FAIRCHILD SEMICONDUCTOR®

March 2013

FDP39N20 / FDPF39N20

N-Channel UniFET™ MOSFET

200 V, 39 A, 66 mΩ

Features

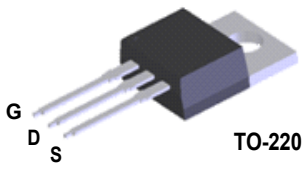
- $R_{DS(on)}$ = 66 mΩ (Max.) @ V_{GS} = 10 V, I_D = 19.5 A
- Low Gate Charge (Typ.38 nC)
- Low C_{rss} (Typ. 57 pF)
- 100% Avalanche Tested

Applications

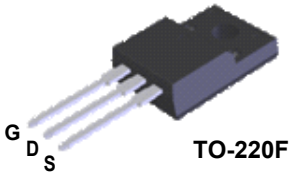
- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

Description

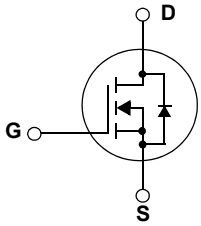
UniFET™ MOSFET is Fairchild Semiconductor®'s high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power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



TO-220



TO-220F



Absolute Maximum Ratings

Symbol	Parameter		FDP39N20	FDPF39N20	Unit
V_{DSS}	Drain-Source Voltage		200		V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)	39 23.4	39 * 23.4 *	A A
I_{DM}	Drain Current	- Pulsed (Note 1)	156	156 *	A
V_{GSS}	Gate-Source voltage		±30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	860		mJ
I_{AR}	Avalanche Current	(Note 1)	39		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	25.1		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate above 25°C	251 2.0	37 0.29	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300		°C

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP39N20	FDPF39N20	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.5	3.4	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	-	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP39N20	FDP39N20	TO-220	-	-	50
FDPF39N20	FDPF39N20	TO-220F	-	-	50

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA	200	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.2	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 200V, V_{GS} = 0V V_{DS} = 160V, T_C = 125°C	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 19.5A	--	0.056	0.066	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 19.5A	--	28.5	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	1640	2130	pF
C_{oss}	Output Capacitance		--	400	520	pF
C_{rss}	Reverse Transfer Capacitance		--	57	85	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 100V, I_D = 39A R_G = 25Ω	--	30	70	ns
t_r	Turn-On Rise Time		--	160	330	ns
$t_{d(off)}$	Turn-Off Delay Time		--	150	310	ns
t_f	Turn-Off Fall Time	(Note 4)	--	150	310	ns
Q_g	Total Gate Charge	V_{DS} = 160V, I_D = 39A V_{GS} = 10V	--	38	49	nC
Q_{gs}	Gate-Source Charge		--	11	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	16.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	39	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	156	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 39A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 39A dI_F/dt =100A/μs	--	152	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.1	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 0.85mH, I_{AS} = 39A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 39A, di/dt ≤ 200A/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

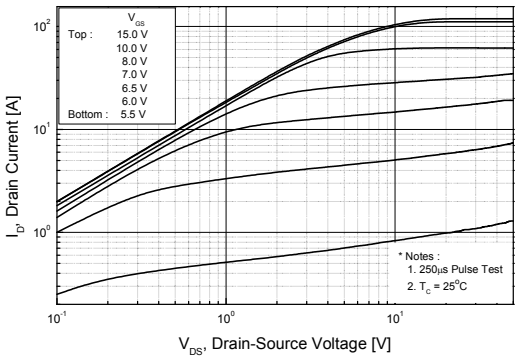


Figure 2. Transfer Characteristics

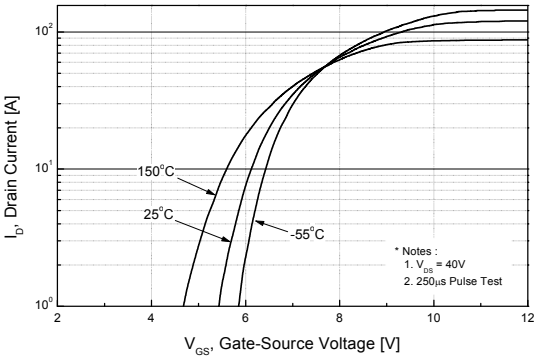


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

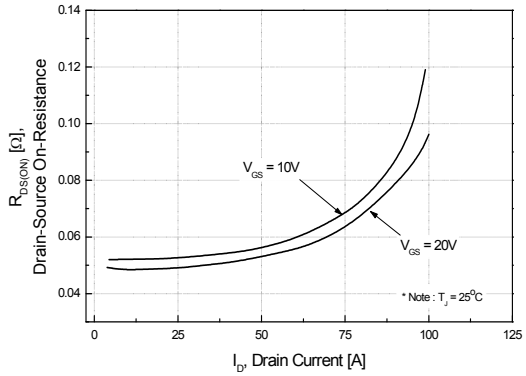


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

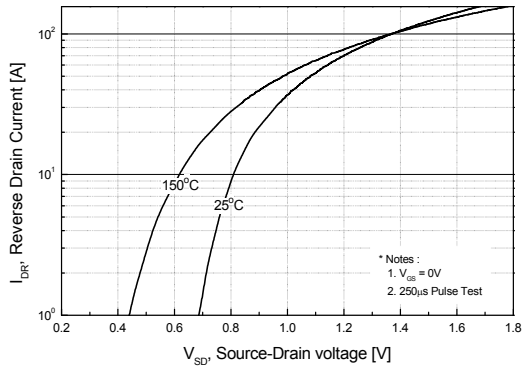


Figure 5. Capacitance Characteristics

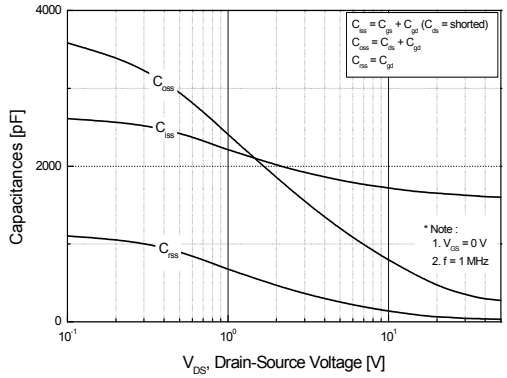
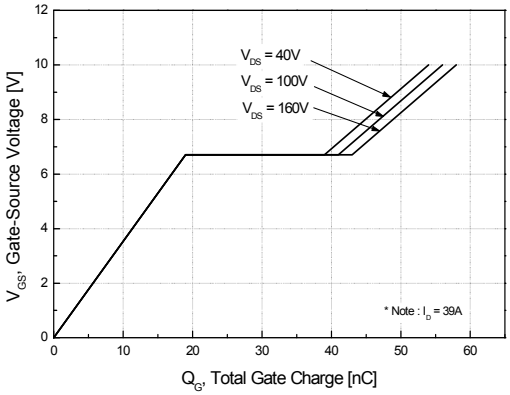


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

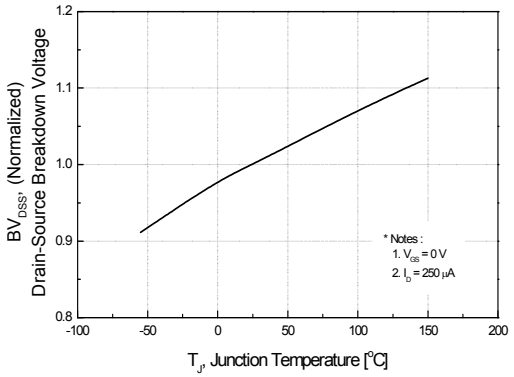


Figure 8. On-Resistance Variation vs. Temperature

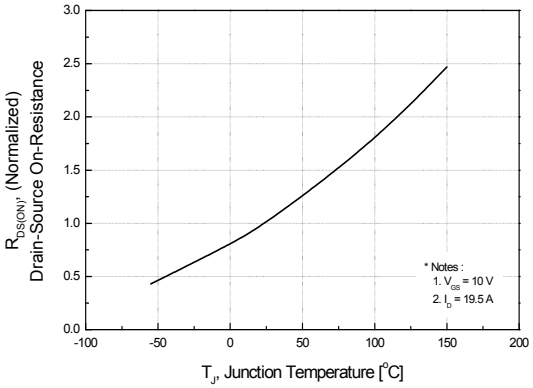


Figure 9-1. Maximum Safe Operating Area - FDP39N20

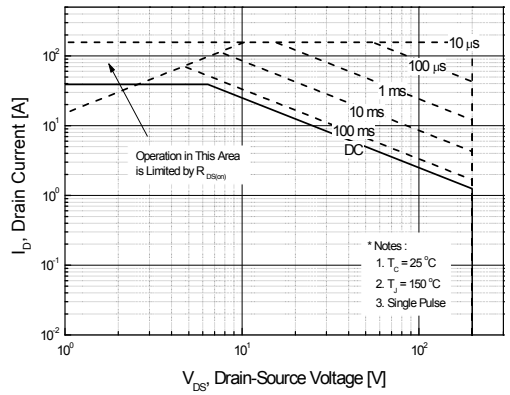


Figure 9-2. Maximum Safe Operating Area - FDPF39N20

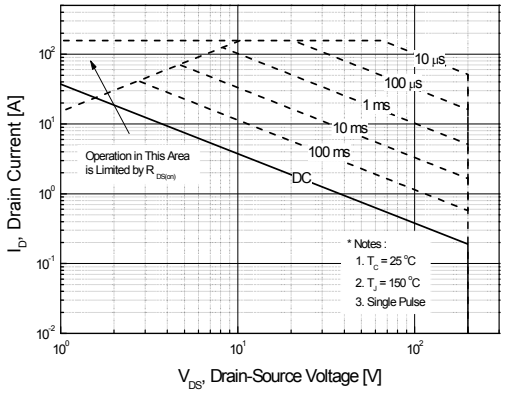
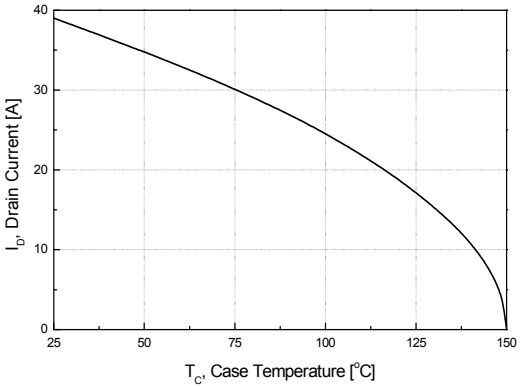


Figure 10. Maximum Drain Currentvs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP39N20

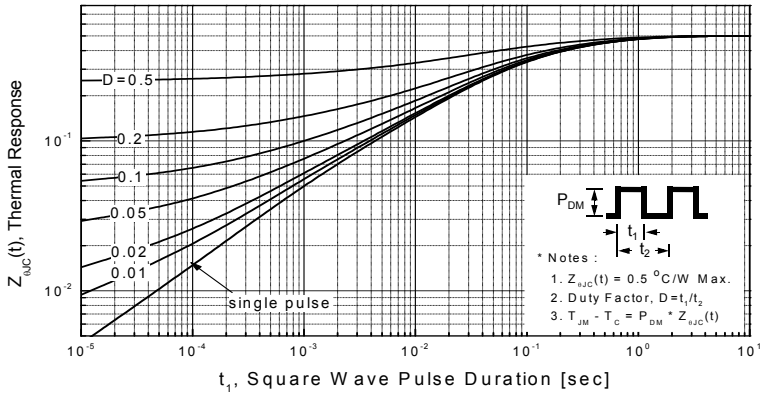
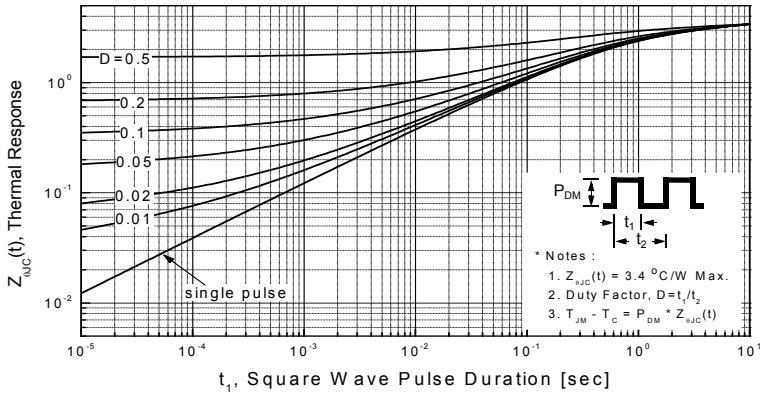
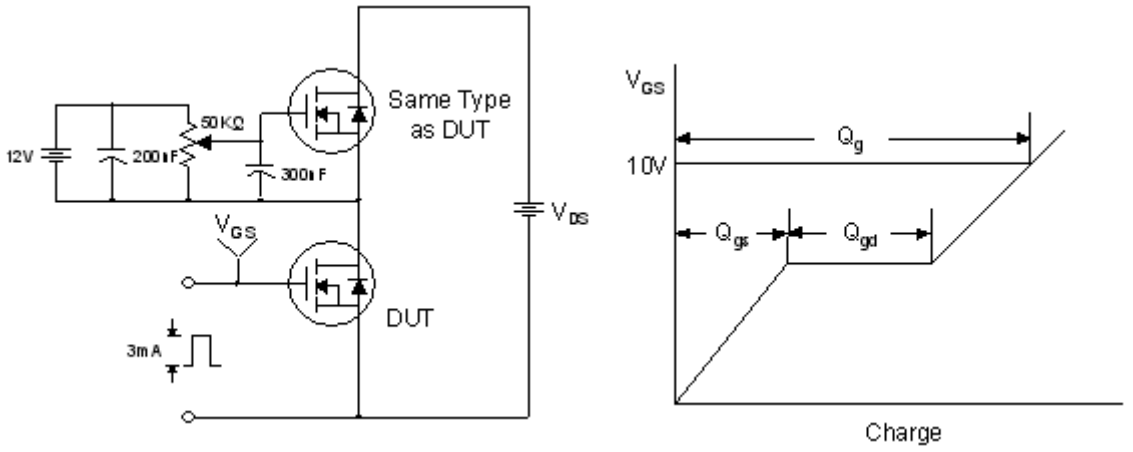


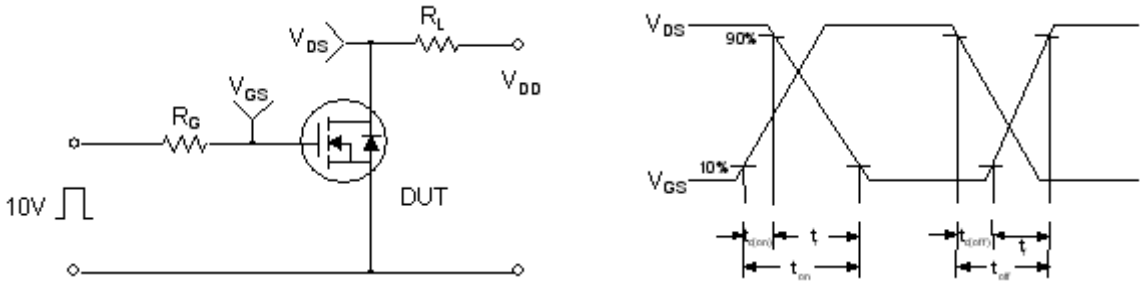
Figure 11-2. Transient Thermal Response Curve - FDPF39N20



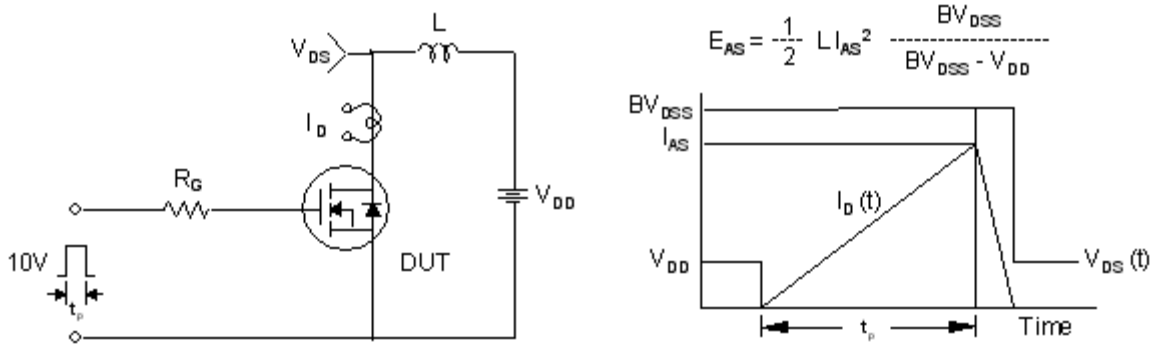
Gate Charge Test Circuit & Waveform



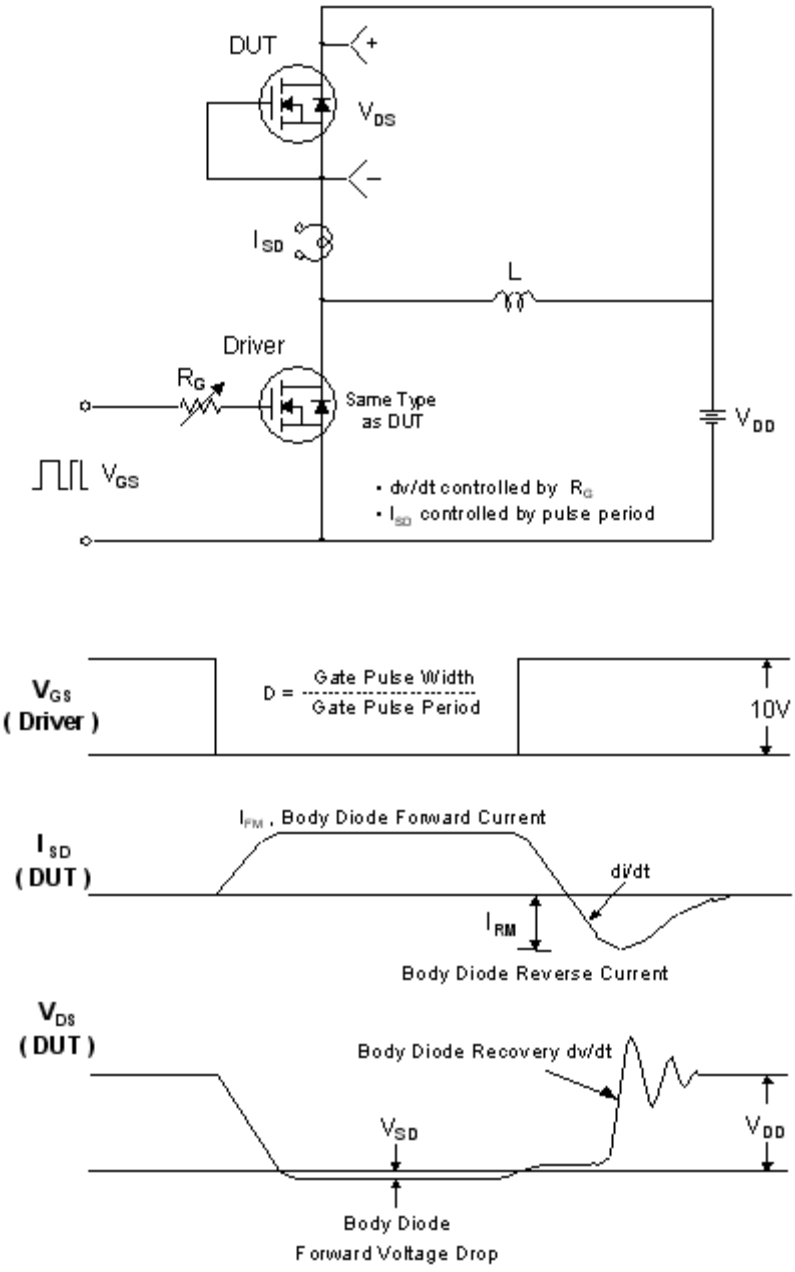
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

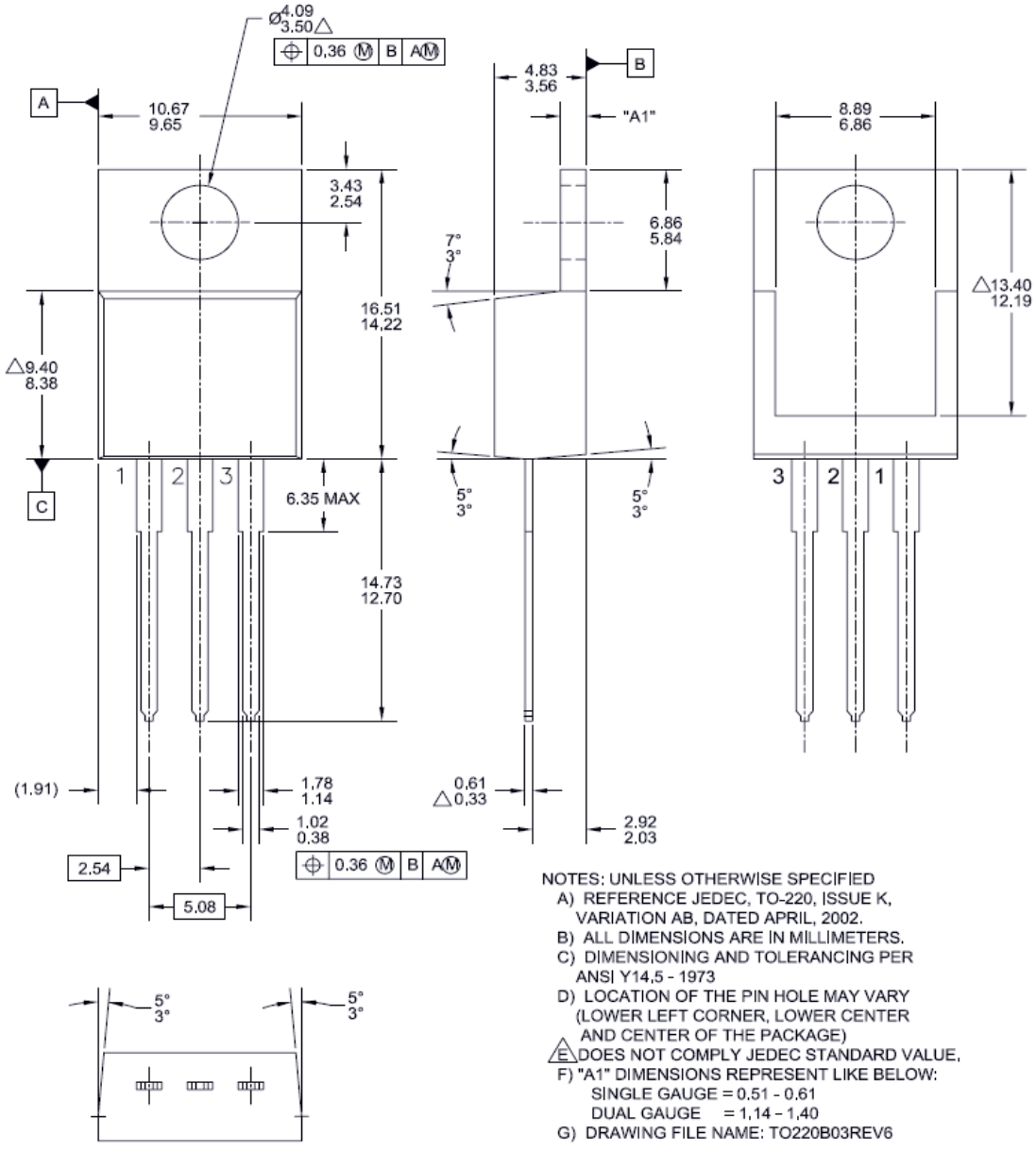


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-220B03

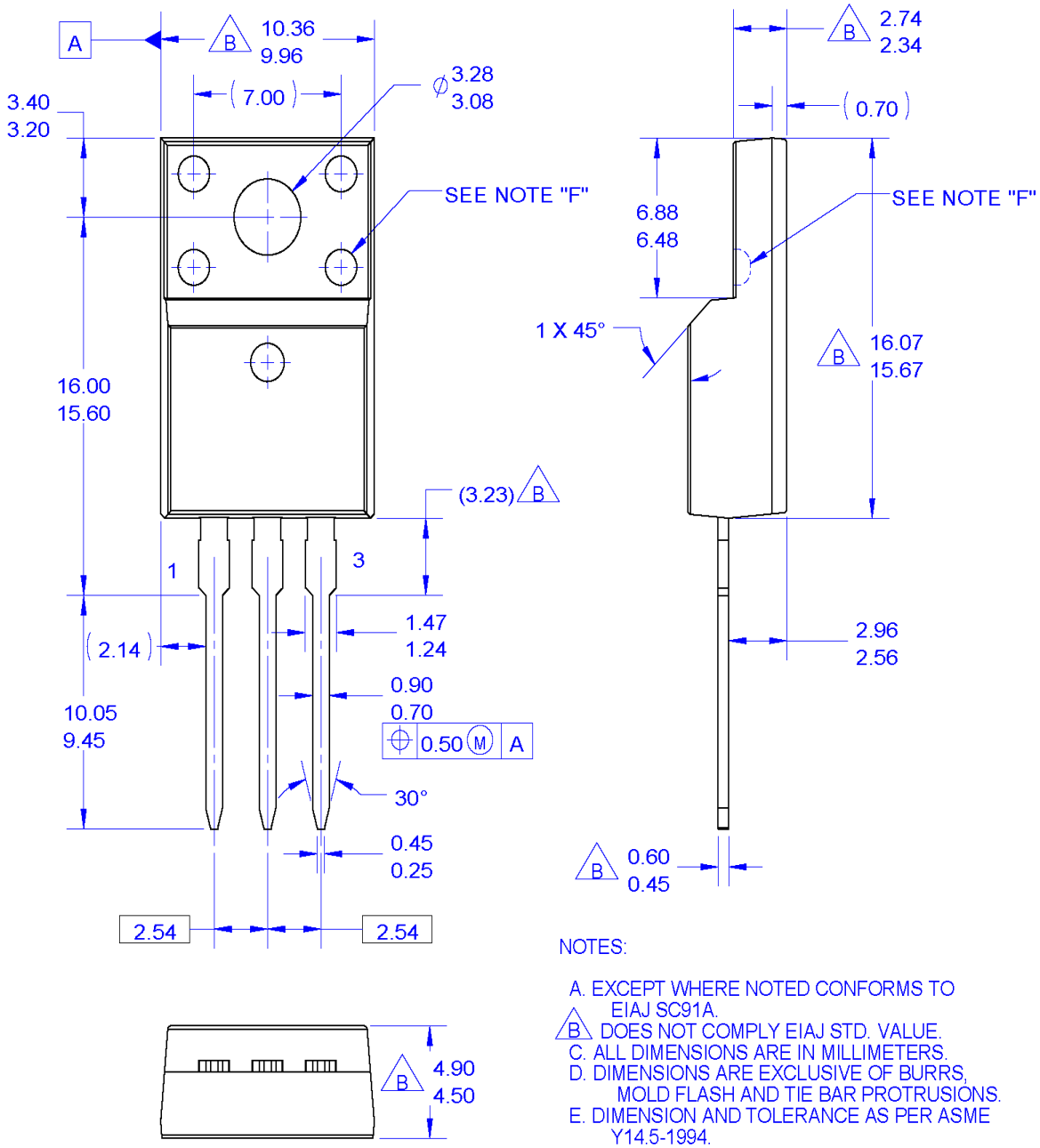


NOTES: UNLESS OTHERWISE SPECIFIED
A) REFERENCE JEDEC, TO-220, ISSUE K, VARIATION AB, DATED APRIL, 2002.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1973
D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
△E DOES NOT COMPLY JEDEC STANDARD VALUE.
F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1,14 – 1,40
G) DRAWING FILE NAME: TO220B03REV6

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: TO220M03REV3

Dimensions in Millimeters

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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