SMD CURRENT SENSE METAL CHIP RESISTOR

TYPE TLM SERIES

INTRODUCTION

TE Connectivity (TE) has extended our low ohmic metal chip resistor TLM series with the High Power TLMQ. This series is designed for current sense circuits in power electronic systems which now also has a more advanced primary overcoat applied on both its top and bottom side which offers higher reliability, accuracy and durability. Supplied as standard on tape and reel for automatic insertion processes.

FEATURES

- Low resistance resistor for current detection
- Small size to power ratio
- Metal foil construction ensures high reliability and performance with very low and stable TCR
- Designed for current sense circuits in power electronic systems
- Pb-Free to meet RoHS Requirements
- High Power Series AEC-Q200 Compliant
- Moisture Sensitivity Level - MSL1

Note: *SMD (Surface mount devices) resistors and inductors should be kept in their original packaging to protect them from ESD (Electrostatic Discharge). The full reels can be broken into smaller quantities, without exposing them to ESD, as long as the components are still in the plastic or paper tape. These resistors and inductors should not be removed from the plastic or paper tape unless they are in an ESD protected environment.*

APPLICATIONS

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor

ELECTRICAL CHARACTERISTICS

Standard Series

Type	Power Rating @ 70°C	Operating Temp. Range	Resistance Range (mΩ)		TCR (PPM/°C)	Weight (mg)
			±1%	5%		
TLM1J	0.125 W	-55~+155°C	10 - 19		±100	2.63
			20 - 100		±50	2.53
					±100	
TLM2A	0.25 W		10 - 19		±100	6.24
			20 - 100		±50	5.63
					±100	
TLM2B	0.5 W		10 – 19		±100	13.30
			20 - 100		±50	11.63
					±100	
TLM2H	0.75 W		10 – 19		±100	31.42
			20 - 100		±50	28.35
					±100	
TLM3A	1 W		10 – 19		±100	45.21
			20 - 100		±50	43.49
					±100	

Operating Voltage=√(P*R) ; Overload Voltage=2.5*√(P*R) ; Operating Current=√(P/R)

High Power Series

Type	Power Rating @ 70 °C	Operating Temp. Range	Max. Overload Current	Resistance Range (mΩ)		TCR (PPM/°C)	Weight (mg)
				±1%	±5%		
TLMQ1J	0.5 W	-55~+170°C	15.8 A	10 - 18		±100	2.63
				19 - 100			2.53
TLMQ2A	0.75 W		19.4 A	10 - 18		±50	6.24
				19 - 100			5.63
TLMQ2B	1 W		22.4 A	10 – 18			13.30
				19 - 100			11.63
TLMQ2H	1.5 W		27.4 A	10 – 18			31.42
				19 - 100			28.35
TLMQ3A	2 W		28.3 A	10 – 18			45.21
				19 - 100			43.49

ENVIRONMENTAL CHARACTERISTICS

Standard Series

Item	Requirement	Test Method
Temperature Coefficient of Resistance (TCR)	As Spec.	**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** -55°C~+125°C, 25°C is the reference temperature
Short Term Overload	±(0.5%+0.05Ω)	**JIS-C-5201-1 4.13** **IEC-60115-1 4.13** 2512 size: 4 X Rated Power for 5 seconds Other size: 5 X Rated Power for 5 seconds
Insulation Resistance	≥10G	**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Max. overload voltage for 1 minute
Endurance	±(1.0%+0.05Ω)	**MIL-STD-202 Method 108A** 70±2°C, RCWV for 1000 hrs with 1.5 hrs “ON” and 0.5 hrs “OFF”
Damp Heat with Load	±(1.0%+0.05Ω)	**JIS-C-5201-1 4.24** **IEC-60115-1 4.24** 40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs “ON” and 0.5 hrs “OFF”
Dry Heat	±(0.5%+0.05Ω)	**JIS-C-5201-1 4.23** **IEC-60115-1 4.23.2** at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	**JIS-C-5201-1 4.33** Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	**JIS-C-5201-1 4.17** **IEC-60115-1 4.17** 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	**JIS-C-5201-1 4.18** **IEC-60115-1 4.18** 260±5°C for 10 seconds
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 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%	**JIS-C-5201-1 4.18** **IEC-600068-2-58 8.2.1** 260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	**JIS-C-5201-1 4.19** **IEC-60115-1 4.19** -55°C to +155°C, 5 cycles

Storage Temperature: 25±3°C; Humidity < 80%RH
Shelf Life: 2 years from production date

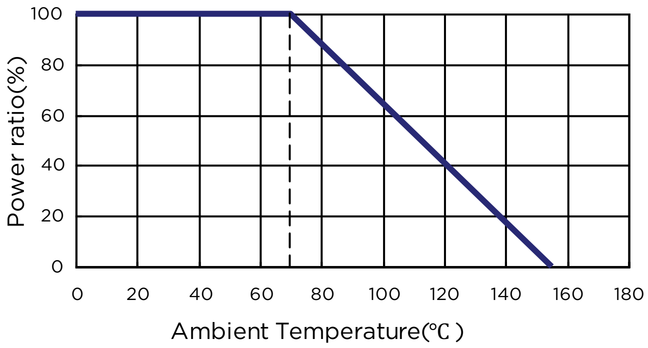
High Power Series

Item	Requirement	Test Method
Temperature Coefficient of Resistance (TCR)	As Spec.	**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** -55°C~+125°C, 25°C is the reference temperature
Short Term Overload	ΔR≤±1%R	**JIS-C-5201-1 4.13** **IEC-60115-1 4.13** 5 X Rated Power for 5 seconds 2512 size: 4* Rated Power for 5 seconds Other size: 5* Rated Power for 5 seconds
Insulation Resistance	≥1000MG	**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Max. overload voltage for 1 minute
Operational Life	ΔR≤±1%R	**MIL-STD-202 Method 108** Condition D Steady State T_A=125°C at derated power. Measurement at 24±4 hours after test conclusion
Biased Humidity	ΔR≤±1%R	**MIL-STD-202 Method 103** 85°C/85R.H., 1000 hrs apply 10% of operating power (current) or limiting element current whichever is lower
High Temperature Exposure	ΔR≤±1%R	**MIL-STD-202 Method 108** At +155°C for 1000 hours
Temperature Cycling	ΔR≤±1%R	**JESD22 Method JA-104** -55°C to +125°, 1000 cycles
Bending Strength (Board Flex)	ΔR≤±1%R)	**JIS-C-5201-1 4.33** Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	**JIS-C-5201-1 4.17** **IEC-60115-1 4.17** 245±5°C for 3 seconds
Resistance to Soldering Heat	ΔR≤±1%R	**JIS-C-5201-1 4.18** **IEC-60115-1 4.18** 260±5°C for 10 seconds
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 minute
Resistance To Solvents	Marking unsmeared	**MIL-STD-202 Method 215** Add Aqueoous wash chemical – OKEM Clean or equivalent. Do not use banned solvents
Mechanical Shock	ΔR≤±1%R	**MIL-STD-202 Method 213** Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6
Vibration	ΔR≤±1%R	**MIL-STD-202 Method 204** 5 g's for 20 min. 12 cycles each of 3 orientations, 10-2000 Hz
ESD	ΔR≤±1%R	**AEC-Q200-002** Human body model 2KV
Flammability	No ignition of the tissue paper or scorching of the pinewood board	**UL-94** V-0 or V-1 are acceptable. Electrical test not required
Terminal Strength	Not broken	**AEC-Q200-006** Force of 1.8kg for 60 seconds

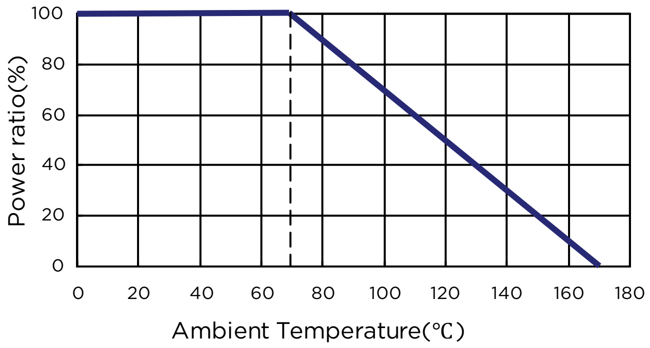
Storage Temperature: 15~28°C; Humidity < 80%RH
Shelf Life: 2 years from production date

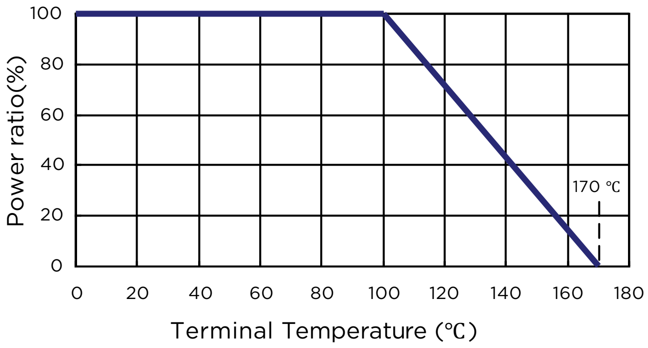
DERATING CURVE

Standard Series



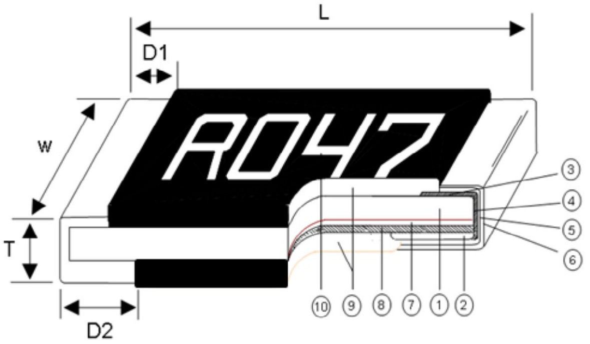
High Power Series





Note: For resistors operated at an ambient temperature of 70°C or higher, the power rating shall be derated in accordance with the above derating curve.

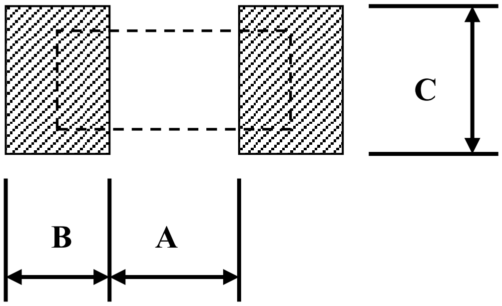
CONSTRUCTION AND DIMENSIONS



1	Alumina Substrate	5	Barrier Layer (Ni)	9	Primary Overcoat (Epoxy)
2	Bottom Electrode (Cu)	6	External Electrode (Sn)	10	Marking (Epoxy)
3	Top Electrode (NiCr)	7	Adhesive (Acrylic)		
4	Edge Electrode (NiCr)	8	Resistor Layer (Alloy)		

Type	Resistance Range (mΩ)	L	W	T	D1	D2
TLM(Q)1J	10 – 18	1.60±0.15	0.85±0.15	0.45±0.15	0.30±0.25	0.35±0.25
	19 - 100	1.60±0.15	0.85±0.15	0.40±0.15	0.30±0.25	0.35±0.25
TLM(Q)2A	10 – 18	2.05±0.15	1.25±0.15	0.60±0.15	0.30±0.25	0.35±0.25
	19 - 100	2.05±0.15	1.25±0.15	0.60±0.15	0.30±0.25	0.35±0.25
TLM(Q)2B	10 - 18	3.10±0.15	1.55±0.15	0.60±0.15	0.50±0.25	0.60±0.30
	19 - 100	3.10±0.15	1.55±0.15	0.60±0.15	0.50±0.25	0.60±0.30
TLM(Q)2H	10 - 18	5.00±0.20	2.50±0.20	0.60±0.15	0.60±0.30	0.80±0.30
	19 - 100	5.00±0.20	2.50±0.20	0.60±0.15	0.60±0.30	0.80±0.30
TLM(Q)3A	10 – 18	6.40±0.20	3.20±0.20	0.60±0.15	0.70±0.30	0.80±0.30
	19 - 100	6.40±0.20	3.20±0.20	0.60±0.15	0.70±0.30	0.80±0.30

RECOMMENDED LAND PATTERN (Unit:mm)



Type	Resistance Range (mΩ)	A	B	C	t (µm)
TLM(Q)1J	10 - 100	0.70	1.05	0.90	35
TLM(Q)2A	10 - 100	1.00	1.00	1.35	70
TLM(Q)2B	10 - 100	1.50	1.40	1.70	105
TLM(Q)2H	10 - 100	2.80	1.80	2.50	105
TLMQ3A	10 - 100	3.80	2.25	3.20	105

t: Copper foil minimum thickness of PCB

MARKING

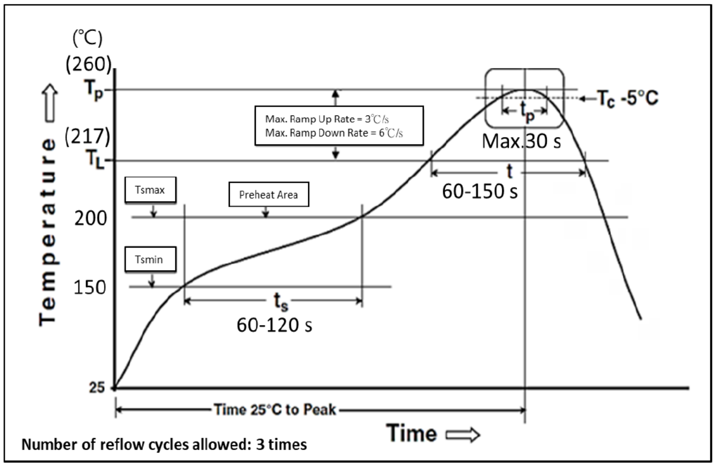
FOR TLM(Q)1J

Type	Code
R10	0.100Ω
R01	0.010Ω
035	0.035Ω
005	0.005Ω

FOR TLM(Q)2A -TLM(Q)3A

Type	Code
R100	0.100Ω
R050	0.050Ω
R010	0.010Ω
R005	0.005Ω

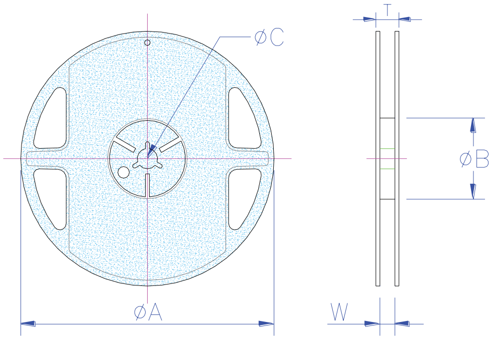
SOLDERING REFLOW PROFILE



Profile Feature	Pb-Free Assembly
Preheat Min. Temperature (T_{smin}) Max Temperature (T_{smax}) Preheating time (t_s) from (T_{smin} to T_{smax})	150 °C 200 °C 60-120 seconds
Ramp-up rate (T_L to T_p)	3 °C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217 °C 60-150 seconds
Min. Peak temperature (T_p min)	235 °C
Max. Peak temperature (T_p max)	260 °C
Time (t_p) within 5 °C of the specified classification temperature (Tc)	30 seconds max.
Ramp-down rate (T_p to T_L)	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

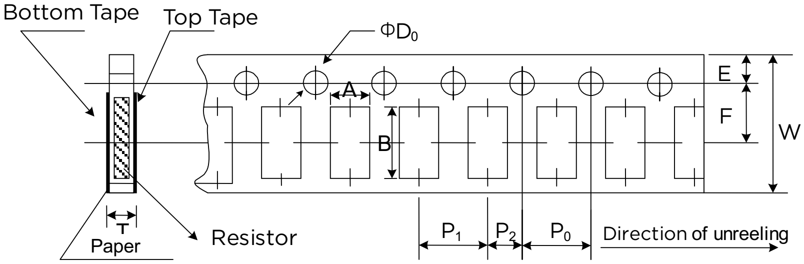
PACKAGING

Packaging Quantity and Reel Dimensions (mm)

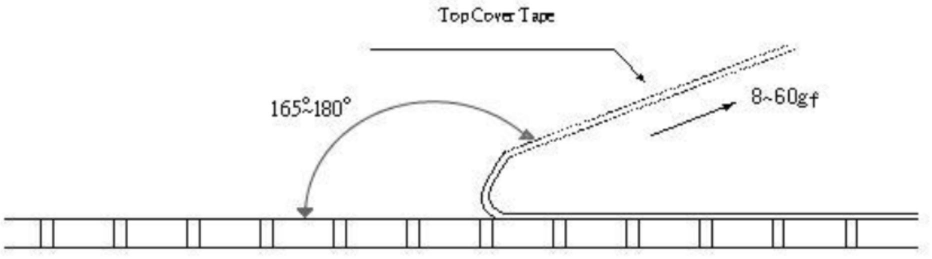


Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
TLM(Q)1J	178.0±1.0	60.0±1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
TLM(Q)2A	178.0±1.0	60.0±1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
TLM(Q)2B	178.0±1.0	60.0±1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
TLM(Q)2H	178.0±1.0	60.0±1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
TLM(Q)3A	178.0±1.0	60.0±1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000

Paper Tape Dimensions (mm)

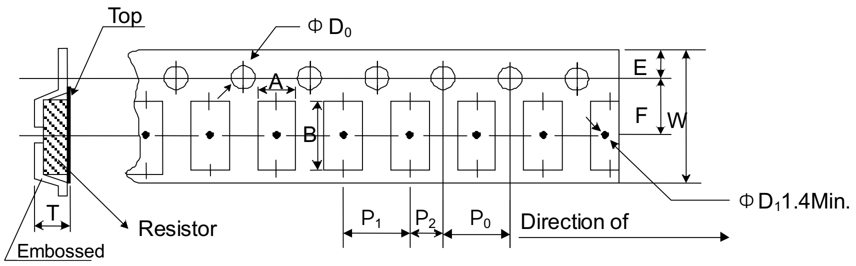


Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
TLM(Q)1J	1.10 ±0.10	1.85 ±0.10	8.0 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	4.00 ±0.05	2.00 ±0.05	1.50 +0.1 -0	0.60 ±0.10
TLM(Q)2A	1.60 ±0.10	2.35 ±0.20	8.0 ±0.20	1.75 ±0.10	3.50 ±0.05	4.00 ±0.10	4.00 ±0.05	2.00 ±0.05	1.50 +0.1 -0	0.95 ±0.10
TLM(Q)2B	1.90 ±0.10	3.50 ±0.20	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	0.95 ±0.10

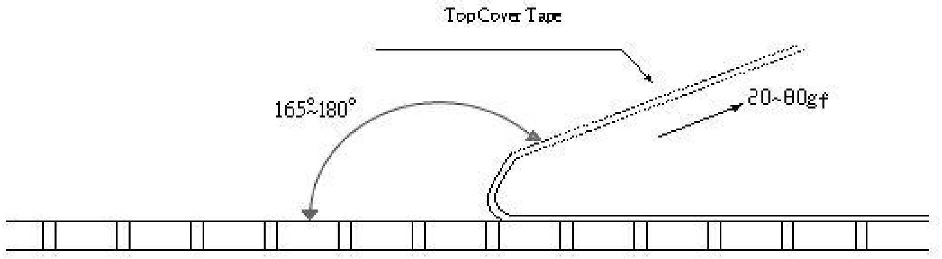


- Peel force of top cover tape
- The peel speed shall be about 300 mm/min±5%
- The peel force of top cover tape shall be between 8gf to 60gf

Embossed Plastic Tape Dimensions (mm)



Type	A	B	W	E	F	P_0	P_1	P_2	ΦD0	T
TLM(Q)2H	2.80 ±0.10	5.50 ±0.10	12.0 ±0.10	1.75 ±0.10	5.50 ±0.05	4.00 ±0.05	4.00 ±0.10	2.00 ±0.05	1.50 ±0.10	1.00 ±0.20
TLM(Q)3A	3.50 ±0.10	6.70 ±0.20	12.0 ±0.10	1.75 ±0.10	5.50 ±0.05	4.00 ±0.05	4.00 ±0.10	2.00 ±0.05	1.50 ±0.10	1.00 ±0.20



- Peel force of top cover tape
- The peel speed shall be about 300 mm/min ±5%
- The peel force of top cover tape shall be between 20 gf to 80 gf

ORDERING INFORMATION

Part Number

TLM 2A E R01 J TD

Common Part

TLM	Standard
TLMQ	High power

Package Size

1J	0603
2A	0805
2B	1206
2H	2010
3A	2512

TCR

D	50PPM
E	100PPM

Pack Style

TD	Reel 5K (0603,0805, 1206)
TE	Reel 4K (2010, 2512)

Tolerance

F	1%
J	5%

Resistance Value

10mΩ	R01
100mΩ	R10

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