

# Si4416DY\*

## Single N-Channel MOSFET

### General Description

This N-Channel Logic Level MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

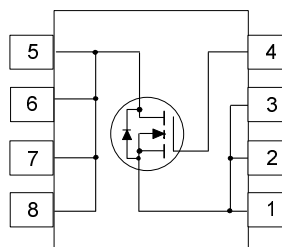
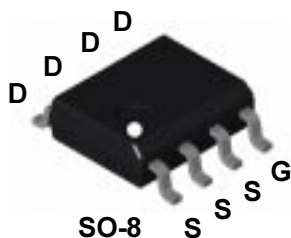
This device is well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

### Applications

- Battery switch
- Load switch
- Motor controls

### Features

- 9 A, 30 V.  $R_{DS(ON)} = 0.018 \Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 0.028 \Omega @ V_{GS} = 4.5 \text{ V}$
- Low gate charge.
- Fast switching speed.
- High performance trench technology for extremely low  $R_{DS(ON)}$ .
- High power and current handling capability.



### Absolute Maximum Ratings T<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units	
V <sub>DSS</sub>	Drain-Source Voltage	30	V	
V <sub>GSS</sub>	Gate-Source Voltage	±20	V	
I <sub>D</sub>	Drain Current - Continuous (Note 1a)	9.0	A	
		- Pulsed		50
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a)	2.5	W	
		(Note 1b)		1.2
		(Note 1c)		1
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C	

### Thermal Characteristics

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	25	°C/W

### Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
4416	SI4416DY	13"	12mm	2500 units

\* Die and manufacturing source subject to change without prior notification.

**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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		21		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}, T_J = 55^\circ\text{C}$			1 25	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

**On Characteristics** (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1			V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-4.5		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 9\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 7.3\text{ A}$			0.018 0.028	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	20			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 9\text{ A}$		27		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		1340		pF
$C_{oss}$	Output Capacitance			340		pF
$C_{riss}$	Reverse Transfer Capacitance			125		pF

**Switching Characteristics** (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A}, R_L = 15\ \Omega$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		12	20	ns
$t_r$	Turn-On Rise Time			13	20	ns
$t_{d(off)}$	Turn-Off Delay Time			38	50	ns
$t_f$	Turn-Off Fall Time			10	20	ns
$t_{rr}$	Drain-Source Reverse Recovery Time	$I_F = 2.1\text{ A}, di/dt = 100\text{A}/\mu\text{s}$			90	nS
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 9\text{ A},$ $V_{GS} = 5\text{ V}$		13	20	nC
$Q_{gs}$	Gate-Source Charge			5		nC
$Q_{gd}$	Gate-Drain Charge			4		nC

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

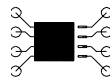
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			2.1		A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.1$ (Note 2)		0.73	1.2	V

**Notes:**

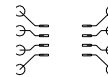
- 1:  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



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



b)  $105^\circ\text{C/W}$  when mounted on a  $0.04\text{ in}^2$  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  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

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