

International Rectifier

Preliminary Data Sheet PD - 9.1135

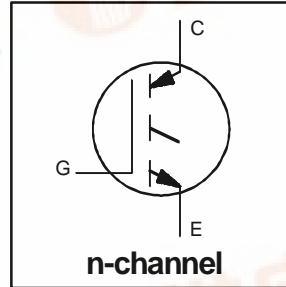
IRGBC40M-S

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated
Fast IGBT

Features

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

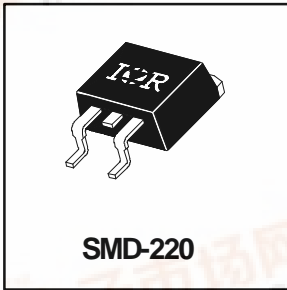


| |
|---|
| $V_{CES} = 600V$ |
| $V_{CE(sat)} \leq 3.0V$ |
| @ V _{GE} = 15V, I _C = 24A |

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 |
| $I_C @ T_C = 25^\circ C$ | 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 | |
| t_{sc} | Short Circuit Withstand Time | 10 | μ s |
| V_{GE} | Gate-to-Emitter Voltage | ± 20 | V |
| E_{ARV} | Reverse Voltage Avalanche Energy ③ | 15 | mJ |
| $P_D @ T_C = 25^\circ C$ | Maximum Power Dissipation | 160 | W |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation | 65 | |
| T_J | Operating Junction and Storage Temperature Range | -55 to +150 | |
| T_{STG} | | | |
| | | | |
| | 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 | $^\circ C/W$ |
| $R_{\theta JA}$ | 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.



IRGBC40M-S



Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--------------------------------------|---|------|------|------|-------|--|
| V _{(BR)CES} | Collector-to-Emitter Breakdown Voltage | 600 | — | — | V | V _{GE} = 0V, I _C = 250μA |
| V _{(BR)ECS} | Emitter-to-Collector Breakdown Voltage ^④ | 20 | — | — | V | V _{GE} = 0V, I _C = 1.0A |
| ΔV _{(BR)CES/ΔT_J} | Temp. 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 |
| | | — | 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 ^⑤ | 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 |
| | | — | — | 1000 | | V _{GE} = 0V, V _{CE} = 600V, 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 | |
| Q _{ge} | Gate - Emitter Charge (turn-on) | — | 8.6 | 10 | | V _{CC} = 400V | |
| Q _{gc} | Gate - Collector Charge (turn-on) | — | 25 | 42 | | V _{GE} = 15V | |
| t _{d(on)} | Turn-On Delay Time | — | 26 | — | ns | T _J = 25°C | |
| t _r | Rise Time | — | 37 | — | | I _C = 24A, V _{CC} = 480V | |
| t _{d(off)} | Turn-Off Delay Time | — | 240 | 410 | | V _{GE} = 15V, R _G = 10Ω | |
| t _f | Fall Time | — | 230 | 420 | | Energy losses include "tail" | |
| 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, | |
| t _r | Rise Time | — | 37 | — | | I _C = 24A, V _{CC} = 480V | |
| t _{d(off)} | Turn-Off Delay Time | — | 380 | — | | V _{GE} = 15V, R _G = 10Ω | |
| t _f | Fall Time | — | 460 | — | | Energy losses include "tail" | |
| E _{ts} | Total Switching Loss | — | 4.5 | — | | mJ | |
| L _E | Internal Emitter Inductance | — | 7.5 | — | nH | Measured 5mm from package | |
| C _{ies} | Input Capacitance | — | 1500 | — | pF | V _{GE} = 0V | |
| C _{oes} | Output Capacitance | — | 190 | — | | V _{CC} = 30V | |
| C _{res} | Reverse Transfer Capacitance | — | 20 | — | | 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=10μH, R_G= 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