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Data Sheet

Customer: _____

Product : Automotive Grade Current Sensing Chip Resistor
 - HCS Series

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

Issued Date: 29-Jun-22

Edition : REV.B3

Record of change

Date	Ver.	Description	Page

VENDOR :

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HCS series.

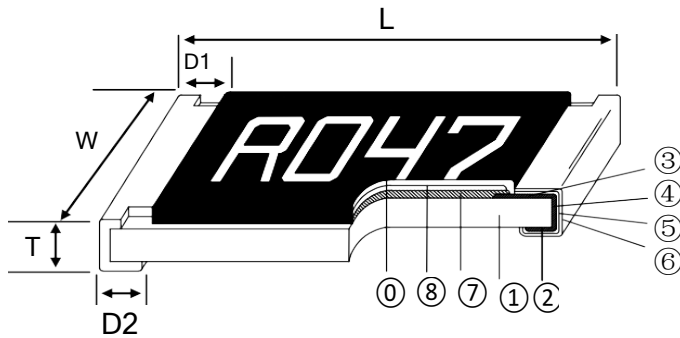
Automotive Grade Current Sensing Chip Resistor



■ 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 $\pm 100\text{PPM}/^\circ\text{C}$
- Resistance values from 1m to 1ohm
- 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
- 100% CCD inspection

■ 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	⑩ Secondary Overcoat

■ Dimensions

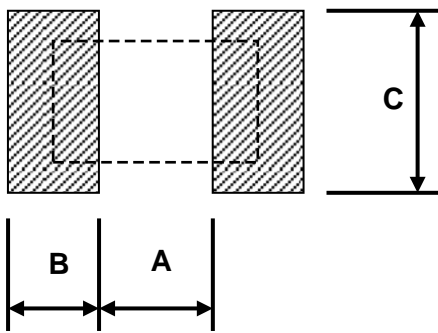
Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight(g) (1000pcs)
HCS02	0402	1.00±0.05	0.50±0.05	0.32±0.10	0.25±0.10	0.20±0.10	0.7
HCS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.99
HCS05	0805	2.00±0.10	1.25±0.10	0.55±0.10	0.30±0.20	0.40±0.25	5.3
HCS06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.30	0.40±0.25	8.82
HCS13	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.30	0.50±0.25	15.5
HCS10	2010	5.00±0.10	2.50±0.15	0.60±0.15	0.60±0.30	0.50±0.25	27.03
HCS12	2512	6.35±0.10	3.10±0.15	0.60±0.10	0.60±0.30	0.55±0.25	43.08
HCS12 (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
HCS12 (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
HCS25	1225	3.20±0.15	6.45±0.15	0.90±0.15	0.60±0.30	0.80±0.25	64.88
HCS37	3720	2.00±0.20	3.75±0.20	0.60±0.10	0.40±0.20	0.40±0.20	19.96
HCS75	7520	2.00±0.20	7.50±0.30	0.60±0.10	0.40±0.20	0.40±0.20	35.71

**** If you have any request not find from above datas, please contact our sales for further information, we may do our best to meet your request.**

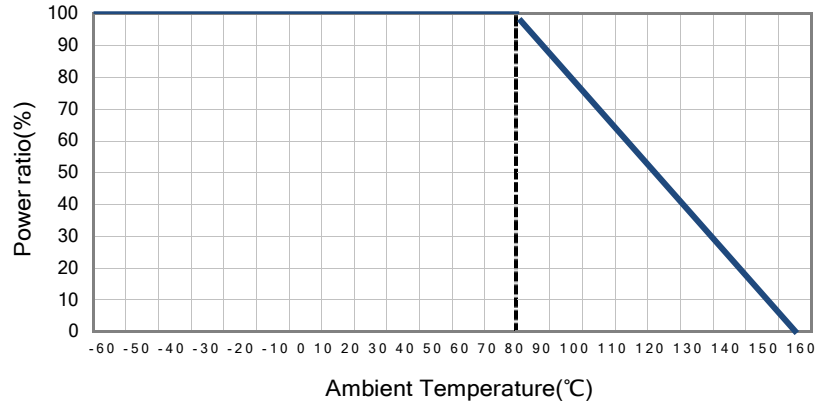
■ Part Numbering

HCS	06	F	T	G	U	R100	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR(P PM/°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:TapingReel	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 R100:0.1Ω1 1R00:1Ω	NA:No Marking A:Automotive Grade

■ Recommend Land Pattern



■ Derating Curve



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

Type	A (mm)	B (mm)	C (mm)
HCS02	0.50	0.50	0.60±0.2
HCS03	0.80	1.00	0.90±0.2
HCS05	1.00	1.00	1.35±0.2
HCS06	2.00	1.15	1.70±0.2
HCS13	2.00	1.15	2.50±0.2
HCS10	3.60	1.40	2.50±0.2
HCS12	4.90	1.60	3.20±0.2
HCS25	1.20	2.00	7.00±0.2
HCS37	1.00	1.80	3.90±0.2
HCS75	1.00	1.80	7.60±0.2

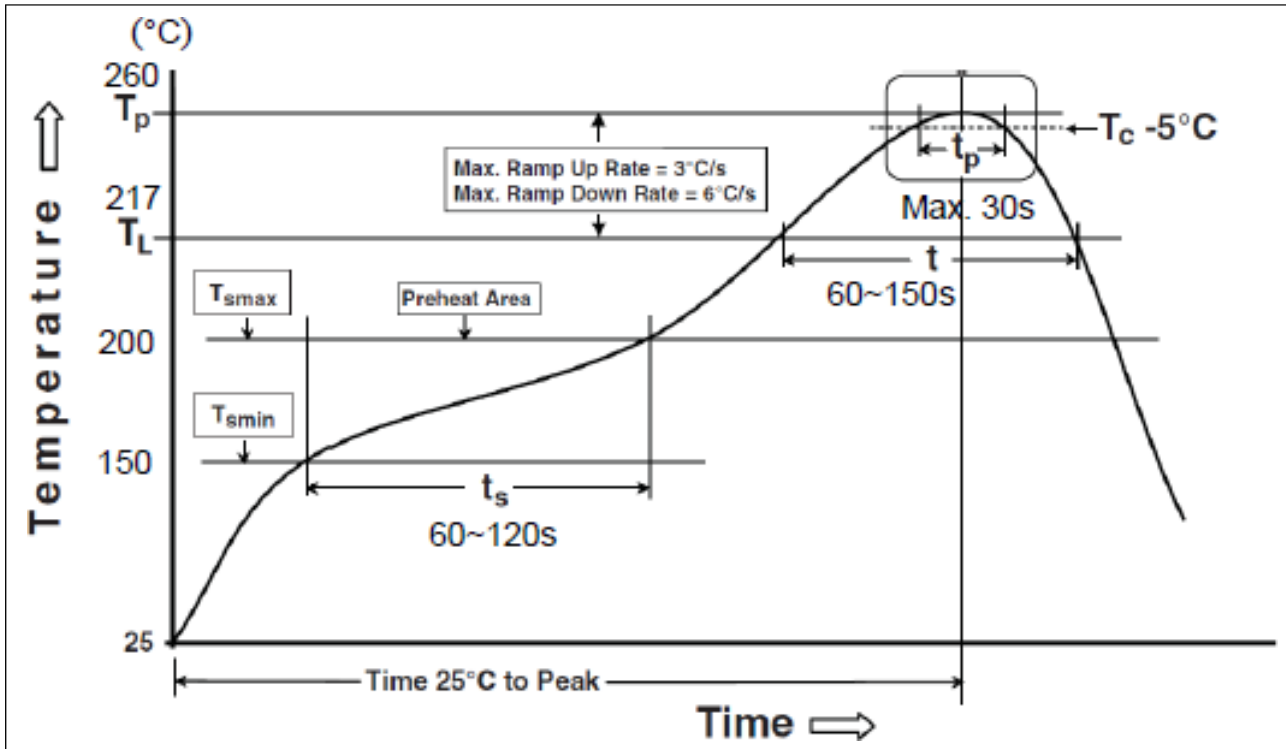
■ Marking for 0603

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

PadLayout(For CS12:High Power Rating Series)

Type	Resistance Range	A (mm)	B (mm)	C (mm)
HCS12	10~99mΩ	4.9	1.6	3.2±0.2
HCS12	100~1000mΩ	1.0	3.55	3.2±0.2

■ Soldering Condition(Ref.IPC/JEDEC J-STD-020 & J-STD-002)



Reflow Profiles	
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 60-120seconds
Ramp-up rate(T _L toT _p)	3°C/second max.
Liquidous temperature(T _L) Time(t _L)maintained aboveT _L	217°C 60-150 seconds
Min.Peak temperature(T _{pmin})	235°C
Max.Peak temperature(T _{pmax})	260°C
Time(t _p)within5°C of the specified classification temperature(T _c)	30 seconds max.
Ramp-down rate(T _p toT _L)	6°C/second max.
Time25°C to peak temperature	8 minutes max.

■ 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%	
HCS02(0402)		1/16W	-55~+155°C	1.11A	50-100 102-500 510-1000			±400 ±300 ±200
HCS03(0603)		1/10W		2.23A	20-50 51-100 102-300 301-1000			±600 ±400 ±300 ±200
HCS05(0805)		1/8W		2.50A	20-50 51-100 102-196 200-1000			±600 ±400 ±300 ±200
HCS06(1206)		1/4W		5.00A	10-20 21-50 51-91 100-1000			±600 ±400 ±300 ±200
HCS13(1210)		1/2W		7.07A				
HCS10(2010)		3/4W		8.66A				
HCS12(2512)		1W		10.0A				
HCS25(1225)		3W		31.6A	3-5 6-20 21-30 33-8000			±300 ±200 ±150 ±100
HCS37(3720)		1W		10.0A	10-18 20-500			±300 ±150
HCS75(7520)		2W		44.7A	—	1-4		±300
			5-10 11-350			±200 ±150		

■ High Power & Ultra High 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%	
HCS02(0402)		1/8W	-55~+155°C	1.58A	50-100 102-500 510-1000			±400 ±300 ±200
HCS03(0603)		1/8W 1/5W		1.58A				
HCS05(0805)		1/4W 1/2W		2.23A				
HCS06(1206)		1/2W		3.16A	50-91 100-1000			±300 ±200
HCS13(1210)		3/4W		3.87A				
HCS10(2010)		1W		4.47A				
HCS12(2512)		1.5W		5.47A				
HCS12(2512)		*2W		6.32A				

*:Ultra High Power

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%	
HCS05(0805)		1/8W	-55~+155°C	1.11A	100-1000			±100
HCS06(1206)		1/4W		1.58A	100-1000			±100
HCS13(1210)		1/2W		2.58A	75-1000			±100
HCS10(2010)		3/4W		3.87A	50-1000			±100
HCS12(2512)		1W		4.47A	50-1000			±100
HCS12(2512)		2W		6.32A	50-1000			±100
HCS37(3720)		1W		3.16A	100-500			±100
HCS75(7520)		2W		6.32A	50-350			±100

Operating Voltage= $\sqrt{P \cdot R}$; Over load 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 At 25°C/-55°C and 25°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 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
	±(1.0%+0.05Ω) for high power rating	
Insulation Resistance	≥10G	JIS C 5201-1 4.6 IEC 60115-1 4.6 Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.05Ω)	MIL-STD-202 Method 108 Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
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
Board Flex	±(1.0%+0.05Ω)	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 4.17J-STD-002 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	MIL-STD-202 Method 210 260±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 CS01:50V; CS02:100V; CS03:150V; CS05:300V CS06/13/10/25/37/75/62:400V; CS12:500V

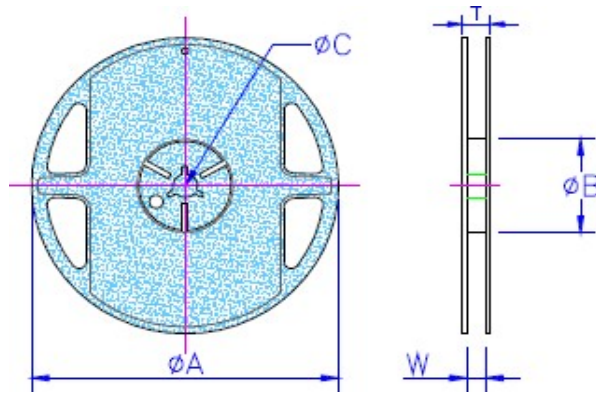
Item	Requirement	TestMethod
Leaching	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$	JISC5201-14.18 IEC60068-2-588.2.1 260 \pm 5°C for 30 seconds
Temperature Cycling	$\pm(0.5\%+0.05\Omega)$	JESD22MethodJA-104 -55°C to +125°C, 1000 cycles
Mechanical Shock	$\pm(0.25\%+0.05\Omega)$	MIL-STD-202Method213 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-202Method204 5g's for 20min., 12 cycles each of 3 orientations, 10-2000Hz
ESD	$\pm(1\%+0.05\Omega)$	AEC-Q200-002 Human body, 2KV
Resistance to Solvents	No visible damage on appearance and marking.	MIL-STD-202Method215 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.
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	$\pm(0.5\%+0.05\Omega)$	EIA-977(Condition A) 60 \pm 2°C, no power rating for 500hrs.

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

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

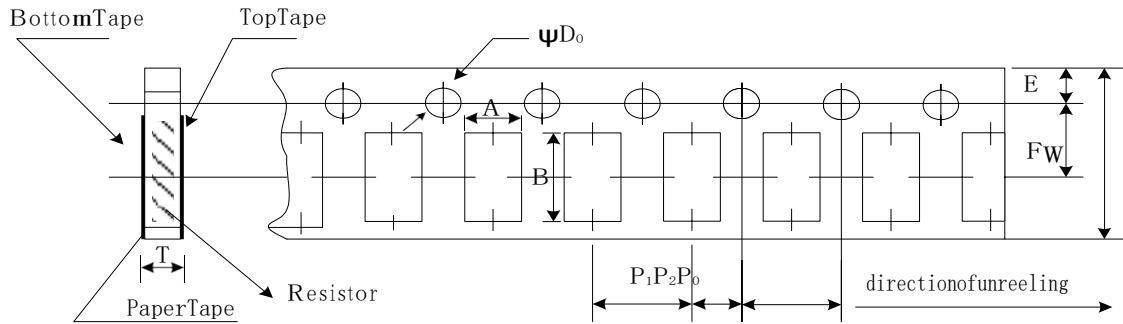
Packaging

Packaging Quantity & Reel Specifications



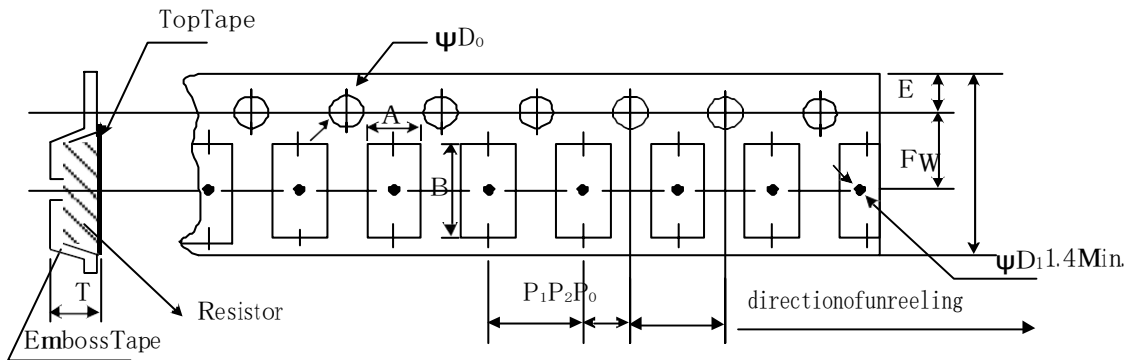
Type	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	PaperTape(EA)	EmbossPIasticTape (EA)
HCS02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	-
HCS03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
HCS05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
HCS06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
HCS13	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	
HCS10	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
HCS12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
HCS12(2W)	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
HCS25	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
HCS37	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	2,000
HCS75	178.0±1.0	60.0+1.0	13.5±0.7	17.5±1.0	19.5±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)
HCS02	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
HCS03	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
HCS05	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
HCS06	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
HCS13	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)
HCS10	2.80±0.10	5.40±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	1.00±0.20
HCS12	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
HCS12(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
HCS25	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
HCS37	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
HCS75	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

■ **Marking**

No Marking for 0402

1%,5% for 0805/1206/1210/2010/2512/1225/3720/7520:4 digits marking

Example:

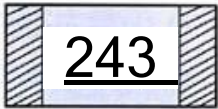
Resistance	47mΩ	75mΩ	15mΩ	750mΩ	820mΩ
Marking	R047	R075	R015	R750	R820

5%for0603:3 digits marking in E24

1%for0603:3 digits marking with under-line in E96(non-including E24 series)



3 digits marking for E24 or R value suffix is zero in E96 :R10=100mΩ; R28=280mΩ



3 digits marking for E96:243=243mΩ;511=511mΩ



HCS series.

Automotive Grade Current Sensing Chip Resistor

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
VersionA3	Jun03,2014	-	- Electrical Specifications updated - CS25 Pad Layout updated
VersionA4	Apr30,2015	-	-Environmental Characteristics updated
VersionA5	Jul15,2016	-	- Remove Material Description - Modify Storage Temperature - CS12 Pad Layout updated
VersionA6	Jan12,2018	-	- Modify1225 Dimension L,W - Environmental Characteristics updated
VersionA7	May20,2019	-	- Modify TCR Test description - Features added 100%CCD inspection - Electrical Specifications updated
VersionA8	Mar23,2020	-	-Environmental Characteristics:Added test voltage for Voltage Proof
VersionA9	Mar10,2021	-	- Modify 2010 Embossed Plastic Tape B Specification - Modify Soldering Condition (IPC/JEDECJ-STD-020)
VersionB	Nov15,2021	-	-Increase the shelf life description
VersionB1	Feb15,2022	-	-Derating Curve changes the temperature range
VersionB2	May18,2022	-	-Add 0805 1/2W high power production range
VersionB3	Jun15,2022	-	-Modify Soldering Condition