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# FDP55N06 / FDPF55N06

## N-Channel UniFET™ MOSFET

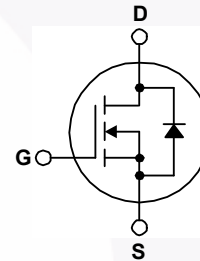
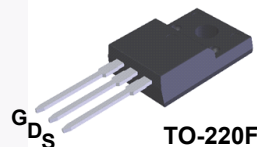
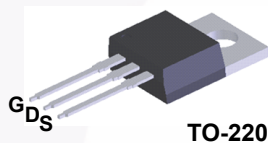
### 60 V, 55 A, 22 mΩ

#### Features

- $R_{DS(on)} = 22 \text{ m}\Omega @ V_{GS} = 10 \text{ V}, I_D = 27.5 \text{ A}$
- Low Gate Charge (Typ. 30 nC)
- Low Crss (Typ. 60 pF)
- 100% Avalanche Tested

#### Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



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

| Symbol         | Parameter   | FDP55N06    | FDPF55N06 | Unit                |
|----------------|---|-------------|-----------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage  | 60          |           | V                   |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )                       | 55          | 55 *      | A                   |
|                | - Continuous ( $T_C = 100^\circ\text{C}$ )                                    | 34.8        | 34.8 *    | A                   |
| $I_{DM}$       | Drain Current - Pulsed (Note 1)   | 220         | 220 *     | A                   |
| $V_{GSS}$      | Gate-Source Voltage   | $\pm 25$    |           | V                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                       | 480         |           | mJ                  |
| $I_{AR}$       | Avalanche Current (Note 1)  | 55          |           | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)  | 11.4        |           | mJ                  |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)  | 4.5         |           | V/ns                |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )                                | 114         | 48        | W                   |
|                | - Derate above $25^\circ\text{C}$   | 0.9         | 0.4       | 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 purposes, 1/8" from case for 5 seconds | 300         |           | $^\circ\text{C}$    |

\* Drain current limited by maximum junction temperature

#### Thermal Characteristics

| Symbol          | Parameter                                     | FDP55N06 | FDPF55N06 | Unit                      |
|-----------------|---|----------|-----------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max.    | 1.1      | 2.58      | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JS}$ | Thermal Resistance, Case-to-Sink, Typ.        | 0.5      | --        | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Max. | 62.5     | 62.5      | $^\circ\text{C}/\text{W}$ |

## Package Marking and Ordering Information

| Device Marking | Device    | Package | Reel Size | Tape Width | Quantity |
|----------------|-----------|---------|-----------|------------|----------|
| FDP55N06       | FDP55N06  | TO-220  | Tube      | N/A        | 50 units |
| FDPF55N06      | FDPF55N06 | TO-220F | Tube      | N/A        | 50 units |

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

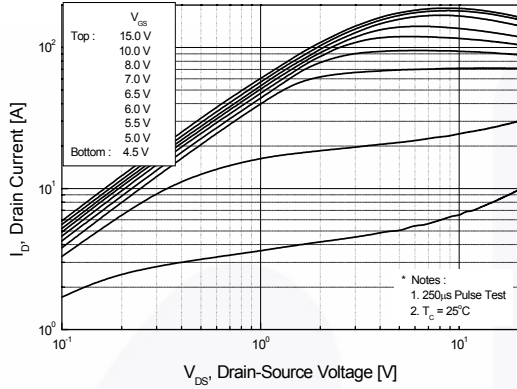
| Symbol  | Parameter   | Test Conditions  | Min      | Typ   | Max   | Units |    |
|---|---|--|----------|-------|-------|-------|----|
| <b>Off Characteristics</b>                                    |   |  |          |       |       |       |    |
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                        | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                   | 60       | --    | --    | V     |    |
| ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>                          | Breakdown Voltage Temperature Coefficient             | I <sub>D</sub> = 250 μA, Referenced to 25°C                                      | --       | 0.05  | --    | V/°C  |    |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current                       | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V                                    | --       | --    | 1     | μA    |    |
|   |   | V <sub>DS</sub> = 48 V, T <sub>C</sub> = 150°C                                   | --       | --    | 10    | μA    |    |
| I <sub>GSSF</sub>   | Gate-Body Leakage Current, Forward                    | V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V                                    | --       | --    | 100   | nA    |    |
| I <sub>GSSR</sub>   | Gate-Body Leakage Current, Reverse                    | V <sub>GS</sub> = -20 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> = 27.5 A                                  | --       | 0.018 | 0.022 | Ω     |    |
| g <sub>FS</sub>   | Forward Transconductance                              | V <sub>DS</sub> = 25 V, I <sub>D</sub> = 27.5 A                                  | --       | 33    | --    | S     |    |
| <b>Dynamic Characteristics</b>                                |   |  |          |       |       |       |    |
| C <sub>iss</sub>  | Input Capacitance                                     | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,<br>f = 1.0 MHz                    | --       | 1160  | 1510  | pF    |    |
| C <sub>oss</sub>  | Output Capacitance                                    |  | --       | 375   | 490   | pF    |    |
| C <sub>rss</sub>  | Reverse Transfer Capacitance                          |  | --       | 60    | 90    | pF    |    |
| <b>Switching Characteristics</b>                              |   |  |          |       |       |       |    |
| t <sub>d(on)</sub>  | Turn-On Delay Time                                    | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 55 A,<br>R <sub>G</sub> = 25 Ω          | --       | 30    | 65    | ns    |    |
| t <sub>r</sub>  | Turn-On Rise Time                                     |  | --       | 130   | 265   | ns    |    |
| t <sub>d(off)</sub>   | Turn-Off Delay Time                                   |  | (Note 4) | --    | 70    | 150   | ns |
| t <sub>f</sub>  | Turn-Off Fall Time                                    |  | (Note 4) | --    | 95    | 195   | ns |
| Q <sub>g</sub>  | Total Gate Charge                                     | V <sub>DS</sub> = 48 V, I <sub>D</sub> = 55A,<br>V <sub>GS</sub> = 10 V          | --       | 30    | 37    | nC    |    |
| Q <sub>gs</sub>   | Gate-Source Charge                                    |  | (Note 4) | --    | 6.5   | --    | nC |
| Q <sub>gd</sub>   | Gate-Drain Charge                                     |  | (Note 4) | --    | 7.5   | --    | nC |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |  |          |       |       |       |    |
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |  | --       | --    | 55    | A     |    |
| I <sub>SM</sub>   | Maximum Pulsed Drain-Source Diode Forward Current     |  | --       | --    | 220   | A     |    |
| V <sub>SD</sub>   | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 55 A                                     | --       | --    | 1.4   | V     |    |
| t <sub>rr</sub>   | Reverse Recovery Time                                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 55 A,<br>dI <sub>F</sub> / dt = 100 A/μs | --       | 40    | --    | ns    |    |
| Q <sub>rr</sub>   | Reverse Recovery Charge                               |  | --       | 55    | --    | μC    |    |

### Notes:

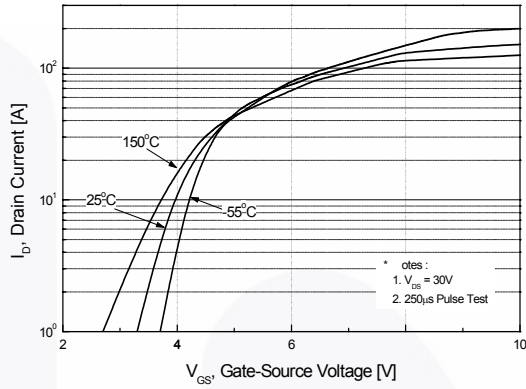
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 5.6mH, I<sub>AS</sub> = 55A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25 Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 55A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Essentially independent of operating temperature

## Typical Performance Characteristics

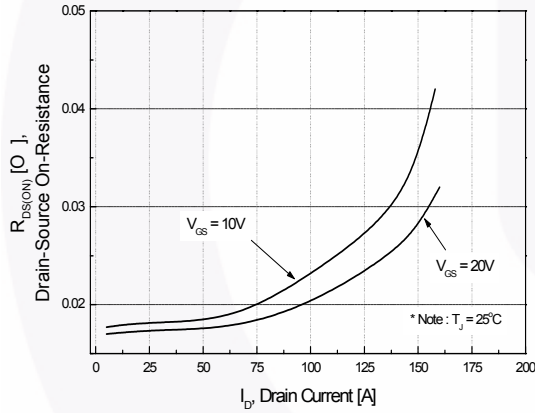
**Figure 1. On-Region Characteristics**



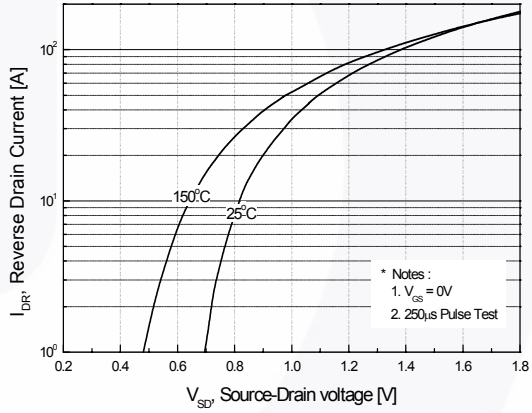
**Figure 2. Transfer Characteristics**



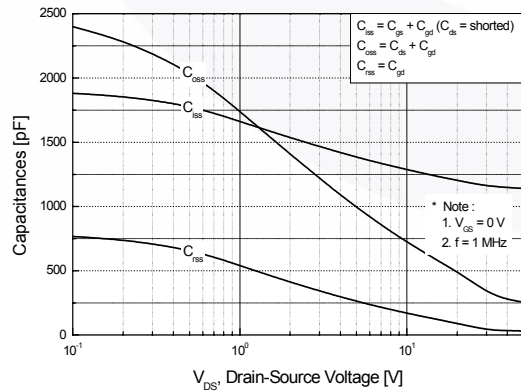
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



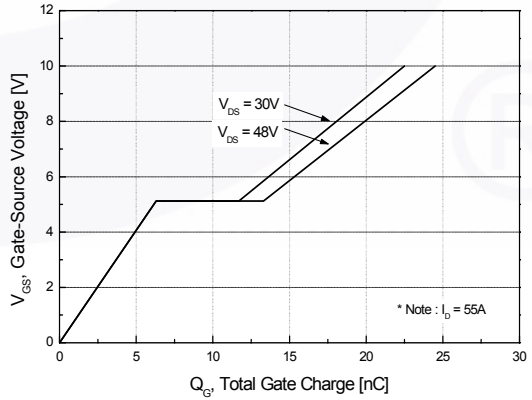
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

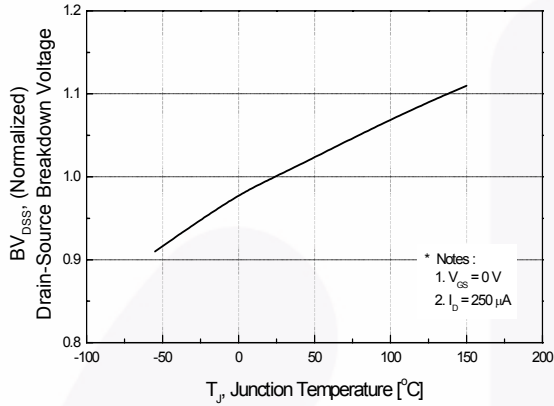


**Figure 6. Gate Charge Characteristics**

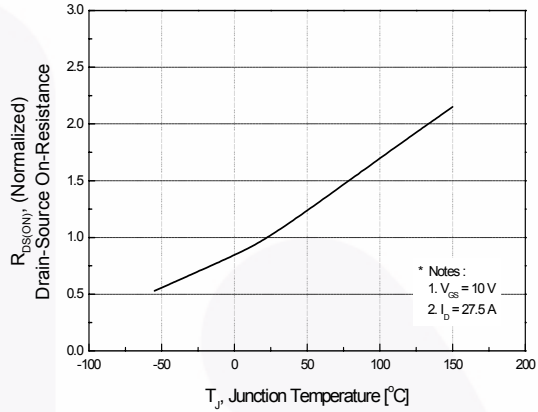


**Typical Performance Characteristics** (Continued)

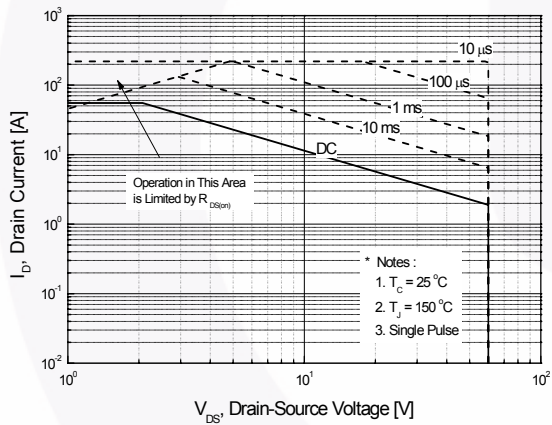
**Figure 7. Breakdown Voltage Variation vs. Temperature**



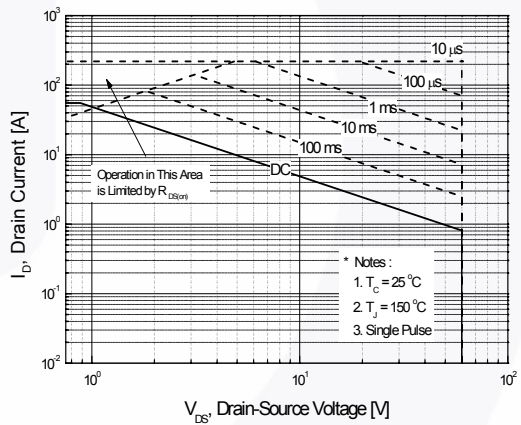
**Figure 8. On-Resistance Variation vs. Temperature**



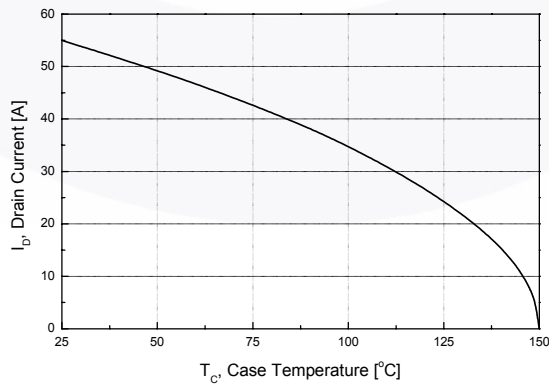
**Figure 9-1. Maximum Safe Operating Area for FDP55N06**



**Figure 9-2. Maximum Safe Operating Area for FDPF55N06**

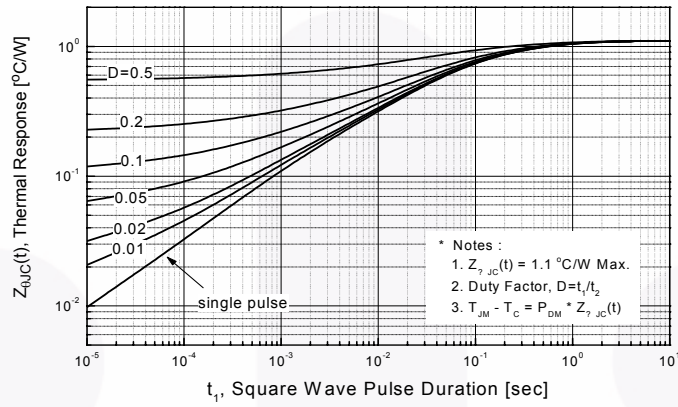


**Figure 10. Maximum Drain Current vs. Case Temperature**



**Typical Performance Characteristics** (Continued)

**Figure 11-1. Transient Thermal Response Curve for FDP55N06**



**Figure 11-2. Transient Thermal Response Curve for FDPF55N06**

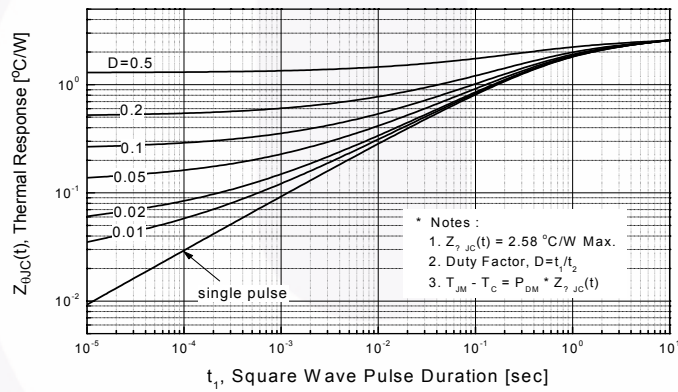


Figure 12. Gate Charge Test Circuit & Waveform

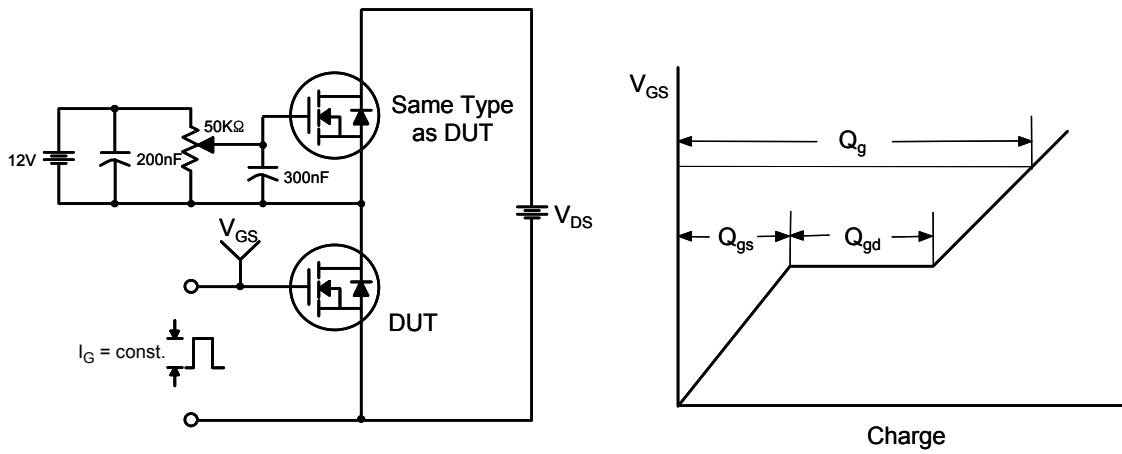


Figure 13. Resistive Switching Test Circuit & Waveforms

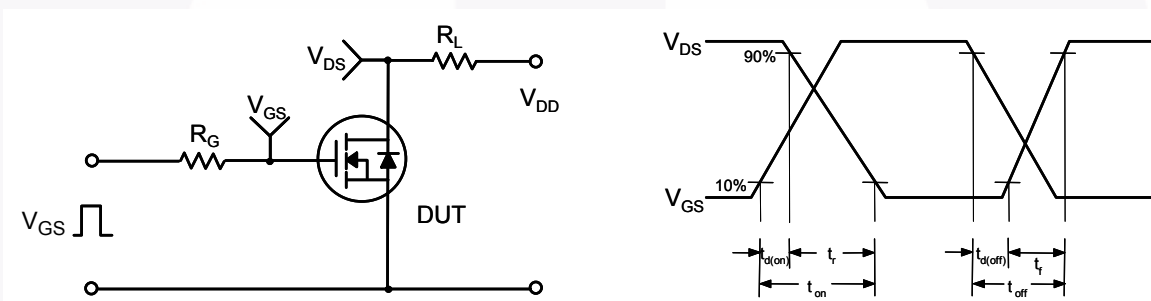
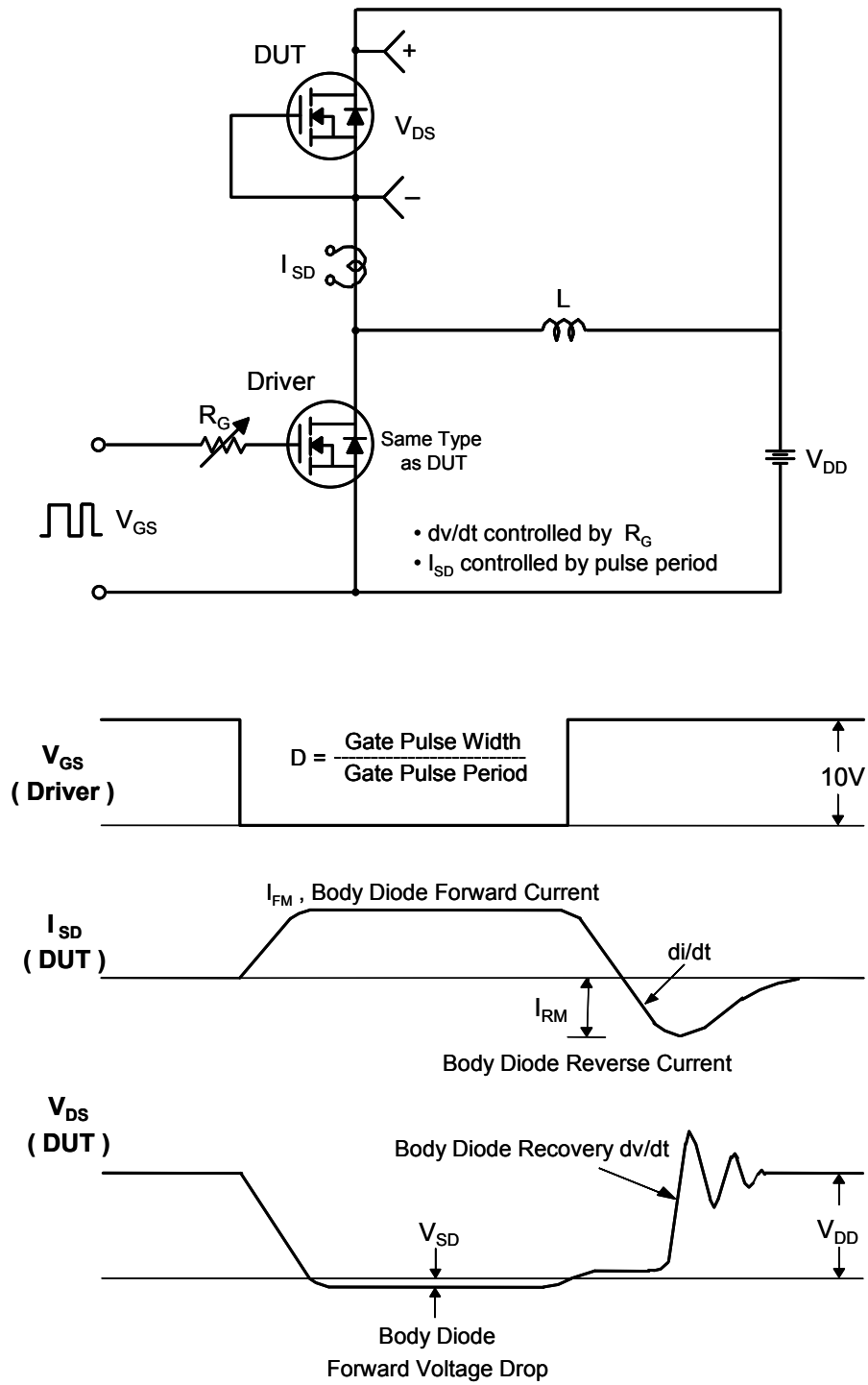


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



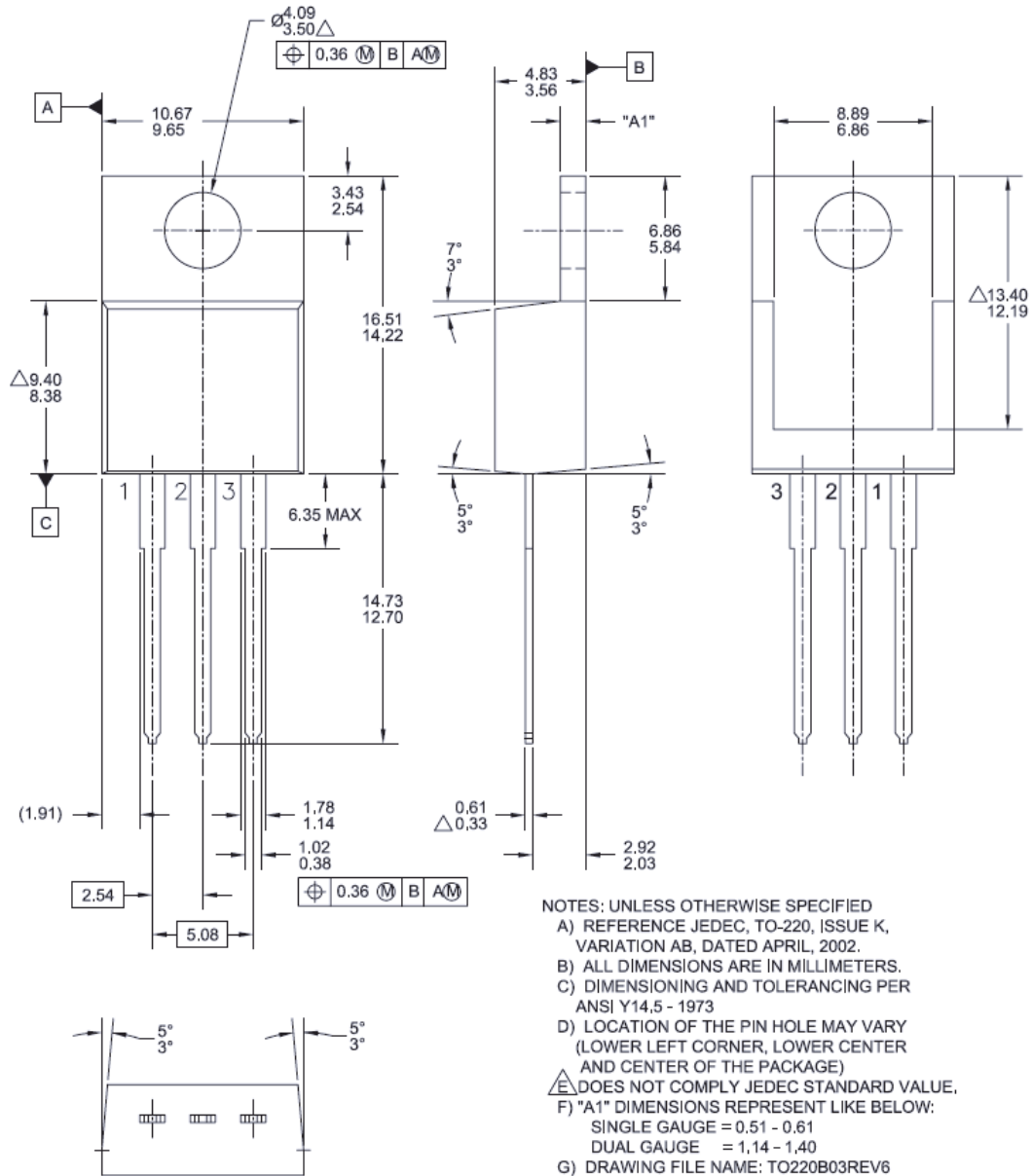
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms





## Mechanical Dimensions

### TO-220 3L



**Figure 16. TO-220, Molded, 3Lead, Jedec Variation AB**

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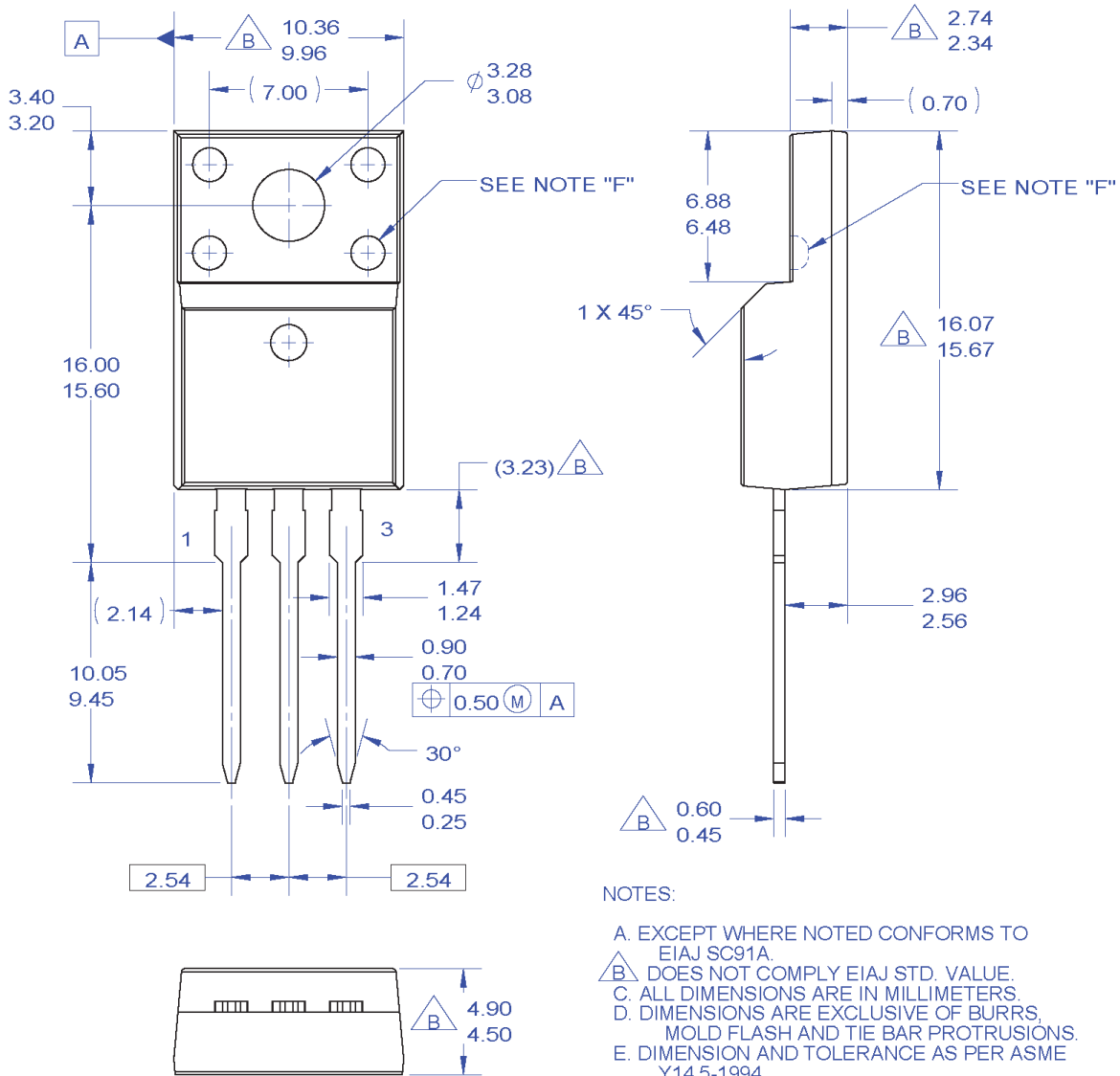
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Dimension in Millimeters

**Mechanical Dimensions**

**TO-220F 3L**



**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: TO220M03REV3

**Figure 17. TO220, Molded, 3LD, Full Pack, EIAJ SC91, Straight Lead**

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Dimension in Millimeters



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| Build it Now™            | GreenBridge™                                    | QFET®                      | TinyBuck®        |
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