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December 2014

FGL12040WD

1200 V, 40 A Field Stop Trench IGBT

Features

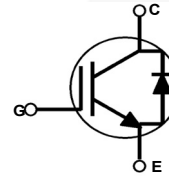
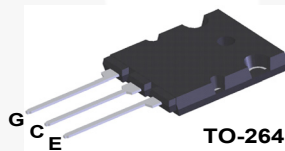
- Maximum Junction Temperature : $T_J = 150^\circ\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- Low Saturation Voltage: $V_{CE(sat)} = 2.3 \text{ V @ } I_C = 40 \text{ A}$
- 100% of The Parts Tested for $I_{LM}^{(1)}$
- Short Circuit Ruggedness $> 5 \text{ us @ } 150^\circ\text{C}$
- High Input Impedance
- RoHS Compliant

General Description

Using novel field stop IGBT technology, Fairchild's new series of field stop 2nd generation IGBTs offer the optimum performance for welder applications where low conduction and switching losses are essential.

Applications

- Only for Welder



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

| Symbol | Description | FGL12040WD | Unit |
|----------------|---|-------------|------------------|
| V_{CES} | Collector to Emitter Voltage | 1200 | V |
| V_{GES} | Gate to Emitter Voltage | ± 25 | V |
| | Transient Gate to Emitter Voltage | ± 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 @ $T_C = 25^\circ\text{C}$ | 100 | A |
| $I_{CM}^{(2)}$ | Pulsed Collector Current | 100 | 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 |
| $I_{FM}^{(2)}$ | Diode Maximum Forward Current | 100 | A |
| SCWT (3) | Short Circuit Withstand Time @ $T_C = 150^\circ\text{C}$ | 5 | us |
| P_D | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$ | 391 | W |
| | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$ | 156 | 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. $V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $I_C = 100 \text{ A}$, $R_G = 23 \Omega$, Inductive Load
2. Repetitive rating : Pulse width limited by max. junction temperature
3. $V_{CC} = 600 \text{ V}$, $V_{GE} = 12 \text{ V}$

FGL12040WD — 1200 V, 40 A Field Stop Trench IGBT

Thermal Characteristics

| Symbol | Parameter | FGL12040WD | Unit |
|-------------------------------|---|------------|-----------------------------|
| $R_{\theta JC}(IGBT)$ | Thermal Resistance, Junction to Case | 0.32 | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JC}(\text{Diode})$ | Thermal Resistance, Junction to Case | 1.0 | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 25 | $^{\circ}\text{C}/\text{W}$ |

Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|-------------|------------|---------|----------------|-----------|------------|----------|
| FGL12040WD | FGL12040WD | TO-264 | Tube | - | - | 25 |

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------------------------------|--|---|------|------|------|------|
| Off Characteristics | | | | | | |
| BV _{CES} | Collector to Emitter Breakdown Voltage | V _{GE} = 0 V, I _C = 250 uA | 1200 | - | - | V |
| ΔBV _{CES} / ΔT _J | Temperature Coefficient of Breakdown Voltage | V _{GE} = 0 V, I _C = 250 uA | - | 1.2 | - | V/°C |
| I _{CES} | Collector Cut-Off Current | V _{CE} = V _{CES} , V _{GE} = 0 V | - | - | 250 | uA |
| I _{GES} | G-E Leakage Current | V _{GE} = V _{GES} , V _{CE} = 0 V | - | - | ±400 | nA |
| On Characteristics | | | | | | |
| V _{GE(th)} | G-E Threshold Voltage | I _C = 40 mA, V _{CE} = V _{GE} | 4.8 | 6.4 | 8.0 | V |
| V _{CE(sat)} | Collector to Emitter Saturation Voltage | I _C = 40 A, V _{GE} = 15 V T _C = 25°C | - | 2.3 | 2.9 | V |
| | | I _C = 40 A, V _{GE} = 15 V, T _C = 150°C | - | 2.5 | - | V |
| Dynamic Characteristics | | | | | | |
| C _{ies} | Input Capacitance | V _{CE} = 30 V, V _{GE} = 0 V, f = 1MHz | - | 2800 | - | pF |
| C _{oes} | Output Capacitance | | - | 105 | - | pF |
| C _{res} | Reverse Transfer Capacitance | | - | 60 | - | pF |
| Switching Characteristics | | | | | | |
| t _{d(on)} | Turn-On Delay Time | V _{CC} = 600 V, I _C = 40 A, R _G = 23 Ω, V _{GE} = 15 V, Inductive Load, T _C = 25°C | - | 45 | - | ns |
| t _r | Rise Time | | - | 70 | - | ns |
| t _{d(off)} | Turn-Off Delay Time | | - | 560 | - | ns |
| t _f | Fall Time | | - | 15 | - | ns |
| E _{on} | Turn-On Switching Loss | | - | 4.1 | - | mJ |
| E _{off} | Turn-Off Switching Loss | | - | 1.0 | - | mJ |
| E _{ts} | Total Switching Loss | | - | 5.1 | - | mJ |
| t _{d(on)} | Turn-On Delay Time | V _{CC} = 600 V, I _C = 40 A, R _G = 23 Ω, V _{GE} = 15 V, Inductive Load, T _C = 150°C | - | 40 | - | ns |
| t _r | Rise Time | | - | 65 | - | ns |
| t _{d(off)} | Turn-Off Delay Time | | - | 472 | - | ns |
| t _f | Fall Time | | - | 51 | - | ns |
| E _{on} | Turn-On Switching Loss | | - | 6.1 | - | mJ |
| E _{off} | Turn-Off Switching Loss | | - | 1.7 | - | mJ |
| E _{ts} | Total Switching Loss | | - | 7.8 | - | mJ |

Electrical Characteristics of the IGBT (Continued)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------|--------------------------|---|------|------|------|------|
| Q_g | Total Gate Charge | $V_{CE} = 600\text{ V}$, $I_C = 40\text{ A}$, $V_{GE} = 15\text{ V}$ | - | 226 | - | nC |
| Q_{ge} | Gate to Emitter Charge | | - | 18 | - | nC |
| Q_{gc} | Gate to Collector Charge | | - | 155 | - | 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 | $I_F = 40\text{ A}$, $T_C = 25^\circ\text{C}$ | - | 3.6 | 4.7 | V |
| | | $I_F = 40\text{ A}$, $T_C = 150^\circ\text{C}$ | - | 3.0 | - | V |
| t_{rr} | Diode Reverse Recovery Time | $V_R = 600\text{ V}$, $I_F = 40\text{ A}$, $di_F/dt = 200\text{ A/us}$, $T_C = 25^\circ\text{C}$ | - | 71 | - | ns |
| I_{rr} | Diode Peak Reverse Recovery Current | | - | 6.8 | - | A |
| Q_{rr} | Diode Reverse Recovery Charge | | - | 242 | - | nC |
| E_{rec} | Reverse Recovery Energy | $V_R = 600\text{ V}$, $I_F = 40\text{ A}$, $di_F/dt = 200\text{ A/us}$, $T_C = 150^\circ\text{C}$ | - | 440 | - | uJ |
| t_{rr} | Diode Reverse Recovery Time | | - | 339 | - | ns |
| I_{rr} | Diode Peak Reverse Recovery Current | | - | 14 | - | A |
| Q_{rr} | Diode Reverse Recovery Charge | | - | 2373 | - | nC |

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

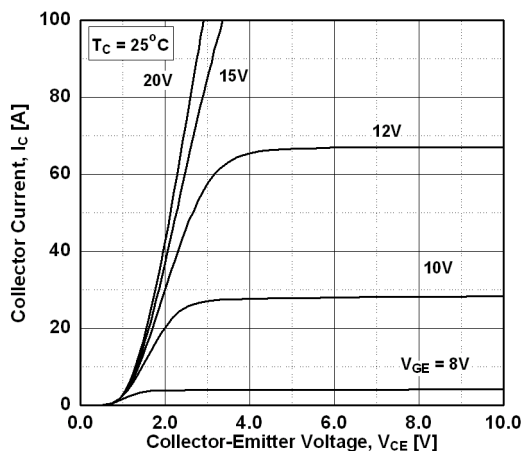


Figure 2. Typical Output Characteristics

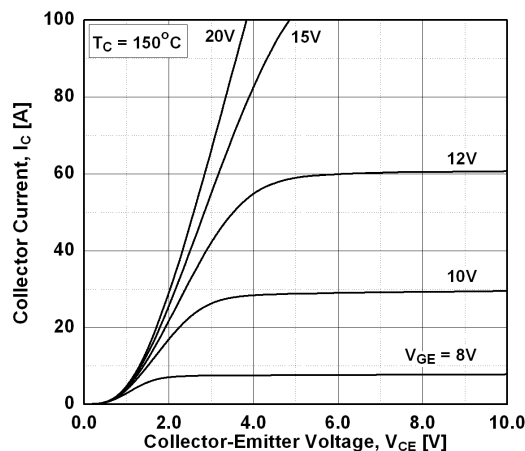


Figure 3. Typical Saturation Voltage Characteristics

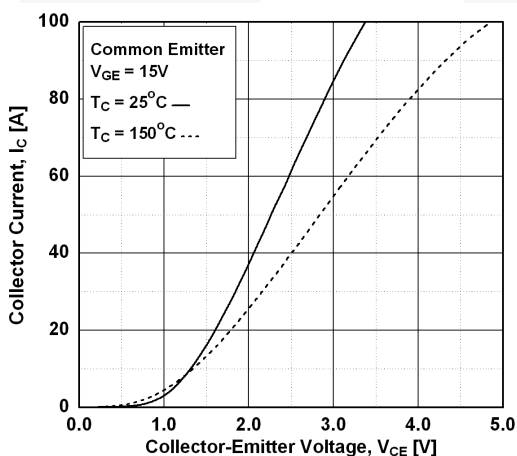


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

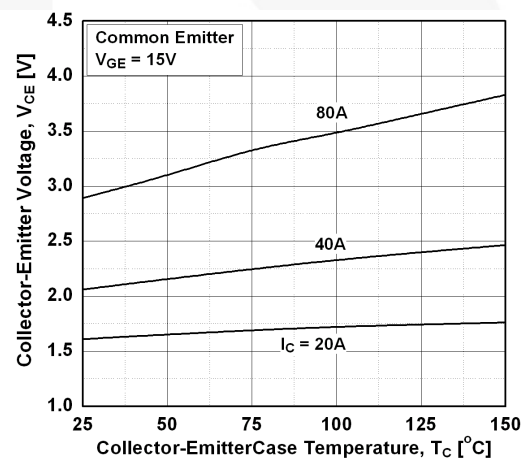


Figure 5. Saturation Voltage vs. V_{GE}

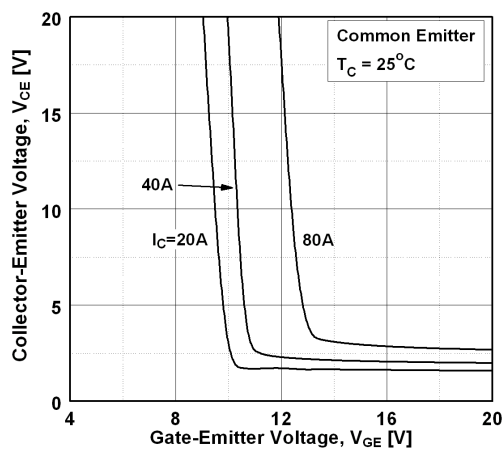
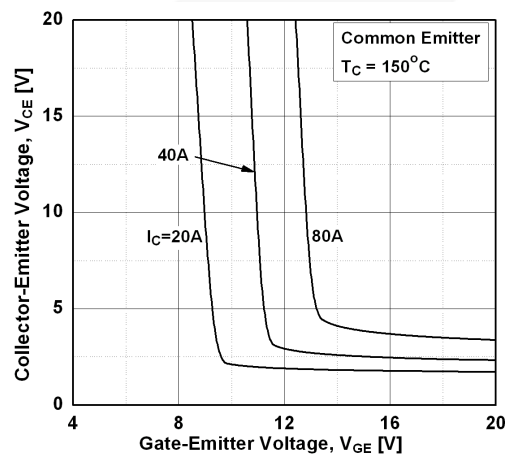


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Capacitance Characteristics

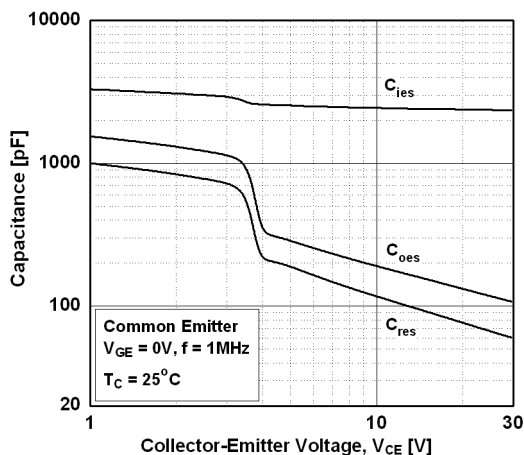


Figure 8. Gate Charge Characteristics

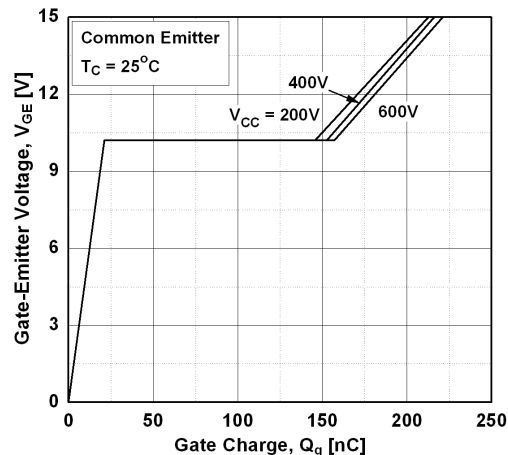


Figure 9. Turn-on Characteristics vs. Gate Resistance

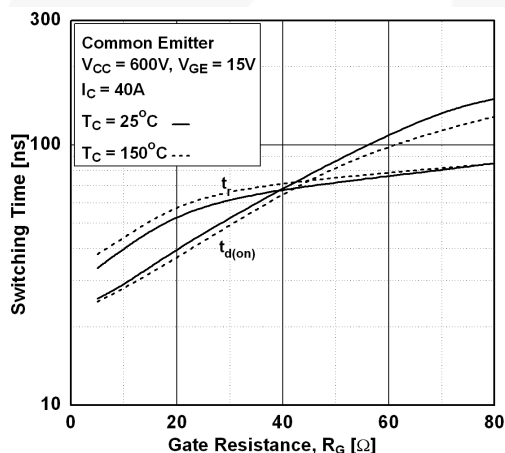


Figure 10. Turn-off Characteristics vs. Gate Resistance

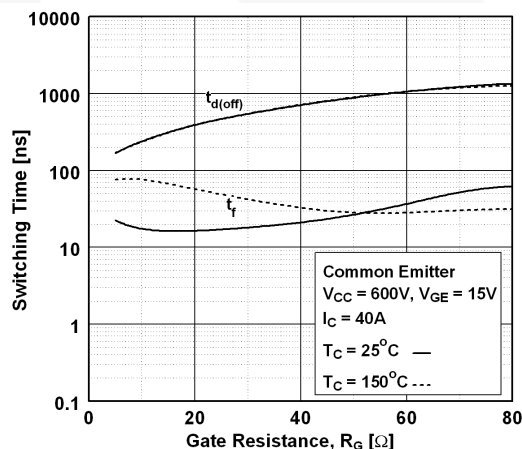


Figure 11. Switching Loss vs. Gate Resistance

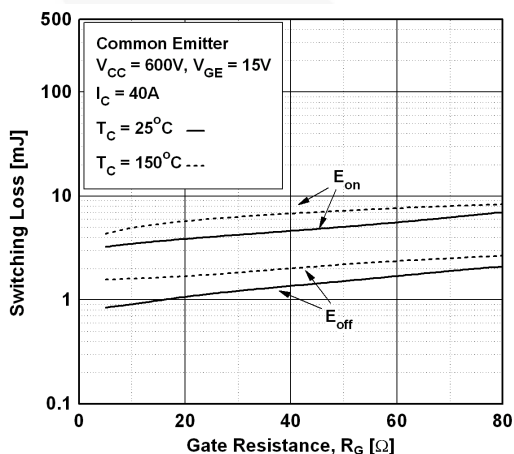
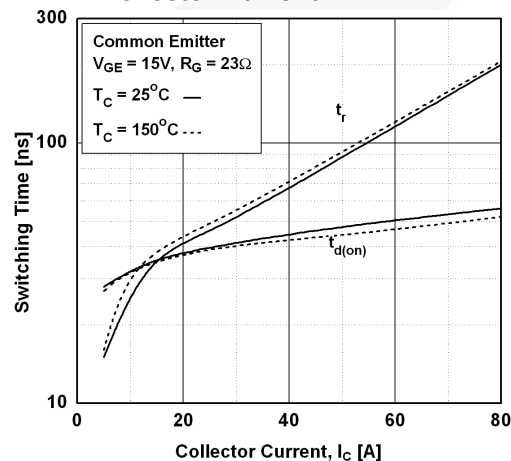


Figure 12. Turn-on Characteristics vs. Collector Current



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

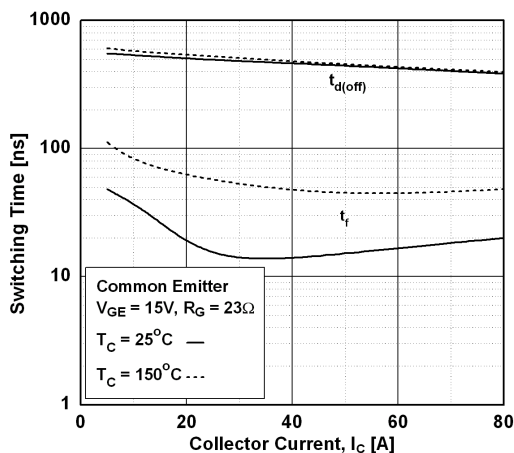


Figure 14. Switching Loss vs. Collector Current

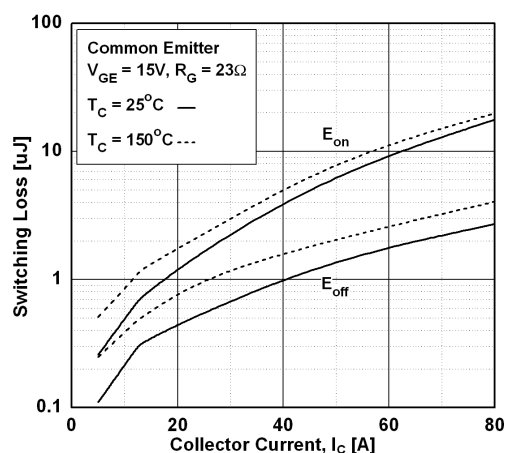


Figure 15. Load Current vs. Frequency

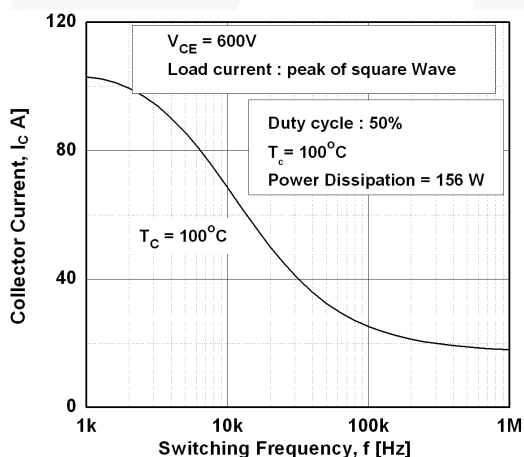


Figure 16. SOA Characteristics

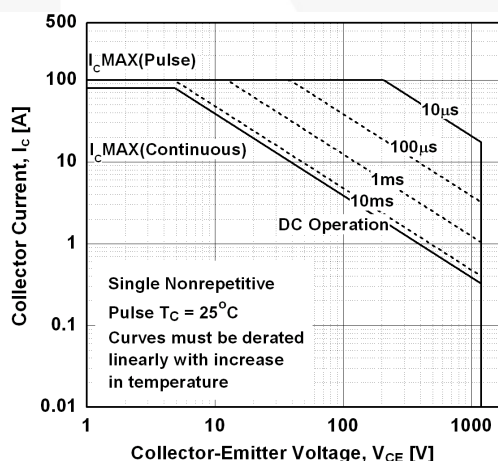


Figure 17. Forward Characteristics

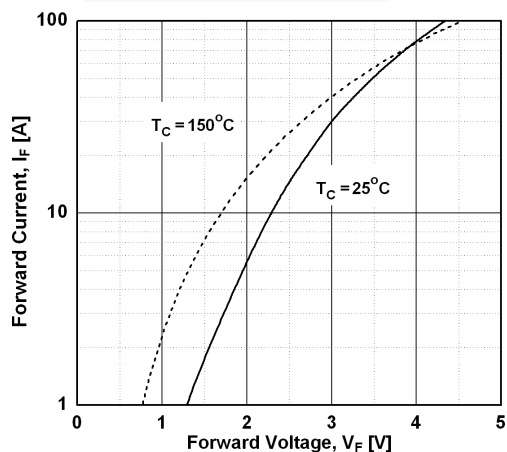
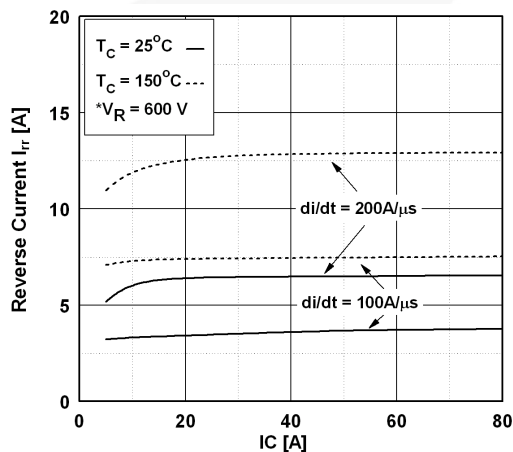


Figure 18. Reverse Recovery Current



Typical Performance Characteristics

Figure 19. Reverse Recovery Time

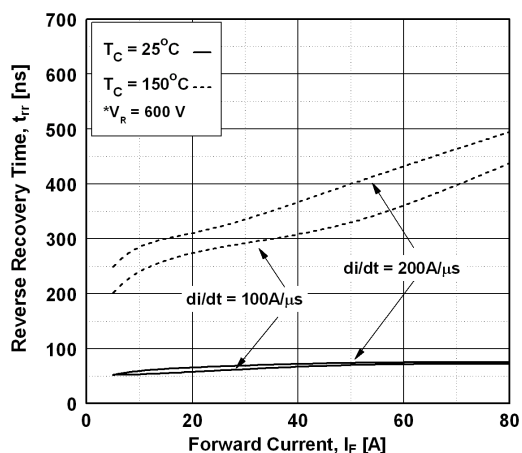


Figure 20. Stored Charge

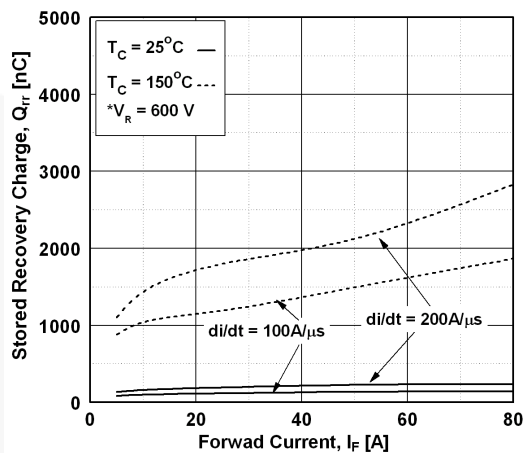


Figure 21. Transient Thermal Impedance of IGBT

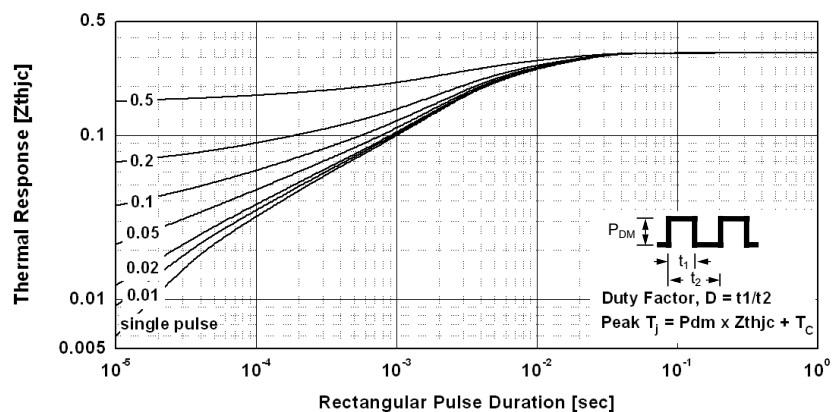
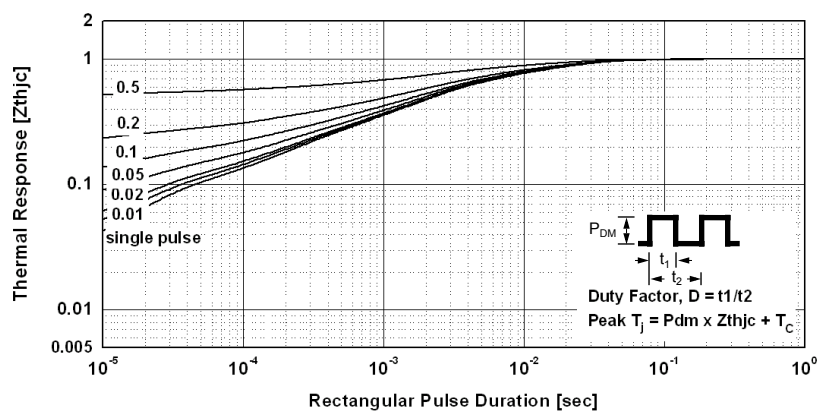


Figure 22. Transient Thermal Impedance of Diode



Mechanical Dimensions

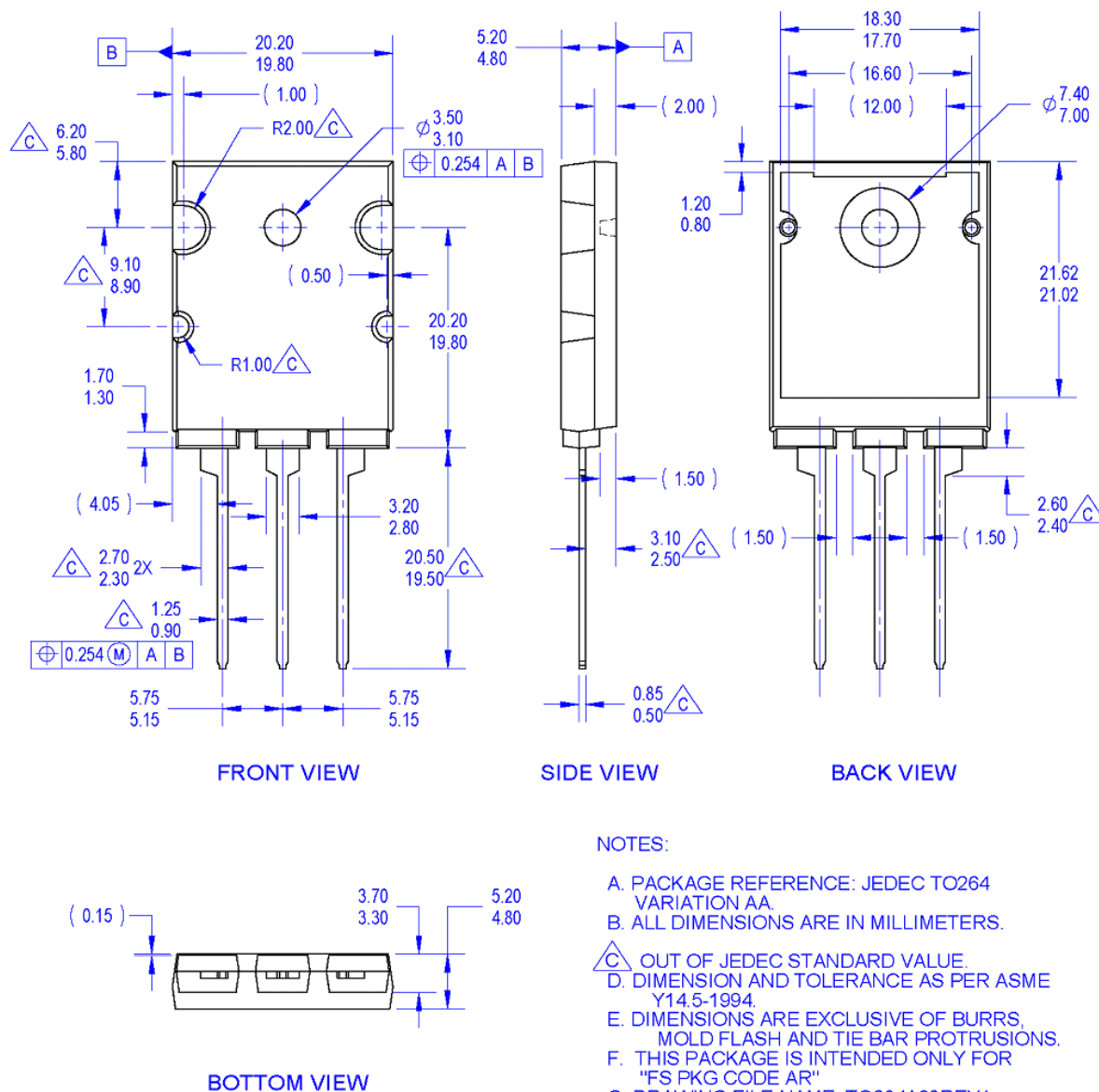


Figure 23. TO264, Molded, 3-Lead, Jedec Variation AA

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