FAIRCHILD SEMICONDUCTOR®

November 2013

FDP10N60NZ / FDPF10N60NZ

N-Channel UniFET™ II MOSFET

600 V, 10 A, 750 mΩ

Features

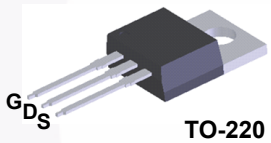
- $R_{DS(on)}$ = 640 mΩ (Typ.) @ V_{GS} = 10 V, I_D = 5 A
- Low Gate Charge (Typ. 23 nC)
- Low C_{rss} (Typ. 10 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability
- ESD Improved Capability
- RoHS Compliant

Applications

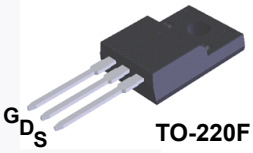
- LCD/ LED/ PDP TV
- Lighting
- Uninterruptible Power Supply

Description

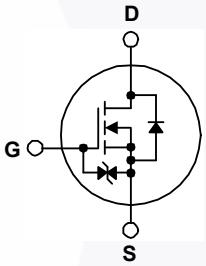
UniFET™ II MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on advanced planar stripe and DMOS technology. This advanced MOSFET family has the smallest on-state resistance among the planar MOSFET, and also provides superior switching performance and higher avalanche energy strength. In addition, internal gate-source ESD diode allows UniFET II MOSFET to withstand over 2kV HBM surge stress. 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		FDP10N60NZ	FDPF10N60NZ	Unit
V_{DSS}	Drain to Source Voltage		600		V
V_{GSS}	Gate to Source Voltage		±25		V
I_D	Drain Current	- Continuous (T_C = 25°C)	10	10*	A
		- Continuous (T_C = 100°C)	6	6*	
I_{DM}	Drain Current	- Pulsed (Note 1)	40	40*	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	550		mJ
I_{AR}	Avalanche Current	(Note 1)	10		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	18.5		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	10		V/ns
P_D	Power Dissipation	(T_C = 25°C)	185	38	W
		- Derate Above 25°C	1.5	0.3	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

*Dran current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FDP10N60NZ	FDPF10N60NZ	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.68	3.3	°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
FDP10N60NZ	FDP10N60NZ	TO-220	Tube	N/A	N/A	50 units
FDPF10N60NZ	FDPF10N60NZ	TO-220F	Tube	N/A	N/A	50 units

Electrical Characteristics T_C = 25°C 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	600	-	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.6	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	-	-	1	μA
		V_{DS} = 480 V, T_C = 125°C	-	-	10	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±25 V, V_{DS} = 0 V	-	-	±10	μA
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 = 5 A	-	0.64	0.75	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 5 A	-	14	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	1110	1475	pF
C_{oss}	Output Capacitance		-	130	175	pF
C_{rss}	Reverse Transfer Capacitance		-	10	15	pF
Q_g	Total Gate Charge at 10V	V_{DS} = 480 V, I_D = 10 A, V_{GS} = 10 V (Note 4)	-	23	30	nC
Q_{gs}	Gate to Source Gate Charge		-	6	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	8	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 10 A, V_{GS} = 10 V, R_G = 25 W (Note 4)	-	25	60	ns
t_r	Turn-On Rise Time		-	50	110	ns
$t_{d(off)}$	Turn-Off Delay Time		-	70	150	ns
t_f	Turn-Off Fall Time		-	50	110	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	10	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	40	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 10 A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 10 A, dI_F/dt = 100 A/μs	-	300	-	ns
Q_{rr}	Reverse Recovery Charge		-	2.0	-	μC

Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 11 mH, I_{AS} = 10 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 10 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

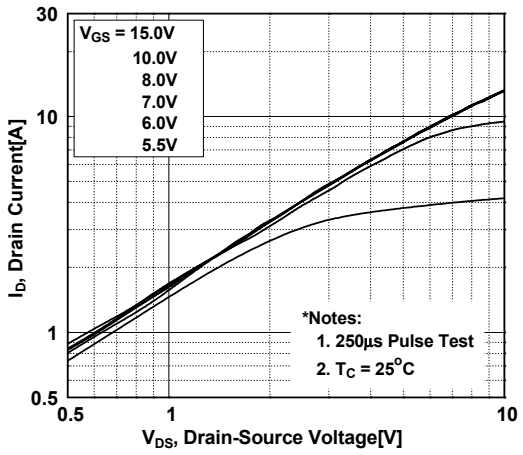


Figure 2. Transfer Characteristics

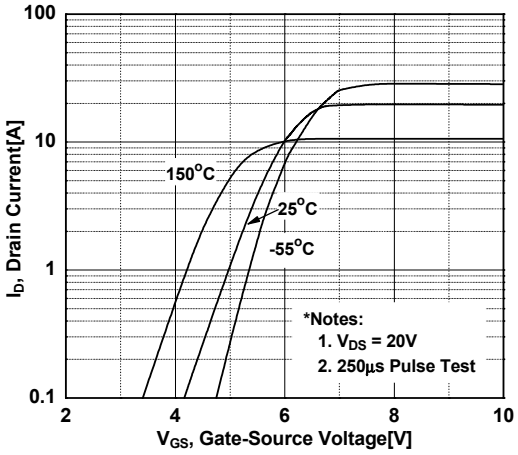


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

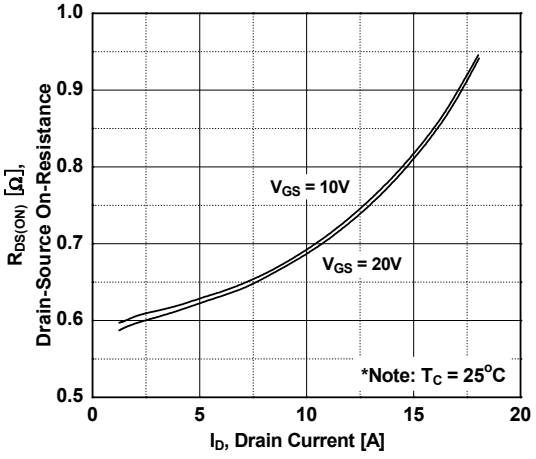


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

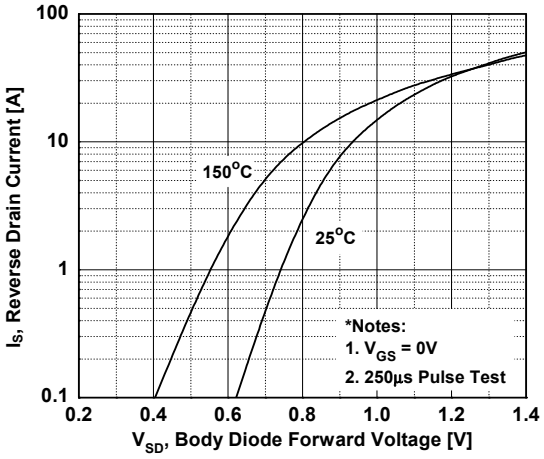


Figure 5. Capacitance Characteristics

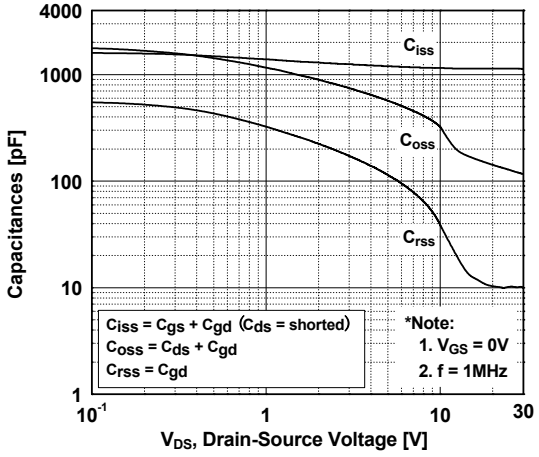
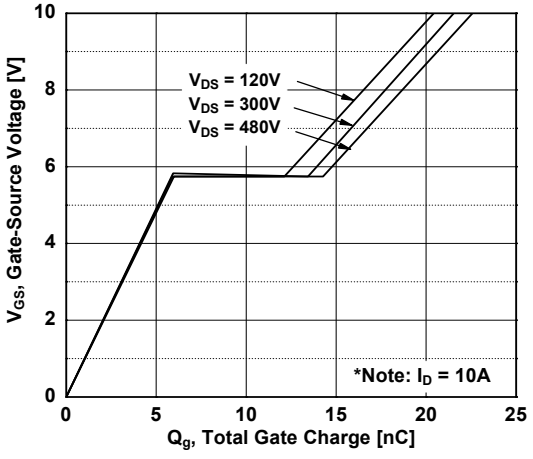


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

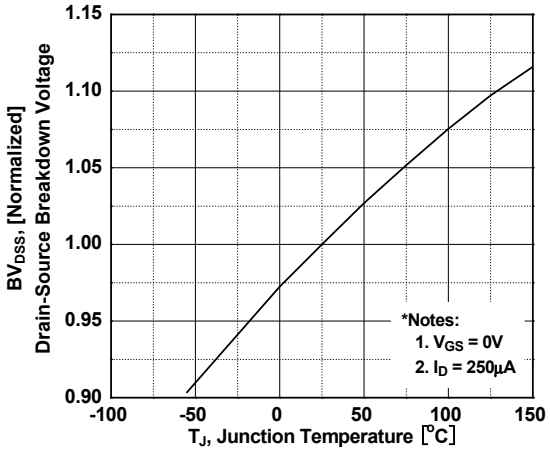


Figure 8. On-Resistance Variation vs. Temperature

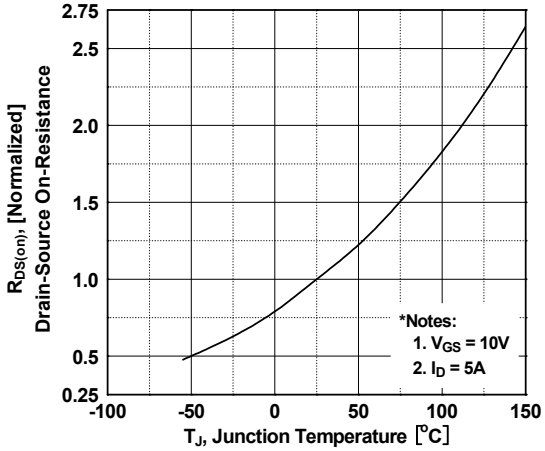


Figure 9. Maximum Safe Operating Area - FDP10N60NZ

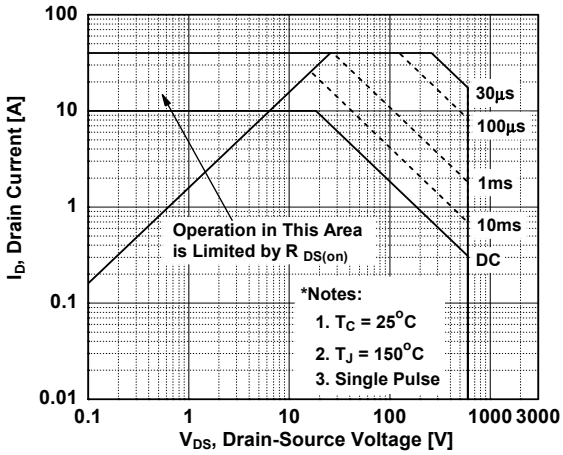


Figure 10. Maximum Safe Operating Area - FDPF10N60NZ

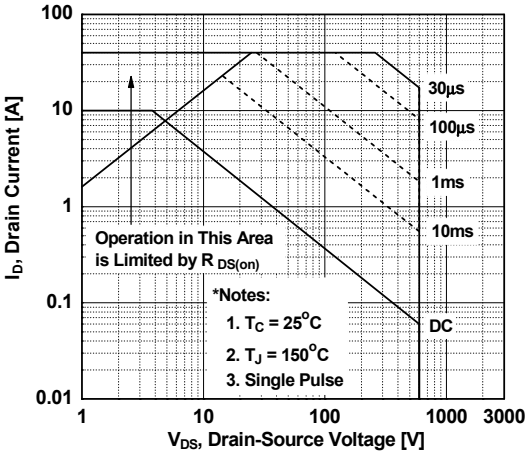
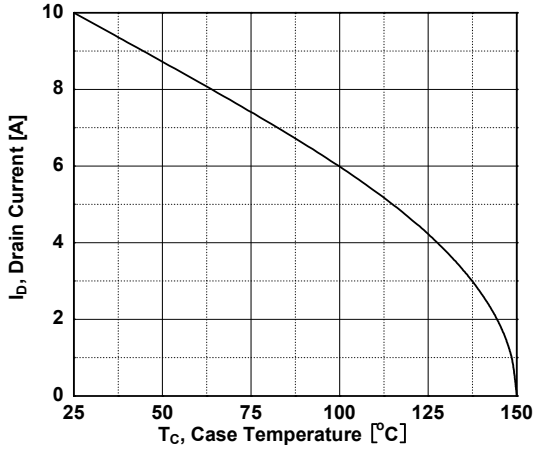


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve - FDP10N60NZ

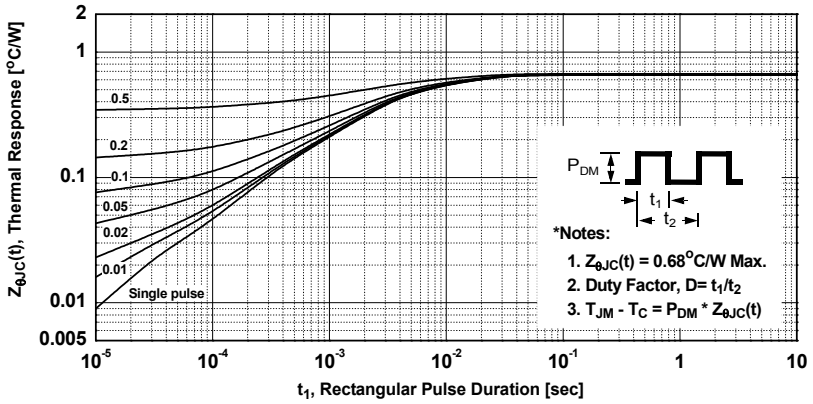
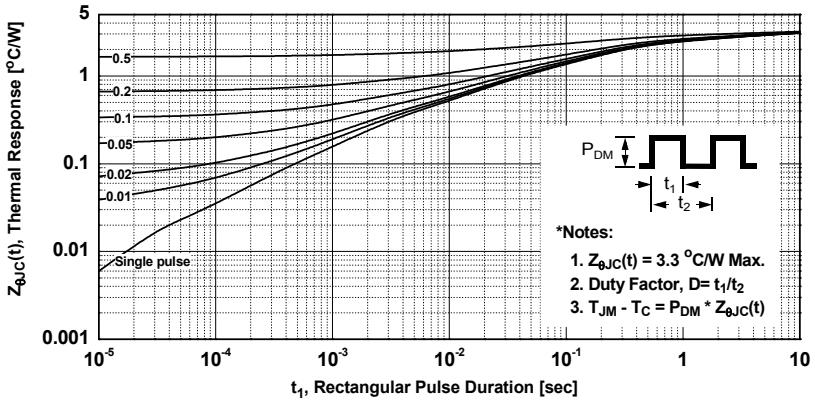


Figure 13. Transient Thermal Response Curve - FDPF10N60NZ



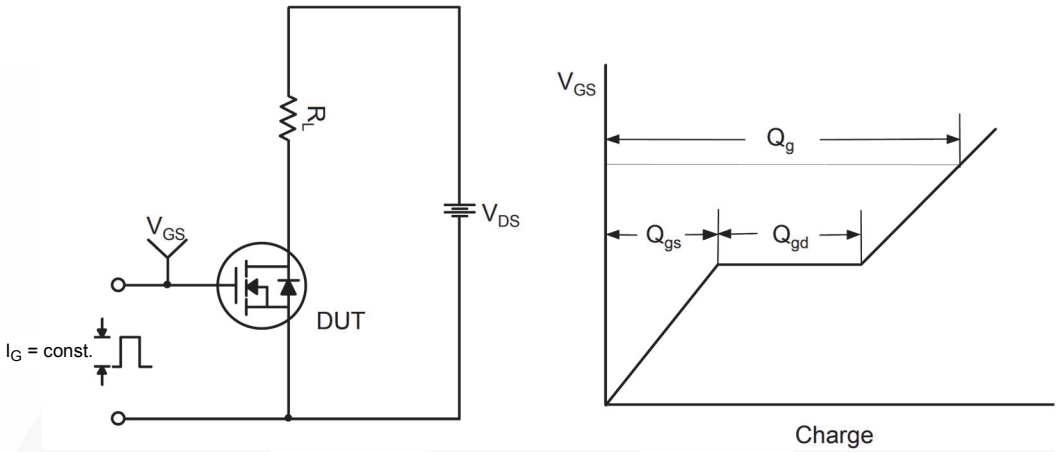


Figure 14. Gate Charge Test Circuit & Waveform

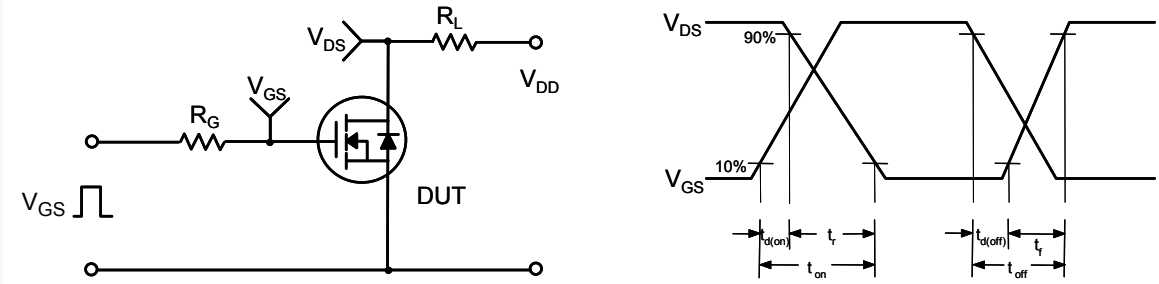


Figure 15. Resistive Switching Test Circuit & Waveforms

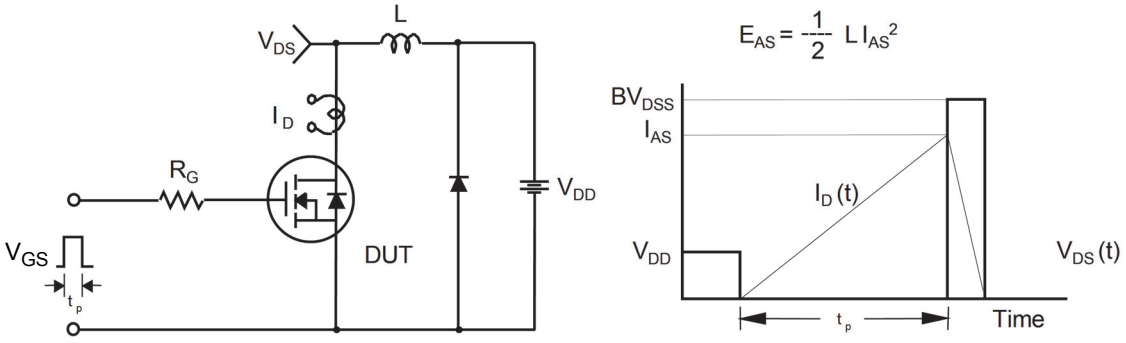


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

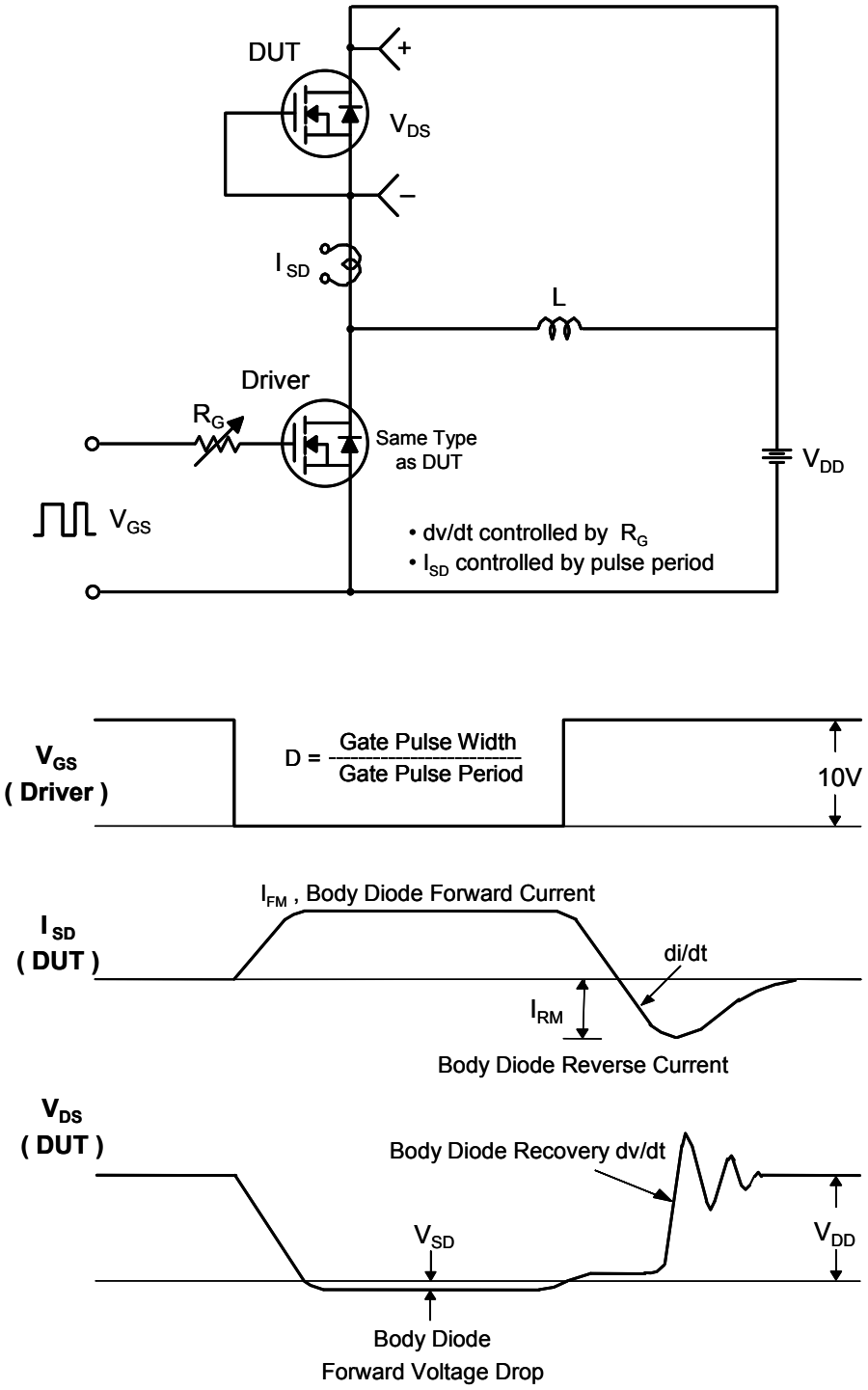


Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

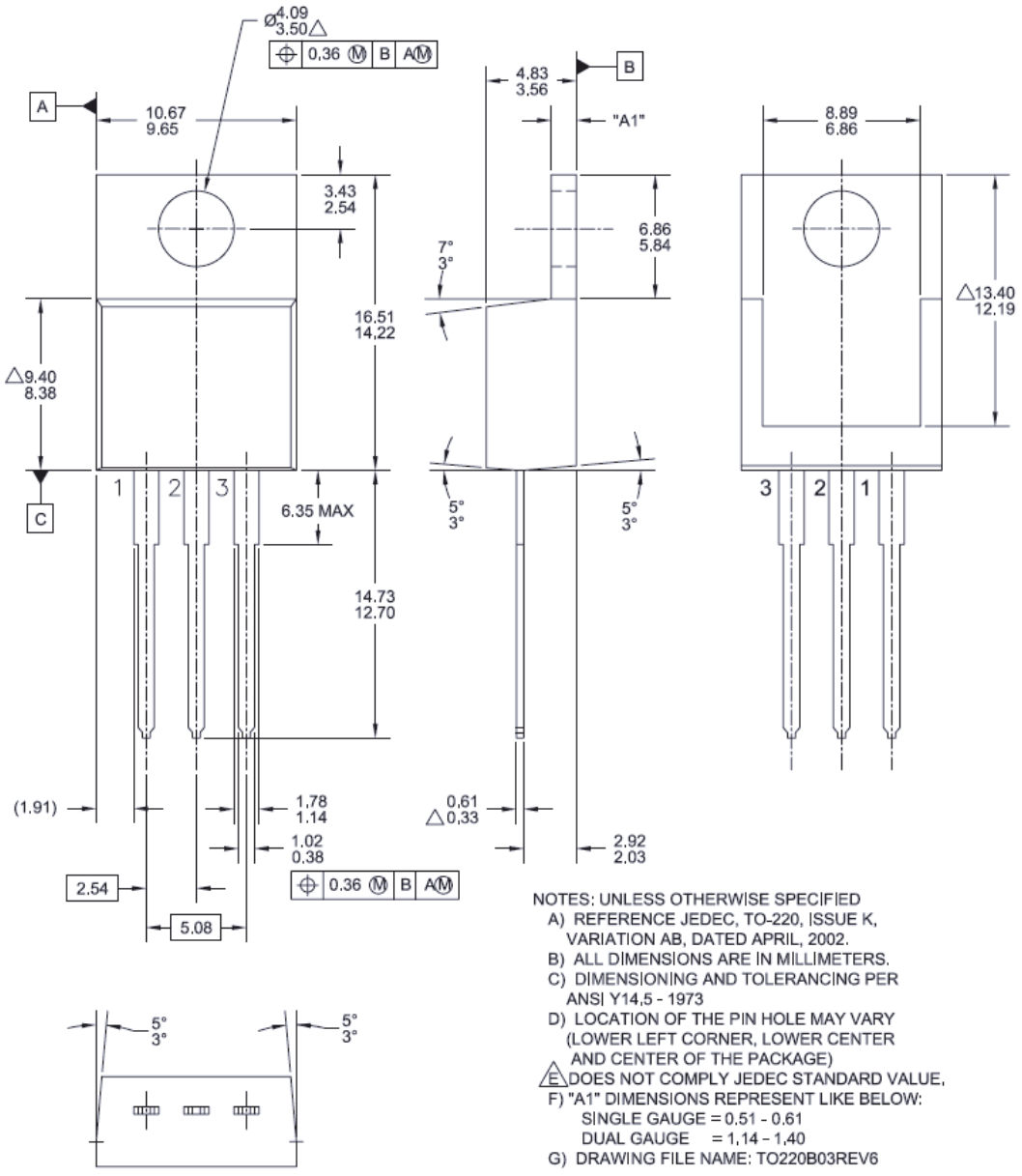


Figure 18. TO-220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions

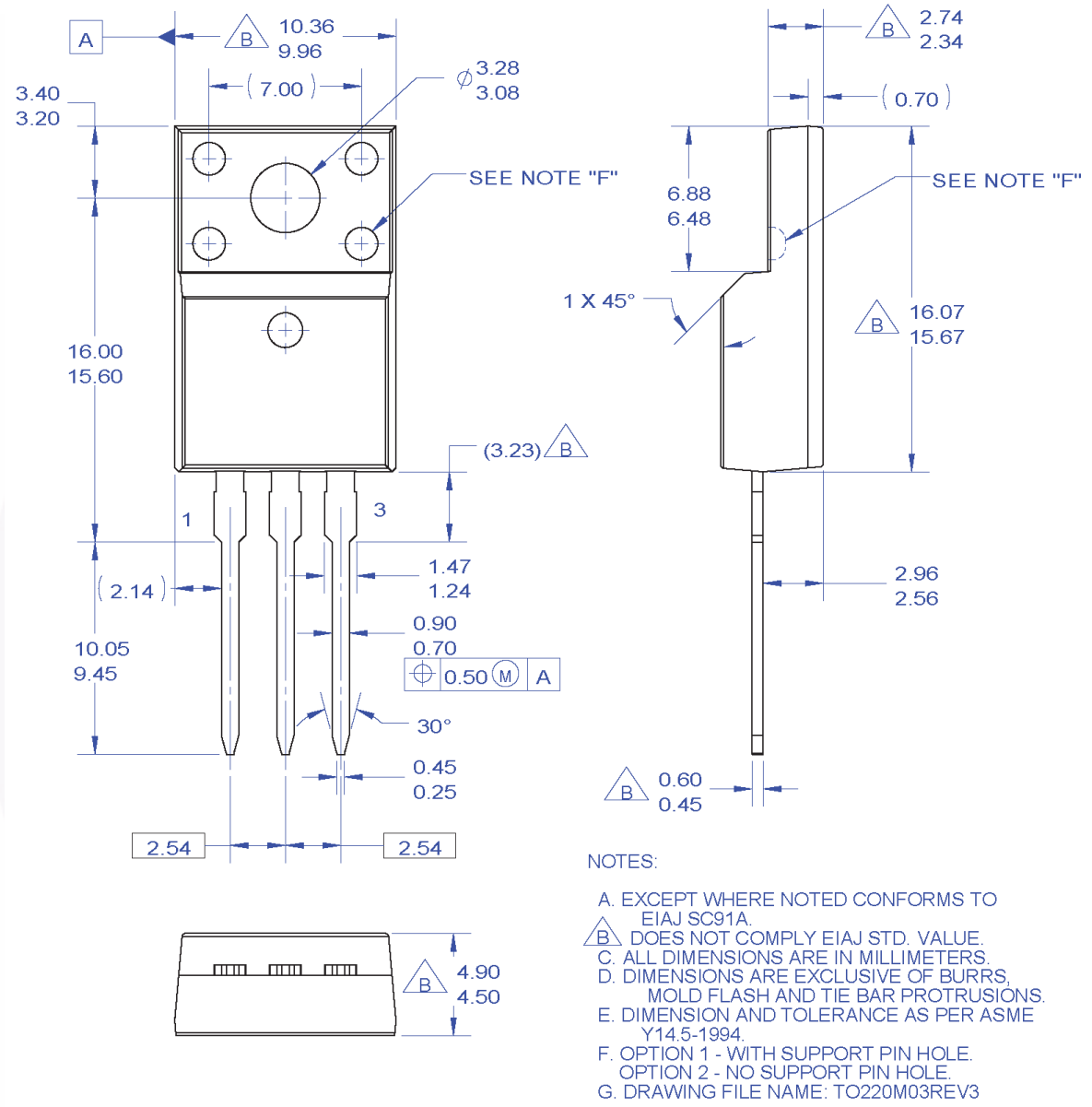

Figure 19. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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