

# DATA SHEET

## SHUNT RESISTOR

PU series

5%, 1%

sizes

2512/ 3921/ 5931

RoHS compliant & Halogen free



**SCOPE**

This specification describes shunt resistor PU series with lead-free terminations made by welding technology.

**APPLICATIONS**

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

**FEATURES**

- AEC-Q200 qualified
- Resistance value down to 0.0001Ω and high power up to 15W
- 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**

PU 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**

M = ±75 ppm/°C

N = ±175 ppm/°C

G = ±200 ppm/°C

H = ±225 ppm/°C

I = ± 300 ppm/°C

O = ±325 ppm/°C

**(5) TAPING REEL**

I3 = 13 inch Dia. reel, standard power, 4W for 2512, 3W for 3921 and 5W for 5931

P5 = 5W, 13 inch Dia. reel

P6 = 6W, 13 inch Dia. Reel

P7 = 7W, 13 inch Dia. reel

P9 = 9W, 13 inch Dia. reel

T3 = 3W, High temperature 13 inch Dia. reel

T5 = 5W, High temperature 13 inch Dia. reel

PA = 10W, 13 inch Dia. Reel

PB = 15W, 13 inch Dia. reel

**(6) RESISTANCE VALUE**

0.1 mΩ to 5 mΩ

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)

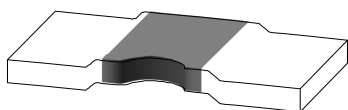
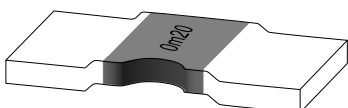
Resistance rule of global part number	
Resistance code rule	Example
0RXXX	0R001 = 1 mΩ
0UX	0U2 = 0.0002 Ω

**ORDERING EXAMPLE**

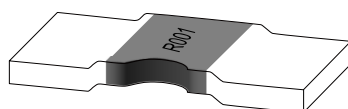
The ordering code of a PU3921, value 0.0005Ω with ±1% tolerance, 3W and high temperature(275°C) supplied in 13-inch tape reel is :  
PU3921FKNT30U5L

**NOTE**

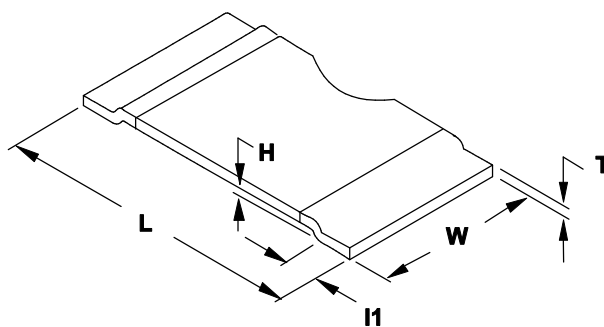
1. All our RSMD products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead-Free Process"

**MARKING****PU2512****No marking****Fig. 1** Value =  $0.2\text{m}\Omega$ **PU3921/ 5931 -  $0.1\sim 0.7\text{m}\Omega$** **4 digits**

The "m" is used as a decimal point ; the other 3 digits are significant and the unit is milliohm

 $0.1\text{m}\Omega$  to  $0.7\text{m}\Omega$ **Fig. 2** Value =  $0.2\text{m}\Omega$ **PU3921/ 5931 -  $1\sim 5\text{m}\Omega$** **4 digits**

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

 $1\text{m}\Omega$  to  $5\text{m}\Omega$ **Fig. 3** Value =  $1\text{m}\Omega$ **OUTLINES AND DIMENSION****Fig. 4-I** Chip resistor outlines**Table I-I** For outlines, please refer to Fig. 3-I

TYPE	L (mm)	W (mm)	H (mm)	I1 (mm)
PU2512	$6.35\pm 0.25$	$3.18\pm 0.25$	$0.35\pm 0.15$	$1.14\pm 0.25$
PU3921	$10.0\pm 0.25$	$5.20\pm 0.25$	$0.50\pm 0.13$	$2.00\pm 0.25$
PU5931	$15.0\pm 0.25$	$7.75\pm 0.25$	$0.50\pm 0.13$	$4.00\pm 0.25$

Resistance Value	$0.1\text{m}\Omega$	$0.2\text{m}\Omega$	$0.25\text{m}\Omega$	$0.3\text{m}\Omega$	$0.4\text{m}\Omega$	$0.5\text{m}\Omega$	$0.7\text{m}\Omega$	$1\text{m}\Omega$	$2\text{m}\Omega$	$3\text{m}\Omega$	$4\text{m}\Omega$	$5\text{m}\Omega$
T (mm)												
Thickness												
PU2512	---	---	---	$0.95\pm 0.13$	---	$0.84\pm 0.13$	---	$0.43\pm 0.13$	$0.66\pm 0.13$	$0.44\pm 0.13$	$0.33\pm 0.13$	$0.31\pm 0.13$
PU3921	---	$1.35\pm 0.13$	$1.05\pm 0.10$	$1.35\pm 0.13$	$1.05\pm 0.13$	$0.86\pm 0.13$	$0.60\pm 0.10$	$0.43\pm 0.13$	$0.72\pm 0.13$	$0.48\pm 0.13$	$0.36\pm 0.13$	$0.25\pm 0.13$
PU5931	$1.42\pm 0.13$	$1.33\pm 0.13$	---	$1.00\pm 0.13$	---	$0.60\pm 0.13$	---	$0.33\pm 0.13$	$0.49\pm 0.13$	$0.33\pm 0.13$	$0.25\pm 0.13$	---

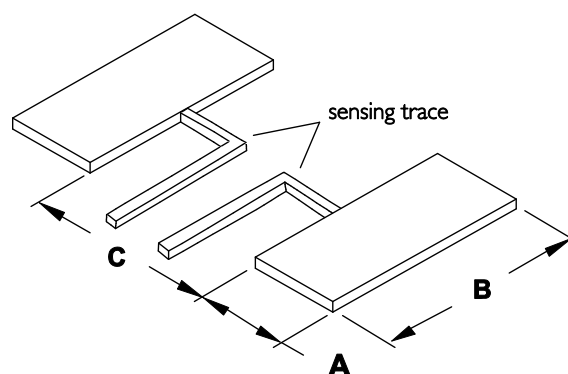


Fig. 4-2 Solder pad dimensions

Note: Series resistors are suitable for IR reflow soldering

Table 1-2 For outlines, please refer to Fig. 4-2

TYPE	A (mm)	B (mm)	C (mm)
PU2512	1.80±0.15	3.40±0.15	3.40±0.13
PU3921	2.75±0.25	6.20±0.25	5.60±0.13
PU5931	5.20±0.25	8.75±0.25	5.60±0.13

Table 2

## ELECTRICAL CHARACTERISTICS

SIZE	POWER RATING	OPERATING TEMP. RANGE	RESISTANCE RANGE	TOLERANCE	TEMPERATURE COEFFICIENT OF RESISTANCE
PU2512	4W		3/ 4/ 5mΩ		
	5W	-65°C to 170°C	1/ 2mΩ	±1%, ±5%	0.3/ 0.5mΩ: ±200ppm/°C 1mΩ: ±175ppm/°C 2~5mΩ: ±75ppm/°C
	6W		0.3/ 0.5mΩ		
PU3921	3W		0.2/ 0.25/ 0.3/ 0.4/ 0.5/ 0.7mΩ 1/ 2/ 3/ 4/ 5mΩ		0.2/ 0.25/ 0.3/ 0.4/ 0.5/ 0.7mΩ: ±175ppm/°C 1~5mΩ: ±75ppm/°C
	5W	-65°C to 170°C	0.2/ 0.25/ 0.3/ 0.4/ 0.5/ 0.7mΩ 1/ 2/ 3/ 4/ 5mΩ	±1%, ±5%	0.2mΩ: ±325ppm/°C 0.2/ 0.25/ 0.3/ 0.4/ 0.5/ 0.7mΩ: ±175ppm/°C 1~5mΩ: ±75ppm/°C
	9W		0.2/ 0.25/ 0.3/ 0.4/ 0.5/ 0.7/ 1mΩ		
	3W	-65°C to 275°C	0.5/ 1/ 2/ 3/ 4mΩ		0.5mΩ: ±175ppm/°C 1~4mΩ: ±75ppm/°C
PU5931	5W		0.2/ 0.3/ 0.5/ 1/ 2/ 3/ 4mΩ		0.2mΩ: ±225ppm/°C 0.3/ 0.5mΩ: ±175ppm/°C 1~4mΩ: ±75ppm/°C
	7W	-65°C to 170°C	0.2/ 0.3/ 0.5/ 1/ 2/ 3/ 4mΩ		0.1mΩ: ±300ppm/°C 0.2mΩ: ±225ppm/°C 0.3/ 0.5mΩ: ±175ppm/°C 1~4mΩ: ±75ppm/°C
	10W		0.2/ 0.3/ 0.5mΩ	±1%, ±5%	
	15W		0.1mΩ		
	5W	-65°C to 275°C	0.3/ 0.5/ 1/ 2/ 3/ 4mΩ		0.3/ 0.5mΩ: ±175ppm/°C 1~4mΩ: ±75ppm/°C

Note: Please contact with sales offices, distributors and representatives in your region before ordering.

## FUNCTIONAL DESCRIPTION

### OPERATING TEMPERATURE RANGE

High Temperature Range Type:

-65°C to +275°C (Fig. 5-1)

Normal Temperature Range Type:

-65°C to +170°C (Fig. 5-2)

### POWER RATING

Standard rated power at 70°C:

PU2512 = 4W

PU3921 = 3W

PU5931 = 5W

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 ( $\Omega$ )

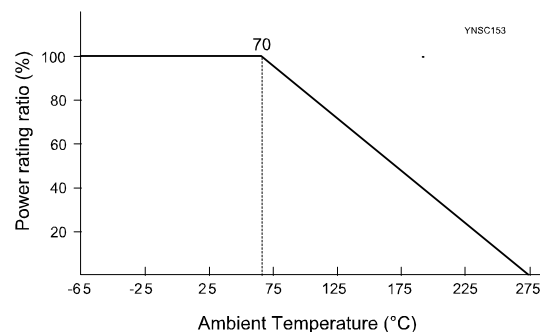


Fig. 5-1 Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{amb}$ )

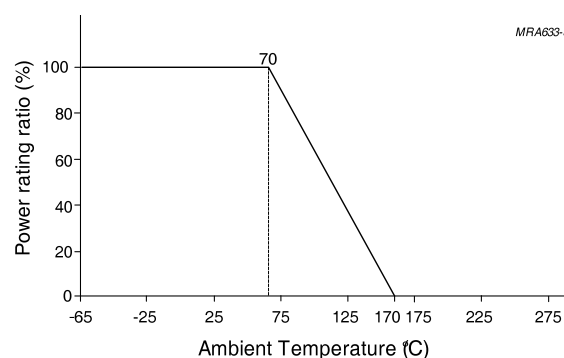


Fig. 5-2 Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{amb}$ )

**PACKING STYLE AND PACKAGING QUANTITY**

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL DIMENSION	2512	3921	5931
Embossed taping reel (K)	13" (330 mm)	4,000	3,000	1,500

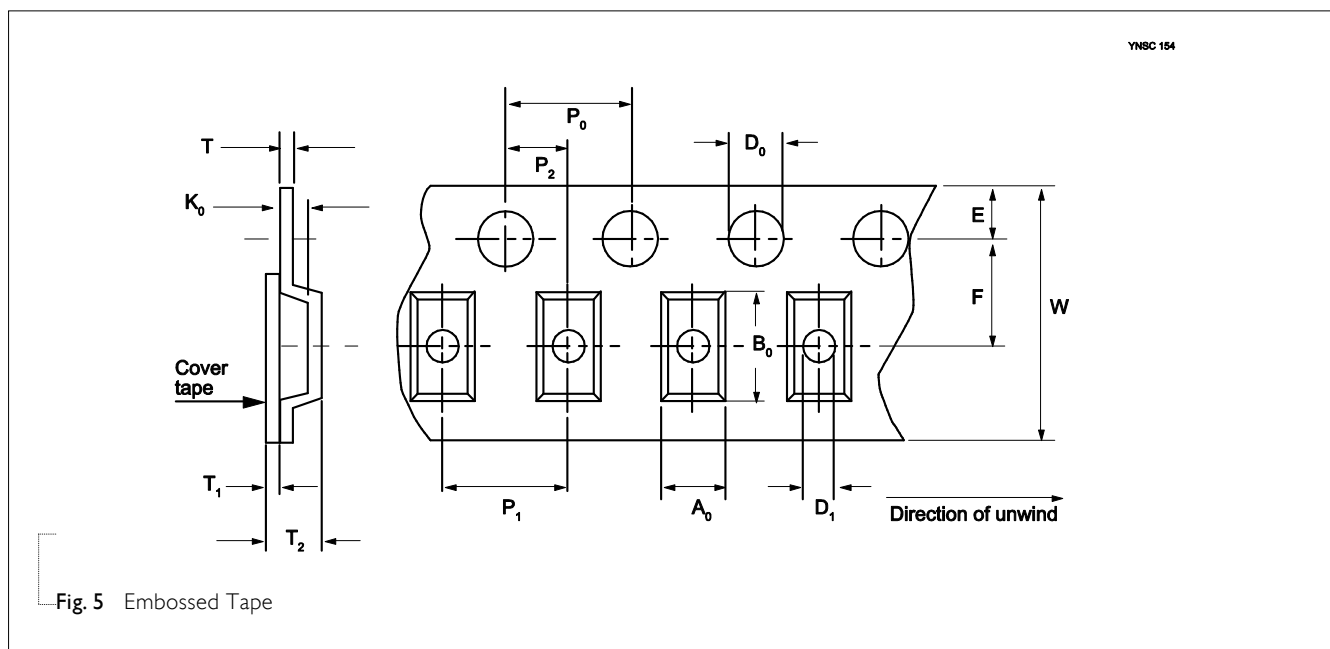
**EMBOSSED TAPE**

Fig. 5 Embossed Tape

Table 4 Dimensions of embossed tape for relevant chip resistors size

DIMENSION	$A_0$	$B_0$	$D_0$	$D_1$	$E$	$F$	$K_0$	$P_0$	$P_1$	$P_2$	$T_1$	$T_2$	$T$	$W$ MAX.
			MIN.				MAX.				MAX.	MAX.	MAX.	
<b>PU2512</b>														
0.3 / 0.5 / 2m $\Omega$	3.58±0.1	6.7±0.1	1.5±0.1	1.5	1.75±0.1	5.5±0.1	1.52	4±0.1	8±0.1	2±0.1	0.1	1.92	0.3	12.3
1 / 3 / 4 / 5m $\Omega$	3.58±0.1	6.7±0.1	1.5±0.1	1.5	1.75±0.1	5.5±0.1	1.14	4±0.1	8±0.1	2±0.1	0.1	1.54	0.3	12.3
<b>PU3921</b>														
0.2 / 0.25 / 0.3 / 0.4 / 0.5 / 0.7 / 2m $\Omega$	5.59±0.1	10.41±0.1	1.5±0.1	1.5	1.75±0.1	7.5±0.1	2.13	4±0.1	8±0.1	2±0.1	0.1	2.64	0.41	16.3
1 / 3 / 4 / 5m $\Omega$	5.59±0.1	10.41±0.1	1.5±0.1	1.5	1.75±0.1	7.5±0.1	1.14	4±0.1	8±0.1	2±0.1	0.1	1.65	0.41	16.3
<b>PU5931</b>														
≤0.3m $\Omega$	8.3±0.1	15.62±0.1	1.5±0.1	1.5	1.75±0.1	11.5±0.1	2.39	4±0.1	12±0.1	2±0.1	0.1	2.9	0.41	24.3
≥0.5m $\Omega$	8.3±0.1	15.62±0.1	1.5±0.1	1.5	1.75±0.1	11.5±0.1	1.22	4±0.1	12±0.1	2±0.1	0.1	1.73	0.41	24.3

Unit : mm

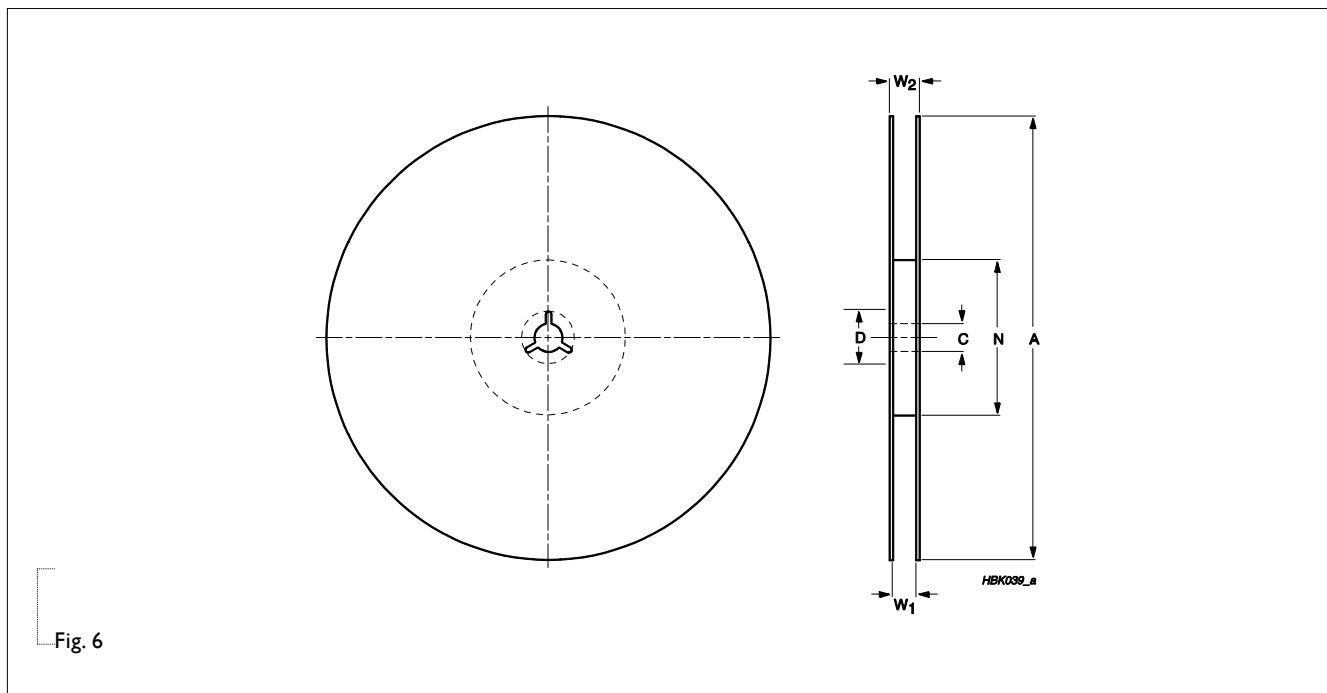
**REEL SPECIFICATION**


Table 5 Dimensions of reel specification for relevant chip resistors size; see Fig. 6

PRODUCT SIZE CODE	REEL SIZE	SYMBOL					
		A	N	C	D	W1	W2 max.
2512	13" ( $\Phi$ 330mm)	330+0 /-3	100±0.5	13.5±0.5	21±0.8	13±0.3	17.5
3921	13" ( $\Phi$ 330mm)	330+0 /-3	100±0.5	13.5±0.5	21±0.8	16.4+2.0/-0	22.4
5931	13" ( $\Phi$ 330mm)	330+0 /-3	100±0.5	13.5±0.5	21±0.8	24.4+2.0/-0	30.4

Unit : mm

**TESTS AND REQUIREMENTS**

Table 6 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Short Time Overload	IEC60115-1 4.13	5 times of rated power for 5 seconds at room temperature	$\pm(1\%+0.0005\ \Omega)$ No visible damage
High Temperature Exposure	AEC-Q200 Test 3 MIL-STD-202 method 108A IEC 60115-1 4.25.3	1,000 hours at maximum operating temperature depending on specification, unpowered, Normal Temperature Range Type: $170\pm3^{\circ}\text{C}$ High Temperature Range Type: $275\pm5^{\circ}\text{C}$	$\pm(1\%+0.0005\ \Omega)$
Moisture Resistance	AEC-Q200 Test 6 MIL-STD-202 method 106F	Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d with $25^{\circ}\text{C}$ / $65^{\circ}\text{C}$ 95% R.H, without steps 7a & 7b, unpowered Parts mounted on test-boards, without condensation on parts Measurement at $24\pm2$ hours after test conclusion	$\pm(1\%+0.0005\ \Omega)$
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 method 103	1,000 hours; $85^{\circ}\text{C}$ / 85% RH 10% of operating power Measurement at $24\pm4$ hours after test conclusion.	$\pm(1\%+0.0005\ \Omega)$
Life/ Operational Life/ Endurance	AEC-Q200 Test 8 MIL-STD-202 method 108A IEC 60115-1 4.25.1	1,000 hours at $70\pm5^{\circ}\text{C}$ applied RCWV 1.5 hours on, 0.5 hour off, still air required	$\pm(1\%+0.0005\ \Omega)$
- Resistance to Soldering Heat	AEC-Q200 Test 15 MIL-STD-202 method 210F IEC 60115-1 4.18	Condition B, no pre-heat of samples Lead free solder, $260^{\circ}\text{C}$ , 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	$\pm(0.5\%+0.0005\ \Omega)$ No visible damage
Thermal Shock	AEC-Q200 Test 16 MIL-STD-202 method 107	$-55/+150^{\circ}\text{C}$ Number of cycles is 300. Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	$\pm(1\%+0.0005\ \Omega)$ No visible damage
Board Flex / Bending	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4) Bending: 2 mm Holding time: minimum 60 seconds	$\pm(1\%+0.0005\ \Omega)$



**REVISION HISTORY**

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 6	Apr. 03, 2019	-	- Extend resistor value for 3921
Version 5	Jun. 28, 2018	-	- Update packing quantity for PU2512
Version 4	Nov. 23, 2017	-	- Added in PU2512
Version 3	May 24, 2017	-	- Added in thickness for 3921 0.4mΩ
Version 2	Jan. 16, 2017	-	- Extend resistor value
Version 1	Jun. 15, 2016	-	- Extend resistor value
Version 0	Mar. 16, 2016	-	- New datasheet for shunt resistor PU series

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