International
IOR Rectifier

Preliminary Data Sheet PD - 9.1115

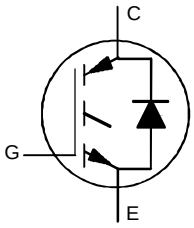
# IRGPH30MD2

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

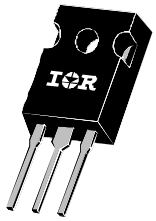
$V_{CE(sat)} \leq 3.5V$

@$V_{GE}$ = 15V, $I_C$ = 9.0A

## 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 | 15 | A |
| $I_C$ @ $T_C$ = 100°C | Continuous Collector Current | 9.0 | |
| $I_{CM}$ | Pulsed Collector Current ① | 30 | |
| $I_{LM}$ | Clamped Inductive Load Current ② | 30 | |
| $I_F$ @ $T_C$ = 100°C | Diode Continuous Forward Current | 6.0 | |
| $I_{FM}$ | Diode Maximum Forward Current | 30 | |
| $t_{sc}$ | Short Circuit Withstand Time | 10 | µs |
| $V_{GE}$ | Gate-to-Emitter Voltage | ± 20 | V |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 100 | W |
| $P_D$ @ $T_C$ = 100°C | Maximum Power Dissipation | 42 | |
| $T_J$ | 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 | — | — | 1.2 | °C/W |
| $R_{\theta JC}$ | Junction-to-Case - Diode | — | — | 2.5 | |
| $R_{\theta CS}$ | 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 |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | — | — | — | V/°C | $V_{GE}$ = 0V, $I_C$ = 1.0mA |
| $V_{CE(on)}$ | Collector-to-Emitter Saturation Voltage | — | 3.1 | 3.5 | V | $I_C$ = 9.0A $V_{GE}$ = 15V |
| | | — | 4.9 | — | | $I_C$ = 15A |
| | | — | 3.6 | — | | $I_C$ = 9.0A, $T_J$ = 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 | — | -14 | — | mV/°C | $V_{CE}$ = $V_{GE}$, $I_C$ = 250µA |
| $g_{fe}$ | Forward Transconductance ④ | 2.5 | — | — | S | $V_{CE}$ = 100V, $I_C$ = 9.0A |
| $I_{CES}$ | Zero Gate Voltage Collector Current | — | — | 250 | µA | $V_{GE}$ = 0V, $V_{CE}$ = 1200V |
| | | — | — | 2500 | | $V_{GE}$ = 0V, $V_{CE}$ = 1200V, $T_J$ = 150°C |
| $V_{FM}$ | Diode Forward Voltage Drop | — | 2.7 | 3.0 | V | $I_C$ = 6.0A |
| | | — | 2.4 | 2.7 | | $I_C$ = 6.0A, $T_J$ = 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) | — | 25 | 30 | nC | $I_C$ = 9.0A |
| $Q_{ge}$ | Gate - Emitter Charge (turn-on) | — | — | 6.0 | | $V_{CC}$ = 960V |
| $Q_{gc}$ | Gate - Collector Charge (turn-on) | — | — | 15 | | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 2.3 | — | ns | $T_J$ = 25°C |
| $t_r$ | Rise Time | — | 10 | — | | $I_C$ = 9.0A, $V_{CC}$ = 960V |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 200 | 450 | | $V_{GE}$ = 15V, $R_G$ = 23Ω |
| $t_f$ | Fall Time | — | 210 | 390 | | Energy losses include "tail" and |
| $E_{on}$ | Turn-On Switching Loss | — | — | — | mJ | diode reverse recovery. |
| $E_{off}$ | Turn-Off Switching Loss | — | — | — | | |
| $E_{ts}$ | Total Switching Loss | — | 4.0 | 7.0 | | |
| $t_{sc}$ | Short Circuit Withstand Time | 10 | — | — | µs | $V_{CC}$ = 720V, $T_J$ = 125°C |
| | | | | | | $V_{GE}$ = 15V, $R_G$ = 23Ω, $V_{CPK}$ < 1000V |
| $t_{d(on)}$ | Turn-On Delay Time | — | 33 | — | ns | $T_J$ = 150°C, |
| $t_r$ | Rise Time | — | 20 | — | | $I_C$ = 9.0A, $V_{CC}$ = 960V |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 480 | — | | $V_{GE}$ = 15V, $R_G$ = 23Ω |
| $t_f$ | Fall Time | — | 450 | — | | Energy losses include "tail" and |
| $E_{ts}$ | Total Switching Loss | — | 8.0 | — | mJ | diode reverse recovery. |
| $L_E$ | Internal Emitter Inductance | — | 13 | — | nH | Measured 5mm from package |
| $C_{ies}$ | Input Capacitance | — | 670 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 50 | — | | $V_{CC}$ = 30V |
| $C_{res}$ | Reverse Transfer Capacitance | — | 10 | — | | $f$ = 1.0MHz |
| $t_{rr}$ | Diode Reverse Recovery Time | — | 53 | 80 | ns | $T_J$ = 25°C |
| | | — | 87 | 130 | | $T_J$ = 125°C $I_F$ = 6.0A |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | — | 4.4 | 8.0 | A | $T_J$ = 25°C |
| | | — | 5.0 | 9.0 | | $T_J$ = 125°C $V_R$ = 200V |
| $Q_{rr}$ | Diode Reverse Recovery Charge | — | 116 | 320 | nC | $T_J$ = 25°C |
| | | — | 233 | 585 | | $T_J$ = 125°C di/dt = 200A/µs |
| $di_{(rec)M}/dt$ | Diode Peak Rate of Fall of Recovery | — | 180 | — | A/µs | $T_J$ = 25°C |
| | During $t_b$ | — | 100 | — | | $T_J$ = 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, $R_G$= 23Ω

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