



August 2007

FGH30N60LSD

Features

- Low saturation voltage: $V_{CE(sat)} = 1.1V @ I_C = 30A$
- High Input Impedance
- Low Conduction Loss

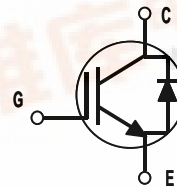
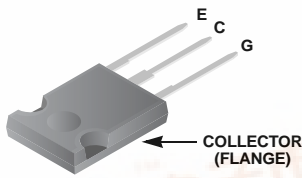
Applications

- Solar Inverters
- UPS, Welder



General Description

The FGH30N60LSD is a MOS gated high voltage switching device combining the best features of MOSFETs and bipolar transistors. This device has the high input impedance of a MOSFET and the low on-state conduction loss of a bipolar transistor.



Absolute Maximum Ratings

| Symbol | Description | FGH30N60LSD | Units |
|--------------|--|-------------|------------|
| V_{CES} | Collector-Emitter Voltage | 600 | V |
| V_{GES} | Gate-Emitter Voltage | ± 20 | V |
| I_C | Collector Current @ $T_C = 25^\circ C$ | 60 | A |
| | Collector Current @ $T_C = 100^\circ C$ | 30 | A |
| $I_{CM} (1)$ | Pulsed Collector Current | 90 | A |
| I_{FSM} | Non-repetitive Peak Surge Current 60Hz Single Half-Sine Wave | 150 | A |
| P_D | Maximum Power Dissipation @ $T_C = 25^\circ C$ | 480 | W |
| | Maximum Power Dissipation @ $T_C = 100^\circ C$ | 192 | W |
| T_J | Operating Junction Temperature | -55 to +150 | $^\circ C$ |
| T_{stg} | Storage Temperature Range | -55 to +150 | $^\circ C$ |
| T_L | Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds | 300 | $^\circ C$ |

Notes :

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

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|-------------------------|---|------|------|--------------|
| $R_{\theta JC} (IGBT)$ | Thermal Resistance, Junction-to-Case | -- | 0.26 | $^\circ C/W$ |
| $R_{\theta JC} (Diode)$ | Thermal Resistance, Junction-to-Case | -- | 0.92 | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 40 | $^\circ C/W$ |



Package Marking and Ordering Information

| Device Marking | Device | Package | Packaging Type | Qty per Tube | Max Qty per Box |
|----------------|---------------|---------|----------------|--------------|-----------------|
| FGH30N60LSD | FGH30N60LSDTU | TO-247 | Tube | 30ea | - |

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-Emitter Breakdown Voltage | V _{GE} = 0V, I _C = 250uA | 600 | -- | -- | V |
| ΔBV _{CES} /ΔT _J | Temperature Coefficient of Breakdown Voltage | V _{GE} = 0V, I _C = 250uA | -- | 0.6 | -- | V/°C |
| I _{CES} | Collector Cut-Off Current | V _{CE} = V _{CES} , V _{GE} = 0V | -- | -- | 250 | uA |
| I _{GES} | G-E Leakage Current | V _{GE} = V _{GES} , V _{CE} = 0V | -- | -- | ±250 | nA |
| On Characteristics | | | | | | |
| V _{GE(th)} | G-E Threshold Voltage | I _C = 250uA, V _{CE} = V _{GE} | 4.0 | 5.5 | 7.0 | V |
| V _{CE(sat)} | Collector to Emitter Saturation Voltage | I _C = 30A, V _{GE} = 15V | -- | 1.1 | 1.4 | V |
| | | I _C = 30A, V _{GE} = 15V, T _C = 125°C | -- | 1.0 | -- | V |
| | | I _C = 60 A, V _{GE} = 15V | -- | 1.3 | -- | V |
| Dynamic Characteristics | | | | | | |
| C _{ies} | Input Capacitance | V _{CE} = 30V, V _{GE} = 0V, f = 1MHz | -- | 3550 | -- | pF |
| C _{oes} | Output Capacitance | | -- | 245 | -- | pF |
| C _{res} | Reverse Transfer Capacitance | | -- | 90 | -- | pF |
| Switching Characteristics | | | | | | |
| t _{d(on)} | Turn-On Delay Time | V _{CC} = 400 V, I _C = 30A, R _G = 6.8Ω, V _{GE} = 15V, Inductive Load, T _C = 25°C | -- | 18 | -- | ns |
| t _r | Rise Time | | -- | 46 | -- | ns |
| t _{d(off)} | Turn-Off Delay Time | | -- | 250 | -- | ns |
| t _f | Fall Time | | -- | 1.3 | 2.0 | us |
| E _{on} | Turn-On Switching Loss | | -- | 1.1 | -- | mJ |
| E _{off} | Turn-Off Switching Loss | | -- | 21 | -- | mJ |
| t _{d(on)} | Turn-On Delay Time | V _{CC} = 400 V, I _C = 30A, R _G = 6.8Ω, V _{GE} = 15V, Inductive Load, T _C = 125°C | -- | 17 | -- | ns |
| t _r | Rise Time | | -- | 45 | -- | ns |
| t _{d(off)} | Turn-Off Delay Time | | -- | 270 | -- | ns |
| t _f | Fall Time | | -- | 2.6 | -- | us |
| E _{on} | Turn-On Switching Loss | | -- | 1.1 | -- | mJ |
| E _{off} | Turn-Off Switching Loss | | -- | 36 | -- | mJ |
| Q _g | Total Gate Charge | V _{CE} = 600 V, I _C = 30A, V _{GE} = 15V | -- | 225 | -- | nC |
| Q _{ge} | Gate-Emitter Charge | | -- | 30 | -- | nC |
| Q _{gc} | Gate-Collector Charge | | -- | 105 | -- | nC |
| L _e | Internal Emitter Inductance | Measured 5mm from PKG | -- | 7 | -- | nH |

Electrical Characteristics of the Diode $T_C = 25^\circ\text{C}$ unless otherwise noted

| Parameter | Conditions | Min. | Typ. | Max | Units | |
|----------------------------|--|---------------------------|------|------|-------|---------------|
| V_{FM} | $I_F = 15\text{A}$ $I_F = 15\text{A}$ | $T_C = 25^\circ\text{C}$ | - | 1.8 | 2.2 | V |
| | | $T_C = 125^\circ\text{C}$ | - | 1.6 | - | V |
| I_{RM} | $V_R = 600\text{V}$ | $T_C = 25^\circ\text{C}$ | - | - | 100 | μA |
| t_{rr} | $I_F = 1\text{A}, di/dt = 100\text{A}/\mu\text{s}, V_{CC} = 30\text{V}$ $I_F = 15\text{A}, di/dt = 100\text{A}/\mu\text{s}, V_{CC} = 390\text{V}$ | $T_C = 25^\circ\text{C}$ | - | - | 35 | ns |
| | | $T_C = 25^\circ\text{C}$ | - | - | 40 | ns |
| t_a t_b Q_{rr} | $I_F = 15\text{A}, di/dt = 100\text{A}/\mu\text{s}, V_{CC} = 390\text{V}$ | $T_C = 25^\circ\text{C}$ | - | 18 | - | ns |
| | | $T_C = 25^\circ\text{C}$ | - | 13 | - | ns |
| | | $T_C = 25^\circ\text{C}$ | - | 27.5 | - | nC |

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

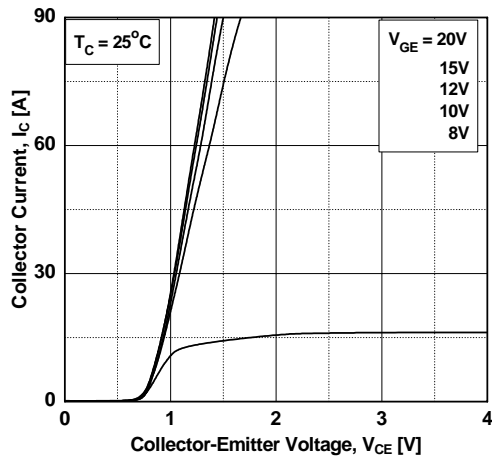


Figure 2. Typical Saturation Voltage Characteristics

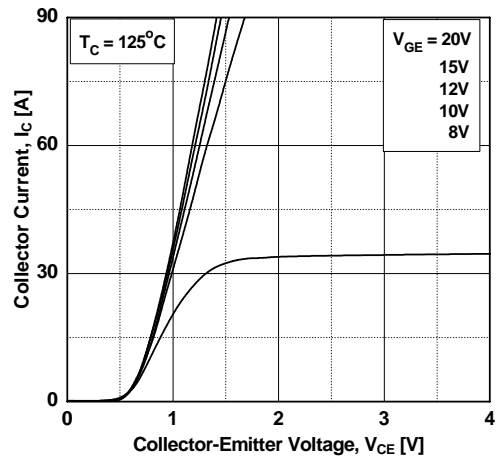


Figure 3. Typical Saturation Voltage Characteristics

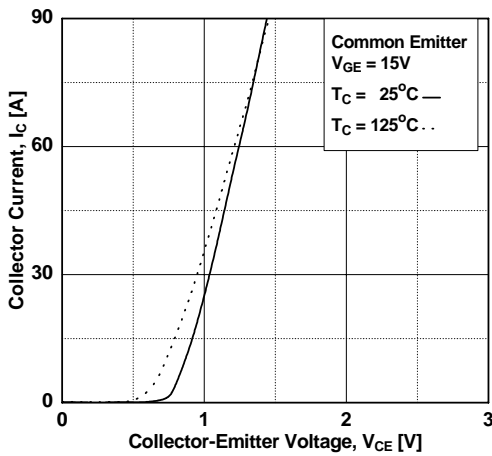


Figure 4. Transfer characteristics

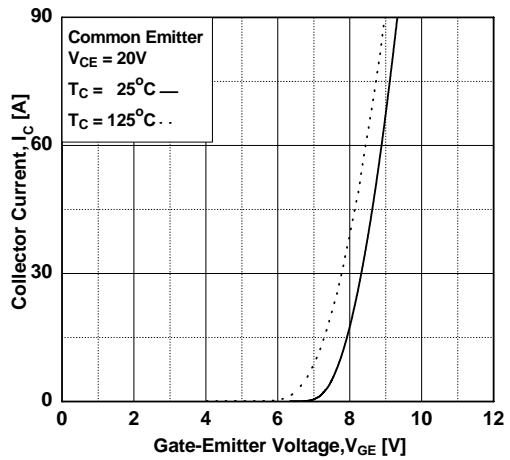


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

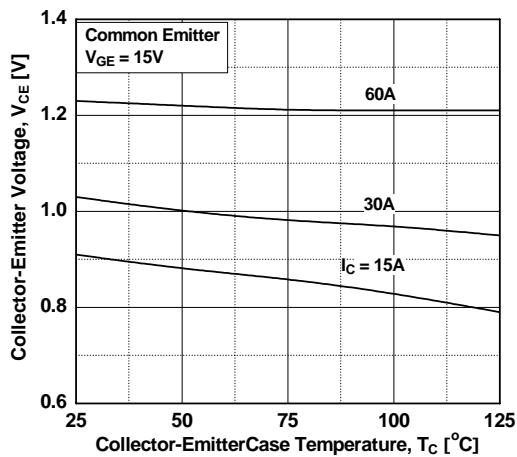
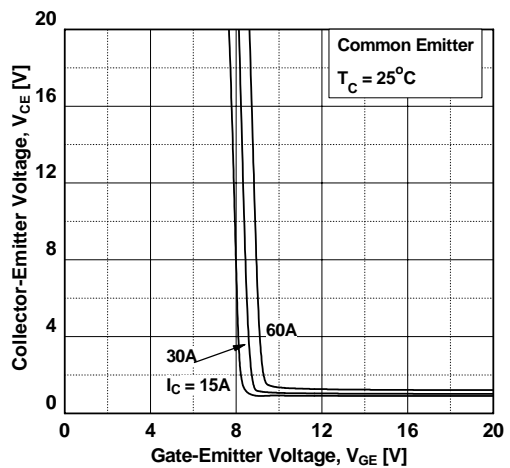


Figure 6. Saturation Voltage vs. Vge



Typical Performance Characteristics (Continued)

Figure 7. Saturation Voltage vs. V_{GE}

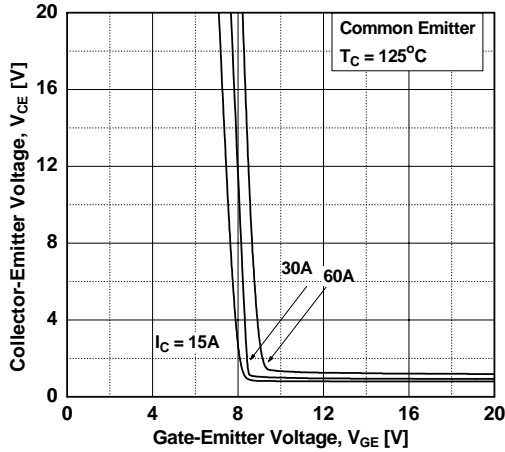


Figure 8. Capacitance characteristics

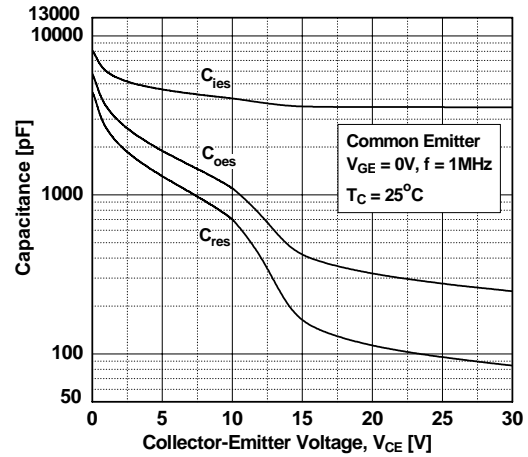


Figure 9. Gate Charge Characteristics

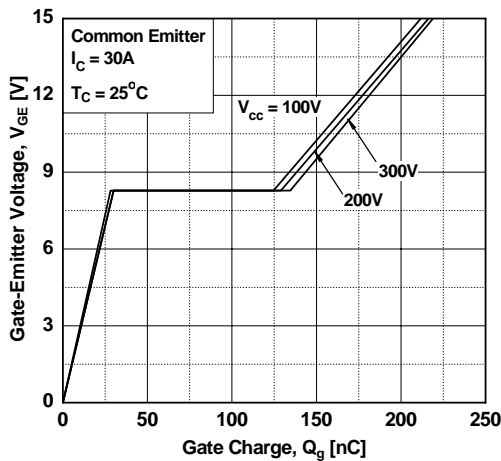


Figure 10. SOA Characteristics

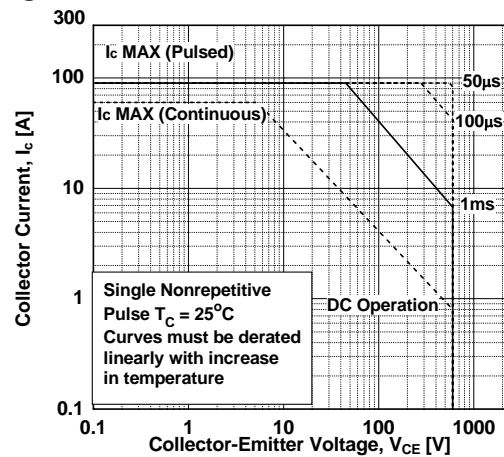


Figure 11. Load Current Vs. Frequency

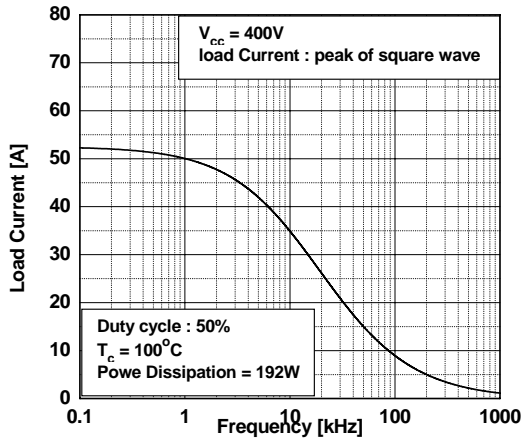
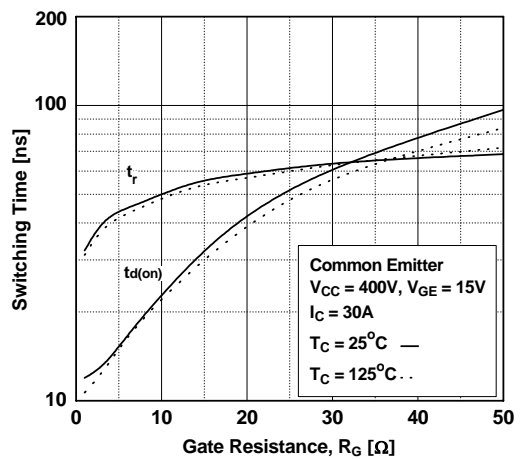


Figure 12. Turn-On Characteristics vs. Gate Resistance



Typical Performance Characteristics (Continued)

Figure 13. Turn-Off Characteristics vs. Gate Resistance

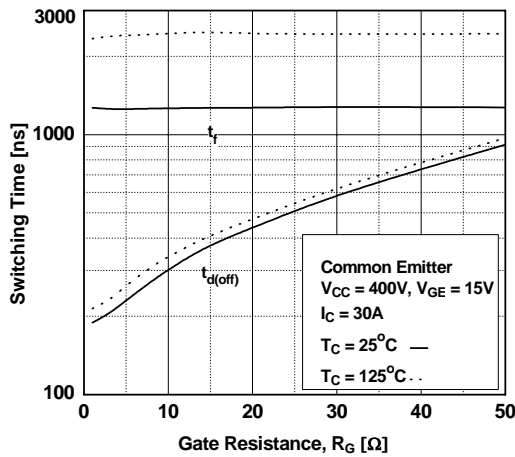


Figure 14. Turn-On Characteristics vs. Collector Current

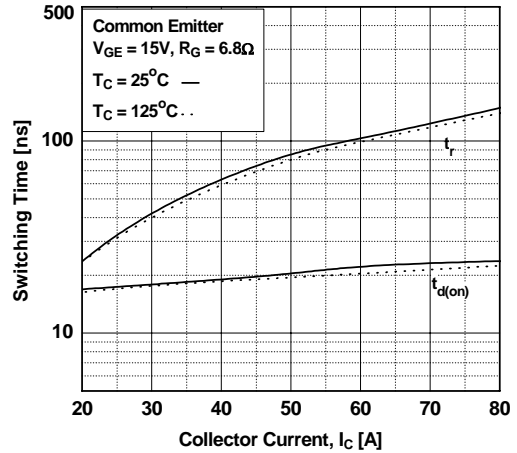


Figure 15. Turn-Off Characteristics vs. Collector Current

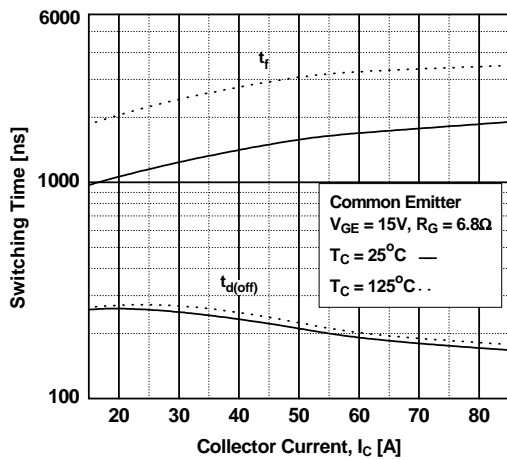


Figure 16. Switching Loss vs Gate Resistance

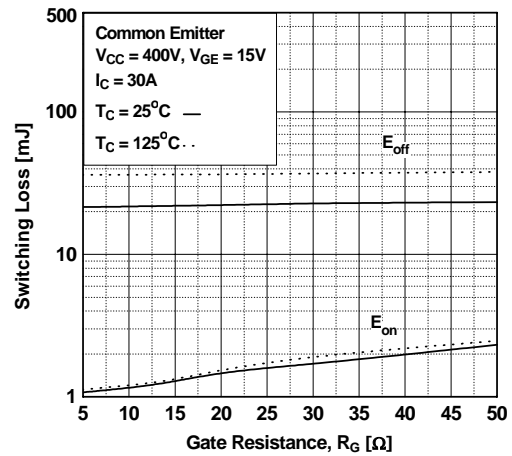


Figure 17. Switching Loss vs Collector Current

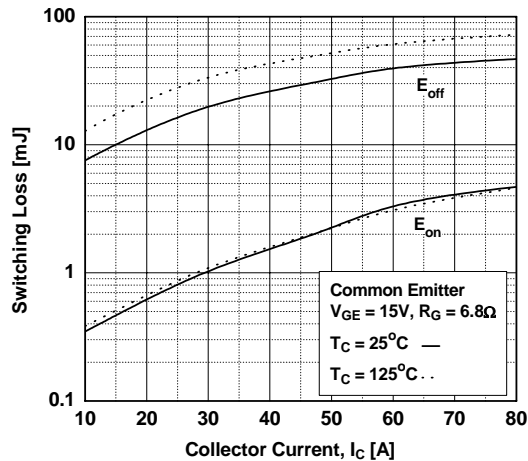


Figure 18. Turn-Off Switching SOA Characteristics

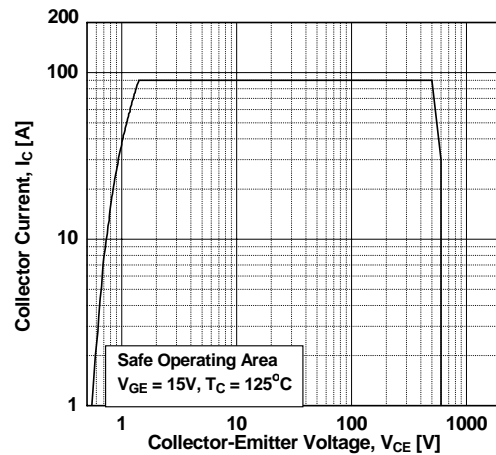


Figure 19. Transient Thermal Impedance of IGBT

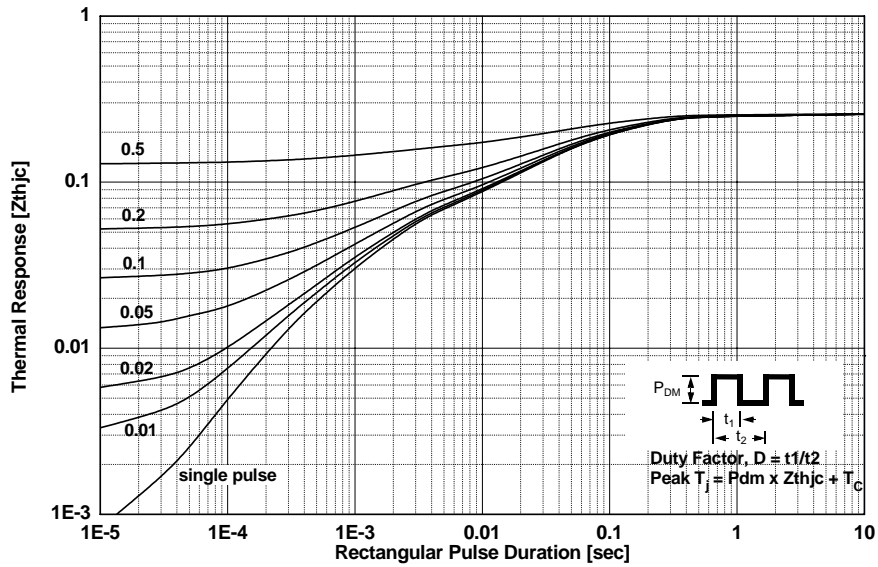


Figure 20. Typical Forward Voltage Drop

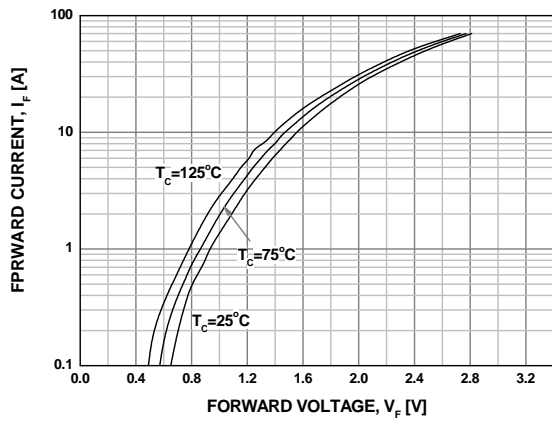


Figure 21. Typical Reverse Current

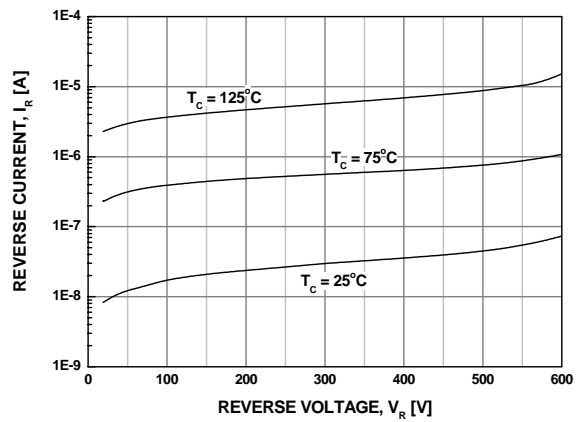
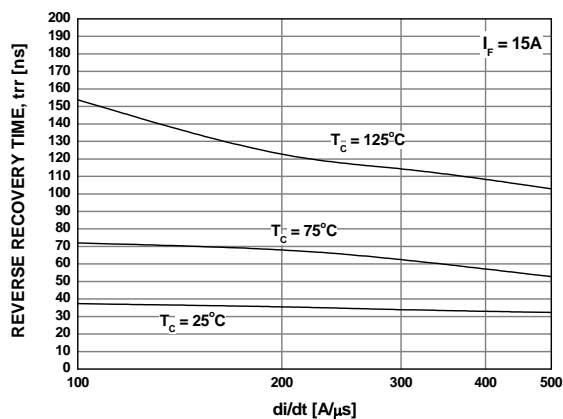


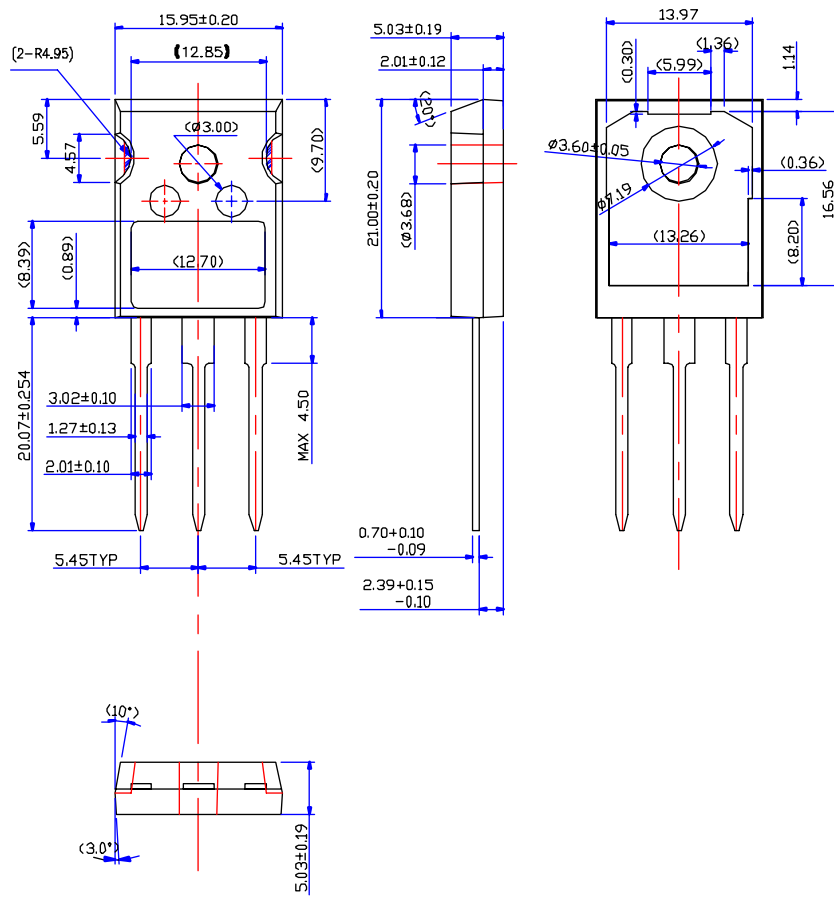
Figure 22. Typical Reverse Recovery Time



Mechanical Dimensions

TO-247AD (FKS PKG CODE 001)

FGH30N60LSD



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