International
IOR Rectifier

Preliminary Data Sheet PD - 9.1118

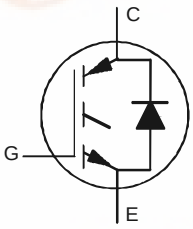
IRGPH40MD2

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

Short Circuit Rated
Fast CoPack IGBT

Features

- Short circuit rated -10µs @125°C, V_{GE} = 15V
- Switching-loss rating includes all "tail" losses
- HEXFRED™ soft ultrafast diodes
- Optimized for medium operating frequency (1 to 10kHz)



n-channel

V_{CES} = 1200V

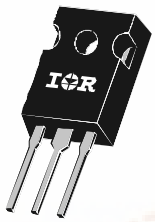
$V_{CE(sat)} \leq 3.4V$

@V_{GE} = 15V, I_C = 18A

Description

Co-packaged IGBTs are a natural extension of International Rectifier's well known IGBT line. They provide the convenience of an IGBT and an ultrafast recovery diode in one package, resulting in substantial benefits to a host of high-voltage, high-current, applications.

These new short circuit rated devices are especially suited for motor control and other applications requiring short circuit withstand capability.



TO-247AC

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current	31	A
I_C @ T_C = 100°C	Continuous Collector Current	18	
I_{CM}	Pulsed Collector Current ①	62	
I_{LM}	Clamped Inductive Load Current ②	62	
I_F @ T_C = 100°C	Diode Continuous Forward Current	8.0	
I_{FM}	Diode Maximum Forward Current	62	
t_{sc}	Short Circuit Withstand Time	10	µs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	160	W
P_D @ T_C = 100°C	Maximum Power Dissipation	65	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +150	°C
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting Torque, 6-32 or M3 Screw.	10 lbf•in (1.1 N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	—	—	0.77	°C/W
$R_{\theta JC}$	Junction-to-Case - Diode	—	—	1.7	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	40	
Wt	Weight	—	6 (0.21)	—	g (oz)

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage ③	1200	—	—	V	V_{GE} = 0V, I_C = 250µA
$\Delta V_{(BR)CES}/\Delta T_J$	Temp. Coeff. of Breakdown Voltage	—	1.1	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.3	3.4	V	I_C = 18A V_{GE} = 15V
		—	3.0	—		I_C = 31A
		—	2.8	—		I_C = 18A, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	Temp. Coeff. of Threshold Voltage	—	-14	—	mV/°C	V_{CE} = V_{GE}, I_C = 250µA
g_{fe}	Forward Transconductance ④	4.0	10	—	S	V_{CE} = 100V, I_C = 18A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 1200V
		—	—	3500		V_{GE} = 0V, V_{CE} = 1200V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop	—	2.6	3.3	V	I_C = 8A
		—	2.3	3.0		I_C = 8A, 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)	—	50	75	nC	I_C = 18A
Qge	Gate - Emitter Charge (turn-on)	—	11	21		V_{CC} = 400V
Q_{gc}	Gate - Collector Charge (turn-on)	—	15	30		
$t_{d(on)}$	Turn-On Delay Time	—	67	—	ns	T_J = 25°C
t_r	Rise Time	—	89	—		I_C = 18A, V_{CC} =800V
$t_{d(off)}$	Turn-Off Delay Time	—	340	930		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	510	930		Energy losses include "tail" and
E_{on}	Turn-On Switching Loss	—	2.1	—	mJ	diode reverse recovery.
E_{off}	Turn-Off Switching Loss	—	5.9	—		
E_{ts}	Total Switching Loss	—	8.0	13		
t_{sc}	Short Circuit Withstand Time	10	—	—	µs	V_{CC} = 720V, T_J = 125°C
						V_{GE} = 15V, R_G = 10Ω, V_{CPK} < 1000V
$t_{d(on)}$	Turn-On Delay Time	—	64	—	ns	T_J = 150°C,
t_r	Rise Time	—	74	—		I_C = 18A, V_{CC} = 800V
$t_{d(off)}$	Turn-Off Delay Time	—	550	—		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	1200	—		Energy losses include "tail" and
E_{ts}	Total Switching Loss	—	16	—	mJ	diode reverse recovery.
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	1400	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	100	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	15	—		f = 1.0MHz
t_{rr}	Diode Reverse Recovery Time	—	63	95	ns	T_J = 25°C
		—	106	160		T_J = 125°C I_F = 8A
I_{rr}	Diode Peak Reverse Recovery Current	—	4.5	8.0	A	T_J = 25°C
		—	6.2	11		T_J = 125°C V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	140	380	nC	T_J = 25°C
		—	335	880		T_J = 125°C di/dt = 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	133	—	A/µs	T_J = 25°C
	During t_b	—	85	—		T_J = 125°C

Notes: ① Repetitive rating; V_{GE}=20V, pulse width limited by max. junction temperature.

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

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

④ Pulse width 5.0µs, single shot.

Refer to Section D - page D-13 for Package Outline 3 - JEDEC Outline TO-247AC