PTC thermistors as limit temperature sensors

SMD, EIA case sizes 0402, 0603 and 0805, superior series

Series/Type: **B59421, B59641, B59721**

Date: August 2019

Sensors

Limit temperature sensors, EIA sizes 0402, 0603 and 0805 **Superior series**

SMD

Applications

- Over-temperature protection of power components
- DC/DC converters
- SMPS
- Notebooks
- Home appliances
- Dimmers
- Electronic ballasts
- Automotive electronics
- Secondary protection of battery packs

Features

- Qualification based on AEC-Q200 rev. D
- Suitable for reflow soldering
- Suitable for flow soldering only for types with ordering code ending in A562
- Fast and reliable response
- RoHS-compatible
- UL approval to UL1434
- Certified in accordance with IEC 60738-1 and IEC 60730-1; Annex J15 and J17
- Lead-free terminations (tinned) for EIA case sizes 0603 and 0805
- Lead-free ceramics for EIA case sizes 0402 and 0805, except B59421A0135A062

Options

- Other T_{sense} or resistance values on request

Delivery mode

- Blister tape (EIA case size 0805) or cardboard tape (EIA case sizes 0402 and 0603), 180-mm reel with 8-mm tape, taping to IEC 60286-3
- Packing unit: 10.000 pcs. for EIA case size 0402, 4.000 pcs. for EIA case sizes 0805 and 0603

General technical data

Max. operating voltage		V_{max}	32	V DC
Minimum operating temperature	($V \leq V_{max}$)	$T_{op,min}$	−40	°C
Maximum operating temperature	($V \leq V_{max}$)	$T_{op,max}$	125 °C or $T_{sense,1}$ +25 °C whichever is higher	°C

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Electrical specifications and ordering codes
EIA case sizes 0402 and 0603

R_R ($V \leq V_{max}$) Ω	ΔR_R %	$T_{sense,1}$ (@ 4.7 kΩ) °C	$T_{sense,2}$ (@ 47 kΩ) °C	Ordering code
EIA case size 0402				
470	±50	75 ±5	-	B59421A0075A062
470	±50	85 ±5	-	B59421A0085A062
470	±50	95 ±5	-	B59421A0095A062
470	±50	105 ±5	-	B59421A0105A062
470	±50	115 ±5	-	B59421A0115A062
470	±50	125 ±5	-	B59421A0125A062
470	±50	135 ±5	-	B59421A0135A062
EIA case size 0603				
470	±50	75 ±5	90 ±7	B59641A0075A062
470	±50	85 ±5	100 ±7	B59641A0085A062
470	±50	95 ±5	110 ±7	B59641A0095A062
470	±50	95 ±5	-	B59641A0095A562
470	±50	105 ±5	120 ±7	B59641A0105A062
470	±50	105 ±5	-	B59641A0105A562
470	±50	115 ±5	130 ±7	B59641A0115A062
470	±50	125 ±5	140 ±7	B59641A0125A062
470	±50	135 ±5	150 ±7	B59641A0135A062
470	±50	145 ±5	-	B59641A0145A062

Note:
In order to limit self heating effects the electrical power during measurement should be below 2 mW for EIA case size 0402 and below 4 mW for EIA case size 0603.

Electrical specifications and ordering codes
EIA case size 0805

R_R ($V \leq V_{max}$) Ω	ΔR_R %	$T_{sense,1}$ °C	R ($T_{sense,1}$ −5°C) kΩ	R ($T_{sense,1}$ +5°C) kΩ	R ($T_{sense,1}$ +15°C) kΩ	Ordering code
EIA case size 0805						
680	±50	70	≤ 5.7	≥ 5.7	≥ 40[1)]	B59721A0070A062
680	±50	80	≤ 5.7	≥ 5.7	≥ 40[1)]	B59721A0080A062
680	±50	90	≤ 5.5	≥ 13.3	≥ 40	B59721A0090A062
680	±50	90	≤ 5.5	≥ 13.3	≥ 40	B59721A0090A562
680	±50	100	≤ 5.5	≥ 13.3	≥ 40	B59721A0100A062
680	±50	100	≤ 5.5	≥ 13.3	≥ 40	B59721A0100A562
680	±50	110	≤ 5.5	≥ 13.3	≥ 40	B59721A0110A062
680	±50	120	≤ 5.5	≥ 13.3	≥ 40	B59721A0120A062
680	±50	130	≤ 5.5	≥ 13.3	≥ 40	B59721A0130A062

Note:
In order to limit self heating effects the electrical power during measurement should be below 6 mW for EIA case size 0805.

1) R ($T_{sense,1}$ +25 °C)

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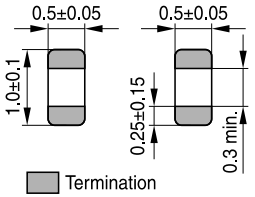
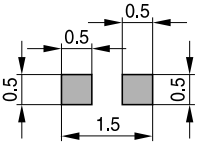
Dimensional drawings in mm

EIA case size 0402



TPT0948-M-E

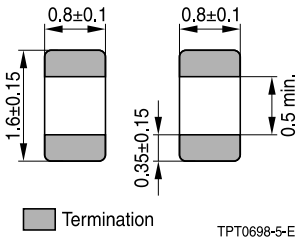
Solder pad



TPT0949-V

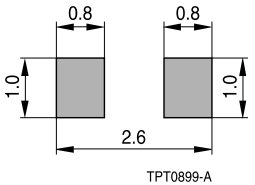
Recommended maximum dimensions (mm)

EIA case size 0603



TPT0698-5-E

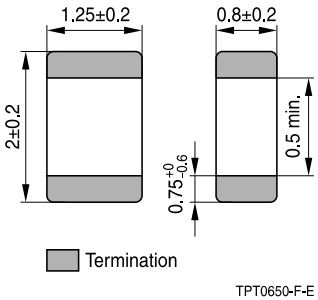
Solder pad



TPT0899-A

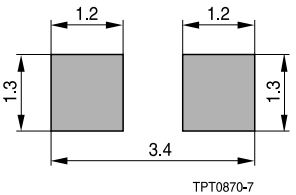
Recommended maximum dimensions (mm)

EIA case size 0805



TPT0650-F-E

Solder pad



TPT0870-7

Recommended maximum dimensions (mm)

Reliability data

Test	Standard	Test conditions	$\lvert\Delta R_{25}/R_{25}\rvert$
Electrical endurance, cycling	IEC 60738-1	Room temperature: I_{smax} , V_{max}; Number of cycles: 100	< 20%
Electrical endurance, constant	IEC 60738-1	Storage at V_{max} and $T_{op,max}$ (@ V_{max}) Test duration: 1000 h	< 20%
Damp heat	IEC 60738-1	Temperature of air: 40 °C Relative humidity of air: 93% Duration: 56 days Test according to IEC 60068-2-78	< 20%
Rapid change of temperature I	IEC 60738-1	$T_{LCT} = T_{op,min}$, $T_{UCT} = T_{op,max}$ Number of cycles: 5 Test duration: 30 min Test according to IEC 60068-2-14, test Na	< 20%
Rapid change of temperature II	AEC-Q200 / IEC 60738-1, item 4.17	$T_{LCT} = -55$ °C, $T_{UCT} = 125$ °C Number of cycles: 1000	< 25%
Vibration I	IEC 60738-1	Frequency: 10 ... 2000 Hz Displacement amplitude: 0.75 mm, resp. Acceleration: 98 m/s² Test duration: 3 × 2 h Test according to IEC 60028-2-6, test Fc	< 20%
Vibration II	MIL-STD-202, method 204	Frequency: 10 ... 2000 Hz Displacement amplitude: 0.75 mm, resp. Acceleration: 50 m/s² Test duration: 3 × 2 h Test according to IEC 60028-2-6, test Fc	< 20%
Shock	IEC 60738-1	Pulse shape: half-sine Acceleration: 400 m/s² Pulse duration: 6 ms; 6 x 5000 pulses Test according to IEC 60068-2-27, test Ea	< 20%
Climatic sequence	IEC 60738-1	Dry heat: $T_{UCT} = 125$ °C Test duration: 16 h Damp heat first cycle Cold: $T_{LCT} = -40$ °C Test duration: 2 h Damp heat 5 cycles Tests performed according to IEC 60068-2-30	< 20%
Bending test	IEC 60738-1	Components reflow-soldered to test board Maximum bendig: 2 mm Test according to IEC 60068-2-21, test Ue	< 20%

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Test	Standard	Test conditions	$\lvert\Delta R_{25}/R_{25}\rvert$
Shear test		Shearing of the component soldered on PCB by a force of 5 N normal to components longitudinal axis	No visible damage
Humidity	AEC-Q200 / MIL-STD-202, method 103	T = 85 °C; H = 85% r.H.; t = 1000 h V = 0.05 · V_{max}	< 20%
Resistance to soldering heat	AEC-Q200 / IEC 60068-2-20, test Tb	Soldering bath: 260 °C; t = 20 s	< 20%
ESD	AEC-Q200-002	150 pF/ 330 Ω; 8 kV contact discharge, 10 pulses in each polarity	< 20%
High temperature load		Soldered PTC to PCB @ 85 °C, load maximum operating voltage for 1.5 h on and 0.5 h off. This cycle is repeated for 1000 ±12 h	< 20%

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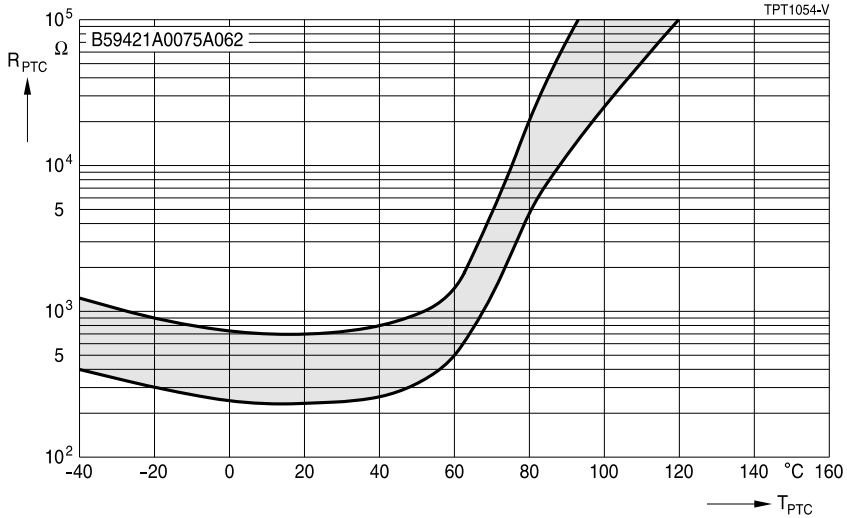
Characteristics (typical) for case size 0402

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	400	815	1.230
−30	345	692	1.040
−20	300	605	910
−10	270	540	810
0	243	486	730
10	235	470	705
20	232	463	695
25	235	470	705
30	238	477	717
35	247	490	739
40	260	520	790
50	320	660	940
60	500	990	1.400

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
70	1.300	2.700	4.700
75	2.400	4.700	9.800
80	4.700	8.500	20.500
85	7.700	14.200	39.500
90	11.700	23.500	72.000
93	14.900	31.000	100.000
100	25.100	59.000	–
106	38.500	100.000	–
110	51.000	–	–
120	100.000	–	–

SMD

Characteristics (typical) for case size 0402

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
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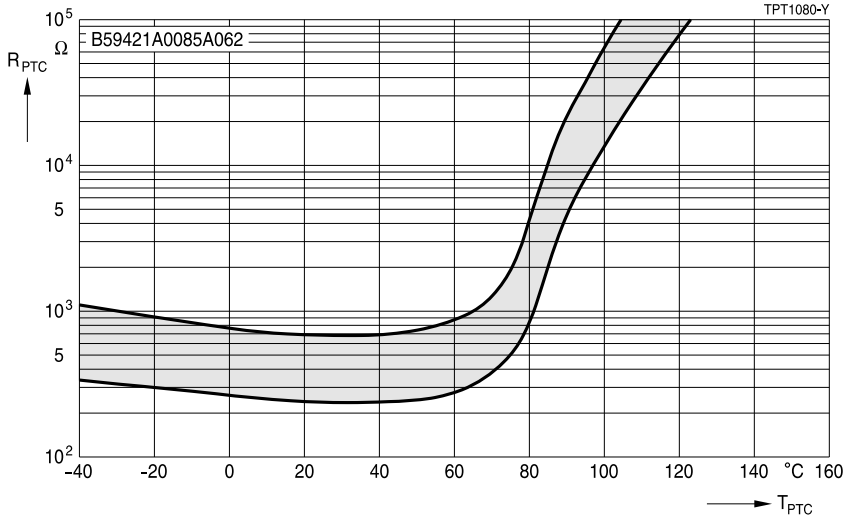

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	409	835	1.260
−30	358	724	1.090
−20	316	640	963
−10	287	578	870
0	264	531	800
10	247	498	748
20	237	476	715
25	235	472	709
30	233	468	706
40	235	473	712
50	249	504	760
55	265	537	809
60	289	588	890

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
65	328	670	1.030
70	410	830	1.450
75	590	1.200	2.500
80	1.070	2.250	4.700
85	2.300	4.700	8.900
90	4.700	8.500	16.000
100	12.800	24.000	46.000
108	24.500	49.000	100.000
117	46.000	100.000	–
120	56.000	–	–
130	100.000	–	–

SMD

Characteristics (typical) for case size 0402

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
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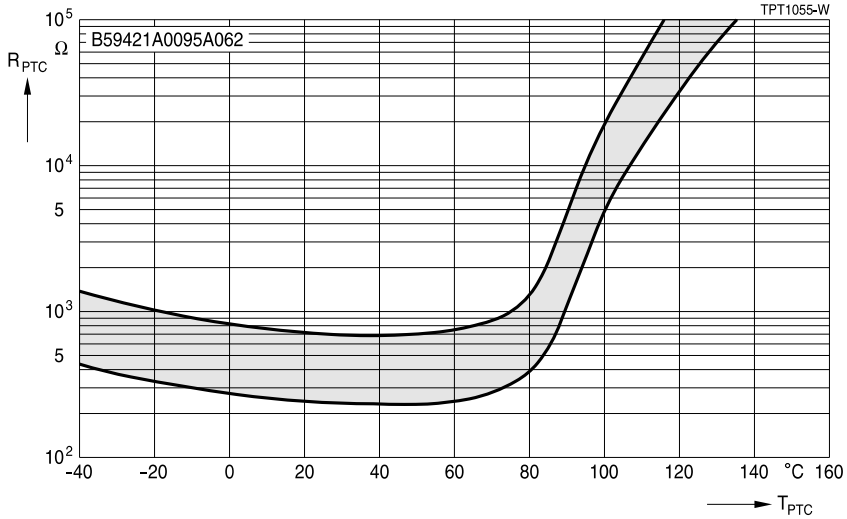


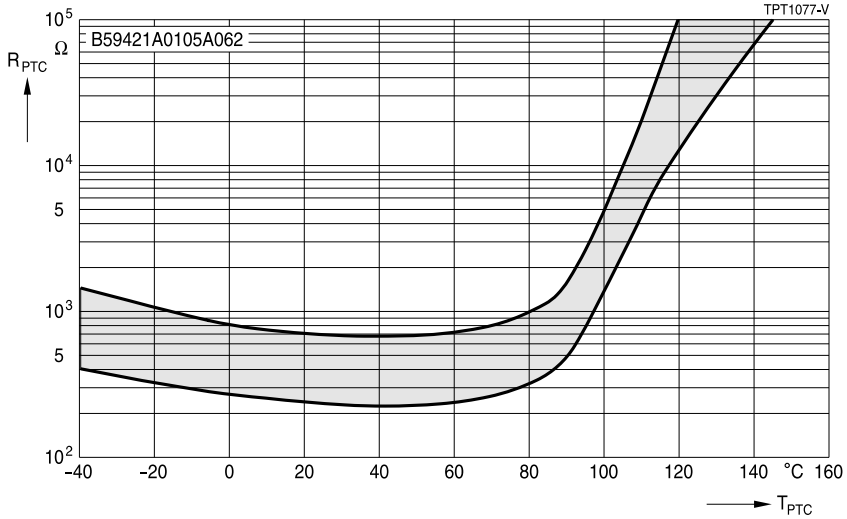
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	429	887	1.346
−30	373	765	1.158
−20	330	673	1.015
−10	297	603	909
0	272	548	824
10	253	508	764
20	240	481	722
25	235	470	705
40	227	452	684
50	231	461	697
60	242	490	743
70	278	570	868
75	316	650	994

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
80	390	810	1.300
85	580	1.200	2.200
90	1.100	2.300	4.700
95	2.300	4.700	10.200
100	4.700	9.300	19.000
110	14.000	27.500	57.000
116	24.000	49.500	100.000
120	33.000	69.000	–
124	45.500	100.000	–
130	71.000	–	–
135	100.000	–	–

SMD

Characteristics (typical) for case size 0402

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



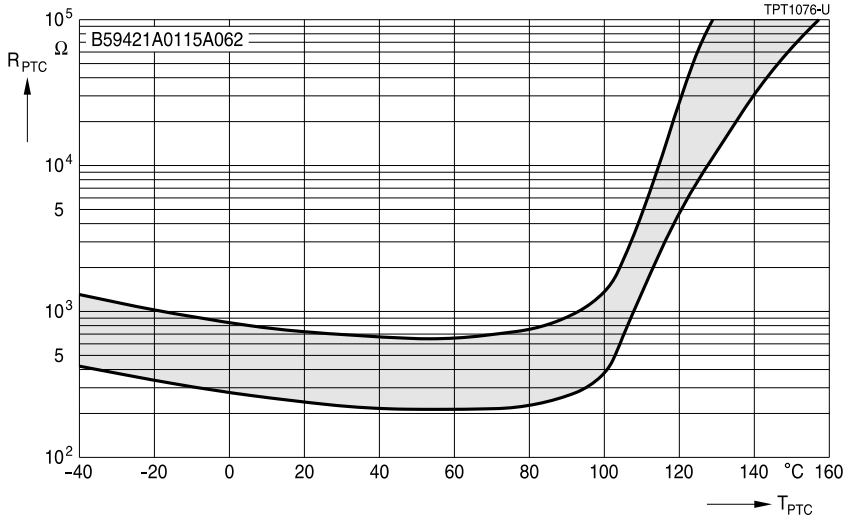
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	420	880	1.340
−30	368	774	1.180
−20	329	679	1.030
−10	298	604	910
0	273	557	840
10	254	517	780
25	235	470	705
40	222	445	667
50	218	436	655
60	219	439	658
70	229	458	687
80	256	518	780

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
90	330	743	1.150
95	460	1.150	2.000
100	930	2.200	4.700
105	2.250	4.700	9.900
110	4.700	9.500	19.000
115	7.500	16.500	35.000
120	11.500	26.000	61.000
125	16.700	42.000	100.000
130	24.000	64.000	–
136	36.000	100.000	–
140	46.000	–	–
153	100.000	–	–

SMD

Characteristics (typical) for case size 0402

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



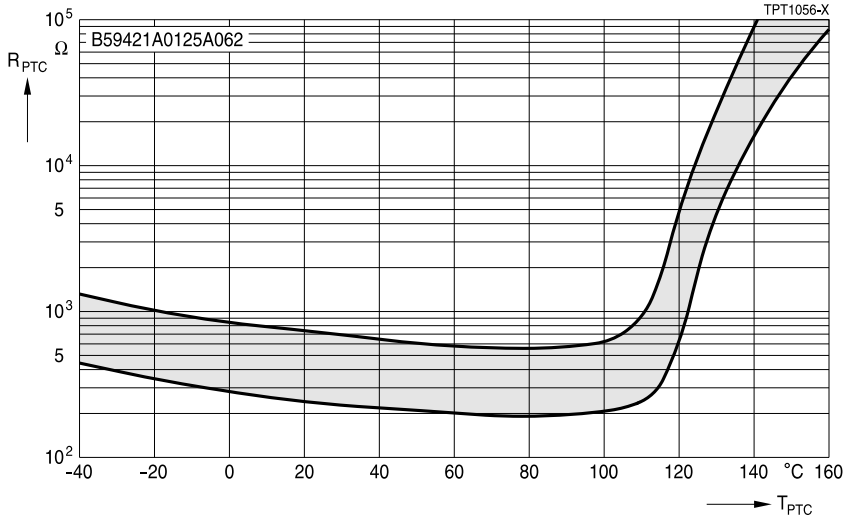
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	420	880	1.340
−30	368	774	1.180
−20	329	679	1.030
−10	298	608	910
0	273	556	840
10	254	514	780
25	235	470	705
40	220	433	655
50	213	416	632
60	207	402	615
70	206	400	605
80	209	408	630
90	226	440	710

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
100	283	580	990
105	372	830	1.750
110	640	1.800	4.700
115	1.700	4.700	12.500
120	4.700	10.500	29.000
129	12.400	29.000	100.000
130	13.500	32.000	–
140	29.600	82.000	–
142	34.500	100.000	–
150	61.000	–	–
157	100.000	–	–

SMD

Characteristics (typical) for case size 0402

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



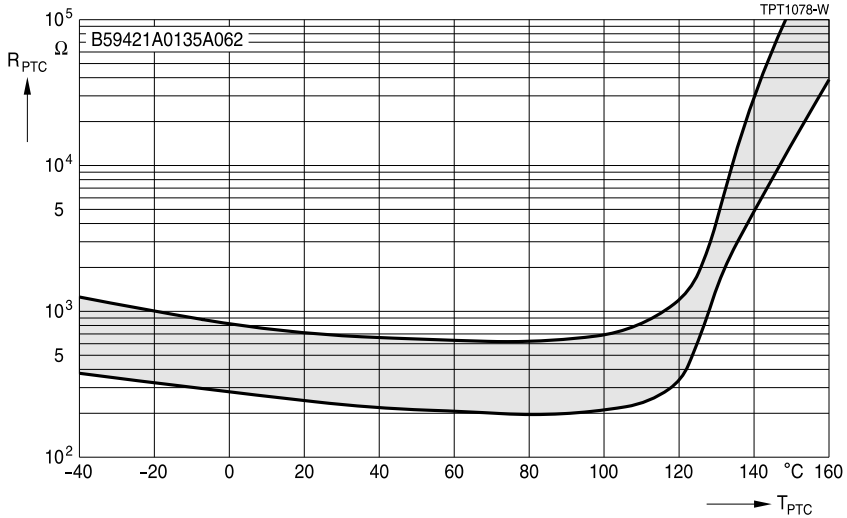
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	435	860	1.310
−30	385	752	1.140
−20	342	675	1.025
−10	308	608	930
0	278	558	848
10	258	514	780
25	235	470	705
40	218	431	645
50	208	410	610
60	200	391	580
70	195	380	562
80	192	373	555
90	194	383	568

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
100	205	416	622
110	240	520	900
115	322	800	1.700
120	630	1.800	4.700
125	1.850	4.700	11.500
130	4.700	9.900	24.000
140	16.000	33.000	88.000
141	17.800	37.000	100.000
150	40.000	92.000	–
151	43.500	100.000	–
160	87.000	–	–
162	100.000	–	–

SMD

Characteristics (typical) for case size 0402

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



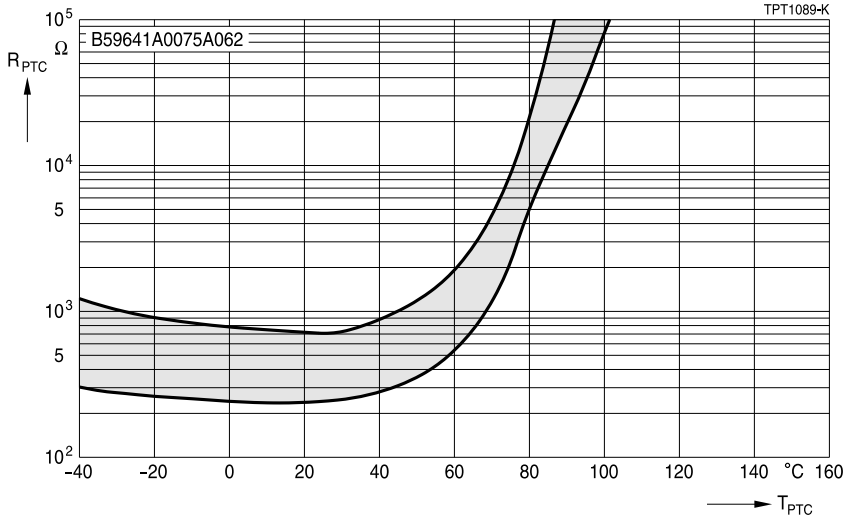
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	467	966	1.465
−30	398	820	1.241
−20	348	710	1.072
−10	310	628	946
0	281	566	852
10	258	517	777
20	241	484	727
25	235	470	705
40	224	447	670
50	219	439	659
60	219	441	662
70	224	453	682
80	235	480	726
90	253	523	810

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
95	270	560	880
100	293	604	970
105	325	670	1.090
110	368	760	1.270
115	438	900	1.530
120	570	1.100	1.960
125	830	1.550	2.800
130	1.350	2.500	4.700
135	2.400	4.700	9.100
140	4.700	9.000	19.000
150	15.000	33.000	88.000
151	16.700	37.000	100.000
160	40.000	95.000	–

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



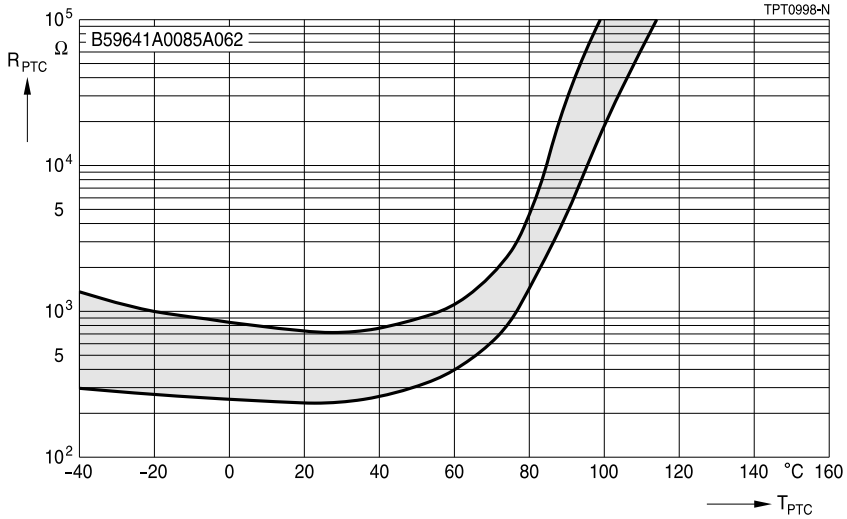
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	296	680	1.100
−30	270	610	980
−20	255	550	870
−10	244	510	790
0	235	485	740
10	231	470	705
20	232	465	700
25	235	470	705
30	240	480	720
40	265	520	800
50	310	620	990

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
60	430	920	1.600
65	590	1.350	2.500
70	1.000	2.300	4.700
75	2.050	4.700	10.000
80	4.700	10.300	25.000
83	7.300	17.000	47.000
96	11.100	26.500	100.000
90	19.000	47.000	–
95	37.000	100.000	–
97	47.000	–	–
103	100.000	–	–

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



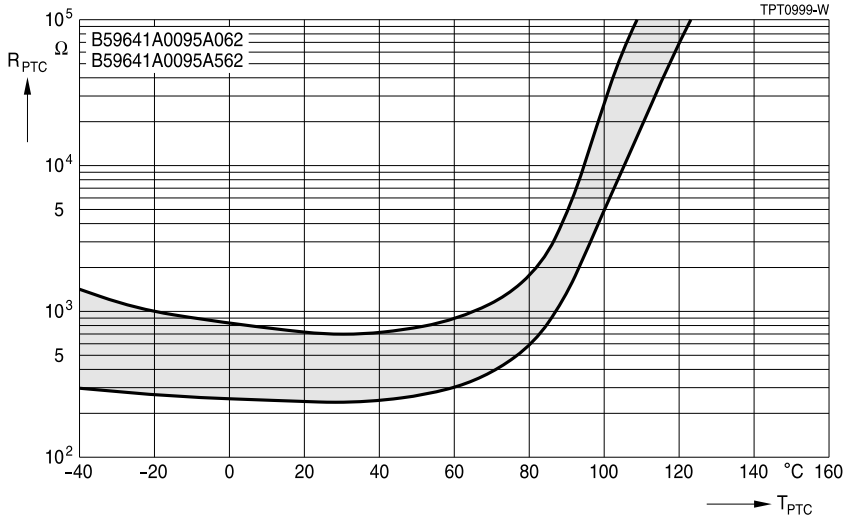
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	350	772	1.250
−20	290	620	970
−10	270	568	880
0	252	522	805
10	242	490	750
25	235	470	705
40	248	490	736
50	278	550	830
60	346	690	1.050
70	498	1.030	1.530
75	680	1.450	2.300
80	1.080	2.300	4.700
85	2.150	4.700	12.000

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
90	4.700	11.000	29.000
93	7.300	17.500	47.000
95	9.700	23.500	61.000
99	17.000	42.000	100.000
100	19.500	47.000	–
105	37.000	82.000	–
107	47.000	100.000	–
110	65.500	–	–
114	100.000	–	–

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



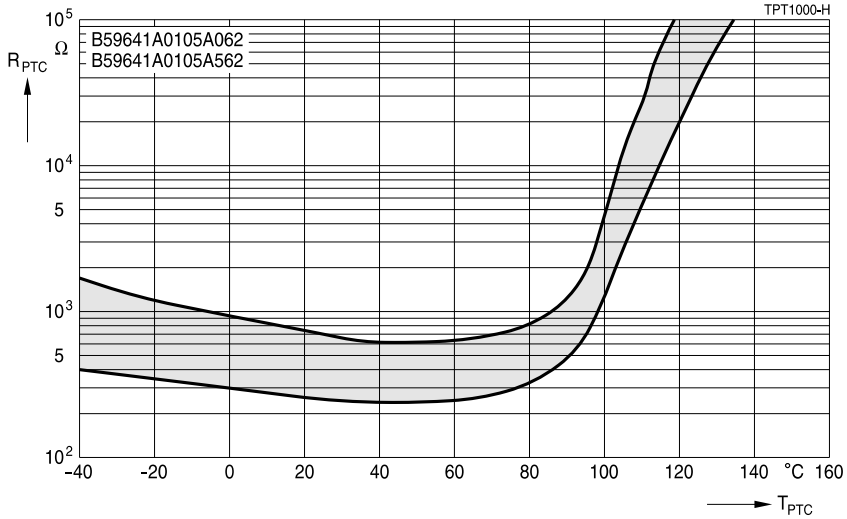
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	350	770	1.300
−20	298	585	999
−10	277	540	900
0	261	510	820
10	248	485	755
20	238	472	715
25	235	470	705
30	237	472	708
40	243	480	725
50	257	510	770
60	285	570	870
70	345	710	1.050
80	478	995	1.550

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
85	640	1.350	2.350
90	1.030	2.210	4.700
95	2.050	4.700	11.000
100	4.700	10.500	28.000
103	7.200	17.000	47.000
108	14.000	35.500	100.000
110	18.300	47.000	
115	36.000	100.000	
117	47.000		
123	100.000		

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



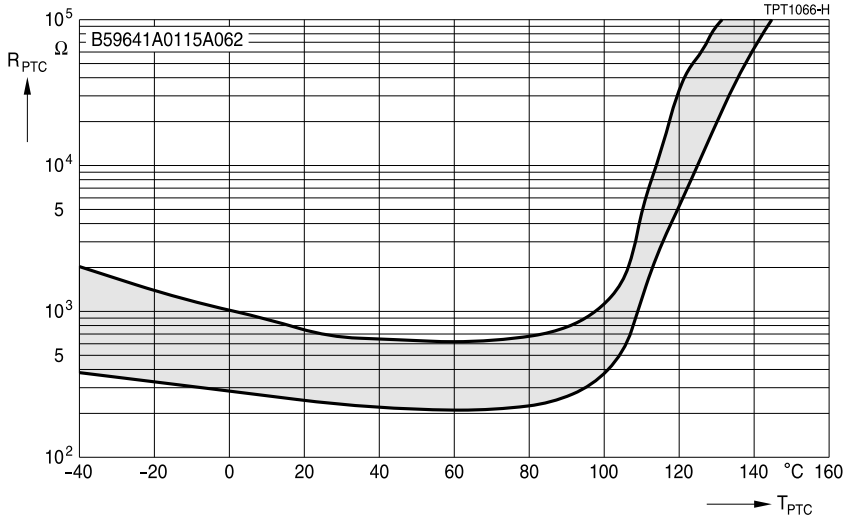
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	500	1.050	1.720
−20	355	743	1.130
−10	310	635	965
0	275	558	850
10	255	508	770
20	240	479	718
25	235	470	705
30	230	460	690
40	222	447	674
50	222	448	676
60	231	465	698
70	252	503	762

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
80	300	585	900
90	450	810	1.380
95	645	1.200	2.200
100	1.100	2.200	4.700
105	2.200	4.700	12.600
110	4.700	10.900	29.500
113	7.500	18.000	47.000
118	15.800	37.000	100.000
120	21.000	47.000	–
125	38.000	83.000	–
127	47.000	100.000	–
136	100.000	–	–

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



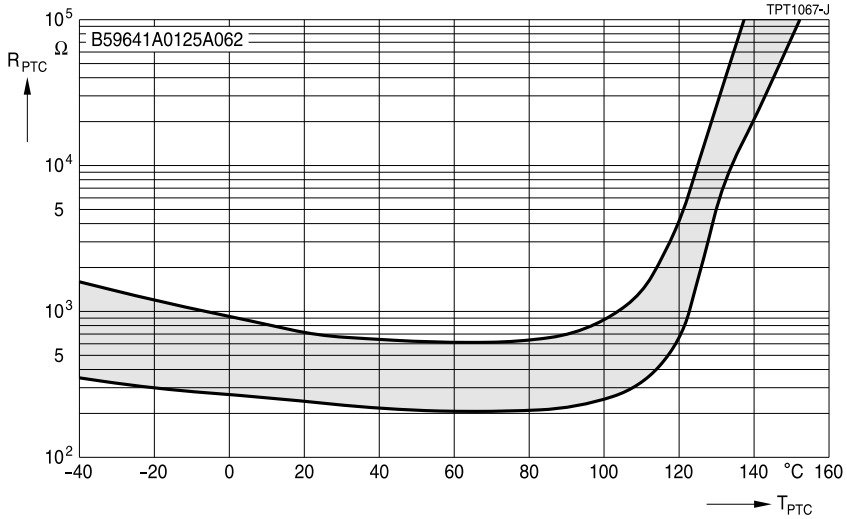
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	410	900	1.700
−20	335	690	1.200
−10	305	612	1.020
0	278	552	890
10	256	510	790
20	241	482	728
25	235	470	705
30	231	460	690
40	225	441	670
50	221	430	655
60	220	425	650
70	225	438	665
80	243	475	710

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
90	290	560	840
100	410	780	1.250
105	570	1.090	2.050
110	960	2.050	4.700
115	1.950	4.700	12.000
120	4.700	11.000	29.000
123	7.700	17.500	47.000
128	15.400	36.000	100.000
130	20.000	47.000	
136	42.500	100.000	
137	47.000		
145	100.000		

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



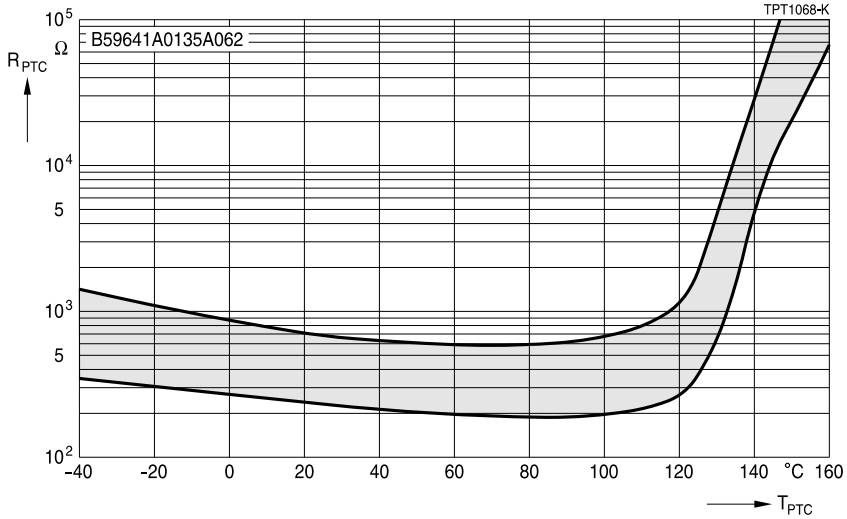
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	380	810	1.500
−20	320	668	1.140
−10	296	612	1.010
0	275	563	900
10	256	520	800
20	241	486	728
25	235	470	705
30	229	458	688
40	220	439	660
50	211	425	641
60	207	417	630
70	206	415	634
80	210	426	655

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
90	222	461	716
100	250	541	900
110	325	765	1.350
115	430	1.060	2.200
120	700	1.900	4.700
125	1.680	4.700	11.000
130	4.700	10.000	28.000
133	7.700	15.500	47.000
137	13.500	29.000	100.000
140	20.000	47.000	–
145	36.700	100.000	–
147	47.000	–	–
154	100.000	–	–

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



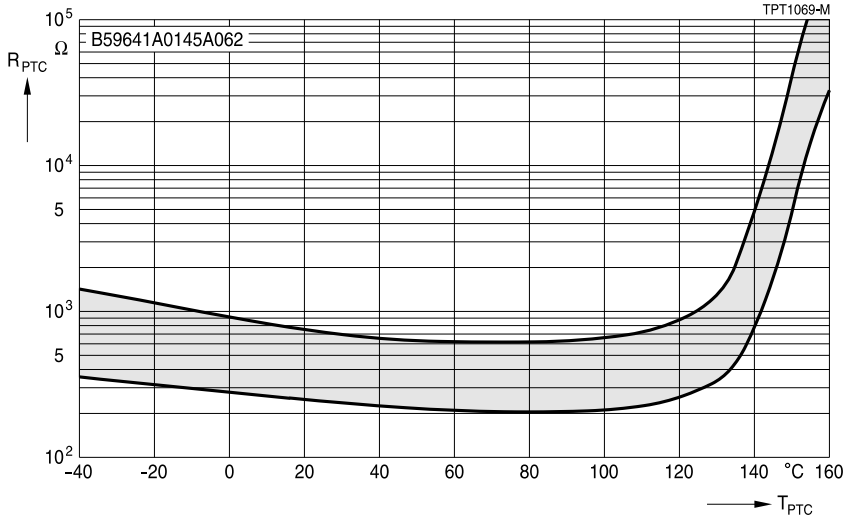
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	380	810	1.460
−20	320	668	1.130
−10	296	612	1.008
0	275	563	900
10	256	520	800
20	241	486	728
25	235	470	705
30	229	456	687
40	218	433	655
50	209	416	630
60	202	404	614
70	198	396	609
80	195	397	615
90	196	405	635

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
100	203	432	690
110	225	495	825
120	292	665	1.230
125	402	980	2.100
130	680	1.950	4.700
135	1.610	4.700	11.000
140	4.700	10.500	28.000
143	7.700	16.500	47.000
147	13.500	30.000	100.000
150	19.800	47.000	–
155	36.800	100.000	–
157	47.000	–	–
163	100.000	–	–

SMD

Characteristics (typical) for case size 0603

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



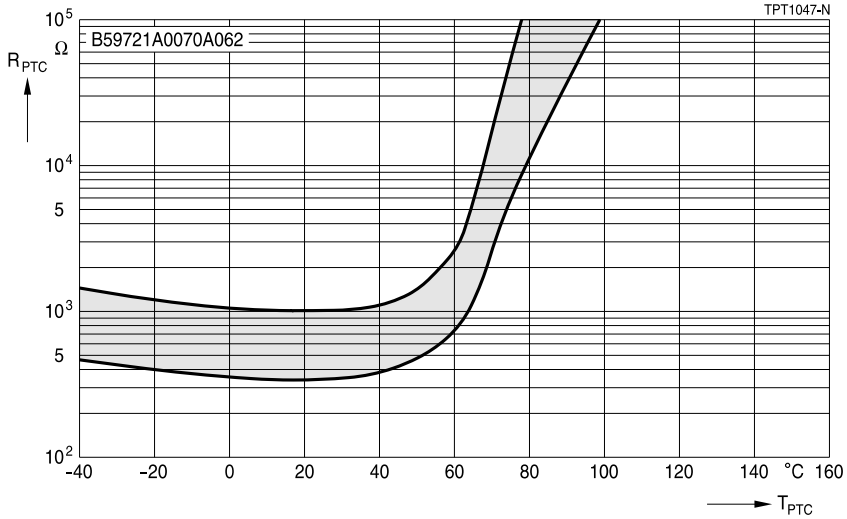
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	380	800	1.400
−20	320	662	1.100
−10	296	608	990
0	275	561	892
10	256	519	795
20	241	485	728
25	235	470	705
30	229	456	687
40	218	433	655
50	209	414	630
60	202	400	614
70	198	392	605
80	195	390	610
90	196	395	625

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
100	205	410	650
110	218	438	710
120	245	505	845
130	310	685	1.280
135	410	1.000	2.150
140	710	2.030	4.700
145	1.610	4.700	11.000
150	4.700	10.500	28.000
153	7.700	16.800	47.000
157	13.500	30.500	100.000
160	19.800	47.000	–
165	37.000	100.000	–
167	47.000	–	–
174	100.000	–	–

SMD

Characteristics (typical) for case size 0805

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



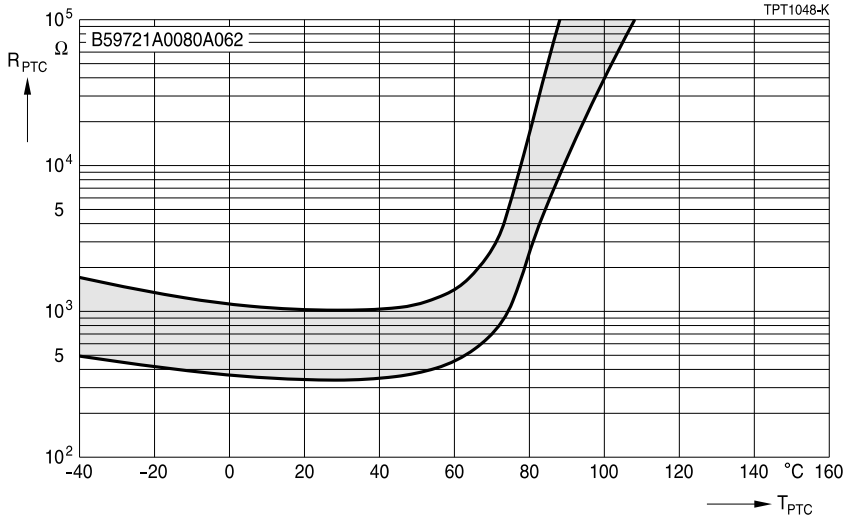
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	460	940	1.430
−20	395	795	1.190
−10	370	745	1.110
0	350	709	1.050
10	340	685	1.022
20	337	678	1.015
25	340	680	1.020
30	345	688	1.030
40	380	735	1.110

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
50	470	870	1.420
60	720	1.370	2.610
65	1.160	2.400	5.700
70	2.500	5.700	16.500
75	5.700	12.500	52.000
78	8.700	19.700	100.000
80	11.200	26.000	–
89	32.500	100.000	–
99	100.000	–	–

SMD

Characteristics (typical) for case size 0805

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



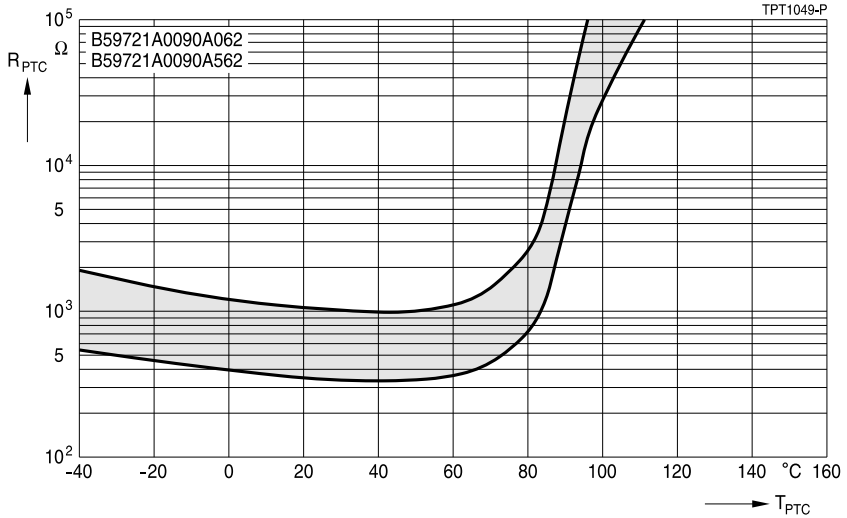
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	490	1.110	1.690
−20	415	905	1.340
−10	388	822	1.210
0	365	755	1.120
10	350	710	1.060
20	342	683	1.025
25	340	680	1.020
30	339	677	1.016
40	348	697	1.045
50	378	750	1.120

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
60	455	900	1.420
70	690	1.390	2.600
75	1.100	2.440	5.700
80	2.500	5.700	17.000
85	5.700	12.700	52.500
88	8.600	20.800	100.000
90	11.400	28.000	–
98	31.500	100.000	–
108	100.000	–	–

SMD

Characteristics (typical) for case size 0805

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



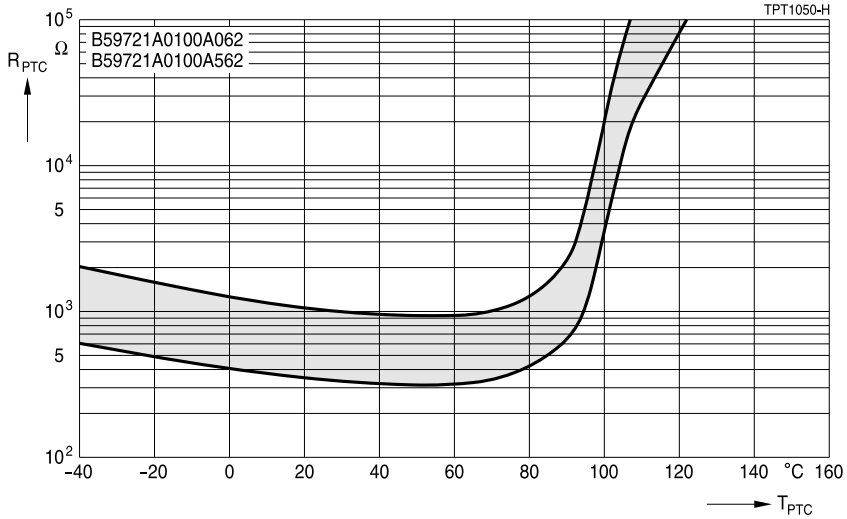
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	540	1.200	1.900
−20	455	960	1.460
−10	420	870	1.310
0	390	790	1.200
10	365	730	1.110
20	347	690	1.040
25	340	680	1.020
30	335	675	1.010
40	330	670	995
50	335	686	1.010

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
60	360	760	1.110
70	450	960	1.450
80	720	1.700	2.600
85	1.290	2.900	5.500
90	3.800	9.200	22.000
95	13.300	26.000	80.000
96	15.900	30.500	100.000
100	28.000	57.000	–
104	45.000	100.000	–
111	100.000	–	–

SMD

Characteristics (typical) for case size 0805

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



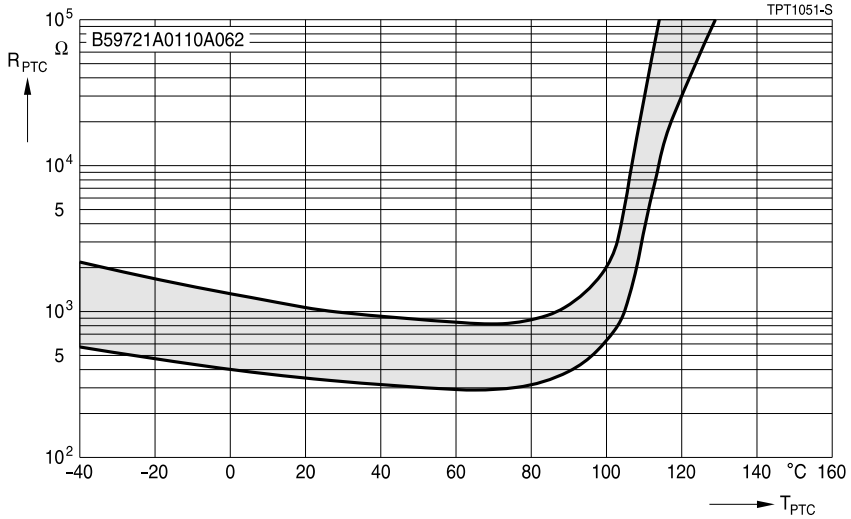
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	600	1.360	2.010
−20	485	1.055	1.570
−10	440	945	1.400
0	403	845	1.250
10	373	765	1.140
20	350	703	1.050
25	340	680	1.020
30	332	662	998
40	320	635	955
50	312	618	930

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
60	315	620	935
70	341	665	1.010
80	420	830	1.270
90	640	1.350	2.200
95	1.100	2.500	5.500
100	3.550	8.300	21.000
105	13.300	26.200	69.000
107	19.000	37.500	100.000
113	39.000	100.000	–
122	100.000	–	–

SMD

Characteristics (typical) for case size 0805

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



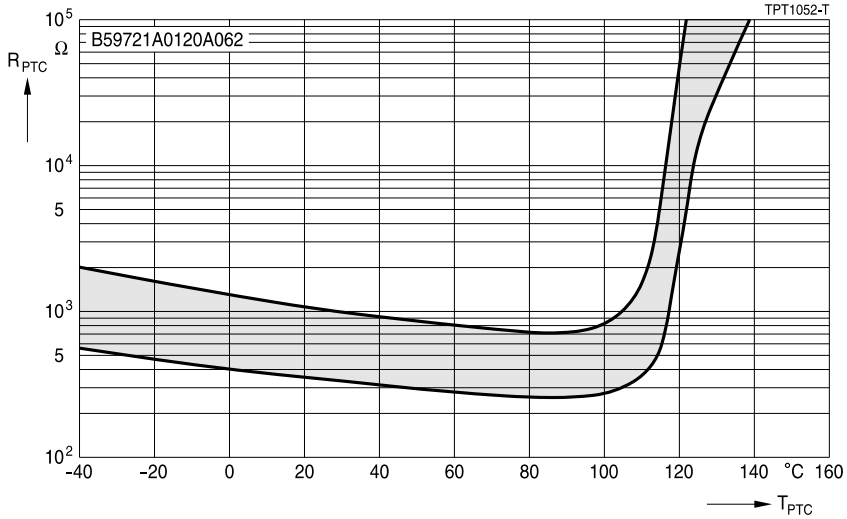
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	565	1.260	2.150
−20	468	1.025	1.660
−10	431	930	1.480
0	400	840	1.320
10	373	766	1.180
20	350	706	1.060
25	340	680	1.020
30	331	653	985
40	315	610	930
50	300	570	875
60	290	538	830

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
70	288	522	810
80	311	560	870
90	385	725	1.110
100	620	1.300	2.080
105	1.080	2.500	5.500
110	3.500	8.500	30.000
114	10.800	25.000	100.000
115	13.300	31.000	–
120	30.000	100.000	–
129	100.000	–	–

SMD

Characteristics (typical) for case size 0805

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



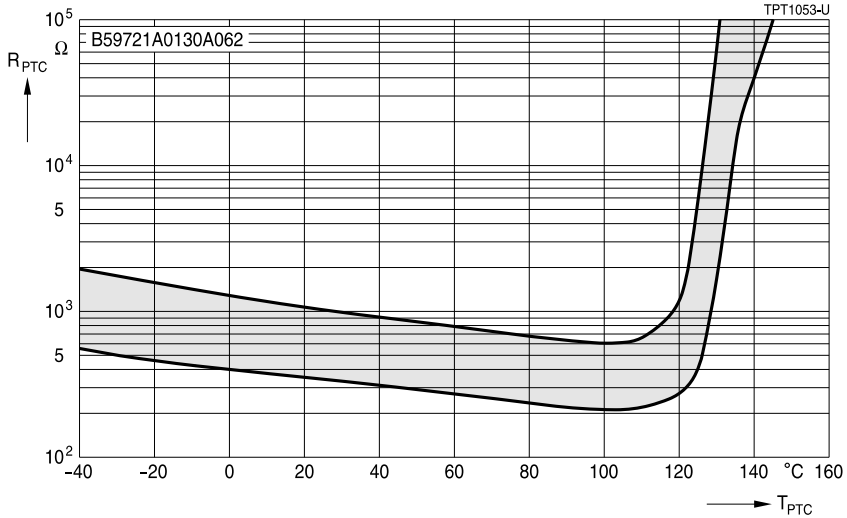
T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	555	1.205	1.980
−20	468	1.000	1.595
−10	432	915	1.435
0	400	833	1.298
10	375	768	1.170
20	352	708	1.060
25	340	680	1.020
30	329	654	983
40	310	604	917
50	292	561	855
60	278	520	798

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
70	266	485	755
80	257	458	715
90	256	454	713
100	275	510	825
110	355	810	1.500
115	560	1.700	5.500
120	2.500	10.000	45.000
122	5.000	19.000	100.000
125	13.300	45.000	–
128	23.000	100.000	–
139	100.000	–	–

SMD

Characteristics (typical) for case size 0805

PTC resistance R_{PTC} versus PTC temperature T_{PTC} (measured at low signal voltage).
R_{min} and R_{max} values are typical values for reference only.



T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
−40	548	1.190	1.930
−20	465	990	1.570
−10	432	908	1.405
0	401	830	1.278
10	375	765	1.160
20	352	707	1.060
25	340	680	1.020
30	329	652	980
40	307	601	910
50	287	556	845
60	268	515	785
70	250	476	726

T_{PTC} °C	R_{min} Ω	$R_{typical}$ Ω	R_{max} Ω
80	233	440	675
90	220	408	630
100	212	390	605
110	218	425	660
120	270	620	1.180
125	410	1.300	5.500
130	1.670	12.000	65.000
131	2.550	19.000	100.000
135	13.300	62.000	–
137	23.000	100.000	–
145	100.000	–	–

SMD

Cautions and warnings

General

- TDK Electronics thermistors are designed for specific applications and should not be used for purposes not identified in our specifications, application notes and data books unless otherwise agreed with TDK Electronics during the design-in-phase.
- Ensure suitability of thermistor through reliability testing during the design-in phase. The thermistors should be evaluated taking into consideration worst-case conditions.

Storage

- Store thermistors only in original packaging. Do not open the package prior to processing.
- Storage conditions in original packaging: storage temperature −25 °C ... +45 °C, relative humidity ≤75% annual mean, maximum 95%, dew precipitation is inadmissible.
- Avoid contamination of thermistors surface during storage, handling and processing.
- Avoid storage of thermistor in harmful environment with effect on function on long-term operation (examples given under operation precautions).
- Use thermistor within the following period after delivery:
  - Through-hole devices (housed and leaded PTCs): 24 months
  - Motor protection sensors, glass-encapsulated sensors and probe assemblies: 24 months
  - Telecom pair and quattro protectors (TPP, TQP): 24 months
  - Leadless PTC thermistors for pressure contacting: 12 months
  - Leadless PTC thermistors for soldering: 6 months
  - SMDs in EIA sizes 3225 and 4032, and for PTCs with metal tags: 24 months
  - SMDs in EIA sizes 1210 and smaller: 12 months

Handling

- PTCs must not be dropped. Chip-offs must not be caused during handling of PTCs.
- The ceramic and metallization of the components must not be touched with bare hands. Gloves are recommended.
- Avoid contamination of thermistor surface during handling.

Soldering (where applicable)

- Use rosin-type flux or non-activated flux.
- Insufficient preheating may cause ceramic cracks.
- Rapid cooling by dipping in solvent is not recommended.
- Complete removal of flux is recommended.
- Standard PTC heaters are not suitable for soldering.

Mounting

- Electrode must not be scratched before/during/after the mounting process.
- Contacts and housing used for assembly with thermistor have to be clean before mounting. Especially grease or oil must be removed.
- When PTC thermistors are encapsulated with sealing material, the precautions given in chapter "Mounting instructions", "Sealing and potting" must be observed.
- When the thermistor is mounted, there must not be any foreign body between the electrode of the thermistor and the clamping contact.
- The minimum force and pressure of the clamping contacts pressing against the PTC must be 10 N and 50 kPa, respectively. In case the assembly is exposed to mechanical shock and/ or vibration this force should be higher in order to avoid movement of the PTC during operation.
- During operation, the thermistor's surface temperature can be very high. Ensure that adjacent components are placed at a sufficient distance from the thermistor to allow for proper cooling at the thermistors.
- Ensure that adjacent materials are designed for operation at temperatures comparable to the surface temperature of thermistor. Be sure that surrounding parts and materials can withstand this temperature.
- Avoid contamination of thermistor surface during processing.

Operation

- Use thermistors only within the specified temperature operating range.
- Use thermistors only within the specified voltage and current ranges.
- Environmental conditions must not harm the thermistors. Use thermistors only in normal atmospheric conditions. Avoid use in deoxidizing gases (chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas etc), corrosive agents, humid or salty conditions. Contact with any liquids and solvents should be prevented.
- Be sure to provide an appropriate fail-safe function to prevent secondary product damage caused by abnormal function (e.g. use VDR for limitation of overvoltage condition).

This listing does not claim to be complete, but merely reflects the experience of TDK Electronics.

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products**. Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

Symbols and terms

Symbol	Term
A	Area
C	Capacitance
C_{th}	Heat capacity
f	Frequency
I	Current
I_{max}	Maximum current
I_R	Rated current
I_{res}	Residual current
I_{PTC}	PTC current
I_r	Residual currrent
$I_{r,oil}$	Residual currrent in oil (for level sensors)
$I_{r,air}$	Residual currrent in air (for level sensors)
I_{RMS}	Root-mean-square value of current
I_S	Switching current
I_{Smax}	Maximum switching current
LCT	Lower category temperature
N	Number (integer)
N_c	Operating cycles at V_{max}, charging of capacitor
N_f	Switching cycles at V_{max}, failure mode
P	Power
P_{25}	Maximum power at 25 °C
P_{el}	Electrical power
P_{diss}	Dissipation power
R_G	Generator internal resistance
R_{min}	Minimum resistance
R_R	Rated resistance @ rated temperature T_R
ΔR_R	Tolerance of R_R
R_P	Parallel resistance
R_{PTC}	PTC resistance
R_{ref}	Reference resistance
R_S	Series resistance
R_{25}	Resistance at 25 °C
$R_{25,match}$	Resistance matching per reel/ packing unit at 25 °C
ΔR_{25}	Tolerance of R_{25}

T	Temperature
t	Time
T_A	Ambient temperature
t_a	Thermal threshold time
T_C	Ferroelectric Curie temperature
t_E	Settling time (for level sensors)
T_R	Rated temperature @ 25 °C or otherwise specified in the data sheet
T_{sense}	Sensing temperature
T_{op}	Operating temperature
T_{PTC}	PTC temperature
t_R	Response time
T_{ref}	Reference temperature
T_{Rmin}	Temperature at minimum resistance
t_S	Switching time
T_{surf}	Surface temperature
UCT	Upper category temperature
V or V_{el}	Voltage (with subscript only for distinction from volume)
$V_{c(max)}$	Maximum DC charge voltage of the surge generator
$V_{F,max}$	Maximum voltage applied at fault conditions in protection mode
V_{RMS}	Root-mean-square value of voltage
V_{BD}	Breakdown voltage
V_{ins}	Insulation test voltage
$V_{link,max}$	Maximum link voltage
V_{max}	Maximum operating voltage
$V_{max,dyn}$	Maximum dynamic (short-time) operating voltage
V_{meas}	Measuring voltage
$V_{meas,max}$	Maximum measuring voltage
V_R	Rated voltage
V_{PTC}	Voltage drop across a PTC thermistor
α	Temperature coefficient
Δ	Tolerance, change
δ_{th}	Dissipation factor
τ_{th}	Thermal cooling time constant
λ	Failure rate
e	Lead spacing (in mm)

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.

7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.
8. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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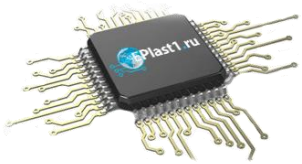

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