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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

November 2013

# FGH25N120FTDS

## 1200 V, 25 A Field Stop Trench IGBT

### Features

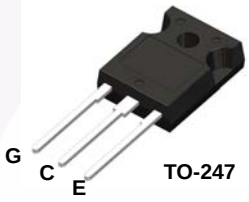
- High Speed Switching
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.60 V @ $I_C$ = 25 A
- High Input Impedance
- RoHS Compliant

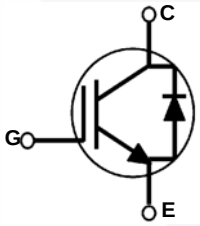
### Applications

- Solar Inverter, UPS, Welder, PFC

### General Description

Using advanced field stop trench technology, Fairchild's 1200V trench IGBTs offer the optimum performance for hard switching application such as solar inverter, UPS, welder and PFC applications.




### Absolute Maximum Ratings

| Symbol | Description | | Ratings | Unit |
|---|---|---|---|---|
| $V_{CES}$ | Collector to Emitter Voltage | | 1200 | V |
| $V_{GES}$ | Gate to Emitter Voltage | | ± 25 | V |
| $I_C$ | Collector Current | @ $T_C$ = 25°C | 50 | A |
| | Collector Current | @ $T_C$ = 100°C | 25 | A |
| $I_{CM\ (1)}$ | Pulsed Collector Current | | 75 | A |
| $I_F$ | Diode Continuous Forward Current | @ $T_C$ = 25°C | 50 | A |
| | Diode Continuous Forward Current | @ $T_C$ = 100°C | 25 | A |
| $I_{FM}$ | Diode Maximum Forward Current | | 75 | A |
| $P_D$ | Maximum Power Dissipation | @ $T_C$ = 25°C | 313 | W |
| | Maximum Power Dissipation | @ $T_C$ = 100°C | 125 | W |
| $T_J$ | Operating Junction Temperature | | -55 to +150 | °C |
| $T_{stg}$ | Storage Temperature Range | | -55 to +150 | °C |
| $T_L$ | Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds | | 300 | °C |

**Notes:**
1: Repetitive rating: Pulse width limited by max. junction temperature

### Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JC}$(IGBT) | Thermal Resistance, Junction to Case | - | 0.4 | °C/W |
| $R_{\theta JC}$(Diode) | Thermal Resistance, Junction to Case | - | 1.25 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | - | 40 | °C/W |

## Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| FGH25N120FTDS | FGH25N120FTDS | TO-247 | Tube | N/A | N/A | 30 |

## Electrical Characteristics of the IGBT $T_C$ = 25°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 μA | 1200 | - | - | V |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0 V | - | - | 1 | mA |
| $I_{GES}$ | G-E Leakage Current | $V_{GE}$ = $V_{GES}$, $V_{CE}$ = 0 V | - | - | ±250 | nA |
| **On Characteristics** | | | | | | |
| $V_{GE(th)}$ | G-E Threshold Voltage | $I_C$ = 25 mA, $V_{CE}$ = $V_{GE}$ | 3.5 | 6 | 7.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$ = 25 A, $V_{GE}$ = 15 V | - | 1.6 | 2 | V |
| | | $I_C$ = 25 A, $V_{GE}$ = 15 V, $T_C$ = 125°C | - | 1.92 | - | V |
| **Dynamic Characteristics** | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ = 30 V, $V_{GE}$ = 0 V, f = 1 MHz | - | 4090 | - | pF |
| $C_{oes}$ | Output Capacitance | | - | 135 | - | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | - | 75 | - | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600 V, $I_C$ = 25 A, $R_G$ = 10 Ω, $V_{GE}$ = 15 V, Inductive Load, $T_C$ = 25°C | - | 26 | 35 | ns |
| $t_r$ | Rise Time | | - | 41 | 53 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 151 | 196 | ns |
| $t_f$ | Fall Time | | - | 102 | 132 | ns |
| $E_{on}$ | Turn-On Switching Loss | | - | 1.42 | 1.84 | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | - | 1.16 | 1.5 | mJ |
| $E_{ts}$ | Total Switching Loss | | - | 2.58 | 3.34 | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600 V, $I_C$ = 25 A, $R_G$ = 10 Ω, $V_{GE}$ = 15 V, Inductive Load, $T_C$ = 125°C | - | 22 | - | ns |
| $t_r$ | Rise Time | | - | 41 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 163 | - | ns |
| $t_f$ | Fall Time | | - | 136 | - | ns |
| $E_{on}$ | Turn-On Switching Loss | | - | 2.04 | - | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | - | 1.58 | - | mJ |
| $E_{ts}$ | Total Switching Loss | | - | 3.62 | - | mJ |
| $Q_g$ | Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 25 A, $V_{GE}$ = 15 V | - | 169 | 225 | nC |
| $Q_{ge}$ | Gate to Emitter Charge | | - | 33 | 44 | nC |
| $Q_{gc}$ | Gate to Collector Charge | | - | 78 | 104 | nC |

## Electrical Characteristics of the Diode $T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{FM}$ | Diode Forward Voltage | $I_F$ = 25 A | $T_C$ = 25°C | - | 2.5 | 3.5 | V |
| | | | $T_C$ = 125°C | - | 2.3 | - | |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 25 A, $di_F/dt$ = 200 A/μs | $T_C$ = 25°C | - | 411 | 535 | ns |
| | | | $T_C$ = 125°C | - | 496 | - | |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | | $T_C$ = 25°C | - | 5.2 | 6.8 | A |
| | | | $T_C$ = 125°C | - | 6.9 | - | |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | $T_C$ = 25°C | - | 1.1 | 1.82 | μC |
| | | | $T_C$ = 125°C | - | 1.7 | - | |

## Typical Performance Characteristics

**Figure 1. Typical Output Characteristics**

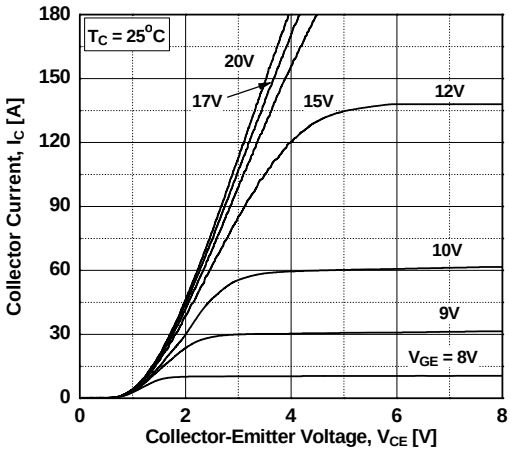



**Figure 2. Typical Output Characteristics**

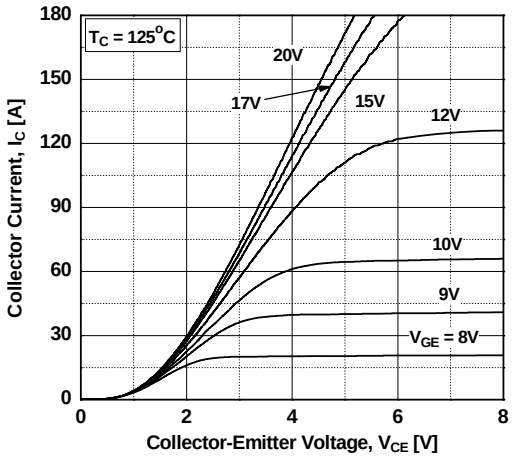



**Figure 3. Typical Saturation Voltage Characteristics**

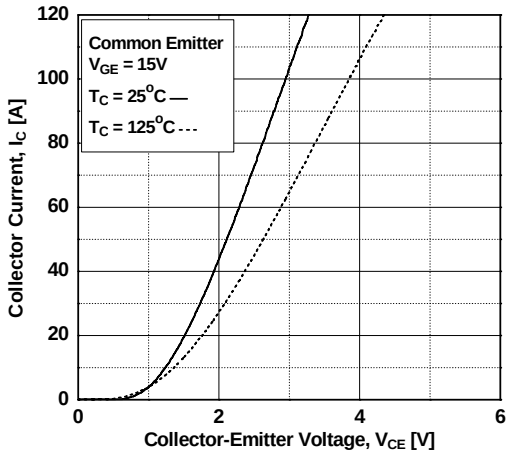



**Figure 4. Transfer Characteristics**

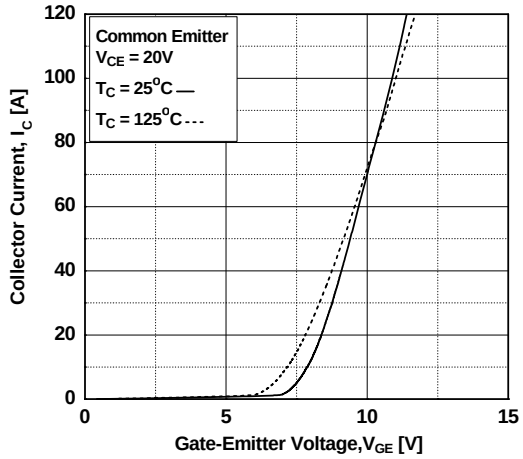



**Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level**

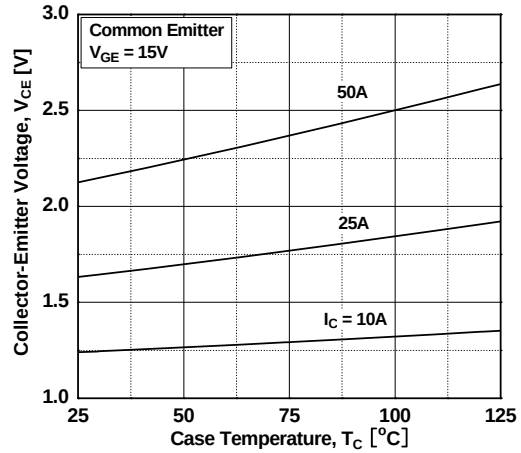
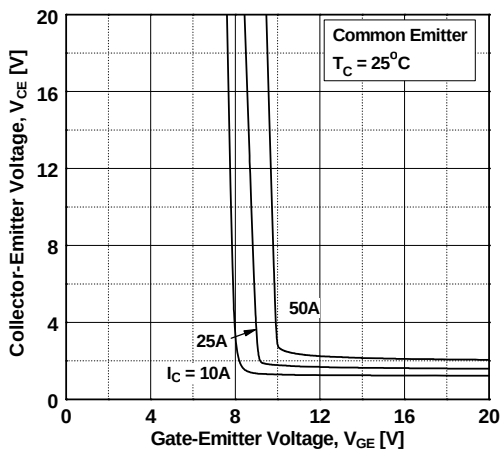
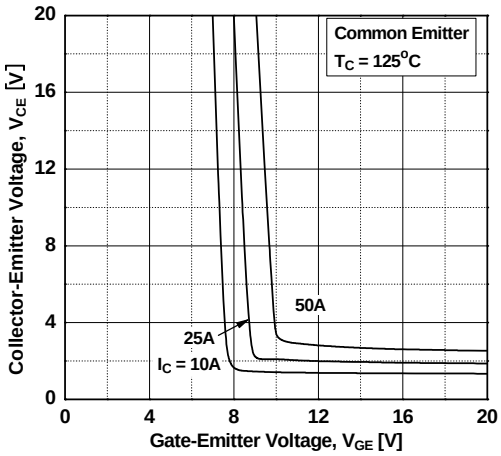



**Figure 6. Saturation Voltage vs. $V_{GE}$**

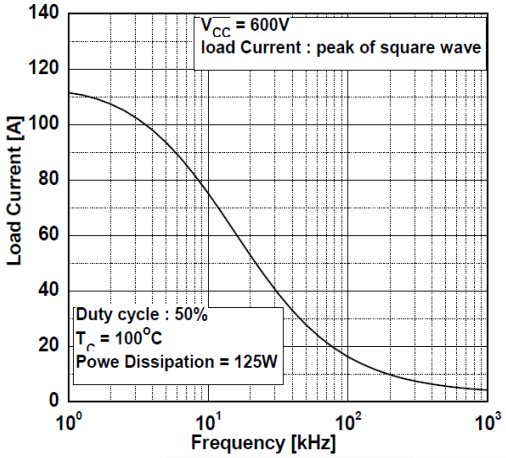


## Typical Performance Characteristics

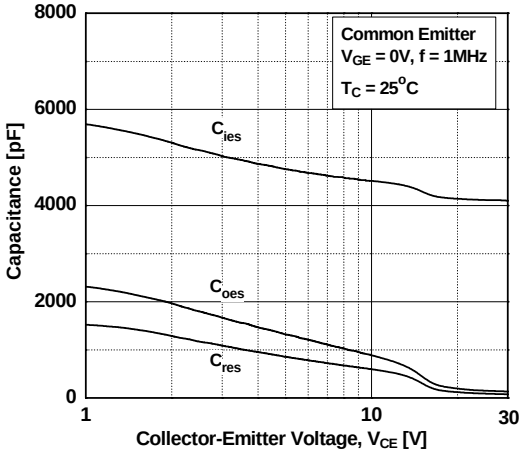
### Figure 7. Saturation Voltage vs. $V_{GE}$



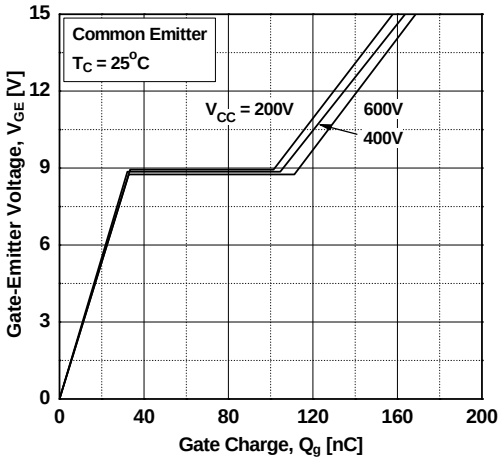

### Figure 8. Load Current vs. Frequency



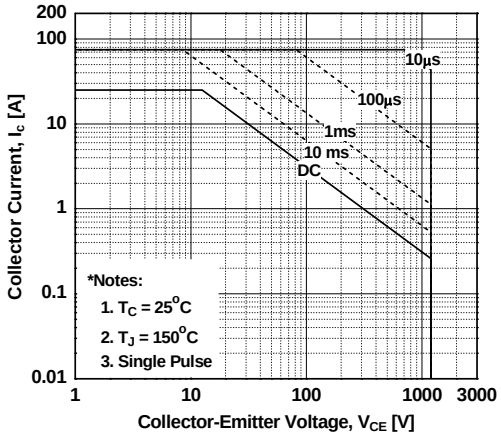

### Figure 9. Capacitance Characteristics



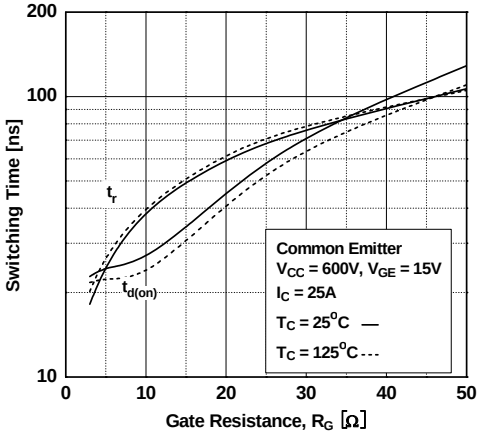

### Figure 10. Gate Charge Characteristics




### Figure 11. SOA Characteristics Gate Resistance




### Figure 12. Turn-on Characteristics vs. Gate Resistance



## Typical Performance Characteristics

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

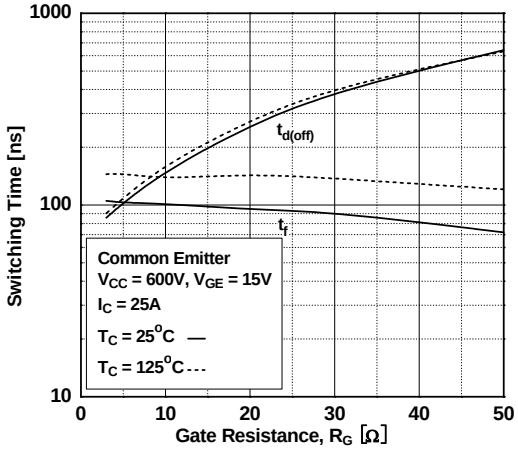



**Figure 14. Turn-on Characteristics vs. Collector Current**

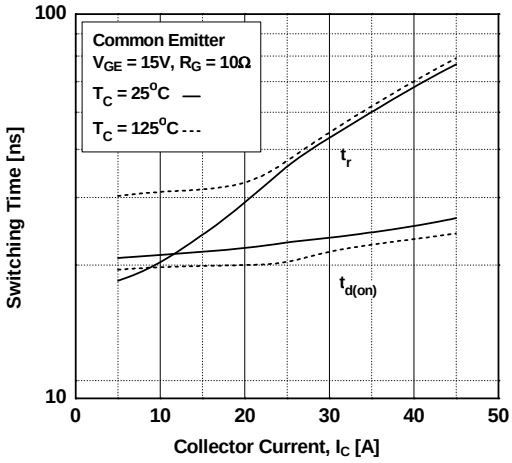



**Figure 15. Turn-off Characteristics vs. Collector Current**

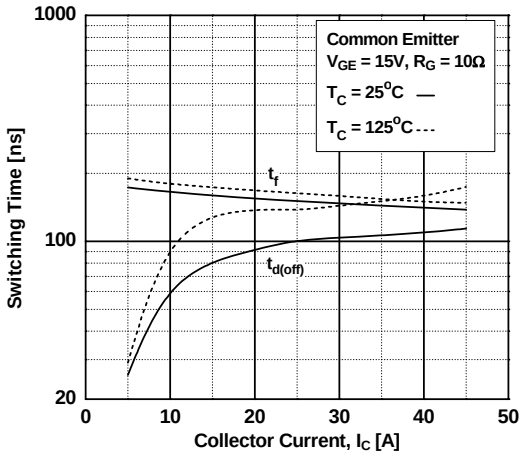



**Figure 16. Switching Loss vs. Gate Resistance**

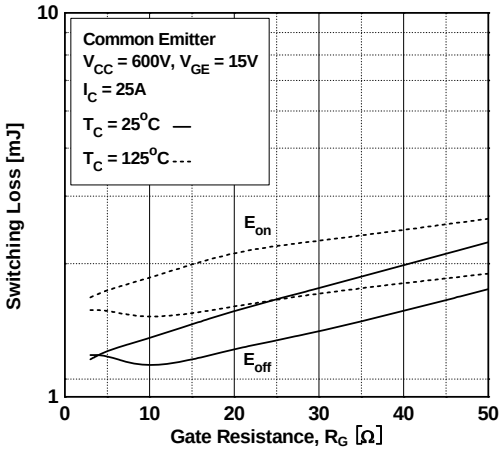



**Figure 17. Switching Loss vs. Collector Current**

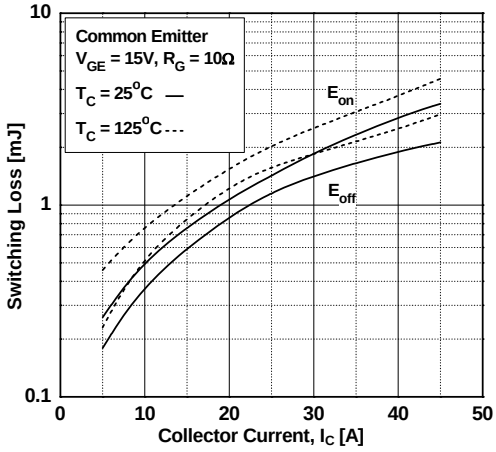
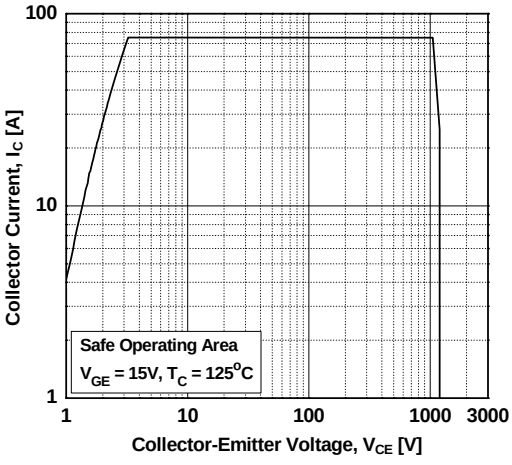



**Figure 18. Turn off Switing SOA Characteristics**



## Typical Performance Characteristics

**Figure 19. Forward Characteristics**

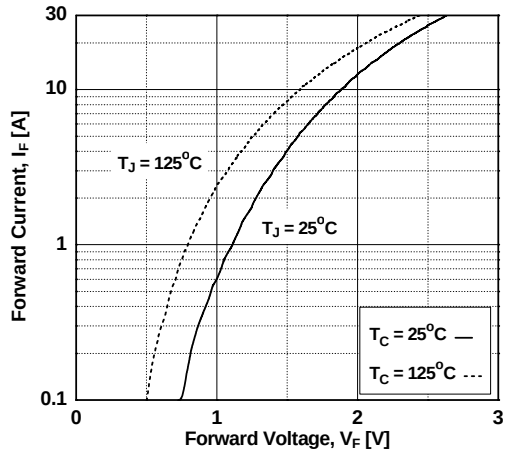



**Figure 20. Reverse Recovery Current**

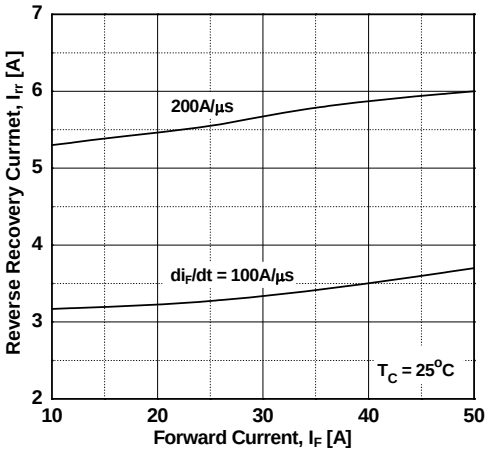



**Figure 21. Stored Charge**

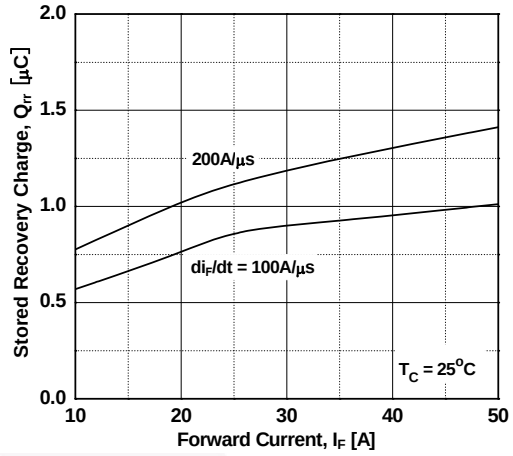



**Figure 22. Reverse Recovery Time**

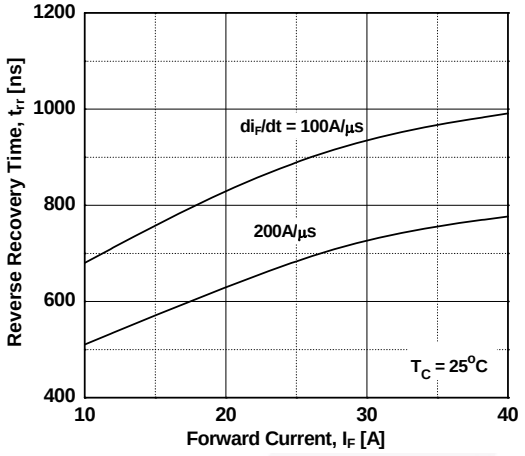
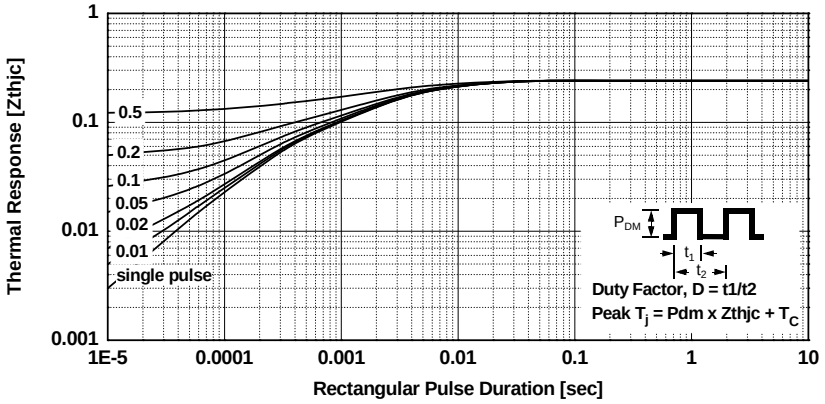
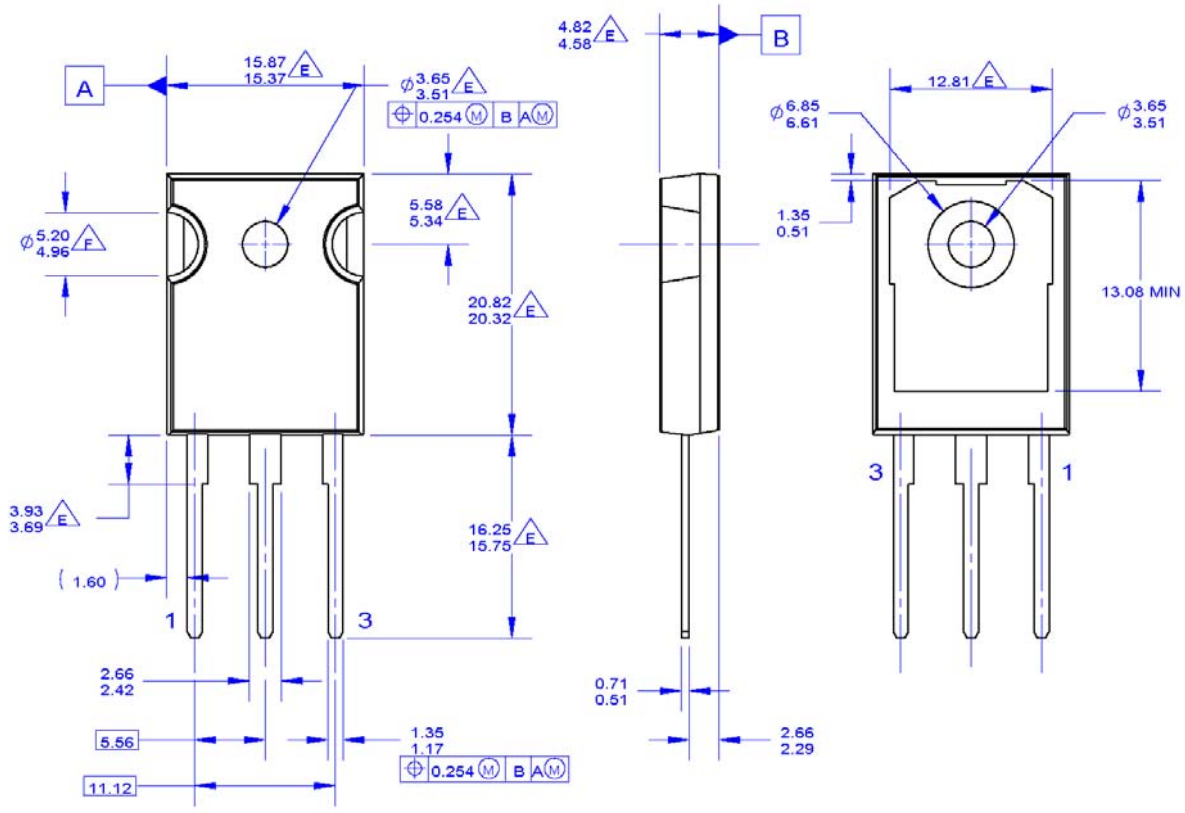



**Figure 23. Transient Thermal Impedance of IGBT**



## Mechanical Dimensions

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B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
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D. DRAWING CONFORMS TO ASME Y14.5 - 1994

E DOES NOT COMPLY JEDEC STANDARD VALUE

F NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03_REV03

**Figure 24. TO-247 3L - TO-247,MOLDED,3 LEAD,JEDEC VARIATION AB**

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**Definition of Terms**

| Datasheet Identification | Product Status | Definition |
|---|---|---|
| Advance Information | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design. |
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Rev. I66

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