International
IOR Rectifier

PD -5.046

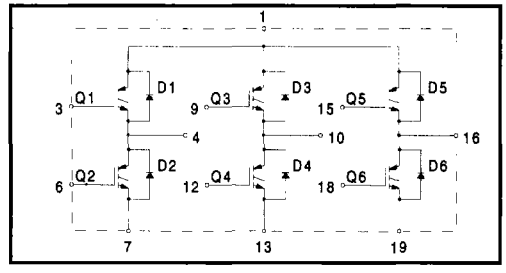
CPV362M4F

IGBT SIP MODULE

Fast IGBT

Features

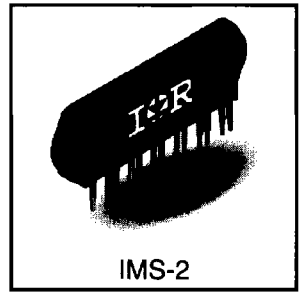
- Fully isolated printed circuit board mount package
- Switching-loss rating includes all "tail" losses
- HEXFRED™ soft ultrafast diodes
- Optimized for medium operating (1 to 10 kHz) see figure 1 for Current vs. Frequency curve



Product Summary

Output Current in a Typical 5.0 kHz Motor Drive

11 A_{RMS} per phase (3.1 kW total) with T_C = 90°C, T_J = 125°C, Supply Voltage 360Vdc, Power Factor 0.8, Modulation Depth 115% (see figure 1)



IMS-2

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.

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	8.8	A
I_C @ T_C = 100°C	Continuous Collector Current, each IGBT	4.8	
I_{CM}	Pulsed Collector Current ①	26	
I_{LM}	Clamped Inductive Load Current ②	26	
I_F @ T_C = 100°C	Diode Continuous Forward Current	3.4	
I_{FM}	Diode Maximum Forward Current	26	
V_{GE}	Gate-to-Emitter Voltage	±20	V
V_{ISOL}	Isolation Voltage, any terminal to case, 1 minute	2500	V_{RMS}
P_D @ T_C = 25°C	Maximum Power Dissipation, each IGBT	23	W
P_D @ T_C = 100°C	Maximum Power Dissipation, each IGBT	9.1	
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	—	5.5	°C/W
$R_{\theta JC}$ (DIODE)	Junction-to-Case, each diode, one diode in conduction	—	9.0	
$R_{\theta CS}$ (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	—	0.72	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.41	1.7	V	I_C = 4.8A V_{GE} = 15V
		—	1.66	—		I_C = 8.8A see figure 2, 5
		—	1.42	—		I_C = 4.8A, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		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	2.9	5.0	—	S	V_{CE} = 100V, I_C = 4.8A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V
		—	—	1700		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop	—	1.4	1.7	V	I_C = 8.0A see figure 13
		—	1.3	1.6		I_C = 8.0A, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±100	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)	—	30	45		I_C = 4.8A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	4.0	6.0	nC	V_{CC} = 400V
Q_{gc}	Gate - Collector Charge (turn-on)	—	13	20		See Fig. 8
$t_{d(on)}$	Turn-On Delay Time	—	49	—		T_J = 25°C
t_r	Rise Time	—	22	—	ns	I_C = 4.8A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	200	300		V_{GE} = 15V, R_G = 50Ω
t_f	Fall Time	—	214	320		Energy losses include "tail" and
E_{on}	Turn-On Switching Loss	—	0.23	—		diode reverse recovery
E_{off}	Turn-Off Switching Loss	—	0.33	—	mJ	see figures 9, 10, 18
E_{ts}	Total Switching Loss	—	0.45	0.70		
$t_{d(on)}$	Turn-On Delay Time	—	48	—		T_J = 150°C, see figures 10,11, 18
t_r	Rise Time	—	25	—	ns	I_C = 4.8A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	435	—		V_{GE} = 15V, R_G = 50Ω
t_f	Fall Time	—	364	—		Energy losses include "tail" and
E_{ts}	Total Switching Loss	—	0.93	—	mJ	diode reverse recovery
C_{ies}	Input Capacitance	—	340	—		V_{GE} = 0V
C_{oes}	Output Capacitance	—	63	—	pF	V_{CC} = 30V see figure 7
C_{res}	Reverse Transfer Capacitance	—	5.9	—		f = 1.0MHz
t_{rr}	Diode Reverse Recovery Time	—	37	55	ns	T_J = 25°C see figure
		—	55	90		T_J = 125°C 14 I_F = 8.0A
I_{rr}	Diode Peak Reverse Recovery Current	—	3.5	50	A	T_J = 25°C see figure
		—	4.5	8.0		T_J = 125°C 15 V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	65	138	nC	T_J = 25°C see figure
		—	124	360		T_J = 125°C 16 di/dt = 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	240	—	A/µs	T_J = 25°C see figure
	During t_b	—	210	—		T_J = 125°C 17

Notes:

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

② V_{CC} = 80% (V_{CES}), V_{GE} = 20V, L = 10µH, R_G = 50Ω, (see figure 19)

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

④ Pulse width 5.0µs, single shot.

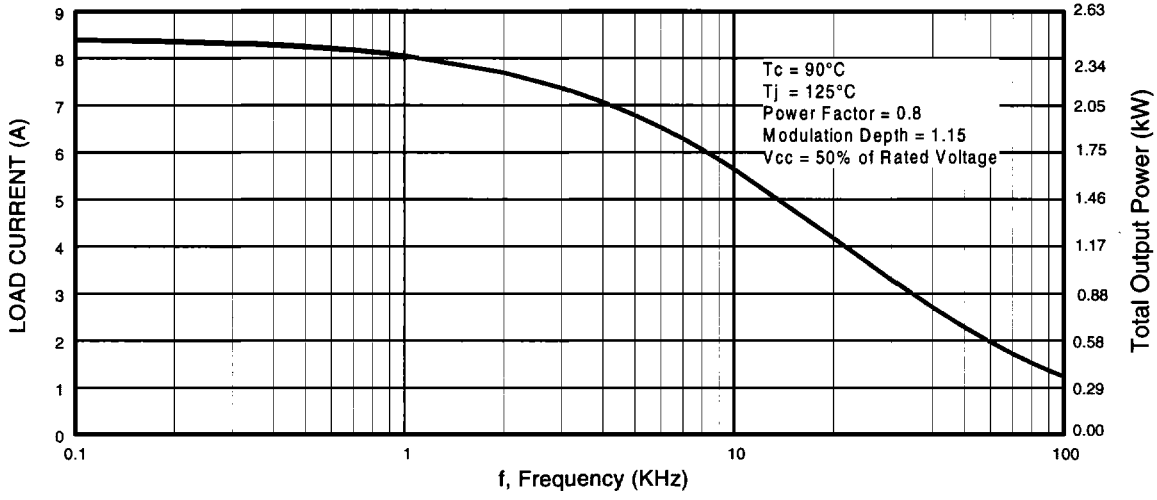


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

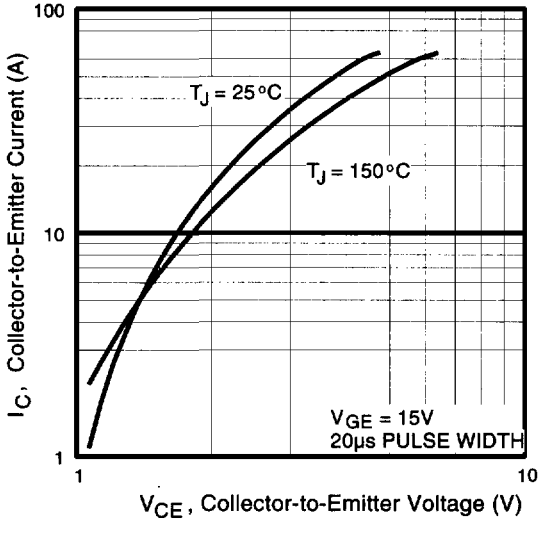


Fig. 2 - Typical Output Characteristics

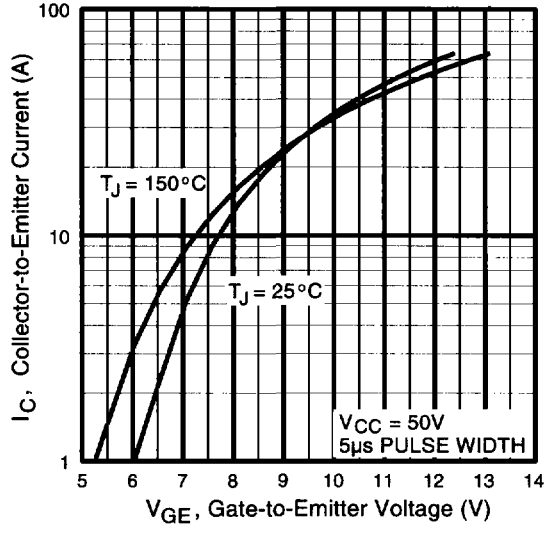


Fig. 3 - Typical Transfer Characteristics

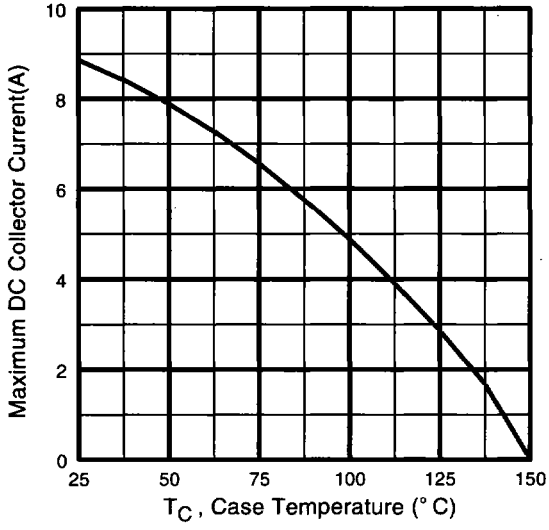


Fig. 4 - Maximum Collector Current vs. Case Temperature

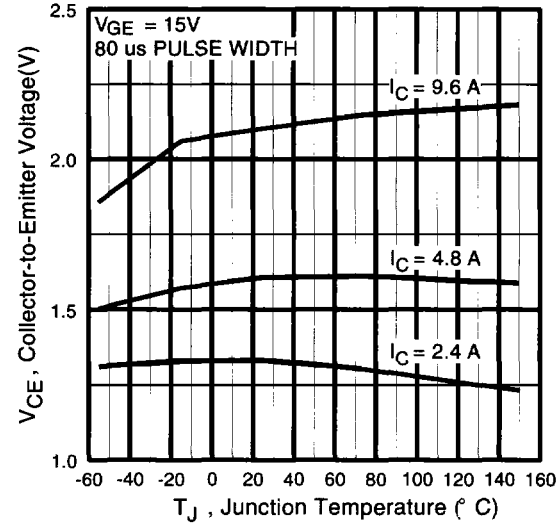


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

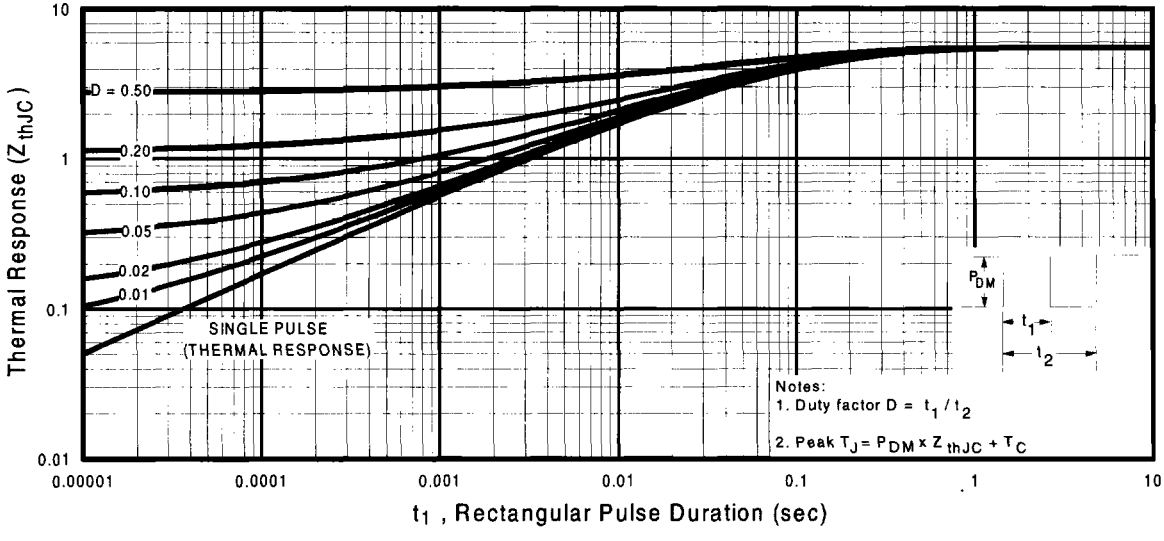


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

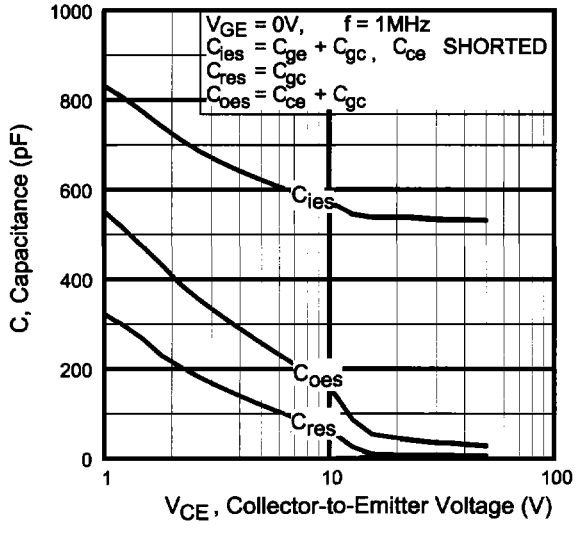


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

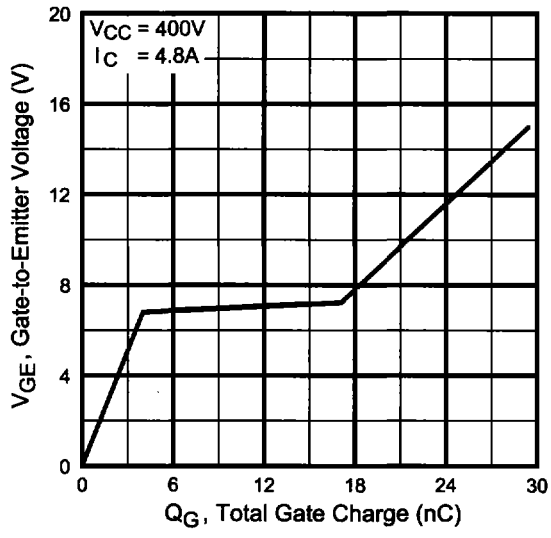


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

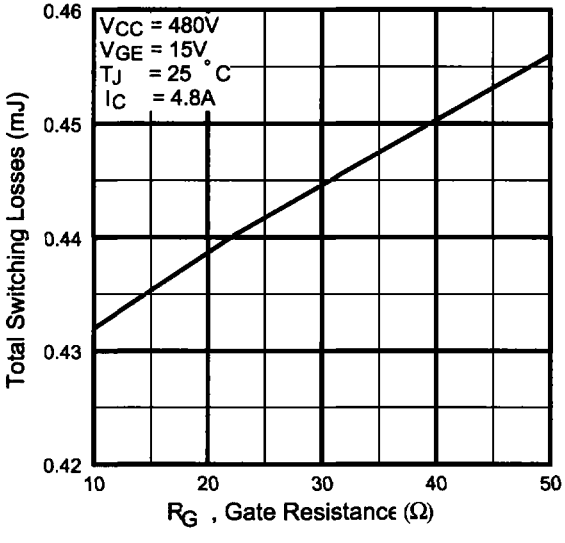


Fig. 9 - Typical Switching Losses vs. Gate Resistance

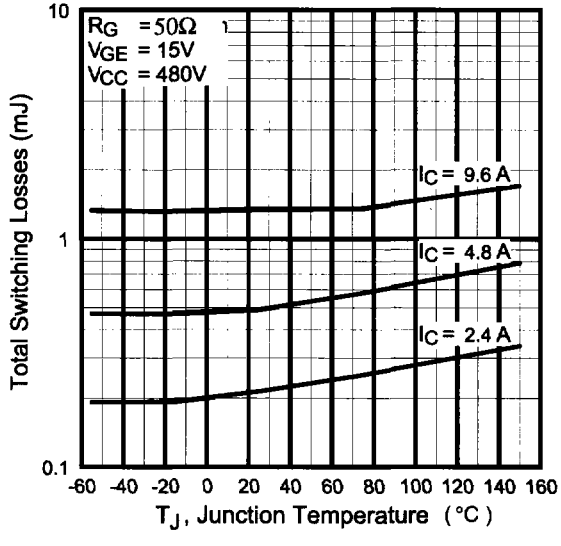


Fig. 10 - Typical Switching Losses vs. Junction Temperature

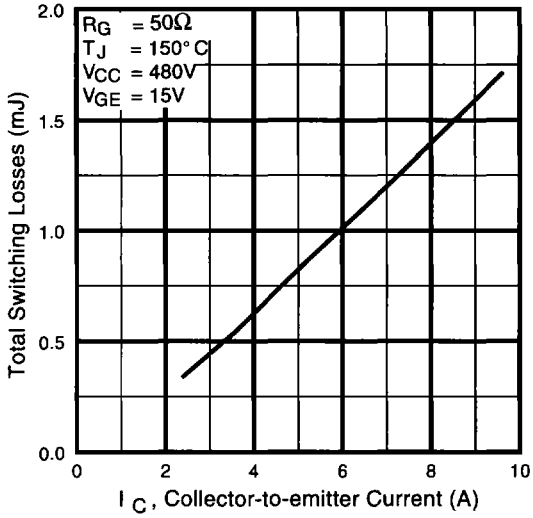


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

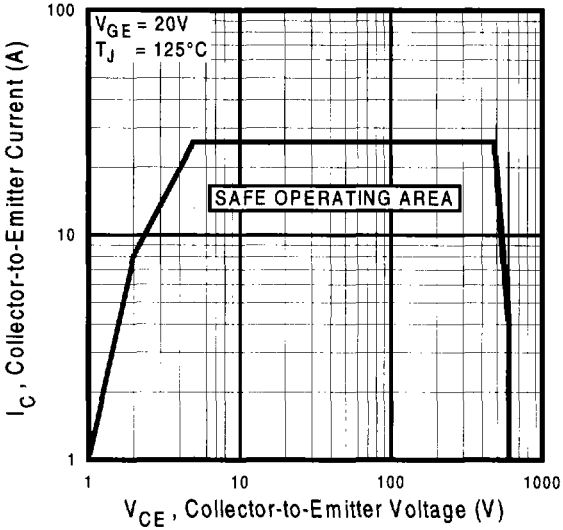


Fig. 12 - Turn-Off SOA

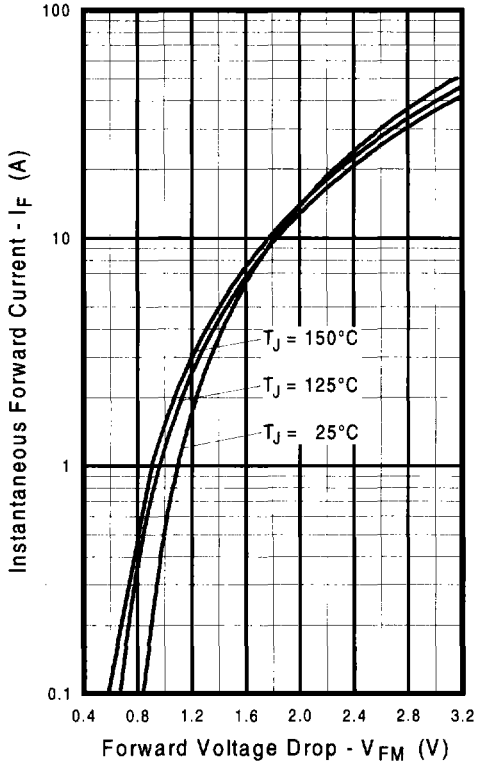


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

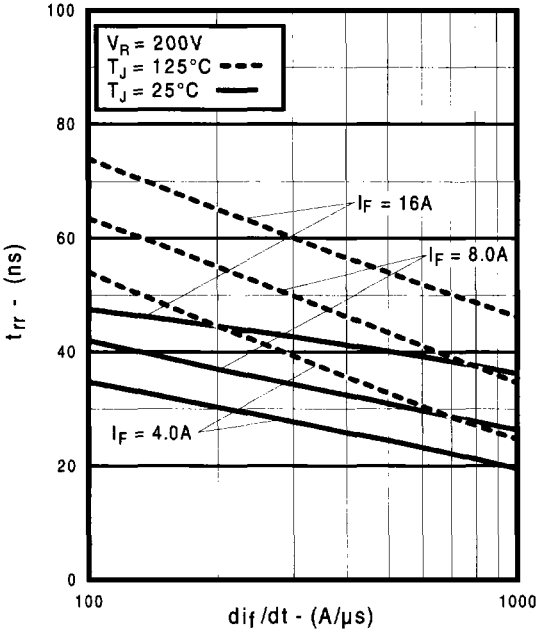


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

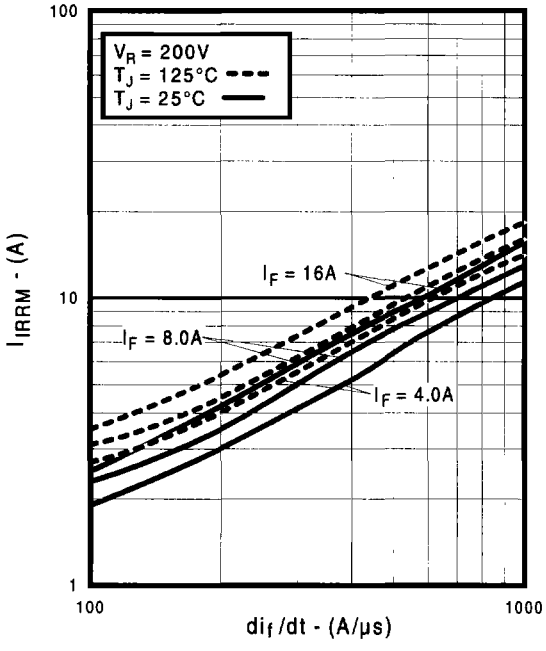


Fig. 15 - Typical Recovery Current vs. di_f/dt

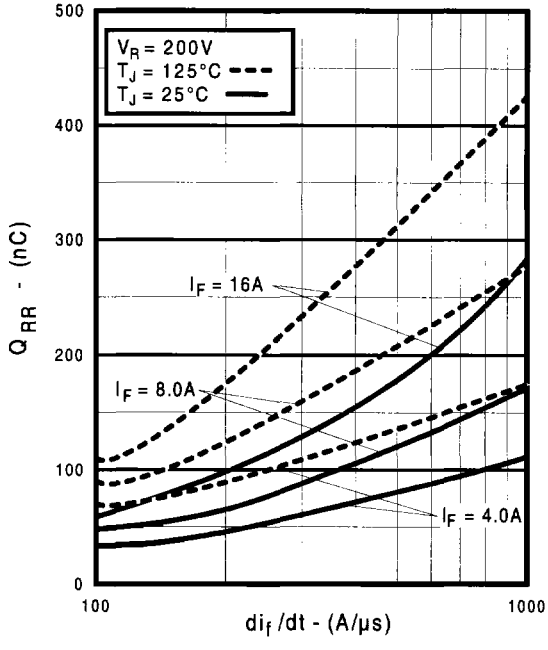


Fig. 16 - Typical Stored Charge vs. di_f/dt

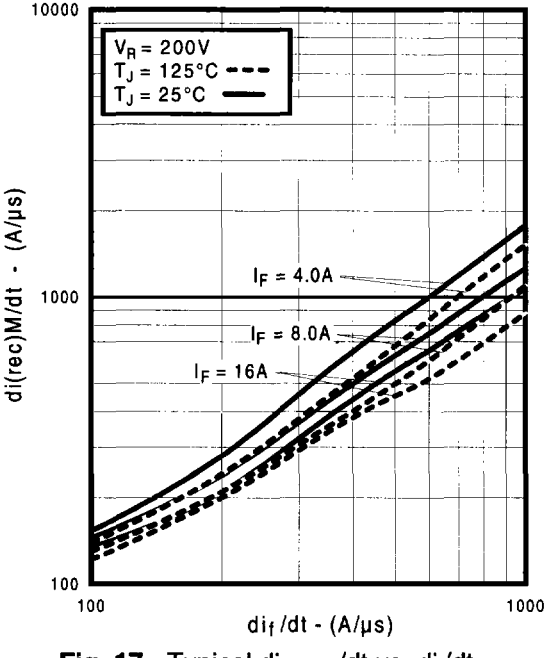


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

Mechanical drawings, Appendix A
Test Circuit diagrams, Appendix B
Switching Loss Waveforms, Appendix C