



FDD3N40 / FDU3N40

400V N-Channel MOSFET

Features

- 2A, 400V, $R_{DS(on)} = 3.4\Omega$ @ $V_{GS} = 10$ V
- Low gate charge (typical 4.5 nC)
- Low C_{rss} (typical 3.7 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 efficient switched mode power supplies and active power factor correction.



Absolute Maximum Ratings

Symbol	Parameter	FDD3N40 / FDU3N40	Unit
V_{DSS}	Drain-Source Voltage	400	V
I_D	Drain Current - Continuous ($T_C = 25^\circ C$) - Continuous ($T_C = 100^\circ C$)	2.0 1.25	A A
I_{DM}	Drain Current - Pulsed	(Note 1)	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	mJ
I_{AR}	Avalanche Current	(Note 1)	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	V/ns
P_D	Power Dissipation ($T_C = 25^\circ C$) - Derate above $25^\circ C$	30 0.24	W W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ C$

* Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	4.2	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Case-to-Sink Typ.	--	110	$^\circ C/W$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD3N40	FDD3N40TM	D-PAK	380mm	16mm	2500
FDD3N40	FDD3N40TF	D-PAK	380mm	16mm	2000
FDU3N40	FDU3N40TU	I-PAK	-	-	70

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0\text{V}$, $I_D = 250\mu\text{A}$	400	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, Referenced to 25°C	--	0.4	--	$^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 400\text{V}$, $V_{\text{GS}} = 0\text{V}$ $V_{\text{DS}} = 320\text{V}$, $T_C = 125^\circ\text{C}$	--	--	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 30\text{V}$, $V_{\text{DS}} = 0\text{V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -30\text{V}$, $V_{\text{DS}} = 0\text{V}$	--	--	-100	nA
On Characteristics						
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_D = 250\mu\text{A}$	3.0	--	5.0	V
$R_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10\text{V}$, $I_D = 1\text{A}$	--	2.8	3.4	Ω
g_{FS}	Forward Transconductance	$V_{\text{DS}} = 40\text{V}$, $I_D = 1\text{A}$	(Note 4)	--	2	--
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{\text{DS}} = 25\text{V}$, $V_{\text{GS}} = 0\text{V}$, $f = 1.0\text{MHz}$	--	173	225	pF
C_{oss}	Output Capacitance		--	30	40	pF
C_{rss}	Reverse Transfer Capacitance		--	3.7	6	pF
Switching Characteristics						
$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{\text{DD}} = 200\text{V}$, $I_D = 3\text{A}$	--	10	30	ns
t_r	Turn-On Rise Time	$R_G = 25\Omega$	--	30	70	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		--	10	30	ns
t_f	Turn-Off Fall Time		--	25	60	ns
Q_g	Total Gate Charge	$V_{\text{DS}} = 320\text{V}$, $I_D = 3\text{A}$	--	4.5	6	nC
Q_{gs}	Gate-Source Charge	$V_{\text{GS}} = 10\text{V}$	--	1.2	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4, 5)	--	2	--
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	2	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	8	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0\text{V}$, $I_S = 2\text{A}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{\text{GS}} = 0\text{V}$, $I_S = 3\text{A}$	--	210	--	ns
Q_{rr}	Reverse Recovery Charge	$dI_F/dt = 100\text{A}/\mu\text{s}$	(Note 4)	--	0.75	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 20\text{mH}$, $I_{AS} = 2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 2\text{A}$, $dI/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq \text{BV}_{\text{DSS}}$, 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

Typical Performance Characteristics

Figure 1. On-Region Characteristics

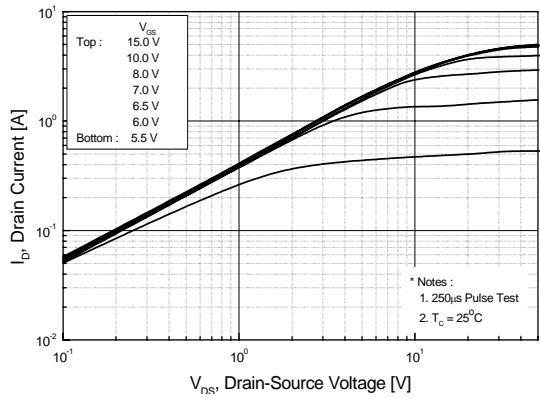


Figure 2. Transfer Characteristics

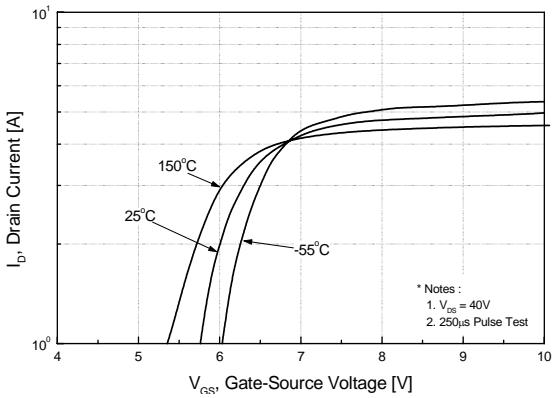


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

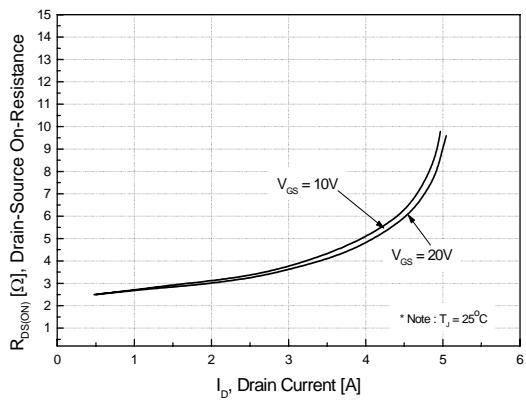


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

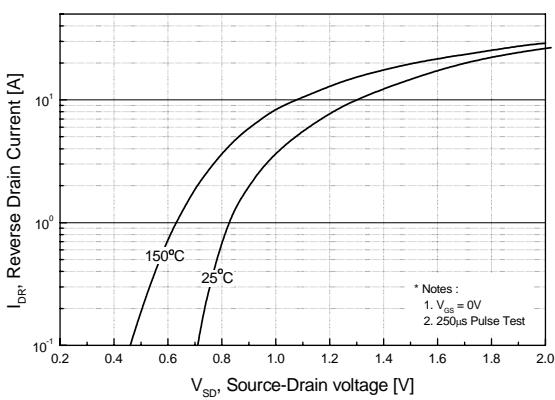


Figure 5. Capacitance Characteristics

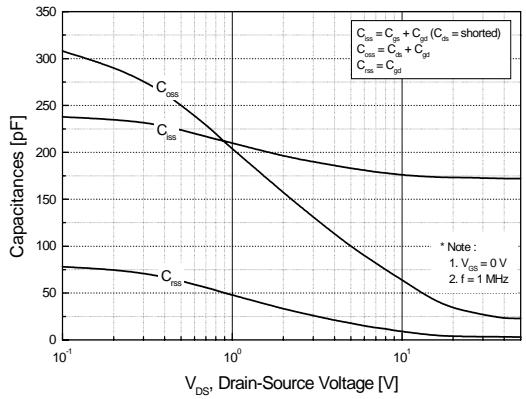


Figure 6. Gate Charge Characteristics

