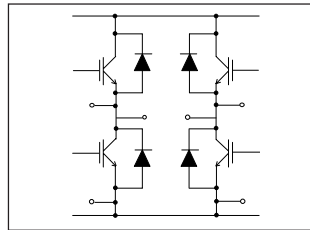


Features

- 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)



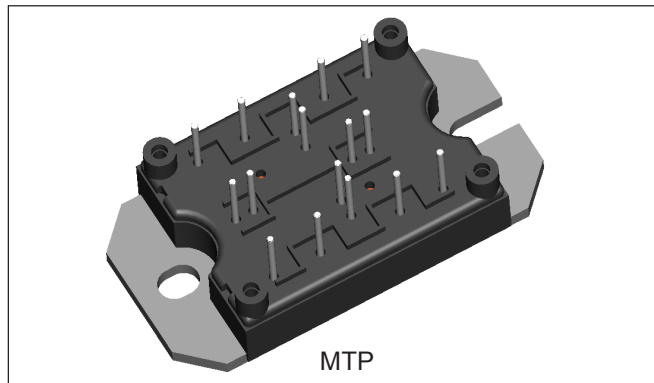
$$V_{CES} = 1200V$$

$$I_C = 40A$$

$$T_C = 25^\circ C$$

Benefits

- Optimized for Welding, UPS and SMPS Applications
- Rugged with UltraFast Performance
- Benchmark Efficiency above 20KHz
- 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

Parameters		Max	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	1200	V
I_C	Continuos Collector Current	@ $T_C = 25^\circ C$	40
		@ $T_C = 106^\circ C$	20
I_{CM}	Pulsed Collector Current	100	
I_{LM}	Clamped Inductive Load Current	100	
I_F	Diode Continuous Forward Current	@ $T_C = 106^\circ C$	25
I_{FM}	Diode Maximum Forward Current	100	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
V_{ISOL}	RMS Isolation Voltage, Any Terminal to Case, $t = 1$ min	2500	
P_D	Maximum Power Dissipation (only IGBT)	@ $T_C = 25^\circ C$	240
		@ $T_C = 100^\circ C$	96

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

Parameters	Min	Typ	Max	Units	Test Conditions
V _{(BR)CES} Collector-to-Emitter Breakdown Voltage	1200			V	V _{GE} = 0V, I _C = 250μA
ΔV _{(BR)CES} /ΔT _J Temperature Coeff. of Breakdown Voltage		+1.3		V/°C	V _{GE} = 0V, I _C = 3mA (25-125°C)
V _{CE(ON)} Collector-to-Emitter Saturation Voltage		3.29	3.59	V	V _{GE} = 15V, I _C = 20A
		4.42	4.66		V _{GE} = 15V, I _C = 40A
		3.87	4.11		V _{GE} = 15V, I _C = 20A T _J = 125°C
		5.32	5.70		V _{GE} = 15V, I _C = 40A T _J = 125°C
		3.99	4.27		V _{GE} = 15V, I _C = 20A T _J = 150°C
V _{GE(th)} Gate Threshold Voltage	4		6	V	V _{CE} = V _{GE} , I _C = 250μA
ΔV _{GE(th)} /ΔT _J Temperature Coeff. of Threshold Voltage		-14		mV/°C	V _{CE} = V _{GE} , I _C = 3mA (25-125°C)
g _{fe} Transconductance		17.5		S	V _{CE} = 50V, I _C = 20A, PW = 80μs
I _{CES} Zero Gate Voltage Collector Current ⁽¹⁾			250	μA	V _{GE} = 0V, V _{CE} = 1200V, T _J = 25°C
		0.7	3.0	mA	V _{GE} = 0V, V _{CE} = 1200V, T _J = 125°C
		2.9	9.0		V _{GE} = 0V, V _{CE} = 1200V, T _J = 150°C
I _{GES} Gate-to-Emitter Leakage Current			±250	nA	V _{GE} = ± 20V

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

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

Parameters	Min	Typ	Max	Units	Test Conditions
Q _g Total Gate Charge (turn-on)		176	264	nC	I _C = 20A V _{CC} = 600V V _{GE} = 15V
Q _{ge} Gate-Emitter Charge (turn-on)		19	30		
Q _{gc} Gate-Collector Charge (turn-on)		89	134		
E _{on} Turn-On Switching Loss		513	770	μJ	V _{CC} = 600V, I _C = 20A V _{GE} = 15V, R _g = 5Ω, L = 200μH T _J = 25°C, Energy losses include tail and diode reverse recovery
E _{off} Turn-Off Switching Loss		402	603		
E _{tot} Total Switching Loss		915	1373		
E _{on} Turn-On Switching Loss		930	1395	μJ	V _{CC} = 600V, I _C = 20A V _{GE} = 15V, R _g = 5Ω, L = 200μH T _J = 125°C, Energy losses include tail and diode reverse recovery
E _{off} Turn-Off Switching Loss		610	915		
E _{tot} Total Switching Loss		1540	2310		
C _{ies} Input Capacitance		2530	3790	pF	V _{GE} = 0V V _{CC} = 30V f = 1.0 MHz
C _{oes} Output Capacitance		344	516		
C _{res} Reverse Transfer Capacitance		78	117		
RBSOA Reverse Bias Safe Operating Area	full square				T _J = 150°C, I _C = 120A V _{CC} = 1000V, V _p = 1200V R _g = 5Ω, V _{GE} = +15V to 0V
SCSOA Short Circuit Safe Operating Area	10			μs	T _J = 150°C V _{CC} = 900V, V _p = 1200V R _g = 5Ω, V _{GE} = +15V to 0V

Diode Characteristics @ T_J = 25°C (unless otherwise specified)

Parameters	Min	Typ	Max	Units	Test Conditions
V _{FM} Diode Forward Voltage Drop		2.48	2.94	V	I _C = 20A
		3.28	3.90		I _C = 40A
		2.44	2.84		I _C = 20A, T _J = 125°C
		3.45	4.14		I _C = 40A, T _J = 125°C
		2.21	2.93		I _C = 20A, T _J = 150°C
E _{rec} Reverse Recovery Energy of the Diode		420	630	μJ	V _{GE} = 15V, R _g = 5Ω, L = 200μH
trr Diode Reverse Recovery Time		98	150	ns	V _{CC} = 600V, I _C = 20A
I _{rr} Peak Reverse Recovery Current		33	50	A	T _J = 125°C

Thermal- Mechanical Specifications

Parameters	Min	Typ	Max	Units
T _J Operating Junction Temperature Range	- 40		150	°C
T _{STG} Storage Temperature Range	- 40		125	
R _{thJC} Junction-to-Case	IGBT		0.35	°C/ W
	Diode		0.40	
R _{thCS} Case-to-Sink (Heatsink Compound Thermal Conductivity = 1 W/mK)	Module		0.06	
Clearance (external shortest distance in air between two terminals)	5.5			mm
Creepage (shortest distance along external surface of the insulating material between 2 terminals)	8			
T Mounting Torque (2)		3 ± 10%		Nm
Wt Weight		66		g (oz)

(2) A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads

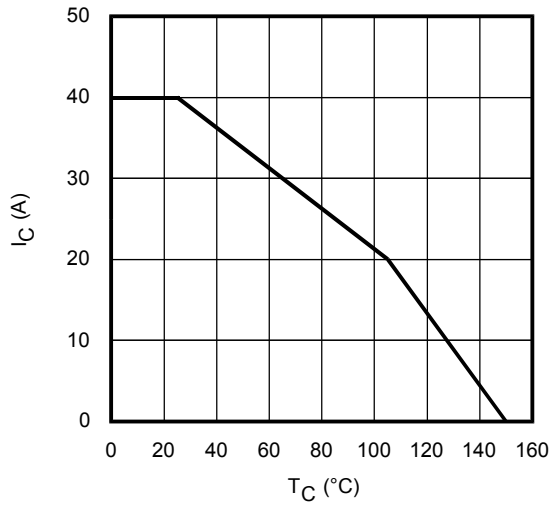


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

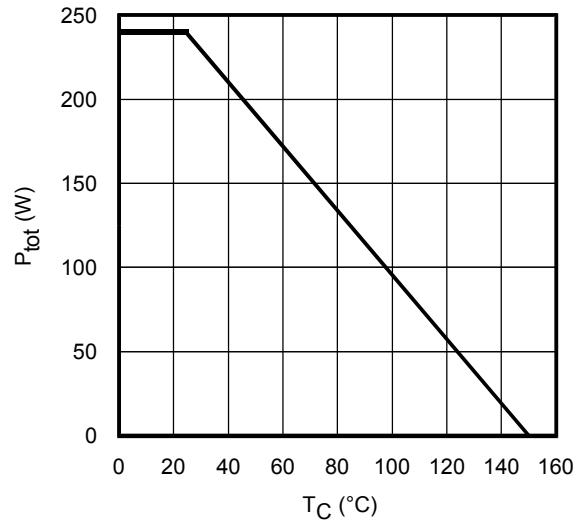


Fig. 2 - Power Dissipation vs. Case Temperature

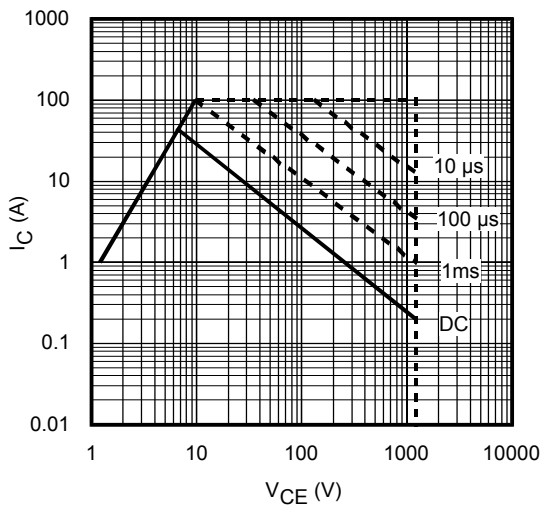


Fig. 3 - Forward SOA
 $T_C = 25^\circ\text{C}$; $T_J \leq 150^\circ\text{C}$

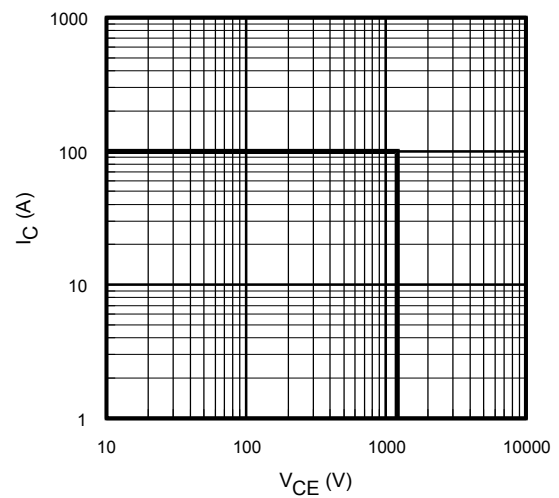


Fig. 4 - Reverse Bias SOA
 $T_J = 150^\circ\text{C}$; $V_{GE} = 15\text{V}$

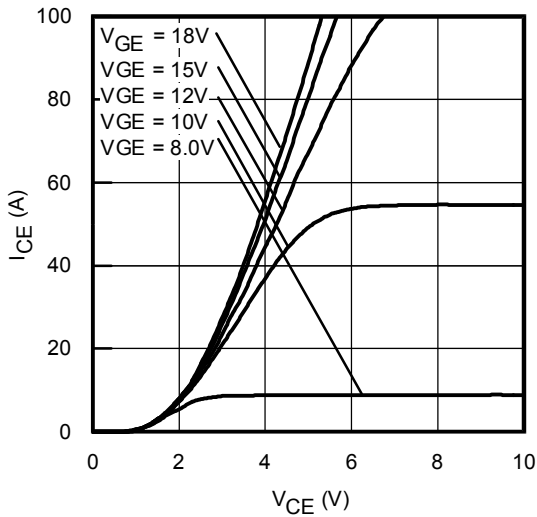


Fig. 5 - Typ. IGBT Output Characteristics
 $T_J = -40^\circ\text{C}; t_p = 80\mu\text{s}$

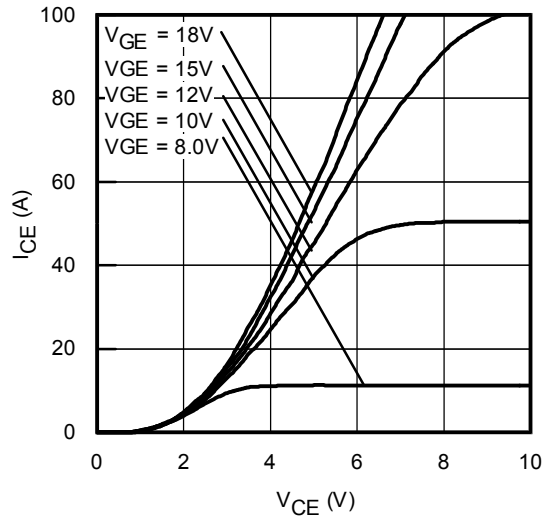


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}; t_p = 80\mu\text{s}$

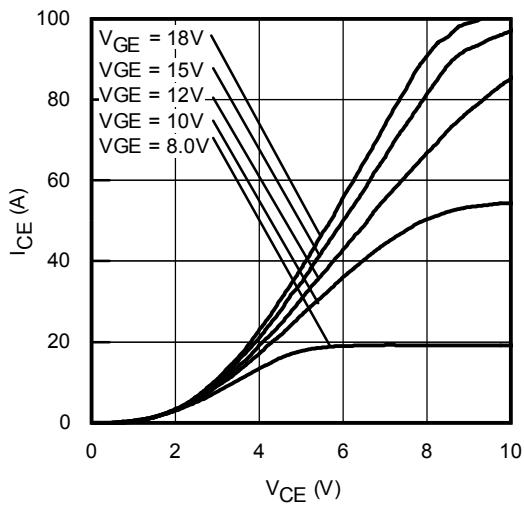


Fig. 7 - Typ. IGBT Output Characteristics
 $T_J = 125^\circ\text{C}; t_p = 80\mu\text{s}$

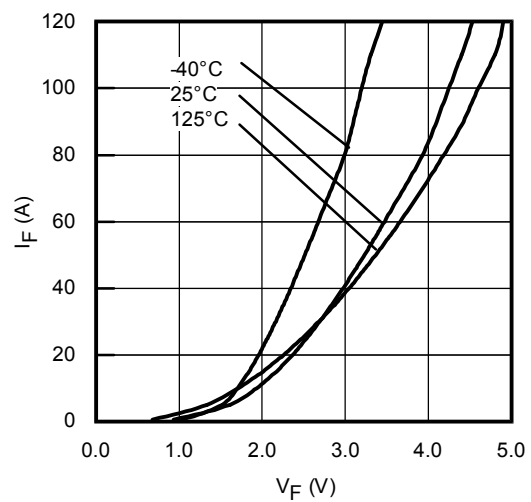


Fig. 8 - Typ. Diode Forward Characteristics
 $t_p = 80\mu\text{s}$

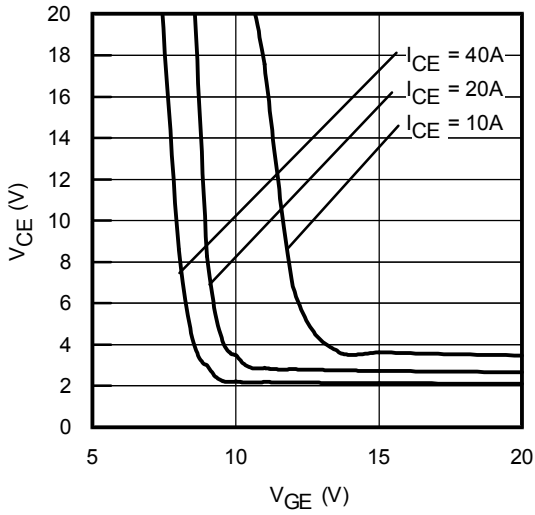


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^\circ\text{C}$

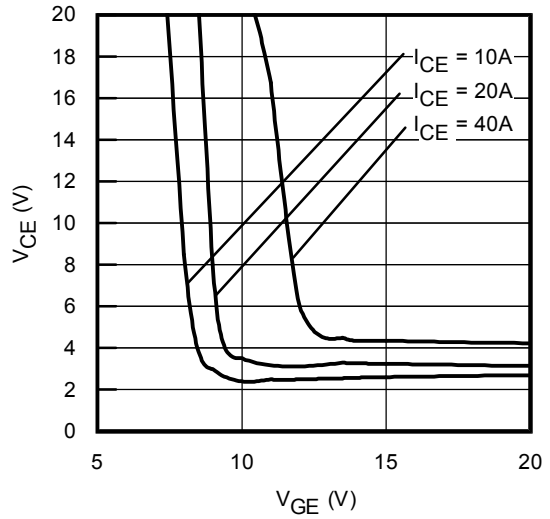


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

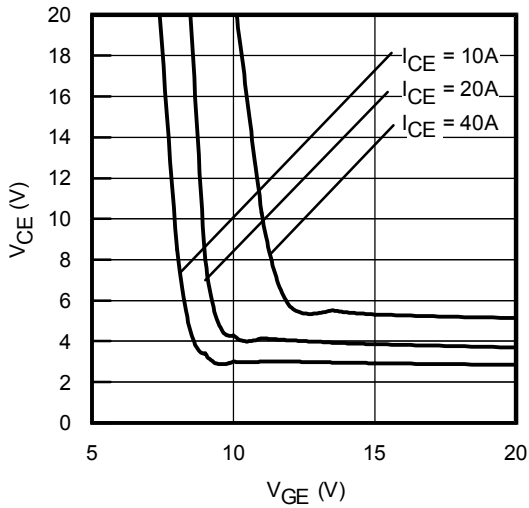


Fig. 11 - Typical V_{CE} vs. V_{GE}
 $T_J = 125^\circ\text{C}$

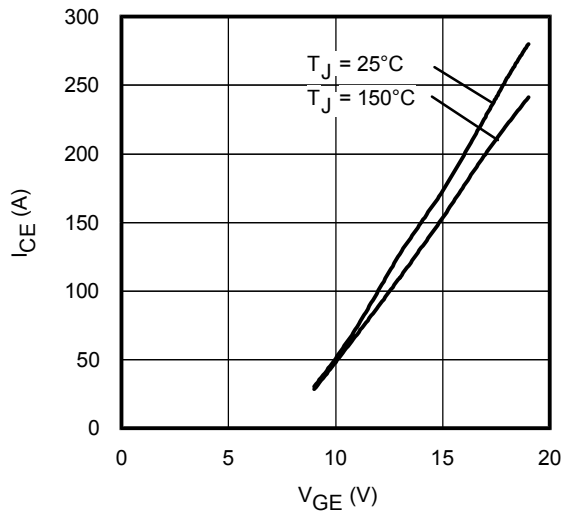


Fig. 12 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$

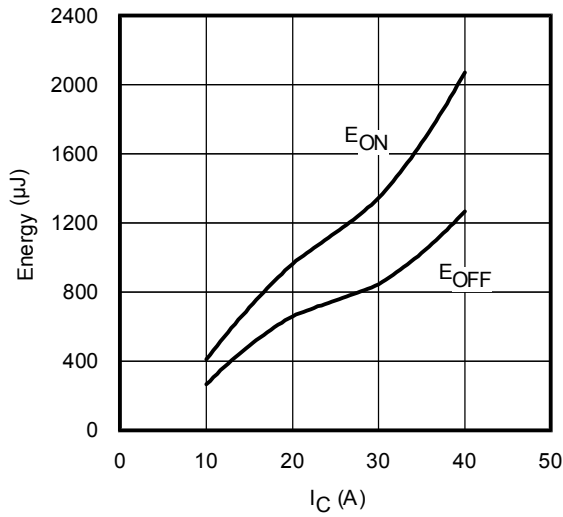


Fig. 13 - Typ. Energy Loss vs. I_C
 $T_J = 150^\circ\text{C}$; $L = 1.4\text{mH}$; $V_{CE} = 400\text{V}$
 $R_G = 5\Omega$; $V_{GE} = 15\text{V}$

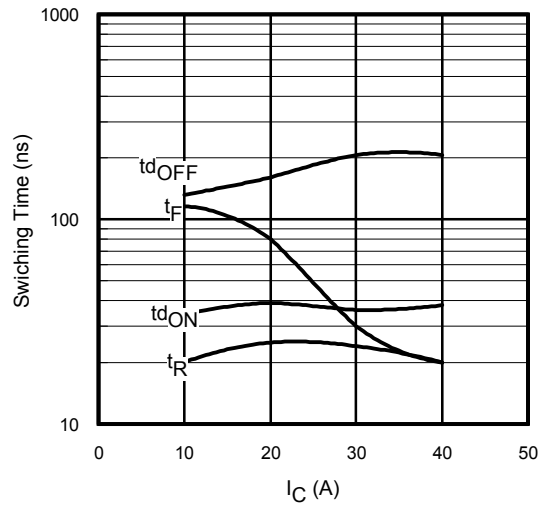


Fig. 14 - Typ. Switching Time vs. I_C
 $T_J = 150^\circ\text{C}$; $L = 1.4\text{mH}$; $V_{CE} = 400\text{V}$
 $R_G = 100\Omega$; $V_{GE} = 15\text{V}$

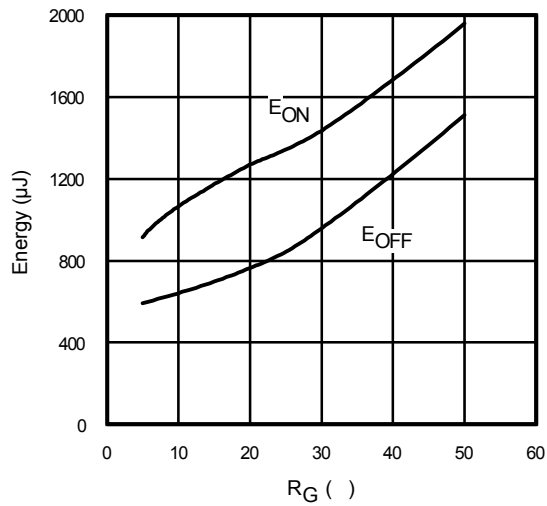


Fig. 15 - Typ. Energy Loss vs. R_G
 $T_J = 150^\circ\text{C}$; $L = 1.4\text{mH}$; $V_{CE} = 400\text{V}$
 $I_{CE} = 5.0\text{A}$; $V_{GE} = 15\text{V}$

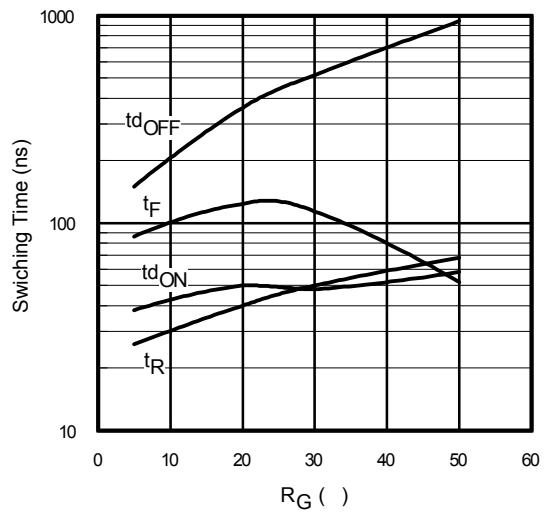


Fig. 16 - Typ. Switching Time vs. R_G
 $T_J = 150^\circ\text{C}$; $L = 1.4\text{mH}$; $V_{CE} = 400\text{V}$
 $I_{CE} = 5.0\text{A}$; $V_{GE} = 15\text{V}$

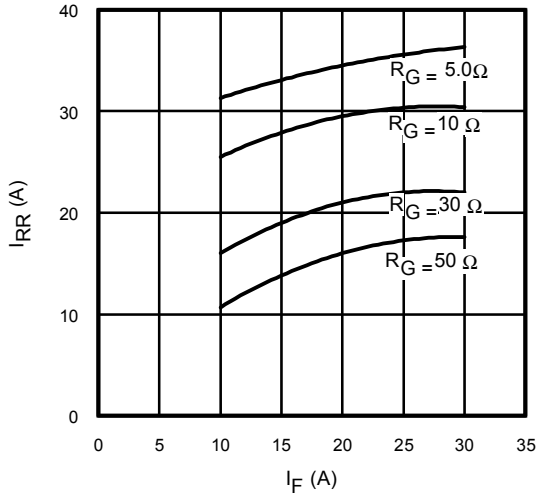


Fig. 17 - Typical Diode I_{RR} vs. I_F
 $T_J = 150^\circ\text{C}$

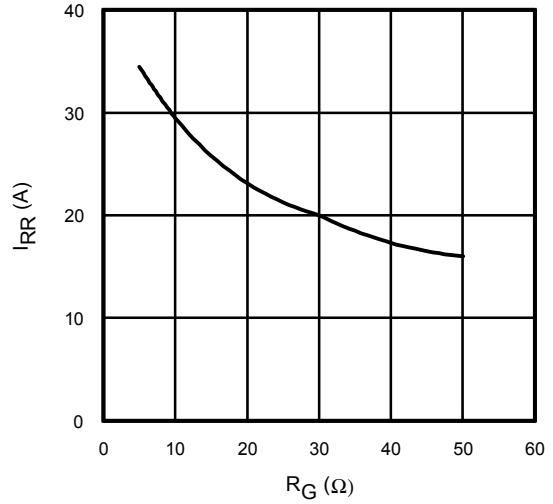


Fig. 18 - Typical Diode I_{RR} vs. R_G
 $T_J = 150^\circ\text{C}; I_F = 5.0\text{A}$

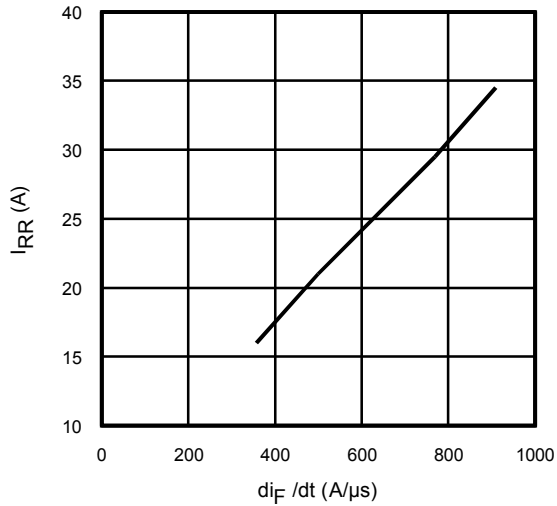


Fig. 19- Typical Diode I_{RR} vs. di_F/dt
 $V_{CC} = 400\text{V}; V_{GE} = 15\text{V};$
 $I_{CE} = 5.0\text{A}; T_J = 150^\circ\text{C}$

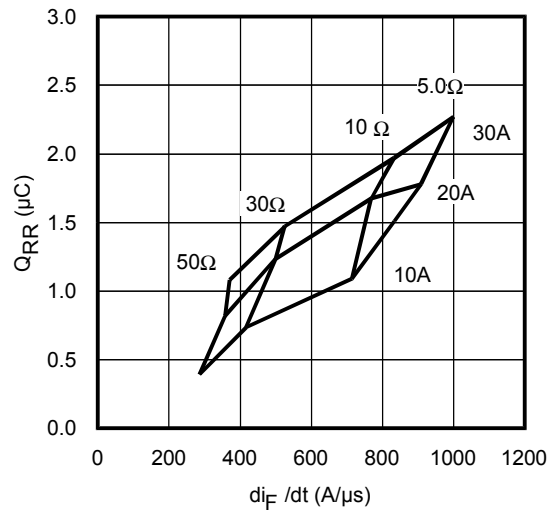


Fig. 20 - Typical Diode Q_{RR}
 $V_{CC} = 400\text{V}; V_{GE} = 15\text{V}; T_J = 150^\circ\text{C}$

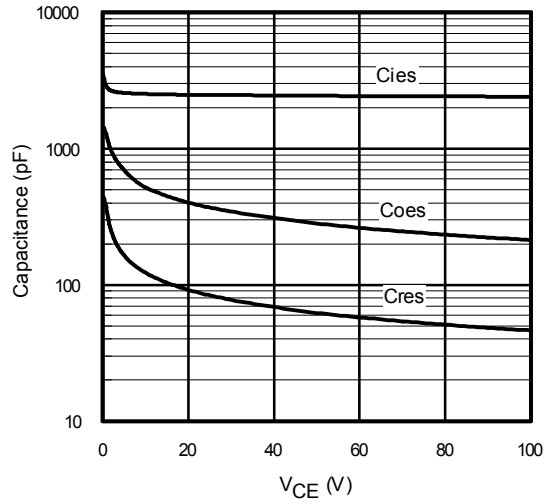


Fig. 21 - Typ. Capacitance vs. V_{CE}
 V_{GE} = 0V; f = 1MHz

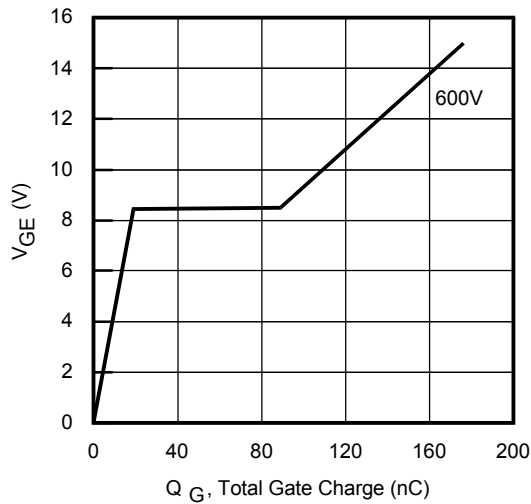


Fig. 22 - Typical Gate Charge vs. V_{GE}
 I_{CE} = 5.0A; L = 600μH

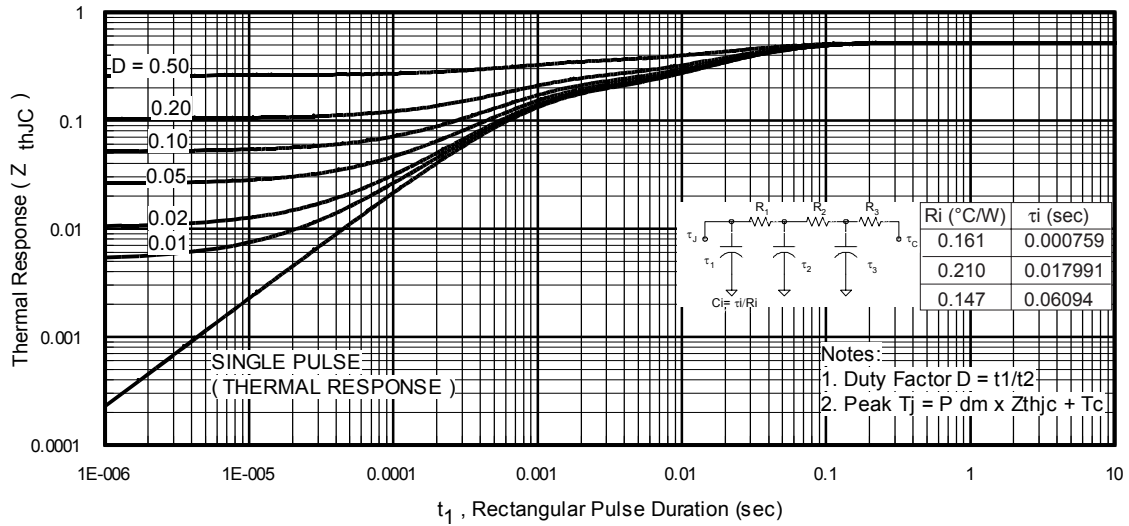


Fig 23. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

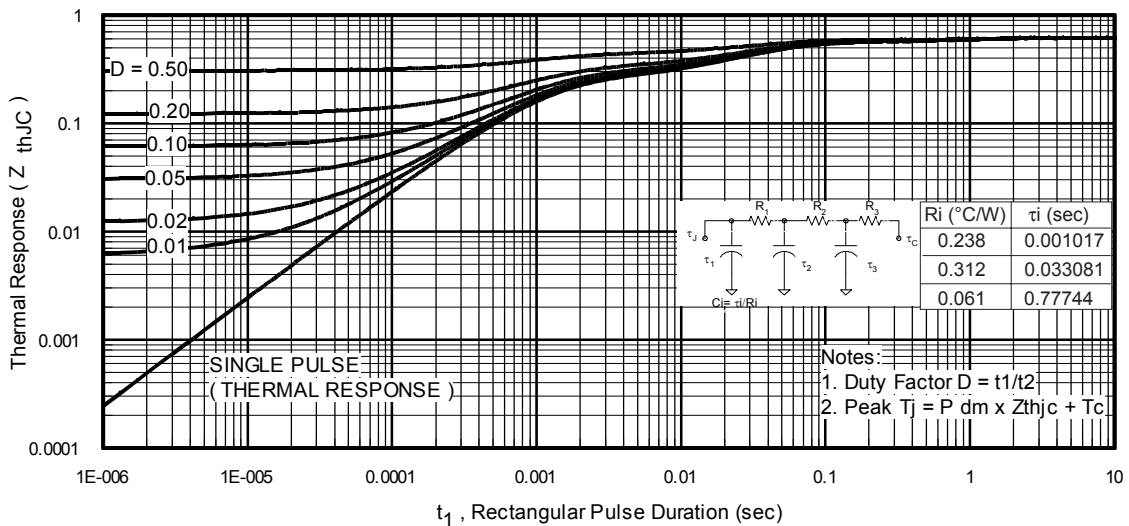


Fig 24. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

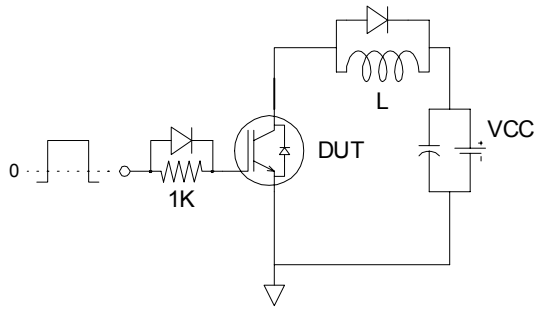


Fig. CT.1 - Gate Charge Circuit (turn-off)

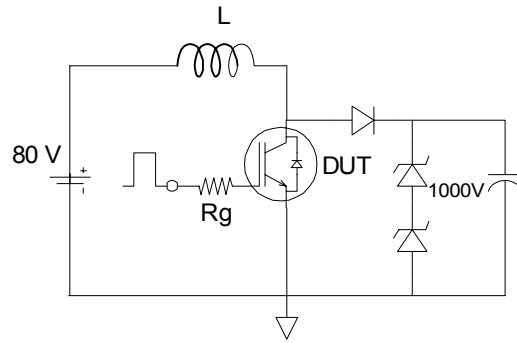


Fig. CT.2 - RBSOA Circuit

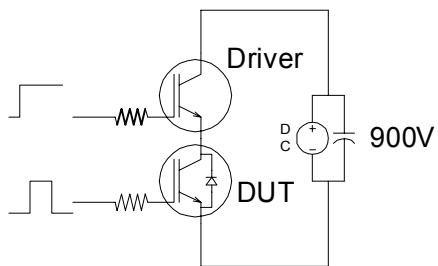


Fig. CT.3 - S.C. SOA Circuit

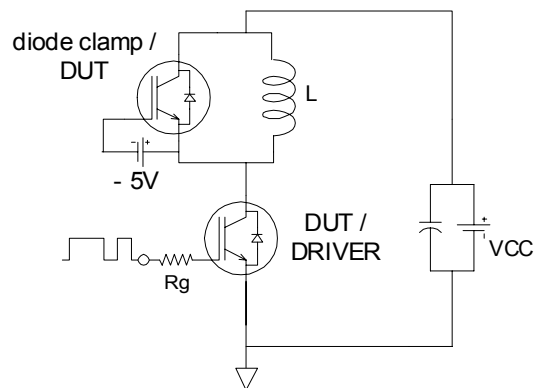
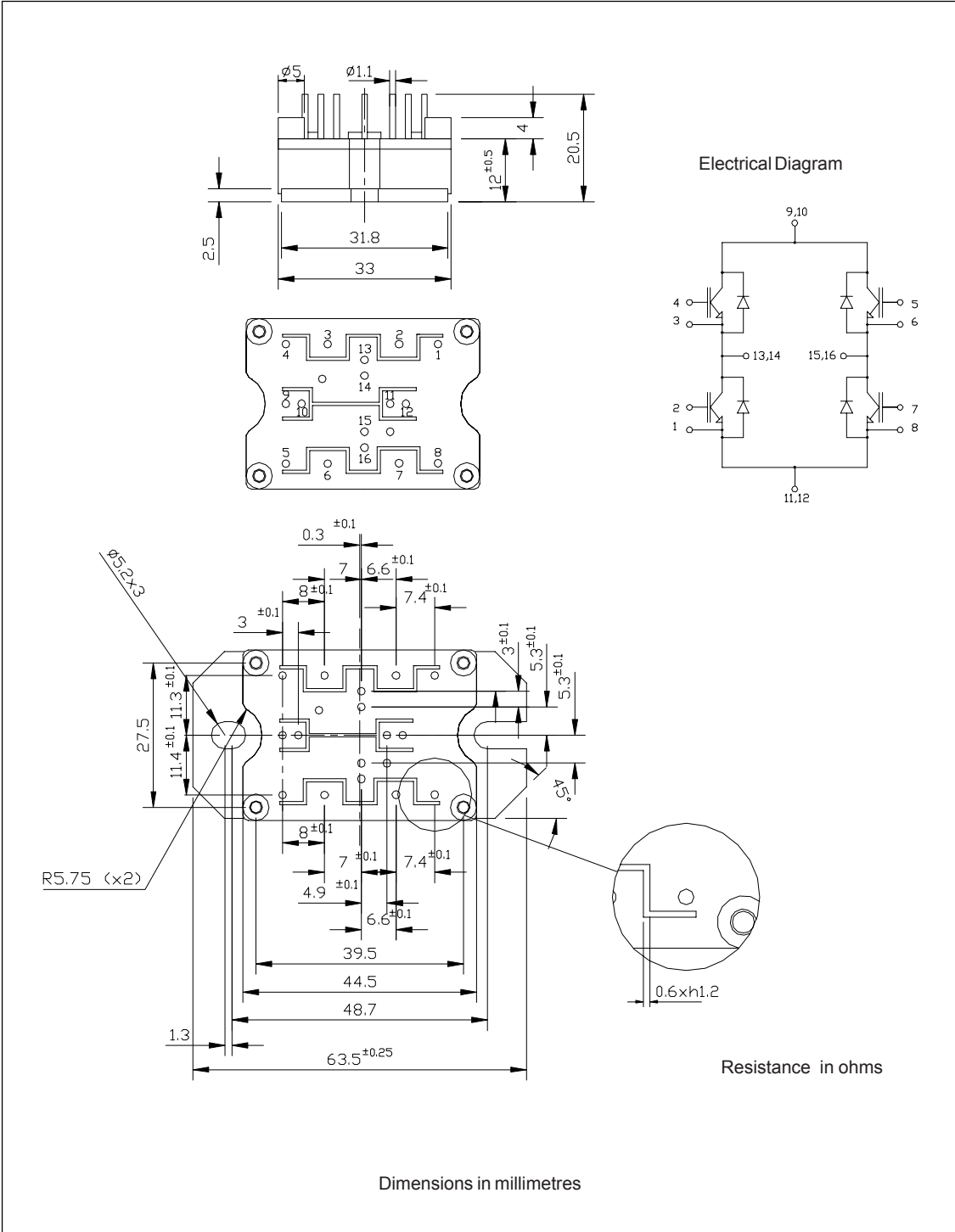


Fig. CT.4 - Switching Loss Circuit

Outline Table



Ordering Information Table

Device Code				
20	MT	120	U	F
①	②	③	④	⑤
1	-	Current rating	(20 = 20A)	
2	-	Essential Part Number		
3	-	Voltage code	(120 = 1200V)	
4	-	Speed/ Type	(U = Ultra Fast IGBT)	
5	-	Circuit Configuration	(F = Full Bridge)	
	-	Special Option		

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level.
Qualification Standards can be found on IR's Web site.

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