FAIRCHILD SEMICONDUCTOR®

November 2013

# FGH75T65UPD_F085
## 650V, 75A Field Stop Trench IGBT

## Features

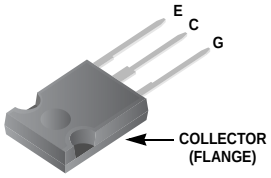
- Maximum Junction Temperature : $T_J = 175^oC$
- Positive Temperaure Co-efficient for easy parallel operating
- High current capability
- Low saturation voltage: $V_{CE(sat)}$ = 1.65V(Typ.) @ $I_C$ = 75A
- High input impedance
- Tightened Parameter Distribution
- RoHS compliant
- Qualified to Automotive Requirements of AEC-Q101

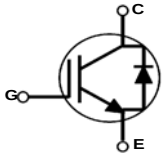
## General Description

Using Novel Field Stop Trench IGBT Technology, Fairchild's new series of Field Stop Trench IGBTs offer the optimum performance for Automotive chargers, Solar Inverter, UPS and Digital Power Generator where low conduction and switching losses are essential.

## Applications

- Automotive chargers, Converters, High Voltage Auxiliaries
- Solar Inverters, UPS, Digital Power Generator




## Absolute Maximum Ratings

| Symbol | Description | | Ratings | Units |
|---|---|---|---|---|
| $V_{CES}$ | Collector to Emitter Voltage | | 650 | V |
| $V_{GES}$ | Gate to Emitter Voltage | | ± 20 | V |
| $I_C$ | Collector Current | @ $T_C = 25^oC$ | 150 | A |
| | Collector Current | @ $T_C = 100^oC$ | 75 | A |
| $I_{CM\ (1)}$ | Pulsed Collector Current | | 225 | A |
| $I_F$ | Diode Forward Current | @ $T_C = 25^oC$ | 75 | A |
| | Diode Forward Current | @ $T_C = 100^oC$ | 50 | A |
| $I_{FM(1)}$ | Pulsed Diode Maximum Forward Current | | 225 | A |
| $P_D$ | Maximum Power Dissipation | @ $T_C = 25^oC$ | 375 | W |
| | Maximum Power Dissipation | @ $T_C = 100^oC$ | 187 | W |
| SCWT | Short Circuit Withstand Time | @ $T_C = 25^oC$ | 5 | us |
| $T_J$ | Operating Junction Temperature | | -55 to +175 | $^oC$ |
| $T_{stg}$ | Storage Temperature Range | | -55 to +175 | $^oC$ |
| $T_L$ | Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds | | 300 | $^oC$ |

## Thermal Characteristics

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $R_{\theta JC}$(IGBT) (2) | Thermal Resistance, Junction to Case | 0.4 | $^oC/W$ |
| $R_{\theta JC}$(Diode) | Thermal Resistance, Junction to Case | 0.86 | $^oC/W$ |

| Symbol | Parameter | Typ. | Units |
|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (PCB Mount)(2) | 40 | $^oC/W$ |

## Package Marking and Ordering Information

| Device Marking | Device | Package | Packing Type | Qty per Tube |
|---|---|---|---|---|
| FGH75T65UPD | FGH75T65UPD_F085 | TO-247 | Tube | 30ea |

*For Fairchild's definition of "green" Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.*

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{CES}$ | Collector to Emitter Breakdown Voltage | $V_{GE}$ = 0V, $I_C$ = 1mA | 650 | - | - | V |
| $\frac{\Delta BV_{CES}}{\Delta T_J}$ | Temperature Coefficient of Breakdown Voltage | $V_{GE}$ = 0V, $I_C$ = 1mA | - | 0.65 | - | V/°C |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | - | - | 250 | μA |
| | | $I_{CES}$ at 80%*$B_{VCES}$, 175°C | - | - | 3600 | |
| $I_{GES}$ | G-E Leakage Current | $V_{GE}$ = $V_{GES}$, $V_{CE}$ = 0V | - | - | ±400 | nA |
| **On Characteristics** | | | | | | |
| $V_{GE(th)}$ | G-E Threshold Voltage | $I_C$ = 75mA, $V_{CE}$ = $V_{GE}$ | 4.0 | 6.0 | 7.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$ = 75A, $V_{GE}$ = 15V | - | 1.69 | 2.3 | V |
| | | $I_C$ = 75A, $V_{GE}$ = 15V, $T_C$ = 175°C | - | 2.21 | - | V |
| **Dynamic Characteristics** | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ = 30V, $V_{GE}$ = 0V, f = 1MHz | - | 5665 | - | pF |
| $C_{oes}$ | Output Capacitance | | - | 205 | - | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | - | 100 | - | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 400V, $I_C$ = 75A, $R_G$ = 3Ω, $V_{GE}$ = 15V, Inductive Load, $T_C$ = 25°C | - | 32 | 48 | ns |
| $t_r$ | Rise Time | | - | 43 | 71 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 166 | 216 | ns |
| $t_f$ | Fall Time | | - | 24 | 33 | ns |
| $E_{on}$ | Turn-On Switching Loss | | - | 2.85 | 4.80 | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | - | 1.20 | 1.60 | mJ |
| $E_{ts}$ | Total Switching Loss | | - | 4.05 | 5.3 | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 400V, $I_C$ = 75A, $R_G$ = 3Ω, $V_{GE}$ = 15V, Inductive Load, $T_C$ = 175°C | - | 30 | - | ns |
| $t_r$ | Rise Time | | - | 57 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 176 | - | ns |
| $t_f$ | Fall Time | | - | 21 | - | ns |
| $E_{on}$ | Turn-On Switching Loss | | - | 4.45 | - | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | - | 1.60 | - | mJ |
| $E_{ts}$ | Total Switching Loss | | - | 6.05 | - | mJ |
| Tsc | Short Circuit Withstand Time | $V_{GE}$ = 15V, $V_{CC}$ ≤ 400V, Rg = 10 Ω | 5 | - | - | us |

**Notes:**

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

2:Rthjc for TO-247 : according to Mil standard 883-1012 test method. Rthja for TO-247 : according to JESD51-2, test method environmental condition and JESD51-10, test boards for through hole perimeter leaded package thermal measurements. JESD51-3 : Low Effective Thermal Conductivity Test Board for Leaded Surface Mount Package.

## Electrical Characteristics of the IGBT (Continued)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max | Units |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | $V_{CE}$ = 400V, $I_C$ = 75A, $V_{GE}$ = 15V | - | 385 | 578 | nC |
| $Q_{ge}$ | Gate to Emitter Charge | | - | 45 | 68 | nC |
| $Q_{gc}$ | Gate to Collector Charge | | - | 210 | 315 | nC |

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

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{FM}$ | Diode Forward Voltage | $I_F$ = 50A | $T_C$ = 25°C | - | 2.1 | 2.6 | V |
| | | | $T_C$ = 175°C | - | 1.7 | - | |
| $E_{rec}$ | Reverse Recovery Energy | $I_F$ =50A, $dI_F/dt$ = 200A/μs | $T_C$ = 175°C | - | 40 | - | uJ |
| $t_{rr}$ | Diode Reverse Recovery Time | | $T_C$ = 25°C | - | 43 | 85 | ns |
| | | | $T_C$ = 175°C | - | 162 | - | |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | $T_C$ = 25°C | - | 83 | 170 | nC |
| | | | $T_C$ = 175°C | - | 805 | - | |

## Typical Performance Characteristics

**Figure 1. Typical Output Characteristics**

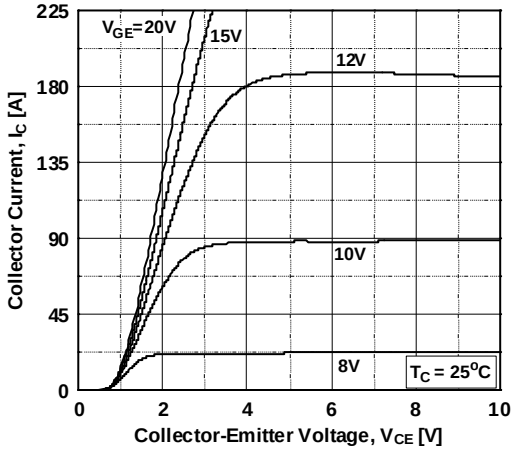



**Figure 2. Typical Output Characteristics**

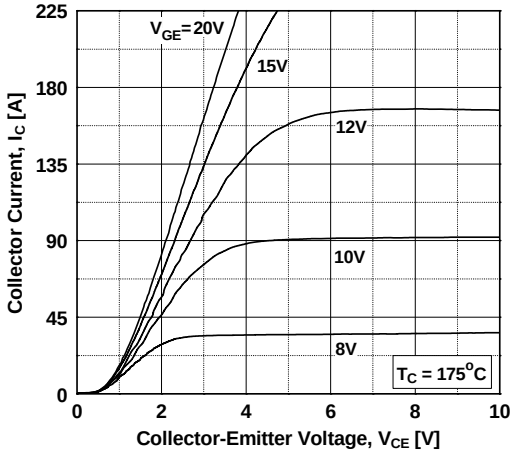



**Figure 3. Typical Saturation Voltage Characteristics**

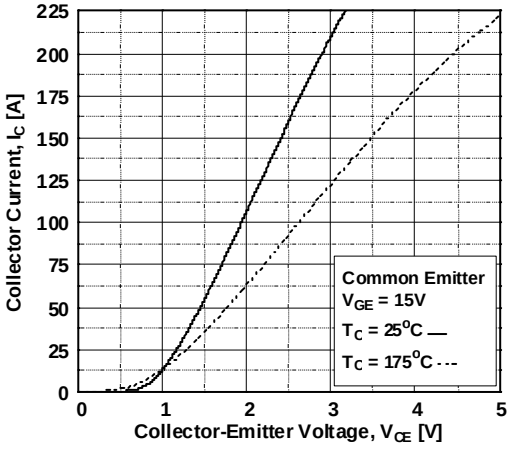



**Figure 4. Transfer Characteristics**

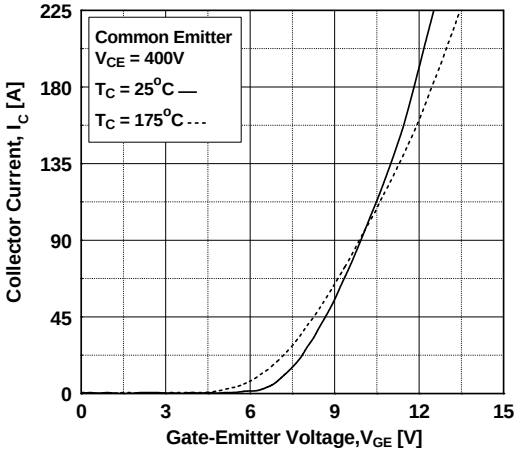



**Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level**

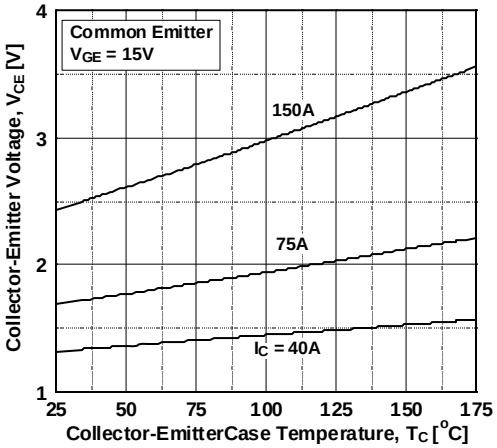
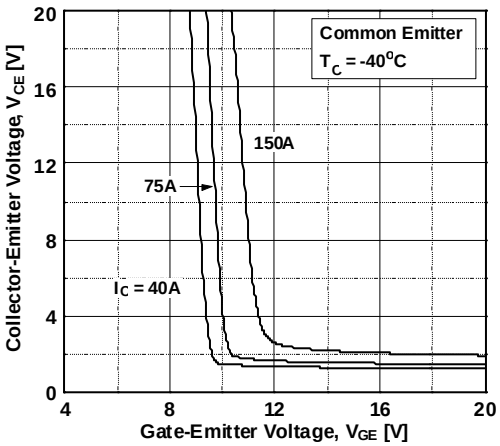



**Figure 6. Saturation Voltage vs. $V_{GE}$**



## Typical Performance Characteristics

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

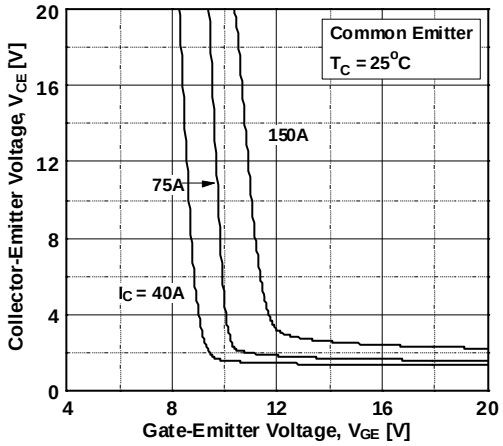



**Figure 8. Saturation Voltage vs. $V_{GE}$**

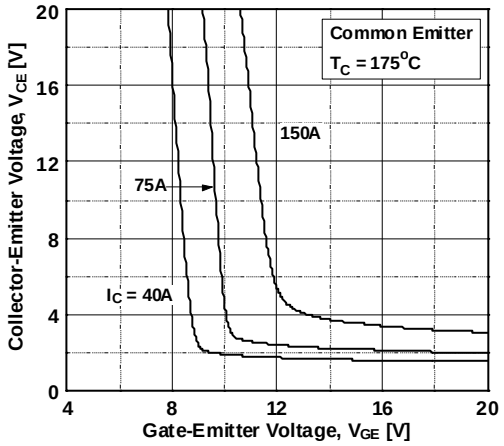



**Figure 9. Capacitance Characteristics**

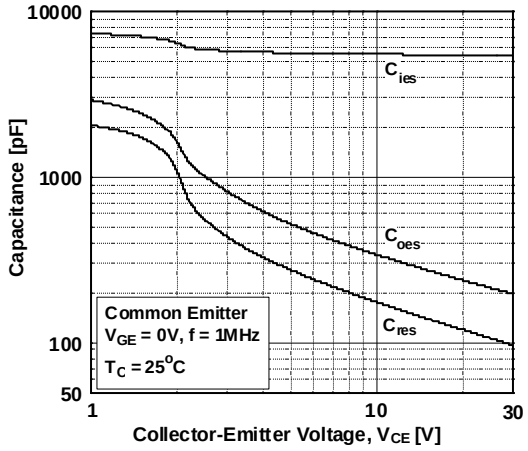



**Figure 10. Gate charge Characteristics**

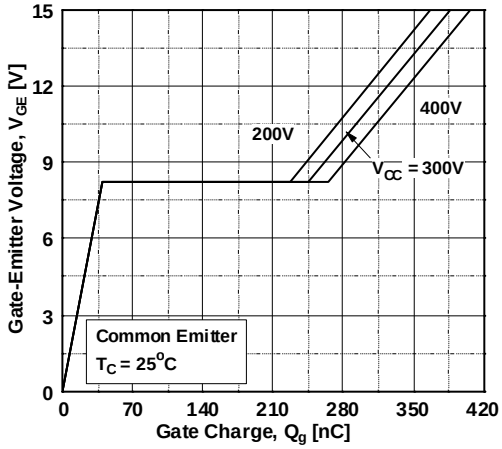



**Figure 11. SOA Characteristics**

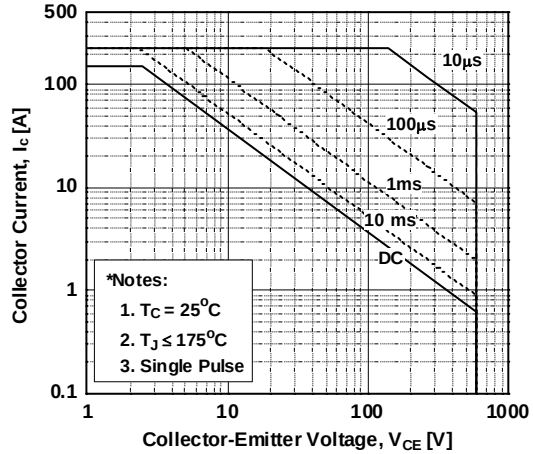
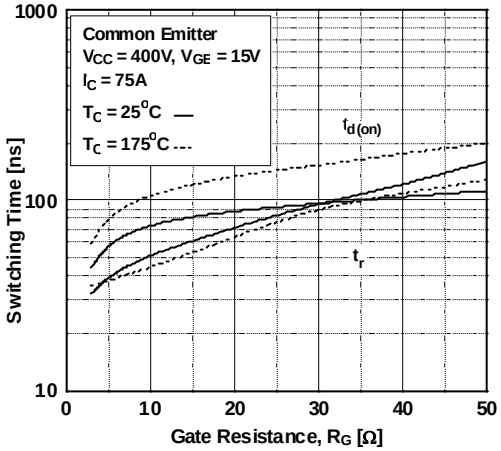



**Figure 12. Turn-on Characteristics vs. Gate Resistance**



## Typical Performance Characteristics

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

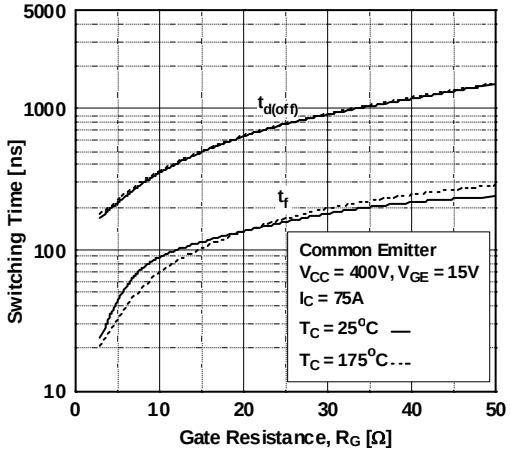



**Figure 14. Turn-on Characteristics vs. Collector Current**

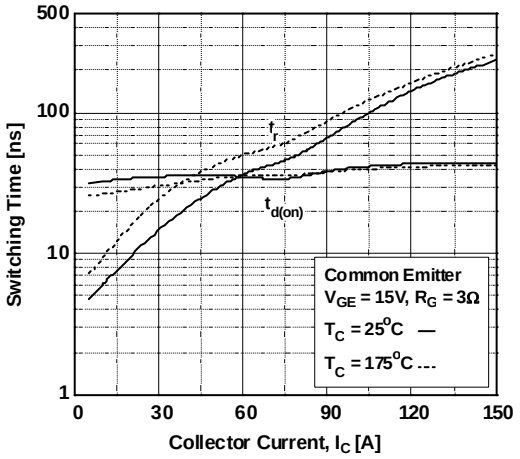



**Figure 15. Turn-off Characteristics vs. Collector Current**

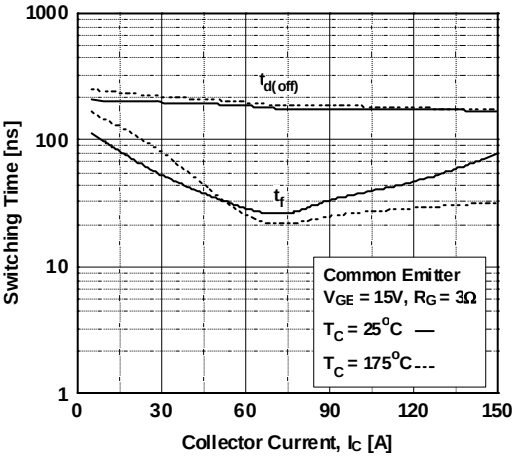



**Figure 16. Switching Loss vs. Gate Resistance**

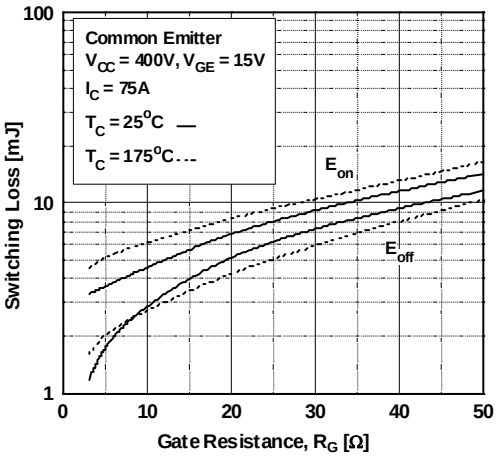



**Figure 17. Switching Loss vs. Collector Current**

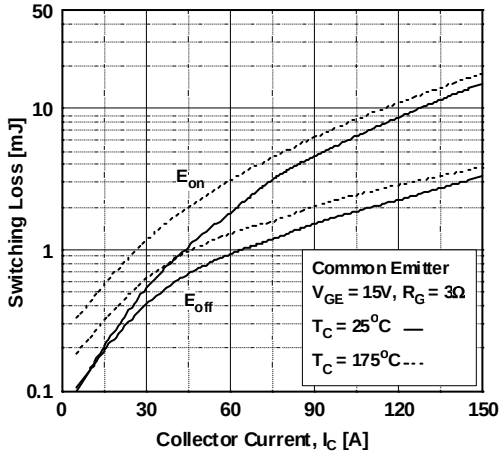
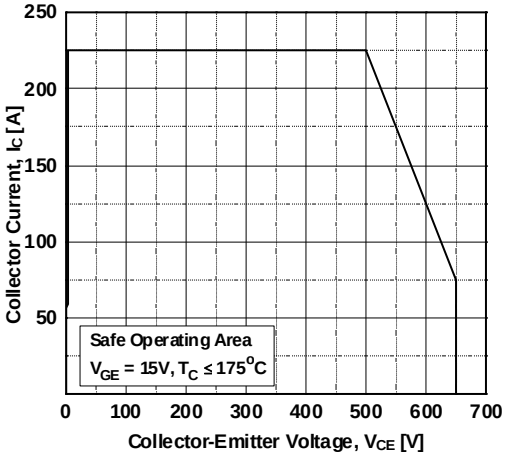
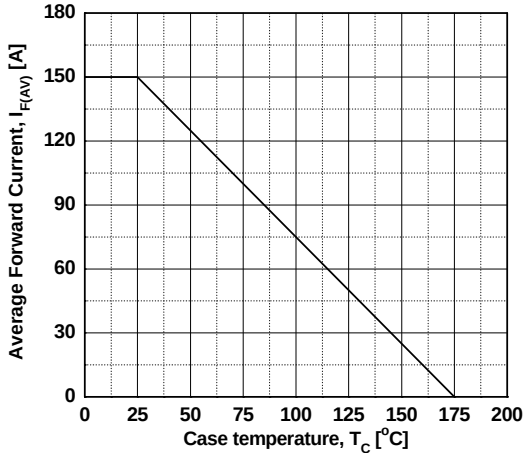



**Figure 18. Turn off Switching SOA Characteristics**

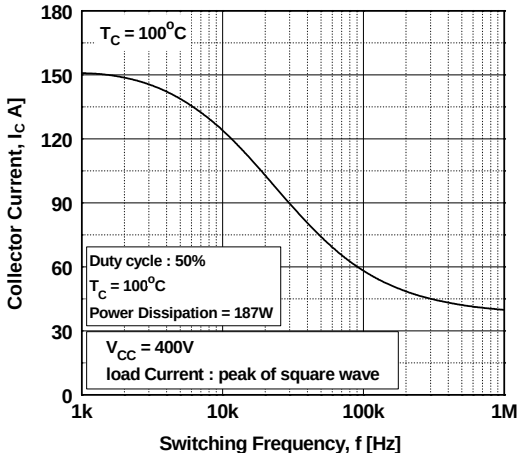


## Typical Performance Characteristics

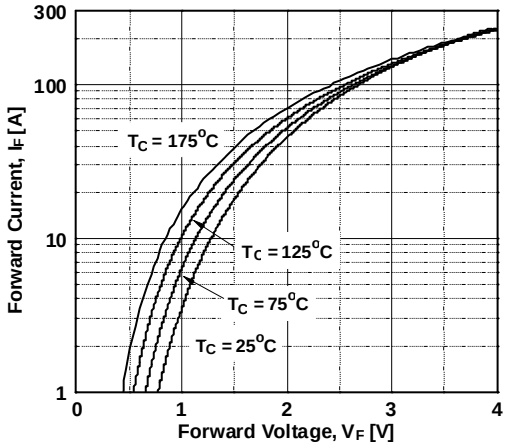
### Figure 19. Current Derating



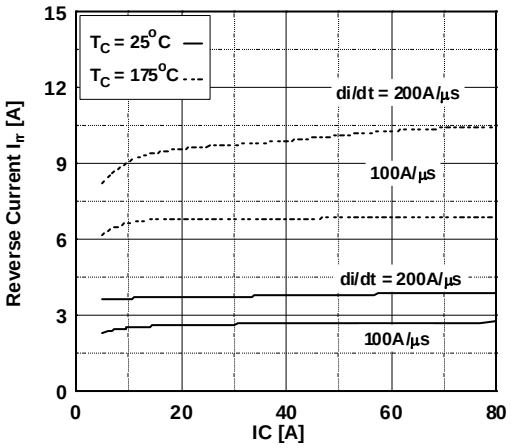

### Figure 20. Load Current Vs. Frequence



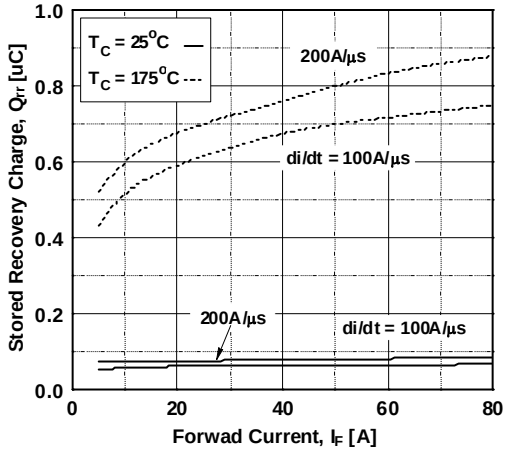

### Figure 21. Forward Characteristics



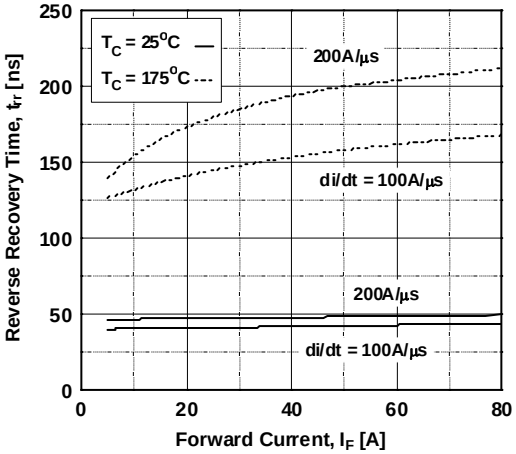

### Figure 22. Reverse Recovery Current




### Figure 23. Stored Charge




### Figure 24. Reverse Recovery Time



## Typical Performance Characteristics

**Figure 25. Transient Thermal Impedance of IGBT**

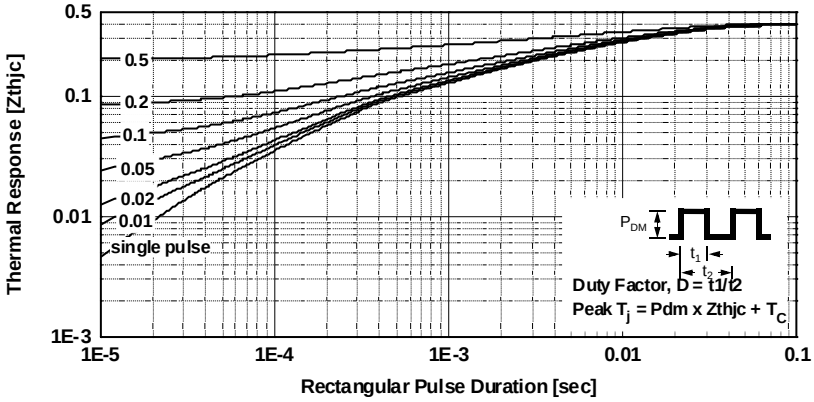
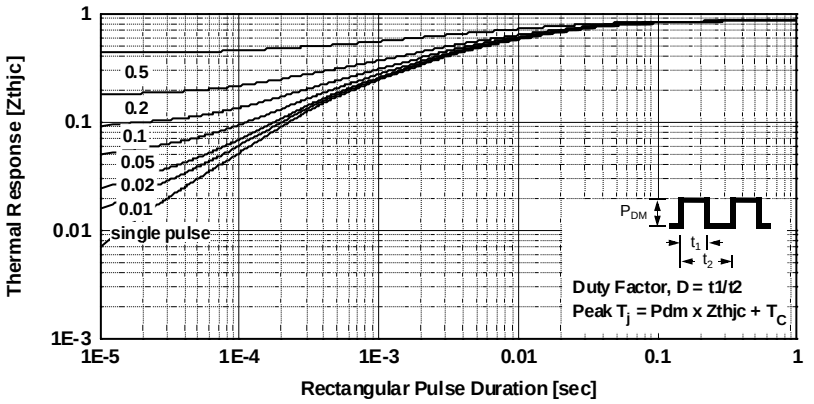
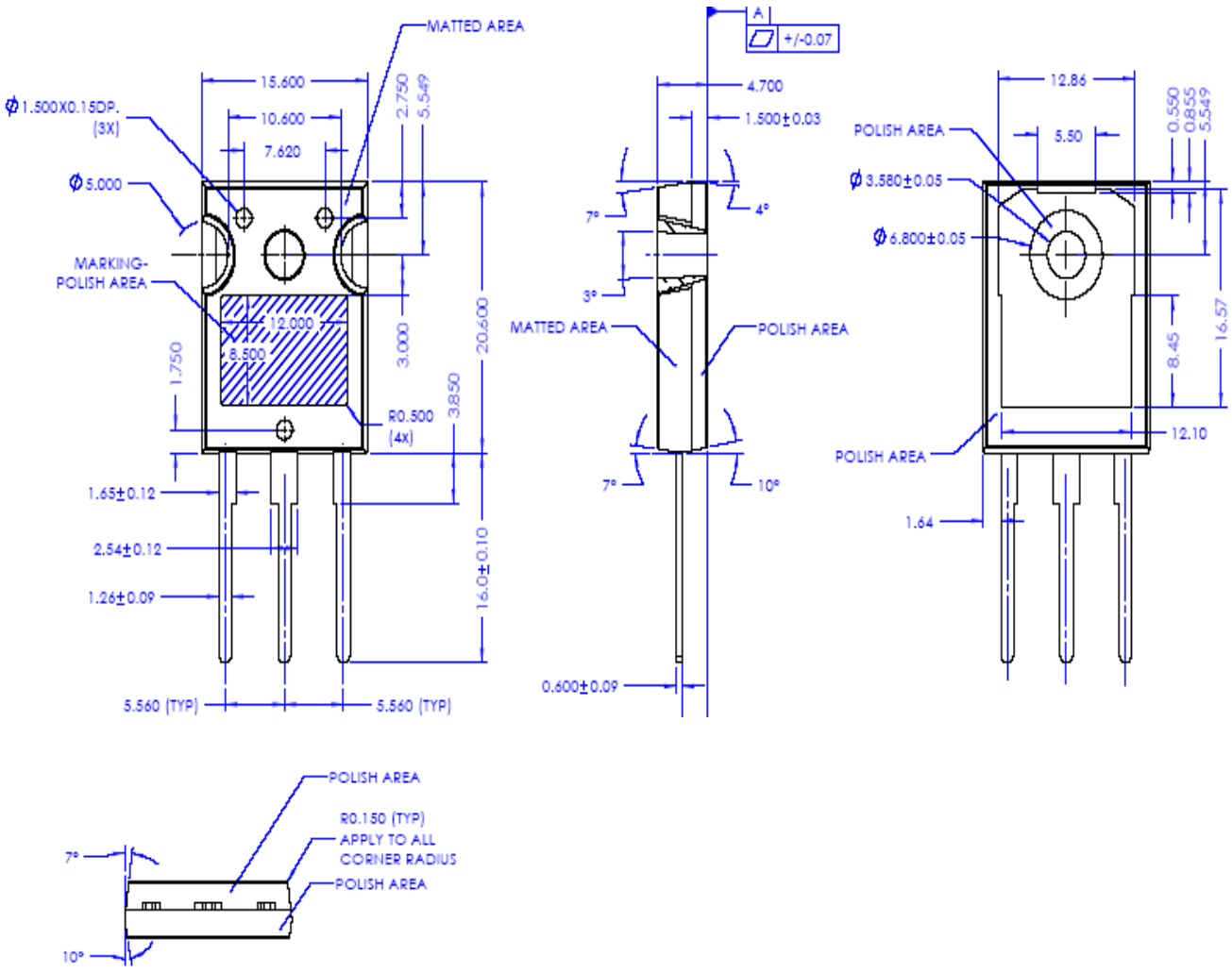



**Figure 26.Transient Thermal Impedance of Diode**



## Mechanical Dimensions

# TO - 247AB (FKS PKG CODE 001)



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SuperSOT™-6
SuperSOT™-8
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TinyCalc™
TinyLogic®
TINYOPTO™
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TinyPWM™
TinyWire™
TranSiC®
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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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**PRODUCT STATUS DEFINITIONS**
**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. |
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Стандарт Электрон Связь

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