

## Thin Film Current Sensing Chip Resistor (TCS Series)



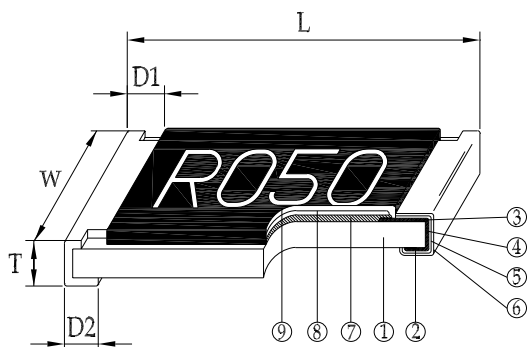
### ■ Features

- 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  $\pm 50$  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

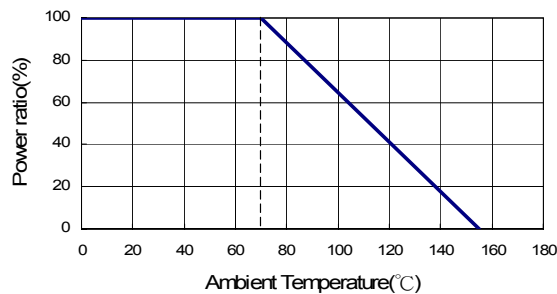
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
TCS02	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	0.56
TCS03	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	3.1
TCS05	0805	2.00 $\pm$ 0.15	1.25 $\pm$ 0.15	0.55 $\pm$ 0.10	0.30 $\pm$ 0.20	0.40 $\pm$ 0.25	5.6
TCS06	1206	3.05 $\pm$ 0.15	1.55 $\pm$ 0.15	0.55 $\pm$ 0.10	0.50 $\pm$ 0.30	0.40 $\pm$ 0.25	12.3
TCS10	2010	5.00 $\pm$ 0.20	2.45 $\pm$ 0.15	0.60 $\pm$ 0.15	0.60 $\pm$ 0.30	0.50 $\pm$ 0.25	26.7
TCS12	2512	6.35 $\pm$ 0.20	3.15 $\pm$ 0.15	0.60 $\pm$ 0.10	0.60 $\pm$ 0.30	0.55 $\pm$ 0.25	49.6

## 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

Item Type	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	-55~+155°C	200 - 300 301 - 1000		±100 ±50
TCS05 (0805)	1/8W		200 - 300 301 - 1000		±100 ±50
TCS06 (1206)	1/4W	-55~+155°C	—	50 - 100	±200 ±100 ±50
TCS10 (2010)	3/4W	-55~+155°C	50 - 100 101 - 300 301 - 1000		±200 ±100 ±50
TCS12 (2512)	1W	-55~+155°C	50 - 100 101 - 300 301 - 1000		±200 ±100 ±50

## High Power Rating Electrical Specifications

Item Type	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.

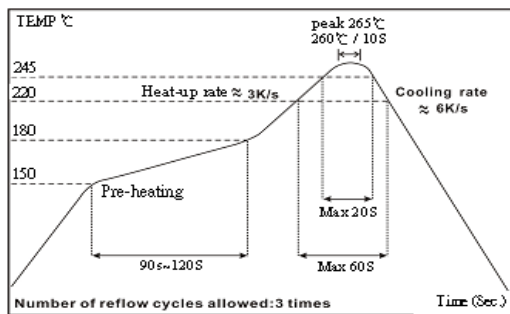
## ■Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	<b>MIL-STD-202 Method 304</b> +25/-55/+25/+125/+25°C
Short Time Overload	±1%	<b>JIS-C-5201-1 5.5</b> RCWV*2.5 or Max. overload voltage whichever is lower for 5seconds
Insulation Resistance	>1000MΩ	<b>MIL-STD-202 Method 302</b> Apply 100V <sub>DC</sub> for 1 minute
Endurance	±1%	<b>MIL-STD-202 Method 108A</b> 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±0.5%	<b>MIL-STD-202 Method 103B</b> 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.	<b>JIS-C-5201-1 6.1.4</b> Bending amplitude 3mm for 10 seconds
Solderability	95% min. coverage	<b>MIL-STD-202 Method 208H</b> 245±5°C for 3 seconds
Resistance to Soldering Heat	±0.5%	<b>MIL-STD-202 Method 210E</b> 260±5°C for 10 seconds
Dielectric Withstand Voltage	By Type	<b>MIL-STD-202 Method 301</b> Apply Max. Overload Voltage for 1 minute
Thermal Shock	±0.5%	<b>MIL-STD-202 Method 107G</b> -55°C ~150°C, 100 cycles
Low Temperature Operation	±0.5%	<b>JIS-C-5201-1 7.1</b> 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 :

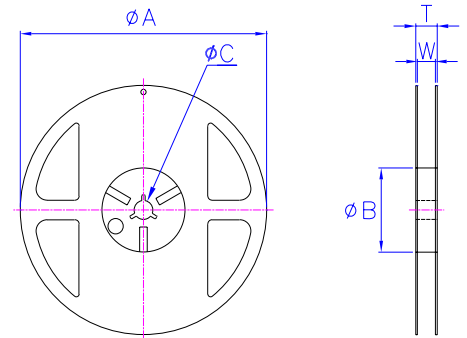
Resistance	1Ω	0.1Ω	0.05Ω	0.015Ω	0.01Ω
Codes	1R00	R100	R050	R015	R010

## Packaging

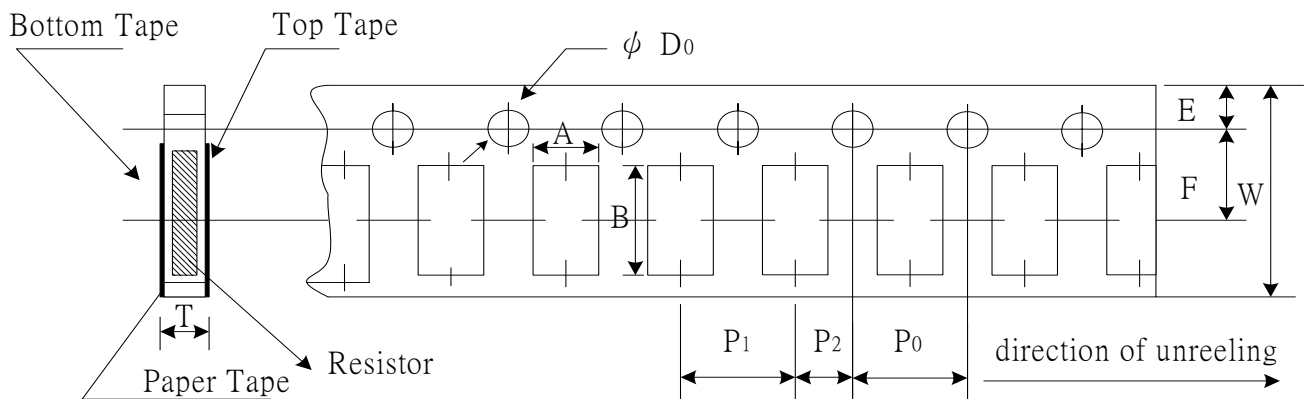
### Packaging Quantity & Reel Specifications

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



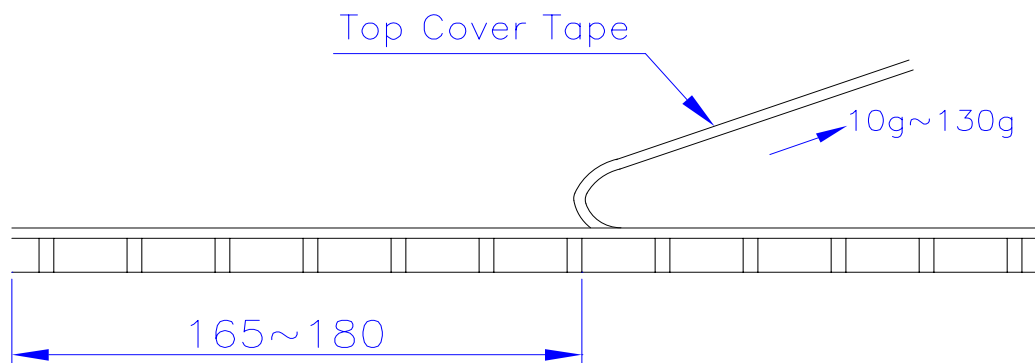
### Paper Tape Specifications



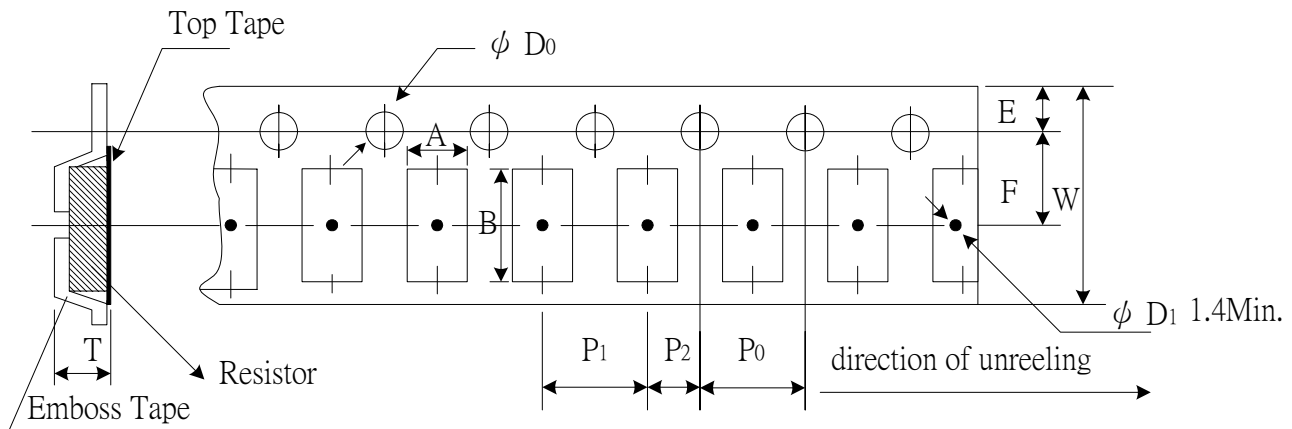
Unit: mm

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



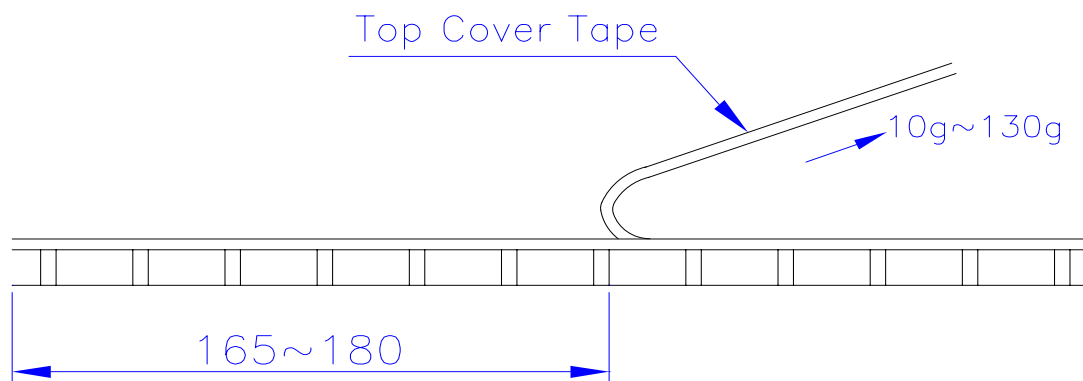
Emboss Plastic Tape Specifications



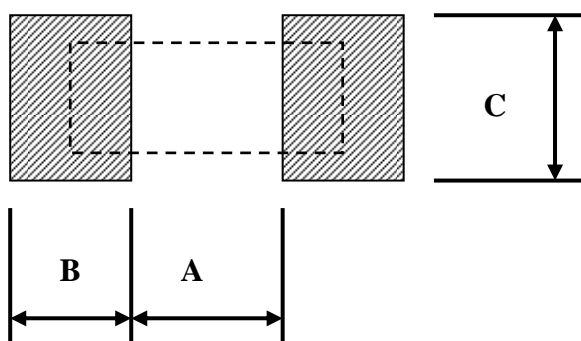
Unit: mm

Type	A	B	W	E	F	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	ψD <sub>0</sub>	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**

<b><u>REVISION</u></b>	<b><u>DATE</u></b>	<b><u>CHANGE NOTIFICATION</u></b>	<b><u>DESCRIPTION</u></b>
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.