

# **DATA SHEET**

**CURRENT SENSOR - LOW TCR** 

PT series

5%, 2%, 1% sizes 0402/0603/0805/1206/2010/2512

RoHS compliant & Halogen free



YAGEO Phícomp



#### SCOPE

This specification describes PT series current sensor - low TCR and high power with lead-free terminations made by thick film process.

## <u>APPLICATIONS</u>

- Converters
- Printer equipment
- Server board
- Telecom
- Consumer electronics
- Car electronics

#### **FEATURES**

- AEC-Q200 qualified
- Halogen Free Epoxy
- RoHS compliant
- Reduce environmentally
- High component and equipment reliability
- Non-forbidden material used in products/production
- Low resistances applied to current sensing
- Moisture sensitivity level: MSL I

#### ORDERING INFORMATION - GLOBAL PART NUMBER

Part numbers is identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

## YAGEO BRAND ordering code

РΤ

## **GLOBAL PART NUMBER (PREFERRED)**

## PT XXXX X X X XX XXXX L

(2) (3) (4) (5) (6) (7)

#### (I) SIZE

0402 / 0603 / 0805 / 1206 / 2010 / 2512

#### (2) TOLERANCE

 $F = \pm 1\%$ 

 $G = \pm 2\%$ 

 $| = \pm 5\%$ 

"-"= jumper ordering

## (3) PACKAGING TYPE

R = Paper taping reel

K = Embossed taping reel

## (4) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Based on spec.

## (5) TAPING REEL

07 = 7 inch dia. Reel and standard power

13 = 13 inch dia. Reel and standard power

7W = 7 inch dia, reel and  $2 \times$  standard power

3W = 13 inch dia. reel and  $2 \times$  standard power

7T = 7 inch dia. reel and  $3 \times$  standard power

#### (6) RESISTANCE VALUE

There are 3~5 digits indicated the resistor value. Letter R is decimal point.

Detailed coding rules of resistance are shown in the table of "Resistance rule of global part number".

## (7) DEFAULT CODE

Letter L is system default code for order only (Note)

number	giobai pai t
Resistance code rule	Example
0RXXX (25 to 910 mΩ)	$0R025 = 25 \text{ m}\Omega$ $0R1 = 100 \text{ m}\Omega$
(20 00 / 10 11122)	$0R91 = 910 \text{ m}\Omega$

Resistance rule of global part

## ORDERING EXAMPLE

The ordering code of a PT0603 chip resistor, 1/5W, value 0.56  $\Omega$  with ±1% tolerance, supplied in 7-inch tape reel is: PT0603FR-7W0R56L.

### NOTE

- I. All our Rchip products meet RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
- On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER / I2NC can be added (both are on customer request)



SERIES

PΤ

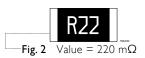
#### MARKING

#### PT0402



No marking

### PT0603



E-24 series / Non-E series (R= 250/400/500 m $\Omega$ ): 3 digits

The "R" is used as a decimal point; the other 2 digits are significant.

## PT0805 / PT1206 / PT2010 / PT2512



E-24 series / Non-E series (R= 250/400/500 m $\Omega$ ): 4 digits

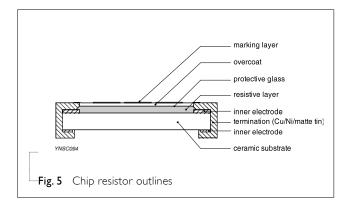
The "R" is used as a decimal point; the other 3 digits are significant.

For further marking information, please refer to data sheet "Chip resistors marking".

## CONSTRUCTION

The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive paste. The composition of the paste is adjusted to give the approximately required resistance and laser cutting of this resistive layer that achieves tolerance trims the value. The resistive layer is covered with a protective coat and printed with the resistance value. Finally, the three external terminations (Cu/Ni/matte tin) are added, as shown in Fig.5.

#### **OUTLINES**





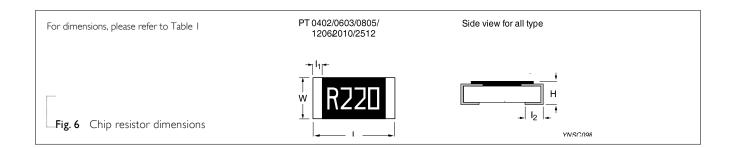
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## **DIMENSIONS**

	Ta	b	le	

TYPE	L (mm)	W (mm)	H (mm)	I <sub>I</sub> (mm)	I <sub>2</sub> (mm)
PT0402	1.00 ±0.10	0.50 ±0.05	0.35 ±0.05	0.20 ±0.10	0.25 ±0.10
PT0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
PT0805	2.00 ±0.10	1.25 ±0.10	0.55 ±0.10	0.35 ±0.20	0.35 ±0.20
PT1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.45 ±0.20
PT1206(Note)	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.75 ±0.20	0.45 ±0.20
PT2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20
PT2512	6.35 ±0.10	3.20 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20

**Note:** For resistance range:  $75m\Omega \le R < 91m\Omega$ 



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## Chip Resistor Surface Mount

## SERIES **0402/0603/0805/1206/2010/2512**

## **ELECTRICAL CHARACTERISTICS**

Table 2								
Туре	Power	Operating Temp. range	Max working voltage	Tolerance	Temperature Coe Resistance		Jumper cı	riteria
PT0402	1/16W				$50\text{m}\Omega \leq R < 68\text{m}\Omega$ $68\text{m}\Omega \leq R < 100\text{m}\Omega$	±600ppm/°C ±300ppm/°C	Max, resistance Rated current	10m <b>Ω</b> 3A
	1/8 W				$100 \text{m}\Omega \leq R < 1\Omega$	±200ppm/°C <sup>-</sup>		
	1/10W				$50m\Omega$ $50m\Omega < R < 68m\Omega$ $68m\Omega \le R < 100m\Omega$	0/+400ppm/°C 0/+350ppm/°C 0/+300ppm/°C-	Max, resistance Rated current	8m <b>Ω</b> 5A
PT0603	1/5 W				$100 \text{m}\Omega \leq R < 1\Omega$	±200ppm/°C		
F10603	I/3 W			E24 <b>±</b> 2%, <b>±</b> 5%	$50m\Omega$ $50m\Omega < R < 68m\Omega$ $68m\Omega$	0/+400ppm/°C 0/+350ppm/°C 0/+300ppm/°C		
DTOOOL	1/8 W	-55°C to +155°C	(PxR)^1/2	E24/E96 ±1%	$50 \text{m} \Omega$ $50 \text{m} \Omega < R < 68 \text{m} \Omega$	0/+350ppm/°C 0/+300ppm/°C	Max. resistance Rated current	5m <b>Ω</b> 6A
PT0805	1/4 W					0/+250ppm/°C ±100ppm/°C		
PT1206	1/4 W			,	$50\text{m}\Omega \leq R < 75\text{m}\Omega$	±350ppm/°C	Max. resistance Rated current	5m <b>Ω</b> 10A
F11206	1/2 W				$75\text{m}\Omega \leq R \leq 100\text{m}\Omega$ $100\text{m}\Omega < R < 1\Omega$	±100ppm/°C- ±75ppm/°C		
DT2010	3/4 W							
PT2010	IW				100 m <b>Ω</b>	±100 ppm/°C		
PT2512	IW				$100 \text{ m}\Omega < R < 1 \Omega$	±75 ppm/°C		
F12312	2W					-		

SERIES

#### FOOTPRINT AND SOLDERING PROFILES

Recommended footprint and soldering profiles, please refer to data sheet "Chip resistors mounting".

## PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	PT0402	PT0603	PT0805	PT1206	PT2010	PT2512
Paper taping reel (R)	7" (178 mm)	10,000	5,000	5,000	5,000		
	13" (330 mm)	50,000	20,000	20,000	20,000		
Embossed taping reel (K)	7" (178 mm)					4,000	4,000

#### NOTE

I. For paper/embossed tape and reel specification/dimensions, please refer to data sheet "Chip resistors packing".

## **FUNCTIONAL DESCRIPTION**

#### **OPERATING TEMPERATURE RANGE**

Range: -55 °C to +155 °C

#### **POWER RATING**

Each type rated power at 70 °C:

PT0402=1/16W, 1/8W

PT0603=1/10W, 1/5W, 1/3W

PT0805=1/8W, 1/4W

PT1206=1/4W, 1/2W

PT2010=3/4W, IW

PT2512=1W, 2W

## **RATED VOLTAGE**

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

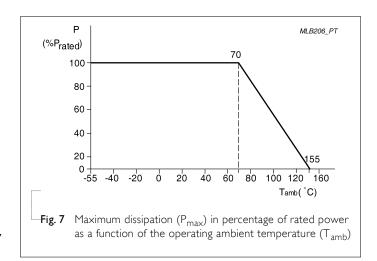
$$V = \sqrt{(P \times R)}$$

## Where

V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

 $R = Resistance value (\Omega)$ 



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## TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of	MIL-STD-202 Method 304	At +25/+125 °C	Refer to table 2
Resistance (T.C.R.)		Formula:	
		T.C.R= $\frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6 \text{ (ppm/°C)}$	
		Where $t_1$ =+25 °C or specified room temperature	
		t <sub>2</sub> =+125 °C test temperature	
		R <sub>I</sub> =resistance at reference temperature in ohms	3
		R <sub>2</sub> =resistance at test temperature in ohms	
Life/			
Endurance	MIL-STD-202 Method 108A IEC 60115-1 4.25.1	1,000 hours at 70±2 °C applied RCWV 1.5 hours on, 0.5 hour off, still air required	± (1.0%+0.0005 Ω)
High Temperature	MIL-STD-202 Method 108A	1,000 hours at maximum operating temperature	e ± (1.0%+0.0005 Ω)
Exposure	IEC 60068-2-2	depending on specification, unpowered	
		No direct impingement of forced air to the part	S
		Tolerances: I55±3 °C	
Moisture Resistance	MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8	3 ± (0.5%+0.0005 Ω)
	7 HE 01 D 202 / Teal 04 100	hours (method 106F), 3 cycles / 24 hours for 10d with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered	2 (0.376+0.0003 \$2)
		Parts mounted on test-boards, without condensation on parts	
		Measurement at 24±2 hours after test conclusion	
Thermal Shock	MIL-STD-202 Method 107	-55/+125 °C	± (1.0%+0.0005 Ω)
		Number of cycles required is 300. Maximum	± (1.070 · 0.0000 32)
		Devices mounted:	
		transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	

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TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Short Time Overload	IEC60115-1 4.13	PT standard power: 2.5 times rated voltage for 5 sec at room temperature	$\pm$ (1.0%+0.0005 $\Omega$ ) No visible damage
		PT high power: 5 times rated power for 5 sec at room temperature	
		PT jumper: 2.5 times rated current for 5 sec at room temperature	
Board Flex/ Bending	IEC 60115-1 4.33	Device mounted on PCB test board as described, only I board bending required Bending for 0402: 5 mm 0603/0805: 3 mm I 206 and above: 2 mm Holding time: minimum 60±I seconds Ohmic value checked during bending	± (1.0%+0.0005 Ω) No visible damage
Soldorability			
Solderability - Wetting	J-STD-002 test B	Electrical Test not required  Magnification 50X  SMD conditions:	Well tinned (≥95% covered) No visible damage
		I <sup>st</sup> step: method B, aging 4 hours at 155 °C dry heat	
		$2^{\text{nd}}$ step: leadfree solder bath at 245±3 °C	
		Dipping time: 3±0.5 seconds	
- Leaching	J-STD-002 test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to	IEC 60115-1 4.18	Condition B, no pre-heat of samples.	± (0.5%+0.0005 Ω)
Soldering Heat		Leadfree solder, 260±5 °C, 10±1 seconds immersion time	No visible damage
		Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	

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**Chip Resistor Surface Mount** 

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## REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	May 24, 2018	-	- Update PT0603 7T coding
Version I	Jul. 02, 2015	-	- Extend resistor value
Version 0	Aug. 21, 2014	-	- New datasheet for current sensor - low TCR PT series sizes of 0402/0603/0805/1206/2010/2512, 1%, 2%, 5% with lead-free termination

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