Digital FET, N-Channel

FDV303N

General Description

These N−Channel enhancement mode field effect transistors are produced using ON Semiconductor's proprietary, high cell density, DMOS technology. This very high density process is tailored to minimize on−state resistance at low gate drive conditions. This device is designed especially for application in battery circuits using either one lithium or three cadmium or NMH cells. It can be used as an inverter or for high−efficiency miniature discrete DC/DC conversion in compact portable electronic devices like cellular phones and pagers. This device has excellent on−state resistance even at gate drive voltages as low as 2.5 V.

Features

- 25 V, 0.68 A Continuous, 2 A Peak
  - $R_{DS(ON)}$ = 0.45 Ω @ V_{GS} = 4.5 V
  - $R_{DS(ON)}$ = 0.6 Ω @ V_{GS}= 2.7 V
- Very Low Level Gate Drive Requirements Allowing Direct Operation in 3 V Circuits, $V_{GS(th)}$ < 1 V
- Gate−Source Zener for ESD Ruggedness, > 6 kV Human Body Model
- Compact Industry Standard SOT−23 Surface Mount Package
- This Device is Pb−Free, Halogen Free/BFR Free and is RoHS Compliant

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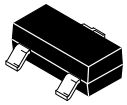
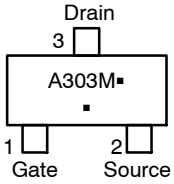


SOT−23 (TO−236)
CASE 318−08
STYLE 21

MARKING DIAGRAM

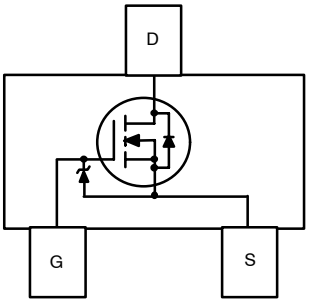


Aor blank = One/two character Loacation Code
303 = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

* Location code can be blank or with characters indicating manufacturing location
* Date Code orientation and overbar may vary depending upon manufacturing location.

PIN ASSIGNMENT



SOT−23

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

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MOSFET MAXIMUM RATINGS T_A = 25°C unless otherwise noted

Symbol	Parameter	FDV303N	Units
V_{DSS}	Drain−Source Voltage, Power Supply Voltage	25	V
V_{GSS}	Gate−Source Voltage, V_{IN}	8	V
I_D	Drain/Output Current − Continuous − Pulsed	 0.68 2	A
P_D	Maximum Power Dissipation	0.35	W
T_J, T_{STG}	Operating and Storage Temperature Range	−55 to 150	°C
ESD	Electrostatic Discharge Rating MIL−STD−883D Human Body Model (100 pf / 1500 Ω)	6.0	kV

THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Units
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient	357	°C/W

ORDERING INFORMATION

Device	Package	Shipping†
FDV303N	SOT−23 Case 318−08	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain−Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temp. Coefficient	I_D = 250 μA, Referenced to 25°C		26		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20 V, V_{GS} = 0 V			1	μA
		T_J = 55°C			10	μA
I_{GSS}	Gate − Body Leakage Current	V_{GS} = 8 V, V_{DS}= 0 V			100	nA
ON CHARACTERISTICS (Note 1)						
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		−2.6		mV/°C
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	0.65	0.8	1	V
$R_{DS(ON)}$	Static Drain−Source On−Resistance	V_{GS} = 4.5 V, I_D = 0.5 A		0.33	0.45	Ω
		T_J =125°C		0.52	0.8	
		V_{GS} = 2.7 V, I_D = 0.2 A		0.44	0.6	
$I_{D(ON)}$	On−State Drain Current	V_{GS} = 2.7 V, V_{DS} = 5 V	0.5			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D= 0.5 A		1.45		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1.0 MHz		50		pF
C_{oss}	Output Capacitance			28		pF
C_{rss}	Reverse Transfer Capacitance			9		pF
SWITCHING CHARACTERISTICS (Note 1)						
$t_{D(on)}$	Turn − On Delay Time	V_{DD} = 6 V, I_D = 0.5 A, V_{GS} = 4.5 V, R_{GEN} = 50 Ω		3	6	ns
t_r	Turn − On Rise Time			8.5	18	ns
$t_{D(off)}$	Turn − Off Delay Time			17	30	ns
t_f	Turn − Off Fall Time			13	25	ns
Q_g	Total Gate Charge	V_{DS} = 5 V, I_D = 0.5 A, V_{GS} = 4.5 V		1.64	2.3	nC
Q_{gs}	Gate−Source Charge			0.38		nC
Q_{gd}	Gate−Drain Charge			0.45		nC
DRAIN−SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I_S	Maximum Continuous Drain−Source Diode Forward Current				0.3	A
V_{SD}	Drain−Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.5 A (Note 1)		0.83	1.2	V

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

TYPICAL CHARACTERISTICS

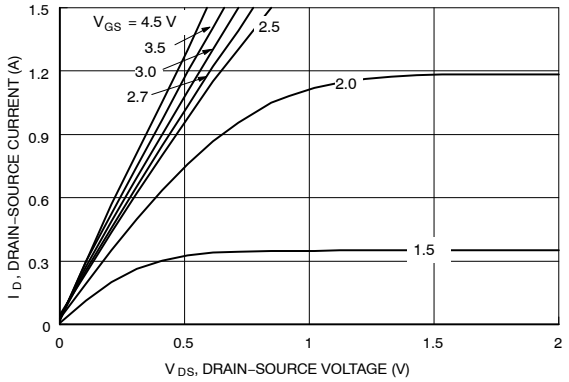


Figure 1. On−Region Characteristics

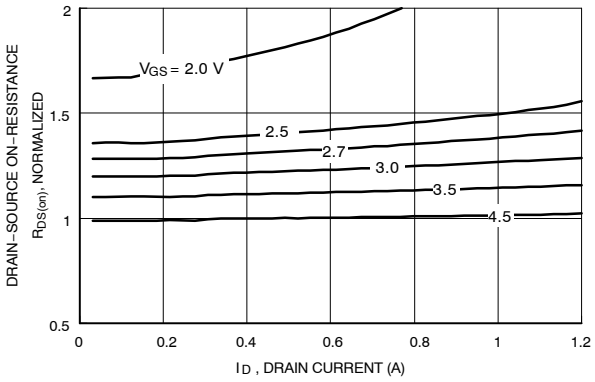


Figure 2. On−Resistance Variation with Drain Current and Gate Voltage

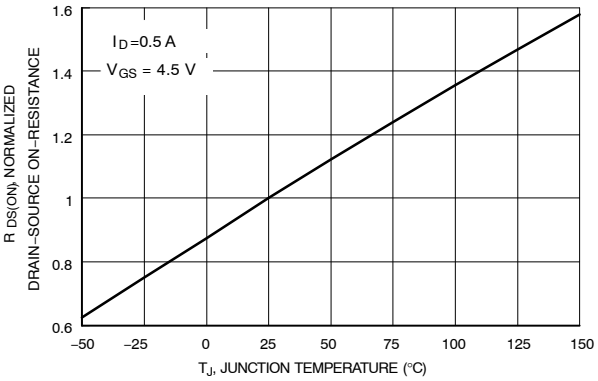


Figure 3. On−Resistance Variation with Temperature

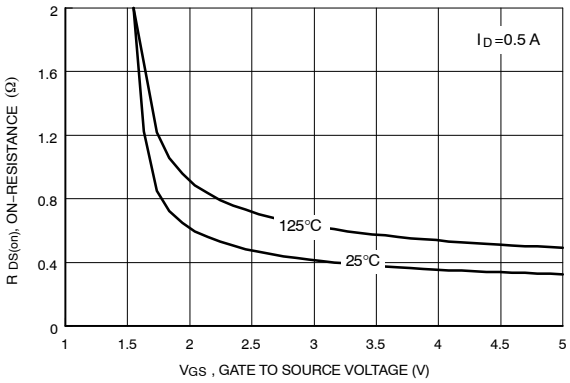


Figure 4. On Resistance Variation with Gate−To− Source Voltage

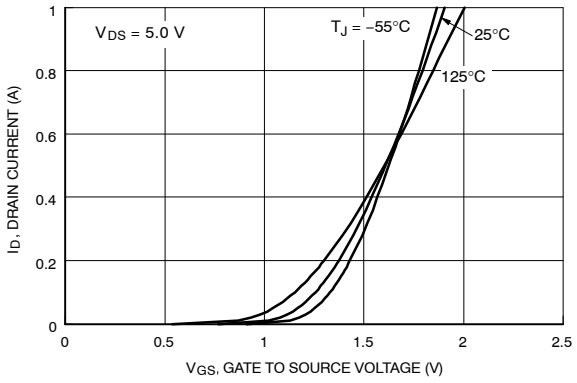


Figure 5. Transfer Characteristics

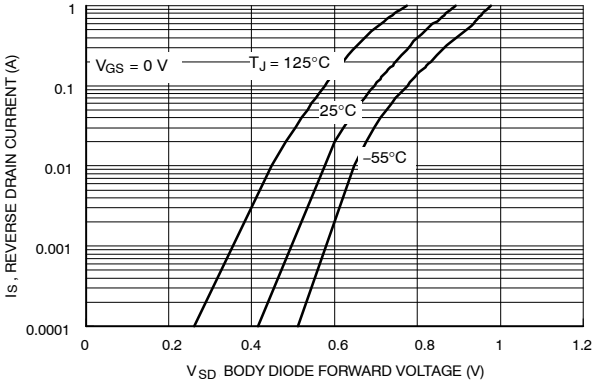


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL CHARACTERISTICS T_J = 25°C Unless Otherwise Noted (continued)

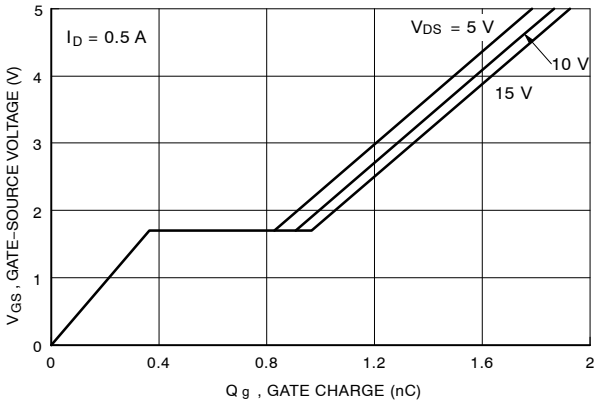


Figure 7. Gate Charge Characteristics

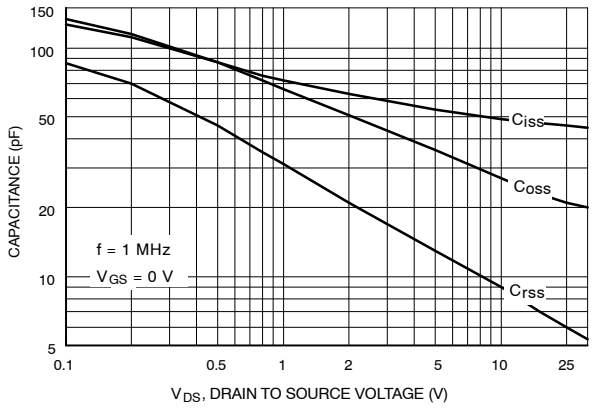


Figure 8. Capacitance Characteristics

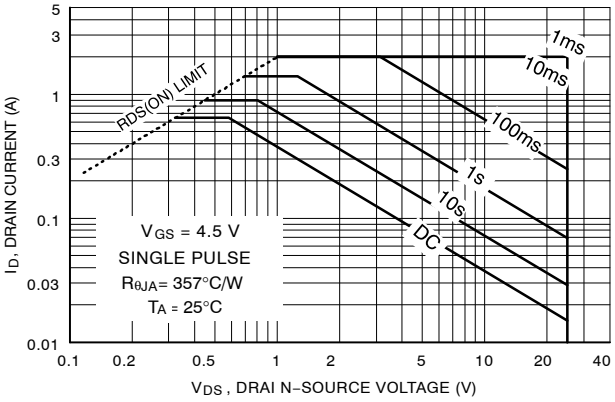


Figure 9. Maximum Safe Operating Area

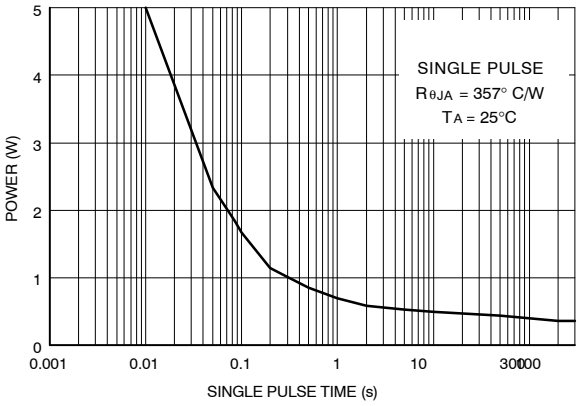


Figure 10. Single Pulse Maximum Power Dissipation

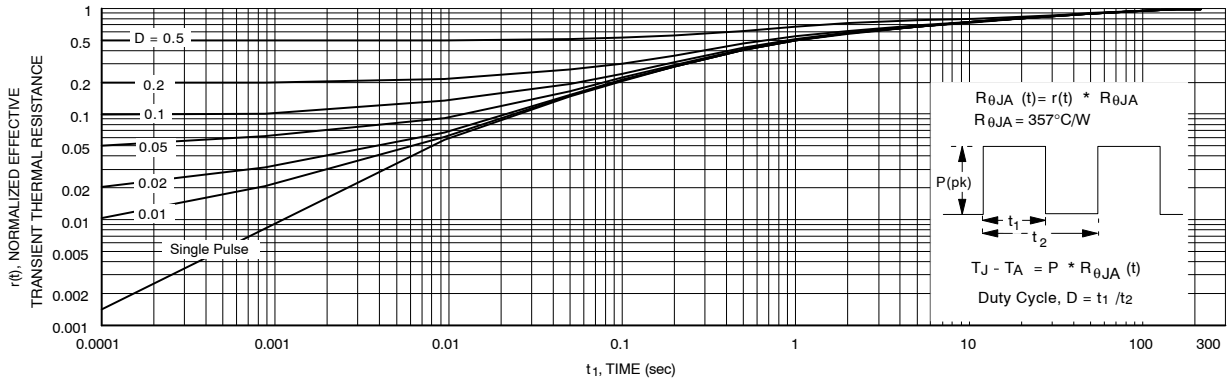
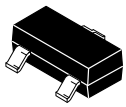


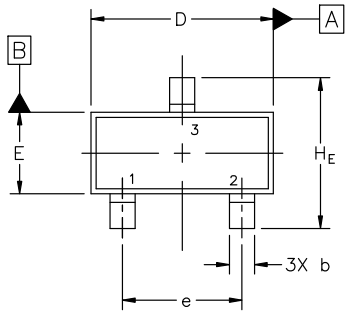
Figure 11. Transient Thermal Response Curve



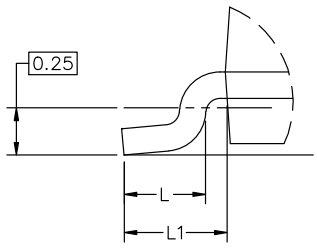
SCALE 4:1

SOT−23 (TO−236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

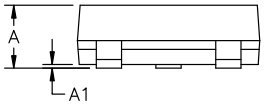
DATE 14 AUG 2024



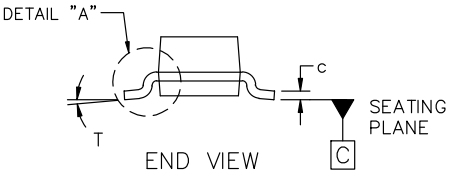
TOP VIEW



DETAIL "A"
Scale 3:1



SIDE VIEW

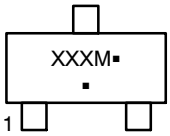


END VIEW

MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
H_E	2.10	2.40	2.64
T	0°	−−−	10°

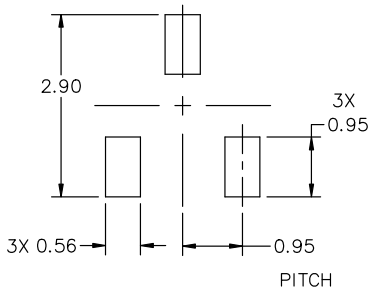
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

GENERIC
MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



RECOMMENDED
MOUNTING FOOTPRINT

* For additional information on our Pb−Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

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CASE 318
ISSUE AU

DATE 14 AUG 2024

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

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