

FQN1N50C

N-Channel QFET® MOSFET

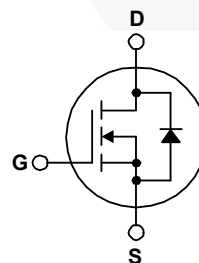
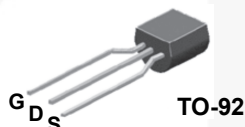
500 V, 0.38 A, 6 Ω

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

- 0.38 A, 500 V, $R_{DS(on)} = 6 \Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 0.19 \text{ A}$
- Low Gate Charge (Typ. 4.9 nC)
- Low C_{rss} (Typ. 4.1 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQN1N50CTA	Unit
V_{DSS}	Drain-Source Voltage	500	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	0.38	A
	- Continuous ($T_C = 100^\circ\text{C}$)	0.24	A
I_{DM}	Drain Current - Pulsed (Note 1)	3.04	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	44.4	mJ
I_{AR}	Avalanche Current (Note 1)	0.38	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	0.21	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_A = 25^\circ\text{C}$)	0.89	W
	Power Dissipation ($T_L = 25^\circ\text{C}$)	2.08	W
	- Derate above 25°C	0.017	W/ $^\circ\text{C}$
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	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQN1N50CTA	Unit
$R_{\theta JL}$	Thermal Resistance, Junction-to-Lead, Max. (Note 5a)	60	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max. (Note 5b)	140	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQN1N50CTA	1N50C	TO-92	AMMO	N/A	N/A	2000 units

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	500	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.5	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V	--	--	50	μA
		V _{DS} = 400 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 = 0.19 A	--	4.6	6.0	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 0.19A	--	0.6	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	150	195	pF
C _{oss}	Output Capacitance		--	28	40	pF
C _{rss}	Reverse Transfer Capacitance		--	4.1	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 250 V, I _D = 1.0 A, R _G = 25 Ω (Note 4)	--	10	30	ns
t _r	Turn-On Rise Time		--	10	30	ns
t _{d(off)}	Turn-Off Delay Time		--	20	50	ns
t _f	Turn-Off Fall Time		--	15	40	ns
Q _g	Total Gate Charge	V _{DS} = 400 V, I _D = 1.0 A, V _{GS} = 10 V (Note 4)	--	4.9	6.4	nC
Q _{gs}	Gate-Source Charge		--	0.66	--	nC
Q _{gd}	Gate-Drain Charge		--	2.9	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	0.38	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	3.04	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 0.38 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 1.0 A, dI _F / dt = 100 A/μs	--	188	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.55	--	μC

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. L = 80 mH, I_{AS} = 1.0 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 0.38 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature.
5. a) Reference point of the R_{θJA} is the drain lead.
b) When mounted on 3"x4.5" FR-4 PCB without any pad copper in a still air environment
(R_{θJA} is the sum of the junction-to-case and case-to-ambient thermal resistance. R_{θCA} is determined by the user's board design)

Typical Performance Characteristics

Figure 1. On-Region Characteristics

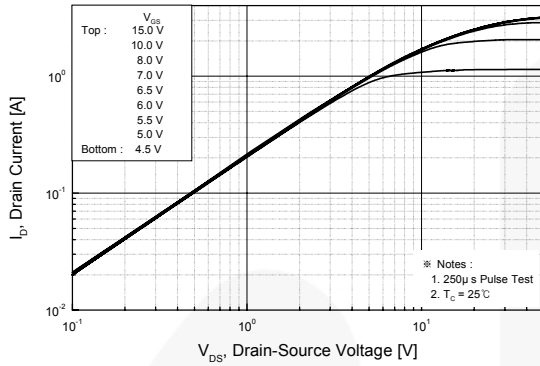


Figure 2. Transfer Characteristics

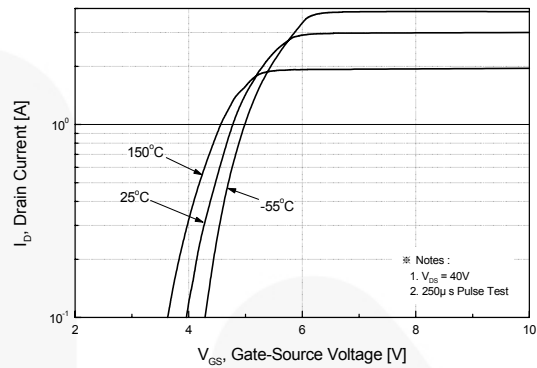


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

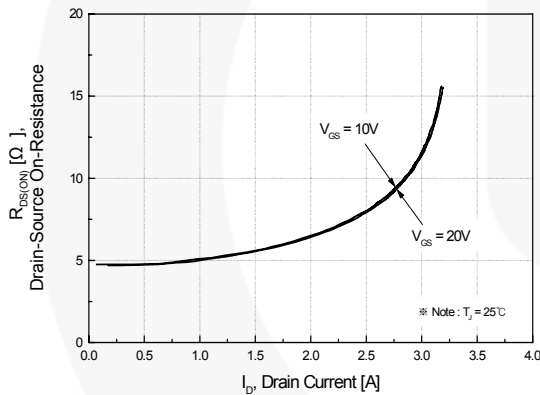


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

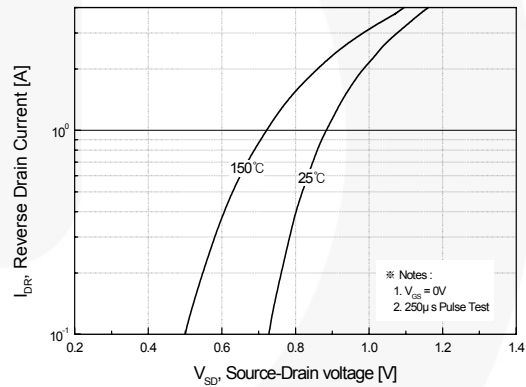


Figure 5. Capacitance Characteristics

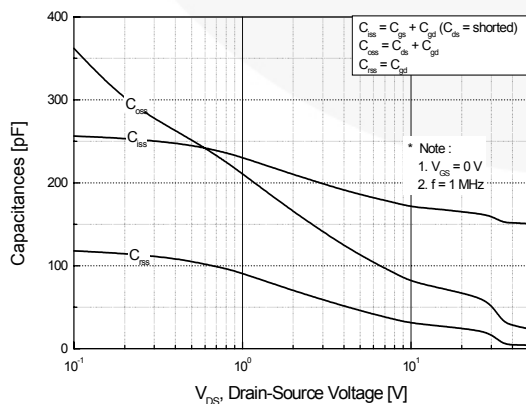
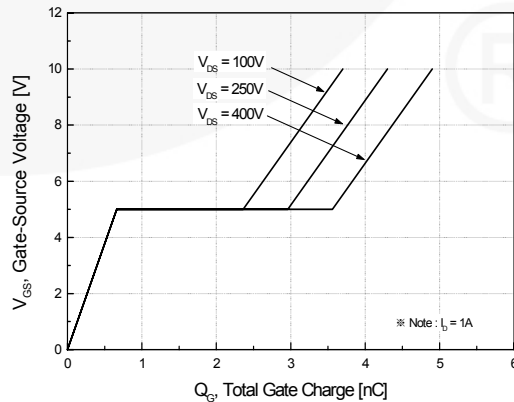


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

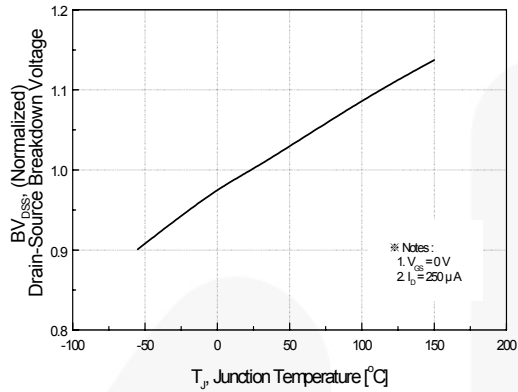


Figure 8. On-Resistance Variation vs. Temperature

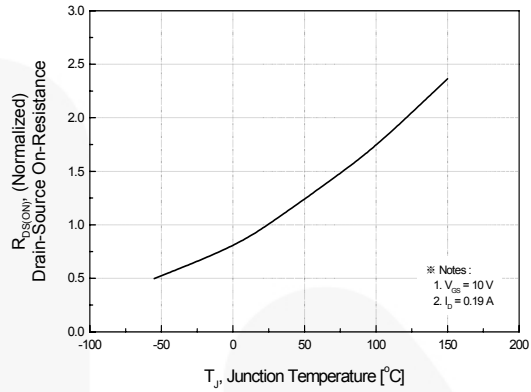


Figure 9. Maximum Safe Operating Area

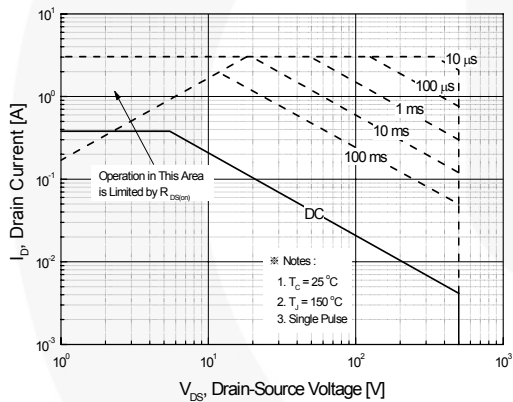


Figure 10. Maximum Drain Current vs. Case Temperature

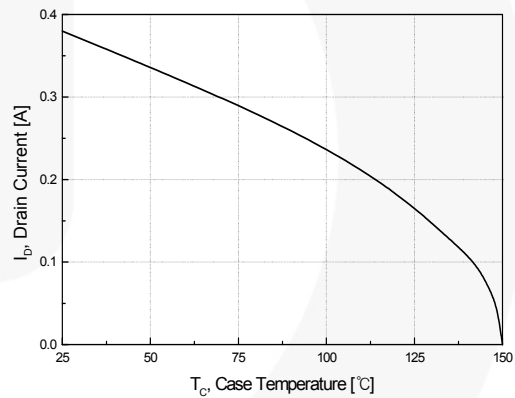
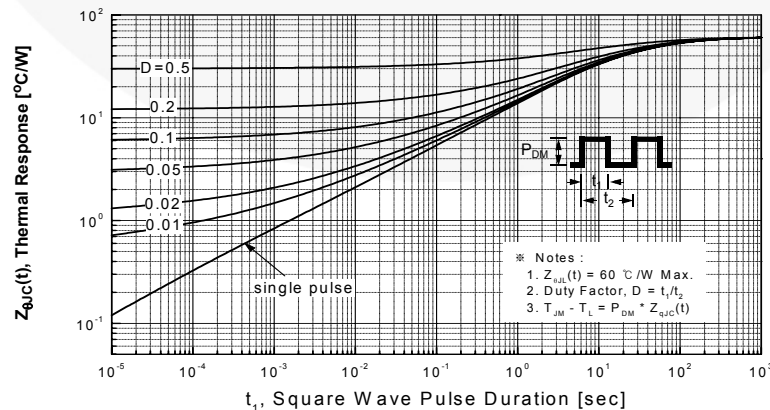


Figure 11. Transient Thermal Response Curve



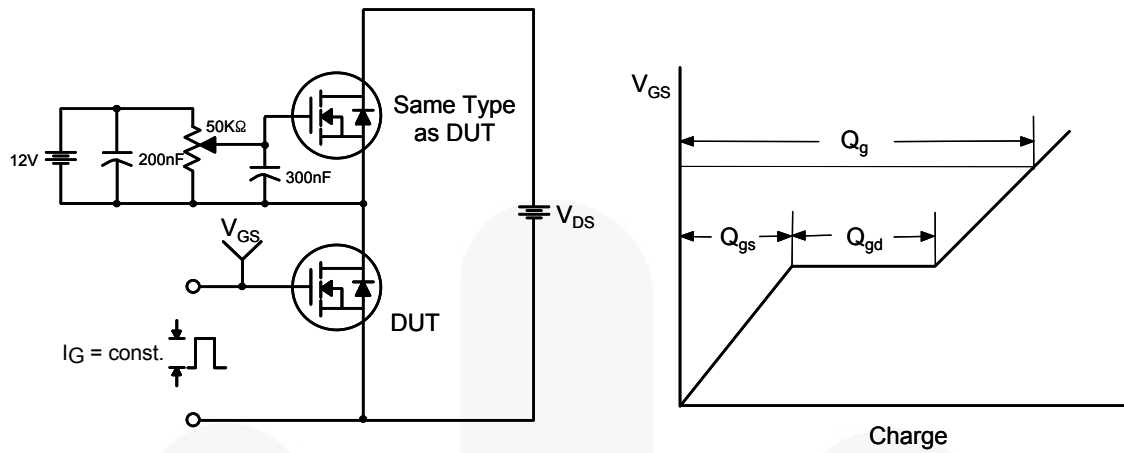


Figure 12. Gate Charge Test Circuit & Waveform

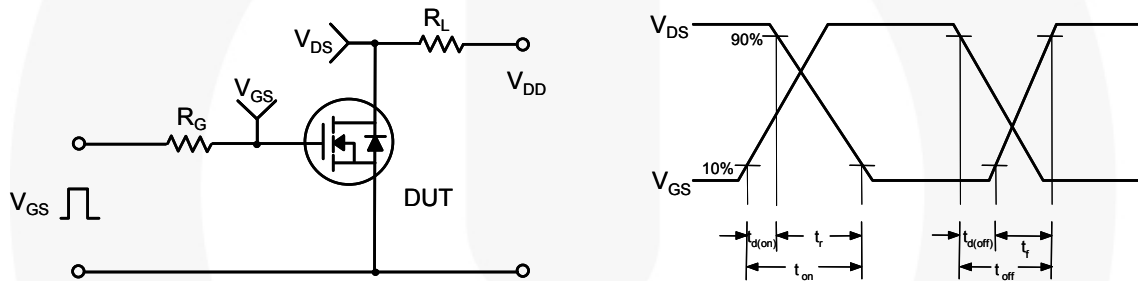


Figure 13. Resistive Switching Test Circuit & Waveforms

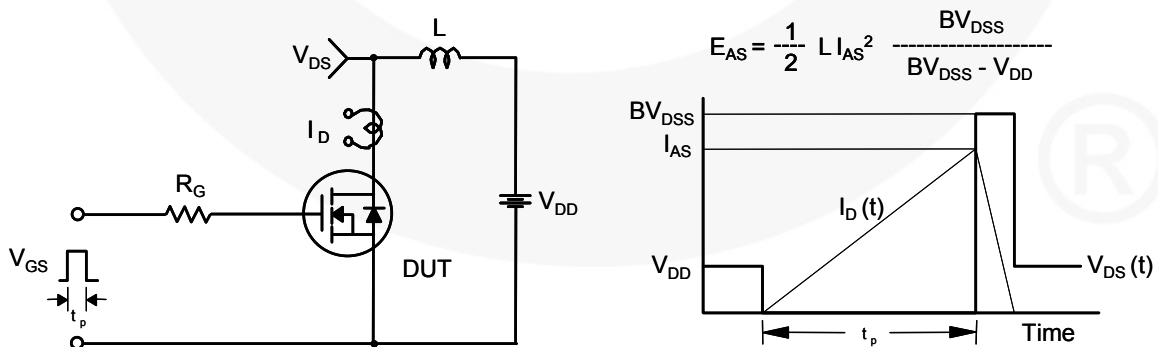


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

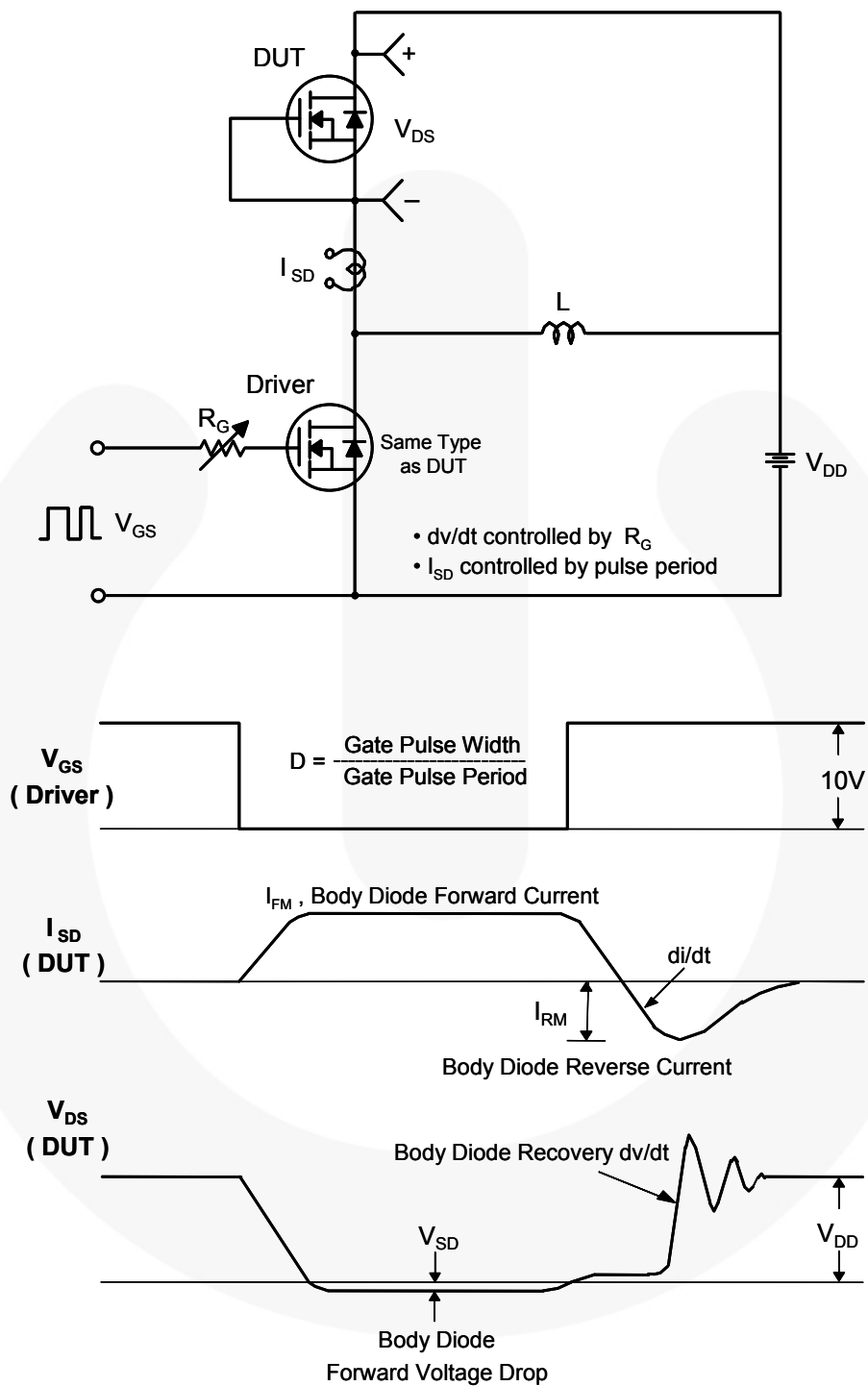
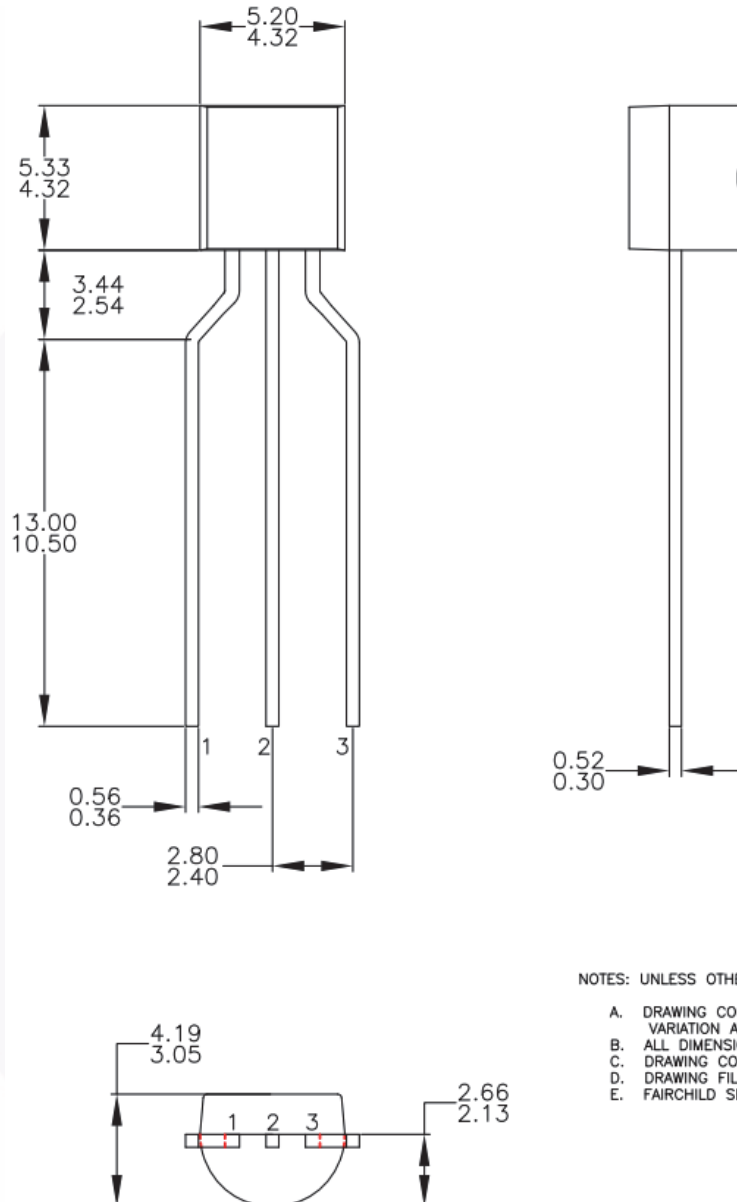


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

- A. DRAWING CONFORMS TO JEDEC MS-013, VARIATION AC.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5M-2009.
- D. DRAWING FILENAME: MKT-ZA03REV3.
- E. FAIRCHILD SEMICONDUCTOR.

Figure 16. TO92, Molded, 3-Lead, 0.200 In Line Spacing LD Form (J61Z Option)

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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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Rev. I66

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