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FDP52N20 / FDPF52N20T

N-Channel UniFET™ MOSFET

200 V, 52 A, ($\sim 1\text{m}\Omega$)

Features

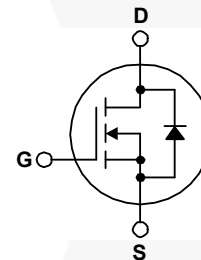
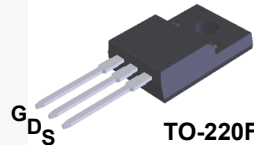
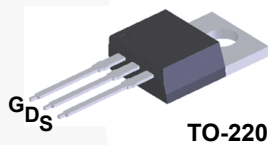
- $R_{DS(on)} = 41\text{ m}\Omega$ (Typ.) @ $V_{GS} = 10\text{ V}$, $I_D = 26\text{ A}$
- Low Gate Charge (Typ. 49 nC)
- Low C_{RSS} (Typ. 66 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

- PDP TV
- 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. 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.



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

Symbol	Parameter	FDP52N20	FDPF52N20T	Unit
V_{DSS}	Drain to Source Voltage	200		V
V_{GSS}	Gate to Source Voltage	± 30		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	52	52*
		- Continuous ($T_C = 100^\circ\text{C}$)	33	33*
I_{DM}	Drain Current	- Pulsed (Note 1)	208	208*
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	2520		mJ
I_{AR}	Avalanche Current (Note 1)	52		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	35.7		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	357	38.5
		- Derate above 25°C	2.86	0.3
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	FDP52N20	FDPF52N20T	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.35	3.3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	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
FDP52N20	FDP52N20	TO-220	Tube	N/A	N/A	50 units
FDPF52N20T	FDPF52N20T	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

BV_{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
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C	-	0.2	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 200 \text{ V}$, $V_{GS} = 0 \text{ V}$	-	-	1	μA
		$V_{DS} = 160 \text{ V}$, $T_C = 125^\circ\text{C}$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}$, $V_{DS} = 0 \text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250 \mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}$, $I_D = 26 \text{ A}$	-	0.041	0.049	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40 \text{ V}$, $I_D = 26 \text{ A}$	-	35	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$ $f = 1 \text{ MHz}$	-	2230	2900	pF
C_{oss}	Output Capacitance		-	540	700	pF
C_{rfs}	Reverse Transfer Capacitance		-	66	100	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 160 \text{ V}$, $I_D = 52 \text{ A}$ $V_{GS} = 10 \text{ V}$	-	49	63	nC
Q_{gs}	Gate to Source Gate Charge		-	19	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	24	-	nC

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100 \text{ V}$, $I_D = 20 \text{ A}$ $R_G = 25 \Omega$	-	53	115	ns
t_r	Turn-On Rise Time		-	175	359	ns
$t_{d(off)}$	Turn-Off Delay Time		-	48	107	ns
t_f	Turn-Off Fall Time	(Note 4)	-	29	68	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	52	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	204	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$, $I_{SD} = 52 \text{ A}$	-	-	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$, $I_{SD} = 52 \text{ A}$	-	162	-	ns
Q_{rr}	Reverse Recovery Charge	$di/dt = 100 \text{ A}/\mu\text{s}$	-	1.3	-	μC

Notes:

- 1: Repetitive rating: pulse-width limited by maximum junction temperature.
- 2: $L = 1.4 \text{ mH}$, $I_{AS} = 52 \text{ A}$, $V_{DD} = 50 \text{ V}$, $R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
- 3: $I_{SD} \leq 52 \text{ A}$, $di/dt \leq 200 \text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
- 4: Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

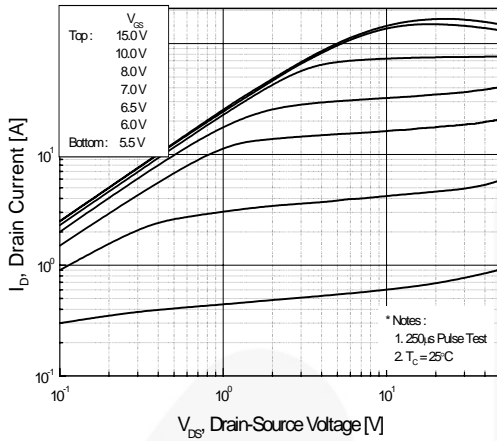


Figure 2. Transfer Characteristics

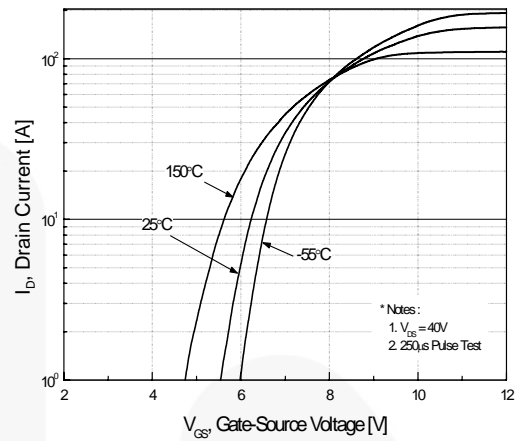


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

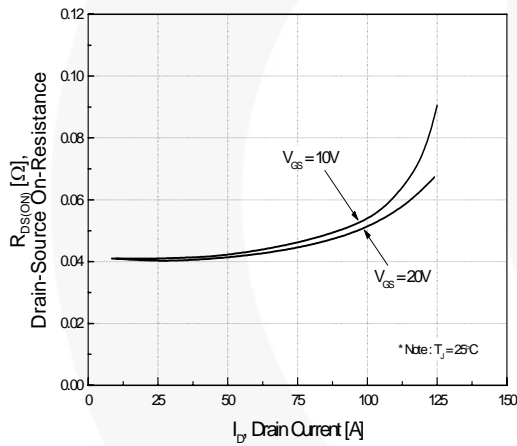


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

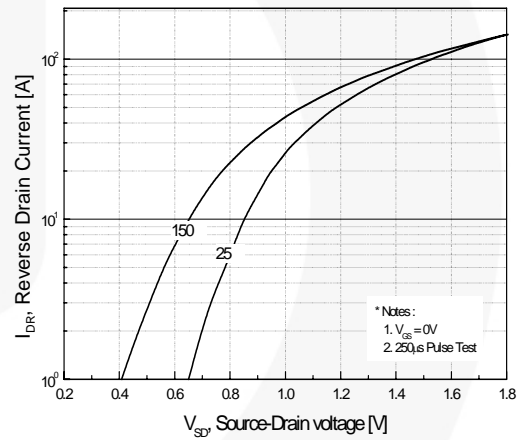


Figure 5. Capacitance Characteristics

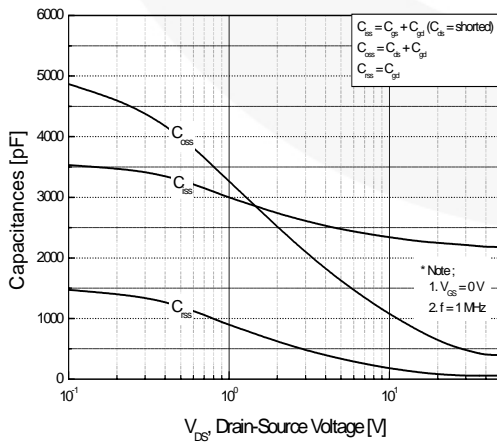
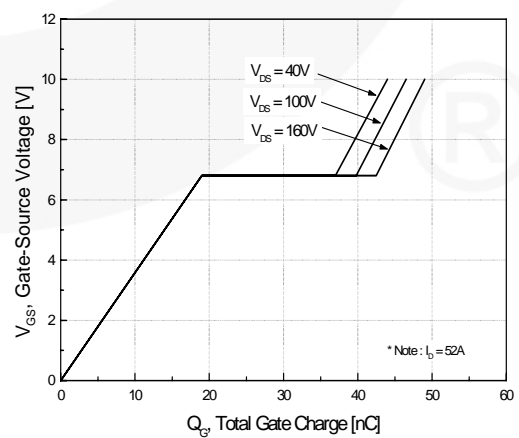


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

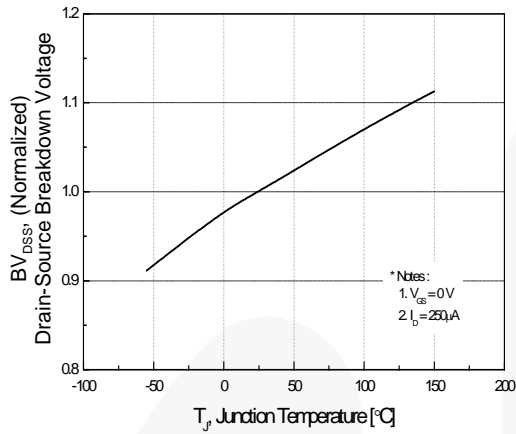


Figure 8. On-Resistance Variation vs. Temperature

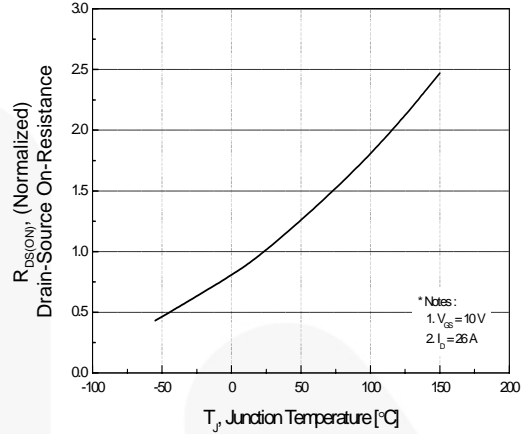


Figure 9-1. Maximum Safe Operating Area - FDP52N20

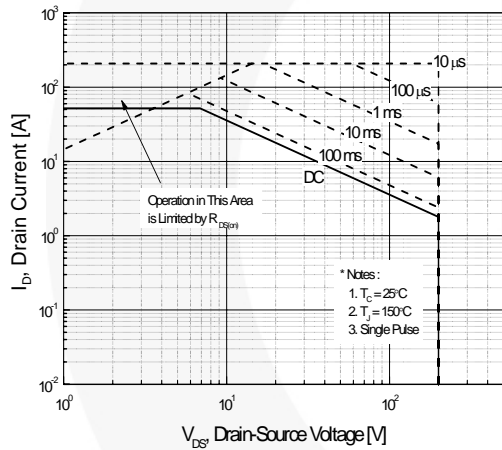


Figure 9-2. Maximum Safe Operating Area - FDPF52N20T

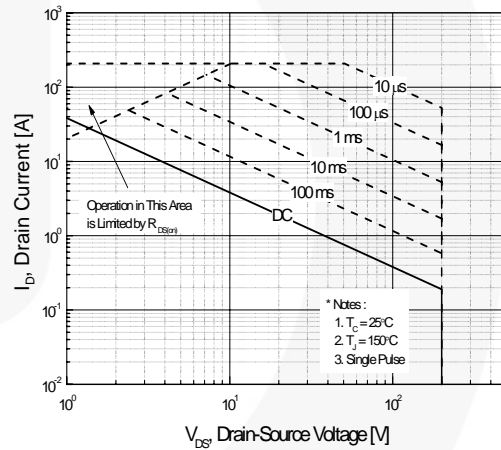
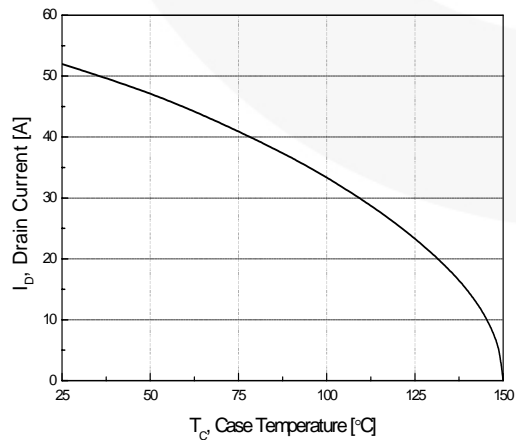


Figure 10. Maximum Drain Current



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP52N20

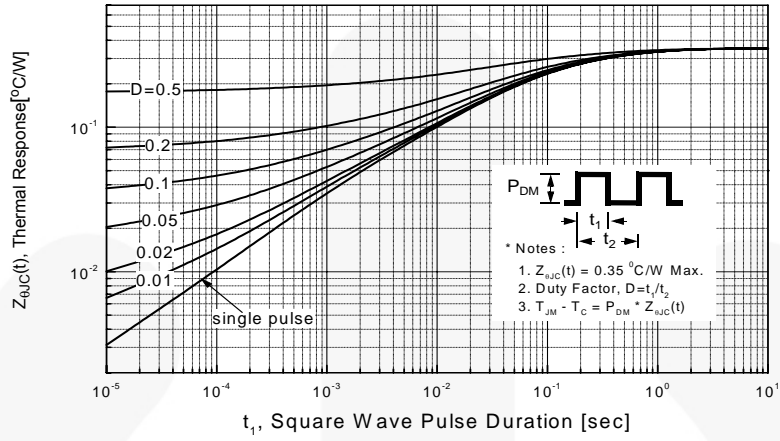
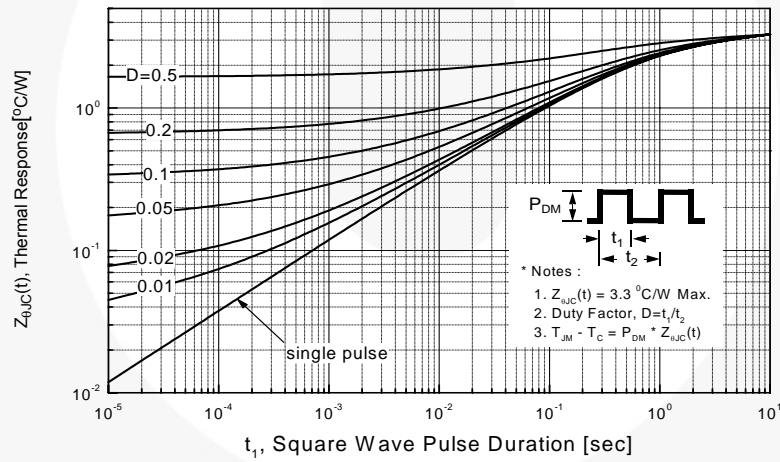


Figure 11-2. Transient Thermal Response Curve - FDPF52N20T



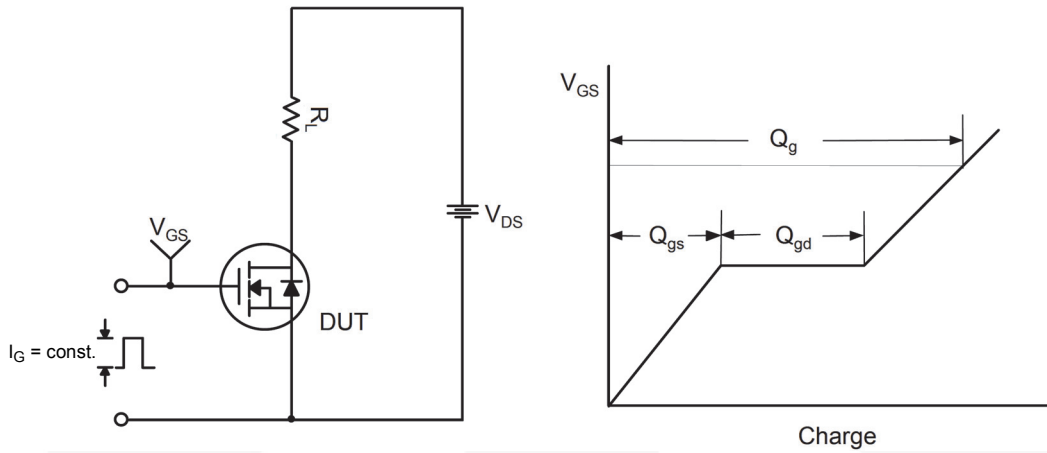


Figure 12. Gate Charge Test Circuit & Waveform

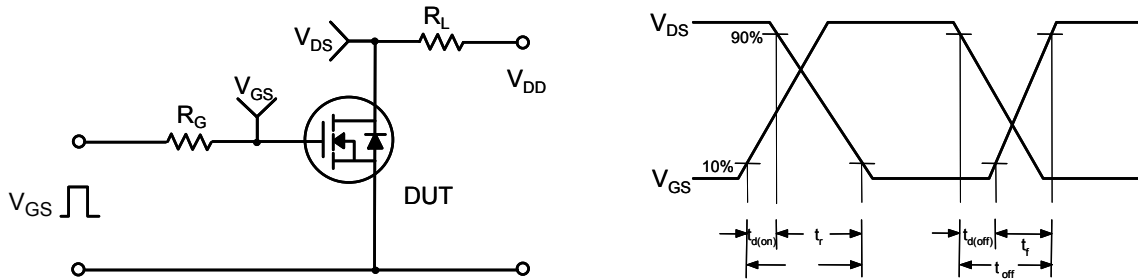


Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

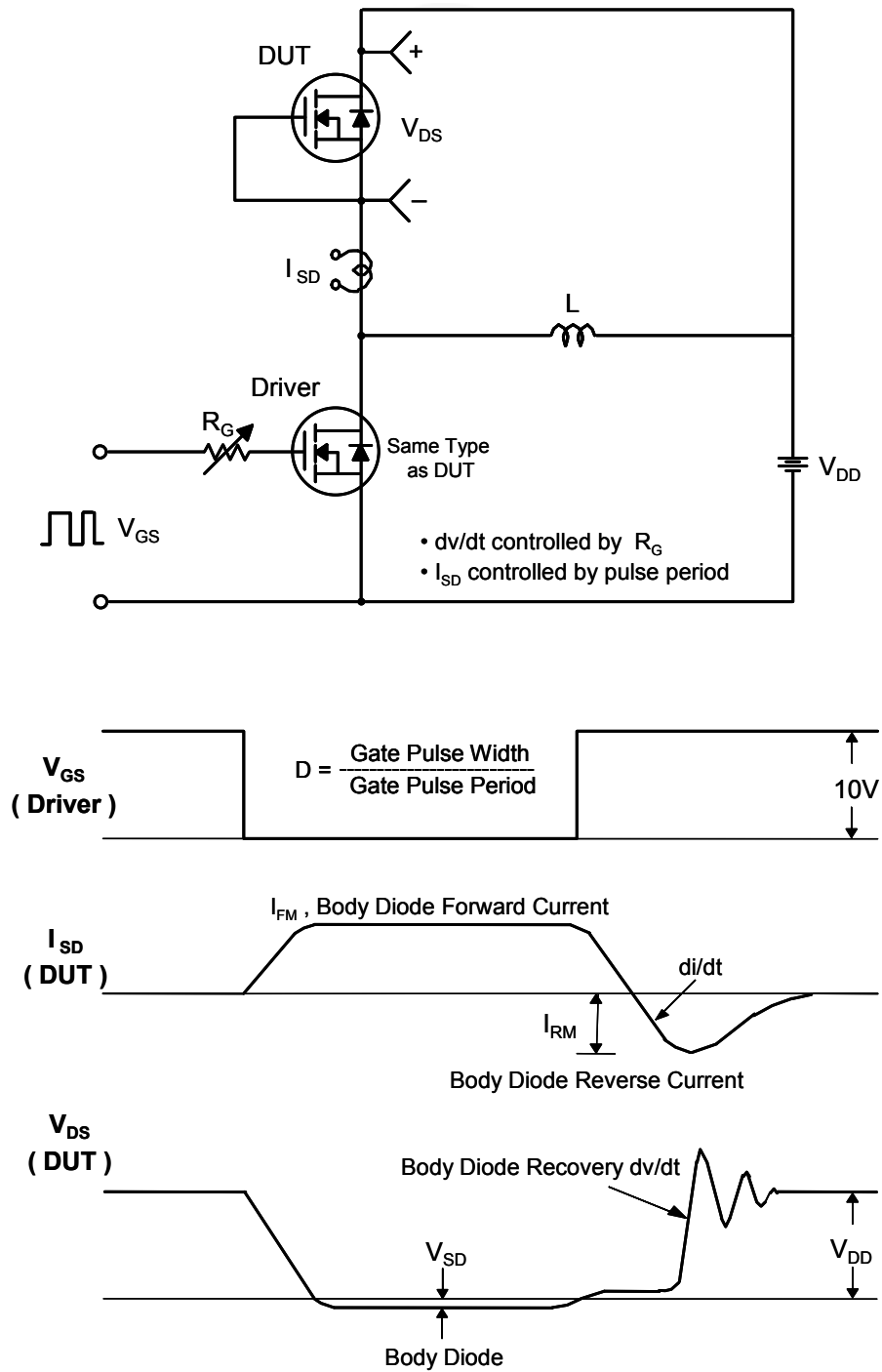


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

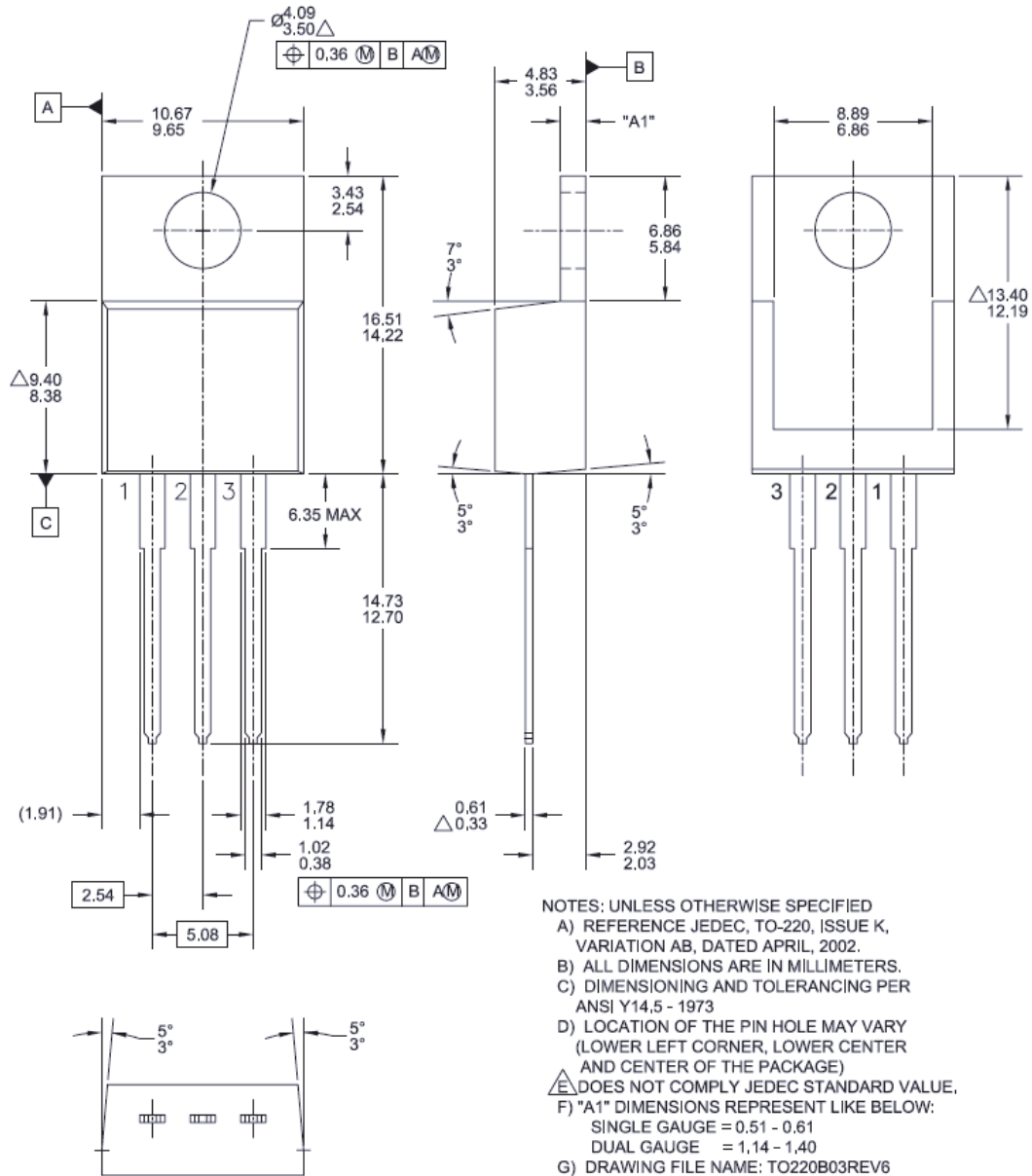


Figure 16. TO-220, Molded, 3-Lead, Jedec Variation AB

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Mechanical Dimensions

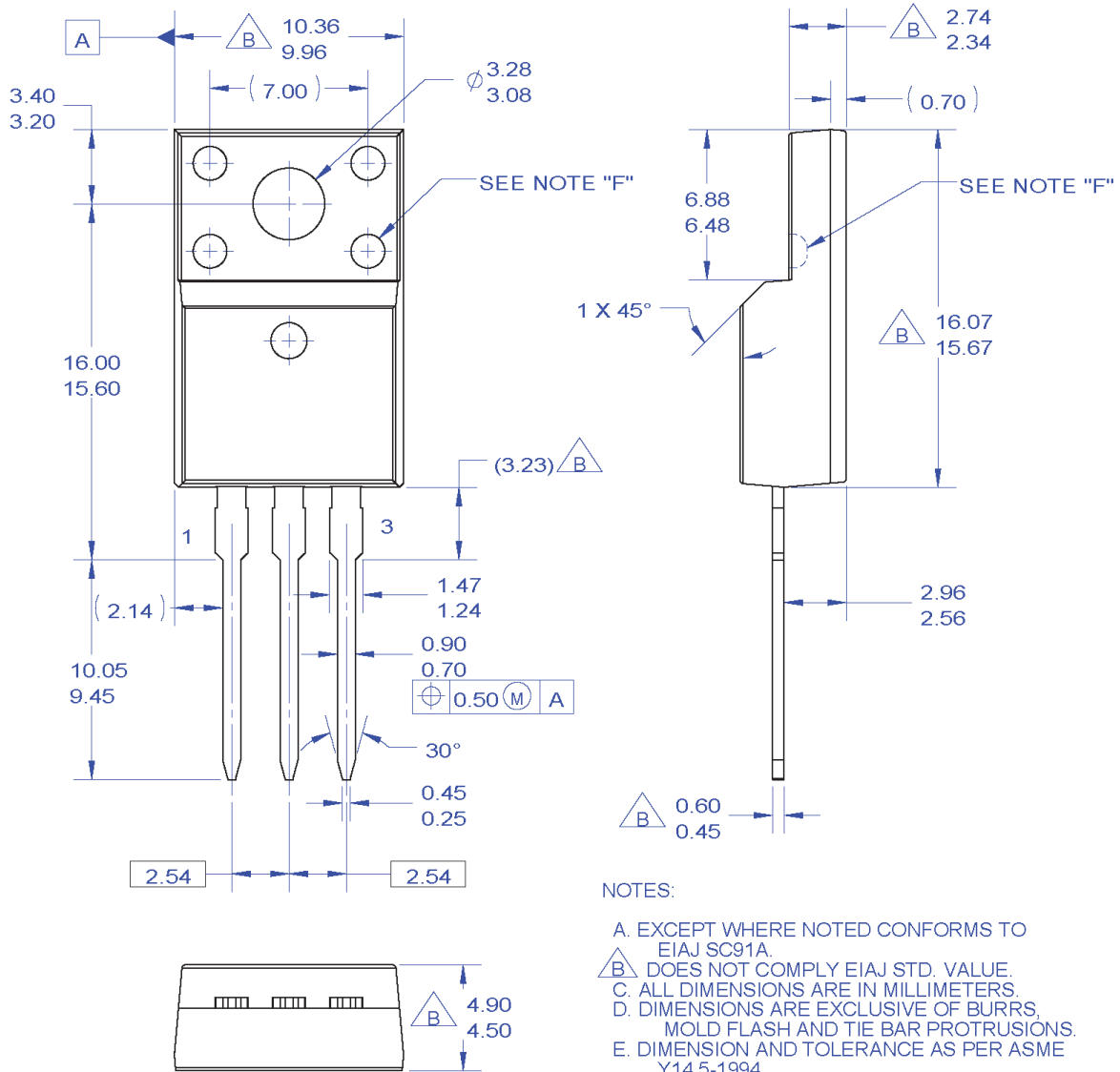


Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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