

AOTF15B65MQ1-VB Datasheet

600V Trench and Fieldstop IGBT

| PRODUCT SUMMARY | | |
|-------------------|---------------|----------------|
| V_{CE} (V) | 600 | |
| I_C (A) | 30 (TC=25 °C) | 15 (TC=100 °C) |
| $V_{CE(sat)}$ (V) | 1.8 | |
| I_{CM} (A) | 45 | |

FEATURES

- Very Low V_{CEsat}
- Low turn-off losses
- High speed switching
- Maximum junction temperature 175°C
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)



RoHS
COMPLIANT
HALOGEN
FREE

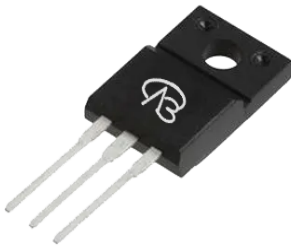
APPLICATIONS

- Telecommunications
 - Server and telecom power supplies
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Consumer and computing
 - ATX power supplies
- Industrial
 - Welding
 - Battery chargers
- Renewable energy
 - Solar (PV inverters)
- Switch mode power supplies (SMPS)

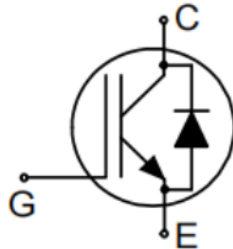
Package pin definition

- Pin1 G - Gate
- Pin2 C & backside - Collector
- Pin3 E - Emitter

TO-220F



Top View



| ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ °C}$, unless otherwise noted) | | | | |
|---|------------------------------|----------------|-----------------------|---------|
| PARAMETER | | SYMBOL | LIMIT | UNIT |
| Collector-Emitter Voltage | | V_{CE} | 600 | V |
| Gate-Emitter Voltage | | V_{GE} | ± 30 | |
| Continuous Collector Current ($T_J = 150\text{ °C}$) | V_{GE} at 15 V | I_C | $T_C = 25\text{ °C}$ | 30 |
| | | | $T_C = 100\text{ °C}$ | 15 |
| Pulsed Collector Current ^a | | I_{CM} | 45 | A |
| Diode Forward Current ^b | | I_F | 15 | A |
| Maximum Power Dissipation | | P_D | $T_C = 25\text{ °C}$ | 34 |
| | | | $T_C = 100\text{ °C}$ | 13.6 |
| Operating Junction and Storage Temperature Range | | T_J, T_{stg} | -55 to +175 | °C |
| Short Circuit Withstand Time $T_C=150$ | $V_{GE}= 15V, V_{CE} = 400V$ | tsc | 3 | μs |
| Short Circuit Withstand Time $T_C=100$ | $V_{GE}= 15V, V_{CE} = 330V$ | | 5 | |
| Soldering Recommendations (Peak Temperature) ^c | | | 260 | °C |
| | | | for 10 s | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Current limited by maximum junction temperature.
- 1.6 mm from case.

| THERMAL RESISTANCE RATINGS | | | | |
|-----------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 78 | °C/W |
| Maximum Junction-to-Case | R_{thJC} | - | 3.6 | |

| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | | |
|---|---------------|--|--|------------|--------|--------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Collector-Emitter Breakdown Voltage | BV_{CE} | $V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$ $V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$ | | 600 600 | - - | - - | V |
| Gate-Source Threshold Voltage (N) | $V_{GE(th)}$ | $V_{CE} = V_{GE}, I_D = 250\text{ }\mu\text{A}$ | | 4 | 5 | 6 | V |
| Zero Gate Voltage Collector Current | I_{CES} | $V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 25\text{ }^\circ\text{C}$ | | - | 1 | 20 | μA |
| | | $V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$ | | - | 1000 | - | μA |
| Gate-Emitter Leakage Current | I_{GES} | $V_{CE} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | - | - | 100 | nA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE} = 15\text{ V}$ | $I_C = 15\text{ A}$ | - | 1.7 | 2.1 | V |
| Forward Transconductance | g_{fs} | $V_{CE} = 20\text{ V}, I_C = 15\text{ A}$ | | - | 16 | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{ies} | $V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V},$ $f = 500\text{ KHz}$ | | - | 1700 | - | pF |
| Output Capacitance | C_{oes} | | | - | 50 | - | |
| Reverse Transfer Capacitance | C_{res} | | | - | 30 | - | |
| Turn-on Energy | E_{on} | $V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 15\text{ A}, R_g = 10\Omega$ | | - | 0.25 | - | nJ |
| Turn-off Energy | E_{off} | | | - | 0.12 | - | |
| Total Gate Charge | Q_g | $V_{GE} = 15\text{ V}$ | $I_C = 15\text{ A}, V_{CE} = 400\text{ V}$ | - | 63 | - | nC |
| Gate-Emitter Charge | Q_{ge} | | | - | 12 | - | |
| Gate to Collector Charge | Q_{gc} | | | - | 15 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 15\text{ A}, R_g = 10\Omega$ | | - | 13 | - | ns |
| Rise Time | t_r | | | - | 26 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 115 | - | |
| Fall Time | t_f | | | - | 36 | - | |
| Internal emitter inductance measured 5 mm | L_E | | | - | 13 | - | nH |
| Diode Characteristics | | | | | | | |
| Diode Forward Current | I_F | IGBT symbol showing the integral reverse junction diode | | - | - | 15 | A |
| Pulsed Diode Forward Current | I_{FM} | | | - | - | 45 | |
| Diode Forward Voltage | V_F | $I_F = 15\text{ A}$ | | - | 1.65 | 2.0 | V |
| Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = 15\text{ A},$ $dI_F/dt = 200\text{ A}/\mu\text{s}, V_R = 400\text{ V}$ | | - | 70 | - | ns |
| Reverse Recovery Charge | Q_{rr} | | | - | 0.48 | - | μC |
| Reverse Recovery Current | I_{RRM} | | | - | 8 | - | A |

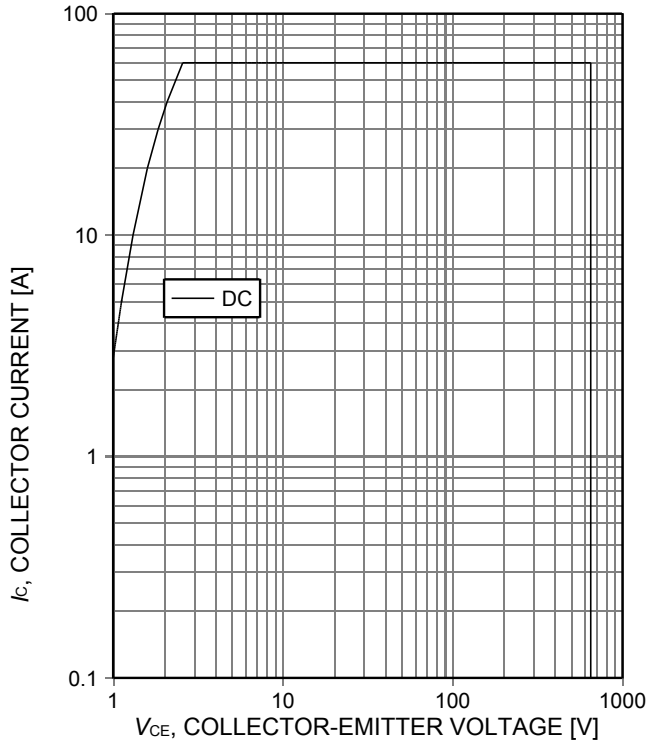


Figure 1. **Forward bias safe operating area**
($D=0$, $T_C=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$.
Recommended use at $V_{GE}\geq 7.5\text{V}$)

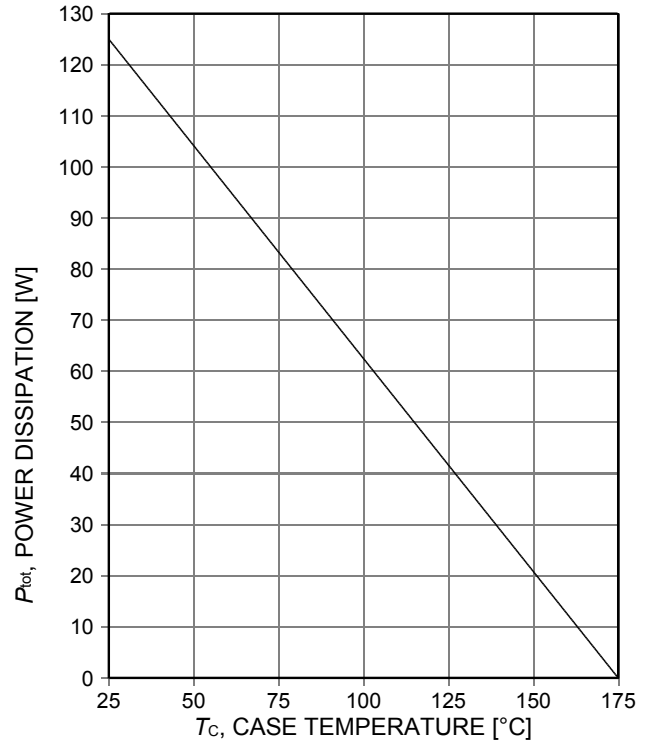


Figure 2. **Power dissipation as a function of case temperature**
($T_{vj}\leq 175^\circ\text{C}$)

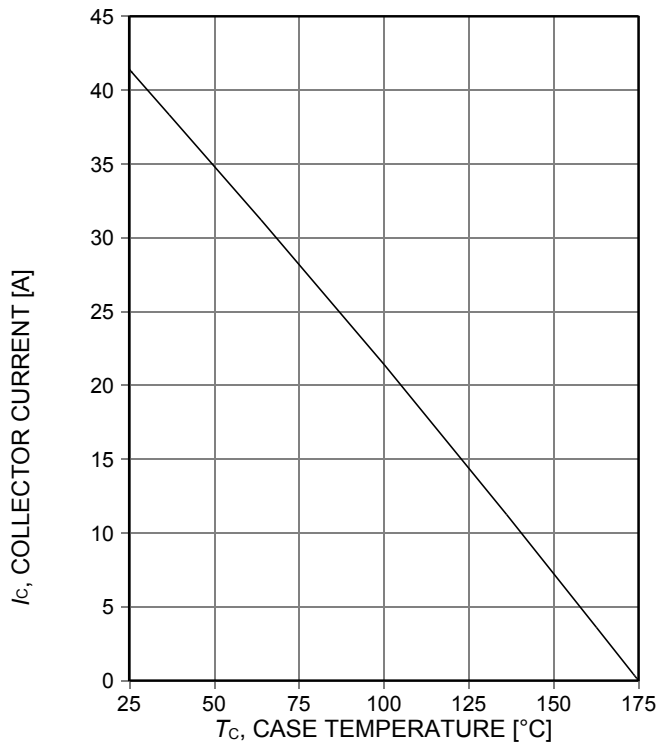


Figure 3. **Collector current as a function of case temperature**

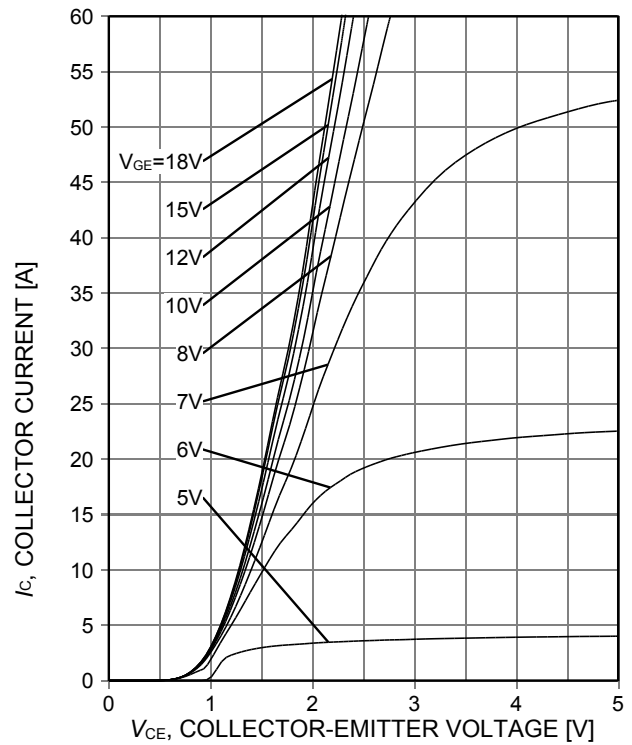


Figure 4. **Typical output characteristic**

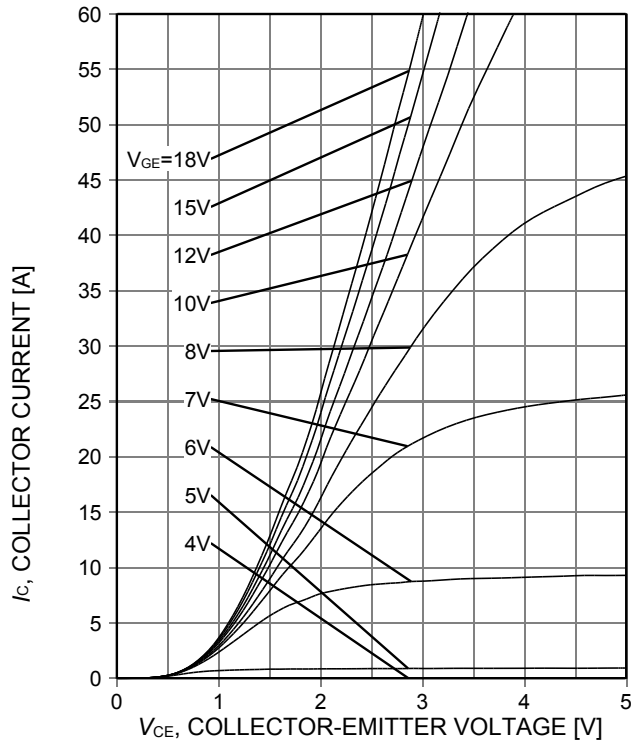


Figure 5. Typical output characteristic ($T_j=150^\circ\text{C}$)

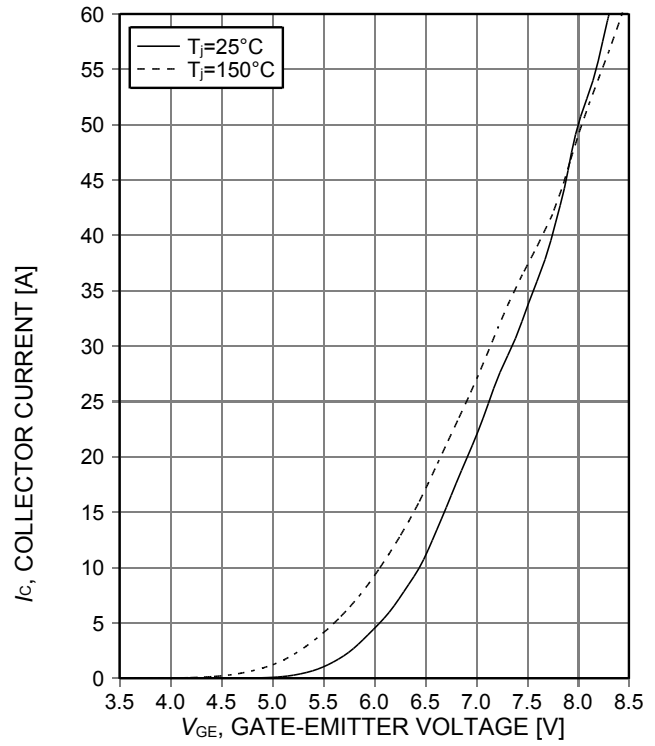


Figure 6. Typical transfer characteristic ($V_{CE}=20\text{V}$)

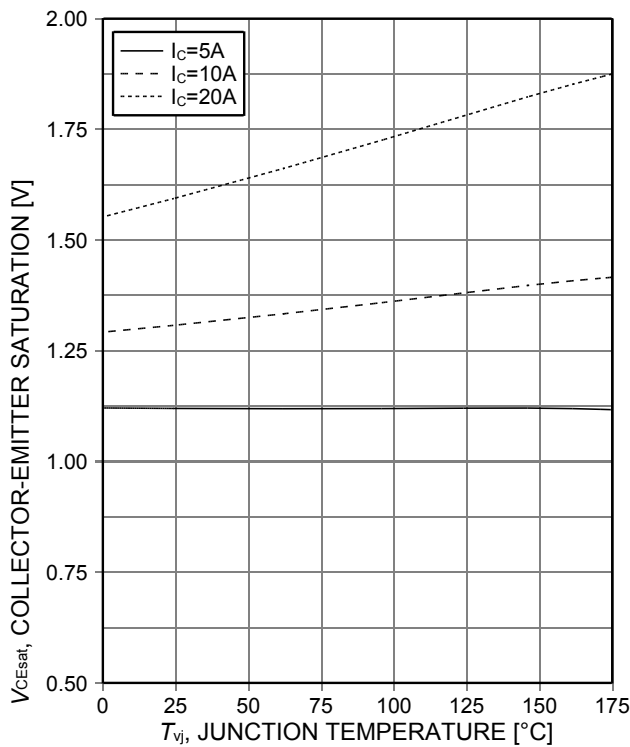


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature

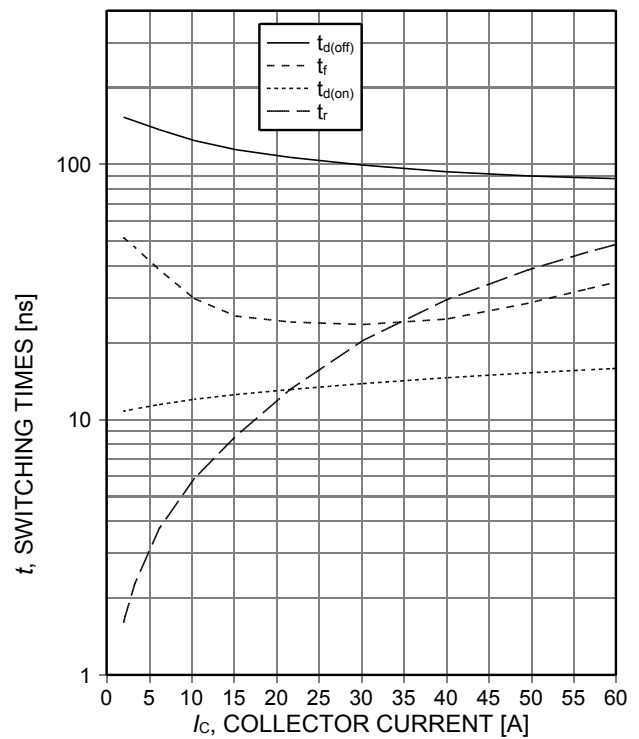


Figure 8. Typical switching times as a function of collector current

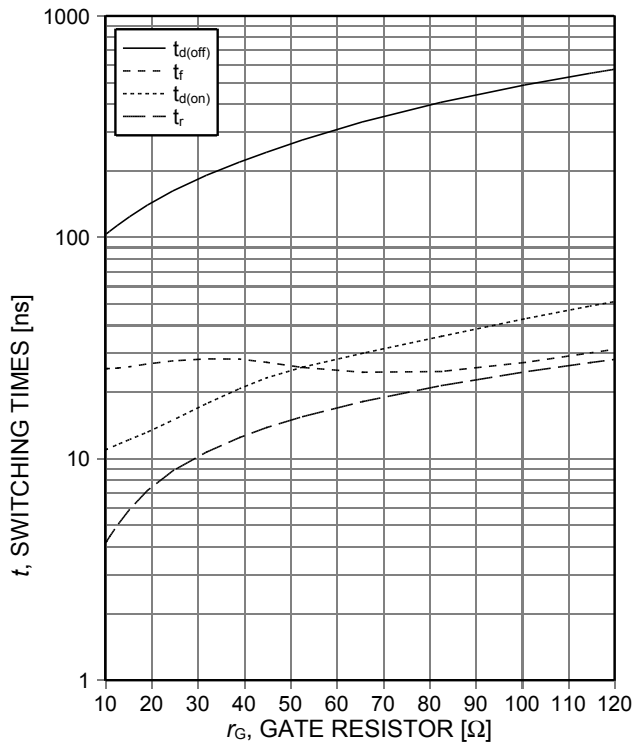


Figure 9. Typical switching times as a function of gate resistor

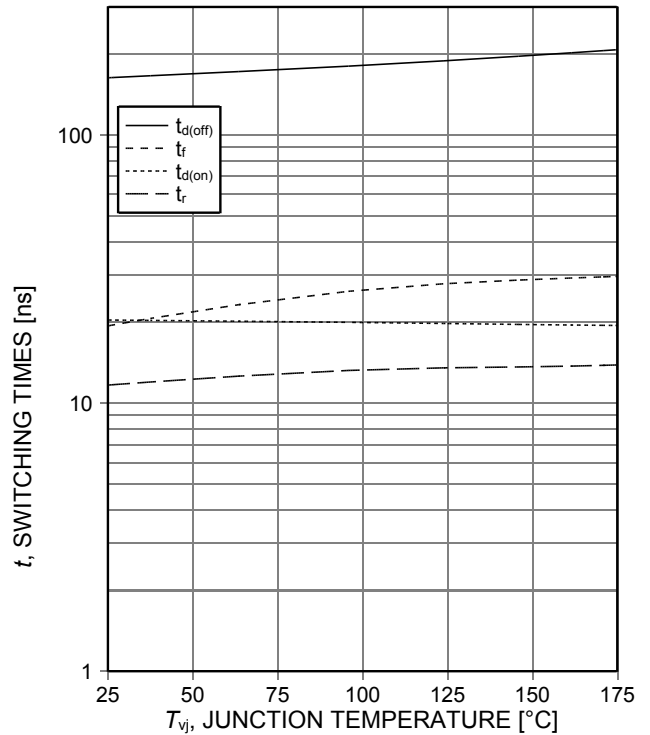


Figure 10. Typical switching times as a function of junction temperature

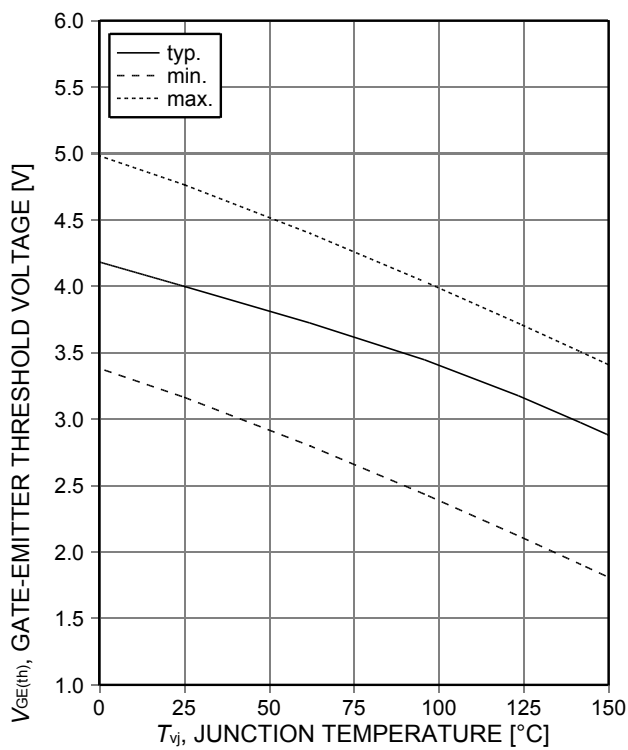


Figure 11. Gate-emitter threshold voltage as a function of junction temperature

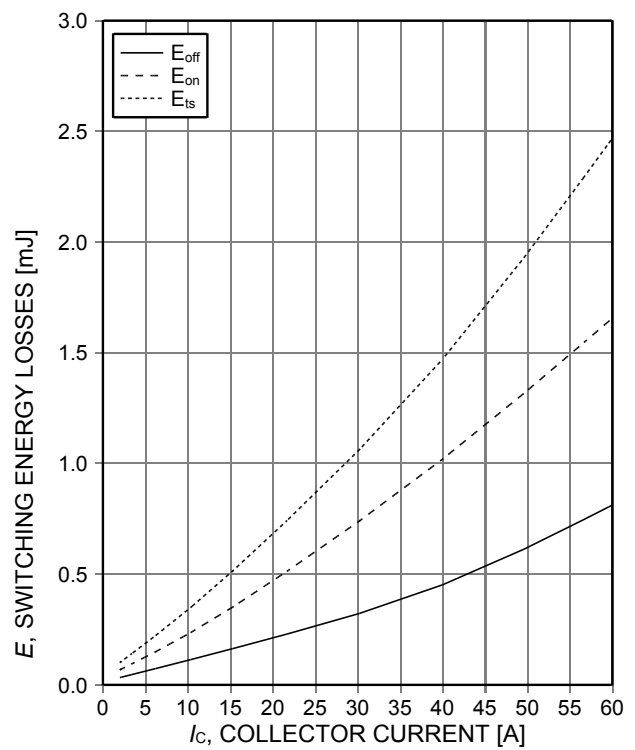


Figure 12. Typical switching energy losses as a function of collector current

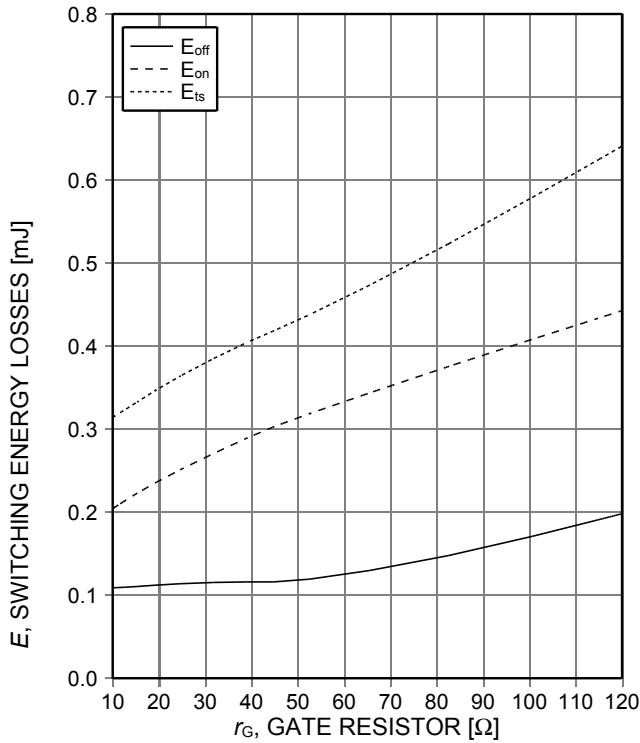


Figure 13. Typical switching energy losses as a function of gate resistor



Figure 14. Typical switching energy losses as a function of junction temperature

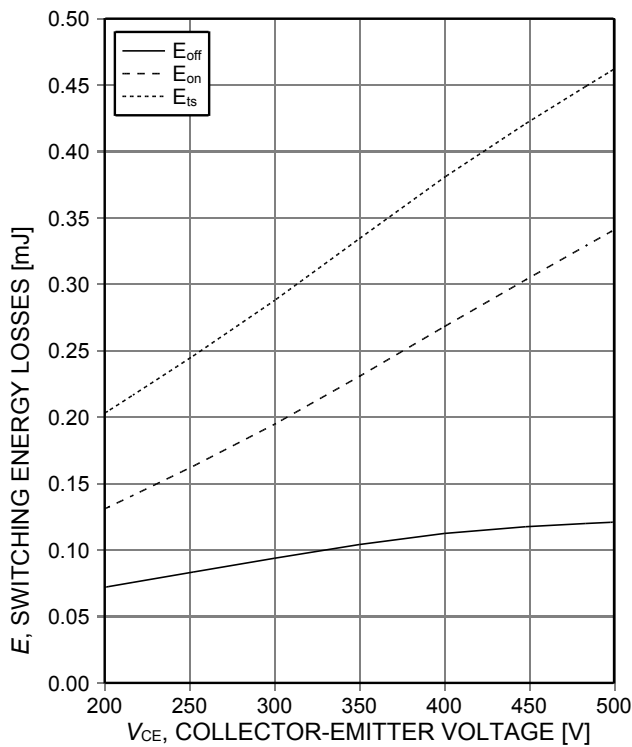


Figure 15. Typical switching energy losses as a function of collector emitter voltage

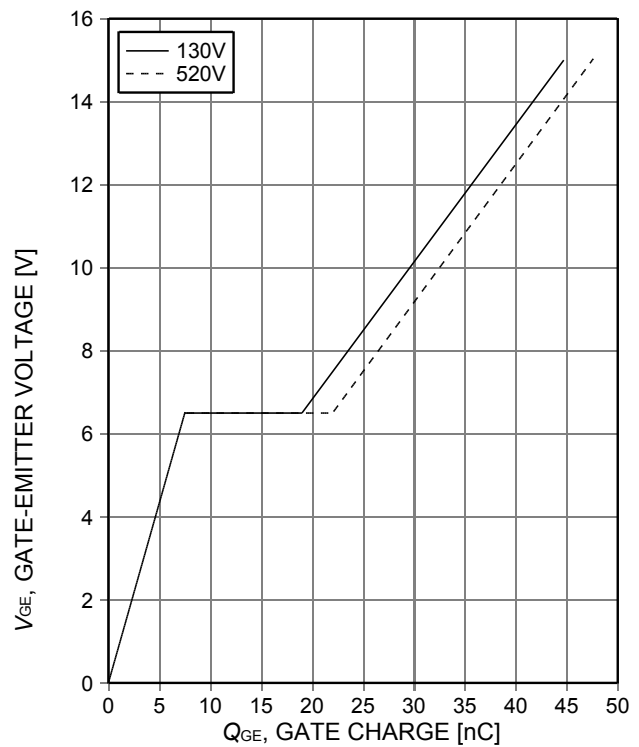


Figure 16. Typical gate charge

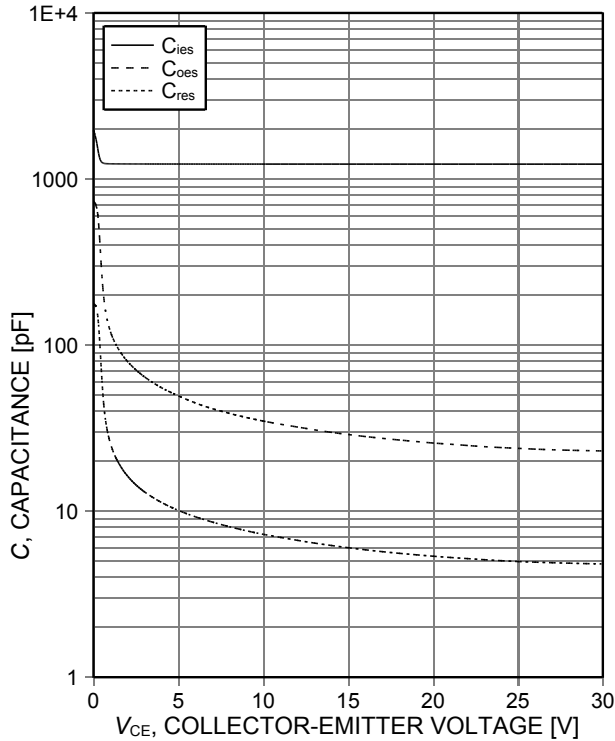


Figure 17. Typical capacitance as a function of collector-emitter voltage

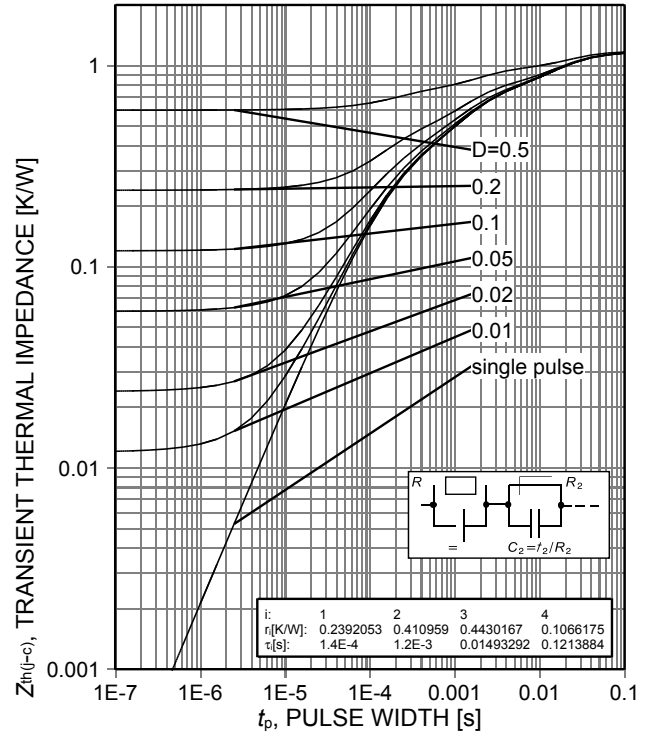


Figure 18. IGBT transient thermal impedance

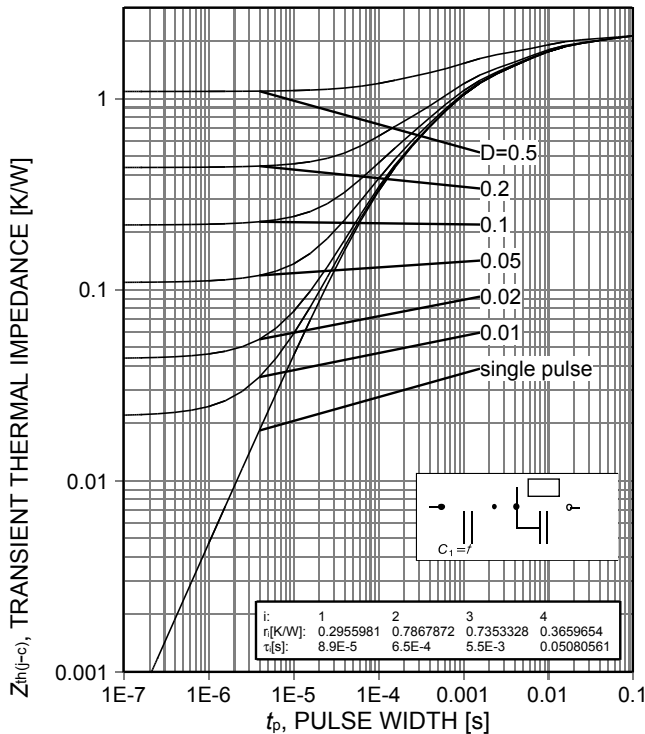


Figure 19. Diode transient thermal impedance as a function of pulse width

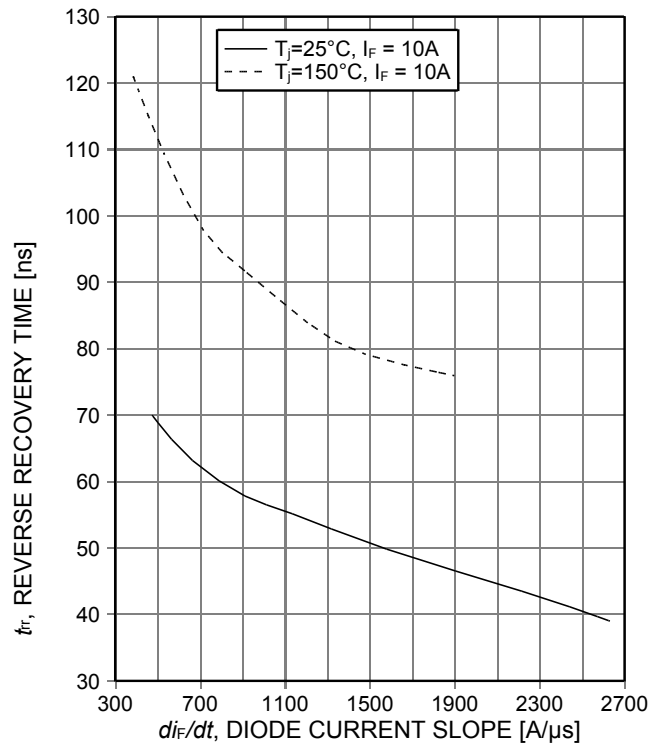
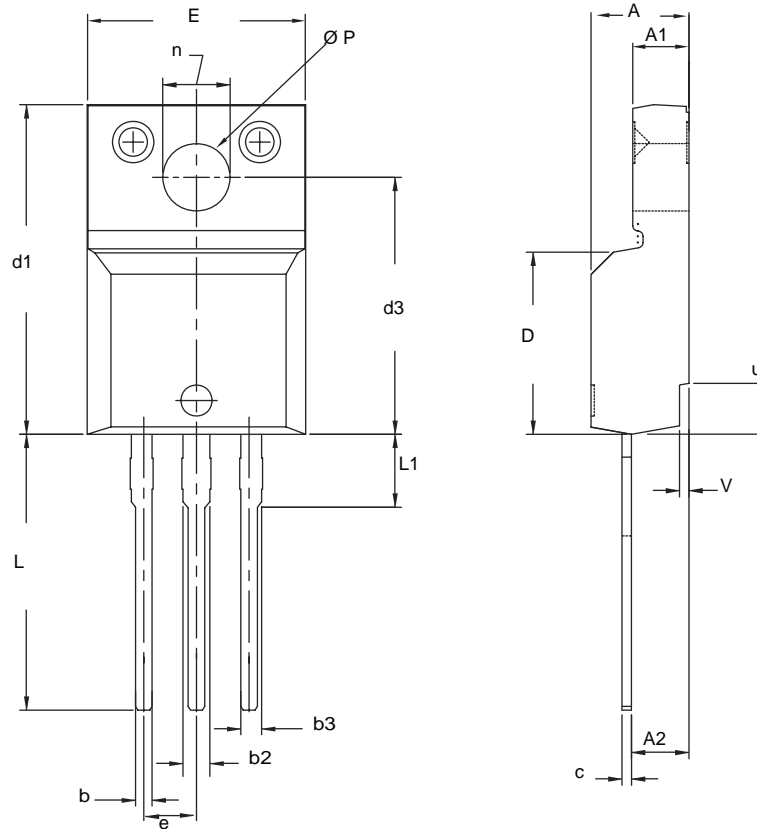


Figure 20. Typical reverse recovery time as a function of diode current slope

TO-220 FULLPAK (HIGH VOLTAGE)



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|--------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.570 | 4.830 | 0.180 | 0.190 |
| A1 | 2.570 | 2.830 | 0.101 | 0.111 |
| A2 | 2.510 | 2.850 | 0.099 | 0.112 |
| b | 0.622 | 0.890 | 0.024 | 0.035 |
| b2 | 1.229 | 1.400 | 0.048 | 0.055 |
| b3 | 1.229 | 1.400 | 0.048 | 0.055 |
| c | 0.440 | 0.629 | 0.017 | 0.025 |
| D | 8.650 | 9.800 | 0.341 | 0.386 |
| d1 | 15.88 | 16.120 | 0.622 | 0.635 |
| d3 | 12.300 | 12.920 | 0.484 | 0.509 |
| E | 10.360 | 10.630 | 0.408 | 0.419 |
| e | 2.54 BSC | | 0.100 BSC | |
| L | 13.200 | 13.730 | 0.520 | 0.541 |
| L1 | 3.100 | 3.500 | 0.122 | 0.138 |
| n | 6.050 | 6.150 | 0.238 | 0.242 |
| Ø P | 3.050 | 3.450 | 0.120 | 0.136 |
| u | 2.400 | 2.500 | 0.094 | 0.098 |
| v | 0.400 | 0.500 | 0.016 | 0.020 |

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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