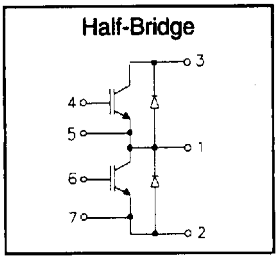
International
IOR Rectifier

PD-9.957B

IRGTI065F06

"HALF-BRIDGE" IGBT INT-A-PAK

Fast Speed IGBT

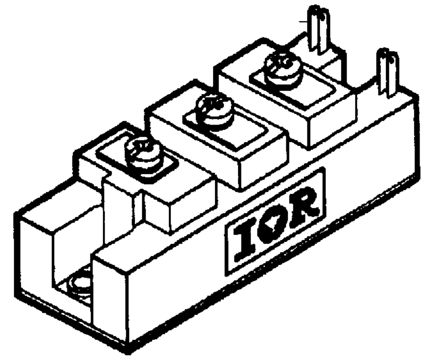


V_{CE} = 600V
I_C = 65A
$V_{CE}(ON) < 2.3V$

- Rugged Design
- Simple gate-drive
- Fast operation up to 10KHz hard switching, or 50KHz resonant
- Switching-Loss Rating includes all "tail" losses

Description

IR's advanced IGBT technology is the key to this line of INT-A-pak Power Modules. The efficient geometry and unique processing of the IGBT allow higher current densities than comparable bipolar power module transistors, while at the same time requiring the simpler gate-drive of the familiar power MOSFET. This superior technology has now been coupled to state of the art assembly techniques to produce a higher current module that is highly suited to power applications such as motor drives, uninterruptible power supplies, welding, induction heating and ultrasonics.



INT-A-PAK case

Absolute Maximum Ratings

Parameter	Description	Value	Units
V_{CES}	Continuous collector to emitter voltage	600	V
I_C @ $T_C = 25°C$	Continuous collector current	65	A
I_C @ $T_C = 85°C$	Continuous collector current	40	
I_C @ $T_C = 100°C$	Continuous collector current	35	
I_{LM}	Peak switching current	130	
I_{FM}	Peak diode forward current (1)	165	
V_{GE}	Gate to emitter voltage	± 20	V
V_{ISOL}	RMS isolation voltage, any terminal to case, t = 1 min	2500	
P_D @ $T_C = 25°C$	Power dissipation	179	W
T_J	Operating junction temperature range	-40 to 150	°C
T_{STG}	Storage temperature range	-40 to 125	

(1) Duration limited by max junction temperature.

Electrical Characteristics - T_J = 25°C, unless otherwise stated

Parameter	Description	Min	Typ	Max	Units	Test Conditions
BV_{CES}	Collector-to-emitter breakdown voltage	600	—	—	V	$V_{GE} = 0V, I_C = 500\mu A$
$V_{CE}(ON)$	Collector-to-emitter voltage	—	—	2.3		$V_{GE} = 15V, I_C = 65A$
		—	2.6	—		$V_{GE}=15V, I_C=65A, T_J=150°C$
V_{FM}	Diode forward voltage - maximum	—	—	3.2		$I_F = 65A, V_{GE} = 0V$
		—	3.2	—		$I_F=65A, V_{GE}=0V, T_J=150°C$
V_{GEth}	Gate threshold voltage	3.0	—	5.5		$I_C = 250\mu A$
ΔV_{GEth}	Threshold voltage temp. coeff.	—	-11	—	mV/°C	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward transconductance	26	—	36	S(℧)	$V_{CE} = 25V, I_C = 65A$
I_{CES}	Collector-to-emitter leakage current	—	—	500	µA	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	5	mA	$V_{GE}=0V, V_{CE}=600V, T_J=150°C$
I_{GES}	Gate-to-emitter leakage current	—	—	±500	nA	$V_{GE} = \pm 20V$

Dynamic Characteristics - T_J = 150°C

Parameter	Description	Min	Typ	Max	Units	Test Conditions
E_{on}	Turn-on switching energy	—	0.05	—	mJ/A	$R_{G1} = 82\Omega, R_{G2} = 0\Omega$
E_{off} (1)	Turn-off switching energy	—	0.17	—		$I_C = 65A, L_S = 100nH$
E_{ts} (1)	Total switching energy	—	—	0.3		$V_{CC} = 360V, V_{GE} = \pm 15V$
$t_{d(on)}$	Turn-on delay time	—	80	—	ns	$R_{G1} = 82\Omega, R_{G2} = 0\Omega$
t_r	Rise time	—	150	—		$I_C = 65A$
$t_{d(off)}$	Turn-off delay time	—	450	—		$V_{CC} = 360V, V_{GE} = \pm 15V$
t_f	Fall time	—	900	—		$L_S = 100nH$
I_{rr}	Diode peak recovery current	—	30	—	A	$R_{G1} = 82\Omega, R_{G2} = 0\Omega$
t_{rr}	Diode recovery time	—	115	—	ns	$I_C = 65A$
Q_{rr}	Diode recovery charge	—	2.0	—	µC	$V_{CC} = 360V, V_{GE} = \pm 15V$
Q_{ge}	Gate-to-emitter charge (turn-on)	77	—	140	nC	$V_{CC} = 360V$
Q_{gc}	Gate-to-collector charge (turn-on)	35	—	70		$I_C = 65A$
Q_g	Total gate charge (turn-on)	13	—	21		$V_{GE} = 15V$
C_{ies}	Input capacitance	—	2900	—	pF	$V_{GE} = 0V$
C_{oes}	Output capacitance	—	330	—		$V_{CC} = 30V$
C_{res}	Reverse transfer capacitance	—	40	—		f = 1MHz

(1) Includes tail losses

Thermal and Mechanical Characteristics

Parameter	Description	Typ	Max	Units
R_{thJC} (IGBT)	Thermal resistance, junction to case, each IGBT	—	0.7	°C/W
R_{thJC} (Diode)	Thermal resistance, junction to case, each diode	—	1.3	
R_{thCS} (Module)	Thermal resistance, case to sink	0.1	—	
Wt	Weight of module	140	—	g

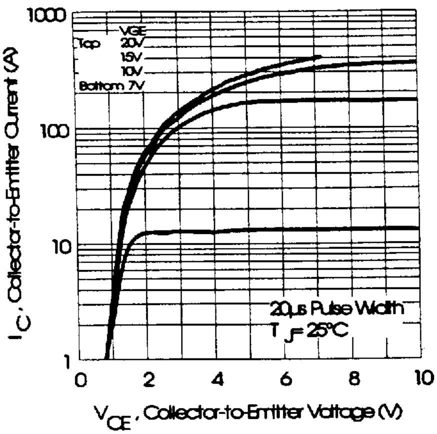


Fig. 1 - Typical Output Characteristics, T_J = 25°C

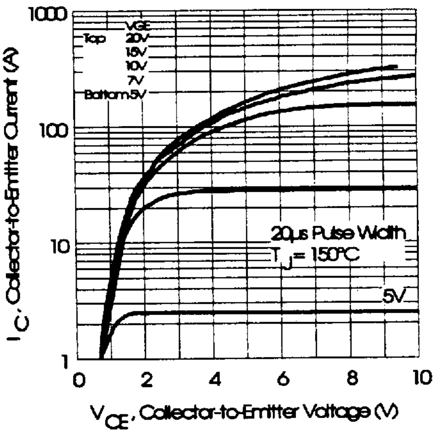


Fig. 2 - Typical Output Characteristics, T_J = 150°C

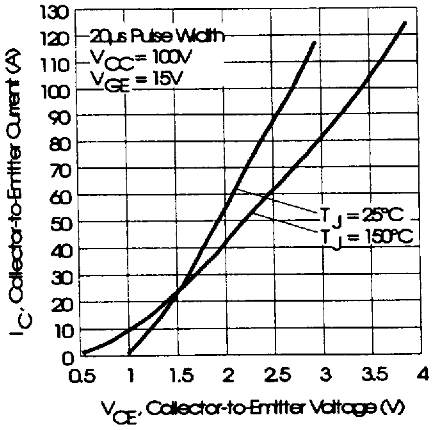


Fig. 3 - Typical Output Characteristics

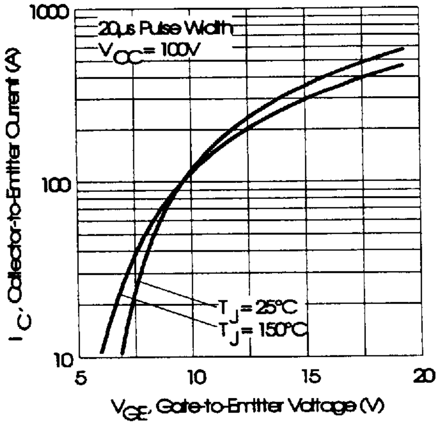


Fig. 4 - Typical Transfer Characteristics

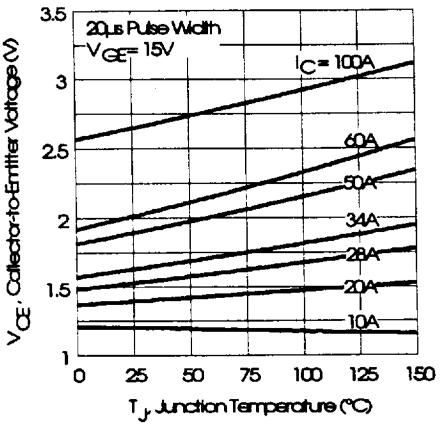


Fig. 5 - Collector-to-Emitter Saturation Typical Voltage vs. Junction Temperature

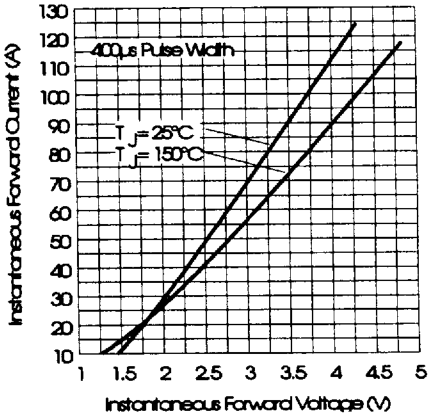


Fig. 6 - Forward Voltage Drop Characteristics

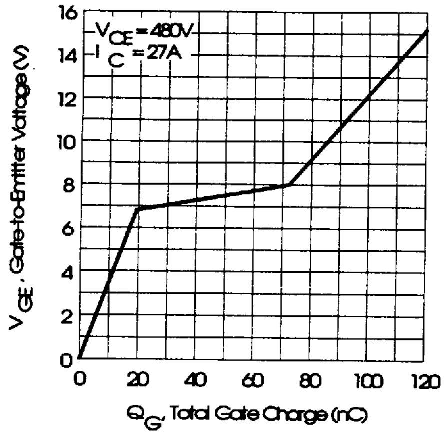


Fig. 7 - Typical Gate Charge vs. Gate-to-Emitter Voltage

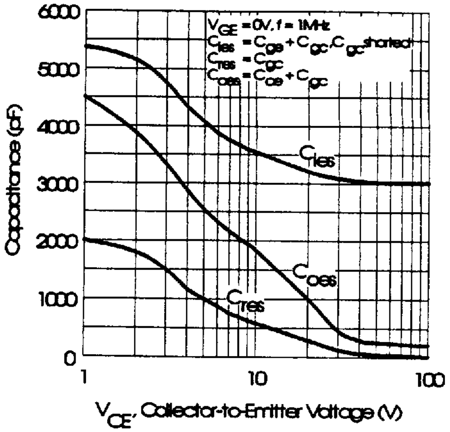


Fig. 8 - Typical Capacitance vs. Collector-to-Emitter Voltage

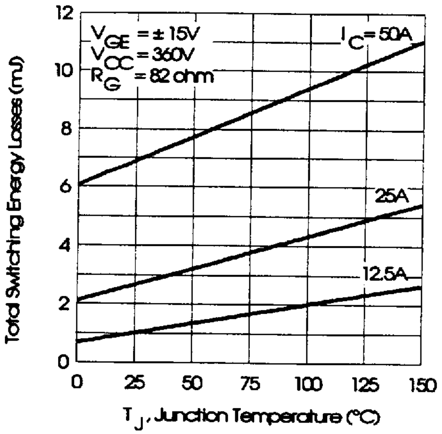


Fig. 9 - Typical Switching Losses vs. Junction Temperature

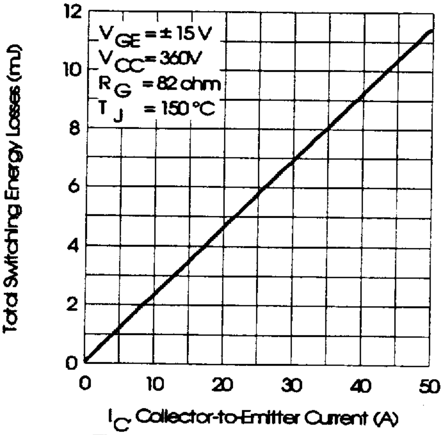


Fig. 10 - Typical Switching Losses vs. Collector-to-Emitter Current

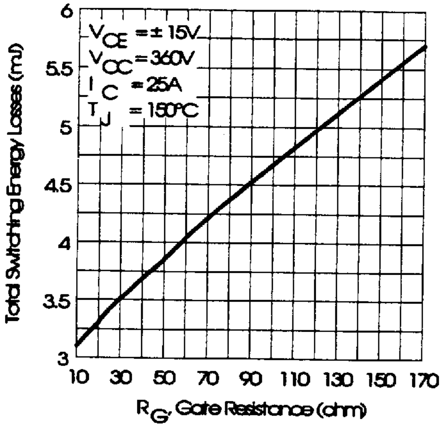


Fig. 11 - Typical Switching Losses vs. Gate Resistance

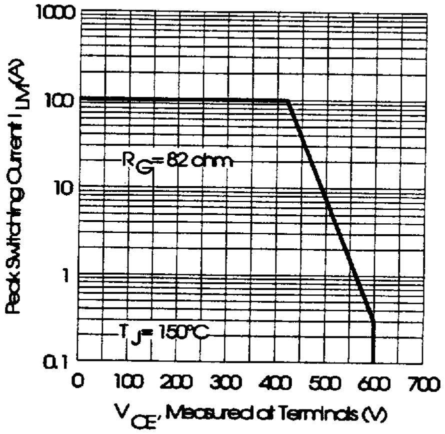


Fig. 12 - Reverse Bias Safe Operating Area

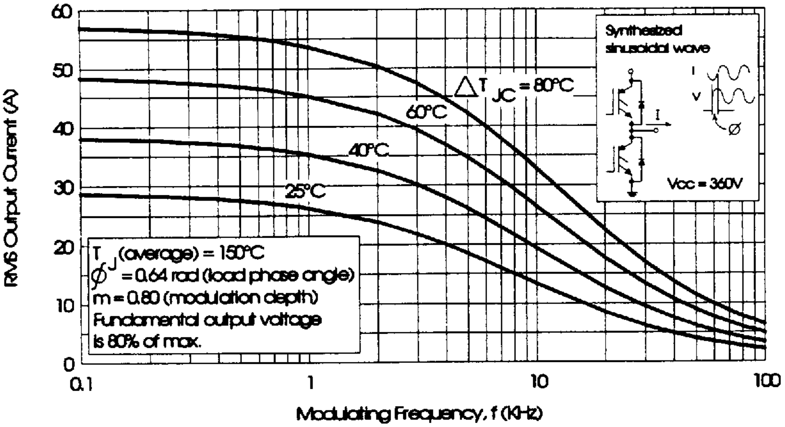


Fig. 13 - Typical RMS Output Current per phase vs. Frequency (Synthesized Sinusoidal Wave)

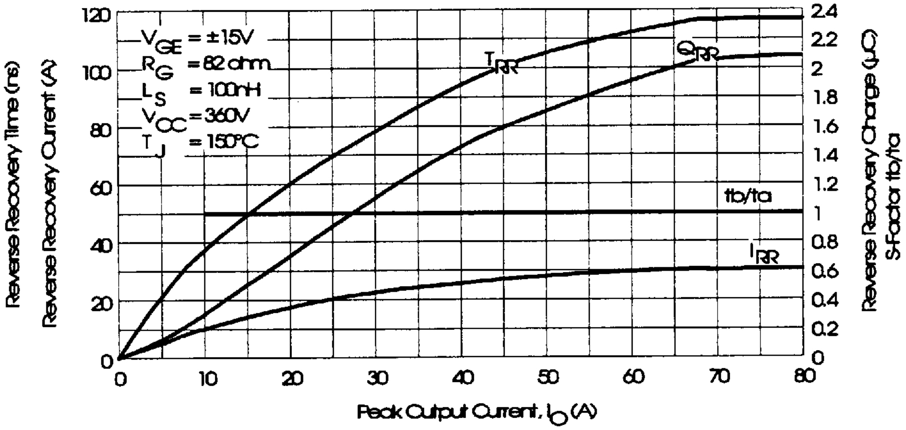


Fig. 14 - Typical Diode Recovery Characteristics as Function of Output Current I_O

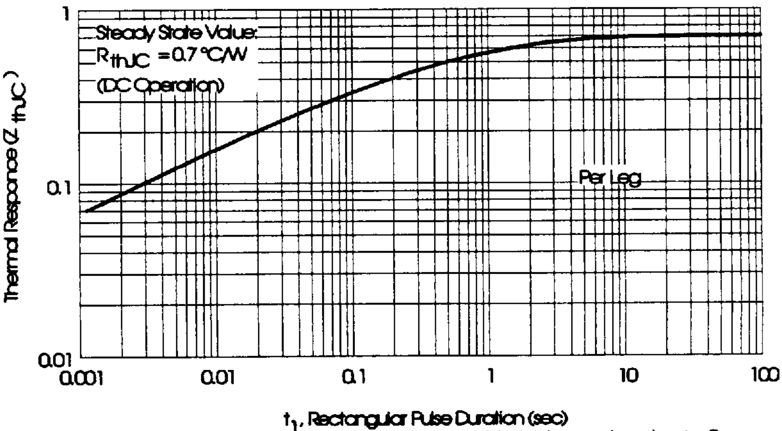
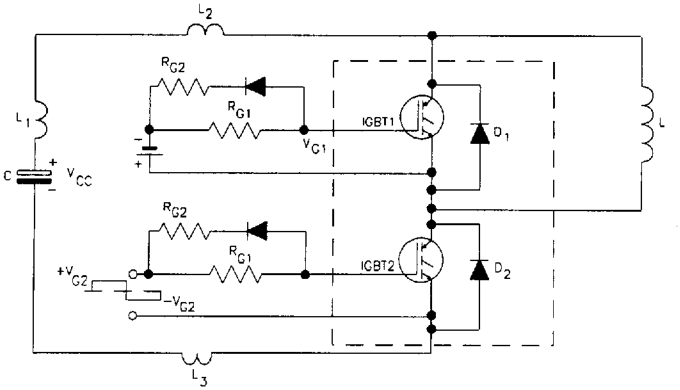


Fig. 15 - Maximum Effective Transient Thermal Impedance, Junction-to-Case



V_{CC} = 360V
L_S = $(L_1 + L_2 + L_3)$ = 100nH
L = 1mH
V_{GE} = ± 15V

Fig. 16 - Test Circuit for Measurement of I_{LM}, E_{ON}, E_{OFF}, Q_{RR}, I_{RR}, $t_{D(ON)}$, t_r, $t_{D(OFF)}$, t_f

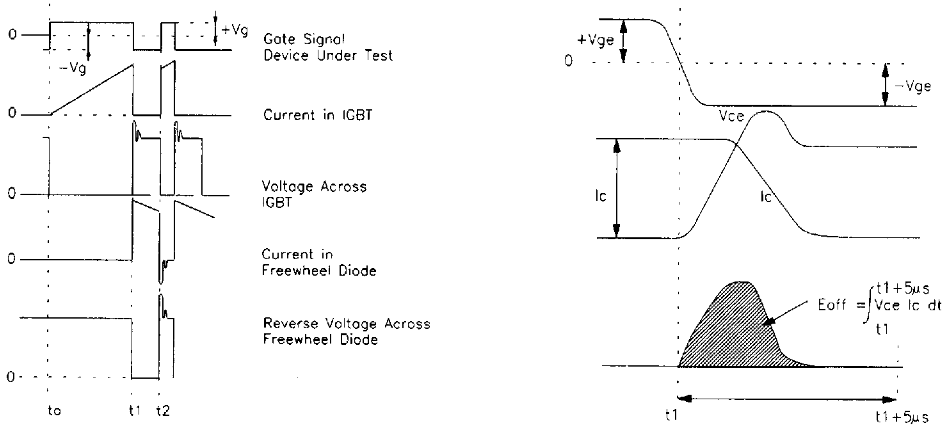


Fig. 17 - Test Waveforms for Circuit of Fig. 16

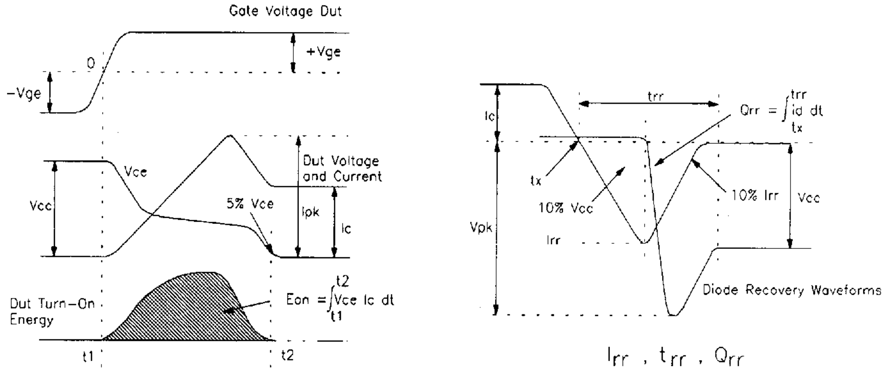


Fig. 18 - Test Waveforms for Circuit of Fig. 16, Defining E_{ON}, E_{REC}, $t_{D(ON)}$, t_r, I_{RR}, t_{RR}, Q_{RR}

Refer to Section D for the following:

Appendix E: Section D - page D-7

Fig. 19 - Waveforms for Switching Time

Package Outline 10 - INT-A-PAK Half Bridge **Section D - page D-16**