MAX-QUALITY ELECTRIC CO; LTD
Thin Film Precision Chip Resistors

Data Sheet

Customer：	
Product：	Current Sensing Chip Resistor –CS Series
Size：	0201/0402/0603/0805/1206/1010/2010/2512 1225/3720/7520
Issued Date：	12-Nov-10
Edition：	REV.C5

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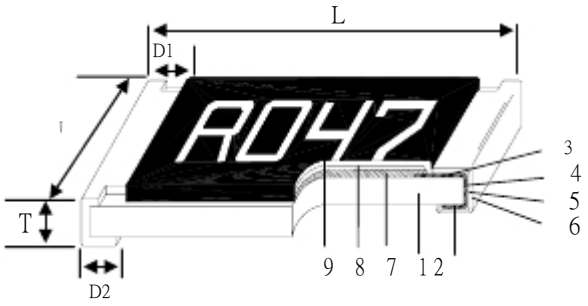
Current Sensing Chip Resistor
(CS Series)

■Features
－3 Watts power rating in 1 Watt size, 1225 package
－Low TCR of ±100 PPM/°C
－Resistance values from 1m to 1 ohm
－High purity alumina substrate for high power dissipation
－Long side terminations with higher power rating

■Applications
－Power Management Applications
－Switching Power Supply
－Over Current Protection in Audio Applications
－Voltage Regulation Module (VRM)
－DC-DC Converter, Battery Pack, Charger, Adaptor
－Automotive Engine Control
－Disk Driver
－Portable Devices (PDA, Cell Phone)

■Construction



1	Alumina Substrate	4	Edge Electrode (NiCr)	7	Resistor Layer (Ag/Pd)
2	Bottom Electrode (Ag)	5	Barrier Layer (Ni)	8	Overcoat (Epoxy)
3	Top Electrode (Ag-Pd)	6	External Electrode (Sn)	9	Marking

■Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CS01	0201	0.58±0.05	0.29±0.05	0.23±0.05	0.12±0.05	0.15±0.05	0.18
CS02	0402	1.00±0.05	0.50±0.05	0.32±0.10	0.25±0.10	0.20±0.10	0.7
CS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.99
CS05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.25	5.3
CS06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.50±0.30	0.40±0.25	8.82
CS13	1210	3.00±0.15	2.50±0.15	0.55±0.10	0.50±0.30	0.50±0.25	15.5
CS10	2010	5.00±0.20	2.45±0.15	0.60±0.15	0.60±0.30	0.50±0.25	27.03
CS12	2512	6.35±0.20	3.15±0.15	0.60±0.10	0.60±0.30	0.55±0.25	43.08
CS12 (2W)	2512 (10 - 99mΩ)	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	0.55±0.25	53.08
CS12 (2W)	2512 (100 - 1000mΩ)	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	2.10±0.10	53.08
CS25	1225	3.10±0.15	6.30±0.15	0.90±0.15	0.60±0.30	0.55±0.25	64.88
CS37	3720	2.00±0.20	3.75±0.20	0.60±0.10	0.40±0.20	0.40±0.20	19.96
CS75	7520	2.00±0.20	7.50±0.30	0.60±0.10	0.40±0.20	0.40±0.20	35.71

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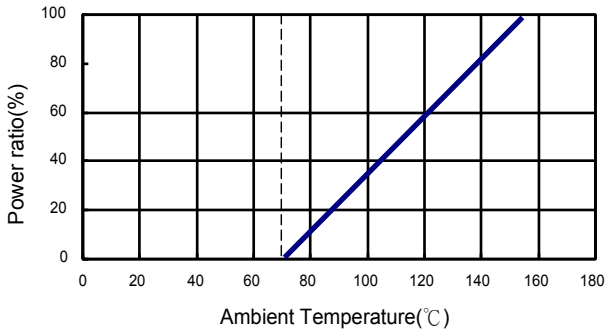
■Part Numbering

CS	06	F	T	G	U	R100	N
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512 25: 1225 37: 3720 75: 7520	F: ±1% G: ±2% J: ±5%	T: Taping Reel B: Bulk	E: ±100 F: ±200 G: ±300 H: ±400 J: ±600 K: ±150 R: ±1000	: Standard A: 1.5W Q: 3/4W S: 2W T: 1W U: 1/2W V: 1/4W W: 1/8W	R010: 0.01Ω R100: 0.1Ω 1R00: 1Ω	: Standard N: No Marking W: Wide

■Derating Curve



■Standard Electrical Specifications

Item / Type	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ) ±1%	Resistance Range (mΩ) ±2%	Resistance Range (mΩ) ±5%	TCR (PPM/°C)
CS01 (0201)	1/20W	-55 ~ +155°C	100 - 149 150 - 500 501 - 1000			±1000 ±600 ±300
CS02 (0402)	1/16W		50 - 100 101 - 500 501 - 1000			±400 ±300 ±200
CS03 (0603)	1/10W		20 - 50 51 - 100 101 - 500 501 - 1000			±600 ±400 ±300 ±200
CS05 (0805)	1/8W		20 - 50 51 - 100 101 - 500 501 - 1000			±600 ±400 ±300 ±200
CS06 (1206) CS13 (1210) CS10 (2010) CS12 (2512)	1/4W 1/2W 3/4W 1W		10 - 20 21 - 50 51 - 99 100 - 1000			±600 ±400 ±300 ±200
CS25 (1225)	3W		3-5 6 - 20 21 - 30 31 - 250 251 - 8000			±300 ±200 ±150 ±100 ±200
CS37 (3720)	1W		10 - 19 20 - 500			±300 ±150
CS75 (7520)	2W		—	1-4		±300
			5 - 10 11 - 350			±200 ±150

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■High Power Rating Electrical Specifications

Type / Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
			±1%	±2%	±5%	
CS02 (0402)	1/8W	-55 ~ +155°C	51 - 100			±400
CS03 (0603)	1/8W		101 - 500			±300
CS05 (0805)	1/4W		501 - 1000			±200
CS06 (1206)	1/2W		10 - 20			±600
CS13 (1210)	3/4W		21 - 50			±400
CS10 (2010)	1W		51 - 99			±300
CS12 (2512)	1.5W		100 - 1000			±200
CS12 (2512)	2W					

■Low TCR Electrical Specifications

Type / Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
			±1%	±2%	±5%	
CS06 (1206)	1/4W	-55 ~ +155°C	100 - 1000			±100
CS13 (1210)	1/2W		75 - 1000			±100
CS10 (2010)	3/4W		50 - 1000			±100
CS12 (2512)	1W		20 - 1000			±100
CS12 (2512)	2W		50 - 1000			±100
CS37 (3720)	1W		100 - 500			±100
CS75 (7520)	2W		50 - 350			±100

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

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

■Marking for 0603

Type	Code
1R0	1.000Ω
R10	0.100Ω
R01	0.010Ω
101	0.101Ω
035	0.035Ω

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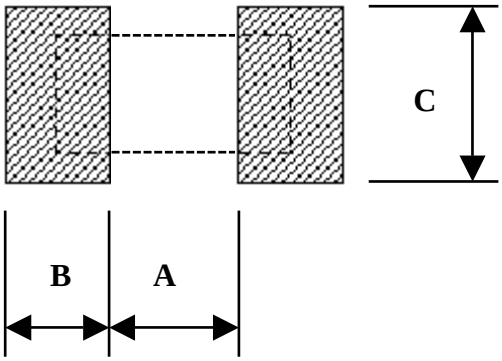
Recommend Land Pattern



Pad Layout (Except For CS12:High Power Rating Series) Unit：mm

Type	A	B	C
CS01	0.25	0.30	0.40±0.2
CS02	0.50	0.50	0.60±0.2
CS03	0.80	1.00	0.90±0.2
CS05	1.00	1.00	1.35±0.2
CS06	2.00	1.15	1.70±0.2
CS13	2.00	1.15	2.5±0.2
CS10	3.60	1.40	2.50±0.2
CS12	4.90	1.60	3.10±0.2
CS25	2.00	2.00	6.40±0.2
CS37	1.00	1.80	3.90±0.2
CS75	1.00	1.80	7.60±0.2

Pad Layout (For CS12:High Power Rating Series) Unit：mm

Type	Resistance	A	B	C
CS12	10~99 mΩ	4.9	1.6	3.1±0.2
CS12	100~1000mΩ	1.0	3.55	3.1±0.2

■Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	**MIL-STD-202F Method 304** +25/-55/+25/+125/+25°C
Short Time Overload	±0.5% ΔR±1% for high power rating	**JIS-C-5201-1 5.5** RCWV*2.5 or Max. overload voltage for 5 seconds
Insulation Resistance	>1000MΩ	**MIL-STD-202F Method 302** Apply 100V_{DC} for 1 minute
Endurance	±1%	**MIL-STD-202F Method 108A** 70±2°C, Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±0.5%	**MIL-STD-202F Method 103B** 40±2°C, 90~95% R.H. Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Dry Heat	±0.5%	**JIS-C-5201-1 7.2** at +155°C for 1000 hrs
Bending Strength	As Spec.	**JIS-C-5201-1 6.1.4** Bending amplitude 3mm for 10 seconds
Solderability	95% min. coverage	**MIL-STD-202F Method 208H** 245±5°C for 3 seconds
Resistance to Soldering Heat	±0.5%	**MIL-STD-202F Method 210E** 260±5°C for 10 seconds
Dielectric Withstand Voltage	By Type	**MIL-STD-202F Method 301** Apply Max. Overload Voltage for l minute
Thermal Shock	±0.5%	**MIL-STD-202F Method 107G** -55°C ~150°C, 100 cycles
Low Temperature Operation	±0.5%	**JIS-C-5201-1 7.1** 1 hour, -65°C followed by 45 minutes of RCWV

Storage Temperature: 25±3°C; Humidity < 80%RH

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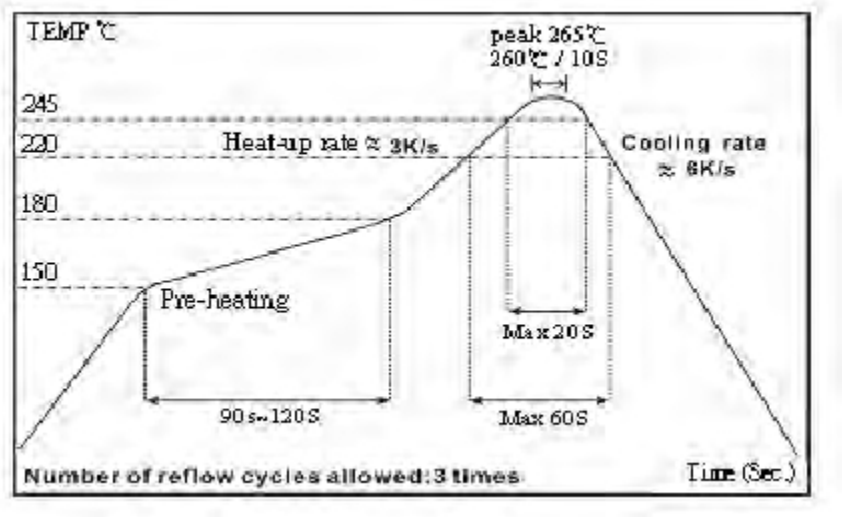
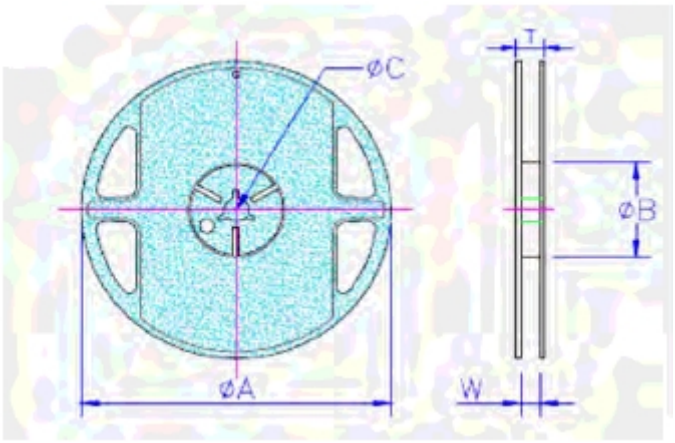
Reflow



Packaging



Packaging Quantity & Reel Specifications

Unit :mm

Type	ψA	ΦB	ψC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
CS01	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	
CS02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	-
CS03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CS05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CS06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CS13	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	
CS10	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
CS12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
CS12 (2W)	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
CS25	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
CS37	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
CS75	178.0±1.0	60.0+1.0	13.5±0.7	17.5±1.0	19.5±1.0	-	2,000

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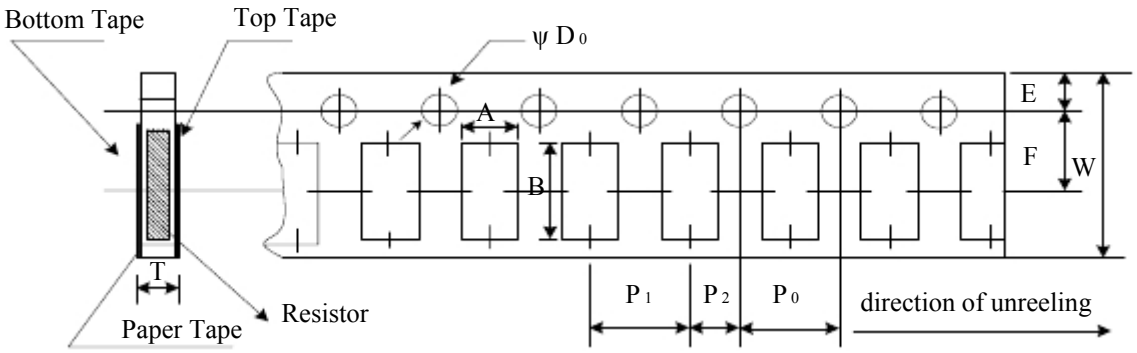
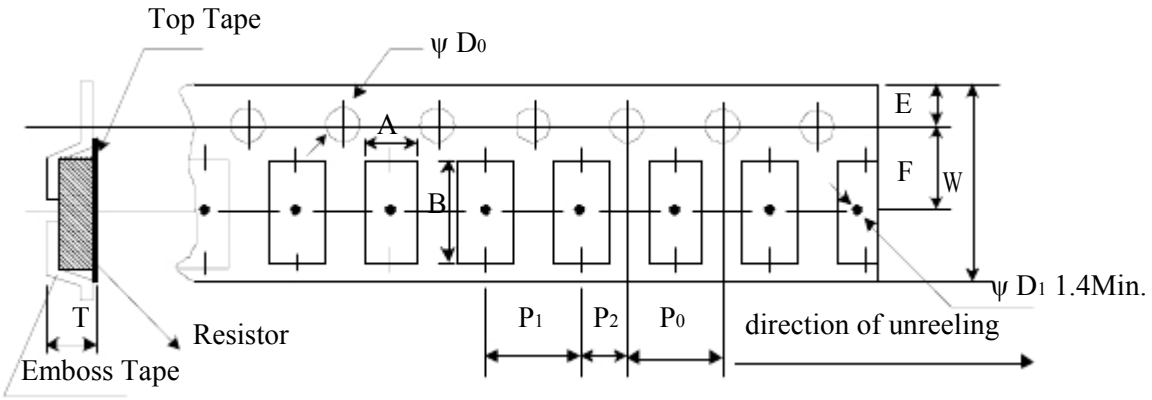
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P0	P1	P2	ΦD₀	T
CS01	0.38±0.05	0.68±0.05	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.42±0.20
CS02	0.65±0.10	1.15±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CS03	1.10±0.10	1.90±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	0.70±0.10
CS05	1.60±0.10	2.40±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	0.85±0.10
CS06	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	0.85±0.10
CS13	2.80±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	0.85±0.10

Emboss Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P₀	P₁	P₂	ψD₀	T
CS10	2.85±0.10	5.45±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
CS12	3.40±0.10	6.65±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
CS12 (2W)	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
CS25	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
CS37	2.50±0.20	4.45±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00 ±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20 ±0.20
CS75	2.50±0.20	8.30±0.20	16.0±0.30	1.75±0.10	7.8±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20 ±0.20