

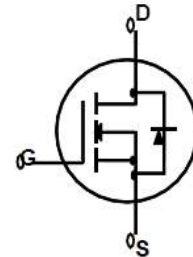
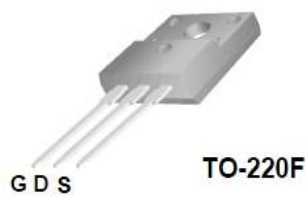
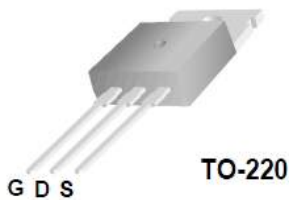
## 650V N-Channel MOSFET

### General Description

This Power MOSFET is produced using SL semi's advanced planar stripe DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for low voltage applications such as DC/DC converters and high efficiency switching for power management in portable and battery operated products.

### Features

- 4.0A, 650V,  $R_{DS(on)} = 3.0\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 15nC)
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



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

| Symbol         | Parameter   | SLS4N65 | SSS4N65     | Units            |
|----------------|---|---------|-------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage  |         | 650         | V                |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )                       |         | 4.0         | A                |
| $I_{DM}$       | Drain Current - Pulsed (Note 1)   |         | 16          | A                |
| $V_{GSS}$      | Gate-Source Voltage   |         | $\pm 30$    | V                |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                       |         | 180         | mJ               |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)  |         | 10          | mJ               |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)  |         | 4.5         | V/ns             |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )                                |         | 104         | W                |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                       |         | -55 to +150 | $^\circ\text{C}$ |
| $T_L$          | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds |         | 300         | $^\circ\text{C}$ |

\* Drain current limited by maximum junction temperature.

# N-CHANNEL MOSFET

# SI4N65

## Electrical Characteristics

$T_C = 25^\circ\text{C}$  unless otherwise noted

| Symbol  | Parameter   | Test Conditions   | Min | Typ | Max  | Units                     |
|---|---|---|-----|-----|------|---------------------------|
| <b>Off Characteristics</b>                                    |   |   |     |     |      |                           |
| $BV_{DSS}$  | Drain-Source Breakdown Voltage                        | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$   | 650 | --  | --   | V                         |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$                          | Breakdown Voltage Temperature Coefficient             | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$                                   | --  | 0.6 | --   | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$   | Zero Gate Voltage Drain Current                       | $V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$  | --  | --  | 1    | $\mu\text{A}$             |
|   |   | $V_{DS} = 520\text{ V}, T_C = 125^\circ\text{C}$  | --  | --  | 10   | $\mu\text{A}$             |
| $I_{GSSF}$  | Gate-Body Leakage Current, Forward                    | $V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$   | --  | --  | 100  | nA                        |
| $I_{GSSR}$  | Gate-Body Leakage Current, Reverse                    | $V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$  | --  | --  | -100 | nA                        |
| <b>On Characteristics</b>                                     |   |   |     |     |      |                           |
| $V_{GS(th)}$  | Gate Threshold Voltage                                | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$   | 2.0 | --  | 4.5  | V                         |
| $R_{DS(on)}$  | Static Drain-Source On-Resistance                     | $V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$  | --  | 2.5 | 3.0  | $\Omega$                  |
| <b>Dynamic Characteristics</b>                                |   |   |     |     |      |                           |
| $C_{iss}$   | Input Capacitance                                     | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$                          | --  | 560 | --   | pF                        |
| $C_{oss}$   | Output Capacitance                                    |   | --  | 55  | --   | pF                        |
| $C_{rss}$   | Reverse Transfer Capacitance                          |   | --  | 7   | --   | pF                        |
| <b>Switching Characteristics</b>                              |   |   |     |     |      |                           |
| $t_{d(on)}$   | Turn-On Delay Time                                    | $V_{DD} = 325\text{ V}, I_D = 4.0\text{ A},$<br>$R_G = 25\ \Omega$<br><br>(Note 4, 5)         | --  | 10  | --   | ns                        |
| $t_r$   | Turn-On Rise Time                                     |   | --  | 40  | --   | ns                        |
| $t_{d(off)}$  | Turn-Off Delay Time                                   |   | --  | 40  | --   | ns                        |
| $t_f$   | Turn-Off Fall Time                                    |   | --  | 50  | --   | ns                        |
| $Q_g$   | Total Gate Charge                                     | $V_{DS} = 520\text{ V}, I_D = 4.0\text{ A},$<br>$V_{GS} = 10\text{ V}$<br><br>(Note 4, 5)     | --  | 16  | -    | nC                        |
| $Q_{gs}$  | Gate-Source Charge                                    |   | --  | 2.5 | --   | nC                        |
| $Q_{gd}$  | Gate-Drain Charge                                     |   | --  | 6.5 | --   | nC                        |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |   |     |     |      |                           |
| $I_S$   | Maximum Continuous Drain-Source Diode Forward Current |   | --  | --  | 4.0  | A                         |
| $I_{SM}$  | Maximum Pulsed Drain-Source Diode Forward Current     |   | --  | --  | 16   | A                         |
| $V_{SD}$  | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 4.0\text{ A}$   | --  | --  | 1.4  | V                         |
| $t_{rr}$  | Reverse Recovery Time                                 | $V_{GS} = 0\text{ V}, I_S = 4.0\text{ A},$<br>$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4) | --  | 300 | --   | ns                        |
| $Q_{rr}$  | Reverse Recovery Charge                               |   | --  | 2.0 | --   | $\mu\text{C}$             |

### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 22\text{ mH}, I_{AS} = 4.0\text{ A}, V_{DD} = 25\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 4.0\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## Typical Characteristics

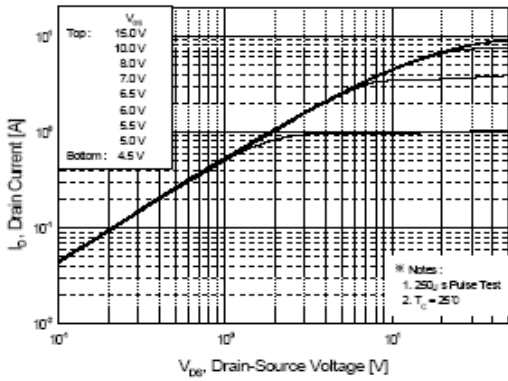


Figure 1. On-Region Characteristics

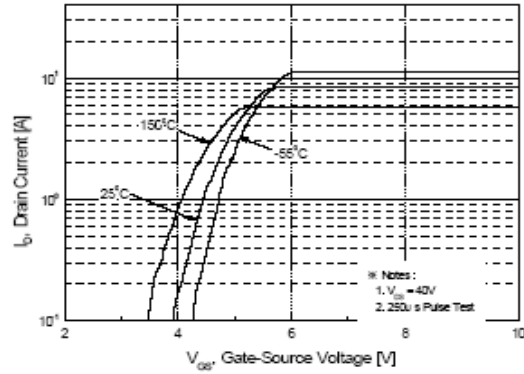


Figure 2. Transfer Characteristics

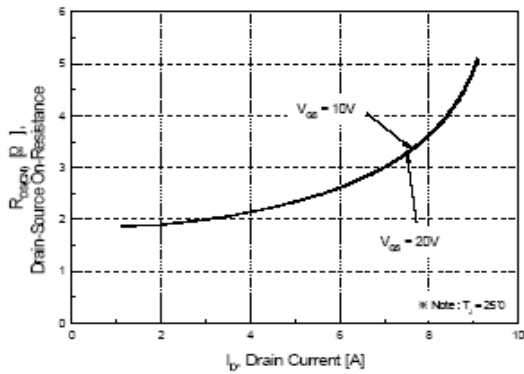


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

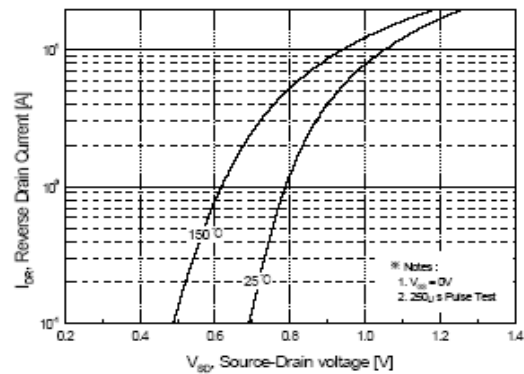


Figure 4. Body Diode Forward Voltage Variation with Source Current

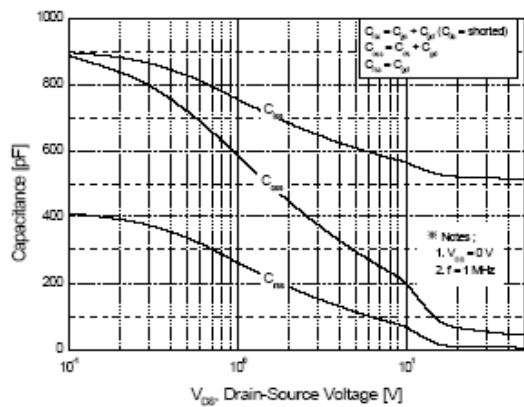


Figure 5. Capacitance Characteristics

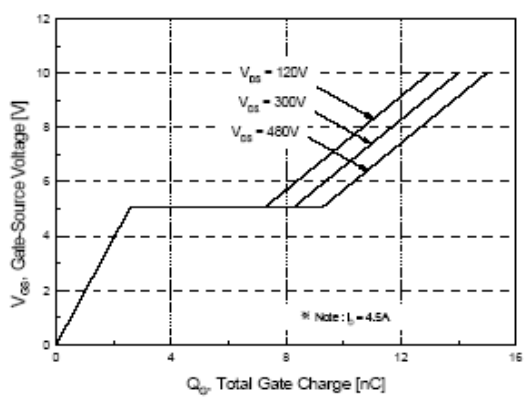


Figure 6. Gate Charge Characteristics

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## Typical Characteristics (Continued)

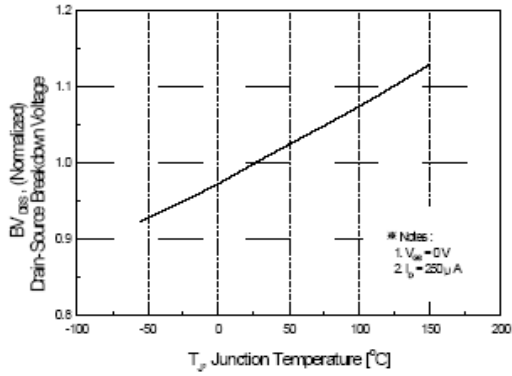


Figure 7. Breakdown Voltage Variation vs Temperature

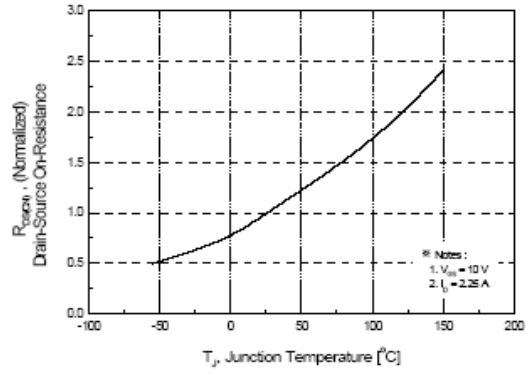


Figure 8. On-Resistance Variation vs Temperature

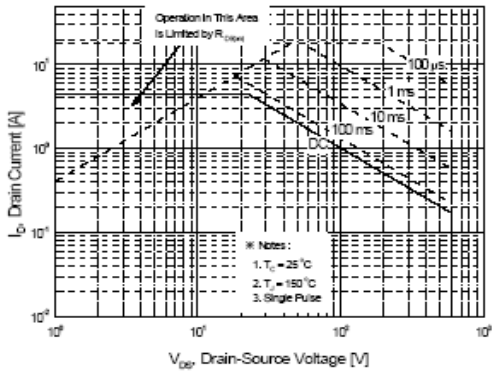


Figure 9-1. Maximum Safe Operating Area for SSS4N65C

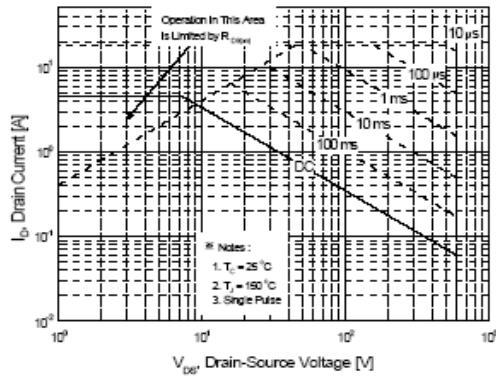


Figure 9-2. Maximum Safe Operating Area for SSS4N65C

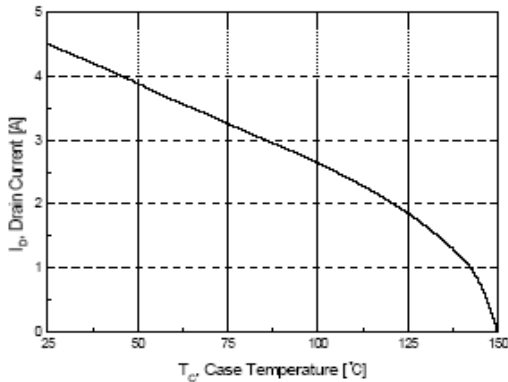


Figure 10. Maximum Drain Current vs Case Temperature

## Typical Characteristics (Continued)

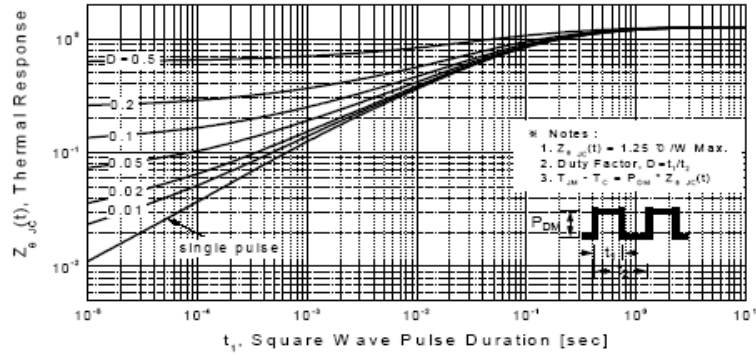


Figure 11-1. Transient Thermal Response Curve for SSS4N65

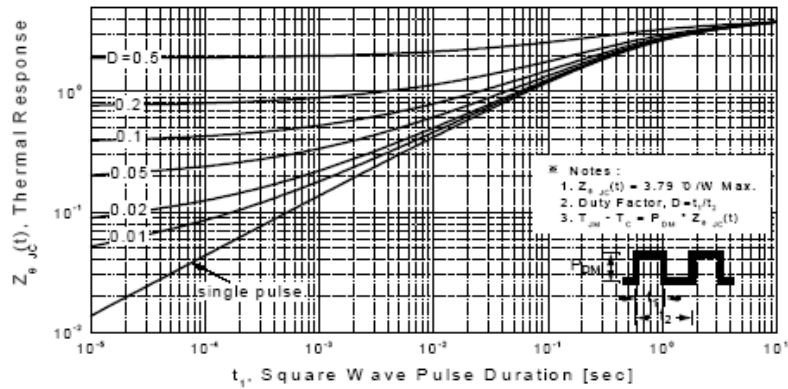
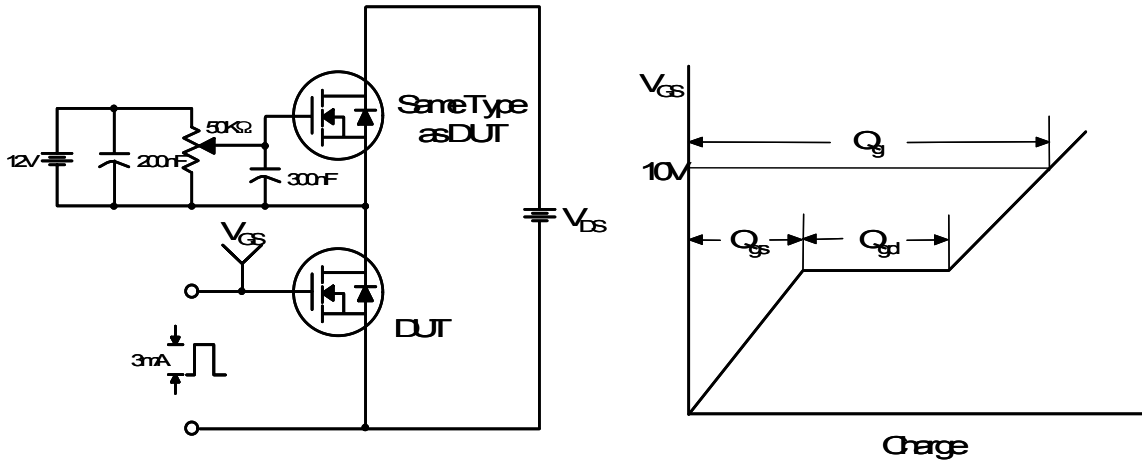


Figure 11-2. Transient Thermal Response Curve for SSS4N65

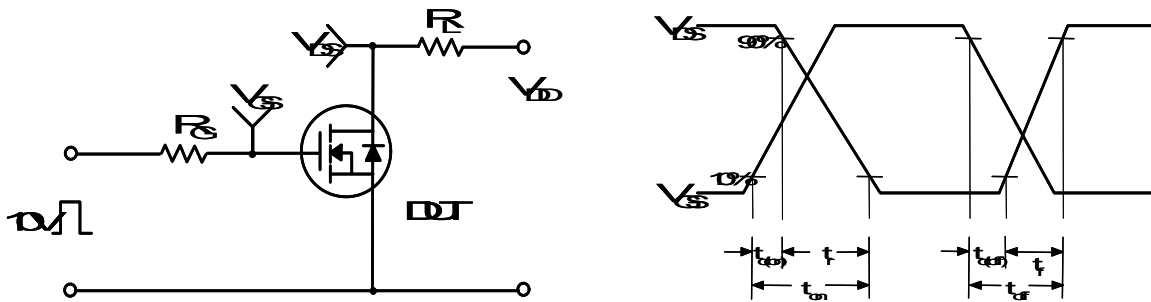
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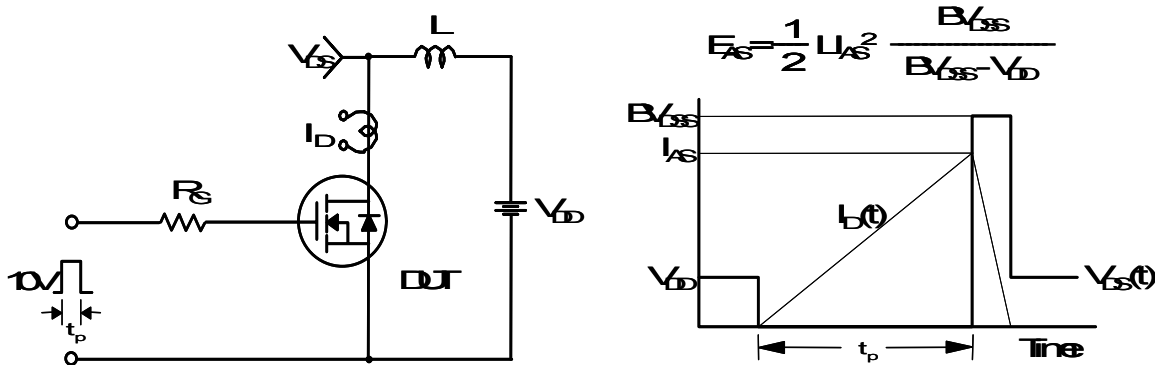
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



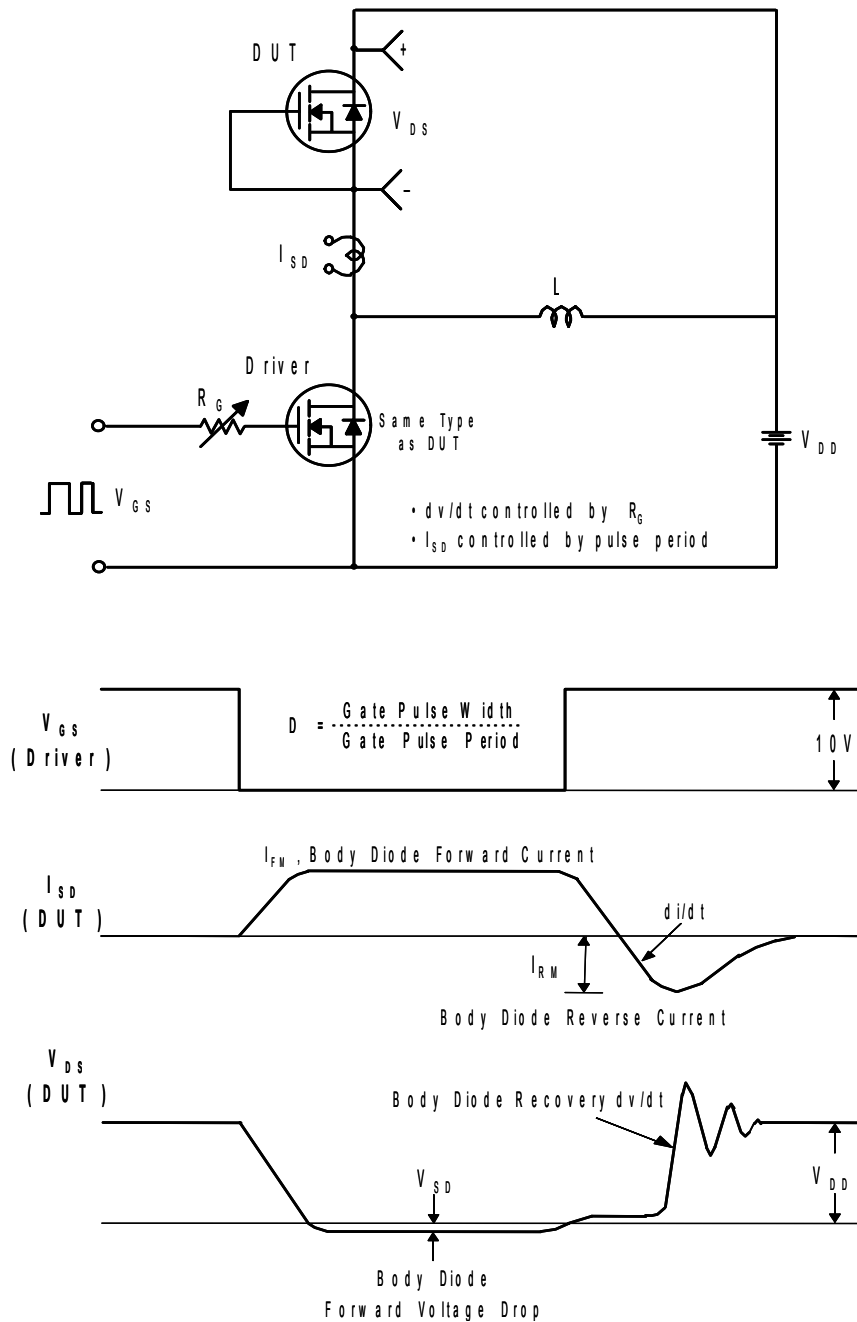
Unclamped Inductive Switching Test Circuit & Waveforms



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Peak Diode Recovery dv/dt Test Circuit & Waveforms

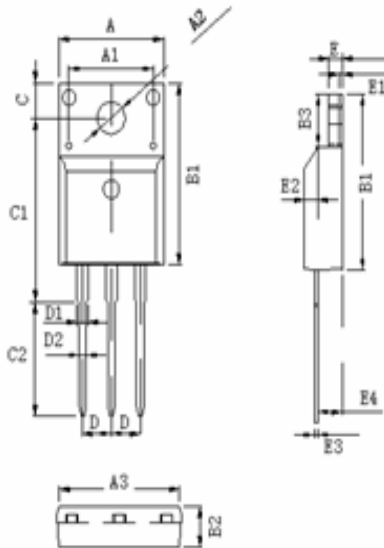


Package Dimensions

TO-220F

τ  
τ  
τ  
τ  
τ  
τ

TO-220F 外形尺寸图



| DIM. | MILLIMETERS. |               |
|------|--------------|---------------|
| A    | 10.03 ± 0.20 |               |
| A1   | 7.00         |               |
| A2   | 3.12 ± 0.10  |               |
| A3   | 9.70 ± 0.20  |               |
| B1   | 15.75 ± 0.20 |               |
| B2   | 4.72 ± 0.20  |               |
| B3   | 6.70 ± 0.20  |               |
| C    | 3.30 ± 0.10  |               |
| C1   | 15.80 ± 0.20 |               |
| C2   | 9.80 ± 0.2   |               |
| D    | Typical 2.54 |               |
| D1   | 1.47 (MAX)   |               |
| D2   | 0.80 ± 0.10  |               |
| E    | 2.55 ± 0.20  |               |
| E1   | 0.70         |               |
| E2   | 1.00 × 45°   |               |
| E3   | 0.50         | +0.1<br>-0.05 |
| E4   | 2.80 ± 0.20  |               |