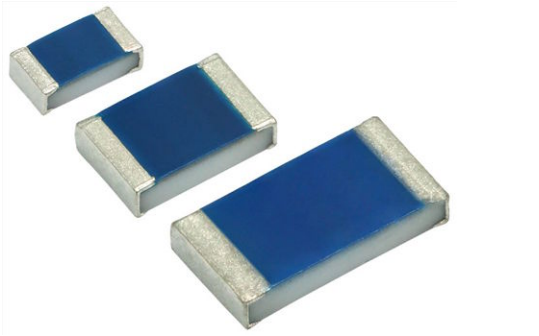
Temperature Dependent Platinum Thin Film Chip Resistor (RTD)



FEATURES

- Standardized characteristics according to IEC 60751
- AEC-Q200 qualified
- Short reaction times down to $t_{0.9} \leq 2$ s (in air)
- Outstanding stability of temperature characteristic
- Superior temperature cycling robustness
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE

DESIGN SUPPORT TOOLS AVAILABLE

3D Models | Design Tools | SPICE Models

APPLICATIONS

Temperature measurement and control in

- Automotive electronics
- Aviation electronics
- Industrial electronics

PTS AT SMD flat chip temperature dependent resistors are the perfect choice for temperature control of electronics operating under varying environmental conditions. The highly controlled platinum thin film manufacturing process guarantees an outstanding stability of temperature characteristics which ensures reliable operation even under harsh conditions. Typical applications include automotive, aviation and industrial electronics.

TECHNICAL SPECIFICATIONS

DESCRIPTION		PTS0603M	PTS0805M	PTS1206M
Resistance values R_0 at 0 °C		100 Ω	100 Ω, 500 Ω	100 Ω, 500 Ω, 1000 Ω
Temperature coefficient (0 °C to +100 °C), IEC60751		+3850 ppm/K		
Tolerance classes		F0.3, F0.6		
Temperature range		-55 °C to +175 °C		
Long term stability $\lvert\Delta R_0/R_0\rvert$; R_0 change after 1000 h at +155 °C		≤ 0.1 %		
Insulation resistance		> 10 MΩ		
Measurement current $I_{meas.}$ (DC) (1)	100 Ω	0.1 mA to 0.50 mA	0.1 mA to 1.0 mA	0.1 mA to 1.0 mA
	500 Ω	-	0.1 mA to 0.40 mA	0.1 mA to 0.40 mA
	1000 Ω	-	-	0.1 mA to 0.25 mA
Self-heating at 0 °C (2)	Calm air (v = 0.0 m/s)	≤ 0.9 K/mW	≤ 0.8 K/mW	≤ 0.7 K/mW
Thermal response time (2)	Flowing water (v = 0.4 m/s)	$t_{0.5} \leq 0.1$ s	$t_{0.5} \leq 0.2$ s	$t_{0.5} \leq 0.3$ s
		$t_{0.9} \leq 0.2$ s	$t_{0.9} \leq 0.3$ s	$t_{0.9} \leq 0.4$ s
	Flowing air (v = 3.0 m/s)	$t_{0.5} \leq 1.0$ s	$t_{0.5} \leq 1.5$ s	$t_{0.5} \leq 2.0$ s
		$t_{0.9} \leq 2.0$ s	$t_{0.9} \leq 3.0$ s	$t_{0.9} \leq 5.0$ s
Failure rate: $FIT_{observed}$		≤ 0.5 x 10^{-9}/h		

Notes

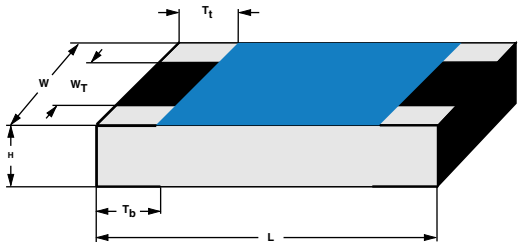
(1) Indicated measurement currents can be applied continuously with self-heating effect of less then 0.1 °C

(2) Valid for sensor element only, in low dissipative mode. Response time and self-heating are influenced by mounting materials as substrate, solder lands, tracks and solders used

For technical questions, contact: nlr@vishay.com

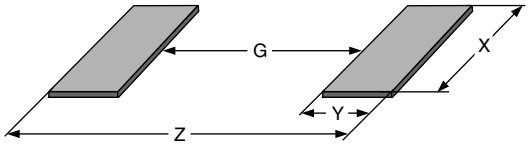
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DIMENSIONS in millimeters



DIMENSIONS AND MASS							
TYPE	H	L	W	W_T	T_t	T_b	MASS (mg)
PTS 0603	0.45 + 0.1/- 0.05	1.55 +0.05 / -0.1	0.85 ± 0.1	> 75 % of W	0.3 + 0.15/- 0.2	0.3 + 0.15/- 0.2	1.9
PTS 0805	0.45 + 0.1 / - 0.05	2.0 ± 0.1	1.25 ± 0.15	> 75 % of W	0.4 ± 0.2	0.4 ± 0.2	4.6
PTS 1206	0.55 ± 0.1	3.1 + 0.1 / - 0.2	1.6 ± 0.15	> 75 % of W	0.5 ± 0.25	0.5 ± 0.25	9.2

SOLDER PAD DIMENSIONS in millimeters



RECOMMENDED SOLDERPAD DIMENSIONS								
TYPE	WAVE SOLDERING				REFLOW SOLDERING			
	G	Y	X	Z	G	Y	X	Z
PTS 0603	0.55	1.1	1.1	2.75	0.65	0.7	0.95	2.05
PTS 0805	0.8	1.25	1.50	3.2	0.9	0.9	1.4	2.7
PTS 1206	1.4	1.5	1.9	4.4	1.5	1.15	1.75	3.8

DESCRIPTION

A homogeneous film of platinum is deposited on a high grade (Al_2O_3) ceramic substrate and conditioned to achieve the correct temperature coefficient and stability. The sensor-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 immunity against tin whisker growth has been proven under extensive testing.

QUALITY

The result of the determined production is verified by an extensive testing procedure and optical inspection performed on 100 % of the individual sensors. Only accepted products are laid directly into the paper tape in accordance with IEC 60286-3.

STORAGE

Solderability is specified for 2 years after production or re-qualification. The permitted storage time is 20 years.

ASSEMBLY

The Pt-sensors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapour phase as shown in IEC61760-1. 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, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system. The use of potting resins in close contact with the protective coating or terminations is not recommended.

For frequent high temperature usage, thermal compatible substrates and solder alloys should be selected to minimize any thermal mismatch.

All products comply with the CEFIC-EECA-EICTA list of legal restrictions on hazardous substances.

This includes full compatibility 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)
- 2002/96/EC Waste Electrical and Electronic Equipment Directive (WEEE)

APPROVALS

The Pt-sensors are tested in accordance with

- IEC 60751
- IEC 60068 series

The PTS AT are AEC-Q200 qualified.

For technical questions, contact: nlr@vishay.com

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PART NUMBER AND PRODUCT DESCRIPTION (1)

PART NUMBER (2): PTS0805M1B500RP100

P	T	S	0	8	0	5	M	1	B	5	0	0	R	P	1	0	0

TYPE	SIZE CODE	VERSION	TOLERANCE CLASS	RESISTANCE VALUE	PACKAGING (3)	SPECIAL
3 digits	4 digits	1 digit	2 digits	4 digits	2 digits	2 digits
PTS = platinum temperature sensor SMD	**0603** **0805** **1206**	**M** = AT (automotive)	**1B** = class F0.3 **2B** = class F0.6	**100R** = 100 Ω **500R** = 500 Ω **1K00** = 1000 Ω	**PU** **P1** **P5**	**00** = standard

PRODUCT DESCRIPTION (4): PTS 0805-B AT P1 500R

PTS	0805	-B	AT	P1	500R
TYPE	SIZE CODE	TOLERANCE CLASS	VERSION	PACKAGING (3)	RESISTANCE VALUE
PTS = platinum temperature sensor SMD	**0603** **0805** **1206**	**B** = class F0.3 **2B** = class F0.6	**AT** = automotive	**PU** **P1** **P5**	**100R** = 100 Ω **500R** = 500 Ω **1K** = 1000 Ω

Notes

(1) Products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION
(2) The part number is shown to facilitate the introduction of a unified part numbering system
(3) Please refer to table PACKAGING
(4) We recommend that the Production Description is used to minimize the possibility of errors in order handling

PACKAGING

TYPE	CODE	QUANTITY	CARRIER TAPE	WIDTH	PITCH	BOX/REEL	BOX/REEL DIAMETER
PTS 0603 PTS 0805 PTS 1206	PU	100	Paper tape acc. IEC 60286-3	8 mm	4 mm	Plastic box	114 mm
	P1	1000				Reel	180 mm/7"
	P5	5000					

TEST AND REQUIREMENTS - PERFORMANCE

TEST	CONDITIONS	REQUIREMENTS $\lvert\Delta R_0/R_0\rvert \leq \pm$	TYPICAL PERFORMANCE	
			$\lvert\Delta R_0/R_0\rvert \leq \pm$	$\Delta T \leq \pm$
High temperature exposure (storage)	AEC-Q200, 1000 h at 155 °C	0.1 %	0.015 %	0.04 °C
High temperature exposure (storage)	1000 h at 175 °C	0.2 %	0.018 %	0.05 °C
Temperature cycling	AEC-Q200, 1000 cycles -55 °C to +155 °C	0.5 %	0.04 %	0.10 °C
Biased humidity	1000 h, 1 mA biased at 85 °C / 85 % rh	0.5 %	0.015 %	0.04 °C
Operational life	1000 h, 1 mA biased at 125 °C	0.2 %	0.01 %	0.03 °C
Vibration	MIL-STD 202, method 204	0.1 %	0.02 %	0.05 °C
Mechanical shock	MIL-STD 202, method 213	0.1 %	0.02 %	0.05 °C
Resistance to soldering heat	Solder bath dipping 10 s at 260°C	0.25 %	0.05 %	0.13 °C
ESD	AEC-Q200-002, HBM (CD) 1.0 kV (0603), 1.5 kV (0805), 2.0 kV (1206)	0.2 %	0.01 %	0.03 °C
Board flex	AEC-Q200-005, 2 mm during 60 s	0.2 %	0.015 %	0.04 °C
Terminal strength	AEC-Q200-006, shear test 10 N / 17.7 N during 60 s	0.25 %	0.018 %	0.05 °C

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FUNCTIONAL PERFORMANCE

The temperature resistance relationships of the PTS series follow different equations:

For the temperature range of -55 °C up to 0 °C:

$$R_T = R_0 \times (1 + A \times T + B \times T^2 + C \times (T - 100\ °C) \times T^3)$$

And for the temperature range of 0 °C up to +175 °C:

$$R_T = R_0 \times (1 + A \times T + B \times T^2)$$

R_T: Resistance as a function of temperature
R_0: Nominal resistance value at 0 °C
T: Temperature in °C

According to IEC 60751 the values of the coefficients are:

$A = 3.9083 \times 10^{-3}\ °C^{-1}$
$B = -5.775 \times 10^{-7}\ °C^{-2}$
$C = -4.183 \times 10^{-12}\ °C^{-4}$

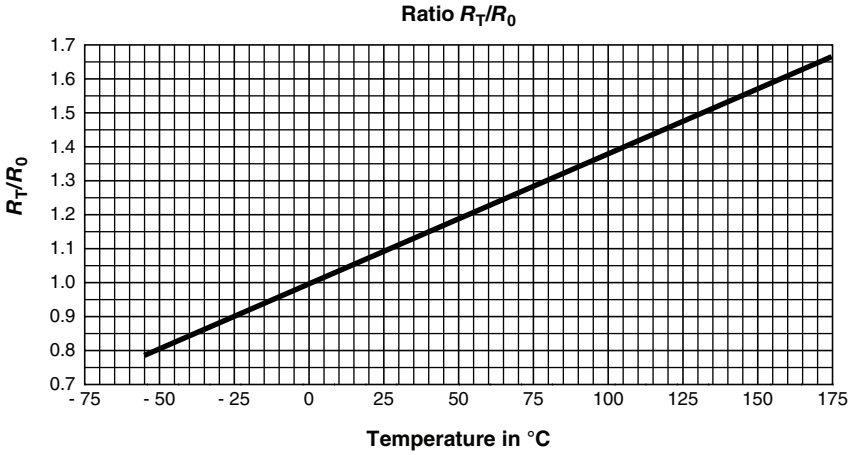
The tolerances values of the PTS AT series are classified by the following equations as specified by IEC 60751:

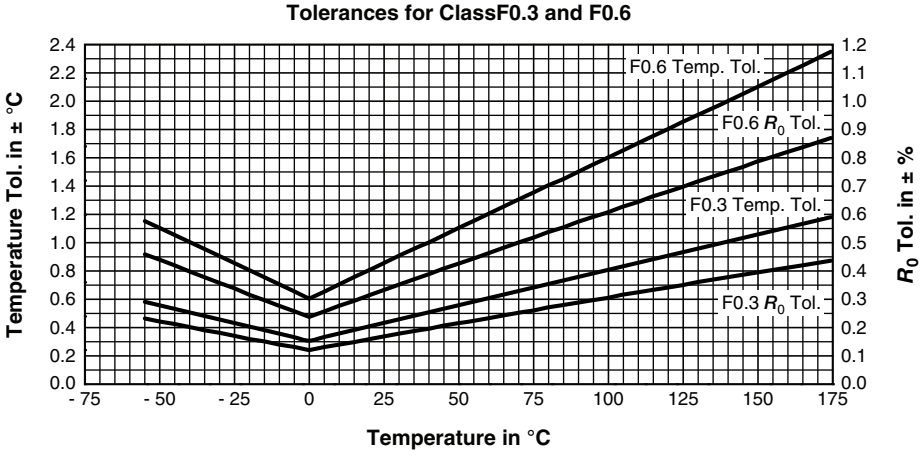
Class F0.3: $\Delta T_{F0.3} = \pm (0.3 + 0.005 \times |T|)$

Class F0.6: $\Delta T_{F0.6} = \pm (0.6 + 0.010 \times |T|)$

NOMINAL RESISTANCE VALUES AND TEMPERATURE TOLERANCE

TEMPERATURE in °C	NOMINAL RESISTANCE in Ω			TOLERANCE in K	
	R_0 = 100 Ω	R_0 = 500 Ω	R_0 = 1000 Ω	CLASS F0.3	CLASS F0.6
-55	78.319	391.59	783.19	± 0.58	± 1.15
-50	80.306	401.53	803.06	± 0.55	± 1.10
-25	90.192	450.96	901.92	± 0.43	± 0.85
0	**100.00**	**500.00**	**1000.00**	**± 0.30**	**± 0.60**
25	109.73	548.67	1097.35	± 0.43	± 0.85
50	119.40	596.99	1193.97	± 0.55	± 1.10
75	128.99	644.94	1289.87	± 0.68	± 1.35
100	138.51	692.53	1385.06	± 0.80	± 1.60
125	147.95	739.76	1479.51	± 0.93	± 1.85
150	157.33	786.63	1573.25	± 1.05	± 2.10
175	166.63	833.13	1666.27	± 1.18	± 2.35





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