

Field Stop Trench IGBT

650 V, 75 A

FGHL75T65MQDTL4

Field stop 4th generation mid speed IGBT technology Full current rated copack Diode technology.

Features

- Maximum Junction Temperature: $T_J = 175^\circ\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(Sat)} = 1.45\text{ V (Typ.) @ } I_C = 75\text{ A}$
- 100% of the Parts are Tested for I_{LM} (Note 2)
- Smooth and Optimized Switching
- Tight Parameter Distribution
- RoHS Compliant

Typical Applications

- Solar Inverter
- UPS, ESS
- PFC, Converters

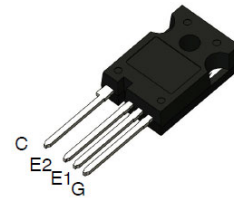
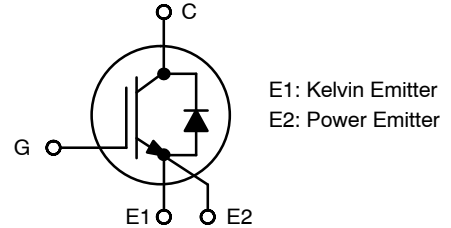
MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|----------------------|----------------------|------------------|
| Collector to Emitter Voltage | V_{CES} | 650 | V |
| Gate to Emitter Voltage Transient Gate to Emitter Voltage | V_{GES} | ± 20 ± 30 | V |
| Collector Current (Note 1) @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$ | I_C | 80 75 | A |
| Pulsed Collector Current (Note 2) | I_{LM} | 300 | A |
| Pulsed Collector Current (Note 3) | I_{CM} | 300 | A |
| Diode Forward Current (Note 1) @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$ | I_F | 80 75 | A |
| Pulsed Diode Maximum Forward Current | I_{FM} | 300 | A |
| Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$ | P_D | 375 188 | W |
| Operating Junction and Storage Temperature Range | T_J , T_{STG} | -55 to +175 | $^\circ\text{C}$ |
| Maximum Lead Temp. for Soldering Purposes (1/8" from Case for 5 s) | T_L | 260 | $^\circ\text{C}$ |

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.

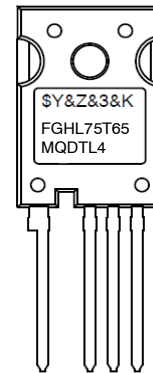
1. Value limit by bond wire
2. $V_{CC} = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 300\text{ A}$, Inductive Load, 100% tested
3. Repetitive rating: Pulse width limited by max. junction temperature

75 A, 650 V
 $V_{CESat} = 1.45\text{ V}$



TO-247-4LD
CASE 340CJ

MARKING DIAGRAM



&Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = 3-Digit Date Code
&K = 2-Digit Lot Traceability Code
FGHL75T65MQDTL4 = Specific Device Code

ORDERING INFORMATION

| Device | Package | Shipping |
|-----------------|------------|-----------------|
| FGHL75T65MQDTL4 | TO-247-4LD | 30 Units / Tube |

FGHL75T65MQDTL4

Thermal Characteristics

| Rating | Symbol | Value | Unit |
|--|-----------------|-------|----------------------|
| Thermal Resistance Junction-to-case, for IGBT | $R_{\theta JC}$ | 0.40 | $^{\circ}\text{C/W}$ |
| Thermal Resistance Junction-to-case, for Diode | $R_{\theta JC}$ | 0.60 | $^{\circ}\text{C/W}$ |
| Thermal Resistance Junction-to-ambient | $R_{\theta JA}$ | 40 | $^{\circ}\text{C/W}$ |

Electrical Characteristics ($T_J = 25^{\circ}\text{C}$ unless otherwise noted)

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

OFF CHARACTERISTICS

| | | | | | | |
|---|---|--------------------------------------|-----|-----|-----------|-----------------------------|
| Collector-emitter Breakdown Voltage, Gate-emitter Short-circuited | $V_{GE} = 0\text{ V},$ $I_C = 1\text{ mA}$ | BV_{CES} | 650 | - | - | V |
| Temperature Coefficient of Breakdown Voltage | $V_{GE} = 0\text{ V},$ $I_C = 1\text{ mA}$ | $\frac{\Delta BV_{CES}}{\Delta T_J}$ | - | 0.6 | - | $\text{V}/^{\circ}\text{C}$ |
| Collector-emitter Cut-off Current, Gate-emitter Short-circuited | $V_{GE} = 0\text{ V},$ $V_{CE} = 650\text{ V}$ | I_{CES} | - | - | 250 | μA |
| Gate Leakage Current, Collector-emitter Short-circuited | $V_{GE} = 20\text{ V},$ $V_{CE} = 0\text{ V}$ | I_{GES} | - | - | ± 400 | nA |

ON CHARACTERISTICS

| | | | | | | | |
|--------------------------------------|---|----------------------------|---------------|-----------------------------|------|------|---|
| Gate-emitter Threshold Voltage | $V_{GE} = V_{CE}, I_C = 75\text{ mA}$ | $V_{GE(th)}$ | 3.0 | 4.5 | 6.0 | V | |
| Collector-emitter Saturation Voltage | $V_{GE} = 15\text{ V},$ $I_C = 75\text{ A},$ | $T_J = 25^{\circ}\text{C}$ | $V_{CE(sat)}$ | - | 1.45 | 1.8 | V |
| | | | | $T_J = 175^{\circ}\text{C}$ | - | 1.65 | - |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|------------------------------|--|-----------|---|------|---|----|
| Input Capacitance | $V_{CE} = 30\text{ V},$ $V_{GE} = 0\text{ V},$ $f = 1\text{ MHz}$ | C_{ies} | - | 4954 | - | pF |
| Output Capacitance | | C_{oes} | - | 163 | - | |
| Reverse Transfer Capacitance | | C_{res} | - | 14 | - | |
| Gate Charge Total | $V_{CE} = 400\text{ V},$ $I_C = 75\text{ A},$ $V_{GE} = 15\text{ V}$ | Q_g | - | 149 | - | nC |
| Gate-to-emitter Charge | | Q_{ge} | - | 27 | - | |
| Gate-to-collector Charge | | Q_{gc} | - | 34 | - | |

SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

| | | | | | | | |
|-------------------------|---|--------------|-----------|-----|-----|----|----|
| Turn-on Delay Time | $T_C = 25^{\circ}\text{C},$ $V_{CC} = 400\text{ V},$ $I_C = 37.5\text{ A},$ $R_G = 10\ \Omega,$ $V_{GE} = 15\text{ V},$ Inductive Load | $t_{d(on)}$ | - | 30 | - | ns | |
| Rise Time | | t_r | - | 16 | - | | |
| Turn-off Delay Time | | $t_{d(off)}$ | - | 190 | - | | |
| Fall Time | | | t_f | - | 35 | - | |
| Turn-on Switching Loss | | | E_{on} | - | 0.6 | - | mJ |
| Turn-off Switching Loss | | | E_{off} | - | 0.5 | - | |
| Total Switching Loss | | | E_{ts} | - | 1.1 | - | |
| Turn-on Delay Time | $T_C = 25^{\circ}\text{C},$ $V_{CC} = 400\text{ V},$ $I_C = 75\text{ A},$ $R_G = 10\ \Omega,$ $V_{GE} = 15\text{ V},$ Inductive Load | $t_{d(on)}$ | - | 32 | - | ns | |
| Rise Time | | t_r | - | 29 | - | | |
| Turn-off Delay Time | | $t_{d(off)}$ | - | 181 | - | | |
| Fall Time | | | t_f | - | 32 | - | |
| Turn-on Switching Loss | | | E_{on} | - | 1.2 | - | mJ |
| Turn-off Switching Loss | | | E_{off} | - | 1.1 | - | |
| Total Switching Loss | | | E_{ts} | - | 2.3 | - | |

FGHL75T65MQDTL4

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

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

SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

| | | | | | | |
|-------------------------|---|--------------|---|-----|---|----|
| Turn-on Delay Time | $T_C = 150^\circ\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 37.5\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load | $t_{d(on)}$ | - | 27 | - | ns |
| Rise Time | | t_r | - | 19 | - | |
| Turn-off Delay Time | | $t_{d(off)}$ | - | 206 | - | |
| Fall Time | | t_f | - | 44 | - | |
| Turn-on Switching Loss | | E_{on} | - | 1.9 | - | mJ |
| Turn-off Switching Loss | | E_{off} | - | 1.8 | - | |
| Total Switching Loss | | E_{ts} | - | 1.8 | - | |
| Turn-on Delay Time | $T_C = 150^\circ\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 75\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load | $t_{d(on)}$ | - | 30 | - | ns |
| Rise Time | | t_r | - | 32 | - | |
| Turn-off Delay Time | | $t_{d(off)}$ | - | 198 | - | |
| Fall Time | | t_f | - | 40 | - | |
| Turn-on Switching Loss | | E_{on} | - | 2.0 | - | mJ |
| Turn-off Switching Loss | | E_{off} | - | 1.4 | - | |
| Total Switching Loss | | E_{ts} | - | 3.4 | - | |

DIODE CHARACTERISTICS

| | | | | | | | |
|-----------------------|---------------------|---------------------------|----------|---|------|-----|---|
| Diode Forward Voltage | $I_F = 75\text{ A}$ | $T_J = 25^\circ\text{C}$ | V_{FM} | - | 1.65 | 2.1 | V |
| | | $T_J = 175^\circ\text{C}$ | | - | 1.55 | - | |

DIODE SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

| | | | | | | |
|-------------------------------|--|-----------|---|------|---|---------------|
| Reverse Recovery Energy | $T_C = 25^\circ\text{C}$, $V_{CE} = 400\text{ V}$, $I_F = 37.5\text{ A}$, $di_F/dt = 1000\text{ A}/\mu\text{s}$ | E_{REC} | - | 105 | - | μJ |
| Diode Reverse Recovery Time | | T_{rr} | - | 58 | - | ns |
| Diode Reverse Recovery Charge | | Q_{rr} | - | 591 | - | nC |
| Reverse Recovery Energy | $T_C = 25^\circ\text{C}$, $V_{CE} = 400\text{ V}$, $I_F = 75\text{ A}$, $di_F/dt = 1000\text{ A}/\mu\text{s}$ | E_{REC} | - | 235 | - | μJ |
| Diode Reverse Recovery Time | | T_{rr} | - | 107 | - | ns |
| Diode Reverse Recovery Charge | | Q_{rr} | - | 1113 | - | nC |
| Reverse Recovery Energy | $T_C = 150^\circ\text{C}$, $V_{CE} = 400\text{ V}$, $I_F = 37.5\text{ A}$, $di_F/dt = 1000\text{ A}/\mu\text{s}$ | E_{REC} | - | 747 | - | μJ |
| Diode Reverse Recovery Time | | T_{rr} | - | 151 | - | ns |
| Diode Reverse Recovery Charge | | Q_{rr} | - | 2780 | - | nC |
| Reverse Recovery Energy | $T_C = 150^\circ\text{C}$, $V_{CE} = 400\text{ V}$, $I_F = 75\text{ A}$, $di_F/dt = 1000\text{ A}/\mu\text{s}$ | E_{REC} | - | 865 | - | μJ |
| Diode Reverse Recovery Time | | T_{rr} | - | 171 | - | ns |
| Diode Reverse Recovery Charge | | Q_{rr} | - | 3286 | - | nC |

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.

FGHL75T65MQDTL4

TYPICAL CHARACTERISTICS

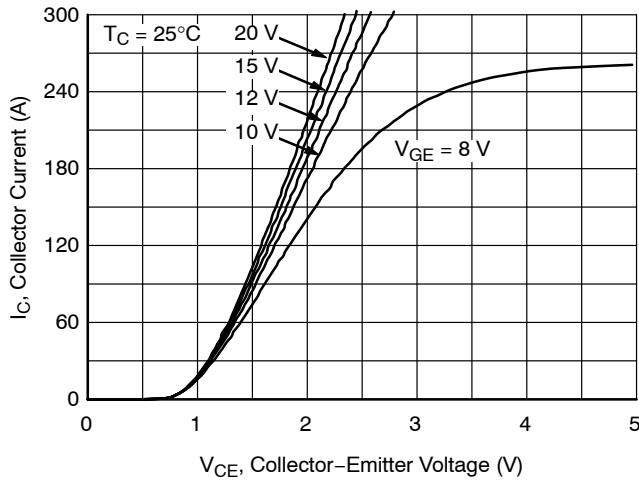


Figure 1. Typical Output Characteristics

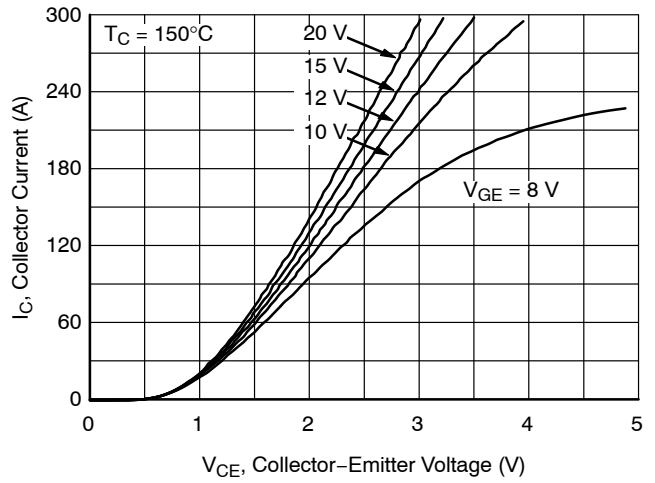


Figure 2. Typical Output Characteristics

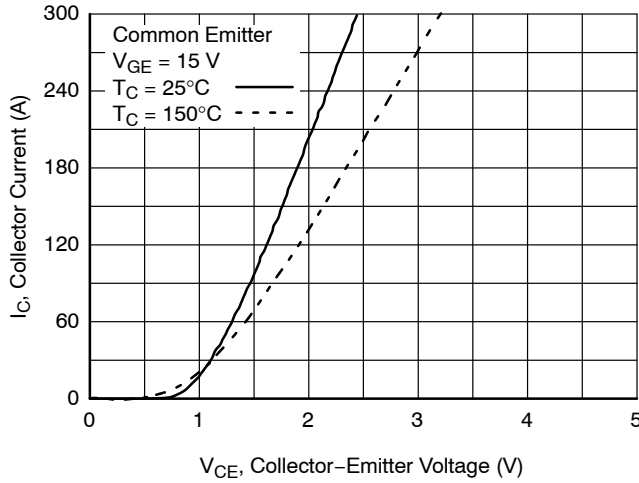


Figure 3. Typical Saturation Voltage

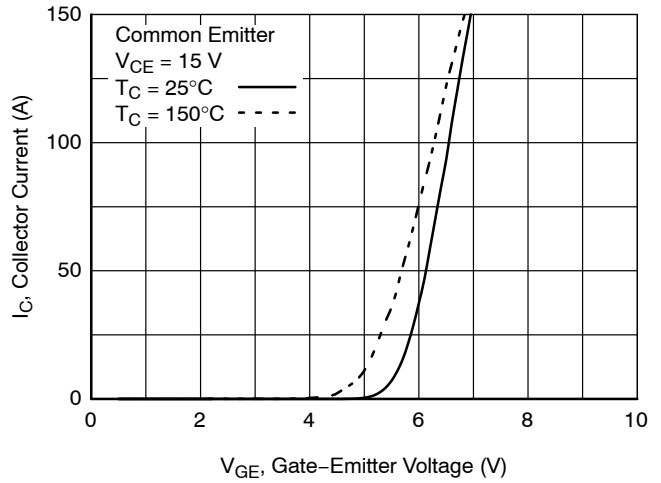


Figure 4. Typical Transfer Characteristics

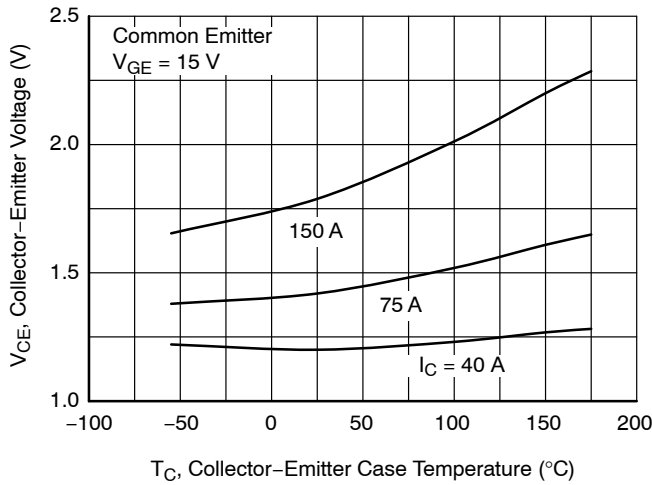


Figure 5. Saturation Voltage vs. Case Temperature

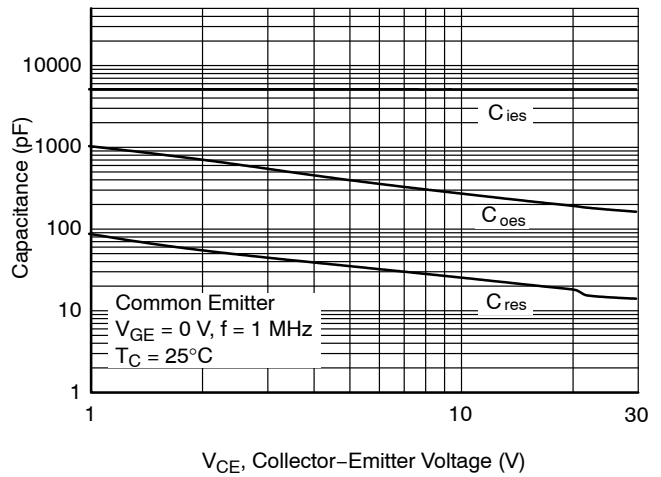


Figure 6. Capacitance Characteristics

FGHL75T65MQDTL4

TYPICAL CHARACTERISTICS (continued)

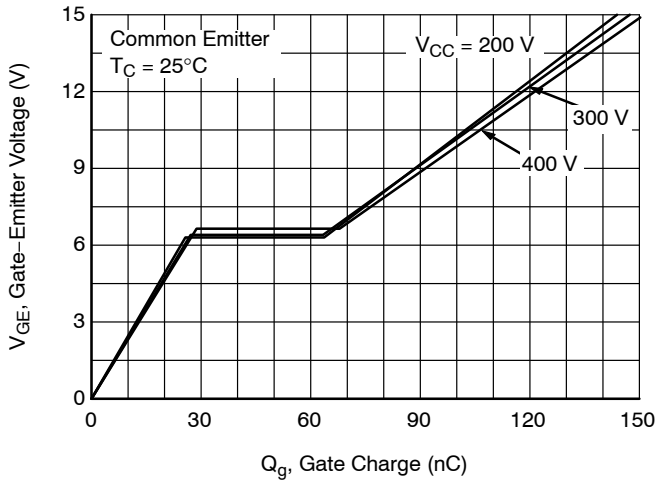


Figure 7. Gate Charge Characteristics

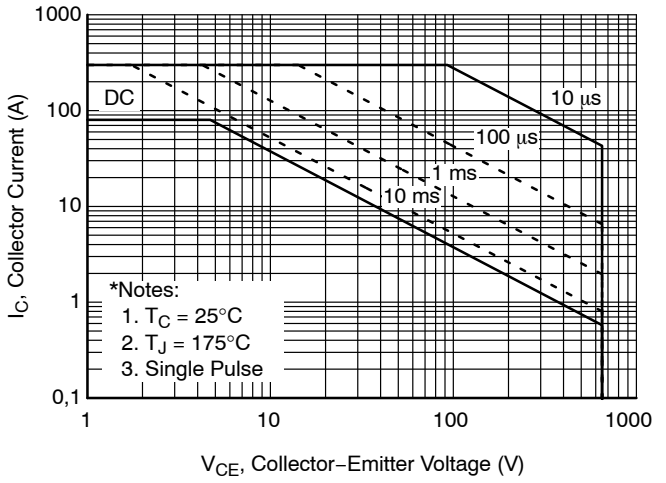


Figure 8. SOA Characteristics

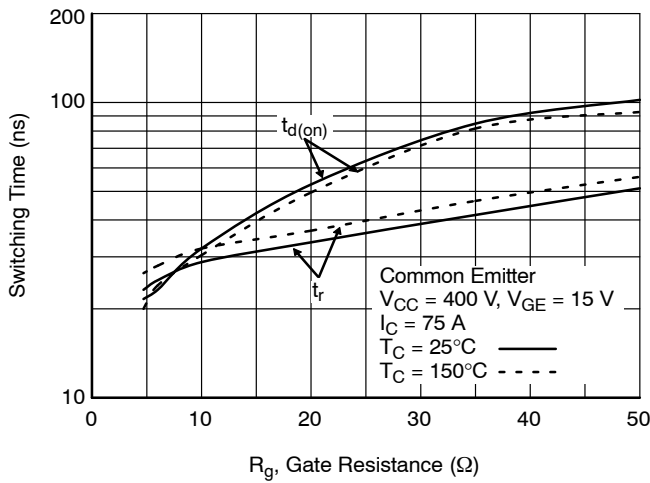


Figure 9. Turn-On Characteristics vs. Gate Resistance

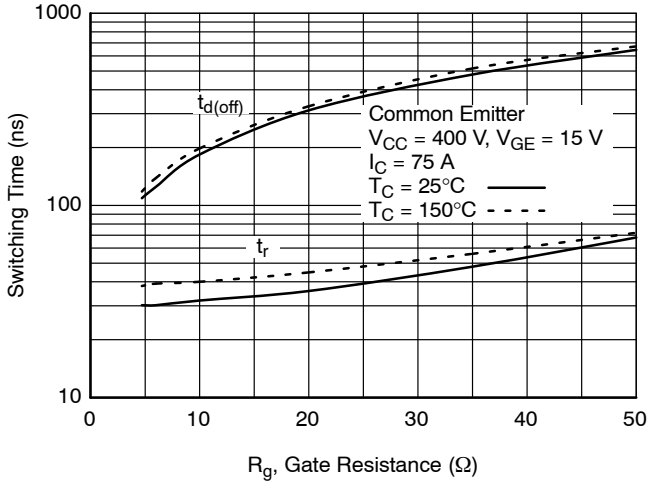


Figure 10. Turn-Off Characteristics vs. Gate Resistance

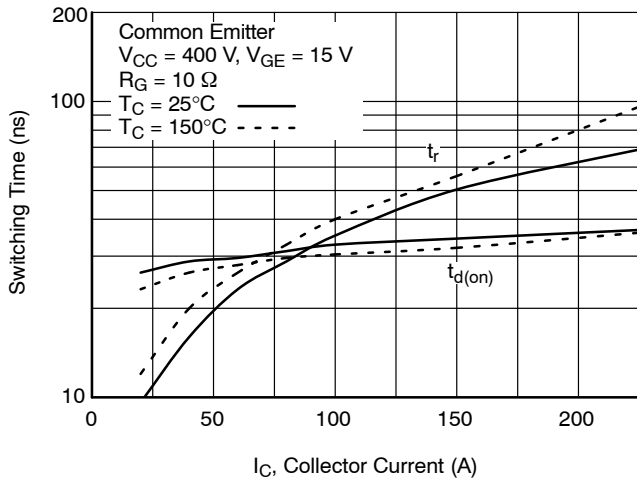


Figure 11. Turn-On Characteristics vs. Collector Current

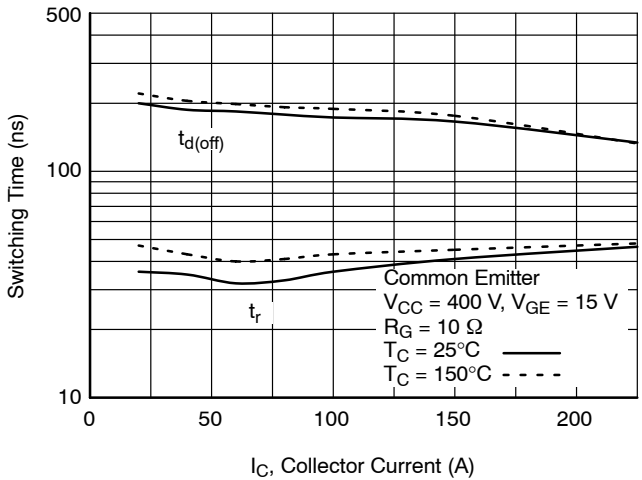


Figure 12. Turn-Off Characteristics vs. Collector Current

FGHL75T65MQDTL4

TYPICAL CHARACTERISTICS (continued)

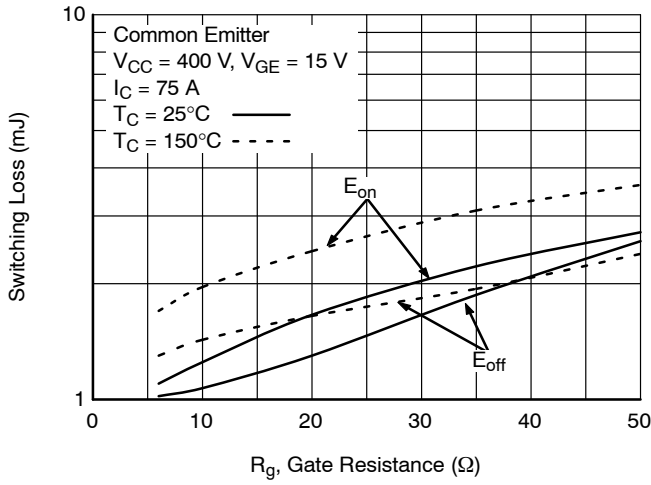


Figure 13. Switching Loss vs. Gate Resistance

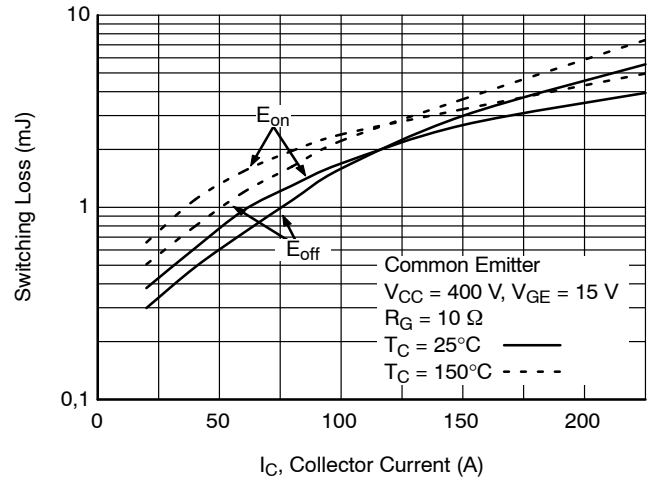


Figure 14. Switching Loss vs. Collector Current

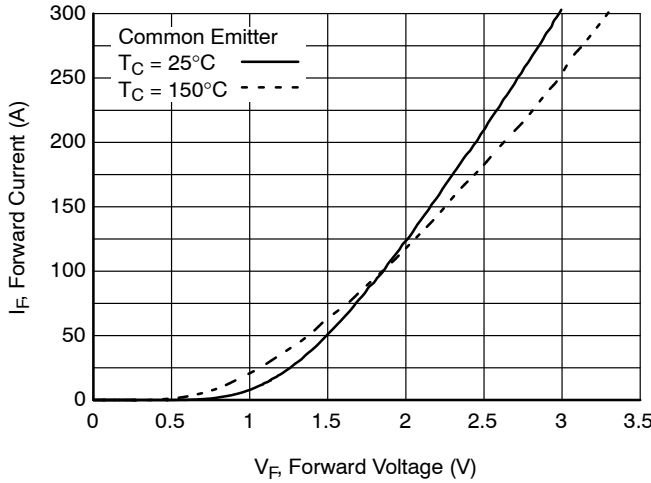


Figure 15. Forward Characteristics

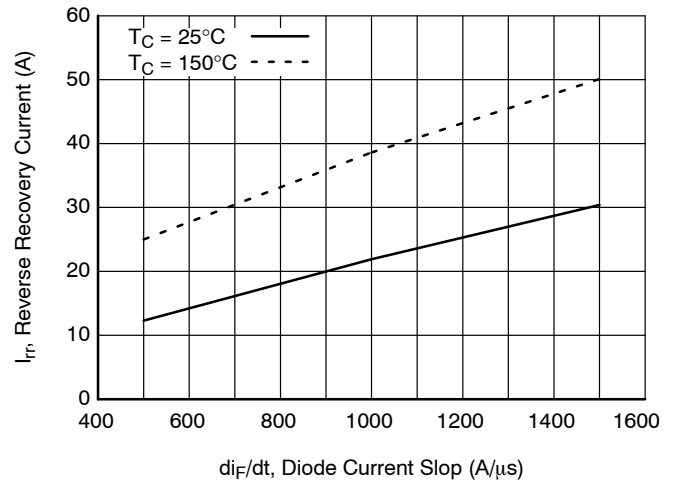


Figure 16. Reverse Recovery Current

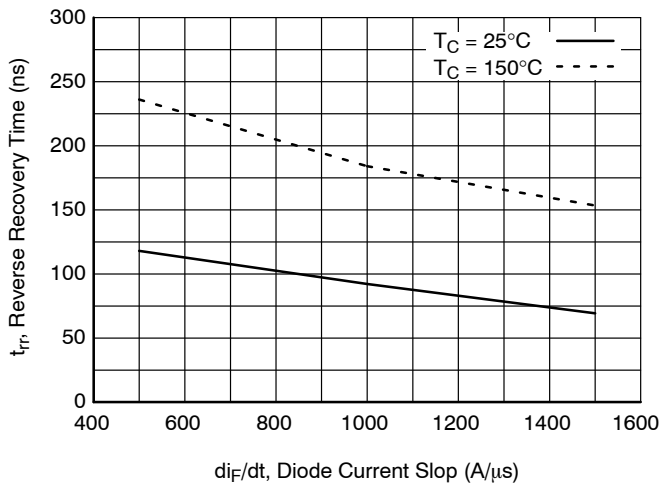


Figure 17. Reverse Recovery Time

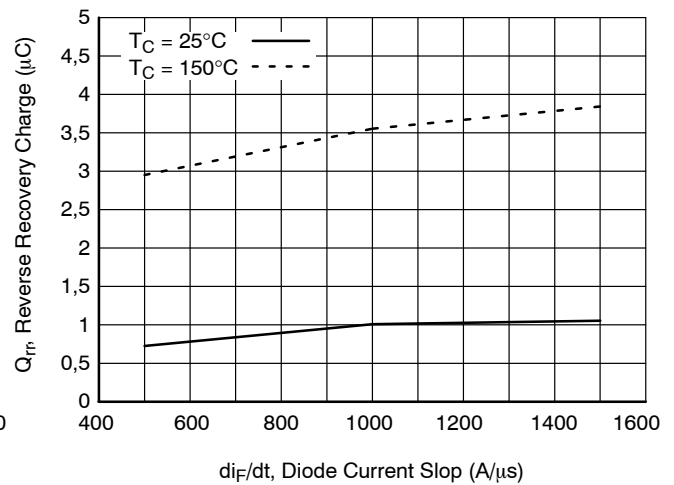


Figure 18. Stored Charge

FGHL75T65MQDTL4

TYPICAL CHARACTERISTICS (continued)

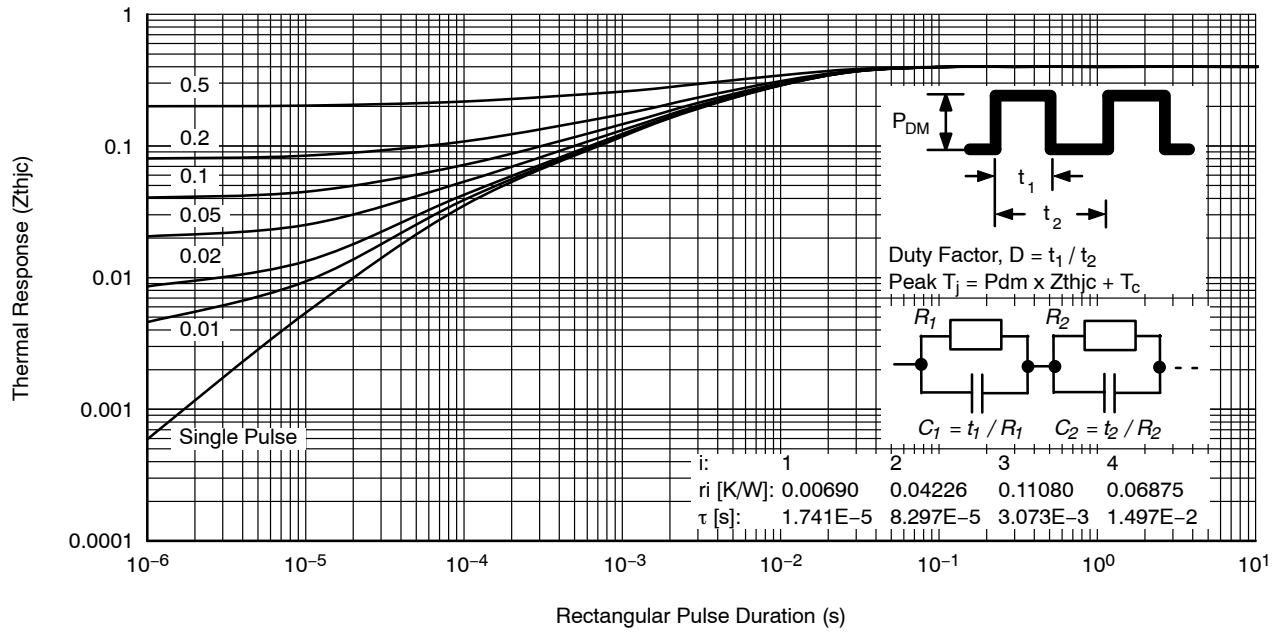


Figure 19. Transient Thermal Impedance of IGBT

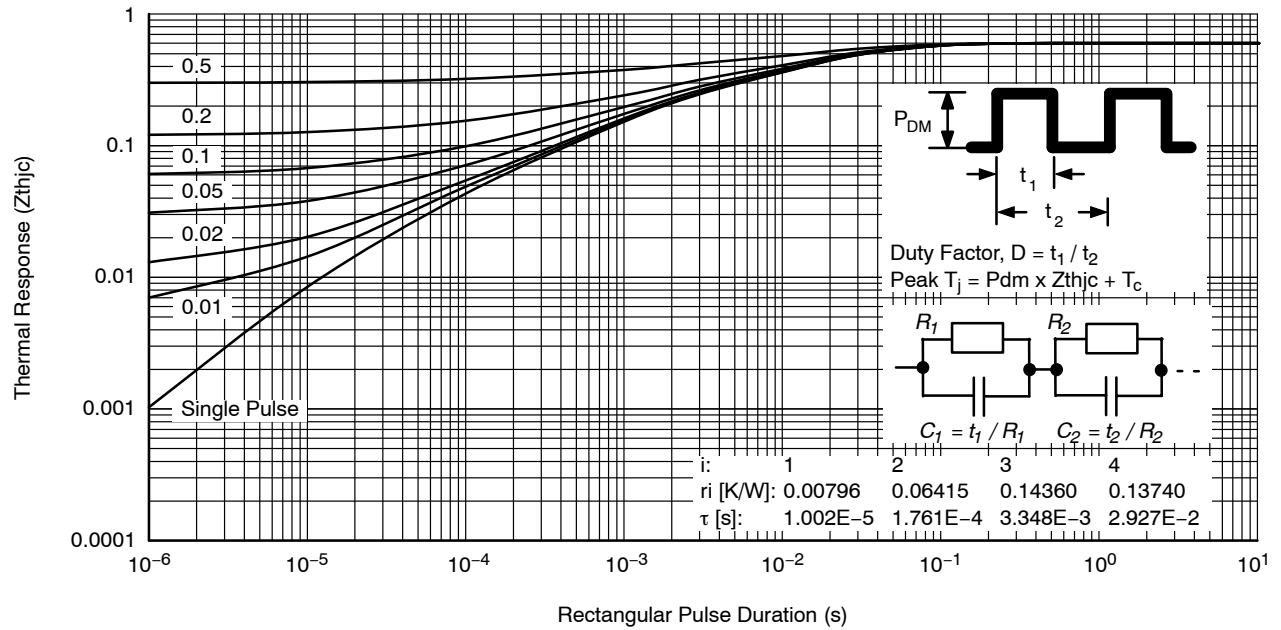
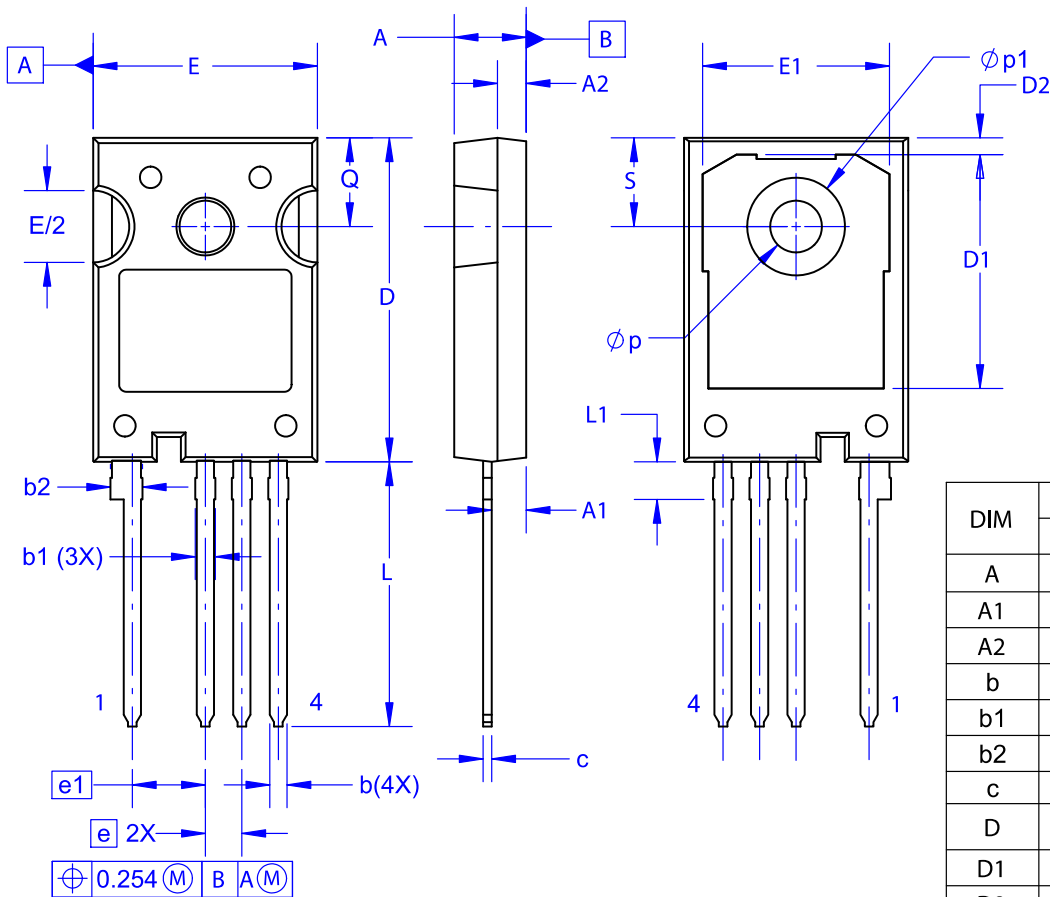


Figure 20. Transient Thermal Impedance of Diode

FGHL75T65MQDTL4

PACKAGE DIMENSIONS

TO-247-4LD
CASE 340CJ
ISSUE A



| 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 | 1.07 | 1.20 | 1.33 |
| b1 | 1.20 | 1.40 | 1.60 |
| b2 | 2.02 | 2.22 | 2.42 |
| c | 0.50 | 0.60 | 0.70 |
| D | 22.34 | 22.54 | 22.74 |
| D1 | 16.00 | 16.25 | 16.50 |
| D2 | 0.97 | 1.17 | 1.37 |
| e | 2.54 BSC | | |
| e1 | 5.08 BSC | | |
| E | 15.40 | 15.60 | 15.80 |
| E1 | 12.80 | 13.00 | 13.20 |
| E/2 | 4.80 | 5.00 | 5.20 |
| L | 18.22 | 18.42 | 18.62 |
| L1 | 2.42 | 2.62 | 2.82 |
| p | 3.40 | 3.60 | 3.80 |
| p1 | 6.60 | 6.80 | 7.00 |
| Q | 5.97 | 6.17 | 6.37 |
| S | 5.97 | 6.17 | 6.37 |

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.
- D. DRAWING CONFORMS TO ASME Y14.5-2009.