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# FGH80N60FD

## 600 V Field Stop IGBT

### Features

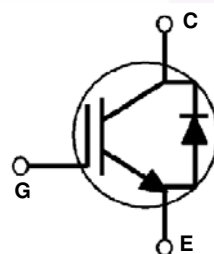
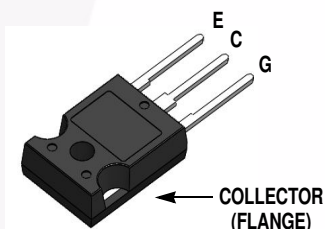
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 1.8\text{ V @ } I_C = 40\text{ A}$
- High Input Impedance
- Fast Switching
- RoHS Compliant

### Applications

- Induction Heating, PFC, Telecom, ESS

### General Description

Using novel field stop IGBT technology, Fairchild's field stop IGBTs offer the optimum performance for induction heating, telecom, ESS and PFC applications where low conduction and switching losses are essential.



### Absolute Maximum Ratings

| Symbol      | Description   | Ratings     | Unit             |
|-------------|---|-------------|------------------|
| $V_{CES}$   | Collector-Emitter Voltage   | 600         | V                |
| $V_{GES}$   | Gate-Emitter Voltage  | $\pm 20$    | V                |
| $I_C$       | Collector Current @ $T_C = 25^\circ\text{C}$                            | 80          | A                |
|             | Collector Current @ $T_C = 100^\circ\text{C}$                           | 40          | A                |
| $I_{CM(1)}$ | Pulsed Collector Current @ $T_C = 25^\circ\text{C}$                     | 160         | A                |
| $P_D$       | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$                    | 290         | W                |
|             | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$                   | 116         | W                |
| $T_J$       | Operating Junction Temperature  | -55 to +150 | $^\circ\text{C}$ |
| $T_{stg}$   | Storage Temperature Range   | -55 to +150 | $^\circ\text{C}$ |
| $T_L$       | Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds | 300         | $^\circ\text{C}$ |

**Notes :**

(1) Repetitive rating : Pulse width limited by max. junction temperature

### Thermal Characteristics

| Symbol                        | Parameter                               | Typ. | Max. | Unit               |
|-------------------------------|---|------|------|--------------------|
| $R_{\theta JC}(\text{IGBT})$  | Thermal Resistance, Junction-to-Case    | --   | 0.43 | $^\circ\text{C/W}$ |
| $R_{\theta JC}(\text{Diode})$ | Thermal Resistance, Junction-to-Case    | --   | 1.5  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$               | Thermal Resistance, Junction-to-Ambient | --   | 40   | $^\circ\text{C/W}$ |



**Package Marking and Ordering Information**

| Part Number  | Top Mark   | Package | Packing Method | Reel Size | Tape Width | Quantity |
|--------------|------------|---------|----------------|-----------|------------|----------|
| FGH80N60FDTU | FGH80N60FD | TO-247  | Tube           | N/A       | N/A        | 30       |

**Electrical Characteristics of the IGBT**  $T_C = 25^\circ\text{C}$  unless otherwise noted

| Symbol                           | Parameter                                    | Test Conditions  | Min. | Typ. | Max.      | Unit                |
|----------------------------------|--|--|------|------|-----------|---------------------|
| <b>Off Characteristics</b>       |  |  |      |      |           |                     |
| $BV_{CES}$                       | Collector-Emitter Breakdown Voltage          | $V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$  | 600  | --   | --        | V                   |
| $\Delta BV_{CES} / \Delta T_J$   | Temperature Coefficient of Breakdown Voltage | $V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$  | --   | 0.6  | --        | V/ $^\circ\text{C}$ |
| $I_{CES}$                        | Collector Cut-Off Current                    | $V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$  | --   | --   | 250       | $\mu\text{A}$       |
| $I_{GES}$                        | G-E Leakage Current                          | $V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$  | --   | --   | $\pm 400$ | nA                  |
| <b>On Characteristics</b>        |  |  |      |      |           |                     |
| $V_{GE(th)}$                     | G-E Threshold Voltage                        | $I_C = 250\text{ }\mu\text{A}, V_{CE} = V_{GE}$  | 4.5  | 5.5  | 7.0       | V                   |
| $V_{CE(sat)}$                    | Collector to Emitter Saturation Voltage      | $I_C = 40\text{ A}, V_{GE} = 15\text{ V}$  | --   | 1.8  | 2.4       | V                   |
|                                  |  | $I_C = 40\text{ A}, V_{GE} = 15\text{ V}, T_C = 125^\circ\text{C}$   | --   | 2.05 | --        | V                   |
| <b>Dynamic Characteristics</b>   |  |  |      |      |           |                     |
| $C_{ies}$                        | Input Capacitance                            | $V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$  | --   | 2110 | --        | pF                  |
| $C_{oes}$                        | Output Capacitance                           |  | --   | 200  | --        | pF                  |
| $C_{res}$                        | Reverse Transfer Capacitance                 |  | --   | 60   | --        | pF                  |
| <b>Switching Characteristics</b> |  |  |      |      |           |                     |
| $t_{d(on)}$                      | Turn-On Delay Time                           | $V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V},$<br>Inductive Load, $T_C = 25^\circ\text{C}$  | --   | 21   | --        | ns                  |
| $t_r$                            | Rise Time                                    |  | --   | 56   | --        | ns                  |
| $t_{d(off)}$                     | Turn-Off Delay Time                          |  | --   | 126  | --        | ns                  |
| $t_f$                            | Fall Time                                    |  | --   | 50   | 100       | ns                  |
| $E_{on}$                         | Turn-On Switching Loss                       |  | --   | 1    | 1.5       | mJ                  |
| $E_{off}$                        | Turn-Off Switching Loss                      |  | --   | 0.52 | 0.78      | mJ                  |
| $E_{ts}$                         | Total Switching Loss                         | --   | 1.52 | 2.28 | mJ        |                     |
| $t_{d(on)}$                      | Turn-On Delay Time                           | $V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V},$<br>Inductive Load, $T_C = 125^\circ\text{C}$ | --   | 20   | --        | ns                  |
| $t_r$                            | Rise Time                                    |  | --   | 54   | --        | ns                  |
| $t_{d(off)}$                     | Turn-Off Delay Time                          |  | --   | 131  | --        | ns                  |
| $t_f$                            | Fall Time                                    |  | --   | 70   | --        | ns                  |
| $E_{on}$                         | Turn-On Switching Loss                       |  | --   | 1.1  | --        | mJ                  |
| $E_{off}$                        | Turn-Off Switching Loss                      |  | --   | 0.78 | --        | mJ                  |
| $E_{ts}$                         | Total Switching Loss                         | --   | 1.88 | --   | mJ        |                     |
| $Q_g$                            | Total Gate Charge                            | $V_{CE} = 400\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$   | --   | 120  | --        | nC                  |
| $Q_{ge}$                         | Gate-Emitter Charge                          |  | --   | 14   | --        | nC                  |
| $Q_{gc}$                         | Gate-Collector Charge                        |  | --   | 58   | --        | nC                  |

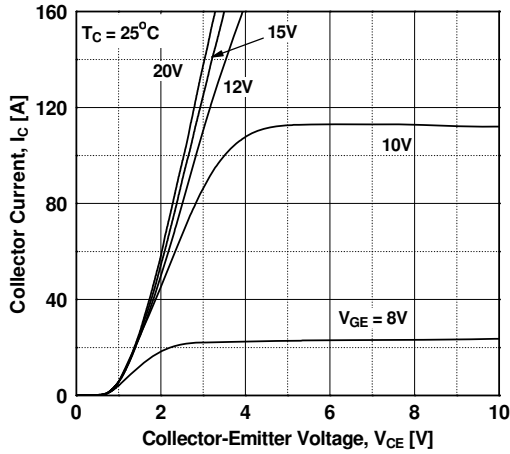
**Electrical Characteristics of the Diode** T<sub>C</sub> = 25°C unless otherwise noted

| Symbol          | Parameter                      | Test Conditions   | Min.                   | Typ. | Max  | Unit |    |
|-----------------|--------------------------------|---|------------------------|------|------|------|----|
| V <sub>FM</sub> | Diode Forward Voltage          | I <sub>F</sub> = 20 A                                     | T <sub>C</sub> = 25°C  | -    | 2.3  | 2.8  | V  |
|                 |                                |   | T <sub>C</sub> = 125°C | -    | 1.7  | -    |    |
| t <sub>rr</sub> | Diode Reverse Recovery Time    | I <sub>F</sub> = 20 A,<br>di <sub>F</sub> / dt = 200 A/μs | T <sub>C</sub> = 25°C  | -    | 36   | -    | ns |
|                 |                                |   | T <sub>C</sub> = 125°C | -    | 105  | -    |    |
| I <sub>rr</sub> | Diode Reverse Recovery Current | I <sub>F</sub> = 20 A,<br>di <sub>F</sub> / dt = 200 A/μs | T <sub>C</sub> = 25°C  | -    | 2.6  | -    | A  |
|                 |                                |   | T <sub>C</sub> = 125°C | -    | 7.8  | -    |    |
| Q <sub>rr</sub> | Diode Reverse Recovery Charge  | I <sub>F</sub> = 20 A,<br>di <sub>F</sub> / dt = 200 A/μs | T <sub>C</sub> = 25°C  | -    | 46.8 | -    | nC |
|                 |                                |   | T <sub>C</sub> = 125°C | -    | 409  | -    |    |

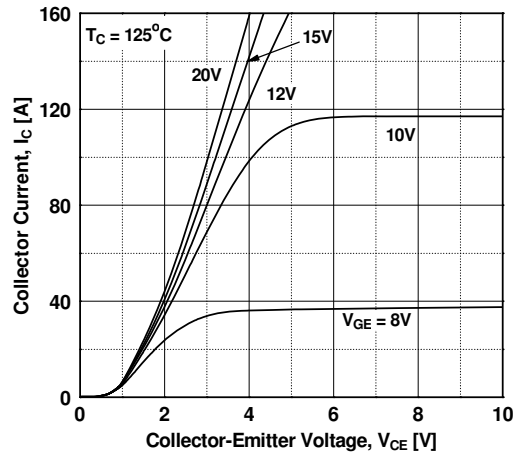


## Typical Performance Characteristics

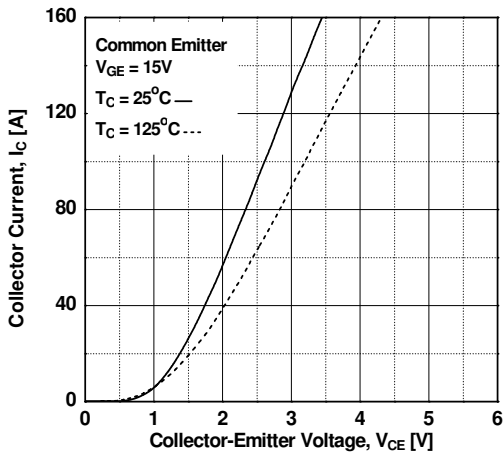
**Figure 1. Typical Output Characteristics**



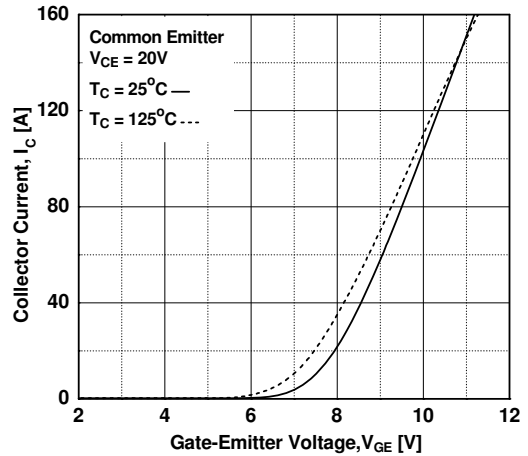
**Figure 2. Typical Saturation Voltage Characteristics**



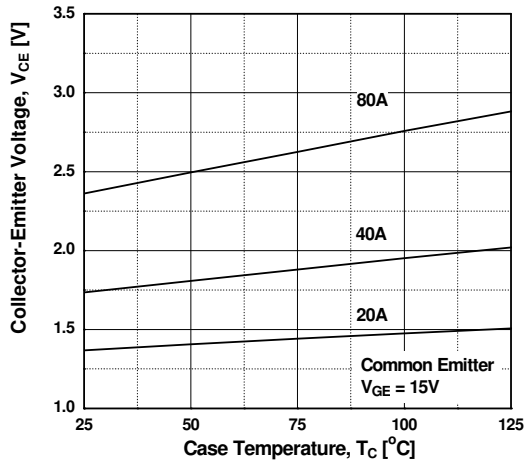
**Figure 3. Typical Saturation Voltage Characteristics**



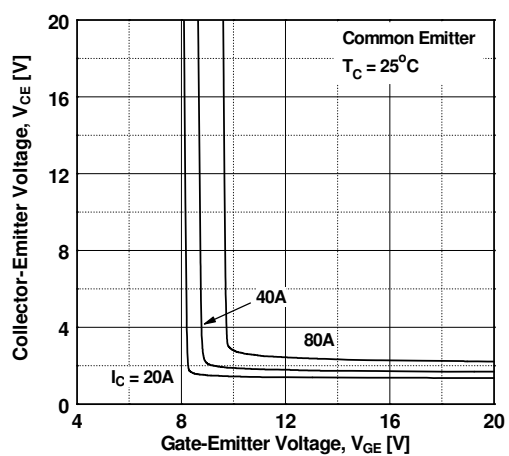
**Figure 4. Transfer Characteristics**



**Figure 5. Saturation Voltage vs. Case**

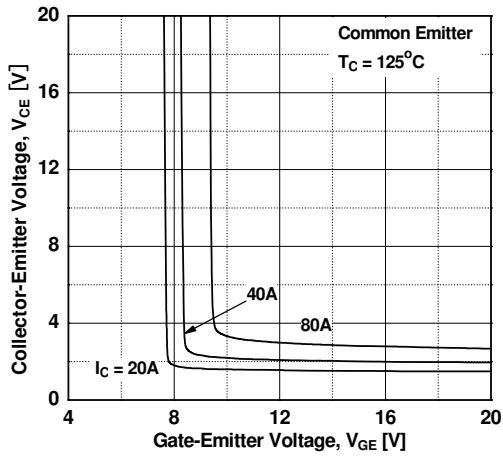


**Figure 6. Saturation Voltage vs. Vge**

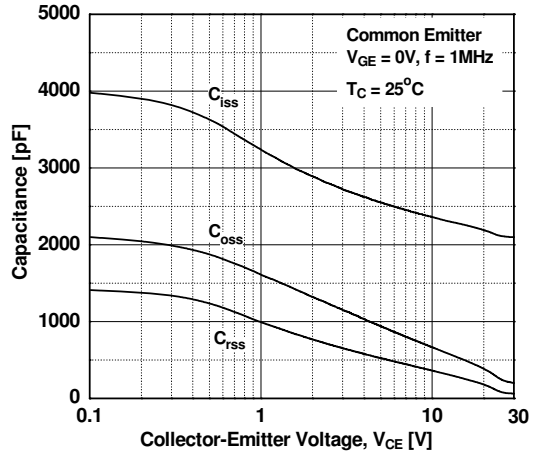


**Typical Performance Characteristics** (Continued)

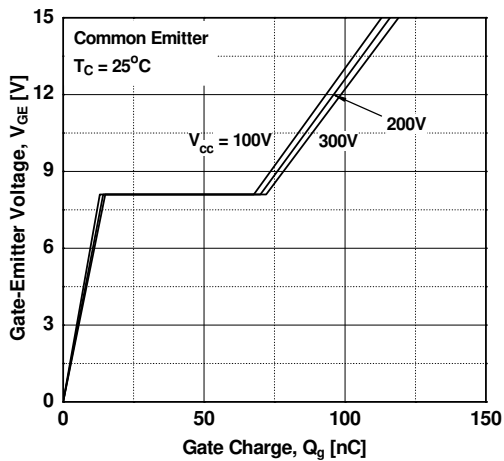
**Figure 7. Saturation Voltage vs. V<sub>GE</sub>**



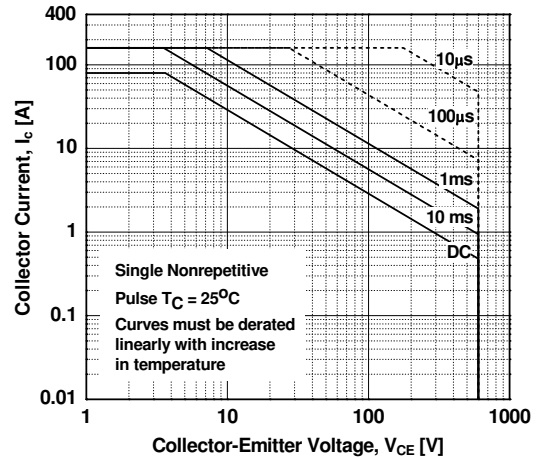
**Figure 8. Capacitance Characteristics**



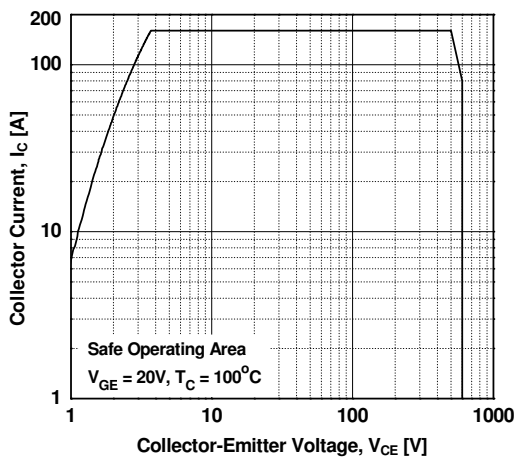
**Figure 9. Gate Charge Characteristics**



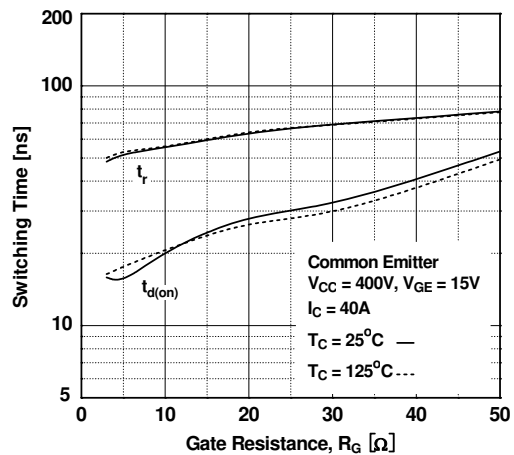
**Figure 10. SOA Characteristics**



**Figure 11. Turn-Off Switching SOA Characteristics**

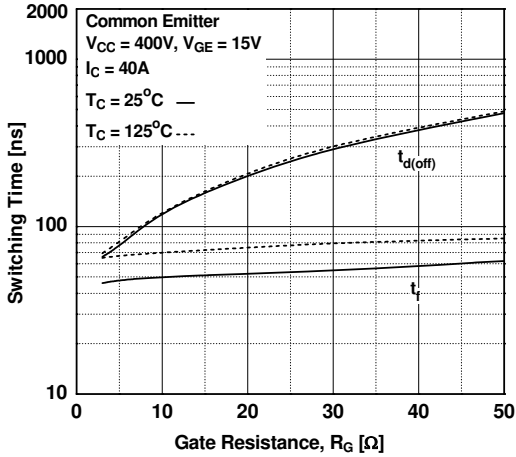


**Figure 12. Turn-On Characteristics vs. Gate Resistance**

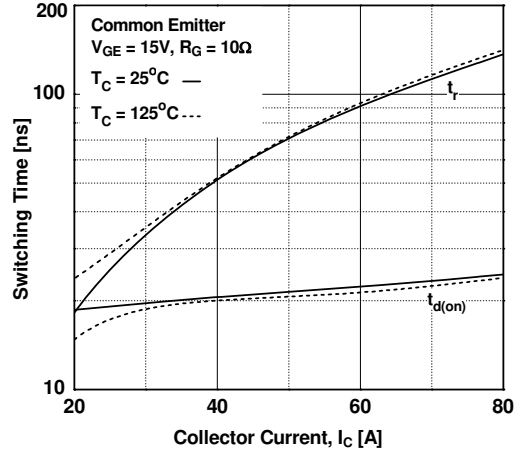


**Typical Performance Characteristics** (Continued)

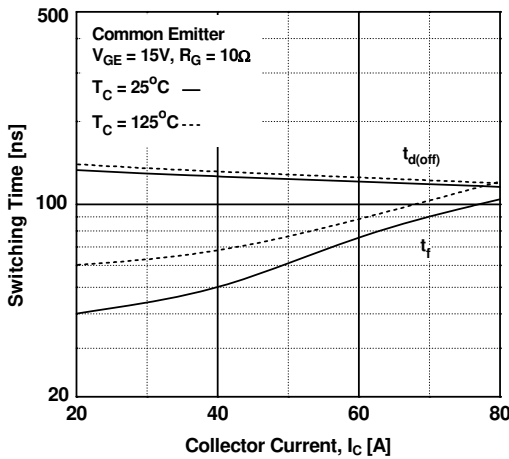
**Figure 13. Turn-Off Characteristics vs. Gate Resistance**



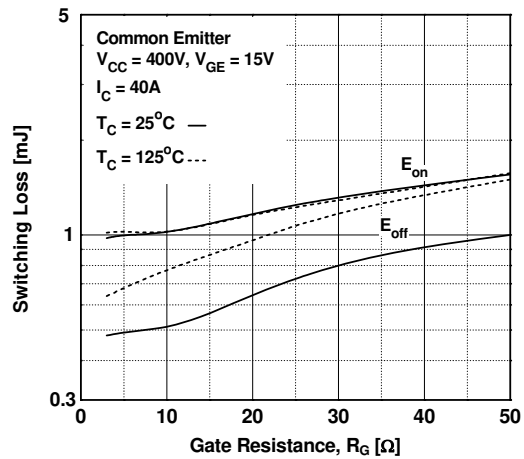
**Figure 14. Turn-On Characteristics vs. Collector Current**



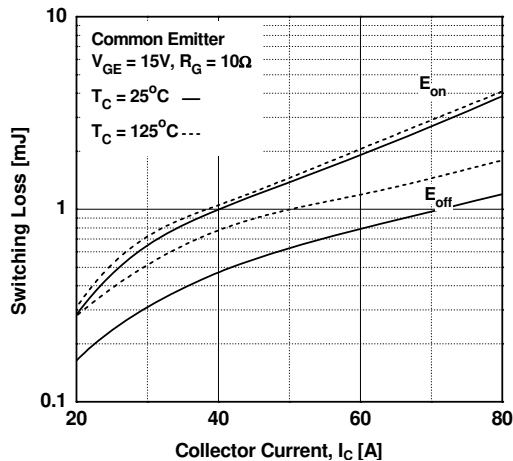
**Figure 15. Turn-Off Characteristics vs. Collector Current**



**Figure 16. Switching Loss vs Gate Resistance**



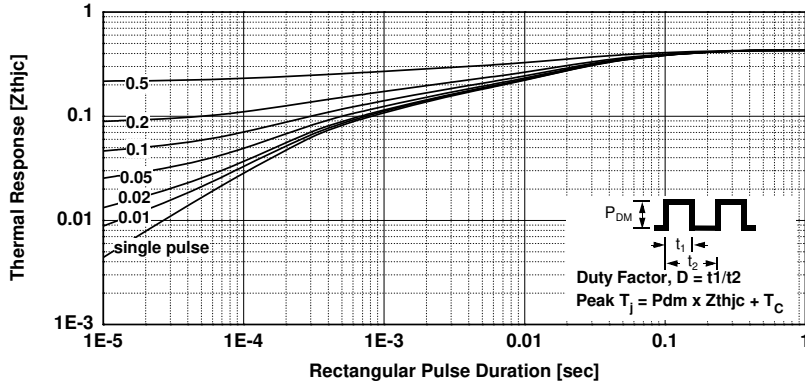
**Figure 17. Switching Loss vs Collector Current**



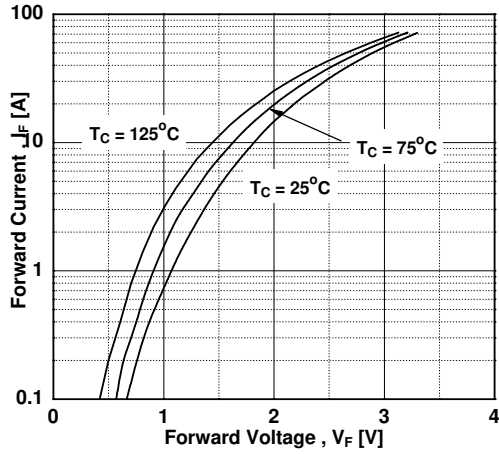


**Typical Performance Characteristics** (Continued)

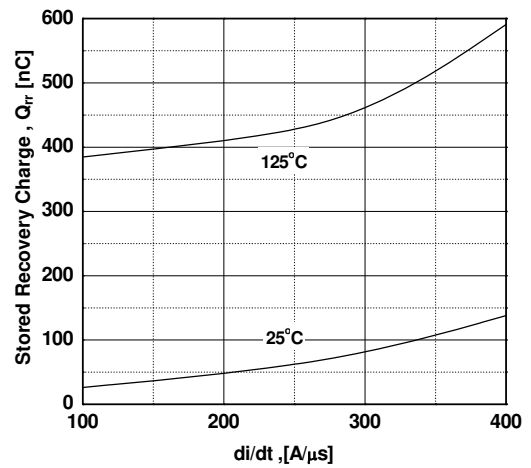
**Figure 18. Transient Thermal Impedance of IGBT**



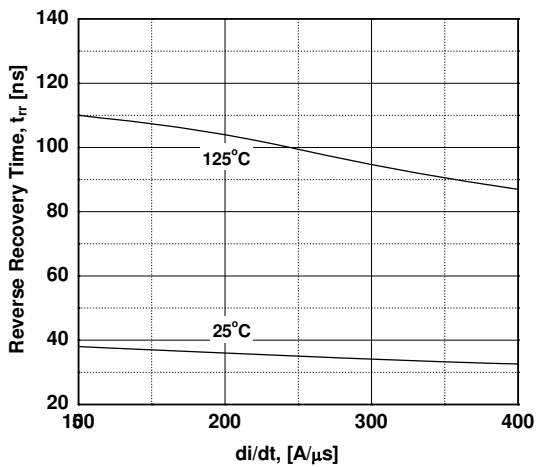
**Figure 19. Forward Characteristics**



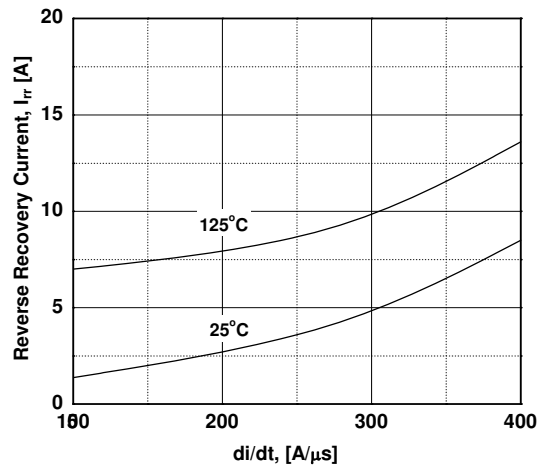
**Figure 20. Stored Charge**



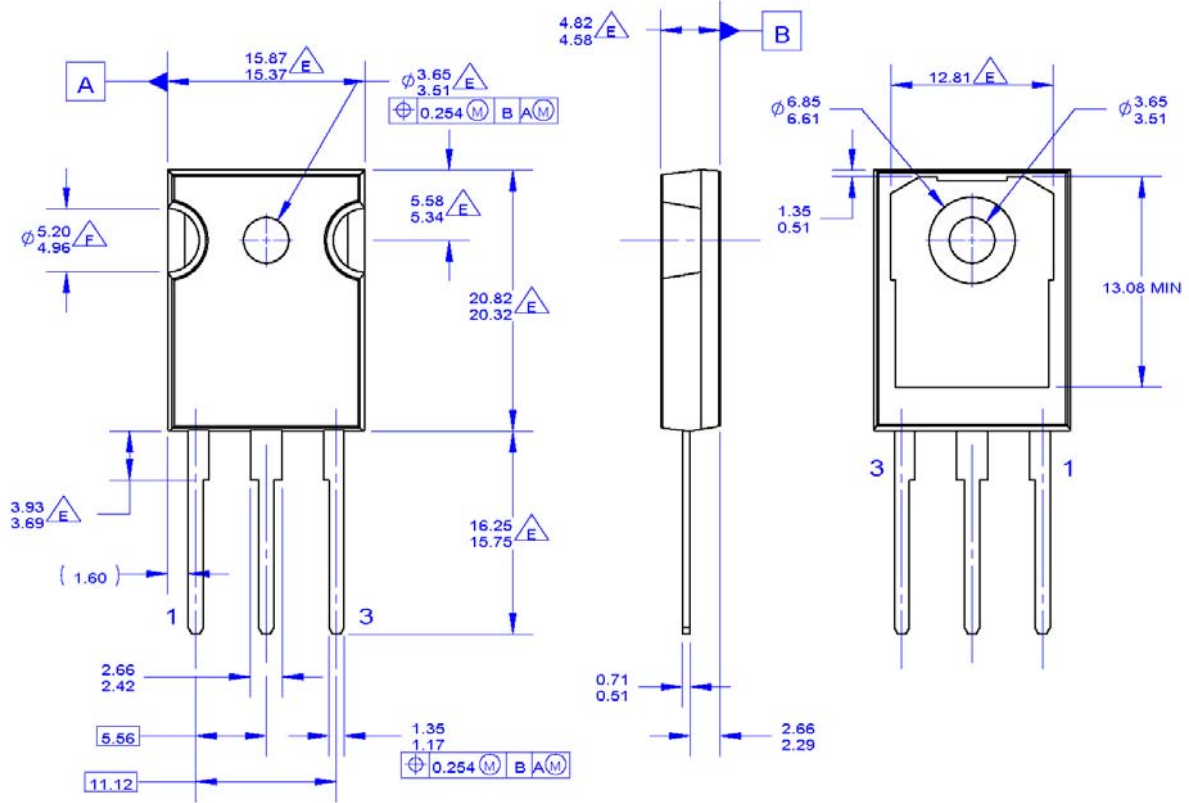
**Figure 21. Reverse Recovery Time**



**Figure 22. Reverse Recovery Current**



## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 1994

- $\triangle E$  DOES NOT COMPLY JEDEC STANDARD VALUE
- $\triangle F$  NOTCH MAY BE SQUARE
- G. DRAWING FILENAME: MKT-TO247A03\_REV03

**Figure 23. TO-247 3L - TO-247,MOLDED,3 LEAD,JEDEC VARIATION AB**

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