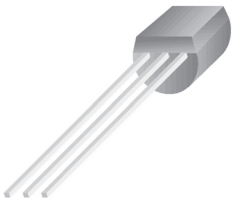
2N3904

General Purpose Transistor NPN

RoHS Device

Halogen Free

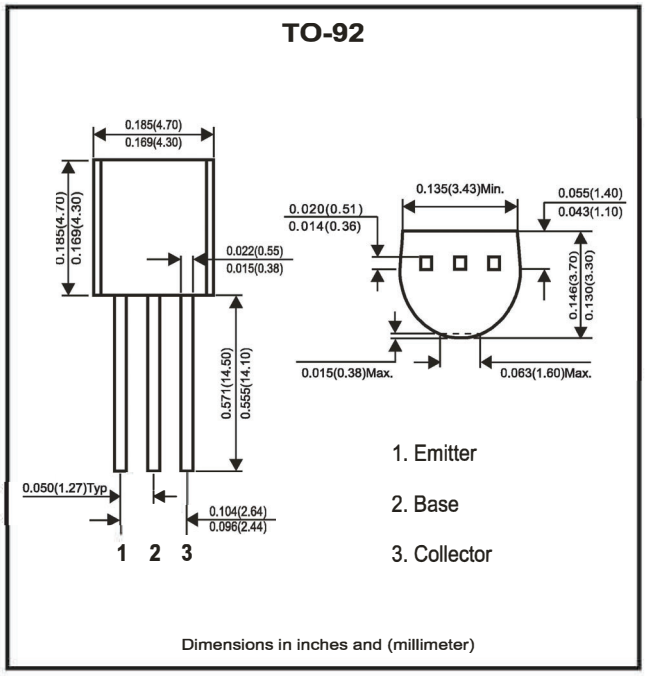


Features

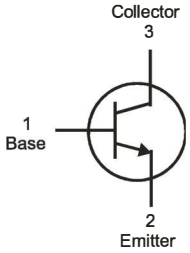
- NPN silicon epitaxial planar transistor for switching and amplifier application.

Mechanical data

- Case: Molded plastic, TO-92.



Circuit Diagram



Maximum Ratings (at TA=25°C unless otherwise noted)

Parameter	Symbol	Min	Max	Unit
Collector-base voltage	V_{CBO}		60	V
Collector-emitter voltage	V_{CEO}		40	V
Emitter-base voltage	V_{EBO}		6	V
Collector current-continuous	I_C		0.2	A
Collector dissipation	P_C		0.625	W
Storage temperature and junction temperature	T_{STG} , T_J	-55	+150	°C

Electrical Characteristics (at TA=25°C unless otherwise noted)

Parameter	Conditions	Symbol	Min	Max	Unit
Collector-Base breakdown voltage	I_C =10μA, I_E=0	$V_{(BR)CBO}$	60		V
Collector-Emitter breakdown voltage	I_C =1mA, I_B=0	$V_{(BR)CEO}$	40		V
Emitter-Base breakdown voltage	I_E =10μA, I_C=0	$V_{(BR)EBO}$	6		V
Collector cut-off current	V_{CB}=60V, I_E=0	I_{CBO}		100	nA
Collector cut-off current	V_{CE}=30V, $V_{BE(off)}$=3V	I_{CEX}		50	nA
Emitter cut-off current	V_{EB}=5V, I_C=0	I_{EBO}		100	nA
DC current gain	V_{CE}=1V, I_C=10mA	$h_{FE(1)}$	100	400	
	V_{CE}=1V, I_C=50mA	$h_{FE(2)}$	60		
	V_{CE}=1V, I_C=100mA	$h_{FE(3)}$	30		
Collector-Emitter saturation voltage	I_C=50mA, I_B=5mA	V_{CE}(sat)		0.3	V
Base-Emitter saturation voltage	I_C=50mA, I_B=5mA	V_{BE}(sat)		0.95	V
Transition frequency	V_{CE}=20V, I_C=10mA f=100MHz	f_T	300		MHz
Delay time	V_{CC}=3V, $V_{BE(off)}$=-0.5V	td		35	nS
Rise time	I_C=10mA, I_{B1}=1mA	tr		35	nS
Storage time	V_{CC}=3V, I_C=10mA	ts		200	nS
Fall time	I_{B1}=I_{B2}=1mA	tf		50	nS

Classification of hFE(1)

Rank	O	Y	G
Range	100-200	200-300	300-400

Rating and Characteristic Curves

Fig.1 - Static Characteristic

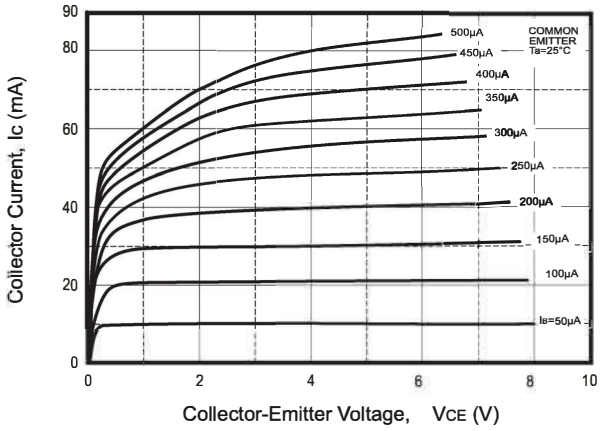
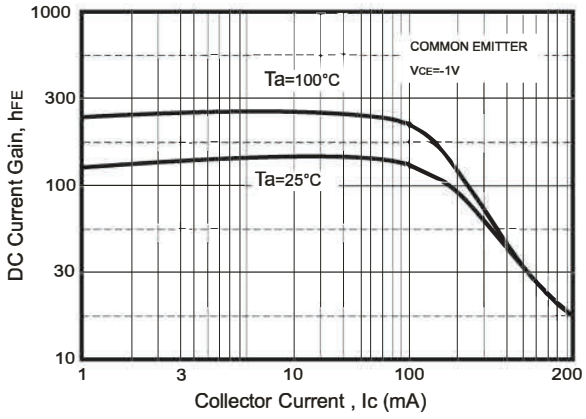


Fig.2 - h_{FE}— I_C



Rating and Characteristic Curves

Fig. 3 - V_{CEsat} — I_C

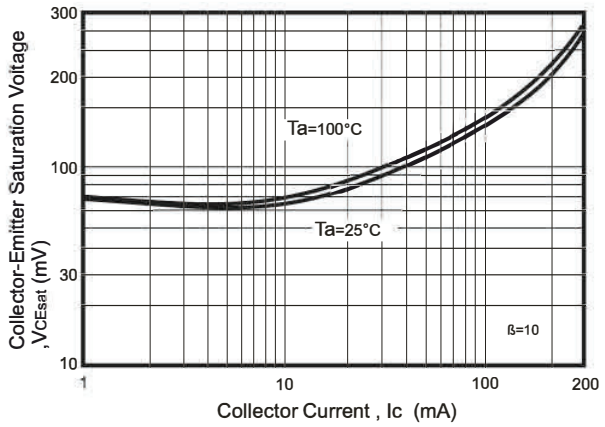


Fig. 4 - $V_{BE}sat$ — I_C

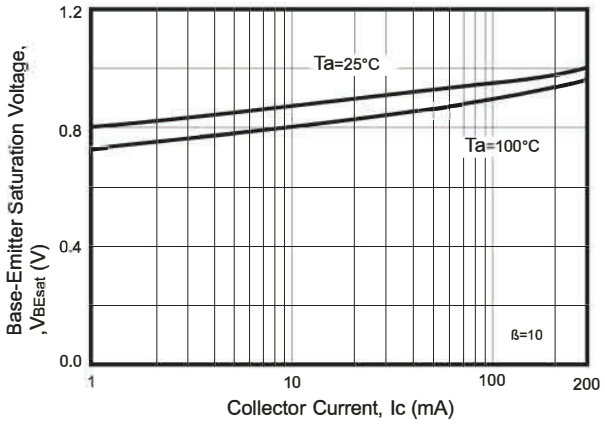


Fig. 5 - I_C — V_{BE}

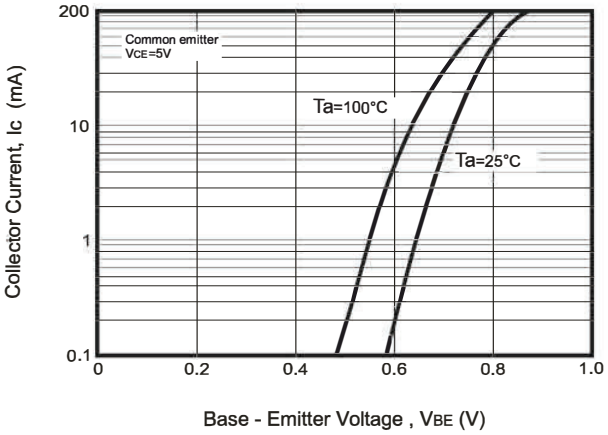


Fig. 6 - C_{ob}/C_{ib} — V_{CB}/V_{EB}

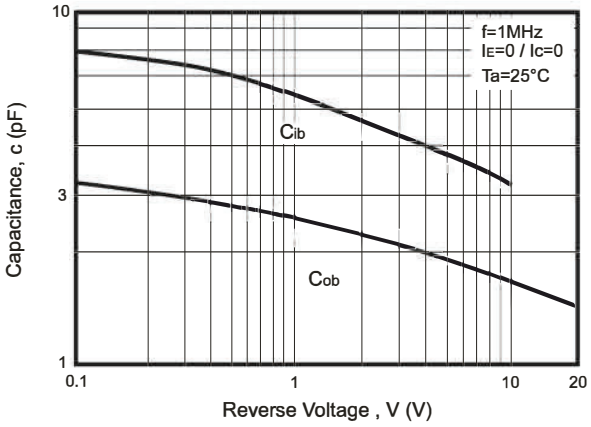


Fig. 7- f_T — I_C

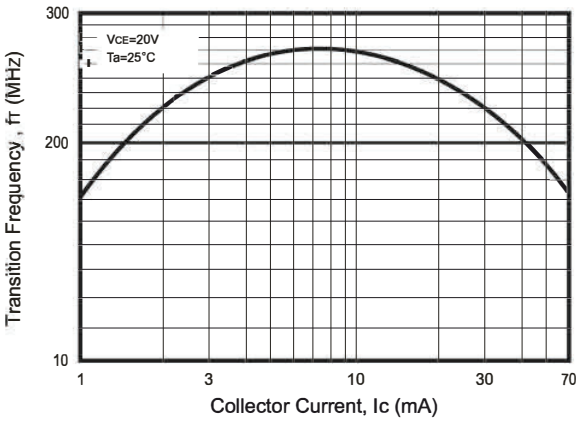
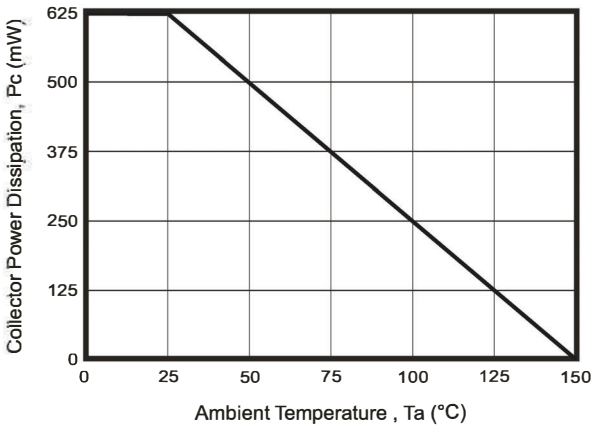
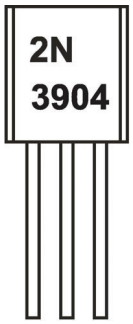


Fig.8 - P_C — Ta



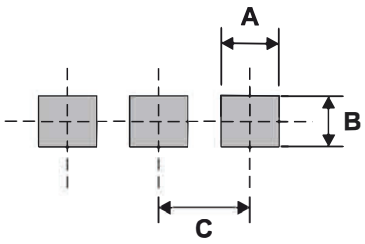
Marking Code

Part Number	Marking Code
2N3904	2N3904



Suggested PAD Layout

SIZE	TO-92	
	(mm)	(inch)
A	0.80	0.031
B	0.70	0.028
C	1.27	0.050



Notes: 1. The pad layout is for reference purposes only.

Standard Packaging

Case Type	BULK PACK
	BAG (pcs)
TO-92	1,000