

# International Rectifier

Preliminary Data Sheet PD - 9.1029

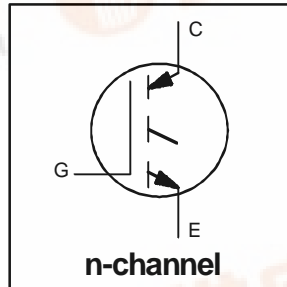
## IRGPH40M

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated  
Fast IGBT

### Features

- Short circuit rated - 10 $\mu$ s @ 125°C, V<sub>GE</sub> = 15V
- Switching-loss rating includes all "tail" losses
- Optimized for medium operating frequency (1 to 10kHz)

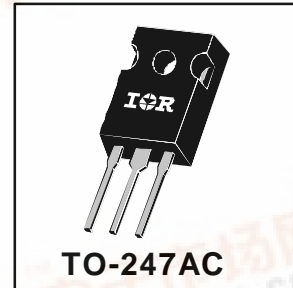


V <sub>CES</sub> = 1200V
V <sub>CE(sat)</sub> ≤ 3.4V
@V <sub>GE</sub> = 15V, I <sub>C</sub> = 18A

### Description

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide 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 <sub>CES</sub>	Collector-to-Emitter Voltage	1200	V
I <sub>C</sub> @ T <sub>C</sub> = 25°C	Continuous Collector Current	31	A
I <sub>C</sub> @ T <sub>C</sub> = 100°C	Continuous Collector Current	18	
I <sub>CM</sub>	Pulsed Collector Current ①	62	
I <sub>LM</sub>	Clamped Inductive Load Current ②	62	
t <sub>sc</sub>	Short Circuit Withstand Time	10	μs
V <sub>GE</sub>	Gate-to-Emitter Voltage	±20	V
E <sub>ARV</sub>	Reverse Voltage Avalanche Energy ③	15	mJ
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation	160	W
P <sub>D</sub> @ T <sub>C</sub> = 100°C	Maximum Power Dissipation	65	
T <sub>J</sub>	Operating Junction and	-55 to +150	°C
T <sub>STG</sub>	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 (1.1N•m)	

### Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	—	0.77	°C/W
R <sub>θCS</sub>	Case-to-Sink, flat, greased surface	—	0.24	—	
R <sub>θJA</sub>	Junction-to-Ambient, typical socket mount	—	—	40	
Wt	Weight	—	6 (0.21)	—	g (oz)



**Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V, I_C = 250\mu\text{A}$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	20	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.1	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.3	3.4	V	$I_C = 18A$
		—	3.0	—		$I_C = 31A$
		—	2.8	—		$I_C = 18A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		$V_{CE} = V_{GE}, I_C = 250\mu\text{A}$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-14	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu\text{A}$
$g_{fe}$	Forward Transconductance ⑤	4.0	10	—	S	$V_{CE} = 100V, I_C = 18A$
$I_{CES}$	Zero Gate Voltage Collector Current	—	—	250	$\mu\text{A}$	$V_{GE} = 0V, V_{CE} = 1200V$
		—	—	3500		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Leakage Current	—	—	$\pm 100$	nA	$V_{GE} = \pm 20V$

**Switching Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge (turn-on)	—	50	75	nC	$I_C = 18A$
$Q_{ge}$	Gate - Emitter Charge (turn-on)	—	11	21		$V_{CC} = 400V$
$Q_{gc}$	Gate - Collector Charge (turn-on)	—	15	30		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	30	—	ns	$T_J = 25^\circ\text{C}$
$t_r$	Rise Time	—	21	—		$I_C = 18A, V_{CC} = 960V$
$t_{d(off)}$	Turn-Off Delay Time	—	400	890		$V_{GE} = 15V, R_G = 10\Omega$
$t_f$	Fall Time	—	390	740		Energy losses include "tail"
$E_{on}$	Turn-On Switching Loss	—	1.1	—		mJ
$E_{off}$	Turn-Off Switching Loss	—	6.3	—		
$E_{ts}$	Total Switching Loss	—	7.4	14		
$t_{sc}$	Short Circuit Withstand Time	10	—	—	$\mu\text{s}$	$V_{CC} = 720V, T_J = 125^\circ\text{C}$ $V_{GE} = 15V, R_G = 10\Omega, V_{CPK} < 1000V$
$t_{d(on)}$	Turn-On Delay Time	—	28	—	ns	$T_J = 150^\circ\text{C}$ ,
$t_r$	Rise Time	—	24	—		$I_C = 18A, V_{CC} = 960V$
$t_{d(off)}$	Turn-Off Delay Time	—	600	—		$V_{GE} = 15V, R_G = 10\Omega$
$t_f$	Fall Time	—	870	—		Energy losses include "tail"
$E_{ts}$	Total Switching Loss	—	15	—		mJ
$L_E$	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
$C_{ies}$	Input Capacitance	—	1360	—	pF	$V_{GE} = 0V$
$C_{oes}$	Output Capacitance	—	100	—		$V_{CC} = 30V$
$C_{res}$	Reverse Transfer Capacitance	—	15	—		$f = 1.0\text{MHz}$

**Notes:**

- ① Repetitive rating;  $V_{GE}=20V$ , pulse width limited by max. junction temperature.      ③ Repetitive rating; pulse width limited by maximum junction temperature.      ⑤ Pulse width 5.0 $\mu\text{s}$ , single shot.
- ②  $V_{CC}=80\%(V_{CES}), V_{GE}=20V, L=10\mu\text{H}, R_G=10\Omega$       ④ Pulse width  $\leq 80\mu\text{s}$ ; duty factor  $\leq 0.1\%$ .

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