

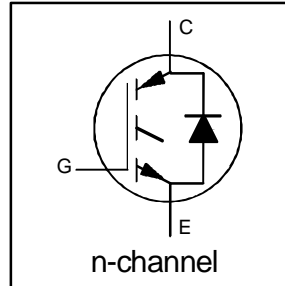
IRGPC40MD2

INSULATED GATE BIPOLAR TRANSISTOR
WITH ULTRAFAST SOFT RECOVERY

Short Circuit Rated
Fast CoPack IGBT

DIODE
Features

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

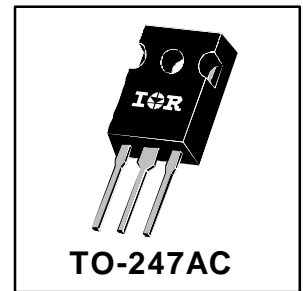


$V_{CES} = 600V$
 $V_{CE(sat)} \leq 3.0V$
@ $V_{GE} = 15V, I_C = 24A$

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.



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	40	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	24	
I_{CM}	Pulsed Collector Current ①	80	
I_{LM}	Clamped Inductive Load Current ②	80	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	15	
I_{FM}	Diode Maximum Forward Current	80	
t_{sc}	Short Circuit Withstand Time	10	μ s
V_{GE}	Gate-to-Emitter Voltage	± 20	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	160	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	65	
T_J	Operating Junction and	-55 to +150	$^\circ C$
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	$^\circ C/W$
$R_{\theta JC}$	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)

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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
ΔV _{(BR)CES} /ΔT _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
ΔV _{GE(th)} /ΔT _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 V _{CC} = 400V	
Q _{ge}	Gate - Emitter Charge (turn-on)	—	8.6	10			
Q _{gc}	Gate - Collector Charge (turn-on)	—	25	42			
t _{d(on)}	Turn-On Delay Time	—	26	—	ns	T _J = 25°C I _C = 24A, V _{CC} = 480V V _{GE} = 15V, R _G = 10Ω Energy losses include "tail" and diode reverse recovery.	
t _r	Rise Time	—	37	—			
t _{d(off)}	Turn-Off Delay Time	—	240	410			
t _f	Fall Time	—	230	420			
E _{on}	Turn-On Switching Loss	—	0.75	—	mJ		
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, I _C = 24A, V _{CC} = 480V V _{GE} = 15V, R _G = 10Ω Energy losses include "tail" and diode reverse recovery.	
t _r	Rise Time	—	37	—			
t _{d(off)}	Turn-Off Delay Time	—	380	—			
t _f	Fall Time	—	460	—			
E _{ts}	Total Switching Loss	—	4.5	—	mJ		
L _E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package	
C _{ies}	Input Capacitance	—	1500	—	pF	V _{GE} = 0V V _{CC} = 30V f = 1.0MHz	
C _{oes}	Output Capacitance	—	190	—			
C _{res}	Reverse Transfer Capacitance	—	20	—			
t _{rr}	Diode Reverse Recovery Time	—	42	60	ns	T _J = 25°C	I _F = 15A V _R = 200V di/dt = 200A/μs
		—	74	120		T _J = 125°C	
I _{rr}	Diode Peak Reverse Recovery Current	—	4.0	6.0	A	T _J = 25°C	
		—	6.5	10		T _J = 125°C	
Q _{rr}	Diode Reverse Recovery Charge	—	80	180	nC	T _J = 25°C	
		—	220	600		T _J = 125°C	
di _(rec) /dt	Diode Peak Rate of Fall of Recovery During t _b	—	188	—	A/μs	T _J = 25°C	
		—	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. ④ Pulse width 5.0μs, single shot.

Refer to Section D for the following: ③ Pulse width ≤ 80μs; duty factor ≤ 0.1%.

Package Outline 3 - JEDEC Outline TO-247AC

Section D - page D-13

Note: For the most current drawings please refer to the IR website at:
<http://www.irf.com/package/>