NTC THERMISTORS: TYPE CL

NTC DISCS FOR INRUSH CURRENT LIMITING

DESCRIPTION:

Disc thermistor with uninsulated lead-wires.

FEATURES:

- Low cost solid state device for inrush current suppression
- Excellent mechanical strength
- Wide operating temperature range: -50°C to 175°C
- Suitable for PCB mounting
- Available as a standard with kinked leads and on tape and reel to EIA RS-468A for automatic insertion

TYPE Fig. 1	Res @ 25°C ±25% (ohms)	Max* Steady State Current AMPS (RMS)	Disc Dia. (Max) (in.)	Disc Thick. (Max) (in.)	Lead Spacing (Ref.) (in.)	Lead Dia. AWG	C_X (max)** µFarads		Equation constants for resistance under load ***			Approx. Res. Under Load at % Max. Rated Current				Diss. Const. (mW/°C)	Time Const. (sec.)
							@120 VAC	@240 VAC	X	Y	Current Range Min.I / Max.I	25%	50%	75%	100%		
CL-11	0.7	12	0.77	0.22	0.328	18	2700	600	0.50	-1.18	4.0≤ 1≤ 12	14	.06	.04	.02	25	100
CL-21	1.3	8	0.55	0.21	0.328	18	800	200	0.60	-1.25	3.0≤ 1≤ 8.0	.25	.09	.06	.04	15	60
CL-30	2.5	8	0.77	0.22	0.328	18	6000	1500	0.81	-1.25	2.5≤ 1≤ 8.0	.34	.14	.09	.06	25	100
CL-40	5	6	0.77	0.22	0.328	18	5200	1300	1.09	-1.27	1.5≤ 1≤ 6.0	.65	.27	.16	.11	25	100
CL-50	7	5	0.77	0.26	0.328	18	5000	1250	1.28	-1.27	1.5≤ 1≤ 5.0	.96	.40	.24	.16	25	120
CL-60	10	5	0.77	0.22	0.328	18	5000	1250	1.45	-1.30	1.2≤ 1≤ 5.0	1.09	.44	.26	.18	25	100
CL-70	16	4	0.77	0.22	0.328	18	5000	1250	1.55	-1.26	1.0≤ 1≤ 4.0	1.55	.65	.39	.27	25	100
CL-80	47	3	0.77	0.22	0.328	18	5000	1250	2.03	-1.29	0.5≤ 1≤ 3.0	2.94	1.20	.71	.49	25	100
CL-90	120	2	0.93	0.22	0.328	18	5000	1250	3.04	-1.36	0.5≤ 1≤ 2.0	7.80	3.04	1.75	1.18	30	120
CL-101	0.5	16	0.93	0.22	0.328	18	4000	1000	0.44	-1.12	4.0≤ 1≤ 16	.09	.04	.03	.02	30	120
CL-110	10	3.2	0.40	0.17	0.250	24	600	150	0.83	-1.29	0.7≤ 1≤ 3.2	1.10	.45	.27	.18	8	30
CL-120	10	1.7	0.40	0.17	0.250	24	600	150	0.61	-1.09	0.4≤ 1≤ 1.7	1.55	.73	.46	.34	4	90
CL-130	50	1.6	0.45	0.17	0.250	24	600	150	1.45	-1.38	0.4≤ 1≤ 1.6	5.13	1.97	1.13	.75	8	30
CL-140	50	1.1	0.45	0.17	0.250	24	600	150	1.01	-1.28	0.2≤ 1≤ 1.1	5.27	2.17	1.28	.89	4	90
CL-150	5	4.7	0.55	0.18	0.328	22	1600	400	0.81	-1.26	1.0≤ 1≤ 4.7	.66	.27	.16	.11	15	110
CL-160	5	2.8	0.55	0.18	0.328	22	1600	400	0.60	-1.05	0.8≤ 1≤ 2.8	.87	.42	.27	.20	9	130
CL-170	16	2.7	0.55	0.18	0.328	22	1600	400	1.18	-1.28	0.5≤ 1≤ 2.7	1.95	.80	.48	.33	15	110
CL-180	16	1.7	0.55	0.18	0.328	22	1600	400	0.92	-1.18	0.4≤ 1≤ 1.7	2.52	1.11	.69	.49	9	130
CL-190	25	2.4	0.55	0.18	0.328	22	800	200	1.33	-1.34	0.5≤ 1≤ 2.4	2.63	1.04	.60	.41	15	110
CL-200	25	1.7	0.55	0.18	0.328	22	800	200	0.95	-1.24	0.4≤ 1≤ 1.7	2.74	1.18	.70	.49	9	130
CL-210	30	1.5	0.40	0.20	0.250	24	600	150	1.02	-1.35	0.3≤ 1≤ 1.5	3.83	1.50	.87	.60	8	30

OPTIONS:

- For kinked leads, add suffix "A"
- For tape and reel, add suffix "B"
- For tape and reel, add suffix "AB"
- Other tolerances in the range 0.7Ω to 120Ω
- Other tolerances, tolerances at other temperatures
- Alternative lead lengths, lead materials, insulations

DATA:

*maximum rating at 25ºC or

$I_{derated} = \sqrt{(1.1425 - 0.0057 \times T_A)} \times I_{max}$ @ 25°C

for ambient temperatures other than 25ºC.

**maximum ratings

***$R_o = X1^Y$ where X and Y are found in the table above

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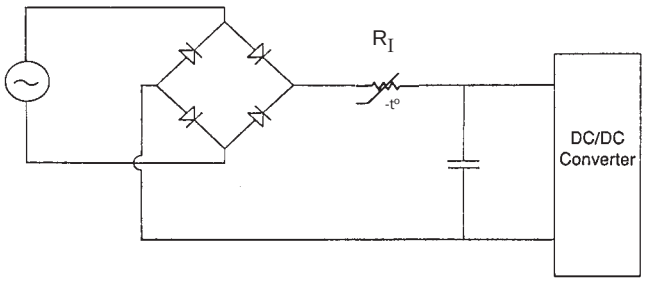

TYPICAL POWER SUPPLY CIRCUIT

INRUSH CURRENT LIMITERS IN SWITCHING POWER SUPPLIES

The problem of current surges in switch-mode power supplies is caused by the large filter capacitors used to smooth the ripple in the rectified 60Hz current prior to being chopped at a high frequency. The diagram above illustrates a circuit commonly used in switching power supplies.

In the circuit above the maximum–current at turn-on is the peak line voltage divided by the value of R; for 120v, it is approximately 120 x $\sqrt{2}/R_I$. Ideally, during turn-on R_I should be very large, and after the supply is operating, should be reduced to zero. The NTC thermistor is ideally suited for this application. It limits surge current by functioning as a power resistor which drops from a high cold resistance to a low hot resistance when heated by the current flowing through it. Some of the factors to consider when designing NTC thermistor as an inrush current limiter are:

- Maximum permissible surge current at turn-on
- Matching the thermistor to the size of the filter capacitors
- Maximum value of steady state current
- Maximum ambient temperature
- Expected life of the power supply

Maximum Surge Current

The main purpose of limiting inrush current is to prevent components in series with the input to the DC/DC convertor from being damaged. Typically, inrush protection prevents nuisance blowing of fuses or breakers as well as welding of switch contacts. Since most thermistor materials are very nearly ohmic at any given temperature, the minimum no-load resistance of the thermistor is calculated by dividing the peak input voltage by the maximum permissible surge current in the power supply ($V_{peak/Imax\ surge}$).