


## Features

- Superior circuit protection
- Overcurrent and overvoltage protection
- Blocks surges up to rated limits
- High speed performance
- Small SMT package
- Agency recognition: 

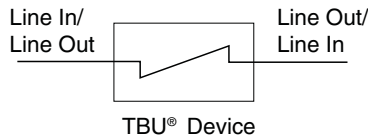
## Applications

- Voice / VDSL cards
- Protection modules and dongles
- Process control equipment
- Test and measurement equipment
- General electronics

# TBU-CA Series - TBU® High Speed Protectors

### General Information

The TBU-CA Series of Bourns® TBU® products are low capacitance single bidirectional high speed protection components, constructed using MOSFET semiconductor technology, and designed to protect against faults caused by short circuits, AC power cross, induction and lightning surges.



### Agency Approval

Description	
UL	File Number: E315805

The TBU® high speed protector placed in the system circuit will monitor the current with the MOSFET detection circuit triggering to provide an effective barrier behind which sensitive electronics will not be exposed to large voltages or currents during surge events. The TBU® device is provided in a surface mount DFN package and meets industry standard requirements such as RoHS and Pb Free solder reflow profiles.

### Absolute Maximum Ratings (@ T<sub>A</sub> = 25 °C Unless Otherwise Noted)

Symbol	Parameter	Part Number	Value	Unit
V <sub>imp</sub>	Peak impulse voltage withstand with duration less than 10 ms	TBU-CA025-xxx-WH	250	V
		TBU-CA040-xxx-WH	400	
		TBU-CA050-xxx-WH	500	
		TBU-CA065-xxx-WH	650	
		TBU-CA085-xxx-WH	850	
V <sub>rms</sub>	Continuous A.C. RMS voltage	TBU-CA025-xxx-WH	100	V
		TBU-CA040-xxx-WH	200	
		TBU-CA050-xxx-WH	250	
		TBU-CA065-xxx-WH	300	
		TBU-CA085-xxx-WH	425	
T <sub>op</sub>	Operating temperature range		-40 to +125	°C
T <sub>stg</sub>	Storage temperature range		-65 to +150	°C
T <sub>jmax</sub>	Maximum Junction Temperature		+125	°C
ESD	HBM ESD protection per IEC 61000-4-2		±2	kV

## BOURNS®

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# TBU-CA Series - TBU® High Speed Protectors

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## Electrical Characteristics (@ T<sub>A</sub> = 25 °C Unless Otherwise Noted)

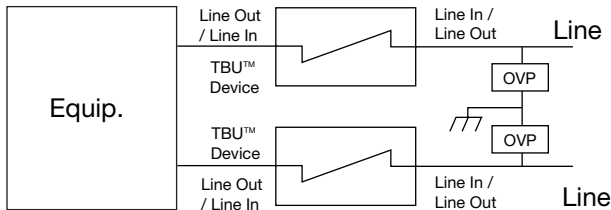
Symbol	Parameter	Part Number	Min.	Typ.	Max.	Unit			
I <sub>trigger</sub>	Current required for the device to go from operating state to protected state	TBU-CAxxx-050-WH	50	75	100	mA			
		TBU-CAxxx-100-WH	100	150	200				
		TBU-CAxxx-200-WH	200	300	400				
		TBU-CAxxx-300-WH	300	450	600				
		TBU-CAxxx-500-WH	500	750	1000				
R <sub>device</sub>	Series resistance of the TBU device	V <sub>imp</sub> = 250 V I <sub>trigger</sub> (min.) = 50 mA	TBU-CA025-050-WH		13.3	15.3	Ω		
		V <sub>imp</sub> = 250 V I <sub>trigger</sub> (min.) = 100 mA	TBU-CA025-100-WH		7.1	8.2			
		V <sub>imp</sub> = 250 V I <sub>trigger</sub> (min.) = 200 mA	TBU-CA025-200-WH		4.2	4.8			
		V <sub>imp</sub> = 250 V I <sub>trigger</sub> (min.) = 300 mA	TBU-CA025-300-WH		3.2	3.8			
		V <sub>imp</sub> = 250 V I <sub>trigger</sub> (min.) = 500 mA	TBU-CA025-500-WH		2.6	3.0			
		V <sub>imp</sub> = 400 V I <sub>trigger</sub> (min.) = 50 mA	TBU-CA040-050-WH		14.3	16.5			
		V <sub>imp</sub> = 400 V I <sub>trigger</sub> (min.) = 100 mA	TBU-CA040-100-WH		8.1	9.4			
		V <sub>imp</sub> = 400 V I <sub>trigger</sub> (min.) = 200 mA	TBU-CA040-200-WH		5.2	6.0			
		V <sub>imp</sub> = 400 V I <sub>trigger</sub> (min.) = 300 mA	TBU-CA040-300-WH		4.3	5.0			
		V <sub>imp</sub> = 400 V I <sub>trigger</sub> (min.) = 500 mA	TBU-CA040-500-WH		3.6	4.2			
		V <sub>imp</sub> = 500 V I <sub>trigger</sub> (min.) = 50 mA	TBU-CA050-050-WH		15.7	18.0			
		V <sub>imp</sub> = 500 V I <sub>trigger</sub> (min.) = 100 mA	TBU-CA050-100-WH		9.5	10.9			
		V <sub>imp</sub> = 500 V I <sub>trigger</sub> (min.) = 200 mA	TBU-CA050-200-WH		6.6	7.5			
		V <sub>imp</sub> = 500 V I <sub>trigger</sub> (min.) = 300 mA	TBU-CA050-300-WH		5.6	6.5			
		V <sub>imp</sub> = 500 V I <sub>trigger</sub> (min.) = 500 mA	TBU-CA050-500-WH		5.0	5.7			
		V <sub>imp</sub> = 650 V I <sub>trigger</sub> (min.) = 50 mA	TBU-CA065-050-WH		17.7	20.3			
		V <sub>imp</sub> = 650 V I <sub>trigger</sub> (min.) = 100 mA	TBU-CA065-100-WH		11.5	13.2			
		V <sub>imp</sub> = 650 V I <sub>trigger</sub> (min.) = 200 mA	TBU-CA065-200-WH		8.6	9.8			
		V <sub>imp</sub> = 650 V I <sub>trigger</sub> (min.) = 300 mA	TBU-CA065-300-WH		7.6	8.8			
		V <sub>imp</sub> = 650 V I <sub>trigger</sub> (min.) = 500 mA	TBU-CA065-500-WH		7.0	8.0			
		V <sub>imp</sub> = 850 V I <sub>trigger</sub> (min.) = 50 mA	TBU-CA085-050-WH		21.4	24.5			
		V <sub>imp</sub> = 850 V I <sub>trigger</sub> (min.) = 100 mA	TBU-CA085-100-WH		15.2	17.4			
		V <sub>imp</sub> = 850 V I <sub>trigger</sub> (min.) = 200 mA	TBU-CA085-200-WH		12.3	14.0			
		V <sub>imp</sub> = 850 V I <sub>trigger</sub> (min.) = 300 mA	TBU-CA085-300-WH		11.3	13.0			
		V <sub>imp</sub> = 850 V I <sub>trigger</sub> (min.) = 500 mA	TBU-CA085-500-WH		10.7	12.2			
		t <sub>block</sub>	Time for the device to go from normal operating state to protected state					1	μs
		I <sub>Q</sub>	Current through the triggered TBU® device with 50 Vdc circuit voltage		0.25	0.50		1.00	mA
		V <sub>reset</sub>	Voltage below which the triggered TBU® device will transition to normal operating state		12	16		20	V
		R <sub>th(j-l)</sub>	Junction to package pads - FR4 using recommended pad layout			98			°C/W
		R <sub>th(j-l)</sub>	Junction to package pads - FR4 using heat sink on board (6 cm <sup>2</sup> ) (1 in <sup>2</sup> )			40			°C/W

# TBU-CA Series - TBU<sup>®</sup> High Speed Protectors

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## Reference Application

The TBU<sup>®</sup> devices are general use protectors used in a wide variety of applications. The maximum voltage rating of the TBU<sup>®</sup> device should never be exceeded. Where necessary, an OVP should be employed to limit the maximum voltage. A cost-effective protection solution combines Bourns<sup>®</sup> TBU<sup>®</sup> protection devices with a pair of Bourns<sup>®</sup> MOVs. For bandwidth sensitive applications, a Bourns<sup>®</sup> GDT may be substituted for the MOV.



## Basic TBU Operation

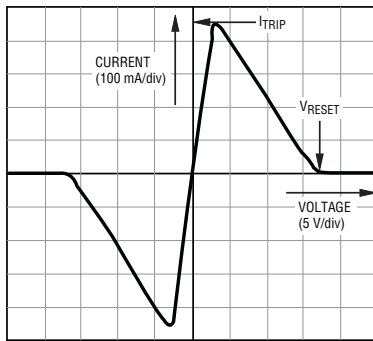
The TBU<sup>®</sup> device, constructed using MOSFET semiconductor technology, placed in the system circuit will monitor the current with the MOSFET detection circuit triggering to provide an effective barrier behind which sensitive electronics are not exposed to large voltages or currents during surge events. The TBU<sup>®</sup> device operates in approximately 1  $\mu$ s - once line current exceeds the TBU<sup>®</sup> device's trigger current  $I_{TRIP}$ . When operated, the TBU<sup>®</sup> device restricts line current to less than 1 mA typically. When operated, the TBU<sup>®</sup> device will block all voltages including the surge up to rated limits.

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

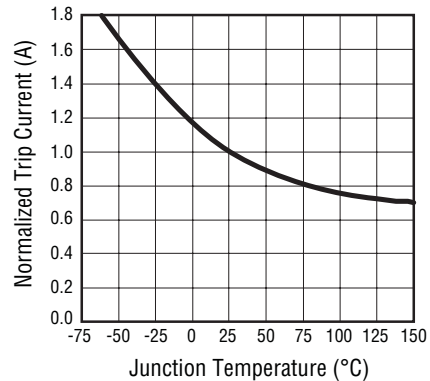
If the line has a normal DC bias above  $V_{RESET}$ , the voltage across the TBU<sup>®</sup> device may not fall below  $V_{RESET}$  after the surge. In such cases, special care needs to be taken to ensure that the TBU<sup>®</sup> device will reset, with software monitoring as one method used to accomplish this. Bourns application engineers can provide further assistance.

## Performance Graphs

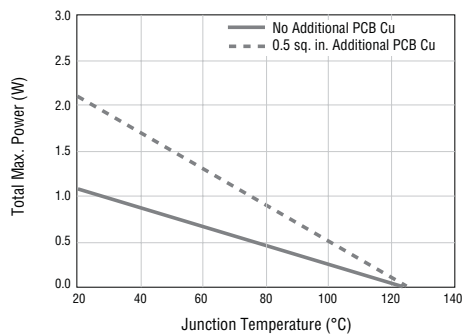
### Typical V-I Characteristics (TBU-CA050-300-WH)



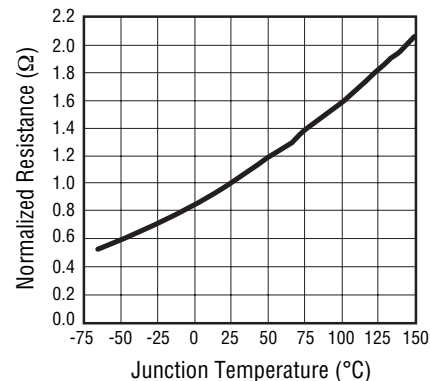
### Typical Trip Current vs. Temperature



### Power Derating Curve

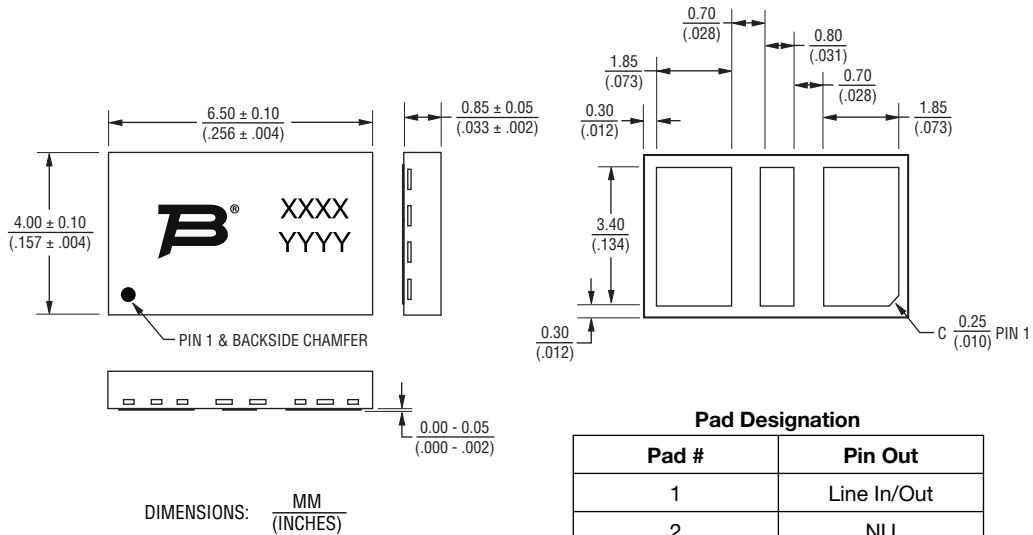


### Typical Resistance vs. Temperature



Specifications are subject to change without notice. Customers should verify actual device performance in their specific applications.

## Product Dimensions

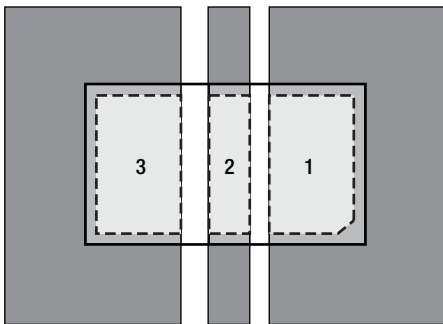


Pad Designation

Pad #	Pin Out
1	Line In/Out
2	NU
3	Line Out/In

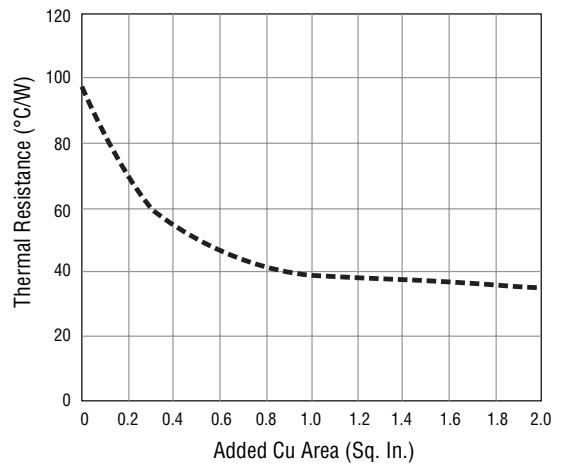
## Recommended Pad Layout

TBU® protectors have matte-tin termination finish. The suggested layout should use Non-Solder Mask Define (NSMD). The recommended stencil thickness is 0.10-0.12 mm (.004-.005 in.) with a stencil opening size 0.025 mm (.0010 in.) less than the device pad size. As when heat sinking any power device, it is recommended that wherever possible, extra PCB copper area is allowed. For minimum parasitic capacitance, do not allow any signal, ground or power signals beneath any of the pads of the device.



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

## Thermal Resistance vs Additional PCB Cu Area

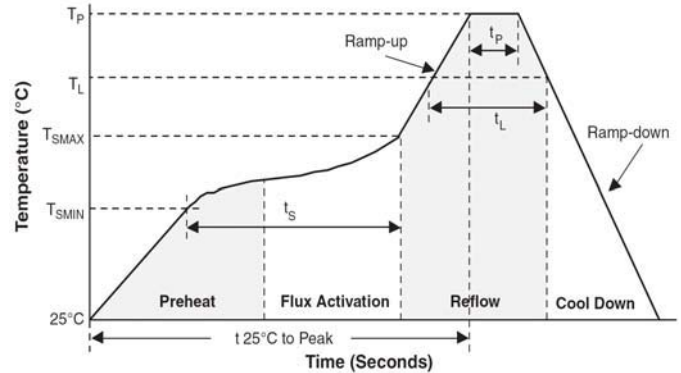


# TBU-CA Series - TBU® High Speed Protectors

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## Reflow Profile

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (T <sub>smax</sub> to T <sub>p</sub> )	3 °C/sec. max.
Preheat <ul style="list-style-type: none"> <li>- Temperature Min. (T<sub>smin</sub>)</li> <li>- Temperature Max. (T<sub>smax</sub>)</li> <li>- Time (t<sub>smin</sub> to t<sub>smax</sub>)</li> </ul>	150 °C 200 °C 60-180 sec.
Time maintained above: <ul style="list-style-type: none"> <li>- Temperature (T<sub>L</sub>)</li> <li>- Time (t<sub>L</sub>)</li> </ul>	217 °C 60-150 sec.
Peak/Classification Temperature (T <sub>p</sub> )	260 °C
Time within 5 °C of Actual Peak Temp. (t <sub>p</sub> )	20-40 sec.
Ramp-Down Rate	6 °C/sec. max.
Time 25 °C to Peak Temperature	8 min. max.



## How to Order

**TBU - CA 085 - 500 - WH**

TBU® Product	_____	_____	_____	_____
Series	_____	_____	_____	_____
CA = Bi-Series				
Impulse Voltage Rating	_____	_____	_____	_____
025 = 250 V				
040 = 400 V				
050 = 500 V				
065 = 650 V				
085 = 850 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

**MANUFACTURER'S TRADEMARK**      **PRODUCT CODE**

**B**®      XXXXX  
              YYYY

**PIN 1**

**MANUFACTURING DATE CODE**

- 1ST DIGIT INDICATES PRODUCT FAMILY:  
A = TBU-CA SERIES
- 2ND & 3RD DIGITS INDICATE IMPULSE VOLTAGE:  
25 = 250 V    40 = 400 V    50 = 500 V  
65 = 650 V    85 = 850 V
- 4TH & 5TH DIGITS INDICATE TRIGGER CURRENT:  
05 = 50 mA    10 = 100 mA    20 = 200 mA  
30 = 300 mA    50 = 500 mA

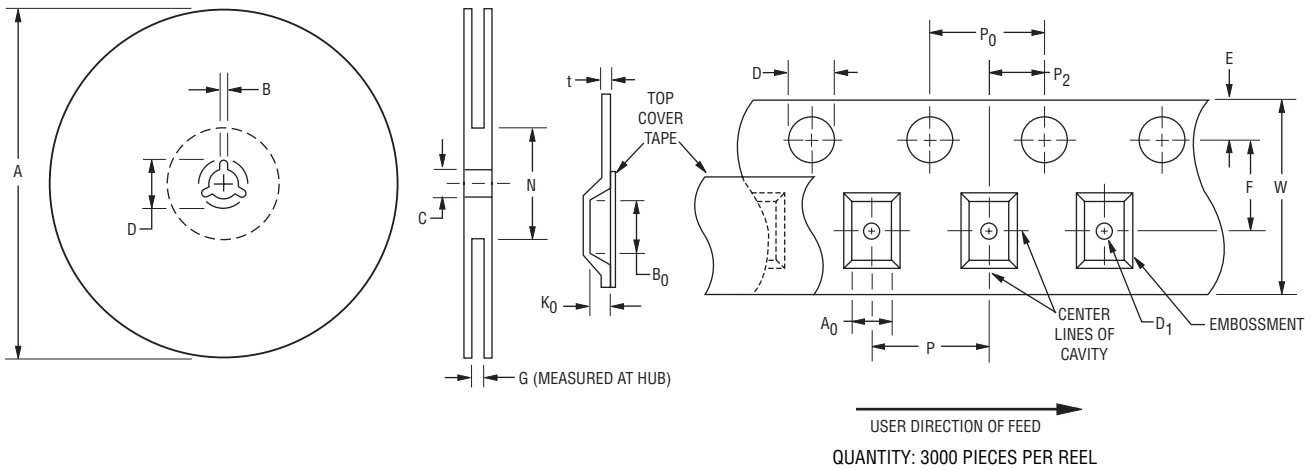
**6-MONTH PERIOD CODES:**  
 A = JAN-JUN 2009    C = JAN-JUN 2010    E = JAN-JUN 2011  
 B = JUL-DEC 2009    D = JUL-DEC 2010    F = JUL-DEC 2011

Specifications are subject to change without notice.  
 Customers should verify actual device performance in their specific applications.

# TBU-CA Series - TBU® High Speed Protectors

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## Packaging Specifications



A		B		C		D		G	N
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Ref.	Ref.
326	330	1.5	2.5	12.8	13.5	20.2	-	16.5	102
(12.835)	(13.002)	(.059)	(.098)	(.504)	(.531)	(.795)		(.650)	(4.016)

A0		B0		D		D1		E		F	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4.3	4.5	6.7	6.9	1.5	1.6	1.5	-	1.65	1.85	7.4	7.6
(.169)	(.177)	(.264)	(.272)	(.059)	(.063)	(.059)		(.065)	(.073)	(.291)	(.299)
K0		P		P0		P2		t		W	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1.0	1.2	7.9	8.1	3.9	4.1	1.9	2.1	0.25	0.35	15.7	16.3
(.039)	(.047)	(.311)	(.319)	(.159)	(.161)	(.075)	(.083)	(.010)	(.014)	(.618)	(.642)

DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$