



CAUTION/WARNING

- The information in this publication has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies.
- Sanken reserves the right to make changes without further notice to any products herein in the interest of improvements in the performance, reliability, or manufacturability of its products. Before placing an order, Sanken advises its customers to obtain the latest version of the relevant information to verify that the information being relied upon is current.
- Application and operation examples described in this catalog are quoted for the sole purpose of reference for the use of the products herein and Sanken can assume no responsibility for any infringement of industrial property rights, intellectual property rights or any other rights of Sanken or any third party which may result from its use.
- When using the products herein, the applicability and suitability of such products for the intended purpose or object shall be reviewed at the users responsibility.
- Although Sanken undertakes to enhance the quality and reliability of its products, the occurrence of failure and defect of semiconductor products at a certain rate is inevitable. Users of Sanken products are requested to take, at their own risk, preventative measures including safety design of the equipment or systems against any possible injury, death, fires or damages to the society due to device failure or malfunction.
- Sanken products listed in this catalog are designed and intended for the use as components in general purpose electronic equipment or apparatus (home appliances, office equipment, telecommunication equipment, measuring equipment, etc.).
Before placing an order, the user's written consent to the specifications is requested.
- When considering the use of Sanken products in the applications where higher reliability is required (transportation equipment and its control systems, traffic signal control systems or equipment, fire/crime alarm systems, various safety devices, etc.), please contact your nearest Sanken sales representative to discuss and obtain written confirmation of your specifications.
- The use of Sanken products without the written consent of Sanken in the applications where extremely high reliability is required (aerospace equipment, nuclear power control systems, life support systems, etc.) is strictly prohibited.
- Anti radioactive ray design is not considered for the products listed herein.
- This publication shall not be reproduced in whole or in part without prior written approval from Sanken.

Contents

SANKEN POWER TRANSISTORS

Transistor Selection Guide..2	B1559.....47	C4138.....91	C5333.....135
Reliability.....6	B1560.....48	C4139.....92	C5370.....136
Temperature Derating in	B1570.....49	C4140.....93	D1769.....137
Safe Operating Area.....9	B1587.....50	C4153.....94	D1785.....138
Accessories.....9	B1588.....51	C4296.....95	D1796.....139
Switching Characteristics	B1647.....52	C4297.....96	D2014.....140
Test Circuit.....10	B1648.....53	C4298.....97	D2015.....141
Symbols and Term.....10	B1649.....54	C4299.....98	D2016.....142
A1186.....11	B1659.....55	C4300.....99	D2017.....143
A1215.....12	B1685.....56	C4301.....100	D2045.....144
A1216.....13	B1686.....57	C4304.....101	D2081.....145
A1262.....14	B1687.....58	C4381/2.....102	D2082.....146
A1294.....15	C2023.....59	C4388.....103	D2083.....147
A1295.....16	C2837.....60	C4418.....104	D2141.....148
A1303.....17	C2921.....61	C4434.....105	D2389.....149
A1386/A.....18	C2922.....62	C4445.....106	D2390.....150
A1488/A.....19	C3179.....63	C4466.....107	D2401.....151
A1492.....20	C3263.....64	C4467.....108	D2438.....152
A1493.....21	C3264.....65	C4468.....109	D2439.....153
A1494.....22	C3284.....66	C4495.....110	D2557.....154
A1567.....23	C3519/A.....67	C4511.....111	D2558.....155
A1568.....24	C3678.....68	C4512.....112	D2560.....156
A1667/8.....25	C3679.....69	C4517/A.....113	D2561.....157
A1673.....26	C3680.....70	C4518/A.....114	D2562.....158
A1693.....27	C3830.....71	C4546.....115	D2589.....159
A1694.....28	C3831.....72	C4557.....116	D2641.....160
A1695.....29	C3832.....73	C4662.....117	D2642.....161
A1725.....30	C3833.....74	C4706.....118	D2643.....162
A1726.....31	C3834.....75	C4883/A.....119	SAH02.....163
A1746.....32	C3835.....76	C4886.....120	SAH03.....164
A1859/A.....33	C3851/A.....77	C4907.....121	SAP09N.....165
A1860.....34	C3852/A.....78	C4908.....122	SAP09P.....166
A1907.....35	C3856.....79	C5002.....123	SAP10N.....167
A1908.....36	C3857.....80	C5003.....124	SAP10P.....168
A1909.....37	C3858.....81	C5071.....125	SAP16N.....169
A2042.....38	C3890.....82	C5099.....126	SAP16P.....170
B1257.....39	C3927.....83	C5100.....127	SAP Series
B1258.....40	C4020.....84	C5101.....128	Application
B1259.....41	C4024.....85	C5124.....129	Information.....171
B1351.....42	C4064.....86	C5130.....130	Discontinued Parts
B1352.....43	C4065.....87	C5239.....131	Guide.....176
B1382.....44	C4073.....88	C5249.....132	
B1383.....45	C4130.....89	C5271.....133	
B1420.....46	C4131.....90	C5287.....134	

Transistor Selection Guide

■ V_{CEO}-I_C

Collector–Emitter Voltage V _{CEO} (V)	800		C3678 C4020 C4299 C4304 C4445 C4908		C3679 C4300		C3680 C4301 C5002 C5003		C5124								
	600		C5249								C4706						
	550		C4517 C4517A C5239		C4518 C4518A C5287				C3927 C4557								
	500					C3830 C4907			C3831								
	400				C4073 C4418 C4662 C5130		C3832 C3890 C4130 C4546		C4138 C4296	C3833 C4297 C5071		C4139 C4298 C4434			C4140		
	380					D2141											
	300	C2023 C5333															
	250					D2017											
	230											A1294 C3263			A1295 C3264		
	200	A1668 C4382	D2016		C5271 D2557 D2558							A1493 C3857			A1494 C3858		
	180	A1859A C4883A										A1386A A1492 A1673 C3519A C3856 C4388			A1216 C2922		
	160											A1215 A1386 C2921 C3519					
	150	A1667 A1859 C4381 C4883						B1559 B1587 D2389 D2438	A1186 B1560 B1588 C2837 D2390 D2439	B1570 D2401	A1303 A1860 C3284 C4886	B1647 B1649 D2560 D2562			B1648 D2561		
	140								A1695 A1909 C4468 C5101								
	120			D2015		D1769 D1785 D2045	C3834 C3835 C4153	A1694 A1908 C4467 C5100	B1259 D2081				B1382 B1420 D2082				B1383 D2083
	110					B1659 B1685 B1686 B1687 D2489 D2641 D2642 D2643											
	100					B1258											
	80		C3852A	A1488A C3851A D2014		A1693 A1725 A1726 A1907 C4466 C4511 C4512 C5099											
	60		C3852	A1262 A1488 B1257 C3179 C3851 D1796						A1568 B1351 B1352 C4065							
	50		C4495						A2042 C4024	A1567 A1746 C4064		C4131					
	40									C5370							
		2	3	4	5	6	7	8	10	12	14	15	16	17	18	25	
Collector Current I _C (A)																	

Transistor Selection Guide

■ Transistors for Switch Mode Power Supplies (for AC80–130V input)

V _{CB0} (V)	V _{CEO} (V)	I _c (A)	MT-25 (TO220)	FM20 (TO220F)	MT-100 (TO3P)	FM100 (TO3PF)
250	200	5		C5271		
500	400	5		C4073		
				C4418		
				C4662		
		7	C3832	C3890		
				C4130		
		10			C4138	C4296
		12			C3833	C4297
					C5071	
		15			C4139	C4298
					C4434	
		18			C4140	
600	400	5		C5130		
		7		C4546		
	500	6	C3830	C4907		
		10			C3831	
	600	3		C5249		

■ Transistors for Switch Mode Power Supplies (for AC180–280V input)

V _{CB0} (V)	V _{CEO} (V)	I _c (A)	MT-25 (TO220)	FM20 (TO220F)	MT-100 (TO3P)	FM100 (TO3PF)
900 (1000)	550	3	C5239	C4517(A)		
		5		C4518(A)	C5287	
		10			C3927	C4557
	600	14			C4706	
900	800	3	C4020	C4908		
					C3678	C4299
				C4304		C4445
		5			C3679	C4300
		7			C3680	C4301

Transistor Selection Guide

Transistors for Audio Amplifiers

■ Single Transistors

● Single Emitter

Part No.	Pc(W)	VCE0(V)	Ic(A)	hFE(min)	fr(MHz)	Package
2SA1725/2SC4511	30	80	6	50	20	FM20 (TO220F)
2SA1726/2SC4512	50					MT-25 (TO220)
2SA1693/2SC4466	60					MT-100 (TO3P)
2SA1907/2SC5099	60					FM100 (TO3PF)
2SA1908/2SC5100	75	120	8			MT-100 (TO3P)
2SA1694/2SC4467	80					FM100 (TO3PF)
2SA1909/2SC5101	80	140	10			MT-100 (TO3P)
2SA1673/2SC4388	85	180	15			FM100 (TO3PF)
2SA1695/2SC4468	100	140	10			MT-100 (TO3P)
2SA1492/2SC3856	130	180	15			MT-200 (2-screw mount)
2SA1493/2SC3857	150	200	15			
2SA1494/2SC3858	200		17			

● LAPT (Multi emitter for High Frequency)

Part No.	Pc(W)	VCE0(V)	Ic(A)	hFE(min)	fr(MHz)	Package
2SA1860/2SC4886	80	150	14	50	50	FM100 (TO3PF)
2SA1186/2SC2837	100		10		60	MT-100 (TO3P)
2SA1303/2SC3284	125		14		50	
2SA1386/2SC3519	130	15	40		35	
2SA1386A/2SC3519A	130					
2SA1294/2SC3263	130		230		17	50
2SA1215/2SC2921	150	160	40			
2SA1216/2SC2922	200	180	35			
2SA1295/2SC3264	200	230				

● Transistors with built in temperature compensation diodes for audio amplifier

Part No.	Pc(W)	VCE0(V)	Ic(A)	hFE(min)	Emitter Resistor(Ω)
SAP09P/SAP09N	80	150	10	5000	0.22
SAP10P/SAP10N	100	150	12	5000	0.22
SAP16P/SAP16N	150	160	15	5000	0.22

Transistor Selection Guide

■ Darlington Transistors

Part No.	Pc(W)	VCEO(V)	Ic(A)	hFE(min)	fT(MHz)	Package
2SB1686	30	110	6	5000	100	FM20 (TO220F)
2SD2642					60	
2SB1659	50				100	MT-25 (TO220)
2SD2589					60	
2SB1685	60				100	MT-100 (TO3P)
2SD2641					60	
2SB1687	60				100	FM100 (TO3PF)
2SD2643					60	
2SB1587	75	8	65			
2SD2438			80			
2SB1559	80	10	65		MT-100 (TO3P)	
2SD2389			80			
2SB1588	80	15	50		FM100 (TO3PF)	
2SD2439			55			
2SB1649	85		200			45
2SD2562						70
2SB1560	100	150	10		MT-100 (TO3P)	
2SD2390			55			
2SB1647	130		15			45
2SD2560						70
2SB1570	150	150	12		MT-200 (2-screw mount)	
2SD2401			55			
2SB1648	200		17			45
2SD2561						70

■ Temperature compensation Transistors and Driver Transistors

Part No.	P _c (W)	V _{CEO} (V)	I _c (A)	h _{FE} (min)	f _T (MHz)	Package	Remarks
2SC4495	25	50	3	500	40	FM20 (TO220F)	Temperature compensation
2SC4883	20	150	2	60	120		Driver, Complement 2SA1859
2SC4883A		180					Driver, Complement 2SA1859A
2SA1859	20	−150	−2	60	60		Driver, Complement 2SC4883
2SA1859A		−180					Driver, Complement 2SC4883A

Reliability

1. Definition of Reliability

The word reliability is an abstract term which refers to the degree to which equipment or components, such as semiconductor devices, are resistant to failure. Reliability can be and is often measured quantitatively. Reliability is defined as "whether equipment or components (such as a semiconductor device) under given conditions perform the same at the end of a given period as at the beginning."

2. Reliability Function

In general, there are three types of failure modes in electronic components:

1. Infant failure
2. Random failure
3. Wear-out failure

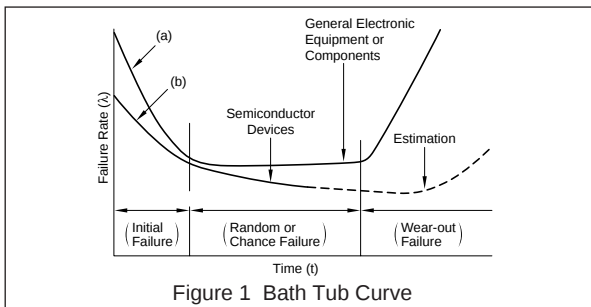


Figure 1 Bath Tub Curve

These three types of failure describe "bathtub curve" shown in Figure 1. Infant failures can be attributed to trouble in the production process and can be eliminated by aging before shipment to customers, stricter control of the production process and quality control measures. Semiconductor devices such as transistors, unlike electronic equipment, take a considerable amount of time to reach the stage where wear-out failure begins to occur. And, as shown in Figure 1 (b), they also last much longer than electronic equipment. This shows that the longer they are used the more stable they actually become.

The reduction that occurs in random failures can be approximated by Weibull distribution, logarithmic normal distribution, or gamma distribution, but Weibull distribution best expresses the phenomenon that occurs with transistors.

3. Quantitative Expression of Reliability

While there are many ways to quantitatively express reliability, two criteria, failure rate and life span, are generally used to define the reliability of semiconductors such as transistors.

a) Failure Rate (FR)

Failure rate often refers to instantaneous failures or $\lambda(t)$. In general of reliability theory, however, the cumulative failure rate, or Reliability Index, is

$$F \cdot R = \frac{r(t)}{N \cdot t} \quad (1)$$

Where N = Net quantity used, and

$r(t)$ = Net quantity failed after t hours

If we assign t the arbitrary

$$F \cdot R = \frac{r}{N} \times 100 \text{ (\%/1,000 hours)} \quad (2)$$

In situations where the cumulative failure rate is small, failure is expressed in units of one Fit, 10^{-9} (failures/hours).

b) Life Span(L)

Life Span can be expressed in terms of average lifespan or as Mean Time Between Failure (MTBF), but assuming that random failure is shown by the Index Distribution [$\lambda(t) = \text{constant}$], then Life Span or L can be shown by the equation

$$L = \frac{1}{F \cdot R} \text{ (hours)} \quad (3)$$

4. Applications Considered on Reliability

- a) The type and specifications of our transistors and semiconductor devices vary depending on the application that will be required by their intended use. Customer should, therefore, determine which type will best suit their purposes.
- b) Note that high temperatures or long soldering periods must be avoided during soldering, as heat can be transmitted through external leads into the interior. This may cause deterioration if the maximum allowable temperature is exceeded.
- c) When using the transistor under pulse operation or inductive load, the Safe Operating Area (SOA) for the current and voltage must not be exceeded (Figure 2).

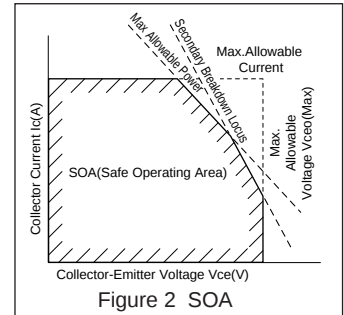


Figure 2 SOA

- d) The reliability of transistors and semiconductor devices is greatly affected by the stress of junction temperature. If we accept in general proceed in the form of Arrhenius equation, the relationship between the junction temperature T_J and lifespan L can be expressed with the following empirical formula

$$\ln L = A + \frac{B}{T_J} \quad (4)$$

It is, hence, very important to derate the junction temperature to assure a high reliability rate.

5. Reliability Test

Sanken bases its test methods and conditions on the following standards. Tests are conducted under these or stricter conditions. The details of these are shown in Table 1.

- MIL-STD-202F (Test method for electrical and electronic components)
- MIL-STD-750C (Test method for semiconductor equipment)
- JIS C 7021 (Endurance test and environmental test method for individual semiconductor devices)
- JIS C 7022 (Endurance test and environmental test method for integrated circuits of semiconductors)

6. Quality Assurance

To ensure high quality and high reliability, quality control and production process control procedures are executed from the receipt of parts through the entire production process. Our quality assurance system is shown in Figure 3.

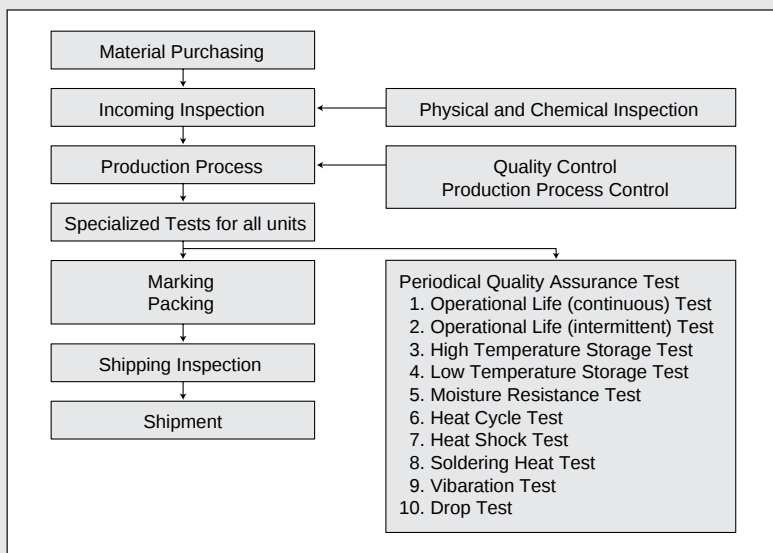
Reliability

Table 1: Test Methods and Conditions

Test	Details of the Testing Method	LTPD(%)
Continuous Operations Test	Collector dissipation with maximum junction temperature is applied continuously at room temperature to judge lifespan and reliability under transistor operating conditions.	*5/1000hrs
Intermittent Operation Test	Power equal to that used in the Continuous Operations Test is applied intermittently to test the transistor's lifespan and reliability under on and off conditions.	5/1000hrs
High Temperature Storage Test	Confirms the highest storage temperature and operating temperature of transistors.	5/1000hrs
Low Temperature Storage Test	Confirms the lowest storage temperature of transistors.	5/1000hrs
Moisture Resistance Test	Tested at RH=85% and TA=85°C for the effects of the interaction between temperature and humidity, and the effects of surface insulation between electrodes and high temperature/high humidity.	5/1000hrs
Heat Cycle Test	Tested at Tstg min – Room temp. – Tstg max – Room temp. for 10 cycles (one cycle 30 min. –5 min. –30 min. –5 min.) to detect mechanical faults and characteristic changes caused by thermal expansion and shrinkage of the transistor.	5
Heat Shock Test	Tested at 100°C (5 min.), 25°C (within 3 sec.), 0°C (5 min.) for 10 cycles to check for mechanical faults and characteristic changes caused by thermal expansion and shrinkage of transistor.	5
Soldering Heat Test	Tested at 260 ± 5°C, 10 ± 1 sec, by dipping lead wire to 1.5mm from the seating plane in solder bath to check for characteristic changes caused by drastic temperature rises of exterior lead wire.	5
Vibrations Test	Tested at amplitude 1.52mm, vibration frequency 10-55 Hz in directions of X, Y, Z, for 2 hours each (total 6 hours) to check for characteristic changes caused by vibration during operation and transportation.	5
Drop Test	Tested by dropping 10 times from 75 cm height to check for mechanical endurance and characteristic changes caused by shock during handling.	5

* Reliability Standard : 60%

Figure 3 Quality Assurance System



Reliability

7. Notes Regarding Storage, Characteristic Tests, and Handling

Since reliability can be affected adversely by improper storage environment and handling methods during Characteristic tests, please observe the following cautions.

a) Cautions for Storage

1. Ensure that storage conditions comply with the standard temperature (5 to 35°C) and the standard relative humidity (arround 40 to 75%) and avoid storage locations that experience extreme changes in temperature or humidity.
2. Avoed locations where dust or harmful gases are present, and avoid direct sunlight.
3. Reinspect for rust in leads and solderbility that have been stored for a long time.

b) Cautions for Characteristic Tests and Handling

1. When characteristic tests are carried out during inspection testing and other standard test periods, protect the transistor from surges of power from the testing device, shorts between the transistor and the heatsink

c) Silicone Grease

When using a heatsink, please coat the back surface of the transistor and both surfaces of the insulating plate with a thin layer of silicone grease to improve heat transfer between the transistor and the heatsink.

Recommended Silicone Grease

- G-746 (Shin-Etsu Chemical)
- YG6260 (GE Toshiba Silicone)
- SC102 (Dow Corning Toray Silicone)

d) Torque when Tightening Screws

Thermal resistance increases when tightening torque is small, and radiation effects are decreased. When the torque is too high, the screw can cut, the heatsink can be deformed, and/or distortion can arise in the product's frame. To avoid these problems, Table 2 shows the recommended tightening torques for each product type.

Table 2. Screw Tightening Torques

Package	Screw Tightening Torque
MT25 (TO-220)	0.490 to 0.686 N · m (5 to 7kgf · cm)
FM20 (TO-220 Full Mold)	0.490 to 0.686 N · m (5 to 7kgf · cm)
MT100 (TO-3P)	0.686 to 0.822 N · m (7 to 9kgf · cm)
FM100 (TO-3P Full Mold)	0.686 to 0.822 N · m (7 to 9kgf · cm)
MT200 (two-point mount)	0.686 to 0.822 N · m (7 to 9kgf · cm)
2GR (one-point mount)	0.686 to 0.822 N · m (7 to 9kgf · cm)

e) Soldering Temperature

In general, the transistor is subjected to high temperatures when it is mounted on the printed circuit board, whether from flow solder from a solderbath, or, in hand operations from a soldering iron. The testing method and test conditions (JIS-C-7021 standards) for a transistor's heat resistance during soldering are:

At a distance of 1.5mm from the transistor's main body, apply 260°C for 10 seconds, and 350°C for 3 seconds.

However, please stay well within these limits and for as short a time as possible during actual soldering.

Reliability

■ Temperature Derating in Safe Operating Area

Flange (case) temperature is typically described as 25°C, but it must be derated subject to the operating temperature.

This derating curve is determined by manufacturing conditions of devices, materials used etc. and in case of a silicon transistor, breakdown voltage and DC Current Gain are significantly deteriorated in the temperature range of 260°C to 360°C.

Hence, the collector current must be derated by using the derating curve in Fig.2 where the breakdown point is set at 260°C.

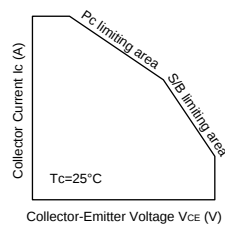


Fig.1 Safe Operating Area

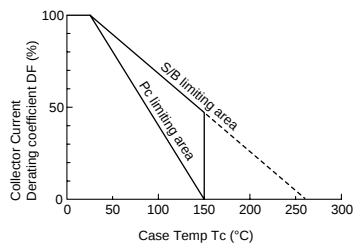


Fig.2 Derating Curve of Safe Operating Area

Derating coefficient is obtained from temperature in Fig.2 and it must be applied to the current value of the safe operating area in order to obtain the derated current.

■ Accessories

- ☆ Sanken Transistors do not include accessories. Accessories may be attached at a cost if requested.
- ☆ Sanken transistor case is a standard size, and can be used with any generally sold accessories.

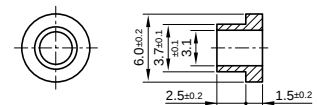
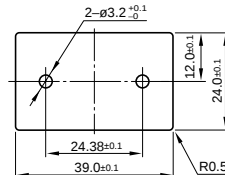
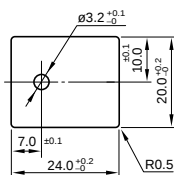
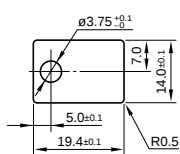
• Insulator: Mica, with a thickness of 0.06mm, +0.045 –0.005 allowance

• Insulation Bush for MT-25 (TO220)

Type Name:Mold(10)Mica

Type Name:Mold(14)Mica

Type Name:Mold(9)Mica

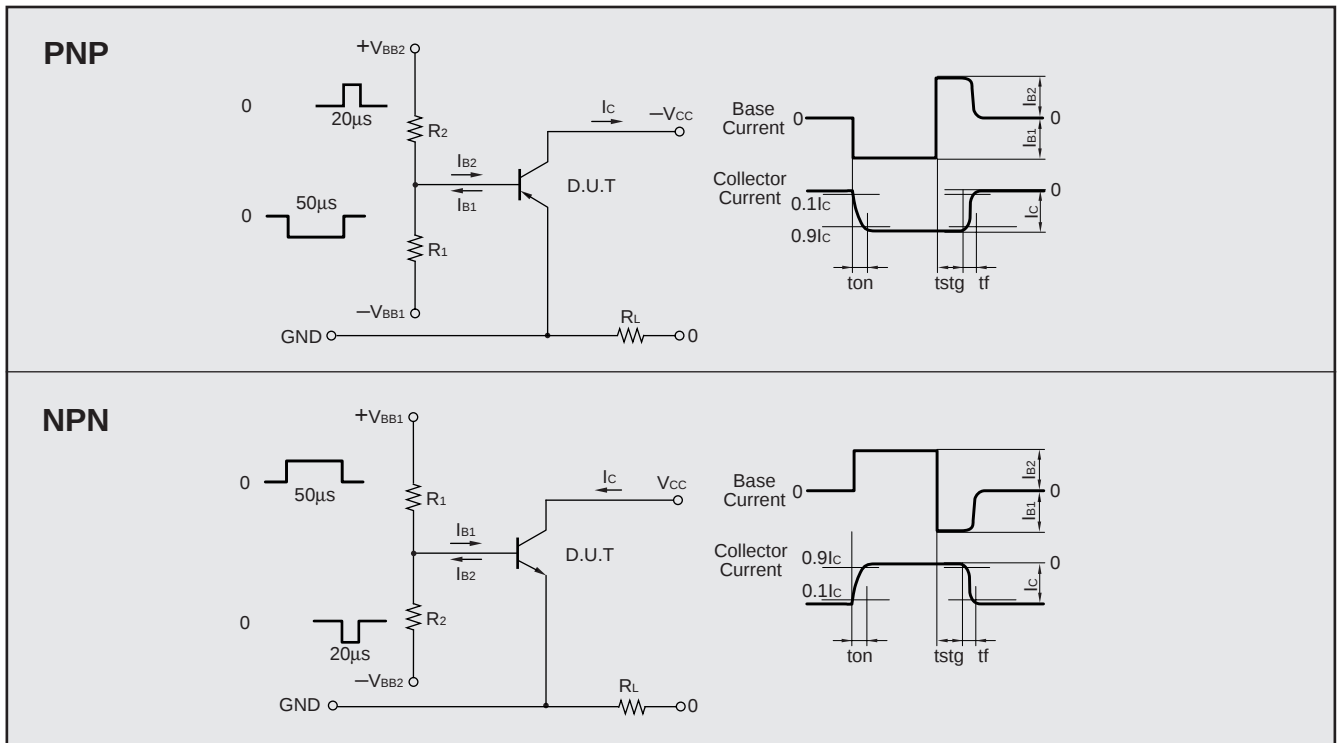


Switching Characteristics

■ Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{B2} (V)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (A)	I_{B2} (A)	t_r (μs)	t_{stg} (μs)	t_f (μs)
-----------------	-----------------------	--------------	-----------------	------------------	------------------	-----------------	-----------------	----------------------	--------------------------	----------------------

■ Switching Characteristics Test Circuit/Measurement Wave Forms



Symbols

Symbol	Item	Definition
V_{CBO}	Collector-Base Voltage	DC Voltage between Collector and Base when Emitter is open
V_{CEO}	Collector-Emitter Voltage	Voltage between Collector and Emitter when Base is open and voltage is reversely applied to Collector junction
V_{EBO}	Emitter-Base Voltage	DC voltage between Emitter and Base when Collector is open
I_C	Collector Current	DC current passing through Collector electrode
I_B	Base Current	DC current passing through Base electrode
P_C	Collector Power Dissipation	Power consumed at Collector junction
T_j	Operating Junction Temperature	Maximum allowable temperature value at absolute maximum ratings
T_{stg}	Storage Temperature	Maximum allowable range of ambient temperature at non-operation
I_{CBO}	Collector Cutoff Current	Collector current when Emitter is open and a specified reverse voltage is applied between Collector and Base
I_{EBO}	Emitter Cutoff Current	Emitter current when Collector is open and a specified reverse voltage is applied between Emitter and Base
$V_{(BR)CEO}$	Collector-Emitter Saturation Voltage	Breakdown voltage between Collector and Emitter when Base is open
h_{FE}	DC Current Gain	Ratio of DC output current and DC input current at a specified voltage and current (Emitter common)
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	DC voltage between Collector and Emitter under specified saturation conditions
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	DC voltage between Base and Emitter under specified saturation conditions
V_{FEC}	Emitter-Collector Diode Forward Voltage	Diode forward voltage between Emitter and Collector when Base is open
f_r	Cut-off Frequency	Frequency at the specified voltage and current where h_{FE} is 1 (0dB)
C_{ob}	Collector Junction capacitance	Junction capacitance between collector and Base at a specified voltage and frequency

• $T_a=25^{\circ}C$ unless otherwise specified.

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC2837)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-150	V
V _{CEO}	-150	V
V _{EB0}	-5	V
I _C	-10	A
I _B	-2	A
P _C	100(Ta=25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

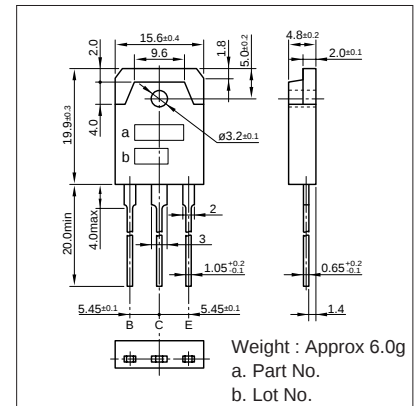
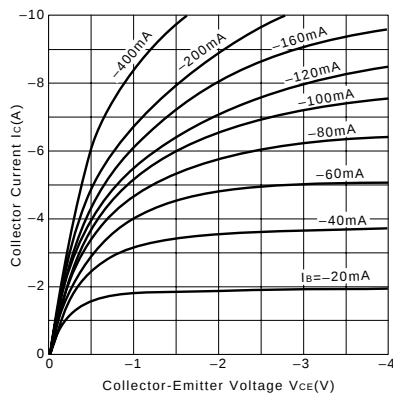
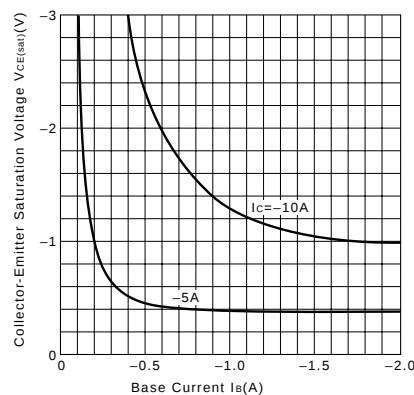
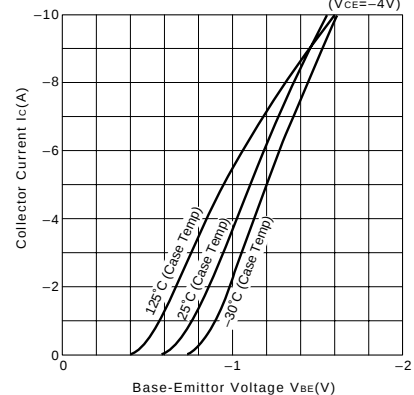
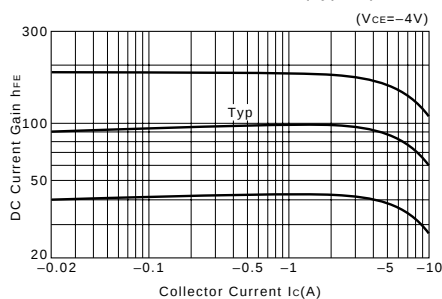
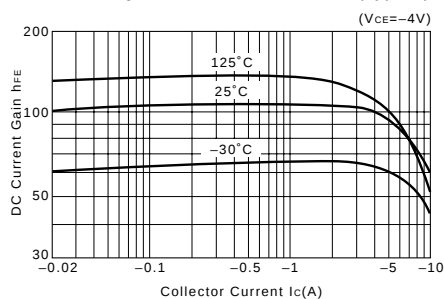
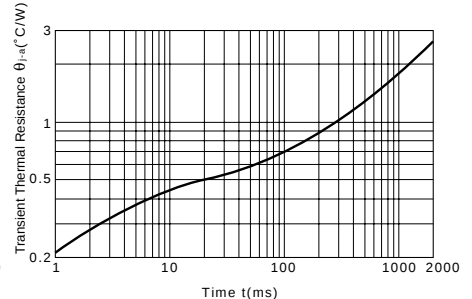
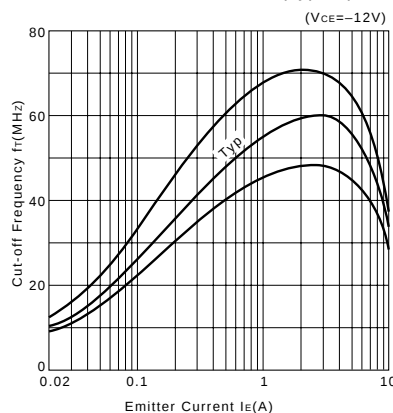
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-150V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V(BR)CEO	I _C =-25mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max	V
f _r	V _{CE} =-12V, I _E =1A	60typ	MHz
COB	V _{CB} =-80V, f=1MHz	110typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

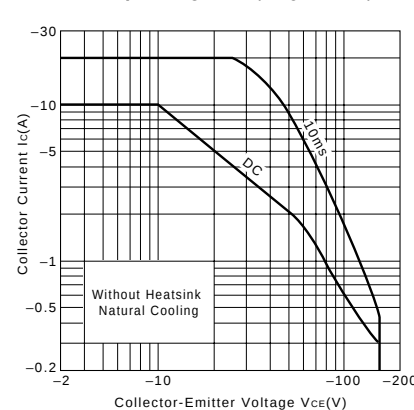
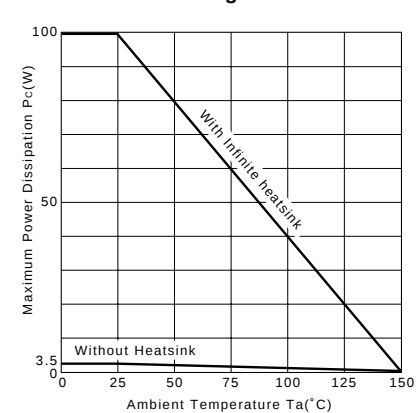
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{B2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	5	-500	500	0.25typ	0.8typ	0.2typ

External Dimensions MT-100(TO3P)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{JA}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC2921)

Application : Audio and General Purpose

■Absolute maximum ratings (Ta=25°C)

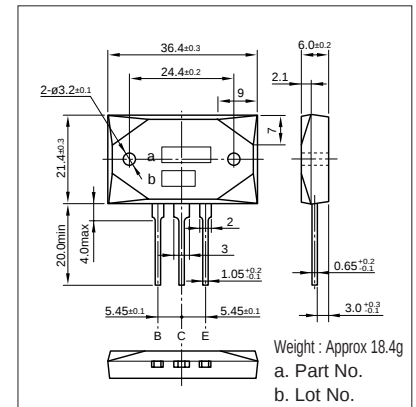
Symbol	Ratings	Unit
V _{CB0}	-160	V
V _{CEO}	-160	V
V _{EB0}	-5	V
I _C	-15	A
I _B	-4	A
P _C	150(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-160V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-25mA	-160min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max	V
f _r	V _{CE} =-12V, I _E =2A	50typ	MHz
COB	V _{CB} =-10V, f=1MHz	400typ	pF

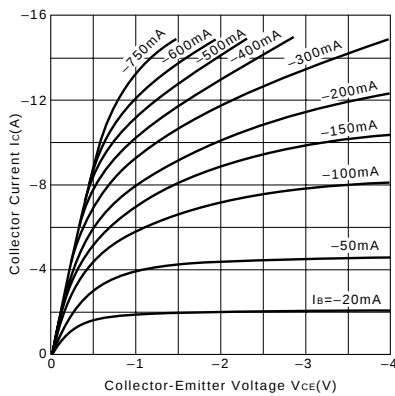
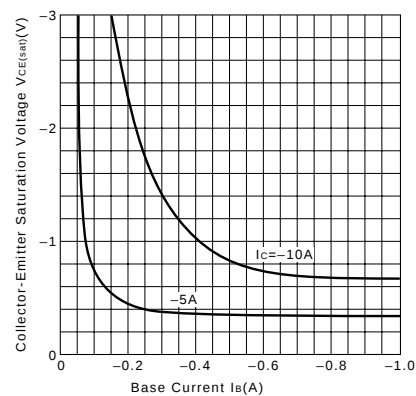
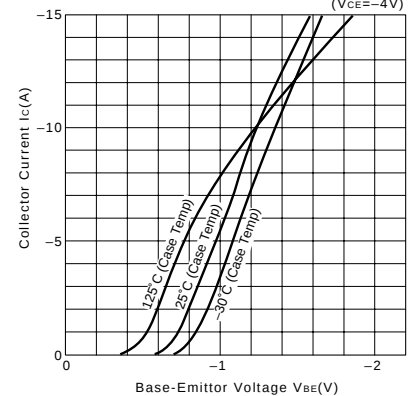
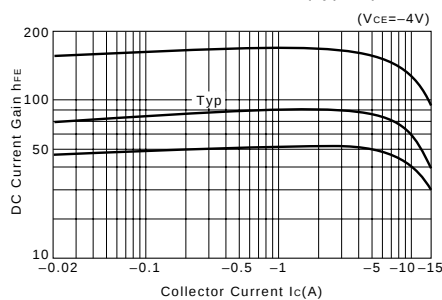
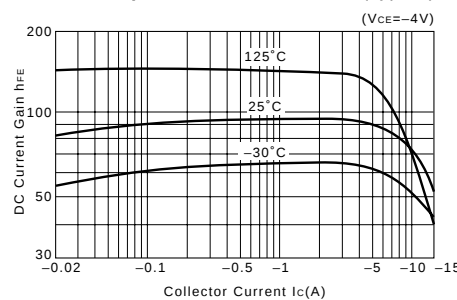
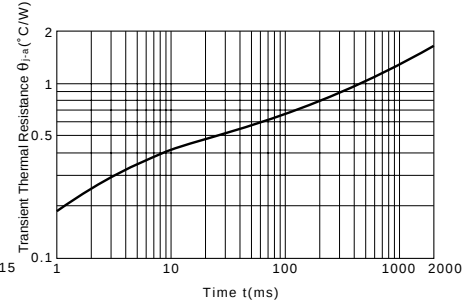
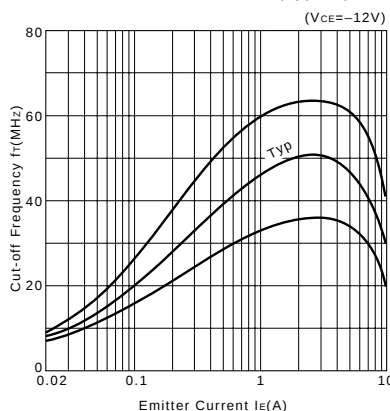
*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

External Dimensions MT-200

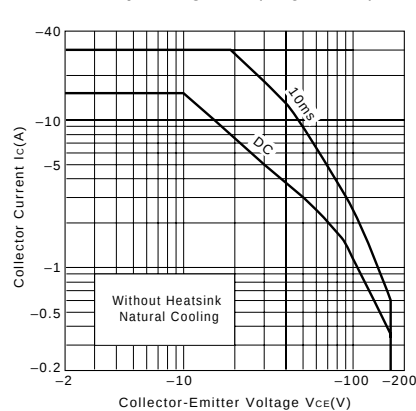
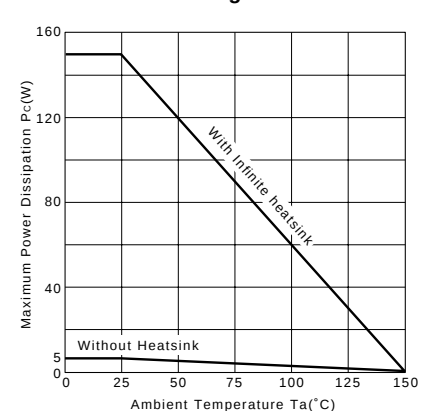


■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{B2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	5	-500	500	0.25typ	0.85typ	0.2typ

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{J-a}-t Characteristicsf_r-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC2922)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

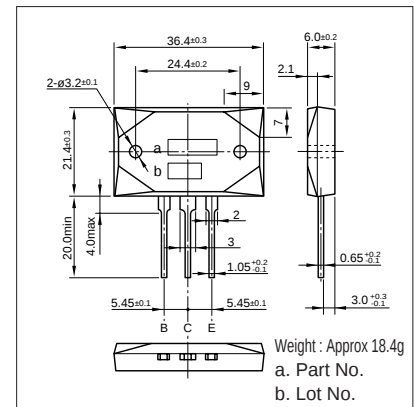
Symbol	Ratings	Unit
VCBO	-180	V
VCEO	-180	V
VEBO	-5	V
IC	-17	A
IB	-5	A
PC	200(Tc=25°C)	W
TJ	150	°C
Tstg	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
VCBO	VCB=-180V	-100max	μA
IEBO	VEB=-5V	-100max	μA
V(BR)CEO	IC=-25mA	-180min	V
hFE	VCE=-4V, IC=-8A	30min*	
VCE(sat)	IC=-8A, IB=-0.8A	-2.0max	V
fr	VCE=-12V, IE=2A	40typ	MHz
COB	VCB=-10V, f=1MHz	500typ	pF

*hFE Rank O(30to60), Y(50to100), P(70to140), G(90to180)

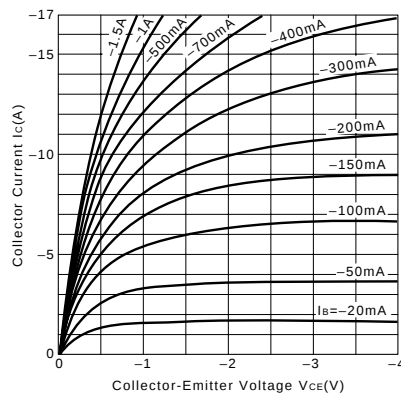
External Dimensions MT-200



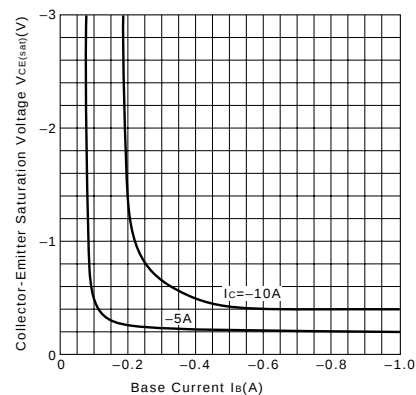
■ Typical Switching Characteristics (Common Emitter)

VCC (V)	RL (Ω)	IC (A)	VB2 (V)	IB1 (A)	IB2 (A)	ton (μs)	tstg (μs)	tf (μs)
-40	4	-10	5	-1	1	0.3typ	0.7typ	0.2typ

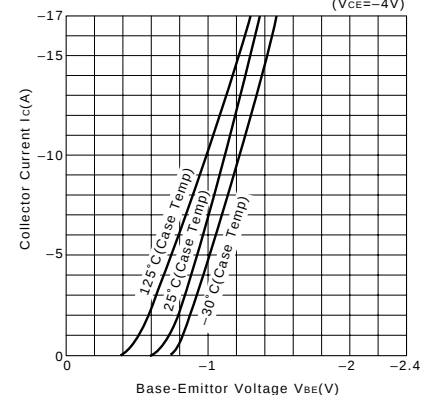
IC-VCE Characteristics (Typical)



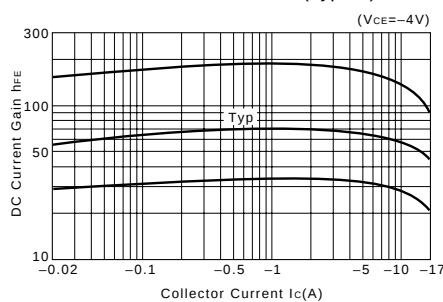
VCE(sat)-IB Characteristics (Typical)



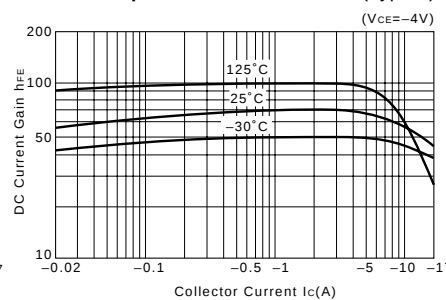
IC-VBE Temperature Characteristics (Typical)



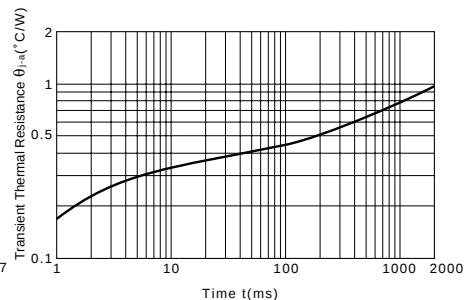
hFE-IC Characteristics (Typical)



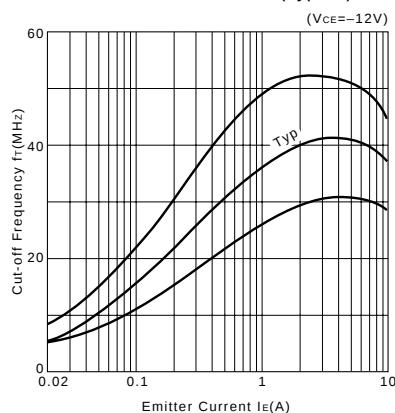
hFE-IC Temperature Characteristics (Typical)



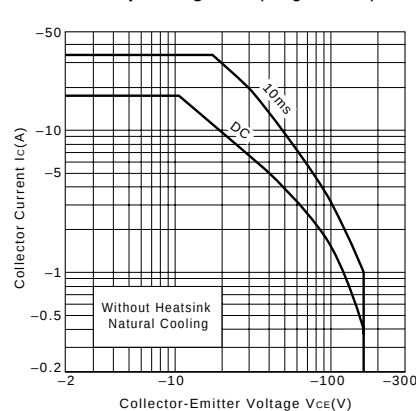
θj-a-t Characteristics



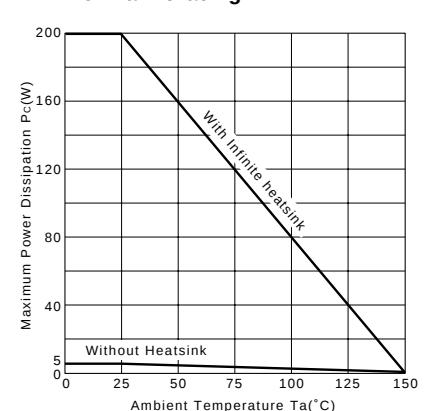
fr-IE Characteristics (Typical)



Safe Operating Area (Single Pulse)



PC-Ta Derating



2SA1262

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3179)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-60	V
V _{CEO}	-60	V
V _{EB0}	-6	V
I _C	-4	A
I _B	-1	A
P _C	30(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

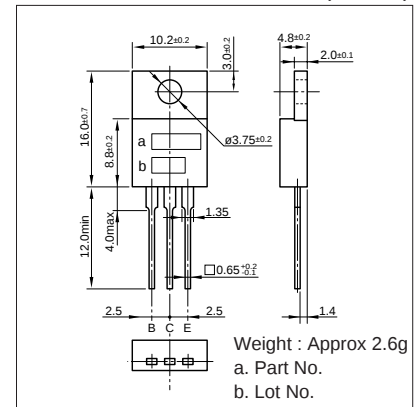
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-60V	-100max	μA
I _{EB0}	V _{EB} =-6V	-100max	μA
V _{(BR)CEO}	I _C =-25mA	-60min	V
h _{FE}	V _{CE} =-4V, I _C =-1A	40min	
V _{CE(sat)}	I _C =-2A, I _B =-0.2A	-0.6max	V
f _T	V _{CE} =-12V, I _E =0.2A	15typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	90typ	pF

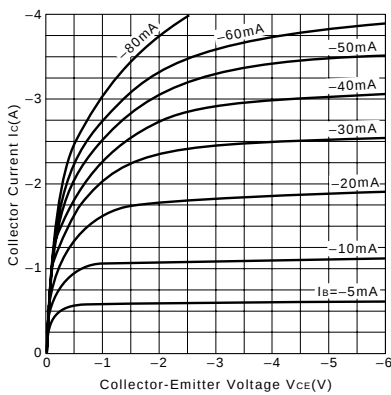
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-20	10	-2	-10	5	-200	200	0.25typ	0.75typ	0.25typ

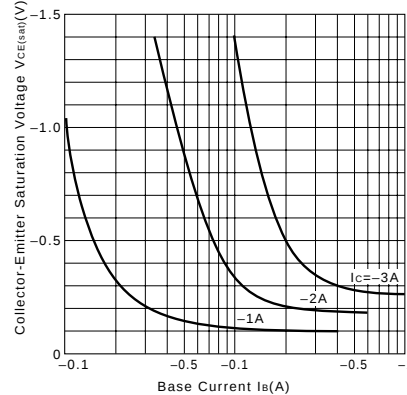
External Dimensions MT-25(TO220)



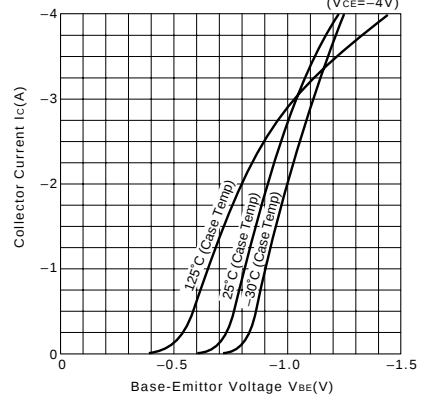
I_C-V_{CE} Characteristics (Typical)



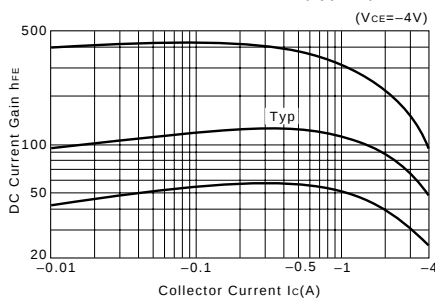
V_{CE(sat)}-I_B Characteristics (Typical)



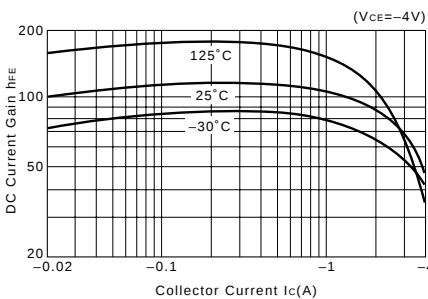
I_C-V_{BE} Temperature Characteristics (Typical)



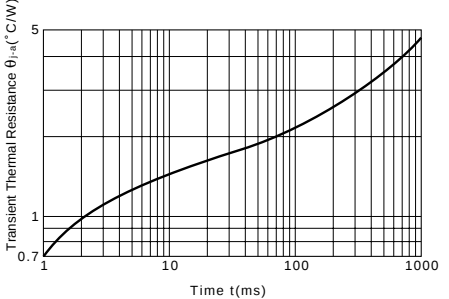
h_{FE}-I_C Characteristics (Typical)



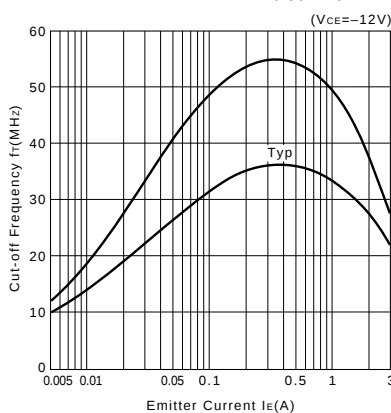
h_{FE}-I_C Temperature Characteristics (Typical)



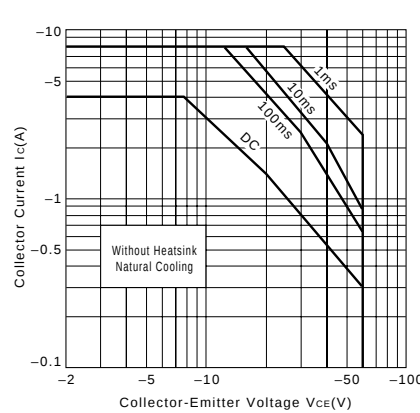
θ_{j-a}-t Characteristics



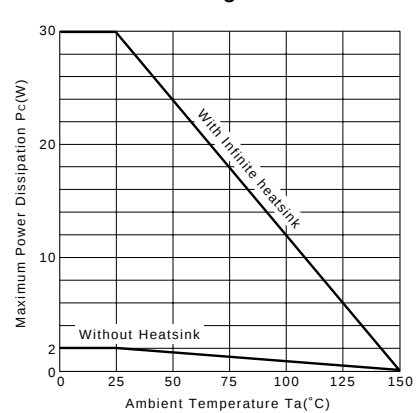
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3263)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

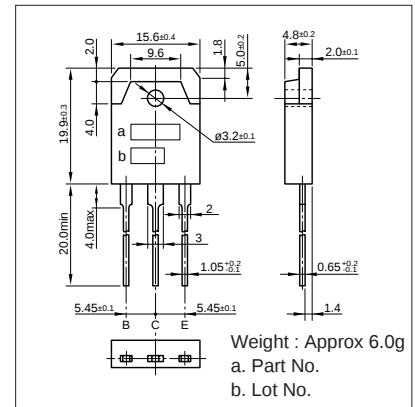
Symbol	Ratings	Unit
V _{CB0}	-230	V
V _{CE0}	-230	V
V _{EB0}	-5	V
I _C	-15	A
I _B	-4	A
P _C	130(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-230V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-25mA	-230min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max	V
f _r	V _{CE} =-12V, I _E =2A	35typ	MHz
COB	V _{CB} =-10V, f=1MHz	500typ	pF

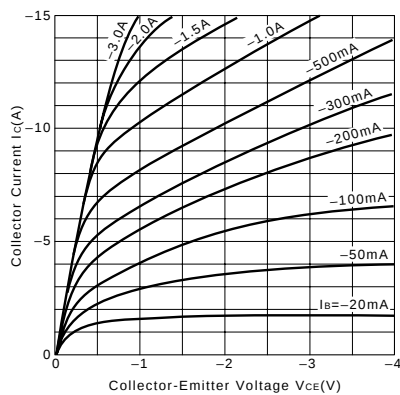
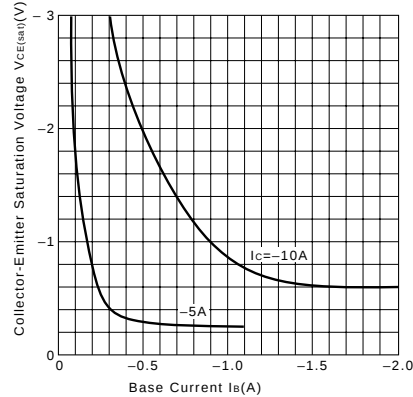
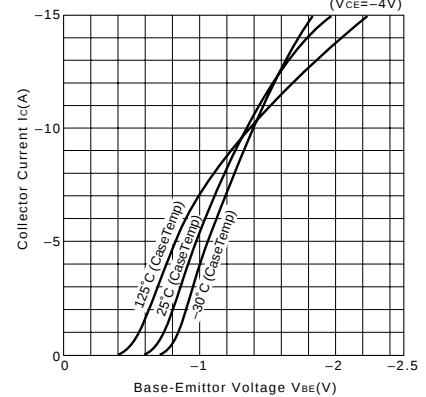
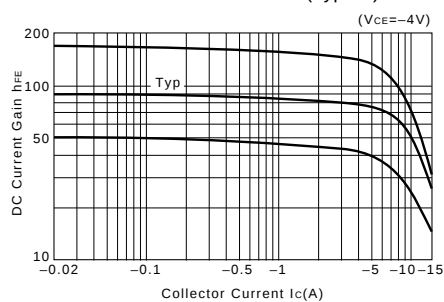
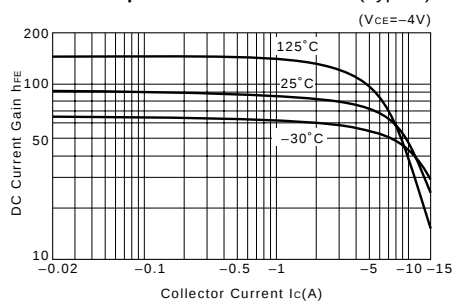
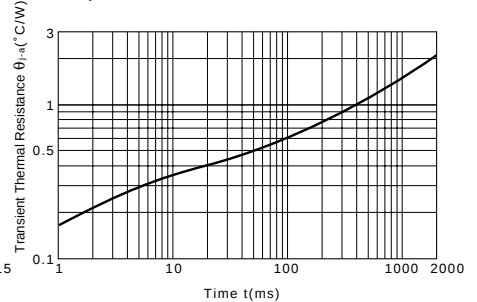
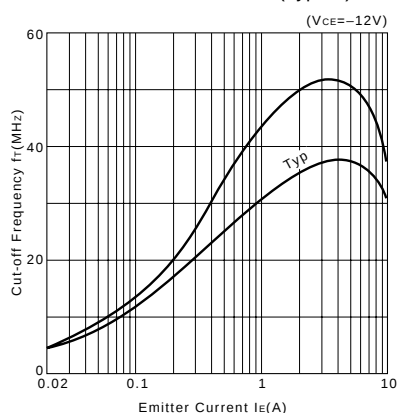
*h_{FE} Rank ○(50to100), Y(70to140)

External Dimensions MT-100(TO3P)

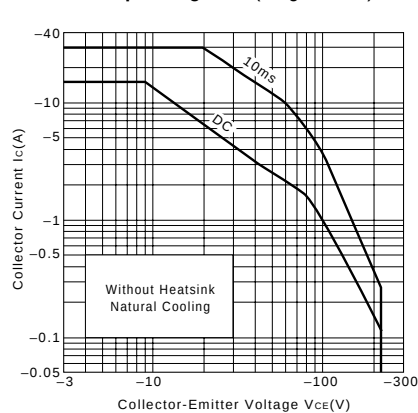
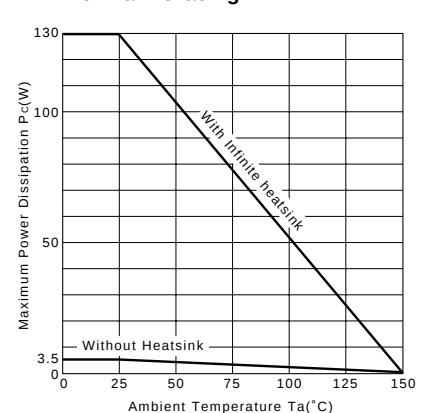


■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	-10	5	-500	500	0.35typ	1.50typ	0.30typ

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{J-a}-t Characteristicsf_r-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3264)

Application : Audio and General

■ Absolute maximum ratings (Ta=25°C)

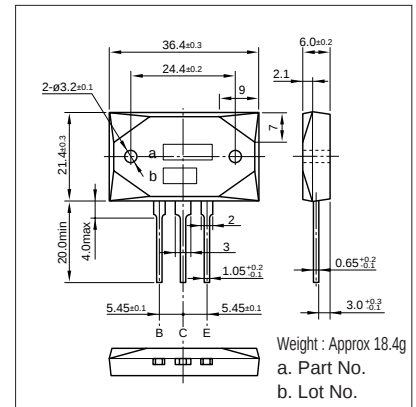
Symbol	Ratings	Unit
V _{CB0}	-230	V
V _{CEO}	-230	V
V _{EB0}	-5	V
I _C	-17	A
I _B	-5	A
P _C	200(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =-230V	-100max	μA
I _{EBO}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-25mA	-230min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max	V
f _r	V _{CE} =-12V, I _E =2A	35typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	500typ	pF

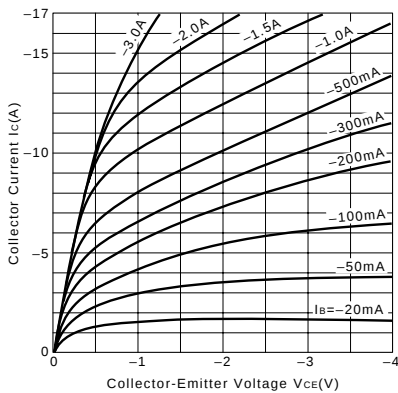
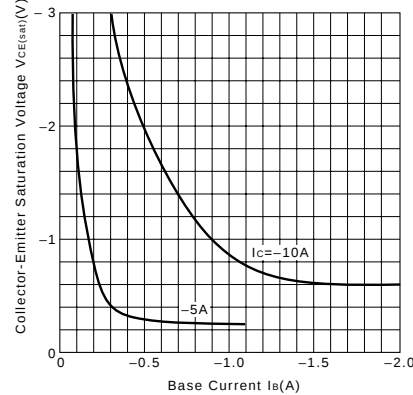
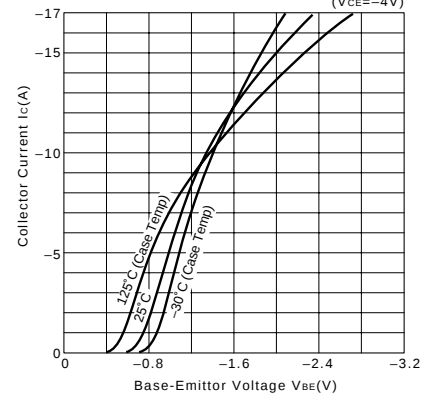
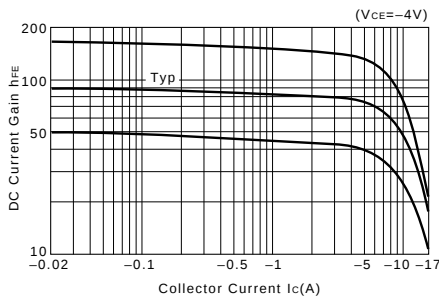
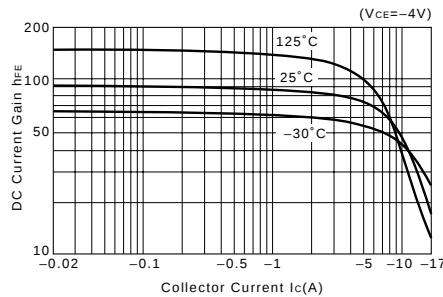
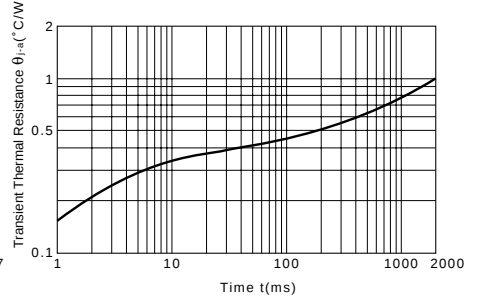
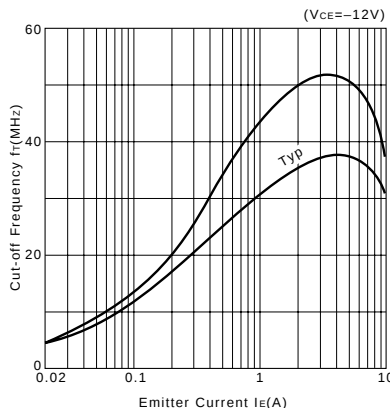
*h_{FE} Rank O(50to100), Y(70to140)

External Dimensions MT-200

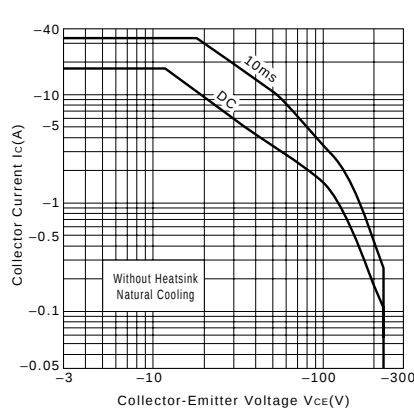
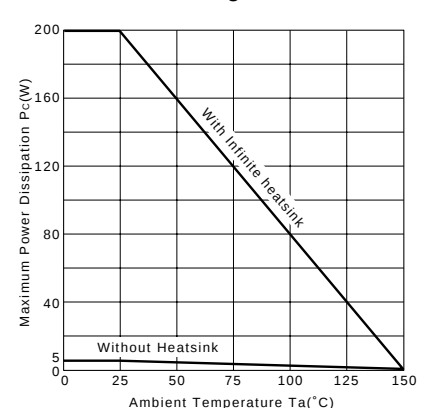


■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	-10	5	-500	500	0.35typ	1.50typ	0.30typ

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{JA}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3284)

Application : Audio and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-150	V
V _{CE0}	-150	V
V _{EB0}	-5	V
I _C	-14	A
I _B	-3	A
P _C	125(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

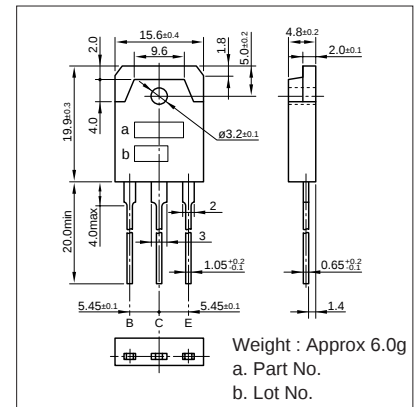
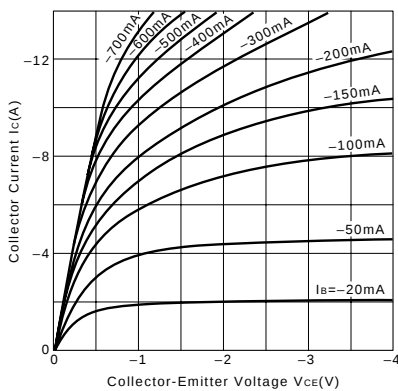
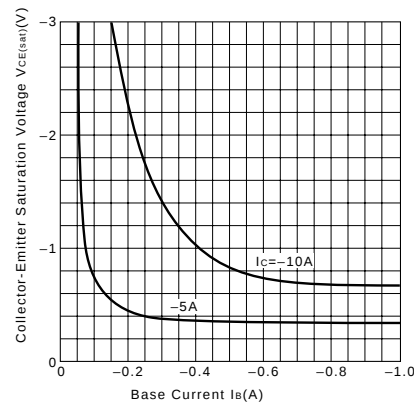
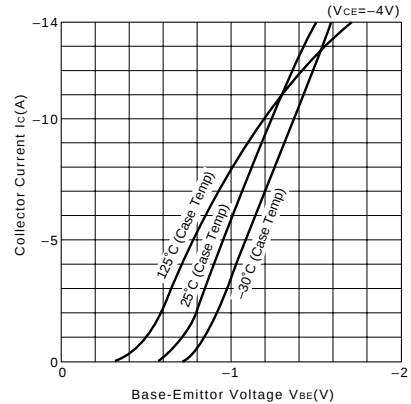
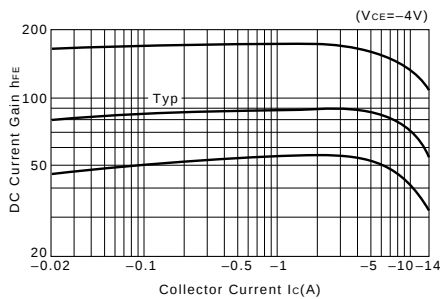
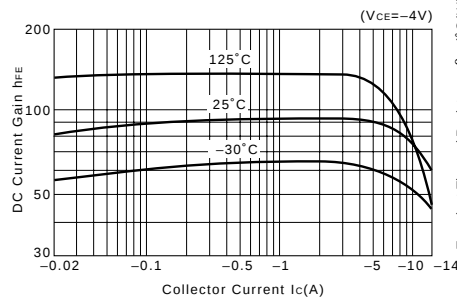
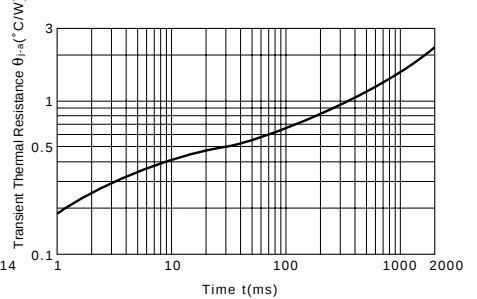
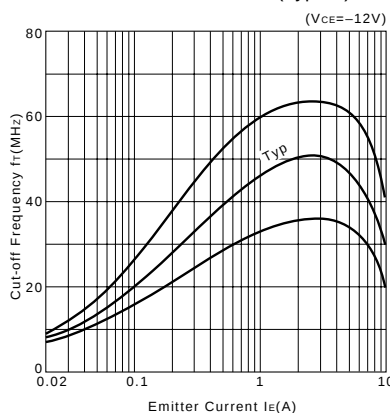
Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =-150V	-100max	μA
I _{EBO}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-25mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	50min	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max	V
f _r	V _{CE} =-12V, I _E =2A	50typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	400typ	pF

*h_{FE} Rank ○(50 to 100), P(70 to 140), Y(90 to 180)

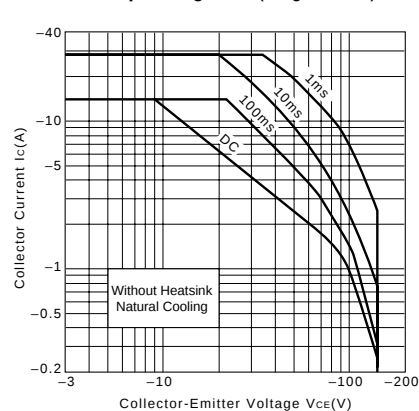
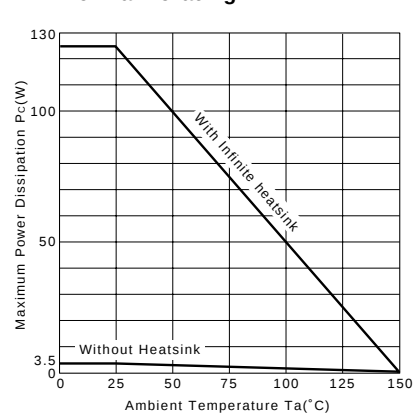
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	-10	5	-500	500	0.25typ	0.85typ	0.2typ

External Dimensions MT-100(TO3P)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{JA}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3519/A)

Application : Audio and General Purpose

■Absolute maximum ratings (Ta=25°C)

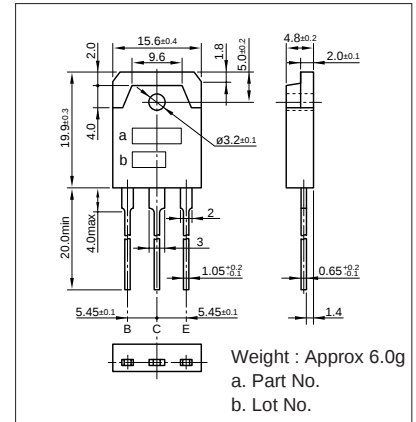
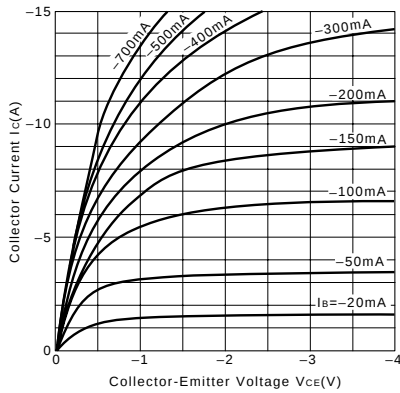
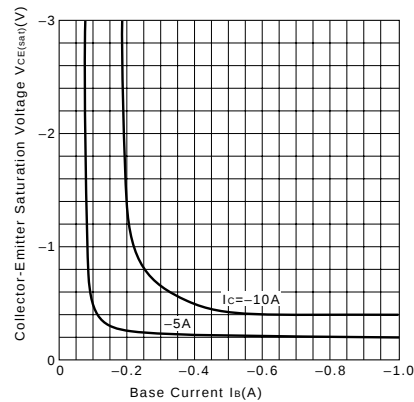
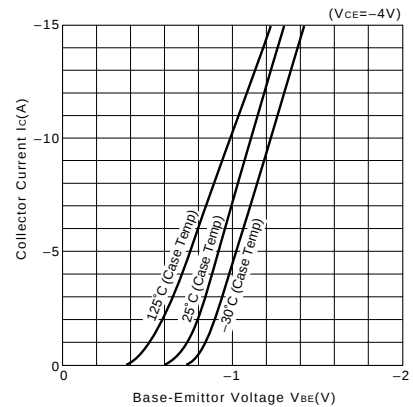
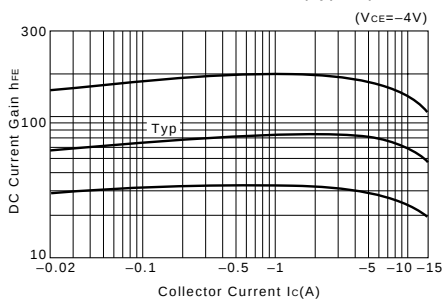
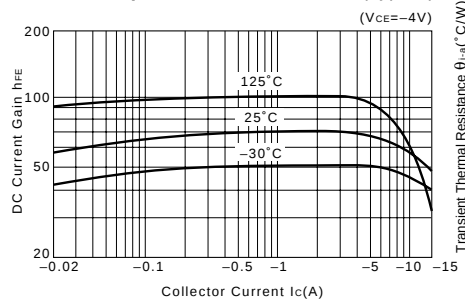
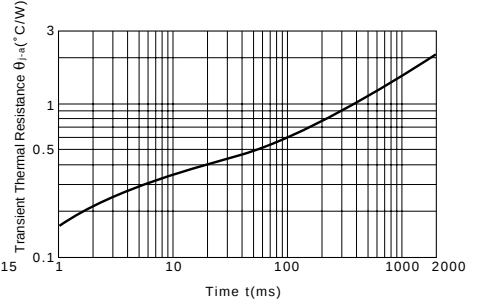
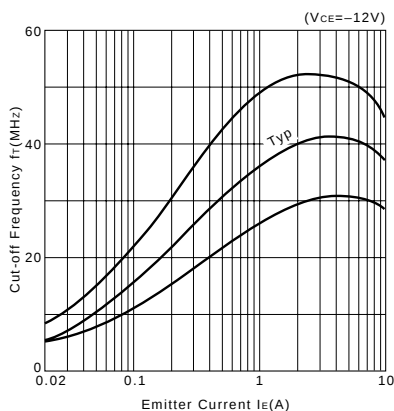
Symbol	Ratings		Unit
	2SA1386	2SA1386A	
V _{CB0}	-160	-180	V
V _{CE0}	-160	-180	V
V _{EB0}	-5		V
I _C	-15		A
I _B	-4		A
P _C	130(T _C =25°C)		W
T _J	150		°C
T _{stg}	-55 to +150		°C

■Electrical Characteristics (Ta=25°C)

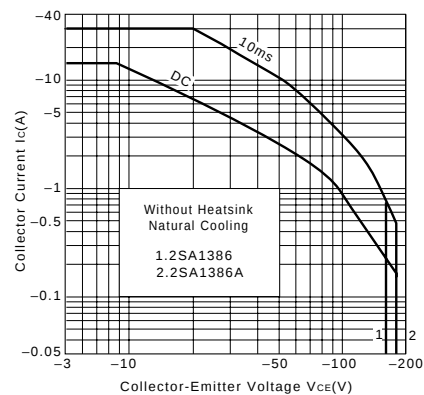
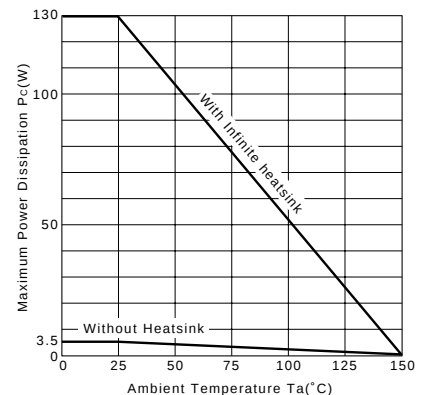
Symbol	Conditions	Ratings		Unit
		2SA1386	2SA1386A	
I _{CBO}	V _{CB} =	-100max	-100max	μA
I _{EB0}	V _{EB} =-5V	-160	-180	V
V _{(BR)CEO}	I _C =-25mA	-160min	-180min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	50min*		
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max		V
f _T	V _{CE} =-12V, I _E =2A	40typ		MHz
C _{OB}	V _{CB} =-10V, f=1MHz	500typ		pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

External Dimensions MT-100(TO3P)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{JA}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

2SA1488/1488A

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3851/A)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings		Unit
	2SA1488	2SA1488A	
V _{CB0}	−60	−80	V
V _{CE0}	−60	−80	V
V _{EBO}	−6		V
I _C	−4		A
I _B	−1		A
P _C	25(T _C = 25°C)		W
T _j	150		°C
T _{stg}	−55 to +150		°C

■Electrical Characteristics

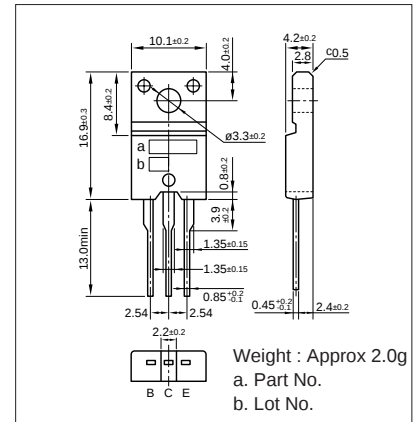
(Ta=25°C)

Symbol	Conditions	Ratings		Unit
		2SA1488	2SA1488A	
ICBO		-100max	-100max	μA
	V _{CB} =	-60	-80	V
IEBO	V _{EB} =-6V	-100max		μA
V(BR)CEO	I _C =-25mA	-60min	-80min	V
h _{FE}	V _{CE} =-4V, I _C =-1A	40min		
V _{CE(sat)}	I _C =-2A, I _B =-0.2A	-0.5max		V
f _T	V _{CE} =-12V, I _E =0.2A	15typ		MHz
COB	V _{CB} =-10V, f=1MHz	90typ		pF

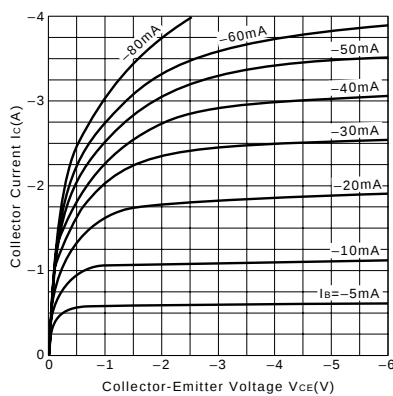
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-12	6	-2	-10	5	-200	200	0.25typ	0.75typ	0.25typ

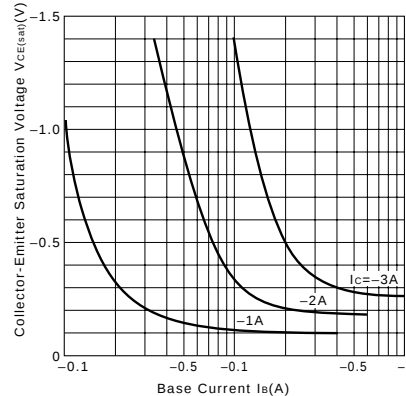
External Dimensions FM20 (TO220F)



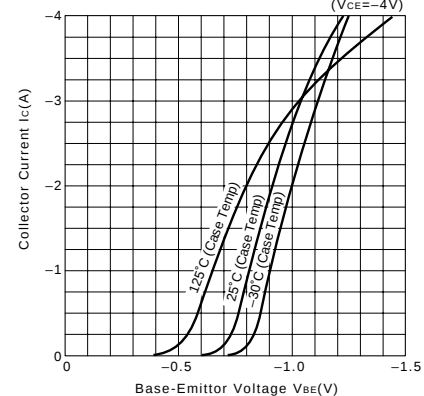
I_C-V_{CE} Characteristics (Typical)



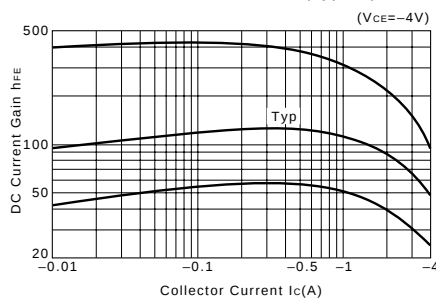
V_{CE(sat)}-I_B Characteristics (Typical)



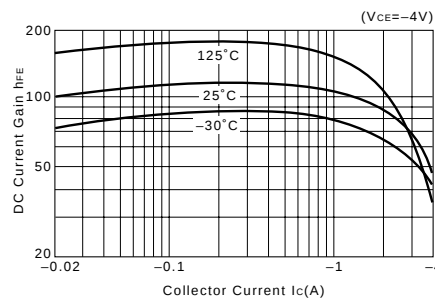
I_C-V_{BE} Temperature Characteristics (Typical)



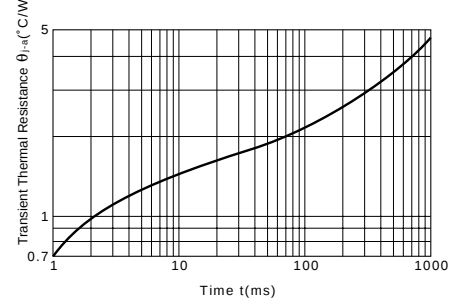
$h_{FE}-I_C$ Characteristics (Typical)



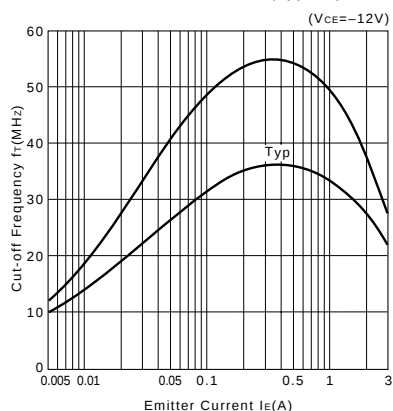
h_{FE} - I_C Temperature Characteristics (Typical)



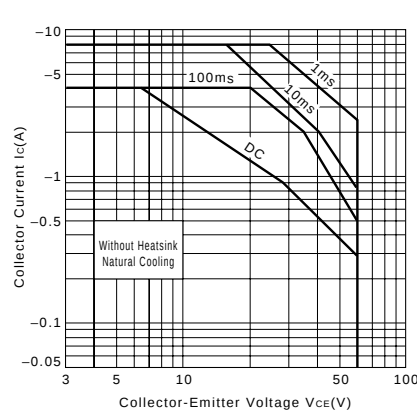
θ_{j-a-t} Characteristics



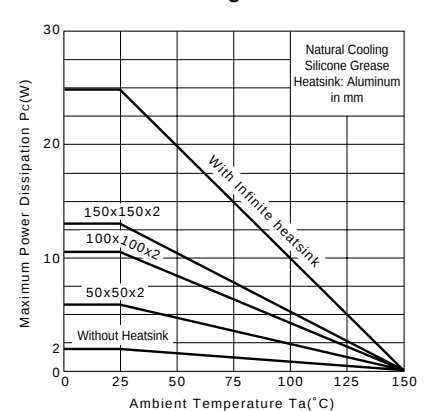
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



Pc-Ta Derating



2SA1492

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3856)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-180	V
V _{CE0}	-180	V
V _{EB0}	-6	V
I _C	-15	A
I _B	-4	A
P _C	130(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

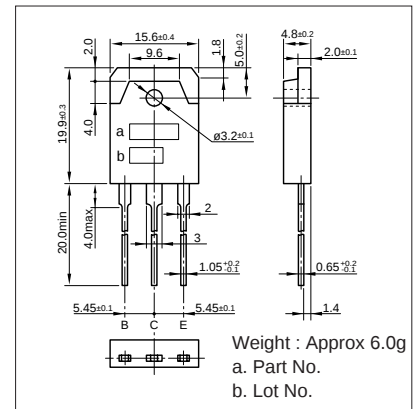
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-180V	-100max	μA
I _{EB0}	V _{EB} =-6V	-100max	μA
V _{(BR)CEO}	I _C =-50mA	-180min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max	V
f _r	V _{CE} =-12V, I _E =0.5A	20typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	500typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

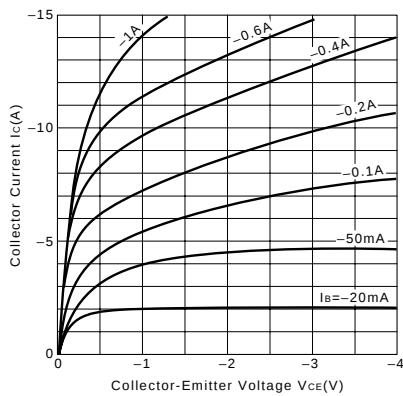
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	4	-10	-10	5	-1	1	0.6typ	0.9typ	0.2typ

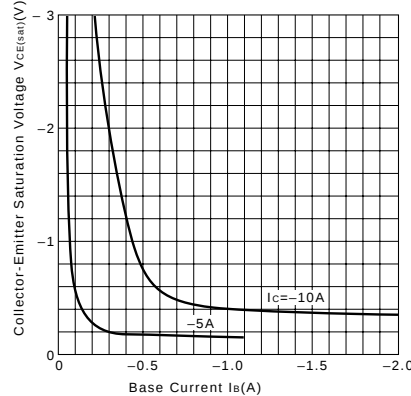
External Dimensions MT-100(TO3P)



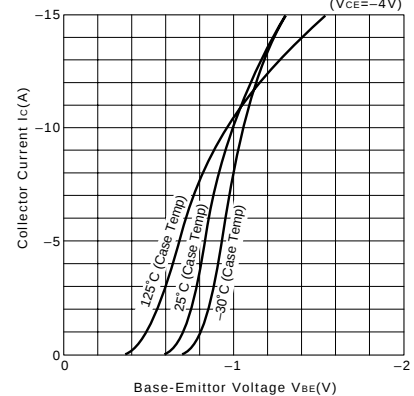
I_C-V_{CE} Characteristics (Typical)



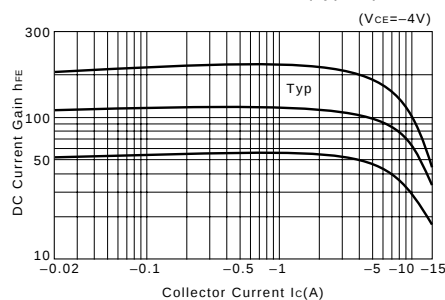
V_{CE(sat)}-I_B Characteristics (Typical)



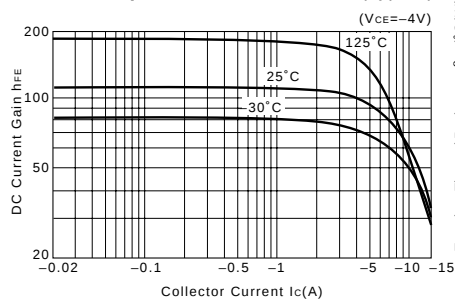
I_C-V_{BE} Temperature Characteristics (Typical)



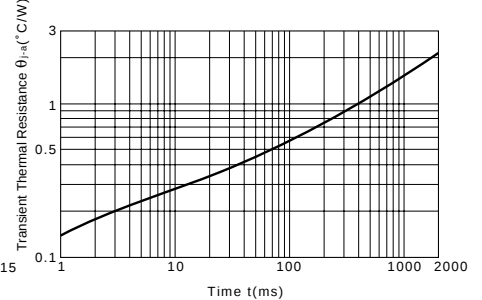
h_{FE}-I_C Characteristics (Typical)



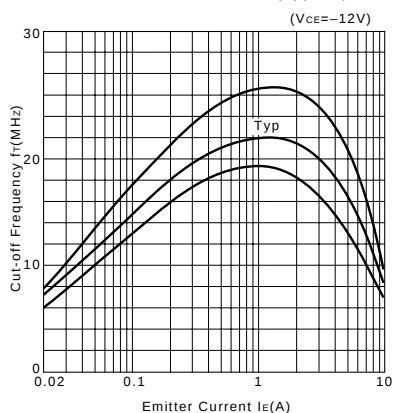
h_{FE}-I_C Temperature Characteristics (Typical)



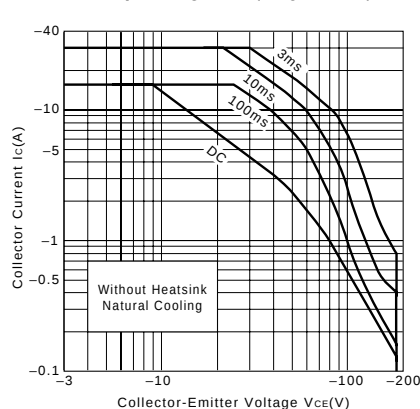
θ_{JA}-t Characteristics



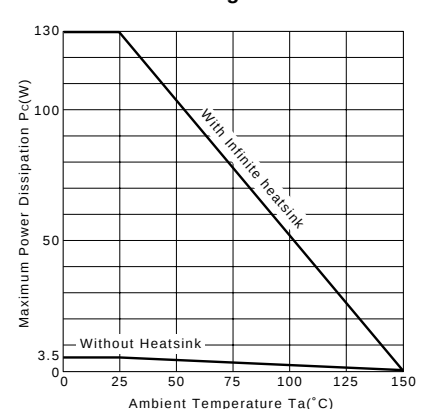
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SA1494

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC3858)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-200	V
V _{CEO}	-200	V
V _{EB0}	-6	V
I _C	-17	A
I _B	-5	A
P _C	200(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

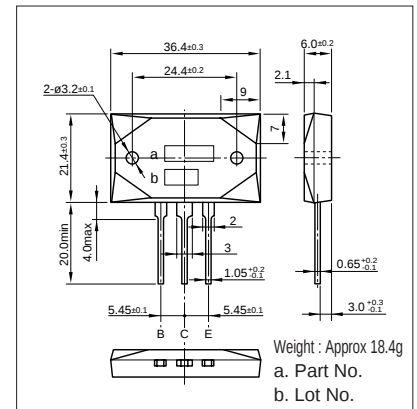
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-200V	-100max	μA
I _{EB0}	V _{EB} =-6V	-100max	μA
V _{(BR)CEO}	I _C =-50mA	-200min	V
h _{FE}	V _{CE} =-4V, I _C =-8A	50min*	
V _{CE(sat)}	I _C =-10A, I _B =-1A	-2.5max	V
f _T	V _{CE} =-12V, I _E =1A	20typ	MHz
COB	V _{CB} =-10V, f=1MHz	500typ	pF

*h_{FE} Rank Y(50to100), P(70to140), G(90to180)

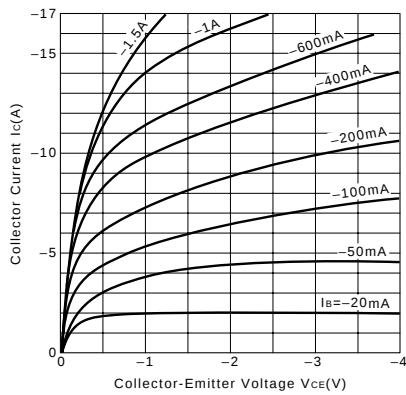
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	4	-10	-10	5	-1	1	0.6typ	0.9typ	0.2typ

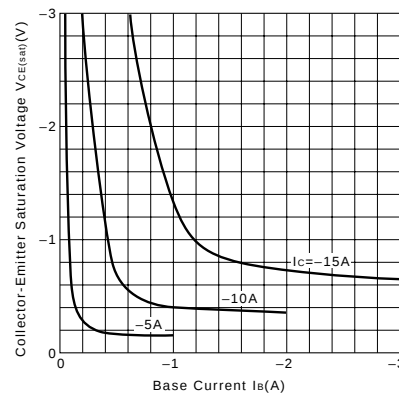
External Dimensions MT-200



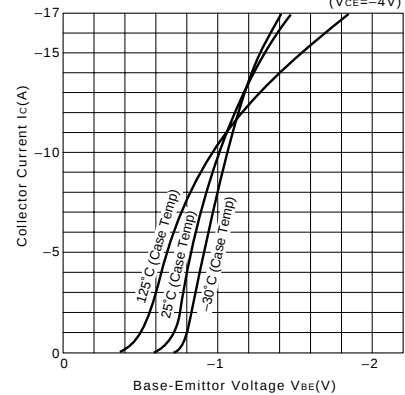
I_C-V_{CE} Characteristics (Typical)



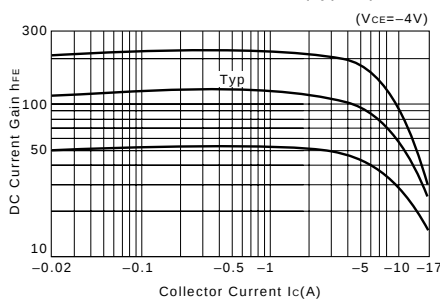
V_{CE(sat)}-I_B Characteristics (Typical)



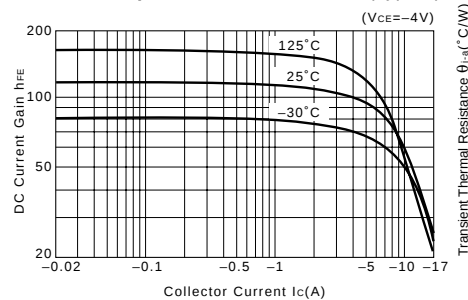
I_C-V_{BE} Temperature Characteristics (Typical)



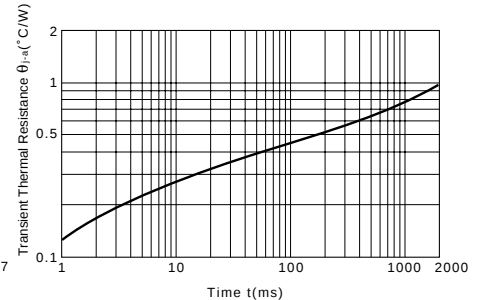
h_{FE}-I_C Characteristics (Typical)



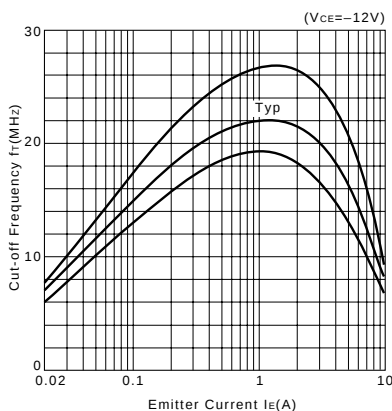
h_{FE}-I_C Temperature Characteristics (Typical)



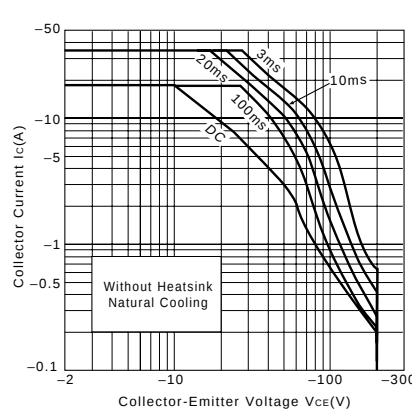
θ_{j-a}-t Characteristics



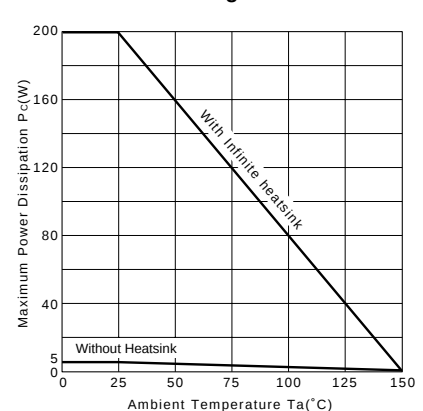
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



Low $V_{CE}(\text{sat})$

2SA1567

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4064)

Application : DC Motor Driver, Chopper Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	-50	V
V_{CEO}	-50	V
V_{EBO}	-6	V
I_C	-12	A
I_B	-3	A
P_C	35(Tc=25°C)	W
T_J	150	°C
T_{stg}	-55 to +150	°C

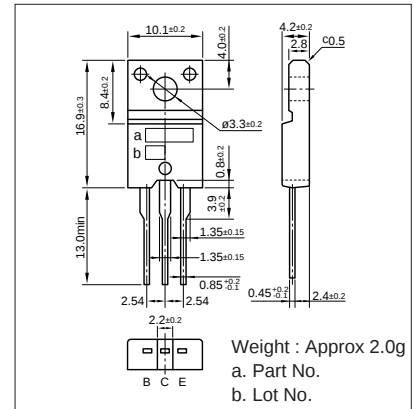
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB} = -50V$	-100max	μA
I_{EBO}	$V_{EB} = -6V$	-100max	μA
$V_{(BR)CEO}$	$I_C = -25mA$	-50min	V
h_{FE}	$V_{CE} = -1V, I_C = -6A$	50min	
$V_{CE(sat)}$	$I_C = -6A, I_B = -0.3A$	-0.35max	V
f_T	$V_{CE} = -12V, I_E = 0.5A$	40typ	MHz
COB	$V_{CB} = -10V, f = 1MHz$	330typ	pF

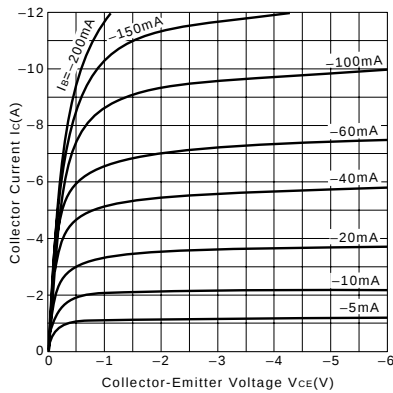
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
-24	4	-6	-10	5	-120	120	0.4typ	0.4typ	0.2typ

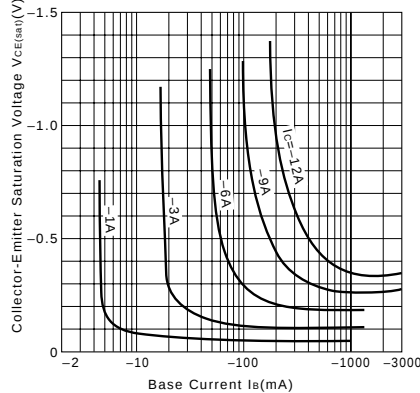
External Dimensions FM20 (TO220F)



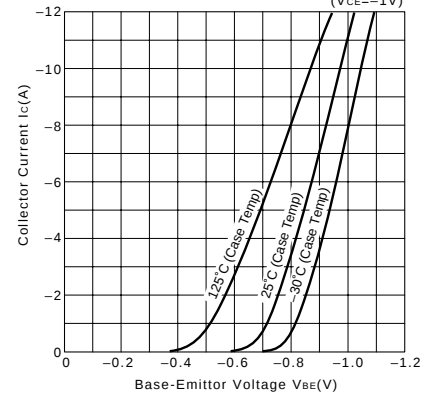
$I_C - V_{CE}$ Characteristics (Typical)



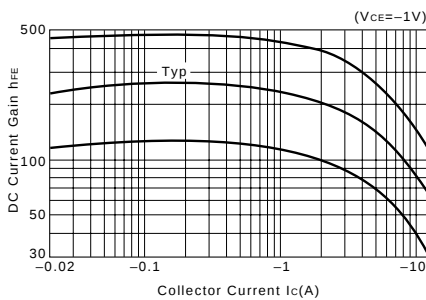
$V_{CE(sat)} - I_B$ Characteristics (Typical)



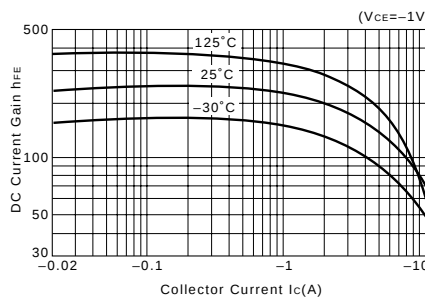
$I_C - V_{BE}$ Temperature Characteristics (Typical)



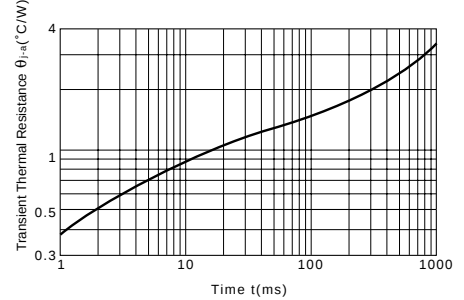
$h_{FE} - I_C$ Characteristics (Typical)



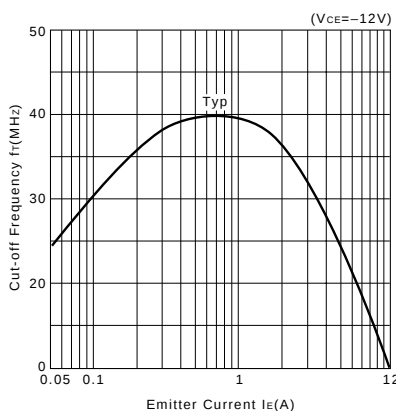
$h_{FE} - I_C$ Temperature Characteristics (Typical)



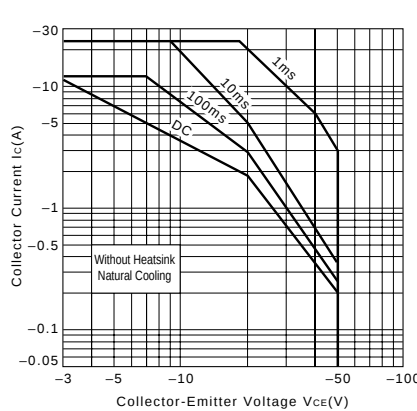
$\theta_{JA} - t$ Characteristics



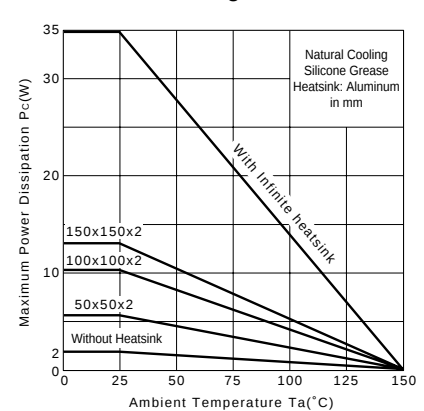
$f_T - I_E$ Characteristics (Typical)



Safe Operating Area (Single Pulse)

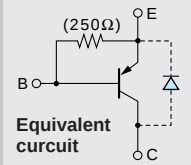


$P_C - T_a$ Derating



Built-in Diode at C-E
Low $V_{CE}(\text{sat})$

2SA1568



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4065)

Application : DC Motor Driver, Chopper Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CB0}	-60	V
V_{CE0}	-60	V
V_{EB0}	-6	V
I_C	± 12	A
I_B	-3	A
P_C	35 (Tc=25°C)	W
T_j	150	°C
T_{stg}	-55 to +150	°C

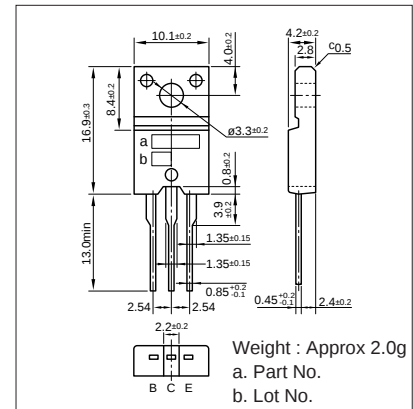
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB} = -60V$	-100max	μA
I_{EBO}	$V_{EB} = -6V$	-60max	mA
$V_{(BR)CEO}$	$I_C = -25mA$	-60min	V
h_{FE}	$V_{CE} = -1V, I_C = -6A$	50min	
$V_{CE(sat)}$	$I_C = -6A, I_B = -0.3A$	-0.35max	V
V_{FEC}	$I_{ECO} = -10A$	-2.5max	V
f_T	$V_{CE} = -12V, I_E = 0.5A$	40typ	MHz
COB	$V_{CB} = -10V, f = 1MHz$	330typ	pF

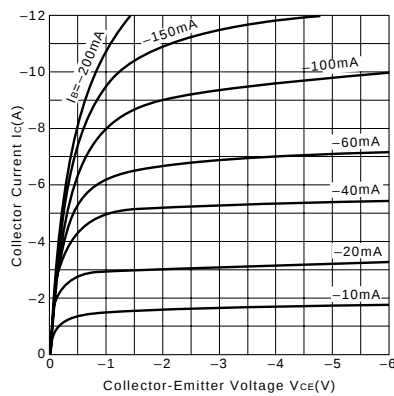
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
-24	4	-6	-10	5	-120	120	0.4typ	0.4typ	0.2typ

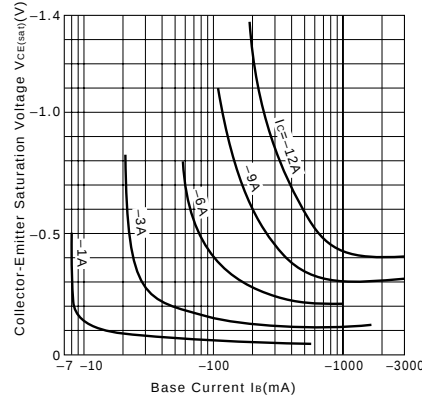
External Dimensions FM20 (TO220F)



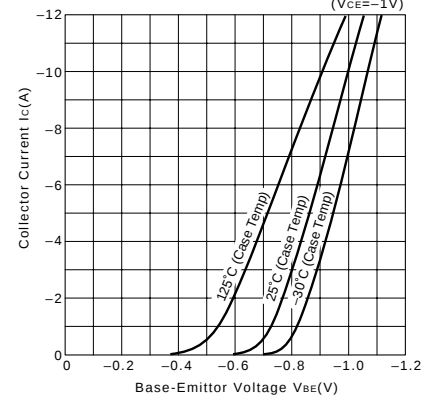
I_C - V_{CE} Characteristics (Typical)



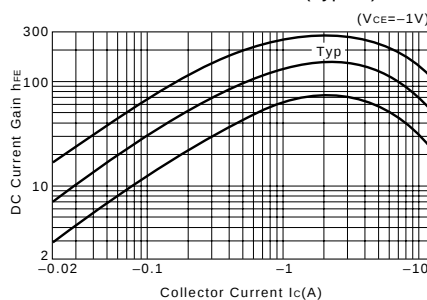
$V_{CE(sat)}$ - I_B Characteristics (Typical)



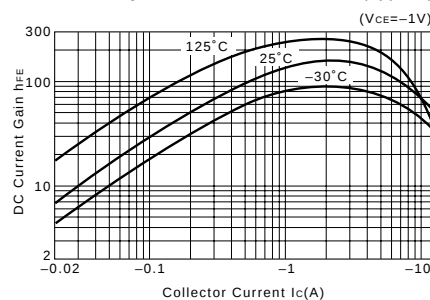
I_C - V_{BE} Temperature Characteristics (Typical)



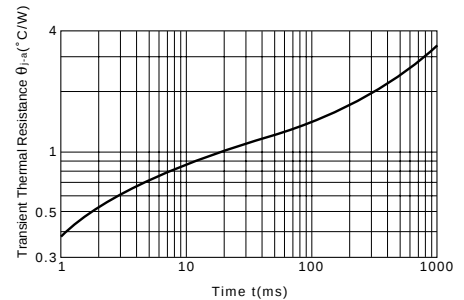
h_{FE} - I_C Characteristics (Typical)



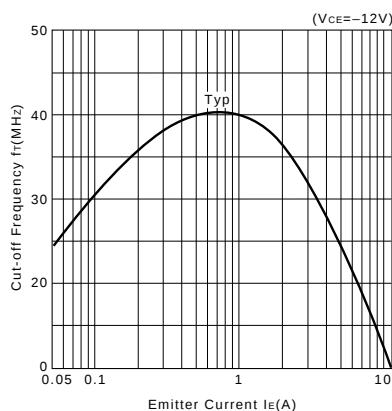
h_{FE} - I_C Temperature Characteristics (Typical)



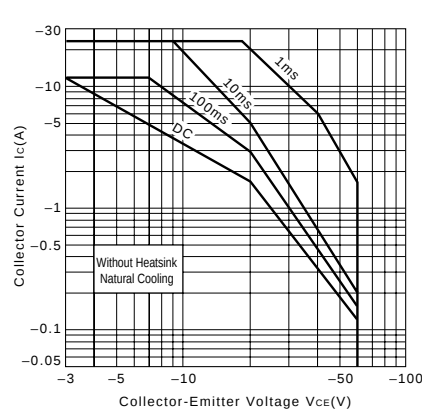
θ_{JA} -t Characteristics



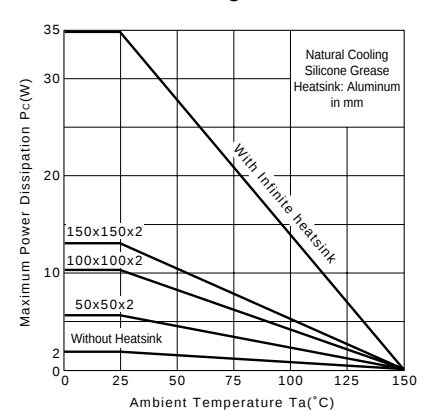
f_T - I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C - T_a Derating



2SA1667/1668

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4381/4382)

Application : TV Vertical Output, Audio Output Driver and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings		Unit
	2SA1667	2SA1668	
V _{CB0}	-150	-200	V
V _{CEO}	-150	-200	V
V _{EB0}	-6		V
I _c	-2		A
I _b	-1		A
P _c	25(Tc=25°C)		W
T _j	150		°C
T _{stg}	-55 to +150		°C

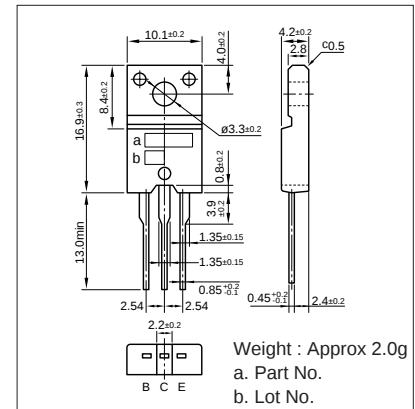
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings		Unit
		2SA1667	2SA1668	
I _{CB0}	V _{CB} =	-10max	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max		μA
V _{(BR)CEO}	I _c =-25mA	-150min	-200min	V
h _{FE}	V _{CE} =-10V, I _c =-0.7A	60min		
V _{CE(sat)}	I _c =-0.7A, I _b =-0.07A	-1.0max		V
f _r	V _{CE} =-12V, I _e =0.2A	20typ		MHz
C _{OB}	V _{CB} =-10V, f=1MHz	60typ		pF

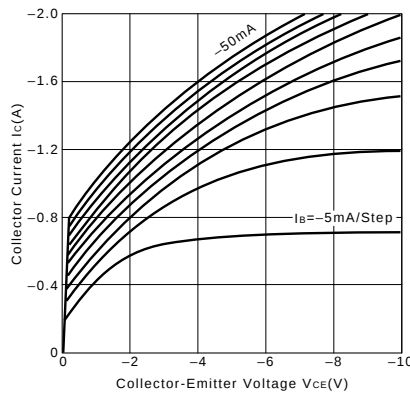
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{b1} (mA)	I _{b2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-20	20	-1	-10	5	-100	100	0.4typ	1.5typ	0.5typ

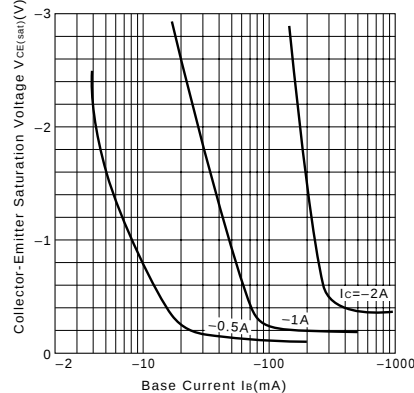
External Dimensions FM20 (TO220F)



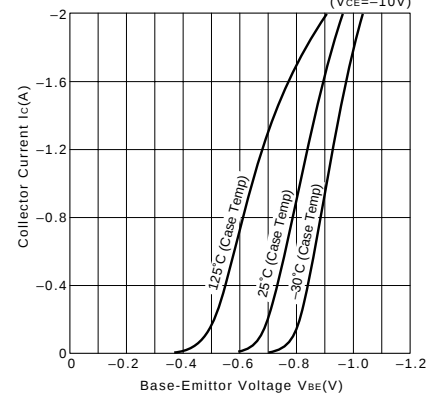
I_c-V_{CE} Characteristics (Typical)



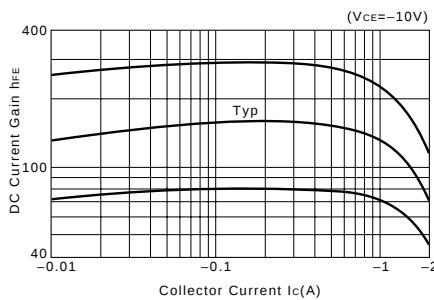
V_{CE(sat)}-I_b Characteristics (Typical)



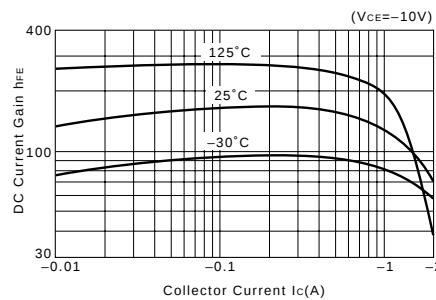
I_c-V_{BE} Temperature Characteristics (Typical)



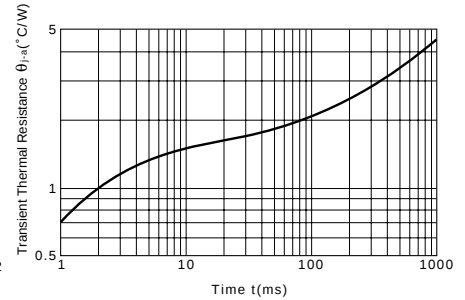
h_{FE}-I_c Characteristics (Typical)



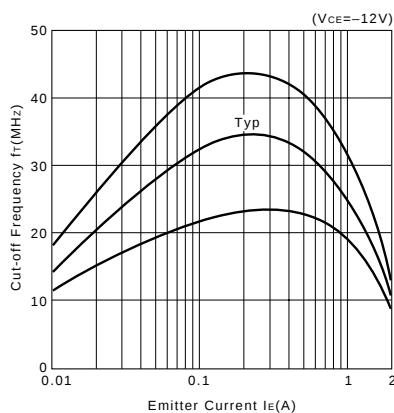
h_{FE}-I_c Temperature Characteristics (Typical)



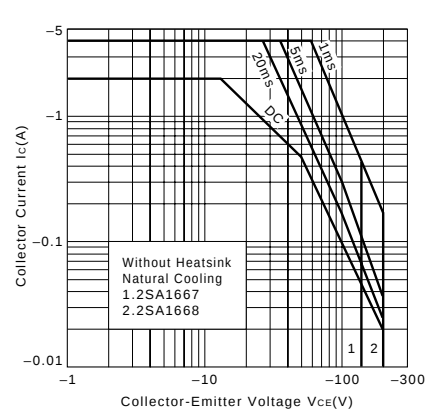
θ_{JA}-t Characteristics



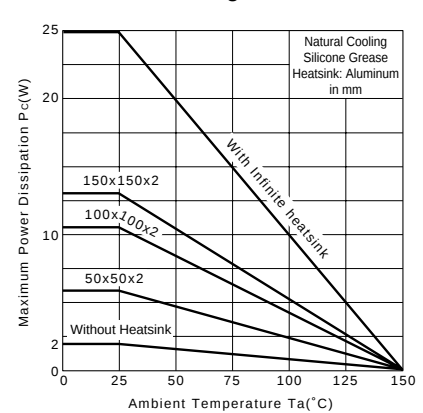
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_c-T_a Derating



2SA1673

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4388)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-180	V
V _{CE0}	-180	V
V _{EB0}	-6	V
I _C	-15	A
I _B	-4	A
P _C	85(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

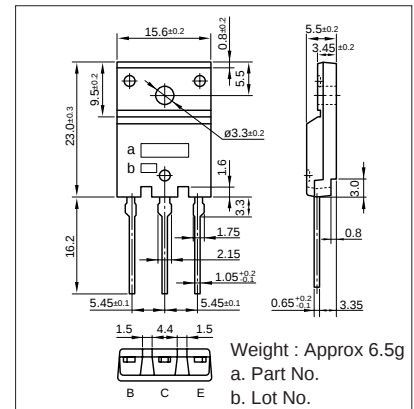
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-180V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-50mA	-180min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-2.0max	V
f _r	V _{CE} =-12V, I _E =0.5A	20typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	500typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

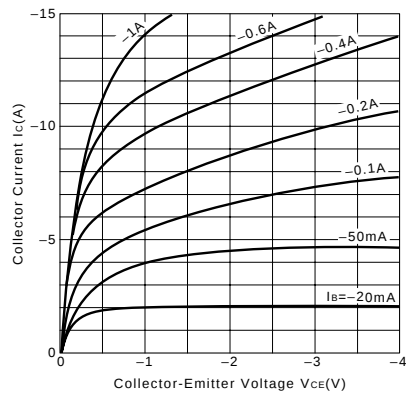
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	4	-10	-10	5	-1	1	0.6typ	0.9typ	0.2typ

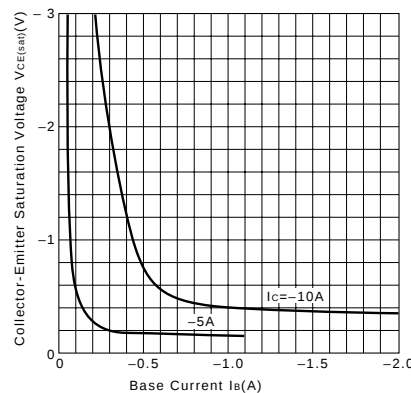
External Dimensions FM100(TO3PF)



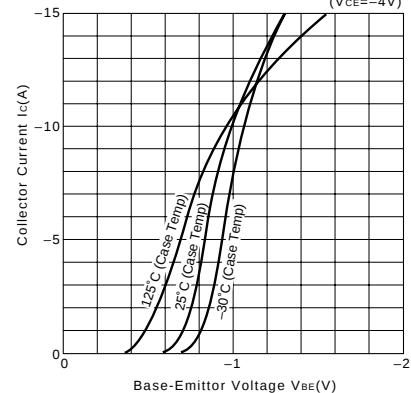
I_C-V_{CE} Characteristics (Typical)



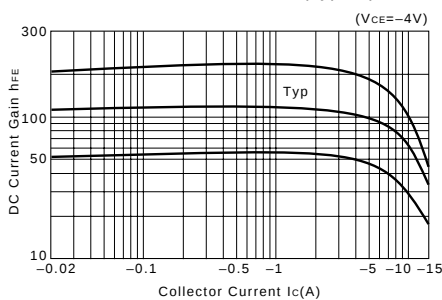
V_{CE(sat)}-I_B Characteristics (Typical)



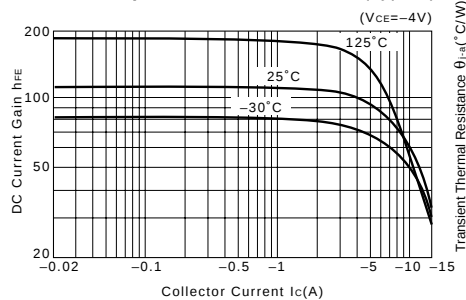
I_C-V_{BE} Temperature Characteristics (Typical)



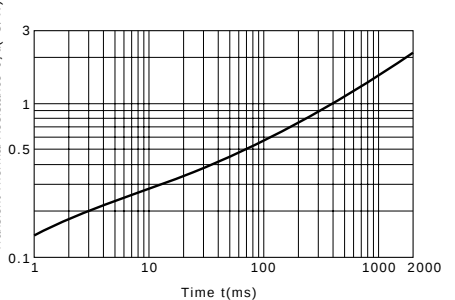
h_{FE}-I_C Characteristics (Typical)



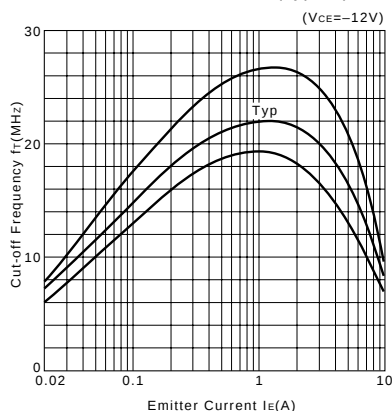
h_{FE}-I_C Temperature Characteristics (Typical)



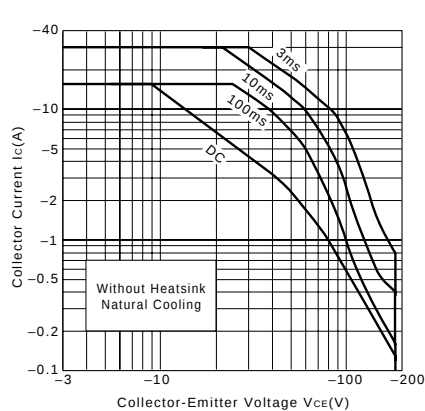
θ_{JA}-t Characteristics



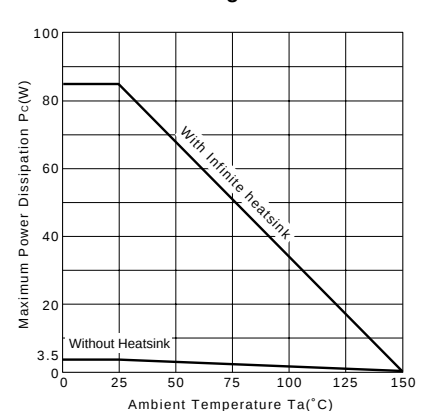
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SA1693

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4466)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	−80	V
VCEO	−80	V
VEBO	−6	V
IC	−6	A
IB	−3	A
PC	60(Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

■Electrical Characteristics (Ta=25°C)

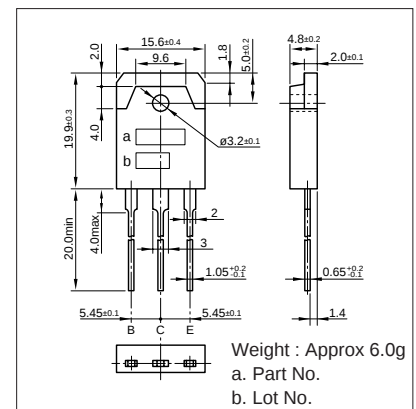
Symbol	Conditions	Ratings	Unit
ICBO	$V_{CB} = -80V$	-10max	μA
IEBO	$V_{EB} = -6V$	-10max	μA
$V_{(BR)CEO}$	$I_C = -50mA$	-80min	V
h_{FE}	$V_{CE} = -4V, I_C = -2A$	50min*	
$V_{CE(sat)}$	$I_C = -2A, I_B = -0.2A$	-1.5max	V
f_T	$V_{CE} = -12V, I_E = 0.5A$	20typ	MHz
COB	$V_{CB} = -10V, f = 1MHz$	150typ	pF

*hFE Rank $\bar{O}$ (50to100), P(70to140), Y(90to180)

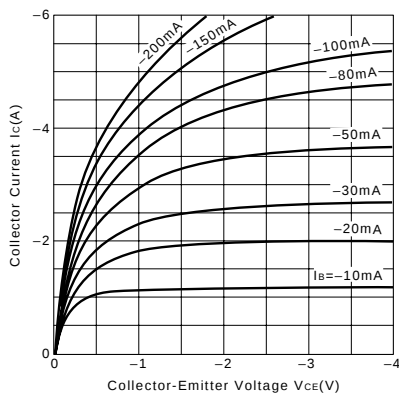
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-30	10	-3	-10	5	-0.3	0.3	0.18typ	1.10typ	0.21typ

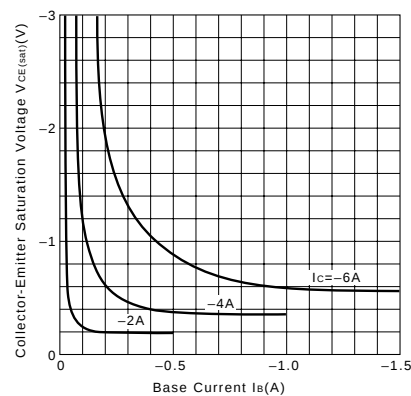
External Dimensions MT-100(TO3P)



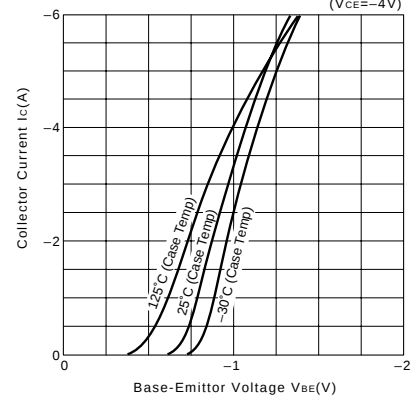
I_C-V_{CE} Characteristics (Typical)



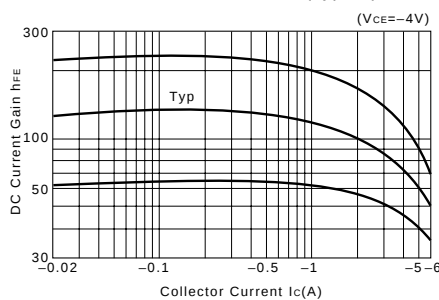
V_{CE(sat)}-I_B Characteristics (Typical)



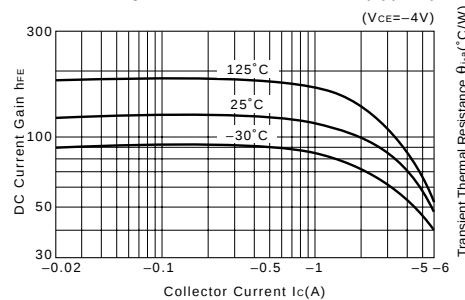
I_C-V_{BE} Temperature Characteristics (Typical)



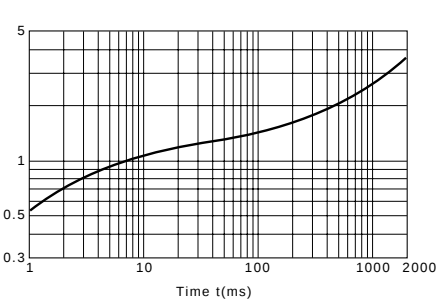
h_{FE} - I_C Characteristics (Typical)



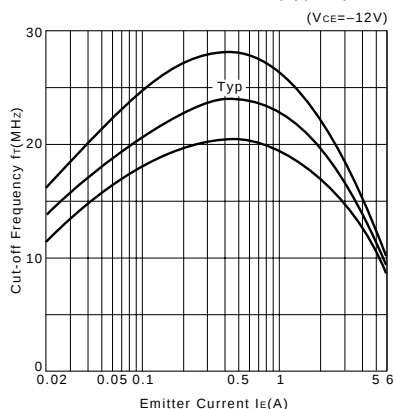
h_{FE} - I_C Temperature Characteristics (Typical)



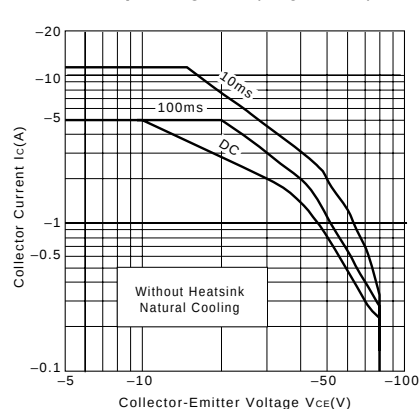
θ_{j-a-t} Characteristics



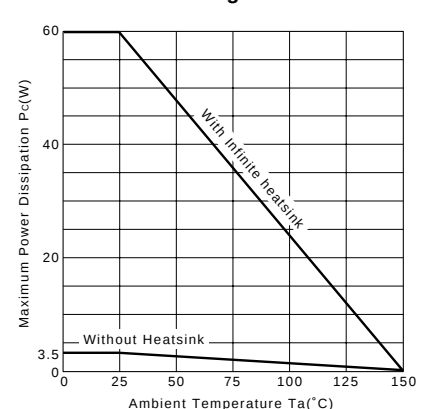
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



Pc-Ta Derating



2SA1694

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4467)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-120	V
V _{CEO}	-120	V
V _{EB0}	-6	V
I _C	-8	A
I _B	-3	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

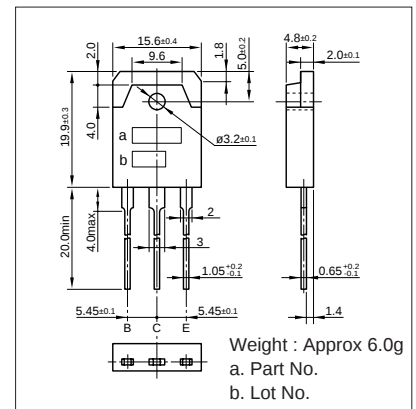
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-120V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-50mA	-120min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	50min*	
V _{CE(sat)}	I _C =-3A, I _B =-0.3A	-1.5max	V
f _r	V _{CE} =-12V, I _E =0.5A	20typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	300typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

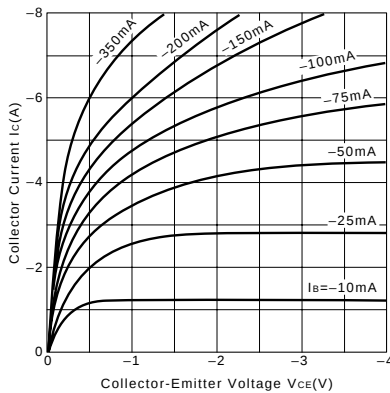
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	10	-4	-10	5	-0.4	0.4	0.14typ	1.40typ	0.21typ

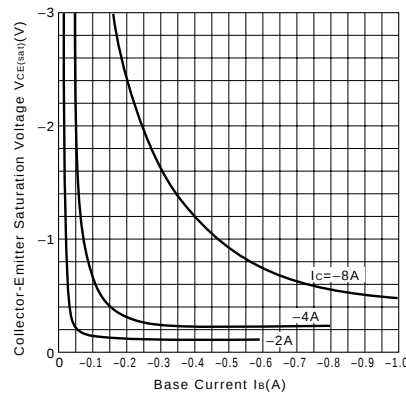
External Dimensions MT-100(TO3P)



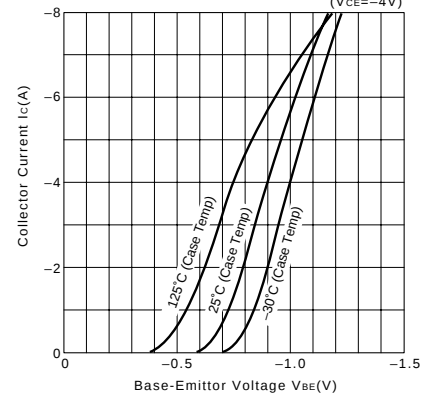
I_C-V_{CE} Characteristics (Typical)



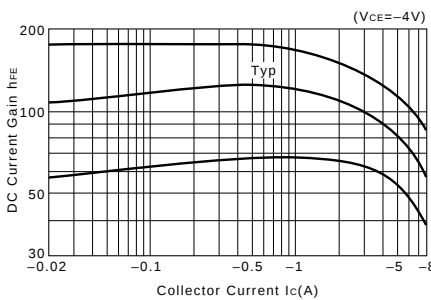
V_{CE(sat)}-I_B Characteristics (Typical)



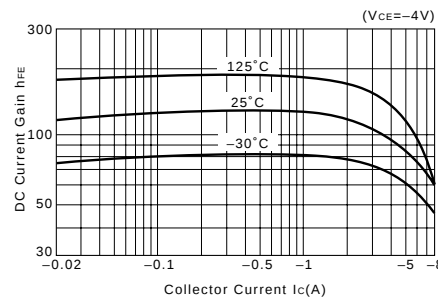
I_C-V_{BE} Temperature Characteristics (Typical)



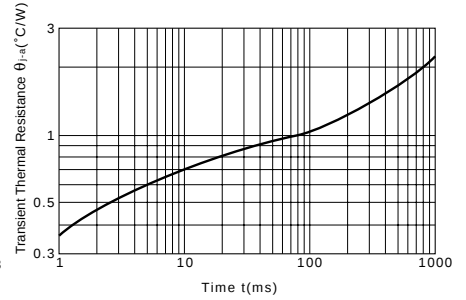
h_{FE}-I_C Characteristics (Typical)



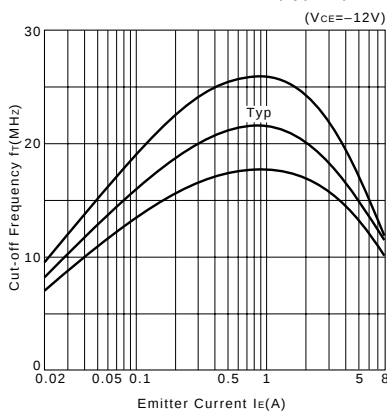
h_{FE}-I_C Temperature Characteristics (Typical)



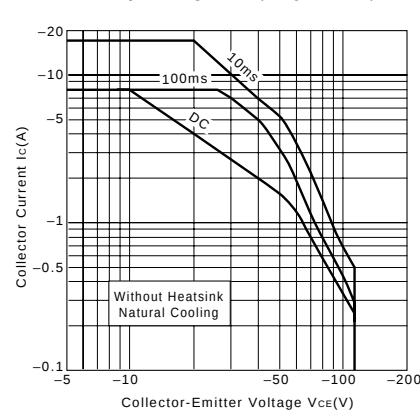
θ_{j-a}-t Characteristics



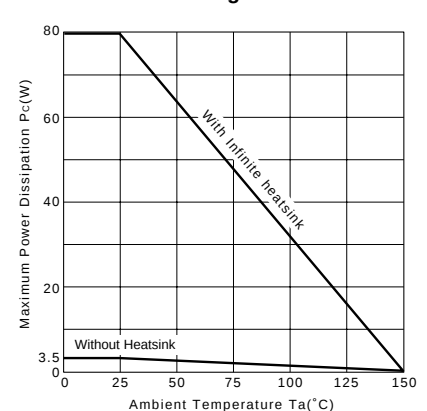
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SA1695

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4468)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-140	V
V _{CE0}	-140	V
V _{EB0}	-6	V
I _C	-10	A
I _B	-4	A
P _C	100(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

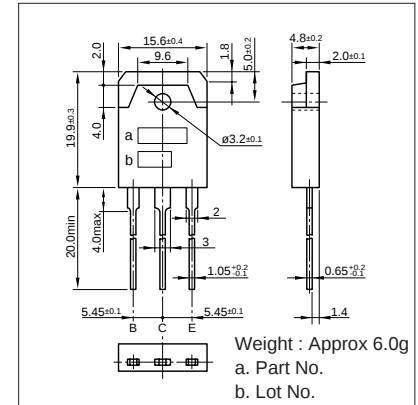
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-140V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-50mA	-140min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-0.5max	V
f _T	V _{CE} =-12V, I _E =0.5A	20typ	MHz
COB	V _{CB} =-10V, f=1MHz	400typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

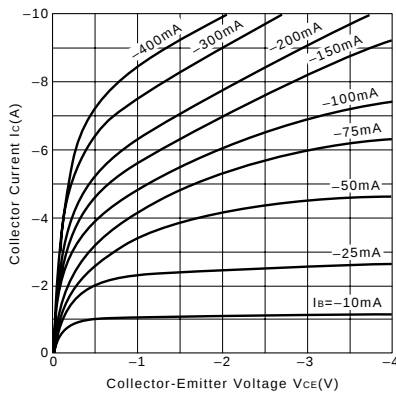
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	-10	5	-0.5	0.5	0.17typ	1.86typ	0.27typ

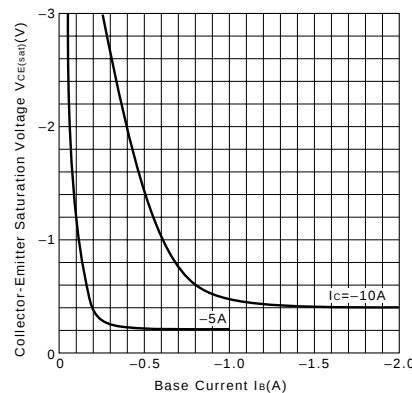
External Dimensions MT-100(TO3P)



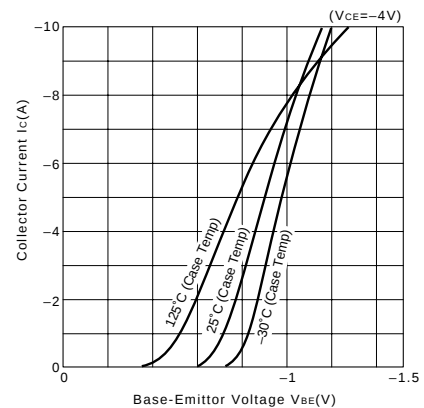
I_C-V_{CE} Characteristics (Typical)



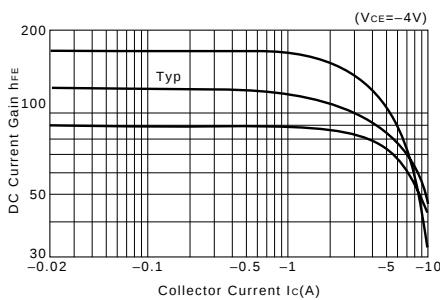
V_{CE(sat)}-I_B Characteristics (Typical)



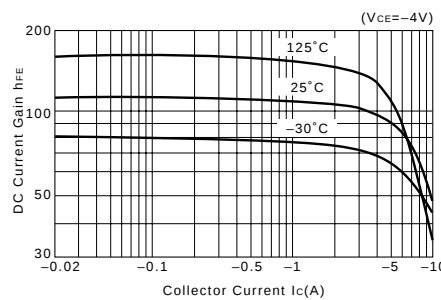
I_C-V_{BE} Temperature Characteristics (Typical)



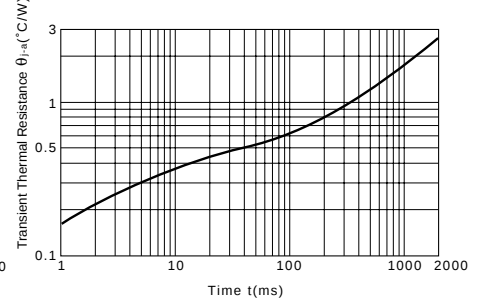
h_{FE}-I_C Characteristics (Typical)



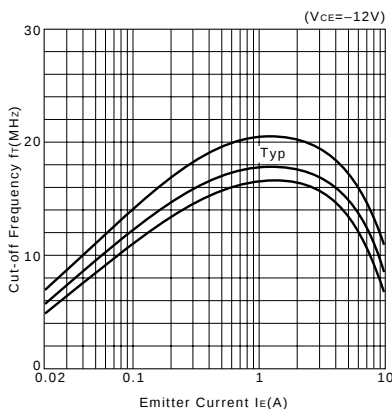
h_{FE}-I_C Temperature Characteristics (Typical)



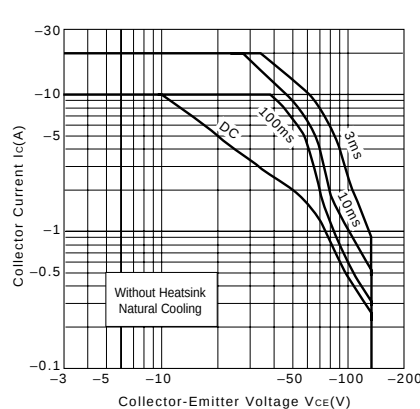
θ_{JA}-t Characteristics



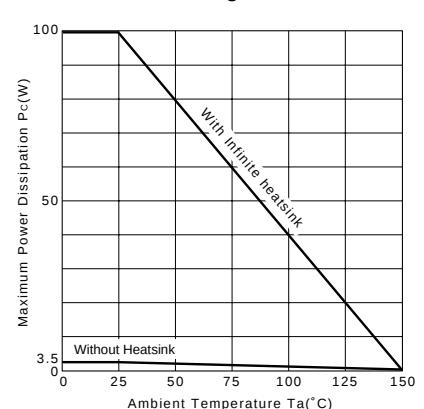
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SA1725

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4511)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-80	V
V _{CEO}	-80	V
V _{EB0}	-6	V
I _C	-6	A
I _B	-3	A
P _C	30(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

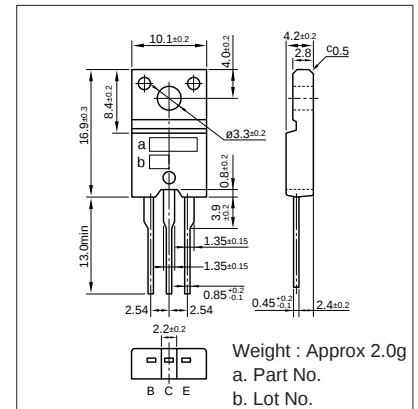
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-80V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-25mA	-80min	V
h _{FE}	V _{CE} =-4V, I _C =-2A	50min*	
V _{CE(sat)}	I _C =-2A, I _B =-0.2A	-0.5max	V
f _T	V _{CE} =-12V, I _E =0.5A	20typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	150typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

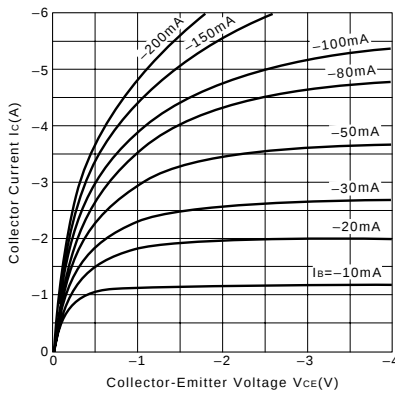
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-30	10	-3	-10	5	-0.3	0.3	0.18typ	1.10typ	0.21typ

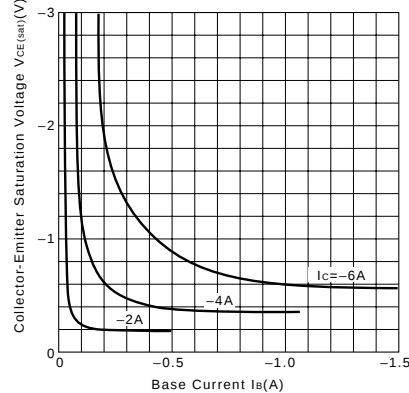
External Dimensions FM20(TO220F)



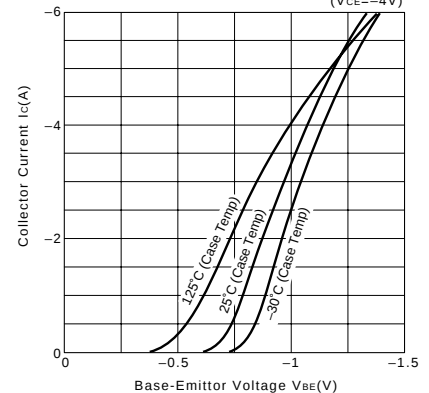
I_C-V_{CE} Characteristics (Typical)



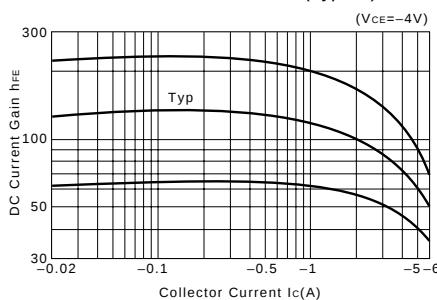
V_{CE(sat)}-I_B Characteristics (Typical)



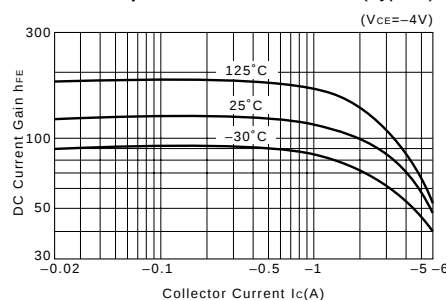
I_C-V_{BE} Temperature Characteristics (Typical)



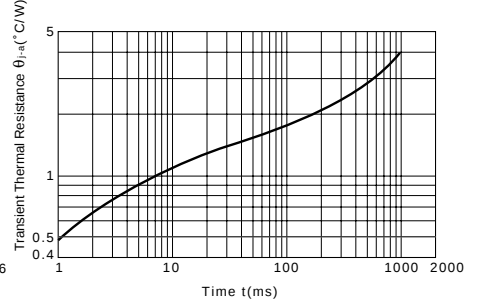
h_{FE}-I_C Characteristics (Typical)



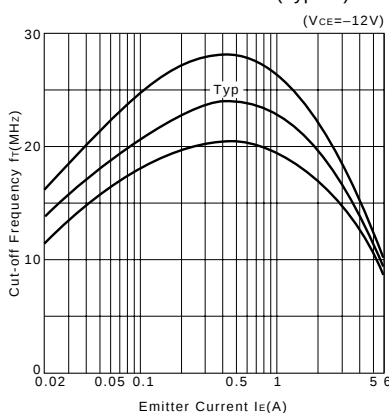
h_{FE}-I_C Temperature Characteristics (Typical)



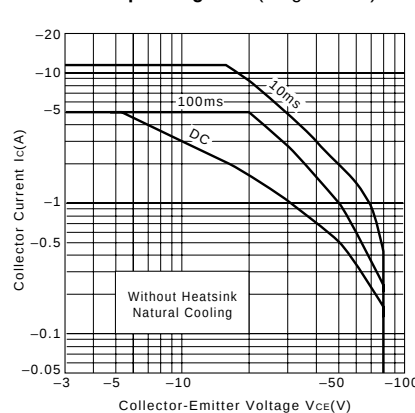
θ_{J-a}-t Characteristics



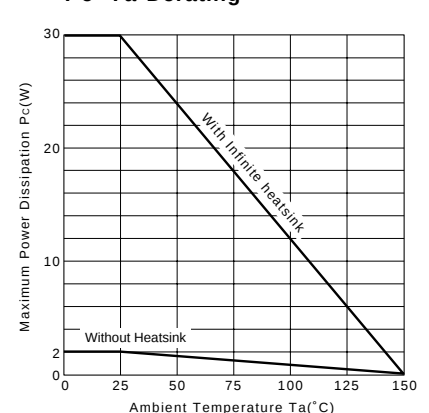
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



Low $V_{CE(sat)}$

2SA1746

Silicon PNP Epitaxial Planar Transistor

Application : Chopper Regulator, Switch and General Purpose

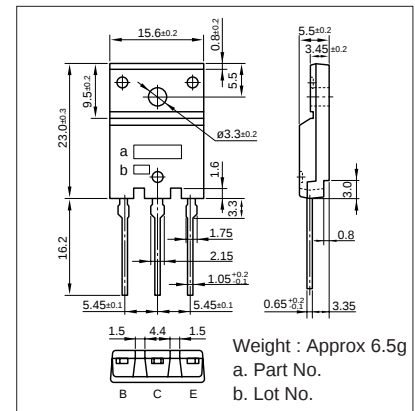
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	-70	V
V_{CEO}	-50	V
V_{EBO}	-6	V
I_C	-12(Pulse-20)	A
I_B	-4	A
P_C	60(Tc=25°C)	W
T_j	150	°C
T_{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB} = -70V$	-10max	μA
I_{EBO}	$V_{EB} = -6V$	-10max	μA
$V_{(BR)CEO}$	$I_C = -25mA$	-50min	V
h_{FE}	$V_{CE} = -1V, I_C = -5A$	50min	
$V_{CE(sat)}$	$I_C = -5A, I_B = -80mA$	-0.5max	V
$V_{BE(sat)}$	$I_C = -5A, I_B = -80mA$	-1.2max	V
f_r	$V_{CE} = -12V, I_E = 1A$	25typ	MHz
COB	$V_{CB} = -10V, f = 1MHz$	400typ	pF

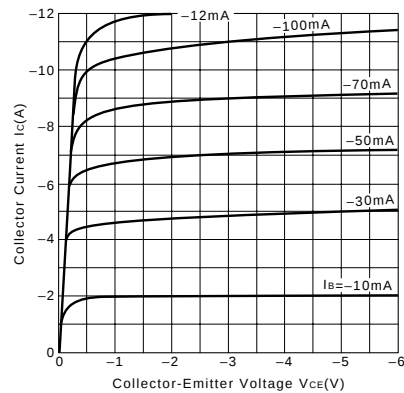
External Dimensions FM100(TO3PF)



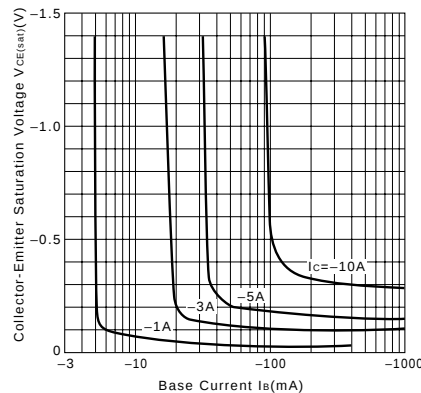
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
-20	4	-5	-10	5	-80	80	0.5typ	0.6typ	0.3typ

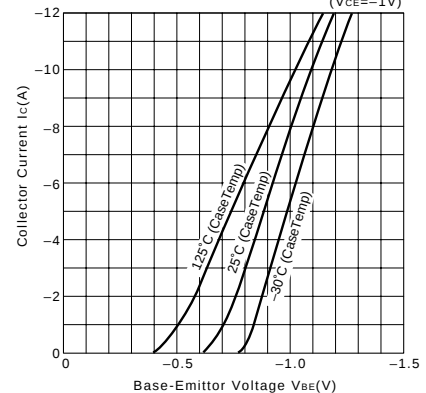
$I_C - V_{CE}$ Characteristics (Typical)



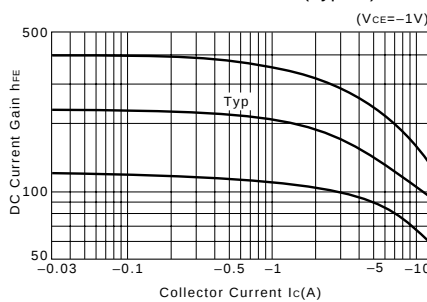
$V_{CE(sat)} - I_B$ Characteristics (Typical)



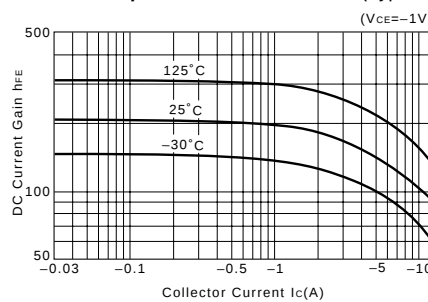
$I_C - V_{BE}$ Temperature Characteristics (Typical)



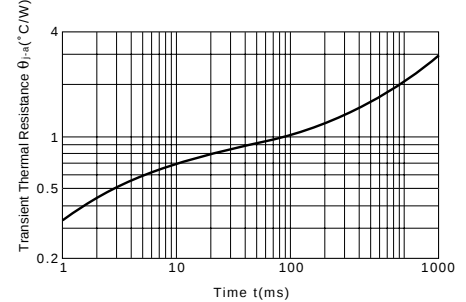
$h_{FE} - I_C$ Characteristics (Typical)



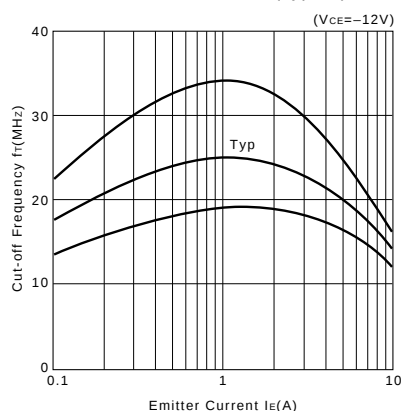
$h_{FE} - I_C$ Temperature Characteristics (Typical)



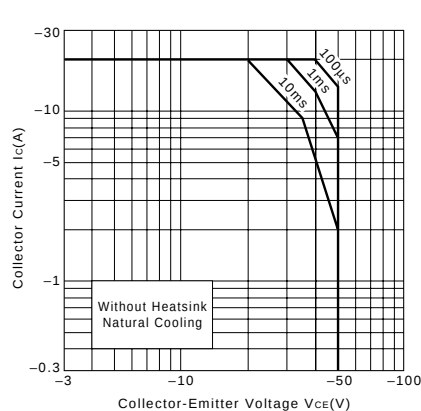
$\theta_{j-a} - t$ Characteristics



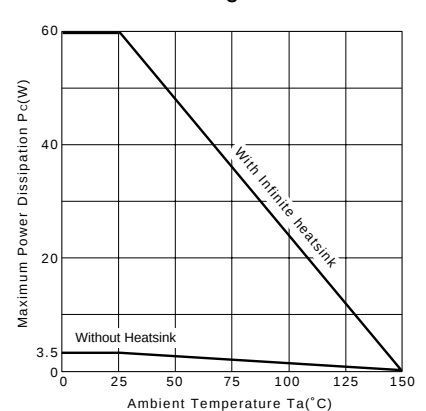
$f_T - I_E$ Characteristics (Typical)



Safe Operating Area (Single Pulse)



$P_C - T_a$ Derating



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC4886)

Application : Audio and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-150	V
V _{CE0}	-150	V
V _{EB0}	-5	V
I _C	-14	A
I _B	-3	A
P _C	80(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

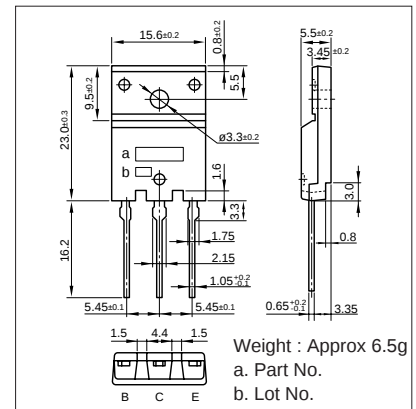
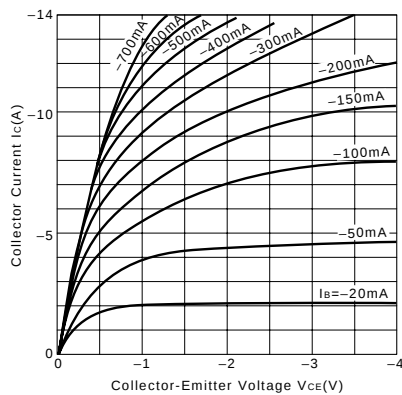
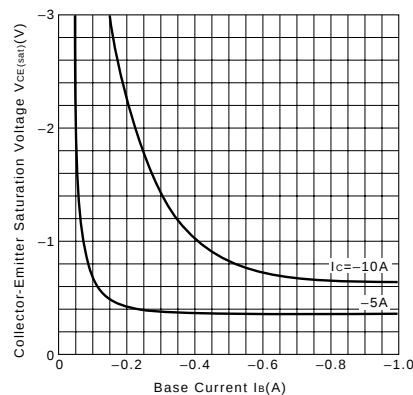
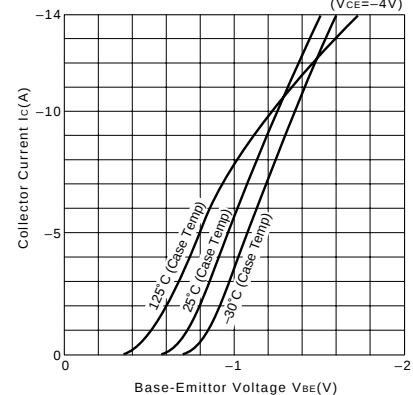
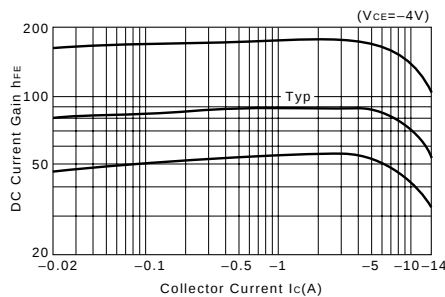
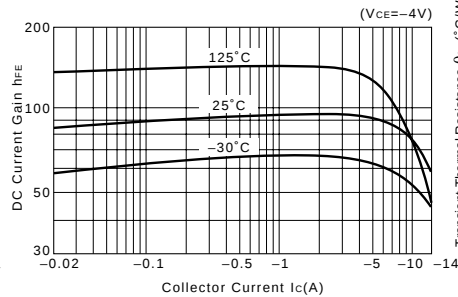
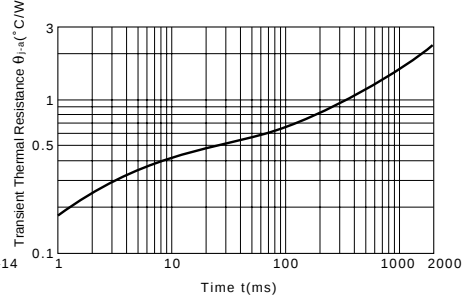
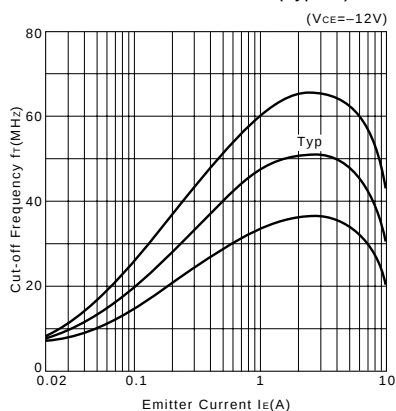
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-150V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-25mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-500mA	-2.0max	V
f _r	V _{CE} =-12V, I _E =2A	50typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	400typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

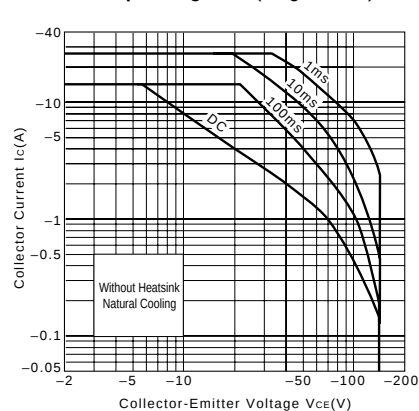
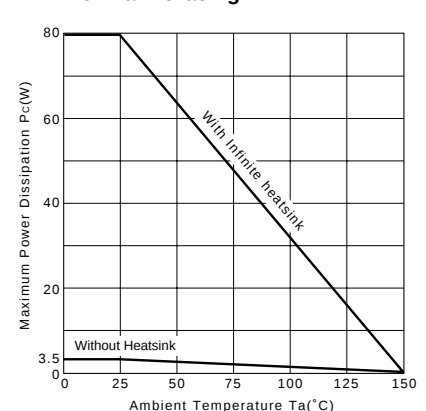
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	-10	5	-500	500	0.25typ	0.85typ	0.2typ

External Dimensions FM100(TO3PF)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{JA}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

2SA1907

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC5099)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-80	V
V _{CE0}	-80	V
V _{EB0}	-6	V
I _C	-6	A
I _B	-3	A
P _C	60(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

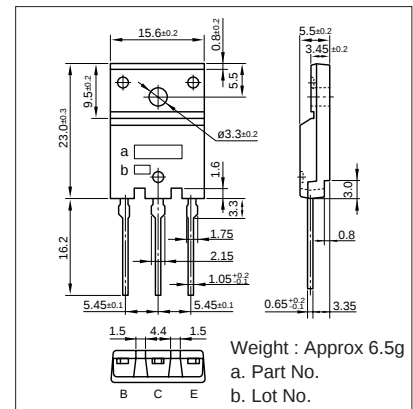
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-80V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-50mA	-80min	V
h _{FE}	V _{CE} =-4V, I _C =-2A	50min*	
V _{CE(sat)}	I _C =-12A, I _B =-0.2A	-0.5max	V
f _T	V _{CE} =-12V, I _E =0.5A	20typ	MHz
COB	V _{CB} =-10V, f=1MHz	150typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

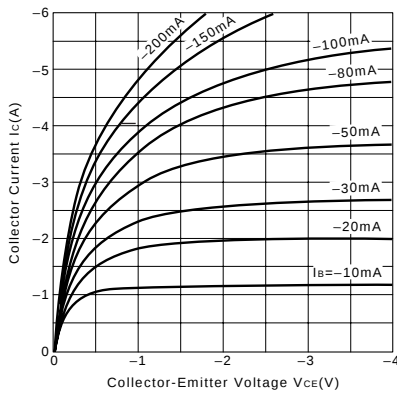
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-30	10	-3	-10	5	-0.3	0.3	0.18typ	1.10typ	0.21typ

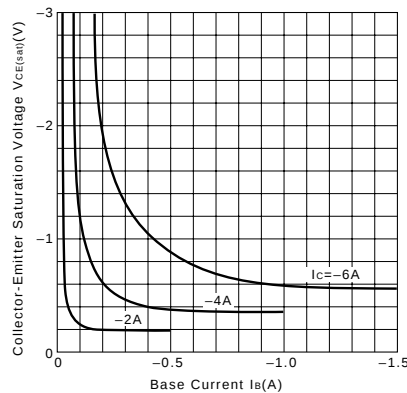
External Dimensions FM100(TO3PF)



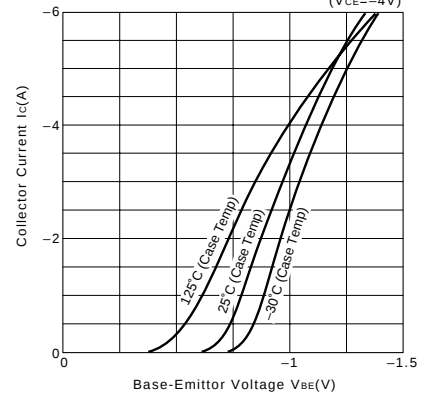
I_C-V_{CE} Characteristics (Typical)



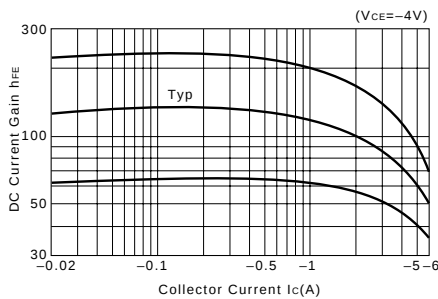
V_{CE(sat)}-I_B Characteristics (Typical)



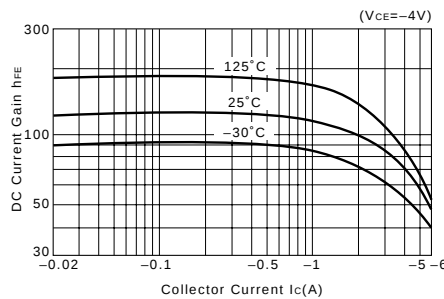
I_C-V_{BE} Temperature Characteristics (Typical)



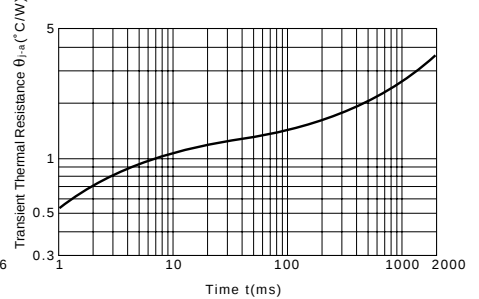
h_{FE}-I_C Characteristics (Typical)



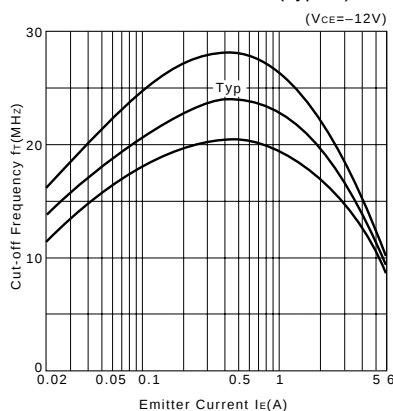
h_{FE}-I_C Temperature Characteristics (Typical)



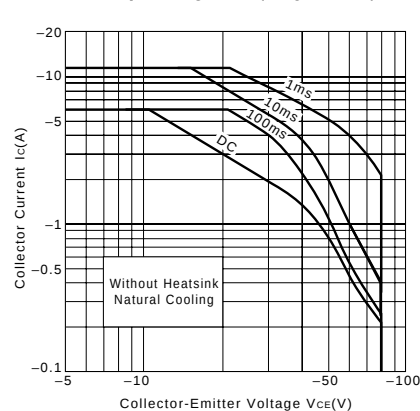
θ_{J-a}-t Characteristics



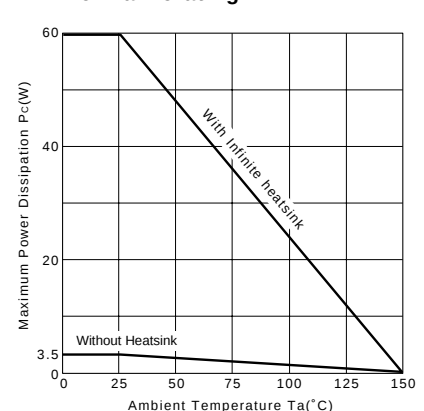
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SA1908

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC5100)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-120	V
V _{CE0}	-120	V
V _{EB0}	-6	V
I _C	-8	A
I _B	-3	A
P _C	75(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

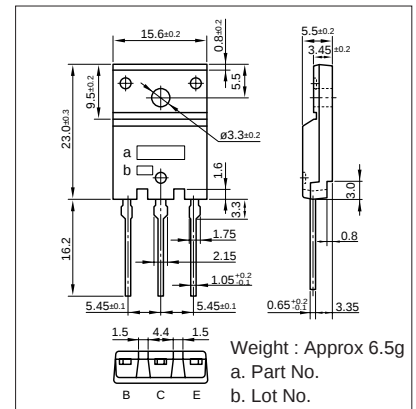
Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =-120V	-10max	μA
I _{EBO}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-50mA	-120min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	50min*	
V _{CE(sat)}	I _C =-3A, I _B =-0.3A	-0.5max	V
f _T	V _{CE} =-12V, I _E =0.5A	20typ	MHz
COB	V _{CB} =-10V, f=1MHz	300typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

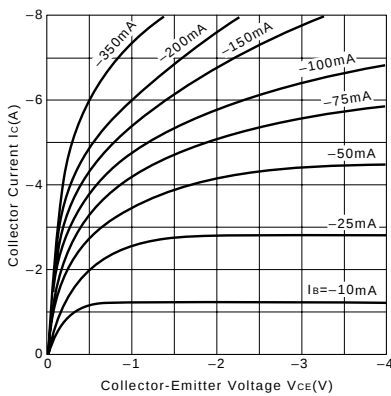
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	10	-4	-10	5	-0.4	0.4	0.14typ	1.40typ	0.21typ

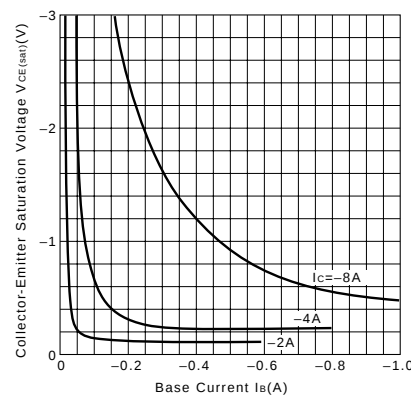
External Dimensions FM100(TO3PF)



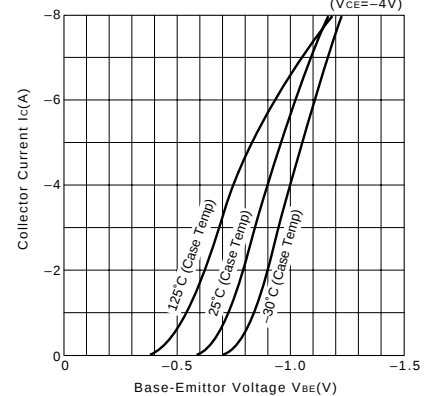
I_C-V_{CE} Characteristics (Typical)



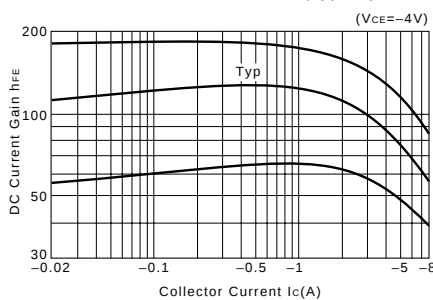
V_{CE(sat)}-I_B Characteristics (Typical)



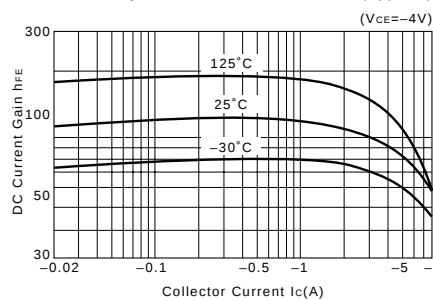
I_C-V_{BE} Temperature Characteristics (Typical)



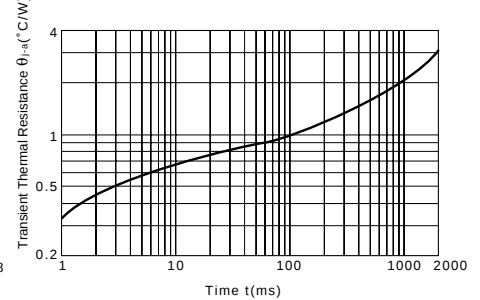
h_{FE}-I_C Characteristics (Typical)



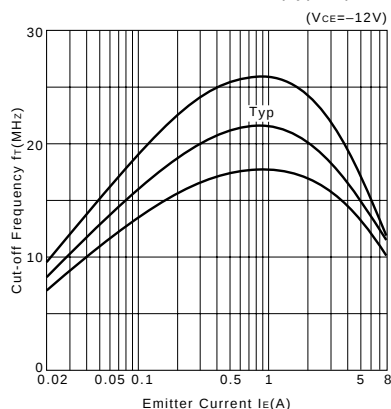
h_{FE}-I_C Temperature Characteristics (Typical)



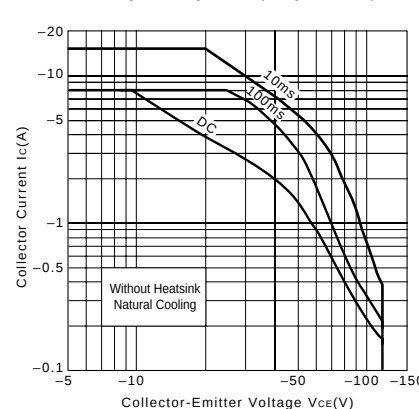
θ_{j-a}-t Characteristics



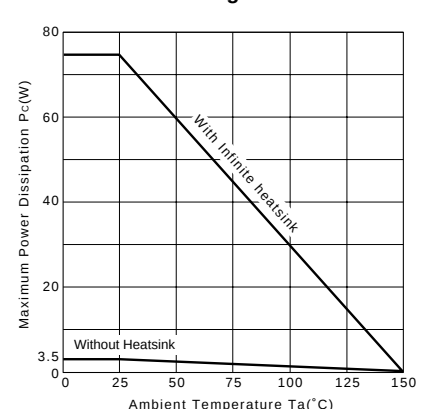
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SA1909

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SC5101)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-140	V
V _{CEO}	-140	V
V _{EB0}	-6	V
I _C	-10	A
I _B	-4	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

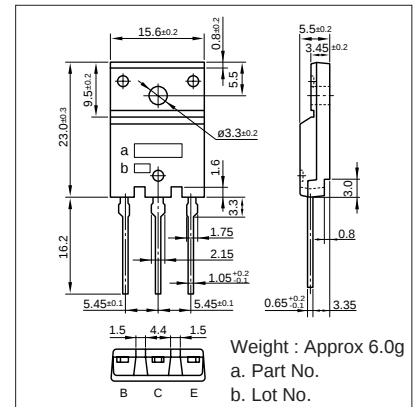
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-140V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-50mA	-140min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	50min*	
V _{CE(sat)}	I _C =-5A, I _B =-0.5A	-0.5max	V
f _T	V _{CE} =-12V, I _E =0.5A	20typ	MHz
COB	V _{CB} =-10V, f=1MHz	400typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

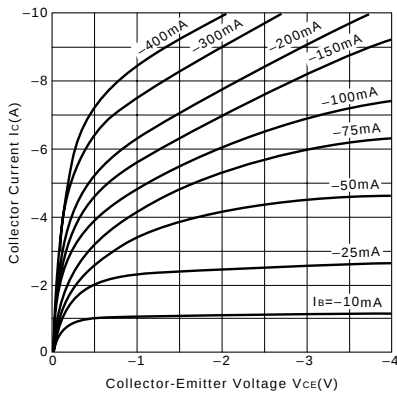
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	12	-5	-10	5	-0.5	0.5	0.17typ	1.86typ	0.27typ

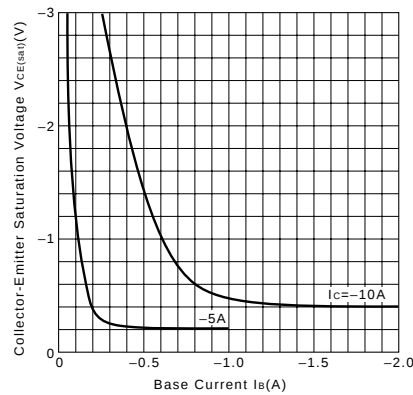
External Dimensions FM100(TO3PF)



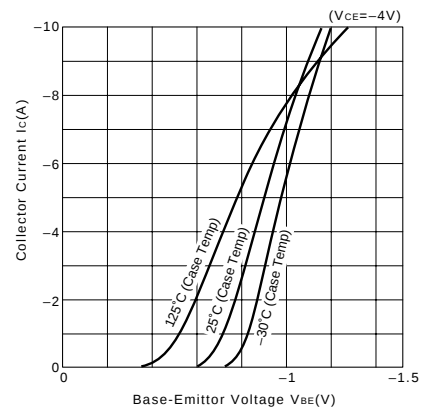
I_C-V_{CE} Characteristics (Typical)



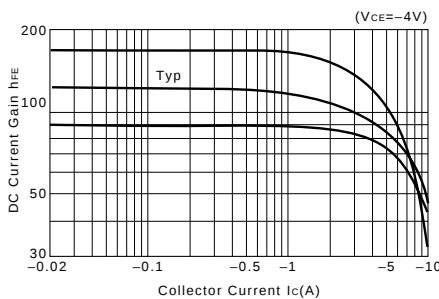
V_{CE(sat)}-I_B Characteristics (Typical)



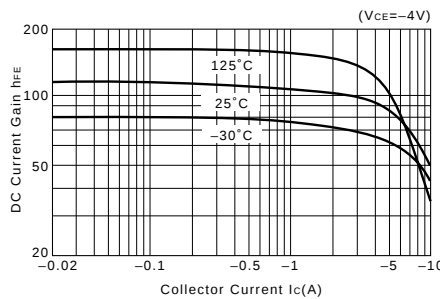
I_C-V_{BE} Temperature Characteristics (Typical)



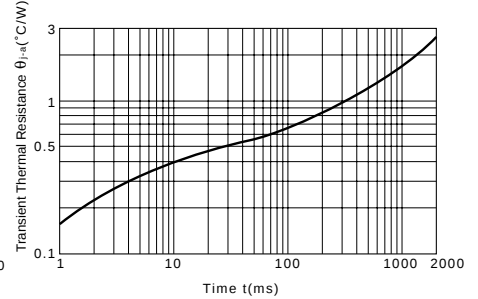
h_{FE}-I_C Characteristics (Typical)



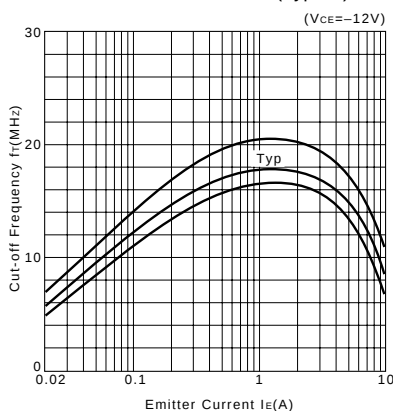
h_{FE}-I_C Temperature Characteristics (Typical)



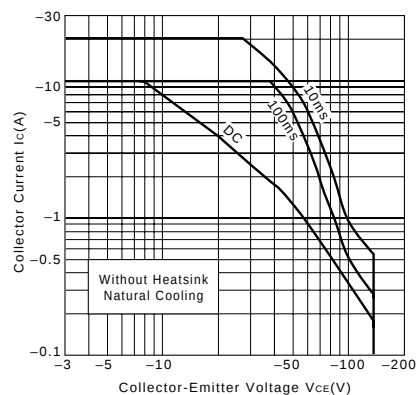
θ_{J-a}-t Characteristics



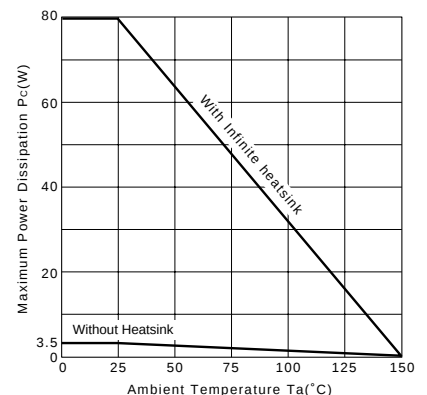
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

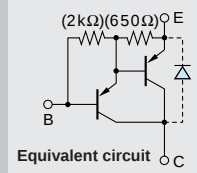


P_C-T_a Derating



Darlington

2SB1257



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2014)

Application : Driver for Solenoid, Relay and Motor and General Purpose

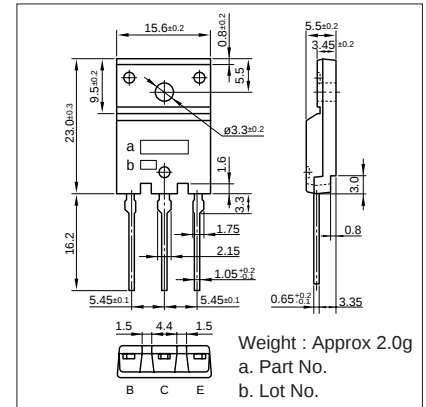
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-60	V
V _{CEO}	-60	V
V _{EB0}	-6	V
I _C	-4(Pulse-6)	A
I _B	-1	A
P _C	25(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

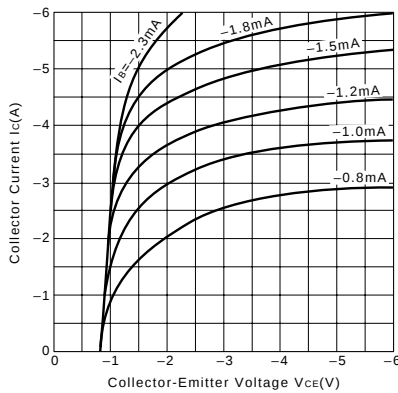
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-60V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-10mA	-60min	V
h _{FE}	V _{CE} =-4V, I _C =-3A	2000min	
V _{CE(sat)}	I _C =-3A, I _B =-6mA	-1.5max	V
V _{BE(sat)}	I _C =-3A, I _B =-6mA	-2max	V
f _r	V _{CE} =-12V, I _E =0.2A	150typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	75typ	pF

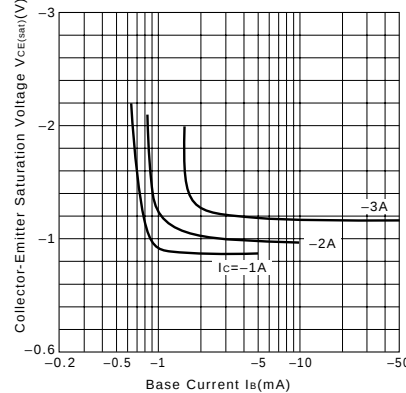
External Dimensions FM20(TO220F)



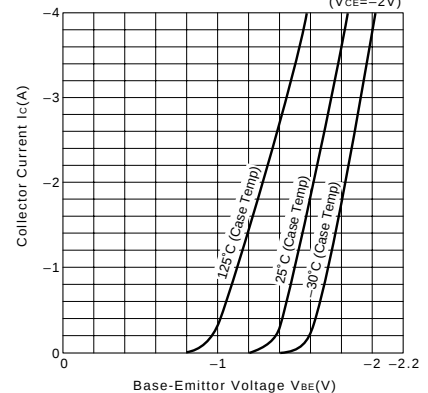
I_C-V_{CE} Characteristics (Typical)



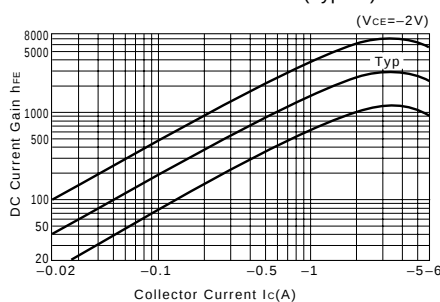
V_{CE(sat)}-I_B Characteristics (Typical)



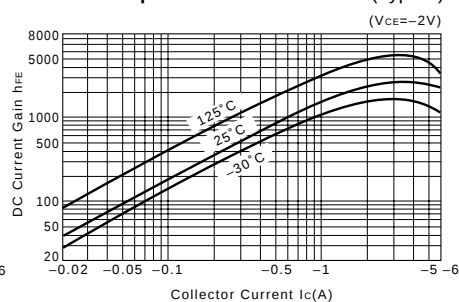
I_C-V_{BE} Temperature Characteristics (Typical)



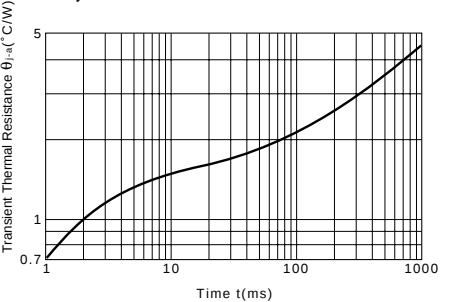
h_{FE}-I_C Characteristics (Typical)



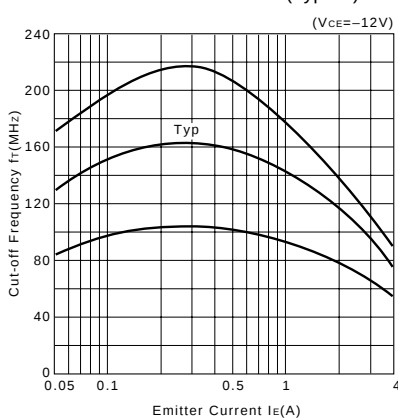
h_{FE}-I_C Temperature Characteristics (Typical)



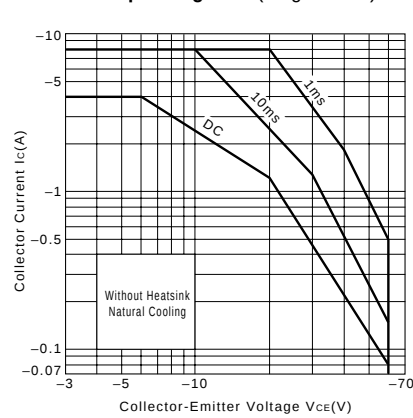
θ_{J-a}-t Characteristics



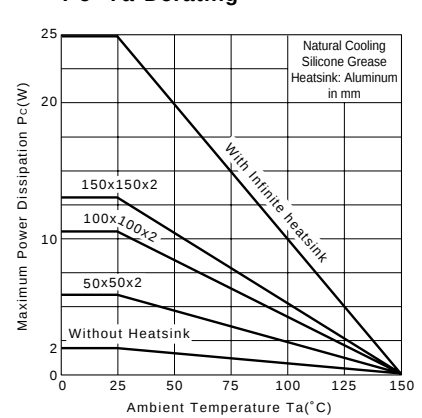
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

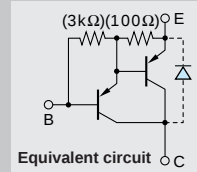


P_C-T_a Derating



Darlington

2SB1258



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD1785)

Application : Driver for Solenoid, Relay and Motor and General Purpose

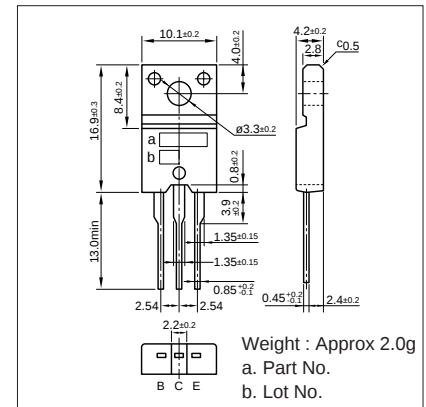
■ **Absolute maximum ratings** (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-100	V
V _{CE0}	-100	V
V _{EB0}	-6	V
I _C	-6(Pulse-10)	A
I _B	-1	A
P _C	30(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

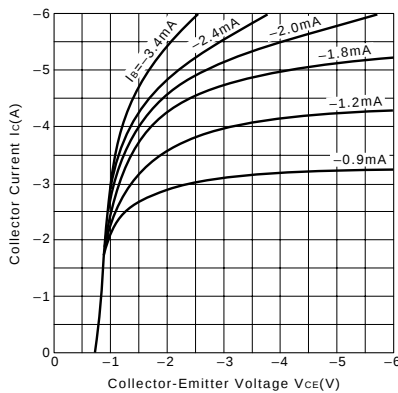
■ **Electrical Characteristics** (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-100V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	μA
V _{(BR)CEO}	I _C =-10mA	-100min	V
h _{FE}	V _{CE} =-2V, I _C =-3A	1000min	
V _{CE(sat)}	I _C =-3A, I _B =-6mA	-1.5max	V
V _{BE(sat)}	I _C =-3A, I _B =-6mA	-2max	V
f _r	V _{CE} =-12V, I _E =0.2A	100typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	100typ	pF

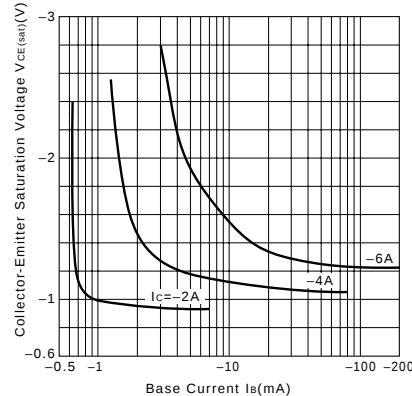
External Dimensions FM20(TO220F)



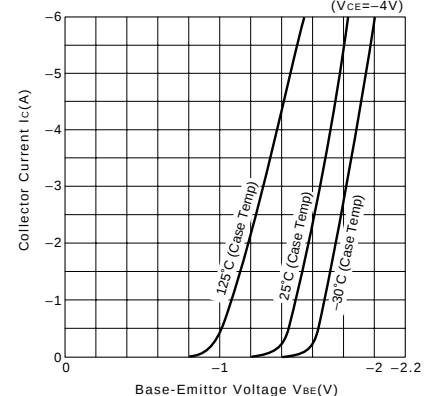
I_C-V_{CE} Characteristics (Typical)



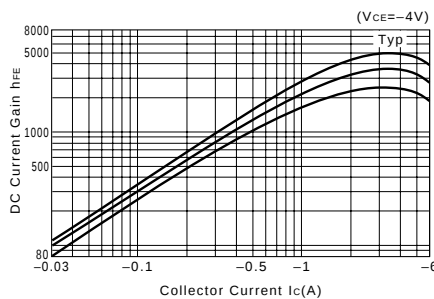
V_{CE(sat)}-I_B Characteristics (Typical)



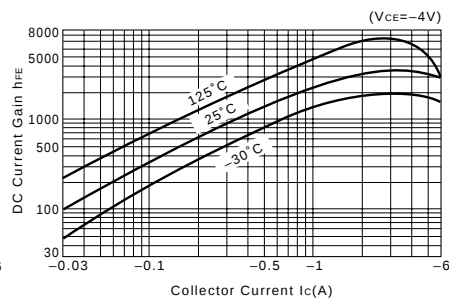
I_C-V_{BE} Temperature Characteristics (Typical)



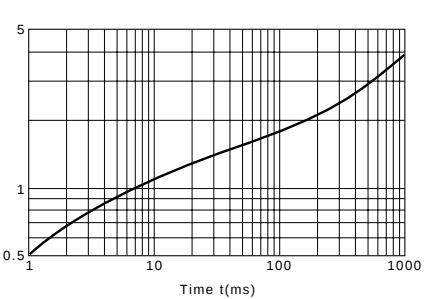
h_{FE}-I_C Characteristics (Typical)



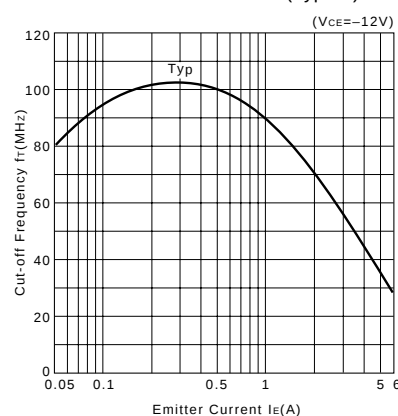
h_{FE}-I_C Temperature Characteristics (Typical)



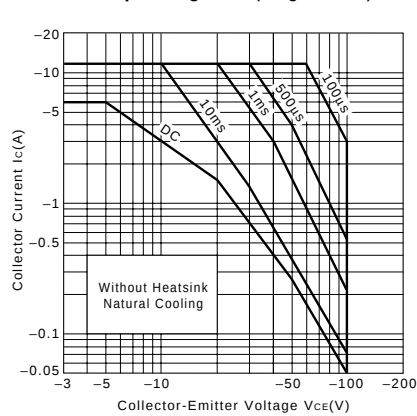
θ_{J-a}-t Characteristics



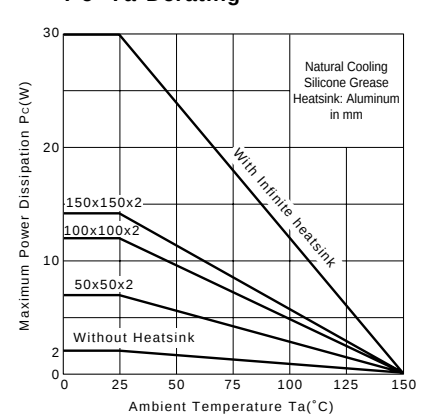
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

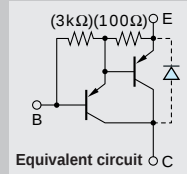


P_C-T_a Derating



Darlington

2SB1259



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2081)

Application : Driver for Solenoid, Relay and Motor and General Purpose

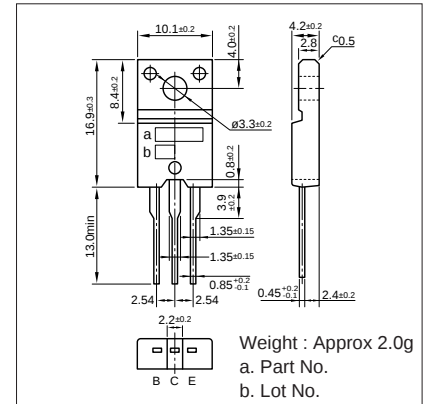
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-120	V
V _{CE0}	-120	V
V _{EB0}	-6	V
I _C	-10(Pulse-15)	A
I _B	-1	A
P _C	30(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

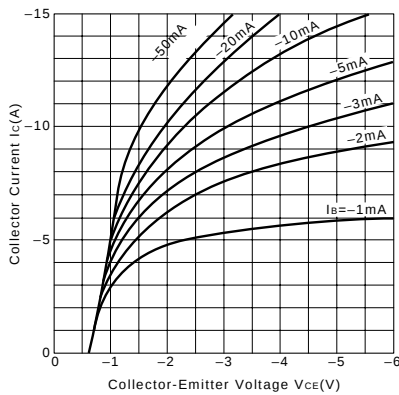
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-120V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	mA
V _{(BR)CEO}	I _C =-10mA	-120min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	2000min	
V _{CE(sat)}	I _C =-5A, I _B =-10mA	-1.5max	V
V _{BE(sat)}	I _C =-5A, I _B =-10mA	-2.0max	V
f _T	V _{CE} =-12V, I _E =0.2A	100typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	145typ	pF

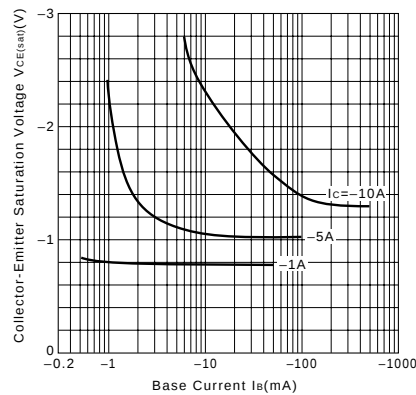
External Dimensions FM20(TO220F)



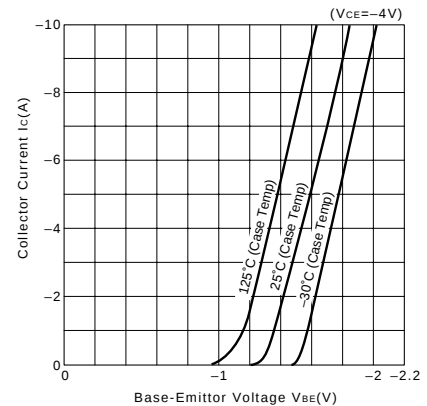
I_C-V_{CE} Characteristics (Typical)



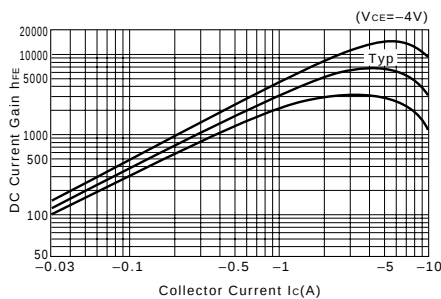
V_{CE(sat)}-I_B Characteristics (Typical)



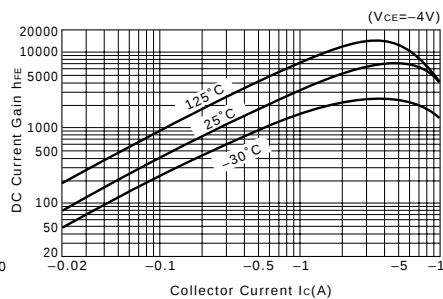
I_C-V_{BE} Temperature Characteristics (Typical)



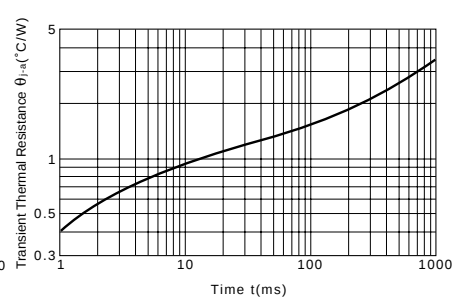
h_{FE}-I_C Characteristics (Typical)



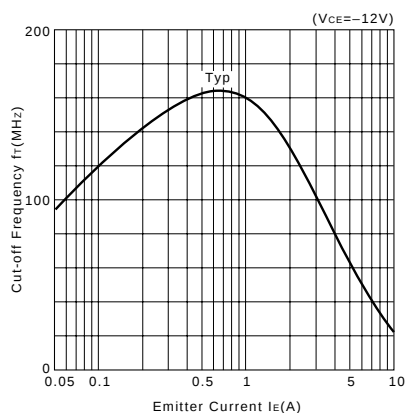
h_{FE}-I_C Temperature Characteristics (Typical)



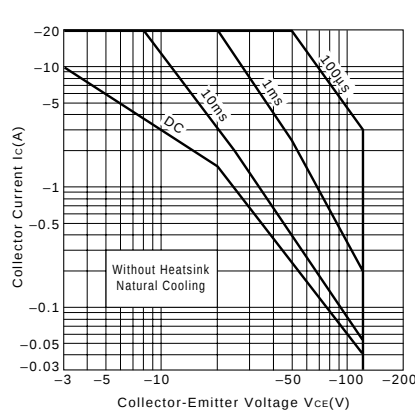
θ_{J-a}-t Characteristics



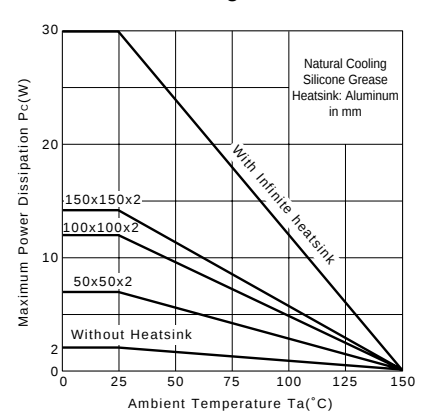
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

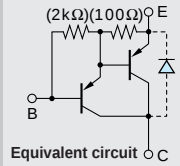


P_C-T_a Derating



Darlington

2SB1351



Silicon PNP Epitaxial Planar Transistor

Application : Driver for Printer Head, Solenoid, Relay, Motor and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-60	V
V _{CE0}	-60	V
V _{EB0}	-6	V
I _C	-12(Pulse-20)	A
I _B	-1	A
P _C	30(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

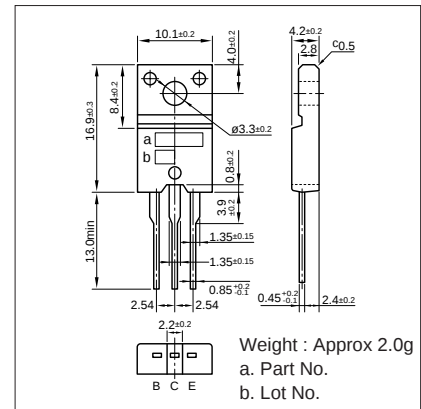
Electrical Characteristics (Ta=25°C)

Symbol	Condition	Ratings	Unit
I _{CB0}	V _{CB} =-60V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	mA
V _{(BR)CEO}	I _C =-10mA	-60min	V
h _{FE}	V _{CE} =-4V, I _C =-10A	2000min	
V _{CE(sat)}	I _C =-10A, I _B =-20mA	-1.5max	V
V _{BE(sat)}	I _C =-10A, I _B =-20mA	-2.0max	V
f _r	V _{CE} =-12V, I _E =1A	130typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	170typ	pF

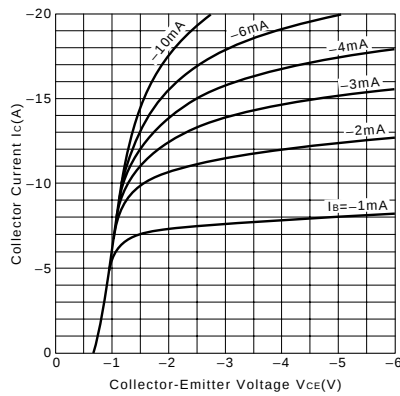
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	4	-10	-10	5	-20	20	0.7typ	1.5typ	0.6typ

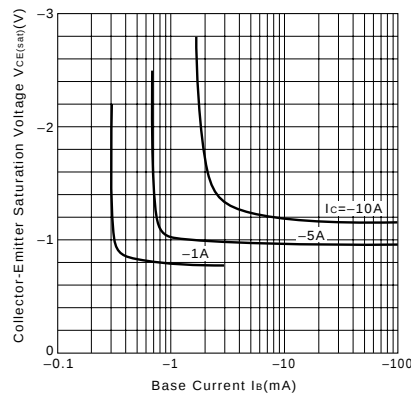
External Dimensions FM20(TO220F)



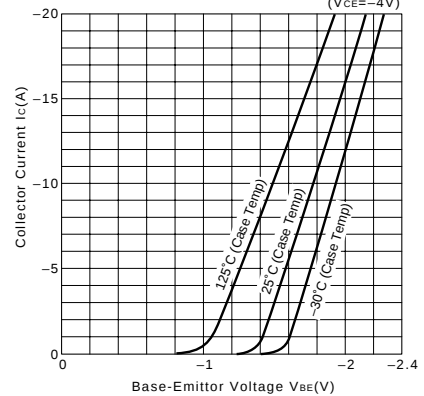
I_C-V_{CE} Characteristics (Typical)



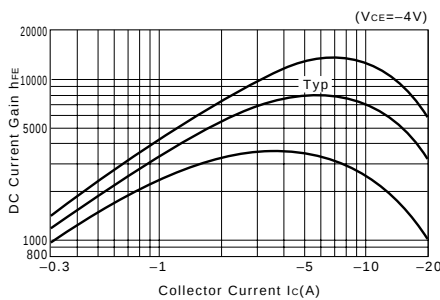
V_{CE(sat)}-I_B Characteristics (Typical)



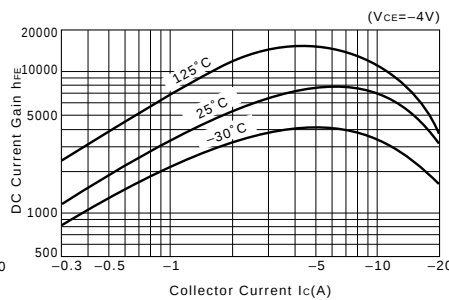
I_C-V_{BE} Temperature Characteristics (Typical)



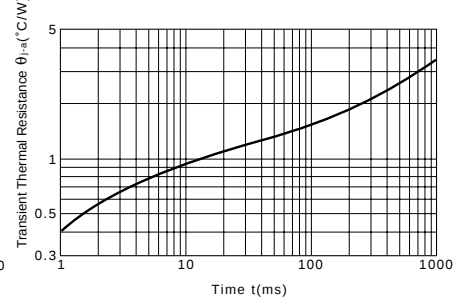
h_{FE}-I_C Characteristics (Typical)



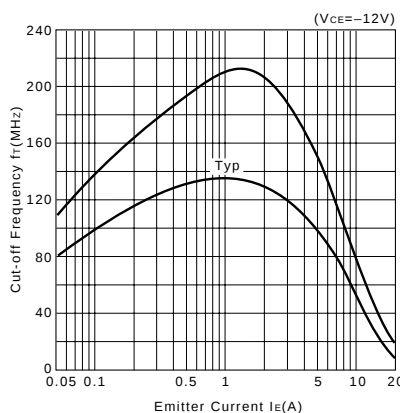
h_{FE}-I_C Temperature Characteristics (Typical)



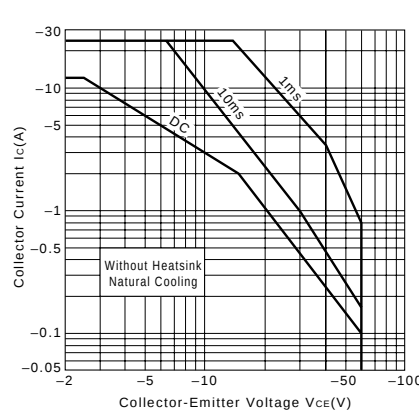
θ_{j-a}-t Characteristics



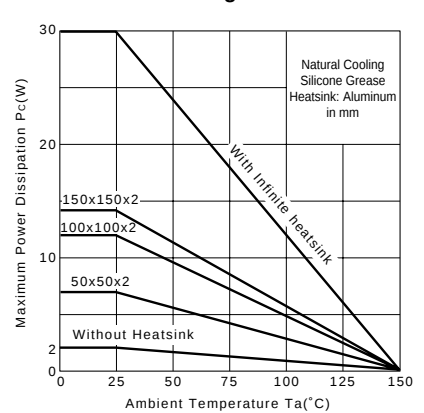
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

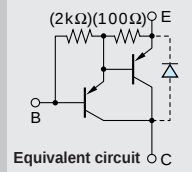


P_C-T_a Derating



Darlington

2SB1352



Silicon PNP Epitaxial Planar Transistor

Application : Driver for Printer Head, Solenoid, Relay, Motor and General Purpose

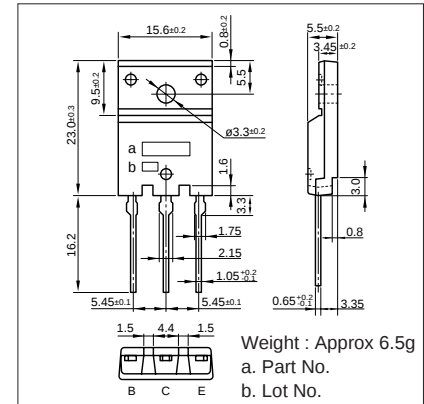
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-60	V
V _{CE0}	-60	V
V _{EB0}	-6	V
I _C	-12(Pulse-20)	A
I _B	-1	A
P _C	60(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-60V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	mA
V(BR) _{CEO}	I _C =-10mA	-60min	V
h _{FE}	V _{CE} =-4V, I _C =-10A	2000min	
V _{CE(sat)}	I _C =-10A, I _B =-20mA	-1.5max	V
V _{BE(sat)}	I _C =-10A, I _B =-20mA	-2.0max	V
f _r	V _{CE} =-12V, I _E =1A	130typ	MHz
COB	V _{CB} =-10V, f=1MHz	170typ	pF

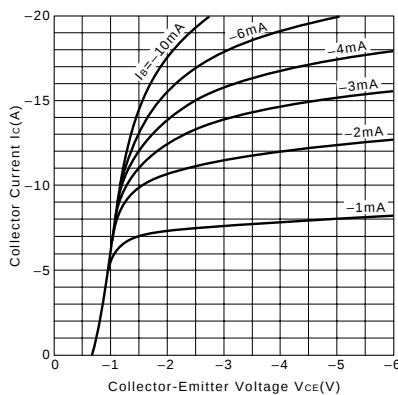
External Dimensions FM100(TO3PF)



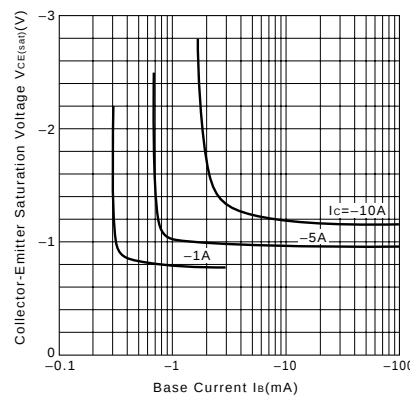
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	4	-10	-10	5	-20	20	0.7typ	1.5typ	0.6typ

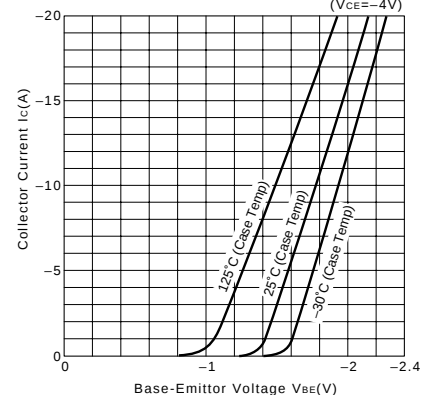
I_C-V_{CE} Characteristics (Typical)



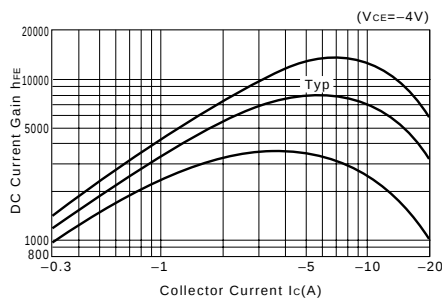
V_{CE(sat)}-I_B Characteristics (Typical)



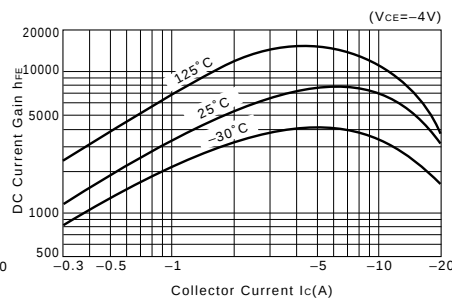
I_C-V_{BE} Temperature Characteristics (Typical)



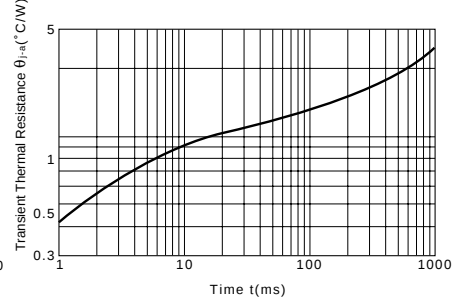
h_{FE}-I_C Characteristics (Typical)



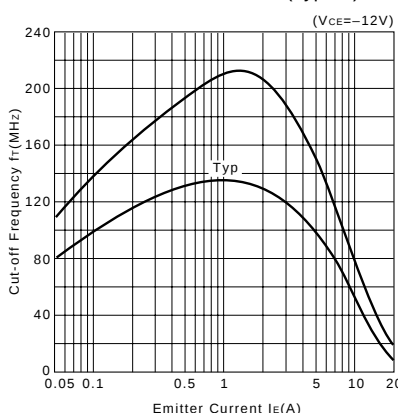
h_{FE}-I_C Temperature Characteristics (Typical)



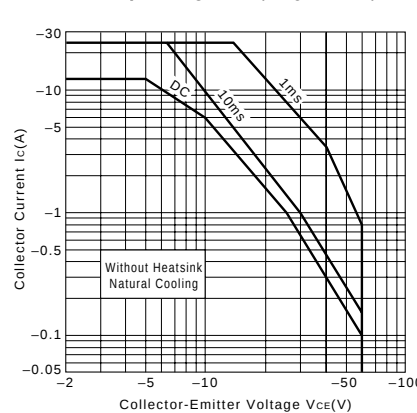
θ_{j-a}-t Characteristics



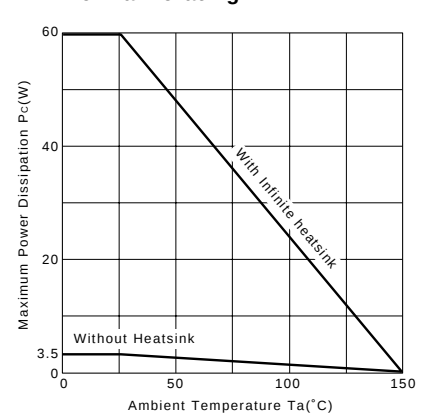
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

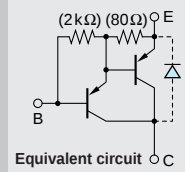


P_C-T_a Derating



Darlington

2SB1382



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2082)

Application : Chopper Regulator, DC Motor Driver and General Purpose

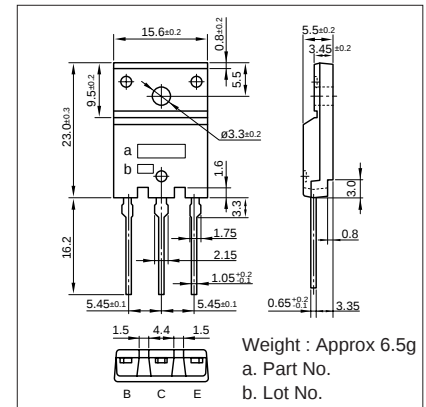
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-120	V
V _{CEO}	-120	V
V _{EB0}	-6	V
I _C	-16(Pulse-26)	A
I _B	-1	A
P _C	75(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

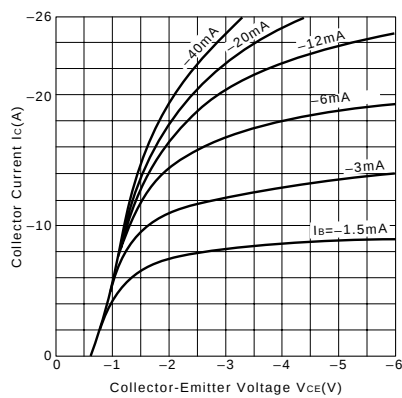
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-120V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	mA
V _{(BR)CEO}	I _C =-10mA	-120min	V
h _{FE}	V _{CE} =-4V, I _C =-8A	2000min	
V _{CE(sat)}	I _C =-8A, I _B =-16mA	-1.5max	V
V _{BE(sat)}	I _C =-8A, I _B =-16mA	-2.5max	V
f _r	V _{CE} =-12V, I _E =1A	50typ	MHz
COB	V _{CB} =-10V, f=1MHz	350typ	pF

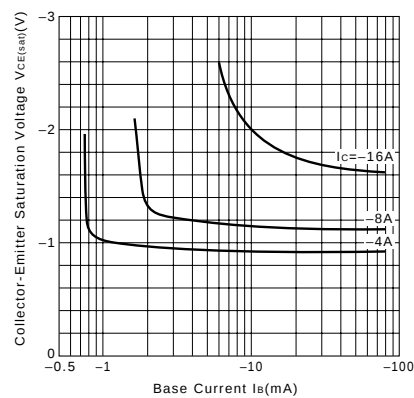
External Dimensions FM100(TO3PF)



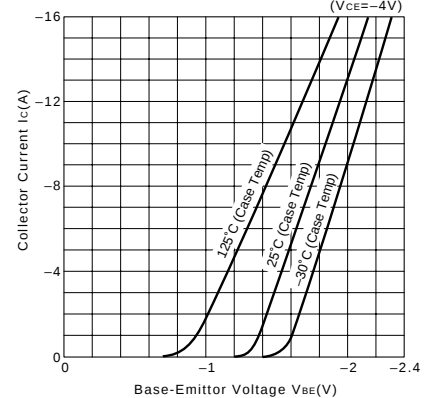
I_C-V_{CE} Characteristics (Typical)



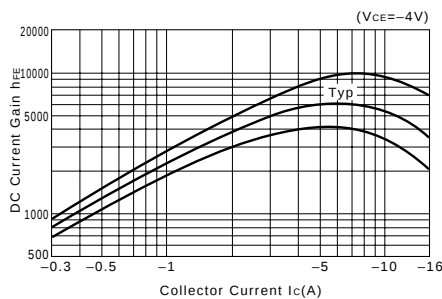
V_{CE(sat)}-I_B Characteristics (Typical)



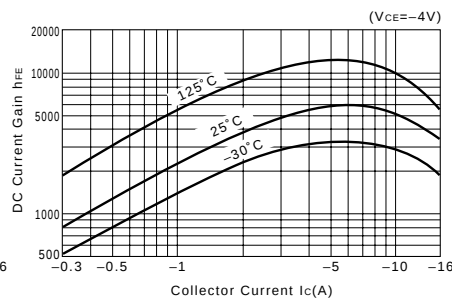
I_C-V_{BE} Temperature Characteristics (Typical)



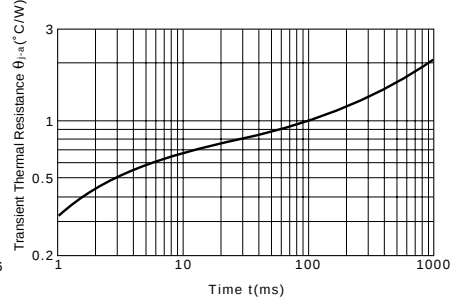
h_{FE}-I_C Characteristics (Typical)



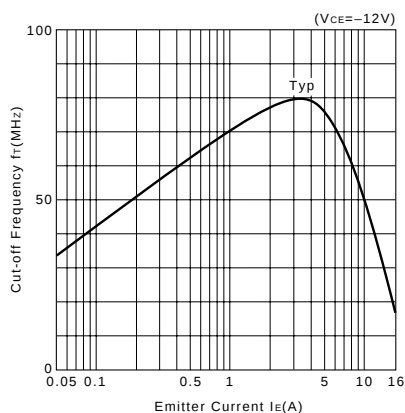
h_{FE}-I_C Temperature Characteristics (Typical)



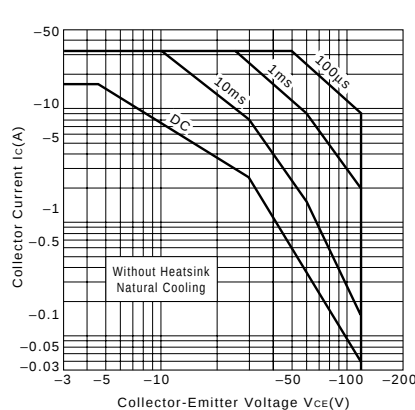
θ_{J-a}-t Characteristics



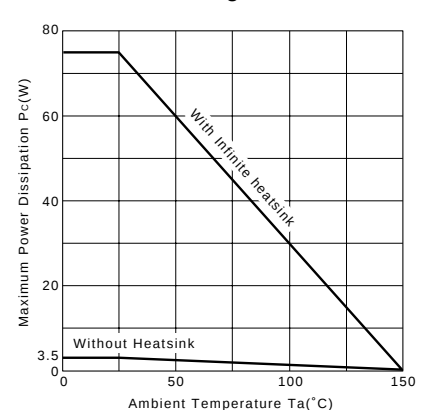
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

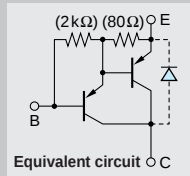


P_C-T_a Derating



Darlington

2SB1383



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2083)

Application : Chopper Regulator, DC Motor Driver and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-120	V
V _{CEO}	-120	V
V _{EB0}	-6	V
I _C	-25(Pulse-40)	A
I _B	-2	A
P _C	120(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

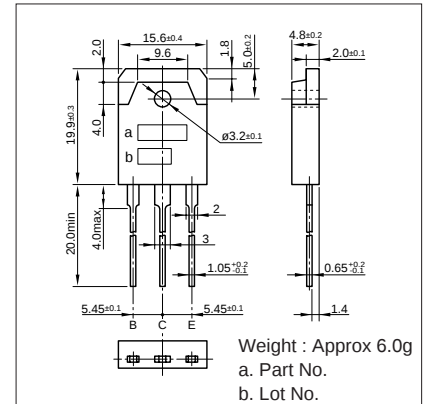
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-120V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	mA
V _{(BR)CEO}	I _C =-25mA	-120min	V
h _{FE}	V _{CE} =-4V, I _C =-12A	2000min	
V _{CE(sat)}	I _C =-12A, I _B =-24mA	-1.8max	V
V _{BE(sat)}	I _C =-12A, I _B =-24mA	-2.5max	V
f _r	V _{CE} =-12V, I _E =1A	50typ	MHz
COB	V _{CB} =-10V, f=1MHz	230typ	pF

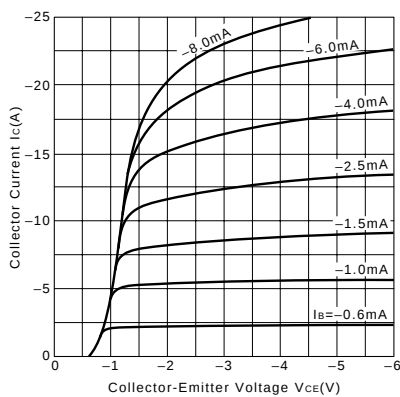
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-24	2	-12	-10	5	-24	24	1.0typ	3.0typ	1.0typ

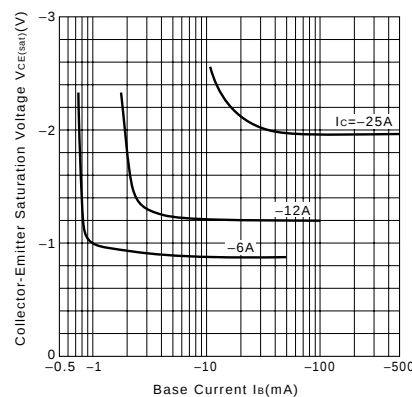
External Dimensions MT-100(TO3P)



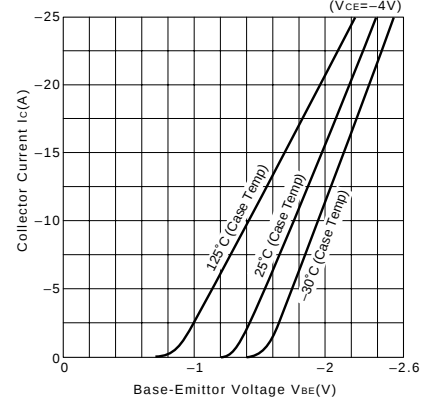
I_C-V_{CE} Characteristics (Typical)



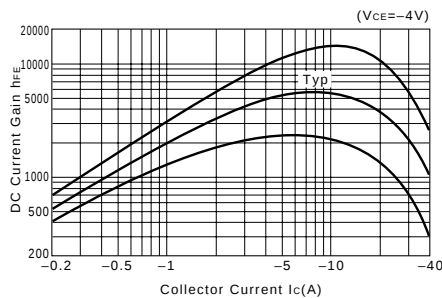
V_{CE(sat)}-I_B Characteristics (Typical)



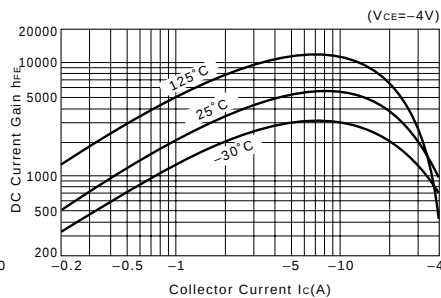
I_C-V_{BE} Temperature Characteristics (Typical)



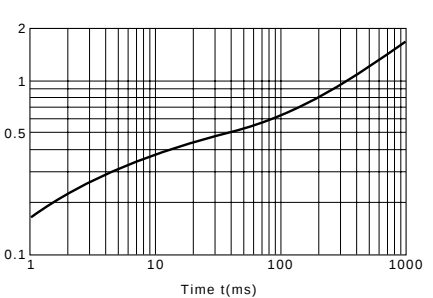
h_{FE}-I_C Characteristics (Typical)



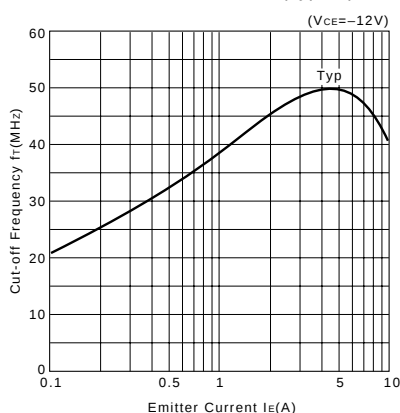
h_{FE}-I_C Temperature Characteristics (Typical)



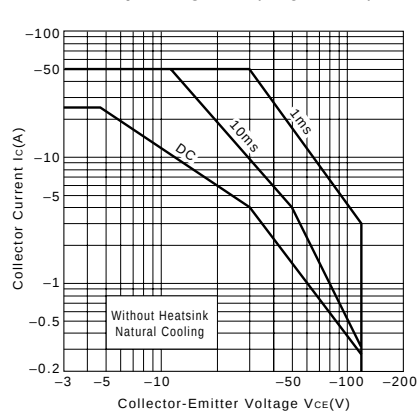
θ_{J-a}-t Characteristics



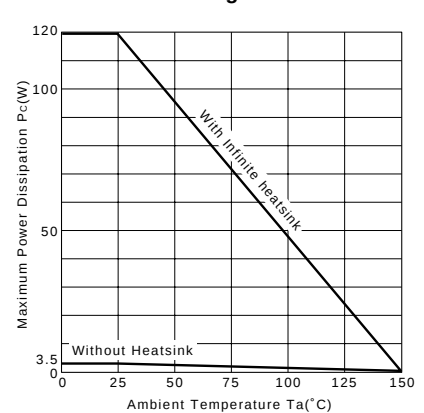
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

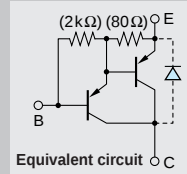


P_C-T_a Derating



Darlington

2SB1420



Silicon PNP Epitaxial Planar Transistor

Application : Chopper Regulator, DC Motor Driver and General Purpose

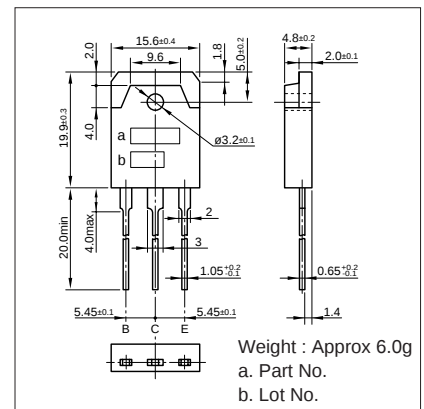
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-120	V
V _{CEO}	-120	V
V _{EB0}	-6	V
I _C	-16(Pulse-26)	A
I _B	-1	A
P _C	80(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-120V	-10max	μA
I _{EB0}	V _{EB} =-6V	-10max	mA
V _{(BR)CEO}	I _C =-10mA	-120min	V
h _{FE}	V _{CE} =-4V, I _C =-8A	2000min	
V _{CE(sat)}	I _C =-8A, I _B =-16mA	-1.5max	V
V _{BE(sat)}	I _C =-8A, I _B =-16mA	-2.5max	V
f _r	V _{CE} =-12V, I _E =1A	50typ	MHz
COB	V _{CB} =-10V, f=1MHz	350typ	pF

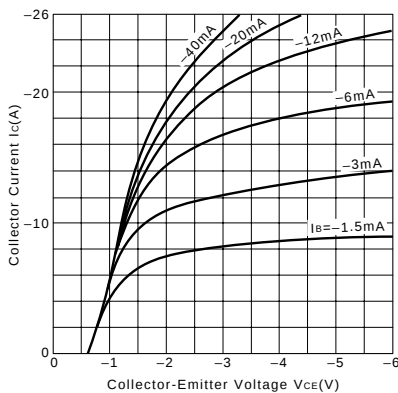
External Dimensions MT-100(TO3P)



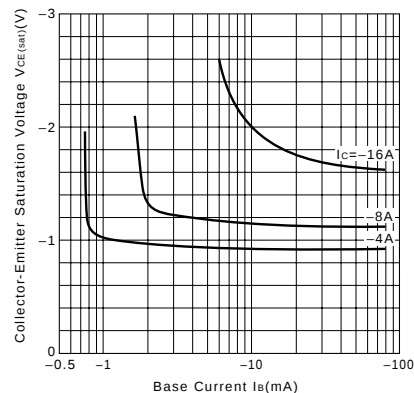
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-24	2	-12	-10	5	-24	24	1.0typ	3.0typ	1.0typ

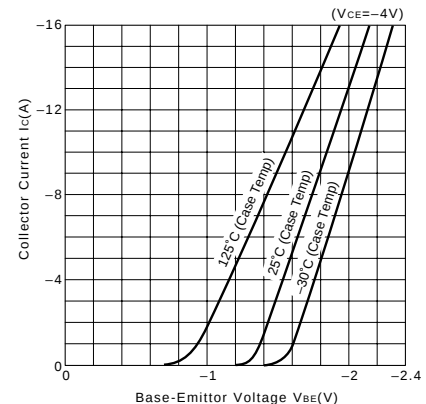
I_C-V_{CE} Characteristics (Typical)



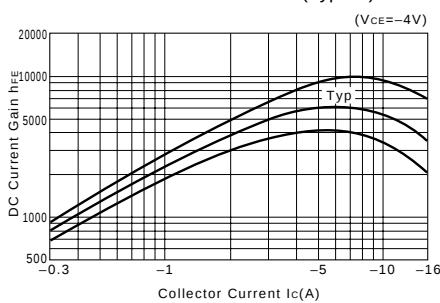
V_{CE(sat)}-I_B Characteristics (Typical)



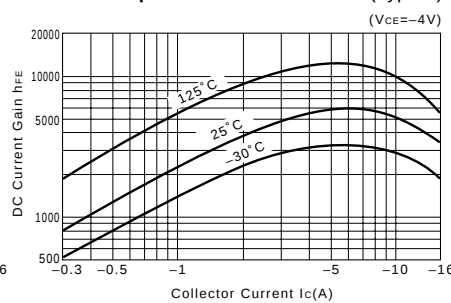
I_C-V_{BE} Temperature Characteristics (Typical)



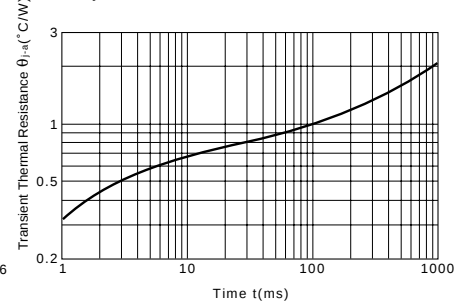
h_{FE}-I_C Characteristics (Typical)



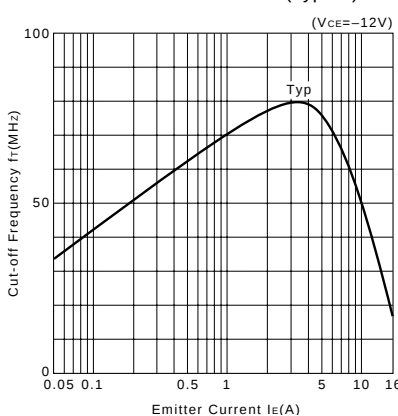
h_{FE}-I_C Temperature Characteristics (Typical)



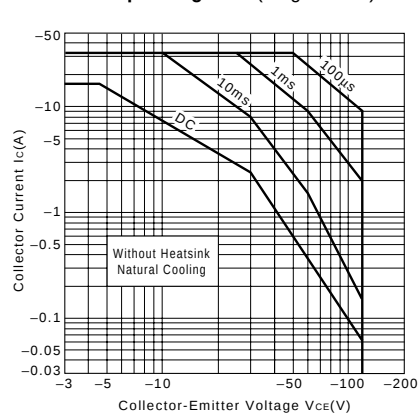
θ_{JA}-t Characteristics



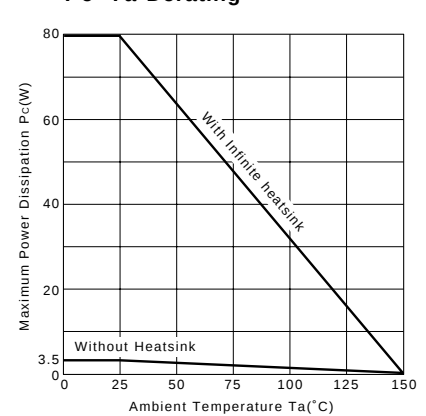
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

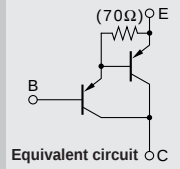


P_C-T_a Derating



Darlington

2SB1559



Equivalent circuit

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2389)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-160	V
V _{CE0}	-150	V
V _{EB0}	-5	V
I _C	-8	A
I _B	-1	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

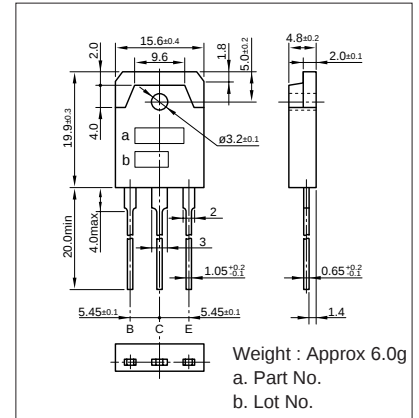
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-160V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-30mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-6A	5000min*	
V _{CE(sat)}	I _C =-6A, I _B =-6mA	-2.5max	V
V _{BE(sat)}	I _C =-6A, I _B =-6mA	-3.0max	V
f _r	V _{CE} =-12V, I _E =1A	65typ	MHz
COB	V _{CB} =-10V, f=1MHz	160typ	pF

*h_{FE} Rank $\bar{O}$ (5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

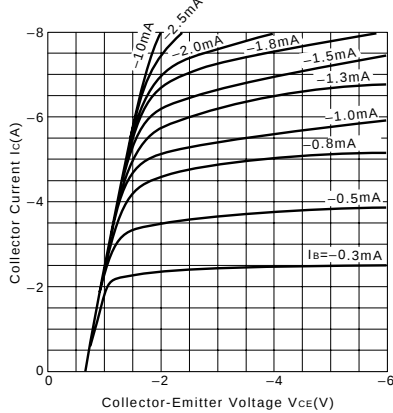
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	10	-6	-10	5	-6	6	0.7typ	3.6typ	0.9typ

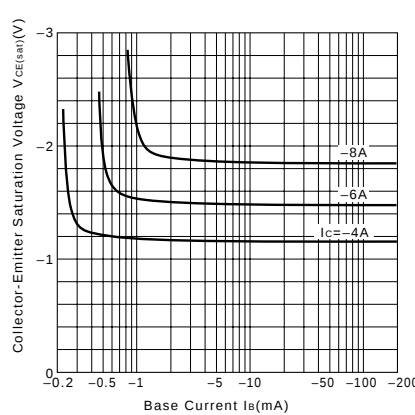
External Dimensions MT-100(TO3P)



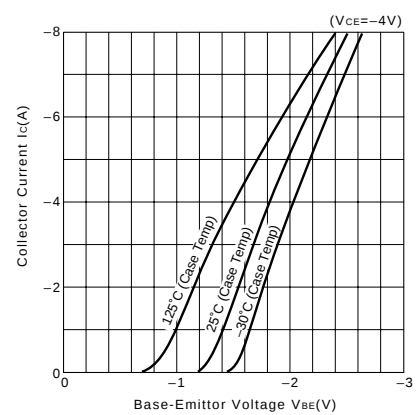
I_C-V_{CE} Characteristics (Typical)



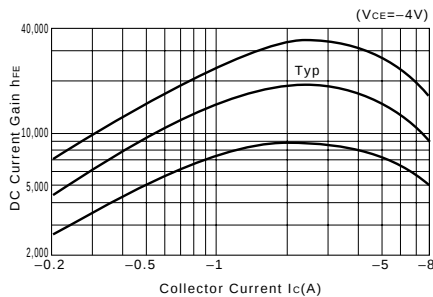
V_{CE(sat)}-I_B Characteristics (Typical)



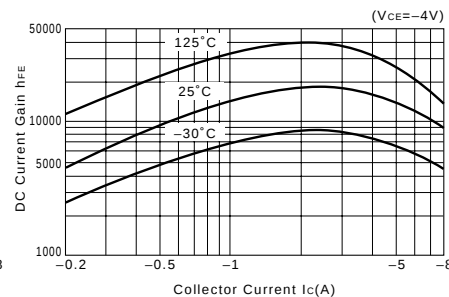
I_C-V_{BE} Temperature Characteristics (Typical)



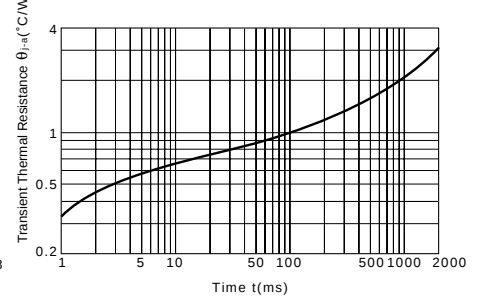
h_{FE}-I_C Characteristics (Typical)



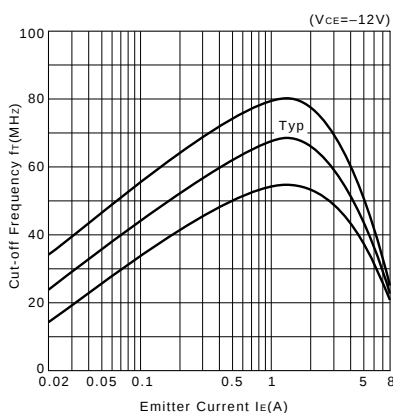
h_{FE}-I_C Temperature Characteristics (Typical)



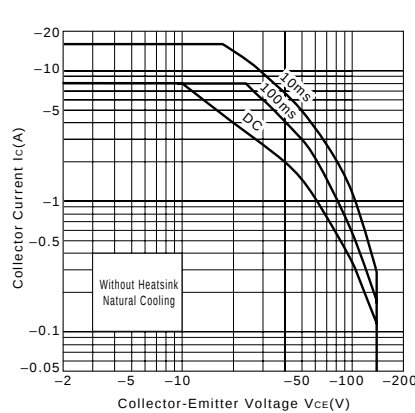
θ_{J-a}-t Characteristics



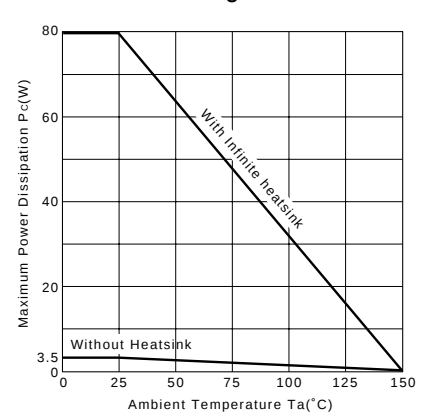
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

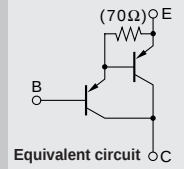


P_C-T_a Derating



Darlington

2SB1560



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2390)

Application : Audio, Series Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-160	V
V _{CEO}	-150	V
V _{EB0}	-5	V
I _C	-10	A
I _B	-1	A
P _C	100(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

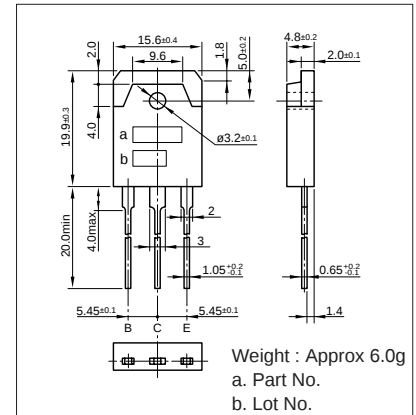
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-160V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-30mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-7A	5000min*	
V _{CE(sat)}	I _C =-7A, I _B =-7mA	-2.5max	V
V _{BE(sat)}	I _C =-7A, I _B =-7mA	-3.0max	V
f _r	V _{CE} =-12V, I _E =2A	50typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	230typ	pF

*h_{FE} Rank Q(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

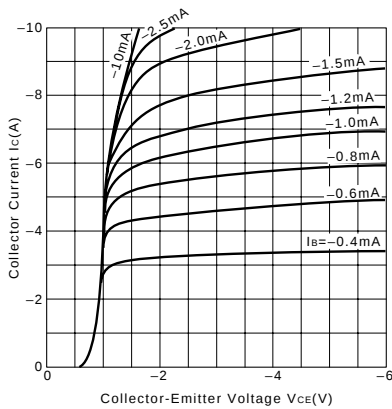
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-70	10	-7	-10	5	-7	7	0.8typ	3.0typ	1.2typ

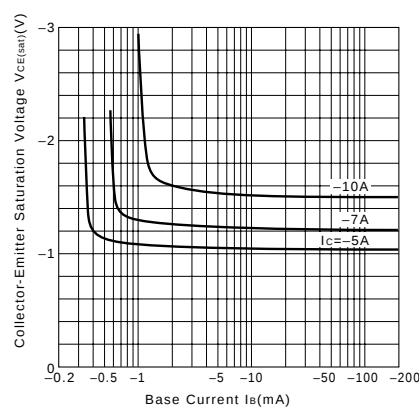
External Dimensions MT-100(TO3P)



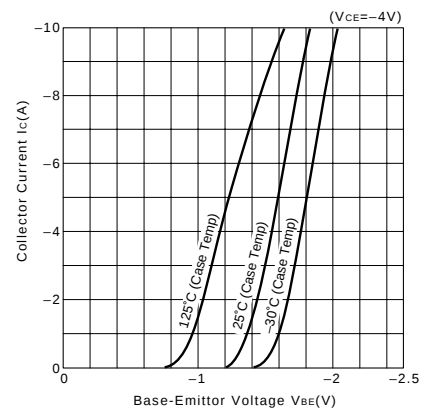
I_C-V_{CE} Characteristics (Typical)



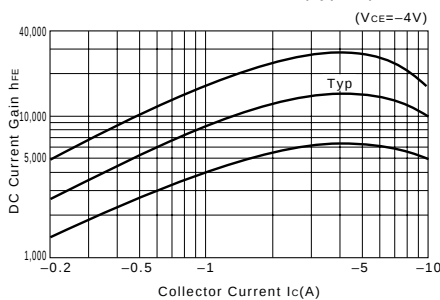
V_{CE(sat)}-I_B Characteristics (Typical)



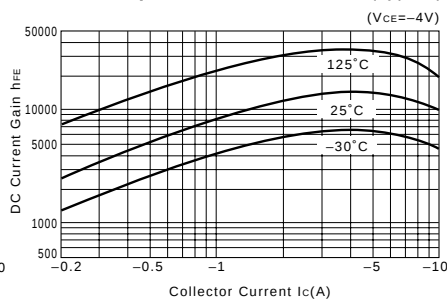
I_C-V_{BE} Temperature Characteristics (Typical)



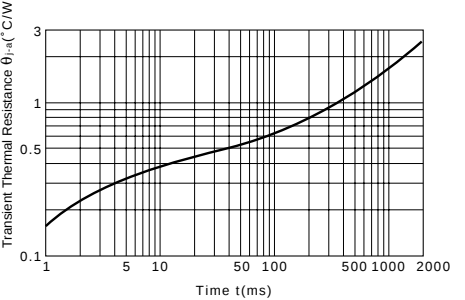
h_{FE}-I_C Characteristics (Typical)



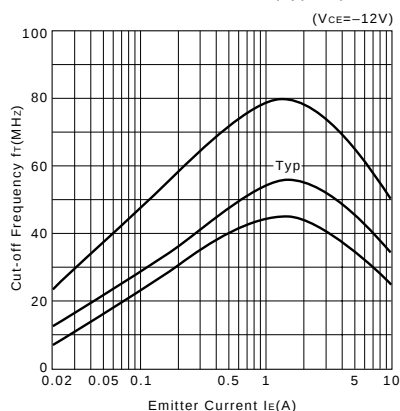
h_{FE}-I_C Temperature Characteristics (Typical)



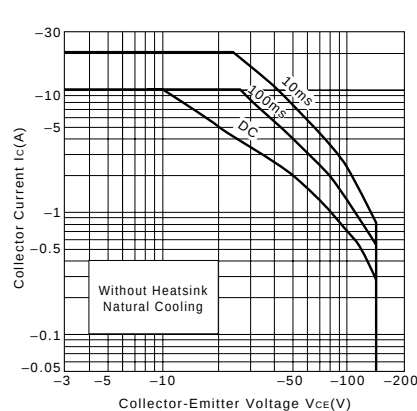
θ_{J-a}-t Characteristics



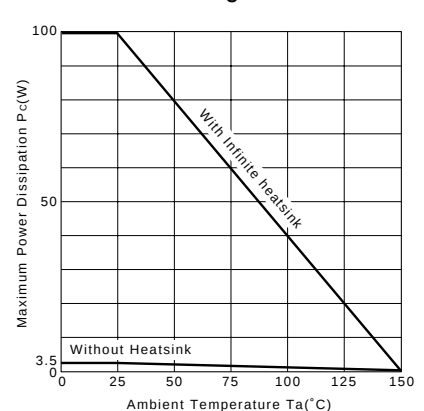
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

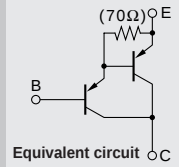


P_C-T_a Derating



Darlington

2SB1570



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2401)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-160	V
V _{CEO}	-150	V
V _{EB0}	-5	V
I _C	-12	A
I _B	-1	A
P _C	150(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

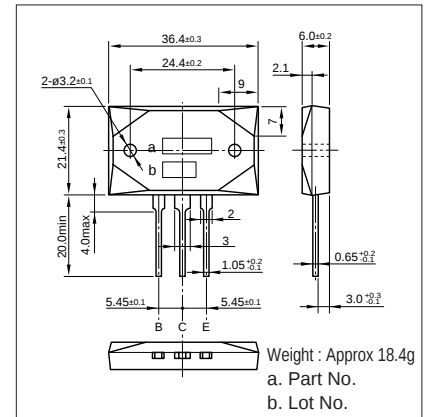
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-160V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V(BR) _{CEO}	I _C =-30mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-7A	5000min*	
V _{CE(sat)}	I _C =-7A, I _B =-7mA	-2.5max	V
V _{BE(sat)}	I _C =-7A, I _E =-7mA	-3.0max	V
f _T	V _{CE} =-12V, I _E =2A	50typ	MHz
COB	V _{CB} =-10V, f=1MHz	230typ	pF

*h_{FE} Rank ○(5000to12000), P(6500to20000), Y(15000to30000)

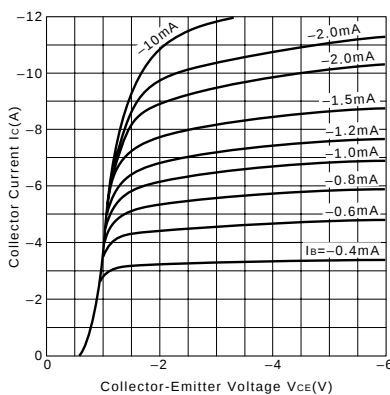
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-70	10	-7	-10	5	-7	7	0.8typ	3.0typ	1.2typ

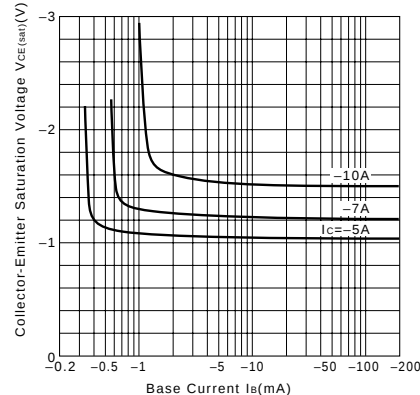
External Dimensions MT-200



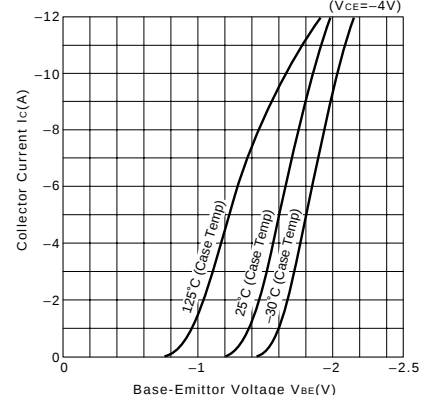
I_C-V_{CE} Characteristics (Typical)



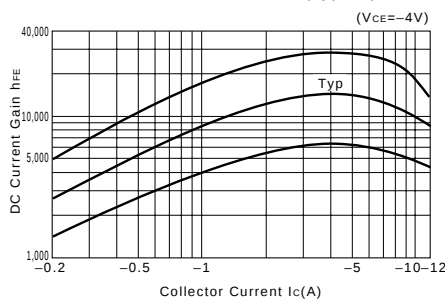
V_{CE(sat)}-I_B Characteristics (Typical)



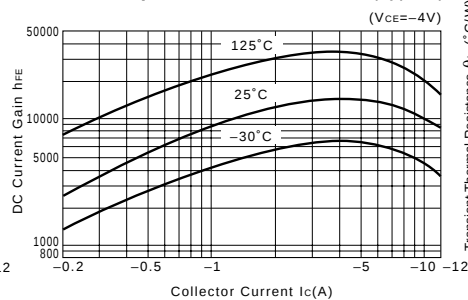
I_C-V_{BE} Temperature Characteristics (Typical)



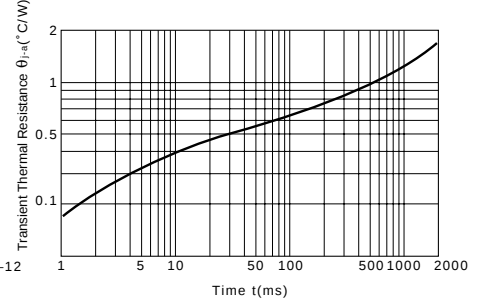
h_{FE}-I_C Characteristics (Typical)



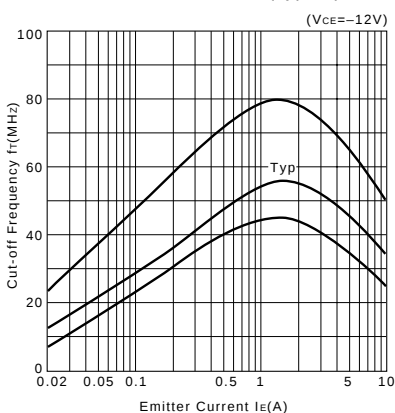
h_{FE}-I_C Temperature Characteristics (Typical)



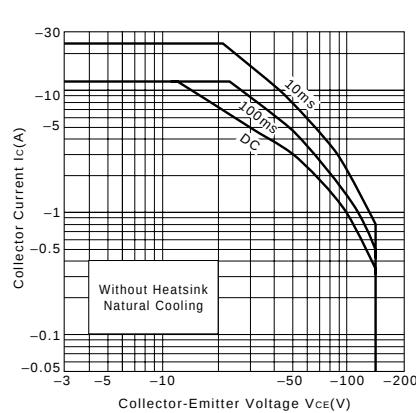
θ_{JA}-t Characteristics



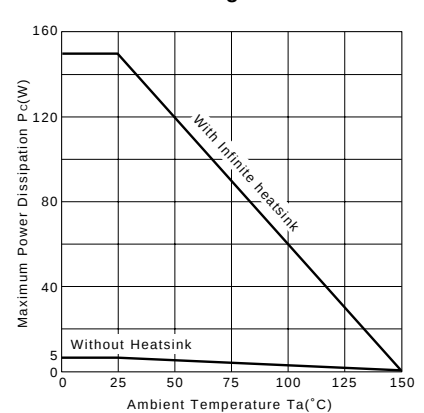
f_T-I_E Characteristics (Typical)



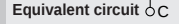
Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SB1587

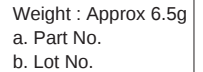


Application : Audio, Series Regulator and General Purpose

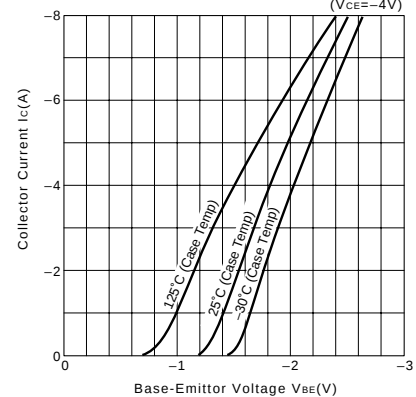
($T_a=25^\circ\text{C}$)

Symbol	Conditions	Ratings	Unit
ICBO	$V_{CB} = -160V$	-100max	μA
IEBO	$V_{EB} = -5V$	-100max	μA
$V_{(BR)CEO}$	$I_C = -30mA$	-150min	V
h_{FE}	$V_{CE} = -4V, I_C = -6A$	5000min^*	
$V_{CE(sat)}$	$I_C = -6A, I_B = -6mA$	-2.5max	V
$V_{BE(sat)}$	$I_C = -6A, I_B = -6mA$	-3.0max	V
f_T	$V_{CE} = -12V, I_E = 1A$	65typ	MHz
COB	$V_{CB} = -10V, f = 1MHz$	160typ	pF

External Dimensions FM100(TO3PF)



V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-60	10	-6	-10	5	-6	6	0.7typ	3.6typ	0.9typ



Time t (ms)	Transient Thermal Resistance θ_{JA} ($^{\circ}\text{C/W}$)
1	0.35
5	0.6
10	0.7
50	0.9
100	1.0
500	1.8
1000	2.5
2000	3.5

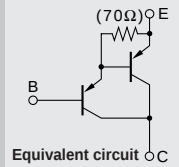
Figure 10.10 is a line graph showing Maximum Power Dissipation P_c (W) on the Y-axis versus Ambient Temperature T_a (°C) on the X-axis. The X-axis ranges from 0 to 150°C with major grid lines every 25°C. The Y-axis ranges from 0 to 80 W with major grid lines every 20 W. Two curves are plotted:

- Without Heatsink:** A horizontal line at $P_c = 3.5$ W from $T_a = 0$ to 150 °C.
- With Infinite heatsink:** A horizontal line at $P_c = 75$ W from $T_a = 0$ to 25 °C, then a diagonal line from $(25, 75)$ to $(150, 0)$.

Ambient Temperature T_a (°C)	Maximum Power Dissipation P_c (W) Without Heatsink	Maximum Power Dissipation P_c (W) With Infinite heatsink
0	3.5	75
25	3.5	75
50	3.5	60
75	3.5	45
100	3.5	30
125	3.5	15
150	3.5	0

Darlington

2SB1588



Equivalent circuit

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2439)

Application : Audio, Series Regulator and General Purpose

■ **Absolute maximum ratings** (Ta=25°C)

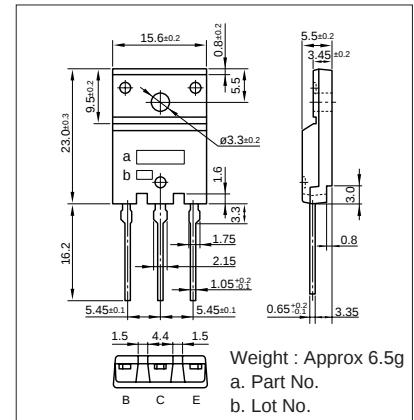
Symbol	Ratings	Unit
V _{CB0}	-160	V
V _{CE0}	-150	V
V _{EB0}	-5	V
I _C	-10	A
I _B	-1	A
P _C	80(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■ **Electrical Characteristics** (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =-160V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-30mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-7A	5000min*	
V _{CE(sat)}	I _C =-7A, I _B =-7mA	-2.5max	V
V _{BE(sat)}	I _C =-7A, I _B =-7mA	-3.0max	V
f _r	V _{CE} =-12V, I _E =2A	50typ	MHz
COB	V _{CB} =-10V, f=1MHz	230typ	pF

*h_{FE} Rank ○(5000to12000), P(6500to20000), Y(15000to30000)

External Dimensions FM100(TO3PF)



Weight : Approx 6.5g

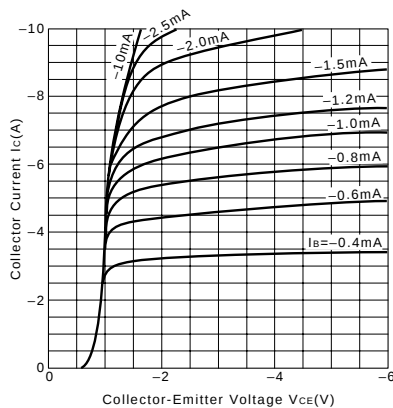
a. Part No.

b. Lot No.

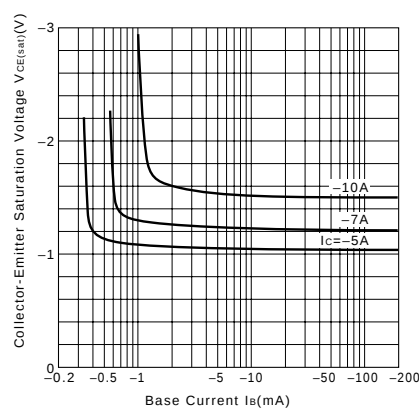
■ **Typical Switching Characteristics (Common Emitter)**

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-70	10	-7	-10	5	-7	7	0.8typ	3.0typ	1.2typ

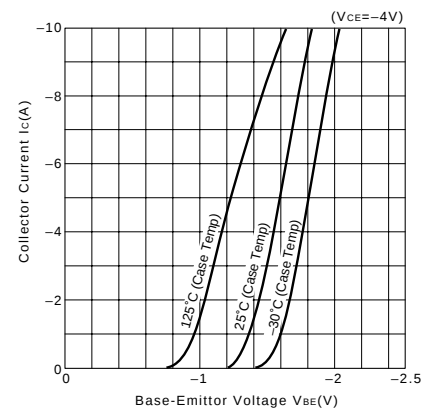
I_C-V_{CE} Characteristics (Typical)



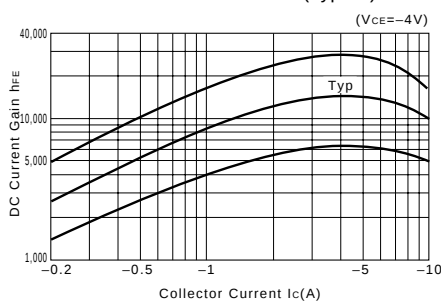
V_{CE(sat)}-I_B Characteristics (Typical)



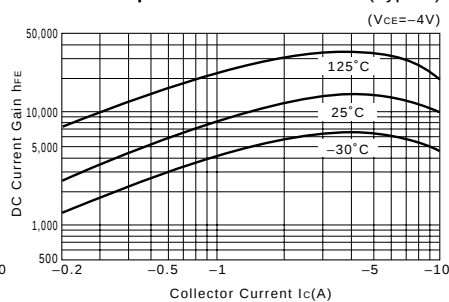
I_C-V_{BE} Temperature Characteristics (Typical)



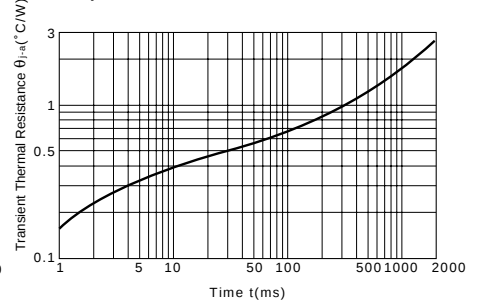
h_{FE}-I_C Characteristics (Typical)



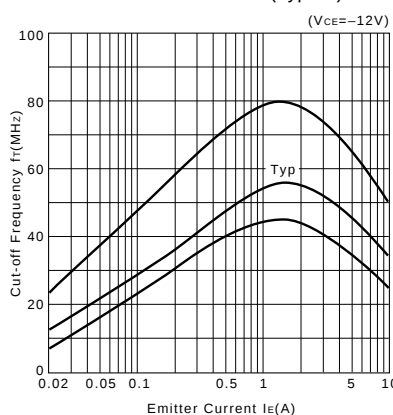
h_{FE}-I_C Temperature Characteristics (Typical)



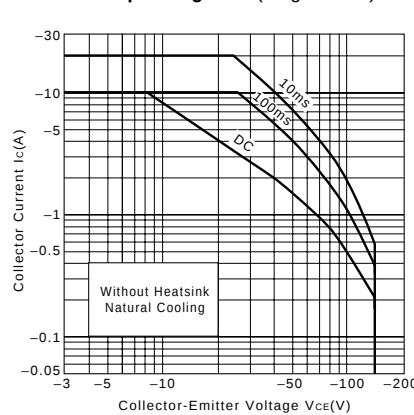
θ_{J-a}-t Characteristics



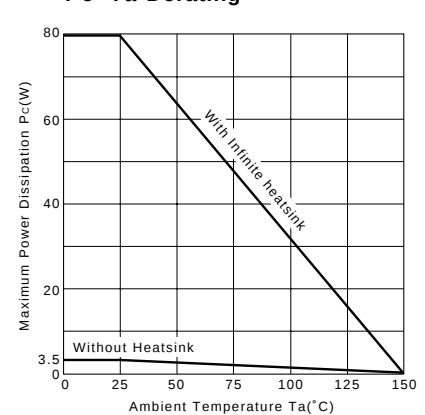
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

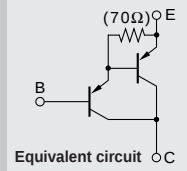


P_C-T_a Derating



Darlington

2SB1647



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2560)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings ($T_a=25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CB0}	-150	V
V_{CE0}	-150	V
V_{EB0}	-5	V
I_C	-15	A
I_B	-1	A
P_C	130($T_C=25^\circ\text{C}$)	W
T_j	150	$^\circ\text{C}$
T_{stg}	-55 to +150	$^\circ\text{C}$

Electrical Characteristics ($T_a=25^\circ\text{C}$)

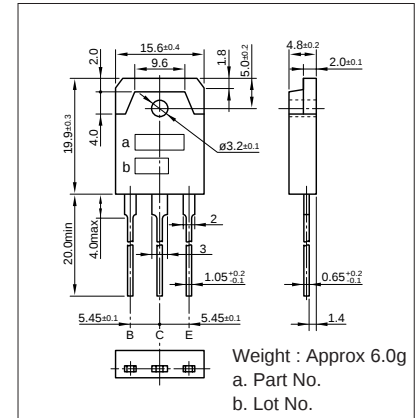
Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=-150\text{V}$	-100max	μA
I_{EBO}	$V_{EB}=-5\text{V}$	-100max	μA
$V_{(BR)CEO}$	$I_C=-30\text{mA}$	-150min	V
h_{FE}	$V_{CE}=-4\text{V}$, $I_C=-10\text{A}$	5000min*	
$V_{CE(sat)}$	$I_C=-10\text{A}$, $I_B=-10\text{mA}$	-2.5max	V
$V_{BE(sat)}$	$I_C=-10\text{A}$, $I_B=-10\text{mA}$	-3.0max	V
f_T	$V_{CE}=-12\text{V}$, $I_E=2\text{A}$	45typ	MHz
C_{OB}	$V_{CB}=-10\text{V}$, $f=1\text{MHz}$	320typ	pF

* h_{FE} Rank O(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

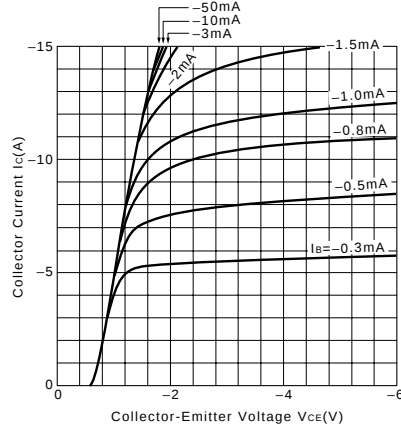
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
-40	4	10	-10	5	-10	10	0.7typ	1.6typ	1.1typ

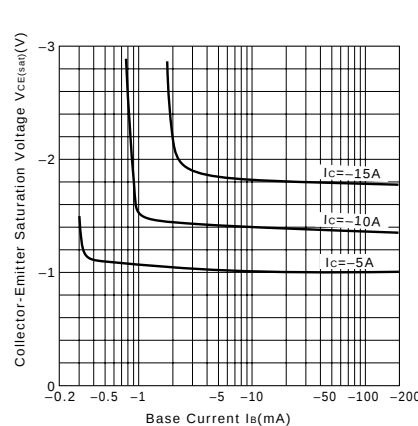
External Dimensions MT-100(TO3P)



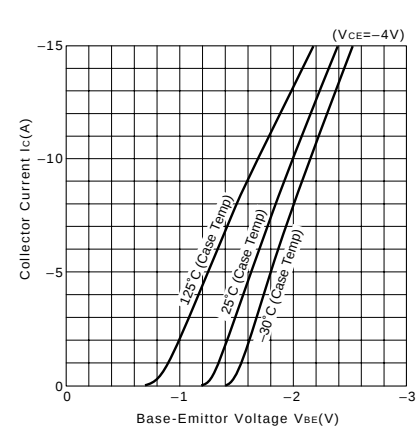
I_C-V_{CE} Characteristics (Typical)



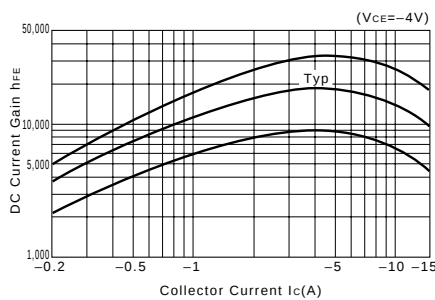
$V_{CE(sat)}-I_B$ Characteristics (Typical)



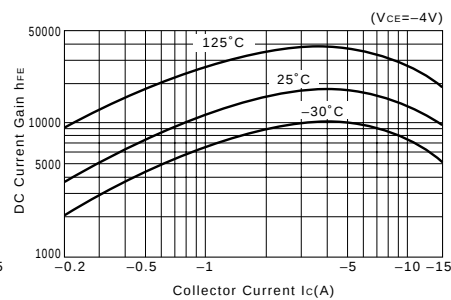
I_C-V_{BE} Temperature Characteristics (Typical)



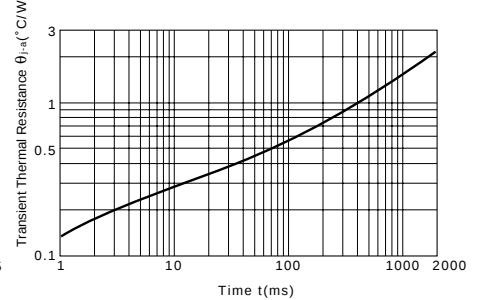
$h_{FE}-I_C$ Characteristics (Typical)



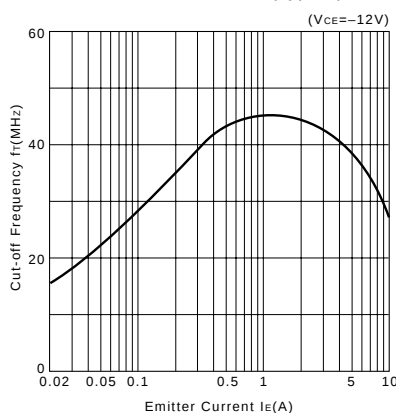
$h_{FE}-I_C$ Temperature Characteristics (Typical)



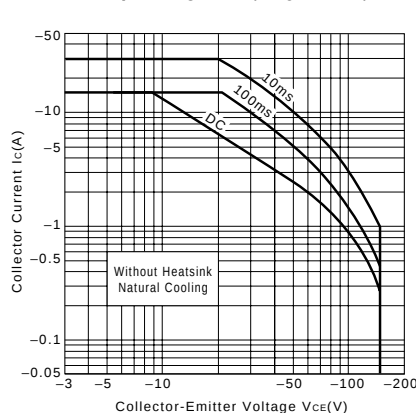
$\theta_{JA}-t$ Characteristics



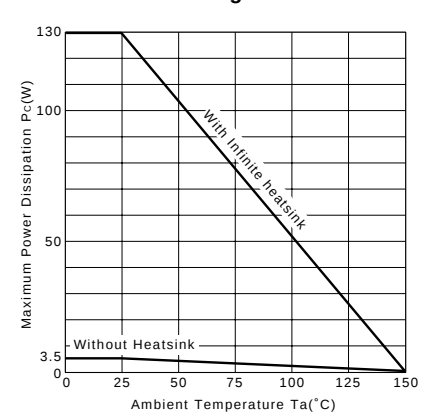
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

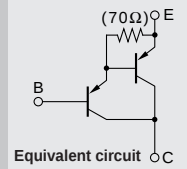


P_C-T_a Derating



Darlington

2SB1648



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2561)

Application : Audio, Series Regulator and General Purpose

■ **Absolute maximum ratings** (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-150	V
V _{CEO}	-150	V
V _{EB0}	-5	V
I _C	-17	A
I _B	-1	A
P _C	200(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■ **Electrical Characteristics** (Ta=25°C)

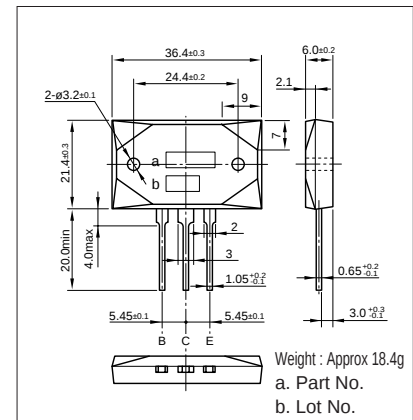
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-150V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V(BR)CEO	I _C =-30mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-10A	5000min*	
V _{CE(sat)}	I _C =-10A, I _B =-10mA	-2.5max	V
V _{BE(sat)}	I _C =-10A, I _B =-10mA	-3.0max	V
f _r	V _{CE} =-12V, I _E =2A	45typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	320typ	pF

*h_{FE} Rank Q(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

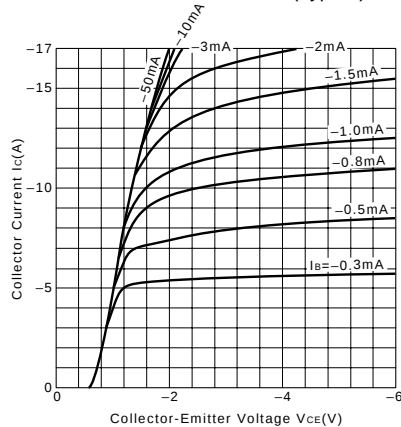
■ **Typical Switching Characteristics (Common Emitter)**

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	4	-10	-10	5	-10	10	0.7typ	1.6typ	1.1typ

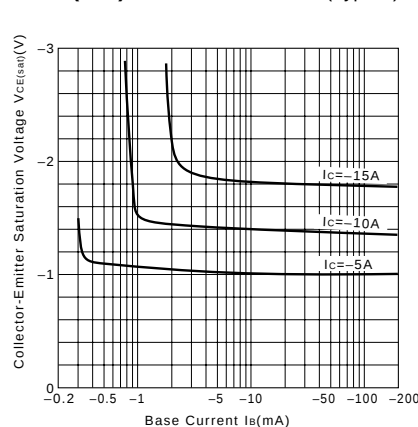
External Dimensions MT-200



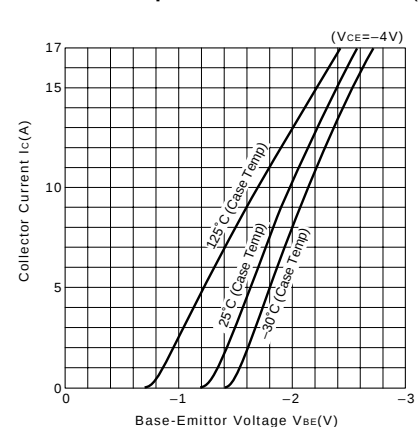
I_C-V_{CE} Characteristics (Typical)



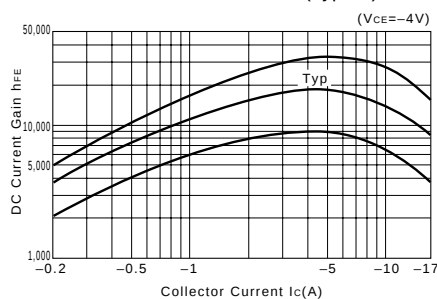
V_{CE(sat)}-I_B Characteristics (Typical)



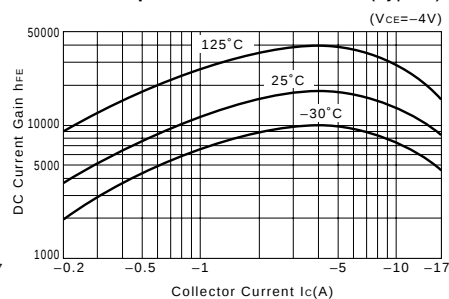
I_C-V_{BE} Temperature Characteristics (Typical)



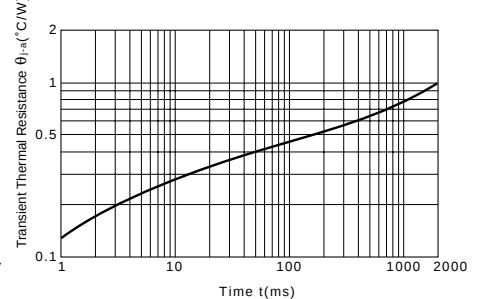
h_{FE}-I_C Characteristics (Typical)



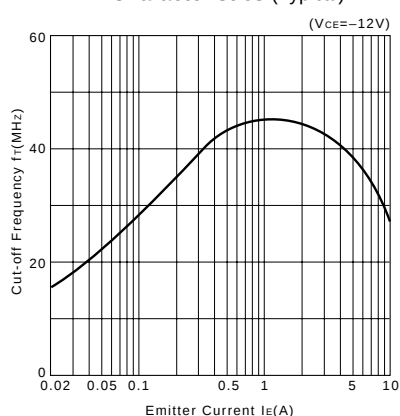
h_{FE}-I_C Temperature Characteristics (Typical)



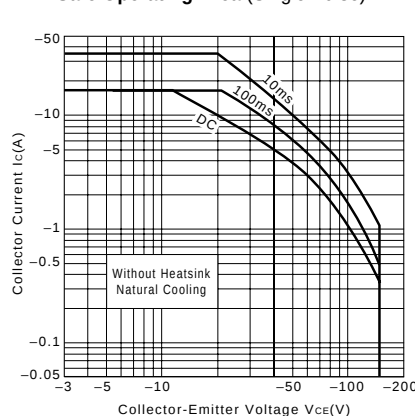
θ_{J-a}-t Characteristics



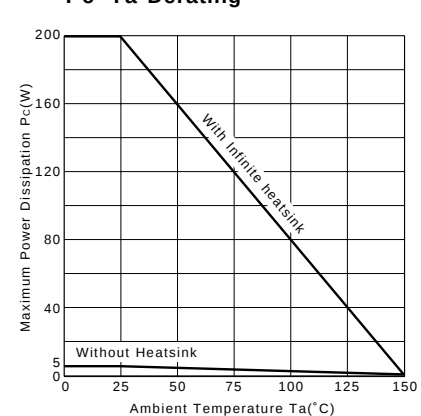
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

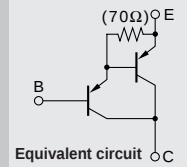


P_C-T_a Derating



Darlington

2SB1649



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2561)

Application : Audio, Series Regulator and General Purpose

■ **Absolute maximum ratings** (Ta=25°C)

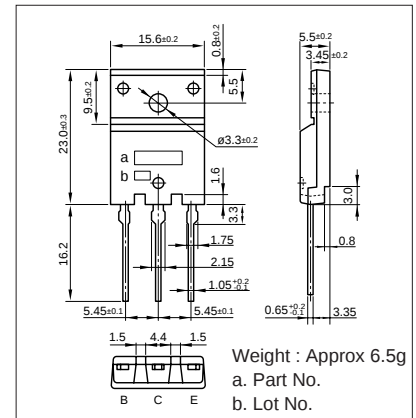
Symbol	Ratings	Unit
V _{CB0}	-150	V
V _{CEO}	-150	V
V _{EB0}	-5	V
I _C	-15	A
I _B	-1	A
P _C	85(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■ **Electrical Characteristics** (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-150V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-30mA	-150min	V
h _{FE}	V _{CE} =-4V, I _C =-10A	5000min*	
V _{CE(sat)}	I _C =-10A, I _B =-10mA	-2.5max	V
V _{BE(sat)}	I _C =-10A, I _B =-10mA	-3.0max	V
f _T	V _{CE} =-12V, I _E =2A	45typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	320typ	pF

*h_{FE} Rank: O(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

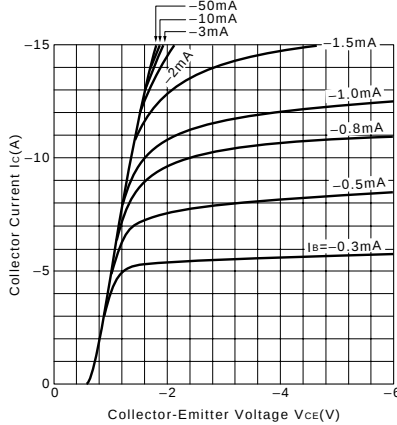
External Dimensions FM100(TO3PF)



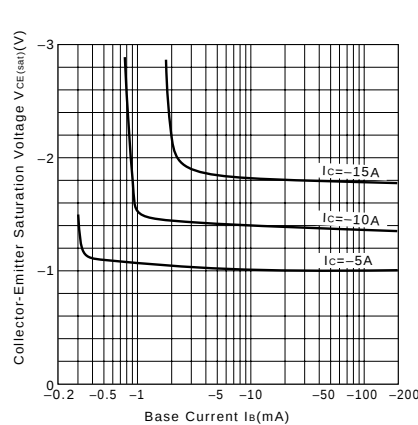
■ **Typical Switching Characteristics (Common Emitter)**

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-40	4	-10	-10	5	-10	10	0.7typ	1.6typ	1.1typ

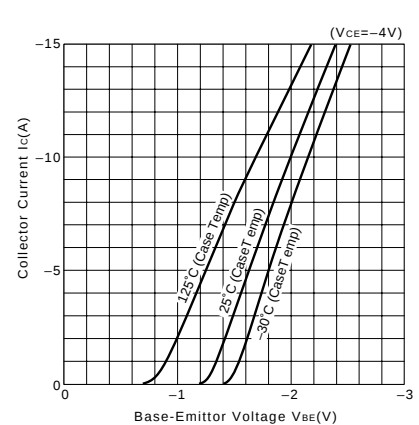
I_C-V_{CE} Characteristics (Typical)



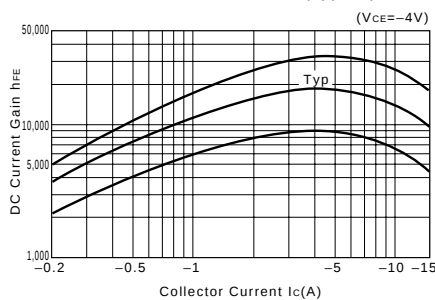
V_{CE(sat)}-I_B Characteristics (Typical)



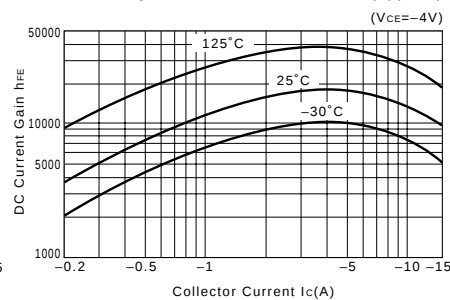
I_C-V_{BE} Temperature Characteristics (Typical)



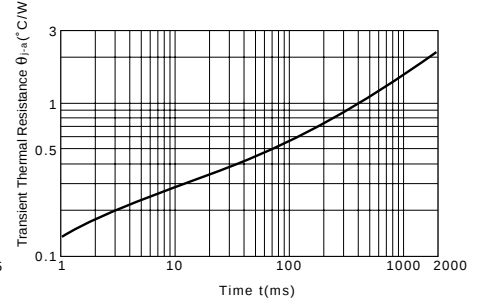
h_{FE}-I_C Characteristics (Typical)



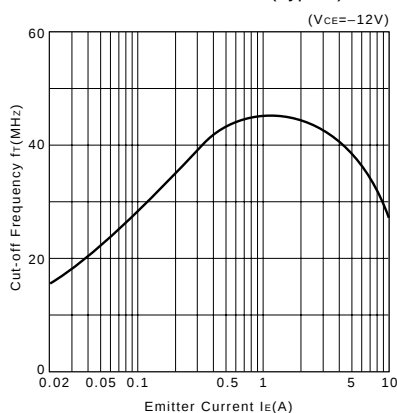
h_{FE}-I_C Temperature Characteristics (Typical)



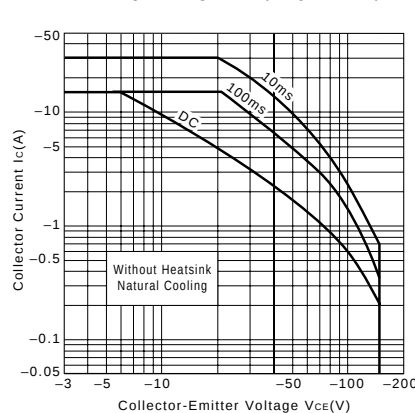
θ_{j-a}-t Characteristics



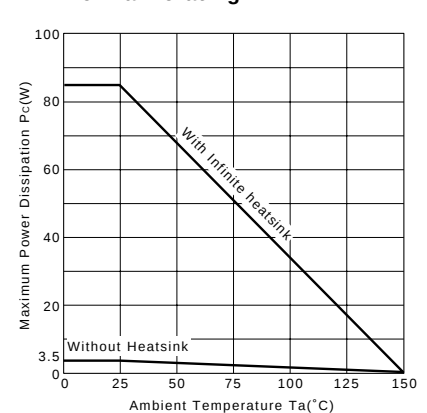
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

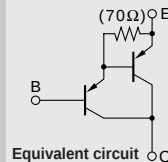


P_C-T_a Derating



Darlington

2SB1659



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2589)

Application : Audio, Series Regulator and General Purpose

■ **Absolute maximum ratings** (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-110	V
V _{CE0}	-110	V
V _{EB0}	-5	V
I _C	-6	A
I _B	-1	A
P _C	50(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■ **Electrical Characteristics** (Ta=25°C)

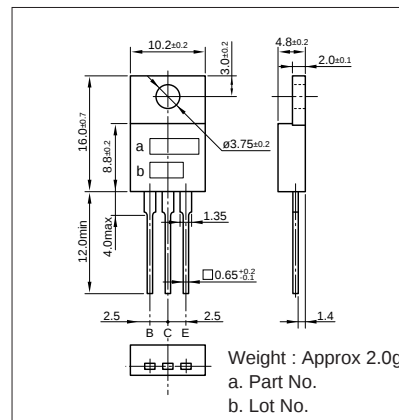
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-110V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CE0}	I _C =-30mA	-110min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	5000min*	
V _{CE(sat)}	I _C =-5A, I _B =-5mA	-2.5max	V
V _{BE(sat)}	I _C =-5A, I _B =-5mA	-3.0max	V
f _r	V _{CE} =-12V, I _E =0.5A	100typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	110typ	pF

*h_{FE} Rank ○(5000to12000), P(6500to20000), Y(15000to30000)

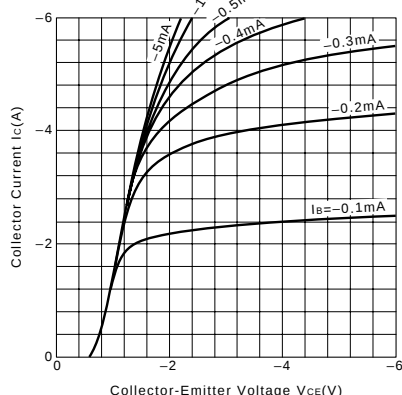
■ **Typical Switching Characteristics (Common Emitter)**

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-30	6	-5	-10	5	-5	5	1.1typ	3.2typ	1.1typ

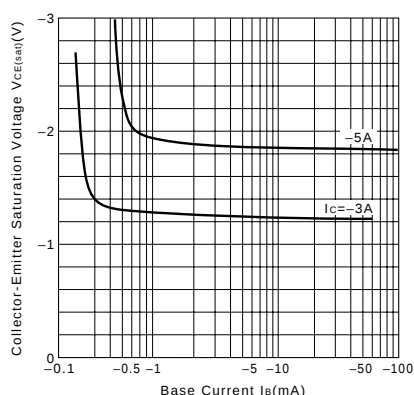
External Dimensions MT-25(TO220)



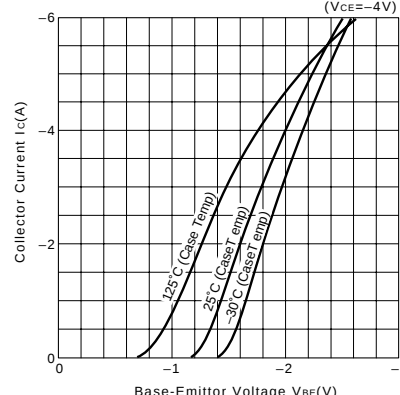
I_C-V_{CE} Characteristics (Typical)



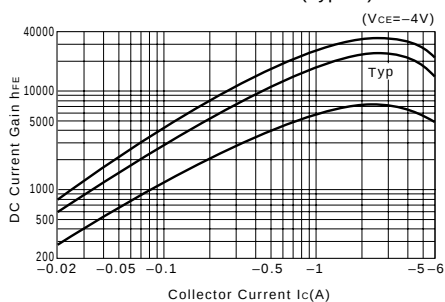
V_{CE(sat)}-I_B Characteristics (Typical)



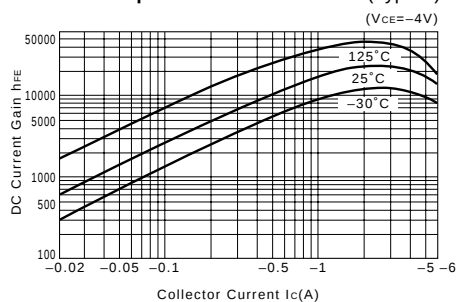
I_C-V_{BE} Temperature Characteristics (Typical)



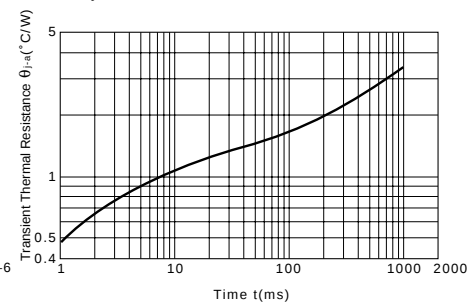
h_{FE}-I_C Characteristics (Typical)



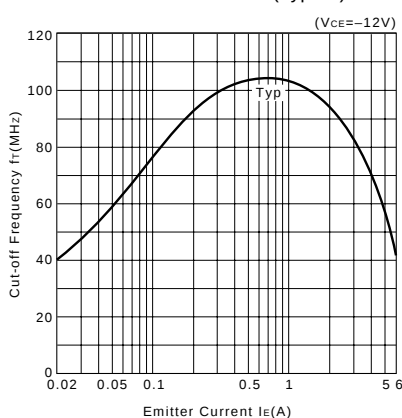
h_{FE}-I_C Temperature Characteristics (Typical)



θ_{JA}-t Characteristics

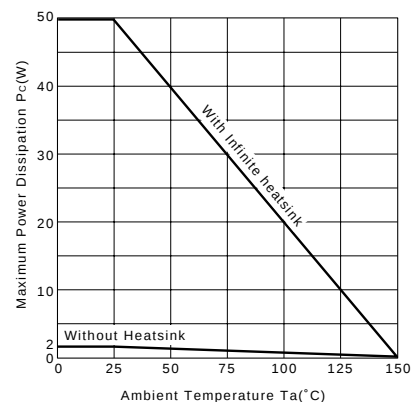


f_T-I_E Characteristics (Typical)



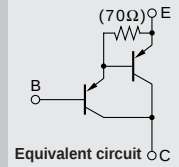
Safe Operating Area (Single Pulse)

P_C-T_a Derating



Darlington

2SB1685



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2641)

Application : Audio, Series Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-110	V
V _{CEO}	-110	V
V _{EB0}	-5	V
I _C	-6	A
I _B	-1	A
P _C	60(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

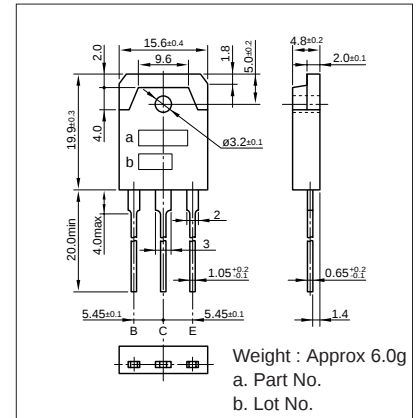
Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =-110V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-30mA	-110min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	5000min*	
V _{CE(sat)}	I _C =-5A, I _B =-5mA	-2.5max	V
V _{BE(sat)}	I _C =-5A, I _B =-5mA	-3.0max	V
f _r	V _{CE} =-12V, I _E =0.5A	100typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	110typ	pF

*h_{FE} Rank ○(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

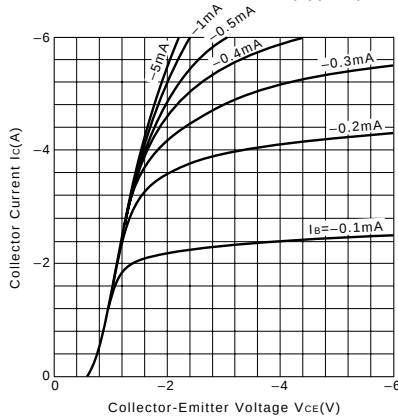
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-30	6	-5	-10	5	-5	5	1.1typ	3.2typ	1.1typ

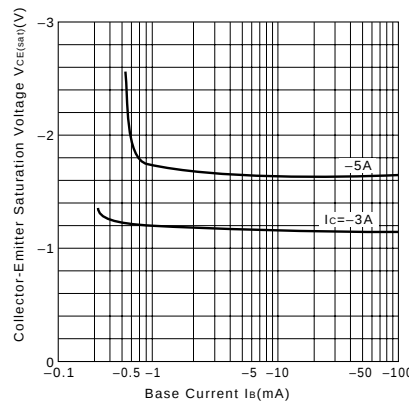
External Dimensions MT-100(TO3P)



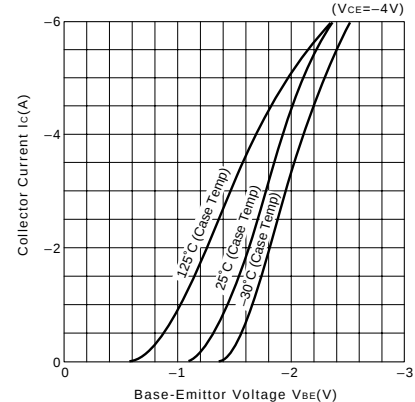
I_C-V_{CE} Characteristics (Typical)



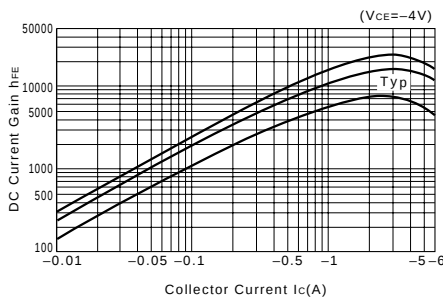
V_{CE(sat)}-I_B Characteristics (Typical)



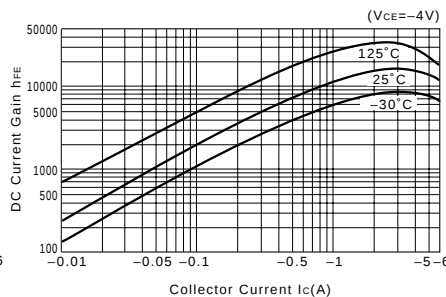
I_C-V_{BE} Temperature Characteristics (Typical)



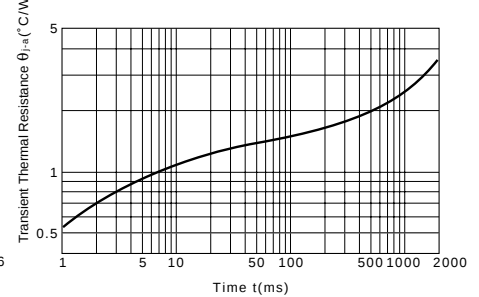
h_{FE}-I_C Characteristics (Typical)



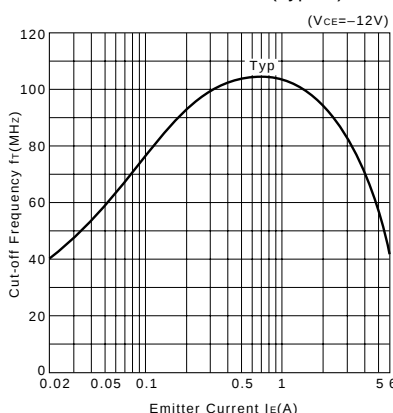
h_{FE}-I_C Temperature Characteristics (Typical)



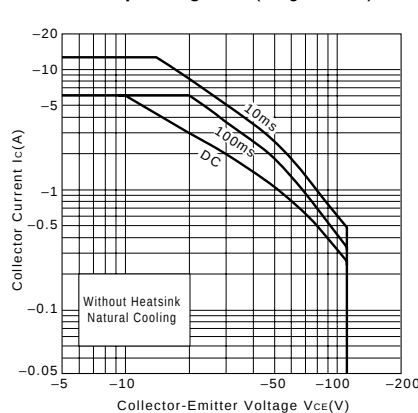
θ_{j-a}-t Characteristics



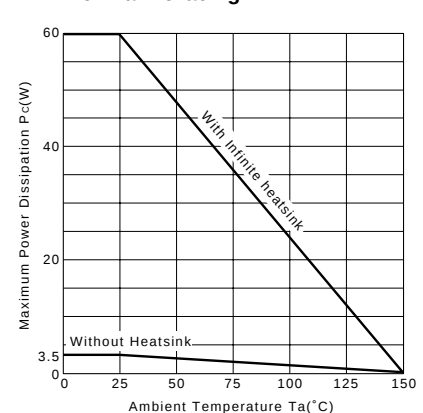
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

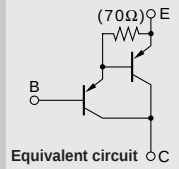


P_C-T_a Derating



Darlington

2SB1686



Equivalent circuit

Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2642)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	-110	V
V _{CEO}	-110	V
V _{EB0}	-5	V
I _C	-6	A
I _B	-1	A
P _C	30(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

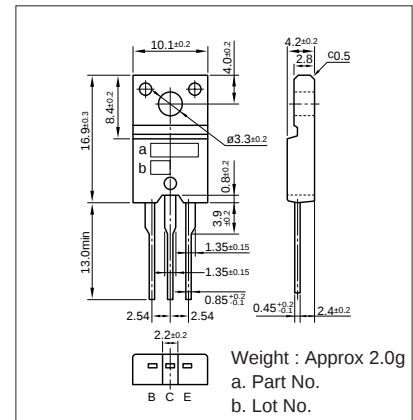
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-110V	-100max	μA
I _{EB0}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-30mA	-110min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	5000min*	
V _{CE(sat)}	I _C =-5A, I _B =-5mA	-2.5max	V
V _{BE(sat)}	I _C =-5A, I _B =-5mA	-3.0max	V
f _T	V _{CE} =-12V, I _E =0.5A	100typ	MHz
COB	V _{CB} =-10V, f=1MHz	110typ	pF

*h_{FE} Rank O(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

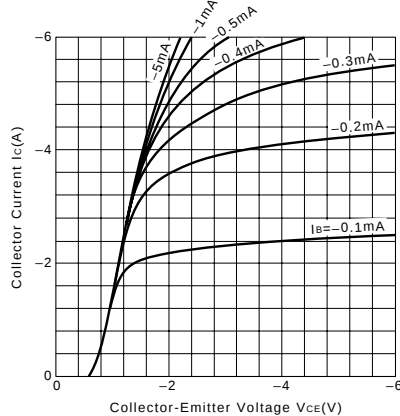
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-30	6	-5	-10	5	-5	5	1.1typ	3.2typ	1.1typ

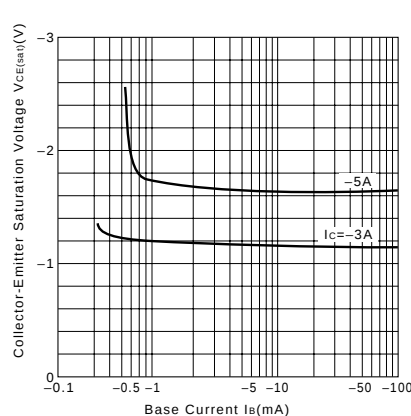
External Dimensions FM20(TO220F)



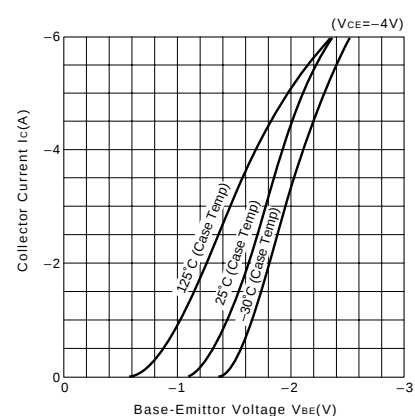
I_C-V_{CE} Characteristics (Typical)



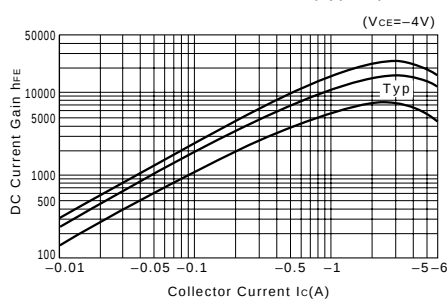
V_{CE(sat)}-I_B Characteristics (Typical)



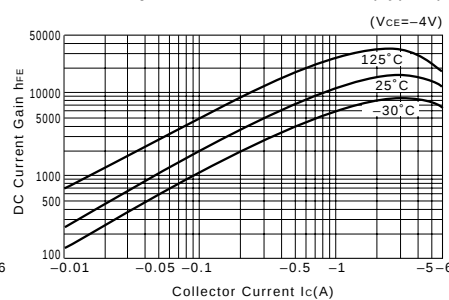
I_C-V_{BE} Temperature Characteristics (Typical)



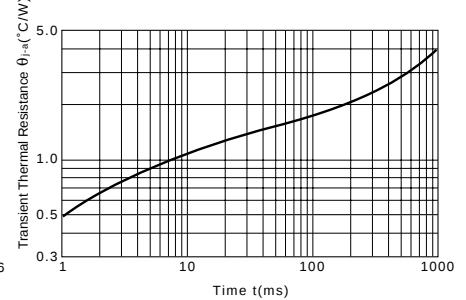
h_{FE}-I_C Characteristics (Typical)



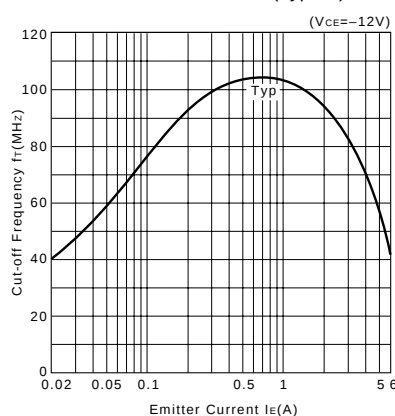
h_{FE}-I_C Temperature Characteristics (Typical)



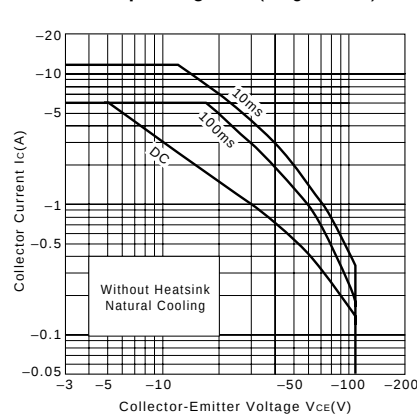
θ_{J-a}-t Characteristics



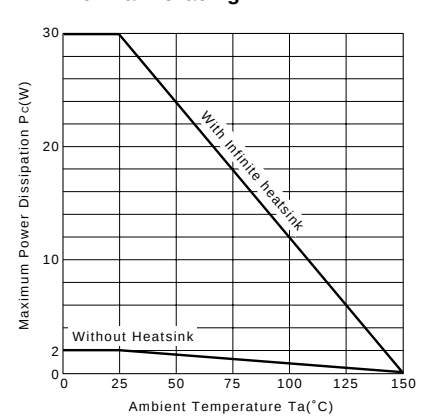
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

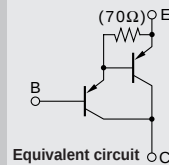


P_C-T_a Derating



Darlington

2SB1687



Silicon PNP Epitaxial Planar Transistor (Complement to type 2SD2643)

Application : Audio, Series Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

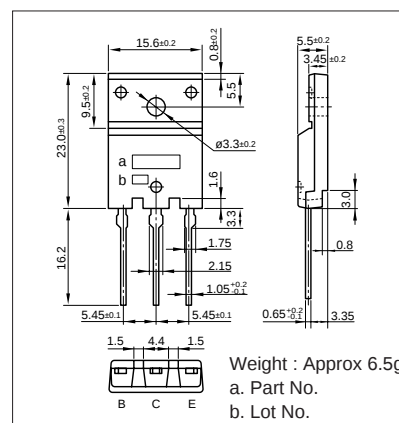
Symbol	Ratings	Unit
V _{CB0}	-110	V
V _{CE0}	-110	V
V _{EB0}	-5	V
I _C	-6	A
I _B	-1	A
P _C	60(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =-110V	-100max	μA
I _{EBO}	V _{EB} =-5V	-100max	μA
V _{(BR)CEO}	I _C =-30mA	-110min	V
h _{FE}	V _{CE} =-4V, I _C =-5A	5000min*	
V _{CE(sat)}	I _C =-5A, I _B =-5mA	-2.5max	V
V _{BE(sat)}	I _C =-5A, I _B =-5mA	-3.0max	V
f _r	V _{CE} =-12V, I _E =0.5A	-100typ	MHz
COB	V _{CB} =-10V, f=1MHz	-110typ	pF

*h_{FE} Rank O(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

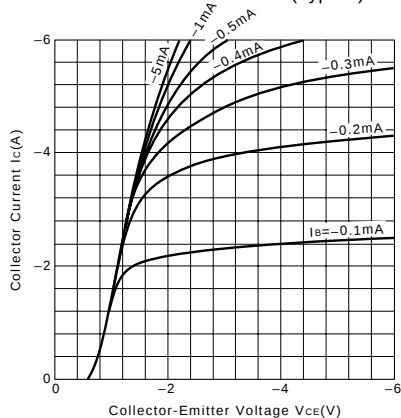
External Dimensions FM100(TO3P)



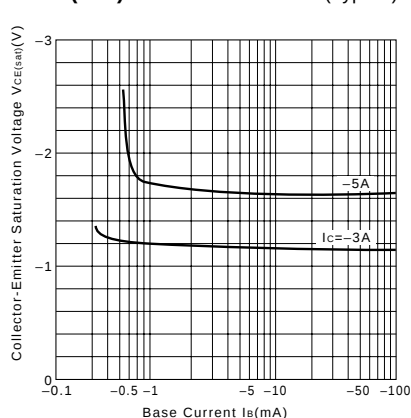
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
-30	6	-5	-10	5	-5	5	1.1typ	3.2typ	1.1typ

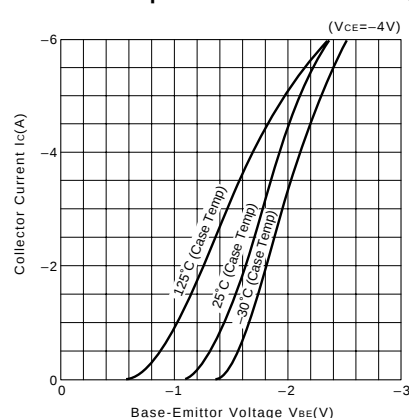
I_C-V_{CE} Characteristics (Typical)



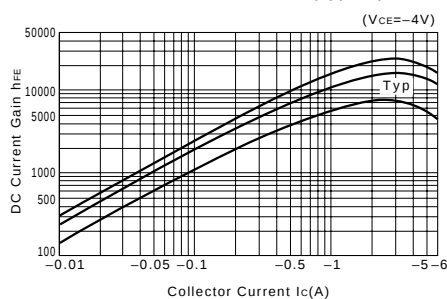
V_{CE(sat)}-I_B Characteristics (Typical)



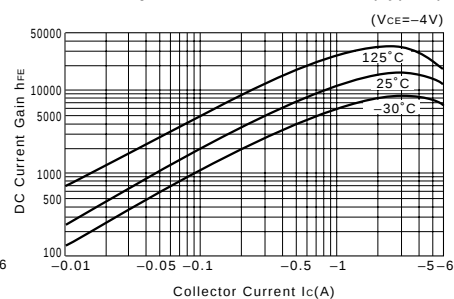
I_C-V_{BE} Temperature Characteristics (Typical)



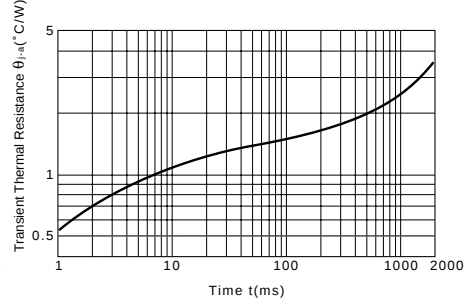
h_{FE}-I_C Characteristics (Typical)



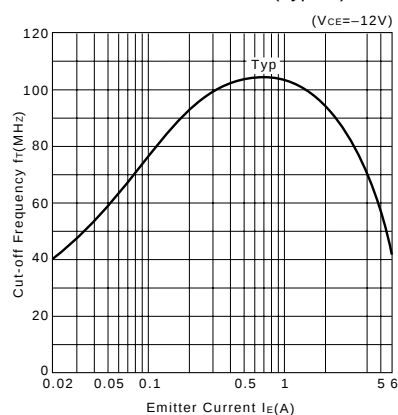
h_{FE}-I_C Temperature Characteristics (Typical)



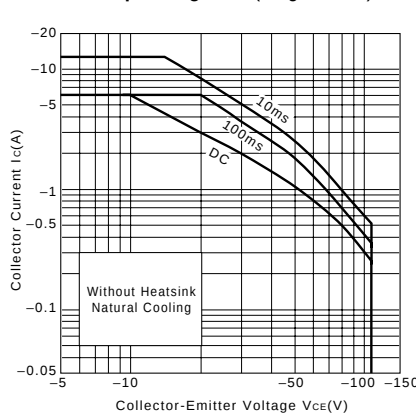
θ_{J-a}-t Characteristics



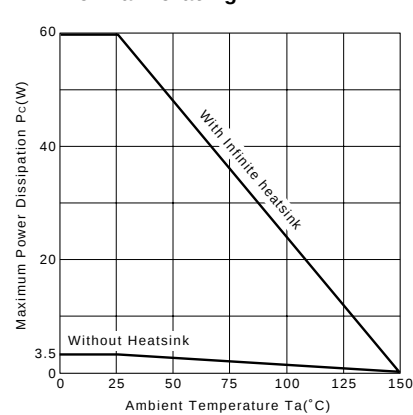
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC2023

Silicon NPN Triple Diffused Planar Transistor

Application : Series Regulator, Switch, and General Purpose

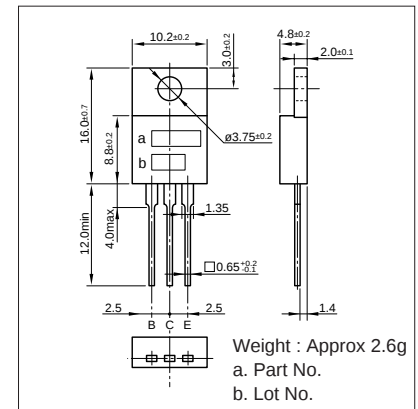
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	300	V
V _{CEO}	300	V
V _{EB0}	6	V
I _C	2	A
I _B	0.2	A
P _C	40(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =300V	1.0max	mA
I _{EB0}	V _{EB} =6V	1.0max	mA
V _{(BR)CEO}	I _C =25mA	300min	V
h _{FE}	V _{CE} =4V, I _C =0.5A	30min	
V _{CE(sat)}	I _C =1.0A, I _B =0.2A	1.0max	V
f _r	V _{CE} =12A, I _E =-0.2A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	75typ	pF

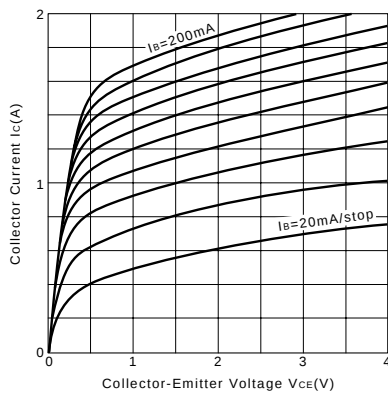
External Dimensions MT-25(TO220)



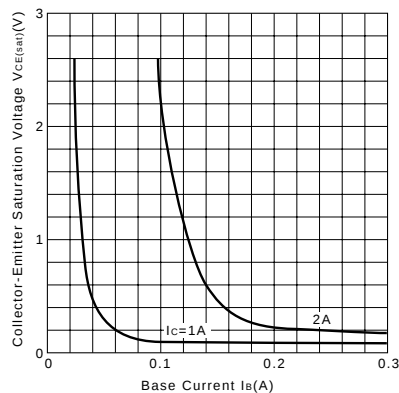
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{B2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
100	100	1.0	-5	100	-200	0.3typ	4.0typ	1.0typ

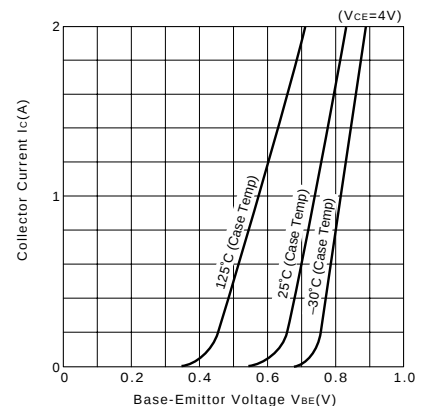
I_C-V_{CE} Characteristics (Typical)



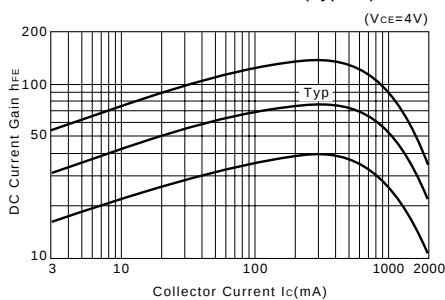
V_{CE(sat)}-I_B Characteristics (Typical)



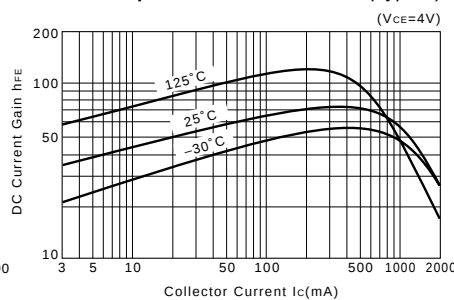
I_C-V_{BE} Temperature Characteristics (Typical)



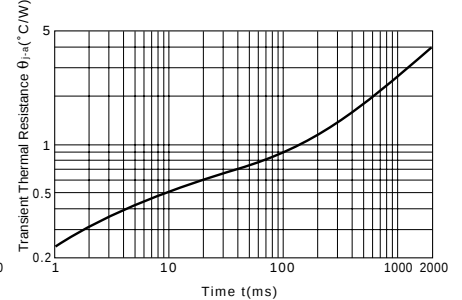
h_{FE}-I_C Characteristics (Typical)



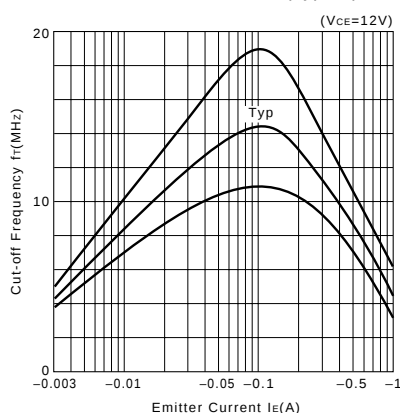
h_{FE}-I_C Temperature Characteristics (Typical)



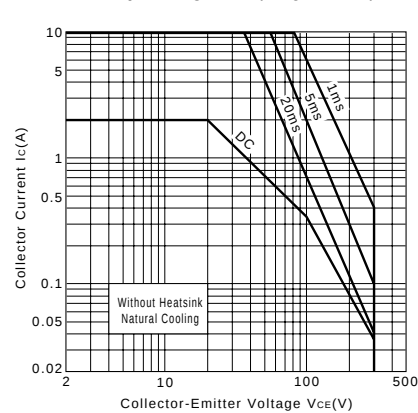
θ_{J-a}-t Characteristics



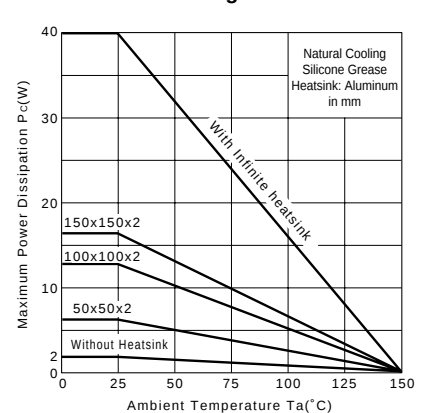
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1186)

Application : Audio and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	150	V
V _{CEO}	150	V
V _{EB0}	5	V
I _C	10	A
I _B	2	A
P _C	100(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

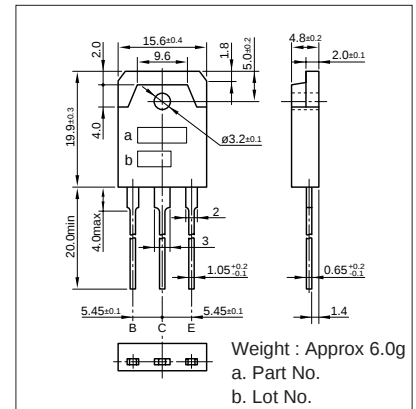
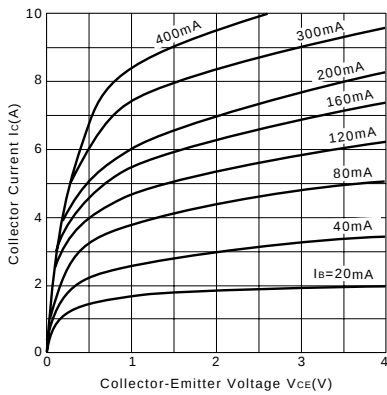
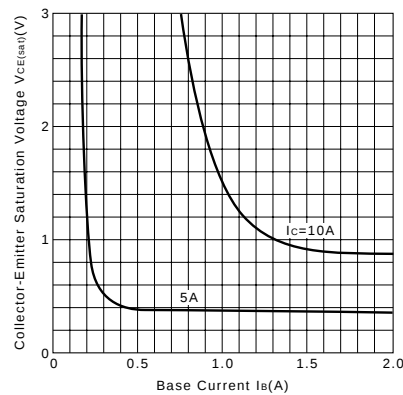
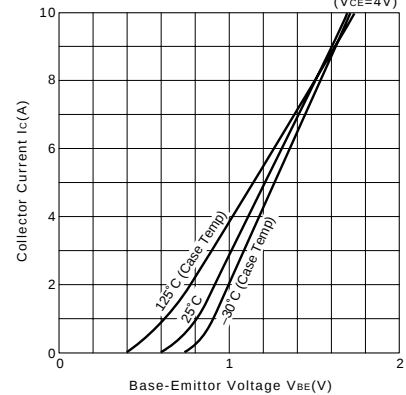
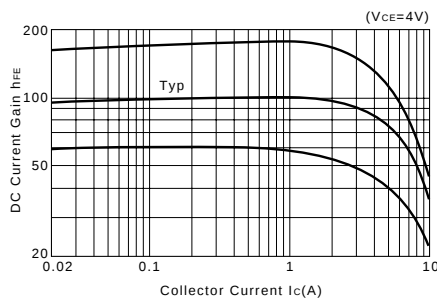
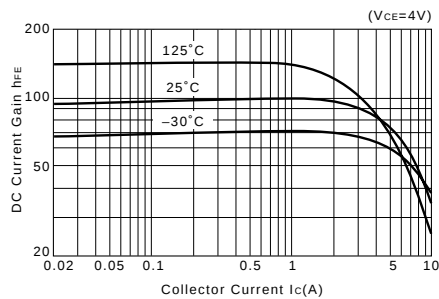
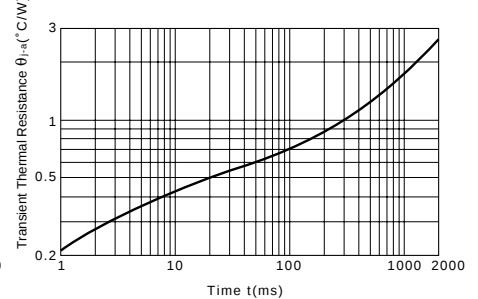
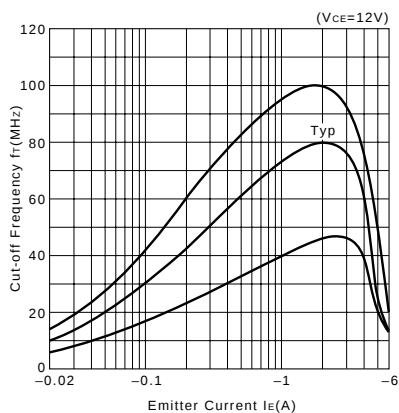
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =150V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =25mA	150min	V
h _{FE}	V _{CE} =4V, I _C =3V	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	2.0max	V
f _r	V _{CE} =12V, I _E =-1A	70typ	MHz
C _{OB}	V _{CB} =80V, f=1MHz	60typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

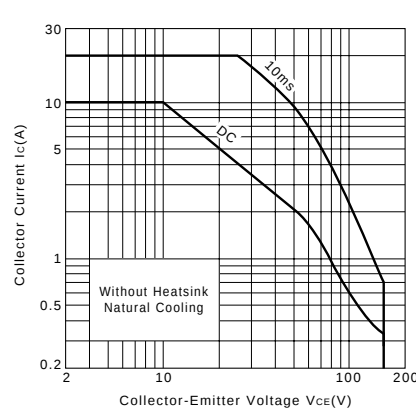
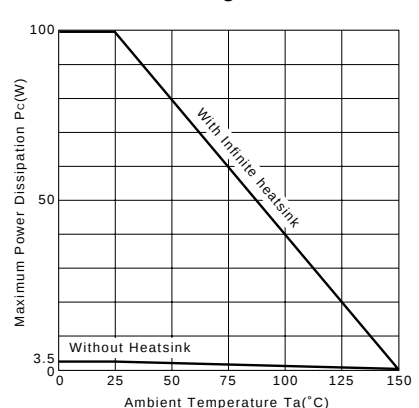
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{B2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	-5	500	-500	0.2typ	1.4typ	0.35typ

External Dimensions MT-100(TO3P)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{J-a}-t Characteristicsf_r-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1215)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

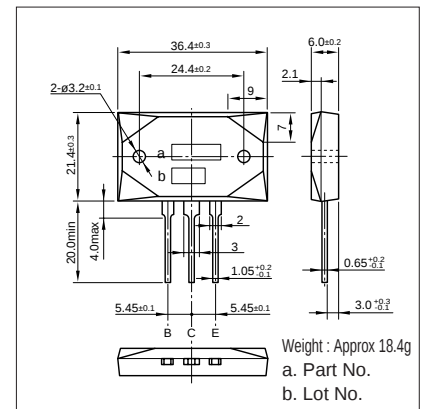
Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CE0}	160	V
V _{EB0}	5	V
I _C	15	A
I _B	4	A
P _C	150(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =160V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =25mA	160min	V
h _{FE}	V _{CE} =4V, I _C =5A	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	2.0max	V
f _r	V _{CE} =12V, I _E =-2A	60typ	MHz
COB	V _{CB} =10V, f=1MHz	200typ	pF

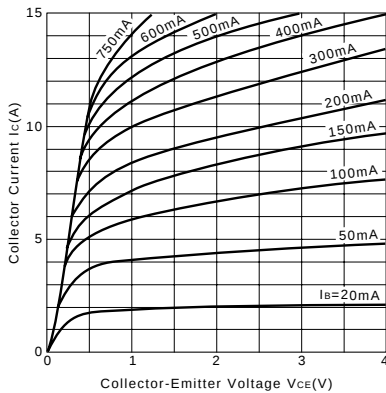
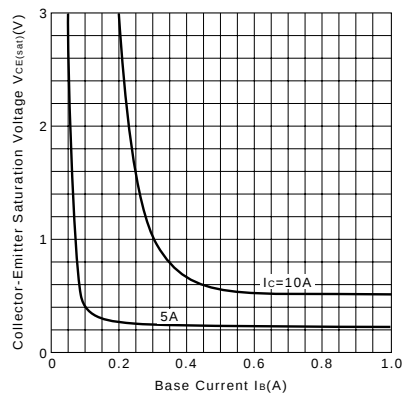
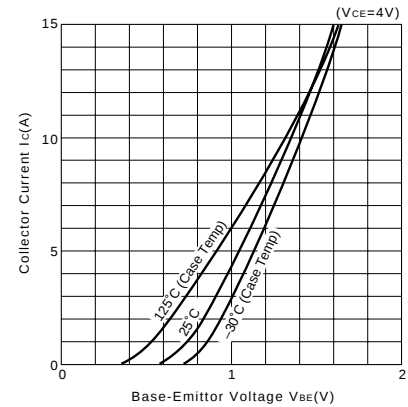
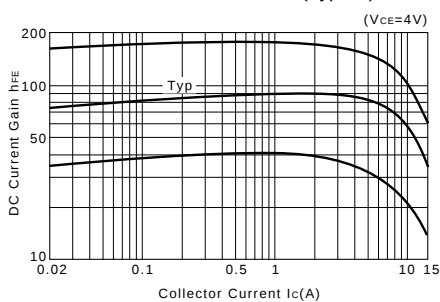
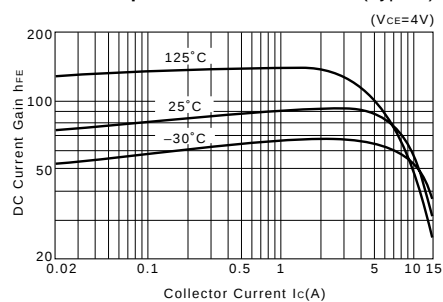
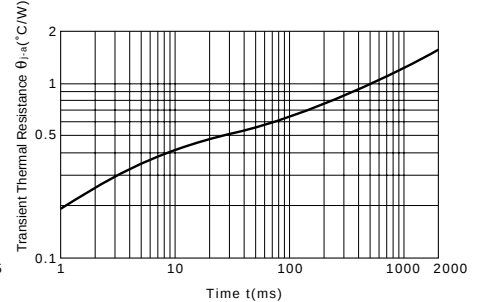
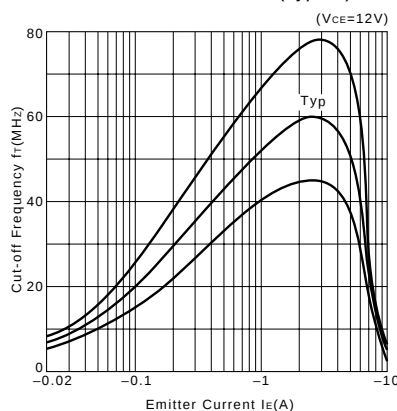
*h_{FE} Rank $\bar{O}$ (50 to 100), P(70 to 140), Y(90 to 180)

External Dimensions MT-200

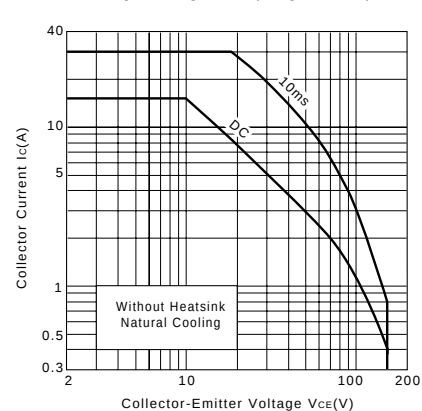
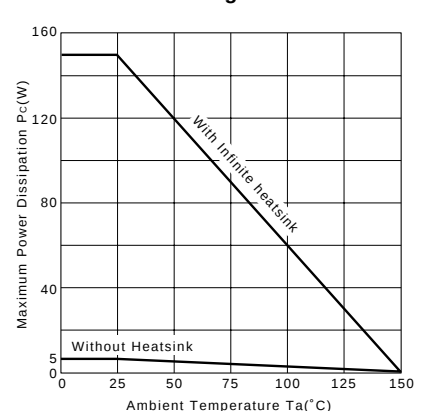


■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{B2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	-5	500	-500	0.2typ	1.5typ	0.35typ

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{j-a}-t Characteristicsf_r-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1216)

Application : Audio and General Purpose

■Absolute maximum ratings (Ta=25°C)

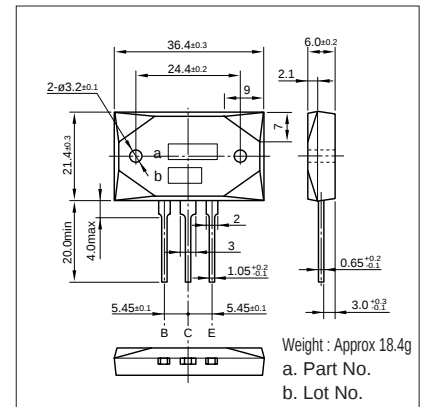
Symbol	Ratings	Unit
V _{CB0}	180	V
V _{CEO}	180	V
V _{EB0}	5	V
I _C	17	A
I _B	5	A
P _C	200(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =180V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =25mA	180min	V
h _{FE}	V _{CE} =4V, I _C =8V	30min*	
V _{CE(sat)}	I _C =8A, I _B =0.8A	2.0max	V
f _r	V _{CE} =12V, I _E =-2A	50typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	250typ	pF

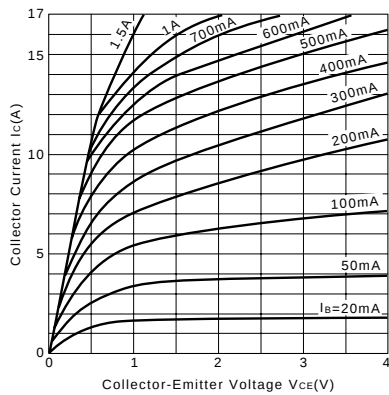
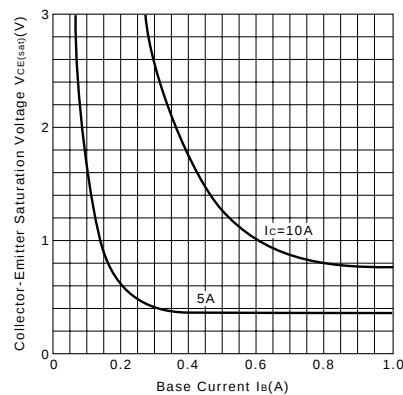
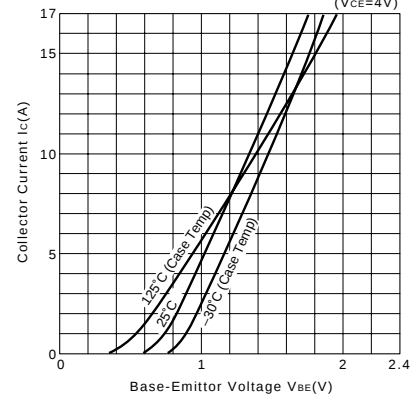
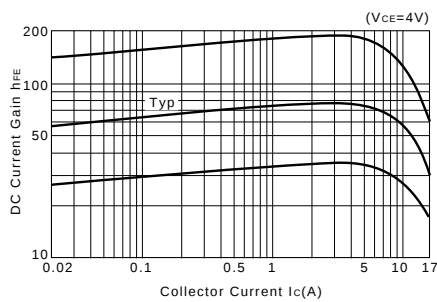
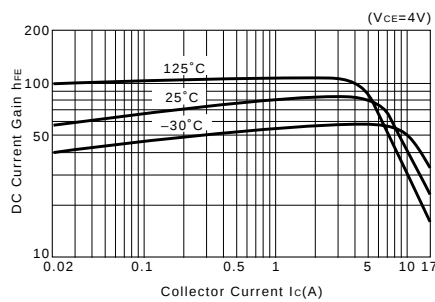
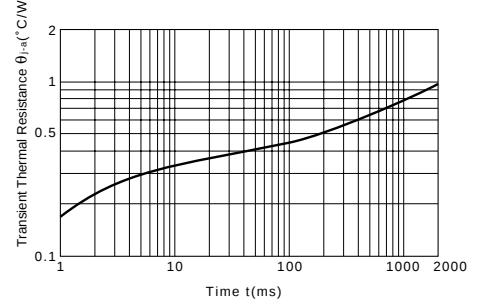
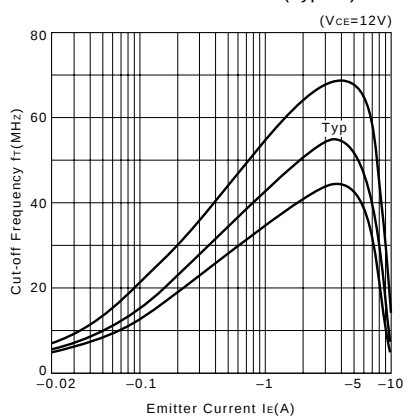
*h_{FE} Rank ○(30 to 60), Y(50 to 100), P(70 to 140), G(90 to 180)

External Dimensions MT-200

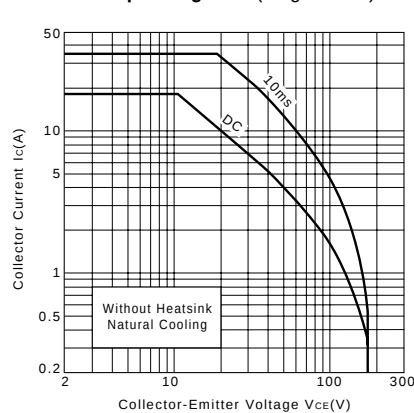
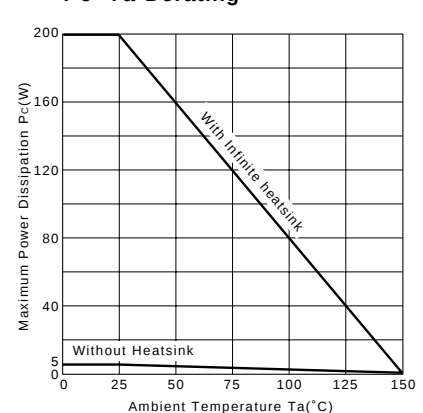


■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{B2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	4	10	-5	1	-1	0.2typ	1.3typ	0.45typ

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{J-a}-t Characteristicsf_r-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1294)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	230	V
V _{CE0}	230	V
V _{EB0}	5	V
I _C	15	A
I _B	4	A
P _C	130(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

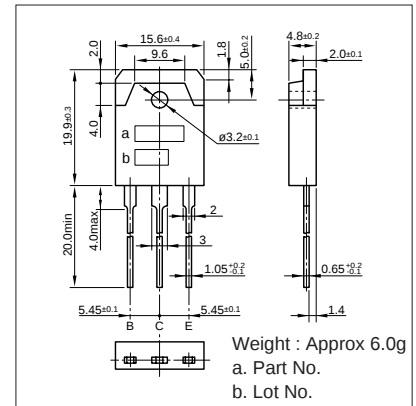
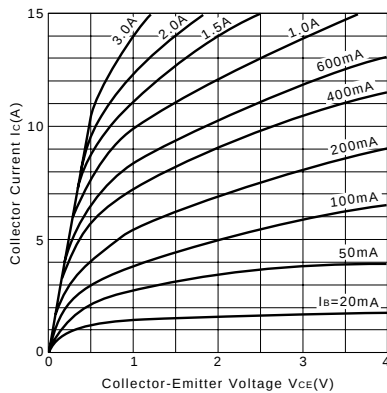
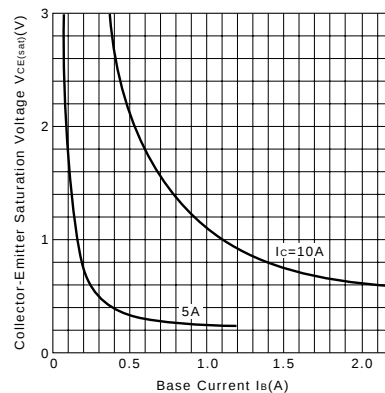
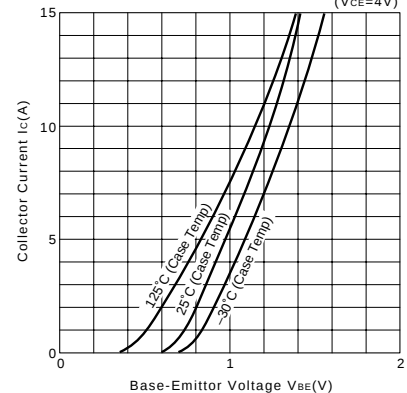
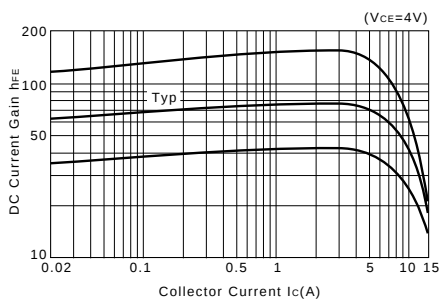
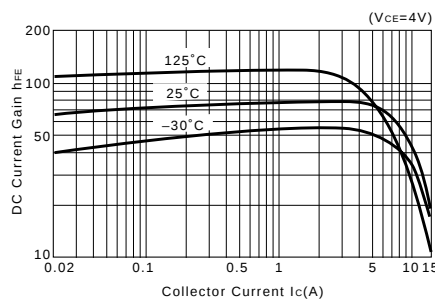
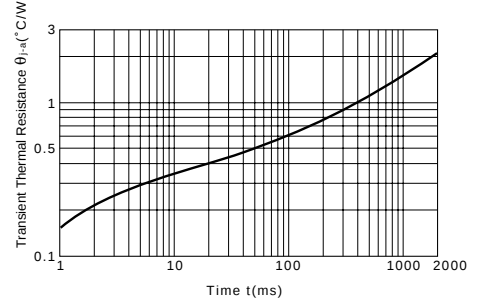
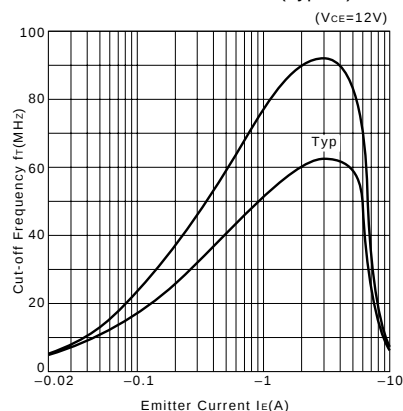
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =230V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =25mA	230min	V
h _{FE}	V _{CE} =4V, I _C =5A	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	2.0max	V
f _r	V _{CE} =12V, I _E =-2A	60typ	MHz
COB	V _{CB} =10V, f=1MHz	250typ	pF

*h_{FE} Rank $\bar{O}$ (50 to 100), Y(70 to 140)

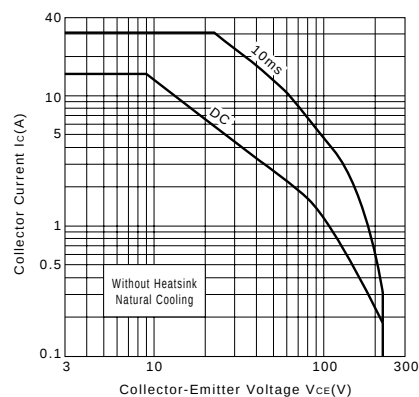
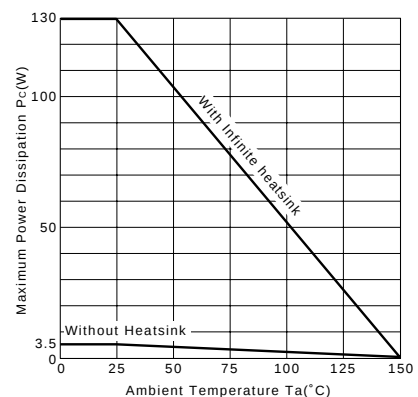
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	10	-5	500	-500	0.30typ	2.40typ	0.50typ

External Dimensions MT-100(TO3P)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{J-a}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1295)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

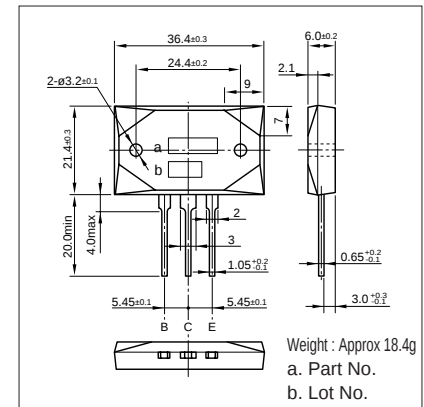
Symbol	Ratings	Unit
V _{CB0}	230	V
V _{CEO}	230	V
V _{EB0}	5	V
I _C	17	A
I _B	5	A
P _C	200(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =230V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =25mA	230min	V
h _{FE}	V _{CE} =4V, I _C =5A	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	2.0max	V
f _r	V _{CE} =12V, I _E =-2A	60typ	MHz
COB	V _{CB} =10V, f=1MHz	250typ	pF

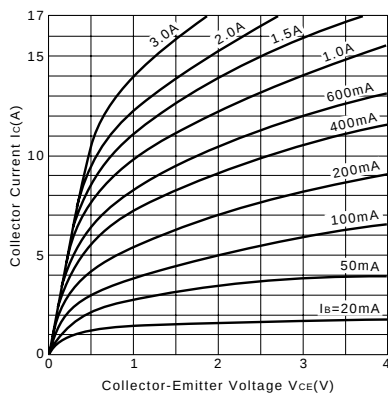
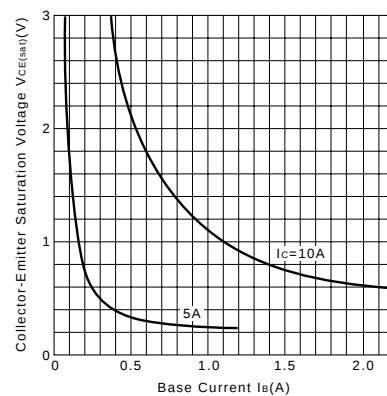
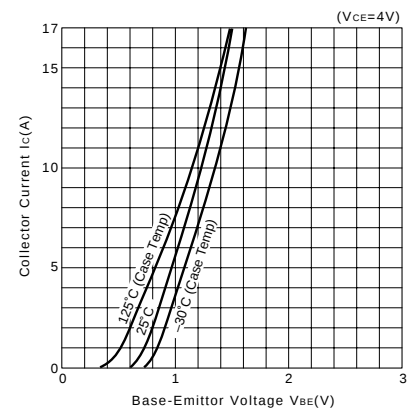
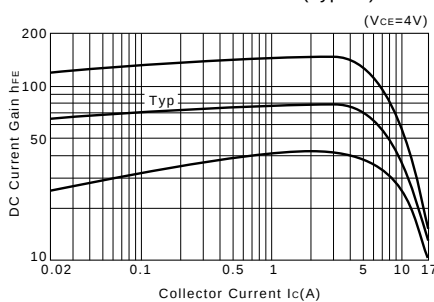
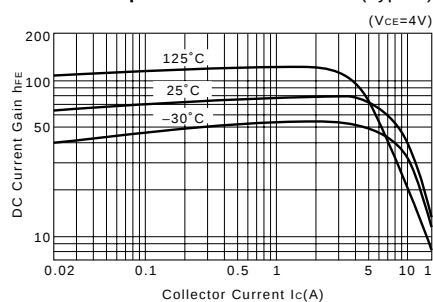
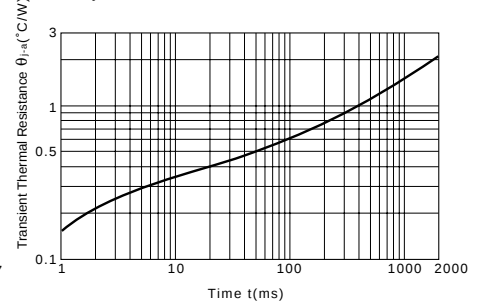
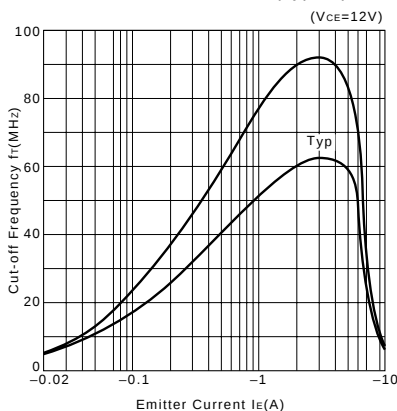
*h_{FE} Rank O(50 to 100), Y(70 to 140)

External Dimensions MT-200

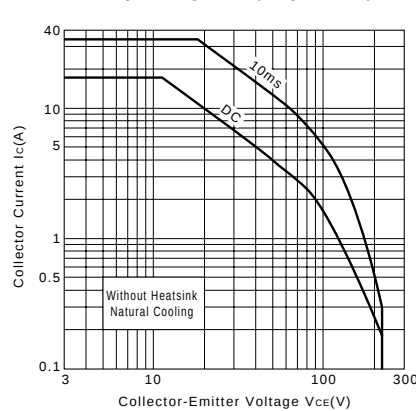
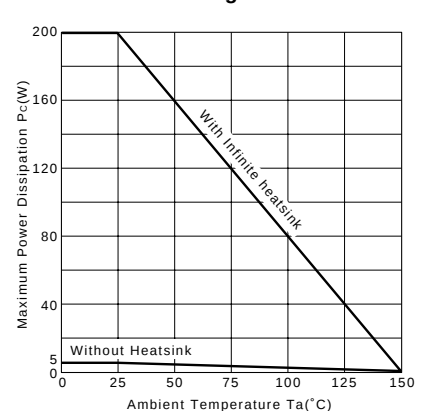


■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	10	-5	0.5	-0.5	0.30typ	2.40typ	0.50typ

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{J-a}-t Characteristicsf_r-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1303)

Application : Audio and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	150	V
V _{CE0}	150	V
V _{EB0}	5	V
I _C	14	A
I _B	3	A
P _C	125(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

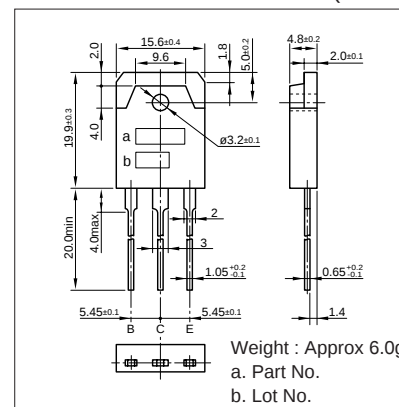
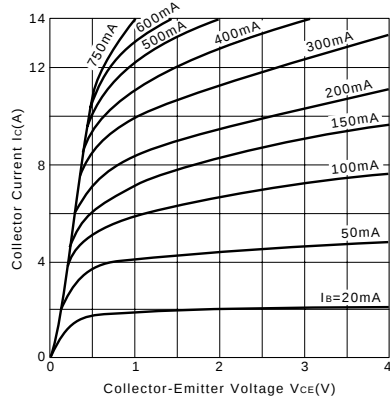
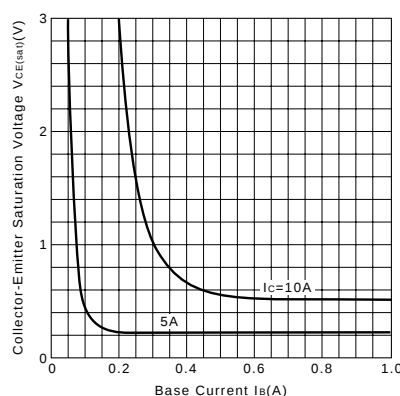
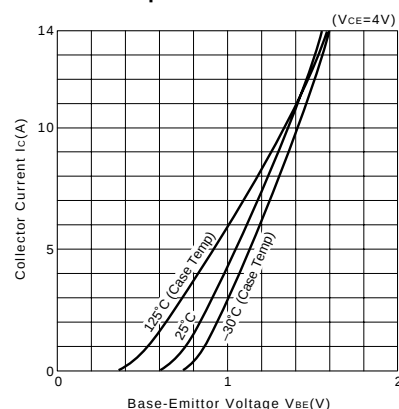
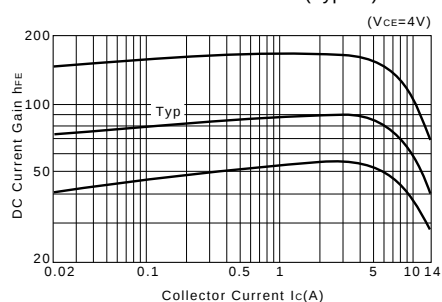
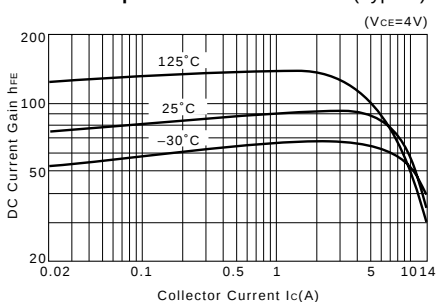
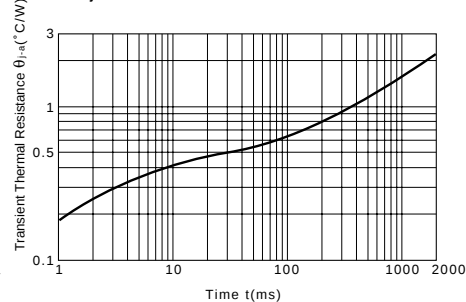
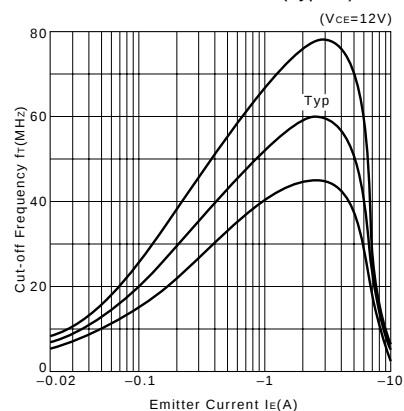
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =150V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =25mA	150min	V
h _{FE}	V _{CE} =4V, I _C =5A	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	2.0max	V
f _r	V _{CE} =12V, I _E =-2A	60typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	200typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

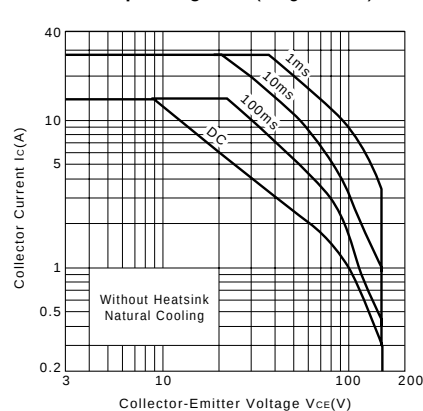
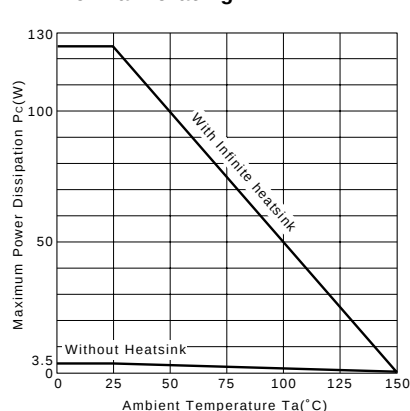
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	10	-5	0.5	-0.5	0.2typ	1.5typ	0.35typ

External Dimensions MT-100(TO3P)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{j-a}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

LAPT 2SC3519/3519A

Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1386/A)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings		Unit
	2SC3519	2SC3519A	
V _{CB0}	160	180	V
V _{CE0}	160	180	V
V _{EB0}	5		V
I _C	15		A
I _B	4		A
P _C	130(T _C =25°C)		W
T _J	150		°C
T _{stg}	-55 to +150		°C

Electrical Characteristics (Ta=25°C)

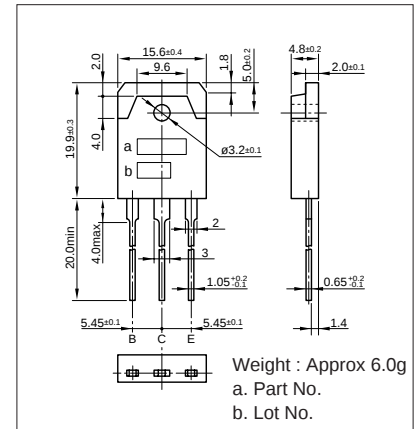
Symbol	Conditions	Ratings		Unit
		2SC3519	2SC3519A	
I _{CB0}	V _{CB} =	100max		μA
I _{EB0}	V _{EB} =5V	100max		μA
V _{(BR)CEO}	I _C =25mA	160min	180min	V
h _{FE}	V _{CE} =4V, I _C =5A	50min*		
V _{CE(sat)}	I _C =5A, I _B =0.5A	2.0max		V
f _r	V _{CE} =12V, I _E =-2A	50typ		MHz
C _{OB}	V _{CB} =10V, f=1MHz	250typ		pF

*h_{FE} Rank: $\bar{O}$ (50 to 100), P(70 to 140), Y(90 to 180)

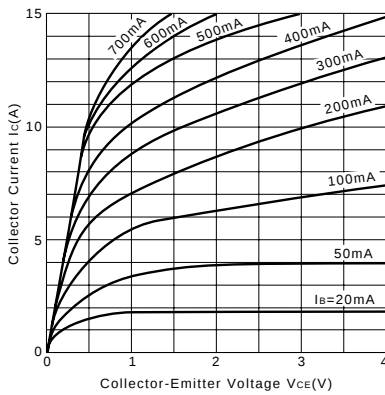
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	4	10	10	-5	1	-1	0.2typ	1.3typ	0.45typ

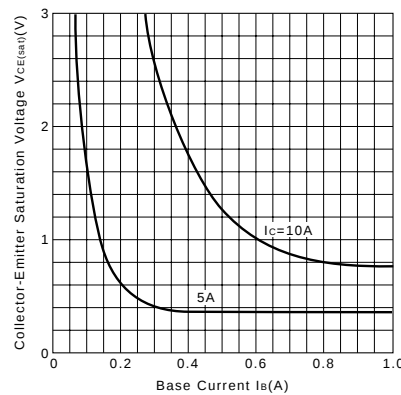
External Dimensions MT-100(TO3P)



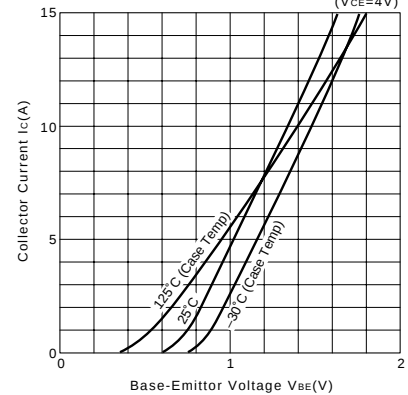
I_C-V_{CE} Characteristics (Typical)



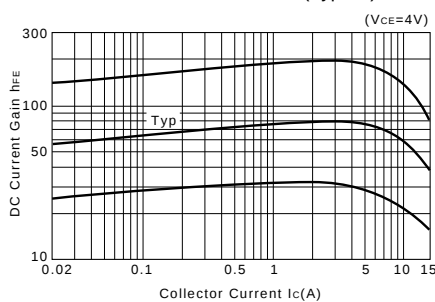
V_{CE(sat)}-I_B Characteristics (Typical)



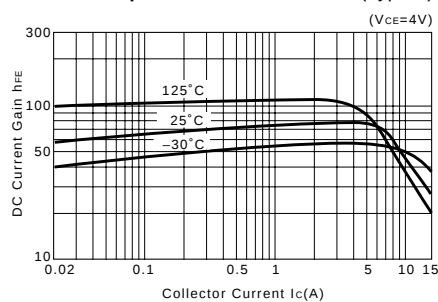
I_C-V_{BE} Temperature Characteristics (Typical)



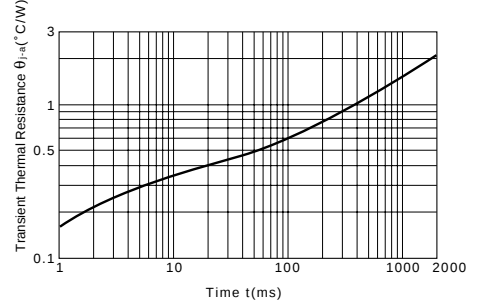
h_{FE}-I_C Characteristics (Typical)



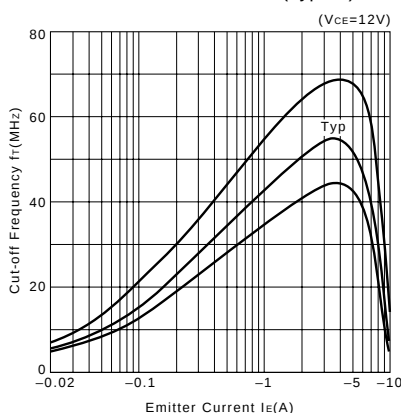
h_{FE}-I_C Temperature Characteristics (Typical)



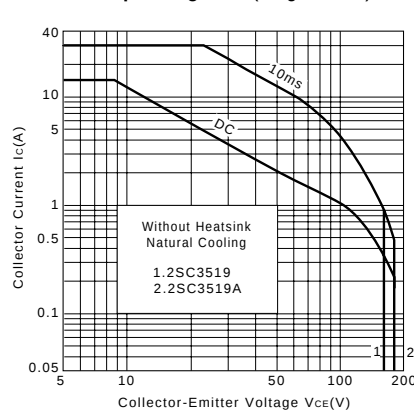
θ_{j-a}-t Characteristics



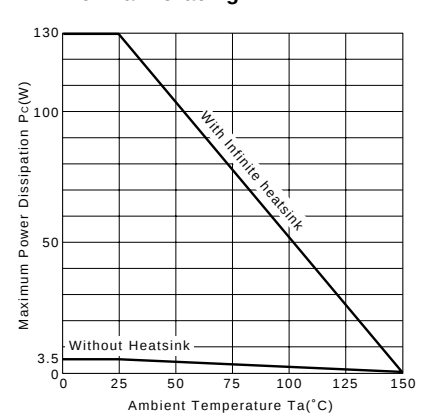
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC3678

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	800	V
V _{EB0}	7	V
I _C	3(Pulse6)	A
I _B	1.5	A
P _C	80(Tc=25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

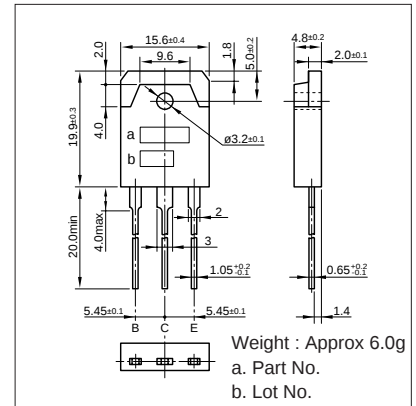
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V(BR)CEO	I _C =10mA	800min	V
h _{FE}	V _{CE} =4V, I _C =1A	10 to 30	
V _{CE(sat)}	I _C =1A, I _B =0.2A	0.5max	V
V _{BE(sat)}	I _C =1A, I _B =0.2A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.3A	6typ	MHz
COB	V _{CB} =10V, f=1MHz	50typ	pF

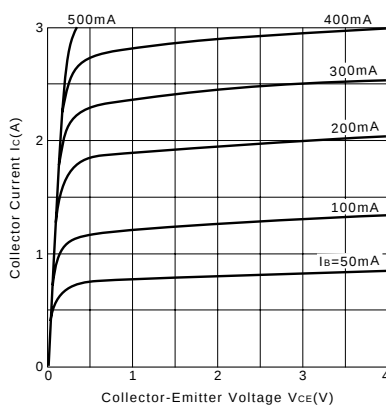
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	250	1	10	-5	0.15	-0.5	1max	5max	1max

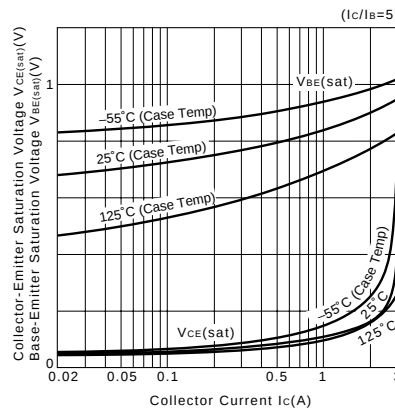
External Dimensions MT-100(TO3P)



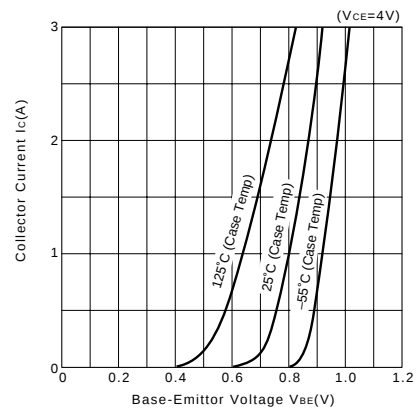
I_C-V_{CE} Characteristics (Typical)



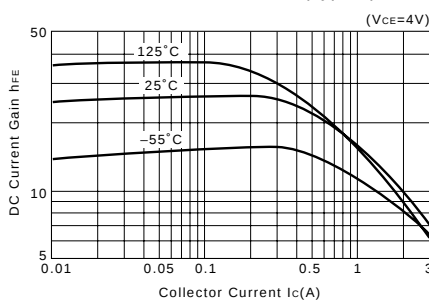
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



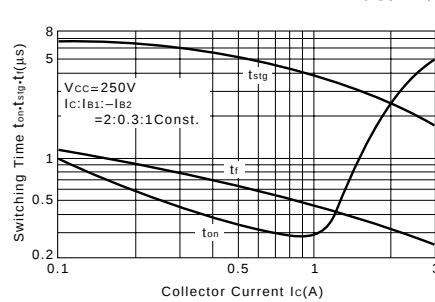
I_C-V_{BE} Temperature Characteristics (Typical)



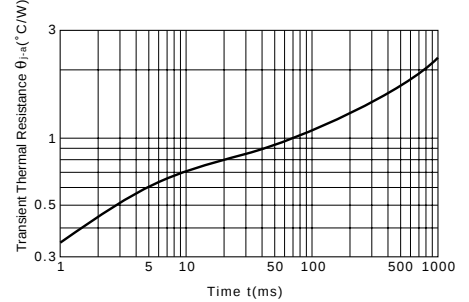
h_{FE}-I_C Characteristics (Typical)



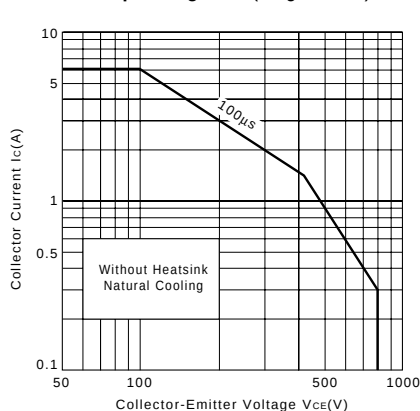
t_{on}•t_{stg}•t_r-I_C Characteristics (Typical)



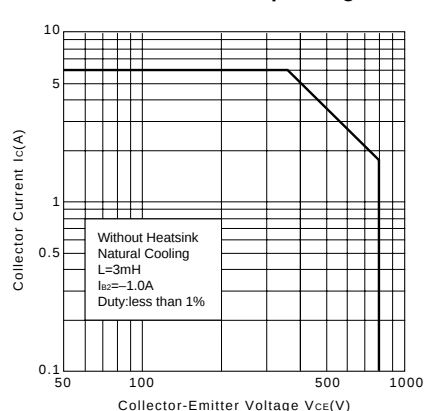
θ_{j-a}-t Characteristics



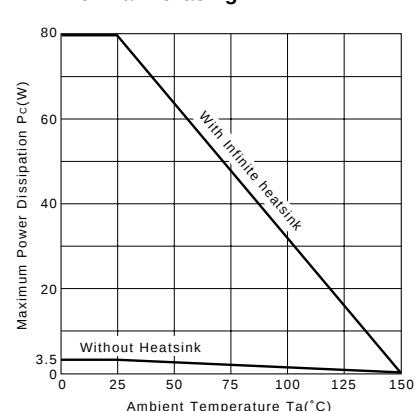
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3679

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	800	V
V _{EBO}	7	V
I _C	5(Pulse10)	A
I _B	2.5	A
P _C	100(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

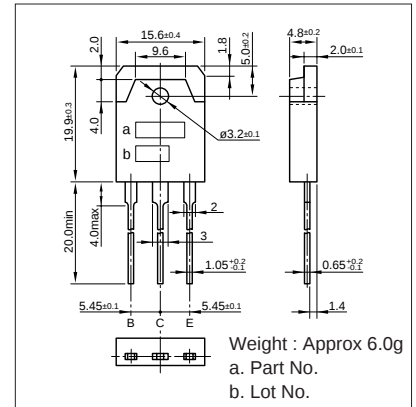
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =800V	100max	μA
I _{EBO}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	800min	V
h _{FE}	V _{CE} =4V, I _C =2A	10to30	
V _{CE(sat)}	I _C =2A, I _B =0.4A	0.5max	V
V _{BE(sat)}	I _C =2A, I _B =0.4A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.5A	6typ	MHz
COB	V _{CB} =10V, f=1MHz	75typ	pF

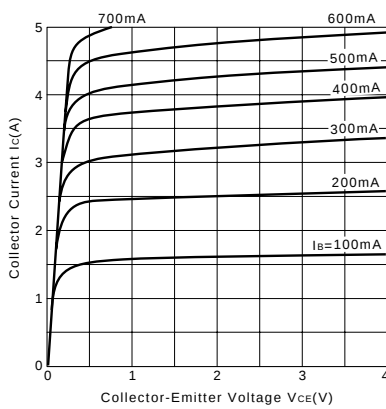
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	125	2	10	-5	0.3	-1	1max	5max	1max

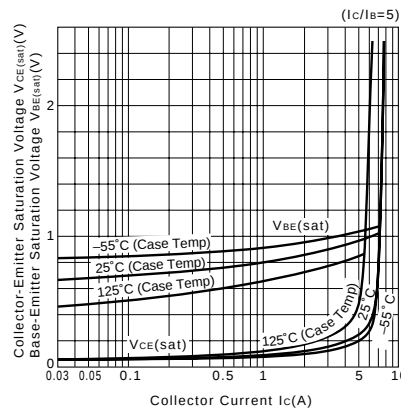
External Dimensions MT-100(TO3P)



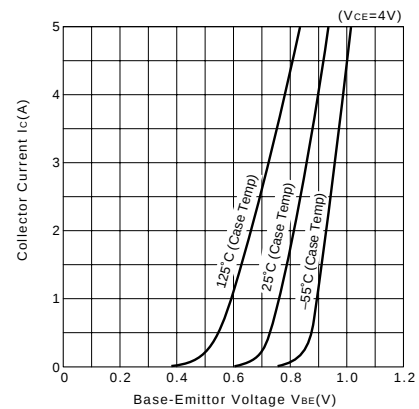
I_C-V_{CE} Characteristics (Typical)



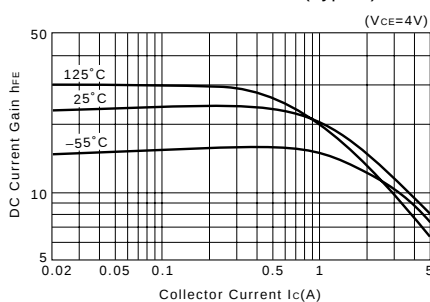
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



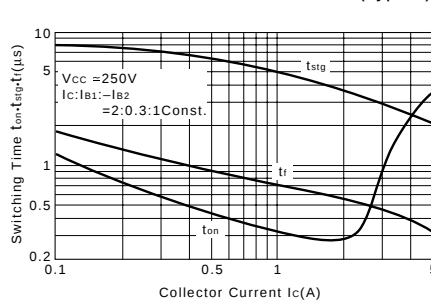
I_C-V_{BE} Temperature Characteristics (Typical)



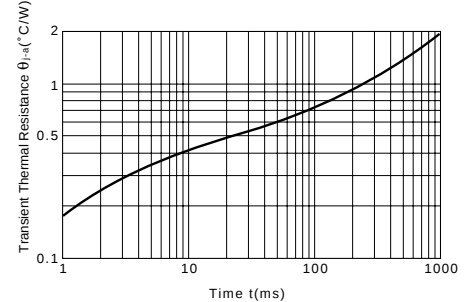
h_{FE}-I_C Characteristics (Typical)



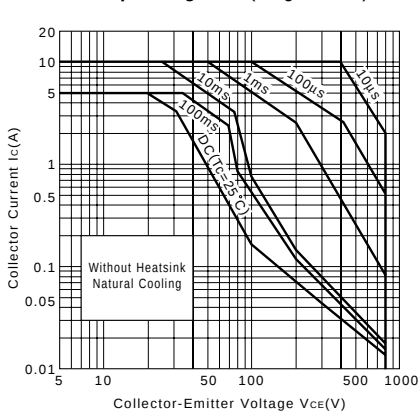
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



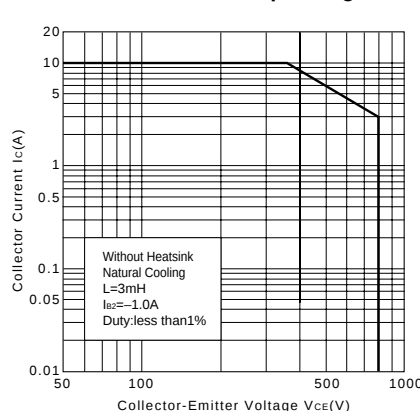
θ_{j-a}-t Characteristics



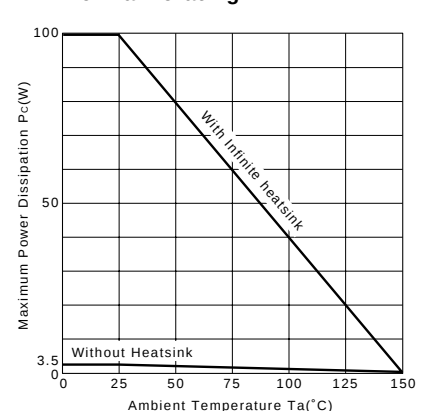
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3680

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	800	V
V _{EB0}	7	V
I _C	7(Pulse14)	A
I _B	3.5	A
P _C	120(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

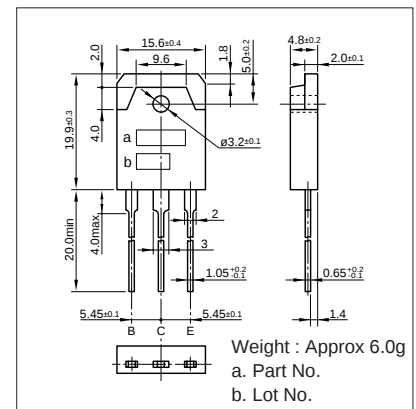
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	800min	V
h _{FE}	V _{CE} =4V, I _C =3A	10 to 30	
V _{CE(sat)}	I _C =3A, I _B =0.6A	0.5max	V
V _{BE(sat)}	I _C =3A, I _B =0.6A	1.2max	V
f _r	V _{CE} =12V, I _E =-2A	6typ	MHz
COB	V _{CB} =10V, f=1MHz	105typ	pF

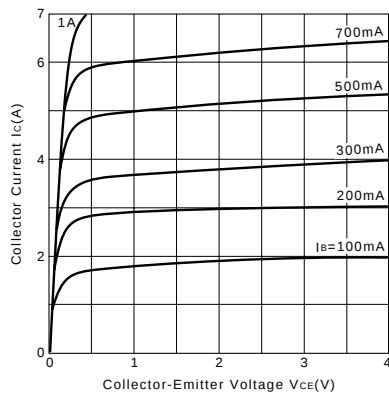
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	83	3	10	-5	0.45	-1.5	1max	5max	1max

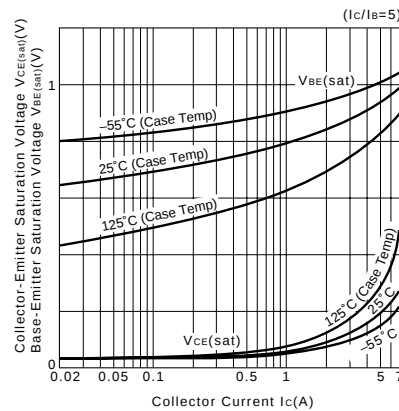
External Dimensions MT-100(TO3P)



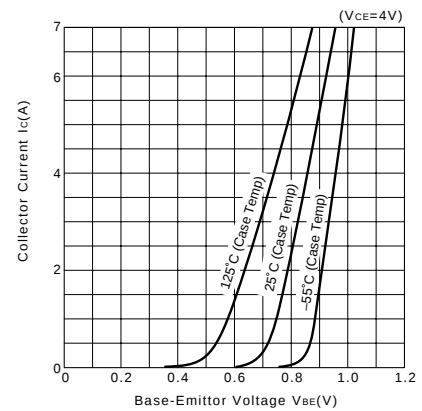
I_C-V_{CE} Characteristics (Typical)



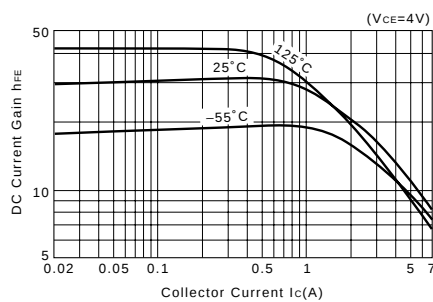
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



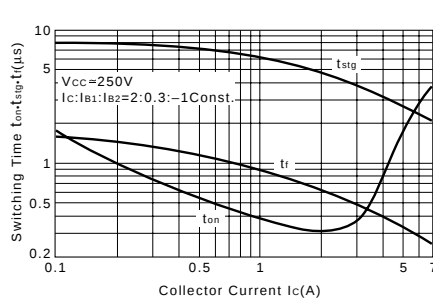
I_C-V_{BE} Temperature Characteristics (Typical)



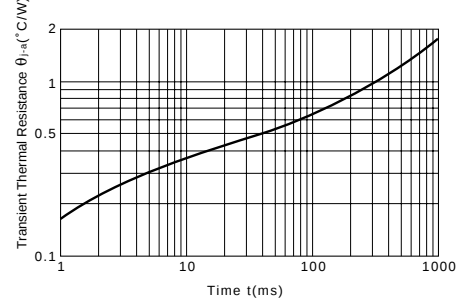
h_{FE}-I_C Characteristics (Typical)



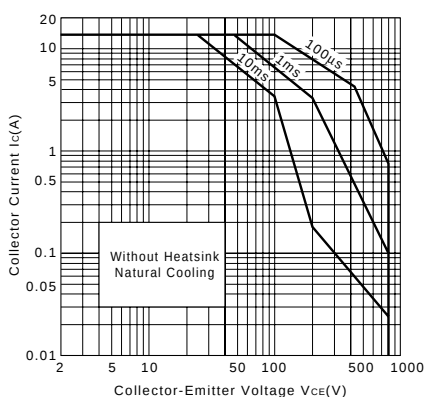
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



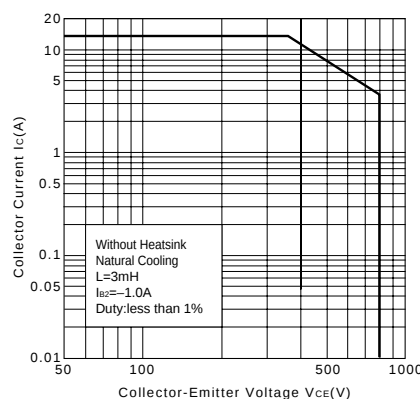
θ_{j-a}-t Characteristics



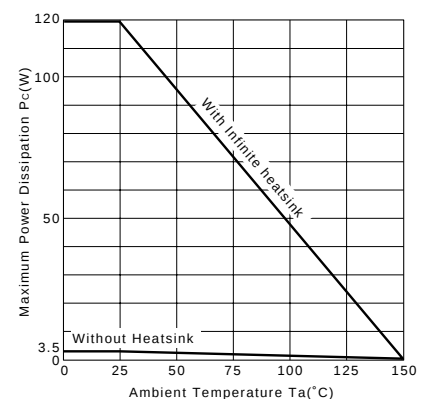
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3830

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	600	V
V _{CEO}	500	V
V _{EB0}	10	V
I _C	6(Pulse12)	A
I _B	2	A
P _C	50(Tc=25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

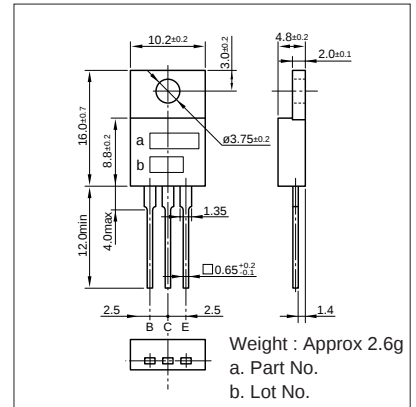
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =600V	1max	mA
I _{EB0}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	500min	V
h _{FE}	V _{CE} =4V, I _C =2A	10 to 30	
V _{CE(sat)}	I _C =2A, I _B =0.4A	0.5max	V
V _{BE(sat)}	I _C =2A, I _B =0.4A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.5A	8typ	MHz
COB	V _{CB} =10V, f=1MHz	45typ	pF

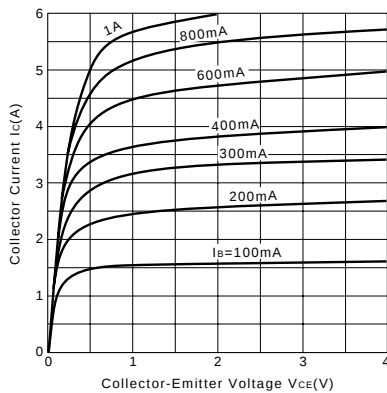
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	100	2	10	-5	0.2	-0.4	1max	4.5max	0.5max

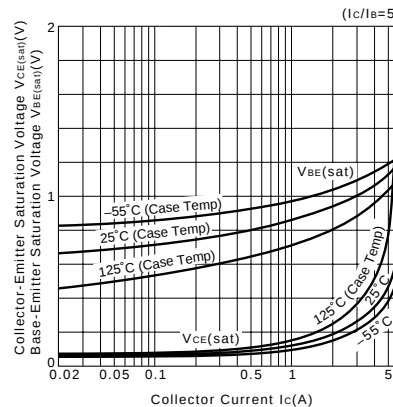
External Dimensions MT-25(TO220)



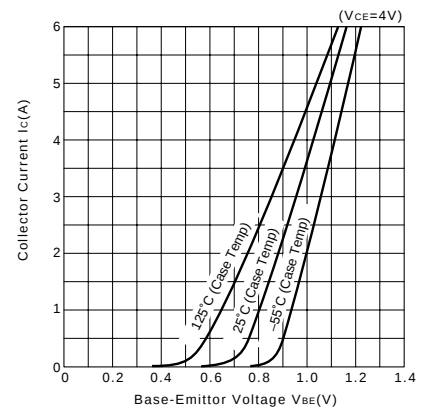
I_C-V_{CE} Characteristics (Typical)



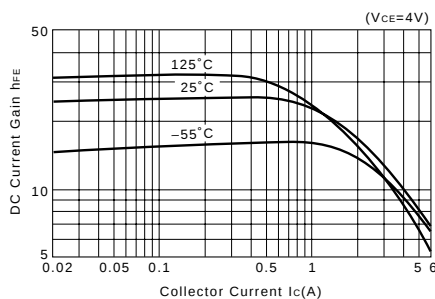
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



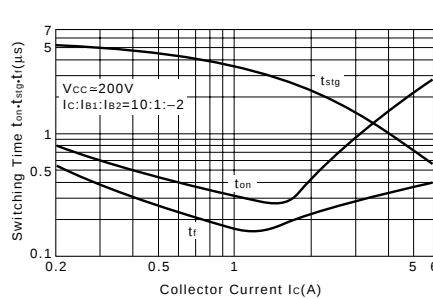
I_C-V_{BE} Temperature Characteristics (Typical)



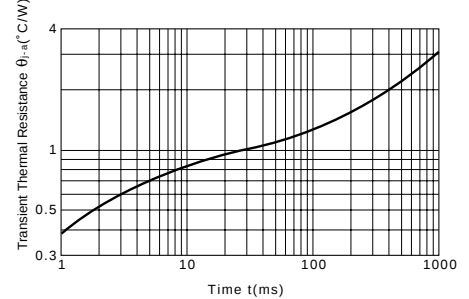
h_{FE}-I_C Characteristics (Typical)



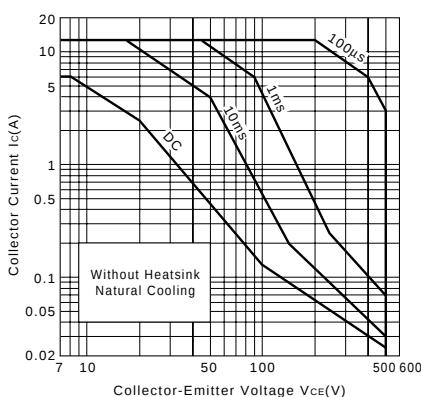
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



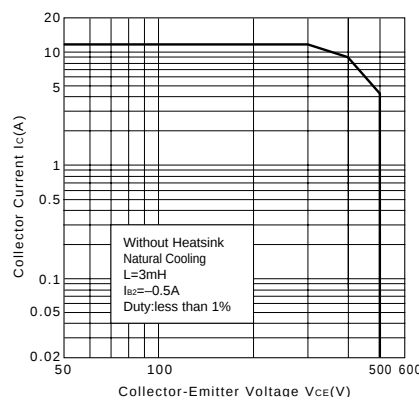
θ_{j-a}-t Characteristics



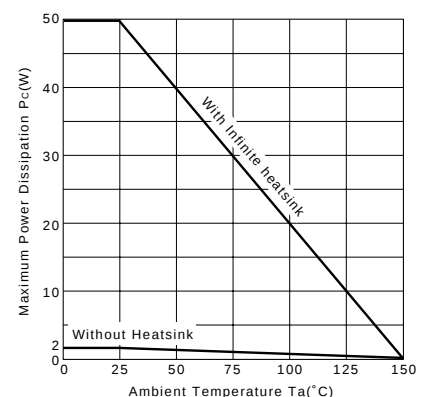
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3831

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	600	V
V _{CE0}	500	V
V _{EB0}	10	V
I _C	10(Pulse20)	A
I _B	4	A
P _C	100(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

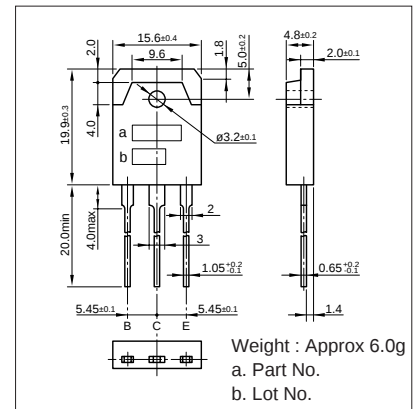
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =600V	1max	mA
I _{EBO}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	500min	V
h _{FE}	V _{CE} =4V, I _C =5A	10 to 30	
V _{CE(sat)}	I _C =5A, I _B =1A	0.5max	V
V _{BE(sat)}	I _C =5A, I _B =1A	1.3 max	V
f _r	V _{CE} =12V, I _E =-1A	8typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	105typ	pF

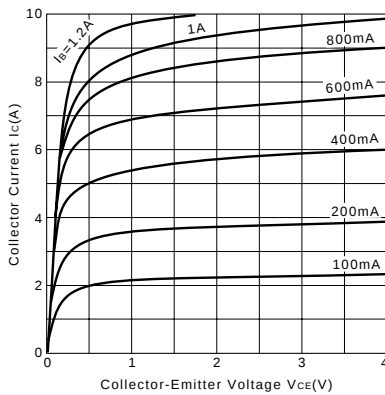
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	40	5	10	-5	0.5	-1.0	1max	4.5max	0.5max

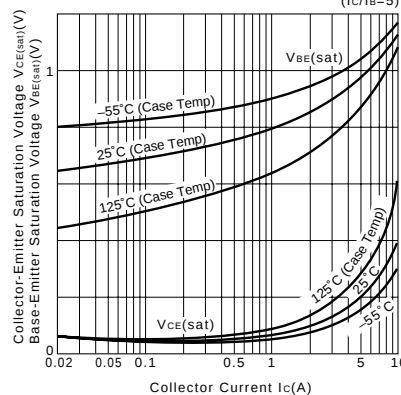
External Dimensions MT-100(TO3P)



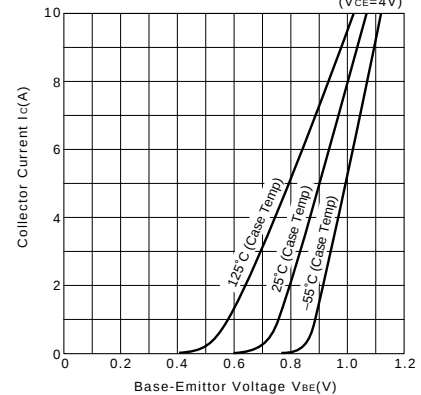
I_C-V_{CE} Characteristics (Typical)



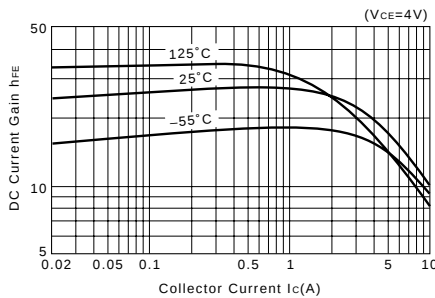
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



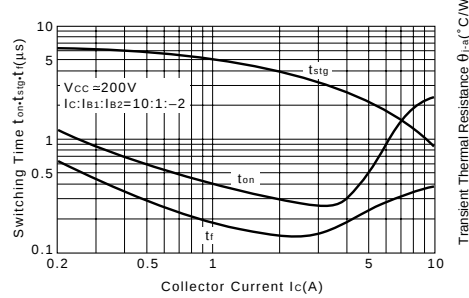
I_C-V_{BE} Temperature Characteristics (Typical)



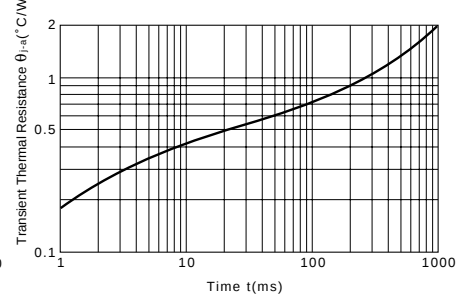
h_{FE}-I_C Characteristics (Typical)



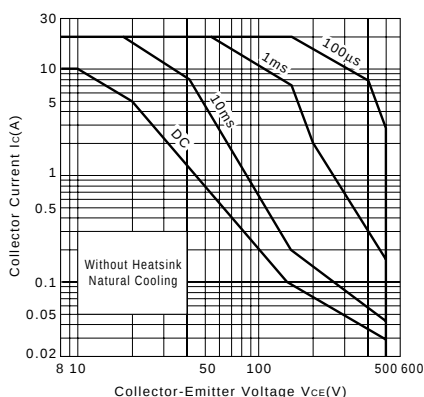
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



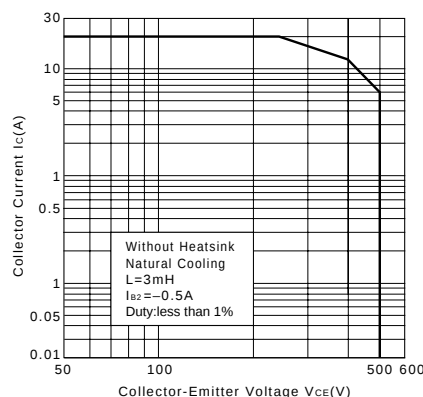
θ_{j-a}-t Characteristics



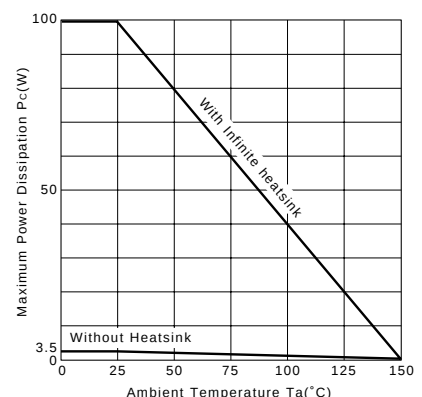
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3832

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EB0}	10	V
I _C	7(Pulse14)	A
I _B	2	A
P _C	50(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

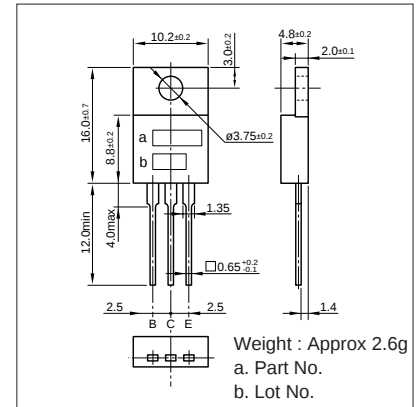
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EBO}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =3A	10to30	
V _{CE(sat)}	I _C =3A, I _B =0.6A	0.5max	V
V _{BE(sat)}	I _C =3A, I _B =0.6A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.5A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	50typ	pF

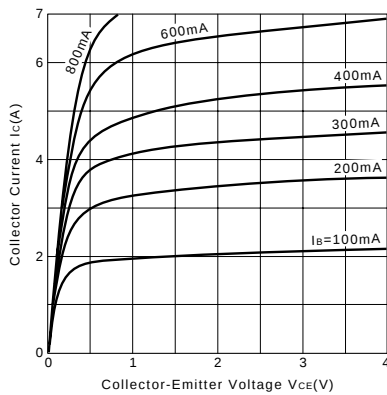
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	66.7	3	10	-5	0.3	-0.6	1max	3max	0.5max

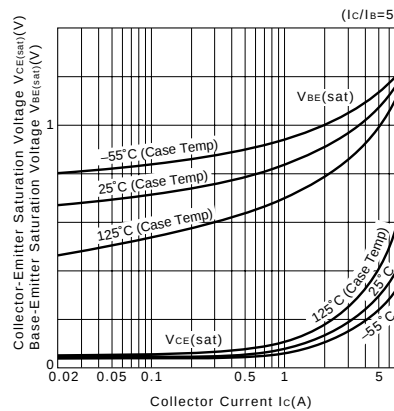
External Dimensions MT-25(TO220)



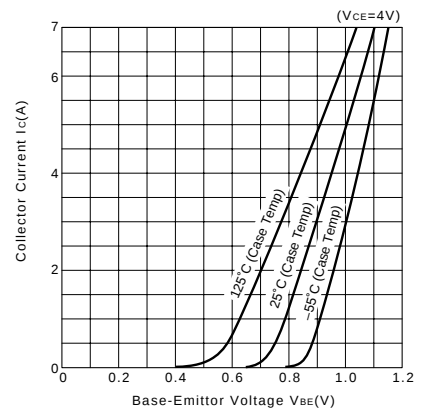
I_C-V_{CE} Characteristics (Typical)



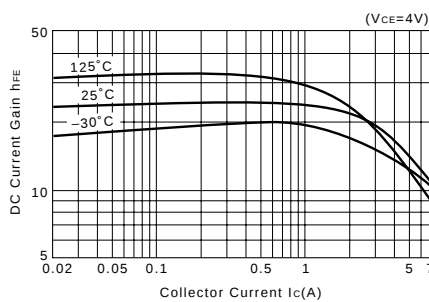
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



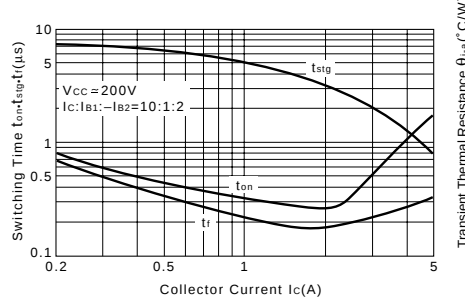
I_C-V_{BE} Temperature Characteristics (Typical)



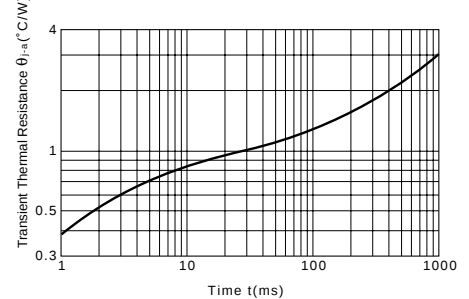
h_{FE}-I_C Characteristics (Typical)



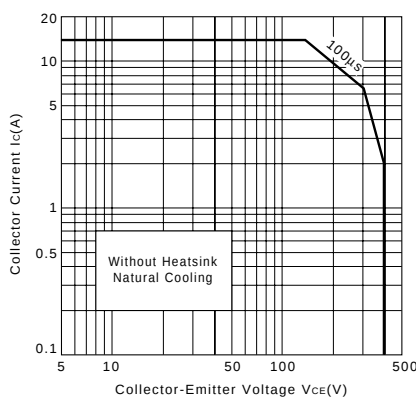
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



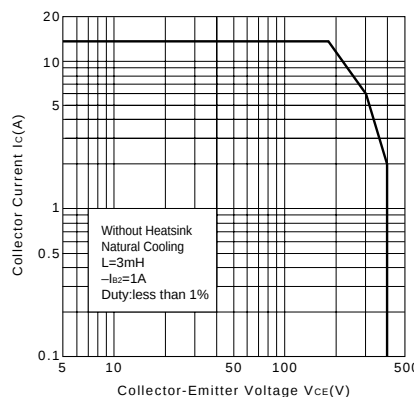
θ_{J-a}-t Characteristics



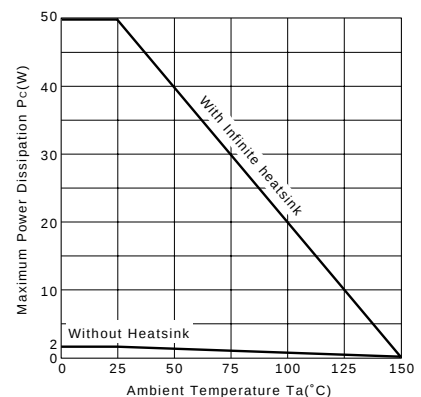
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3833

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EB0}	10	V
I _C	12(Pulse24)	A
I _B	4	A
P _C	100(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics

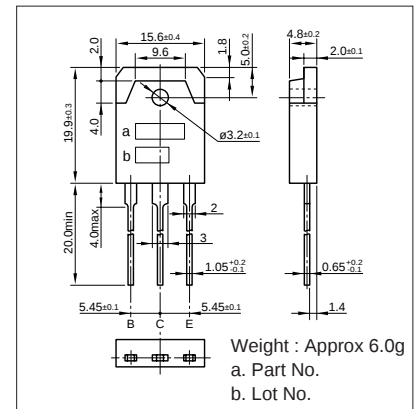
(Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EBO}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =7A	10 to 30	
V _{CE(sat)}	I _C =7A, I _B =1.4A	0.5max	V
V _{BE(sat)}	I _C =7A, I _B =1.4A	1.3max	V
f _r	V _{CE} =12V, I _E =-1A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	105typ	pF

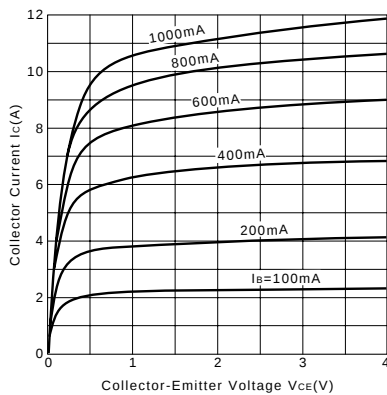
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	28.5	7	10	-5	0.7	-1.4	1.0max	3.0max	0.5max

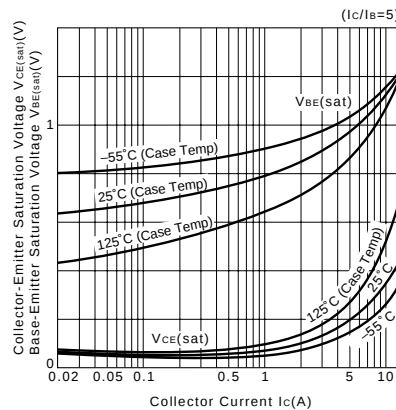
External Dimensions MT-100(TO3P)



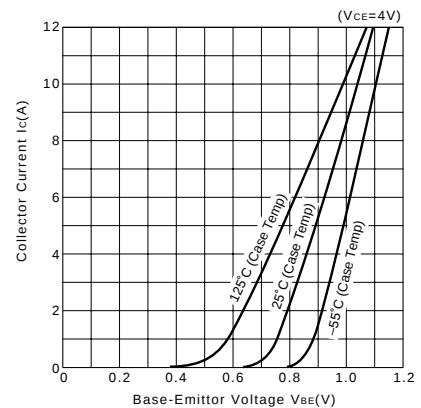
I_C-V_{CE} Characteristics (Typical)



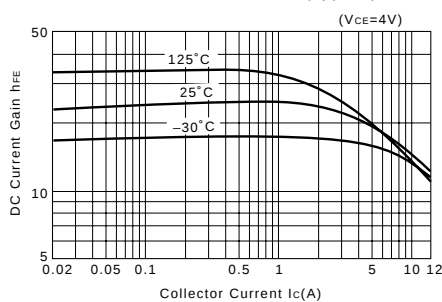
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



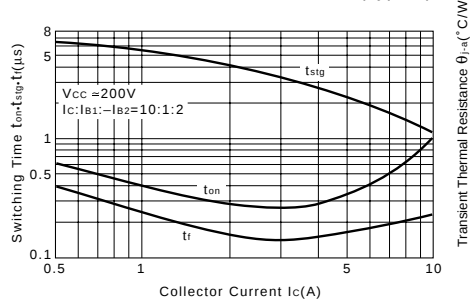
I_C-V_{BE} Temperature Characteristics (Typical)



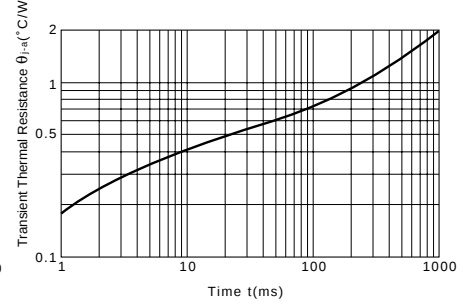
h_{FE}-I_C Characteristics (Typical)



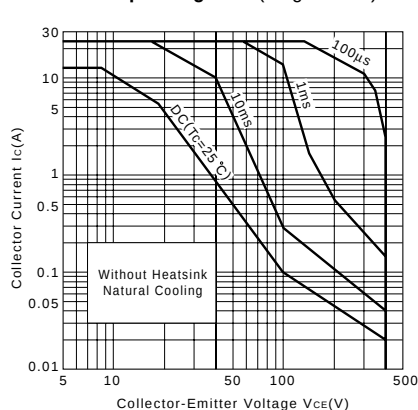
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



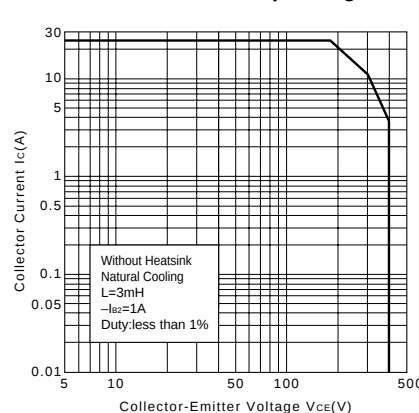
θ_{J-a}-t Characteristics



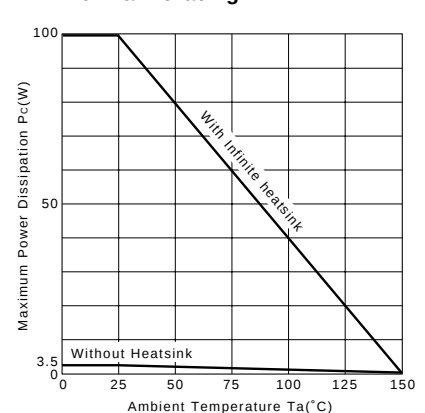
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3834

Silicon NPN Triple Diffused Planar Transistor (Switching Transistor)

Application : Humidifier, DC-DC Converter, and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CE0}	120	V
V _{EB0}	8	V
I _c	7(Pulse14)	A
I _B	3	A
P _c	50(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

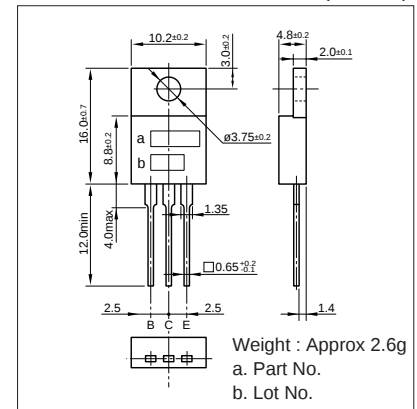
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	100max	μA
I _{EB0}	V _{EB} =8V	100max	μA
V _{(BR)CEO}	I _c =50mA	120min	V
h _{FE}	V _{CE} =4V, I _c =3A	70 to 220	
V _{CE(sat)}	I _c =3A, I _B =0.3A	0.5max	V
V _{BE(sat)}	I _c =3A, I _B =0.3A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.5A	30typ	MHz
COB	V _{CB} =10V, f=1MHz	110typ	pF

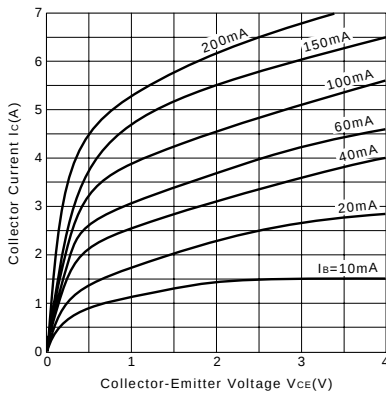
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
50	16.7	3	10	-5	0.3	-0.6	0.5max	3.0max	0.5max

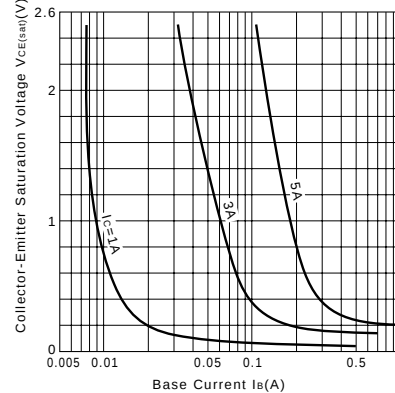
External Dimensions MT-25(TO220)



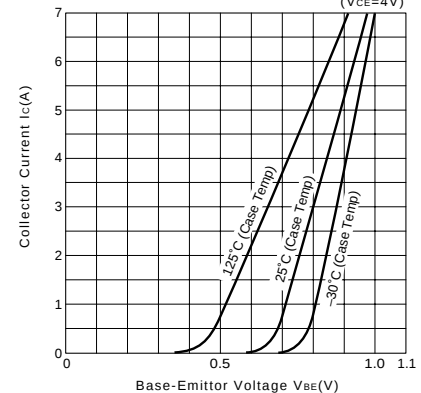
I_c-V_{CE} Characteristics (Typical)



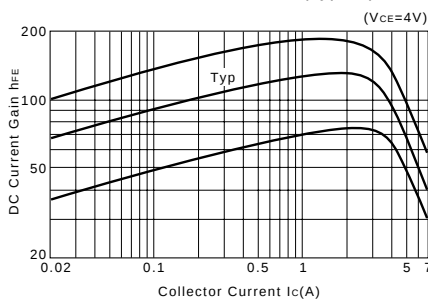
V_{CE(sat)}-I_B Characteristics (Typical)



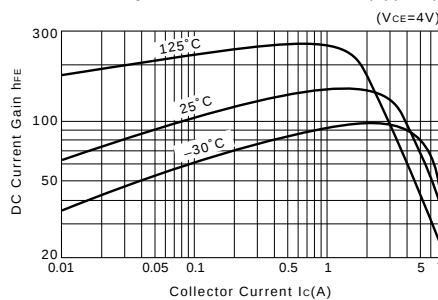
I_c-V_{BE} Temperature Characteristics (Typical)



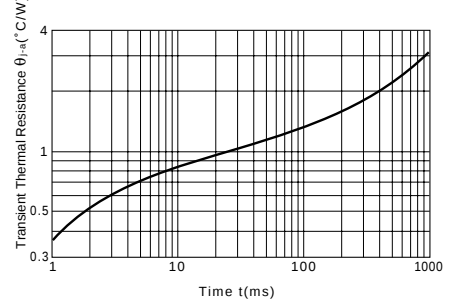
h_{FE}-I_c Characteristics (Typical)



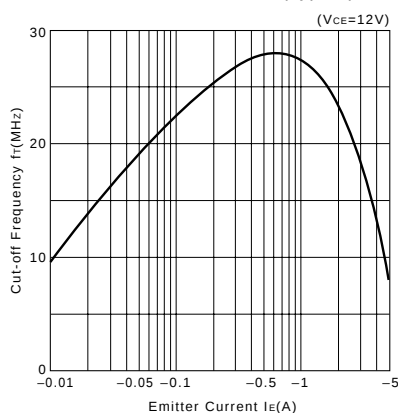
h_{FE}-I_c Temperature Characteristics (Typical)



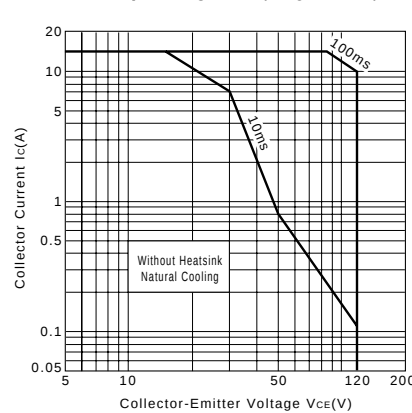
θ_{j-a}-t Characteristics



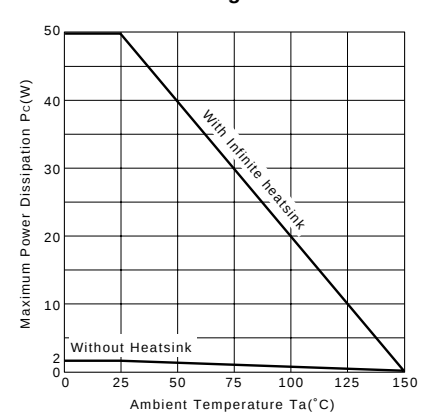
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_c-T_a Derating



2SC3835

Silicon NPN Triple Diffused Planar Transistor (Switching Transistor)

Application : Humidifier, DC-DC Converter, and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CEO}	120	V
V _{EB0}	8	V
I _C	7(Pulse14)	A
I _B	3	A
P _C	70(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

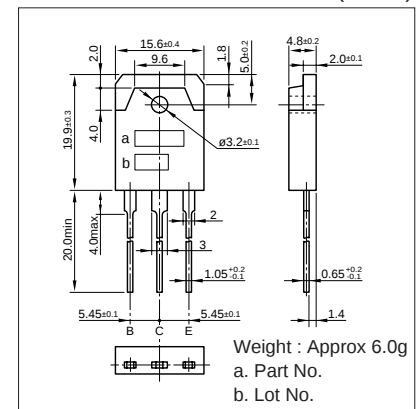
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	100max	μA
I _{EB0}	V _{EB} =8V	100max	μA
V _{(BR)CEO}	I _C =50mA	120min	V
h _{FE}	V _{CE} =4V, I _C =3A	70 to 220	
V _{CE(sat)}	I _C =3A, I _B =0.3A	0.5max	V
V _{BE(sat)}	I _C =3A, I _B =0.3A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.5A	30typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	110typ	pF

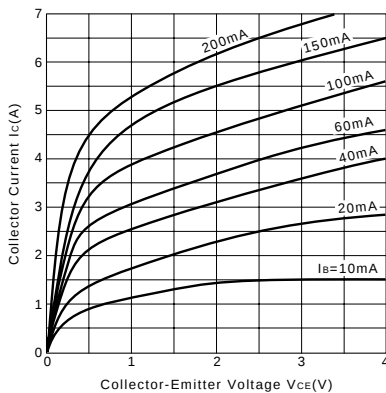
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
50	16.7	3	10	-5	0.3	-0.6	0.5max	3.0max	0.5max

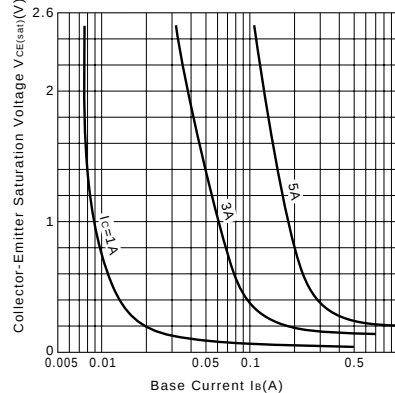
External Dimensions MT-100(TO3P)



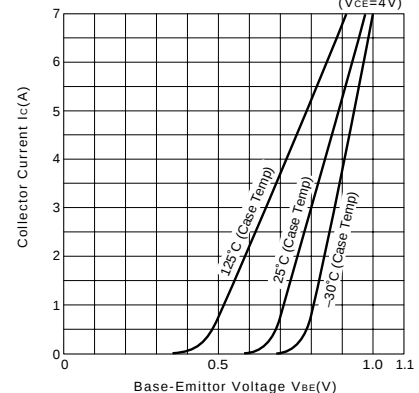
I_C-V_{CE} Characteristics (Typical)



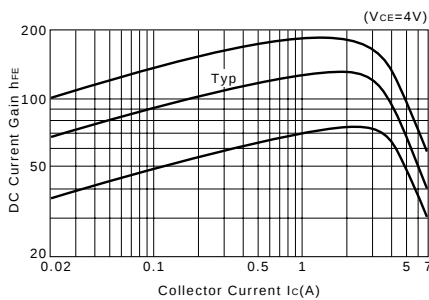
V_{CE(sat)}-I_B Characteristics (Typical)



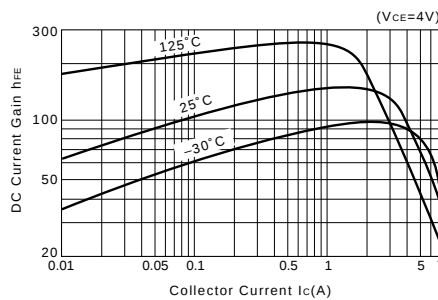
I_C-V_{BE} Temperature Characteristics (Typical)



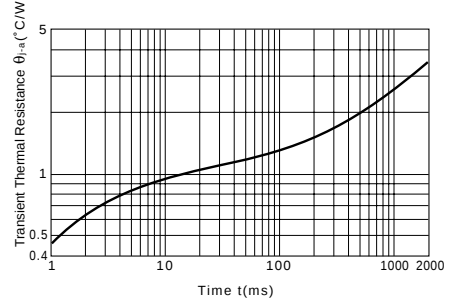
h_{FE}-I_C Characteristics (Typical)



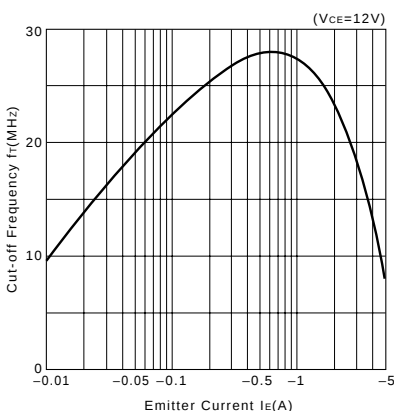
h_{FE}-I_C Temperature Characteristics (Typical)



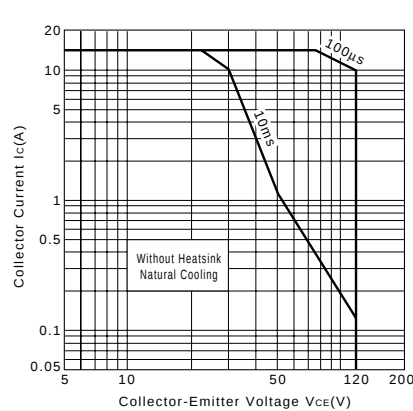
θ_{JA}-t Characteristics



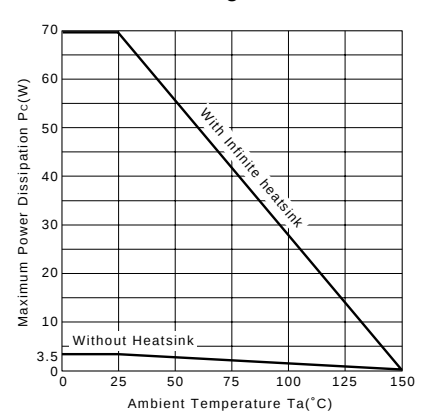
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC3852/3852A

Application : Driver for Solenoid and Motor, Series Regulator and General Purpose

(Ta=25°C)

Symbol	Conditions		Ratings		Unit
			2SC3852	2SC3852A	
ICBO			10max		μA
		$V_{CB}=$	80	100	V
IEBO	$V_{EB}=6V$		100max		μA
$V_{(BR)CEO}$	$I_C=25mA$		60min	80min	V
h_{FE}	$V_{CE}=4V, I_C=0.5A$		500min		
$V_{CE(sat)}$	$I_C=2A, I_B=50mA$		0.5max		V
f_T	$V_{CE}=12V, I_E=-0.2A$		15typ		MHz
COB	$V_{CB}=10V, f=1MHz$		50typ		pF

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
20	20	1.0	10	-5	15	-30	0.8typ	3.0typ	1.2typ

Weight : Approx 2.0g

a. Part No.

b. Lot No.

The graph plots Collector Current I_C (mA) on the y-axis (0 to 3) against Collector-Emitter Voltage V_{CE} (V) on the x-axis (0 to 6). Multiple curves are shown for different base currents I_B : 12 mA, 8 mA, 5 mA, 3 mA, 2 mA, 1 mA, and 0.5 mA. The curves show that I_C increases with V_{CE} and is approximately equal to I_B in the active region.

The graph plots the Collector-Emitter Saturation Voltage $V_{CE(sat)}$ in Volts (V) on the y-axis against the Base Current I_B in Amperes (A) on the x-axis. The y-axis is logarithmic, ranging from 0.1 to 1.0 V. The x-axis is also logarithmic, ranging from 0.001 to 1.0 A. Three curves are shown for different collector currents I_C : 1A, 2A, and 3A. The curves show that $V_{CE(sat)}$ decreases as I_B increases and as I_C decreases.

I_B (A)	$V_{CE(sat)}$ (V) for $I_C = 1A$	$V_{CE(sat)}$ (V) for $I_C = 2A$	$V_{CE(sat)}$ (V) for $I_C = 3A$
0.002	0.8	-	-
0.005	0.4	0.8	-
0.01	0.3	0.6	0.9
0.05	0.2	0.4	0.6
0.1	0.18	0.35	0.5
0.5	0.15	0.3	0.4
1.0	0.14	0.28	0.38

The graph shows the relationship between Collector Current I_C (A) and Base-Emitter Voltage V_{BE} (V) for a BJT at $V_{CE}=4V$. The curves are plotted for three different temperatures: 125°C, 25°C, and -30°C. The curves show that I_C increases exponentially with V_{BE} , and the curves shift to the left as temperature decreases.

V_{BE} (V)	I_C (A) at 125°C	I_C (A) at 25°C	I_C (A) at -30°C
0.5	0.0	0.0	0.0
0.6	0.5	0.0	0.0
0.7	1.5	0.2	0.0
0.8	3.0	1.0	0.1
0.9	-	2.0	0.5
1.0	-	4.0	1.0

Graph of DC Current Gain h_{FE} vs Collector Current I_C (A) for BC107C at $V_{CE}=4V$. The graph shows three curves: Typ (typical), and two solid lines representing the range. The y-axis is logarithmic from 100 to 2000. The x-axis is logarithmic from 0.01 to 3 A. The typical curve peaks at $h_{FE} \approx 1000$ for $I_C \approx 0.1$ A.

Graph showing DC Current Gain h_{FE} versus Collector Current I_C (A) for the 2N4350 transistor at $V_{CE} = 4V$. The curves are plotted for three temperatures: $125^\circ C$, $25^\circ C$, and $-30^\circ C$. The y-axis is logarithmic, ranging from 100 to 2000. The x-axis is logarithmic, ranging from 0.01 to 3 A. The gain increases with temperature and peaks around $I_C = 0.1 A$.

The graph shows the transient thermal resistance θ_{JA} in $^{\circ}\text{C}/\text{W}$ as a function of time t in milliseconds (ms) for a 2N3055 transistor. The y-axis is logarithmic, ranging from 0.5 to 5. The x-axis is also logarithmic, ranging from 1 to 1000 ms. The curve starts at approximately 0.7 $^{\circ}\text{C}/\text{W}$ at 1 ms and increases to about 4.5 $^{\circ}\text{C}/\text{W}$ at 1000 ms. Operating conditions are specified as $V_{CB}=10\text{V}$ and $I_E=-2\text{A}$.

Time t (ms)	Transient Thermal Resistance θ_{JA} ($^{\circ}\text{C}/\text{W}$)
1	0.7
10	1.5
100	2.5
1000	4.5

Graph of Cut-off Frequency f_T (MHz) vs. Emitter Current I_E (A) for the 2N4350 JFET. The graph shows two curves: a solid line for typical performance and a dashed line for minimum performance. The typical curve peaks at approximately 20 MHz at $I_E = -0.1$ A, while the minimum curve peaks at approximately 16 MHz at $I_E = -0.1$ A. The graph is for $V_{DS} = 12V$.

The graph plots Collector Current I_c (A) on the y-axis (log scale, 0.05 to 10) against Collector-Emitter Voltage V_{CE} (V) on the x-axis (log scale, 3 to 100). Four curves are shown: DC, 100ms, 10ms, and 1ms. A shaded region labeled 'Without Heatsink Natural Cooling' is present for $V_{CE} > 10$ V and $I_c < 3$ A.

V_{CE} (V)	I_c (A) - DC	I_c (A) - 100ms	I_c (A) - 10ms	I_c (A) - 1ms
10	3.0	3.0	3.0	3.0
20	2.0	2.5	3.0	3.0
50	0.5	1.5	2.5	3.0
60	0.3	0.4	0.4	0.4

The graph illustrates the relationship between maximum power dissipation and ambient temperature for a MOSFET. The y-axis represents Maximum Power Dissipation P_c in Watts (W), ranging from 0 to 30. The x-axis represents Ambient Temperature T_a in degrees Celsius ($^{\circ}\text{C}$), ranging from 0 to 150. Two curves are shown: 'Without Heatsink' and 'With Infinite heatsink'.

Ambient Temperature T_a ($^{\circ}\text{C}$)	Maximum Power Dissipation P_c (W) Without Heatsink	Maximum Power Dissipation P_c (W) With Infinite heatsink
0	2.5	25
25	2.5	25
50	2.5	20
75	2.5	15
100	2.5	10
125	2.5	5
150	2.5	0

2SC3857

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1493)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CEO}	200	V
V _{EB0}	6	V
I _C	15	A
I _B	5	A
P _C	150(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

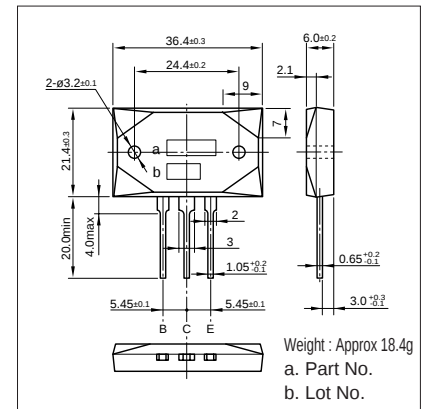
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	100max	μA
I _{EB0}	V _{EB} =6V	100max	μA
V _{(BR)CEO}	I _C =50mA	200min	V
h _{FE}	V _{CE} =4V, I _C =5A	50min*	
V _{CE(sat)}	I _C =10A, I _B =1A	3.0max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	250typ	pF

*h_{FE} Rank ○(50 to 100), P(70 to 140), Y(90 to 180)

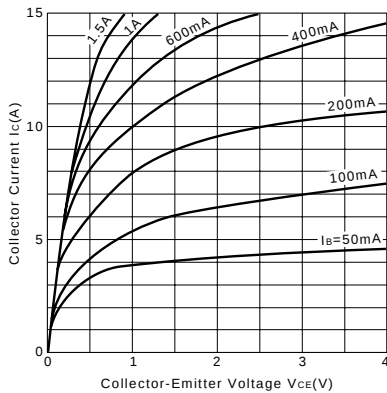
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	10	-5	0.5	-0.5	0.3typ	2.4typ	0.4typ

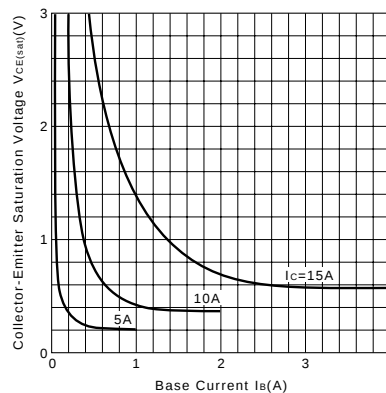
External Dimensions MT-200



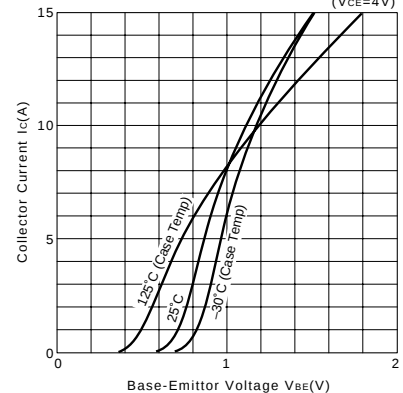
I_C-V_{CE} Characteristics (Typical)



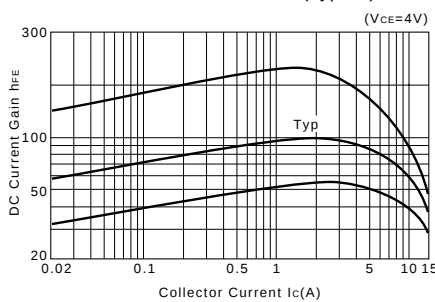
V_{CE(sat)}-I_B Characteristics (Typical)



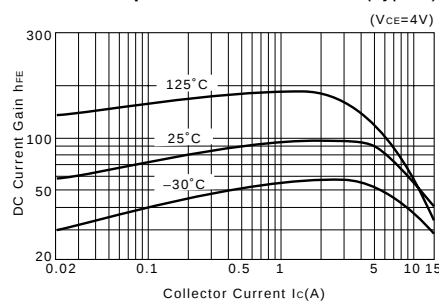
I_C-V_{BE} Temperature Characteristics (Typical)



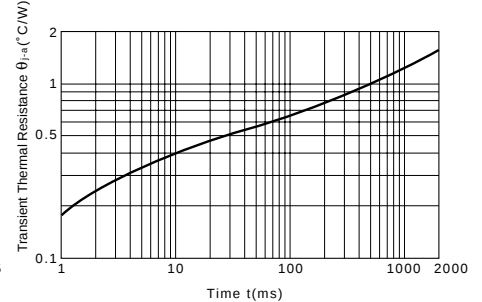
h_{FE}-I_C Characteristics (Typical)



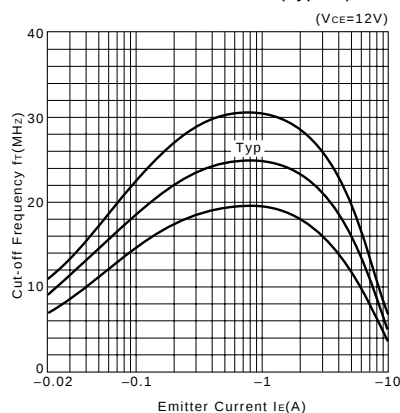
h_{FE}-I_C Temperature Characteristics (Typical)



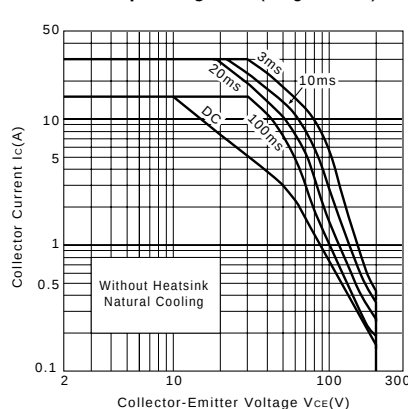
θ_{J-a}-t Characteristics



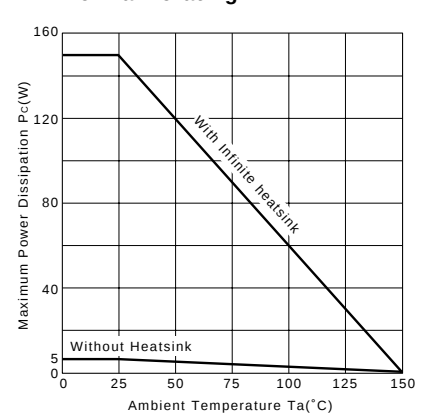
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC3858

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1494)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	200	V
VCEO	200	V
VEBO	6	V
IC	17	A
IB	5	A
PC	200(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

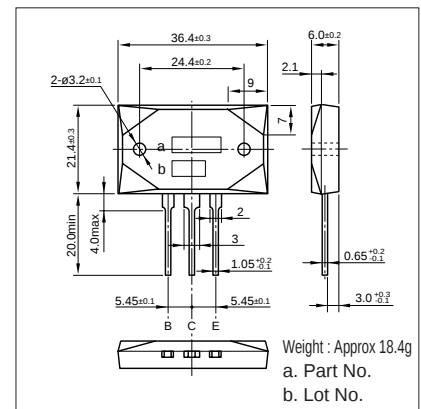
Symbol	Conditions	Ratings	Unit
ICBO	VCB=200V	100max	μA
IEBO	VEB=6V	100max	μA
V(BR)CEO	IC=50mA	200min	V
hFE	VCE=4V, IC=8A	50min*	
VCE(sat)	IC=10A, IB=1A	2.5max	V
fr	VCE=12V, IE=-1A	20typ	MHz
COB	VCB=10V, f=1MHz	300typ	pF

*hFE Rank Y(50 to 100), P(70 to 140), G(90 to 180)

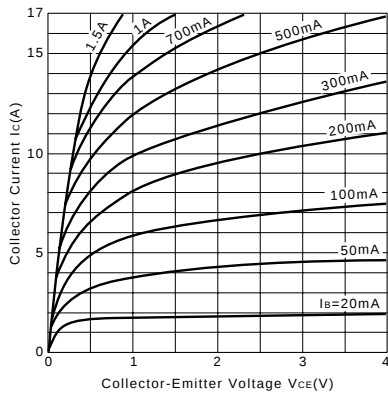
Typical Switching Characteristics (Common Emitter)

VCC (V)	RL (Ω)	IC (A)	VBB1 (V)	VBB2 (V)	IB1 (A)	IB2 (A)	ton (μs)	tstg (μs)	tf (μs)
40	4	10	10	-5	1	-1	0.5typ	1.8typ	0.6typ

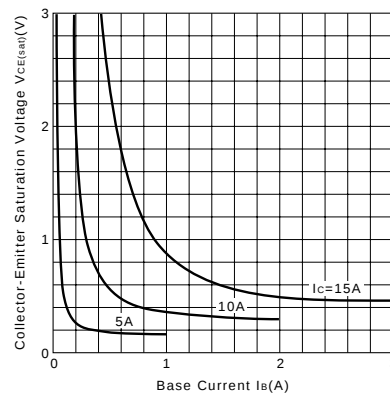
External Dimensions MT-200



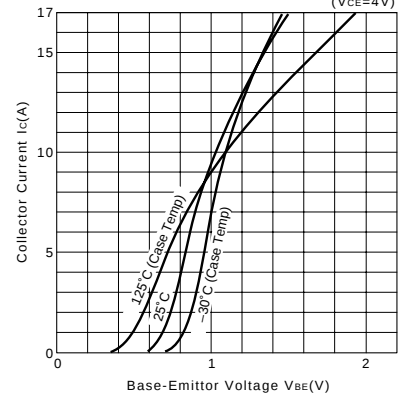
IC-VCE Characteristics (Typical)



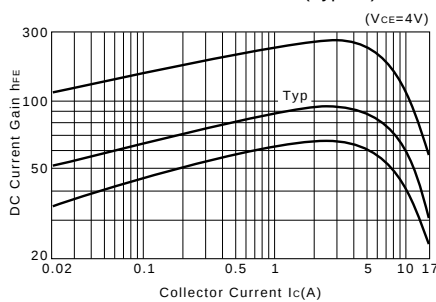
VCE(sat)-IB Characteristics (Typical)



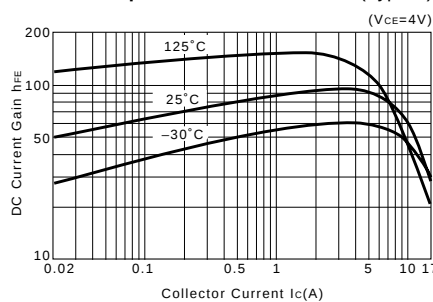
IC-VBE Temperature Characteristics (Typical)



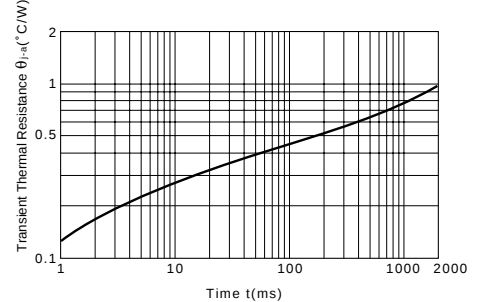
hFE-IC Characteristics (Typical)



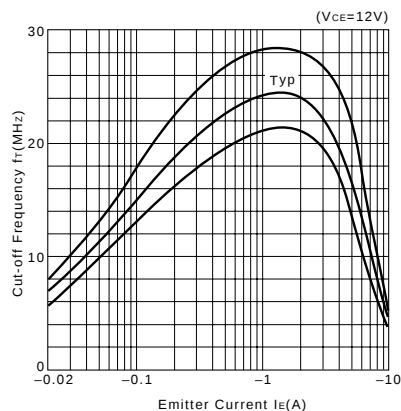
hFE-IC Temperature Characteristics (Typical)



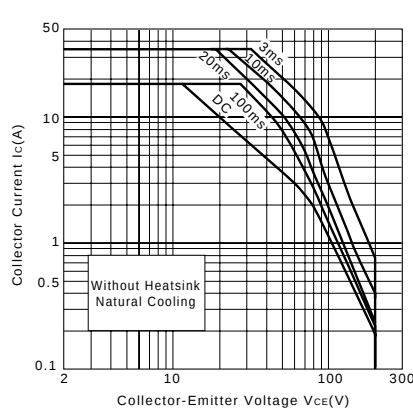
θJA-t Characteristics



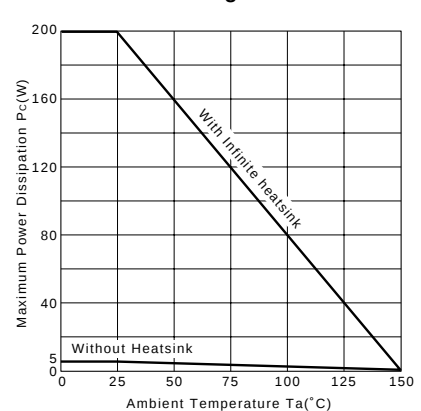
fr-IE Characteristics (Typical)



Safe Operating Area (Single Pulse)



PC-Ta Derating



2SC3890

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

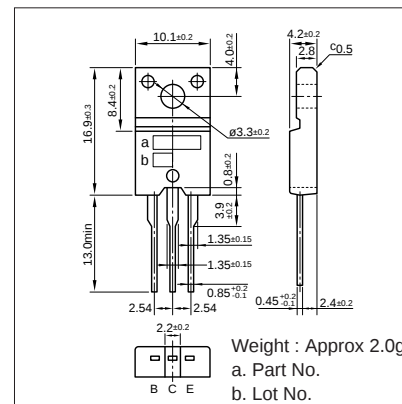
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CE0}	400	V
V _{EB0}	10	V
I _C	7(Pulse14)	A
I _B	2	A
P _C	30(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =500V	100max	μA
I _{EB0}	V _{EB} =10V	100max	μA
V(BR)CEO	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =3A	10 to 30	
V _{CE(sat)}	I _C =3A, I _B =0.6A	0.5max	V
V _{BE(sat)}	I _C =3A, I _B =0.6A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.5A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	50typ	pF

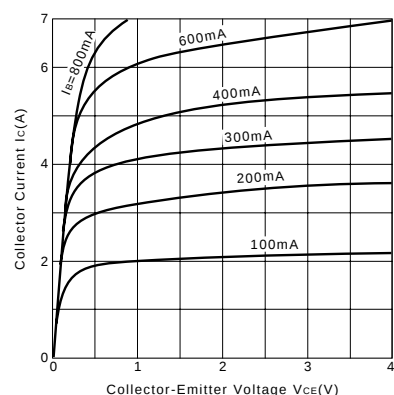
External Dimensions FM20(TO220F)



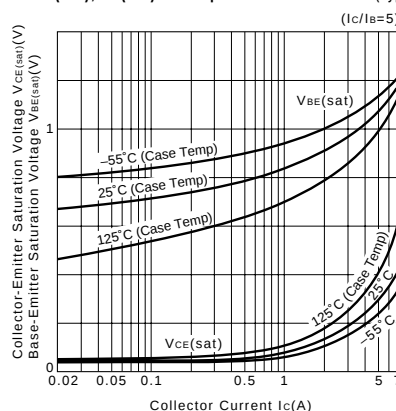
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	66	3	10	-5	0.3	-0.6	1max	3max	0.5max

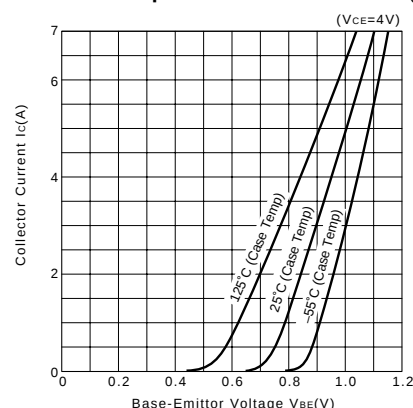
I_C-V_{CE} Characteristics (Typical)



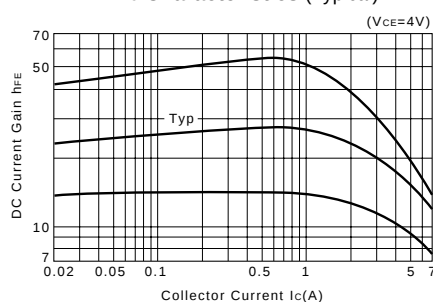
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



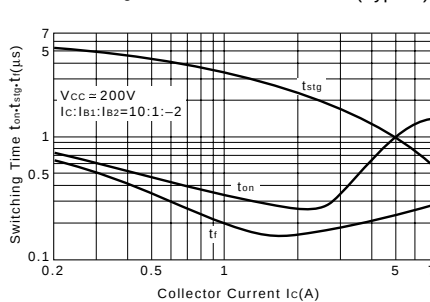
I_C-V_{BE} Temperature Characteristics (Typical)



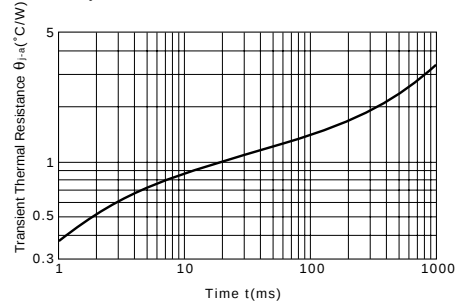
h_{FE}-I_C Characteristics (Typical)



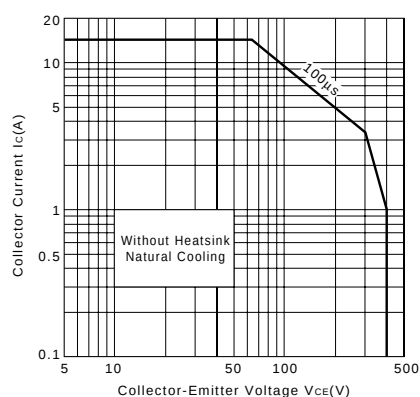
t_{on}, t_{stg}, t_f-I_C Characteristics (Typical)



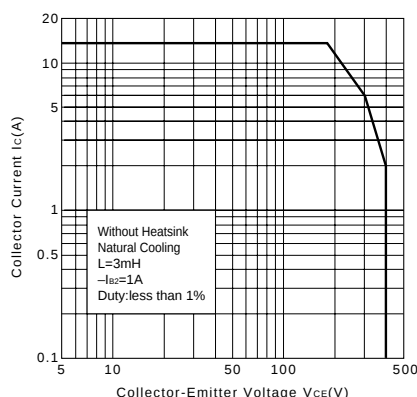
θ_{JA}-t Characteristics



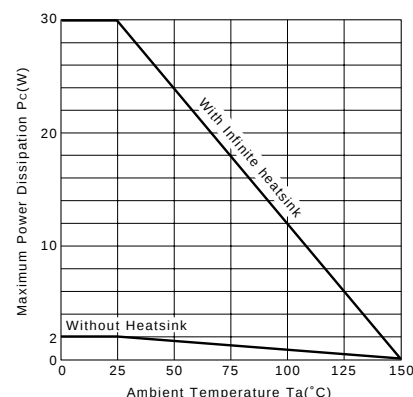
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC3927

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	550	V
V _{EB0}	7	V
I _C	10(Pulse15)	A
I _B	5	A
P _C	120(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

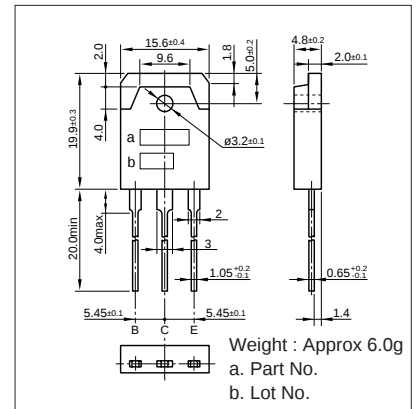
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	550min	V
h _{FE}	V _{CE} =4V, I _C =5A	10 to 28	
V _{CE(sat)}	I _C =5A, I _B =1A	0.5max	V
V _{BE(sat)}	I _C =5A, I _B =1A	1.2max	V
f _r	V _{CE} =12V, I _E =-1A	6typ	MHz
COB	V _{CB} =10V, f=1MHz	105typ	pF

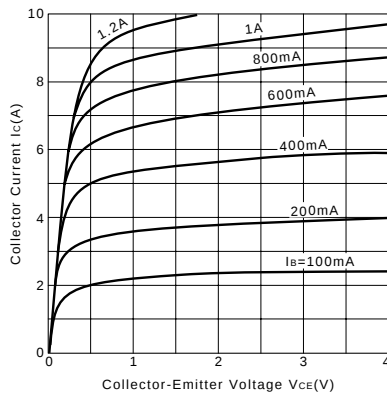
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	50	5	10	-5	0.75	-1.5	1max	5max	0.5max

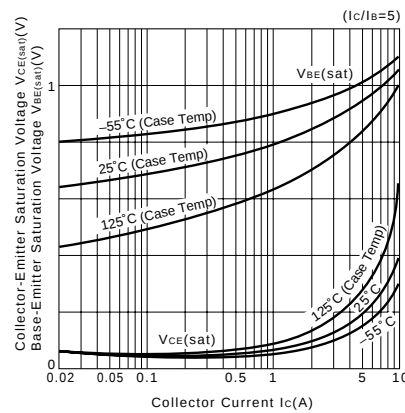
External Dimensions MT-100(TO3P)



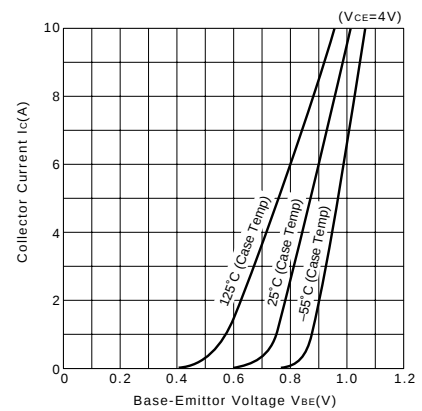
I_C-V_{CE} Characteristics (Typical)



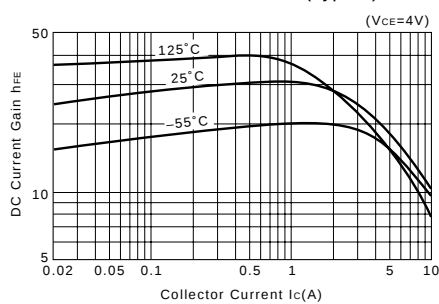
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



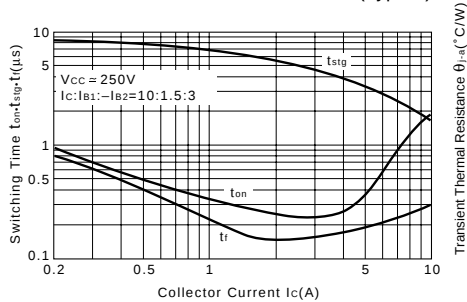
I_C-V_{BE} Temperature Characteristics (Typical)



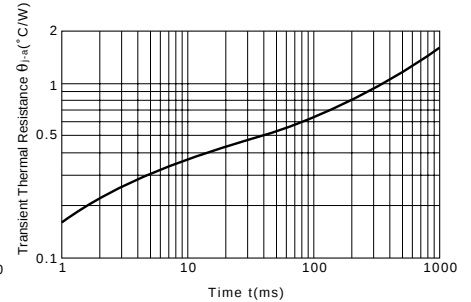
h_{FE}-I_C Characteristics (Typical)



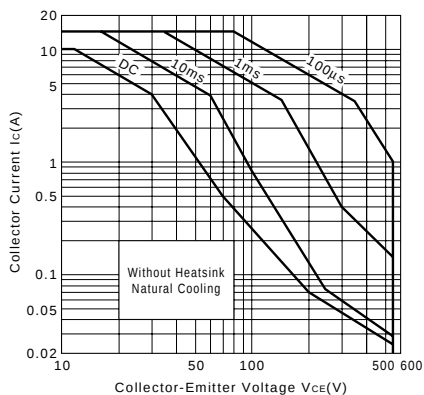
t_{on}, t_{stg}, t_f-I_C Characteristics (Typical)



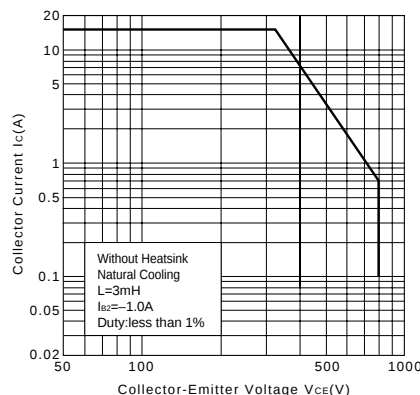
θ_{j-a}-t Characteristics



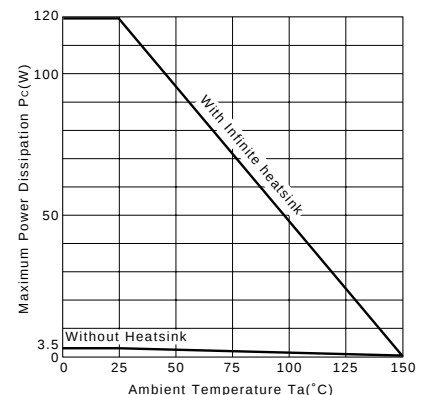
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4020

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	900	V
VCEO	800	V
VEBO	7	V
Ic	3(Pulse6)	A
IB	1.5	A
Pc	50(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

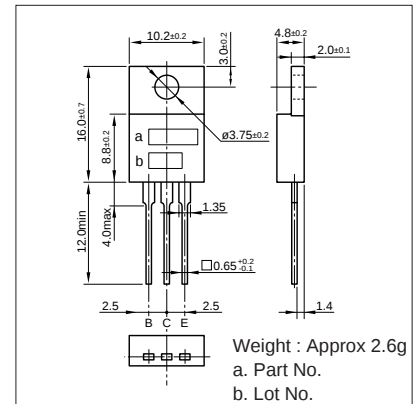
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
ICBO	$V_{CB}=800V$	100max	μA
IEBO	$V_{EB}=7V$	100max	μA
$V_{(BR)CEO}$	$I_C=10mA$	800min	V
h_{FE}	$V_{CE}=4V, I_C=0.7A$	10 to 30	
$V_{CE(sat)}$	$I_C=0.7A, I_B=0.14A$	0.5max	V
$V_{BE(sat)}$	$I_C=0.7A, I_B=0.14A$	1.2max	V
f _r	$V_{CE}=12V, I_E=-0.3A$	6typ	MHz
COB	$V_{CB}=10V, f=1MHz$	40typ	pF

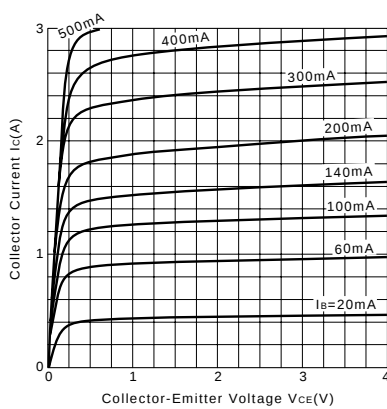
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	357	0.7	10	-5	0.1	-0.35	1max	5max	1max

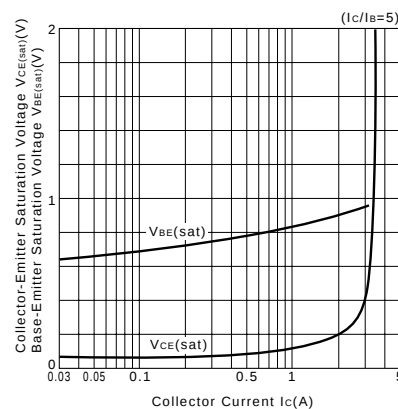
External Dimensions MT-25(TO220)



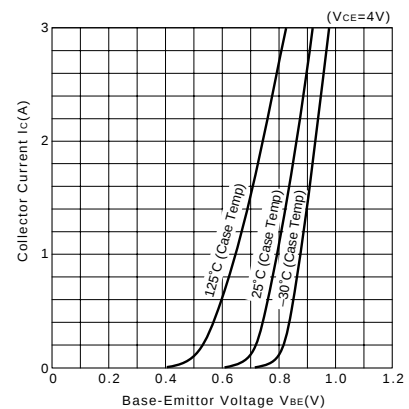
I_C-V_{CE} Characteristics (Typical)



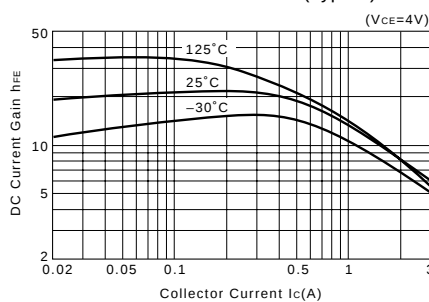
V_{CE}(sat), V_{BE}(sat)-I_C Temperature Characteristics (Typical)



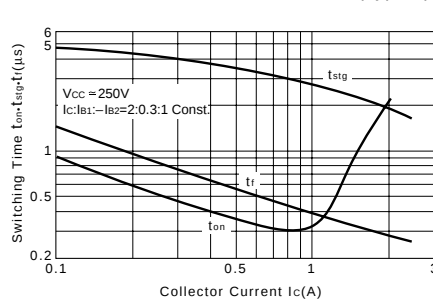
I_C-V_{BE} Temperature Characteristics (Typical)



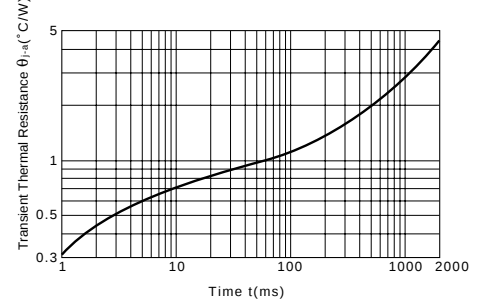
$h_{FE}-I_C$ Characteristics (Typical)



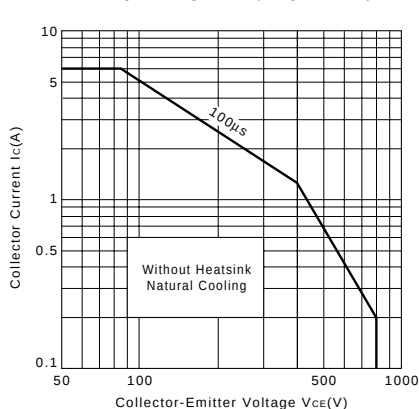
t_{on}•t_{stg}•t_f–I_C Characteristics (Typical)



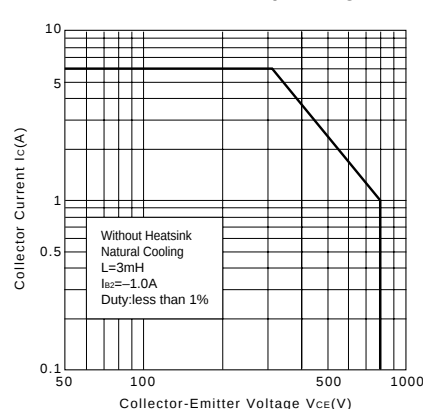
θ_{j-a-t} Characteristics



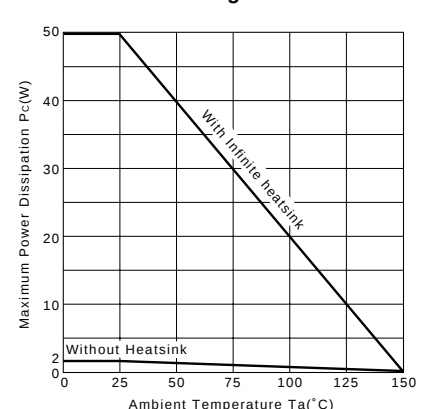
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



Pc-Ta Derating



2SC4024

Application : DC-DC Converter, Emergency Lighting Inverter and General Purpose

(Ta=25°C)

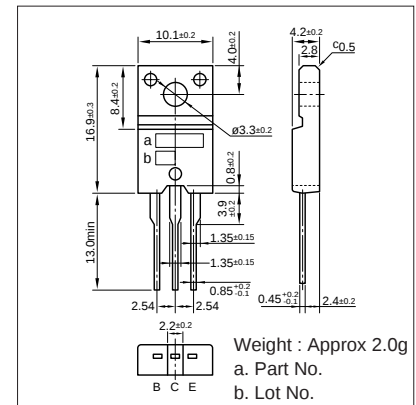
Symbol	Ratings	Unit
VCBO	100	V
VCEO	50	V
VEBO	15	V
IC	10	A
IB	3	A
PC	35(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

Symbol	Conditions	Ratings	Unit
ICBO	$V_{CB}=100V$	10max	μA
IEBO	$V_{EB}=15V$	10max	μA
$V_{(BR)CEO}$	$I_C=25mA$	50min	V
h_{FE}	$V_{CE}=4V, I_C=1A$	300 to 1600	
$V_{CE(sat)}$	$I_C=5A, I_B=0.1A$	0.5max	V
f_T	$V_{CE}=12V, I_E=-0.5A$	24typ	MHz
COB	$V_{CB}=10V, f=1MHz$	150typ	pF

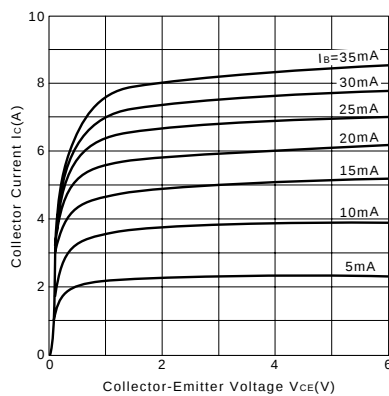
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
20	4	5	0.1	-0.1	0.5typ	2.0typ	0.5typ

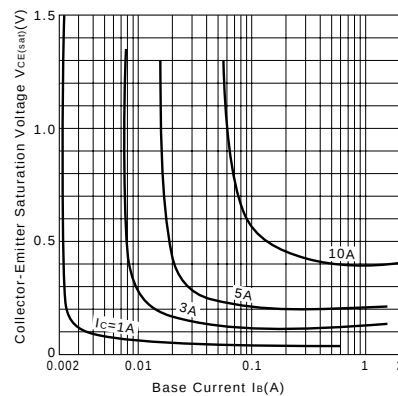
External Dimensions FM20(TO220F)



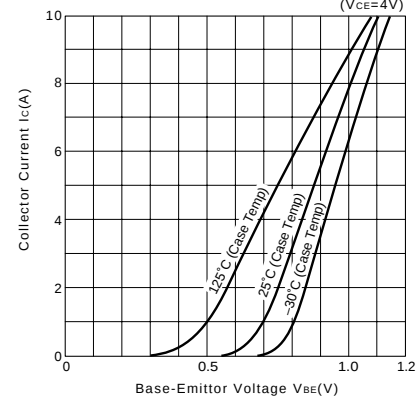
I_C-V_{CE} Characteristics (Typical)



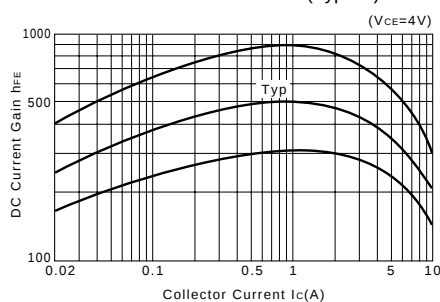
V_{CE(sat)}-I_B Characteristics (Typical)



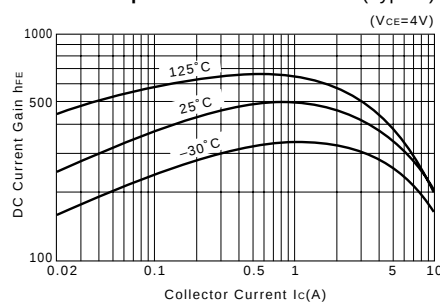
I_C-V_{BE} Temperature Characteristics (Typical)



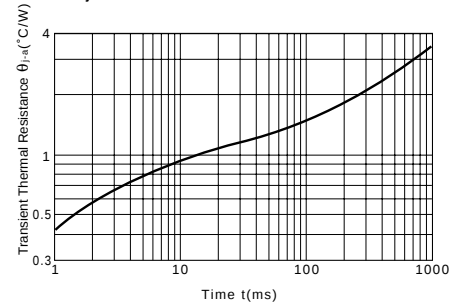
$h_{FE}-I_C$ Characteristics (Typical)



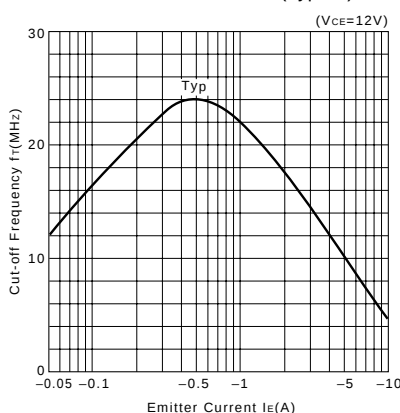
h_{FE} - I_C Temperature Characteristics (Typical)



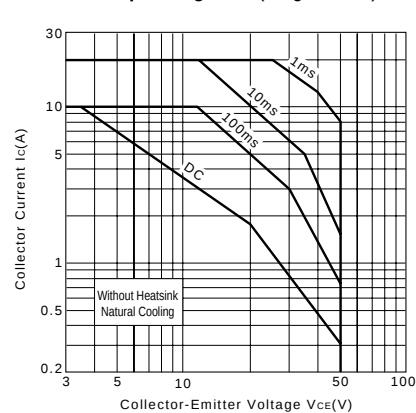
θ_{j-a-t} Characteristics



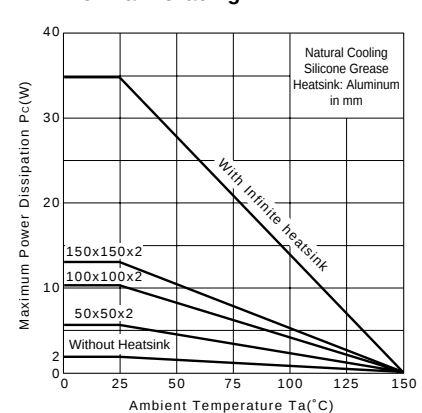
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



Pc-Ta Derating



LOW $V_{CE}(\text{sat})$

2SC4064

Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1567)

Application : DC Motor Driver and General Purpose

Absolute maximum ratings ($T_a=25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CB0}	50	V
V_{CE0}	50	V
V_{EB0}	6	V
I_C	12	A
I_B	3	A
P_C	35($T_c=25^\circ\text{C}$)	W
T_j	150	$^\circ\text{C}$
T_{stg}	-55 to +150	$^\circ\text{C}$

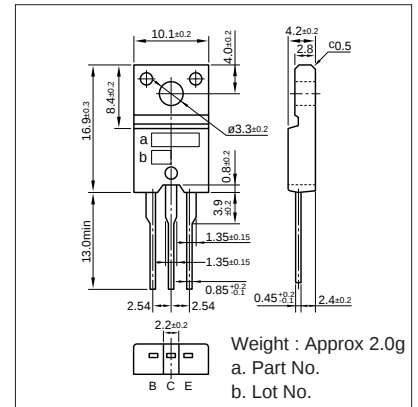
Electrical Characteristics ($T_a=25^\circ\text{C}$)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=50\text{V}$	100max	μA
I_{EBO}	$V_{EB}=6\text{V}$	10max	μA
$V_{(BR)CEO}$	$I_C=25\text{mA}$	50min	V
h_{FE}	$V_{CE}=1\text{V}$, $I_C=6\text{A}$	50min	
$V_{CE(\text{sat})}$	$I_C=6\text{A}$, $I_B=0.3\text{A}$	0.35max	V
f_r	$V_{CE}=12\text{V}$, $I_E=-0.5\text{A}$	40typ	MHz
COB	$V_{CB}=12\text{V}$, $f=1\text{MHz}$	180typ	pF

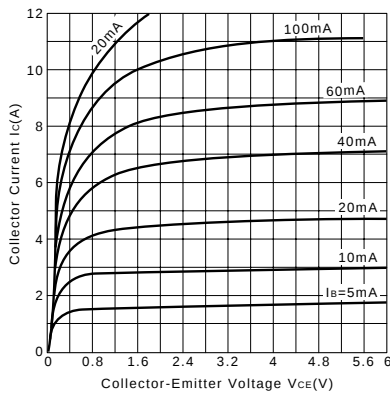
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (A)	I_{B2} (A)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
24	4	6	10	-5	0.12	-0.12	0.6typ	1.4typ	0.4typ

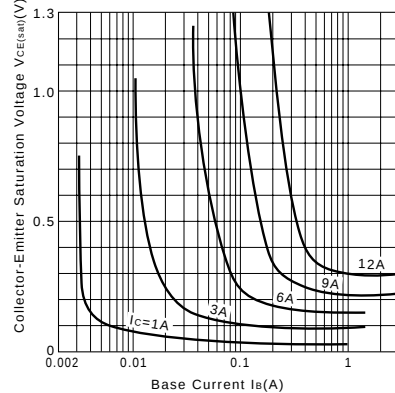
External Dimensions FM20(TO220F)



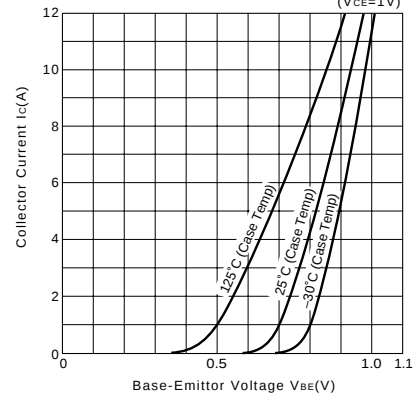
I_C-V_{CE} Characteristics (Typical)



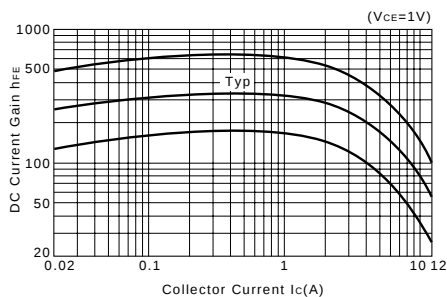
$V_{CE(\text{sat})}-I_B$ Characteristics (Typical)



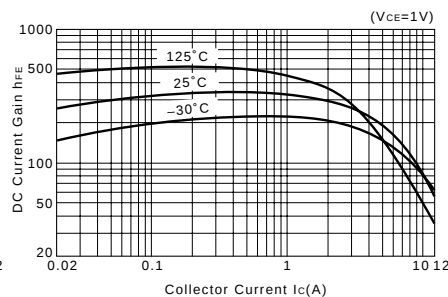
I_C-V_{BE} Temperature Characteristics (Typical)



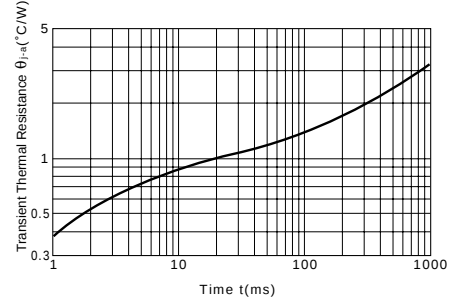
$h_{FE}-I_C$ Characteristics (Typical)



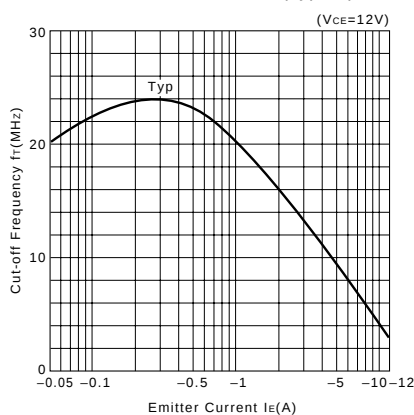
$h_{FE}-I_C$ Temperature Characteristics (Typical)



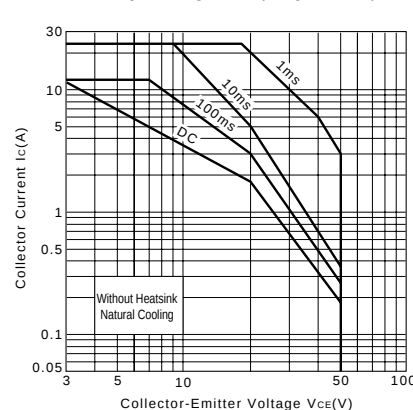
$\theta_{JA}-t$ Characteristics



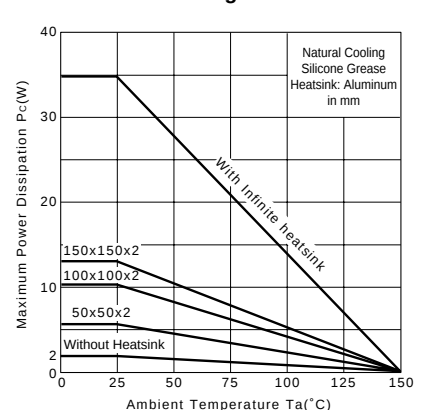
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

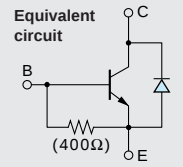


P_C-T_a Derating



Built-in Diode at C-E
Low $V_{CE}(\text{sat})$

2SC4065



Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1568)

Application : DC Motor Driver and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CB0}	60	V
V_{CE0}	60	V
V_{EB0}	6	V
I_C	± 12	A
I_B	3	A
P_C	35(Tc=25°C)	W
T_j	150	°C
T_{stg}	-55 to +150	°C

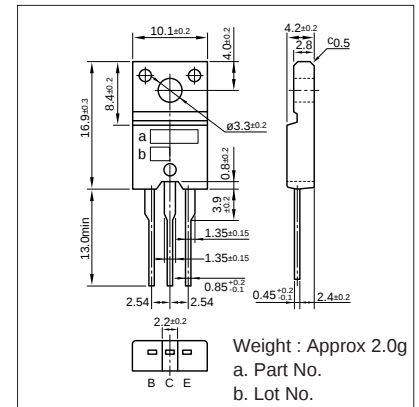
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=60V$	100max	μA
I_{EBO}	$V_{EB}=6V$	60max	mA
$V_{(BR)CEO}$	$I_C=25mA$	60min	V
h_{FE}	$V_{CE}=1V, I_C=6A$	50min	
$V_{CE(sat)}$	$I_C=6A, I_B=1.3A$	0.35max	V
V_{FEC}	$V_{ECO}=10A$	2.5max	V
f_r	$V_{CE}=12V, I_E=-0.5A$	24typ	MHz
COB	$V_{CB}=10V, f=1MHz$	180typ	PF

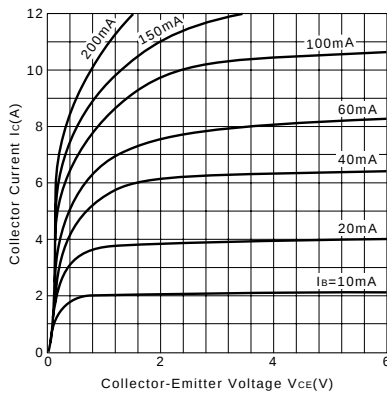
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (A)	I_{B2} (A)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
24	4	6	10	-5	0.12	-0.12	0.6typ	1.4typ	0.4typ

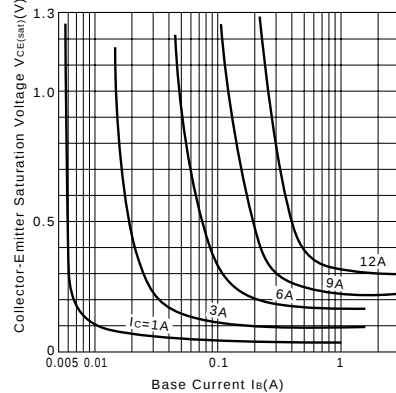
External Dimensions FM20(TO220F)



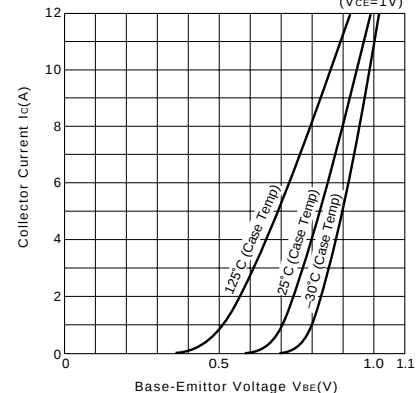
I_C - V_{CE} Characteristics (Typical)



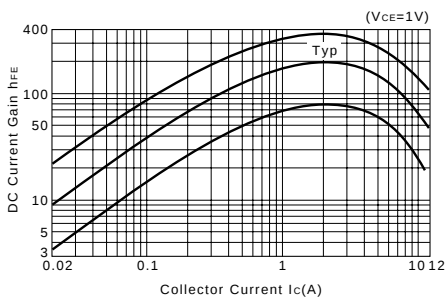
$V_{CE(sat)}$ - I_B Characteristics (Typical)



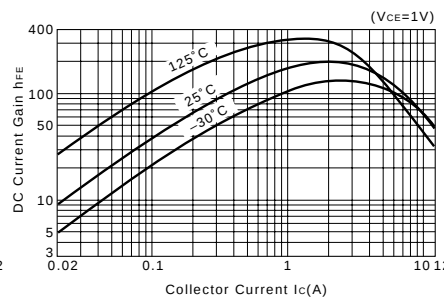
I_C - V_{BE} Temperature Characteristics (Typical)



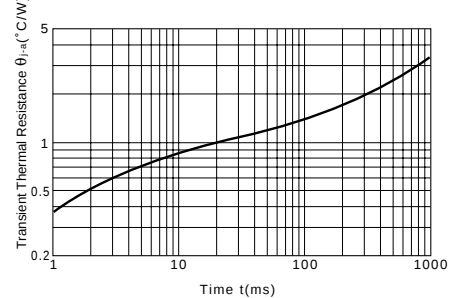
h_{FE} - I_C Characteristics (Typical)



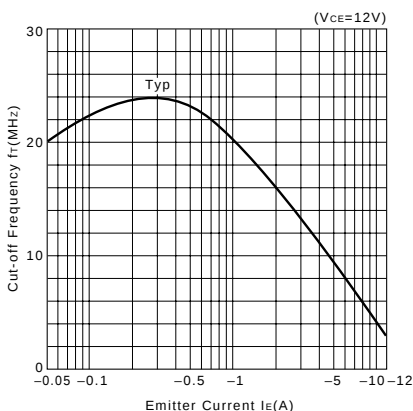
h_{FE} - I_C Temperature Characteristics (Typical)



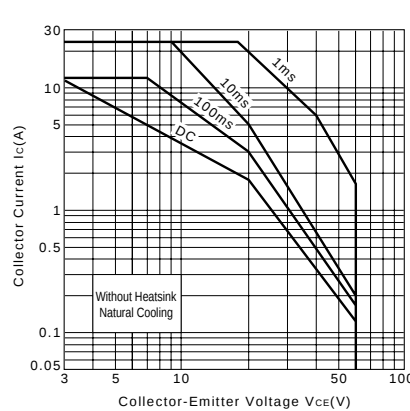
θ_{j-a} -t Characteristics



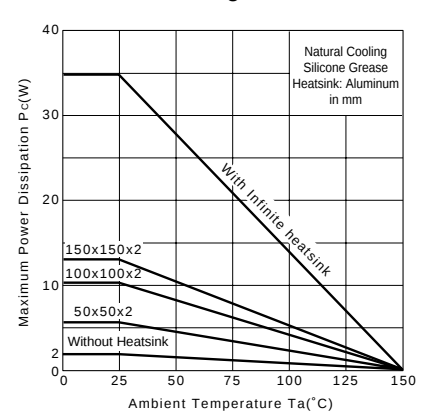
f_T - I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C - T_a Derating



2SC4073

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CE0}	400	V
V _{EB0}	10	V
I _C	5(Pulse10)	A
I _B	2	A
P _C	30(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

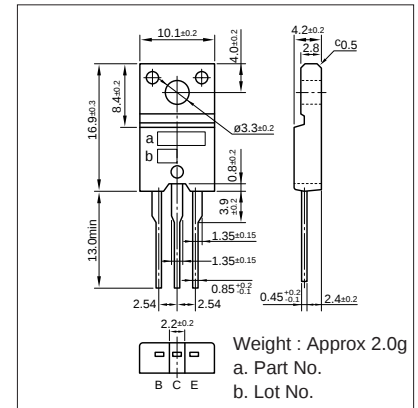
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =500V	100max	μA
I _{EB0}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =2A	10 to 30	
V _{CE(sat)}	I _C =2A, I _B =0.4A	0.5max	V
V _{BE(sat)}	I _C =2A, I _B =0.4A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.3A	10typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	30typ	pF

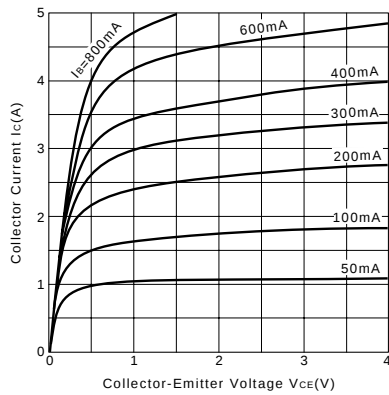
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	100	2	10	-5	0.2	-0.4	1max	3max	0.5max

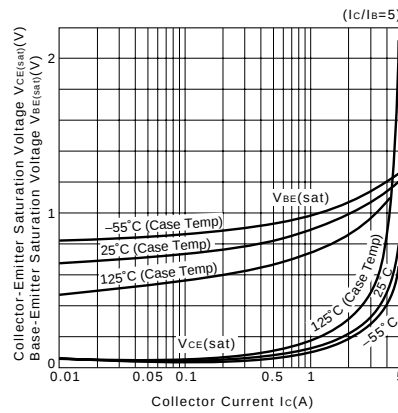
External Dimensions FM20(TO220F)



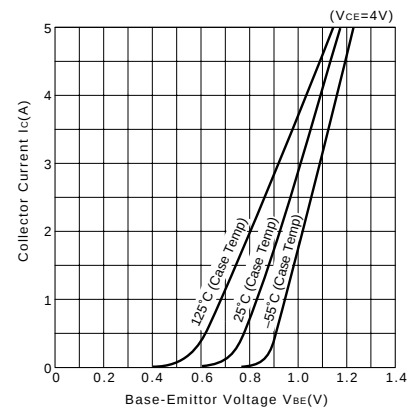
I_C-V_{CE} Characteristics (Typical)



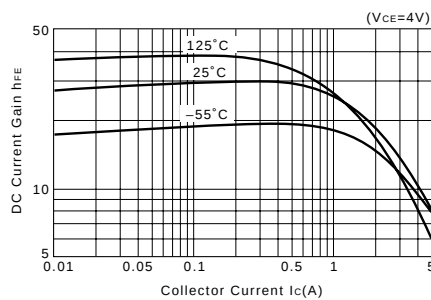
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



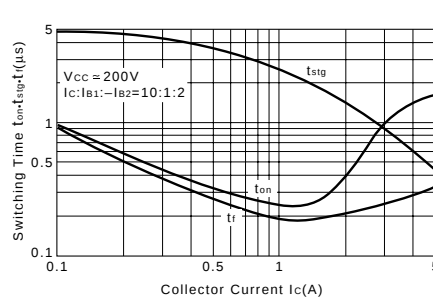
I_C-V_{BE} Temperature Characteristics (Typical)



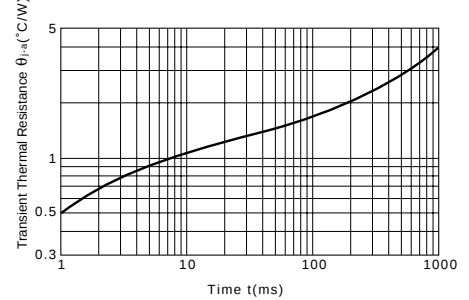
h_{FE}-I_C Characteristics (Typical)



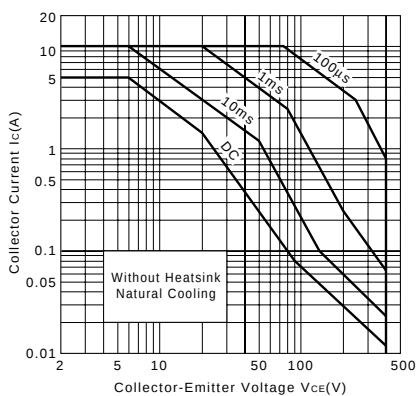
t_{on}, t_{stg}, t_f-I_C Characteristics (Typical)



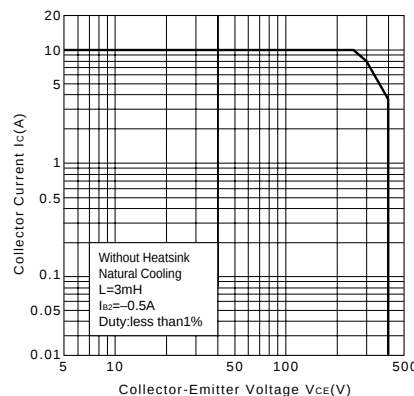
θ_{j-a}-t Characteristics



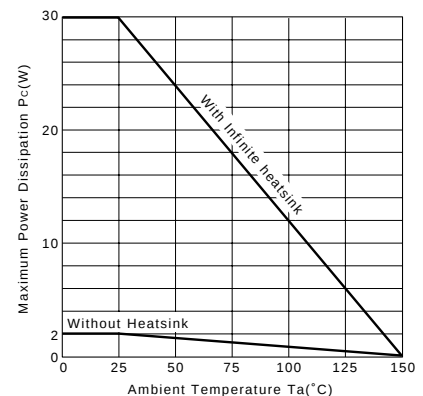
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4130

Silicon NPN Epitaxial Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EB0}	10	V
I _C	7(Pulse14)	A
I _B	2	A
P _C	30(Tc=25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

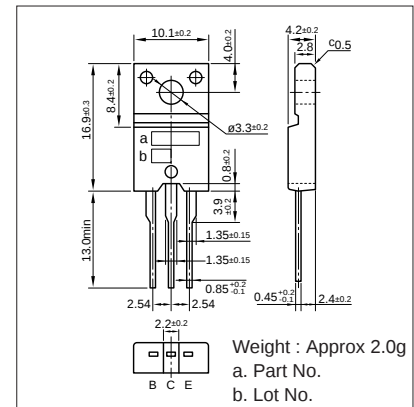
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EB0}	V _{EB} =10V	100max	μA
V(BR) _{CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =3A	10 to 30	
V _{CE(sat)}	I _C =3A, I _B =0.6A	0.5max	V
V _{BE(sat)}	I _C =3A, I _B =0.6A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.5A	15typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	50typ	pF

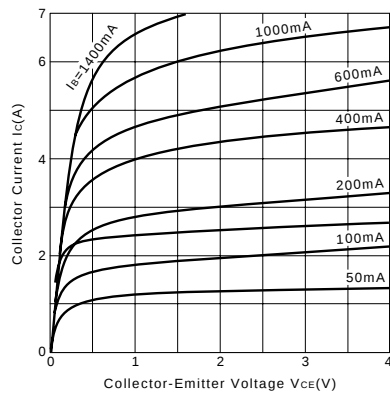
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	67	3	10	-5	0.3	-0.6	1max	2.2max	0.5max

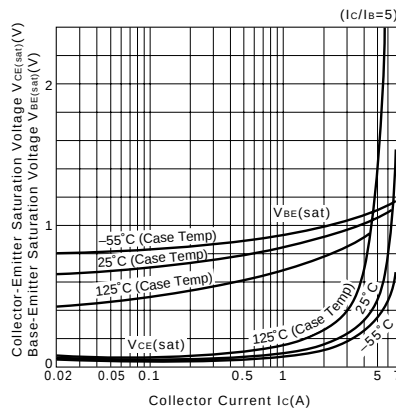
External Dimensions FM20(TO220F)



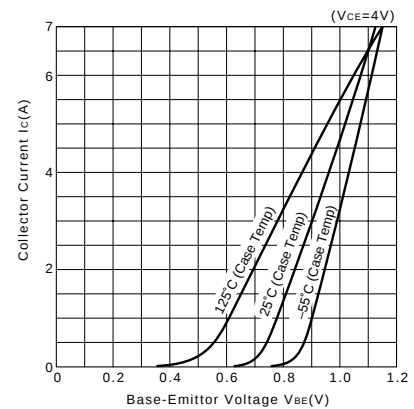
I_C-V_{CE} Characteristics (Typical)



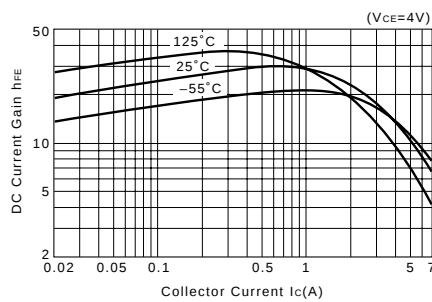
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



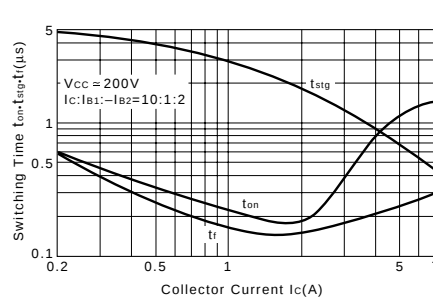
I_C-V_{BE} Temperature Characteristics (Typical)



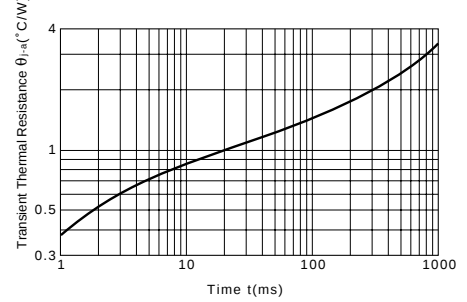
h_{FE}-I_C Characteristics (Typical)



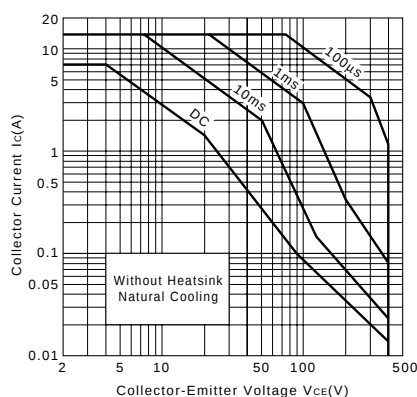
t_{on}, t_{stg}, t_f-I_C Characteristics (Typical)



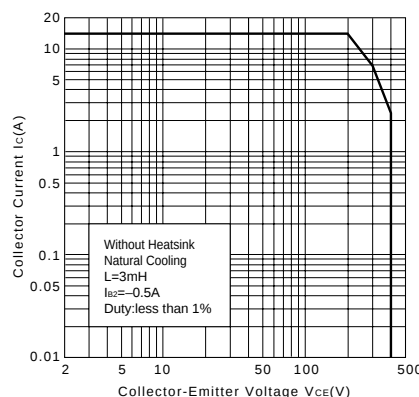
θ_{J-a}-t Characteristics



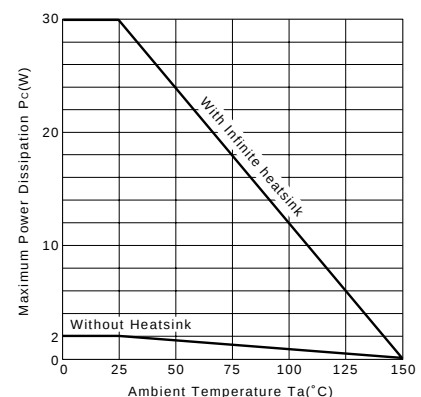
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



Low $V_{CE(sat)}$

2SC4131

Silicon NPN Epitaxial Planar Transistor

Application : DC-DC Converter, Emergency Lighting Inverter and General Purpose

Absolute maximum ratings ($T_a=25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CB0}	100	V
V_{CE0}	50	V
V_{EB0}	15	V
I_c	15(Pulse25)	A
I_B	4	A
P_c	60($T_c=25^\circ\text{C}$)	W
T_j	150	$^\circ\text{C}$
T_{stg}	-55 to +150	$^\circ\text{C}$

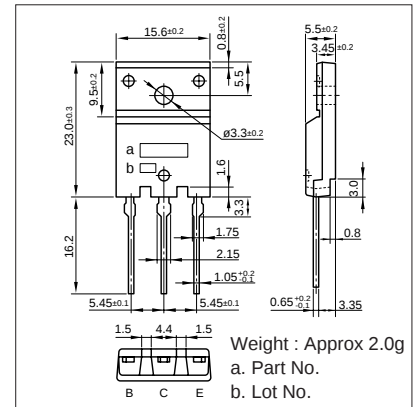
Electrical Characteristics ($T_a=25^\circ\text{C}$)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=100\text{V}$	10max	μA
I_{EBO}	$V_{EB}=15\text{V}$	10max	μA
$V_{(BR)CEO}$	$I_c=25\text{mA}$	50min	V
h_{FE}	$V_{CE}=1\text{V}$, $I_c=5\text{A}$	60 to 360	
$V_{CE(sat)}$	$I_c=5\text{A}$, $I_B=80\text{mA}$	0.5max	V
$V_{BE(sat)}$	$I_c=5\text{A}$, $I_B=80\text{mA}$	1.2max	V
f_r	$V_{CE}=12\text{V}$, $I_E=-1\text{A}$	18typ	MHz
C_{OB}	$V_{CB}=10\text{V}$, $f=1\text{MHz}$	210typ	pF

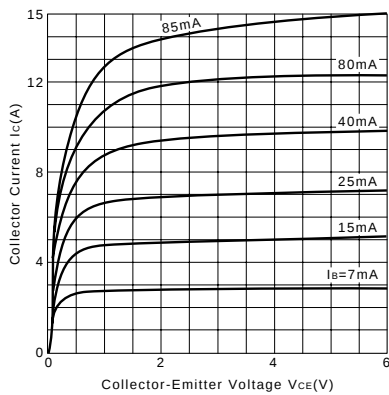
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_c (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (A)	I_{B2} (A)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
20	4	5	10	-5	0.08	-0.08	0.5typ	2.0typ	0.4typ

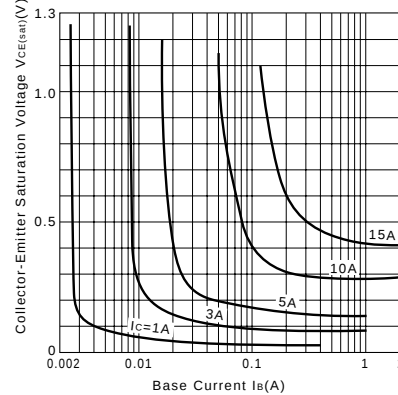
External Dimensions FM100(TO3PF)



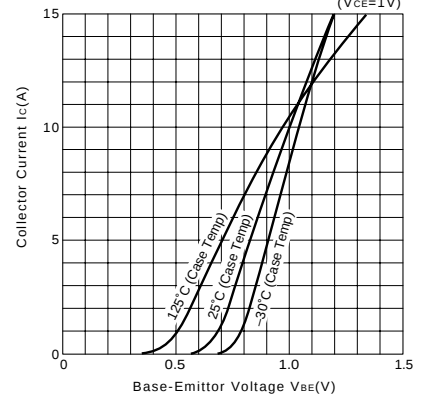
I_c-V_{CE} Characteristics (Typical)



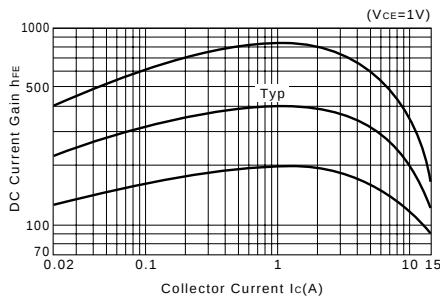
$V_{CE(sat)}-I_B$ Characteristics (Typical)



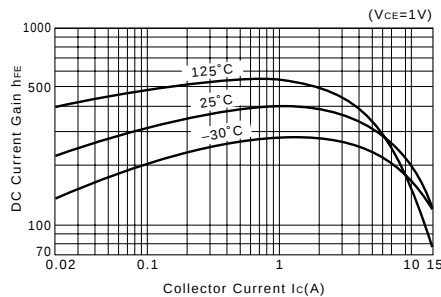
I_c-V_{BE} Temperature Characteristics (Typical)



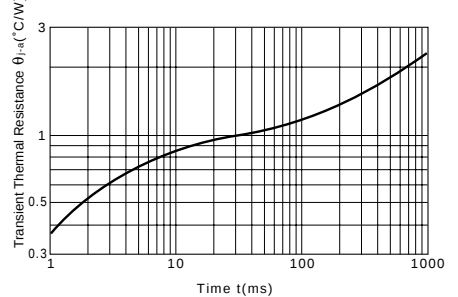
$h_{FE}-I_c$ Characteristics (Typical)



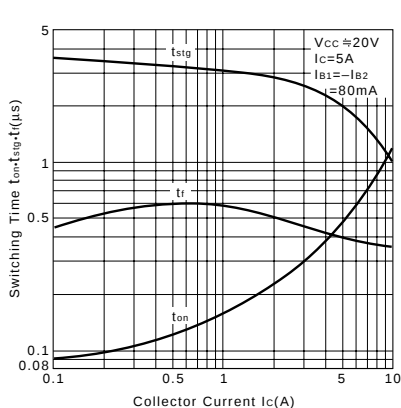
$h_{FE}-I_c$ Temperature Characteristics (Typical)



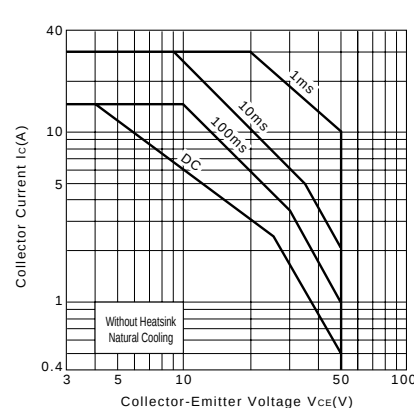
$\theta_{j-a}-t$ Characteristics



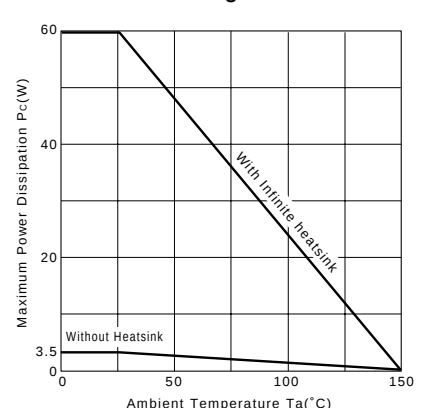
$t_{on} \cdot t_{stg} \cdot t_f - I_c$ Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_c-T_a Derating



2SC4138

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	500	V
VCEO	400	V
VEBO	10	V
IC	10(Pulse20)	A
IB	4	A
PC	80(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

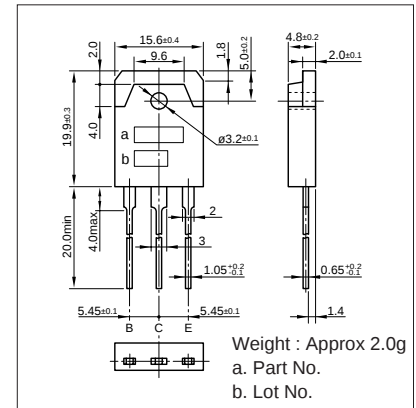
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
ICBO	VCB=500V	100max	μA
IEBO	VEB=10V	100max	μA
V(BR)CEO	IC=25mA	400min	V
hFE	VCE=4V, IC=6A	10 to 30	
VCE(sat)	IC=6A, IB=1.2A	0.5max	V
VBE(sat)	IC=6A, IB=1.2A	1.3max	V
fr	VCE=12V, IE=-0.7A	10typ	MHz
COB	VCB=10V, f=1MHz	85typ	pF

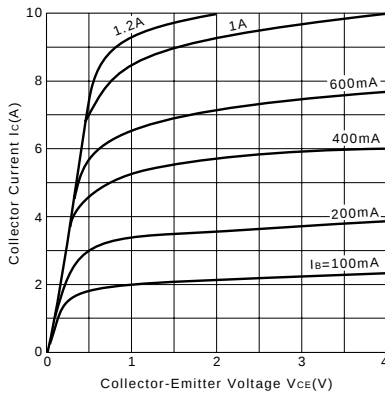
Typical Switching Characteristics (Common Emitter)

VCC (V)	RL (Ω)	IC (A)	VBB1 (V)	VBB2 (V)	IB1 (A)	IB2 (A)	ton (μs)	tstg (μs)	tf (μs)
200	33.3	6	10	-5	0.6	-1.2	1max	3max	0.5max

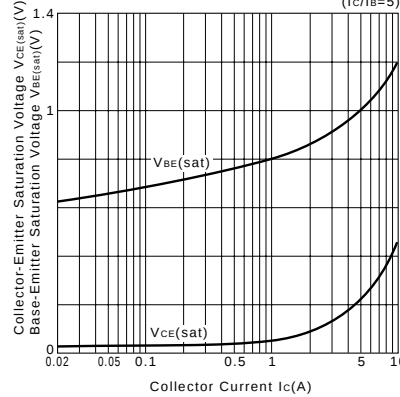
External Dimensions MT-100(TO3P)



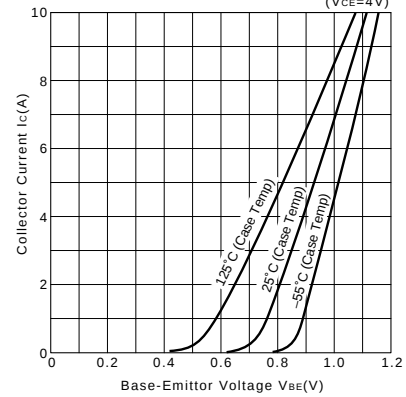
IC-VCE Characteristics (Typical)



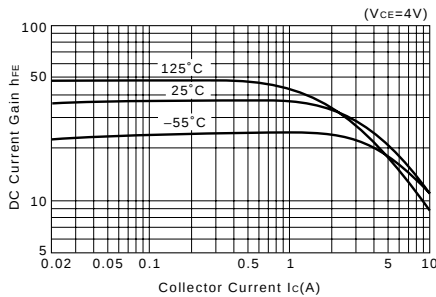
VCE(sat), VBE(sat)-IC Temperature Characteristics (Typical)



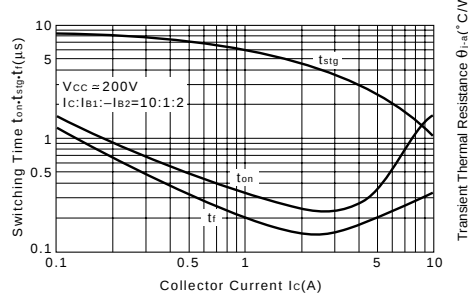
IC-VBE Temperature Characteristics (Typical)



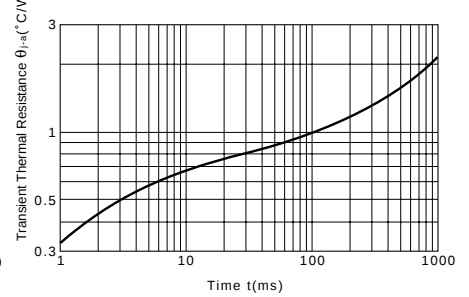
hFE-IC Characteristics (Typical)



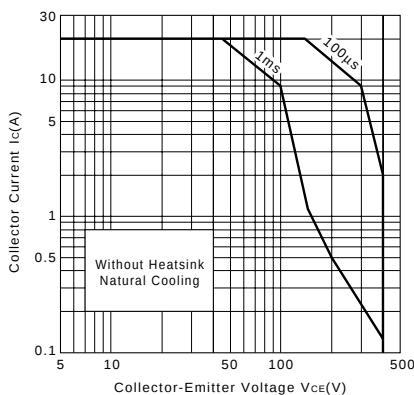
ton, tstg, tf-IC Characteristics (Typical)



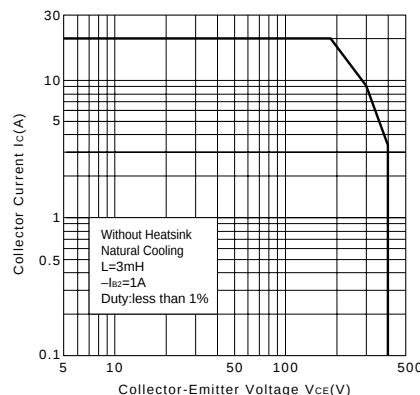
θja-t Characteristics



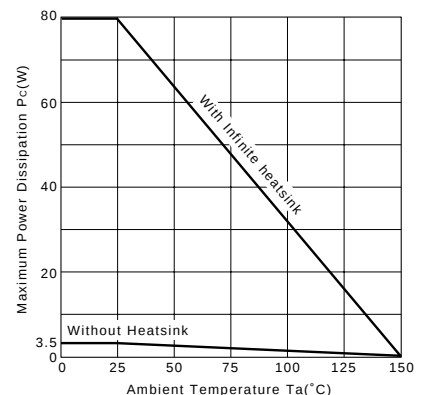
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



PC-Ta Derating



2SC4139

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EBO}	10	V
I _C	15(Pulse30)	A
I _B	5	A
P _C	120(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

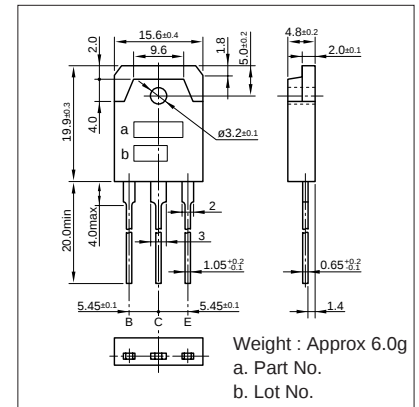
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EBO}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =8A	10 to 30	
V _{CE(sat)}	I _C =8A, I _B =1.6A	0.5max	V
V _{BE(sat)}	I _C =8A, I _B =1.6A	1.3max	V
f _r	V _{CE} =12V, I _E =-1.5A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	85typ	pF

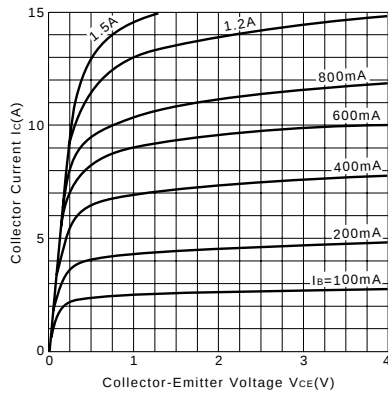
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	25	8	10	-5	0.8	-1.6	1max	3max	0.5max

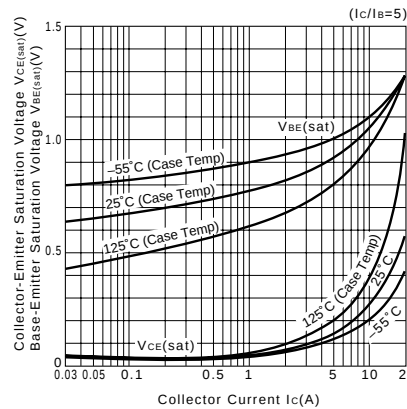
External Dimensions MT-100(TO3P)



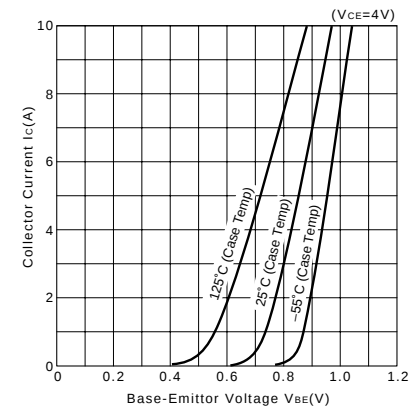
I_C-V_{CE} Characteristics (Typical)



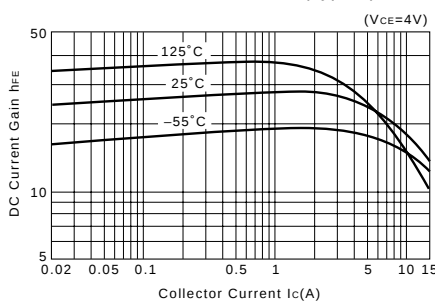
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



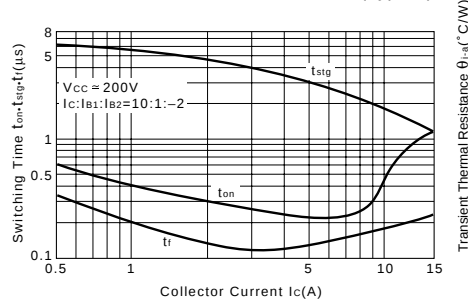
I_C-V_{BE} Temperature Characteristics (Typical)



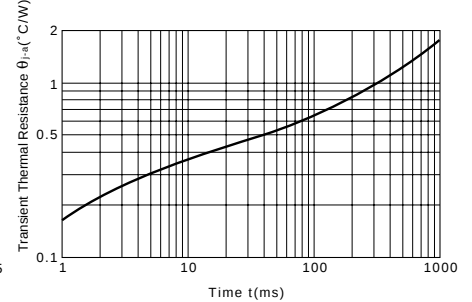
h_{FE}-I_C Characteristics (Typical)



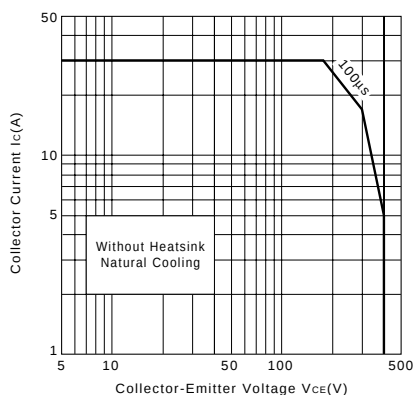
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



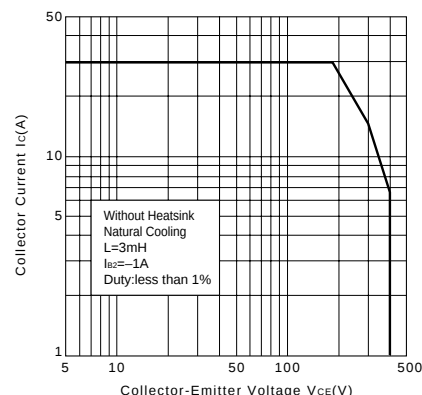
θ_{JA}-t Characteristics



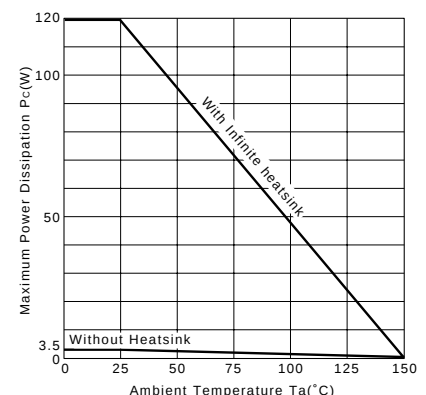
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4140

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	500	V
VCEO	400	V
VEBO	10	V
IC	18(Pulse36)	A
IB	6	A
PC	130(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

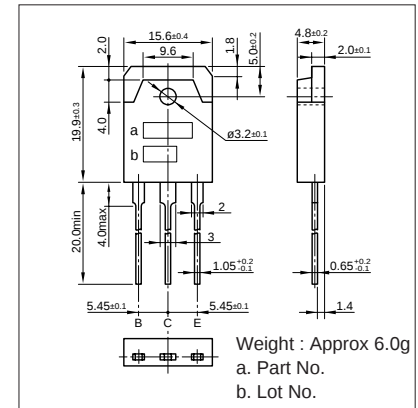
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
ICBO	VCB=500V	100max	μA
IEBO	VEB=10V	100max	μA
V(BR)CEO	IC=25mA	400min	V
hFE	VCE=4V, IC=10A	10 to 30	
VCE(sat)	IC=10A, IB=2A	0.5max	V
VBE(sat)	IC=10A, IB=2A	1.3max	V
fr	VCE=12V, IE=-2.0A	10typ	MHz
COB	VCB=10V, f=1MHz	165typ	pF

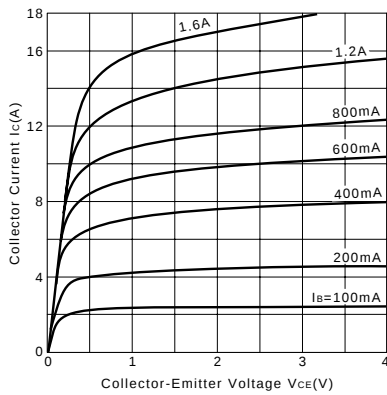
Typical Switching Characteristics (Common Emitter)

VCC (V)	RL (Ω)	IC (A)	VBB1 (V)	VBB2 (V)	IB1 (A)	IB2 (A)	ton (μs)	tstg (μs)	tf (μs)
200	20	10	10	-5	1	-2	1max	3max	0.5max

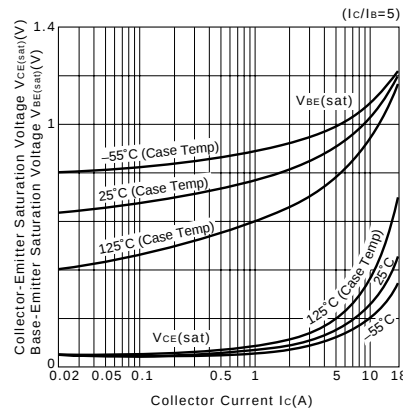
External Dimensions MT-100(TO3P)



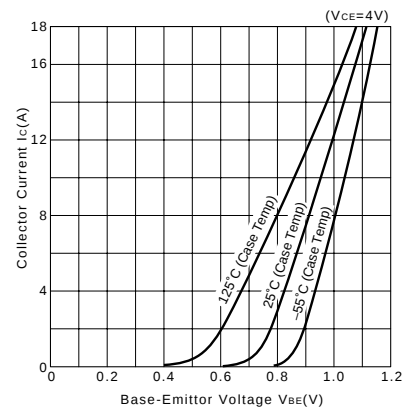
IC-VCE Characteristics (Typical)



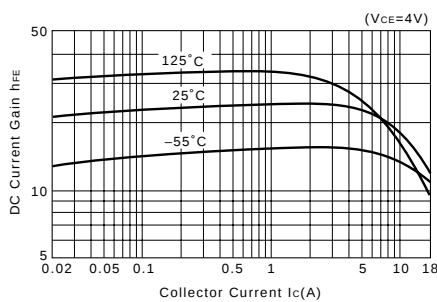
VCE(sat), VBE(sat)-IC Temperature Characteristics (Typical)



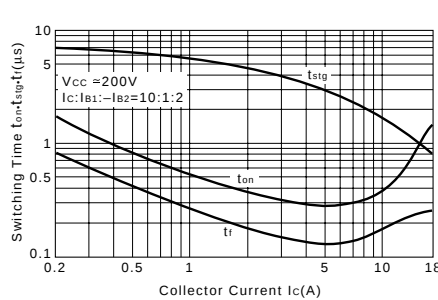
IC-VBE Temperature Characteristics (Typical)



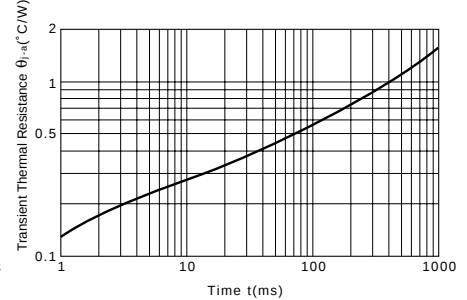
hFE-IC Characteristics (Typical)



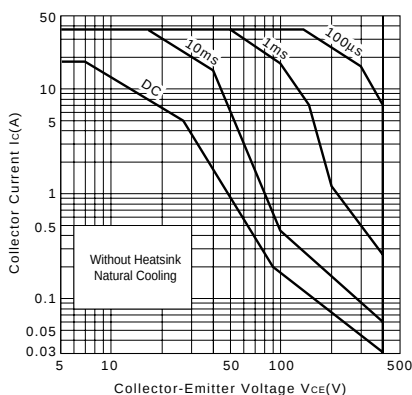
ton, tstg, tr-IC Characteristics (Typical)



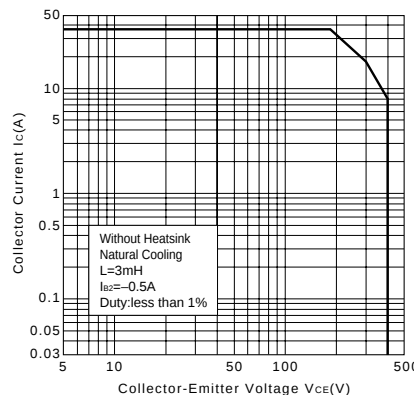
θJA-t Characteristics



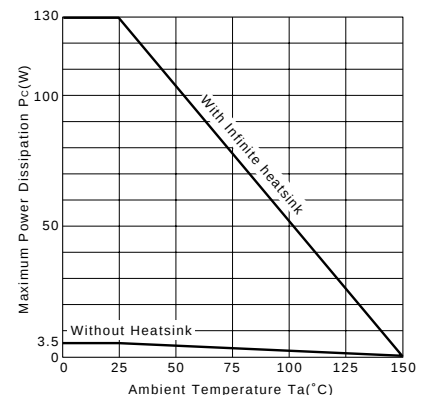
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



PC-Ta Derating



2SC4153

Silicon NPN Triple Diffused Planar Transistor (Switching Transistor)

Application : Humidifier, DC-DC Converter, and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CEO}	120	V
V _{EB0}	8	V
I _C	7(Pulse14)	A
I _B	3	A
P _C	30(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

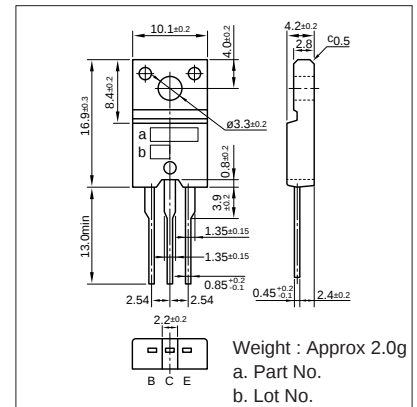
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	100max	μA
I _{EB0}	V _{EB} =8V	100max	μA
V _{(BR)CEO}	I _C =50mA	120min	V
h _{FE}	V _{CE} =4V, I _C =3A	70 to 220	
V _{CE(sat)}	I _C =3A, I _B =0.3A	0.5max	V
V _{BE(sat)}	I _C =3A, I _B =0.3A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.5A	30typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	110typ	pF

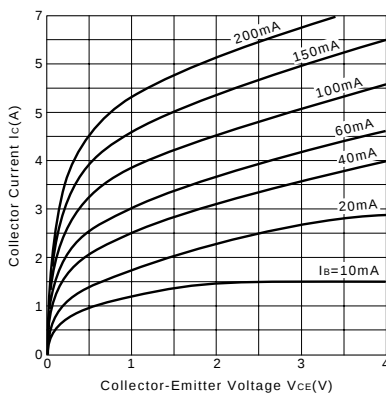
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
50	16.7	3	10	-5	0.3	-0.6	0.5max	3max	0.5max

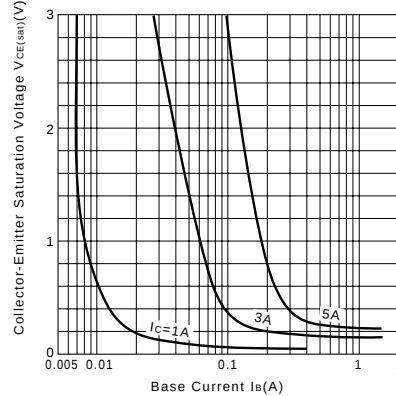
External Dimensions FM20(TO220F)



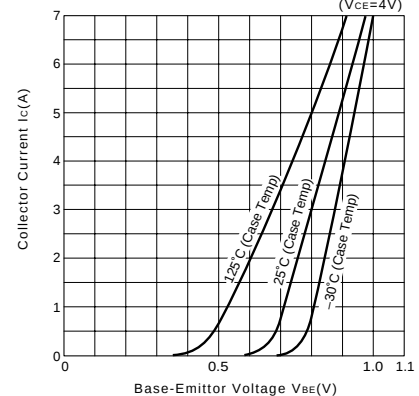
I_C-V_{CE} Characteristics (Typical)



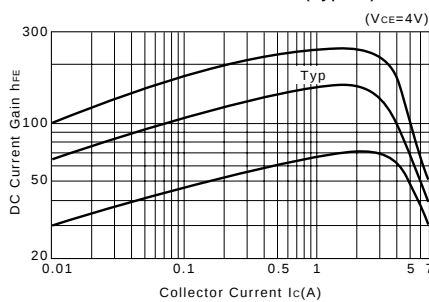
V_{CE(sat)}-I_B Characteristics (Typical)



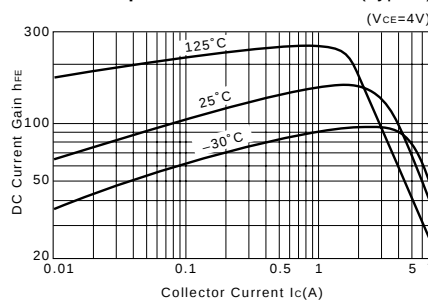
I_C-V_{BE} Temperature Characteristics (Typical)



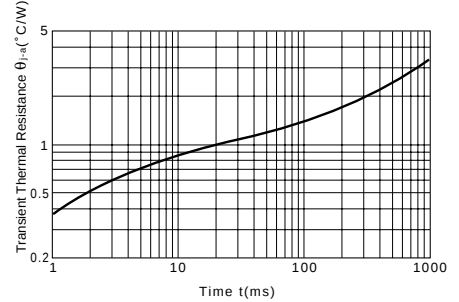
h_{FE}-I_C Characteristics (Typical)



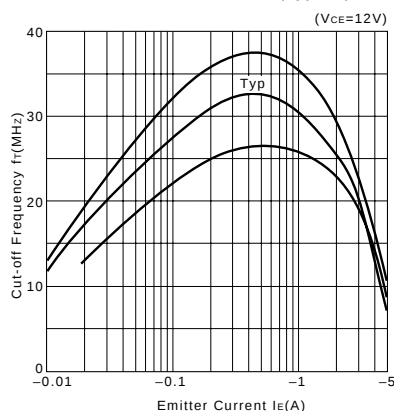
h_{FE}-I_C Temperature Characteristics (Typical)



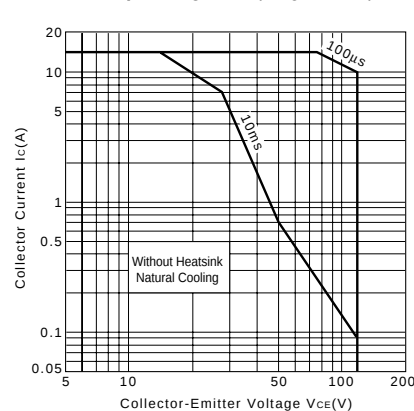
θ_{j-a}-t Characteristics



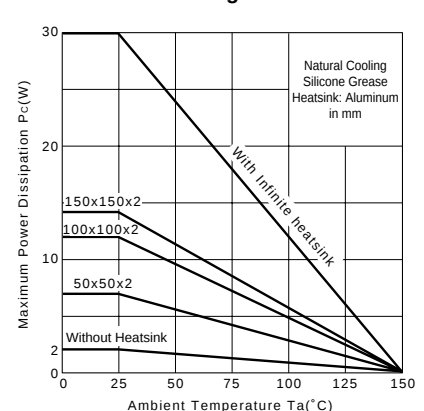
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC4296

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EB0}	10	V
I _C	10(Pulse20)	A
I _B	4	A
P _C	75(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

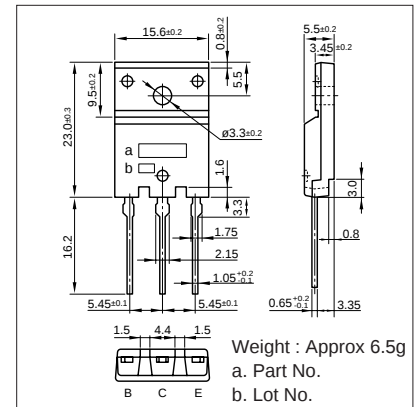
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =500V	100max	μA
I _{EB0}	V _{EB} =10V	100max	μA
V(BR) _{CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =6A	10 to 30	
V _{CE(sat)}	I _C =6A, I _B =1.2A	0.5max	V
V _{BE(sat)}	I _C =6A, I _B =1.2A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.7A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	85typ	pF

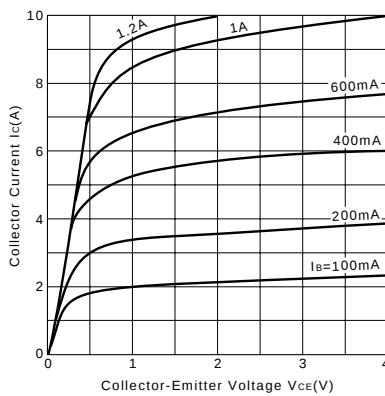
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	33	6	10	-5	0.6	-1.2	1max	3max	0.5max

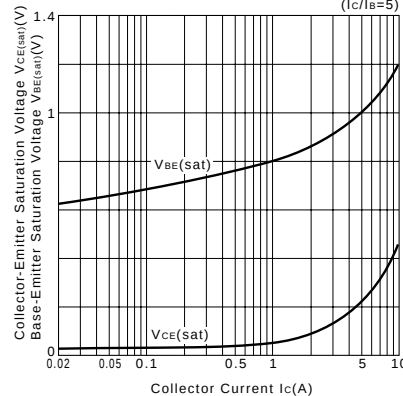
External Dimensions FM100(TO3PF)



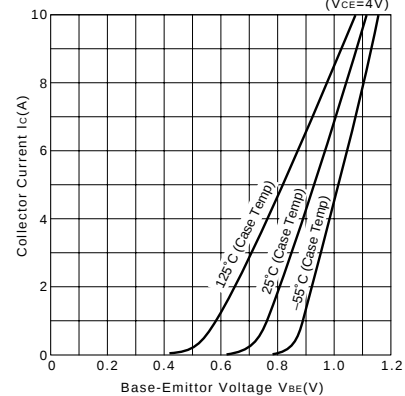
I_C-V_{CE} Characteristics (Typical)



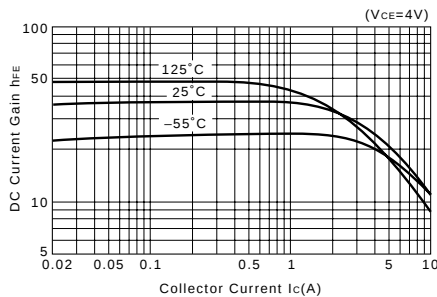
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



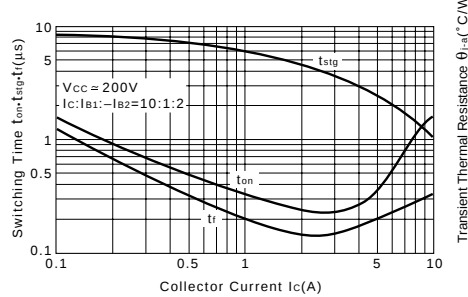
I_C-V_{BE} Temperature Characteristics (Typical)



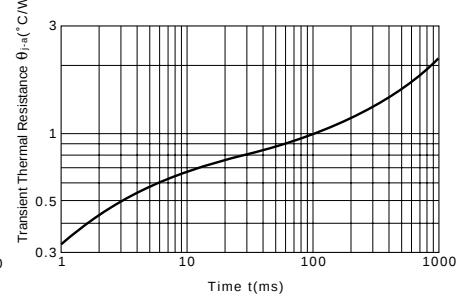
h_{FE}-I_C Characteristics (Typical)



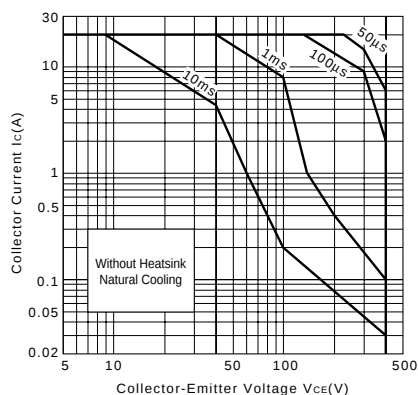
t_{on}, t_{stg}, t_f-I_C Characteristics (Typical)



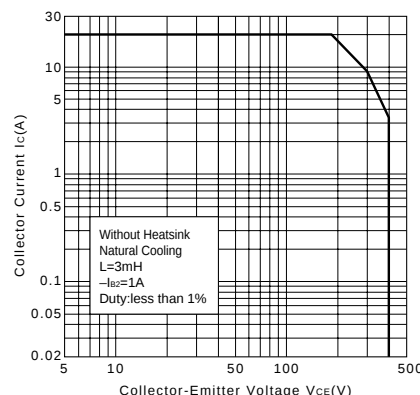
θ_{j-a}-t Characteristics



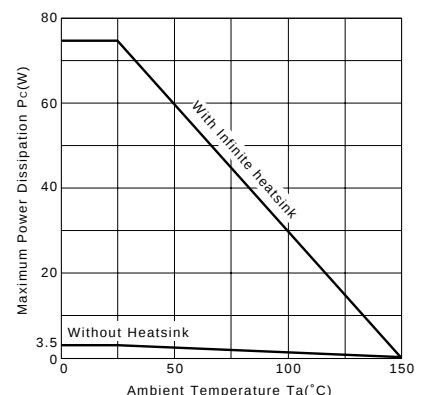
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4297

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	500	V
VCEO	400	V
VEBO	10	V
Ic	12(Pulse24)	A
IB	4	A
PC	75(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

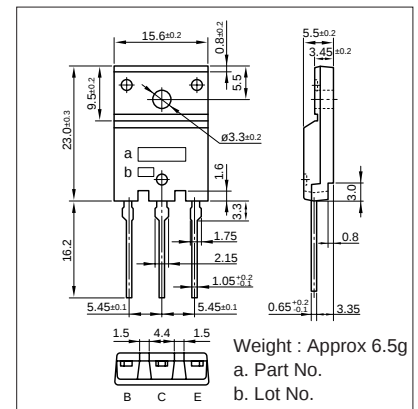
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
ICBO	$V_{CB}=500V$	100max	μA
IEBO	$V_{EB}=10V$	100max	μA
$V_{(BR)CEO}$	$I_C=25mA$	400min	V
h_{FE}	$V_{CE}=4V, I_C=7A$	10to 30	
$V_{CE(sat)}$	$I_C=7A, I_B=1.4A$	0.5max	V
$V_{BE(sat)}$	$I_C=7A, I_B=1.4A$	1.3max	V
f_T	$V_{CE}=12V, I_E=-1A$	10typ	MHz
COB	$V_{CB}=10V, f=1MHz$	105typ	pF

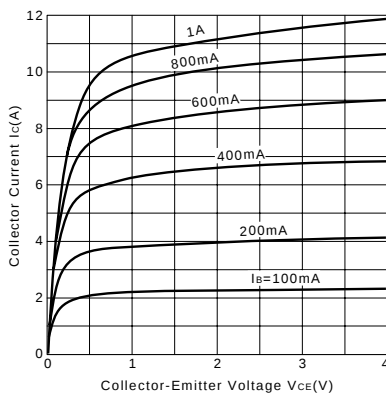
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	28.5	7	10	-5	0.7	-1.4	1max	3max	0.5max

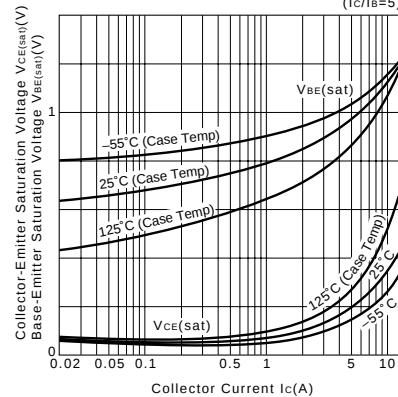
External Dimensions FM100(TO3PF)



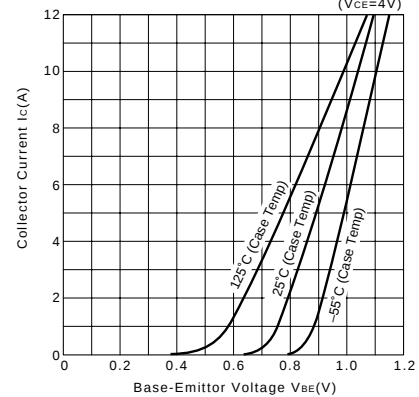
I_C-V_{CE} Characteristics (Typical)



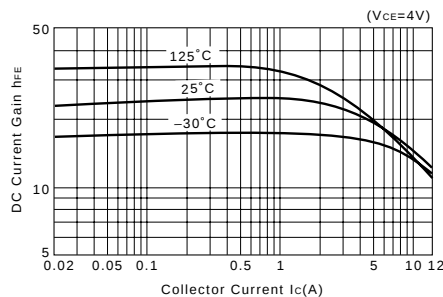
V_{CE}(sat), V_{BE}(sat)-I_C Temperature Characteristics (Typical)



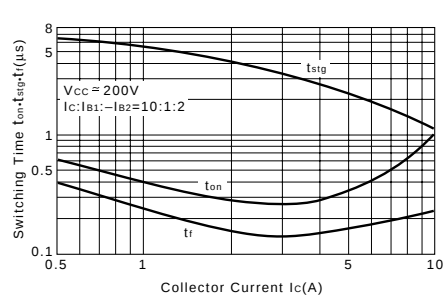
I_C-V_{BE} Temperature Characteristics (Typical)



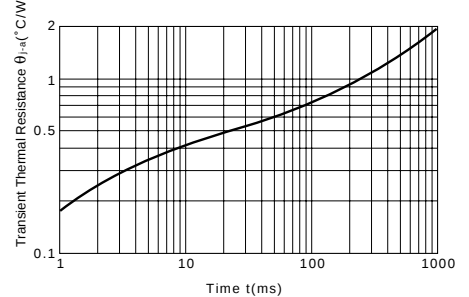
$h_{FE}-I_C$ Characteristics (Typical)



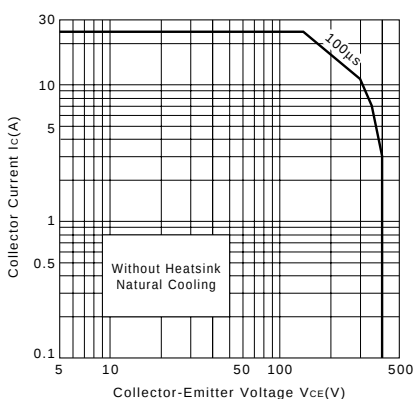
t_{on}•t_{stg}•t_f–I_C Characteristics (Typical)



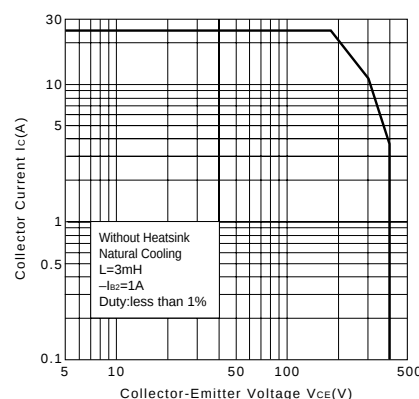
θ_{j-a-t} Characteristics



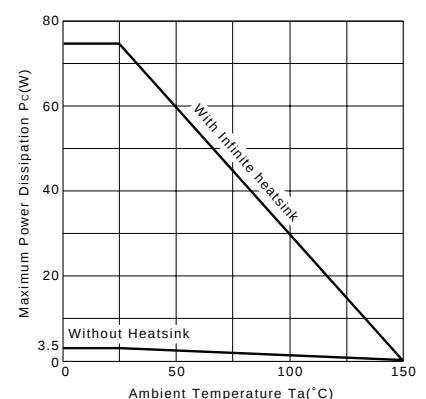
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



Pc-Ta Derating



2SC4298

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EB0}	10	V
I _C	15(Pulse30)	A
I _B	5	A
P _C	80(Tc=25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

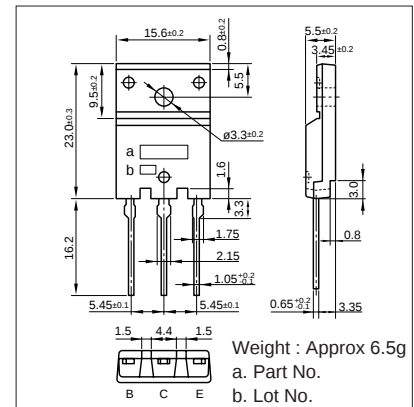
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =500V	100max	μA
I _{EB0}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =8A	10 to 30	
V _{CE(sat)}	I _C =8A, I _B =1.6A	0.5max	V
V _{BE(sat)}	I _C =8A, I _B =1.6A	1.3max	V
f _r	V _{CE} =12V, I _E =-1.5A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	85typ	pF

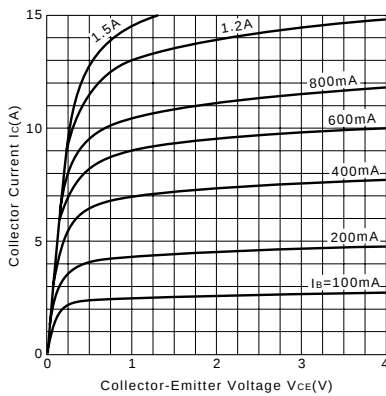
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	25	8	10	-5	0.8	-1.6	1max	3max	0.5max

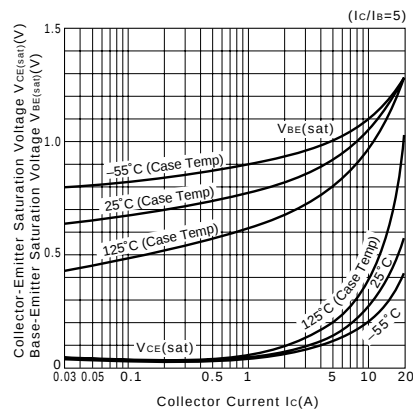
External Dimensions FM100(TO3PF)



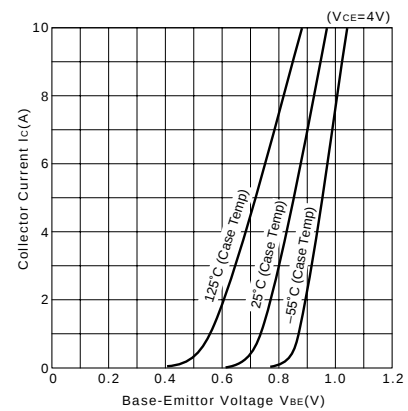
I_C-V_{CE} Characteristics (Typical)



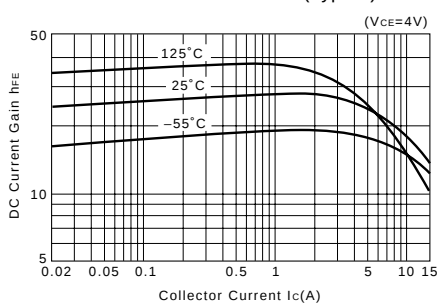
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



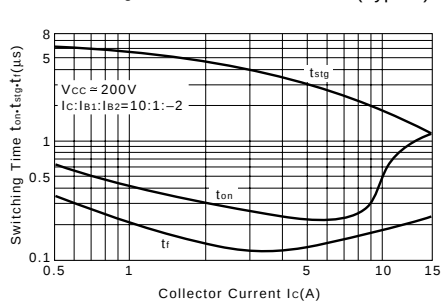
I_C-V_{BE} Temperature Characteristics (Typical)



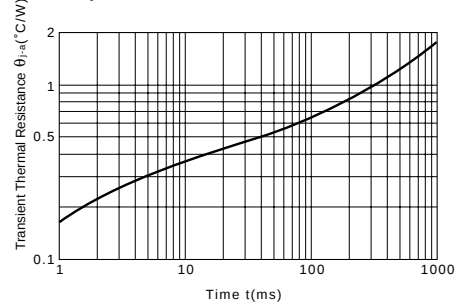
h_{FE}-I_C Characteristics (Typical)



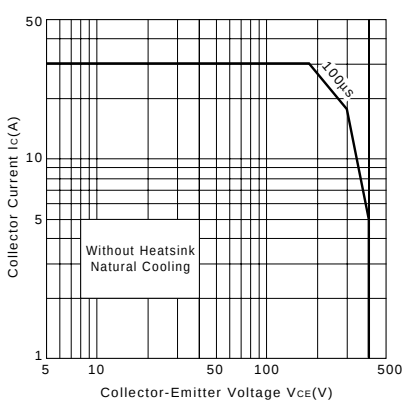
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



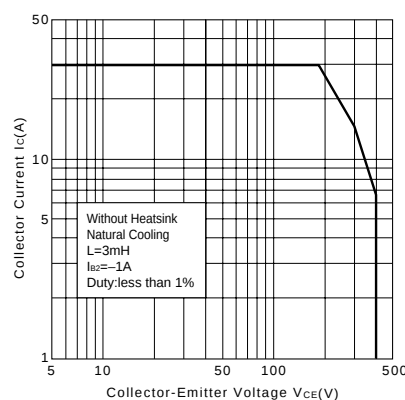
θ_{j-a}-t Characteristics



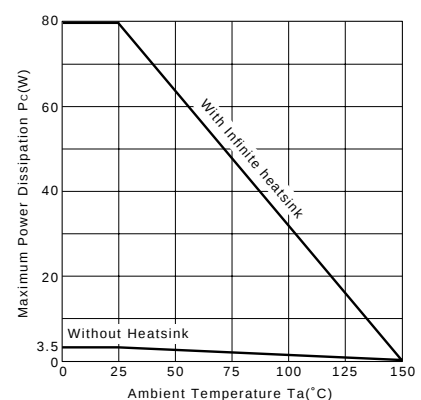
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4299

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CE0}	800	V
V _{EB0}	7	V
I _C	3(Pulse6)	A
I _B	1.5	A
P _C	70(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

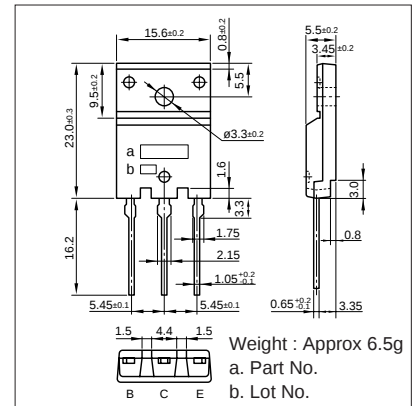
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	800min	V
h _{FE}	V _{CE} =4V, I _C =1A	10 to 30	
V _{CE(sat)}	I _C =1A, I _B =0.2A	0.5max	V
V _{BE(sat)}	I _C =1A, I _B =0.2A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.3A	6typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	50typ	pF

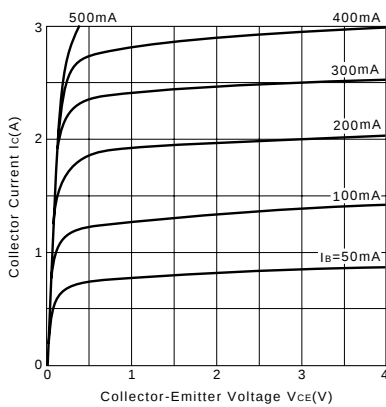
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	250	1	10	-5	0.15	-0.5	1max	5max	1max

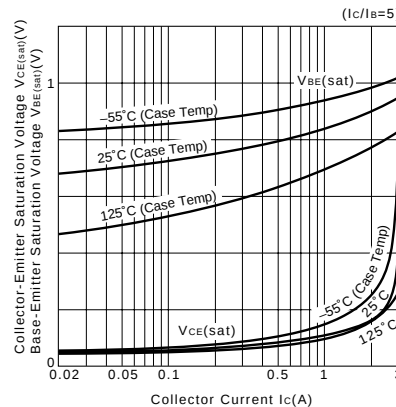
External Dimensions FM100(TO3PF)



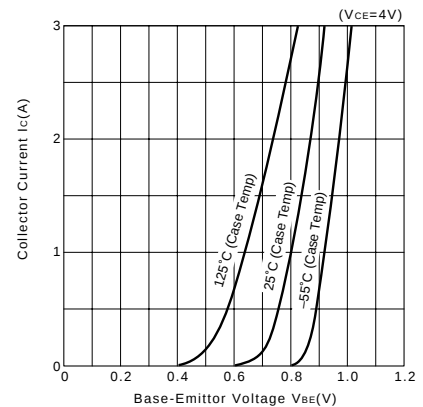
I_C-V_{CE} Characteristics (Typical)



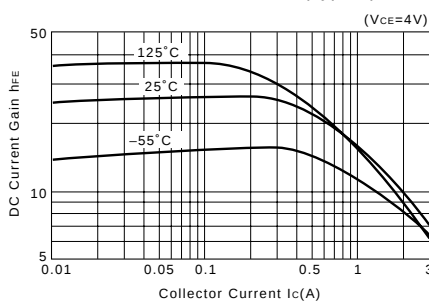
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



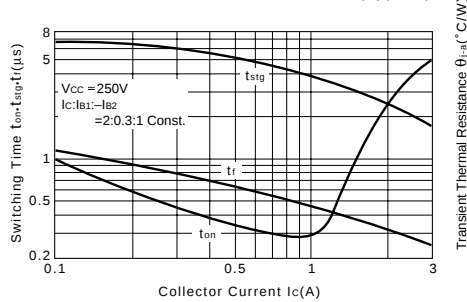
I_C-V_{BE} Temperature Characteristics (Typical)



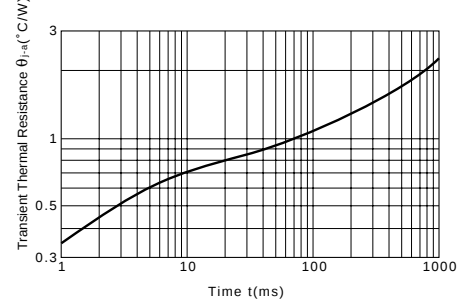
h_{FE}-I_C Characteristics (Typical)



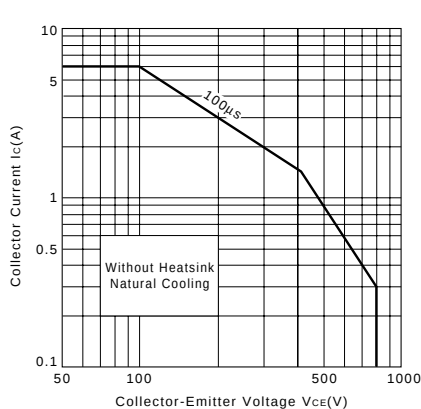
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



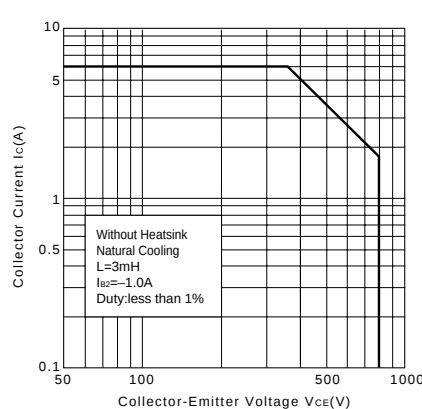
θ_{j-a}-t Characteristics



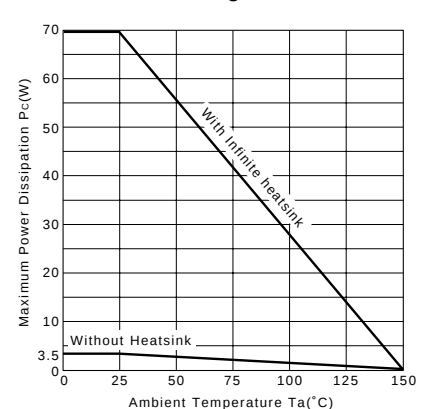
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4300

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	800	V
V _{EB0}	7	V
I _C	5(Pulse10)	A
I _B	2.5	A
P _C	75(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

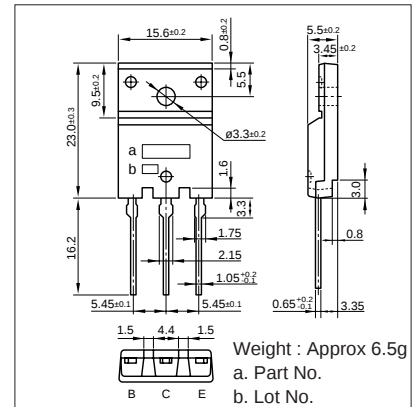
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	800min	V
h _{FE}	V _{CE} =4V, I _C =2A	10 to 30	
V _{CE(sat)}	I _C =2A, I _B =0.4A	0.5max	V
V _{BE(sat)}	I _C =2A, I _B =0.4A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.5A	6typ	MHz
COB	V _{CB} =10V, f=1MHz	75typ	pF

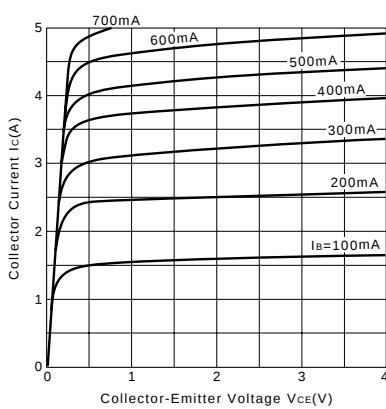
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	125	2	10	-5	0.3	-1	1max	5max	1max

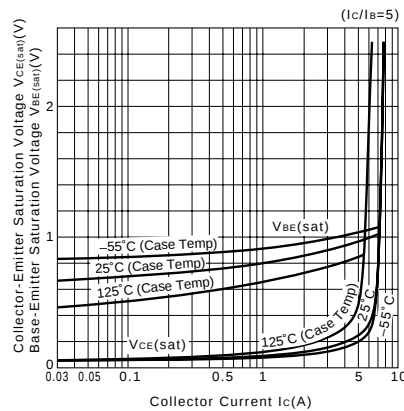
External Dimensions FM100(TO3PF)



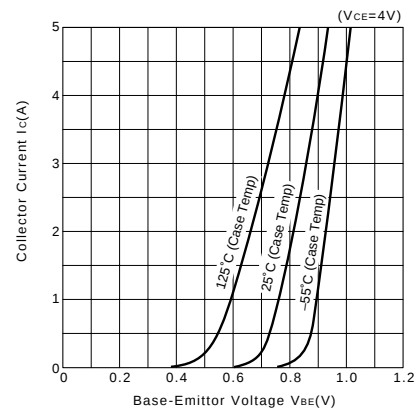
I_C-V_{CE} Characteristics (Typical)



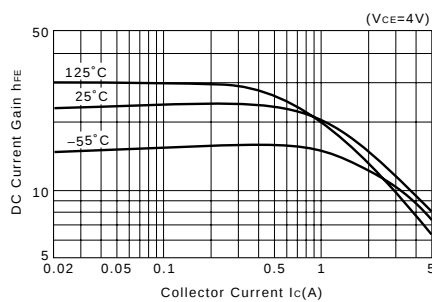
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



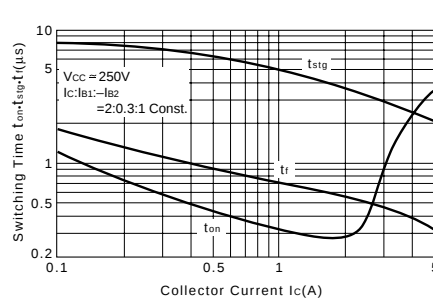
I_C-V_{BE} Temperature Characteristics (Typical)



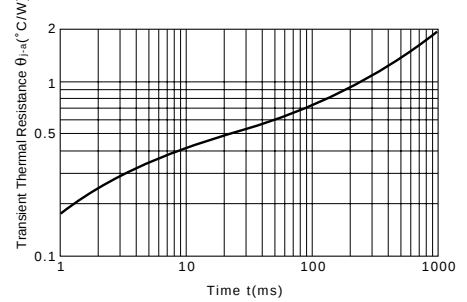
h_{FE}-I_C Characteristics (Typical)



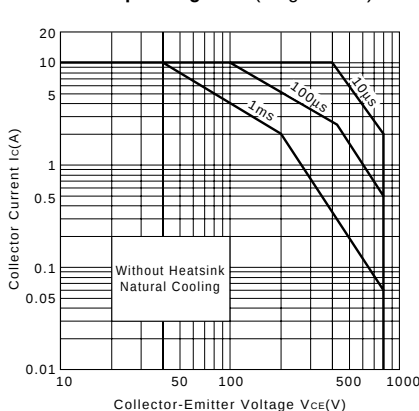
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



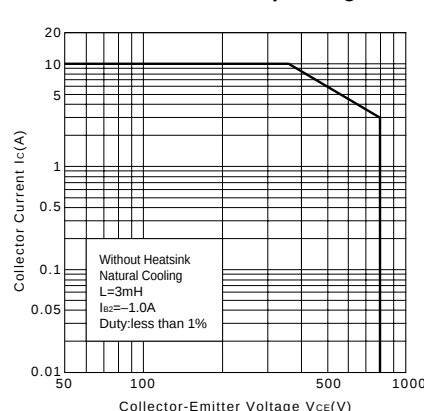
θ_{j-a}-t Characteristics



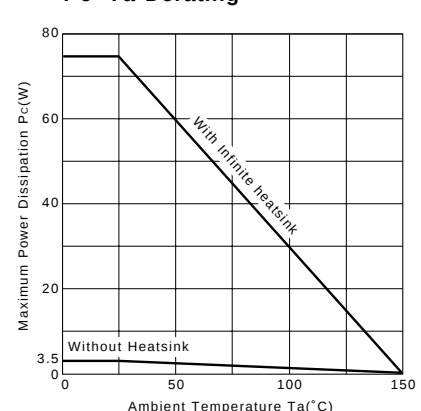
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4301

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor) Application : Switching Regulator, Lighting Inverter and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	800	V
V _{EB0}	7	V
I _C	7(Pulse14)	A
I _B	3.5	A
P _C	80(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

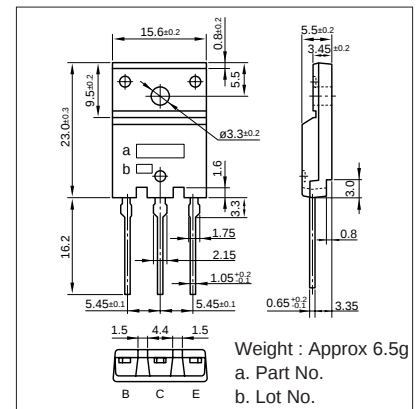
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =800V	100max	μA
I _{EBO}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	800min	V
h _{FE}	V _{CE} =4V, I _C =3A	10 to 30	
V _{CE(sat)}	I _C =3A, I _B =0.6A	0.5max	V
V _{BE(sat)}	I _C =3A, I _B =0.6A	1.2max	V
f _r	V _{CE} =12V, I _E =-1A	6typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	105typ	pF

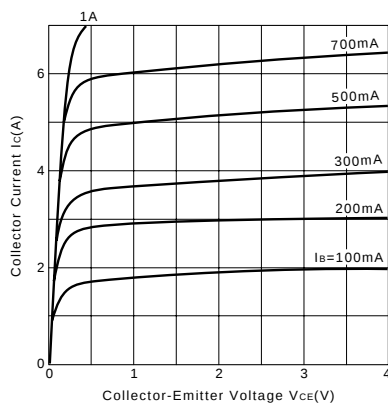
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	83	3	10	-5	0.45	-1.5	1max	5max	1max

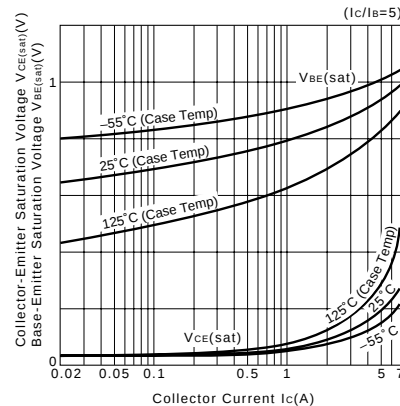
External Dimensions FM100(TO3PF)



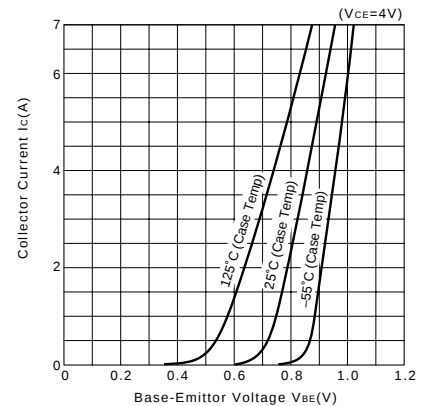
I_C-V_{CE} Characteristics (Typical)



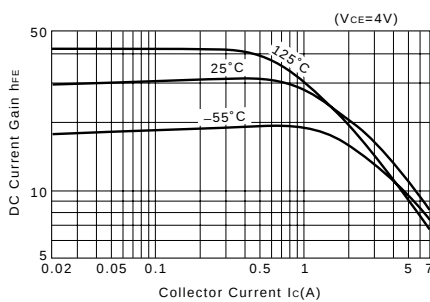
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



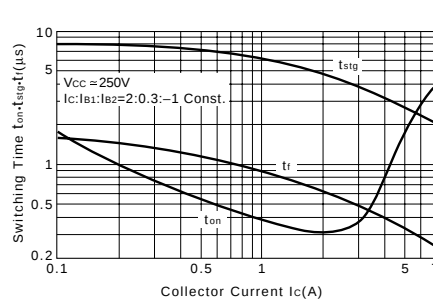
I_C-V_{BE} Temperature Characteristics (Typical)



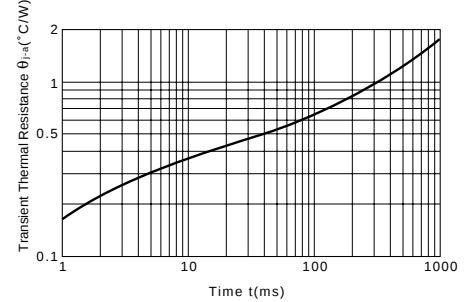
h_{FE}-I_C Characteristics (Typical)



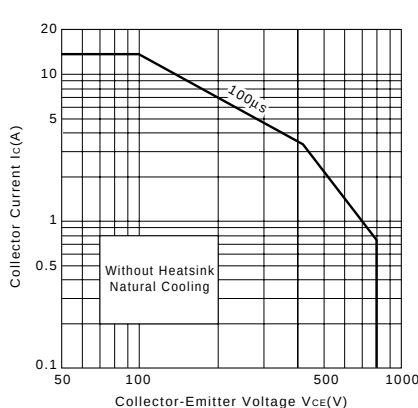
t_{on}•t_{stg}•t_r-I_C Characteristics (Typical)



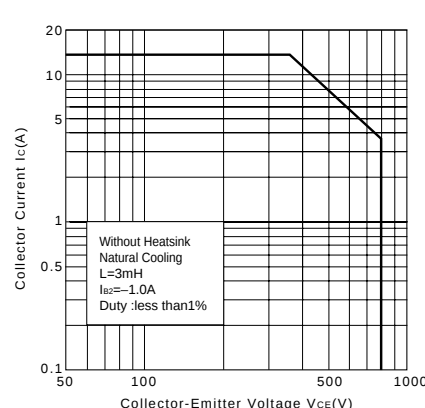
θ_{J-a}-t Characteristics



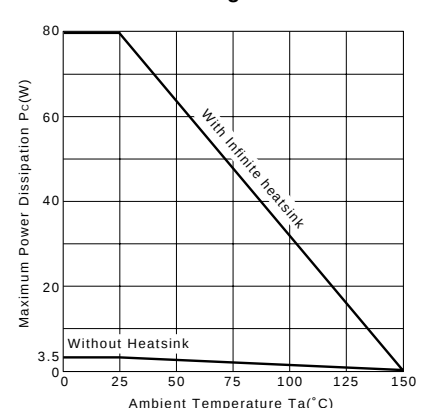
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4304

Silicon NPN Triple Diffused Planar Transistor (High Voltage High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CE0}	800	V
V _{EB0}	7	V
I _c	3(Pulse6)	A
I _B	1.5	A
P _c	35(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

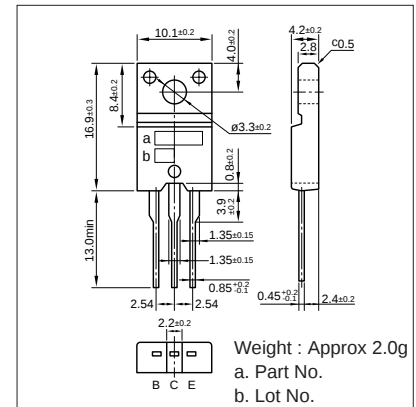
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V(BR) _{CEO}	I _c =10mA	800min	V
h _{FE}	V _{CE} =4V, I _c =0.7A	10 to 30	
V _{CE(sat)}	I _c =0.7A, I _B =0.14A	0.5max	V
V _{BE(sat)}	I _c =0.7A, I _B =0.14A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.3A	15typ	MHz
COB	V _{CB} =10V, f=1MHz	50typ	pF

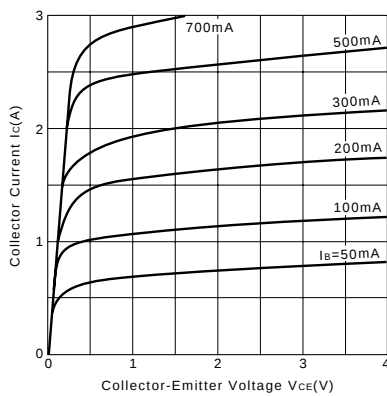
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	357	0.7	10	-5	0.1	-0.35	0.7max	4.0max	0.7max

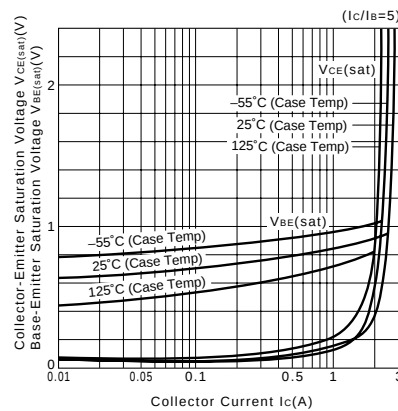
External Dimensions FM20(TO220F)



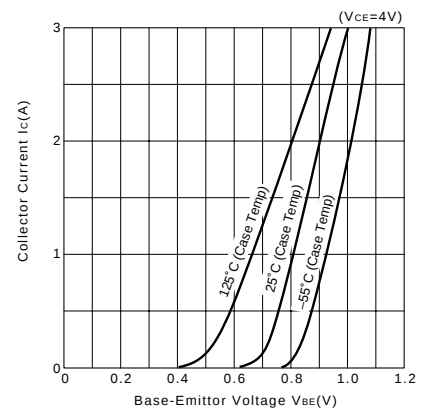
I_c-V_{CE} Characteristics (Typical)



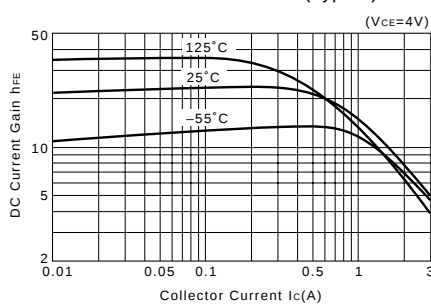
V_{CE(sat)}, V_{BE(sat)}-I_c Temperature Characteristics (Typical)



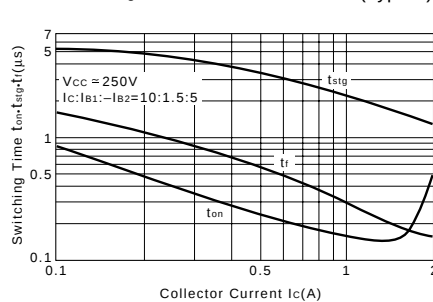
I_c-V_{BE} Temperature Characteristics (Typical)



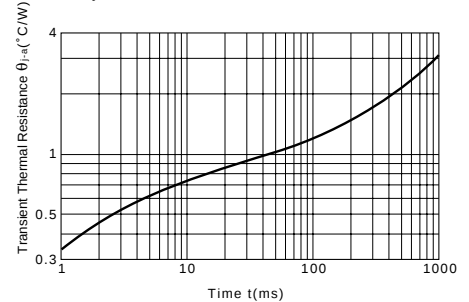
h_{FE}-I_c Characteristics (Typical)



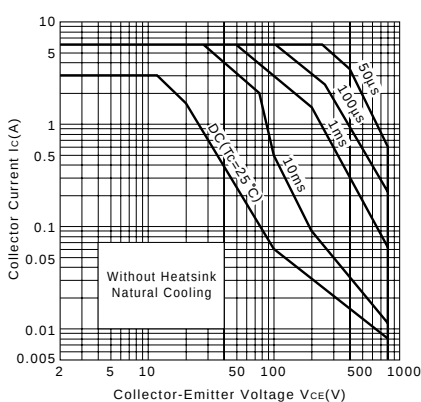
t_{on}, t_{stg}, t_f-I_c Characteristics (Typical)



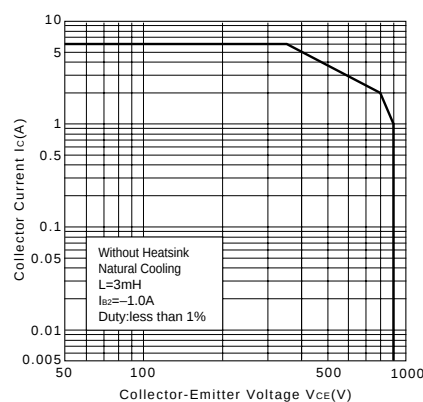
θ_{j-a}-t Characteristics



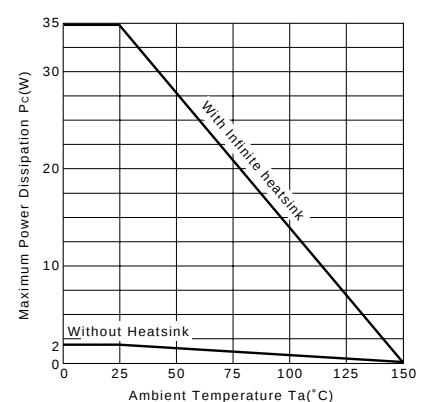
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_c-T_a Derating



2SC4381/4382

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1667/1668)

Application : TV Vertical Output, Audio Output Driver and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings		Unit
	2SC4381	2SC4382	
V _{CB0}	150	200	V
V _{CE0}	150	200	V
V _{EB0}	6		V
I _c	2		A
I _B	1		A
P _c	25(Tc=25°C)		W
T _j	150		°C
T _{stg}	-55 to +150		°C

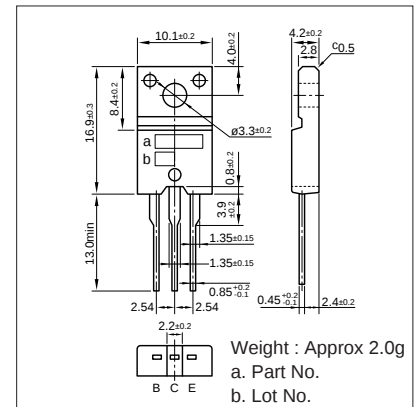
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings		Unit
		2SC4381	2SC4382	
I _{CB0}	V _{CB} =	10max		μA
I _{EB0}	V _{EB} =6V	10max		μA
V _{(BR)CEO}	I _c =25mA	150min	200min	V
h _{FE}	V _{CE} =10V, I _c =0.7A	60min		
V _{CE(sat)}	I _c =0.7A, I _B =0.07A	1.0max		V
f _r	V _{CE} =12V, I _E =-0.2A	15typ		MHz
C _{OB}	V _{CB} =10V, f=1MHz	35typ		pF

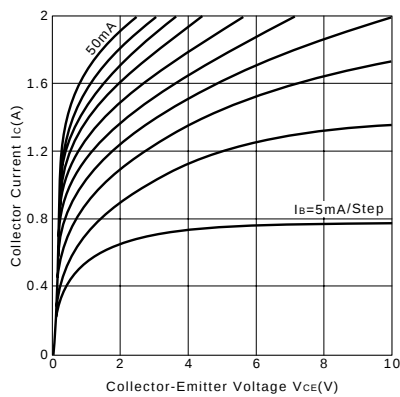
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
20	20	1	10	-5	100	-100	1.0typ	3.0typ	1.5typ

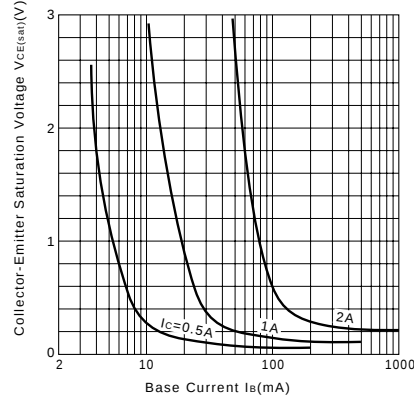
External Dimensions FM20(TO220F)



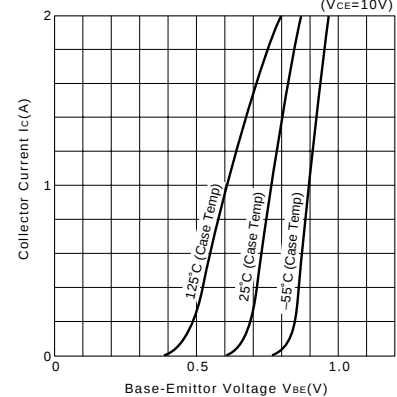
I_c-V_{CE} Characteristics (Typical)



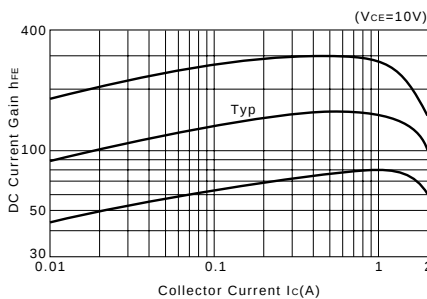
V_{CE(sat)}-I_B Characteristics (Typical)



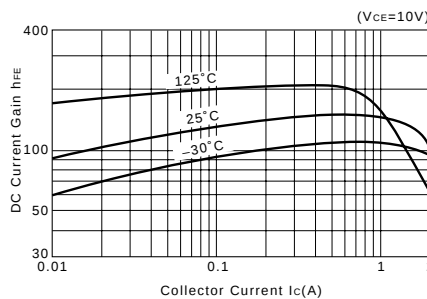
I_c-V_{BE} Temperature Characteristics (Typical)



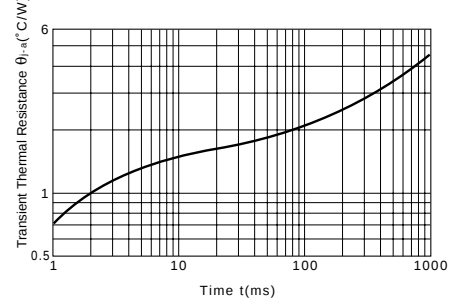
h_{FE}-I_c Characteristics (Typical)



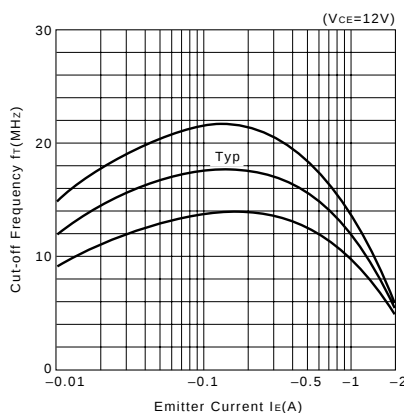
h_{FE}-I_c Temperature Characteristics (Typical)



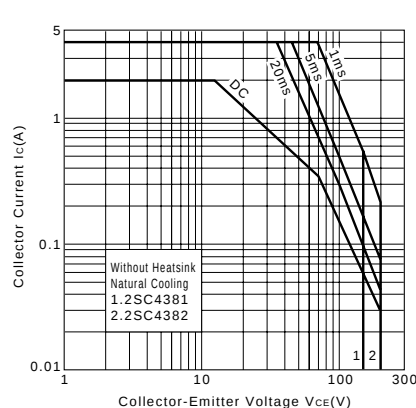
θ_{j-a}-t Characteristics



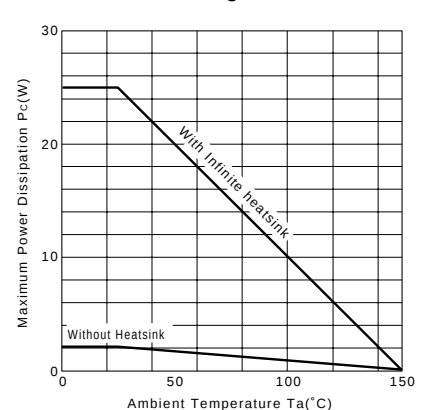
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_c-T_a Derating



2SC4388

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1673)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CE0}	180	V
V _{EB0}	6	V
I _C	15	A
I _B	4	A
P _C	85(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

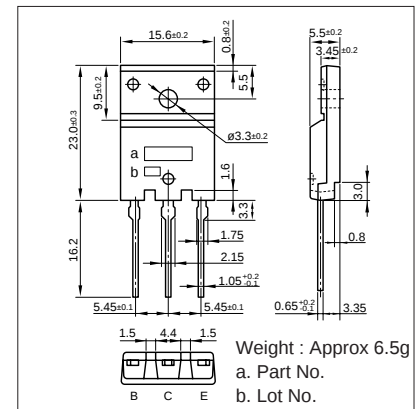
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =50mA	180min	V
h _{FE}	V _{CE} =4V, I _C =3A	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	2.0max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
COB	V _{CB} =10V, f=1MHz	300typ	pF

*h_{FE} Rank: O(50 to 100), P(70 to 140), Y(90 to 180)

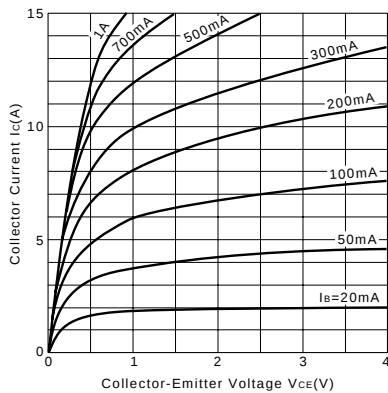
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	4	10	10	-5	1	-1	0.5max	1.8max	0.6max

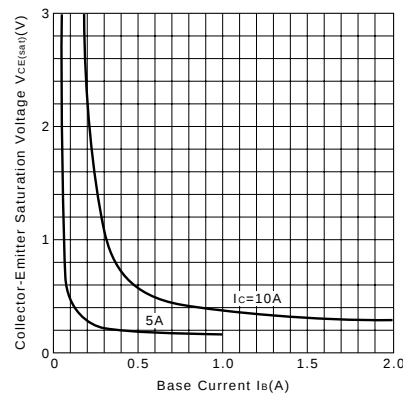
External Dimensions FM100(TO3PF)



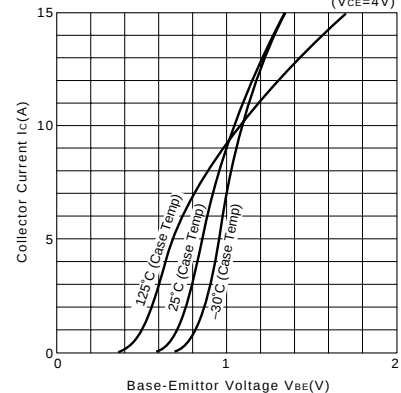
I_C-V_{CE} Characteristics (Typical)



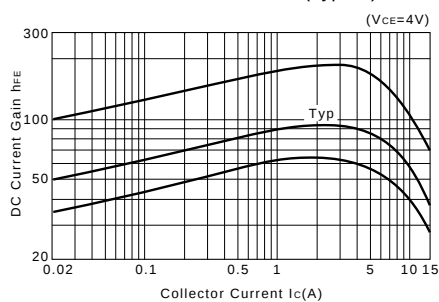
V_{CE(sat)}-I_B Characteristics (Typical)



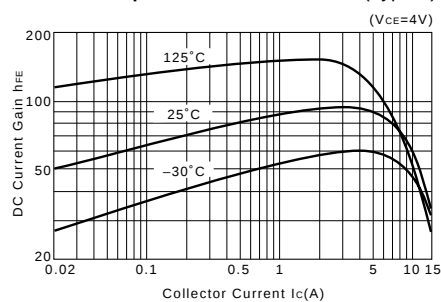
I_C-V_{BE} Temperature Characteristics (Typical)



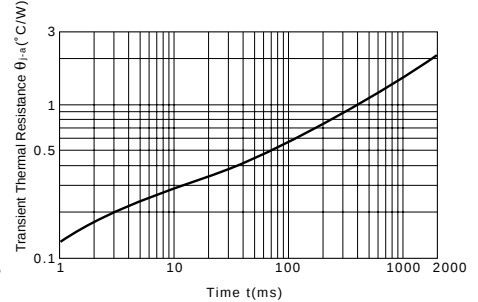
h_{FE}-I_C Characteristics (Typical)



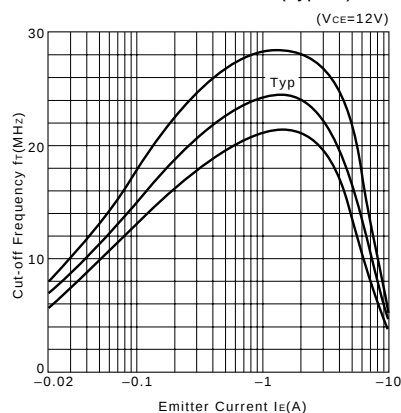
h_{FE}-I_C Temperature Characteristics (Typical)



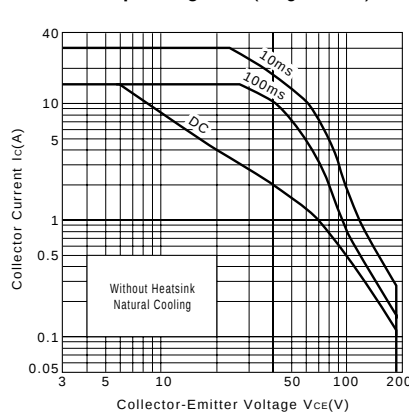
θ_{J-a}-t Characteristics



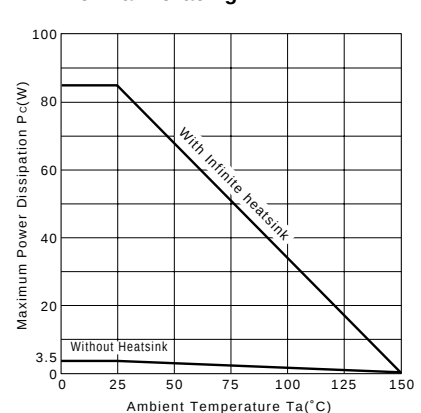
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC4418

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

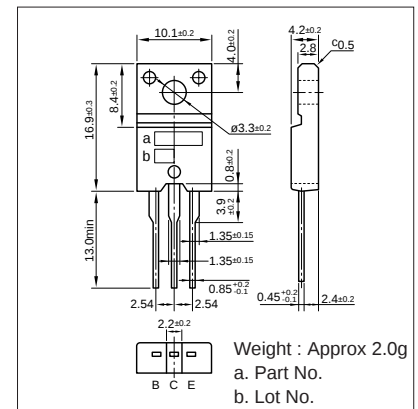
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CE0}	400	V
V _{EB0}	10	V
I _C	5(Pulse10)	A
I _B	2	A
P _C	30(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

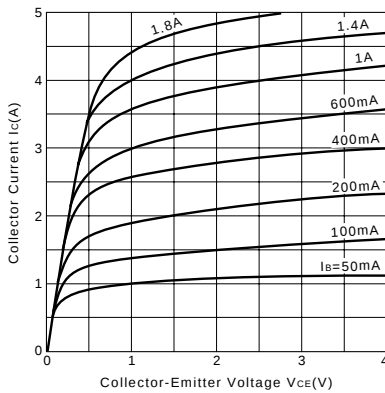
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EBO}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =1.5A	10to30	
V _{CE(sat)}	I _C =1.5A, I _B =0.3A	0.5max	V
V _{BE(sat)}	I _C =1.5A, I _B =0.3A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.3A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	30typ	pF

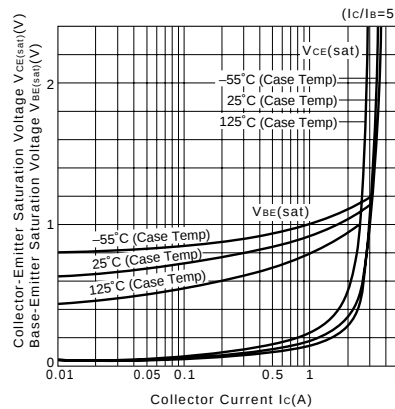
External Dimensions FM20(TO220F)



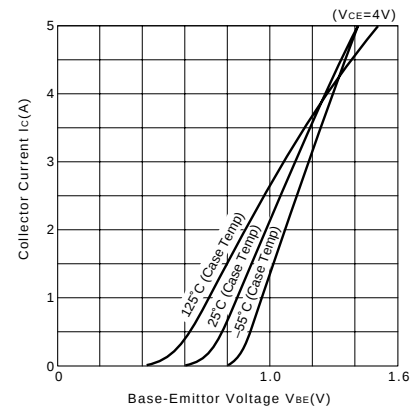
I_C-V_{CE} Characteristics (Typical)



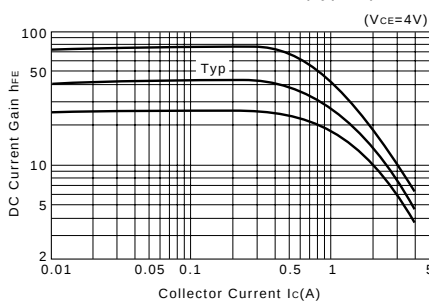
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



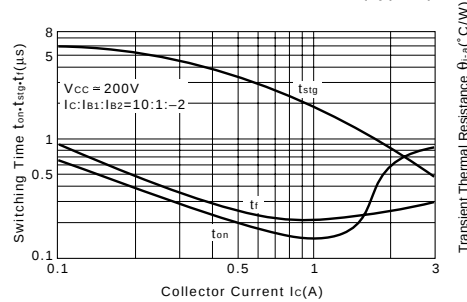
I_C-V_{BE} Temperature Characteristics (Typical)



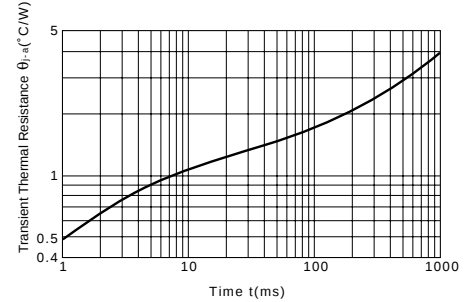
h_{FE}-I_C Characteristics (Typical)



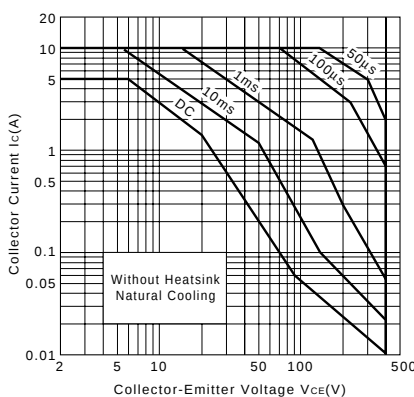
t_{on}•t_{stg}•t_r-I_C Characteristics (Typical)



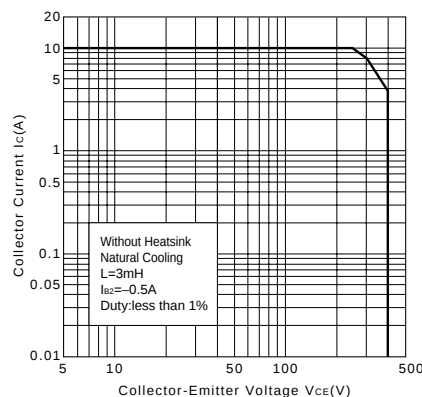
θ_{JA}-t Characteristics



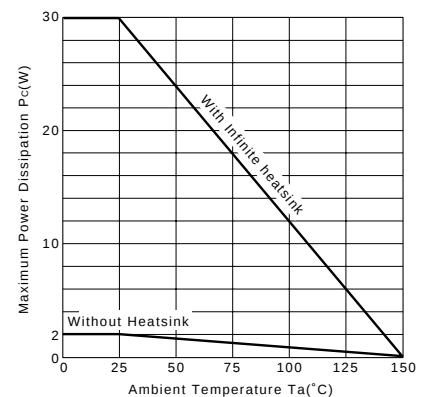
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4434

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator, Lighting Inverter, and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CE0}	400	V
V _{EB0}	10	V
I _C	15(Pulse30)	A
I _B	5	A
P _C	120(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

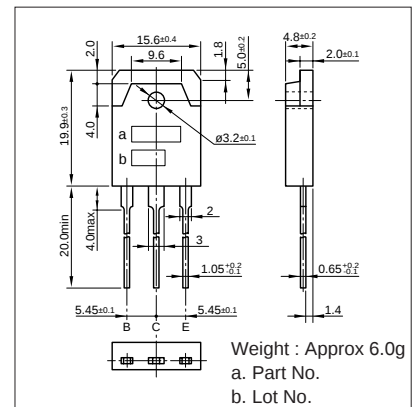
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =500V	100max	μA
I _{EB0}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =8A	10 to 25	
V _{CE(sat)}	I _C =8A, I _B =1.6A	0.7max	V
V _{BE(sat)}	I _C =8A, I _B =1.6A	1.3max	V
f _r	V _{CE} =12V, I _E =-1.5A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	135typ	pF

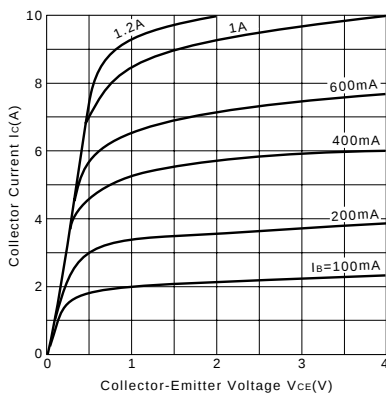
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	25	8	10	-5	1.6	-3.2	0.5max	2.0max	0.15max

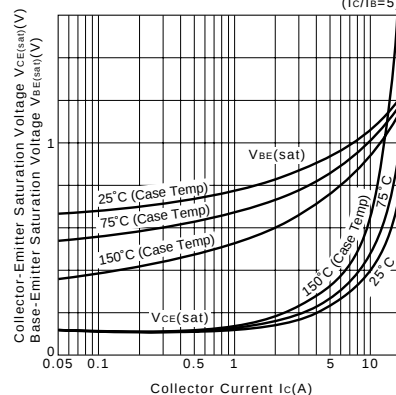
External Dimensions MT-100(TO3P)



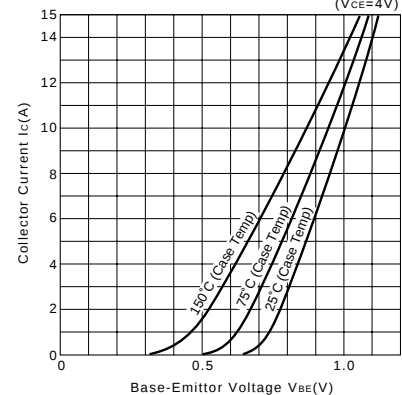
I_C-V_{CE} Characteristics (Typical)



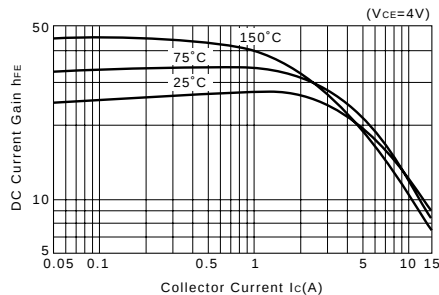
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



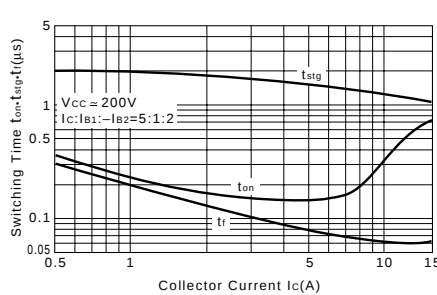
I_C-V_{BE} Temperature Characteristics (Typical)



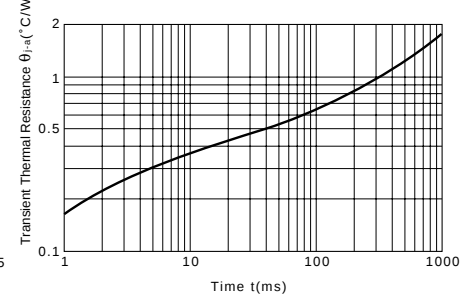
h_{FE}-I_C Temperature Characteristics (Typical)



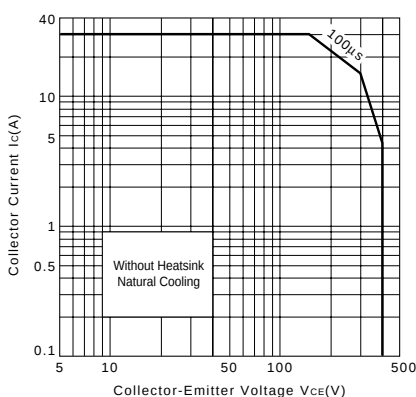
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



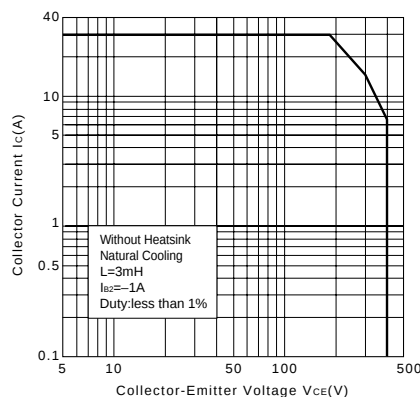
θ_{j-a}-t Characteristics



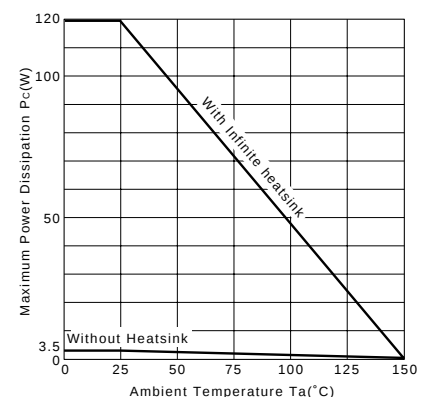
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4445

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

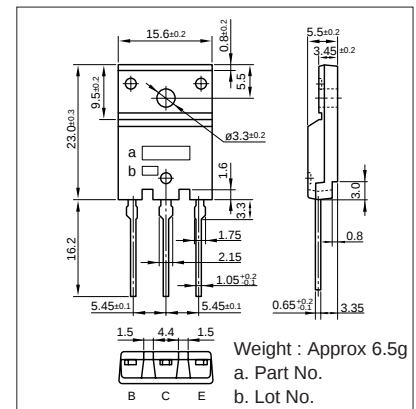
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CE0}	800	V
V _{EB0}	7	V
I _C	3(Pulse6)	A
I _B	1.5	A
P _C	60(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	800min	V
h _{FE}	V _{CE} =4V, I _C =0.7A	10 to 30	
V _{CE(sat)}	I _C =0.7A, I _B =0.14A	0.5max	V
V _{BE(sat)}	I _C =0.7A, I _B =0.14A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.3A	15typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	50typ	pF

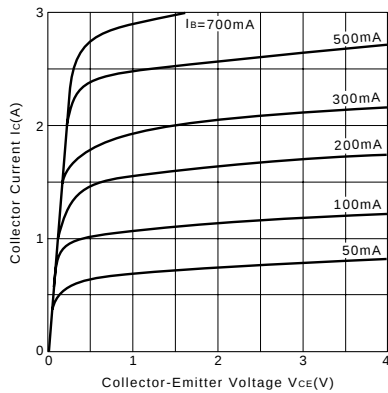
External Dimensions FM100(TO3PF)



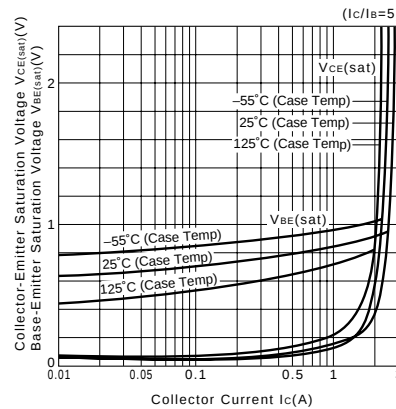
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	357	0.7	10	-5	0.1	-0.35	0.7max	4max	0.7max

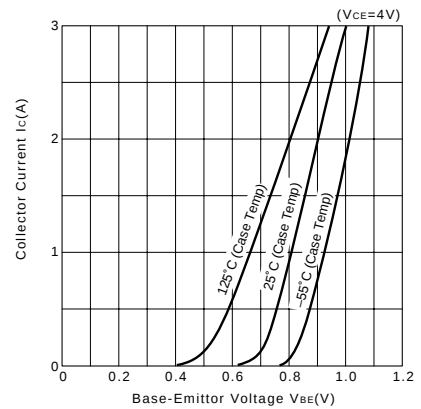
I_C-V_{CE} Characteristics (Typical)



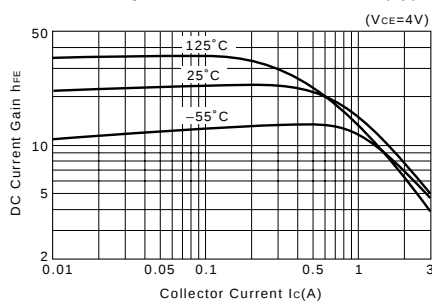
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



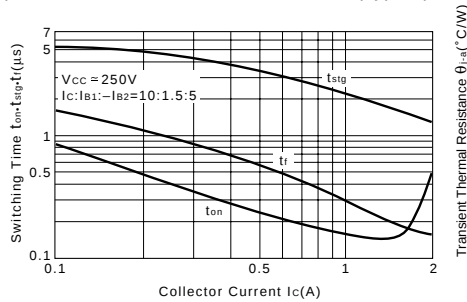
I_C-V_{BE} Temperature Characteristics (Typical)



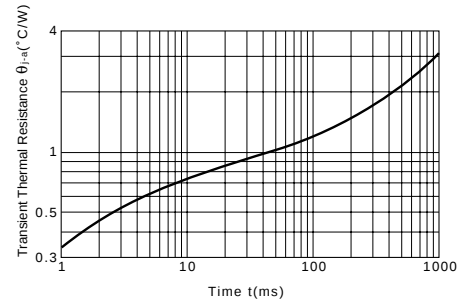
h_{FE}-I_C Temperature Characteristics (Typical)



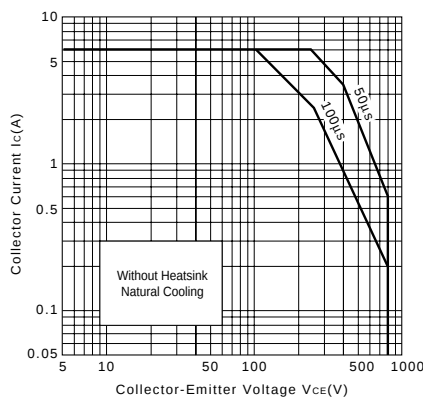
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



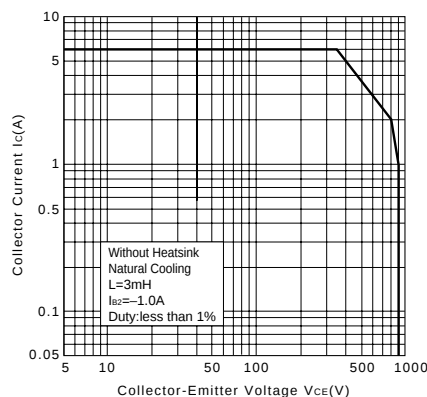
θ_{j-a}-t Characteristics



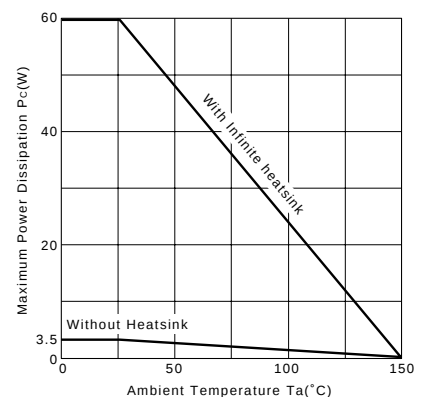
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4466

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1693)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CE0}	80	V
V _{EB0}	6	V
I _c	6	A
I _B	3	A
P _c	60(T _c =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

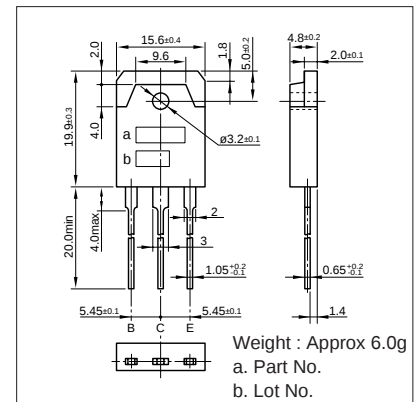
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _c =50mA	80min	V
h _{FE}	V _{CE} =4V, I _c =2A	50min*	
V _{CE(sat)}	I _c =2A, I _B =0.2A	1.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
COB	V _{CB} =10V, f=1MHz	110typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

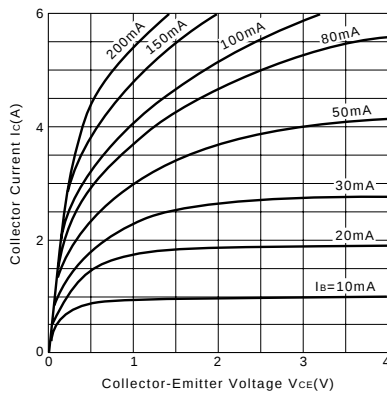
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-5	0.3	-0.3	0.16typ	2.60typ	0.34typ

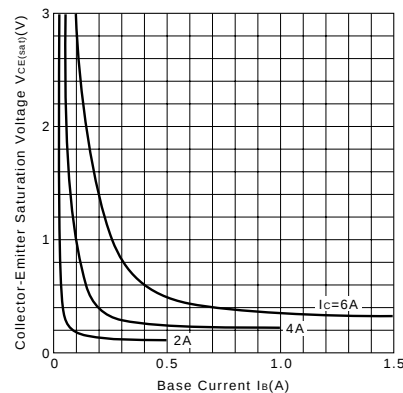
External Dimensions MT-100(TO3P)



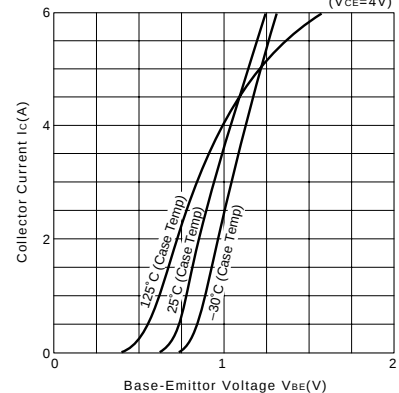
I_c-V_{CE} Characteristics (Typical)



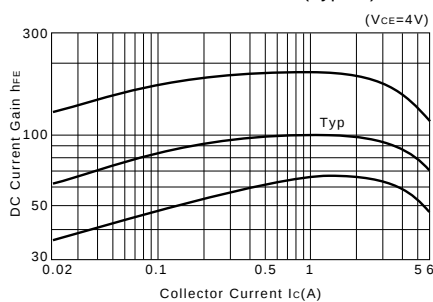
V_{CE(sat)}-I_B Characteristics (Typical)



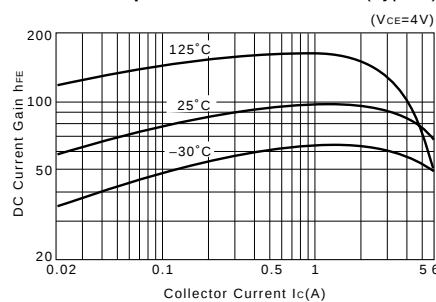
I_c-V_{BE} Temperature Characteristics (Typical)



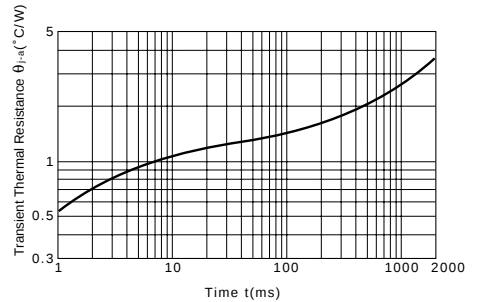
h_{FE}-I_c Characteristics (Typical)



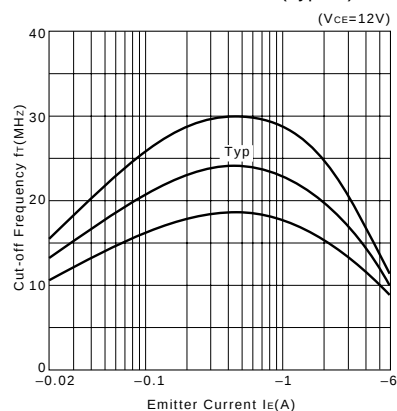
h_{FE}-I_c Temperature Characteristics (Typical)



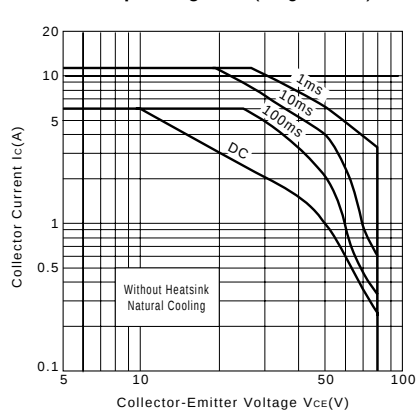
θ_{J-a}-t Characteristics



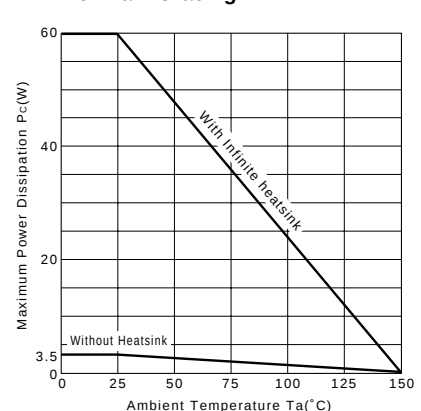
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_c-T_a Derating



2SC4467

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1694)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CEO}	120	V
V _{EBO}	6	V
I _C	8	A
I _B	3	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

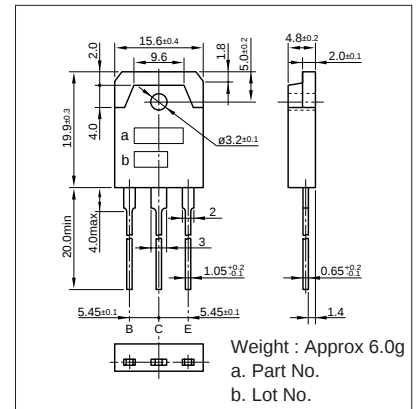
Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =160V	10max	μA
I _{EBO}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =50mA	120min	V
h _{FE}	V _{CE} =4V, I _C =3A	50min*	
V _{CE(sat)}	I _C =3A, I _B =0.3A	1.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	200typ	pF

*h_{FE} Rank $\bar{O}$ (50to100), P(70to140), Y(90to180)

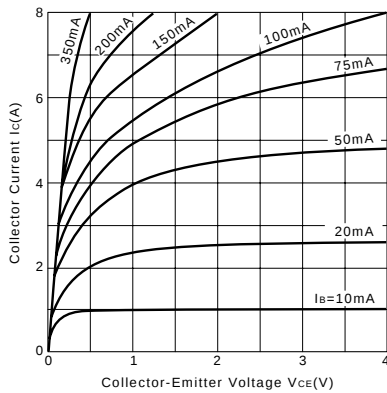
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	10	4	10	-5	0.4	-0.4	0.13typ	3.50typ	0.32typ

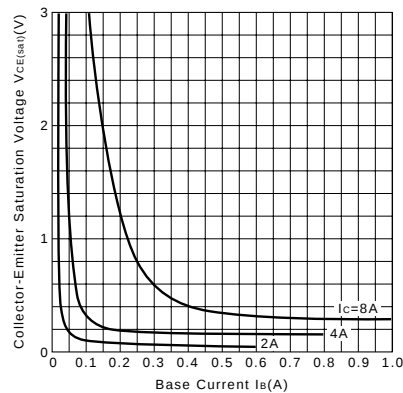
External Dimensions MT-100(TO3P)



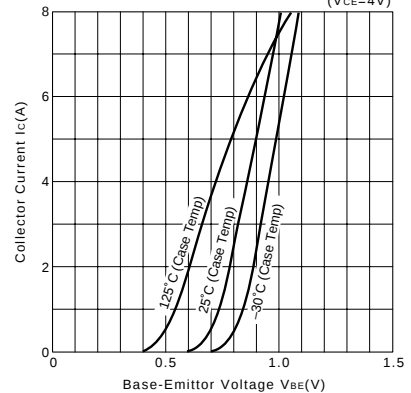
I_C-V_{CE} Characteristics (Typical)



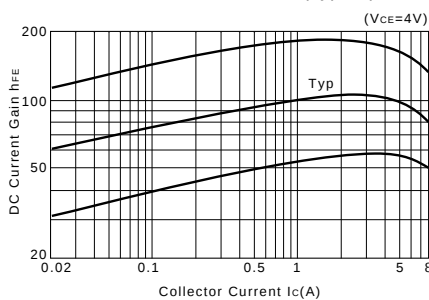
V_{CE(sat)}-I_B Characteristics (Typical)



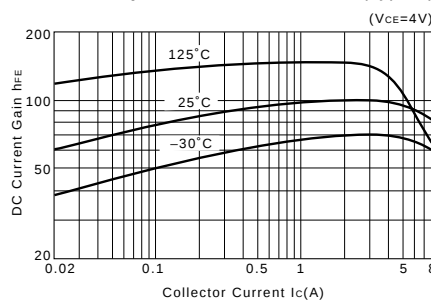
I_C-V_{BE} Temperature Characteristics (Typical)



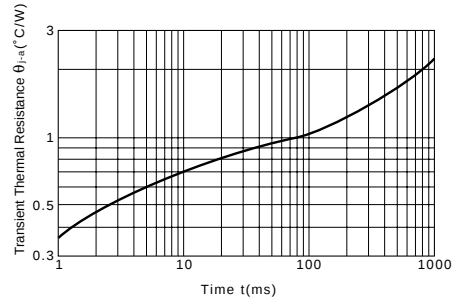
h_{FE}-I_C Characteristics (Typical)



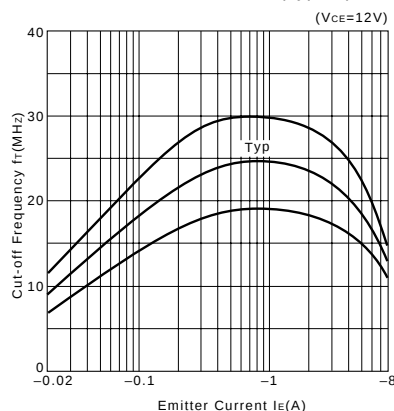
h_{FE}-I_C Temperature Characteristics (Typical)



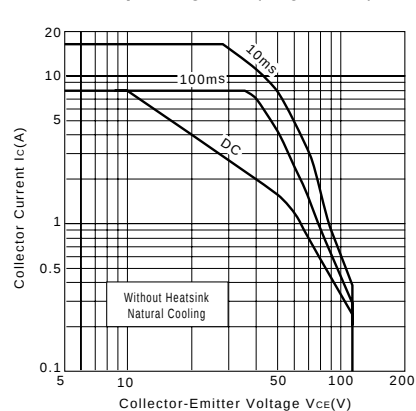
θ_{J-a}-t Characteristics



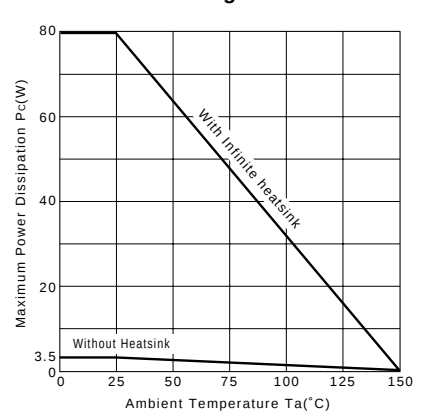
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC4468

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1695)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CE0}	140	V
V _{EB0}	6	V
I _C	10	A
I _B	4	A
P _C	100(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

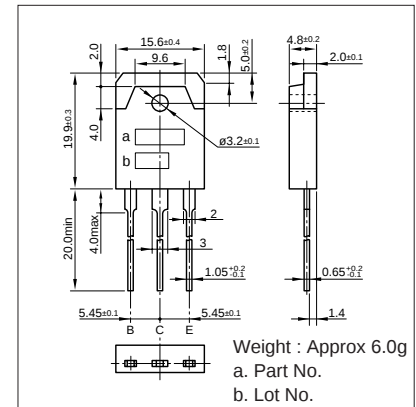
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =50mA	140min	V
h _{FE}	V _{CE} =4V, I _C =3A	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	0.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
COB	V _{CB} =10V, f=1MHz	250typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

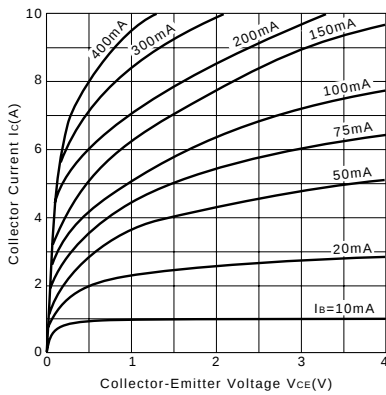
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	10	-5	0.5	-0.5	0.24typ	4.32typ	0.40typ

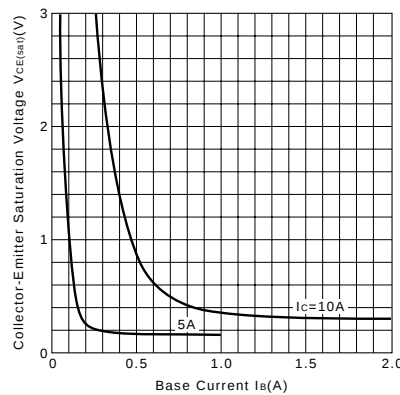
External Dimensions MT-100(TO3P)



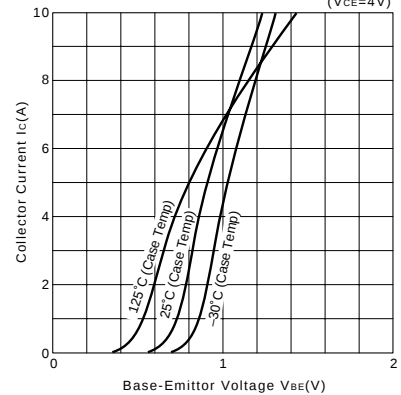
I_C-V_{CE} Characteristics (Typical)



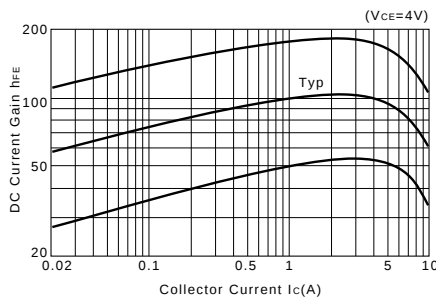
V_{CE(sat)}-I_B Characteristics (Typical)



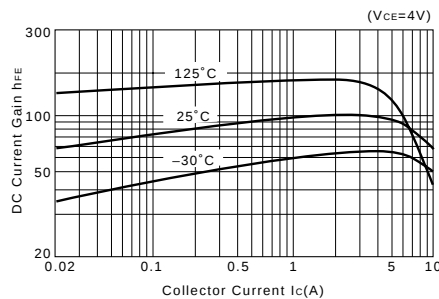
I_C-V_{BE} Temperature Characteristics (Typical)



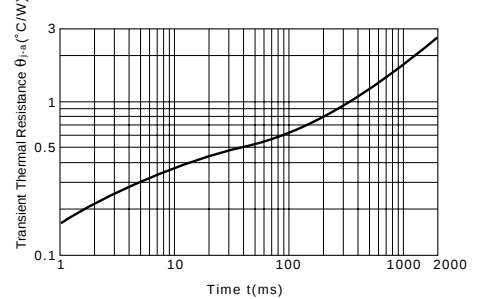
h_{FE}-I_C Characteristics (Typical)



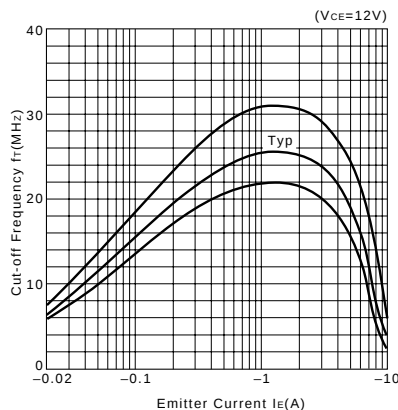
h_{FE}-I_C Temperature Characteristics (Typical)



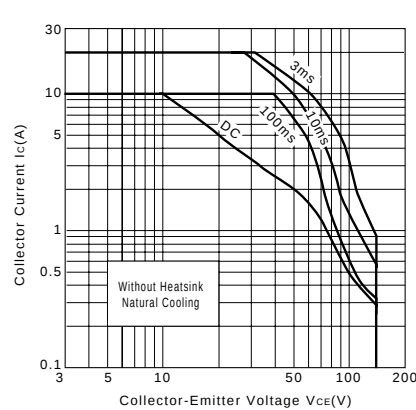
θ_{j-a}-t Characteristics



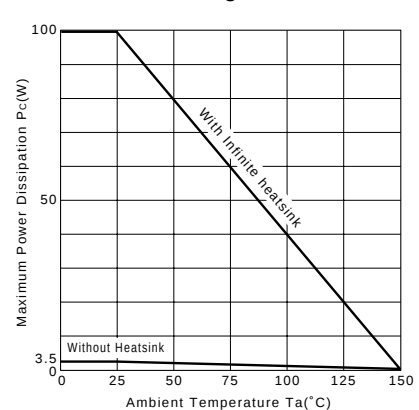
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



High h_{FE}
Low $V_{CE(sat)}$

2SC4495

Silicon NPN Triple Diffused Planar Transistor

Application : Audio Temperature Compensation and General Purpose

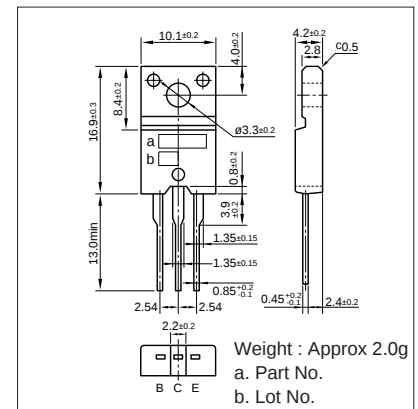
Absolute maximum ratings ($T_a=25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CBO}	80	V
V_{CEO}	50	V
V_{EBO}	6	V
I_C	3	A
I_B	1	A
P_C	25($T_c=25^\circ\text{C}$)	W
T_j	150	$^\circ\text{C}$
T_{stg}	-55 to +150	$^\circ\text{C}$

Electrical Characteristics ($T_a=25^\circ\text{C}$)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=80\text{V}$	10max	μA
I_{EBO}	$V_{EB}=6\text{V}$	10max	μA
$V_{(BR)CEO}$	$I_C=25\text{mA}$	50min	V
h_{FE}	$V_{CE}=4\text{V}$, $I_C=0.5\text{A}$	500min	
$V_{CE(sat)}$	$I_C=1\text{A}$, $I_B=20\text{mA}$	0.5max	V
f_r	$V_{CE}=12\text{V}$, $I_E=-0.1\text{A}$	40typ	MHz
C_{OB}	$V_{CB}=10\text{V}$, $f=1\text{MHz}$	30typ	pF

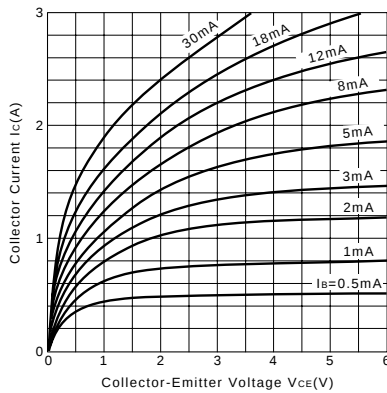
External Dimensions FM20(TO220F)



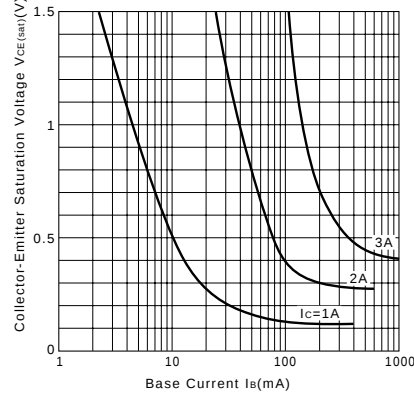
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
20	20	1	10	-5	15	-30	0.45typ	1.60typ	0.85typ

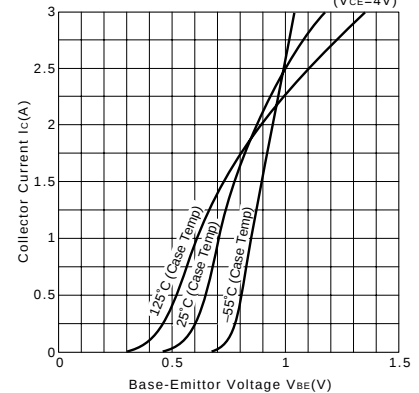
I_C-V_{CE} Characteristics (Typical)



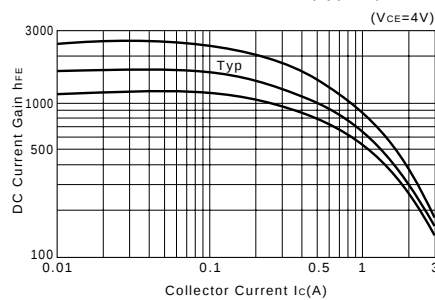
$V_{CE(sat)}-I_B$ Characteristics (Typical)



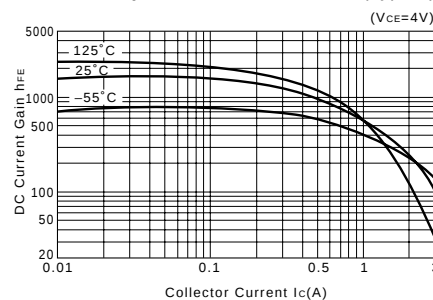
I_C-V_{BE} Temperature Characteristics (Typical)



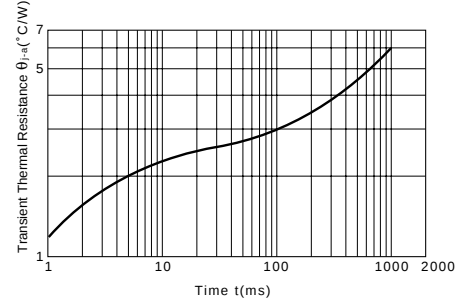
$h_{FE}-I_C$ Characteristics (Typical)



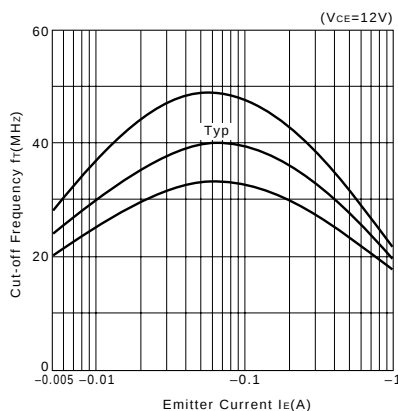
$h_{FE}-I_C$ Temperature Characteristics (Typical)



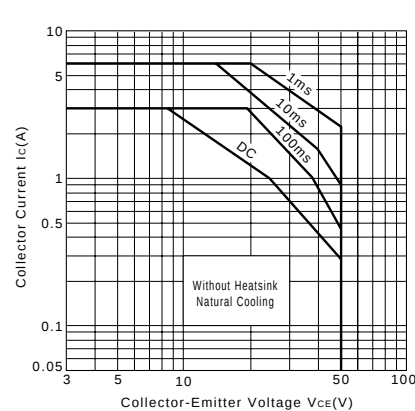
$\theta_{JA}-t$ Characteristics



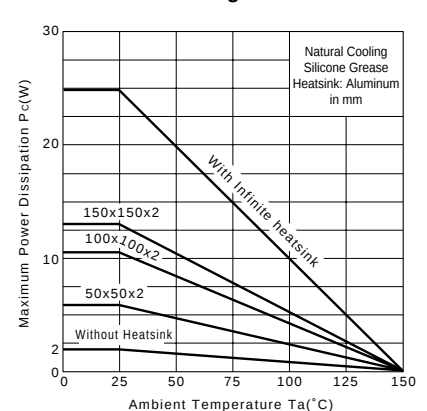
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC4511

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1725)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CEO}	80	V
V _{EB0}	6	V
I _C	6	A
I _B	3	A
P _C	30(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

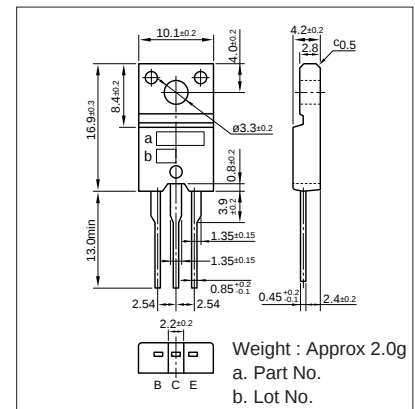
Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =25mA	80min	V
h _{FE}	V _{CE} =4V, I _C =2A	50min*	
V _{CE(sat)}	I _C =2A, I _B =0.2A	0.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	110typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

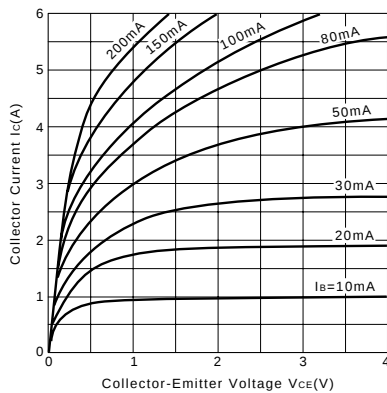
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-5	0.3	-0.3	0.16typ	2.60typ	0.34typ

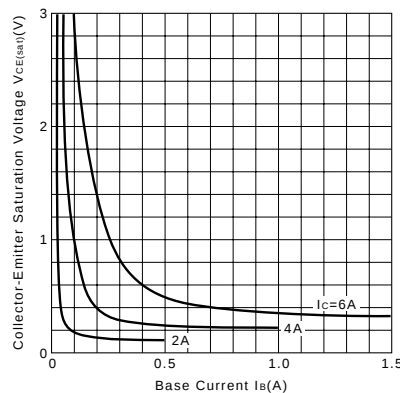
External Dimensions FM20(TO220F)



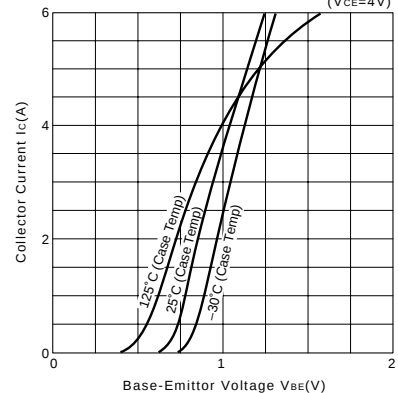
I_C-V_{CE} Characteristics (Typical)



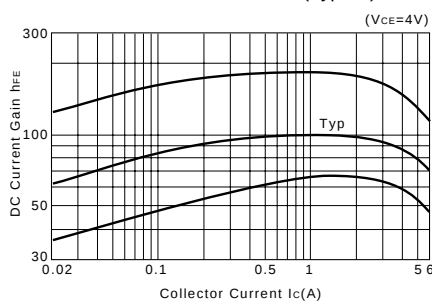
V_{CE(sat)}-I_B Characteristics (Typical)



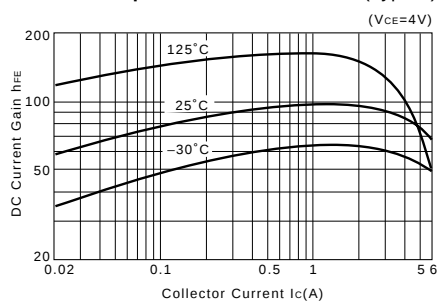
I_C-V_{BE} Temperature Characteristics (Typical)



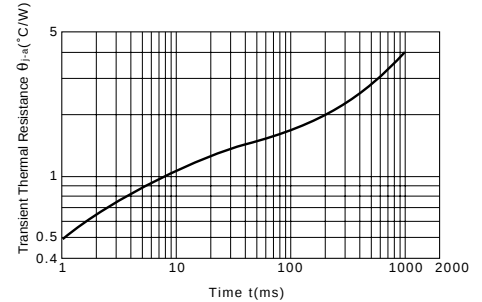
h_{FE}-I_C Characteristics (Typical)



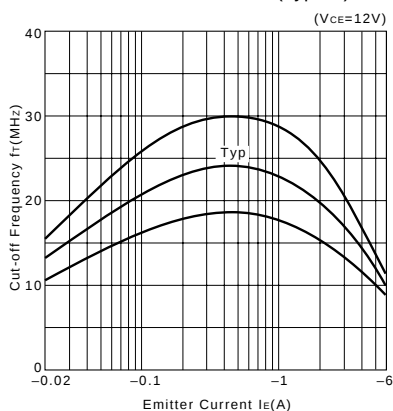
h_{FE}-I_C Temperature Characteristics (Typical)



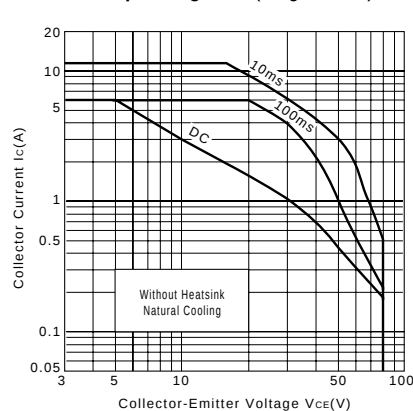
θ_{j-a}-t Characteristics



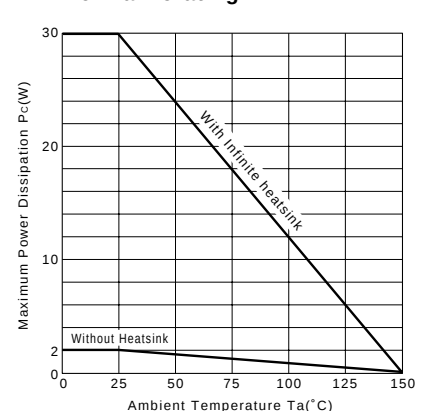
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC4512

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1726)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CEO}	80	V
V _{EB0}	6	V
I _C	6	A
I _B	3	A
P _C	50(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

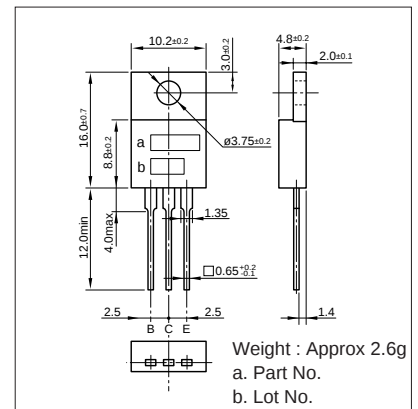
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =25mA	80min	V
h _{FE}	V _{CE} =4V, I _C =2A	50min	
V _{CE(sat)}	I _C =5A, I _B =0.2A	0.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	110typ	pF

*h_{FE} Rank $\bar{O}$ (50to100), P(70to140), Y(90to180)

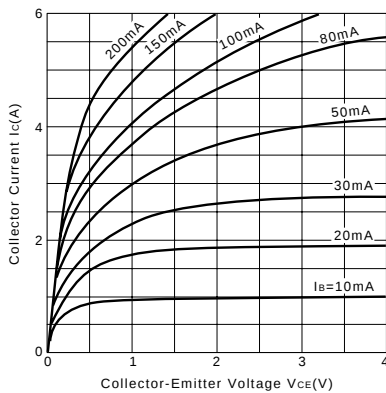
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-5	0.3	-0.3	0.16typ	2.60typ	0.34typ

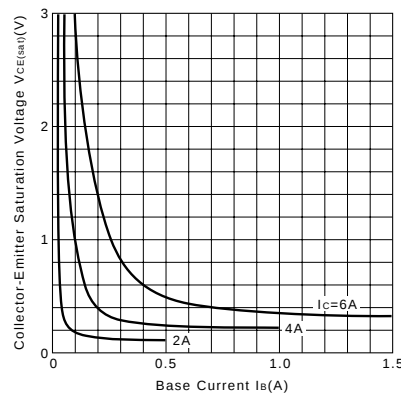
External Dimensions MT-25(TO220)



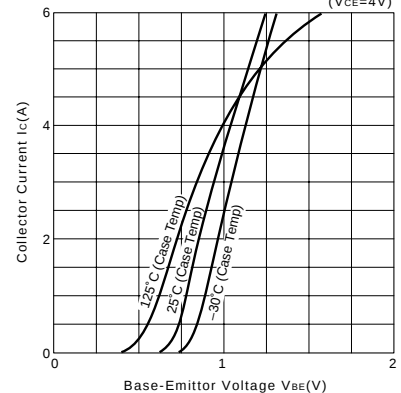
I_C-V_{CE} Characteristics (Typical)



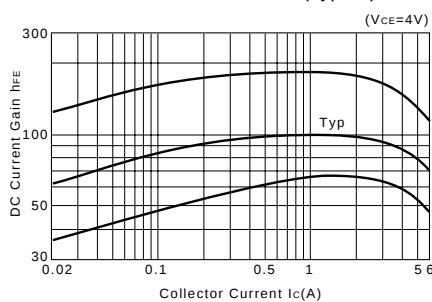
V_{CE(sat)}-I_B Characteristics (Typical)



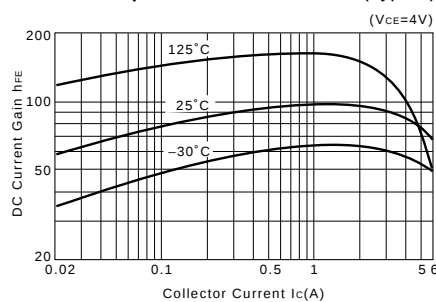
I_C-V_{BE} Temperature Characteristics (Typical)



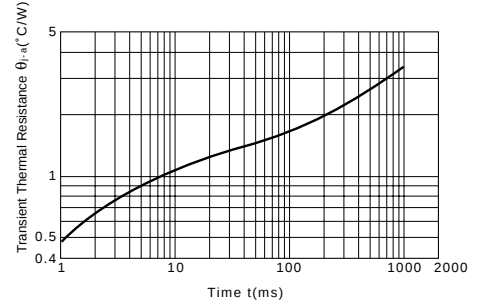
h_{FE}-I_C Characteristics (Typical)



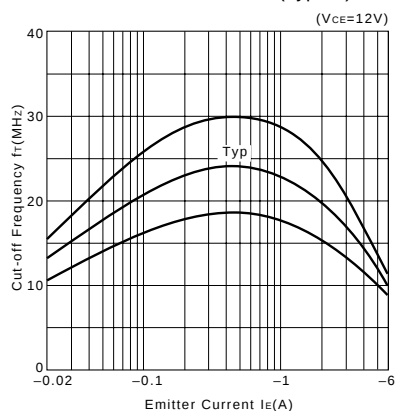
h_{FE}-I_C Temperature Characteristics (Typical)



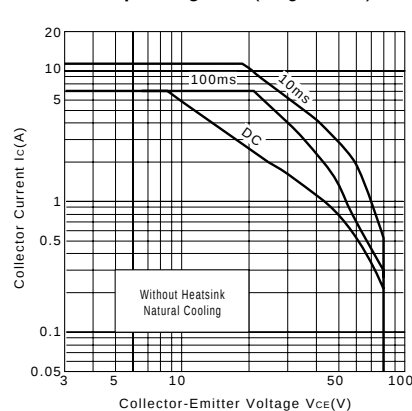
θ_{j-a}-t Characteristics



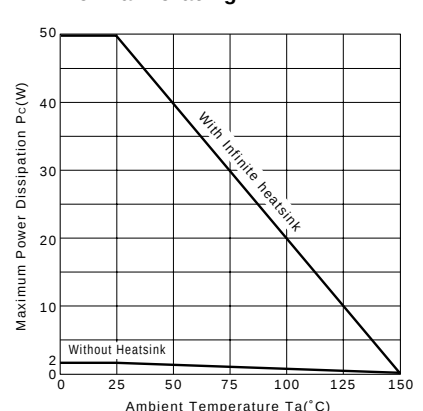
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC4517/4517A

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings		Unit
	2SC4517	2SC4517A	
V _{CB0}	900	1000	V
V _{CE0}	550		V
V _{EB0}	7		V
I _C	3(Pulse6)		A
I _B	1.5		A
P _C	30(T _C =25°C)		W
T _j	150		°C
T _{stg}	-55 to +150		°C

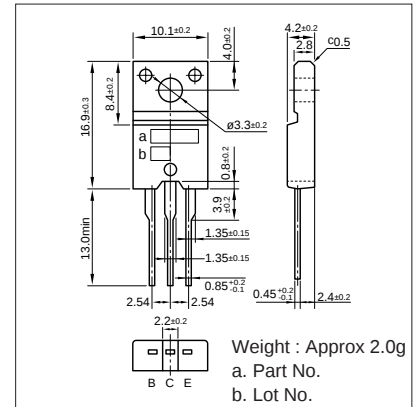
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings		Unit
		2SC4517	2SC4517A	
ICBO	V _{CB} =800V	100max		μA
IEBO	V _{EB} =7V	100max		μA
V(BR)CEO	I _C =10mA	550min		V
h _{FE}	V _{CE} =4V, I _C =1A	10to30		
V _{CE(sat)}	I _C =1A, I _B =0.2A	0.5max		V
V _{BE(sat)}	I _C =1A, I _B =0.2A	1.2max		V
f _T	V _{CE} =12V, I _E =-0.25A	6typ		MHz
COB	V _{CB} =10V, f=1MHz	35typ		pF

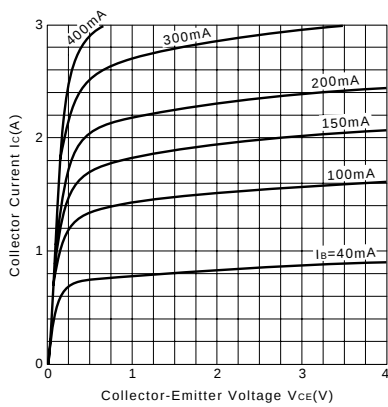
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	250	1	10	-5	0.15	-0.45	0.7max	4max	0.5max

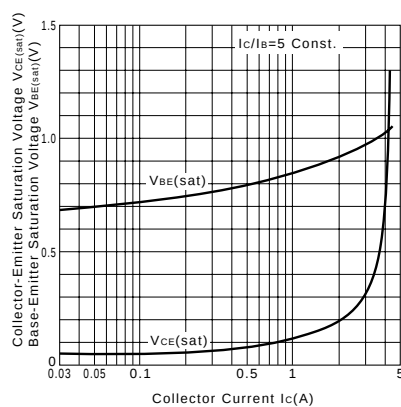
External Dimensions FM20(TO220F)



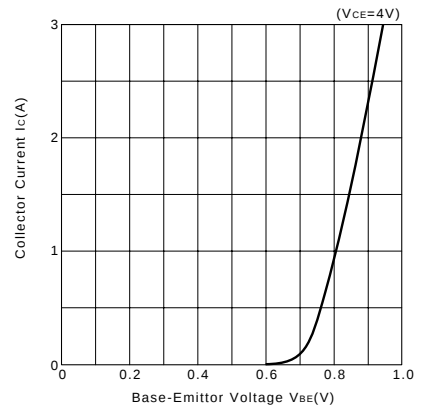
I_C–V_{CE} Characteristics (Typical)



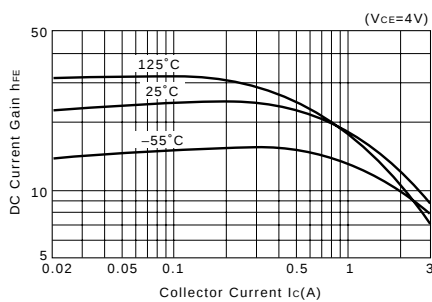
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



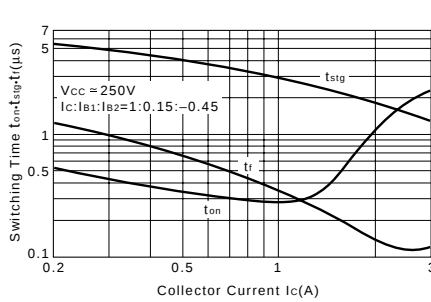
IC-V_{BE} Temperature Characteristics (Typical)



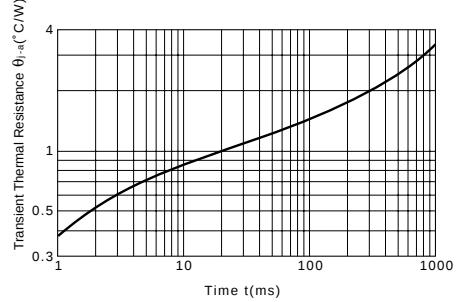
h_{FE} - I_C Temperature Characteristics (Typical)



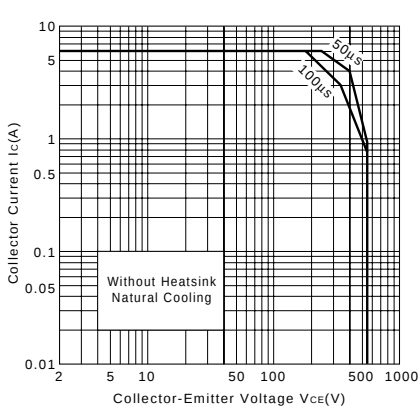
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



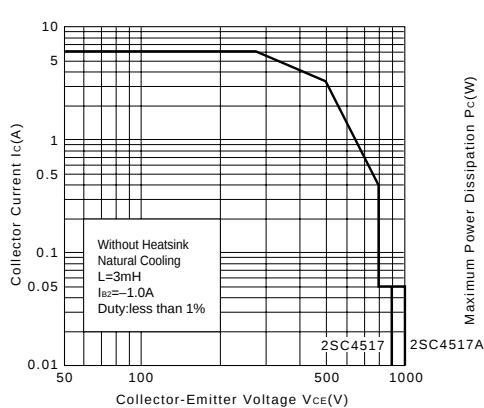
θ_{j-a-t} Characteristics



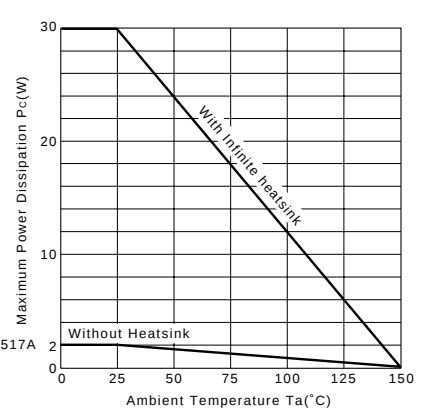
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



Pc-Ta Derating



2SC4518/4518A

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator, Lighting Inverter and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings		Unit
	2SC4518	2SC4518A	
VCBO	900	1000	V
VCEO	550		V
VEBO	7		V
IC	5(Pulse10)		A
IB	2.5		A
PC	35(Tc=25°C)		W
Tj	150		°C
Tstg	-55 to +150		°C

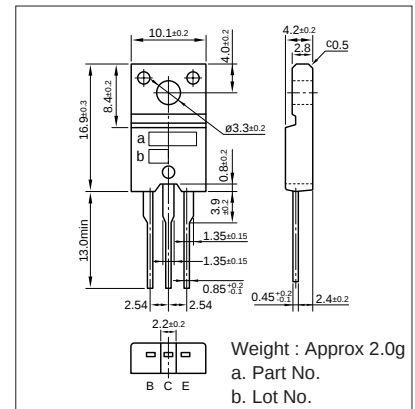
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings		Unit
		2SC4518	2SC4518A	
ICBO	VCB=800V	100max		μA
IEBO	VEB=7V	100max		μA
V(BR)CEO	IC=10mA	550min		V
hFE	VCE=4V, IC=1.8A	10 to 25		
VCE(sat)	IC=1.8A, IB=0.36A	0.5max		V
VBE(sat)	IC=1.8A, IB=0.36A	1.2max		V
fr	VCE=12V, IE=-0.35A	6typ		MHz
COB	VCB=10V, f=1MHz	50typ		pF

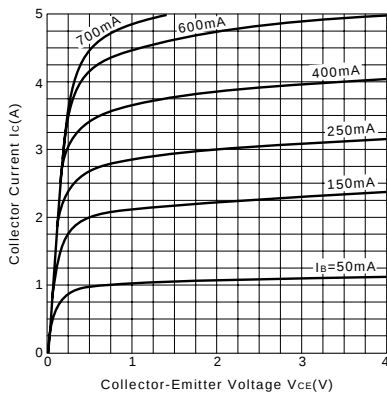
Typical Switching Characteristics (Common Emitter)

VCC (V)	RL (Ω)	IC (A)	VBB1 (V)	VBB2 (V)	IB1 (A)	IB2 (A)	ton (μs)	tstg (μs)	tf (μs)
250	139	1.8	10	-5	0.27	-0.9	0.7max	4max	0.5max

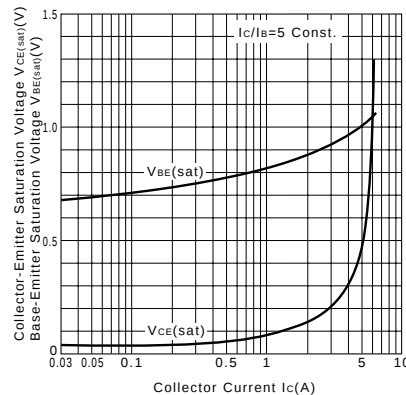
External Dimensions FM20(TO220F)



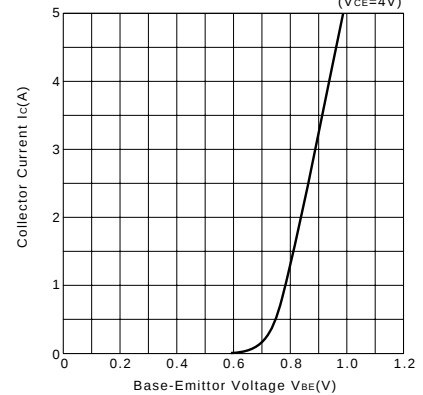
IC-VCE Characteristics (Typical)



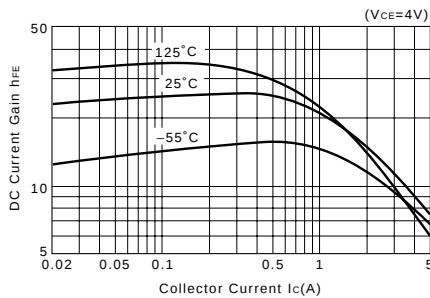
VCE(sat), VBE(sat)-IC Temperature Characteristics (Typical)



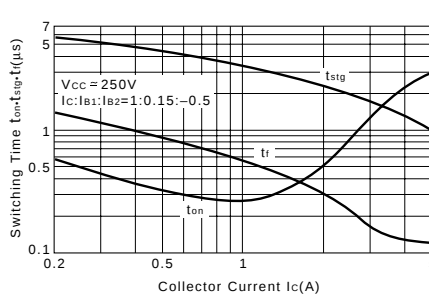
IC-VBE Temperature Characteristics (Typical)



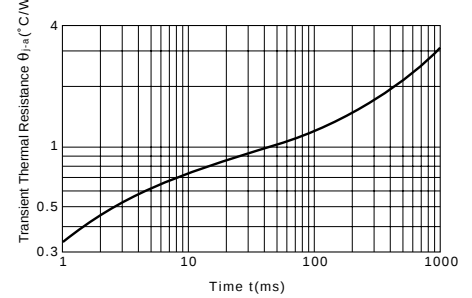
hFE-IC Temperature Characteristics (Typical)



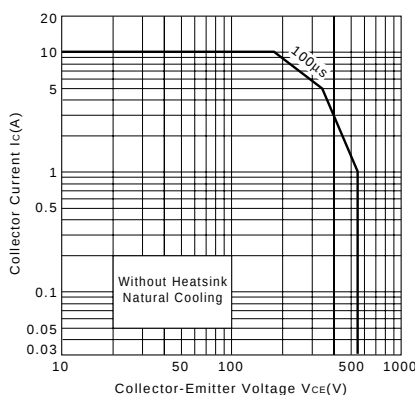
ton•tstg•tr-IC Characteristics (Typical)



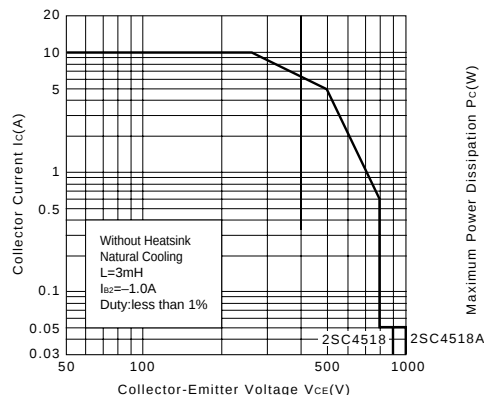
θja-t Characteristics



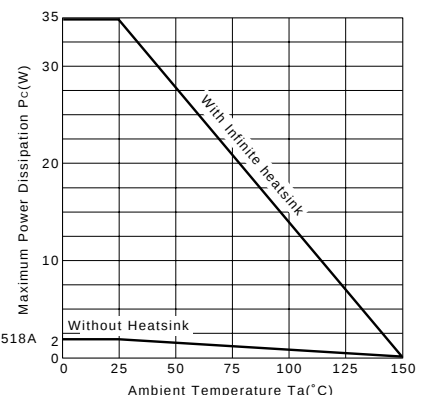
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



PC-Ta Derating



2SC4546

Silicon NPN Triple Diffused Planar Transistor (High Voltage and Ultra-high Speed Switching Transistor) Application : Switching Regulator, Lighting Inverter and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	600	V
V _{CEO}	400	V
V _{EB0}	7	V
I _C	7(Pulse14)	A
I _B	2	A
P _C	30(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

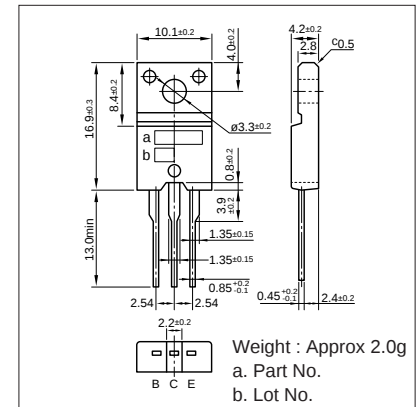
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =600V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =3A	10to25	
V _{CE(sat)}	I _C =3A, I _B =0.6A	0.7max	V
V _{BE(sat)}	I _C =3A, I _B =0.6A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.5A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	55typ	pF

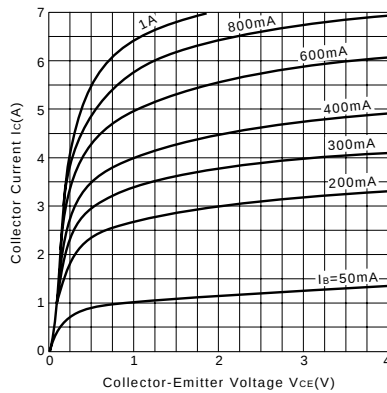
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	67	3	10	-5	0.6	-1.2	0.5max	2max	0.15max

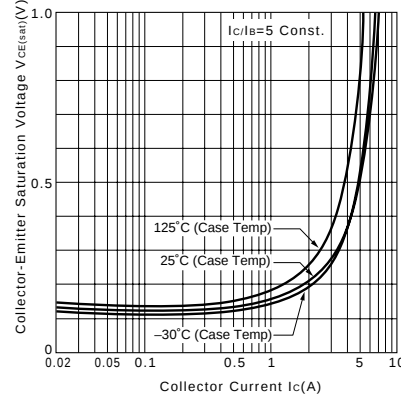
External Dimensions FM20(TO220F)



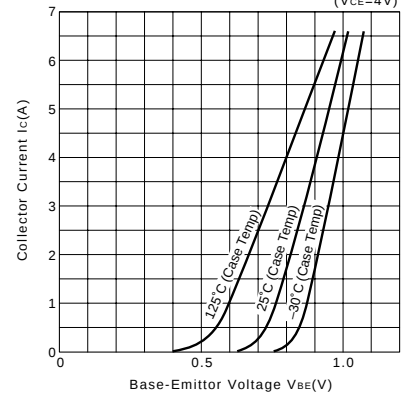
I_C-V_{CE} Characteristics (Typical)



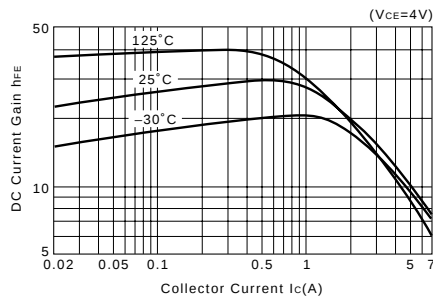
V_{CE(sat)}-I_C Characteristics (Typical)



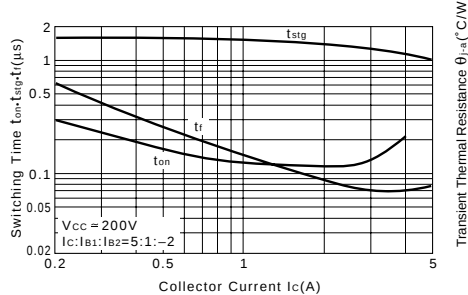
I_C-V_{BE} Temperature Characteristics (Typical)



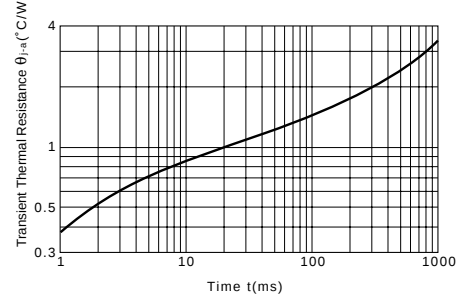
h_{FE}-I_C Temperature Characteristics (Typical)



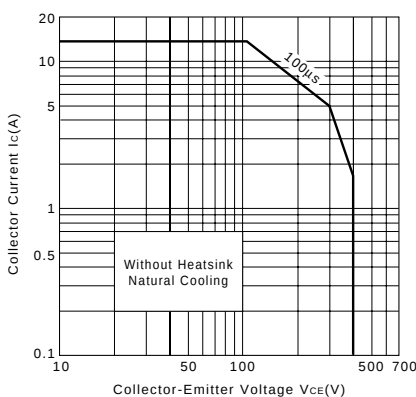
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



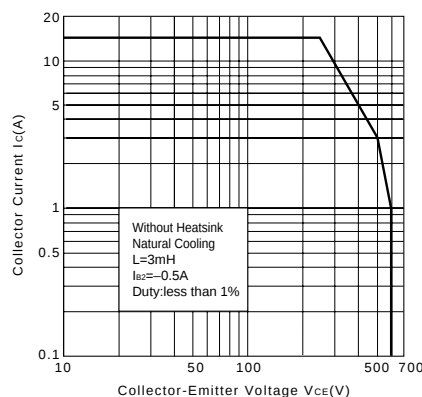
θ_{J-a}-t Characteristics



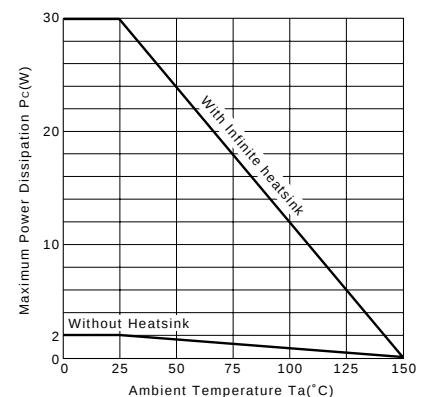
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4557

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	550	V
V _{EB0}	7	V
I _C	10(Pulse20)	A
I _B	5	A
P _C	80(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

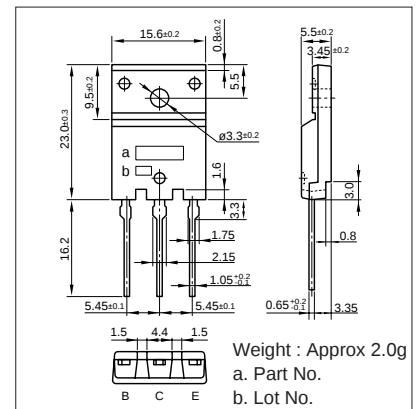
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	550min	V
h _{FE}	V _{CE} =4V, I _C =5A	10 to 28	
V _{CE(sat)}	I _C =5A, I _B =1A	0.5max	V
V _{BE(sat)}	I _C =5A, I _B =1A	1.2max	V
f _r	V _{CE} =12V, I _E =-1A	6typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	105typ	pF

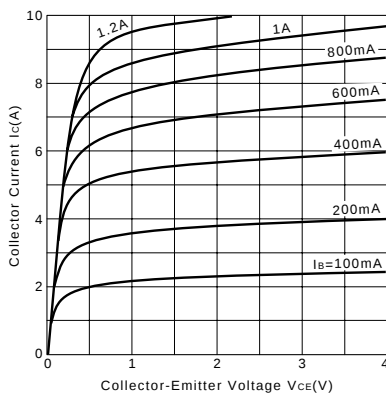
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	50	5	10	-5	0.75	-1.5	1max	5max	0.5max

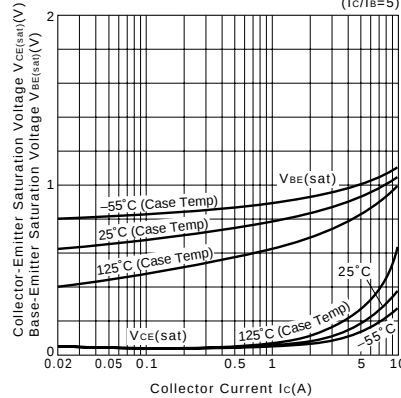
External Dimensions FM100(TO3PF)



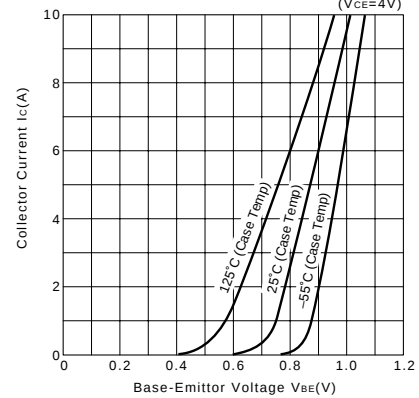
I_C-V_{CE} Characteristics (Typical)



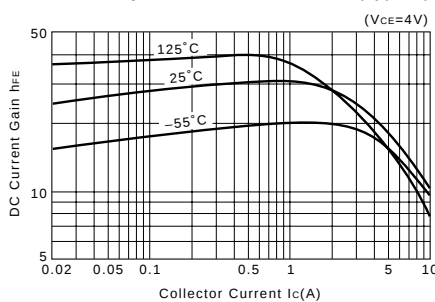
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



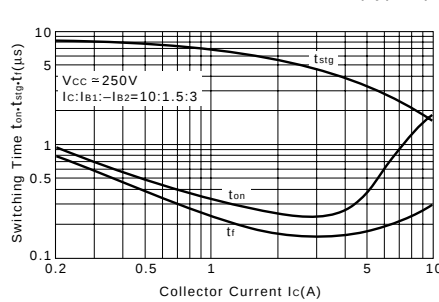
I_C-V_{BE} Temperature Characteristics (Typical)



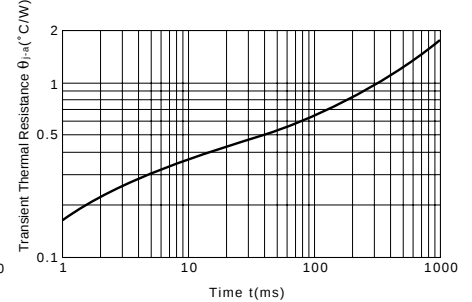
h_{FE}-I_C Temperature Characteristics (Typical)



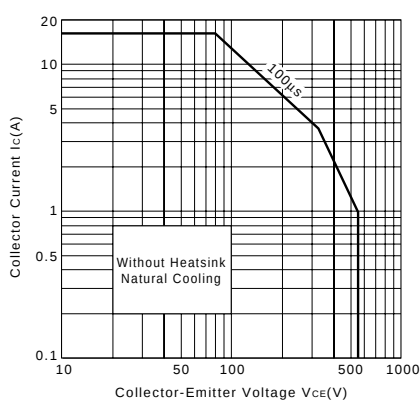
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



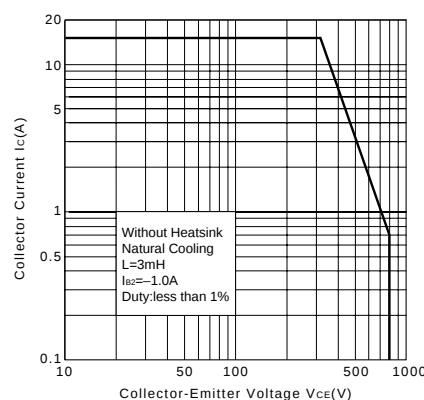
θ_{JA}-t Characteristics



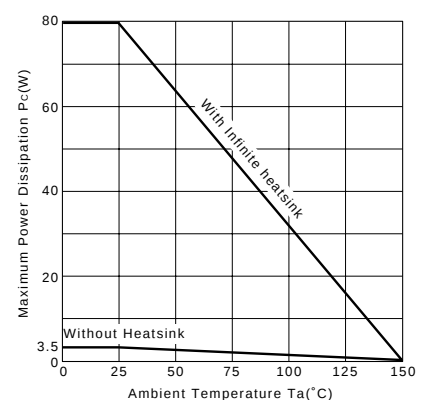
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4662

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EBO}	10	V
I _C	5(Pulse10)	A
I _B	2	A
P _C	30(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

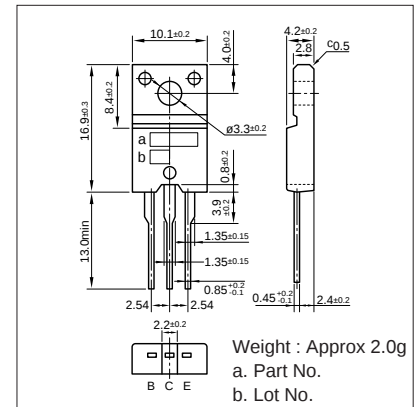
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EBO}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =1.5A	10 to 30	
V _{CE(sat)}	I _C =1.5A, I _B =0.3A	0.5max	V
V _{BE(sat)}	I _C =1.5A, I _B =0.3A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.3A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	30typ	pF

Typical Switching Characteristics (Common Emitter)

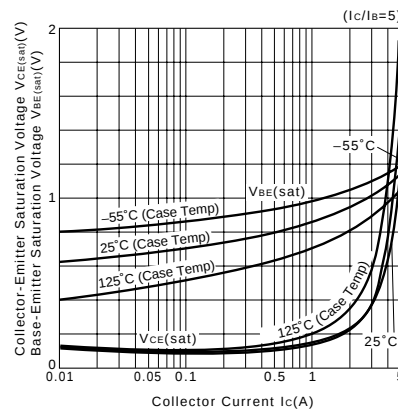
V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	133	1.5	10	-5	0.15	-0.3	1max	2.5max	0.5max

External Dimensions FM20(TO220F)

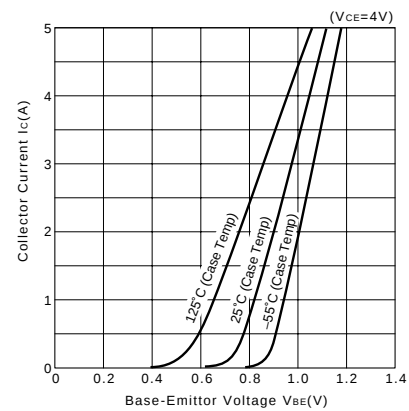


I_C-V_{CE} Characteristics (Typical)

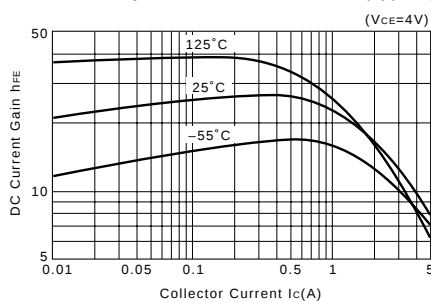
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



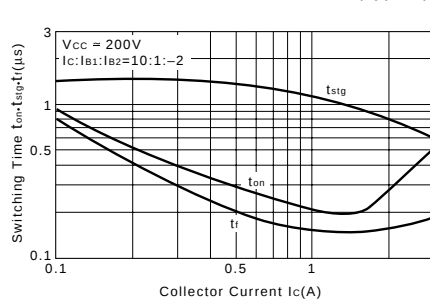
I_C-V_{BE} Temperature Characteristics (Typical)



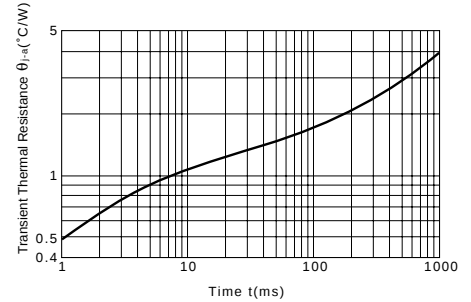
h_{FE}-I_C Temperature Characteristics (Typical)



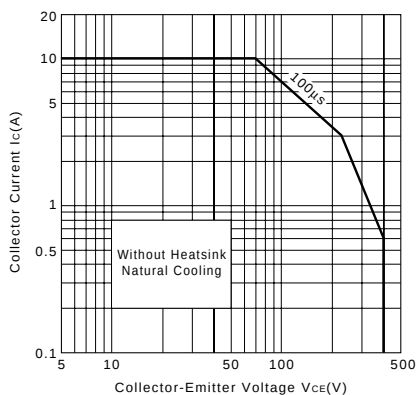
t_{on}•t_{stg}•t_r-I_C Characteristics (Typical)



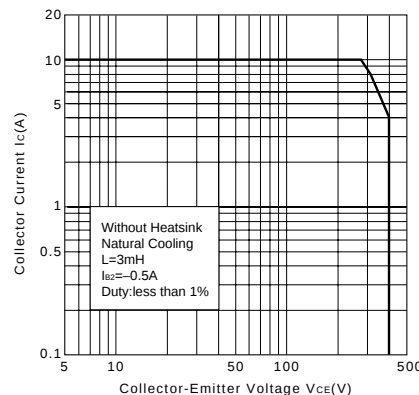
θ_{JA}-t Characteristics



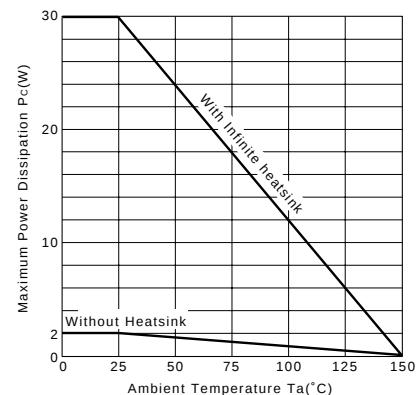
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC4706

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	600	V
V _{EB0}	7	V
I _C	14(Pulse28)	A
I _B	7	A
P _C	130(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55to+150	°C

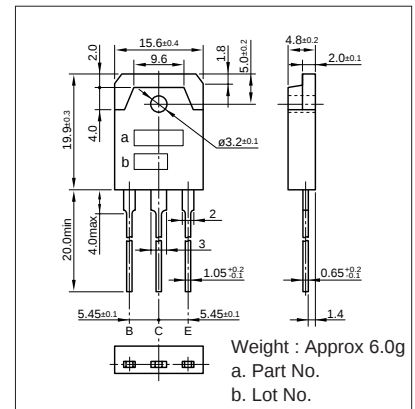
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =800V	100max	μA
I _{EBO}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	600min	V
h _{FE}	V _{CE} =4V, I _C =7A	10to25	
V _{CE(sat)}	I _C =7A, I _B =1.4A	0.5max	V
V _{BE(sat)}	I _C =7A, I _B =1.4A	1.2max	V
f _r	V _{CE} =12V, I _E =-1.5A	6typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	160typ	pF

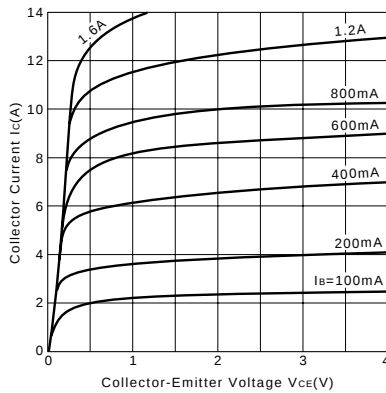
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	35.7	7	10	-5	1.05	-3.5	1max	5max	0.7max

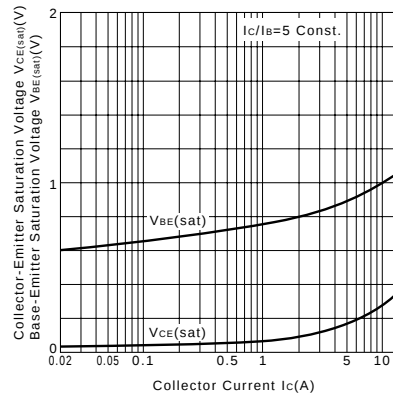
External Dimensions MT-100(TO3P)



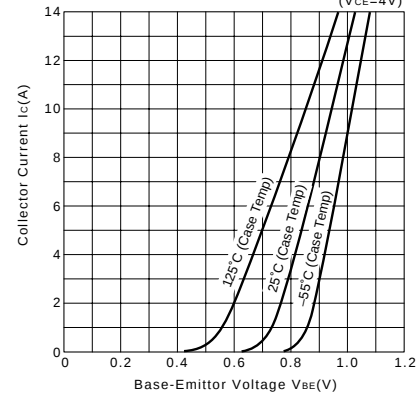
I_C-V_{CE} Characteristics (Typical)



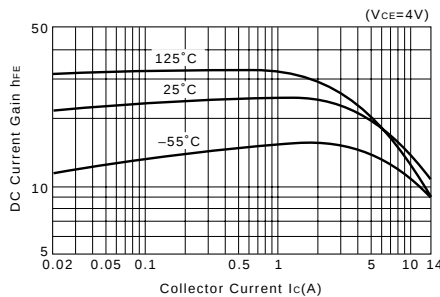
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



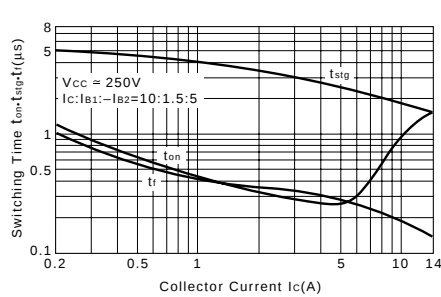
I_C-V_{BE} Temperature Characteristics (Typical)



h_{FE}-I_C Temperature Characteristics (Typical)

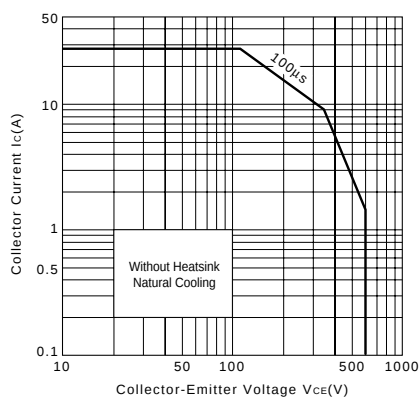


t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)

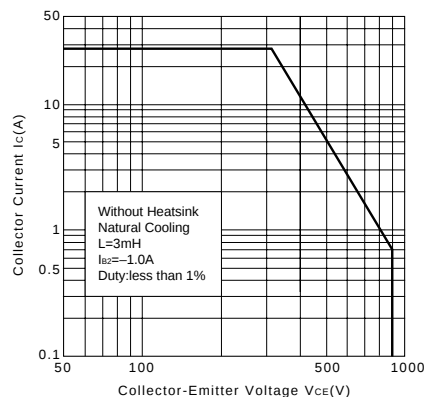


θ_{J-a}-t Characteristics

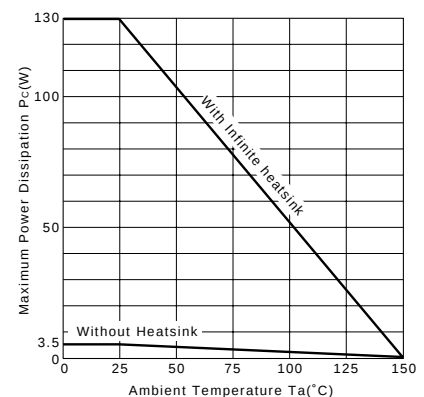
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



Silicon NPN Epitaxial Planar Transistor (Complement to type 2SA1860)

Application : Audio and General Purpose

■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	150	V
V _{CEO}	150	V
V _{EB0}	5	V
I _C	14	A
I _B	3	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

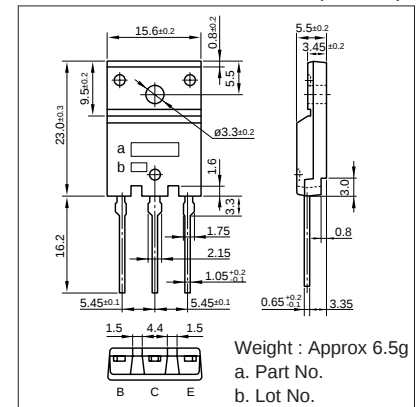
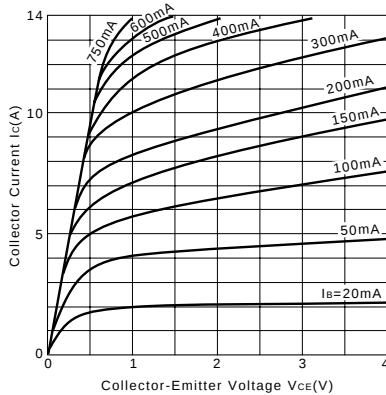
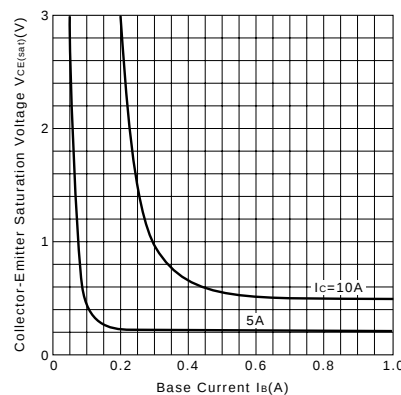
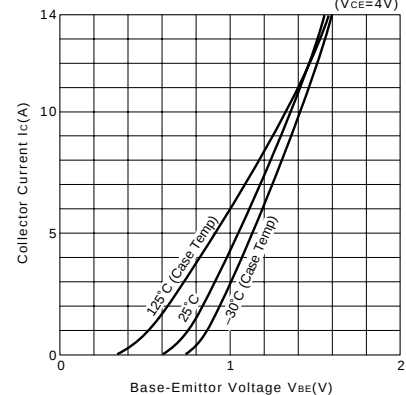
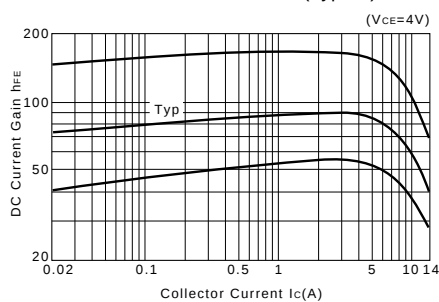
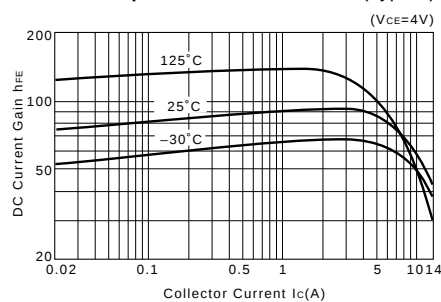
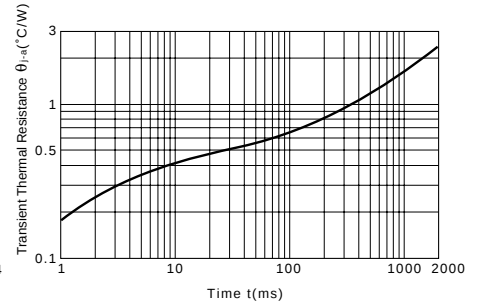
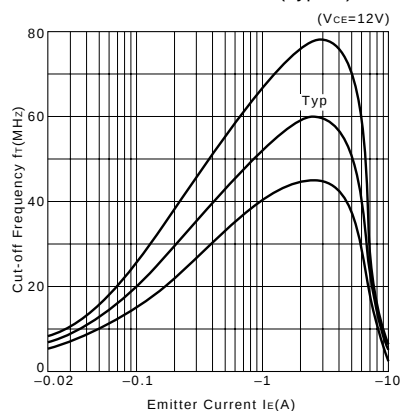
Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =150V	100max	μA
I _{EBO}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =25mA	150min	V
h _{FE}	V _{CE} =4V, I _C =5A	50min*	
V _{CE(sat)}	I _C =5A, I _B =500mA	2.0max	V
f _r	V _{CE} =12V, I _E =-2A	60typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	200typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

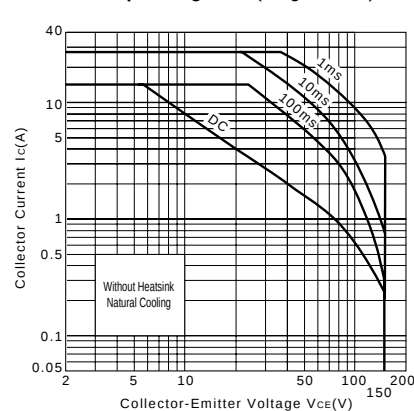
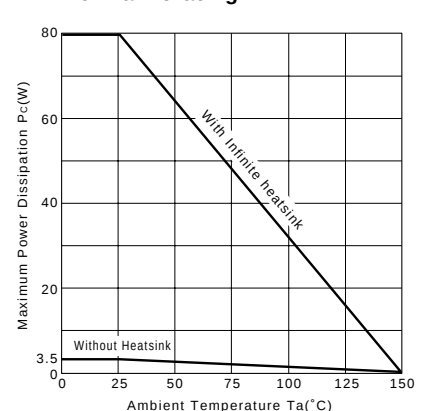
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	10	-5	0.5	-0.5	0.26typ	1.5typ	0.35typ

External Dimensions FM100(TO3PF)

I_C-V_{CE} Characteristics (Typical)V_{CE(sat)}-I_B Characteristics (Typical)I_C-V_{BE} Temperature Characteristics (Typical)h_{FE}-I_C Characteristics (Typical)h_{FE}-I_C Temperature Characteristics (Typical)θ_{j-a}-t Characteristicsf_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

P_C-T_a Derating

2SC4908

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CEO}	800	V
V _{EB0}	7	V
I _c	3(Pulse6)	A
I _B	1.5	A
P _c	35(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

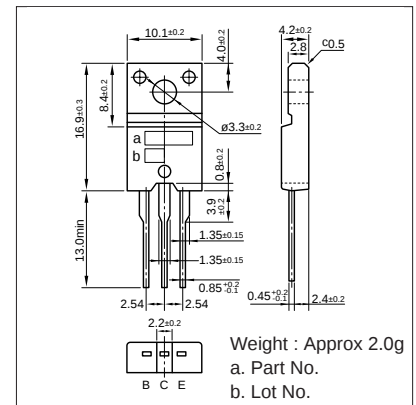
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _c =10mA	800min	V
h _{FE}	V _{CE} =4V, I _c =0.7A	10 to 30	
V _{CE(sat)}	I _c =0.7A, I _B =0.14A	0.5max	V
V _{BE(sat)}	I _c =0.7A, I _B =0.14A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.3A	6typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	40typ	pF

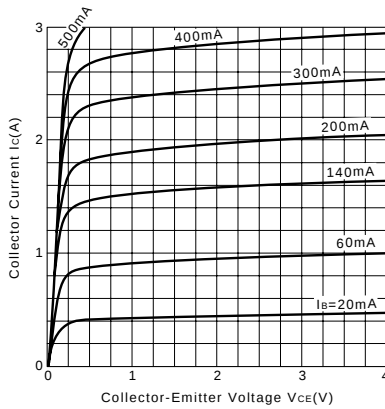
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	357	0.7	10	-5	0.1	-0.35	1max	5max	1max

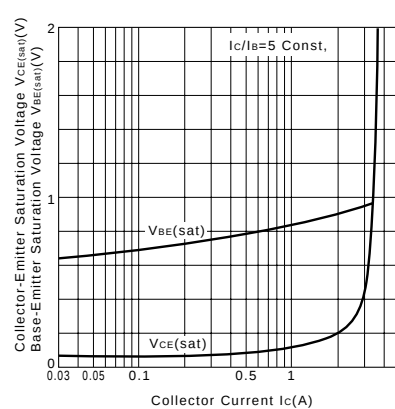
External Dimensions FM20(TO220F)



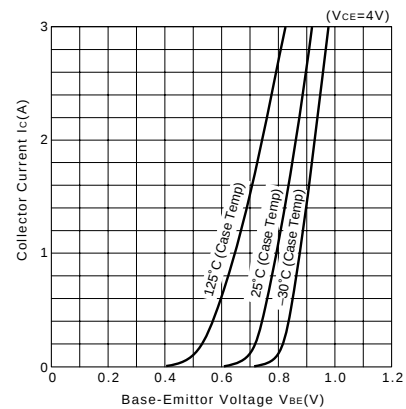
I_c-V_{CE} Characteristics (Typical)



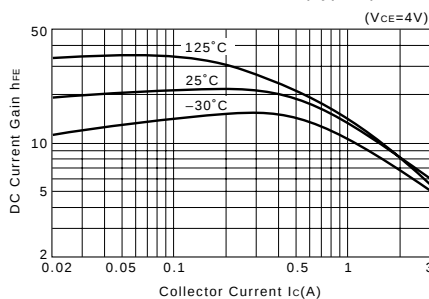
V_{CE(sat)}, V_{BE(sat)}-I_c Temperature Characteristics (Typical)



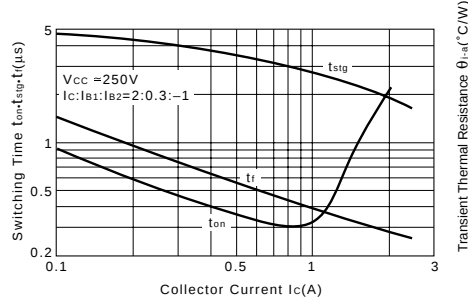
I_c-V_{BE} Temperature Characteristics (Typical)



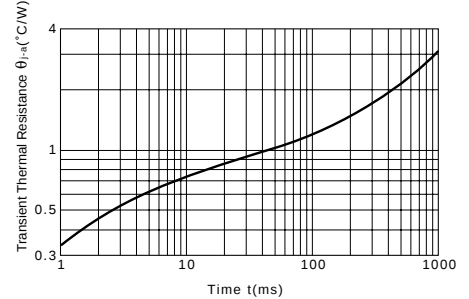
h_{FE}-I_c Characteristics (Typical)



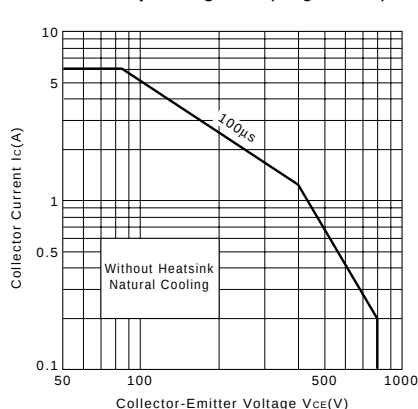
t_{on}•t_{stg}•t_f-I_c Characteristics (Typical)



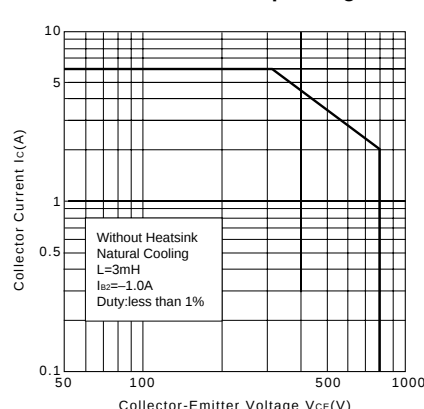
θ_{j-a}-t Characteristics



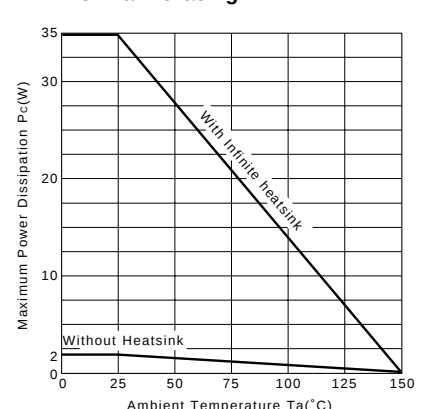
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_c-T_a Derating



2SC5002

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Display Horizontal Deflection Output, Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	1500	V
V _{CEO}	800	V
V _{EBO}	6	V
I _c	7(Pulse14)	A
I _B	3.5	A
P _c	80(T _c =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

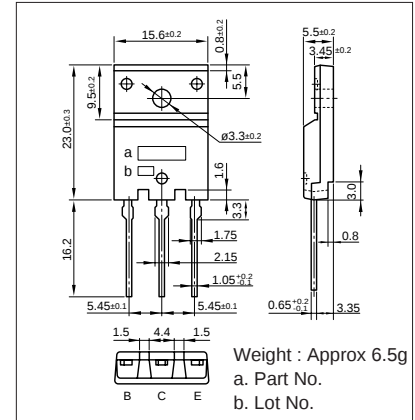
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB01}	V _{CB} =1200V	100max	μA
I _{CB02}	V _{CB} =1500V	1max	mA
I _{EBO}	V _{EB} =6V	100max	μA
V _{(BR)CEO}	I _c =10mA	800min	V
h _{FE1}	V _{CE} =5V, I _c =1A	8min	
h _{FE2}	V _{CE} =5V, I _c =5A	4to9	
V _{CE(sat)}	I _c =5A, I _B =1.2A	5max	V
V _{BE(sat)}	I _c =5A, I _B =1.2A	1.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	4typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	100typ	pF

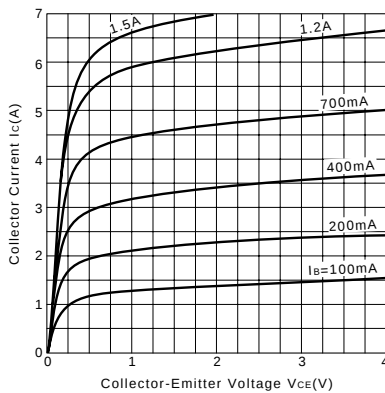
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{stg} (μs)	t _f (μs)
200	50	4	10	-5	0.8	-1.6	4.0max	0.2max

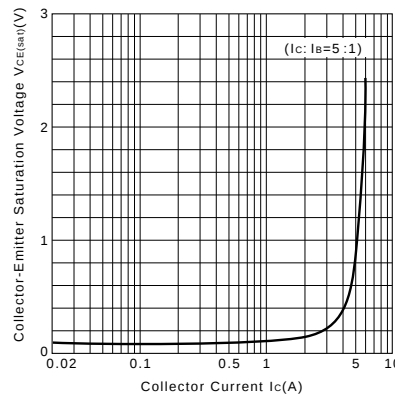
External Dimensions FM100(TO3PF)



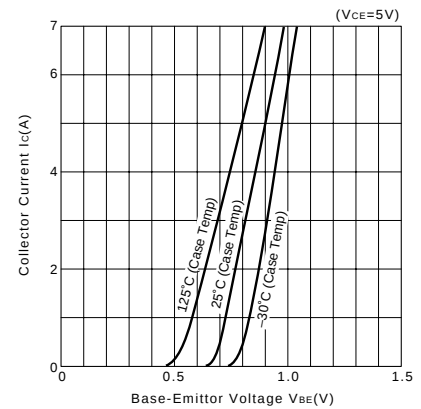
I_c-V_{CE} Characteristics (Typical)



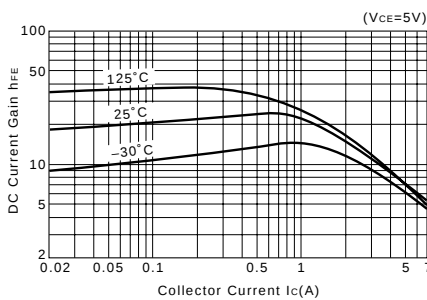
V_{CE(sat)}-I_c Characteristics (Typical)



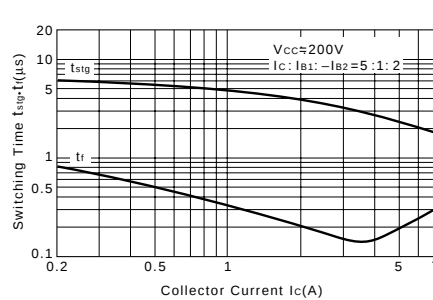
I_c-V_{BE} Temperature Characteristics (Typical)



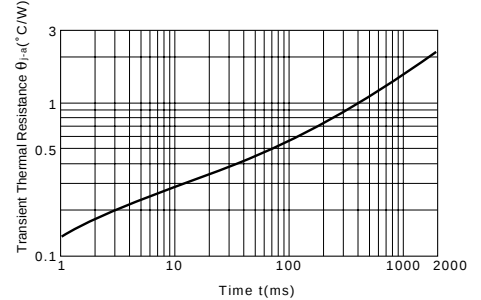
h_{FE}-I_c Characteristics (Typical)



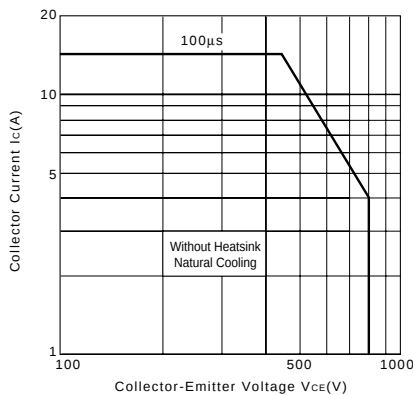
t_{stg}•t_r-I_c Characteristics (Typical)



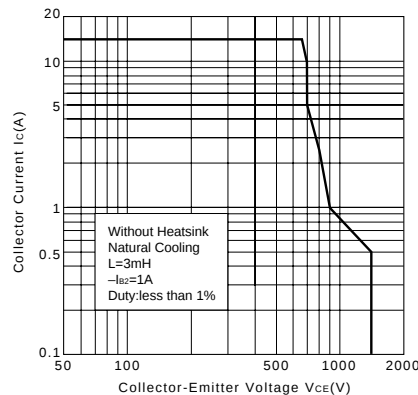
θ_{J-a}-t Characteristics



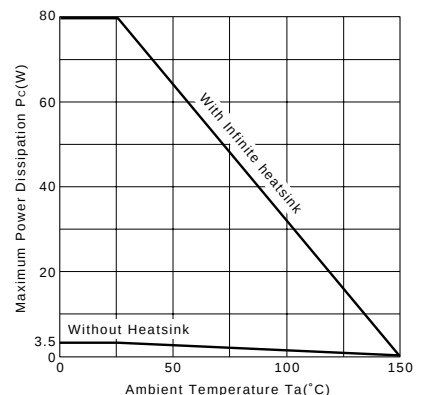
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area

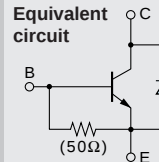


P_c-T_a Derating



Built-in Damper Diode

2SC5003



Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Display Horizontal Deflection Output, Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	1500	V
V _{CEO}	800	V
V _{EBO}	6	V
I _C	7(Pulse14)	A
I _B	3.5	A
P _C	80(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

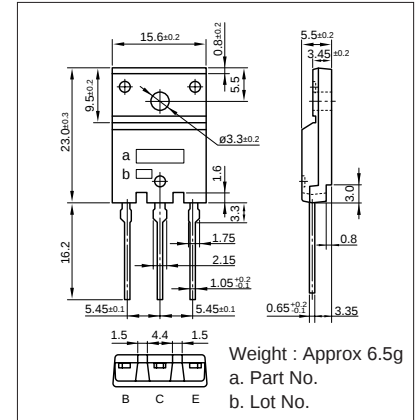
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO1}	V _{CB} =1200V	100max	μA
I _{CBO2}	V _{CB} =1500V	1max	mA
I _{CEO}	V _{CE} =800V	1max	mA
V _{EBO}	I _{EB} =300mA	6min	V
h _{FE1}	V _{CE} =5V, I _C =1A	8min	
h _{FE2}	V _{CE} =5V, I _C =5A	4to9	
V _{CE(sat)}	I _C =5A, I _B =1.2A	5max	V
V _{BE(sat)}	I _C =5A, I _B =1.2A	1.5max	V
V _{FEC}	I _{EC} =7A	2.0max	V
f _r	V _{CE} =12V, I _E =-0.5A	4typ	MHz
COB	V _{CB} =10V, f=1MHz	100typ	pF

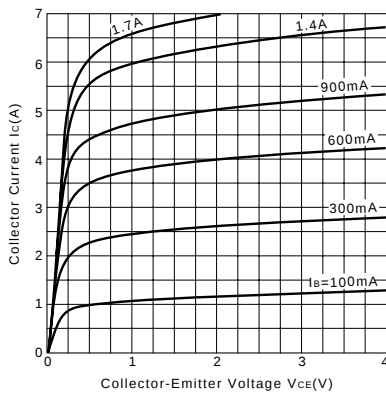
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{stg} (μs)	t _f (μs)
200	50	4	10	-5	0.8	-1.6	4.0max	0.2max

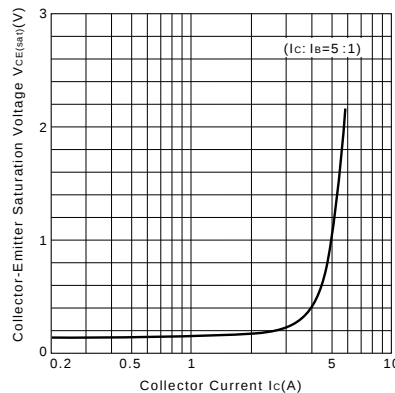
External Dimensions FM100(TO3PF)



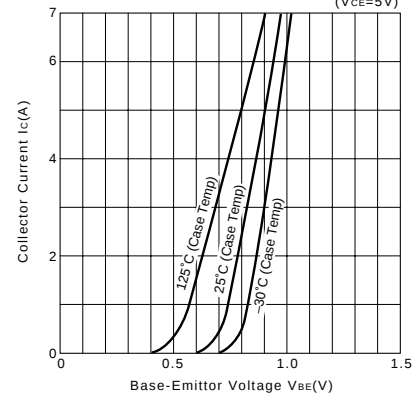
I_C-V_{CE} Characteristics (Typical)



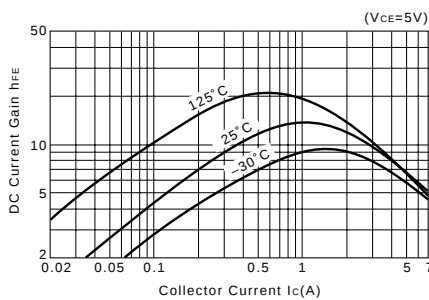
V_{CE(sat)}-I_C Characteristics (Typical)



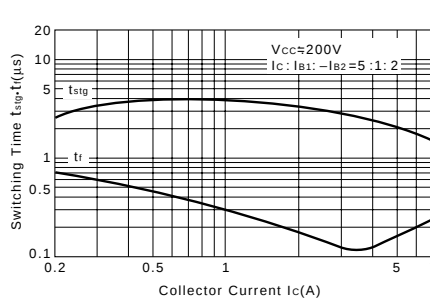
I_C-V_{BE} Temperature Characteristics (Typical)



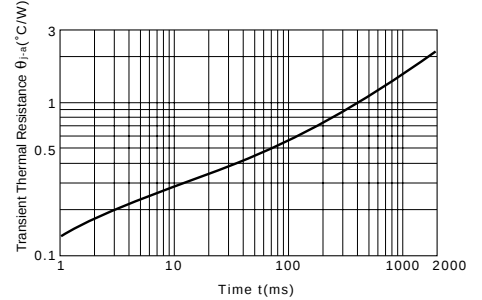
h_{FE}-I_C Characteristics (Typical)



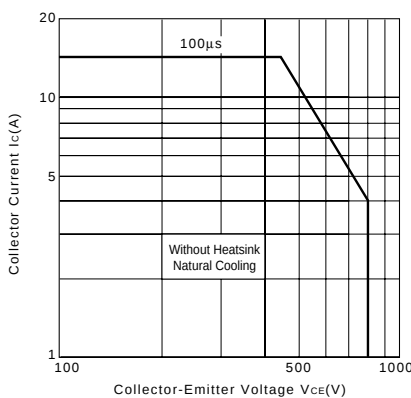
t_{stg}·t_r-I_C Characteristics (Typical)



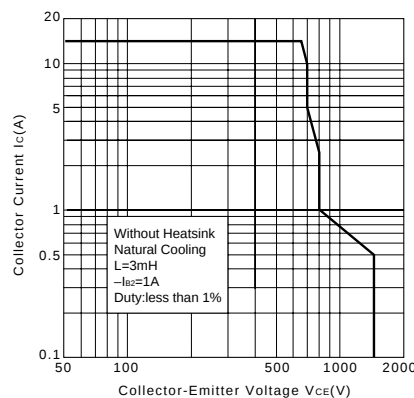
θ_{j-a}-t Characteristics



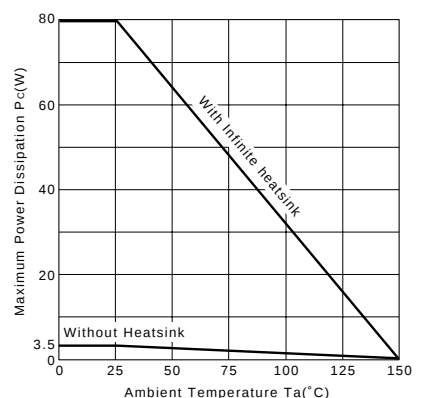
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC5071

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	500	V
V _{CEO}	400	V
V _{EB0}	10	V
I _C	12(Pulse24)	A
I _B	4	A
P _C	100(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

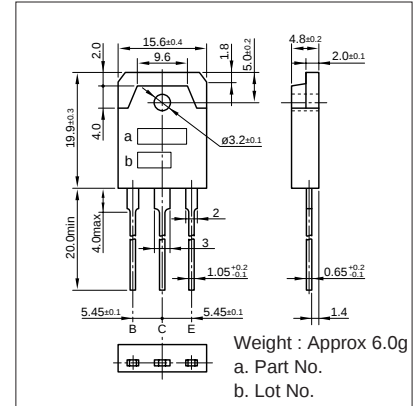
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EBO}	V _{EB} =10V	100max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =7A	10 to 30	
V _{CE(sat)}	I _C =7A, I _B =1.4A	0.5max	V
V _{BE(sat)}	I _C =7A, I _B =1.4A	1.3max	V
f _r	V _{CE} =12V, I _E =-1A	10typ	MHz
COB	V _{CB} =10V, f=1MHz	105typ	pF

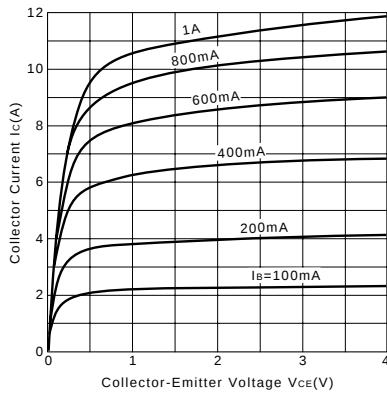
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	28.5	7	10	-5	0.7	-1.4	1.0max	3.0max	0.5max

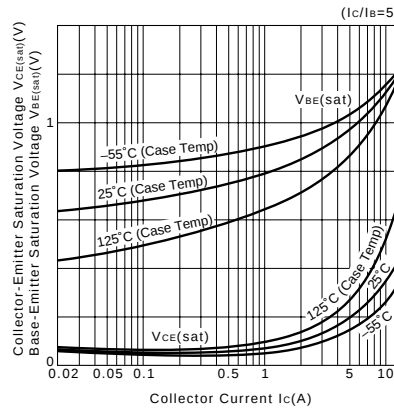
External Dimensions MT-100(TO3P)



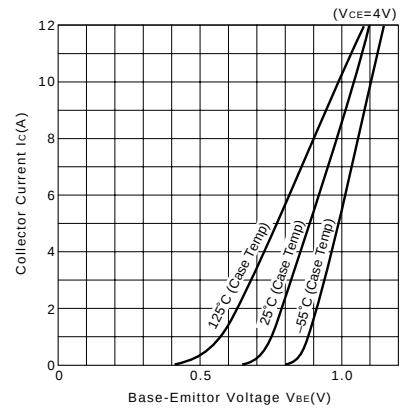
I_C-V_{CE} Characteristics (Typical)



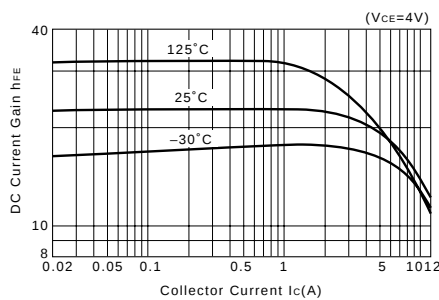
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



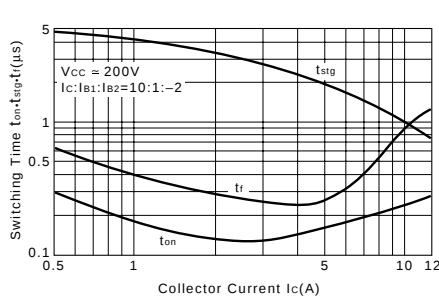
I_C-V_{BE} Temperature Characteristics (Typical)



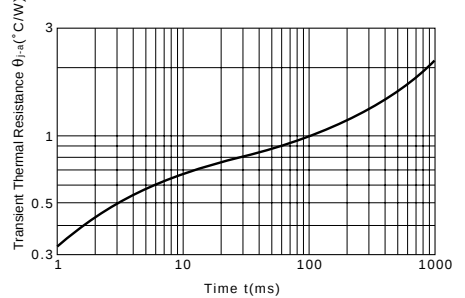
h_{FE}-I_C Characteristics (Typical)



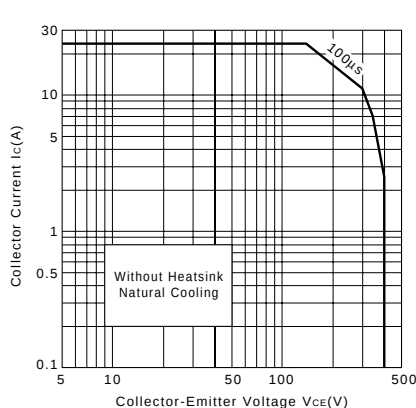
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



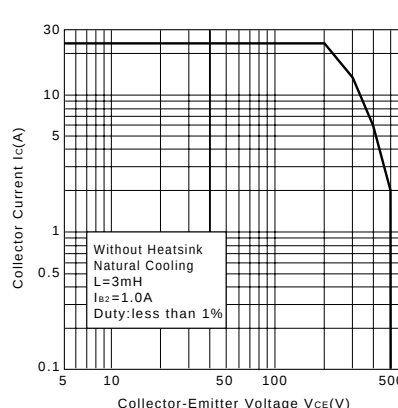
θ_{J-a}-t Characteristics



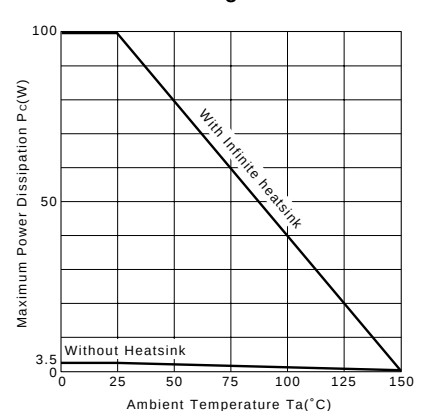
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC5099

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1907)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

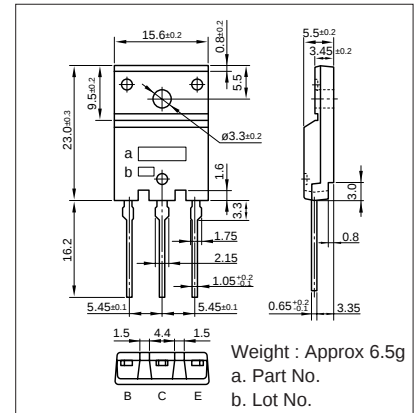
Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CE0}	80	V
V _{EB0}	6	V
I _C	6	A
I _B	3	A
P _C	60(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =50mA	80min	V
h _{FE}	V _{CE} =4V, I _C =2A	50min*	
V _{CE(sat)}	I _C =2A, I _B =0.2A	0.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	110typ	pF

*h_{FE} Rank O(50 to 100), P(70 to 140), Y(90 to 180)

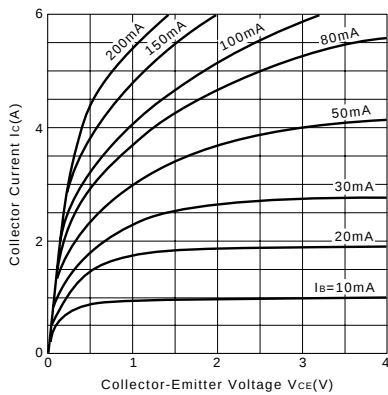
External Dimensions FM100(TO3PF)



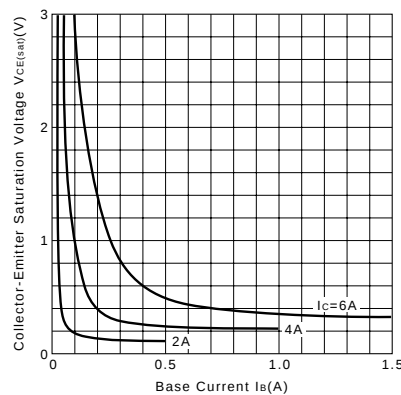
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-5	0.3	-0.3	0.16typ	2.60typ	0.34typ

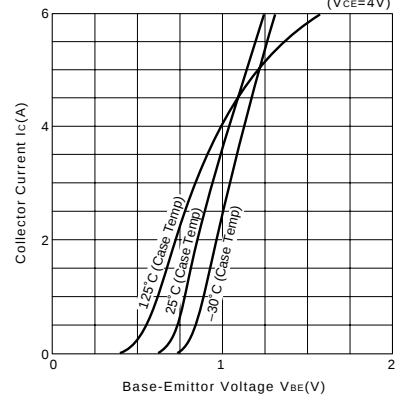
I_C-V_{CE} Characteristics (Typical)



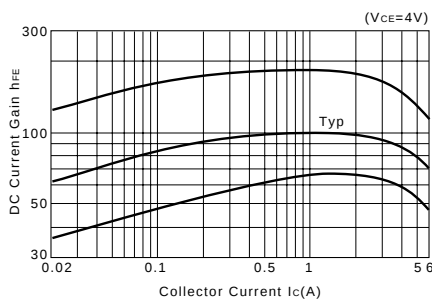
V_{CE(sat)}-I_B Characteristics (Typical)



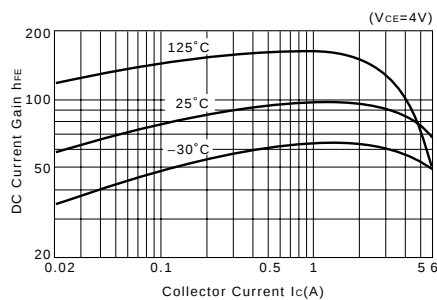
I_C-V_{BE} Temperature Characteristics (Typical)



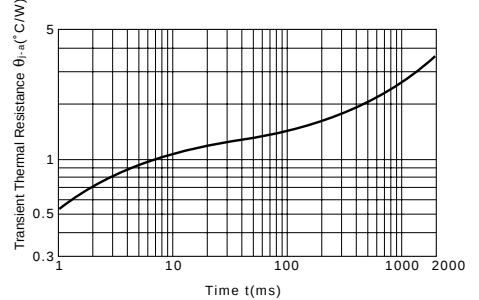
h_{FE}-I_C Characteristics (Typical)



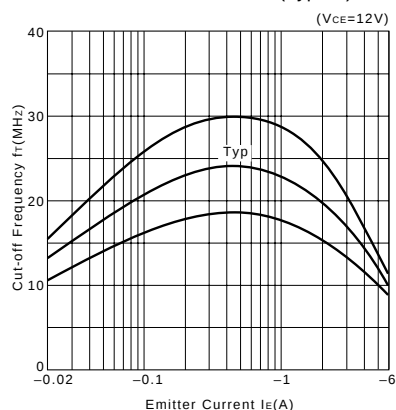
h_{FE}-I_C Temperature Characteristics (Typical)



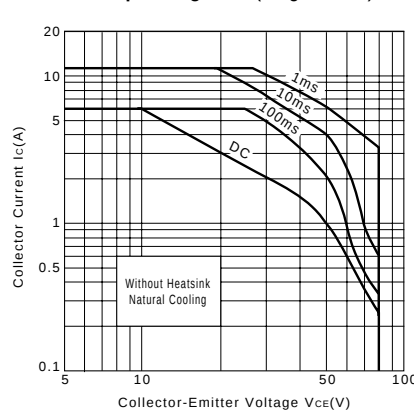
θ_{j-a}-t Characteristics



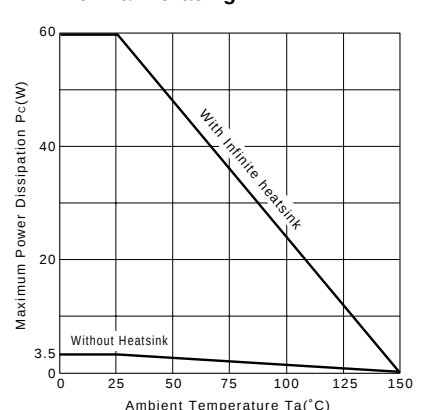
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC5100

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1908)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CE0}	120	V
V _{EB0}	6	V
I _C	8	A
I _B	3	A
P _C	75(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

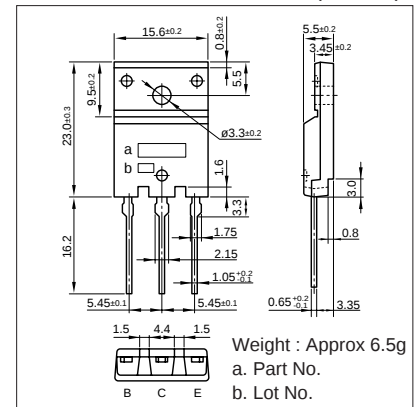
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =160V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =50mA	120min	V
h _{FE}	V _{CE} =4V, I _C =3A	50min*	
V _{CE(sat)}	I _C =3A, I _B =0.3A	0.5max	V
f _T	V _{CE} =12V, I _E =-0.5A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	200typ	pF

*h_{FE} Rank O(50to100), P(70to140), Y(90to180)

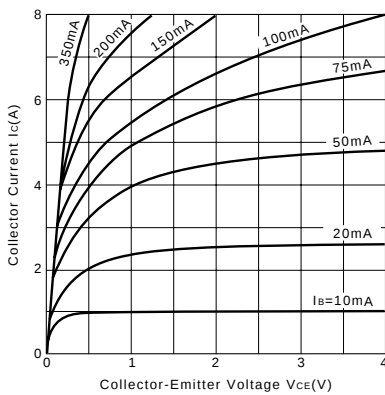
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	10	4	10	-5	0.4	-0.4	0.13typ	3.50typ	0.32typ

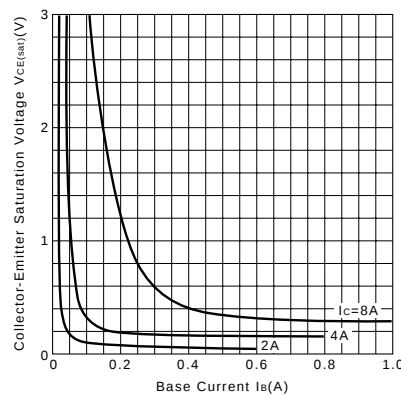
External Dimensions FM100(TO3PF)



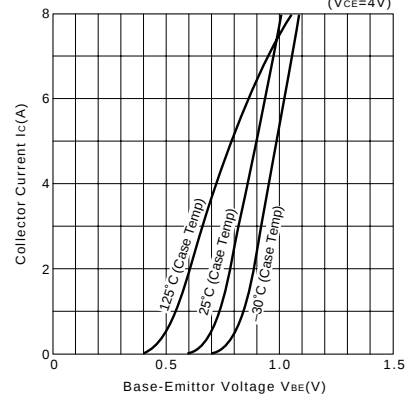
I_C-V_{CE} Characteristics (Typical)



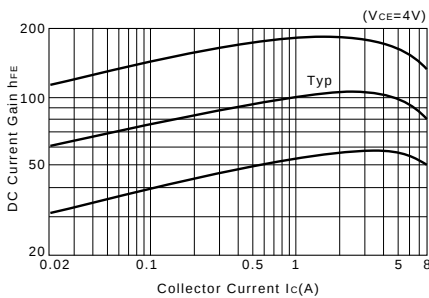
V_{CE(sat)}-I_B Characteristics (Typical)



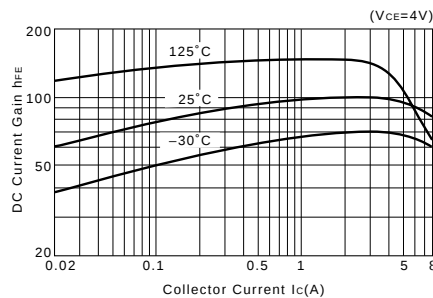
I_C-V_{BE} Temperature Characteristics (Typical)



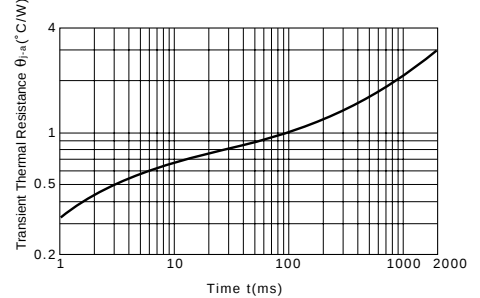
h_{FE}-I_C Characteristics (Typical)



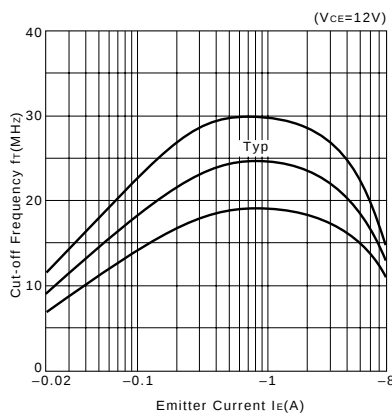
h_{FE}-I_C Temperature Characteristics (Typical)



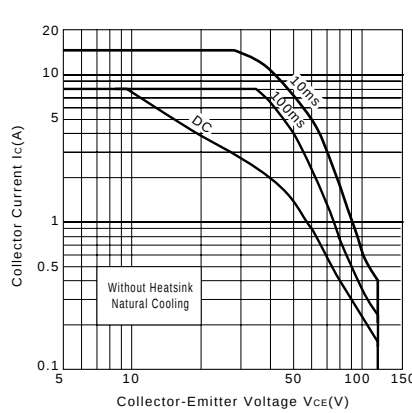
θ_{j-a}-t Characteristics



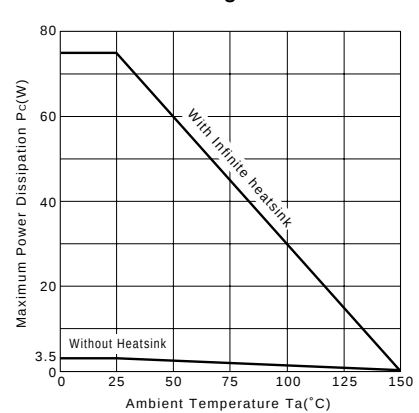
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC5101

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SA1909)

Application : Audio and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CE0}	140	V
V _{EB0}	6	V
I _C	10	A
I _B	4	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

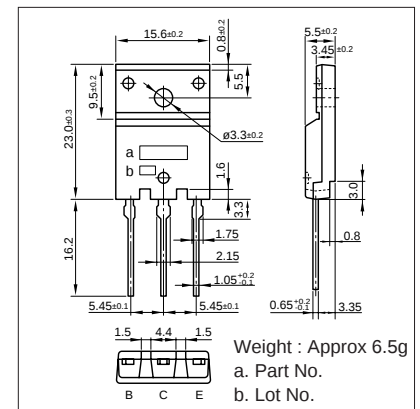
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	10max	μA
I _{EB0}	V _{EB} =6V	10max	μA
V _{(BR)CEO}	I _C =50mA	140min	V
h _{FE}	V _{CE} =4V, I _C =3A	50min*	
V _{CE(sat)}	I _C =5A, I _B =0.5A	0.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	20typ	MHz
COB	V _{CB} =10V, f=1MHz	250typ	pF

*h_{FE} Rank $\bar{O}$ (50 to 100), P(70 to 140), Y(90 to 180)

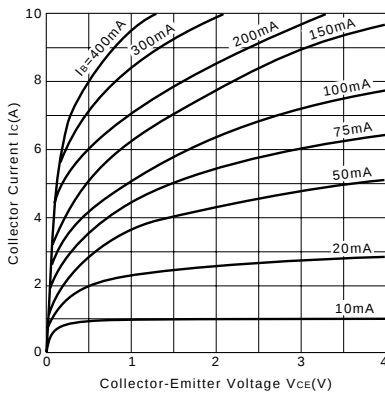
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	12	5	10	-5	0.5	-0.5	0.24typ	4.32typ	0.40typ

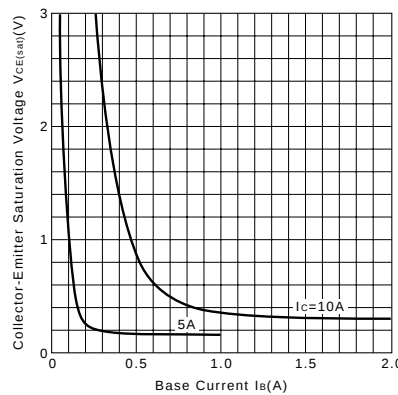
External Dimensions FM100(TO3PF)



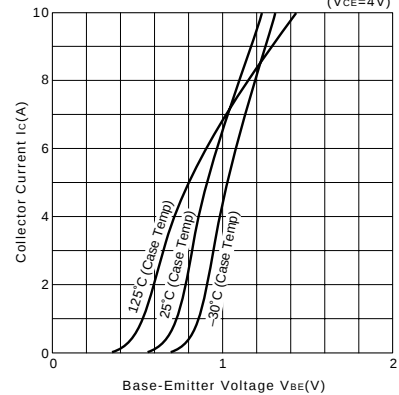
I_C-V_{CE} Characteristics (Typical)



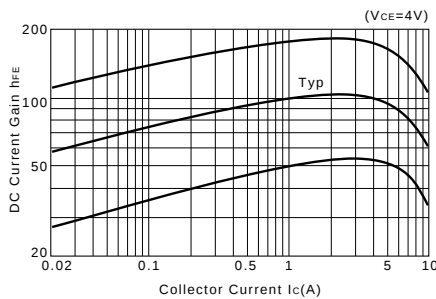
V_{CE(sat)}-I_B Characteristics (Typical)



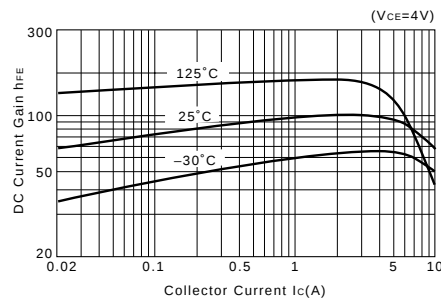
I_C-V_{BE} Temperature Characteristics (Typical)



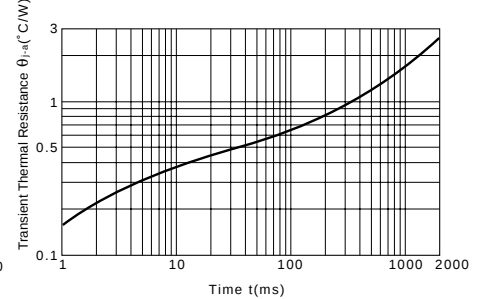
h_{FE}-I_C Characteristics (Typical)



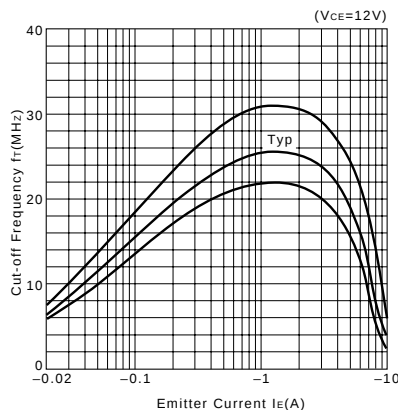
h_{FE}-I_C Temperature Characteristics (Typical)



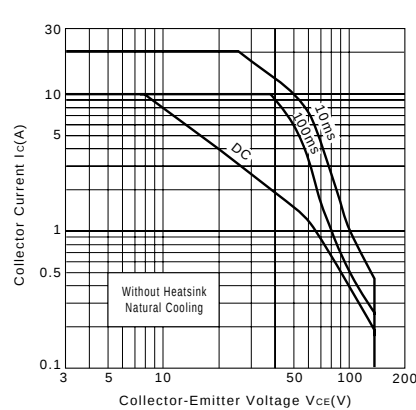
θ_{JA}-t Characteristics



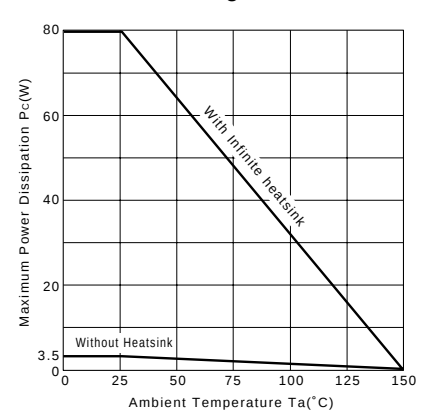
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SC5124

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Display Horizontal Deflection Output, Switching Regulator and General Purpose

■ Absolute maximum ratings (Ta=25°C)

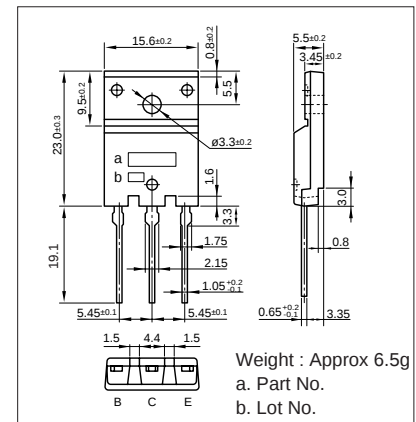
Symbol	Ratings	Unit
VCBO	1500	V
VCEO	800	V
VEBO	6	V
Ic	10(Pulse20)	A
Ib	5	A
Pc	100(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

■Electrical Characteristics

Symbol	Conditions	Ratings	Unit
ICBO1	$V_{CB}=1200V$	100max	μA
ICBO2	$V_{CB}=1500V$	1max	mA
IEBO	$V_{EB}=6V$	100max	μA
$V_{(BR)CEO}$	$I_C=10mA$	800min	V
hFE1	$V_{CE}=5V, I_C=1A$	8min	
hFE2	$V_{CE}=5V, I_C=8A$	4to9	
$V_{CE(sat)}$	$I_C=8A, I_B=2A$	5max	V
$V_{BE(sat)}$	$I_C=8A, I_B=2A$	1.5max	V
f _r	$V_{CE}=12V, I_E=-1A$	3typ	MHz
C _{OB}	$V_{CB}=10V, f=1MHz$	130typ	pF

($T_a=25^{\circ}\text{C}$)

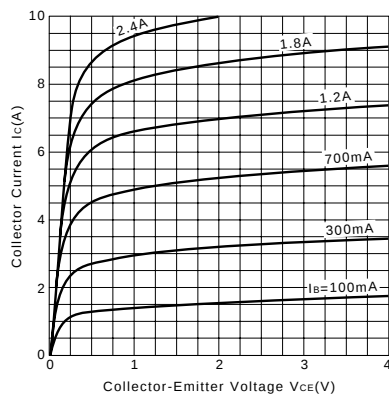
External Dimensions FM100(TO3PF)



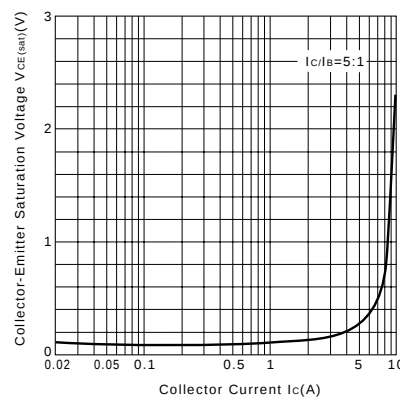
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	33.3	6	10	-5	1.2	-2.4	0.1typ	4.0typ	0.2typ

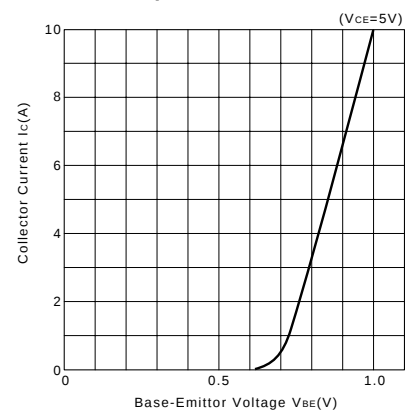
I_C-V_{CE} Characteristics (Typical)



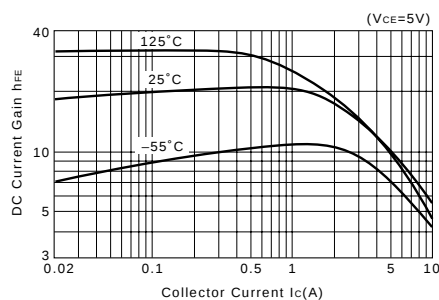
V_{CE(sat)}-I_C Characteristics (Typical)



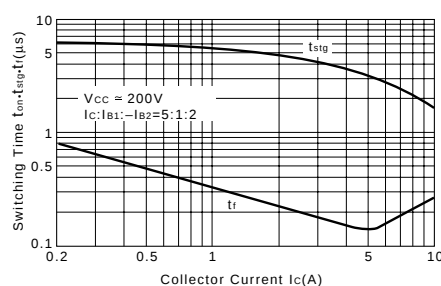
I_C-V_{BE} Temperature Characteristics (Typical)



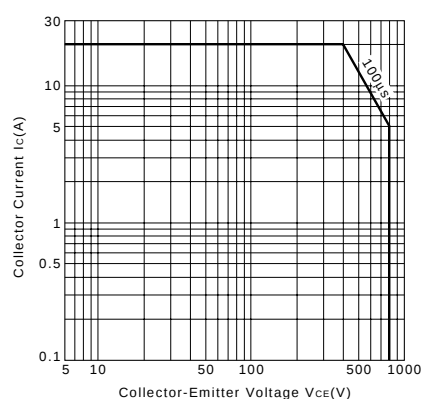
$h_{FE}-I_C$ Characteristics (Typical)



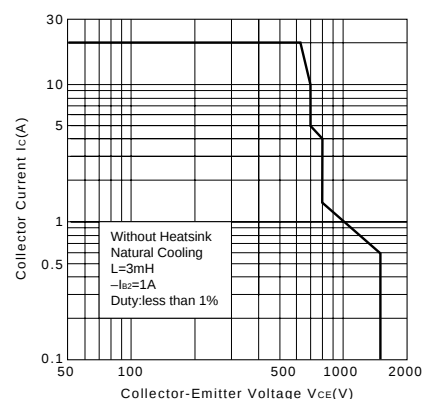
t_{stg}•t_f-I_c Characteristics (Typical)



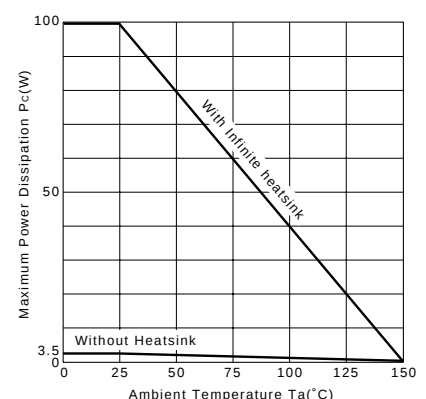
θ_{j-a-t} Characteristics



Reverse Bias Safe Operating Area



Pc-Ta Derating



2SC5130

Silicon NPN Triple Diffused Planar Transistor (High Voltage and High Speed Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	600	V
V _{CEO}	400	V
V _{EB0}	10	V
I _C	5(Pulse10)	A
I _B	2	A
P _C	30(Tc=25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

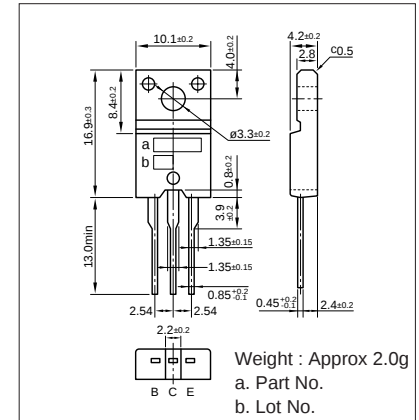
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =500V	100max	μA
I _{EB0}	V _{EB} =10V	10max	μA
V _{(BR)CEO}	I _C =25mA	400min	V
h _{FE}	V _{CE} =4V, I _C =1.5A	10 to 30	
V _{CE(sat)}	I _C =1.5A, I _B =0.3A	0.5max	V
V _{BE(sat)}	I _C =1.5A, I _B =0.3A	1.3max	V
f _r	V _{CE} =12V, I _E =-0.3A	20typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	30typ	pF

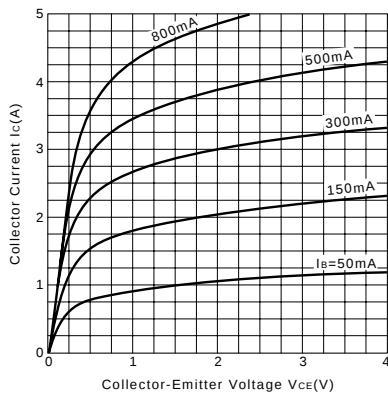
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	133	1.5	10	-5	0.15	-0.3	1max	2max	0.3max

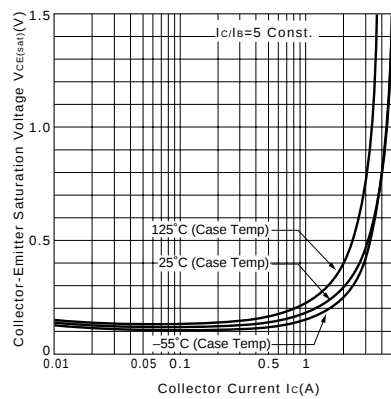
External Dimensions FM20(TO220F)



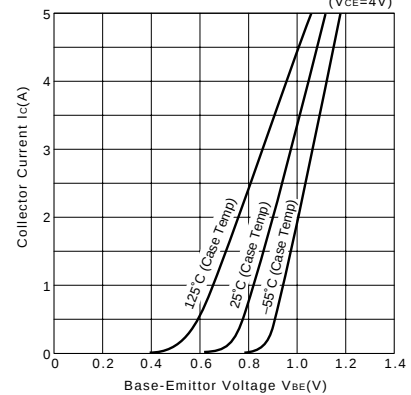
I_C-V_{CE} Characteristics (Typical)



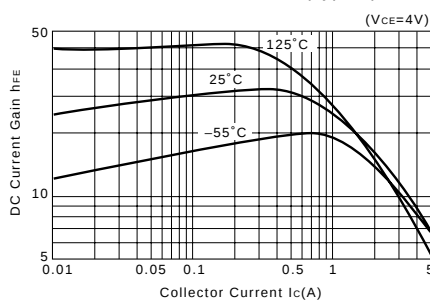
V_{CE(sat)}-I_C Characteristics (Typical)



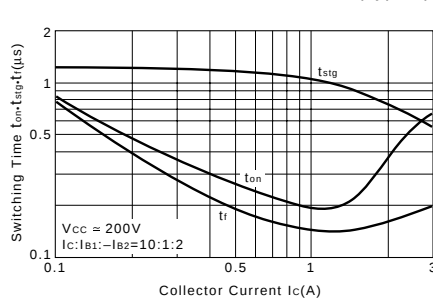
I_C-V_{BE} Temperature Characteristics (Typical)



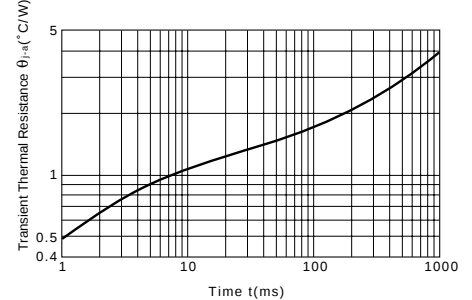
h_{FE}-I_C Characteristics (Typical)



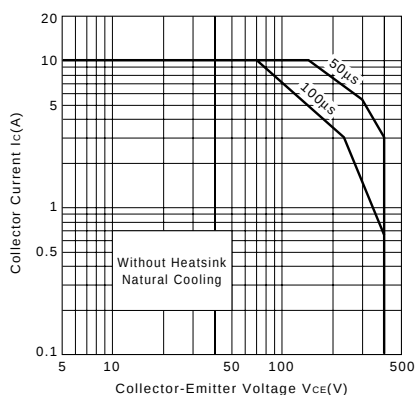
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



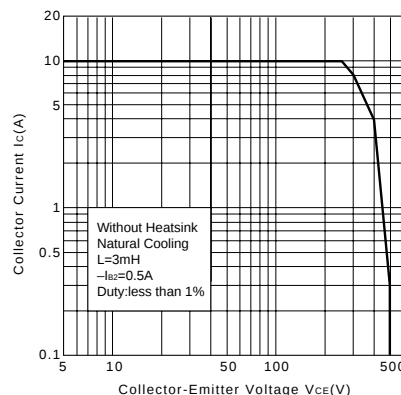
θ_{j-a}-t Characteristics



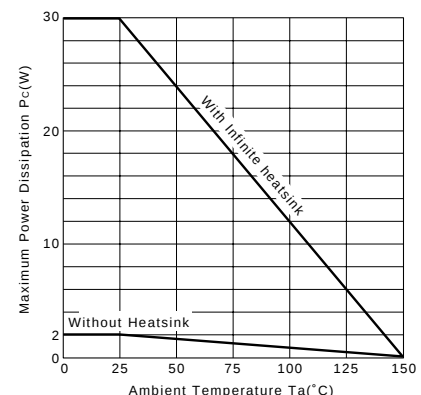
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC5239

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CE0}	550	V
V _{EB0}	7	V
I _c	3(Pulse6)	A
I _B	1.5	A
P _c	50(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

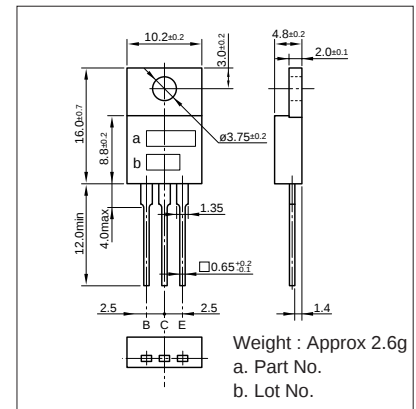
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =800V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _c =10mA	550min	V
h _{FE}	V _{CE} =4V, I _c =1A	10 to 30	
V _{CE(sat)}	I _c =1A, I _B =0.2A	0.5max	V
V _{BE(sat)}	I _c =1A, I _B =0.2A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.25A	6typ	MHz
COB	V _{CB} =10V, f=1MHz	35typ	pF

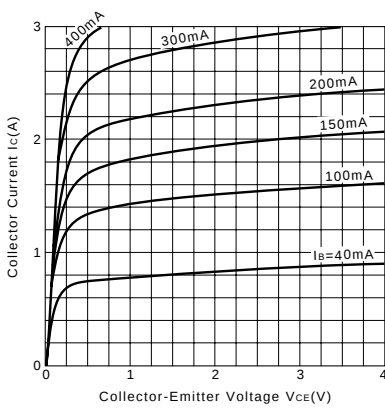
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	250	1	10	-5	0.15	-0.45	0.7max	4.0max	0.5max

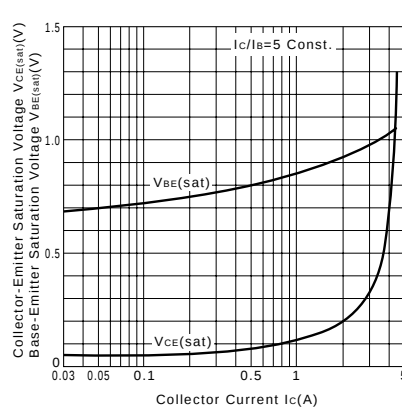
External Dimensions MT-25(TO220)



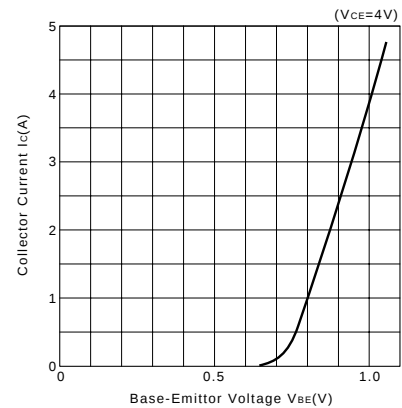
I_c-V_{CE} Characteristics (Typical)



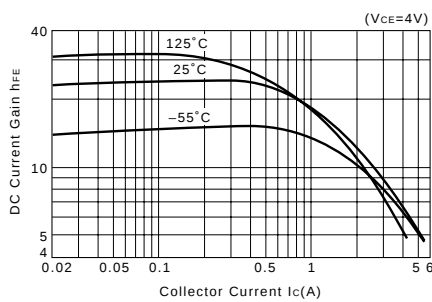
V_{CE(sat)}, V_{BE(sat)}-I_c Temperature Characteristics (Typical)



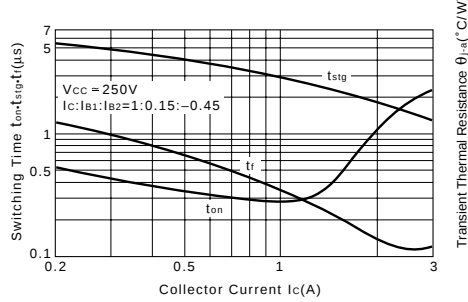
I_c-V_{BE} Temperature Characteristics (Typical)



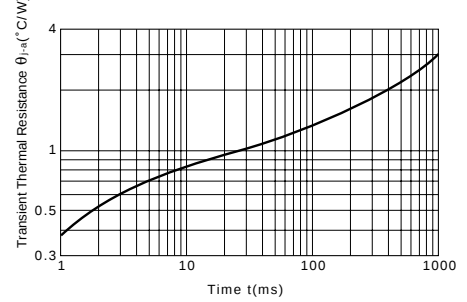
h_{FE}-I_c Characteristics (Typical)



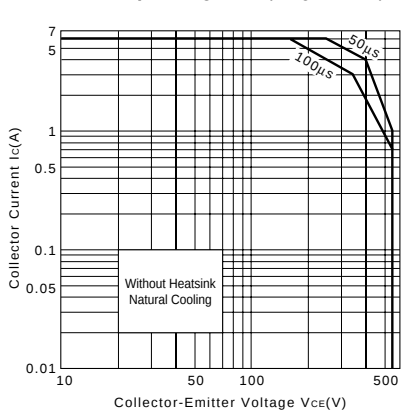
t_{on}•t_{stg}•t_f-I_c Characteristics (Typical)



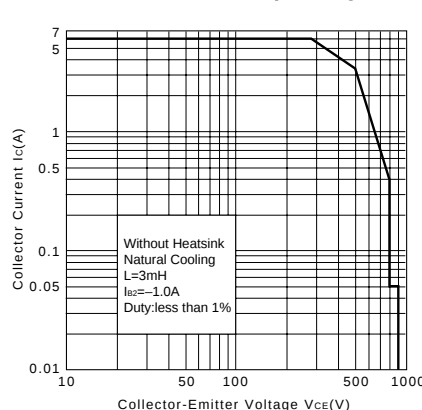
θ_{j-a}-t Characteristics



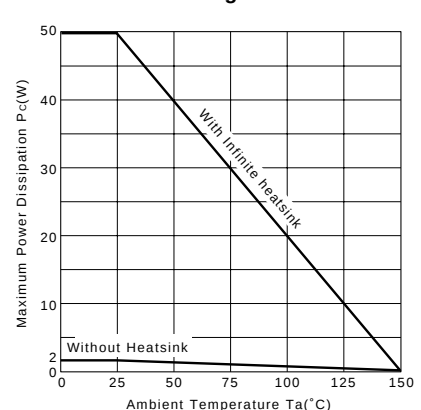
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_c-T_a Derating



2SC5249

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	600	V
V _{CE0}	600	V
V _{EB0}	7	V
I _c	3(Pulse)	A
I _B	1.5	A
P _c	35(T _c =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

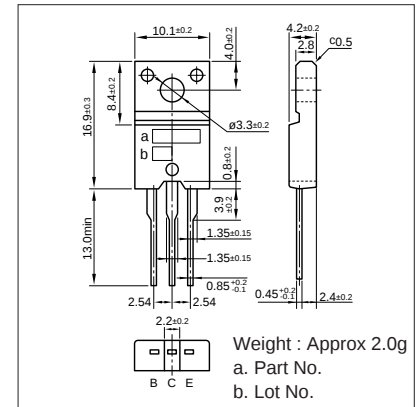
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =600V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _c =10mA	600min	V
h _{FE}	V _{CE} =4V, I _c =1A	20 to 40	
V _{CE(sat)}	I _c =1A, I _B =0.2A	0.5max	V
V _{BE(sat)}	I _c =1A, I _B =0.2A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.3A	6typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	50typ	pF

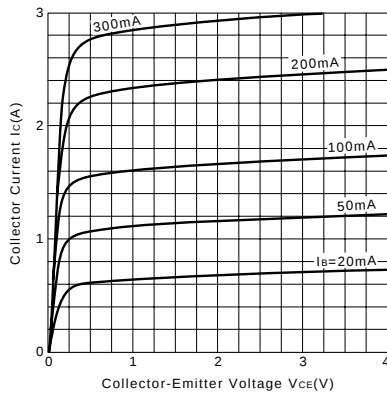
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _c (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
200	200	1	10	-5	0.1	-0.1	1.0max	19max	1.0max

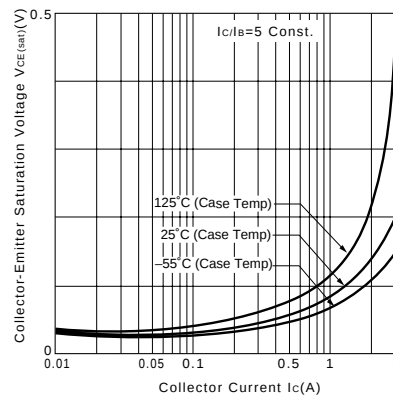
External Dimensions FM20(TO220F)



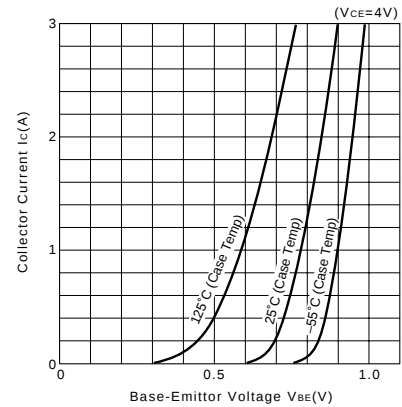
I_c-V_{CE} Characteristics (Typical)



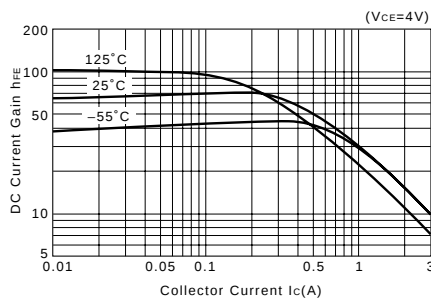
V_{CE(sat)}-I_c Characteristics (Typical)



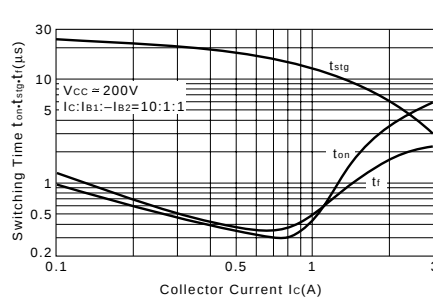
I_c-V_{BE} Temperature Characteristics (Typical)



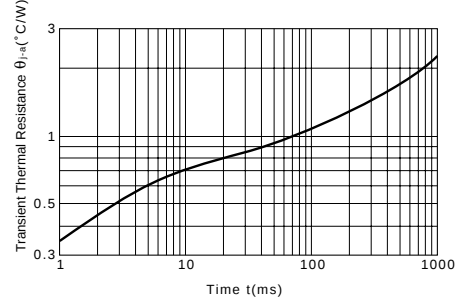
h_{FE}-I_c Characteristics (Typical)



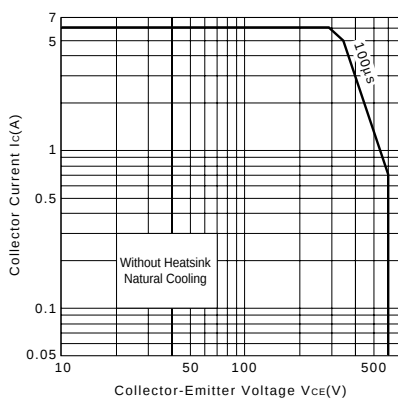
t_{on}•t_{stg}•t_r-I_c Characteristics (Typical)



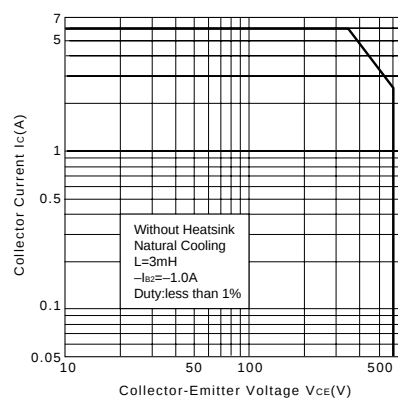
θ_{j-a}-t Characteristics



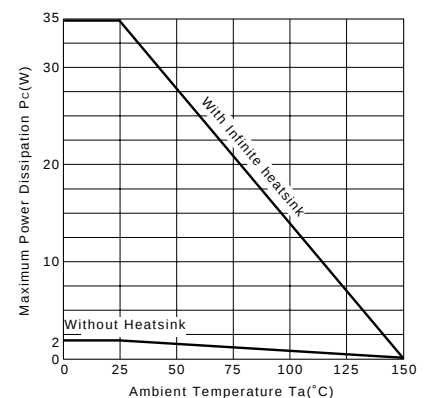
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_c-T_a Derating



2SC5271

Silicon NPN Triple Diffused Planar Transistor

Application : Resonant Switching Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	300	V
V _{CEO}	200	V
V _{EB0}	7	V
I _C	5(Pulse10)	A
I _B	2	A
P _C	30(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

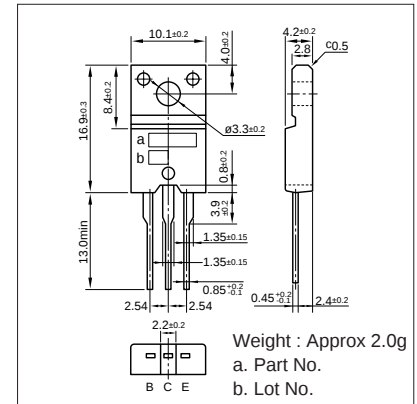
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =300V	100max	μA
I _{EB0}	V _{EB} =7V	100max	μA
V(BR) _{CEO}	I _C =10mA	200min	V
h _{FE1}	V _{CE} =2V, I _C =2.5A	10to30	
h _{FE2}	V _{CE} =2V, I _C =1mA	15min	
V _{CE(sat)}	I _C =2.5A, I _B =0.5A	1.0max	V
V _{BE(sat)}	I _C =2.5A, I _B =0.5A	1.5max	V
f _r	V _{CE} =12V, I _E =-0.5A	10typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	45typ	pF

■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
150	60	2.5	10	-5	0.5	-1.0	0.3max	1.0max	0.1max

External Dimensions FM20(TO220F)



2SC5287

Silicon NPN Triple Diffused Planar Transistor (High Voltage Switching Transistor)

Application : Switching Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	900	V
V _{CE0}	550	V
V _{EB0}	7	V
I _C	5(Pulse10)	A
I _B	2.5	A
P _C	80(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

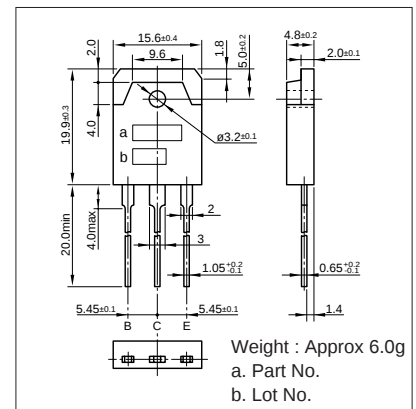
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =800V	100max	μA
I _{EBO}	V _{EB} =7V	100max	μA
V _{(BR)CEO}	I _C =10mA	550min	V
h _{FE}	V _{CE} =4V, I _C =1.8A	10 to 25	
V _{CE(sat)}	I _C =1.8A, I _B =0.36A	0.5max	V
V _{BE(sat)}	I _C =1.8A, I _B =0.36A	1.2max	V
f _r	V _{CE} =12V, I _E =-0.35A	6typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	50typ	pF

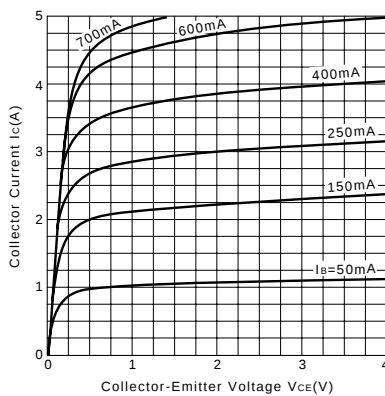
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (A)	I _{B2} (A)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
250	139	1.8	10	-5	0.27	-0.9	0.7max	4.0max	0.5max

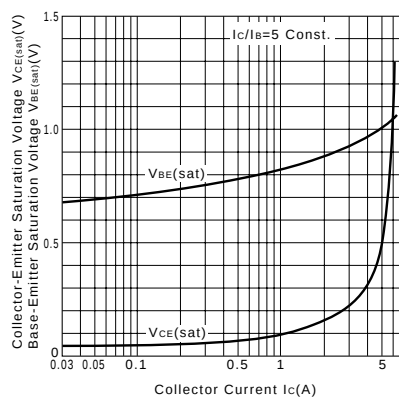
External Dimensions MT-100(TO3P)



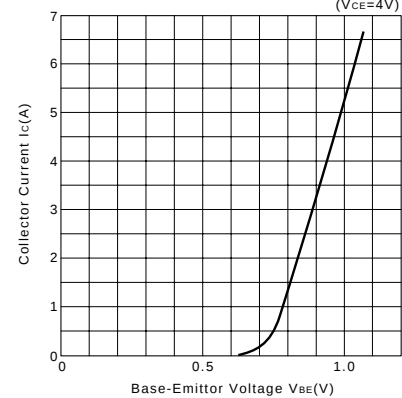
I_C-V_{CE} Characteristics (Typical)



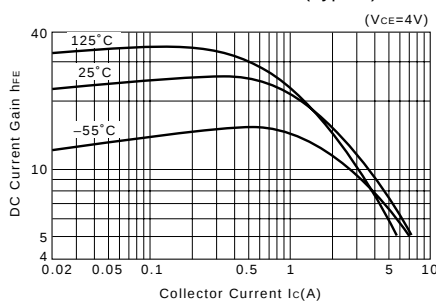
V_{CE(sat)}, V_{BE(sat)}-I_C Temperature Characteristics (Typical)



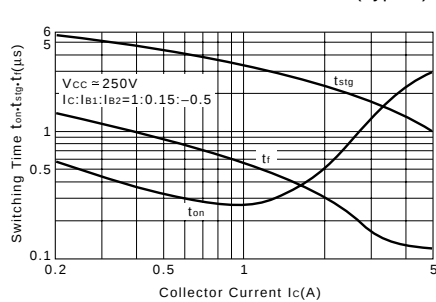
I_C-V_{BE} Temperature Characteristics (Typical)



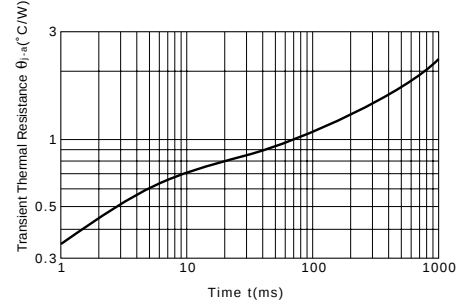
h_{FE}-I_C Characteristics (Typical)



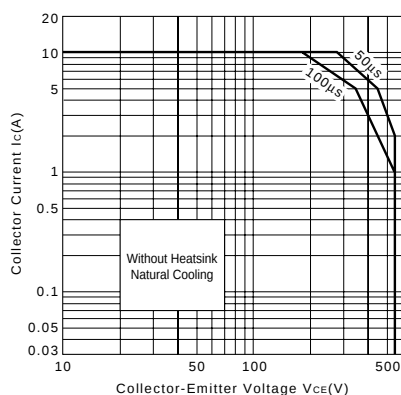
t_{on}•t_{stg}•t_f-I_C Characteristics (Typical)



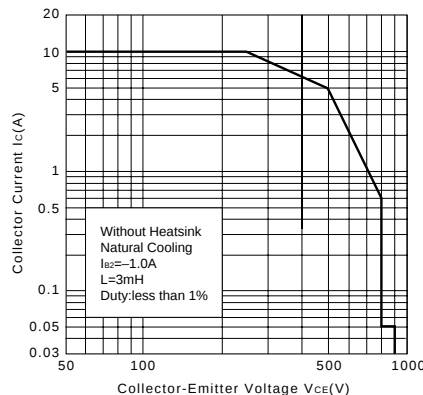
θ_{j-a}-t Characteristics



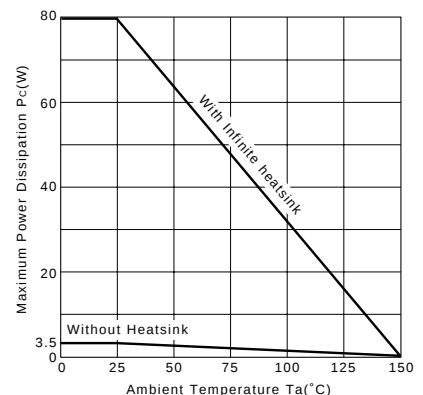
Safe Operating Area (Single Pulse)



Reverse Bias Safe Operating Area



P_C-T_a Derating



2SC5333

Silicon NPN Triple Diffused Planar Transistor

Application : Series Regulator, Switch, and General Purpose

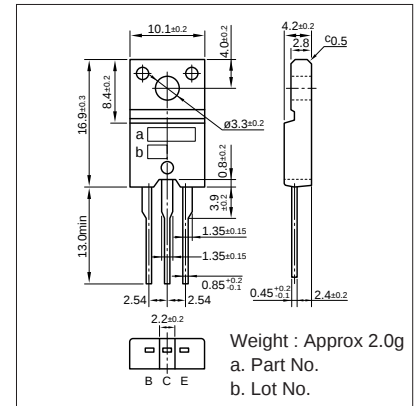
Absolute maximum ratings ($T_a=25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CB0}	300	V
V_{CE0}	300	V
V_{EB0}	6	V
I_C	2	A
I_B	0.2	A
P_C	35($T_c=25^\circ\text{C}$)	W
T_j	150	$^\circ\text{C}$
T_{stg}	-55to+150	$^\circ\text{C}$

Electrical Characteristics ($T_a=25^\circ\text{C}$)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=300\text{V}$	1.0max	mA
I_{EBO}	$V_{EB}=6\text{V}$	1.0max	mA
$V_{(BR)CEO}$	$I_C=25\text{mA}$	300min	V
h_{FE}	$V_{CE}=4\text{V}$, $I_C=0.5\text{A}$	30min	
$V_{CE(sat)}$	$I_C=1.0\text{A}$, $I_B=0.2\text{A}$	1.0max	V
f_T	$V_{CE}=12\text{V}$, $I_E=-0.2\text{A}$	10typ	MHz
COB	$V_{CB}=10\text{V}$, $f=1\text{MHz}$	75typ	pF

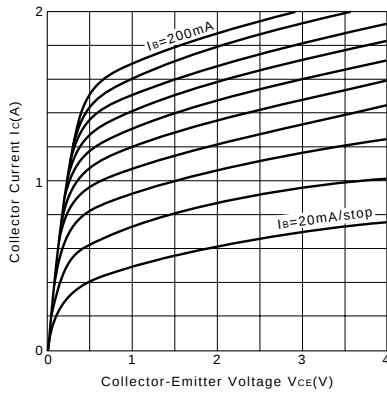
External Dimensions FM20(TO220F)



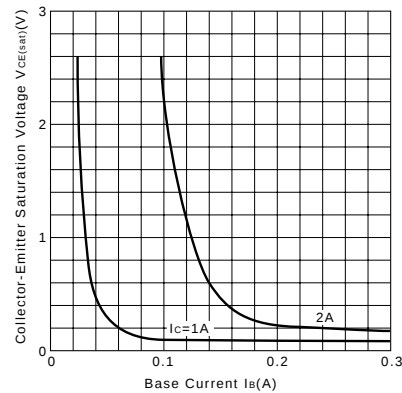
Typical Switching Characteristics (Common Emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{B2} (V)	I_{B1} (A)	I_{B2} (A)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
100	100	1.0	-5	0.1	-0.2	0.3typ	4.0typ	1.0typ

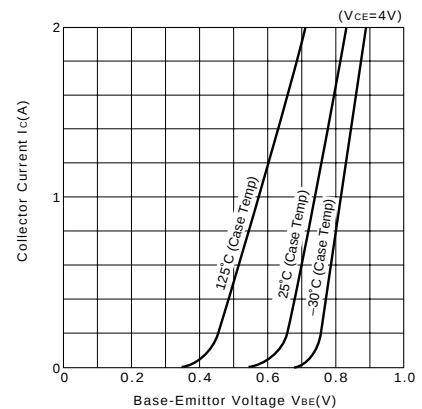
I_C-V_{CE} Characteristics (Typical)



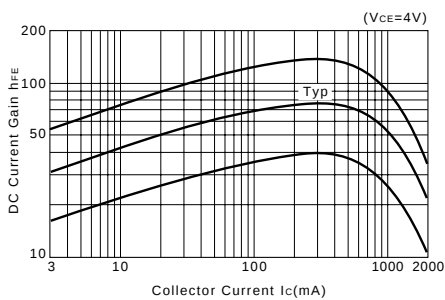
$V_{CE(sat)}-I_B$ Characteristics (Typical)



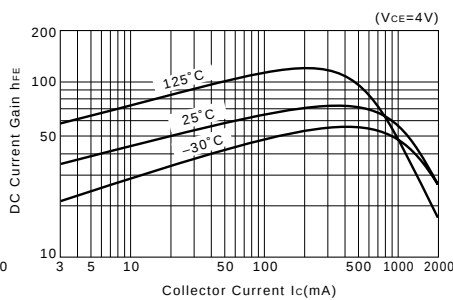
I_C-V_{BE} Temperature Characteristics (Typical)



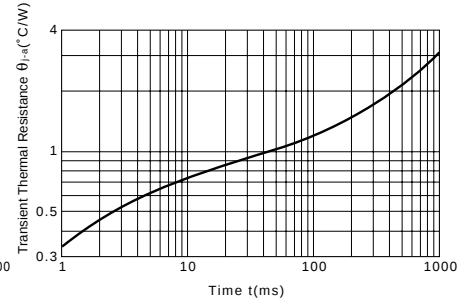
$h_{FE}-I_C$ Characteristics (Typical)



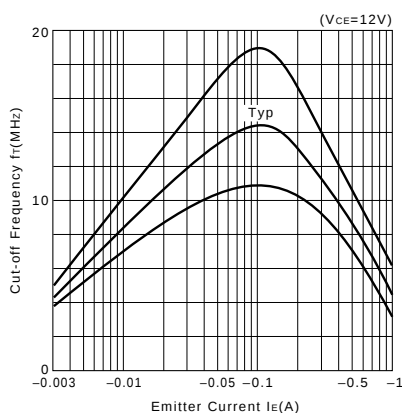
$h_{FE}-I_C$ Temperature Characteristics (Typical)



$\theta_{JA}-t$ Characteristics

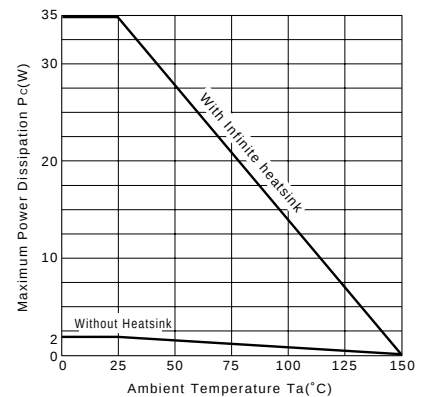


f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

P_C-T_a Derating



2SC5370

Silicon NPN Epitaxial Planar Transistor

Application : Emergency Lighting Inverter and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	60	V
V _{CEO}	40	V
V _{EB0}	7	V
I _C	12	A
I _B	3	A
P _C	30(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55to+150	°C

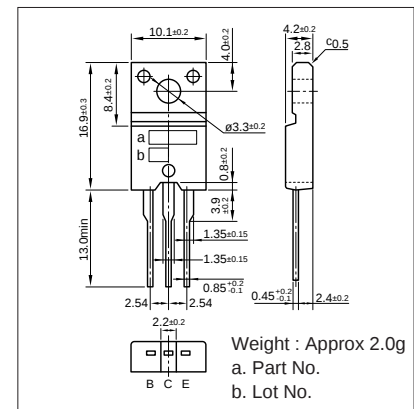
■Electrical Characteristics

(Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =60V	10max	μA
I _{EB0}	V _{EB} =7V	10max	μA
V _{(BR)CEO}	I _C =25mA	40min	V
h _{FE}	V _{CE} =2V, I _C =6A	70min*	
V _{CE(sat)}	I _C =6A, I _B =0.3A	0.3max	V
V _{BE(sat)}	I _C =6A, I _B =0.3A	1.2max	V
f _r	V _{CE} =12V, I _E =-3A	90typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	120typ	pF

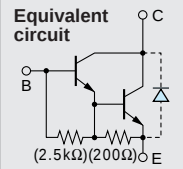
*h_{FE} Rank $\bar{O}$ (70to140), Y(120to240), G(200to400)

External Dimensions FM20(TO220F)



Darlington

2SD1769



Silicon NPN Triple Diffused Planar Transistor

Application : Driver for Solenoid, Relay and Motor, Series Regulator, and General Purpose

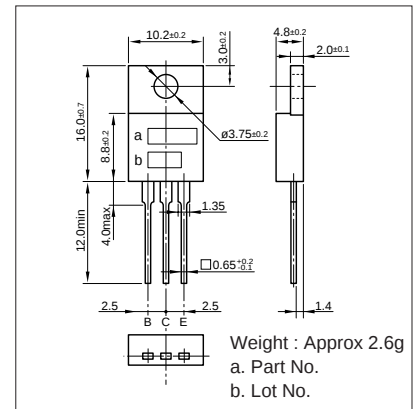
■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CE0}	120	V
V _{EB0}	6	V
I _C	6(Pulse10)	A
I _B	1	A
P _C	50(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	20max	mA
V _{(BR)CEO}	I _C =10mA	120min	V
h _{FE}	V _{CE} =2V, I _C =3A	2000min	
V _{CE(sat)}	I _C =3A, I _B =3mA	1.5max	V
V _{BE(sat)}	I _C =3A, I _B =3mA	2.0max	V
f _r	V _{CE} =12V, I _E =-0.2A	100typ	MHz
COB	V _{CB} =10V, f=1MHz	typ	pF

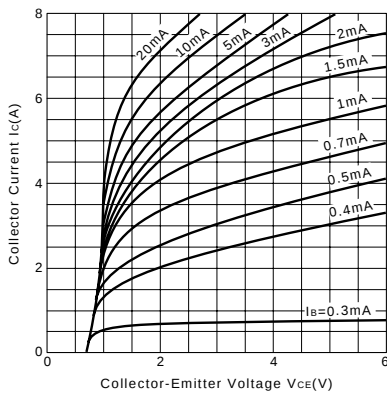
External Dimensions MT-25(TO220)



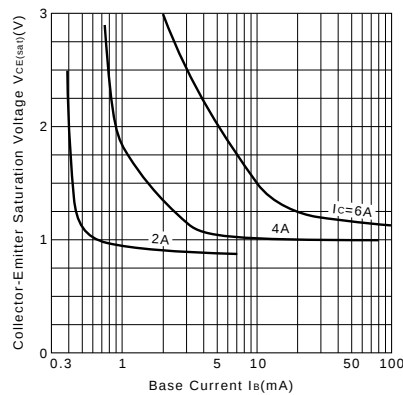
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-1.5	3	-3	0.5typ	5.5typ	1.5typ

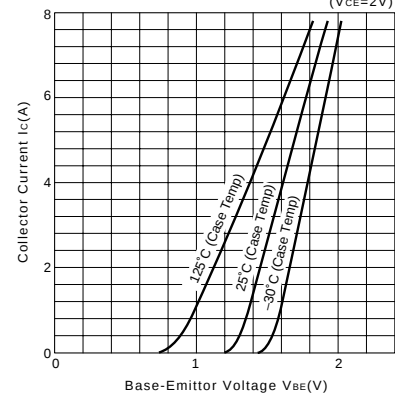
I_C-V_{CE} Characteristics (Typical)



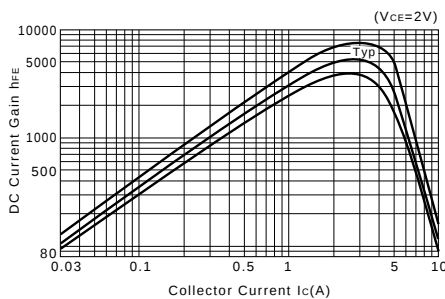
V_{CE(sat)}-I_B Characteristics (Typical)



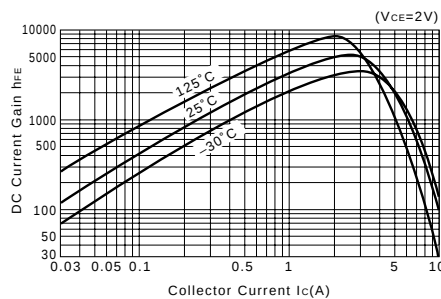
I_C-V_{BE} Temperature Characteristics (Typical)



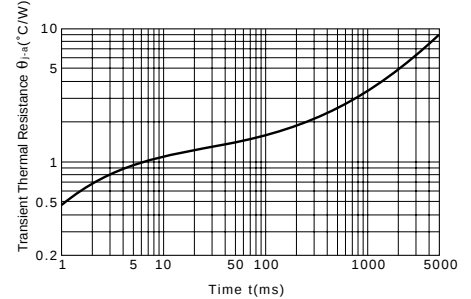
h_{FE}-I_C Characteristics (Typical)



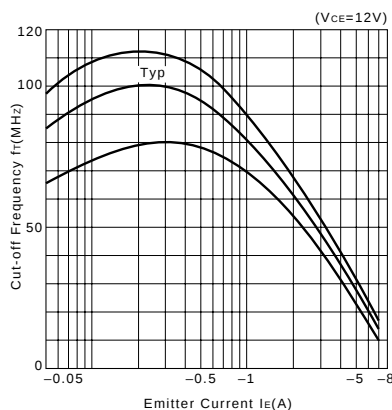
h_{FE}-I_C Temperature Characteristics (Typical)



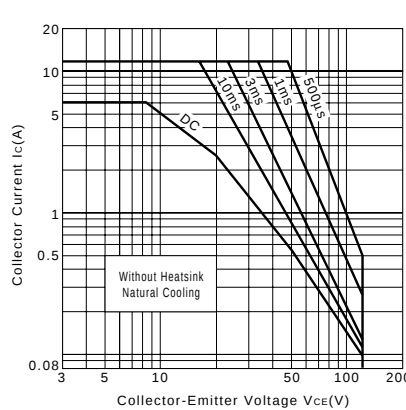
θ_{JA}-t Characteristics



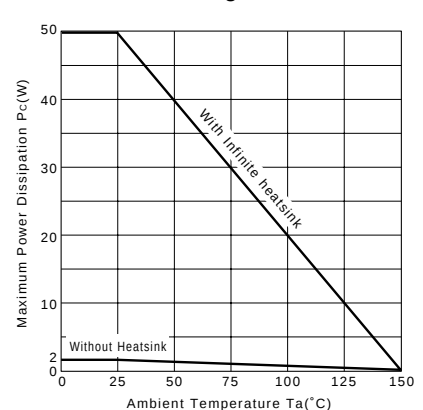
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



2SD1785

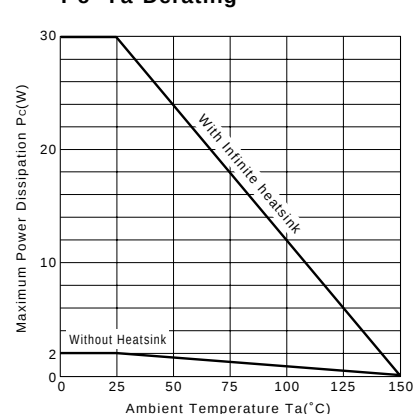
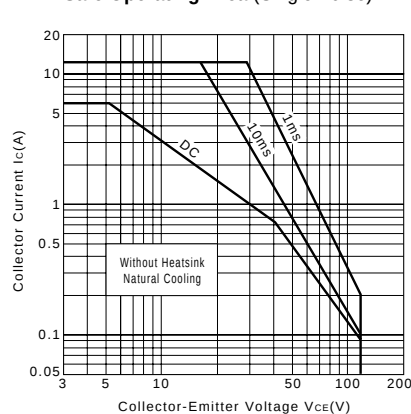
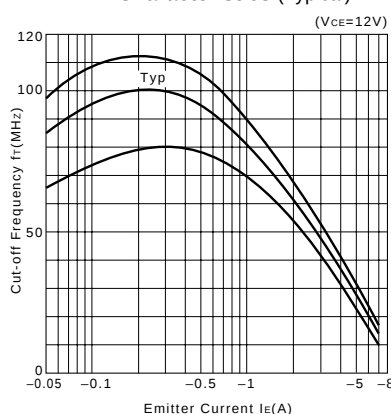
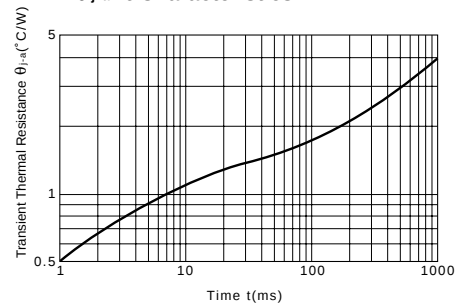
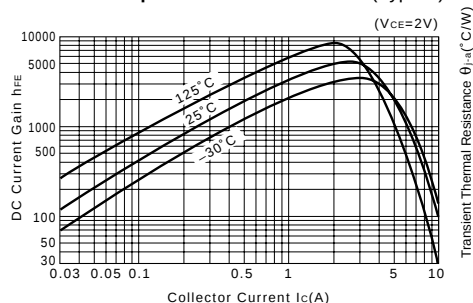
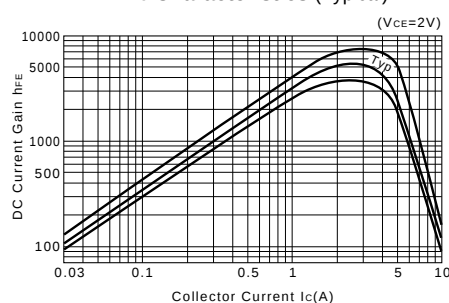
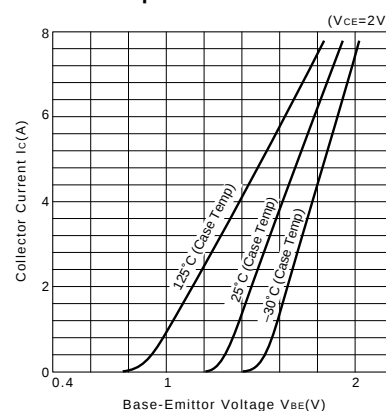
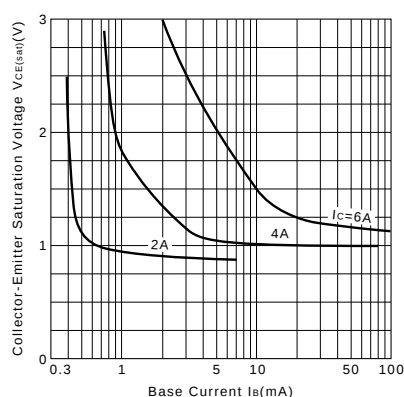
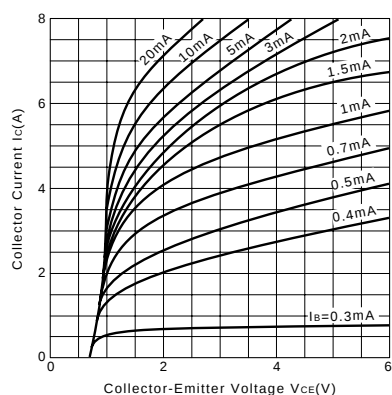
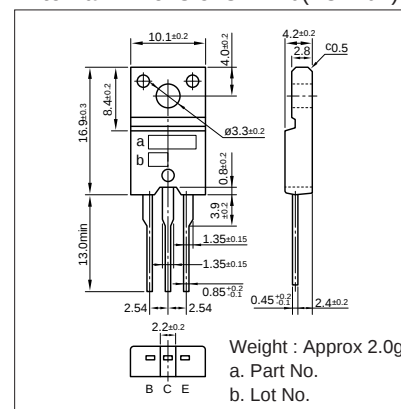


Application : Driver for Solenoid, Relay and Motor, Series Regulator, and General Purpose

External Dimensions FM20(TO220F)

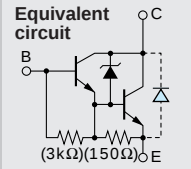
Symbol	Conditions	Ratings	Unit
ICBO	$V_{CB}=120V$	10max	μA
IEBO	$V_{EB}=6V$	10max	mA
$V_{(BR)CEO}$	$I_C=10mA$	120min	V
h_{FE}	$V_{CE}=2V, I_C=3A$	2000min	
$V_{CE(sat)}$	$I_C=2A, I_B=3mA$	1.5max	V
f _T	$V_{CE}=12V, I_E=-0.1A$	100typ	MHz
C _{OB}	$V_{CB}=10V, f=1MHz$	70typ	pF

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-1.5	3	-3	0.5typ	5.5typ	1.5typ



Built-in Avalanche Diode for Surge Absorbing Darlington

2SD1796



Silicon NPN Triple Diffused Planar Transistor

Application : Driver for Solenoid, Relay and Motor and General Purpose

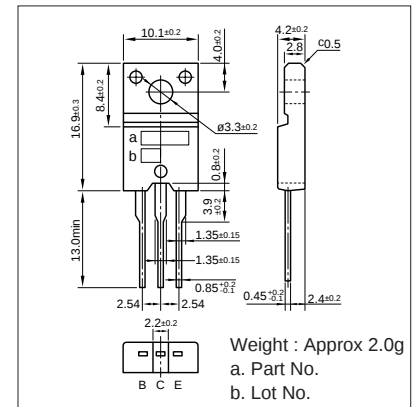
■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	60±10	V
V _{CEO}	60±10	V
V _{EB0}	6	V
I _C	4	A
I _B	0.5	A
P _C	25(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

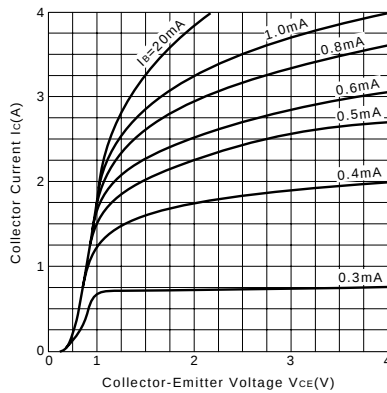
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =50V	10max	μA
I _{EBO}	V _{EB} =6V	10max	mA
V _{(BR)CEO}	I _C =10mA	60±10	V
h _{FE}	V _{CE} =4V, I _C =3A	2000min	
V _{CE(sat)}	I _C =3A, I _B =10mA	1.5max	V
f _T	V _{CE} =12V, I _E =-0.2A	60typ	MHz
COB	V _{CB} =10V, f=1MHz	45 typ	pF

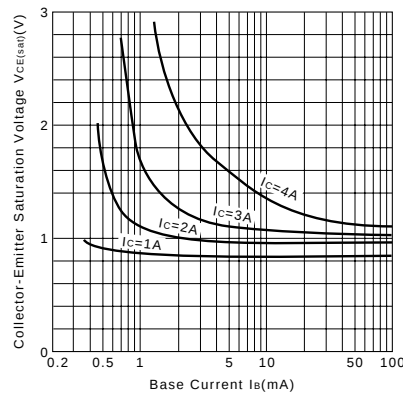
External Dimensions FM20(TO220F)



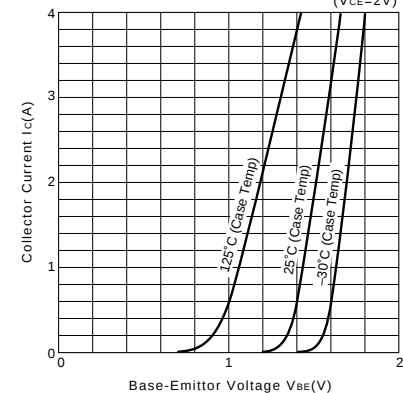
I_C-V_{CE} Characteristics (Typical)



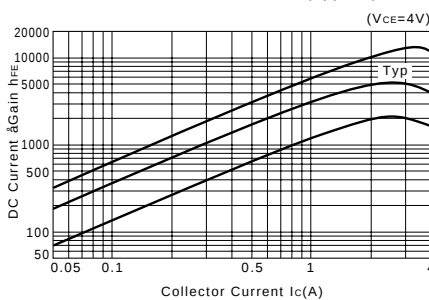
V_{CE(sat)}-I_B Characteristics (Typical)



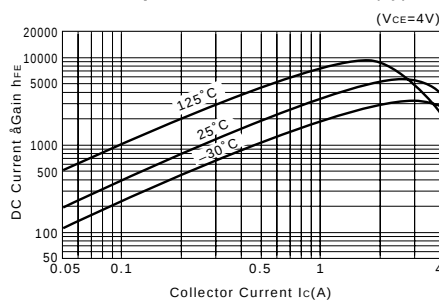
I_C-V_{BE} Temperature Characteristics (Typical)



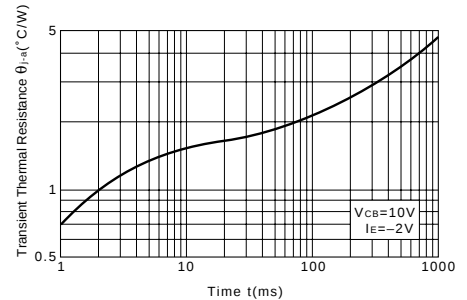
h_{FE}-I_C Characteristics (Typical)



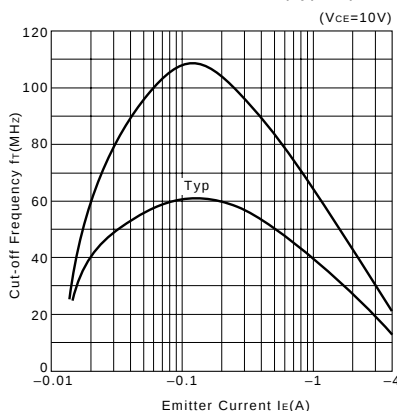
h_{FE}-I_C Temperature Characteristics (Typical)



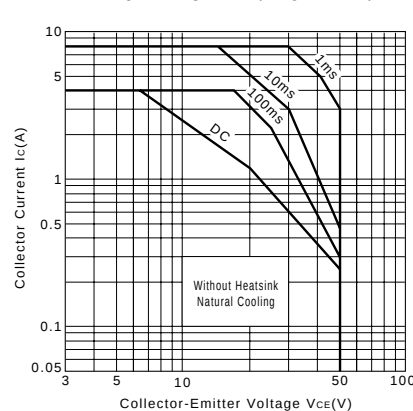
θ_{JA}-t Characteristics



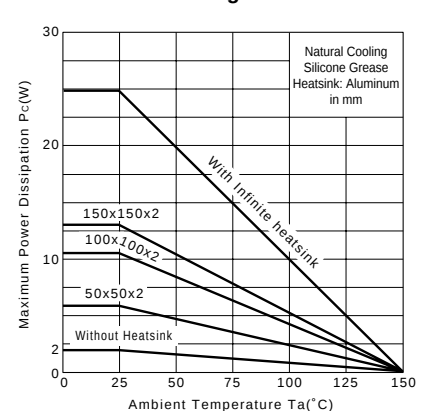
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

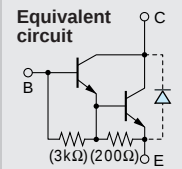


P_C-T_a Derating



Darlington

2SD2014



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1257)

Application : Driver for Solenoid, Relay and Motor, Series Regulator, and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CE0}	80	V
V _{EB0}	6	V
I _C	4	A
I _B	0.5	A
P _C	25(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

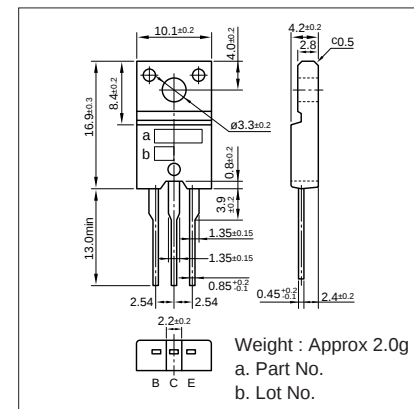
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	mA
V _{(BR)CEO}	I _C =10mA	80min	V
h _{FE}	V _{CE} =2V, I _C =3A	2000min	
V _{CE(sat)}	I _C =3A, I _B =3mA	1.5max	V
V _{BE(sat)}	I _C =3A, I _B =3mA	2.0max	V
f _r	V _{CE} =12V, I _E =-0.1A	75typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	45typ	pF

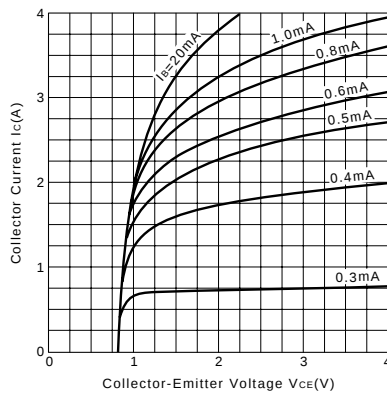
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-5	10	-10	1.0typ	4.0typ	1.5typ

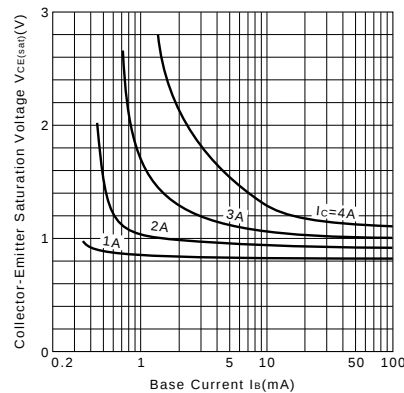
External Dimensions FM20(TO220F)



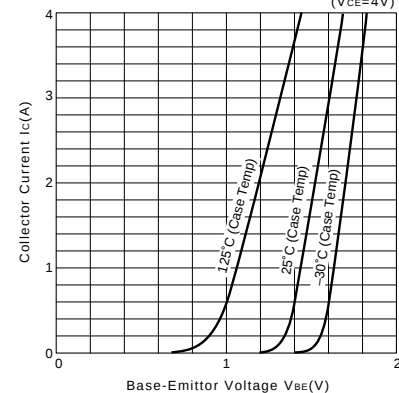
I_C-V_{CE} Characteristics (Typical)



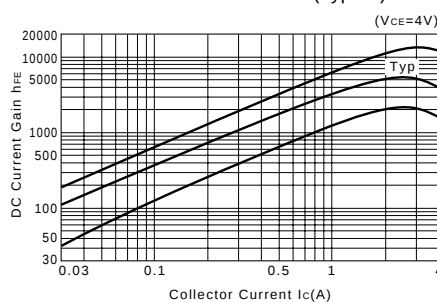
V_{CE(sat)}-I_B Characteristics (Typical)



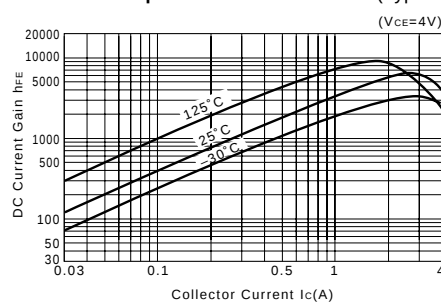
I_C-V_{BE} Temperature Characteristics (Typical)



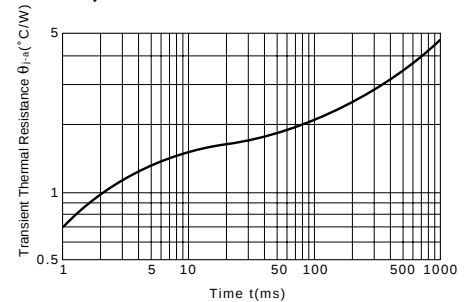
h_{FE}-I_C Characteristics (Typical)



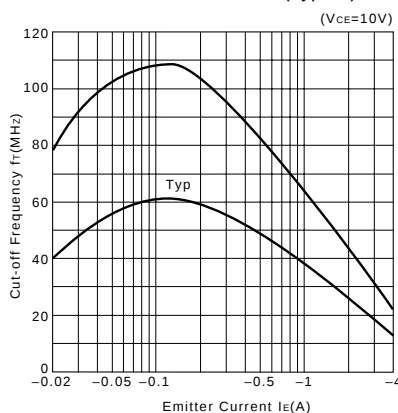
h_{FE}-I_C Temperature Characteristics (Typical)



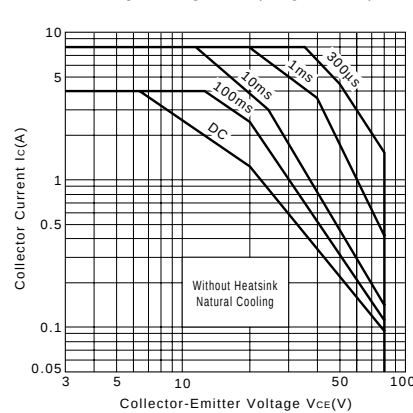
θ_{j-a}-t Characteristics



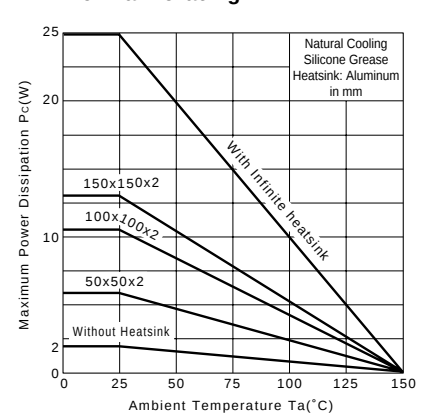
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

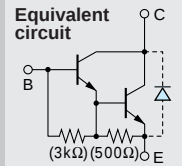


P_C-T_a Derating



Darlington

2SD2015



Silicon NPN Triple Diffused Planar Transistor

Application : Driver for Solenoid, Relay and Motor and General Purpose

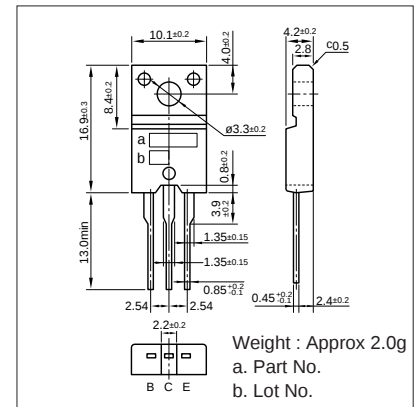
■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	150	V
VCEO	120	V
VEBO	6	V
IC	4	A
IB	0.5	A
PC	25(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
ICBO	V _{CB} =150V	10max	μA
IEBO	V _{EB} =6V	10max	mA
V(BR)CEO	I _C =10mA	120min	V
h _{FE}	V _{CE} =2V, I _C =2A	2000min	
V _{CE(sat)}	I _C =2A, I _B =2mA	1.5max	V
V _{BE(sat)}	I _C =2A, I _B =2mA	2.0max	V
f _r	V _{CE} =12V, I _E =-0.1A	40typ	MHz
COB	V _{CB} =10V, f=1MHz	40typ	pF

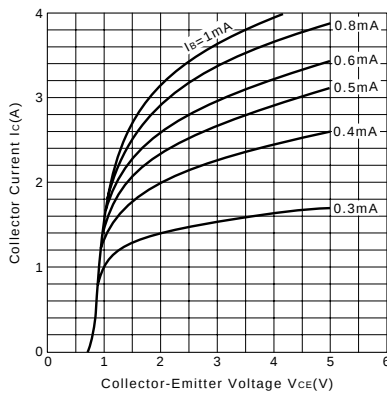
External Dimensions FM20(TO220F)



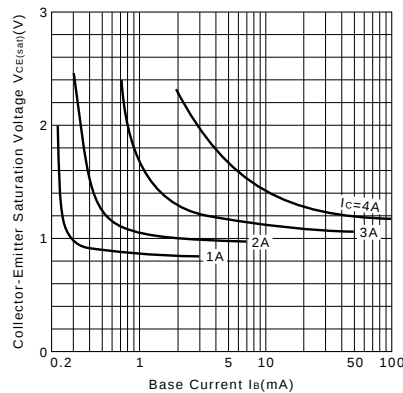
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	20	2	10	-5	10	-10	0.6typ	5.0typ	2.0typ

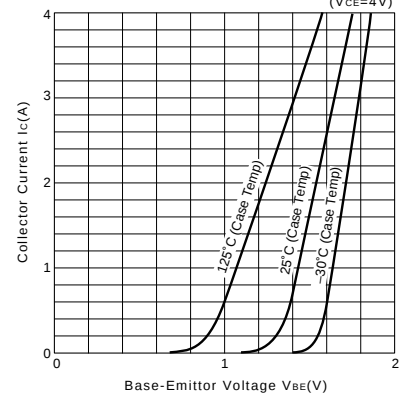
I_C-V_{CE} Characteristics (Typical)



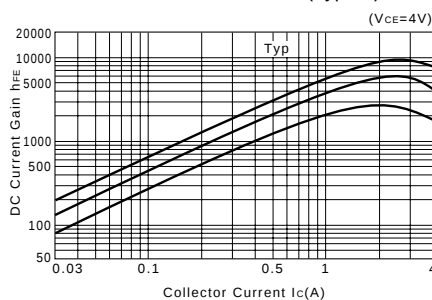
V_{CE(sat)}-I_B Characteristics (Typical)



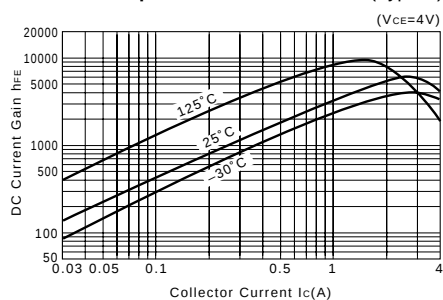
I_C-V_{BE} Temperature Characteristics (Typical)



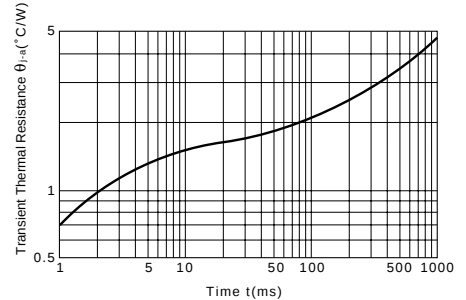
h_{FE}-I_C Characteristics (Typical)



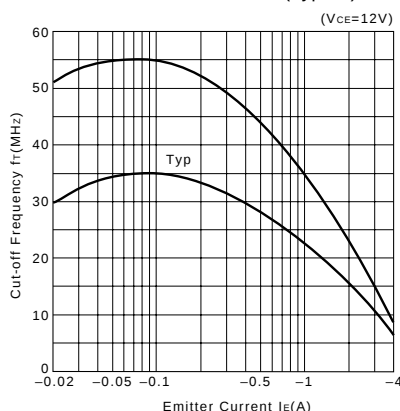
h_{FE}-I_C Temperature Characteristics (Typical)



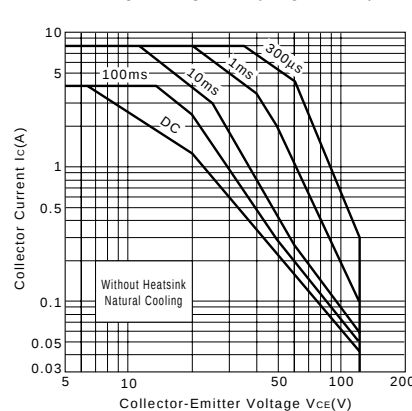
θ_{JA}-t Characteristics



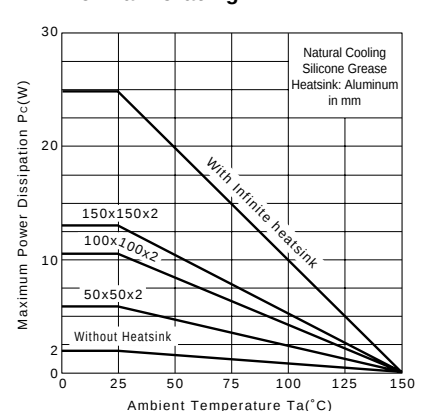
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

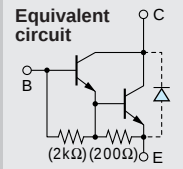


P_C-T_a Derating



Darlington

2SD2016



Silicon NPN Triple Diffused Planar Transistor

Application : Igniter, Relay and General Purpose

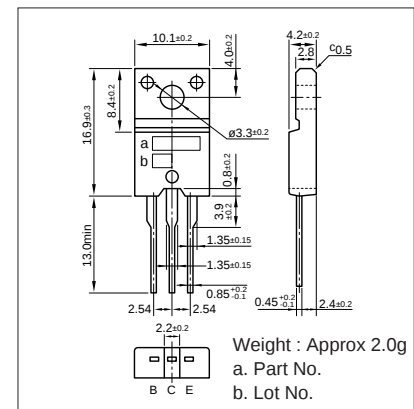
■ **Absolute maximum ratings** ($T_a=25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CB0}	200	V
V_{CE0}	200	V
V_{EB0}	6	V
I_C	3	A
I_B	0.5	A
P_C	25 ($T_c=25^\circ\text{C}$)	W
T_j	150	$^\circ\text{C}$
T_{stg}	-55 to +150	$^\circ\text{C}$

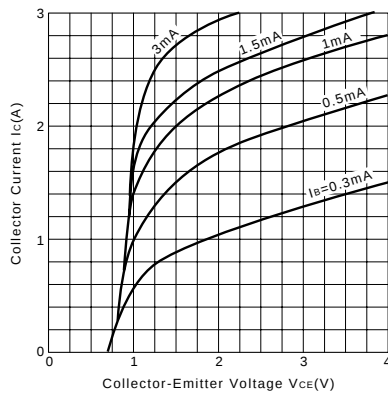
■ **Electrical Characteristics** ($T_a=25^\circ\text{C}$)

Symbol	Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=200\text{V}$	10max	μA
I_{EBO}	$V_{EB}=6\text{V}$	10max	mA
$V_{(BR)CEO}$	$I_C=10\text{mA}$	200min	V
h_{FE}	$V_{CE}=4\text{V}, I_C=1\text{A}$	1000 to 15000	
$V_{CE(sat)}$	$I_C=1\text{A}, I_B=1.5\text{mA}$	1.5max	V
$V_{BE(sat)}$	$I_C=1\text{A}, I_B=1.5\text{mA}$	2.0max	V
f_r	$V_{CE}=12\text{V}, I_E=-0.1\text{A}$	90typ	MHz
C_{OB}	$V_{CB}=10\text{V}, f=1\text{MHz}$	40typ	pF

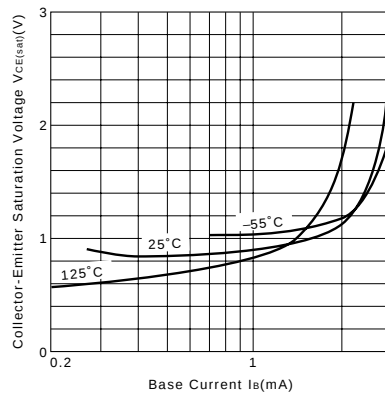
External Dimensions FM20(TO220F)



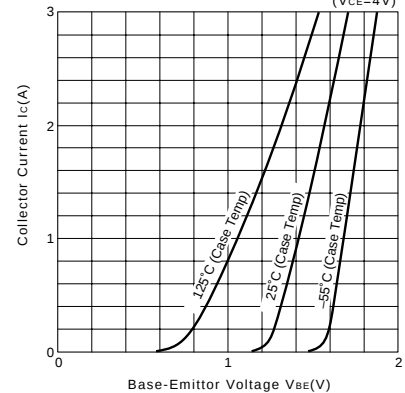
I_C-V_{CE} Characteristics (Typical)



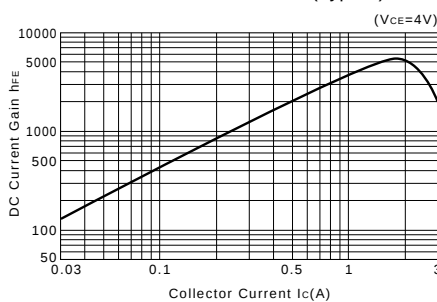
$V_{CE(sat)}-I_B$ Characteristics (Typical)



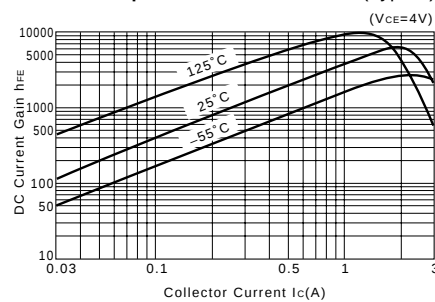
I_C-V_{BE} Temperature Characteristics (Typical)



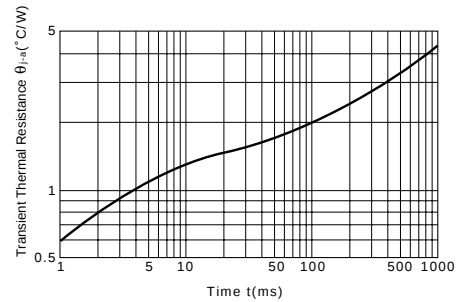
$h_{FE}-I_C$ Characteristics (Typical)



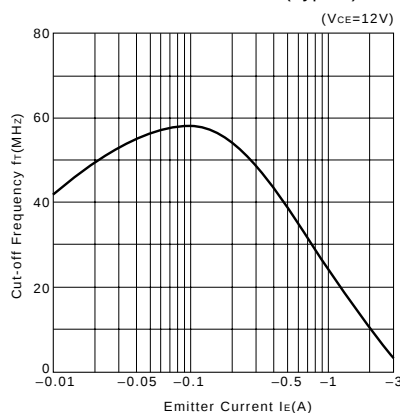
$h_{FE}-I_C$ Temperature Characteristics (Typical)



$\theta_{JA}-t$ Characteristics

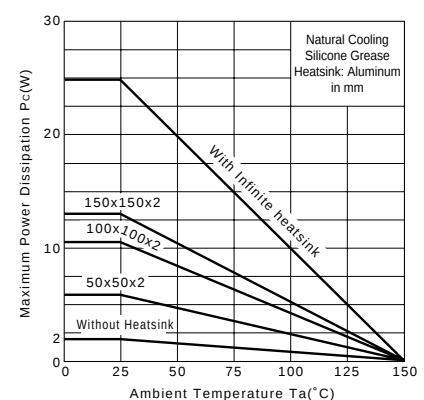


f_T-I_E Characteristics (Typical)



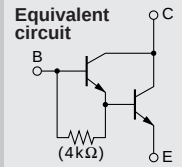
Safe Operating Area (Single Pulse)

P_C-T_a Derating



Darlington

2SD2017



Silicon NPN Triple Diffused Planar Transistor

Application : Driver for Solenoid, Relay and Motor and General Purpose

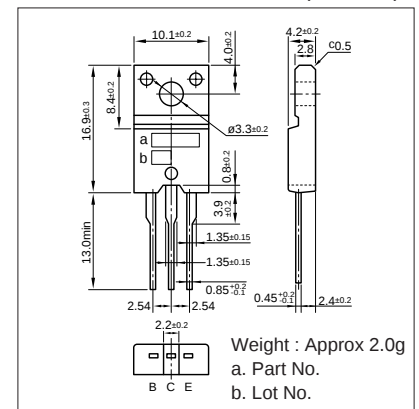
■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	300	V
V _{CE0}	250	V
V _{EB0}	20	V
I _C	6	A
I _B	1	A
P _C	35(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

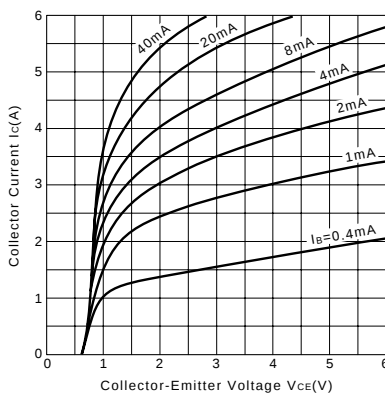
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =300V	100max	μA
I _{EB0}	V _{EB} =20V	10max	mA
V _{(BR)CEO}	I _C =25mA	250min	V
h _{FE}	V _{CE} =2V, I _C =2A	2000min	
V _{CE(sat)}	I _C =2A, I _B =2mA	1.5max	V
V _{BE(sat)}	I _C =2A, I _B =2mA	2.0max	V
f _r	V _{CE} =12V, I _E =-1A	20typ	MHz
COB	V _{CB} =10V, f=1MHz	65typ	pF

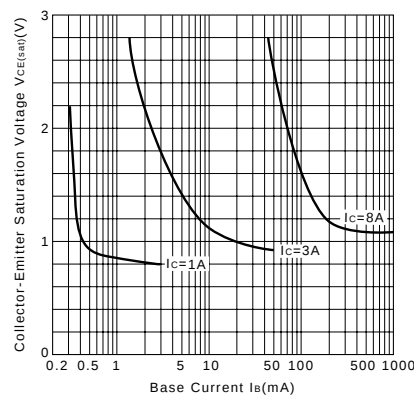
External Dimensions FM20(TO220F)



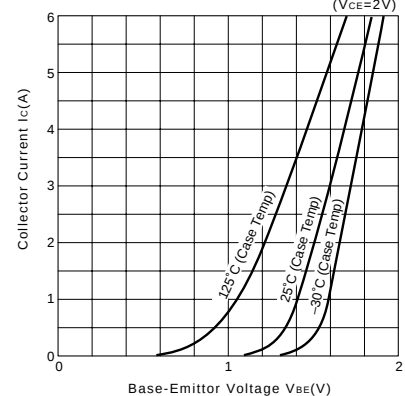
I_C-V_{CE} Characteristics (Typical)



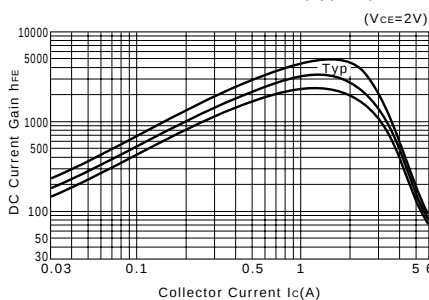
V_{CE(sat)}-I_B Characteristics (Typical)



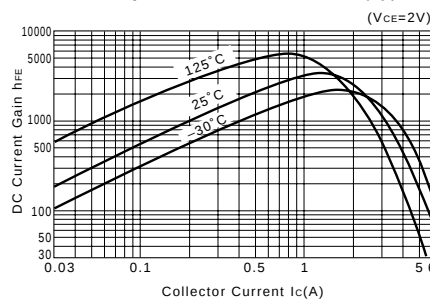
I_C-V_{BE} Temperature Characteristics (Typical)



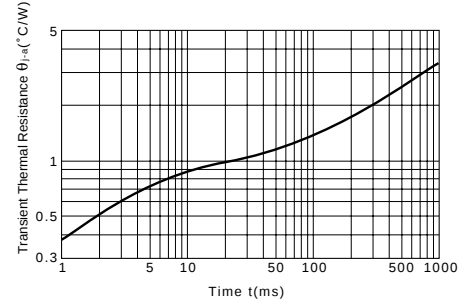
h_{FE}-I_C Characteristics (Typical)



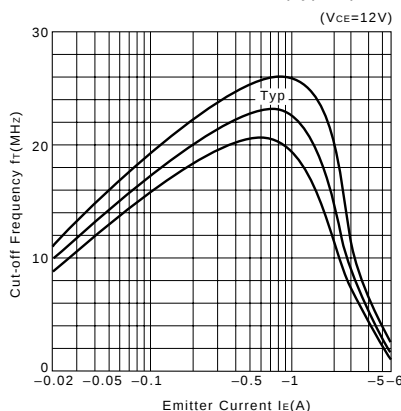
h_{FE}-I_C Temperature Characteristics (Typical)



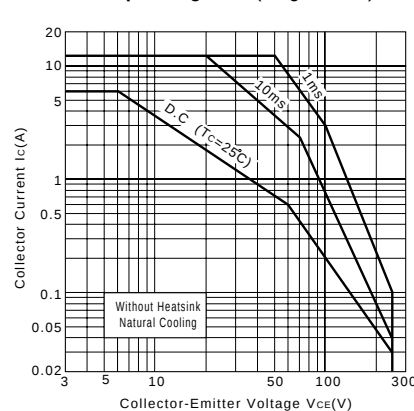
θ_{JA}-t Characteristics



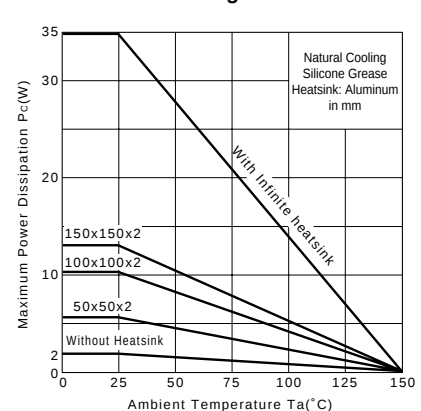
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

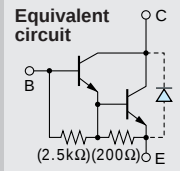


P_C-T_a Derating



Darlington

2SD2045



Silicon NPN Triple Diffused Planar Transistor

Application : Driver for Solenoid, Motor and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CEO}	120	V
•V _{EB0}	6	V
I _C	6(Pulse10)	A
I _B	1	A
P _C	50(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

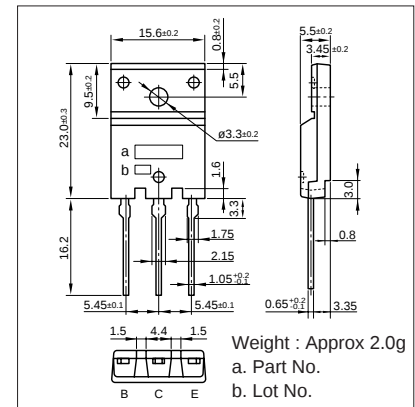
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	mA
V _{(BR)CEO}	I _C =10mA	120min	V
h _{FE}	V _{CE} =2V, I _C =3A	2000min	
V _{CE(sat)}	I _C =3A, I _B =3mA	1.5max	V
V _{BE(sat)}	I _C =3A, I _B =3mA	2.0max	V
f _r	V _{CE} =12V, I _E =-1A	50typ	MHz
COB	V _{CB} =10V, f=1MHz	70typ	pF

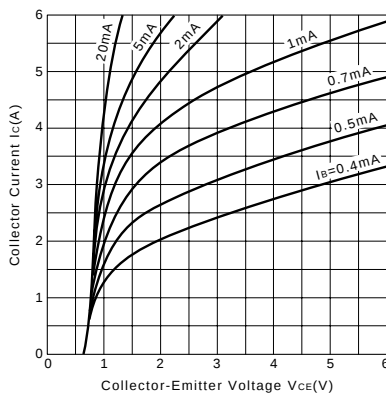
■Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	10	3	10	-5	3	-3	0.5typ	5.5typ	1.5typ

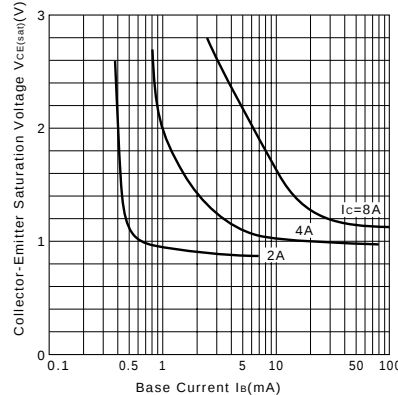
External Dimensions FM100(TO3PF)



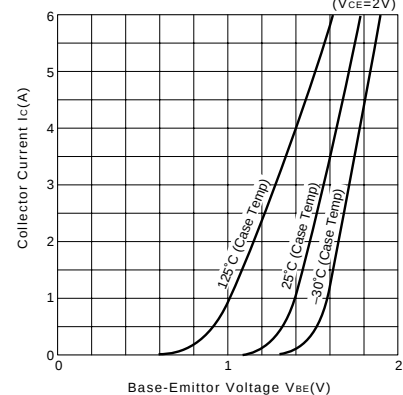
I_C-V_{CE} Characteristics (Typical)



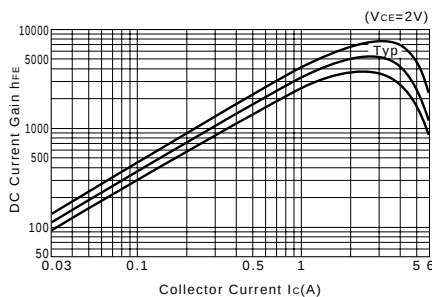
V_{CE(sat)}-I_B Characteristics (Typical)



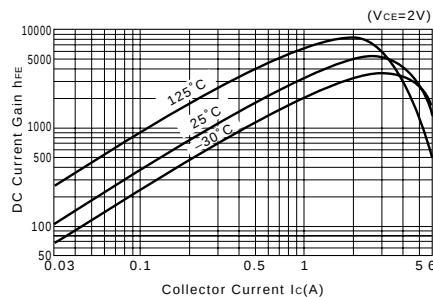
I_C-V_{BE} Temperature Characteristics (Typical)



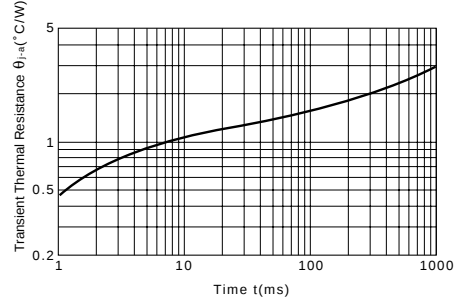
h_{FE}-I_C Characteristics (Typical)



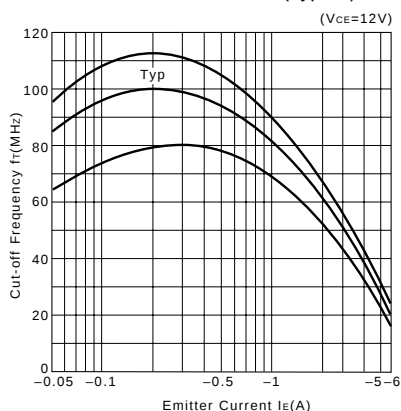
h_{FE}-I_C Temperature Characteristics (Typical)



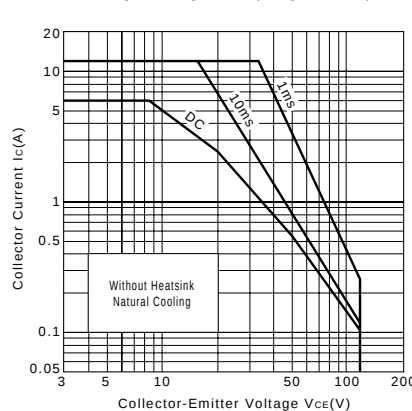
θ_{j-a}-t Characteristics



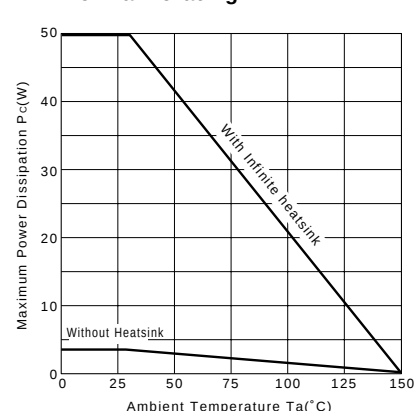
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

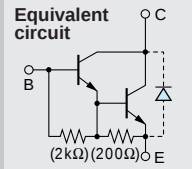


P_C-T_a Derating



Darlington

2SD2081



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1259)

Application : Driver for Solenoid, Motor and General Purpose

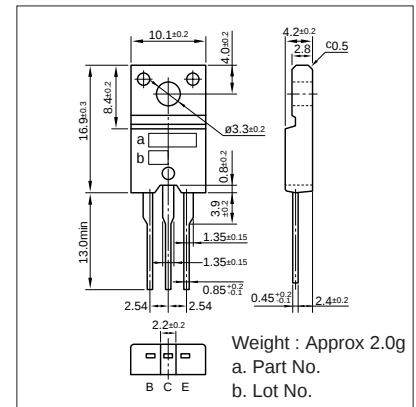
■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CEO}	120	V
V _{EB0}	6	V
I _C	10(Pulse15)	A
I _B	1	A
P _C	30(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

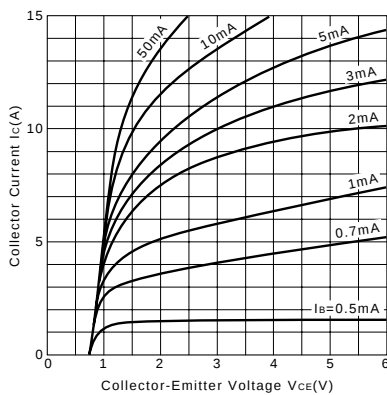
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	mA
V _{(BR)CEO}	I _C =10mA	120min	V
h _{FE}	V _{CE} =4V, I _C =5A	2000min	
V _{CE(sat)}	I _C =5A, I _B =5mA	1.5max	V
V _{BE(sat)}	I _C =5A, I _B =5mA	2.0max	V
f _r	V _{CE} =12V, I _E =-0.5A	60typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	95typ	pF

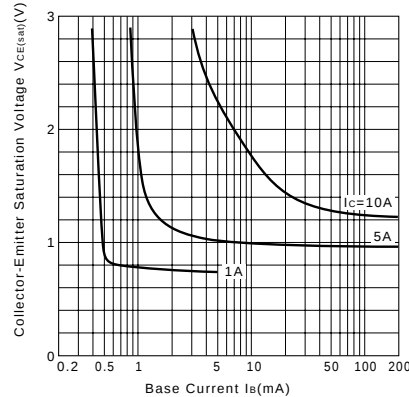
External Dimensions FM20(TO220F)



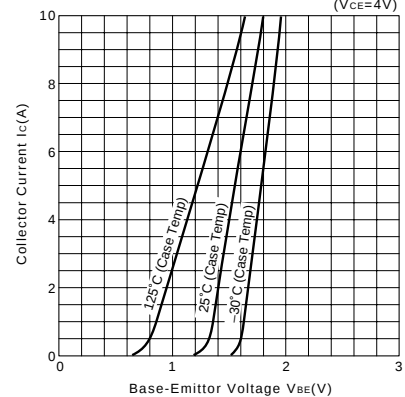
I_C-V_{CE} Characteristics (Typical)



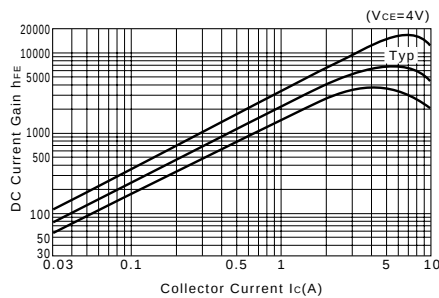
V_{CE(sat)}-I_B Characteristics (Typical)



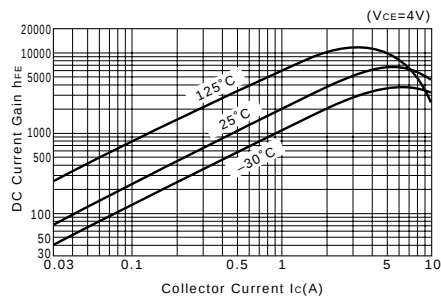
I_C-V_{BE} Temperature Characteristics (Typical)



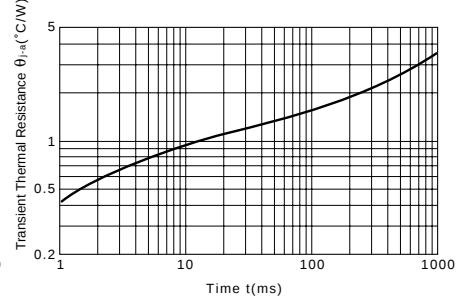
h_{FE}-I_C Characteristics (Typical)



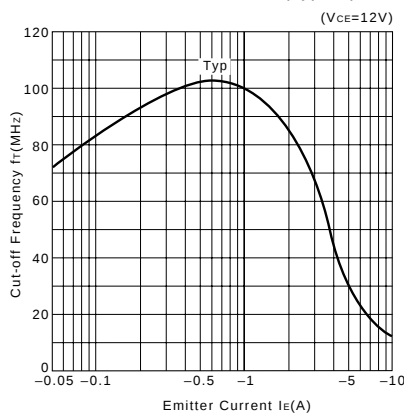
h_{FE}-I_C Temperature Characteristics (Typical)



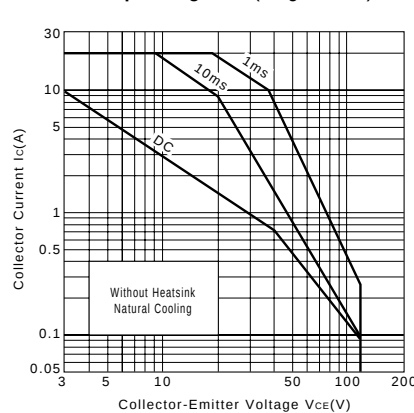
θ_{j-a}-t Characteristics



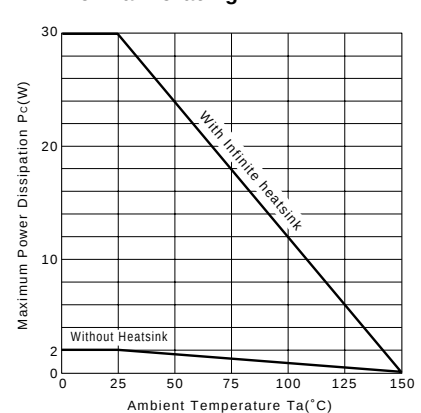
f_r-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

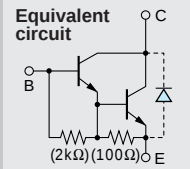


P_C-T_a Derating



Darlington

2SD2082



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1382)

Application : Driver for Solenoid, Motor and General Purpose

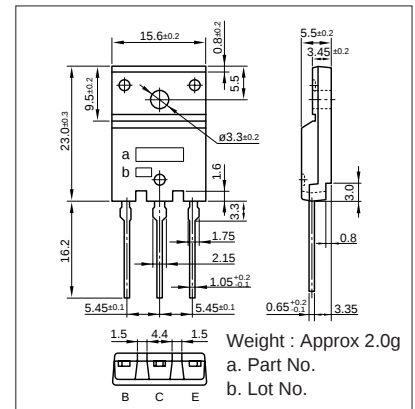
■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CE0}	120	V
V _{EB0}	6	V
I _C	16(Pulse26)	A
I _B	1	A
P _C	75(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

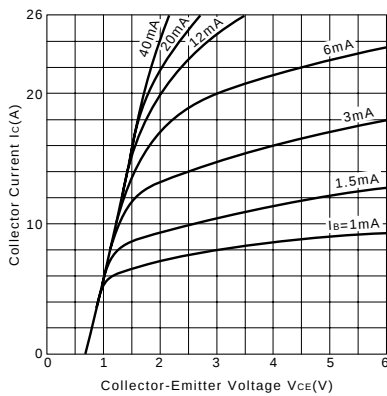
■Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	mA
V _{(BR)CEO}	I _C =10mA	120min	V
h _{FE}	V _{CE} =4V, I _C =8A	2000min	
V _{CE(sat)}	I _C =8A, I _B =16mA	1.5max	V
V _{BE(sat)}	I _C =8A, I _B =16mA	2.5max	V
f _T	V _{CE} =12V, I _E =-1A	20typ	MHz
COB	V _{CB} =10V, f=1MHz	210typ	pF

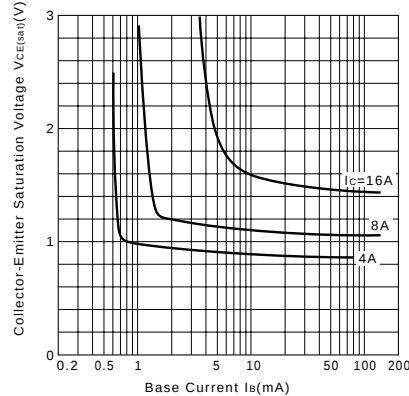
External Dimensions FM100(TO3PF)



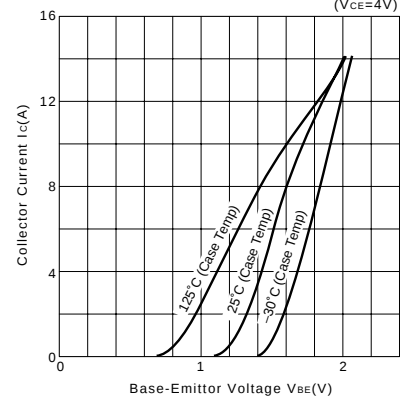
I_C-V_{CE} Characteristics (Typical)



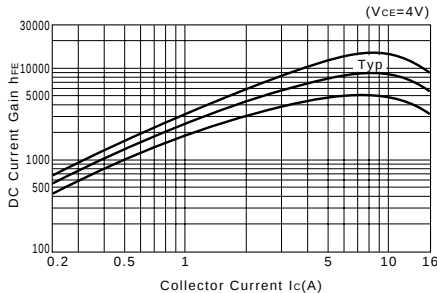
V_{CE(sat)}-I_B Characteristics (Typical)



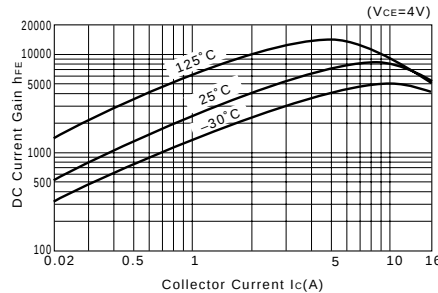
I_C-V_{BE} Temperature Characteristics (Typical)



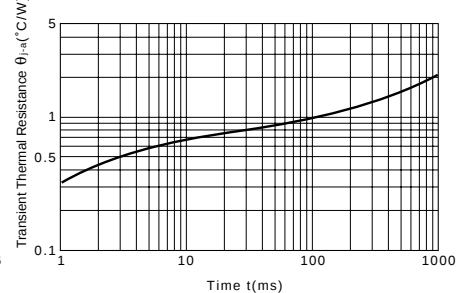
h_{FE}-I_C Characteristics (Typical)



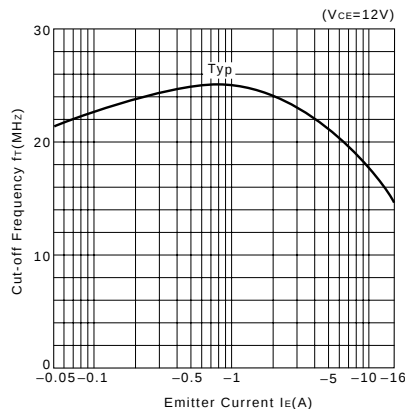
h_{FE}-I_C Temperature Characteristics (Typical)



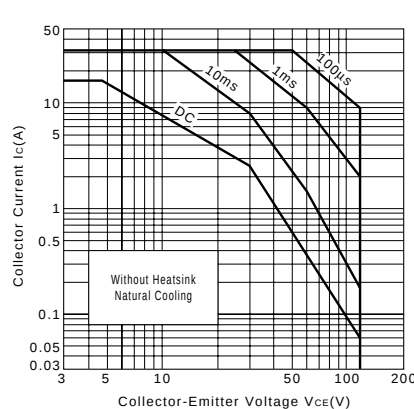
θ_{j-a}-t Characteristics



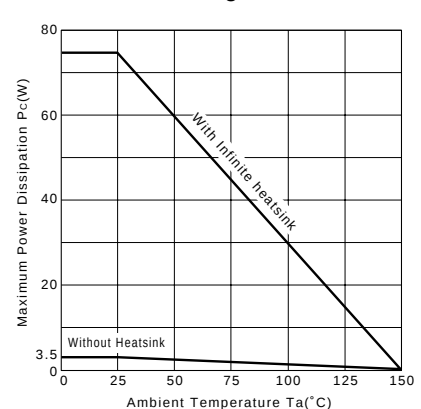
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

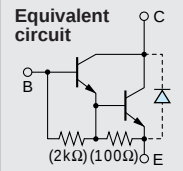


P_C-T_a Derating



Darlington

2SD2083



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1383)

Application : Driver for Solenoid, Motor and General Purpose

■ **Absolute maximum ratings** (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	120	V
V _{CE0}	120	V
V _{EB0}	6	V
I _C	25(Pulse40)	A
I _B	2	A
P _C	120(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

■ **Electrical Characteristics**

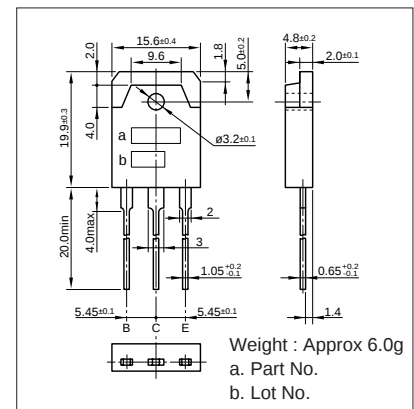
(Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =120V	10max	μA
I _{EB0}	V _{EB} =6V	10max	mA
V _{(BR)CEO}	I _C =25mA	120min	V
h _{FE}	V _{CE} =4V, I _C =12A	2000min	
V _{CE(sat)}	I _C =12A, I _B =24mA	1.8max	V
V _{BE(sat)}	I _C =12A, I _B =24mA	2.5max	V
f _r	V _{CE} =12V, I _E =-1A	20typ	MHz
COB	V _{CB} =10V, f=1MHz	340typ	pF

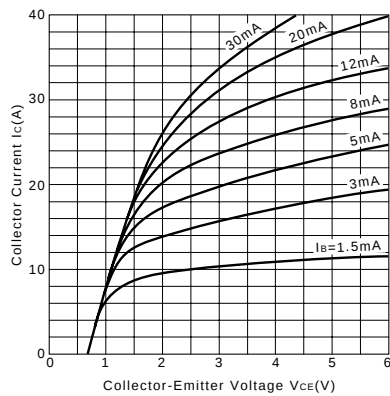
■ **Typical Switching Characteristics (Common Emitter)**

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
24	2	12	10	-5	24	-24	1.0typ	6.0typ	1.0typ

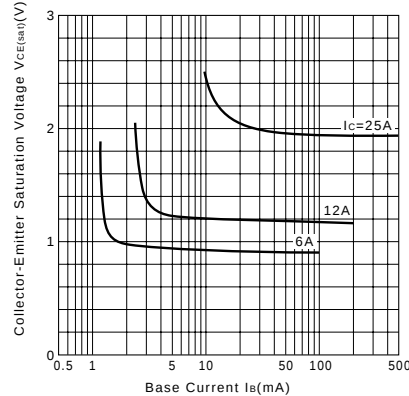
External Dimensions MT-100(TO3P)



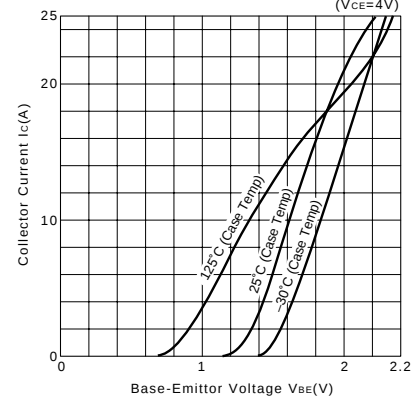
I_C-V_{CE} Characteristics (Typical)



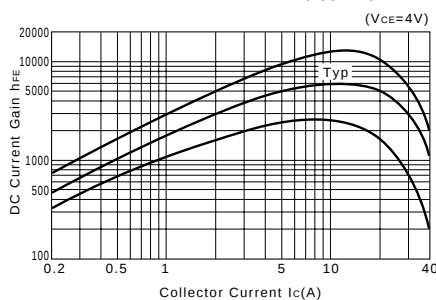
V_{CE(sat)}-I_B Characteristics (Typical)



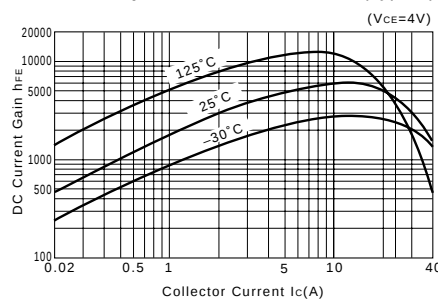
I_C-V_{BE} Temperature Characteristics (Typical)



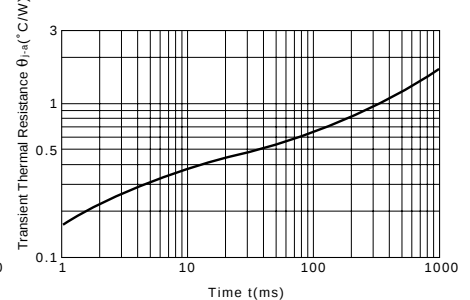
h_{FE}-I_C Characteristics (Typical)



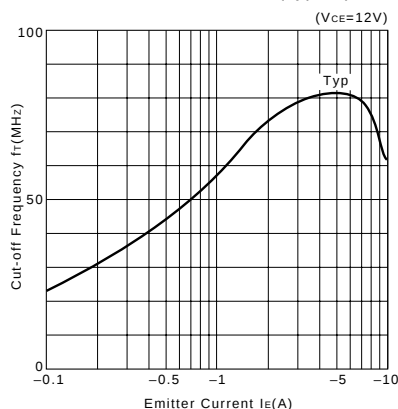
h_{FE}-I_C Temperature Characteristics (Typical)



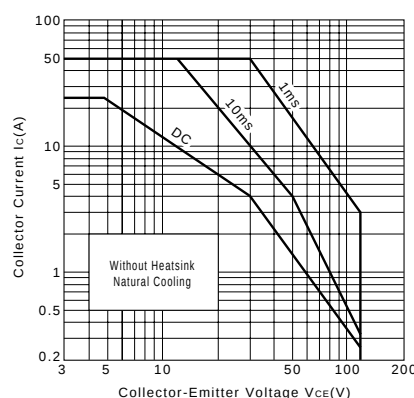
θ_{J-a}-t Characteristics



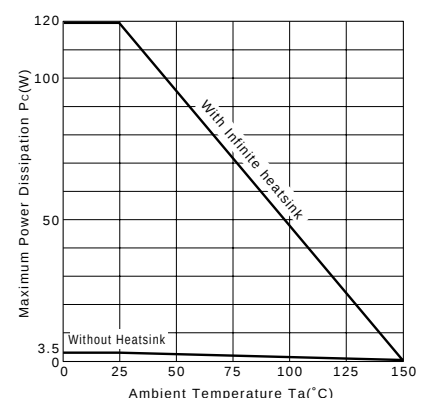
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



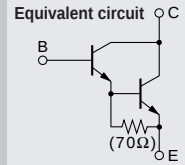
P_C-T_a Derating



2SD2141

Darlington

2SD2389



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1559)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

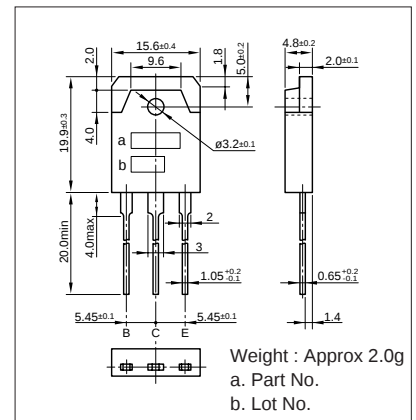
Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CE0}	150	V
V _{EB0}	5	V
I _C	8	A
I _B	1	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =160V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	150min	V
h _{FE}	V _{CE} =4V, I _C =6A	5000min*	
V _{CE(sat)}	I _C =6A, I _B =6mA	2.5max	V
V _{BE(sat)}	I _C =6A, I _B =6mA	3.0max	V
f _r	V _{CE} =12V, I _E =-1A	80typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	85typ	pF

*h_{FE} Rank: O(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

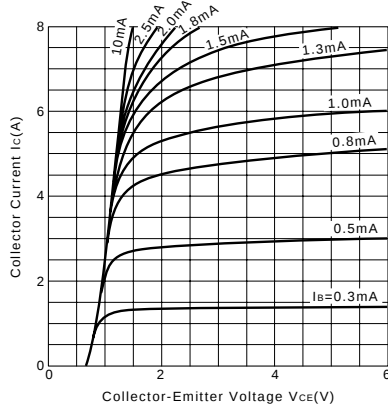
External Dimensions MT-100(TO3P)



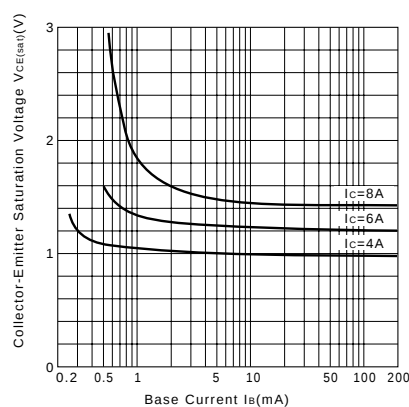
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	10	6	10	-5	6	-6	0.6typ	10.0typ	0.9typ

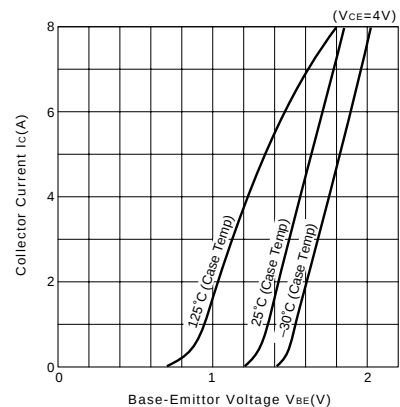
I_C-V_{CE} Characteristics (Typical)



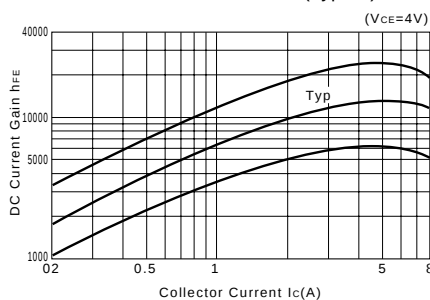
V_{CE(sat)}-I_B Characteristics (Typical)



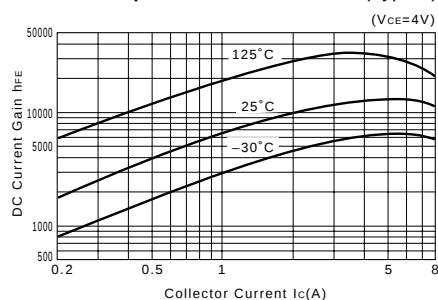
I_C-V_{BE} Temperature Characteristics (Typical)



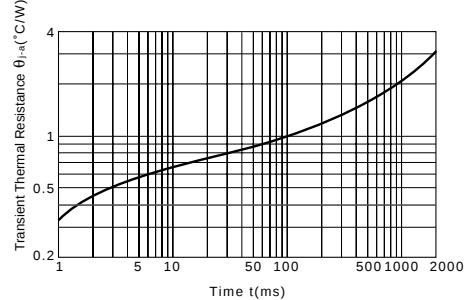
h_{FE}-I_C Characteristics (Typical)



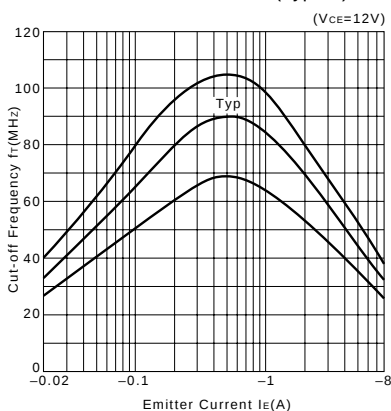
h_{FE}-I_C Temperature Characteristics (Typical)



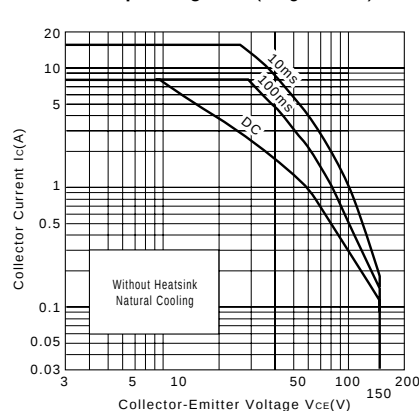
θ_{j-a}-t Characteristics



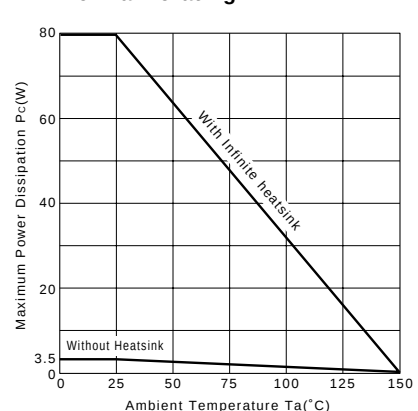
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

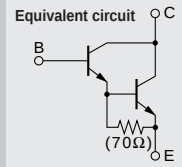


P_C-T_a Derating



Darlington

2SD2390



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1560)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CEO}	150	V
V _{EB0}	5	V
I _C	10	A
I _B	1	A
P _C	100(T _C =25°C)	W
T _J	150	°C
Tstg	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

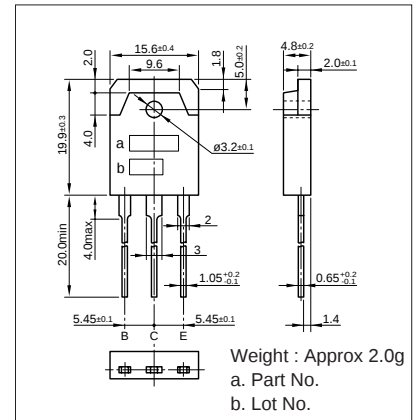
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =160V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	150min	V
h _{FE}	V _{CE} =4V, I _C =7A	5000min*	
V _{CE(sat)}	I _C =7A, I _B =7mA	2.5max	V
V _{BE(sat)}	I _C =7A, I _B =7mA	3.0max	V
f _r	V _{CE} =12V, I _E =-2A	55typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	95typ	pF

*h_{FE} Rank O(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

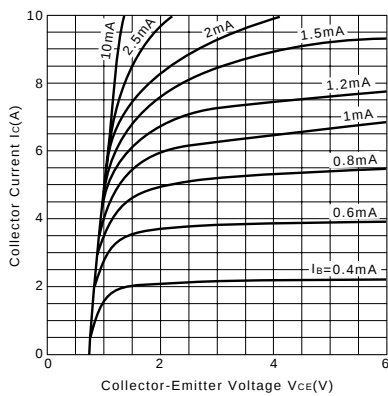
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
70	10	7	10	-5	7	-7	0.5typ	10.0typ	1.1typ

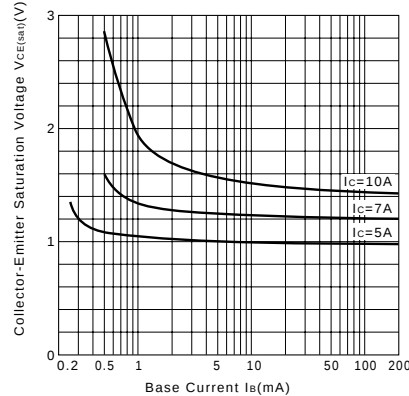
External Dimensions MT-100(TO3P)



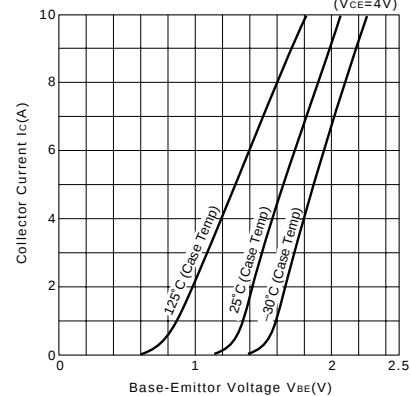
I_C-V_{CE} Characteristics (Typical)



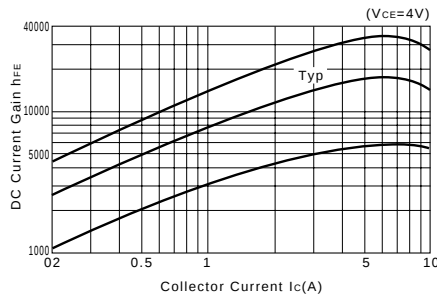
V_{CE(sat)}-I_B Characteristics (Typical)



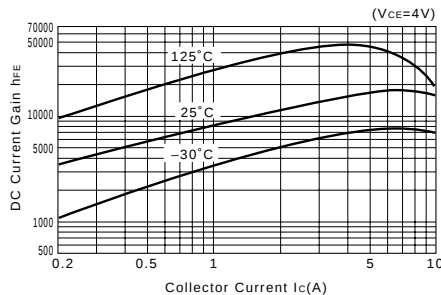
I_C-V_{BE} Temperature Characteristics (Typical)



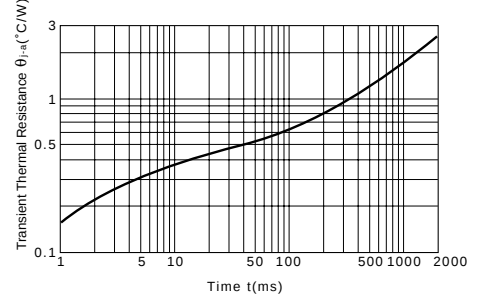
h_{FE}-I_C Characteristics (Typical)



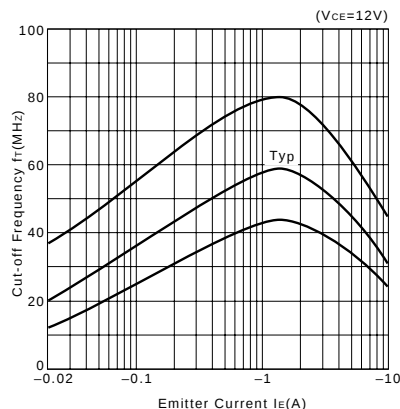
h_{FE}-I_C Temperature Characteristics (Typical)



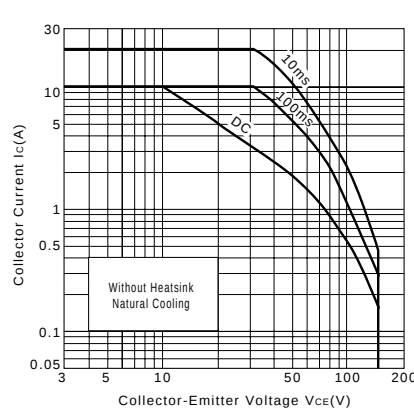
θ_{j-a}-t Characteristics



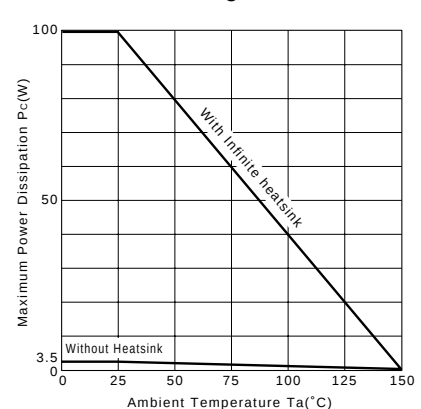
f_T-I_E Characteristics (Typical)



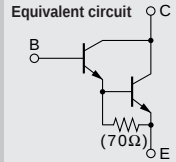
Safe Operating Area (Single Pulse)



P_C-T_a Derating



Darlington



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1570)

Application : Audio, Series Regulator and General Purpose

■Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CBO}	160	V
V _{CEO}	150	V
V _{EBO}	5	V
I _C	12	A
I _B	1	A
P _C	150(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

■Electrical Characteristics (Ta=25°C)

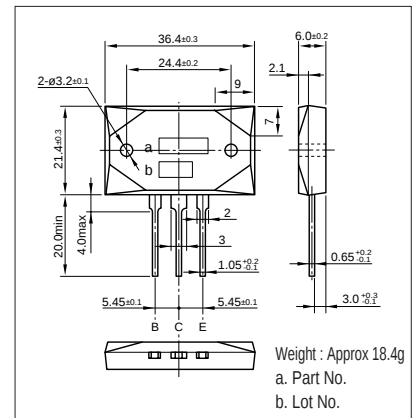
Symbol	Conditions	Ratings	Unit
ICBO	$V_{CB}=160V$	100max	μA
IEBO	$V_{EB}=5V$	100max	μA
$V_{(BR)CEO}$	$I_C=30mA$	150min	V
hFE	$V_{CE}=4V, I_C=7A$	5000min*	
$V_{CE(sat)}$	$I_C=7A, I_B=7mA$	2.5max	V
$V_{BE(sat)}$	$I_C=7A, I_B=7mA$	3.0max	V
f _T	$V_{CE}=12V, I_E=-2A$	55typ	MHz
COB	$V_{CB}=10V, f=1MHz$	95typ	pF

*h_{FE} Rank $\bar{O}$ (5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

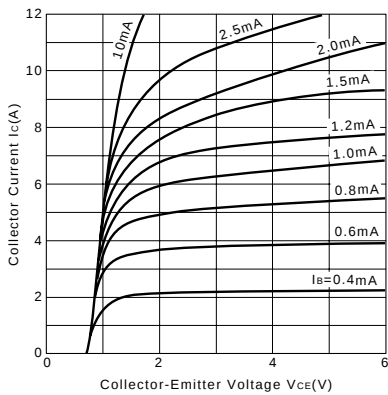
■ Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
70	10	7	10	-5	7	-7	0.5typ	10.0typ	1.1typ

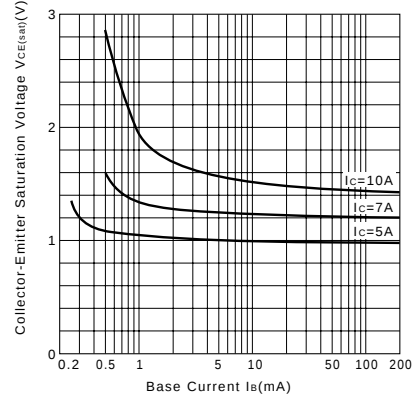
External Dimensions MT-200



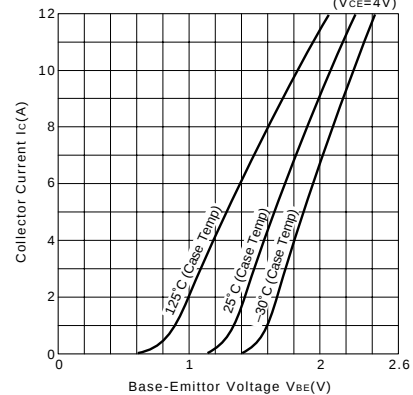
I_C - V_{CE} Characteristics (Typical)



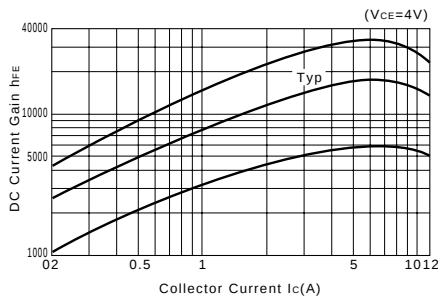
V_{CE(sat)}-I_B Characteristics (Typical)



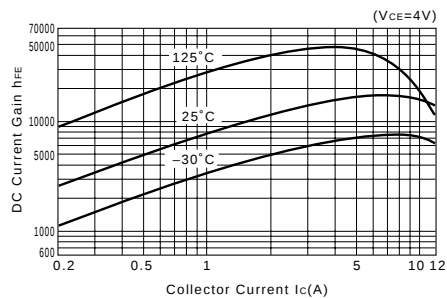
I_C-V_{BE} Temperature Characteristics (Typical)



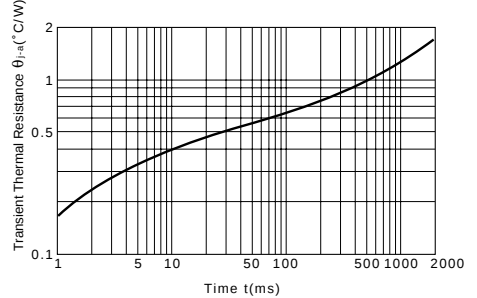
$h_{FE}-I_C$ Characteristics (Typical)



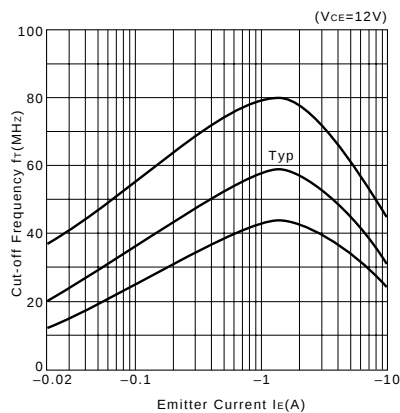
h_{FE} - I_C Temperature Characteristics (Typical)



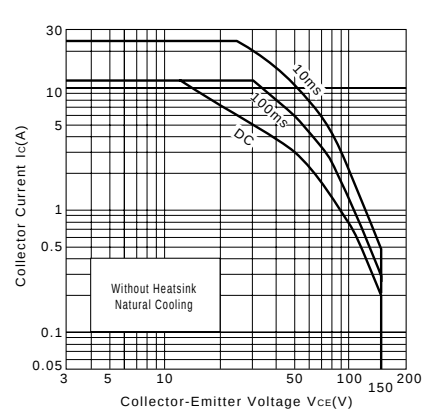
θ_{j-a-t} Characteristics



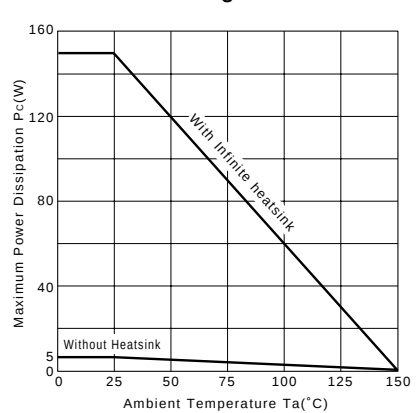
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

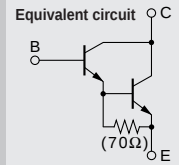


Pc-Ta Derating



Darlington

2SD2438



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1587)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

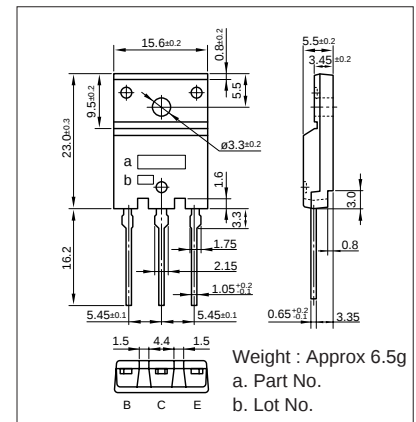
Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CE0}	150	V
V _{EB0}	5	V
I _C	8	A
I _B	1	A
P _C	75(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =160V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	150min	V
h _{FE}	V _{CE} =4V, I _C =6A	5000min*	
V _{CE(sat)}	I _C =6A, I _B =6mA	2.5max	V
V _{BE(sat)}	I _C =6A, I _B =6mA	3.0max	V
f _r	V _{CE} =12V, I _E =-1A	80typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	85typ	pF

*h_{FE} Rank Q(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

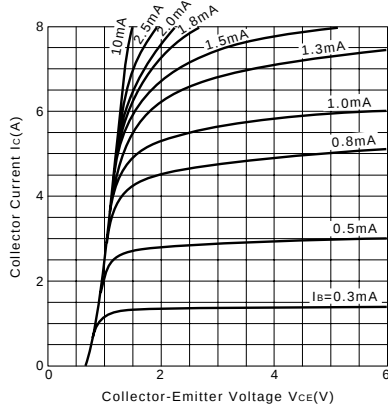
External Dimensions FM100(TO3PF)



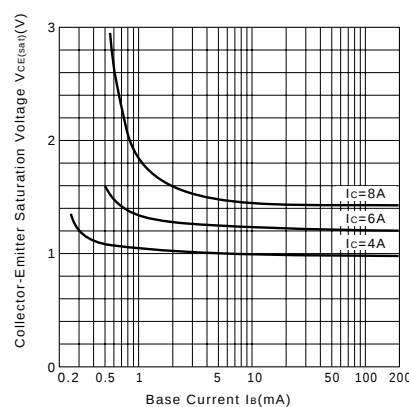
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
60	10	6	10	-2	6	-6	0.6typ	10.0typ	0.9typ

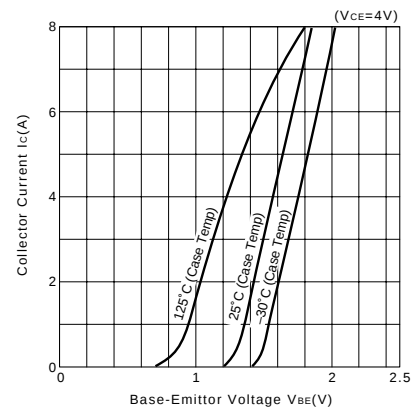
I_C-V_{CE} Characteristics (Typical)



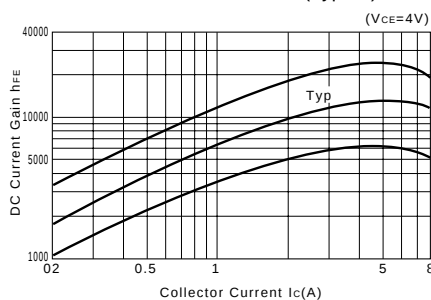
V_{CE(sat)}-I_B Characteristics (Typical)



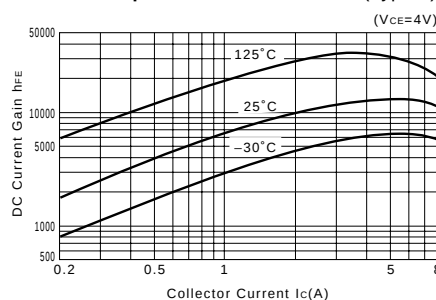
I_C-V_{BE} Temperature Characteristics (Typical)



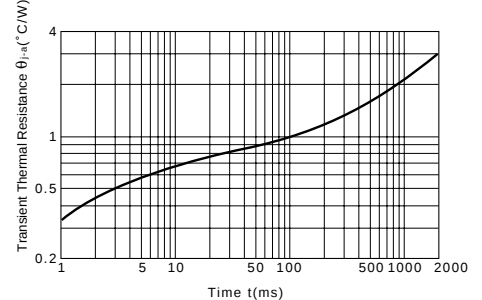
h_{FE}-I_C Characteristics (Typical)



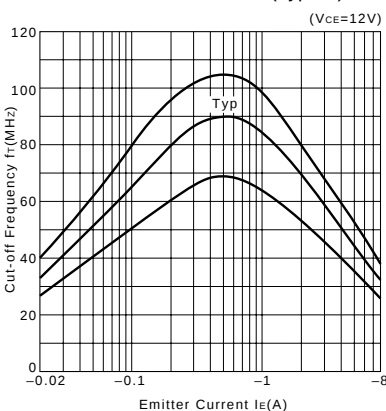
h_{FE}-I_C Temperature Characteristics (Typical)



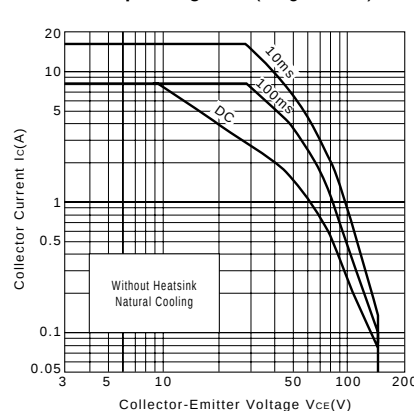
θ_{j-a}-t Characteristics



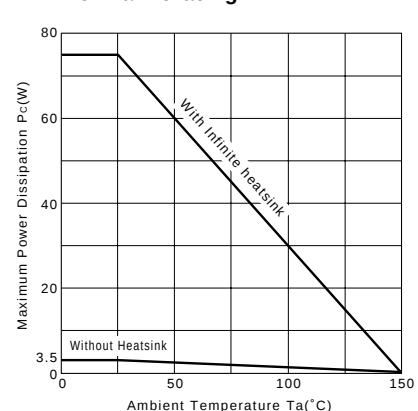
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

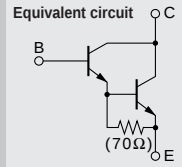


P_C-T_a Derating



Darlington

2SD2439



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1588)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CE0}	150	V
V _{EB0}	5	V
I _C	10	A
I _B	1	A
P _C	80(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

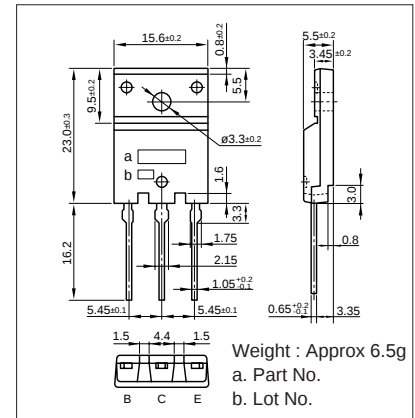
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =160V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	150min	V
h _{FE}	V _{CE} =4V, I _C =7A	5000min*	
V _{CE(sat)}	I _C =7A, I _B =7mA	2.5max	V
V _{BE(sat)}	I _C =7A, I _B =7mA	3.0max	V
f _r	V _{CE} =12V, I _E =-2A	55typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	95typ	pF

*h_{FE} Rank Q(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

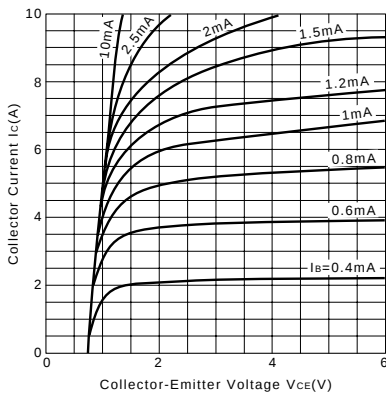
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
70	10	7	10	-5	7	-7	0.5typ	10.0typ	1.1typ

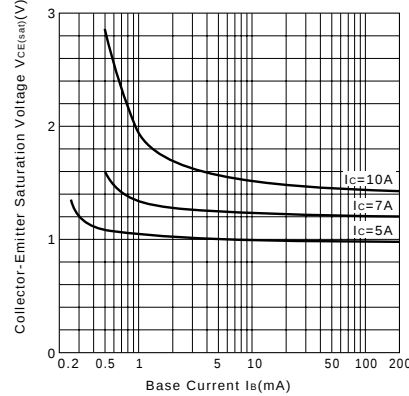
External Dimensions FM100(TO3PF)



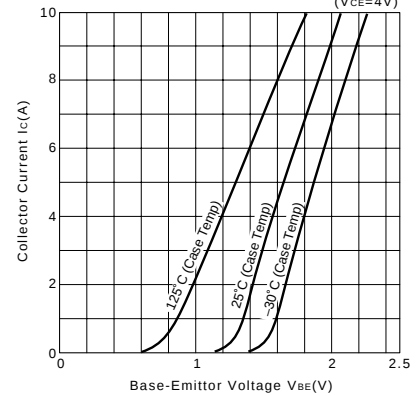
I_C-V_{CE} Characteristics (Typical)



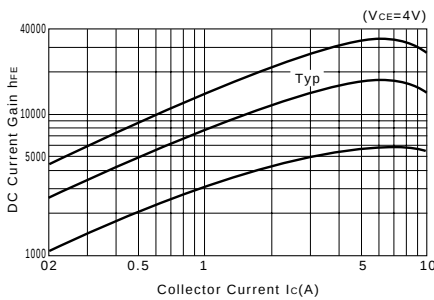
V_{CE(sat)}-I_B Characteristics (Typical)



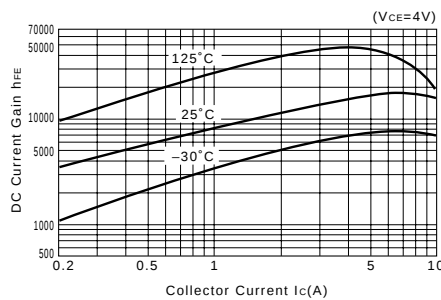
I_C-V_{BE} Temperature Characteristics (Typical)



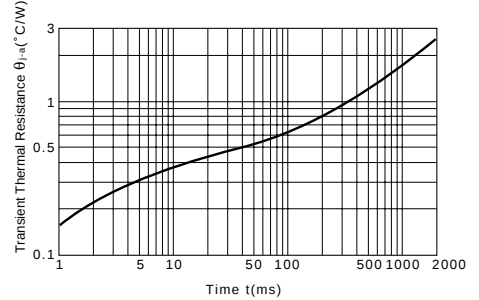
h_{FE}-I_C Characteristics (Typical)



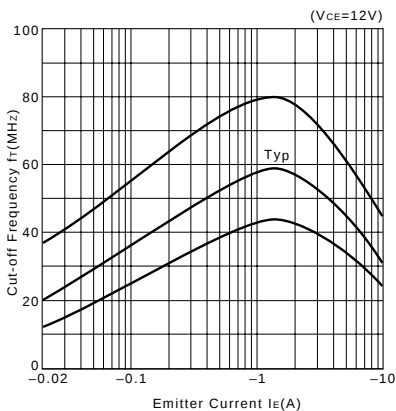
h_{FE}-I_C Temperature Characteristics (Typical)



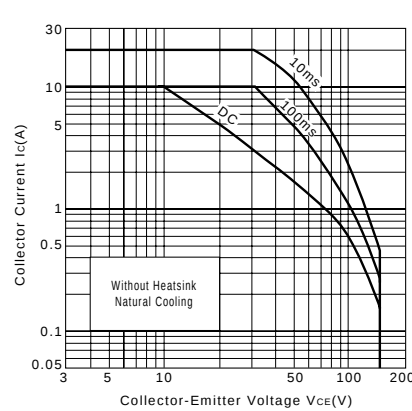
θ_{j-a}-t Characteristics



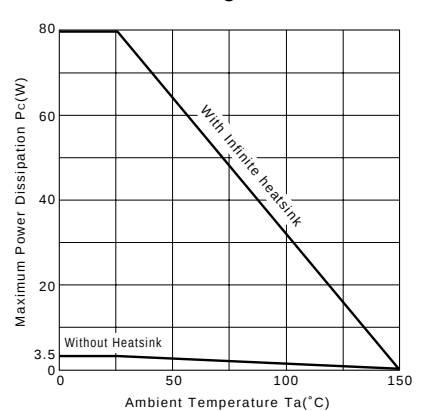
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

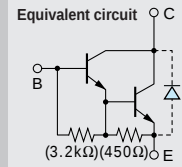


P_C-T_a Derating



Darlington

2SD2557



Silicon NPN Triple Diffused Planar Transistor

Application : Series Regulator and General Purpose

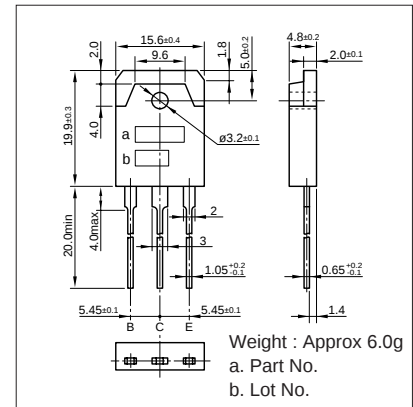
■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CE0}	200	V
V _{EB0}	6	V
I _C	5	A
I _B	2	A
P _C	70(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

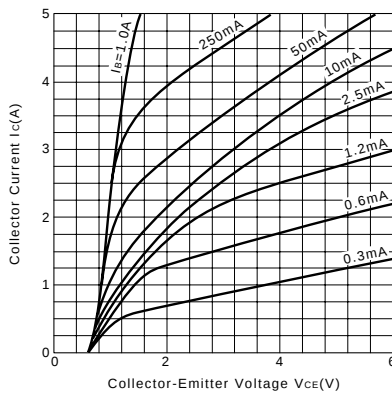
■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =200V	100max	μA
I _{EBO}	V _{EB} =6V	5max	mA
V _{(BR)CEO}	I _C =10mA	200min	V
h _{FE}	V _{CE} =5V, I _C =1A	1500 to 6500	
V _{CE(sat)}	I _C =1A, I _B =5mA	1.5max	V
f _r	V _{CE} =10V, I _E =-0.5A	15typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	110typ	pF

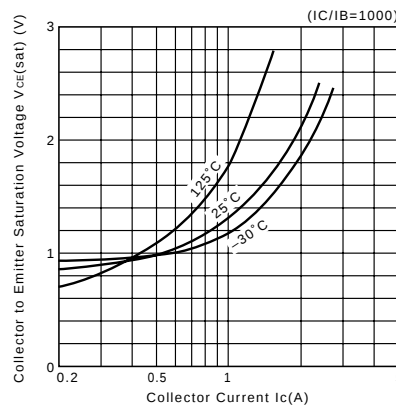
External Dimensions MT-100(TO3P)



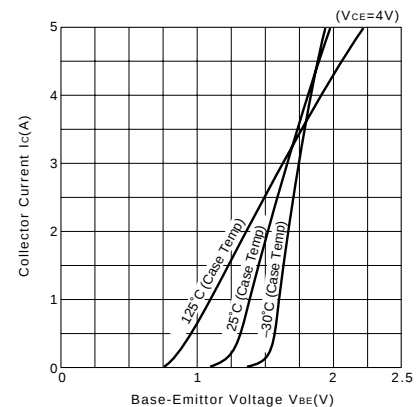
I_C-V_{CE} Characteristics (Typical)



V_{CE(sat)}-I_C Temperature Characteristics (Typical)

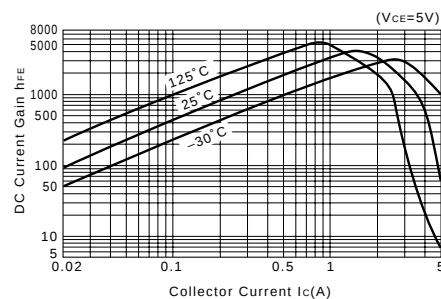


I_C-V_{BE} Temperature Characteristics (Typical)

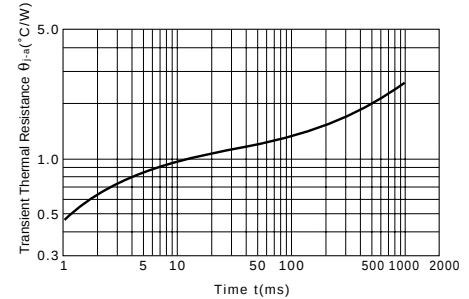


h_{FE}-I_C Characteristics (Typical)

h_{FE}-I_C Temperature Characteristics (Typical)

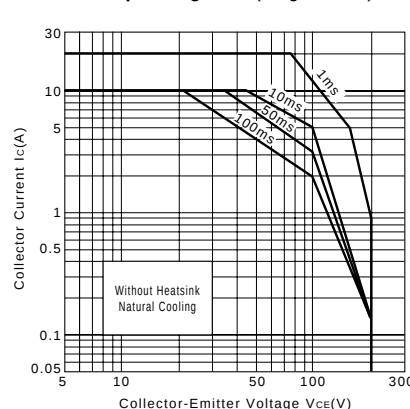


θ_{j-a}-t Characteristics

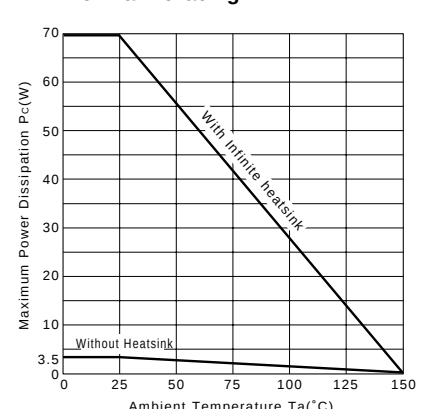


f_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

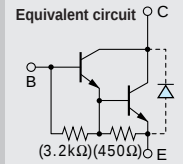


P_C-T_a Derating



Darlington

2SD2558



Silicon NPN Triple Diffused Planar Transistor

Application : Series Regulator and General Purpose

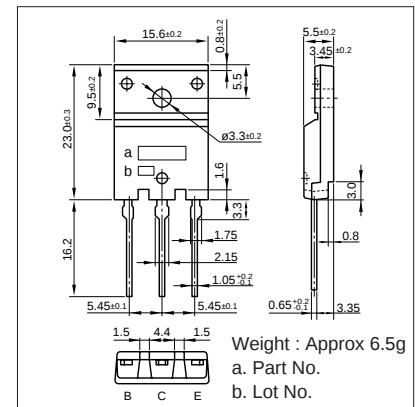
■ Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	200	V
V _{CE0}	200	V
V _{EB0}	6	V
I _C	5	A
I _B	2	A
P _C	60(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

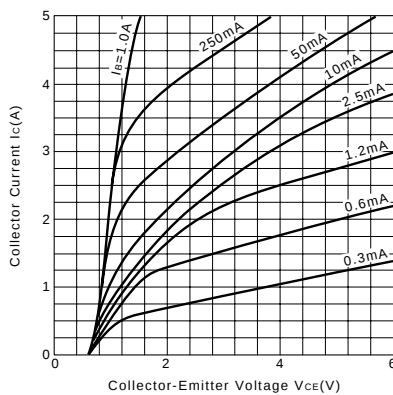
■ Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =200V	100max	μA
I _{EB0}	V _{EB} =6V	5max	mA
V _{(BR)CEO}	I _C =10mA	200min	V
h _{FE}	V _{CE} =5V, I _C =1A	1500 to 6500	
V _{CE(sat)}	I _C =1A, I _B =5mA	1.5max	V
f _T	V _{CE} =10V, I _E =-0.5A	15typ	MHz
COB	V _{CB} =10V, f=1MHz	110typ	pF

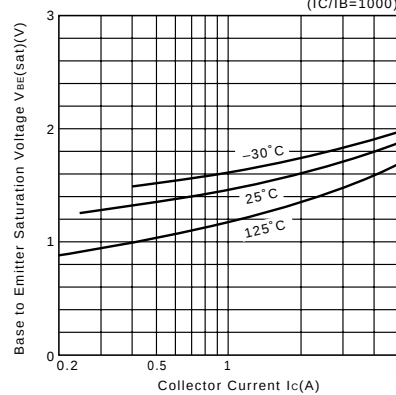
External Dimensions FM100(TO3PF)



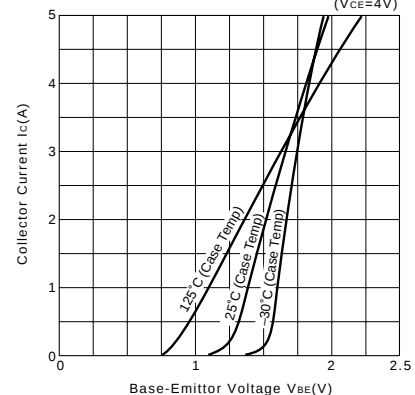
I_C-V_{CE} Characteristics (Typical)



V_{BE(sat)}-I_C Temperature Characteristics (Typical)

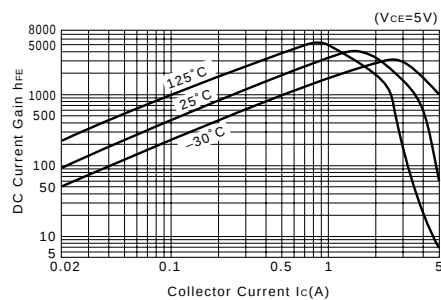


I_C-V_{BE} Temperature Characteristics (Typical)

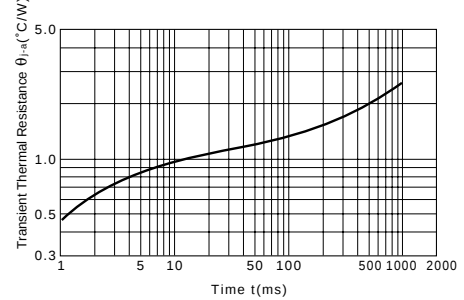


h_{FE}-I_C Characteristics (Typical)

h_{FE}-I_C Temperature Characteristics (Typical)

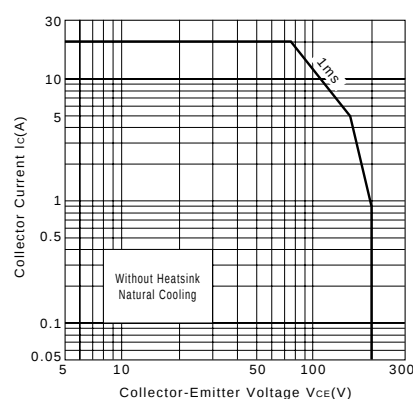


θ_{J-a}-t Characteristics

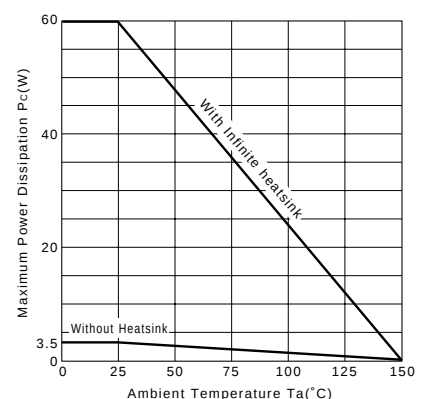


f_T-I_E Characteristics (Typical)

Safe Operating Area (Single Pulse)

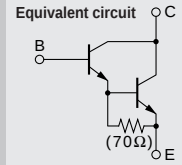


P_C-T_a Derating



Darlington

2SD2560



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1647)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

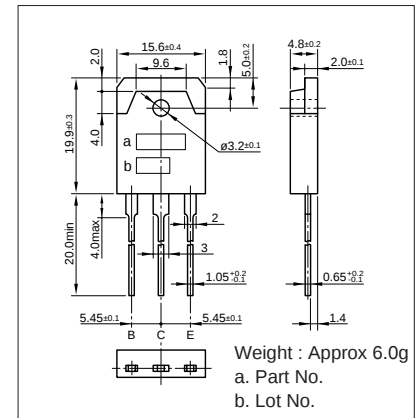
Symbol	Ratings	Unit
V _{CB0}	150	V
V _{CE0}	150	V
V _{EB0}	5	V
I _C	15	A
I _B	1	A
P _C	130(T _C =25°C)	W
T _J	150	°C
Tstg	-55to+150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =150V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	150min	V
h _{FE}	V _{CE} =4V, I _C =10A	5000min*	
V _{CE(sat)}	I _C =10A, I _B =10mA	2.5max	V
V _{BE(sat)}	I _C =10A, I _B =10mA	3.0max	V
f _r	V _{CE} =12V, I _E =-2A	70typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	120typ	pF

*h_{FE} Rank Q(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

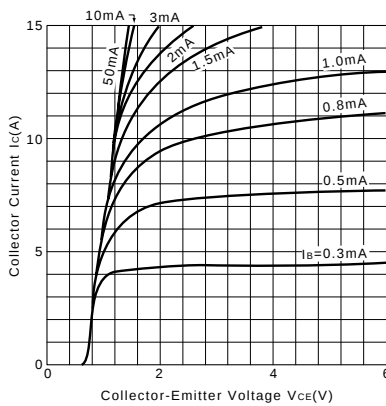
External Dimensions MT-100(TO3P)



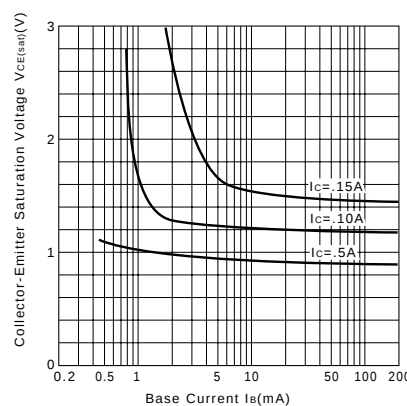
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	4	10	10	-5	10	-10	0.8typ	4.0typ	1.2typ

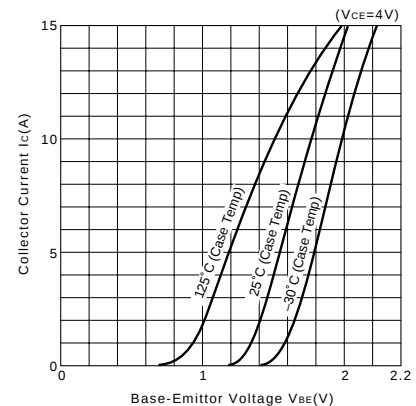
I_C-V_{CE} Characteristics (Typical)



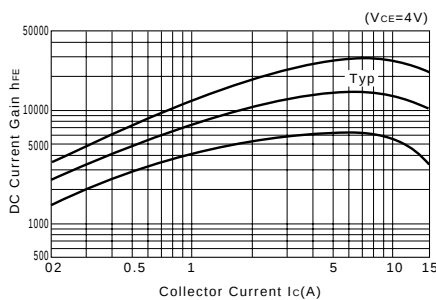
V_{CE(sat)}-I_B Characteristics (Typical)



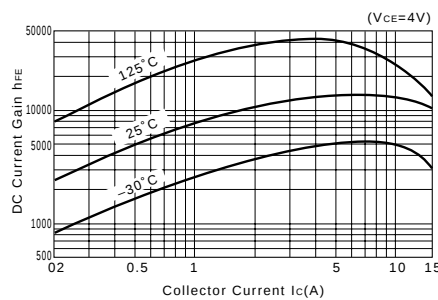
I_C-V_{BE} Temperature Characteristics (Typical)



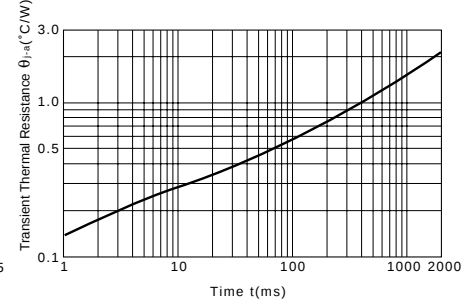
h_{FE}-I_C Characteristics (Typical)



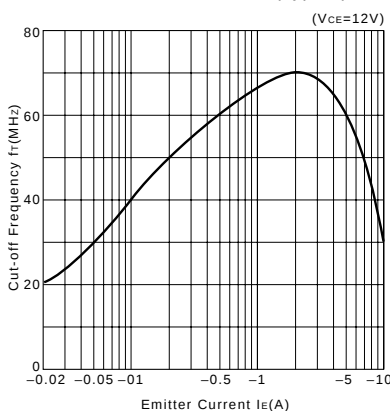
h_{FE}-I_C Temperature Characteristics (Typical)



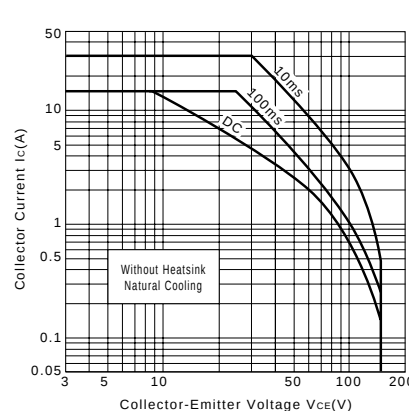
θ_{J-a}-t Characteristics



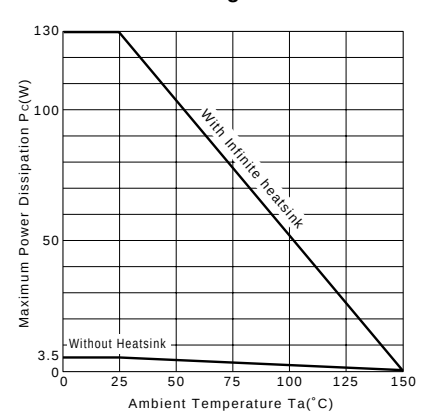
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

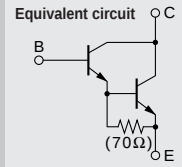


P_C-T_a Derating



Darlington

2SD2561



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1648)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
VCBO	150	V
VCEO	150	V
VEBO	5	V
IC	17	A
IB	1	A
PC	200(Tc=25°C)	W
Tj	150	°C
Tstg	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

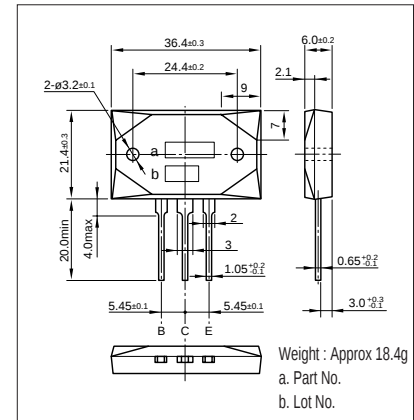
Symbol	Conditions	Ratings	Unit
ICBO	VCB=150V	100max	μA
IEBO	VEB=5V	100max	μA
V(BR)CEO	IC=30mA	150min	V
hFE	VCE=4V, IC=10A	5000min*	
VCE(sat)	IC=10A, IB=10mA	2.5max	V
VBE(sat)	IC=10A, IB=10mA	3.0max	V
fr	VCE=12V, IE=-2A	70typ	MHz
COB	VCB=10V, f=1MHz	120typ	pF

*hFE Rank: O(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

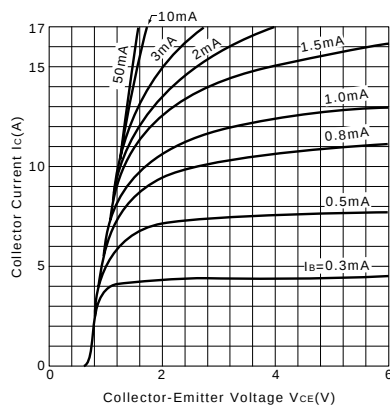
Typical Switching Characteristics (Common Emitter)

VCC (V)	RL (Ω)	IC (A)	VBB1 (V)	VBB2 (V)	IB1 (mA)	IB2 (mA)	ton (μs)	tstg (μs)	tf (μs)
40	4	10	10	-5	10	-10	0.8typ	4.0typ	1.2typ

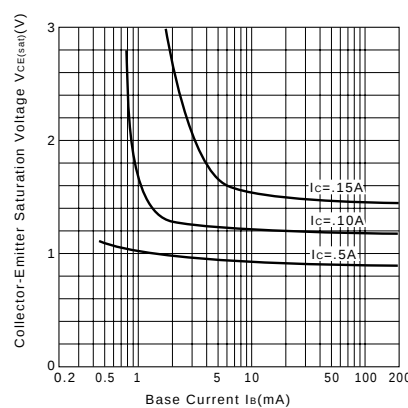
External Dimensions MT-200



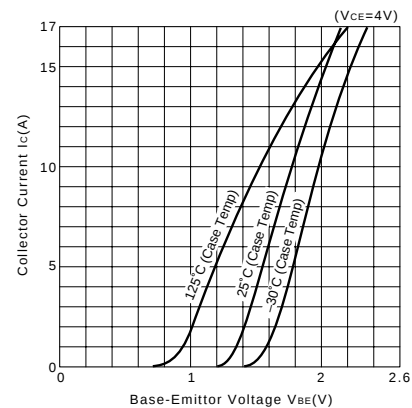
IC-VCE Characteristics (Typical)



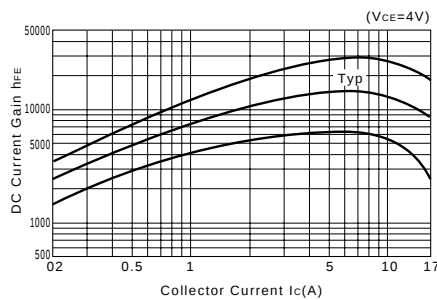
VCE(sat)-IB Characteristics (Typical)



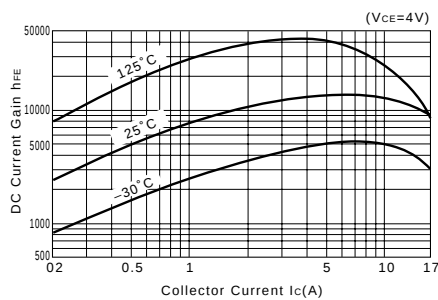
IC-VBE Temperature Characteristics (Typical)



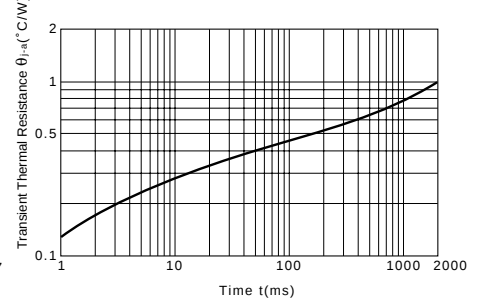
hFE-IC Characteristics (Typical)



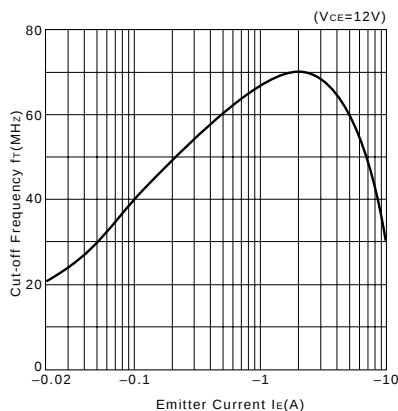
hFE-IC Temperature Characteristics (Typical)



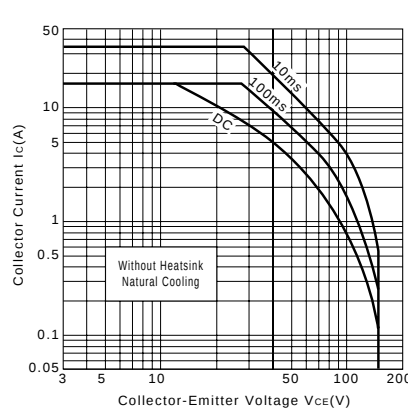
θja-t Characteristics



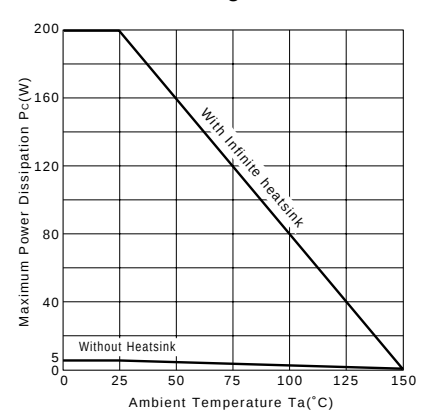
fT-IE Characteristics (Typical)



Safe Operating Area (Single Pulse)

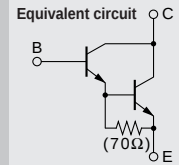


PC-Ta Derating



Darlington

2SD2562



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1649)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

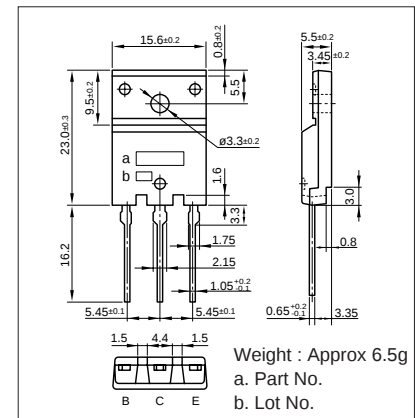
Symbol	Ratings	Unit
V _{CB0}	150	V
V _{CE0}	150	V
V _{EB0}	5	V
I _C	15	A
I _B	1	A
P _C	85(T _C =25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =150V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	150min	V
h _{FE}	V _{CE} =4V, I _C =10A	5000min*	
V _{CE(sat)}	I _C =10A, I _B =10mA	2.5max	V
V _{BE(sat)}	I _C =10A, I _B =10mA	3.0max	V
f _r	V _{CE} =12V, I _E =-2A	70typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	120typ	pF

*h_{FE} Rank O(5000to12000), P(6500to20000), Y(15000to30000)

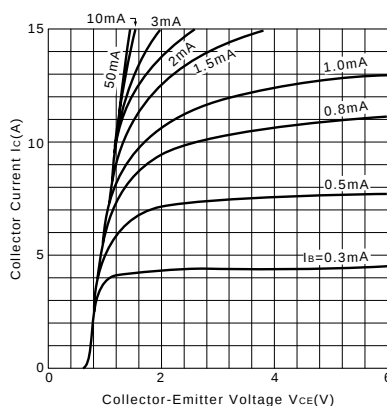
External Dimensions FM100(TO3PF)



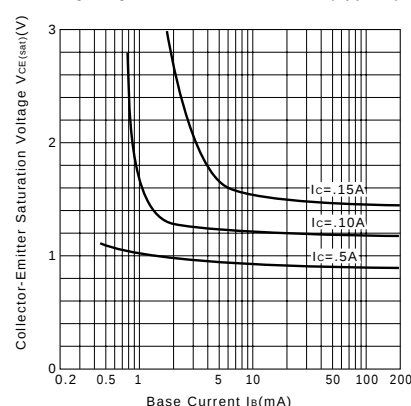
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
40	4	10	10	-5	10	-10	0.8typ	4.0typ	1.2typ

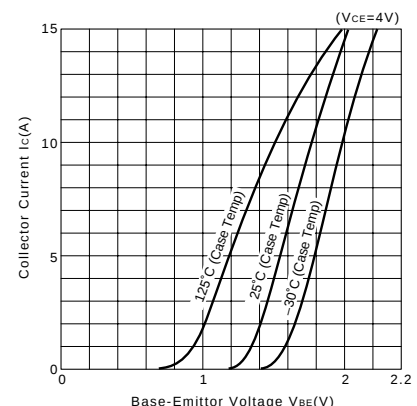
I_C-V_{CE} Characteristics (Typical)



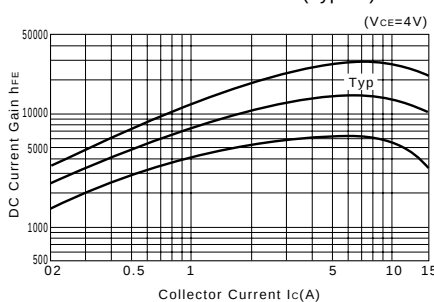
V_{CE(sat)}-I_B Characteristics (Typical)



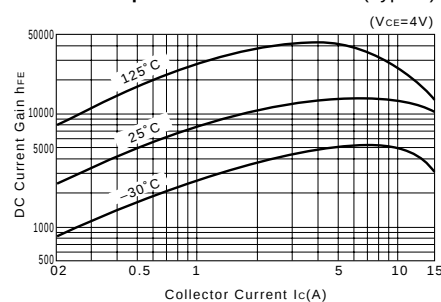
I_C-V_{BE} Temperature Characteristics (Typical)



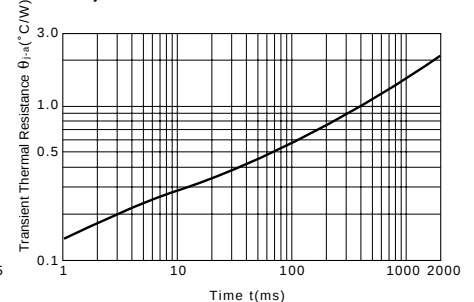
h_{FE}-I_C Characteristics (Typical)



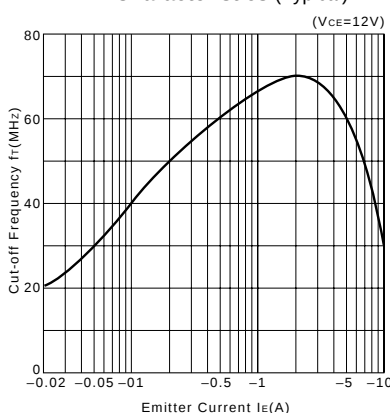
h_{FE}-I_C Temperature Characteristics (Typical)



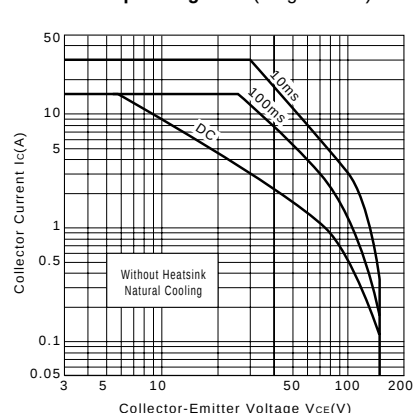
θ_{JA}-t Characteristics



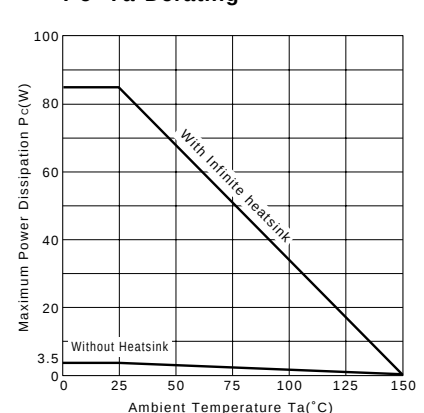
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)



P_C-T_a Derating



Darlington 2SD2589

Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1659)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	110	V
V _{CE0}	110	V
V _{EB0}	5	V
I _C	6	A
I _B	1	A
P _C	50(Tc=25°C)	W
T _j	150	°C
Tstg	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

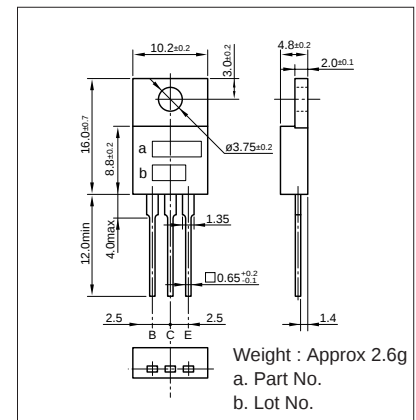
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =110V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	110min	V
h _{FE}	V _{CE} =4V, I _C =5A	5000min*	
V _{CE(sat)}	I _C =5A, I _B =5mA	2.5max	V
V _{BE(sat)}	I _C =5A, I _B =5mA	3.0max	V
f _T	V _{CE} =12V, I _E =-0.5A	60typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	55typ	pF

*h_{FE} Rank Q(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

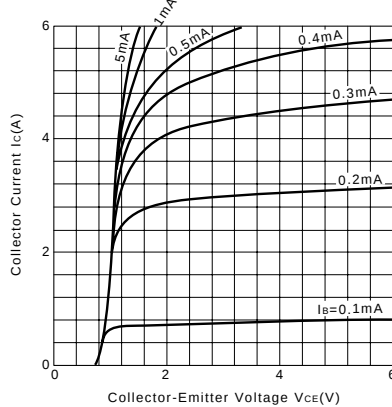
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	6	5	10	-5	5	-5	0.8typ	6.2typ	1.1typ

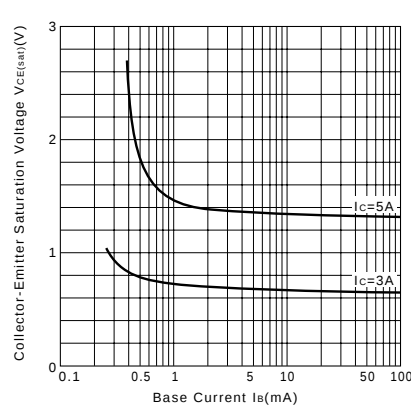
External Dimensions FM-25(TO220)



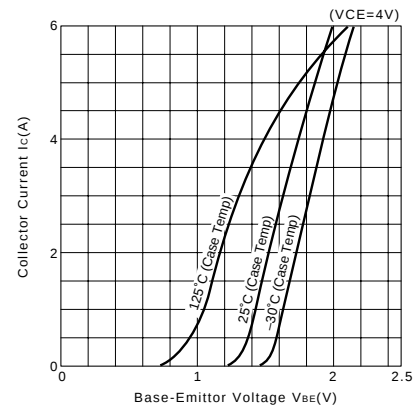
I_C-V_{CE} Characteristics (Typical)



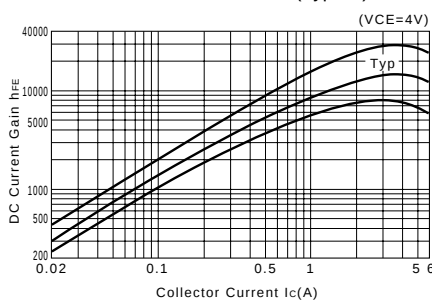
V_{CE(sat)}-I_B Characteristics (Typical)



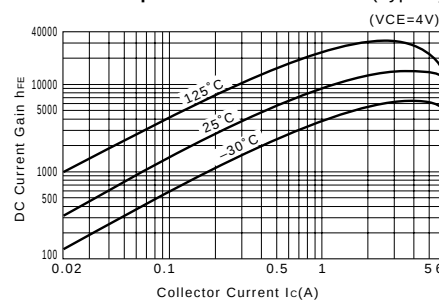
I_C-V_{BE} Temperature Characteristics (Typical)



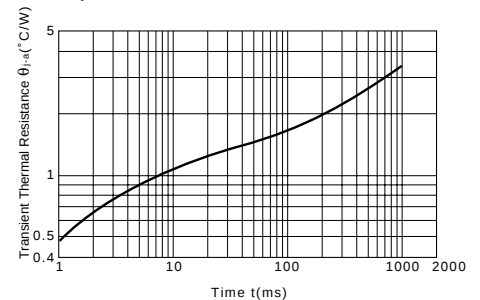
h_{FE}-I_C Characteristics (Typical)



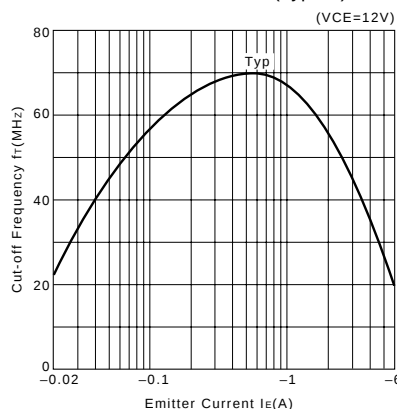
h_{FE}-I_C Temperature Characteristics (Typical)



θ_{j-a}-t Characteristics

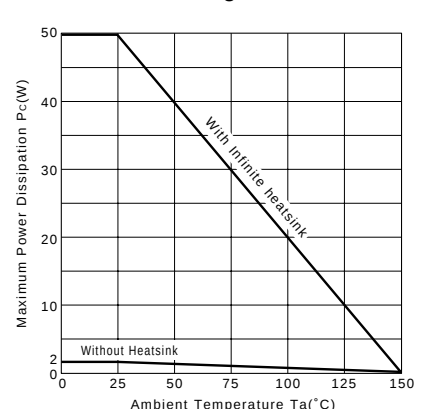


f_T-I_E Characteristics (Typical)



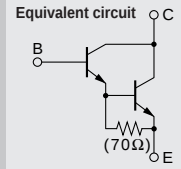
Safe Operating Area (Single Pulse)

P_C-T_a Derating



Darlington

2SD2641



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1685)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	110	V
V _{CE0}	110	V
V _{EB0}	5	V
I _C	6	A
I _B	1	A
P _C	60(Tc=25°C)	W
T _j	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

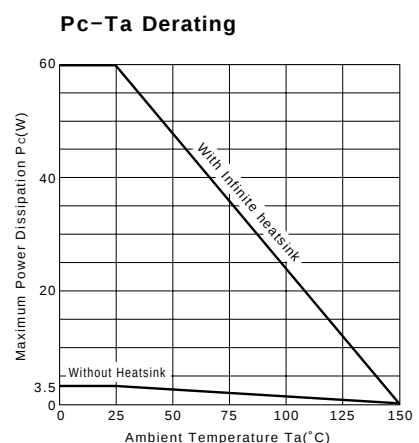
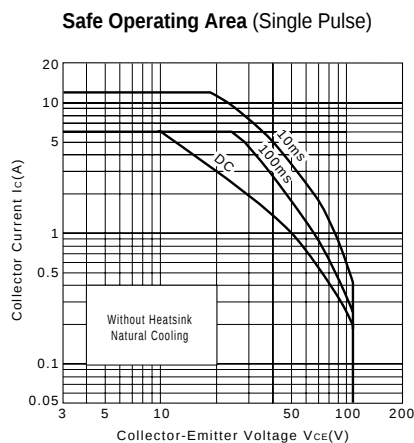
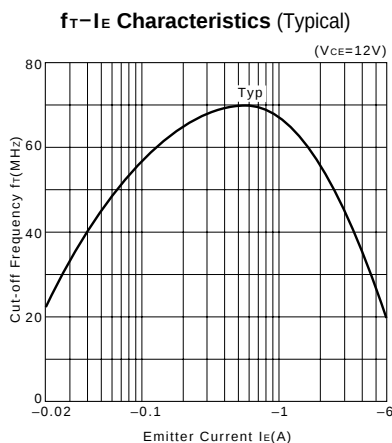
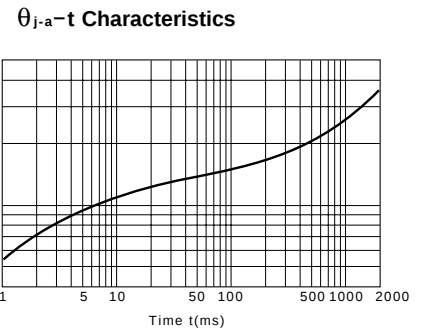
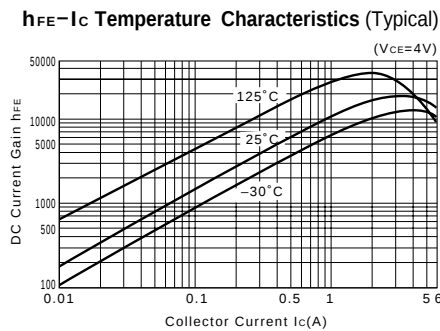
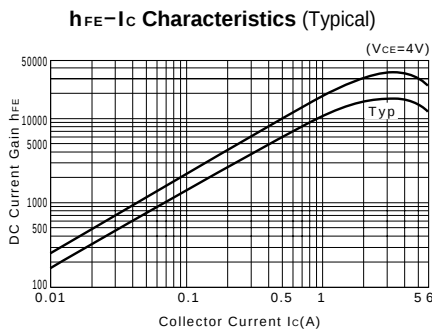
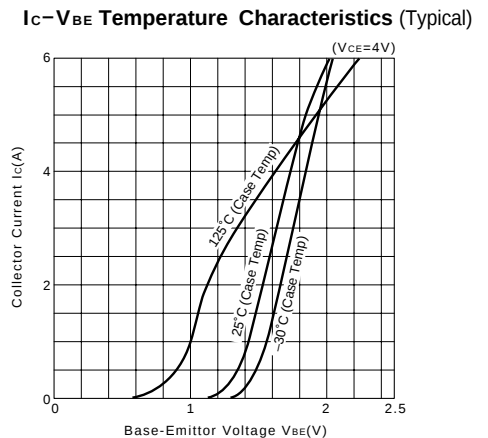
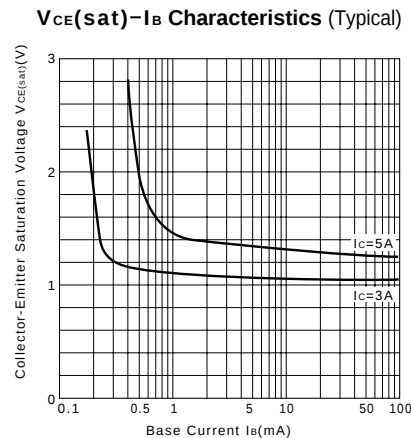
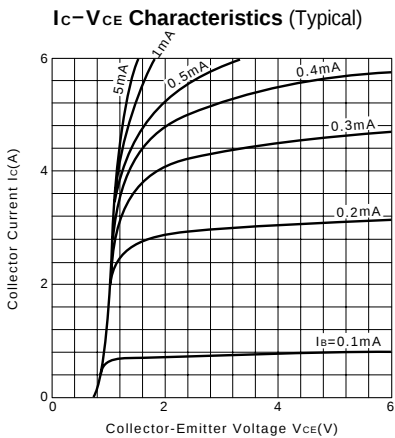
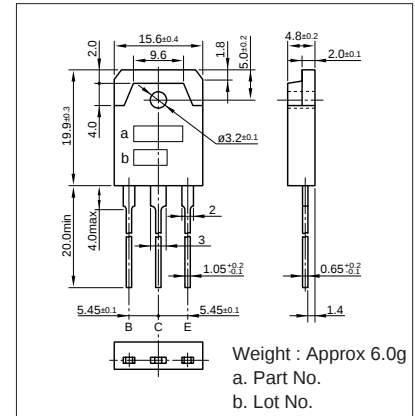
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =110V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	110min	V
h _{FE}	V _{CE} =4V, I _C =5A	5000min*	
V _{CE(sat)}	I _C =5A, I _B =5mA	2.5max	V
V _{BE(sat)}	I _C =5A, I _B =5mA	3.0max	V
f _T	V _{CE} =12V, I _E =-2A	60typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	55typ	pF

*h_{FE} Rank Q(5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

Typical Switching Characteristics (Common Emitter)

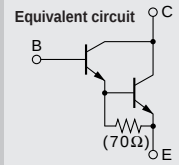
V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	6	5	10	-5	5	-5	0.8typ	6.2typ	1.1typ

External Dimensions MT-100(TO3P)



Darlington

2SD2642



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1687)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	110	V
V _{CE0}	110	V
V _{EB0}	5	V
I _C	6	A
I _B	1	A
P _C	30(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

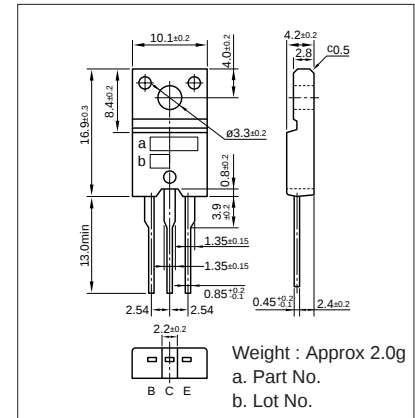
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =110V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	110min	V
h _{FE}	V _{CE} =4V, I _C =5A	5000min*	
V _{CE(sat)}	I _C =5A, I _B =5mA	2.5max	V
V _{BE(sat)}	I _C =5A, I _B =5mA	3.0max	V
f _T	V _{CE} =12V, I _E =-0.5A	60typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	55typ	pF

*h_{FE} Rank: $\bar{O}$ (5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

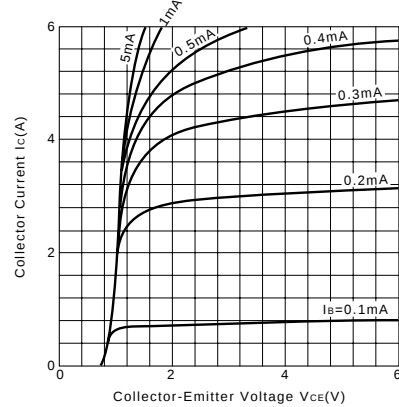
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	6	5	10	-5	5	-5	0.8typ	6.2typ	1.1typ

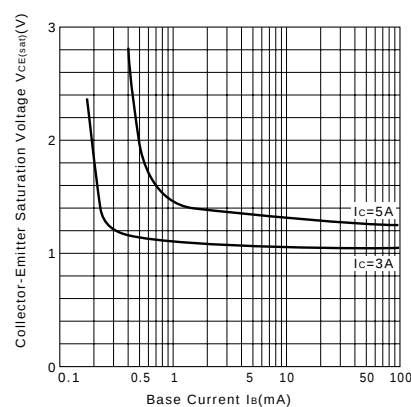
External Dimensions FM20(TO220F)



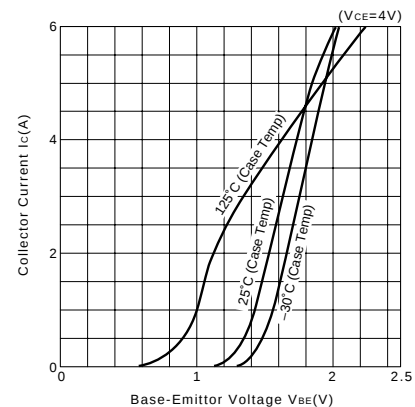
I_C-V_{CE} Characteristics (Typical)



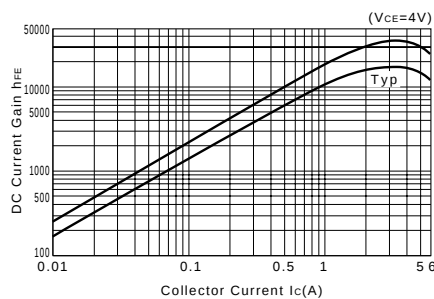
V_{CE(sat)}-I_B Characteristics (Typical)



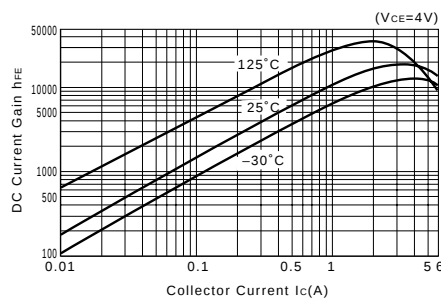
I_C-V_{BE} Temperature Characteristics (Typical)



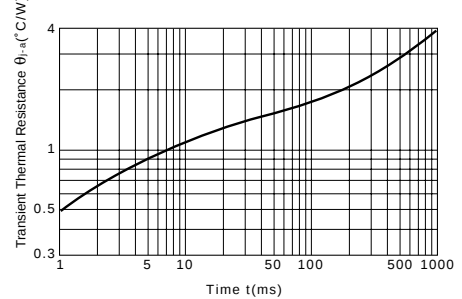
h_{FE}-I_C Characteristics (Typical)



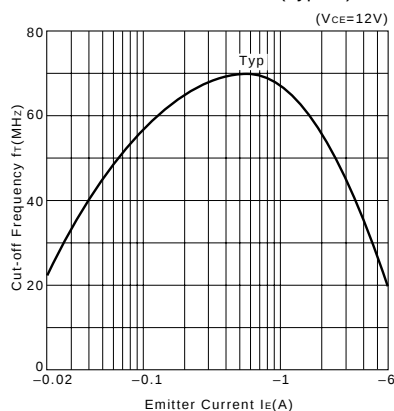
h_{FE}-I_C Temperature Characteristics (Typical)



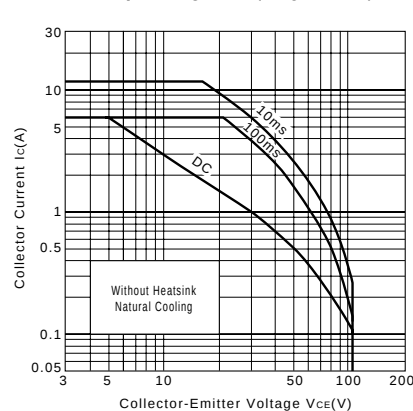
θ_{J-a}-t Characteristics



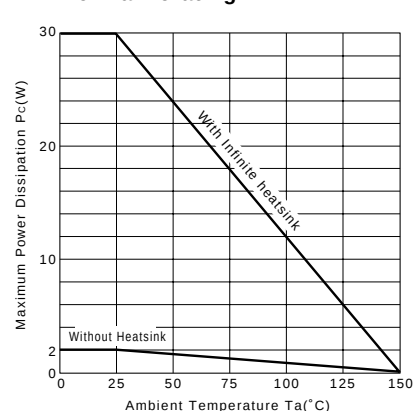
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

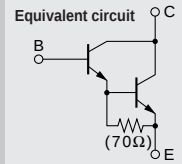


P_C-T_a Derating



Darlington

2SD2643



Silicon NPN Triple Diffused Planar Transistor (Complement to type 2SB1687)

Application : Audio, Series Regulator and General Purpose

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	110	V
V _{CE0}	110	V
V _{EB0}	5	V
I _C	6	A
I _B	1	A
P _C	60(T _C =25°C)	W
T _J	150	°C
T _{stg}	-55 to +150	°C

Electrical Characteristics (Ta=25°C)

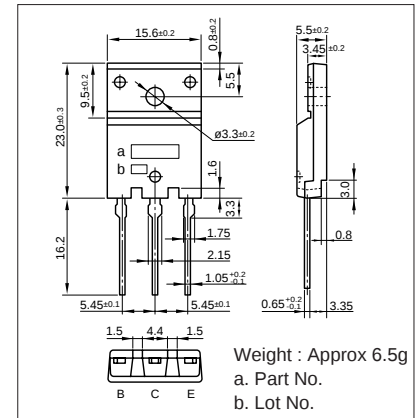
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =110V	100max	μA
I _{EB0}	V _{EB} =5V	100max	μA
V _{(BR)CEO}	I _C =30mA	110min	V
h _{FE}	V _{CE} =4V, I _C =5A	5000min*	
V _{CE(sat)}	I _C =5A, I _B =5mA	2.5max	V
V _{BE(sat)}	I _C =5A, I _B =5mA	3.0max	V
f _r	V _{CE} =12V, I _E =-0.5A	60typ	MHz
C _{OB}	V _{CB} =10V, f=1MHz	55typ	pF

*h_{FE} Rank $\bar{O}$ (5000 to 12000), P(6500 to 20000), Y(15000 to 30000)

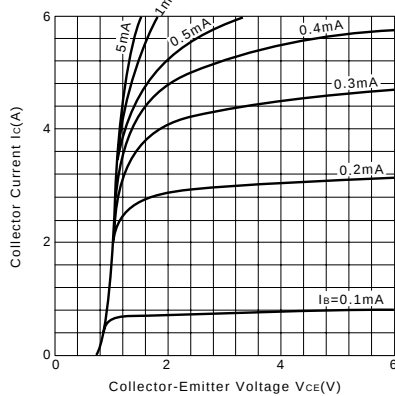
Typical Switching Characteristics (Common Emitter)

V _{CC} (V)	R _L (Ω)	I _C (A)	V _{BB1} (V)	V _{BB2} (V)	I _{B1} (mA)	I _{B2} (mA)	t _{on} (μs)	t _{stg} (μs)	t _f (μs)
30	6	5	10	-5	5	-5	0.8typ	6.2typ	1.1typ

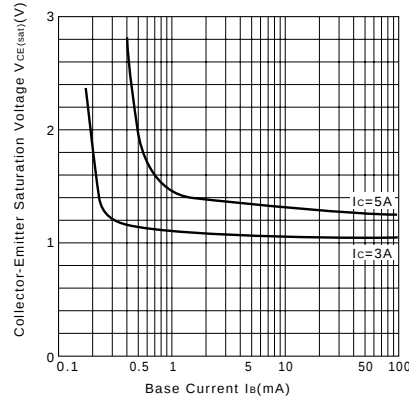
External Dimensions FM100(TO3PF)



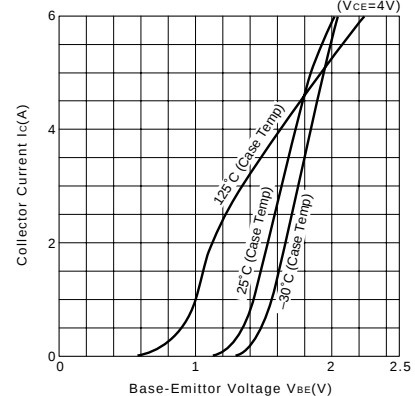
I_C-V_{CE} Characteristics (Typical)



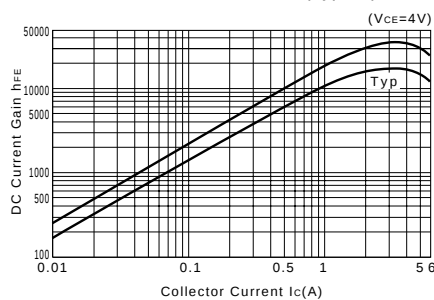
V_{CE(sat)}-I_B Characteristics (Typical)



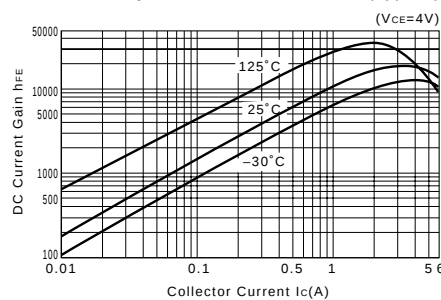
I_C-V_{BE} Temperature Characteristics (Typical)



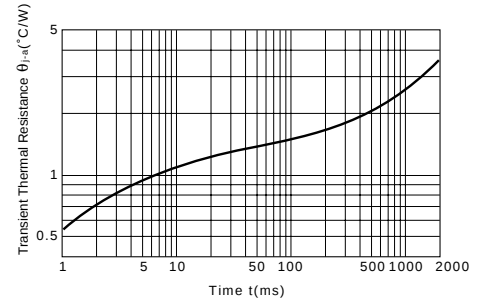
h_{FE}-I_C Characteristics (Typical)



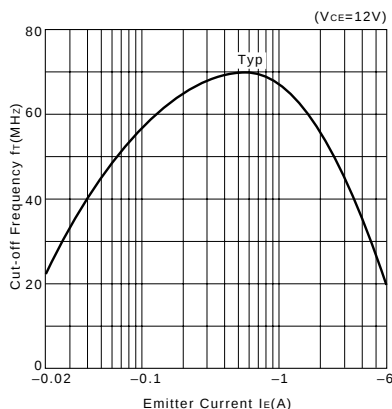
h_{FE}-I_C Temperature Characteristics (Typical)



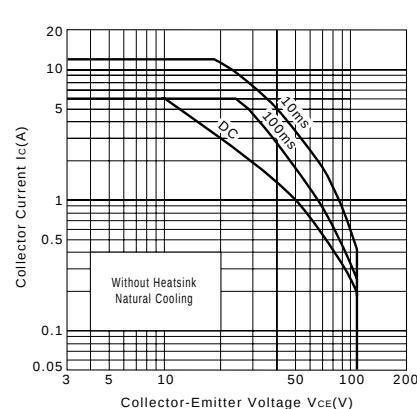
θ_{JA}-t Characteristics



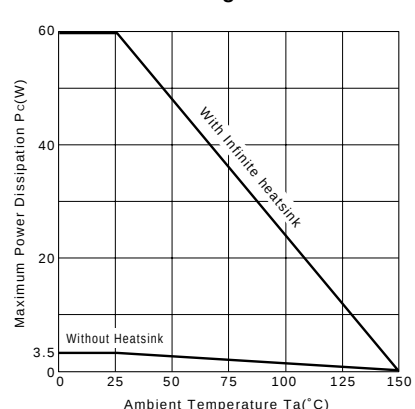
f_T-I_E Characteristics (Typical)



Safe Operating Area (Single Pulse)

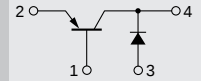


P_C-T_a Derating



SAH02

Equivalent circuit



Silicon PNP Epitaxial Planar Transistor with Shottky Barrier Diode

Application : Chopper Regulator

Absolute maximum ratings (Ta=25°C)

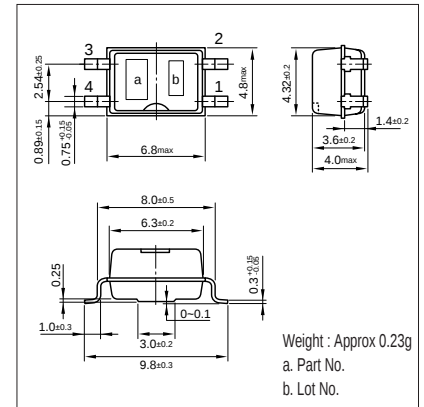
Symbol	Ratings	Unit
V _{CB0}	-30	V
V _{CEO}	-30	V
V _{EB0}	-10	V
I _C	-3	A
I _B	-0.5	A
P _C	800(Ta=25°C)	mW
T _j	125	°C
T _{stg}	-40 to +125	°C

Electrical Characteristics (Ta=25°C)

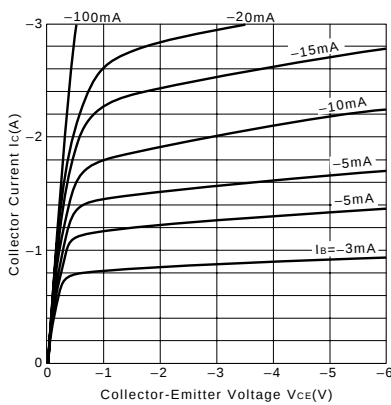
Symbol	Conditions	Ratings	Unit
I _{CB0}	V _{CB} =-30V	-10max	μA
I _{EB0}	V _{EB} =-10V	-10max	μA
V _{(BR)CEO}	I _C =-10mA	-30min	V
h _{FE1}	V _{CE} =-2V, I _C =-1A	100min	
h _{FE2}	V _{CE} =-2V, I _C =-0.5A	150min	
V _{CE(sat)}	I _C =-0.5A, I _B =-20mA	-0.3max	V
f _r	V _{CE} =-12V, I _E =0.3A	100typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	45typ	pF

V _R	I _R =100μA	30 min	V
V _F	I _F =0.5A	0.55 max	V
t _{rr}	I _F =±100mA	15 typ	ns

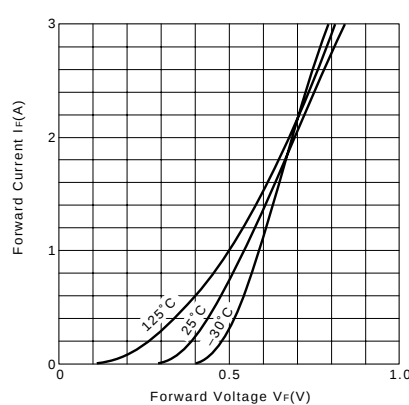
External Dimensions PS Pack



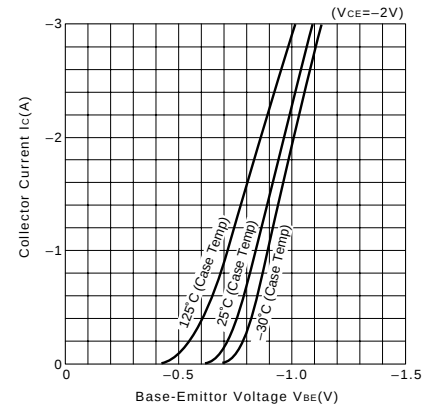
I_C-V_{CE} Characteristics (Typical)



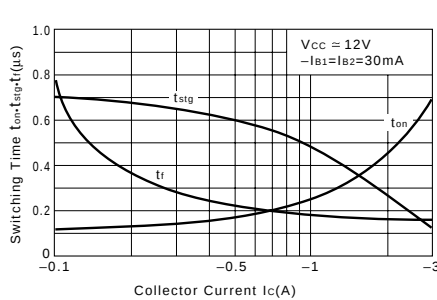
Diode I_F-V_F Characteristics



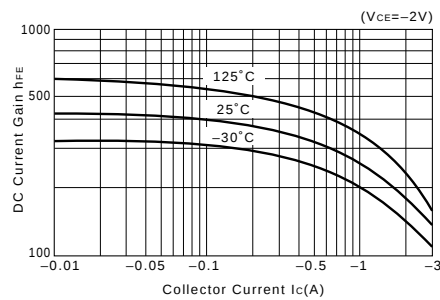
I_C-V_{BE} Temperature Characteristics (Typical)



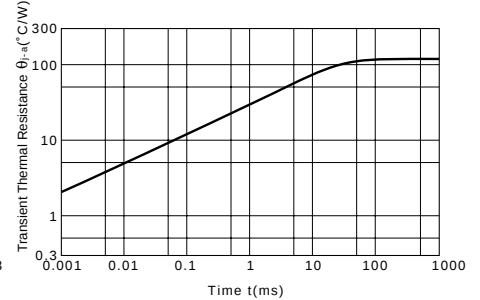
t_{on}•t_{stg}•t_{tr}-I_C Characteristics (Typical)



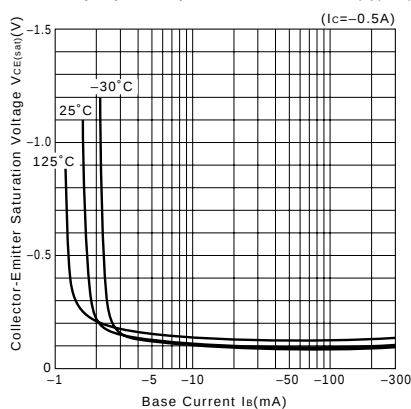
h_{FE}-I_C Temperature Characteristics (Typical)



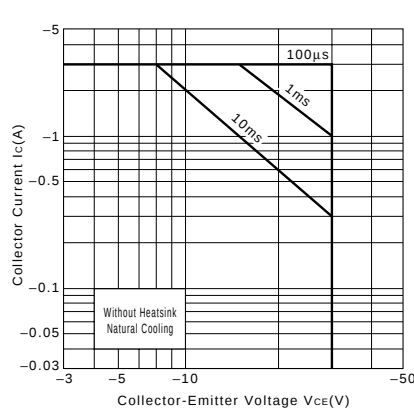
θ_{j-a}-t Characteristics



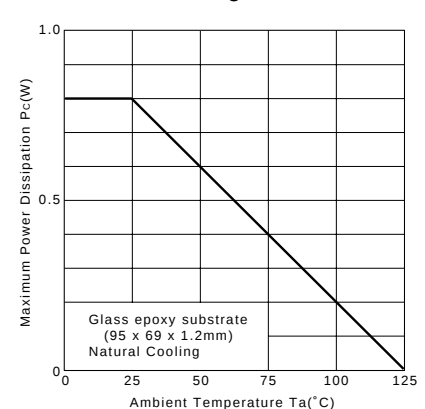
V_{CE(sat)}-I_B Temperature Characteristics (Typical)



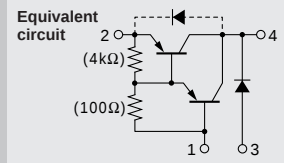
Safe Operating Area (Single Pulse)



P_C-T_a Derating



SAH03



Silicon PNP Epitaxial Planar Transistor with Fast-Recovery Rectifier Diode

Application : Voltage change switch for motor

Absolute maximum ratings (Ta=25°C)

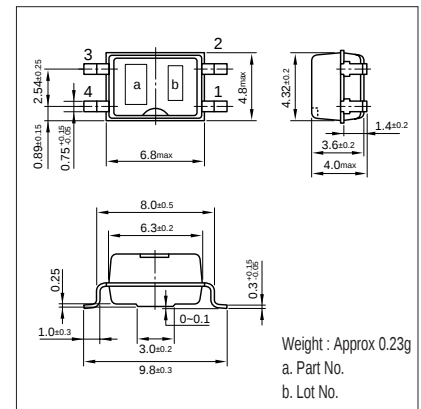
Symbol	Ratings	Unit
V _{CB0}	-60	V
V _{CEO}	-60	V
V _{EB0}	-6	V
I _C	-1.2	A
I _B	-0.1	A
P _C	1.0(Ta=25°C)	W
T _j	150	°C
T _{stg}	-40to+150	°C

Electrical Characteristics (Ta=25°C)

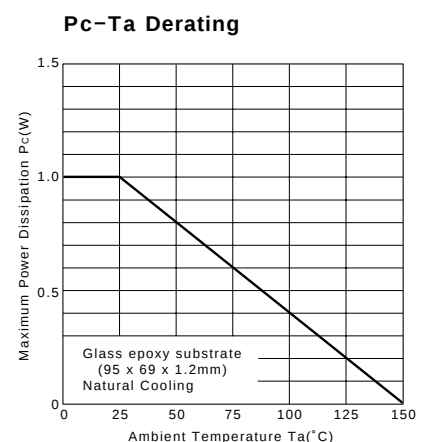
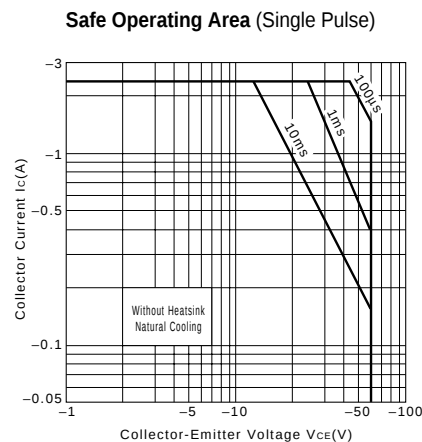
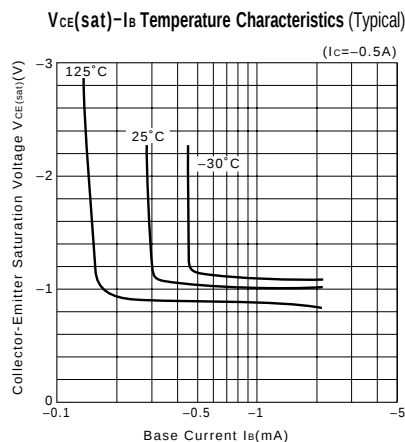
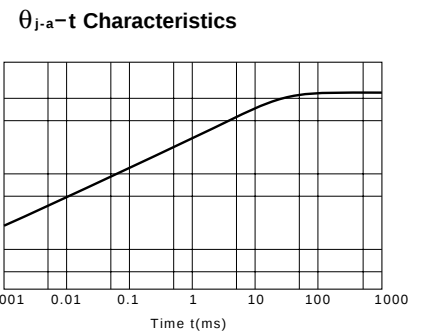
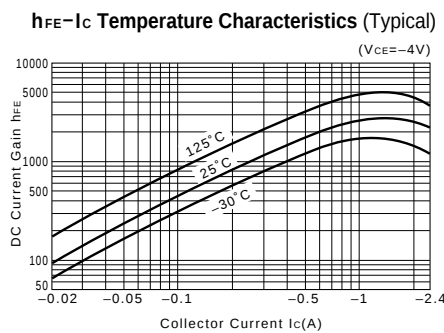
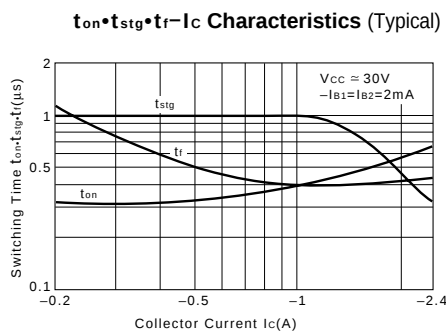
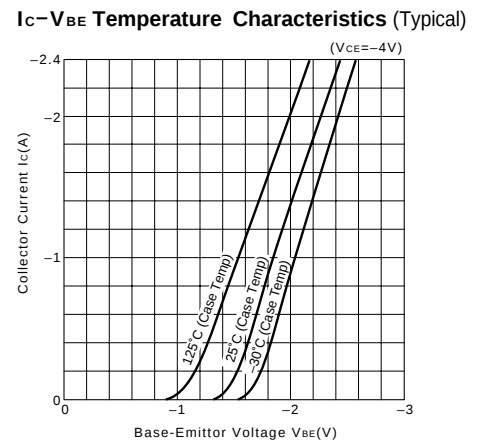
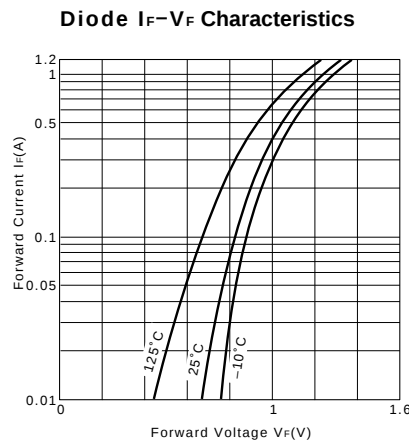
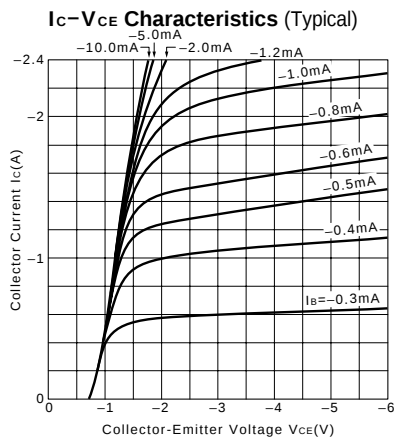
Symbol	Conditions	Ratings	Unit
I _{CBO}	V _{CB} =-60V	-10max	μA
I _{EBO}	V _{EB} =-6V	-3max	mA
V _{(BR)CEO}	I _C =-10mA	-60min	V
h _{FE}	V _{CE} =-4V, I _C =-1A	2000 to 12000	
V _{CE(sat)}	I _C =-1A, I _B =-2mA	-1.4max	V
f _r	V _{CE} =-12V, I _E =0.1A	100typ	MHz
C _{OB}	V _{CB} =-10V, f=1MHz	30typ	pF

V _R	I _R =100μA	100 min	V
V _F	I _F =0.5A	1.5 max	V
t _{rr}	I _F =±100mA	100 typ	ns

External Dimensions PS Pack

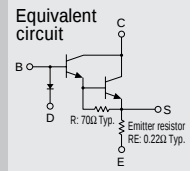


Weight : Approx 0.23g
a. Part No.
b. Lot No.



Built-in temperature
compensation diodes
Built-in emitter resistor
Darlington

SAP09N



(Complement to type SAP09P)

Application: Audio

■ Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CB0}	150	V
V_{CEO}	150	V
V_{EBO}	5	V
I_C	10	A
I_B	1	A
P_C	80 ($T_c = 25^\circ\text{C}$)	W
I_{F1}	10	mA
T_J	150	$^\circ\text{C}$
T_{stg}	-40 to +150	$^\circ\text{C}$

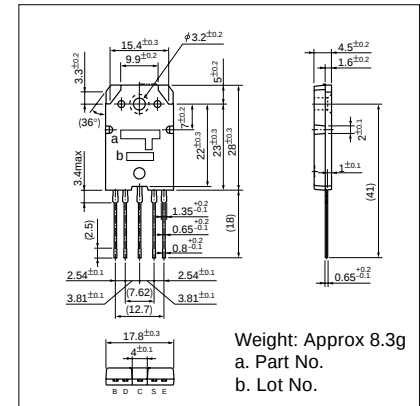
■ Electrical Characteristics ($T_a = 25^\circ\text{C}$)

Symbol	Conditions	Ratings			Unit
		min	typ	max	
I_{CBO}	$V_{CB} = 150\text{V}$			100	μA
I_{EBO}	$V_{EB} = 5\text{V}$			100	μA
V_{CEO}	$I_C = 30\text{mA}$	150			V
h_{FE}^*	$V_{CE} = 4\text{V}$, $I_C = 6\text{A}$	5000		20000	
$V_{CE(sat)}$	$I_C = 6\text{A}$, $I_B = 6\text{mA}$			2.0	V
$V_{BE(sat)}$	$I_C = 6\text{A}$, $I_B = 6\text{mA}$			2.5	V
V_{BE}	$V_{CE} = 20\text{V}$, $I_C = 40\text{mA}$		1220		mV
V_{BE}	$I_F = 2.5\text{mA}$		705		mV
R_E	$I_E = 1\text{A}$	0.176	0.22	0.264	Ω

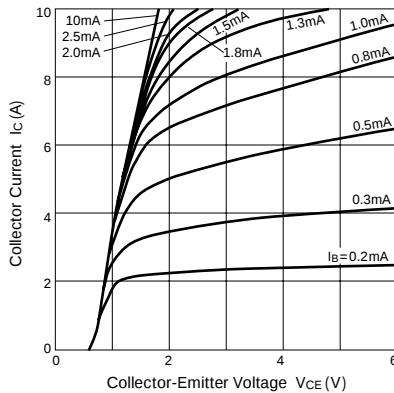
* h_{FE} Rank $\bar{O}$ (5000 to 12000), Y (8000 to 20000)

External Dimensions

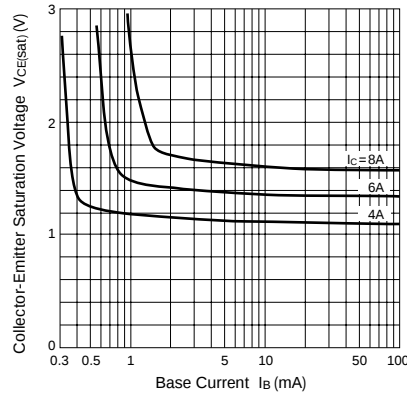
(Unit: mm)



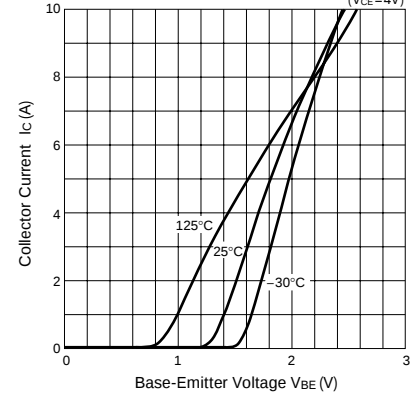
$I_C - V_{CE}$ Characteristics (Typical)



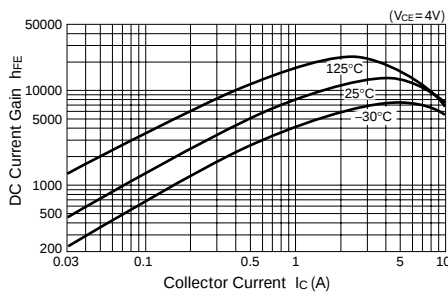
$V_{CE(sat)} - I_B$ Characteristics (Typical)



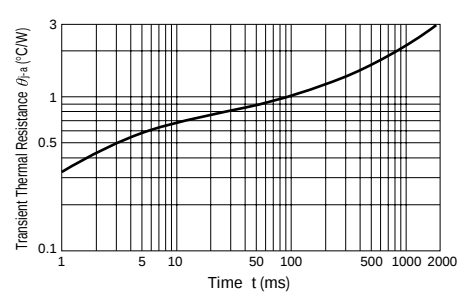
$I_C - V_{BE}$ Temperature Characteristics



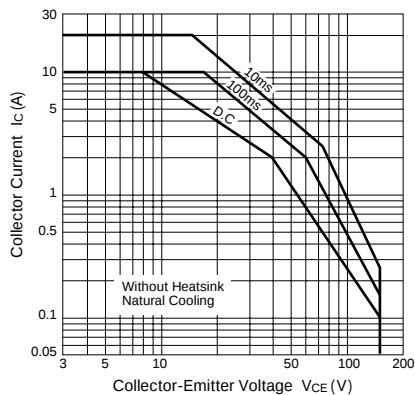
$h_{FE} - I_C$ Characteristics (Typical)



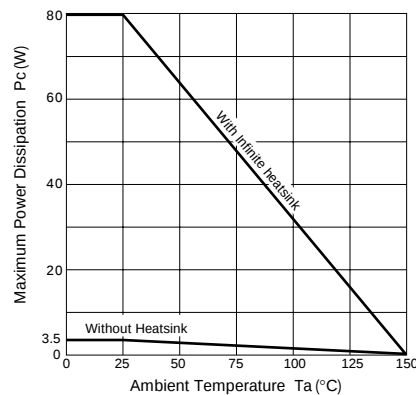
$\theta_{j-a} - t$ Characteristics



Safe Operating Area (Single Pulse)



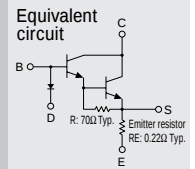
$P_C - T_a$ Derating



SAP 09P

Built-in temperature
compensation diodes
Built-in emitter resistor
Darlington

SAP10N



(Complement to type SAP10P)

Application: Audio

Absolute maximum ratings (Ta=25°C)

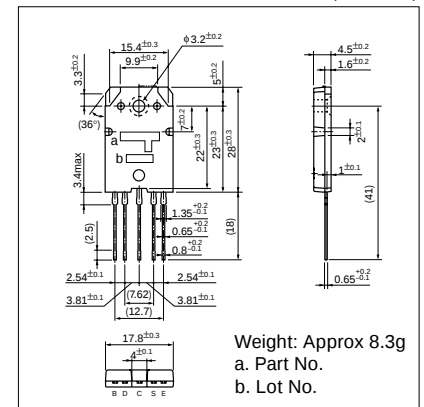
Symbol	Ratings	Unit
VCBO	150	V
VCEO	150	V
VEBO	5	V
IC	12	A
IB	1	A
PC	100 (Tc=25°C)	W
Di IF	10	mA
Tj	150	°C
Tstg	-40 to +150	°C

Electrical Characteristics (Ta=25°C)

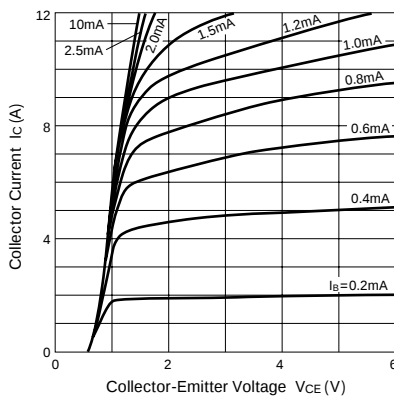
Symbol	Conditions	Ratings			Unit
		min	typ	max	
ICBO	V _{CB} =150V			100	μA
IEBO	V _{EB} =5V			100	μA
VCEO	I _C =30mA	150			V
hFE *	V _{CE} =4V, I _C =7A	5000		20000	
VCE(sat)	I _C =7A, I _B =7mA			2.0	V
VBE(sat)	I _C =7A, I _B =7mA			2.5	V
VBE	V _{CE} =20V, I _C =40mA		1200		mV
Di VF	I _F =2.5mA		705		mV
RE	I _E =1A	0.176	0.22	0.264	Ω

*hFE Rank $\bar{O}$ (5000 to 12000), Y (8000 to 20000)

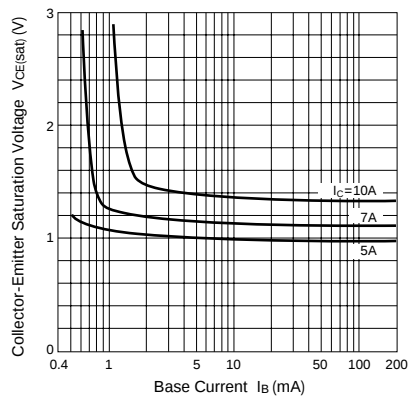
External Dimensions (Unit: mm)



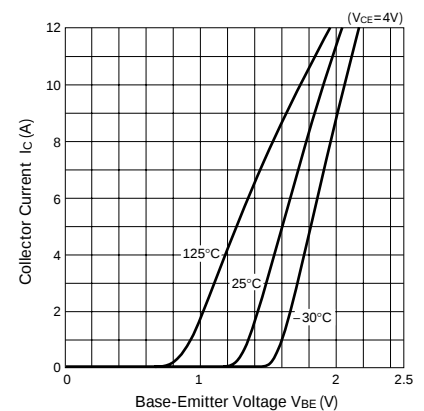
IC-VCE Characteristics (Typical)



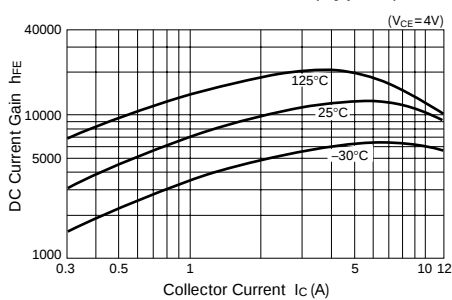
VCE(sat)-IB Characteristics (Typical)



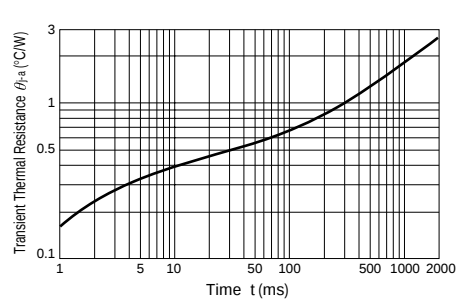
IC-VBE Temperature Characteristics (Typical)



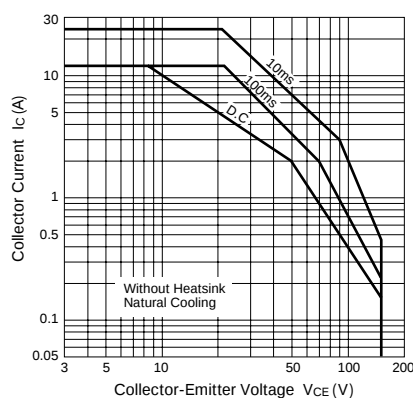
hFE-IC Characteristics (Typical)



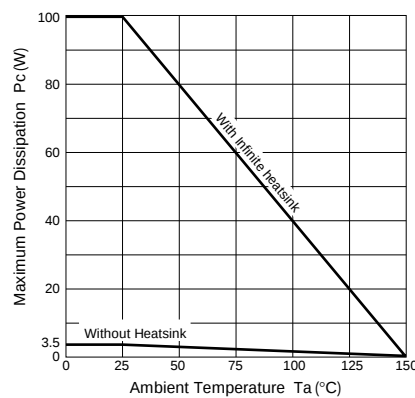
θja-t Characteristics



Safe Operating Area (Single Pulse)

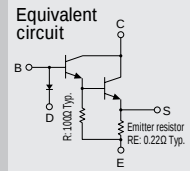


PC-Ta Derating



Built-in temperature
compensation diodes
Built-in emitter resistor
Darlington

SAP16N



(Complement to type SAP16P)

Application: Audio

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V _{CB0}	160	V
V _{CEO}	160	V
V _{EB0}	5	V
I _C	15	A
I _B	1	A
P _C	150 (T _C =25°C)	W
Di I _F	10	mA
T _J	150	°C
Tstg	-40 to +150	°C

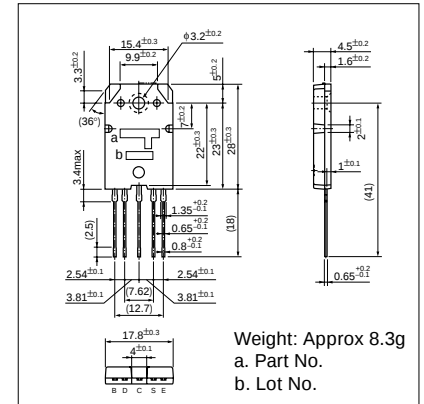
Electrical Characteristics (Ta=25°C)

Symbol	Conditions	Ratings			Unit
		min	typ	max	
I _{CB0}	V _{CB} =160V			100	μA
I _{EB0}	V _{EB} =5V			100	μA
V _{CEO}	I _C =30mA	160			V
h _{FE} *	V _{CE} =4V, I _C =10A	5000		20000	
V _{CE(sat)}	I _C =10A, I _B =10mA			2.0	V
V _{BE(sat)}	I _C =10A, I _B =10mA			2.5	V
V _{BE}	V _{CE} =20V, I _C =40mA		1190		mV
Di V _F	I _F =2.5mA		705		mV
R _E	I _E =1A	0.176	0.22	0.264	Ω
R _{EB}		90	100	110	Ω

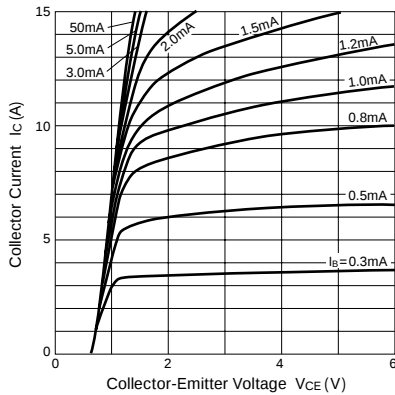
*h_{FE} Rank $\bar{O}$ (5000 to 12000), Y (8000 to 20000)

External Dimensions

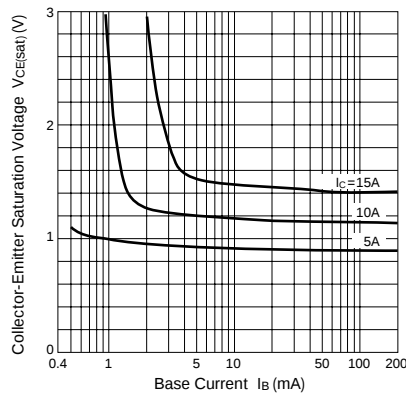
(Unit: mm)



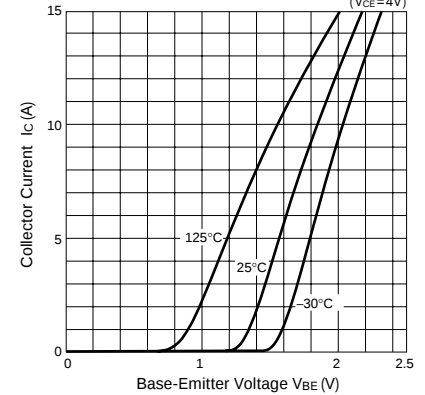
I_C-V_{CE} Characteristics (Typical)



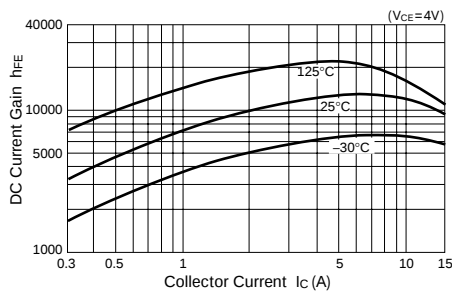
V_{CE(sat)}-I_B Characteristics (Typical)



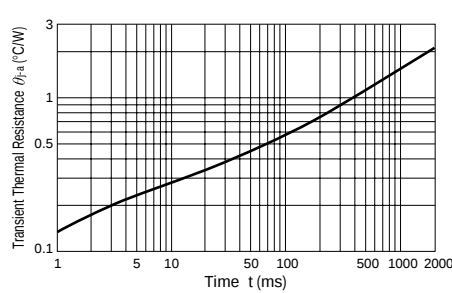
I_C-V_{BE} Temperature Characteristics (Typical)



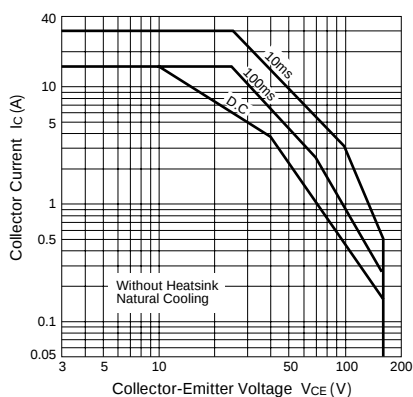
h_{FE}-I_C Characteristics (Typical)



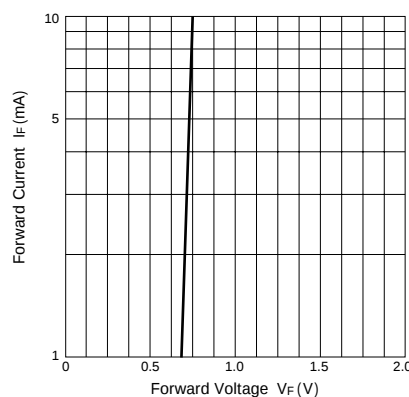
θ_{J-a}-t Characteristics



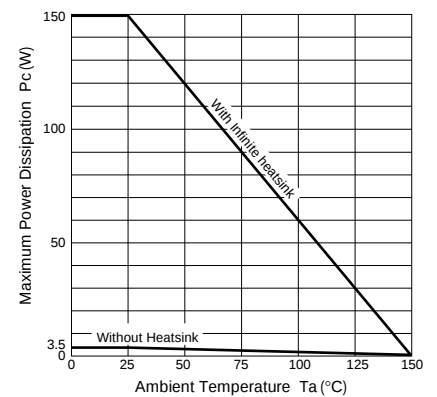
Safe Operating Area (Single Pulse)



Di I_F-V_F Characteristics (Typical)

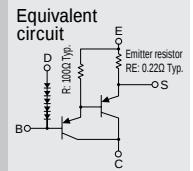


P_C-T_a Derating



Built-in temperature
compensation diodes
Built-in emitter resistor
Darlington

SAP16P



(Complement to type SAP16N)

Application: Audio

■ Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Symbol	Ratings	Unit
V_{CB0}	-160	V
V_{CE0}	-160	V
V_{EB0}	-5	V
I_C	-15	A
I_B	-1	A
P_C	150 ($T_c = 25^\circ\text{C}$)	W
$D_i I_F$	10	mA
T_J	150	$^\circ\text{C}$
T_{stg}	-40 to +150	$^\circ\text{C}$

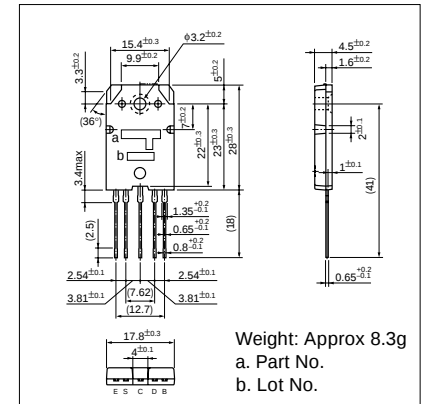
■ Electrical Characteristics ($T_a = 25^\circ\text{C}$)

Symbol	Conditions	Ratings			Unit
		min	typ	max	
I_{CB0}	$V_{CB} = -160\text{V}$			-100	μA
I_{EB0}	$V_{EB} = -5\text{V}$			-100	μA
V_{CE0}	$I_C = -30\text{mA}$	-160			V
h_{FE}^*	$V_{CE} = -4\text{V}, I_C = -10\text{A}$	5000		20000	
$V_{CE(sat)}$	$I_C = -10\text{A}, I_B = -10\text{mA}$			-2.0	V
$V_{BE(sat)}$	$I_C = -10\text{A}, I_B = -10\text{mA}$			-2.5	V
V_{BE}	$V_{CE} = -20\text{V}, I_C = -40\text{mA}$		1200		mV
$D_i V_F$	$I_F = 2.5\text{mA}$		1540		mV
R_E	$I_E = 1\text{A}$	0.176	0.22	0.264	Ω
R_{EB}		90	100	110	Ω

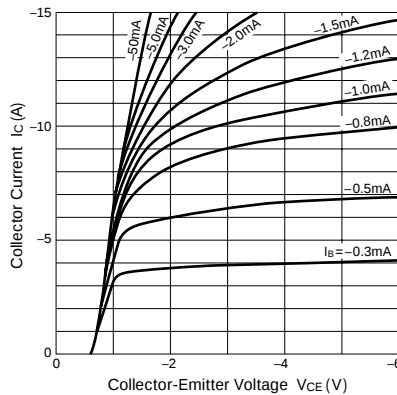
* h_{FE} Rank $\bar{O}$ (5000 to 12000), Y (8000 to 20000)

External Dimensions

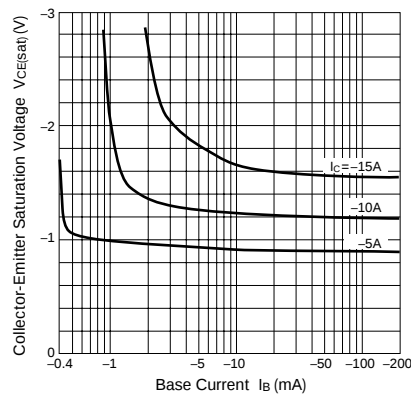
(Unit: mm)



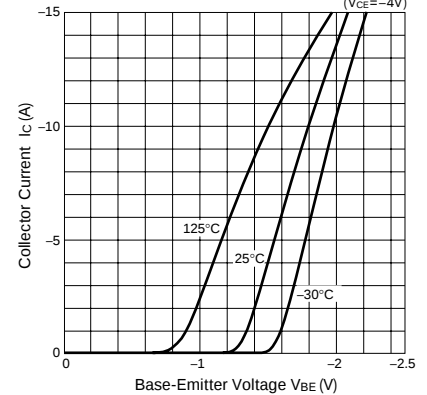
$I_C - V_{CE}$ Characteristics (Typical)



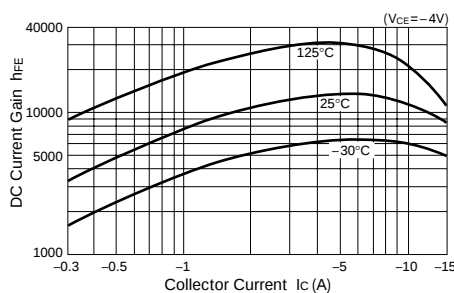
$V_{CE(sat)} - I_B$ Characteristics (Typical)



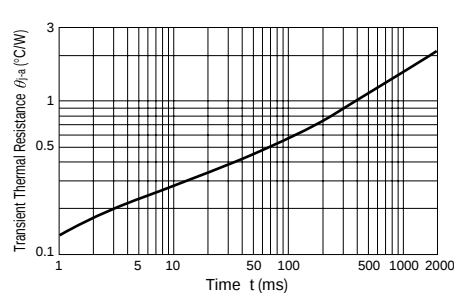
$I_C - V_{BE}$ Temperature Characteristics (Typical)



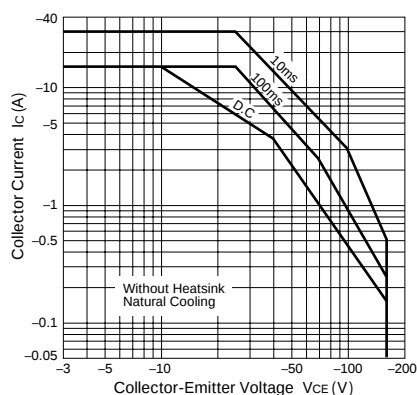
$h_{FE} - I_C$ Characteristics (Typical)



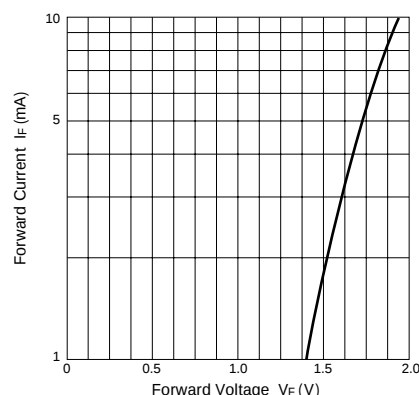
$\theta_{JA} - t$ Characteristics



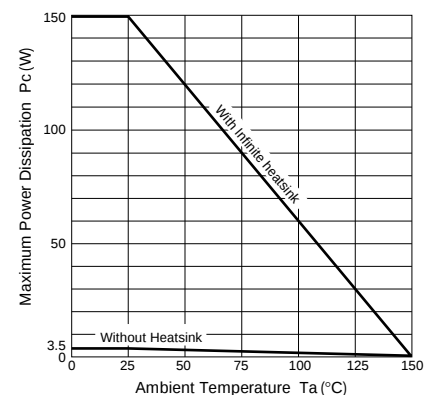
Safe Operating Area (Single Pulse)



$D_i I_F - V_F$ Characteristics (Typical)



$P_C - T_a$ Derating



SAP Series

Application Information

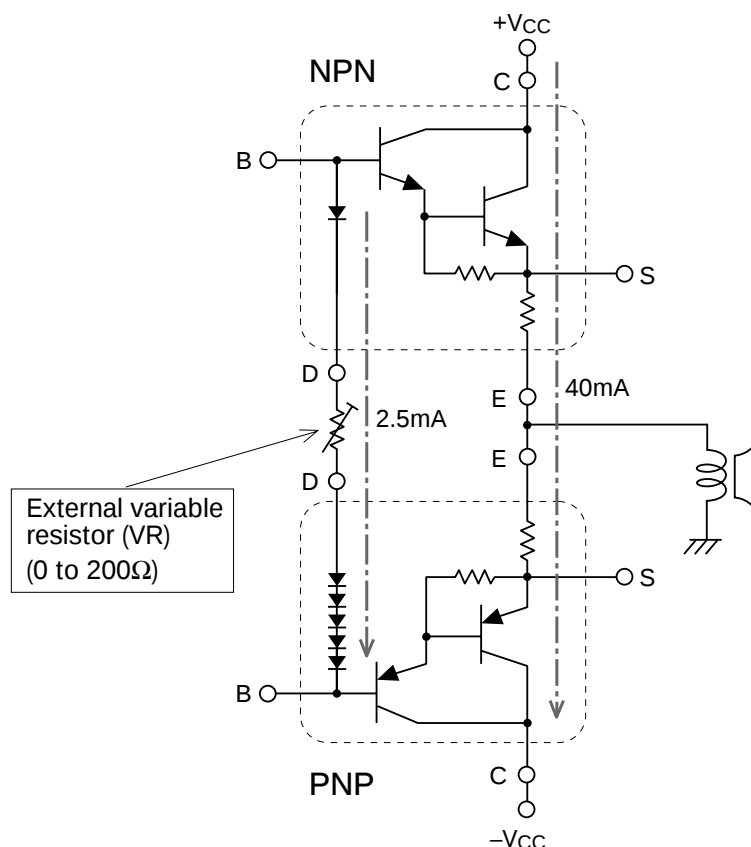
1. Recommended Operating Conditions

- ① Add a variable resistor (VR) between diode terminals to adjust the idling current. The resistor having 0 to 200 Ω is to be used.
- ② Adjust the forward current flowing over the diodes at 2.5mA.
- ③ Adjust the idling current at 40mA with the external variable resistor.

Both the temperature coefficients for the transistor and the diodes are matched under the above conditions. Both the PNP and the NPN are Darlington transistors, so the temperature change ratio of the total four V_{BE} of the transistors is subject to the compensation. One PN junction diode in the NPN and five Schottky barrier diodes in the PNP are built-in, and the total six diodes are operating as the temperature compensation.

The temperature coefficient of the total diodes (its variable value) becomes smaller with a larger forward current (approximately -0.2mV/ to 1mA), and the coefficient of the total transistors (its variable value) also becomes smaller with a larger idling current (approximately -0.1mV/ to 10mA), but the both variable values are small.

Thus, the distortion of the temperature coefficient caused by the different current is small, so the thermal runaway may not be occurred due to the changes of the recommended ratings; however, the actual operation is to be confirmed by using an experimental equipment or board.



2. External Variable Resistor

Total forward voltage (at $I_F = 2.5\text{mA}$) of the diodes is designed to be equal or less than that of total V_{BE} (at $I_C = 40\text{mA}$) of the transistor, thus the idling current is required to be adjusted at 40mA with an additional external variable resistor.

The relations are shown as below:

$$\text{Total } V_F \text{ of Diode} \leq \text{Total } V_{BE} \text{ of Transistor} + \text{Total } V_{RE} \text{ of Emitter Resistor}$$

$$\Delta V = 0 \text{ to } 500\text{mV}$$

The V_{BE} of the transistor is dependent to the h_{FE} , and the V_{BE} is lower with higher h_{FE} and vice versa. The h_{FE} for both the PNP and the NPN varies between $5k$ and $20k$; thus the V_{BE} is the lowest with the combination of maximum h_{FE} ($20k$) each and it is the highest with the combination of minimum h_{FE} ($5k$) each.

Presuming the voltage difference between the V_F of the diodes and the V_{BE} of the transistors (including the total voltage drops of the two emitter resistors) as ΔV .

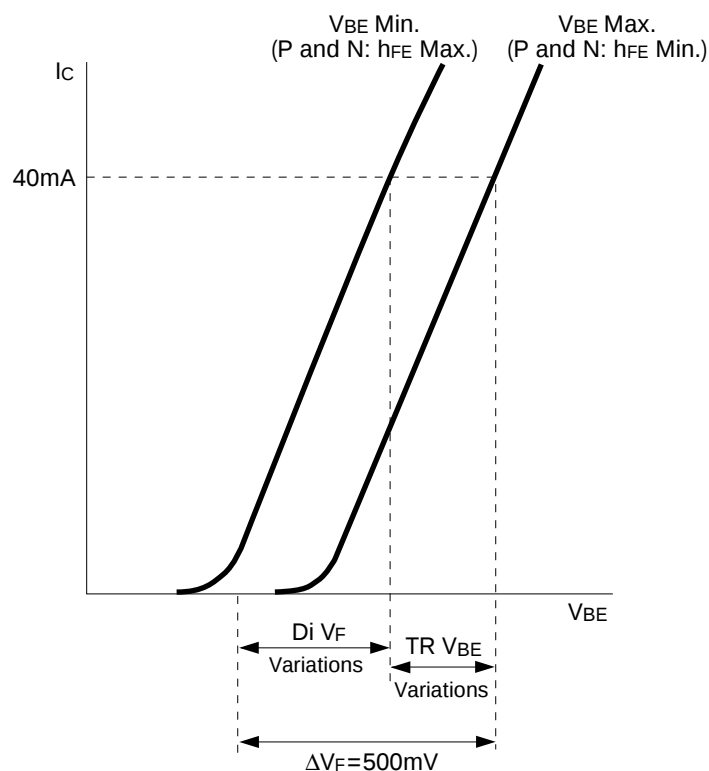
$$\text{Minimum } V_{BE} - \text{Maximum } V_F \text{ variations of the diodes} = 0$$

$$\text{Maximum } V_{BE} - \text{Minimum } V_F \text{ variations of the diodes} = 500\text{mV}$$

The current flowing over the diodes and the VR is adjusted at 2.5mA ; therefore

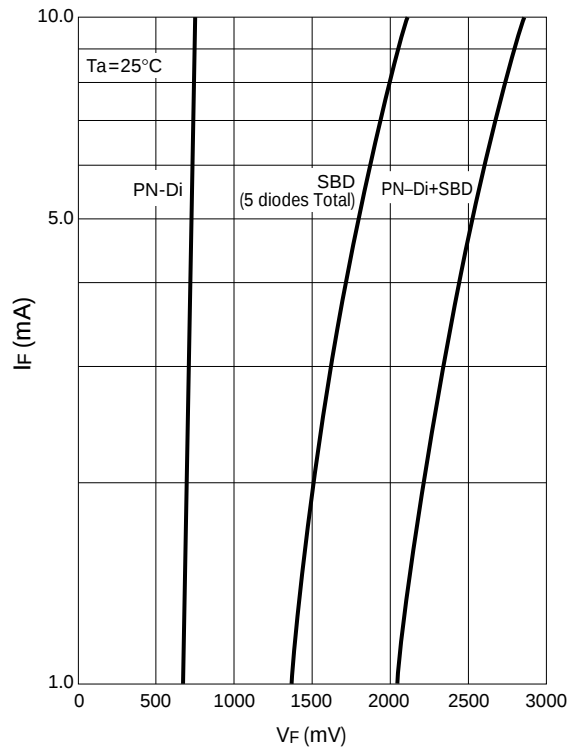
$$500\text{mV} \div 2.5\text{mA} = 200\Omega$$

Consequently, the applicable VR value is to be 0 to 200%



3. Characteristics of the temperature compensation diodes

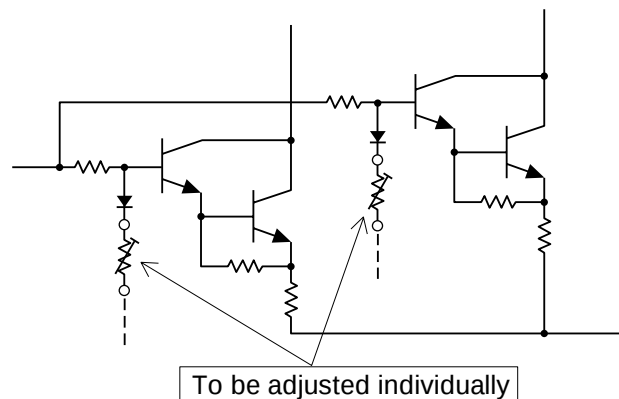
The several temperature compensation diodes are connected in series, so the forward voltage is varied with small current fluctuations. Therefore, in case the forward current flowing over the diodes is set at 2.5mA and over, the forward voltage rises, and in the worst combinations, the idling current reaches to 40mA and over with minimum V_R of 0Ω . On the contrary, in case the forward current is set at 2.5mA or below, the idling current may not reach to 40mA with maximum V_R of 200Ω .



$I_F - V_F$ Characteristics

4. Parallel push-pull application

Adjustments of the idling current are required by each the resistor in parallel push-pull applications. One side adjustment will cause the idling current to be unstable (seesaw operation) because of the different h_{FE} .



5. Destruction capacity of the built-in emitter resistor

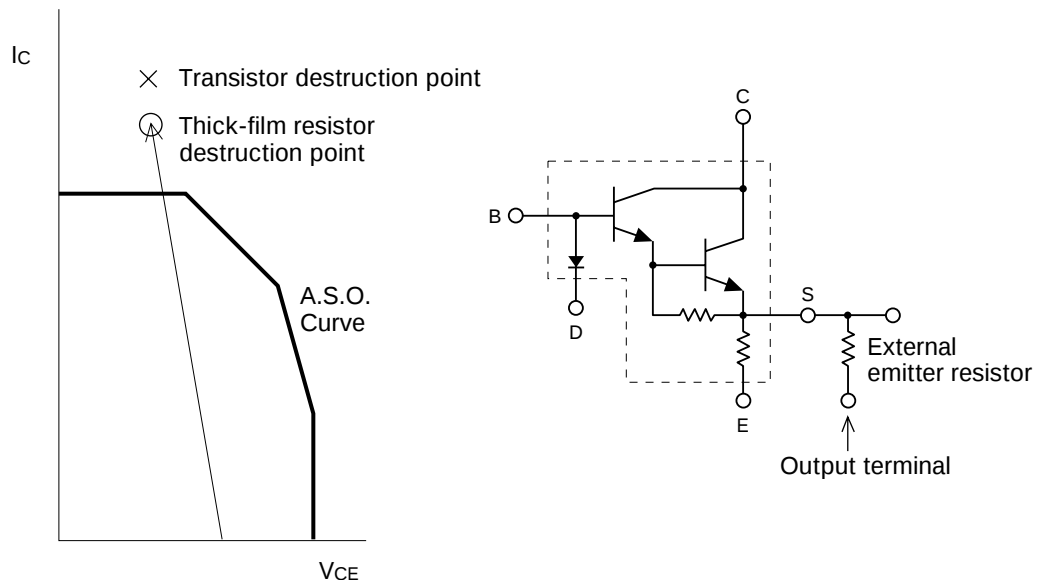
A thick-film resistor is used for the built-in resistor. The thick-film resistor has weaker destruction point in the P_c area (especially for large current flowing area) than that of the transistor chip itself. There is less concern, however, as this is subject to the area beyond an Are of Safe Operation (A.S.O.).

However, under the evaluation like a short circuit test in which the current exceeds the guaranteed value, it may cause the emitter resistor to be destroyed before the transistor itself is destroyed.

Consequently, the current value (or time) that operates the protection circuit is to be set at lower than that of discrete device configurations. In the application of car audio amplifiers, the same manners as the above need to be considered because the large current is flowed at low impedance.

In addition, once the transistor falls into thermal runaway due to a soldering failure to the external VR added between diodes or other failure manners, as the worst case, there may cause a resin crack or smoke emissions by flare up. Flame retardant molding resin is used, and the material of the product is conformed to the most sever standard UL94V0. However it is recommended that the careful consideration be given to a protection circuit, and the protection circuits should be provided appropriately in due course.

If the operating conditions are not to be matched to the ratings, it is also recommended that the E (Emitter resistor) terminal should be opened and the external emitter resistor should be added to the S (Sensing) terminal shown as below.



Discontinued Parts Guide

Discontinued Parts	Replacement Parts
2SA744to745	2SA1694to1695
2SA746to747	2SA1695
2SA764to765	2SA1725to1726
2SA807to808	2SA1693to1694
2SA878	—
2SA892	2SB1351
2SA907to909	2SA1215to1216,1295
2SA971	—
2SA980to982	2SA1694
2SA1067	—
2SA1068	—
2SA1102	2SA1693
2SA1103	2SA1694
2SA1104	2SA1694
2SA1105	2SA1695
2SA1106	2SA1695
2SA1116	2SA1493
2SA1117	2SA1494
2SA1135	2SA1693
2SA1169	2SA1493
2SA1170	2SA1494
2SA1187	—
2SA1205	2SA1746
2SA1355	2SA1262,1488
2SB622	—
2SB711to712	2SB1259,1351
2SB1005	2SB1257
2SB1476	2SB1624
2SB1586	2SB1625
2SC1107	2SC3179,3851
2SC1108	2SC3851A
2SC1109	2SC3179,3851
2SC1110	2SC3851A
2SC1111to1112	2SC4467to4468
2SC1113	2SC4511to4512
2SC1114	—
2SC1115to1116	2SC4468
2SC1402to1403	2SC4467to4468
2SC1436	—
2SC1437	—
2SC1440to1441	—
2SC1442to1443	—
2SC1444to1445	2SC4511to4512
2SC1454	—
2SC1477	—
2SC1504	2SC2023
2SC1577to1578	2SC3833,3831
2SC1579to1580	2SC4706
2SC1584to1585	2SC2921-2922,3264
2SC1618to1619	2SC4466-4467
2SC1629	2SD2045
2SC1664	2SC4558
2SC1768	—
2SC1777	—
2SC1783	—
2SC1786	—
2SC1828	2SC3832,3830

Discontinued Parts	Replacement Parts
2SC1829	—
2SC1830	2SD2082,2083
2SC1831	—
2SC1832	—
2SC1888to1889	2SC3852,3852A
2SC2022	2SC2023
2SC2147	—
2SC2198	2SC4024
2SC2199	2SC4131
2SC2256	—
2SC2260to2262	2SC4467
2SC2302	2SC3832
2SC2303	2SC3833
2SC2304	2SC3833
2SC2305	—
2SC2306	2SC4140
2SC2307	2SC3833
2SC2317	2SD2016
2SC2354	2SC2023
2SC2364	—
2SC2365	2SC3831
2SC2491	2SC4024
2SC2492	—
2SC2493	—
2SC2577	2SC4466
2SC2578	2SC4467
2SC2579	2SC4467
2SC2580	2SC4468
2SC2581	2SC4468
2SC2607	2SC3857
2SC2608	2SC3858
2SC2665	2SC4466
2SC2723	2SC4140
2SC2761	—
2SC2773	2SC3857
2SC2774	2SC3858
2SC2809	—
2SC2810A	2SC4820
2SC2825	2SD2045
2SC2838	—
2SC2900	—
2SC3409	2SC3679
2SC3520	2SC4140
2SC3706	—
2SC3909	2SC3680
2SC4023	2SC5124
2SC4199,4199A	2SC5124
2SC4302	2SC4301
2SC4303,4303A	2SC5002
2SC4494	2SC4495
2SC4756	2SC5002
2SD15to18	2SC4468
2SD80to84	2SC4466,4467
2SD90to94	2SC3179,3851,3851A
2SD163to166	2SC4468
2SD201to203	2SC4466to4467
2SD211to214	2SC4468

Discontinued Parts	Replacement Parts
2SD219to221	2SC3179,3851,3851A
2SD219Flo221F	2SC3179,3851,3851A
2SD222to224	2SC3179,3851,3851A
2SD236to238	2SC3179,3851,3851A
2SD241to244	2SC3179,3851,3851A
2SD256to259	2SC3179,3851,3851A
2SD419to421	2SD1769,1785
2SD556to557	2SC4468
2SD593to594	2SC4020
2SD605	—
2SD606	—
2SD614to615	2SD1769,1785
2SD617	2SD2082
2SD721	2SD2081
2SD722	2SD2081
2SD807	2SC3679
2SD810	2SC4024
2SD971	—
2SD972	2SD1796
2SD1031	2SD1769,1785
2SD1170	2SD2045
2SD1532	2SD2015
2SD2231	2SD2493
2SD2437	2SD2494

Repair Parts	Replacement Parts
2SA768to769	2SA1262,1488,1488A
2SA770to771	2SA1725,1726
2SA957to958	2SA1667,1668
2SA1489	2SA1693
2SA1490	2SA1694
2SA1491	2SA1695
2SA1643	2SA1725
2SA1670	2SA1907
2SA1671	2SA1908
2SA1672	2SA1909
2SB1624	2SB1685
2SB1625	2SB1687
2SB1626	2SB1686
2SC1826to1827	2SC3179,3851,3851A
2SC1983to1984	2SC3852,3852A
2SC1985to1986	2SC4511,4512
2SC2167to2168	2SC4381,4382
2SC2315to2316	2SC4558
2SC2810	2SC3890
2SC3300	2SC4131
2SC3853	2SC4466
2SC3854	2SC4467
2SC3855	2SC4468
2SC4385	2SC5099
2SC4386	2SC5100
2SC4387	2SC5101
2SC4503	2SD2083
2SC4558	2SD2495
2SC4820	2SC4518
2SD2493	2SD2641
2SD2494	2SD2643
2SD2495	2SD2642



Sanken Electric Co.,Ltd.
1-11-1 Nishi-Ikebukuro,Toshima-ku, Tokyo
PHONE: 03-3986-6164
FAX: 03-3986-8637

Overseas Sales Offices

• Asia

Sanken Electric Korea Co.,Ltd.

SK Life B/D 6F,
168 Kongduk-dong, Mapo-ku, Seoul, 121-705, Korea
PHONE: 82-2-714-3700
FAX: 82-2-3272-2145

Taiwan Sanken Electric Co.,Ltd.

Room 902, No.88, Chung Hsiao E. Rd., Sec. 2
Taipei, Taiwan R.O.C.
PHONE: 886-2-2356-8161
FAX: 886-2-2356-8261

Sanken Electric Singapore Pte.Ltd.

150 Beach Road, #14-03 The Gateway West,
Singapore 0718
PHONE: 291-4755
FAX: 297-1744

Sanken Electric Hong Kong Co.,Ltd.

1018 Ocean Centre, Canton Road,
Kowloon, Hong Kong
PHONE: 2735-5262
FAX: 2735-5494

• North America

Allegro MicroSystems,Inc.

115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615, U.S.A.
PHONE: (508) 853-5000
FAX: (508) 853-7861

• Europe

Allegro MicroSystems Europe Limited.

Balfour House, Churchfield Road,
Walton-on-Thames, Surrey KT12 2TD, U.K.
PHONE: 01932-253355
FAX: 01932-246622