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December 2013

FDPF390N15A N-Channel PowerTrench® MOSFET

150 V, 15 A, 40 mΩ

Features

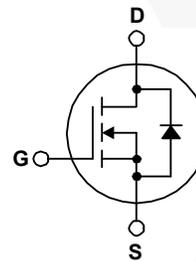
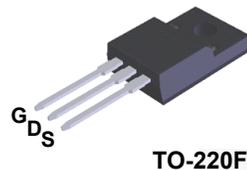
- $R_{DS(on)} = 31\text{ m}\Omega$ (Typ.) @ $V_{GS} = 10\text{ V}$, $I_D = 15\text{ A}$
- Fast Switching Speed
- Low Gate Charge, $Q_G = 14.3\text{ nC}$ (Typ.)
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

Applications

- Consumer Appliances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Motor Solar Inverter



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

| Symbol | Parameter | FDPF390N15A | Unit |
|----------------|---|---|------------------|
| V_{DSS} | Drain to Source Voltage | 150 | V |
| V_{GSS} | Gate to Source Voltage | ± 20 | V |
| I_D | Drain Current | - Continuous ($T_C = 25^\circ\text{C}$, Silicon Limited) | 15 |
| | | - Continuous ($T_C = 100^\circ\text{C}$, Silicon Limited) | 10 |
| I_{DM} | Drain Current | - Pulsed (Note 1) | 60 |
| E_{AS} | Single Pulsed Avalanche Energy | (Note 2) | 78 |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 6.0 |
| P_D | Power Dissipation | ($T_C = 25^\circ\text{C}$) | 22 |
| | | - Derate above 25°C | 0.18 |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +175 | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds. | 300 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | FDPF390N15A | Unit |
|-----------------|---|-------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 5.7 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | 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 |
|-------------|-------------|---------|----------------|-----------|------------|----------|
| FDPF390N15A | FDPF390N15A | TO-220F | Tube | N/A | N/A | 50 units |

Electrical Characteristics T_C = 25°C unless otherwise noted.

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

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|-----|-----|------|------|
| BV _{DSS} | Drain to Source Breakdown Voltage | I _D = 250 μA, V _{GS} = 0 V | 150 | - | - | V |
| ΔBV _{DSS} / ΔT _J | Breakdown Voltage Temperature Coefficient | I _D = 250 μA, Referenced to 25°C | - | 0.1 | - | V/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 120 V, V _{GS} = 0 V | - | - | 1 | μA |
| | | V _{DS} = 120 V, T _C = 125°C | - | - | 500 | |
| I _{GSS} | Gate to Body Leakage Current | V _{GS} = ±20 V, V _{DS} = 0 V | - | - | ±100 | nA |

On Characteristics

| | | | | | | |
|---------------------|--------------------------------------|---|-----|----|-----|----|
| V _{GS(th)} | Gate Threshold Voltage | V _{GS} = V _{DS} , I _D = 250 μA | 2.0 | - | 4.0 | V |
| R _{DS(on)} | Static Drain to Source On Resistance | V _{GS} = 10 V, I _D = 15 A | - | 31 | 40 | mΩ |
| g _{FS} | Forward Transconductance | V _{DS} = 10 V, I _D = 15 A | - | 32 | - | S |

Dynamic Characteristics

| | | | | | | |
|----------------------|------------------------------------|---|----------|------|------|----|
| C _{iss} | Input Capacitance | V _{DS} = 75 V, V _{GS} = 0 V f = 1 MHz | - | 965 | 1285 | pF |
| C _{oss} | Output Capacitance | | - | 96 | 130 | pF |
| C _{rss} | Reverse Transfer Capacitance | | - | 5.8 | - | pF |
| C _{oss(er)} | Energy Related Output Capacitance | V _{DS} = 75 V, V _{GS} = 0 V | - | 169 | - | pF |
| Q _{g(tot)} | Total Gate Charge at 10V | V _{DS} = 75 V, I _D = 27 A V _{GS} = 10 V | - | 14.3 | 18.6 | nC |
| Q _{gs} | Gate to Source Gate Charge | | - | 5.0 | - | nC |
| Q _{gs2} | Gate Charge Threshold to Plateau | | - | 2.0 | - | nC |
| Q _{gd} | Gate to Drain "Miller" Charge | | (Note 4) | - | 3.5 | - |
| ESR | Equivalent Series Resistance (G-S) | f = 1 MHz | - | 1.4 | - | Ω |

Switching Characteristics

| | | | | | | |
|---------------------|---------------------|---|----------|----|----|----|
| t _{d(on)} | Turn-On Delay Time | V _{DD} = 75 V, I _D = 27 A V _{GS} = 10 V, R _G = 4.7 Ω | - | 14 | 38 | ns |
| t _r | Turn-On Rise Time | | - | 10 | 30 | ns |
| t _{d(off)} | Turn-Off Delay Time | | - | 20 | 50 | ns |
| t _f | Turn-Off Fall Time | | (Note 4) | - | 5 | 20 |

Drain-Source Diode Characteristics

| | | | | | | |
|-----------------|--|---|---|-----|------|----|
| I _S | Maximum Continuous Drain to Source Diode Forward Current | - | - | 15 | A | |
| I _{SM} | Maximum Pulsed Drain to Source Diode Forward Current | - | - | 64 | A | |
| V _{SD} | Drain to Source Diode Forward Voltage | V _{GS} = 0 V, I _{SD} = 15 A | - | - | 1.25 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0 V, I _{SD} = 27 A | - | 63 | - | ns |
| Q _{rr} | Reverse Recovery Charge | di/dt = 100 A/μs | - | 131 | - | nC |

Notes:

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2. Starting T_J = 25°C, L = 3 mH, I_{SD} = 7.2 A
3. I_{SD} ≤ 15 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

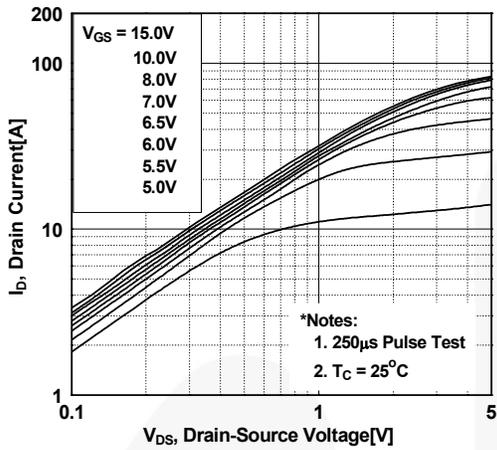


Figure 2. Transfer Characteristics

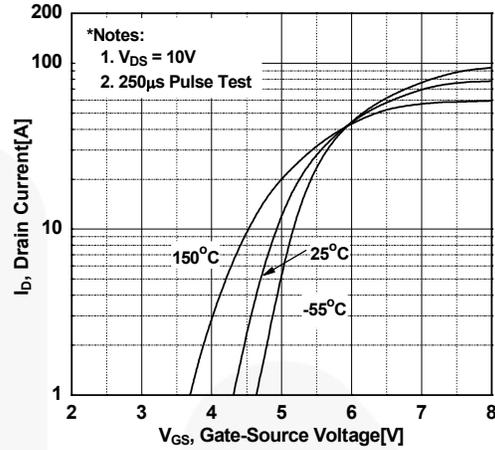


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

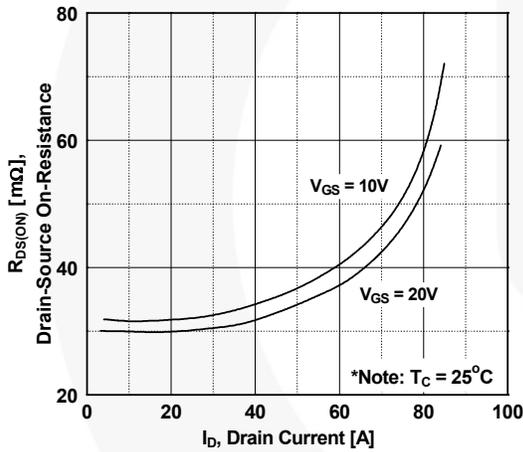


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

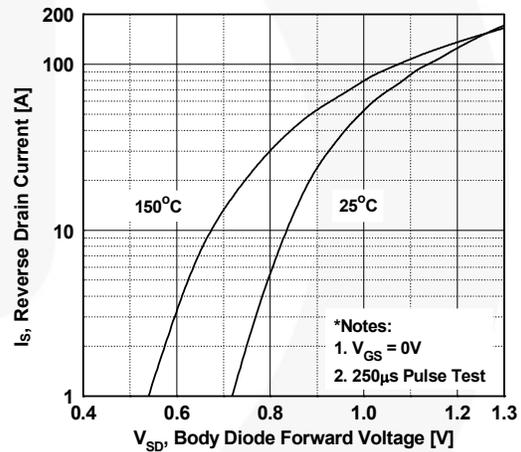


Figure 5. Capacitance Characteristics

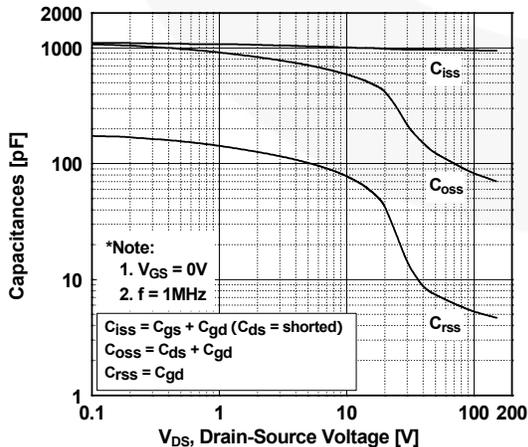
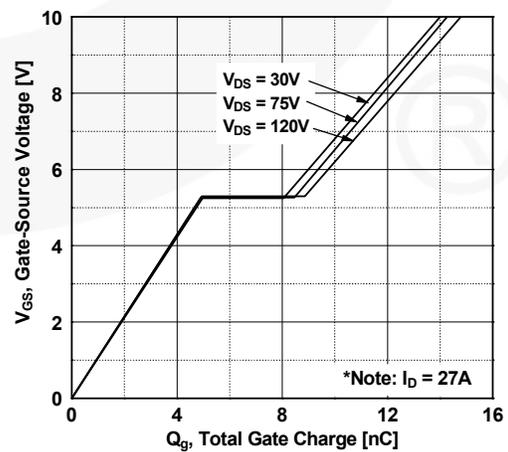


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

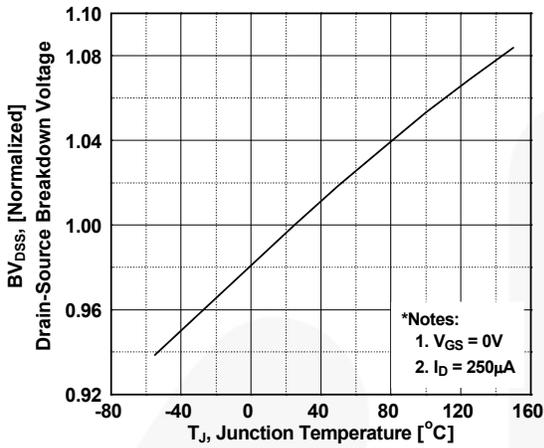


Figure 8. On-Resistance Variation vs. Temperature

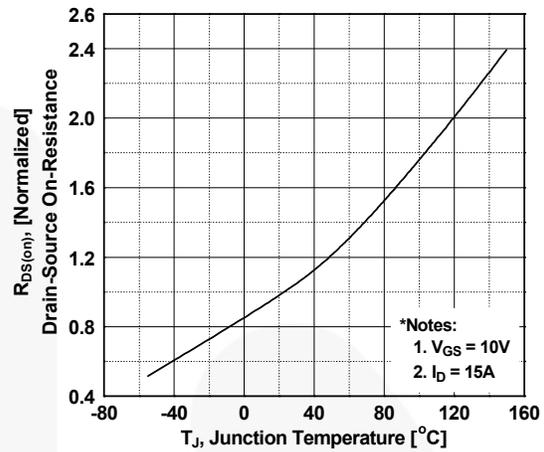


Figure 9. Maximum Safe Operating Area

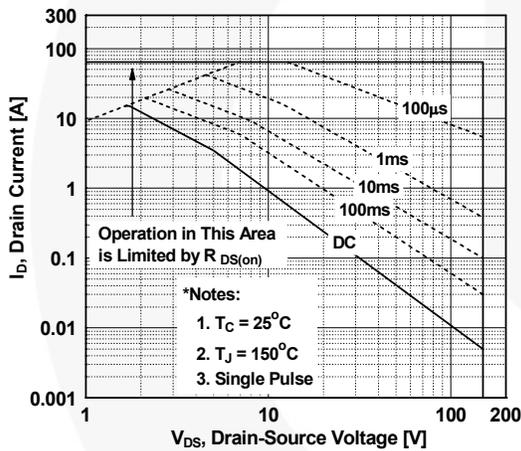


Figure 10. Maximum Drain Current vs. Case Temperature

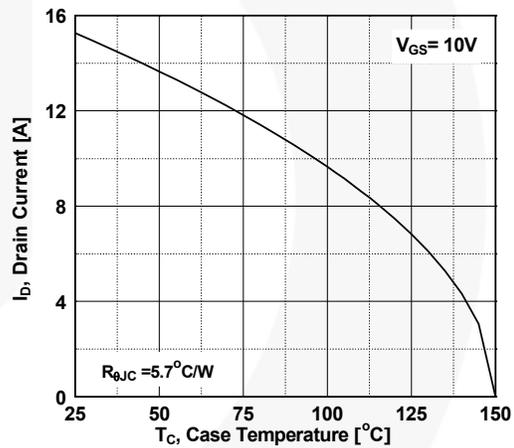


Figure 11. E_oss vs. Drain to Source Voltage

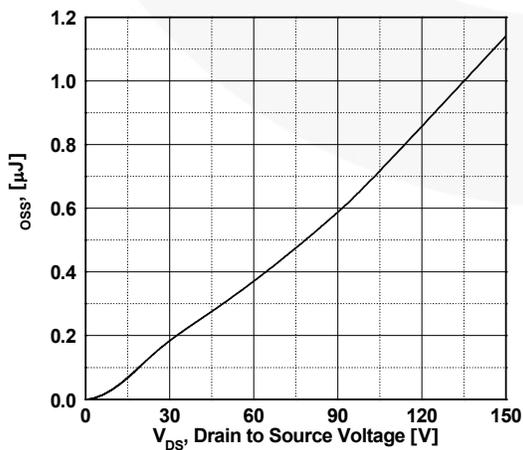
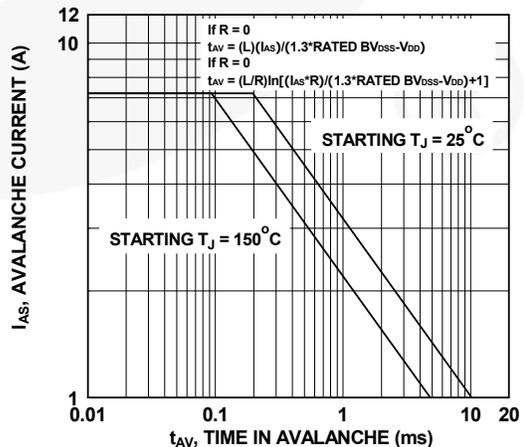
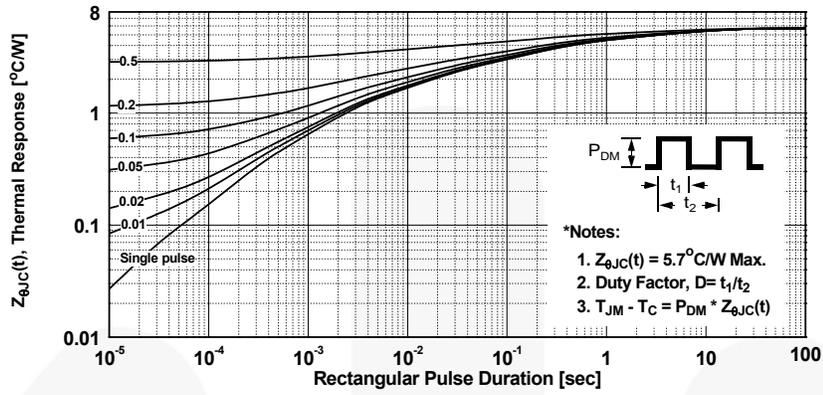


Figure 12. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve



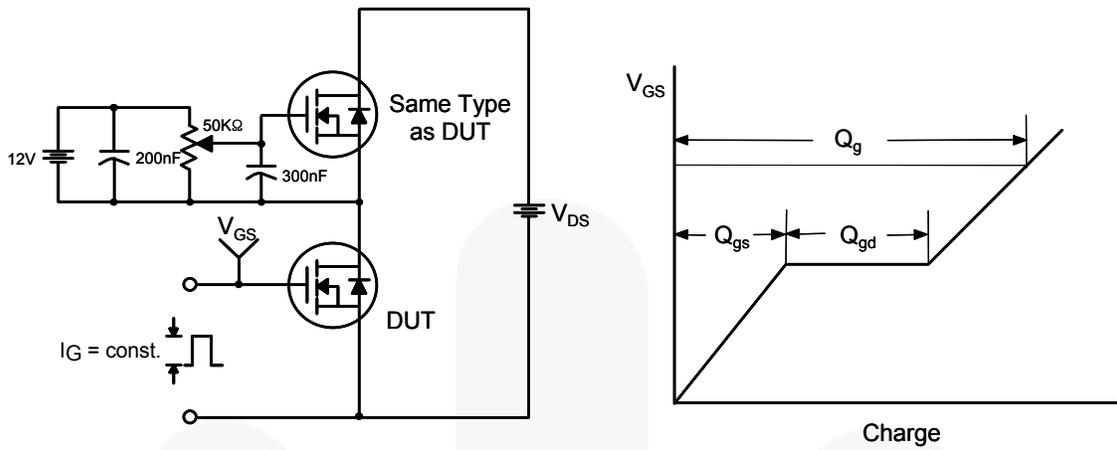


Figure 14. Gate Charge Test Circuit & Waveform

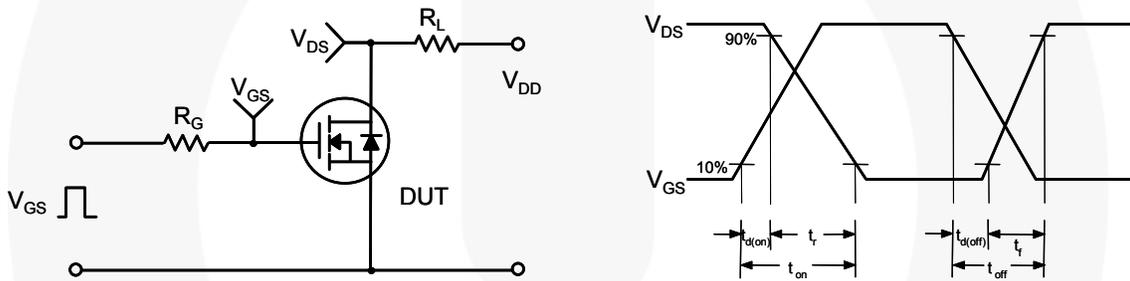


Figure 15. Resistive Switching Test Circuit & Waveforms

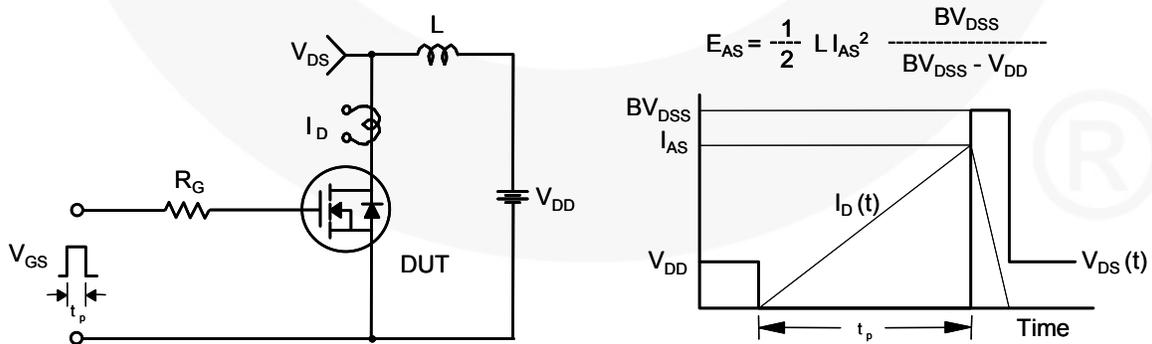


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

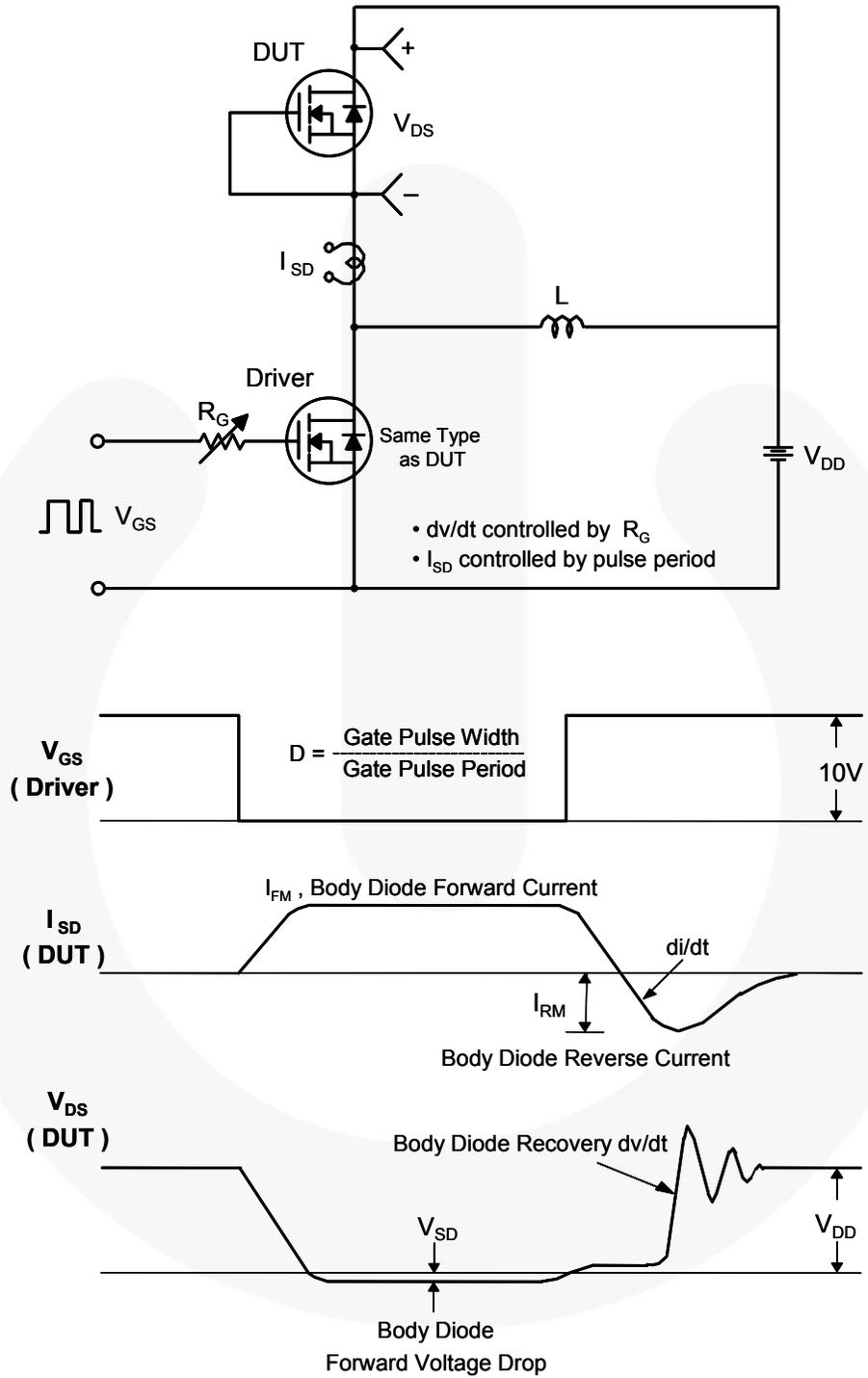
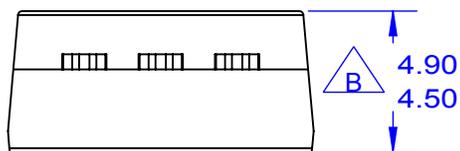
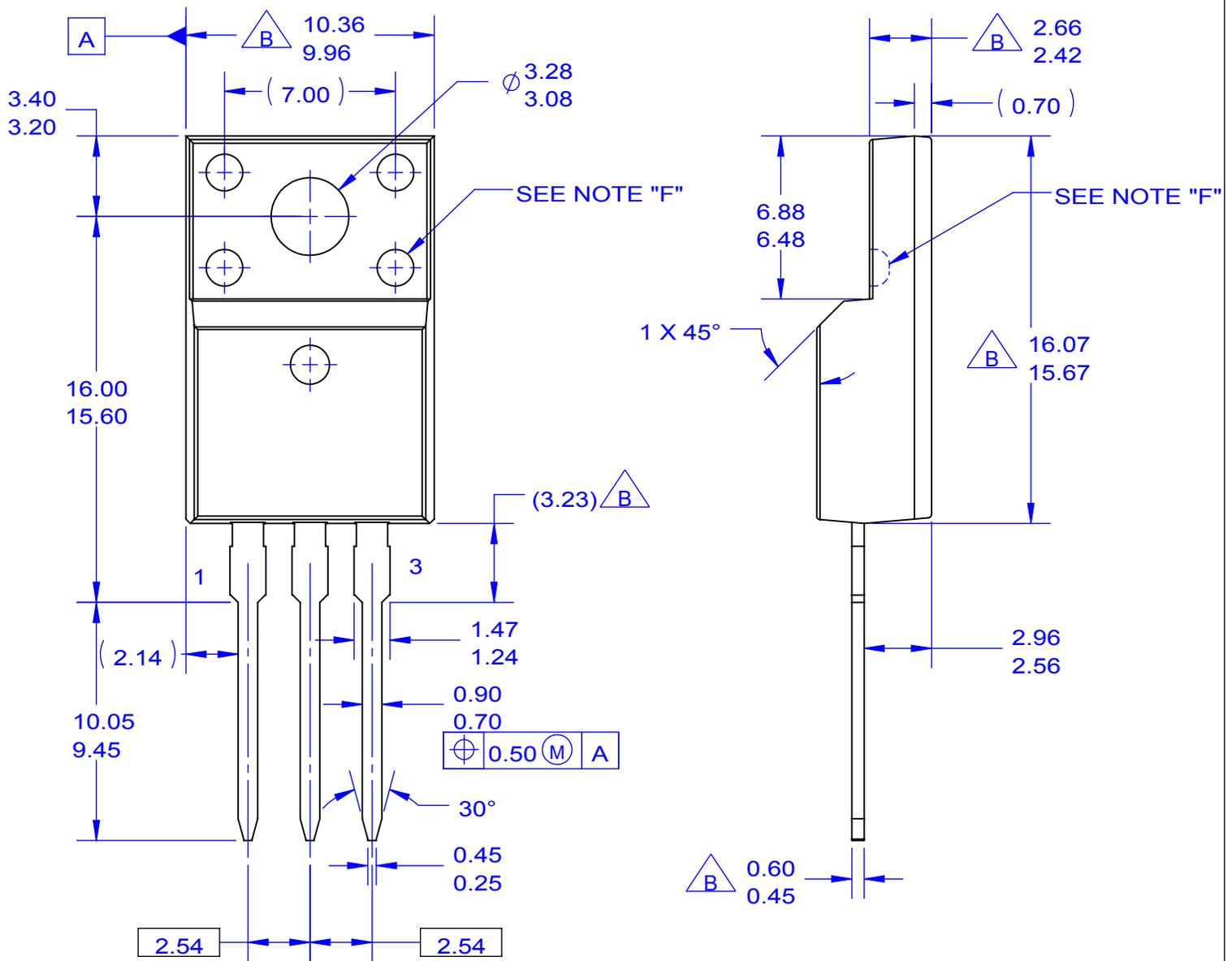


Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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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 Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV5

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