

# DATA SHEET

**CURRENT SENSOR - LOW TCR**

AUTOMOTIVE GRADE

PE\_L series

5%, 1%, 0.5%, 0.1%

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 film 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**

- B = ±0.1% (only for 0805, > 50mΩ)
- 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 code rule	Example
0RXXX	0R001 = 1 mΩ
(1 to 910 mΩ)	0R1 = 100 mΩ
	0R91 = 910 mΩ

**ORDERING EXAMPLE**

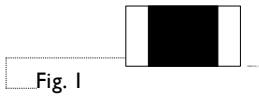
The ordering code of a PE2512 1W chip resistor, value 0.1 Ω with ±1% tolerance, supplied in 7-inch tape reel is: PE2512FKM070R1L

**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**

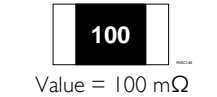
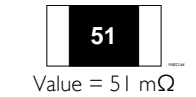
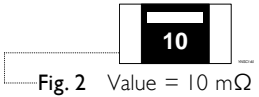
$5\text{m}\Omega \leq R \leq 50\text{m}\Omega$

$51\text{m}\Omega \leq R \leq 99\text{m}\Omega$

$100\text{m}\Omega \leq R \leq 910\text{m}\Omega$

2 digits

resistance range:  $5\text{m}\Omega \leq R \leq 99\text{m}\Omega$



3 digits

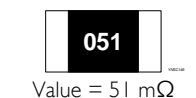
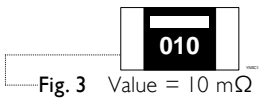
resistance range:  $100\text{m}\Omega \leq R \leq 910\text{m}\Omega$

**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



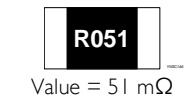
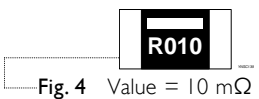
**PE1206**

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

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

4 digits

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



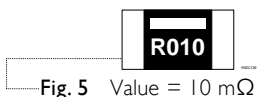
**PE2010 / PE2512**

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

$100\text{m}\Omega < R \leq 910\text{m}\Omega$

4 digits

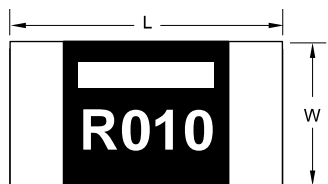
The "R" is used as a decimal point; the other 3 digits are significant.



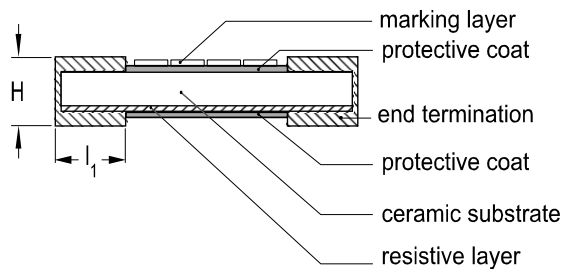
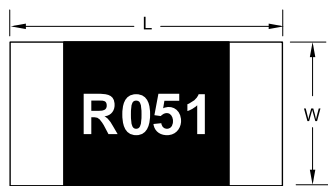
**Outlines**

For dimensions, please refer to Table I

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



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



YWSC14E

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>i</sub> (mm)
PE0201	50 mΩ ≤ R ≤ 910 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 ≤ 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 ≤ R ≤ 6 mΩ	2.03±0.25	1.27±0.25	0.35±0.25	0.73±0.25
	7 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 ≤ 910 mΩ	5.08±0.25	2.54±0.25	0.64±0.25	0.51±0.25
PE2512	6 mΩ ≤ R ≤ 910 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 mΩ ≤ R ≤ 910 mΩ	50 mΩ ≤ R ≤ 70 mΩ ±350 ppm/°C 70 mΩ < R ≤ 910 mΩ ±100 ppm/°C
0402	1/16W	1/8W	1/6W	1/4W	---		10 mΩ ≤ R ≤ 910 mΩ	±100 ppm/°C
0603	1/10W	1/5W	1/3W	2/5W	1/2W	±0.1% (only for 0805, >50mΩ)	5 mΩ ≤ R ≤ 910 mΩ	±75 ppm/°C ±100 ppm/°C
PE 0805	1/8W	1/4W	1/3W	1/2W	---	±0.5% (≥10 mΩ)		
1206	1/4W	1/2W	---	1W	---	±1% ±5%	5 mΩ ≤ R ≤ 19 mΩ 20 mΩ ≤ R ≤ 910 mΩ	±75 ppm/°C, ±100 ppm/°C ±50 ppm/°C, ±75 ppm/°C, ±100 ppm/°C
2010	1/2W	1W	---	---	---		5 mΩ ≤ R ≤ 910 mΩ	±50 ppm/°C ±75 ppm/°C
2512	1W	2W	---	---	---		6 mΩ ≤ R ≤ 910 mΩ	±100 ppm/°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°C to +125°C (Fig. 6-1)

PE0603 to PE2512 Range: -55°C to +170°C (Fig. 6-2)

**POWER RATING**

Standard rated power at 70°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:

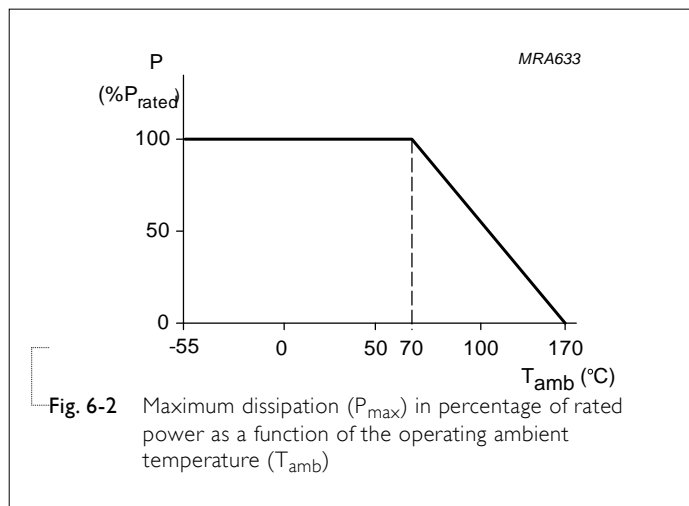
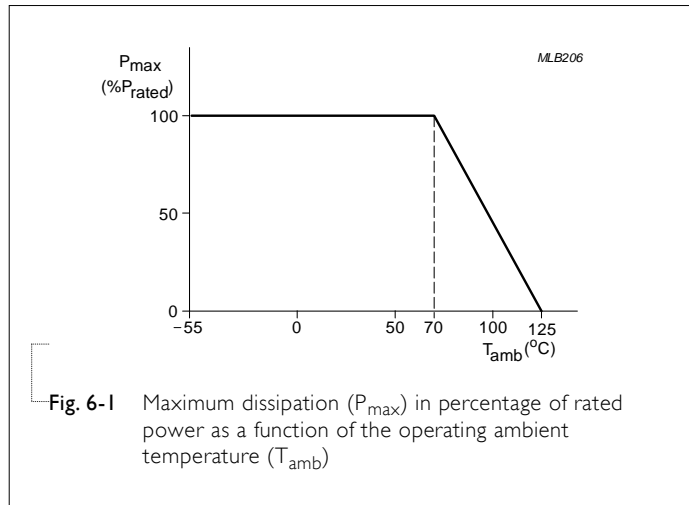
$$V = \sqrt{(P \times R)}$$

Where

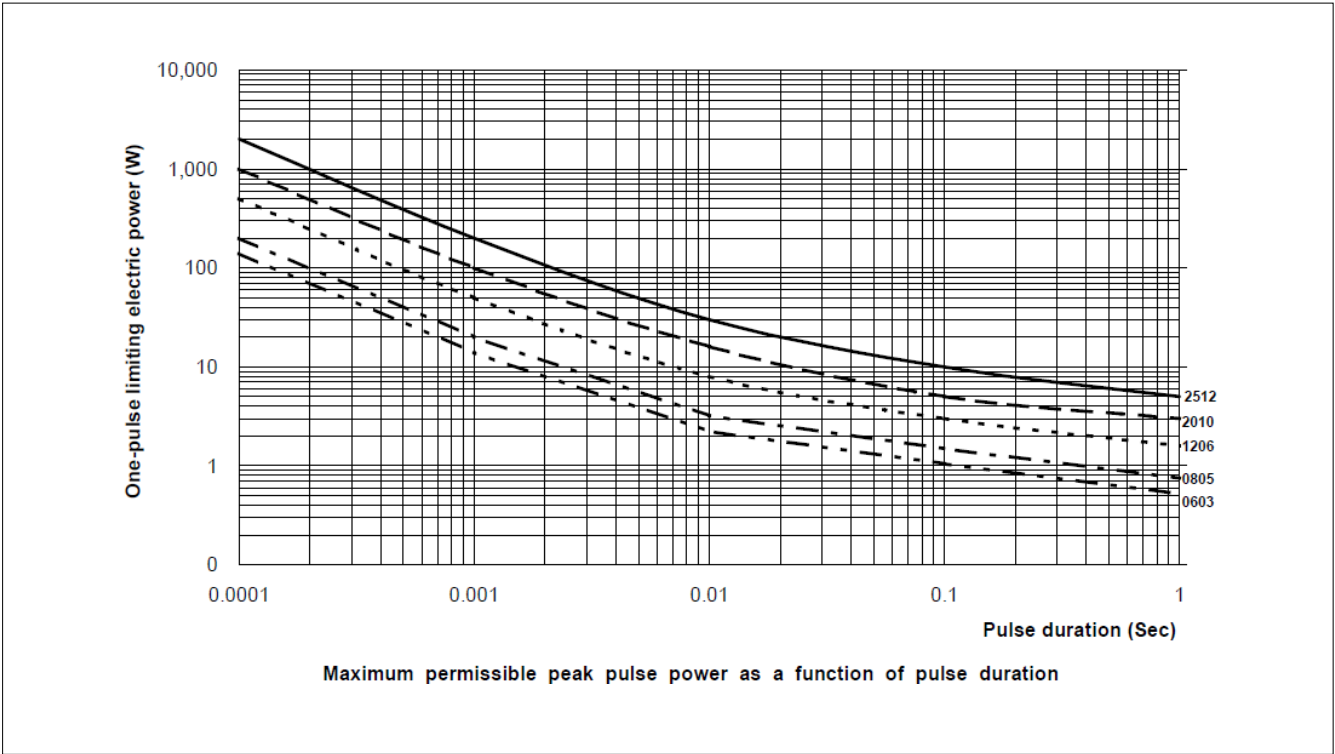
V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

R = Resistance value (Ω)



**PULSE LOAD BEHAVIOR**



**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**

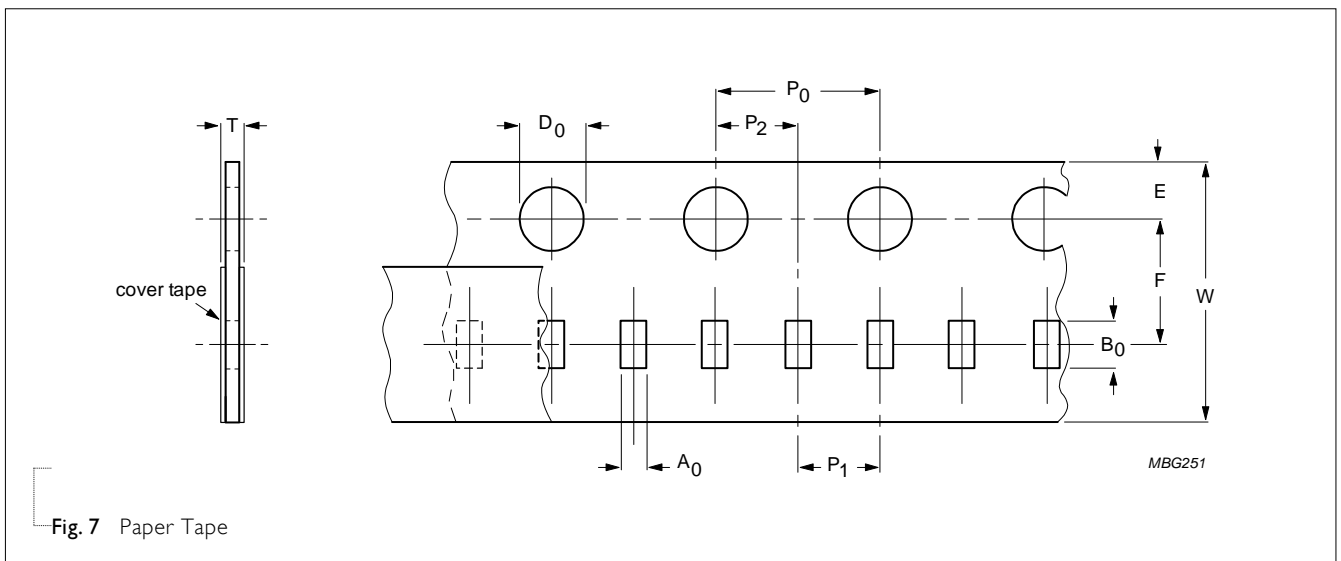


Table 4 Dimensions of paper tape for relevant chip resistors size

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**

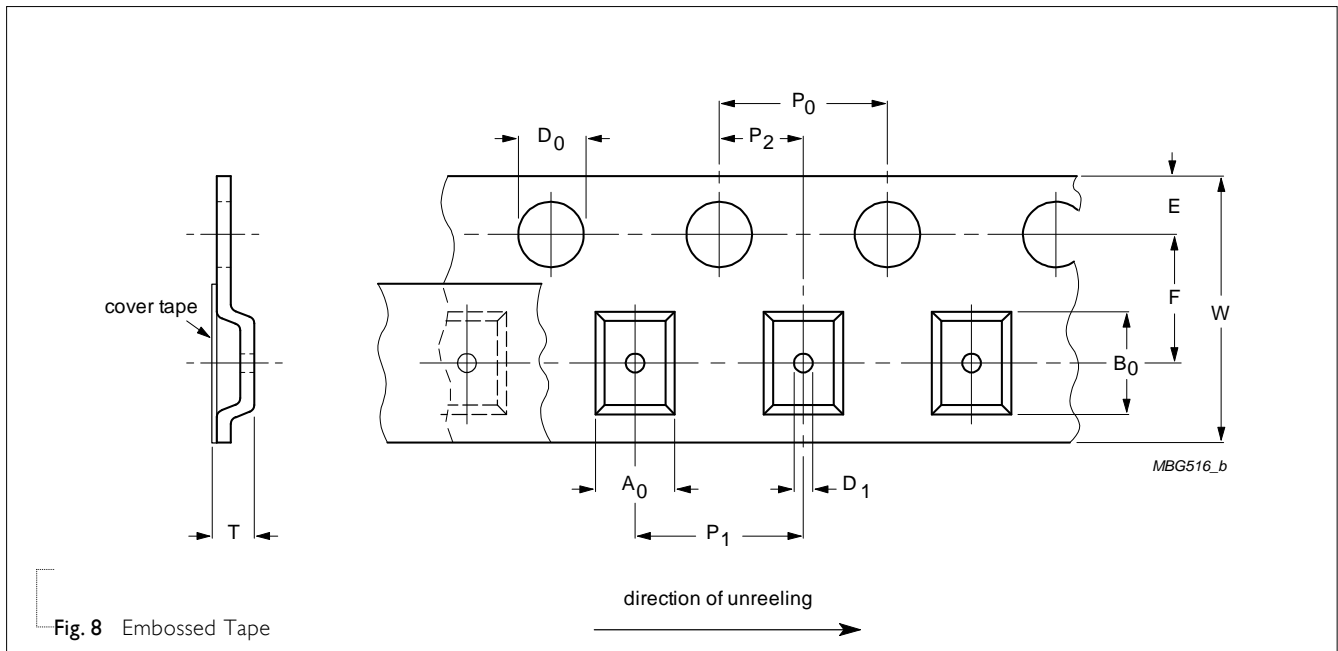


Fig. 8 Embossed Tape

Table 5 Dimensions of embossed tape for relevant chip resistors size

SIZE	SYMBOL										Unit: mm
	A <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>	ØD <sub>1</sub>	T
PE2010	3.00±0.15	5.60±0.15	12.10±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.10	1.50±0.10	0.80±0.15
PE2512	3.40±0.15	6.70±0.15	12.10±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.10	1.50±0.10	0.80±0.15

**REEL SPECIFICATION**

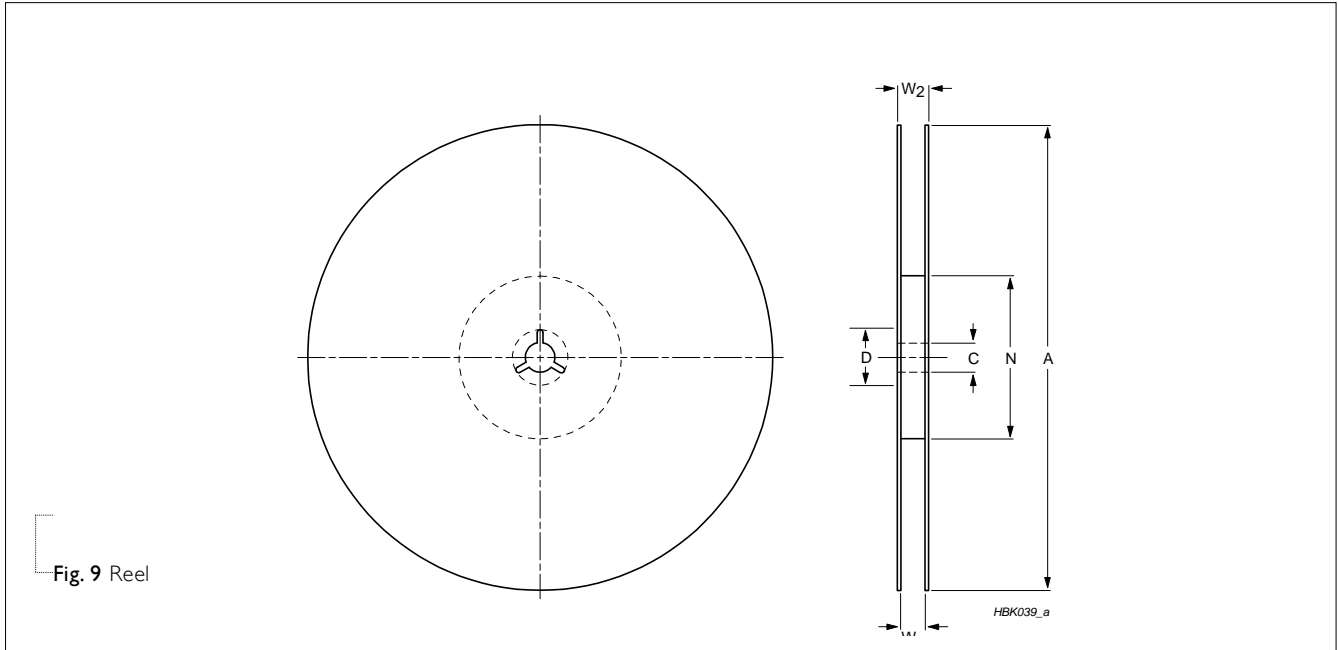


Fig. 9 Reel

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 <sub>1</sub>	W <sub>2</sub> MAX.	
PE0201	10,000	7" (Ø178 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" (Ø178 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" (Ø178 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" (Ø178 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" (Ø178 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	-- (Ø178 mm)	7"	--	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	12.3 +1/-0	18.4	
PE2512	4000	-- (Ø178 mm)	7"	--	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**

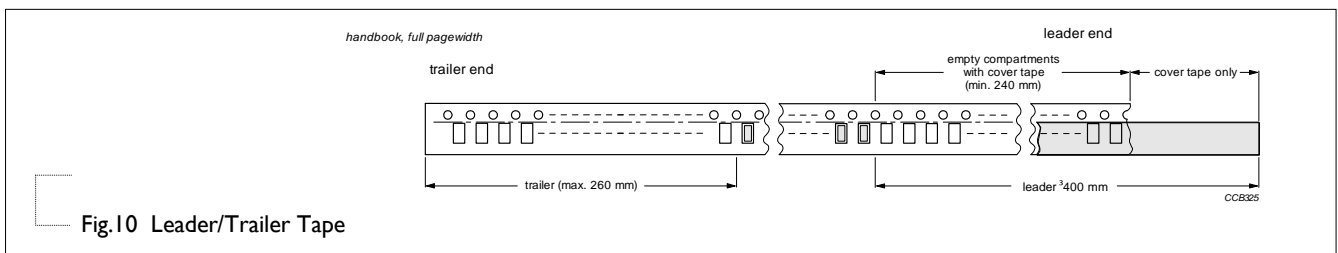


Fig.10 Leader/Trailer Tape



**FOOTPRINT AND SOLDERING PROFILES**

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

**FOOTPRINT**

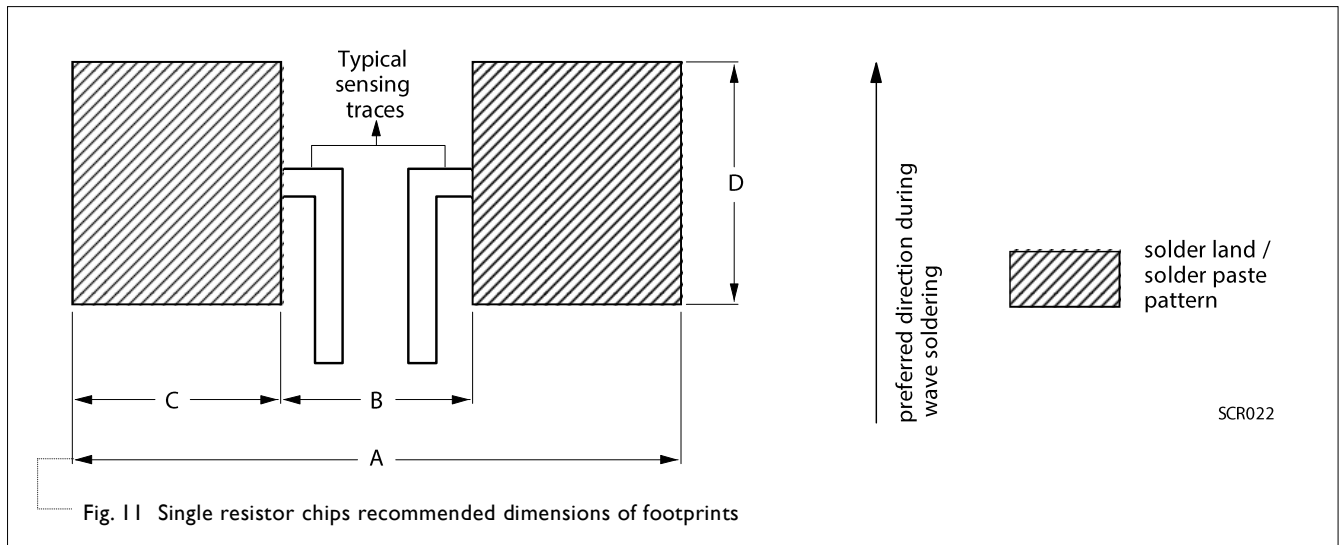


Table 7 Footprint dimensions

SIZE	RESISTANCE RANGE	Unit: mm			
		A	B	C	D
PE0201	50 mΩ ≤ R ≤ 910 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 ≤ R ≤ 910 mΩ	2.52	0.50	1.01	1.01
PE0805	5 mΩ ≤ 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 ≤ 910 mΩ	6.10	3.30	1.40	3.05
PE2512	6 mΩ	7.40	3.18	2.11	3.68
	7 mΩ ≤ R ≤ 910 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 125±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	0201: ±(5%+0.0005 Ω) Others: ±(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.	0201: ±(5%+0.0005 Ω) Others : ±(1.0%+0.0005 Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	IPC/JEDEC	Electrical Test not required	Well tinned ( $\geq 95\%$ 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 $\pm$ 3 °C Dipping time: 3 $\pm$ 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	$\pm(0.5\%+0.0005 \Omega)$
	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 8	Jun. 11, 2020	-	- Update the dimension for PE0805 5mohm & 6mohm - Update the marking for PE0603 - Extend resistance range for PE0201
Version 7	Jan. 21, 2019	-	- Extended resistor value for PE2010 and 2512
Version 6	Oct. 22, 2018	-	- Extend resistor value for PE0603 and 0805, and 0.1% tol for 0805 > 50mΩ - Add in pulse load behavior
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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