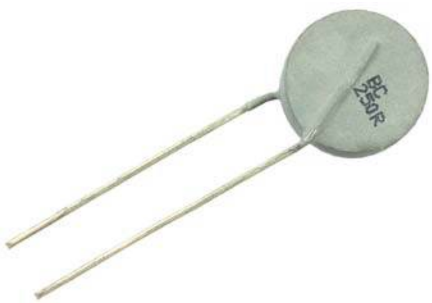
PTC Thermistors, Inrush current limiter and Energy Load-Dump



FEATURES

- High energy absorption levels up to 240 J
- High number of inrush-power cycles: > 50 000 cycles
- Highly resistant against non-switching peak-powers of up to 25 kW
- Can handle high direct voltage up to 800 V
- Self protecting in case of overload
- No risk of over-heating
- Rugged construction
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

QUICK REFERENCE DATA		
PARAMETER	VALUE	UNIT
Resistance at 25 °C (R_{25}) (1)	60 to 500	Ω
Switching temperature	130 to 140	°C
Maximum inrush current	40	A
Maximum AC voltage	350 to 560	V_{RMS}
Maximum DC voltage (1)	500 to 800	V_{DC}
Operating temperature range	-40 to 105	°C
Storage temperature range	-40 to 165	°C
Dissipation factor	11.5 to 15.5	mW/K
Thermal time constant (still air cooling)	110 to 150	s
Weight	3.2 to 5.0	g

Note

(1) Other resistance values and maximum operating voltages available on request.
Matched resistance values available on request.

APPLICATIONS

Inrush current limiting and load-dump resistor in:

- Smoothing and DC-link capacitor banks
- Power inverters
- Discharge - charge circuits

PTCEL thermistors of similar resistance and size may be used in series and parallel combinations to obtain higher energy absorption levels. PTCEL thermistors may not be used in series connections to obtain higher voltage levels.

DESCRIPTION

These PTC inrush current limiting or energy absorbing thermistors consist of a medium resistivity doped barium titanate ceramic with copper clad steel wires lead (Pb)-free soldered to the Ag metalized pellet. A high temperature silicone coating covers the ceramic body and is marked with the cold resistance value, logo, EL and date code.

PACKAGING

PTC thermistors are available in 100 pieces (PTCEL13) or 50 pieces (PTCEL17) bulk packed or tape on reel option 500 pieces on request.

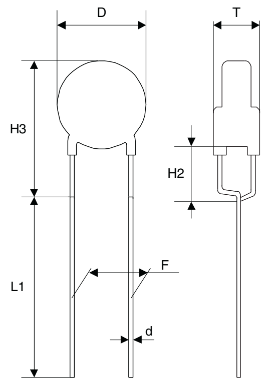
ELECTRICAL DATA AND ORDERING INFORMATION

PART NUMBER	R_{25} (Ω)	R_{25} TOL. (%)	$V_{MAX.}$ (V_{RMS})	$V_{LINK\ MAX.}$ (V_{DC})	$R_{MIN.}$ < 1.5 V_{DC} (Ω)	I_{HOLD} AT 25°C (mA)	C_{th} (J/K)	$E_{MAX.}$ 1 CYCLE AT 25°C (J)	τ_{th} (s)	DISSIPATION FACTOR (mW/K)	WEIGHT (g)
PTCEL13R600LBE	60	30	350	500	32	120	1.45	150	110	11.5	3.2
PTCEL13R121MBE	120	30	440	625	64	85	1.45	150	110	11.5	3.2
PTCEL13R251NBE	250	30	480	680	130	60	1.45	150	110	11.5	3.2
PTCEL13R501RBE	500	30	560	800	260	42	1.45	150	110	11.5	3.2
PTCEL17R600MBE	60	30	440	625	32	140	2.3	240	150	15.5	5
PTCEL17R121NBE	120	30	460	650	64	100	2.3	240	150	15.5	5

Note

- Tape on Reel version available on request. Other resistance values or max voltage levels available on request.

OUTLINE AND DIMENSIONS in millimeters



COMPONENT DIMENSIONS in millimeters		
	PTCEL13	**PTCEL17**
D	13 max.	17 max.
H1	17 max.	21 max.
H2	3 ± 1	3 ± 1
d	0.6 ± 0.06	0.8 ± 0.08
L1	20 min.	20 min.
F	5 ± 0.8	5 ± 0.8
T	7.0 max.	7.5 max.

REQUIRED NUMBER OF PTC THERMISTORS TO LIMIT CURRENT AND ABSORB ENERGY

By using several PTC's in a series / parallel network, the maximum current limitation and absorbed energy levels can be further optimized. For homogeneous current and energy distribution it is recommended to combine only PTCEL of the same size and matched resistance value. Energy absorption per PTC in a network depends on current distribution in the network and as such on the individual PTC resistance value. PTCEL thermistors might be used in a series connection to further lower the inrush current, but not to increase the maximum allowed voltage levels. Following formula may be used to calculate the minimum number of PTCEL thermistors required in a DC link or other capacitor bank application to properly charge or discharge a given amount of energy without follow current:

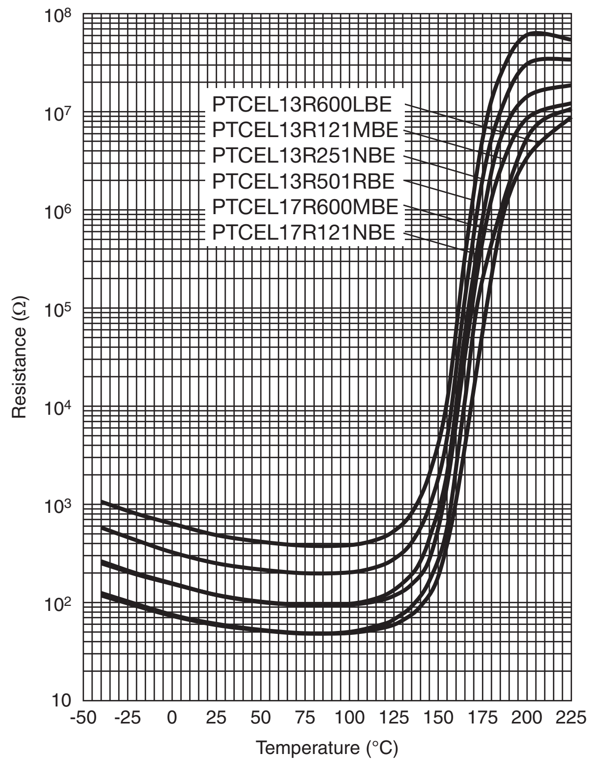
$$N \geq \frac{C \times V^2}{2 \times C_{th} \times (T_{sw} - T_{amb})}$$

Notes

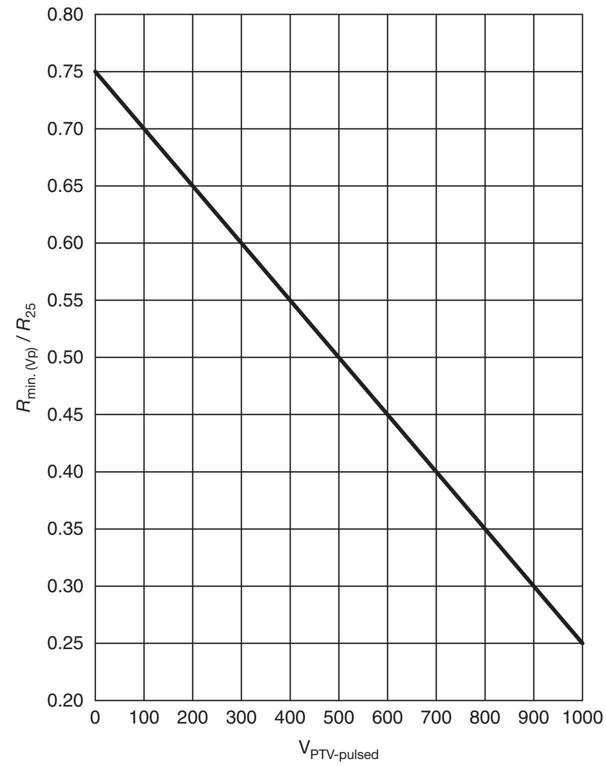
- N is the number of PTCEL required in the network.
- C is the total capacitor value to charge or discharge in F.
- V is the maximum DC voltage on the capacitor C.
- C_{th} is the thermal capacity of one PTC in [J/K] (see table).
- T_{sw} is the minimum switching temperature of the PTCEL (130 °C).
- T_{amb} is the maximum ambient temperature at which the PTC needs to operate.

RESISTANCE vs. TEMPERATURE

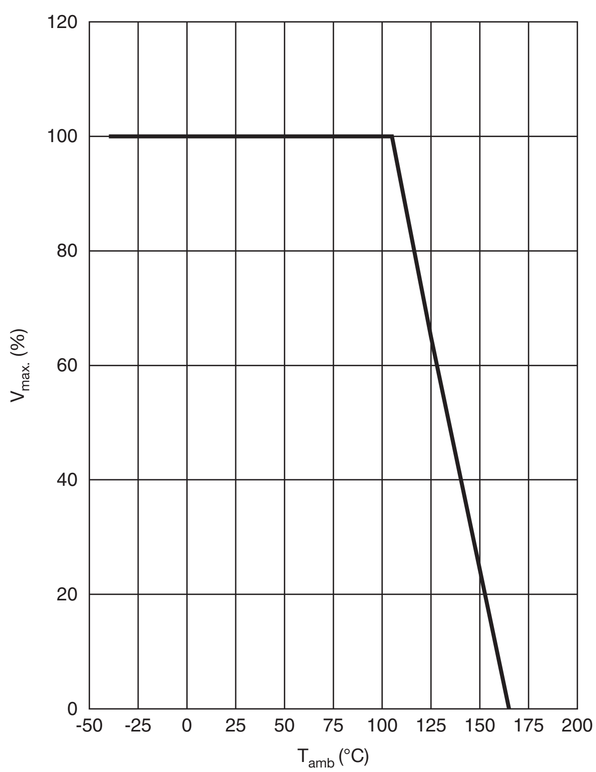
$V_m \leq 1.5\ V_{DC}$



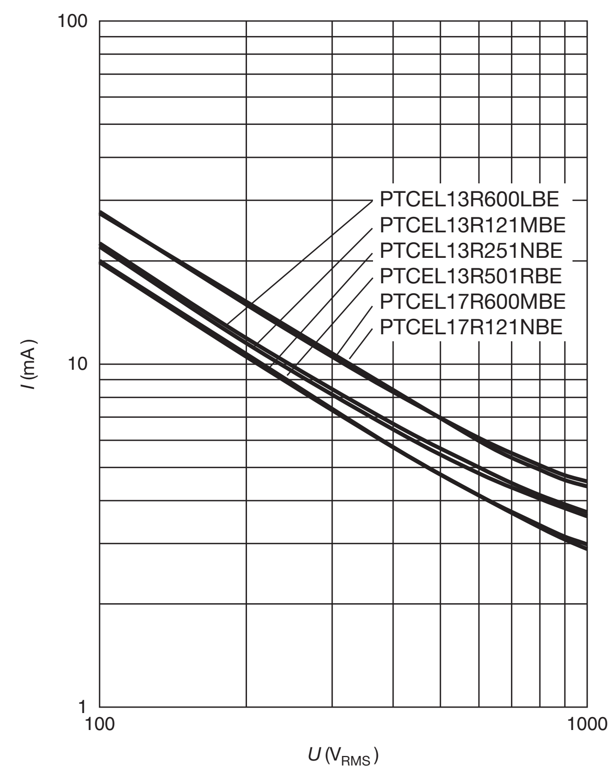
MINIMUM PTC RESISTANCE UNDER PULSED VOLTAGE



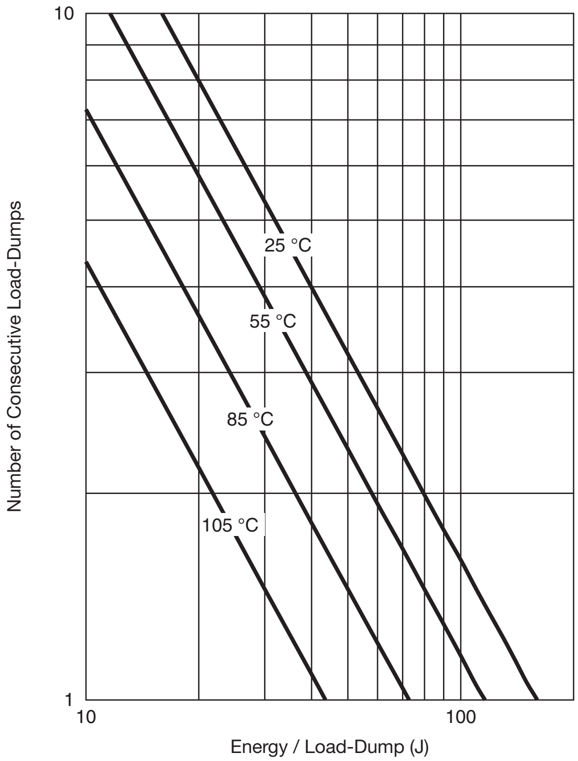
$V_{MAX.}$ DERATING VS. T_{AMB}



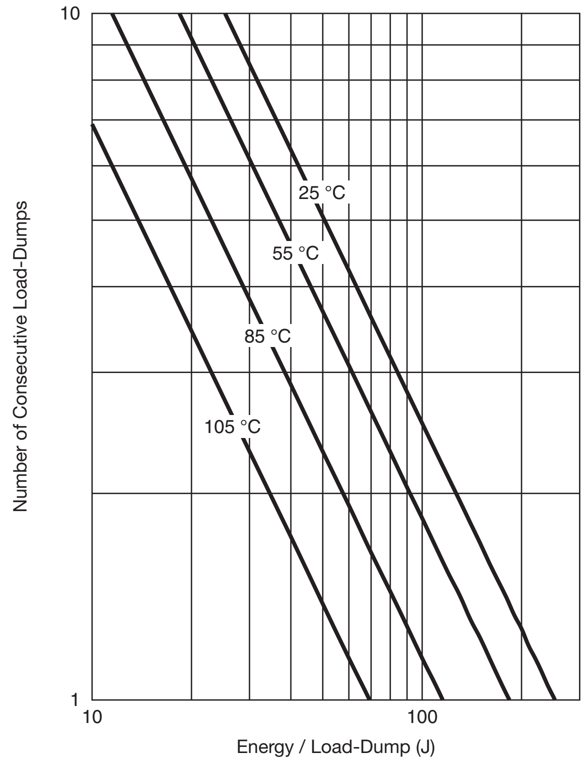
RESIDUAL CURRENT VS. VOLTAGE



CONSECUTIVE ENERGY LOAD-DUMPS AT DIFFERENT T_{AMB} FOR PTCEL13



CONSECUTIVE ENERGY LOAD-DUMPS AT DIFFERENT T_{AMB} FOR PTCEL17



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