

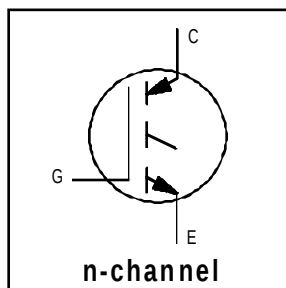
IRGPH40M

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated
Fast IGBT

Features

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



$$V_{\text{CES}} = 1200\text{V}$$

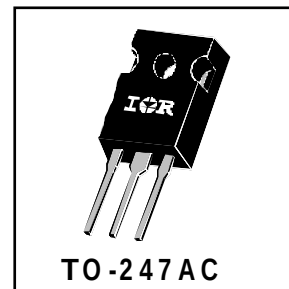
$$V_{\text{CE(sat)}} \leq 3.4\text{V}$$

$$\text{@ } V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 18\text{A}$$

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_{CES}	Collector-to-Emitter Voltage	1200	V
$I_{\text{C}} @ T_{\text{C}} = 25^\circ\text{C}$	Continuous Collector Current	31	A
$I_{\text{C}} @ T_{\text{C}} = 100^\circ\text{C}$	Continuous Collector Current	18	
I_{CM}	Pulsed Collector Current ①	62	
I_{LM}	Clamped Inductive Load Current ②	62	
t_{sc}	Short Circuit Withstand Time	10	μs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	15	mJ
$P_{\text{D}} @ T_{\text{C}} = 25^\circ\text{C}$	Maximum Power Dissipation	160	W
$P_{\text{D}} @ T_{\text{C}} = 100^\circ\text{C}$	Maximum Power Dissipation	65	
T_{J}	Operating Junction and	-55 to +150	$^\circ\text{C}$
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 (1.1N•m)	

Thermal Resistance

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

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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	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	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		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	----	-14	----	$mV/^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ⑤	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		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	----	----	± 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	$V_{CC} = 720V, T_J = 125^\circ\text{C}$ $V_{GE} = 15V, R_G = 10\Omega, V_{CPK} < 1000V$
E_{off}	Turn-Off Switching Loss	----	4.0	----		
E_{ts}	Total Switching Loss	----	5.1	8.0		
t_{sc}	Short Circuit Withstand Time	10	----	----	μs	
$t_{d(on)}$	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	----	9.0	----	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	----		$f = 1.0MHz$

Notes:

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