

# FDPF3860T

## N-Channel PowerTrench® MOSFET

100 V, 20 A, 38.2 mΩ

### Features

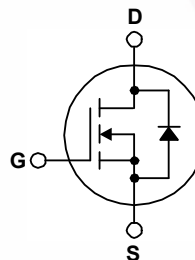
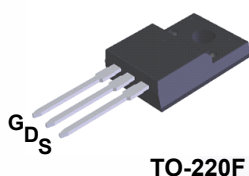
- $R_{DS(on)} = 29.1 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 5.9 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### 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
- LCD/LED/PDP TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter



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

| Symbol         | Parameter  | FDPF3860T                                  | Unit               |
|----------------|--|--|--------------------|
| $V_{DSS}$      | Drain to Source Voltage  | 100  | V                  |
| $V_{GSS}$      | Gate to Source Voltage   | $\pm 20$                                   | V                  |
| $I_D$          | Drain Current  | - Continuous ( $T_C = 25^\circ\text{C}$ )  | A                  |
|                |  | - Continuous ( $T_C = 100^\circ\text{C}$ ) |                    |
| $I_{DM}$       | Drain Current  | - Pulsed (Note 1)                          | A                  |
| $E_{AS}$       | Single Pulsed Avalanche Energy                                       | (Note 2)                                   | mJ                 |
| $I_{AR}$       | Avalanche Current  | (Note 1)                                   | A                  |
| $E_{AR}$       | Repetitive Avalanche Energy  | (Note 1)                                   | mJ                 |
| $dv/dt$        | Peak Diode Recovery $dv/dt$  | (Note 3)                                   | V/ns               |
| $P_D$          | Power Dissipation  | ( $T_C = 25^\circ\text{C}$ )               | W                  |
|                |  | - Derate Above $25^\circ\text{C}$          | $W/^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                              | -55 to +150                                | $^\circ\text{C}$   |
| $T_L$          | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | 300  | $^\circ\text{C}$   |

### Thermal Characteristics

| Symbol          | Parameter                                     | FDPF3860T | Unit               |
|-----------------|---|-----------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 3.7       | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | 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 |
|-------------|-----------|---------|----------------|-----------|------------|----------|
| FDPF3860T   | FDPF3860T | TO-220F | Tube           | N/A       | N/A        | 50 units |

## 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         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$ , $T_J = 25^\circ\text{C}$ | 100 | -   | -         | V                  |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$                  | -   | 0.1 | -         | $V/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 80\ \text{V}$ , $V_{GS} = 0\ \text{V}$                             | -   | -   | 1         | $\mu\text{A}$      |
|                                |   | $V_{DS} = 48\ \text{V}$ , $T_C = 150^\circ\text{C}$                          | -   | -   | 500       |                    |
| $I_{GSS}$                      | Gate to Body Leakage Current              | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$                         | -   | -   | $\pm 100$ | nA                 |

### On Characteristics

|              |                                      |   |     |      |      |            |
|--------------|--------------------------------------|---|-----|------|------|------------|
| $V_{GS(th)}$ | Gate Threshold Voltage               | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$    | 2.5 | -    | 4.5  | V          |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\ \text{V}$ , $I_D = 5.9\ \text{A}$ | -   | 29.1 | 38.2 | m $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10\ \text{V}$ , $I_D = 5.9\ \text{A}$ | -   | 21   | -    | S          |

### Dynamic Characteristics

|           |                              |   |   |      |      |    |
|-----------|------------------------------|---|---|------|------|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\ \text{V}$ , $V_{GS} = 0\ \text{V}$ ,<br>$f = 1\ \text{MHz}$ | - | 1350 | 1800 | pF |
| $C_{oss}$ | Output Capacitance           |   | - | 145  | 190  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |   | - | 60   | 90   | pF |

### Switching Characteristics

|              |                               |  |   |    |    |    |
|--------------|-------------------------------|--|---|----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 50\ \text{V}$ , $I_D = 5.9\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_G = 6\ \Omega$ | - | 15 | 40 | ns |
| $t_r$        | Turn-On Rise Time             |  | - | 17 | 45 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |  | - | 24 | 60 | ns |
| $t_f$        | Turn-Off Fall Time            |  | - | 7  | 25 | ns |
| $Q_{g(tot)}$ | Total Gate Charge at 10V      | $V_{DS} = 80\ \text{V}$ , $I_D = 5.9\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$                     | - | 23 | 35 | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |  | - | 7  | -  | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |  | - | 8  | -  | nC |

### Drain-Source Diode Characteristics

|                 |  |   |   |    |     |    |
|-----------------|--|---|---|----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current | -   | - | 20 | A   |    |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     | -   | - | 80 | A   |    |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 5.9 A                                    | - | -  | 1.3 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 5.9 A,<br>dI <sub>F</sub> /dt = 100 A/μs | - | 40 | -   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |   | - | 56 | -   | nC |

#### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $L = 16\ \text{mH}$ ,  $I_{AS} = 5.9\ \text{A}$ ,  $V_{DD} = 50\ \text{V}$ ,  $R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 5.9\ \text{A}$ ,  $di/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

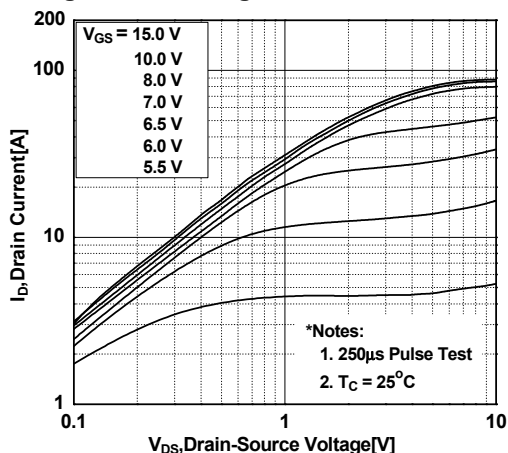


Figure 2. Transfer Characteristics

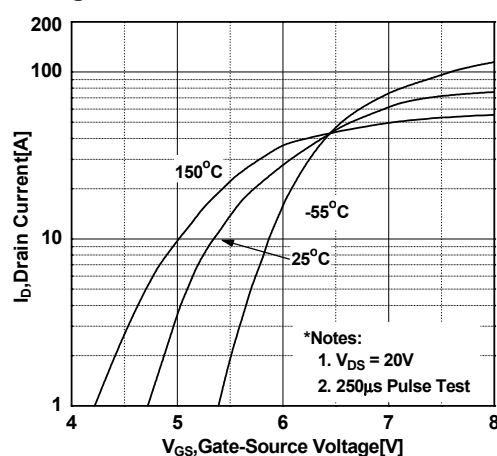


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

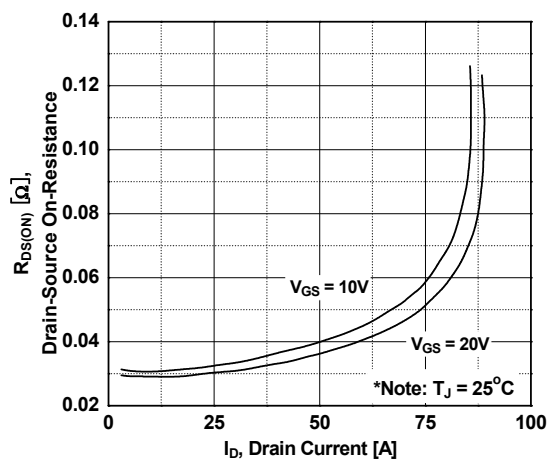


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

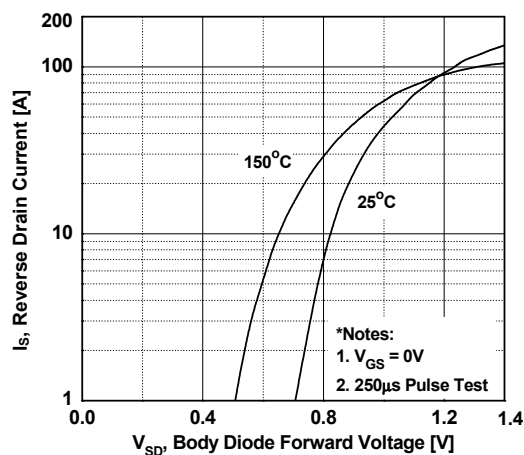


Figure 5. Capacitance Characteristics

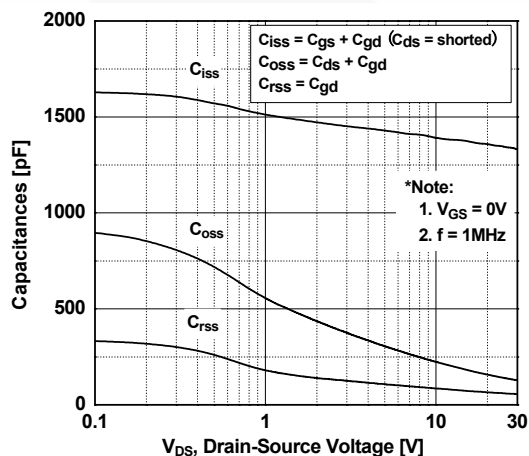
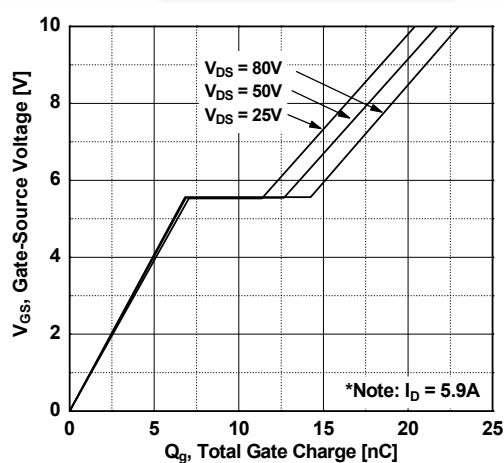


Figure 6. Gate Charge Characteristics



# Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

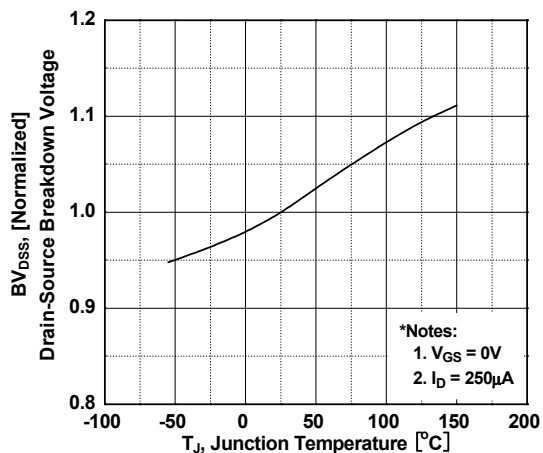


Figure 8. On-Resistance Variation vs. Temperature

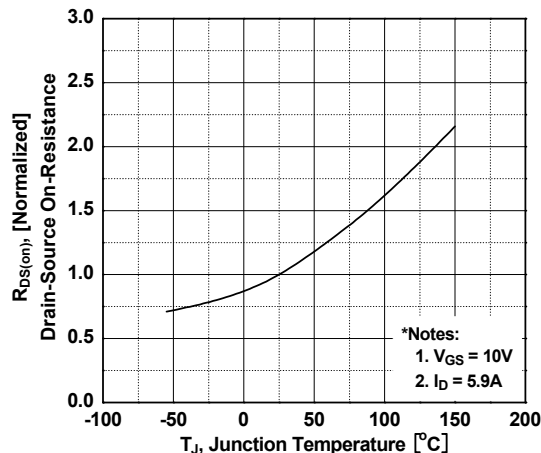


Figure 9. Maximum Safe Operating Area

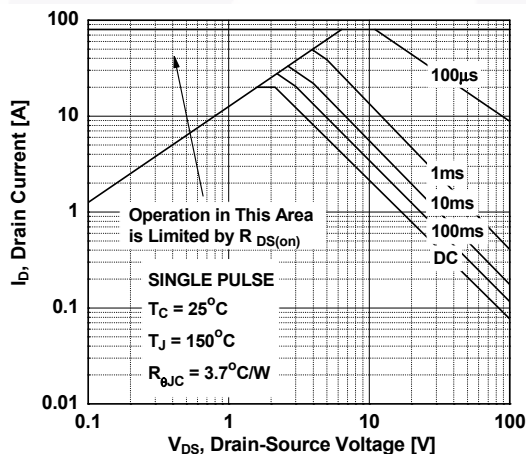


Figure 10. Maximum Drain Current vs. Case Temperature

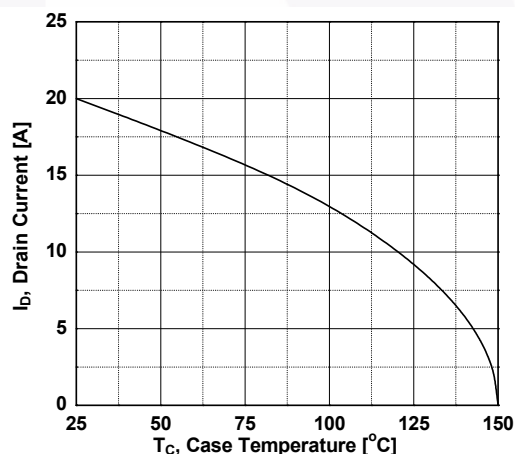


Figure 11. Transient Thermal Response Curve

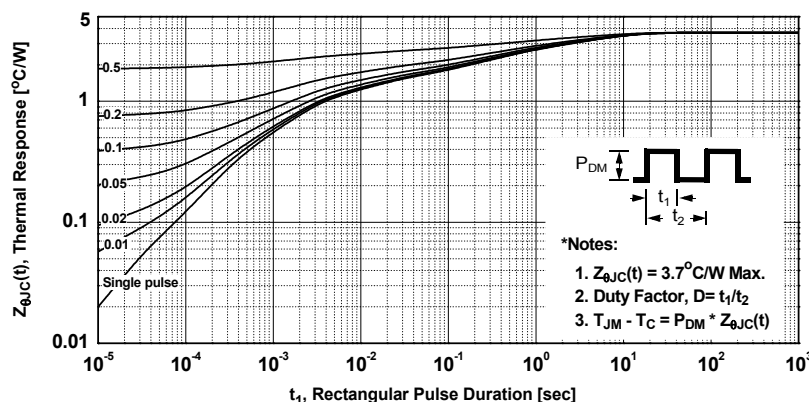




Figure 12. Gate Charge Test Circuit & Waveform

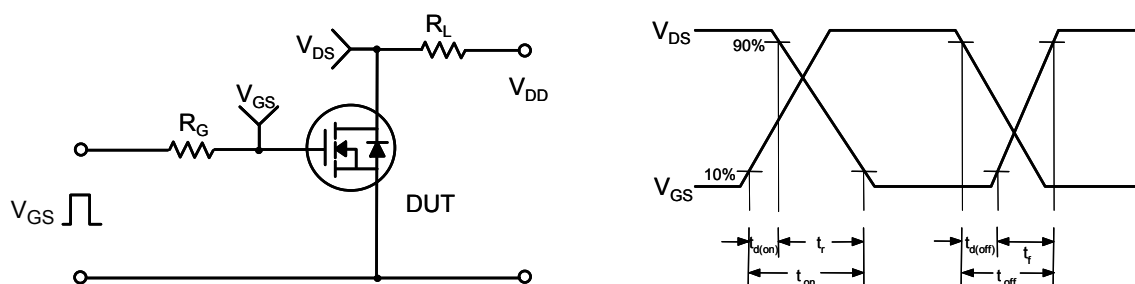
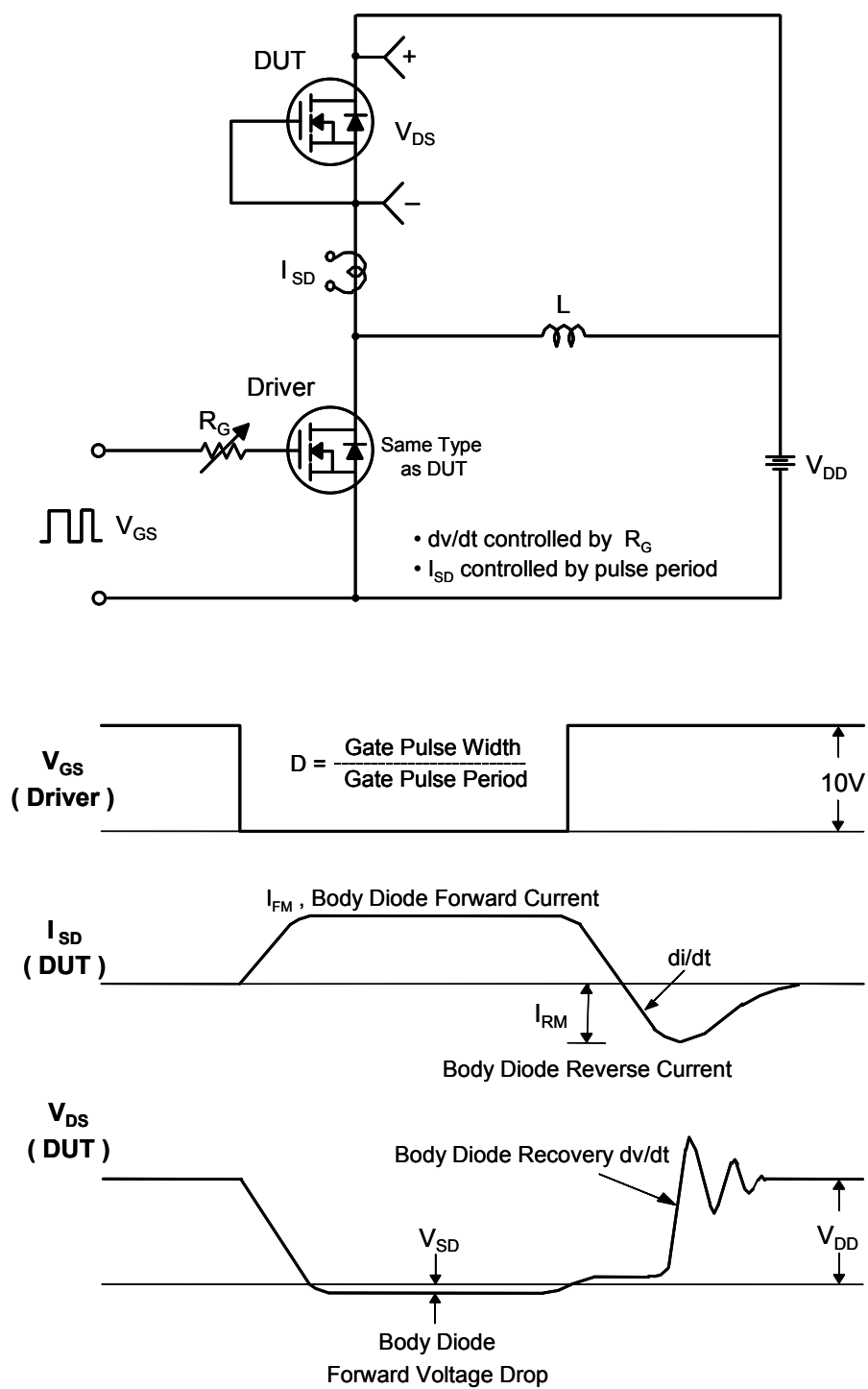


Figure 13. Resistive Switching Test Circuit & Waveforms

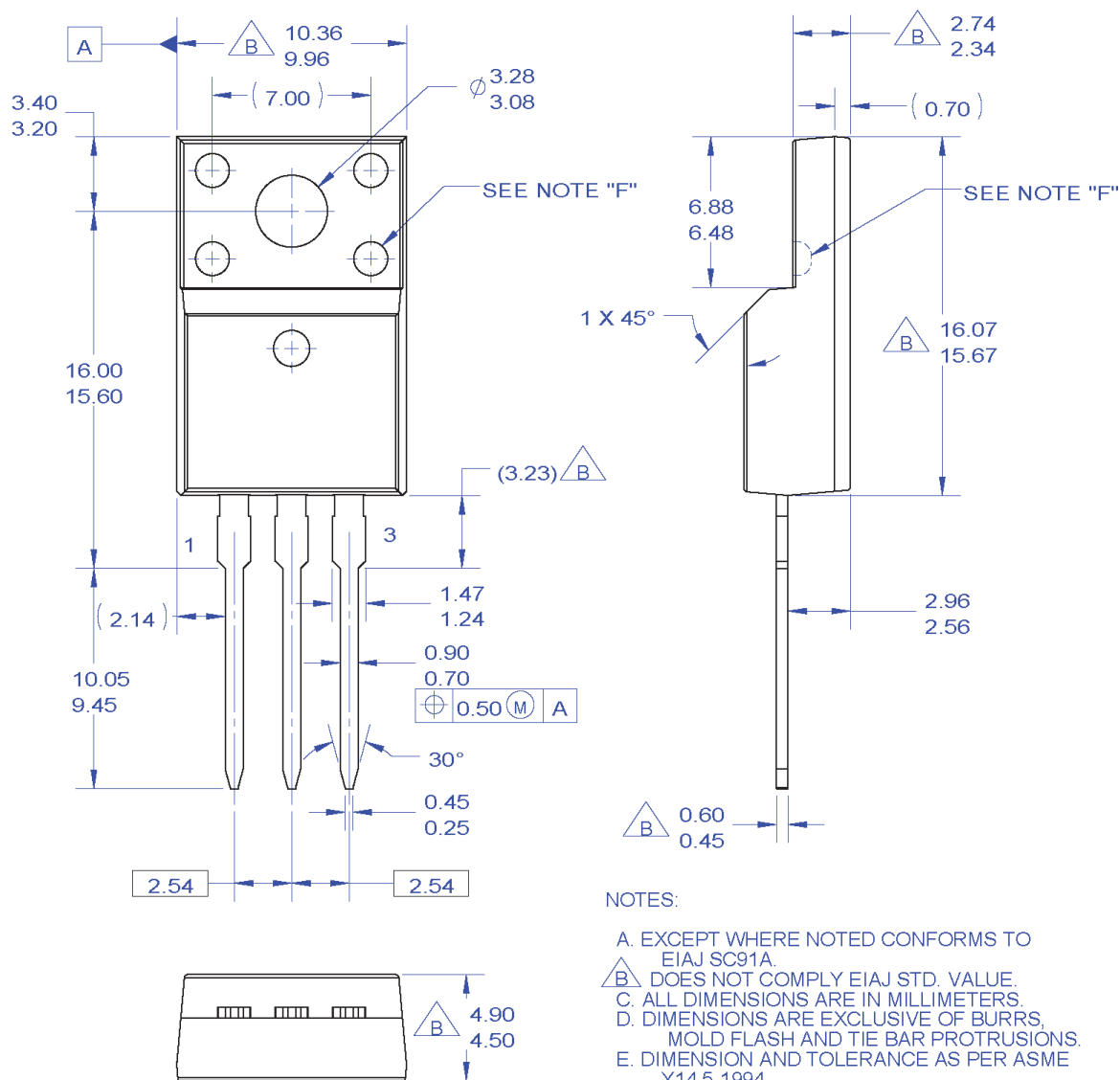


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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

# Mechanical Dimensions



## NOTES:

- EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- DOES NOT COMPLY EIAJ STD. VALUE.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- OPTION 1 - WITH SUPPORT PIN HOLE.
- OPTION 2 - NO SUPPORT PIN HOLE.
- DRAWING FILE NAME: TO220M03REV3

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

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|  | MicroPak™                                       |                            |  |
| Fairchild®  | MicroPak2™                                      |                            | UHC®  |
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| FACT®   | mWSaver®  |                            | VCX™  |
| FAST®   | OptoHiT™  |                            | VisualMax™  |
| FastvCore™  | OPTOLOGIC®                                      |                            | VoltagePlus™  |
| FETBench™   | OPTOPLANAR®                                     |                            | XS™   |
| FPS™  |   |                            |   |

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| Preliminary              | First Production      | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
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Rev. I66



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