

# FGL60N170D

## General Description

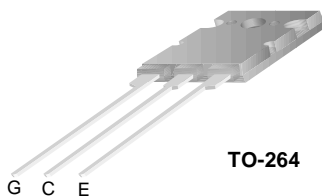
Fairchild's Insulated Gate Bipolar Transistor (IGBT) provides low conduction and switching losses. FGL60N170D is designed for the Induction Heating applications.

## Features

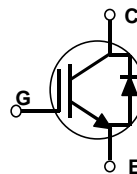
- High Speed Switching
- Low Saturation Voltage :  $V_{CE(sat)} = 5.0\text{ V @ } I_C = 60\text{ A}$
- High Input Impedance
- Built-in Fast Recovery Diode

## Application

Home Appliance, Induction Heater, IH JAR, Micro Wave Oven



TO-264



## Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol      | Description   | FGL60N170D  | Units            |
|-------------|---|-------------|------------------|
| $V_{CES}$   | Collector-Emitter Voltage   | 1700        | V                |
| $V_{GES}$   | Gate-Emitter Voltage  | $\pm 25$    | V                |
| $I_C$       | Collector Current @ $T_C = 25^\circ\text{C}$                      | 60          | A                |
|             | Collector Current @ $T_C = 100^\circ\text{C}$                     | 30          | A                |
| $I_{CM(1)}$ | Pulsed Collector Current  | 180         | A                |
| $I_F$       | Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$      | 15          | A                |
| $I_{FM}$    | Diode Maximum Forward Current                                     | 150         | A                |
| $P_D$       | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$              | 200         | W                |
|             | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$             | 80          | W                |
| $T_J$       | Operating Junction Temperature                                    | -55 to +150 | $^\circ\text{C}$ |
| $T_{stg}$   | Storage Temperature Range   | -55 to +150 | $^\circ\text{C}$ |
| $T_L$       | Maximum Lead Temp. for Soldering Purposes from Case for 5 Seconds | 300         | $^\circ\text{C}$ |

**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    | --   | 0.625 | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ (DIODE) | Thermal Resistance, Junction-to-Case    | --   | 0.83  | $^\circ\text{C/W}$ |
| $R_{\theta A}$          | Thermal Resistance, Junction-to-Ambient | --   | 25    | $^\circ\text{C/W}$ |

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

| Symbol                     | Parameter                           | Test Conditions                 | Min. | Typ. | Max.      | Units |
|----------------------------|-------------------------------------|---------------------------------|------|------|-----------|-------|
| <b>Off Characteristics</b> |                                     |                                 |      |      |           |       |
| $BV_{CES}$                 | Collector-Emitter Breakdown Voltage | $V_{GE} = 0V, I_C = 3mA$        | 1700 | --   | --        | V     |
| $I_{CES}$                  | Collector Cut-off Current           | $V_{CE} = V_{CES}, V_{GE} = 0V$ | --   | --   | 3.0       | mA    |
| $I_{GES}$                  | G-E Leakage Current                 | $V_{GE} = V_{GES}, V_{CE} = 0V$ | --   | --   | $\pm 100$ | nA    |

**On Characteristics**

|               |   |                               |     |     |     |   |
|---------------|---|-------------------------------|-----|-----|-----|---|
| $V_{GE(th)}$  | G-E Threshold Voltage                   | $I_C = 60mA, V_{CE} = V_{GE}$ | 3.5 | 5.0 | 7.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C = 60A, V_{GE} = 15V$     | -   | 5.0 | 6.0 | V |

**Dynamic Characteristics**

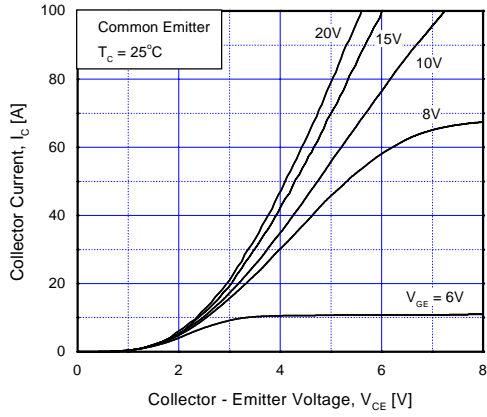
|           |                              |  |    |      |    |    |
|-----------|------------------------------|--|----|------|----|----|
| $C_{ies}$ | Input Capacitance            | $V_{CE} = 30V, V_{GE} = 0V,$<br>$f = 1MHz$ | -- | 2500 | -- | pF |
| $C_{oes}$ | Output Capacitance           |  | -- | 220  | -- | pF |
| $C_{res}$ | Reverse Transfer Capacitance |  | -- | 80   | -- | pF |

**Switching Characteristics**

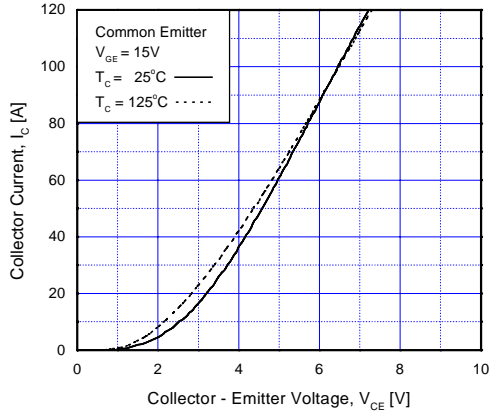
|              |                       |  |    |     |     |    |
|--------------|-----------------------|--|----|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time    | $V_{CC} = 600V, I_C = 60A,$<br>$R_G = 51\Omega, V_{GE} = 15V,$<br>Resistive Load, $T_C = 25^\circ\text{C}$ | -- | 100 | 200 | ns |
| $t_r$        | Rise Time             |  | -- | 350 | 700 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time   |  | -- | 200 | 400 | ns |
| $t_f$        | Fall Time             |  | -- | 100 | 300 | ns |
| $Q_g$        | Total Gate Charge     | $V_{CE} = 600V, I_C = 60A,$<br>$V_{GE} = 15V$  | -- | 120 | 180 | nC |
| $Q_{ge}$     | Gate-Emitter Charge   |  | -- | 20  | 30  | nC |
| $Q_{gc}$     | Gate-Collector Charge |  | -- | 45  | 70  | nC |

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

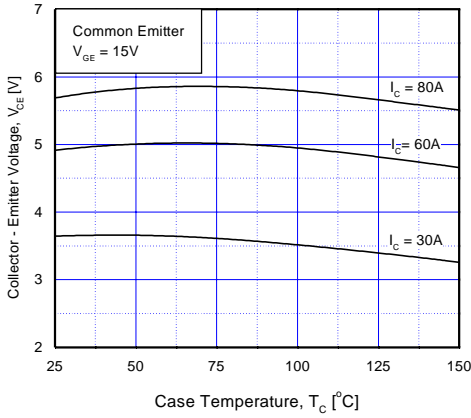
| Symbol   | Parameter                     | Test Conditions                       | Min. | Typ. | Max. | Units         |
|----------|-------------------------------|---------------------------------------|------|------|------|---------------|
| $V_{FM}$ | Diode Forward Voltage         | $I_F = 15A$                           | --   | 1.35 | 1.6  | V             |
|          |                               | $I_F = 60A$                           | --   | 1.92 | 2.2  |               |
| $t_{rr}$ | Diode Reverse Recovery Time   | $I_F = 60A, di/dt = 20A/\mu\text{S}$  | --   | 0.6  | 1.0  | $\mu\text{s}$ |
| $I_R$    | Instantaneous Reverse Current | $V_{RRM} = 1700V$                     | --   | 0.3  | 5    | $\mu\text{A}$ |
| $C_J$    | Junction Capacitance          | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$ | --   | 80   | --   | pF            |



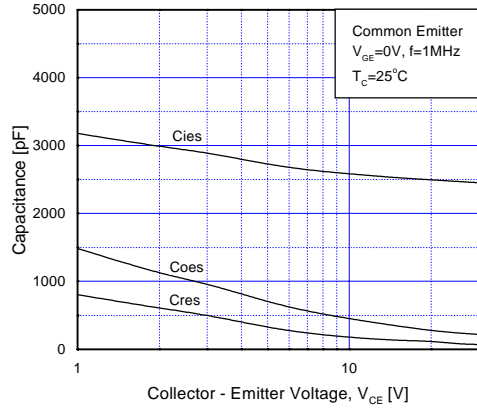
**Fig 1. Typical Output Characteristics**



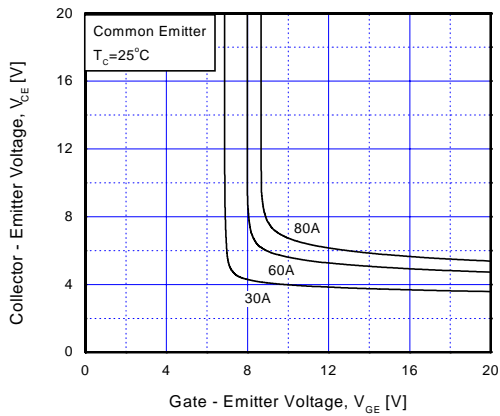
**Fig 2. Typical Saturation Voltage Characteristics**



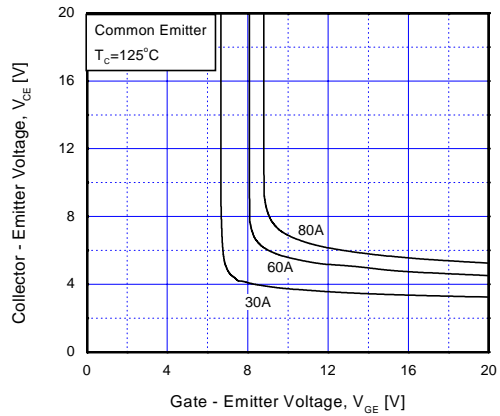
**Fig 3. Collector to Emitter Saturation Voltage vs. Case Temperature**



**Fig 4. Typical Capacitance vs. Collector to Emitter Voltage**



**Fig 5. Saturation Voltage vs.  $V_{GE}$**



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

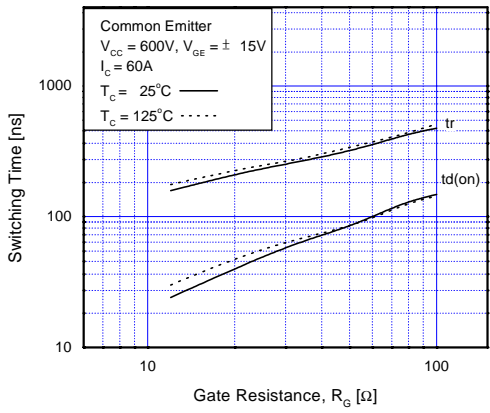


Fig 7. Turn on Characteristics vs. Gate Resistance

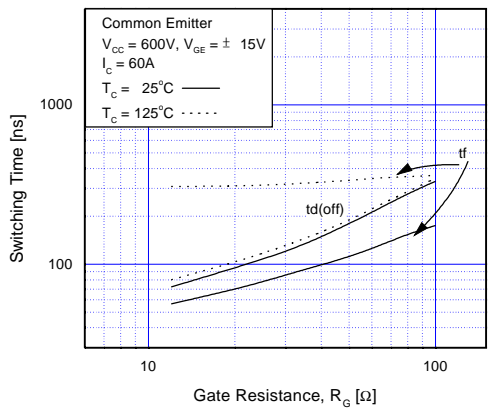


Fig 8. Turn off Characteristics vs. Gate Resistance

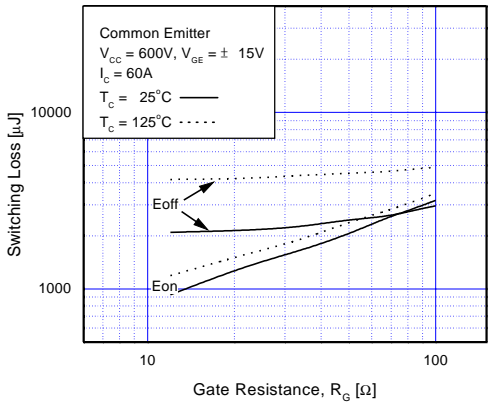


Fig 9. Switching Loss vs. Gate Resistance

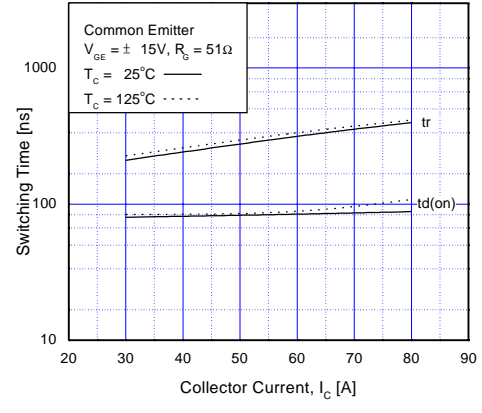


Fig 10. Turn on Characteristics vs. Collector Current

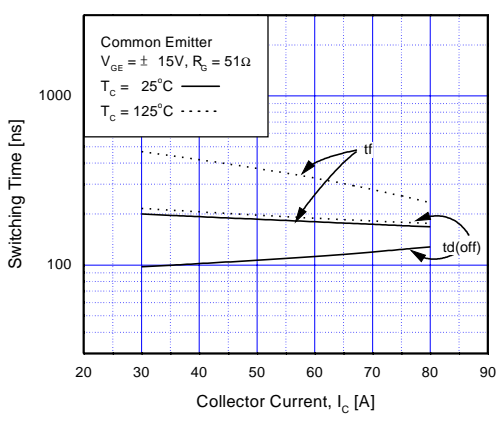


Fig 11. Turn off Characteristics vs. Collector Current

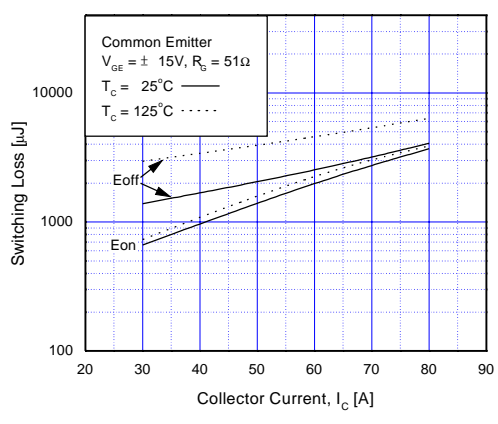
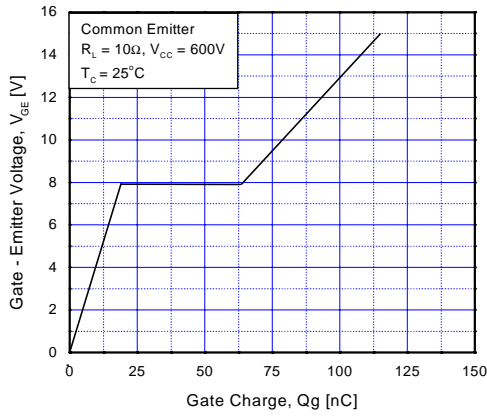
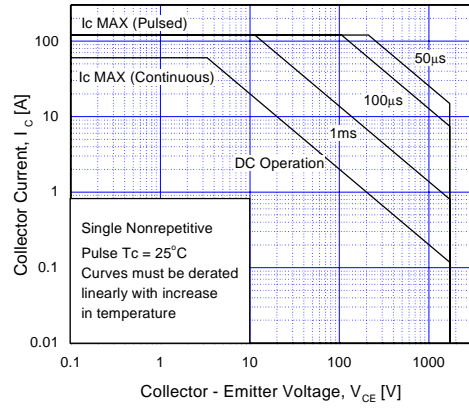


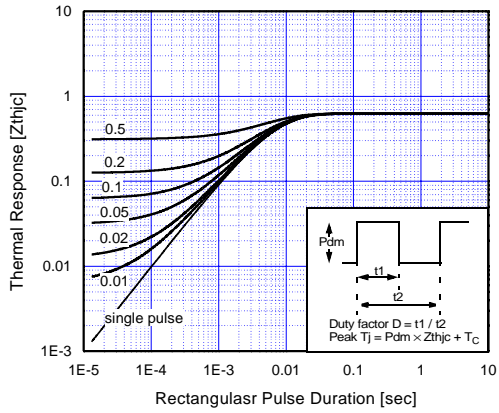
Fig 12. Switching Loss vs. Collector Current



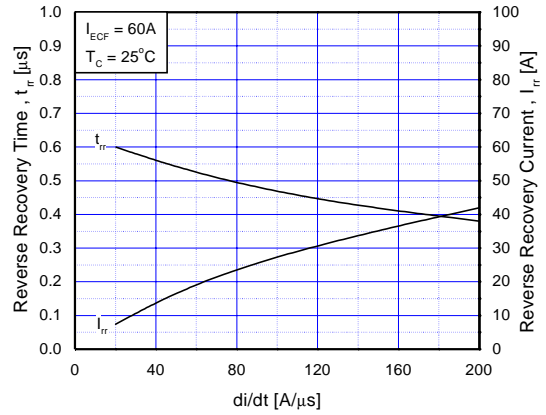
**Fig 13. Gate Charge Characteristics**



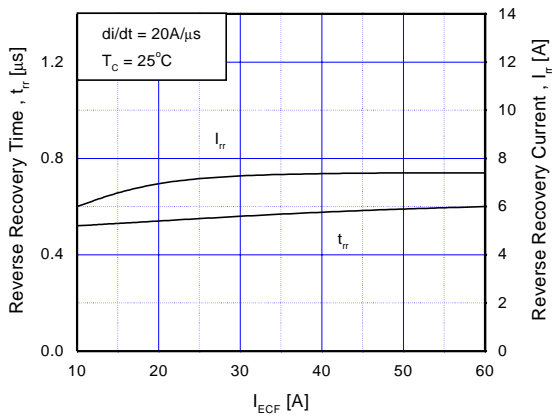
**Fig 14. Turn off SOA Characteristics**



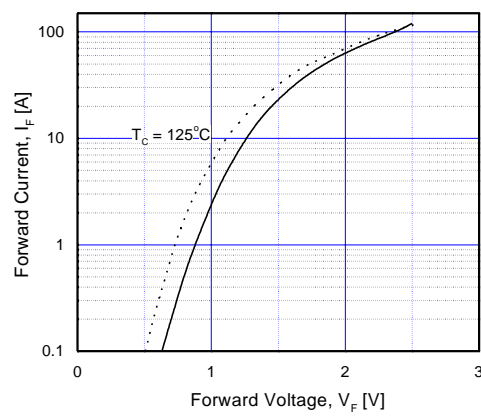
**Fig 15. Transient Thermal Impedance of IGBT**



**Fig 16. Typical Trr vs. di/dt**



**Fig 17. Typical Trr vs. Forward Current**



**Fig 18. Typical Forward Voltage Drop vs. Forward Current**

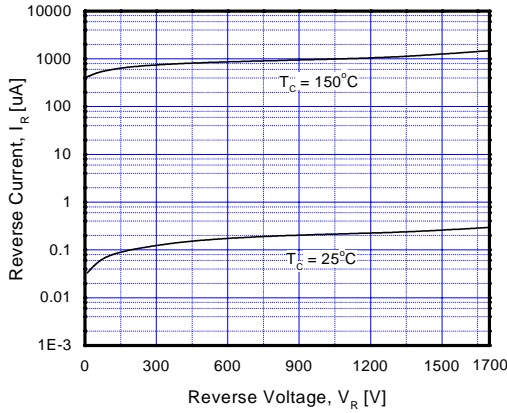


Fig 19. Reverse Current vs. Reverse Voltage

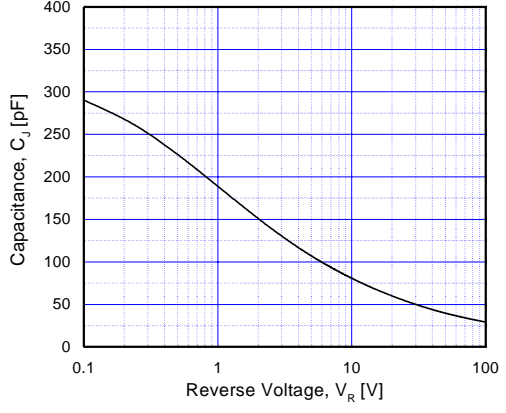


Fig 20. Capacitance vs. Reverse Voltage For Diode



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