

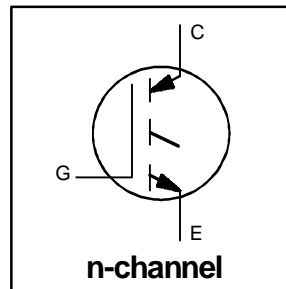
## IRGBC40M-S

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated  
Fast IGBT

### Features

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

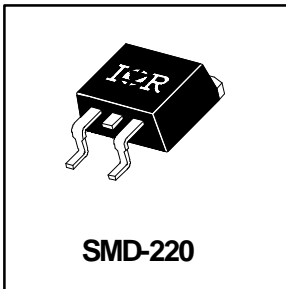


$V_{CES} = 600\text{V}$
$V_{CE(sat)} \leq 3.0\text{V}$
@ $V_{GE} = 15\text{V}$ , $I_C = 24\text{A}$

### 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	600	V
$I_C @ T_C = 25^\circ\text{C}$	Continuous Collector Current	40	A
$I_C @ T_C = 100^\circ\text{C}$	Continuous Collector Current	24	
$I_{CM}$	Pulsed Collector Current ①	80	
$I_{LM}$	Clamped Inductive Load Current ②	80	
$t_{sc}$	Short Circuit Withstand Time	10	$\mu\text{s}$
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy ③	15	mJ
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	160	W
$P_D @ T_C = 100^\circ\text{C}$	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
$R_{\theta JC}$	Junction-to-Case	—	—	0.77	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient, (PCB mount)**	—	—	40	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	80	
Wt	Weight	—	2 (0.07)	—	g (oz)

\*\* When mounted on 1" square PCB (FR-4 or G-10 Material)

For recommended footprint and soldering techniques refer to application note #AN-994.

## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
V <sub>(BR)ECS</sub>	Emitter-to-Collector Breakdown Voltage ④	20	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0A
ΔV <sub>(BR)CES/ΔT<sub>J</sub></sub>	Temp. Coeff. of Breakdown Voltage	—	0.70	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0mA
V <sub>CE(on)</sub>	Collector-to-Emitter Saturation Voltage	—	2.0	3.0	V	I <sub>C</sub> = 24A V <sub>GE</sub> = 15V
		—	2.6	—		I <sub>C</sub> = 40A
		—	2.4	—		I <sub>C</sub> = 24A, T <sub>J</sub> = 150°C
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	—	5.5		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
ΔV <sub>GE(th)/ΔT<sub>J</sub></sub>	Temperature Coeff. of Threshold Voltage	—	-12	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
g <sub>fe</sub>	Forward Transconductance ⑤	9.2	12	—	S	V <sub>CE</sub> = 100V, I <sub>C</sub> = 24A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	250	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V
		—	—	1000		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 150°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

## Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions	
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	59	80	nC	I <sub>C</sub> = 24A	
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	8.6	10		V <sub>CC</sub> = 400V	
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	25	42		V <sub>GE</sub> = 15V	
t <sub>d(on)</sub>	Turn-On Delay Time	—	26	—	ns	T <sub>J</sub> = 25°C	
t <sub>r</sub>	Rise Time	—	37	—		I <sub>C</sub> = 24A, V <sub>CC</sub> = 480V	
t <sub>d(off)</sub>	Turn-Off Delay Time	—	240	410		V <sub>GE</sub> = 15V, R <sub>G</sub> = 10Ω	
t <sub>f</sub>	Fall Time	—	230	420		Energy losses include "tail"	
E <sub>on</sub>	Turn-On Switching Loss	—	0.75	—		mJ	
E <sub>off</sub>	Turn-Off Switching Loss	—	1.65	—			
E <sub>ts</sub>	Total Switching Loss	—	2.4	3.6			
t <sub>sc</sub>	Short Circuit Withstand Time	10	—	—		μs	V <sub>CC</sub> = 360V, T <sub>J</sub> = 125°C V <sub>GE</sub> = 15V, R <sub>G</sub> = 10Ω, V <sub>CPK</sub> < 500V
t <sub>d(on)</sub>	Turn-On Delay Time	—	28	—		ns	T <sub>J</sub> = 150°C,
t <sub>r</sub>	Rise Time	—	37	—			I <sub>C</sub> = 24A, V <sub>CC</sub> = 480V
t <sub>d(off)</sub>	Turn-Off Delay Time	—	380	—	V <sub>GE</sub> = 15V, R <sub>G</sub> = 10Ω		
t <sub>f</sub>	Fall Time	—	460	—	Energy losses include "tail"		
E <sub>ts</sub>	Total Switching Loss	—	4.5	—	mJ		
L <sub>E</sub>	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package	
C <sub>ies</sub>	Input Capacitance	—	1500	—	pF	V <sub>GE</sub> = 0V	
C <sub>oes</sub>	Output Capacitance	—	190	—		V <sub>CC</sub> = 30V	
C <sub>res</sub>	Reverse Transfer Capacitance	—	20	—		f = 1.0MHz	

### Notes:

- ① Repetitive rating; V<sub>GE</sub>=20V, pulse width limited by max. junction temperature.
- ② V<sub>CC</sub>=80%(V<sub>CES</sub>), V<sub>GE</sub>=20V, L=10μH, R<sub>G</sub>= 10Ω
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width ≤ 80μs; duty factor ≤ 0.1%.
- ⑤ Pulse width 5.0μs, single shot.

Refer to Section D for the following:

Package Outline 2 - SMD-220 Section D - page D-12