

# FDPF390N15A

## N-Channel PowerTrench® MOSFET

150 V, 15 A, 40 mΩ

### Features

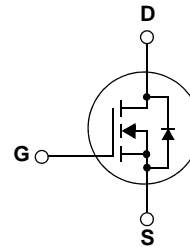
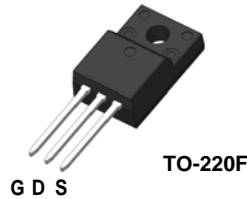
- $R_{DS(on)} = 31 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 15 \text{ A}$
- Fast Switching Speed
- Low Gate Charge,  $Q_G = 14.3 \text{ nC}$  (Typ.)
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advance 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



### MOSFET 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	$\pm 20$	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 $25^\circ\text{C}$	0.18
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 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

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDPF390N15A	FDPF390N15A	TO-220F	-	-	50

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	150	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.1	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 120\text{V}, V_{GS} = 0\text{V}$ $V_{DS} = 120\text{V}, T_C = 125^\circ\text{C}$	-	-	1 500	$\mu\text{A}$
$I_{GSS}$	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	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 15\text{A}$	-	31	40	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{V}, I_D = 15\text{A}$	-	32	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 75\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	965	1285	pF
$C_{oss}$	Output Capacitance		-	96	130	pF
$C_{riss}$	Reverse Transfer Capacitance		-	5.8	-	pF
$C_{oss(er)}$	Energy Related Output Capacitance	$V_{DS} = 75\text{V}, V_{GS} = 0\text{V}$	-	169	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 75\text{V}, I_D = 27\text{A}$ $V_{GS} = 10\text{V}$	-	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)	$f = 1\text{MHz}$	-	1.4	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 75\text{V}, I_D = 27\text{A}$ $V_{GS} = 10\text{V}, R_{GEN} = 4.7\Omega$	-	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

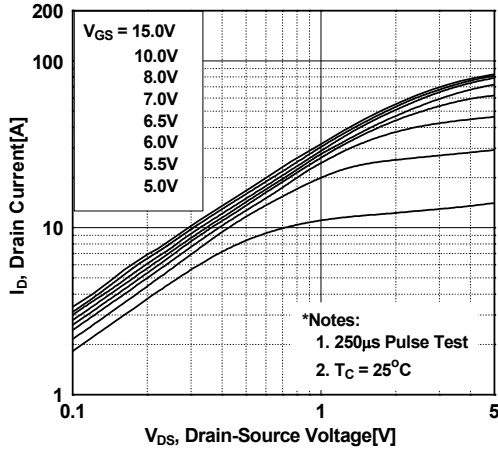
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	15	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	64	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 15\text{A}$	-	-	1.25	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 27\text{A}$	-	63	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$	-	131	-	nC

#### Notes:

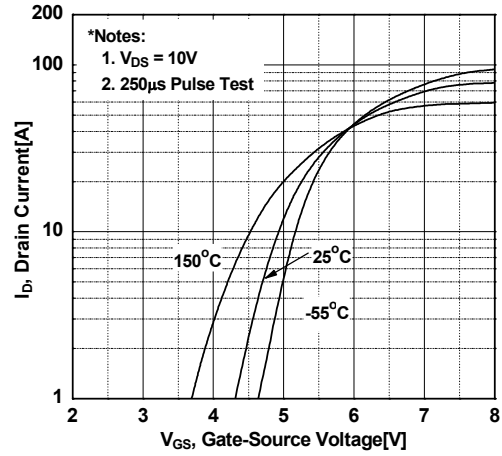
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{mH}$ ,  $I_{SD} = 7.2\text{A}$
3.  $I_{SD} \leq 15\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

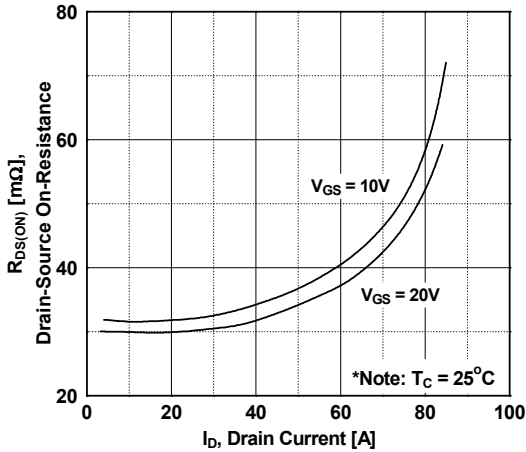
**Figure 1. On-Region Characteristics**



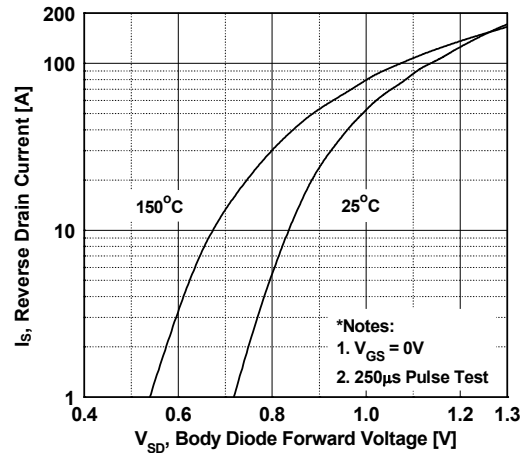
**Figure 2. Transfer Characteristics**



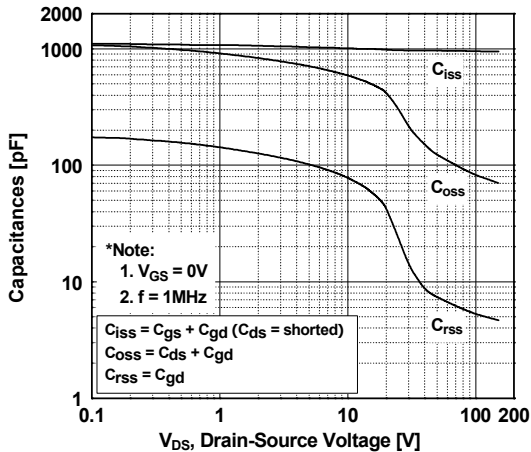
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



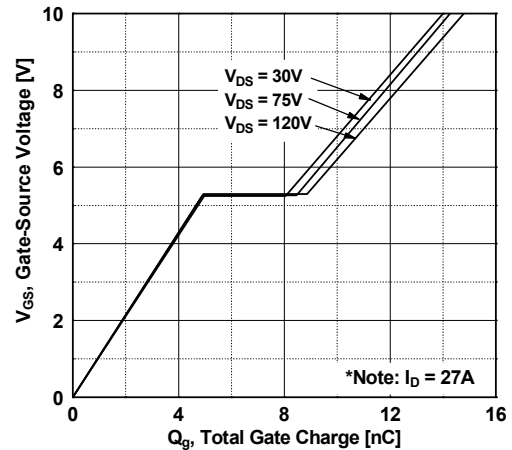
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

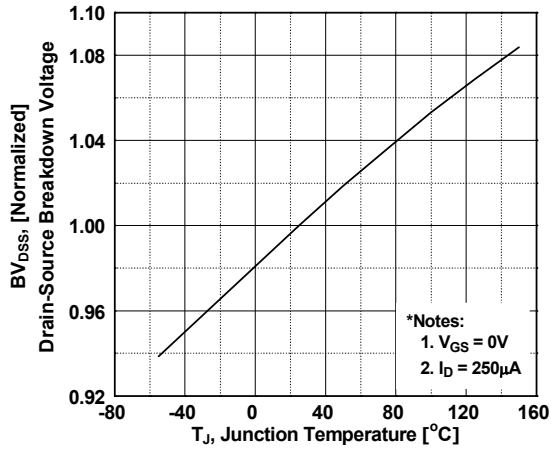


**Figure 6. Gate Charge Characteristics**

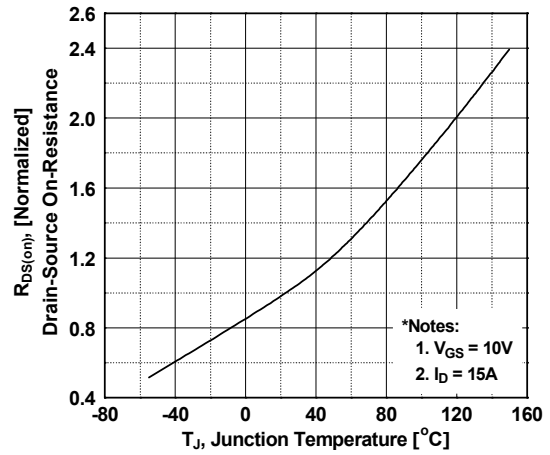


**Typical Performance Characteristics** (Continued)

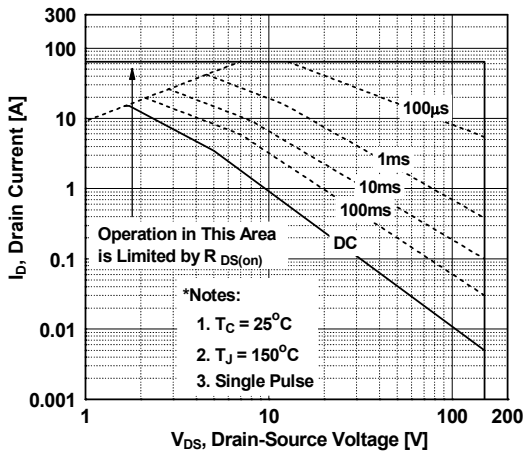
**Figure 7. Breakdown Voltage Variation vs. Temperature**



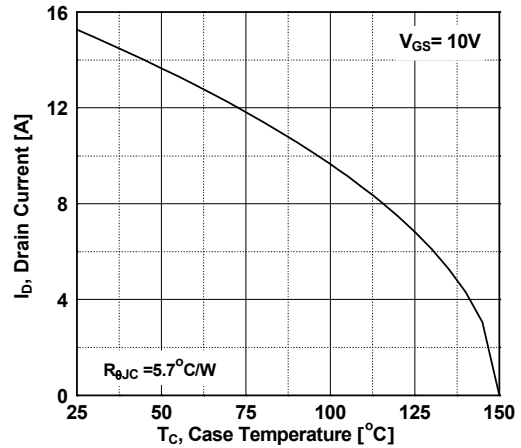
**Figure 8. On-Resistance Variation vs. Temperature**



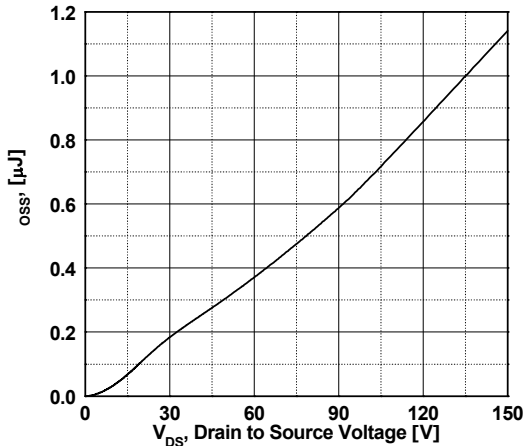
**Figure 9. Maximum Safe Operating Area**



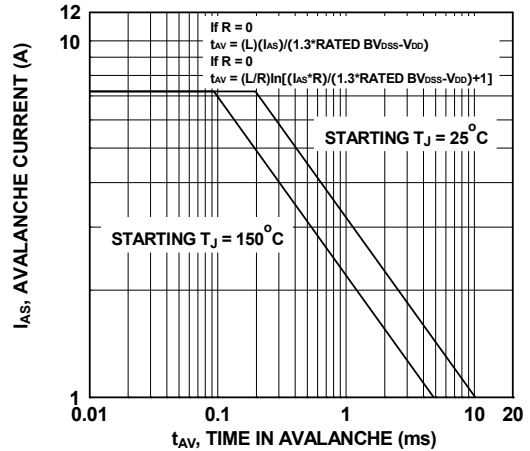
**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Eoss vs. Drain to Source Voltage**

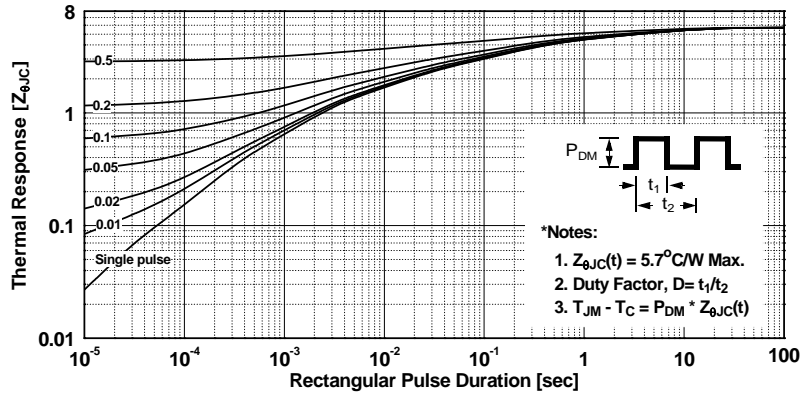


**Figure 12. Unclamped Inductive Switching Capability**

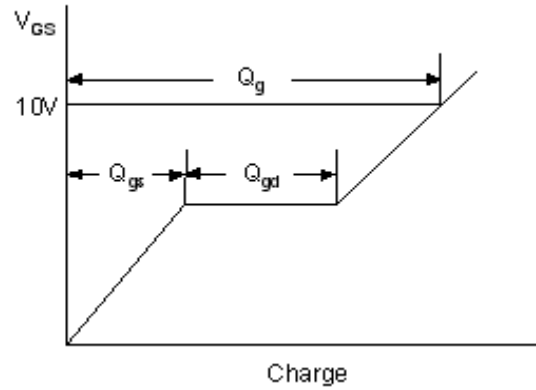
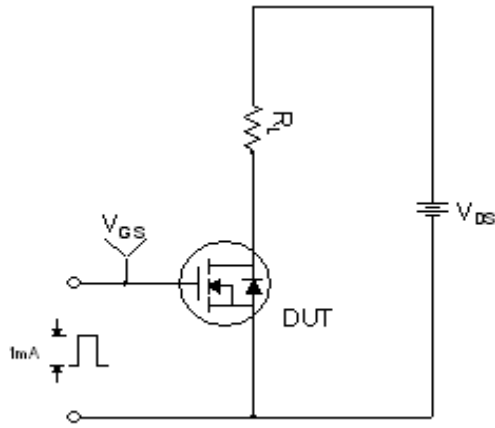


Typical Performance Characteristics (Continued)

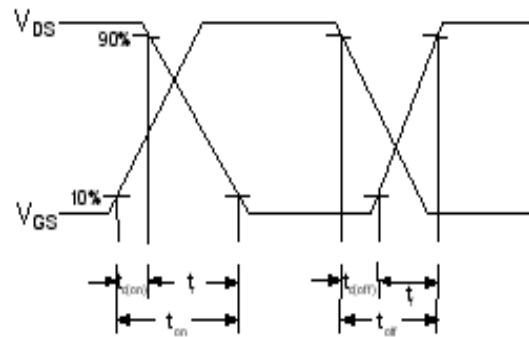
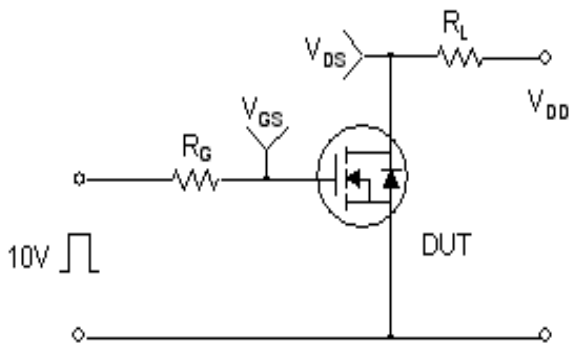
Figure 12. Transient Thermal Response Curve



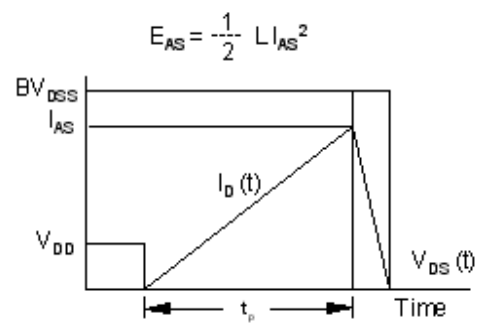
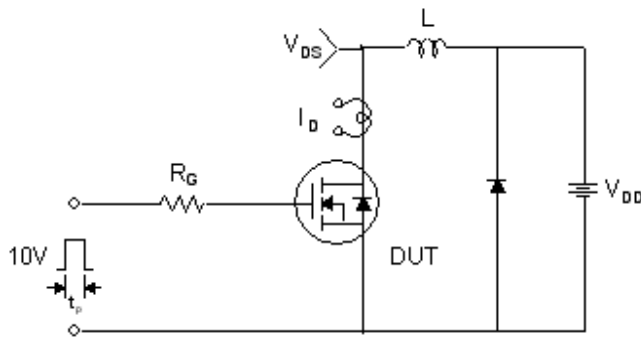
**Gate Charge Test Circuit & Waveform**



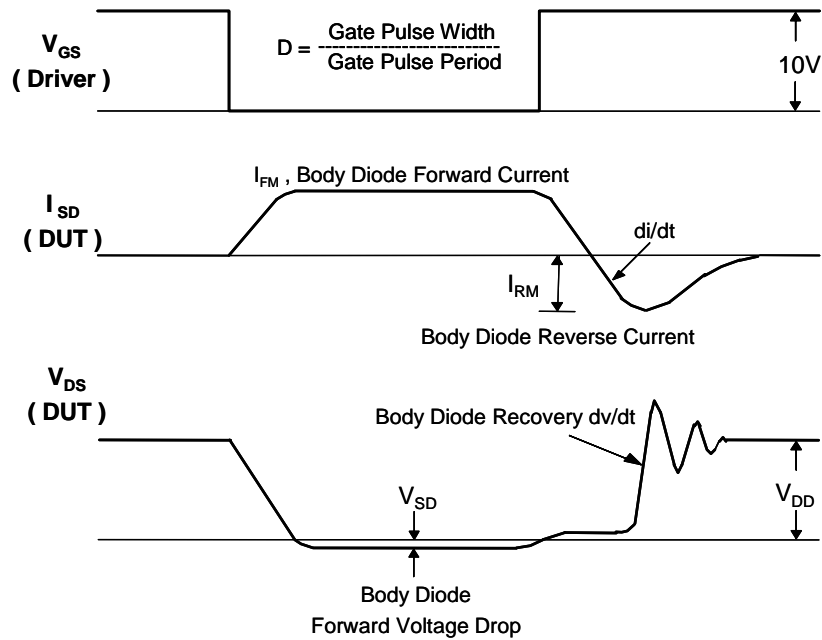
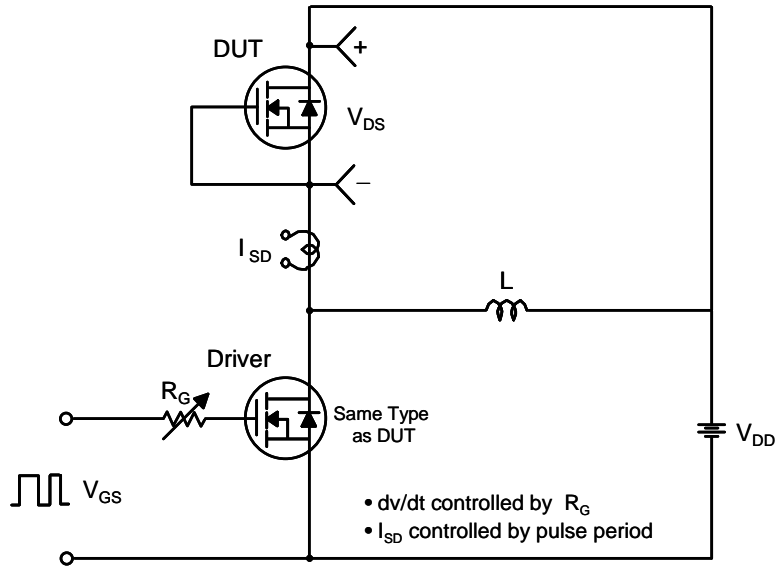
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

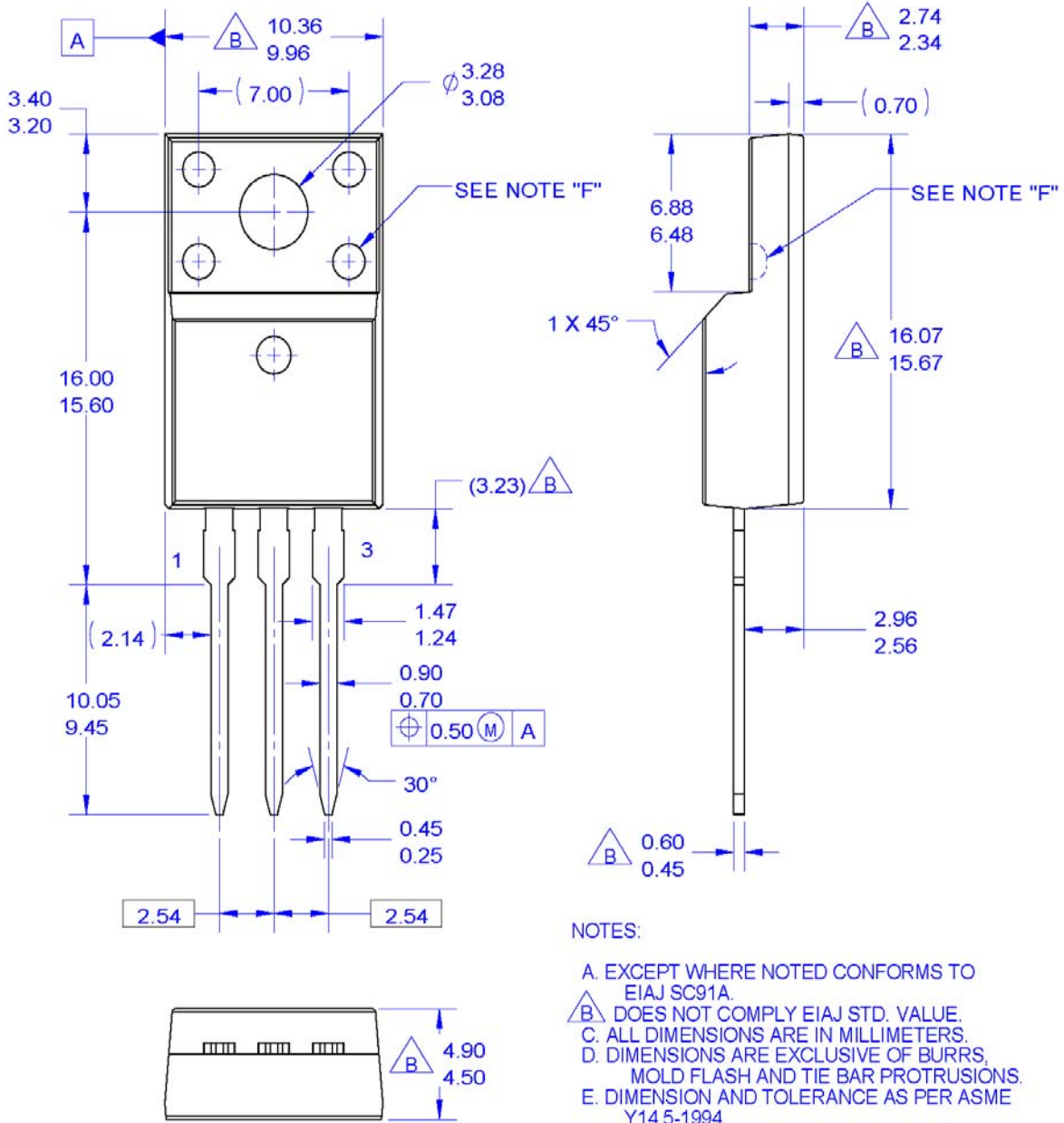


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**Mechanical Dimensions**

**TO-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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- |   |   |   |   |
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| AccuPower™  | F-PFST™   | PowerXS™  | <b>E</b> SYSTEM®*   |
| AX-CAP®*  | FRFET®  | Programmable Active Droop™  | TinyBoost™  |
| BitSiC™   | Global Power Resource <sup>SM</sup>             | QFET®   | TinyBuck™   |
| Build it Now™   | Green Bridge™                                   | QS™   | TinyCalc™   |
| CorePLUS™   | Green FPS™                                      | Quiet Series™   | TinyLogic®  |
| CorePOWER™  | Green FPS™ e-Series™                            | RapidConfigure™   | TINYOPTO™   |
| CROSSVOLT™  | Gmax™   |  ™ | TinyPower™  |
| CTL™  | GTO™  | Saving our world, 1mW/W/kW at a time™   | TinyPWM™  |
| Current Transfer Logic™   | IntelliMAX™                                     | SignalWise™   | TinyWire™   |
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| ESBC™   | MicroFET™                                       | STEALTH™  |  SerDes™ |
|  ® | MicroPak™                                       | SuperFET®   | UHC®  |
| Fairchild®  | MicroPak2™                                      | SuperSOT™-3   | Ultra FRFET™  |
| Fairchild Semiconductor®  | MillerDrive™                                    | SuperSOT™-6   | UniFET™   |
| FACT Quiet Series™  | MotionMax™                                      | SuperSOT™-8   | VCX™  |
| FACT®   | mWSaver™  | SupreMOS®   | VisualMax™  |
| FAST®   | OptoHiT™  | SyncFET™  | VoltagePlus™  |
| FastvCore™  | OPTOLOGIC®                                      |   | XST™  |
| FETBench™   | OPTOPLANAR®                                     |   |   |

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- A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I64