

A S J

DATA SHEET

Fully Lead-Free Thick Film Chip Resistors

CRF Series ($\geq 1\Omega$)

0.1% TO 5%, TCR ± 150 TO ± 200

SIZE: 0201/0402/0603/0805/1206/1210/2010/2512

RoHs Compliant



FULLY LEAD-FREE THICK FILM CHIP RESISTORS

CRF Series ($\geq 1\Omega$)

DS-ENG-024

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1. SCOPE

- 1.1 This specification is applicable to fully lead-free and halogen free CRF series thick film chip resistors.
- 1.2 The fully lead-free products – No RoHS exemptions.
- 1.3 This product is for general purpose.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CRF	32	-	104	-	J	K
Type	Size (Inch/mm)		Nominal Resistance		Resistance Tolerance	Packaging
Fully Lead Free Thick Film Chip Resistors	05(0201) 10(0402) 16(0603) 21(0805) 32(1206) 40(1210) 50(2010) 63(2512)		5% (3-Digit)	EX. $10\Omega=100$ $4.7\Omega=4R7$ Jumper=000	B= $\pm 0.1\%$ D= $\pm 0.5\%$ F= $\pm 1\%$ J= $\pm 5\%$ Z=Zero Ohm	E=4,000 pcs Lead Free L=5,000 pcs Lead Free K=10,000 pcs Lead Free Y=20,000 pcs Lead Free N=50,000 pcs Lead Free
			0.1% 0.5% 1% (4 Digit)	EX. $10.2\Omega=10R2$ $10K\Omega=1002$ Jumper=0000		

3. RATING

3.1 Rated Power

3.1.1. Resistor Range

Type	Rated Power at 70°C	Max. Working Voltage	Max. Overload Voltage
CRF05 (0201)	$\frac{1}{20}$ W	25V	50V
CRF10 (0402)	$\frac{1}{16}$ W	50V	100V
CRF16 (0603)	$\frac{1}{10}$ W	75V	150V
CRF21 (0805)	$\frac{1}{8}$ W	150V	300V
CRF32 (1206)	$\frac{1}{4}$ W	200V	400V
CRF40 (1210)	$\frac{1}{2}$ W	200V	400V
CRF50 (2010)	$\frac{3}{4}$ W	200V	400V
CRF63 (2512)	1W	200V	400V

3.2 Power Derating Curve

Type	CRF05(0201)	Other
Operating Temperature Range	$-55^{\circ}\text{C} \sim +125^{\circ}\text{C}$	$-55^{\circ}\text{C} \sim +155^{\circ}\text{C}$
Explain	If the ambient temperature exceeds 70 degrees centigrade to 125 degrees centigrade, the power can be modified by the curve as below.	If the ambient temperature exceeds 70 degrees centigrade to 155 degrees centigrade, the power can be modified by the curve as below.
Figure	<p>The graph shows Rating Power (%) on the y-axis (0 to 100) versus Ambient Temperature (°C) on the x-axis (-55 to 160). The power is constant at 100% until 70°C, then derates linearly to 0% at 125°C. A dashed line marks the 70°C point, and another dashed line marks the 125°C point.</p>	<p>The graph shows Rating Power (%) on the y-axis (0 to 100) versus Ambient Temperature (°C) on the x-axis (-55 to 160). The power is constant at 100% until 70°C, then derates linearly to 0% at 155°C. A dashed line marks the 70°C point, and another dashed line marks the 155°C point.</p>

3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

Ambient Temperature = $+5^{\circ}\text{C}$ to $+35^{\circ}\text{C}$

Relative Humidity = $< 85\% \text{ RH}$

Air Pressure = 86 kPa to 106 kPa

If there may be any doubt about the results, measurement shall be made within the following limits:

Ambient Temperature = $20 \pm 2^{\circ}\text{C}$

Relative Humidity = 60 to $70\% \text{ RH}$

Air Pressure = 86 kPa to 106 kPa

3.4 Operating Temperature Range -55°C to $+155^{\circ}\text{C}$ (0201 : -55°C to $+125^{\circ}\text{C}$)

3.5 Storage Temperature Range -5°C to $+40^{\circ}\text{C}$ / $< 85\% \text{ RH}$

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating: Level 1

3.8 Product Assurance ASJ resistor shall warranty 24 months from the date of shipment.

3.9 ASJ resistors are RoHS compliance in accordance to RoHS Directive.

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3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm/℃)	Resistance Range				JUMPER (0Ω)		JUMPER (0Ω)	
					B(±0.1%) E-24、E-96	D(±0.5%) E-24、E-96	F(±1%) E-24、E-96	J(±5%) E-24	J (±5%)	F (±1%)	J (±5%)	F (±1%)
CRF05 (0201)	$\frac{1}{20}$ W	25V	50V	±200	100Ω≤R≤1MΩ	1Ω≤R≤1MΩ	1Ω≤R≤10MΩ	1Ω≤R≤10MΩ	0.5A	0.5A	50mΩ MAX.	35mΩ MAX.
CRF10 (0402)	$\frac{1}{16}$ W	50V	100V	±200	100Ω≤R≤1MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤10MΩ	1Ω≤R≤10MΩ	1A	1.5A	50mΩ MAX.	20mΩ MAX.
CRF16 (0603)	$\frac{1}{10}$ W	75V	150V	±150	100Ω≤R≤1MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	1A	2A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	2.2MΩ < R≤10MΩ	2.2MΩ < R≤10MΩ				
CRF21 (0805)	$\frac{1}{8}$ W	150V	300V	±150	100Ω≤R≤1MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	2A	2.5A	50mΩ MAX.	20mΩ MAX
				±200	-----	-----	2.2MΩ < R≤10MΩ	2.2MΩ < R≤10MΩ				
CRF32 (1206)	$\frac{1}{4}$ W	200V	400V	±150	100Ω≤R≤1MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	2A	3.5A	50mΩ MAX.	20mΩ MAX
				±200	-----	-----	2.2MΩ < R≤10MΩ	2.2MΩ < R≤10MΩ				
CRF40 (1210)	$\frac{1}{2}$ W	200V	400V	±150	100Ω≤R≤1MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	2A	4A	50mΩ MAX.	20mΩ MAX.
				±200	-----	-----	2.2MΩ < R≤10MΩ	2.2MΩ < R≤10MΩ				
CRF50 (2010)	$\frac{3}{4}$ W	200V	400V	±150	100Ω≤R≤1MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	2A	5A	50mΩ MAX.	20mΩ MAX
				±200	-----	-----	2.2MΩ < R≤10MΩ	2.2MΩ < R≤10MΩ				
CRF63 (2512)	1W	200V	400V	±150	100Ω≤R≤1MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	1Ω≤R≤2.2MΩ	2A	7A	50mΩ MAX.	20mΩ MAX
				±200	-----	-----	2.2MΩ < R≤10MΩ	2.2MΩ < R≤10MΩ				
Operating Temperature Range				-55℃ ~ +155℃ (0201:-55℃ ~ +125℃)								

3.11 Voltage Rating

The resistor shall have a DC continuous working voltage or a rms. AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined from the following

$$E = \sqrt{R \times P}$$

E= Voltage rating (v)
 P= Power rating (w)
 R= Nominal resistance(Ω)

3.12 All product, product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.

4. MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

Part Number	Color	Marking on Product
CRF05 (0201)	-	No marking
CRF10 (0402)	-	No marking
CRF16 (0603)	Light Yellow	1. Tolerance: $\pm 1\%$ (F), 0.5% (D), 0.1% (B) ✕ Four Numerals Marking(E96 Series) ✕ 0603 three characters marking based on E96 marking standard. 2. Tolerance: $\pm 5\%$ (J) ✕ Three Numerals marking 3. Zero ohm jumper resistor ✕ The marking used shall be 0
CRF21 (0805)		
CRF32 (1206)		
CRF40 (1210)		
CRF50 (2010)		
CRF63 (2512)		

4.1 Numeric Numbering

4.1.1 5% Tolerance: **Three Numerals Marking**

First 2 digits are significant figures; third digit is number of zeros. Letter R is decimal point.

Example

Nominal Resistance	Marking	Remarks
1 Ω	1R0	$1 \times 10^0 = 1$
10 Ω	100	$10 \times 10^0 = 10$
100 Ω	101	$10 \times 10^1 = 100$
4.7K Ω	472	$47 \times 10^2 = 4700$
47K Ω	473	$47 \times 10^3 = 47000$
470K Ω	474	$47 \times 10^4 = 470000$
4.7M Ω	475	$47 \times 10^5 = 4700000$

4.1.2 0.1%, 0.5%, 1% Tolerance : **Four Numerals Marking**

First 3 digits are significant figures; fourth digit is number of zeros.

Examples:

Nominal Resistance	Marking	Remarks
1 Ω	1R00	$1 \times 10^0 = 1$
10 Ω	10R0	$10 \times 10^0 = 10$
100 Ω	1000	$100 \times 10^0 = 100$
4.7K Ω	4701	$470 \times 10^1 = 4700$
47K Ω	4702	$470 \times 10^2 = 47000$
470K Ω	4703	$470 \times 10^3 = 470000$
1M Ω	1004	$100 \times 10^4 = 1000000$

4.1.3 0603 1% Tolerance: **Three Character E-96 Marking Standard.**

The first 2 digits for the 3 digits E-96 part marking standard, (Refer Table 2 & 3).

The third character is a letter multiplier:

Nominal resistance	Marking	Remark
33.2 Ω	51 X	332 X $10^{-1} \Omega$
150 Ω	18 A	150 X $10^0 \Omega$
4.99K Ω	68 B	499 X $10^1 \Omega$
1 0.2K Ω	02 C	102 X $10^2 \Omega$
100K Ω	01 D	100 X $10^3 \Omega$

4.1.3.1 EIA-96 Marking Scheme

Table 2 Significant figures

Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol	Significant Figures	Symbol
100	01	178	25	316	49	562	73
102	02	182	26	324	50	576	74
105	03	187	27	332	51	590	75
107	04	191	28	340	52	604	76
110	05	196	29	348	53	619	77
113	06	200	30	357	54	634	78
115	07	205	31	365	55	649	79
118	08	210	32	374	56	665	80
121	09	215	33	383	57	681	81
124	10	221	34	392	58	698	82
127	11	226	35	402	59	715	83
130	12	232	36	412	60	732	84
133	13	237	37	422	61	750	85
137	14	243	38	432	62	768	86
140	15	249	39	442	63	787	87
143	16	255	40	453	64	806	88
147	17	261	41	464	65	825	89
150	18	267	42	475	66	845	90
154	19	274	43	487	67	866	91
158	20	280	44	499	68	887	92
162	21	287	45	511	69	909	93
165	22	294	46	523	70	931	94
169	23	301	47	536	71	953	95
174	24	309	48	549	72	976	96

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Table 3 Multiplier

Symbol	Multiplier	Symbol	Multiplier
A	10^0	G	10^6
B	10^1	H	10^7
C	10^2	X	10^{-1}
D	10^3	Y	10^{-2}
E	10^4		
F	10^5		



Product Specification

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5. DIMENSIONS, CONSTRUCTIONS AND MATERIALS

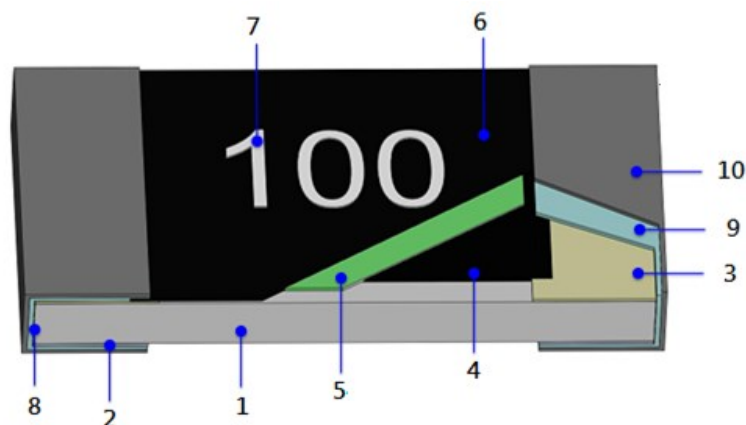
5.1 Dimensions

Unit:mm



Dimension		L	W	H	L1	L2
Type	Size Code					
CRF05	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
CRF10	0402	1.00±0.10	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10
CRF16	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.15	0.30±0.15
CRF21	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.15
CRF32	1206	3.05±0.10	1.55±0.10	0.50±0.10	0.45±0.20	0.35±0.15
CRF40	1210	3.05±0.10	2.55±0.10	0.55±0.10	0.50±0.20	0.50±0.20
CRF50	2010	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.20
CRF63	2512	6.30±0.20	3.20±0.20	0.55±0.10	0.60±0.20	0.60±0.20

5.2 Structure graph



1	Ceramic substrate	6	2 nd Protective coating
2	Bottom inner electrode	7	Marking(except CRF05 & CRF10)
3	Top inner electrode	8	Terminal inner electrode
4	Resistive layer	9	Ni plating
5	1 st Protective coating	10	Sn plating

5.3 Plating Thickness:

5.3.1 Ni: $\geq 2\mu\text{m}$

5.3.2 Sn(Tin): $\geq 3\mu\text{m}$

5.3.3 Sn(Tin):Matte Sn

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6. Reliability Test

6.1 Electrical Performance Test

Item	Conditions	Specifications	
		Resistors	Jumper
Temperature Coefficient of Resistance	Refer to JIS-C5201-1 4.8 $TCR(ppm/^{\circ}C) = \frac{(R2 - R1)}{R1(T2 - T1)} \times 10^6$ R1: Resistance at room temperature R2: Resistance at -55℃ or +125℃ T1: Room temperature T2: Temperature -55℃ or +125℃	Refer to item 3.10	NA
Short Time Overload	Refer to JIS-C5201-1 4.13 Applied 2.5 times rated voltage for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Rated voltage refer to item 3.10 general specifications)	0.1%、0.5%、1%:ΔR%=±1.0% 5%:ΔR%=±2.0%	Refer to item 3.10
Dielectric Withstand Voltage	Refer to JIS-C5201-1 4.7 Put the resistor in the fixture, add VAC (see SPEC below) in +,- terminal for. CRF05、10、16 apply 300 VAC 1 minute. CRF21、32、40、50、63 apply 500 VAC 1 minute.	No short or burned on the appearance.	
Intermittent Overload	Refer to JIS-C5201-1 4.13 Put the tested resistor in chamber under temperature 25±2℃ and load 2.5 times rated DC voltage for 1 sec on, 25 sec off,10000 $^{+400}_{-0}$ test cycles, then it be left at no-load for 1 hour , then measure its resistance variance rate. Jumper : Applied Maximum overload current	ΔR%=±5.0%	Refer to item 3.10



Product Specification

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6.2 Mechanical Performance Test

Item	Conditions	Specifications	
		Resistors	Jumper
Solderability	Refer to JIS-C5201-1 4.17 Preconditioning Put the tested resistor in the apparatus of PCT, at a temperature of 105°C, humidity of 100% RH, and pressure of 1.22×10^5 Pa for a duration of 4 hours. Then after left the tested resistor in room temperature for 2 hours or more. Test method: The resistor be immersed into solder pot in temperature $235 \pm 5^\circ\text{C}$ for 2 sec, then the resistor is left as placed under microscope to observed its solder area.	Solder coverage over 95%	
Resistance to Soldering Heat	Refer to JIS-C5201-1 4.18 ©Test method 1 (Solder pot test): The tested resistor be immersed into molten solder of $260^{+5}_{-0}^\circ\text{C}$ for 10 seconds. Then the resistor is left in the room for 1 hour. ©Test method 2 (Solder pot test): The tested resistor be immersed into molten solder of $260^{+5}_{-0}^\circ\text{C}$ for 30 seconds. Then the resistor is left as placed under microscope to observe its solder area. ©Test method 3 (Electric iron test): Preheating temperature : $350 \pm 10^\circ\text{C}$ Electric iron preheating time : 3^{+1}_{-0} sec Preheating the electric iron on electrode termination, as after that step placed the iron over 60 min. and measured its resistance variance rate.	Test item 1: (1).Variance rate on resistance: $\Delta R\% = \pm 1.0\%$ Test item 2: (1).Solder coverage over 95%. (2).The underlying material (such as ceramic) shall not be visible at the crest corner area of the electrode. Test item 3: (1).Variance rate on resistance: $\Delta R\% = \pm 1.0\%$	Refer to item 3.10

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Item	Conditions	Specifications	
		Resistors	Jumper
Joint Strength of Solder	<p>Refer to JIS-C5201-1 4.33</p> <p>◎Bending Strength: Solder tested resistor on to PC board add force in the middle down, and under load measured its resistance variance rate.</p> <p>D:CRF10、16、21=5mm CRF05、32、40=3mm CRF50、63=2mm</p>	$\Delta R\% = \pm 1.0\%$	Refer to item 3.10

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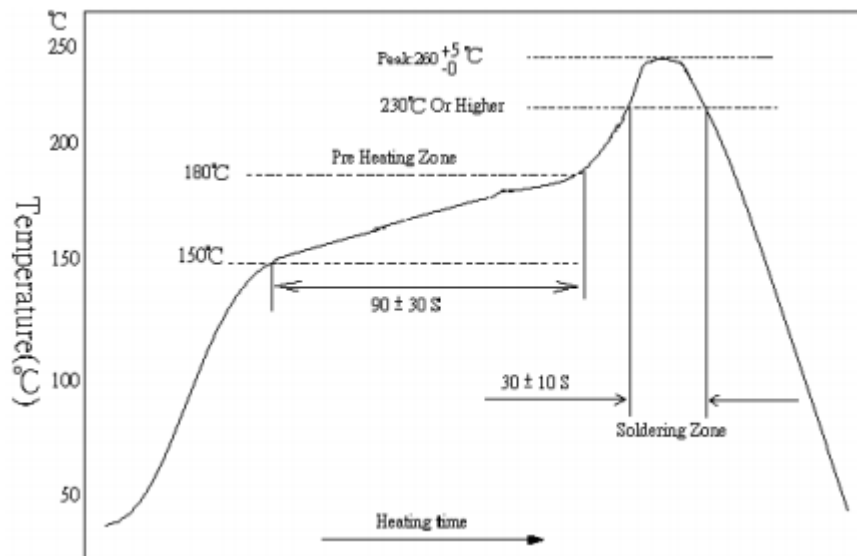
6.3 Environmental Test

Item	Conditions	Specifications									
		Resistors	Jumper								
Resistance to Dry Heat	Refer to JIS-C5201-1 4.25 Put tested resistor in chamber under temperature 155±5°C for 1000 ⁺⁴⁸ ₋₀ hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.(CRF05、CRF16 for 125±3°C)	0.1%、0.5%、1%:ΔR%=±1.0% 5%:ΔR%=±2.0%	Refer to item 3.10								
Thermal Shock	Refer to MIL-STD 202 Method 107 Put the tested resistor in the chamber under the Thermal Shock which shown in the following table shall be repeated 300 times consecutively. Then leaving the tested resistor in the room temperature for 1 hours, and measure its resistance variance rate. <table><tr><th colspan="2">Testing Condition</th></tr><tr><td>Lowest Temperature</td><td>-55±5°C</td></tr><tr><td>Highest Temperature</td><td>125±5°C</td></tr><tr><td>Temperature-retaining time</td><td>15 minutes each</td></tr></table>	Testing Condition		Lowest Temperature	-55±5°C	Highest Temperature	125±5°C	Temperature-retaining time	15 minutes each	0.1%、0.5%、1%:ΔR%=±0.5% 5%:ΔR%=±1.0%	Refer to item 3.10
Testing Condition											
Lowest Temperature	-55±5°C										
Highest Temperature	125±5°C										
Temperature-retaining time	15 minutes each										
Loading Life in Moisture	Refer to JIS-C5201-1 4.24 Put the tested resistor in the chamber under temperature 40±2°C, relative humidity 90~95% and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.	<table><tr><th>Type</th><th>ΔR%</th></tr><tr><td>CRF05</td><td>0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%</td></tr><tr><td>Other</td><td>0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%</td></tr></table>	Type	ΔR%	CRF05	0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%	Other	0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%	Refer to item 3.10		
Type	ΔR%										
CRF05	0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%										
Other	0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%										
Load Life	Refer to JIS-C5201-1 4.25 Put the tested resistor in chamber under temperature 70±2°C and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.	<table><tr><th>Type</th><th>ΔR%</th></tr><tr><td>CRF05</td><td>0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%</td></tr><tr><td>Other</td><td>0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%</td></tr></table>	Type	ΔR%	CRF05	0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%	Other	0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%	Refer to item 3.10		
Type	ΔR%										
CRF05	0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%										
Other	0.1%、0.5%、1%: ΔR%=±1.5% 5%: ΔR%=±3.0%										

6.4 Technical application notes: This is for recommendation, customer are please to perform adjustment according to actual application)

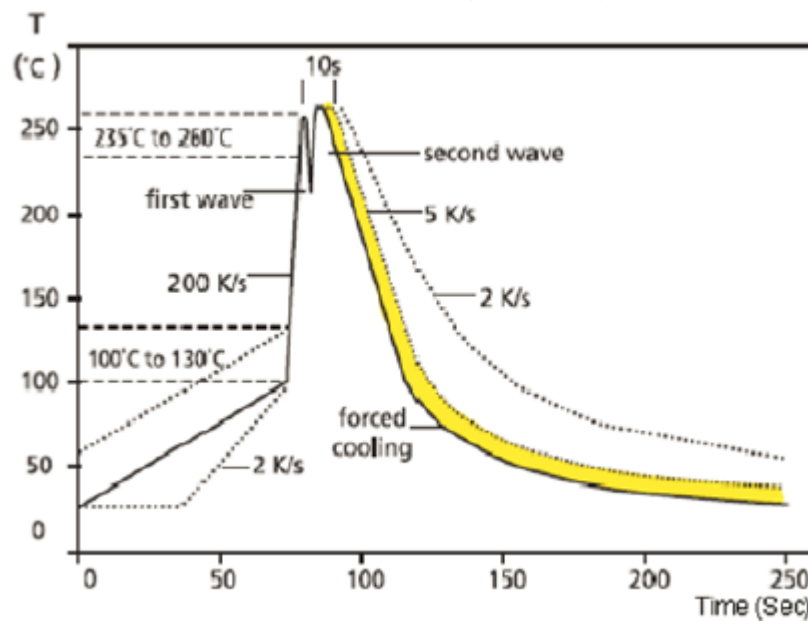
Soldering Profile

6.4.1 Lead Free IR Reflow Soldering Profile



Remark: The peak temperature of soldering heat is 260 ± 5 °C

6.4.2 Lead Free Double wave Soldering Profile.(Applies to 0603 size inclusive above product)

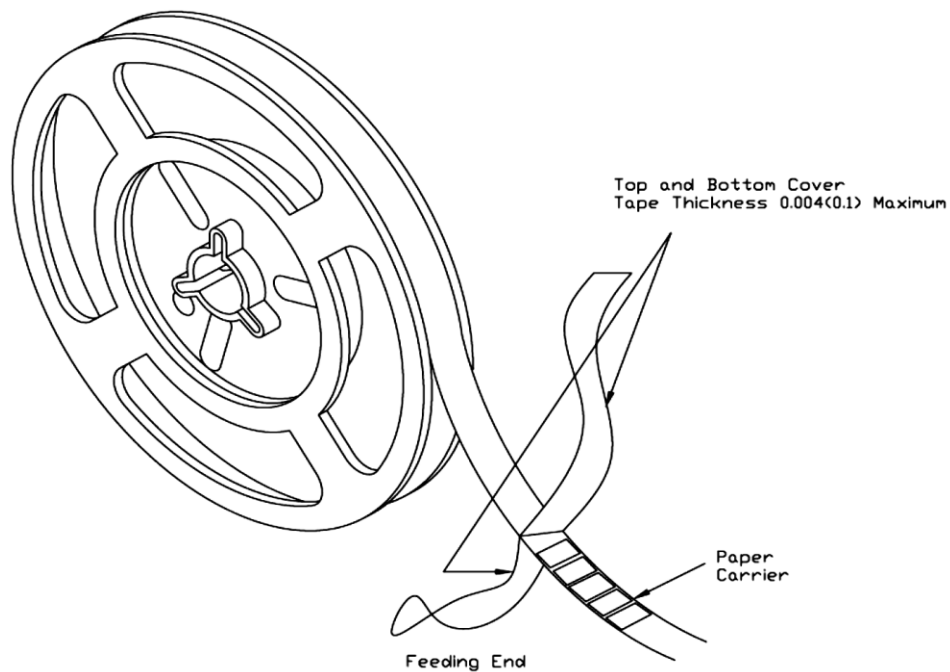


6.4.3 Soldering Iron: Temperature $350^\circ\text{C} \pm 10^\circ\text{C}$, dwell time shall be less than 3 sec.

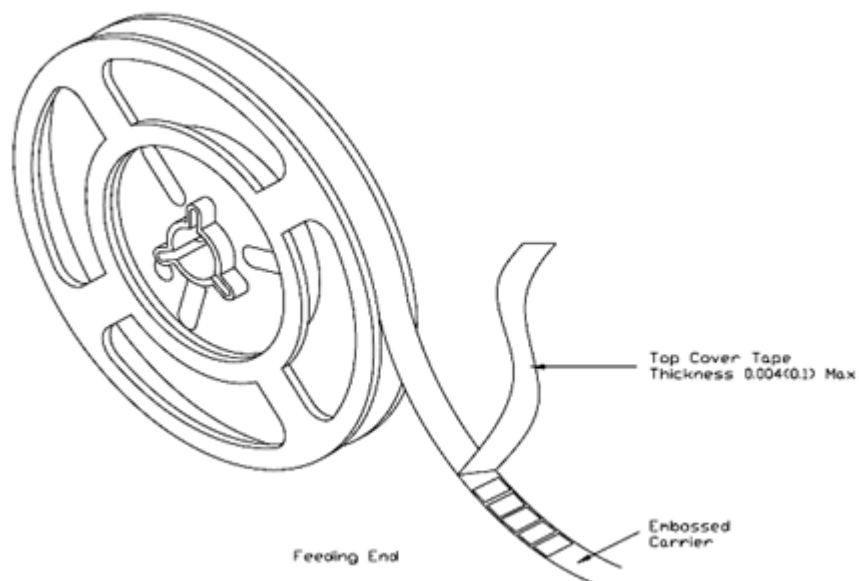
7. TAPING

7.1 Structure of Taping

Paper Carrier

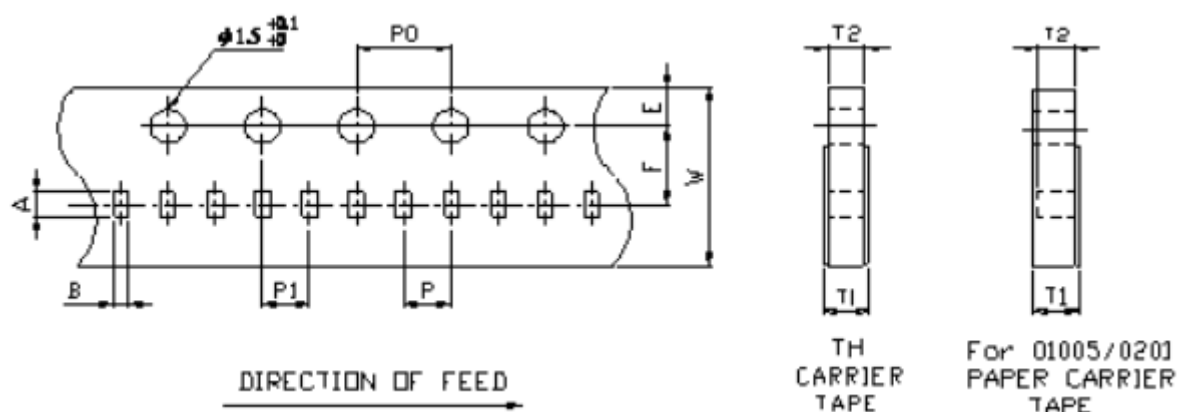


Embossed Plastic Carrier



7.2 Dimension

7.2.1 Dimension of Punched Paper Tape Carrier System (CRF05 and CRF10)



Remark: Pitch tolerance over any 10 pitches of P_0 is ± 0.2 mm

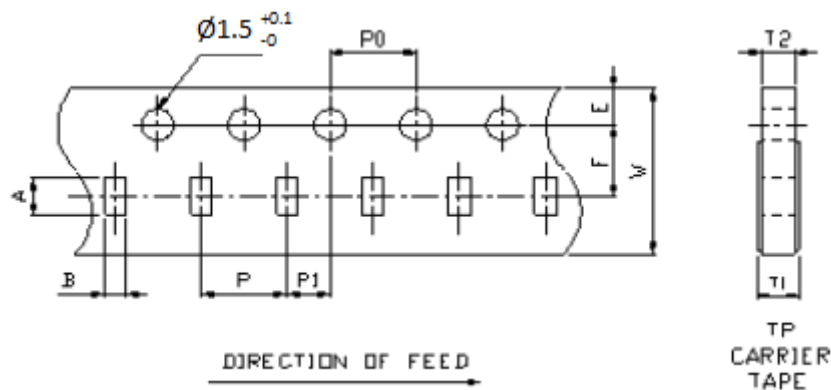
Dimension of Punched Paper Tape Carrier System (CRF05 & CRF10)

(unit : mm)

Code	A	B	W	E	F	T1
CFR05	0.68 ± 0.05	0.38 ± 0.03	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	$0.42^{+0.1}_{-0}$
CRF10	1.15 ± 0.05	0.65 ± 0.05	8.00 ± 0.20	1.75 ± 0.10	3.50 ± 0.05	$0.42^{+0.2}_{-0}$

Code	T2	P	P0	10xP0	P1
CRF05	0.28 ± 0.02	2.00 ± 0.05	4.00 ± 0.05	40.0 ± 0.20	2.00 ± 0.05
CRF10	0.40 ± 0.05	2.00 ± 0.10	4.00 ± 0.05	40.0 ± 0.20	2.00 ± 0.05

7.2.2 Dimension of Punched Paper Tape Carrier System (CRF16, 21, 32)

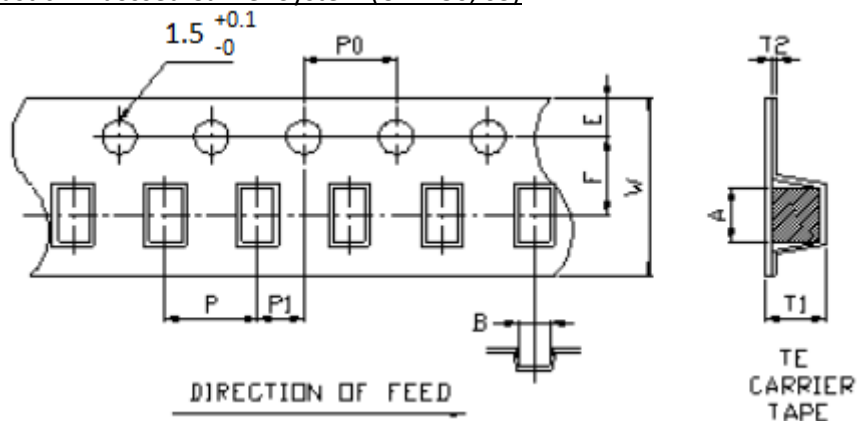


Remark: Pitch tolerance over any 10 pitches of P_0 is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CRF - 16, 21, 32)

Code	A	B	W	E	F	T1	T2	P	P0	P1
CRF16	1.8 ± 0.10	1.0 ± 0.10	8.0 ± 0.20	1.75 ± 0.10	3.50 ± 0.05	$0.60^{+0.2}_{-0}$	0.60 ± 0.10	4.0 ± 0.10	4.0 ± 0.05	2.0 ± 0.05
CRF21	2.3 ± 0.10	1.55 ± 0.1	8.0 ± 0.20	1.75 ± 0.10	3.50 ± 0.05	$0.75^{+0.2}_{-0}$	0.75 ± 0.10	4.0 ± 0.10	4.0 ± 0.05	2.0 ± 0.05
CRF32	3.5 ± 0.20	1.9 ± 0.20	8.0 ± 0.20	1.75 ± 0.10	3.50 ± 0.05	$0.75^{+0.2}_{-0}$	0.75 ± 0.10	4.0 ± 0.10	4.0 ± 0.05	2.0 ± 0.05
CRF40	3.5 ± 0.20	2.8 ± 0.20	8.0 ± 0.20	1.75 ± 0.10	3.50 ± 0.05	$0.75^{+0.2}_{-0}$	0.75 ± 0.10	4.0 ± 0.10	4.0 ± 0.05	2.0 ± 0.05

Dimension of Plastic Embossed Carrier System (CRF -50, 63)



Code	A	B	W	E	F	T1	T2	P	P0	P1
CRF50	5.5 ± 0.20	2.8 ± 0.20	12.0 ± 0.20	1.75 ± 0.10	5.50 ± 0.05	1.10 ± 0.15	0.23 ± 0.15	4.0 ± 0.10	4.0 ± 0.05	2.0 ± 0.05
CRF63	6.7 ± 0.20	3.4 ± 0.20	12.0 ± 0.20	1.75 ± 0.10	5.50 ± 0.05	1.10 ± 0.15	0.23 ± 0.15	4.0 ± 0.10	4.0 ± 0.05	2.0 ± 0.05

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7.3 Packaging

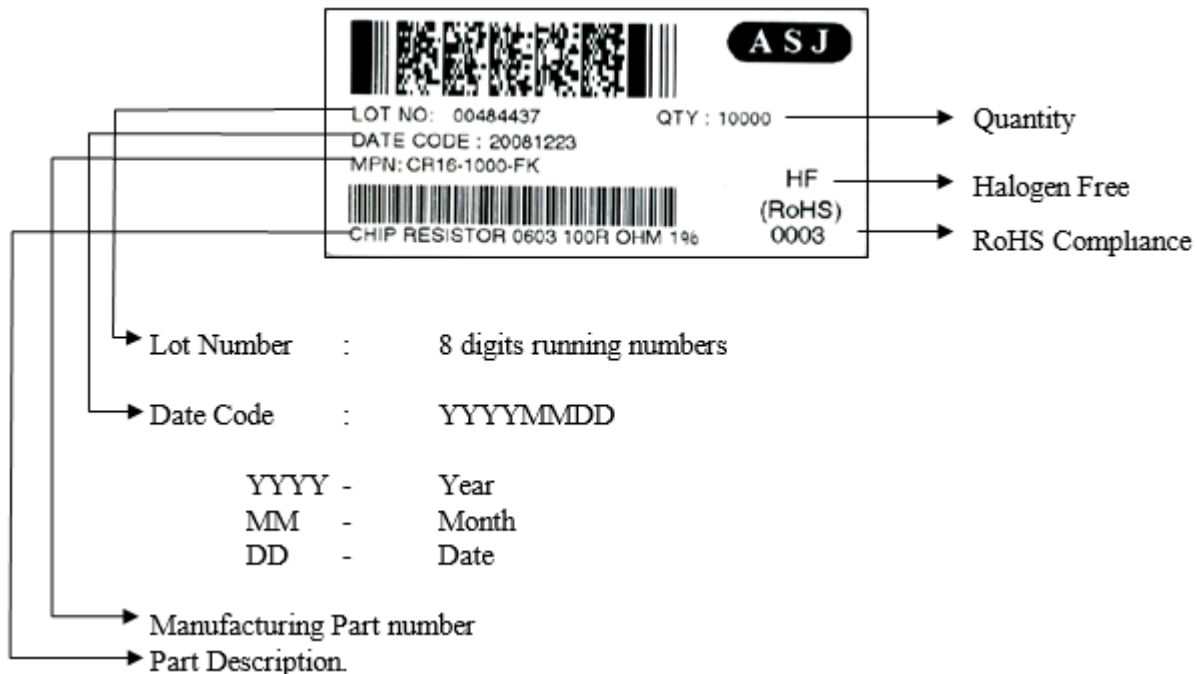
7.3.1 Taping

7.3.2 Quantity – Tape and Reels

Packaging Quantity(pcs/reel)				
Punch Paper Carrier Tape				
Code	2mm Pitch	4mm Pitch	Model	Remark
CRF05 CRF10	10,000 pcs	-----	7" Reel	-----
	20,000 pcs	-----	7" Reel	-----
	50,000 pcs	-----	13" Reel	-----
CRF16	-----	5,000 pcs	7" Reel	-----
CRF21	-----	10,000 pcs	10" Reel	-----
CRF32	-----	20,000 pcs	13" Reel	-----
CRF40	-----	20,000 pcs	13" Reel	-----
Plastic Embossed Carrier Tape				
Code	4mm Pitch	8mm Pitch	Model	Remark
CRF50	4,000 pcs	-----	7" Reel	-----
CRF63	4,000 pcs	-----	7" Reel	-----

7.3.3 Identification

Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.3.4 Packaging Reel Box

Dimension	Reel Box	Number of Reels
185 × 60 × 186 mm	25K Box	5
185 × 120 × 186 mm	50K Box	10

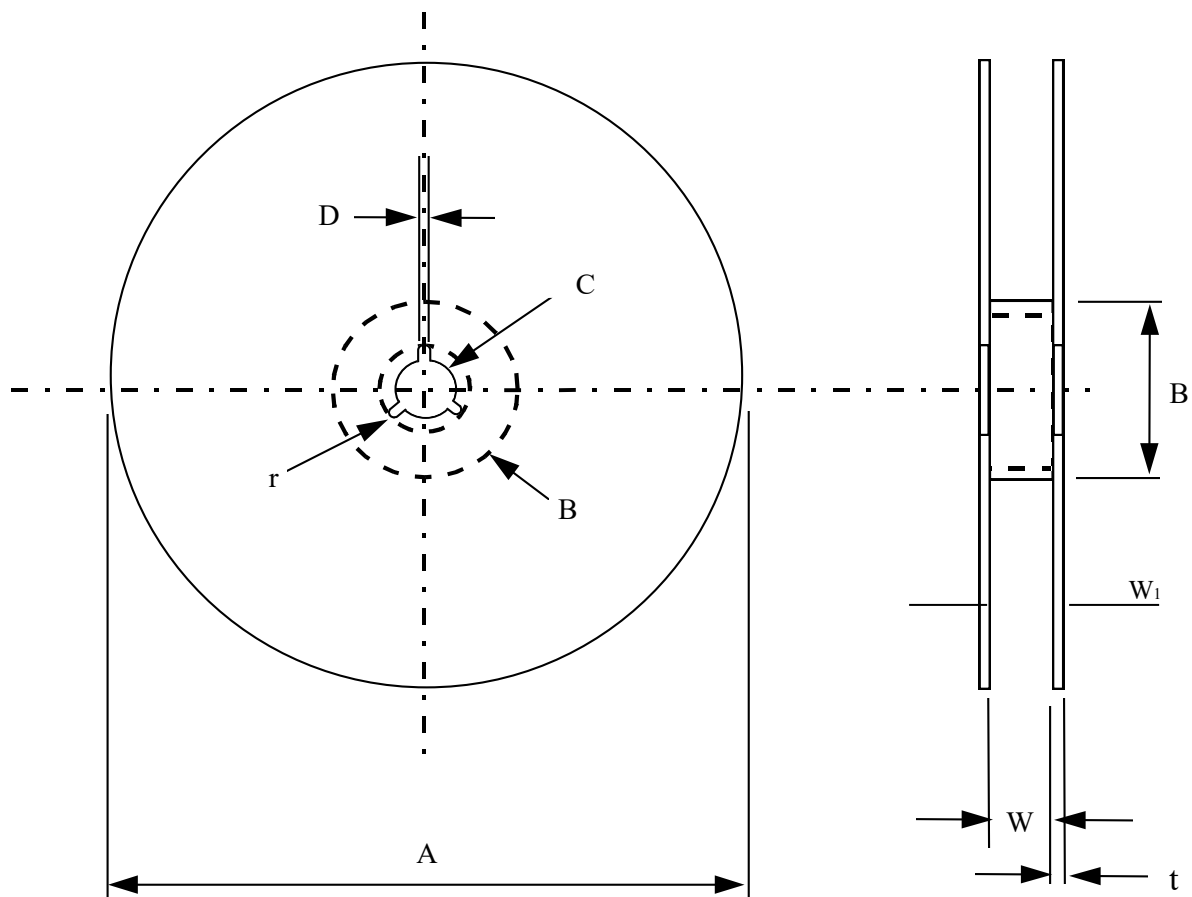
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7.3.5 Reel Dimensions



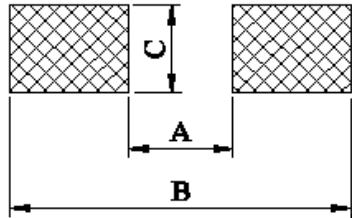
Model	A	B	C	D	W	W ₁	t	r
7" Reel (5K) (except 0201 & 0402 10K)	$\phi 178 \pm 2.0$	$\phi 60 \text{ min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	11 ± 0.1	14.4 max	1.0 ± 0.1	1.0
7" Reel (4K)	$\phi 178 \pm 2.0$	$\phi 60 \text{ min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	13 ± 1.0	14.4 max	1.2 ± 0.1	1.0
10" Reel (10K)	$\phi 254 \pm 2.0$	$\phi 60 \text{ min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	11 ± 1.0	14.4 max	1.5 ± 0.1	1.0
13" Reel (20K, 50K)	$\phi 330 \pm 2.0$	$\phi 60 \text{ min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	11 ± 1.0	14.4 max	2.1 ± 0.1	-
13" Reel (20K, 50K)	$\phi 330 \pm 1.0$	$\phi 100 \pm 1$	13.5 ± 0.5	$2 \sim 3 \pm 0.5$	10 ± 0.5	-	-	-

8. SURFACE MOUNT LAND PATTERNS Design (For Reflow Soldering)

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance

Unit: mm

DIM TYPE	A	B	C
CRF05	0.3	1.0	0.4
CRF10	0.5	1.5	0.6
CRF16	0.8	2.1	0.9
CRF21	1.2	3.0	1.3
CRF32	2.2	4.2	1.6
CRF40	2.2	4.2	2.8
CRF50	3.5	6.1	2.8
CRF63	3.8	8.0	3.5



9. Measurement Point

Bottom electrode	Unit : mm	
<p> ⊙ Current Terminal ⊖ Voltage Terminal </p>	DIM TYPE	
	CRF05	0.44±0.05
	CRF10	0.80±0.05
	CRF16	1.35±0.05
	CRF21	1.80±0.05
	CRF32	2.90±0.05
	CRF40	2.90±0.05
	CRF50	4.50±0.05
	CRF63	5.90±0.05

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10. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	03.04.2017		Initial Release
Version.2	17.05.2018		1·Remove clause 1.4, AEC-Q200 standard 2·Update Part Numbering System at clause 2 3·Update Rated Power at clause 3 4·Update TCR and related information into clause 3.10 5·Update Voltage Rating and Current Rating at clause 3.11 6·Update Marking on product at clause 4 7·Update Dimension at clause 5.1 8·Update Reliability test information at clause 6 9·Update Structure of Taping at clause 7.1 10·Update Tape Dimension at clause 7.2 11·Update packaging at clause 7.3 12·Update reel dimension at clause 7.3.5 13·Update surface mount land pattern dimension at clause 8 14·Update measurement point at clause 9
Version.3	29.01.2019		Datasheet update
Version.4	20.03.2019		1·Update clause 2 Part Numbering System 2 \ Update clause 3.1.1 Resistor Range 3 \ Update clause 3.10 table 4·Update clause 4 table 5 \ Update clause 5.1 dimension table 6 \ Update clause 6.1 , 6.2 7 \ Update clause 7.2.2 dimension table 8 \ Update clause 7.3.2 quantity table 9 \ Update clause 8 Land Pattern table 10 \ Update clause 9 Measurement Point table
Version.5	20.06.2019		1·Add in 0.1% to clause 2 2·Add in 0.1% to clause 3.10 3·Add in 0.1% to clause 6 reliability test
Version.6	10.09.2019		1·Revise clause 3.9 2·Revise clause 4.1.2
Version.7	04.06.2020		1·Revise clause 3.5 2·Revise clause 3.10 TCR table
Version.8	02.11.2020		Revise clause 3.10 TCR table