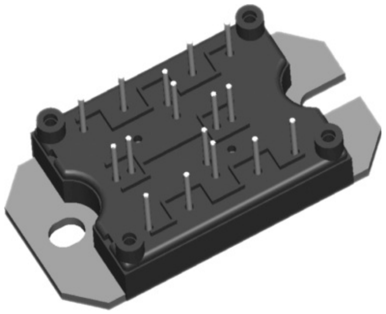
"Full Bridge" IGBT MTP (Ultrafast NPT IGBT), 20 A



MTP

PRODUCT SUMMARY	
V_{CES}	600 V
$I_{C(DC)}$	20 A at T_C = 97 °C
$V_{CE(on)}$ (typical) at I_C = 20 A, 25 °C	1.9 V

FEATURES

Pb-free
RoHS
COMPLIANT

- Generation 5 Non Punch Through (NPT) technology
- Positive $V_{CE(on)}$ temperature coefficient
- 10 μs short circuit capability
- FRED Pt® hyperfast rectifier
- Low $V_{CE(on)}$
- Square RBSOA
- Very low conduction and switching losses
- 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

BENEFITS

- Optimized for welding, UPS and SMPS applications
- 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 voltage	V_{CES}		600	V
Continuous collector current	I_C	T_C = 25 °C	35	A
		T_C = 80 °C	24	
Pulsed collector current	I_{CM}		70	
Clamped inductive load current	I_{LM}		70	
Diode continuous forward current	I_F	T_C = 95 °C	20	
Peak diode forward current	I_{FSM}		70	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, t = 1 minute	2500	
Maximum power dissipation per single IGBT	P_D	T_C = 25 °C	114	W
		T_C = 80 °C	64	

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 = 500 µA	600	-	-	V
Temperature coefficient of breakdown voltage	$\Delta V_{(BR)CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 1 mA (25 to 125 °C)	-	+ 0.6	-	V/°C
Collector to emitter saturation voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 20 A	-	1.9	2.2	V
		V_{GE} = 15 V, I_C = 40 A	-	2.57	3.0	
		V_{GE} = 15 V, I_C = 20 A, T_J = 125 °C	-	2.22	2.5	
		V_{GE} = 15 V, I_C = 40 A, T_J = 125 °C	-	3.15	3.5	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 µA	3.5	4.4	5.5	
Temperature coefficient of threshold voltage	$V_{GE(th)}/\Delta T_J$	V_{CE} = V_{GE}, I_C = 1 mA (25 to 125 °C)	-	- 10	-	mV/°C
Collector to emitter leaking current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	-	4	100	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 125 °C	-	80	200	
Diode forward voltage drop	V_{FM}	V_{GE} = 0 V, I_F = 20 A	-	1.63	1.9	V
		V_{GE} = 0 V, I_F = 40 A	-	1.88	2.2	
		V_{GE} = 0 V, I_F = 20 A, T_J = 125 °C	-	1.32	1.6	
		V_{GE} = 0 V, I_F = 40 A, T_J = 125 °C	-	1.62	1.85	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V	-	-	± 200	nA

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} = 300 V V_{GE} = 15 V	-	72	-	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	16	-	
Gate to collector charge (turn-on)	Q_{gc}		-	24	-	
Turn-on switching loss	E_{on}	V_{CC} = 360 V, I_C = 20 A, V_{GE} = 15 V, R_g = 5 Ω, L = 500 µH, energy losses include tail and diode reverse recovery	-	0.18	-	mJ
Turn-off switching loss	E_{off}		-	0.27	-	
Total switching loss	E_{tot}		-	0.45	-	
Turn-on switching loss	E_{on}	V_{CC} = 360 V, I_C = 20 A, V_{GE} = 15 V, R_g = 5 Ω, L = 500 µH, T_J = 125 °C, energy losses include tail and diode reverse recovery	-	0.25	-	
Turn-off switching loss	E_{off}		-	0.36	-	
Total switching loss	E_{tot}		-	0.61	-	
Turn-on delay time	$t_{d(on)}$		-	67	-	ns
Rise time	t_r		-	23	-	
Turn-off delay time	$t_{d(off)}$		-	101	-	
Fall time	t_f		-	127	-	
Input capacitance	C_{ies}	V_{GE} = 0 V V_{CC} = 30 V f = 1.0 MHz	-	1316	-	pF
Output capacitance	C_{oes}		-	335	-	
Reverse transfer capacitance	C_{res}		-	40	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 70 A V_{CC} = 400 V, V_p = 600 V R_g = 22 Ω, V_{GE} = + 15 V to 0 V	Fullsquare			
Short circuit safe operating area	SCSOA	T_J = 150 °C V_{CC} = 400 V, V_p = 600 V R_g = 22 Ω, V_{GE} = + 15 V to 0 V	10	-	-	µs

RECOVERY SPECIFICATIONS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Diode reverse recovery time	t_{rr}	I_F = 20 A dI/dt = 200 A/μs V_R = 400 V	-	85	106	ns
Diode peak reverse current	I_{rr}		-	4.5	6	A
Diode recovery charge	Q_{rr}		-	188	318	nC
Diode reverse recovery time	t_{rr}	I_F = 20 A dI/dt = 200 A/μs, V_R = 400 V T_J = 125 °C	-	132	156	ns
Diode peak reverse current	I_{rr}		-	9.5	11	A
Diode recovery charge	Q_{rr}		-	626	842	nC

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	IGBT	R_{thJC}		-	-	1.1	°C/W
	Diode			-	-	2.1	
Case to sink per module		R_{thCS}		-	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

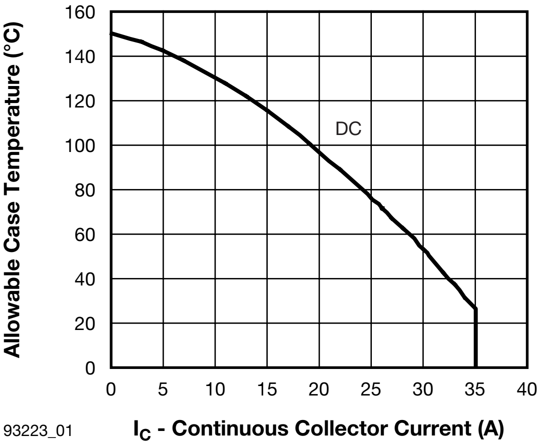


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

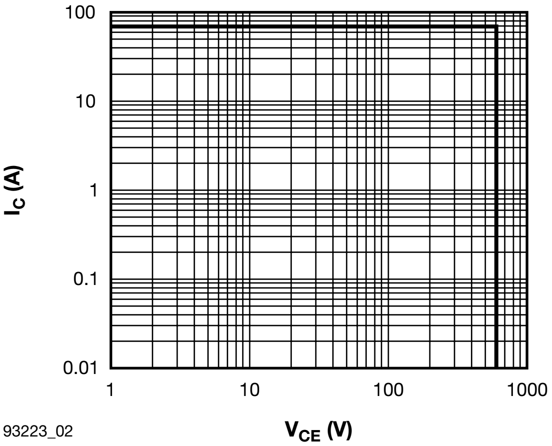


Fig. 2 - IGBT Reverse BIAS SOA
T_J = 150 °C; V_{GE} = 15 V

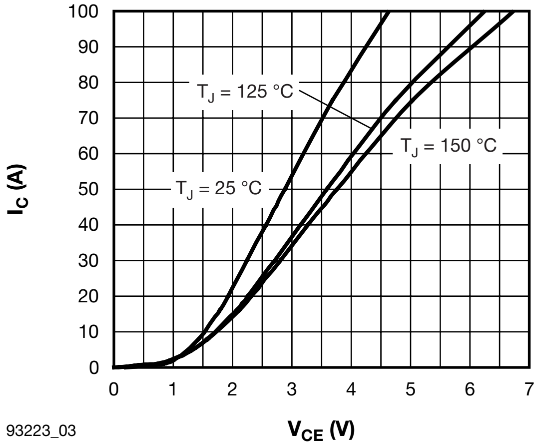


Fig. 3 - Typical IGBT Collector Current Characteristics V_{GE} = 15 V

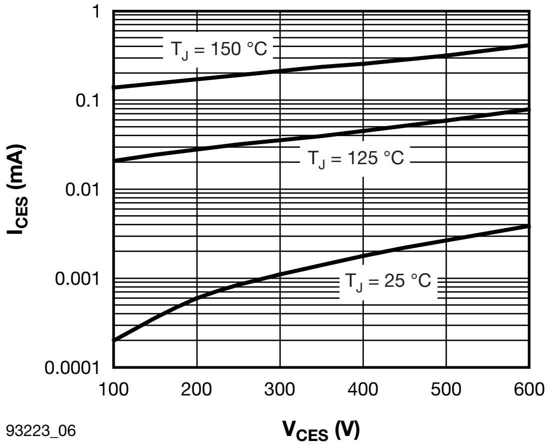


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

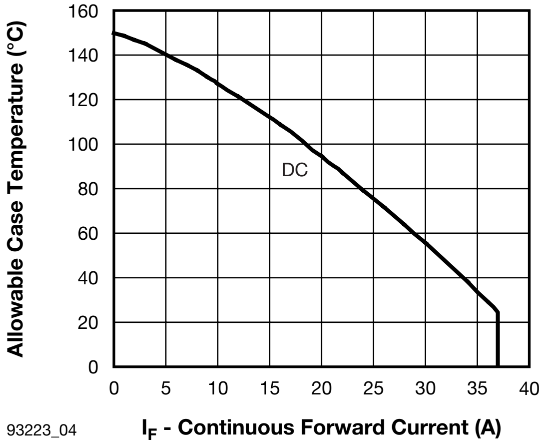


Fig. 4 - Maximum DC Forward Current vs. Case Temperature

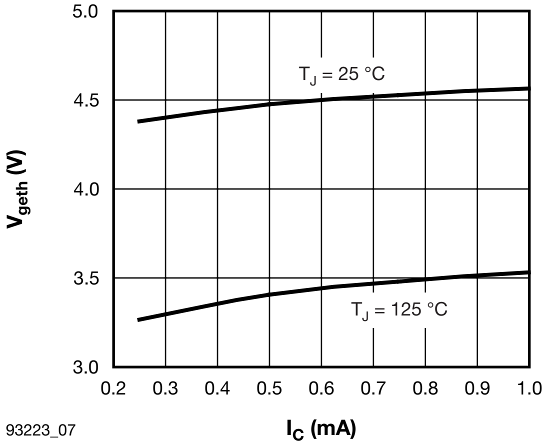


Fig. 7 - Typical IGBT Threshold Voltage

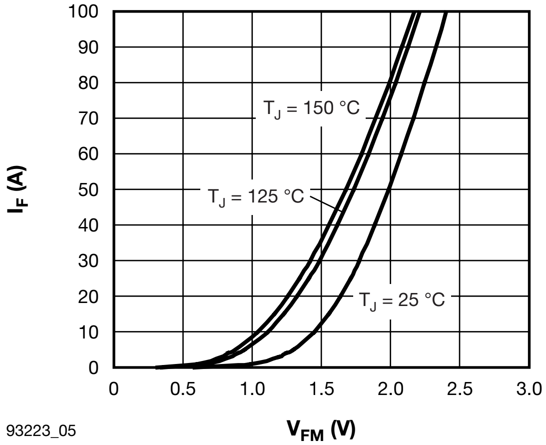


Fig. 5 - Typical Diode Forward Characteristics

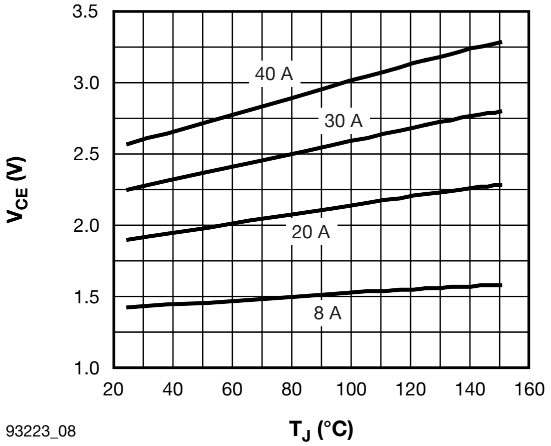


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

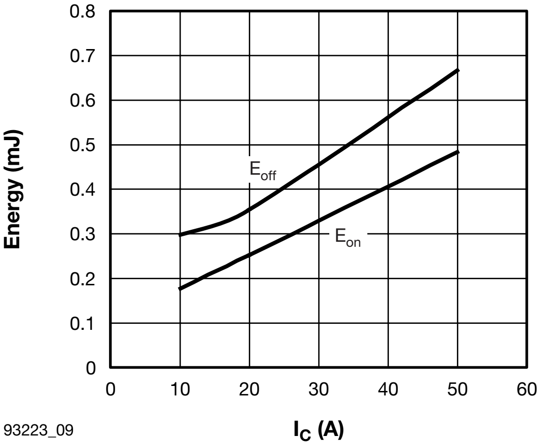


Fig. 9 - Typical IGBT Energy Loss vs. I_C, T_J = 125 °C
V_{CC} = 360 V, V_{GE} = 15 V, L = 500 µH, R_g = 5 Ω

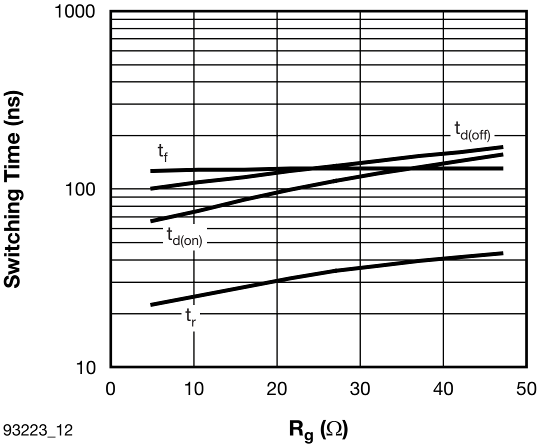


Fig. 12 - Typical IGBT Switching Time vs. R_g, T_J = 125 °C
I_C = 20 A, V_{CC} = 360 V, V_{GE} = 15 V, L = 500 µH

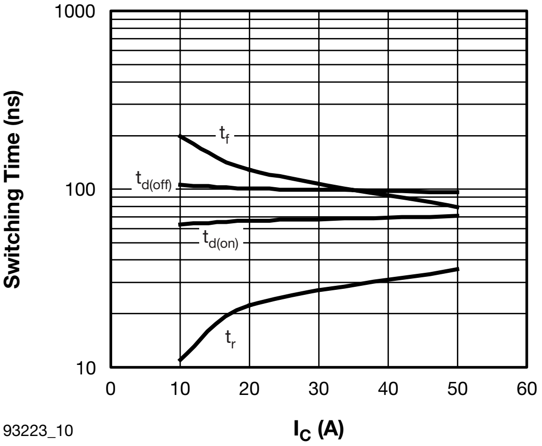


Fig. 10 - Typical IGBT Switching Time vs. I_C, T_J = 125 °C
V_{CC} = 360 V, V_{GE} = 15 V, L = 500 µH, R_g = 5 Ω

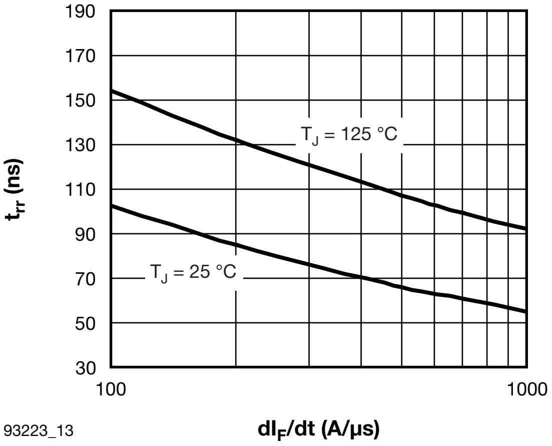


Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
V_R = 400 V; I_F = 20 A

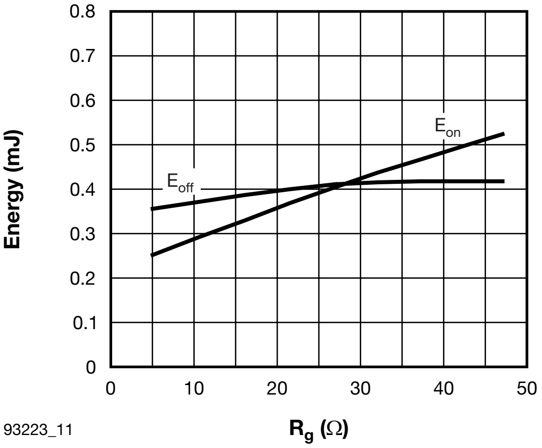


Fig. 11 - Typical IGBT Energy Loss vs. R_g, T_J = 125 °C
I_C = 20 A, V_{CC} = 360 V, V_{GE} = 15 V, L = 500 µH

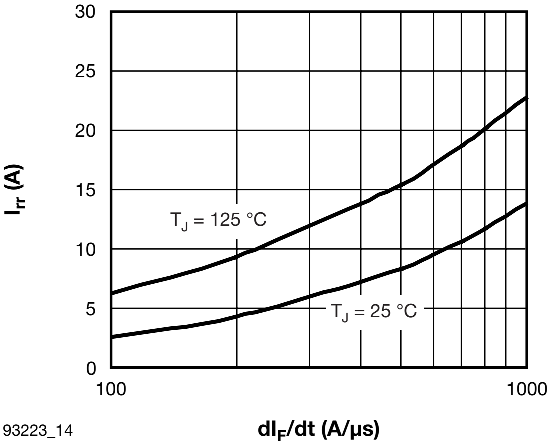


Fig. 14 - Typical I_{rr} Diode vs. dI_F/dt
V_R = 400 V; I_F = 20 A

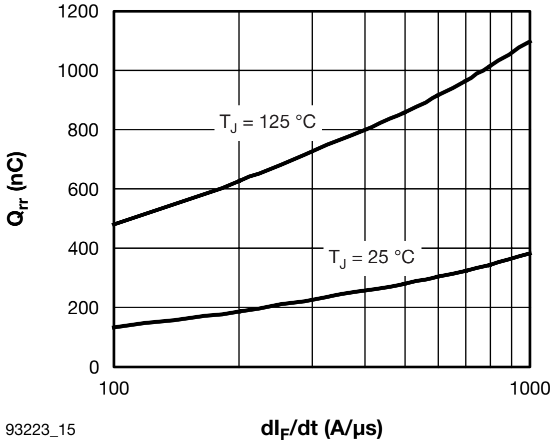


Fig. 15 - Typical Q_{rr} Diode vs. dI_F/dt
V_R = 400 V; I_F = 20 A

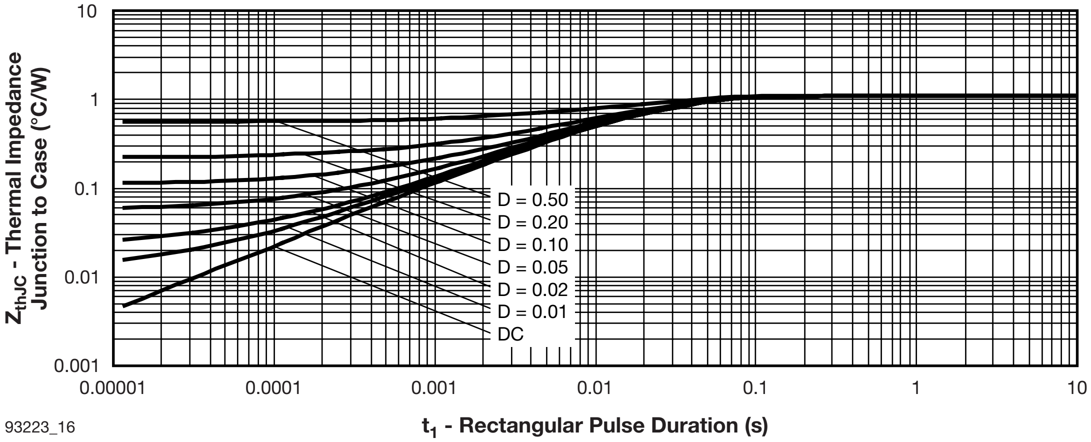


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

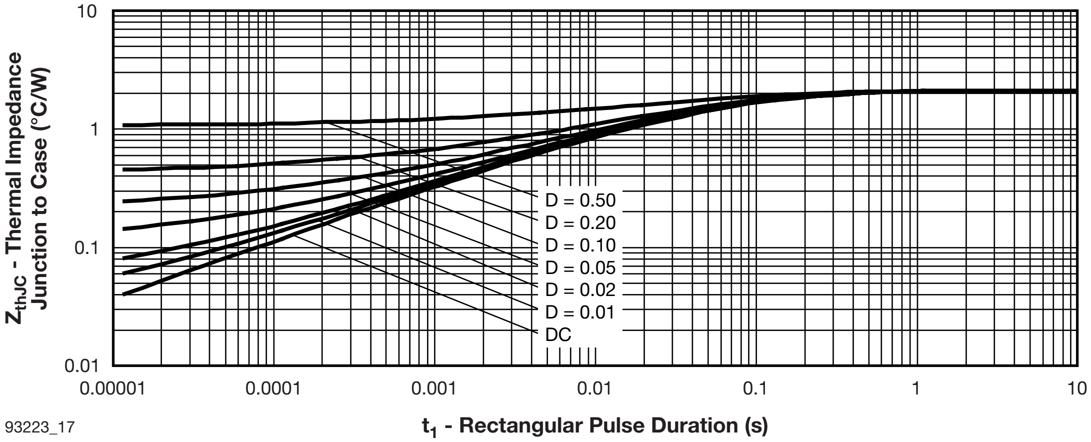


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)

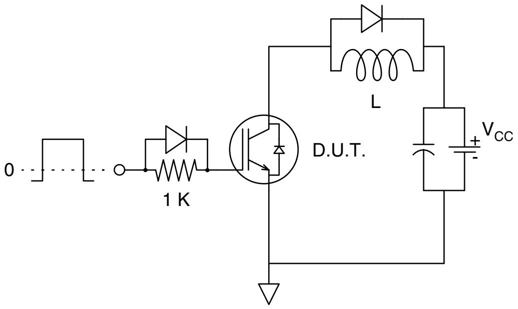


Fig. C.T.1 - Gate Charge Circuit (Turn-Off)

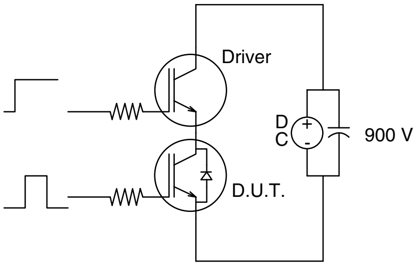


Fig. C.T.3 - S.C. SOA Circuit

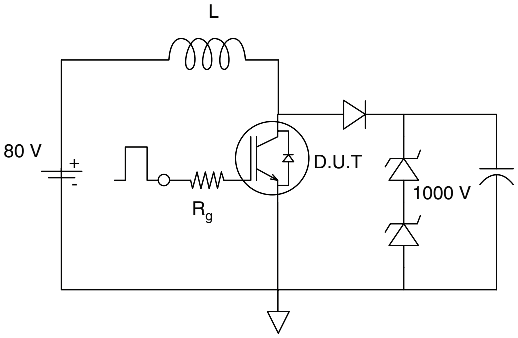


Fig. C.T.2 - RBSOA Circuit

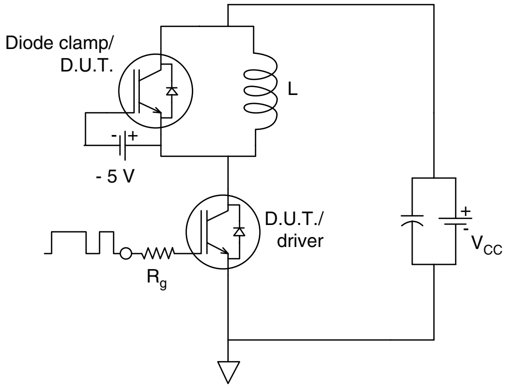


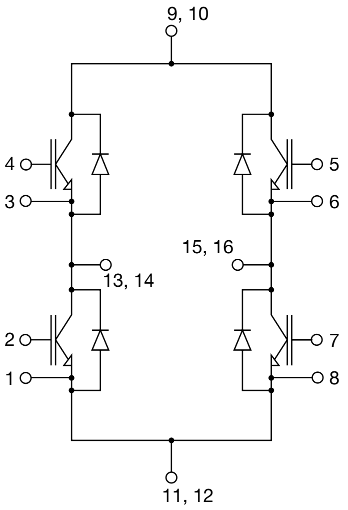
Fig. C.T.4 - Switching Loss Circuit

ORDERING INFORMATION TABLE

Device code	**20**	**MT**	**060**	**K**	**F**
	①	②	③	④	⑤

1 - Current rating (20 = 20 A)
2 - Essential part number
3 - Voltage code (060 = 600 V)
4 - Speed/type (K = Ultrafast IGBT)
5 - Circuit configuration (F = Full bridge)

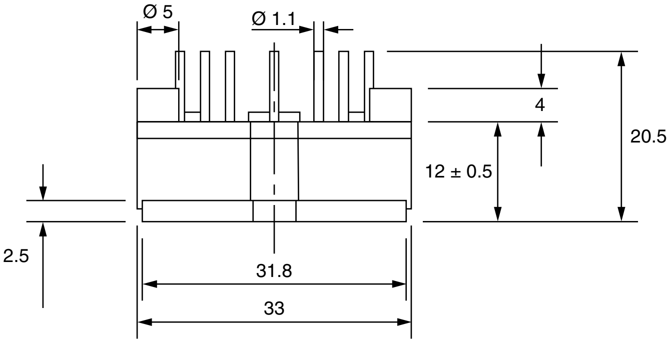
CIRCUIT CONFIGURATION

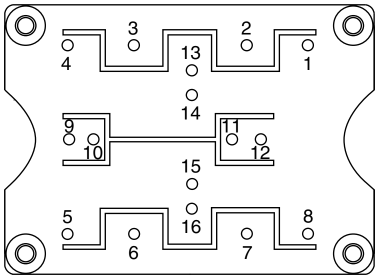


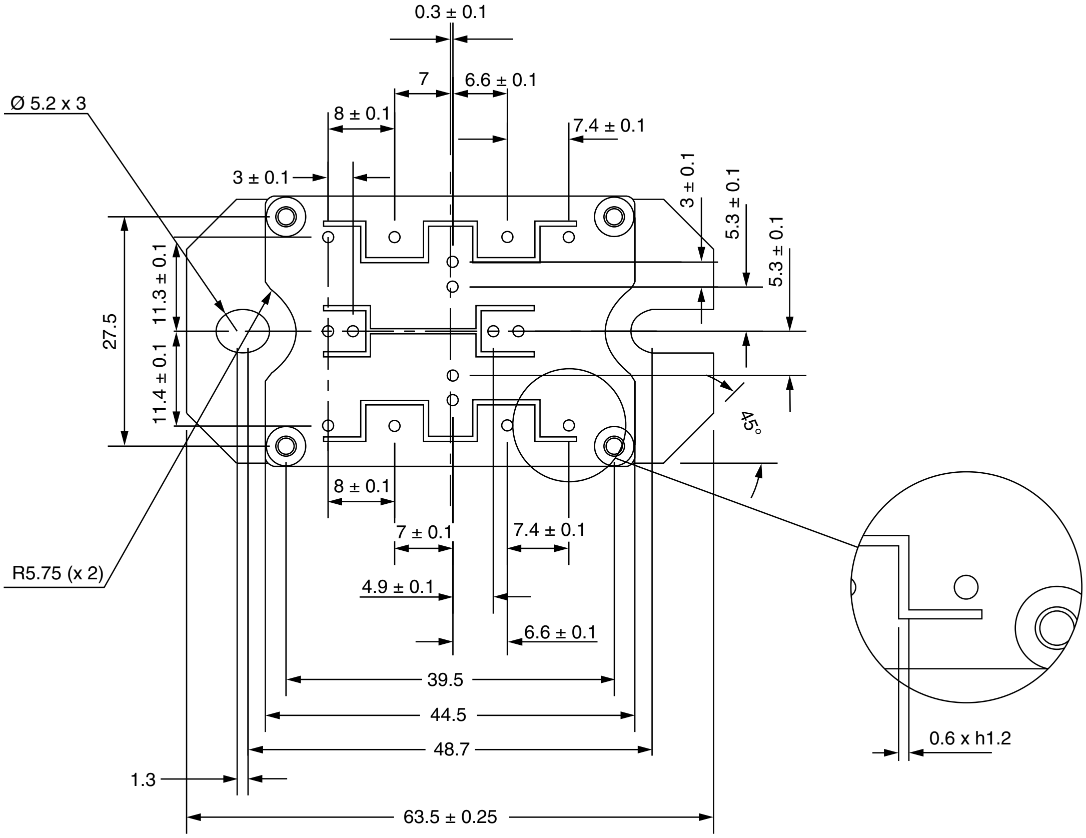
LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95245

MTP MOSFET/IGBT Full-Bridge

DIMENSIONS in millimeters







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