International IOR Rectifier

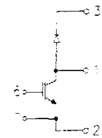
PD-9.1160

IRGKIN050M12

"CHOPPER LOW SIDE SWITCH" IGBT INT-A-PAK

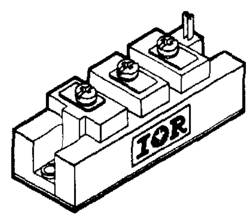
Low conduction loss IGBT

Low Side Switch



V_{CE} = 1200V
I_C = 50A
$V_{CE}(ON)$ < 2.7V
t_{sc} > 10µs

- Rugged Design
- Simple gate-drive
- Switching-Loss Rating includes all "tail" losses
- Short circuit rated



INT-A-PAK case

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. These modules are short circuit rated for applications such as motor control requiring this important feature.

Absolute Maximum Ratings

Parameter	Description	Value	Units
V_{CES}	Continuous collector to emitter voltage	1200	V
I_C @ T_C = 25°C	Maximum Continuous collector current	100	
I_C @ T_C = 85°C	Maximum Continuous collector current	65	
I_C @ T_C = 100°C	Maximum Continuous collector current	45	A
I_{LM}	Peak switching current	100	
I_{FM}	Peak diode forward current (1)	100	
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	455	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	1200	—	—	V	V_{GE} = 0V, I_C = 1.5mA
$V_{CE}(ON)$	Collector-to-emitter voltage	—	2.2	2.7		V_{GE} = 15V, I_C = 50A
		—	1.8	—		V_{GE}=15V, I_C=25A, T_J=150°C
V_{FM}	Diode forward voltage - maximum	—	3.2	3.4		I_F = 50A, V_{GE} = 0V
		—	2.6	—		I_F=50A, V_{GE}=0V, T_J=150°C
V_{GEth}	Gate threshold voltage	3.0	—	5.5		I_C = 750μA
ΔV_{GEth}	Threshold voltage temp. coefficient	—	-11	—	mV/°C	V_{CE} = V_{GE}, I_C = 750μA
g_{fe}	Forward transconductance	27	—	53	S(℧)	V_{CE} = 25V, I_C = 50A
I_{CES}	Collector-to-emitter leakage current	—	—	1.5	mA	V_{GE} = 0V, V_{CE} = 1200V
		—	—	15		V_{GE}=0V, V_{CE}=1200V, T_J=150°C
I_{GES}	Gate-to-emitter leakage current	—	—	±1.5	μA	V_{GE} = ±20V

Dynamic Characteristics - T_J = 125°C, unless otherwise stated

Parameter	Description	Min	Typ	Max	Units	Test Conditions
E_{on}	Turn-on switching energy	—	0.19	—	mJ/A	R_G = 10Ω, V_{CC} = 600V
E_{off} (1)	Turn-off switching energy	—	0.36	—		I_C = 50A, L_S = 100nH
E_{ts} (1)	Total switching energy	—	—	0.60		V_{GE} = ±15V
$t_{d(on)}$	Turn-on delay time	—	200	250	ns	R_G = 10Ω, V_{CC} = 600V
t_r	Rise time	—	200	250		I_C = 50A
$t_{d(off)}$	Turn-off delay time	—	125	200		V_{GE} = ±15V
t_f	Fall time	—	650	—		Resistive load, T_J = 25°C
I_{rr}	Diode peak recovery current	—	35	—	A	R_G = 10Ω, V_{CC} = 600V
t_{rr}	Diode recovery time	—	215	—	ns	I_C = 50A
Q_{rr}	Diode recovery charge	—	4.5	—	μC	V_{GE} = ±15V
Q_{ge}	Gate-to-emitter charge (turn-on)	35	—	130	nC	V_{CC} = 600V
Q_{gc}	Gate-to-collector charge (turn-on)	120	—	250		I_C = 50A
Q_g	Total gate charge (turn-on)	380	—	680		V_{GE} = 15V
C_{ies}	Input capacitance	8000	—	8300	pF	V_{GE} = 0V
C_{oes}	Output capacitance	490	—	820		V_{CC} = 30V
C_{res}	Reverse transfer capacitance	490	—	750		f = 1MHz
t_{sc}	Short circuit withstand time	10	—	—	μs	V_{CC} = 720V, V_{GE} = ±15V Min. R_G = 10Ω, V_{CEP} = 1000V

(1) Includes tail losses

Thermal and Mechanical Characteristics

Parameter	Description	Typ	Max	Units
R_{thJC} (IGBT)	Thermal resistance, junction to case, each IGBT	—	0.275	°C/W
R_{thJC} (Diode)	Thermal resistance, junction to case, each diode	—	0.380	
R_{thCS} (Module)	Thermal resistance, case to sink	0.041	0.100	
Wt	Weight of module	150	—	g

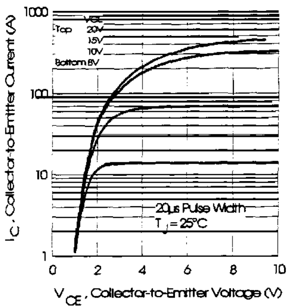


Fig. 1 - Typical Output Characteristics, $T_J = 25°C$

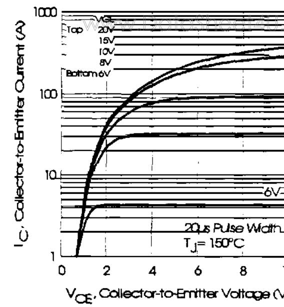


Fig. 2 - Typical Output Characteristics, $T_J = 150°C$

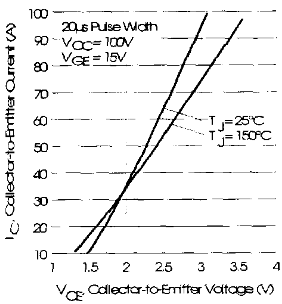


Fig. 3 - Typical Output Characteristics

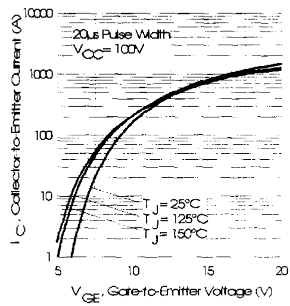


Fig. 4 - Typical Transfer Characteristics

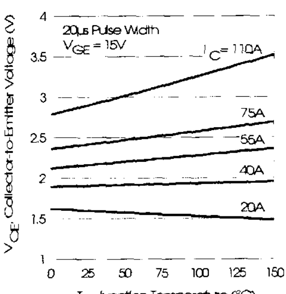


Fig. 5 - Collector-to-Emitter Saturation Typical Voltage vs. Junction Temperature

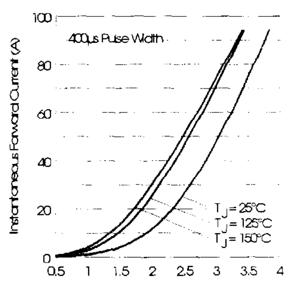


Fig. 6 - Forward Voltage Drop Characteristics

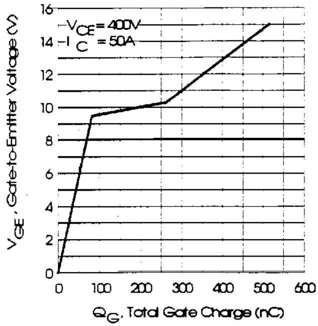


Fig. 7 - Typical Gate Charge vs. Gate-to-Emitter Voltage

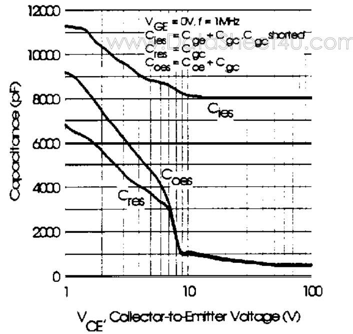


Fig. 8 - Typical Capacitance vs. Collector-to-Emitter Voltage

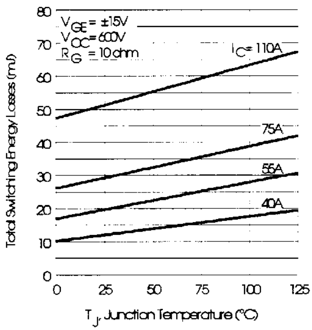


Fig. 9 - Typical Switching Losses vs. Junction Temperature

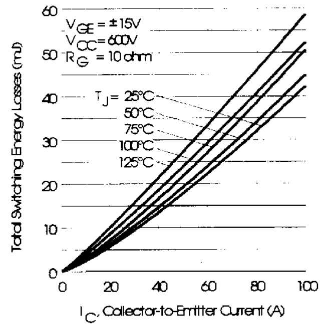


Fig. 10 - Typical Switching Losses vs. Collector-to-Emitter Current

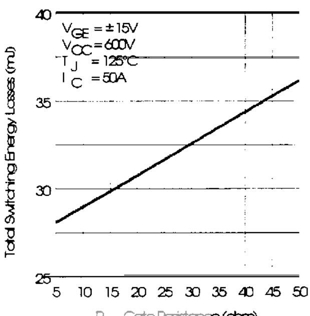


Fig. 11 - Typical Switching Losses vs. Gate Resistance

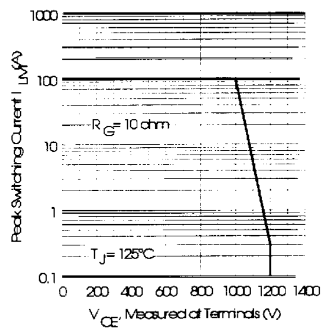


Fig. 12 - Reverse Bias Safe Operating Area

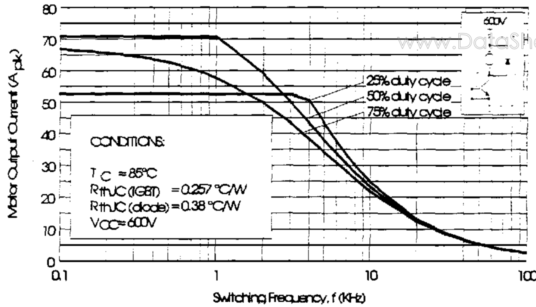


Fig. 13 - RMS Output Current vs. Frequency

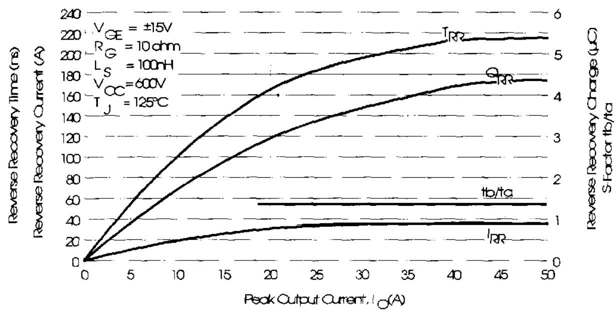


Fig. 14 - Typical Diode Recovery Characteristics as Function of Output Current I_O

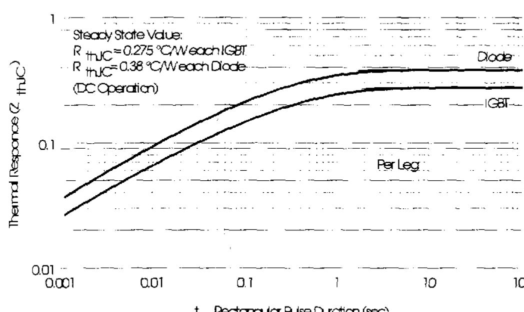


Fig. 15 - *Maximum Effective* Transient Thermal Impedance, Junction-to-Case

Motor Control

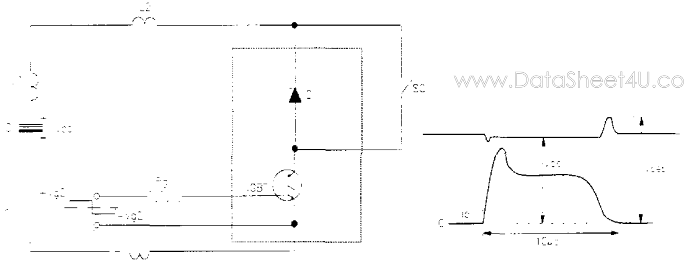
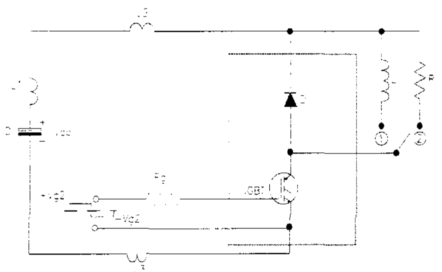


Fig. 16 - Test Circuit for Short Circuit



① = Inductive Load

② = Resistive Load

V_{CC} = 600V
L_S = $(L_1 + L_2 + L_3)$ = 100nH
L = 1mH
V_{GE} = ± 15V
R = 10Ω

Fig. 17 - Test Circuit for Measurement of I_{LM}, E_{ON}, E_{OFF}, Q_{RR}

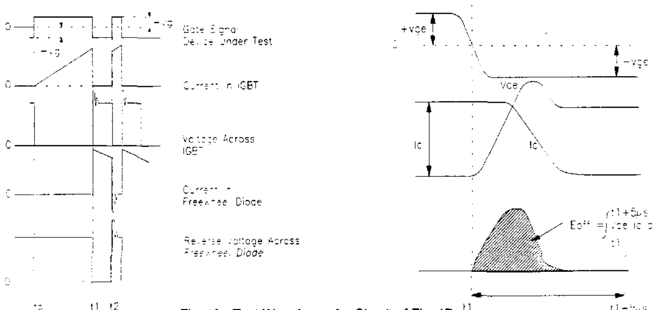


Fig. 18 - Test Waveforms for Circuit of Fig. 17

Refer to Section D for the following:
Appendix I: Section D - page D-11

Fig. 19 - Test Waveforms for Circuit of Fig. 17, Defining E_{ON}, E_{REC}, Q_{RR}
Fig. 20 - Waveforms for Switching Time

Package Outline 7- INT-A-PAK. New - Low Side Switch **Section D - page D-15**