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# **SMD PTC - Nickel Thin Film Linear Thermistors**



## **FEATURES**

- · Alumina substrate base with nickel based PTC thin film element
- 0603, 0805, and 1206 sizes available
- Available in tape and reel packaging
- Standard  $R_{25}$  tolerances:  $\pm 0.5$  %,  $\pm 1$  %,  $\pm 5$  %
- Operation range -55 °C to +150 °C
- High stability over the entire temperature range
- cUL recognized component: File E148885
- AEC-Q200 qualified (grade 1)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

QUICK REFERENCE DATA							
PARAMETER							
DESCRIPTION	TFPT0603	TFPT0805	TFPT1206				
Resistance value at 25 °C <sup>(2)</sup>	100 to 1K	100 to 5K	100 to 10K	Ω			
Tolerance on $R_{25}$ -value <sup>(2)</sup>		± 0.5; ± 1; ± 5		%			
TCR at 25 °C		4110					
Tolerance on TCR at 25 °C <sup>(1)</sup>							
Operating temperature range:							
at rated power		°C					
at zero dissipation <sup>(4)</sup>		C					
Dissipation factor $\delta$ (for information only)	1.8	mW/K					
Maximum rated power at 70 °C (P70)	75	mW					
Maximum working voltage RCWV (3)	30	V					
Climatic category (LCT/UCT/days)	55/150/56 -						
Weight	2 5.5 10						

#### Notes

<sup>(1)</sup> Contact Vishay if closer TCR lot tolerance is desired.

<sup>(2)</sup> Other  $R_{25}$ -values and tolerances are available upon request.

<sup>(3)</sup> Rated continuous working voltage is maximum working voltage or  $\sqrt{P_{70} \times R}$  whichever is less.

<sup>(4)</sup> Zero power or zero dissipation is considered as measuring power max. 1 % of rated power  $P_{70}$ .

STANDARD RESISTANCE VALUES at 25 °C in $\Omega$								
100	180	330	560	1.0K	1.8K	3.3K	5.0K	8.2K
120	220	390	680	1.2K	2.2K	3.9K	5.6K	10.0K
150	270	470	820	1.5K	2.7K	4.7K	6.8K	

#### Note

Rated continuous working voltage is maximum working voltage or  $\sqrt{P_{70} \times R}$  whichever is less.



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## **DIMENSIONS** in millimeters



PART NUMBER	Α	В	С	D	Е
TFPT 0603	1.55	0.80	0.45	0.30	0.30
	± 0.10	± 0.10	± 0.10	± 0.20	± 0.20
TFPT 0805	2.00	1.25	0.45	0.40	0.40
	± 0.15	± 0.15	± 0.10	± 0.20	± 0.20
TFPT 1206	3.05	1.50	0.55	0.50	0.50
	± 0.15	± 0.15	± 0.10	± 0.25	± 0.25



CONSTRUCTION



### Note

<sup>•</sup> Zero power is considered as measuring power max. 1 % of rated power P<sub>70</sub>.

TESTS AND REQUIREMENTS							
TEST	CONDITIONS <sup>(1)</sup>	REQUIREMENTS MAX  \DR_{25}/R_{25}					
High temperature exposure (storage)	AEC-Q200, 1000 h at 150 °C	0.25 %					
Temperature cycling	AEC-Q200, 1000 cycles -55 °C / +125 °C	0.25 %					
Dies od humiditu	1000 h, 1 mA biased at 85 °C / 85 % RH	0.25 %					
Blased Hulflidity	1000 h, 1 mA biased at 40 °C / 95 % RH	0.25 %					
Operational life	1000 h, <i>P</i> <sub>70</sub> max biased at 85 °C	0.25 %					
Mechanical shock and vibration	MIL-STD 202, method 213 - 204	0.50 %					
Resistance to soldering heat	MIL-STD 202, method 210, solderbath dipping 10 s at 260°C	0.25 %					
ESD <sup>(2)</sup>	AEC-Q200-002, HBM (CD) 0.5 kV (0603), 1.0 kV (0805), 1.0 kV (1206)	0.25 %					
Board flex	AEC-Q200-005, 2 mm during 60 s	0.25 %					
Terminal strength	AEC-Q200-006, shear test 17.7 N during 60 s	0.25 %					

### Notes

<sup>(1)</sup> Environmental performance specifications use test procedures as outlined in MIL-R23648D, MIL-STD 202 and AEC-Q200.

<sup>(2)</sup> TFPTs are ESD sensitive.

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AVERAGE RATIO R/R <sub>25</sub> TFPT ALL SIZES AND VALUES											
TEMP.	R/R <sub>25</sub>	TEMP.	R/R <sub>25</sub>	TEMP.	R/R <sub>25</sub>	TEMP.	R/R <sub>25</sub>	TEMP.	R/R <sub>25</sub>	TEMP.	R/R <sub>25</sub>
		-20	0.825	20	0.980	60	1.150	100	1.337	140	1.541
		-19	0.828	21	0.984	61	1.155	101	1.342	141	1.547
		-18	0.832	22	0.988	62	1.159	102	1.347	142	1.552
		-17	0.836	23	0.992	63	1.164	103	1.352	143	1.557
		-16	0.839	24	0.996	64	1.168	104	1.357	144	1.563
-55	0.702	-15	0.843	25	1.000	65	1.173	105	1.362	145	1.568
-54	0.705	-14	0.847	26	1.004	66	1.177	106	1.367	146	1.574
-53	0.708	-13	0.851	27	1.008	67	1.182	107	1.372	147	1.579
-52	0.712	-12	0.854	28	1.012	68	1.186	108	1.377	148	1.584
-51	0.715	-11	0.858	29	1.017	69	1.191	109	1.382	149	1.590
-50	0.719	-10	0.862	30	1.021	70	1.196	110	1.387	150	1.595
-49	0.722	-9	0.866	31	1.025	71	1.200	111	1.392		
-48	0.725	-8	0.869	32	1.029	72	1.205	112	1.397		
-47	0.729	-7	0.873	33	1.033	73	1.209	113	1.402		
-46	0.732	-6	0.877	34	1.037	74	1.214	114	1.407		
-45	0.736	-5	0.881	35	1.042	75	1.219	115	1.412		
-44	0.739	-4	0.885	36	1.046	76	1.223	116	1.417		
-43	0.743	-3	0.889	37	1.050	77	1.228	117	1.422		
-42	0.746	-2	0.892	38	1.054	78	1.232	118	1.427		
-41	0.749	-1	0.896	39	1.059	79	1.237	119	1.432		
-40	0.753	0	0.900	40	1.063	80	1.242	120	1.437		
-39	0.756	1	0.904	41	1.067	81	1.246	121	1.442		
-38	0.760	2	0.908	42	1.071	82	1.251	122	1.448		
-37	0.763	3	0.912	43	1.076	83	1.256	123	1.453		
-36	0.767	4	0.916	44	1.080	84	1.261	124	1.458		
-35	0.771	5	0.920	45	1.084	85	1.265	125	1.463		
-34	0.774	6	0.924	46	1.089	86	1.270	126	1.468		
-33	0.778	7	0.927	47	1.093	87	1.275	127	1.473		
-32	0.781	8	0.931	48	1.097	88	1.280	128	1.478		
-31	0.785	9	0.935	49	1.102	89	1.284	129	1.484		
-30	0.788	10	0.939	50	1.106	90	1.289	130	1.489		
-29	0.792	11	0.943	51	1.110	91	1.294	131	1.494		
-28	0.796	12	0.947	52	1.115	92	1.299	132	1.499		
-27	0.799	13	0.951	53	1.119	93	1.303	133	1.505		
-26	0.803	14	0.955	54	1.124	94	1.308	134	1.510		
-25	0.806	15	0.959	55	1.128	95	1.313	135	1.515		
-24	0.810	16	0.963	56	1.133	96	1.318	136	1.520		
-23	0.814	17	0.967	57	1.137	97	1.323	137	1.526		
-22	0.817	18	0.971	58	1.141	98	1.328	138	1.531		
-21	0.821	19	0.975	59	1.146	99	1.333	139	1.536		

## **RATIO FORMULA**

$$\begin{split} R_{\rm T} &= R_{25} \ge (9.0014 \ge 10^{-1} + 3.87235 \ge 10^{-3} \, (^{\circ}{\rm C})^{-1} \ge T + 4.86825 \ge 10^{-6} \, (^{\circ}{\rm C})^{-2} \ge T^2 + 1.37559 \ge 10^{-9} \, (^{\circ}{\rm C})^{-3} \ge T^3) \\ T_{(^{\circ}{\rm C})} &= 28.54 \ge (R_{\rm T}/R_{25})^3 - 158.5 \ge (R_{\rm T}/R_{25})^2 + 474.8 \ge (R_{\rm T}/R_{25}) - 319.85) \end{split}$$

RATIO TOLERANCES						
LOW TEMP.	HIGH TEMP.	TOL.				
-55 °C	+150 °C	±4%				
-40 °C	+125 °C	± 3 %				
-20 °C	+85 °C	±2%				
0 °C	+55 °C	±1%				
+12 °C	+40 °C	± 0.5 %				

## **RATIO TOLERANCE EXAMPLES:**

At 40 °C, ratio =  $1.063 \pm 0.5 \%$  (0.005) so, ratio = 1.058 to 1.068At 125 °C, ratio =  $1.460 \pm 3 \%$  (0.044) so, ratio = 1.416 to 1.504

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3 For technical questions, contact: <u>nlr@vishay.com</u> Document Number: 33017

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