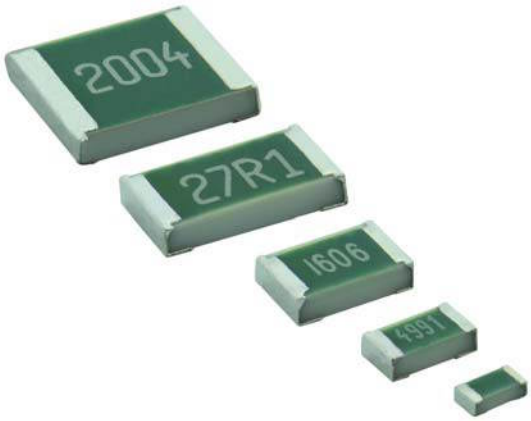
Lead (Pb)-Bearing High Stability Thin Film Chip Resistors



TNPW High Stability Thin Film Chip Resistors are the perfect choice for most fields of modern electronics where lead (Pb)-bearing terminations are mandatory and reliability and stability are of major concern.

FEATURES

- Metal film layer on high quality ceramic
- SnPb termination plating, Pb content > 6 %
- Excellent overall stability at different environmental conditions ≤ 0.05 % (1000 h rated power at 70 °C)
- Low temperature coefficient and tight tolerances (± 0.1 %; ± 10 ppm/K)
- Single lot date code available

APPLICATIONS

- Military
- Avionics
- Industrial

TECHNICAL SPECIFICATIONS

DESCRIPTION	TNPW0402	TNPW0603	TNPW0805	TNPW1206	TNPW1210 (1)
Imperial size	0402	0603	0805	1206	1210
Metric size code	RR1005M	RR1608M	RR2012M	RR3216M	RR3225M
Resistance range	10 Ω to 100 kΩ	10 Ω to 332 kΩ	10 Ω to 1 MΩ	10 Ω to 2 MΩ	10 Ω to 3.01 MΩ
Resistance tolerance	± 1 %; ± 0.5 %; ± 0.1 %				
Temperature coefficient	± 50 ppm/K; ± 25 ppm/K; ± 15 ppm/K; ± 10 ppm/K				
Climatic category (LCT/UCT/days)	55/125/56	55/125/56	55/125/56	55/125/56	55/125/56
Rated dissipation, P_{70} (2)	0.063 W	0.1 W	0.125 W	0.25 W	0.33 W
Operating voltage, $U_{max.}$ AC_{RMS} or DC	50 V	75 V	150 V	200 V	200 V
Permissible film temperature, $\vartheta_{F\ max.}$	155 °C				
Operating Temperature Range	-55 °C to 125 °C (155 °C)				
Thermal resistance (3)	870 K/W	550 K/W	440 K/W	220 K/W	170 K/W
Insulation voltage:					
U_{ins} 1 min	75 V	100 V	200 V	300 V	300 V
Continuous	75 V	75 V	75 V	75 V	75 V
Failure rate: $FIT_{observed}$	≤ 0.3 x 10^{-9}/h				

Notes

(1) The detail specification EN140401-801 does not cover this product size.

(2) Rated voltage $\sqrt{P \times R}$. The power dissipation on the resistor generates a temperature rise against the local ambient, depending on the heat flow support of the printed-circuit board (thermal resistance). The rated dissipation applies only if the permitted film temperature is not exceeded.

(3) Measuring conditions in accordance with EN 140401-801.

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TEMPERATURE COEFFICIENT AND RESISTANCE RANGE

TYPE	TCR	TOLERANCE	RESISTANCE	E-SERIES
TNPW0402	±50 ppm/K	± 1 %	10 Ω to 100 kΩ	E24; E96
	±25 ppm/K	± 0.5 %		E24; E192
		± 0.1 %	47 Ω to 100 kΩ	
	±15 ppm/K	± 0.1 %		
	±10 ppm/K	± 0.1 %		
TNPW0603	±50 ppm/K	± 1 %	10 Ω to 332 kΩ	E24; E96
	±25 ppm/K	± 0.5 %		E24; E192
		± 0.1 %		
	±15 ppm/K	± 0.1 %	47 Ω to 332 kΩ	
	±10 ppm/K	± 0.1 %		
TNPW0805	±50 ppm/K	± 1 %	10 Ω to 1.0 MΩ	E24; E96
	±25 ppm/K	± 0.5 %		E24; E192
		± 0.1 %		
	±15 ppm/K	± 0.1 %	47 Ω to 1.0 MΩ	
	±10 ppm/K	± 0.1 %		
TNPW1206	±50 ppm/K	± 1 %	10 Ω to 2.0 MΩ	E24; E96
	±25 ppm/K	± 0.5 %		E24; E192
		± 0.1 %		
	±15 ppm/K	± 0.1 %	47 Ω to 2.0 MΩ	
	±10 ppm/K	± 0.1 %		
TNPW1210	±50 ppm/K	± 1 %	10 Ω to 3.01 MΩ	E24; E96
	±25 ppm/K	± 0.5 %		E24; E192
		± 0.1 %	47 Ω to 2.13 MΩ	
	±15 ppm/K	± 0.1 %		
	±10 ppm/K	± 0.1 %		

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: TNPW12061K32DETA

T	N	P	W	1	2	0	6	1	K	3	2	D	E	T	A		

TYPE/SIZE	RESISTANCE	TOLERANCE	TCR	PACKAGING	SPECIAL
TNPW0402 **TNPW0603** **TNPW0805** **TNPW1206** **TNPW1210**	**R** = Decimal **K** = Thousand **M** = Million (4 digits)	**B** = ± 0.1 % **D** = ± 0.5 % **F** = ± 1.0 %	**H** = ± 50 ppm/K **E** = ± 25 ppm/K **X** = ± 15 ppm/K **Y** = ± 10 ppm/K	**TP** **TD** **CN** **TA** **TC**	Blank = Standard **0H** = Single lot date code

Product Description: TNPW-1206 1.32K 0.5 % T-9 RT1

TNPW-1206	1.32K	0.5 %	T-9	RT1	

TYPE/SIZE	RESISTANCE	TOLERANCE	TCR	PACKAGING	SPECIAL
TNPW-0402 **TNPW-0603** **TNPW-0805** **TNPW-1206** **TNPW-1210**	Examples: **1K32** = 1320 Ω **99.68K** = 99 680 Ω **360** = 360 Ω	**± 0.1 %** **± 0.5 %** **± 1.0 %**	**T-2** = ± 50 ppm/K **T-9** = ± 25 ppm/K **T-10** = ± 15 ppm/K **T-13** = ± 10 ppm/K	**TP1** **RT7** **R52** **RT1** **RT6**	Blank = Standard **BV20545** = Single lot date code

Notes

- The products can be ordered using either the PRODUCT DESCRIPTION or the PART NUMBER.

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PACKAGING						
TYPE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	REEL DIAMETER
TNPW0402	TP1 = TP (1)	1000	Tape and reel cardboard tape acc. IEC 60286-3 Type I	8 mm	2	180 mm/7"
TNPW0402	RT7 = TD	10 000		8 mm	2	180 mm/7"
TNPW0603 TNPW0805 TNPW1206 TNPW1210	R52 = CN (1)	1000		8 mm	4	180 mm/7"
TNPW0603 TNPW0805 TNPW1206 TNPW1210	RT1 = TA	5000		8 mm	4	180 mm/7"

Note

(1) 1000 pieces packaging quantity is only available for precision resistors with tolerance ± 0.1 %.

DESCRIPTION

The production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade ceramic body (Al_2O_3) and conditioned to achieve the desired temperature coefficient. A special laser is used to achieve the target value by smoothly cutting an appropriate groove in the resistive layer without damaging the ceramics. The resistor elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final tin-lead (SnPb) on nickel plating. The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. Only accepted products are placed into the tape in accordance with **IEC 60286-3, Type I**. Resistance marking is not applied on TNPW0402.

ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase as shown in **IEC 61760-1 (1)**. Solderability is specified for 2 years after production. The permitted storage time is 20 years.

The terminations are plated with SnPb solder, controlled for a minimum lead Pb content of 6 % for compliance with the respective requirements of Bellcore, MIL and ESCC specifications.

The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

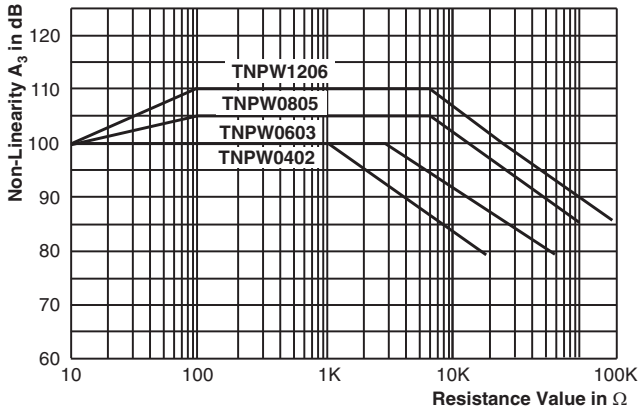
The suitability of conformal coatings, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

RELATED PRODUCTS

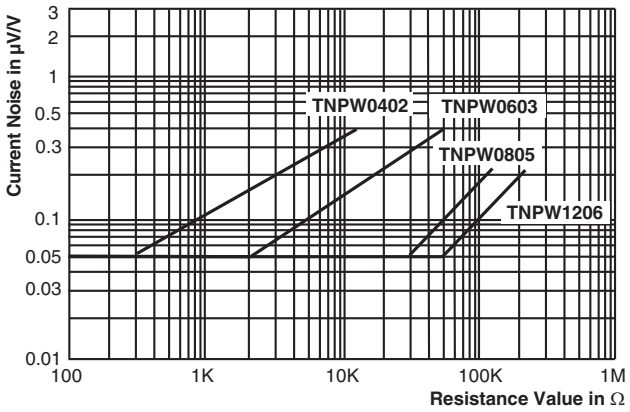
For ordering TNPW with lead free terminations please refer to latest edition of data sheet TNPW e3, (www.vishay.com/doc?28758).

TNPS .... ESCC high-reliability thin film chip resistors are the premium choice for design and manufacture of equipment, where mature technology and proven reliability are of utmost importance.
(www.vishay.com/doc?28789)

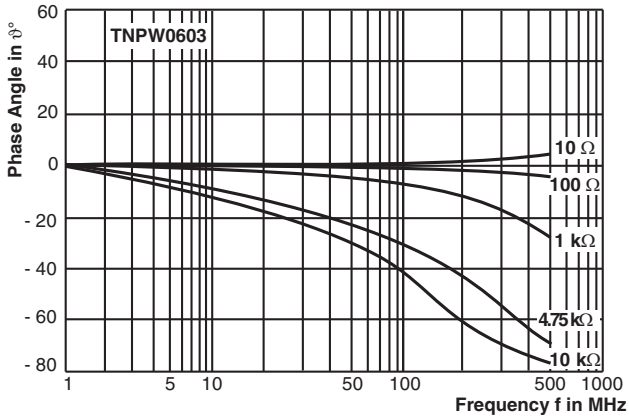
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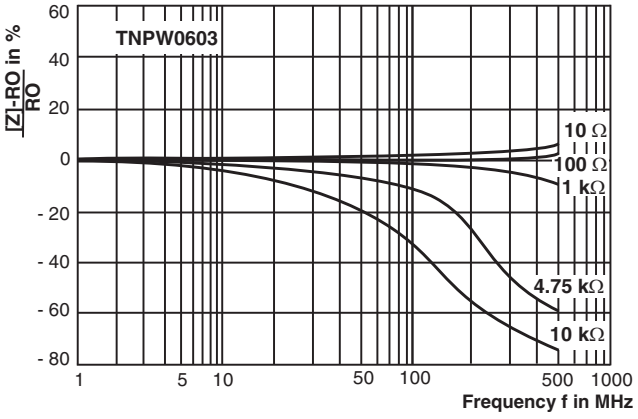
Non-Linearity



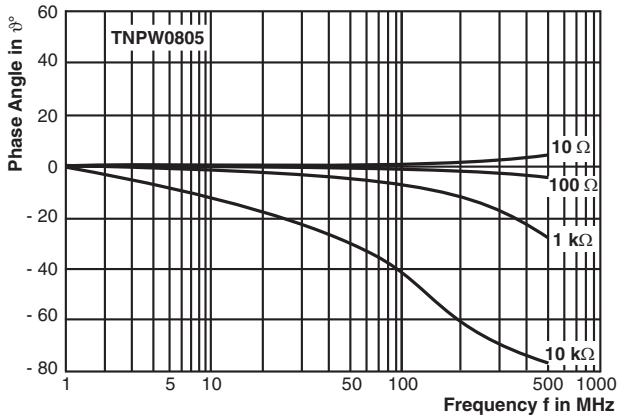
Current Noise



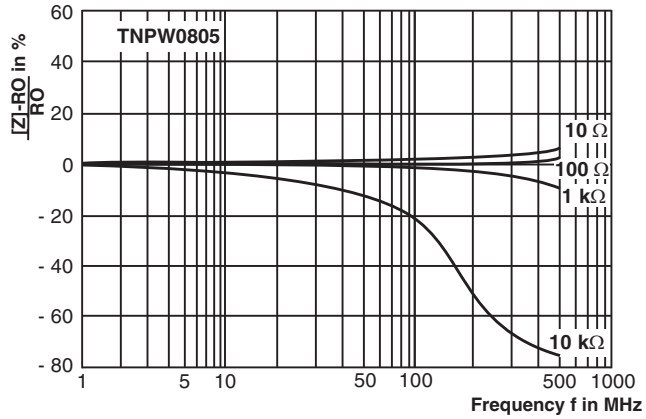
HF Performance



HF Performance

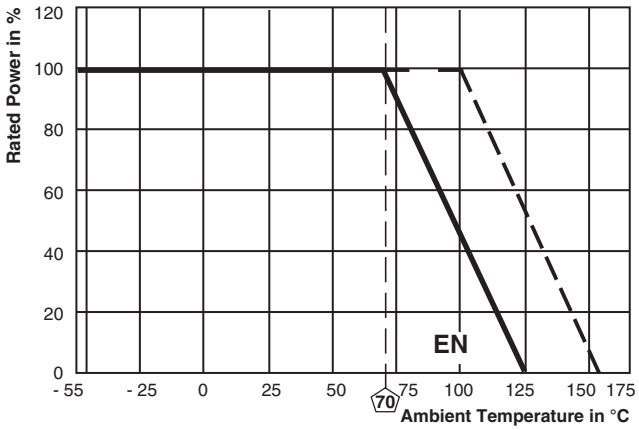


HF Performance



HF Performance

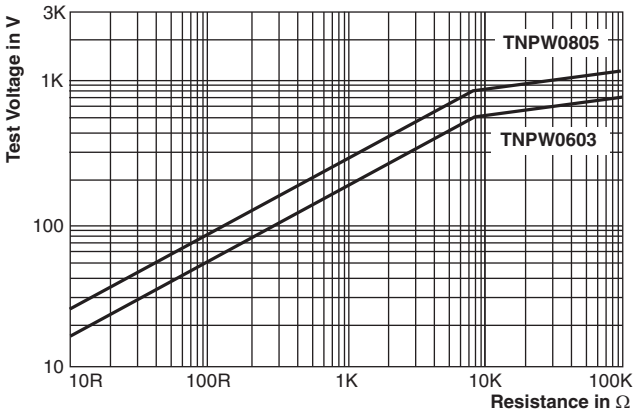
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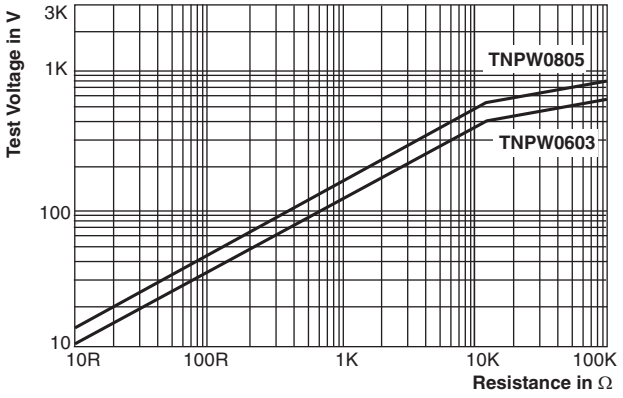
Derating

Note

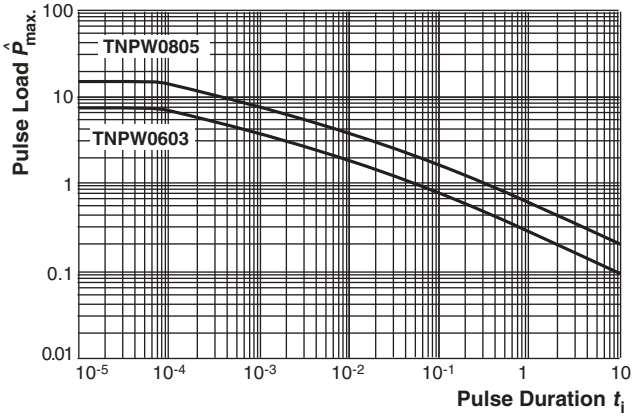
- The solid line is based on IEC/EN reference test conditions which is considered as standard mode. However, above that the maximum permissible film temperature is 155 °C (dashed line).



Single-Pulse High Voltage Overload Test
1.2/50 µs EN 140000 4.27

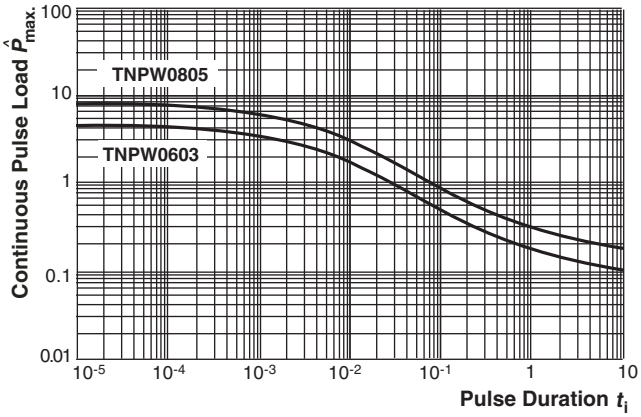


Single-Pulse High Voltage Overload Test
10/700 µs EN 140000 4.27



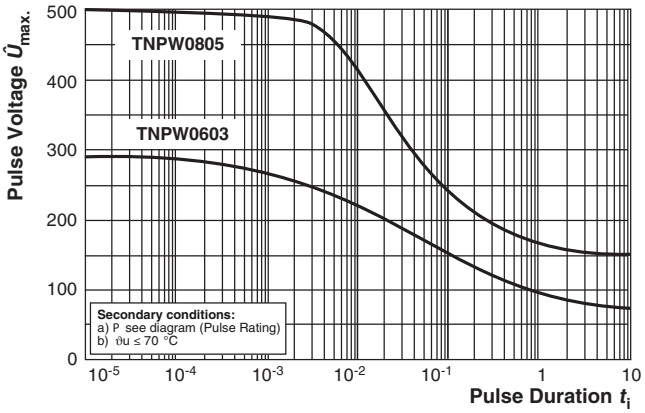
Single Pulse

Maximum pulse load, single pulse;
applicable if $\bar{P} \rightarrow 0$ and $n \leq 1000$ and $\hat{U} \leq \hat{U}_{max.}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode



Maximum pulse load, continuous pulses;
applicable if $\bar{P} \leq P$ (ϑ_{amb}) and $\hat{U} \leq \hat{U}_{max.}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Continuous Pulse



Maximum pulse voltage, single and continuous pulses;
applicable if $\bar{P} \leq P_{max.}$;
for permissible resistance change equivalent to 8000 h operation in standard operation mode

Pulse Voltage

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TEST AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:
IEC 60115-1, generic specification (includes tests)
EN 140400, sectional specification (includes schedule for qualification approval)
EN 140401-801, detail specification (includes schedule for conformance inspection)

The testing also covers most of the requirements specified by EIA/ECA-703 and JIS-C-5201-1. The tests are carried out under standard atmospheric conditions in accordance with IEC 60068-1, 5.3. A climate category is applied, defined by the lower category temperature (LCT), the upper category temperature (UCT), and the number of days of the damp heat, steady-state test (56).

Unless otherwise specified the following values apply:
Temperature: 15 °C to 35 °C
Relative humidity: 45 % to 75 %
Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar).

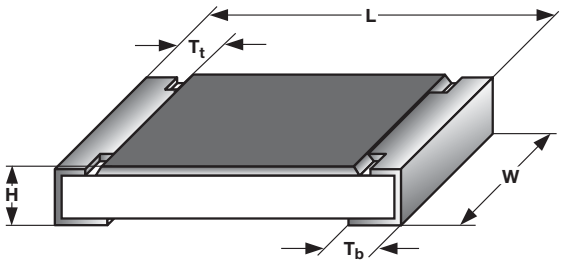
The components are mounted for testing on boards in accordance with EN60115-1, 4.31 unless otherwise specified. The parameters stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN140401-801.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (ΔR)		
			Stability for product type:			
			TNPW0402 TNPW0603 TNPW0805 TNPW1206 TNPW1210	10 Ω to < 100 Ω	≥ 100 Ω to 3.01 MΩ	10 Ω to 3.01 MΩ
4.5	-	Resistance	-	± 0.1 %		± 1 %; ± 0.5 %
4.8.4.2	-	Temperature coefficient	At (20/- 55/20) °C and (20/125/20) °C	± 25 ppm/K; ± 15 ppm/K; ± 10 ppm/K		± 50 ppm/K; ± 25 ppm/K
4.25.1	-	Endurance at 70 °C	$U = \sqrt{P_{70} \times R}$ or ≤ $U_{max.}$; 1.5 h on; 0.5 h off; 70 °C; 1000 h	± (0.1 % R + 0.02 Ω)	± (0.05 % R + 0.01 Ω)	± (0.25 % R + 0.05 Ω)
4.25.3	-	Endurance at upper category temperature	125 °C; 1000 h	± (0.1 % R + 0.02 Ω)	± (0.05 % R + 0.01 Ω)	± (0.5 % R + 0.05 Ω)
4.13	-	Short time overload	$U = 2.5 \times \sqrt{P_{70} \times R}$ ≤ 2 x $U_{max.}$; 2 s	± (0.05 % R + 0.01 Ω)	± (0.02 % R + 0.01 Ω)	± (0.1 % R + 0.02 Ω)
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; (93 ± 3) % RH; 56 days	± (0.1 % R + 0.02 Ω)	± (0.05 % R + 0.01 Ω)	± (0.5 % R + 0.05 Ω)
4.19	14 (Na)	Rapid change of temperature	30 min at - 55 °C: 30 min at 125 °C; 5 cycles	± (0.05 % R + 0.01 Ω)	± (0.02 % R + 0.01 Ω)	± (0.1 % R + 0.02 Ω)
4.18.2	58 (Td)	Resistance to soldering heat	Solder bath method; (260 ± 5) °C; (10 ± 1) s	± (0.05 % R + 0.01 Ω)	± (0.02 % R + 0.01 Ω)	± (0.1 % R + 0.02 Ω)
4.35	-	Flammability, needle flame test	IEC 60695-11-5; 10 s	No burning after 30 s		

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DIMENSIONS



DIMENSIONS AND MASS						
TYPE	H (mm)	L (mm)	W (mm)	T_t (mm)	T_b (mm)	MASS (mg)
TNPW0402	0.35 ± 0.05	1.0 ± 0.05	0.5 ± 0.05	0.2 ± 0.10	0.2 ± 0.10	0.65
TNPW0603	0.45 ± 0.10	1.6 ± 0.10	0.85 ± 0.10	0.3 ± 0.20	0.3 ± 0.20	2
TNPW0805	0.45 ± 0.10	2.0 ± 0.15	1.25 ± 0.15	0.4 ± 0.20	0.4 ± 0.20	5.5
TNPW1206	0.55 ± 0.10	3.2 ± 0.15	1.6 ± 0.15	0.5 ± 0.25	0.5 ± 0.25	10
TNPW1210	0.60 ± 0.15	3.2 ± 0.15	2.45 ± 0.15	0.5 ± 0.25	0.5 ± 0.25	16

SOLDER PAD DIMENSIONS



SOLDER PAD DIMENSIONS						
TYPE	REFLOW SOLDERING			WAVE SOLDERING		
	Y (mm)	X (mm)	G (mm)	Y (mm)	X (mm)	G (mm)
TNPW0402	0.4	0.6	0.5	-	-	-
TNPW0603	0.5	0.9	1.0	0.9	0.9	1.0
TNPW0805	0.7	1.3	1.2	0.9	1.3	1.3
TNPW1206	0.9	1.7	2.0	1.1	1.7	2.3
TNPW1210	0.9	2.5	2.0	1.1	2.5	2.3

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