FAIRCHILD SEMICONDUCTOR®

August 2010

QFET®

FQP11N40C/FQPF11N40C
400V N-Channel MOSFET

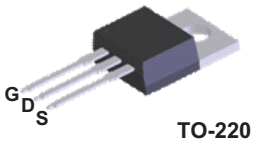
Features

- 10.5 A, 400V, $R_{DS(on)}$ = 0.5 Ω @V_{GS} = 10 V
- Low gate charge (typical 28 nC)
- Low Crss (typical 85pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

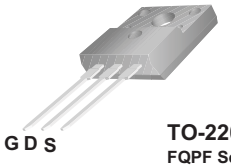
Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

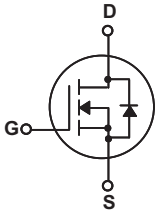
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.



TO-220
FQP Series



TO-220F
FQPF Series



Absolute Maximum Ratings

Symbol	Parameter		FQP11N40C	FQPF11N40C	Units
V_{DSS}	Drain-Source Voltage		400		V
I_D	Drain Current - Continuous (T_C = 25°C)		10.5	10.5 *	A
	- Continuous (T_C = 100°C)		6.6	6.6 *	A
I_{DM}	Drain Current - Pulsed	(Note 1)	42	42 *	A
V_{GSS}	Gate-Source Voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	360		mJ
I_{AR}	Avalanche Current	(Note 1)	11		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	13.5		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation (T_C = 25°C)		135	44	W
	- Derate above 25°C		1.07	0.35	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300		°C

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQP11N40C	FQPF11N40C	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.93	2.86	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQP11N40C	FQP11N40C	TO-220	--	--	50
FQPF11N40C	FQPF11N40C	TO-220F	--	--	50

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	400	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.54	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 400 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 320 V, T_C = 125°C	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5.25 A	--	0.43	0.53	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 5.25 A (Note 4)	--	7.1	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	840	1090	pF
C_{oss}	Output Capacitance		--	250	325	pF
C_{rss}	Reverse Transfer Capacitance		--	85	110	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 200 V, I_D = 10.5 A, R_G = 25 Ω	--	14	40	ns
t_r	Turn-On Rise Time		--	89	190	ns
$t_{d(off)}$	Turn-Off Delay Time		--	81	170	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	81	170	ns
Q_g	Total Gate Charge	V_{DS} = 320 V, I_D = 10.5 A, V_{GS} = 10 V	--	28	35	nC
Q_{gs}	Gate-Source Charge		--	4	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	15	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	10.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	42	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 10.5 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 10.5 A, dI_F / dt = 100 A/μs (Note 4)	--	290	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.4	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 5.7 mH, I_{AS} = 10.5A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 10.5A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

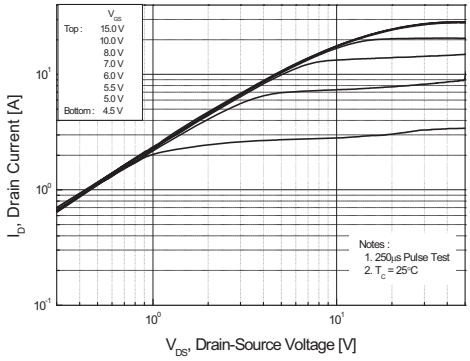


Figure 2. Transfer Characteristics

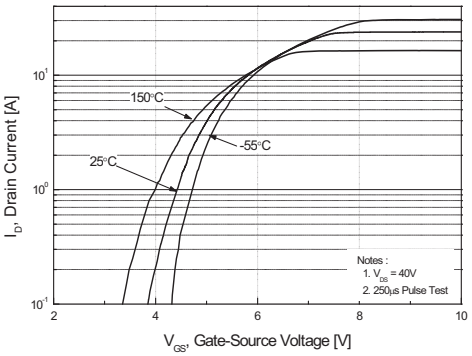


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

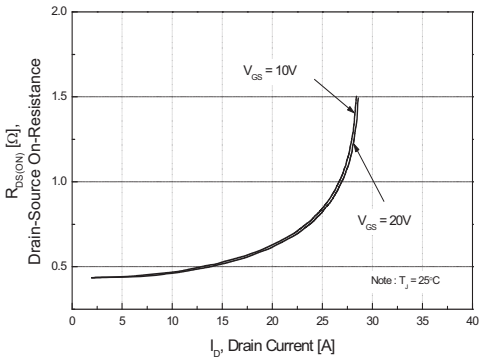


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

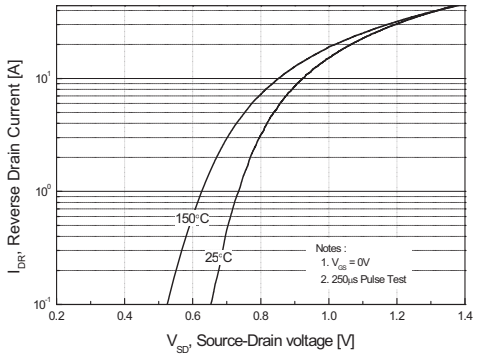


Figure 5. Capacitance Characteristics

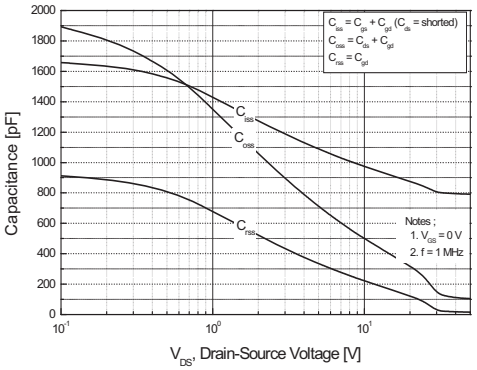
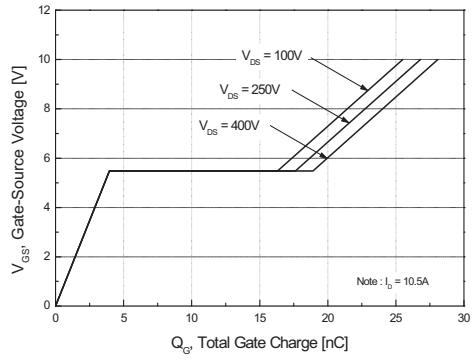


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

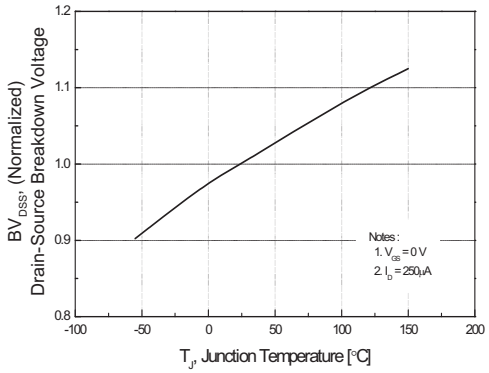


Figure 8. On-Resistance Variation vs. Temperature

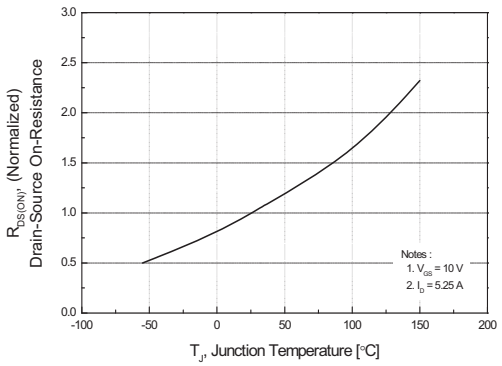


Figure 9-1. Maximum Safe Operating Area of FQP4N50C

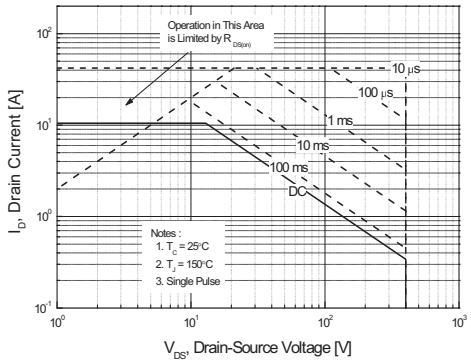


Figure 9-2. Maximum Safe Operating Area of FQPF4N50C

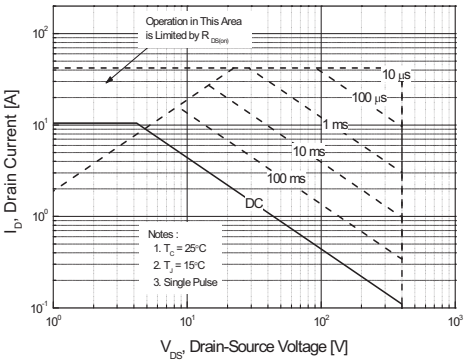
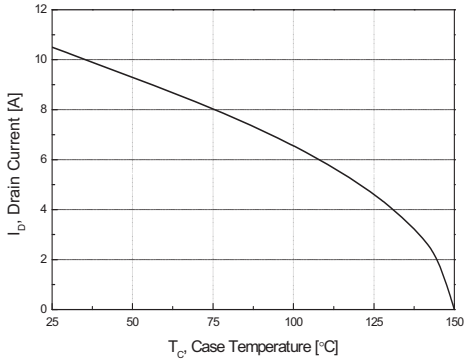


Figure10.MaximumDrainCurrent



Typical Performance Characteristics (Continued)

Figure 11-1. ransient Thermal Response Curve of FQP3N50C

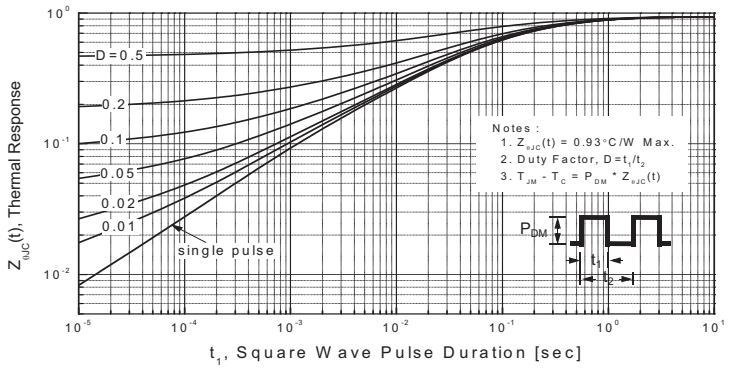
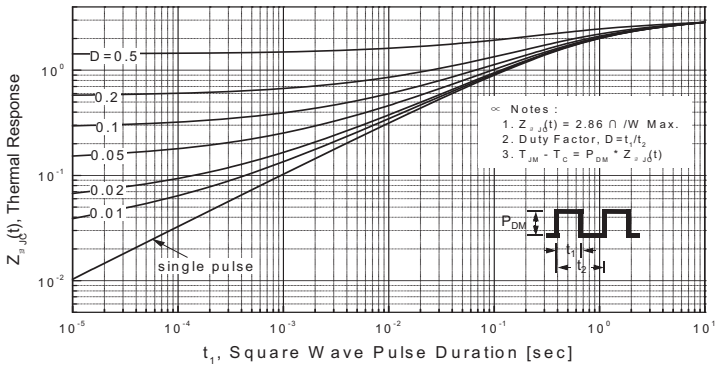
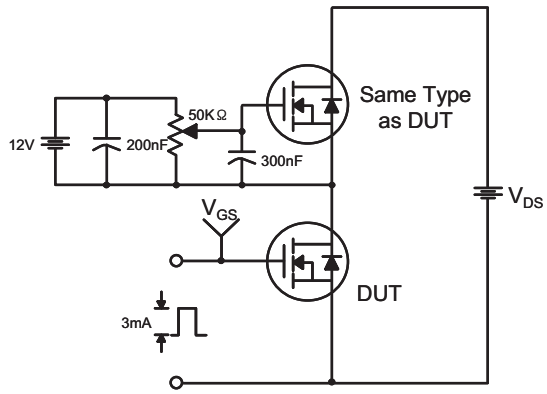
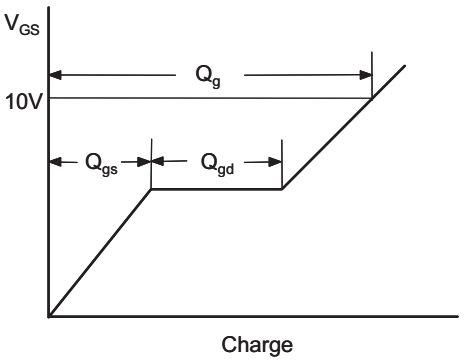


Figure 11-2. ransient Thermal Response Curve of FQPF3N50C

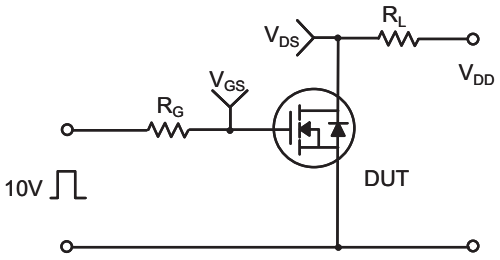


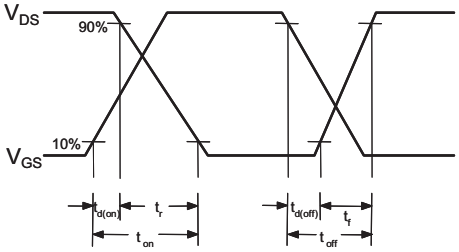
Gate Charge Test Circuit & Waveform



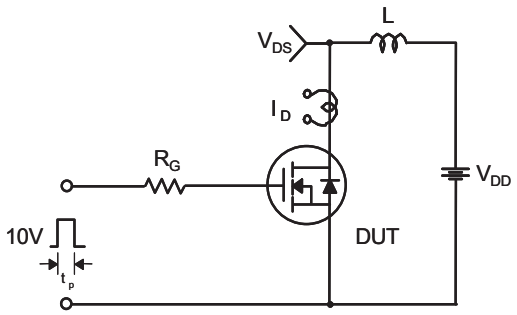


Resistive Switching Test Circuit & Waveforms

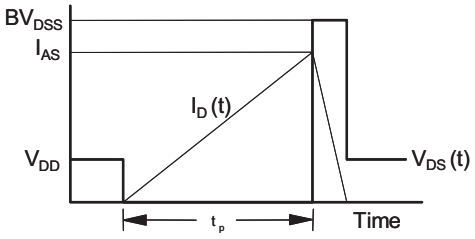




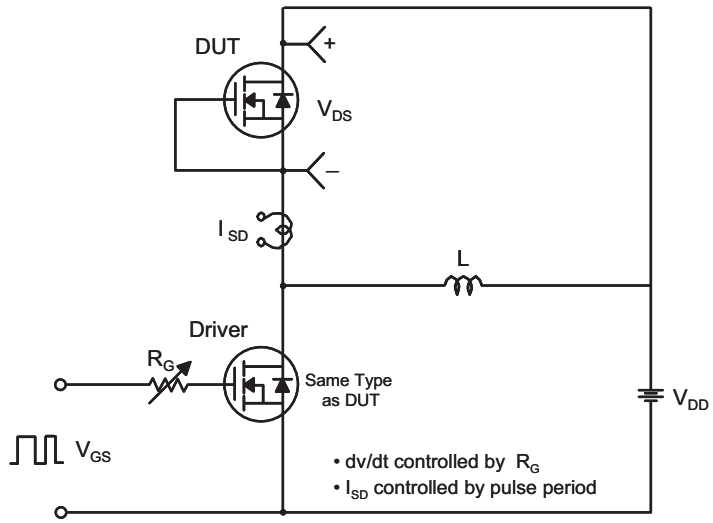
Unclamped Inductive Switching Test Circuit & Waveforms

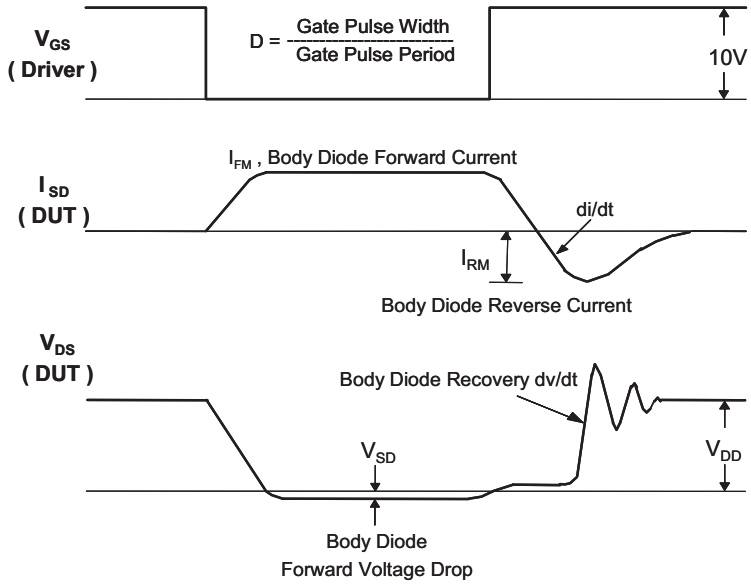


$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



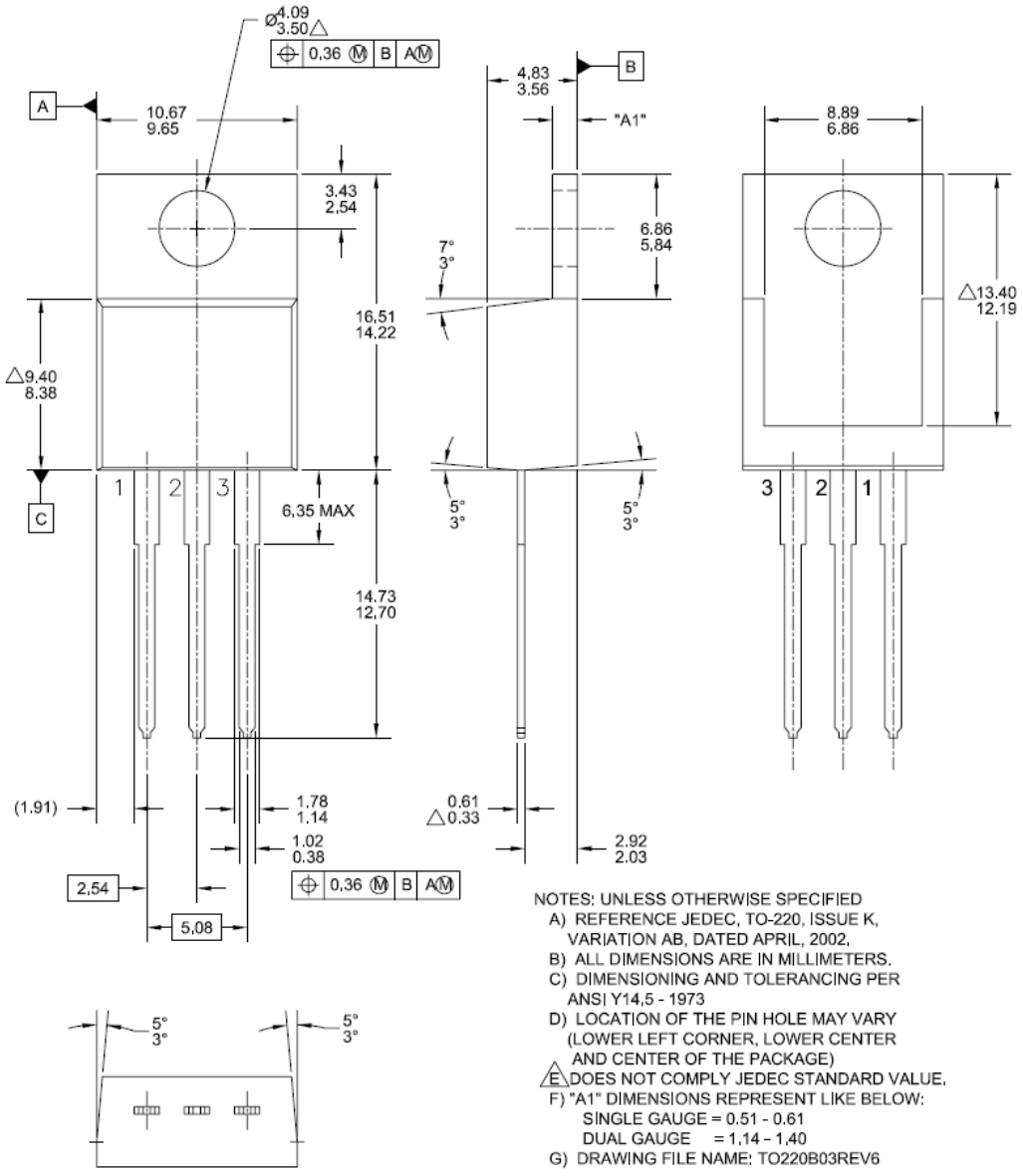
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

TO-220



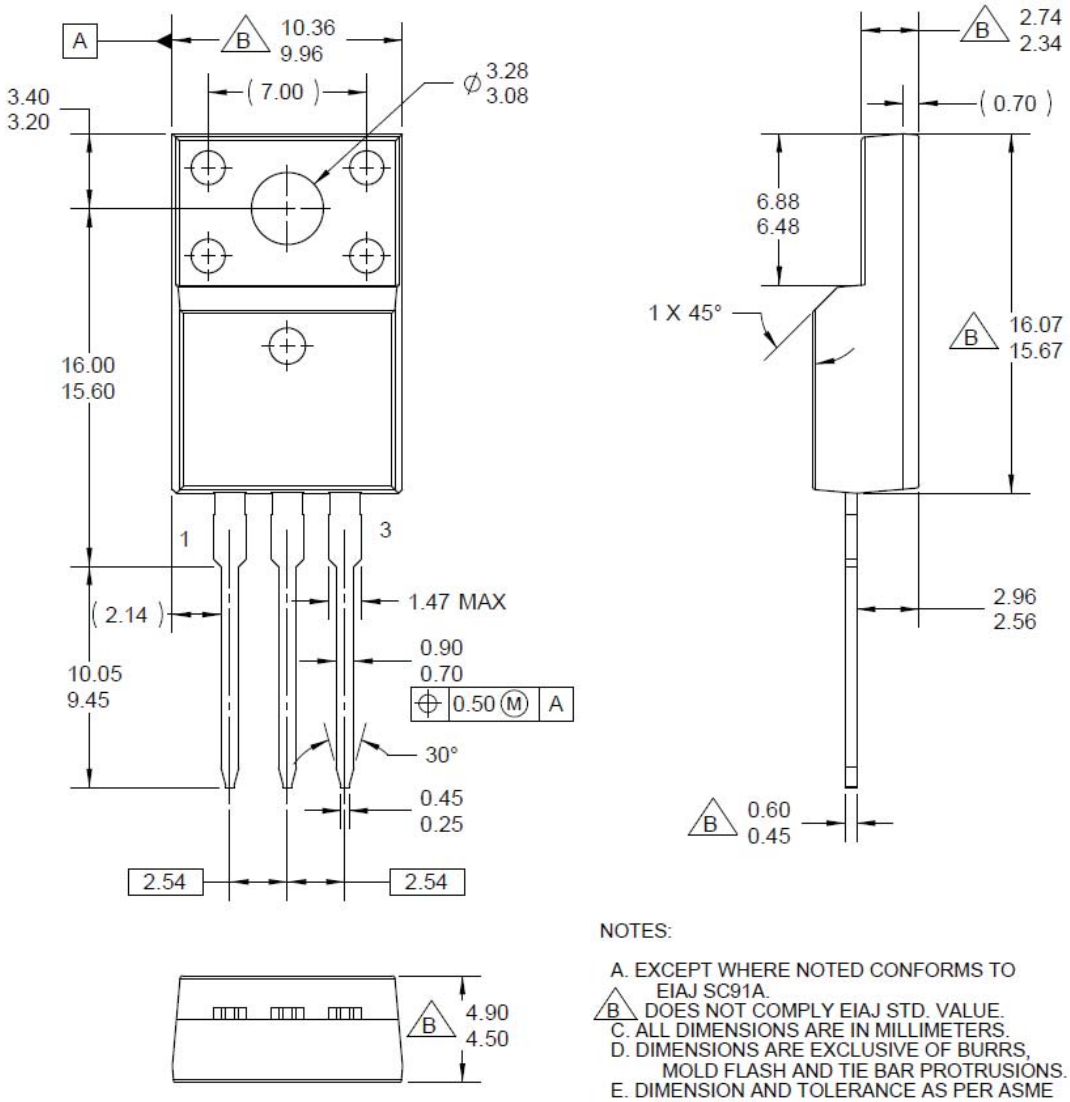
NOTES: UNLESS OTHERWISE SPECIFIED

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 (Continued)

TO-220F



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. DRAWING FILE NAME: TO220M03REV1

Dimensions in Millimeters

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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PRODUCT STATUS DEFINITIONS

Definition of Terms

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.

Rev. I48