International
IOR Rectifier

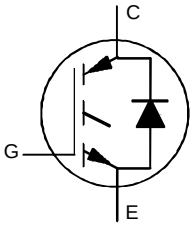
IRGPC40MD2

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} = 600V

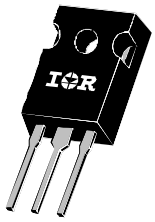
$V_{CE(sat)} \leq 3.0V$

@V_{GE} = 15V, I_C = 24A

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	600	V
I_C @ T_C = 25°C	Continuous Collector Current	40	A
I_C @ T_C = 100°C	Continuous Collector Current	24	
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	15	
I_{FM}	Diode Maximum Forward Current	80	
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	Operating Junction and	-55 to +150	°C
T_{STG}	Storage Temperature Range		
	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)

Revision 2

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage ③	600	—	—	V	V_{GE} = 0V, I_C = 250µA
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.70	—	V/°C	V_{GE} = 0V, I_C = 1.0mA
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.0	3.0	V	I_C = 24A V_{GE} = 15V
		—	2.6	—		I_C = 40A
		—	2.4	—		I_C = 24A, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		V_{CE} = V_{GE}, I_C = 250µA
$\Delta V_{GE(th)}/\Delta T_J$	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 = 24A
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	µA	V_{GE} = 0V, V_{CE} = 600V
		—	—	3500		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop	—	1.3	1.7	V	I_C = 15A
		—	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)	—	59	80	nC	I_C = 24A
Qge	Gate - Emitter Charge (turn-on)	—	8.6	10		V_{CC} = 400V
Q_{gc}	Gate - Collector Charge (turn-on)	—	25	42		
$t_{d(on)}$	Turn-On Delay Time	—	26	—	ns	T_J = 25°C
t_r	Rise Time	—	37	—		I_C = 24A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	240	410		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	230	420		Energy losses include "tail" and
E_{on}	Turn-On Switching Loss	—	0.75	—	mJ	diode reverse recovery.
E_{off}	Turn-Off Switching Loss	—	1.65	—		
E_{ts}	Total Switching Loss	—	2.4	3.6		
t_{sc}	Short Circuit Withstand Time	10	—	—	µs	V_{CC} = 360V, T_J = 125°C
						V_{GE} = 15V, R_G = 10Ω, V_{CPK} < 500V
$t_{d(on)}$	Turn-On Delay Time	—	28	—	ns	T_J = 150°C,
t_r	Rise Time	—	37	—		I_C = 24A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	380	—		V_{GE} = 15V, R_G = 10Ω
t_f	Fall Time	—	460	—		Energy losses include "tail" and
E_{ts}	Total Switching Loss	—	4.5	—	mJ	diode reverse recovery.
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	1500	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	190	—		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	—	20	—		f = 1.0MHz
t_{rr}	Diode Reverse Recovery Time	—	42	60	ns	T_J = 25°C
		—	74	120		T_J = 125°C I_F = 15A
I_{rr}	Diode Peak Reverse Recovery Current	—	4.0	6.0	A	T_J = 25°C
		—	6.5	10		T_J = 125°C V_R = 200V
Q_{rr}	Diode Reverse Recovery Charge	—	80	180	nC	T_J = 25°C
		—	220	600		T_J = 125°C di/dt = 200A/µs
$di_{(rec)M}/dt$	Diode Peak Rate of Fall of Recovery	—	188	—	A/µs	T_J = 25°C
	During t_b	—	160	—		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 for the following:

Package Outline 3 - JEDEC Outline TO-247AC **Section D - page D-13**