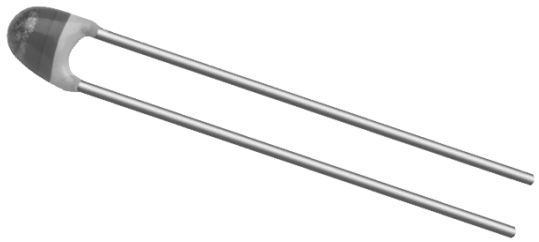
# NTC Thermistors, Accuracy Line



## FEATURES

- Accuracy over a wide temperature range
- High stability over a long life
- Excellent price/performance ratio

## APPLICATIONS

- Temperature sensing and control

These thermistors have a negative temperature coefficient. The device consists of a chip with two tinned solid copper-plated leads. It is grey lacquered and colour coded, but not insulated.

## PACKAGING

The thermistors are packed in bulk or tape on reel; see code numbers and relevant packaging quantities.

## QUICK REFERENCE DATA

| PARAMETER | VALUE |
|---|---|
| Resistance value at 25 °C | 3.3 Ω to 470 kΩ |
| Tolerance on $R_{25}$-value | ±2%; ±3%; ±5%; ±10% |
| Tolerance on $B_{25/85}$-value | ±0.5% to ±3% |
| Maximum dissipation | 500 mW |
| Dissipation factor δ (for information only) | 7 mW/K<br>8.5 mW/K (for 640..338 to 689) |
| Response time | 1.2 s |
| Thermal time constant τ (for information only) | 15 s |
| Operating temperature range:<br>at zero dissipation; continuously<br>at zero dissipation; for short periods<br>at maximum dissipation (500 mW) | <br>–40 to +125 °C<br>≤150 °C<br>0 to 55 °C |
| Climatic category | 40/125/56 |
| Mass | ≈0.3 g |

## ELECTRICAL DATA AND ORDERING INFORMATION

| $R_{25}$ (Ω) | $B_{25/85}$-VALUE | CATALOG NUMBER 2322 640 6.... | | | | COLOR CODE (see dimensions drawing and note 1) | | |
|---|---|---|---|---|---|---|---|---|
| | | $R_{25}$ ±2% | $R_{25}$ ±3% | $R_{25}$ ±5% | $R_{25}$ ±10% | I | II | III |
| 3.3 | 2880 K ±3% | 4338 | 6338 | 3338 | 2338 | orange | orange | gold |
| 4.7 | 2880 K ±3% | 4478 | 6478 | 3478 | 2478 | yellow | violet | gold |
| 6.8 | 2880 K ±3% | 4688 | 6688 | 3688 | 2688 | blue | grey | gold |
| 10 | 2990 K ±3% | 4109 | 6109 | 3109 | 2109 | brown | black | black |
| 15 | 3041 K ±3% | 4159 | 6159 | 3159 | 2159 | brown | green | black |
| 22 | 3136 K ±3% | 4229 | 6229 | 3229 | 2229 | red | red | black |
| 33 | 3390 K ±3% | 4339 | 6339 | 3339 | 2339 | orange | orange | black |
| 47 | 3390 K ±3% | 4479 | 6479 | 3479 | 2479 | yellow | violet | black |
| 68 | 3390 K ±3% | 4689 | 6689 | 3689 | 2689 | blue | grey | black |
| 100 | 3560 K ±0.75% | 4101 | 6101 | 3101 | 2101 | brown | black | brown |
| 150 | 3560 K ±0.75% | 4151 | 6151 | 3151 | 2151 | brown | green | brown |
| 220 | 3560 K ±0.75% | 4221 | 6221 | 3221 | 2221 | red | red | brown |
| 330 | 3560 K ±0.75% | 4331 | 6331 | 3331 | 2331 | orange | orange | brown |
| 470 | 3560 K ±0.5% | 4471 | 6471 | 3471 | 2471 | yellow | violet | brown |
| 680 | 3560 K ±0.5% | 4681 | 6681 | 3681 | 2681 | blue | grey | brown |
| 1000 | 3528 K ±0.5% | 4102 | 6102 | 3102 | 2102 | brown | black | red |
| 1500 | 3528 K ±0.5% | 4152 | 6152 | 3152 | 2152 | brown | green | red |

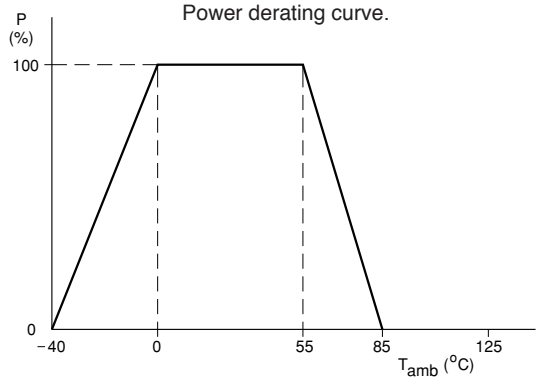
| $R_{25}$ (Ω) | $B_{25/85}$-VALUE | CATALOG NUMBER 2322 640 6.... | | | | COLOR CODE (see dimensions drawing and note 1) | | |
|---|---|---|---|---|---|---|---|---|
| | | $R_{25}$ ±2% | $R_{25}$ ±3% | $R_{25}$ ±5% | $R_{25}$ ±10% | I | II | III |
| 2000 | 3528 K ±0.5% | 4202 | 6202 | 3202 | 2202 | red | black | red |
| 2200 | 3977 K ±0.75% | 4222 | 6222 | 3222 | 2222 | red | red | red |
| 2700 | 3977 K ±0.75% | 4272 | 6272 | 3272 | 2272 | red | violet | red |
| 3300 | 3977 K ±0.75% | 4332 | 6332 | 3332 | 2332 | orange | orange | red |
| 4700 | 3977 K ±0.75% | 4472 | 6472 | 3472 | 2472 | yellow | violet | red |
| 6800 | 3977 K ±0.75% | 4682 | 6682 | 3682 | 2682 | blue | grey | red |
| 10000 | 3977 K ±0.75% | 4103 | 6103 | 3103 | 2103 | brown | black | orange |
| 12000 | 3740 K ±2% | 4123 | 6123 | 3123 | 2123 | brown | red | orange |
| 15000 | 3740 K ±2% | 4153 | 6153 | 3153 | 2153 | brown | green | orange |
| 22000 | 3740 K ±2% | 4223 | 6223 | 3223 | 2223 | red | red | orange |
| 33000 | 4090 K ±1.5% | 4333 | 6333 | 3333 | 2333 | orange | orange | orange |
| 47000 | 4090 K ±1.5% | 4473 | 6473 | 3473 | 2473 | yellow | violet | orange |
| 68000 | 4190 K ±1.5% | 4683 | 6683 | 3683 | 2683 | blue | grey | orange |
| 100000 | 4190 K ±1.5% | 4104 | 6104 | 3104 | 2104 | brown | black | yellow |
| 150000 | 4370 K ±2.5% | 4154 | 6154 | 3154 | 2154 | brown | green | yellow |
| 220000 | 4370 K ±2.5% | 4224 | 6224 | 3224 | 2224 | red | red | yellow |
| 330000 | 4570 K ±1.5% | 4334 | 6334 | 3334 | 2334 | orange | orange | yellow |
| 470000 | 4570 K ±1.5% | 4474 | 6474 | 3474 | 2474 | yellow | violet | yellow |

**Notes**

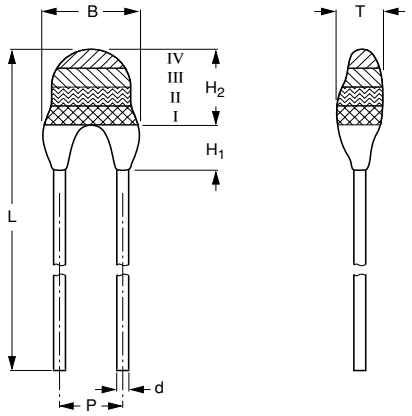
1. Dependent upon $R_{25}$-tolerance, the band IV is coloured as follows:
   a) for $R_{25}$ ±2%, band IV is coloured red
   b) for $R_{25}$ ±3%, band IV is coloured orange
   c) for $R_{25}$ ±5%, band IV is coloured gold
   d) for $R_{25}$ ±10%, band IV is coloured silver.

## DERATING AND TEMPERATURE TOLERANCES

Power derating curve.




## DIMENSIONS in millimeters




2322 640 6.338 to 6.474.

## PHYSICAL DIMENSIONS FOR RELEVANT TYPE

| CODE NUMBER 2322 640 ..... | $B_{max}$ | d | $H_1$ | | $H_2$ max | L | P | $T_{max}$ |
|---|---|---|---|---|---|---|---|---|
| | | | MIN. | MAX. | | | | |
| 6.338 to 6.221 | 5.0 | 0.6 ±0.06 | 1.0 | 4.0 | 6.0 | 24 ±1.5 | 2.54 | 4.0 |
| 6.331 to 6.474 | 3.3 ±0.5 | 0.6 ±0.06 | – | 2.0 ±1.0 | 6.0 | 24 ±1.5 | 2.54 | 3.0 |

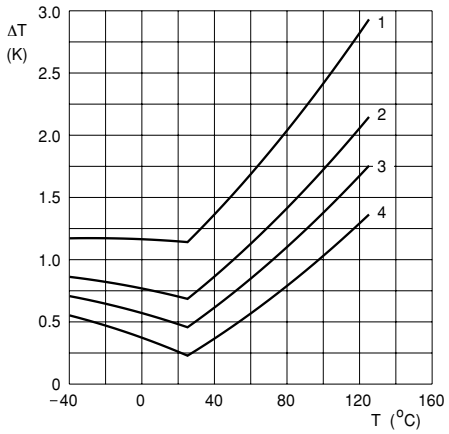
## MARKING

The thermistors are marked with coloured bands; see dimensions drawing and “Electrical data and ordering information”.

## MOUNTING

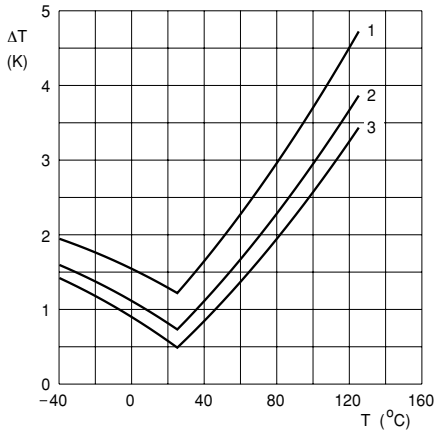
By soldering in any position.

## TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE.



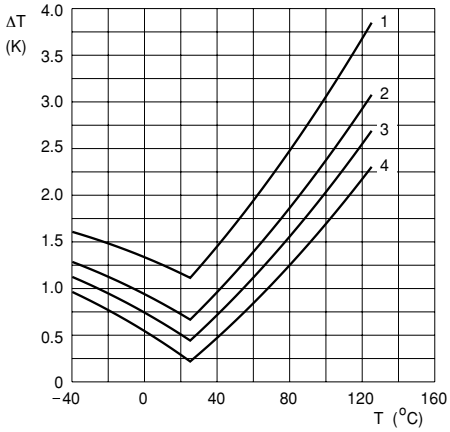

Curves valid for 2.2 to 10 kΩ.
Curve 1: $\Delta R_{25}/R_{25}$ = 5%.
Curve 2: $\Delta R_{25}/R_{25}$ = 3%.
Curve 3: $\Delta R_{25}/R_{25}$ = 2%.
Curve 4: $\Delta R_{25}/R_{25}$ = 1%
(for 2322 640 5.... series only).

## TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE.



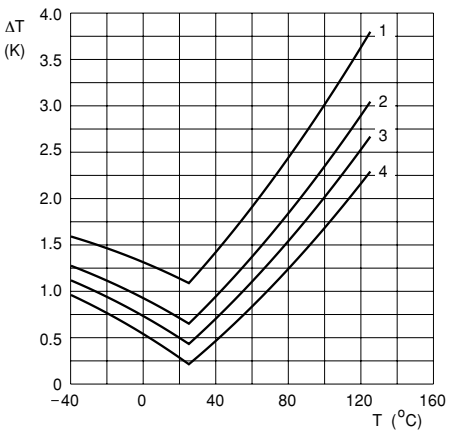

Curves valid for 12 to 22 kΩ.
Curve 1: $\Delta R_{25}/R_{25}$ = 5%.
Curve 2: $\Delta R_{25}/R_{25}$ = 3%.
Curve 3: $\Delta R_{25}/R_{25}$ = 2%.

## TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE.



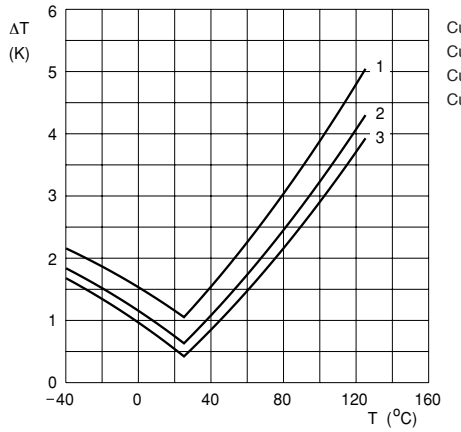

Curves valid for 33 to 47 kΩ.
Curve 1: $\Delta R_{25}/R_{25}$ = 5%.
Curve 2: $\Delta R_{25}/R_{25}$ = 3%.
Curve 3: $\Delta R_{25}/R_{25}$ = 2%.
Curve 4: $\Delta R_{25}/R_{25}$ = 1%
(for 2322 640 5.... series only).

## TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE.



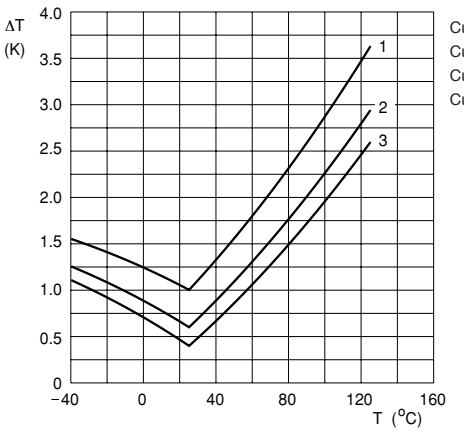

Curves valid for 68 to 100 kΩ.
Curve 1: $\Delta R_{25}/R_{25}$ = 5%.
Curve 2: $\Delta R_{25}/R_{25}$ = 3%.
Curve 3: $\Delta R_{25}/R_{25}$ = 2%.
Curve 4: $\Delta R_{25}/R_{25}$ = 1%
(for 2322 640 5.... series only).

## TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE.




Curves valid for 150 to 220 kΩ.
Curve 1: $\Delta R_{25}/R_{25}$ = 5%.
Curve 2: $\Delta R_{25}/R_{25}$ = 3%.
Curve 3: $\Delta R_{25}/R_{25}$ = 2%.

## TEMPERATURE DEVIATION AS A FUNCTION OF THE AMBIENT TEMPERATURE.




Curves valid for 330 to 470 kΩ.
Curve 1: $\Delta R_{25}/R_{25}$ = 5%.
Curve 2: $\Delta R_{25}/R_{25}$ = 3%.
Curve 3: $\Delta R_{25}/R_{25}$ = 2%.

## $R_T$ VALUE AND TOLERANCE

These thermistors have a narrow tolerance on the B-value, the result of which provides a very small tolerance on the nominal resistance value over a wide temperature range. For this reason the usual graphs of R = f(T) are replaced by Resistance Values at Intermediate Temperatures Tables, together with a formula to calculate the characteristics with a high precision.

## FORMULAE TO DETERMINE NOMINAL RESISTANCE VALUES

The resistance values at intermediate temperatures, or the operating temperature values, can be calculated using the following interpolation laws
(extended *"Steinhart and Hart"*):

$$R\,(T) = R_{ref} \times e^{(A + B/T + C/T^2 + D/T^3)} \qquad (1)$$

$$T\,(R) = \left(A_1 + B_1 \ln\frac{R}{R_{ref}} + C_1 \ln^2\frac{R}{R_{ref}} + D_1 \ln^3\frac{R}{R_{ref}}\right)^{-1} \qquad (2)$$

where:

A, B, C, D, $A_1$, $B_1$, $C_1$ and $D_1$ are constant values depending on the material concerned; see table below.

$R_{ref}$ is the resistance value at a reference temperature (in this event 25 °C).

T is the temperature in K.

Formulae numbered (1) and (2) are interchangeable with an error of max. 0.005 °C in the range 25 °C to 125 °C and max. 0.015 °C in the range –40 °C to +25 °C.

## DETERMINATION OF THE RESISTANCE/TEMPERATURE DEVIATION FROM NOMINAL VALUE

The total resistance deviation is obtained by combining the '$R_{25}$-tolerance' and the 'resistance deviation due to B-tolerance'.

When:

X = $R_{25}$-tolerance

Y = resistance deviation due to B-tolerance

Z = complete resistance deviation,

then: $Z = \left[\left(1 + \frac{X}{100}\right) \times \left(1 + \frac{Y}{100}\right) - 1\right] \times 100\%$ or $Z \approx X + Y$.

When:

TC = temperature coefficient

$\Delta T$ = temperature deviation,

then: $\Delta T = \frac{Z}{TC}$

The temperature tolerances are plotted in the graphs on the previous page.

**Example:** at 0 °C, assume X = 5%, Y = 0.89% and TC = 5.08%/K (see Table ), then:

$$Z = \left\{\left[1 + \frac{5}{100}\right] \times \left[1 + \frac{0.89}{100}\right] - 1\right\} \times 100\%$$

$$= \{1.05 \times 1.0089 - 1\} \times 100\% = 5.9345\% \ (\approx 5.93\%)$$

$$\Delta T = \frac{Z}{TC} = \frac{5.93}{5.08} = 1.167\ °C\ (\approx 1.17\ °C)$$

A NTC with a $R_{25}$-value of 10 kΩ has a value of 32.56 kΩ between –1.17 and +1.17 °C.

**PARAMETERS FOR DETERMINING NOMINAL RESISTANCE VALUES**

| $B_{25/85}$-VALUE (K) | A | B (K) | C ($10^5K^2$) | D ($10^6K^3$) | $A_1$ ($10^{-3}$) | $B_1$ ($10^{-4}K^{-1}$) | $C_1$ ($10^{-6}K^{-2}$) | $D_1$ ($10^{-7}K^{-3}$) |
|---|---|---|---|---|---|---|---|---|
| 2880 | –9.094 | 2251.74 | 229098 | –27.4482 | 3.354016 | 3.495020 | 2.095959 | 4.260615 |
| 2990 | –10.2296 | 2887.62 | 132336 | –25.0251 | 3.354016 | 3.415560 | 4.955455 | 4.364236 |
| 3041 | –11.1334 | 3658.73 | –102895 | 0.516652 | 3.354016 | 3.349290 | 3.683843 | 7.050455 |
| 3136 | –12.4493 | 4702.74 | –402687 | 31.96830 | 3.354016 | 3.243880 | 2.658012 | –2.70156 |
| 3390 | –12.6814 | 4391.97 | –232807 | 15.09643 | 3.354016 | 2.993410 | 2.135133 | –8.05672 |
| 3528(1) | –12.0596 | 3687.667 | –7617.13 | –5914730 | 3.354016 | 2.909670 | 1.632136 | 0.719220 |
| 3528(2) | –21.0704 | 11903.95 | –2504699 | 247033800 | 3.354016 | 2.933908 | 3.494314 | –7.71269 |
| 3560 | –13.0723 | 4190.574 | –47158.4 | –11992560.91 | 3.354016 | 2.884193 | 4.118032 | 1.786790 |
| 3740 | –13.8973 | 4557.725 | –98275 | –7522357 | 3.354016 | 2.744032 | 3.666944 | 1.375492 |
| 3977 | –14.6337 | 4791.842 | –115334 | –3730535 | 3.354016 | 2.569355 | 2.626311 | 0.675278 |
| 4090 | –15.5322 | 5229.973 | –160451 | –5414091 | 3.354016 | 2.519107 | 3.510939 | 1.105179 |
| 4190 | –16.0349 | 5459.339 | –191141 | –3328322 | 3.354016 | 2.460382 | 3.405377 | 1.034240 |
| 4370 | –16.8717 | 5759.15 | –194267 | –6869149 | 3.354016 | 2.367720 | 3.585140 | 1.255349 |
| 4570 | –17.6439 | 6022.726 | –203157 | –7183526 | 3.354016 | 2.264097 | 3.278184 | 1.097628 |

**Notes**

1. Temperature < 25 °C.
2. Temperature ≥25 °C.

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) | | |
|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | |
| | | | | **6.338** | **6.478** | **6.688** |
| –40 | 13.6364 | 8.08 | –4.97 | 45.00 | 64.09 | 92.73 |
| –35 | 10.6806 | 7.30 | –4.80 | 35.25 | 50.20 | 72.63 |
| –30 | 8.4350 | 6.55 | –4.64 | 27.84 | 39.64 | 57.36 |
| –25 | 6.7148 | 5.84 | –4.48 | 22.16 | 31.56 | 45.66 |
| –20 | 5.3866 | 5.15 | –4.33 | 17.78 | 25.32 | 36.63 |
| –15 | 4.3532 | 4.49 | –4.19 | 14.37 | 20.46 | 29.60 |
| –10 | 3.5432 | 3.85 | –4.05 | 11.69 | 16.65 | 24.09 |
| –5 | 2.9035 | 3.24 | –3.92 | 9.58 | 13.65 | 19.74 |
| 0 | 2.3950 | 2.65 | –3.79 | 7.90 | 11.26 | 16.29 |
| 5 | 1.9880 | 2.08 | –3.66 | 6.56 | 9.34 | 13.52 |
| 10 | 1.6602 | 1.54 | –3.55 | 5.48 | 7.80 | 11.29 |
| 15 | 1.3944 | 1.01 | –3.43 | 4.60 | 6.55 | 9.48 |
| 20 | 1.1777 | 0.49 | –3.32 | 3.89 | 5.54 | 8.01 |
| 25 | 1.0000 | 0.00 | –3.22 | 3.30 | 4.70 | 6.80 |
| 30 | 0.8534 | 0.48 | –3.12 | 2.82 | 4.01 | 5.80 |
| 35 | 0.7319 | 0.94 | –3.02 | 2.42 | 3.44 | 4.98 |
| 40 | 0.6307 | 1.39 | –2.93 | 2.08 | 2.96 | 4.29 |
| 45 | 0.5459 | 1.82 | –2.84 | 1.80 | 2.57 | 3.71 |
| 50 | 0.4746 | 2.24 | –2.76 | 1.57 | 2.23 | 3.23 |
| 55 | 0.4143 | 2.65 | –2.68 | 1.37 | 1.95 | 2.82 |
| 60 | 0.3631 | 3.04 | –2.60 | 1.20 | 1.71 | 2.47 |
| 65 | 0.3194 | 3.43 | –2.52 | 1.05 | 1.50 | 2.17 |
| 70 | 0.2820 | 3.80 | –2.45 | 0.93 | 1.33 | 1.92 |
| 75 | 0.2499 | 4.16 | –2.38 | 0.82 | 1.17 | 1.70 |
| 80 | 0.2222 | 4.51 | –2.32 | 0.73 | 1.04 | 1.51 |
| 85 | 0.1982 | 4.85 | –2.25 | 0.65 | 0.93 | 1.35 |
| 90 | 0.1774 | 5.19 | –2.19 | 0.59 | 0.83 | 1.21 |
| 95 | 0.1592 | 5.51 | –2.13 | 0.53 | 0.75 | 1.08 |
| 100 | 0.1433 | 5.82 | –2.07 | 0.47 | 0.67 | 0.97 |
| 105 | 0.1294 | 6.13 | –2.02 | 0.43 | 0.61 | 0.88 |
| 110 | 0.1171 | 6.43 | –1.97 | 0.39 | 0.55 | 0.80 |
| 115 | 0.1063 | 6.72 | –1.92 | 0.35 | 0.50 | 0.72 |
| 120 | 0.0967 | 7.00 | –1.87 | 0.32 | 0.45 | 0.66 |
| 125 | 0.0882 | 7.28 | –1.82 | 0.29 | 0.41 | 0.60 |
| 130 | 0.0806 | 7.55 | –1.77 | 0.27 | 0.38 | 0.55 |
| 135 | 0.0739 | 7.81 | –1.73 | 0.24 | 0.35 | 0.50 |
| 140 | 0.0678 | 8.07 | –1.69 | 0.22 | 0.32 | 0.46 |
| 145 | 0.0624 | 8.32 | –1.65 | 0.21 | 0.29 | 0.42 |
| 150 | 0.0575 | 8.56 | –1.61 | 0.19 | 0.27 | 0.39 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) |
|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables |
| | | | | **6.109** |
| –40 | 13.675 | 8.39 | –4.86 | 136.75 |
| –35 | 10.763 | 7.58 | –4.72 | 107.63 |
| –30 | 8.5318 | 6.81 | –4.58 | 85.32 |
| –25 | 6.8097 | 6.06 | –4.44 | 68.10 |
| –20 | 5.4717 | 5.35 | –4.31 | 54.72 |
| –15 | 4.4253 | 4.66 | –4.18 | 44.25 |
| –10 | 3.6017 | 4.00 | –4.06 | 36.02 |
| –5 | 2.9494 | 3.37 | –3.94 | 29.49 |
| 0 | 2.4295 | 2.75 | –3.82 | 24.30 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) |
|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables |
| | | | | **6.109** |
| 5 | 2.0128 | 2.16 | –3.71 | 20.13 |
| 10 | 1.6767 | 1.59 | –3.60 | 16.77 |
| 15 | 1.4042 | 1.04 | –3.50 | 14.04 |
| 20 | 1.1821 | 0.51 | –3.39 | 11.82 |
| 25 | 1.0000 | 0.00 | –3.30 | 10.00 |
| 30 | 0.8500 | 0.50 | –3.20 | 8.50 |
| 35 | 0.7259 | 0.98 | –3.11 | 7.26 |
| 40 | 0.6226 | 1.44 | –3.03 | 6.23 |
| 45 | 0.5363 | 1.89 | –2.94 | 5.36 |
| 50 | 0.4639 | 2.33 | –2.86 | 4.64 |
| 55 | 0.4029 | 2.75 | –2.78 | 4.03 |
| 60 | 0.3512 | 3.16 | –2.71 | 3.51 |
| 65 | 0.3073 | 3.56 | –2.64 | 3.07 |
| 70 | 0.2698 | 3.95 | –2.57 | 2.70 |
| 75 | 0.2377 | 4.32 | –2.50 | 2.38 |
| 80 | 0.2101 | 4.69 | –2.43 | 2.10 |
| 85 | 0.1864 | 5.04 | –2.37 | 1.86 |
| 90 | 0.1658 | 5.38 | –2.31 | 1.66 |
| 95 | 0.1479 | 5.72 | –2.25 | 1.48 |
| 100 | 0.1323 | 6.05 | –2.20 | 1.32 |
| 105 | 0.1187 | 6.36 | –2.14 | 1.19 |
| 110 | 0.1068 | 6.67 | –2.09 | 1.07 |
| 115 | 0.0964 | 6.98 | –2.04 | 0.96 |
| 120 | 0.0871 | 7.27 | –1.99 | 0.87 |
| 125 | 0.0790 | 7.56 | –1.94 | 0.79 |
| 130 | 0.0717 | 7.84 | –1.90 | 0.72 |
| 135 | 0.0653 | 8.11 | –1.85 | 0.65 |
| 140 | 0.0596 | 8.37 | –1.81 | 0.60 |
| 145 | 0.0545 | 8.63 | –1.77 | 0.55 |
| 150 | 0.0500 | 8.89 | –1.73 | 0.50 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) |
|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables |
| | | | | **6.159** |
| –40 | 17.042 | 8.53 | –5.54 | 255.63 |
| –35 | 12.993 | 7.71 | –5.31 | 194.90 |
| –30 | 10.017 | 6.92 | –5.10 | 150.26 |
| –25 | 7.8037 | 6.17 | –4.90 | 117.06 |
| –20 | 6.1382 | 5.44 | –4.71 | 92.07 |
| –15 | 4.8719 | 4.74 | –4.53 | 73.08 |
| –10 | 3.8996 | 4.07 | –4.37 | 58.49 |
| –5 | 3.1461 | 3.42 | –4.22 | 47.19 |
| 0 | 2.5571 | 2.80 | –4.07 | 38.36 |
| 5 | 2.0930 | 2.20 | –3.94 | 31.40 |
| 10 | 1.7245 | 1.62 | –3.81 | 25.87 |
| 15 | 1.4298 | 1.06 | –3.69 | 21.45 |
| 20 | 1.1924 | 0.52 | –3.57 | 17.89 |
| 25 | 1.0000 | 0.00 | –3.47 | 15.00 |
| 30 | 0.8431 | 0.50 | –3.36 | 12.65 |
| 35 | 0.7144 | 0.99 | –3.26 | 10.72 |
| 40 | 0.6083 | 1.47 | –3.17 | 9.12 |
| 45 | 0.5203 | 1.92 | –3.08 | 7.80 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) |
|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables |
| | | | | **6.159** |
| 50 | 0.4470 | 2.37 | –3.00 | 6.70 |
| 55 | 0.3856 | 2.80 | –2.92 | 5.78 |
| 60 | 0.3339 | 3.21 | –2.84 | 5.01 |
| 65 | 0.2903 | 3.62 | –2.76 | 4.35 |
| 70 | 0.2533 | 4.01 | –2.69 | 3.80 |
| 75 | 0.2218 | 4.39 | –2.62 | 3.33 |
| 80 | 0.1948 | 4.77 | –2.56 | 2.92 |
| 85 | 0.1717 | 5.13 | –2.50 | 2.58 |
| 90 | 0.1518 | 5.48 | –2.44 | 2.28 |
| 95 | 0.1346 | 5.82 | –2.38 | 2.02 |
| 100 | 0.1196 | 6.15 | –2.32 | 1.79 |
| 105 | 0.1067 | 6.47 | –2.27 | 1.60 |
| 110 | 0.0954 | 6.79 | –2.22 | 1.43 |
| 115 | 0.0855 | 7.09 | –2.17 | 1.28 |
| 120 | 0.0768 | 7.39 | –2.12 | 1.15 |
| 125 | 0.0691 | 7.69 | –2.07 | 1.04 |
| 130 | 0.0624 | 7.97 | –2.03 | 0.94 |
| 135 | 0.0565 | 8.25 | –1.98 | 0.85 |
| 140 | 0.0512 | 8.52 | –1.94 | 0.77 |
| 145 | 0.0465 | 8.78 | –1.90 | 0.70 |
| 150 | 0.0423 | 9.04 | –.86 | 0.63 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) |
|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables |
| | | | | **6.229** |
| –40 | 17.042 | 8.80 | –5.54 | 374.92 |
| –35 | 12.993 | 7.95 | –5.31 | 285.85 |
| –30 | 10.017 | 7.14 | –5.10 | 220.38 |
| –25 | 7.8037 | 6.36 | –4.90 | 171.68 |
| –20 | 6.1382 | 5.61 | –4.71 | 135.04 |
| –15 | 4.8719 | 4.89 | –4.53 | 107.18 |
| –10 | 3.8996 | 4.20 | –4.37 | 85.79 |
| –5 | 3.1461 | 3.53 | –4.22 | 69.21 |
| 0 | 2.5571 | 2.89 | –4.07 | 56.26 |
| 5 | 2.0930 | 2.27 | –3.94 | 46.05 |
| 10 | 1.7245 | 1.67 | –3.81 | 37.94 |
| 15 | 1.4298 | 1.10 | –3.69 | 31.45 |
| 20 | 1.1924 | 0.54 | –3.57 | 26.23 |
| 25 | 1.0000 | 0.00 | –3.47 | 22.00 |
| 30 | 0.8431 | 0.52 | –3.36 | 18.55 |
| 35 | 0.7144 | 1.02 | –3.26 | 15.72 |
| 40 | 0.6083 | 1.51 | –3.17 | 13.38 |
| 45 | 0.5203 | 1.98 | –3.08 | 11.45 |
| 50 | 0.4470 | 2.44 | –3.00 | 9.83 |
| 55 | 0.3856 | 2.88 | –2.92 | 8.48 |
| 60 | 0.3339 | 3.32 | –2.84 | 7.35 |
| 65 | 0.2903 | 3.73 | –2.76 | 6.39 |
| 70 | 0.2533 | 4.14 | –2.69 | 5.57 |
| 75 | 0.2218 | 4.53 | –2.62 | 4.88 |
| 80 | 0.1948 | 4.91 | –2.56 | 4.29 |
| 85 | 0.1717 | 5.29 | –2.50 | 3.78 |
| 90 | 0.1518 | 5.65 | –2.44 | 3.34 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) |
|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables |
| | | | | **6.229** |
| 95 | 0.1346 | 6.00 | –2.38 | 2.96 |
| 100 | 0.1196 | 6.34 | –2.32 | 2.63 |
| 105 | 0.1067 | 6.68 | –2.27 | 2.35 |
| 110 | 0.0954 | 7.00 | –2.22 | 2.10 |
| 115 | 0.0855 | 7.32 | –2.17 | 1.88 |
| 120 | 0.0768 | 7.62 | –2.12 | 1.69 |
| 125 | 0.0691 | 7.93 | –2.07 | 1.52 |
| 130 | 0.0624 | 8.22 | –2.03 | 1.37 |
| 135 | 0.0565 | 8.50 | –1.98 | 1.24 |
| 140 | 0.0512 | 8.78 | –1.94 | 1.13 |
| 145 | 0.0165 | 9.06 | –1.90 | 1.02 |
| 150 | 0.0423 | 9.32 | –1.86 | 0.93 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) | | |
|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | |
| | | | | **6.339** | **6.479** | **6.689** |
| –40 | 21.4241 | 9.51 | –5.94 | 707.00 | 1006.93 | 1456.84 |
| –35 | 16.0147 | 8.59 | –5.70 | 528.48 | 752.69 | 1089.00 |
| –30 | 12.1074 | 7.72 | –5.49 | 399.54 | 569.05 | 823.30 |
| –25 | 9.2511 | 6.87 | –5.28 | 305.29 | 434.80 | 629.07 |
| –20 | 7.1395 | 6.06 | –5.09 | 235.60 | 335.56 | 485.49 |
| –15 | 5.5619 | 5.29 | –4.90 | 183.54 | 261.41 | 378.21 |
| –10 | 4.3715 | 4.54 | –4.73 | 144.26 | 205.46 | 297.26 |
| –5 | 3.4647 | 3.82 | –4.57 | 114.33 | 162.84 | 235.60 |
| 0 | 2.7678 | 3.12 | –4.42 | 91.34 | 130.09 | 188.21 |
| 5 | 2.2276 | 2.45 | –4.27 | 73.51 | 104.70 | 151.48 |
| 10 | 1.8057 | 1.81 | –4.13 | 59.59 | 84.87 | 122.79 |
| 15 | 1.4735 | 1.18 | –4.00 | 48.63 | 69.26 | 100.20 |
| 20 | 1.2102 | 0.58 | –3.88 | 39.94 | 56.88 | 82.29 |
| 25 | 1.0000 | 0.00 | –3.76 | 33.00 | 47.00 | 68.00 |
| 30 | 0.8311 | 0.56 | –3.64 | 27.43 | 39.06 | 56.51 |
| 35 | 0.6946 | 1.11 | –3.54 | 22.92 | 32.64 | 47.23 |
| 40 | 0.5835 | 1.63 | –3.43 | 19.26 | 27.42 | 39.68 |
| 45 | 0.4927 | 2.14 | –3.34 | 16.26 | 23.16 | 33.50 |
| 50 | 0.4180 | 2.64 | –3.24 | 13.79 | 19.65 | 28.42 |
| 55 | 0.3563 | 3.12 | –3.15 | 11.76 | 16.74 | 24.23 |
| 60 | 0.3050 | 3.58 | –3.07 | 10.06 | 14.33 | 20.74 |
| 65 | 0.2622 | 4.03 | –2.98 | 8.65 | 12.32 | 17.83 |
| 70 | .02263 | 4.47 | –2.90 | 7.47 | 10.64 | 15.39 |
| 75 | 0.1961 | 4.90 | –2.83 | 6.47 | 9.22 | 13.33 |
| 80 | 0.1705 | 5.31 | –2.76 | 5.63 | 8.02 | 11.60 |
| 85 | 0.1489 | 5.71 | –2.69 | 4.91 | 7.00 | 10.12 |
| 90 | 0.1304 | 6.11 | –2.62 | 4.30 | 6.13 | 8.86 |
| 95 | 0.1146 | 6.49 | –2.55 | 3.78 | 5.38 | 7.79 |
| 100 | 0.1010 | 6.86 | –2.49 | 3.33 | 4.75 | 6.87 |
| 105 | 0.0893 | 7.22 | –2.43 | 2.95 | 4.20 | 6.07 |
| 110 | 0.0792 | 7.57 | –2.37 | 2.61 | 3.72 | 5.38 |
| 115 | 0.0704 | 7.91 | –2.32 | 2.32 | 3.31 | 4.79 |
| 120 | 0.0628 | 8.24 | –2.26 | 2.07 | 2.95 | 4.27 |
| 125 | 0.0561 | 8.57 | –2.21 | 1.85 | 2.64 | 3.82 |
| 130 | 0.0503 | 8.88 | –2.16 | 1.66 | 2.37 | 3.42 |
| 135 | 0.0452 | 9.19 | –2.11 | 1.49 | 2.13 | 3.07 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) | | |
|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | |
| | | | | **6.339** | **6.479** | **6.689** |
| 140 | 0.0407 | 9.49 | –2.07 | 1.34 | 1.91 | 2.77 |
| 145 | 0.0368 | 9.79 | –2.02 | 1.21 | 1.73 | 2.50 |
| 150 | 0.0333 | 10.08 | –1.98 | 1.10 | 1.56 | 2.26 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | | | | |
| | | | | **6.101** | **6.151** | **6.221** | **6.331** | **6.471** | **6.681** |
| –40 | 21.9261 | 2.50 | –5.75 | 2192.6 | 2388.9 | 4823.7 | 7236 | 10503 | 14910 |
| –35 | 16.5224 | 2.26 | –5.57 | 1652.2 | 2478.4 | 3634.9 | 5452 | 7766 | 11235 |
| –30 | 12.5583 | 2.03 | –5.40 | 1255.8 | 1883.7 | 2762.8 | 4144 | 5902 | 8540 |
| –25 | 9.62492 | 1.80 | –5.24 | 962.5 | 1443.7 | 2117.5 | 3176 | 4524 | 6545 |
| –20 | 7.43618 | 1.59 | –5.08 | 743.6 | 1115.4 | 1636.0 | 2454 | 3495 | 5057 |
| –15 | 5.78976 | 1.39 | –4.93 | 579.0 | 868.5 | 1273.7 | 1911 | 2721 | 3937 |
| –10 | 4.54158 | 1.19 | –4.78 | 454.2 | 681.2 | 999.1 | 1499 | 1235 | 3088 |
| –5 | 3.58813 | 1.00 | –4.64 | 358.8 | 538.2 | 789.4 | 1184 | 1686 | 2440 |
| 0 | 2.85449 | 0.82 | –4.51 | 285.4 | 428.2 | 628.0 | 942.0 | 1342 | 1941 |
| 5 | 2.28599 | 0.64 | –4.38 | 228.6 | 342.9 | 502.9 | 754.4 | 1074 | 1554 |
| 10 | 1.84245 | 0.47 | –4.25 | 184.2 | 276.4 | 405.3 | 608.0 | 865.9 | 1253 |
| 15 | 1.49414 | 0.31 | –4.13 | 149.4 | 224.1 | 328.7 | 493.1 | 702.2 | 1016 |
| 20 | 1.21887 | 0.15 | –4.01 | 121.9 | 182.8 | 268.2 | 402.2 | 572.9 | 828.8 |
| 25 | 1.000 | 0.00 | –3.90 | 100.0 | 150.0 | 220.0 | 330.0 | 470.0 | 680.0 |
| 30 | 0.82494 | 0.15 | –3.80 | 82.5 | 123.7 | 181.5 | 272.2 | 387.7 | 561.0 |
| 35 | 0.68413 | 0.29 | –3.69 | 68.4 | 102.6 | 150.5 | 225.8 | 321.5 | 465.2 |
| 40 | 0.57025 | 0.43 | –3.59 | 57.0 | 85.5 | 125.5 | 188.2 | 268.0 | 387.8 |
| 45 | 0.47765 | 0.56 | –3.50 | 47.8 | 71.6 | 105.1 | 157.6 | 224.5 | 324.8 |
| 50 | 0.40198 | 0.69 | –3.40 | 40.2 | 60.3 | 88.4 | 132.7 | 188.9 | 273.3 |
| 55 | 0.33984 | 0.82 | –3.31 | 34.0 | 51.0 | 74.8 | 112.1 | 159.7 | 231.1 |
| 60 | 0.28856 | 0.94 | –3.23 | 28.9 | 43.3 | 63.5 | 95.23 | 135.6 | 196.2 |
| 65 | 0.24606 | 1.06 | –3.15 | 24.6 | 36.9 | 54.1 | 81.20 | 115.6 | 167.3 |
| 70 | 0.21067 | 1.17 | –3.07 | 21.1 | 31.6 | 46.3 | 69.52 | 99.00 | 143.3 |
| 75 | 0.18108 | 1.29 | –2.99 | 18.1 | 27.2 | 39.8 | 59.76 | 85.11 | 123.1 |
| 80 | 0.15623 | 1.39 | –2.91 | 15.6 | 23.4 | 34.4 | 51.56 | 73.43 | 106.2 |
| 85 | 0.13529 | 1.50 | –2.84 | 13.5 | 20.3 | 29.8 | 44.65 | 63.59 | 92.00 |
| 90 | 0.11757 | 1.60 | –2.77 | 11.8 | 17.6 | 25.9 | 38.80 | 55.26 | 79.95 |
| 95 | 0.10251 | 1.70 | –2.71 | 10.3 | 15.4 | 22.6 | 33.83 | 48.18 | 69.71 |
| 100 | 0.08968 | 1.80 | –2.64 | 8.97 | 13.5 | 19.7 | 29.59 | 42.15 | 60.98 |
| 105 | 0.07871 | 1.89 | –2.58 | 7.87 | 11.8 | 17.3 | 25.97 | 36.99 | 53.52 |
| 110 | 0.06928 | 1.99 | –2.52 | 6.93 | 10.4 | 15.2 | 22.86 | 32.56 | 47.11 |
| 115 | 0.06117 | 2.08 | –2.46 | 6.12 | 9.18 | 13.5 | 20.19 | 28.75 | 41.60 |
| 120 | 0.05416 | 2.16 | –2.41 | 5.42 | 8.12 | 11.9 | 17.87 | 25.46 | 36.83 |
| 125 | 0.04809 | 2.25 | –2.35 | 4.81 | 7.21 | 10.6 | 15.87 | 22.60 | 32.70 |
| 130 | 0.04282 | 2.33 | –2.30 | 4.28 | 6.42 | 9.42 | 14.13 | 20.12 | 29.11 |
| 135 | 0.03822 | 2.41 | –2.25 | 3.82 | 5.73 | 8.41 | 12.61 | 17.96 | 25.99 |
| 140 | 0.03420 | 2.49 | –2.20 | 3.42 | 5.13 | 7.52 | 11.29 | 16.07 | 23.25 |
| 145 | 0.03068 | 2.57 | –2.15 | 3.07 | 4.60 | 6.75 | 10.12 | 14.42 | 20.86 |
| 150 | 0.02758 | 2.65 | –2.10 | 2.76 | 4.14 | 6.07 | 9.10 | 12.96 | 18.76 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (Ω) | | |
|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | |
| | | | | **6.102** | **6.152** | **6.202** |
| –40 | 23.3402 | 1.65 | –6.06 | 23342 | 35013 | 46684 |
| –35 | 17.3347 | 1.49 | –5.84 | 17336 | 26004 | 34672 |
| –30 | 13.0166 | 1.34 | –5.62 | 13018 | 19526 | 26035 |
| –25 | 9.8764 | 1.19 | –5.42 | 9877 | 14816 | 19754 |
| –20 | 7.5682 | 1.05 | –5.23 | 7569 | 11353 | 15138 |
| –15 | 5.8541 | 0.92 | –5.05 | 5855 | 8782 | 11709 |
| –10 | 4.5688 | 0.79 | –4.87 | 4569 | 6854 | 9138 |
| –5 | 3.5961 | 0.66 | –4.71 | 3596 | 5395 | 7193 |
| 0 | 2.8533 | 0.54 | –4.55 | 2854 | 4280 | 5707 |
| 5 | 2.2815 | 0.43 | –4.40 | 2282 | 3422 | 4563 |
| 10 | 1.8376 | 0.31 | –4.26 | 1838 | 2457 | 3675 |
| 15 | 1.4904 | 0.21 | –4.12 | 1491 | 2236 | 2981 |
| 20 | 1.2169 | 0.10 | –3.99 | 1217 | 1826 | 2434 |
| 25 | 1.0000 | 0.00 | –3.87 | 1000 | 1500 | 2000 |
| 30 | 0.8266 | 0.10 | –3.75 | 826.7 | 1240 | 1653 |
| 35 | 0.6873 | 0.19 | –3.63 | 687.4 | 1031 | 1375 |
| 40 | 0.5746 | 0.28 | –3.53 | 574.6 | 861.9 | 1149 |
| 45 | 0.4827 | 0.37 | –3.42 | 482.7 | 724.1 | 965.0 |
| 50 | 0.4073 | 0.46 | –3.32 | 407.4 | 611.0 | 814.7 |
| 55 | 0.3452 | 0.54 | –3.23 | 345.2 | 517.8 | 690.5 |
| 60 | 0.2937 | 0.62 | –3.14 | 293.7 | 440.6 | 587.5 |
| 65 | 0.2508 | 0.70 | –3.05 | 250.8 | 376.2 | 501.7 |
| 70 | 0.2149 | 0.78 | –2.97 | 214.9 | 322.4 | 429.8 |
| 75 | 0.1847 | 0.85 | –2.89 | 184.8 | 277.1 | 369.5 |
| 80 | 0.1593 | 0.92 | –2.81 | 159.3 | 238.9 | 318.6 |
| 85 | 0.1377 | 0.99 | –2.73 | 137.7 | 206.6 | 275.5 |
| 90 | 0.11942 | 1.06 | –2.66 | 119.4 | 179.1 | 238.9 |
| 95 | 0.10380 | 1.13 | –2.59 | 103.8 | 155.7 | 207.6 |
| 100 | 0.09045 | 1.19 | –2.53 | 90.46 | 135.7 | 180.9 |
| 105 | 0.07900 | 1.25 | –2.46 | 79.00 | 118.5 | 158.0 |
| 110 | 0.06915 | 1.31 | –2.40 | 69.16 | 103.7 | 138.3 |
| 115 | 0.06066 | 1.37 | –2.34 | 60.66 | 90.99 | 121.3 |
| 120 | 0.05332 | 1.43 | –2.29 | 53.32 | 79.98 | 106.6 |
| 125 | 0.04696 | 1.49 | –2.23 | 46.96 | 70.44 | 93.9 |
| 130 | 0.04143 | 1.54 | –2.18 | 41.44 | 62.15 | 82.9 |
| 135 | 0.03662 | 1.60 | –2.13 | 36.63 | 54.94 | 73.3 |
| 140 | 0.03243 | 1.65 | –2.08 | 32.43 | 48.65 | 64.9 |
| 145 | 0.02877 | 1.70 | –2.03 | 28.77 | 43.16 | 57.5 |
| 150 | 0.02556 | 1.75 | –1.98 | 25.56 | 38.34 | 51.1 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | | | | |
| | | | | **6.222** | **6.272** | **6.332** | **6.472** | **6.682** | **6.103** |
| –40 | 33.21 | 2.66 | 6.57 | 73.06 | 89.67 | 109.6 | 156.1 | 225.8 | 332.1 |
| –35 | 23.99 | 2.41 | 6.36 | 52.78 | 64.77 | 79.17 | 112.8 | 163.1 | 240.0 |
| –30 | 17.52 | 2.17 | 6.15 | 38.55 | 47.31 | 57.82 | 82.35 | 119.1 | 175.2 |
| –25 | 12.93 | 1.94 | 5.95 | 28.44 | 34.91 | 42.67 | 60.77 | 87.92 | 129.3 |
| –20 | 9.636 | 1.71 | 5.76 | 21.20 | 26.02 | 31.80 | 45.30 | 65.53 | 96.36 |
| –15 | 7.250 | 1.50 | 5.58 | 15.95 | 19.58 | 23.93 | 34.08 | 49.30 | 72.50 |
| –10 | 5.505 | 1.29 | 5.40 | 12.11 | 14.86 | 18.16 | 25.87 | 37.43 | 55.05 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | | | | |
| | | | | **6.222** | **6.272** | **6.332** | **6.472** | **6.682** | **6.103** |
| –5 | 4.216 | 1.08 | 5.24 | 9.275 | 11.38 | 13.91 | 19.81 | 28.67 | 42.16 |
| 0 | 3.255 | 0.89 | 5.08 | 7.162 | 8.790 | 10.74 | 15.30 | 22.14 | 32.56 |
| 5 | 2.534 | 0.70 | 4.92 | 5.575 | 6.842 | 8.362 | 11.91 | 17.23 | 25.34 |
| 10 | 1.987 | 0.52 | 4.78 | 4.372 | 5.366 | 6.558 | 9.340 | 13.51 | 19.87 |
| 15 | 1.570 | 0.34 | 4.64 | 3.454 | 4.239 | 5.181 | 7.378 | 10.67 | 15.70 |
| 20 | 1.249 | 0.17 | 4.50 | 2.747 | 3.372 | 4.121 | 5.869 | 8.492 | 12.49 |
| 25 | 1.000 | 0.00 | 4.37 | 2.200 | 2.700 | 3.300 | 4.700 | 6.800 | 10.00 |
| 30 | 0.8059 | 0.16 | 4.25 | 1.773 | 2.176 | 2.660 | 3.788 | 5.480 | 8.059 |
| 35 | 0.6535 | 0.32 | 4.13 | 1.438 | 1.764 | 2.156 | 3.072 | 4.444 | 6.535 |
| 40 | 0.5330 | 0.47 | 4.02 | 1.173 | 1.439 | 1.759 | 2.505 | 3.624 | 5.330 |
| 45 | 0.4372 | 0.62 | 3.91 | 0.9618 | 1.180 | 1.443 | 2.055 | 2.972 | 4.372 |
| 50 | 0.3605 | 0.77 | 3.80 | 0.7932 | 0.973 | 1.190 | 1.694 | 2.451 | 3.606 |
| 55 | 0.2989 | 0.91 | 3.70 | 0.6575 | 0.807 | 0.9863 | 1.405 | 2.032 | 2.989 |
| 60 | 0.2490 | 1.05 | 3.60 | 0.5478 | 0.672 | 0.8217 | 1.170 | 1.693 | 2.490 |
| 65 | 0.2084 | 1.18 | 3.51 | 0.4586 | 0.562 | 0.6879 | 0.9797 | 1.417 | 2.084 |
| 70 | 0.1753 | 1.31 | 3.42 | 0.3857 | 0.473 | 0.5785 | 0.8239 | 1.192 | 1.753 |
| 75 | 0.1481 | 1.44 | 3.33 | 0.3258 | 0.399 | 0.4887 | 0.6960 | 1.007 | 1.481 |
| 80 | 0.1256 | 1.57 | 3.25 | 0.2764 | 0.339 | 0.4146 | 0.5905 | 0.8544 | 1.256 |
| 85 | 0.1070 | 1.69 | 3.16 | 0.2355 | 0.289 | 0.3532 | 0.5031 | 0.7278 | 1.070 |
| 90 | 0.09154 | 1.81 | 3.09 | 0.2014 | 0.247 | 0.3021 | 0.4303 | 0.6225 | 0.9154 |
| 95 | 0.07860 | 1.93 | 3.01 | 0.1729 | 0.212 | 0.2594 | 0.3694 | 0.5345 | 0.7860 |
| 100 | 0.06773 | 2.04 | 2.94 | 0.1490 | 0.182 | 0.2235 | 0.3183 | 0.4607 | 0.6773 |
| 105 | 0.05858 | 2.15 | 2.87 | 0.1289 | 0.158 | 0.1933 | 0.2753 | 0.3983 | 0.5858 |
| 110 | 0.05083 | 2.26 | 2.80 | 0.1118 | 0.137 | 0.1677 | 0.2389 | 0.3457 | 0.5083 |
| 115 | 0.04426 | 2.37 | 2.73 | 0.0974 | 0.1195 | 0.1461 | 0.2080 | 0.3010 | 0.4426 |
| 120 | 0.03866 | 2.47 | 2.67 | 0.0851 | 0.1044 | 0.1276 | 0.1817 | 0.2629 | 0.3866 |
| 125 | 0.03387 | 2.57 | 2.61 | 0.0745 | 0.0915 | 0.1118 | 0.1592 | 0.2303 | 0.3387 |
| 130 | 0.02977 | 2.67 | 2.55 | 0.0655 | 0.0804 | 0.0982 | 0.1399 | 0.2024 | 0.2977 |
| 135 | 0.02624 | 2.77 | 2.49 | 0.0577 | 0.0709 | 0.0866 | 0.1233 | 0.1784 | 0.2624 |
| 140 | 0.02319 | 2.86 | 2.43 | 0.0510 | 0.0626 | 0.0765 | 0.1090 | 0.1577 | 0.2319 |
| 145 | 0.02055 | 2.96 | 2.38 | 0.0452 | 0.0555 | 0.0678 | 0.0966 | 0.1398 | 0.2055 |
| 150 | 0.01826 | 3.05 | 2.33 | 0.0402 | 0.0493 | 0.0603 | 0.0858 | 0.1242 | 0.1826 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | | |
|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | |
| | | | | **6.123** | **6.153** | **6.223** |
| –40 | 25.78 | 6.81 | 6.09 | 309.4 | 386.8 | 567.2 |
| –35 | 19.13 | 6.16 | 5.89 | 229.5 | 286.9 | 420.8 |
| –30 | 14.32 | 5.53 | 5.70 | 171.8 | 214.8 | 315.0 |
| –25 | 10.82 | 4.93 | 5.52 | 129.8 | 162.3 | 238.0 |
| –20 | 8.245 | 4.35 | 5.35 | 98.93 | 123.7 | 181.4 |
| –15 | 6.335 | 3.80 | 5.19 | 76.02 | 95.03 | 139.4 |
| –10 | 4.907 | 3.26 | 5.03 | 58.88 | 73.60 | 107.9 |
| –5 | 3.830 | 2.74 | 4.88 | 45.95 | 57.44 | 84.25 |
| 0 | 3.011 | 2.24 | 4.73 | 36.13 | 45.16 | 66.24 |
| 5 | 2.384 | 1.76 | 4.60 | 28.60 | 35.76 | 52.45 |
| 10 | 1.900 | 1.30 | 4.46 | 22.80 | 28.50 | 41.81 |
| 15 | 1.525 | 0.85 | 4.34 | 18.30 | 22.87 | 33.55 |
| 20 | 1.231 | 0.42 | 4.21 | 14.77 | 18.47 | 27.09 |
| 25 | 1.000 | 0.00 | 4.10 | 12.00 | 15.00 | 22.00 |
| 30 | 0.8170 | 0.41 | 3.98 | 9.804 | 12.26 | 17.97 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | | |
|---|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | | |
| | | | | **6.123** | **6.153** | **6.223** |
| 35 | 0.6712 | 0.80 | 3.88 | 8.054 | 10.07 | 14.77 |
| 40 | 0.5543 | 1.19 | 3.77 | 6.652 | 8.315 | 12.20 |
| 45 | 0.4602 | 1.57 | 3.67 | 5.522 | 6.903 | 10.12 |
| 50 | 0.3839 | 1.94 | 3.57 | 4.607 | 5.759 | 8.447 |
| 55 | 0.3219 | 2.30 | 3.48 | 3.862 | 4.828 | 7.081 |
| 60 | 0.2710 | 2.65 | 3.39 | 3.252 | 4.067 | 5.963 |
| 65 | 0.2293 | 2.99 | 3.30 | 2.751 | 3.439 | 5.044 |
| 70 | 0.1947 | 3.33 | 3.22 | 2.337 | 2.921 | 4.284 |
| 75 | 0.1661 | 3.66 | 3.14 | 1.993 | 2.492 | 3.654 |
| 80 | 0.1422 | 3.98 | 3.06 | 1.707 | 2.134 | 3.129 |
| 85 | 0.1223 | 4.29 | 2.99 | 1.467 | 1.834 | 2.690 |
| 90 | 0.1055 | 4.60 | 2.92 | 1.266 | 1.583 | 2.321 |
| 95 | 0.09135 | 4.90 | 2.85 | 1.096 | 1.370 | 2.010 |
| 100 | 0.07937 | 5.19 | 2.78 | 0.9524 | 1.190 | 1.746 |
| 105 | 0.06919 | 5.48 | 2.71 | 0.8302 | 1.038 | 1.522 |
| 110 | 0.06050 | 5.76 | 2.65 | 0.7260 | 0.9075 | 1.331 |
| 115 | 0.05307 | 6.04 | 2.59 | 0.6369 | 0.7961 | 1.168 |
| 120 | 0.04670 | 6.31 | 2.53 | 0.5604 | 0.7005 | 1.027 |
| 125 | 0.04121 | 6.57 | 2.47 | 0.4945 | 0.6181 | 0.9065 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.333** | **6.473** |
| –40 | 33.81 | 5.55 | 6.55 | 1116 | 1589 |
| –35 | 24.50 | 5.02 | 6.34 | 808.6 | 1151 |
| –30 | 17.93 | 4.52 | 6.15 | 591.7 | 842.8 |
| –25 | 13.25 | 4.03 | 5.96 | 437.1 | 622.6 |
| –20 | 9.875 | 3.56 | 5.78 | 325.9 | 464.1 |
| –15 | 7.425 | 3.10 | 5.61 | 245.0 | 349.0 |
| –10 | 5.630 | 2.67 | 5.45 | 185.8 | 264.6 |
| –5 | 4.304 | 2.24 | 5.29 | 142.0 | 202.3 |
| 0 | 3.315 | 1.84 | 5.14 | 109.4 | 155.8 |
| 5 | 2.573 | 1.44 | 4.99 | 84.91 | 120.9 |
| 10 | 2.011 | 1.07 | 4.85 | 66.37 | 94.53 |
| 15 | 1.583 | 0.70 | 4.72 | 52.24 | 74.40 |
| 20 | 1.254 | 0.34 | 4.59 | 41.39 | 58.95 |
| 25 | 1.000 | 0.00 | 4.46 | 33.00 | 47.00 |
| 30 | 0.8024 | 0.33 | 4.34 | 26.47 | 37.71 |
| 35 | 0.6474 | 0.66 | 4.23 | 21.37 | 30.43 |
| 40 | 0.5255 | 0.98 | 4.12 | 17.34 | 24.70 |
| 45 | 0.4288 | 1.28 | 4.01 | 14.15 | 20.15 |
| 50 | 0.3518 | 1.59 | 3.91 | 11.61 | 16.53 |
| 55 | 0.2901 | 1.88 | 3.81 | 9.572 | 13.63 |
| 60 | 0.2403 | 2.17 | 3.71 | 7.931 | 11.30 |
| 65 | 0.2001 | 2.45 | 3.62 | 6.603 | 9.404 |
| 70 | 0.1674 | 2.72 | 3.53 | 5.522 | 7.865 |
| 75 | 0.1406 | 2.99 | 3.44 | 4.639 | 6.607 |
| 80 | 0.1186 | 3.25 | 3.36 | 3.913 | 5.573 |
| 85 | 0.1004 | 3.51 | 3.28 | 3.315 | 4.721 |
| 90 | 0.08542 | 3.76 | 3.20 | 2.819 | 4.015 |
| 95 | 0.07292 | 4.00 | 3.13 | 2.406 | 3.427 |
| 100 | 0.06248 | 4.24 | 3.06 | 2.062 | 2.936 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.333** | **6.473** |
| 105 | 0.05372 | 4.47 | 2.98 | 1.773 | 2.525 |
| 110 | 0.04635 | 4.70 | 2.92 | 1.530 | 2.179 |
| 115 | 0.04013 | 4.93 | 2.85 | 1.342 | 1.886 |
| 120 | 0.03485 | 5.15 | 2.79 | 1.150 | 1.638 |
| 125 | 0.03037 | 5.36 | 2.73 | 1.002 | 1.427 |
| 130 | 0.02654 | 5.57 | 2.67 | 0.8757 | 1.247 |
| 135 | 0.02326 | 5.78 | 2.61 | 0.7675 | 1.093 |
| 140 | 0.02044 | 5.98 | 2.55 | 0.6746 | 0.9608 |
| 145 | 0.01802 | 6.18 | 2.50 | 0.5945 | 0.8468 |
| 150 | 0.01592 | 6.37 | 2.44 | 0.5254 | 0.7483 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.683** | **6.104** |
| –40 | 36.66 | 5.69 | 6.70 | 2493 | 3666 |
| –35 | 26.38 | 5.15 | 6.49 | 1794 | 2638 |
| –30 | 19.17 | 4.63 | 6.29 | 1303 | 1917 |
| –25 | 14.06 | 4.13 | 6.10 | 956.2 | 1406 |
| –20 | 10.41 | 3.65 | 5.92 | 708.0 | 1041 |
| –15 | 7.779 | 3.18 | 5.74 | 528.9 | 777.9 |
| –10 | 5.861 | 2.73 | 5.57 | 398.5 | 586.1 |
| –5 | 4.453 | 2.30 | 5.41 | 302.8 | 445.3 |
| 0 | 3.409 | 1.88 | 5.26 | 231.8 | 340.9 |
| 5 | 2.631 | 1.48 | 5.11 | 178.9 | 263.1 |
| 10 | 2.044 | 1.09 | 4.97 | 139.0 | 204.4 |
| 15 | 1.600 | 0.72 | 4.83 | 108.8 | 160.0 |
| 20 | 1.261 | 0.35 | 4.70 | 85.74 | 126.1 |
| 25 | 1.000 | 0.00 | 4.57 | 68.00 | 100.0 |
| 30 | 0.7981 | 0.34 | 4.45 | 54.27 | 79.81 |
| 35 | 0.6408 | 0.67 | 4.35 | 43.57 | 64.08 |
| 40 | 0.5175 | 1.00 | 4.22 | 35.19 | 51.74 |
| 45 | 0.4202 | 1.32 | 4.11 | 28.57 | 42.02 |
| 50 | 0.3431 | 1.63 | 4.00 | 23.33 | 34.31 |
| 55 | 0.2816 | 1.93 | 3.90 | 19.15 | 28.16 |
| 60 | 0.2322 | 2.22 | 3.80 | 15.79 | 23.22 |
| 65 | 0.1925 | 2.51 | 3.71 | 13.09 | 19.25 |
| 70 | 0.1602 | 2.79 | 3.62 | 10.90 | 16.03 |
| 75 | 0.1340 | 3.06 | 3.53 | 9.114 | 13.40 |
| 80 | 0.1126 | 3.33 | 3.45 | 7.655 | 11.26 |
| 85 | 0.09496 | 3.59 | 3.36 | 6.457 | 9.496 |
| 90 | 0.08042 | 3.85 | 3.28 | 5.469 | 8.042 |
| 95 | 0.06837 | 4.10 | 3.21 | 4.649 | 6.837 |
| 100 | 0.05835 | 4.35 | 3.13 | 3.968 | 5.835 |
| 105 | 0.04998 | 4.59 | 3.06 | 3.399 | 4.998 |
| 110 | 0.04296 | 4.82 | 2.99 | 2.921 | 4.296 |
| 115 | 0.03705 | 5.05 | 2.92 | 2.519 | 3.705 |
| 120 | 0.03206 | 5.28 | 2.86 | 2.180 | 3.206 |
| 125 | 0.02783 | 5.50 | 2.80 | 1.892 | 2.783 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.154** | **6.224** |
| –40 | 41.02 | 10.10 | 6.89 | 6153 | 9024 |
| –35 | 29.29 | 9.12 | 6.68 | 4394 | 6444 |
| –30 | 21.12 | 8.18 | 6.48 | 3168 | 4646 |
| –25 | 15.37 | 7.28 | 6.29 | 2305 | 3381 |
| –20 | 11.28 | 6.42 | 6.11 | 1693 | 2483 |
| –15 | 8.358 | 5.59 | 5.93 | 1254 | 1839 |
| –10 | 6.242 | 4.80 | 5.76 | 936.4 | 1373 |
| –5 | 4.700 | 4.03 | 5.60 | 705.0 | 1034 |
| 0 | 3.567 | 3.30 | 5.44 | 535.0 | 784.7 |
| 5 | 2.727 | 2.59 | 5.29 | 409.1 | 600.0 |
| 10 | 2.101 | 1.90 | 5.15 | 315.1 | 462.1 |
| 15 | 1.629 | 1.25 | 5.01 | 244.4 | 358.4 |
| 20 | 1.272 | 0.61 | 4.88 | 190.8 | 279.9 |
| 25 | 1.000 | 0.00 | 4.75 | 150.0 | 220.0 |
| 30 | 0.7910 | 0.59 | 4.62 | 118.6 | 174.0 |
| 35 | 0.6295 | 1.18 | 4.51 | 94.42 | 138.5 |
| 40 | 0.5039 | 1.74 | 4.39 | 75.58 | 110.9 |
| 45 | 0.4056 | 2.30 | 4.28 | 60.85 | 89.24 |
| 50 | 0.3283 | 2.84 | 4.17 | 49.25 | 72.24 |
| 55 | 0.2672 | 3.37 | 4.07 | 40.08 | 58.78 |
| 60 | 0.2185 | 3.89 | 3.97 | 32.78 | 48.08 |
| 65 | 0.1796 | 4.40 | 3.87 | 26.94 | 39.51 |
| 70 | 0.1483 | 4.90 | 3.78 | 22.25 | 32.63 |
| 75 | 0.1231 | 5.39 | 3.69 | 18.46 | 27.07 |
| 80 | 0.1025 | 5.86 | 3.60 | 15.38 | 22.56 |
| 85 | 0.08582 | 6.33 | 3.52 | 12.87 | 18.88 |
| 90 | 0.07213 | 6.79 | 3.44 | 10.82 | 15.87 |
| 95 | 0.06086 | 7.24 | 3.36 | 9.129 | 13.39 |
| 100 | 0.05155 | 7.68 | 3.28 | 7.732 | 11.34 |
| 105 | 0.04383 | 8.11 | 3.21 | 6.574 | 9.642 |
| 110 | 0.03740 | 8.53 | 3.14 | 5.610 | 8.228 |
| 115 | 0.03203 | 8.94 | 3.07 | 4.804 | 7.046 |
| 120 | 0.02752 | 9.35 | 3.00 | 4.128 | 6.054 |
| 125 | 0.02372 | 9.75 | 2.94 | 3.559 | 5.219 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.334** | **6.474** |
| –40 | 48.62 | 6.22 | 7.13 | 16044 | 22850 |
| –35 | 34.19 | 5.63 | 6.91 | 11282 | 16068 |
| –30 | 24.28 | 5.06 | 6.71 | 8013 | 11413 |
| –25 | 17.42 | 4.51 | 6.52 | 5747 | 8185 |
| –20 | 12.61 | 3.98 | 6.33 | 4161 | 5926 |
| –15 | 9.211 | 3.47 | 6.15 | 3040 | 4329 |
| –10 | 6.788 | 2.98 | 5.98 | 2240 | 3190 |
| –5 | 5.045 | 2.51 | 5.82 | 1665 | 2371 |
| 0 | 3.781 | 2.06 | 5.66 | 1248 | 1776 |
| 5 | 2.855 | 1.62 | 5.50 | 942.3 | 1342 |
| 10 | 2.173 | 1.19 | 5.36 | 717.1 | 1021 |
| 15 | 1.666 | 0.78 | 5.22 | 549.8 | 783.0 |
| 20 | 1.286 | 0.38 | 5.08 | 424.5 | 604.6 |

| $T_{oper}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.334** | **6.474** |
| 25 | 1.000 | 0.00 | 4.95 | 330.0 | 470.0 |
| 30 | 0.7825 | 0.37 | 4.82 | 258.2 | 367.8 |
| 35 | 0.6163 | 0.74 | 4.70 | 203.4 | 289.6 |
| 40 | 0.4883 | 1.09 | 4.59 | 161.1 | 229.5 |
| 45 | 0.3892 | 1.44 | 4.47 | 128.4 | 182.9 |
| 50 | 0.3120 | 1.77 | 4.36 | 103.0 | 146.7 |
| 55 | 0.2515 | 2.10 | 4.26 | 83.00 | 118.2 |
| 60 | 0.2038 | 2.43 | 4.15 | 67.26 | 95.80 |
| 65 | 0.1660 | 2.74 | 4.06 | 54.79 | 78.03 |
| 70 | 0.1359 | 3.05 | 3.96 | 44.86 | 63.88 |
| 75 | 0.1118 | 3.35 | 3.87 | 36.90 | 52.55 |
| 80 | 0.09240 | 3.64 | 3.78 | 30.49 | 43.43 |
| 85 | 0.07670 | 3.93 | 3.69 | 25.31 | 36.05 |
| 90 | 0.06395 | 4.21 | 3.61 | 21.10 | 30.06 |
| 95 | 0.05354 | 4.48 | 3.53 | 17.67 | 25.16 |
| 100 | 0.04501 | 4.75 | 3.45 | 14.85 | 21.15 |
| 105 | 0.03798 | 5.01 | 3.37 | 12.53 | 17.85 |
| 110 | 0.03218 | 5.27 | 3.30 | 10.70 | 15.12 |
| 115 | 0.02736 | 5.52 | 3.23 | 9.029 | 12.86 |
| 120 | 0.02335 | 5.77 | 3.16 | 7.704 | 10.97 |
| 125 | 0.01999 | 6.01 | 3.09 | 6.597 | 9.396 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH $R_{25}$ AT 68 KΩ AND 100 KΩ

| $T_{amb}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.683** | **6.104** |
| –40 | 36.66 | 5.69 | 6.70 | 2493 | 3666 |
| –35 | 26.38 | 5.15 | 6.49 | 1794 | 2638 |
| –30 | 19.17 | 4.63 | 6.29 | 1303 | 1917 |
| –25 | 14.06 | 4.13 | 6.10 | 956.2 | 1406 |
| –20 | 10.41 | 3.65 | 5.92 | 708.0 | 1041 |
| –15 | 7.779 | 3.18 | 5.74 | 528.9 | 777.9 |
| –10 | 5.861 | 2.73 | 5.57 | 398.5 | 586.1 |
| –5 | 4.453 | 2.30 | 5.41 | 302.8 | 445.3 |
| 0 | 3.409 | 1.88 | 5.26 | 231.8 | 340.9 |
| 5 | 2.631 | 1.48 | 5.11 | 178.9 | 263.1 |
| 10 | 2.044 | 1.09 | 4.97 | 139.0 | 204.4 |
| 15 | 1.600 | 0.72 | 4.83 | 108.8 | 160.0 |
| 20 | 1.261 | 0.35 | 4.70 | 85.74 | 126.1 |
| 25 | 1.000 | 0.00 | 4.57 | 68.00 | 100.0 |
| 30 | 0.7981 | 0.34 | 4.45 | 54.27 | 79.81 |
| 35 | 0.6408 | 0.67 | 4.35 | 43.57 | 64.08 |
| 40 | 0.5175 | 1.00 | 4.22 | 35.19 | 51.74 |
| 45 | 0.4202 | 1.32 | 4.11 | 28.57 | 42.02 |
| 50 | 0.3431 | 1.63 | 4.00 | 23.33 | 34.31 |
| 55 | 0.2816 | 1.93 | 3.90 | 19.15 | 28.16 |
| 60 | 0.2322 | 2.22 | 3.80 | 15.79 | 23.22 |
| 65 | 0.1925 | 2.51 | 3.71 | 13.09 | 19.25 |
| 70 | 0.1602 | 2.79 | 3.62 | 10.90 | 16.03 |
| 75 | 0.1340 | 3.06 | 3.53 | 9.114 | 13.40 |
| 80 | 0.1126 | 3.33 | 3.45 | 7.655 | 11.26 |
| 85 | 0.09496 | 3.59 | 3.36 | 6.457 | 9.496 |

| $T_{amb}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) | |
|---|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables | |
| | | | | **6.683** | **6.104** |
| 90 | 0.08042 | 3.85 | 3.28 | 5.469 | 8.042 |
| 95 | 0.06837 | 4.10 | 3.21 | 4.649 | 6.837 |
| 100 | 0.05835 | 4.35 | 3.13 | 3.968 | 5.835 |
| 105 | 0.04998 | 4.59 | 3.06 | 3.399 | 4.998 |
| 110 | 0.04296 | 4.82 | 2.99 | 2.921 | 4.296 |
| 115 | 0.03705 | 5.05 | 2.92 | 2.519 | 3.705 |
| 120 | 0.03206 | 5.28 | 2.86 | 2.180 | 3.206 |
| 125 | 0.02783 | 5.50 | 2.80 | 1.892 | 2.783 |

## RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES WITH $R_{25}$ AT 470 KΩ

| $T_{amb}$ (°C) | $R_T/R_{25}$ | ΔR DUE TO B-TOLERANCE (%) | TC (%/K) | $R_{25}$ (kΩ) |
|---|---|---|---|---|
| | | | | **2322 640 .....;** see note 1 at end of tables |
| | | | | **5.474** |
| –40 | 48.62 | 6.22 | 7.13 | 22850 |
| –35 | 34.19 | 5.63 | 6.91 | 16068 |
| –30 | 24.28 | 5.06 | 6.71 | 11413 |
| –25 | 17.42 | 4.51 | 6.52 | 8185 |
| –20 | 12.61 | 3.98 | 6.33 | 5926 |
| –15 | 9.211 | 3.47 | 6.15 | 4329 |
| –10 | 6.788 | 2.98 | 5.98 | 3190 |
| –5 | 5.045 | 2.51 | 5.82 | 2371 |
| 0 | 3.781 | 2.06 | 5.66 | 1776 |
| 5 | 2.855 | 1.62 | 5.50 | 1342 |
| 10 | 2.173 | 1.19 | 5.36 | 1021 |
| 15 | 1.666 | 0.78 | 5.22 | 783.0 |
| 20 | 1.286 | 0.38 | 5.08 | 604.6 |
| 25 | 1.000 | 0.00 | 4.95 | 470.0 |
| 30 | 0.7825 | 0.37 | 4.82 | 367.8 |
| 35 | 0.6163 | 0.74 | 4.70 | 289.6 |
| 40 | 0.4883 | 1.09 | 4.59 | 229.5 |
| 45 | 0.3892 | 1.44 | 4.47 | 182.9 |
| 50 | 0.3120 | 1.77 | 4.36 | 146.7 |
| 55 | 0.2515 | 2.10 | 4.26 | 118.2 |
| 60 | 0.2038 | 2.43 | 4.15 | 95.80 |
| 65 | 0.1660 | 2.74 | 4.06 | 78.03 |
| 70 | 0.1359 | 3.05 | 3.96 | 63.88 |
| 75 | 0.1118 | 3.35 | 3.87 | 52.55 |
| 80 | 0.09240 | 3.64 | 3.78 | 43.43 |
| 85 | 0.07670 | 3.93 | 3.69 | 36.05 |
| 90 | 0.06395 | 4.21 | 3.61 | 30.06 |
| 95 | 0.05354 | 4.48 | 3.53 | 25.16 |
| 100 | 0.04501 | 4.75 | 3.45 | 21.15 |
| 105 | 0.03798 | 5.01 | 3.37 | 17.85 |
| 110 | 0.03218 | 5.27 | 3.30 | 15.12 |
| 115 | 0.02736 | 5.52 | 3.23 | 12.86 |
| 120 | 0.02335 | 5.77 | 3.16 | 10.97 |
| 125 | 0.01999 | 6.01 | 3.09 | 9.396 |

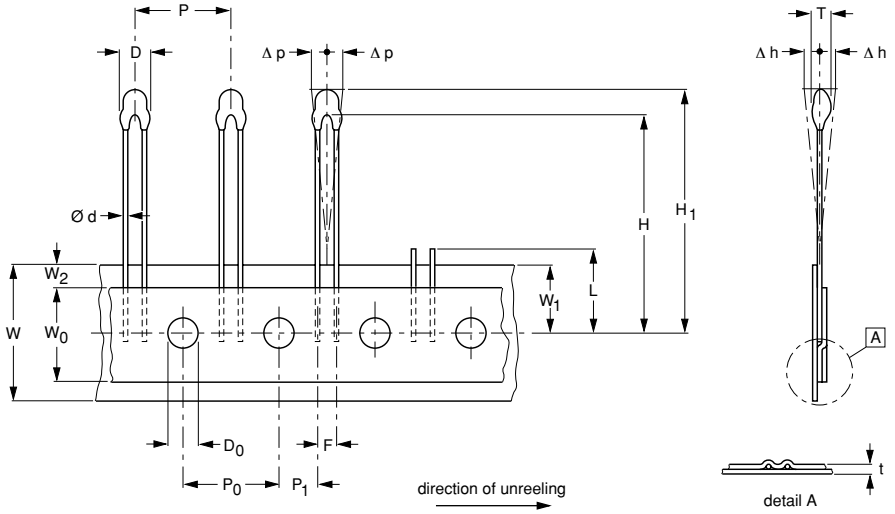
**Note** to Resistance Values At Intermediate Temperature Tables

1. Replace dot in last 5 digits of catalog number by a number according to the following details and depending on tolerance on required $R_{25}$-value: 4 for a tolerance of ±2%; 6 for a tolerance of ±3%; 3 for a tolerance of ±5%; 2 for a tolerance of ±10%.

## PACKAGING

### TAPE SPECIFICATIONS

Thermistors on tape.



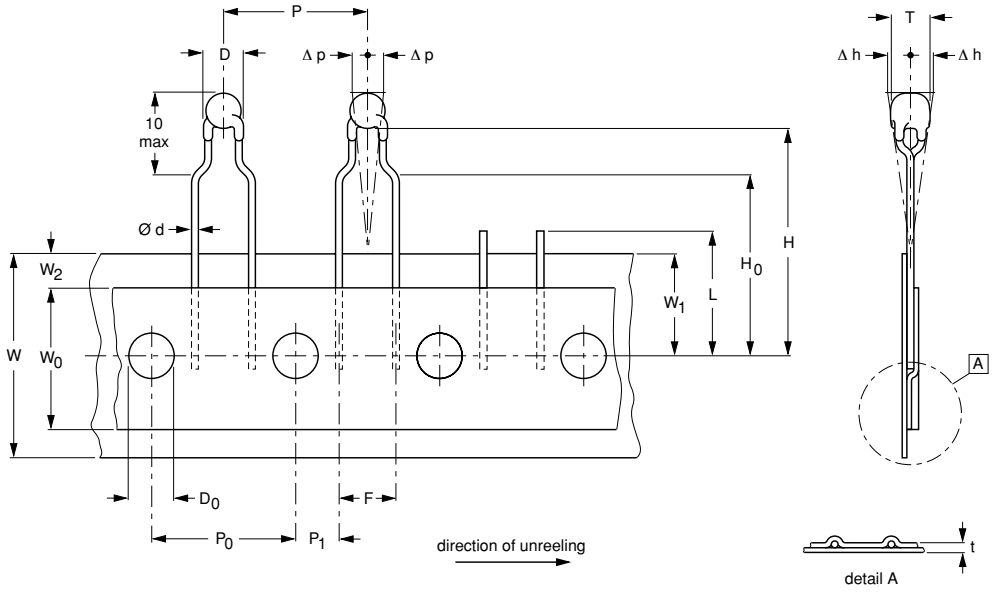

**1E pitch**
2322 640 4....

| DIMENSIONS OF TAPE IN ACCORDANCE WITH *"IEC 60286-2"* | | | |
|---|---|---|---|
| **SYMBOL** | **PARAMETER** | **DIMENSIONS (mm)** | |
| | | **VALUE** | **TOLERANCE** |
| D | body diameter(2) | 3.3 | +0.5 |
| T | maximum total thickness | ≤3 | – |
| d | lead diameter | 0.6 | ±0.06 |
| P | pitch between thermistors | 12.7 | ±1 |
| $P_0$ | feed-hole pitch (cumulative pitch error ±0.2 mm/20 products) | 12.7 | ±0.3 |
| $P_1$ | feed-hole centre to lead centre | 5.08 | ±0.7 |
| Δp | component alignment | 0 | ±1.3 |
| F | lead-to-lead distance | 2.54 | ±0.3 |
| Δh | component alignment | 0 | ±2 |
| W | tape width | 18.0 | +1/-0.5 |
| $W_0$ | hold-down tape width | ≥12.5 | – |
| $W_1$ | feed-hole position | 9.0 | ±0.5 |
| $W_2$ | hold-down tape position | ≤3 | – |
| H | component to tape centre | 22(1) | ±1 |
| $H_1$ | component height | ≤32 | – |
| L | length of snipped lead | ≤11 | – |
| $D_0$ | feed-hole diameter | 4.0 | ±0.2 |
| t | total tape thickness with cardboard tape 0.5 ±0.1 mm | 0.65 | ±0.2 |
| | inspection level: S3 mechanical | – | 1% |

**Note**

1. Taped products with H= 45±1, are available on request.
2. D ≤5 max for 6404.338 to 221.

Thermistors on tape.




**2E pitch**
2322 640 3....

## DIMENSIONS OF TAPE IN ACCORDANCE WITH *"IEC 60286-2"*

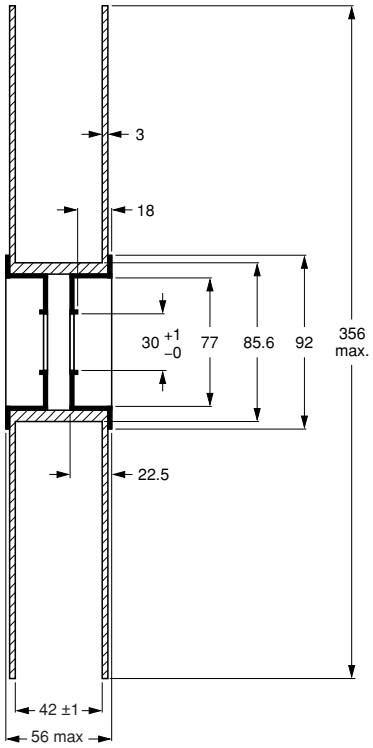
| SYMBOL | PARAMETER | DIMENSIONS (mm) | |
|---|---|---|---|
| | | VALUE | TOLERANCE |
| D | body diameter(1) | 3.3 | +0.5 |
| T | maximum total thickness(2) | ≤3.2 | – |
| d | lead diameter | 0.6 | ±0.06 |
| P | pitch between thermistors | 12.7 | ±1 |
| $P_0$ | feed-hole pitch (cumulative pitch error ±0.2 mm/20 products) | 12.7 | ±0.3 |
| $P_1$ | feed-hole centre to lead centre | 3.85 | ±0.7 |
| Δp | component alignment | 0 | ±1.3 |
| F | lead-to-lead distance | 2.54 | ±0.3 |
| Δh | component alignment | 0 | ±2 |
| W | tape width | 18.0 | +1/-0.5 |
| $W_0$ | hold-down tape width | ≥12.5 | – |
| $W_1$ | feed-hole position | 9.0 | +0.75/-0.5 |
| $W_2$ | hold-down tape position | ≤3 | – |
| H | component to tape centre | 20 | +2 |
| $H_0$ | lead wire clinch height | 16 | ±0.5 |
| L | length of snipped lead | ≤11 | – |
| $D_0$ | feed-hole diameter | 4.0 | ±0.3 |
| t | total tape thickness with cardboard tape 0.5 ±0.1 mm | 0.7 | ±0.2 |
| | inspection level: S3 mechanical | – | 1% |

**Note**

1. D ≤5 max for 640 3. 338 to 640 4. 221.
2. T ≤4 max for 640 3. 338 to 640 4. 221.

## REEL SPECIFICATIONS

Dimensions of the reel.




| CODE NUMBERS AND RELEVANT PACKAGING QUANTITIES | | | |
|---|---|---|---|
| PARAMETER | BULK | TAPE AND REEL(1) 1e pitch | TAPE AND REEL(1) 2e pitch |
| | 2322 640 6.... | 2322 640 4.... | 2322 640 3.... |
| Quantity | 500 | 1500 per reel, 2 reels per box | 1500 per reel, 2 reels per box |

**Note**

1. The maximum number of empty places per reel shall not exceed 0.1% of the total number of components per reel. With no consecutive positions empty.

## CHARACTERISTICS OF TAPED PRODUCTS

Minimum pull-out force of the component: 5 N.

Minimum peel-off force of adhesive tape: 6N.

Minimum tearing force tape: 15 N.

Minimum pull-off force of tape-reel: 5 N.

## STORAGE CONDITIONS

Storage temperature range: –25 to +40 °C.

Maximum relative humidity: 80%.

## TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with *"IEC publication 60068-2; Environmental testing"*, except where indicated.

| STABILITY TESTS | | | | |
|---|---|---|---|---|
| CECC 32 100 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS |
| D3; 4.20.1 | | endurance | 25 °C; 1000 hours | ΔR/R < 1% |
| | 1 | endurance | –40 °C; 1000 hours | ΔR/R < 1% |
| | 539 | endurance | 500 mW; 55 °C; 1000 hours | ΔR/R < 3% (note 1) |
| | 2 | dry heat, | 125 °C; 1000 hours | ΔR/R < 3% |
| D1; 4.19 | 3 | damp heat | 56 days at 40 °C; 90 to 95% RH | ΔR/R < 3% |
| C2; 4.14 | 14 | rapid change of temperature | –40 °C to +125 °C; 50 cycles | ΔR/R < 2% |
| **Other applicable tests** | | | | |
| | 21 | robustness of leads:<br>tensile strength<br>bending | <br>loading force 10 N<br>loading force 5 N | ΔR/R ≤ 1% |
| | 58 | soldering:<br>solderability<br>resistance to heat | <br>240 °C max.; duration 4 s max.<br>265 °C max.; duration 5 s max. | ΔR/R ≤ 1% (note 2) |
| | 27 | impact | free fall; 1 m | ΔR/R ≤ 1% |
| | 29 | shock | 490 m/s; half sinewave | ΔR/R ≤ 1% |
| | 45 | resistance to solvent | ambient temp for 5 min; | no traces of lacquer on |
| | 6 | vibration | 1.5 mm peak to peak: 10 to 58 Hz | no visible damage |
| | 2 | inflammability | 1980, needle flame test | non-flammable |

**Notes**

1. For $R_{25} \geq 100\ k\Omega$ the drift requirement is $\Delta R/R < 5\%$.
2. For $R_{25}$ from 2.2 kΩ to 10 kΩ, requirement is ±2% max.