FAIRCHILD SEMICONDUCTOR™

December 2000

QFET™

FQB10N20L / FQI10N20L

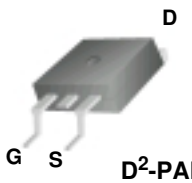
200V LOGIC N-Channel MOSFET

General Description

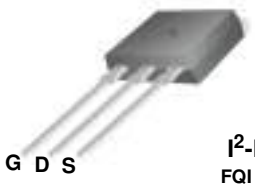
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.
This advanced technology is especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation modes. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supplies, and motor control.

Features

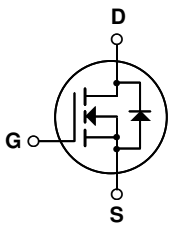
- 10A, 200V, $R_{DS(on)}$ = 0.36Ω @V_{GS} = 10 V
- Low gate charge (typical 13 nC)
- Low Crss (typical 14 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Low level gate drive requirement allowing direct operation from logic drivers



D^2-PAK
FQB Series



I^2-PAK
FQI Series



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		FQB10N20L / FQI10N20L	Units
V_{DSS}	Drain-Source Voltage		200	V
I_D	Drain Current - Continuous (T_C = 25°C)		10	A
	- Continuous (T_C = 100°C)		6.3	A
I_{DM}	Drain Current - Pulsed	(Note 1)	40	A
V_{GSS}	Gate-Source Voltage		± 20	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	180	mJ
I_{AR}	Avalanche Current	(Note 1)	10	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	8.7	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	5.5	V/ns
P_D	Power Dissipation (T_A = 25°C) *		3.13	W
	Power Dissipation (T_C = 25°C)		87	W
	- Derate above 25°C		0.7	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
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	1.44	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	°C/W

* When mounted on the minimum pad size recommended (PCB Mount)

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	200	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.18	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 200 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 160 V, T_C = 125°C	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 20 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -20 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	1.0	--	2.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5.0 A	--	0.29	0.36	Ω
		V_{GS} = 5 V, I_D = 5.0 A (Note 4)		0.3	0.38	
g_{FS}	Forward Transconductance	V_{DS} = 30 V, I_D = 5.0 A	--	10.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	640	830	pF
C_{oss}	Output Capacitance		--	95	125	pF
C_{rss}	Reverse Transfer Capacitance		--	14	18	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 100 V, I_D = 10 A, R_G = 25 Ω (Note 4, 5)	--	13	35	ns
t_r	Turn-On Rise Time		--	150	310	ns
$t_{d(off)}$	Turn-Off Delay Time		--	50	110	ns
t_f	Turn-Off Fall Time		--	95	200	ns
Q_g	Total Gate Charge	V_{DS} = 160 V, I_D = 10 A, V_{GS} = 5 V (Note 4, 5)	--	13	17	nC
Q_{gs}	Gate-Source Charge		--	2.4	--	nC
Q_{gd}	Gate-Drain Charge		--	6.1	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	10	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	40	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 10 A	--	--	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 10 A, (Note 4)	--	120	--	ns
Q_{rr}	Reverse Recovery Charge	dI_F / dt = 100 A/μs	--	0.57	--	μC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 2.7mH, I_{AS} = 10A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 10A, di/dt ≤ 300A/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 Characteristics

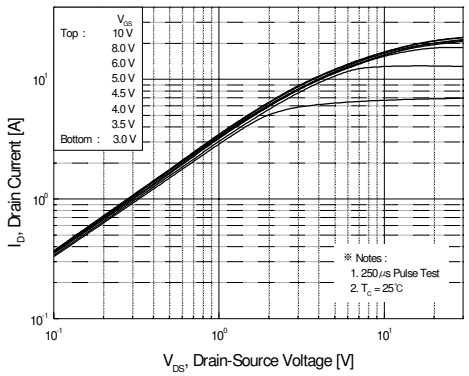


Figure 1. On-Region Characteristics

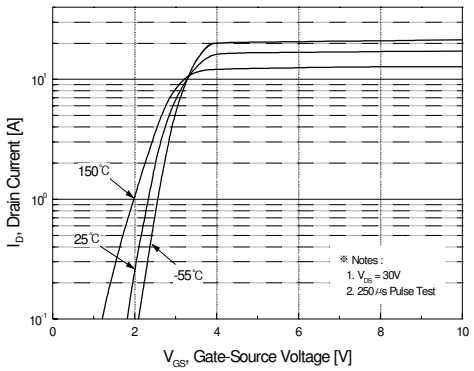


Figure 2. Transfer Characteristics

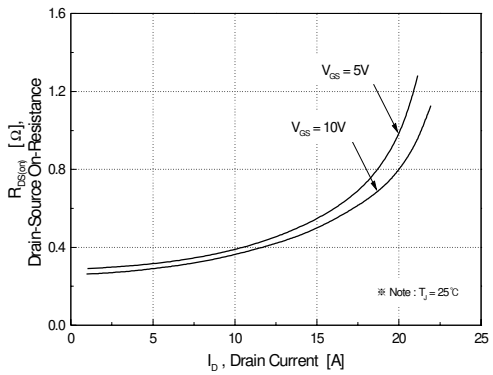


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

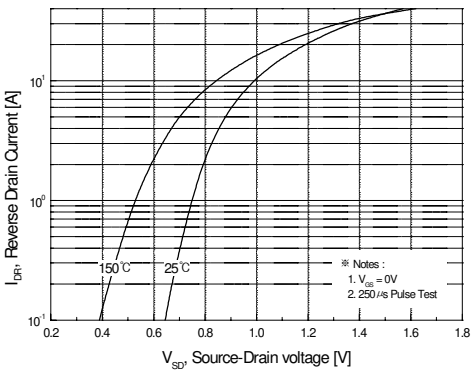


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

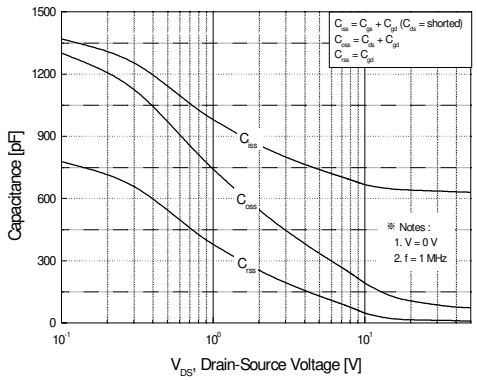


Figure 5. Capacitance Characteristics

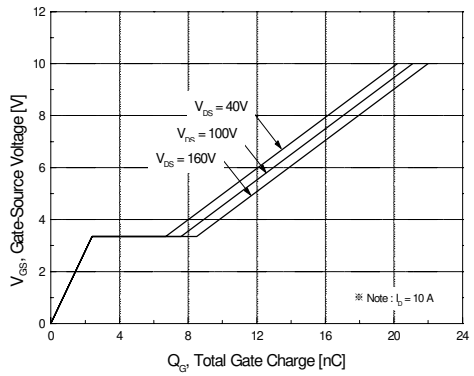


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

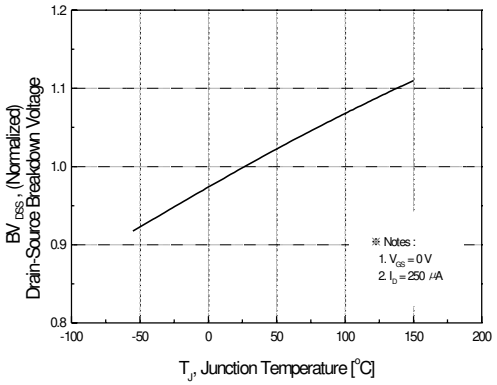


Figure 7. Breakdown Voltage Variation vs. Temperature

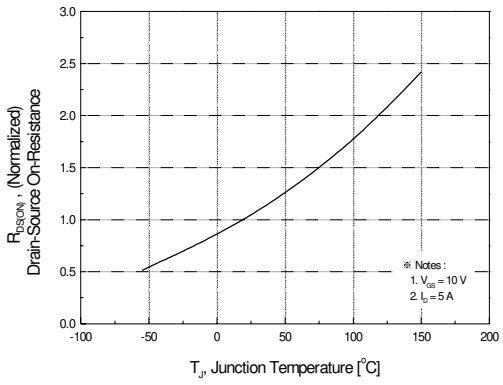


Figure 8. On-Resistance Variation vs. Temperature

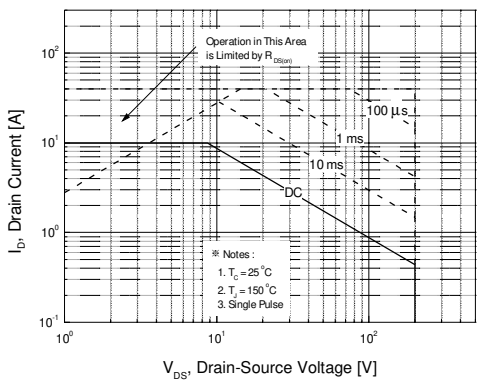


Figure 9. Maximum Safe Operating Area

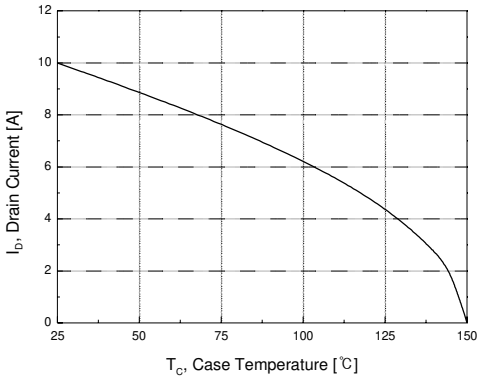


Figure 10. Maximum Drain Current vs. Case Temperature

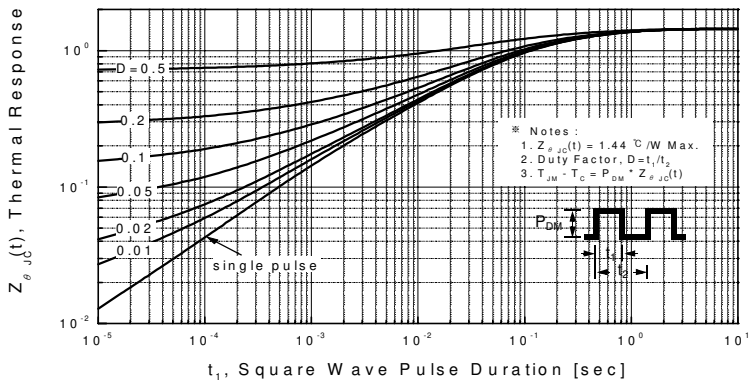
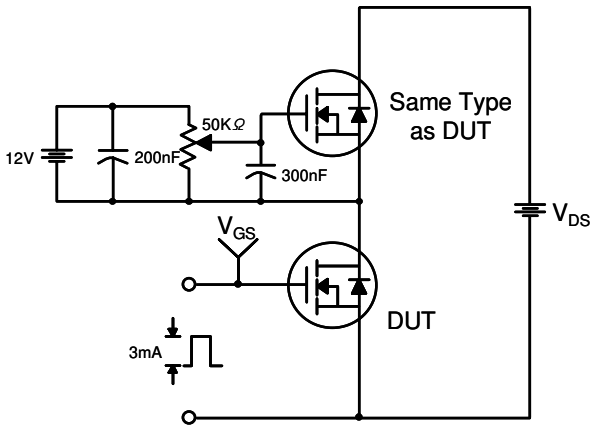
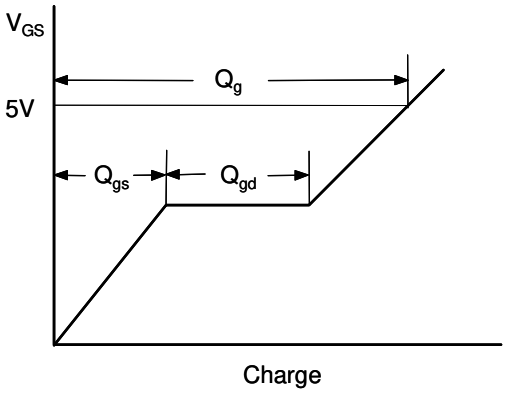


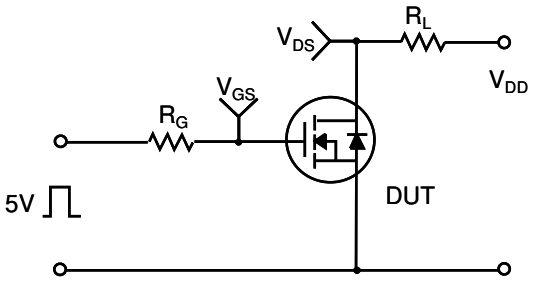
Figure 11. Transient Thermal Response Curve

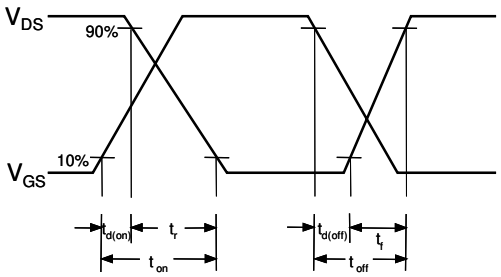
Gate Charge Test Circuit & Waveform



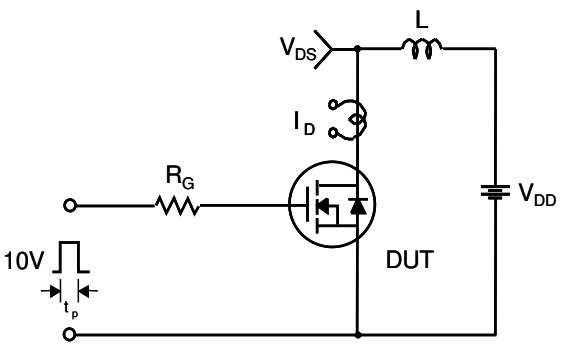


Resistive Switching Test Circuit & Waveforms

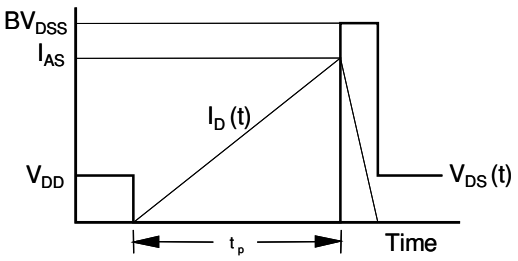




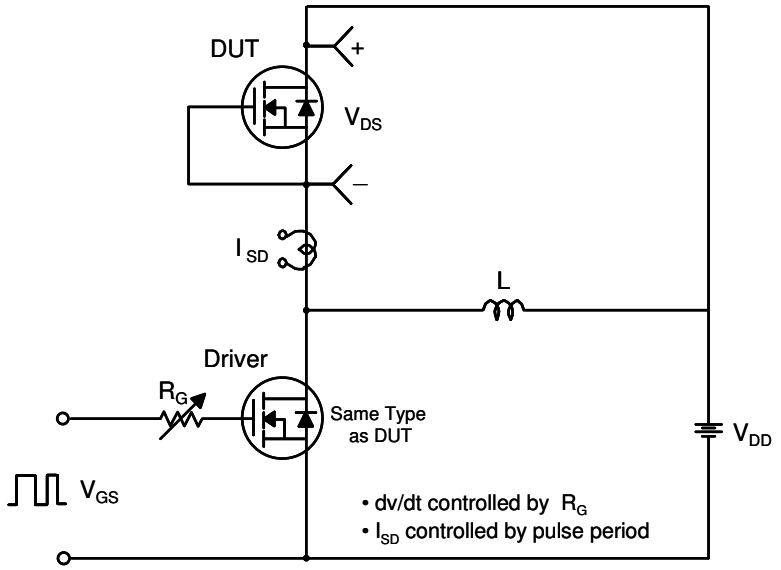
Unclamped Inductive Switching Test Circuit & Waveforms

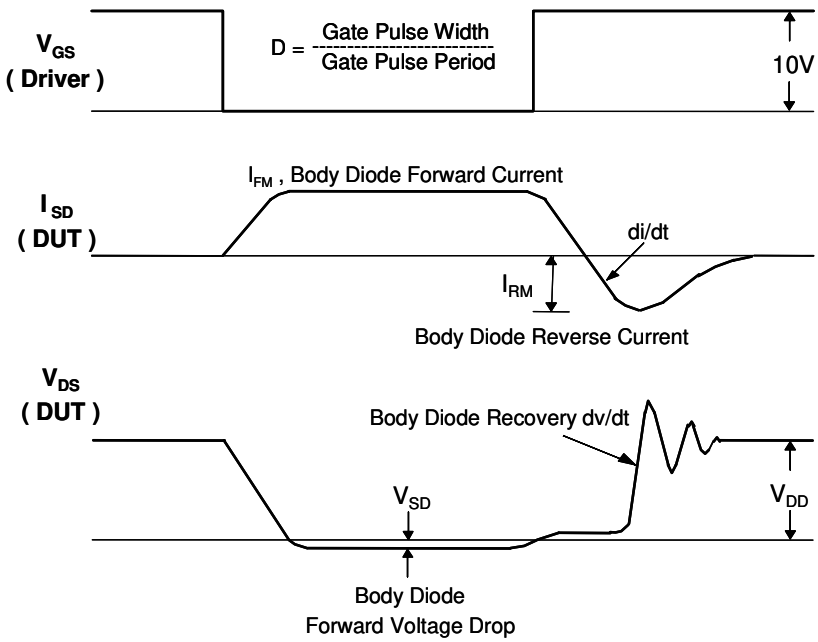


$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$



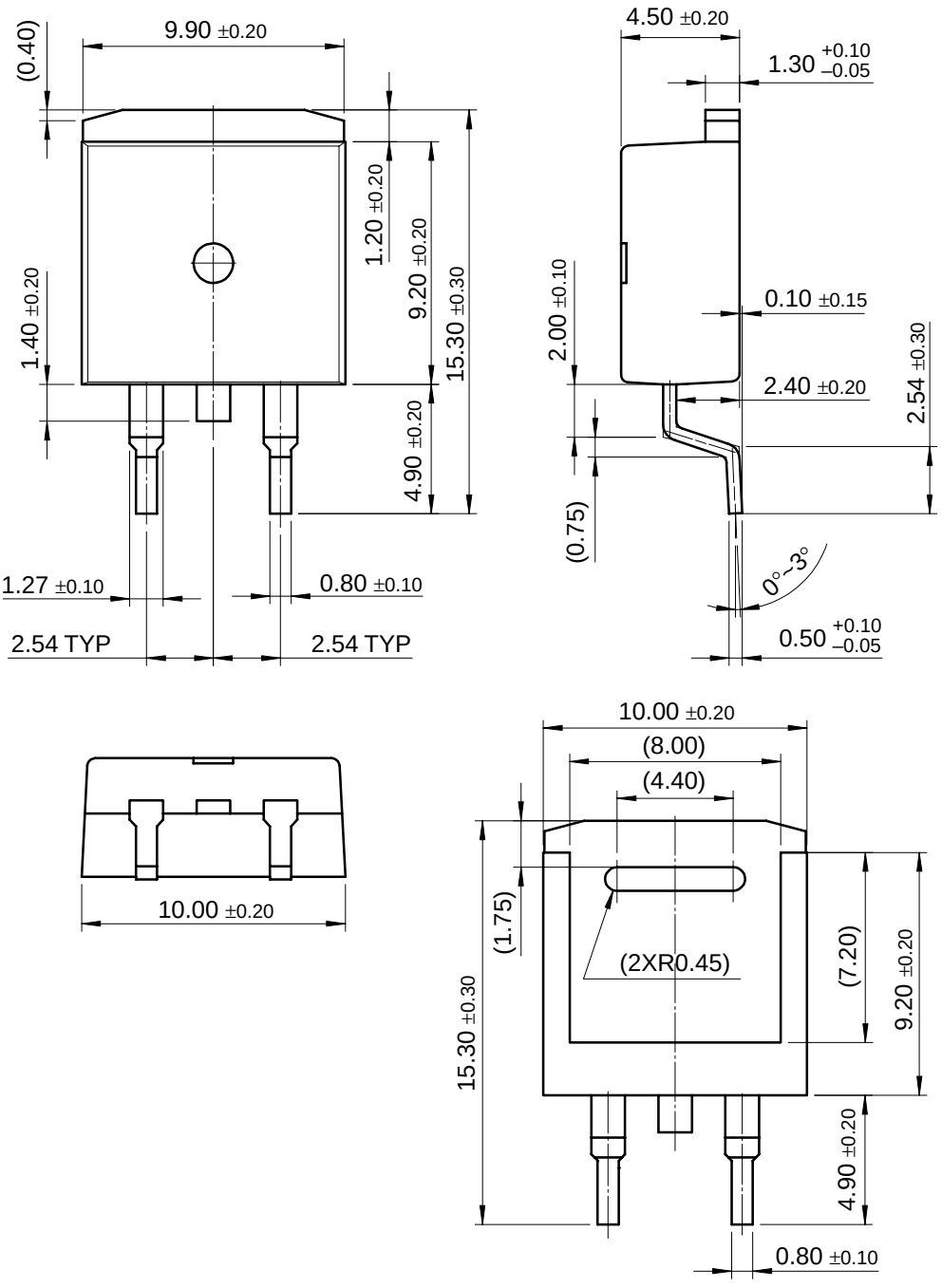
Peak Diode Recovery dv/dt Test Circuit & Waveforms





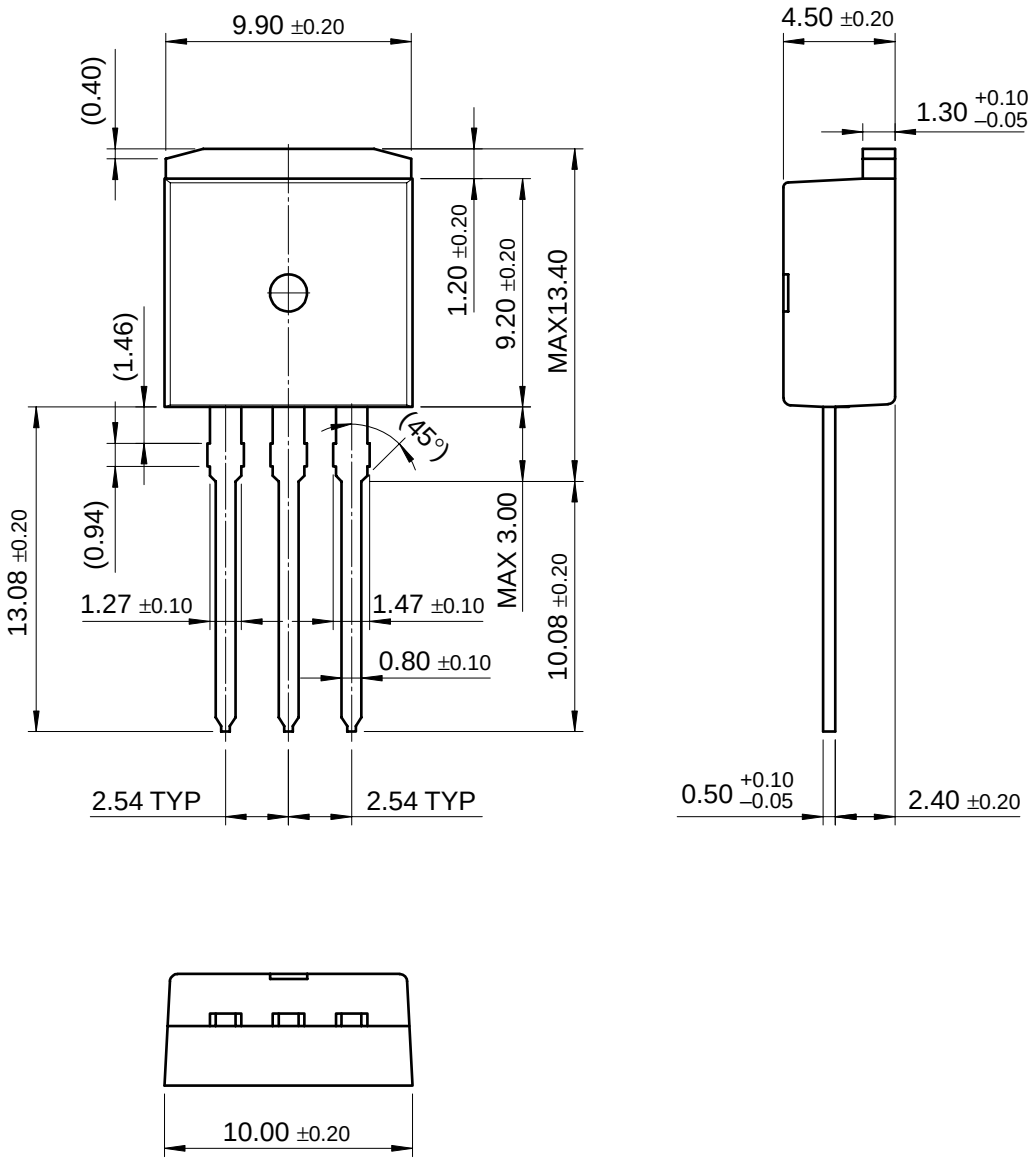
Package Dimensions

D^2PAK



Package Dimensions (Continued)

I²PAK



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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.

FQB10N20L
200V N-Channel Logic Level QFET

Contents

Datasheet
Download this datasheet

PDF

e-mail this datasheet

[E-

This page
Print version

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Request samples
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Product Change Notices (PCNs)
Support
Distributor and field sales representatives
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Design tools

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back to top

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back to top

Product status/pricing/packaging

Product	Product status	Pricing*	Package type	Leads	Packing method
FQB10N20LTM	Full Production	$0.62	TO-263(D2PAK)	2	TAPE REEL

* 1,000 piece Budgetary Pricing

back to top

Models

Package & leads	Condition	Temperature range	Software version	Revision date
PSPICE				
TO-263(D2PAK)-2	Electrical/Thermal	-55°C to 150°C	9.2	Jul 21, 2000

back to top

FQI10N20L
200V N-Channel Logic Level QFET

Contents

Datasheet
Download this datasheet

PDF

e-mail this datasheet

[E-

This page
Print version

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Request samples
How to order products
Product Change Notices (PCNs)
Support
Distributor and field sales representatives
Quality and reliability
Design tools

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back to top

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back to top

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FQI10N20LTU	Full Production	$0.62	TO-262(I2PAK)	3	RAIL

* 1,000 piece Budgetary Pricing

back to top

Models

Package & leads	Condition	Temperature range	Software version	Revision date
PSPICE				
TO-262(I2PAK)-3	Electrical/Thermal	-55°C to 150°C	9	Jul 21, 2000

back to top