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# FGL60N100BNTD

## 1000 V, 60 A NPT Trench IGBT

### Features

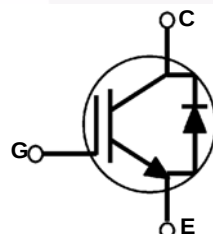
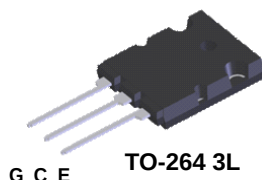
- High Speed Switching
- Low Saturation Voltage:  $V_{CE(sat)} = 2.5 \text{ V @ } I_C = 60 \text{ A}$
- High Input Impedance
- Built-in Fast Recovery Diode

### Applications

- UPS, Welder

### General Description

Using Fairchild's proprietary trench design and advanced NPT technology, the 1000V NPT IGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation. This device offers the optimum performance for hard switching application such as UPS, welder applications.



### Absolute Maximum Ratings

| Symbol       | Description                                                             | Ratings     | Unit             |
|--------------|-------------------------------------------------------------------------|-------------|------------------|
| $V_{CES}$    | Collector to Emitter Voltage                                            | 1000        | V                |
| $V_{GES}$    | Gate to Emitter Voltage                                                 | $\pm 25$    | V                |
| $I_C$        | Collector Current @ $T_C = 25^\circ\text{C}$                            | 60          | A                |
|              | Collector Current @ $T_C = 100^\circ\text{C}$                           | 42          | A                |
| $I_{CM} (1)$ | Pulsed Collector Current @ $T_C = 25^\circ\text{C}$                     | 200         | A                |
| $I_F$        | Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$            | 15          | A                |
| $P_D$        | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$                    | 180         | W                |
|              | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$                   | 72          | 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                               | Ratings | Unit               |
|-------------------------------|-----------------------------------------|---------|--------------------|
| $R_{\theta JC}(\text{IGBT})$  | Thermal Resistance, Junction to Case    | 0.69    | $^\circ\text{C/W}$ |
| $R_{\theta JC}(\text{Diode})$ | Thermal Resistance, Junction to Case    | 2.08    | $^\circ\text{C/W}$ |
| $R_{\theta JA}$               | Thermal Resistance, Junction to Ambient | 25      | $^\circ\text{C/W}$ |

## Package Marking and Ordering Information

| Part Number   | Top Mark      | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---------------|---------------|---------|----------------|-----------|------------|----------|
| FGL60N100BNTD | FGL60N100BNTD | TO-264  | Tube           | N/A       | N/A        | 30       |

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

| Symbol                    | Parameter                               | Test Conditions                                                                                                                            | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics       |                                         |                                                                                                                                            |      |      |      |      |
| BV <sub>CES</sub>         | Collector to Emitter Breakdown Voltage  | V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA                                                                                               | 1000 | -    | -    | V    |
| I <sub>CES</sub>          | Collector Cut-Off Current               | V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0 V                                                                                 | -    | -    | 1    | mA   |
| I <sub>GES</sub>          | G-E Leakage Current                     | V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0 V                                                                                 | -    | -    | ±500 | nA   |
| On Characteristics        |                                         |                                                                                                                                            |      |      |      |      |
| V <sub>GE(th)</sub>       | G-E Threshold Voltage                   | I <sub>C</sub> = 60 mA, V <sub>CE</sub> = V <sub>GE</sub>                                                                                  | 4.0  | 5.0  | 7.0  | V    |
| V <sub>CE(sat)</sub>      | Collector to Emitter Saturation Voltage | I <sub>C</sub> = 10 A, V <sub>GE</sub> = 15 V                                                                                              | -    | 1.5  | 1.8  | V    |
|                           |                                         | I <sub>C</sub> = 60 A, V <sub>GE</sub> = 15 V,                                                                                             | -    | 2.5  | 2.9  | V    |
| Dynamic Characteristics   |                                         |                                                                                                                                            |      |      |      |      |
| C <sub>ies</sub>          | Input Capacitance                       | V <sub>CE</sub> = 10 V, V <sub>GE</sub> = 0 V,<br>f = 1MHz                                                                                 | -    | 6000 | -    | pF   |
| C <sub>oes</sub>          | Output Capacitance                      |                                                                                                                                            | -    | 260  | -    | pF   |
| C <sub>res</sub>          | Reverse Transfer Capacitance            |                                                                                                                                            | -    | 200  | -    | pF   |
| Switching Characteristics |                                         |                                                                                                                                            |      |      |      |      |
| t <sub>d(on)</sub>        | Turn-On Delay Time                      | V <sub>CC</sub> = 600 V, I <sub>C</sub> = 60 A,<br>R <sub>G</sub> = 51 Ω, V <sub>GE</sub> = 15 V,<br>Inductive Load, T <sub>C</sub> = 25°C | -    | 140  | -    | ns   |
| t <sub>r</sub>            | Rise Time                               |                                                                                                                                            | -    | 320  | -    | ns   |
| t <sub>d(off)</sub>       | Turn-Off Delay Time                     |                                                                                                                                            | -    | 630  | -    | ns   |
| t <sub>f</sub>            | Fall Time                               |                                                                                                                                            | -    | 130  | -    | ns   |
| Q <sub>g</sub>            | Total Gate Charge                       | V <sub>CE</sub> = 600 V, I <sub>C</sub> = 60 A,<br>V <sub>GE</sub> = 15 V, T <sub>C</sub> = 25°C                                           | -    | 275  | -    | nC   |
| Q <sub>ge</sub>           | Gate to Emitter Charge                  |                                                                                                                                            | -    | 45   | -    | nC   |
| Q <sub>gc</sub>           | Gate to Collector Charge                |                                                                                                                                            | -    | 95   | -    | 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> = 15 A                  | -    | 1.2  | 1.7 | V    |
|                 |                             | I <sub>F</sub> = 60 A                  | -    | 1.8  | 2.1 | V    |
| t <sub>rr</sub> | Diode Reverse Recovery Time | I <sub>F</sub> = 60 A, di/dt = 20 A/us | -    | 1.2  | 1.5 | us   |
| I <sub>R</sub>  | Instantaneous               | V <sub>RRM</sub> = 1000 V              | -    | 0.05 | 2.0 | uA   |

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

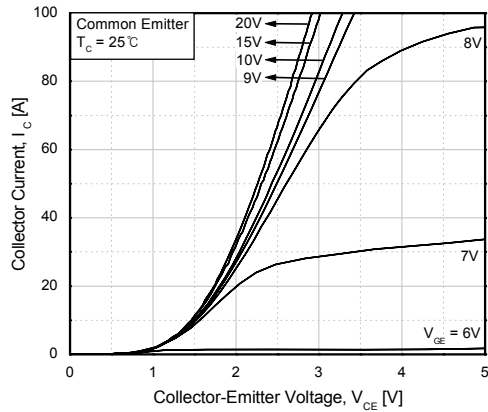


Figure 2. Typical Saturation Voltage Characteristics

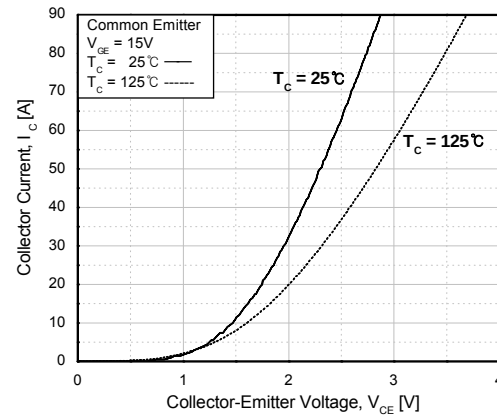


Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level

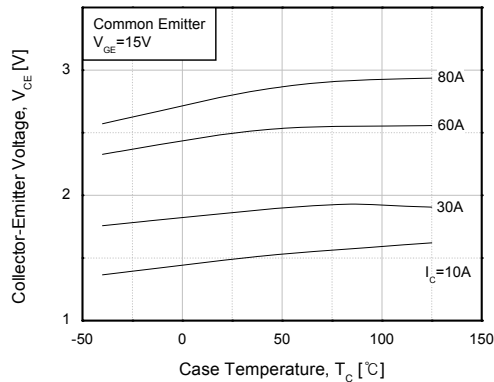


Figure 4. Saturation Voltage vs. V\_GE

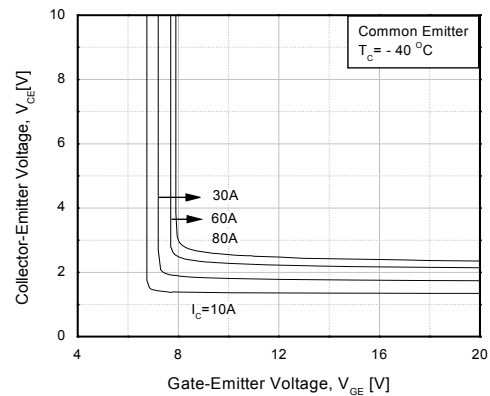


Figure 5. Saturation Voltage vs. V\_GE

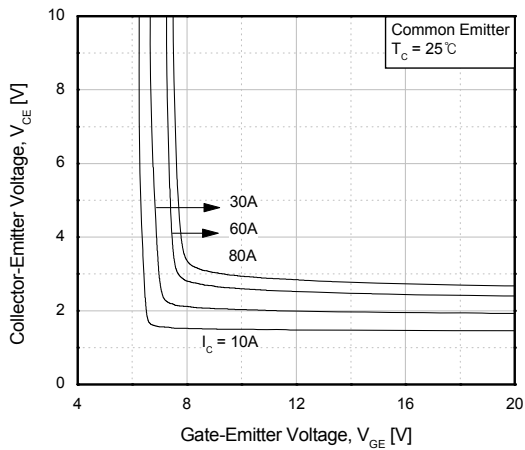
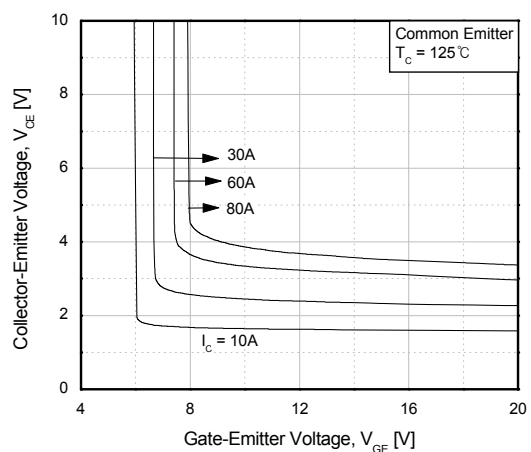


Figure 6. Saturation Voltage vs. V\_GE



## Typical Performance Characteristics

Figure 7. Capacitance Characteristics

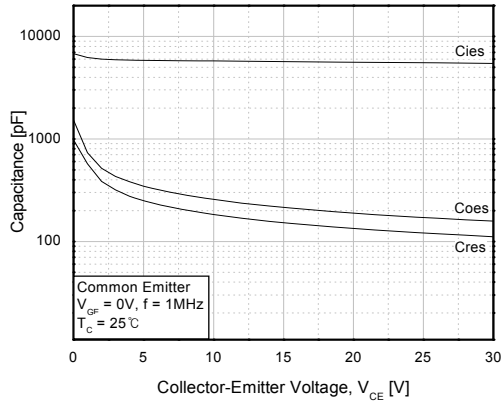


Figure 8. Switching Loss vs. Gate Resistance

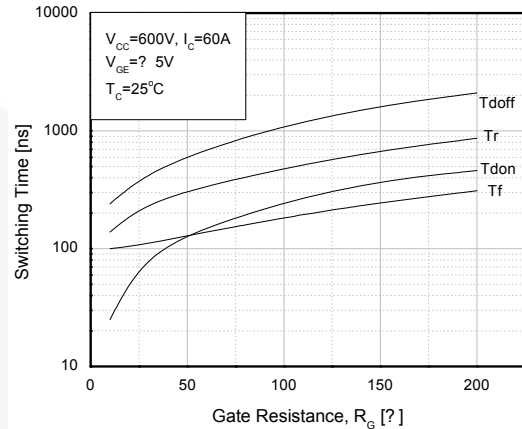


Figure 9. Switching Characteristics vs. Collector Current

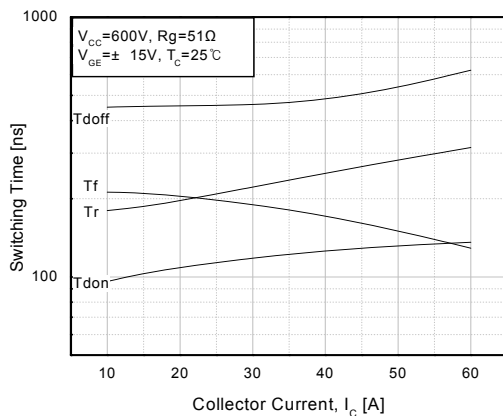


Figure 10. Gate Charge Characteristics

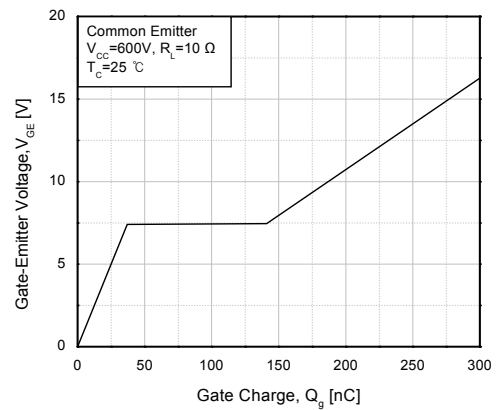


Figure 11. SOA Characteristics

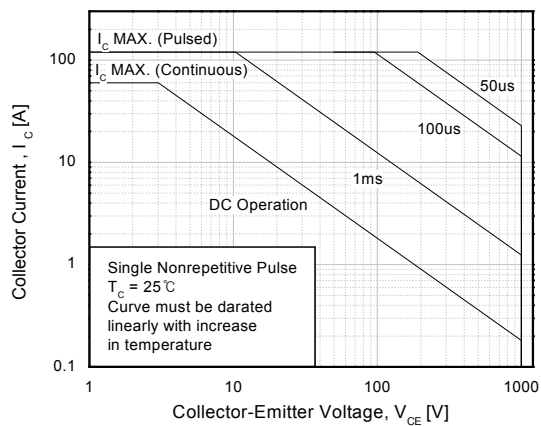
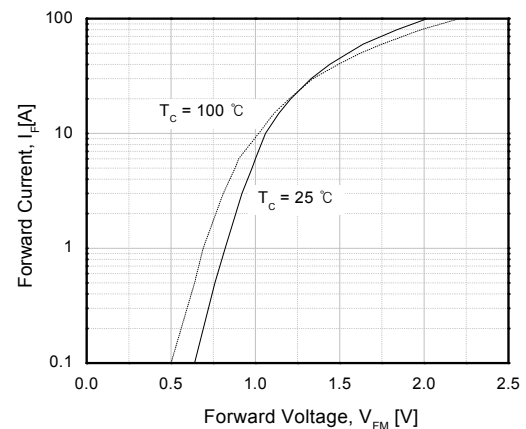


Figure 12. Forward Characteristics



## Typical Performance Characteristics

Figure 13. Reverse Recovery Characteristics vs.  $di/dt$

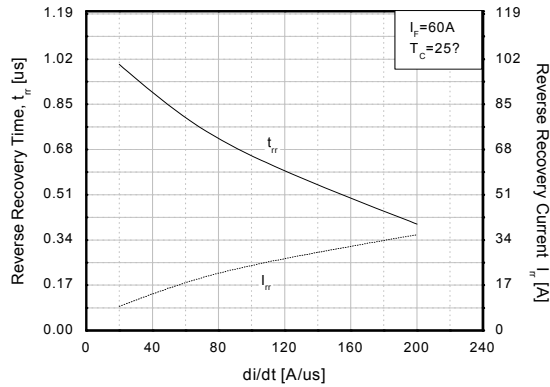


Figure 14. Reverse Recovery Characteristics vs. Forward Current

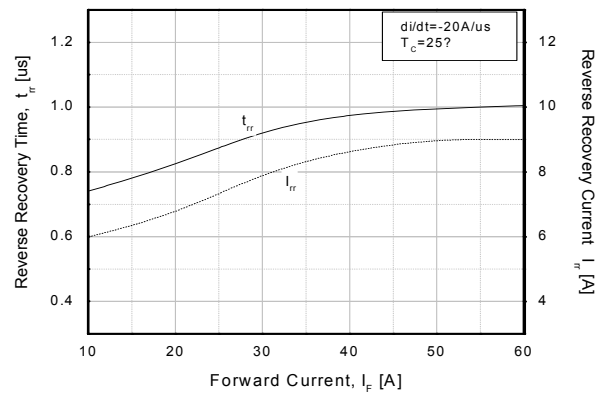


Figure 15. Reverse Current vs. Reverse Voltage

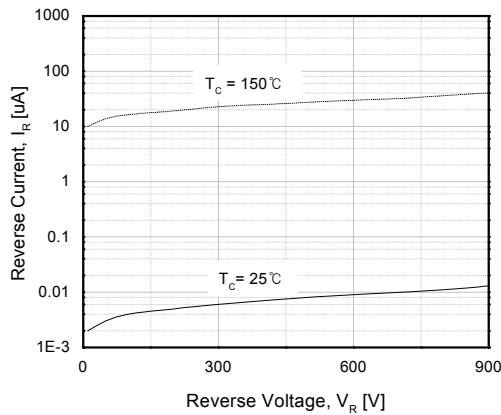


Figure 16. Junction Capacitance

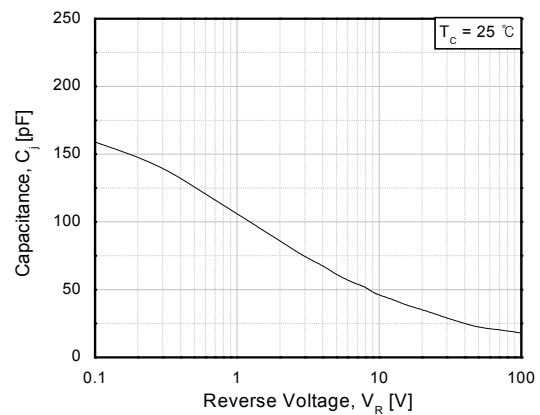
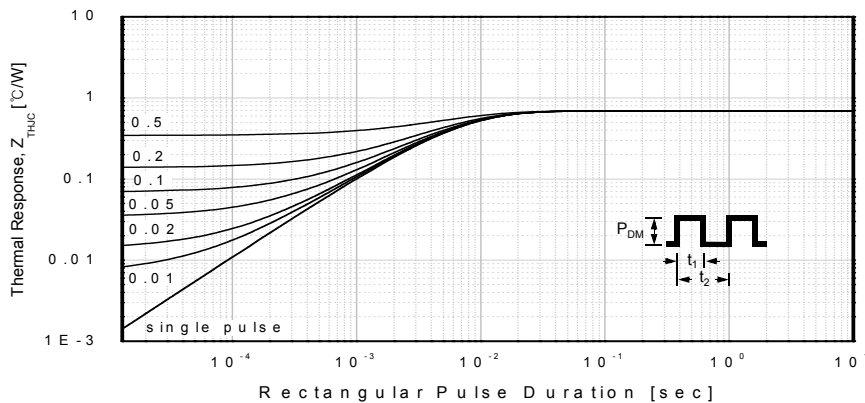
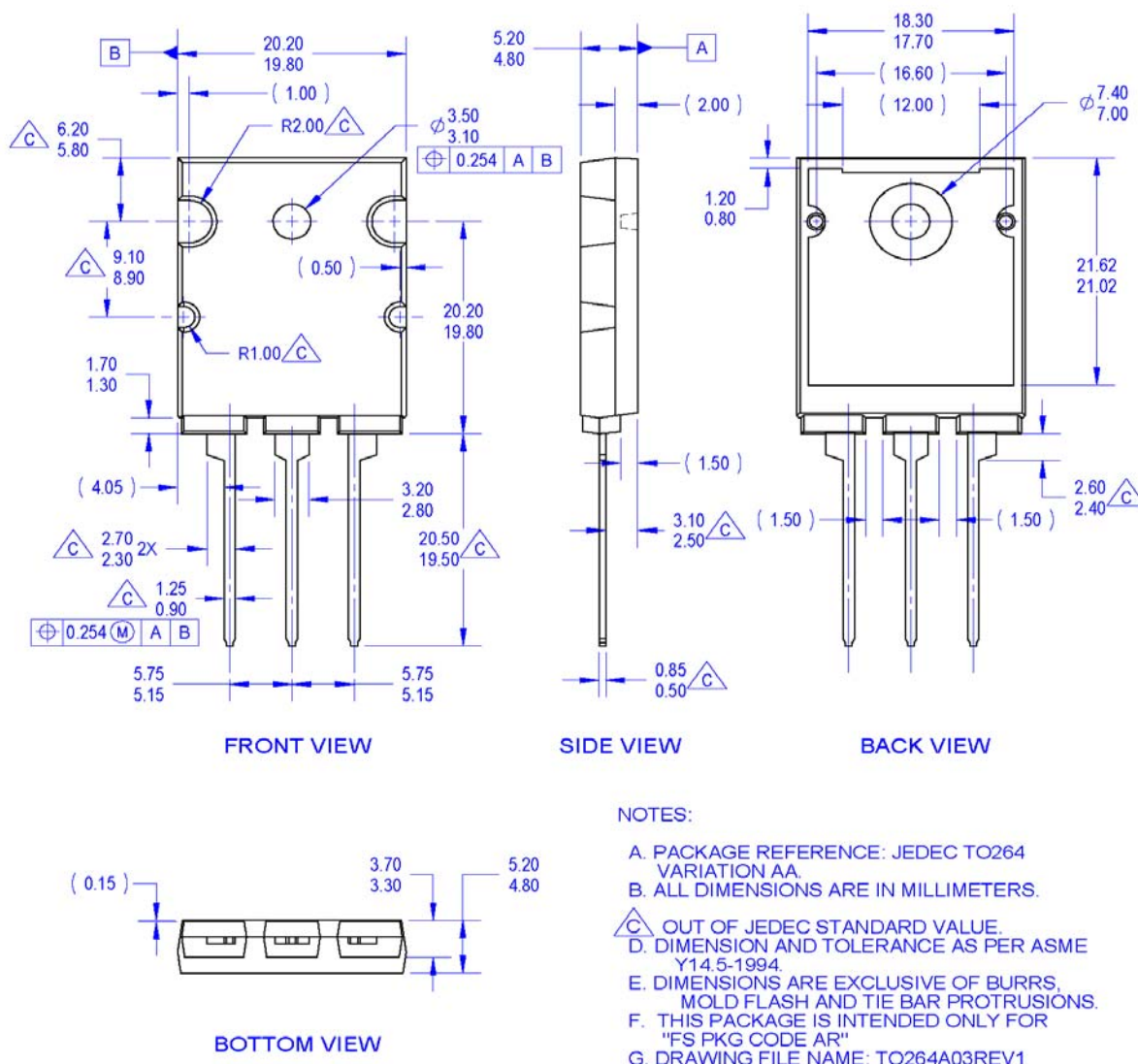


Figure 17. Transient Thermal Impedance of IGBT



## Mechanical Dimensions



**Figure 18. TO-264 3L - 3LD; TO264; MOLDED; JEDEC VARIATION AA**

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