FAIRCHILD SEMICONDUCTOR®

March 2013

FQN1N60C

N-Channel QFET MOSFET

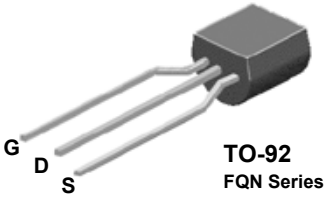
600 V, 0.30 A, 11.5 Ω

Description

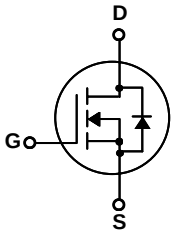
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor®'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

Features

- 0.30 A, 600 V, $R_{DS(on)}$ = 11.5 Ω (Max) @V_{GS} = 10 V, ID = 0.14 A
- Low Gate Charge (Typ. 4.8 nC)
- Low Crss (Typ. 3.5 pF)
- 100% Avalanche Tested



TO-92
FQN Series



Absolute Maximum Ratings

Symbol	Parameter		FQN1N60C	Unit
V_{DSS}	Drain-Source Voltage		600	V
I_D	Drain Current	- Continuous (T_C = 25°C)	0.3	A
		- Continuous (T_C = 100°C)	0.18	A
I_{DM}	Drain Current - Pulsed (Note 1)		1.2	A
V_{GSS}	Gate-Source Voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		33	mJ
I_{AR}	Avalanche Current (Note 1)		0.3	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		0.3	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation (T_A = 25°C)		1	W
	Power Dissipation (T_L = 25°C)		3	W
	- Derate above 25°C		0.02	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

Thermal Characteristics

Symbol	Parameter		Typ	Max	Unit
$R_{\theta JL}$	Thermal Resistance, Junction-to-Lead	(Note 6a)	--	50	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 6b)	--	140	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
1N60C	FQN1N60C	TO-92	--	--	2000ea

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	600	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	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	--	--	50	μA
		V_{DS} = 480 V, T_C = 125°C	--	--	250	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 = 0.15 A	--	9.3	11.5	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 0.3 A (Note 4)	--	0.75	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	130	170	pF
C_{oss}	Output Capacitance		--	19	25	pF
C_{rss}	Reverse Transfer Capacitance		--	3.5	6	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 1.1 A, R_G = 25 Ω	--	7	24	ns
t_r	Turn-On Rise Time		--	21	52	ns
$t_{d(off)}$	Turn-Off Delay Time		--	13	36	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	27	64	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 1.1 A, V_{GS} = 10 V	--	4.8	6.2	nC
Q_{gs}	Gate-Source Charge		--	0.7	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	2.7	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	0.3	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	1.2	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.3 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 1.1 A, dI_F / dt = 100 A/μs (Note 4)	--	190	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.53	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 59mH, I_{AS} = 1.1A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 0.3A, 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
6. a) Reference point of the $R_{\theta JL}$ is the drain lead
   b) When mounted on 3"x4.5" FR-4 PCB without any pad copper in a still air environment
   ($R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance. $R_{\theta CA}$ is determined by the user's board design)

Typical Performance Characteristics

Figure 1. On-Region Characteristics

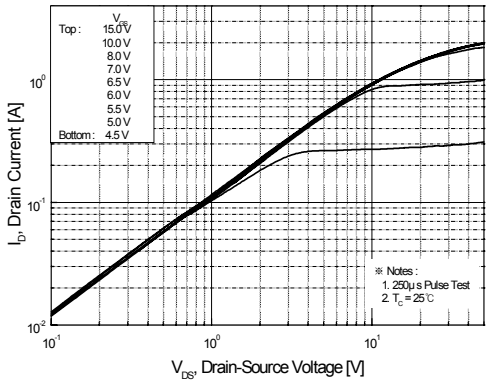


Figure 2. Transfer Characteristics

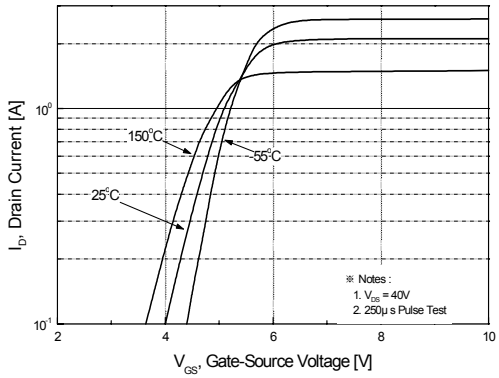


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

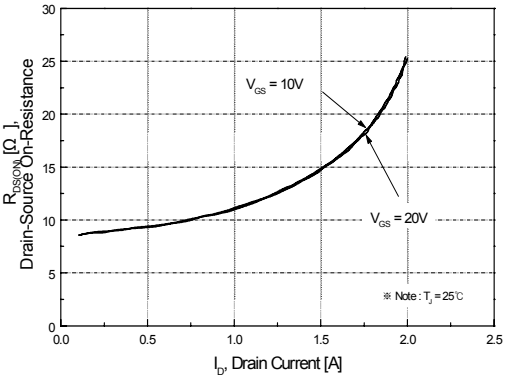


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

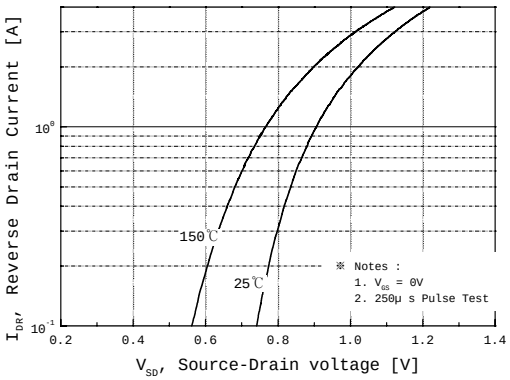


Figure 5. Capacitance Characteristics

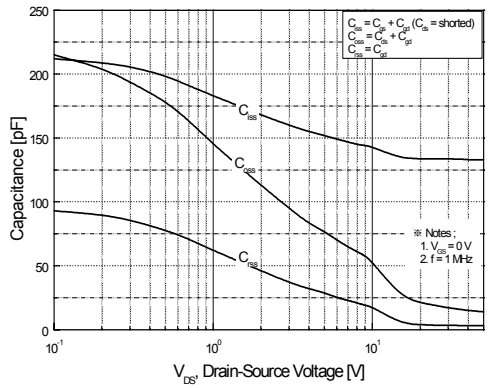
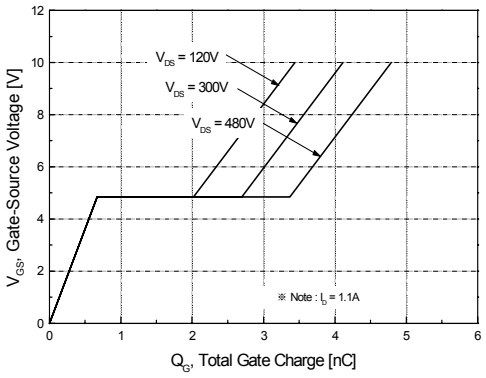


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

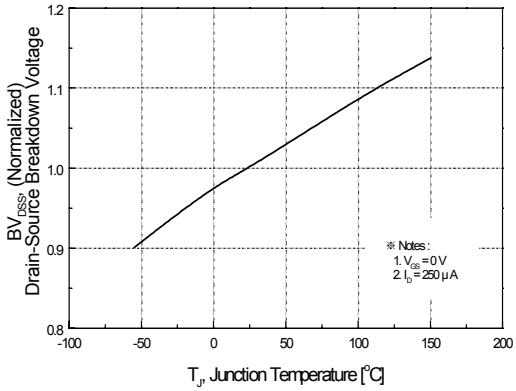


Figure 8. On-Resistance Variation vs. Temperature

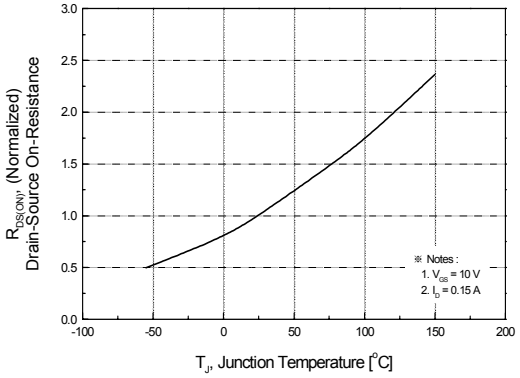


Figure 9. Maximum Safe Operating Area

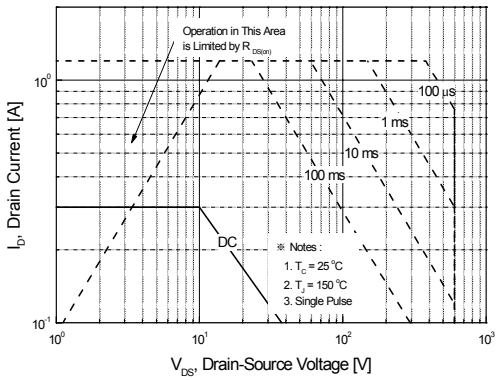


Figure 10. Maximum Drain Current vs. Case Temperature

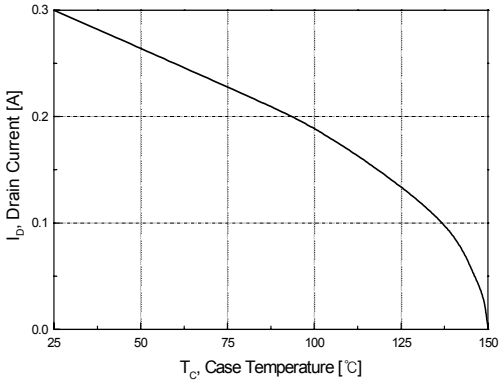
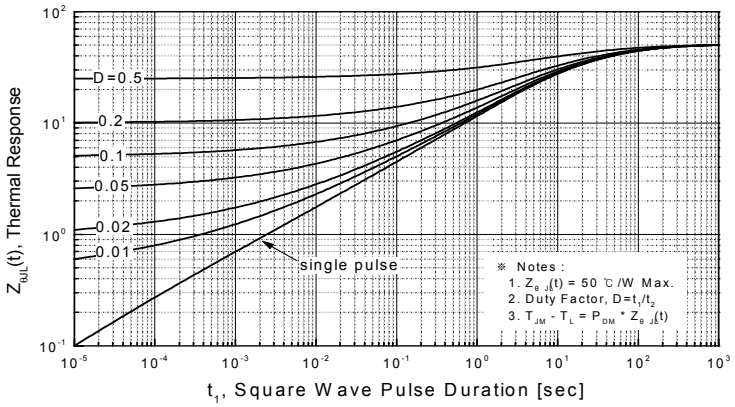
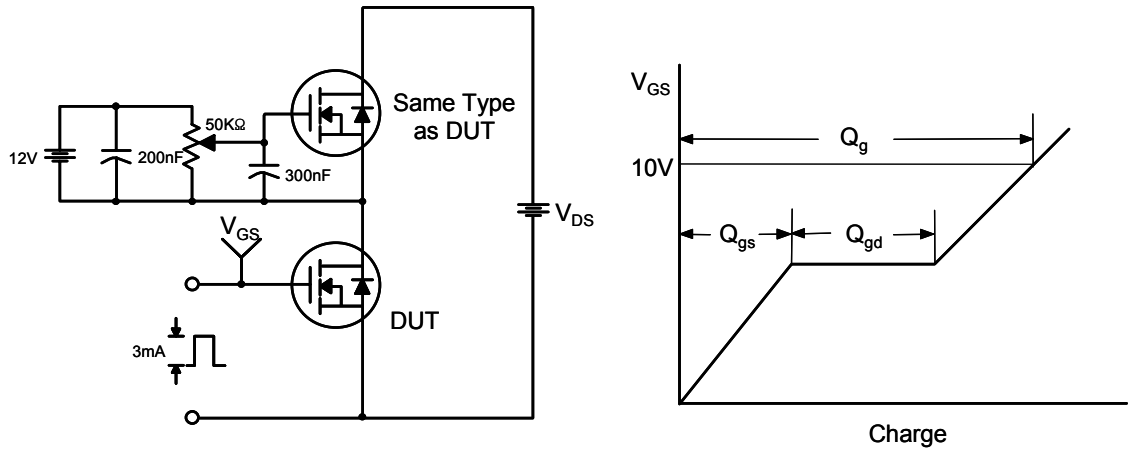


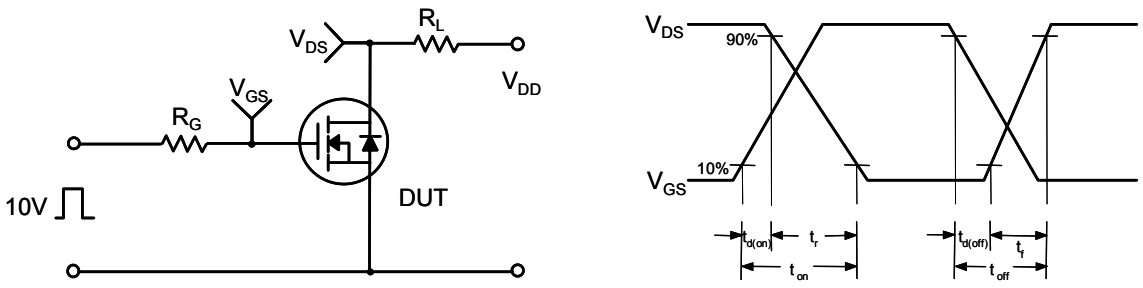
Figure 11. Transient Thermal Response Curve



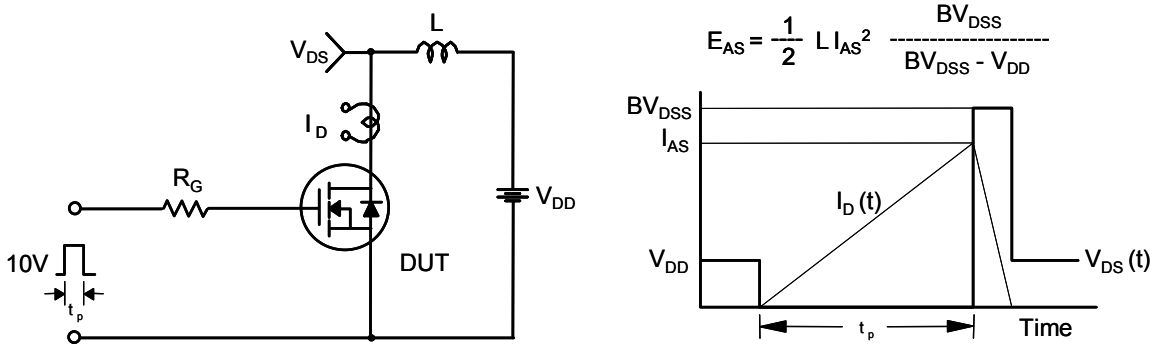
Gate Charge Test Circuit & Waveform



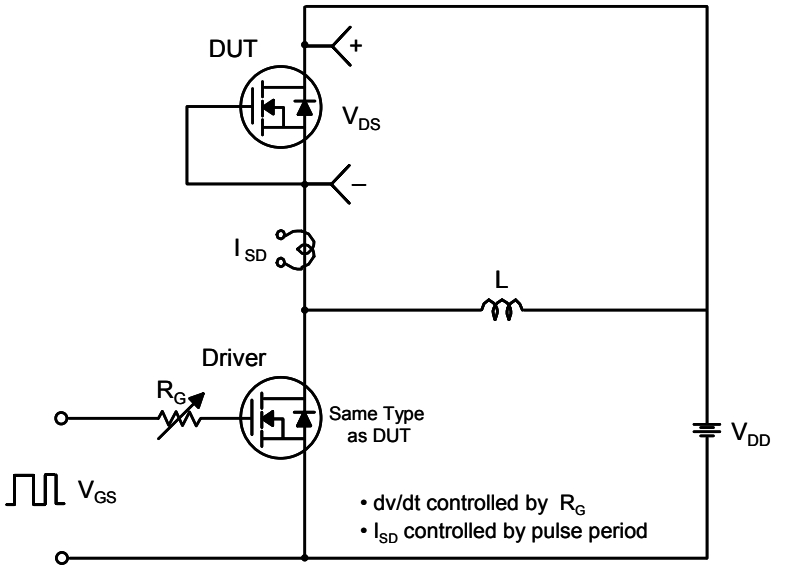
Resistive Switching Test Circuit & Waveforms

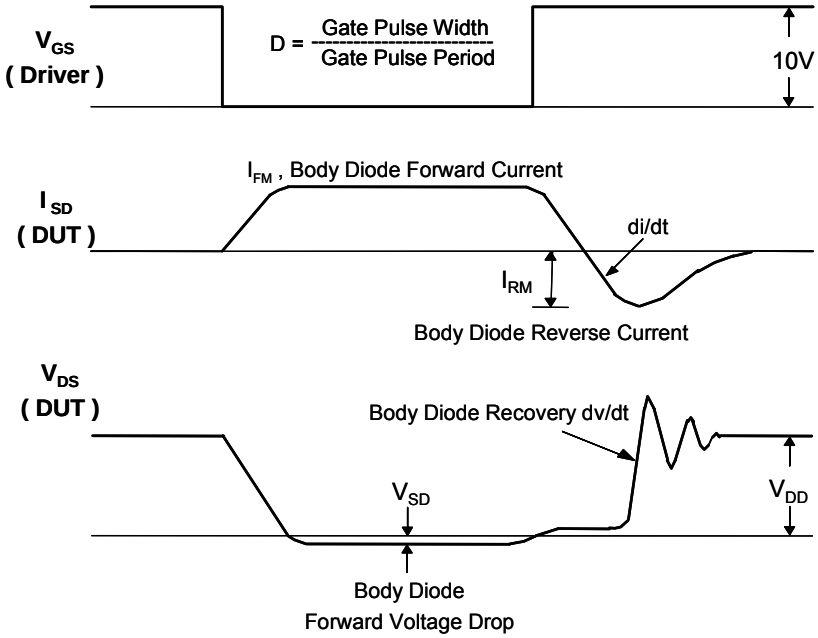


Unclamped Inductive Switching Test Circuit & Waveforms



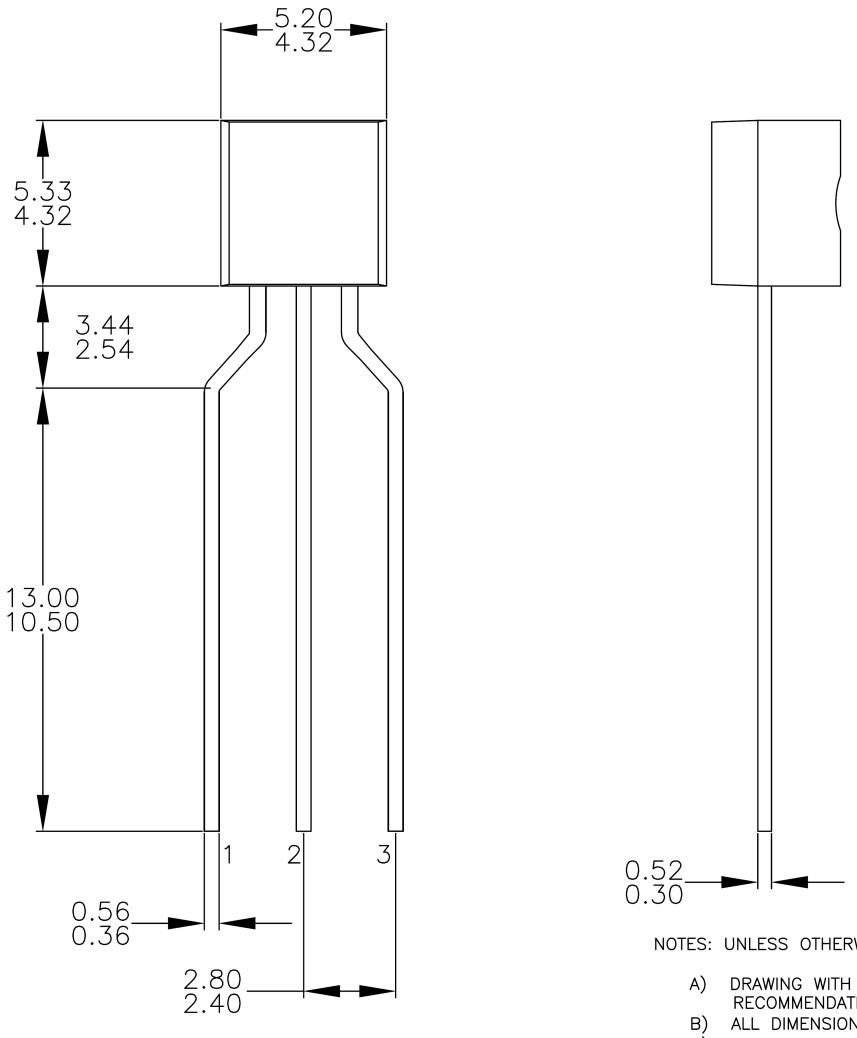
Peak Diode Recovery dv/dt Test Circuit & Waveforms

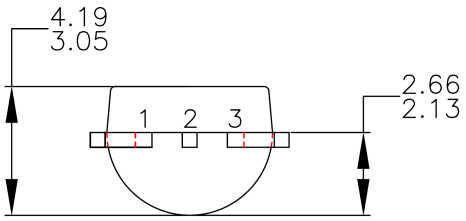




Mechanical Dimensions

TO-92





NOTES: UNLESS OTHERWISE SPECIFIED

A) DRAWING WITH REFERENCE TO JEDEC TO−92 RECOMMENDATIONS.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DRAWING CONFORMS TO ASME Y14.5M−1994.
D) TO−92 (92,94,96,97,98) PIN CONFIGURATION:

PIN	92			94			96			97			98		
	P	F	M	P	F	M	B	F	M	P	F	M	P	F	M
1	E	S	S	E	S	S	B	D	G	C	G	D	C	G	D
2	B	D	G	C	G	D	E	S	S	B	D	G	E	S	S
3	C	G	D	B	D	G	C	G	D	E	S	S	B	D	G

LEGEND:

P − BIPOLAR
F − JFET
M − DMOS
E − EMITTER
B − BASE
C − COLLECTOR
D − DRAIN
S − SOURCE
G − GATE

E) FOR PACKAGE 92, 94, 96, 97 AND 98: PIN CONFIGURATION DRAIN "D" AND SOURCE "S" ARE INTERCHANGEAGLE AT JFET "F" OPTION.
F) DRAWING FILENAME: MKT−ZA03FREV2.

Dimensions in Millimeters

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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. I64