POLYTRONICS
POLYTRONICS TECHNOLOGY CORP.

SMD0603 HF Series Surface Mount PTC Devices

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Description

The 0603 series provides miniature surface mount resettable overcurrent protection with holding current from 10mA to 500mA. This world's smallest PTC is suitable for ultra portable applications where space is at a premium and the device current is low.

Features

- RoHS compliant and lead-free
- Halogen-free
- Compact design saves board space
- Low profile
- Fast response to fault current
- Compatible with high temperature solders

Applications

- Mobile phones and PDAs
- Portable MP3 and media player
- Mobile Internet Device (MID)
- USB peripherals
- IC VCC protection

Agency Approval and Environmental Compliance

Agency	File Number
c UL us	E201431
TÜVRheinland	R50099121

Regulation	Standard
RoHS	2011/65/EU
Halogen Free	IEC 61249-2-21:2003

Electrical Characteristics

Part Number	I_{hold} (A)	I_{trip} (A)	V_{max} (Vdc)	I_{max} (A)	$P_{d\ typ.}$ (W)	Maximum Time To Trip		Resistance		Agency Approval	
						Current (A)	Time (Sec.)	R_{min} (Ω)	$R_{1\ max}$ (Ω)	c UL us	TÜVRheinland
SMD0603P001TF	0.01	0.05	60	40	0.50	0.20	1.00	15.00	100.0	✓	✓
SMD0603P002TF	0.02	0.06	60	40	0.50	0.20	1.00	12.00	70.00	✓	✓
SMD0603P003TF	0.03	0.09	36	40	0.50	0.20	1.00	6.000	50.00	✓	✓
SMD0603P004TF	0.04	0.12	24	20	0.50	0.20	1.00	4.000	40.00	✓	✓
SMD0603P005TF	0.05	0.15	24	20	0.50	0.25	1.00	3.500	30.00	✓	✓
SMD0603P008TF	0.08	0.20	15	40	0.50	0.40	1.00	2.500	12.00	✓	✓
SMD0603P010TF	0.10	0.30	15	40	0.50	0.50	1.00	0.900	6.000	✓	✓
SMD0603P020TF	0.20	0.50	9	40	0.50	1.00	0.60	0.550	3.500	✓	✓
SMD0603P025TF	0.25	0.55	9	40	0.50	8.00	0.08	0.500	3.000	✓	✓
SMD0603P035TF	0.35	0.75	6	40	0.50	8.00	0.10	0.200	1.000	✓	✓
SMD0603P050TF	0.50	1.00	6	40	0.50	8.00	0.10	0.100	0.680	✓	✓

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Note on Electrical Characteristics

- **Vocabulary**
  - I_{hold} = Hold current: maximum current device will pass without tripping in 23ºC still air.
  - I_{trip} = Trip current: minimum current at which the device will trip in 23 ºC still air.
  - V_{max} = Maximum voltage device can withstand without damage at rated current (I_{max})
  - I_{max} = Maximum fault current device can withstand without damage at rated voltage (V_{max})
  - $P_{d\ typ.}$ = Typical power dissipated from device when in the tripped state at 23 ºC still air.
  - R_{min} = Minimum resistance of device in initial (un-soldered) state.
  - $R_{1\ max}$ = Maximum resistance of device at 23 ºC measured one hour after tripping or reflow soldering of 260 ºC for 20 sec.
- **Value is determined by the specified PWB.**
- **Caution: Operation beyond the specified rating may result in damage and possible arcing and flame.**
- **Specifications are subject to change without notice.**

Polymeric PTC Selecting Guide

- **Determine the following operating parameters for the circuits:**
  - Normal operating current (I_{hold})
  - Maximum interrupt current (I_{max})
  - Maximum circuit voltage (V_{max})
  - Normal operating temperature surrounding device (minºC/maxºC)
- **Select the device form factor and dimension suitable for the application:**
  - Surface Mount Device (SMD)
  - Axial Leaded Device (ALD)
  - Other Customized Form Factors
  - Radial Leaded Device (RLD)
  - DISC Device
- **Compare the maximum rating for V_{max} and I_{max} of the PPTC device with the circuit in application and make sure the circuit's requirement does not exceed the device rating.**
- **Check that PPTC device's trip time (time-to-trip) will protect the circuit.**
- **Verify that the circuit operating temperature is within the PPTC device's normal operating temperature range.**
- **Verify the performance and suitability of the chosen PPTC device in the application.**

⚠WARNING

- **Mechanical Stress**
  - PPTC devices will undergo a thermal expansion during fault condition. If PPTC devices are installed or placed in an application where the space between PPTC devices and the surrounding materials (e.g., covering materials, packaging materials, encapsulate materials and the like) is insufficient, it will cause an inhibiting effect upon the thermal expansion. Pressing, twisting, bending and other kinds of mechanical stress will also adversely affect the performance of the PPTC devices, and shall not be used or applied.
- **Chemical Pollutants**
  - Silicone-based oils, oils, solvents, gels, electrolytes, fuels, acids, and the like will adversely affect the properties of PPTC devices, and shall not be used or applied.
- **Electronic and Thermal Effect**
  - PPTC devices are secondary protection devices and are used solely for sporadic, accidental over-current or over-temperature error condition, and shall NOT be used if or when constant or repeated fault conditions (such fault conditions may be caused by, among others, incorrect pin-connection of a connector) or over-extensive trip events may occur.
  - PTTC devices are different from fuses and, when a fault condition occurs, will go into high-resistance state and do not open circuit, in which case the voltage at such PPTC devices may reach a hazardous level.
  - Operation over the maximum rating or other forms of improper use may cause failure, arcing, flame and/or other damage to the PPTC devices.
  - Conductive material contamination, such as metal particle, may induce shortage, flame or arcing.
  - Due to the inductance, the operation circuits may generate a circuit voltage (Ldi/dt) above the rated voltage of PPTC devices, which shall not be used under such circumstances.
- **General**
  - Customers shall evaluate and test the properties of PPTC devices independently to verify and ensure that their individual applications will be met.
  - The performance of PPTC devices will be adversely affected if they are improperly used under electronic, thermal and/or mechanical procedures and/or conditions non-conformant to those recommended by manufacturer.
  - Customers shall be responsible for determining whether it is necessary to have back-up, failsafe and/or fool-proof protection to avoid or minimize damage that may result from extra-ordinary, irregular function or failure of PPTC devices.
  - Any and all responsibilities and liabilities are disclaimed if any item under this notice of warning is not complied with.

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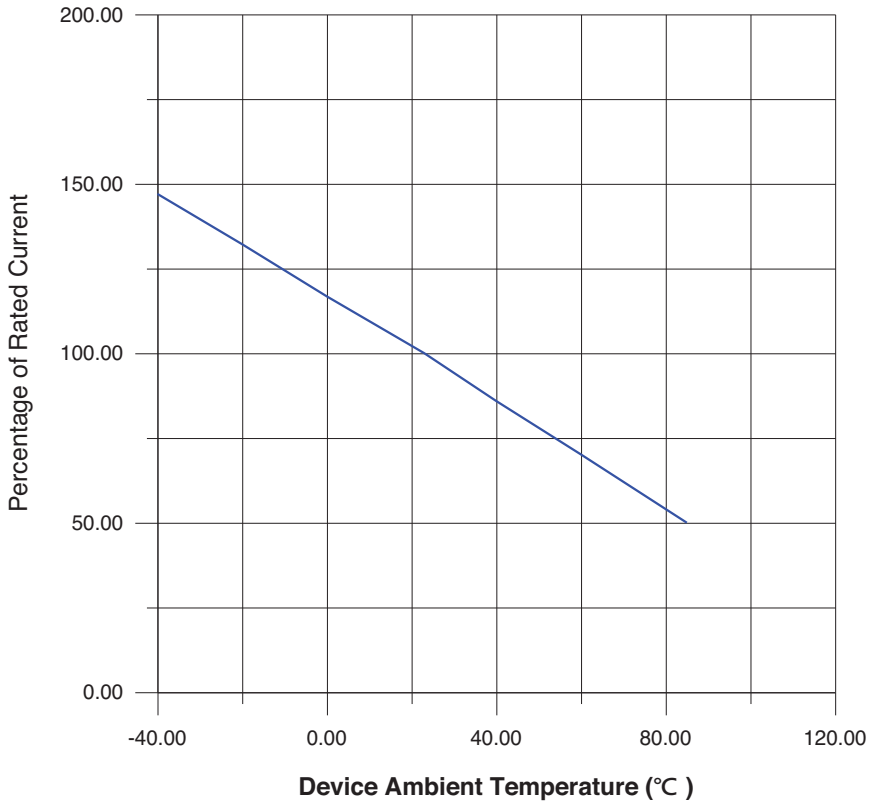
Thermal Derating Curve



Thermal Derating Chart

Recommended Hold Current (A) at Ambient Temperature (°C)

Part Number	Ambient Operation Temperature								
	-40 °C	-20 °C	0 °C	23 °C	40 °C	50 °C	60 °C	70 °C	85 °C
SMD0603P001TF	0.0156	0.0138	0.0121	0.0100	0.0085	0.0076	0.0067	0.0058	0.0045
SMD0603P002TF	0.0299	0.0268	0.0236	0.0200	0.0173	0.0157	0.0142	0.0126	0.0102
SMD0603P003TF	0.0454	0.0405	0.0356	0.0300	0.0258	0.0234	0.0209	0.0185	0.0148
SMD0603P004TF	0.0520	0.0480	0.0440	0.0400	0.0320	0.0280	0.0240	0.0200	0.0120
SMD0603P005TF	0.076	0.067	0.059	0.050	0.043	0.039	0.035	0.031	0.025
SMD0603P008TF	0.125	0.110	0.096	0.080	0.068	0.061	0.054	0.047	0.036
SMD0603P010TF	0.13	0.12	0.11	0.10	0.08	0.07	0.06	0.05	0.03
SMD0603P020TF	0.27	0.25	0.23	0.20	0.17	0.14	0.12	0.10	0.07
SMD0603P025TF	0.32	0.29	0.27	0.25	0.21	0.18	0.16	0.14	0.10
SMD0603P035TF	0.47	0.41	0.38	0.35	0.29	0.26	0.24	0.20	0.14
SMD0603P050TF	0.67	0.59	0.54	0.50	0.41	0.37	0.34	0.29	0.20

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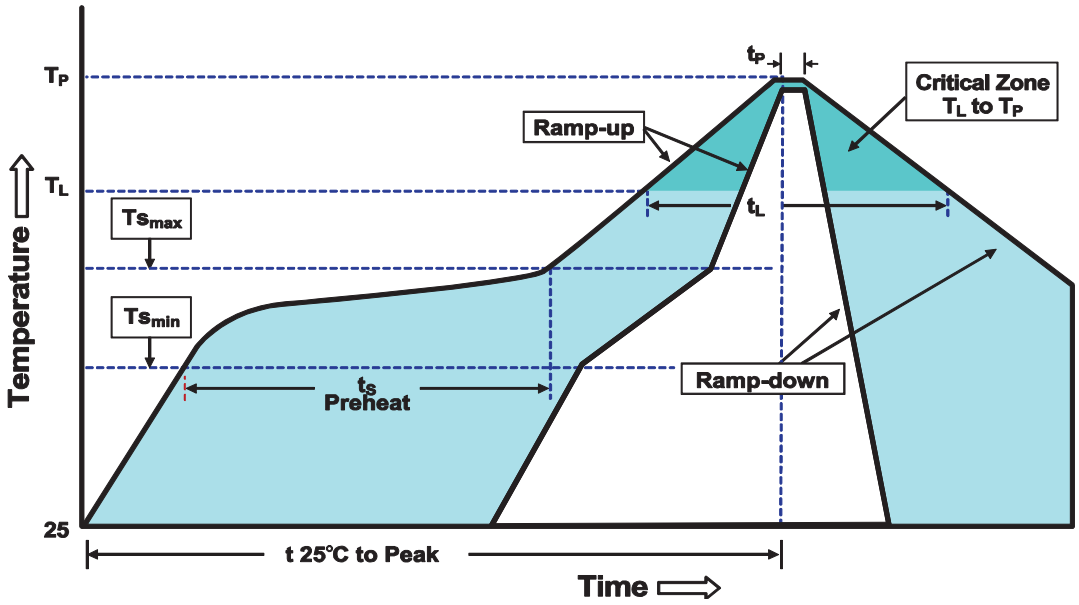
Soldering Parameters



Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to T_P)	3°C/second max.
Preheat -Temperature Min (Ts_{min}) -Temperature Max (Ts_{max}) -Time (Ts_{min} to Ts_{max})	 150°C 200°C 60-180 seconds
Time maintained above: -Temperature (T_L) -Time (t_L)	 217°C 60-150 seconds
Peak Temperature (T_P)	260°C
Time within 5°C of actual Peak Temperature (t_P)	20-40 seconds
Ramp-Down Rate	6 °C /second max.
Time 25°C to Peak Temperature	8 minutes max.
Storage Condition	0°C ~35°C, ≦70%RH

- Recommended reflow methods: IR, vapor phase oven, hot air oven, N_2 environment for lead-free
- Recommended maximum paste thickness is 0.25mm (0.010 inch)
- Devices can be cleaned using standard industry methods and solvents.

Note 1: All temperature refer to topside of the package, measured on the package body surface.

Note 2: If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

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Physical Dimensions (mm.)

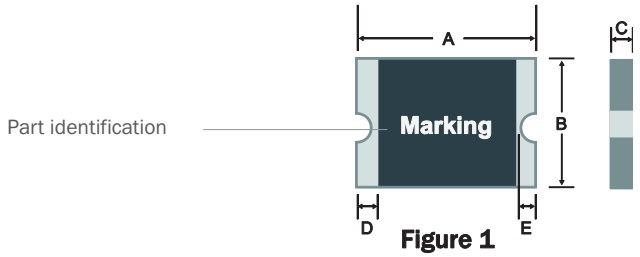

Figure 1

Part Number	A		B		C		D		E	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
SMD0603P001TF	1.40	1.80	0.60	1.00	0.40	0.95	0.15	0.50	--	0.40
SMD0603P002TF	1.40	1.80	0.60	1.00	0.40	0.95	0.15	0.50	--	0.40
SMD0603P003TF	1.40	1.80	0.60	1.00	0.40	0.95	0.15	0.50	--	0.40
SMD0603P004TF	1.40	1.80	0.60	1.00	0.40	0.75	0.15	0.50	--	0.40
SMD0603P005TF	1.40	1.80	0.60	1.00	0.40	0.75	0.15	0.50	--	0.40
SMD0603P008TF	1.40	1.80	0.60	1.00	0.40	0.60	0.15	0.50	--	0.40
SMD0603P010TF	1.40	1.80	0.60	1.00	0.40	0.75	0.15	0.50	--	0.40
SMD0603P020TF	1.40	1.80	0.60	1.00	0.40	0.75	0.15	0.50	--	0.40
SMD0603P025TF	1.40	1.80	0.60	1.00	0.40	0.75	0.15	0.50	--	0.40
SMD0603P035TF	1.40	1.80	0.60	1.00	0.75	0.95	0.15	0.50	--	0.40
SMD0603P050TF	1.40	1.80	0.60	1.00	0.75	0.95	0.15	0.50	--	0.40

Environmental Specifications

Operating Temperature	-40°C to +85 °C
Maximum Device Surface Temperature in Tripped State	125°C
Passive Aging	+85°C , 1000 hours ±5% typical resistance change
Humidity Aging	+85°C , 85%R.H. 1000 hours ±5% typical resistance change
Thermal Shock	MIL-STD-202 Method 107G +85°C /-40°C 20 times -30% typical resistance change
Solvent Resistance	MIL-STD-202, Method 215 No change
Vibration	MIL-STD-883C, Method 2007.1, Condition A No change
Moisture Sensitivity Level	Level 1, J-STD-020C

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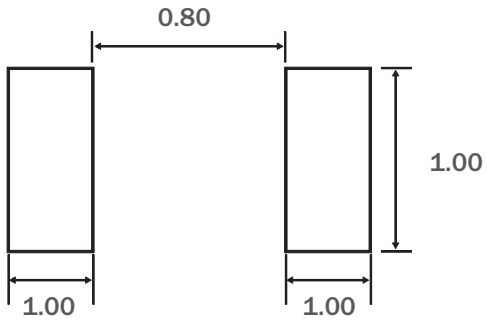
Packaging Quantity and Marking

Recommended Pad Layout (mm.)



Part Number	Marking	Quantity
SMD0603P001TF	●	4000
SMD0603P002TF	2	4000
SMD0603P003TF	▲	4000
SMD0603P004TF	—	4000
SMD0603P005TF	/	4000
SMD0603P008TF	Y	4000
SMD0603P010TF	C	4000
SMD0603P020TF	H	4000
SMD0603P025TF	I	4000
SMD0603P035TF	F	4000
SMD0603P050TF	J	4000

◎ 8 mm tape on 7 inch reel per EIA-481 (equivalent to IEC286, part 3)

Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material: Matte Tin (Sn))
Lead Solderability	Meets EIA Specification RS186-9E, ANSI/J-STD-002 Category 3.

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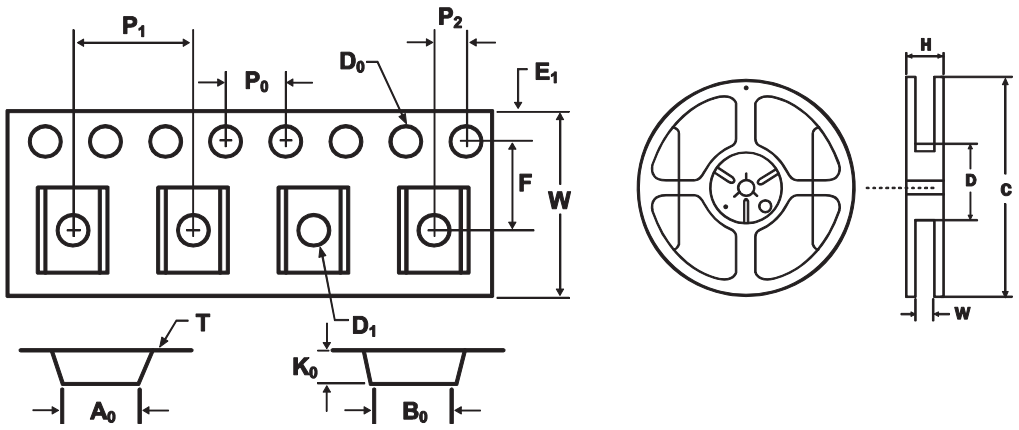
Tape Specifications: EIA-481 (mm.)

	P004TF, P005TF P008TF, P010TF P020TF, P025TF	P001TF, P002TF P003TF P035TF, P050TF
W	8.00 ± 0.30	8.00 ± 0.30
F	3.50 ± 0.05	3.50 ± 0.05
E_1	1.75 ± 0.10	1.75 ± 0.10
D_0	1.55 ± 0.05	1.55 ± 0.05
D_1	0.50 ± 0.10	0.50 ± 0.10
P_0	4.00 ± 0.10	4.00 ± 0.10
P_1	4.00 ± 0.10	4.00 ± 0.10
P_2	2.00 ± 0.05	2.00 ± 0.05
A_0	1.10 ± 0.10	1.10 ± 0.10
B_0	1.92 ± 0.10	1.92 ± 0.10
T	0.20 ± 0.10	0.20 ± 0.10
K_0	0.72 ± 0.10	0.96 ± 0.10
Leader min.	390	390
Trailer min.	160	160

Reel Dimensions: EIA-481 (mm.)

C	Ø178 ± 1.0
D	Ø60.2 ± 0.5
H	11.0 ± 0.5
W	9.0 ± 1.5



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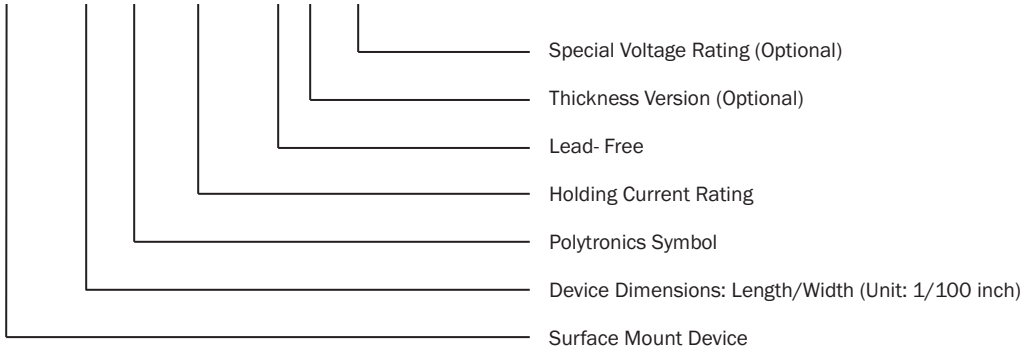
Part Number System

SMD 0603 P □□□ TF T /□□



Cross Reference

Polytronics / EVERFUSE®	Cross Reference	
	TE Connectivity / PolySwitch®	Bourns / Multifuse®
SMD0603P001TF	-	-
SMD0603P002TF	-	-
SMD0603P003TF	-	-
SMD0603P004TF	-	-
SMD0603P005TF	-	-
SMD0603P008TF	-	-
SMD0603P010TF	FemtoSMD010F	-
SMD0603P020TF	FemtoSMD020F	MF-FSMF020X
SMD0603P025TF	-	-
SMD0603P035TF	FemtoSMD035F	MF-FSMF035X
SMD0603P050TF	-	MF-FSMF050X

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“Multifuse” is a registered trademark of Bourns, Inc.
“PolySwitch” is a registered trademark of TE Connectivity Ltd.