



March 1999

FDV301N Digital FET , N-Channel

General Description

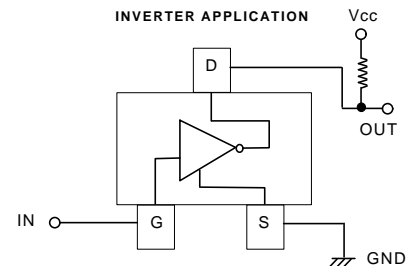
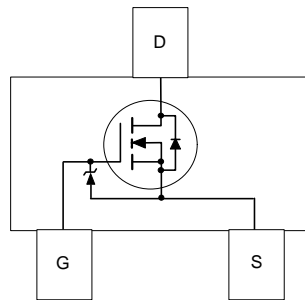
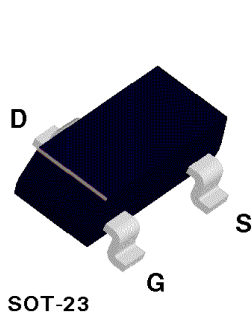
This N-Channel logic level enhancement mode field effect transistor is produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for digital transistors. Since bias resistors are not required, this one N-channel FET can replace several different digital transistors, with different bias resistor values.

Features

- 25 V, 0.22 A continuous, 0.5 A Peak.
 $R_{DS(ON)} = 5 \Omega @ V_{GS} = 2.7 V$
 $R_{DS(ON)} = 4 \Omega @ V_{GS} = 4.5 V.$
- Very low level gate drive requirements allowing direct operation in 3V circuits. $V_{GS(th)} < 1.5V.$
- Gate-Source Zener for ESD ruggedness. >6kV Human Body Model
- Replace multiple NPN digital transistors with one DMOS FET.



Mark:301



Absolute Maximum Ratings $T_A = 25^\circ C$ unless other wise noted

Symbol	Parameter	FDV301N	Units
V_{DSS}, V_{CC}	Drain-Source Voltage, Power Supply Voltage	25	V
V_{GSS}, V_I	Gate-Source Voltage, V_{IN}	8	V
I_D, I_O	Drain/Output Current - Continuous	0.22	A
		0.5	
P_D	Maximum Power Dissipation	0.35	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	$^\circ C$
ESD	Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm)	6.0	kV

THERMAL CHARACTERISTICS

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	357	$^\circ C/W$
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Inverter Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$I_{O(off)}$	Zero Input Voltage Output Current	$V_{CC} = 20\text{ V}, V_I = 0\text{ V}$			1	μA
$V_{I(off)}$	Input Voltage	$V_{CC} = 5\text{ V}, I_O = 10\text{ }\mu\text{A}$			0.5	V
$V_{I(on)}$		$V_O = 0.3\text{ V}, I_O = 0.005\text{ A}$	1			V
$R_{O(on)}$	Output to Ground Resistance	$V_I = 2.7\text{ V}, I_O = 0.2\text{ A}$		4	5	Ω

Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
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OFF CHARACTERISTICS

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	25			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		25		$\text{mV}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	μA
			$T_J = 55^\circ\text{C}$			10
I_{GSS}	Gate - Body Leakage Current	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$			100	nA

ON CHARACTERISTICS (Note)

$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		-2.1		$\text{mV}/^\circ\text{C}$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.65	0.85	1.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 2.7\text{ V}, I_D = 0.2\text{ A}$		3.8	5	Ω
			$T_J = 125^\circ\text{C}$	6.3	9	
			$V_{GS} = 4.5\text{ V}, I_D = 0.4\text{ A}$	3.1	4	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 2.7\text{ V}, V_{DS} = 5\text{ V}$	0.2			A
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 0.4\text{ A}$		0.2		S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		9.5		pF
C_{oss}	Output Capacitance			6		pF
C_{riss}	Reverse Transfer Capacitance			1.3		pF

SWITCHING CHARACTERISTICS (Note)

$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = 6\text{ V}, I_D = 0.5\text{ A},$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 50\text{ }\Omega$		3.2	8	ns
t_r	Turn - On Rise Time			6	15	ns
$t_{D(off)}$	Turn - Off Delay Time			3.5	8	ns
t_f	Turn - Off Fall Time			3.5	8	ns
Q_g	Total Gate Charge	$V_{DS} = 5\text{ V}, I_D = 0.2\text{ A},$ $V_{GS} = 4.5\text{ V}$		0.49	0.7	nC
Q_{gs}	Gate-Source Charge			0.22		nC
Q_{gd}	Gate-Drain Charge			0.07		nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I_S	Maximum Continuous Drain-Source Diode Forward Current			0.29		A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 0.29\text{ A}$ (Note)		0.8	1.2	V

Note:
Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2.0\%$.

Typical Electrical Characteristics

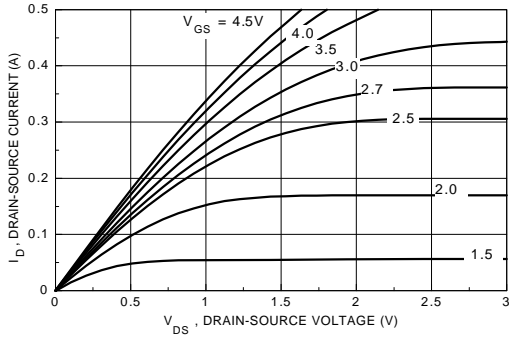


Figure 1. On-Region Characteristics.

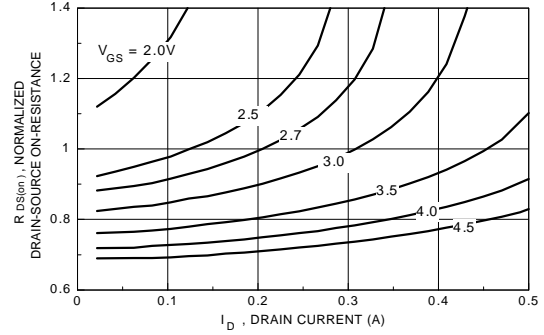


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

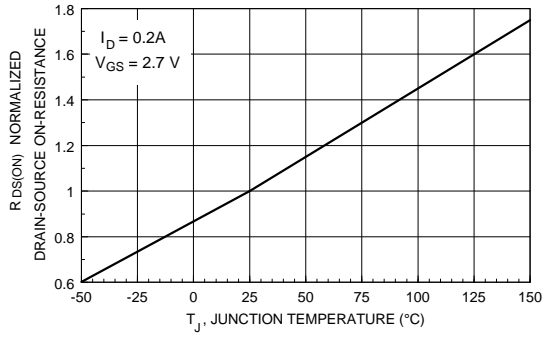


Figure 3. On-Resistance Variation with Temperature.

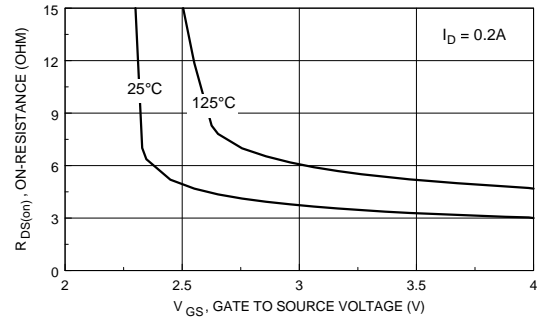


Figure 4. On Resistance Variation with Gate-To-Source Voltage.

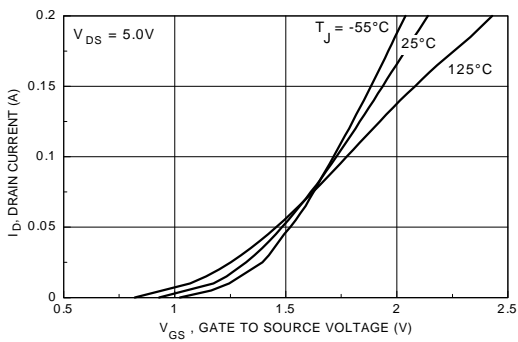


Figure 5. Transfer Characteristics.

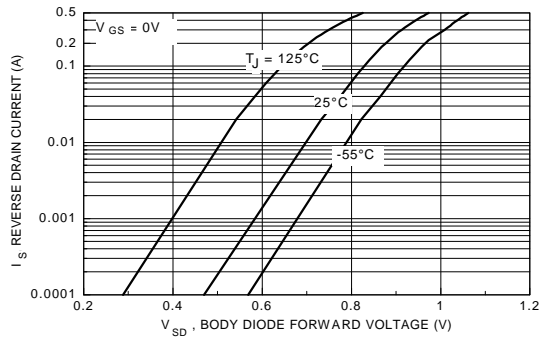


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical And Thermal Characteristics

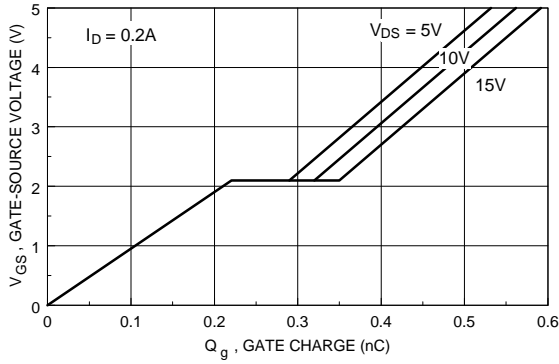


Figure 7. Gate Charge Characteristics.

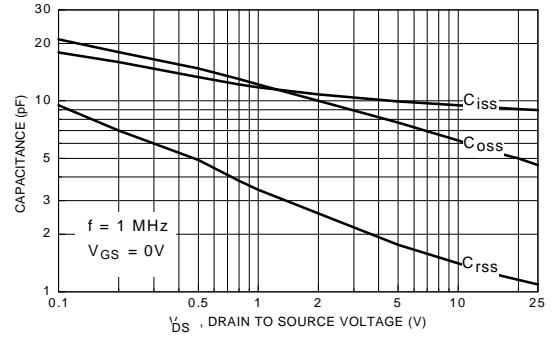


Figure 8. Capacitance Characteristics.

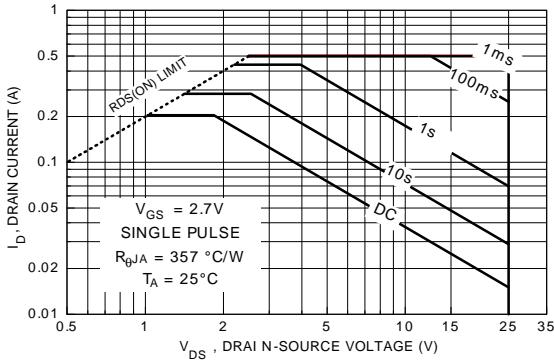


Figure 9. Maximum Safe Operating Area.

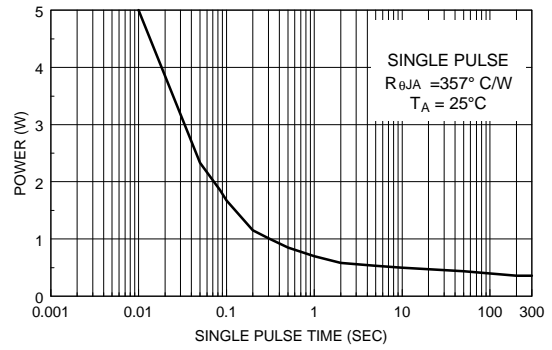


Figure 10. Single Pulse Maximum Power Dissipation.

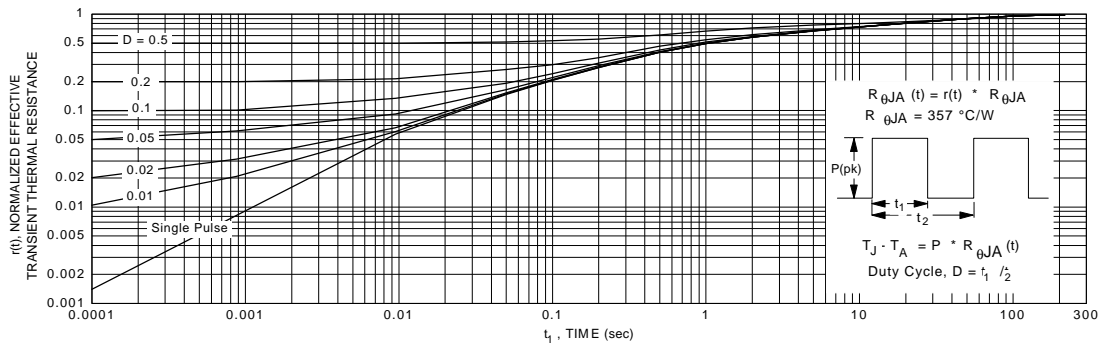


Figure 11. Transient Thermal Response Curve.

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