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TR Selection Guide and Product Data

This section has two parts:
- **A Selection Guide that walks you through the process of selecting the correct TR device for a circuit.**
- **Product Data that outlines TR electrical characteristics, physical characteristics, agency recognitions, part number/ specification matrix, tape and reel specifications, and ordering information for TR devices.**

TR Selection Guide

Follow these seven steps to select a PolySwitch TR device for a circuit:

1. Define the operating parameters for the circuit. These include:
   - Maximum ambient operating temperature
   - Normal operating current
   - Maximum operating voltage (TR is 60 V maximum)
   - Maximum interrupt current
   - Maximum interrupt voltage
2. Select the TR device that accommodates the circuit's maximum ambient operating temperature and normal operating current.
3. Compare the TR device's maximum operating voltage and maximum interrupt current with the circuit's to be sure the circuit does not exceed the device ratings.
4. Check the TR device's time-to-trip to be sure it will protect the circuit.
5. Verify that the circuit's ambient operating temperatures are within the TR device's operating temperature range.
6. Verify that the TR device's dimensions fit the application's space considerations.
7. Independently evaluate and test the suitability and performance

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1. Define the circuit's operating parameters.

Fill in the following information about the circuit:

Maximum ambient operating temperature	________
Normal operating current	________
Maximum operating voltage (TR is 60 V max.)	________
Maximum interrupt current	________
Maximum interrupt voltage (see Step 3 table)	________

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

Look across the top of the table below to find the temperature that most closely matches the circuit's maximum ambient operating temperature. Look

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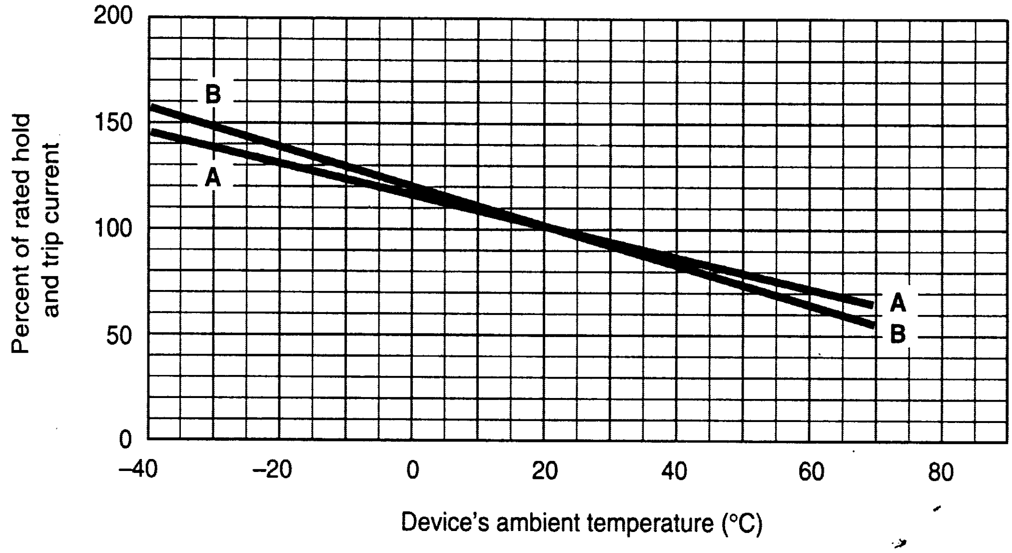
Thermal derating curve

A = TR250-180U
B = All other TR devices



3. Compare maximum operating voltages and currents.

Look down the first column of the table below to find the part number(s) you selected in Step 2. Look to the right in that row to find the device's maximum interrupt voltage, maximum interrupt current, and maximum operating voltage.

Compare the three ratings with the circuit's to be sure the circuit's ratings do not exceed those of the TR device.

WARNING:

TR devices are not intended for continuous utility line voltage such as 120/220 V or 240 V.

Maximum device voltages and currents

	Part number*	Max. operating voltage (V)	Max. interrupt. voltage (V)*	Max. interrupt current (A)**
New	TR250-080T/080U	60	250	3
New	TR250-110U	60	250	3
	TR250-120T/120UT	60	250	3
	TR250-120/120U	60	250	3
	TR250-145/145U	60	250	3
	TR250-180U	60	250	10
	TR600-150	60	600	3
	TR600-160	60	600	3

*Applies to all products which share the same prefix.
**Device capabilities may exceed these ratings depending on test conditions. Refer to the Telecommunication Application Notes for details.

4. Determine Time-to-trip.

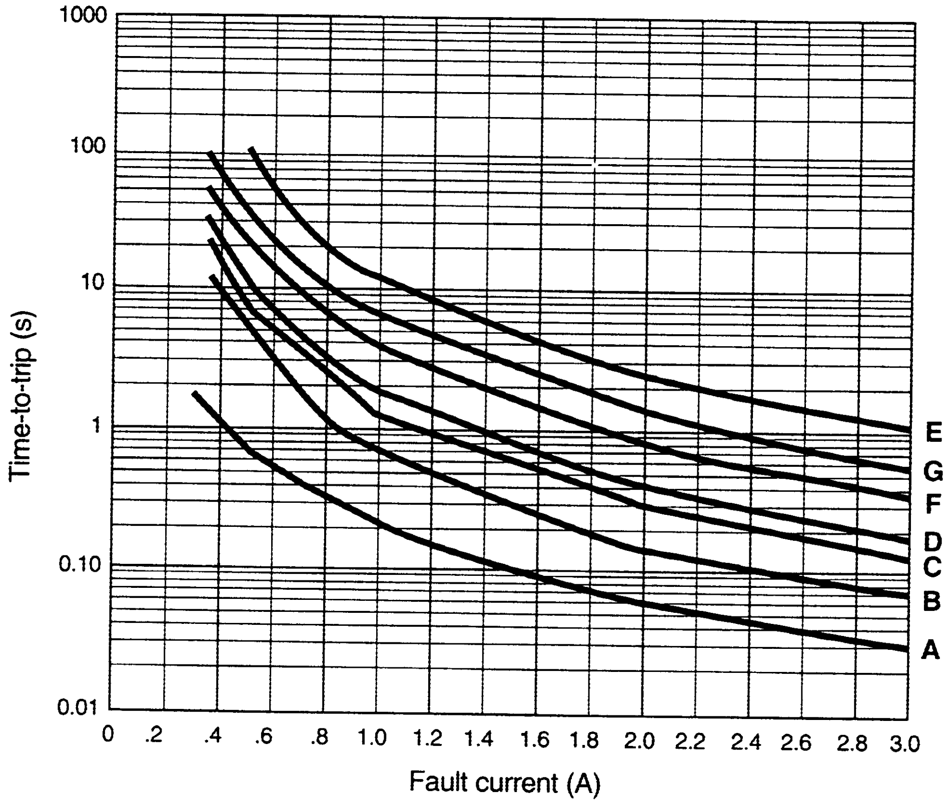
Time-to-trip is the amount of time it takes for a device to switch to a high-resistance state once a fault current has been applied across the device.

Identifying the TR device's switching time is important in order to provide the desired protection capabilities. If the device you choose trips or switches too fast, undesired or nuisance tripping will occur. If the device trips too slowly, the components being protected may be damaged before the device switches to a high-resistance state.

The chart below shows the typical time-to-trip at 20°C for each PolySwitch TR device. On the chart, find the time-to-trip for the TR device you selected. If the TR device's time-to-trip is too fast or too slow for the circuit, go back to Step 2 and choose an alternate device.

Typical time-to-trip at 20°C

- New A = TR250-080T/08U
- New B = TR250-110U/120UT/120T
- C = TR250-120/120U
- D = TR250-145/145U
- E = TR250-180U
- F = TR600-150
- G = TR600-160



5. Verify ambient operating conditions.

Ensure that your application's minimum and maximum ambient temperatures are within the operating temperature range of –40°C and 85°C.

Device surface temperature in the tripped state is typically 120°C.

6. Verify the TR device's dimensions.

Using dimensions from the table below, compare the dimensions of the TR device you selected with the application's space considerations.

Product dimensions (millimeters/*inches*)

Part number*	Fig.	A max.	B max.	C max.	D nom.	E nom.
New TR250-080U	1	4.80 *(0.20)*	9.10 *(0.36)*	3.80 *(0.15)*	4.70 *(0.19)*	5.00 *(0.20)*
New TR250-080T-B-1.0-0.125	1	5.30 *(0.21)*	9.30 *(0.37)*	3.80 *(0.15)*	3.30 *(0.13)*	5.00 *(0.20)*
New TR250-110U	1	5.30 *(0.21)*	9.40 *(0.37)*	3.80 *(0.15)*	4.70 *(0.19)*	5.00 *(0.20)*
TR250-120U/120UT	2	6.00 *(0.24)*	10.00 *(0.40)*	3.80 *(0.15)*	4.70 *(0.19)*	5.00 *(0.20)*
TR250-120/120T	2	6.50 *(0.26)*	11.00 *(0.43)*	4.60 *(0.18)*	4.70 *(0.19)*	5.00 *(0.20)*
TR250-145U	2	6.00 *(0.24)*	10.00 *(0.40)*	3.80 *(0.15)*	4.70 *(0.19)*	5.00 *(0.20)*
TR250-145	2	6.50 *(0.26)*	11.00 *(0.43)*	4.60 *(0.18)*	4.70 *(0.19)*	5.00 *(0.20)*
TR250-180U	2	10.40 *(0.41)*	12.60 *(0.50)*	3.60 *(.140)*	4.70 *(0.19)*	5.00 *(0.20)*
TR600-150	2	13.50 *(0.53)*	12.60 *(0.50)*	6.00 *(0.24)*	4.70 *(0.19)*	5.00 *(0.20)*
TR600-160	2	16.00 *(0.63)*	12.60 *(0.50)*	6.00 *(0.24)*	4.70 *(0.19)*	5.00 *(0.20)*
TR600-160-0.130	2	16.00 *(0.63)*	12.60 *(0.50)*	6.00 *(0.24)*	3.30 *(0.13)*	5.00 *(0.20)*
TR600-160-RA-B-0.5-0.130	2	16.00 *(0.63)*	12.60 *(0.50)*	6.00 *(0.24)*	3.30 *(0.13)*	5.00 *(0.20)*

* Applies to all part numbers which share the same prefix

Figure 1

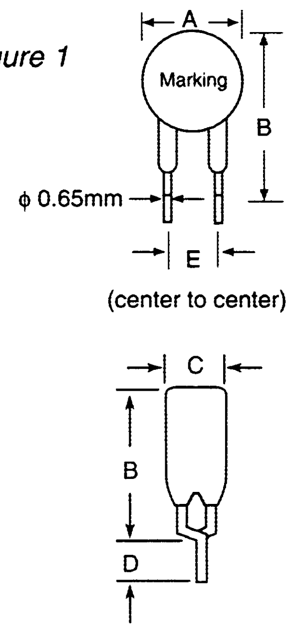
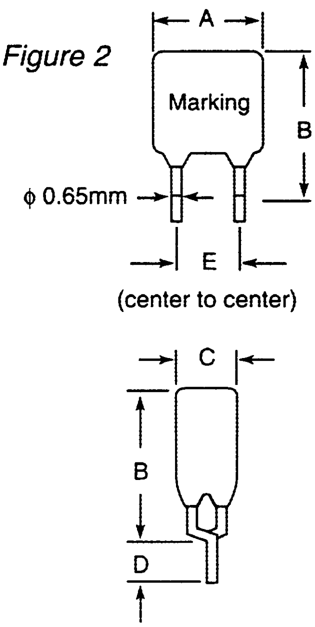


Figure 2



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TR Product Data

Now that you have selected your TR device, please review the device's characteristics in this section to verify that the device will perform as required.

Electrical characteristics (20°)

Part number	I_H (A)	Max Op Voltage (V)	V max (V)	I max (A)	Rmin (ohms)	Rmax (ohms)	R_1max (ohms)	Bin Range (ohms)	Agency recognition
New TR250-080U	0.080	60	250	3	14.0	20	33.0		*
New TR250-080T-B-1.0-0.125	0.080	60	250	3	15.0	22	33.0	1.0	*
New TR250-110U	0.110	60	250	3	5.0	9.0	16.0		*
TR250-120U	0.120	60	250	3	6.0	10.0	16.0		UL, CSA
TR250-120UT-B-0.5	0.120	60	250	3	7.0	12.0	16.0	0.5	UL, CSA
TR250-120	0.120	60	250	3	4.0	8.0	16.0		UL, CSA
TR250-120T-RF-B-0.5	0.120	60	250	3	6.0	10.5	16.0	0.5	UL, CSA

Physical characteristics

Flammability	per IEC 695-2-2 Needle Flame Test for 20 sec.
Lead material	Tin/lead-plated copper, 22 AWG, ∅ 0.65 mm/0.026 in
Solderability	per MIL-STD 202, Method 208
Solder heat withstand	per IEC-STD 68-2-20, Test Tb, Section 5, Method 1A
Solvent resistance	per MIL-STD 202, Method 215B

Agency recognitions

UL	File #E74889
CSA	File #CA78165-7

Part number/ specification matrix

Specification	TR250-110U	TR250-120*	TR250-120T*	TR250-145*	TR250-180U	TR600-150*	TR600-160*
FCC Part 68							
UL1459							
UL497A							
Bellcore GR1089							
ITU K.20							
ITU K.21							

*Applies to all products which share the same prefix.

Note:

PolySwitch devices will assist equipment to meet the specifications described above.

Refer to the Telecommunication Application Notes for details.

Tape and reel specifications (dimensions in millimeters)

Product availability: TR250/TR600
Devices taped with reference to EIA468-B standard. See table below and Figures 1 and 2,for details.

Dimension description	EIA mark	IEC mark	Dimensions Dim. (mm)	Tol. (mm)
Carrier tape width	W	W	18	–0.5/+1.0
Hold down tape width	W_4	W_0	5	min.
Top distance between tape edges	W_6	W_2	3	max.
Sprocket hole position	W_5	W_1	9	–0.5/+0.75
Sprocket hole diameter	D_0	D_0	4	±0.2
Abscissa to plane (straight lead)*	H	H	18.5	±3.0
Abscissa to plane (kinked lead)*	H_0	H_0	16	-0.5/+0.6
Abscissa to top	H_1	H_1	32.2	max.
Overall width w/lead protrusion		C_1	43.2	max.
Overall Width w/o lead protrusion		C_2	42.5	max.
Lead protrusion	L_1	l_1	1.0	max.
Protrusion of cut-out	L	L	11	max.
Protrusion beyond hold down tape	l_2	l_2	Not specified	
Sprocket hole pitch	P_0	P_0	12.7	±0.3
Device pitch: TR250			12.7	
Device pitch: TR600			25.4	
Pitch tolerance			20 consec.	±1
Tape thickness	t	t	0.9	max.
Tape thickness with splice*	t_1		2.0	max.
Splice sprocket hole alignment			0	±0.3
Body lateral deviation	Δh	Δh	0	±1.0
Body tape plane deviation	Δp	Δp	0	±1.3
Lead seating plane deviation	ΔP_1	P_1	0	±0.7
Lead spacing*	F	F	5.08	-0.5/+0.6
Reel width	w_2	w	56	max.
Reel diameter	a	d	370	max.
Space between flanges less device	w_1		4.75	±3.25
Arbor hole diameter	c	f	26	±12.0
Core diameter	n	h	80	max.
Box			56/372/372	max.
Consecutive missing places*			3 maximum	
Empty places per reel*			Not specified	

*Differs from EIA Specification.

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Figure 1: EIA Referenced Taped Component Dimensions

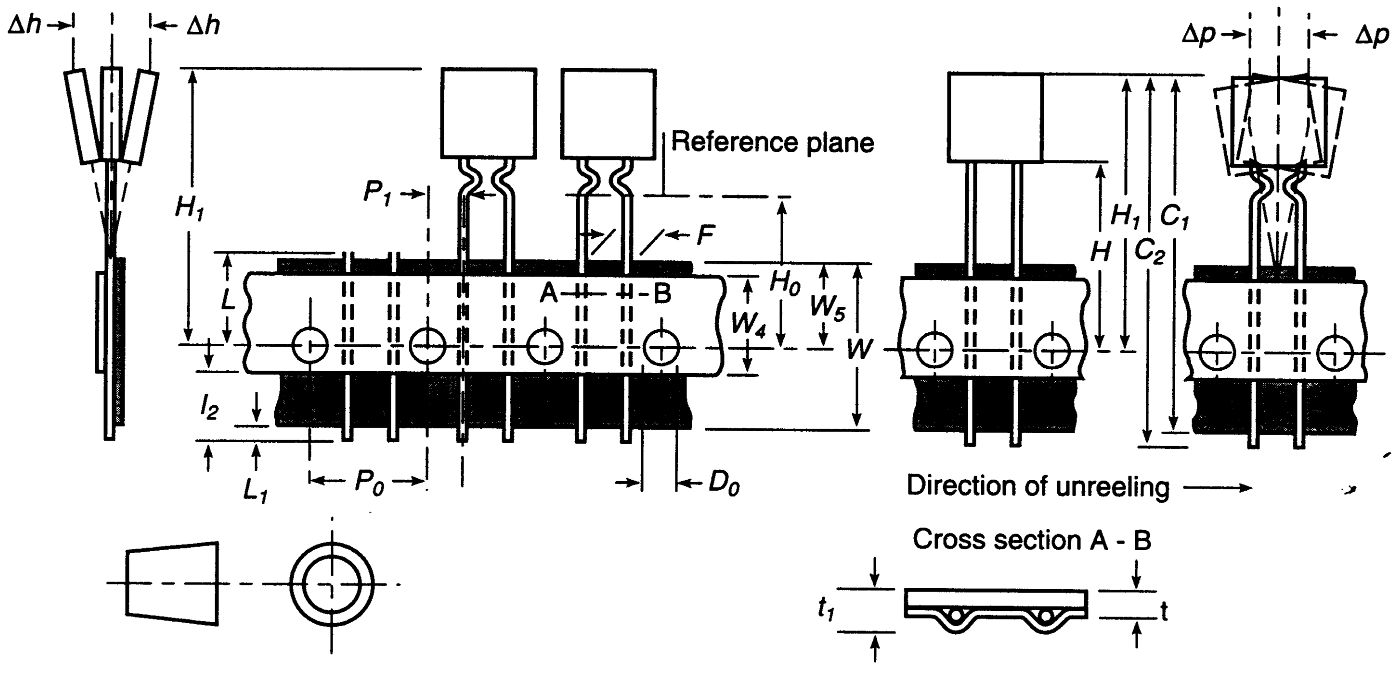
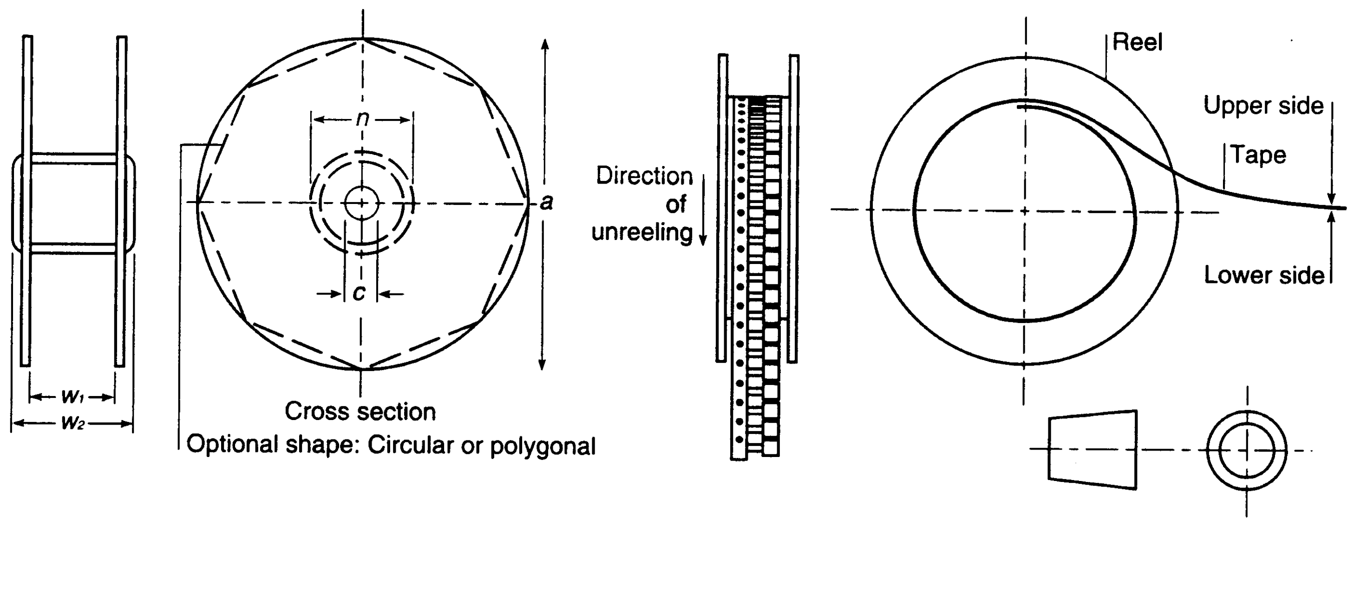


Figure 2: Reel Dimensions



Ordering information

Product description	Bag quantity	Tape and reel quantity	Standard package
New TR250-080T/080U	500	-	10000
New TR250-110U	500	-	10000
TR250-120/120U*	500	-	10000
TR250-120T/120UT*	500	-	10000
TR250-120-2/120U-2	-	1500	7500
TR250-145/145U*	500	-	10000
TR250-145-2/145U-2	-	1500	7500
TR250-180U	500	-	10000
TR250-180U-2	-	1500	7500
TR600-150*	500	-	10000
TR600-150-2	-	600	3000
TR600-160*	500	-	10000
TR600-160-2	-	600	3000

* Applies to all products that share the same prefix.

Resistance sorted and binned

TR devices are available resistance sorted and resistance binned.

Resistance sorted devices

Resistance sorted devices (part number suffix "Rx") are supplied with resistance values that are within specified limits of the product's full range of resistance.

Feature

- Tighter resistance limits.

Benefits

- Tighter resistance ranges offer greater flexibility for design engineers:
  - Lower resistance range devices allow designers a tighter resistance budget which can allow for increased loop length on line card designs.
  - Higher resistance range parts may allow the designer to adjust line resistance while still meeting total resistance requirements.

Resistance binned devices

Resistance binned devices are supplied such that all parts in one package are within 0.5 Ω of each other (1.0Ω for 080T devices). Individual binned packages are supplied from the full resistance limits of the specified product.

Feature

- Tighter resistance balance between any two parts in a package.

Benefit

- Resistance binned devices provide tighter tolerance parts on a tip-ring line pair. This reduces the tip-ring resistance differential, limiting the possibility of line imbalance.

Part numbering system

T☐ ☐☐☐-☐☐☐ ☐

- Blank = Bulk packaged
- U = Unencapsulated part*
- S = Straight leads*
- 2 = Tape and reel
- Bxx = Resistance sorted in bins of xx Ω
- T = Improved resistance stability*
- Rx = Resistance sorted

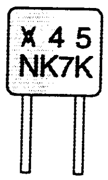
Hold current (mA)

Maximum interrupt voltage rating (V)

- R = Radial-leaded parts
- C = Chips**

*Available for TR250 series only.
**Some products are available in chip form factor in the TC and TGC product lines. Contact your Raychem representative for product information.

Part marking system



Example

Part marking for TR250

X - ☐☐

- ☐☐ — Part ID
- X — Raychem symbol

☐☐☐☐ — Lot number/Date code

Part description	Part ID
New TR250-080T/080U	08*
TR250-110	10
TR250-120/120U	20
TR250-120T/120UT	20
TR250-145/145U	45
New TR250-180U	80

*Production lots of TR250-080 series made prior to July 1, 1998 were marked as "80". To distinguish between the TR250-080 devices and TR250-180U devices note that TR250-080 devices have a round chip geometry.

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Part marking system

Part marking for TR600