

APPROVAL SHEET

TTU25

$\pm 5\%$, $\pm 1\%$

**Ultra Low TCR / High Power
Current Sensor**

Size: 2512



*Contents in this sheet are subject to change without prior notice.

FEATURES

1. High Power rating in Small package size 2512 with Low TCR 50 ppm/°C
2. Extra low Resistance down to 0.001Ω with High Power Rating 3W
3. 170°C Operating Temperature Certainly .
4. Suitable for Lead Free Soldering .

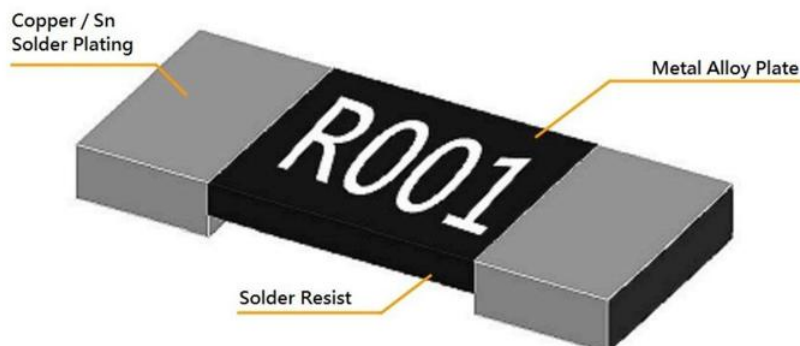
APPLICATIONS

- Current sensor
- Medical equipment
- Measuring instrument
- Communication device
- Power supply
- Computer
- White Good

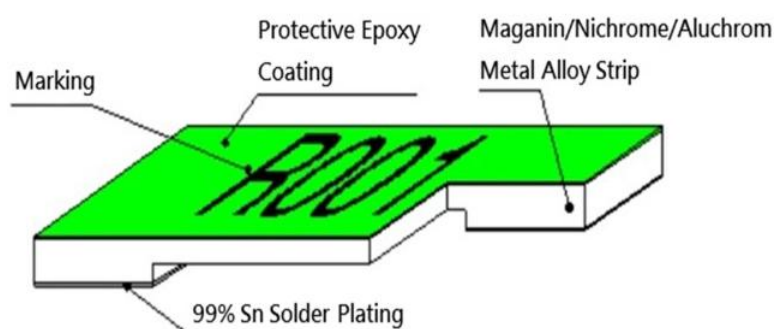
DESCRIPTION

This specification describes TTU series current sensor – Extra high power and low TCR with lead-free terminations made by metal alloy plate.

■ High power (TTU25,100PPM)



■ Ultra Low TCR /High Power (TTU 25, 50ppm)



Quick Reference Data

■ High Power

Series	Size Code	Operating Temperature	Functional code		Resistance Range (mΩ)	Resistance Tolerance
			Power	TCR		
			S	P		
TTU	2512 (6342)	-55°C to +155°C	3W	100ppm/°C	1	±1% ±5%

■ Ultra Low TCR /High Power

Series	Size Code	Operating Temperature	Functional code				Resistance Range (mΩ)	Resistance Tolerance
			Power			TCR		
			Q	R	S	N		
TTU	2512 (6342)	-55°C to +170°C			3W	50ppm/°C	1, 1.5, 2, 2.5, 3, 3.5	±1%
				2.5W			4, 4.5, 5, 6	±5%
			2W				6.5, 7, 7.5, 8, 9, 10	

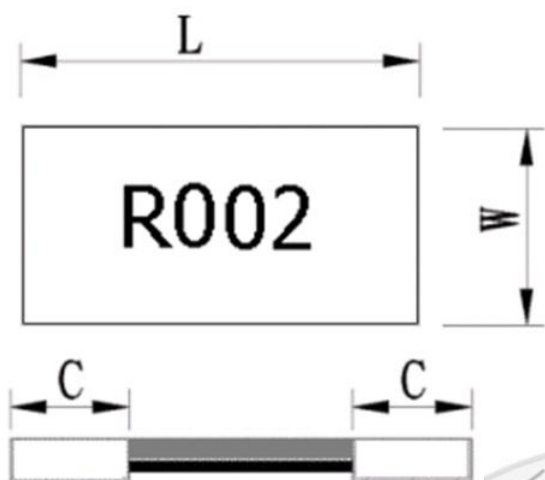
Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see “IEC publication 60115-8”
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$$

DIMENSIONS:(unit:mm)

2512



■ High Power :

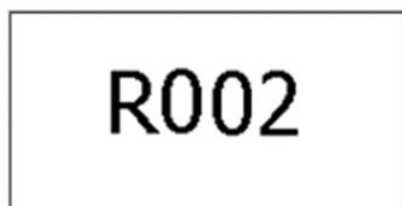
Type	Resistance Range (mΩ)	L(mm)	W(mm)	C(mm)
TTU2512	1	6.40±0.25	3.20±0.25	2.65±0.25

■ Ultra Low TCR /High Power :

Type	Resistance Range (mΩ)	L(mm)	W(mm)	C(mm)
TTU2512	1	6.35±0.25	3.0±0.2	1.93±0.25
TTU2512	1.5	6.35±0.25	3.0±0.2	1.43±0.25
TTU2512	2, 2.5, 3, 3.5	6.35±0.25	3.0±0.2	1.18±0.25
TTU2512	4, 4.5	6.35±0.25	3.0±0.2	2.18±0.25
TTU2512	5, 6	6.35±0.25	3.0±0.2	1.93±0.25
TTU2512	6.5, 7, 7.5	6.35±0.25	3.0±0.2	1.43±0.25
TTU2512	8, 9, 10	6.35±0.25	3.0±0.2	1.18±0.25

Marking

2512(4 digits)



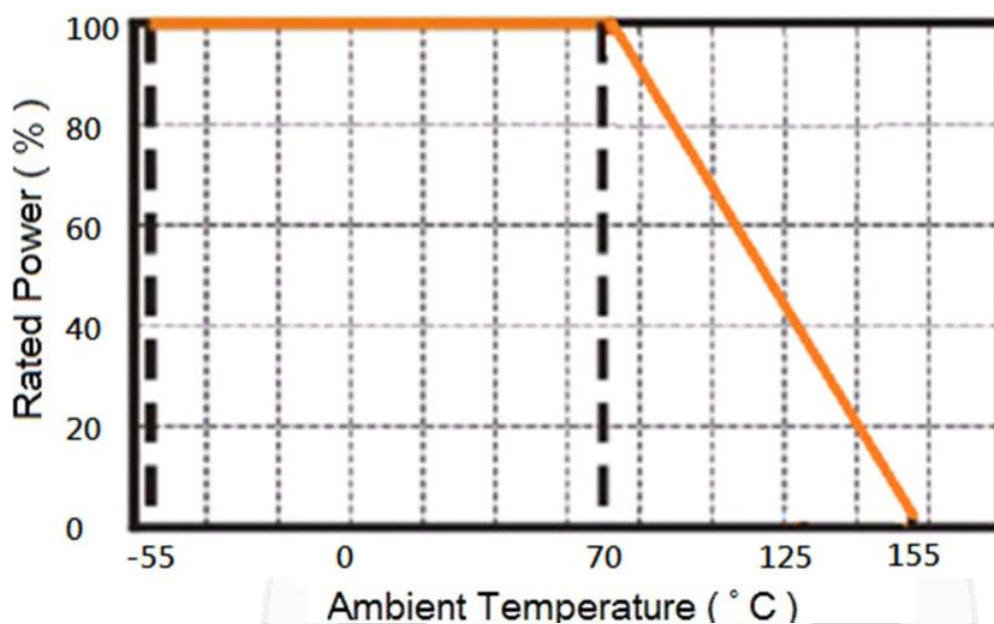
R002=2mR

FUNCTIONAL DESCRIPTION

DERATING

The power that the resistor can dissipate depends on the operating temperature; see Fig2

■ High Power :



■ Ultra Low TCR /High Power :

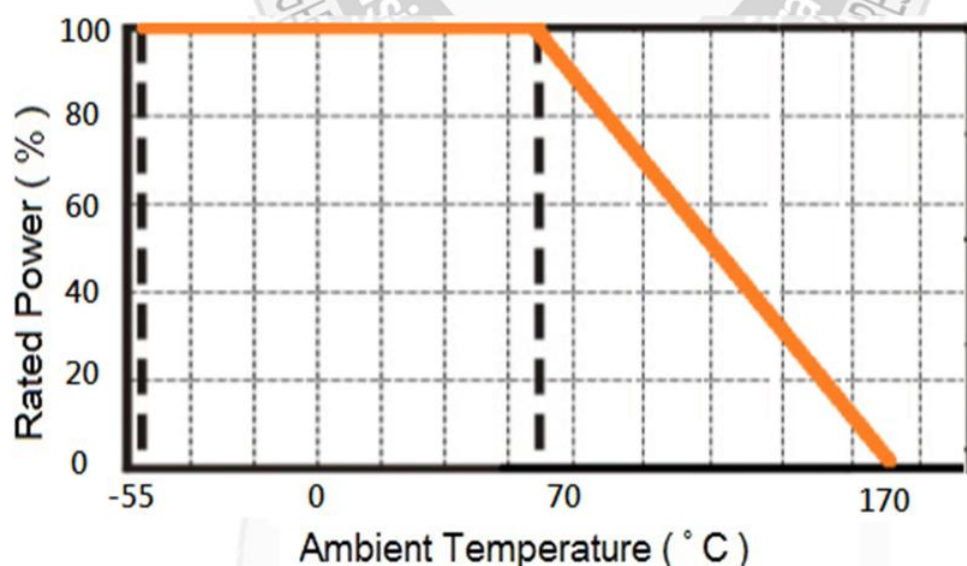


Fig.2 Maximum dissipation in percentage of rated power
As a function of the ambient temperature

MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds within lead-free solder bath. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering profile and condition that provide reliable joints without any damage are given in Fig 3. and Table 1.

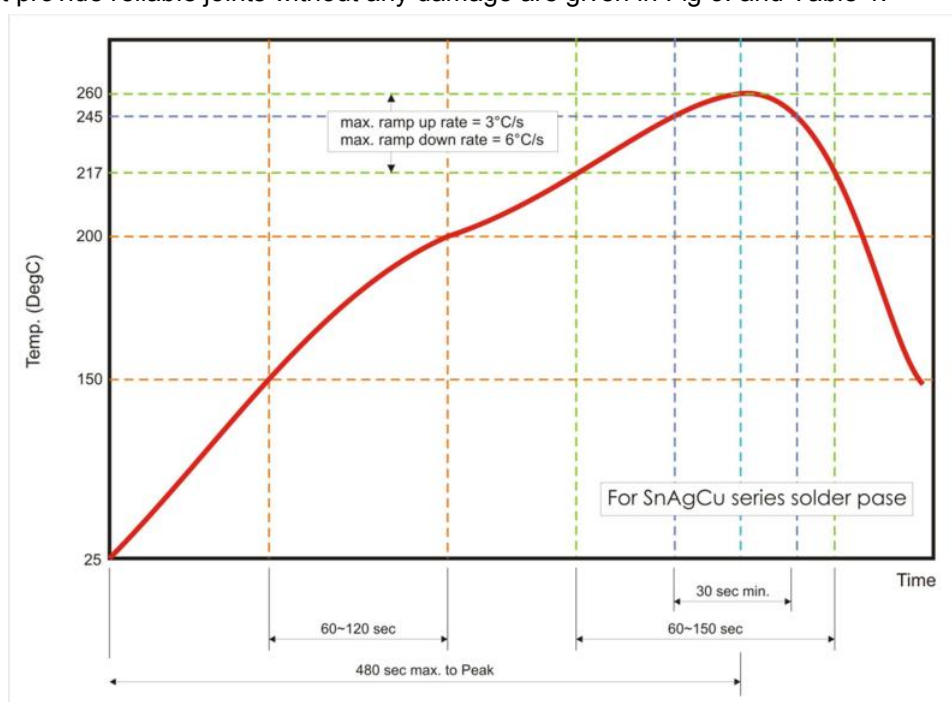


Fig. 3 Infrared soldering profile for Chip Resistors

Table 1. Infrared soldering condition for Chip Resistors

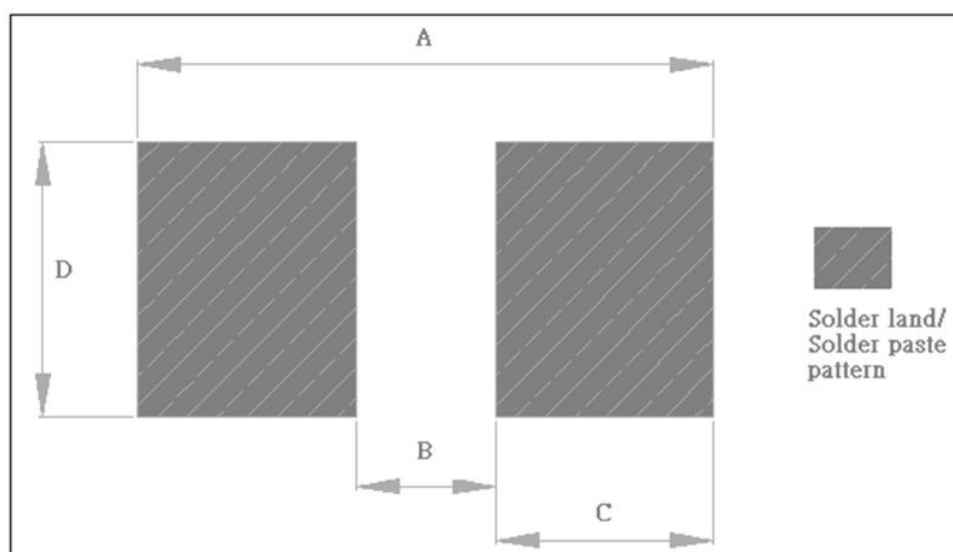
Temperature Condition	Exposure Time
Average ramp-up rate (217°C to 260°C)	Less than 3°C/second
Between 150 and 200°C	Between 60-120 seconds
> 217°C	Between 60-150 seconds
Peak Temperature	260°C +0/-5°C
Time within 245°C	Min. 30 seconds
Ramp-down rate (Peak to 217°C)	Less than 6°C/second
Time from 25°C to Peak	No greater than 480 seconds

CATALOGUE NUMBERS

TTU	08	S	N	XXXX	F	T	L
Type code	Size code	Power Rating	TCR	Resistance	Tolerance	Packaging code	Termination Code
High Power & Ultra Low TCR /High Power Current Sensor	25: 2512	S: 3W R: 2.5W Q: 2W P: 1W	P: 100ppm N: 50ppm	e.g. : R001=1mΩ R0L5=0.5mΩ R3L5=3.5 mΩ R010=10 mΩ	F: 1.0% J : 5.0%	T: 7" Taped & Reeled	L: Sn base (lead free)

Recommend Solder Pad Dimensions

2- wire pad layout



■ High Power :

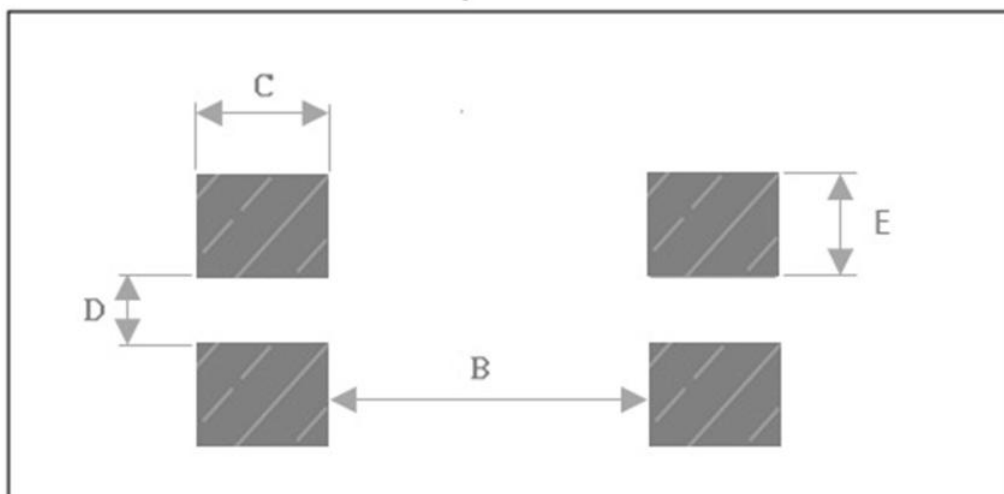
Type	Resistance Range (mΩ)	A(mm)	B(mm)	C(mm)	D(mm)
TTU2512	1	8.00	1.00	3.50	4.00

■ Ultra Low TCR /High Power :

TTU2512	1	6.8	2.04	2.38	3.4
TTU2512	1.5	6.8	3.04	1.88	3.4
TTU2512	2, 2.5, 3, 3.5	6.8	3.54	1.63	3.4
TTU2512	4, 4.5	6.8	1.54	2.63	3.4
TTU2512	5, 6	6.8	2.04	2.38	3.4
TTU2512	6.5, 7, 7.5	6.8	3.04	1.88	3.4
TTU2512	8, 9, 10	6.8	3.54	1.63	3.4

4-wire pad layout

Note: No Circuits between pads to avoid short circuit



■ High Power/ Ultra Low TCR

Type	Resistance Range (mΩ)	B(mm)	C(mm)	D(mm)	E(mm)
TTU2512	1	2.04	2.38	1.0	1.2
TTU2512	1.5	3.04	1.88	1.0	1.2
TTU2512	2, 2.5, 3, 3.5	3.54	1.63	1.0	1.2
TTU2512	4, 4.5	1.54	2.63	1.0	1.2
TTU2512	5, 6	2.04	2.38	1.0	1.2
TTU2512	6.5, 7, 7.5	3.04	1.88	1.0	1.2
TTU2512	8, 9, 10	3.54	1.63	1.0	1.2

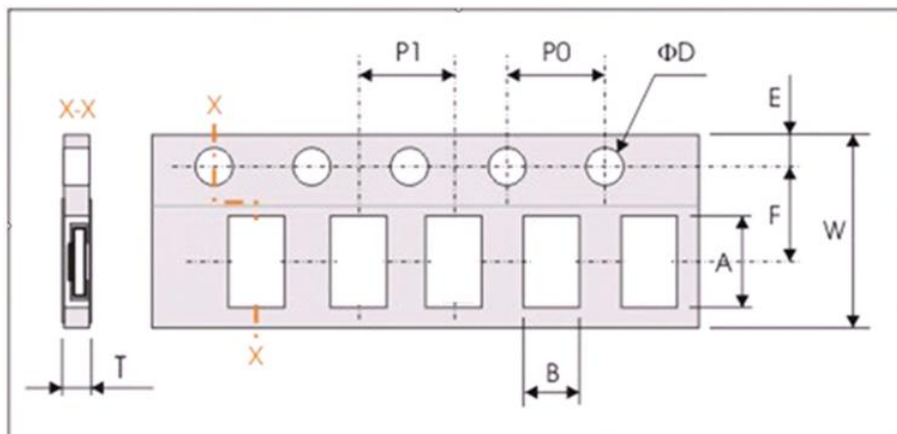
TEST AND REQUIREMENTS(JIS C 5201-1 : 1998)

TEST	PROCEDURE	REQUIREMENT
		Resistor
DC resistance IEC 60115-1 / JIS C 5201-1 , Clause 4.5	F: ±1%, G: ±5%	Within the specified tolerance
Temperature Coefficient of Resistance(T.C.R) IEC 60115-1 4.8.4.1	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ (ppm/°C) R ₁ : Resistance at reference temperature R ₂ : Resistance at test temperature t ₁ : 20°C+5°C-1°C t ₂ : 125°C+5°C-1°C	Refer to “ QUICK REFERENCE DATA “
Short time Overload (S.T.O.L) IEC60115-1 4.13	■ High Power series 2.5 times of rated power for 5 seconds at room temperature	No visible damage <±(0.5%)
	■ Ultra Low TCR/High Power Series : 5 times the rated power is applied to the resistor for 5 seconds and the change in resistance is measured after 30mins	<±(1.0%)
Resistance to soldering heat(R.S.H) MIL-STD-202G-method 210F IEC 60115-1 4.18	■ High Power Series : 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	No visible damage <±(0.5%)
	■ Ultra Low TCR/High Power Series : The resistor is immersed in solder bath at 260±5oC for 10±1secs and the resistance is measured 1hr after the test.	<±(1.0%)
Solderability IPC/JEDEC J-STD-002B test B	■ High Power Series: SMD conditions: 1st step: method B, aging 4 hours at 155 °C dry heat 2nd step: lead-free solder bath at 245± 3 °C Dipping time: 3± 0.5 seconds	good tinning (>95% covered) no visible damage
	■ Ultra Low TCR/High Power Series : The resistor is immersed in solder bath at 260±5°C for 2±0.5secs.	
Thermal Shock MIL-STD-202G-method 107	■ High Power series -55/+155 °C Note: Number of cycles required is 300. Devices mounted. Maximum transfer time is 20 seconds. Dwell time is 15 minutes and the change in resistance is measured after 2hrs.	<±(1.0%)
	■ Ultra Low TCR/High Power Series : -55/+150 °C Note: Number of cycles required is 1000. Devices mounted . Maximum transfer time is 20 seconds. Dwell time is 15 minutes and the change in resistance is measured after 2hrs.	

Endurance MIL-STD-202G-method 108 IEC 60115-1 4.25.1	70±2°C, 1000 hours, loaded with RCWV,,1.5 hours on and 0.5 hours off	<±(1.0%)
Humidity(Steady State) MIL-STD-202 Method 103 / IEC 60115-1 4.24.2	■ High Power series 1,000 hours at 85°C/85%R.H. no condensation on the devices, circulating air. ■ Ultra Low TCR/High Power Series : The resistor is placed in a chamber for 1000hrs at 40±2 °C, 90~95% RH. The rated power is applied to the resistor (duty cycle: 90mins ON, 30mins OFF). The change in resistance is measured 60mins after removal from test chamber.	<±(1.0%)
Bending Strength IEC60115-1 4.33	■ High Power series Device mounted on PCB test board as described, only 1 board bending required Bending : 2mm Holding time: minimum 60±1secs ■ Ultra Low TCR/High Power Series : The resistor is re-flow soldered to a test board and placed in a test fixture. Pressure is applied to achieve bending amplitude of 3mm for 10secs. The change in resistance is measured before and during the pressurization.	<±(1.0%)
High Temperature Exposure MIL-STD-202G-method 108 IEC 60115-1 4.25.3	■ High Power series 1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 0805 and above 155± 5°C ■ Ultra Low TCR/High Power Series : The resistor is placed in a constant temperature-humidity chamber at 170±2oC for 1000hrs and the resistance is measured 60mins after the end of the cycle.	<±(1.0%)
Low Temperature Storage	■ High Power series : The resistor is placed in a chamber at -55°C and the rated power is applied to the resistor for 1,000 hrs. The change in resistance is measured 60min after removal from test chamber.	<±(0.5%)
Low Temperature Operation	■ Ultra Low TCR/High Power Series : The resistor is placed in a chamber at -65±2°C and the rated power is applied to the resistor for 24hrs. The change in resistance is measured 60min after removal from test chamber.	<±(1.0%)
Insulation Resistance Clause 4.6	100V DC for 1 minute.	>100 MΩ

PACKAGING

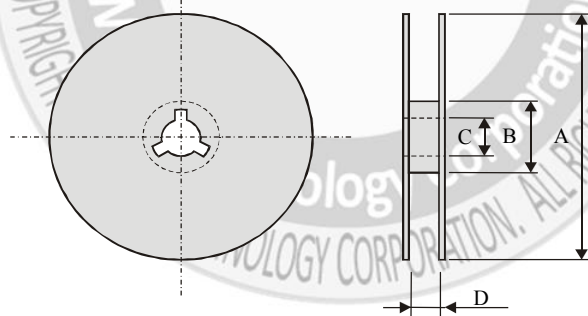
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
TTU25 /High Power (1mΩ)	6.70±0.20	3.50±0.20	12.00±0.30	5.50±0.05	1.75±0.10
TTU25 /Ultra Low TCR	6.75±0.10	3.40±0.10	12.00±0.1	5.50±0.05	1.75±0.10

Series No.	P1	P0	ΦD	T
TTU25 /High Power (1mΩ)	4.00±0.10	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max 1.1
TTU25 /Ultra Low TCR	4.00±0.10	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.81±0.10

Reel dimensions



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5

Taping quantity :

- 4,000 pcs per reel with embossed Tape: TTU25 /High Power (1mΩ)
- 2,000 pcs per reel with embossed Tape: TTU25 /Ultra Low TCR /High Power (1mΩ~10mΩ)