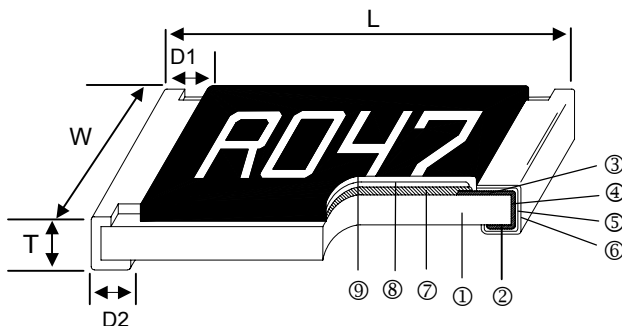


Automotive Grade Current Sensing Chip Resistor

■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/ $^{\circ}\text{C}$
- 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
- RoHS Compliance

■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	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

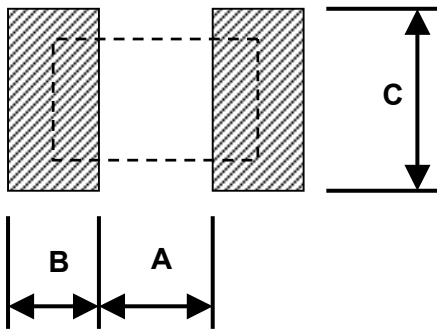
■Dimensions

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

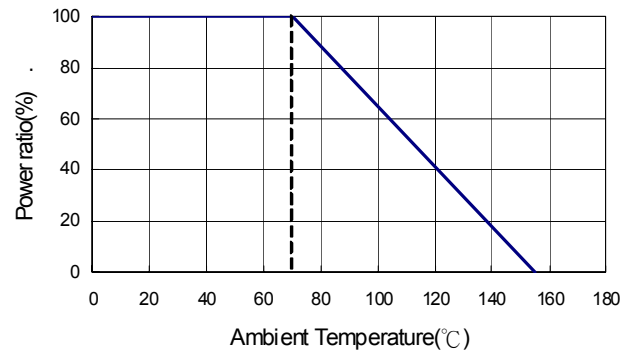
Part Numbering

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	3.20±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

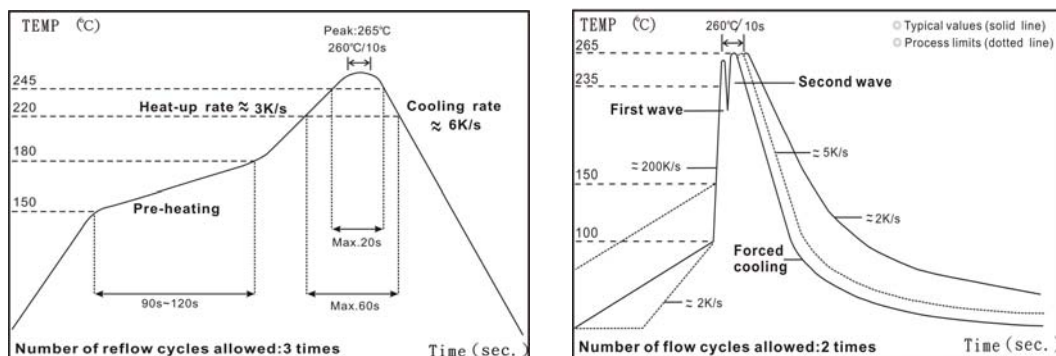
Marking for 0603

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	3.2±0.2
CS12	100~1000mΩ	1.0	3.55	3.2±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				
CS10 (2010)	3/4W		8.66A				
CS12 (2512)	1W		10.0A				
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	±300
		5 - 10 11 - 350			±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		1.58A				
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	$\pm(0.5\%+0.05\Omega)$	JIS C 5201-1 4.13 IEC 60115-1 4.13 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
	$\pm(1.0\%+0.05\Omega)$ for high power rating	
Insulation Resistance	$\geq 10G$	JIS C 5201-1 4.6 IEC 60115-1 4.6 Max. Overload Voltage for 1 minute
Endurance	$\pm(1.0\%+0.05\Omega)$	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1 MIL-STD-202 Method 108 70 $\pm$ 2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	$\pm(1.0\%+0.05\Omega)$	MIL-STD-202 Method 103 1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	$\pm(0.5\%+0.05\Omega)$	MIL-STD-202 Method 108 at +155°C for 1000 hrs
Board Flex	$\pm(1.0\%+0.05\Omega)$	AEC-Q200-005 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 J-STD-002 245 $\pm$ 5°C for 3 seconds
Resistance to Soldering Heat	$\pm(0.5\%+0.05\Omega)$	MIL-STD-202 Method 210 260 $\pm$ 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 $\leq 5\%$ Total leaching area $\leq 10\%$	JIS C 5201-1 4.18 IEC 60068-2-58 8.2.1 260 $\pm$ 5°C for 30 seconds
Temperature Cycling	$\pm(0.5\%+0.05\Omega)$	JESD22 Method JA-104 -55°C to +125°C, 1000 cycles
Mechanical Shock	$\pm(0.25\%+0.05\Omega)$	MIL-STD-202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\pm(0.5\%+0.05\Omega)$	MIL-STD-202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\pm(1\%+0.05\Omega)$	AEC-Q200-002 Human body, 2KV
Resistance to Solvents	No visible damage on appearance and marking.	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.

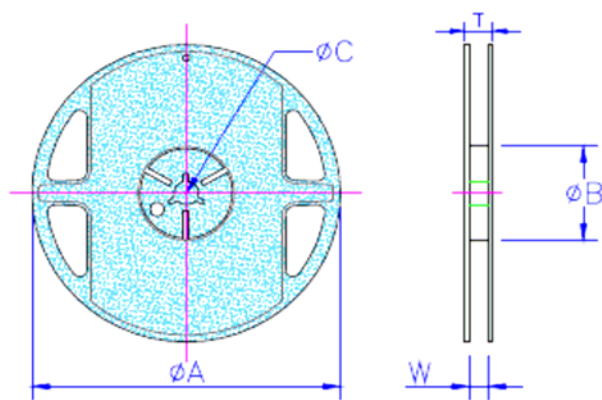
Item	Requirement	Test Method
Flammability	No ignition of the tissue paper or scorching or the pinewood board	UL-94 V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	$\pm(0.5\%+0.05\Omega)$	ASTM-B-809-95 H2S, 50 $\pm$ 2°C, 91~93% R.H., no power rating for 1000 hrs

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

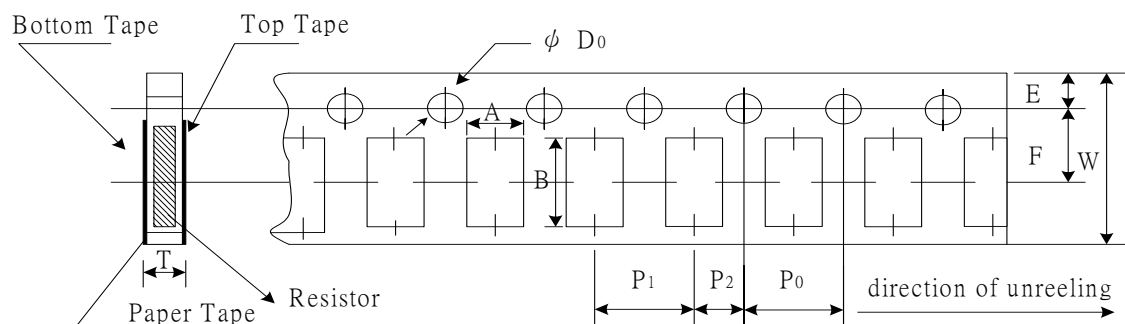
■ **Storage Temperature: 15~28°C; Humidity < 80%RH**

■ Packaging

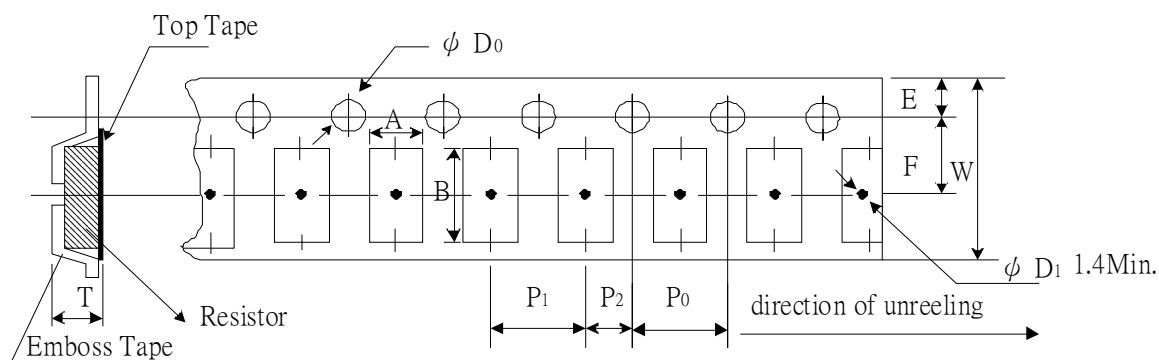
Packaging Quantity & Reel Specifications



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)	P0 (mm)	P1 (mm)	P2 (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	Apr 30, 2015	-	- Environmental Characteristics updated - Remove Material Description
Version A5	Jul 15, 2016	-	- Modify Storage Temperature - CS12 Pad Layout updated