



# FDP18N20F / FDPF18N20FT

## N-Channel UniFET™ FRFET® MOSFET

### 200 V, 18 A, 140 mΩ

#### Features

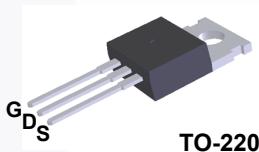
- $R_{DS(on)} = 120 \text{ mΩ}$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 9 \text{ A}$
- Low Gate Charge (Typ. 20 nC)
- Low  $C_{rss}$  (Typ. 24 pF)
- 100% Avalanche Tested
- RoHS Compliant

#### Applications

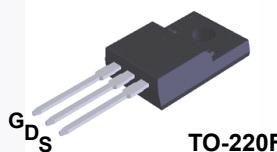
- LCD/LED TV
- Consumer Appliances
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

#### Description

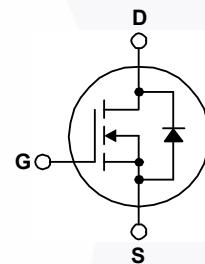
UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. The body diode's reverse recovery performance of UniFET FRFET® MOSFET has been enhanced by lifetime control. Its  $t_{rr}$  is less than 100nsec and the reverse dv/dt immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET's body diode is significant. 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.



TO-220



TO-220F



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

Symbol	Parameter		FDP18N20F	FDPF18N20FT	Unit
$V_{DSS}$	Drain to Source Voltage		200		V
$V_{GSS}$	Gate to Source Voltage		$\pm 30$		V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	18	18*	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	10.8	10.8*	
$I_{DM}$	Drain Current	- Pulsed (Note 1)	72	72*	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		324		mJ
$I_{AR}$	Avalanche Current (Note 1)		18		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)		10		mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)		4.5		V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	100	41	W	W/ $^\circ\text{C}$
		- Derate Above $25^\circ\text{C}$	0.83	0.33	
$T_J, T_{STG}$	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		$^\circ\text{C}$

\*Drain current limited by maximum junction temperature.

#### Thermal Characteristics

Symbol	Parameter	FDP18N20F	FDPF18N20FT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.2	3.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP18N20F	FDP18N20F	TO-220	Tube	N/A	N/A	50 units
FDPF18N20FT	FDPF18N20FT	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	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}, T_J = 25^\circ\text{C}$	200	-	-	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}, \text{Referenced to } 25^\circ\text{C}$	-	0.2	-	$\text{V}/^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS} = 200 \text{ V}, V_{GS} = 0 \text{ V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 160 \text{ V}, T_C = 125^\circ\text{C}$	-	-	100	
$I_{\text{GSS}}$	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	3.0	-	5.0	V
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 9 \text{ A}$	-	0.12	0.14	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20 \text{ V}, I_D = 9 \text{ A}$	-	13.6	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	885	1180	pF
$C_{oss}$	Output Capacitance		-	200	270	pF
$C_{rss}$	Reverse Transfer Capacitance		-	24	35	pF
$Q_{g(\text{tot})}$	Total Gate Charge at 10V		-	20	26	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DS} = 160 \text{ V}, I_D = 18 \text{ A}, V_{GS} = 10 \text{ V}$	-	5	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	9	nC

### Switching Characteristics

$t_{d(\text{on})}$	Turn-On Delay Time	$V_{DD} = 100 \text{ V}, I_D = 18 \text{ A}, V_{GS} = 10 \text{ V}, R_G = 25 \Omega$	-	16	40	ns
$t_r$	Turn-On Rise Time		-	50	110	ns
$t_{d(\text{off})}$	Turn-Off Delay Time		-	50	110	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	40	90

### Drain-Source Diode Characteristics

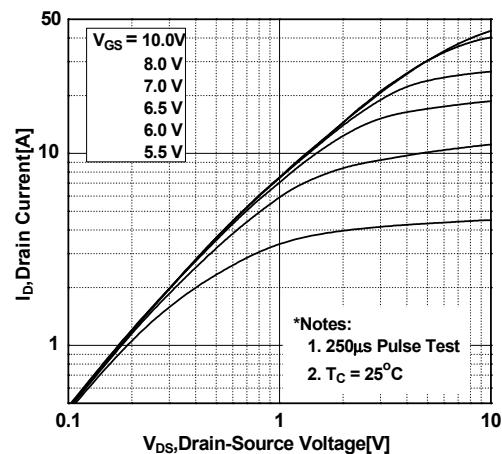
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	18	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	72	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 18 \text{ A}$	-	-	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{SD} = 18 \text{ A}, \text{d}I/\text{d}t = 100 \text{ A}/\mu\text{s}$	-	80	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	240	-	nC

#### Notes:

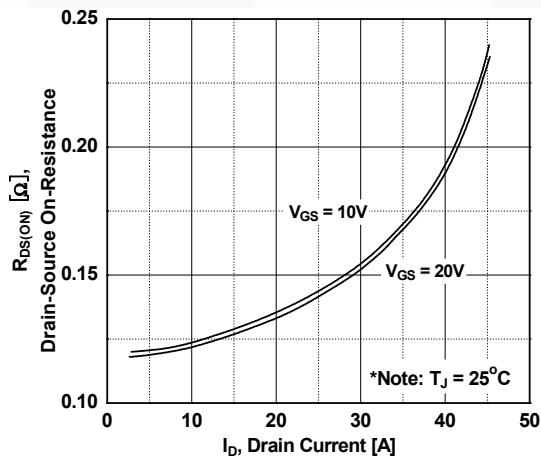
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $L = 2 \text{ mH}, I_{AS} = 18 \text{ A}, V_{DD} = 50 \text{ V}, R_G = 2.5 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 18 \text{ A}, \text{d}I/\text{d}t \leq 200 \text{ A}/\mu\text{s}, V_{DD} \leq \text{BV}_{\text{DSS}}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

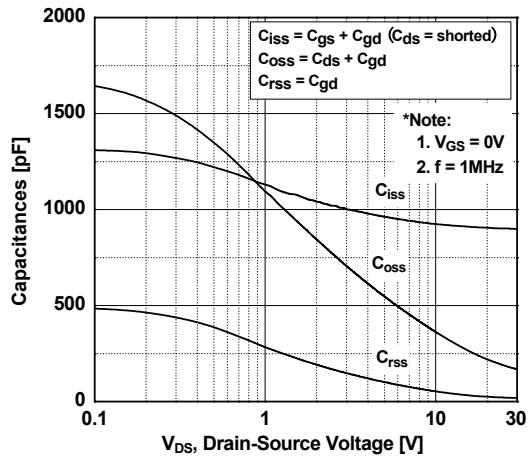
**Figure 1. On-Region Characteristics**



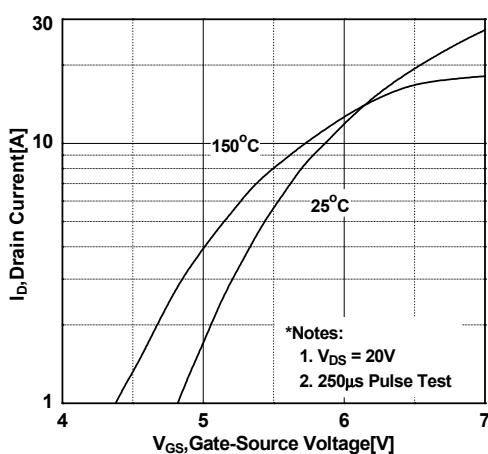
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



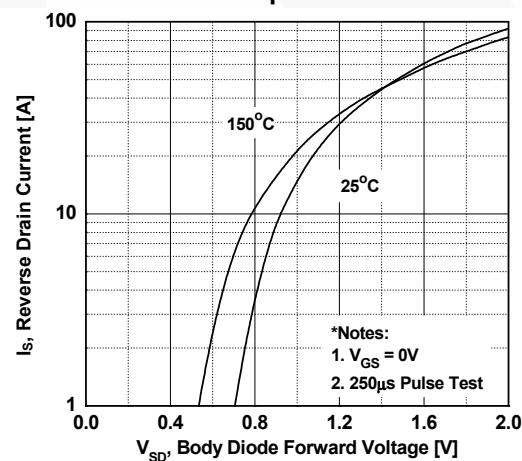
**Figure 5. Capacitance Characteristics**



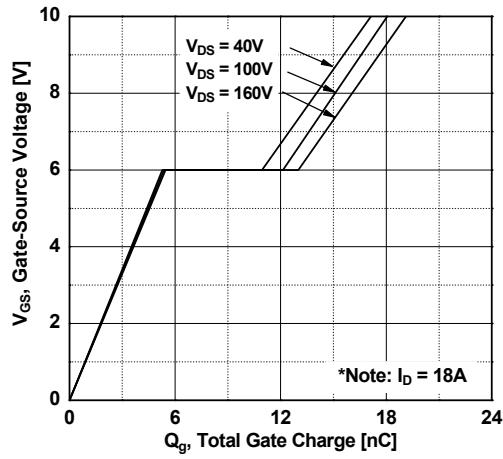
**Figure 2. Transfer Characteristics**



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

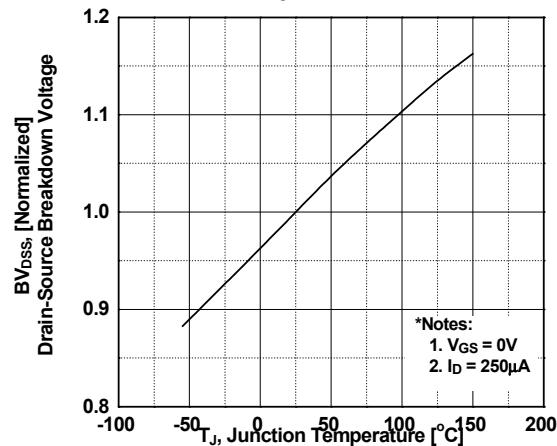


**Figure 6. Gate Charge Characteristics**

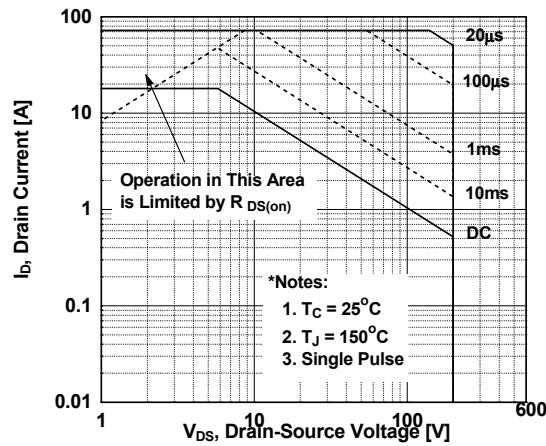


## Typical Performance Characteristics (Continued)

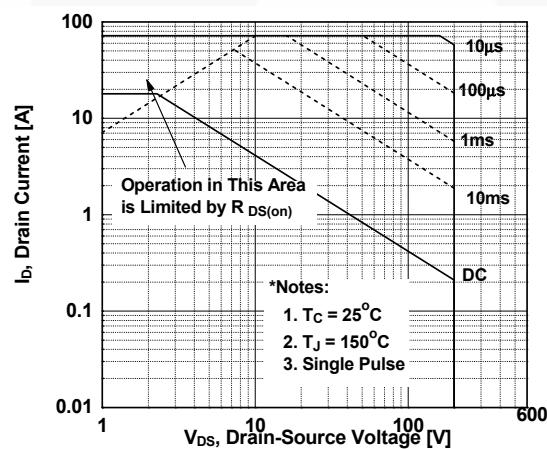
**Figure 7. Breakdown Voltage Variation vs. Temperature**



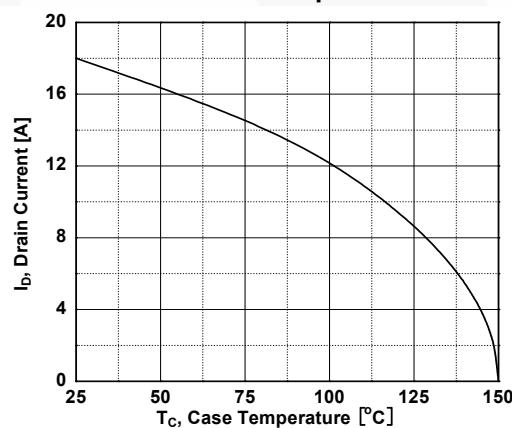
**Figure 8-1. Maximum Safe Operating Area - FDP18N20F**



**Figure 8-2. Maximum Safe Operating Area - FDPF18N20FT**



**Figure 9. Maximum Drain Current vs. Case Temperature**



**Figure 10-1. Transient Thermal Response Curve - FDP18N20F**

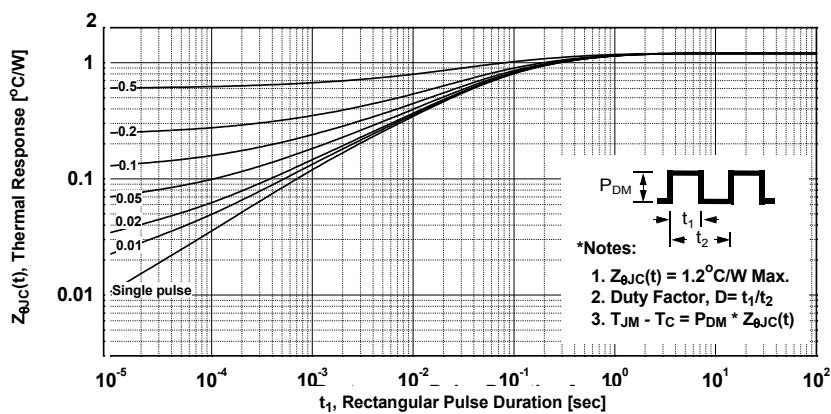
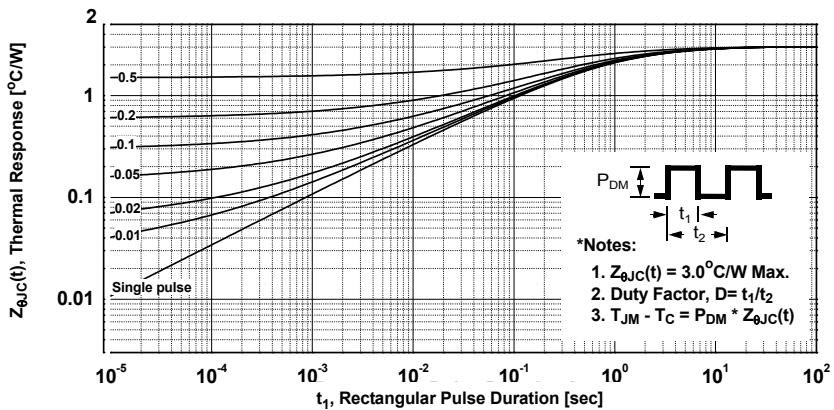


Figure 10-2. Transient Thermal Response Curve - FDPF18N20FT



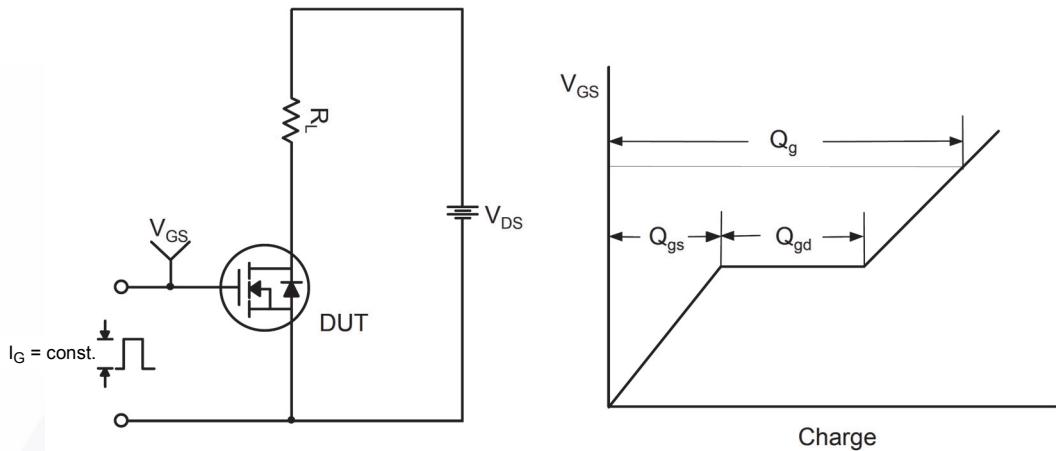


Figure 11. Gate Charge Test Circuit & Waveform

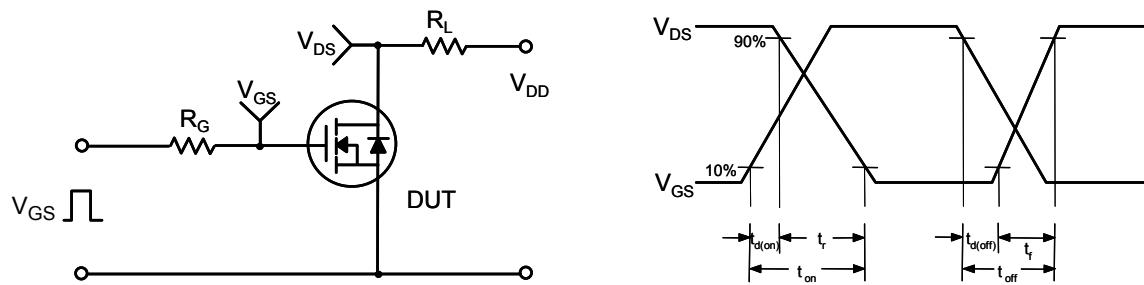


Figure 12. Resistive Switching Test Circuit & Waveforms

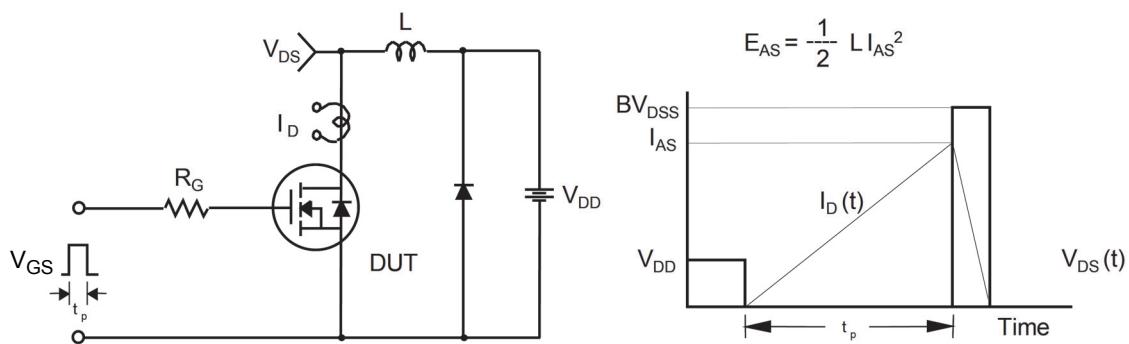


Figure 13. Unclamped Inductive Switching Test Circuit & Waveforms

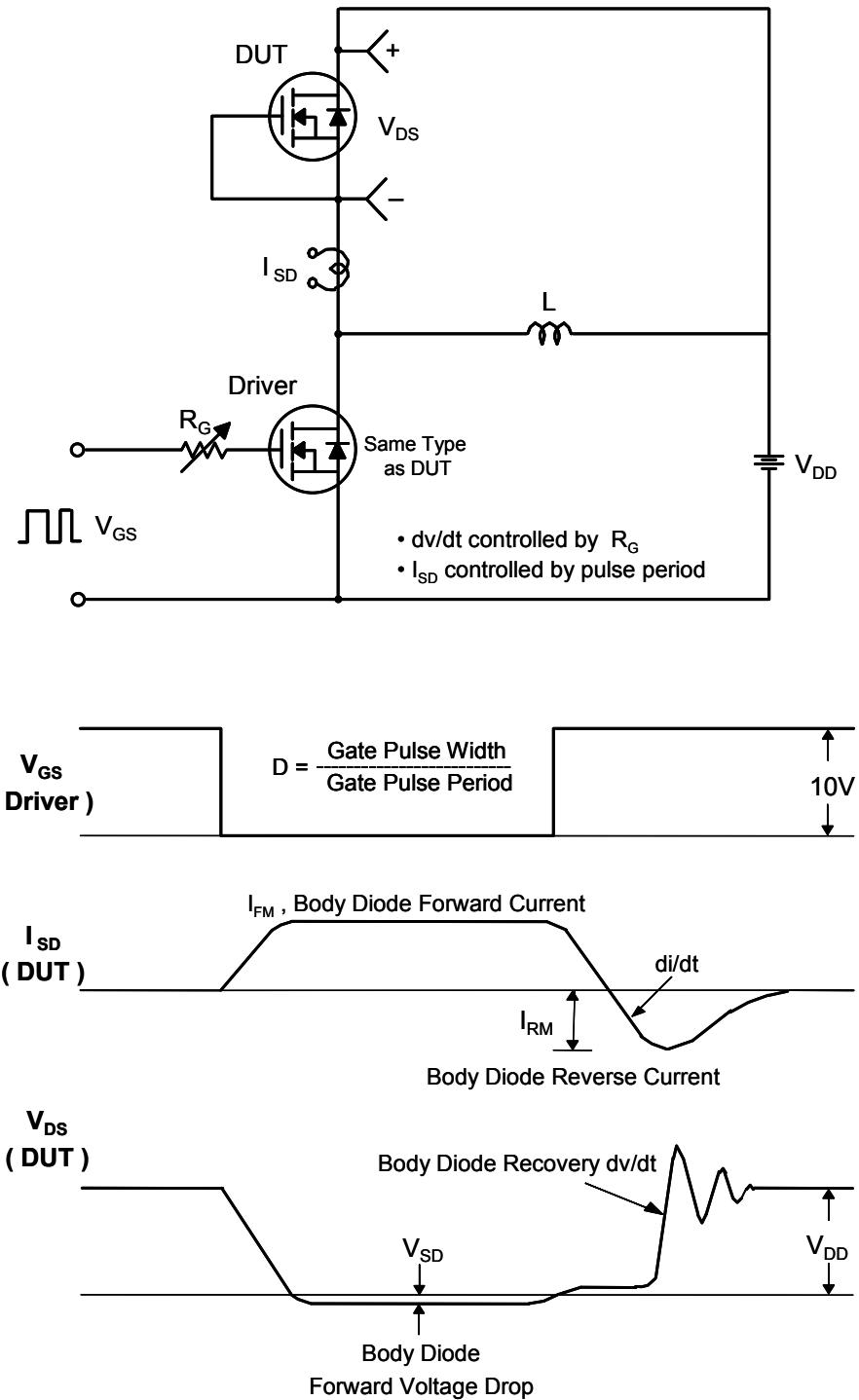


Figure 14. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions

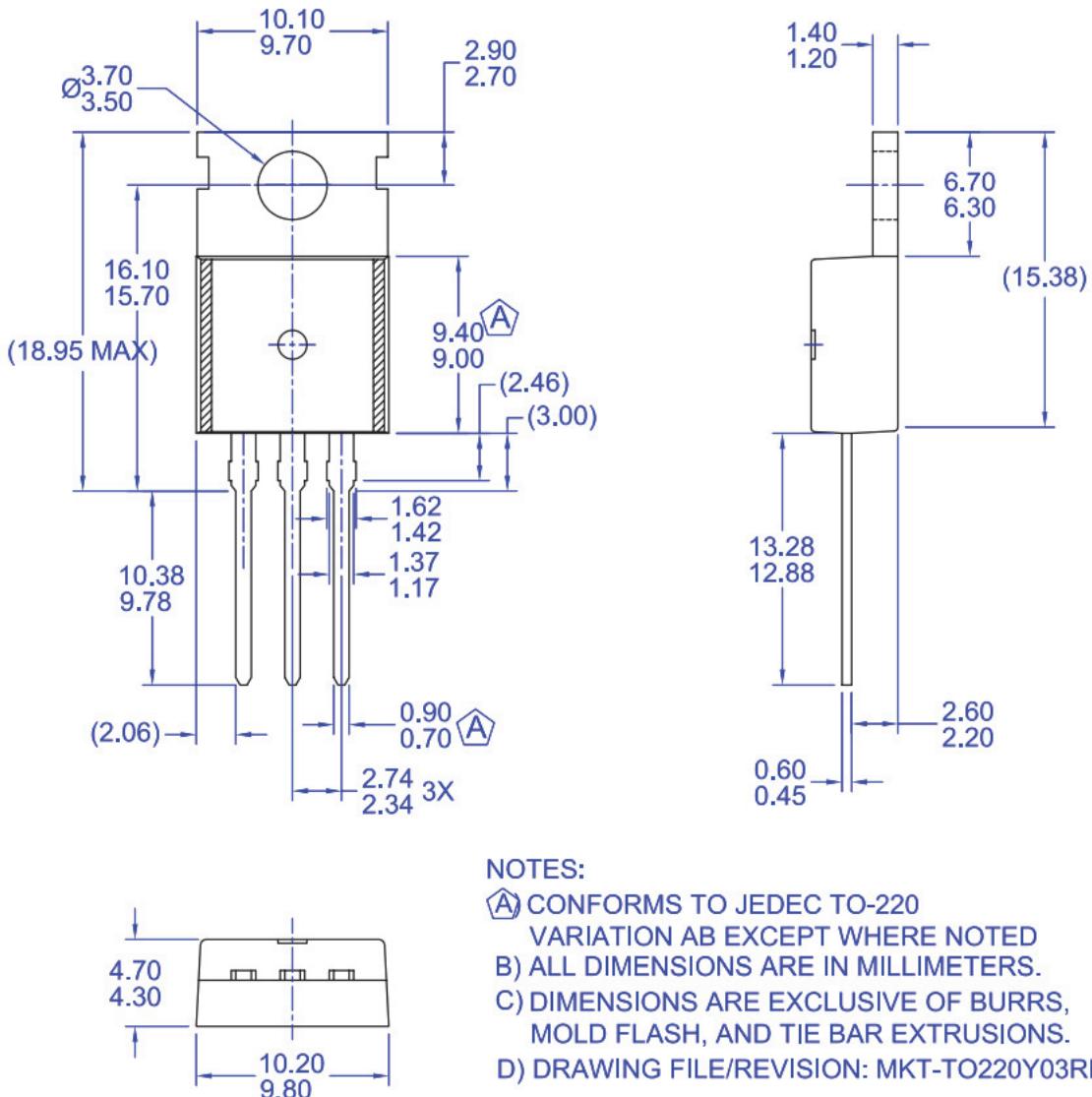


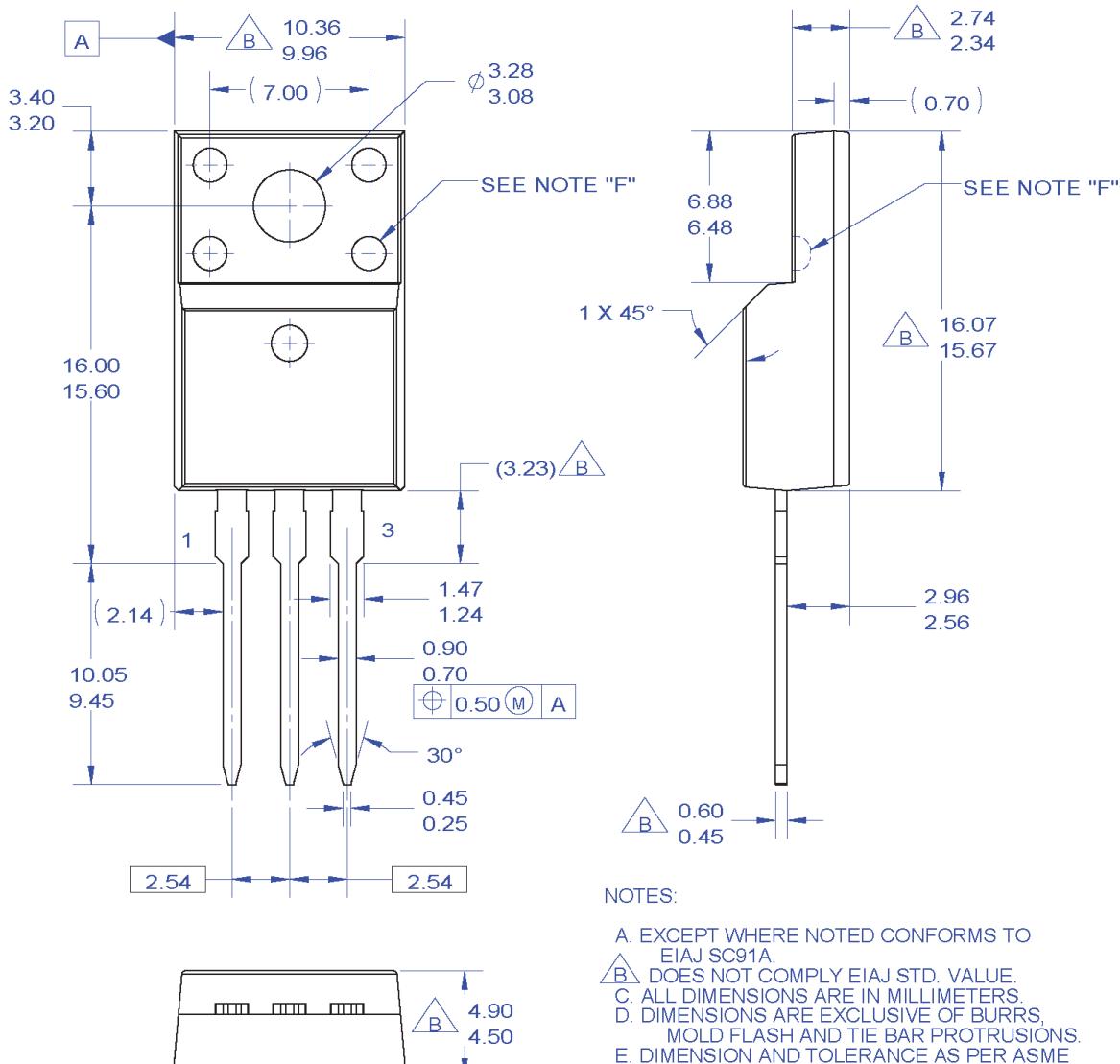
Figure 15. TO220, Molded, 3-Lead, Jedec Variation AB

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## Mechanical Dimensions



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

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