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# FQPF11N50CF

## N-Channel QFET® FRFET® MOSFET

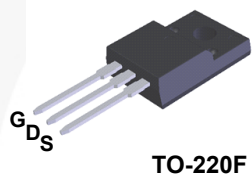
500 V, 11 A, 550 mΩ

### Description

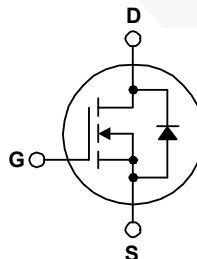
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

### Features

- 11 A, 500 V,  $R_{DS(on)} = 550 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 5.5 \text{ A}$
- Low Gate Charge (Typ. 43 nC)
- Low  $C_{rss}$  (Typ. 20 pF)
- 100% Avalanche Tested
- Fast Recovery Body Diode



TO-220F



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

| Symbol         | Parameter  | FQPF11N50CF | Unit                |
|----------------|--|-------------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage   | 500         | V                   |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )                      | 11*         | A                   |
|                | - Continuous ( $T_C = 100^\circ\text{C}$ )                                   | 7*          | A                   |
| $I_{DM}$       | Drain Current - Pulsed (Note 1)  | 44*         | A                   |
| $V_{GSS}$      | Gate-Source voltage  | $\pm 30$    | V                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                      | 670         | mJ                  |
| $I_{AR}$       | Avalanche Current (Note 1)   | 11          | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)   | 19.5        | mJ                  |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)   | 4.5         | V/ns                |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )                               | 48          | W                   |
|                | - Derate above $25^\circ\text{C}$  | 0.39        | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                      | -55 to +150 | $^\circ\text{C}$    |
| $T_L$          | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300         | $^\circ\text{C}$    |

\*Drain current limited by maximum junction temperature

### Thermal Characteristics

| Symbol          | Parameter                                     | FQPF11N50CF | Unit                      |
|-----------------|---|-------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 2.58        | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5        |                           |

## Package Marking and Ordering Information

| Device Marking | Device      | Package | Reel Size | Tape Width | Quantity |
|----------------|-------------|---------|-----------|------------|----------|
| FQPF11N50CF    | FQPF11N50CF | TO-220F | Tube      | N/A        | 50 units |

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

| Symbol  | Parameter   | Conditions   | Min      | Typ  | Max  | Unit |
|---|---|--|----------|------|------|------|
| <b>Off Characteristics</b>                                    |   |  |          |      |      |      |
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                        | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                 | 500      | --   | --   | V    |
| ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>                          | Breakdown Voltage Temperature Coefficient             | I <sub>D</sub> = 250 μA, Referenced to 25°C                                    | --       | 0.5  | --   | V/°C |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current                       | V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V                                 | --       | --   | 10   | μA   |
|   |   | V <sub>DS</sub> = 400 V, T <sub>C</sub> = 125°C                                | --       | --   | 100  | μA   |
| I <sub>GSSF</sub>   | Gate-Body Leakage Current, Forward                    | V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V                                  | --       | --   | 100  | nA   |
| I <sub>GSSR</sub>   | Gate-Body Leakage Current, Reverse                    | V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V                                 | --       | --   | -100 | nA   |
| <b>On Characteristics</b>                                     |   |  |          |      |      |      |
| V <sub>GS(th)</sub>   | Gate Threshold Voltage                                | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                    | 2.0      | --   | 4.0  | V    |
| R <sub>DS(on)</sub>   | Static Drain-Source On-Resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5.5 A                                 | --       | 0.48 | 0.55 | Ω    |
| g <sub>FS</sub>   | Forward Transconductance                              | V <sub>DS</sub> = 40 V, I <sub>D</sub> = 5.5 A                                 | --       | 15   | --   | S    |
| <b>Dynamic Characteristics</b>                                |   |  |          |      |      |      |
| C <sub>iSS</sub>  | Input Capacitance                                     | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz                     | --       | 1515 | 2055 | pF   |
| C <sub>oss</sub>  | Output Capacitance                                    |  | --       | 185  | 235  | pF   |
| C <sub>rSS</sub>  | Reverse Transfer Capacitance                          |  | --       | 25   | 30   | pF   |
| <b>Switching Characteristics</b>                              |   |  |          |      |      |      |
| t <sub>d(on)</sub>  | Turn-On Delay Time                                    | V <sub>DD</sub> = 250 V, I <sub>D</sub> = 11 A<br>R <sub>G</sub> = 25 Ω        | --       | 24   | 57   | ns   |
| t <sub>r</sub>  | Turn-On Rise Time                                     |  | --       | 70   | 150  | ns   |
| t <sub>d(off)</sub>   | Turn-Off Delay Time                                   |  | --       | 120  | 250  | ns   |
| t <sub>f</sub>  | Turn-Off Fall Time                                    |  | (Note 4) | --   | 75   | 160  |
| Q <sub>g</sub>  | Total Gate Charge                                     | V <sub>DS</sub> = 400 V, I <sub>D</sub> = 11 A<br>V <sub>GS</sub> = 10 V       | --       | 43   | 55   | nC   |
| Q <sub>gs</sub>   | Gate-Source Charge                                    |  | --       | 8    | --   | nC   |
| Q <sub>gd</sub>   | Gate-Drain Charge                                     |  | (Note 4) | --   | 19   | --   |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |  |          |      |      |      |
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |  | --       | --   | 11   | A    |
| I <sub>SM</sub>   | Maximum Pulsed Drain-Source Diode Forward Current     |  | --       | --   | 44   | A    |
| V <sub>SD</sub>   | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 11 A                                   | --       | --   | 1.4  | V    |
| t <sub>rr</sub>   | Reverse Recovery Time                                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 11 A<br>di <sub>F</sub> /dt = 100 A/μs | --       | 90   | --   | ns   |
| Q <sub>rr</sub>   | Reverse Recovery Charge                               |  | --       | 1.5  | --   | μC   |

### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 10 mH, I<sub>AS</sub> = 11 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 11 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C
4. Essentially independent of operating temperature.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

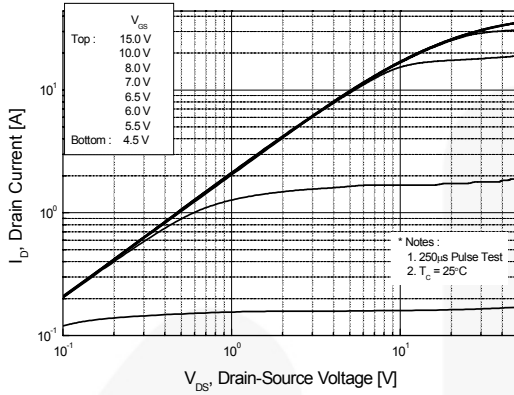


Figure 2. Transfer Characteristics

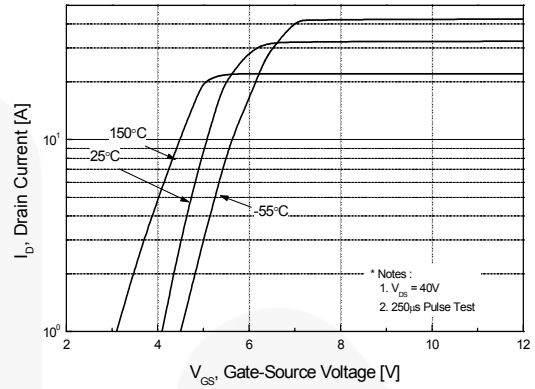


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

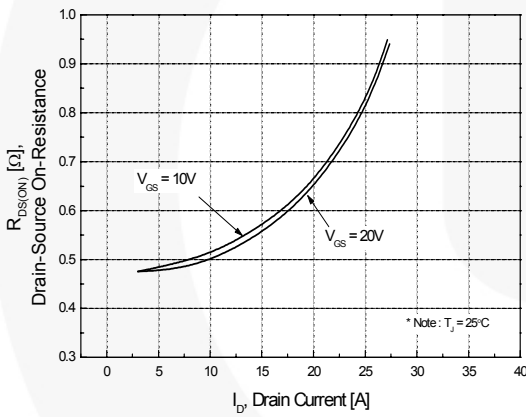


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

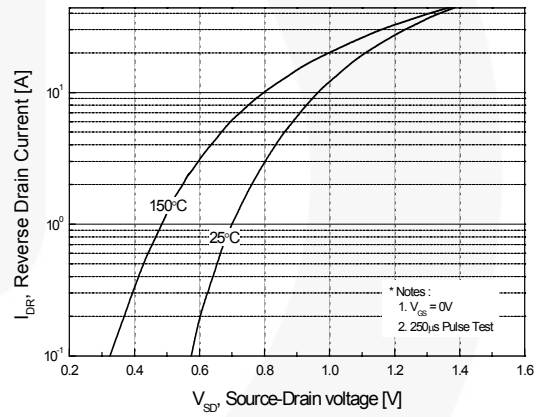


Figure 5. Capacitance Characteristics

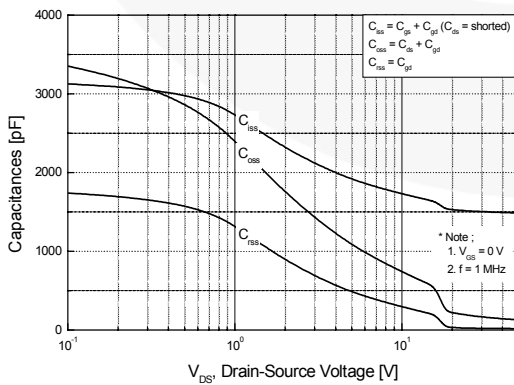
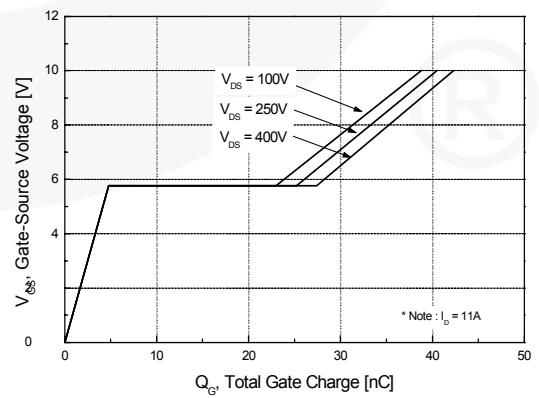
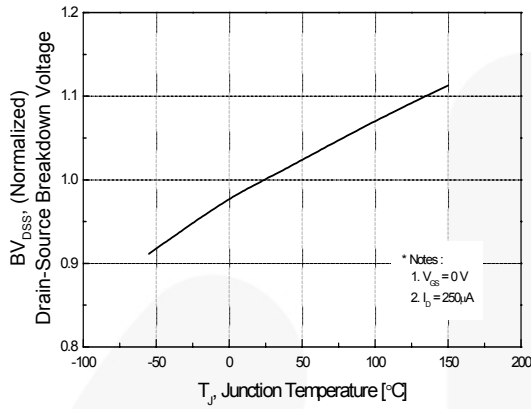


Figure 6. Gate Charge Characteristics

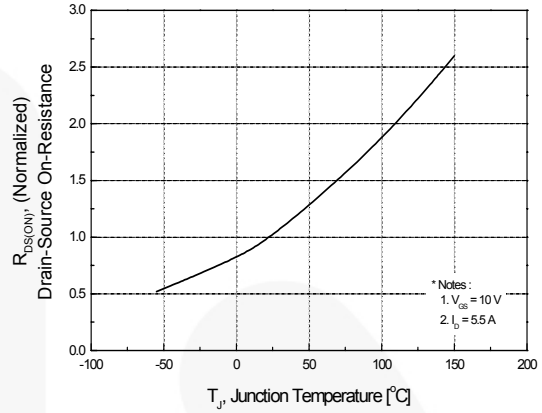


**Typical Performance Characteristics (Continued)**

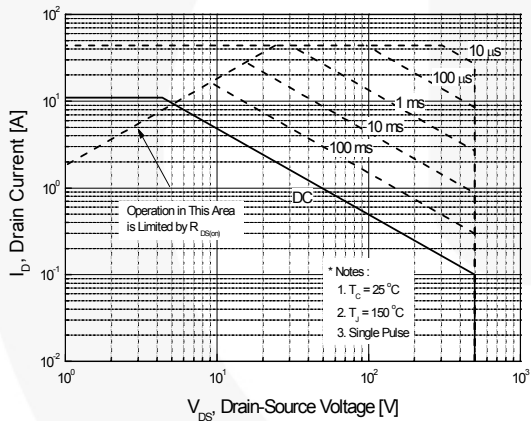
**Figure 7. Breakdown Voltage Variation vs. Temperature**



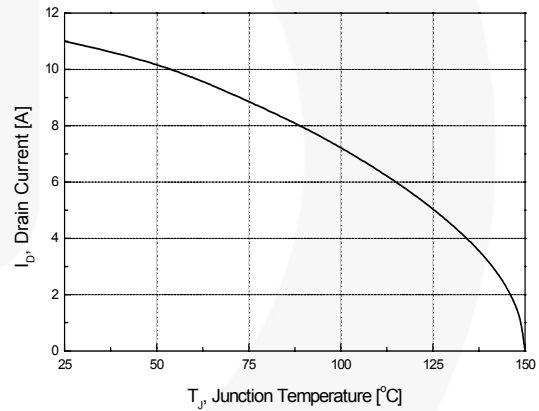
**Figure 8. On-Resistance Variation vs. Temperature**



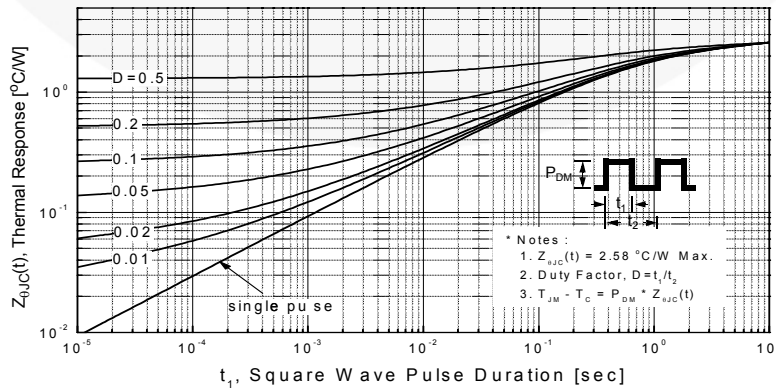
**Figure 9. Maximum Safe Operating Area**



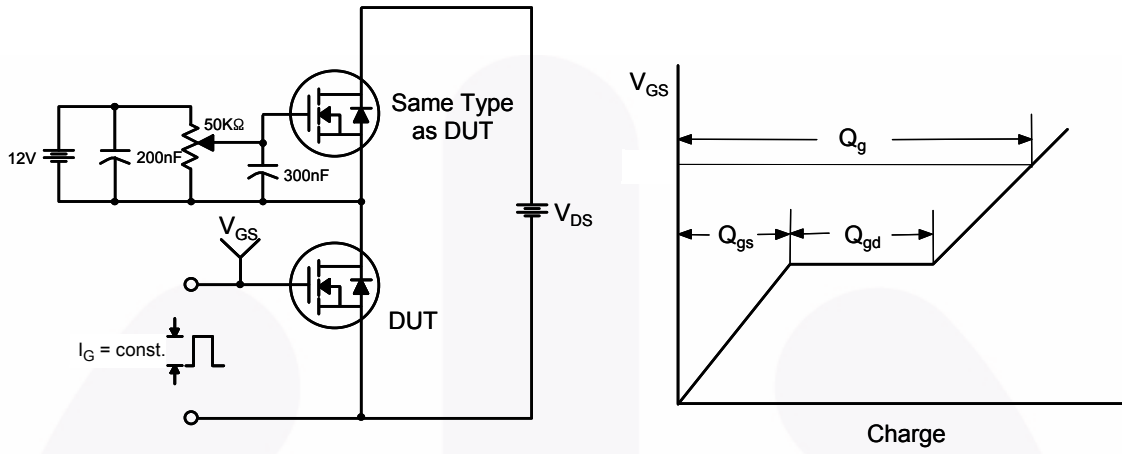
**Figure 10. Maximum Drain Current vs. Case Temperature**



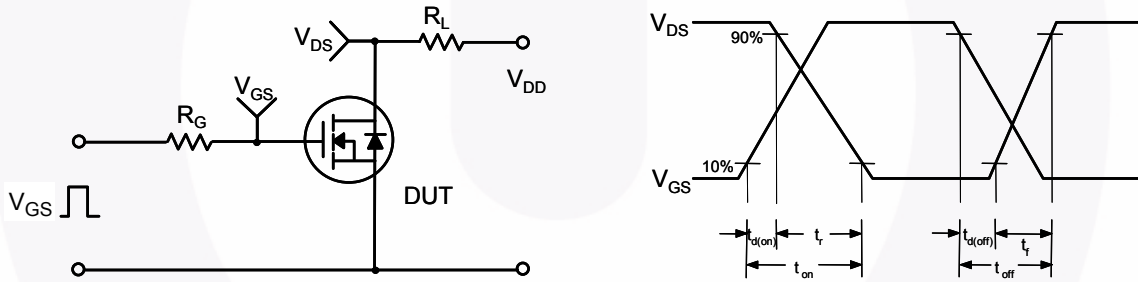
**Figure 11. Transient Thermal Response Curve**



**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

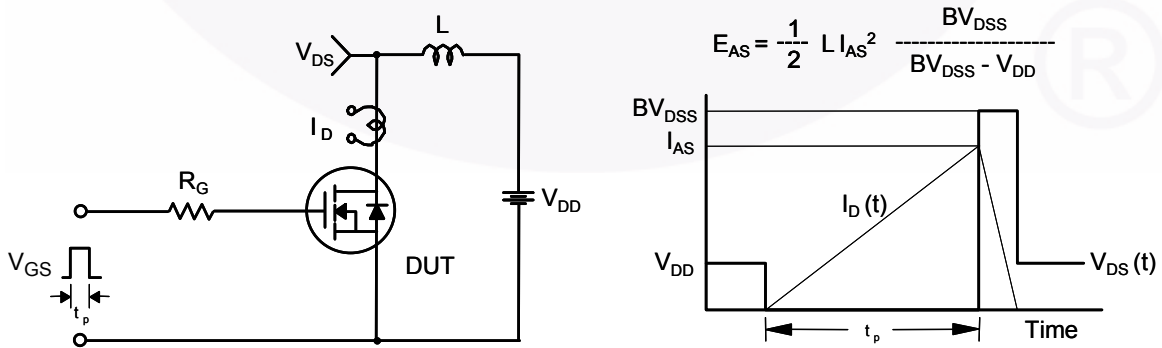
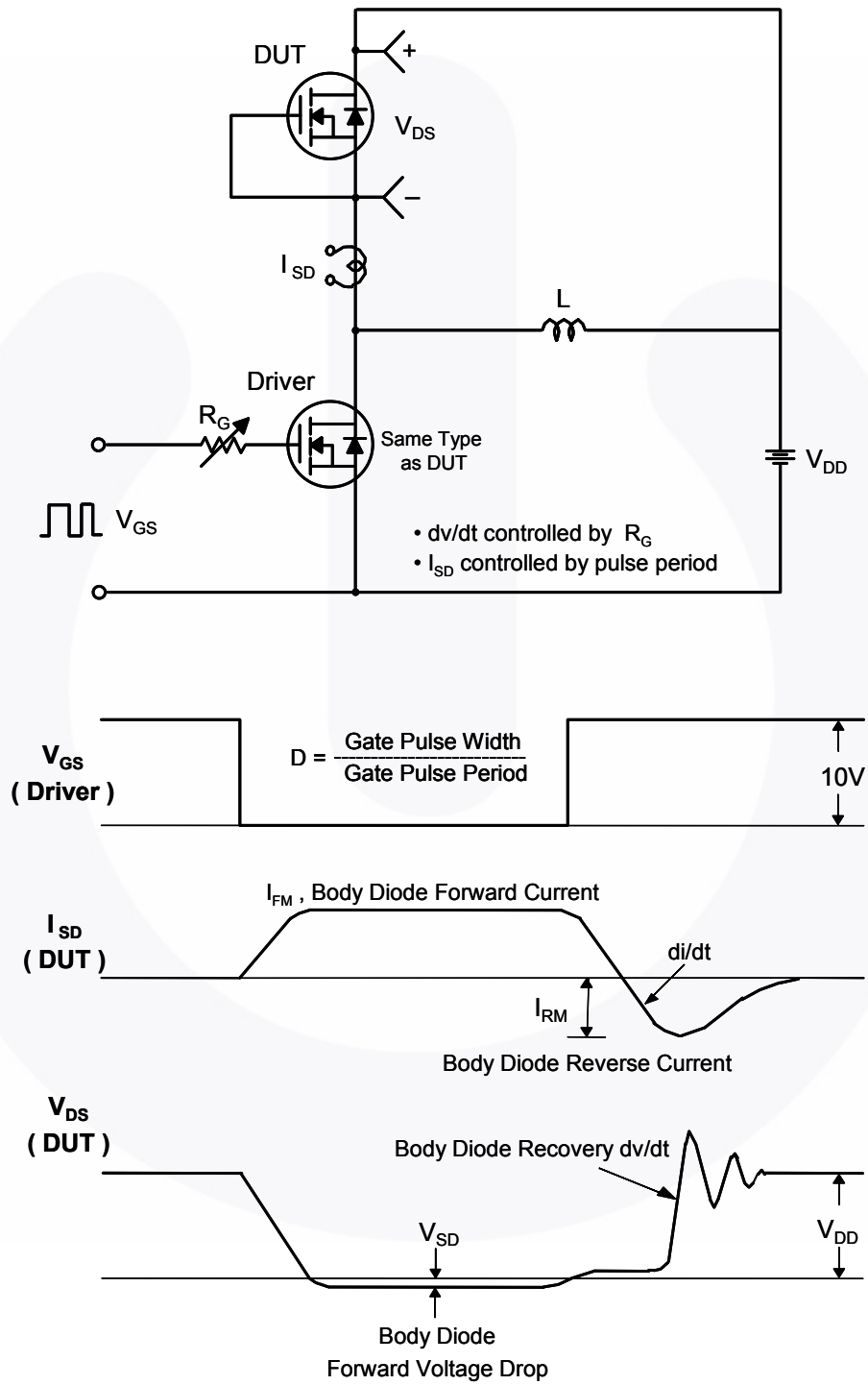
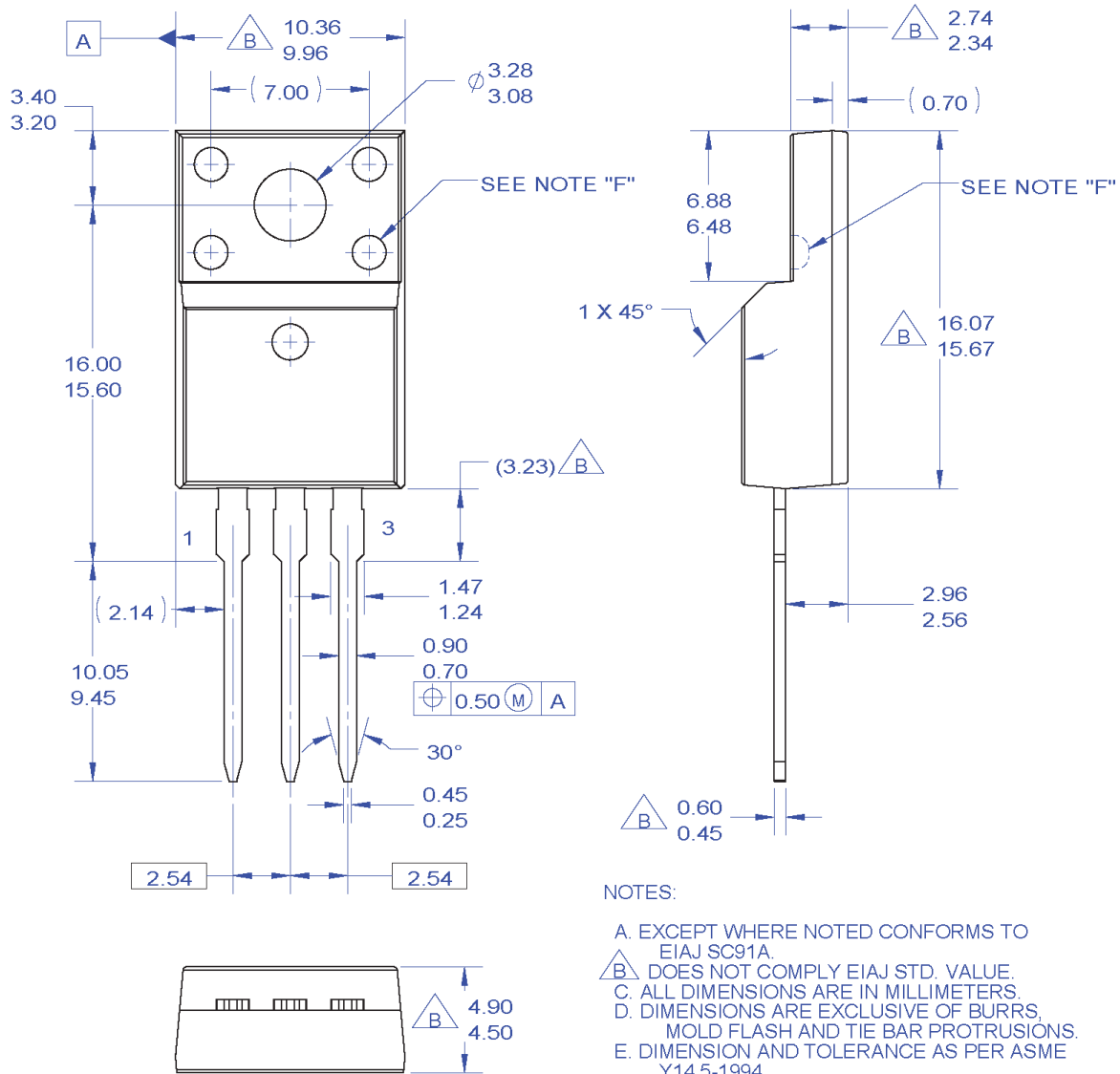


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



## Mechanical Dimensions



### NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- $\triangle B$ . 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: TO220M03REV3

**Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead**

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