



ON Semiconductor®

## FDS9431A

### P-Channel 2.5V Specified MOSFET

#### General Description

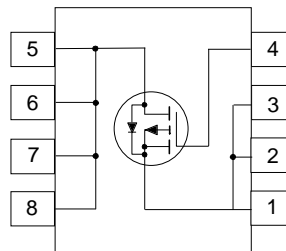
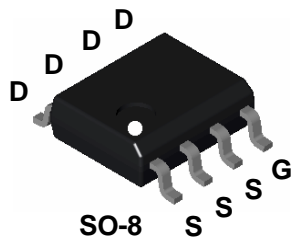
This P-Channel 2.5V specified MOSFET is produced using ON Semiconductor's proprietary, high cell density, DMOS technology. This very high density process has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

#### Applications

- DC/DC converter
- Power management
- Load switch
- Battery protection

#### Features

- -3.5 A, -20 V.  $R_{DS(ON)} = 0.130 \Omega$  @  $V_{GS} = -4.5$  V  
 $R_{DS(ON)} = 0.180 \Omega$  @  $V_{GS} = -2.5$  V.
- Fast switching speed.
- High density cell design for extremely low  $R_{DS(ON)}$ .
- High power and current handling capability.



#### Absolute Maximum Ratings

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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	-20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 8$	V
$I_D$	Drain Current - Continuous (Note 1a) - Pulsed	-3.5	A
		-18	
$P_D$	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	2.5	W
		1.2	
		1.0	
$T_J, T_{stg}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

#### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	25	$^\circ\text{C/W}$

#### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS9431A	FDS9431A	13"	12mm	2500 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		-28		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

**On Characteristics** (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-0.4	-0.6	-1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		2		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}$ $V_{GS} = -2.5\text{ V}, I_D = -3.0\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}$ $T_J = 125^\circ\text{C}$		0.110 0.140 0.155	0.130 0.180 0.220	$\Omega$ $\Omega$ $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-10			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -3.5\text{ A}$		6.5		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		405		pF
$C_{oss}$	Output Capacitance			170		pF
$C_{rss}$	Reverse Transfer Capacitance			45		pF

**Switching Characteristics** (Note 2)

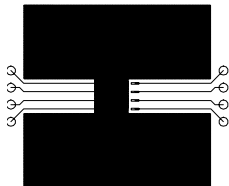
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -5\text{ V}, I_D = -1\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$		6.5	13	ns
$t_r$	Turn-On Rise Time			20	35	ns
$t_{d(off)}$	Turn-Off Delay Time			31	50	ns
$t_f$	Turn-Off Fall Time			21	35	ns
$Q_g$	Total Gate Charge	$V_{DS} = -5\text{ V}, I_D = -3.5\text{ A},$ $V_{GS} = -4.5\text{ V}$		6	8.5	nC
$Q_{gs}$	Gate-Source Charge			0.8		nC
$Q_{gd}$	Gate-Drain Charge			1.3		nC

**Drain-Source Diode Characteristics and Maximum Ratings**

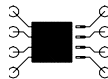
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				-2.1	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -2.1\text{ A}$ (Note 2)		-0.7	-1.2	V

**Notes:**

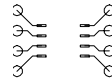
1:  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz. copper.



b)  $105^\circ\text{C/W}$  when mounted on a 0.04 in<sup>2</sup> pad of 2 oz. copper.



c)  $125^\circ\text{C/W}$  on a minimum mounting pad.

Scale 1 : 1 on letter size paper

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

## Typical Characteristics

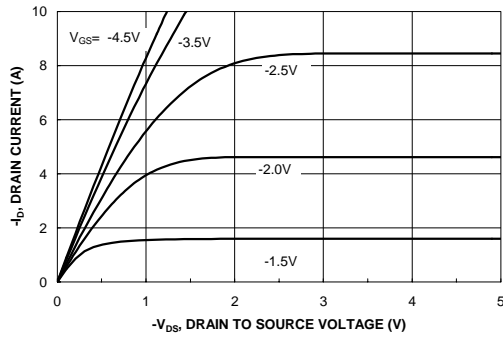


Figure 1. On-Region Characteristics.

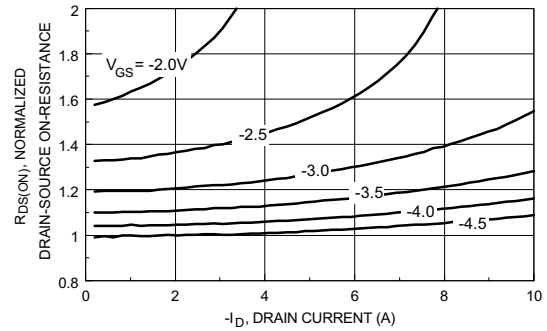


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

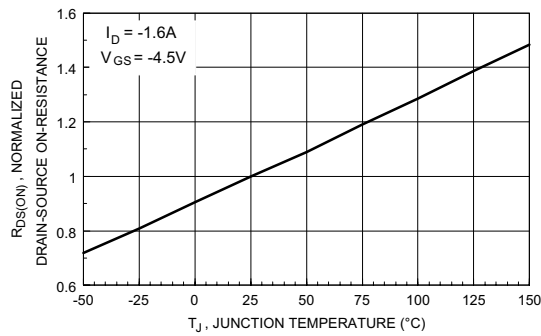


Figure 3. On-Resistance Variation with Temperature.

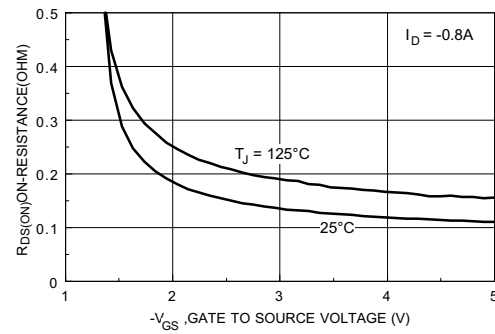


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

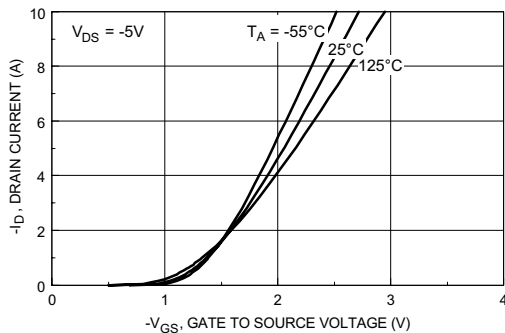


Figure 5. Transfer Characteristics.

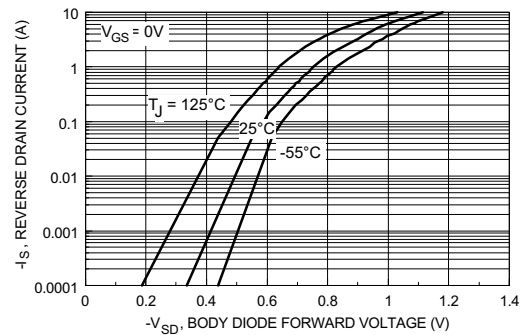
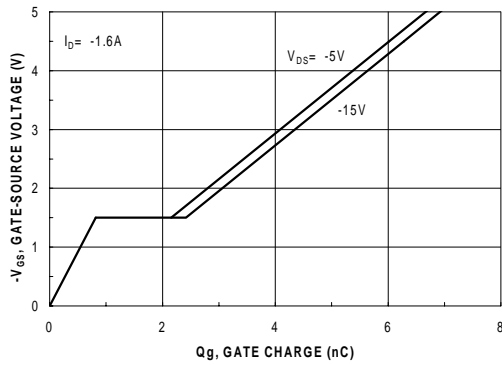
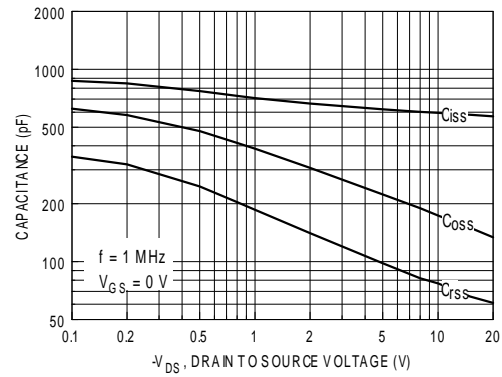


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

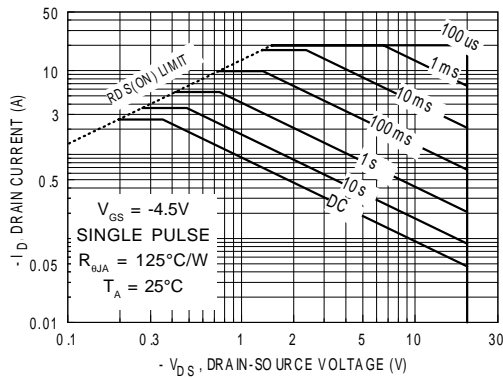
## Typical Characteristics (continued)



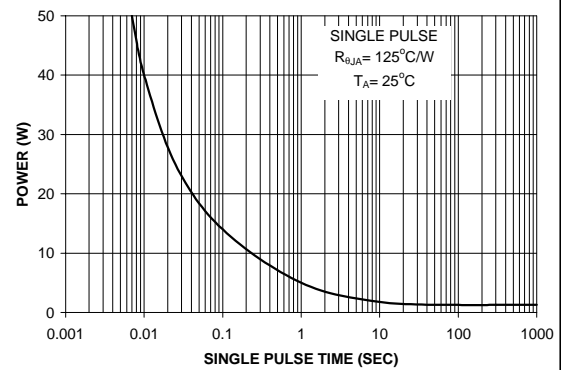
**Figure 7. Gate Charge Characteristics.**



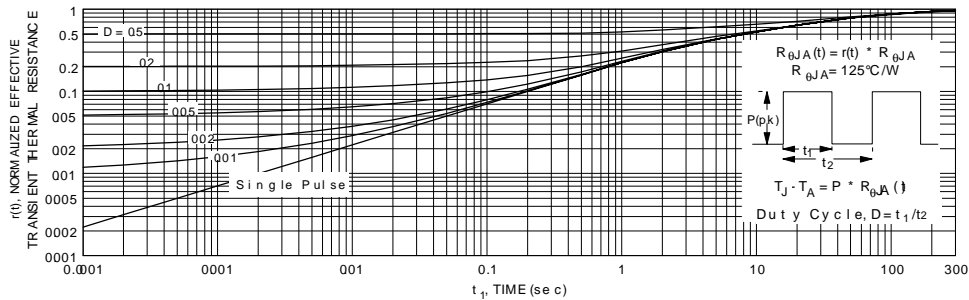
**Figure 8. Capacitance Characteristics.**



**Figure 9. Maximum Safe Operating Area.**




**Figure 10. Single Pulse Maximum Power Dissipation.**



**Figure 11. Transient Thermal Response Curve.**

Thermal characterization performed using the conditions described in Note 1c.  
Transient thermal response will change depending on the circuit board design.

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