

CPV363M4K

IGBT SIP MODULE

Features

- Short Circuit Rated UltraFast: Optimized for high operating frequencies >5.0 kHz , and Short Circuit Rated to $10\mu\text{s}$ @ 125°C , $V_{\text{GE}} = 15\text{V}$
- 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

6.7 A_{RMS} per phase (1.94 kW total) with $T_C = 90^\circ\text{C}$, $T_J = 125^\circ\text{C}$, Supply Voltage 360Vdc, Power Factor 0.8, Modulation Depth 115% (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.

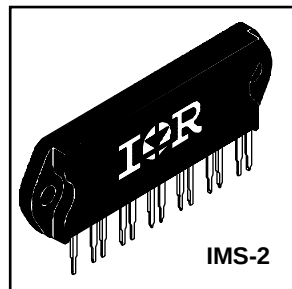
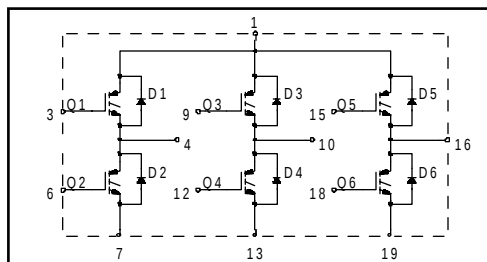
Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ $T_C = 25^\circ\text{C}$	Continuous Collector Current, each IGBT	11	A
I_C @ $T_C = 100^\circ\text{C}$	Continuous Collector Current, each IGBT	6.0	
I_{CM}	Pulsed Collector Current ①	22	
I_{LM}	Clamped Inductive Load Current ②	22	
I_F @ $T_C = 100^\circ\text{C}$	Diode Continuous Forward Current	6.1	
I_{FM}	Diode Maximum Forward Current	22	
t_{sc}	Short Circuit Withstand Time	10	μs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
V_{ISOL}	Isolation Voltage, any terminal to case, 1 minute	2500	V_{RMS}
P_D @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation, each IGBT	36	W
P_D @ $T_C = 100^\circ\text{C}$	Maximum Power Dissipation, each IGBT	14	
T_J	Operating Junction and	-40 to +150	$^\circ\text{C}$
T_{STG}	Storage Temperature Range		
	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
$R_{\theta\text{JC}}$ (IGBT)	Junction-to-Case, each IGBT, one IGBT in conduction	—	3.5	$^\circ\text{C/W}$
$R_{\theta\text{JC}}$ (DIODE)	Junction-to-Case, each diode, one diode in conduction	—	5.5	
$R_{\theta\text{CS}}$ (MODULE)	Case-to-Sink, flat, greased surface	0.1	—	
Wt	Weight of module	20 (0.7)	—	g (oz)

Short Circuit Rated UltraFast IGBT



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 ^③	600	—	—	V	$V_{GE} = 0V$, $I_C = 250\mu A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temp. Coeff. of Breakdown Voltage	—	0.45	—	V/ $^\circ\text{C}$	$V_{GE} = 0V$, $I_C = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.72	2.10	V	$I_C = 6.0A$ $V_{GE} = 15V$ See Fig. 2, 5
		—	2.00	—		$I_C = 11A$
		—	1.60	—		$I_C = 6.0A$, $T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}$, $I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temp. Coeff. of Threshold Voltage	—	-13	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}$, $I_C = 250\mu A$
g_{fe}	Forward Transconductance ^④	3.0	6.0	—	S	$V_{CE} = 100V$, $I_C = 12A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V$, $V_{CE} = 600V$
		—	—	2500		$V_{GE} = 0V$, $V_{CE} = 600V$, $T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	1.4	1.7	V	$I_C = 12A$ See Fig. 13
		—	1.3	1.6		$I_C = 12A$, $T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	61	91	nC	$I_C = 6A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	7.4	11		$V_{CC} = 400V$
Q_{gc}	Gate - Collector Charge (turn-on)	—	27	40		See Fig. 8
$t_{d(on)}$	Turn-On Delay Time	—	55	—	ns	$T_J = 25^\circ\text{C}$
t_r	Rise Time	—	24	—		$I_C = 6.0A$, $V_{CC} = 480V$
$t_{d(off)}$	Turn-Off Delay Time	—	107	160		$V_{GE} = 15V$, $R_G = 23\Omega$
t_f	Fall Time	—	92	140		Energy losses include "tail" and diode reverse recovery.
E_{on}	Turn-On Switching Loss	—	0.28	—	mJ	See Fig. 9, 10, 18
E_{off}	Turn-Off Switching Loss	—	0.10	—		
E_{ts}	Total Switching Loss	—	0.39	0.50		
t_{sc}	Short Circuit Withstand Time	10	—	—	μs	$V_{CC} = 360V$, $T_J = 125^\circ\text{C}$ $V_{GE} = 15V$, $R_G = 23\Omega$, $V_{CPK} < 500V$
$t_{d(on)}$	Turn-On Delay Time	—	54	—	ns	$T_J = 150^\circ\text{C}$, See Fig.10, 11, 18
t_r	Rise Time	—	24	—		$I_C = 6.0A$, $V_{CC} = 480V$
$t_{d(off)}$	Turn-Off Delay Time	—	161	—		$V_{GE} = 15V$, $R_G = 23\Omega$
t_f	Fall Time	—	244	—		Energy losses include "tail" and diode reverse recovery.
E_{ts}	Total Switching Loss	—	0.60	—	mJ	
C_{ies}	Input Capacitance	—	740	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	100	—		$V_{CC} = 30V$ See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	9.3	—		$f = 1.0MHz$
t_{rr}	Diode Reverse Recovery Time	—	42	60	ns	$T_J = 25^\circ\text{C}$ See Fig. 14
		—	80	120		$T_J = 125^\circ\text{C}$
I_{rr}	Diode Peak Reverse Recovery Current	—	3.5	6.0		$T_J = 25^\circ\text{C}$ See Fig. 15
		—	5.6	10		$T_J = 125^\circ\text{C}$
Q_{rr}	Diode Reverse Recovery Charge	—	80	180	nC	$T_J = 25^\circ\text{C}$ See Fig. 16
		—	220	600		$T_J = 125^\circ\text{C}$
$d i_{(rec)M} / dt$	Diode Peak Rate of Fall of Recovery During t_b	—	180	—	A/ μs	$T_J = 25^\circ\text{C}$ See Fig. 17
		—	120	—		$T_J = 125^\circ\text{C}$

Notes:

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

② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G=23\Omega$, (See fig. 19)

④ Pulse width 5.0 μs , single shot.

③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.

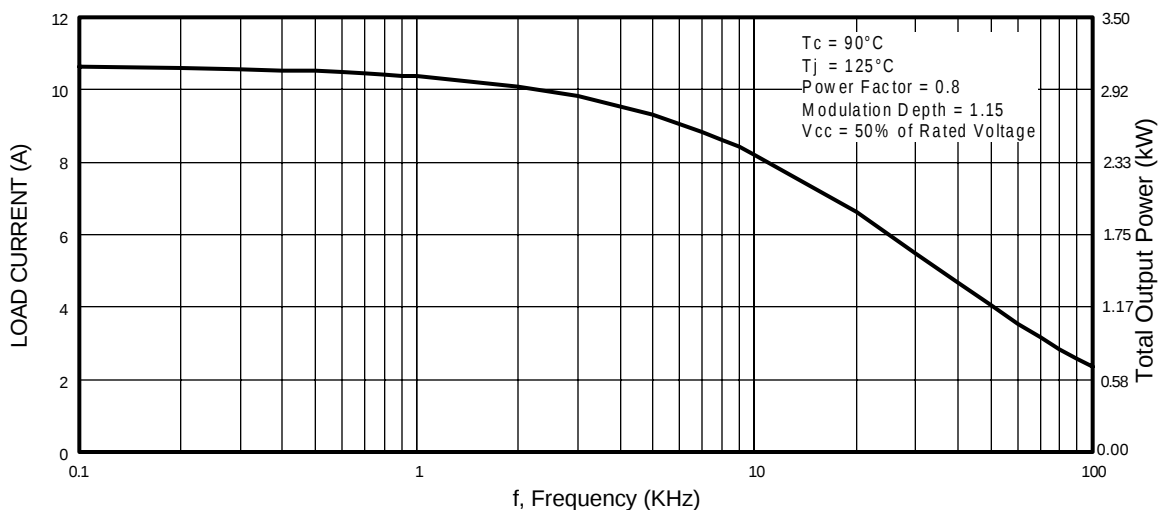


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

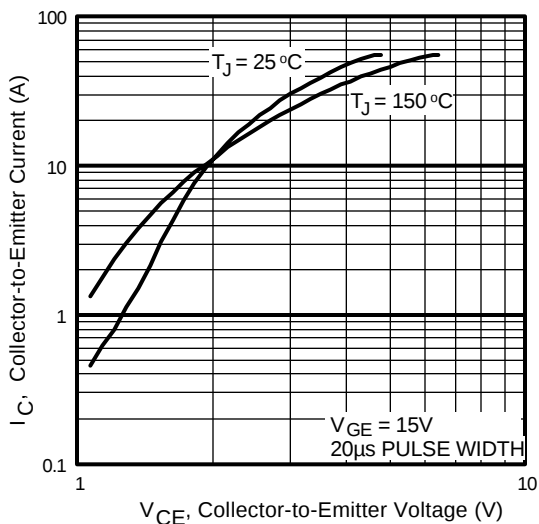


Fig. 2 - Typical Output Characteristics

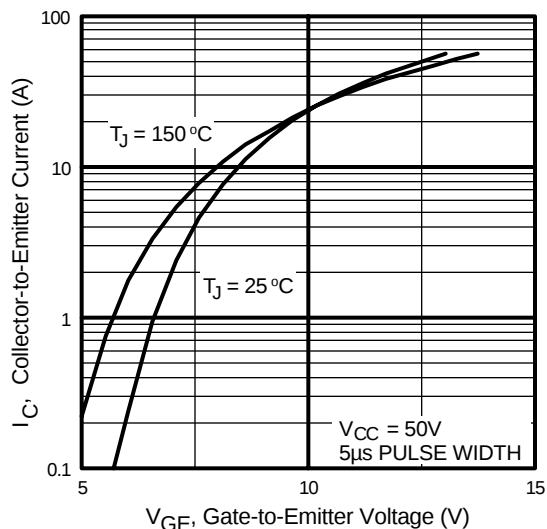


Fig. 3 - Typical Transfer Characteristics

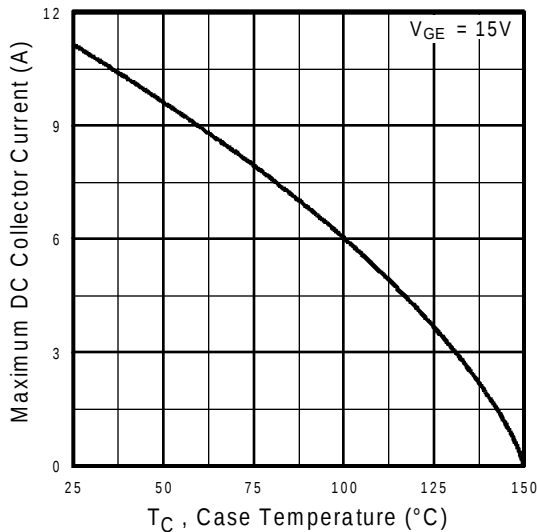


Fig. 4 - Maximum Collector Current vs. Case Temperature

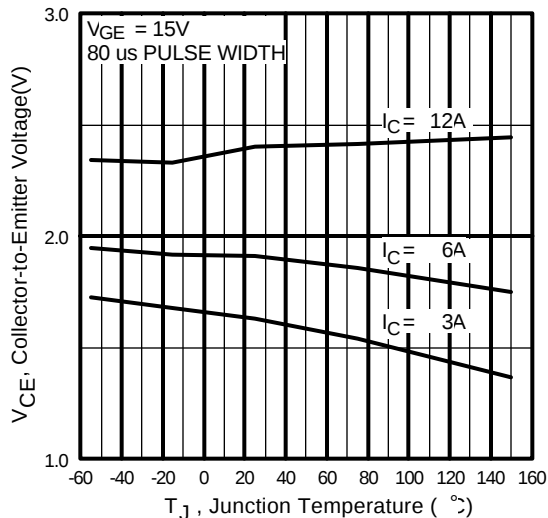


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

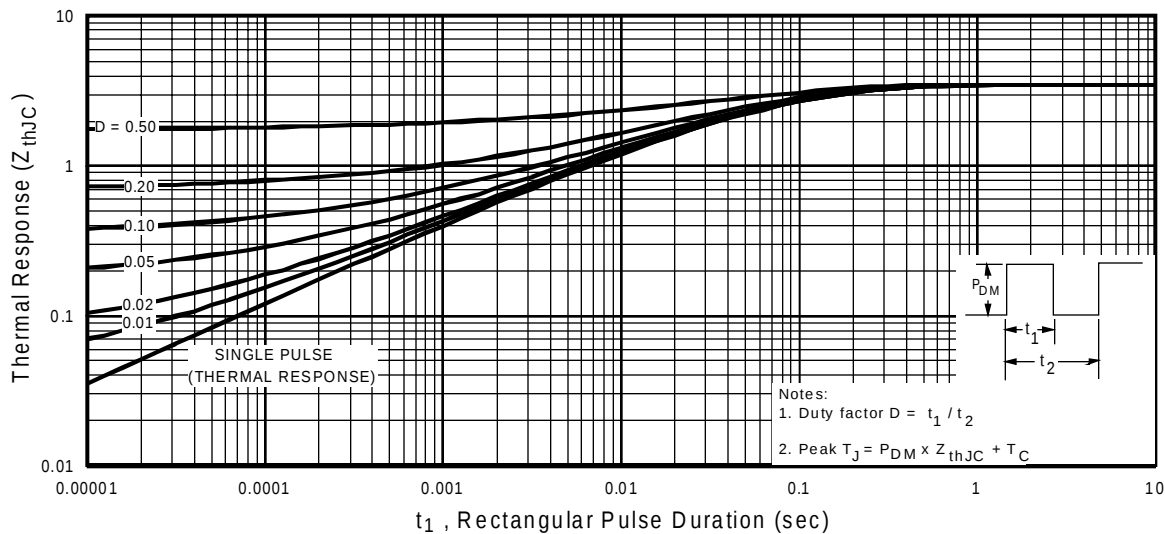


Fig. 6 - Maximum IGBT Effective Transient Thermal Impedance, Junction-to-Case

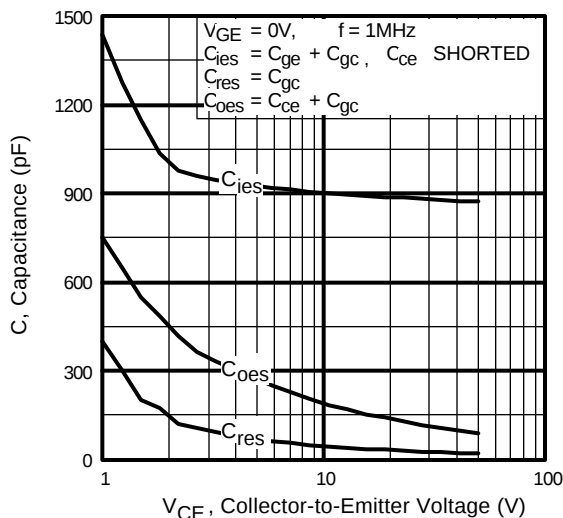


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

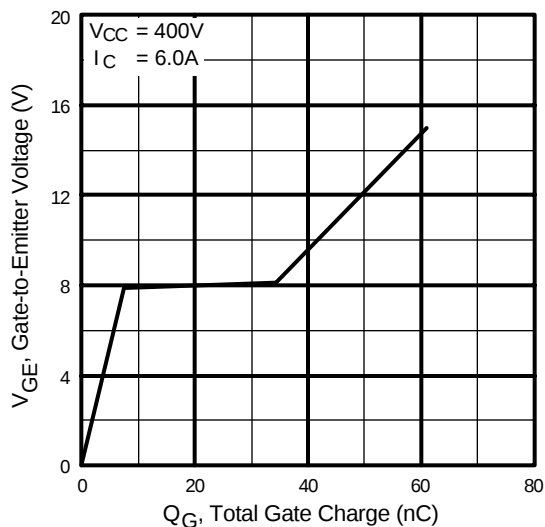


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

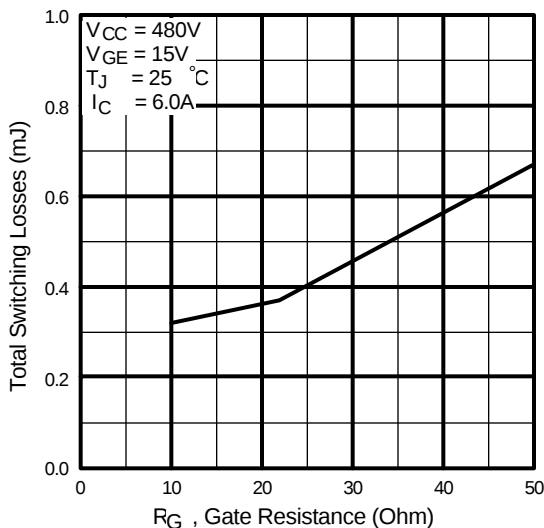


Fig. 9 - Typical Switching Losses vs. Gate Resistance

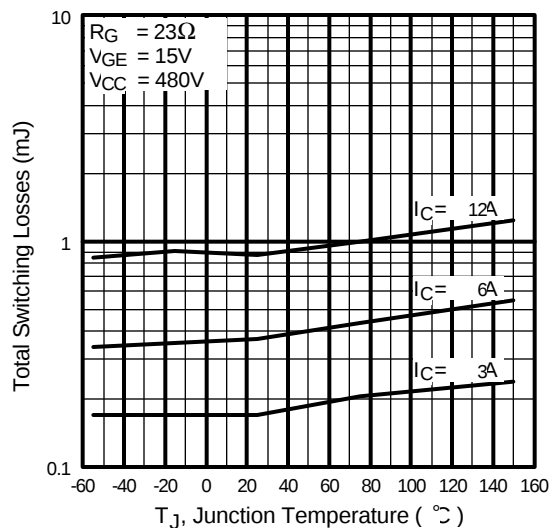


Fig. 10 - Typical Switching Losses vs. Junction Temperature

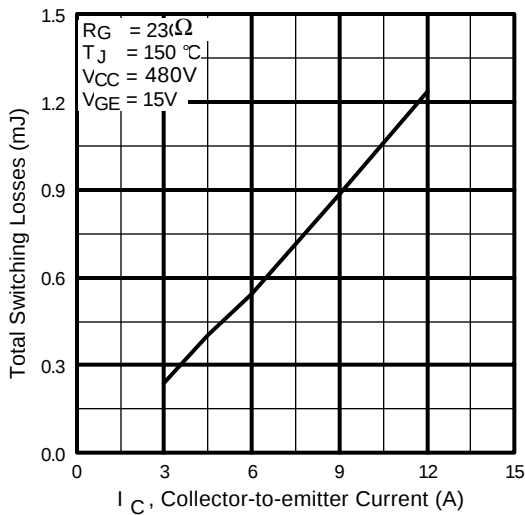


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

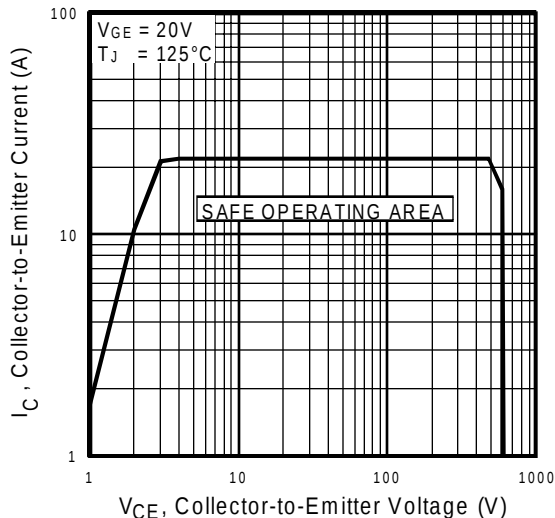


Fig. 12 - Turn-Off SOA

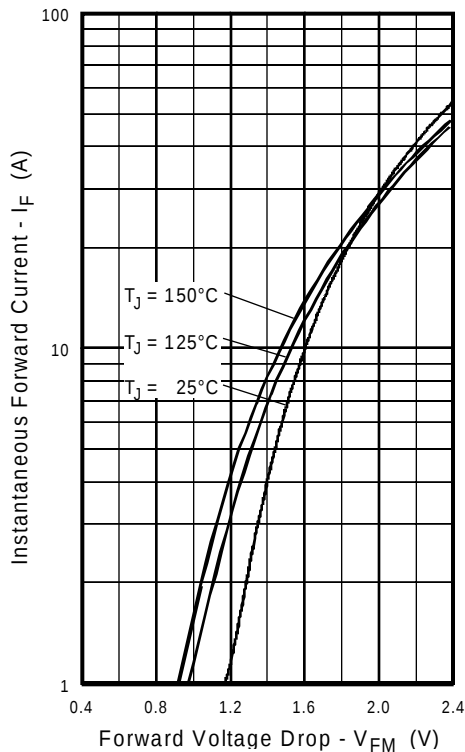


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

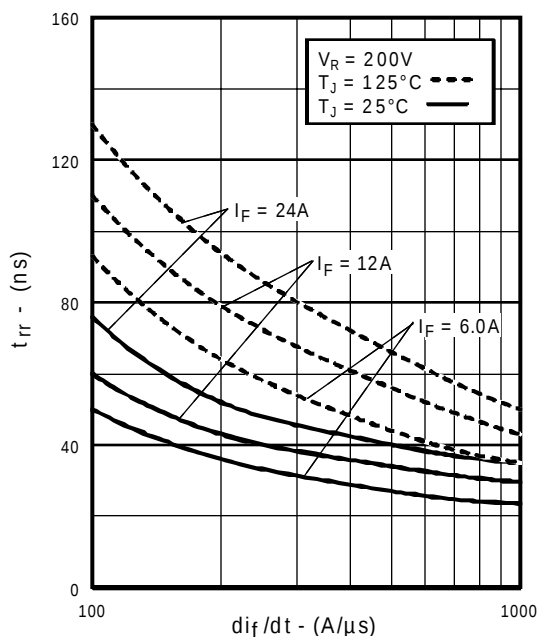


Fig. 14 - Typical Reverse Recovery vs. di/dt

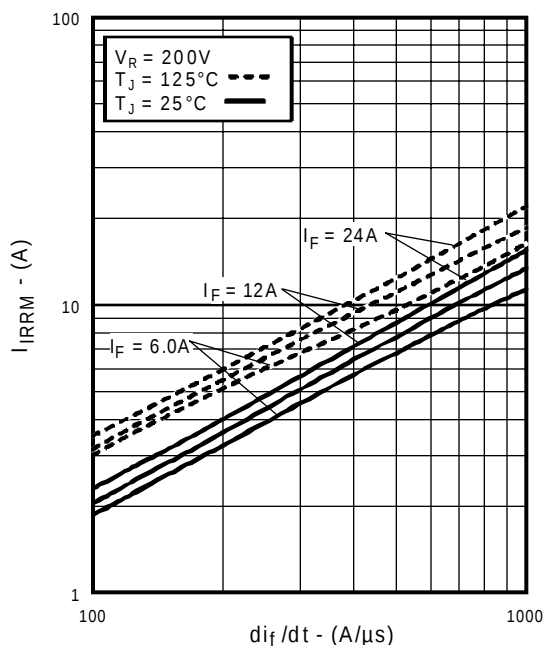


Fig. 15 - Typical Recovery Current vs. di/dt

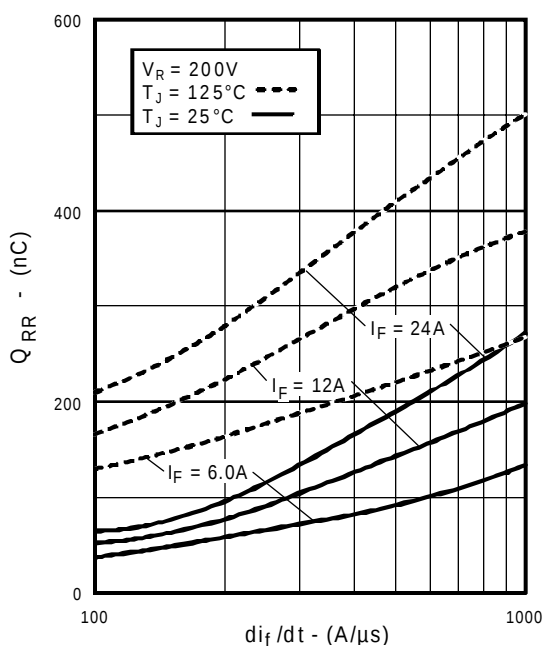


Fig. 16 - Typical Stored Charge vs. di/dt

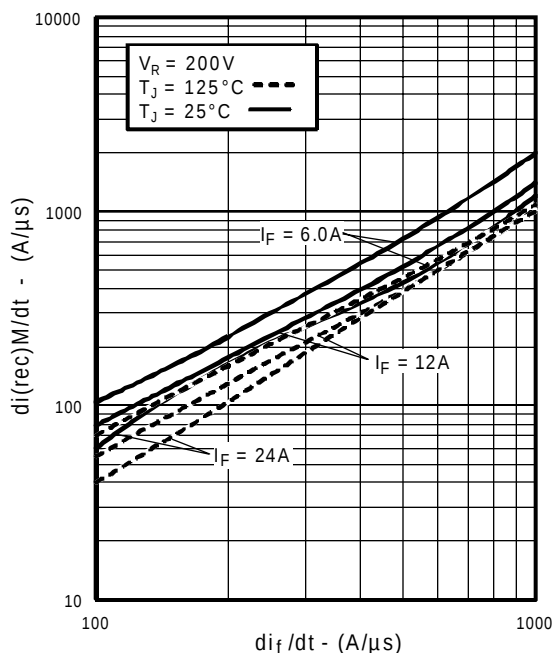


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di/dt

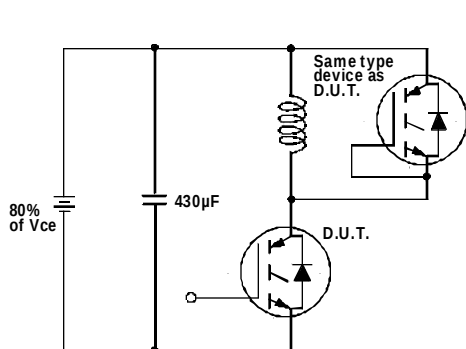


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

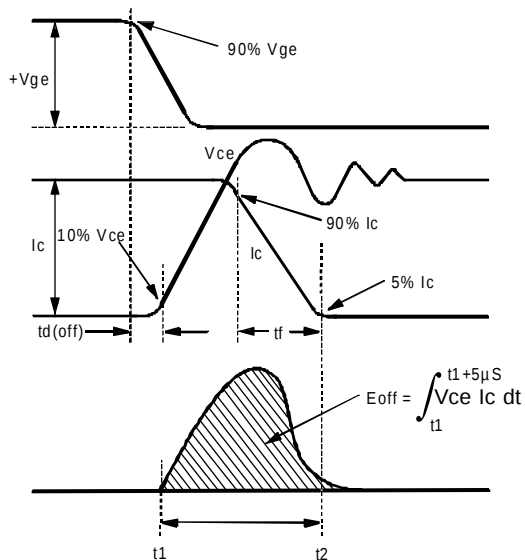


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

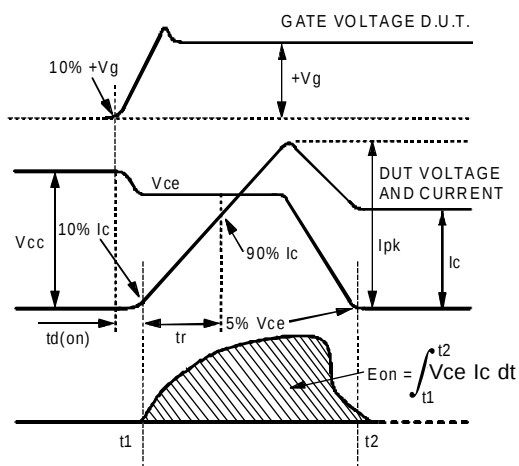


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

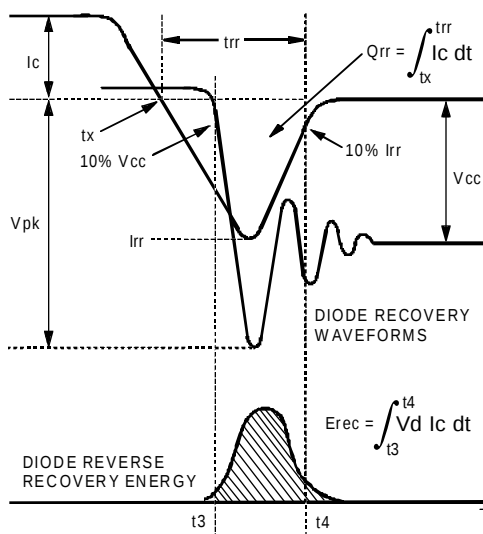


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

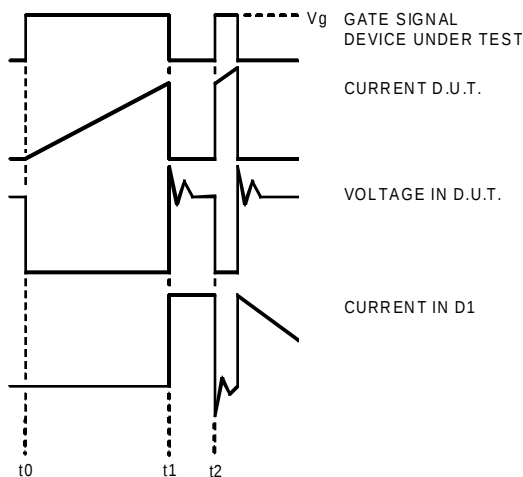


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

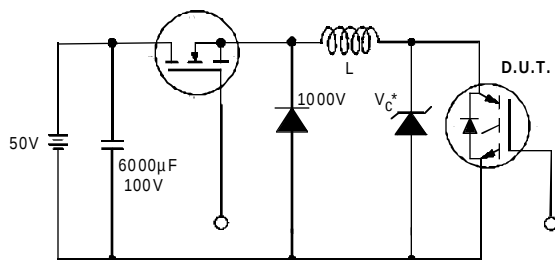


Figure 19. Clamped Inductive Load Test Circuit

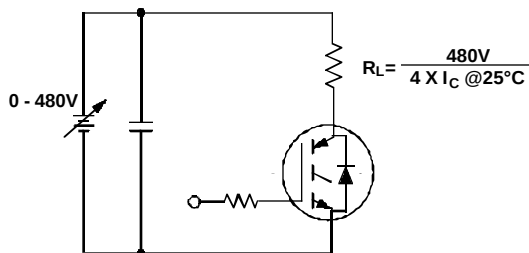
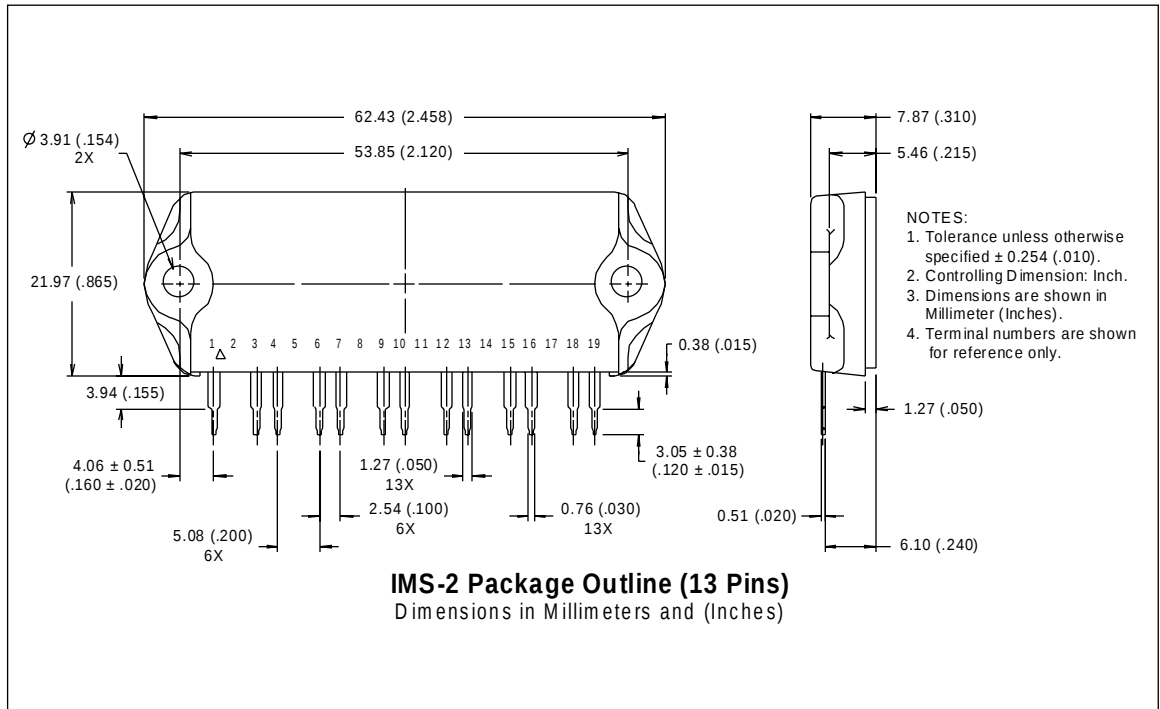


Figure 20. Pulsed Collector Current Test Circuit

Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES})$, $V_{GE}=20V$, $L=10\mu H$, $R_G = 10\Omega$ (Figure 19)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.

Case Outline — IMS-2





Notice

The products described herein were acquired by Vishay Intertechnology, Inc., as part of its acquisition of International Rectifier's Power Control Systems (PCS) business, which closed in April 2007. Specifications of the products displayed herein are pending review by Vishay and are subject to the terms and conditions shown below.

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