

# DATA SHEET

**CURRENT SENSOR - LOW TCR**

AUTOMOTIVE GRADE

PE\_L series

5%, 1%, 0.5%

sizes

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

RoHS compliant & Halogen free



**SCOPE**

This specification describes PE series current sensor - low TCR with lead-free terminations made by metal foil with ceramic substrate.

**APPLICATIONS**

- Consumer goods
- Computer
- Telecom / Datacom
- Industrial / Power supply
- Automotive
- Alternative Energy

**FEATURES**

- AEC-Q200 qualified
- Halogen-free Epoxy
- RoHS compliant
- Reduce environmentally hazardous wastes
- High component and equipment reliability
- None forbidden-materials used in products/production
- Low resistances applied to current sensing

**ORDERING INFORMATION - GLOBAL PART NUMBER**

Global part numbers are identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

**GLOBAL PART NUMBER**

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

**(1) SIZE**

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

**(2) TOLERANCE**

D = ±0.5% (≥10mΩ)    F = ±1%    J = ±5%

**(3) PACKAGING TYPE**

R = Paper/ PE taping reel  
 K = Embossed taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

E = ±50 ppm/°C  
 M = ±75 ppm/°C  
 F = ±100 ppm/°C  
 J = ±350 ppm/°C

**(5) TAPING REEL**

07 / 7W / 7T / 47 / 57= 7 inch dia. Reel and specific rated power.  
 Detailed power rating are shown in the Table 2.

**(6) RESISTANCE VALUE**

5 mΩ to 910 mΩ  
 There are 3~5 digits indicated the resistance 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 the system default code for ordering only. (Note)

Resistance rule of global part number	
Resistance code rule	Example
0RXXX	0R001 = 1 mΩ
(1 to 910 mΩ)	0R1 = 100 mΩ
	0R91 = 910 mΩ

**ORDERING EXAMPLE**

The ordering code of a PE2512 1W chip resistor, value 0.006 Ω with ±1% tolerance, supplied in 7-inch tape reel is:  
**PE2512FKM070R006L**

**NOTE**

I. All our RSMD products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead-Free Process"

**MARKING**

PE0201 / PE0402



No marking

PE0603

$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$

$51\text{m}\Omega \leq R \leq 910\text{m}\Omega$



2 digits

PE0805

$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$

$51\text{m}\Omega \leq R \leq 910\text{m}\Omega$



3 digits

PE1206

$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$

$51\text{m}\Omega \leq R \leq 910\text{m}\Omega$



4 digits

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

PE2010 / PE2512

$5\text{m}\Omega \leq R \leq 100\text{m}\Omega$



4 digits

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

**Outlines**

For dimensions, please refer to Table I

$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$



$51\text{m}\Omega \leq R \leq 910\text{m}\Omega$



YNSC14E

Fig. 5 Chip resistor outlines

**DIMENSION**
**Table 1** For outlines, please refer to Fig. 4

TYPE	RESISTANCE RANGE	L (mm)	W (mm)	H (mm)	l <sub>1</sub> (mm)
PE0201	50 mΩ ≤ R ≤ 200 mΩ	0.60±0.03	0.31±0.04	0.27±0.04	0.14±0.06
PE0402	10 mΩ ≤ R ≤ 910 mΩ	1.00+0.10/-0.15	0.50+0.10/-0.15	0.35±0.15	0.25±0.10
PE0603	5 mΩ, 10 mΩ, 15mΩ, 20 mΩ ≤ R ≤ 50 mΩ	1.60±0.20	0.76±0.25	0.35±0.25	0.38±0.25
	51 mΩ ≤ R ≤ 910 mΩ	1.52±0.25	0.76±0.25	0.45±0.10	0.38±0.25
PE0805	5 mΩ, 10 mΩ, 15mΩ, 20 mΩ ≤ R ≤ 50 mΩ	2.03±0.25	1.27±0.25	0.35±0.25	0.38±0.25
	51 mΩ ≤ R ≤ 910 mΩ	2.03±0.25	1.27±0.25	0.55±0.10	0.35±0.20
PE1206	5 mΩ	3.20±0.25	1.60±0.25	0.64±0.25	0.64±0.25
	6 mΩ ≤ R ≤ 910 mΩ	3.20±0.25	1.60±0.25	0.64±0.25	0.51±0.25
PE2010	5 mΩ ≤ R ≤ 6 mΩ	5.08±0.25	2.54±0.25	0.64±0.25	1.47±0.25
	7 mΩ ≤ R ≤ 100 mΩ	5.08±0.25	2.54±0.25	0.64±0.25	0.51±0.25
PE2512	6 mΩ ≤ R ≤ 100 mΩ	6.35±0.25	3.18±0.25	0.64±0.25	0.76±0.25

**Note:**

1. For relevant physical dimensions, please refer to construction outlines.
2. Please contact with sales offices, distributors and representatives in your region before ordering.

**ELECTRICAL CHARACTERISTICS**

Table 2

SERIES	SIZE	POWER RATING (1)					TOLERANCE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT OF RESISTANCE
		07	7W	7T	47	57			
	0201	1/20W	1/10W	---	---	---	$50\text{ m}\Omega \leq R \leq 200\text{ m}\Omega$	$20\text{ m}\Omega \leq R \leq 70\text{ m}\Omega \pm 350\text{ ppm}/^\circ\text{C}$ $70\text{ m}\Omega < R \leq 200\text{ m}\Omega \pm 100\text{ ppm}/^\circ\text{C}$	
	0402	1/16W	1/8W	1/6W	1/4W	---	$10\text{ m}\Omega \leq R \leq 910\text{ m}\Omega$	$\pm 100\text{ ppm}/^\circ\text{C}$	
	0603	1/10W	1/5W	1/3W	2/5W	1/2W	$\pm 0.5\% (\geq 10\text{ m}\Omega)$	$5\text{ m}\Omega, 10\text{ m}\Omega, 15\text{ m}\Omega$	
PE	0805	1/8W	1/4W	1/3W	1/2W	---	$\pm 1\%$	$20\text{ m}\Omega \leq R \leq 910\text{ m}\Omega$	$\pm 75\text{ ppm}/^\circ\text{C}$
	1206	1/4W	1/2W	---	1W	---	$\pm 5\%$	$5\text{ m}\Omega \leq R \leq 910\text{ m}\Omega$	$\pm 100\text{ ppm}/^\circ\text{C}$
	2010	1/2W	1W	---	---	---		$5\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$	$\pm 50\text{ ppm}/^\circ\text{C}$
	2512	1W	2W	---	---	---		$6\text{ m}\Omega \leq R \leq 100\text{ m}\Omega$	$\pm 75\text{ ppm}/^\circ\text{C}$ $\pm 100\text{ ppm}/^\circ\text{C}$

- Note: 1. Global part number (code 10 - 11)  
2. Please contact with sales offices, distributors and representatives in your region before ordering.

**FUNCTIONAL DESCRIPTION**

**OPERATING TEMPERATURE RANGE**

PE0201 to PE0402 Range:  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$  (Fig. 6-1)

PE0603 to PE2512 Range:  $-55^\circ\text{C}$  to  $+170^\circ\text{C}$  (Fig. 6-2)

**POWER RATING**

Standard rated power at  $70^\circ\text{C}$ :

- PE0201 = 1/20W
- PE0402 = 1/16W
- PE0603 = 1/10W
- PE0805 = 1/8W
- PE1206 = 1/4W
- PE2010 = 1/2W
- PE2512 = 1W

For detail power value, please refer to Table 2.

**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 ( $\Omega$ )



**PACKING STYLE AND PACKAGING QUANTITY**

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	PE0201	PE0402	PE0603	PE0805	PE1206	PE2010	PE2512
Paper taping reel (R)	7" (178 mm)	10,000	10,000	5,000	5,000	4,000	---	---
Embossed taping reel (K)	7" (178 mm)	---	---	---	---	---	4,000	4,000

**PAPER TAPE**

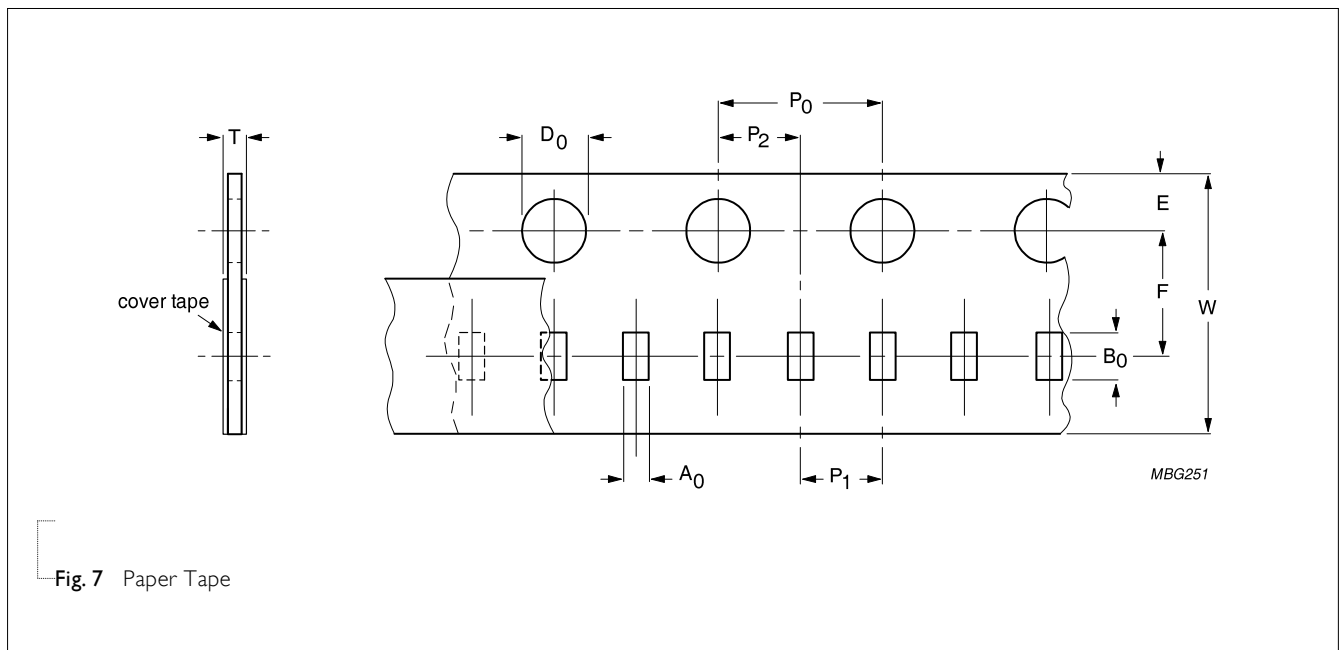


Fig. 7 Paper Tape

Table 4 Dimensions of paper tape for relevant chip resistors size

SIZE	SYMBOL										Unit: mm
	A <sub>0</sub>	B <sub>0</sub>	W	E	F	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	ØD <sub>0</sub>	T	
PE0201	0.35±0.10	1.65±0.10	8.00±0.30	1.75±0.10	3.50±0.10	4.00±0.10	2.00±0.05	2.00±0.05	1.50±0.10	0.53±0.10	
PE0402	0.65±0.10	1.15±0.10	8.00±0.30	1.75±0.10	3.50±0.10	4.00±0.10	2.00±0.05	2.00±0.05	1.50±0.10	0.53±0.10	
PE0603	1.20±0.15	1.90±0.15	8.00±0.30	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.10	0.55±0.15	
PE0805	1.60±0.15	2.30±0.15	8.00±0.30	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.10	0.85±0.15	
PE1206	1.90±0.10	3.50±0.10	8.00±0.30	1.75±0.10	3.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.10	1.50±0.10	

**EMBOSSED TAPE**



Fig. 8 Embossed Tape

Table 5 Dimensions of embossed tape for relevant chip resistors size

SIZE	SYMBOL										Unit: mm
	$A_0$	$B_0$	$W$	$E$	$F$	$P_0$	$P_1$	$P_2$	$\varnothing D_0$	$\varnothing D_1$	
PE2010	$3.00 \pm 0.15$	$5.60 \pm 0.15$	$12.10 \pm 0.30$	$1.75 \pm 0.10$	$5.50 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$2.00 \pm 0.10$	$1.50 \pm 0.10$	$1.50 \pm 0.10$	$0.80 \pm 0.15$
PE2512	$3.40 \pm 0.15$	$6.70 \pm 0.15$	$12.10 \pm 0.30$	$1.75 \pm 0.10$	$5.50 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$2.00 \pm 0.10$	$1.50 \pm 0.10$	$1.50 \pm 0.10$	$0.80 \pm 0.15$

**REEL SPECIFICATION**



Fig. 9 Reel

Table 6 Dimensions of reel specification for relevant chip resistors size

SIZE	QUANTITY PER REEL	REEL SIZE			SYMBOL		Unit: mm				
		8 mm TAPE WIDE	12 mm TAPE WIDE	24 mm TAPE WIDE	A	N	C	D	$W_1$	$W_2$ MAX.	
PE0201	10,000	7" ( $\varnothing 178$ mm)	---	---	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	9.0±0.30	12.4	
PE0402	10,000	7" ( $\varnothing 178$ mm)	---	---	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	9.0±0.30	12.4	
PE0603	5000	7" ( $\varnothing 178$ mm)	--	--	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	8.4 +1/-0	12.4	
PE0805	5000	7" ( $\varnothing 178$ mm)	--	--	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	8.4 +1/-0	12.4	
PE1206	4000	7" ( $\varnothing 178$ mm)	--	--	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	8.4 +1/-0	12.4	
PE2010	4000	--	7" ( $\varnothing 178$ mm)	--	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	12.3 +1/-0	18.4	
PE2512	4000	--	7" ( $\varnothing 178$ mm)	--	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	12.3 +1/-0	18.4	

**LEADER/TRAILER TAPE SPECIFICATION**



Fig.10 Leader/Trailer Tape



**FOOTPRINT AND SOLDERING PROFILES**

For recommended soldering profiles, please refer to data sheet “Chip resistors mounting”.

**FOOTPRINT**



Table 7 Footprint dimensions

SIZE	RESISTANCE RANGE	Unit: mm			
		A	B	C	D
PE0201	50 mΩ ≤ R ≤ 200 mΩ	1.00	0.30	0.35	0.40
PE0402	10 mΩ ≤ R ≤ 910 mΩ	1.45	0.35	0.55	0.55
PE0603	5 mΩ, 10 mΩ, 15 mΩ, 20mΩ ≤ R ≤ 910 mΩ	2.52	0.50	1.01	1.01
PE0805	5 mΩ, 10 mΩ, 15 mΩ, 20mΩ ≤ R ≤ 910 mΩ	2.54	0.50	1.02	1.27
PE1206	5 mΩ ≤ R ≤ 910 mΩ	3.90	0.76	1.57	1.78
PE2010	5 mΩ ≤ R ≤ 6 mΩ	6.12	1.40	2.36	3.05
	7 mΩ ≤ R ≤ 100 mΩ	6.10	3.30	1.40	3.05
PE2512	6 mΩ	7.40	3.18	2.11	3.68
	7 mΩ ≤ R ≤ 100 mΩ	7.36	4.06	1.65	3.68

**TESTS AND REQUIREMENTS**

Table 8 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Life/ Operational Life/ Endurance	MIL-STD-202G-method 108 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%+0.0005 Ω)
High Temperature Exposure/ Endurance at Upper Category Temperature	MIL-STD-202G-method 108 IEC 60115-1 4.25.3	1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 0201/0402 155±3°C 0603 and above 170±3°C	±(1%+0.0005 Ω)
Moisture Resistance	MIL-STD-202G-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-202G-method 107	-55/+125 °C Note: Number of cycles required is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(1%+0.0005 Ω)
Short Time Overload	IEC60115-1 4.13	5 times of rated power for 5 seconds at room temperature	±(1%+0.0005 Ω) No visible damage
Board Flex/ Bending	IEC60115-1 4.33	Device mounted on PCB test board as described, only 1 board bending required Bending for 0201: 3mm 0402 and above: 2mm Holding time: minimum 60 seconds	±(1%+0.0005 Ω) No visible damage
Biased Humidity	MIL-STD-202 Method 103	1,000 hours at 85°C/85%R.H. 10% of operating power, no condensation on the devices, circulating air.	± (1.0 % + 0.0005Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	IPC/JEDEC	Electrical Test not required	Well tinned (≥95% covered)
	J-STD-002B test B	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±3 °C Dipping time: 3±0.5 seconds	No visible damage
- Leaching	IPC/JEDEC J-STD-002B test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to Soldering Heat	MIL-STD-202G-method 210F	Condition B, no pre-heat of samples	±(0.5%+0.0005 Ω)
	IEC 60115-1 4.18	Leadfree solder, 260 °C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	No visible damage

**REVISION HISTORY**

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 5	Nov 23,2016	-	- Extend resistor value for 0.5%
Version 4	Dec. 21, 2015	-	- Update resistance value
Version 3	Aug. 06, 2015	-	- Update 0603 to 1206 TCR
Version 2	Apr. 20, 2015	-	- Extend resistor value
Version 1	Mar. 04, 2015	-	- Update TCR and operating temperature
Version 0	Feb. 10, 2015	-	- New datasheet for current sensor - low TCR PE series sizes of 0201/0402/0603/0805/1206/2010/2512, 0.5%, 1%, and 5%

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