

# 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.

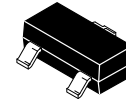
### Features

- 25 V, 0.68 A Continuous, 2 A Peak
  - ◆  $R_{DS(ON)} = 0.45 \Omega @ V_{GS} = 4.5 V$
  - ◆  $R_{DS(ON)} = 0.6 \Omega @ V_{GS} = 2.7 V$
- 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



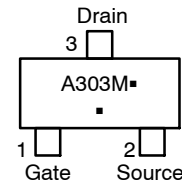
ON Semiconductor®

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SOT-23 (TO-236)  
CASE 318-08  
STYLE 21

### MARKING DIAGRAM



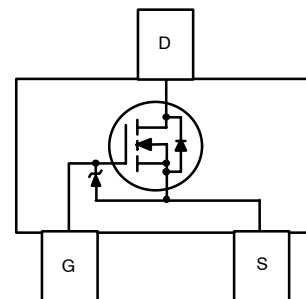
A or blank = One/two character Location Code  
303 = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(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.

# FDV303N

## MOSFET MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ 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	$^\circ\text{C}$
ESD	Electrostatic Discharge Rating MIL–STD–883D Human Body Model (100 pf / 1500 $\Omega$ )	6.0	kV

## THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Units
$R_{\theta JA}$	Thermal Resistance, Junction–to–Ambient	357	$^\circ\text{C}/\text{W}$

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
FDV303N	SOT–23 Case 318–08	3000 / Tape & Reel

<sup>†</sup>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](#).

# FDV303N

**ELECTRICAL CHARACTERISTICS**  $T_J = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
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**OFF CHARACTERISTICS**

BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temp. Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C		26		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V			1	μA
					10	μA
I <sub>GSS</sub>	Gate - Body Leakage Current	V <sub>GS</sub> = 8 V, V <sub>DS</sub> = 0 V			100	nA

**ON CHARACTERISTICS** (Note 1)

$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C		-2.6		mV/°C
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	0.65	0.8	1	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.5 A		0.33	0.45	Ω
					0.52	
		V <sub>GS</sub> = 2.7 V, I <sub>D</sub> = 0.2 A		0.44	0.6	
I <sub>D(on)</sub>	On-State Drain Current	V <sub>GS</sub> = 2.7 V, V <sub>DS</sub> = 5 V	0.5			A
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 0.5 A		1.45		S

**DYNAMIC CHARACTERISTICS**

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz		50		pF
C <sub>oss</sub>	Output Capacitance			28		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			9		pF

**SWITCHING CHARACTERISTICS** (Note 1)

t <sub>D(on)</sub>	Turn - On Delay Time	V <sub>DD</sub> = 6 V, I <sub>D</sub> = 0.5 A, V <sub>GS</sub> = 4.5 V, R <sub>GEN</sub> = 50 Ω		3	6	ns
t <sub>r</sub>	Turn - On Rise Time			8.5	18	ns
t <sub>D(off)</sub>	Turn - Off Delay Time			17	30	ns
t <sub>f</sub>	Turn - Off Fall Time			13	25	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 0.5 A, V <sub>GS</sub> = 4.5 V		1.64	2.3	nC
Q <sub>gs</sub>	Gate-Source Charge			0.38		nC
Q <sub>gd</sub>	Gate-Drain Charge			0.45		nC

**DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS**

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				0.3	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 0.5 A (Note 1)		0.83	1.2	V

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

TYPICAL CHARACTERISTICS

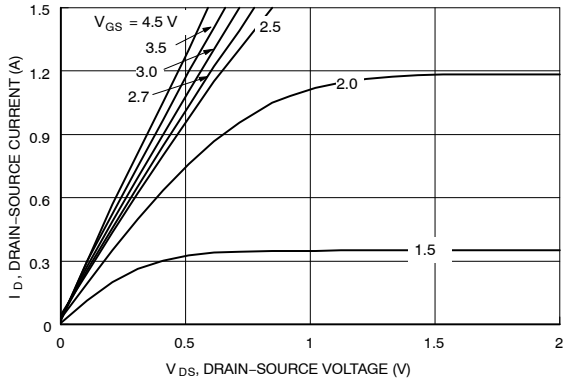


Figure 1. On-Region Characteristics

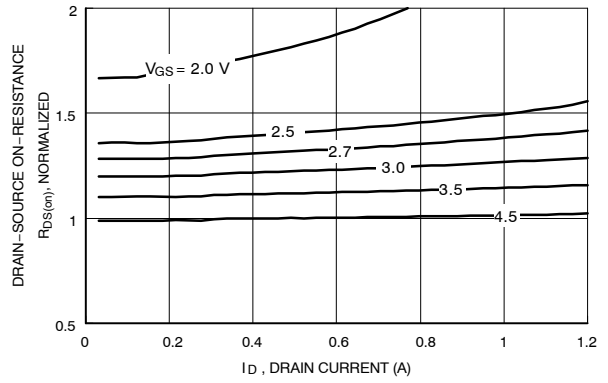


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

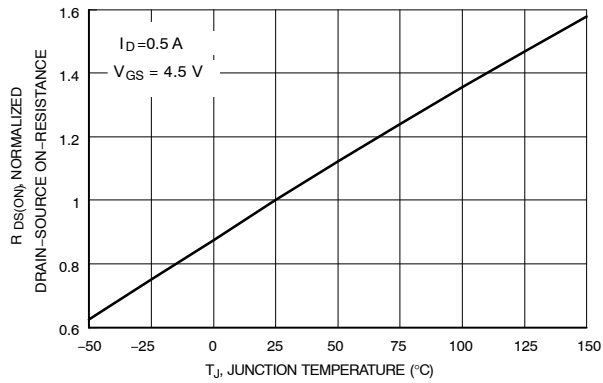


Figure 3. On-Resistance Variation with Temperature

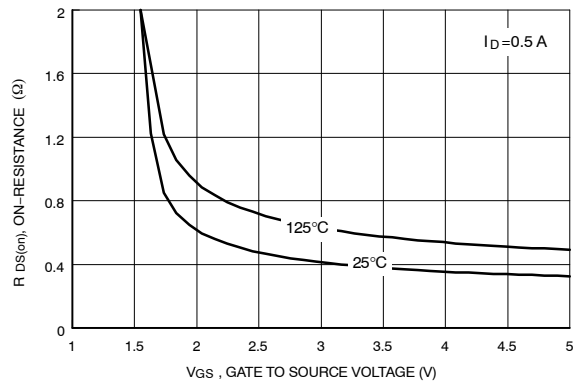


Figure 4. On Resistance Variation with Gate-To-Source Voltage

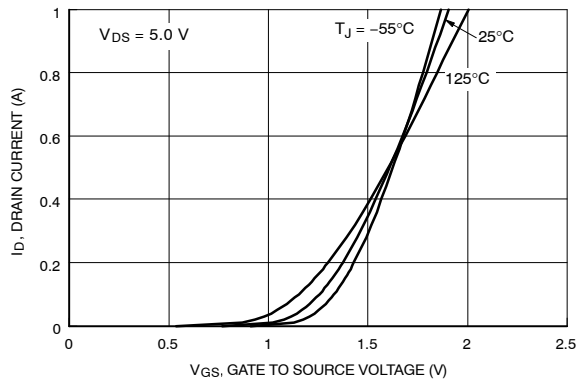


Figure 5. Transfer Characteristics

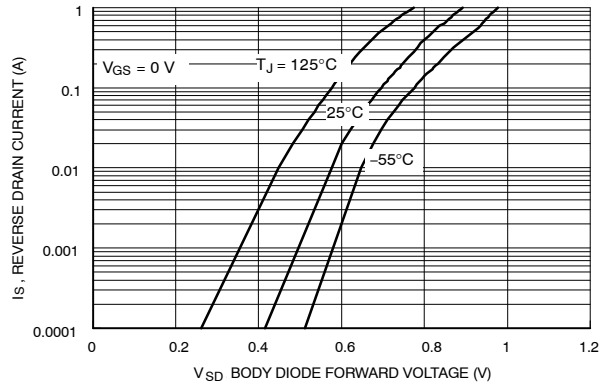


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  Unless Otherwise Noted (continued)

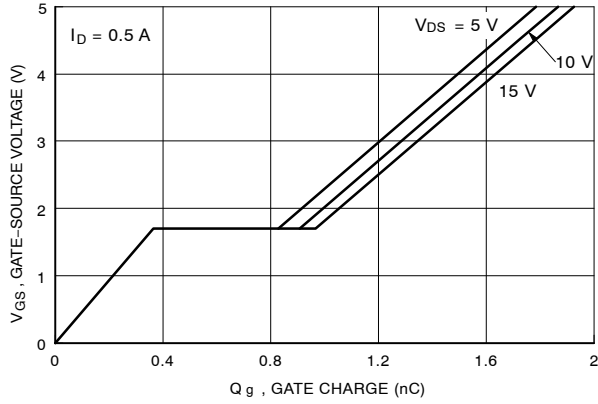


Figure 7. Gate Charge Characteristics

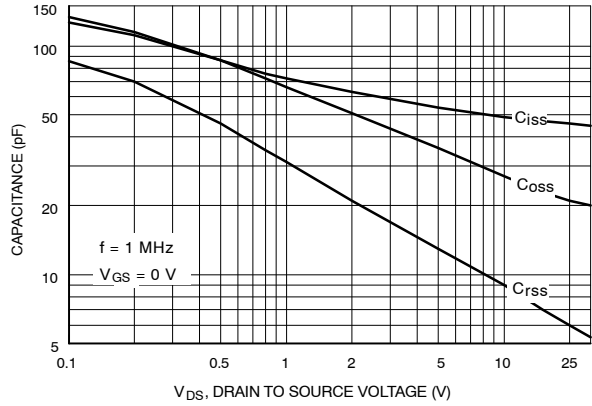


Figure 8. Capacitance Characteristics

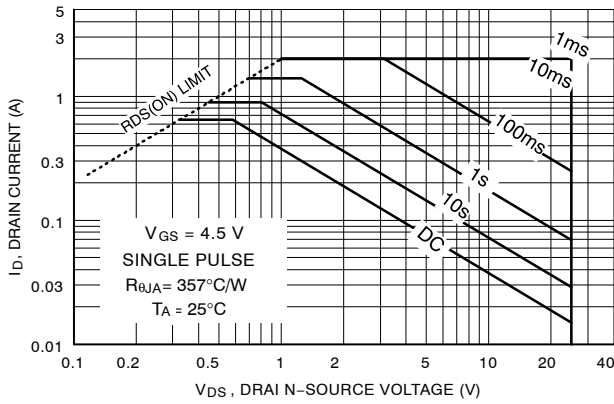


Figure 9. Maximum Safe Operating Area

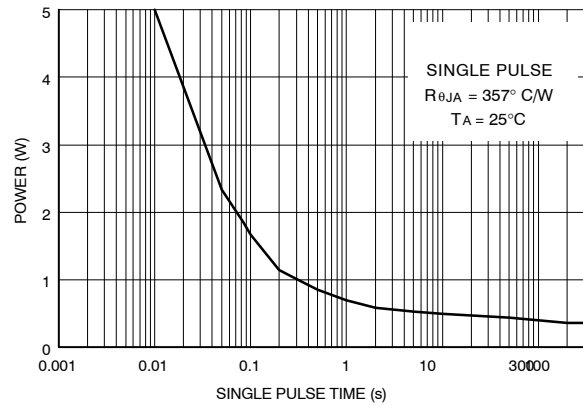


Figure 10. Single Pulse Maximum Power Dissipation

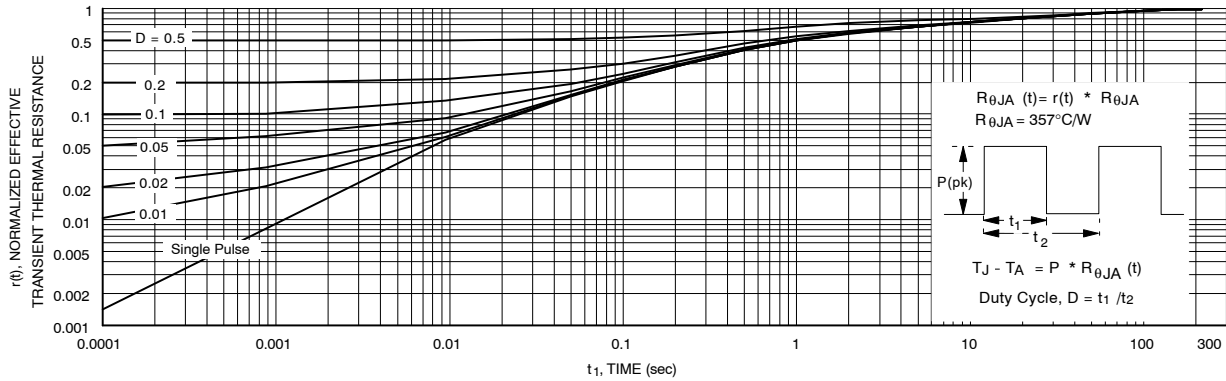


Figure 11. Transient Thermal Response Curve

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**SOT-23 (TO-236)**  
CASE 318  
ISSUE AT

DATE 01 MAR 2023

SCALE 4:1



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. CONTROLLING DIMENSION: 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.

DIM	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.89	1.00	1.11	0.035	0.039	0.044
A1	0.01	0.06	0.10	0.000	0.002	0.004
b	0.37	0.44	0.50	0.015	0.017	0.020
c	0.08	0.14	0.20	0.003	0.006	0.008
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.080
L	0.30	0.43	0.55	0.012	0.017	0.022
L1	0.35	0.54	0.69	0.014	0.021	0.027
H <sub>E</sub>	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

**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 ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**STYLES ON PAGE 2**

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS



### SOT-23 (TO-236) CASE 318 ISSUE AT

DATE 01 MAR 2023

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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