TS Series
Surface Mount



Description

Littelfuse PolySwitch® products for telecommunication and networking devices help to meet the growing demand for resettable overcurrent protection. They also provide protection against damage caused by power cross and induced power surges as defined by ITU, Telcordia GR1089, and IEC 62368-1. Littelfuse offers chip, surface-mount, and radial-leaded configurations.

Applications

Networking Machines and Systems:

- Modem
- Phone set
- Fax machine
- Phone wall outlet
- Alarm system
- PBX system
- MDF module
- T1/E1 equipment
- Analog and digital line card
- xDSL modem and splitter
- Powered Ethernet system
- VoIP (Voice over Internet Protocol) equipment
- LAN, WAN equipment
- Customer premise equipment
- Access network hardware

Features & Benefits

- Resettable overcurrent protection
- Fast time-to-trip
- Resistance sorted and matched devices available
- Low parasitic capacitance/flat impedance with frequency
- Recognized to UL 1434, approved to CSA TIL No. CA-3A and EN 60730-1.

Agency Approvals

Agency	Agency File/Certificate Number
	E74889*
	78166*
	72161787*

* See Electrical Characteristic Table for approved part numbers.

Electrical Characteristics

Part Number	Ordering Part Number	I_H	I_T	V_{MAX}		I_{MAX}	$P_{D\ Typ}$	Max Time-to-trip		R_{MIN}	R_{MAX}	R_{1MAX}	Agency Approvals		
				Operating	Interrupt	Interrupt									
		(A)	(A)	(V_{DC})	(V_{RMS})	(A)	(W)	(A)	(s)	(Ω)	(Ω)	(Ω)			
TS250/TSL250/TSM250/TSV250 – Surface-mount — 250VAC															
TSL250-080F-2	E72246-000	0.080	0.240	80	250	3.0	1.2	1.0	0.8	5.0	11.0	20.0**	x	x	x
TSL250-130F-2	RF3835-000	0.130	0.260	60	250	3.0	1.5	1.0	2.0	4.0	8.0	12.0**	—	—	—
TS250-130F-2	E44331-000	0.130	0.260	60	250	3.0	1.1	1.0	0.9	6.5	12.0	20.0**	x	x	x
		—	—	60	600	1.0	—	—	—	—	—	—			
TS250-130F-RA-2	E18772-000	0.130	0.260	60	250	3.0	1.1	1.0	1.4	6.5	9.0	15.0**	x	x	—
		—	—	60	600	1.0	—	—	—	—	—	—			
TS250-130F-RB-2	D48481-000	0.130	0.260	60	250	3.0	1.1	1.0	0.7	9.0	12.0	20.0**	x	x	—
		—	—	60	600	1.0	—	—	—	—	—	—			
TS250-130F-RC-B-0.5-2	A05570-000	0.130	0.260	60	250	3.0	1.1	1.0	1.1	7.0	10.0	17.0**	x	x	—
		—	—	60	600	1.0	—	—	—	—	—	—			

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Electrical Characteristics

Part Number	Ordering Part Number	I_H	I_T	V_{MAX}		I_{MAX}	$P_{D\ Typ}$	Max Time-to-trip		R_{MIN}	R_{MAX}	R_{1MAX}	Agency Approvals		
				Operating	Interrupt	Interrupt									
		(A)	(A)	(V_{DC})	(V_{RMS})	(A)	(W)	(A)	(s)	(Ω)	(Ω)	(Ω)			
TS250/TSL250/TSM250/TSV250 – Surface-mount — 250V_{AC}															
TSM250-130F-2	RF4825-000	0.130	0.260	60	250	3.0	1.5	1.0	2.4	4.0	9.0	15.0	x	—	—
TSV250-130F-2	F59779-000	0.130	0.260	60	250	3.0	1.5	1.0	2.0	4.0	7.0	12.0**	x	x	x
TS600 – Surface-mount — 600V_{AC} (Single Channel)															
TS600-170F-2	D83387-000	0.170	0.400	60	600	3.0	2.5	1.0	10.0	4.0	9.0	18.0	x	x	—
TS600-200F-RA-B-0.5-2	F02483-000	0.200	0.400	60	600	3.0	2.5	1.0	12.0	4.0	7.5	13.5	x	x	—
TS600-400F-2	RF0309-000	0.400	1.000	60	600	3.0	2.0	3.0	5.0	0.5	1.1	2.0	x	x	—
TSM600 – Surface-mount — 600V_{AC} (Dual Channel)															
TSM600-250F-2	A88766-000	0.250	0.860	250	600	3.0	2.0	3.0	0.8	1.0	3.5	7.0	x	x	—
TSM600-250F-RA-2	A88390-000	0.250	0.860	250	600	3.0	2.0	3.0	1.0	1.0	3.0	5.0	x	x	—
TSM600-400F-2	E12392-000	0.400	1.000	250	600	3.0	2.0	3.0	5.0	0.5	1.1	2.0	x	—	—

Notes:

I_H : Hold current: maximum current device will pass without interruption in 20°C still air.

I_T : Trip current: minimum current that will switch the device from low resistance to high resistance in 20°C still air.

V_{MAX} Operating : Maximum continuous voltage device can withstand without damage at rated current. This voltage is used for component Recognition under UL1434.

V_{MAX} Interrupt : Maximum voltage that can be safely placed across a device in its tripped state.

I_{MAX} Interrupt : Maximum fault current device can withstand without damage at rated operating voltage. This current is used for component Recognition under UL1434. Devices may trip safely under higher level power cross conditions to assist equipment in meeting the appropriate ITU, UL60950 or GR1089 industry requirements.

P_D : Power dissipated from device when in the tripped state in 20°C still air.

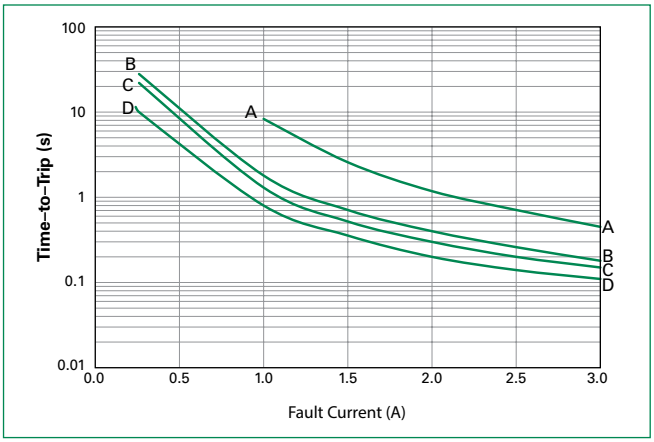
R_{MIN} : Minimum resistance of device as supplied at 20°C unless otherwise specified.

R_{MAX} : Maximum resistance of device as supplied at 20°C unless otherwise specified.

R_{1MAX} : Maximum resistance measured one hour post-trip or post-reflow at 20°C.

** Applies to all products which share the same prefix.

Typical Time-to-Trip Curves at 25°C



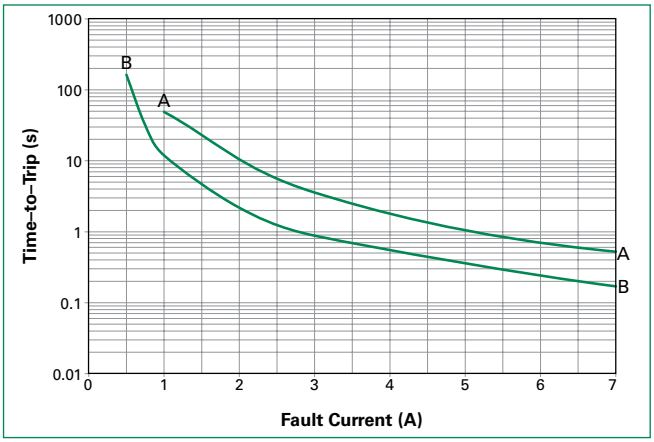
TS250

A = TSV250-184F

B = TSV250-130F/TSL250-130F/TSM250-130F

C = TS250-130F

D = TSL250-080F



TS600/TSM600

A = TS600-400/TSM600-400F

B = TSM600-250F/TS600-170F/200F

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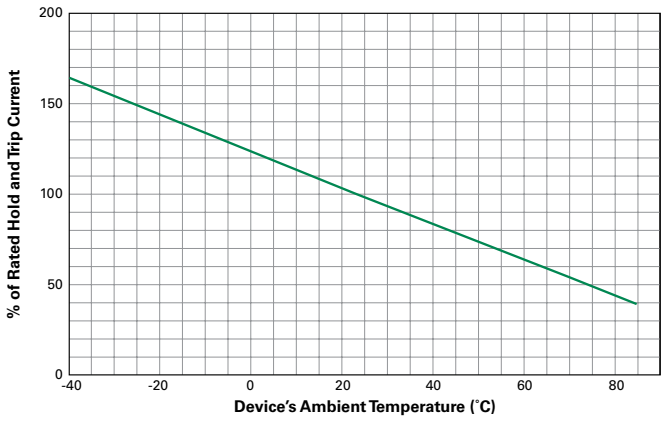
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Temperature Rerating

Maximum Ambient Temperature									
Part Number**	-40°C	-20°C	0°C	20°C	40°C	50°C	60°C	70°C	85°C
Hold Current (A)									
TS250/TSL250/TSM250/TSV250 – Surface-mount* — 250V_{AC}									
TSL250-080F	0.124	0.110	0.095	0.080	0.066	0.059	0.051	0.044	0.033
TSL250-130F	0.208	0.182	0.156	0.130	0.104	0.091	0.078	0.065	0.045
TS250-130F	0.208	0.182	0.156	0.130	0.104	0.091	0.078	0.065	0.045
TSM250-130F	0.208	0.182	0.156	0.130	0.104	0.091	0.078	0.065	0.045
TSV250-130F	0.208	0.182	0.156	0.130	0.104	0.091	0.078	0.065	0.045
TSV250-184F	0.286	0.252	0.218	0.184	0.150	0.134	0.118	0.102	0.075
TS600 – Surface-mount† — 600V_{AC} (Single Channel)									
TS600-170F	0.264	0.230	0.200	0.170	0.140	0.125	0.109	0.094	0.070
TS600-200F	0.310	0.275	0.238	0.200	0.165	0.147	0.128	0.110	0.083
TS600-400F	0.640	0.560	0.480	0.400	0.320	0.270	0.230	0.190	0.130
TSM600 – Surface-mount† — 600V_{AC} (Dual Channel)									
TSM600-250F	0.400	0.350	0.300	0.250	0.198	0.170	0.140	0.117	0.083
TSM600-400F	0.640	0.560	0.480	0.400	0.320	0.270	0.230	0.190	0.130

* 250V_{AC} interrupt products may help equipment pass ITU K.20, K.21 and K.45 recommendations and Telcordia GR-1089 Port Type 2 and 4 requirements.
† 600V_{AC} interrupt products may help equipment pass UL60950, TIA-968-A and GR1089 Port Type 1, 3 and 5 requirements.
** Applies to all products which share the same prefix.

TSx250/TS600/TSM600 – Temperature Rerating Curve



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TS250/TSV250/TSM250/TSL250 – Physical Specifications

Terminal Material	Tin-plated Brass, Nickel Under-plating (TS250/TSV250/TSL250) Tin-plated Copper (TSM250)
Soldering Characteristics	IEC 60068-2-58

Note: Devices are not intended to be placed through a reflow process.

TS250/TSV250/TSM250/TSL250 – Environmental Specifications

Test	Conditions
Passive Aging	60°C, 1000 hrs 85°C, 1000 hrs
Humidity Aging	85°C, 85% R.H., 500 hrs
Thermal Shock	125°C, -55°C (10 Times)
Solvent Resistance	MIL-STD-202, Method 215F
Moisture Resistance Level	Level 1, J-STD-020
Storage Conditions	40°C max, 70% RH max; devices should remain in original sealed bags prior to use. Devices may not meet specified values if these storage conditions are exceeded.

TS600 – Physical Specifications

Terminal Material	Tin-plated Brass
Insulating Material	Nylon Resin (UL94V-0), 1000V Dielectric Rating
Soldering Characteristics	ANSI/J-STD-002, Category 3
Solder Heat Withstand	IEC 60068-2-58, Test Tb, Section 8

TS600 – Environmental Specifications

Test	Conditions
Passive Aging	60°C, 1000 hrs 85°C, 1000 hrs
Humidity Aging	85°C, 85% R.H., 1000 hrs
Thermal Shock	125°C, -55°C (10 Times)
Solvent Resistance	MIL-STD-202, Method 215F
Moisture Resistance Level	Level 1, J-STD-020
Storage Conditions	40°C max, 70% RH max; devices should remain in original sealed bags prior to use. Devices may not meet specified values if these storage conditions are exceeded.

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TSM600 – Physical Specifications

Terminal Material	Tin-plated Brass
Insulating Material	Nylon Resin (UL94V-0), 1000V Dielectric Rating
Soldering Characteristics	IEC 60068-2-58, Method 7
Solder Heat Withstand	IEC 60068-2-58, Test Tb, Section 5 Method 1a

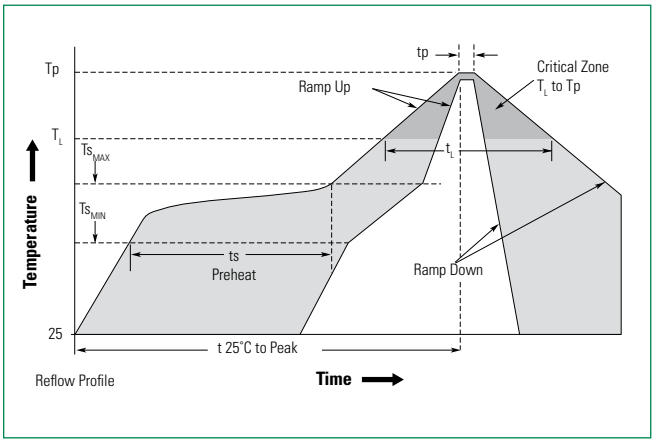
TSM600 – Environmental Specifications

Test	**Conditions**
Passive Aging	60°C, 1000 hrs 85°C, 1000 hrs
Humidity Aging	85°C, 85% R.H., 1000 hrs
Thermal Shock	125°C, -55°C (10 Times)
Solvent Resistance	MIL-STD-202, Method 215J
Moisture Resistance Level	Level 2A, J-STD-020
Storage Conditions	40°C max, 70% RH max; devices should remain in original sealed bags prior to use. Devices may not meet specified values if these storage conditions are exceeded.

Solder Reflow Recommendations

Profile Feature	Pb-Free Assembly
Average ramp up rate (Ts_{MAX} to Tp)	3°C/s max
Preheat	
Temperature min (Ts_{MIN})	150°C
Temperature max (Ts_{MAX})	200°C
Time (ts_{MIN} to ts_{MAX})	60-180 s
Time maintained above:	
Temperature (T_L)	217°C
Time (t_L)	60-150 s
Peak/Classification temperature (Tp)	260°C
Time within 5°C of actual peak temperature	
Time (tp)	20-40 s
Ramp down rate	6°C/s max
Time 25°C to peak temperature	8min max

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



Solder Reflow

- Recommended reflow method: IR, vapor phase oven, hot air oven.
- Surface-mount devices are not intended to be wave soldered to the bottom side of the board.
- Recommended maximum paste thickness of 0.25mm (0.010in).
- Devices can be cleaned using standard industry methods and solvents.

Rework

- If a device is removed from the board, it should be discarded and replaced with a new device.

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Dimension Figures

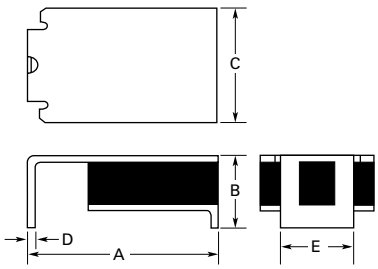


Figure 1

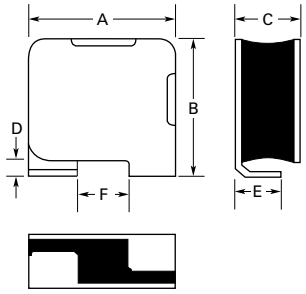


Figure 2

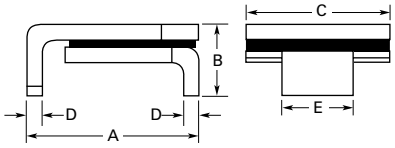


Figure 3

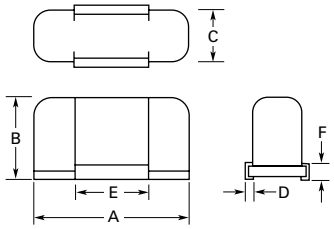


Figure 4

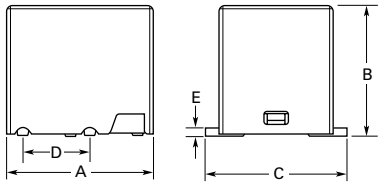


Figure 5

Dimensions and Weights

Part Number	Dimensions in Millimeters (Inches)												Figure	Device Mass (g) (Only for Reference)
	A		B		C		D		E		F			
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
TS250/TSL250/TSM250/TSV250 – Surface-mount* — 250V_{AC}														
TSL250-080F	6.7 (0.27)	7.9 (0.31)	2.7 (0.11)	3.7 (0.15)	4.8 (0.19)	5.3 (0.21)	0.2 (0.01)	0.4 (0.02)	2.5 (0.10)	3.1 (0.12)	—	—	3	2.80
TSL250-130F	6.7 (0.27)	7.9 (0.31)	2.7 (0.11)	3.7 (0.15)	4.8 (0.19)	5.3 (0.21)	0.2 (0.01)	0.4 (0.02)	2.5 (0.10)	3.1 (0.12)	—	—	3	2.80
TS250-130F	8.5 (0.34)	9.4 (0.37)	—	3.4 (0.14)	—	7.4 (0.29)	0.3‡ (0.01)	—	3.8‡ (0.15)	—	—	—	1	3.60
TSM250-130F	8.2 (0.323)	8.9 (0.35)	—	9.0 (0.354)	7.8 (0.307)	8.6 (0.339)	—	3.9 (0.154)	—	0.7 (0.026)	—	—	5	0.64
TSV250-130F	—	6.10 (0.24)	—	6.90 (0.27)	—	3.20 (0.13)	0.56 (0.02)	—	—	1.90 (0.08)	1.60 (0.07)	2.30 (0.09)	2	2.80
TSV250-184F	—	6.10 (0.24)	—	6.90 (0.27)	—	3.20 (0.13)	0.56 (0.02)	—	—	1.90 (0.08)	1.60 (0.07)	2.30 (0.09)	2	2.80
TS600 – Surface-mount† — 600V_{AC} (Single Channel)														
TS600-170F	18.3 (0.72)	19.4 (0.77)	11.6 (0.46)	12.3 (0.49)	7.2 (0.29)	8.3 (0.33)	1.7 (0.07)	2.4 (0.10)	9.9 (0.39)	10.4 (0.41)	1.5 (0.06)	2.3 (0.09)	4	23.6
TS600-200F	18.3 (0.72)	19.4 (0.77)	11.6 (0.46)	12.3 (0.49)	7.2 (0.29)	8.3 (0.33)	1.7 (0.07)	2.4 (0.10)	9.9 (0.39)	10.4 (0.41)	1.5 (0.06)	2.3 (0.09)	4	23.6
TS600-400F	18.3 (0.72)	19.4 (0.77)	11.6 (0.46)	12.3 (0.49)	7.2 (0.29)	8.3 (0.33)	1.7 (0.07)	2.4 (0.10)	9.9 (0.39)	10.4 (0.41)	1.5 (0.06)	2.3 (0.09)	4	19.8

† 600V_{AC} interrupt products may help equipment pass UL60950, TIA-968-A and GR1089 Port Type 1, 3 and 5 requirements.

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TS Series
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Dimension Figures

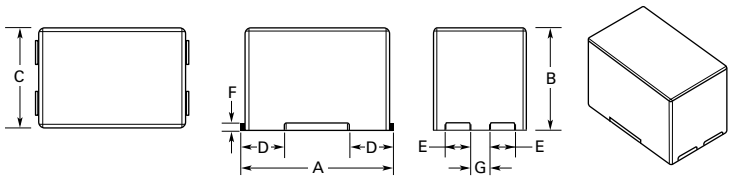


Figure 6

Dimensions and Weights

Part Number	Dimensions in Millimeters (Inches)														Figure	Device Mass (g) (Only for Reference)
	A		B		C		D		E		F		G			
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
TSM600 – Surface-mount† — 600V$_{AC}$ (Dual Channel)																
TSM600-250F	17.0	17.60	11.20	11.70	10.40	11.20	4.80	5.20	2.50	2.80	0.60	1.0	2.2	3.1	6	31.2
	(0.67)	(0.69)	(0.44)	(0.46)	(0.41)	(0.44)	(0.19)	(0.20)	(0.10)	(0.11)	(0.02)	(0.04)	(0.09)	(0.12)		
TSM600-400F	17.0	17.60	11.20	11.70	10.40	11.20	4.80	5.20	2.50	2.80	0.60	1.0	2.2	3.1	6	31.2
	(0.67)	(0.69)	(0.44)	(0.46)	(0.41)	(0.44)	(0.19)	(0.20)	(0.10)	(0.11)	(0.02)	(0.04)	(0.09)	(0.12)		

† 600V$_{AC}$ interrupt products may help equipment pass UL60950, TIA-968-A and GR1089 Port Type 1, 3 and 5 requirements.

Packaging and Marking Information

Part Number	Bag Quantity	Tape and Reel Quantity	Standard Package Quantity	Part Marking	Agency Approvals
TS250/TSL250/TSM250/TSV250 – Surface-mount — 250V$_{AC}$					
TSL250-080F-2	—	1,500	7,500	T08	UL, CSA,TÜV
TSL250-130F-2	—	1,500	7,500	T13	—
TS250-130F-2	—	1,500	7,500	T13	UL, CSA, TÜV
TSM250-130F-2	—	600	3,000	T13M	UL
TSV250-130F	2500	—	10,000	T13V	UL, CSA, TÜV
TSV250-130F-2	—	1,200	6,000	T13V	UL, CSA, TÜV
TSV250-184F	2500	—	10,000	T18V	UL
TS600 – Surface-mount — 600V$_{AC}$ (Single Channel)					
TS600-170F-2	—	300	900	T20	UL, CSA
TS600-200F-RA-2	—	300	900	T20	UL, CSA
TS600-400F-2	—	300	900	T40	UL, CSA
TSM600 – Surface-mount — 600V$_{AC}$ (Dual Channel)					
TSM600-250F-2	—	200	600	TSM600	UL, CSA
TSM600-250F-RA-2	—	200	600	TSM600	UL, CSA
TSM600-400F-2	—	200	600	TSM600-4	UL

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Recommended Pad Layouts in millimeters (inches) Nominal

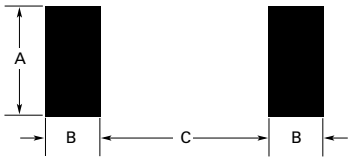


Figure 1

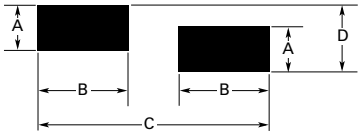


Figure 2

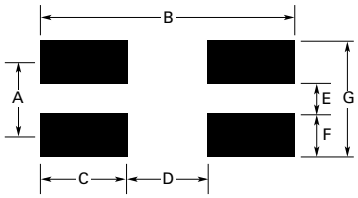


Figure 3

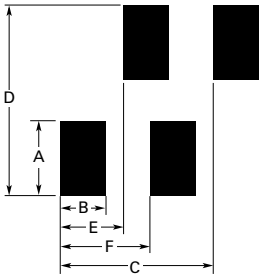
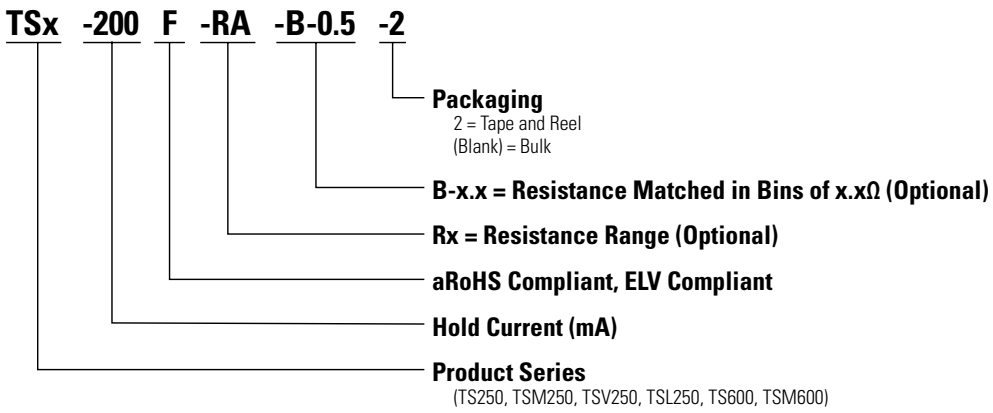


Figure 4

Device	A	B	C	D	E	F	G	Figure
TS250 (All)	4.6 (0.180)	1.80 (0.070)	6.10 (0.240)	—	—	—	—	1
TSM250 (All)	3.20 (0.126)	2.00 (0.079)	6.70 (0.264)	8.20 (0.323)	2.60 (0.102)	3.90 (0.154)	—	4
TSV250 (All)	2.29 (0.090)	2.41 (0.095)	6.35 (0.250)	3.43 (0.135)	—	—	—	2
TSL250 (All)	3.6 (0.140)	1.80 (0.070)	5.50 (0.220)	—	—	—	—	1
TS600 (All)	10.42 (0.410)	3.30 (0.130)	3.35 (0.132)	—	—	—	—	1
TSM600 (All)	5.2 (0.205)	17.80 (0.701)	5.54 (0.218)	6.75 (0.266)	2.08 (0.082)	3.12 (0.123)	8.39 (0.331)	3

Part Ordering Number System



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TS Series
Surface Mount

TS250/TSV250/TSM250/TSL250 – Tape and Reel Specifications

TS devices are packaged per EIA 481 and EIA 481-2 standards.
See Figures 1 and 2 for details.

Description	EIA Mark	TS250		TSM250		TSV250		TSL250	
		Dimension (mm)	Tolerance (mm)	Dimension (mm)	Tolerance (mm)	Dimension (mm)	Tolerance (mm)	Dimension (mm)	Tolerance (mm)
Carrier Tape Width	W	16	±0.30	24.0	±0.50	16.0	±0.30	16	±0.30
Sprocket Hole Pitch	P_0	4.0	±0.10	4.0	±0.10	4.0	±0.10	4.0	±0.10
	P_1	12.0	±0.10	16.0	±0.10	8.0	±0.10	8.0	±0.10
	P_2	2.0	±0.10	2.0	±0.10	2.0	±0.10	2.0	±0.10
	A_0	6.9	±0.23	7.05	±0.20	5.5	±0.10	5.5	±0.10
	B_0	9.6	±0.15	8.85	±0.20	6.2	±0.10	7.9	±0.10
	B_1 max	12.1	—	12.45	—	8.0	—	9.2	—
Sprocket Hole Diameter	D_0	1.5	-0/+0.1	1.5	-0/+1.0	1.55	±0.05	1.55	±0.05
	F	7.5	±0.10	11.5	±0.10	7.5	±0.10	7.5	±0.10
	E_1	1.75	±0.10	1.75	±0.10	1.75	±0.10	1.75	±0.10
	E_2 min	14.25	—	22.25	—	—	—	—	—
Tape Thickness	T max	0.4	—	0.5	±0.50	0.45	—	0.35	—
Tape Thickness with Splice Cover Tape Thickness	T_1 max	0.1	—	0.1	—	0.1	—	0.1	—
	K_0	3.4	±0.15	8.55	±0.20	7.0	±0.10	3.70	±0.10
	Leader min	300	—	300	—	390	—	390	—
	Trailer min	300	—	160	—	160	—	160	—
Reel Dimensions									
Reel Diameter	A max	340	—	390	—	340	—	340	—
Core Diameter	N min	50	—	75	—	50	—	50	—
Space between Flanges-less Device	W_1	16.4	-0/+2.0	25.4	±0.5	16.4	-0/+2.0	16.4	-0/+2.0
Reel Width	W_2 max	22.4	—	30.4	—	22.4	—	22.4	—

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TS Series
Surface Mount

TS600/TSM600 – Tape and Reel Specifications

TS devices are packaged per EIA 481 and EIA 481-2 standards.
See Figures 1 and 2 for details.

Description	EIA Mark	TS600		TSM600	
		Dimension (mm)	Tolerance (mm)	Dimension (mm)	Tolerance (mm)
Carrier Tape Width	W	32	±0.3	32	±0.3
Sprocket Hole Pitch	P_0	4.0	±0.1	4.0	±0.1
	P_1	16	±0.1	24	±0.1
	P_2	2.0	±0.1	2.0	±0.1
	A_0	10	±0.1	11.2	±0.1
	B_0	19.2	±0.1	17.8	±0.1
	B_1 max	21.6	—	23.45	—
Sprocket Hole Diameter	D_0	1.5	-0/+1.0	1.5	-0/+1.0
	F	14.2	±0.1	14.2	±0.1
	E_1	1.75	±0.1	1.74	±0.1
	E_2 min	28.4	±0.1	28.4	±0.1
Tape Thickness	T max	0.50	±0.5	0.5	±0.5
Tape Thickness with Splice	T_1 max	0.1	—	0.1	—
	K_0	13.2	±0.1	11.9	±0.1
	Leader min	390	—	390	—
	Trailer min	160	—	160	—
Reel Dimensions					
Reel Diameter	A max	360	—	360	—
Core Diameter	N min	50	—	50	—
Space between Flanges-less Device	W_1	32.4	-0/+2.0	32.4	-0/+2.0
Reel Width	W_2 max	40	—	40	—

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TS Series
Surface Mount

Tape and Reel Diagrams

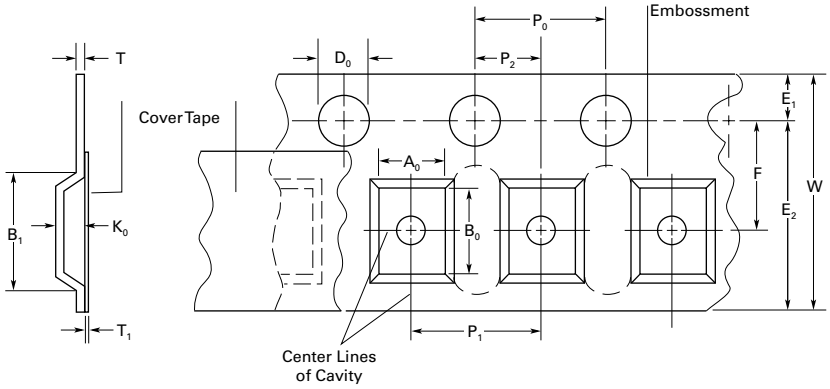


Figure 1

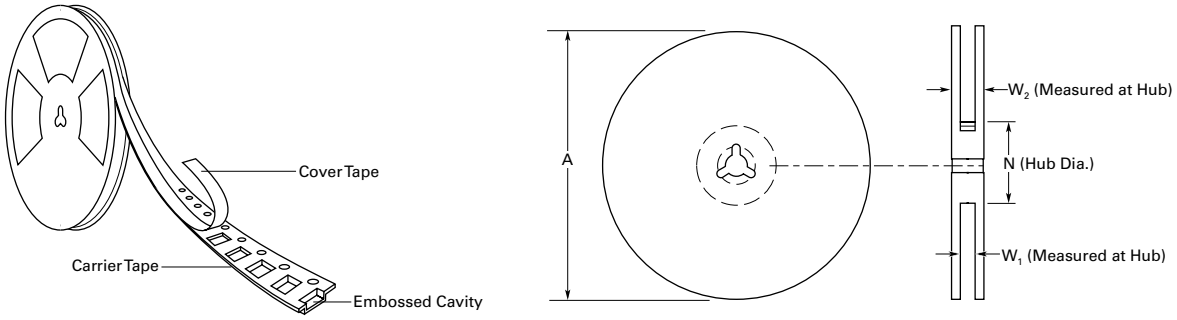


Figure 2

Warning

- Users should independently evaluate the suitability of and test each product selected for their own application.
- Operation beyond the maximum ratings or improper use may result in device damage and possible electrical arcing and flame.
- These devices are intended for protection against damage caused by occasional overcurrent or overtemperature fault conditions and should not be used when repeated fault conditions or prolonged trip events are anticipated.
- Contamination of the PPTC material with certain silicone-based oils or some aggressive solvents can adversely impact the performance of the devices.
- Device performance can be impacted negatively if devices are handled in a manner inconsistent with recommended electronic, thermal, and mechanical procedures for electronic components.
- PPTC devices are not recommended for installation in applications where the device is constrained such that its PTC properties are inhibited, for example in rigid potting materials or in rigid housings, which lack adequate clearance to accommodate device expansion.
- Operation in circuits with a large inductance can generate a circuit voltage (Ldi/dt) above the rated voltage of the device.

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