# STGB20H65DFB2-VB Datasheet

## 600V Trench and Fieldstop IGBT

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{CE}$ (V) | 600 | |
| $I_C$ (A) | 50 (TC=25°C) | 25 (TC=100°C) |
| $V_{CE}$ (sat) (V) | 1.9 | |
| $I_{CM}$ (A) | 75 | |

### FEATURES

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

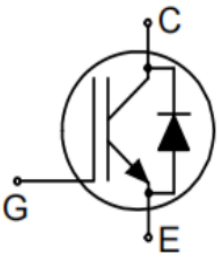
RoHS COMPLIANT
HALOGEN FREE

### 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)

TO-263

Top View




### Package pin definition

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

**ABSOLUTE MAXIMUM RATINGS** ($T_C$ = 25 °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 °C) | $V_{GE}$ at 15 V | $T_C$ = 25 °C | $I_C$ | 50 | A |
| | | $T_C$ = 100 °C | | 25 | |
| Pulsed Collector Current [a] | | | $I_{CM}$ | 75 | |
| Diode Forward Current [b] | | | $I_F$ | 25 | A |
| Maximum Power Dissipation | | $T_C$ = 25 °C | $P_D$ | 92 | W |
| | | $T_C$ = 100 °C | | 58 | W |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | -55 to +175 | °C |
| Short Circuit Withstand Time TC=150°C | VGE= 15V, VCE≤ 400V | | $t_{SC}$ | 3 | µs |
| Short Circuit Withstand Time TC=100°C | VGE= 15V, VCE≤330V | | | 5 | |
| Soldering Recommendations (Peak Temperature) [c] | for 10 s | | | 260 | °C |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature.

b. Current limited by maximum junction temperature.

c. 1.6 mm from case.

| THERMAL RESISTANCE RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TYP.** | **MAX.** | **UNIT** |
| Maximum Junction-to-Ambient | $R_{thJA}$ | - | 40 | °C/W |
| Maximum Junction-to-Case | $R_{thJC}$ | - | 1.5 | |

| **SPECIFICATIONS** ($T_J$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | |
| Collector-Emitter Breakdown Voltage | $BV_{CE}$ | $V_{GE}$ = 0 V, $I_C$ = 250 µA<br>$V_{GE}$ = 0 V, $I_C$ = 1 mA | 600<br>600 | -<br>- | -<br>- | V |
| Gate-Source Threshold Voltage (N) | $V_{GE(th)}$ | $V_{CE}$ = $V_{GE}$, $I_D$ = 250 µA | 4 | 5 | 6 | V |
| Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{CE}$ = 600 V, $V_{GE}$ = 0 V, $T_J$ = 25 °C | - | 1 | 20 | µA |
| | | $V_{CE}$ = 600 V, $V_{GE}$ = 0 V, $T_J$ = 150 °C | - | 1000 | - | µA |
| Gate-Emitter Leakage Current | $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GS}$ = ± 2 0 V | - | - | 100 | nA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}$ = 15 V, $I_C$ = 30 A | - | 1.9 | 2.1 | V |
| Forward Transconductance | $g_{fs}$ | $V_{CE}$ = 20 V, $I_C$ = 30 A | - | 40 | - | S |
| **Dynamic** | | | | | | |
| Input Capacitance | $C_{ies}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 25 V, f = 500 KHz | - | 3200 | - | pF |
| Output Capacitance | $C_{oes}$ | | - | 87 | - | |
| Reverse Transfer Capacitance | $C_{res}$ | | - | 25 | - | |
| Turn-on Energy | $E_{on}$ | $V_{CE}$ = 400 V , $V_{GE}$ = 0 /15V, $I_C$ = 30 A, $R_g$ = 15Ω | - | 0.48 | - | nJ |
| Turn-off Energy | $E_{off}$ | | - | 0.31 | - | |
| Total Gate Charge | $Q_g$ | $V_{GE}$ = 15 V, $I_C$ = 30 A, $V_{CE}$ = 400 V | - | 24 | - | nC |
| Gate-Emitter Charge | $Q_{ge}$ | | - | 18 | - | |
| Gate to Collector Charge | $Q_{gc}$ | | - | 55 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{CE}$ = 400 V , $V_{GE}$ = 0 /15V, $I_C$ = 30 A, $R_g$ = 10Ω | - | 33 | - | ns |
| Rise Time | $t_r$ | | - | 33 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 152 | - | |
| Fall Time | $t_f$ | | - | 40 | - | |
| 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 | - | - | 25 | A |
| Pulsed Diode Forward Current | $I_{FM}$ | | - | - | 75 | |
| Diode Forward Voltage | $V_F$ | $I_F$ = 30 A | - | 1.94 | 2.0 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = 30 A, $dI_F/dt$ = 200 A/µs, $V_R$ = 400 V | - | 80 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 0.26 | - | µC |
| Reverse Recovery Current | $I_{RRM}$ | | - | 13 | - | A |

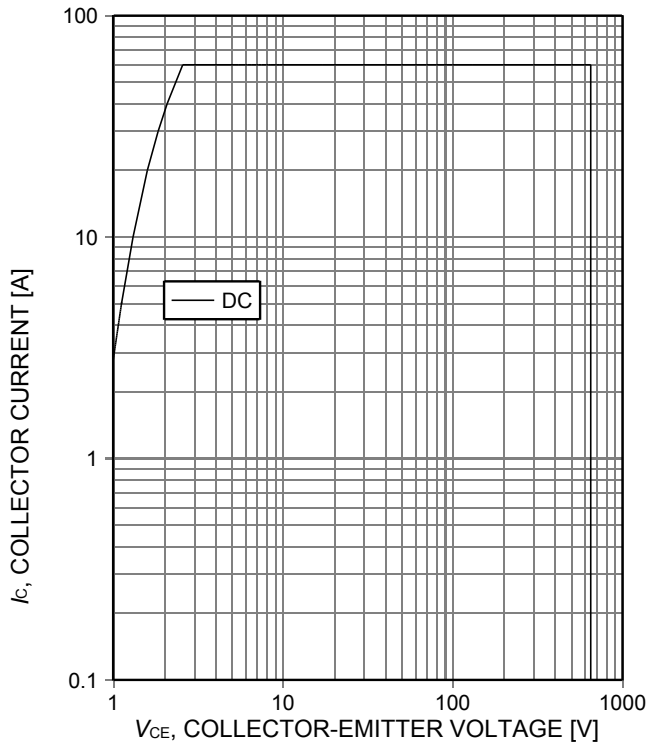



Figure 1. **Forward bias safe operating area** ($D$=0, $T_C$=25°C, $T_{vj}$≤175°C; $V_{GE}$=15V. Recommended use at $V_{GE}$≥7.5V)

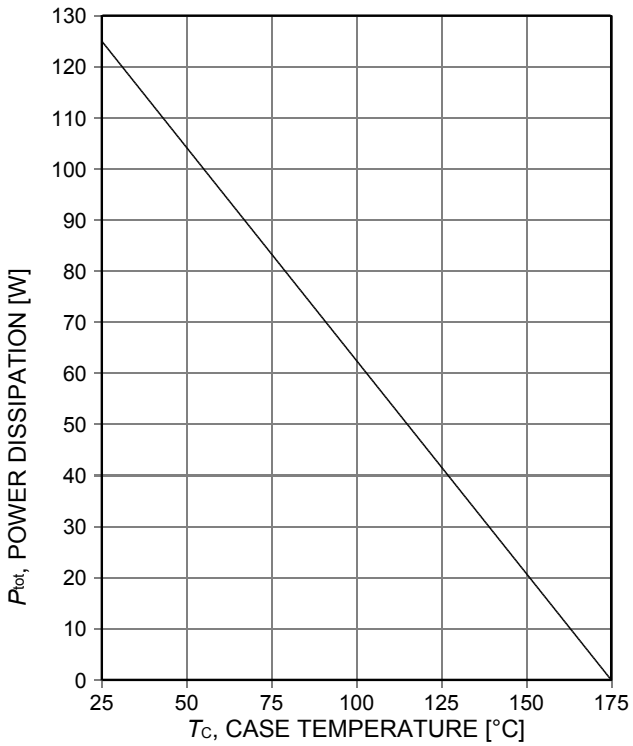



Figure 2. **Power dissipation as a function of case temperature** ($T_{vj}$≤175°C)

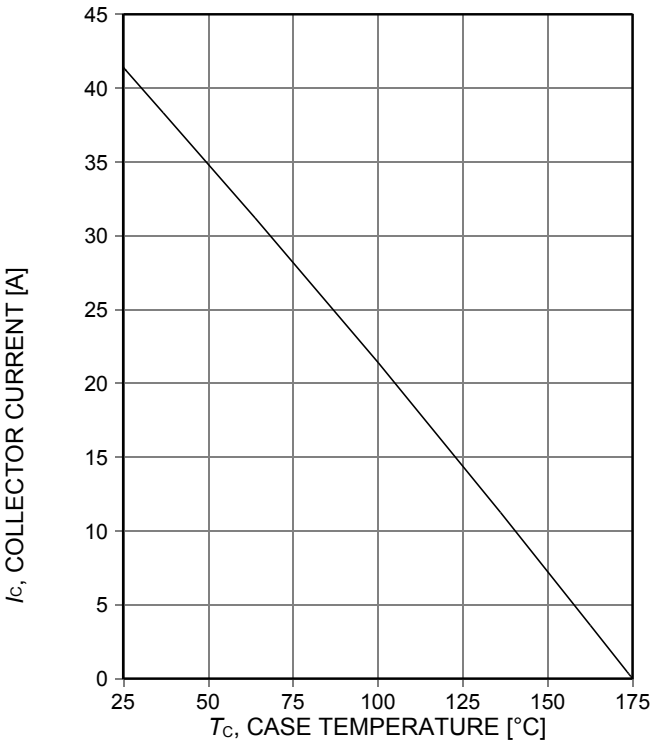



Figure 3. **Collector current as a function of case temperature**

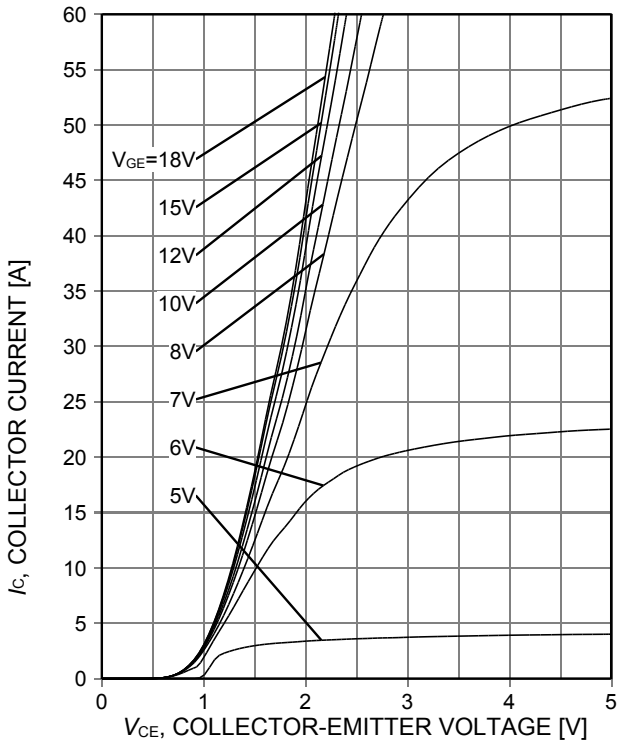



Figure 4. **Typical output characteristic**

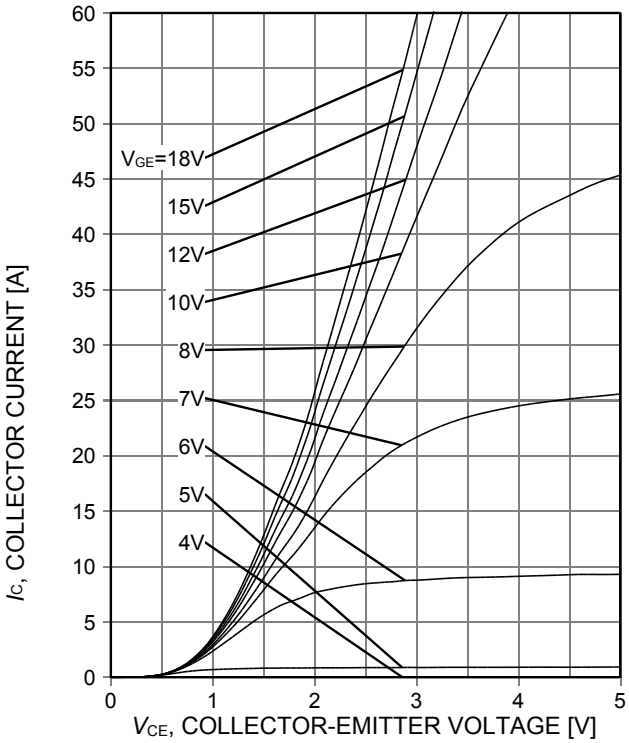



Figure 5. **Typical output characteristic** ($T_{vj}$=150°C)

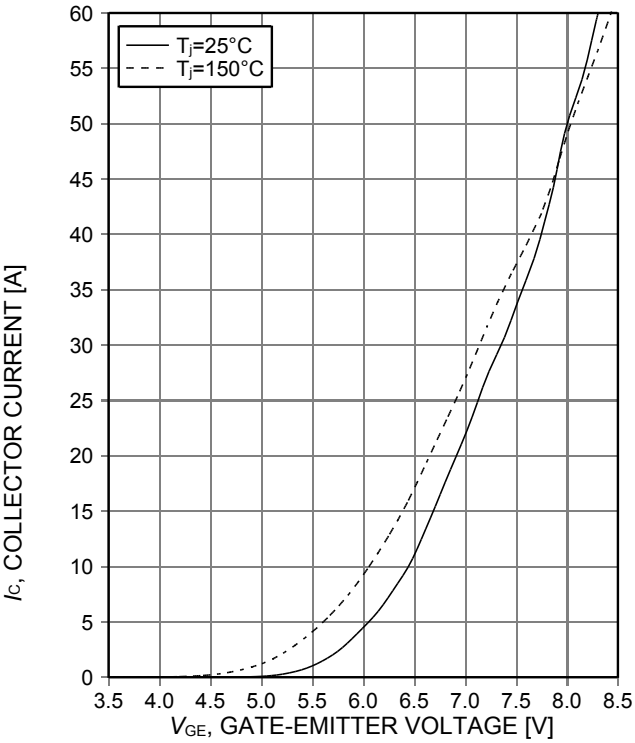



Figure 6. **Typical transfer characteristic** ($V_{CE}$=20V)

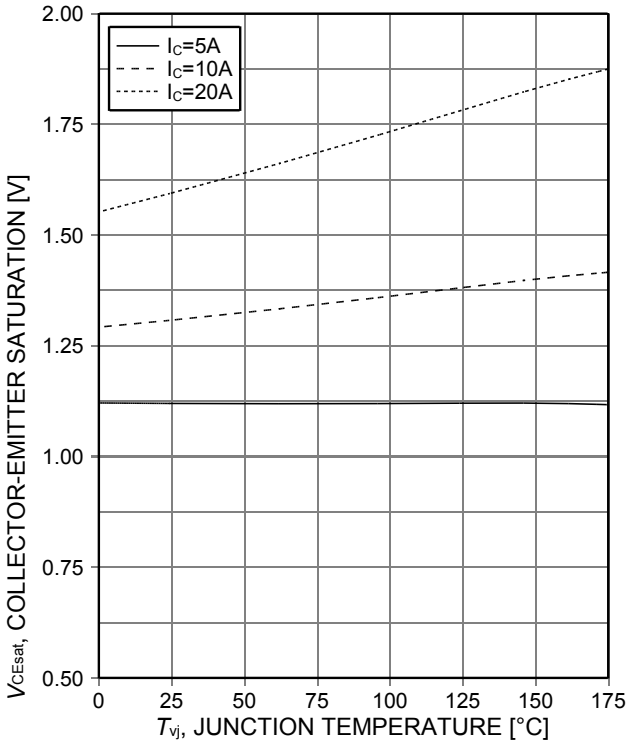



Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**

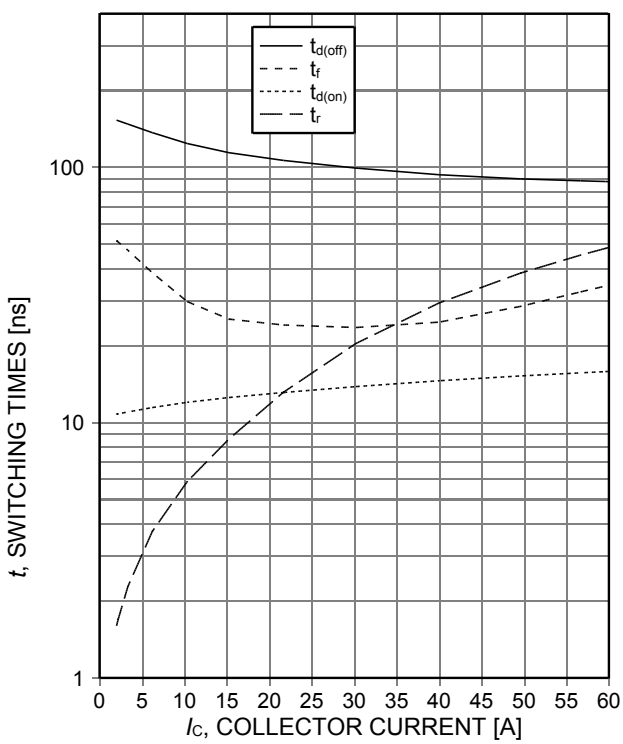



Figure 8. **Typical switching times as a function of collector current**

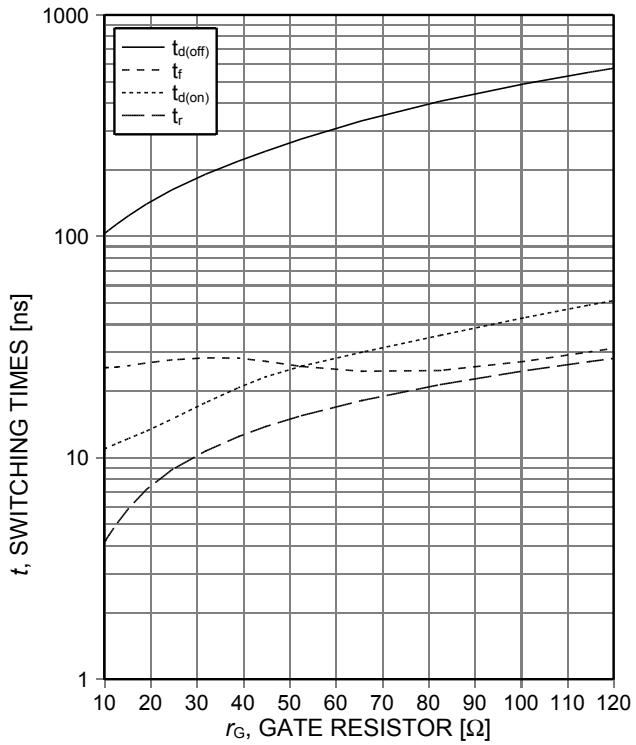



Figure 9. **Typical switching times as a function of gate resistor**

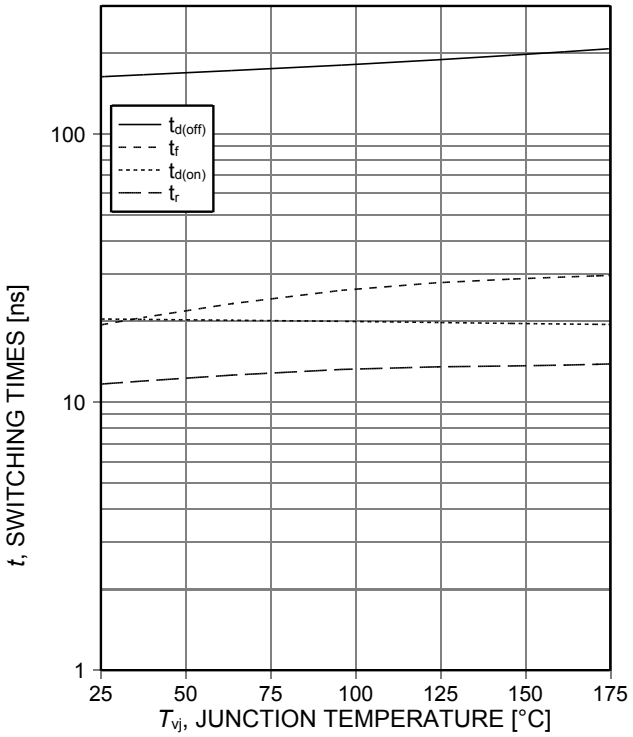



Figure 10. **Typical switching times as a function of junction temperature**

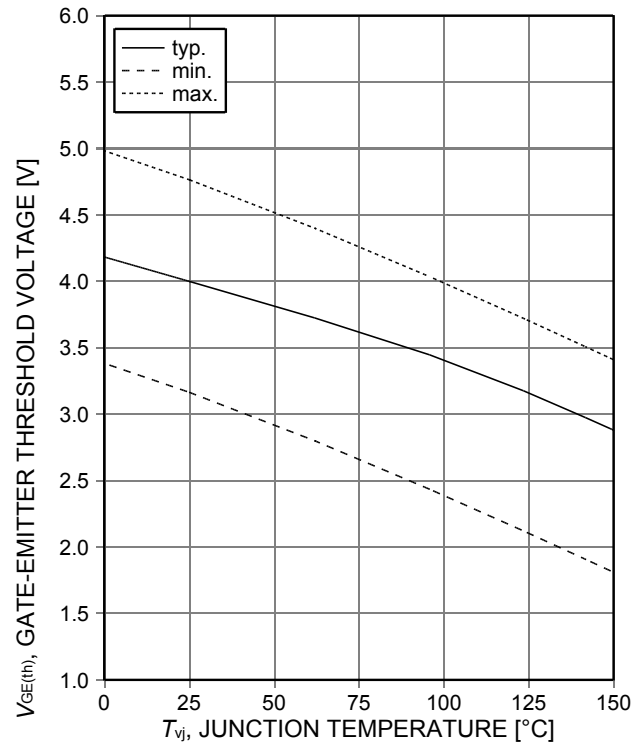



Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**

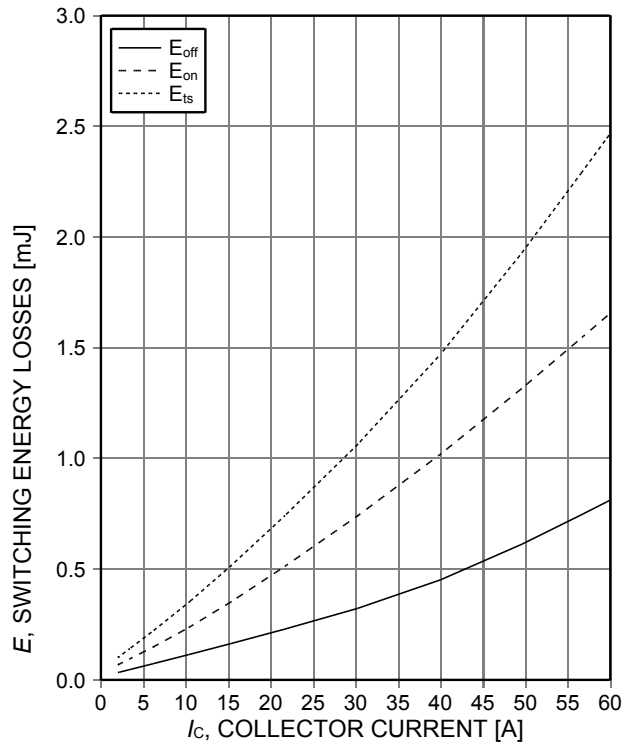



Figure 12. **Typical switching energy losses as a function of collector current**

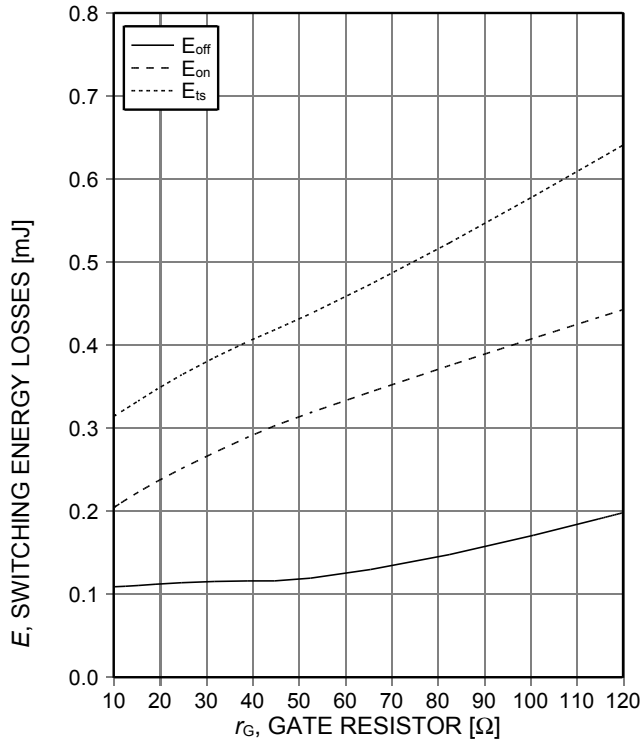



Figure 13. **Typical switching energy losses as a function of gate resistor**

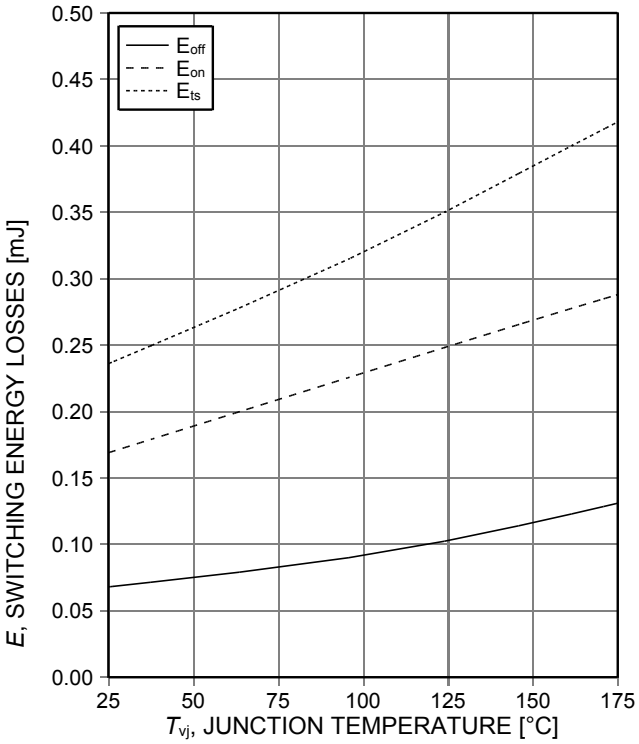



Figure 14. **Typical switching energy losses as a function of junction temperature**

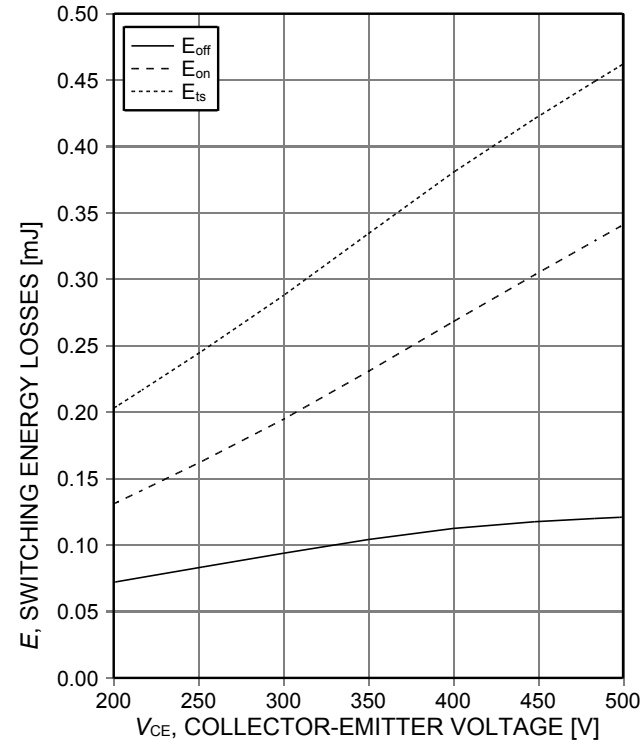



Figure 15. **Typical switching energy losses as a function of collector emitter voltage**

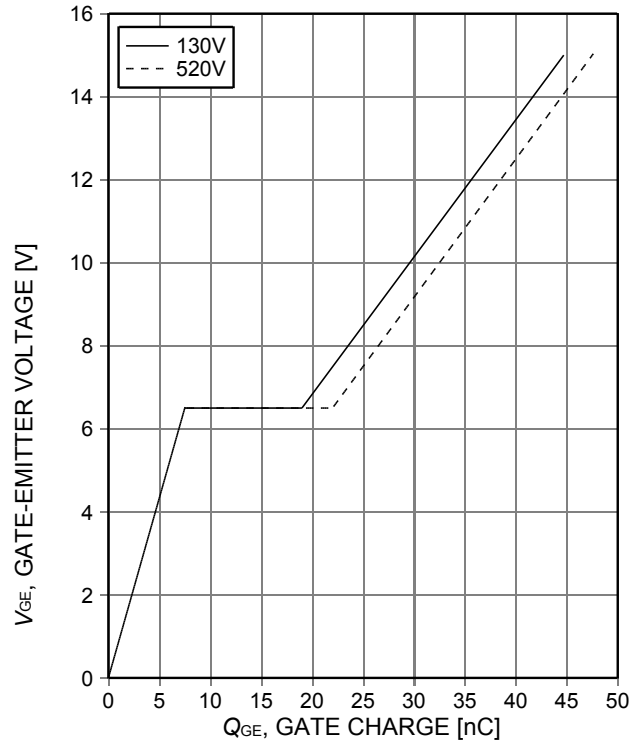



Figure 16. **Typical gate charge**

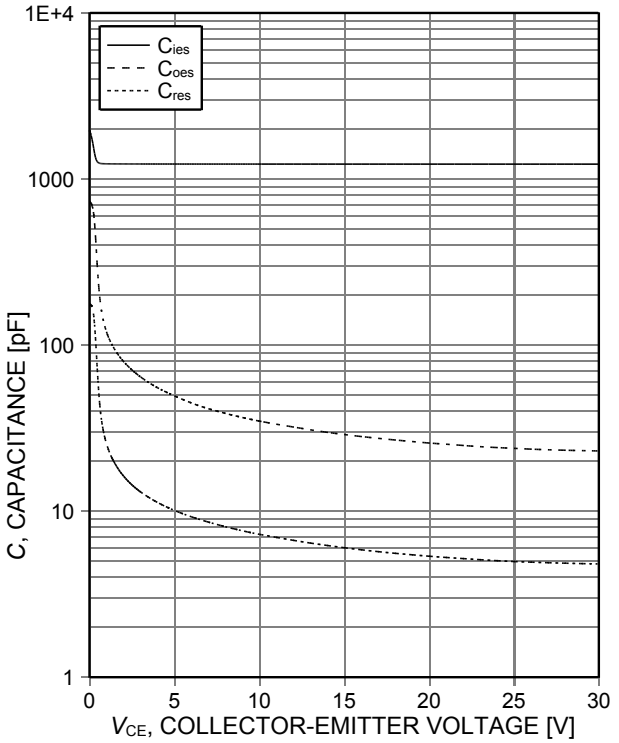



Figure 17. **Typical capacitance as a function of collector-emitter voltage**

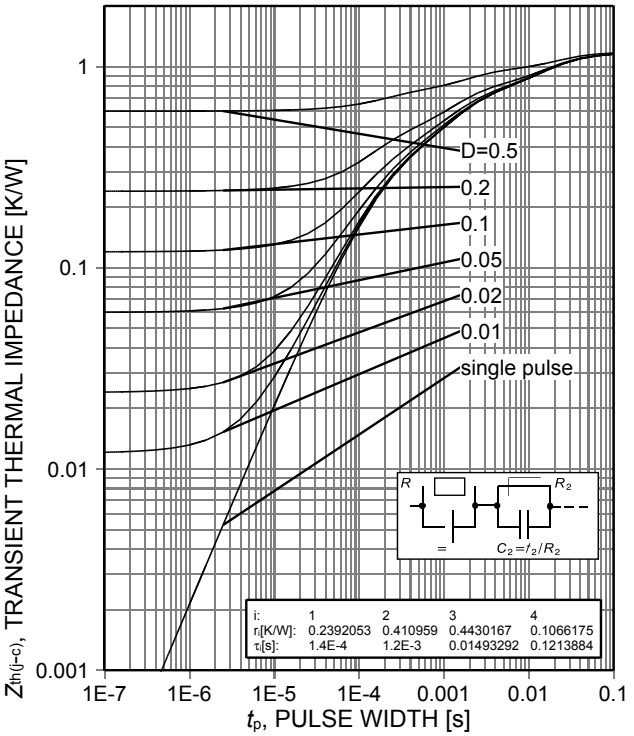



Figure 18. **IGBT transient thermal impedance**

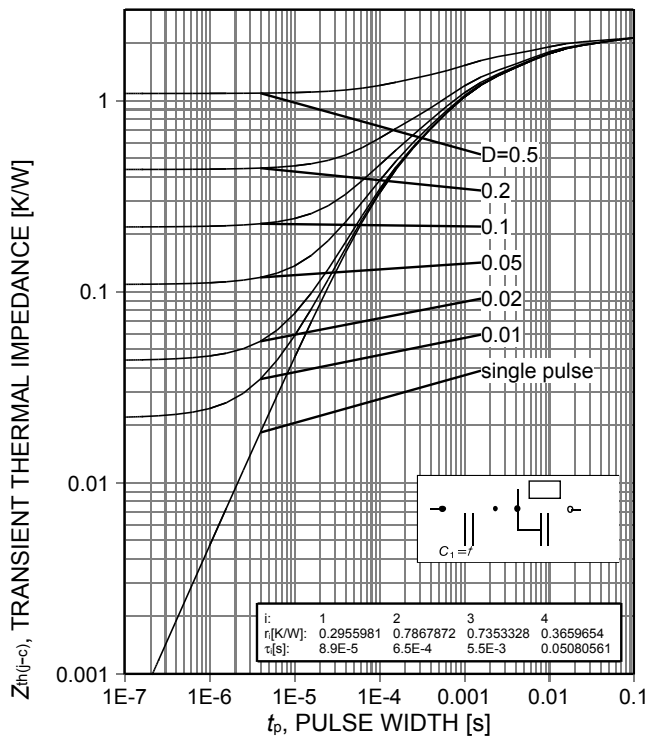



Figure 19. **Diode transient thermal impedance as a function of pulse width**

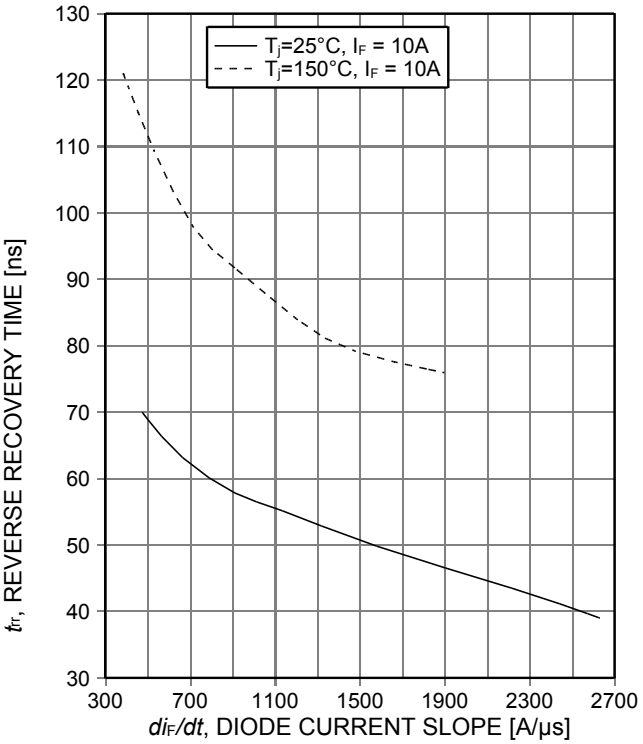
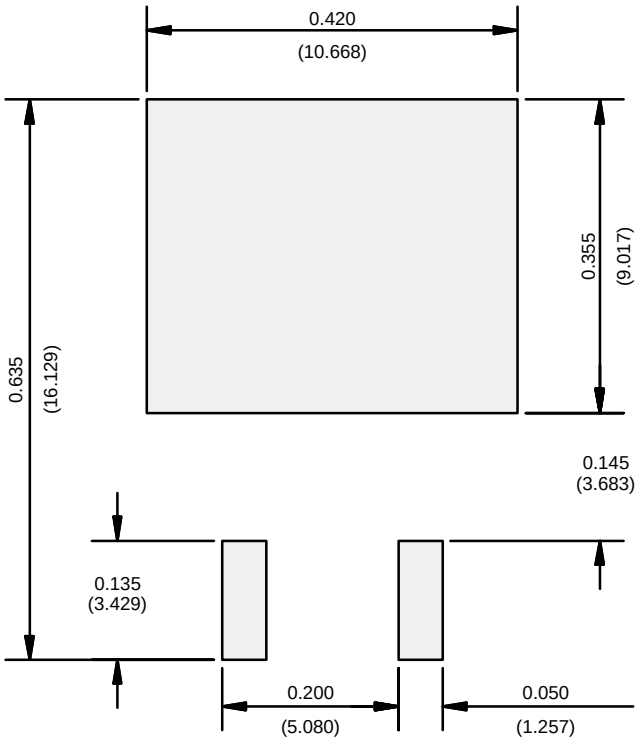


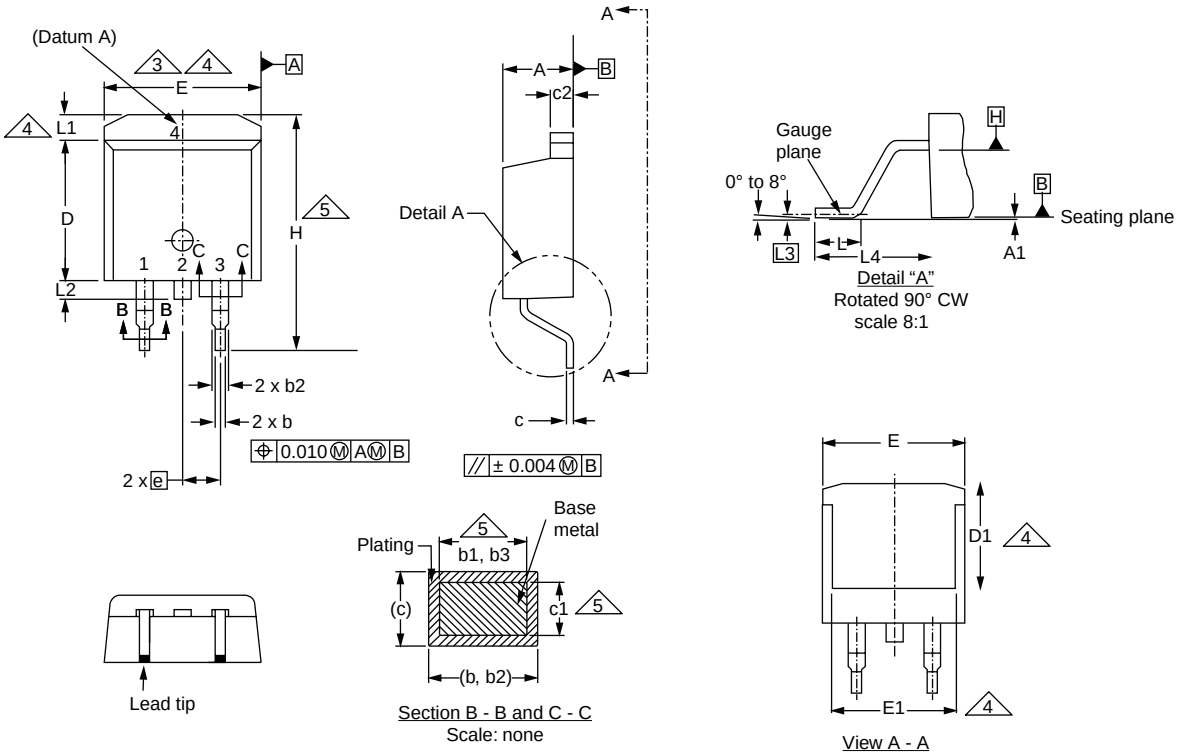

Figure 20. **Typical reverse recovery time as a function of diode current slope**

## RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead




Recommended Minimum Pads
Dimensions in Inches/(mm)

## TO-263AB (HIGH VOLTAGE)




| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM. | MIN. | MAX. | MIN. | MAX. |
| A | 4.06 | 4.83 | 0.160 | 0.190 |
| A1 | 0.00 | 0.25 | 0.000 | 0.010 |
| b | 0.51 | 0.99 | 0.020 | 0.039 |
| b1 | 0.51 | 0.89 | 0.020 | 0.035 |
| b2 | 1.14 | 1.78 | 0.045 | 0.070 |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 |
| c | 0.38 | 0.74 | 0.015 | 0.029 |
| c1 | 0.38 | 0.58 | 0.015 | 0.023 |
| c2 | 1.14 | 1.65 | 0.045 | 0.065 |
| D | 8.38 | 9.65 | 0.330 | 0.380 |

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM. | MIN. | MAX. | MIN. | MAX. |
| D1 | 6.86 | - | 0.270 | - |
| E | 9.65 | 10.67 | 0.380 | 0.420 |
| E1 | 6.22 | - | 0.245 | - |
| e | 2.54 BSC | | 0.100 BSC | |
| H | 14.61 | 15.88 | 0.575 | 0.625 |
| L | 1.78 | 2.79 | 0.070 | 0.110 |
| L1 | - | 1.65 | - | 0.066 |
| L2 | - | 1.78 | - | 0.070 |
| L3 | 0.25 BSC | | 0.010 BSC | |
| L4 | 4.78 | 5.28 | 0.188 | 0.208 |

**Notes**

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.

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