

## SGL60N90DG3

### General Description

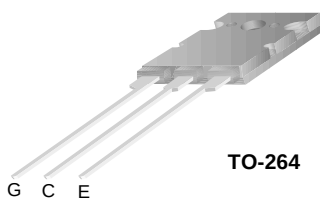
Insulated Gate Bipolar Transistors (IGBTs) with a trench gate structure provide superior conduction and switching performance in comparison with transistors having a planar gate structure. They also have wide noise immunity. These devices are very suitable for induction heating applications.

### Features

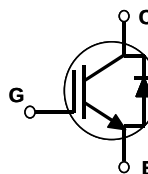
- High speed switching
- Low saturation voltage :  $V_{CE(sat)} = 2.0 \text{ V @ } I_C = 60\text{A}$
- High input impedance
- Built-in fast recovery diode

### Applications

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



TO-264



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

| Symbol      | Description                                                             | SGL60N90DG3 | Units            |
|-------------|-------------------------------------------------------------------------|-------------|------------------|
| $V_{CES}$   | Collector-Emitter Voltage                                               | 900         | V                |
| $V_{GES}$   | Gate-Emitter Voltage                                                    | $\pm 25$    | V                |
| $I_C$       | Collector Current @ $T_C = 25^\circ\text{C}$                            | 60          | A                |
|             | Collector Current @ $T_C = 100^\circ\text{C}$                           | 42          | A                |
| $I_{CM(1)}$ | Pulsed Collector Current                                                | 120         | A                |
| $I_F$       | Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$            | 15          | A                |
| $P_D$       | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$                    | 180         | W                |
|             | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$                   | 72          | 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, 1/8" 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              |
|-------------------------------|-----------------------------------------|------|------|--------------------|
| $R_{\theta JC}(\text{IGBT})$  | Thermal Resistance, Junction-to-Case    | --   | 0.69 | $^\circ\text{C/W}$ |
| $R_{\theta JC}(\text{DIODE})$ | Thermal Resistance, Junction-to-Case    | --   | 2.08 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$               | Thermal Resistance, Junction-to-Ambient | --   | 25   | $^\circ\text{C/W}$ |

## Electrical Characteristics of the IGBT T<sub>C</sub> = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|-------|

### Off Characteristics

|                   |                                     |                                                           |     |    |       |    |
|-------------------|-------------------------------------|-----------------------------------------------------------|-----|----|-------|----|
| BV <sub>CES</sub> | Collector-Emitter Breakdown Voltage | V <sub>GE</sub> = 0V, I <sub>C</sub> = 250uA              | 900 | -- | --    | V  |
| I <sub>CES</sub>  | Collector Cut-Off Current           | V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V | --  | -- | 1.0   | mA |
| I <sub>GES</sub>  | G-E Leakage Current                 | V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V | --  | -- | ± 500 | nA |

### On Characteristics

|                      |                                         |                                                          |     |     |     |   |
|----------------------|-----------------------------------------|----------------------------------------------------------|-----|-----|-----|---|
| V <sub>GE(th)</sub>  | G-E Threshold Voltage                   | I <sub>C</sub> = 60mA, V <sub>CE</sub> = V <sub>GE</sub> | 4.0 | 5.0 | 7.0 | V |
| V <sub>CE(sat)</sub> | Collector to Emitter Saturation Voltage | I <sub>C</sub> = 10A, V <sub>GE</sub> = 15V              | --  | 1.4 | 1.8 | V |
|                      |                                         | I <sub>C</sub> = 60A, V <sub>GE</sub> = 15V              | --  | 2.0 | 2.7 | V |

### Dynamic Characteristics

|                  |                              |                                                         |    |      |    |    |
|------------------|------------------------------|---------------------------------------------------------|----|------|----|----|
| C <sub>ies</sub> | Input Capacitance            | V <sub>CE</sub> =10V, V <sub>GE</sub> = 0V,<br>f = 1MHz | -- | 6500 | -- | pF |
| C <sub>oes</sub> | Output Capacitance           |                                                         | -- | 250  | -- | pF |
| C <sub>res</sub> | Reverse Transfer Capacitance |                                                         | -- | 220  | -- | pF |

### Switching Characteristics

|                     |                       |                                                                                                                                        |    |     |     |    |
|---------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------|----|-----|-----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time    | V <sub>CC</sub> = 600 V, I <sub>C</sub> = 60A,<br>R <sub>G</sub> = 51Ω, V <sub>GE</sub> =15V,<br>Resistive Load, T <sub>C</sub> = 25°C | -- | 250 | 400 | ns |
| t <sub>r</sub>      | Rise Time             |                                                                                                                                        | -- | 450 | 700 | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time   |                                                                                                                                        | -- | 450 | 700 | ns |
| t <sub>f</sub>      | Fall Time             | V <sub>CE</sub> = 600 V, I <sub>C</sub> = 60A,<br>V <sub>GE</sub> = 15V                                                                | -- | 250 | 400 | ns |
| Q <sub>g</sub>      | Total Gate Charge     |                                                                                                                                        | -- | 260 | 300 | nC |
| Q <sub>ge</sub>     | Gate-Emitter Charge   |                                                                                                                                        | -- | 70  | --  | nC |
| Q <sub>gc</sub>     | Gate-Collector Charge |                                                                                                                                        | -- | 60  | --  | nC |

## Electrical Characteristics of DIODE T<sub>C</sub> = 25°C unless otherwise noted

| Symbol          | Parameter                     | Test Conditions                      | Min. | Typ. | Max. | Units |
|-----------------|-------------------------------|--------------------------------------|------|------|------|-------|
| V <sub>FM</sub> | Diode Forward Voltage         | I <sub>F</sub> = 15A                 | --   | 1.2  | 1.7  | V     |
|                 |                               | I <sub>F</sub> = 60A                 | --   | 1.75 | 2.0  | V     |
| t <sub>rr</sub> | Diode Reverse Recovery Time   | I <sub>F</sub> = 60A di/dt = 20 A/us |      | 1.2  | 1.5  | us    |
| I <sub>R</sub>  | Instantaneous Reverse Current | V <sub>RRM</sub> = 900V              | --   | 0.05 | 2    | uA    |

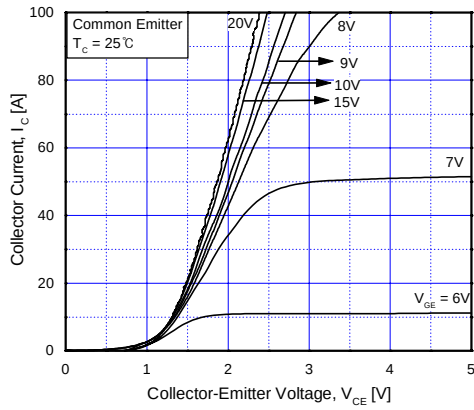


Fig 1. Typical Output Characteristics

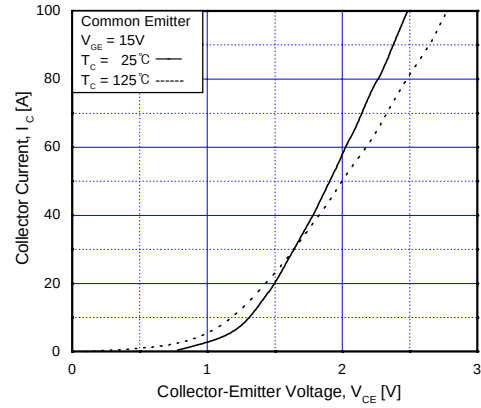


Fig 2. Typical Saturation Voltage Characteristics

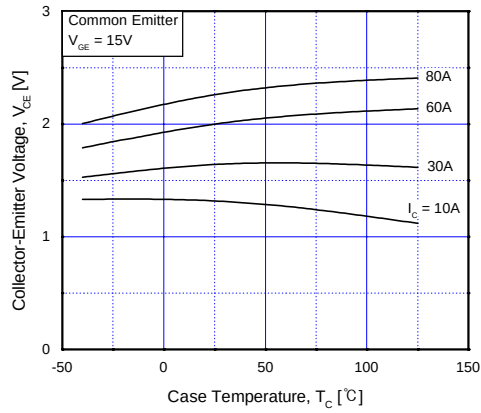


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

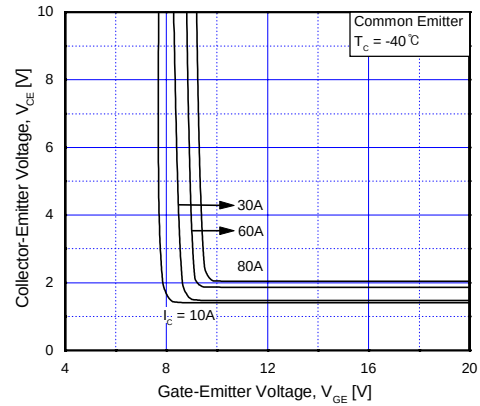


Fig 4. Saturation Voltage vs.  $V_{GE}$

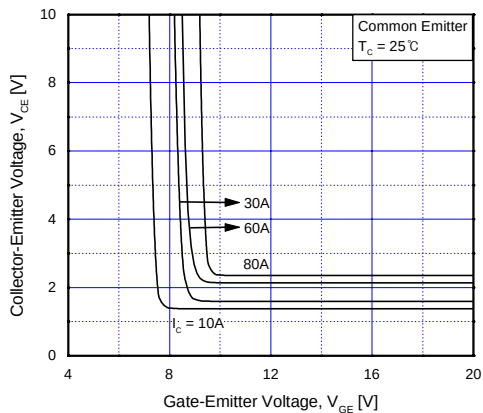


Fig 5. Saturation Voltage vs.  $V_{GE}$

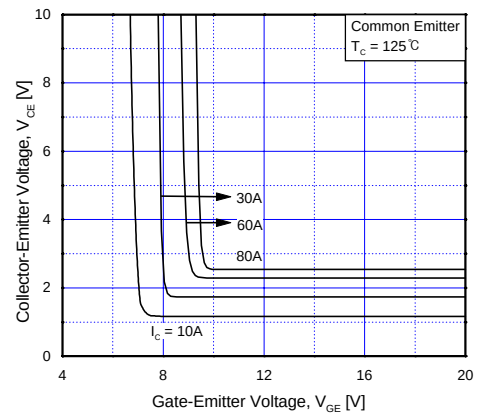


Fig 6. Saturation Voltage vs.  $V_{GE}$

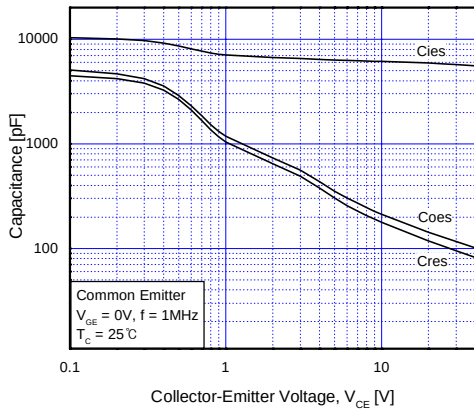


Fig 7. Capacitance Characteristics

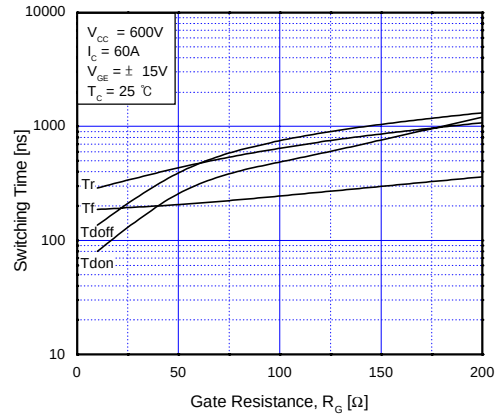


Fig 8. Switching Characteristics vs. Gate Resistance

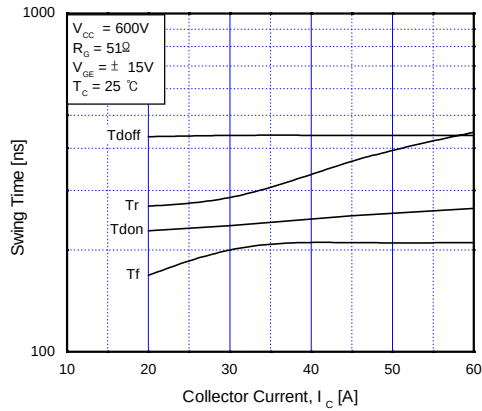


Fig 9. Switching Characteristics vs. Collector Current

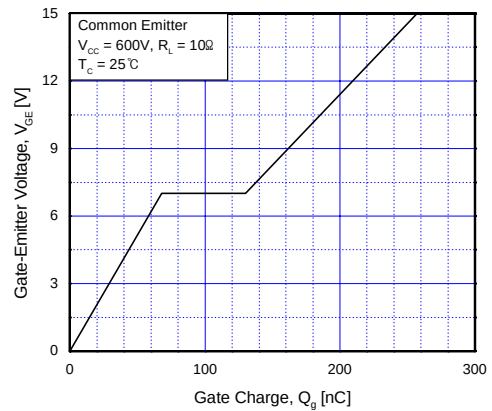


Fig 10. Gate Charge Characteristics

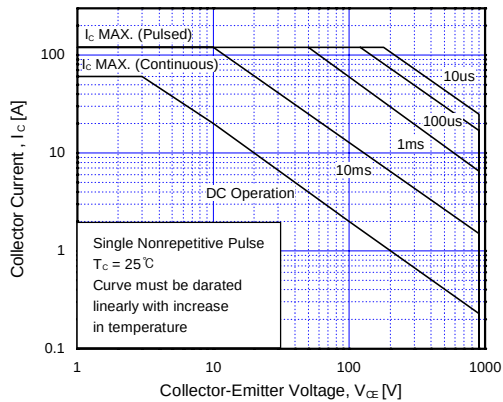


Fig 11. SOA Characteristics

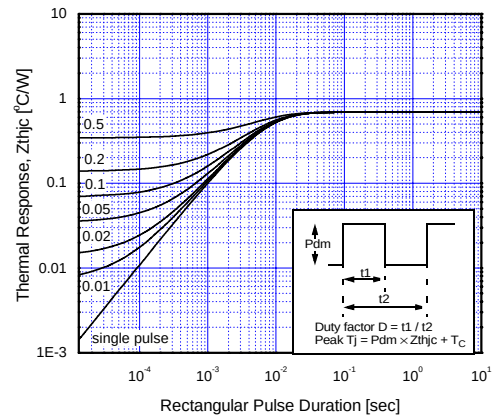


Fig 12. Transient Thermal Impedance of IGBT

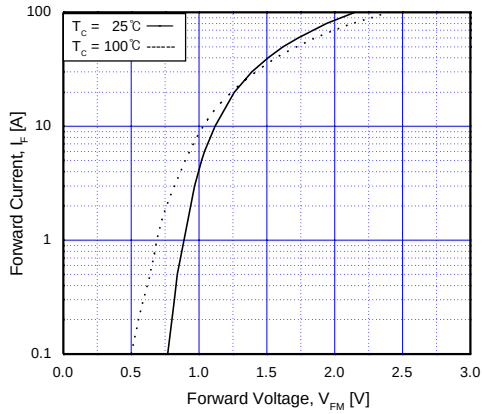


Fig 13. Forward Characteristics

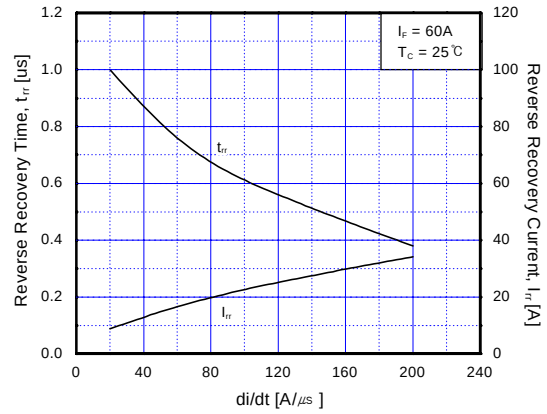


Fig 14. Reverse Recovery Characteristics vs.  $di/dt$

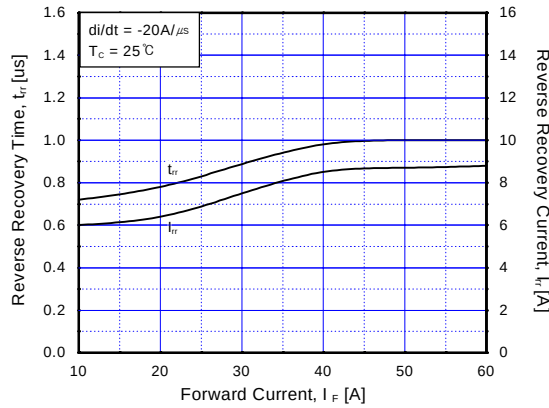


Fig 15. Reverse Recovery Characteristics vs. Forward Current

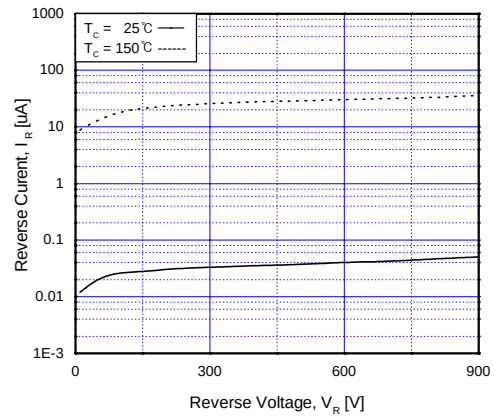


Fig 16. Reverse Current vs. Reverse Voltage

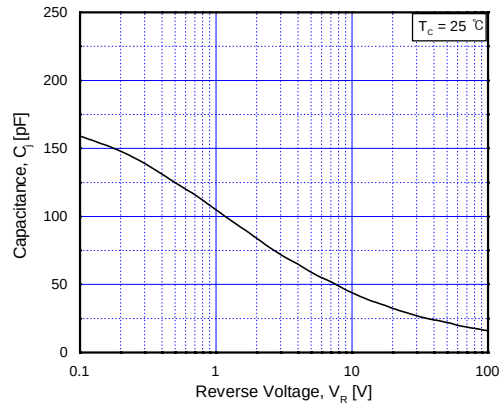


Fig 17. Junction capacitance

**SGL60N90DG3**

Technical drawing of a mechanical part, likely a connector or plug, showing top and side views with dimensions in millimeters.

**Top View Dimensions:**

- Overall width:  $20.00 \pm 0.20$
- Overall height:  $20.00 \pm 0.20$
- Distance from top edge to center line:  $10.00$  (split into  $9.00$  and  $1.00$ )
- Distance from left edge to center line:  $10.00$  (split into  $8.30$  and  $1.70$ )
- Distance from center line to corner center:  $8.30$
- Distance from center line to central feature center:  $7.00$
- Corner radius:  $R2.00$  and  $R1.00$
- Central feature diameter:  $\phi 3.30 \pm 0.20$
- Distance from bottom edge to center line:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from left edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from right edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from bottom edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )

**Side View Dimensions:**

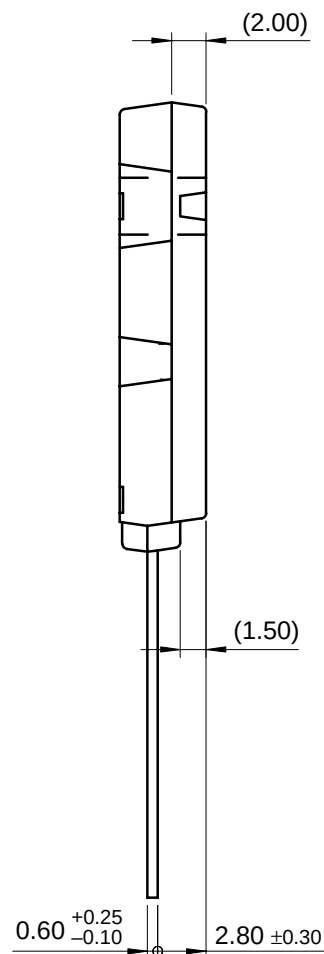
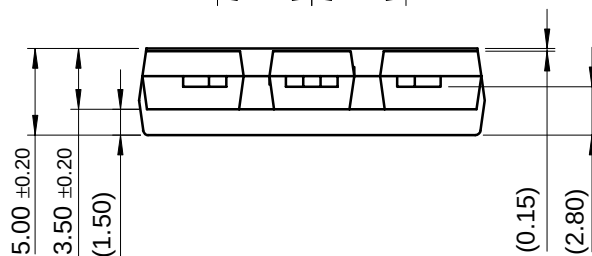
- Overall height:  $20.00 \pm 0.20$
- Distance from top edge to center line:  $10.00$  (split into  $9.00$  and  $1.00$ )
- Distance from center line to bottom edge:  $10.00$  (split into  $9.00$  and  $1.00$ )
- Distance from top edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from center line to corner center:  $8.30$
- Distance from bottom edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from left edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from right edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from top edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from center line to central feature center:  $7.00$
- Distance from bottom edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from left edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from right edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$

**Bottom View Dimensions:**

- Overall width:  $20.00 \pm 0.20$
- Distance from top edge to center line:  $10.00$  (split into  $9.00$  and  $1.00$ )
- Distance from center line to bottom edge:  $10.00$  (split into  $9.00$  and  $1.00$ )
- Distance from top edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from center line to corner center:  $8.30$
- Distance from bottom edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from left edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from right edge to corner center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from top edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from center line to central feature center:  $7.00$
- Distance from bottom edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from left edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from right edge to central feature center:  $11.00$  (split into  $9.00$  and  $2.00$ )
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$
- Distance from top edge to bottom edge:  $20.00 \pm 0.20$

**Notes:**

- 5.45TYP
- 5.45  $\pm 0.30$
- 5.45TYP
- 5.45  $\pm 0.30$



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SGL60N90DG3 Rev. A1

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| DenseTrench™         | GTO™                | POP™                | Stealth™         |           |
| DOME™                | HiSeC™              | Power247™           | SuperSOT™-3      |           |
| EcoSPARK™            | I <sup>2</sup> C™   | PowerTrench®        | SuperSOT™-6      |           |
| E <sup>2</sup> CMOS™ | ISOPPLANAR™         | QFET™               | SuperSOT™-8      |           |
| EnSigna™             | LittleFET™          | QS™                 | SyncFET™         |           |
| FACT™                | MicroFET™           | QT Optoelectronics™ | TinyLogic™       |           |
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