# onsemi

## Digital FET, P-Channel FDV304P, FDV304P-F169

#### **General Description**

This P-Channel enhancement mode field effect transistors is produced using **onsemi**'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 power applications such as notebook computers and cellular phones. This device has excellent on-state resistance even at gate drive voltages as low as 2.5 V.

#### Features

- -25 V, -0.46 A Continuous, -1.5 A Peak
  - $R_{DS(on)} = 1.1 \Omega @ V_{GS} = -4.5 V$
  - $R_{DS(on)} = 1.5 \ \Omega @ V_{GS} = -2.7 \ V$
- Very Low Level Gate Drive Requirements Allowing Direct Operation in 3 V Circuits. V<sub>GS(th)</sub> < 1.5 V
- Gate–Source Zener for ESD Ruggedness. > 6 kV Human Body Model

**ABSOLUTE MAXIMUM BATINGS** ( $T_A = 25^{\circ}C$  unless otherwise noted.)

- Compact Industry Standard SOT-23 Surface Mount Package
- This Device is Pb-Free and Halide Free

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	-25	V
V <sub>GSS</sub>	Gate-Source Voltage	-8	V
I <sub>D</sub>	Drain Current – Continuous	-0.46	А
	Drain Current – Pulsed	-1.5	
PD	Maximum Power Dissipation	0.35	W
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	–55 to 150	°C
ESD	Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100 pF/1500 $\Omega$ )	6.0	kV

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

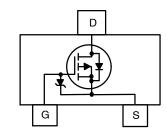
#### THERMAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted.)

Symbol	Parameter	Value	Unit
$R_{ hetaJA}$	Thermal Resistance, Junction-to-Ambient	357	°C/W

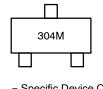


SOT-23-3 CASE 318-08

#### ELECTRICAL CONNECTION



#### MARKING DIAGRAM



304 = Specific Device Code M = Date Code

#### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
FDV304P	SOT-23-3 (Pb-Free, Halide-Free)	3000 / Tape & Reel
FDV304P-F169	SOT-23-3 (Pb-Free, Halide-Free)	3000 / Tape & Reel

+For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, <u>BRD8011/D</u>.

### FDV304P, FDV304P-F169

#### ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted.)

Symbol	Parameter	Test Conditions	Min	Тур	Max	Unit		
OFF CHARACT	OFF CHARACTERISTICS							
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS}$ = 0 V, $I_D$ = –250 $\mu A$	-25	-	-	V		
$\Delta BV_{DSS}/\Delta T_{J}$	Breakdown Voltage Temp. Coefficient	$I_D$ = –250 $\mu A,$ Referenced to 25°C	-	-22	-	mV/°C		
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	$V_{DS}$ = -20 V, $V_{GS}$ = 0 V	-	-	-1	μΑ		
		$V_{DS}$ = –20 V, $V_{GS}$ = 0 V, $T_J$ = 55°C	-	-	-10			
I <sub>GSS</sub>	Gate-Body Leakage Current	$V_{GS} = -8 \text{ V},  V_{DS} = 0 \text{ V}$	-	-	-100	nA		

#### **ON CHARACTERISTICS** (Note 1)

$\Delta V_{GS(th)} / \Delta T_J$	Gate Threshold Voltage Temp. Coefficient	$I_D = -250 \ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$	-	2.1	-	mV/°C
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250 \ \mu A$	-0.65	-0.86	-1.5	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	$V_{GS}$ = -2.7 V, I <sub>D</sub> = -0.25 A	-	1.22	1.5	Ω
		$V_{GS}$ = -4.5 V, $I_D$ = -0.5 A	-	0.87	1.1	
		$V_{GS}$ = –4.5 V, $I_D$ = –0.5 A, $T_J$ = 125°C	-	1.21	2	
I <sub>D(on)</sub>	On-State Drain Current	$V_{GS}$ = -2.7 V, $V_{DS}$ = -5 V	-0.5	_	-	А
		$V_{GS}$ = -4.5 V, $V_{DS}$ = -5 V	-1	_	-	
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = -5 \text{ V}, \text{ I}_{D} = -0.5 \text{ A}$	-	0.8	-	S

#### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	$V_{DS}$ = $-10$ V, $V_{GS}$ = 0 V, f = 1.0 MHz	—	63	-	pF
C <sub>oss</sub>	Output Capacitance		-	34	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	10	-	

#### SWITCHING CHARACTERISTICS (Note 1)

t <sub>D(on)</sub>	Turn-On Delay Time	$V_{DD} = -6 \text{ V, } I_D = -0.5 \text{ A,} \\ V_{GS} = -4.5 \text{ V, } \text{R}_{GEN} = 50 \ \Omega$	-	7	20	ns
t <sub>r</sub>	Turn-On Rise Time		-	8	20	
t <sub>D(off)</sub>	Turn-Off Delay Time		-	55	110	
t <sub>f</sub>	Turn-Off Fall Time		-	35	70	
Qg	Total Gate Charge	$V_{DS} = -5 \text{ V}, \text{ I}_{D} = -0.25 \text{ A},$ $V_{GS} = -4.5 \text{ V}$	-	1.1	1.5	nC
Q <sub>gs</sub>	Gate-Source Charge		-	0.32	-	
Q <sub>gd</sub>	Gate-Drain Charge		-	0.25	_	

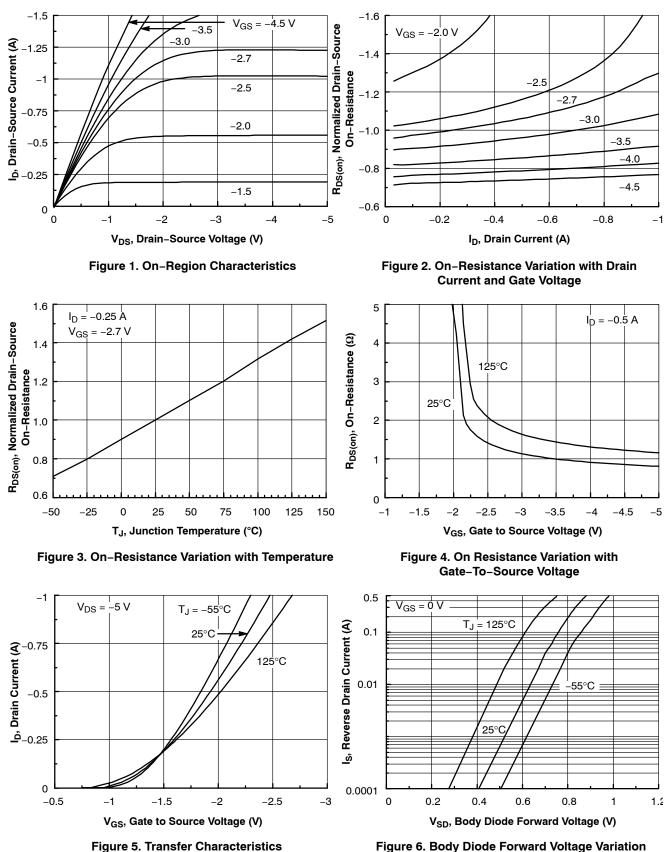
#### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

۱ <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-0.5	А
V <sub>SD</sub>	Drain–Source Diode Forward Voltage $V_{GS} = 0 \text{ V}, I_S = -0.5 \text{ A}$ (Note 1)	-	-0.89	-1.2	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions. 1. Pulse Test: Pulse Width  $\leq$  300 µs, Duty Cycle  $\leq$  2.0%.

#### FDV304P, FDV304P-F169

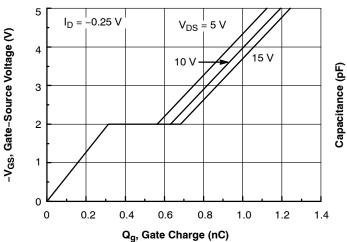
#### **TYPICAL CHARACTERISTICS**





#### FDV304P, FDV304P-F169

#### TYPICAL CHARACTERISTICS (continued)





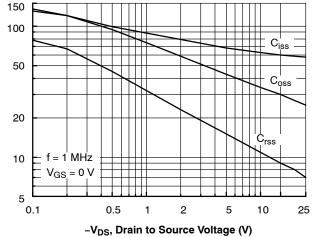


Figure 8. Capacitance Characteristics

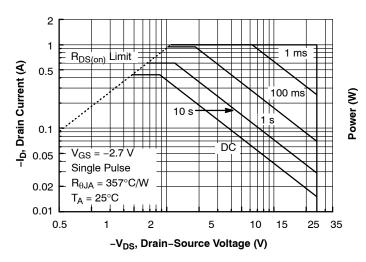


Figure 9. Maximum Safe Operating Area

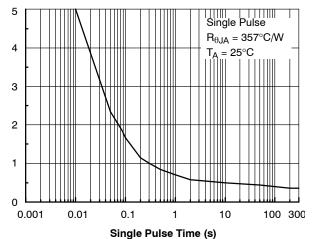


Figure 10. Maximum Pulse Maximum Power Dissipation

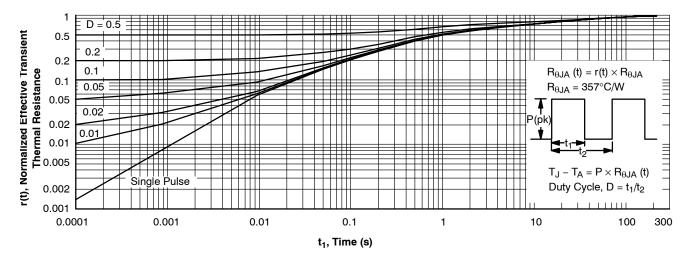


Figure 11. Transient Thermal Response Curve





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