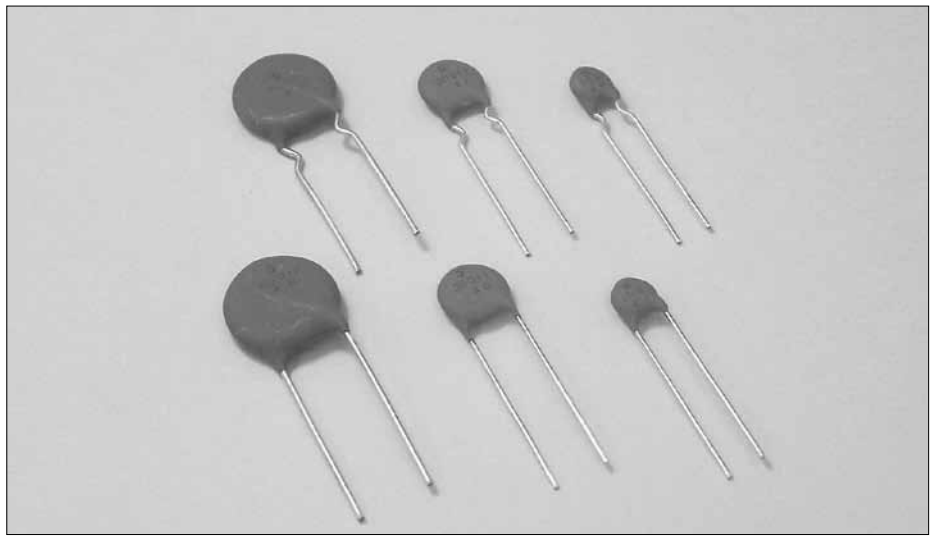
POWER THERMISTOR

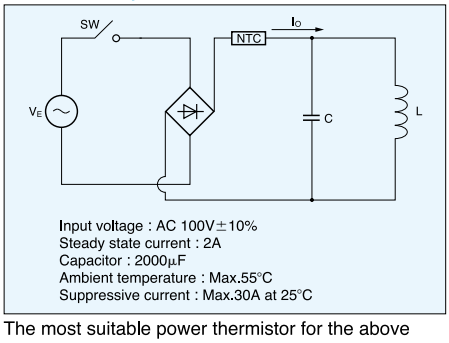
The POWER THERMISTOR is a device for suppressing inrush current to an electric circuit. Circuits including electric bulbs or capacitors induce a inrush current more than 100 times the normal current when the circuit switch is turned on. The POWER THERMISTOR in the circuits protects electric equipments from being damaged by limiting the inrush current.



Application

The power thermistor will suppress inrush current which is caused by a capacitor, filament for a bulb, inverter for fluorescent lamp, a heater and etc., also will control fan motor speed of cooler for electric circuit.
It is developed to use for power supply of TV, VCR instead of cement resistor.

How to use the power thermistor



Input voltage : AC 100V±10%
Steady state current : 2A
Capacitor : 2000μF
Ambient temperature : Max.55°C
Suppressive current : Max.30A at 25°C

The most suitable power thermistor for the above circuit is required to fulfill the following terms and conditions.

1. The permissible current at ambient temperature of 55°C should be over 2A.
2. The thermistor resistance for suppressive current which becomes below 30A should be over 4.2 ohm from the under-mentioned formula.

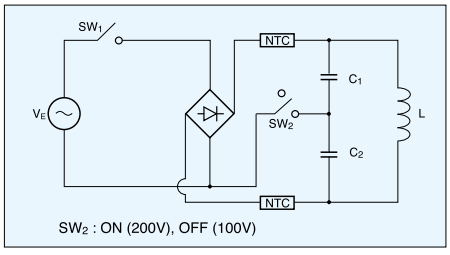
$$\frac{\sqrt{2}\,V_E \times 1.1}{R_C + R_{25}} \leqq 30$$

R_C : Internal resistance value in the circuit is 1 ohm (100V/100A)
R_{25} : Rated zero-power resistance at 25°C

3. Max. capacitance shall be over 2000μF at AC 100V.

Accordingly, suitable thermistors are 6D2-22, 5D2-18 and 8D2-18, and if we consider in the points of small time constant which means a small size and large effect for suppressive current which means large rated zero-power resistance, 8D2-18 is the most suitable one.

Use the following circuit in the power supply for 100V and 200V.



SW_2 : ON (200V), OFF (100V)

Thermal time constant

If ambient temperature of a thermistor is changed from T_1 to T_2 suddenly, temperature of the thermistor changes slowly.
The time constant means the time when temperature of the thermistor reaches 63% of the temperature difference.

Residual resistance

If current is flowed through a thermistor, any heat will be generated in the thermistor by which its resistance will be decreased, however, a decrease of a resistance will be stabilized at a saturation resistance value which is determined by impressed electric power and a dissipation constant. The residual resistance value means maximum saturation resistance value when the maximum permissible current is flowed through the thermistor.

Temperature coefficient α

The temperature coefficient of a thermistor is expressed by the following equation ;

$$\alpha = -\frac{B}{T_2} \times 100\ (\%/^\circ C)$$

Dissipation factor

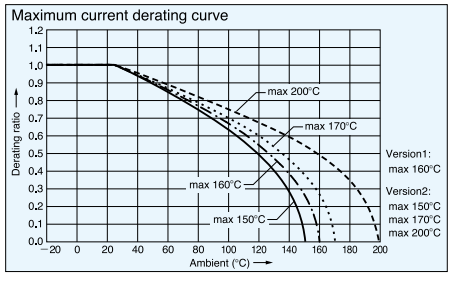
If small voltage is applied to a thermistor, small current will flow which produce enough heat in the thermistor. Dissipation factor is electric power which make 1°C raise by heat in a thermistor.

$$\delta = \frac{P}{\Delta t}\ (mW/^\circ C)$$

P is applied electric power.
Δt is rised temperature of the thermistor.

Maximum permissible current

If the maximum permissible current flows to a thermistor at 25°C, temperature of the thermistor rises to 200°C, (160°C). When ambient temperature is above 25°C, the maximum permissible current shall be over reduced as the maximum permissible current reduction curve.



Reliability tests

Version1

Dry heat test

Test sample is exposed in air at 160°C for 1,000 hours. ΔR25/R25 ±15%

Damp heat test

Test sample is exposed in atmosphere of 95%RH at 40°C for 1,000 hours. ΔR25/R25 ±15%

Load test

Test sample is applied the maximum rating current in air at 25°C for 1,000 hours. ΔR25/R25 ±15%

Change of temperature

Test sample is given 10 times of the following temperature cycle,
→ −40°C for 30 minutes → room temperature for 5 minutes →
→ 160°C for 30 minutes → room temperature for 5 minutes.
ΔR25/R25 ±15%

Version2

Dry heat test

Test sample is exposed in air at 150°C～200°C for 1,000 hours. ΔR25/R25 ±20%

Damp heat test

Test sample is exposed in atmosphere of 95%RH at 40°C for 1,000 hours. ΔR25/R25 ±15%

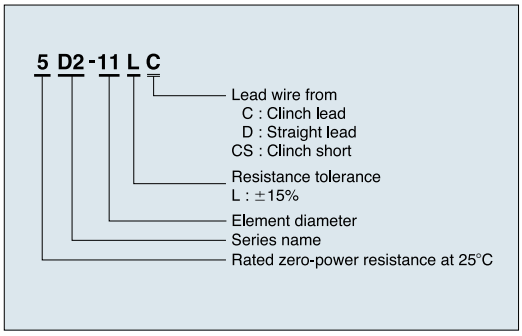
Load test

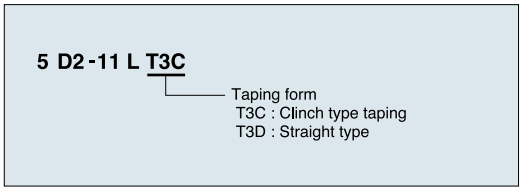
Test sample is applied the maximum rating current in air at 25°C for 1,000 hours. ΔR25/R25 ±20%

Change of temperature

Test sample is given 10 times of the following temperature cycle,
→ −40°C for 30 minutes → room temperature for 5 minutes →
→ 160°C for 30 minutes → room temperature for 5 minutes.
ΔR25/R25 ±15%

Part number





Applications

- Switching power supply
- Adapter
- LC, Plasma TV, DVD player
- AV, home electricity, Air-con
- OA, printer, PC

etc.

Acquisition Standard

UL1434 File No. E92669

Specifications : D2 Series Version 1

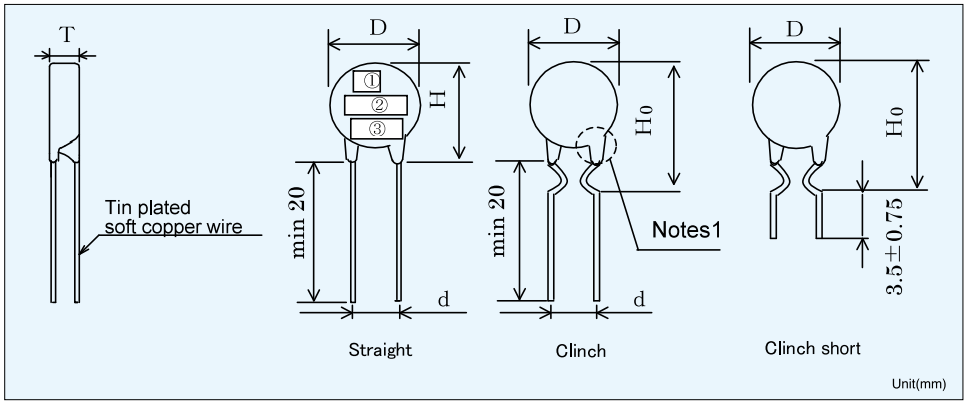
Part No.	Rated zero-power resistance (±15%)	Dissipation factor	Thermal time constant	Maximum current at 25°C	Residual resistance	Maximum permissible capacitance		Category temperature range
	[Ω]	[mW/°C]	[S]	[A]	[Ω]	AC.100V	AC.220V	(°C)
5D2-07 □ □	5.0	(30)	(35)	3.0	0.36	400	80	−40~+160
8D2-07 □ □	8.0		(41)	2.0	0.58	560	110	
10D2-07 □ □	10.0		(45)		0.72	680	140	
12D2-07 □ □	12.0		(41)	1.7	0.78	380	80	
16D2-07 □ □	16.0		(45)	2.0	1.04	800	160	
22D2-07 □ □	22.0		(50)	1.0	1.43	960	190	
2D2-10 □ □	2.0	(32)	(50)	5.0	0.15	1640	330	
3D2-10 □ □	3.0		(53)	4.0	0.22	1720	350	
5D2-10 □ □	5.0		(53)		0.33	1440	290	
8D2-10 □ □	8.0		(70)	3.0	0.52	1560	320	
10D2-10 □ □	10.0		(75)		0.65	1640	330	
12D2-10 □ □	12.0		(53)	1.8	0.71	830	170	
16D2-10 □ □	16.0		(70)	1.6	0.94			
2D2-14 □ □	2.0	(36)	(90)	5.0	0.15	4200	860	
3D2-14 □ □	3.0		(80)		0.20	3080	630	
4D2-14 □ □	4.0		(95)		0.26	3400	700	
5D2-14 □ □	5.0		(110)	4.0	0.33	3600	740	
8D2-14 □ □	8.0		(80)	2.5	0.47	1390	280	
10D2-14 □ □	10.0		(95)	2.2	0.59	1790	370	
12D2-14 □ □	12.0		(105)	2.0	0.71	2190	450	
16D2-14 □ □	16.0		(115)	1.8	0.94	2790	570	

*The rated values in "Dissipation factor" and "Thermal time constant" are for reference.

Specifications : D2 Series Version 2

Part No.	Rated zero-power resistance (±15%)	Dissipation factor	Thermal time constant	Maximum current at 25°C	Residual resistance	Maximum permissible capacitance		Category temperature range	Rated B-value (±5%)
	[Ω]	[mW/°C]	[S]	[A]	[Ω]	AC.100V	AC.220V	(°C)	[K]
5D2-05 ☐ ☐	5.0	(15)	(20)	2.0	0.48	860	170	−50～+150	2650
10D2-05 ☐ ☐	10.0	(7)		1.0	0.91				2700
20D2-05 ☐ ☐	20.0	(1)		0.3	1.66				2800
5D2-08 ☐ ☐	5.0	(22)	(35)	3.0	0.35	1260	260	−50～+170	2700
10D2-08 ☐ ☐	10.0	(17)		2.0	0.63				2800
15D2-08 ☐ ☐	15.0	(26)			0.94	2880	590		2800
20D2-08 ☐ ☐	20.0	(8)		1.0	1.13				2900
2D2-11 ☐ ☐	2.0	(26)	(40)	5.0	0.15	2700	550	−50～+170	2650
3D2-11 ☐ ☐	3.0	(24)		4.0	0.22	4830	990		2650
4D2-11 ☐ ☐	4.0	(31)			0.28	2880	590		2700
5D2-11 ☐ ☐	5.0	(39)			0.35	2700	550		2700
8D2-11 ☐ ☐	8.0	(31)		3.0	0.50				2800
10D2-11 ☐ ☐	10.0	(42)		3.1	0.63	2880	590		2800
12D2-11 ☐ ☐	12.0	(21)		2.0	0.75	4030	830		2800
15D2-11 ☐ ☐	15.0	(34)		2.5	0.80	2880	590		2950
16D2-11 ☐ ☐	16.0	(37)			0.86				2950
20D2-11 ☐ ☐	20.0	(28)		2.0	1.02				3000
1D2-13 ☐ ☐	1.0	(12)	(55)	6.0	0.06	860	170	−50～+200	2650
2D2-13 ☐ ☐	2.0	(21)			0.10				2700
4D2-13 ☐ ☐	4.0	(24)		5.0	0.18				2800
4.7D2-13 ☐ ☐	4.7	(26)			0.18	2700	550		2900
5D2-13 ☐ ☐	5.0	(27)			0.19				2900
8D2-13 ☐ ☐	8.0	(25)		4.0	0.27	2880	590		3000
10D2-13 ☐ ☐	10.0	(29)			0.32				3050
12D2-13 ☐ ☐	12.0	(37)			0.41	4830	990		3000
15D2-13 ☐ ☐	15.0	(25)		3.0	0.48				3050
16D2-13 ☐ ☐	16.0	(26)			0.51				3050
1D2-15 ☐ ☐	1.0	(22)	(70)	8.0	0.06	6910	1420	−50～+200	2650
1.5D2-15 ☐ ☐	1.5	(29)			0.08				2650
2D2-15 ☐ ☐	2.0	(37)			0.10				2700
3D2-15 ☐ ☐	3.0	(36)		7.0	0.13	4030	830		2800
4D2-15 ☐ ☐	4.0	(48)			0.18				2800
4.7D2-15 ☐ ☐	4.7	(37)		6.0	0.18				2900
5D2-15 ☐ ☐	5.0	(39)			0.19				2900
8D2-15 ☐ ☐	8.0	(39)		5.0	0.27				3000
10D2-15 ☐ ☐	10.0	(49)			0.34	5760	1190		3000
12D2-15 ☐ ☐	12.0	(54)			0.39				3050
15D2-15 ☐ ☐	15.0	(41)		4.0	0.45				3100
16D2-15 ☐ ☐	16.0	(44)			0.48				3100
4D2-18 ☐ ☐	4.0	(59)	(90)	8.0	0.16	6910	1420	−50～+200	2900
5D2-18 ☐ ☐	5.0	(66)			0.18				2950
8D2-18 ☐ ☐	8.0	(53)		6.0	0.26				3050
10D2-18 ☐ ☐	10.0	(62)			0.30				3100
47D2-18 ☐ ☐	47.0	(21)		2.0	0.94				3450
3D2-22 ☐ ☐	3.0	(48)	(130)	8.0	0.13	12600	2610	−50～+200	2800
4D2-22 ☐ ☐	4.0	(59)			0.16				2900
6D2-22 ☐ ☐	6.0	(43)		6.0	0.21				3000

Dimentions



①: Trade mark **5** ②: Part.No. (Notes 2) ③: Lot.No.

Notes1 : In case of adding strength to lead wire from the side, it may occur crack and fragment at a part of pants legs.

Notes2 : In case of D2-05, Marking is Resistance and D2. (example) 5D2-05…「5D2」

Dimensions Version 1

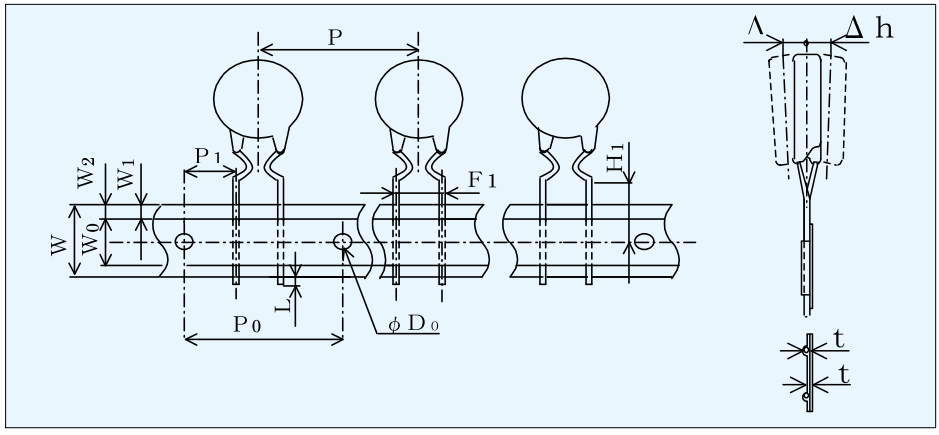
Part No.	Dimensions [mm]					
	D	H	T	d	H0	lead wire
□D2-07 □ □	max. 11.0	max. 13.0	max. 9.0	5.0±1.0	max. 16.0	(ϕ0.8)
□D2-10 □ □	max. 13.0	max. 17.0			max. 19.5	
□D2-14 □ □	max. 17.0	max. 21.0		7.5±1.0	max. 22.5	

Dimensions Version 2

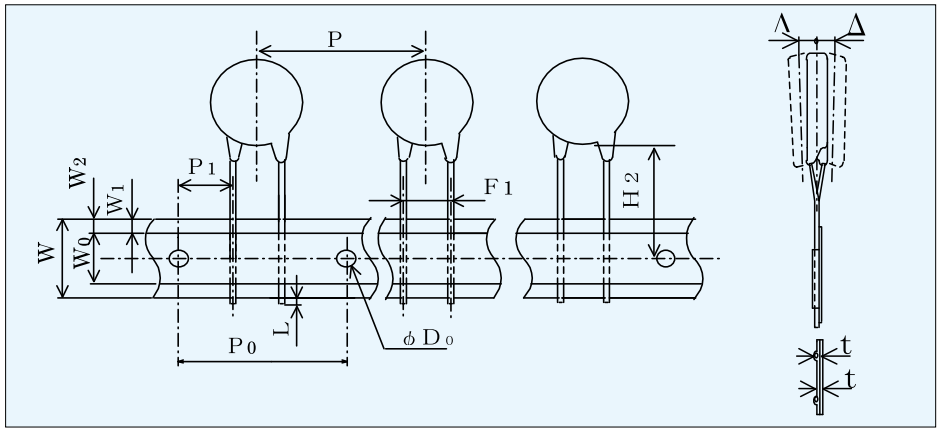
Part No.	Dimensions [mm]					
	D	H	T	d	H0	lead wire
□D2-05 □ □	max 8.5	max 11.5	max. 7.0	5.0±1.0	max 15.5	(ϕ0.8)
□D2-08 □ □	max 10.0	max 13.0			max 17.0	
□D2-11 □ □	max 11.5	max 15.0	max. 8.0	7.5±1.0	max 18.5	
□D2-13 □ □	max 14.5	max 18.0			max 21.5	
□D2-15 □ □	max 16.5	max 20.0		10.0±1.0	max 23.0	(ϕ1.0)
□D2-18 □ □	max 19.5	max 23.0			max 26.0	
□D2-22 □ □	max 23.0	max 26.5	max. 8.5		max 29.5	

Taping

Clinch type taping : T3C



Straight type taping : T3D



Taping qty

version 1

D2-07 D2-10	1,000pcs/box
D2-14	(Part 500pcs/box)

version 2

D2-05 D2-08 D2-11	1,000pcs/box
D2-13	(Part 500pcs/box)

Dimensions (Version 1)

Unit(mm)

	P	P0	P1	W	W0	W1	W2	H1
D2-07	15.0±1.0	15.0±3.0	5.0±0.7	17.5～19.0	min5.0	9.0±0.5	max3.0	16.0±0.5
D2-10	15.0±1.0							
D2-14	30.0±1.0		3.75±0.7					
	H2	L	F1	ϕD0	t	t1	Δh	
D2-07	19.0～21.5	max1.0	5.0±0.5	4.0±0.2	0.6±0.3	max1.5	0±2.0	
D2-10								
D2-14			7.5±0.5					

Dimensions (Version 2)

	P	P0	P1	W	W0	W1	W2	H1
D2-05	15.0±1.0	15.0±3.0	5.0±0.7	17.5～19.0	min5.0	9.0±0.5	max3.0	16.0±0.5
D2-08	15.0±1.0							
D2-11	15.0±1.0		3.75±0.7					
D2-13	30.0±1.0							
	H2	L	F1	ϕD0	t	t1	Δh	
D2-05	19.0～21.5	max1.0	5.0±0.5	4.0±0.2	0.6±0.3	max1.5	0±2.0	
D2-08								
D2-11			7.5±0.5					
D2-13								