

FDP16N50 / FDPF16N50 / FDPF16N50T

N-Channel UniFET™ MOSFET

500 V, 16 A, 380 mΩ

Features

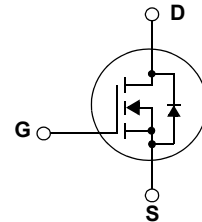
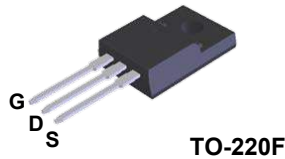
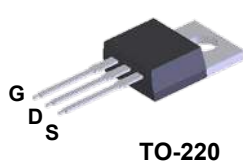
- $R_{DS(on)} = 380 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 8 \text{ A}$
- Low Gate Charge (Typ. 32 nC)
- Low Crss (Typ. 20 pF)
- 100% Avalanche Tested

Applications

- LCD/LED/PDP TV
- Lighting
- Uninterruptible Power Supply

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

| Symbol | Parameter | FDP16N50 | FDPF16N50 / FDPF16N50T | Unit |
|----------------|--|-------------|------------------------|---------------------|
| V_{DSS} | Drain-Source Voltage | 500 | | V |
| I_D | Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$) | 16 | 16 * | A |
| | | 9.6 | 9.6 * | A |
| I_{DM} | Drain Current - Pulsed (Note 1) | 64 | 64 * | A |
| V_{GSS} | Gate-Source voltage | ± 30 | | V |
| E_{AS} | Single Pulsed Avalanche Energy (Note 2) | 780 | | mJ |
| I_{AR} | Avalanche Current (Note 1) | 16 | | A |
| E_{AR} | Repetitive Avalanche Energy (Note 1) | 20 | | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | 4.5 | | V/ns |
| P_D | Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C | 200 | 38.5 | W |
| | | 1.59 | 0.3 | 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 | FDP16N50 | FDPF16N50 / FDPF16N50T | Unit |
|-----------------|---|----------|------------------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Max. | 0.63 | 3.3 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta CS}$ | 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 |
|----------------|------------|---------|-----------|------------|----------|
| FDPF16N50 | FDPF16N50 | TO-220F | - | - | 50 |
| FDPF16N50T | FDPF16N50T | TO-220F | - | - | 50 |

Electrical Characteristics T_C = 25°C unless otherwise noted

| Symbol | Parameter | Conditions | Min. | Typ. | Max | Unit |
|---|---|--|------|------|---------|----------|
| Off Characteristics | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} = 0V, I _D = 250μA | 500 | -- | -- | V |
| ΔBV _{DSS} / ΔT _J | Breakdown Voltage Temperature Coefficient | I _D = 250μA, Referenced to 25°C | -- | 0.5 | -- | V/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 500V, V _{GS} = 0V V _{DS} = 400V, T _C = 125°C | -- | -- | 1 10 | μA μA |
| I _{GSSF} | Gate-Body Leakage Current, Forward | V _{GS} = 30V, V _{DS} = 0V | -- | -- | 100 | nA |
| I _{GSSR} | Gate-Body Leakage Current, Reverse | V _{GS} = -30V, V _{DS} = 0V | -- | -- | -100 | nA |
| On Characteristics | | | | | | |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = 250μA | 3.0 | -- | 5.0 | V |
| R _{DS(on)} | Static Drain-Source On-Resistance | V _{GS} = 10V, I _D = 8A | -- | 0.31 | 0.38 | Ω |
| g _{FS} | Forward Transconductance | V _{DS} = 40V, I _D = 8A (Note 4) | -- | 23 | -- | S |
| Dynamic Characteristics | | | | | | |
| C _{iss} | Input Capacitance | V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz | -- | 1495 | 1945 | pF |
| C _{oss} | Output Capacitance | | -- | 235 | 310 | pF |
| C _{rss} | Reverse Transfer Capacitance | | -- | 20 | 30 | pF |
| Switching Characteristics | | | | | | |
| t _{d(on)} | Turn-On Delay Time | V _{DD} = 250V, I _D = 16A R _G = 25Ω (Note 4, 5) | -- | 40 | 90 | ns |
| t _r | Turn-On Rise Time | | -- | 150 | 310 | ns |
| t _{d(off)} | Turn-Off Delay Time | | -- | 65 | 140 | ns |
| t _f | Turn-Off Fall Time | | -- | 80 | 170 | ns |
| Q _g | Total Gate Charge | V _{DS} = 400V, I _D = 16A V _{GS} = 10V (Note 4, 5) | -- | 32 | 45 | nC |
| Q _{gs} | Gate-Source Charge | | -- | 8.5 | -- | nC |
| Q _{gd} | Gate-Drain Charge | | -- | 14 | -- | nC |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I _S | Maximum Continuous Drain-Source Diode Forward Current | | -- | -- | 9.2 | A |
| I _{SM} | Maximum Pulsed Drain-Source Diode Forward Current | | -- | -- | 37 | A |
| V _{SD} | Drain-Source Diode Forward Voltage | V _{GS} = 0V, I _S = 16A | -- | -- | 1.4 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0V, I _S = 16A di _F /dt = 100A/μs (Note 4) | -- | 490 | -- | ns |
| Q _{rr} | Reverse Recovery Charge | | -- | 5.0 | -- | μC |

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 5.5mH, I_{AS} = 16A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 16A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

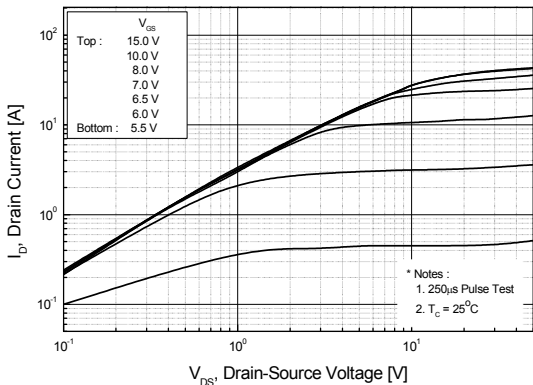


Figure 2. Transfer Characteristics

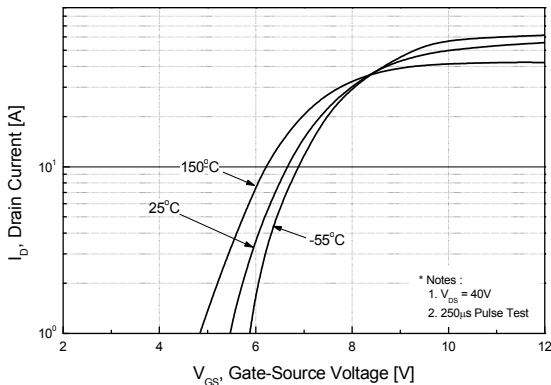


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

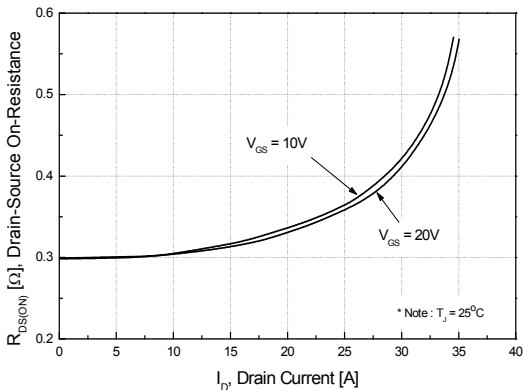


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

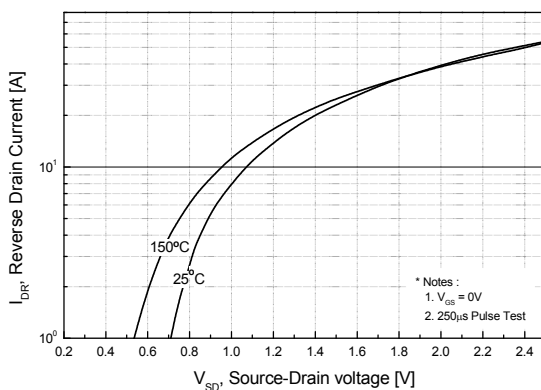


Figure 5. Capacitance Characteristics

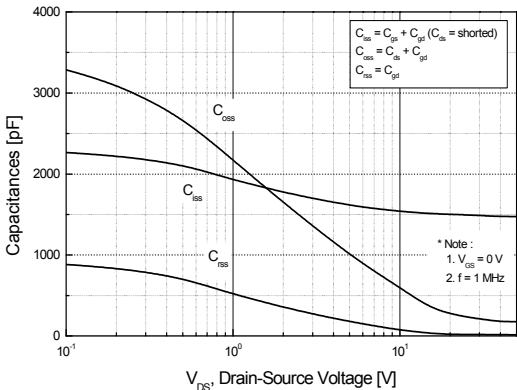
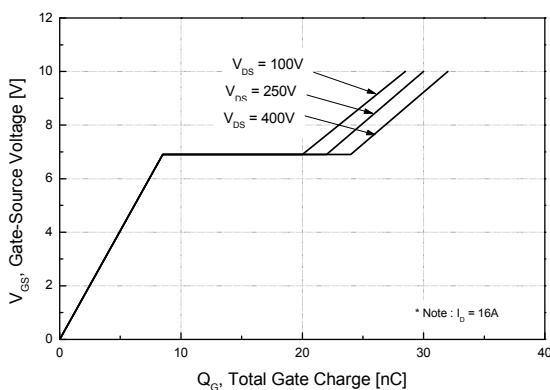


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

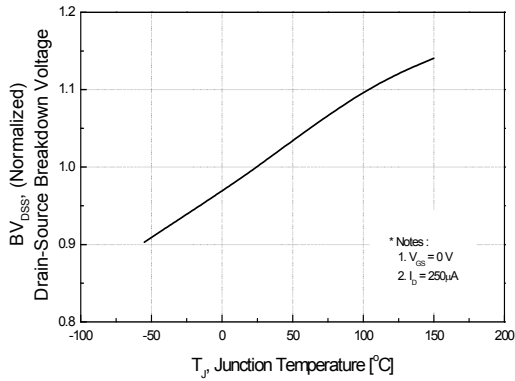


Figure 8. On-Resistance Variation vs. Temperature

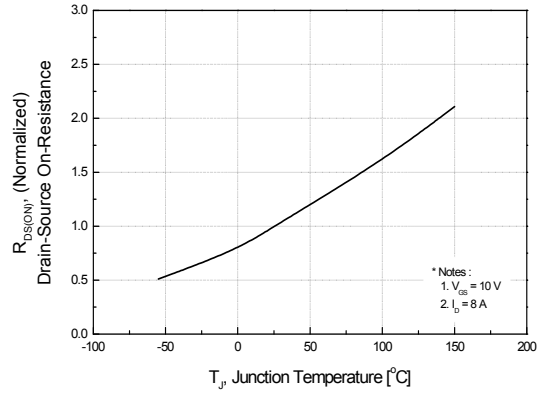


Figure 9-1. Maximum Safe Operating Area - FDP16N50

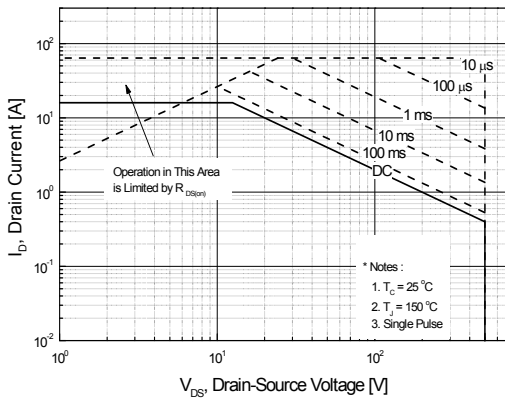


Figure 9-2. Maximum Safe Operating Area - FDPF16N50 / FDPF16N50T

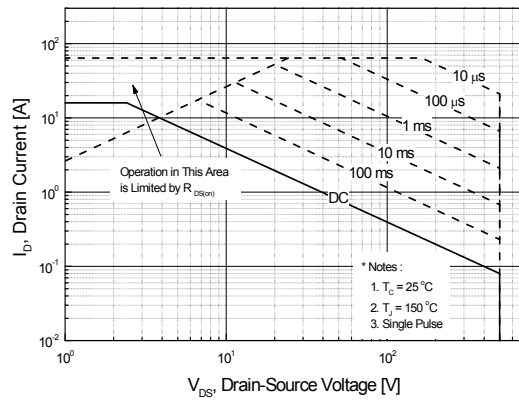
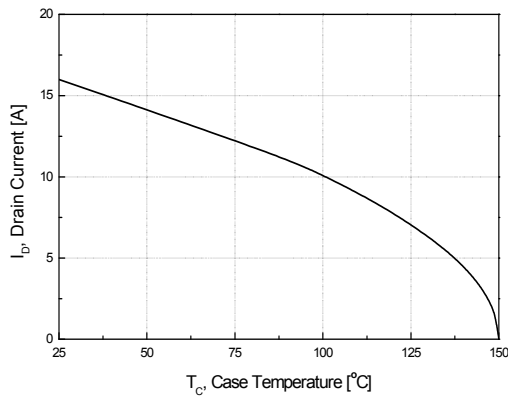


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP16N50

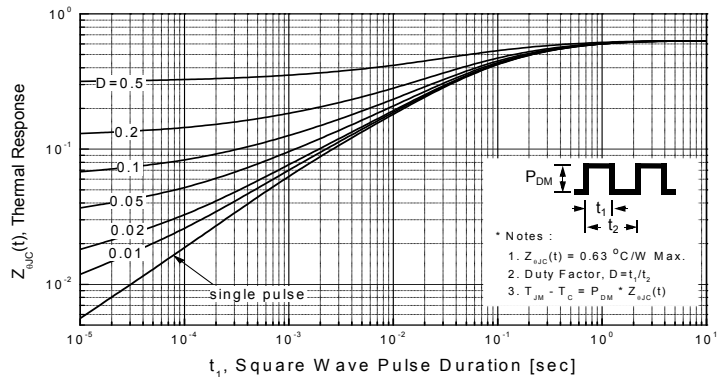
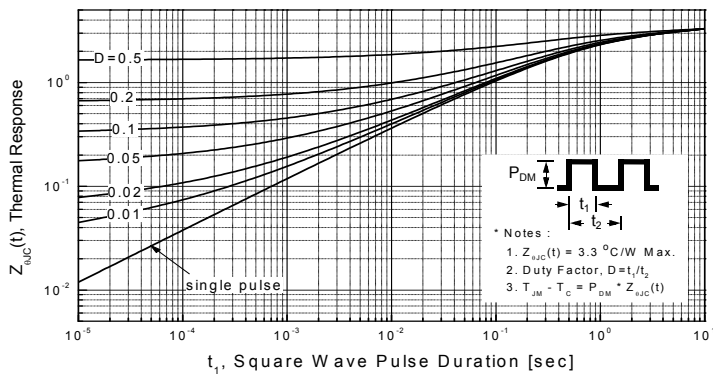
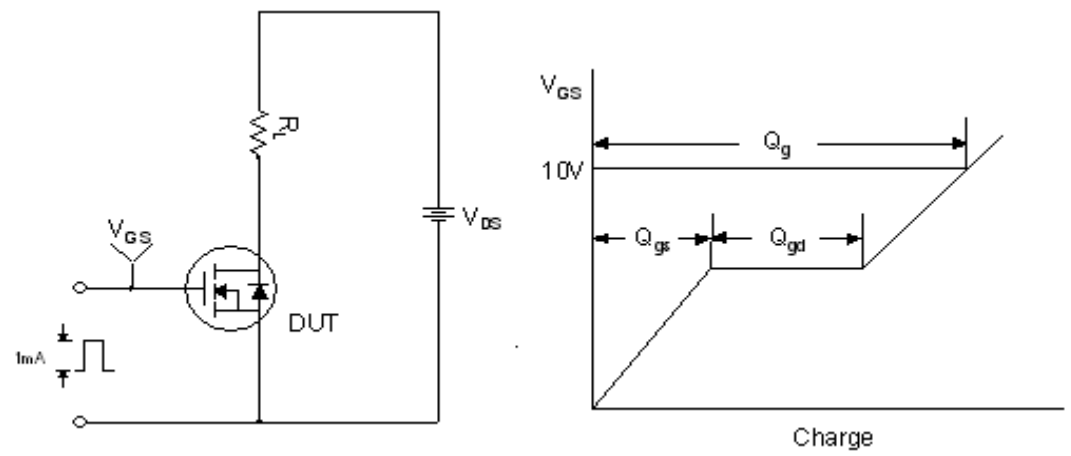


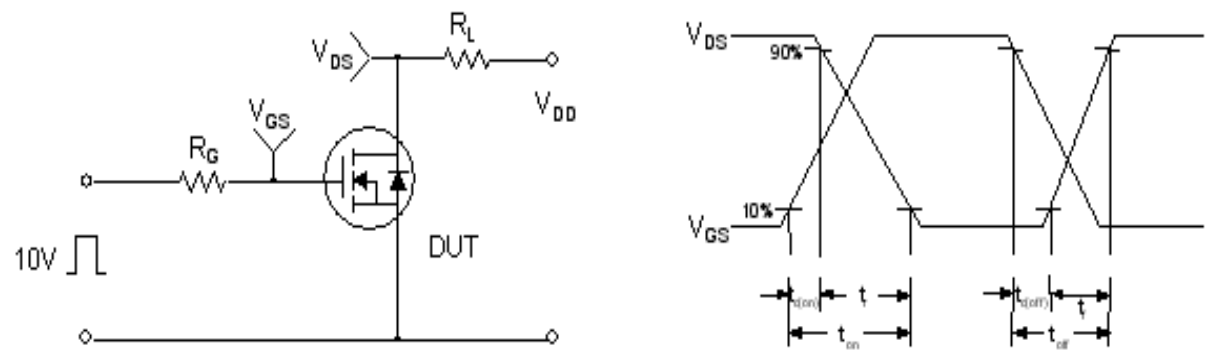
Figure 11-2. Transient Thermal Response Curve - FDPF16N50 / FDPF16N50T



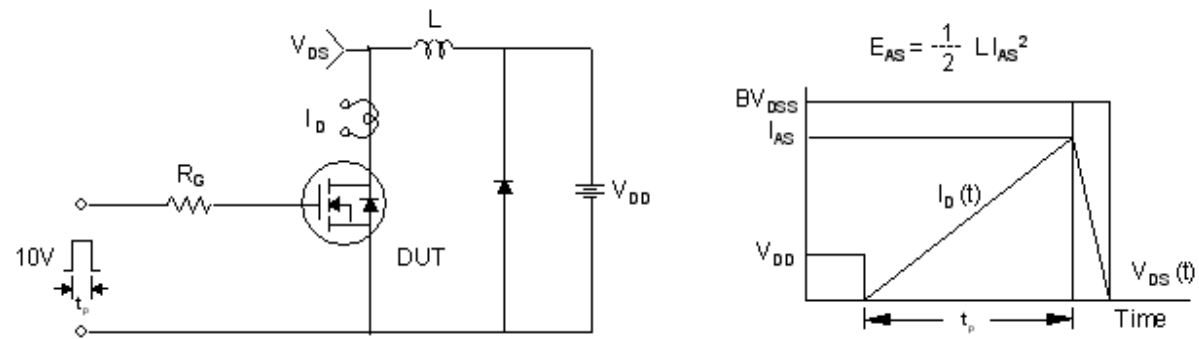
Gate Charge Test Circuit & Waveform



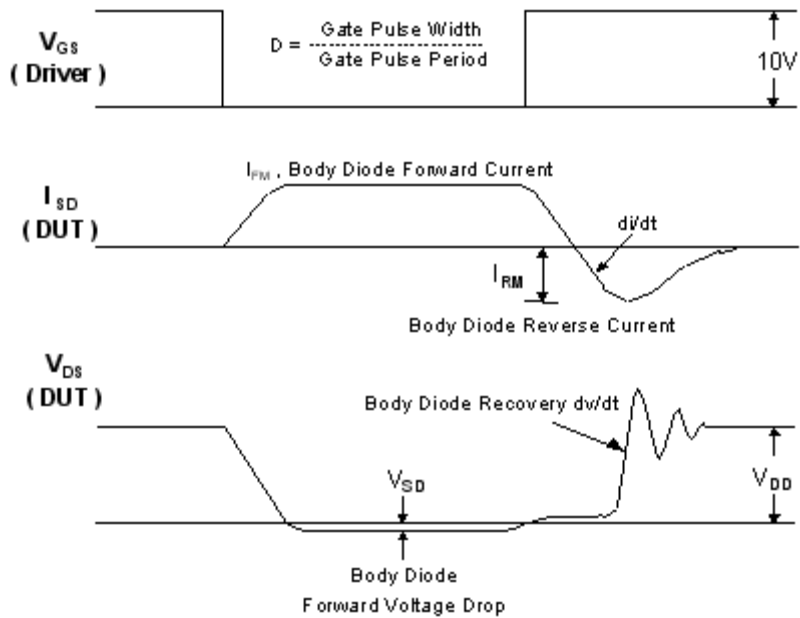
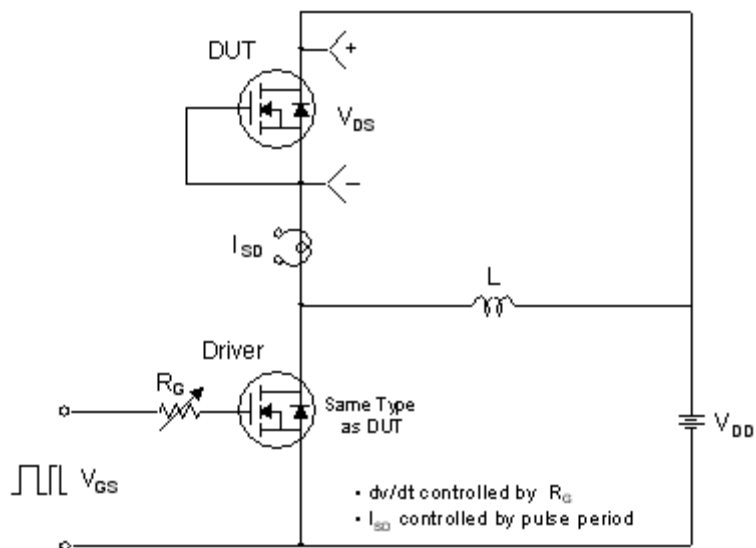
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

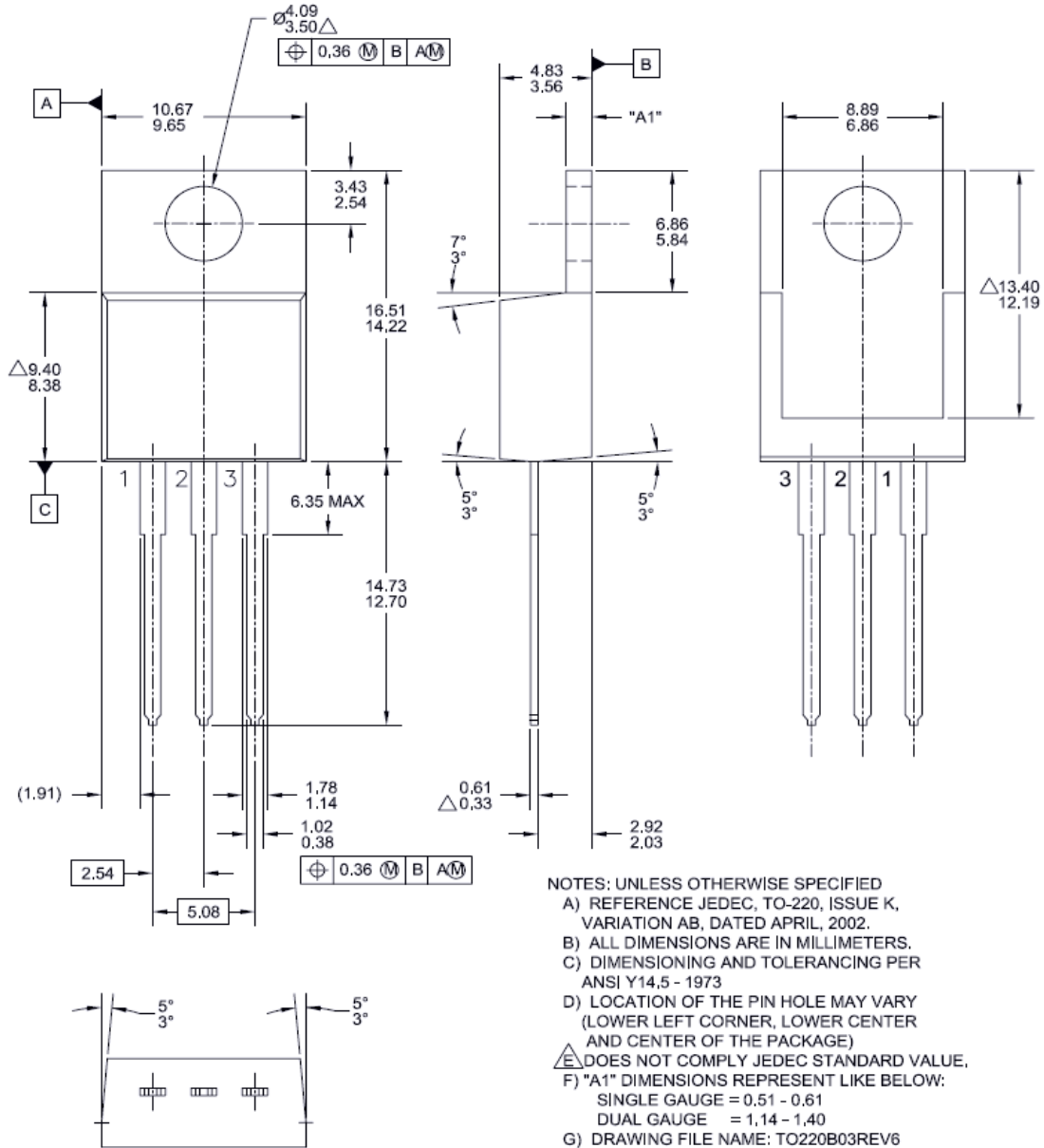


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

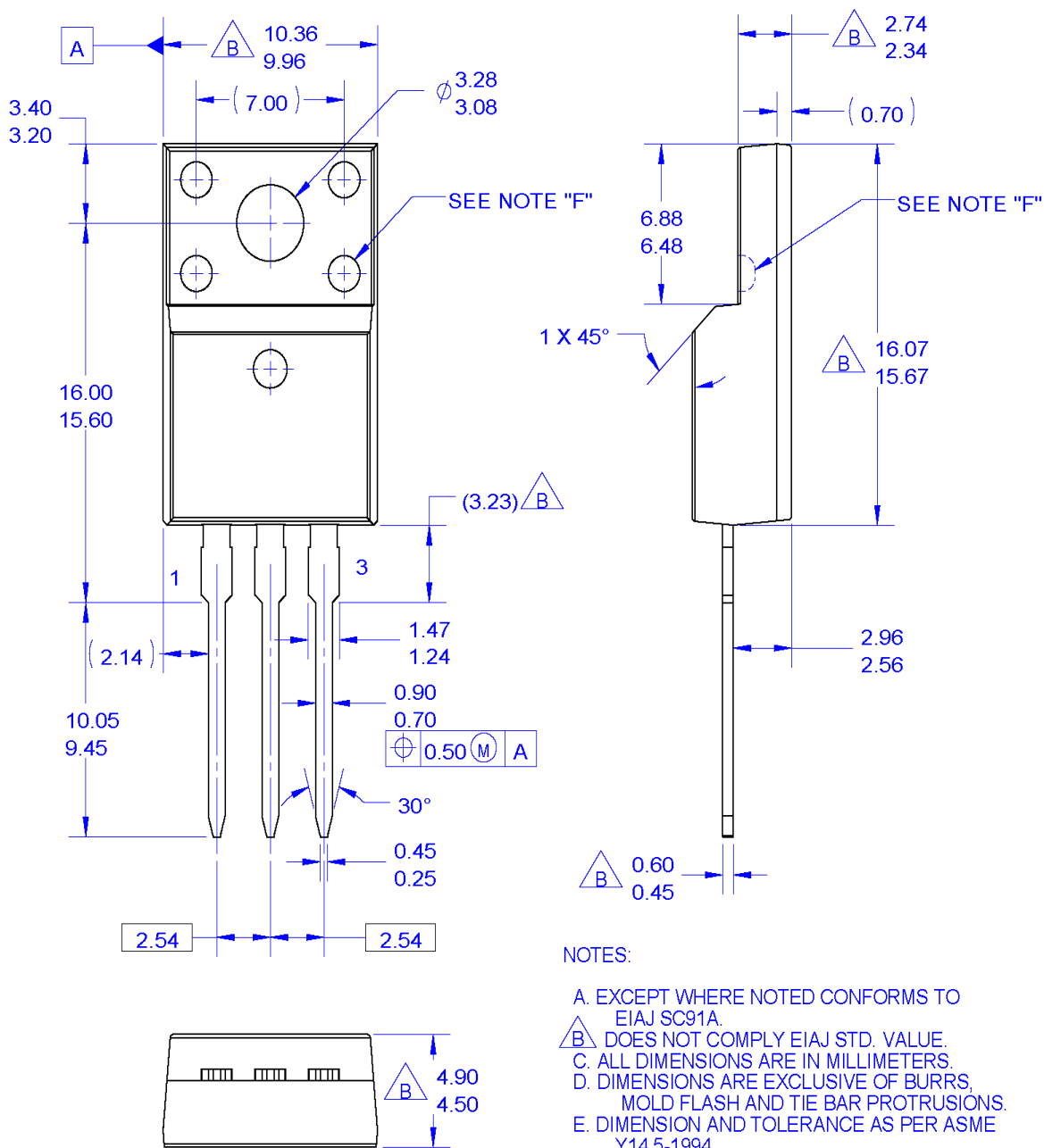
TO-220B03



Dimensions in Millimeters

Mechanical Dimensions

TO-220M03



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

Dimensions in Millimeters



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