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# FGH40T120SMD / FGH40T120SMD\_F155

## 1200 V, 40 A FS Trench IGBT



### Features

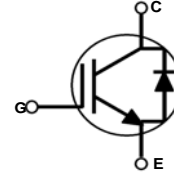
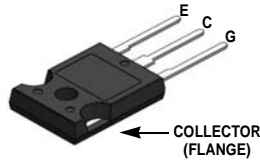
- FS Trench Technology, Positive Temperature Coefficient
- High Speed Switching
- Low Saturation Voltage:  $V_{CE(sat)} = 1.8 \text{ V @ } I_C = 40 \text{ A}$
- 100% of the Parts tested for  $I_{LM}(1)$
- High Input Impedance
- RoHS Compliant

### General Description

Using innovative field stop trench IGBT technology, Fairchild®'s new series of field stop trench IGBTs offer the optimum performance for hard switching application such as solar inverter, UPS, welder and PFC applications.

### Applications

- Solar Inverter, Welder, UPS & PFC applications.



### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol      | Description   | Ratings     | Unit             |
|-------------|---|-------------|------------------|
| $V_{CES}$   | Collector to Emitter Voltage  | 1200        | V                |
| $V_{GES}$   | Gate to Emitter Voltage   | $\pm 25$    | V                |
|             | Transient Gate to Emitter Voltage                                       | $\pm 30$    | V                |
| $I_C$       | Collector Current @ $T_C = 25^\circ\text{C}$                            | 80          | A                |
|             | Collector Current @ $T_C = 100^\circ\text{C}$                           | 40          | A                |
| $I_{LM}(1)$ | Clamped Inductive Load Current @ $T_C = 25^\circ\text{C}$               | 160         | A                |
| $I_{CM}(2)$ | Pulsed Collector Current  | 160         | A                |
| $I_F$       | Diode Continuous Forward Current @ $T_C = 25^\circ\text{C}$             | 80          | A                |
|             | Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$            | 40          | A                |
| $I_{FM}$    | Diode Maximum Forward Current   | 240         | A                |
| $P_D$       | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$                    | 555         | W                |
|             | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$                   | 277         | W                |
| $T_J$       | Operating Junction Temperature  | -55 to +175 | $^\circ\text{C}$ |
| $T_{stg}$   | Storage Temperature Range   | -55 to +175 | $^\circ\text{C}$ |
| $T_L$       | Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds | 300         | $^\circ\text{C}$ |

### Thermal Characteristics

| Symbol                        | Parameter                               | Typ. | Max. | Unit                      |
|-------------------------------|---|------|------|---------------------------|
| $R_{\theta JC}(IGBT)$         | Thermal Resistance, Junction to Case    | --   | 0.27 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JC}(\text{Diode})$ | Thermal Resistance, Junction to Case    | --   | 0.89 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$               | Thermal Resistance, Junction to Ambient | --   | 40   | $^\circ\text{C}/\text{W}$ |

**Notes:**

1.  $V_{CC} = 600 \text{ V}, V_{GE} = 15 \text{ V}, I_C = 160 \text{ A}, R_G = 10 \Omega$ . Inductive Load
2. Limited by  $T_{jmax}$

### Package Marking and Ordering Information

| Device Marking | Device            | Package    | Reel Size | Tape Width | Quantity |
|----------------|-------------------|------------|-----------|------------|----------|
| FGH40T120SMD   | FGH40T120SMD      | TO-247 A03 | -         | -          | 30       |
| FGH40T120SMD   | FGH40T120SMD_F155 | TO-247G03  | -         | -          | 30       |

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

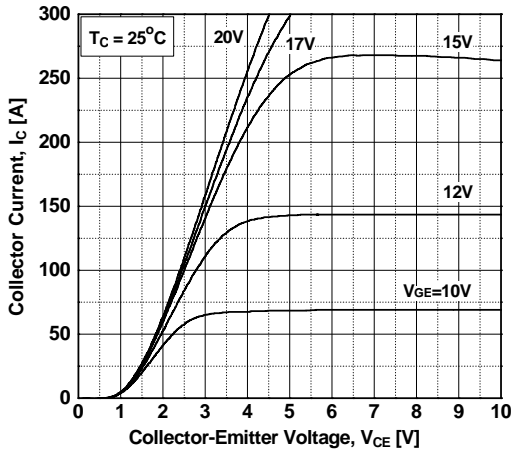
| Symbol                           | Parameter                               | Test Conditions   | Min. | Typ. | Max.      | Unit          |
|----------------------------------|---|---|------|------|-----------|---------------|
| <b>Off Characteristics</b>       |   |   |      |      |           |               |
| $V_{CES}$                        | Collector to Emitter Breakdown Voltage  | $V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$   | 1200 | -    | -         | V             |
| $I_{CES}$                        | 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                   | $I_C = 40\text{ mA}, V_{CE} = V_{GE}$   | 4.9  | 6.2  | 7.5       | V             |
| $V_{CE(sat)}$                    | Collector to Emitter Saturation Voltage | $I_C = 40\text{ A}, V_{GE} = 15\text{ V}$<br>$T_C = 25^\circ\text{C}$   | -    | 1.8  | 2.4       | V             |
|                                  |   | $I_C = 40\text{ A}, V_{GE} = 15\text{ V},$<br>$T_C = 175^\circ\text{C}$   | -    | 2.0  | -         | V             |
| <b>Dynamic Characteristics</b>   |   |   |      |      |           |               |
| $C_{ies}$                        | Input Capacitance                       | $V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V},$<br>$f = 1\text{ MHz}$  | -    | 4300 | -         | pF            |
| $C_{oes}$                        | Output Capacitance                      |   | -    | 180  | -         | pF            |
| $C_{res}$                        | Reverse Transfer Capacitance            |   | -    | 100  | -         | pF            |
| <b>Switching Characteristics</b> |   |   |      |      |           |               |
| $t_{d(on)}$                      | Turn-On Delay Time                      | $V_{CC} = 600\text{ V}, I_C = 40\text{ A},$<br>$R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V},$<br>Inductive Load, $T_C = 25^\circ\text{C}$  | -    | 40   | -         | ns            |
| $t_r$                            | Rise Time                               |   | -    | 47   | -         | ns            |
| $t_{d(off)}$                     | Turn-Off Delay Time                     |   | -    | 475  | -         | ns            |
| $t_f$                            | Fall Time                               |   | -    | 10   | -         | ns            |
| $E_{on}$                         | Turn-On Switching Loss                  |   | -    | 2.7  | -         | mJ            |
| $E_{off}$                        | Turn-Off Switching Loss                 |   | -    | 1.1  | -         | mJ            |
| $E_{ts}$                         | Total Switching Loss                    | -   | 3.8  | -    | mJ        |               |
| $t_{d(on)}$                      | Turn-On Delay Time                      | $V_{CC} = 600\text{ V}, I_C = 40\text{ A},$<br>$R_G = 10\text{ }\Omega, V_{GE} = 15\text{ V},$<br>Inductive Load, $T_C = 175^\circ\text{C}$ | -    | 40   | -         | ns            |
| $t_r$                            | Rise Time                               |   | -    | 55   | -         | ns            |
| $t_{d(off)}$                     | Turn-Off Delay Time                     |   | -    | 520  | -         | ns            |
| $t_f$                            | Fall Time                               |   | -    | 50   | -         | ns            |
| $E_{on}$                         | Turn-On Switching Loss                  |   | -    | 3.4  | -         | mJ            |
| $E_{off}$                        | Turn-Off Switching Loss                 |   | -    | 2.5  | -         | mJ            |
| $E_{ts}$                         | Total Switching Loss                    | -   | 5.9  | -    | mJ        |               |
| $Q_g$                            | Total Gate Charge                       | $V_{CE} = 600\text{ V}, I_C = 40\text{ A},$<br>$V_{GE} = 15\text{ V}$   | -    | 370  | -         | nC            |
| $Q_{ge}$                         | Gate to Emitter Charge                  |   | -    | 23   | -         | nC            |
| $Q_{gc}$                         | Gate to Collector Charge                |   | -    | 210  | -         | nC            |

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

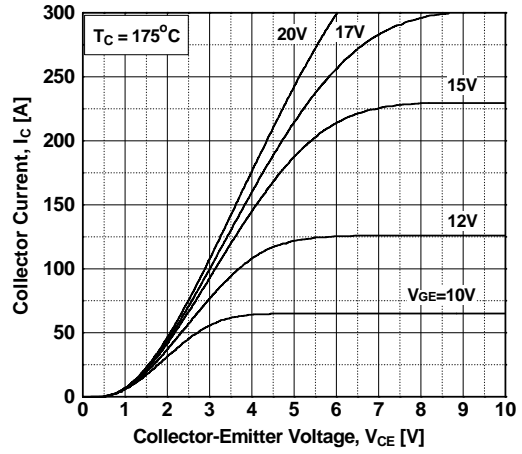
| Symbol   | Parameter                           | Test Conditions  | Min. | Typ. | Max. | Unit |
|----------|-------------------------------------|--|------|------|------|------|
| $V_{FM}$ | Diode Forward Voltage               | $I_F = 40\text{ A}, T_C = 25^\circ\text{C}$  | -    | 3.8  | 4.8  | V    |
|          |                                     | $I_F = 40\text{ A}, T_C = 175^\circ\text{C}$   | -    | 2.7  | -    | V    |
| $t_{rr}$ | Diode Reverse Recovery Time         | $V_R = 600\text{ V}, I_F = 40\text{ A},$<br>$di_F/dt = 200\text{ A/us}, T_C = 25^\circ\text{C}$  | -    | 65   | -    | ns   |
| $I_{rr}$ | Diode Peak Reverse Recovery Current |  | -    | 7.2  | -    | A    |
| $Q_{rr}$ | Diode Reverse Recovery Charge       |  | -    | 234  | -    | nC   |
| $t_{rr}$ | Diode Reverse Recovery Time         | $V_R = 600\text{ V}, I_F = 40\text{ A},$<br>$di_F/dt = 200\text{ A/us}, T_C = 175^\circ\text{C}$ | -    | 200  | -    | ns   |
| $I_{rr}$ | Diode Peak Reverse Recovery Current |  | -    | 18.0 | -    | A    |
| $Q_{rr}$ | Diode Reverse Recovery Charge       |  | -    | 1800 | -    | nC   |

## Typical Performance Characteristics

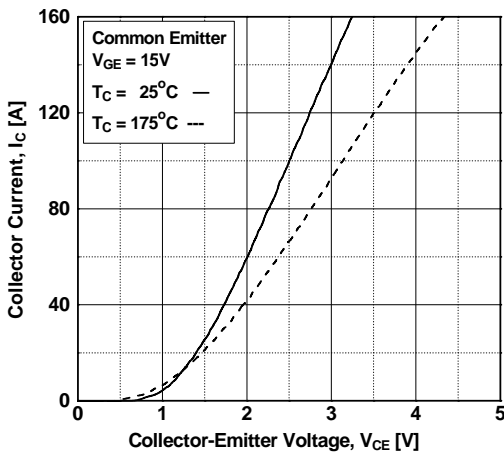
**Figure 1. Typical Output Characteristics**



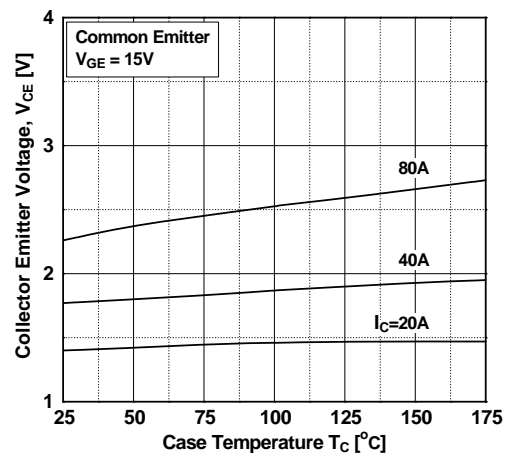
**Figure 2. Typical Output Characteristics**



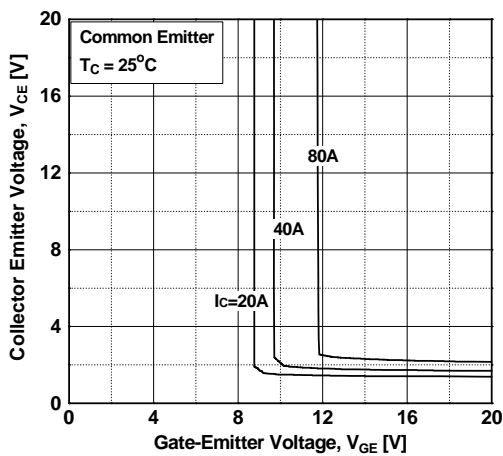
**Figure 3. Typical Saturation Voltage Characteristics**



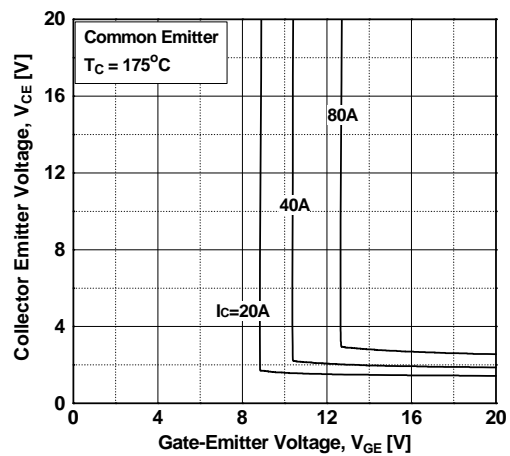
**Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level**



**Figure 5. Saturation Voltage vs. Vge**



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



## Typical Performance Characteristics

Figure 7. Capacitance Characteristics

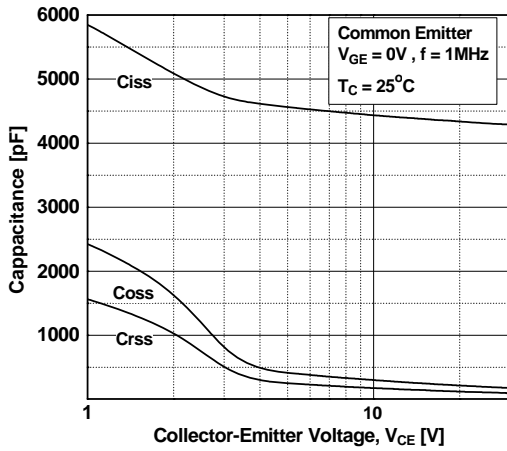


Figure 8. Load Current vs. Frequency

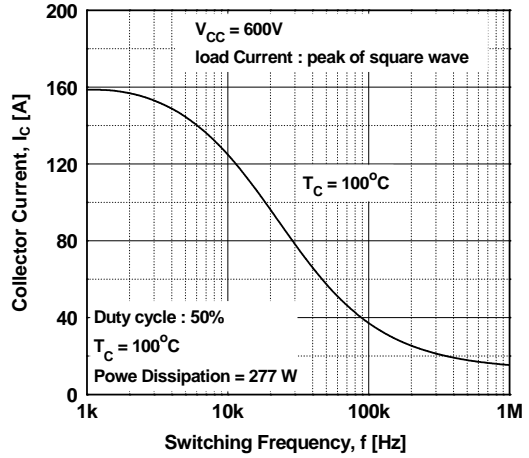


Figure 9. Turn-on Characteristics vs. Gate Resistance

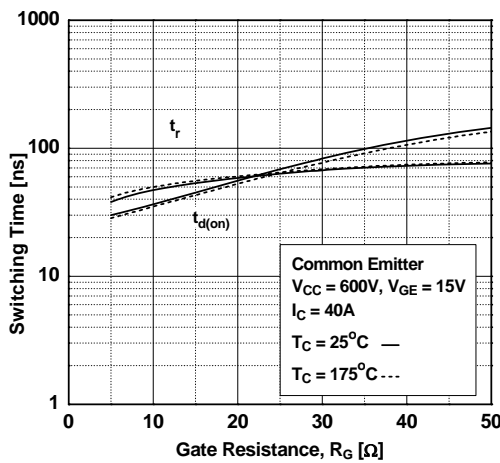


Figure 10. Turn-off Characteristics vs. Gate Resistance

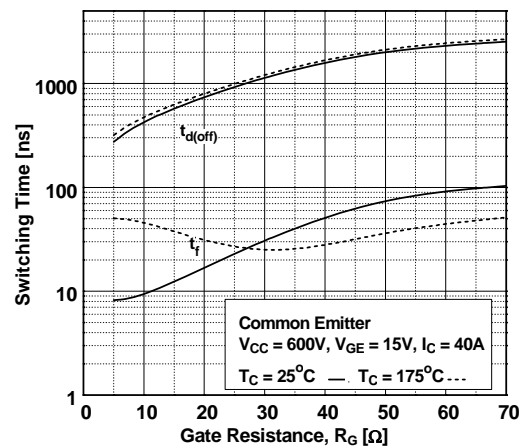


Figure 11. Switching Loss vs. Gate Resistance

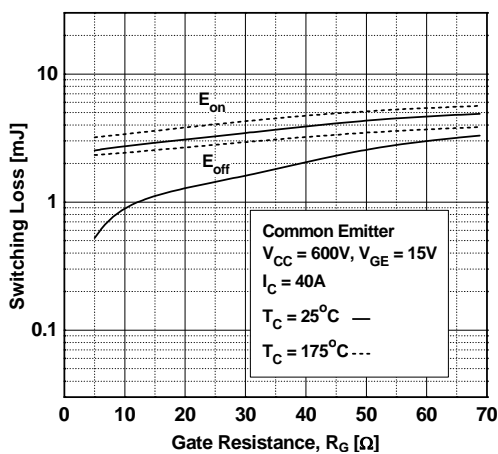
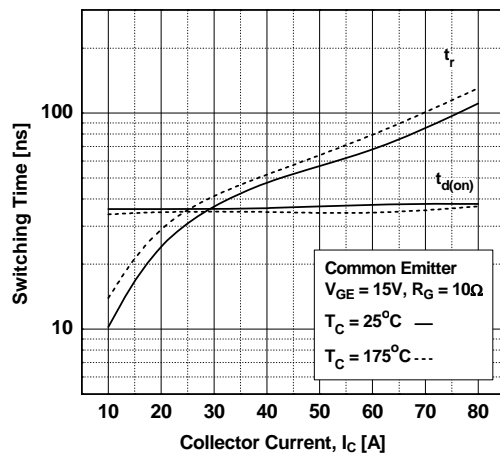


Figure 12. Turn-on Characteristics vs. Collector Current



## Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

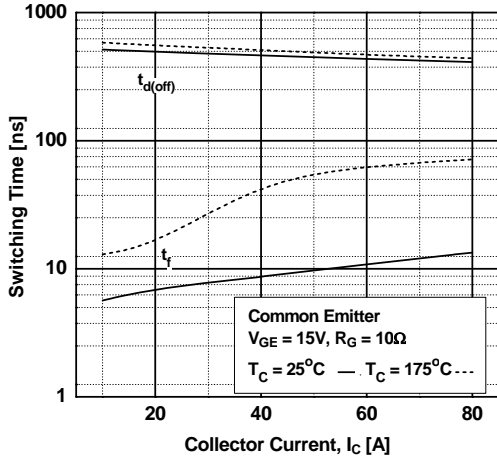


Figure 15. Gate Charge Characteristics

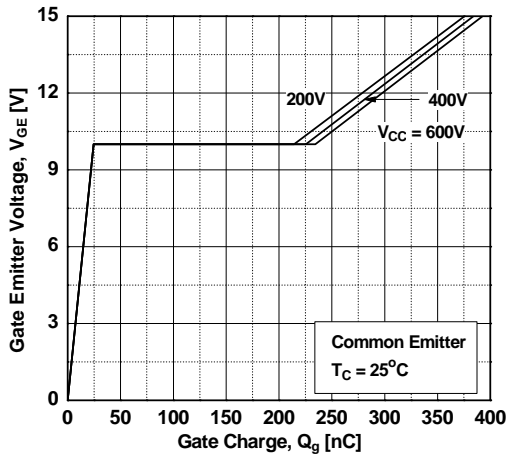


Figure 17. Forward Characteristics

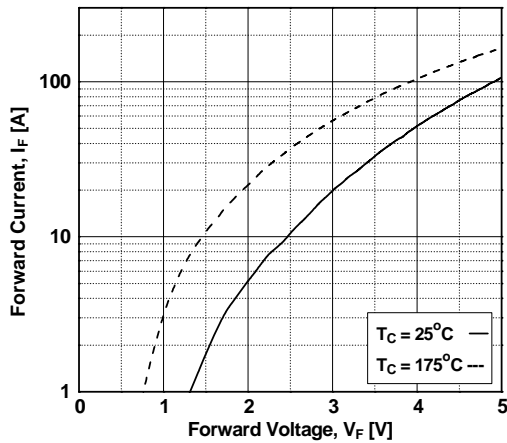


Figure 14. Switching Loss vs. Collector Current

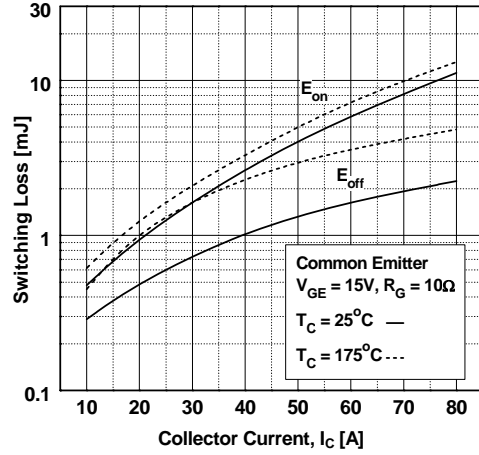


Figure 16. SOA Characteristics

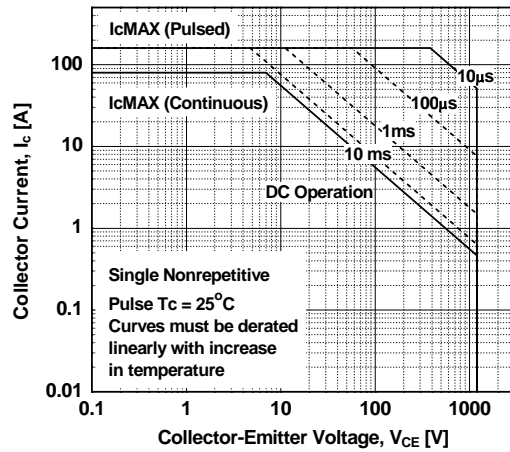
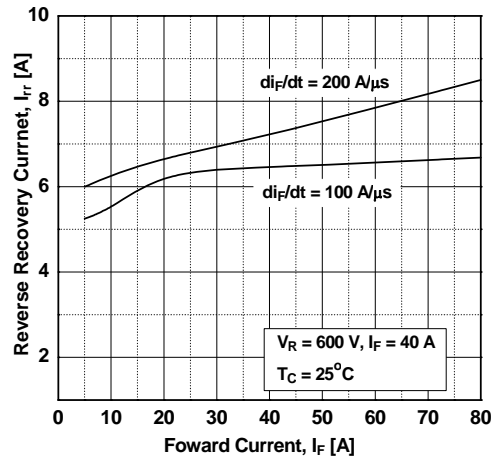


Figure 18. Reverse Recovery Current



## Typical Performance Characteristics

Figure 19. Reverse Recovery Time

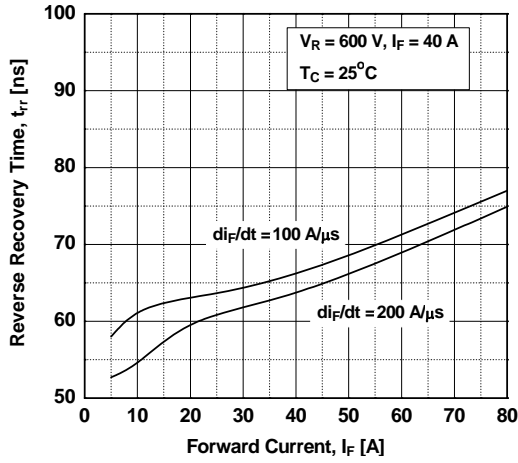


Figure 20. Stored Charge

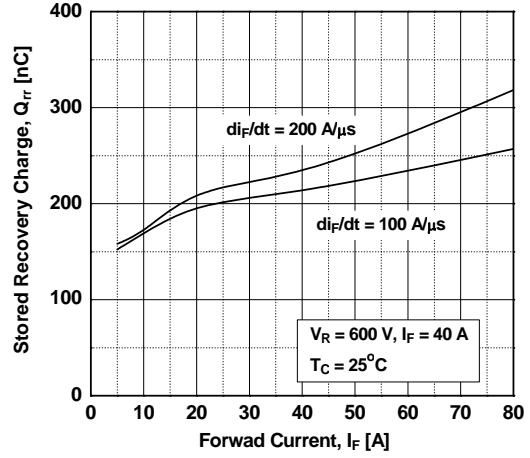
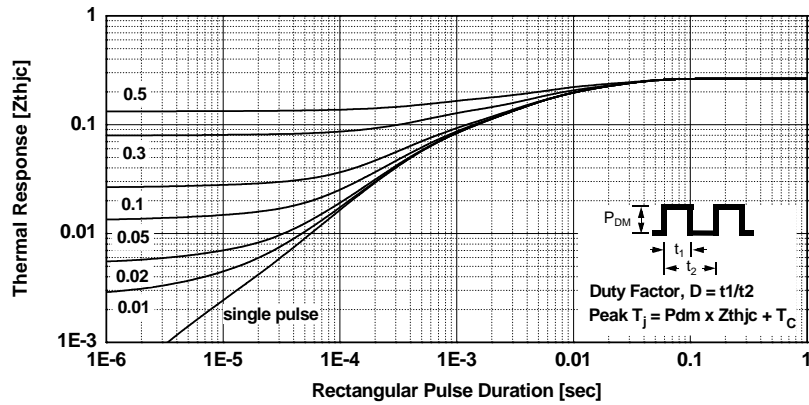


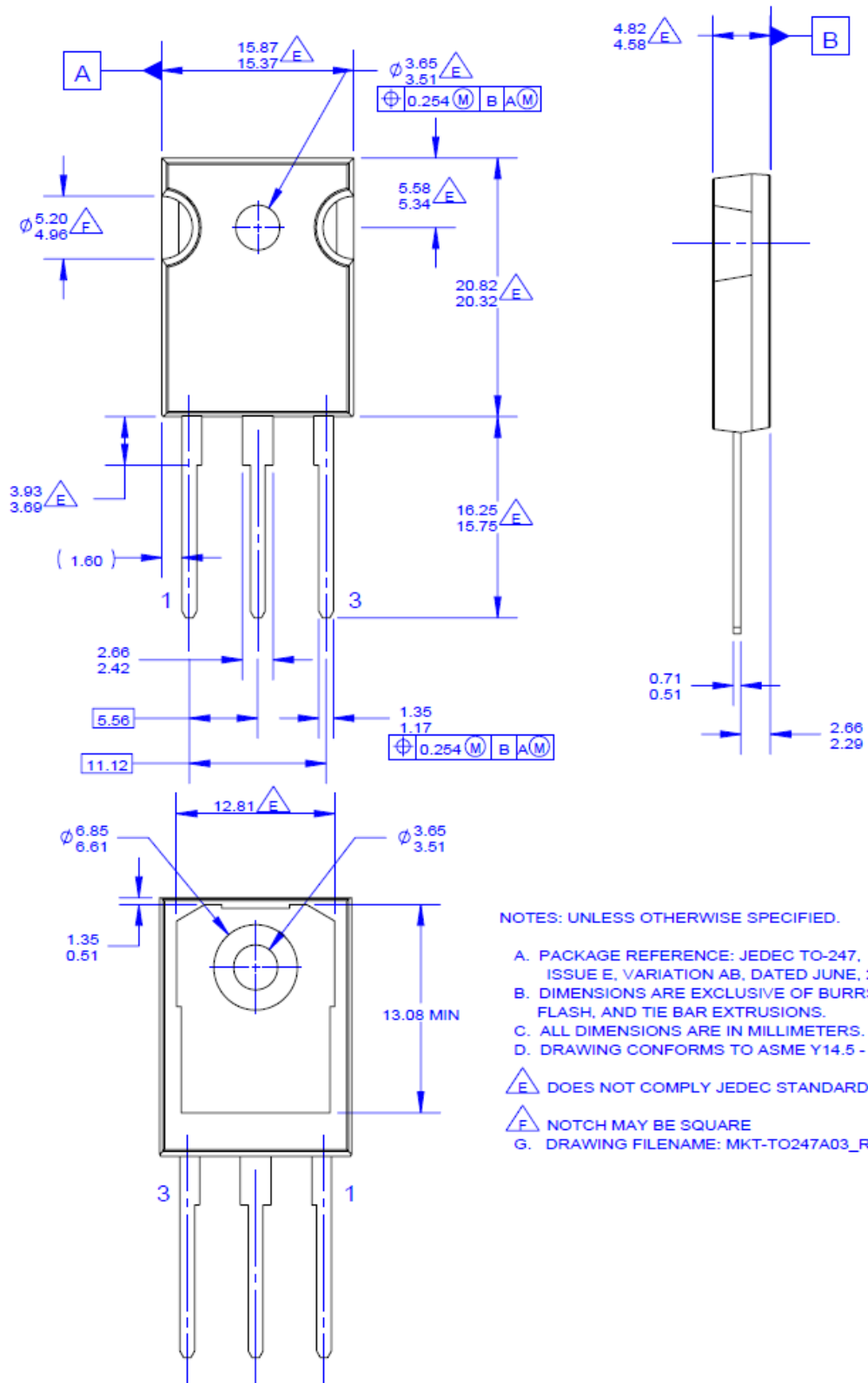
Figure 21. Transient Thermal Impedance of IGBT





Mechanical Dimensions

TO - 247A03

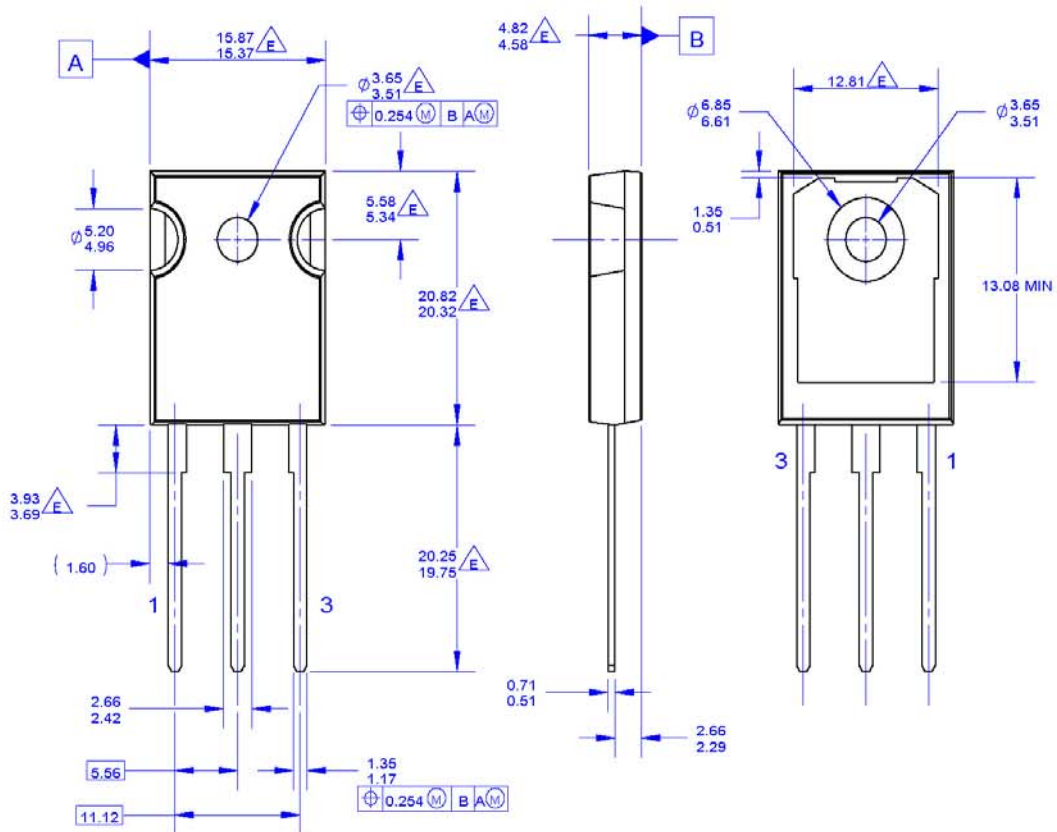


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# Mechanical Dimensions

## TO-247G03



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