Thin Film Technology Corp.

Product Family: 2-Terminal Low Ohm Current Sense Resistors

Part Number Series: WEL Series Short Side Electrode Automotive

RoHS COMPLIANT 2011/65/EU

HF HALOGEN-FREE

Construction:

- High purity alumina substrate
- Metal foil resistive element
- Epoxy-resin overcoat
- Wrap around electrodes
- 100% matte tin over Ni terminations
- RoHS complainant and Pb free
- Inherently Anti-Sulfur

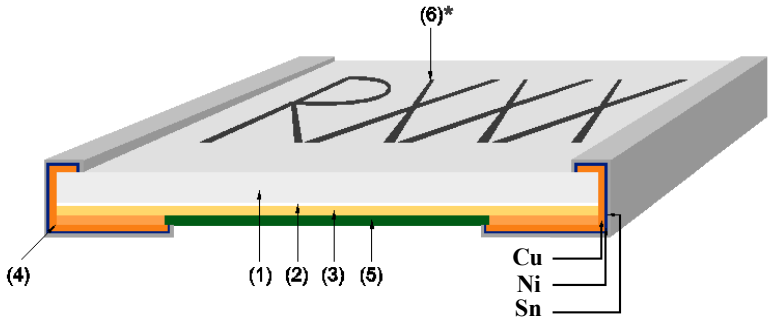
Features:

- TCR down to ±50ppm/°C
- Resistances from 3mΩ~570mΩ
- Optimal linearity in I/V conversion
- High volume production suitable for commercial and special applications
- Competitive pricing
- Moisture Sensitivity Level=1
- AEC-Q200 Qualified

Description:

These low ohm current sense resistors are designed for tight resistance tolerance, low noise, long-term stability and high heat dissipation capability in a small package. This series is ideal for use in power management modules, motor control circuits and automotive applications.

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)
6	Marking* (Flame-retardant epoxy, UL-94-V0)

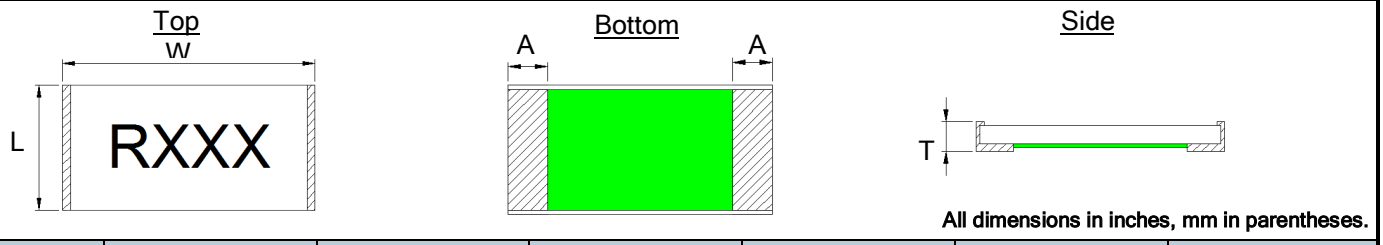
***** Note: Marking is 2 digits (XX) for 0603 case size, 3 digits (XXX) for 0805, and 4 digits (RXXX) for all other case sizes.

Part Numbering: Ex: WEL0805MR010FA-T5

Series Name	English Size	Material	Resistance Value	Resistance Tolerance	Automotive Grade	T&R Packaging Quantity
WEL	(refer to "type" in electrical tables)	**M** = MnCu **C** = NiCu	Use 4 digit code for all other cases. "R" denotes decimal position. Ex. **R010** = 10mΩ **R100** =100mΩ	**D** = ±0.5%***** **F** = ±1.0% (refer to tables)	**A =** AEC-Q200	**-T1** = 1,000 **-T2** = 2,000 **-T4** = 4,000 **-T5** = 5,000 (refer to tables)

***** Note: ±0.5% (D) tolerance is not available for all resistance values. See electrical specifications table.

Product Dimensions:



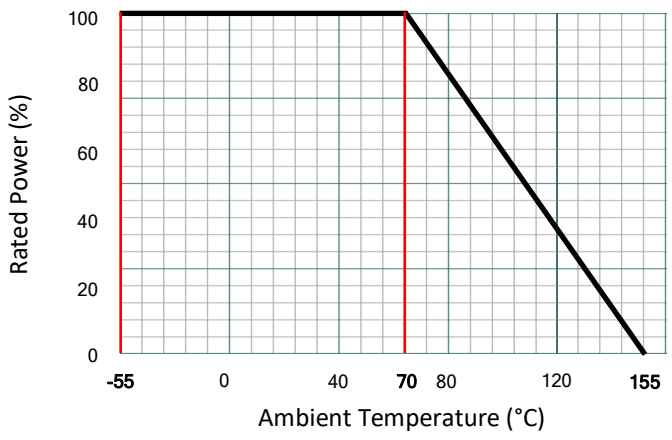
All dimensions in inches, mm in parentheses.

Dimension (Metric)	Resistance Range	Material	L	W	A	T
WEL0603 (1608)	5mΩ	M	0.067 ±0.008 (1.70 ±0.20)	0.035 ±0.008 (0.90 ±0.20)	0.020 ±0.008 (0.50 ±0.20)	0.026 ±0.008 (0.65 ±0.20)
	6mΩ~20mΩ				0.016 ±0.008 (0.40 ±0.20)	
WEL0805 (2012)	5mΩ~49mΩ	M	0.083 ±0.008 (2.10 ±0.20)	0.053 ±0.008 (1.35 ±0.20)	0.020 ±0.008 (0.50 ±0.20)	0.026 ±0.008 (0.65 ±0.20)
	50mΩ~200mΩ	C				
WEL1206 (3216)	3mΩ	M	0.130 ±0.008 (3.30 ±0.20)	0.067 ±0.008 (1.70 ±0.20)	0.047 ±0.012 (1.20 ±0.30)	0.026 ±0.008 (0.65 ±0.20)
	4mΩ~49mΩ				0.027 ±0.012 (0.68 ±0.30)	
	50mΩ~570mΩ	C				
WEL2010 (5025)	5mΩ	M	0.201 ±0.008 (5.10 ±0.20)	0.102 ±0.008 (2.60 ±0.20)	0.067 ±0.012 (1.70 ±0.30)	0.026 ±0.008 (0.65 ±0.20)
	6mΩ~49mΩ				0.028 ±0.012 (0.70 ±0.30)	
	50mΩ~300mΩ	C				
WEL2512 (6432)	50mΩ~350mΩ	C	0.252 ±0.012 (6.40 ±0.30)	0.126 ±0.012 (3.20 ±0.30)	0.041 ±0.012 (1.05 ±0.30)	0.026 ±0.008 (0.65 ±0.20)

Electrical Specifications:

Type	WEL0603		WEL0805		WEL1206		WEL2010		WEL2512
Metric Size	1608		2012		3216		5025		6432
Power Rating	1/2W		3/4W		1W		1.5W		2W
Resistance Range (mΩ)	5~9	10~20	5~9	10~200	3~9	10~570	5~9	10~300	50~350
Resistance Tolerance % (code)	±1.0(F)	±0.5(D) ±1.0(F)	±1.0(F)	±0.5(D) ±1.0(F)	±1.0(F)	±0.5(D) ±1.0(F)	±1.0(F)	±0.5(D) ±1.0(F)	±0.5(D) ±1.0(F)
TCR ppm/°C	±100	±50	±100	±50	±100	±50	±100	±50	±50
Operating Temp. Range	-55°C~+155°C								
Rated Voltage	√(Power x Resistance)								
Packaging (code)	5,000 pcs/reel (-T5)						4,000 pcs/reel (-T4)		

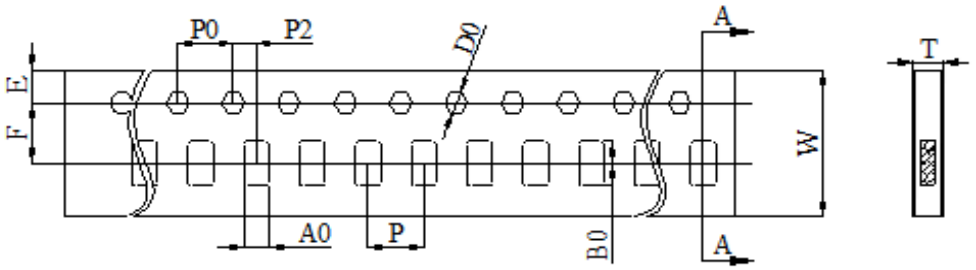
Power Derating Curve:



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 1 hour minimum or until failure occurs	Must meet AEC-Q200 requirements

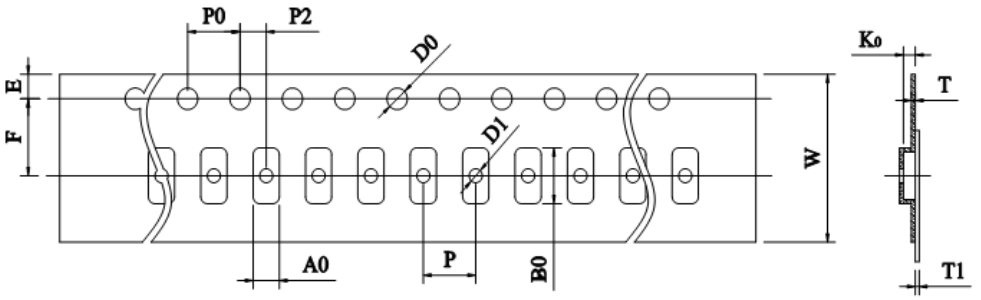
Paper Tape Dimensions:



All dimensions in mm.

Size	W	P0	P	P2	A0	B0	D0	F	E	T
0603	8.00 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	1.10 ±0.10	1.90 ±0.10	1.50 ±0.10	3.50 ±0.10	1.75 ±0.10	0.75 ±0.10
0805	8.00 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	1.55 ±0.10	2.30 ±0.10	1.50 ±0.10	3.50 ±0.10	1.75 ±0.10	0.87 ±0.10
1206	8.00 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	2.05 ±0.20	3.65 ±0.20	1.50 ±0.10	3.50 ±0.10	1.75 ±0.10	0.87 ±0.10

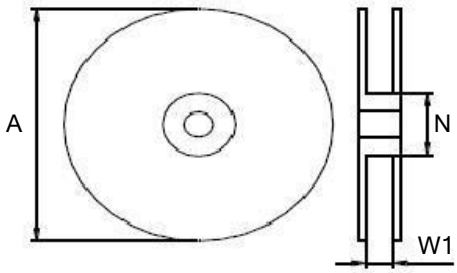
Plastic Tape Dimensions:



All dimensions in mm.

Size	W	P0	P	P2	A0	B0	D0	F	E	T	T1	K0
2010	12.0 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	2.85 ±0.20	5.45 ±0.20	1.50 ±0.10	5.50 ±0.10	1.75 ±0.10	0.25 ±0.10	Max 0.10	0.80 ±0.20
2512					3.40 ±0.20	6.75 ±0.20						1.00 ±0.20

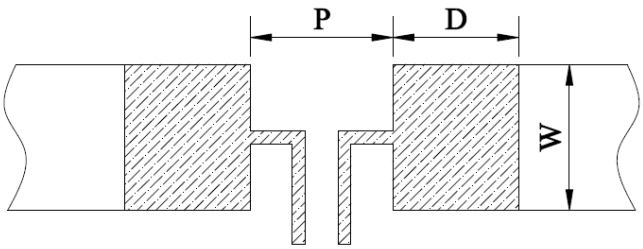
Reel Dimensions:



All dimensions in mm.

Size	0603	0805	1206	2010	2512
Quantity	5,000 pcs/reel			4,000 pcs/reel	
A	178 ±5.00				
N	60.0 ±2.00				
W1	9.00 ±1.00			13.0 ±1.00	

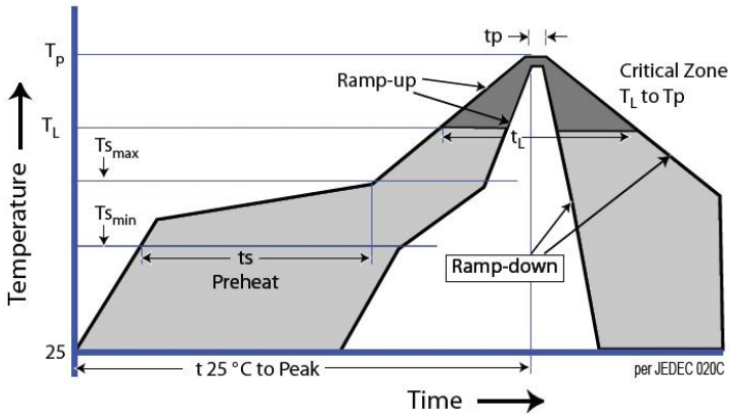
Recommended Land Pattern:



All dimensions in mm.

Size	Resistance Range	P	W	D
0603	5mΩ	0.50	0.92	1.35
	6mΩ~20mΩ	0.60		1.30
0805	5mΩ~200mΩ	0.80	1.44	1.40
1206	3mΩ	0.60	1.84	2.10
	4mΩ~570mΩ	1.20		1.80
2010	5mΩ	1.40	2.88	3.30
	6mΩ~300mΩ	2.70		2.65
2512	50mΩ~350mΩ	3.10	3.57	3.10

Soldering Profile:



Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.
Preheat	
- Temperature Min (Ts_{min})	150 °C
- Temperature Max (Ts_{max})	200 °C
- Time (ts_{min} to ts_{max})	60-180 seconds
Time maintained above:	
- Temperature (T_L)	217 °C
- Time (t_L)	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:

Environment Conditions:

Products should be stored under the following environmental conditions.

- Temperature: +5 to +35°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.