

# DATA SHEET

## CURRENT SENSOR - LOW TCR

PT series

5%, 2%, 1%

sizes 0402/0603/0805/1206/2010/2512

RoHS compliant & Halogen free



SCOPE

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

APPLICATIONS

- 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 1

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**

**GLOBAL PART NUMBER (PREFERRED)**

**PT XXXX X X X XX XXXX L**  
 (1) (2) (3) (4) (5) (6) (7)

**(1) SIZE**

0402 / 0603 / 0805 / 1206 / 2010 / 2512

**(2) TOLERANCE**

F = ±1%  
 G = ±2%  
 J = ±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 x standard power  
 3W = 13 inch dia. reel and 2 x standard power  
 7T = 7 inch dia. reel and 3 x 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)

Resistance code rule	Example
0RXXX (25 to 910 mΩ)	0R025 = 25 mΩ 0R1 = 100 mΩ 0R91 = 910 mΩ

**ORDERING EXAMPLE**

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

**NOTE**

1. All our Rchip products meet RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER / 12NC can be added (both are on customer request)

**MARKING**

**PT0402**



No marking

Fig. 4

**PT0603**



E-24 series / Non-E series (R= 250/400/500 mΩ): 3 digits

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

Fig. 2 Value = 220 mΩ

**PT0805 / PT1206 / PT2010 / PT2512**



E-24 series / Non-E series (R= 250/400/500 mΩ): 4 digits

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

Fig. 3 Value = 220 mΩ

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**



Fig. 5 Chip resistor outlines

**DIMENSIONS**

Table I

TYPE	L (mm)	W (mm)	H (mm)	l <sub>1</sub> (mm)	l <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(Notes)	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:  $75m\Omega \leq R < 91m\Omega$



**ELECTRICAL CHARACTERISTICS**

Table 2

Type	Power	Operating Temp. range	Max working voltage	Tolerance	Temperature Coefficient of Resistance	Jumper criteria			
PT0402	1/16W	-55°C to +155°C	(P×R) <sup>1/2</sup>	E24 ±2%, ±5% E24/E96 ±1%	50mΩ ≤ R < 68mΩ	±600ppm/°C	Max. resistance 10mΩ		
					68mΩ ≤ R < 100mΩ	±300ppm/°C	Rated current 3A		
1/8 W					100mΩ ≤ R < 1Ω	±200ppm/°C	--		
PT0603	1/10W						50mΩ	0/+400ppm/°C	Max. resistance 8mΩ
							50mΩ < R < 68mΩ	0/+350ppm/°C	Rated current 5A
	1/5 W						68mΩ ≤ R < 100mΩ	0/+300ppm/°C	--
							100mΩ ≤ R < 1Ω	±200ppm/°C	--
PT0805	1/3 W						50mΩ	0/+400ppm/°C	--
							50mΩ < R < 68mΩ	0/+350ppm/°C	--
							68mΩ	0/+300ppm/°C	--
PT1206	1/8 W			50mΩ	0/+350ppm/°C	Max. resistance 5mΩ			
	1/4 W			50mΩ < R < 68mΩ	0/+300ppm/°C	Rated current 6A			
PT1206	1/4 W			68mΩ ≤ R < 100mΩ	0/+250ppm/°C	--			
	1/2 W			100mΩ ≤ R < 1Ω	±100ppm/°C	--			
PT2010	1/4 W			50mΩ ≤ R < 75mΩ	±350ppm/°C	Max. resistance 5mΩ			
	1/2 W			75mΩ ≤ R ≤ 100mΩ	±100ppm/°C	Rated current 10A			
PT2010	3/4 W			100mΩ < R < 1Ω	±75ppm/°C	--			
	1W					--			
PT2512	1W			100 mΩ	±100 ppm/°C	--			
	2W			100 mΩ < R < 1 Ω	±75 ppm/°C	--			

**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**

1. 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, 1W

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 (Ω)



Fig. 7 Maximum dissipation (P<sub>max</sub>) in percentage of rated power as a function of the operating ambient temperature (T<sub>amb</sub>)

**TESTS AND REQUIREMENTS**
**Table 4** Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/+125 °C  <b>Formula:</b> $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ Where t <sub>1</sub> =+25 °C or specified room temperature t <sub>2</sub> =+125 °C test temperature R <sub>1</sub> =resistance at reference temperature in ohms R <sub>2</sub> =resistance at test temperature in ohms	Refer to table 2
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 Exposure	MIL-STD-202 Method 108A IEC 60068-2-2	1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 155±3 °C	± (1.0%+0.0005 Ω)
Moisture Resistance	MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered Parts mounted on test-boards, without condensation on parts Measurement at 24±2 hours after test conclusion	± (0.5%+0.0005 Ω)
Thermal Shock	MIL-STD-202 Method 107	-55/+125 °C Number of cycles required is 300. Maximum Devices mounted: transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	± (1.0%+0.0005 Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Short Time Overload	IEC60115-I 4.13	PT standard power: 2.5 times rated voltage for 5 sec at room temperature 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	$\pm (1.0\%+0.0005 \Omega)$ No visible damage
Board Flex/ Bending	IEC 60115-I 4.33	Device mounted on PCB test board as described, only 1 board bending required Bending for 0402: 5 mm 0603/0805: 3 mm 1206 and above: 2 mm Holding time: minimum $60 \pm 1$ seconds Ohmic value checked during bending	$\pm (1.0\%+0.0005 \Omega)$ No visible damage
Solderability - Wetting	J-STD-002 test B	Electrical Test not required Magnification 50X SMD conditions: 1 <sup>st</sup> step: method B, aging 4 hours at 155 °C dry heat 2 <sup>nd</sup> step: leadfree solder bath at $245 \pm 3$ °C Dipping time: $3 \pm 0.5$ seconds	Well tinned ( $\geq 95\%$ covered) No visible damage
- Leaching	J-STD-002 test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to Soldering Heat	IEC 60115-I 4.18	Condition B, no pre-heat of samples. Leadfree solder, $260 \pm 5$ °C, $10 \pm 1$ seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	$\pm (0.5\%+0.0005 \Omega)$ No visible damage



REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	May 24, 2018	-	- Update PT0603 7T coding
Version 1	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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