

FrelTec GmbH

Mathildenstr. 10A
82319 Starnberg
Germany

Ultra Low Ohm - Metal Strip Chip Resistor SMD

SMD

SPECIFICATION

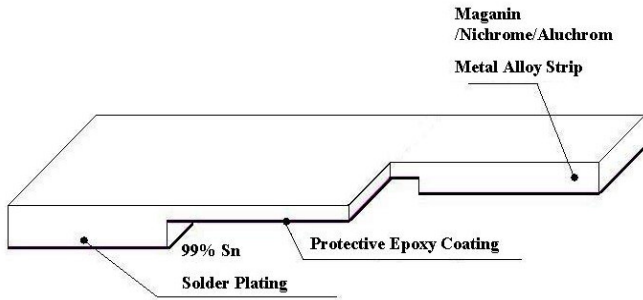
Part Number

047	06*	R010*	J*	T05*	O	D	G**
Type	Size	Value	Tolerance	Packing	TCR	Power Rating	Marking
047 : SMD Ultra Low Ohm Metal Strip Chip Resistor	06 : 1206	The last digit is the multiplier	J : $\pm 5\%$	E02: Embossed Tape and Reel for 2k pc (7"reel)	E : $\pm 50\text{ppm}/^\circ\text{C}$	J: 1W	B: Black Coating
	20 : 2010	which denotes the number of zero following	H : $\pm 3\%$	T05: Paper Tape and Reel for 5k pc (7"reel)	O : $\pm 75\text{ppm}/^\circ\text{C}$	K: 1,5W	G: Green Coating
	25 : 2512		F : $\pm 1\%$		F : $\pm 100\text{ppm}/^\circ\text{C}$	L: 2W	
		Example:			X : $\pm 150\text{ppm}/^\circ\text{C}$	N: 2,5W	
		97R6=			G : $\pm 200\text{ppm}/^\circ\text{C}$	M: 3W	
		R100 = 0,10hm					
		R050 = 0,050hm					
		R001: 0,0010hm					
		0M50 = 0,0005Ohm			** 1206 and 2010 no marking, no coating		
		1M50: 0,0015Ohm			* not all combination is possible		

All products according to RoHS (2015/863/EU)

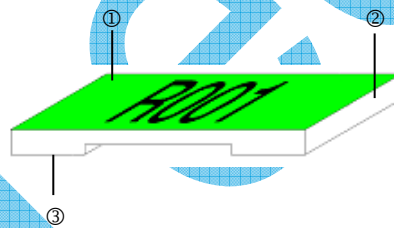
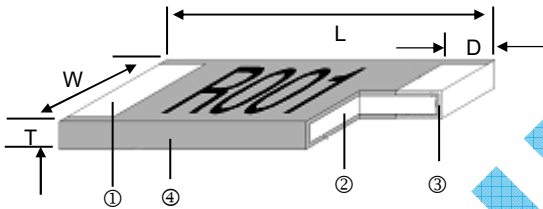
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Construction
1206 and 2010



Type	Type	Material
1206	0,50mOhm to 3mOhm	Manganese, Copper
	3,5mOhm to 10mOhm	Aluminum, Iron, Copper
2010	0,50mOhm to 3,5mOhm	Manganese, Copper
	4mOhm to 10mOhm	Aluminum, Iron, Copper

2512



Black - Wave or Reflow reflow soldering

Green - Reflow soldering only

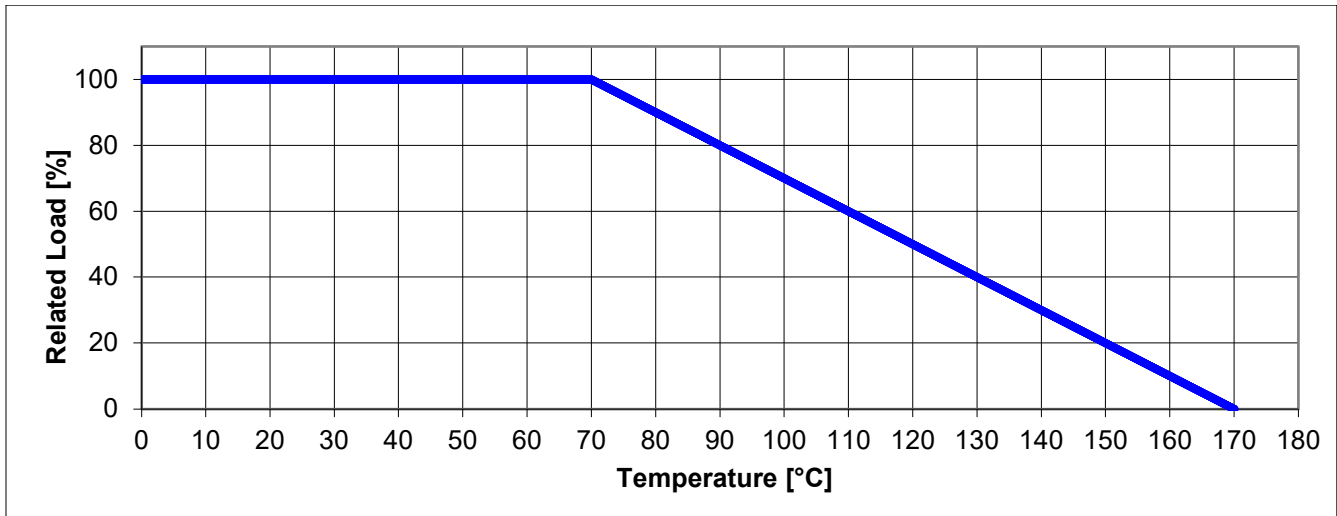
①	Solder Plating
②	Alloy Plate
③	Barrier Layer
④	Overcoat

①	Overcoat
②	Alloy Plate
③	Solder Plating

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Power Derating Curve

For resistors operated in ambient temperatures above 70 °C , power rating shall be derated in accordance with figure below, Operating Temperature Range : -55°C 170°C



Voltage Rating:

Rated Voltage: 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= Rated voltage [V]

P= Power rating [W]

R= Nominal resistance [Ω]

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

047 Series

Standard Electrical Specifications

	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
			F(±1%)	H(±3%)	F(±5%)	
04706 1206	1W	-55°C ~ +170°C	0,5			±200
	1W		0,75 - 10			±50
04725 2512	1W		0,5, 0,75, 1, 1,5, 2			±50
	1W		6, 6,5, 7			±75
	1W		4, 5, 10			±100
	1W		2,5, 3			±150

Special High Power Rating Electrical Specifications

	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
			F(±1%)	H(±3%)	F(±5%)	
04720 2010	1,5W	-55°C ~ +170°C	0,5			±100
	1,5W		0,75 - 10			±50
04725 2512	2W		0,5, 0,75, 1, 1,5, 2			±50
	2W		6, 6,5, 7			±75
	2W		4, 5, 10			±100
	2W		2,5, 3			±150
	3W		0,5, 0,75, 1, 12,5, 2			±50
	3W		6, 6,5,7			±75
	3W		4, 5, 10			±100
	3W		2,5, 3			±150
04725 2512 (green coating)	2W		6,5, 7, 8, 9, 10			±50
	2,5W		4, 4,5, 5, 6			±50
	3W		1, 1,5, 2, 2,5, 3, 3,5			±50
	3W		0,5, 0,75			±100

Resistance code examples

Resistance (3Marking), green Coating

Resistance	0,5mΩ	1,5mΩ	1mΩ	3mΩ	0,75mΩ
Codes	M50	1M5	R001	R003	M75

Resistance (4Marking), black Coating

Resistanc	1mΩ	1,5mΩ	2mΩ	7mΩ	10Ω	0,5mΩ
Codes	R001	1M50	R002	R007	R010	0M50

SMD Dimensions

Part No.	Coating	Resistance (mΩ)	L	W	T	D	
04706 1206	black coating	0,5	3,20±0,25	1,60±0,10	0,60±0,20	1,35±0,25	
		0,75				1,23±0,25	
		1,0, 3,5, 4,0, 5,0, 6,0				1,10±0,25	
		2,0, 2,5, 3,0, 10				0,60±0,25	
		1,2 1,5, 7,0, 8,0, 9,0				0,90±0,25	
04720 2010	black coating	0,5	5,08±0,25	2,54±0,15	0,60±0,20	2,17±0,25	
		0,75				2,04±0,25	
		1,0, 1,5				1,84±0,25	
		2,0, 6,0, 7,0, 8,0				1,54±0,25	
		3,0, 3,5				1,04±0,25	
		4,0, 5,0, 5,5				1,84±0,25	
		9,0, 10				1,29±0,25	
04725 2512	green coating	0,50	6,35±0,25	3,00±0,20	0,60±0,20	2,68±0,25	
		0,75				2,48±0,25	
		1,0, 5,0, 6,0				1,93±0,25	
		1,5, 6,5, 7,0, 7,5				1,43±0,25	
		2,0, 2,5, 3,0, 3,5				1,18±0,25	
		4,0, 4,5				2,18±0,25	
		5,0, 6,0				1,93±0,25	
		8,0 - 10				1,18±0,25	
	black coating	0,50	6,35±0,254	3,18±0,254	0,55±0,20	1,30±0,38	1,25±0,20
		0,75					0,75±0,20
		1,00					0,65±0,20
		1,50					0,45±0,20
		2,00					0,35±0,20
		2,50					0,65±0,20
		3,00					0,45±0,20
		4,00					0,35±0,20
		5,00					0,32±0,20
		6,00					0,30±0,20
		6,50					0,27±0,20
7,00	0,25±0,20						
10,00	0,25±0,20						

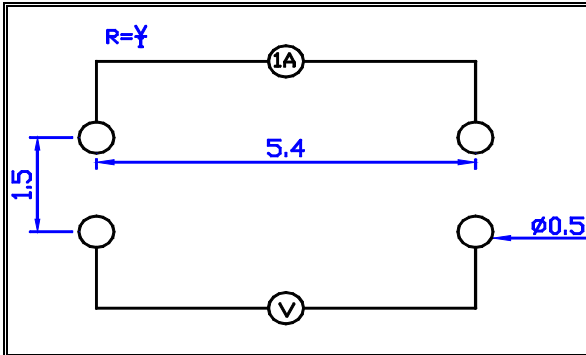
Unit: mm

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Measurements

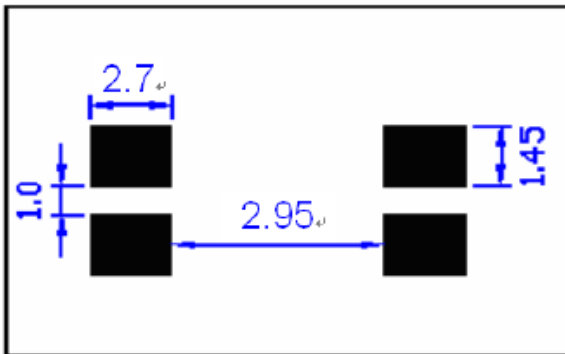
1. 2512 4-wire precision measurement (Black Coating)

Equipment: ADEX AX-1152D DC Low Ohm Meter
 Excitation Current: 3A (0,5mΩ~1,5 mΩ)
 1A (2mΩ~10mΩ)



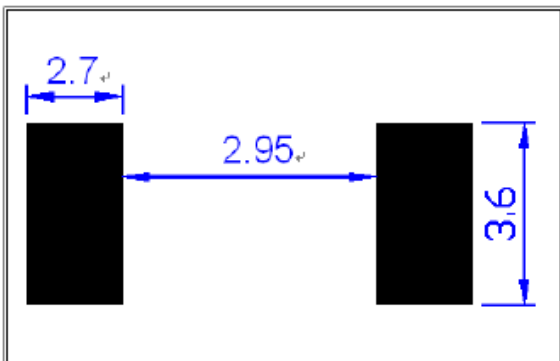
2. 2512 4-wire pad layout (recommended for precision current sensing)

Note: No circuits between pads to avoid short circuit



3. 2512 2-wire pad layout

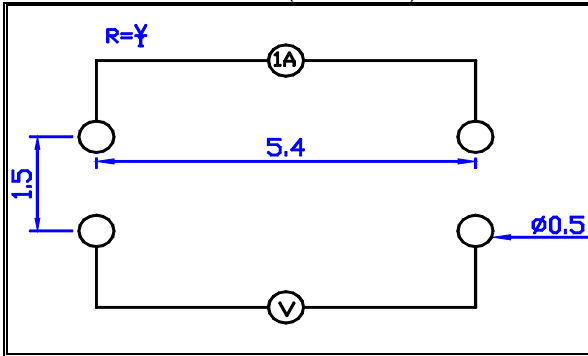
Note: No circuits between pads to avoid short circuit



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4. 2512 4-wire precision measurement (Green Coating)

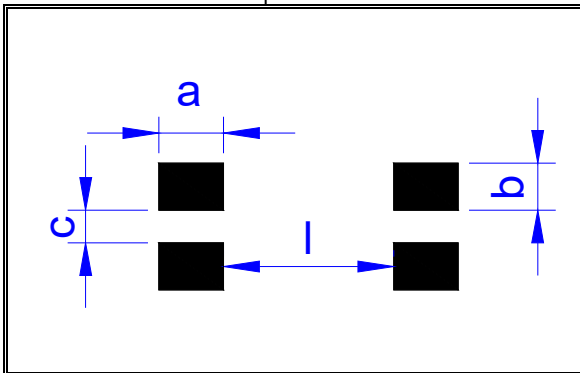
Equipment: ADEX AX-1152D DC Low Ohm Meter
 Excitation Current: 3A (0,5mΩ~1,5 mΩ)
 1A (2mΩ~10mΩ)



Unit: mm

5. 2512 4-wire pad layout (recommended for precision current sensing)

Note: No circuits between pads to avoid short circuit



	a m/m	b m/m	c m/m	l m/m
0,50mΩ	3,13	1,2	1,0	0,52
0,75mΩ	2,93			0,94
1mΩ	2,38			2,04
1,5mΩ	1,88			3,04
2 to 3,5mΩ	1,63			3,54
4 to 4,5mΩ	2,63			1,54
5 to 6mΩ	2,38			2,04
6,5 to 7mΩ	1,88			3,04
8 to 10mΩ	1,63			3,54

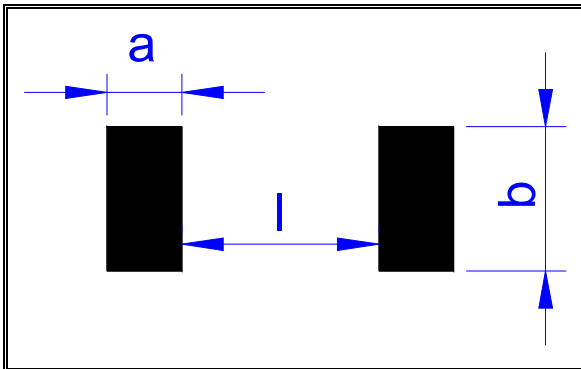
Unit: mm

SMD

6. 2512 2-wire pad layout

Note: No circuits between pads to avoid short circuit

Unit: mm

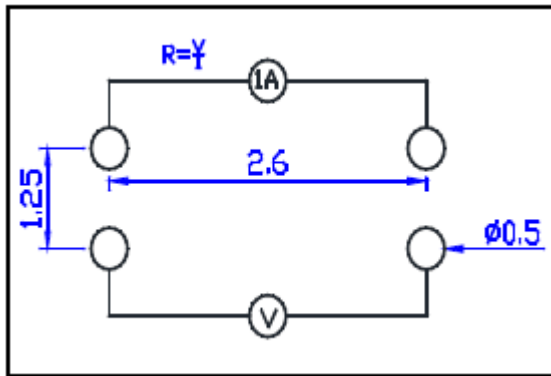


	a m/m	b m/m	l m/m
0,50mΩ	3,13	3,4	0,52
0,75mΩ	2,93		0,94
1mΩ	2,38		2,04
1,5mΩ	1,88		3,04
2 to 3,5mΩ	1,63		3,54
4 to 4,5mΩ	2,63		1,54
5 to 6mΩ	2,38		2,04
6,5 to 7mΩ	1,88		3,04
8 to 10mΩ	1,63		3,54

Unit: mm

7. 1206 4-wire precision measurement

Equipment: ADEX AX-1152D DC Low Ohm Meter
Excitation Current: 1A (0,5mΩ~10mΩ)

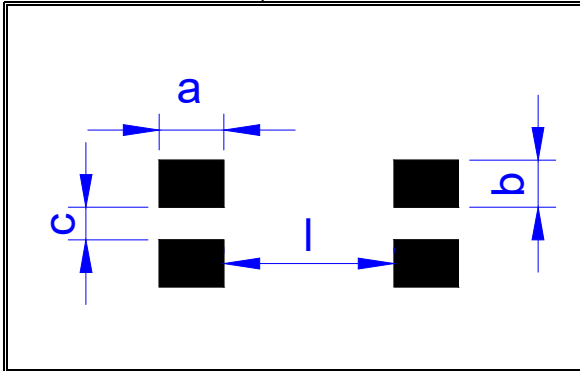


Unit: mm

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8. 1206 4-wire pad layout (recommended for precision current sensing)

Note: No circuits between pads to avoid short circuit



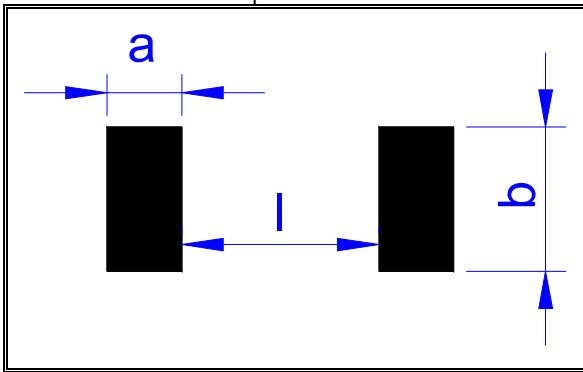
	a m/m	b m/m	c m/m	l m/m		
0,50mΩ	1,80	0,7	0,5	0,55		
0,75mΩ	1,68					
1mΩ	1,55					
1,2mΩ	1,35			0,5	0,5	0,95
1,5mΩ						1,55
2 to 3mΩ	1,05					0,55
3,5 to 6mΩ	1,55					0,95
7 to 9mΩ	1,35					1,55
10mΩ	1,05					

Unit: mm

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9. 1206 2-wire pad layout

Note: No circuits between pads to avoid short circuit

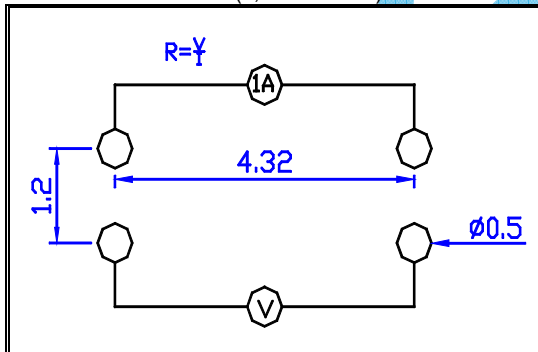


	a m/m	b m/m	l m/m
0,50mΩ	1,80	1,90	0,55
0,75mΩ	1,68		
1mΩ	1,55	1,89	0,95
1,2mΩ	1,35	1,90	
1,5mΩ	1,35	1,89	1,55
2 to 3mΩ	1,05		0,55
3,5 to 6mΩ	1,55		0,95
7 to 9mΩ	1,35		1,55
10mΩ	1,05		

Unit: mm

10. 2010 4-wire precision measurement

Equipment: ADEX AX-1152D DC Low Ohm Meter
Excitation Current: 1A (0,5mΩ~10mΩ)

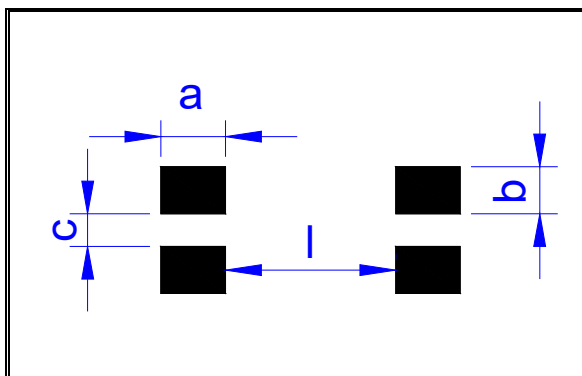


Unit: mm

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11. 2010 4-wire pad layout (recommended for precision current sensing)

Note: No circuits between pads to avoid short circuit

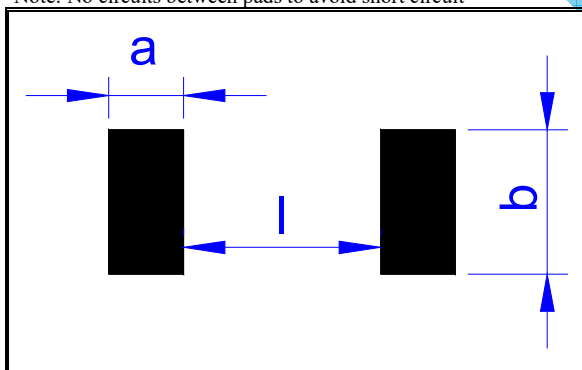


	a m/m	b m/m	c m/m	l m/m
0,50mΩ	2,61	1,045	0,8	0,60
0,75mΩ	2,49			0,80
1mΩ to 1,5mΩ	2,29			0,95
2mΩ	1,99			1,55
3mΩ to 3,5mΩ	1,49			2,55
4 to 5,5mΩ	2,29			0,95
6 to 8mΩ	1,99			1,55
9 to 10mΩ	1,74			2,05

Unit: mm

12. 2010 2-wire pad layout

Note: No circuits between pads to avoid short circuit



Unit: mm

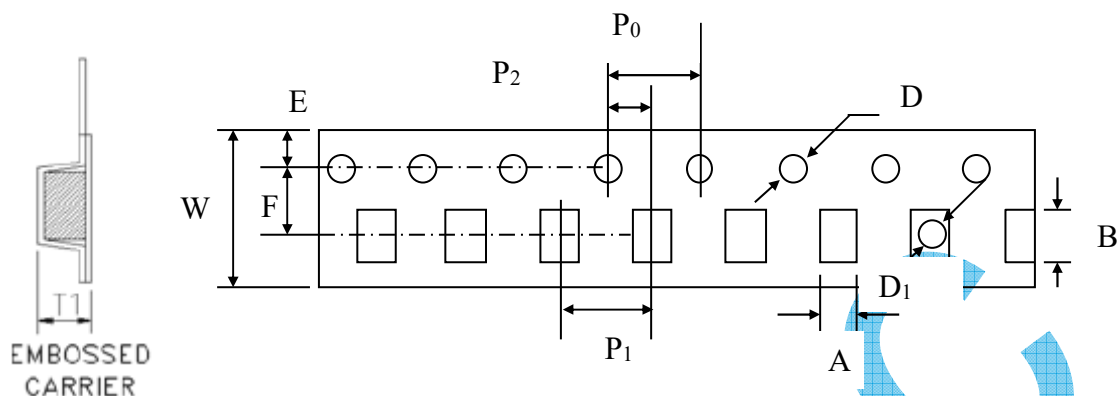
	a m/m	b m/m	l m/m
0,50mΩ	2,61	2,89	0,60
0,75mΩ	2,49		0,80
1mΩ to 1,5mΩ	2,29		0,95
2mΩ	1,99		1,55
3mΩ to 3,5mΩ	1,49		2,55
4 to 5,5mΩ	2,29		0,95
6 to 8mΩ	1,99		1,55
9 to 10mΩ	1,74		2,05

Unit: mm

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SPECIFICATION

Tape And Reel Package



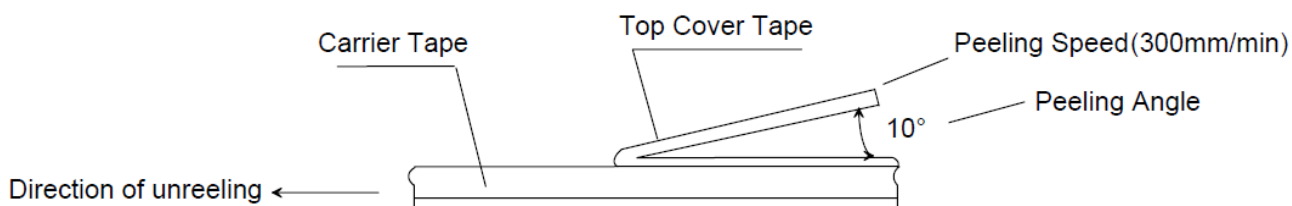
Type	Resistance [mΩ]	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD	ΦD ₁	T1
1206	0,5 to 10	1,90±0,1	3,60±0,1	8,0±0,2	1,75±0,1	3,5±0,05	4,0±0,1	4,00±0,1	2,0±0,05	1,55±0,05	1,0min.	0,87±0,1
2010	0,5 to 10	2,85±0,1	5,55±0,1	12,0±0,2	1,75±0,1	5,5±0,05	4,0±0,1	4,00±0,1	2,0±0,05	1,55±0,05	1,4min.	0,85±0,1
2512	0,50 to 0,75	3,40±0,1	6,75±0,1	12,0±0,1	1,75±0,1	5,5±0,05	4,0±0,1	4,00±0,1	2,0±0,05	1,55±0,05	1,4min.	1,45±0,2
	1 to 10											0,81±0,1
2512 (green coating)	0,5 to 10	3,40±0,1	6,75±0,1	12,0±0,1	1,75±0,1	5,5±0,05	4,0±0,1	4,00±0,1	2,0±0,05	1,55±0,05	1,4min.	0,81±0,1

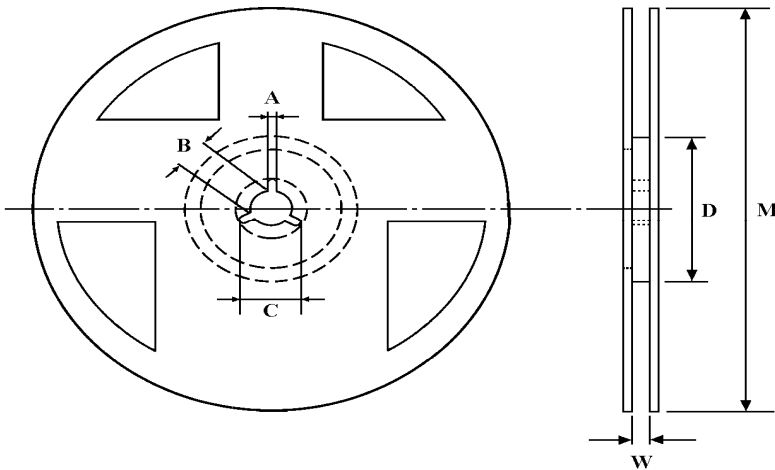
1. The cumulative tolerance of 10 sprockets hole pitch is $\pm 0,2$ mm.
2. Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
3. A & B measured 0,3mm from the bottom of the packet
4. T measured at a point on the inside bottom of the packet to the top surface of the carrier.
5. Pocket position relative to sprocket hole is measured as the true position of the pocket and not the pocket hole.

Cover Tape Peel off Strength

Specifications:

- 1206– peel force of top cover tape shall be between 20 to 90g
The peel speed shall be about 300mm/min $\pm 5\%$
- for 2010 , 2512 – peel force of top cover tape shall be between 20 to 110g
The peel speed shall be about 300mm/min $\pm 5\%$



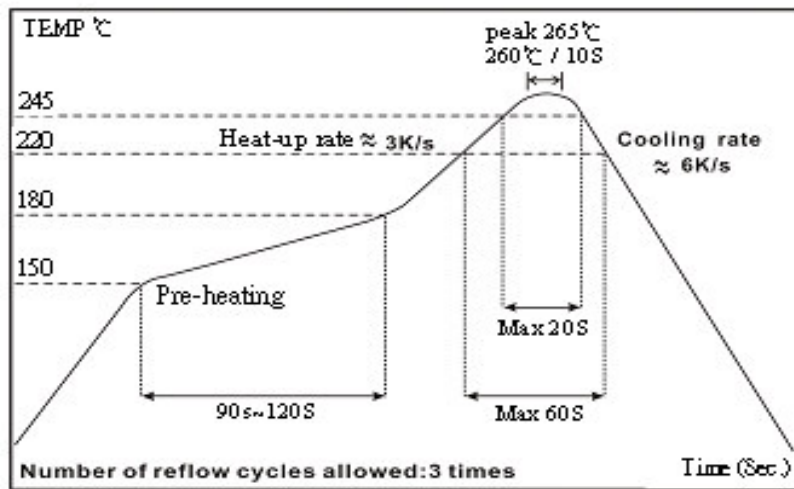


Type	Packaging	M	A	B	C	D	W	T
047 06 ... T05	Embossed	178.5±1.5	2+0,51 -0	13.0±0.5	18,45+0,20 -0	60+1 -0	9,0±0,5	11,5±0,5
047 20 ... E04	Embossed	178.5±1.5	2+0,51 -0	13.0±0.5	18,45+0,20 -0	60+1 -0	13,0±0,5	15,5±0,5
047 25 ... E04	Embossed	178.5±1.5	2+0,51 -0	13.0±0.5	18,45+0,20 -0	60+1 -0	13,0±0,5	15,5±0,5

Stock period

The performance of these products, including the solderability, is guaranteed for 12 month, provided that they remain packed as they were when delivered and stored at a temperature of 25°C ± 3°C and a relative humidity less than 80%RH

Lead Free Reflow Soldering Profile



Green coating "Reflow Air Convection" is available
Green coating can't be working with wave soldering bath

SMD
Strip

Item	Requirement		Test Method
	Black coating	Green coating	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		MIL-STD-202F Method 304 +25/-55/+25/+125/+25°C
Short Time Overload	±0,5%	±1%	JIS-C-5201-1 5.5 5*rated power for 5 seconds
Endurance	±1%	±1%	MIL-STD-202F Method 108A 70±2°C, Max. working voltage for 1000 hrs with 1,5 hrs "ON" and 0,5 hrs "OFF"
Dry Heat	±1%	±1%	JIS-C-5201-1 7.2 at +170°C for 1000 hrs"
Solderability	95% min. coverage		MIL-STD-202F Method 208H 245±5°C for 3 seconds
Resistance to Soldering Heat	±0,5%	±1%	MIL-STD-202F Method 210E 260±5°C for 10 seconds
Thermal Shock	±0,5%	±1%	MIL-STD-202F Method 107G -55°C ~ 150°C, 100 cycles

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