

FDP52N20 / FDPF52N20T N-Channel UniFET™ MOSFET 200 V, 52 A, 49 mΩ

Features

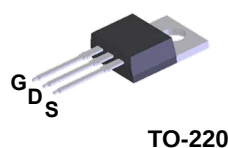
- $I_{DS(on)} = 41 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 26 \text{ A}$
- Low Gate Charge (Typ. 49 nC)
- Low C_{rss} (Typ. 66 pF)
- 100% Avalanche Tested
- RoHS Compliant

Applications

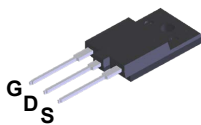
- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

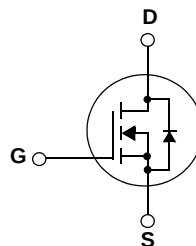
UniFET™ MOSFET is Fairchild Semiconductor®'s high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



TO-220



TO-220F



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 Purpose, 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	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case to Sink, Typ.	0.5	-	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

Package Marking and Ordering Information $T_C = 25^\circ\text{C}$ unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP52N20	FDP52N20	TO-220	-	-	50
FDPF52N20T	FDPF52N20T	TO-220F	-	-	50

Electrical Characteristics

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	$V_{DS} = 40\text{V}$, $I_D = 26\text{A}$ (Note 4)	-	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_{rss}	Reverse Transfer Capacitance		-	66	100	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 160\text{V}$, $I_D = 52\text{A}$ $V_{GS} = 10\text{V}$ (Note 4, 5)	-	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	$V_{DD} = 100\text{V}$, $I_D = 20\text{A}$ $R_G = 25\Omega$ (Note 4, 5)	-	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		-	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} = 0V, I _{SD} = 52A	-	-	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _{SD} = 52A	-	162	-	ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt = 100A/μs (Note 4)	-	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. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

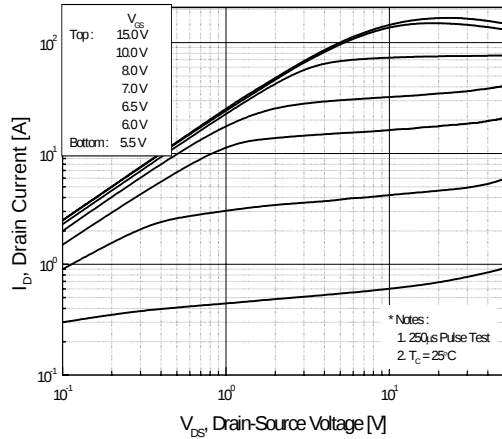


Figure 2. Transfer Characteristics

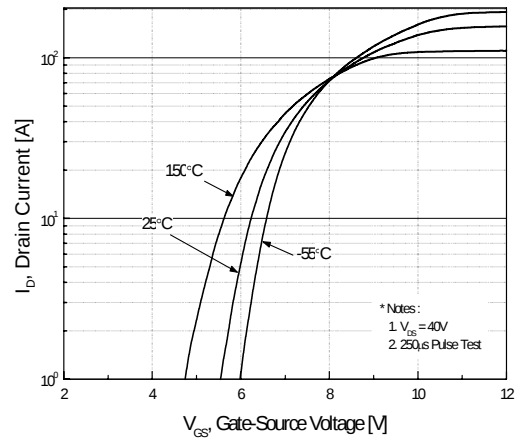


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

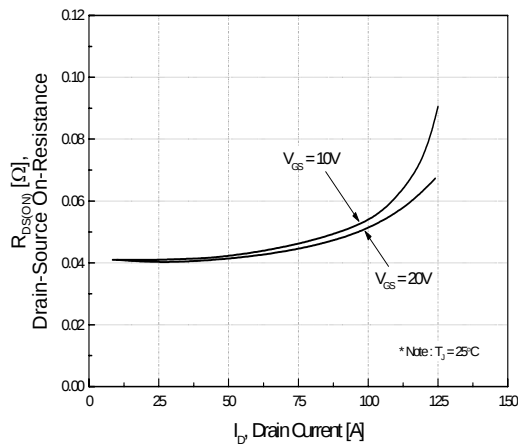


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

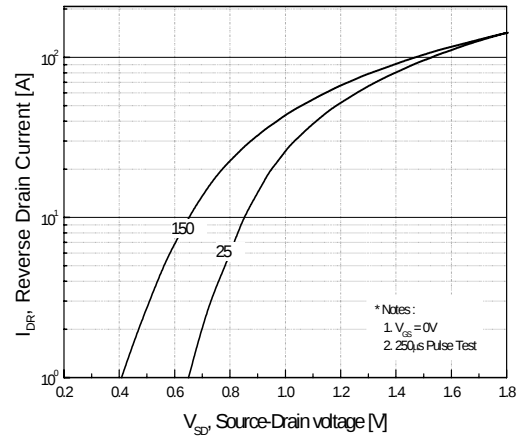


Figure 5. Capacitance Characteristics

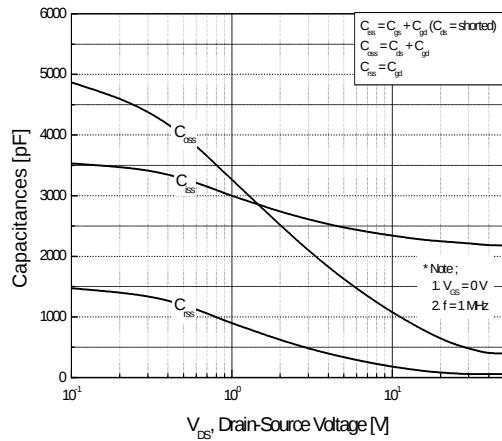
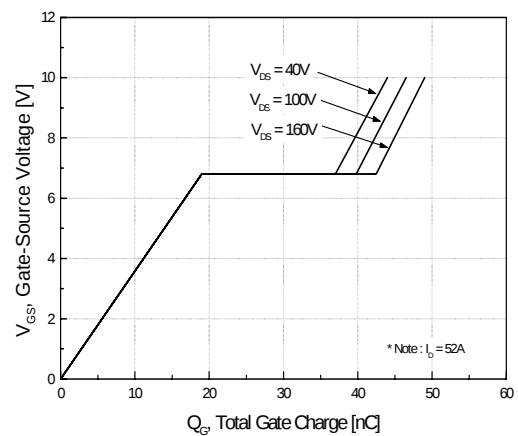


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

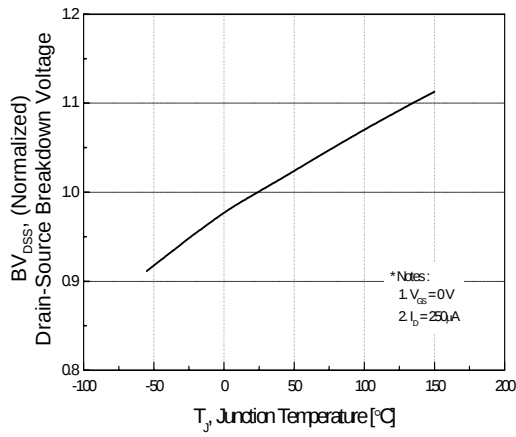


Figure 8. On-Resistance Variation vs. Temperature

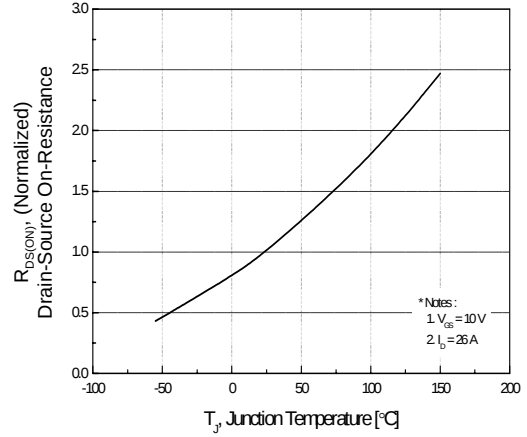


Figure 9-1. Maximum Safe Operating Area - FDP52N20

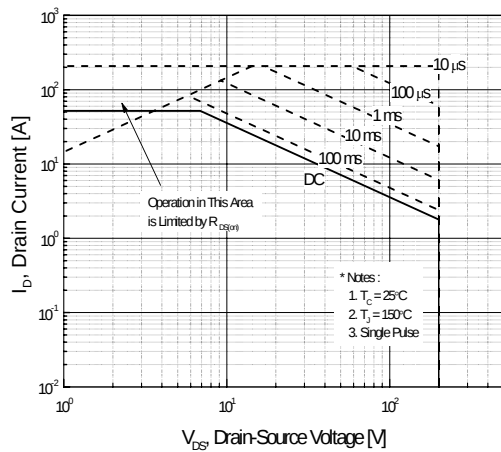


Figure 9-2. Maximum Safe Operating Area - FDPF52N20T

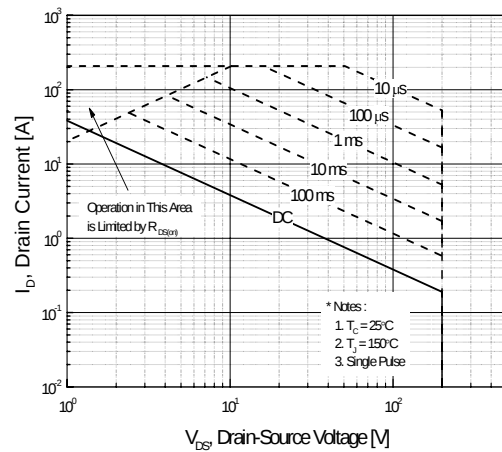
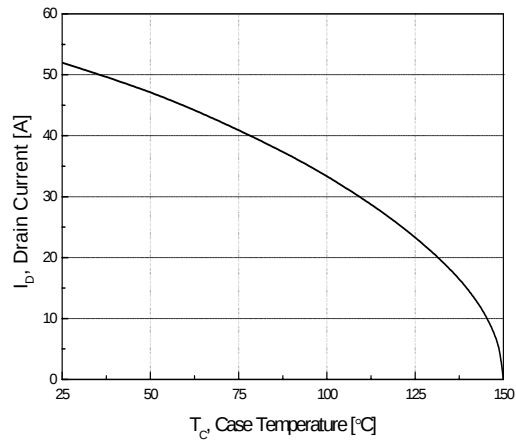


Figure 10. Maximum Drain Current



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP52N20

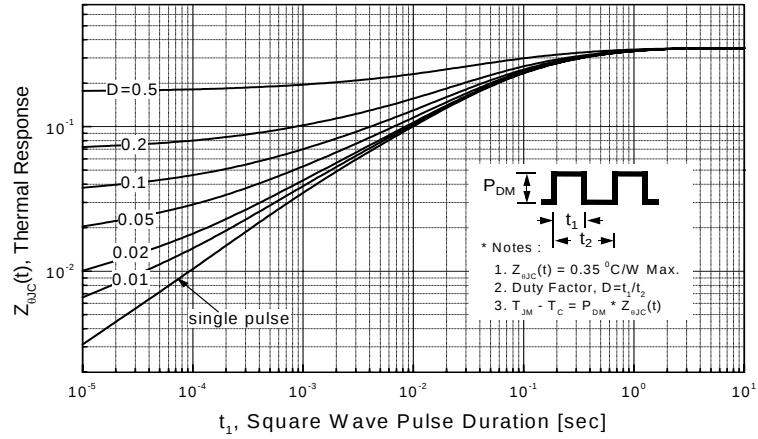
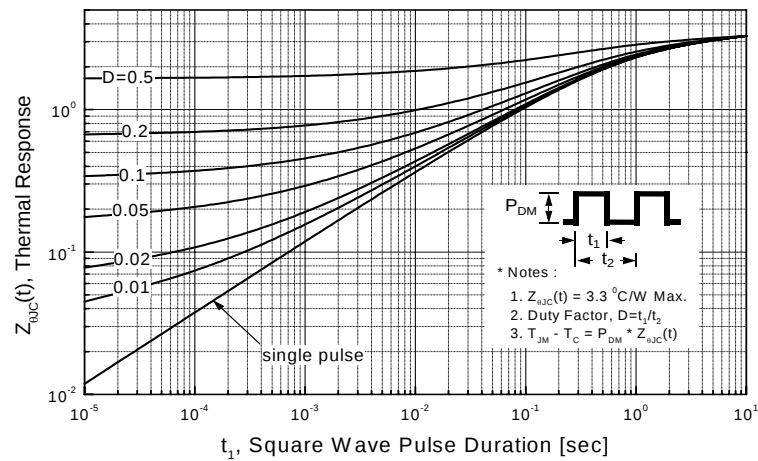
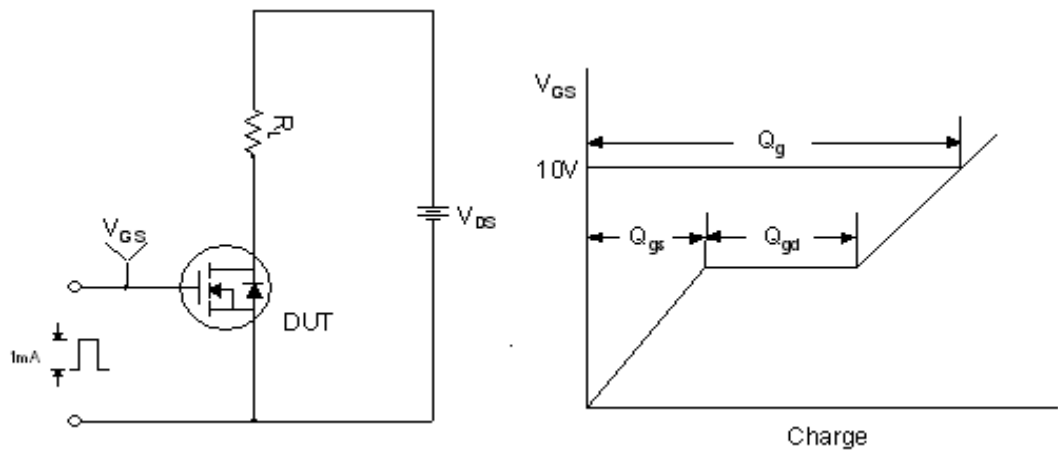


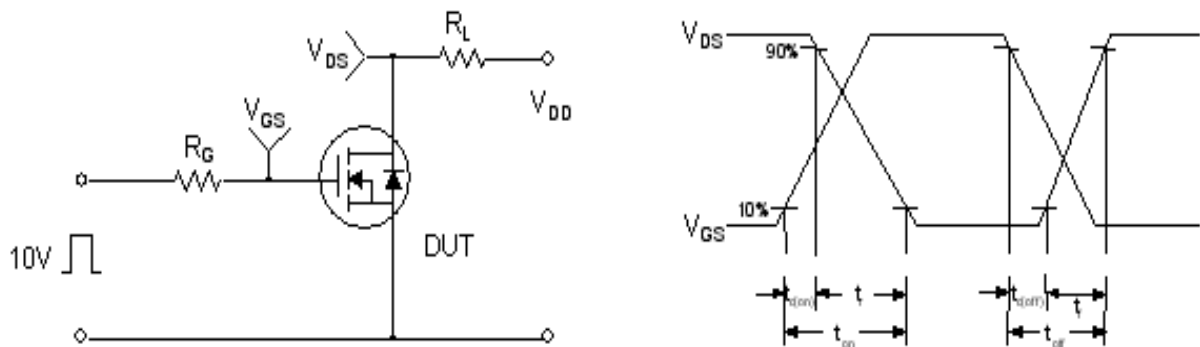
Figure 11-2. Transient Thermal Response Curve - FDPF52N20T



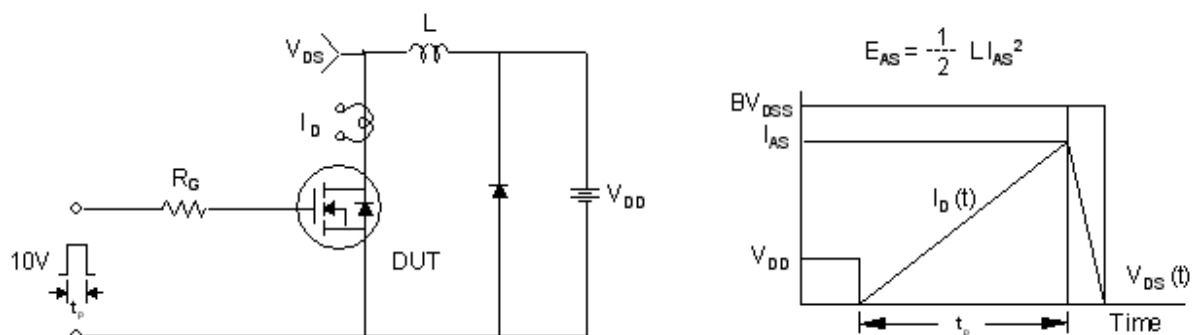
Gate Charge Test Circuit & Waveform



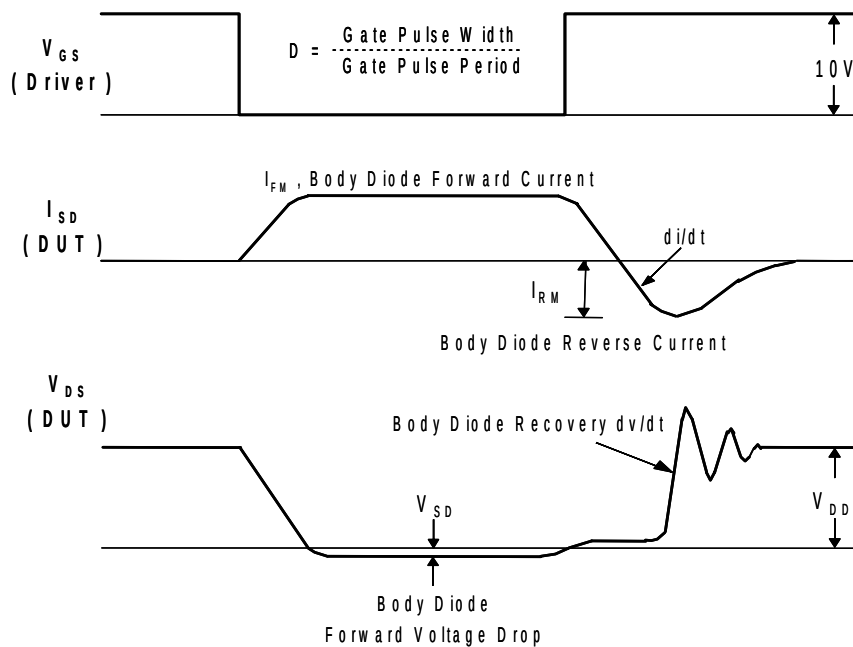
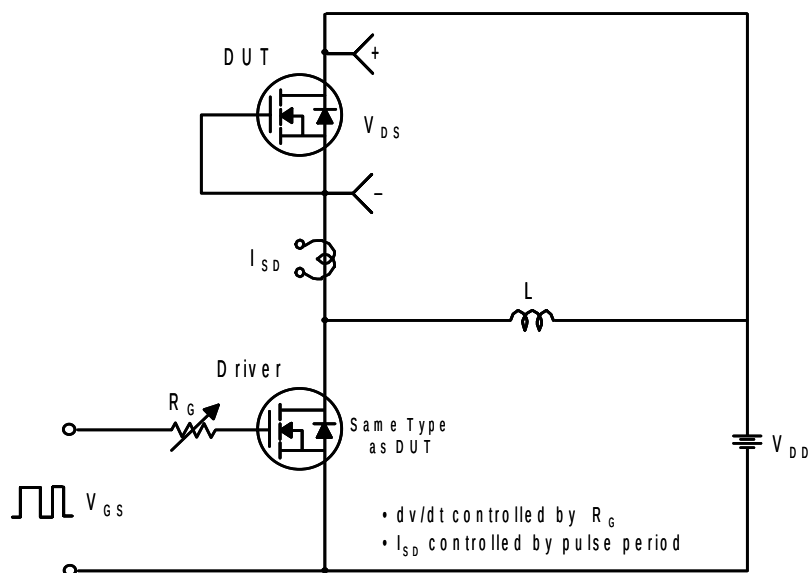
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

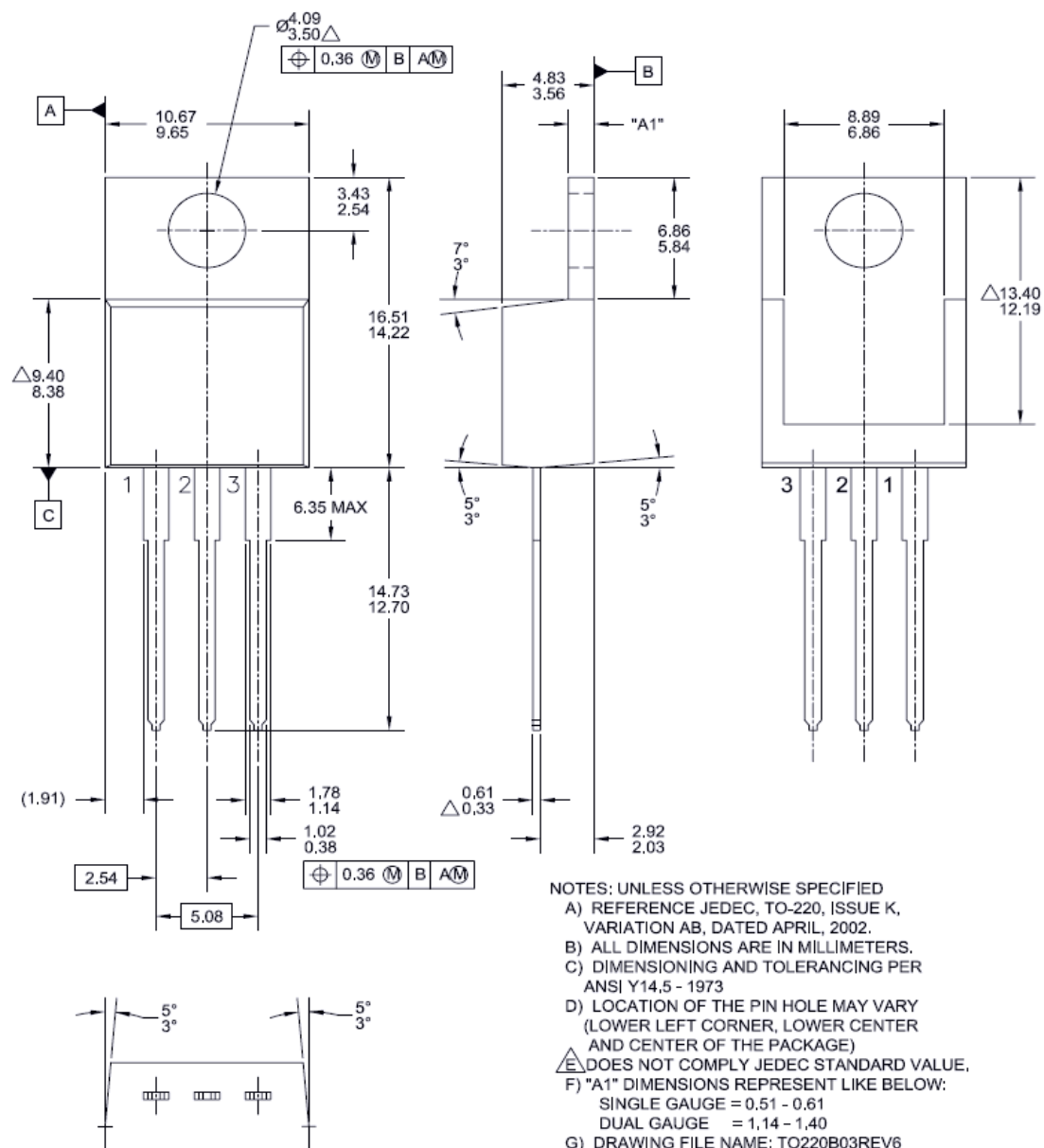


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

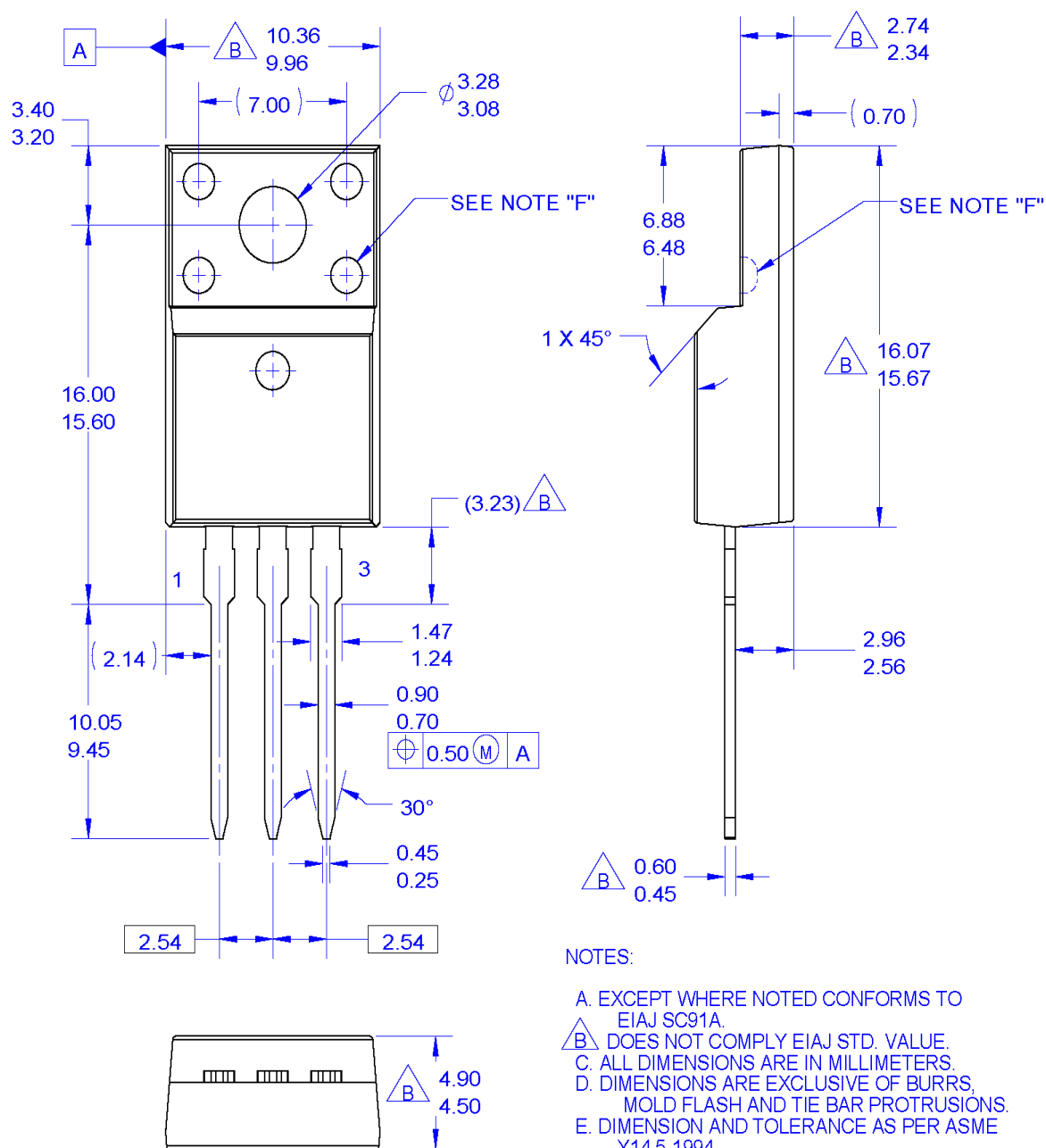
TO-220B03



Dimensions in Millimeters

Mechanical Dimensions

TO-220M03



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.**
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: T0220M03REV3

Dimensions in Millimeters

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CTL™	GTO™	TM	TinyPWM™
Current Transfer Logic™	IntelliMAX™	Saving our world, 1mW/W/kW at a time™	TinyWire™
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Datasheet Identification	Product Status	Definition
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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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