

Data Sheet

Customer:

Product: Automotive Grade Current Sensing Chip Resistor – CS..A Series

Size: 0402/0603/0805/1206/1210/2010/2512/1225/3720/7520

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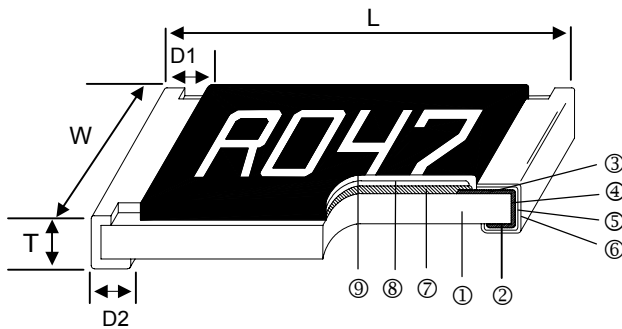
Automotive Grade Current Sensing Chip Resistor



■ Features

- AEC-Q200 Compliance
- Highly reliable multilayer electrode construction
- Reduced size of final equipment reliability
- 3 Watts power rating in 1 Watt size, 1225 package
- Low TCR of ± 100 PPM/ $^{\circ}$ C
- Resistance values from 1m to 1 ohm
- High purity alumina substrate for high power dissipation
- Long side terminations with higher power rating
- Special construction to prevent sulfuration in a sulfur containing environment

■ Construction



■ Applications

- Automotive Industry
- 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

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

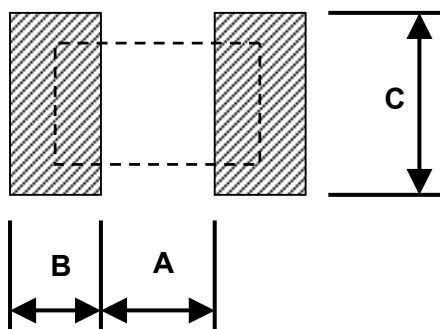
■ Dimensions

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
CS02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.32 \pm 0.10	0.25 \pm 0.10	0.20 \pm 0.10	0.7
CS03	0603	1.60 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	1.99
CS05	0805	2.00 \pm 0.10	1.25 \pm 0.10	0.55 \pm 0.10	0.30 \pm 0.20	0.40 \pm 0.25	5.3
CS06	1206	3.10 \pm 0.10	1.55 \pm 0.10	0.55 \pm 0.10	0.50 \pm 0.30	0.40 \pm 0.25	8.82
CS13	1210	3.10 \pm 0.10	2.60 \pm 0.15	0.55 \pm 0.10	0.50 \pm 0.30	0.50 \pm 0.25	15.5
CS10	2010	5.00 \pm 0.10	2.50 \pm 0.15	0.60 \pm 0.15	0.60 \pm 0.30	0.50 \pm 0.25	27.03
CS12	2512	6.35 \pm 0.10	3.10 \pm 0.15	0.60 \pm 0.10	0.60 \pm 0.30	0.55 \pm 0.25	43.08
CS12 (2W)	2512 (10 - 99m Ω)	6.35 \pm 0.20	3.15 \pm 0.15	0.74 \pm 0.10	0.60 \pm 0.30	0.55 \pm 0.25	53.08
CS12 (2W)	2512 (100 - 1000m Ω)	6.35 \pm 0.20	3.15 \pm 0.15	0.74 \pm 0.10	0.60 \pm 0.30	2.10 \pm 0.10	53.08
CS25	1225	3.10 \pm 0.15	6.30 \pm 0.15	0.90 \pm 0.15	0.60 \pm 0.30	0.80 \pm 0.25	64.88
CS37	3720	2.00 \pm 0.20	3.75 \pm 0.20	0.60 \pm 0.10	0.40 \pm 0.20	0.40 \pm 0.20	19.96
CS75	7520	2.00 \pm 0.20	7.50 \pm 0.30	0.60 \pm 0.10	0.40 \pm 0.20	0.40 \pm 0.20	35.71

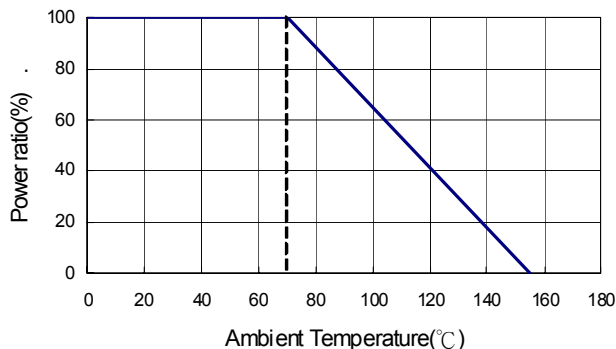
Part Numbering

CS	06	F	T	G	U	R100	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	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	: Standard S: 2W A: 1.5W T: 1W Q: 3/4W U: 1/2W V: 1/4W P: 1/5W W: 1/8W	R010: 0.01Ω R100: 0.1Ω 1R00: 1Ω	NA: No Marking WA: Wide A: Automotive Grade

Recommend Land Pattern



Derating Curve



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

Type	A (mm)	B (mm)	C (mm)
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	2.50±0.2
CS10	3.60	1.40	2.50±0.2
CS12	4.90	1.60	3.10±0.2
CS25	1.20	2.00	7.00±0.2
CS37	1.00	1.80	3.90±0.2
CS75	1.00	1.80	7.60±0.2

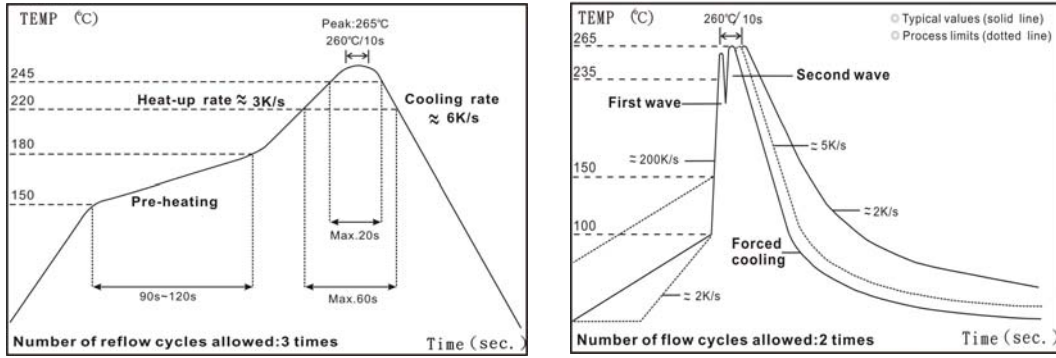
Marking for 0603

Type	Code
1R0	1.000Ω
R10	0.100Ω
R01	0.010Ω
<u>102</u>	0.102Ω
<u>024</u>	0.024Ω

Pad Layout (For CS12:High Power Rating Series)

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

■ Soldering Condition



IR Reflow Soldering

Wave Soldering (Flow Soldering)

- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

■ Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)	
					±1%	±2%	±5%		
CS02 (0402)		1/16W	-55 ~ +155°C	1.11A	50 - 100	102 - 500	510 - 1000	±400 ±300 ±200	
CS03 (0603)		1/10W		2.23A	20 - 50	51 - 100	102 - 500	510 - 1000	±600 ±400 ±300 ±200
CS05 (0805)		1/8W		2.50A	20 - 50	51 - 100	102 - 196	200 - 1000	±600 ±400 ±300 ±200
CS06 (1206)		1/4W		5.00A	10 - 20	21 - 50	51 - 91	100 - 1000	±600 ±400 ±300 ±200
CS13 (1210)		1/2W		7.07A	10 - 20	21 - 50	51 - 91	100 - 1000	±600 ±400 ±300 ±200
CS10 (2010)		3/4W		8.66A	10 - 20	21 - 50	51 - 91	100 - 1000	±600 ±400 ±300 ±200
CS12 (2512)		1W		10.0A	10 - 20	21 - 50	51 - 91	100 - 1000	±600 ±400 ±300 ±200
CS25 (1225)		3W		31.6A	3 - 5	6 - 20	21 - 30	33 - 8000	±300 ±200 ±150 ±100
CS37 (3720)		1W		10.0A	10 - 18	20 - 500			±300 ±150
CS75 (7520)		2W		44.7A	—	1 - 4	5 - 10	11 - 350	±300 ±200 ±150

High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±2%	±5%	
CS02 (0402)	1/8W	-55 ~ +155°C	1.58A	50 - 100 102 - 500 510 - 1000			±400 ±300 ±200
CS03 (0603)	1/8W 1/5W		1.58A				
CS05 (0805)	1/4W		2.23A				
CS06 (1206)	1/2W		3.16A	50 - 91 100 - 1000			±300 ±200
CS13 (1210)	3/4W		3.87A				
CS10 (2010)	1W		4.47A				
CS12 (2512)	1.5W		5.47A				
CS12 (2512)	2W		6.32A				

Low TCR Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±2%	±5%	
CS05 (0805)	1/8W	-55 ~ +155°C	1.11A	100 - 1000			±100
CS06 (1206)	1/4W		1.58A	100 - 1000			±100
CS13 (1210)	1/2W		2.58A	75 - 1000			±100
CS10 (2010)	3/4W		3.87A	50 - 1000			±100
CS12 (2512)	1W		4.47A	50 - 1000			±100
CS12 (2512)	2W		6.32A	50 - 1000			±100
CS37 (3720)	1W		3.16A	100 - 500			±100
CS75 (7520)	2W		6.32A	50 - 350			±100

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

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

Environmental Characteristics

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°C~+125°C, 25°C is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	JIS C 5201-1 4.13 IEC 60115-1 4.13
	±(1.0%+0.05Ω) for high power rating	RCWV*2.5 or Max. Overload voltage whichever is lower 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)	JIS C 5201-1 4.25 IEC 60115-1 4.25.1 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Biased Humidity	±(1.0%+0.05Ω)	MIL-STD-202 Method 103 1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	±(0.5%+0.05Ω)	MIL-STD-202 Method 108 at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	JIS C 5201-1 4.33 IEC 60115-1 4.33 Bending once for 5 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 60068-2-58 8.2.1 260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	JESD22 Method JA-104 -55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	MIL-STD-202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	MIL-STD-202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(1%+0.05Ω)	AEC-Q200-002 Human body, 2KV
Resistance to solvents	Marking Unsmearred	MIL-STD-202 Method 215 Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal strength	No broken	AEC-Q200-006 Force of 1.8kg for 60 seconds.

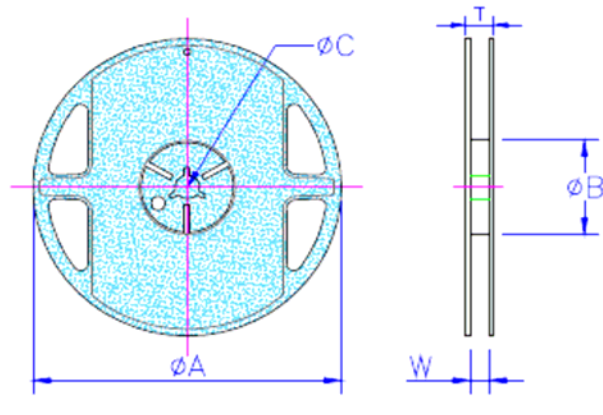
Item	Requirement	Test Method
Flammability	No ignition of the tissue paper or scorching or the pinewood board	UL-94 V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	$\pm(0.5\%+0.05\Omega)$	ASTM-B-809-95 H2S, 50 \pm 2°C, 91~93% R.H., no power rating for 1000 hrs

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower.

■ **Storage Temperature: 25 \pm 3°C; Humidity < 80%RH**

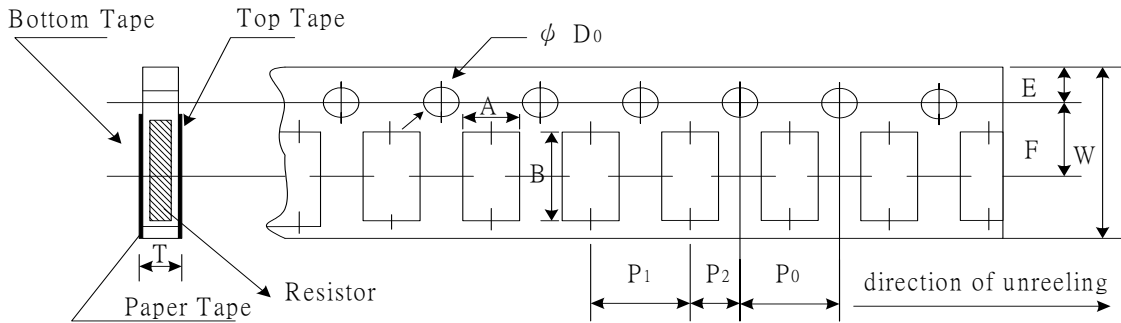
■ **Packaging**

Packaging Quantity & Reel Specifications



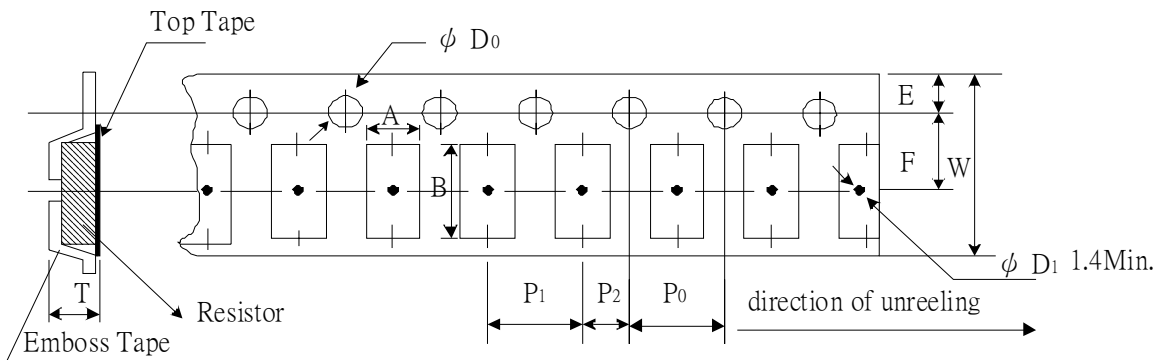
Type	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	Paper Tape (EA)	Emboss Plastic Tape (EA)
CS02	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	10,000	-
CS03	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS05	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS06	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS13	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS10	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	4,000
CS12	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	4,000
CS12 (2W)	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	2,000
CS25	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	2,000
CS37	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	2,000
CS75	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	17.5 \pm 1.0	19.5 \pm 1.0	-	2,000

Paper Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P0 (mm)	P1 (mm)	P2 (mm)	ΦD ₀ (mm)	T (mm)
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	2.90±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

Emboss Plastic Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P ₀ (mm)	P ₁ (mm)	P ₂ (mm)	ΦD ₀ (mm)	T (mm)
CS10	2.80±0.10	5.50±0.10	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	1.00±0.20
CS12	3.50±0.10	6.70±0.10	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	1.00±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

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version A3	Jun 03,2014	-	- Electrical Specifications updated - CS25 Pad Layout updated
Version A4	Apr30, 2015	-	- Environmental Characteristics updated