

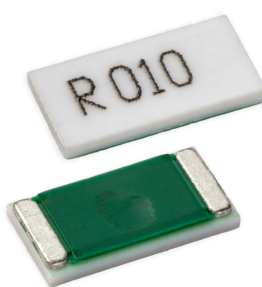


Thin Film Technology Corp.

Product Family: 2-Terminal Low Ohm Current Sense Resistors

Part Number Series: D1WKL Series

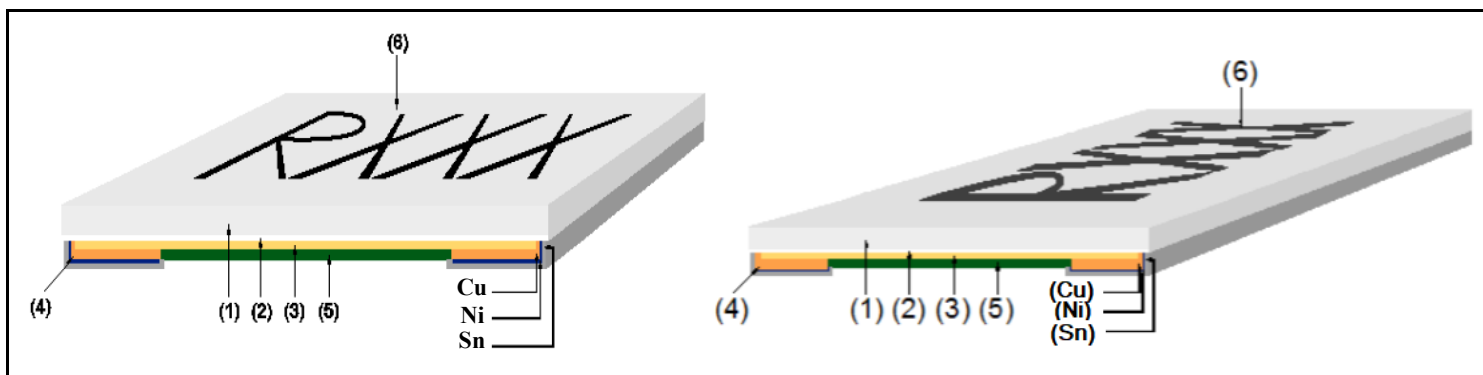


	Construction: • High purity alumina ceramic • Cu alloy resistive element • Epoxy-resin overcoat • Non-wrapped terminations • Halogen free • RoHS compliant and Pb free • Inherently anti-sulfur	Features: • 0508, 0603, 0612, 0805, 0815, 0830, 1020, 1206, 1225, 1530, 1836, 2010, 2139, 2512, 3921, 4527 English case sizes • Power up to 5W • Resistance from 1mΩ~700mΩ • TCR's down to ±50ppm/°C • Tolerance down to ±0.5% • Moisture Sensitivity Level (MSL) = 1
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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. This series varies from the WEL series as it has non-wrapped electrodes.

Product Construction:



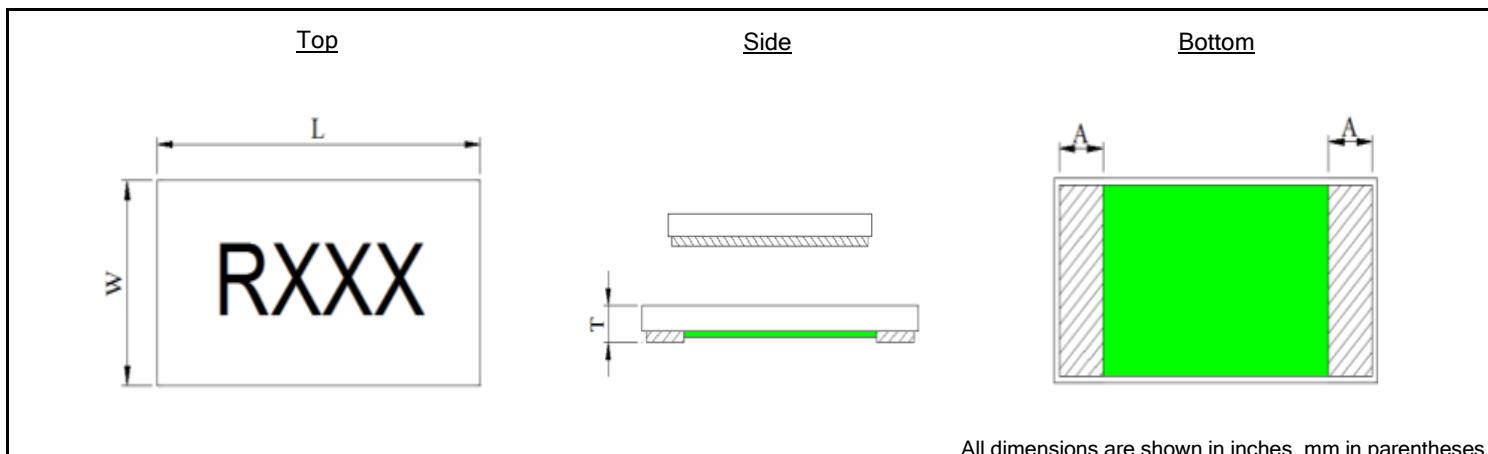
Number	Description
1	Substrate (alumina ceramic)
2	Adhesion layer (epoxy)
3	Resistive element (Cu alloy foil)
4	Terminal electrodes (Cu, Ni, Sn)
5	Protective coating (flame-retardant epoxy)
6	Marking* (flame-retardant epoxy)

* Note: Marking is 2 digits (XX) for 0603 case size, 3 digits (XXX) for 0805 and 0508 case sizes, and 4 digits (RXXX) for all other case sizes.

Part Numbering: Ex: D1WKL0508MR010F-T5

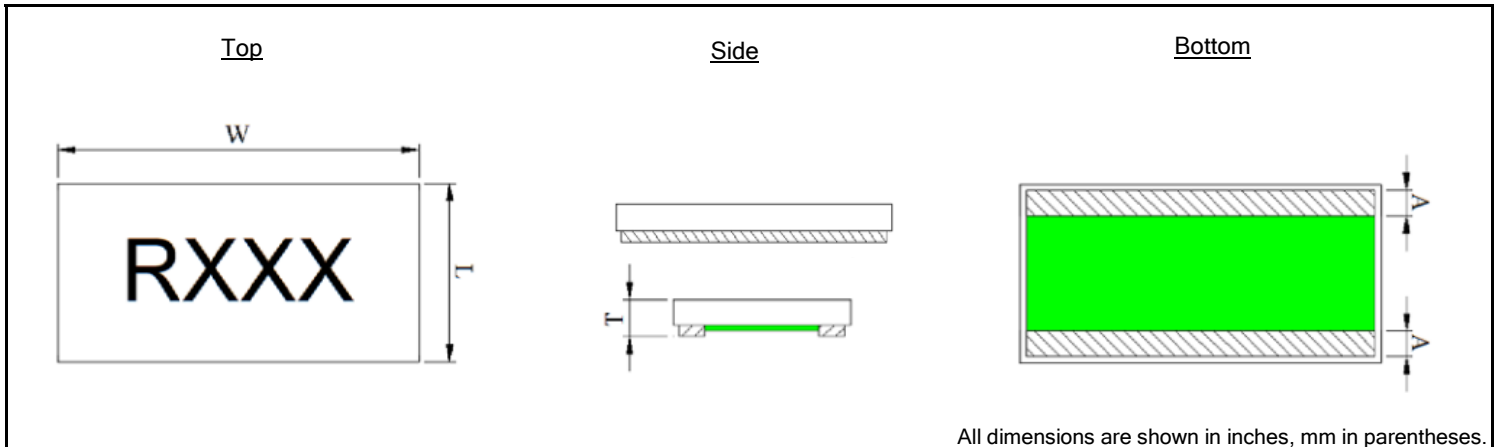
Series Name	English Size (Metric Size)	Material Code	Resistance Value	Resistance Tolerance	T&R Packaging Quantity
D1WKL	(Refer to "type" in the electrical tables)	M	Ex. R010 = 10mΩ R100 = 100mΩ (Refer to electrical tables)	D = ±0.5%* F = ±1.0%	-T1 = 1,000 pcs/reel -T2 = 2,000 pcs/reel -T4 = 4,000 pcs/reel -T5 = 5,000 pcs/reel (Refer to electrical tables)

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

Short Side Product Dimensions:

All dimensions are shown in inches, mm in parentheses.

Dimension (Metric)	Electrode Type	Resistance Range	L	W	T	A
D1WKL0603M (1608)	A	5mΩ	0.063 ±0.008 (1.60 ±0.20)	0.031 ±0.008 (0.80 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.014 ±0.008 (0.35 ±0.20)
		6mΩ~100mΩ				0.010 ±0.008 (0.25 ±0.20)
D1WKL0805M (2012)	A	3mΩ	0.079 ±0.008 (2.00 ±0.20)	0.050 ±0.008 (1.25 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.020 ±0.008 (0.50 ±0.20)
		4mΩ~500mΩ				0.014 ±0.008 (0.35 ±0.20)
D1WKL1206M (3216)	A	3mΩ	0.126 ±0.008 (3.20 ±0.20)	0.063 ±0.008 (1.60 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.041 ±0.008 (1.05 ±0.20)
		4mΩ~700mΩ				0.021 ±0.008 (0.53 ±0.20)
D1WKL2010M (5025)	A	2mΩ~3mΩ	0.197 ±0.008 (5.00 ±0.20)	0.098 ±0.008 (2.50 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.077 ±0.008 (1.95 ±0.20)
		4mΩ~700mΩ				0.022 ±0.008 (0.55 ±0.20)
D1WKL2512M (6432)	A	2mΩ	0.248 ±0.012 (6.30 ±0.30)	0.122 ±0.012 (3.10 ±0.30)	0.024 ±0.008 (0.60 ±0.20)	0.104 ±0.008 (2.65 ±0.20)
		3mΩ				0.096 ±0.008 (2.45 ±0.20)
		4mΩ~700mΩ				0.035 ±0.008 (0.90 ±0.20)
D1WKL3921M (11050)	A	2mΩ	0.433 ±0.012 (11.0 ±0.30)	0.197 ±0.012 (5.00 ±0.30)	0.024 ±0.008 (0.60 ±0.20)	0.187 ±0.012 (4.75 ±0.30)
		3mΩ				0.173 ±0.012 (4.40 ±0.30)
		4mΩ~100mΩ				0.087 ±0.012 (2.21 ±0.30)
D1WKL4527M (11470)	A	2mΩ	0.453 ±0.040 (11.5 ±1.00)	0.276 ±0.040 (7.00 ±1.00)	0.024 ±0.012 (0.60 ±0.30)	0.191 ±0.016 (4.85 ±0.40)
		3mΩ~100mΩ				0.100 ±0.016 (2.55 ±0.40)

Long Side Product Dimensions:

All dimensions are shown in inches, mm in parentheses.

Dimension (Metric)	Electrode Type	Resistance Range	L	W	T	A
D1WKL0508M (1220)	B	1mΩ~100mΩ	0.049 ±0.008 (1.25 ±0.20)	0.079 ±0.008 (2.00 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.011 ±0.008 (0.28 ±0.20)
D1WKL0612M (1632)	B	1mΩ	0.063 ±0.008 (1.60 ±0.20)	0.126 ±0.008 (3.20 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.016 ±0.012 (0.40 ±0.30)
		2mΩ~100mΩ				0.010 ±0.008 (0.25 ±0.20)
D1WKL0815M (2040)	B	1mΩ~100mΩ	0.083 ±0.008 (2.10 ±0.20)	0.146 ±0.008 (3.70 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.018 ±0.008 (0.46 ±0.20)
D1WKL1020M (2550)	B	1mΩ~100mΩ	0.098 ±0.008 (2.50 ±0.20)	0.197 ±0.008 (5.00 ±0.20)	0.024 ±0.008 (0.60 ±0.20)	0.020 ±0.008 (0.50 ±0.20)
D1WKL1225M (3264)	B	1mΩ~100mΩ	0.122 ±0.012 (3.10 ±0.30)	0.248 ±0.012 (6.30 ±0.30)	0.024 ±0.008 (0.60 ±0.20)	0.018 ±0.008 (0.45 ±0.20)
D1WKL0830M (2276)	B	1mΩ~100mΩ	0.098 ±0.012 (2.50 ±0.30)	0.295 ±0.012 (7.50 ±0.30)	0.024 ±0.008 (0.60 ±0.20)	0.021 ±0.012 (0.53 ±0.30)
D1WKL1530M (3876)	B	1mΩ~100mΩ	0.150 ±0.012 (3.80 ±0.30)	0.299 ±0.012 (7.60 ±0.30)	0.024 ±0.008 (0.60 ±0.20)	0.022 ±0.012 (0.55 ±0.30)
D1WKL1836M (4590)	B	1mΩ~100mΩ	0.177 ±0.012 (4.50 ±0.30)	0.354 ±0.012 (9.00 ±0.30)	0.024 ±0.008 (0.60 ±0.20)	0.026 ±0.012 (0.65 ±0.30)
D1WKL2043M (05110)	B	1mΩ~100mΩ	0.197 ±0.012 (5.00 ±0.30)	0.433 ±0.016 (11.0 ±0.40)	0.024 ±0.008 (0.60 ±0.20)	0.030 ±0.012 (0.75 ±0.30)

Electrical Specifications:

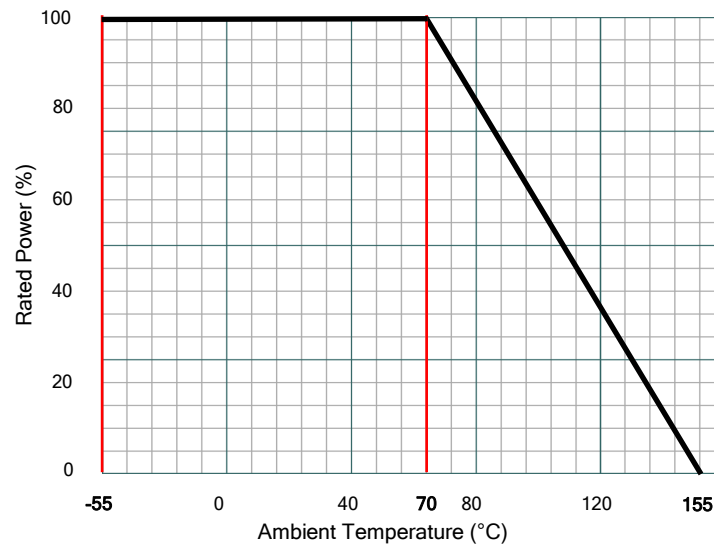
Item		D1WKL0603		D1WKL0805		D1WKL1206	
Electrode Style		Type "A" - Short Side Electrode					
Metric Size		1608		2012		3216	
Power Rating		1/2W (0.5W)		3/4W (0.75W)		1W	
Resistance Tolerance % (code)	±0.5%(D)	-	10mΩ~100mΩ	-	10mΩ~500mΩ	-	10mΩ~700mΩ
	±1.0%(F)	5mΩ~9mΩ		3mΩ~9mΩ		3mΩ~9mΩ	
Resistance Offering		1mΩ steps					
TCR ppm/°C		±100	±50	±100	±50	±100	±50
Operating Temp. Range		-55°C~+155°C					
Rated Voltage		√(Power x Resistance)					
Packaging (code)		5,000pcs/reel (-T5)					

Electrical Specifications (Cont.):

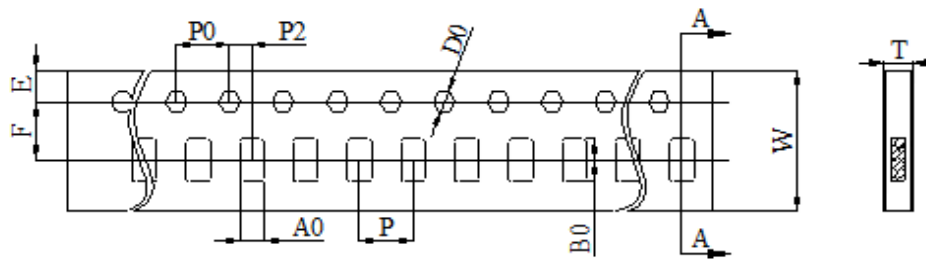
Item		D1WKL2010		D1WKL2512		D1WKL3921		D1WKL4527	
Electrode Style		Type “A” - Short Side Electrode							
Metric Size		5025		6432		11050		11470	
Power Rating		1½W (1.5W)		2W		3W		4W	
Resistance Tolerance % (code)	±0.5%(D)	-	10mΩ~700mΩ	-	10mΩ~700mΩ	-	10mΩ~100mΩ	-	10mΩ~100mΩ
	±1.0%(F)	2mΩ~9mΩ		2mΩ~9mΩ		2mΩ~9mΩ		2mΩ~9mΩ	
Resistance Offering		1mΩ steps							
TCR ppm/°C		±100	±50	±100	±50	±100	±50	±100	±50
Operating Temp. Range		-55°C~+155°C							
Rated Voltage		√(Power x Resistance)							
Packaging (code)		4,000pcs/reel (-T4)				2,000pcs/reel (-T2)		1,000pcs/reel (-T1)	

Item		D1WKL0508		D1WKL0612		D1WKL0815		D1WKL1020		D1WKL1225	
Electrode Style		Type “B” - Long Side Electrode									
Metric Size		1220		1632		2040		2550		3264	
Power Rating		1W		1½W (1.5W)		2W				3W	
Resistance Tolerance % (code)	±0.5%(D)	-	10mΩ~100mΩ	-	10mΩ~100mΩ	-	10mΩ~100mΩ	-	10mΩ~100mΩ	-	10mΩ~100mΩ
	±1.0%(F)	1mΩ~9mΩ		1mΩ~9mΩ		1mΩ~9mΩ		1mΩ~9mΩ		1mΩ~9mΩ	
Resistance Offering		1mΩ steps									
TCR ppm/°C		±100	±50	±100	±50	±100	±50	±100	±50	±100	±50
Operating Temp. Range		-55°C~+155°C									
Rated Voltage		$\sqrt{(\text{Power} \times \text{Resistance})}$									
Packaging (code)		5,000pcs/reel (-T5)					4,000pcs/reel (-T4)				

Item		D1WKL0830		D1WKL1530		D1WKL1836		D1WKL2139	
Electrode Style		Type “B” - Long Side Electrode							
Metric Size		2276		3876		4590		05110	
Power Rating		3W		4W				5W	
Resistance Tolerance % (code)	±0.5%(D)	-	10mΩ~100mΩ	-	10mΩ~100mΩ	-	10mΩ~100mΩ	-	10mΩ~100mΩ
	±1.0%(F)	1mΩ~9mΩ		1mΩ~9mΩ		1mΩ~9mΩ		1mΩ~9mΩ	
Resistance Offering		1mΩ steps							
TCR ppm/°C		±100	±50	±100	±50	±100	±50	±100	±50
Operating Temp. Range		-55°C~+155°C							
Rated Voltage		$\sqrt{(\text{Power} \times \text{Resistance})}$							
Packaging (code)		4,000pcs/reel (-T4)		2,000pcs/reel (-T2)					

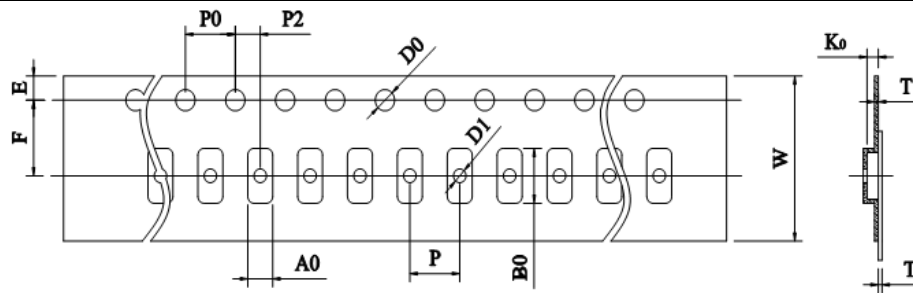
Power Derating Curve:**Reliability Specifications:**

Test	Procedure	Specification
Short Time Overload IEC60115-1 4.13	$P = 2.5PR$; $T = 25 \pm 2^{\circ}\text{C}$, $t = 5$ seconds	$\pm(1.0\%+0.5\text{m}\Omega)$
Load Life IEC60115-1 4.25	$T = 70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ $V_{\text{test}} = V_{\text{max}}$; $t = 90$ mins "ON" and 30 mins "OFF" Test period: 1,000 hours	$\pm(2.0\%+0.5\text{m}\Omega)$
Temperature Cycle (Thermal Shock) IEC60115-1 4.19	Repeat 100 cycles as follows: $-55 \pm 3^{\circ}\text{C}$ (30 min.) / $+155 \pm 3^{\circ}\text{C}$ (30 min.)	$\pm(1.0\%+0.5\text{m}\Omega)$
Resistance To Solder Heat IEC60115-1 4.18	Through Reflow, parts are subjected to 3 reflow cycles	$\pm(1.0\%+0.5\text{m}\Omega)$
Mechanical Shock IEC60115-1 4.21	$A = 100\text{G}$, $t = 6\text{ms}$	$\pm(1.0\%+0.5\text{m}\Omega)$
High Temperature Exposure IEC60115-1 4.25	$T = +155 \pm 2^{\circ}\text{C}$; $t = 1000\text{h}$	$\pm(1.0\%+0.5\text{m}\Omega)$
Low Temperature Storage IEC60115-1 4.25	$T = -55 \pm 2^{\circ}\text{C}$; $t = 1000\text{h}$	$\pm(1.0\%+0.5\text{m}\Omega)$
Moisture Load Life IEC60115-1 4.25	$V_{\text{test}} = V_{\text{max}}$; $T = 60 \pm 2^{\circ}\text{C}$; $\text{RH} = 95\%$; $t = 90$ mins "ON", 30 mins "OFF", 1000h	$\pm(2.0\%+0.5\text{m}\Omega)$
Solderability IEC60115-1 4.17	Dip into solder at $T = 245 \pm 5^{\circ}\text{C}$, $t = 3 \pm 1$ second	The covered area $>95\%$
Substrate Bending IEC60115-1 4.33	Span between fulcrums: 90mm, Bend Width: 2mm Test Board: Glass-epoxy board Thickness = 1.6mm	$\pm(1.0\%+0.5\text{m}\Omega)$

Paper Tape Dimensions:

All dimensions in mm.

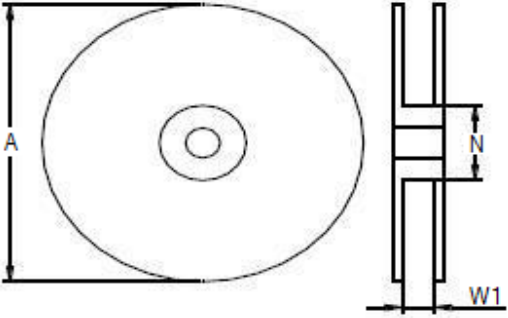
Type	W	P0	P	P2	A0	B0	D0	F	E	T
0603	8.00 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	0.98 ±0.10	1.85 ±0.10	1.50 ±0.10	3.50 ±0.10	1.75 ±0.10	0.75 ±0.10
0805	8.00 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	1.55 ±0.10	2.30 ±0.10	1.50 ±0.10	3.50 ±0.10	1.75 ±0.10	0.75 ±0.10
1206	8.00 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	1.90 ±0.20	3.50 ±0.20	1.50 ±0.10	3.50 ±0.10	1.75 ±0.10	0.75 ±0.10
0508	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	0.75 ±0.10
0612	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	0.75 ±0.10

Plastic Tape Dimensions:

All dimensions in mm.

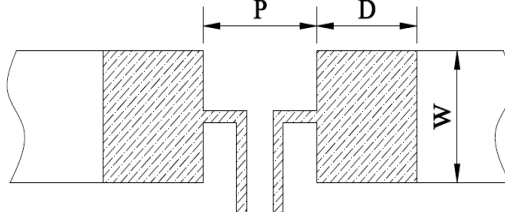
Type	W	P0	P	P2	A0	B0	D0	F	E	T	T1	K0
2010	12.0 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	2.85 ±0.20	5.45 ±0.20	1.50 ±0.10	5.50 ±0.10	1.75 ±0.10	0.25 ±0.10	Max 0.10	0.80 ±0.20
2512	12.0 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	3.40 ±0.20	6.75 ±0.20	1.50 ±0.10	5.50 ±0.10	1.75 ±0.10	0.25 ±0.10	Max 0.10	1.00 ±0.20
3921	24.0 ±0.30	4.00 ±0.10	8.00 ±0.10	2.00 ±0.10	5.50 ±0.20	11.5 ±0.20	1.50 ±0.10	11.5 ±0.10	1.75 ±0.10	0.30 ±0.10	Max 0.10	0.90 ±0.20
4527	24.0 ±0.30	4.00 ±0.10	12.0 ±0.10	2.00 ±0.10	7.50 ±0.20	12.0 ±0.20	1.50 ±0.10	11.5 ±0.10	1.75 ±0.10	0.30 ±0.10	Max 0.10	0.90 ±0.20
0815	12.0 ±0.40	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	2.30 ±0.20	4.10 ±0.20	1.50 ±0.10	5.50 ±0.10	1.75 ±0.10	0.25 ±0.10	Max 0.10	0.75 ±0.20
1020	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
1225	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	1.00 ±0.20
0830	16.0 ±0.30	4.00 ±0.10	4.00 ±0.10	2.00 ±0.10	2.80 ±0.20	8.00 ±0.20	1.50 ±0.10	7.50 ±0.10	1.75 ±0.10	0.30 ±0.10	Max 0.10	0.80 ±0.20
1530	16.0 ±0.30	4.00 ±0.10	8.00 ±0.10	2.00 ±0.10	4.15 ±0.20	7.95 ±0.20	1.50 ±0.10	7.50 ±0.10	1.75 ±0.10	0.30 ±0.10	Max 0.10	0.90 ±0.20
1836	16.0 ±0.30	4.00 ±0.10	8.00 ±0.10	2.00 ±0.10	4.85 ±0.20	9.35 ±0.20	1.50 ±0.10	7.50 ±0.10	1.75 ±0.10	0.30 ±0.10	Max 0.10	0.90 ±0.20
2139	24.0 ±0.30	4.00 ±0.10	8.00 ±0.10	2.00 ±0.10	5.50 ±0.20	11.5 ±0.20	1.50 ±0.10	11.5 ±0.10	1.75 ±0.10	0.30 ±0.10	Max 0.10	0.90 ±0.20

Reel Dimensions:

	Type	A	N	W1
	0603	178 ±5.00	60.0 ±2.00	9.00 ±1.00
	0805			9.00 ±1.00
	1206			9.00 ±1.00
	2010			13.0 ±1.00
	2512			13.0 ±1.00
	3921			24.5 ±1.00
	4527			24.5 ±1.00
	0508			9.00 ±1.00
	0612			9.00 ±1.00
	0815			13.0 ±1.00
	1020			13.0 ±1.00
	1225			13.0 ±1.00
	0830			17.0 ±1.00
	1530			17.0 ±1.00
	1836			17.0 ±1.00
	2139			24.5 ±1.00

All dimensions in mm.

Recommended Land Pattern:

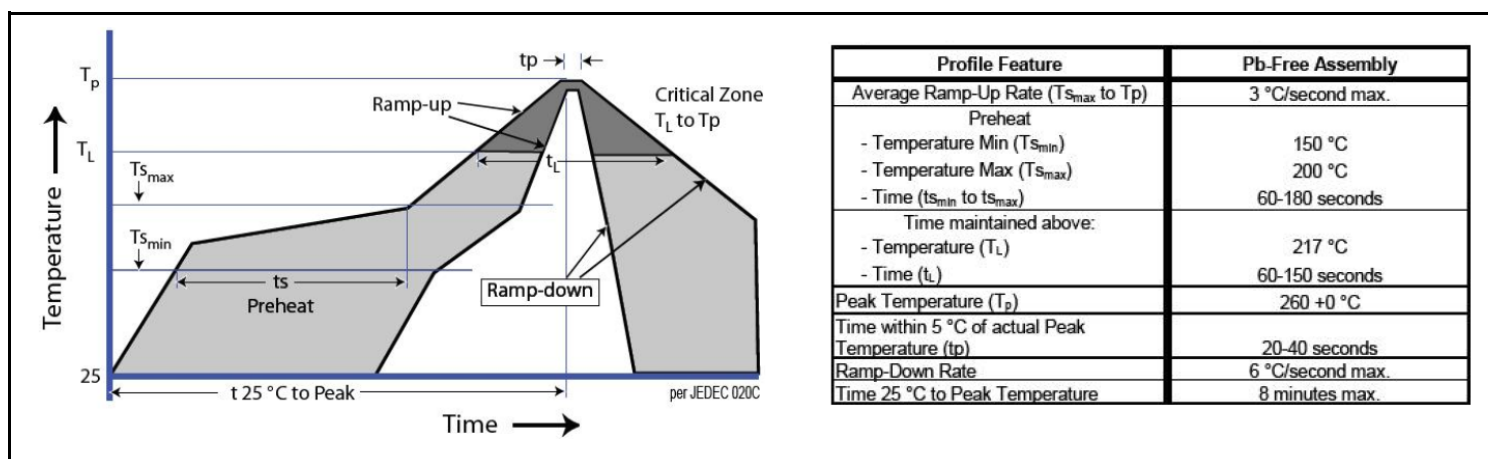
	Type	Electrode Type	Resistance Range	P	W	D
	0603	A	5mΩ	0.50	0.92	1.35
			6mΩ~100mΩ	0.60		1.30
	0805	A	3mΩ	0.50	1.44	1.55
			4mΩ~500mΩ	0.80		1.40
	1206	A	3mΩ	0.60	1.84	2.10
			4mΩ~700mΩ	1.20		1.80
	2010	A	2mΩ	0.70	2.88	3.65
			3mΩ			2.65
			4mΩ~700mΩ	2.70		
	2512	A	2mΩ	0.60	3.57	4.35
			3mΩ	0.90		4.20
			4mΩ~700mΩ	3.10		3.10
	3921	A	2mΩ	1.10	5.75	6.45
3mΩ			1.70	6.15		
4mΩ~8mΩ			5.00	4.50		
9mΩ~100mΩ						
4527	A	2mΩ	1.20	8.05	6.65	
		3mΩ~100mΩ	5.20		4.65	

All dimensions in mm.

Recommended Land Pattern (Cont.):

	Type	Electrode Type	Resistance Range	P	W	D
	0508	B	1mΩ~100mΩ	0.60	2.30	1.10
	0612	B	1mΩ	0.50	3.68	1.35
			2mΩ~100mΩ	0.60		1.30
	0815	B	1mΩ~100mΩ	0.70	4.26	1.45
	1020	B	1mΩ~100mΩ	1.00	5.75	2.25
	1225	B	1mΩ~100mΩ	1.40	7.25	2.35
	0830	B	1mΩ~100mΩ	0.95	8.63	2.28
	1530	B	1mΩ~100mΩ	1.70	8.74	2.55
	1836	B	1mΩ~100mΩ	2.10	10.35	2.70
	2139	B	1mΩ~100mΩ	2.40	12.65	2.80

All dimensions in mm.

Soldering Profile:**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.