

Thin Film Current Sensing Chip Resistor (TCS Series)



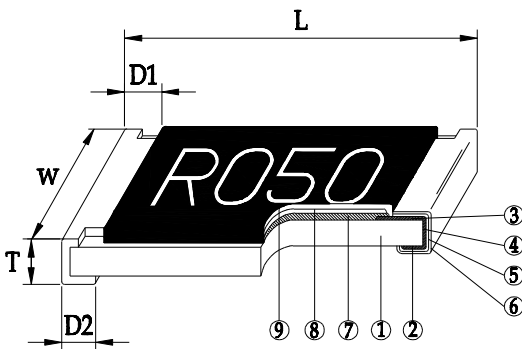
■ Features

- Thin film process
- High power rating up to 3 Watts in 2512 size
- Tight tolerance down to $\pm 0.5\%$
- Extremely low TCR down to ± 50 PPM/ $^{\circ}\text{C}$
- Resistance values from 50m to 1ohm
- High purity alumina substrate for high power dissipation

■ Applications

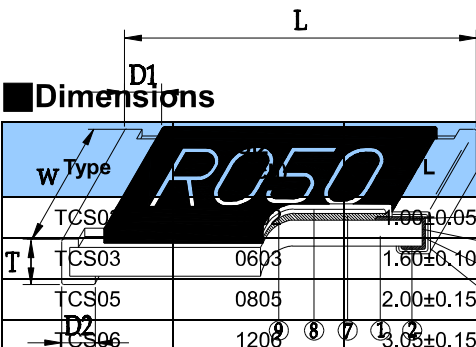
- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Automotive Engine Control
- Disk Driver
- Portable Devices (PDA, Cell Phone)

■ Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

■ Dimensions



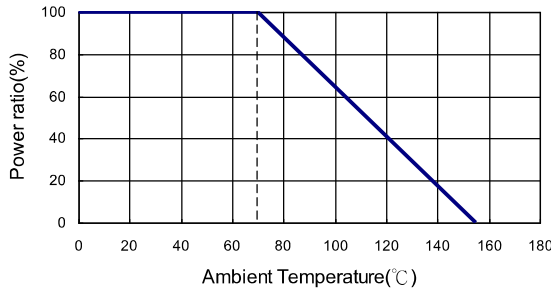
Unit: mm

Type	W	T	D1	D2	Weight (g) (1000pcs)
TCS03	0603	0.32 \pm 0.10	0.25 \pm 0.10	0.20 \pm 0.10	0.56
TCS05	0805	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	3.1
TCS06	1206	0.55 \pm 0.10	0.50 \pm 0.30	0.40 \pm 0.25	5.6
TCS10	2010	0.60 \pm 0.15	0.60 \pm 0.30	0.50 \pm 0.25	12.3
TCS12	2512	0.60 \pm 0.10	0.60 \pm 0.30	0.55 \pm 0.25	26.7

Part Numbering

TCS	12	F	T	F		R010	N
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	D: ±50 E: ±100 F: ±200	: Standard R: 3W	R010: 0.01Ω R100: 0.1Ω 1R00: 1Ω	: Standard N: No Marking

Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)		TCR (PPM/°C)
				±0.5%	±1%	
TCS02 (0402)		1/16W	-55~+155°C	500 - 1000		±100 ±50
TCS03 (0603)		1/10W		200 - 300 301 - 1000	±100 ±50	
TCS05 (0805)		1/8W		200 - 300 301 - 1000		
TCS06 (1206)		1/4W	-55~+155°C	—	50 - 100	±200 ±100 ±50
				101 - 300 301 - 1000		
TCS10 (2010)		3/4W	-55~+155°C	50 - 100 101 - 300 301 - 1000		±200 ±100 ±50
TCS12 (2512)		1W		50 - 100 101 - 300 301 - 1000		±200 ±100 ±50

High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)		TCR (PPM/°C)
				±0.5%	±1%	
TCS12 (2512)		3W	-55~+155°C	100 - 1000		±100

Operating Voltage= $\sqrt{P \cdot R}$

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$

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

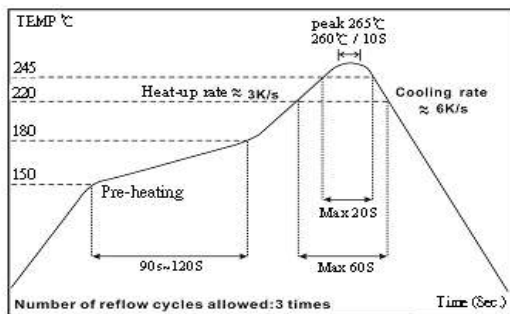
Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	MIL-STD-202 Method 304 +25/-55/+25/+125/+25°C
Short Time Overload	±1%	JIS-C-5201-1 4.13 RCWV*2.5 or Max. overload voltage whichever is lower for 5seconds
Insulation Resistance	>1000MΩ	MIL-STD-202 Method 302 Apply 100V _{DC} for 1 minute
Endurance	±1%	MIL-STD-202 Method 108A 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±0.5%	MIL-STD-202 Method 103B 40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Bending Strength	As Spec.	JIS-C-5201-1 4.33 Bending amplitude 3mm for 10 seconds
Solderability	95% min. coverage	MIL-STD-202 Method 208H 245±5°C for 3 seconds
Resistance to Soldering Heat	±0.5%	MIL-STD-202 Method 210E 260±5°C for 10 seconds
Dielectric Withstand Voltage	By Type	MIL-STD-202 Method 301 Apply Max. Overload Voltage for 1 minute
Thermal Shock	±0.5%	MIL-STD-202 Method 107G -55°C ~150°C, 100 cycles
Low Temperature Operation	±0.5%	JIS-C-5201-1 4.36 1 hour, -65°C followed by 45 minutes of RCWV

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

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

Reflow



Marking

0603 3digit marking

Example :

Resistance	1Ω	0.1Ω	0.15Ω	0.01Ω	0.101Ω	0.035Ω
Codes	1R0	R10	R15	R01	<u>101</u>	<u>035</u>

0805~2512 4digit marking

Example :

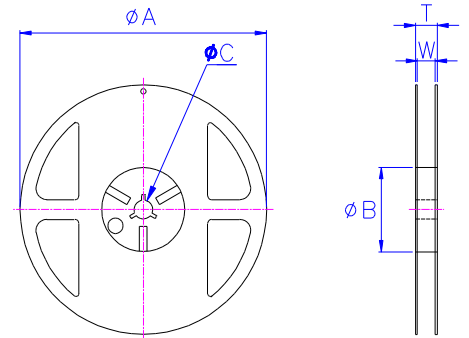
Resistance	1Ω	0.1Ω	0.05Ω	0.015Ω	0.01Ω
Codes	1R00	R100	R050	R015	R010

■ Packaging

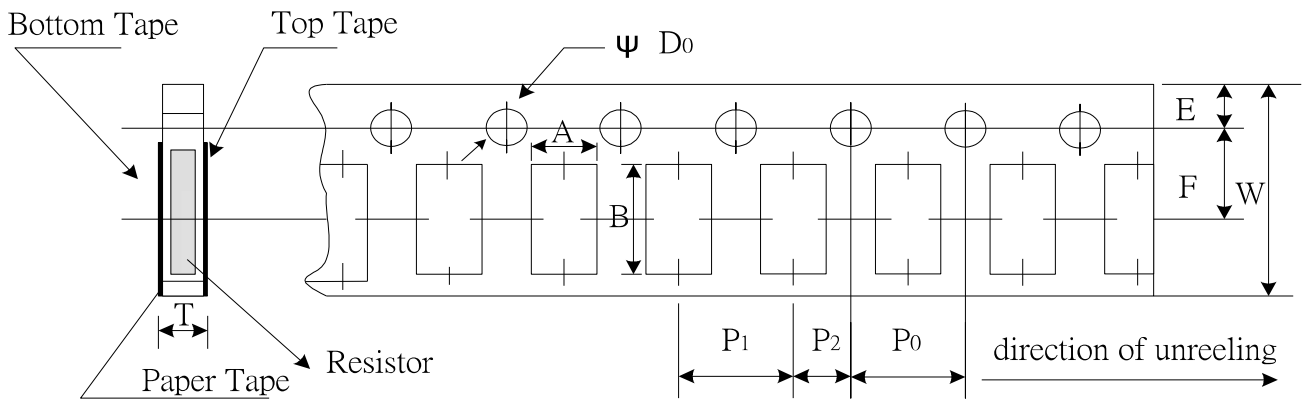
Packaging Quantity & Reel Specifications

Unit : mm

Type	nA	nB	nC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
TCS02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	
TCS03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
TCS05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
TCS06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
TCS10	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.00	15.5±1.0	-	4,000
TCS12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.00	15.5±1.0	-	4,000



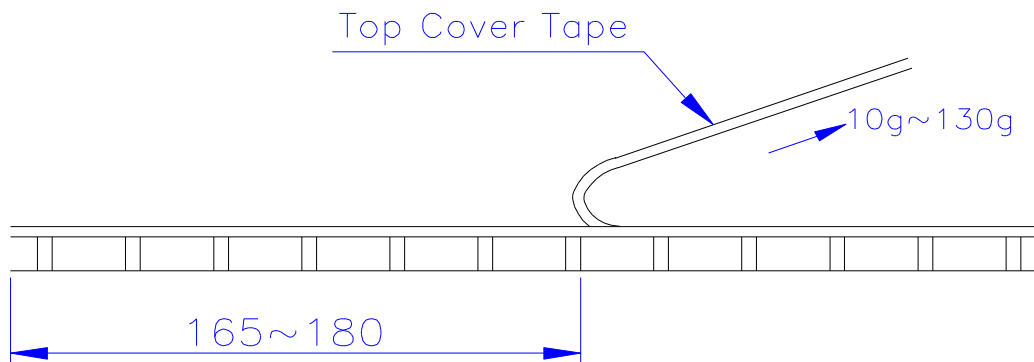
Paper Tape Specifications



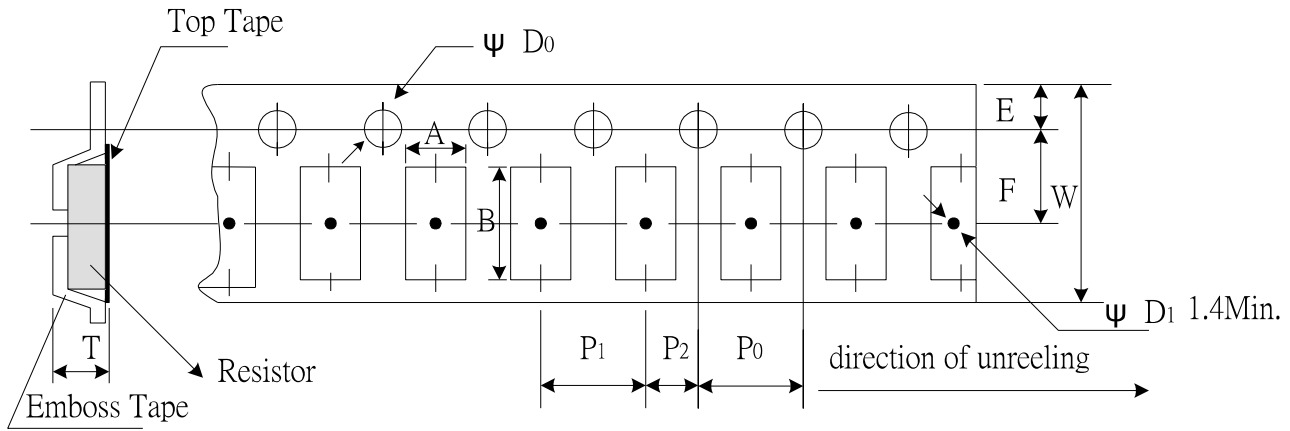
Unit: mm

Type	A	B	W	E	F	P0	P1	P2	ψD0	T
TCS02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
TCS03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
TCS05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
TCS06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

- Peel force of top cover tape
- The peel speed shall be about 300mm/min±5%
- The peel force of top cover tape shall be between 10 to 100g



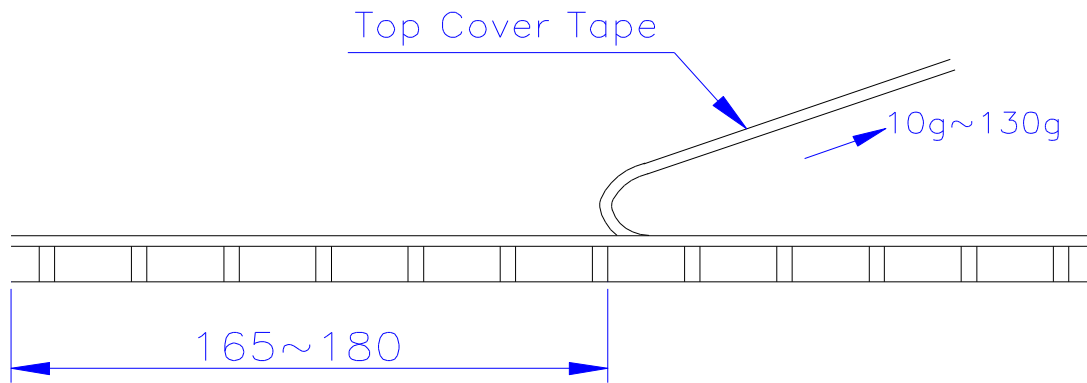
Emboss Plastic Tape Specifications



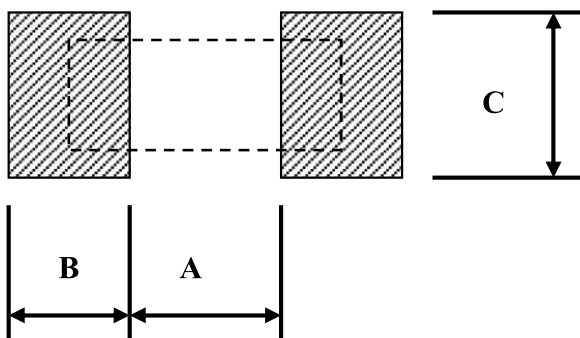
Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ψD_0	T
TCS10	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
TCS12	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

- Peel force of top cover tape
- The peel speed shall be about 300mm/min±5%
- The peel force of top cover tape shall be between 10 to 130g



Recommend Land Pattern



Unit : mm

Type	A	B	C
TCS02	0.50	0.50	0.60±0.2
TCS03	0.80	1.00	0.90±0.2
TCS05	1.00	1.00	1.35±0.2
TCS06	2.00	1.15	1.70±0.2
TCS10	3.60	1.40	2.50±0.2
TCS12	4.90	1.60	3.10±0.2

REVISION HISTORY

<u>REVISION</u>	<u>DATE</u>	<u>CHANGE NOTIFICATION</u>	<u>DESCRIPTION</u>
Version B2	May 08,2015	-	- Correct the element of Top Electrode.
Version B3	July 10,2015	-	- Add 0.5% tolerance for High Power Rating Electrical Specifications
Version B4	Mar 02, 2016	-	- Modify Storage Temperature. - Remove Material Description.
Version B5	Nov 10, 2017	-	- Correct the reference standard in Environmental Characteristics.