Innovative Service Around the Globe YAGEO

DATA SHEET

SHUNT RESISTOR AUTOMOTIVE GRADE

PW series

5%, 1%

Sizes

2512/ 3921/ 5931

RoHS compliant & Halogen free



YAGEO

Product specification – September 6, 2024 V.1

SCOPE

This specification describes shunt resistor PW series made by welding technology.

APPLICATIONS

- Power
- Telecom base station
- Automotive (Headlight/ Window control/ Engine control unit/ Steering control…)
- Alternative energy

FEATURES

- AEC-Q200 qualified
- Moisture sensitivity level: MSL 1
- Total lead free without RoHS exemption
- Welding metal plate construction

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

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

(1) SIZE

2512/ 3921/ 5931

(2) TOLERANCE

F = ±1% J = ±5%

(3) PACKAGING TYPE

K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

E = ±50 ppm/°C
M = ±75 ppm/°C
F = ±100 ppm/°C
L = ±150 ppm/°C
N = ±175 ppm/°C
G = ±200 ppm/°C
H = ±225 ppm/°C
I = ±300 ppm/°C

(5) TAPING REEL

13 = 13 inch Dia. reel (7 inch Dia. reel for 2512), standard power, 3W for 2512, 3921 and 5931, 5W
P4 = 4W, 13 inch Dia. Reel (7 inch Dia. reel for 2512)
P5 = 5W, 13 inch Dia. Reel (7 inch Dia. reel for 2512)
P6 = 6W, 13 inch Dia. Reel (7 inch Dia. reel for 2512)
P7 = 7W, 13 inch Dia. Reel
P8 = 8W, 13 inch Dia. Reel
P9 = 9W, 13 inch Dia. Reel
PA = 10W, 13 inch Dia. Reel
PC = 12W, 13 inch Dia. Reel
PB = 15W, 13 inch Dia. Reel

(6) RESISTANCE VALUE

0.1mΩ to 5mΩ
There are 3~5 digits indicated the resistance value. Letter R/ U 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
0UX	0U2 = 0.2 mΩ

ORDERING EXAMPLE

The ordering code of a PW3921, value 0.0005Ω with ±1% tolerance, 9W and TCR 75 ppm supplied in 13-inch tape reel is : PW3921FKMP90U5L

NOTE

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

MARKING

PW2512

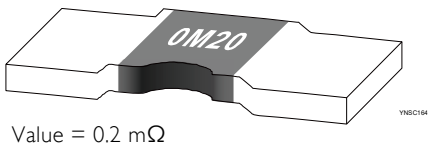


Fig. 1 Value = 0.2 mΩ

The "R" and "M" are used as a decimal point.

If resistance value is round number, the decimal code is "R".

If it is not round number, such as 0.2mΩ or 1.5mΩ etc, the decimal code is "M".

The other 3 digits are significant and the unit is milliohm

PW3921/5931

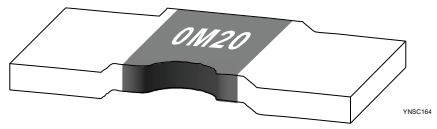


Fig. 2 Value = 0.2 mΩ

The "R" and "M" are used as a decimal point.

If resistance value is round number, the decimal code is "R".

If it is not round number, such as 0.2mΩ or 1.5mΩ etc, the decimal code is "M".

The other 3 digits are significant and the unit is milliohm

OUTLINES AND DIMENSION

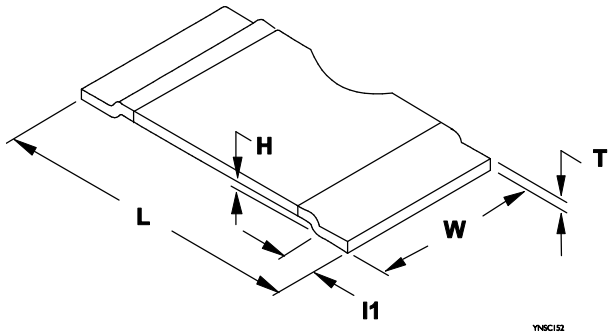


Fig. 3 Chip resistor outlines

Table 1 For outlines, please refer to Fig. 3

TYPE		L (mm)	W (mm)	H (mm)	l1 (mm)
PW2512		6.35±0.25	3.18±0.25	0.45±0.15	1.14±0.25
PW3921	0.1mR	10.0±0.25	5.20±0.25	0.50±0.15	3.30±0.25
	others				2.00±0.25
PW5931		15.0±0.25	7.60±0.25	0.50±0.15	4.00±0.25

Table 2

Resistance Value		0.1mΩ	0.2mΩ	0.25mΩ	0.3mΩ	0.4mΩ	0.5mΩ	0.7 mΩ	1 mΩ	1.5 mΩ	2 mΩ	3 mΩ	4 mΩ	5 mΩ
T (mm) Thickness	PW2512	---	---	---	0.95±0.13	0.75± 0.13	0.84±0.13	---	0.43±0.13	---	0.66±0.13	0.44±0.13	0.33±0.13	0.31±0.13
	PW3921	1.42±0.13	1.35±0.13	1.05±0.13	1.35±0.13	1.05 ±0.13	0.86±0.13	0.60±0.13	0.43±0.13	0.92±0.13	0.72±0.13	0.48±0.13	0.36±0.13	0.25±0.13
	PW5931	1.42±0.13	1.33±0.13	---	1.00±0.13	---	0.60±0.13	---	0.33±0.13	---	0.49±0.13	0.33±0.13	0.25±0.13	---

Remark: The thickness of products can be counted by H dimension + T dimension (mm) ± Tolerance 0.28 (mm)

ELECTRICAL CHARACTERISTICS

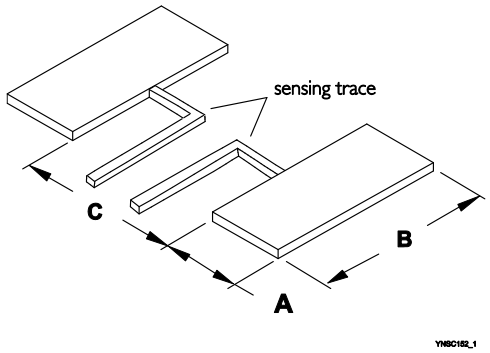


Fig. 4 Solder pad dimensions

Note: Series resistors are suitable for IR reflow soldering

Table 3 For outlines, please refer to Fig. 4

TYPE		A (mm)	B (mm)	C (mm)
PW2512		1.80±0.15	3.40±0.15	3.40±0.13
PW3921	0.1mΩ	3.96±0.25	6.20±0.25	3.76±0.13
	> 0.1mΩ	2.75±0.25	6.20±0.25	5.60±0.13
PW5931		5.20±0.25	8.75±0.25	5.60±0.13

Table 4

SIZE	POWER RATING[4]	OPERATING TEMP. RANGE	RESISTANCE RANGE	TOLERANCE[2]	TEMPERATURE COZEFFICIENT OF RESISTANCE[3]
PW2512	3W(13) 4W(P4)	-65°C to 170°C	0.3/ 0.4/ 0.5/ 1 / 2 / 3 / 4/ 5mΩ	±1% (F) ± 5% (J)	±200ppm/°C (G): 0.3mΩ ±175ppm/°C (N): 0.4/0.5/1mΩ ±75ppm/°C (M) ±50ppm/°C (E): ≧2mΩ
	5W(P5)		0.3/ 0.4/ 0.5/1/ 2mΩ		
	6W(P6)		0.3/ 0.4/ 0.5/1mΩ		
PW3921	3W(13) 5W(P5)	-65°C to 170°C	0.1/ 0.2/ 0.25/ 0.3/ 0.4/ 0.5/ 0.7mΩ 1/ 1.5/ 2 / 3/ 4/ 5mΩ	±1% (F) ± 5% (J)	±300ppm/°C (I): 0.1mΩ ±175ppm/°C (N): 0.2mΩ ±150ppm/°C (L): 0.3/0.4mΩ ±75ppm/°C (M): ≧0.5mΩ ±50ppm/°C (E): ≧1mΩ
	6W(P6)		0.1/ 0.2 / 0.25/ 0.3/ 0.4/ 0.5/ 0.7mΩ 1/ 1.5/ 2mΩ		
	8W(P8) 9W(P9)		0.1/ 0.2/ 0.25/ 0.3/ 0.4/ 0.5/ 0.7/ 1mΩ		
	10W(PA) 12W(PC)		0.1/ 0.2 / 0.25/ 0.3/ 0.4/ 0.5mΩ		
PW5931	5W(13)	-65°C to 170°C	0.1/ 0.2/ 0.3/ 0.5mΩ 1 / 2 / 3 / 4mΩ	±1% (F) ± 5% (J)	±300ppm/°C (I): 0.1mΩ ±150ppm/°C (L): 0.2mΩ ±100ppm/°C (F): ≧0.3mΩ ±75ppm/°C (M): ≧1mΩ ±50ppm/°C (E): ≧2mΩ
	7W(P7)		0.1/ 0.2/ 0.3/ 0.5mΩ 1 / 2 / 3mΩ		
	9W(P9)		0.1/ 0.2/ 0.3/ 0.5mΩ 1mΩ		
	10W(PA)		0.1/ 0.2/ 0.3/ 0.5mΩ		
	15W(PB)		0.1/ 0.2mΩ		

Note: 1. Please contact with sales offices, distributors, and representatives in your region before ordering.
2. Global part number (code7)
3. Global part number (code 9)
4. Global part number (code 10-11) The shunt resistors' rated power is highly related to the combinate heat equivalent from PCB and resistance element. It is recommended to consider design principles such as larger pad surfaces, increasing copper weights, etc., to keep the terminal under its thermal limit.

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

Temperature Range is
-65°C to +170°C (Fig.5)

POWER RATING

Standard rated power at 70°C:

PW2512 = 3W
PW3921 = 3W
PW5931 = 5W

For detail power value, please refer to Table 4.

RATED VOLTAGE

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

$$V = \sqrt{(PxR)}$$

or max. working voltage whichever is less
Where

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

P = Rated power (W)

R = Resistance value (Ω)

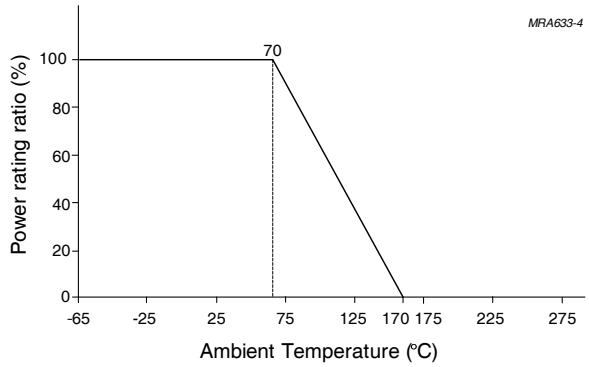


Fig. 5 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating terminal temperature ($T_{amb.}$)

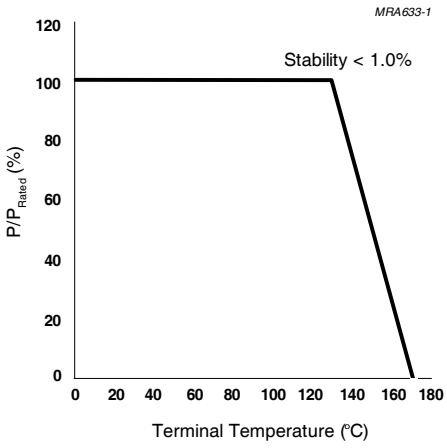


Fig. 6 Stability Performance

PACKING STYLE AND PACKAGING QUANTITY

Table 5 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	2512	3921	5931
Embossed taping reel (K)	7" (178 mm)	0.3~0.5, 2mR 2500pcs 1,3,4,5 4000pcs	---	---
	13" (330 mm)	---	0.1 2000 0.2~0.4 2500 >0.4 3000	0.1~0.3 2000 >0.3 2500

EMBOSSED TAPE

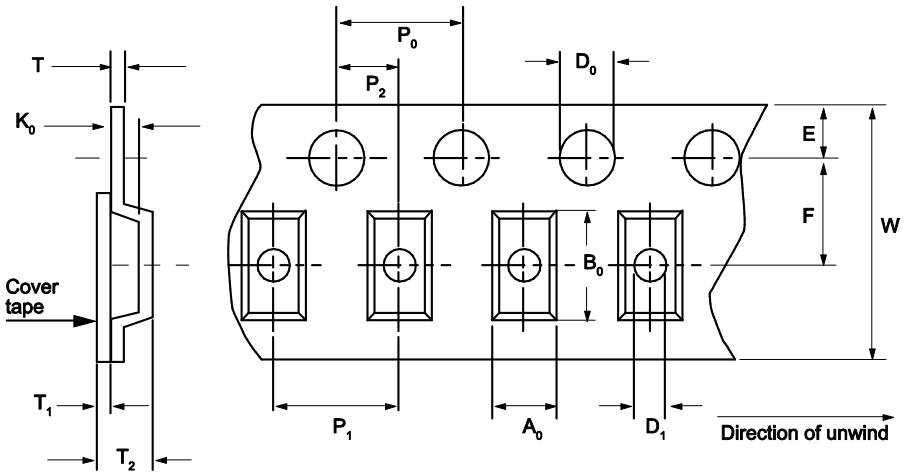


Fig. 7 Embossed Tape

Table 6 Dimensions of embossed tape for relevant chip resistors size

DIMENSION	A0	B0	D0	D1 MIN.	E	F	K0 MAX.	P0	P1	P2	T1 MAX.	T2 MAX.	T MAX.	W MAX.
PW2512														
0.3/ 0.4/ 0.5/ 2mΩ	3.58±0.1	6.70±0.1	1.5±0.1	1.45	1.75±0.1	5.5±0.1	1.75	4±0.1	4±0.1	2±0.1	0.1	1.92	0.30	12.3
1/ 3/ 4/ 5mΩ	3.58±0.1	6.70±0.1	1.5±0.1	1.45	1.75±0.1	5.5±0.1	1.25	4±0.1	4±0.1	2±0.1	0.1	1.54	0.30	12.3
PW3921														
0.1mΩ	5.80±0.1	10.41±0.1	1.5±0.1	1.45	1.75±0.1	11.5±0.1	2.4	4±0.1	12±0.1	2±0.1	0.1	2.7	0.41	24.3
0.2/ 0.25/ 0.3/ 0.4mΩ	5.59±0.1	10.41±0.1	1.5±0.1	1.45	1.75±0.1	11.5±0.1	2.13	4±0.1	12±0.1	2±0.1	0.1	2.64	0.41	24.3
0.5/ 0.7/1/1.5/2/3/4/5mΩ	5.59±0.1	10.41±0.1	1.5±0.1	1.45	1.75±0.1	11.5±0.1	1.6	4±0.1	12±0.1	2±0.1	0.1	1.9	0.41	24.3
PW5931														
≦0.3mΩ	8.3±0.1	15.62±0.1	1.5±0.1	1.45	1.75±0.1	11.5±0.1	2.7	4±0.1	12±0.1	2±0.1	0.1	3.0	0.41	24.3
≧0.5mΩ	8.3±0.1	15.62±0.1	1.5±0.1	1.45	1.75±0.1	11.5±0.1	1.6	4±0.1	12±0.1	2±0.1	0.1	1.9	0.41	24.3

Unit : mm

REEL SPECIFICATION

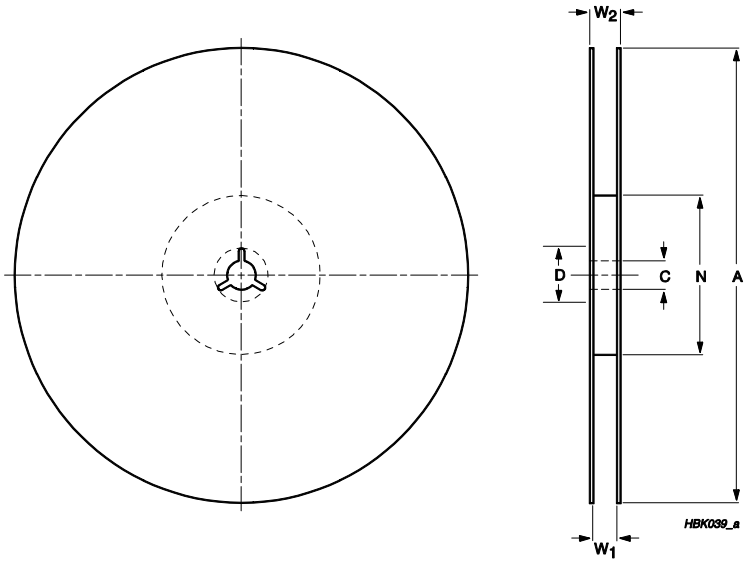


Fig. 8

Table 7 Dimensions of reel specification for relevant chip resistors size; see Fig. 8

PRODUCT SIZE CODE	REEL SIZE	SYMBOL					
		A	N	C	D	W1	W2 max.
PW2512	7" (Φ178mm)	178±2	60±1	13.5±0.5	21±0.8	13.6±0.5	17.5
PW3921	13" (Φ330mm)	330+0 /-3	100±2	13.5±0.5	21±0.8	24.4+2.0/-0	30.4
PW5931	13" (Φ330mm)	330+0 /-3	100±2	13.5±0.5	21±0.8	24.4+2.0/-0	30.4

Unit : mm

TESTS AND REQUIREMENTS

Table 8 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Short Time Overload	IEC 60115-1 8.1	5 times of rated power for 5 seconds at room temperature	±(1%+0.0005 Ω) No visible damage
High Temperature Exposure	MIL-STD-202 method 108 IEC 60068-2-2	1,000 hours at maximum operating temperature depending on specification, unpowered,	±(1%+0.0005 Ω)
Temperature Cycling	JESD22-A104	-55/+155°C, 1000 cycles Dwell time is 15 minutes. Devices mounted Air – Air.	±(1%+0.0005 Ω)
Biased Humidity	MIL-STD-202 method 103	1,000 hours; 85 °C / 85% RH 10% of operating power	±(1%+0.0005 Ω)
Life/ Operational Life/ Endurance	MIL-STD-202 method 108 IEC 60115-1 7.1	1,000 hours at 70 °C applied rated power 1.5 hours on, 0.5 hour off, still air required	±(1%+0.0005 Ω)
Resistance to Soldering Heat	MIL-STD-202 method 210	Specimen passed 3 times reflow temperature at 260°C, with solder.	±(0.5%+0.0005 Ω) No visible damage
Board Flex / Bending	AEC-Q200-005	Chips mounted on a glass epoxy resin PCB (FR4) Bending: 2 mm Holding time: minimum 60 seconds	±(1%+0.0005 Ω)
Vibration	MIL-STD-202 method 204	5 g's for 20 min., 12 cycles each of 3 orientations Test from 10-2000 Hz	±(1%+0.0005 Ω)

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 1	Sep. 6, 2024	-	- PW3921 range extend to 0.1mR
Version 0	Aug. 2, 2024	-	- First issue of this specification

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