

Designer's™ Data Sheet

Insulated Gate Bipolar Transistor

N-Channel Enhancement-Mode Silicon Gate

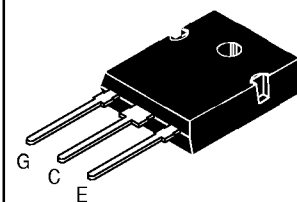
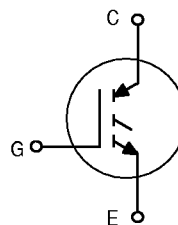
MGW30N60

Motorola Preferred Device

IGBT IN TO-247
30 A @ 90°C
50 A @ 25°C
600 VOLTS
SHORT CIRCUIT RATED

This Insulated Gate Bipolar Transistor (IGBT) uses an advanced termination scheme to provide an enhanced and reliable high voltage-blocking capability. Short circuit rated IGBT's are specifically suited for applications requiring a guaranteed short circuit withstand time such as Motor Control Drives. Fast switching characteristics result in efficient operation at high frequencies.

- Industry Standard High Power TO-247 Package with Isolated Mounting Hole
- High Speed E_{off} : 60 μ s per Amp typical at 125°C
- High Short Circuit Capability – 10 μ s minimum
- Robust High Voltage Termination
- Robust RBSOA



CASE 340F-03, Style 4
TO-247AE

MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|------------------------------------|----------------------|------------------------------|
| Collector-Emitter Voltage | V_{CES} | 600 | Vdc |
| Collector-Gate Voltage ($R_{GE} = 1.0 \text{ M}\Omega$) | V_{CGR} | 600 | Vdc |
| Gate-Emitter Voltage — Continuous | V_{GE} | ± 20 | Vdc |
| Collector Current — Continuous @ $T_C = 25^\circ\text{C}$ — Continuous @ $T_C = 90^\circ\text{C}$ — Repetitive Pulsed Current (1) | I_{C25} I_{C90} I_{CM} | 50 30 100 | Adc Apk |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 202 1.61 | Watts W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -55 to 150 | $^\circ\text{C}$ |
| Short Circuit Withstand Time ($V_{CC} = 360 \text{ Vdc}$, $V_{GE} = 15 \text{ Vdc}$, $T_J = 25^\circ\text{C}$, $R_G = 20 \Omega$) | t_{sc} | 10 | μs |
| Thermal Resistance — Junction to Case – IGBT — Junction to Ambient | $R_{\theta JC}$ $R_{\theta JA}$ | 0.62 45 | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds | T_L | 260 | $^\circ\text{C}$ |
| Mounting Torque, 6-32 or M3 screw | | 10 lbf•in (1.13 N•m) | |

(1) Pulse width is limited by maximum junction temperature.

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

Preferred devices are Motorola recommended choices for future use and best overall value.

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|-------------------|----------|----------|-------------|--------------|
| Collector-to-Emitter Breakdown Voltage (V _{GE} = 0 Vdc, I _C = 250 μAdc) Temperature Coefficient (Positive) | BV _{CES} | 600 — | — 870 | — — | Vdc mV/°C |
| Emitter-to-Collector Breakdown Voltage (V _{GE} = 0 Vdc, I _{EC} = 100 mAdc) | BV _{ECS} | 25 | — | — | Vdc |
| Zero Gate Voltage Collector Current (V _{CE} = 600 Vdc, V _{GE} = 0 Vdc) (V _{CE} = 600 Vdc, V _{GE} = 0 Vdc, T _J = 125°C) | I _{CES} | — — | — — | 100 2500 | μAdc |
| Gate-Body Leakage Current (V _{GE} = ± 20 Vdc, V _{CE} = 0 Vdc) | I _{GES} | — | — | 250 | nAdc |

ON CHARACTERISTICS (1)

| | | | | | |
|--|---------------------|-------------|----------------------|-------------------|--------------|
| Collector-to-Emitter On-State Voltage (V _{GE} = 15 Vdc, I _C = 15 Adc) (V _{GE} = 15 Vdc, I _C = 15 Adc, T _J = 125°C) (V _{GE} = 15 Vdc, I _C = 30 Adc) | V _{CE(on)} | — — — | 2.20 2.10 2.60 | 2.90 — 3.45 | Vdc |
| Gate Threshold Voltage (V _{CE} = V _{GE} , I _C = 1 mAdc) Threshold Temperature Coefficient (Negative) | V _{GE(th)} | 4.0 — | 6.0 10 | 8.0 — | Vdc mV/°C |
| Forward Transconductance (V _{CE} = 10 Vdc, I _C = 30 Adc) | g _{fe} | — | 15 | — | Mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|---|------------------|---|------|---|----|
| Input Capacitance | (V _{CE} = 25 Vdc, V _{GE} = 0 Vdc, f = 1.0 MHz) | C _{ies} | — | 4280 | — | pF |
| Output Capacitance | | C _{oes} | — | 275 | — | |
| Transfer Capacitance | | C _{res} | — | 19 | — | |

SWITCHING CHARACTERISTICS (1)

| | | | | | | |
|-------------------------|--|---------------------|---|------|------|----|
| Turn-On Delay Time | (V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc, L = 300 μH R _G = 20 Ω, T _J = 25°C) Energy losses include "tail" | t _{d(on)} | — | 76 | — | ns |
| Rise Time | | t _r | — | 80 | — | |
| Turn-Off Delay Time | | t _{d(off)} | — | 348 | — | |
| Fall Time | | t _f | — | 188 | — | |
| Turn-Off Switching Loss | | E _{off} | — | 0.98 | 1.28 | |
| Turn-On Delay Time | (V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc, L = 300 μH R _G = 20 Ω, T _J = 125°C) Energy losses include "tail" | t _{d(on)} | — | 73 | — | ns |
| Rise Time | | t _r | — | 95 | — | |
| Turn-Off Delay Time | | t _{d(off)} | — | 394 | — | |
| Fall Time | | t _f | — | 418 | — | |
| Turn-Off Switching Loss | | E _{off} | — | 1.90 | — | |
| Gate Charge | (V _{CC} = 360 Vdc, I _C = 30 Adc, V _{GE} = 15 Vdc) | Q _T | — | 150 | — | nC |
| | | Q ₁ | — | 30 | — | |
| | | Q ₂ | — | 45 | — | |

INTERNAL PACKAGE INDUCTANCE

| | | | | | |
|--|----------------|---|----|---|----|
| Internal Emitter Inductance (Measured from the emitter lead 0.25" from package to emitter bond pad) | L _E | — | 13 | — | nH |
|--|----------------|---|----|---|----|

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

TYPICAL ELECTRICAL CHARACTERISTICS

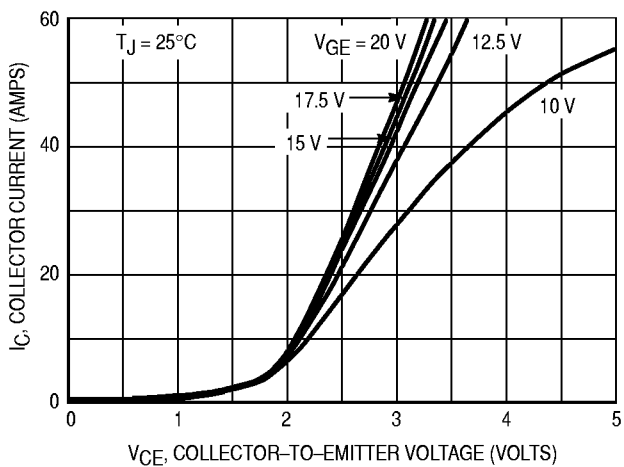


Figure 1. Output Characteristics, $T_J = 25^\circ\text{C}$

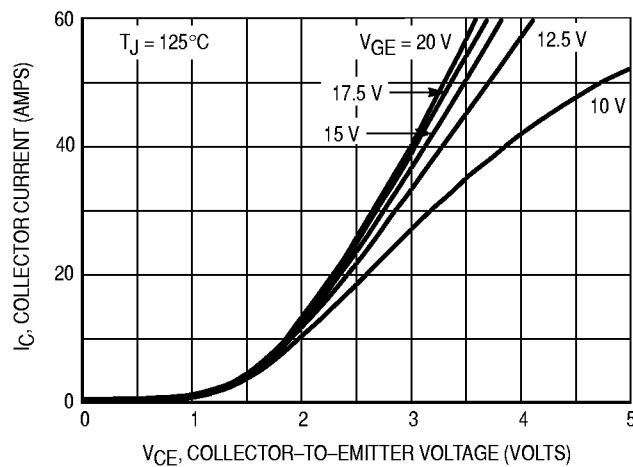


Figure 2. Output Characteristics, $T_J = 125^\circ\text{C}$

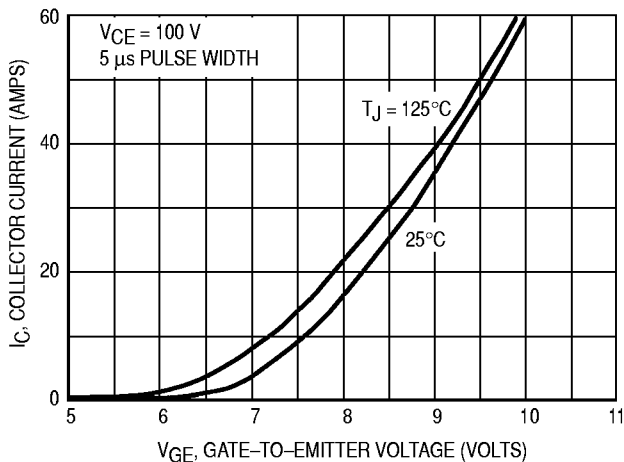


Figure 3. Transfer Characteristics

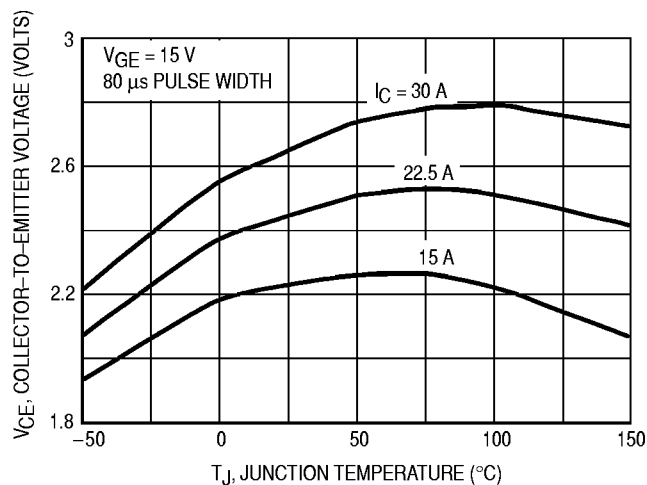


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

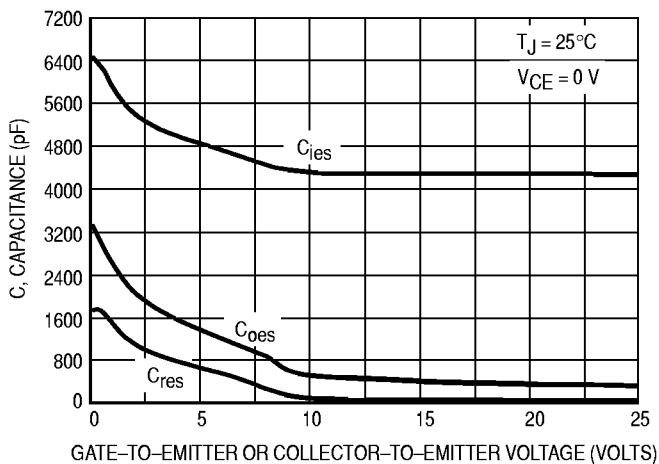


Figure 5. Capacitance Variation

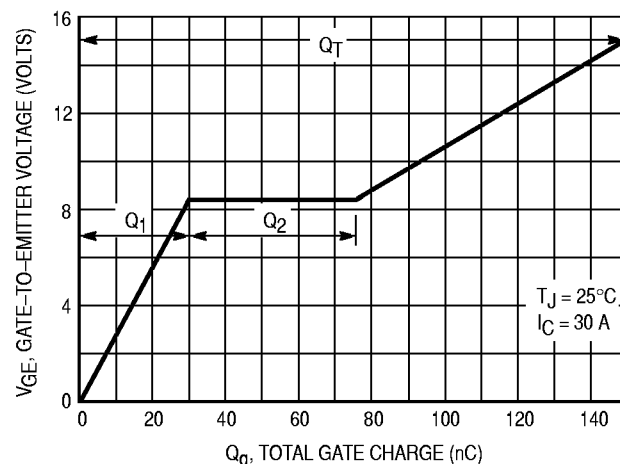


Figure 6. Gate-to-Emitter Voltage versus Total Charge

MGW30N60

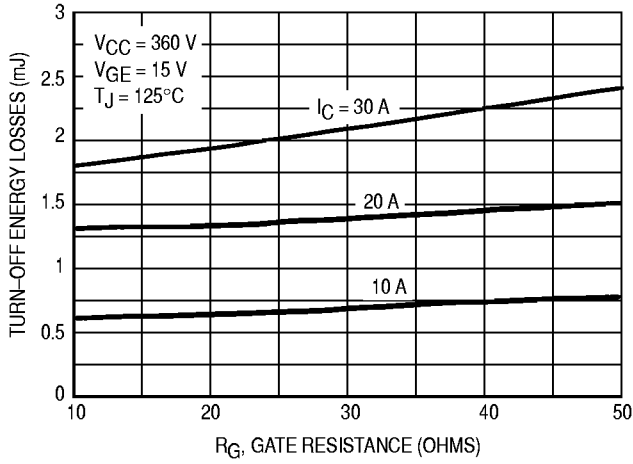


Figure 7. Turn-Off Losses versus Gate Resistance

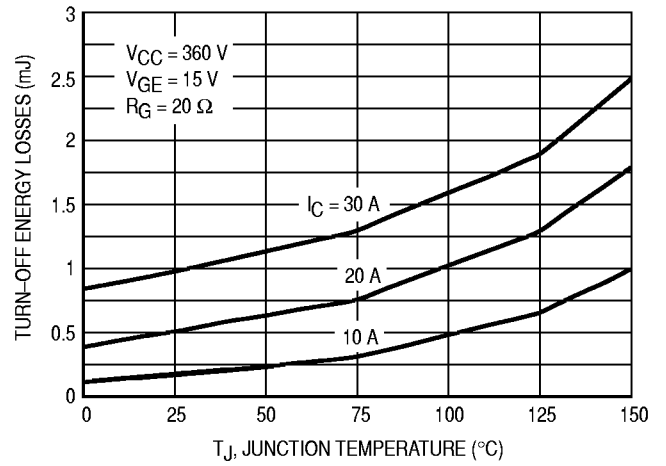


Figure 8. Turn-Off Losses versus Junction Temperature

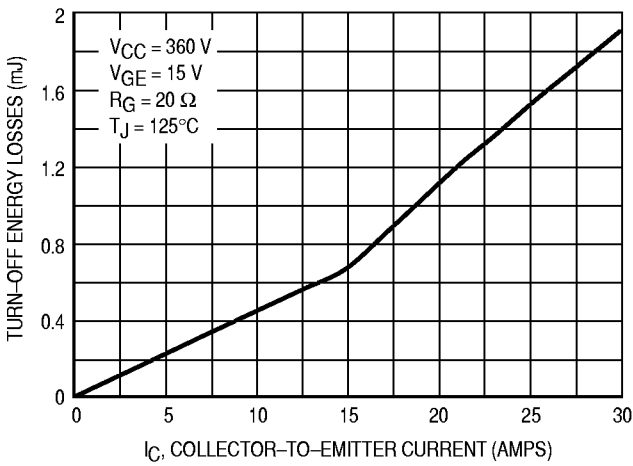


Figure 9. Turn-Off Losses versus Collector-to-Emitter Current

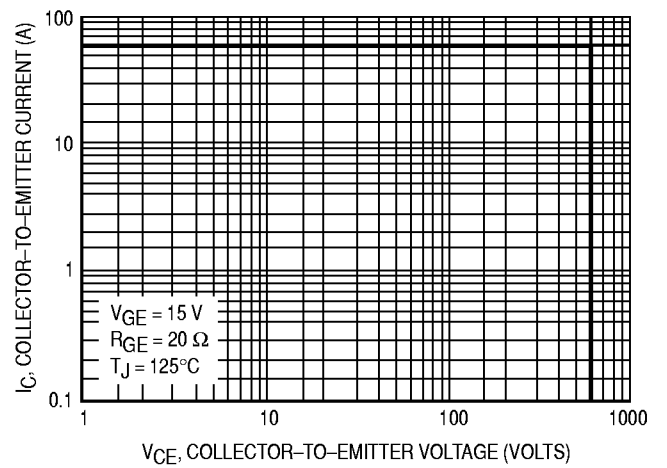
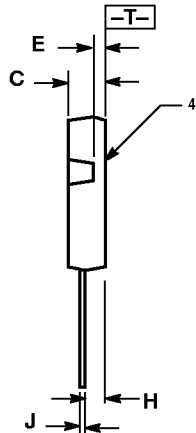
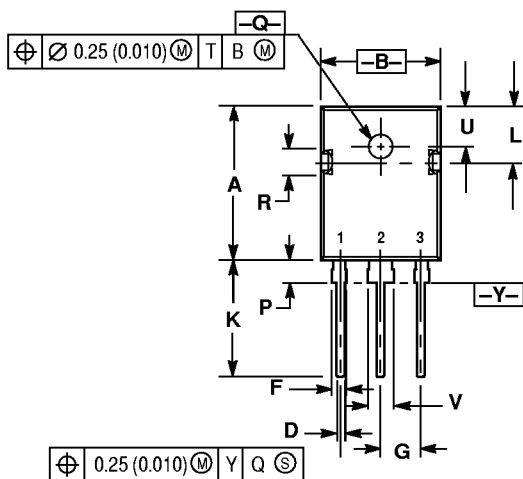


Figure 10. Reverse Biased Safe Operating Area

PACKAGE DIMENSIONS




NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 20.40 | 20.90 | 0.803 | 0.823 |
| B | 15.44 | 15.95 | 0.608 | 0.628 |
| C | 4.70 | 5.21 | 0.185 | 0.205 |
| D | 1.09 | 1.30 | 0.043 | 0.051 |
| E | 1.50 | 1.63 | 0.059 | 0.064 |
| F | 1.80 | 2.18 | 0.071 | 0.086 |
| G | 5.45 BSC | | 0.215 BSC | |
| H | 2.56 | 2.87 | 0.101 | 0.113 |
| J | 0.48 | 0.68 | 0.019 | 0.027 |
| K | 15.57 | 16.08 | 0.613 | 0.633 |
| L | 7.26 | 7.50 | 0.286 | 0.295 |
| P | 3.10 | 3.38 | 0.122 | 0.133 |
| Q | 3.50 | 3.70 | 0.138 | 0.145 |
| R | 3.30 | 3.80 | 0.130 | 0.150 |
| U | 5.30 BSC | | 0.209 BSC | |
| V | 3.05 | 3.40 | 0.120 | 0.134 |

STYLE 4:
 PIN 1. GATE
 2. COLLECTOR
 3. EMITTER
 4. COLLECTOR

CASE 340F-03
 TO-247AE
 ISSUE E

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How to reach us:

USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447 or 602-303-5454

MFAX: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
INTERNET: <http://Design-NET.com>

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,
3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-81-3521-8315

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

