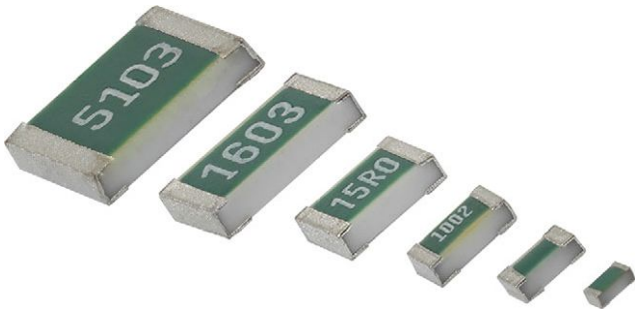
High Stability Thin Film Flat Chip Resistors



TNPW e3 precision thin film flat chip resistors are the perfect choice for most fields of modern electronics where highest reliability and stability is of major concern. Typical applications include automotive, industrial, test and measuring equipment, and medical equipment.

FEATURES

- Superior moisture resistivity (85 °C; 85 % RH)
- Excellent overall stability at different environmental conditions ≤ 0.05 % (1000 h rated power at 70 °C)
- AEC-Q200 qualified
- Single lot date code (optional)
- Sulfur resistance verified according to ASTM B 809
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

HALOGEN FREE

APPLICATIONS

- Automotive
- Industrial equipment
- Test and measuring equipment
- Medical equipment

TECHNICAL SPECIFICATIONS

DESCRIPTION	TNPW0201 e3 (1)	TNPW0402 e3	TNPW0603 e3	TNPW0805 e3	TNPW1206 e3	TNPW1210 e3
Imperial size	0201	0402	0603	0805	1206	1210
Metric size code	RR0603M	RR1005M	RR1608M	RR2012M	RR3216M	RR3225M
Resistance range	22 Ω to 40 kΩ	10 Ω to 100 kΩ	1 Ω to 332 kΩ	1 Ω to 1 MΩ	1 Ω to 2 MΩ	10 Ω to 3.01 MΩ
Resistance tolerance	± 0.5 %; ± 0.1 %	± 1 %; ± 0.5 %; ± 0.1 %				
Temperature coefficient	± 25 ppm/K	± 50 ppm/K; ± 25 ppm/K; ± 15 ppm/K; ± 10 ppm/K				
Rated dissipation, P_{70} (2)	0.075 W	0.100 W	0.125 W	0.200 W	0.400 W	0.500 W
Operating voltage, $U_{max.}$ AC_{RMS} or DC	25 V	50 V	75 V	150 V	200 V	200 V
Permissible film temperature, $\vartheta_{F\ max.}$ (2)	155 °C					
Operating temperature range	-55 °C to 155 °C					
Internal thermal resistance (2)	-	90 K/W	63 K/W	38 K/W	32 K/W	-
Permissible voltage against ambient (insulation): 1 min; U_{ins}	50 V	75 V	100 V	200 V	300 V	300 V
Failure rate: $FIT_{observed}$	≤ 0.1 x 10^{-9}/h					

Notes

(1) AEC-Q200 qualification for ohmic values above 25 kΩ pending

(2) Please refer to APPLICATION INFORMATION

APPLICATION INFORMATION

When the resistor dissipates power, a temperature rise above the ambient temperature occurs, dependent on the thermal resistance of the assembled resistor together with the printed circuit board. The rated dissipation applies only if the permitted film temperature is not exceeded.

Please consider the application note “Thermal Management in Surface-Mounted Resistor Applications” (www.vishay.com/doc?28844) for information on the general nature of thermal resistance.

These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION			
OPERATION MODE		**STANDARD**	**POWER**
Rated dissipation, P_{70}	**TNPW0201 e3**	0.050 W	0.075 W
	TNPW0402 e3	0.063 W	0.100 W
	TNPW0603 e3	0.100 W	0.125 W
	TNPW0805 e3	0.125 W	0.200 W
	TNPW1206 e3	0.250 W	0.400 W
	TNPW1210 e3	0.330 W	0.500 W
Operating temperature range		-55 °C to 125 °C	-55 °C to 155 °C
Permissible film temperature, $\vartheta_{F\,max.}$		125 °C	155 °C
Max. resistance change at P_{70} for resistance range, $\lvert\Delta R/R\rvert$ after:	**TNPW0201 e3**	22 Ω to 40 kΩ	22 Ω to 40 kΩ
	TNPW0402 e3	10 Ω to 100 kΩ	10 Ω to 100 kΩ
	TNPW0603 e3	1 Ω to 332 kΩ	1 Ω to 332 kΩ
	TNPW0805 e3	1 Ω to 1 MΩ	1 Ω to 1 MΩ
	TNPW1206 e3	1 Ω to 2 MΩ	1 Ω to 2 MΩ
	TNPW1210 e3	10 Ω to 3.01 MΩ	10 Ω to 3.01 MΩ
	1000 h	≤ 0.05 %	≤ 0.10 %
	8000 h	≤ 0.10 %	≤ 0.20 %
	225 000 h	≤ 0.30 %	≤ 0.60 %

Note

- The presented operation modes do not refer to different types of resistors, but actually show examples of different loads, that lead to different film temperatures and different achievable load-life stability (drift) of the resistance value. A suitable low thermal resistance of the circuit board assembly must be safeguarded in order to maintain the film temperature of the resistors within the specified limits. Please consider the application note “Thermal Management in Surface-Mounted Resistor Applications” (www.vishay.com/doc?28844) for information on the general nature of thermal resistance

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
TYPE / SIZE	**TCR**	**TOLERANCE**	**RESISTANCE**	**E-SERIES**
TNPW0201 e3	± 25 ppm/K	± 0.5 %	22 Ω to 40 kΩ	E24; E192
		± 0.1 %	22 Ω to 25 kΩ	
TNPW0402 e3	± 50 ppm/K	± 1 %	10 Ω to 100 kΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	47 Ω to 100 kΩ	
	± 25 ppm/K	± 1 %	10 Ω to 100 kΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	47 Ω to 100 kΩ	
	± 15 ppm/K	± 0.1 %		
	± 10 ppm/K			
TNPW0603 e3	± 50 ppm/K	± 1 %	1 Ω to 332 kΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	3.5 Ω to 332 kΩ	
	± 25 ppm/K	± 1 %	1 Ω to 332 kΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	3.5 Ω to 332 kΩ	
	± 15 ppm/K	± 0.1 %	47 Ω to 332 kΩ	
	± 10 ppm/K			
TNPW0805 e3	± 50 ppm/K	± 1 %	1 Ω to 1 MΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	3.5 Ω to 1 MΩ	
	± 25 ppm/K	± 1 %	1 Ω to 1 MΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	3.5 Ω to 1 MΩ	
	± 15 ppm/K	± 0.1 %		
	± 10 ppm/K			
TNPW1206 e3	± 50 ppm/K	± 1 %	1 Ω to 2 MΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	3.5 Ω to 2 MΩ	
	± 25 ppm/K	± 1 %	1 Ω to 2 MΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	3.5 Ω to 2 MΩ	
	± 15 ppm/K	± 0.1 %	47 Ω to 2 MΩ	
	± 10 ppm/K			
TNPW1210 e3	± 50 ppm/K	± 1 %	10 Ω to 3.01 MΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	47 Ω to 2.13 MΩ	
	± 25 ppm/K	± 1 %	10 Ω to 3.01 MΩ	E24; E96
		± 0.5 %		E24; E192
		± 0.1 %	47 Ω to 2.13 MΩ	
	± 15 ppm/K	± 0.1 %		
	± 10 ppm/K			

PACKAGING

TYPE / SIZE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	PACKAGING DIMENSIONS
TNPW0201 e3	ET7 = ED	10 000	Paper tape according IEC 60286-3, Type 1a	8 mm	2 mm	Ø 180 mm / 7"
TNPW0402 e3	EP1 = EP	1000 (1)				
	ET2 = EI	5000				
	ET7 = ED	10 000				
TNPW0603 e3 **TNPW0805 e3** **TNPW1206 e3** **TNPW1210 e3**	E52 = EN	1000 (1)			4 mm	Ø 180 mm / 7"
	ET1 = EA	5000				
	ET6 = EC (2)	20 000			4 mm	Ø 330 mm / 13"

Notes

(1) 1000 pieces packaging is available only for precision resistors with tolerance ± 0.1 % and temperature coefficient ≤ ± 25 ppm/K

(2) 20 000 pieces packaging is available only for resistors with TCR ± 25 ppm/K and ± 50 ppm/K

PART NUMBER AND PRODUCT DESCRIPTION

Part Number: TNPW12061K32DEEA

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

TYPE / SIZE	RESISTANCE	TOLERANCE	TCR	PACKAGING	SPECIAL
TNPW0201 **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	**ED** **EP** **EI** **EN** **EA** **EC** (E.. = lead-free)	Up to 2 digits Blank = standard 0H = single lot date code

Product Description: TNPW1206 1K32 0.5 % T-9 ET1 e3

TNPW1206	1K32	0.5 %	T-9	ET1	e3
TYPE / SIZE	RESISTANCE	TOLERANCE	TCR	PACKAGING	LEAD (Pb)-FREE
TNPW0201 **TNPW0402** **TNPW0603** **TNPW0805** **TNPW1206** **TNPW1210**	**54R1** = 54.1 Ω **1K32** = 1320 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	**ET7** **EP1** **ET2** **E52** **ET1** **ET6** (E.. = lead-free)	**e3** = pure matte tin termination finish BV 20545 = single lot date code

Note

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

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of special metal alloy is deposited on a high grade ceramic substrate (Al_2O_3) and conditioned to achieve the desired temperature coefficient. Specially designed inner contacts are deposited on both sides. A special laser is used to achieve the target value by smoothly fine trimming the resistive layer without damaging the ceramics. A further conditioning is applied in order to stabilize the trimming result. The resistor elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure matte tin on nickel plating.

The result of the determined production is verified by an extensive testing procedure and optical inspection performed on 100 % of the individual chip resistors. This includes full screening for the elimination of products with a potential risk of early life failures (feasible for $R \geq 10\ \Omega$). Only accepted products are laid directly into the tape in accordance with **IEC 60286-3, Type 1a** [(1)].

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)]. 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, potting compounds and their processes, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

The resistors are RoHS-compliant, the pure matte tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. Solderability is specified for 2 years after production or requalification. The permitted storage time is 20 years. The immunity of the plating against tin whisker growth has been proven under extensive testing.

MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein [(2)]
- The Global Automotive Declarable Substance List (GADSL) [(3)]
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) [(4)] for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree.

Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at www.vishay.com/doc?49037.

RELATED PRODUCTS

The TNPW with SnPb termination plating is designed for those applications, where lead bearing terminations are mandatory. For ordering TNPW with SnPb terminations please refer to latest edition of datasheet TNPW (www.vishay.com/doc?31006).

TNPU e3 ultra precision thin film flat chip resistors combine the proven reliability of TNPW e3 products with a most advanced level of precision and stability (www.vishay.com/doc?28779).

TNPS .... ESCC high-reliability thin film chip resistors are the premium choice for design and manufacture of equipment, where matured technology and proven reliability are of utmost importance. They are regularly used in communication and research satellites and fit equally well into aircraft and military electronic systems.

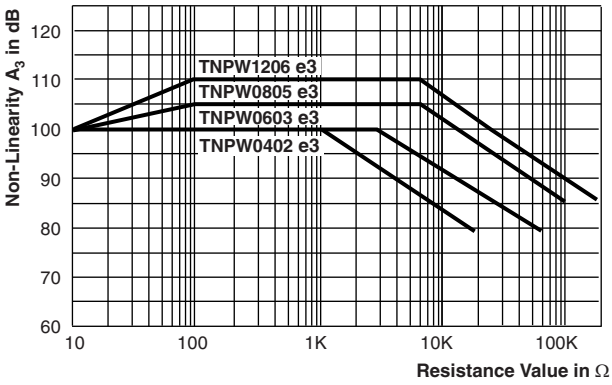
Approval of the TNPS .... ESCC products is granted by the European Space Components Coordination and registered in the ESCC Qualified Parts List, REP005 (www.vishay.com/doc?28789).

TNPV e3 High Voltage Thin Film Flat Chip Resistors are designed for most fields of modern electronics where precision, reliability and stability at high operating voltage are primary concerns (www.vishay.com/doc?28881).

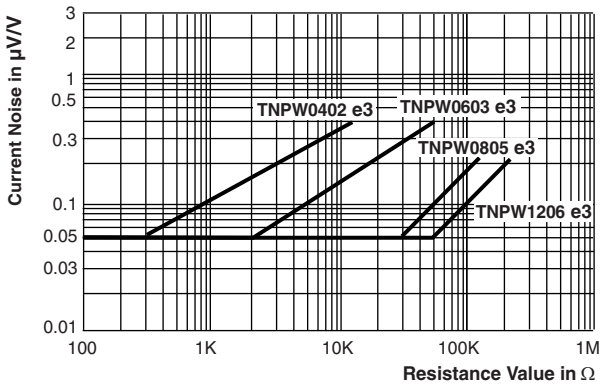
Notes

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents
(2) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474
(3) The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at www.gadsl.org
(4) The SVHC list is maintained by the European Chemical Agency (ECHA) and available at http://echa.europa.eu/candidate-list-table

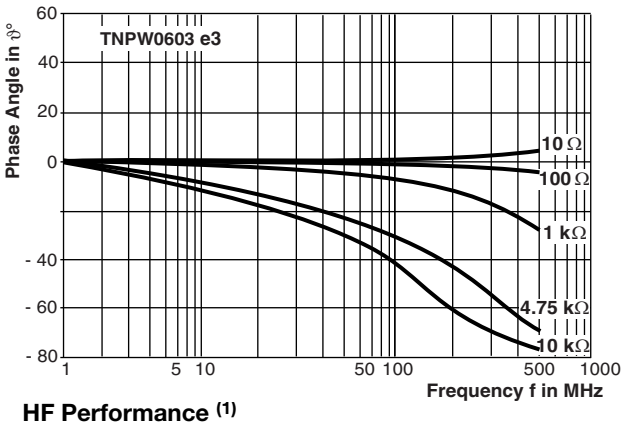
FUNCTIONAL PERFORMANCE



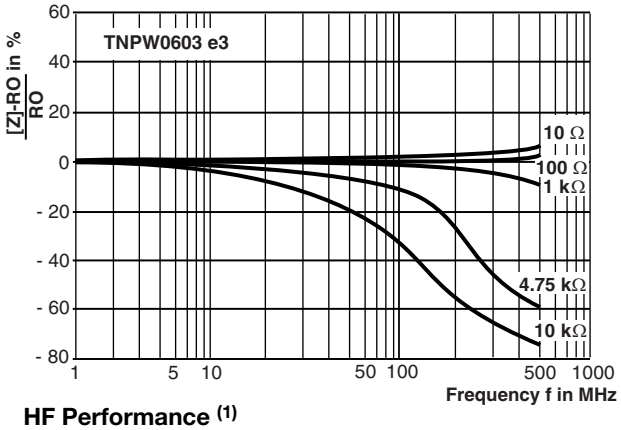
Non-Linearity



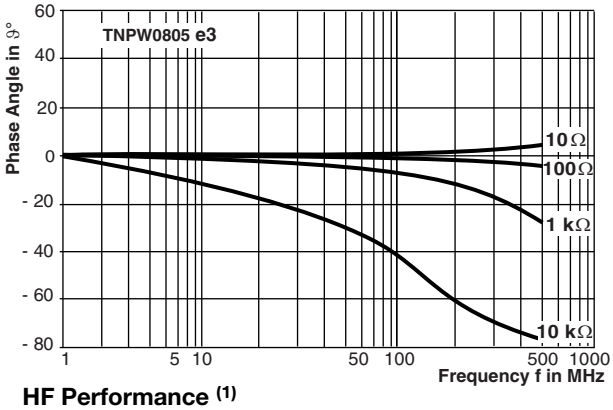
Current Noise



HF Performance (1)



HF Performance (1)



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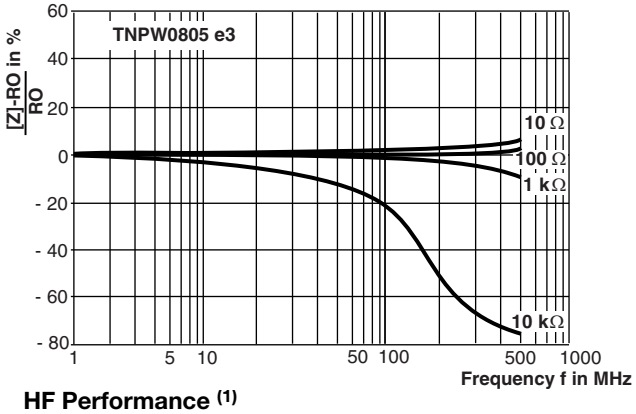
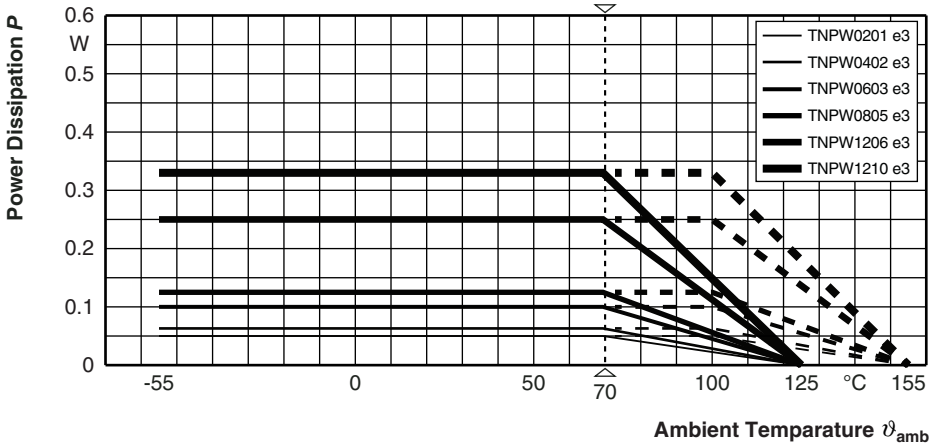


HF Performance (1)

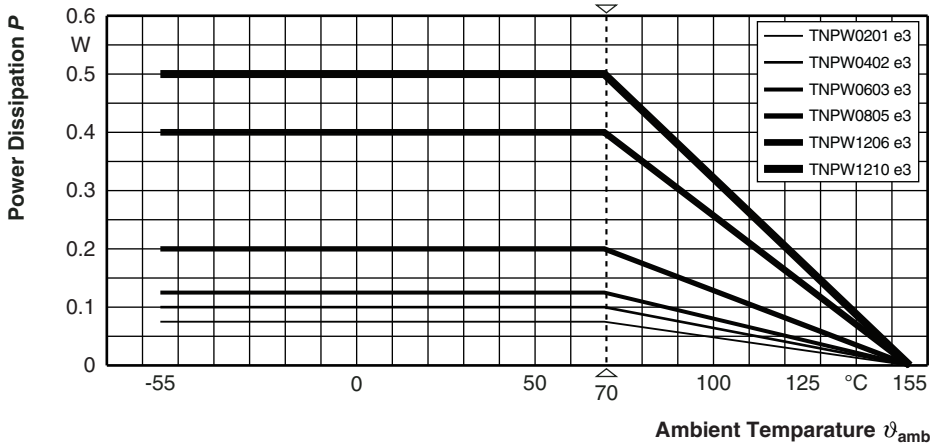
Note

(1) Typical figures. HF-characteristic also depends on termination and circuit design

FUNCTIONAL PERFORMANCE



Derating - Standard Operation

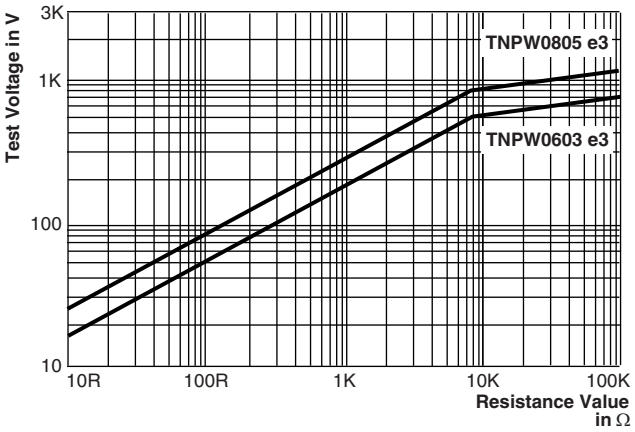


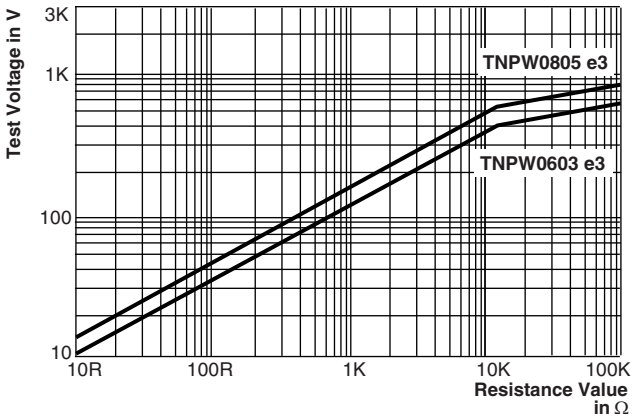
Derating - Power Operation

Note

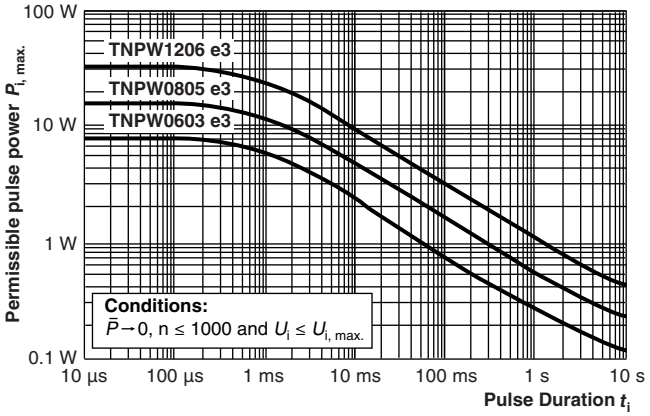
- The solid line is based on IEC/EN reference test conditions which is considered as standard mode. However, above that the maximum permissible film temperature is 155 °C (dashed line)

FUNCTIONAL PERFORMANCE

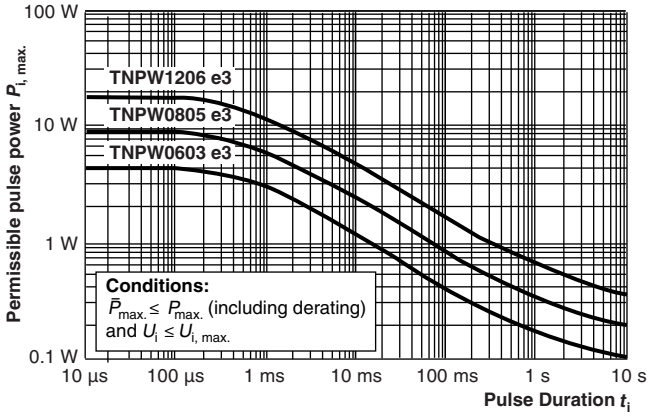




Single-Pulse High Voltage Overload Test 1.2/50 µs EN140000 4.27

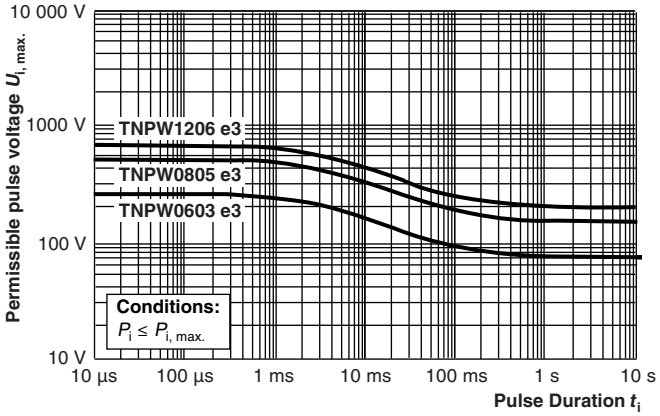


Single-Pulse High Voltage Overload Test 10/700 µs EN140000 4.27



Maximum Pulse Load $P_{i, max.}$ for Single Pulses

Maximum Pulse Load $P_{i, max.}$ for Continuous Pulses



Maximum Pulse Voltage $U_{i, max.}$

TEST AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification

EN 60115-8 (successor of EN 140400), sectional specification

EN 140401-801, detail specification

IEC 60068-2-xx, test methods

The parameters stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-801. The detail specification EN 140401-801 does not cover case size 0201. The table presents only the most important tests, for the full test schedule refer to the documents listed above. However, some additional tests and a number of improvements against those minimum requirements have been included.

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, 4.3, whereupon the following values are applied:

Temperature: 15 °C to 35 °C

Relative humidity: 25 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar)

A climatic category LCT / UCT / 56 is applied, defined by the lower category temperature (LCT), the upper category temperature (UCT), and the duration of exposure in the damp heat, steady state test (56 days).

The components are mounted for testing on printed circuit boards in accordance with EN 60115-8, 2.4.2, unless otherwise specified.

TEST PROCEDURES AND REQUIREMENTS

EN 60115-1 CLAUSE	IEC 60068-2 (1) TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE (δR)
			Stability for product types:	
			TNPW0201 e3	22 Ω to 40 kΩ
			TNPW0402 e3	10 Ω to 100 kΩ
			TNPW0603 e3	1 Ω to 332 kΩ
			TNPW0805 e3	1 Ω to 1 MΩ
			TNPW1206 e3	1 Ω to 2 MΩ
			TNPW1210 e3	10 Ω to 3.01 MΩ
4.5	-	Resistance	-	± 1 %; ± 0.5 %; ± 0.1 %
4.8	-	Temperature coefficient	At (20 / -55 / 20) °C and (20 / 125 / 20) °C	± 50 ppm/K; ± 25 ppm/K; ± 15 ppm/K; ± 10 ppm/K
4.25.1	-	Endurance at 70 °C: standard operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max.}$; whichever is the less severe; 1.5 h on; 0.5 h off; 70 °C; 1000 h	± (0.05 % R + 0.01 Ω)
			70 °C; 8000 h	± (0.1 % R + 0.02 Ω)
		Endurance at 70 °C: power operation mode	$U = \sqrt{P_{70} \times R}$ or $U = U_{max.}$; whichever is the less severe; 1.5 h on; 0.5 h off; 70 °C; 1000 h	± (0.1 % R + 0.01 Ω)
			70 °C; 8000 h	± (0.2 % R + 0.02 Ω)
4.25.3	-	Endurance at upper category temperature	125 °C; 1000 h	± (0.05 % R + 0.01 Ω)
			155 °C; 1000 h	± (0.1 % R + 0.02 Ω)
4.24	78 (Cab)	Damp heat, steady state	(40 ± 2) °C; 56 days; (93 ± 3) % RH	± (0.1 % R + 0.01 Ω)
4.37	67 (Cy)	Damp heat, steady state accelerated: Standard operation mode	(85 ± 2) °C (85 ± 5) % RH $U = \sqrt{0.1 \times P_{70} \times R}$; $U \leq 0.3 \times U_{max.}$; 1000 h	± (0.25 % R + 0.05 Ω)
-	1 (Ab)	Cold	-55 °C; 2 h	± (0.05 % R + 0.01 Ω)

TEST PROCEDURES AND REQUIREMENTS				
EN 60115-1 CLAUSE	**IEC 60068-2 (1) TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS PERMISSIBLE CHANGE (δR)**
			Stability for product types:	
			TNPW0201 e3	22 Ω to 40 kΩ
			TNPW0402 e3	10 Ω to 100 kΩ
			TNPW0603 e3	1 Ω to 332 kΩ
			TNPW0805 e3	1 Ω to 1 MΩ
			TNPW1206 e3	1 Ω to 2 MΩ
			TNPW1210 e3	10 Ω to 3.01 MΩ
4.19	14 (Na)	Rapid change of temperature	30 min at LCT and 30 min at UCT; LCT = - 55 °C; UCT = 125 °C; 1000 cycles	± (0.1 % R + 0.01 Ω)
4.13	-	Short time overload: standard operation mode	$U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$; whichever is the less severe; 5 s	± (0.05 % R + 0.01 Ω)
		Short time overload: power operation mode	$U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$; whichever is the less severe; 5 s	± (0.1 % R + 0.01 Ω)
4.27	-	Single pulse high voltage overload: standard operation mode	Severity no. 4: $U = 10 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$; whichever is the less severe; 10 pulses 10 µs/700 µs	± (0.5 % R + 0.02 Ω) no visible damage
		Single pulse high voltage overload: power operation mode	Severity no. 4: $U = 10 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max.}$; whichever is the less severe; 10 pulses 10 µs/700 µs	± (1 % R + 0.02 Ω) no visible damage
4.39	-	Periodic electric overload: standard operation mode	$U = \sqrt{15 \times P_{70} \times R}$ or $U = 2 \times U_{max.}$; 0.1 s on; 2.5 s off; whichever is the less severe; 1000 cycles	± (0.5 % R + 0.05 Ω) no visible damage
		Periodic electric overload: power operation mode	$U = \sqrt{15 \times P_{70} \times R}$ or $U = 2 \times U_{max.}$; 0.1 s on; 2.5 s off; whichever is the less severe; 1000 cycles	± (1 % R + 0.05 Ω) no visible damage
4.38	-	Electro static discharge (human body model)	IEC 61340-3-1 (1); 3 pos. + 3 neg. (equivalent to MIL-STD-883, method 3015) TNPW0201 e3: 200 V TNPW0402 e3: 400 V TNPW0603 e3: 1000 V TNPW0805 e3: 1500 V TNPW 1206 e3: 2000 V	± (0.5 % R + 0.05 Ω)
4.22	6 (Fc)	Vibration	Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s²; 7.5 h	± (0.05 % R + 0.01 Ω) no visible damage

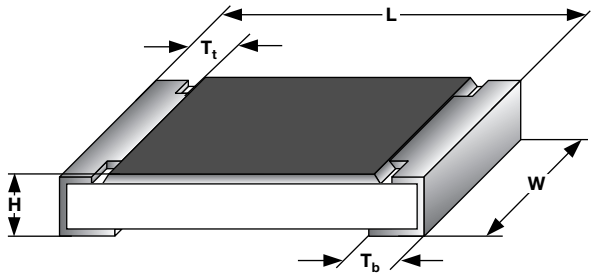
TEST PROCEDURES AND REQUIREMENTS				
EN 60115-1 CLAUSE	**IEC 60068-2 (1) TEST METHOD**	**TEST**	**PROCEDURE**	**REQUIREMENTS PERMISSIBLE CHANGE (δR)**
			Stability for product types:	
			TNPW0201 e3	22 Ω to 40 kΩ
			TNPW0402 e3	10 Ω to 100 kΩ
			TNPW0603 e3	1 Ω to 332 kΩ
			TNPW0805 e3	1 Ω to 1 MΩ
			TNPW1206 e3	1 Ω to 2 MΩ
			TNPW1210 e3	10 Ω to 3.01 MΩ
4.17	58 (Td)	Solderability	Solder bath method; SnPb40; non-activated flux (215 ± 3) °C; (3 ± 0.3) s	Good tinning (≥ 95 % covered); no visible damage
			Solder bath method; SnAg3Cu0.5 or SnAg3.5; non-activated flux (235 ± 3) °C; (2 ± 0.2) s	
4.18	58 (Td)	Resistance to soldering heat	Solder bath method; (260 ± 5) °C; (10 ± 1) s (2)	± (0.02 % R + 0.01 Ω)
4.29	45 (XA)	Component solvent resistance	Isopropyl alcohol + 50 °C; method 2	No visible damage
4.32	21 (Ue_3)	Shear (adhesion)	TNPW0201 e3: 2 N	No visible damage
			TNPW0402 e3 and TNPW0603 e3: 9 N	
			TNPW0805 e3 and TNPW1206 e3: 45 N	
4.33	21 (Ue_1)	Substrate bending	Depth 2 mm, 3 times	± (0.05 % R + 0.01 Ω) no visible damage, no open circuit in bent position
4.7	-	Voltage proof	$U_{RMS} = U_{ins}$; 60 ± 5 s	No flashover or breakdown
4.35	-	Flammability	IEC 60695-11-5 (1), needle flame test; 10 s	No burning after 30 s

Notes

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents

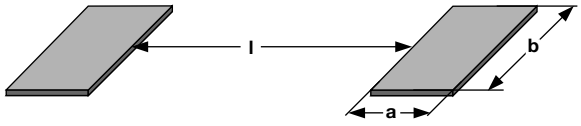
(2) For TNPW0201 e3 only similar to DIN EN 60115-8 test procedure. Due to the components small size they were fixed by glue previous to testing instead of applying tweezers

DIMENSIONS



DIMENSIONS AND MASS					
TYPE / SIZE	L (mm)	W (mm)	H (mm)	T_t / T_b (mm)	MASS (mg)
TNPW0201 e3	0.6 ± 0.05	0.3 ± 0.05	0.23 ± 0.03	0.12 ± 0.05	0.14
TNPW0402 e3	1.0 ± 0.05	0.5 ± 0.05	0.35 ± 0.05	0.2 ± 0.10	0.65
TNPW0603 e3	1.55 ± 0.05	0.85 ± 0.10	0.45 ± 0.10	0.3 ± 0.20	2
TNPW0805 e3	2.0 ± 0.1	1.25 ± 0.15	0.45 ± 0.10	0.4 ± 0.20	5.5
TNPW1206 e3	3.2 + 0.1 / - 0.2	1.6 ± 0.15	0.55 ± 0.10	0.5 ± 0.25	10
TNPW1210 e3	3.2 + 0.1 / - 0.2	2.45 ± 0.15	0.60 ± 0.15	0.5 ± 0.25	16

SOLDER PAD DIMENSIONS



RECOMMENDED SOLDER PAD DIMENSIONS						
TYPE / SIZE	REFLOW SOLDERING			WAVE SOLDERING		
	a (mm)	b (mm)	l (mm)	a (mm)	b (mm)	l (mm)
TNPW0201 e3	0.28	0.43	0.23	-	-	-
TNPW0402 e3	0.4	0.6	0.5	-	-	-
TNPW0603 e3	0.5	0.9	1.0	0.9	0.9	1.0
TNPW0805 e3	0.7	1.3	1.2	0.9	1.3	1.3
TNPW1206 e3	0.9	1.7	2.0	1.1	1.7	2.3
TNPW1210 e3	0.9	2.5	2.0	1.1	2.5	2.3

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TNPW12062K37BEEN TNPW12066K90BEEN TNPW120637K4BEEN TNPW120662K6BEEN TNPW08052K64BEEN TNPW0805442KBEEN TNPW08055K11BEEN TNPW08055K23BEEN TNPW12061K43BEEN TNPW12061K58BEEN TNPW12061K80BEEN TNPW120610K2BEEN TNPW120611K8BEEN TNPW120612K0BEEN TNPW120614K3BEEN TNPW120618K0BEEN TNPW12062K21BEEN TNPW12062K32BEEN TNPW12062K49BEEN TNPW120625K5BEEN TNPW120628K7BEEN TNPW12063K44BEEN TNPW12063K57BEEN TNPW120635K7BEEN TNPW12064K12BEEN TNPW12064K37BEEN TNPW1206402RBEEN TNPW120653K6BEEN TNPW1206750RBEEN TNPW12068K06BEEN TNPW1206806RBEEN TNPW08054K75BEEN TNPW08053K61BEEA TNPW08053K61BEEN TNPW080554R9BEEN TNPW080561R9BEEN TNPW08052K61BEEN TNPW080524R9BEEA TNPW080524R9BEEN TNPW080580K0BEEA TNPW080580K0BEEN TNPW080540K0BEEA TNPW080540K0BEEN TNPW080521K0BEEN TNPW080525K0BEEN TNPW080524K0BEEN TNPW080525K0BEEA TNPW080512K0BEEN TNPW080516K0BEEN TNPW080537K0BEEN TNPW080536K0BEEN TNPW080534K0BEEN TNPW080530K0BEEN TNPW080537K0BEEA TNPW080575K0BEEN TNPW06031292BEEN TNPW06031292BEEA TNPW0805383RBEEN TNPW12063K44BEEA TNPW12061K30BEEN TNPW12062K18BEEA TNPW12062K18BEEN TNPW06032K55BEEN TNPW0805294KBEEN TNPW0805284KBEEN TNPW0805284KBEEA TNPW0805294KBEEA TNPW1206203KBEEA TNPW1206243KBEEN TNPW1206203KBEEN TNPW1206453KBEEA TNPW1206453KBEEN TNPW1206523KBEEA TNPW1206523KBEEN TNPW1206113KBEEN TNPW1206133KBEEN TNPW12061003BEEA TNPW12061003BEEN TNPW12066003BEEN TNPW12066003BEEA TNPW12062103BEEN TNPW12062403BEEN TNPW12061K52BEEN TNPW12061K52BEEA TNPW12063K52BEEN TNPW12063K52BEEA TNPW080568K1BEEN TNPW080519K1BEEN TNPW0603182KBEEA TNPW0603182KBEEN TNPW08055360BEEN TNPW12068K66BEEN TNPW06034991BEEA TNPW06034991BEEN TNPW12062K55BEEN TNPW12068873BEEN TNPW080524K3BEEN TNPW080583K3BEEN TNPW080583K3BEEA TNPW080545K3BEEN