

FrelTec GmbH

Mathildenstr. 10A
82319 Starnberg
Germany

Current Sensing Chip Resistor SMD

FrelTec Current Sensing Chip Resistor

SMD Low Ohm

SPECIFICATION

Part Number

017	05*	R010*	J*	T05**	D*	E*
Type	Size	Value	Tolerance	Packing	TCR	Power Rating
017 : SMD Current Sensing Chip Resistor	01 : 0201	R = Decimal	F : ±1%	T10: Tape and reel for 10k pc (7"reel)	F : ±100ppm/°C	U: 1/20W
	02 : 0402	Example: R010= 0,01Ohm	G : ±2%	T05: Tape and reel for 05k pc (7"reel)	X : ±150ppm/°C	B: 1/16W
	03 : 0603	R001= 1mOhm	J : ±5%	E04: Tape and reel for 4k pc (7"reel)	G : ±200ppm/°C	C: 1/10W
	05 : 0805	4-digit Ohm value		E02: Tape and reel for 2k pc (7"reel)	H : ±300ppm/°C	D: 1/8W
	06 : 1206				I : ±400ppm/°C	S: 1/5W
	10 : 1210			** T10, for 0201 and 0402 Paper Type	K : ±600ppm/°C	E: 1/4W
	20 : 2010			** T05, for 0603 to 1210 and 0612 all Paper Type	P : ±1000ppm/°C	H: 1/2W
	25 : 2512			** E04, for 2010 and 2512 (w/o 2W) all Embossed Type		I: 3/4W
	15 : 1225			** E02, for 2512 (2W), 1225, 3720 and 7520 all Embossed Type		J: 1W
	37 : 3720					K: 1,5W
	75 : 7520					L: 2W
	62 : 0612					M: 3W
						* not all combination is possible

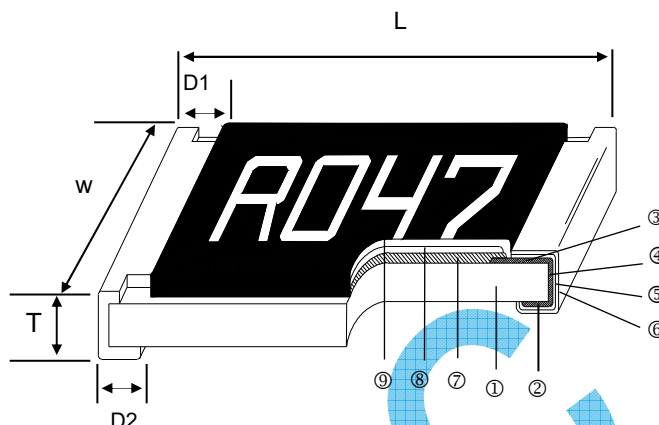
This specification is applicable to lead and halogen free series thick film chip resistors.

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

FrelTec Current Sensing Chip Resistor

SMD Low Ohm THICK FILM CHIP RESISTORS

- 1 Alumina Substrate
- 2 Bottom Electrode
- 3 Top Electrode
- 4 Edge Electrode
- 5 Barrier Layer
- 6 External Electrode
- 7 Resistor Layer
- 8 Primary Overcoat
- 9 Secondary Overcoat



Dimensions

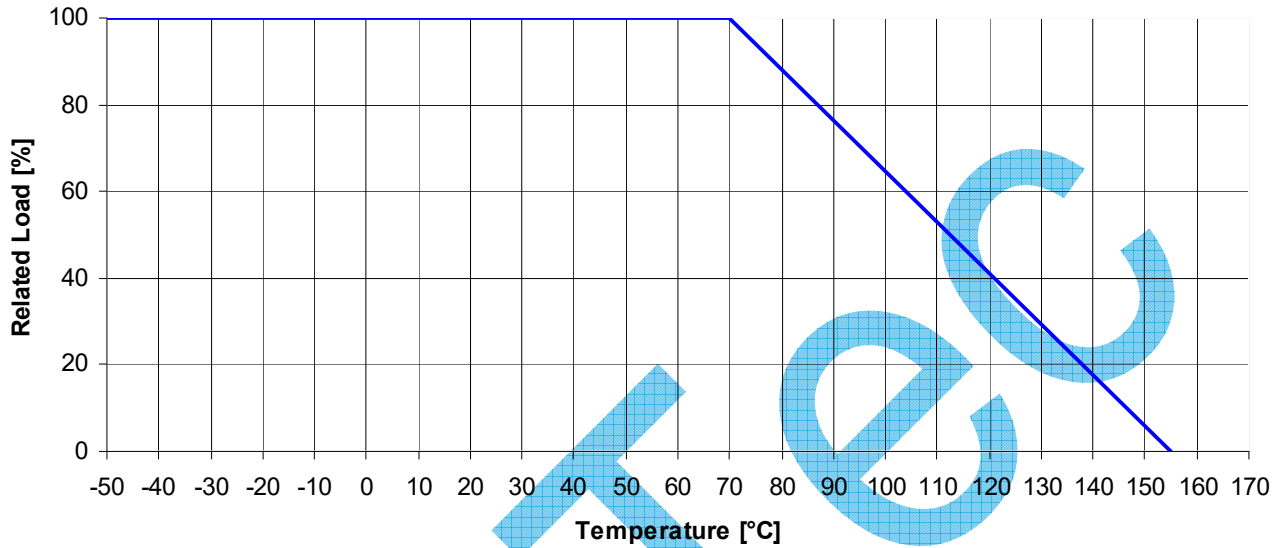
Size (Inch)	L	W	T	D1	D2
0201	0,60±0,03	0,30±0,03	0,23±0,05	0,12±0,05	0,15±0,05
0402	1,00±0,05	0,50±0,05	0,32±0,10	0,25±0,10	0,20±0,10
0603	1,60±0,10	0,80±0,10	0,45±0,10	0,30±0,20	0,30±0,20
0805	2,00±0,10	1,25±0,10	0,55±0,10	0,30±0,20	0,40±0,25
1206	3,10±0,10	1,55±0,10	0,55±0,10	0,50±0,30	0,40±0,25
1206 102mΩ to 1Ω	3,15±0,10	1,60±0,10	0,65±0,10	0,80±0,20	0,80±0,20
1210	3,10±0,10	2,60±0,15	0,55±0,10	0,50±0,30	0,50±0,25
2010	5,00±0,10	2,50±0,15	0,60±0,15	0,60±0,30	0,50±0,25
2512	6,35±0,10	3,10±0,15	0,60±0,10	0,60±0,30	0,55±0,25
2512 (10 - 99mΩ)	6,35±0,20	3,15±0,15	0,74±0,10	0,60±0,30	0,55±0,25
2512 (100 - 1000mΩ)	6,35±0,20	3,15±0,15	0,74±0,10	0,60±0,30	2,10±0,10
1225	3,20±0,15	6,45±0,15	0,90±0,15	0,60±0,30	0,80±0,25
3720	2,00±0,20	3,75±0,20	0,60±0,10	0,40±0,20	0,40±0,20
7520	2,00±0,20	7,50±0,30	0,60±0,10	0,40±0,20	0,40±0,20
0612	1,55±0,10	3,10±0,15	0,55±0,10	0,30±0,15	0,45±0,15

(unit: mm)

SMD Low Ohm

Power Derating Curve

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below. Operating temperature -55°C to +155°C



SMD Low Ohm

Current Sensing Chip Resistor

THICK FILM CHIP RESISTORS

Rating

017 Series

Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Max. Operating Current	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
					±1% E96+E24	±2% E96+E24	±5% E24	
0201	1/20W	0,70A			100 - 147			±1000
					150 - 500			±600
					501 - 1000			±300
0402	1/16W	1,11A			50 - 100			±400
					102 - 500			±300
					510 - 1000			±200
0603	1/10W	2,23A			20 - 50			±600
					51 - 100			±400
					102 - 300			±300
					301 - 1000			±200
0805	1/8W	2,50A			20 - 50			±600
					51 - 100			±400
					101 - 196			±300
					200 - 1000			±200
1206	1/4W	5,00A			10 - 20			±600
					21 - 50			±400
					51 - 91			±300
1210	1/2W	7,07A		-55 ~ +155°C	100 - 1000			±200
					10 - 20			±600
					21 - 50			±400
					51 - 91			±300
2010	3/4W	8,66A			100 - 1000			±200
					10 - 20			±600
					21 - 50			±400
					51 - 91			±300
2512	1W	10,0A			100 - 1000			±200
					10 - 20			±600
					21 - 50			±400
					51 - 91			±300
1225	3W	31,6A			3 - 5			±300
					6 - 20			±200
					21 - 30			±150
					33 - 8000			±100
3720	1W	10,0A			10 - 18			±300
					20 - 500			±150
7520	2W	44,7A			-	1 - 4		±300
					5 - 10			±200
					11 - 350			±150
0612	1W	10,0A			10 - 27			±600
					30 - 91			±300
					100 - 499			±200
					500 - 1000			±100

High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Max. Operating Current	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
					±1% E96+E24	±2% E96+E24	±5% E24	
0402	1/8W	1,56A			51 - 100			±400
					102 - 500			±300
					510 - 1000			±200
0603	1/8W	1,98A			51 - 100			±400
					102 - 500			±300
					510 - 1000			±200
	1/5W				51 - 100			±400
					102 - 500			±300
					510 - 1000			±200
0805	1/4W	2,21A			51 - 100			±400
					102 - 500			±300
					510 - 1000			±200
1206	1/2W	7,07A		-55 ~ +155°C	10 - 20			±600
					21 - 50			±400
					51 - 91			±300
	1W				100 - 1000			±200
					102 - 1000			±100
					10 - 20			±600
1210	3/4W	8,66A			21 - 50			±400
					51 - 91			±300
					100 - 1000			±200
2010	1W	10,0A			10 - 20			±600
					21 - 50			±400
					51 - 91			±300
					100 - 1000			±200
2512	1.5W	12,2A			10 - 20			±600
					21 - 50			±400
	2W				51 - 91			±300
					100 - 1000			±200

Low TCR Electrical Specifications

Type	Item	Power Rating at 70°C	Max. Operating Current	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
					±1% E96+E24	±2% E96+E24	±5% E24	
0805	1/8W	1,11A			100 - 1000			±100
1206	1/4W	1,58A			100 - 1000			
1210	1/2W	2,58A			75 - 1000			
2010	3/4W	3,87A			50 - 1000			
2512	1W	7,07A		-55 ~ +155°C	20 - 1000			
	2W	6,32A			50 - 1000			
3720	1W	3,16A			100 - 500			
7520	2W	6,32A			50 - 350			

Operating Current= $\sqrt{P/R}$

FrelTec Current Sensing Chip Resistor

SMD Low Ohm

SPECIFICATION

E96 and E24 (1%, 5%) 0805 to 2512 (0201, 0402 and 0603 1W no marking)



≥100mΩ: 4 digit in E24 series, later three digits are significant figures; first digit is multiplier (10⁻³).
 <100mΩ: 4 digit in E24 series, later two digits are significant figures; first two digit is multiplier (10⁻³).
 Examples ≥100mΩ: R100=100mOhm (E24 series and E96 series)
 <100mΩ: R022 = 22mOhm (E24 series)

E96 and E24 (1%, 5%) 0603

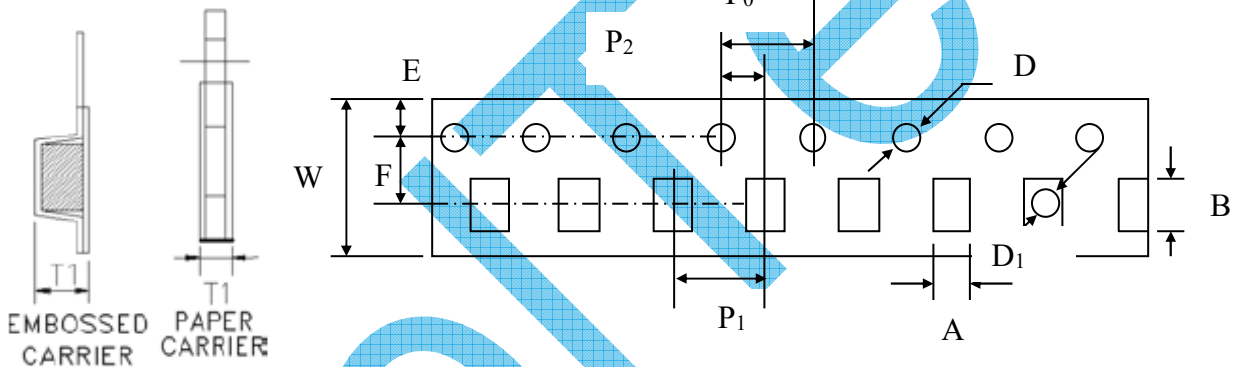


≥100mΩ: 3 digit in E24 series, later two digits are significant figures; first digit is multiplier (10⁻³).
 <100mΩ: 3 digit in E24 series, later two digits are significant figures; first digit is multiplier (10⁻³).
 Examples ≥100mΩ: R10=100mOhm
 <100mΩ: 022 = 22mOhm

Values for E96 series with special requirement are with no marking.

SPECIFICATION

Tape And Reel Package



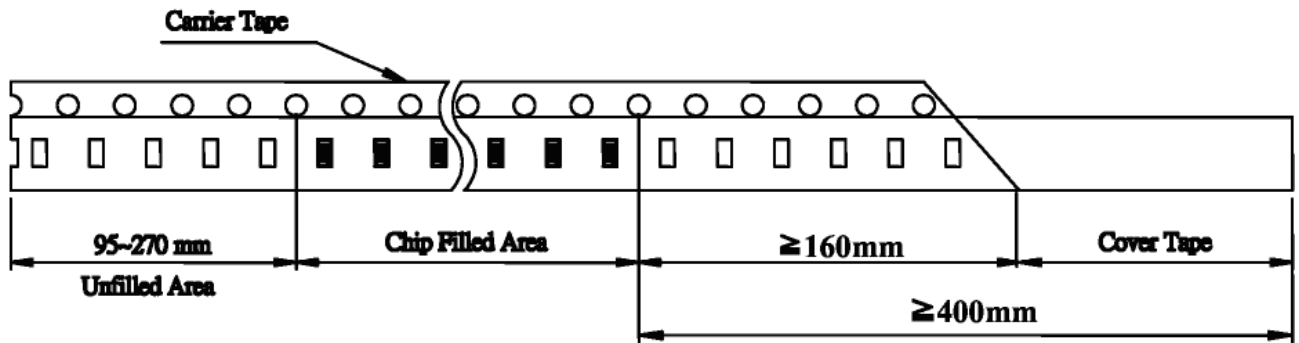
In Accordance with EIA RS-481

Packing	Size	A	B	W	E	F	P ₀	P ₁	P ₂	D	D ₀	T ₁
Paper Tape (T)	0201	0,38±0,05	0,68±0,05	8,0±0,20	1,75±0,10	3,50±0,05	4,00±0,10	2,00±0,05	2,00±0,05	1,50+0,1,-0	-	0,42±0,20
	0402	0,65±0,10	1,15±0,10	8,0±0,20	1,75±0,10	3,50±0,05	4,00±0,10	2,00±0,05	2,00±0,05	1,50+0,1,-0	-	0,45±0,10
	0603	1,10±0,10	1,90±0,10	8,0±0,20	1,75±0,10	3,50±0,05	4,00±0,10	4,00±0,05	2,00±0,05	1,50+0,1,-0	-	0,70±0,10
	0805	1,60±0,10	2,40±0,20	8,0±0,20	1,75±0,10	3,50±0,05	4,00±0,10	4,00±0,05	2,00±0,05	1,50+0,1,-0	-	0,85±0,10
	1206	1,90±0,10	3,50±0,20	8,0±0,20	1,75±0,10	3,50±0,05	4,00±0,10	4,00±0,05	2,00±0,05	1,50+0,1,-0	-	0,85±0,10
	1210	2,80±0,10	3,50±0,20	8,0±0,20	1,75±0,10	3,50±0,05	4,00±0,10	4,00±0,05	2,00±0,05	1,50+0,1,-0	-	0,85±0,10
	0612	1,90±0,10	3,50±0,20	8,0±0,20	1,75±0,10	3,50±0,05	4,00±0,10	4,00±0,05	2,00±0,05	1,50+0,1,-0	-	0,85±0,10
Embossed Tape (E)	2010	2,80±0,10	5,50±0,10	12,0±0,30	1,75±0,10	5,5±0,05	4,00±0,05	4,00±0,10	2,00±0,05	1,50+0,10	1,4 Min	1,00±0,20
	2512	3,50±0,10	6,70±0,10	12,0±0,30	1,75±0,10	5,5±0,05	4,00±0,05	4,00±0,10	2,00±0,05	1,50+0,10	1,4 Min	1,00±0,20
	2512 (2W)	3,38±0,10	6,68±0,10	12,0±0,30	1,75±0,10	5,5±0,10	4,00±0,10	4,00±0,10	2,00±0,05	1,55+0,05	1,4 Min	1,45±0,20
	1225	3,38±0,10	6,68±0,10	12,0±0,30	1,75±0,10	5,5±0,10	4,00±0,10	4,00±0,10	2,00±0,05	1,55+0,05	1,4 Min	1,45±0,20
	3720	2,50±0,20	4,45±0,20	12,0±0,30	1,75±0,10	5,5±0,05	4,00 ±0,05	4,00±0,10	2,00±0,05	1,50+0,10	1,4 Min	1,20 ±0,20
	7520	2,50±0,20	8,30±0,20	16,0±0,30	1,75±0,10	7,8±0,05	4,00±0,05	4,00±0,10	2,00±0,05	1,50+0,10	1,4 Min	1,20 ±0,20

SMD Low Ohm

FrelTec Current Sensing Chip Resistor

Lead Dimensions:



FrelTec

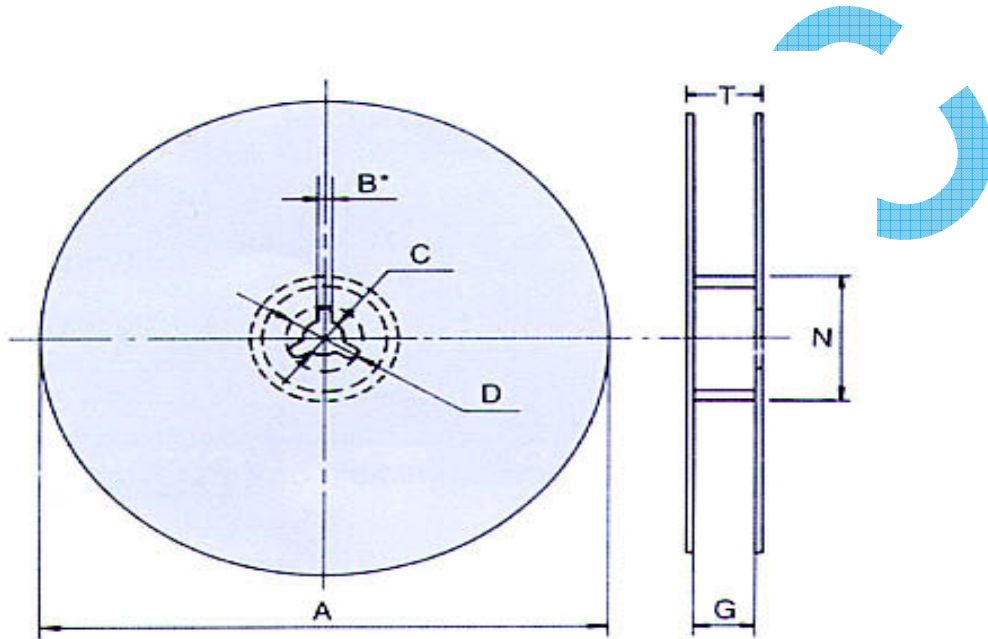
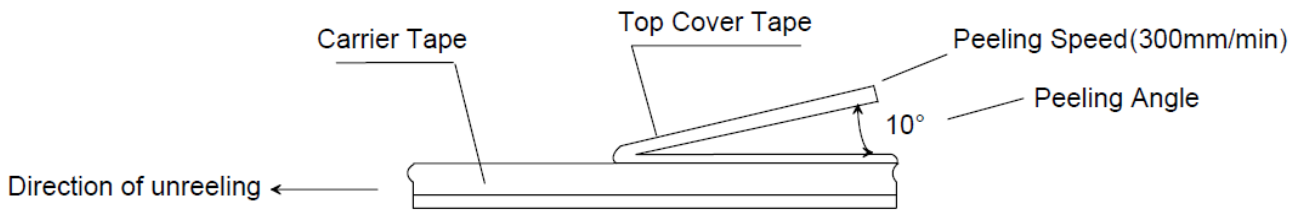
SMD Low Ohm

Current Sensing Chip Resistor

Cover Tape Peel off Strength

Specifications: 0402 => 0,07~0,5N (7,1~51gf)

0603, 0805, 1206, 1210, 2512 => 0,07~0,7N (7,1~71.4gf)

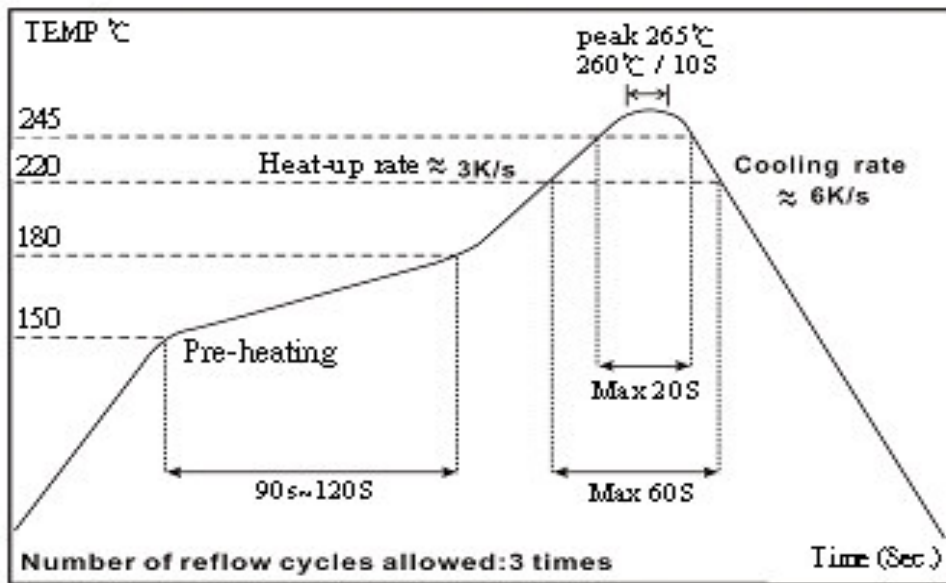


Symbol	Type	A	N	C	G	T	
Dimension	0201	178,0±1,0	60,0±1,0	13,5±0,7	9,5±0,1	11,5±1,0	in mm
	0402						
	0603						
	0805						
	1206				13,5±1,0	15,5±1,0	
	1210						
	2010						
	2512				17,5±1,0	19,5±1,0	
	1225						
	3720						
	7520				9,5±1,0	11,5±1,0	
0612							

Stock period

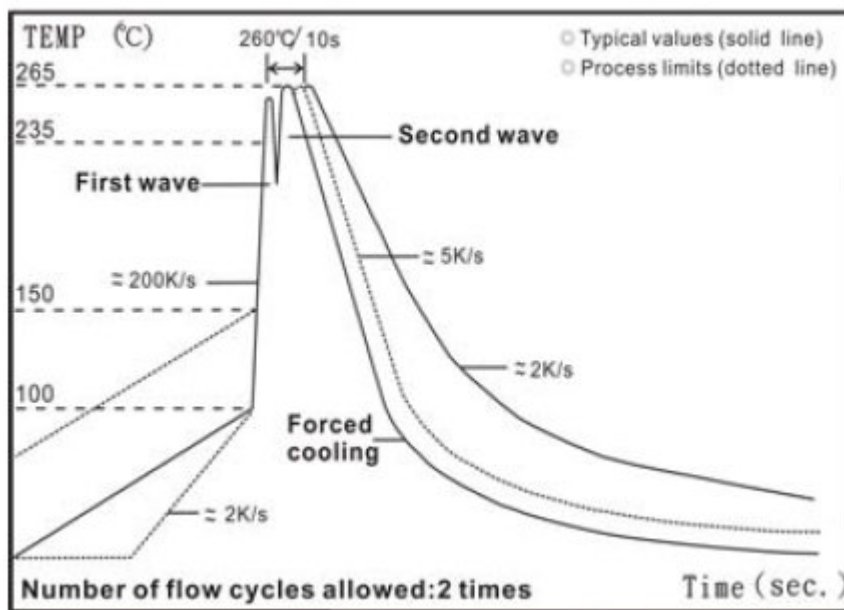
The temperature condition must be controlled at 22 ± 5 °C, the R.H. must be controlled below 80% RH before soldering. The stock can maintain quality level in 12 months.

IR Reflow Soldering Profile



Remark: The peak temperature of soldering heat is 260 °C for 10 seconds.

Wave Soldering Profile



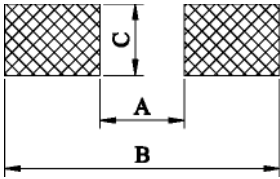
Remark: The peak temperature of soldering heat is 260 °C for 10 seconds.

Soldering Iron: Temperature 410°C shall be less than 5 seconds.

FrelTec

SMD Low Ohm Current Sensing Chip Resistor

Recommended Land Pattern Design (For Reflow Soldering):



Size	A	B	C
0201	0,25	0,85	0,40±0,2
0402	0,50	1,50	0,60±0,2
0603	0,80	2,80	0,90±0,2
0805	1,00	3,00	1,35±0,2
1206	2,00	4,30	1,70±0,2
1206 1W	0,90	4,30	1,70±0,2
1210	2,00	4,30	2,50±0,2
2010	3,60	6,40	2,50±0,2
2512	4,90	8,10	3,20±0,2
2512 2W 10 – 99 mOhm	4,90	8,10	3,20±0,2
2512 2W 100 – 1000 mOhm	1,00	8,10	3,20±0,2
1225	1,20	5,20	7,00±0,2
3720	1,00	4,60	3,90±0,2
7520	1,00	4,60	7,60±0,2
0612	0,60	2,60	3,20±0,2

Unit: mm

SMD Low Ohm

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	JIS-C-5201-1 4.8 IEC-60115-1 4.8 -55°C~+125°C, 25°C is the reference temperature
Short Time Overload	$\pm(0,5\%+0,05\Omega)$	JIS-C-5201-1 4.13 IEC-60115-1 4.13 RCWV*2,5 or Max. overload voltage whichever is lower for 5 s
	$\pm(1,0\%+0,05\Omega)$ for high power rating	
Insulation Resistance	>10GΩ	JIS-C-5201-1 4.6 IEC-60115-1 4.6 Max Overload voltage for 1 min
Endurance	$\pm(1,0\%+0,05\Omega)$	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1 70±2°C, RCWV for 1000 h with 1,5 h "ON" and 0,5 h "OFF"
Damp Heat with Load	$\pm(0,5\%+0,05\Omega)$ 1206 1W: $\pm(1,0\%+0,05\Omega)$	JIS-C-5201-1 4.24 IEC-60115-1 4.24 40±2°C, 90~95% R.H. RCWV for 1000 h with 1.5 h "ON" and 0.5 h "OFF"
Dry Heat	$\pm(0,5\%+0,05\Omega)$ 1206 1W: $\pm(1,0\%+0,05\Omega)$	JIS-C-5201-1 4.23 IEC-60115-1 4.23.2 at +155°C for 1000 h
Bending Strength	$\pm(1,0\%+0,05\Omega)$	JIS-C-5201-1 4.33 IEC-60115-1 4.33 Bending once for 5 s with 3mm 2010, 2512 Size: 2mm
Solderability	95% min. coverage	JIS-C-5201-1 4.17 IEC-60115-1 4.17 245±5°C for 3 s
Resistance to Soldering Heat	$\pm(0,5\%+0,05\Omega)$ 1206 1W: $\pm(1,0\%+0,05\Omega)$	JIS-C-5201-1 4.18 IEC-60115-1 4.18 260±5°C for 10 s
Voltage Proof	No breakdown or flashover	JIS-C-5201-1 4.7 IEC-60115-1 4.7 1,42 times Max. Operating Voltage for 1 min.
Leaching	Individual leaching area ≤5% Total leaching area ≤10%	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1 260±5°C for 30 s
Rapid Change of Temperature	$\pm(0,5\%+0,05\Omega)$ 1206 1W: $\pm(1,0\%+0,05\Omega)$	JIS-C-5201-1 4.19 IEC-60115-1 4.19 -55°C to +155°C, 5 cycles

RCWV (Rated Continuous Working Voltage) = $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

Published by FrelTec® GmbH
Mathildenstr. 10A; 82319 Starnberg; Germany
© 2019 FrelTec® GmbH. All Rights Reserved.

The following applies to all products named in this publication:

1. The information describes the type of component and shall not be considered as assured characteristics.
2. Terms of delivery and rights to change design reserved.
3. Some parts of this publication contain statements about the suitability of our products for certain areas of application. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. Nevertheless, we explicitly point out that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application. As a rule, FrelTec® is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a FrelTec® product with the properties described in the product specification is suitable for use in a particular customer application.
4. We also point out that in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
5. The warnings, cautions and product-specific notes must be observed.
6. In order to satisfy certain technical requirements, some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as "hazardous"). Useful information on this will be found in our Material Data Sheets. Should you have any more detailed questions, please contact our sales offices.
7. We constantly strive to improve our products. Consequently, the products described in this publication may change from time to time. The same is true for the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also reserve the right to discontinue production and delivery of products. Consequently, we cannot guarantee that all products named in this publication will always be available.
8. Unless otherwise agreed in individual contracts, all orders are subject to the current version of the "General conditions for the supply of products and services of the electrical and electronics industry" published by the German Electrical and Electronics Industry Association (ZVEI), available at www.freltec.com.
9. As far as patents or other rights of third parties are concerned, liability is only assumed for components per se, not for applications, processes and circuits implemented within components or assemblies.
10. The trade name FrelTec® is a trademark registered or pending in Europe and in other countries.