Current Sensing Metal Chip Resistor

■Features

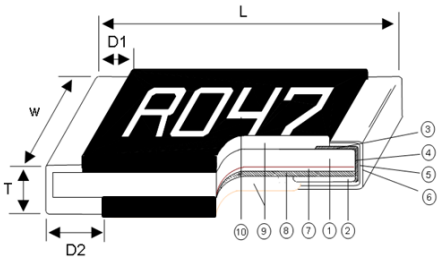
- SMD Type designed for automatic insertion (CSM02：The soldering side has a black mark on the product surface .)
- High power rating in small size
- Low resistance resistor for current detection
- Metal foil construction ensures high reliability and performance with very low and stable TCR
- Designed for current sense circuits in power electronic systems
- Pb-Free to meet RoHS requirements
- AEC-Q200 Qualified (only High Power Rating)
- Inherently Anti-Sulfur

■Applications

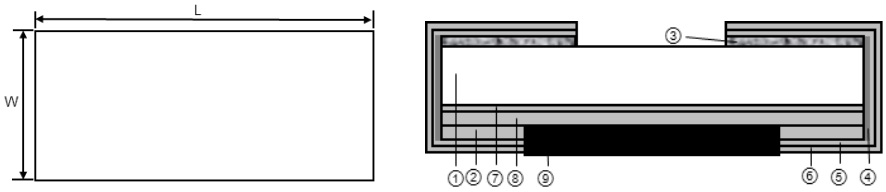
- Automotive (only High Power Rating)
- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor

■Construction

For 0603 - 2512 Size



For 0402 Size



①	Alumina Substrate	⑤	Barrier Layer	⑨	Primary Overcoat
②	Bottom Electrode	⑥	External Electrode	⑩	Marking
③	Top Electrode	⑦	Adhesive		
④	Edge Electrode	⑧	Resistor Layer		

■Dimensions

For Standard Series

Type	Size (Inch)	Power (W)	Resistance Range (mΩ)	L	W	T	D1	D2	Weight (g) (1000pcs)
CSM03	0603	1/8	10 – 18	1.60±0.15	0.85±0.15	0.45±0.15	0.30±0.25	0.35±0.25	2.63
			19 – 100	1.60±0.15	0.85±0.15	0.40±0.15	0.30±0.25	0.35±0.25	2.53
CSM05	0805	1/4	10 – 18	2.05±0.15	1.25±0.15	0.60±0.15	0.30±0.25	0.35±0.25	6.24
			19 – 100	2.05±0.15	1.25±0.15	0.60±0.15	0.30±0.25	0.35±0.25	5.63
CSM06	1206	1/2	10 – 18	3.10±0.15	1.55±0.15	0.60±0.15	0.50±0.25	0.60±0.25	13.30
			19 – 100	3.10±0.15	1.55±0.15	0.60±0.15	0.50±0.25	0.60±0.25	11.63
CSM10	2010	3/4	10 – 18	5.00±0.20	2.50±0.20	0.60±0.15	0.60±0.30	0.80±0.30	31.42
			19 – 100	5.00±0.20	2.50±0.20	0.60±0.15	0.60±0.30	0.80±0.30	28.35
CSM12	2512	1	10 – 18	6.40±0.20	3.10±0.20	0.60±0.15	0.70±0.30	0.80±0.30	45.21
			19 – 100	6.40±0.20	3.10±0.20	0.60±0.15	0.70±0.30	0.80±0.30	43.49

For High Power Series

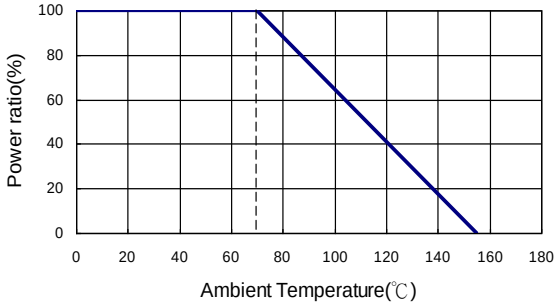
Type	Size (Inch)	Power (W)	Resistance Range (mΩ)	L	W	T	D1	D2	Weight (g) (1000pcs)
CSM02	0402	1/4	5 – 9	1.05±0.10	0.55±0.10	0.45±0.10	-	0.35±0.15	1.09
			10 – 18	1.05±0.10	0.55±0.10	0.45±0.10	-	0.30±0.15	1.11
			19 – 50	1.05±0.10	0.55±0.10	0.40±0.10	-	0.30±0.15	0.93
CSM03	0603	1/2	5 – 9	1.60±0.15	0.85±0.15	0.45±0.15	0.30±0.25	0.55±0.25	2.50
			10 – 18	1.60±0.15	0.85±0.15	0.45±0.15	0.30±0.25	0.35±0.25	2.63
			19 – 100	1.60±0.15	0.85±0.15	0.40±0.15	0.30±0.25	0.35±0.25	2.53
CSM05	0805	3/4	5 – 9	2.05±0.15	1.25±0.15	0.60±0.15	0.30±0.25	0.60±0.25	6.37
			10 – 18	2.05±0.15	1.25±0.15	0.60±0.15	0.30±0.25	0.35±0.25	6.24
			19 – 100	2.05±0.15	1.25±0.15	0.60±0.15	0.30±0.25	0.35±0.25	5.63
CSM06	1206	1	5 – 9	3.10±0.15	1.55±0.15	0.60±0.15	0.50±0.25	1.00±0.25	12.14
			10 – 18	3.10±0.15	1.55±0.15	0.60±0.15	0.50±0.25	0.60±0.25	13.30
			19 – 100	3.10±0.15	1.55±0.15	0.60±0.15	0.50±0.25	0.60±0.25	11.63
CSM10	2010	1.5	5 – 9	5.00±0.20	2.50±0.20	0.60±0.15	0.60±0.30	1.55±0.30	28.59
			10 – 18	5.00±0.20	2.50±0.20	0.60±0.15	0.60±0.30	0.80±0.30	31.42
			19 – 100	5.00±0.20	2.50±0.20	0.60±0.15	0.60±0.30	0.80±0.30	28.35
CSM12	2512	2	5 – 9	6.40±0.20	3.10±0.20	0.60±0.15	0.70±0.30	1.80±0.30	48.30
			10 – 18	6.40±0.20	3.10±0.20	0.60±0.15	0.70±0.30	0.80±0.30	45.21
			19 – 100	6.40±0.20	3.10±0.20	0.60±0.15	0.70±0.30	0.80±0.30	43.49

■Part Numbering

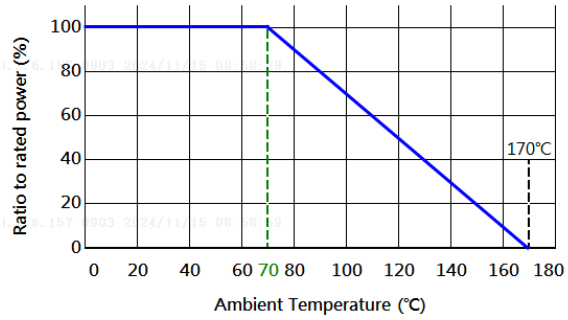
CSM	06	F	T	E	U	R006	
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	TCR (PPM/°C)	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	D: ±0.5% F: ±1% G: ±2% J: ±5%	T: Taping Reel	D: ±50 E: ±100 K: ±150 F: ±200 G: ±300	W : 1/8W V : 1/4W U: 1/2W Q: 3/4W T: 1W A: 1.5W S: 2W	R003: 0.003Ω R010: 0.01Ω R100: 0.1Ω	Marking for E96 / E24

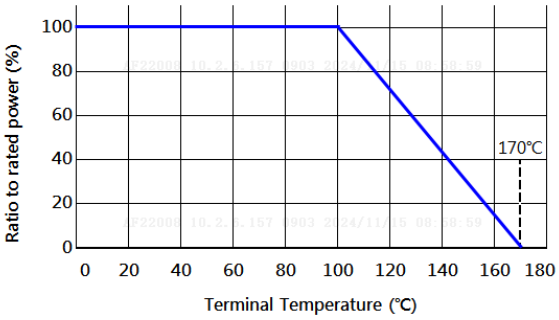
■Derating Curve

For Standard Series



For High Power Series





■Electrical Specifications

For Standard Series

Item / Type	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)				TCR (PPM/°C)
			±0.5%	±1%	±2%	±5%	
CSM03 (0603)	1/8W	-55 ~ +155°C	-	10 - 19			±100
				20 - 100			±50 ±100
CSM05 (0805)	1/4W		-	10 - 19			±100
			30 - 100	20 - 100			±50 ±100
CSM06 (1206)	1/2W		-	10 - 19			±100
			30 - 100	20 - 100			±50 ±100
CSM10 (2010)	3/4W		-	10 - 19			±100
			30 - 100	20 - 100			±50 ±100
CSM12 (2512)	1W		-	10 - 19			±100
			30 - 100	20 - 100			±50 ±100

For High Power Series

Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Overload Current	Resistance Range (mΩ)				TCR (PPM/°C)
				±0.5%	±1%	±2%	±5%	
CSM02 (0402)	1/4W	-55 ~ +170°C	15.8A	-	5 - 6			±300
			13.4A	-	7 - 9			±200
			11.2A	30 - 50	10 - 50			±100
CSM03 (0603)	1/2W		22.7A	-	5 - 6			±150
			18.9A	-	7 - 9			±100
			15.8A	30 - 100	10 - 100			±100
CSM05 (0805)	3/4W		27.4A	-	5 - 9			±100
			19.4A	30 - 100	10 - 100			±50
CSM06 (1206)	1W		31.6A	-	5 - 9			±100
			22.4A	30 - 100	10 - 100			±50
CSM10 (2010)	1.5W		38.7A	-	5 - 9			±100
			27.4A	30 - 100	10 - 100			±50
CSM12 (2512)	2W		40.0A	-	5 - 9			±100
			28.3A	30 - 100	10 - 100			±50

Operating Voltage=$\sqrt{}$(P*R) ; Overload Voltage=2.5*$\sqrt{}$(P*R) ; Operating Current=$\sqrt{}$(P/R)

■Viking is capable of manufacturing the optional spec based on customer's requirement.

■Environmental Characteristics

For Standard Series

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℃~+125℃, 25℃ is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	**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	≧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℃, 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℃, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs “ON” and 0.5 hr “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℃ for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	**JIS-C-5201-1 4.18** **IEC-60115-1 4.18** 260±5℃ 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-60068-2-58 8.2.1** 260±5℃ for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	**JIS-C-5201-1 4.19** **IEC-60115-1 4.19** -55℃ to +155℃, 5 cycles

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■ **Storage Temperature: 15~28°C; Humidity < 80%RH**

■ **Shelf Life: 2 years from production date.**

■Environmental Characteristics

For High Power Series

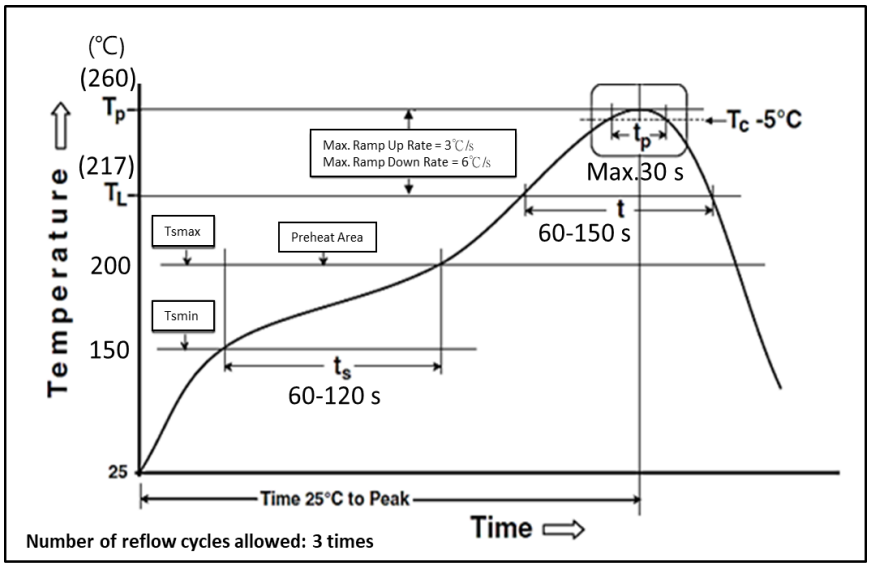
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** -55℃~+125℃, 25℃ is the reference temperature
Short Time Overload	△R≤±1%R	**JIS-C-5201-1 4.13** **IEC-60115-1 4.13** 5 X Rated Power for 5 seconds 2512 size: 4* Rated Power for 5 seconds. Other size: 5* Rated Power for 5 seconds.
Insulation Resistance	≧1000MΩ	**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Max. Overload Voltage for 1 minute
Operational Life	△R≤±1%R	**MIL-STD-202 Method 108** Condition D Steady State T_A=125℃ at derated power. Measurement at 24±4 hours after test conclusion
Biased Humidity	△R≤±1%R	**MIL-STD-202 Method 103** 85℃/85RH., 1000 hrs, apply 10% of operating power (current) or limiting element current whichever is lower
High Temperature Exposure	△R≤±1%R	**MIL-STD-202 Method 108** at +155℃ for 1000 hrs
Temperature Cycling	△R≤±1%R	**JESD22 Method JA-104** -55℃ to +125℃, 1000 cycles
Bending Strength (Board Flex)	△R≤±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℃ for 3 seconds
Resistance to Soldering Heat	△R≤±1%R	**JIS-C-5201-1 4.18** **IEC-60115-1 4.18** 260±5℃ 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 Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Mechanical Shock	△R≤±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	△R≤±1%R	**MIL-STD-202 Method 204** 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	△R≤±1%R	**AEC-Q200-002** **Human body model** 0402 sizes: 1KV Other sizes: 2KV
Flammability	No ignition of the tissue paper or scorching or the pinewood board	**UL-94** V-0 or V-1 are acceptable. Electrical test not required.
Terminal strength	No broken	**AEC-Q200-006** Force of 1.8kg for 60 seconds

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■ **Storage Temperature: 15~28°C; Humidity < 80%RH**

■ **Shelf Life: 2 years from production date.**

■Soldering Condition(IPC/JEDEC J-STD-020)



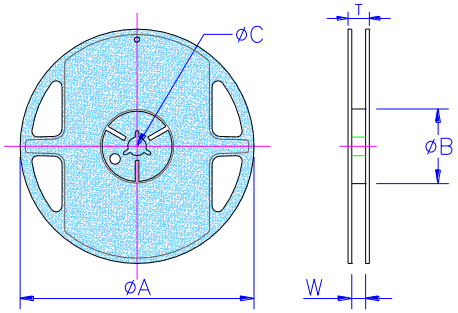
Reflow Profiles	
Profile Feature	**Pb-Free Assembly**
Preheat Min. Temperature (Tsmin) Max Temperature (Tsmax) Preheating time (ts) from (Tsmin to Tsmax)	 150 °C 200 °C 60-120 seconds
Ramp-up rate (T_L to Tp)	3 °C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217 °C 60-150 seconds
Min. Peak temperature (Tp min)	235°C
Max. Peak temperature (Tp max)	260°C
Time (tp) within 5 °C of the specified classification temperature (Tc)	30 seconds max.
Ramp-down rate (Tp to T_L)	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

■Packaging

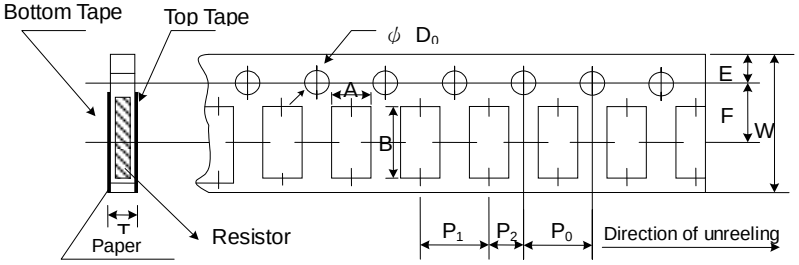
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
CSM02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	-
CSM03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSM05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSM06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSM10	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
CSM12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000



Paper Tape Specifications

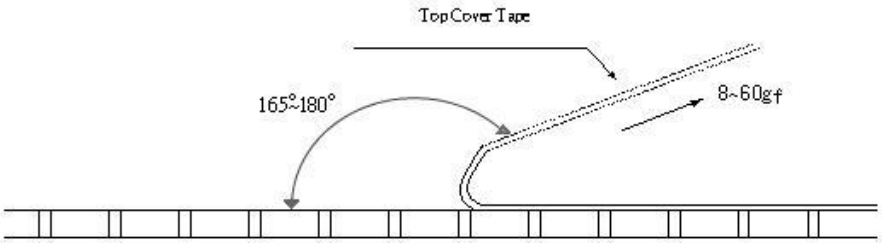


Unit: mm

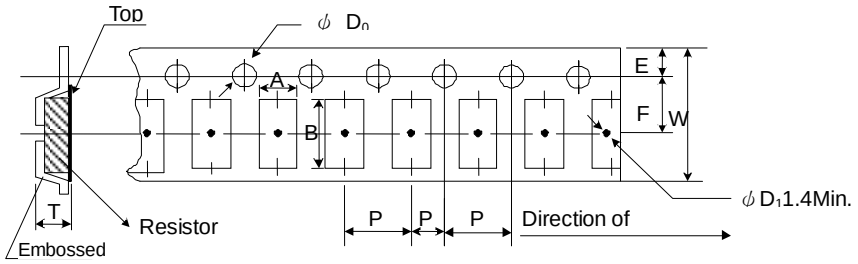
Current Sensing Metal Chip Resistor

Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
CSM02	0.66±0.06	1.18±0.06	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.60±0.06
CSM03	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±0.05
CSM05	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±0.05
CSM06	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±0.05

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



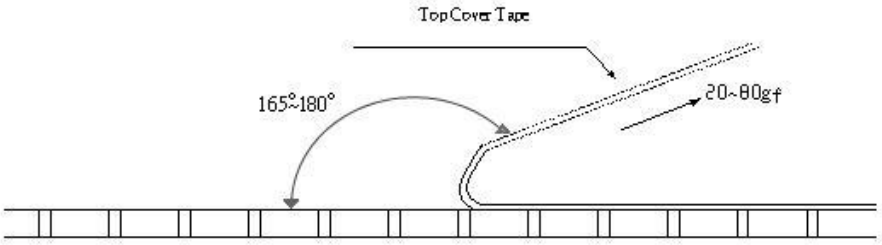
Embossed Plastic Tape Specifications



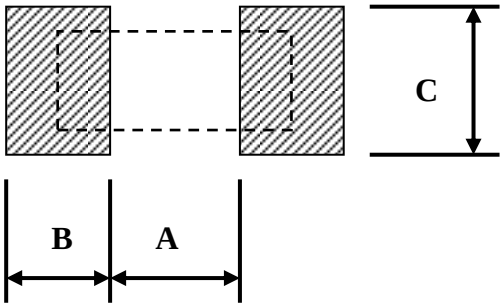
Unit: mm

Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
CSM10	2.80±0.10	5.50±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CSM12	3.50±0.10	6.70±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

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



■Recommend Land Pattern



Pad Layout

Type	Resistance Range	A (mm)	B (mm)	C (mm)	t (μm)
CSM02	5-50mΩ	0.50	0.50	0.60	35
CSM03	5-9mΩ	0.40	1.20	0.90	35
	10-100mΩ	0.70	1.05	0.90	35
CSM05	5-9mΩ	0.80	1.10	1.35	70
	10-100mΩ	1.00	1.00	1.35	70
CSM06	5-9mΩ	0.9	1.70	1.70	105
	10-100mΩ	1.50	1.40	1.70	105
CSM10	5-9mΩ	1.70	2.35	2.50	105
	10-100mΩ	2.80	1.80	2.50	105
CSM12	5-9mΩ	2.30	2.90	3.20	105
	10-100mΩ	3.60	2.25	3.20	105

t：copper toil minimum thickness of PCB

■Marking

No Marking for 0402

For 0603

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

For 0805-2512

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