Thick Film Chip Resistors
Type MCR Series

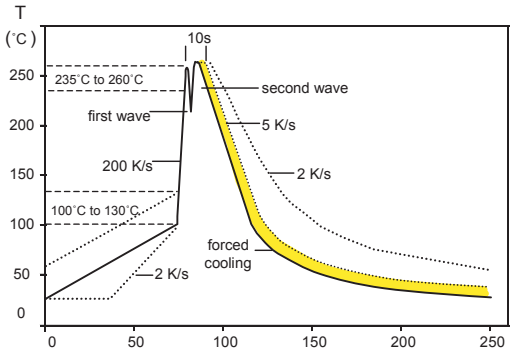
Δ Features

- Small size and lightweight with size range per int'l standard.
- Highly stable in auto-placement surface mounting application.
- Compatible with flow and reflow soldering.
- Suitable for lead free soldering.

Δ Applications

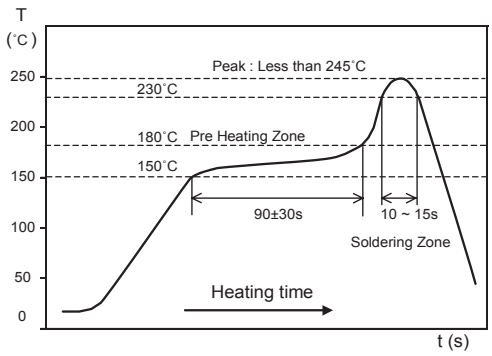
- Consumer electronics
- Medical equipment
- Telecom equipment
- Automotive, industry
- Computer

Δ Soldering Temperature Curve



Typical values (solid line).
Process limits (dotted line).

WAVE soldering.



IR Reflow Soldering

Δ How to Order

Part Number

Example	MCR	0603	T	J	123	LF
	Type	Size	Packing	Tolerance	Resistance Value	
	MCR	0201	T: Tape	B: ±0.1%	123 = 12x10^3	LF = Lead Free
		0402		C: ±0.25%	= 12k Ω	
		0603		D: ±0.5%		
		0805		F: ±1%		
		1206		G: ±2%		
		1210		J: ±5%		
		2010				
		2512				

Δ Resistance Marking

E-24 Series

473

3 digit marking for E24
ex. 473: 47x10^3 = 47KΩ
105: 10x10^5 = 1MΩ
1R5: 15x10^-1 = 1.5Ω
0: 0Ω

1R00

4 digit marking for E241: Ω~10mΩ
ex. 1R00: 1Ω
R470 470mΩ
R010 10mΩ

E-96 Series

1542

4 digit marking for E96
ex. 1542: 154x10^2 = 15K4Ω

0C2

3 digit marking for E96 - 0603
ex. 0C2 (see table)
102x10^2 = 10K2Ω

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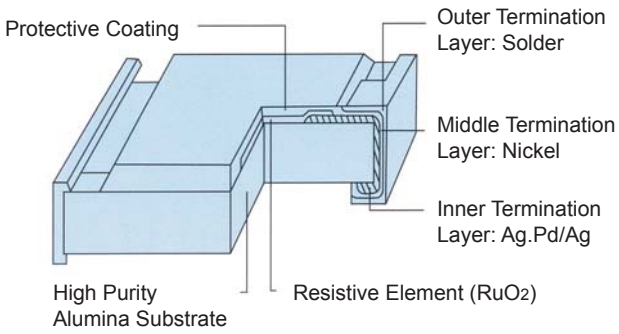
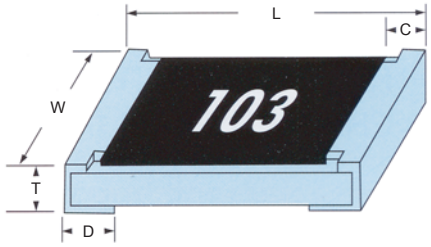
Δ Configuration



Δ Dimensions

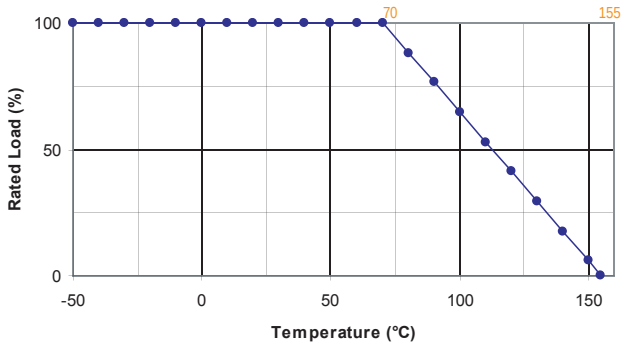


Size	L	W	C	D	T
0201	0.60 ± 0.05	0.30 ± 0.05	0.25 ± 0.05	0.15 ± 0.05	0.25 ± 0.05
0402	1.00 ± 0.05	0.50 ± 0.05	0.20 ± 0.10	0.25 ± 0.10	0.35 ± 0.05
0603	1.60 ± 0.10	0.80 ± 0.10	0.30 ± 0.20	0.30 ± 0.20	0.45 ± 0.10
0805	2.00 ± 0.15	1.20 ± 0.15	0.40 ± 0.20	0.40 ± 0.20	0.50 ± 0.10
1206	3.10 ± 0.15	1.60 ± 0.15	0.50 ± 0.25	0.50 ± 0.25	0.55 ± 0.10
1210	3.10 ± 0.15	2.65 ± 0.15	0.50 ± 0.20	0.50 ± 0.25	0.55 ± 0.10
2010	5.00 ± 0.20	2.50 ± 0.20	0.60 ± 0.25	0.60 ± 0.25	0.60 ± 0.10
2512	6.30 ± 0.20	3.10 ± 0.20	0.60 ± 0.25	0.60 ± 0.25	0.60 ± 0.15
1225	3.10 ± 0.20	6.30 ± 0.20	0.60 ± 0.25	0.90 ± 0.25	0.60 ± 0.15

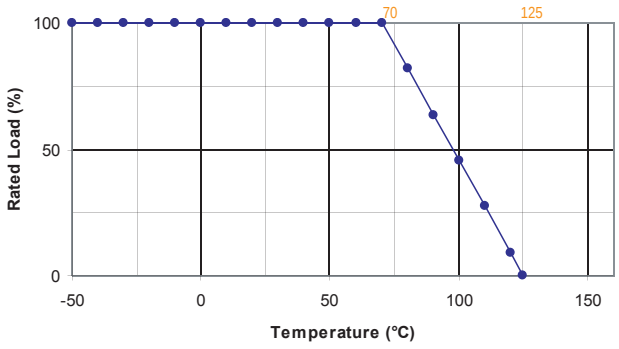
units: mm

Δ Power Derating Curve

For All Except 0201



For 0201 Only



*Maximum dissipation in percentage of rated power as a function of the ambient temperature.

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Type MCR Series

Δ Rating

Type	Size	Power Rating at 70 ˚C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/ ˚C)	Resistance Range Min.	Resistance Range Max.	Standard Resistance Values
	0201	1/20W	15V	30V	± 1%(F)	± 300	10Ω	1M Ω	E-24
					± 5%(J)		0Ω &1 Ω	1M Ω	
	0402	1/16W	50V	100V	± 1%(F)	± 200	10Ω	1M Ω	E-96
					± 5%(J)		0Ω &1 Ω	10M Ω	E-24
	0603	1/10W	50V	100V	±0. 1%(B)	± 50	20Ω	510K Ω	E-96
					±0.2 5%(C)	± 50	20Ω	510K Ω	E-96
	0805	1/8W	150V	300V	± 0.5%(D)	± 50	20Ω	510K Ω	E-96
					± 1%(F)	± 100 ± 50	10Ω	1M Ω	E-96
	1206	1/4W	200V	400V	± 2%(G)	± 200	1Ω	10M Ω	E-24
					± 5%(J)	± 200	0Ω &1 Ω	10M Ω	E-24
	2010	1/2W	200V	400V	± 1%(F)	± 100	1Ω	10M Ω	E-96
					± 5%(J)	± 200	0Ω &1 Ω	10M Ω	E-24
	2512	1W	200V	400V	± 1%(F)	± 100	1Ω	10M Ω	E-96
					± 5%(J)	± 200	0Ω &1 Ω	10M Ω	E-24

Jumper : • 0201,0402,0603 size maximum resistance Rmax ≤ 50m Ω and rated current I_R≤ 1A
• 0805,1206,2010,2512 size maximum resistance Rmax ≤ 50m Ω and rated current I_R≤ 2A

1Ω ~10 Ω : • Temperature Coefficient of Resistance for 0402,0603,0805,1206 = -300~+500
• Temperature Coefficient of Resistance for 0201,2010,2512 = ± 300

Δ Low Resistance

Type	Size	Power Rating at 70 ˚C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance (%)	Temperature Coefficient (TCR; ppm/ ˚C)	Resistance Range Min.	Resistance Range Max.
	0603	1/10W	302mV	754mV	± 1%(F) ± 5%(J)	± 300	100m Ω	910m Ω
	0805	1/8W	337mV	843mV		± 400	50m Ω	91m Ω
	1206	1/4W	477mV	1192mV		± 200	50m Ω	910m Ω
	2010	1/2W	675mV	1686mV	± 1%(F) ± 5%(J)	± 400	40m Ω	47m Ω
						± 600	22m Ω	39m Ω
	2512	1W	954mV	2385mV		± 1000	10m Ω	20m Ω
	1225	2W	1349mV	3373mV	± 1%(F) ± 5%(J)	± 100	20m Ω	910m Ω
						± 150	10m Ω	19m Ω

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Δ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J ± 5% G: ± 2% F: ± 1% D: ± 0.5% C: ± 0.25% B: ± 0.1% Zero ohm Jumper ＜50mΩ	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	J,G: Δ R≤ ± (2% + 0.1Ω) F,D: Δ R≤ ± (1% + 0.05Ω) C,B: Δ R≤ ± (0.5% + 0.05Ω)	IEC 60115-1 4.13 / JIS C 5202 5.5 2.5X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the 245 ± 2°C molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	J,G: Δ R≤ ± (1% + 0.1Ω) F,D,C,B: Δ R≤ ± (0.5% + 0.05Ω) No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With 260 ± 5°C for 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	J,G ± 200ppm/°C F ± 100 ± 50ppm/°C D,C,B ± 50ppm/°C	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : 25°C(T1)→ -55°C(T2) 25°C(T1)→ 125°C(T2) $TCR\ (ppm/^{\circ}C) = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25°C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	J,G: Δ R≤ ± (3% + 0.1Ω) F,D: Δ R≤ ± (1% + 0.05Ω) C,B: Δ R≤ ± (0.5% + 0.05Ω)	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at 40 ± 2°C and 90~95% R.H. with the rated voltage applied.Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	J,G: Δ R≤ ± (3% + 0.1Ω) F,D: Δ R≤ ± (1% + 0.05Ω) C,B: Δ R≤ ± (0.5% + 0.05Ω)	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max.Keep the resistor at 70 ± 2°C ambient
Intermittent Overload	Δ R≤ ± (5% + 0.1Ω) No mechanical damage	JIS C 5202 5.8 4.0xRated voltage (Max. Overload Voltage) 1 sec ON, 25 sec OFF, test 10,000 cycles
Temperature Cycle	J,G: Δ R≤ ± (1% + 0.1Ω) F,D,C,B: Δ R≤ ± (0.5% + 0.05Ω) No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55°C(30 min.) ~ + 25 °C(2~3 min.) +125°C(30 min.) ~ + 25 °C(2~3 min.) for 0201 -55°C(30 min.) ~ + 25 °C(2~3 min.) +155°C(30 min.) ~ + 25 °C(2~3 min.) for others
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: 100 ± 15V
Bending Strength	J,G: Δ R≤ ± (1% + 0.1Ω) F,D,C,B: Δ R≤ ± (0.5% + 0.05Ω) No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0201 , 0402 , 0603 , 0805 2mm for 1206 , 2010 , 1225 , 2512

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Thick Film Chip Resistors
Type MCR Series - Low Resistance

Δ Specifications and Test Methods

ITEM	SPECIFICATION	TEST METHOD
DC Resistance	J± 5%, F: ±1%	IEC 60115-1 4.5 / JIS C 5202 5.1 Measure the resistance value.
Short time Overload	J:Δ R≤± (2% + 0.5mΩ) F:Δ R≤± (1% + 0.5mΩ)	IEC 60115-1 4.13 / JIS C 5202 5.5 2.5X Rated voltage or Max. Overload Voltage for 5 sec. measure resistance after 30 minutes
Solderability	Over 95% of termination must be covered with solder	IEC 60115-1 4.17 / JIS C 5202 6.5 After immersing flux, dip in the 245 ± 2 ˚C molten solder bath for 3 ± 0.5 sec.
Resistance to Solder Heat	J:Δ R≤± (1% + 0.5mΩ) F:Δ R≤± (0.5% + 0.5mΩ) No mechanical damage	IEC 60115-1 4.18 / JIS C 5202 6.4 With 260 ± 5˚Cfor 10 ± 1 sec.
Temperature Coefficient of Resistance (TCR)	Size : 0603 , 0805 100mΩ ~ 910mΩ :± 300ppm/ ˚C Size : 1206 , 2010 , 2512 50mΩ ~ 910mΩ :± 200ppm/ ˚C Size : 1225 20mΩ ~ 910mΩ :± 100ppm/ ˚C reference for other resistance range in page 4	IEC 60115-1 4.8.4.2 / JIS C 5202 5.2 Test temperature : 25 ˚C(T1)→ -55˚C(T2) 25˚C(T1)→ -125˚C(T2) $TCR\ (ppm/^{\circ}C) = \frac{R2-R1}{R1} \times \frac{1}{T2-T1} \times 10^6$ T1: 25˚C T2: Test temperature R1: Resistance at reference temperature (T1) R2: Resistance at test temperature (T2)
Load Life Humidity	J:Δ R≤± (3% + 0.5mΩ) F:Δ R≤± (1% + 0.5mΩ)	IEC 60115-1 4.24.2 / JIS C 5202 7.9 Maintain the temperature of the resistor at 40 ± 2 ˚C and 90~95% R.H. with the rated voltage applied.Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.
Load Life	J:Δ R≤± (3% + 0.5mΩ) F:Δ R≤± (1% + 0.5mΩ)	IEC 60115-1 4.25.1 / JIS C 5202 7.10 Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max.Keep the resistor at 70 ± 2˚Cambient
Temperature Cycle	J:Δ R≤± (1% + 1mΩ) F:Δ R≤± (0.5% +1mΩ) No mechanical damage	IEC 60115-1 4.19 / JIS C 5202 7.4 Repeat 5 cycles as follows -55˚C(30 min.) ~ + 25 ˚C(2~3 min.) +125˚C(30 min.) ~ + 25 ˚C(2~3 min.) for 0201 -55˚C(30 min.) ~ + 25 ˚C(2~3 min.) +155˚C(30 min.) ~ + 25 ˚C(2~3 min.) for others
Insulation Resistance	Between termination and coating must be over 1000M Ω	IEC 60115-1 4.6.1.1 / JIS C 5202 5.6 Test voltage: 100 ± 15V
Bending Strength	J:Δ R≤± (1% + 1mΩ) F:Δ R≤± (0.5% +1mΩ) No mechanical damage	IEC 60115-1 4.33 Resistance change after bended on the 90mm PCB. Bend: 3mm for 0201 , 0402 , 0603 , 0805 2mm for 1206 , 2010 , 1225 , 2512

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