



April 2000

QFET™

FQD16N15 / FQU16N15

150V N-Channel MOSFET

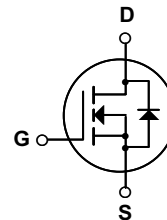
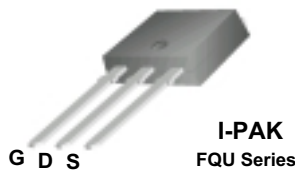
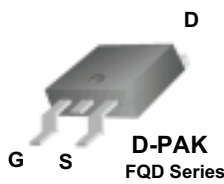
General Description

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

This advanced technology 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 low voltage applications such as audio amplifier, high efficiency switching for DC/DC converters, and DC motor control, uninterrupted power supply.

Features

- 11.8A, 150V, $R_{DS(on)} = 0.16\Omega @ V_{GS} = 10V$
- Low gate charge (typical 23 nC)
- Low Crss (typical 30 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter	FQD16N15 / FQU16N15	Units
V _{DSS}	Drain-Source Voltage	150	V
I _D	Drain Current - Continuous (T _C = 25°C) - Continuous (T _C = 100°C)	11.8	A
		7.45	A
I _{DM}	Drain Current - Pulsed (Note 1)	47.2	A
V _{GSS}	Gate-Source Voltage	± 25	V
E _{AS}	Single Pulsed Avalanche Energy (Note 2)	230	mJ
I _{AR}	Avalanche Current (Note 1)	11.6	A
E _{AR}	Repetitive Avalanche Energy (Note 1)	5.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	6.0	V/ns
P _D	Power Dissipation (T _A = 25°C) *	2.5	W
	Power Dissipation (T _C = 25°C)	55	W
	- Derate above 25°C	0.44	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 _{θJC}	Thermal Resistance, Junction-to-Case	--	2.27	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient *	--	50	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	--	110	°C/W

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

Electrical Characteristics

$T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	150	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.17	--	$V/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 150\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 120\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 5.9\text{ A}$	--	0.123	0.16	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 5.9\text{ A}$	--	8.5	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	700	910	pF
C_{oss}	Output Capacitance		--	145	190	pF
C_{rss}	Reverse Transfer Capacitance		--	30	40	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 75\text{ V}, I_D = 16.4\text{ A},$ $R_G = 25\ \Omega$	--	11	30	ns
t_r	Turn-On Rise Time		--	115	240	ns
$t_{d(off)}$	Turn-Off Delay Time		--	50	110	ns
t_f	Turn-Off Fall Time		--	80	170	ns
Q_g	Total Gate Charge	$V_{DS} = 120\text{ V}, I_D = 16.4\text{ A},$ $V_{GS} = 10\text{ V}$	--	23	30	nC
Q_{gs}	Gate-Source Charge		--	4.5	--	nC
Q_{gd}	Gate-Drain Charge		--	11	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	11.8	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	47.2	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 11.8\text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 16.4\text{ A},$ $dI_F / dt = 100\text{ A}/\mu\text{s}$	--	85	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.35	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 2.75\text{mH}, I_{AS} = 11.8\text{ A}, V_{DD} = 25\text{ V}, R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 16.4\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width $\leq 300\ \mu\text{s}$, Duty cycle $\leq 2\%$
5. Essentially independent of operating temperature

Typical Characteristics

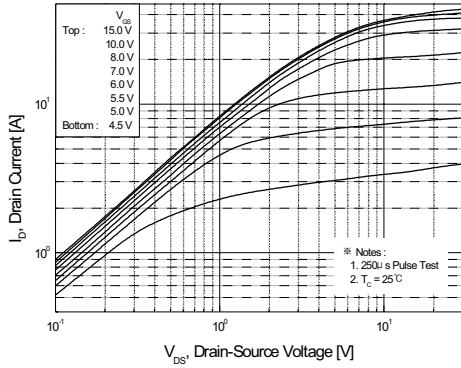


Figure 1. On-Region Characteristics

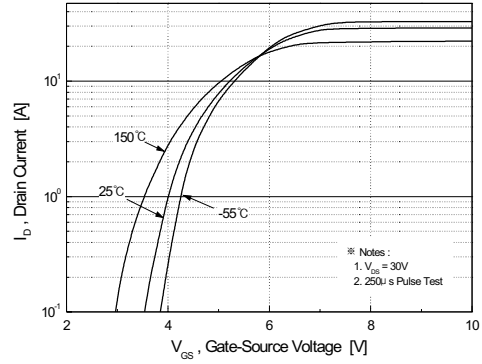


Figure 2. Transfer Characteristics

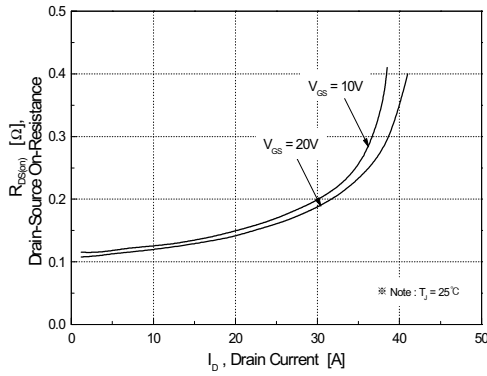


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

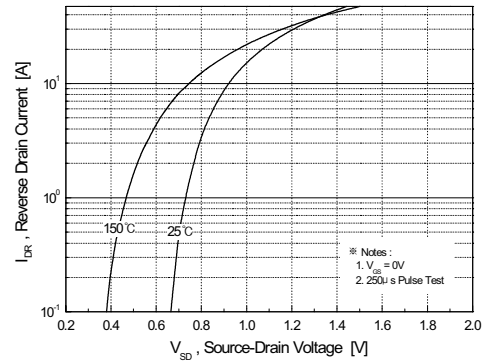


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

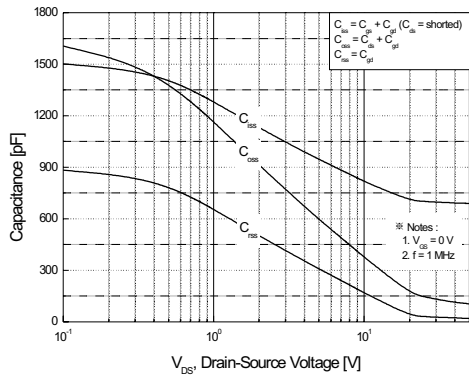


Figure 5. Capacitance Characteristics

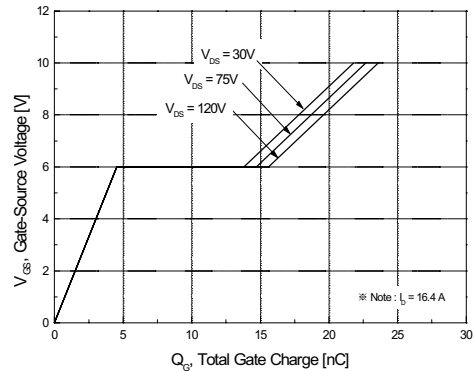


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

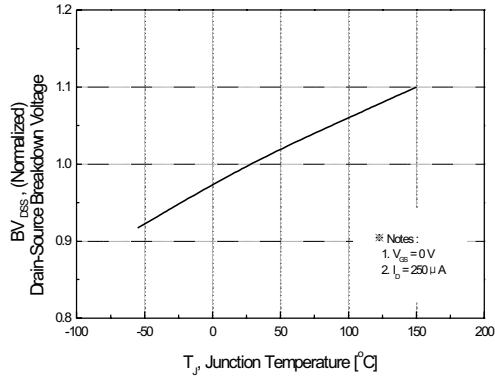


Figure 7. Breakdown Voltage Variation vs. Temperature

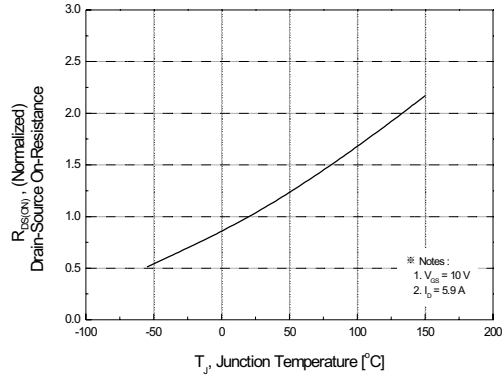


Figure 8. On-Resistance Variation vs. Temperature

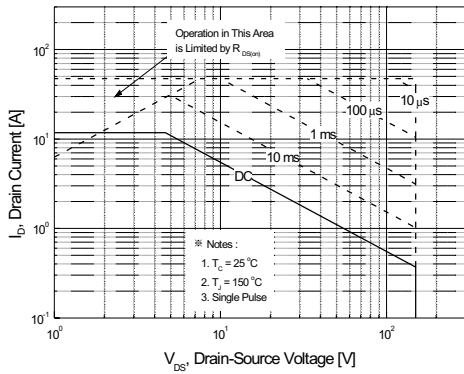


Figure 9. Maximum Safe Operating Area

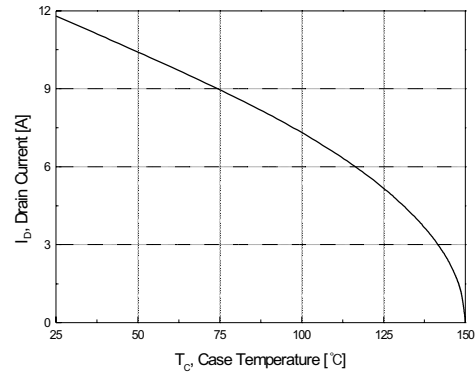


Figure 10. Maximum Drain Current vs. Case Temperature

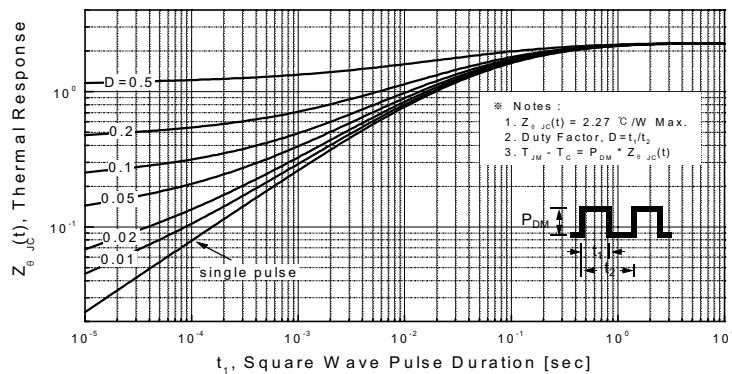
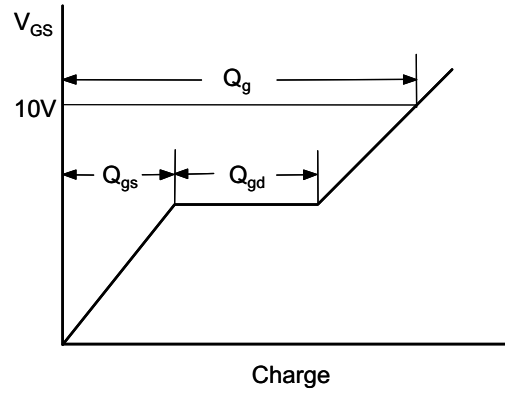
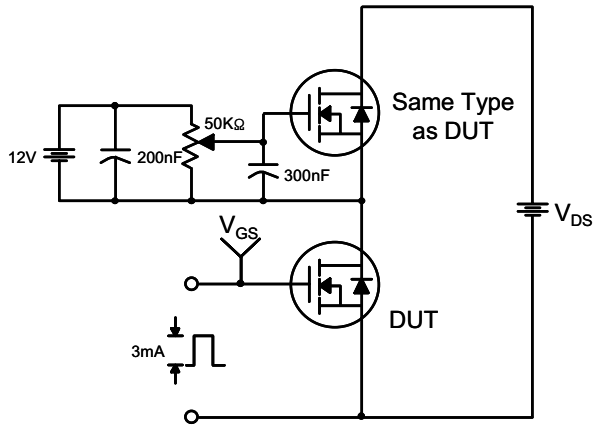
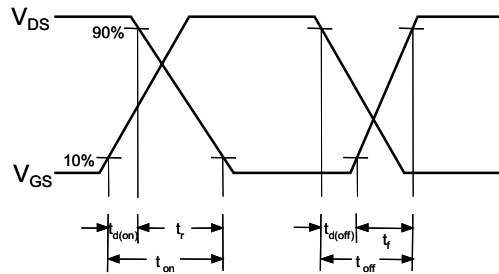
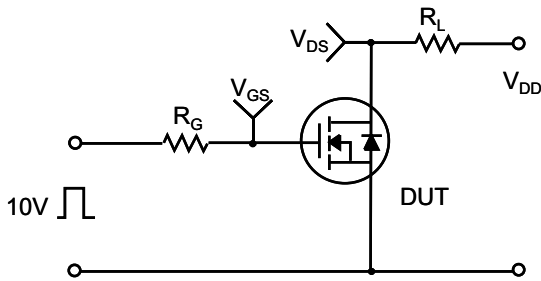


Figure 11. Transient Thermal Response Curve

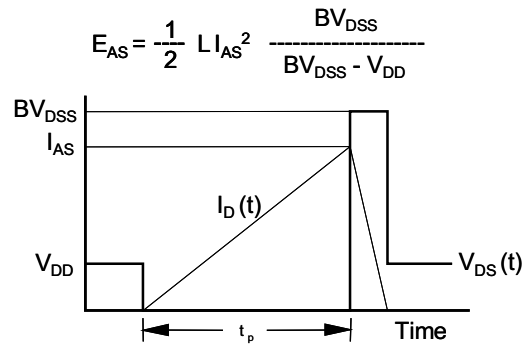
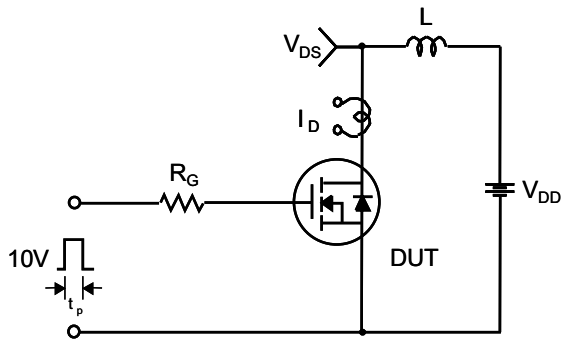
Gate Charge Test Circuit & Waveform



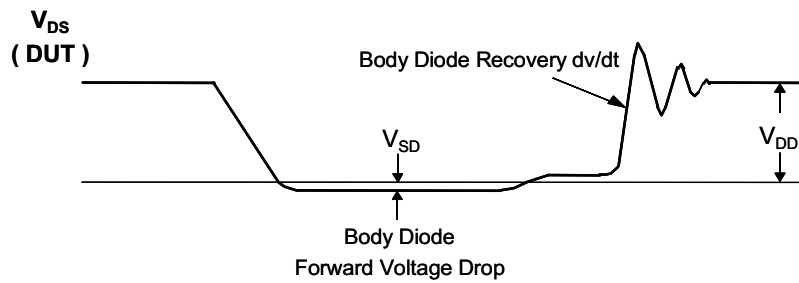
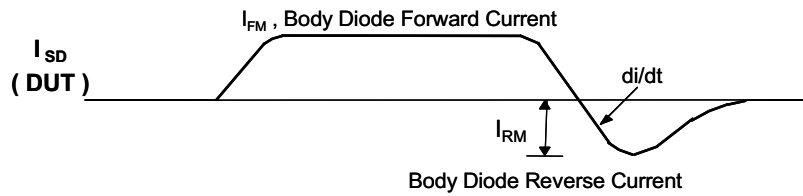
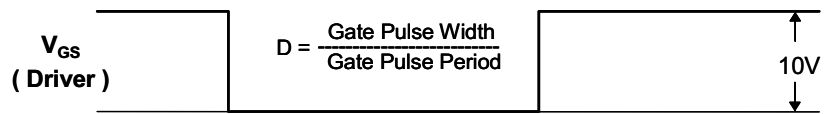
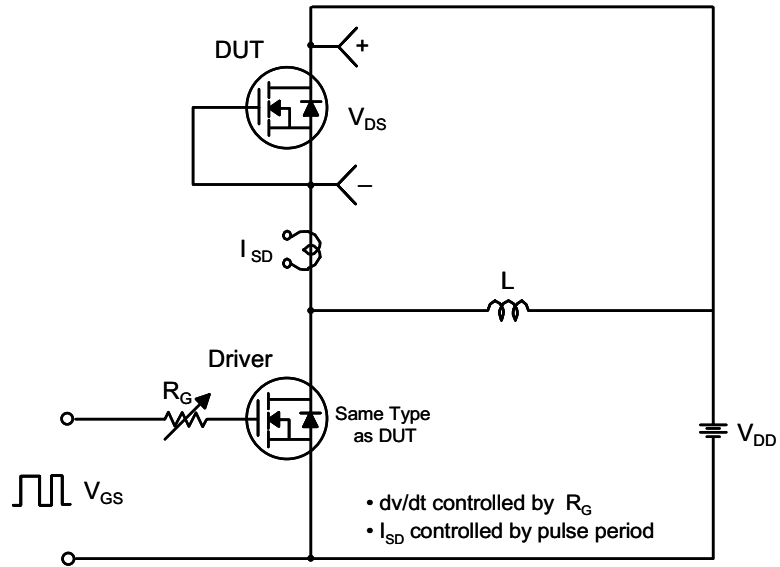
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

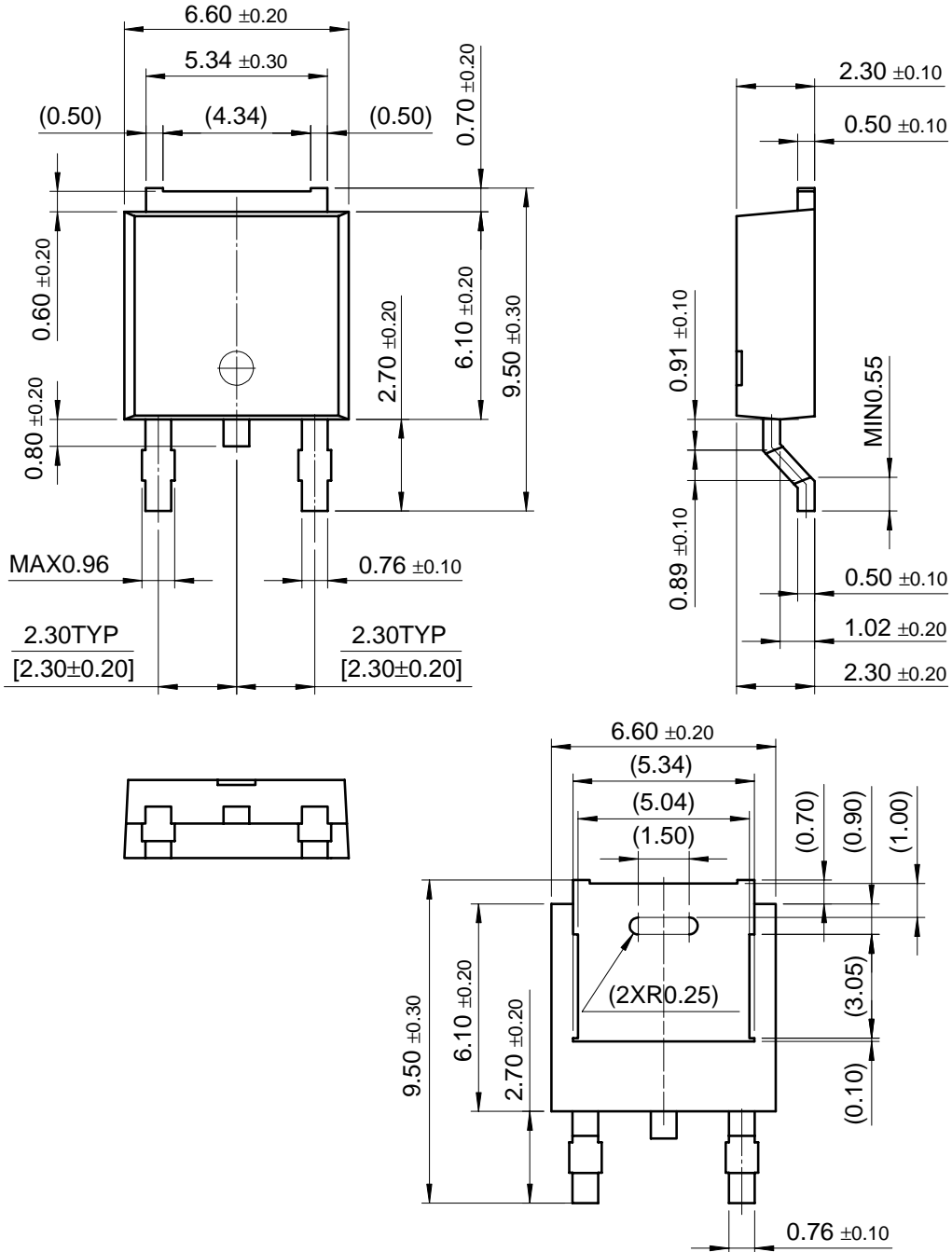


Peak Diode Recovery dv/dt Test Circuit & Waveforms



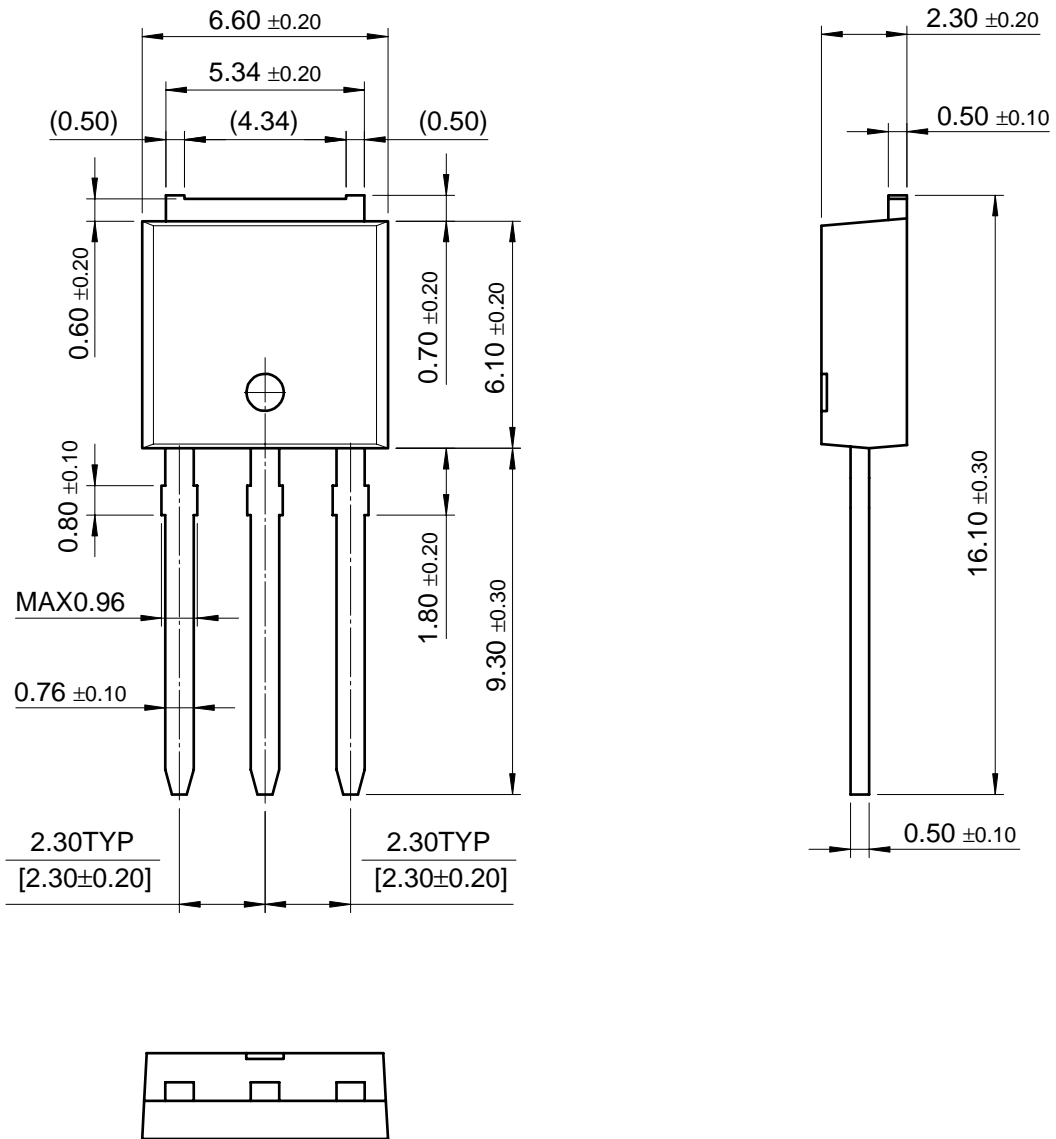
Package Dimensions

DPAK



Package Dimensions (Continued)

IPAK



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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.
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FQD16N15
150V N-Channel QFET

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General description

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Product status/pricing/packaging

Datasheet

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Product	Product status	Pricing*	Package type	Leads	Packing method
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FQD16N15TF	Full Production	\$0.58	TO-252(DPAK)	2	TAPE REEL
FQD16N15TM	Full Production	\$0.58	TO-252(DPAK)	2	TAPE REEL

* 1,000 piece Budgetary Pricing

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Models

Package & leads	Condition	Temperature range	Software version	Revision date
PSPICE				
TO-252(DPAK)-2	Electrical/Thermal	-55°C to 175°C	9	Oct 21, 2000

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