

# Si9953DY\*

## Dual P-Channel Enhancement Mode MOSFET

### General Description

These P-Channel Enhancement Mode MOSFETs are produced using Fairchild Semiconductor's advance process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

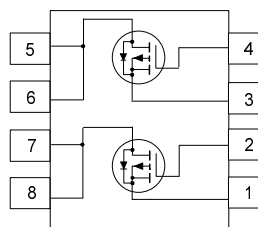
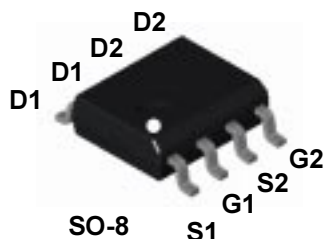
These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

### Applications

- Battery switch
- Load switch
- Motor controls

### Features

- -2.3 A, -20 V.  $R_{DS(on)} = 0.250 \Omega @ V_{GS} = -10 V$   
 $R_{DS(on)} = 0.400 \Omega @ V_{GS} = -4.5 V.$
- Low gate charge.
- Fast switching speed.
- 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	-20	V
V <sub>GSS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub>	Drain Current - Continuous (Note 1a)	-2.3	A
	- Pulsed	-10	
P <sub>D</sub>	Power Dissipation for Dual Operation	2.0	W
	Power Dissipation for Single Operation (Note 1a)	1.6	
	(Note 1b)	1.0	
	(Note 1c)	0.9	
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	62.5	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	40	°C/W

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
9953	Si9953DY	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
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-16		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}, T_J = 55^\circ\text{C}$			-2 -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	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-1.0			V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		3.5		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{ V}, I_D = -1\text{ A}$ $V_{GS} = -10\text{ V}, I_D = -1\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = -4.5\text{ V}, I_D = -0.5\text{ A}$		0.11 0.15 0.24	0.25 0.30 0.40	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$ $V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-10 -1.5			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -15\text{ V}, I_D = -2.3\text{ A}$		4		S

## Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		350		pF
$C_{oss}$	Output Capacitance			260		pF
$C_{riss}$	Reverse Transfer Capacitance			100		pF

## Switching Characteristics (Note 2)

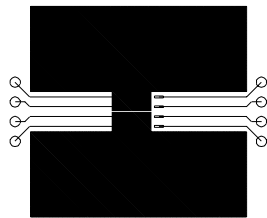
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{ V}, I_D = -1\text{ A}, R_L = 10\ \Omega$ $V_{GS} = -10\text{ V}, R_{GEN} = 6\ \Omega$		9	40	ns
$t_r$	Turn-On Rise Time			21	40	ns
$t_{d(off)}$	Turn-Off Delay Time			21	90	ns
$t_f$	Turn-Off Fall Time			8	50	ns
$t_{rr}$	Drain-Source Reverse Recovery Time	$I_F = -1.7\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$			100	nS
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{ V}, I_D = -2.3\text{ A},$ $V_{GS} = -10\text{ V}$		10	25	nC
$Q_{gs}$	Gate-Source Charge			1.6		nC
$Q_{gd}$	Gate-Drain Charge			3.4		nC

## Drain-Source Diode Characteristics and Maximum Ratings

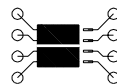
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-1.7		A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -1.7\text{ A}$ <small>(Note 2)</small>		-0.8	-1.2	V

### Notes:

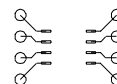
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $78^\circ\text{C/W}$  when mounted on a  $0.5\text{ in}^2$  pad of 2 oz. copper.



b)  $125^\circ\text{C/W}$  when mounted on a  $0.02\text{ in}^2$  pad of 2 oz. copper.



c)  $135^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz. copper.

Scale 1 : 1 on letter size paper

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

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