Introducing

PolySwitch Device Selection Guide

PolySwitch circuit protection devices are made from a composite of semi-crystalline polymer and conductive particles

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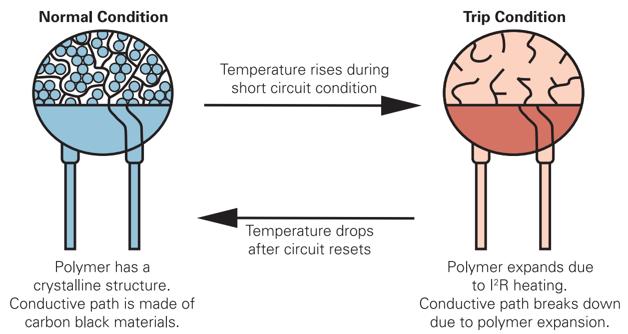
How a PolySwitch Device Works



At normal temperature, the conductive particles form low-resistance networks in the polymer. However, if the temperature rises, either from high current through the part or from an increase in the ambient temperature, the crystallites in the polymer melt and become amorphous. The increase in volume during melting of the crystalline phase separates the conductive particles resulting in a large non-linear increase in the resistance of the device.

STEPS FOR SELECTING A POLYSWITCH DEVICE

Example

Maximum ambient operating temperature	50°C
Normal operating current	350 mA
Maximum operating voltage	12 V
Maximum interrupt current	20 A

Step 1: Determine your circuit's parameters

You will need to determine the following parameters of your circuit:
- Maximum ambient operating temperature
- Normal operating current
- Maximum operating voltage
- Maximum interrupt current

Example

Thermal Derating for Surface-mount Devices [Hold Current (A) at Ambient Temperature (°C)]

Part Number	Maximum Ambient Temperature -40°C	-20°C	0°C	20°C	25°C	40°C	50°C	60°C
microSMD Series Size 3225 mm/1210 mils								
microSMD005F	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.03
microSMD010F	0.15	0.13	0.12	0.10	0.10	0.09	0.08	0.06
microSMD035F	0.51	0.46	0.40	0.35	0.34	0.30	0.27	0.24
microSMD050F	0.76	0.66	0.58	0.50	0.48	0.42	0.38	0.35
microSMD075F	1.10	0.97	0.86	0.75	0.72	0.64	0.58	0.55

Step 2: Select a PolySwitch device that will accommodate the circuit's maximum ambient temperature and normal operating current.

Use the Thermal Derating [Hold Current (A) at Ambient Temperature (°C)] table and choose the temperature that most closely matches the circuit's maximum ambient temperature. Look down that column to find the value equal to or greater than the circuit's normal operating current. Now look to the far left of that row to find the part number that will best accommodate that current.

Example

Electrical Characteristics for Surface-mount Devices at Room Temperature

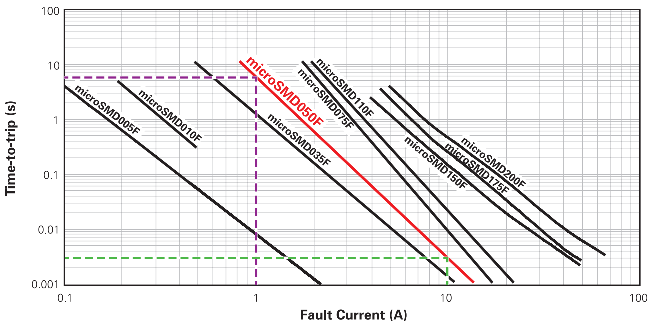
Part Number	I_H (A)	I_T (A)	V_{MAX} (V_{DC})	I_{MAX} (A)	$P_{D\,MAX}$ (W)	Max. Time-to-Trip (A)	Max. Time-to-Trip (s)
microSMD Series Size 3225 mm/1210 mils							
microSMD005F	0.05	0.15	30	10	1.00	0.25	1.50
microSMD010F	0.10	0.25	30	10	0.80	0.50	1.00
microSMD035F	0.35	0.75	6	40	0.80	8.00	0.20
microSMD050F	0.50	1.00	13.2	40	0.80	8.00	0.05
microSMD075F	0.75	1.50	6	40	0.80	8.00	0.10

Step 3: Compare the selected device's maximum electrical ratings with the circuit's maximum operating voltage and interrupt current.

Use the Electrical Characteristics table to verify the part you selected in Step 2 will handle your circuit's maximum operating voltage and interrupt current. Find the device's maximum operating voltage (V_{MAX}) and maximum interrupt current (I_{MAX}). Ensure that V_{MAX} and I_{MAX} are greater than or equal to the circuit's maximum operating voltage and maximum fault current.

Example

Time-to-Trip Curve for microSMDxxxF



----- 1A of fault current: trip in approx 5 seconds

----- 10A of fault current: trip in approx 3 milliseconds

Step 4: Determine time-to-trip

Time-to-trip is the amount of time it takes for a device to switch to a high-resistance state once a fault current has been applied through the device. Identifying the PolySwitch device's time-to-trip is important in order to provide the desired protection capabilities. If the chosen device trips too fast, undesired or nuisance tripping may occur. If the device trips too slowly, the components being protected may be damaged before the device can trip and limit the current. Use the Typical Time-to-trip Curves at 20°C to determine if the PolySwitch device's time-to-trip characteristics are acceptable at expected fault levels. If not, go back to Step 2 and choose an alternate device.

Example

Thermal Derating for Surface-mount Devices
[Hold Current (A) at Ambient Temperature (°C)]

Part Number	Maximum Ambient Temperature -40°C	-20°C	0°C	20°C	25°C	40°C	50°C	60°C	70°C	80°C	85°C	125°C
microSMD Series Size 3225 mm/1210 mils												
microSMD005F	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.02	0.02	-
microSMD010F	0.15	0.13	0.12	0.10	0.10	0.09	0.08	0.06	0.06	0.05	0.05	-
microSMD035F	0.51	0.46	0.40	0.35	0.34	0.30	0.27	0.24	0.22	0.19	0.18	-
microSMD050F	0.76	0.66	0.58	0.50	0.48	0.42	0.38	0.35	0.29	0.25	0.23	-
microSMD075F	1.10	0.97	0.86	0.75	0.72	0.64	0.58	0.55	0.47	0.42	0.39	-

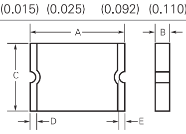
Step 5: Verify ambient operating temperature

Ensure that your application's minimum and maximum ambient temperatures are within the operating temperature of the PolySwitch device. Most PolySwitch devices have an operating temperature range from -40°C to 85°C with some exceptions to 125°C.

Example

Dimensions for Surface-mount Devices
in Millimeters (Inches)

Part Number	A Min.	A Max.	B Min.	B Max.	C Min.	C Max.	D Min.	D Max.	E Min.	E Max.
microSMD Series Size 3225 mm/1210 mils										
microSMD050F	3.0 (0.118)	3.43 (0.135)	0.38 (0.015)	0.62 (0.025)	2.35 (0.092)	2.80 (0.110)	0.25 (0.010)	0.75 (0.030)	0.076 (0.003)	-



Step 6: Verify the PolySwitch device dimensions

Use the Dimensions table to compare the dimensions of the PolySwitch device you selected with the application's space considerations.

DEFINITION OF TERMS

I_H	the maximum steady state current at 20°C that can be passed through a PolySwitch device without causing the device to trip
I_T	the minimum current that will cause the PolySwitch device to trip at 20°C
V_{MAX}	the maximum voltage that can safely be dropped across a PolySwitch device in its tripped state also called: Maximum Device Voltage, Maximum Voltage, V_{MAX}, Max Interrupt Voltage
I_{MAX}	the maximum fault current that can safely be used to trip a PolySwitch device
P_D	the power (in watts) dissipated by a PolySwitch device in its tripped state
R_{MAX}	the maximum resistance prior to the trip of PolySwitch device
R_{MIN}	the minimum resistance prior to the trip of PolySwitch device
$R1_{MAX}$	the maximum resistance of a PolySwitch device at 20°C 1 hour after being tripped and reset or after reflow soldering
RTripped T_{yp}	the typical resistance of PolySwitch 1 hour after the initial trip and reset

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