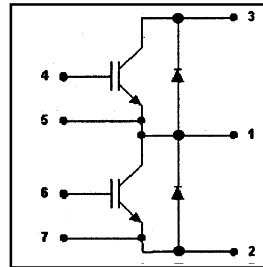


Features

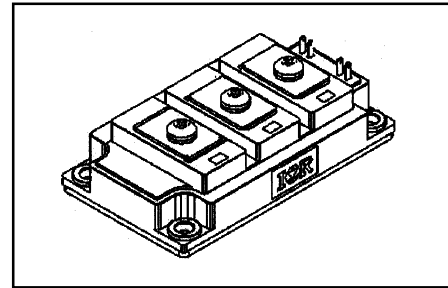
- Generation 4 IGBT technology
- Standard: Optimized for minimum saturation voltage and operating frequencies up to 10kHz
- Very low conduction and switching losses
- HEXFRED™ antiparallel diodes with ultra- soft recovery
- Industry standard package
- UL approved



$V_{CES} = 1200V$
 $V_{CE(on)} \text{ typ.} = 2.4V$
@ $V_{GE} = 15V, I_C = 250A$

Benefits

- Increased operating efficiency
- Direct mounting to heatsink
- Performance optimized for power conversion: UPS, SMPS, Welding
- Lower EMI, requires less snubbing



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	250	A
I_{CM}	Pulsed Collector Current①	500	
I_{LM}	Peak Switching Current②	500	
I_{FM}	Peak Diode Forward Current	500	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
V_{ISOL}	RMS Isolation Voltage, Any Terminal To Case, $t = 1 \text{ min}$	2500	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	1250	W
$P_D @ T_C = 85^\circ C$	Maximum Power Dissipation	650	
T_J	Operating Junction Temperature Range	-40 to +150	$^\circ C$
T_{STG}	Storage Temperature Range	-40 to +125	

Thermal / Mechanical Characteristics

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case - IGBT	—	0.10	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case - Diode	—	0.20	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink - Module	0.1	—	
	Mounting Torque, Case-to-Heatsink	—	4.0	N·m
	Mounting Torque, Case-to-Terminal 1, 2 & 3③	—	3.0	
	Weight of Module	400	—	g

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V, I_C = 1mA$
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	2.4	2.9		$V_{GE} = 15V, I_C = 250A$
		—	2.1	—		$V_{GE} = 15V, I_C = 250A, T_J = 125^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = 6V, I_C = 3mA$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/ $^\circ\text{C}$	$V_{CE} = 6V, I_C = 3mA$
g_{fe}	Forward Transconductance ④	—	323	—	S	$V_{CE} = 25V, I_C = 250A$
I_{CES}	Collector-to-Emitter Leaking Current	—	—	2.0	mA	$V_{GE} = 0V, V_{CE} = 1200V$
		—	—	20		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 125^\circ\text{C}$
V_{FM}	Diode Forward Voltage - Maximum	—	3.0	4.0	V	$I_F = 250A, V_{GE} = 0V$
		—	2.9	—		$I_F = 250A, V_{GE} = 0V, T_J = 125^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	500	nA	$V_{GE} = \pm 20V$

Dynamic Characteristics - $T_J = 125^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	1979	2968	nC	$V_{CC} = 400V, V_{GE} = 15V$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	334	501		$I_C = 297A$
Q_{gc}	Gate - Collector Charge (turn-on)	—	655	983		$T_J = 25^\circ\text{C}$
$t_{d(on)}$	Turn-On Delay Time	—	731	—	ns	$R_{G1} = 15\Omega, R_{G2} = 0\Omega$
t_r	Rise Time	—	227	—		$I_C = 250A$
$t_{d(off)}$	Turn-Off Delay Time	—	653	—		$V_{CC} = 720V$
t_f	Fall Time	—	343	—		$V_{GE} = \pm 15V$
E_{on}	Turn-On Switching Energy	—	54	—	mJ	See Fig.17 through Fig.21
E_{off}	Turn-Off Switching Energy	—	54	—		
E_{ts}	Total Switching Energy	—	108	162		
C_{ies}	Input Capacitance	—	44517	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	1979	—		$V_{CC} = 30V$
C_{res}	Reverse Transfer Capacitance	—	383	—		$f = 1MHz$
t_{rr}	Diode Reverse Recovery Time	—	214	—	ns	$I_C = 250A$
I_{rr}	Diode Peak Reverse Current	—	155	—	A	$R_{G1} = 15\Omega$
Q_{rr}	Diode Recovery Charge	—	16540	—	nC	$R_{G2} = 0\Omega$
$di_{(rec)}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	1970	—	A/ μs	$V_{CC} = 720V$ $di/dt = 1368A/\mu s$

Details of note ① through ④ are on the last page

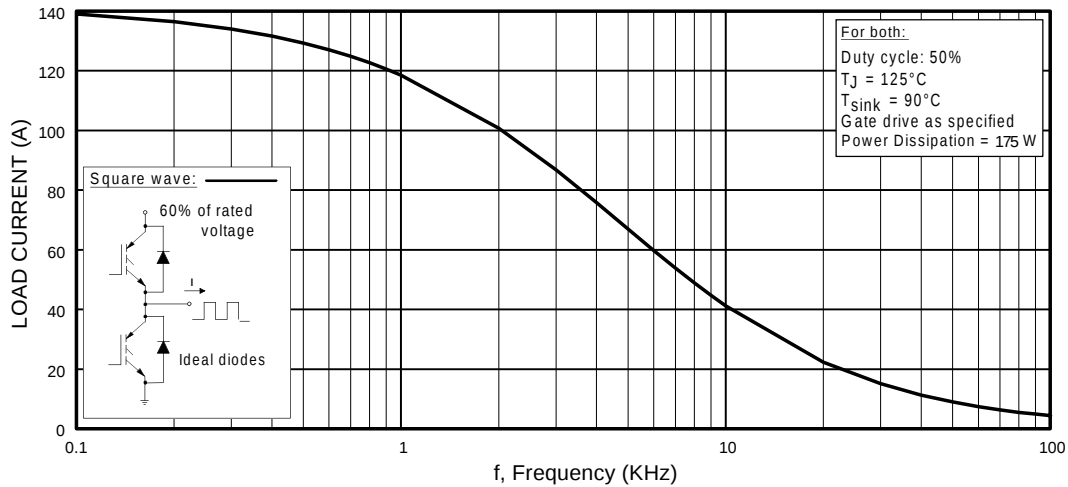


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

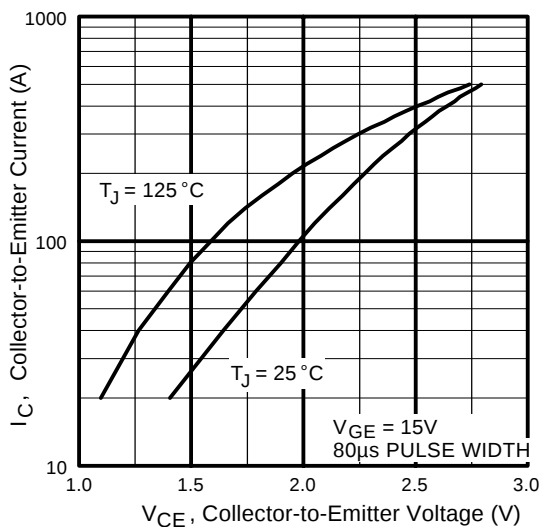


Fig. 2 - Typical Output Characteristics

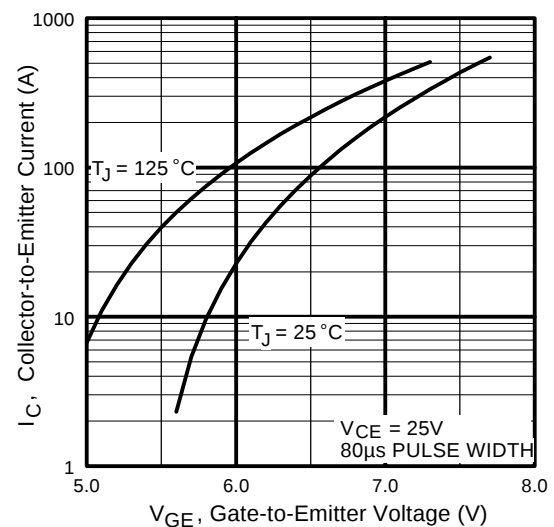


Fig. 3 - Typical Transfer Characteristics

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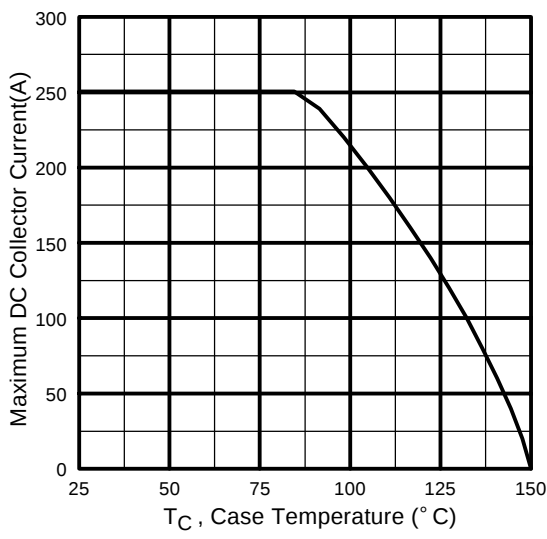


Fig. 4 - Maximum Collector Current vs. Case Temperature

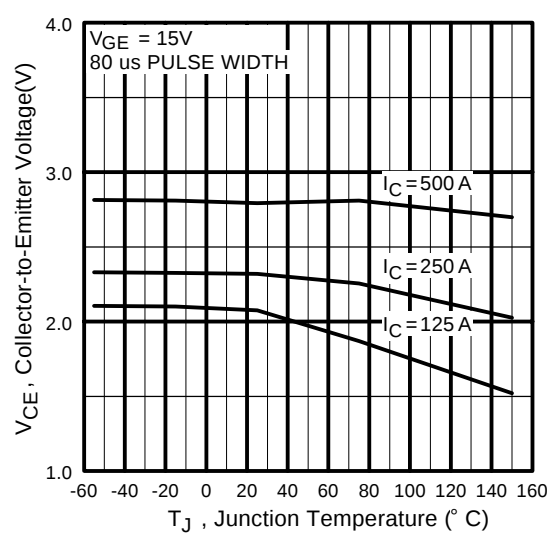


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

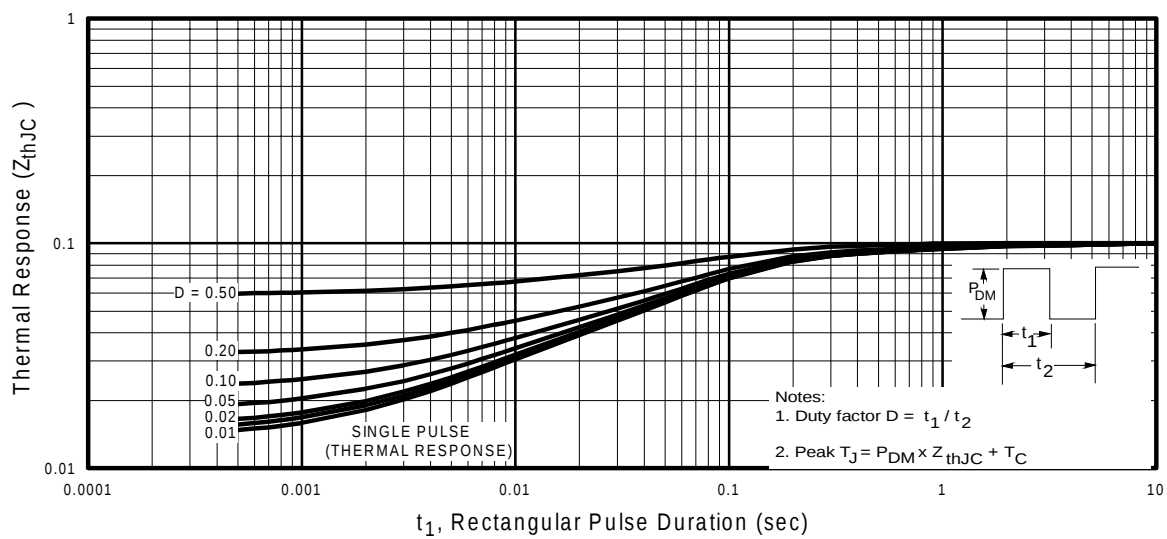


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

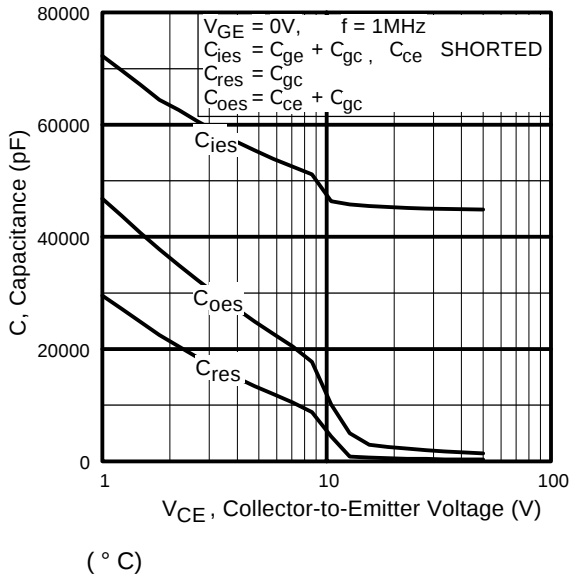


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

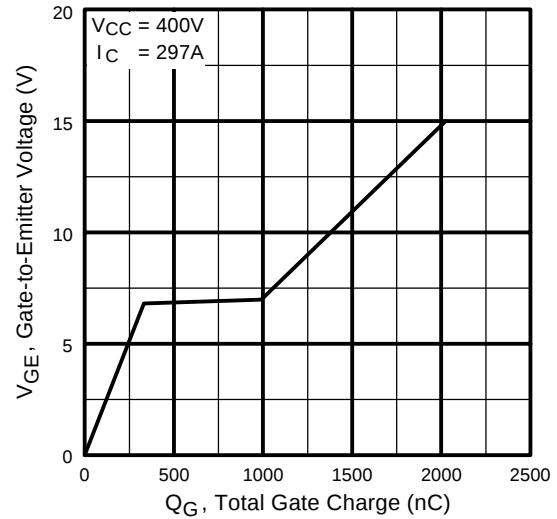


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

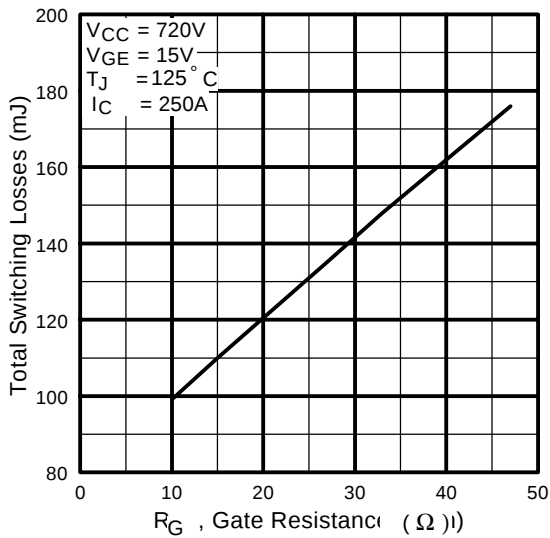


Fig. 9 - Typical Switching Losses vs. Gate Resistance

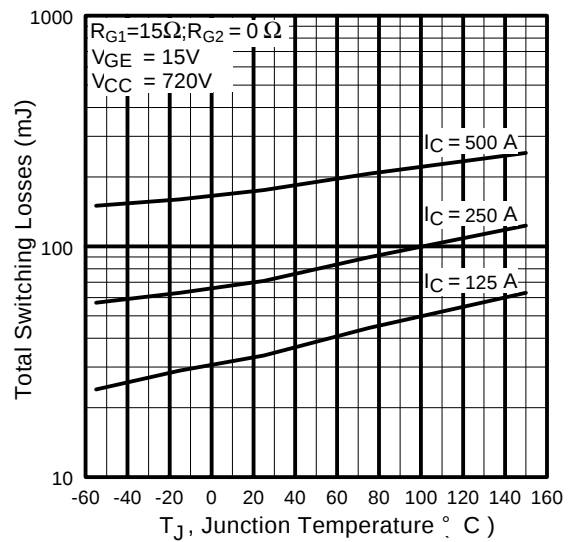
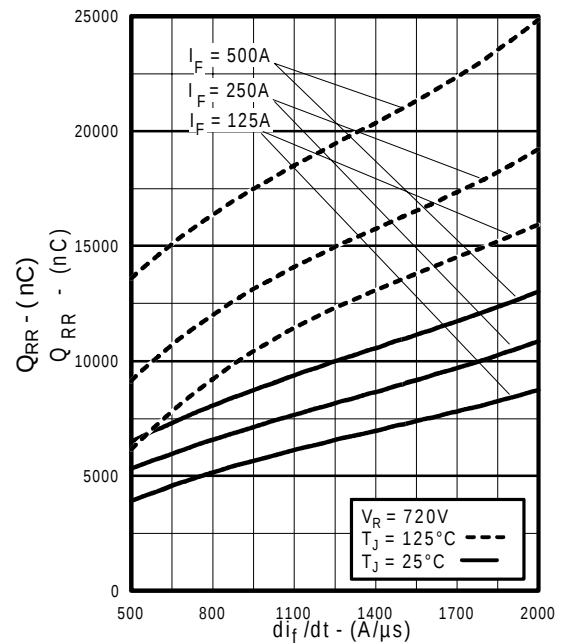
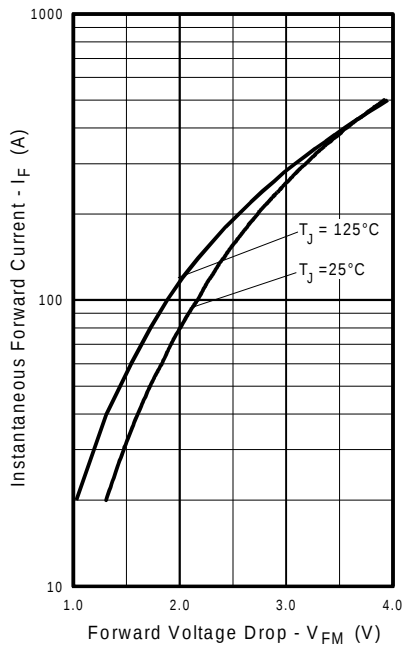
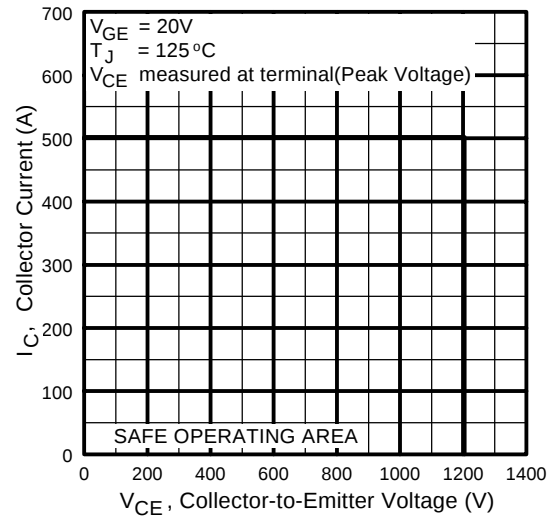
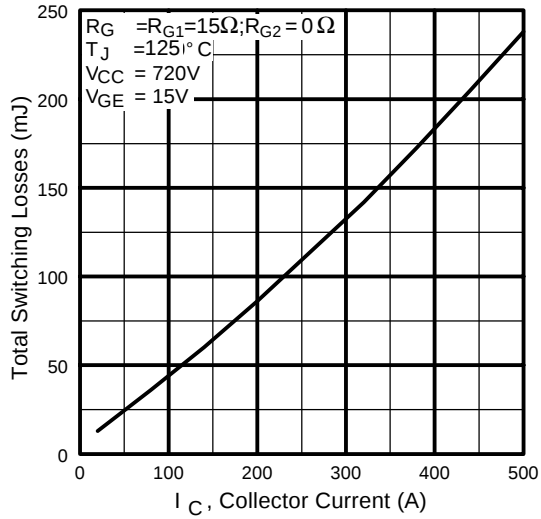


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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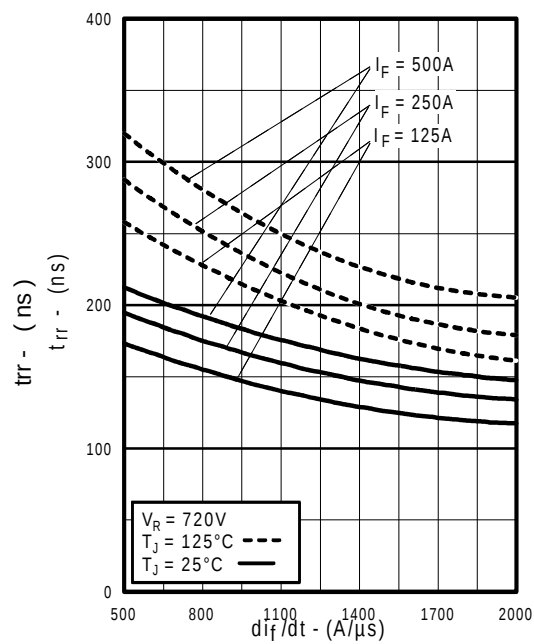


Fig. 15 - Typical Reverse Recovery vs. di_F/dt

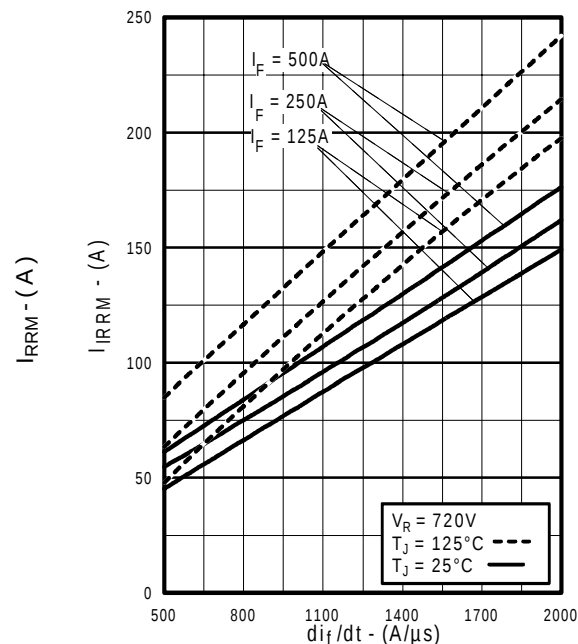


Fig. 16 - Typical Recovery Current vs. di_F/dt

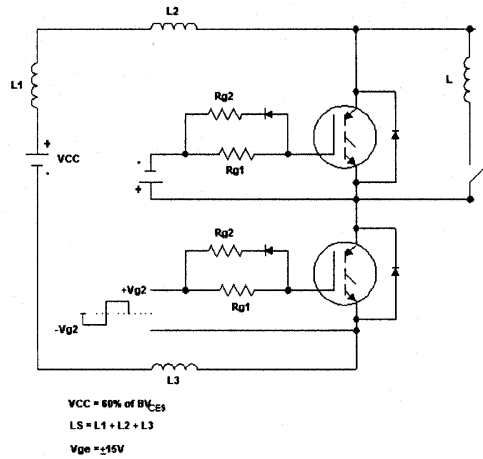


Fig. 17 - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

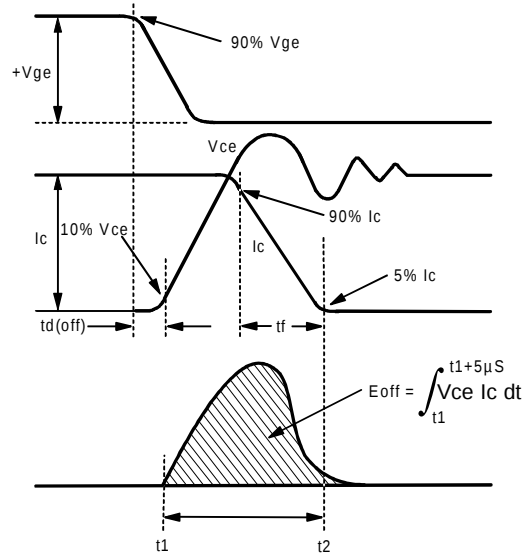


Fig. 18 - Test Waveforms for Circuit of Fig. 17, Defining E_{off} , $t_{d(off)}$, t_f

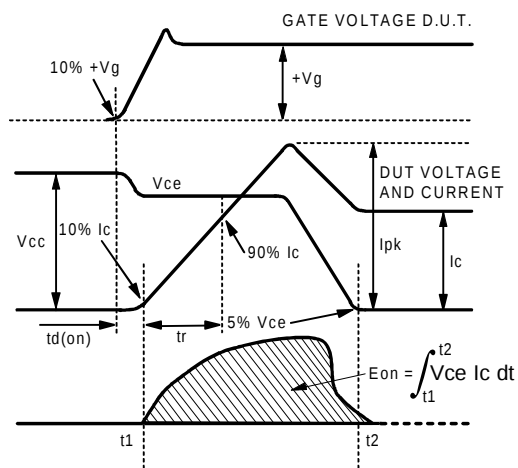


Fig. 19 - Test Waveforms for Circuit of Fig. 17, Defining E_{on} , $t_{d(on)}$, t_r

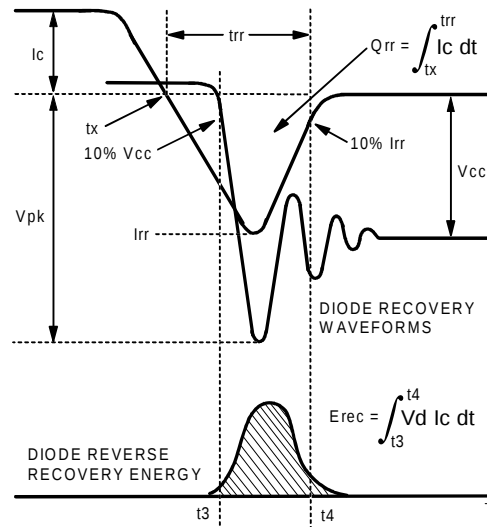


Fig. 20 - Test Waveforms for Circuit of Fig. 17, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

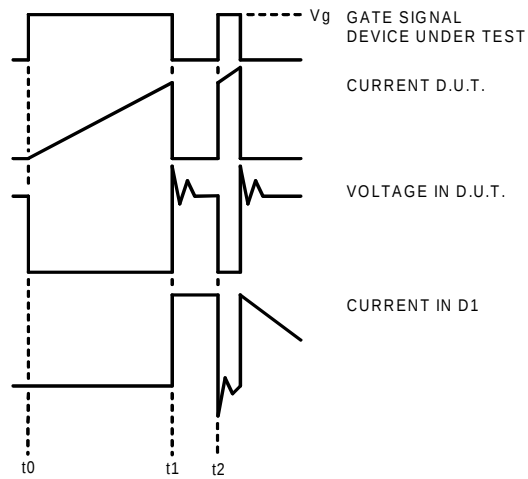


Figure 21. Macro Waveforms for Figure 17's Test Circuit

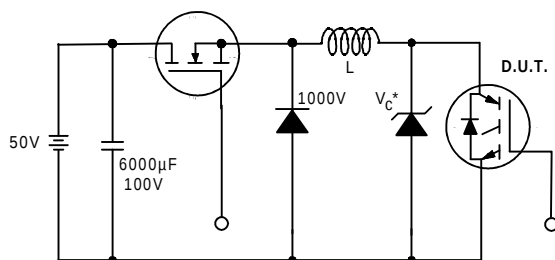


Figure 22. Clamped Inductive Load Test Circuit

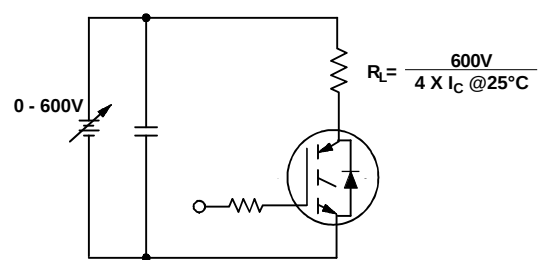


Figure 23. Pulsed Collector Current Test Circuit

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- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature.
- ② See fig. 17
- ③ For screws M5x0.8
- ④ Pulse width 80 μs ; single shot.

Technical drawings of the 3000 Series PCB Mounting Bracket showing front, side, and top views with dimensions in millimeters (mm) and inches (in).

Front View Dimensions:

- Overall Width: 54.5 (2.145) / 53.5 (2.106)
- Overall Height: 25.0 (0.984) / 22.0 (0.866)
- Mounting Hole Spacing: 21.5 (0.846) / 20.5 (0.807)
- Mounting Hole Diameter: 9.0 (0.354) / 7.0 (0.276)
- Fast-On Tab Spacing: 25.0 (0.984) / 22.0 (0.866)
- Fast-On Tab Width: 2.8 x 0.5

Side View Dimensions:

- Overall Height: 48.5 (1.909) / 47.5 (1.870)
- Mounting Hole Spacing: 32.0 (1.260) / 30.0 (1.181)
- Mounting Hole Diameter: 9.0 (0.354) / 8.0 (0.315)
- Fast-On Tab Spacing: 31.5 (1.240) / 30.0 (1.200)

Top View Dimensions:

- Overall Width: 93.3 (3.673) / 92.7 (3.673)
- Overall Height: 62.75 (2.470) / 61.25 (2.411)
- Mounting Hole Spacing: 22.5 (0.886) / 21.5 (0.846)
- Mounting Hole Diameter: 18.25 (0.719) / 17.75 (0.699)
- Fast-On Tab Spacing: 17.5 (0.689) / 16.5 (0.650)
- Fast-On Tab Width: 6.5 (0.256) / 5.5 (0.217)
- Fast-On Tab Diameter: $\phi 6.75$ (0.267) / $\phi 6.25$ (0.246)

Dimensions are shown in millimeters (inches).

Dimensions are shown in millimeters (inches)

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