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*IGBT*

# SGL60N90DG3

## General Description

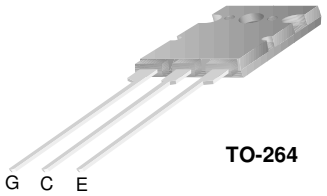
Insulated Gate Bipolar Transistors (IGBTs) with a trench gate structure provide superior conduction and switching performance in comparison with transistors having a planar gate structure. They also have wide noise immunity. These devices are very suitable for induction heating applications.

## Features

- High speed switching
- Low saturation voltage : $V_{CE(sat)}$ = 2.0 V @ $I_C$ = 60A
- High input impedance
- Built-in fast recovery diode

## Applications

Home appliances, induction heaters, induction heating JARs, and microwave ovens.

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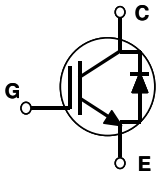



## Absolute Maximum Ratings

$T_C$ = 25°C unless otherwise noted

| Symbol | Description | | SGL60N90DG3 | Units |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | | 900 | V |
| $V_{GES}$ | Gate-Emitter Voltage | | ± 25 | V |
| $I_C$ | Collector Current | @ $T_C$ = 25°C | 60 | A |
| | Collector Current | @ $T_C$ = 100°C | 42 | A |
| $I_{CM\ (1)}$ | Pulsed Collector Current | | 120 | A |
| $I_F$ | Diode Continuous Forward Current | @ $T_C$ = 100°C | 15 | A |
| $P_D$ | Maximum Power Dissipation | @ $T_C$ = 25°C | 180 | W |
| | Maximum Power Dissipation | @ $T_C$ = 100°C | 72 | W |
| $T_J$ | Operating Junction Temperature | | -55 to +150 | °C |
| $T_{stg}$ | Storage Temperature Range | | -55 to +150 | °C |
| $T_L$ | Maximum Lead Temp. for soldering purposes, 1/8" from case for 5 seconds | | 300 | °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 | -- | 0.69 | °C/W |
| $R_{\theta JC}$(DIODE) | Thermal Resistance, Junction-to-Case | -- | 2.08 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 25 | °C/W |

## 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 | 900 | -- | -- | V |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | -- | -- | 1.0 | mA |
| $I_{GES}$ | G-E Leakage Current | $V_{GE}$ = $V_{GES}$, $V_{CE}$ = 0V | -- | -- | ± 500 | nA |
| **On Characteristics** | | | | | | |
| $V_{GE(th)}$ | G-E Threshold Voltage | $I_C$ = 60mA, $V_{CE}$ = $V_{GE}$ | 4.0 | 5.0 | 7.0 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$ = 10A, $V_{GE}$ = 15V | -- | 1.4 | 1.8 | V |
| | | $I_C$ = 60A, $V_{GE}$ = 15V | -- | 2.0 | 2.7 | V |
| **Dynamic Characteristics** | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=10V, $V_{GE}$ = 0V, f = 1MHz | -- | 6500 | -- | pF |
| $C_{oes}$ | Output Capacitance | | -- | 250 | -- | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | -- | 220 | -- | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600 V, $I_C$ = 60A, $R_G$ = 51Ω, $V_{GE}$=15V, Resistive Load, $T_C$ = 25°C | -- | 250 | 400 | ns |
| $t_r$ | Rise Time | | -- | 450 | 700 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 450 | 700 | ns |
| $t_f$ | Fall Time | | -- | 250 | 400 | ns |
| $Q_g$ | Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 60A, $V_{GE}$ = 15V | -- | 260 | 300 | nC |
| $Q_{ge}$ | Gate-Emitter Charge | | -- | 70 | -- | nC |
| $Q_{gc}$ | Gate-Collector Charge | | -- | 60 | -- | nC |

## Electrical Characteristics of DIODE $T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{FM}$ | Diode Forward Voltage | $I_F$ = 15A | -- | 1.2 | 1.7 | V |
| | | $I_F$ = 60A | -- | 1.75 | 2.0 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 60A di/dt = 20 A/us | | 1.2 | 1.5 | us |
| $I_R$ | Instantaneous Reverse Current | $V_{RRM}$ = 900V | -- | 0.05 | 2 | uA |

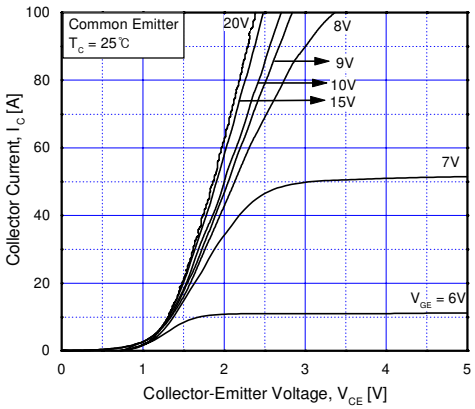



**Fig 1. Typical Output Characteristics**

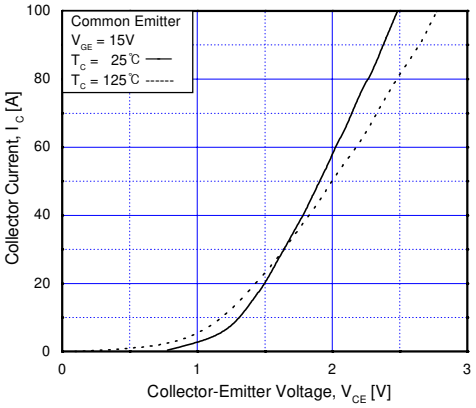



**Fig 2. Typical Saturation Voltage Characteristics**

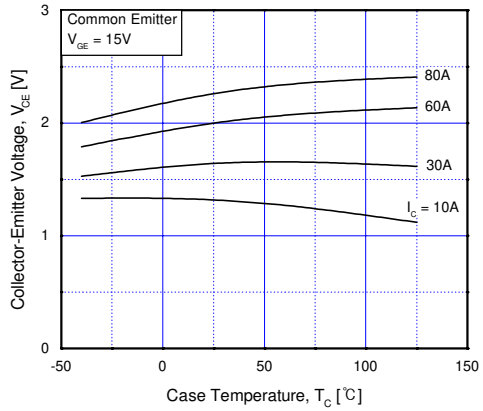



**Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level**

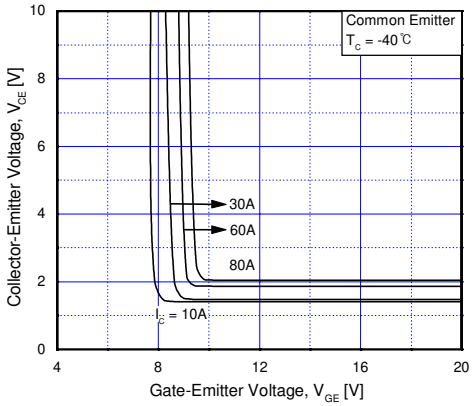



**Fig 4. Saturation Voltage vs. $V_{GE}$**

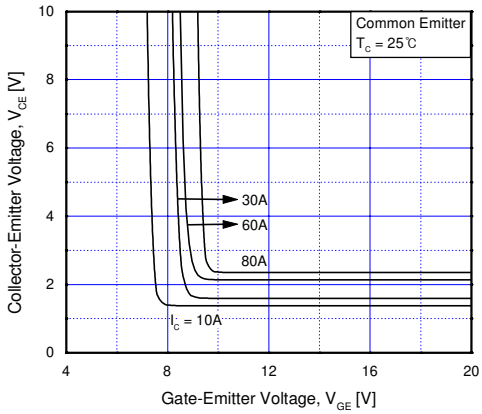



**Fig 5. Saturation Voltage vs. $V_{GE}$**

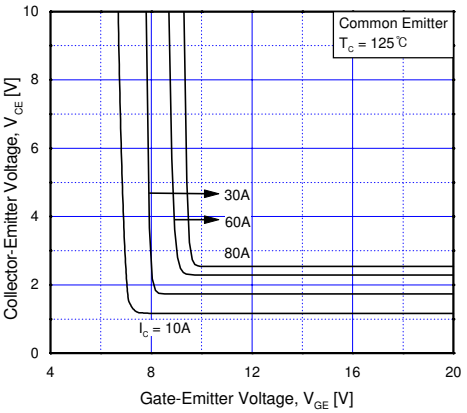



**Fig 6. Saturation Voltage vs. $V_{GE}$**

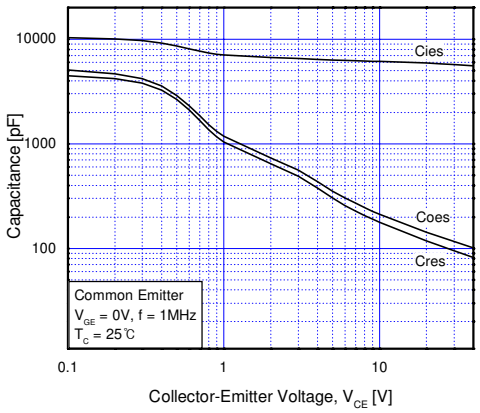



**Fig 7. Capacitance Characteristics**

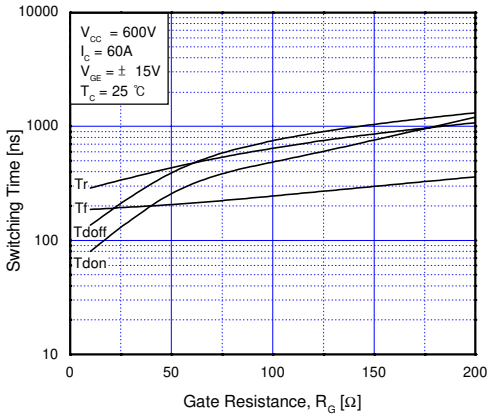



**Fig 8. Switching Characteristics vs. Gate Resistance**

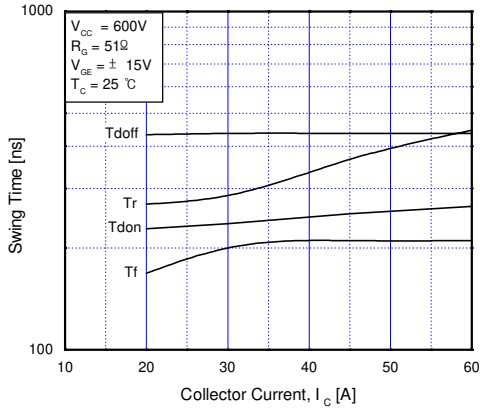



**Fig 9. Switching Characteristics vs. Collector Current**

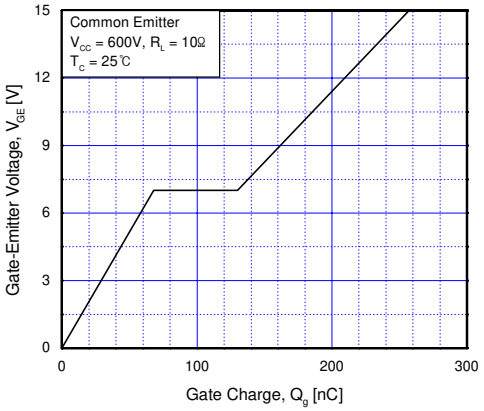



**Fig 10. Gate Charge Characteristics**

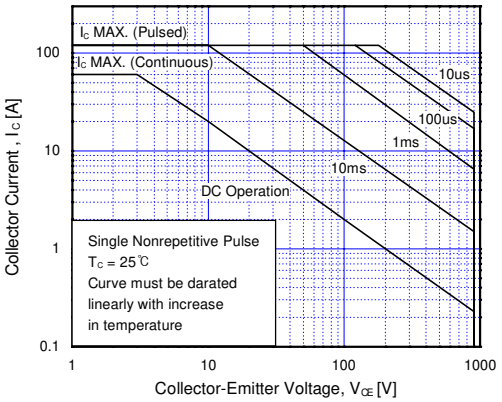



**Fig 11. SOA Characteristics**

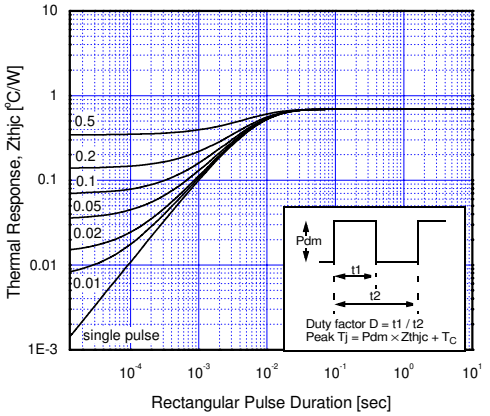



**Fig 12. Transient Thermal Impedance of IGBT**

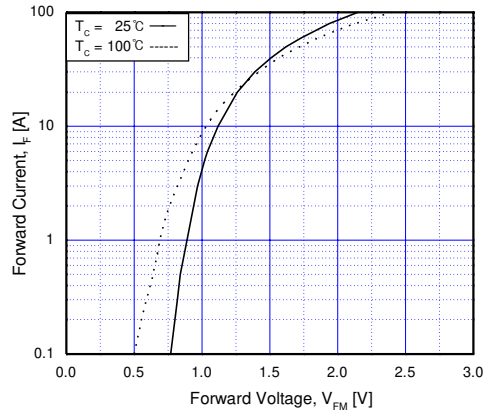



**Fig 13. Forward Characteristics**

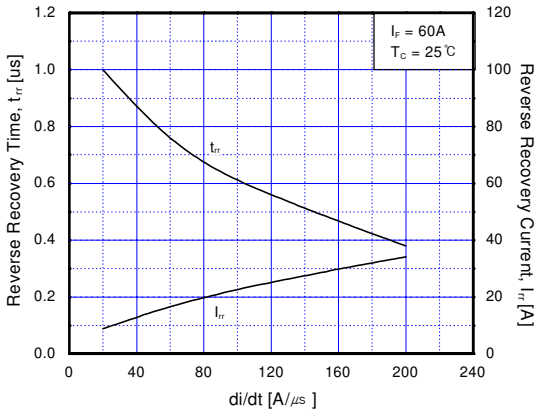



**Fig 14. Reverse Recovery Characteristics vs. di/dt**

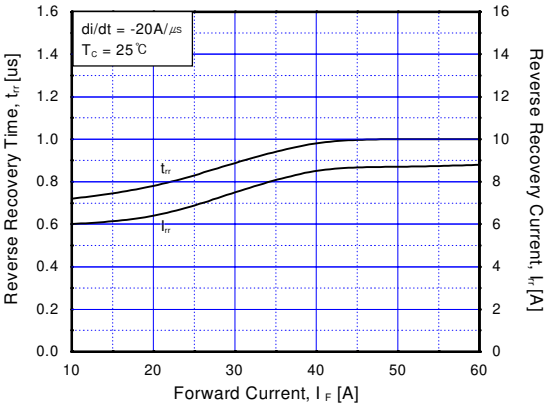



**Fig 15. Reverse Recovery Characteristics vs. Forward Current**

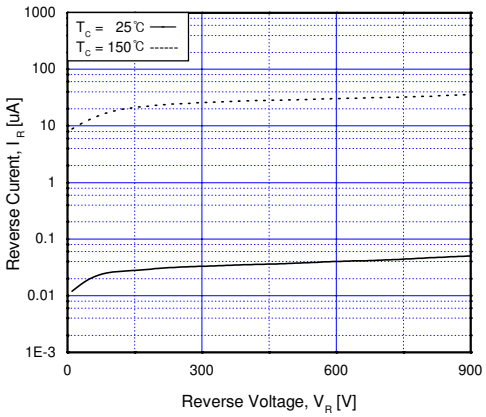



**Fig 16. Reverse Current vs. Reverse Voltage**

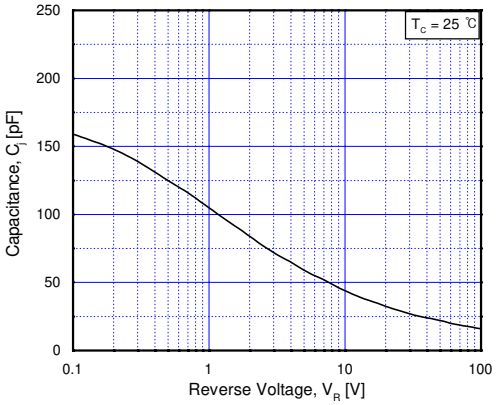
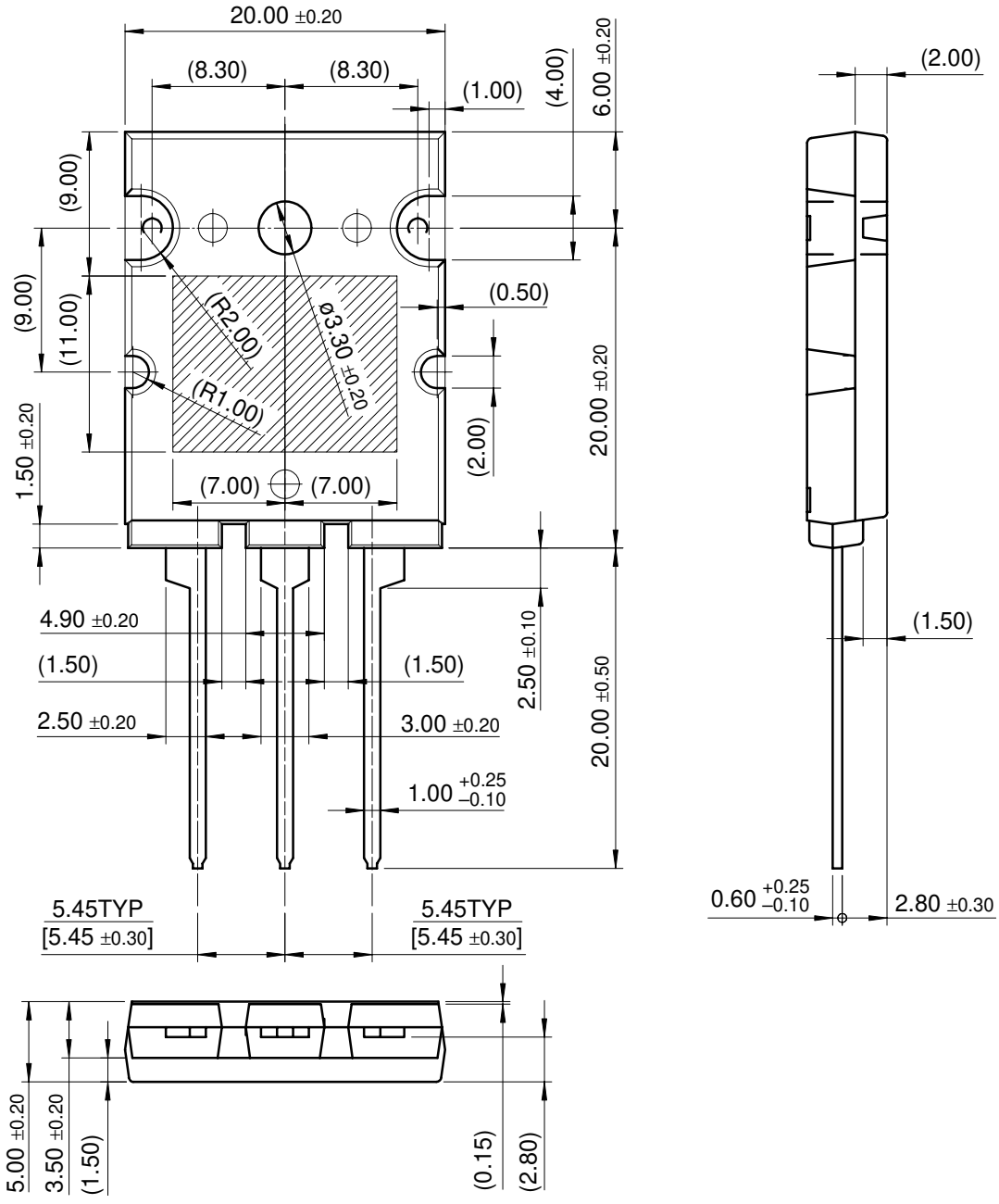



**Fig 17. Junction capacitance**

## Package Dimension

# TO-264




Dimensions in Millimeters

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