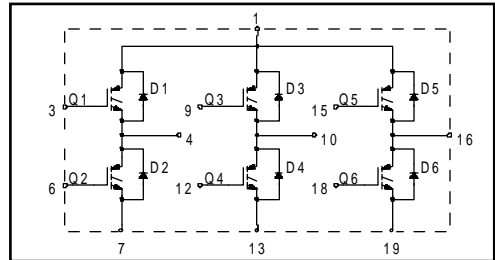


IGBT SIP MODULE

Short Circuit Rated UltraFast IGBT

Features

- Short Circuit Rated UltraFast: Optimized for high operating frequencies >5.0 kHz , and Short Circuit Rated to 10μs @ 125°C, V<sub>GE</sub> = 15V
- 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



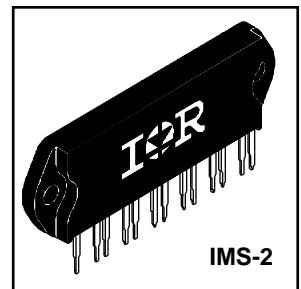
Product Summary

Output Current in a Typical 20 kHz Motor Drive

11 A<sub>RMS</sub> per phase (3.1 kW total) with T<sub>C</sub> = 90°C, T<sub>J</sub> = 125°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 <sub>CES</sub>	Collector-to-Emitter Voltage	600	V
I <sub>C</sub> @ T <sub>C</sub> = 25°C	Continuous Collector Current	24	A
I <sub>C</sub> @ T <sub>C</sub> = 100°C	Continuous Collector Current	13	
I <sub>CM</sub>	Pulsed Collector Current ①	48	
I <sub>LM</sub>	Clamped Inductive Load Current ②	48	
t <sub>sc</sub>	Short Circuit Withstand Time	9.3	μs
V <sub>GE</sub>	Gate-to-Emitter Voltage	±20	V
V <sub>ISOL</sub>	Isolation Voltage, any terminal to case, 1 min	2500	V <sub>RMS</sub>
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation, each IGBT	63	W
P <sub>D</sub> @ T <sub>C</sub> = 100°C	Maximum Power Dissipation, each IGBT	25	
T <sub>J</sub>	Operating Junction and	-55 to +150	°C
T <sub>STG</sub>	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 <sub>θJC</sub> (IGBT)	Junction-to-Case, each IGBT, one IGBT in conduction	—	2.0	°C/W
R <sub>θJC</sub> (DIODE)	Junction-to-Case, each diode, one diode in conduction	—	3.0	
R <sub>θCS</sub> (MODULE)	Case-to-Sink, flat, greased surface	0.10	—	
Wt	Weight of module	20 (0.7)	—	g (oz)

## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage <sup>③</sup>	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
ΔV <sub>(BR)CES/ΔT<sub>J</sub></sub>	Temperature Coeff. of Breakdown Voltage	—	0.63	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0mA
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	1.80	2.3	V	I <sub>C</sub> = 13A I <sub>C</sub> = 24A I <sub>C</sub> = 13A, T <sub>J</sub> = 150°C V <sub>GE</sub> = 15V See Fig. 2, 5
		—	1.80	—		
		—	1.56	—		
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	—	6.0		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
ΔV <sub>GE(th)/ΔT<sub>J</sub></sub>	Temperature Coeff. of Threshold Voltage	—	-13	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
g <sub>fe</sub>	Forward Transconductance <sup>④</sup>	11	18	—	S	V <sub>CE</sub> = 100V, I <sub>C</sub> = 10A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	250	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 150°C
		—	—	3500		
V <sub>FM</sub>	Diode Forward Voltage Drop	—	1.3	1.7	V	I <sub>C</sub> = 15A I <sub>C</sub> = 15A, T <sub>J</sub> = 150°C See Fig. 13
		—	1.2	1.6		
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

## Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	110	170	nC	I <sub>C</sub> = 13A V <sub>CC</sub> = 400V V <sub>GE</sub> = 15V See Fig.8
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	14	21		
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	49	74		
t <sub>d(on)</sub>	Turn-On Delay Time	—	50	—	ns	T <sub>J</sub> = 25°C I <sub>C</sub> = 13A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 10Ω
t <sub>r</sub>	Rise Time	—	30	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	110	170		
t <sub>f</sub>	Fall Time	—	91	140		
E <sub>on</sub>	Turn-On Switching Loss	—	0.56	—	mJ	Energy losses include "tail" and diode reverse recovery See Fig. 9,10, 18
E <sub>off</sub>	Turn-Off Switching Loss	—	0.28	—		
E <sub>ts</sub>	Total Switching Loss	—	0.84	1.1		
t <sub>sc</sub>	Short Circuit Withstand Time	10	—	—	μs	V <sub>CC</sub> = 360V, T <sub>J</sub> = 125°C V <sub>GE</sub> = 15V, R <sub>G</sub> = 10Ω, V <sub>C<sub>PK</sub></sub> < 500V
t <sub>d(on)</sub>	Turn-On Delay Time	—	47	—	ns	T <sub>J</sub> = 150°C, See Fig. 11,18 I <sub>C</sub> = 13A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 10Ω Energy losses include "tail" and diode reverse recovery
t <sub>r</sub>	Rise Time	—	30	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	250	—		
t <sub>f</sub>	Fall Time	—	150	—		
E <sub>ts</sub>	Total Switching Loss	—	1.28	—		
L <sub>E</sub>	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	—	1600	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V f = 1.0MHz See Fig. 7
C <sub>oes</sub>	Output Capacitance	—	130	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	55	—		
t <sub>rr</sub>	Diode Reverse Recovery Time	—	42	60	ns	T <sub>J</sub> = 25°C See Fig. 14 T <sub>J</sub> = 125°C
		—	74	120		
I <sub>rr</sub>	Diode Peak Reverse Recovery Current	—	4.0	6.0	A	T <sub>J</sub> = 25°C See Fig. 15 T <sub>J</sub> = 125°C
		—	6.5	10		
Q <sub>rr</sub>	Diode Reverse Recovery Charge	—	80	180	nC	T <sub>J</sub> = 25°C See Fig. 16 T <sub>J</sub> = 125°C
		—	220	600		
di <sub>(rec)</sub> M/dt	Diode Peak Rate of Fall of Recovery During t <sub>b</sub>	—	188	—	A/μs	T <sub>J</sub> = 25°C See Fig. 17 T <sub>J</sub> = 125°C
		—	160	—		

I<sub>F</sub> = 15A

V<sub>R</sub> = 200V

di/dt = 200Aμs

## 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

