Thin Film Technology Corp.

Product Family: 4-Terminal, Current Sensing Chip Resistor

Part Number Series: WRL-L4 Series

RoHS COMPLIANT 2011/65/EU

HF HALOGEN-FREE

Construction:

- 4-terminals, separate voltage and current terminals
- High purity alumina substrate
- MnCu resistive alloy
- Inherently Anti-Sulfur
- 100% matte tin over Ni terminations
- Halogen free
- RoHS compliant and Pb Free

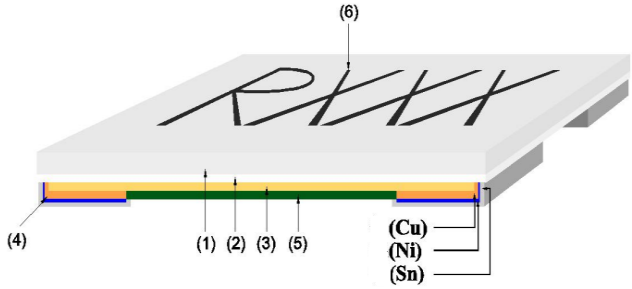
Features:

- 1206 & 2512 English case sizes
- Power rating up to 1W
- Resistance down to 0.5mΩ
- TCR down to ±30ppm/°C
- Tolerance down to ±0.3%
- High sensing accuracy
- AEC-Q200 Qualified
- Moisture Sensitivity Level (MSL) = 1

Description:

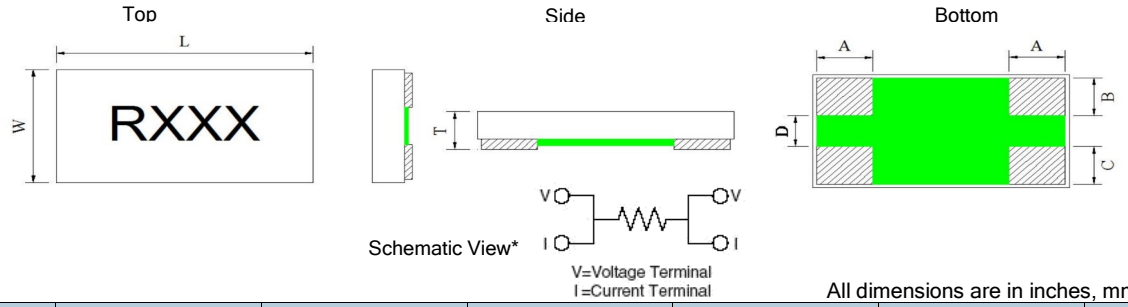
These four-terminal, low resistance chip resistors are of superior quality and provide separate voltage and current terminals for high precision and reliability. Constructed with a bottom side element to reduce any terminal parasitics and provide better accuracy versus top side element competitors. The resistive foil element used is a proprietary alloy of nickel and copper making it impervious to environmental conditions as the element is anti-corrosive and anti-sulfur. This element exhibits ultra load life stability over time and industry leading heat dissipation making it suitable for automotive, battery pack or harsh environments.

Product Construction:



Number	Description
1	Substrate (Alumina Ceramic)
2	Adhesion layer (Epoxy)
3	Resistive element (Cu alloy foil)
4	Terminal electrode (Cu, Ni, Sn)
5	Protective coating (Flame-retardant epoxy, UL-94-V0, green)
6	Marking (Flame-retardant epoxy, UL-94-V0, black)

Product Dimensions:



All dimensions are in inches, mm in parentheses.

Dimension (Metric)	L	W	T	A	B/C	D
WRL1206 (3216)	0.126 ±0.008 (3.20 ±0.20)	0.063 ±0.008 (1.60 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.022 ±0.008 (0.55 ±0.20)	0.020 ±0.008 (0.50 ±0.20)
WRL2512 (6432)	0.248 ±0.008 (6.30 ±0.20)	0.122 ±0.008 (3.10 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.037 ±0.008 (0.95 ±0.20)	0.041 ±0.008 (1.05 ±0.20)	0.040 ±0.008 (1.00 ±0.20)

* Note: Rotating the schematic 180° will have no effect to the circuit.

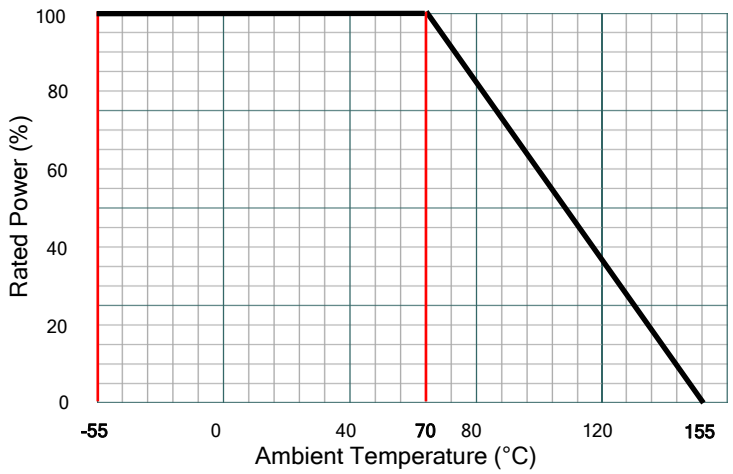
Part Numbering: Ex: WRL1206L4R010D-T5

Series Name	English Size (Metric)	4 Terminal Indicator	Resistance Value	Resistance Tolerance	Automotive Grade	T&R Packaging Quantity
WRL	**1206** (3216) **2512** (6432)	L4	Use 4 digit code for all values. "R" or "M" denotes decimal position as necessary. Ex: **R005** = 5mΩ **0M50** = 0.5mΩ	**C** = ±0.3% **D** = ±0.5% **F** = ±1.0% (Refer to table)	**A** = AEC-Q200 (Leave Blank for non AEC-Q200)	**-T4 =** 4,000pcs/reel **-T5** = 5,000pcs/reel (Refer to table)

Electrical Specifications:

Type	WRL1206				WRL2512			
Metric Size	3216				6432			
Power Rating	1/2W (0.50W)				1/3W (0.33W)	1/2W (0.50W)	1.0W	1.0W
Resistance Range	0.5mΩ	1mΩ~4mΩ	5mΩ~9mΩ	10mΩ~100mΩ	0.5mΩ	1mΩ~2mΩ	3mΩ~4mΩ	5mΩ~100mΩ
TCR ppm/°C	±100	±75	±50	±30	±100	±75	±50	±30
Resistance Tolerance % (code)	±1%(F)	±0.5%(D), ±1%(F)		±0.3%(C)±0.5%(D)	±0.5%(D), ±1%(F)			
Operating Temp. Range	-55°C~+155°C							
Packaging (code)	5,000pcs/reel (-T5)				4,000pcs/reel (-T4)			

Power Derating Curve:



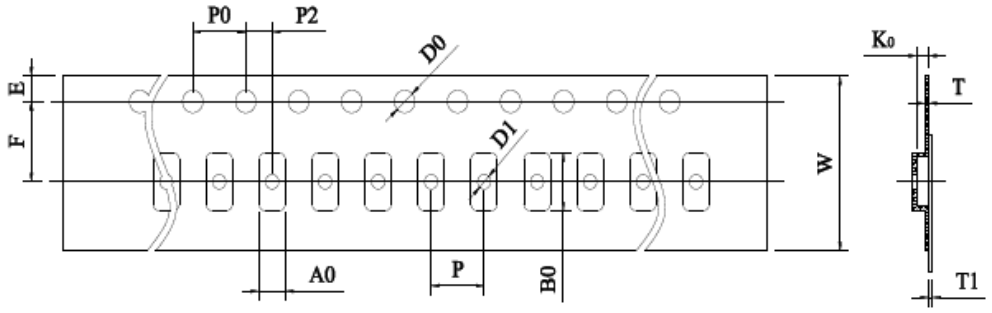
Reliability Specifications:

Test	Procedure	Specification
Short Time Over Load IEC60115-1 4.13	P = 2.5Pr ; T = 25 ±2°C , t = 5sec.	±1.0%
High Temp. Exposure IEC60115-1 4.25	T = +170 ±2°C ; t = 1000h	±1.0%
Low Temp. Storage IEC60115-1 4.25	T = -55 ±2°C ; t = 1000h	±1.0%
Moisture Load Life (60°C, 95%RH) IEC60115-1 4.25	$V_{test} = V_{max}$; T=60 ±2°C ; RH = 95%; t = 90min ON, 30min OFF, 1000h	±2.0%
Thermal Shock IEC60115-1 4.19	[-55°C 30min. → R.T. 3min. → +150°C 30min.→ R.T. 3min], 100 Cycles	±1.0%
Load Life at 70°C IEC60115-1 4.25	$V_{test} = V_{max}$; T = 70 ±2°C; t = 90min ON, 30min OFF,1000h	±2%
Solderability IEC60115-1 4.17	Dip into solder at T = 245 ±5°C, t = 3 ±0.5sec.	The covered area >95%
Resistance to Solder Heat IEC60115-1 4.18	Through Reflow T = 275 ±5°C , t = 20 ±1sec.	±1.0%
Mechanical Shock IEC60115-1 4.21	a = 100G , t = 11ms, 5 times shock	±1.0%
Substrate Bending IEC60115-1 4.33	Span between fulcrums : 90mm Bend Width : 2mm ; Test board : Glass-Epoxy Board Thickness = 1.6mm	±1.0%

AEC-Q200 Test Requirements (Table 7):

AEC Test #	Test Name	AEC-Q200 Test Requirements	Specification
3	High Temp. Exposure (Storage) MIL-STD-202, Method 108	Test Temp 125 ±3°C Test Period: 1,000 hours No Electrical Load	±1.0%
4	Temp. Cycling (Thermal Shock) JESD22 Method JA-104	Repeat 1,000 cycles as follows: -55 ±3°C for 30 minutes 125 ±3°C for 30 minutes Transition time of 1 minute max	±1.0%
7	Biased Humidity MIL-STD-202, Method 103	Test conditions: 85°C and 85% RH 10% of rated power Test Period 1,000 hours	±1.0%
8	Load Life (Operational Life) MIL-STD-202, Method 108	Test Temperature: 125 ±3°C Applied voltage: rated power (derated Power will be required if temp exceeds the derating point of part) Test Period: 1,000 hours (condition D)	±1.0%
12	Resistance to Solvents MIL-STD-202, Method 215	3 minute soak 2-3 ounce force 10 strokes/repetition 3 repetitions	No damage
13	Mechanical Shock MIL-STD-202, Method 213	Force: 100G peak Test duration: 6 ms Half-sine waveform Velocity: 12.3ft/sec	±1.0%
14	Vibration MIL-STD-202, Method 204	Frequency: 10-2,000 Hz Acceleration: 5G Test duration: 20 minutes, 12 cycles	±1.0%
15	Resistance to soldering heat MIL-STD-202, Method 210	Condition B (Solder dip, no pre-heat) 260 ±5°C	±1.0%
17	ESD AEC-Q200-002	HBM, 100pF, 1.5k ohms Repetition: 5 times	±1.0%
18	Solderability J-STD-002	Non-activated flux dip: 5-10 seconds SAC solder dip: 2 ±0.5 seconds at 245 ±5°C	95% coverage
20	Flammability UL-94	V-0 or V-1 are acceptable Electrical test not required	Provide certificate
21	Board Flex AEC-Q200-005	90 mm span between fulcrums 2 mm bend 60 seconds minimum holding time	±1.0%
22	Terminal Strength (SMD) AEC-Q200-006	Force of 17.7 N 60 seconds	±1.0%
24	Flame Retardance AEC-Q200-001	Mounted parts subjected to voltages from 9.0 to 32 VDC (current clamped up to 500A) in 1.0 VDC increments. Voltage applied for 1hour minimum or until failure occurs	Must meet AEC-Q200 requirements

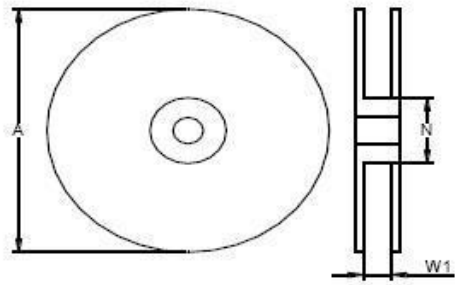
Plastic Taping Dimensions:



All dimensions in mm.

Type	W	P0	P	P2	A0	B0	D0	F	E	T	T1	K0
WRL1206	8.00 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	1.90 ±0.20	3.50 ±0.20	1.50 ±0.10	3.50 ±0.10	1.75 ±0.10	0.20 ±0.10	Max 0.10	0.85 ±0.20
WRL2512	12.0 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	3.40 ±0.20	6.75 ±0.20	1.50 ±0.10	5.50 ±0.10	1.75 ±0.10	0.25 ±0.10	Max 0.10	0.81 ±0.20

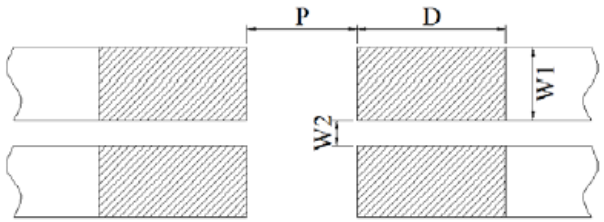
Reel Dimensions:



All dimensions in mm.

Type	A	N	W1
WRL1206	178 ±5.00	60.0 ±2.00	9.00 ±1.00
WRL2512	178 ±5.00	60.0 ±2.00	13.0 ±1.00

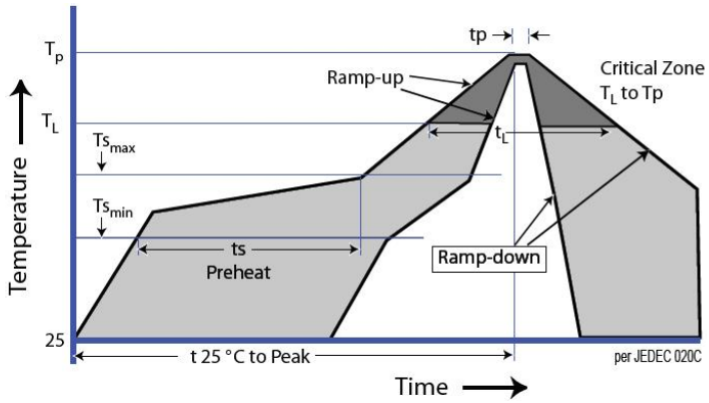
Recommended Land Pattern:



All dimensions in mm.

Type	P	W1	W2	D
WRL1206	1.20	1.10	0.30	1.80
WRL2512	3.10	1.40	0.70	2.00

Recommended Soldering Profile:



Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.
Preheat - Temperature Min (Ts_{min}) - Temperature Max (Ts_{max}) - Time (ts_{min} to ts_{max})	 150 °C 200 °C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	 217 °C 60-150 seconds
Peak Temperature (T_p)	260 +0 °C
Time within 5 °C of actual Peak Temperature (tp)	20-40 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	8 minutes max.

Storage Conditions:

Environmental Conditions:

Products should be stored under the following environmental conditions:

- Temperature: +5 to +40°C
- Humidity: 45 to 85% relative humidity
- Do not keep products in environments where they may be subject to particulate contamination or harmful gases such as sulfuric acid or hydrogen chloride as it may cause oxidization on electrodes, resulting in poor solderability.
- Products should be stored in a space that does not expose it to high temperatures, vibration, or direct sunlight.
- Products should be stored in the original airtight packaging until use.