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December 2013

## FDPF320N06L

### N-Channel Logic Level PowerTrench® MOSFET

#### 60 V, 21 A, 25 mΩ

#### Features

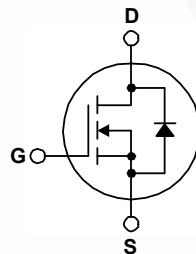
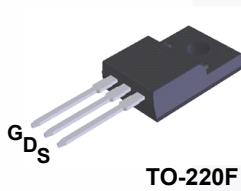
- $R_{DS(on)} = 20 \text{ mΩ}$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 21 \text{ A}$
- $R_{DS(on)} = 23 \text{ mΩ}$  (Typ.) @  $V_{GS} = 5 \text{ V}$ ,  $I_D = 17 \text{ A}$
- Low Gate Charge (Typ. 23.2 nC)
- Low  $C_{rss}$  (Typ. 64 pF)
- Fast Switching Speed
- 100% Avalanche Tested
- Improved dv/dt 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



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

Symbol	Parameter		FDPF320N06L	Unit
$V_{DSS}$	Drain to Source Voltage		60	V
$V_{GSS}$	Gate to Source Voltage		$\pm 20$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	21	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	15	
$I_{DM}$	Drain Current	- Pulsed (Note 1)	84	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		66	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)		6.0	V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	26	W
		- Derate Above $25^\circ\text{C}$	0.17	
$T_J, T_{STG}$	Operating and Storage Temperature Range		-55 to +175	°C
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	°C

#### Thermal Characteristics

Symbol	Parameter	FDPF320N06L	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	5.8	°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
FDPF320N06L	FDPF320N06L	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
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#### Off Characteristics

$\text{BV}_{\text{DSS}}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	60	-	-	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}, \text{Referenced to } 25^\circ\text{C}$	-	0.04	-	$\text{V}^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}$ $V_{DS} = 48 \text{ V}, T_C = 150^\circ\text{C}$	-	-	1	$\mu\text{A}$
$I_{\text{GSS}}$	Gate to Body Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	$\pm 100$	$\mu\text{A}$

#### On Characteristics

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	1.0	-	2.5	V
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 21 \text{ A}$ $V_{GS} = 5 \text{ V}, I_D = 17 \text{ A}$	-	20	25	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10 \text{ V}, I_D = 21 \text{ A}$	-	34	-	S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}$ $f = 1 \text{ MHz}$	-	1105	1470	pF
$C_{oss}$	Output Capacitance		-	115	150	pF
$C_{rss}$	Reverse Transfer Capacitance		-	64	-	pF
$Q_{g(\text{tot})}$	Total Gate Charge at 10V	$V_{GS} = 10 \text{ V}$	-	23.2	30.2	nC
$Q_{g(\text{tot})}$	Total Gate Charge at 5V	$V_{GS} = 5 \text{ V}$	-	12.7	16.5	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DS} = 48 \text{ V},$ $I_D = 21 \text{ A}$	(Note 4)	3.4	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge	$I_D = 21 \text{ A}$	-	6.3	-	nC

#### Switching Characteristics

$t_{d(\text{on})}$	Turn-On Delay Time	$V_{DD} = 30 \text{ V}, I_D = 21 \text{ A},$ $V_{GS} = 5 \text{ V}, R_G = 4.7 \Omega$	-	16	42	ns
$t_r$	Turn-On Rise Time		-	34	78	ns
$t_{d(\text{off})}$	Turn-Off Delay Time		-	27	64	ns
$t_f$	Turn-Off Fall Time		(Note 4)	8	26	ns
ESR	Equivalent Series Resistance (G-S)	$f = 1 \text{ MHz}$	-	2	-	$\Omega$

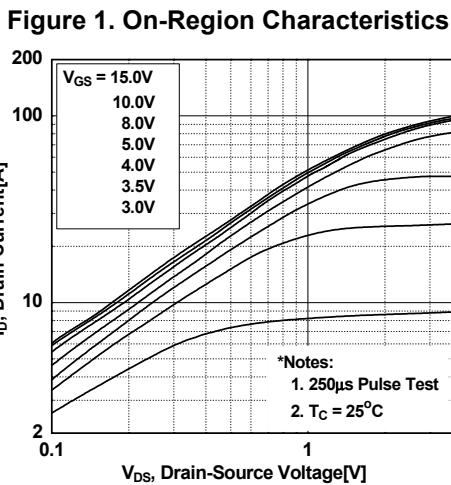
#### Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	21	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	84	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 21 \text{ A}$	-	-	1.3
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{SD} = 21 \text{ A}, V_{DD} = 48 \text{ V},$ $dI_F/dt = 100 \text{ A}/\mu\text{s}$	-	27	-
$Q_{rr}$	Reverse Recovery Charge	-	23	-	nC

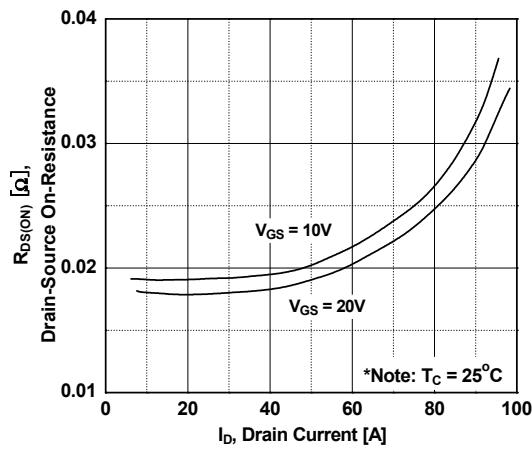
**Notes:**

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $L = 1 \text{ mH}, I_{AS} = 11.5 \text{ A}, R_G = 25 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 21 \text{ A}, di/dt \leq 200 \text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

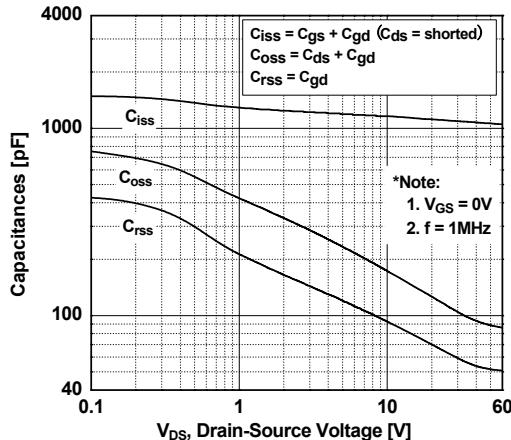
## Typical Performance Characteristics



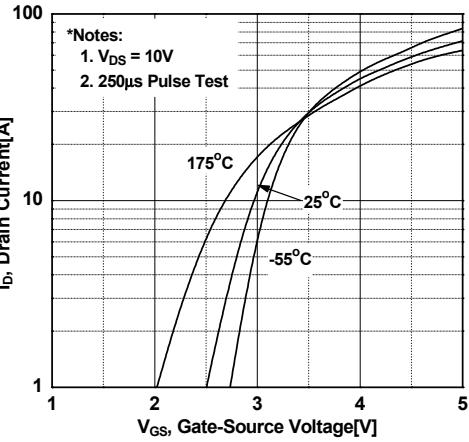
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



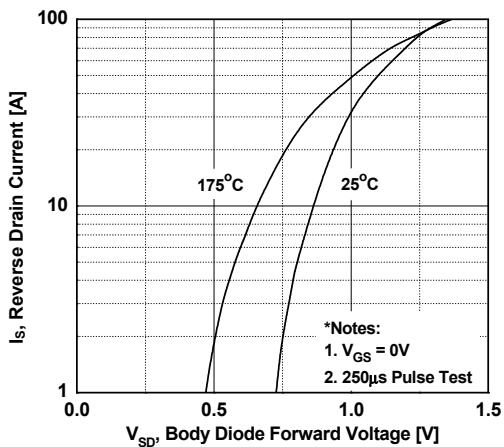
**Figure 5. Capacitance Characteristics**



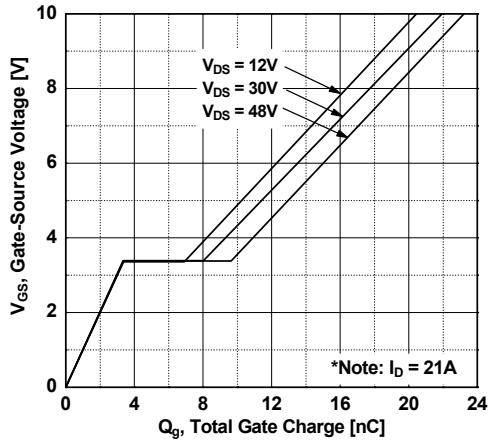
**Figure 2. Transfer Characteristics**



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

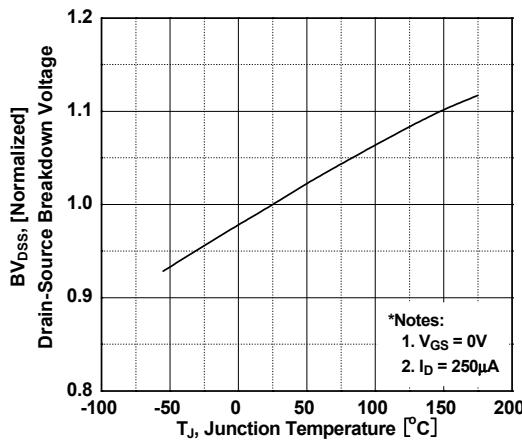


**Figure 6. Gate Charge Characteristics**

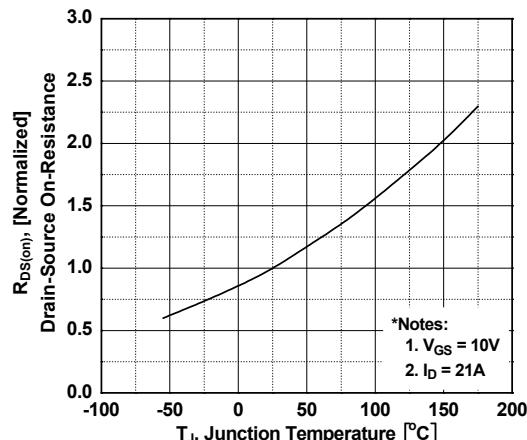


**Typical Performance Characteristics** (Continued)

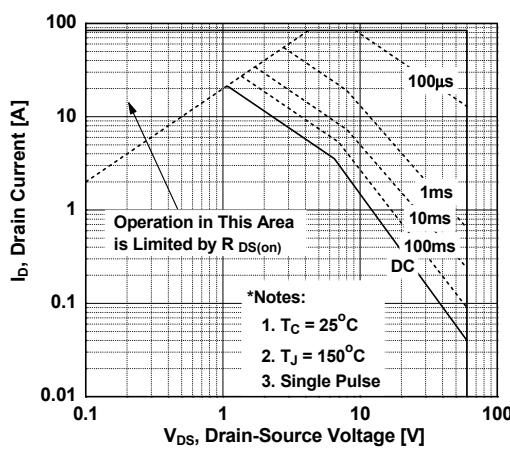
**Figure 7. Breakdown Voltage Variation vs. Temperature**



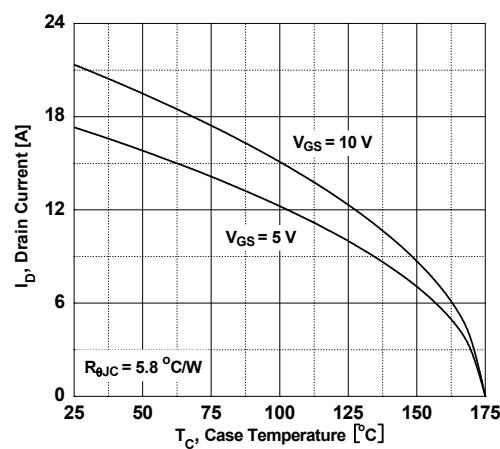
**Figure 8. On-Resistance Variation vs. Temperature**



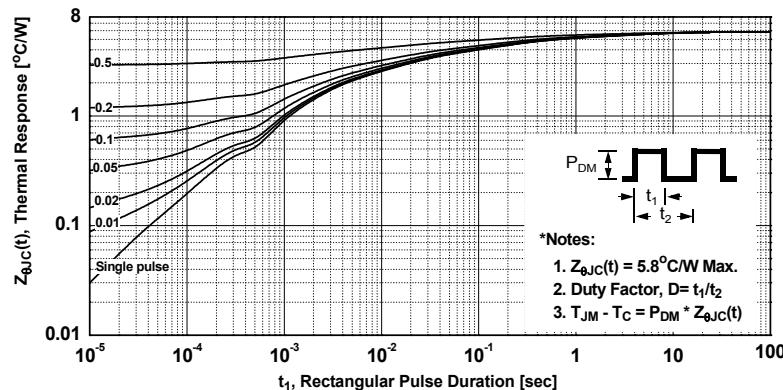
**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Transient Thermal Response Curve**



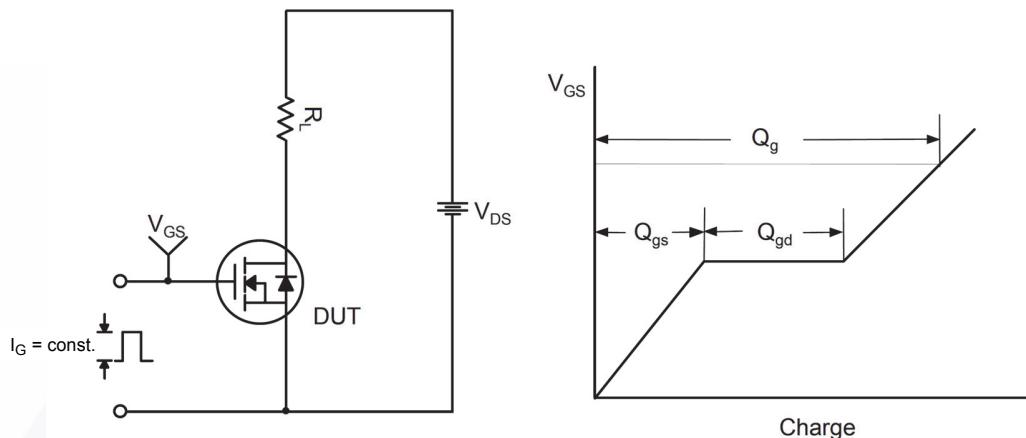


Figure 12. Gate Charge Test Circuit & Waveform

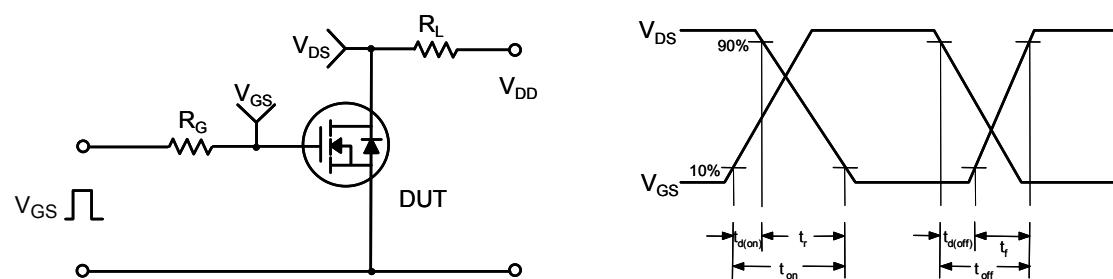


Figure 13. Resistive Switching Test Circuit & Waveforms

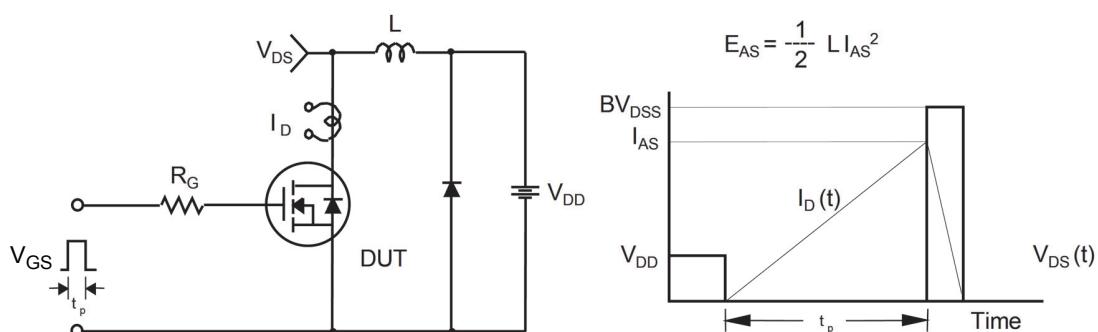
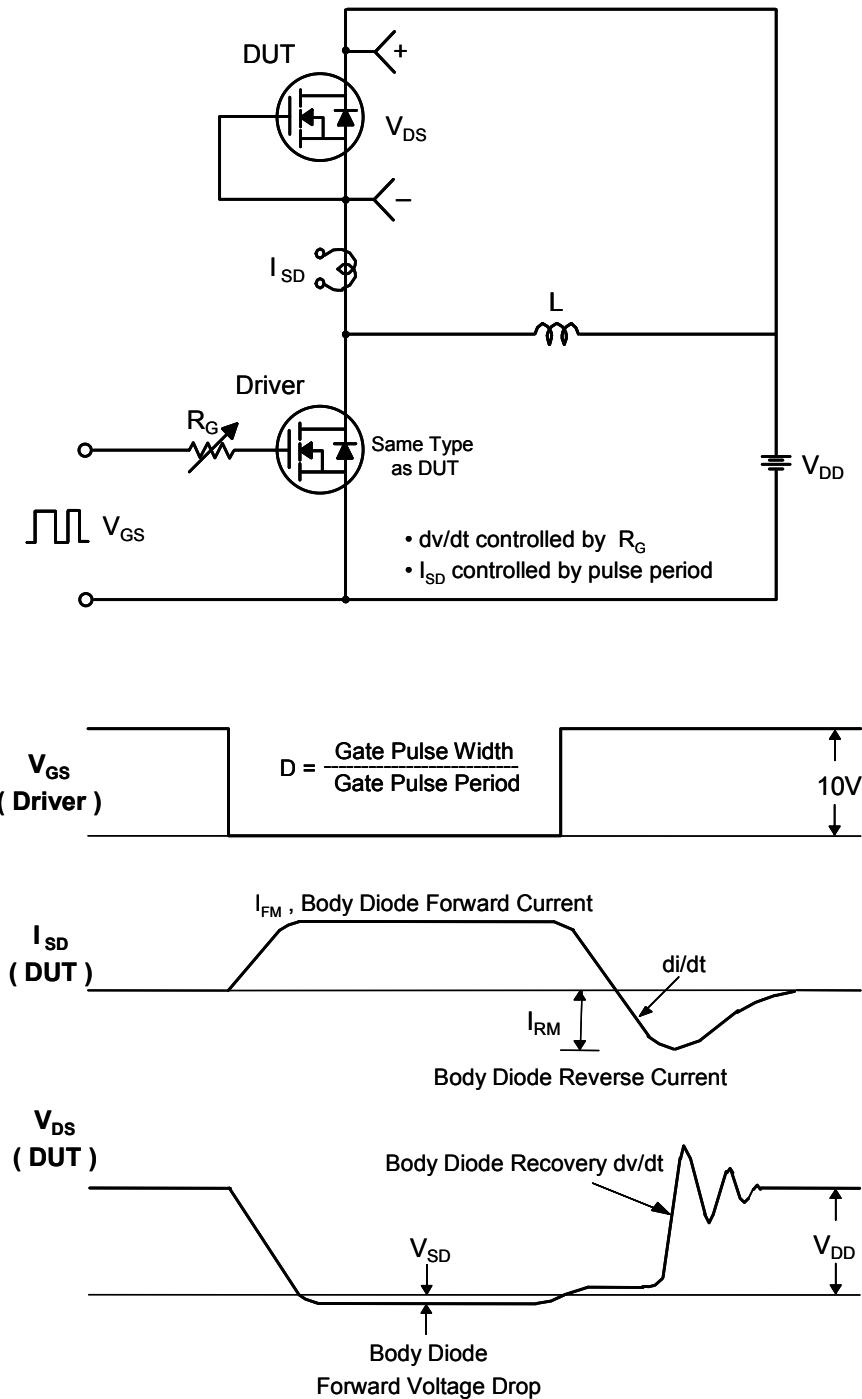
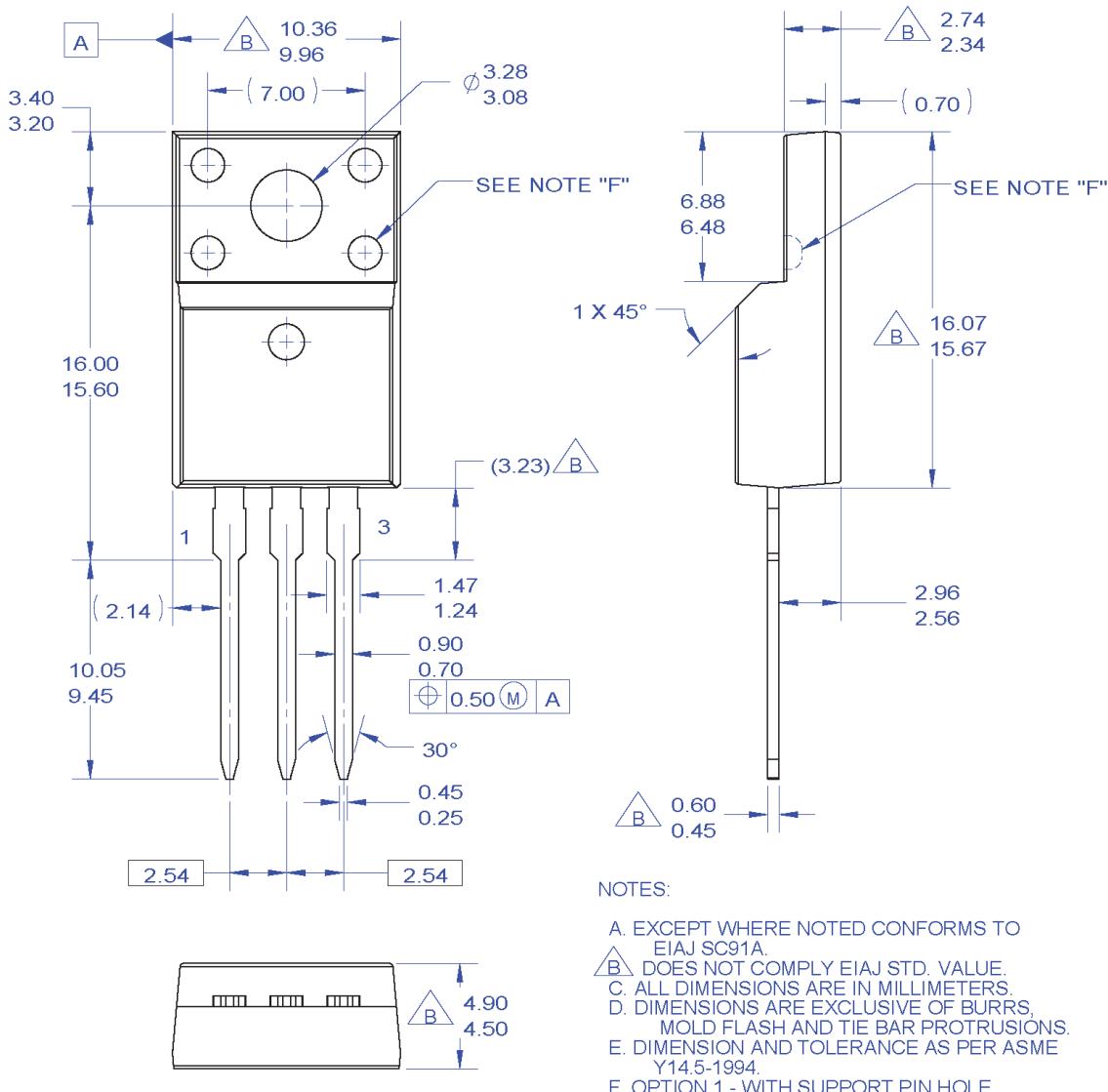


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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

## Mechanical Dimensions



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

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