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DIRECT

Electronics Tech.

(CS)

Chip Current Detecting Resistor

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Product Introduction

Direct Chip Current Detecting Chip Resistor (CS) saves space and weight.

Features :

- Low TCR of ± 100 PPM/ $^{\circ}$ C.
- Resistance Values from $1\text{m}\Omega$ to $8000\text{m}\Omega$.
- 3W Power Rating in 1W size, 1225 Package.
- Long size Terminations with Higher Power Rating.
- High Purity Alumina Substrate for High Power Dissipation.
- Products with Pb-free Terminations Meet RoHS Requirements.

Applications :

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

Direct Electronics has launched the (CS) series, a family of ultra-small and low value surface mount current sensing resistor. These smaller sizes save space on the circuit board, allowing the production of smaller and lighter products.

The new series complements Direct's existing (LRC) Series, offering metal resistive film on ceramic construction but providing increased choice for product designers in the form of smaller sizes options of 0201, 0402, 0603, 0805, 1206, 2010, 2512, 1225, 3720, 7520, and 0612.

Designed for current detecting in power electronic systems, the fully RoHS compliant (CS) series is suitable for a range of applications including the monitoring of power usage and battery life; and provision of output protection for power supplies; as well as for a range of consumer and automotive products such as satellite navigation, handheld PDAs and digital set-top boxes.

The series offers ohm values as low as $1\text{m}\Omega$ to minimize power consumption and has an ambient temperature range of -55°C to $+155^{\circ}\text{C}$.

Exhibiting a resistance range up to $8000\text{m}\Omega$ and excellent heat dissipation qualities, the series offers designers enhanced power handling capabilities and protection from the threat of localized heating, resulting in the production of a more energy efficient product.

As demand continues to grow for reduced size, handheld and portable devices operating at low voltages, designers will look to manufacturers to produce smaller and smaller current sense resistors. Direct expects that demand for its latest range of small size resistor will be high.

For more chip low ohm thick film resistors, please link to Direct official website "[Current Sense Resistors](#)". Contact us with your specific needs.

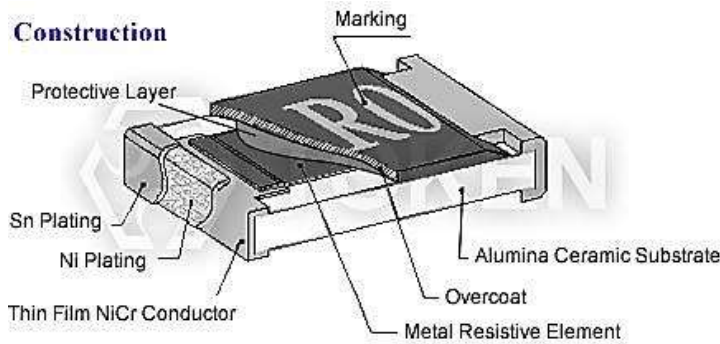


► **Construction & Dimensions**

Construction & Dimensions (Unit: mm)

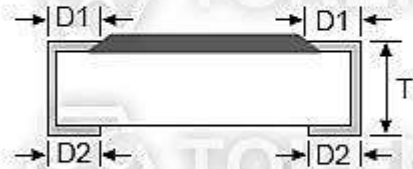
Type	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) / 1000pcs
CS01 (0201)	0.60±0.03	0.30±0.03	0.23±0.05	0.12±0.05	0.15±0.05	0.18
CS02 (0402)	1.00±0.05	0.50±0.05	0.32±0.10	0.25±0.10	0.20±0.10	0.7
CS03 (0603)	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.99
CS05 (0805)	2.00±0.10	1.25±0.10	0.55±0.10	0.30±0.20	0.40±0.25	5.3
CS06 (1206)	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.30	0.40±0.25	8.82
CS13 (1210)	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.30	0.50±0.25	15.5
CS10 (2010)	5.00±0.10	2.50±0.15	0.60±0.15	0.60±0.30	0.50±0.25	27.03
CS12 (2512)	6.35±0.10	3.10±0.15	0.60±0.10	0.60±0.30	0.55±0.25	43.08
CS12 (2512) 2W (10 ~ 99)mΩ	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	0.55±0.25	53.08
CS12 (2512) 2W (100 ~ 1000)mΩ	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	0.80±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
CS62 (0612)	1.55±0.10	3.10±0.15	0.55±0.10	0.30±0.15	0.45±0.15	10.19

Construction



(CS) Surface Mount Construction

0201/0402/0603/0805/1206/2010/2512



1225/3720/7520



Current Detecting (CS) - Dimensions



Marking for 0603 Current Detecting Resistor (CS)

Marking	Value
1R0	1.000Ω
R10	0.100Ω
R01	0.010Ω
138	0.138Ω
039	0.039Ω



Electrical Specifications

Standard Electrical Specifications (CS)

Type	Power Rating at 70°C	Operating Temp. Range	Resistance Tolerance (%)	Max. Operating Current (A)	Resistance Range (mΩ)	TCR (PPM/°C)	
CS01 (0201)	1/20W	(-55 ~ +155)°C	±1% ±2% ±5%	0.70A	100 - 147 150 - 500 510 - 1000	±1000 ±600 ±300	
CS02 (0402)	1/16W			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	±600	
CS13 (1210)	1/2W			7.07A	21 - 50	±400	
CS10 (2010)	3/4W			8.66A	51 - 91	±300	
CS12 (2512)	1W			10.0A	100 - 1000	±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			±2%,±5%	44.7A	1 - 4 5 - 10 11 - 350	±300 ±200 ±150
CS62 (0612)	1W			±1% ±2% ±5%	10.0A	10 - 27 30 - 91 100 - 499 500 - 1000	±600 ±300 ±200 ±100

- Operating Current $I = \sqrt{(P / R)}$, Operating Voltage $V = \sqrt{(P \cdot R)}$, or Max. Operating voltage whichever is lower.
- Optional specifications can be required.



High Power Rating Electrical Specifications Energy Efficient (CS)

Type	Power Rating at 70°C	Operating Temp. Range	Resistance Tolerance (%)	Max. Operating Current (A)	Resistance Range (mΩ)	TCR (PPM/°C)
CS02 (0402)	1/8W	(-55 ~ +155)°C	±1% ±2% ±5%	1.56A	51 - 100	±400
CS03 (0603)	1/8W, 1/5W			1.98A	102 - 500	±300
CS05 (0805)	1/4W			2.21A	510 - 1000	±200
CS06 (1206)	1/2W			7.07A	10 - 20 21 - 50 51 - 91 100 - 1000	±600 ±400 ±300 ±200
CS13 (1210)	3/4W			8.66A		
CS10 (2010)	1W			10.0A		
CS12 (2512)	1.5W			12.2A		
CS12 (2512)	*2W			14.1A		

● * Ultra High Power

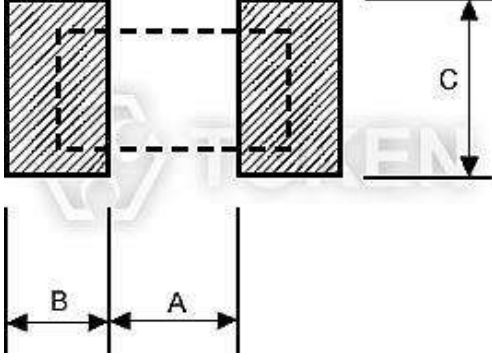
Low TCR Electrical Specifications (CS)

Type	Power Rating at 70°C	Operating Temp. Range	Resistance Tolerance (%)	Max. Operating Current (A)	Resistance Range (mΩ)	TCR (PPM/°C)
CS05 (0805)	1/8W	(-55 ~ +155)°C	±1% ±2% ±5%	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			7.07A	20 - 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



Land Pattern

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

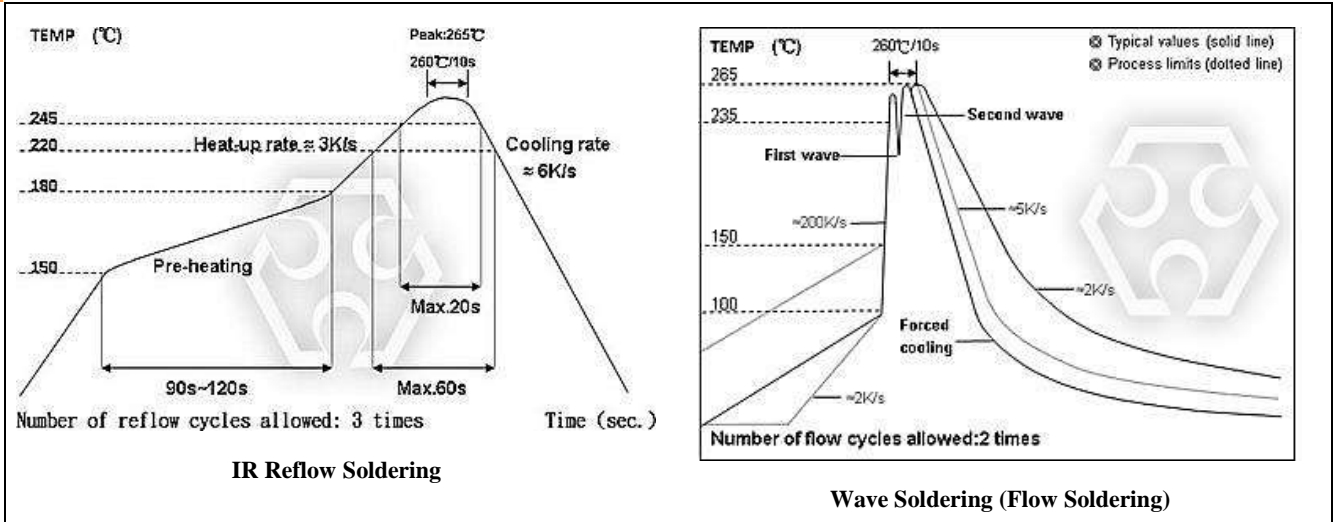
Figure	Codes	A (mm)	B (mm)	C (mm)
 <p>(CS) Recommend Land Pattern</p>	CS01	0.25	0.30	0.40±0.2
	CS02	0.50	0.50	0.60±0.2
	CS03	0.80	1.00	0.90±0.2
	CS05	1.00	1.00	1.35±0.2
	CS06	2.00	1.15	1.70±0.2
	CS13	2.00	1.15	2.50±0.2
	CS10	3.60	1.40	2.50±0.2
	CS12	4.90	1.60	3.20±0.2
	CS25	1.20	2.00	7.00±0.2
	CS37	1.00	1.80	3.90±0.2
	CS75	1.00	1.80	7.60±0.2
	CS62	0.60	1.00	3.20±0.2

Pad Layout (For CS12: Ultra High Power Rating Series) (CS)

Codes	Resistance Range	A (mm)	B (mm)	C (mm)
CS12	(10~99)mΩ	4.90	1.60	3.20±0.2
CS12	(100~1000)mΩ	1.00	3.55	3.20±0.2

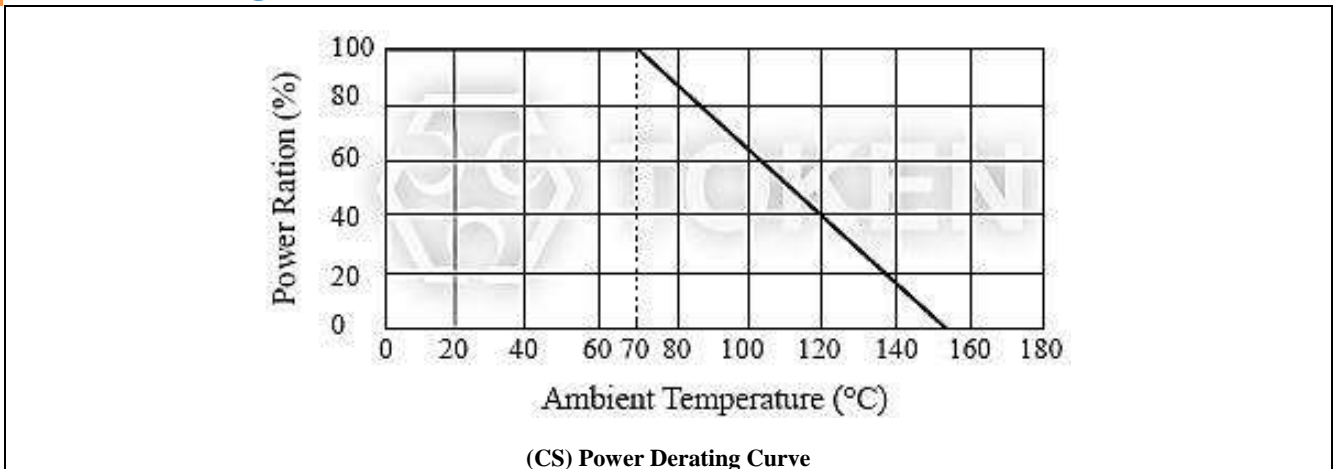
► **Soldering & Derating**

Soldering Condition (CS)



- (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

Power Derating Curve (CS)



Environmental Characteristics

Environmental Characteristics (CS)

Item	Specification	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 less for 5 seconds.
Insulation Resistance	≥10GΩ	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"
Damp Heat with Load	±(0.5%+0.05Ω)	JIS-C-5201-1 4.24 IEC-60115-1 4.24 40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "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 IEC-60115-1 4.33 Bending once for 5 seconds with 3mm 2010, 2512 sizes: 2mm
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
Rapid Change of Temperature	±(0.5%+0.05Ω)	JIS-C-5201-1 4.19 IEC-60115-1 4.19 -55°C to +155°C, 5 cycles

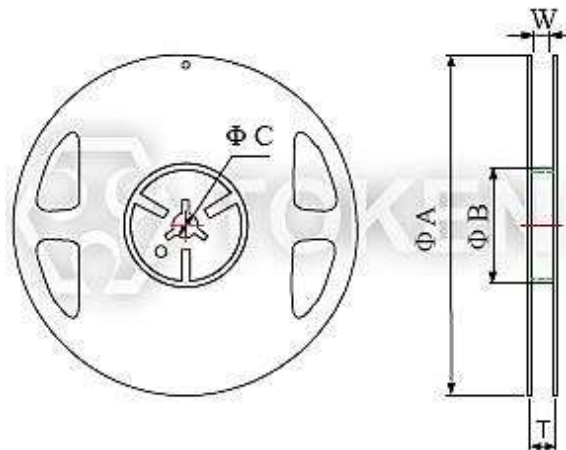
- Rated continuous Working Voltage (RCWV) = $\sqrt{\text{Power Rating} \times \text{Resistance Value}(\Omega)}$ or Max. Operating voltage whichever is lower.
- Storage Temperature: 15 ~ 28°C; Humidity < 80%RH;



▶ Reel & Tape

Packing Quantity & Reel Specifications (CS)

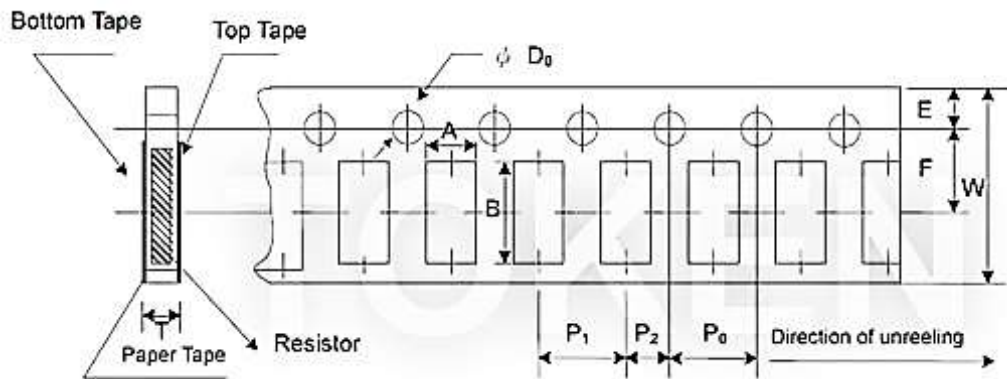
Type	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	Paper Tape(EA)	Embossed Tape (EA)
CS01	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	-
CS02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	-
CS03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CS05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	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
CS62	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-



Reel Dimensions

Paper Tape Specifications (CS)

Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P ₀ (mm)	P ₁ (mm)	P ₂ (mm)	ΦD ₀ (mm)	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	2.90±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
CS62	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

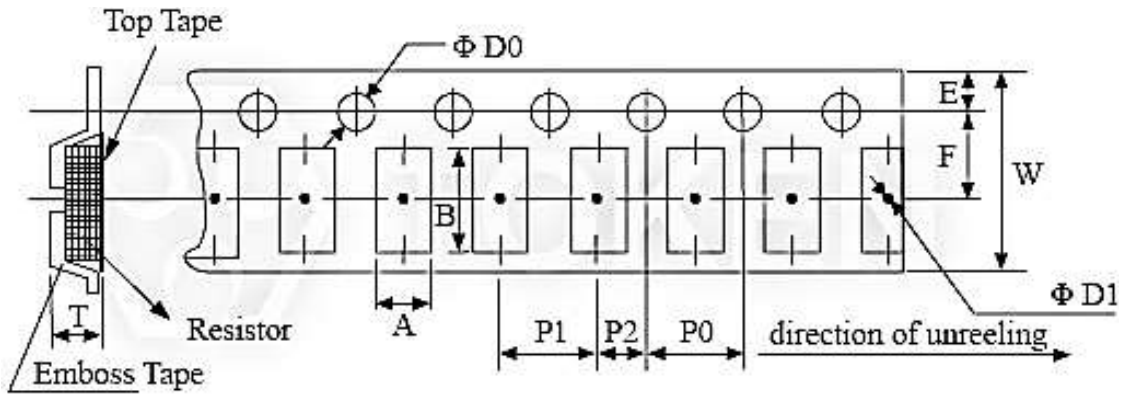


Paper Tape Specifications



Emboss Plastic Tape Specifications (CS)

Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P ₀ (mm)	P ₁ (mm)	P ₂ (mm)	ΦD ₀ (mm)	ΦD ₁ (mm)	T
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	1.4 Min.	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	1.4 Min.	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	1.4 Min.	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	1.4 Min.	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	1.4 Min.	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	1.4 Min.	1.20±0.20



Emboss Plastic Tape Specifications



Order Codes

Order Codes (CS)

CS	12	J	TR	G	A	R100	N							
Product Type	Dimensions (L×W)(mm)		Resistance Tolerance (%)		Package		TCR (PPM/°C)		Power Rating(W)		Resistance (Ω)		Marking	
	01	0201	J	±5	P	Bulk	E	±100	R	3	R010	0.01	N	No Marking
	02	0402	G	±2	TR	Taping Reel	K	±150	S	2	R100	0.1	W	Wide
	03	0603	F	±1			F	±200	A	1.5	1R00	1		
	05	0805					G	±300	T	1				
	06	1206					H	±400	Q	3/4				
	13	1210					J	±600	U	1/2				
	10	2010					R	±1000	V	1/4				
	12	2512							P	1/5				
	25	1225							W	1/8				
	37	3720							X	1/10				
	75	7520							Y	1/16				
	62	0612												



► General Information

Your Current Options - Direct Current Sense

As the world becomes more and more technology-driven, the uses for current sensing components will continue to increase. The need for even lower resistance value ranges is already becoming evident, as is the need for these resistors to handle more power. The industry-wide trend is the emergence of smaller and smaller products.

Direct Electronics offers a wide variety of current sensing products from the industry to military standards, such as current sense in Thin-Film / Thick-Film Technology, Bare Element Resistors, and Open Air Shunts. This enables Direct to present an astounding number of possible solutions for any circuit design needs.

Applications of Current Detecting Components

Direct's TCS and CS Series unique form factor provides automotive designers with several advantages. Both TCS and CS Series are ideal for applications involving window lift motors, fuel pump systems, seat belt pretensions, and pulse width modulator feedback.

The wider resistive element and lower resistance enables higher current to pass through the device. Direct's LRC ultra low Ohmic metal strip chip series provides the inherent ability to flex slightly and offers stress relief during extreme temperature cycling on typical or metal substrates. This LRC series is suitable for switch power supply applications (DC-DC Converter, Charger, and Adaptor) and power management of monitor.

The open air design of bare element resistor LRA and LRB Series provide a far cooler operation by allowing more air flow under the resistive element to keep excess heat from being transmitted to the PC board. They are suitable for high power AC/DC detection of power supply circuit.

Direct axial moulded BWL series provides power rating up to 10 watts and lower resistance 0.005Ω , is ideal for all types of current sensing applications including switching and linear power supplies, instruments and power amplifiers.

Direct standard current sensing components can be replacement for Vishay, IRC, Ohmite, KOA, Yageo devices with fast delivery and more competitive price. Contact us with your specific needs.

