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April 2014

FQA40N25

N-Channel QFET® MOSFET

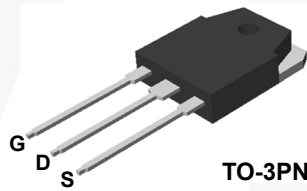
250 V, 40 A, 70 mΩ

Description

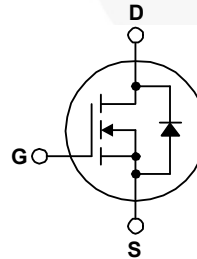
This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength.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

Features

- 40 A, 250 V, $R_{DS(on)} = 70 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 20 \text{ A}$
- Low Gate Charge (Typ. 85nC)
- Low Crss (Typ. 70pF)
- 100% Avalanche Tested



TO-3PN



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

Symbol	Parameter	FQA40N25	Unit
V_{DSS}	Drain-Source Voltage	250	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	40	A
		25	A
I_{DM}	Drain Current - Pulsed (Note 1)	160	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	800	mJ
I_{AR}	Avalanche Current (Note 1)	40	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	28	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C	280	W
		2.22	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 purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQA40N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.45	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.24	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	$^\circ\text{C}/\text{W}$

FQA40N25 — N-Channel QFET® MOSFET

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQA40N25	FQA40N25	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics $T_c = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	250	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.24	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 200\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$	--	0.051	0.07	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 20\text{ A}$	--	29	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	3100	4000	pF
C_{oss}	Output Capacitance		--	620	800	pF
C_{rss}	Reverse Transfer Capacitance		--	70	90	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 125\text{ V}, I_D = 40\text{ A},$ $R_G = 25\ \Omega$	--	70	150	ns
t_r	Turn-On Rise Time		--	580	1150	ns
$t_{d(off)}$	Turn-Off Delay Time		--	120	250	ns
t_f	Turn-Off Fall Time		(Note 4)	--	165	340
Q_g	Total Gate Charge	$V_{DS} = 200\text{ V}, I_D = 40\text{ A},$ $V_{GS} = 10\text{ V}$	--	85	110	nC
Q_{gs}	Gate-Source Charge		--	25	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	--	46	--

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	40	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	160	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 40\text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 40\text{ A},$	--	220	--	ns
Q_{rr}	Reverse Recovery Charge	$dI_F / dt = 100\text{ A}/\mu\text{s}$	--	2.0	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 0.8\text{ mH}, I_{AS} = 40\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 40\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature

Typical Characteristics

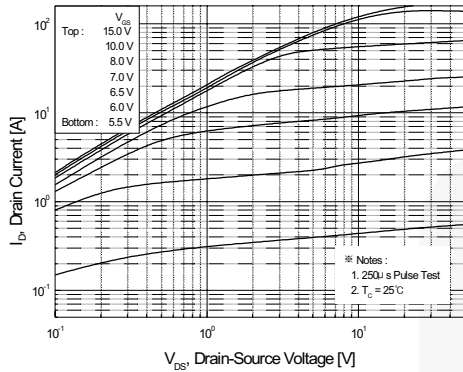


Figure 1. On-Region Characteristics

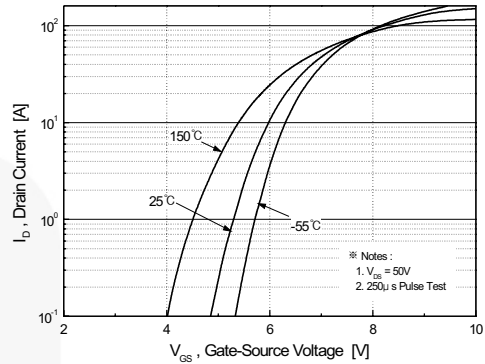


Figure 2. Transfer Characteristics

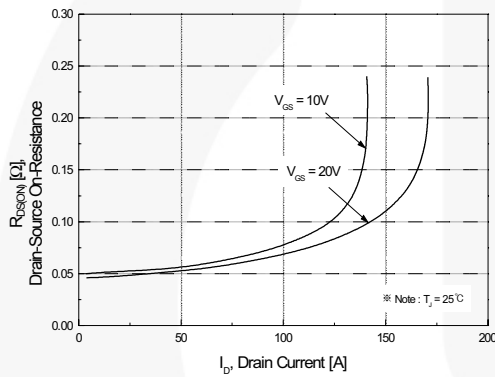


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

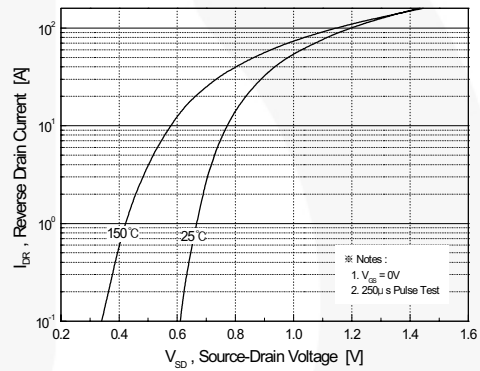


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

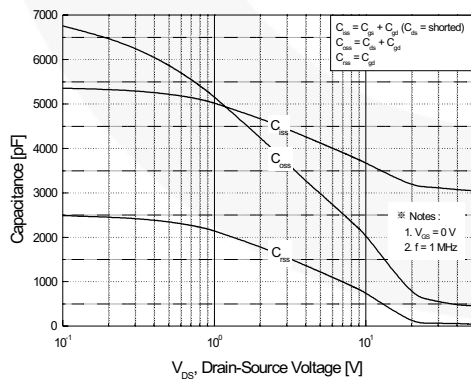


Figure 5. Capacitance Characteristics

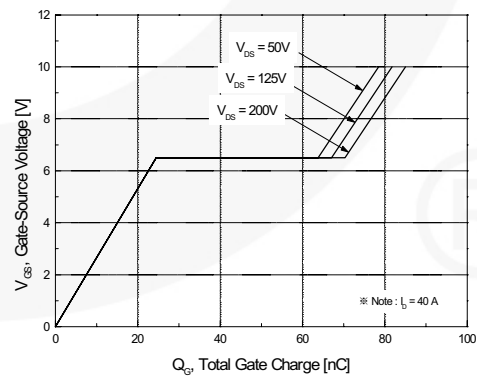


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

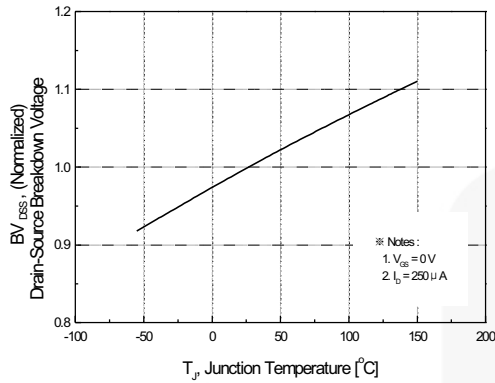


Figure 7. Breakdown Voltage Variation vs. Temperature

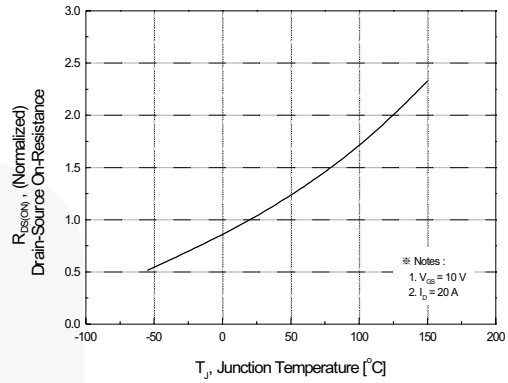


Figure 8. On-Resistance Variation vs. Temperature

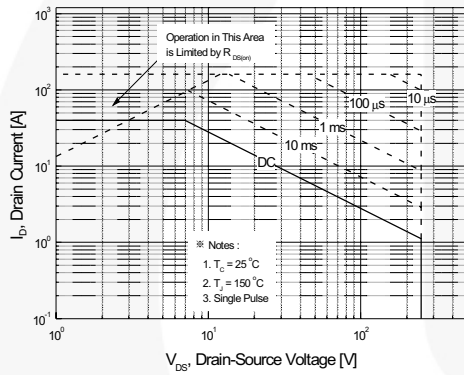


Figure 9. Maximum Safe Operating Area

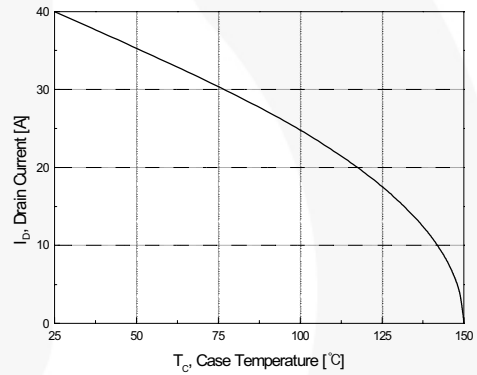


Figure 10. Maximum Drain Current vs. Case Temperature

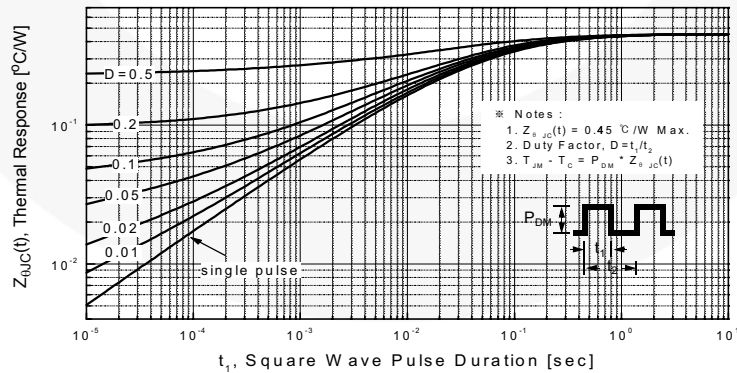


Figure 11. Transient Thermal Response Curve



Figure 12. Gate Charge Test Circuit & Waveform

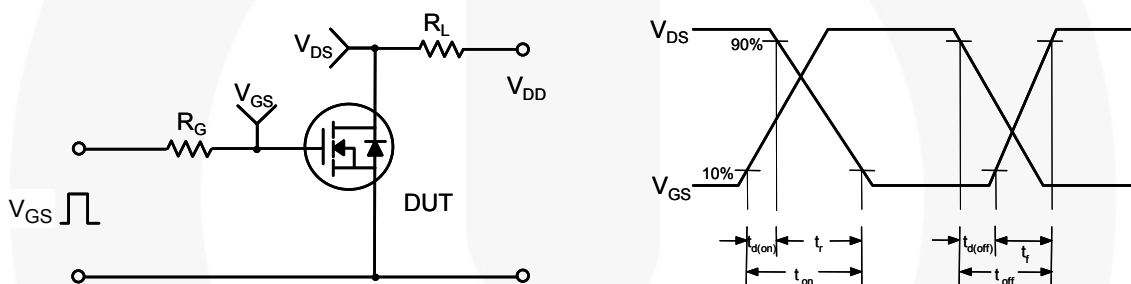


Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

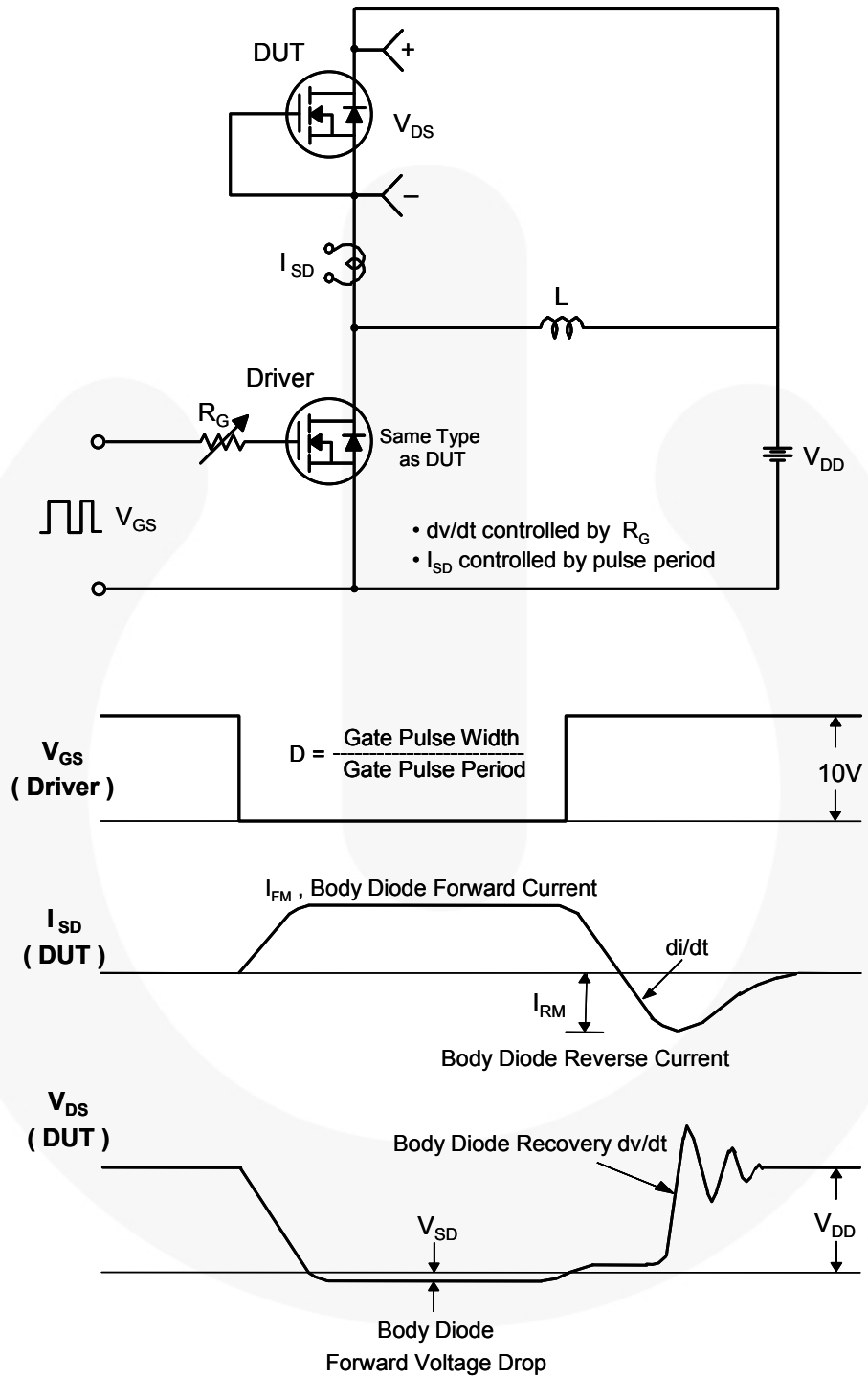
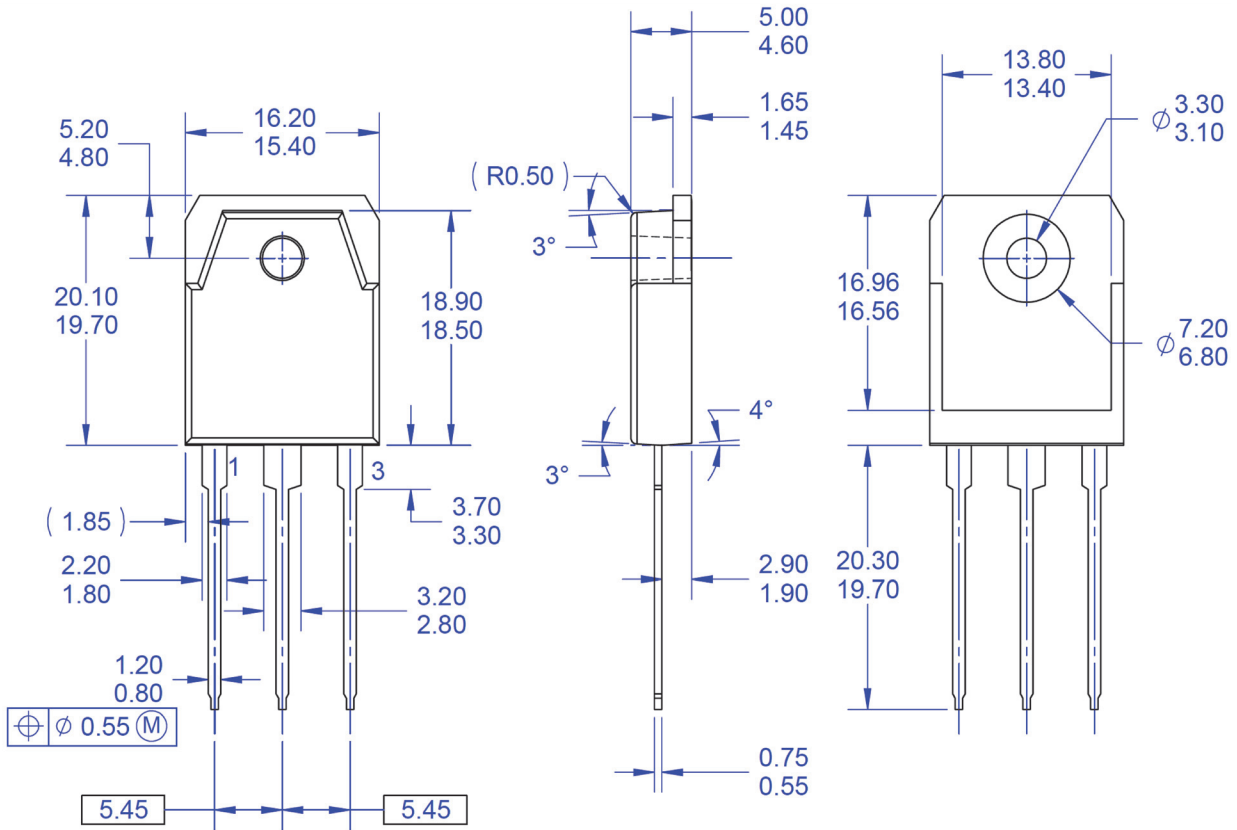


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

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Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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