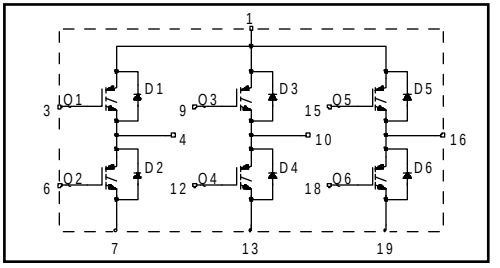
International
IOR Rectifier

PRELIMINARY

CPV364M4F

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 Fig. 1 for Current vs. Frequency curve

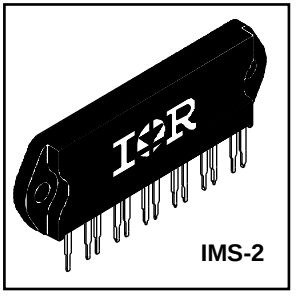
Product Summary

Output Current in a Typical 5.0 kHz Motor Drive

18 A_{RMS} per phase (4.6 kW total) with T_C = 90°C, T_J = 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.



IMS-2

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	27	A
I_C @ T_C = 100°C	Continuous Collector Current, each IGBT	15	
I_{CM}	Pulsed Collector Current ①	80	
I_{LM}	Clamped Inductive Load Current ②	80	
I_F @ T_C = 100°C	Diode Continuous Forward Current	9.3	
I_{FM}	Diode Maximum Forward Current	80	
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	63	W
P_D @ T_C = 100°C	Maximum Power Dissipation, each IGBT	25	
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	——	2.0	°C/W
$R_{\theta JC}$ (DIODE)	Junction-to-Case, each diode, one diode in conduction	——	3.0	
$R_{\theta CS}$ (MODULE)	Case-to-Sink, flat, greased surface	0.10	——	
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 Voltage③	600	—	—	V	V_{GE} = 0V, I_C = 250µA
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.69	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	1.35	1.5	V	I_C = 15A V_{GE} = 15V
		—	1.60	—		I_C = 27A See Fig. 2, 5
		—	1.35	—		I_C = 15A, 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	—	-12	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ④	9.2	12	—	S	V_{CE} = 100V, I_C = 27A
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°C
V_{FM}	Diode Forward Voltage Drop	—	1.3	1.7	V	I_C = 15A See Fig. 13
		—	1.2	1.6		I_C = 15A, 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)	—	100	160		I_C = 15A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	15	23	nC	V_{CC} = 400V
Q_{gc}	Gate - Collector Charge (turn-on)	—	37	56		V_{GE} = 15V See Fig. 8
$t_{d(on)}$	Turn-On Delay Time	—	42	—		T_J = 25°C
t_r	Rise Time	—	18	—	ns	I_C = 15A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	220	330		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	160	240		Energy losses include "tail" and
E_{on}	Turn-On Switching Loss	—	0.46	—		diode reverse recovery.
E_{off}	Turn-Off Switching Loss	—	0.86	—	mJ	See Fig. 9, 10, 11, 18
E_{ts}	Total Switching Loss	—	1.32	1.8		
$t_{d(on)}$	Turn-On Delay Time	—	39	—		T_J = 150°C, See Fig. 9, 10, 11, 18
t_r	Rise Time	—	19	—	ns	I_C = 15A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	410	—		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	290	—		Energy losses include "tail" and
E_{ts}	Total Switching Loss	—	2.5	—	mJ	diode reverse recovery.
C_{ies}	Input Capacitance	—	2200	—		V_{GE} = 0V
C_{oes}	Output Capacitance	—	140	—	pF	V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	29	—		f = 1.0MHz
t_{rr}	Diode Reverse Recovery Time	—	42	60	ns	T_J = 25°C See Fig.
		—	74	120		T_J = 125°C 14 I_F = 15A
I_{rr}	Diode Peak Reverse Recovery Charge	—	4.0	6.0	A	T_J = 25°C See Fig.
		—	6.5	10		T_J = 125°C 15 V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	80	180	nC	T_J = 25°C See Fig.
		—	220	600		T_J = 125°C 16 di/dt =200Aµs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	188	—	A/µs	T_J = 25°C See Fig.
	During t_b	—	160	—		T_J = 125°C 17

Notes:

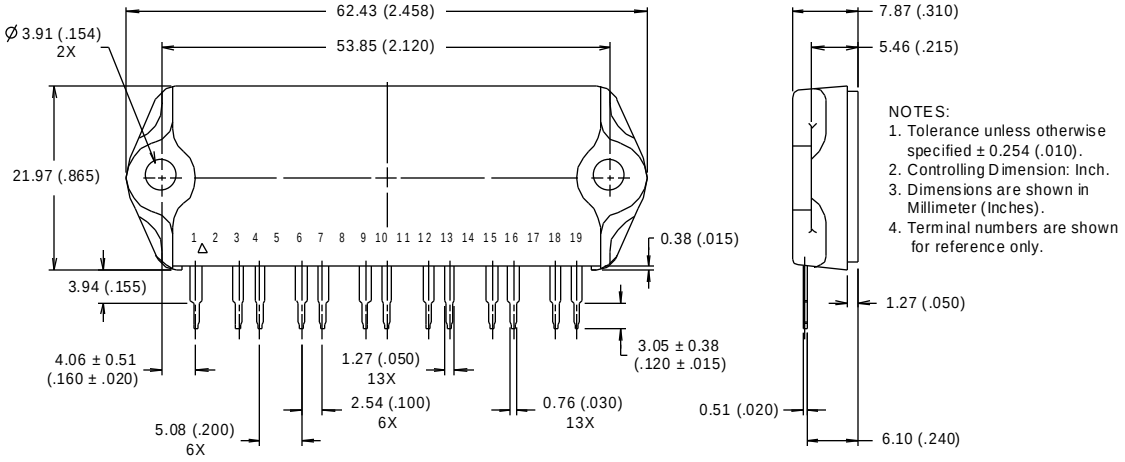
① Repetitive rating: V_{GE}=20V; pulse width limited by maximum junction temperature (figure 20)

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

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

④ Pulse width 5.0µs, single shot.

Case Outline — IMS-2



IMS-2 Package Outline (13 Pins)
Dimensions in Millimeters and (Inches)

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