


INT-A-PAK "Half-Bridge" (Ultrafast Speed IGBT), 209 A


INT-A-PAK
FEATURES

- Generation 5 Non Punch Through (NPT) technology
- Ultrafast: Optimized for hard switching speed 8 kHz to 60 kHz
- Low $V_{CE(on)}$
- 10 μ s short circuit capability
- Square RBSOA
- Positive $V_{CE(on)}$ temperature coefficient
- HEXFRED[®] antiparallel diode with ultrasoft reverse recovery characteristics
- Industry standard package
- Al₂O₃ DBC
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC
- Designed for industrial level


**RoHS
COMPLIANT**
PRODUCT SUMMARY

V_{CES}	600 V
I_C DC	209 A
$V_{CE(on)}$ at 200 A, 25 °C	2.6 V

BENEFITS

- Benchmark efficiency for UPS and welding application
- Rugged transient performance
- Direct mounting on heatsink
- Very low junction to case thermal resistance

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25\text{ °C}$	209	A
		$T_C = 80\text{ °C}$	142	
Pulsed collector current	I_{CM}		400	
Clamped inductive load current	I_{LM}		400	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	178	
		$T_C = 80\text{ °C}$	121	
Gate to emitter voltage	V_{GE}		± 20	V
Maximum power dissipation	P_D	$T_C = 25\text{ °C}$	781	W
		$T_C = 80\text{ °C}$	438	
Isolation voltage	V_{ISOL}	Any terminal to case, t = 1 minute	2500	V

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CE)}$	$V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	1.95	2.1	
		$V_{GE} = 15\text{ V}, I_C = 200\text{ A}$	-	2.6	2.84	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	2.28	2.5	
		$V_{GE} = 15\text{ V}, I_C = 200\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.14	3.48	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 500\text{ }\mu\text{A}$	3	4.2	6	
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	0.005	0.2	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	0.01	15	
Diode forward voltage drop	V_{FM}	$I_C = 100\text{ A}$	-	1.39	1.78	V
		$I_C = 200\text{ A}$	-	1.64	2.2	
		$I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.32	1.69	
		$I_C = 200\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.67	2.30	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 200	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Turn-on switching loss	E_{on}	$I_C = 200\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 10\text{ }\Omega, L = 200\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	3.65	-	mJ
Turn-off switching loss	E_{off}		-	6.9	-	
Total switching loss	E_{tot}		-	10.55	-	
Turn-on switching loss	E_{on}	$I_C = 200\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 10\text{ }\Omega, L = 200\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	3.8	-	ns
Turn-off switching loss	E_{off}		-	7.8	-	
Total switching loss	E_{tot}		-	11.6	-	
Turn-on delay time	$t_{d(on)}$		-	507	-	
Rise time	t_r		-	133	-	
Turn-off delay time	$t_{d(off)}$		-	538	-	
Fall time	t_f	-	92	-		
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^\circ\text{C}, I_C = 400\text{ A}, R_g = 27\text{ }\Omega, V_{GE} = 15\text{ V to }0$	Fullsquare			
Short circuit safe operating area	SCSOA	$T_J = 150\text{ }^\circ\text{C}, V_{CC} = 400\text{ V}, V_P = 600\text{ V}, R_g = 27\text{ }\Omega, V_{GE} = 15\text{ V to }0$	10	-	-	
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, dI_F/dt = 200\text{ A}/\mu\text{s}, V_{CC} = 400\text{ V}, T_J = 25\text{ }^\circ\text{C}$	-	226	260	ns
Diode peak reverse current	I_{rr}		-	17	20	A
Diode recovery charge	Q_{rr}		-	1900	2600	nC
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, dI_F/dt = 200\text{ A}/\mu\text{s}, V_{CC} = 400\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	290	330	ns
Diode peak reverse current	I_{rr}		-	25	30	A
Diode recovery charge	Q_{rr}		-	3600	5000	nC

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Operating junction and storage temperature range	T_J, T_{Stg}	- 40	-	150	$^{\circ}\text{C}$
Junction to case per leg	IGBT	-	0.13	0.16	$^{\circ}\text{C}/\text{W}$
	Diode	-	0.19	0.32	
Case to sink per module	R_{thCS}	-	0.1	-	
Mounting torque	case to heatsink	-	-	4	Nm
	case to terminal 1, 2, 3	-	-	3	
Weight		-	185	-	g

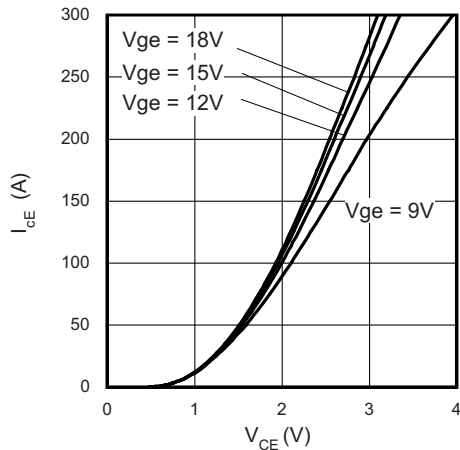
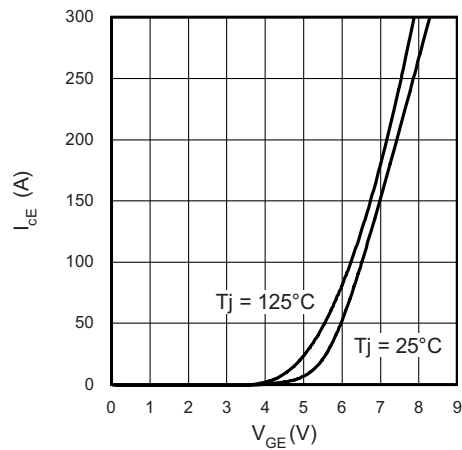
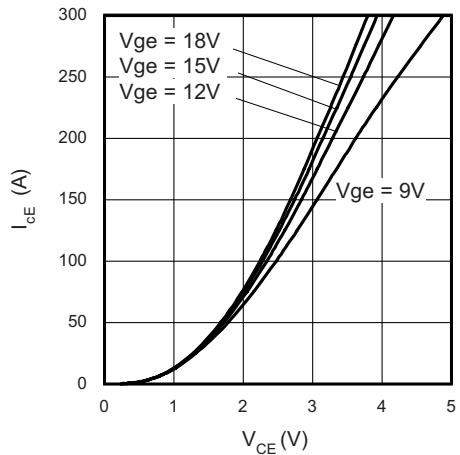
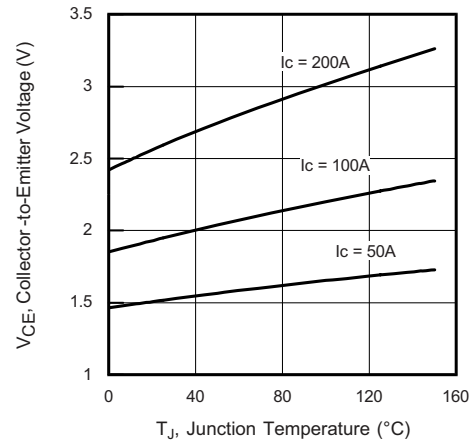

 Fig. 1 - Typical IGBT Output Characteristics
 $T_J = 25^{\circ}\text{C}$, $t_p = 500 \mu\text{s}$

 Fig. 3 - Typical Transfer Characteristics
 $V_{CE} = 20 \text{ V}$, $t_p = 500 \mu\text{s}$

 Fig. 2 - Typical IGBT Output Characteristics
 $T_J = 125^{\circ}\text{C}$, $t_p = 500 \mu\text{s}$


Fig. 4 - Typical Collector to Emitter Voltage vs. Junction Temperature

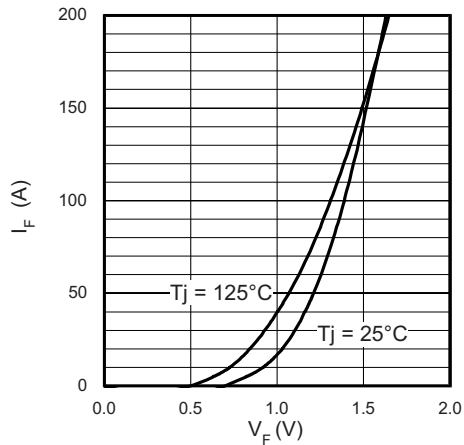


Fig. 5 - Diode Forward Characteristics,
 $t_p = 500 \mu s$

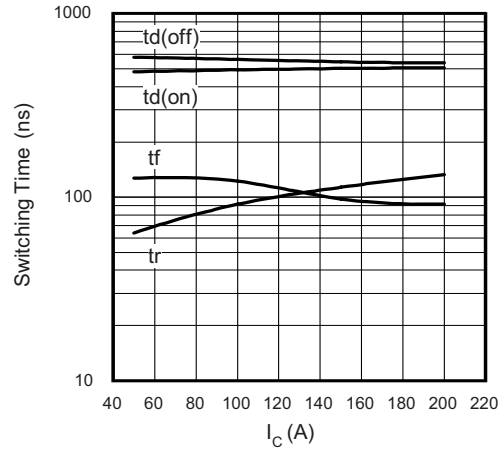


Fig. 8 - Typical Switching Time vs. I_C
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $R_g = 10 \Omega$, $V_{GE} = 15 V$

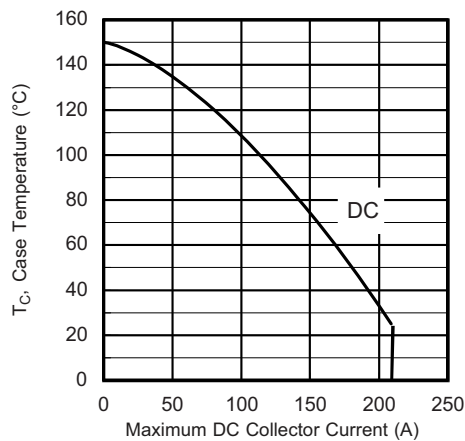


Fig. 6 - Maximum Collector Current vs.
Case Temperature

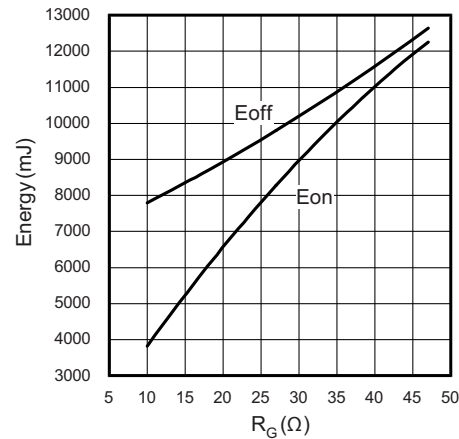


Fig. 9 - Typical Energy Loss vs. R_g
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $I_{CE} = 200 A$, $V_{GE} = 15 V$

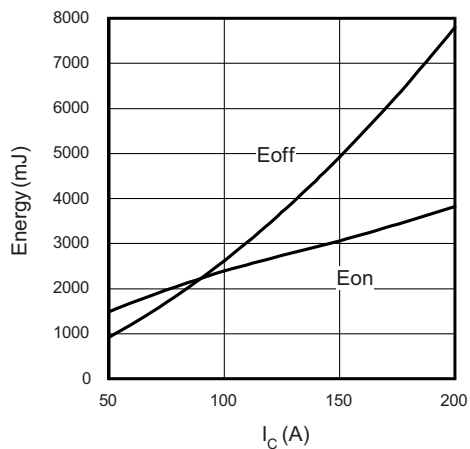


Fig. 7 - Typical Energy Loss vs. I_C
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $R_g = 10 \Omega$, $V_{GE} = 15 V$

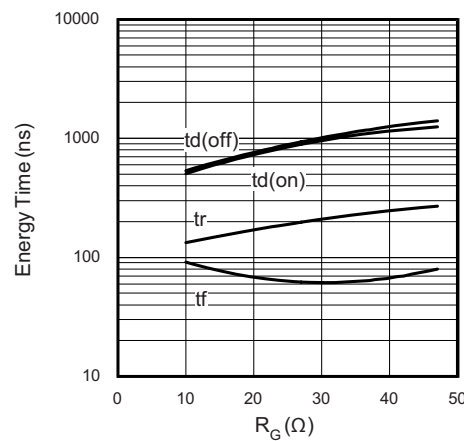


Fig. 10 - Typical Switching Time vs. R_g
 $T_J = 125^\circ C$, $L = 200 \mu H$, $V_{CC} = 360 V$,
 $I_{CE} = 200 A$, $V_{GE} = 15 V$

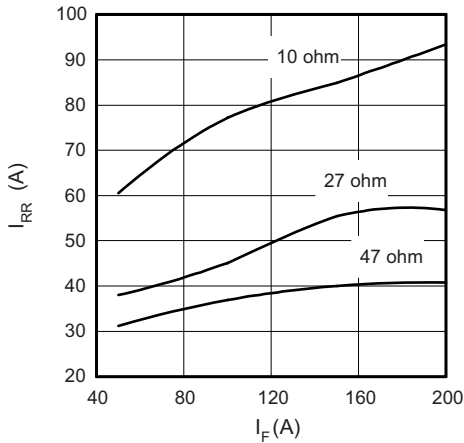


Fig. 11 - Typical Diode I_{rr} vs. I_F
 $T_J = 125^\circ\text{C}$

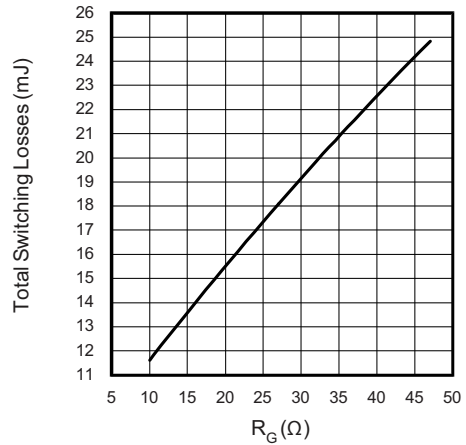


Fig. 14 - Typical Switching Losses vs. Gate Resistance
 $T_J = 125^\circ\text{C}$, $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$,
 $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

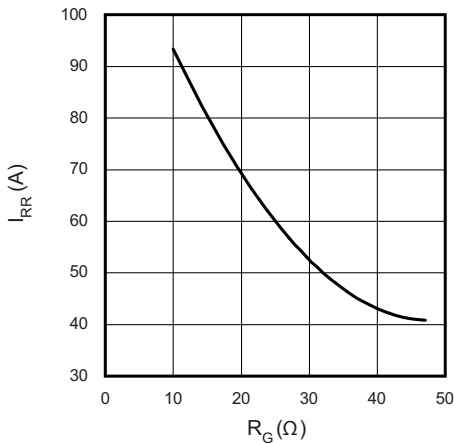


Fig. 12 - Typical Diode I_{rr} vs. R_g
 $T_J = 125^\circ\text{C}$, $I_F = 200\ \text{A}$

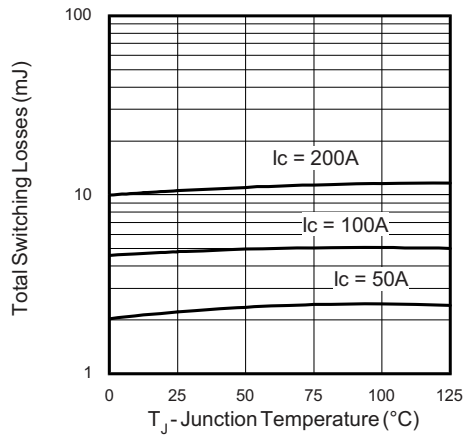


Fig. 15 - Typical Switching Losses vs. Junction Temperature;
 $L = 200\ \mu\text{H}$, $R_g = 10\ \Omega$, $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

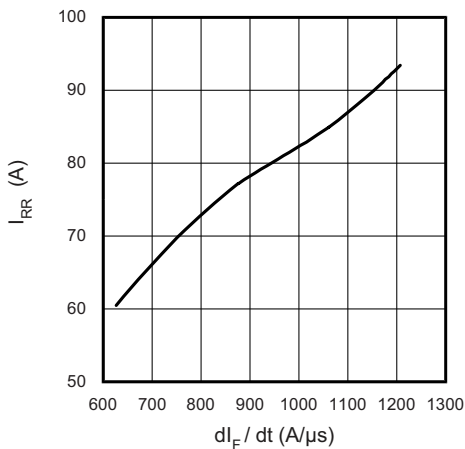


Fig. 13 - Typical Diode I_{rr} vs. di_F/dt
 $T_J = 125^\circ\text{C}$, $V_{CC} = 360\ \text{V}$, $I_F = 200\ \text{A}$, $V_{GE} = 15\ \text{V}$

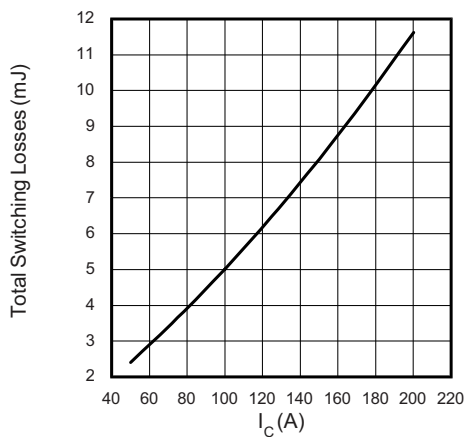


Fig. 16 - Typical Switching Losses vs. Collector to Emitter Current;
 $T_J = 125^\circ\text{C}$, $R_{g1} = 10\ \Omega$, $R_{g2} = 0\ \Omega$, $V_{CC} = 360\ \text{V}$, $V_{GE} = 15\ \text{V}$

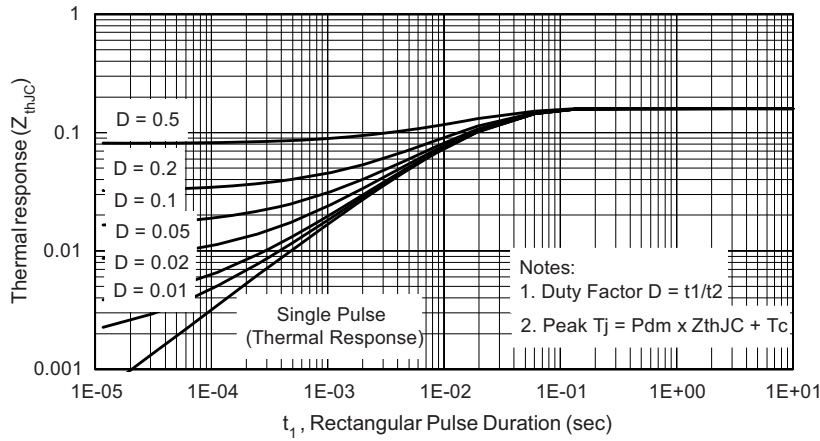


Fig. 17 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

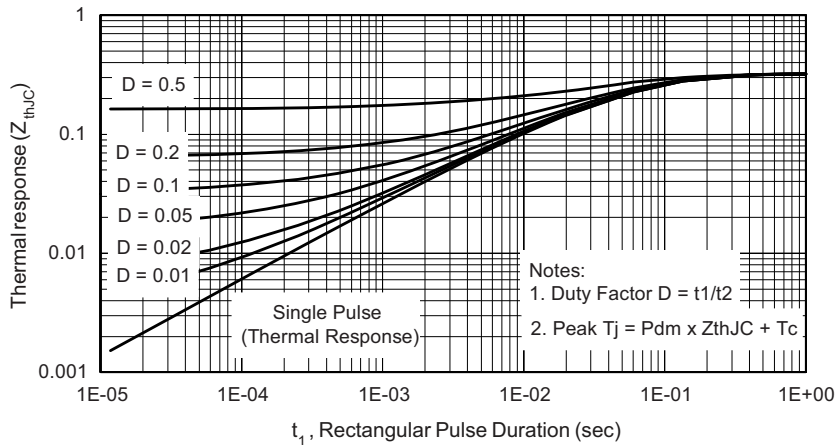
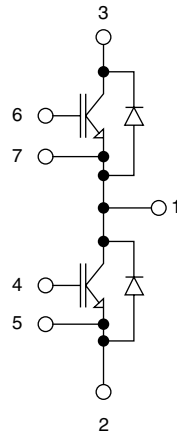


Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case (HEXFRED®)

ORDERING INFORMATION TABLE

Device code	G	B	200	T	S	60	N	PbF
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Insulated Gate Bipolar Transistor (IGBT)
- 2** - B = IGBT Generation 5 NPT
- 3** - Current rating (200 = 200 A)
- 4** - Circuit configuration (T = Half-bridge)
- 5** - Package indicator (S = INT-A-PAK)
- 6** - Voltage rating (60 = 600 V)
- 7** - Speed/type (N = Ultrafast IGBT)
- 8** - Lead (Pb)-free

CIRCUIT CONFIGURATION

LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95173
------------	--



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.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. 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.