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September 2000

***IGBT***

# SGL60N90DG3

## General Description

Insulated Gate Bipolar Transistors (IGBTs) with trench gate structure have superior performance in conduction and switching to planar gate structure, and also have wide noise immunity. These devices are well suitable for IH 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

## Application

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

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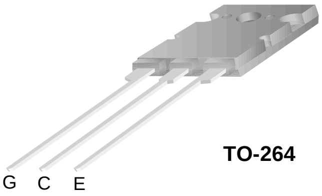

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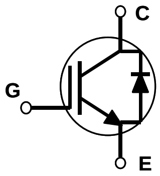

## Absolute Maximum Ratings

$T_C$ = 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 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 |

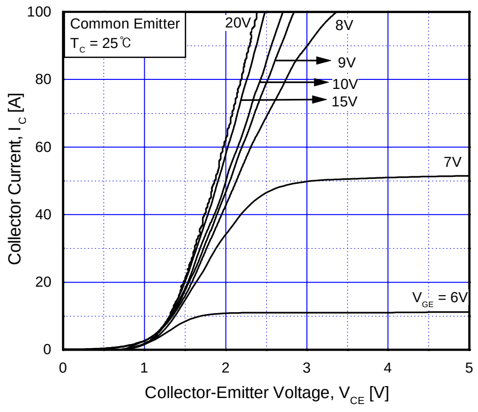

**Fig 1. Typical Output Characteristics**

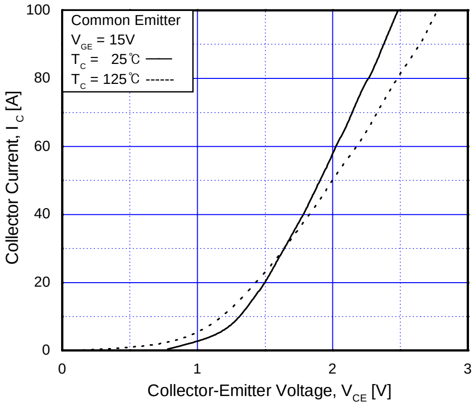

**Fig 2. Typical Saturation Voltage Characteristics**

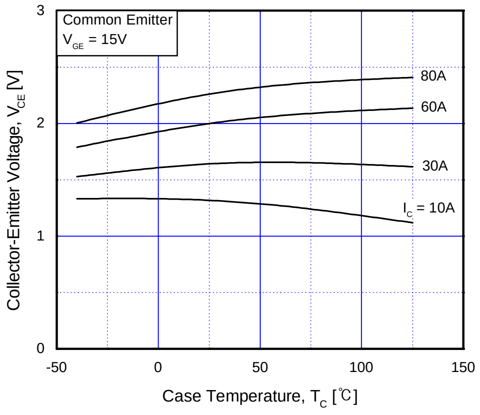

**Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level**

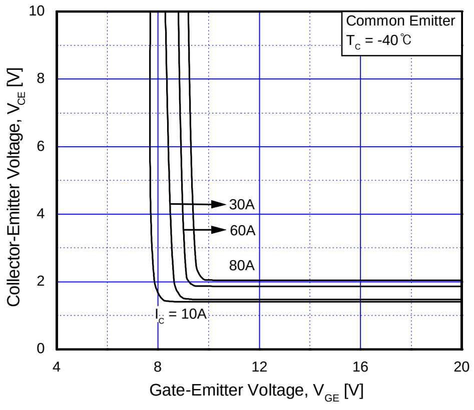

**Fig 4. Saturation Voltage vs. $V_{GE}$**

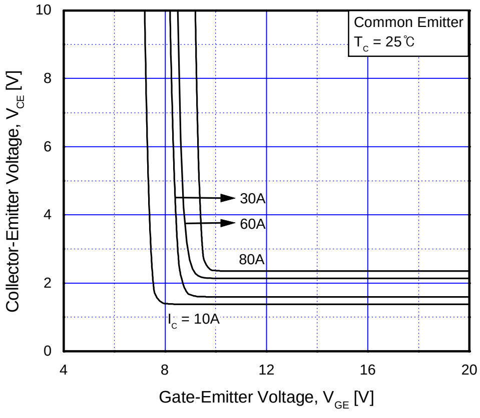

**Fig 5. Saturation Voltage vs. $V_{GE}$**

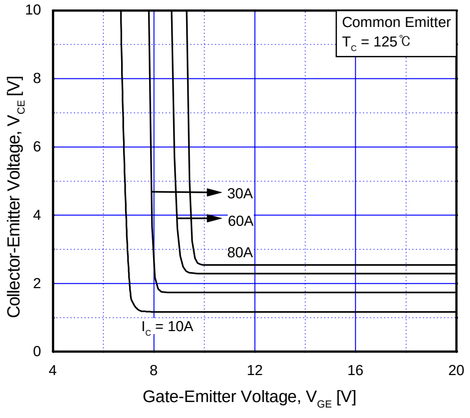

**Fig 6. Saturation Voltage vs. $V_{GE}$**

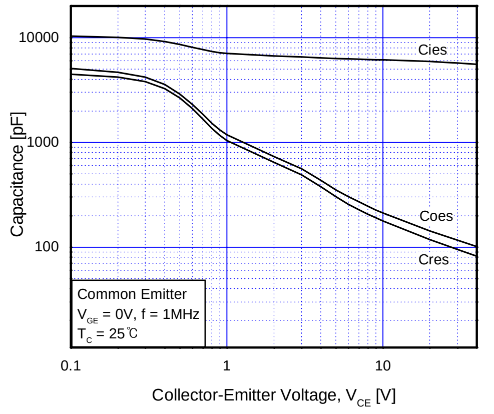

Fig 7. Capacitance Characteristics

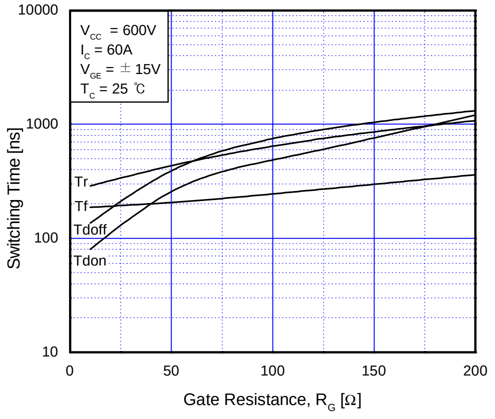

Fig 8. Switching Characteristics vs. Gate Resistance

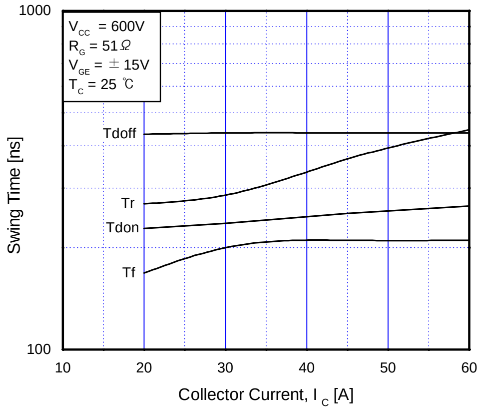

Fig 9. Switching Characteristics vs. Collector Current

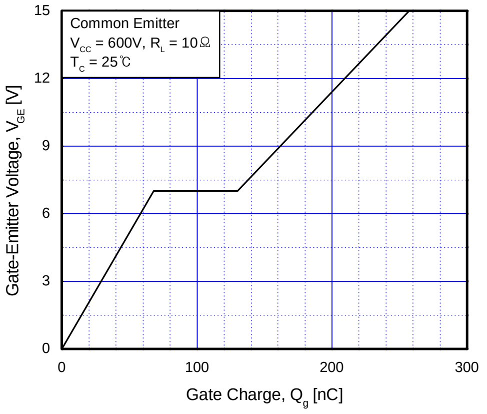

Fig 10. Gate Charge Characteristics

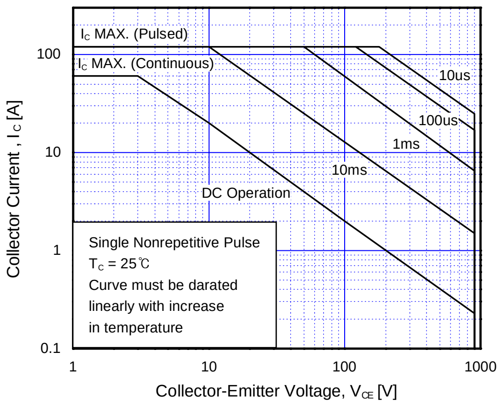

Fig 11. SOA Characteristics

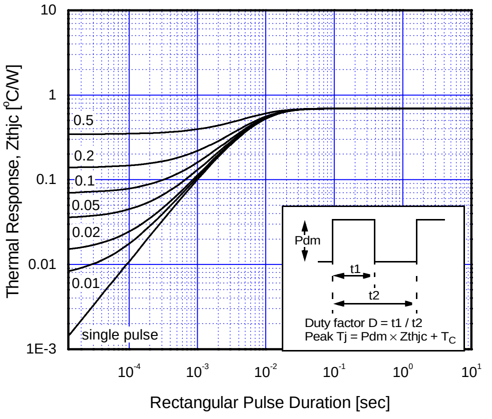

Fig 12. Transient Thermal Impedance of IGBT

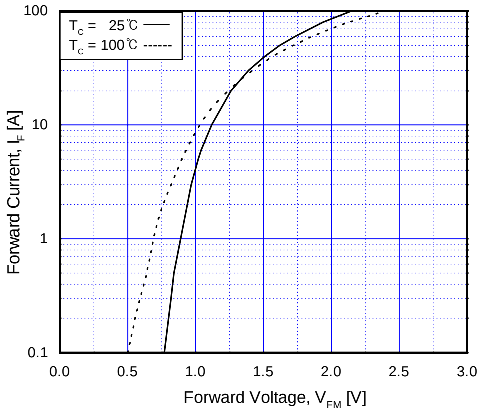

Fig 13. Forward Characteristics

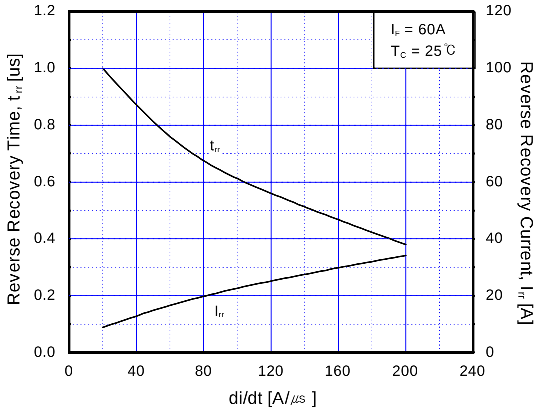

Fig 14. Reverse Recovery Characteristics vs. di/dt

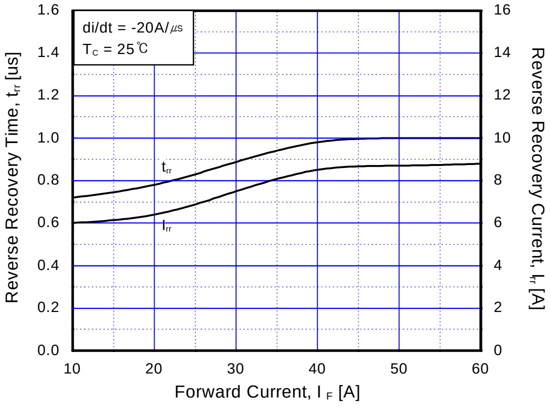

Fig 15. Reverse Recovery Characteristics vs. Forward Current

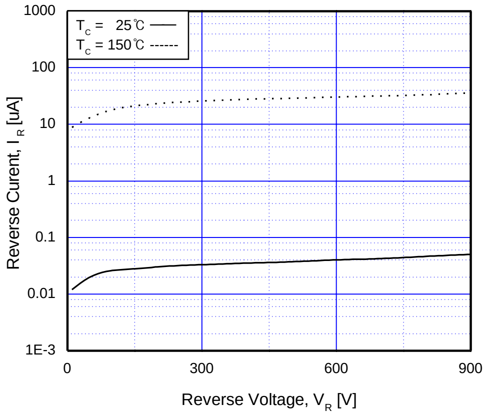

Fig 16. Reverse Current vs. Reverse Voltage

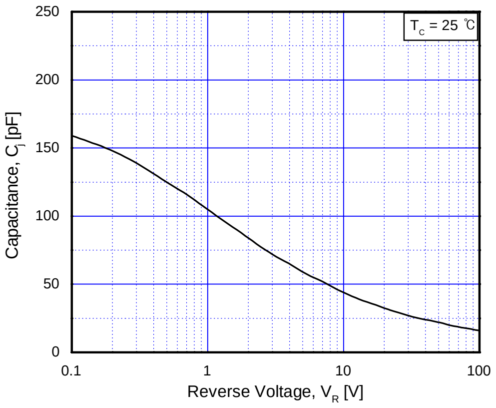

Fig 17. Junction capacitance

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