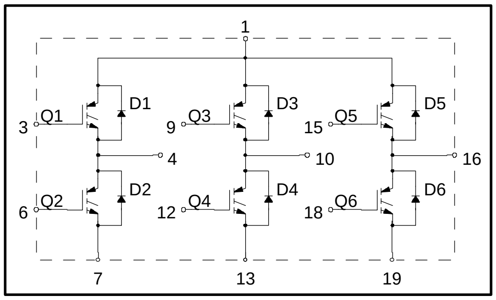
International
IOR Rectifier

PD - 5.024A

CPV363MU

IGBT SIP MODULE

Ultra-Fast IGBT



Features

- Fully isolated printed circuit board mount package
- Switching-loss rating includes all "tail" losses
- HEXFRED™ soft ultrafast diodes
- Optimized for high operating frequency (over 5kHz) See Fig. 1 for Current vs. Frequency curve

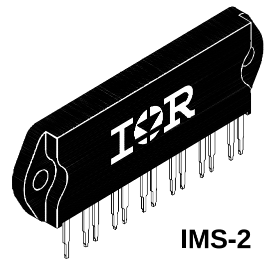
Product Summary

Output Current in a Typical 20 kHz Motor Drive

5.4 A_{RMS} per phase (1.7 kW total) with T_C = 90°C, T_J = 125°C, Supply Voltage 360Vdc, Power Factor 0.8, Modulation Depth 80% (See Figure 1)

Description

The IGBT technology is the key to International Rectifier's advanced line of IMS (Insulated Metal Substrate) Power Modules. These modules are more efficient than comparable bipolar transistor modules, while at the same time having the simpler gate-drive requirements of the familiar power MOSFET. This superior technology has now been coupled to a state of the art materials system that maximizes power throughput with low thermal resistance. This package is highly suited to motor drive applications and where space is at a premium.



IMS-2

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current, each IGBT	13	A
I_C @ T_C = 100°C	Continuous Collector Current, each IGBT	6.8	
I_{CM}	Pulsed Collector Current ①	40	
I_{LM}	Clamped Inductive Load Current ②	40	
I_F @ T_C = 100°C	Diode Continuous Forward Current	6.1	
I_{FM}	Diode Maximum Forward Current	40	
V_{GE}	Gate-to-Emitter Voltage	±20	V
V_{ISOL}	Isolation Voltage, any terminal to case, 1 min.	2500	V_{RMS}
P_D @ T_C = 25°C	Maximum Power Dissipation, each IGBT	36	W
P_D @ T_C = 100°C	Maximum Power Dissipation, each IGBT	14	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-40 to +150	°C
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting torque, 6-32 or M3 screw.	5-7 lbf•in (0.55-0.8 N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$ (IGBT)	Junction-to-Case, each IGBT, one IGBT in conduction	—	3.5	°C/W
$R_{\theta JC}$ (DIODE)	Junction-to-Case, each diode, one diode in conduction	—	5.5	
$R_{\theta CS}$ (MODULE)	Case-to-Sink,flat,greased surface	0.1	—	
Wt	Weight of module	20 (0.7)	—	g (oz)

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage ③	600	—	—	V	V_{GE} = 0V, I_C = 250µA	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.63	—	V/°C	V_{GE} = 0V, I_C = 1.0mA	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.9	2.4	V	I_C = 6.8A	V_{GE} = 15V See Fig. 2, 5
		—	2.3	—		I_C = 13A	
		—	1.8	—		I_C = 6.8A, T_J = 150°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		$V_{CE} = V_{GE}$, I_C = 250µA	
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/°C	$V_{CE} = V_{GE}$, I_C = 250µA	
g_{fe}	Forward Transconductance ④	4.0	6.0	—	S	V_{CE} = 100V, I_C = 6.8A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V	
		—	—	2500		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C	
V_{FM}	Diode Forward Voltage Drop	—	1.4	1.7	V	I_C = 12A	See Fig. 13
		—	1.3	1.6		I_C = 12A, T_J = 150°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±500	nA	V_{GE} = ±20V	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions		
Q_g	Total Gate Charge (turn-on)	—	29	36	nC	I_C = 6.8A V_{CC} = 400V See Fig. 8		
Q_{ge}	Gate - Emitter Charge (turn-on)	—	4.8	6.8				
Q_{gc}	Gate - Collector Charge (turn-on)	—	12	17				
$t_{d(on)}$	Turn-On Delay Time	—	25	—	ns	T_J = 25°C I_C = 6.8A, V_{CC} = 480V V_{GE} = 15V, R_G = 23Ω Energy losses include "tail" and diode reverse recovery. See Fig. 9, 10, 11, 18		
t_r	Rise Time	—	15	—				
$t_{d(off)}$	Turn-Off Delay Time	—	92	200				
t_f	Fall Time	—	93	190				
E_{on}	Turn-On Switching Loss	—	0.23	—	mJ			
E_{off}	Turn-Off Switching Loss	—	0.13	—				
E_{ts}	Total Switching Loss	—	0.36	0.62				
$t_{d(on)}$	Turn-On Delay Time	—	25	—	ns	T_J = 150°C, See Fig. 9, 10, 11, 18 I_C = 6.8A, V_{CC} = 480V V_{GE} = 15V, R_G = 23Ω Energy losses include "tail" and diode reverse recovery.		
t_r	Rise Time	—	15	—				
$t_{d(off)}$	Turn-Off Delay Time	—	160	—				
t_f	Fall Time	—	200	—				
E_{ts}	Total Switching Loss	—	0.71	—	mJ			
C_{ies}	Input Capacitance	—	660	—	pF	V_{GE} = 0V V_{CC} = 30V ƒ = 1.0MHz	See Fig. 7	
C_{oes}	Output Capacitance	—	100	—				
C_{res}	Reverse Transfer Capacitance	—	11	—				
t_{rr}	Diode Reverse Recovery Time	—	42	60	ns	T_J = 25°C	See Fig. 14	I_F = 12A V_R = 200V di/dt = 200A/µs
		—	80	120		T_J = 125°C		
I_{rr}	Diode Peak Reverse Recovery Current	—	3.5	6.0	A	T_J = 25°C	See Fig. 15	
		—	5.6	10		T_J = 125°C		
Q_{rr}	Diode Reverse Recovery Charge	—	80	180	nC	T_J = 25°C	See Fig. 16	
		—	220	600		T_J = 125°C		
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery During t_b	—	180	—	A/µs	T_J = 25°C	See Fig. 17	
		—	116	—		T_J = 125°C		

Notes:

① Repetitive rating; V_{GE}=20V, pulse width limited by max. junction temperature. (See fig. 20)

② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10µH, R_G= 23Ω, (See fig. 19)

③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

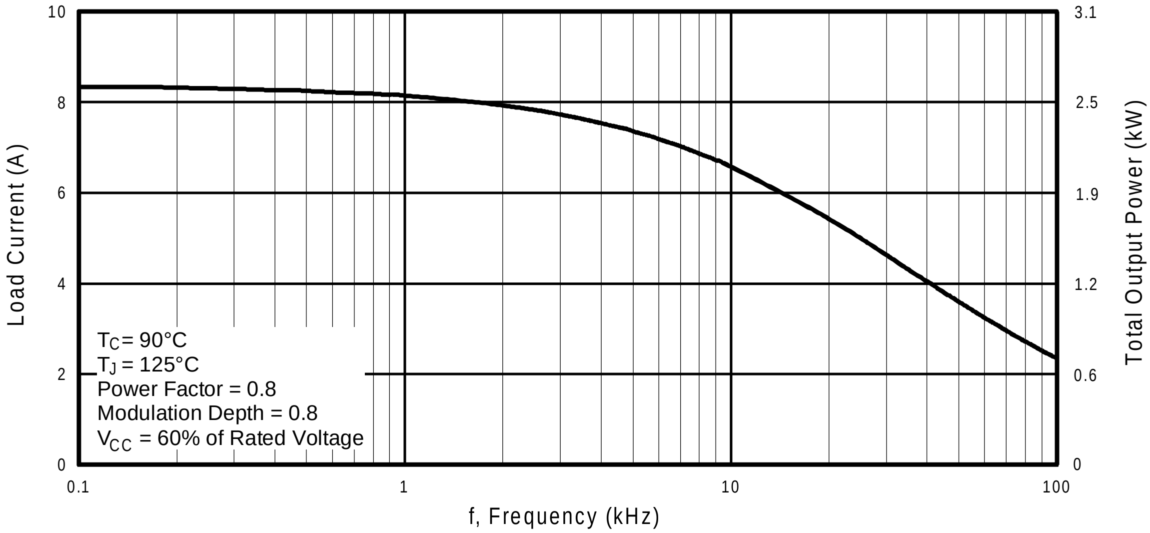
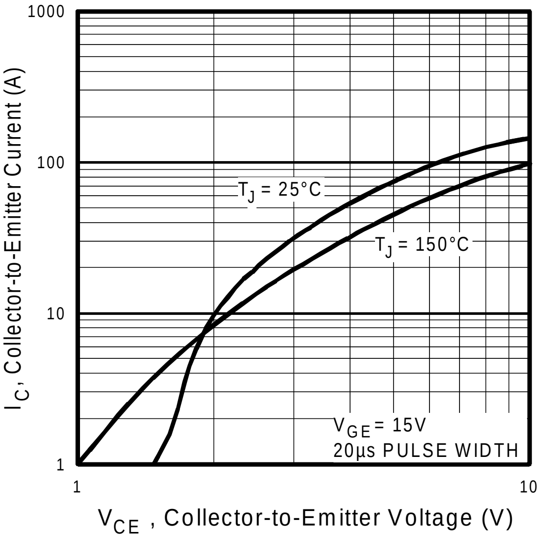


Fig. 1 - RMS Current and Output Power, Synthesized Sine Wave



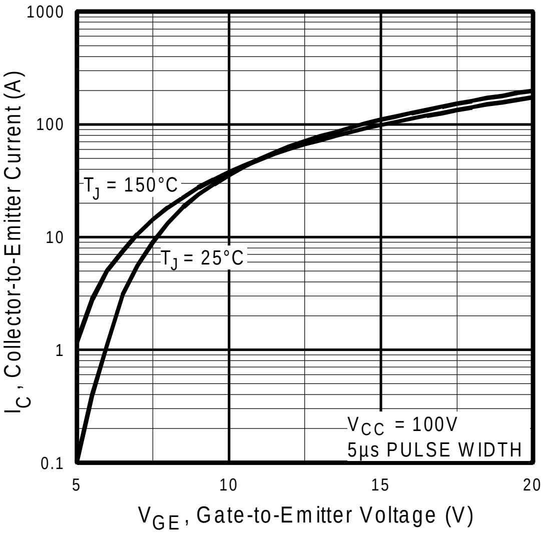


Fig. 2 - Typical Output Characteristics

Fig. 3 - Typical Transfer Characteristics

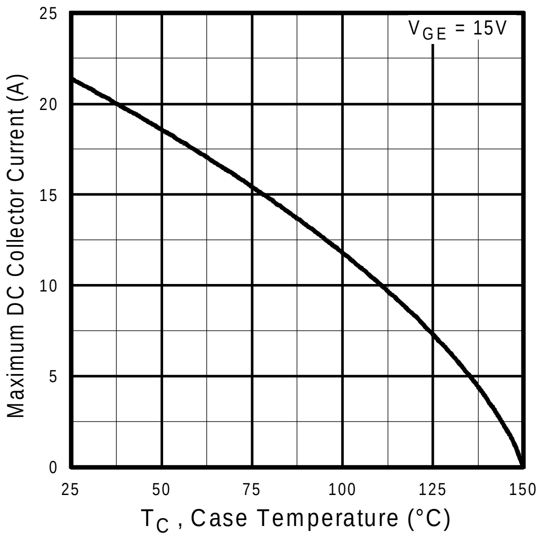


Fig. 4 - Maximum Collector Current vs. Case Temperature

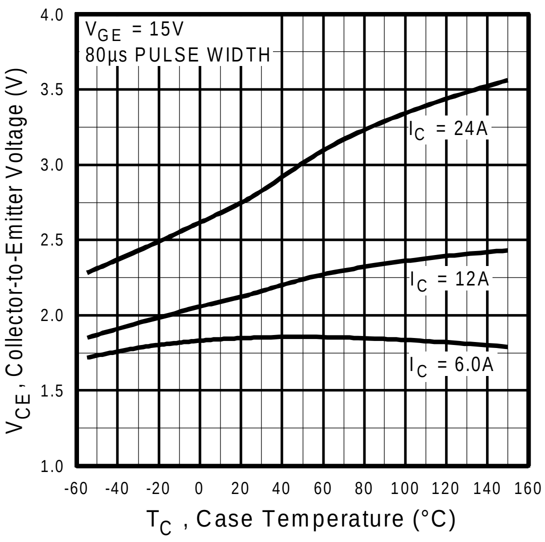


Fig. 5 - Collector-to-Emitter Voltage vs. Case Temperature

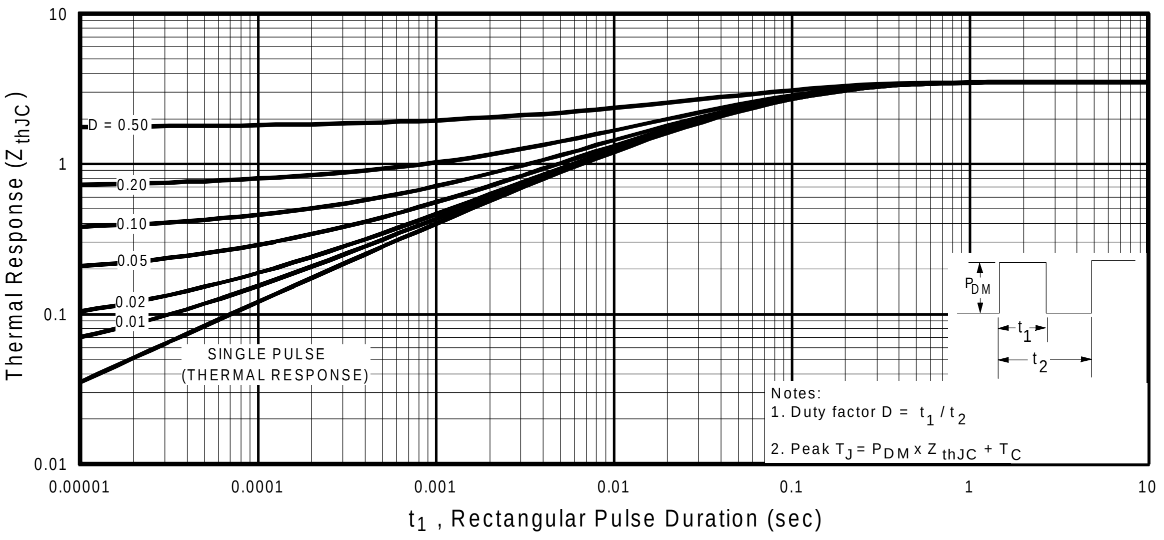


Fig. 6 - Maximum IGBT Effective Transient Thermal Impedance, Junction-to-Case

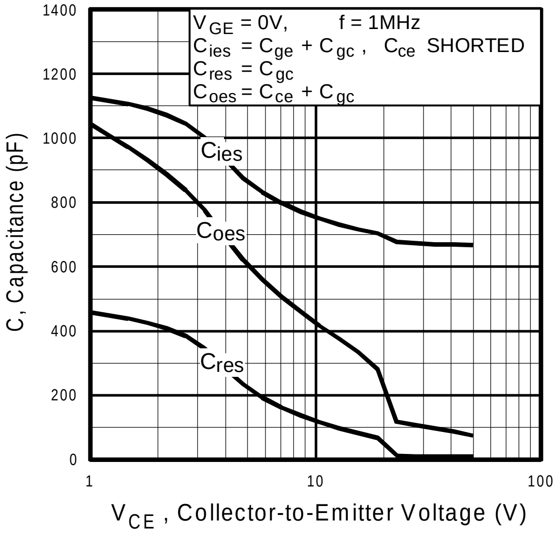


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

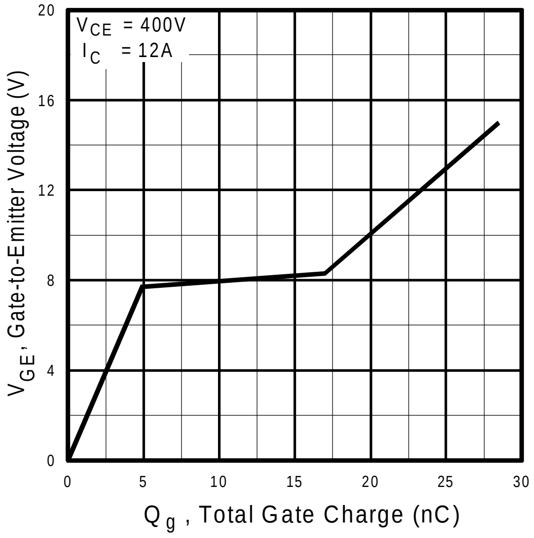


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

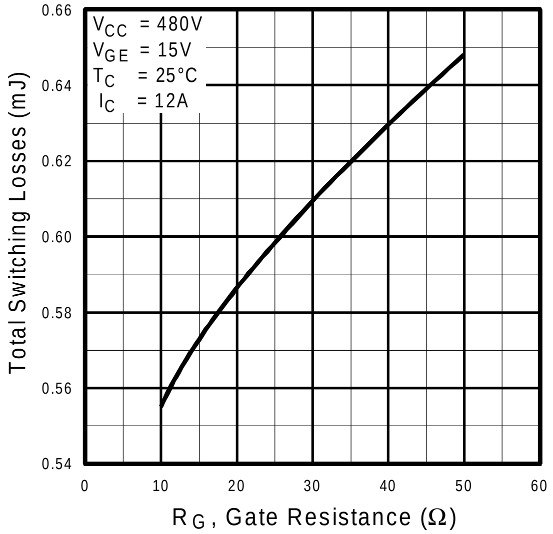


Fig. 9 - Typical Switching Losses vs. Gate Resistance

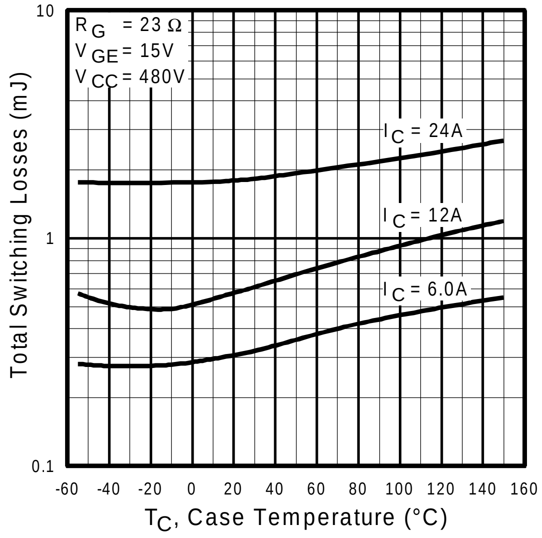


Fig. 10 - Typical Switching Losses vs. Case Temperature

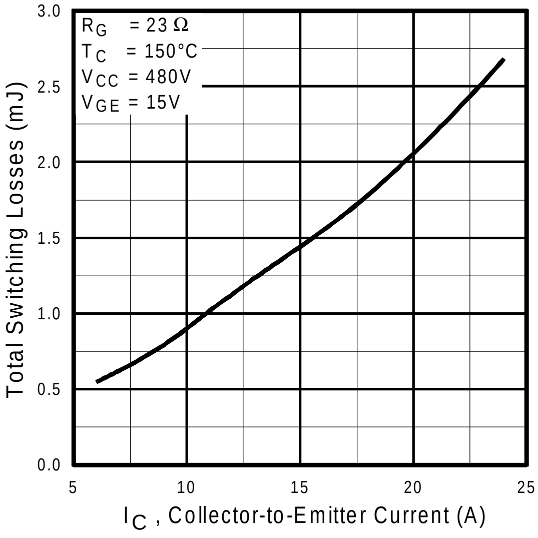


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

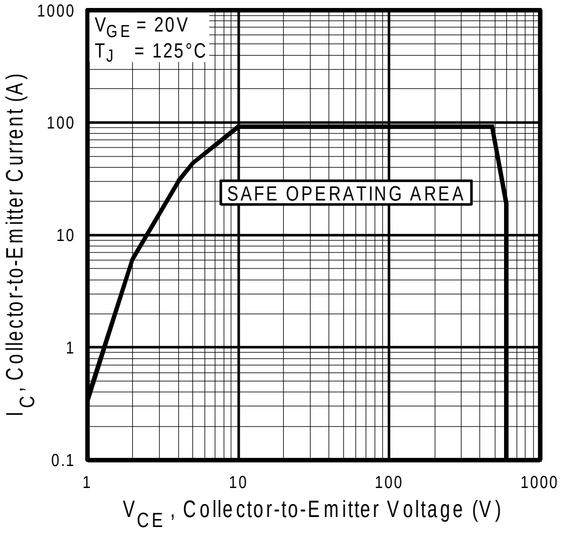


Fig. 12 - Turn-Off SOA

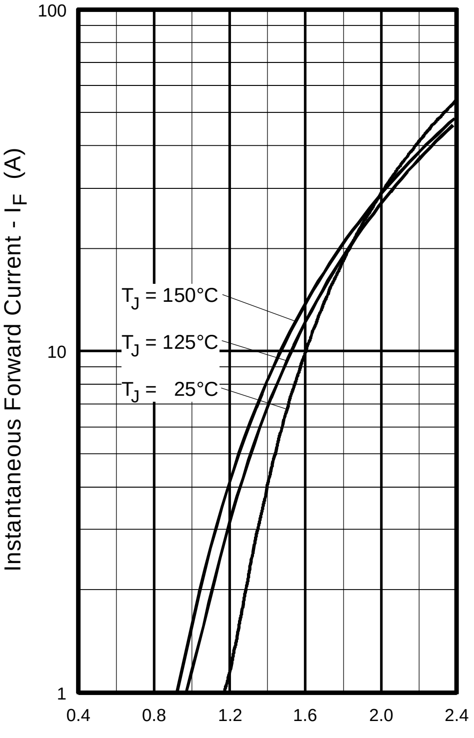


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

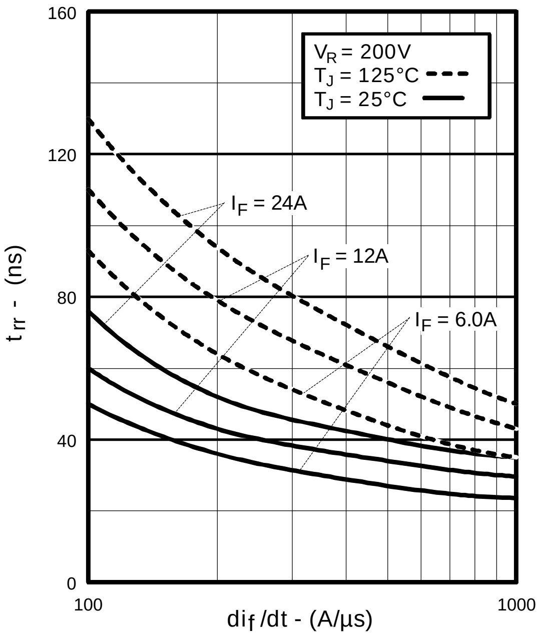


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

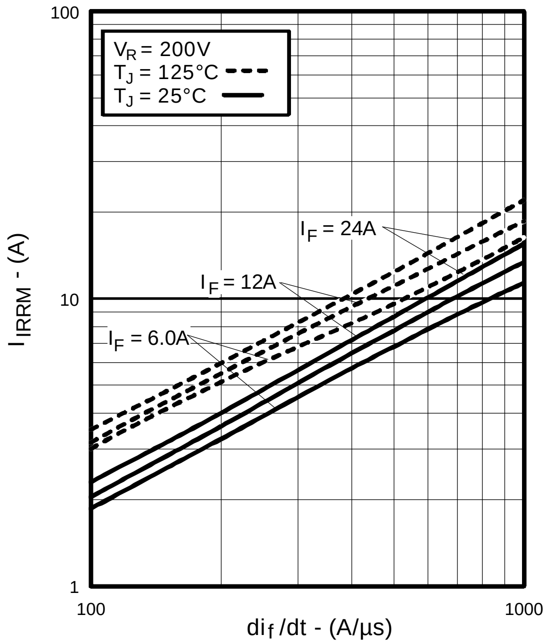


Fig. 15 - Typical Recovery Current vs. di_f/dt

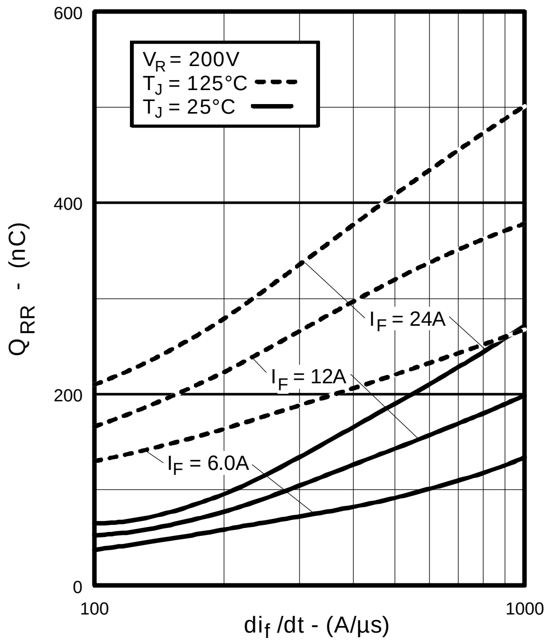


Fig. 16 - Typical Stored Charge vs. di_f/dt

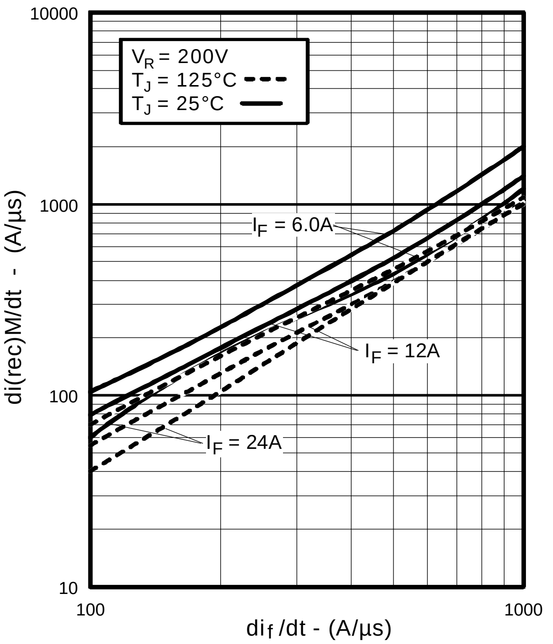


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

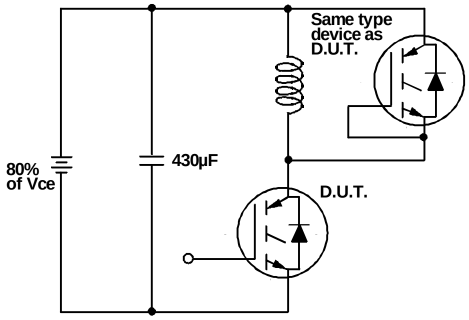


Fig.18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

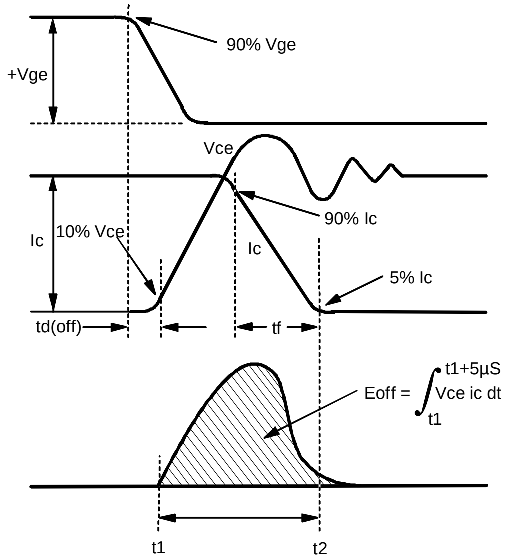


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

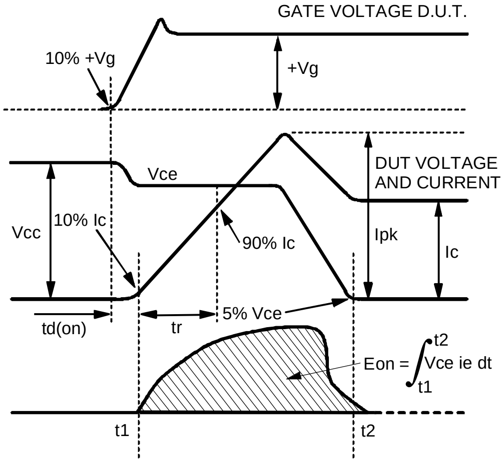


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

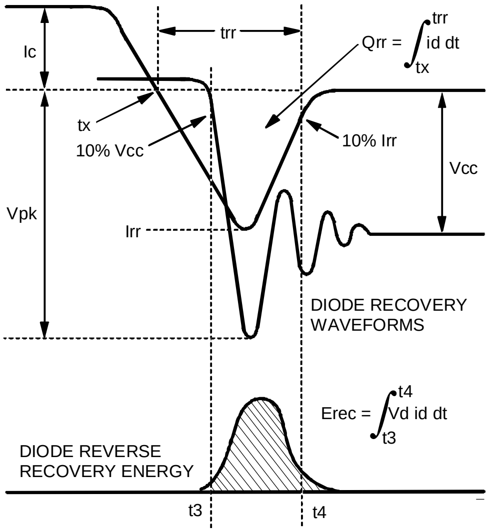


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

Refer to Section D for the following:
Appendix D: Section D - page D-6

Fig. 18e - Macro Waveforms for Test Circuit of Fig. 18a
Fig. 19 - Clamped Inductive Load Test Circuit
Fig. 20 - Pulsed Collector Current Test Circuit

Package Outline 5 - IMS-2 Package (13 pins) **Section D - page D-14**