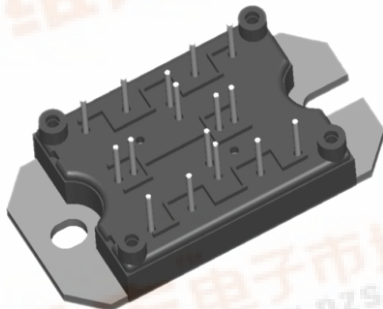



"Full Bridge" IGBT MTP (Ultrafast NPT IGBT), 40 A



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
- Aluminum nitride DBC
- 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 $T_C = 25\text{ }^\circ\text{C}$	40 A
$V_{CE(on)}$	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	$T_C = 25\text{ }^\circ\text{C}$	40	A
		$T_C = 106\text{ }^\circ\text{C}$	20	
Pulsed collector current	I_{CM}		100	
Clamped inductive load current	I_{LM}		100	
Diode continuous forward current	I_F	$T_C = 106\text{ }^\circ\text{C}$	25	
Diode maximum forward current	I_{FM}		100	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ 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 °C 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 °C 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 V _{CC} = 600 V V _{GE} = 15 V	-	176	264	nC
Gate to emitter charge (turn-on)	Q _{ge}		-	19	30	
Gate to collector charge (turn-on)	Q _{gc}		-	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 = 1 mH, T _J = 25 °C, energy losses include tail and diode reverse recovery	-	0.92	-	mJ
Turn-off switching loss	E _{off}		-	0.46	-	
Total switching loss	E _{tot}		-	1.38	-	
Turn-on switching loss	E _{on}	V _{CC} = 600 V, I _C = 20 A, V _{GE} = 15 V, R _g = 5 Ω, L = 1 mH, T _J = 125 °C, energy losses include tail and diode reverse recovery	-	1.29	-	mJ
Turn-off switching loss	E _{off}		-	0.81	-	
Total switching loss	E _{tot}		-	2.1	-	
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 ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Diode forward voltage drop	V_{FM}	$I_C = 20\text{ A}$	-	2.48	2.94	V
		$I_C = 40\text{ A}$	-	3.28	3.90	
		$I_C = 20\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	2.44	2.84	
		$I_C = 40\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	3.45	4.14	
		$I_C = 20\text{ A}, T_J = 150\text{ }^\circ\text{C}$	-	2.21	2.93	
Reverse recovery energy of the diode	E_{rec}	$V_{GE} = 15\text{ V}, R_g = 5\text{ }\Omega, L = 200\text{ }\mu\text{H}$	-	420	630	μJ
Diode reverse recovery time	t_{rr}	$V_{CC} = 600\text{ V}, I_C = 20\text{ A}$	-	98	150	ns
Peak reverse recovery current	I_{rr}	$T_J = 125\text{ }^\circ\text{C}$	-	33	50	A

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T_J		- 40	-	150	$^\circ\text{C}$
Storage temperature range	T_{Stg}		- 40	-	125	
Junction to case	R_{thJC}	IGBT	-	0.35	0.52	$^\circ\text{C/W}$
		Diode	-	0.40	0.61	
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 \pm 10 %			Nm
Weight			66			g

20MT120UFP



Vishay High Power Products "Full Bridge" IGBT MTP
(Ultrafast NPT IGBT), 40 A

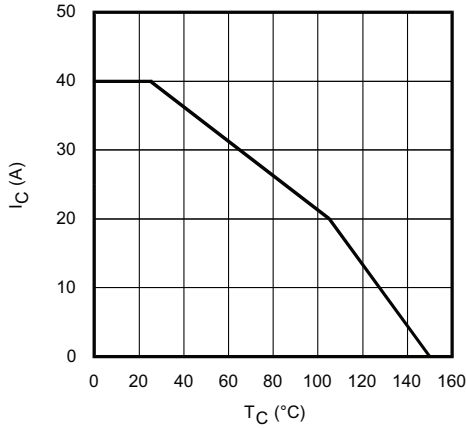


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

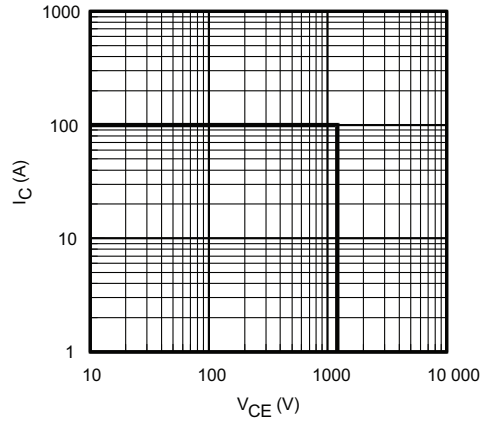


Fig. 4 - Reverse Bias SOA
T_J = 150 °C; V_{GE} = 15 V

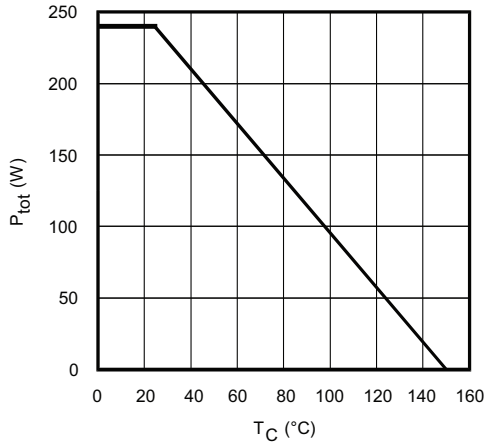


Fig. 2 - Power Dissipation vs. Case Temperature

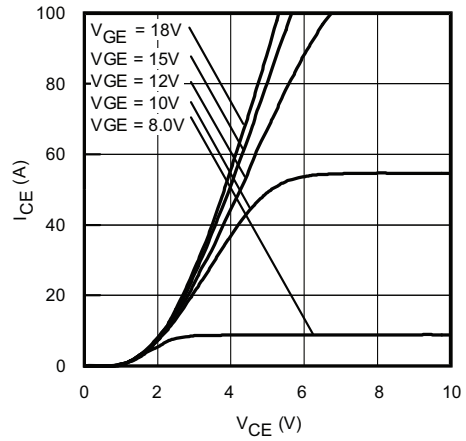


Fig. 5 - Typical IGBT Output Characteristics
T_J = - 40 °C; t_p = 80 μs

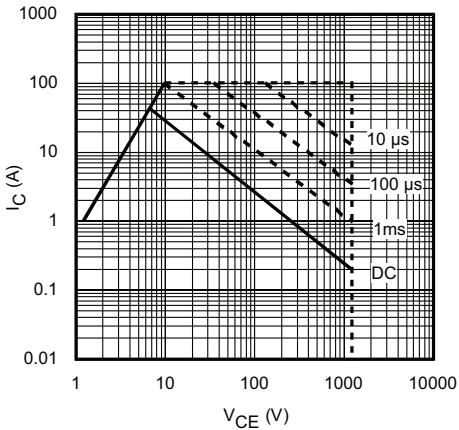


Fig. 3 - Forward SOA
T_C = 25 °C; T_J ≤ 150 °C

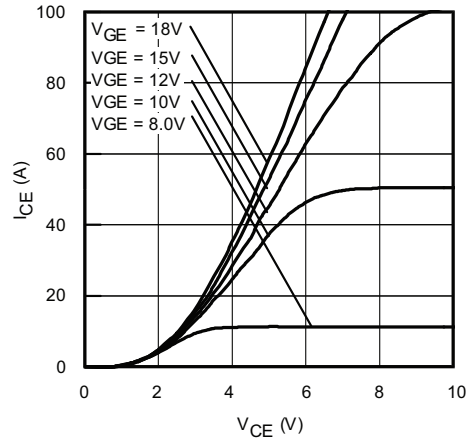


Fig. 6 - Typical IGBT Output Characteristics
T_J = 25 °C; t_p = 80 μs

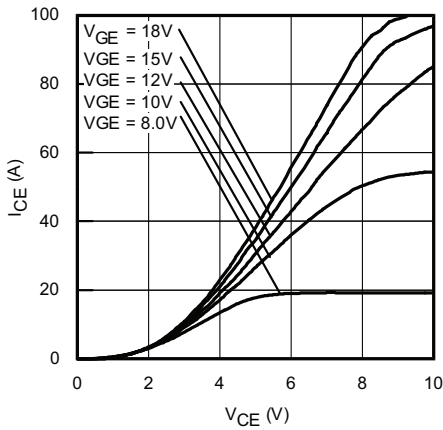


Fig. 7 - Typical IGBT Output Characteristics
 $T_J = 125^\circ\text{C}$; $t_p = 80 \mu\text{s}$

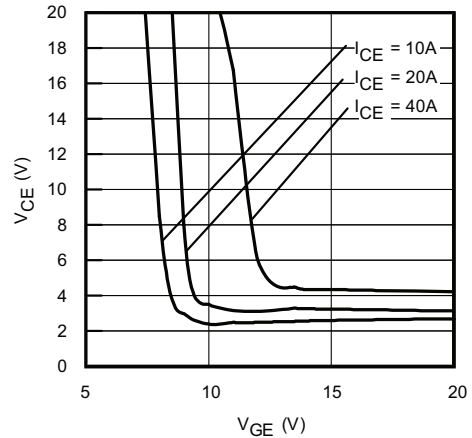


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

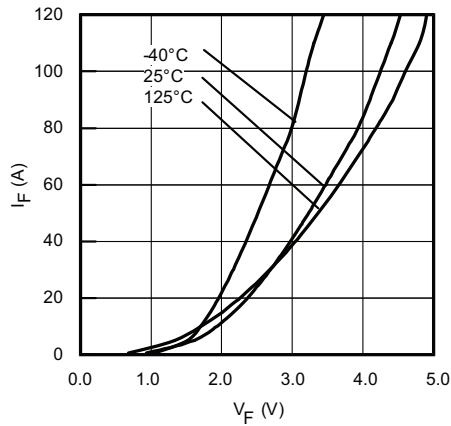


Fig. 8 - Typical Diode Forward Characteristics
 $t_p = 80 \mu\text{s}$

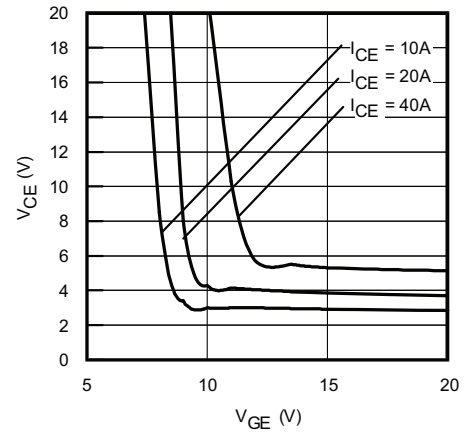


Fig. 11 - Typical V_{CE} vs. V_{GE}
 $T_J = 125^\circ\text{C}$

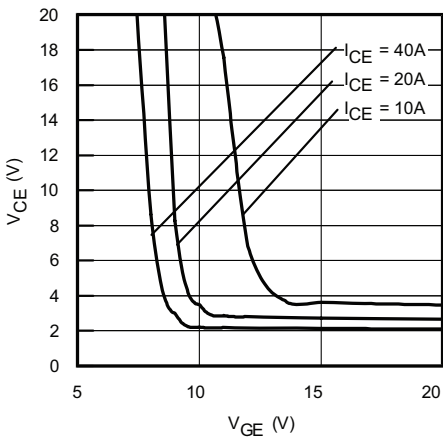


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^\circ\text{C}$

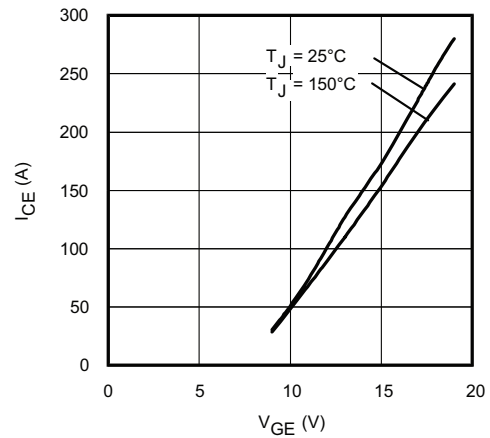


Fig. 12 - Typical Transfer Characteristics
 $V_{CE} = 50 \text{ V}$; $t_p = 10 \mu\text{s}$

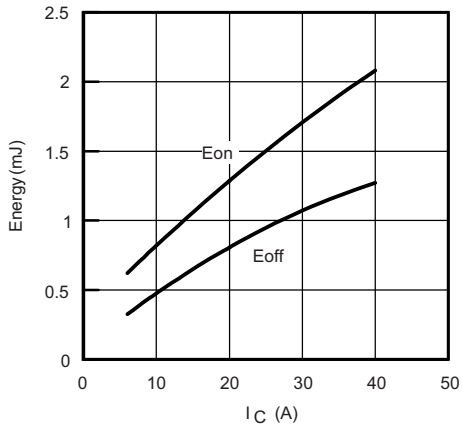


Fig. 13 - Typical Energy Loss vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$; $L = 1\text{ mH}$; $V_{CC} = 600\text{ V}$
 $R_g = 5\ \Omega$; $V_{GE} = 15\text{ V}$

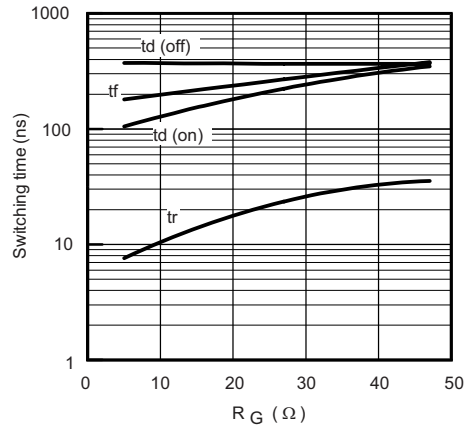


Fig. 16 - Typical Switching Time vs. R_g
 $T_J = 150\text{ }^\circ\text{C}$; $L = 1\text{ mH}$; $V_{CC} = 600\text{ V}$
 $I_{CE} = 6\text{ A}$; $V_{GE} = 15\text{ V}$

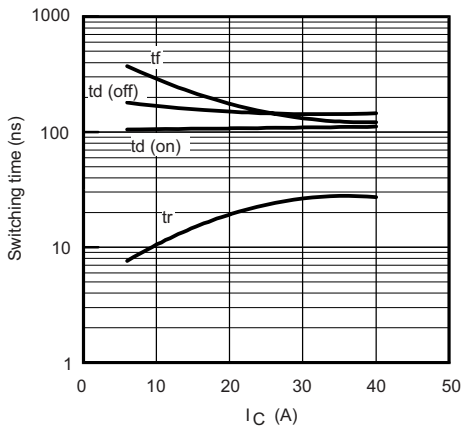


Fig. 14 - Typical Switching Time vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$; $L = 1\text{ mH}$; $V_{CC} = 600\text{ V}$
 $R_g = 5\ \Omega$; $V_{GE} = 15\text{ V}$

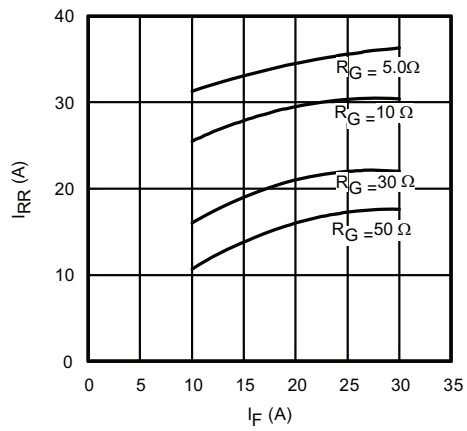


Fig. 17 - Typical Diode I_{rr} vs. I_F
 $T_J = 150\text{ }^\circ\text{C}$

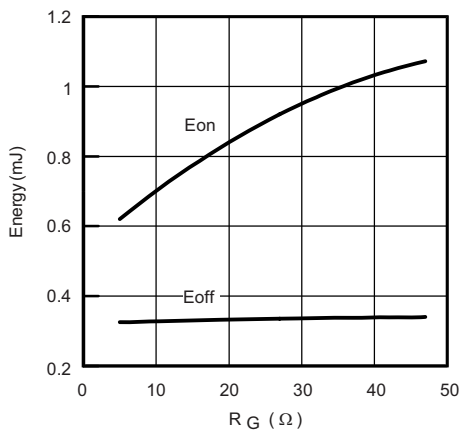


Fig. 15 - Typical Energy Loss vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$; $L = 1\text{ mH}$; $V_{CC} = 600\text{ V}$
 $I_{CE} = 6\text{ A}$; $V_{GE} = 15\text{ V}$

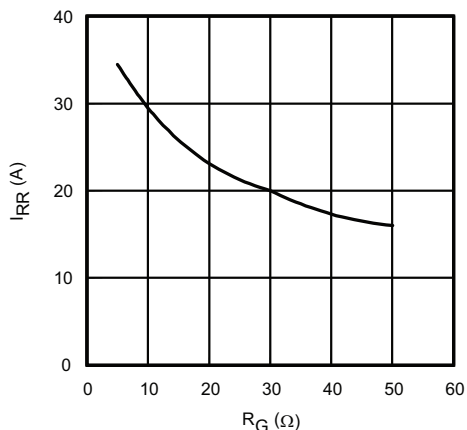


Fig. 18 - Typical Diode I_{rr} vs. R_g
 $T_J = 150\text{ }^\circ\text{C}$; $I_F = 5.0\text{ A}$

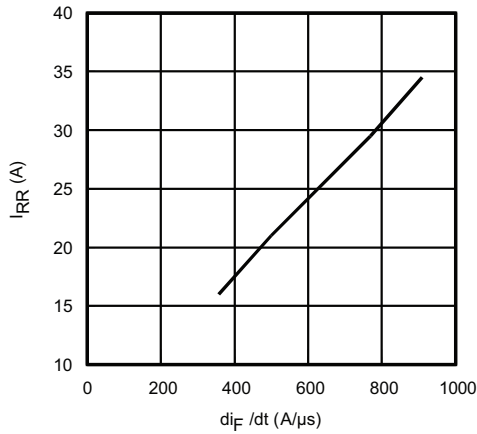


Fig. 19 - Typical Diode I_{rr} vs. di_F/dt
 $V_{CC} = 400\text{ V}$; $V_{GE} = 15\text{ V}$; $I_{CE} = 5.0\text{ A}$; $T_J = 150\text{ }^\circ\text{C}$

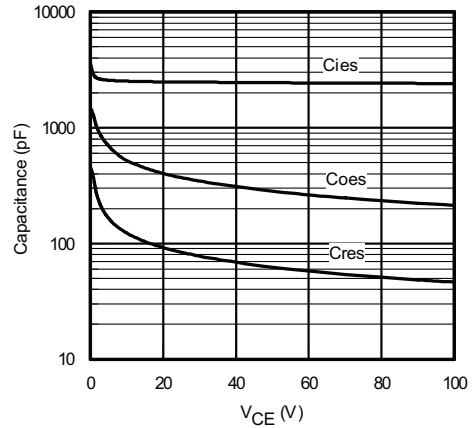


Fig. 21 - Typical Capacitance vs. V_{CE}
 $V_{GE} = 0\text{ V}$; $f = 1\text{ MHz}$

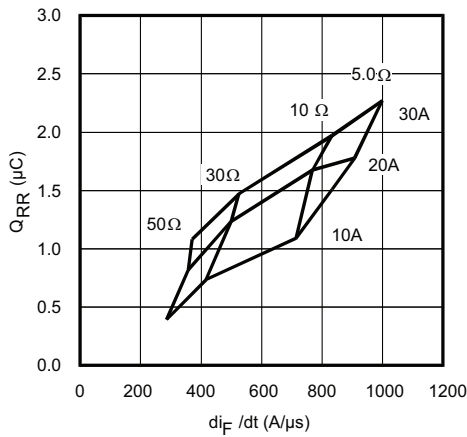


Fig. 20 - Typical Diode Q_{rr} vs. di_F/dt
 $V_{CC} = 400\text{ V}$; $V_{GE} = 15\text{ V}$; $T_J = 150\text{ }^\circ\text{C}$

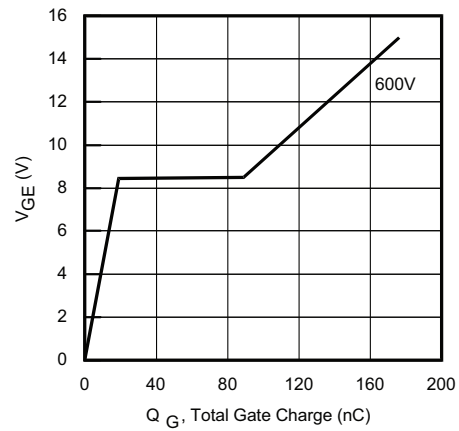


Fig. 22 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 5.0\text{ A}$; $L = 600\text{ } \mu\text{H}$

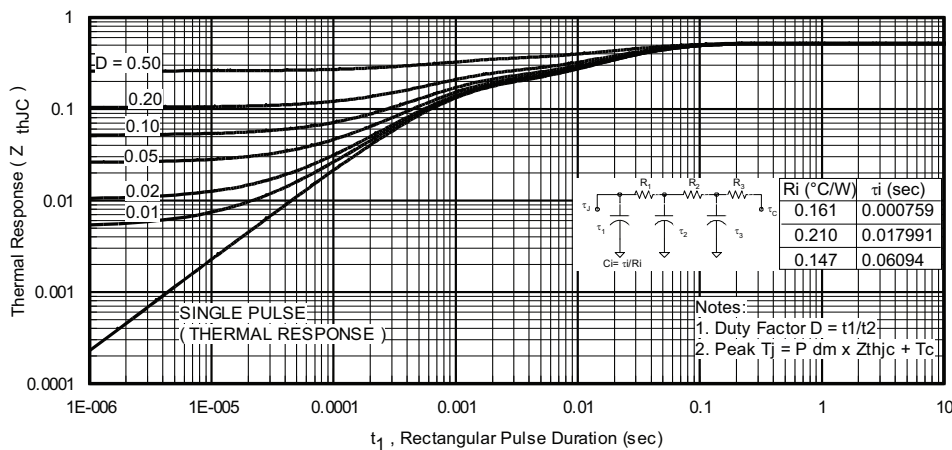


Fig. 23 - Maximum Transient Thermal Impedance, Junction to Case (IGBT)

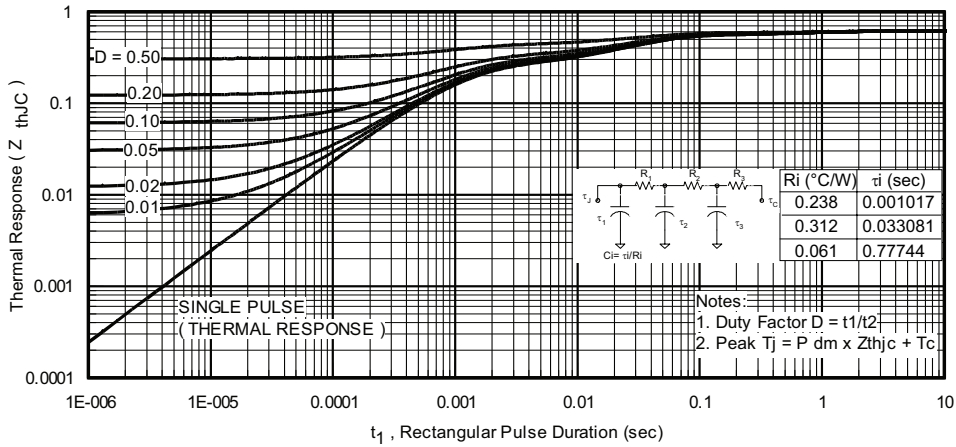


Fig. 24 - Maximum Transient Thermal Impedance, Junction to Case (Diode)

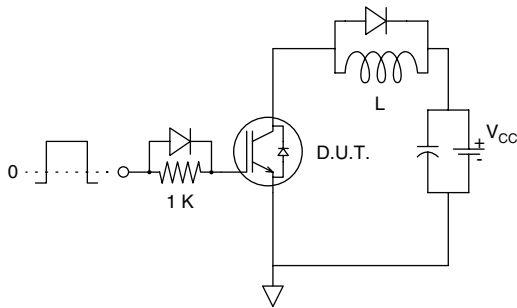


Fig. CT.1 - Gate Charge Circuit (Turn-Off)

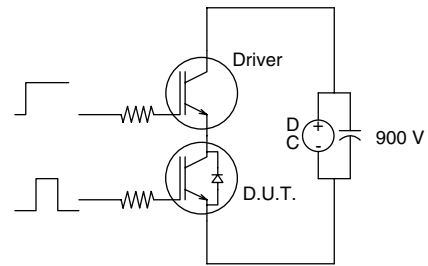


Fig. CT.3 - S.C. SOA Circuit

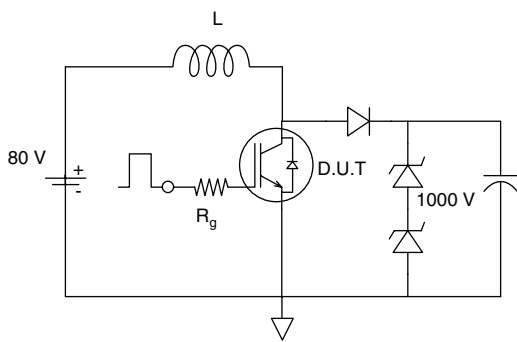


Fig. CT.2 - RBSOA Circuit

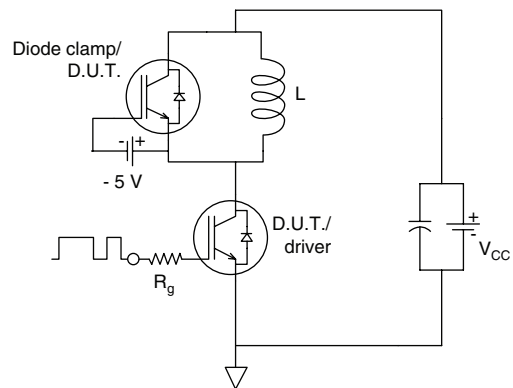


Fig. CT.4 - Switching Loss Circuit

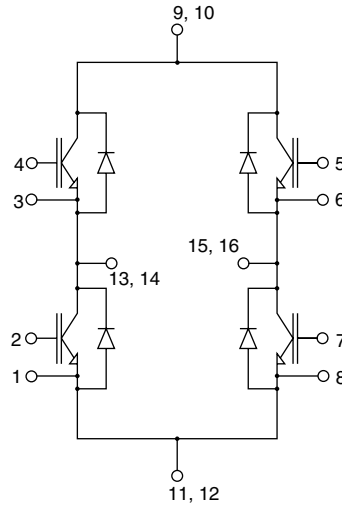
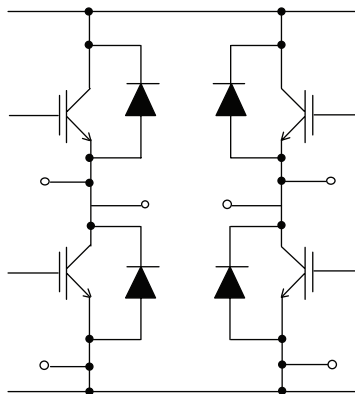


Fig. 25 - Electrical diagram

ORDERING INFORMATION TABLE

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

CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95245

Disclaimer

All product specifications and data are subject to change without notice.

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 herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

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.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.