Applications

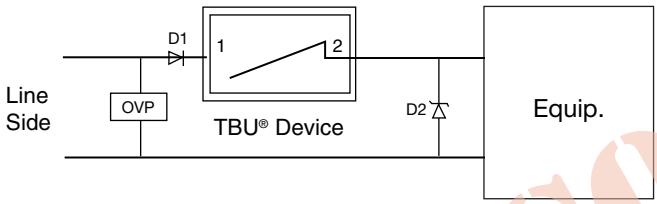
- Set top box LNB ports
- Protection modules and dongles
- Process control equipment
- Test and measurement equipment
- General electronics

Electrical Characteristics (@ T_A = 25 °C Unless Otherwise Noted)

Symbol	Parameter		Part Number	Min.	Typ.	Max.	Unit
$I_{trigger}$	Current required for the device to go from operating state to protected state		TBU-KExxx-050-WH TBU-KExxx-100-WH TBU-KExxx-200-WH TBU-KExxx-300-WH TBU-KExxx-500-WH	50 100 200 300 500	75 150 300 450 750	100 200 400 600 1000	mA
R_{device}	Series resistance of the TBU® device	V_{imp} = 250 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 250 V $I_{trigger}$ (min.) = 500 mA	TBU-KE025-050-WH TBU-KE025-100-WH TBU-KE025-200-WH TBU-KE025-300-WH TBU-KE025-500-WH		12.5 6.3 3.4 2.4 1.8	14.6 7.5 4.1 3.1 2.3	Ω
		V_{imp} = 400 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 400 V $I_{trigger}$ (min.) = 500 mA	TBU-KE040-050-WH TBU-KE040-100-WH TBU-KE040-200-WH TBU-KE040-300-WH TBU-KE040-500-WH		13.0 6.8 3.9 3.0 2.3	15.2 8.1 4.7 3.7 2.9	
		V_{imp} = 500 V $I_{trigger}$ (min.) = 50 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 100 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 200 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 300 mA V_{imp} = 500 V $I_{trigger}$ (min.) = 500 mA	TBU-KE050-050-WH TBU-KE050-100-WH TBU-KE050-200-WH TBU-KE050-300-WH TBU-KE050-500-WH		13.7 7.5 4.6 3.6 3.0	16.0 8.9 5.5 4.5 3.6	
t_{block}	Time for the device to go from normal operating state to protected state					1	µs
I_Q	Current through the triggered TBU® device with 50 Vdc circuit voltage			0.25	0.50	1.00	mA
V_{reset}	Voltage below which the triggered TBU® device will transition to normal operating state			10	14	18	V
$R_{th(j-l)}$	Junction to package pads - FR4 using recommended pad layout				116		°C/W
$R_{th(j-l)}$	Junction to package pads - FR4 using heat sink on board (6 cm^2)				96		°C/W

Reference Application

The TBU® device can be used to protect against excessive voltage surges in DC biased equipment, as shown in the figure below. Diode D1 prevents reverse voltage surges from damaging the equipment, and the TBU® protector prevents any positive surges from causing damage. An overvoltage protection device, such as an MOV, may be used to provide additional overvoltage protection if the surge voltage is likely to be above the maximum rating of the TBU® device. D1 reverse voltage rating should be greater than that of the OVP device at the maximum surge current level. Typically, a 1N4007 is a suitable choice. D2 should be chosen to be above the normal working voltage of the protected device, but below its absolute maximum rating.



Basic TBU Operation

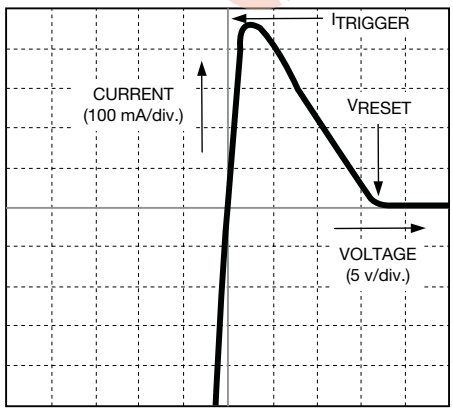
The TBU® device is a silicon-based, solid-state, resettable device which is placed in series with a signal path. The TBU® device operates in approximately 1 μs - once line current exceeds the TBU® device's trigger current $I_{trigger}$. When operated, the TBU® device restricts line current to less than 1 mA typically. When operated, the TBU® device will block all system voltages and any other voltages including the surge up to rated limits.

After the surge, the TBU® device resets when the voltage across the TBU® device falls to the V_{reset} level. The TBU® device will automatically reset on lines which have no DC bias or have DC bias below V_{reset} (such as unpowered signal lines).

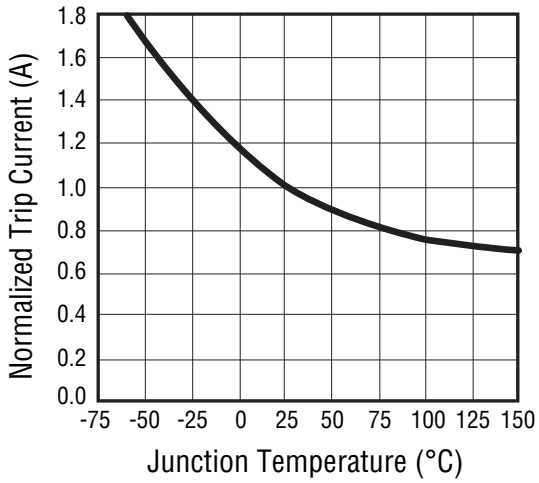
If the line has a normal DC bias above V_{reset}, the voltage across the TBU® device may not fall below V_{reset} after the surge. In such cases, special care needs to be taken to ensure that the TBU® device will reset, otherwise an automatic or manual power down will be required. Bourns application engineers can provide further assistance.

Performance Graphs

V-I Characteristic - TBU-KE050-300-WH (Pin 2-1)

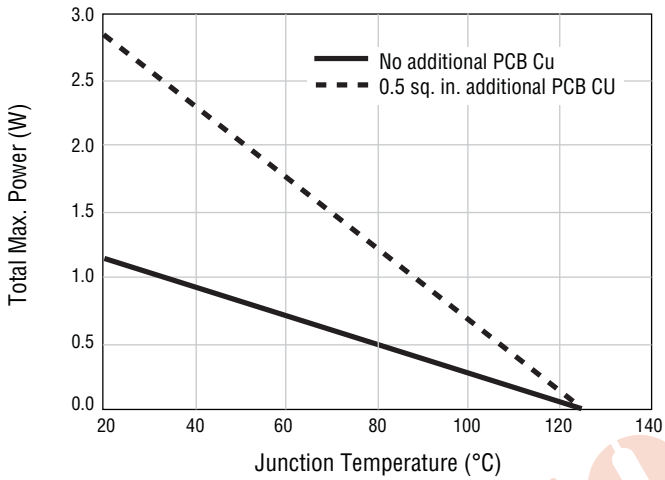


Typical Trigger Current vs. Temperature

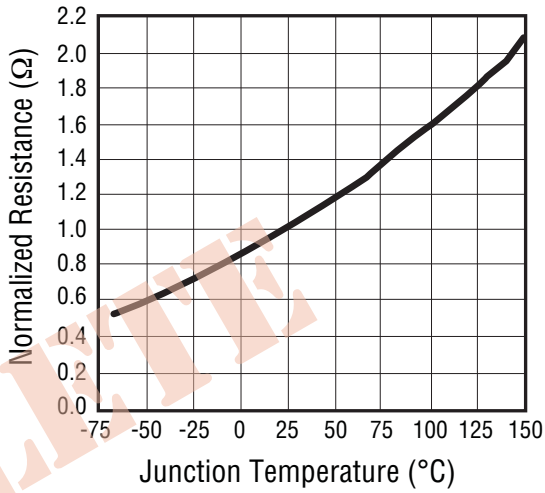


Performance Graphs (Continued)

Power Derating Curve

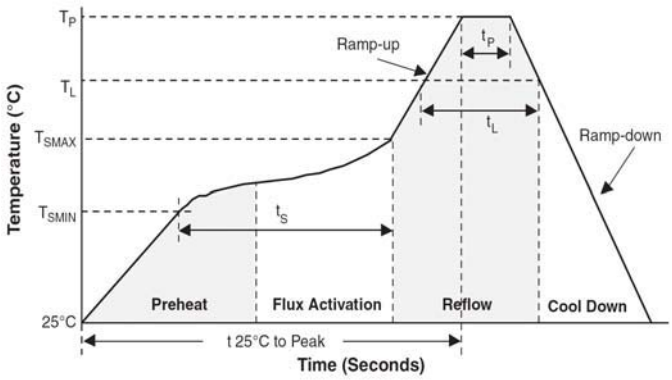


Typical Resistance vs. Temperature

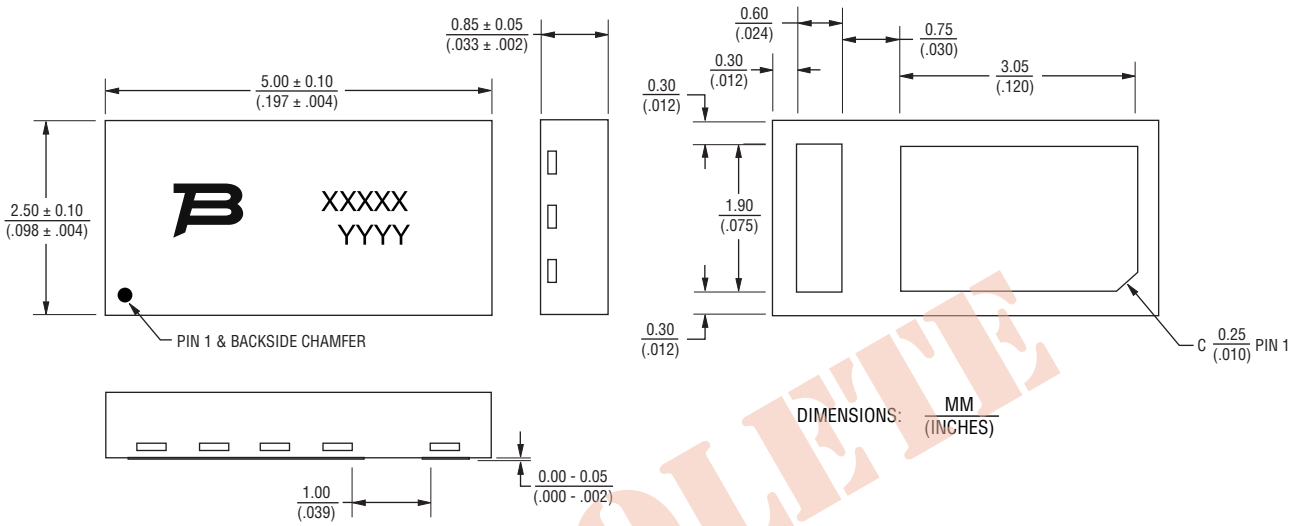


Reflow Profile

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (Tsmax to Tp)	3 °C/sec. max.
Preheat - Temperature Min. (Tsmin) - Temperature Max. (Tsmax) - Time (tsmin to tsmax)	 150 °C 200 °C 60-180 sec.
Time maintained above: - Temperature (TL) - Time (tL)	 217 °C 60-150 sec.
Peak/Classification Temperature (Tp)	260 °C
Time within 5 °C of Actual Peak Temp. (tp)	20-40 sec.
Ramp-Down Rate	6 °C/sec. max.
Time 25 °C to Peak Temperature	8 min. max.

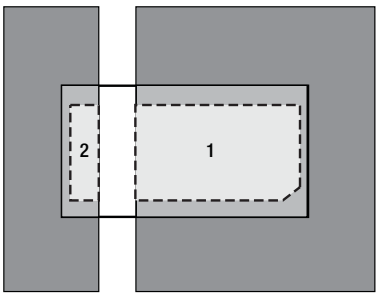


Product Dimensions



Recommended Pad Layout

TBU® High-Speed Protectors have a 100 % matte-tin termination finish. For improved thermal dissipation, the recommended layout uses PCB copper areas which extend beyond the exposed solder pad. The exposed solder pads should be defined by a solder mask which matches the pad layout of the TBU® device in size and spacing. It is recommended that they should be the same dimension as the TBU® pads but if smaller solder pads are used, they should be centered on the TBU® package terminal pads and not more than 0.10-0.12 mm (0.004-0.005 in.) smaller in overall width or length. Solder pad areas should not be larger than the TBU® pad sizes to ensure adequate clearance is maintained. The recommended stencil thickness is 0.10-0.12 mm (0.004-0.005 in.) with a stencil opening size 0.025 mm (0.0010 in.) less than the solder pad size. Extended copper areas beyond the solder pad significantly improve the junction to ambient thermal resistance, resulting in operation at lower junction temperatures with a corresponding benefit of reliability. All pads should soldered to the PCB, including pads marked as NC or NU but no electrical connection should be made to these pads. For minimum parasitic capacitance, it is recommended that signal, ground or power signals are not routed beneath any pad.

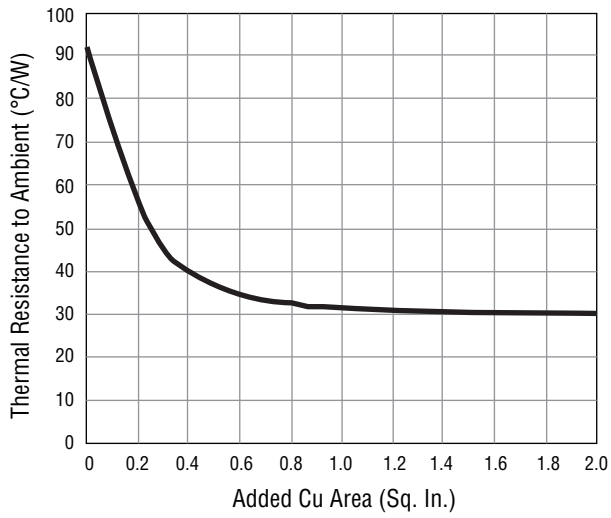


Dark grey areas show added PCB copper area for better thermal resistance.

Pad Designation

Pad #	Pin Out
1	Line Side
2	Load Side

Thermal Resistance vs. Additional PCB Cu Area



TBU-KE Series - TBU® High-Speed Protectors

BOURNS®

How to Order

TBU - KE 025 - 500 - WH

TBU® Product

Series
KE = Uni-Series

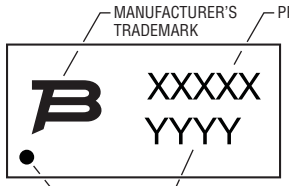
Impulse Voltage Rating
025 = 250 V
040 = 400 V
050 = 500 V

Trigger Current
050 = 50 mA
100 = 100 mA
200 = 200 mA
300 = 300 mA
500 = 500 mA

Hold to Trip Ratio Suffix
W = Hold to Trip Ratio

Package Suffix
H = DFN Package

Typical Part Marking

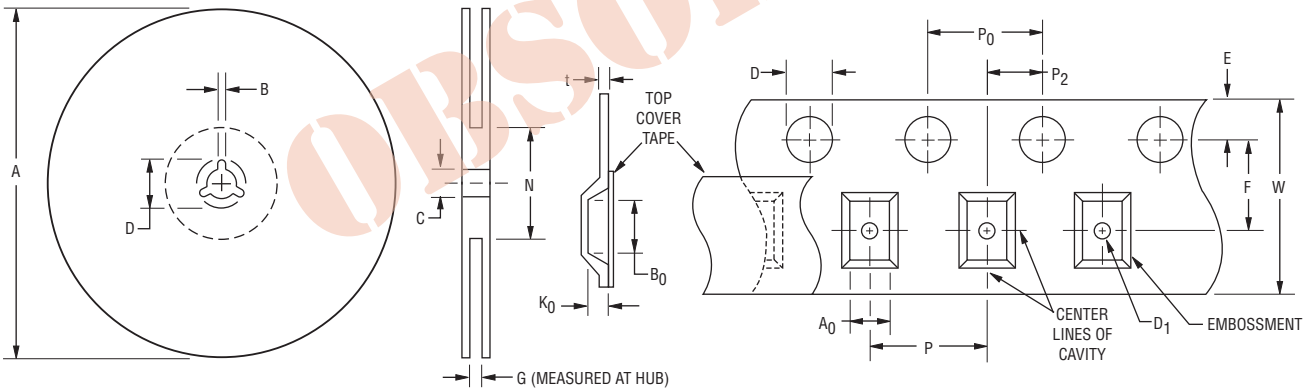


- 1ST & 2ND DIGITS INDICATE PRODUCT FAMILY:
  E = TBU-KE SERIES
- 2ND & 3RD DIGITS INDICATE IMPULSE VOLTAGE:
  25 = 250 V 40 = 400 V 50 = 500 V
- 4TH & 5TH DIGITS INDICATE TRIGGER CURRENT:
  05 = 50 mA 10 = 100 mA 20 = 200 mA
  30 = 300 mA 50 = 500 mA

- 1ST DIGIT INDICATES THE YEAR'S 6-MONTH PERIOD.
- 2ND DIGIT INDICATES THE WEEK NUMBER IN THE 6-MONTH PERIOD.
- 3RD & 4TH DIGITS INDICATE SPECIFIC LOT FOR THE WEEK.

6-MONTH PERIOD CODES:
A = JAN-JUN 2009 C = JAN-JUN 2010 E = JAN-JUN 2011
B = JUL-DEC 2009 D = JUL-DEC 2010 F = JUL-DEC 2011

Packaging Specifications



QUANTITY: 3000 PIECES PER REEL

A		B		C		D		G	N
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Ref.	Ref.
176 (6.929)	178 (7.008)	1.5 (.059)	2.5 (.098)	12.8 (.504)	13.5 (.531)	20.2 (.795)	-	16.5 (.650)	102 (4.016)

A_0		B_0		D		D_1		E		F	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	max.
2.8 (.110)	3.0 (.118)	5.4 (.212)	5.6 (.220)	1.5 (.059)	1.6 (.063)	1.5 (.059)	-	1.65 (.065)	1.85 (.073)	5.45 (.214)	5.55 (.218)
K_0		P		P_0		P_2		t		W	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1.1 (.043)	1.3 (.051)	3.8 (.150)	4.2 (.165)	3.8 (.150)	4.2 (.165)	1.95 (.077)	2.05 (.081)	0.25 (.010)	0.35 (.014)	11.7 (.461)	12.3 (.484)

DIMENSIONS: MM (INCHES)

REV. 04/15