



## Features

- Extremely high speed performance
- Blocks high voltages and currents
- Two TBU® protectors in one small package
- Simple, superior circuit protection
- Minimal PCB area
- RoHS compliant\* , UL Recognized

Bourns® Model P500-G and P850-G Series TBU® HSPs are not recommended for POTS applications. This series is suited for applications requiring a dual bidirectional device where 50 ohms of series resistance is acceptable. For new SLIC applications, we recommend that customers evaluate our [TBU-PL Series](#).

## P500-G and P850-G Series Dual TBU® High-Speed Protectors

### Transient Blocking Units - TBU® Devices

Bourns® Model P500-G and P850-G TBU® products are dual high-speed bidirectional protection components, constructed using MOSFET semiconductor technology, designed to protect against faults caused by short circuits, AC power cross, induction and lightning surges.

The TBU® high speed protector, triggering as a function of the MOSFET, blocks surges and provides an effective barrier behind which sensitive electronics are not 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.

### Agency Approval

UL recognized component File # E315805.

### Industry Standards

		Description	Model
Telcordia	GR-1089	Port Type 2, 4	P500-G
		Port Type 3, 5	P850-G
ITU-T	K.20, K.20E, K.21, K.21E, K.45		P850-G

### Absolute Maximum Ratings (T<sub>amb</sub> = 25 °C)

Symbol	Parameter		Value	Unit
V <sub>imp</sub>	Maximum protection voltage for impulse faults with rise time ≥ 1 μsec	P500-Gxxx-WH P850-Gxxx-WH	500 850	V
V <sub>rms</sub>	Maximum protection voltage for continuous V <sub>rms</sub> faults	P500-Gxxx-WH P850-Gxxx-WH	300 425	V
T <sub>op</sub>	Operating temperature range		-40 to +85	°C
T <sub>stg</sub>	Storage temperature range		-65 to +150	°C

### Electrical Characteristics (T<sub>amb</sub> = 25 °C)

Symbol	Parameter		Min.	Typ.	Max.	Unit
I <sub>op</sub>	Maximum current through the device that will not cause current blocking	P500-G120-WH P500-G200-WH P850-G120-WH P850-G200-WH			100 200 100 200	mA
I <sub>trigger</sub>	Typical current for the device to go from normal operating state to protected state	P500-G120-WH P500-G200-WH P850-G120-WH P850-G200-WH		150 275 150 275		mA
I <sub>out</sub>	Maximum current through the device	P500-G120-WH P500-G200-WH P850-G120-WH P850-G200-WH			200 400 200 400	mA
R <sub>device</sub>	Series resistance of the TBU® device			50	55	Ω
R <sub>bal</sub>	Line-to line series resistance difference between two TBU® devices				2	Ω
t <sub>block</sub>	Maximum time for the device to go from normal operating state to protected state				1	μs
I <sub>quiescent</sub>	Current through the triggered TBU® device with 50 Vdc circuit voltage			0.7		mA
V <sub>reset</sub>	Voltage below which the triggered TBU® device will transition to normal operating state			22		V

The P-G series TBU® devices are bidirectional; specifications are valid in both directions.

\*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011.

Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

## Applications

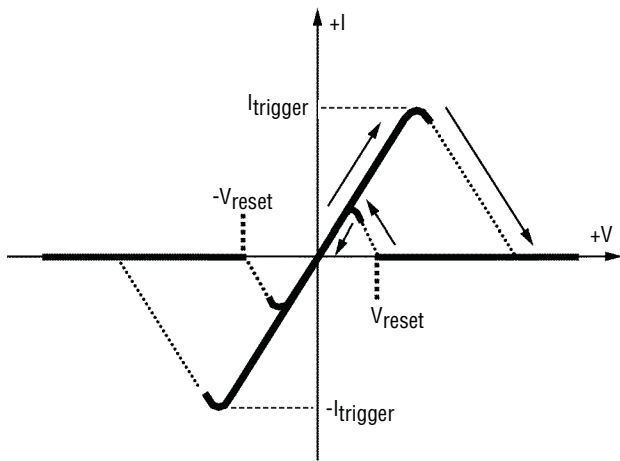
- Sensor protection
- Signal line protection

# P500-G and P850-G Series Dual TBU® High-Speed Protectors

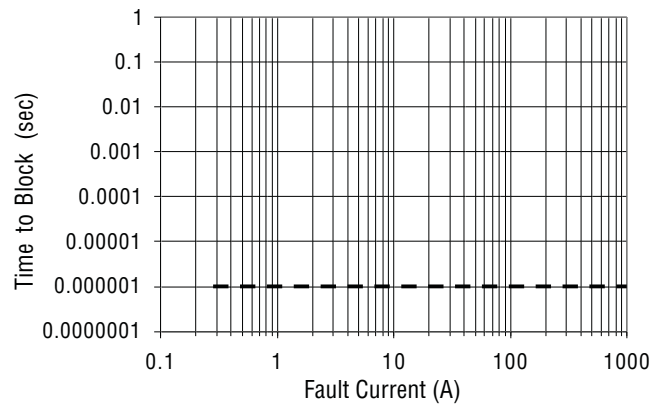
**BOURNS®**

### Typical Performance Characteristics

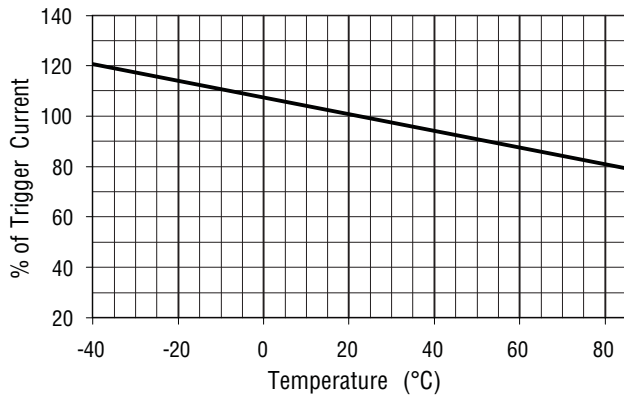
#### V-I Characteristics



#### Time to Block vs. Fault Current



#### Trigger Current Temperature



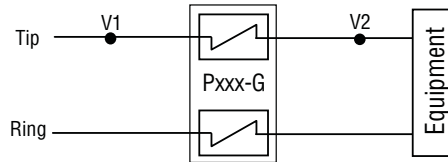
# P500-G and P850-G Series Dual TBU® High-Speed Protectors



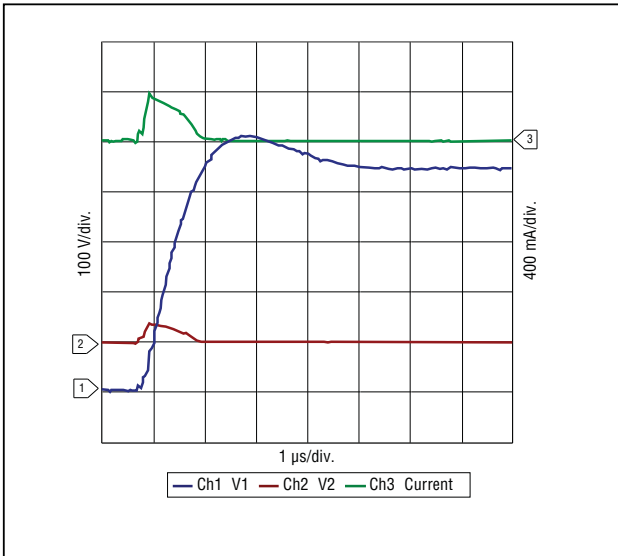
## Operational Characteristics

The graphs below demonstrate the operational characteristics of the TBU® device. For each graph the fault voltage, protected side voltage, and current is presented.

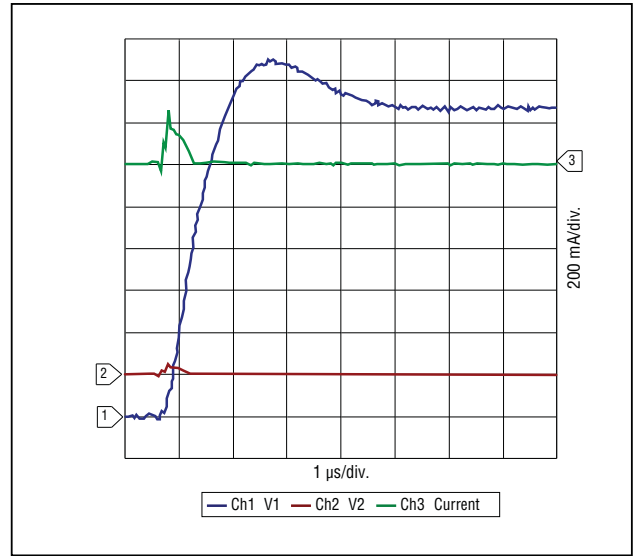
TEST CONFIGURATION DIAGRAM



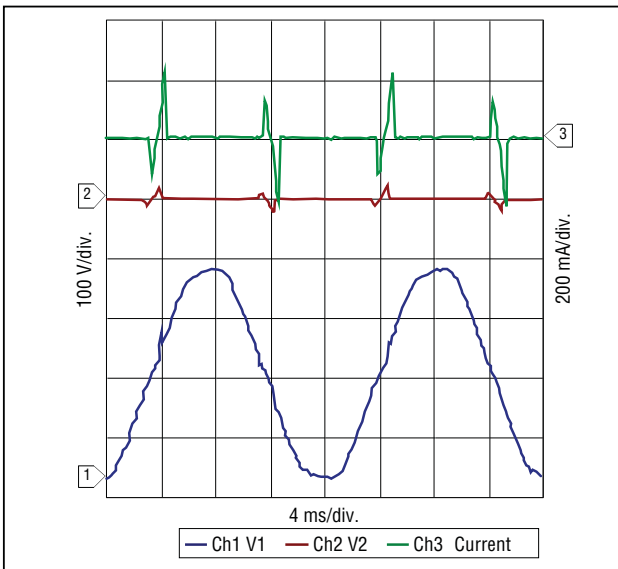
### P500-G Lightning, 500 V



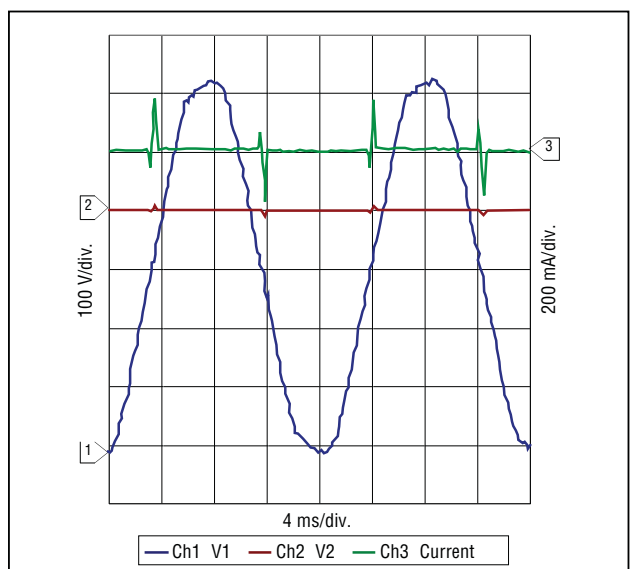
### P850-G Lightning, 850 V



### P500-G Power Fault, 120 Vrms, 25 A



### P850-G Power Fault, 230 Vrms, 25 A



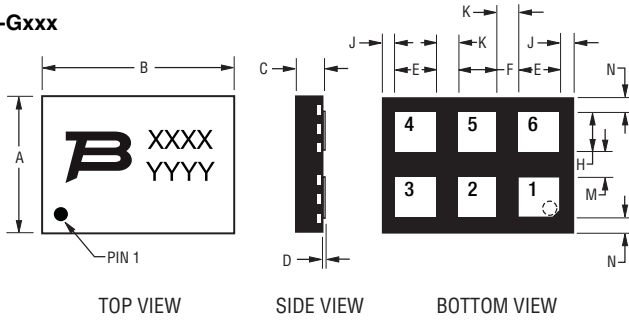
Specifications are subject to change without notice. The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

# P500-G and P850-G Series Dual TBU® High-Speed Protectors

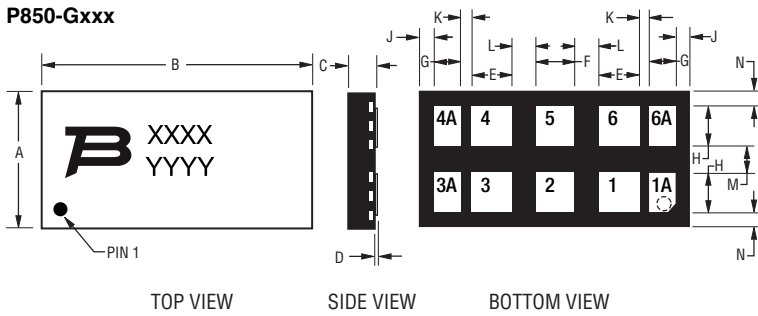
**BOURNS®**

## Product Dimensions

### P500-Gxxx



### P850-Gxxx

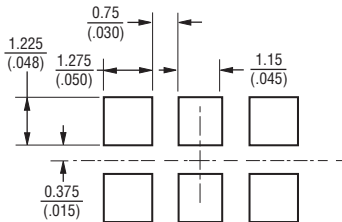


Pads 1A and 1 are internally connected; the same for pads 3A with 3, 4A with 4, and 6A with 6. This allows for one PCB layout to accommodate the P500 or P850.

Dim.	P500-G			P850-G		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	3.40 (.139)	4.00 (.157)	4.10 (.161)	3.40 (.139)	4.00 (.157)	4.10 (.161)
B	5.90 (.232)	6.00 (.236)	6.10 (.240)	8.15 (.321)	8.25 (.325)	8.35 (.329)
C	0.80 (.031)	0.85 (.033)	0.90 (.035)	0.80 (.031)	0.85 (.033)	0.90 (.035)
D	0.000 (.000)	0.025 (.001)	0.050 (.002)	0.000 (.000)	0.025 (.001)	0.050 (.002)
E	1.15 (.045)	1.25 (.049)	1.35 (.053)	1.15 (.045)	1.25 (.049)	1.35 (.053)
F	1.05 (.041)	1.15 (.045)	1.25 (.049)	1.05 (.041)	1.15 (.045)	1.25 (.049)
G	--	--	--	0.725 (.029)	0.825 (.032)	0.925 (.036)
H	1.10 (.043)	1.20 (.047)	1.30 (.051)	1.10 (.043)	1.20 (.047)	1.30 (.051)
J	0.375 (.015)	0.425 (.017)	0.475 (.019)	0.375 (.015)	0.425 (.017)	0.475 (.019)
K	0.70 (.028)	0.75 (.030)	0.80 (.031)	0.25 (.010)	0.30 (.012)	0.35 (.014)
L	--	--	--	0.70 (.028)	0.75 (.030)	0.80 (.031)
M	0.70 (.028)	0.75 (.030)	0.80 (.031)	0.70 (.028)	0.75 (.030)	0.80 (.031)
N	0.375 (.015)	0.425 (.017)	0.475 (.018)	0.375 (.015)	0.425 (.017)	0.475 (.018)

## Recommended Pad Layout

### P500-Gxxx

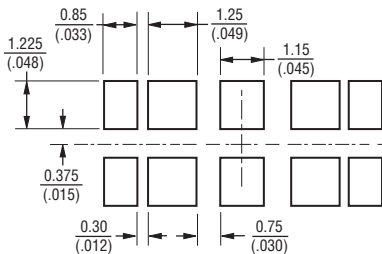


### Pad Designation

Pad #	Apply
1	Tip In
2	NC
3	Tip Out
4	Ring Out
5	NC
6	Ring In

NC = Solder to PCB; do not make electrical connection, do not connect to ground.

### P850-Gxxx



### Pad Designation

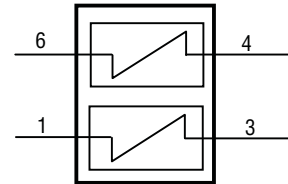
Pad #	Apply	Pad #	Apply
1A	Tip In	4A	Ring Out
1	Tip In	4	Ring Out
2	NC	5	NC
3	Tip Out	6	Ring In
3A	Tip Out	6A	Ring In

NC = Solder to PCB; do not make electrical connection, do not connect to ground.

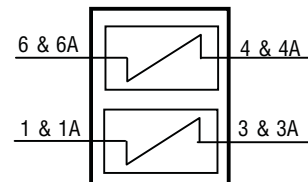
DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

## Block Diagram

### P500-Gxxx



### P850-Gxxx



TBU® devices have matte-tin termination finish. Suggested layout should use non-solder mask define (NSMD). Recommended stencil thickness is 0.10-0.12 mm (.004-.005 in.) with 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.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

Specifications are subject to change without notice.

# P500-G and P850-G Series Dual TBU® High-Speed Protectors

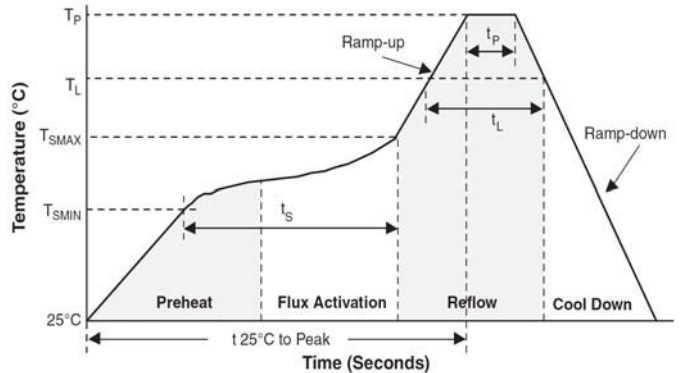
**BOURNS®**

## Thermal Resistances

Part #	Symbol	Parameter	Value	Unit
P500-G	R <sub>th(j-a)</sub>	Junction to leads (package)	113	°C/W
		Junction to leads (per TBU® device)	236	°C/W
P850-G	R <sub>th(j-a)</sub>	Junction to leads (package)	119	°C/W
		Junction to leads (per TBU® device)	215	°C/W

## 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.



Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

# P500-G and P850-G Series Dual TBU® High-Speed Protectors

# BOURNS®

## How to Order

**P 500 - G 120 - WH**

Form Factor \_\_\_\_\_  
 P = Two TBU® protectors in one device  
 Impulse Voltage Rating \_\_\_\_\_  
 500 = 500 V  
 850 = 850 V  
 Directional Indication for Paired Devices \_\_\_\_\_  
 G = Bidirectional  
 Iop Indicator \_\_\_\_\_  
 120 = 100 mA  
 200 = 200 mA

## Typical Part Marking

MANUFACTURER'S TRADEMARK\*  
 MARKING NUMBER  
 50GA = P500-G120-WH  
 50GB = P500-G200-WH  
 85GA = P850-G120-WH  
 85GB = P850-G200-WH

PIN 1

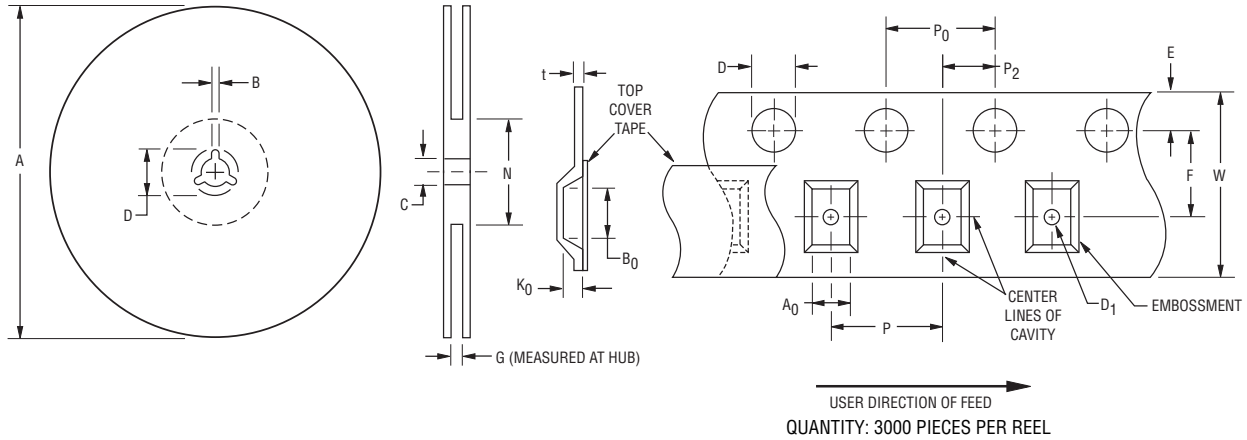
MANUFACTURING DATE CODE\*  
 - 1ST DIGIT INDICATES THE YEAR'S 6-MONTH PERIOD.  
 - 2ND DIGIT INDICATES THE WEEK NUMBER IN THE 6-MONTH PERIOD.  
 - 3RD & 4TH DIGITS INDICATE SPECIFIC LOT FOR THE WEEK.

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

EXAMPLE: ARBC  
 - 1ST DIGIT 'A' = JAN-JUN 2009  
 - 2ND DIGIT 'R' = WEEK 18; WEEK OF APRIL 27  
 - 3RD & 4TH DIGITS 'BC' = LOT SPECIFIC INFORMATION

\*TRANSITION FROM FULTEC TRADEMARK AND LOT CODE TO BOURNS TRADEMARK AND DATE CODE IN 2009.

## Packaging Specifications (per EIA468-B)



Device	A		B		C		D		G	N
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Ref.	Ref.
P500-G, P850-G	326 (12.835)	330.25 (13.002)	1.5 (.059)	2.5 (.098)	12.8 (.504)	13.5 (.531)	20.2 (.795)	-	16.5 (.650)	102 (4.016)

Device	A <sub>0</sub>		B <sub>0</sub>		D		D <sub>1</sub>		E		F	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
P500-G	4.2 (.165)	4.4 (.173)	6.2 (.244)	6.4 (.252)	1.5 (.059)	1.6 (.063)	1.5 (.059)	-	1.65 (.065)	1.85 (.073)	5.4 (.213)	5.6 (.220)
P850-G	4.2 (.165)	4.4 (.173)	8.45 (.333)	8.65 (.341)	1.5 (.059)	1.6 (.063)	1.5 (.059)	-	1.65 (.065)	1.85 (.073)	7.4 (.291)	7.6 (.299)

Device	K <sub>0</sub>		P		P <sub>0</sub>		P <sub>2</sub>		t		W	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
P500-G	1.0 (.039)	1.2 (.047)	7.9 (.311)	8.1 (.319)	3.9 (.159)	4.1 (.161)	1.9 (.075)	2.1 (.083)	0.25 (.010)	0.35 (.014)	11.7 (.461)	12.3 (.484)
P850-G	1.1 (.043)	1.3 (.051)	7.9 (.311)	8.1 (.319)	3.9 (.159)	4.1 (.161)	1.9 (.075)	2.1 (.083)	0.25 (.010)	0.35 (.014)	15.7 (.618)	16.3 (.642)

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

Specifications are subject to change without notice. The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

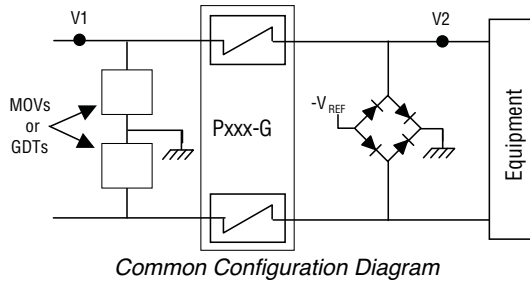
# P500-G and P850-G Series Dual TBU® High-Speed Protectors



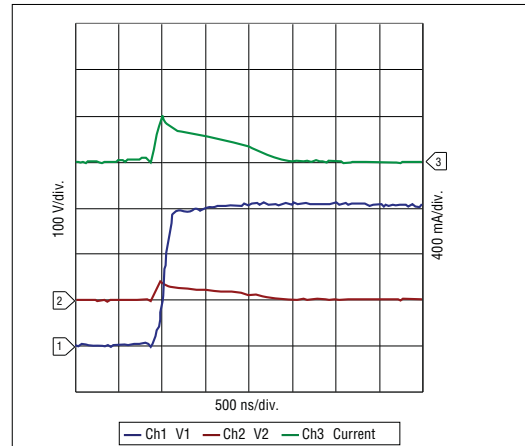
## Reference Designs

A cost-effective protection solution combines the Bourns® TBU® protection device with a pair of MOVs or Bourns® GDTs and a diode bridge. The diagram below illustrates a common configuration of these components. The graphs to the right demonstrate the operational characteristics of the circuit.

For new SLIC applications, we recommend that customers evaluate our new **TBU-PL series**.

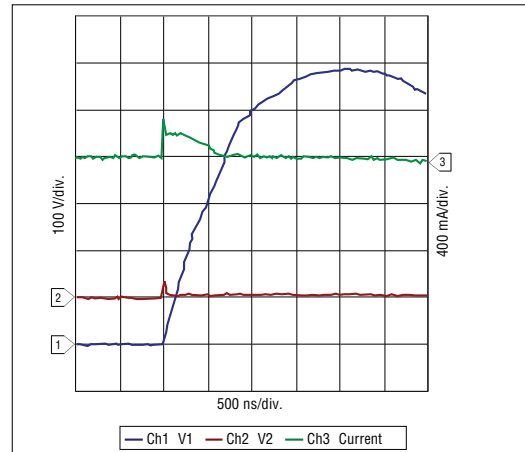


P500-G Configuration (GR-1089 Intra-building and 5 kV Lightning)			
Product	Qty.	Part Number	Source
TBU® Device	1	P500-Gxxx-WH	Bourns, Inc.
MOV	2	<a href="#">MOV-10D201K</a>	Bourns, Inc.
Diode bridge	2	GSD2004S-V MMBD2004S	Vishay Diodes Inc.



P500-G Solution: 5000 V Lightning 2/10 μsec, 500 A

P850-G Configuration (ITU-T K.20, K.21, K.20E, K.21E, K.45)			
Product	Qty.	Part Number	Source
TBU® Device	1	P850-G120-WH	Bourns, Inc.
MOV	2	<a href="#">MOV-10D361K</a>	Bourns, Inc.
Diode bridge	2	GSD2004S-V MMBD2004S	Vishay Diodes Inc.



P850-G Solution: 4000 V Lightning 10/700 μsec, 100 A



Asia-Pacific: Tel: +886-2 2562-4117 • Fax: +886-2 2562-4116

EMEA: Tel: +36 88 520 390 • Fax: +36 88 520 211

The Americas: Tel: +1-951 781-5500 • Fax: +1-951 781-5700

[www.bourns.com](http://www.bourns.com)

REV. 10/13

"TBU" is a registered trademark of Bourns, Inc. in the United States and other countries.

Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.

Users should verify actual device performance in their specific applications.