

IGBT - SMPS 300 V

FGH50N3

Description

Using ON Semiconductor's planar technology, this IGBT is ideal for many high voltage switching applications operating at high frequencies where low conduction losses are essential. This device has been optimized for medium frequency switch mode power supplies.

Features

- Low Saturation Voltage: $V_{CE(sat)} = 1.4 \text{ V Max}$
- Low $E_{OFF} = 6.6 \text{ uJ/A}$
- $SCWT = 8 \text{ } \mu\text{s @ } = 125^{\circ}\text{C}$
- 300 V Switching SOA Capability
- Positive Temperature Coefficient above 50 A
- This is a Pb-Free Device

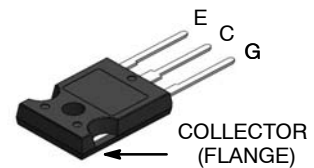
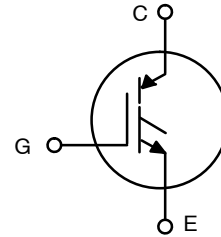
Applications

- SMPS



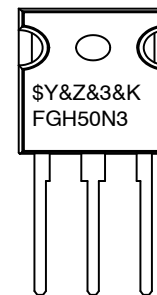
ON Semiconductor®

www.onsemi.com



TO-247-3LD
CASE 340CK

MARKING DIAGRAM



| | |
|---------|-------------------------|
| \$Y | = ON Semiconductor Logo |
| &Z | = Assembly Plant Code |
| &3 | = Numeric Date Code |
| &K | = Lot Code |
| FGH50N3 | = Specific Device Code |

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

FGH50N3

MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

| Parameter | Symbol | Ratings | Unit |
|--|-------------------|------------------------|------|
| Collector to Emitter Breakdown Voltage | BV _{CES} | 300 | V |
| Collector Current Continuous | I _C | T _C = 25°C | 75 |
| | | T _C = 110°C | 75 |
| Collector Current Pulsed (Note 1) | I _{CM} | 240 | A |
| Gate to Emitter Voltage Continuous | V _{GES} | ±20 | V |
| Gate to Emitter Voltage Pulsed | V _{GEM} | ±30 | V |
| Switching Safe Operating Area at T _J = 150°C, Figure 2 | SSOA | 150 A at 300 V | |
| Single Pulse Avalanche Energy, I _{CE} = 30 A, L = 1.78 mH, V _{DD} = 50 V | E _{AS} | 800 | mJ |
| Single Pulse Reverse Avalanche Energy, I _{EC} = 30 A, L = 1.78 mH, V _{DD} = 50 V | E _{ARV} | 800 | mJ |
| Power Dissipation Total | P _D | T _C = 25°C | 463 |
| Power Dissipation Derating | | T _C > 25°C | 3.7 |
| Operating Junction Temperature Range | T _J | -55 to +150 | °C |
| Storage Temperature Range Range | T _{STG} | -55 to +150 | °C |
| Short Circuit Withstand Time (Note 2) | t _{SC} | 8 | μs |

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. Pulse width limited by maximum junction temperature.
2. V_{CE(PK)} = 180 V, T_J = 125°C, V_{GE} = 12 Vdc, R_G = 5 Ω

PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device | Package | Tape Width | Quantity |
|----------------|---------|---------|------------|----------|
| FGH50N3 | FGH50N3 | TO-247 | N/A | 30 |

THERMAL CHARACTERISTICS

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-----------------------------------|------------------|-----------------|-----|-----|------|------|
| Thermal Resistance, Junction-Case | R _{θJC} | TO-247 | - | - | 0.27 | °C/W |

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-----------|--------|-----------------|-----|-----|-----|------|
|-----------|--------|-----------------|-----|-----|-----|------|

OFF STATE CHARACTERISTICS

| | | | | | | |
|--|-------------------|--|------------------------|---|------|-----|
| Collector to Emitter Breakdown Voltage | BV _{CES} | I _{CE} = 250 μA, V _{GE} = 0 V, | 300 | - | - | V |
| Emitter to Collector Breakdown Voltage | BV _{ECS} | I _{EC} = 10 mA, V _{GE} = 0 V | 15 | - | - | V |
| Collector to Emitter Leakage Current | I _{CES} | V _{CE} = 300 V | T _J = 25°C | - | - | 250 |
| | | | T _J = 125°C | - | - | 2.0 |
| Gate to Emitter Leakage Current | I _{GES} | V _{GE} = ±20 V | - | - | ±250 | nA |

ON STATE CHARACTERISTICS

| | | | | | | | |
|---|----------------------|--|------------------------|---|------|-----|---|
| Collector to Emitter Saturation Voltage | V _{CE(SAT)} | I _{CE} = 30 A, V _{GE} = 15 V | T _J = 25°C | - | 1.30 | 1.4 | V |
| | | | T _J = 125°C | - | 1.25 | 1.4 | V |

DYNAMIC CHARACTERISTICS

| | | | | | | | |
|-----------------------------------|---------------------|---|------------------------|-----|-----|---|----|
| Gate Charge | Q _{G(ON)} | I _{CE} = 30 A, V _{CE} = 150 V | V _{GE} = 15 V | - | 180 | - | nC |
| | | | V _{GE} = 20 V | - | 228 | - | nC |
| Gate to Emitter Threshold Voltage | V _{GE(TH)} | I _{CE} = 250 μA, V _{CE} = V _{GE} | 4.0 | 4.8 | 5.5 | V | |
| Gate to Emitter Plateau Voltage | V _{GEP} | I _{CE} = 30 A, V _{CE} = 150 V | - | 7.0 | - | V | |

FGH50N3

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted) (continued)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|----------------------------------|---------------|--|-----|-----|-----|---------------|
| SWITCHING CHARACTERISTICS | | | | | | |
| Switching SOA | SSOA | $T_J = 150^\circ\text{C}$, $R_G = 5 \Omega$, $V_{GE} = 15 \text{ V}$, $L = 25 \mu\text{H}$, $V_{CE} = 300 \text{ V}$ | 150 | – | – | A |
| Current Turn-On Delay Time | $t_{d(ON)I}$ | IGBT and Diode at $T_J = 25^\circ\text{C}$, $I_{CE} = 30 \text{ A}$, $V_{CE} = 180 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 5 \Omega$, $L = 100 \mu\text{H}$, Test Circuit – Figure 20 | – | 20 | – | ns |
| Current Rise Time | t_{rI} | | – | 15 | – | ns |
| Current Turn-Off Delay Time | $t_{d(OFF)I}$ | | – | 135 | – | ns |
| Current Fall Time | t_{fI} | | – | 12 | – | ns |
| Turn-On Energy (Note 3) | E_{ON2} | | – | 130 | – | μJ |
| Turn-Off Energy Loss (Note 4) | E_{OFF} | | – | 92 | 120 | μJ |
| Current Turn-On Delay Time | $t_{d(ON)I}$ | IGBT and Diode at $T_J = 125^\circ\text{C}$, $I_{CE} = 30 \text{ A}$, $V_{CE} = 180 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 5 \Omega$, $L = 100 \mu\text{H}$, Test Circuit – Figure 20 | – | 19 | – | ns |
| Current Rise Time | t_{rI} | | – | 13 | – | ns |
| Current Turn-Off Delay Time | $t_{d(OFF)I}$ | | – | 155 | 190 | ns |
| Current Fall Time | t_{fI} | | – | 7 | 15 | ns |
| Turn-On Energy (Note 3) | E_{ON2} | | – | 225 | 270 | μJ |
| Turn-Off Energy (Note 4) | E_{OFF} | | – | 135 | 200 | 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.

- E_{ON2} is the turn-on loss when a typical diode is used in the test circuit and the diode is at the same T_J as the IGBT. The diode type is specified in Figure 20.
- Turn-Off Energy Loss (E_{OFF}) is defined as the integral of the instantaneous power loss starting at the trailing edge of the input pulse and ending at the point where the collector current equals zero ($I_{CE} = 0 \text{ A}$). All devices were tested per JEDEC Standard No. 24-1 Method for Measurement of Power Device Turn-Off Switching Loss. This test method produces the true total Turn-Off Energy Loss.

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

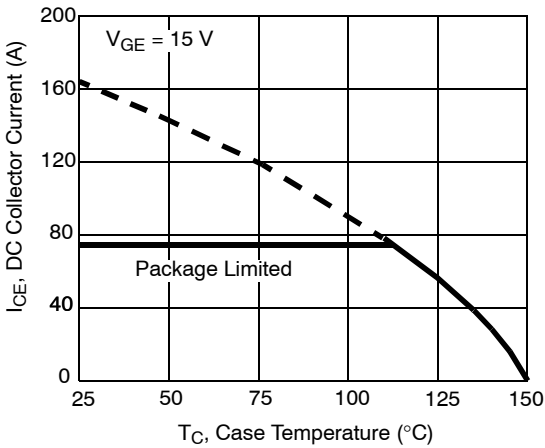


Figure 1. DC Collector Current vs. Case Temperature

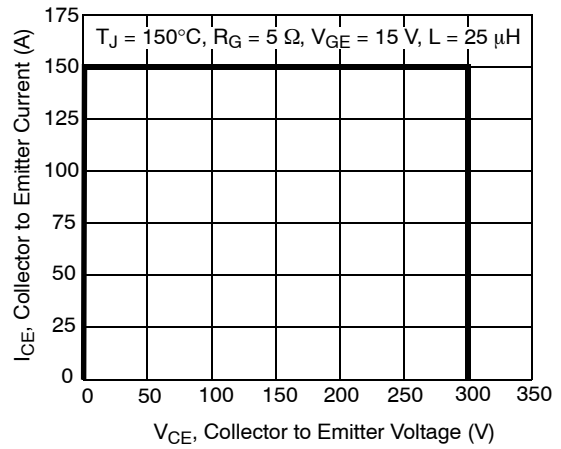


Figure 2. Minimum Switching Safe Operating Area

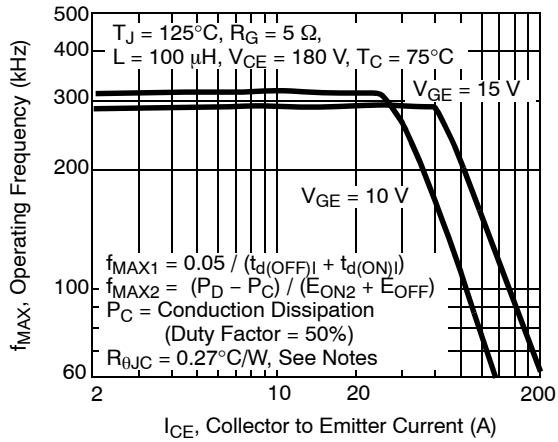


Figure 3. Operating Frequency vs. Collector to Emitter Current

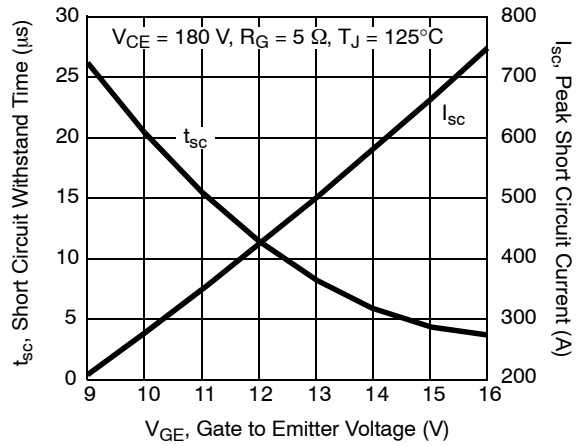


Figure 4. Short Circuit Withstand Time

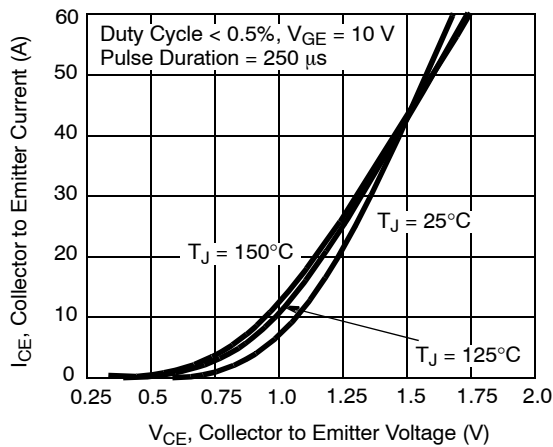


Figure 5. Collector to Emitter On-State Voltage

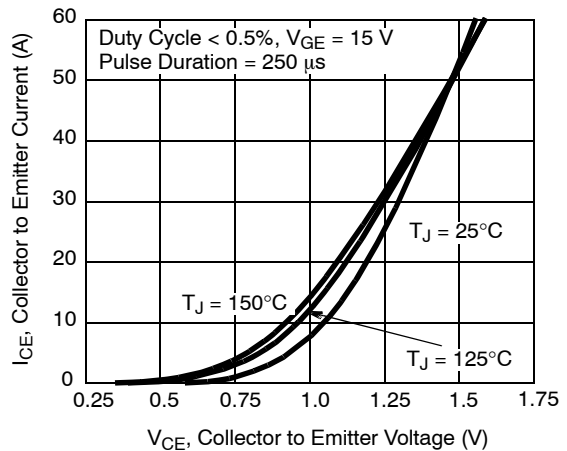


Figure 6. Collector to Emitter On-State Voltage

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

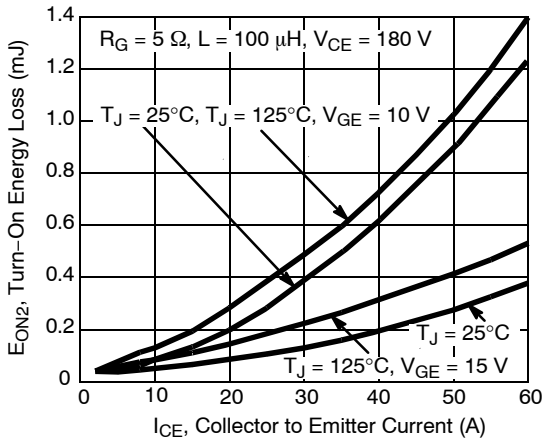


Figure 7. Turn-On Energy Loss vs. Collector to Emitter Current

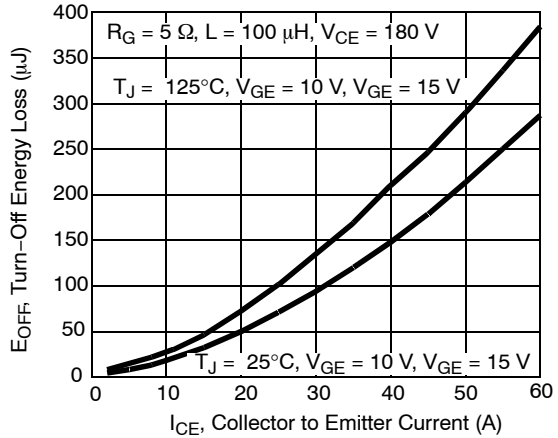


Figure 8. Turn-Off Energy Loss vs. Collector to Emitter Current

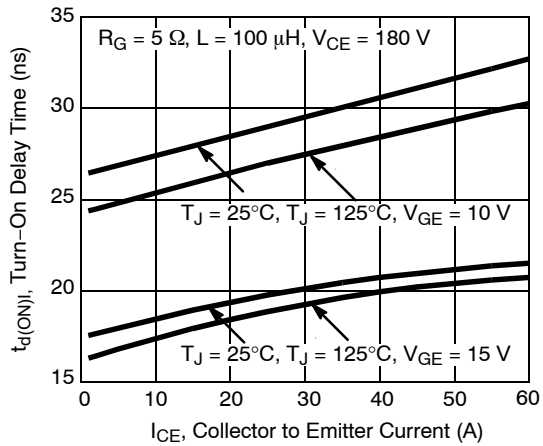


Figure 9. Turn-On Delay Time vs. Collector to Emitter Current

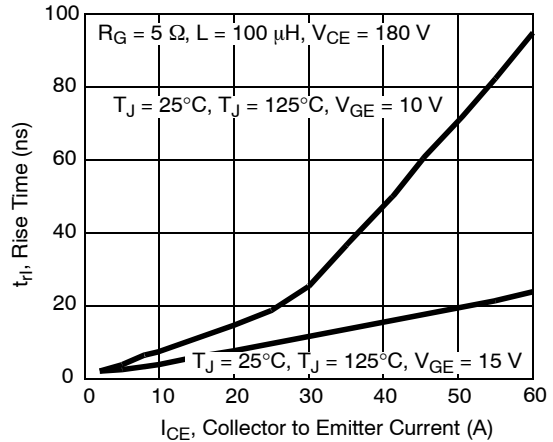


Figure 10. Turn-On Rise Time vs. Collector to Emitter Current

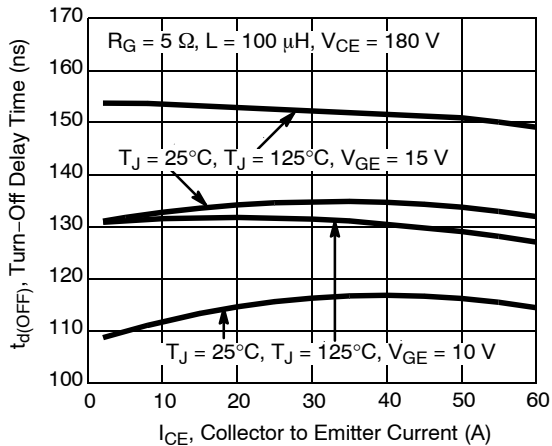


Figure 11. Turn-Off Delay Time vs. Collector to Emitter Current

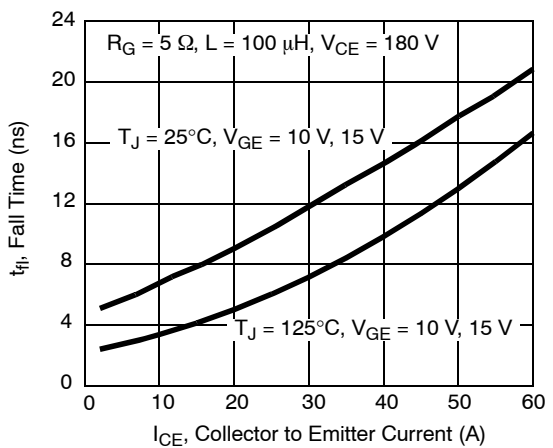


Figure 12. Fall Time vs. Collector to Emitter Current

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

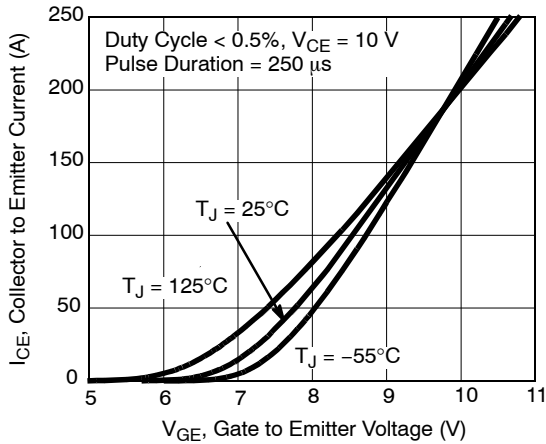


Figure 13. Transfer Characteristics

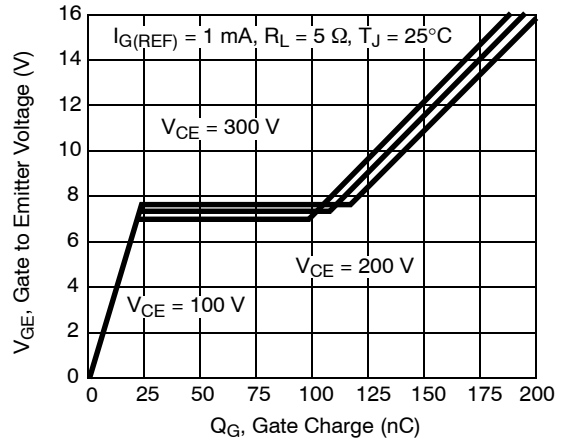


Figure 14. Gate Charge

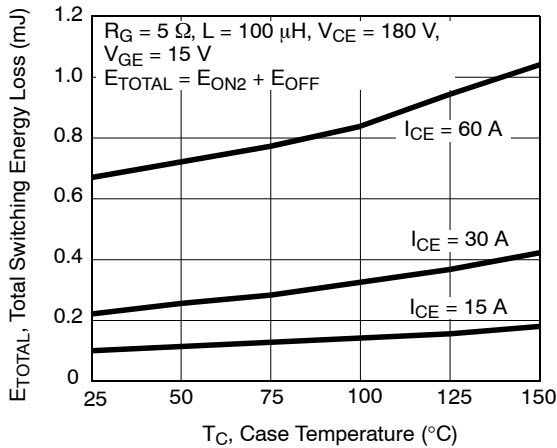


Figure 15. Total Switching Loss vs. Case Temperature

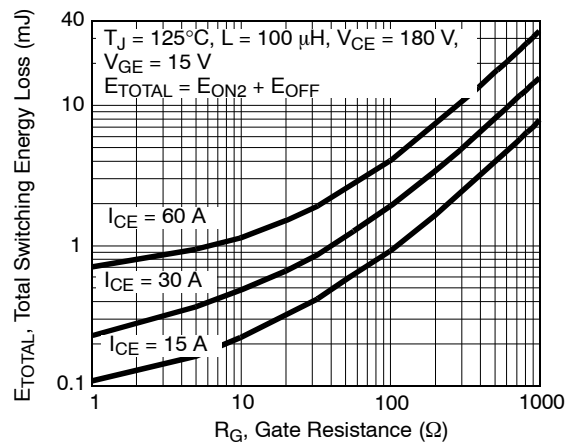


Figure 16. Total Switching Loss vs. Gate Resistance

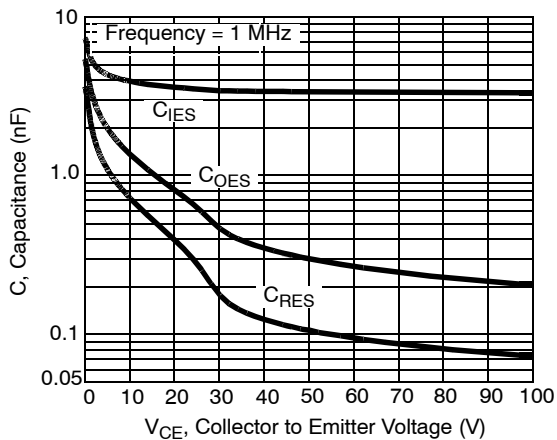


Figure 17. Capacitance vs. Collector to Emitter Voltage

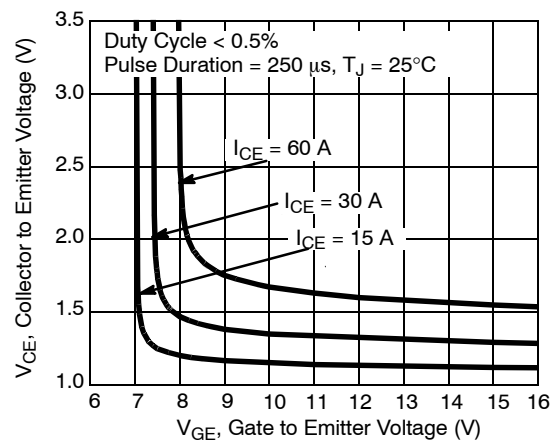


Figure 18. Collector to Emitter On-State Voltage vs. Gate to Emitter Voltage

FGH50N3

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

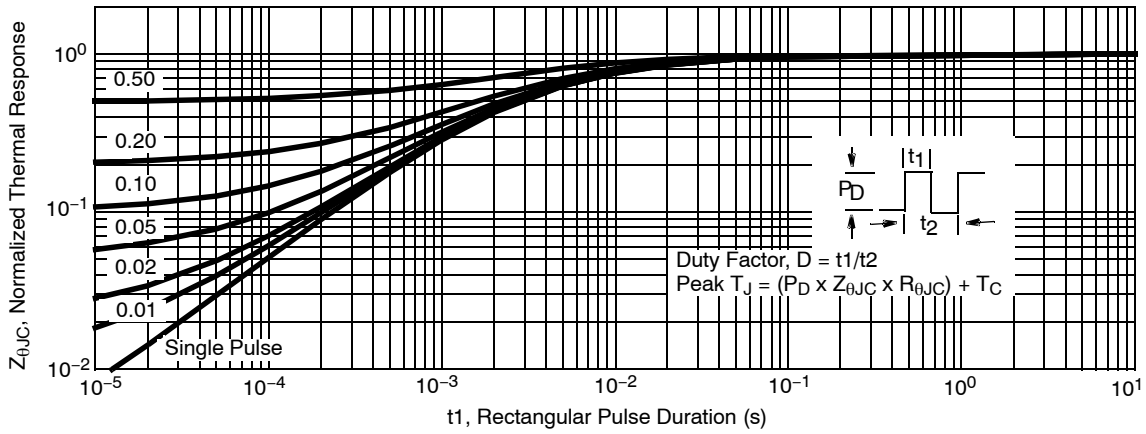


Figure 19. IGBT Normalized Transient Thermal Impedance, Junction to Case

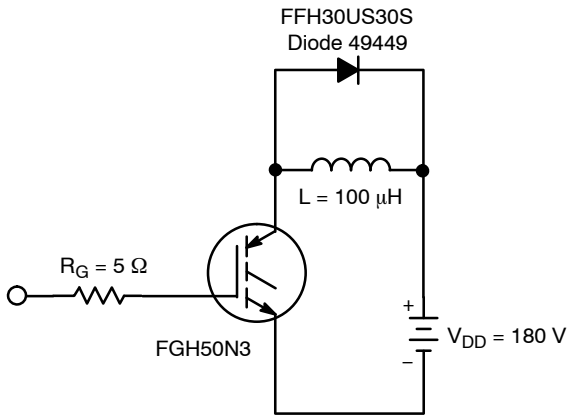


Figure 20. Inductive Switching Test Circuit

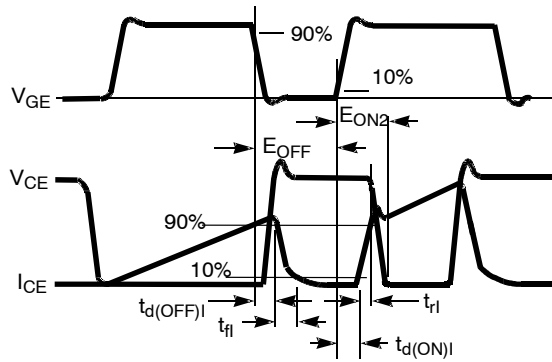
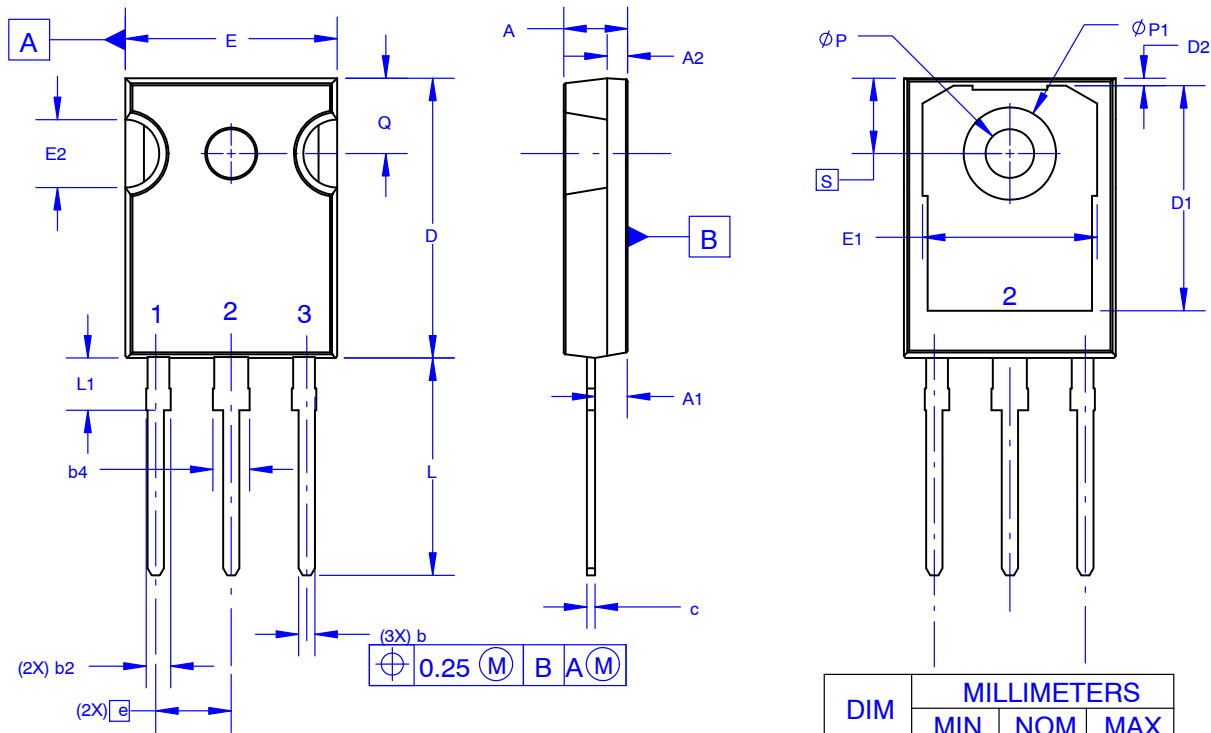


Figure 21. Switching Test Waveforms

TO-247-3LD SHORT LEAD
CASE 340CK
ISSUE A

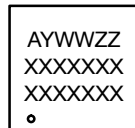
DATE 31 JAN 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
 A = Assembly Location
 Y = Year
 WW = Work Week
 ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

| DIM | MILLIMETERS | | |
|-----|-------------|-------|-------|
| | MIN | NOM | MAX |
| A | 4.58 | 4.70 | 4.82 |
| A1 | 2.20 | 2.40 | 2.60 |
| A2 | 1.40 | 1.50 | 1.60 |
| b | 1.17 | 1.26 | 1.35 |
| b2 | 1.53 | 1.65 | 1.77 |
| b4 | 2.42 | 2.54 | 2.66 |
| c | 0.51 | 0.61 | 0.71 |
| D | 20.32 | 20.57 | 20.82 |
| D1 | 13.08 | ~ | ~ |
| D2 | 0.51 | 0.93 | 1.35 |
| E | 15.37 | 15.62 | 15.87 |
| E1 | 12.81 | ~ | ~ |
| E2 | 4.96 | 5.08 | 5.20 |
| e | ~ | 5.56 | ~ |
| L | 15.75 | 16.00 | 16.25 |
| L1 | 3.69 | 3.81 | 3.93 |
| ØP | 3.51 | 3.58 | 3.65 |
| ØP1 | 6.60 | 6.80 | 7.00 |
| Q | 5.34 | 5.46 | 5.58 |
| S | 5.34 | 5.46 | 5.58 |

| | | |
|-------------------------|-----------------------|--|
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| DESCRIPTION: | TO-247-3LD SHORT LEAD | PAGE 1 OF 1 |

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