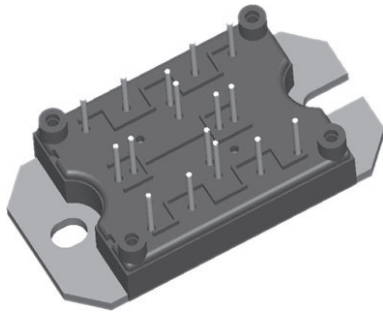



"Full Bridge" IGBT MTP (Ultrafast NPT IGBT), 20 A


MTP

FEATURES

- Ultrafast Non Punch Through (NPT) technology
- Positive $V_{CE(on)}$ temperature coefficient
- 10 μ s short circuit capability
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- Low diode V_F
- Square RBSOA
- Al_2O_3 DBC substrate
- Very low stray inductance design for high speed operation
- UL approved file E78996 
- Speed 8 kHz to 60 kHz
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level


RoHS
COMPLIANT

PRODUCT SUMMARY	
V_{CES}	1200 V
I_C at $T_C = 96\text{ }^\circ\text{C}$	20 A
$V_{CE(on)}$ (typical) at $I_C = 20\text{ A}$, $25\text{ }^\circ\text{C}$	3.29 V

BENEFITS

- Optimized for welding, UPS and SMPS applications
- Rugged with ultrafast performance
- Outstanding ZVS and hard switching operation
- Low EMI, requires less snubbing
- Excellent current sharing in parallel operation
- Direct mounting to heatsink
- PCB solderable terminals
- Very low junction to case thermal resistance

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter breakdown voltage	V_{CES}		1200	V
Continuous collector current	I_C	$T_C = 96\text{ }^\circ\text{C}$	20	A
Pulsed collector current	I_{CM}		100	
Clamped inductive load current	I_{LM}		100	
Diode maximum forward current	I_{FM}		100	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1\text{ minute}$	2500	
Maximum power dissipation (only IGBT)	P_D	$T_C = 25\text{ }^\circ\text{C}$	240	W
		$T_C = 100\text{ }^\circ\text{C}$	96	



ELECTRICAL SPECIFICATIONS (T _J = 25 °C unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	V _{(BR)CES}	V _{GE} = 0 V, I _C = 250 μA	1200	-	-	V
Temperature coefficient of breakdown voltage	ΔV _{(BR)CES} /ΔT _J	V _{GE} = 0 V, I _C = 3 mA (25 to 125 °C)	-	+ 1.3	-	V/°C
Collector to emitter saturation voltage	V _{CE(on)}	V _{GE} = 15 V, I _C = 20 A	-	3.29	3.59	V
		V _{GE} = 15 V, I _C = 40 A	-	4.42	4.66	
		V _{GE} = 15 V, I _C = 20 A, T _J = 125 °C	-	3.87	4.11	
		V _{GE} = 15 V, I _C = 40 A, T _J = 125 °C	-	5.32	5.70	
		V _{GE} = 15 V, I _C = 20 A, T _J = 150 °C	-	3.99	4.27	
Gate threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 250 μA	4	-	6	
Temperature coefficient of threshold voltage	V _{GE(th)} /ΔT _J	V _{CE} = V _{GE} , I _C = 3 mA (25 to 125 °C)	-	- 14	-	mV/°C
Transconductance	g _{fe}	V _{CE} = 50 V, I _C = 20 A, PW = 80 μs	-	17.5	-	S
Zero gate voltage collector current	I _{CES} ⁽¹⁾	V _{GE} = 0 V, V _{CE} = 1200 V, T _J = 25 °C	-	-	250	μA
		V _{GE} = 0 V, V _{CE} = 1200 V, T _J = 125 °C	-	0.7	3.0	mA
		V _{GE} = 0 V, V _{CE} = 1200 V, T _J = 150 °C	-	2.9	9.0	
Gate to emitter leakage current	I _{GES}	V _{GE} = ± 20 V	-	-	± 250	nA

Note

⁽¹⁾ I_{CES} includes also opposite leg overall leakage

SWITCHING CHARACTERISTICS (T _J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q _g	I _C = 20 A	-	176	264	nC
Gate to emitter charge (turn-on)	Q _{ge}	V _{CC} = 600 V	-	19	30	
Gate to collector charge (turn-on)	Q _{gc}	V _{GE} = 15 V	-	89	134	
Turn-on switching loss	E _{on}	V _{CC} = 600 V, I _C = 20 A, V _{GE} = 15 V, R _g = 5 Ω, L = 200 μH, T _J = 25 °C, energy losses include tail and diode reverse recovery	-	0.513	0.770	mJ
Turn-off switching loss	E _{off}		-	0.402	0.603	
Total switching loss	E _{tot}		-	0.915	1.373	
Turn-on switching loss	E _{on}	V _{CC} = 600 V, I _C = 20 A, V _{GE} = 15 V, R _g = 5 Ω, L = 200 μH, T _J = 125 °C, energy losses include tail and diode reverse recovery	-	0.930	1.395	mJ
Turn-off switching loss	E _{off}		-	0.610	0.915	
Total switching loss	E _{tot}		-	1.540	2.310	
Input capacitance	C _{ies}	V _{GE} = 0 V, V _{CC} = 30 V, f = 1.0 MHz	-	2530	3790	pF
Output capacitance	C _{oes}		-	344	516	
Reverse transfer capacitance	C _{res}		-	78	117	
Reverse bias safe operating area	RBSOA	T _J = 150 °C, I _C = 120 A, V _{CC} = 1000 V, V _p = 1200 V, R _g = 5 Ω, V _{GE} = + 15 V to 0 V	Fullsquare			
Short circuit safe operating area	SCSOA	T _J = 150 °C, V _{CC} = 900 V, V _p = 1200 V, R _g = 5 Ω, V _{GE} = + 15 V to 0 V	10	-	-	μs



DIODE SPECIFICATIONS (T _J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Diode forward voltage drop	V _{FM}	I _C = 20 A	-	2.48	2.94	V
		I _C = 40 A	-	3.28	3.90	
		I _C = 20 A, T _J = 125 °C	-	2.44	2.84	
		I _C = 40 A, T _J = 125 °C	-	3.45	4.14	
		I _C = 20 A, T _J = 150 °C	-	2.21	2.93	
Reverse recovery energy of the diode	E _{rec}	V _{GE} = 15 V, R _g = 5 Ω, L = 200 μH	-	420	630	μJ
Diode reverse recovery time	t _{rr}	V _{CC} = 600 V, I _C = 20 A	-	98	150	ns
Peak reverse recovery current	I _{rr}	T _J = 125 °C	-	33	50	A

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T _J		- 40	-	150	°C
Storage temperature range	T _{Stg}		- 40	-	125	
Junction to case	R _{thJC}	IGBT	-	0.53	0.64	°C/W
		Diode	-	0.69	0.83	
Case to sink per module	R _{thCS}	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	
Clearance		External shortest distance in air between 2 terminals	5.5	-	-	mm
Creepage		Shortest distance along external surface of the insulating material between 2 terminals	8	-	-	
Mounting torque		A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads.	3 ± 10 %			Nm
Weight			66			g

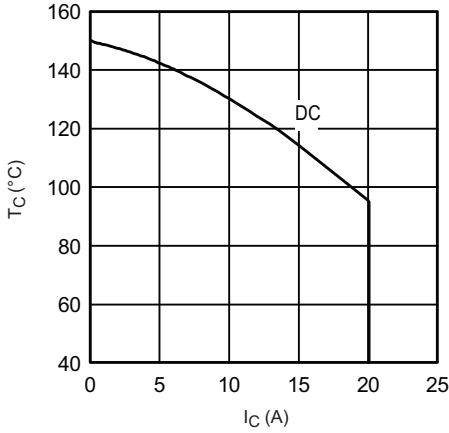


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

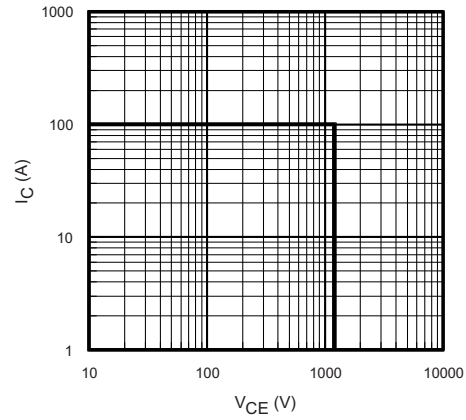


Fig. 4 - Reverse Bias SOA
 $T_J = 150\text{ }^\circ\text{C}; V_{GE} = 15\text{ V}$

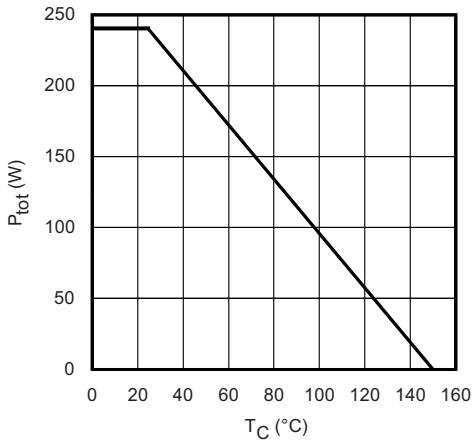


Fig. 2 - Power Dissipation vs. Case Temperature

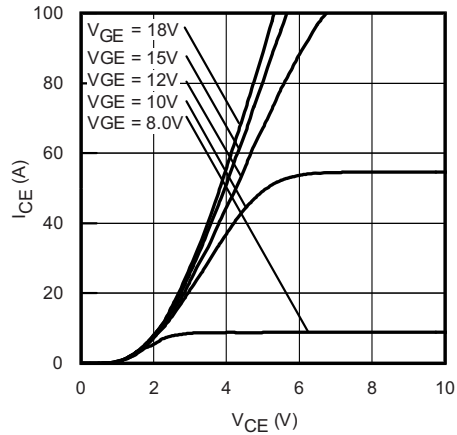


Fig. 5 - Typical IGBT Output Characteristics
 $T_J = -40\text{ }^\circ\text{C}; t_p = 80\text{ }\mu\text{s}$

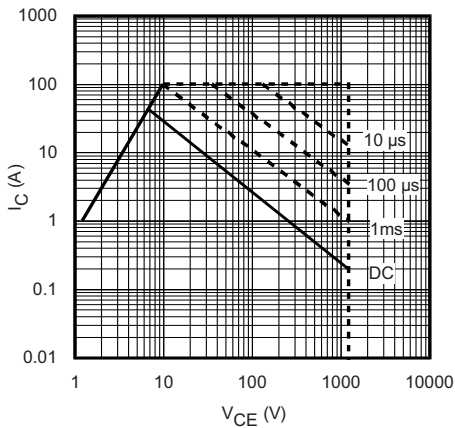


Fig. 3 - Forward SOA
 $T_C = 25\text{ }^\circ\text{C}; T_J \leq 150\text{ }^\circ\text{C}$

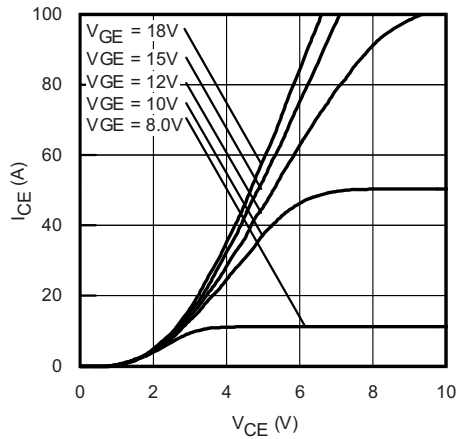


Fig. 6 - Typical IGBT Output Characteristics
 $T_J = 25\text{ }^\circ\text{C}; t_p = 80\text{ }\mu\text{s}$

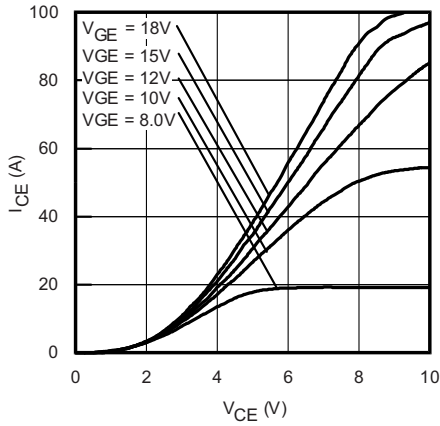


Fig. 7 - Typical IGBT Output Characteristics
 $T_J = 125^\circ\text{C}$; $t_p = 80 \mu\text{s}$

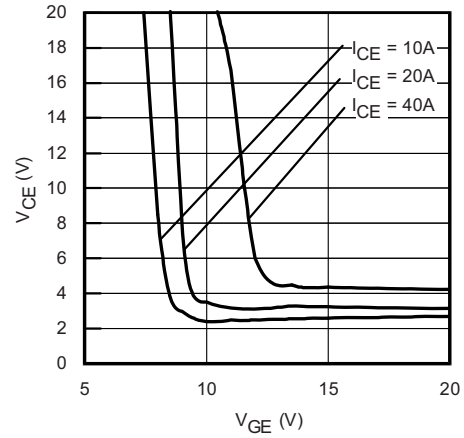


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

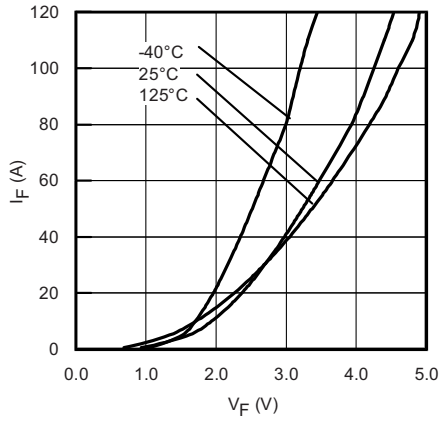


Fig. 8 - Typical Diode Forward Characteristics
 $t_p = 80 \mu\text{s}$

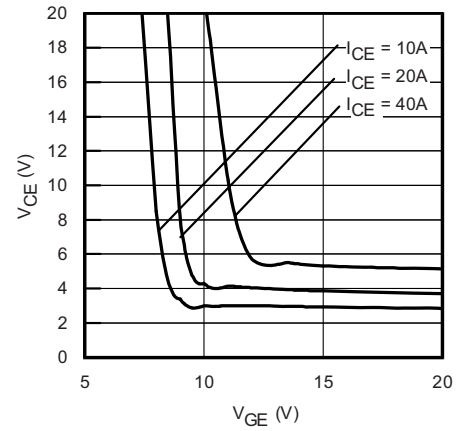


Fig. 11 - Typical V_{CE} vs. V_{GE}
 $T_J = 125^\circ\text{C}$

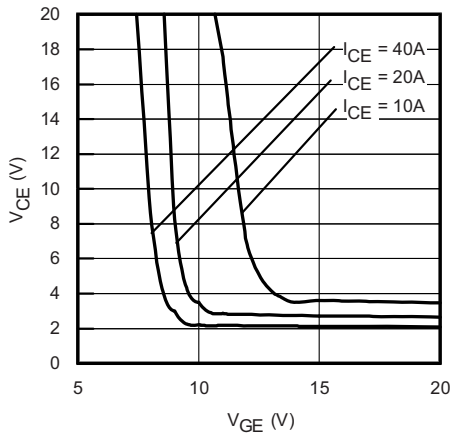


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^\circ\text{C}$

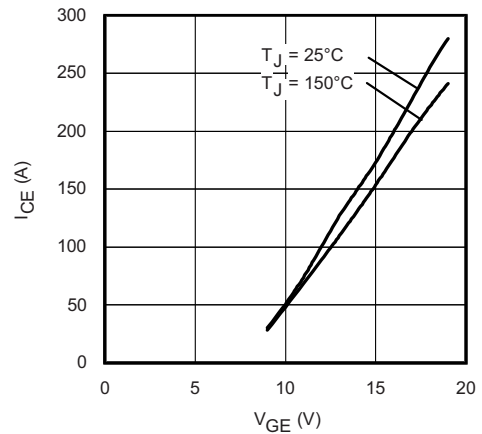


Fig. 12 - Typical Transfer Characteristics
 $V_{CE} = 50 \text{ V}$; $t_p = 10 \mu\text{s}$

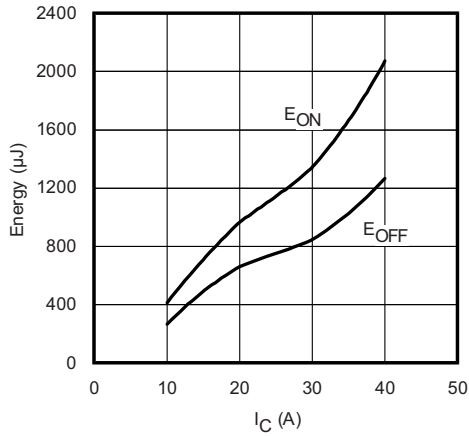


Fig. 13 - Typical Energy Loss vs. I_C
 $T_J = 150\text{ }^\circ\text{C}$; $L = 1.4\text{ mH}$; $V_{CE} = 400\text{ V}$
 $R_g = 5\text{ }\Omega$; $V_{GE} = 15\text{ V}$

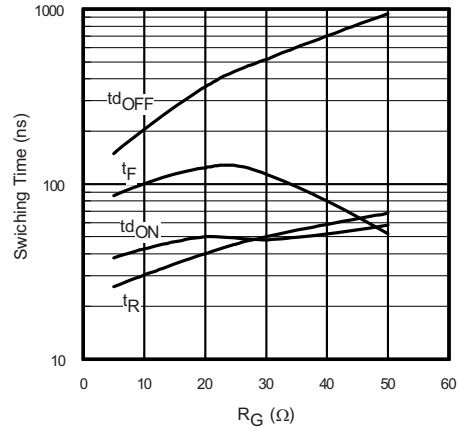


Fig. 16 - Typical Switching Time vs. R_g
 $T_J = 150\text{ }^\circ\text{C}$; $L = 1.4\text{ mH}$; $V_{CE} = 400\text{ V}$
 $I_{CE} = 5.0\text{ A}$; $V_{GE} = 15\text{ V}$

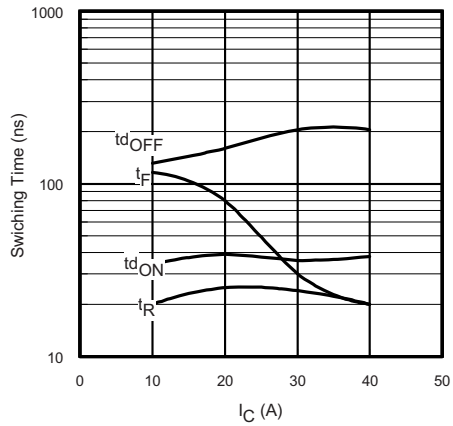


Fig. 14 - Typical Switching Time vs. I_C
 $T_J = 150\text{ }^\circ\text{C}$; $L = 1.4\text{ mH}$; $V_{CE} = 400\text{ V}$
 $R_g = 100\text{ }\Omega$; $V_{GE} = 15\text{ V}$

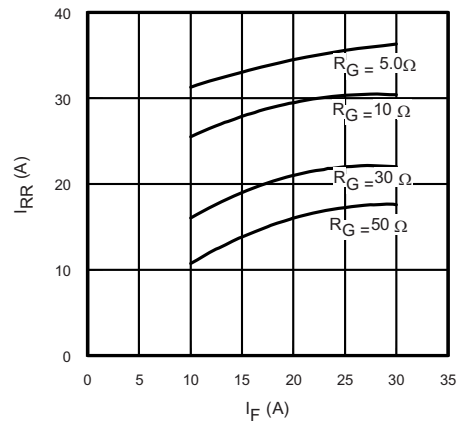


Fig. 17 - Typical Diode I_{rr} vs. I_F
 $T_J = 150\text{ }^\circ\text{C}$

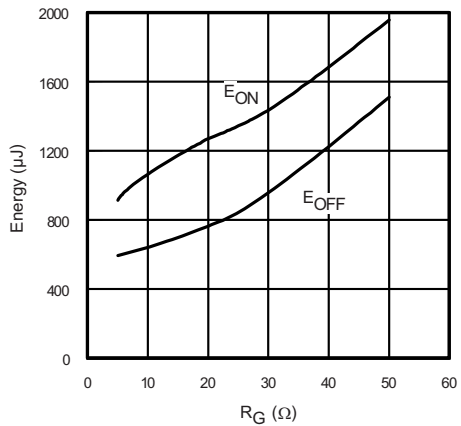


Fig. 15 - Typical Energy Loss vs. R_g
 $T_J = 150\text{ }^\circ\text{C}$; $L = 1.4\text{ mH}$; $V_{CE} = 400\text{ V}$
 $I_{CE} = 5.0\text{ A}$; $V_{GE} = 15\text{ V}$

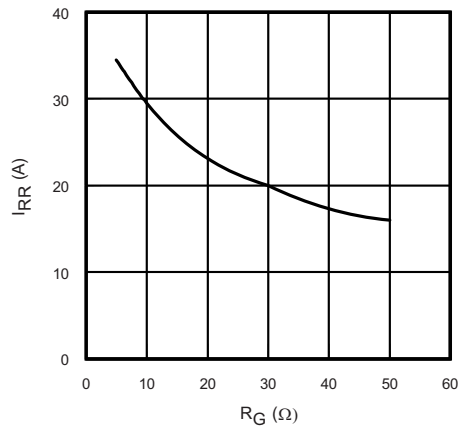


Fig. 18 - Typical Diode I_{rr} vs. R_g
 $T_J = 150\text{ }^\circ\text{C}$; $I_F = 5.0\text{ A}$

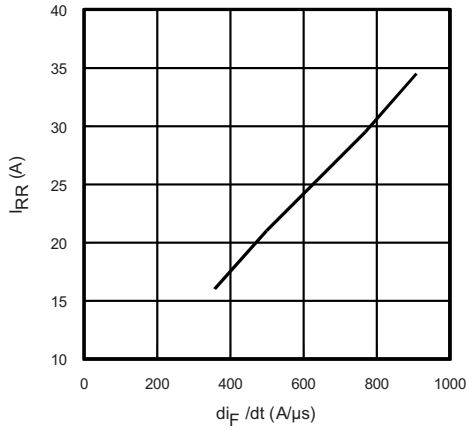


Fig. 19 - Typical Diode I_{RR} vs. di_F/dt
 $V_{CC} = 400\text{ V}$; $V_{GE} = 15\text{ V}$; $I_{CE} = 5.0\text{ A}$; $T_J = 150\text{ }^\circ\text{C}$

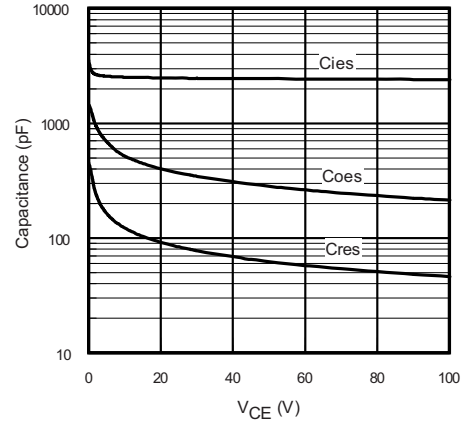


Fig. 21 - Typical Capacitance vs. V_{CE}
 $V_{GE} = 0\text{ V}$; $f = 1\text{ MHz}$

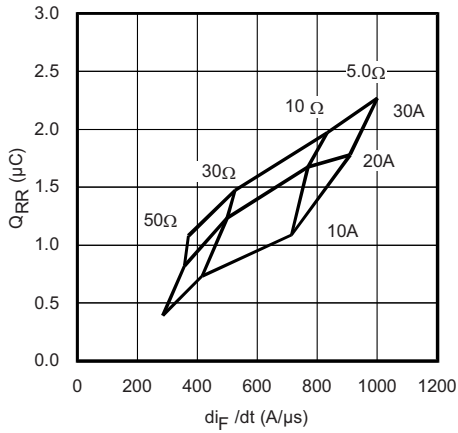


Fig. 20 - Typical Diode Q_{RR}
 $V_{CC} = 400\text{ V}$; $V_{GE} = 15\text{ V}$; $T_J = 150\text{ }^\circ\text{C}$

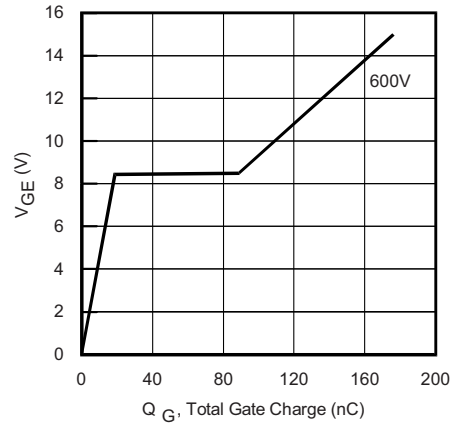


Fig. 22 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 5.0\text{ A}$; $L = 600\text{ } \mu\text{H}$

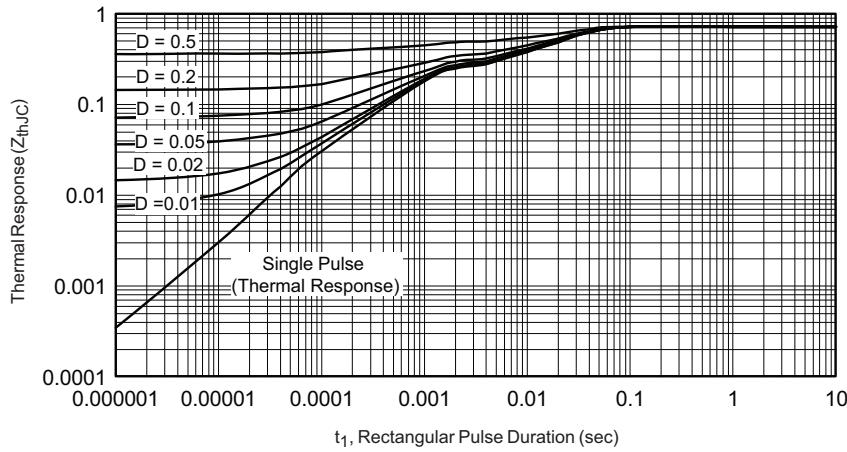


Fig. 23 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

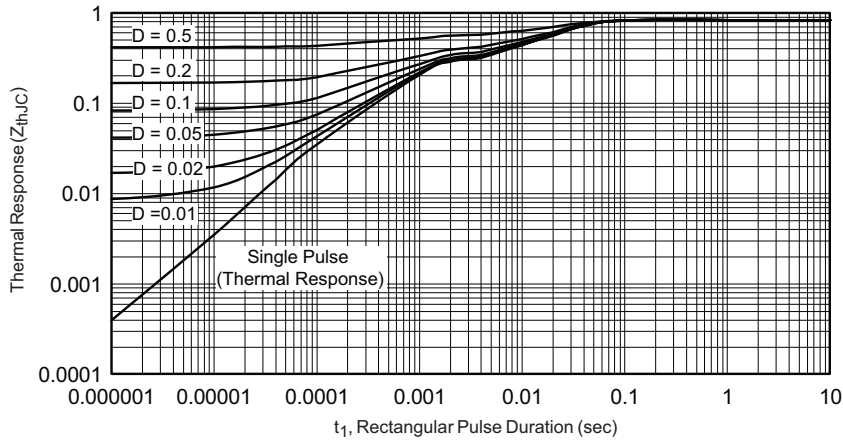


Fig. 24 - Maximum Transient Thermal Impedance, Junction to Case (Diode)

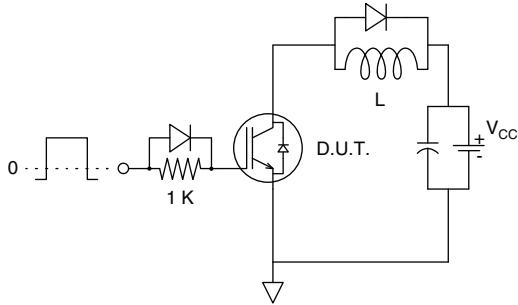


Fig. CT.1 - Gate Charge Circuit (Turn-Off)

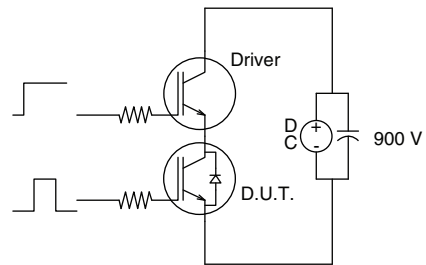


Fig. CT.3 - S.C. SOA Circuit

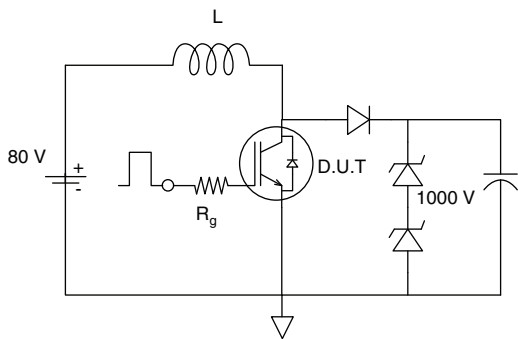


Fig. CT.2 - RBSOA Circuit

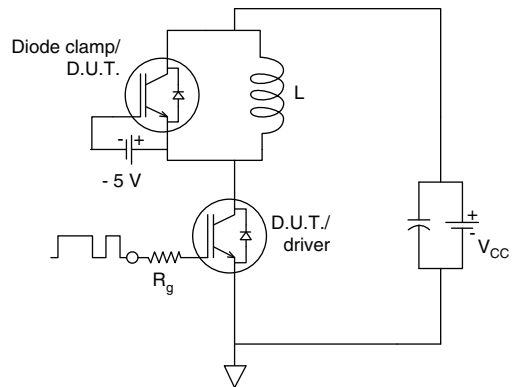


Fig. CT.4 - Switching Loss Circuit

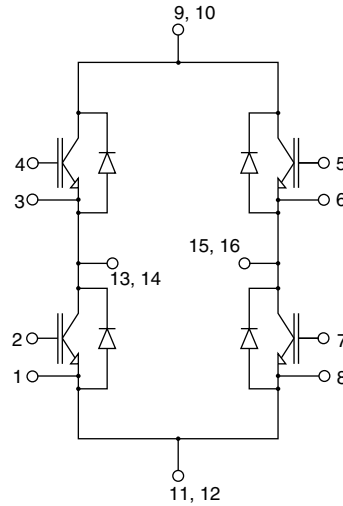


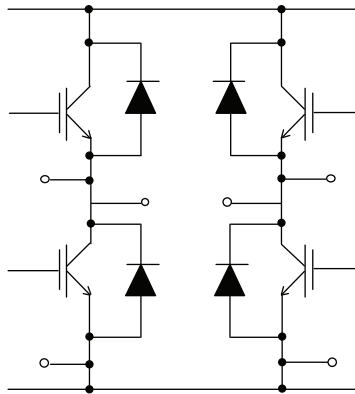
Fig. 25 - Electrical diagram

ORDERING INFORMATION TABLE

Device code	20	MT	120	U	F	A	PbF
	①	②	③	④	⑤	⑥	⑦

- 1** - Current rating (20 = 20 A)
- 2** - Essential part number
- 3** - Voltage code (120 = 1200 V)
- 4** - Speed/type (U = Ultrafast IGBT)
- 5** - Circuit configuration (F = Full bridge)
- 6** - A = Al₂O₃ DBC substrate
- 7** - Lead (Pb)-free

CIRCUIT CONFIGURATION

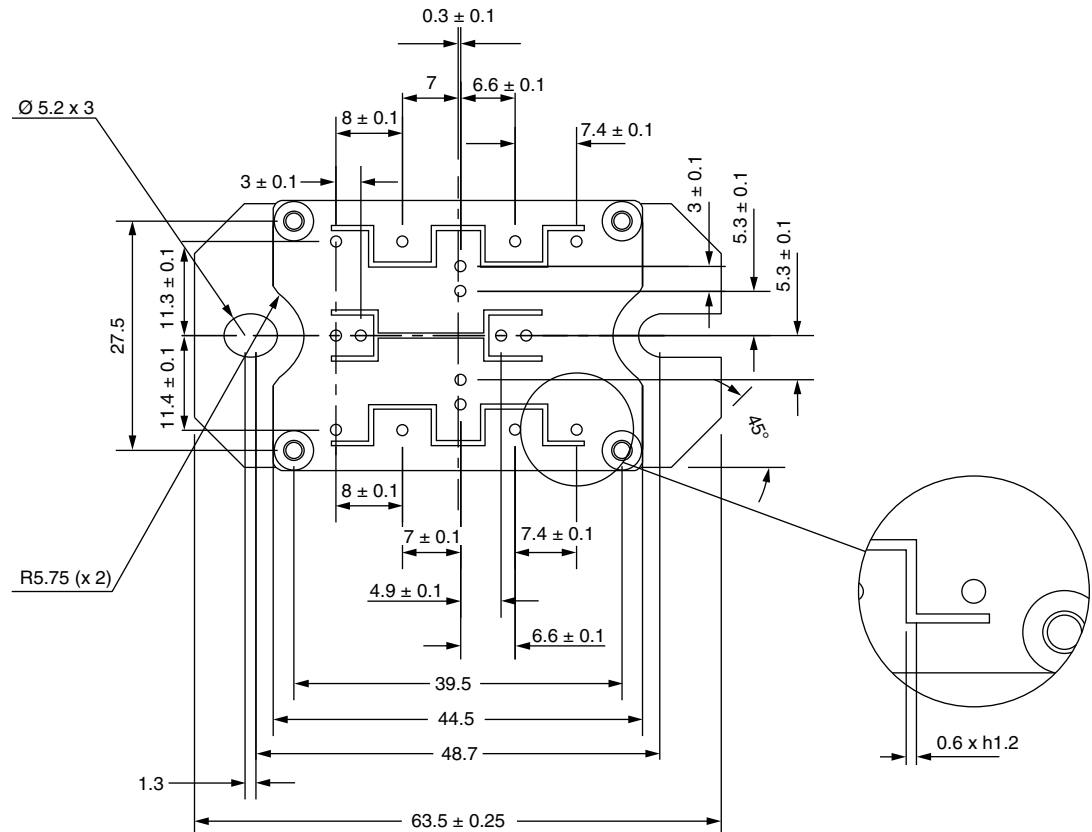
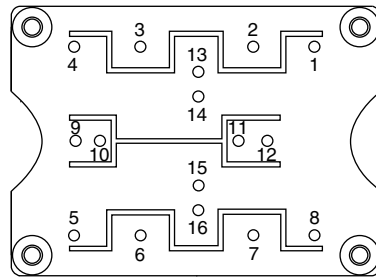
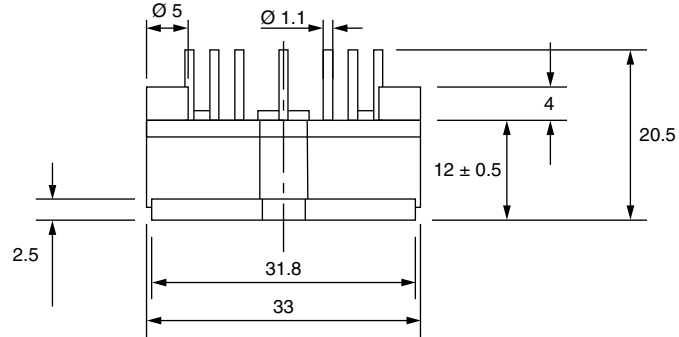


LINKS TO RELATED DOCUMENTS

Dimensions	www.vishay.com/doc?95245
------------	--

MTP MOSFET/IGBT Full-Bridge

DIMENSIONS in millimeters





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.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.