Thyristor/Diode and Thyristor/Thyristor (Super MAGN-A-PAK Power Modules), 500 A

Super MAGN-A-PAK

FEATURES

- High current capability
- High surge capability
- Industrial standard package
- 3000 V_{RMS} isolating voltage with non-toxic substrate
- UL approved file E78996
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

TYPICAL APPLICATIONS

- Motor starters
- DC motor controls - AC motor controls
- Uninterruptible power supplies

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$, $I_{F(AV)}$	500 A
Type	Modules - thyristor, standard
Package	Super MAGN-A-PAK

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$, $I_{F(AV)}$	T_C = 82 °C	500	A
$I_{T(RMS)}$	T_C = 82 °C	785	A
I_{TSM}	50 Hz	17.8	kA
	60 Hz	18.7	
I^2t	50 Hz	1591	kA^2s
	60 Hz	1452	
$I^2\sqrt{t}$		15 910	$kA^2\sqrt{s}$
V_{RRM}	Range	800 to 1600	V
T_{Stg}	Range	-40 to +150	°C
T_J	Range	-40 to +130	

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS				
TYPE NUMBER	VOLTAGE CODE	V_{RRM}/V_{DRM}, MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM}/I_{DRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
VS-VSK.500	08	800	900	100
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

ON-STATE CONDUCTION						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**			**VALUES**	**UNITS**
Maximum average on-state current at case temperature	$I_{T(AV)}$, $I_{F(AV)}$	180° conduction, half sine wave			500	A
					82	°C
Maximum RMS on-state current	$I_{T(RMS)}$	180° conduction, half sine wave at T_C = 82 °C			785	A
Maximum peak, one-cycle, non-repetitive on-state surge current	I_{TSM}, I_{FSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial T_J = T_J maximum	17.8	kA
		t = 8.3 ms			18.7	
		t = 10 ms	100 % V_{RRM} reapplied		15.0	
		t = 8.3 ms			15.7	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		1591	kA^2s
		t = 8.3 ms			1452	
		t = 10 ms	100 % V_{RRM} reapplied		1125	
		t = 8.3 ms			1027	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied			15 910	$kA^2\sqrt{s}$
Low level value or threshold voltage	$V_{T(TO)1}$	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), T_J = T_J maximum			0.85	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), T_J = T_J maximum			0.93	
Low level value on-state slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), T_J = T_J maximum			0.36	mΩ
High level value on-state slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), T_J = T_J maximum			0.32	
Maximum on-state voltage drop	V_{TM}	I_{pk} = 1500 A, T_J = 25 °C, t_p = 10 ms sine pulse			1.50	V
Maximum forward voltage drop	V_{FM}	I_{pk} = 1500 A, T_J = 25 °C, t_p = 10 ms sine pulse			1.50	V
Maximum holding current	I_H	T_J = 25 °C, anode supply 12 V resistive load			500	mA
Maximum latching current	I_L				1000	

SWITCHING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum rate of rise of turned-on current	dI/dt	T_J = T_J maximum, I_{TM} = 400 A, V_{DRM} applied	1000	A/µs
Typical delay time	t_d	Gate current 1 A, dI_g/dt = 1 A/µs V_d = 0.67 % V_{DRM}, T_J = 25 °C	2.0	µs
Typical turn-off time	t_q	I_{TM} = 750 A; T_J = T_J maximum, dI/dt = - 60 A/µs, V_R = 50 V, dV/dt = 20 V/µs, gate 0 V 100 Ω	200	

BLOCKING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum critical rate of rise of off-state voltage	dV/dt	T_J = 130 °C, linear to V_D = 80 % V_{DRM}	1000	V/µs
RMS insulation voltage	V_{INS}	t = 1 s	3000	V
Maximum peak reverse and off-state leakage current	I_{RRM}, I_{DRM}	T_J = T_J maximum, rated V_{DRM}/V_{RRM} applied	100	mA

TRIGGERING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	P_{GM}	$T_J = T_J$ maximum, $t_p \leq 5$ ms	10	W
Maximum peak average gate power	$P_{G(AV)}$	$T_J = T_J$ maximum, f = 50 Hz, d% = 50	2.0	
Maximum peak positive gate current	$+I_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms	3.0	A
Maximum peak positive gate voltage	$+V_{GM}$		20	V
Maximum peak negative gate voltage	$-V_{GM}$		5.0	
Maximum DC gate current required to trigger	I_{GT}	T_J = 25 °C, V_{ak} 12 V	200	mA
DC gate voltage required to trigger	V_{GT}		3.0	V
DC gate current not to trigger	I_{GD}	$T_J = T_J$ maximum	10	mA
DC gate voltage not to trigger	V_{GD}		0.25	V

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction operating temperature range	T_J		-40 to +130	°C
Maximum storage temperature range	T_{Stg}		-40 to +150	
Maximum thermal resistance, junction to case per junction	R_{thJC}	DC operation	0.065	K/W
Maximum thermal resistance, case to heatsink per module	R_{thC-hs}	Mounting surface smooth, flat and greased	0.02	
Mounting torque ± 10 % — Super MAGN-A-PAK to heatsink		A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound	6 to 8	Nm
Mounting torque ± 10 % — busbar to super MAGN-A-PAK			12 to 15	
Approximate weight			1500	g
Case style		See dimensions - link at the end of datasheet	Super MAGN-A-PAK	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.009	0.006	$T_J = T_J$ maximum	K/W
120°	0.011	0.011		
90°	0.014	0.015		
60°	0.021	0.022		
30°	0.037	0.038		

Note

- Table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC

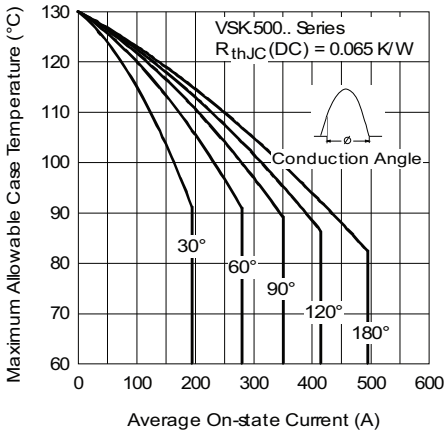


Fig. 1 - Current Ratings Characteristics

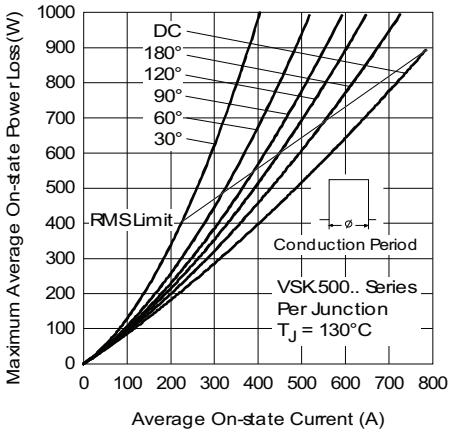


Fig. 4 - On-State Power Loss Characteristics

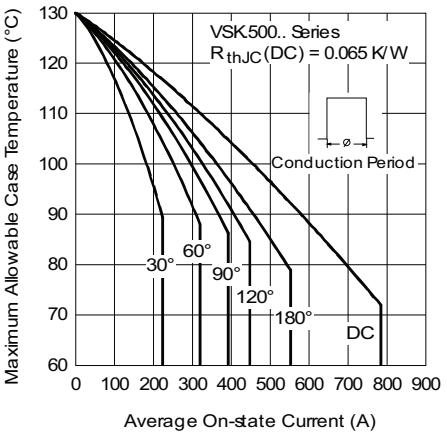


Fig. 2 - Current Ratings Characteristics

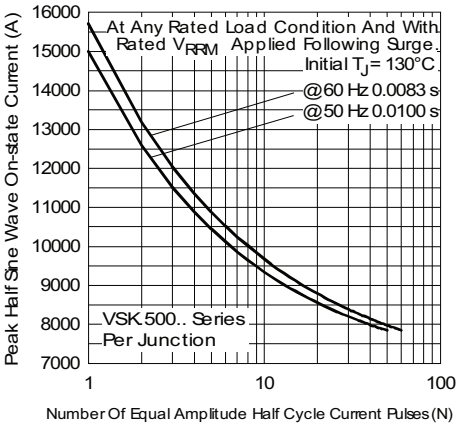


Fig. 5 - Maximum Non-Repetitive Surge Current

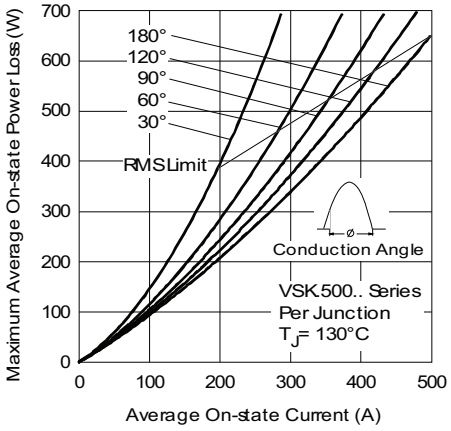


Fig. 3 - On-State Power Loss Characteristics

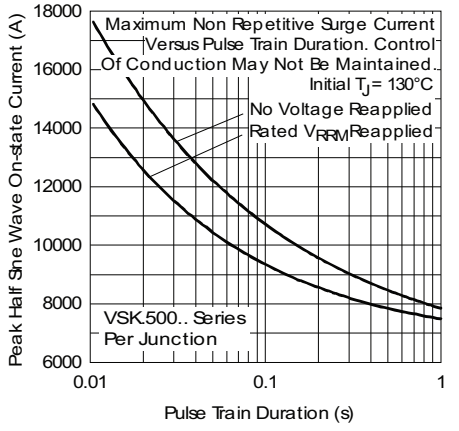


Fig. 6 - Maximum Non-Repetitive Surge Current

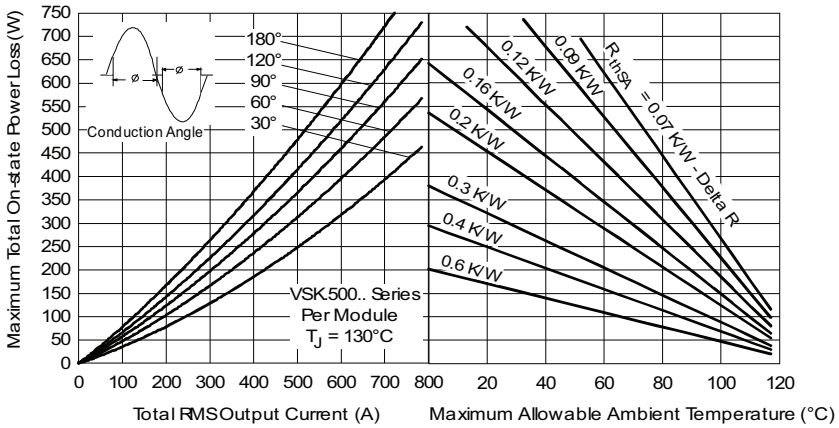


Fig. 7 - On-State Power Loss Characteristics

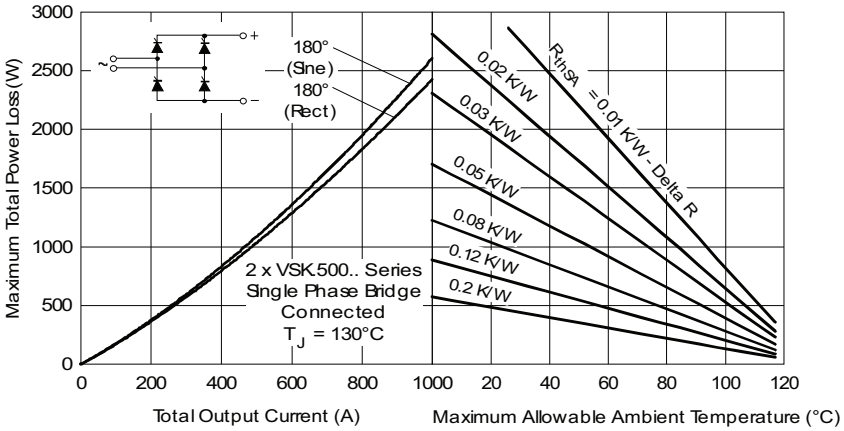


Fig. 8 - On-State Power Loss Characteristics

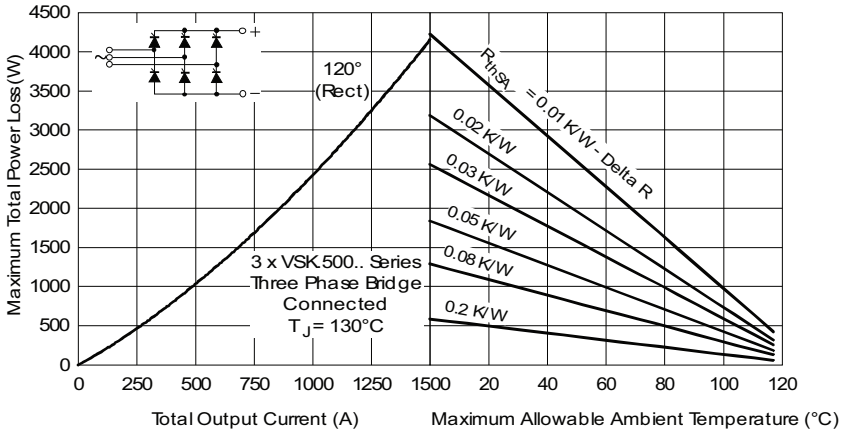


Fig. 9 - On-State Power Loss Characteristics

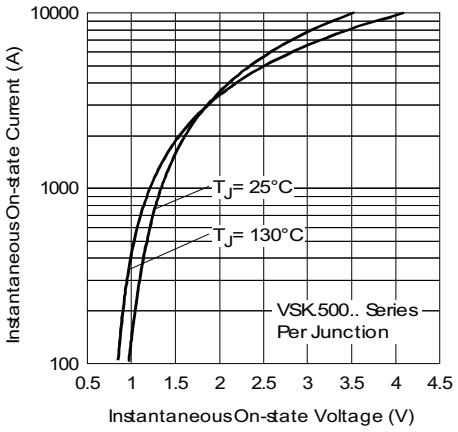


Fig. 10 - On-State Voltage Drop Characteristics

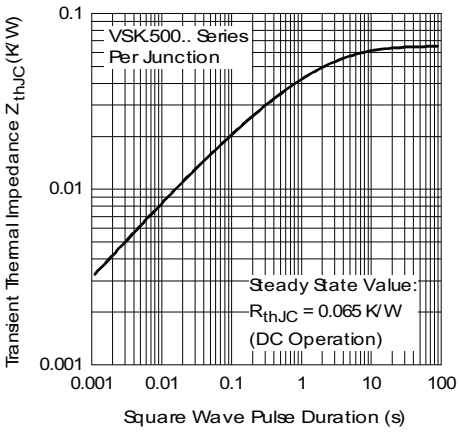


Fig. 11 - Thermal Impedance Z_{thJC} Characteristics

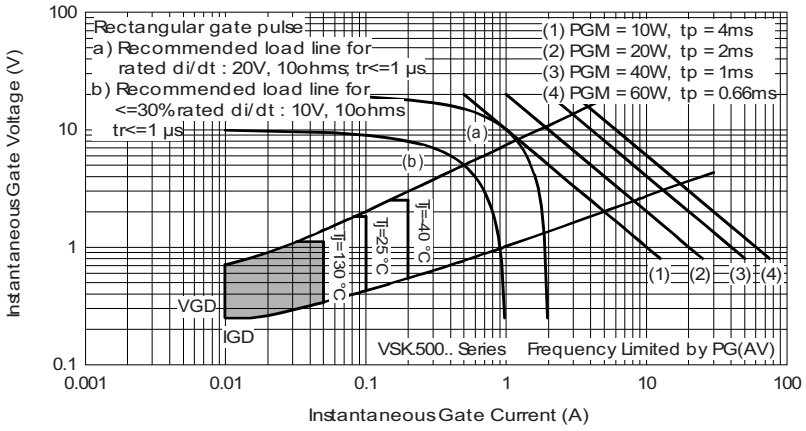


Fig. 12 - Gate Characteristics

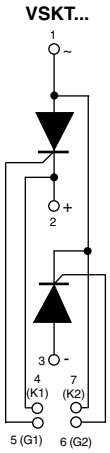
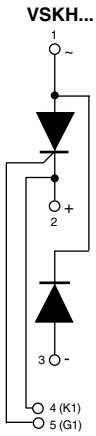
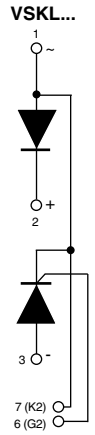
ORDERING INFORMATION TABLE

Device code	VS-VS	KT	500	-	16	PbF
	1	2	3		4	5

- 1 - Vishay Semiconductors product
- 2 - Circuit configuration (see end of datasheet)
- 3 - Current rating
- 4 - Voltage code x 100 = V_{RRM} (see voltage ratings table)
- 5 - Lead (Pb)-free

Note

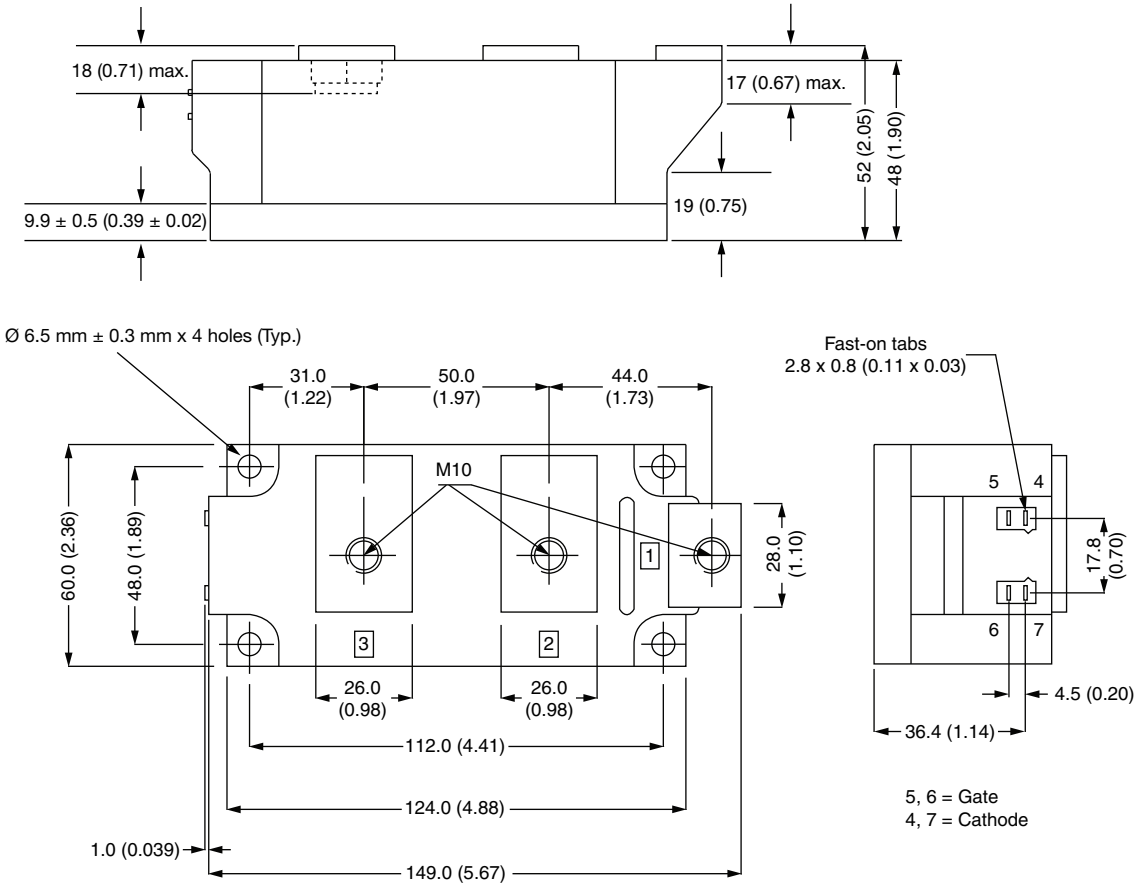
- To order the optional hardware go to www.vishay.com/doc?95172

CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	**CIRCUIT CONFIGURATION CODE**	**CIRCUIT DRAWING**
Two SCRs doubler circuit	KT	
SCR/diode doubler circuit, positive control	KH	
SCR/diode doubler circuit, negative control	KL	

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95283

Super MAGN-A-PAK Thyristor/Diode

DIMENSIONS in millimeters (inches)



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.