

Features

- Superior circuit protection
- Overcurrent and overvoltage protection
- Blocks surges up to rated limits
- High-speed performance
- Small SMT package
- Agency listing: [®]
- RoHS* and AEC-Q101 compliant**

Applications

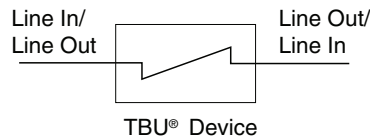
- Voice / VDSL cards
- Protection modules and dongles
- Process control equipment
- Test and measurement equipment
- General electronics

TBU-CA-Q Series - TBU[®] High-Speed Protectors

General Information

The TBU-CA-Q 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.

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 up to the device's specified maximum limits. The TBU[®] device is provided in a halogen free***, surface mount DFN package and meets industry standard requirements such as RoHS and Pb Free solder reflow profiles.



Additional Information

Click these links for more information:



Agency Listing

Description	
UL	File Number: E315805

Absolute Maximum Ratings (@ T_A = 25 °C Unless Otherwise Noted)

Symbol	Parameter	Part Number	Value	Unit
V _{imp}	Peak impulse voltage withstand with duration less than 10 ms	TBU-CA025-xxx-WH-Q	250	V
		TBU-CA065-xxx-WH-Q	650	
		TBU-CA085-xxx-WH-Q	850	
V _{rms}	Continuous A.C. RMS voltage	TBU-CA025-xxx-WH-Q	100	V
		TBU-CA065-xxx-WH-Q	300	
		TBU-CA085-xxx-WH-Q	425	
T _{op}	Operating temperature range		-55 to +125	°C
T _{stg}	Storage temperature range		-65 to +150	°C
T _{jmax}	Maximum junction temperature		+125	°C
ESD	HBM ESD protection per IEC 61000-4-2		±2	kV

Environmental Characteristics

Parameter	Value
Moisture Sensitivity Level	1
ESD Classification (HBM)	1A



WARNING Cancer and Reproductive Harm - www.P65Warnings.ca.gov

* RoHS Directive 2015/863, Mar 31, 2015 and Annex.

** "Q" part number suffix for automotive and other applications requiring appropriate AEC-Q101 compliance.

*** Bourns considers a product to be "halogen free" if (a) the Bromine (Br) content is 900 ppm or less; (b) the Chlorine (Cl) content is 900 ppm or less; and (c) the total Bromine (Br) and Chlorine (Cl) content is 1500 ppm or less.

Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

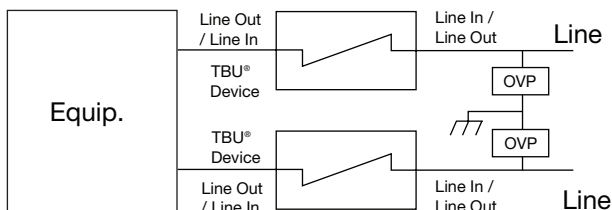
The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at www.bourns.com/docs/legal/disclaimer.pdf.

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-CAxxx-050-WH-Q	50	75	100	mA	
		TBU-CAxxx-100-WH-Q	100	150	200		
		TBU-CAxxx-300-WH-Q	300	450	600		
		TBU-CAxxx-500-WH-Q	500	750	1000		
R _{device}	Series resistance of the TBU® device	V _{imp} = 250 V I _{trigger} (min.) = 50 mA	TBU-CA025-050-WH-Q		13.3	15.3	Ω
		V _{imp} = 650 V I _{trigger} (min.) = 50 mA	TBU-CA065-050-WH-Q		17.7	20.3	
		V _{imp} = 650 V I _{trigger} (min.) = 100 mA	TBU-CA065-100-WH-Q		11.5	13.2	
		V _{imp} = 650 V I _{trigger} (min.) = 300 mA	TBU-CA065-300-WH-Q		7.6	8.8	
		V _{imp} = 850 V I _{trigger} (min.) = 100 mA	TBU-CA085-100-WH-Q		15.2	17.4	
		V _{imp} = 850 V I _{trigger} (min.) = 500 mA	TBU-CA085-500-WH-Q		10.7	12.2	
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		12	16	20	V	
R _{th(j-l)}	Junction to package pads - FR4 using recommended pad layout			129		°C/W	
R _{th(j-l)}	Junction to package pads - FR4 using heat sink on board (6 cm ²) (1 in ²)			40		°C/W	

Reference Application

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



Basic TBU Operation

The TBU® 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 up to the device's specified maximum limits. 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 will limit the current to less than the I_{trigger} value within the t_{block} duration. If voltage above V_{reset} is continuously sustained, the TBU® device will subsequently reduce the current to a quiescent current level within a period of time that is dependent upon the applied voltage.

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, with software monitoring as one method used to accomplish this. Bourns application engineers can provide further assistance.

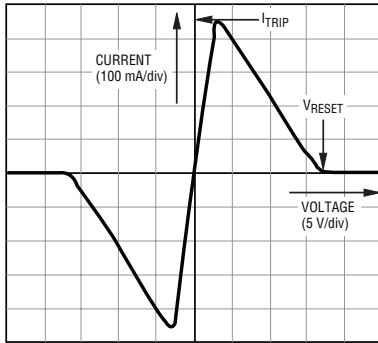
Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

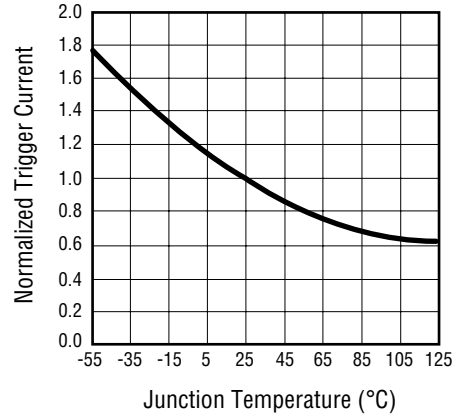
The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at www.bourns.com/docs/legal/disclaimer.pdf.

Performance Graphs

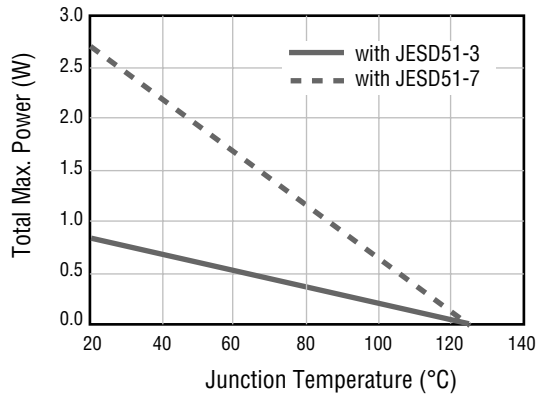
Typical V-I Characteristics



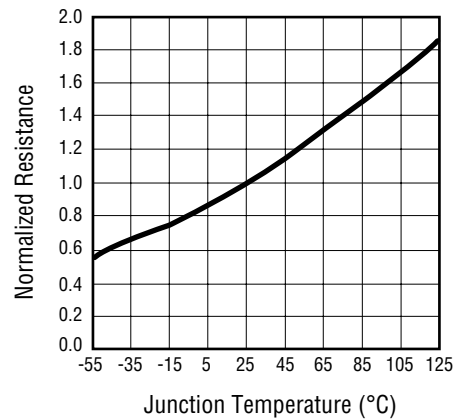
Typical Trigger Current vs. Temperature



Power Derating Curve



Typical Resistance vs. Temperature

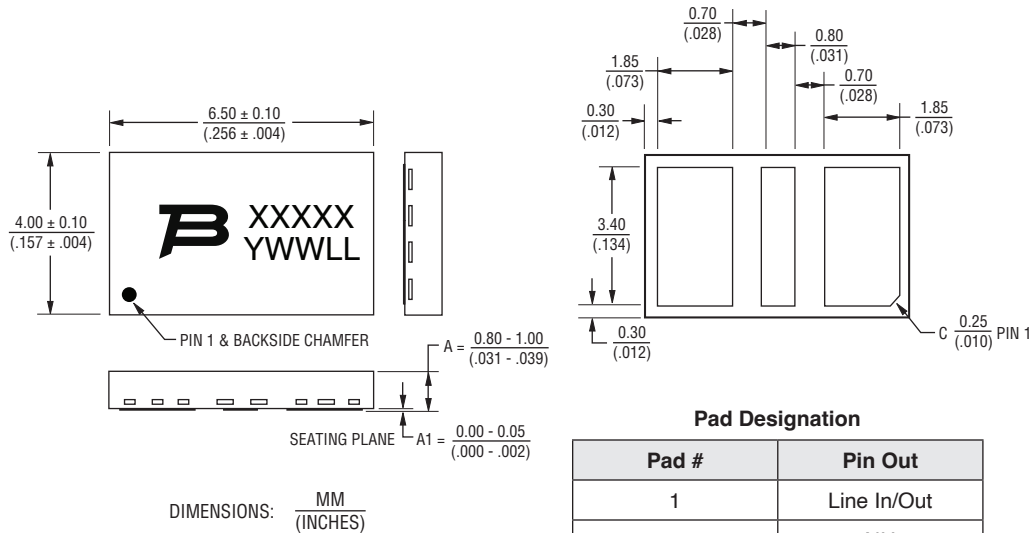


Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at www.bourns.com/docs/legal/disclaimer.pdf.

Product Dimensions

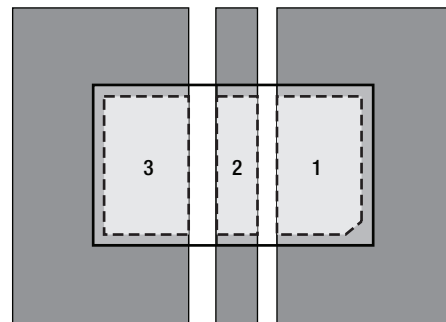


Pad Designation

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

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. For best performance, Bourns recommends that solder pads 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 be 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 be 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, Bourns recommends that ground or power signals not be routed beneath any pad.



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

Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

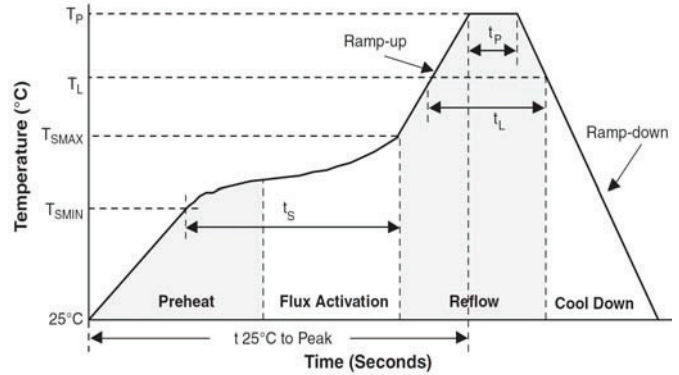
The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at www.bourns.com/docs/legal/disclaimer.pdf.

TBU-CA-Q Series - TBU® High-Speed Protectors



Reflow Profile

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



How to Order

TBU - CA xxx - yyy - WH - Q

TBU® Product _____

Series _____
 CA = Bi-Series

Impulse Voltage Rating _____
 025 = 250 V
 065 = 650 V
 085 = 850 V

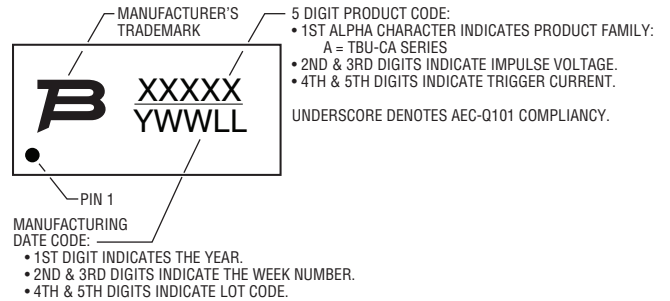
Trigger Current _____
 050 = 50 mA
 100 = 100 mA
 300 = 300 mA
 500 = 500 mA

Hold to Trip Ratio Suffix _____
 W = Hold to Trip Ratio = 2

Package Suffix _____
 H = DFN Package

AEC-Q101 Suffix _____
 Q = AEC-Q101 Compliant

Typical Part Marking



Specifications are subject to change without notice.

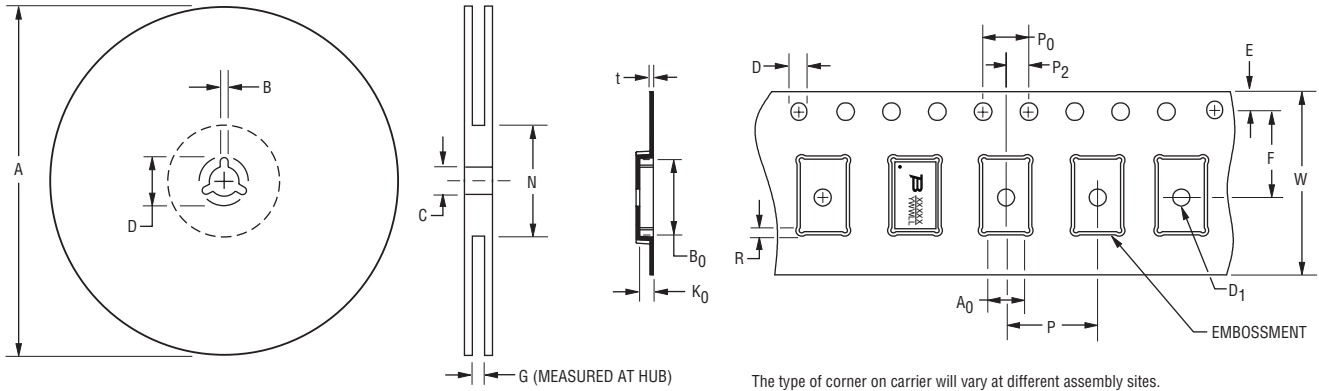
Users should verify actual device performance in their specific applications.

The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at www.bourns.com/docs/legal/disclaimer.pdf.

TBU-CA-Q Series - TBU® High-Speed Protectors

BOURNS®

Packaging Specifications



The type of corner on carrier will vary at different assembly sites.

USER DIRECTION OF FEED
 QUANTITY: 3000 PIECES PER REEL

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		R		t	
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	0.5	0.25	0.35
(.039)	(.047)	(.311)	(.319)	(.159)	(.161)	(.075)	(.083)	(0)	(.020)	(.010)	(.014)

W	
Min.	Max.
15.7	16.3
(.618)	(.642)

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

BOURNS®

Asia-Pacific: Tel: +886-2 2562-4117 • Email: asiacus@bourns.com
 EMEA: Tel: +36 88 885 877 • Email: eurocus@bourns.com
 The Americas: Tel: +1-951 781-5500 • Email: americus@bourns.com
www.bourns.com

REV. 03/23

“TBU” is a registered trademark of Bourns, Inc. in the United States and other countries. Specifications are subject to change without notice. Users should verify actual device performance in their specific applications. The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at www.bourns.com/docs/legal/disclaimer.pdf.

This legal disclaimer applies to purchasers and users of Bourns® products manufactured by or on behalf of Bourns, Inc. and its affiliates (collectively, "Bourns").

Unless otherwise expressly indicated in writing, Bourns® products and data sheets relating thereto are subject to change without notice. Users should check for and obtain the latest relevant information and verify that such information is current and complete before placing orders for Bourns® products.

The characteristics and parameters of a Bourns® product set forth in its data sheet are based on laboratory conditions, and statements regarding the suitability of products for certain "typical" applications are based on Bourns' knowledge of typical requirements in generic applications. Bourns assumes that "typical" applications include failsafe/backup features to address critical risks to users and are designed to allow rework of Bourns® product to avoid scrap of a device solely due to malfunctioning Bourns® product. The characteristics and parameters of a Bourns® product in a user application may vary from the data sheet characteristics and parameters due to (i) the combination of the Bourns® product with other components in the user's application, or (ii) the environment of the user application itself. The characteristics and parameters of a Bourns® product also can and do vary in different applications and actual performance may vary over time. Thus, users should always verify the actual performance of the Bourns® product in their specific devices and applications and make their own independent judgments regarding the suitability of Bourns® product and the amount of additional test margin to design into their device or application to compensate for differences between laboratory and real-world conditions.

Unless Bourns has explicitly designated an individual Bourns® product as meeting the requirements of a particular industry standard (e.g., IATF 16949) or a particular qualification (e.g., UL listed or recognized), Bourns is not responsible for any failure of an individual Bourns® product to meet the requirements of such industry standard or particular qualification even if such industry standard or qualification is a "state of art". Users of Bourns® products are responsible for ensuring compliance with safety-related requirements and standards applicable to their devices or applications.

Bourns® products are not recommended, authorized or intended for use in applications where failure or malfunction may result in personal injury, death, or severe property or environmental damage, such as without limitation nuclear, life-critical medical and certain automotive and aviation applications. Except as set forth in the bullet points below or unless expressly and specifically approved in writing on a case-by-case basis by an authorized Bourns' representative, use of any Bourns® products in such unauthorized high-risk applications is at the user's sole risk.

- Bourns considers implantable/invasive devices and devices/procedures designed as life-supporting or life-sustaining by the U.S. Food and Drug Administration or equivalent organizations outside of the United States as "life-critical" medical applications. Bourns expressly identifies those Bourns® standard products that are suitable for use in typical medical applications that are not life-critical in its publication entitled "Bourns Medical Grade Component Guide."
- Bourns expressly identifies those Bourns® standard products that are suitable for use in typical automotive applications associated with any Automate Safety Integrity Level (ASIL) in its publication entitled "Bourns Automotive Grade Component Guide." Bourns' designation of Bourns® product as compliant with the AEC-Q standard does not by itself mean that Bourns has approved such product for use in an automotive application.
- Bourns expressly identifies Bourns® standard products that are suitable for use in the typical aviation applications/systems requiring System Design Assurance Level (RTCA DO-254 DAL) of C, D or E in its publication entitled "Bourns Civilian Aerospace/Aviation Grade Component Guide." Bourns does not test its products for compliance with United States Federal Aviation Administration standards or any other generally equivalent governmental organization standard applicable to products designed or manufactured for use in aviation applications. Use of Bourns® standard components in aviation applications associated with RTCA DO-254 DAL A or B without proper approval noted above shall be at the user's sole risk.
- Bourns will review and authorize on a case-by-case basis the use of Bourns® standard products which are at least AEC-Q compliant in space-related civil applications (rockets, satellites) with a negotiated cross-waiver and indemnity agreement.

The use and level of testing applicable to Bourns® custom products shall be negotiated on a case-by-case basis by Bourns and the user for which such Bourns® custom products are specially designed. Absent a written agreement between Bourns and the user regarding the use and level of such testing, the above provisions applicable to Bourns® standard products shall also apply to such Bourns® custom products.

Use of Bourns® products or Bourns' technology in military/defense applications must be reviewed with Bourns for compliance with applicable export control laws and embargoes. Users shall not sell, transfer, export or re-export (which includes transfers within a country) any Bourns® products or technology or technical data for use in activities which involve the design, development, production, use or stockpiling of nuclear, chemical or biological weapons or missiles, nor shall they use Bourns® products or technology or technical data in any facility which engages in activities relating to such devices. Further, Bourns® products and Bourns' technology and technical data may not under any circumstance be exported or re-exported to countries subject to international sanctions or embargoes. Bourns® products and technology may not, without prior authorization from Bourns and/or the Government of a country where such product/technology is designed and/or manufactured, be resold, transferred, or re-exported (including within the same country) to any party not eligible to receive commodities, software, and technical data originating in such country.

To the maximum extent permitted by applicable law, Bourns disclaims (i) any and all liability for special, punitive, consequential, incidental or indirect damages or lost revenues or lost profits, and (ii) any and all implied warranties (those not based on parameters specified in Bourns' data sheets and/or specifications), including implied warranties of fitness for particular purpose, non-infringement and merchantability.

For your convenience, copies of this Legal Disclaimer Notice with German, Spanish, Japanese, Traditional Chinese and Simplified Chinese bilingual versions are available at:

Web Page: <https://www.bourns.com/legal/disclaimers-terms-and-policies>

PDF: <https://www.bourns.com/docs/Legal/disclaimer.pdf>