January 2006

QFET ®

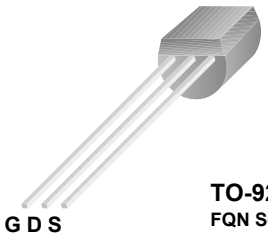
FQN1N50C
500V N-Channel MOSFET

Features

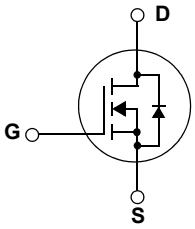
- 0.38 A, 500 V, $R_{DS(on)}$ = 6.0 Ω @ V_{GS} = 10 V
- Low gate charge (typical 4.9 nC)
- Low Crss (typical 4.1 pF)
- Fast switching
- 100 % avalanche tested
- Improved dv/dt capability

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-92
FQN Series



Absolute Maximum Ratings

Symbol	Parameter		FQN1N50C	Units
V_{DSS}	Drain-Source Voltage		500	V
I_D	Drain Current	- Continuous (T_C = 25°C)	0.38	A
		- Continuous (T_C = 100°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°C)		0.89	W
	Power Dissipation (T_L = 25°C)		2.08	W
	- Derate above 25°C		0.017	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	Units
$R_{\theta JL}$	Thermal Resistance, Junction-to-Lead	(Note 6a)	--	60	°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
1N50C	FQN1N50C	TO-92	--	--	2000ea

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	500	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	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 (Note 4)	--	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	--	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	(Note 4, 5)	--	15	40	ns
Q_g	Total Gate Charge	V_{DS} = 400 V, I_D = 1.0 A, V_{GS} = 10 V	--	4.9	6.4	nC
Q_{gs}	Gate-Source Charge		--	0.66	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	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 (Note 4)	--	188	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.55	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 80mH, I_{AS} = 1.0A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 0.38A, 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

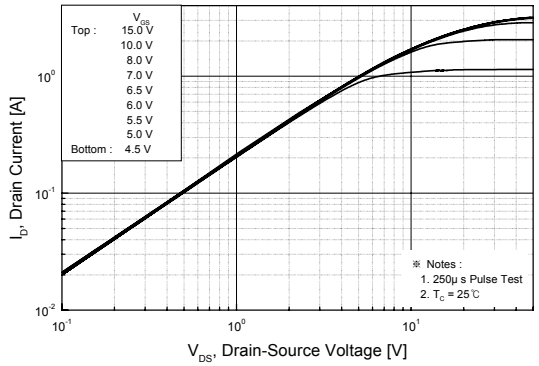


Figure 2. Transfer Characteristics

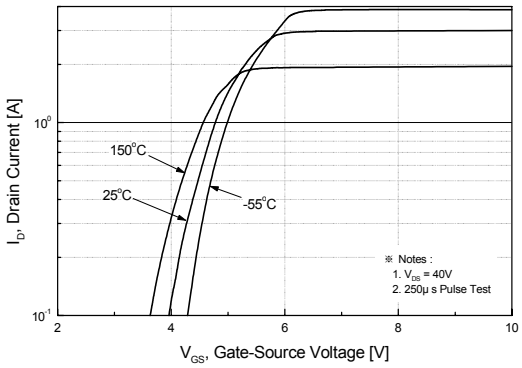


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

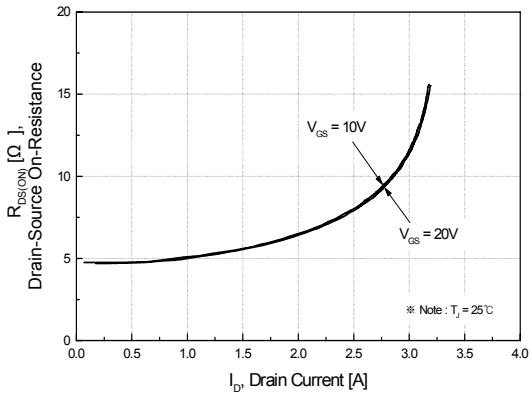


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

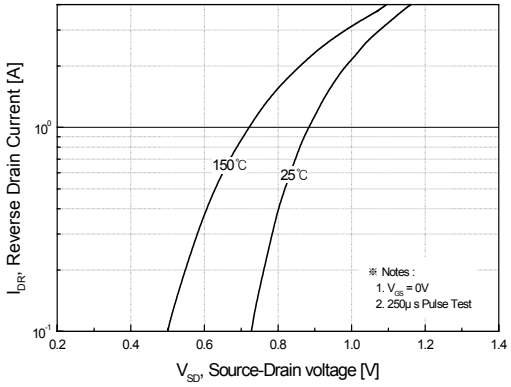


Figure 5. Capacitance Characteristics

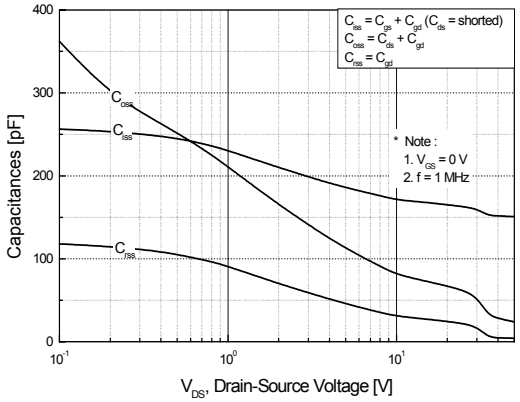
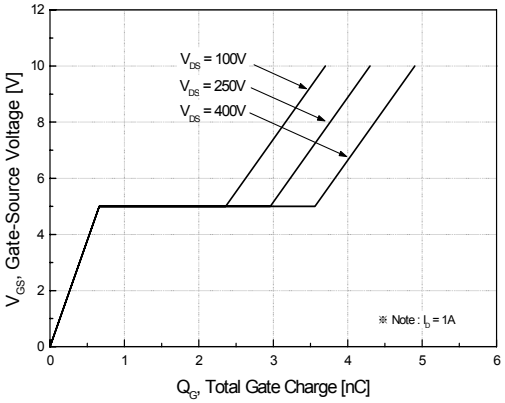


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

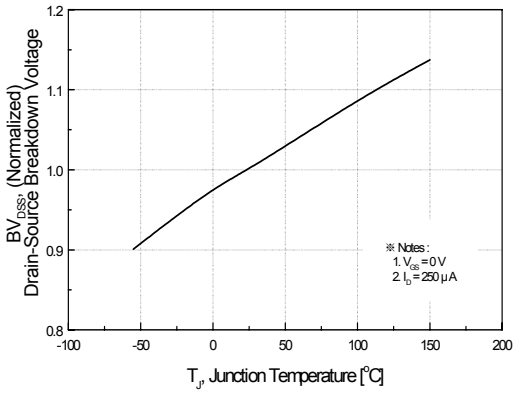


Figure 8. On-Resistance Variation vs. Temperature

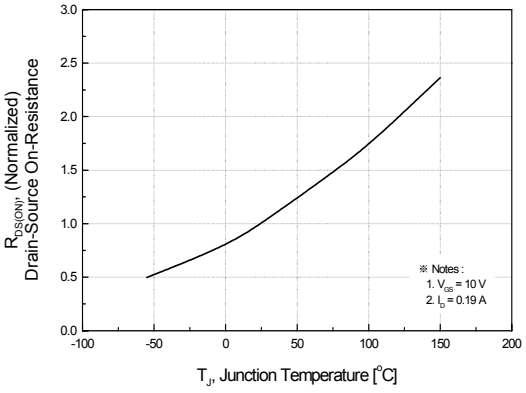


Figure 9. Maximum Safe Operating Area

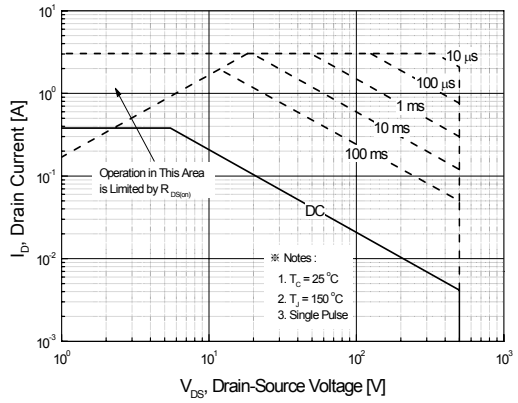


Figure 10. Maximum Drain Current vs. Case Temperature

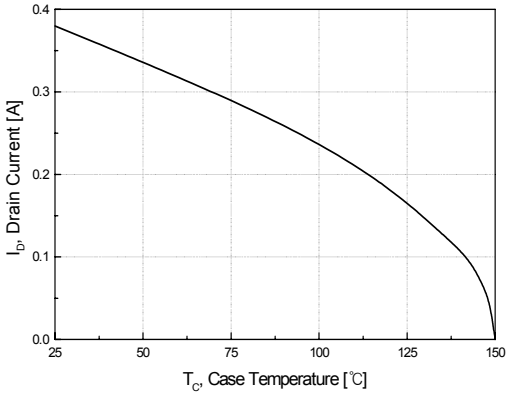
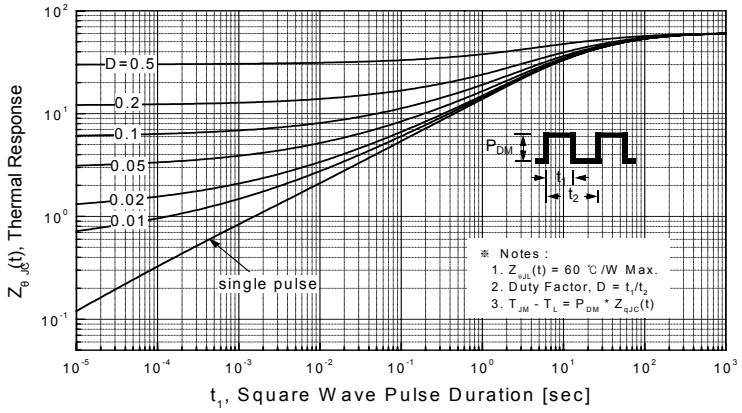
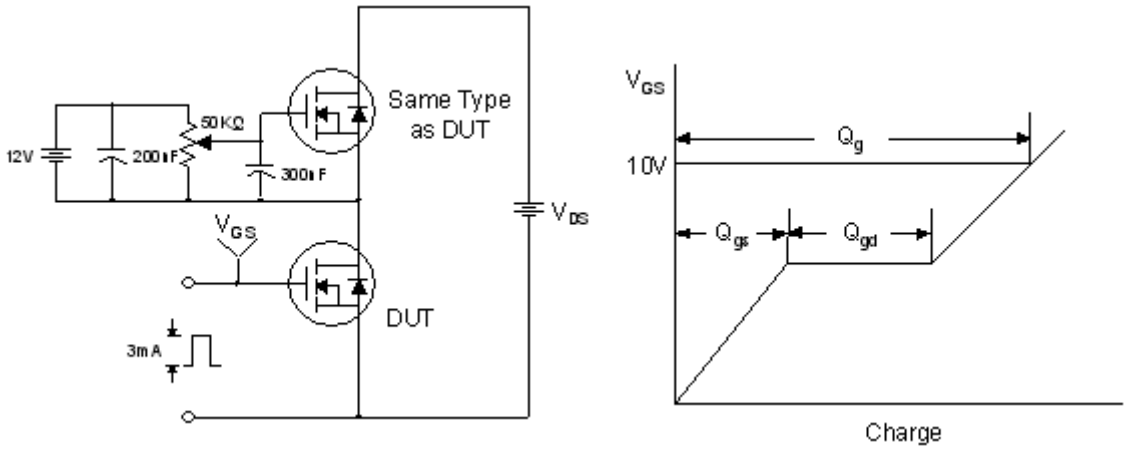


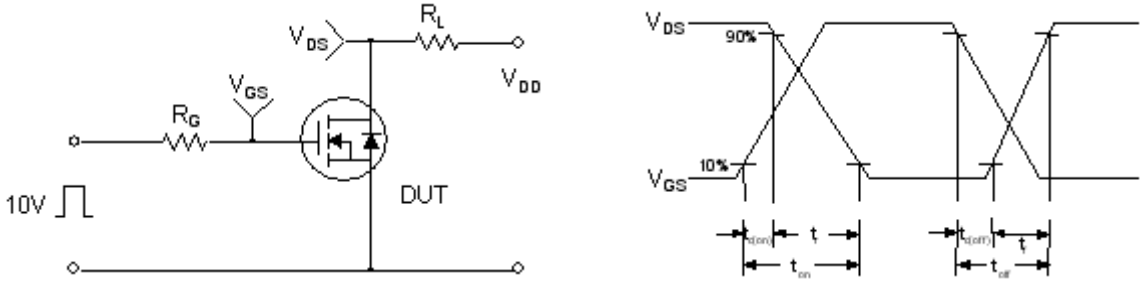
Figure 11. Transient Thermal Response Curve



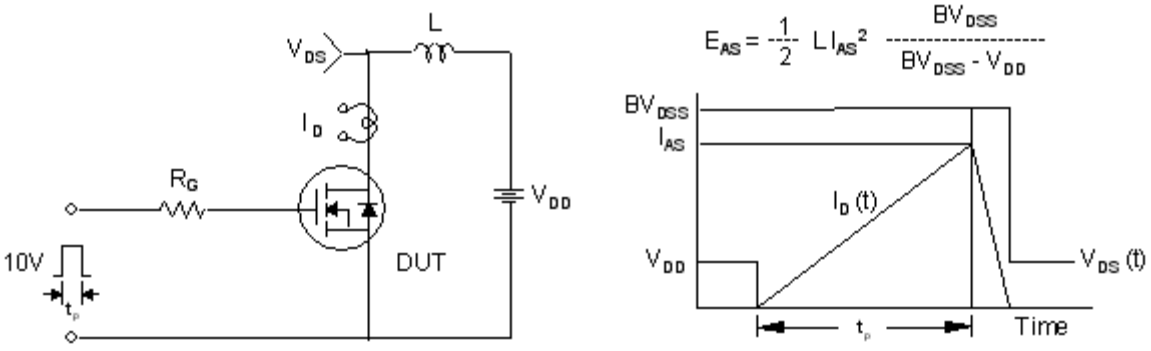
Gate Charge Test Circuit & Waveform



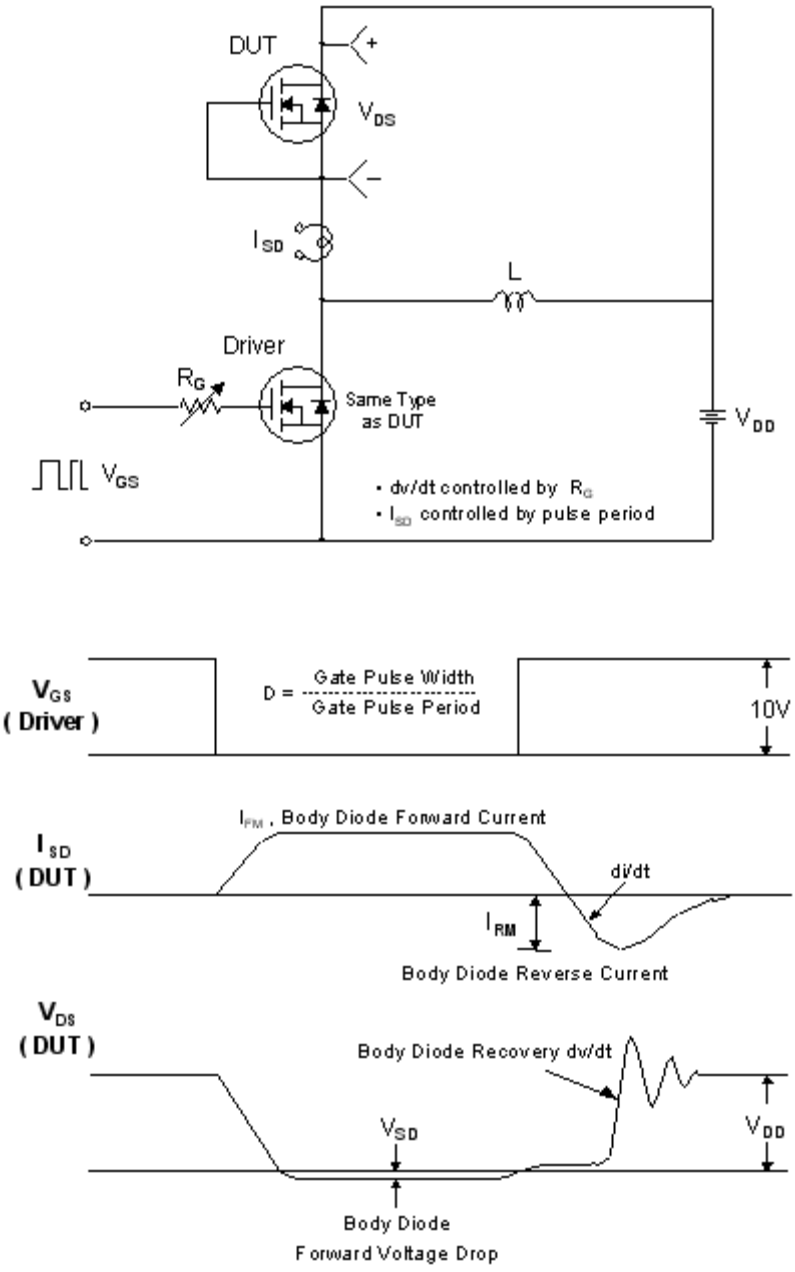
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

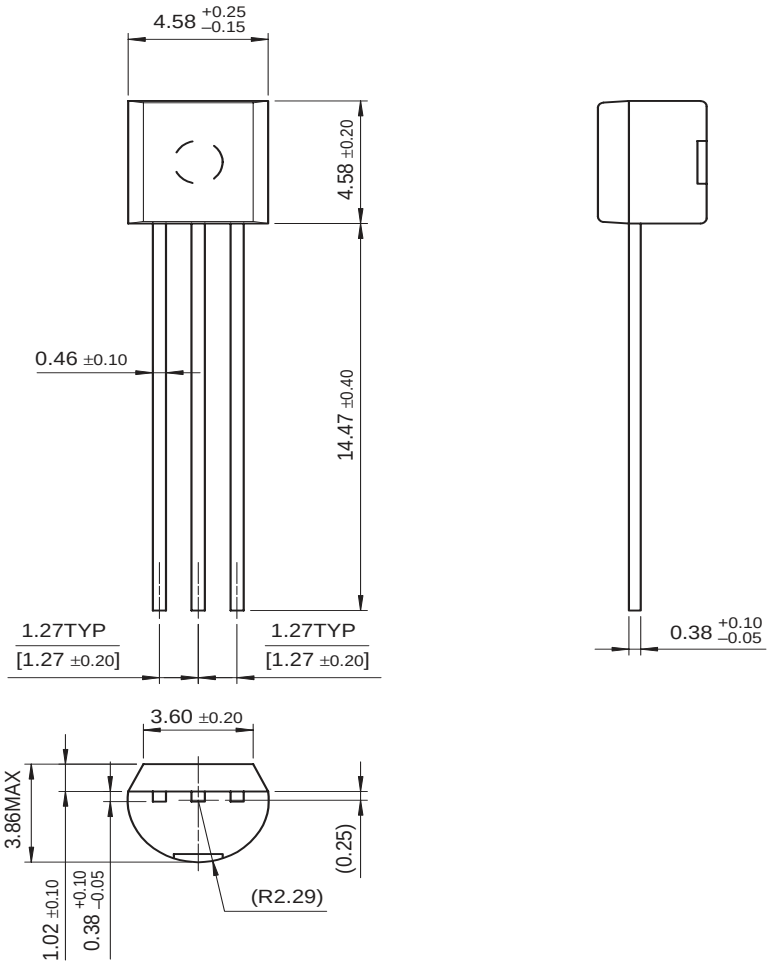


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-92



Dimensions in Millimeters

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PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

FQN1N50C

500V N-Channel MOSFET

Contents

BUY

Datasheet
Download this datasheet

e-mail this datasheet

This page
Print version

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- Request samples
- How to order products
- Product Change Notices (PCNs)
- Support
- Sales support
- Quality and reliability
- Design center

General description

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back to top

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back to top

Product status/pricing/packaging

BUY

Product	Product status	Pb-free Status	Pricing*	Package type	Leads	Packing method	Package Marking Convention**

FQN1N50CBU	Full Production	Full Production	$0.316	TO-92	3	BULK	Line 1: 1N50C Line 2: &3
FQN1N50CTA	Full Production	Full Production	$0.316	TO-92	3	AMMO	Line 1: 1N50C Line 2: &3

* Fairchild 1,000 piece Budgetary Pricing
** A sample button will appear if the part is available through Fairchild's on-line samples program. If there is no sample button, please contact a Fairchild distributor to obtain samples

Indicates product with Pb-free second-level interconnect. For more information click here.

Package marking information for product FQN1N50C is available. Click here for more information .

back to top

Qualification Support

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Product
FQN1N50CBU
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back to top