FAIRCHILD SEMICONDUCTOR®

November 2013

FDP18N20F / FDPF18N20FT

N-Channel UniFET™ FRFET® MOSFET

200 V, 18 A, 140 mΩ

Features

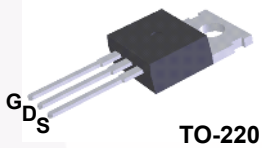
- $R_{DS(on)}$ = 120 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 9 A
- Low Gate Charge (Typ. 20 nC)
- Low C_{rss} (Typ. 24 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

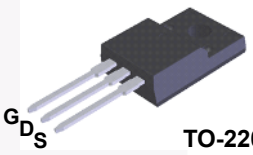
- LCD/LED TV
- Consumer Appliances
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

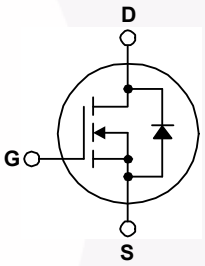
UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. The body diode's reverse recovery performance of 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°C unless otherwise noted.

Symbol	Parameter		FDP18N20F	FDPF18N20FT	Unit
V_{DSS}	Drain to Source Voltage		200		V
V_{GSS}	Gate to Source Voltage		±30		V
I_D	Drain Current	- Continuous (T_C = 25°C)	18	18*	A
		- Continuous (T_C = 100°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°C)	100	41	W
		- Derate Above 25°C	0.83	0.33	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300		°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	°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 $T_C = 25^oC$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V, T_J = 25°C	200	-	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.2	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 200 V, V_{GS} = 0 V	-	-	10	μA
		V_{DS} = 160 V, T_C = 125°C	-	-	100	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 9 A	-	0.12	0.14	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 9 A	-	13.6	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	885	1180	pF
C_{oss}	Output Capacitance		-	200	270	pF
C_{rss}	Reverse Transfer Capacitance		-	24	35	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 160 V, I_D = 18 A, V_{GS} = 10 V (Note 4)	-	20	26	nC
Q_{gs}	Gate to Source Gate Charge		-	5	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	9	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 100 V, I_D = 18 A, V_{GS} = 10 V, R_G = 25 Ω (Note 4)	-	16	40	ns
t_r	Turn-On Rise Time		-	50	110	ns
$t_{d(off)}$	Turn-Off Delay Time		-	50	110	ns
t_f	Turn-Off Fall Time		-	40	90	ns
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 V, I_{SD} = 18 A	-	-	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 18 A, dI_F/dt = 100 A/μs	-	80	-	ns
Q_{rr}	Reverse Recovery Charge		-	240	-	nC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 2 mH, I_{AS} = 18 A, V_{DD} = 50 V, R_G = 2 5Ω, starting T_J = 25°C.
3. I_{SD} ≤ 18 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

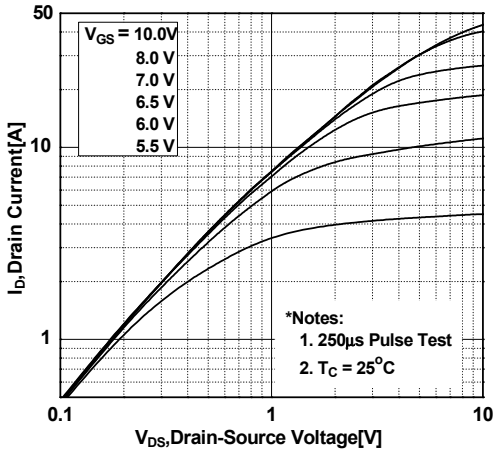


Figure 2. Transfer Characteristics

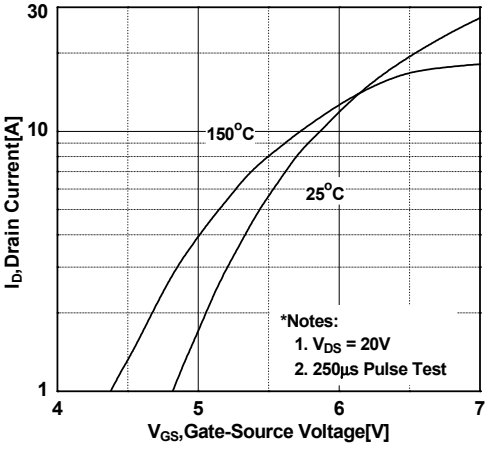


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

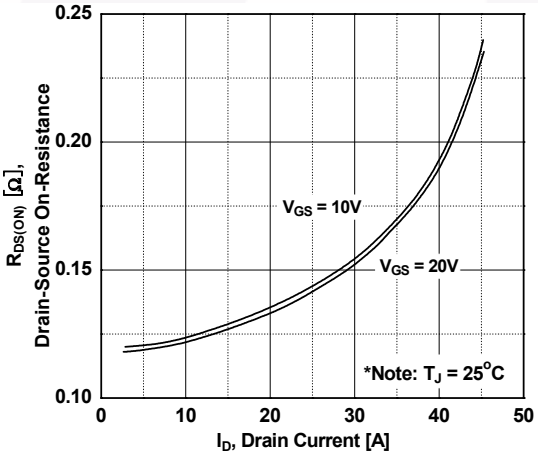


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

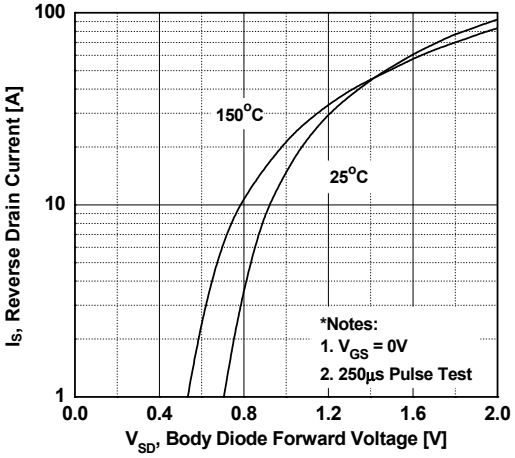


Figure 5. Capacitance Characteristics

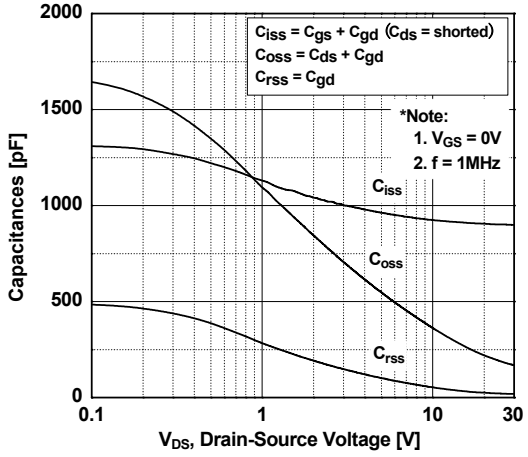
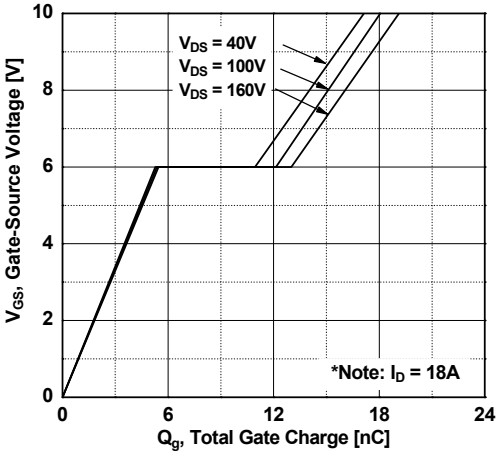


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

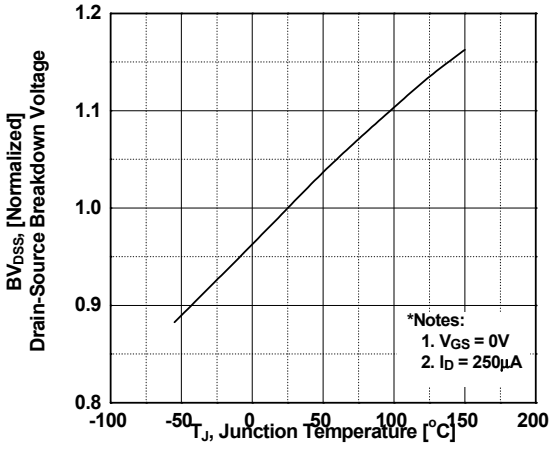


Figure 8-1. Maximum Safe Operating Area - FDP18N20F

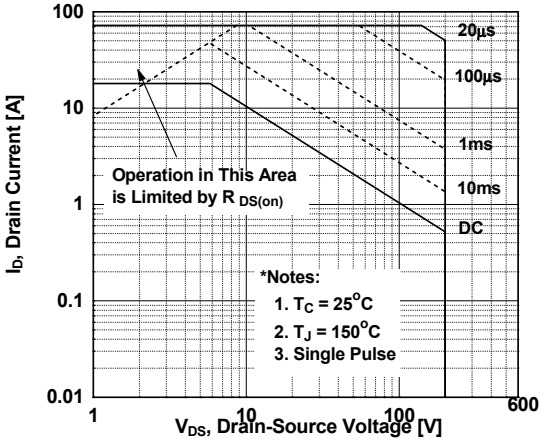


Figure 8-2. Maximum Safe Operating Area - FDPF18N20FT

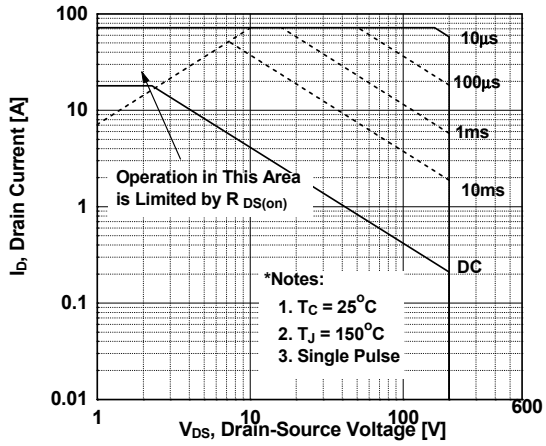


Figure 9. Maximum Drain Current vs. Case Temperature

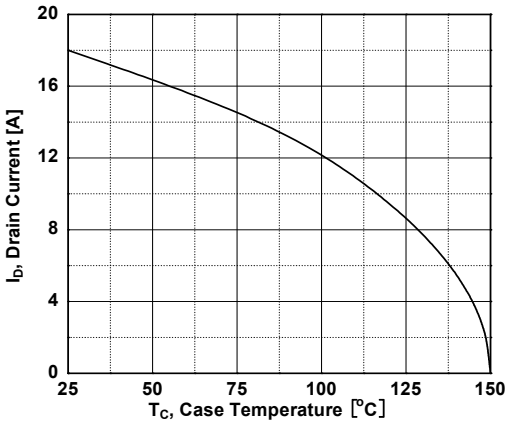


Figure 10-1. Transient Thermal Response Curve - FDP18N20F

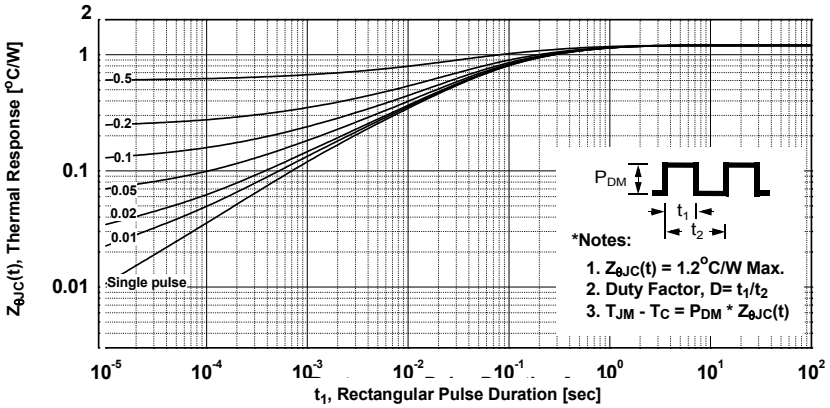
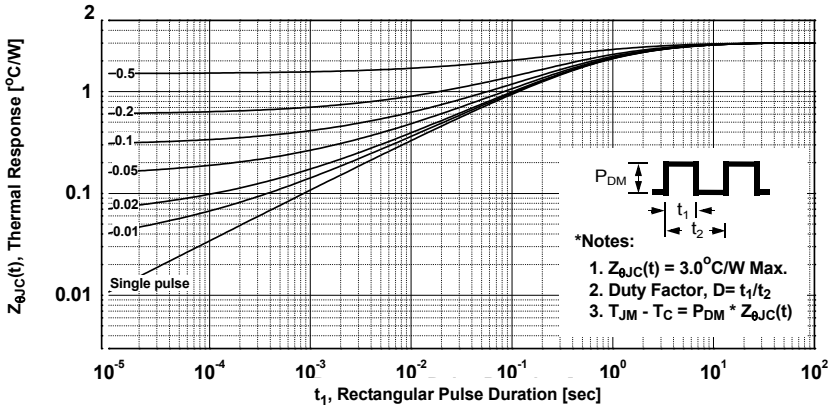


Figure 10-2. Transient Thermal Response Curve - FDPF18N20FT



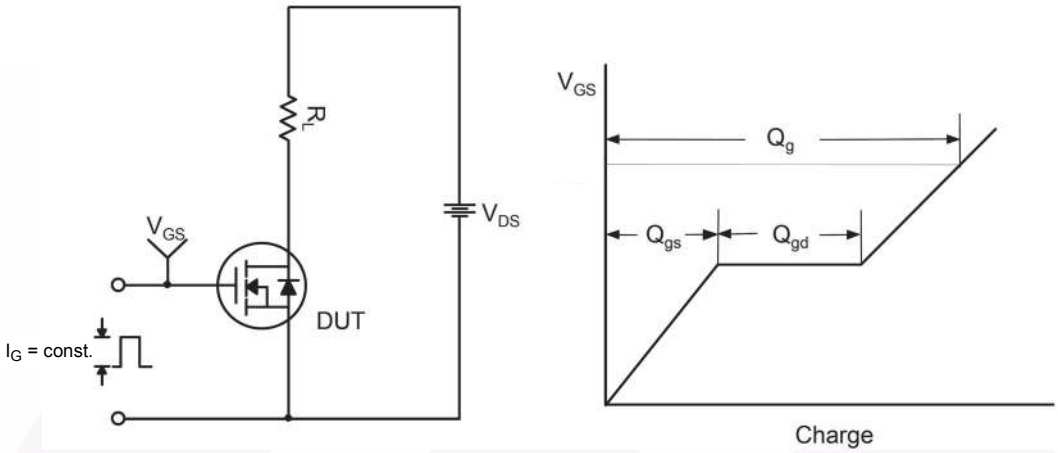


Figure 11. Gate Charge Test Circuit & Waveform

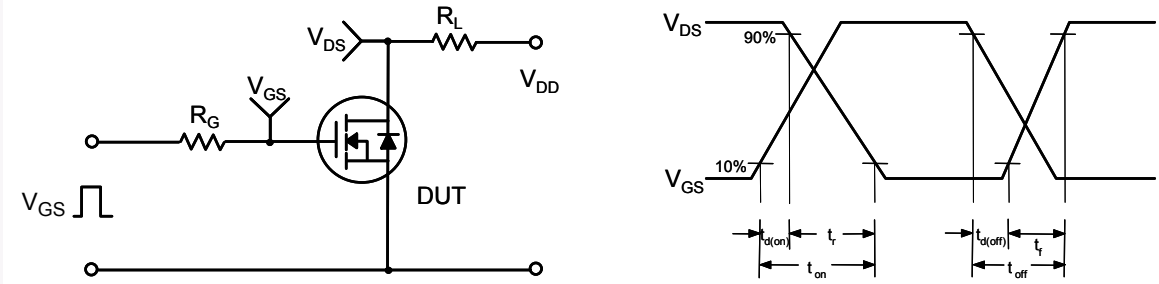


Figure 12. Resistive Switching Test Circuit & Waveforms

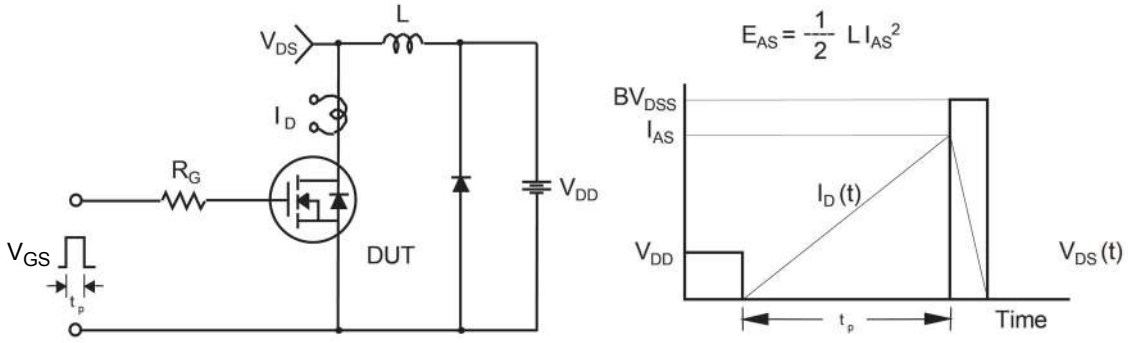


Figure 13. Unclamped Inductive Switching Test Circuit & Waveforms

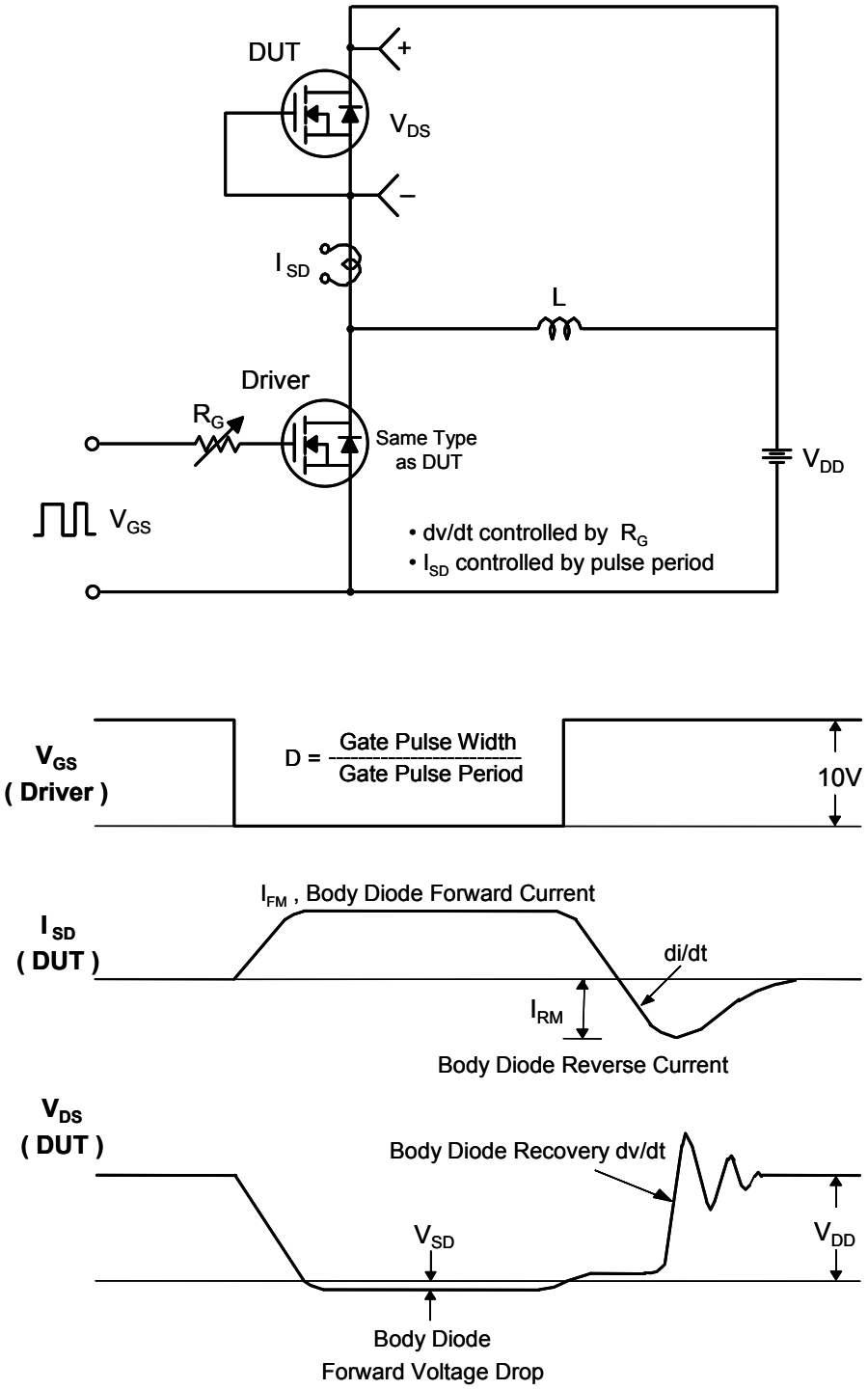


Figure 14. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

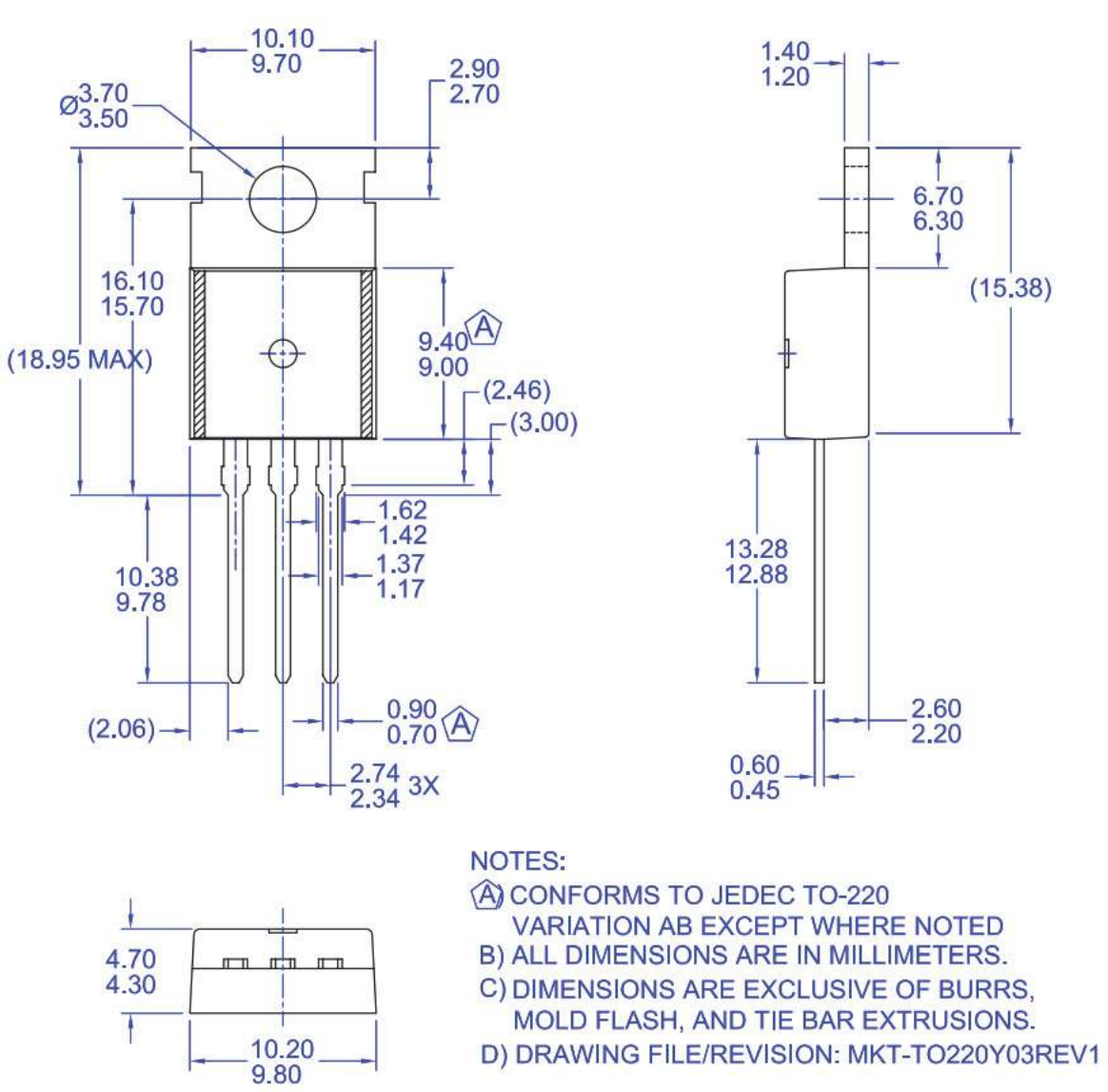


Figure 15. TO220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions

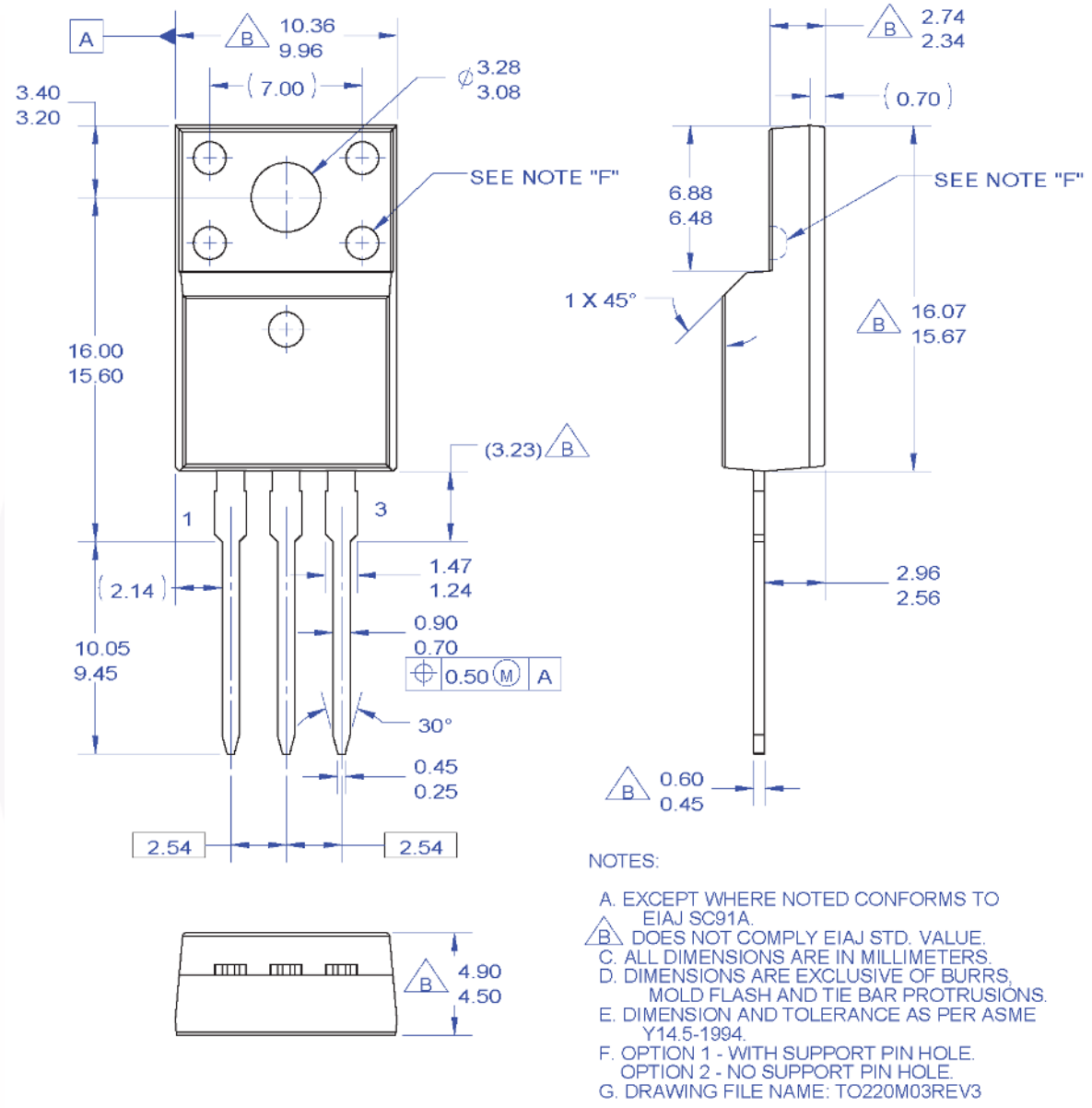

Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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