Innovative Service Around the Globe YAGEO

DATA SHEET

CURRENT SENSOR - LOW TCR

AUTOMOTIVE GRADE

PE_L series

5%, 1%, 0.5%, 0.1%

sizes

0100/ 0201/ 0402/ 0603/ 0805/ 1206/ 2010/ 2512/ 2817/ 4527

RoHS compliant & Halogen free

YAGEO

Product Specification – August 7, 2024 V.13

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
- Moisture sensitivity level: MSL 1
- Halogen-free Epoxy
- Total lead free without RoHS exemption
- RoHS compliant
- Reduce environmentally hazardous wastes
- High component and equipment reliability
- None forbidden-materials used in products/production
- Low resistances applied to current sensing
- PE series soldering is compliant with J-STD-020D

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

0100/ 0201/ 0402/ 0603/ 0805/ 1206/ 2010/ 2512/ 2817/ 4527

(2) TOLERANCE

B = ±0.1%
D = ±0.5%
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
G = ±200 ppm/C
I = ±300 ppm/°C
J = ±350 ppm/°C

(5) TAPING REEL

07 / 13 / 7W / 3W / 7T / 47 / 57 / 67 = 7 inch dia. Reel and specific rated power.

Detailed power rating are shown in the Table 2.

(6) RESISTANCE VALUE

5 mΩ to 1Ω

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
	0R001 = 1 mΩ
0RXXX	0R1 = 100 mΩ
(1 to 910 mΩ)	0R91 = 910 mΩ

ORDERING EXAMPLE

The ordering code of a PE2512 1W TCR 75 ppm chip resistor, value 0.1 Ω with ±1% tolerance, supplied in 7-inch tape reel is: PE2512FKM070R1L

NOTE

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

MARKING

PE0100

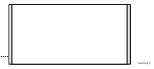

Fig. 1

No marking

PE0201 / PE0402

Fig. 2

No marking

PE0603

5mΩ ≤ R ≤ 50mΩ

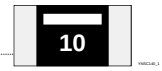

Fig. 3 Value = 10 mΩ

51mΩ ≤ R ≤ 99mΩ

Value = 51 mΩ

100mΩ ≤ R ≤ 1Ω

Value = 100 mΩ

2 digits

resistance range: 5mΩ ≤ R ≤ 99mΩ

3 digits

resistance range: 100mΩ ≤ R ≤ 1Ω

PE0805

5mΩ ≤ R ≤ 50mΩ

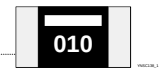

Fig. 4 Value = 10 mΩ

51mΩ ≤ R ≤ 1Ω

Value = 51 mΩ

3 digits

PE1206

5mΩ ≤ R ≤ 50mΩ

Fig. 5 Value = 10 mΩ

51mΩ ≤ R ≤ 910mΩ

Value = 51 mΩ

4 digits

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

PE2010 / PE2512 (1W&2W)

5mΩ ≤ R ≤ 100mΩ

Fig. 6 Value = 10 mΩ

100mΩ < R ≤ 910mΩ

Value = 510 mΩ

4 digits

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

PE1206 (1.5W) / PE2010 (3W) / PE2512 (3W~5W) / PE2817

Fig. 7

No marking

PE4527

5mΩ ≤ R ≤ 120mΩ

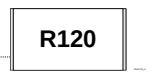

Fig. 8 Value = 120 mΩ

4 digits

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

Outlines

For dimensions, please refer to Table 1

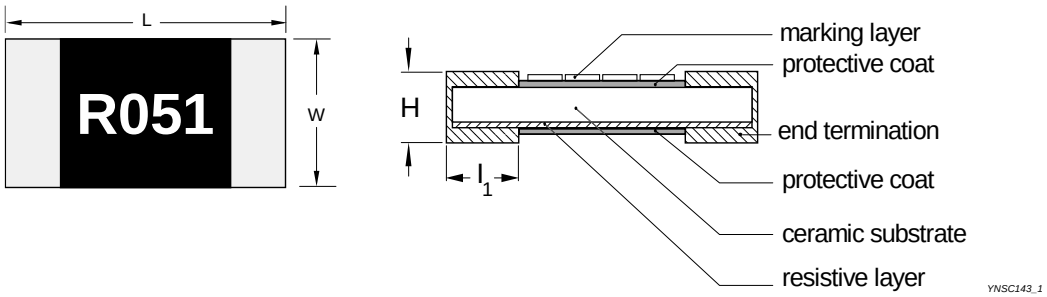

Fig. 9 Chip resistor outlines for PE0100~ PE2512

For dimensions, please refer to Table 1

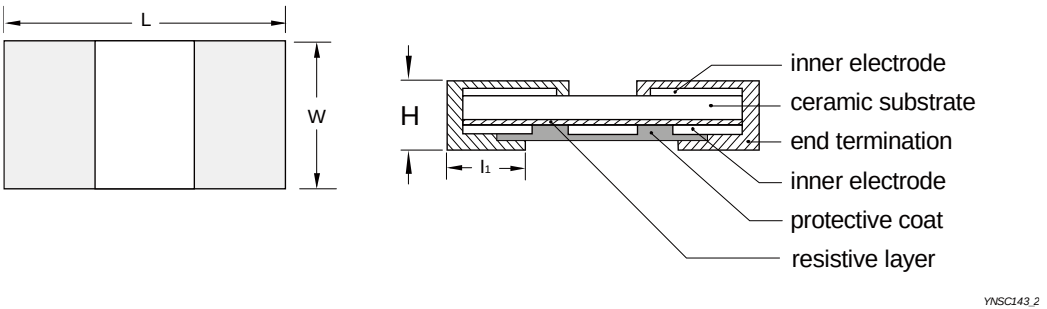

Fig. 10 Chip resistor outlines for PE1206 (1.5W) / PE2010 (3W) / PE2512 (3W&5W) / PE2817

For dimensions, please refer to Table 1

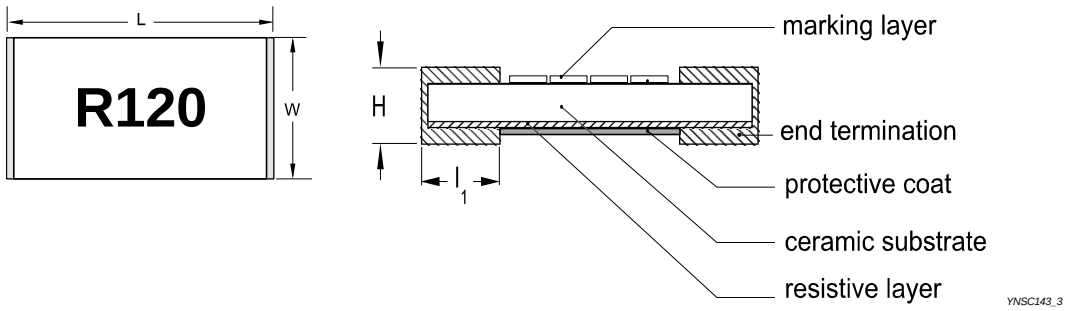

Fig. 11 Chip resistor outlines for PE4527

DIMENSION

Table 1 For outlines, please refer to Fig. 9 & Fig. 10

TYPE	RESISTANCE RANGE	L (mm)	W (mm)	H (mm)	I_1 (mm)
PE0100	100 mΩ ≤ R ≤ 1Ω	0.40±0.03	0.20±0.03	0.14±0.03	0.10±0.03
PE0201	50 mΩ ≤ R ≤ 1Ω	0.60±0.03	0.31±0.04	0.27±0.04	0.14±0.06
PE0402	10 mΩ ≤ R ≤ 1Ω	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 ≤ 1Ω	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 ≤ 1Ω	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
PE1206 1.5W	20 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
PE2010 3W	20 mΩ ≤ R ≤ 910 mΩ	5.08±0.25	2.54±0.25	0.64±0.25	0.70±0.25
PE2512 1W & 2W	6 mΩ ≤ R ≤ 910 mΩ	6.35±0.25	3.18±0.25	0.64±0.25	0.76±0.25
PE2512 3W ~ 5W	20 mΩ ≤ R ≤ 910 mΩ	6.35±0.25	3.15±0.25	0.64±0.25	0.90±0.25
PE2817	20 mΩ ≤ R ≤ 910 mΩ	7.10±0.25	4.20±0.25	0.64±0.25	1.00±0.25
PE4527	5 mΩ	11.75±0.45	7.20±0.45	0.65±0.20	3.00±0.45
	6 mΩ ≤ R ≤ 120 mΩ	11.75±0.45	7.20±0.45	0.65±0.20	2.70±0.45

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 @ 70°C (1) 07	7W	7T	47	57	67	TOLERANCE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT OF RESISTANCE	UNIT WEIGHT (mg/pcs)
PE	0100	1/32W	1/16W	---	---	---	---	±1%, ±5%	100 mΩ ≤ R ≤ 299 mΩ	±300 ppm/°C	0.033
									300 mΩ ≤ R ≤ 1Ω	±200 ppm/°C	
	0201	1/20W	1/10W	---	---	---	---		50 mΩ ≤ R ≤ 70 mΩ	±350 ppm/°C	0.250
									70 mΩ < R ≤1Ω	±100 ppm/°C	
	0402	1/16W	1/8W	1/6W	1/4W	---	---		10 mΩ ≤ R ≤ 1Ω	±100 ppm/°C	0.833
	0603	1/10W	1/5W	1/3W	2/5W	1/2W	---		5 mΩ ≤ R ≤ 1Ω	±75 ppm/°C, ±100 ppm/°C	3.030
	0805	1/8W	1/4W	1/3W	1/2W	---	---	±0.1% (only for 0805, >50 mΩ) ±0.5% (≥10 mΩ) ±1% ±5%			5.761
	1206	1/4W	1/2W	---	1W	---	---		5 mΩ ≤ R ≤ 19 mΩ	±75 ppm/°C, ±100 ppm/°C	13.324
									20 mΩ ≤ R ≤ 910 mΩ	±50 ppm/°C, ±75 ppm/°C ±100 ppm/°C	
		---	---	---	---	---	1.5W			±100 ppm/°C	
	2010	1/2W	1W	---	2W	---	---		5 mΩ ≤ R ≤ 910 mΩ	±50 ppm/°C, ±75 ppm/°C ±100 ppm/°C	27.447
		---	---	---	---	---	3W		20 mΩ ≤ R ≤ 910 mΩ	±100 ppm/°C	
	2512	1W	2W	---	---	---	---		6 mΩ ≤ R ≤ 910 mΩ	±50 ppm/°C, ±75 ppm/°C ±100 ppm/°C	43.821
		---	---	3W	4W	5W	---		20 mΩ ≤ R ≤ 910 mΩ	±100 ppm/°C	50.872

Table 3

SERIES	SIZE	POWER RATING @ 70°C (1) 13(3)	3W(3)					TOLERANCE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT OF RESISTANCE	UNIT WEIGHT (mg/pcs)
PE	2817	7W	---	---	---	---	---	±0.5%, ±1%, ±5%	20 mΩ ≤ R ≤ 910 mΩ	±100 ppm/°C	80.717
	4527	2W	3W	---	---	---	---		5 mΩ ≤ R ≤ 120 mΩ	±75 ppm/°C, ±100 ppm/°C	251.587

Note: 1. Global part number (code 10 - 11)
2. Please contact with sales offices, distributors and representatives in your region before ordering.
3. 13 & 3W are only for PE2817 & PE4527

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

PE0100 to PE0402 Range: -55°C to +125°C (Fig.11)
PE0603 to PE4527 Range: -55°C to +170°C (Fig.12)

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)

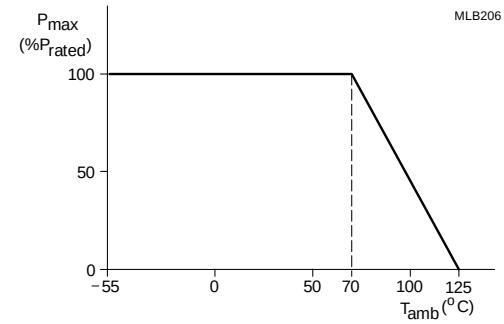

Fig. 12 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

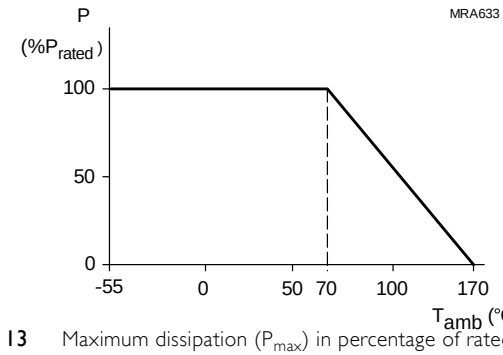

Fig. 13 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

PULSE LOAD BEHAVIOR

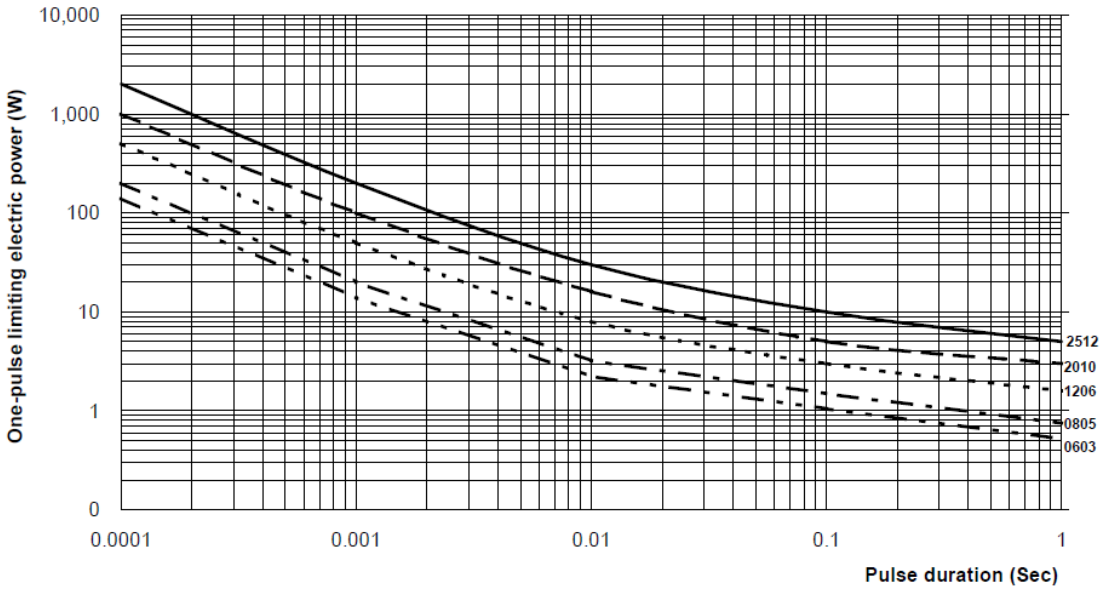

Fig. 14 Maximum permissible peak pulse power as a function of pulse duration

Note: 1. The curve of 2512 above is for 1W&2W
2. These curves are only valid for the resistance value below 10mΩ

PACKING STYLE AND PACKAGING QUANTITY

Table 4 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	PRODUCT SIZE / QUANTITY									
		0100	0201	0402	0603	0805	1206	2010	2512	2817	4527
Paper/PE taping reel (R)	7" (178 mm)	20,000	10,000	10,000	5,000	5,000	4,000	---	---	---	---
Embossed taping reel (K)	7" (178 mm)	---	---	---	---	---	---	4,000	4,000	---	---
	13" (330 mm)	---	---	---	---	---	---	---	---	4,000	1,000

PAPER/PE TAPE

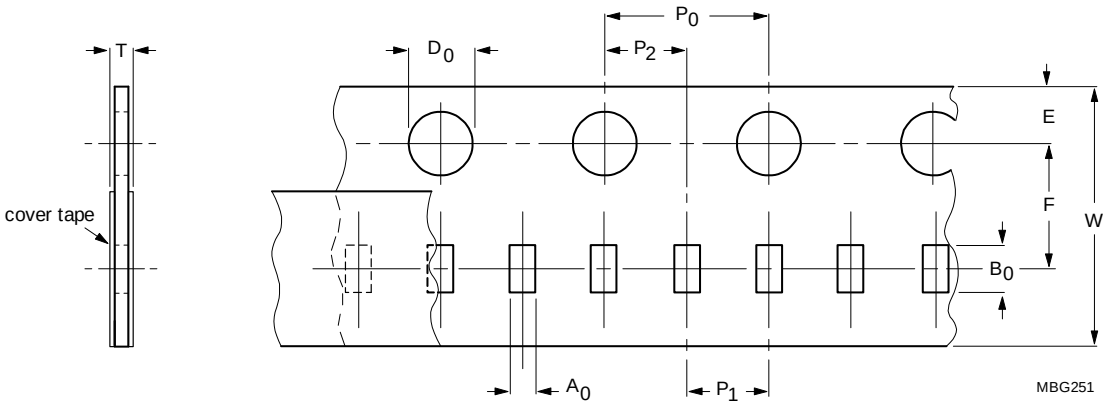

Fig. 15 Paper/PE Tape

Table 5 Dimensions of Paper/PE tape for relevant chip resistors size

Unit: mm

SIZE	SYMBOL									
	A_0	B_0	W	E	F	P_0	P_1	P_2	$\varnothing D_0$	T
PE0100	0.24±0.03	0.45±0.03	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.05	2.00±0.10	2.00±0.05	1.55±0.05	0.31±0.10
PE0201	0.41±0.10	0.70±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	1.55±0.05	0.40±0.10
PE0402	0.65±0.10	1.20±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	1.55±0.05	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	1.55±0.05	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	1.55±0.05	0.75±0.15
PE1206	1.90±0.15	3.50±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	1.55±0.05	0.85±0.15

EMBOSSED TAPE

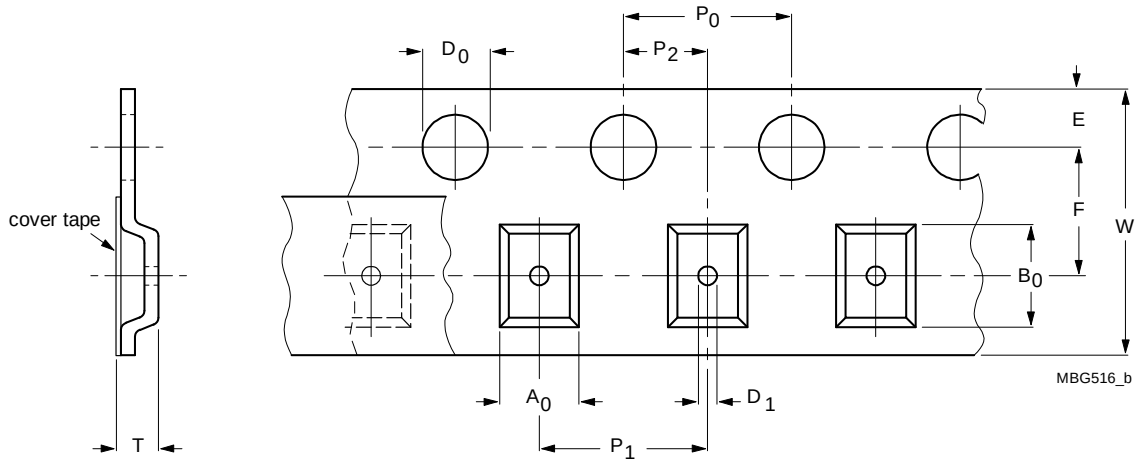

Fig. 16 Embossed Tape

Table 6 Dimensions of embossed tape for relevant chip resistors size

Unit: mm

SIZE	SYMBOL										
	A_0	B_0	W	E	F	P_0	P_1	P_2	$\varnothing D_0$	$\varnothing D_1$	T
PE2010	3.00±0.15	5.60±0.15	12.00±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	1.55±0.05	0.80±0.15
PE2512	3.40±0.15	6.70±0.15	12.00±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	1.55±0.05	0.85±0.15
PE2817	4.50±0.20	7.40±0.20	12.00±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	1.55±0.05	0.85±0.15
PE4527	7.50±0.20	12.0±0.20	24.00±0.30	1.75±0.10	11.50±0.10	4.00±0.10	12.00±0.10	2.00±0.10	1.55±0.05	1.55±0.05	0.90±0.15

REEL SPECIFICATION

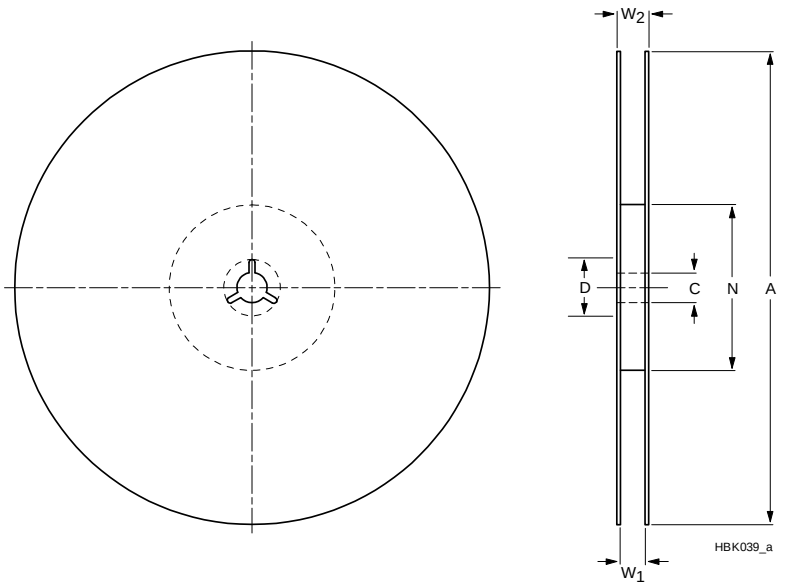

Fig. 17 Reel

Table 7 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	$W_{2\ MAX.}$
PE0100	20,000	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
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	5,000	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	5,000	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	4,000	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	4,000	---	7" (Ø178 mm)	---	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	12.3+1/-0	18.4
PE2512	4,000	---	7" (Ø178 mm)	---	180.0+0/-3	60.0+1/-0	13.0±0.2	21.0±0.8	12.3+1/-0	18.4
PE2817	4,000	---	---	13" (Ø330 mm)	330.0+0/-3	100.0±0.5	13.5±0.5	21.0±0.8	16.4+2.0/-0	22.4
PE4527	1,000	---	---	13" (Ø330 mm)	330.0+0/-3	100.0±0.5	13.5±0.5	21.0±0.8	24.4+2.0/-0	30.4

LEADER/TRAILER TAPE SPECIFICATION

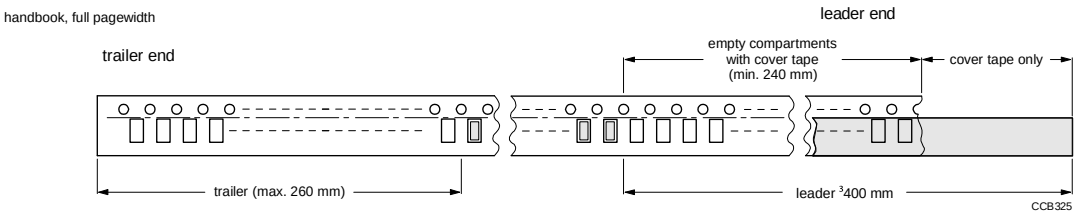

Fig.18 Leader/Trailer Tape

FOOTPRINT AND SOLDERING PROFILES

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

FOOTPRINT

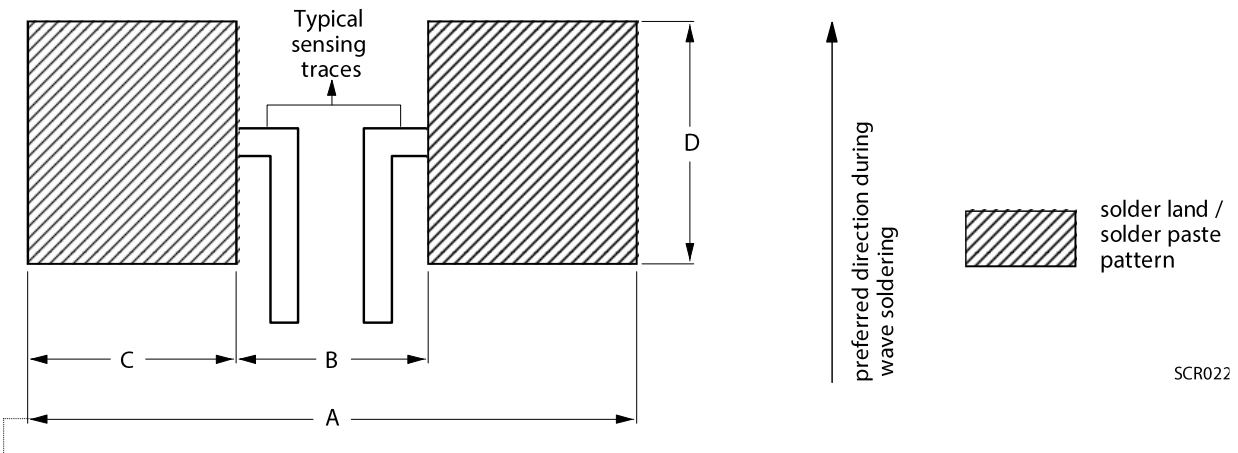

Fig. 19 Single resistor chips recommended dimensions of footprints

Table 8 Footprint dimensions

Unit: mm

SIZE	RESISTANCE RANGE	A	B	C	D
PE0100	100 mΩ ≤ R ≤ 1Ω	0.49~0.78	0.15~0.18	0.17~0.30	0.25~0.40
PE0201	50 mΩ ≤ R ≤ 1Ω	1.00	0.30	0.35	0.40
PE0402	10 mΩ ≤ R ≤ 1Ω	1.45	0.35	0.55	0.55
PE0603	5 mΩ ≤ R ≤ 1Ω	2.52	0.50	1.01	1.01
PE0805	5 mΩ ≤ R ≤ 1Ω	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
PE2817	20 mΩ ≤ R ≤ 910 mΩ	8.10	3.20	2.45	4.80
PE4527	5 mΩ	14.50	4.00	5.25	8.05
	6 mΩ ≤ R ≤ 120 mΩ	14.50	4.40	5.05	8.05

TESTS AND REQUIREMENTS

Table 9 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	0100 : ±(3%+0.0005 Ω) Others : ±(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: 0100/0201/0402 125±3 °C 0603 and above 170±3 °C	0100 : ±(3%+0.0005 Ω) Others : ±(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	0100/0201: ±(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	0100 : ±(2%+0.0005 Ω) Others : ±(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 0100 : 5mm 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.	0100/0201: ±(5%+0.0005 Ω) Others : ±(1.0%+0.0005 Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	IPC/JEDEC J-STD-002B test B	Electrical Test not required Magnification 50X SMD conditions: 1st step: method B, aging 4 hours at 155 °C dry heat 2nd step: leadfree solder bath at 245±3 °C Dipping time: 3±0.5 seconds	Well tinned (≥95% covered) 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 IEC 60115-14.18	Condition B, no pre-heat of samples Leadfree solder, 260 °C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	0100 : ±(1%+0.0005 Ω) Others : ±(0.5%+0.0005 Ω) No visible damage

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 13	Aug. 7, 2024	-	- Update PE2512 power rating (4W)
Version 12	Jul. 12, 2023	-	- Update PE4527 & PE2817 packing reel size information
Version 11	Mar. 24, 2023	-	- Extend PE0201, PE0402, PE0603 and PE0805's resistor range from 910 mΩ to 1Ω - Update the dimensions of reel specification - Add unit weight - Extend PE1206 & PE2010 power rating - PE2512 TCR range update
Version 10	Jan. 18, 2021	-	- Add rated power of PE2512 3W&5W - Add sizes of PE0100, PE2817 and PE4527
Version 9	Sep. 1, 2020	-	- Update dimensions of tape for PE0201 and PE1206
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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