

MOSFET – Power, N-Channel, SUPERFET III, Easy Drive 650 V, 17 A, 190 mΩ



FCPF190N65S3R0L

Description

SUPERFET III MOSFET is ON Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate. Consequently, SUPERFET III MOSFET Easy drive series helps manage EMI issues and allows for easier design implementation.

Features

- 700 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 159 \text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 33 \text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(\text{eff})} = 300 \text{ pF}$)
- 100% Avalanche Tested
- This Device is Pb-Free and is RoHS Compliant

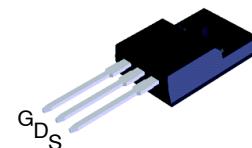
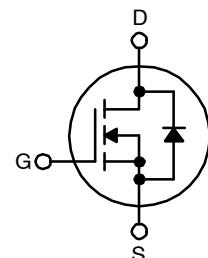
Applications

- Computing / Display Power Supplies
- Telecom / Server Power Supplies
- Industrial Power Supplies
- Lighting / Charger / Adapter

ON Semiconductor®

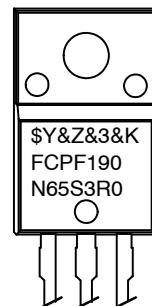
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| V_{DSS} | $R_{DS(on) \text{ MAX}}$ | $I_D \text{ MAX}$ |
|-----------|--------------------------|-------------------|
| 650 V | 190 mΩ @ 10 V | 17 A |



TO-220
CASE 340BF

MARKING DIAGRAM



\$Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = Numeric Date Code
&K = Lot Code
FCPF190N65S3R0 = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

FCPF190N65S3R0L

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

| Symbol | Parameter | | Value | Unit |
|-----------------------------------|--|-------------------------------------|-------------|------|
| V _{DSS} | Drain to Source Voltage | | 650 | V |
| V _{GSS} | Gate to Source Voltage | DC | ±30 | V |
| | | AC (f > 1 Hz) | ±30 | V |
| I _D | Drain Current | Continuous (T _C = 25°C) | 17* | A |
| | | Continuous (T _C = 100°C) | 11* | |
| I _{DM} | Drain Current | Pulsed (Note 1) | 42.5* | A |
| E _{AS} | Single Pulsed Avalanche Energy (Note 2) | | 76 | mJ |
| I _{AS} | Avalanche Current (Note 2) | | 2.5 | A |
| E _{AR} | Repetitive Avalanche Energy (Note 1) | | 1.44 | mJ |
| dv/dt | MOSFET dv/dt | | 100 | V/ns |
| | Peak Diode Recovery dv/dt (Note 3) | | 20 | |
| P _D | Power Dissipation | T _C = 25°C | 33 | W |
| | | Derate Above 25°C | 1.15 | W/°C |
| T _J , T _{STG} | Operating and Storage Temperature Range | | -55 to +150 | °C |
| T _L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | | 300 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

*Drain current limited by maximum junction temperature.

1. Repetitive rating: pulse-width limited by maximum junction temperature.

2. I_{AS} = 2.5 A, R_G = 25 Ω, starting T_J = 25°C.

3. I_{SD} ≤ 8.5 A, di/dt ≤ 200 A/ms, V_{DD} ≤ 400 V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

| Symbol | Parameter | Value | Unit |
|------------------|---|-------|------|
| R _{θJC} | Thermal Resistance, Junction to Case, Max. | 3.76 | °C/W |
| R _{θJA} | Thermal Resistance, Junction to Ambient, Max. | 62.5 | |

PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|-----------------|----------------|---------|----------------|-----------|------------|----------|
| FCPF190N65S3R0L | FCPF190N65S3R0 | TO-220F | Tube | N/A | N/A | 50 Units |

FCPF190N65S3R0L

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|--|---|---|-----|------|-----------|------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $V_{\text{GS}} = 0 \text{ V}, I_{\text{D}} = 1 \text{ mA}, T_J = 25^\circ\text{C}$ | 650 | | | V |
| | | $V_{\text{GS}} = 0 \text{ V}, I_{\text{D}} = 1 \text{ mA}, T_J = 150^\circ\text{C}$ | 700 | | | V |
| $\Delta \text{BV}_{\text{DSS}} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_{\text{D}} = 1 \text{ mA}$, Referenced to 25°C | | 0.6 | | $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{\text{DS}} = 650 \text{ V}, V_{\text{GS}} = 0 \text{ V}$ | | 1 | | μA |
| | | $V_{\text{DS}} = 520 \text{ V}, T_C = 125^\circ\text{C}$ | | 0.89 | | |
| I_{GSS} | Gate to Body Leakage Current | $V_{\text{GS}} = \pm 30 \text{ V}, V_{\text{DS}} = 0 \text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|---------------------|--------------------------------------|---|-----|-----|-----|------------------|
| $V_{\text{GS(th)}}$ | Gate Threshold Voltage | $V_{\text{GS}} = V_{\text{DS}}, I_{\text{D}} = 0.39 \text{ mA}$ | 2.5 | | 4.5 | V |
| $R_{\text{DS(on)}}$ | Static Drain to Source On Resistance | $V_{\text{GS}} = 10 \text{ V}, I_{\text{D}} = 8.5 \text{ A}$ | | 159 | 190 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{\text{DS}} = 20 \text{ V}, I_{\text{D}} = 8.5 \text{ A}$ | | 10 | | S |

DYNAMIC CHARACTERISTICS

| | | | | | | | |
|-------------------------|-----------------------------------|---|--|------|-----|----------|----|
| C_{iss} | Input Capacitance | $V_{\text{DS}} = 400 \text{ V}, V_{\text{GS}} = 0 \text{ V}, f = 1 \text{ MHz}$ | | 1350 | | pF | |
| C_{oss} | Output Capacitance | | | 30 | | pF | |
| $C_{\text{oss(ef)}}(e)$ | Effective Output Capacitance | $V_{\text{DS}} = 0 \text{ V to } 400 \text{ V}, V_{\text{GS}} = 0 \text{ V}$ | | 300 | | pF | |
| $C_{\text{oss(er)}}$ | Energy Related Output Capacitance | $V_{\text{DS}} = 0 \text{ V to } 400 \text{ V}, V_{\text{GS}} = 0 \text{ V}$ | | 43 | | pF | |
| $Q_{\text{g(tot)}}$ | Total Gate Charge at 10V | $V_{\text{DS}} = 400 \text{ V}, I_{\text{D}} = 8.5 \text{ A}, V_{\text{GS}} = 10 \text{ V}$ (Note 4) | | 33 | | nC | |
| Q_{gs} | Gate to Source Gate Charge | | | | 7.9 | | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | | | 14 | | nC |
| ESR | Equivalent Series Resistance | $f = 1 \text{ MHz}$ | | 0.5 | | Ω | |

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|---------------------|--|--|----|--|----|
| $t_{\text{d(on)}}$ | Turn-On Delay Time | $V_{\text{DD}} = 400 \text{ V}, I_{\text{D}} = 8.5 \text{ A}, V_{\text{GS}} = 10 \text{ V}, R_{\text{g}} = 4.7 \Omega$ (Note 4) | | 17 | | ns |
| t_r | Turn-On Rise Time | | | 16 | | ns |
| $t_{\text{d(off)}}$ | Turn-Off Delay Time | | | 42 | | ns |
| t_f | Turn-Off Fall Time | | | 6 | | ns |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|-----------------|--|---|--|------|-----|----|
| I_{S} | Maximum Continuous Source to Drain Diode Forward Current | | | 17 | | A |
| I_{SM} | Maximum Pulsed Source to Drain Diode Forward Current | | | 42.5 | | A |
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{\text{GS}} = 0 \text{ V}, I_{\text{SD}} = 8.5 \text{ A}$ | | 1.2 | | V |
| t_{rr} | Reverse Recovery Time | $V_{\text{DD}} = 400 \text{ V}, I_{\text{SD}} = 8.5 \text{ A}, \frac{dI_{\text{F}}}{dt} = 100 \text{ A/ms}$ | | 313 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | | 4.9 | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

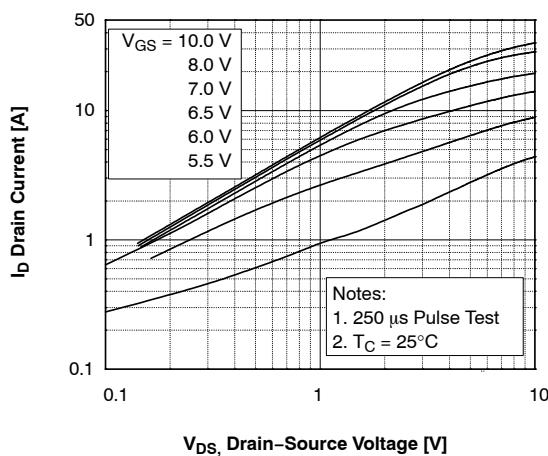


Figure 1. On-Region Characteristics

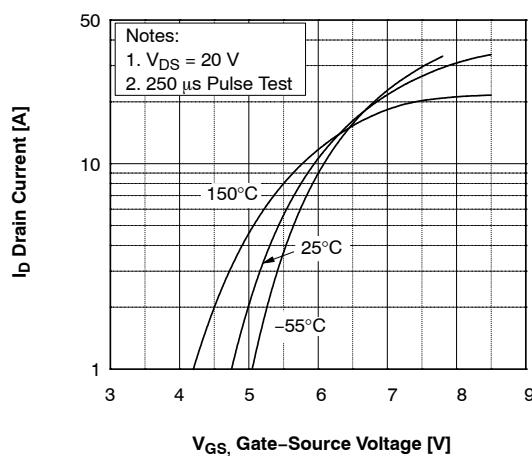


Figure 2. Transfer Characteristics

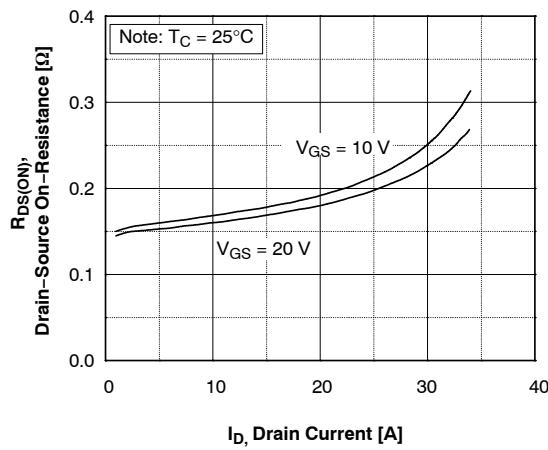


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

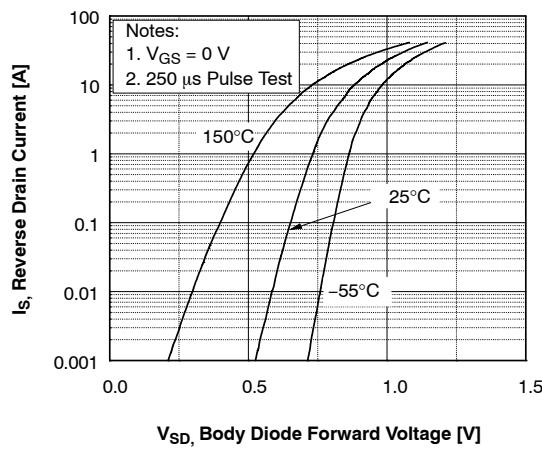


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

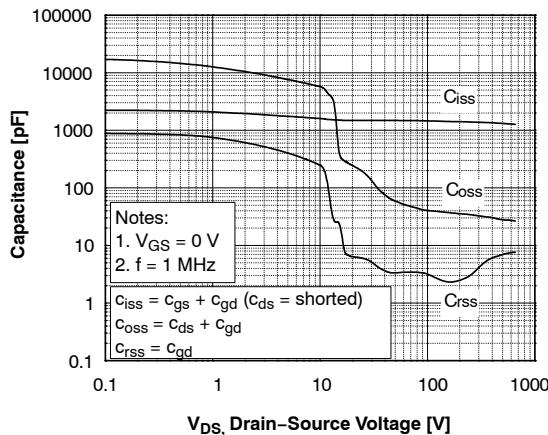


Figure 5. Capacitance Characteristics

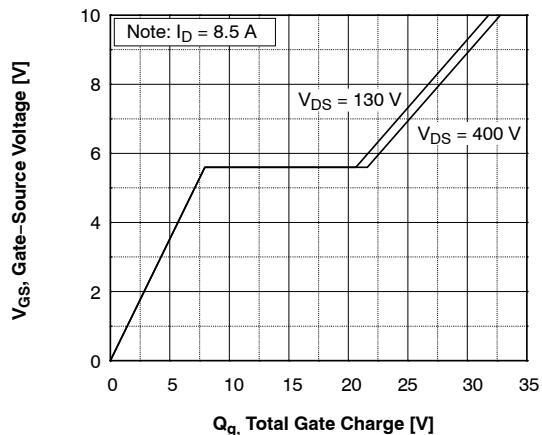


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

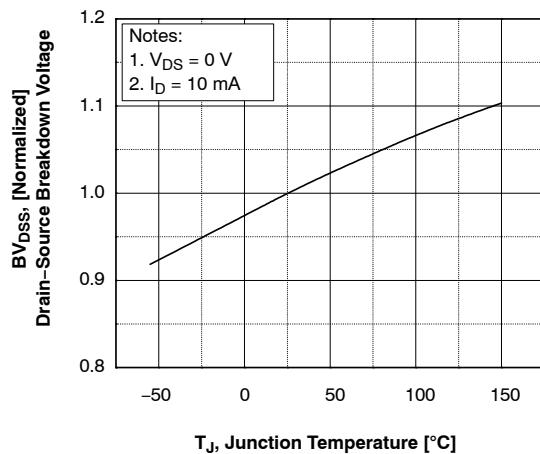


Figure 7. Breakdown Voltage Variation vs. Temperature

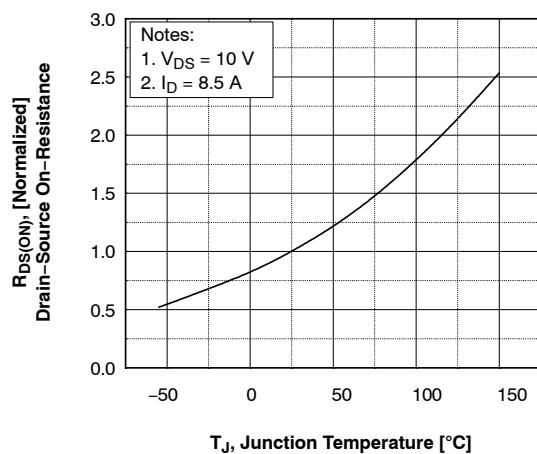


Figure 8. On-Resistance Variation vs. Temperature

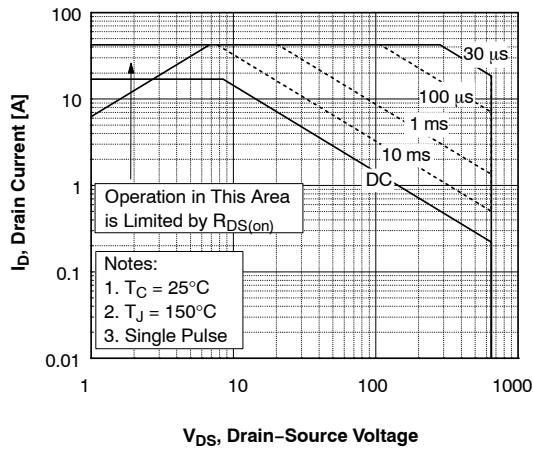


Figure 9. Maximum Safe Operating Area

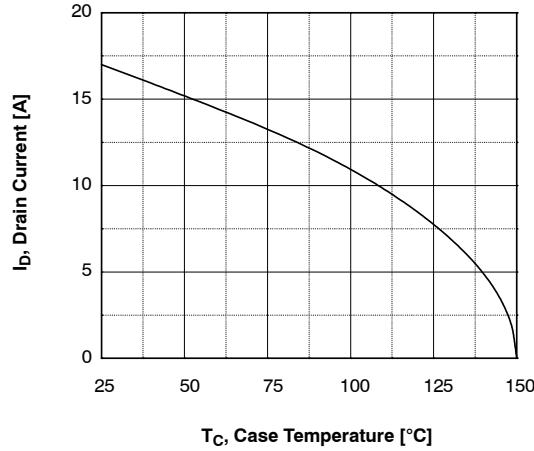


Figure 10. Maximum Drain Current vs. Case Temperature

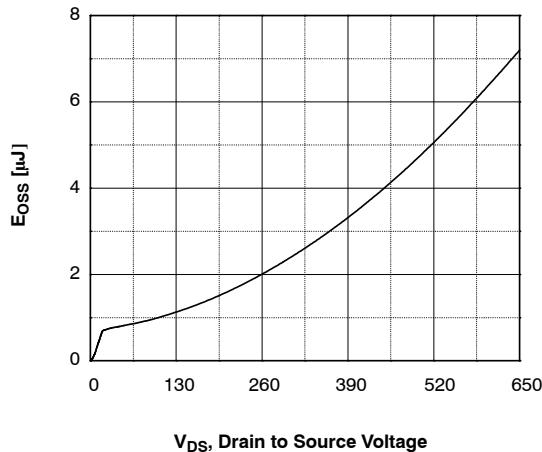


Figure 11. E_{oss} vs. Drain to Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

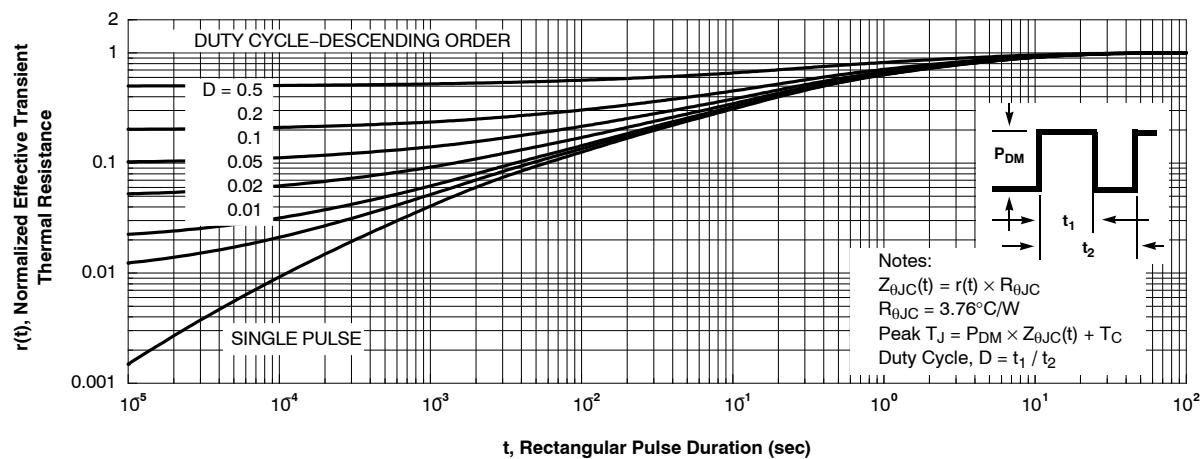


Figure 12. Transient Thermal Response Curve

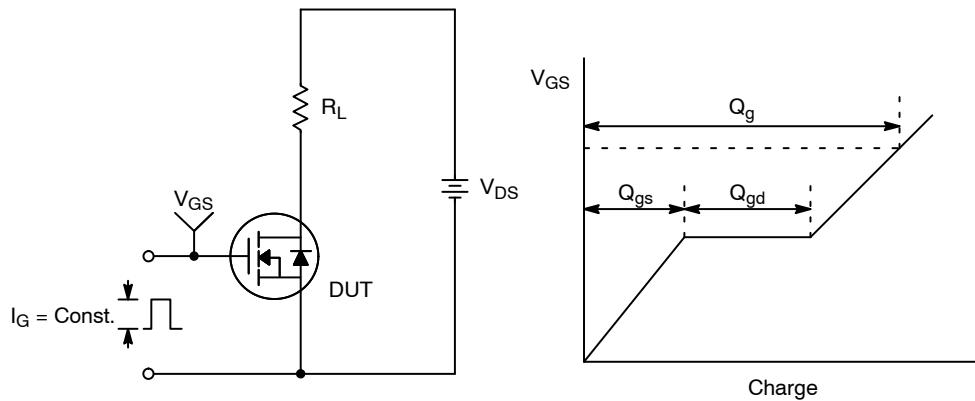


Figure 13. Gate Charge Test Circuit & Waveform

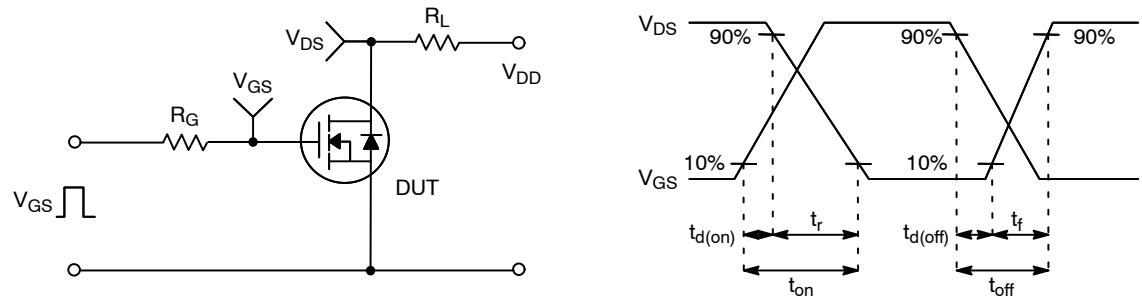


Figure 14. Resistive Switching Test Circuit & Waveforms

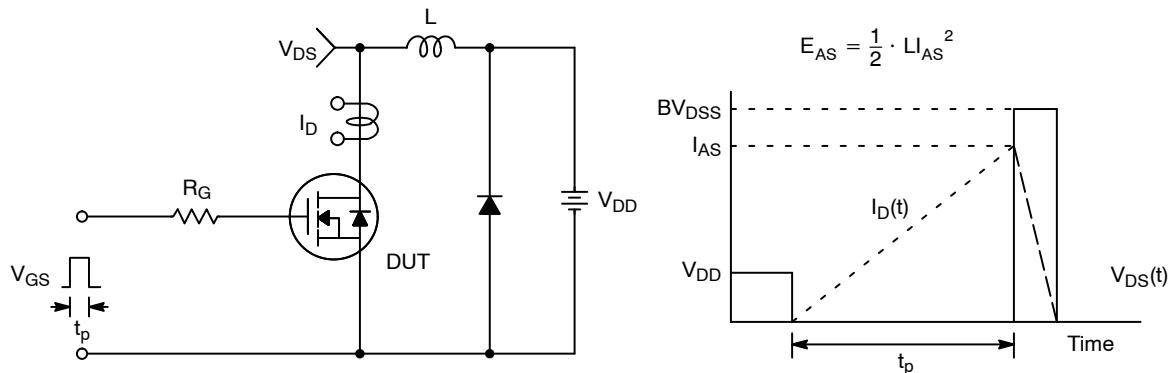


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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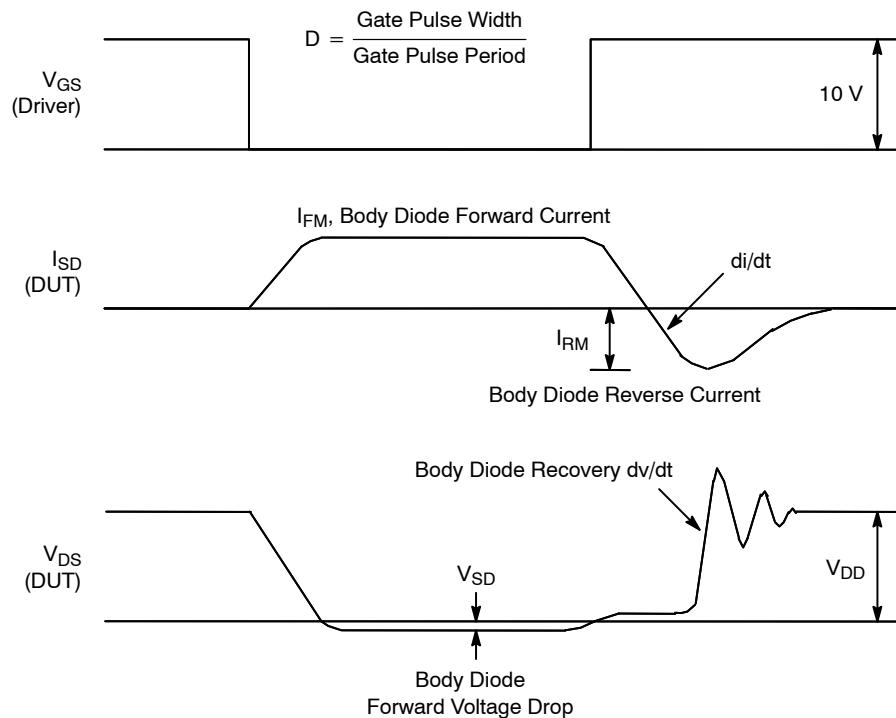
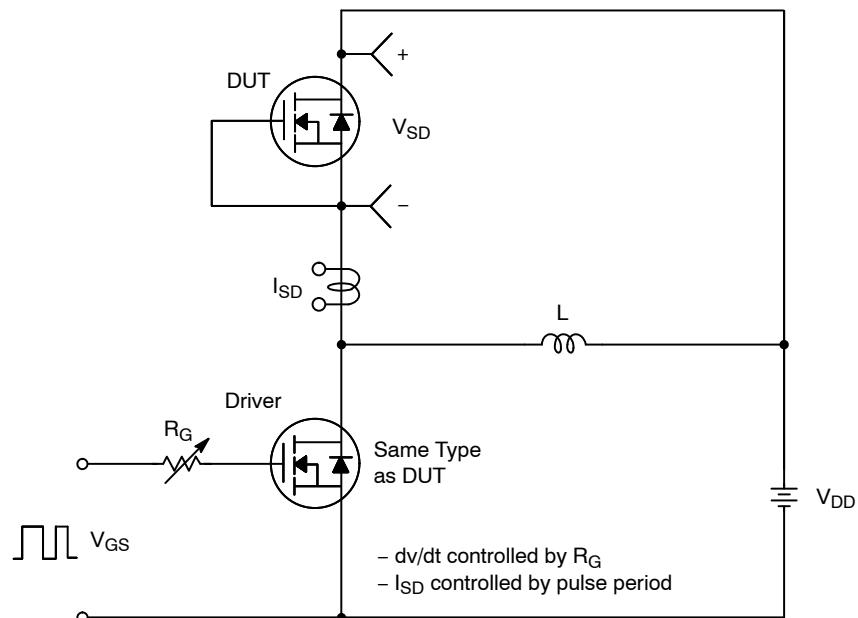
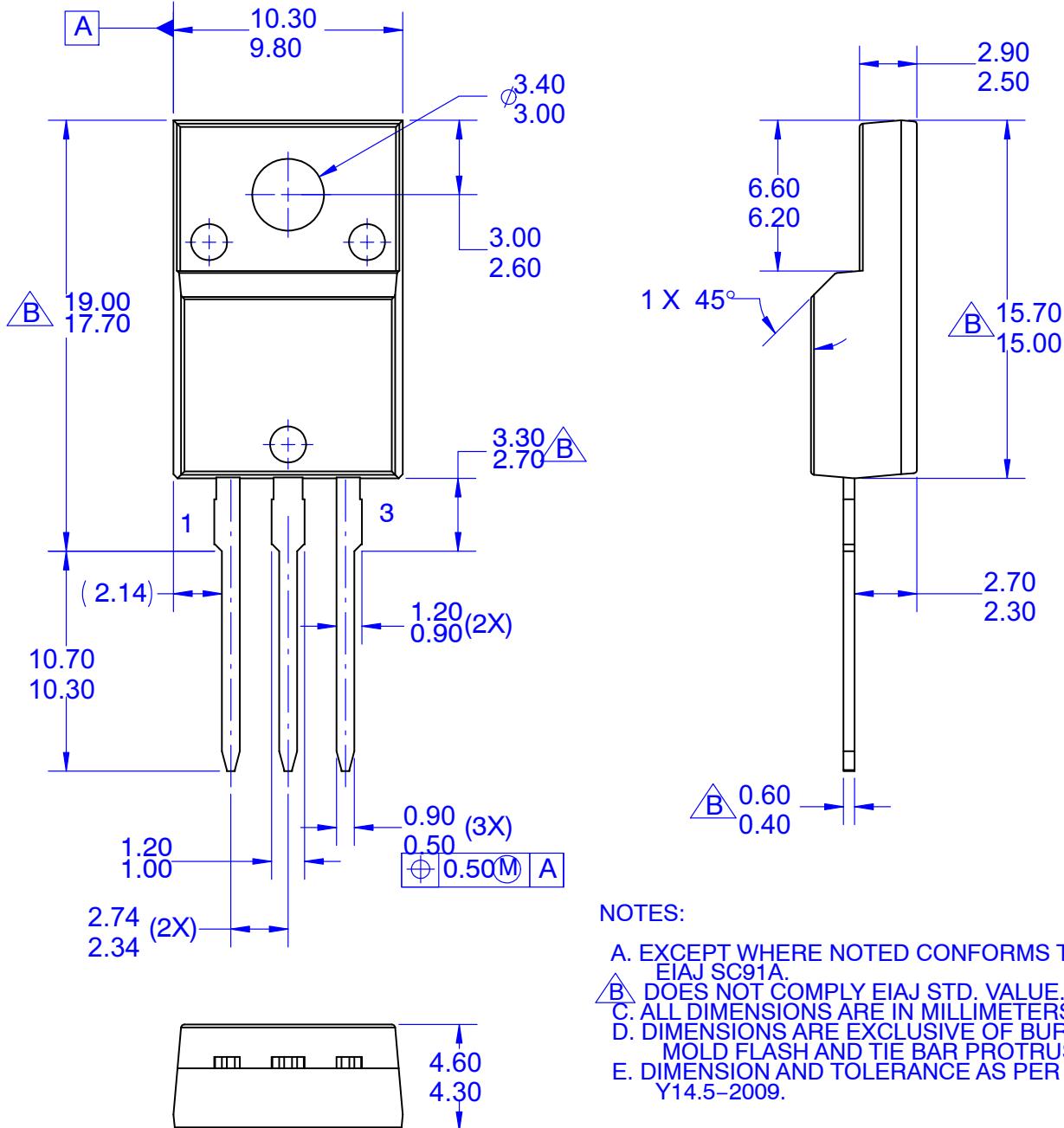


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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TO-220 FULLPAK 3LD
CASE 340BF
ISSUE O

DATE 31 AUG 2016



NOTES:

A. EXCEPT WHERE NOTED CONFORMS TO
EIAJ SC91A.

 B. DOES NOT COMPLY EIAJ STD. VALUE.

C. ALL DIMENSIONS ARE IN MILLIMETERS.

D. DIMENSIONS ARE EXCLUSIVE OF BURRS,
MOLD FLASH AND TIE BAR PROTRUSIONS.

E. DIMENSION AND TOLERANCE AS PER ASME
Y14.5-2009

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