# IGBT - Field Stop, Trench

## 650 V, 75 A

*Product Preview*

# FGH75T65SHDTLN4

Using the novel field stop 3rd generation IGBT technology, FGH75T65SHDTLN4 offers the optimum performance for solar inverter, UPS, welder, telecom, ESS and PFC applications where low conduction loss and switching loss are essential.

**Features**

- Maximum Junction Temperature: $T_J$ = 175°C
- Positive Temperature Co−efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(Sat)}$ = 1.6 V (Typ.) @ $I_C$ = 75 A
- 100% of the Parts Tested for $I_{LM}$(1)
- High Input Impedance
- Fast Switching
- Tight Parameter Distribution
- Pb Free and RoHS Compliant
- Not Recommended for Reflow and Full PKG Dipping

**Typical Applications**

- Solar Inverter
- UPS
- Welder
- Telecom
- ESS
- PFC

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Collector−to−Emitter Voltage | | $V_{CES}$ | 650 | V |
| Gate−to−Emitter Voltage<br>Transient Gate−to−Emitter Voltage | | $V_{GES}$ | ±20<br>±30 | V |
| Collector Current | $T_C$ = 25°C | $I_C$ | 150 | A |
| | $T_C$ = 100°C | | 75 | |
| Pulsed Collector Current (Note 1) | | $I_{LM}$ | 300 | A |
| Pulsed Collector Maximum Current (Note 2) | | $I_{CM}$ | 300 | A |
| Diode Forward Current | $T_C$ = 25°C | $I_F$ | 125 | A |
| | $T_C$ = 100°C | | 75 | |
| Pulsed Diode Maximum Forward Current (Note 2) | | $I_{FM}$ | 300 | A |
| Maximum Power Dissipation | $T_C$ = 25°C | $P_D$ | 455 | W |
| | $T_C$ = 100°C | | 227 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | −55 to +175 | °C |
| Maximum Lead Temperature for Soldering Purposes (1/8″ from case for 5 seconds) | | $T_L$ | 300 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. $V_{CC}$ = 400 V, $V_{GE}$ = 15 V, $I_C$ = 300 A, $R_G$ = 73 Ω, Inductive Load
2. Repetitive rating: pulse width limited by max. Junction temperature

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

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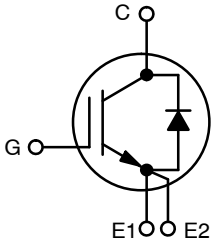
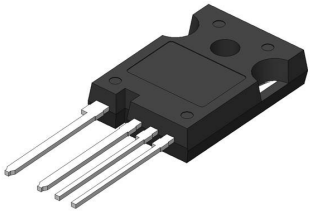
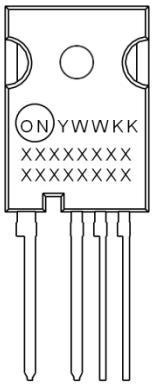
**75 A, 650 V**
**$V_{CE(sat)}$ = 1.6 V**
**$E_{on}$ = 1.06 mJ**



**TO−247**
**THIN LEADS**
**CASE 340CW**

**DEVICE MARKING INFORMATION**




Line 1: Date Code
Line 2: Device Marking
Line 3: Device Marking

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| FGH75T65SHDTLN4 | TO−247 | 30 Units / Tube |

**Table 1. THERMAL CHARACTERISTICS**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, for IGBT | 0.33 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, for Diode | 0.65 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 40 | °C/W |

**Table 2. ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Collector−emitter breakdown voltage, gate−emitter short−circuited | $BV_{CES}$ | $V_{GE}$ = 0 V, $I_C$ = 1 mA | 650 | – | – | V |
| Temperature Coefficient of Breakdown Voltage | $\Delta BV_{CES}/\Delta T_J$ | $V_{GE}$ = 0 V, $I_C$ = 1 mA | – | 0.65 | – | V/°C |
| Collector−emitter cut−off current, gate−emitter short−circuited | $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 650 V | – | – | 250 | μA |
| Gate leakage current, collector−emitter short−circuited | $I_{GES}$ | $V_{GE}$ = ±20 V, $V_{CE}$ = 0 V | – | – | ±400 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate−emitter threshold voltage | $V_{GE(th)}$ | $V_{GE}$ = $V_{CE}$, $I_C$ = 75 mA | 4.0 | 5.5 | 7.5 | V |
| Collector−emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}$ = 15 V, $I_C$ = 75 A,<br>$V_{GE}$ = 15 V, $I_C$ = 75 A, $T_J$ = 175°C | –<br>– | 1.6<br>2.28 | 2.1<br>– | mV/°C |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{ies}$ | $V_{CE}$ = 30 V, $V_{GE}$ = 0 V, f = 1 MHz | – | 3710 | – | pF |
| Output Capacitance | $C_{oes}$ | | – | 183 | – | |
| Reverse Transfer Capacitance | $C_{res}$ | | – | 43 | – | |
| Gate Charge Total | $Q_g$ | $V_{CE}$ = 400 V, $I_C$ = 75 A, $V_{GE}$ = 15 V | – | 126 | – | nC |
| Gate−to−Emitter Charge | $Q_{ge}$ | | – | 24.1 | – | |
| Gate−to−Collector Charge | $Q_{gc}$ | | – | 47.6 | – | |
| **SWITCHING CHARACTERISTICS, INDUCTIVE LOAD** | | | | | | |
| Turn−On Delay Time | $t_{d(on)}$ | $T_C$ = 25°C<br>$V_{CC}$ = 400 V, $I_C$ = 75 A<br>Rg = 15 Ω<br>$V_{GE}$ = 15 V<br>Inductive Load, $T_C$ = 25°C | – | 55 | – | ns |
| Rise Time | $t_r$ | | – | 50 | – | |
| Turn−Off Delay Time | $t_{d(off)}$ | | – | 189 | – | |
| Fall Time | $t_f$ | | – | 39 | – | |
| Turn−On Switching Loss | $E_{on}$ | | – | 1.06 | – | mJ |
| Turn−Off Switching Loss | $E_{off}$ | | – | 1.56 | – | |
| Total Switching Loss | $E_{ts}$ | | – | 2.62 | – | |
| Turn−On Delay Time | $t_{d(on)}$ | $V_{CC}$ = 400 V, $I_C$ = 75 A<br>Rg = 15 Ω<br>$V_{GE}$ = 15 V<br>Inductive Load, $T_C$ = 175°C | – | 48 | – | ns |
| Rise Time | $t_r$ | | – | 56 | – | |
| Turn−Off Delay Time | $t_{d(off)}$ | | – | 205 | – | |
| Fall Time | $t_f$ | | – | 40 | – | |
| Turn−On Switching Loss | $E_{on}$ | | – | 2.34 | – | mJ |
| Turn−Off Switching Loss | $E_{off}$ | | – | 1.81 | – | |
| Total Switching Loss | $E_{ts}$ | | – | 4.15 | – | |
| **DIODE CHARACTERISTICS** | | | | | | |
| Forward voltage | $V_F$ | $I_F$ = 75 A<br>$I_F$ = 75 A, $T_J$ = 175°C | –<br>– | 1.8<br>1.7 | 2.1<br>– | V |

**Table 2. ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **DIODE CHARACTERISTICS** | | | | | | |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25°C<br>$I_F$ = 75 A, $di_F/dt$ = 200 A/μs | – | 36 | – | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | – | 18 | – | |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 175°C<br>$I_F$ = 75 A, $di_F/dt$ = 200 A/μs | – | 270 | – | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | – | 2199 | – | μC |
| Reverse Recovery Energy | $E_{rec}$ | | – | 160 | – | μJ |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## TYPICAL CHARACTERISTICS

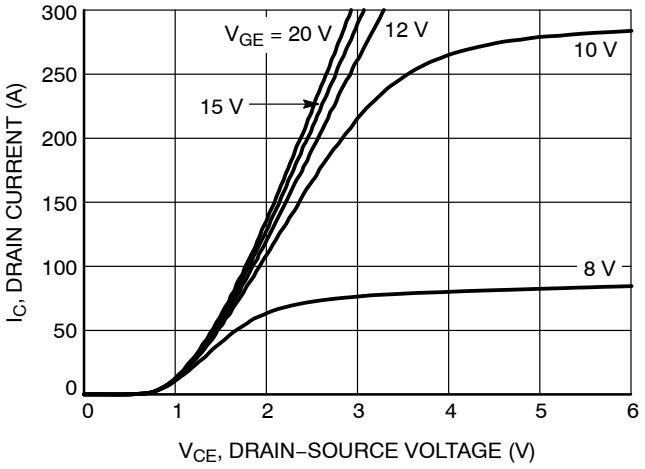



**Figure 1. Typical Output Characteristics (25°C)**

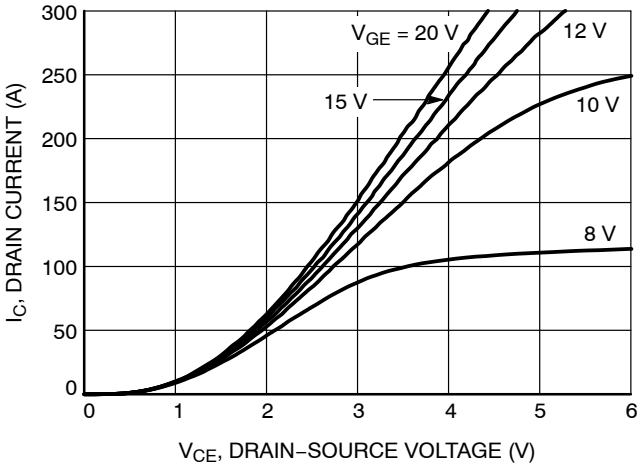



**Figure 2. Typical Output Characteristics (175°C)**

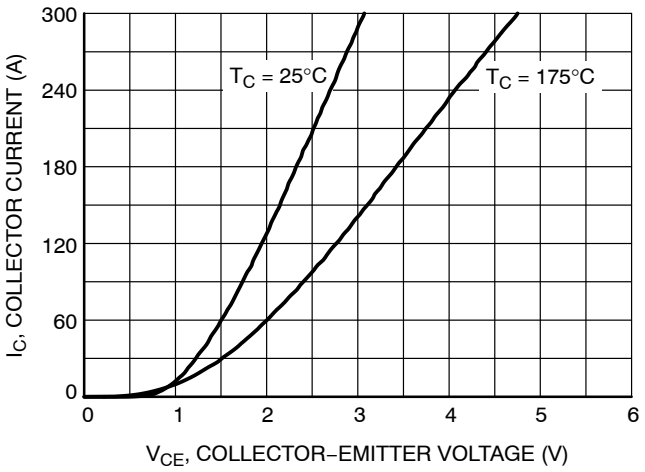



**Figure 3. Typical Saturation Voltage Characteristics**

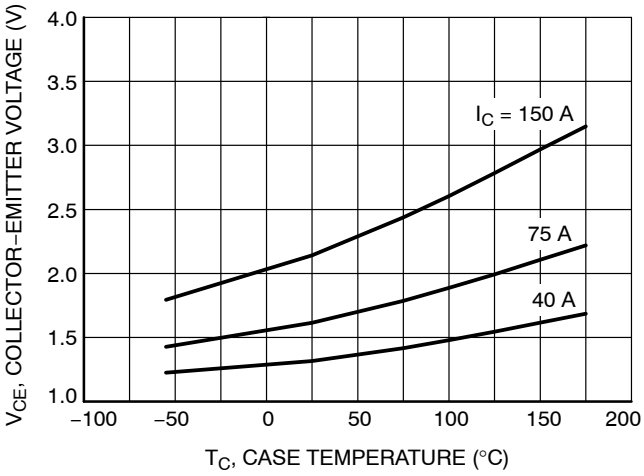



**Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level**

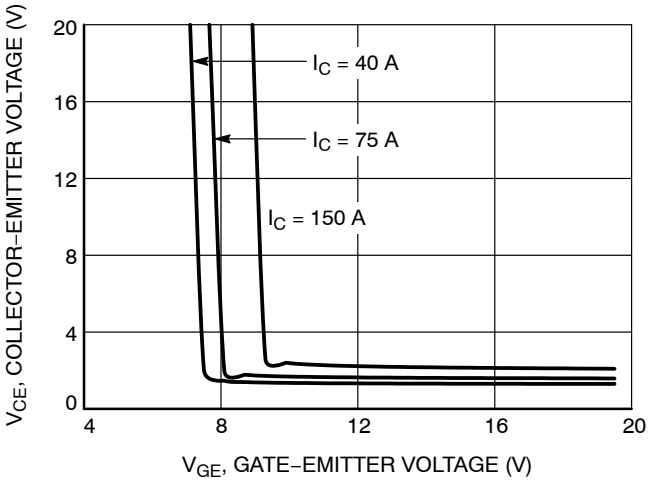



**Figure 5. Saturation Voltage vs. $V_{GE}$ (25°C)**

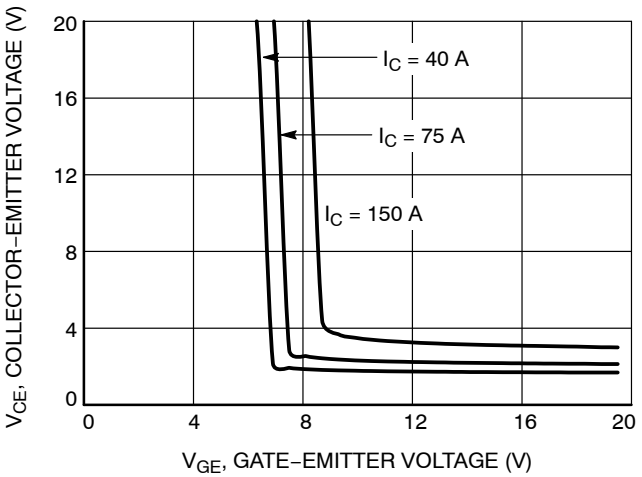



**Figure 6. Saturation Voltage vs. $V_{GE}$ (175°C)**

## TYPICAL CHARACTERISTICS

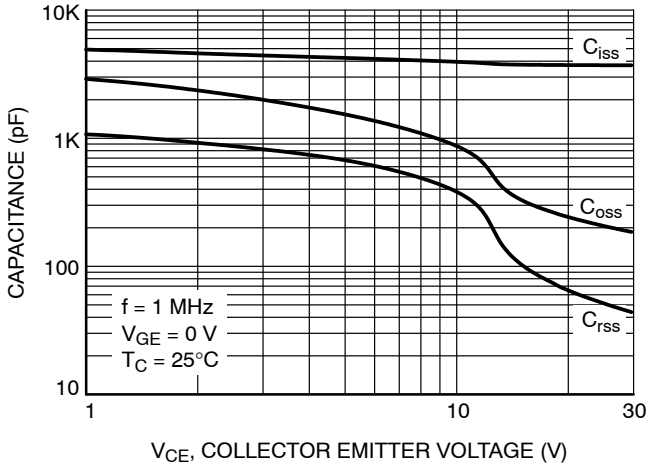



**Figure 7. Capacitance Characteristics**

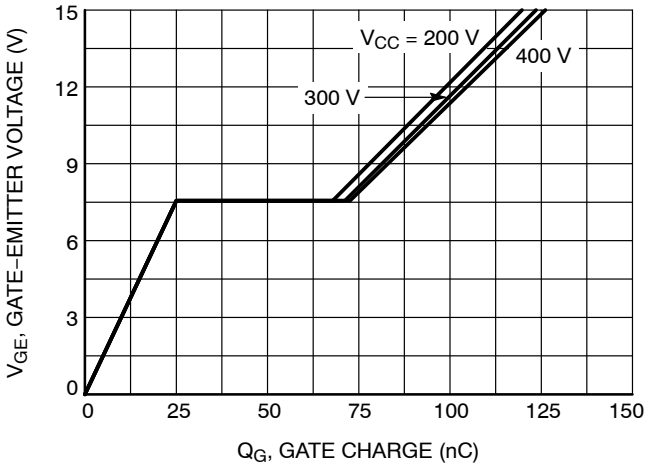



**Figure 8. Gate Charge Characteristics**

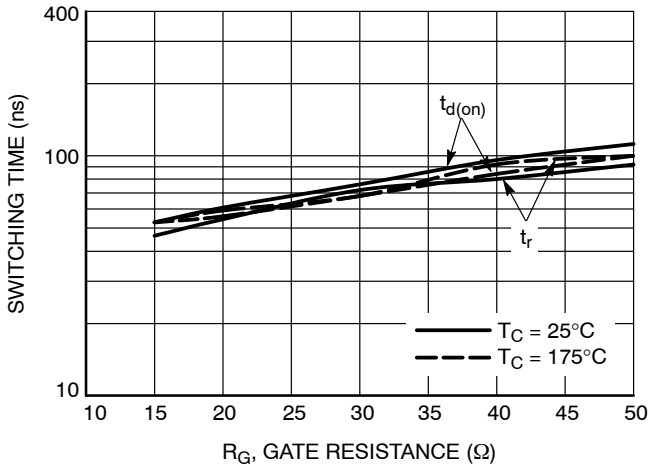



**Figure 9. Turn−On Characteristics vs. Gate Resistance**

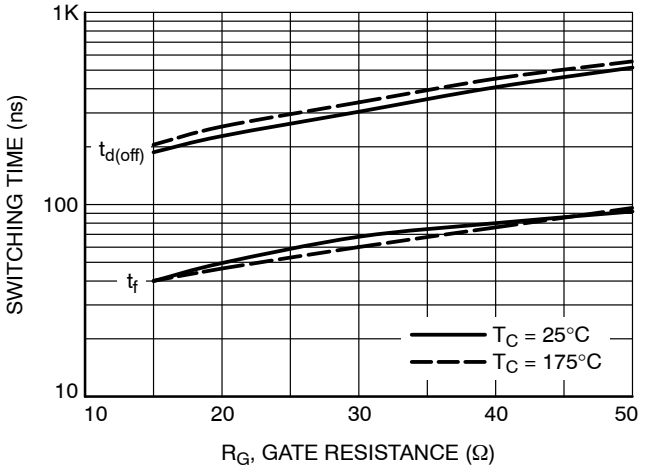



**Figure 10. Turn−Off Characteristics vs. Gate Resistance**

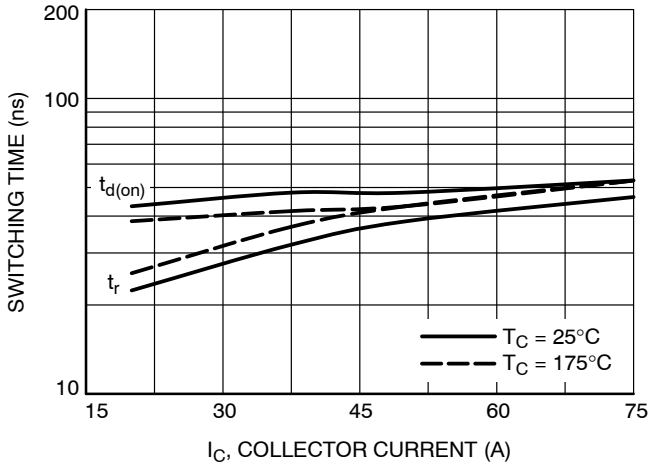



**Figure 11. Turn−On Characteristics vs. Collector Current**

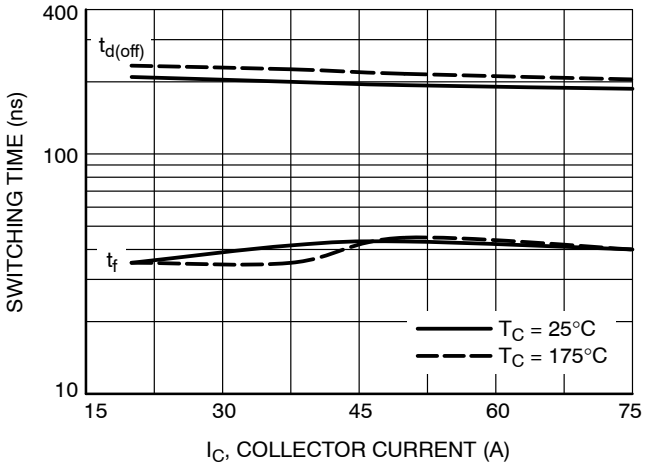



**Figure 12. Turn−Off Characteristics vs. Collector Current**

## TYPICAL CHARACTERISTICS

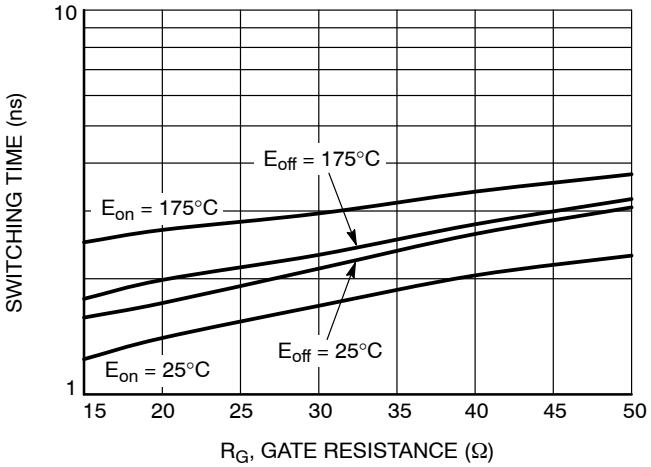



**Figure 13. Switching Loss vs. Gate Resistance**

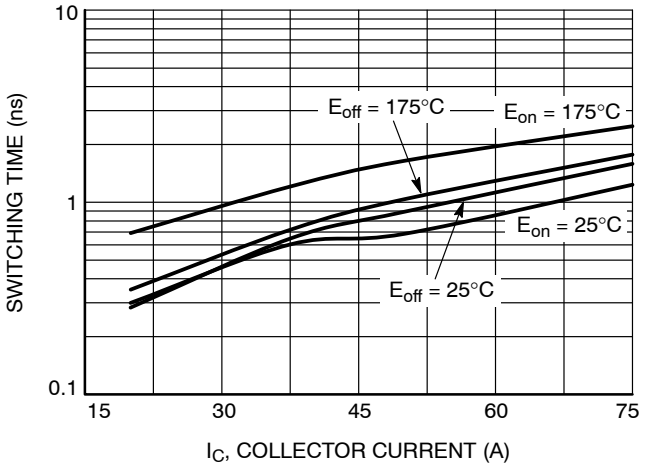



**Figure 14. Switching Loss vs. Collector Current**

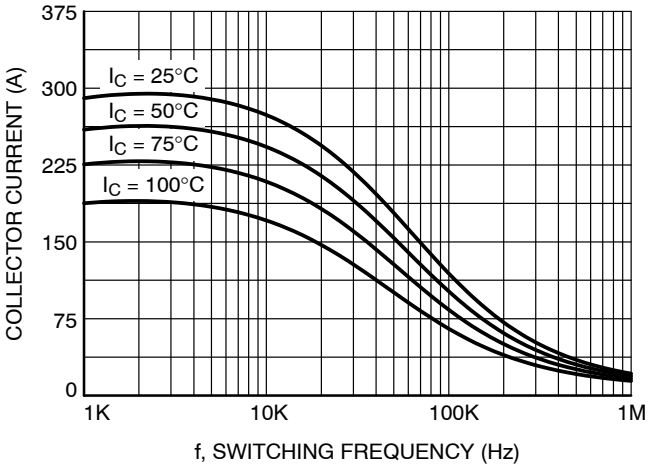



**Figure 15. Load Frequency Template**

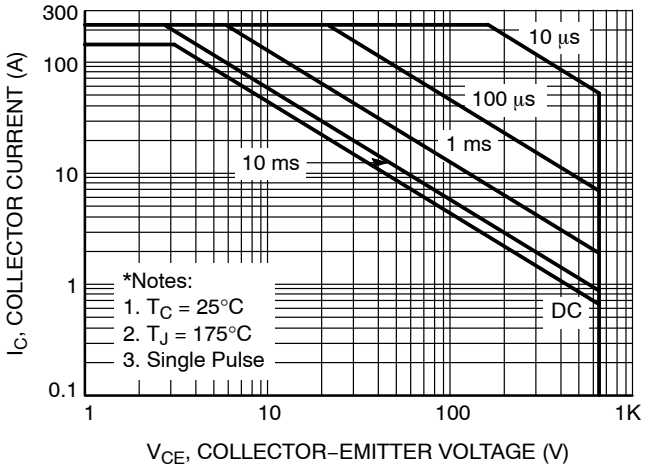



**Figure 16. SOA Characteristics**

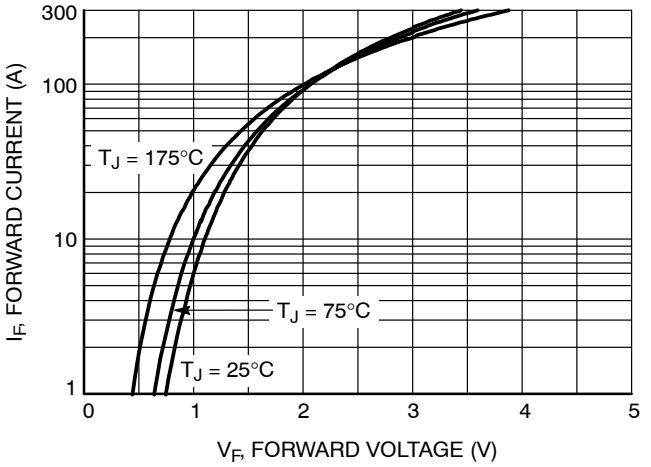



**Figure 17. Forward Characteristics**

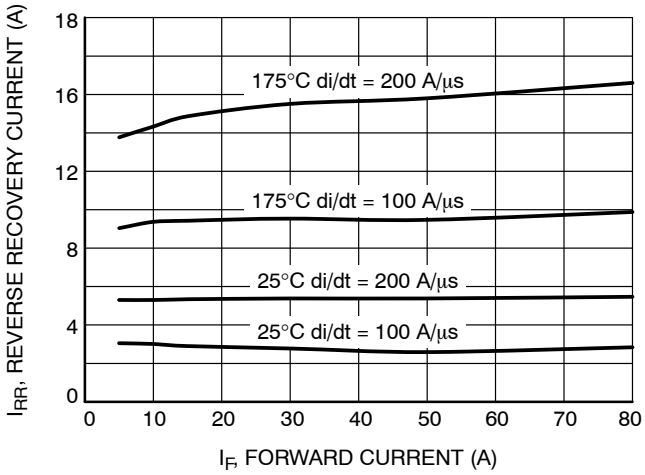



**Figure 18. Reverse Recovery Current**

## TYPICAL CHARACTERISTICS

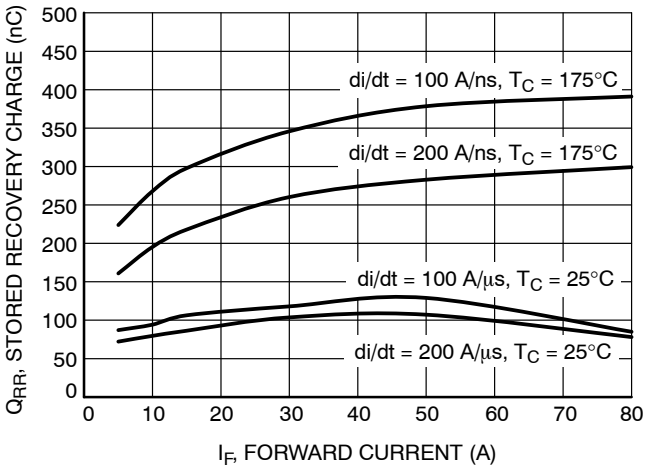



**Figure 19. Reverse Recovery Time**

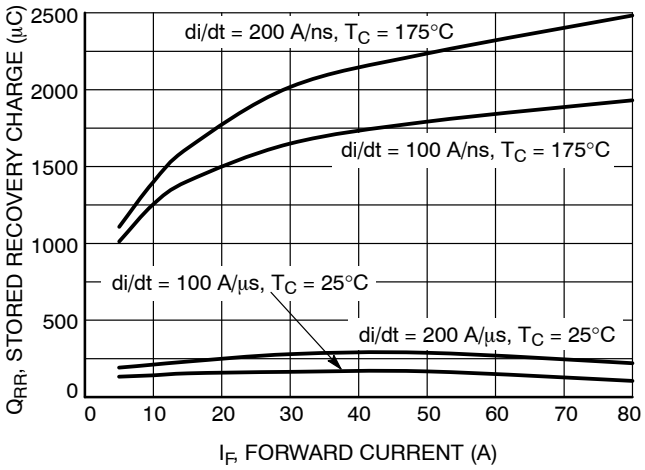



**Figure 20. Stored Charge**

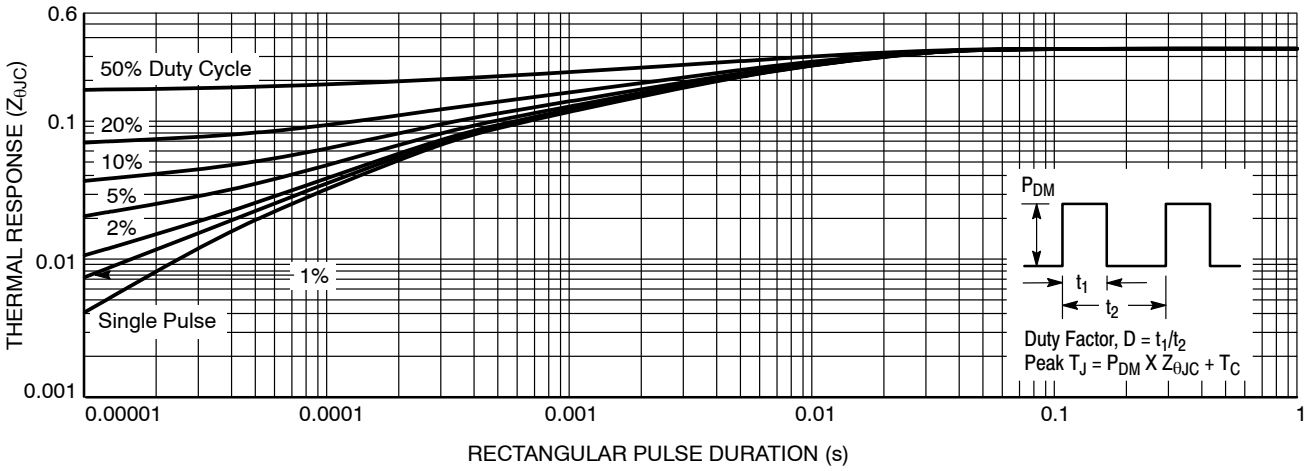



**Figure 21. Transient Thermal Impedance of IGBT**

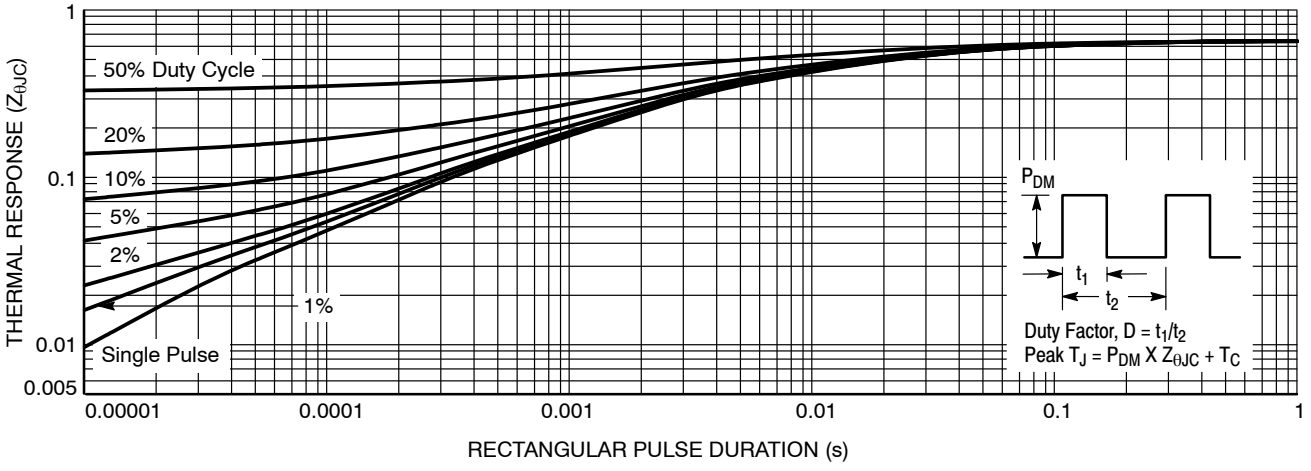
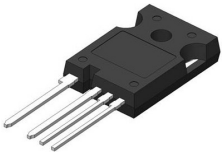



**Figure 22. Transient Thermal Impedance of Diode**

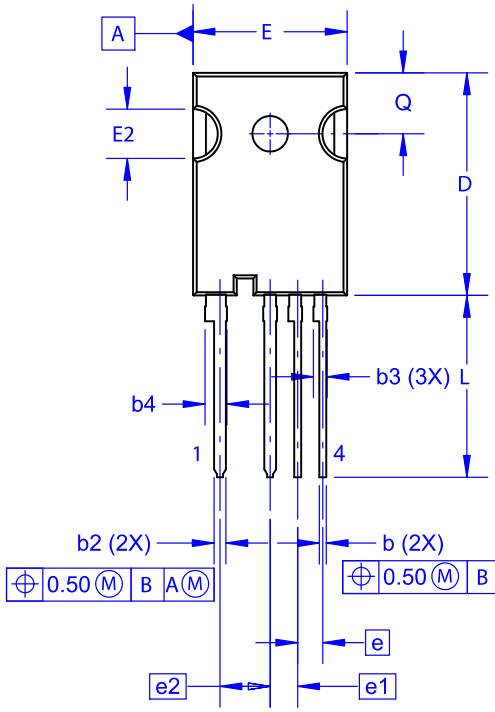
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

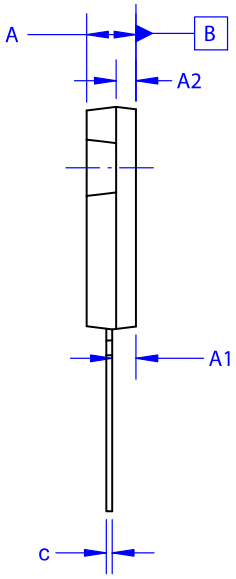


**TO−247 4−LEAD, THIN LEADS**
CASE 340CW
ISSUE A

DATE 16 SEP 2019




SCALE 1.5 : 1

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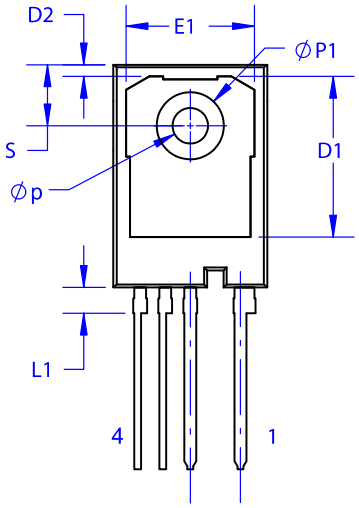


SCALE 1.5 : 1

NOTES:

A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS,MOLD FLASH AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.10 | 2.40 | 2.70 |
| A2 | 1.80 | 2.00 | 2.20 |
| b | 0.57 | 0.70 | 0.83 |
| b2 | 1.07 | 1.20 | 1.33 |
| b3 | 1.20 | 1.40 | 1.60 |
| b4 | 2.02 | 2.22 | 2.42 |
| c | 0.50 | 0.60 | 0.70 |
| D | 22.34 | 22.54 | 22.74 |
| D1 | 16.00 | 16.30 | 16.50 |
| D2 | 0.97 | 1.17 | 1.37 |
| e | | 2.54 | |
| e1 | | 2.79 | |
| e2 | | 5.08 | |
| E | 15.40 | 15.60 | 15.80 |
| E1 | 12.80 | 13.00 | 13.20 |
| E2 | 4.80 | 5.00 | 5.20 |
| L | 18.12 | 18.42 | 18.72 |
| L1 | 2.42 | 2.62 | 2.82 |
| Øp | 3.40 | 3.60 | 3.80 |
| ØP1 | 6.60 | 6.80 | 7.00 |
| Q | 5.97 | 6.17 | 6.37 |
| S | 5.97 | 6.17 | 6.37 |

| | | | |
|---|---|---|---|
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| **DESCRIPTION:** | **TO−247 4−LEAD, THIN LEADS** | | **PAGE 1 OF 1** |

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