

High-Speed DMOS Quad FET Analog Switch Arrays



SD5400 / SD5401 / SD5402

FEATURES:

- Low Propagation Time 600 ps
- Low On Resistance
- Low Insertion Loss
- Low Capacitances: Analog Input 3.5pF typ.
Input (Gate) 2.4pF typ.
Output 1.3pF typ.
Feedback 0.3pF typ.
- Low Crosstalk -107dB typ. @ 3kHz
- Bidirectional Operation

APPLICATIONS:

- Analog Switching
- Audio Routing
- Sample & Hold
- Crosspoint Switches
- Choppers
- Video Switching

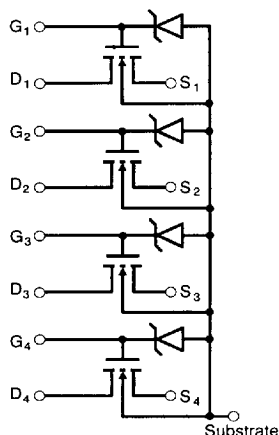
DESCRIPTION:

The SD5400 Series, consisting of SD5400, SD5401 and SD5402 are monolithic arrays of four bidirectional, high performance analog switches manufactured with implanted, high-speed, high-voltage and low-resistance double-diffused MOS (DMOS) process. The maximum threshold of 2V permits simple direct TTL and CMOS driving in small signal applications. The SD5400 was designed to handle $\pm 10V$ analog input signals. The SD5401 was designed to handle $\pm 5V$ analog input signals. The SD5402 was designed to handle $\pm 7.5V$ analog input signals. The devices are available in SO-14, a 14-pin plastic miniature package and in die form for hybrid applications. Custom devices based on SD5000 Series can also be ordered.

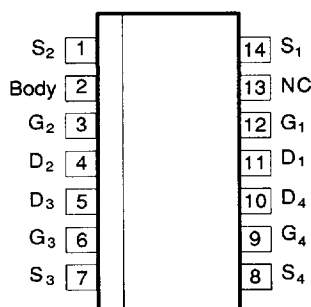
ORDERING INFORMATION

Part	Package	Temperature Range
SD5400CY	Plastic SO-14 Package	-55°C to +125°C
SD5401CY	Plastic SO-14 Package	-55°C to +125°C
SD5402CY	Plastic SO-14 Package	-55°C to +125°C
XSD5000	Sorted Chips in Carriers	-55°C to +125°C
XSD5001	Sorted Chips in Carriers	-55°C to +125°C
XSD5002	Sorted Chips in Carriers	-55°C to +125°C

Functional Block Diagram



SO Pin Configuration



TOP VIEW

CD2

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DC ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	SD5400		SD5401		SD5402		UNITS	CONDITIONS
		MIN.	TYP. MAX.	MIN.	TYP. MAX.	MIN.	TYP. MAX.		
Analog Signal Range	V_{analog}	- 10	+ 10	-5	+5	- 7.5	+ 7.5	V	
Breakdown Voltage									
Drain-Source	BV_{DS}	20	25	10	25	15	25	V	$V_{GS} = V_{BS} = -5V, I_D = 10nA$
Source-Drain	BV_{SD}	20		10		15		V	$V_{GD} = V_{BD} = -5V, I_S = 10nA$
Drain-Body	BV_{DB}	25		15		22.5		V	$V_{GB} = 0V, I_D = 10nA$ Source Open
Source-Body	BV_{SB}	25		15		22.5		V	$V_{GB} = 0V, I_S = 10\mu A$, Drain Open
Leakage Current—SD5400									
Drain-Source	$I_{DS(off)}$		1.0 10.0					nA	$V_{GS} = V_{BS} = -5V, V_{DS} = 20V$
Source-Drain	$I_{SD(off)}$		1.0 10.0					nA	$V_{GD} = V_{BD} = -5V, V_{SD} = 20V$
Gate	I_{GBS}		1.0					μA	$V_{DB} = V_{SB} = 0V, V_{GB} = 30V$
Leakage Current—SD5401									
Drain-Source	$I_{DS(off)}$			1.0 10.0				nA	$V_{GS} = V_{BS} = -5V, V_{DS} = 10V$
Source-Drain	$I_{SD(off)}$			1.0 10.0				nA	$V_{GD} = V_{BD} = -5V, V_{SD} = 10V$
Gate	I_{GBS}			1.0				μA	$V_{DB} = V_{SB} = 0V, V_{GB} = 25V$
Leakage Current—SD5402									
Drain-Source	$I_{DS(off)}$					1.0 10.0		nA	$V_{GS} = V_{BS} = -5V, V_{DS} = 15V$
Source-Drain	$I_{SD(off)}$					1.0 10.0		nA	$V_{GD} = V_{BD} = -5V, V_{SD} = 15V$
Gate	I_{GBS}					1.0 1.0		μA	$V_{DB} = V_{SB} = 0V, V_{GB} = 30V$
Threshold Voltage	V_T	0.1 1.0 2.0		0.1 1.0 2.0		0.1 1.0 2.0		V	$V_{DS} = V_{GS} = V_T, V_{SB} = 0V, I_D = 1\mu A$
Drain-Source ON Resistance	$R_{DS(on)}$	50 70		50 70		50 70		Ω	$V_{GS} = 5V$
		30		30		30		Ω	$V_{GS} = 10V$
		23		23		19		Ω	$V_{GS} = 15V$
		19		19		19		Ω	$V_{GS} = 20V$
Match ON Resistance	$R_{DS(on)}$	1 5		1 5		1 5		Ω	$V_{GS} = 5V$

AC ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$ (Common to SD5400, SD5401, SD5402)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Forward Transconductance	g_{fs}	10	12		mS	$V_{DS} = 10V, I_D = 20mA, V_{SB} = 0V, f = 1kHz$
Capacitances						
Gate Node	C_G		2.4	3.5	pF	} $V_{DS} = 10V, f = 1MHz$ $V_{GS} = V_{BS} = -15V$
Drain Node	C_D		1.3	1.5	pF	
Source Node	C_S		3.5	4.0	pF	
Reverse Transfer	C_{DG}		0.3	0.5	pF	
Crosstalk	C_T		- 107.0		dB	$f = 3kHz, R_G = 600\Omega$

SWITCHING CHARACTERISTICS $T_A = 25^\circ\text{C}$ (Common to SD5400, SD5401, SD5402)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	CONDITONS
Turn-on Time	$t_{d(on)}$		0.7	1.0	ns	} $R_L = 680\Omega, R_G = 51$ $V_{DD} = 5V$ $V_{G(on)} = 10V$
Rise Time	t_r		0.8	1.0	ns	
Turn-off Time	t_{off}^*		10.0		ns	

* t_{off} is dependent on R_L and C_L and does not depend on the device characteristics.

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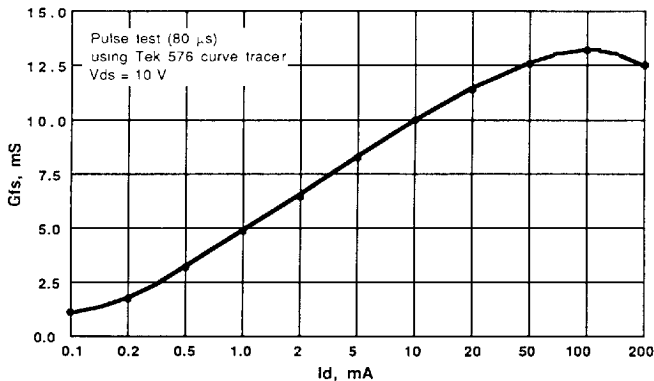


ABSOLUTE MAXIMUM RATINGS

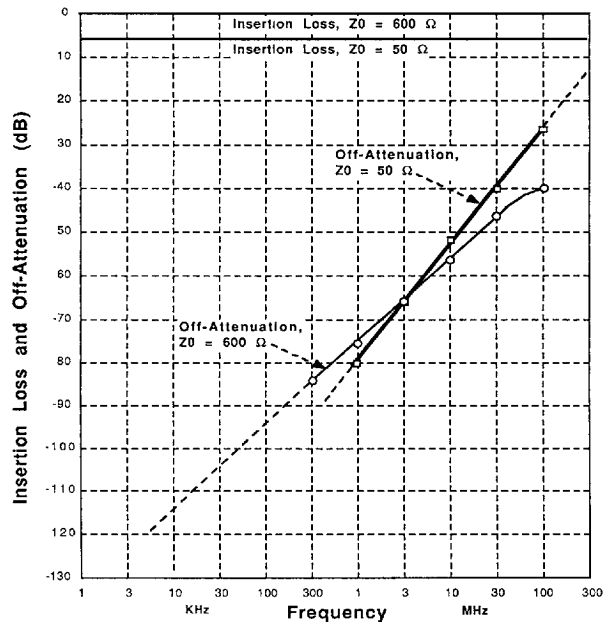
PARAMETER	SYMBOL	SD5400 MAX VALUE	SD5401 MAX VALUE	SD5402 MAX VALUE	UNITS
Breakdown Voltage					
Drain-Source	V_{DS}	20	10	15	V
Source-Drain	V_{SD}	20	10	15	V
Drain-Body	V_{DB}	25	15	22.5	V
Source-Body	V_{SB}	25	15	22.5	V
Gate-Source	V_{GS}	30/- 25	25/- 15	30/- 22.5	V
Gate-Body	V_{GB}	30/- 0.3	25/- 0.3	30/- 0.3	V
Gate-Drain	V_{GD}	30/- 25	30/- 15	30/- 22.5	V
Drain Current	I_D	50	50	50	mA
Temperature Range					
Operating	T_J	- 55 to + 85	- 55 to + 85	- 55 to + 85	°C
Storage	T_S	- 55 to + 150	- 55 to + 150	- 55 to + 150	°C
Power Dissipation					
Package	P_D	640 (Note 1)	640 (Note 1)	640 (Note 1)	mW
Each Device	P_D	300 (Note 2)	300 (Note 2)	300 (Note 2)	mW

Note 1: Linear Derating Factor — 10.7mW/°C above 25°C
Note 2: Linear Derating Factor — 5.0mW/°C above 25°C

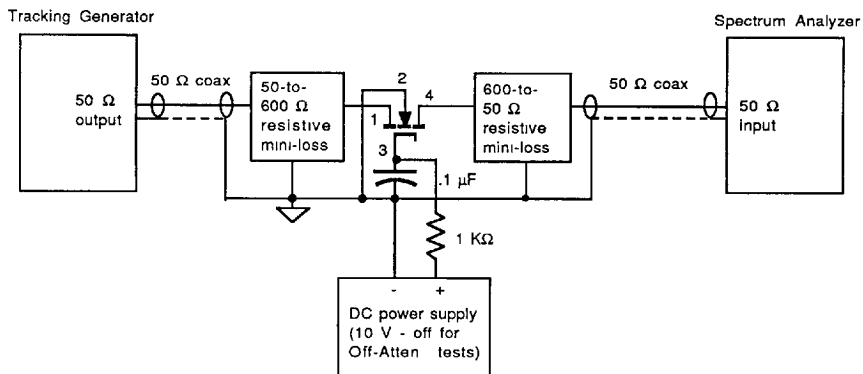
Forward Transconductance vs. Drain Current



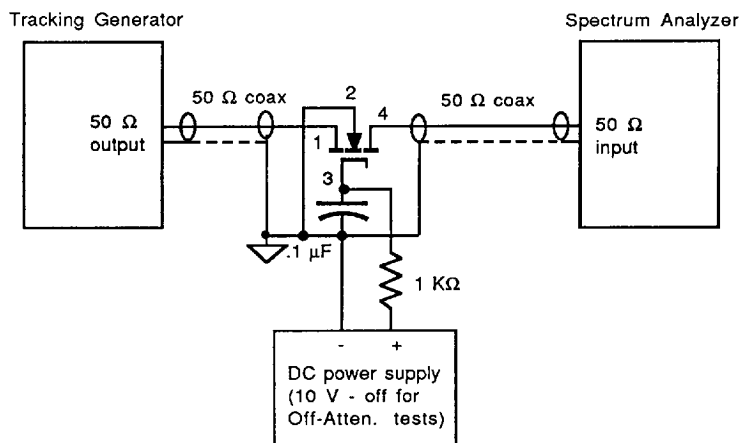
Insertion Loss and Off-Attenuation vs. Frequency



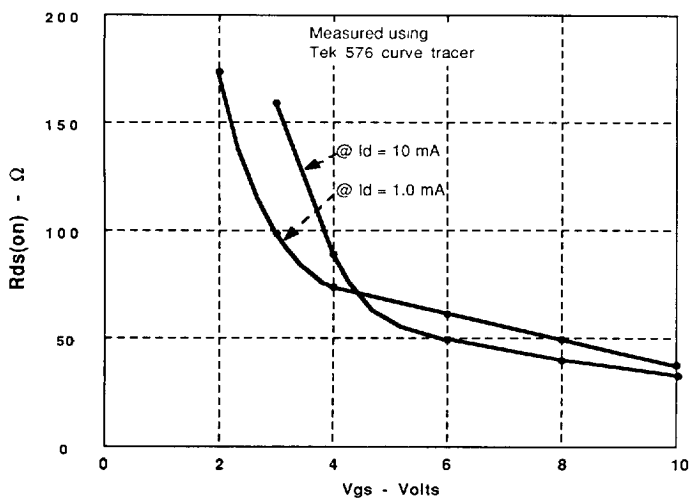
600 Ω Insertion Loss and Off-Attenuation Fixture Schematic (un-shielded leads near device under test are extremely short)



50 Ω Insertion Loss and Off-Attenuation Fixture Schematic (un-shielded leads near device under test are extremely short)

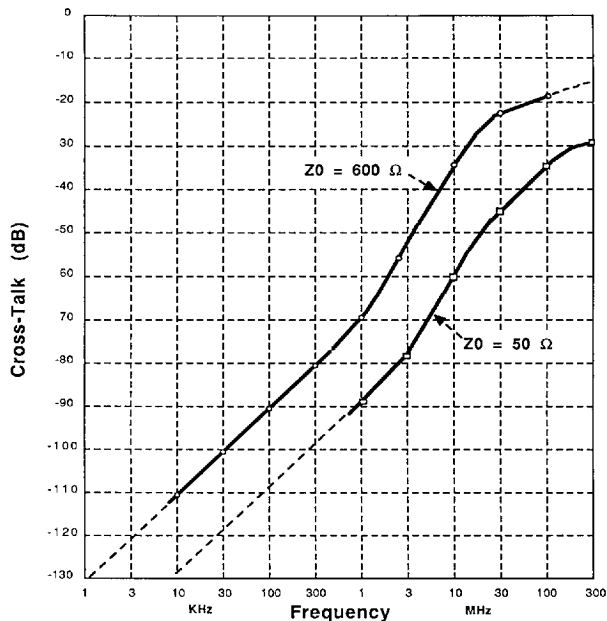


Drain-Source DC On-Resistance vs. Gate-to-Source Voltage

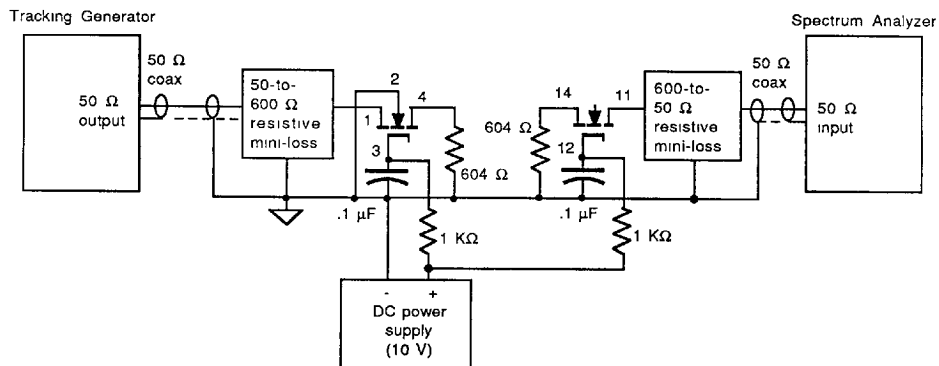


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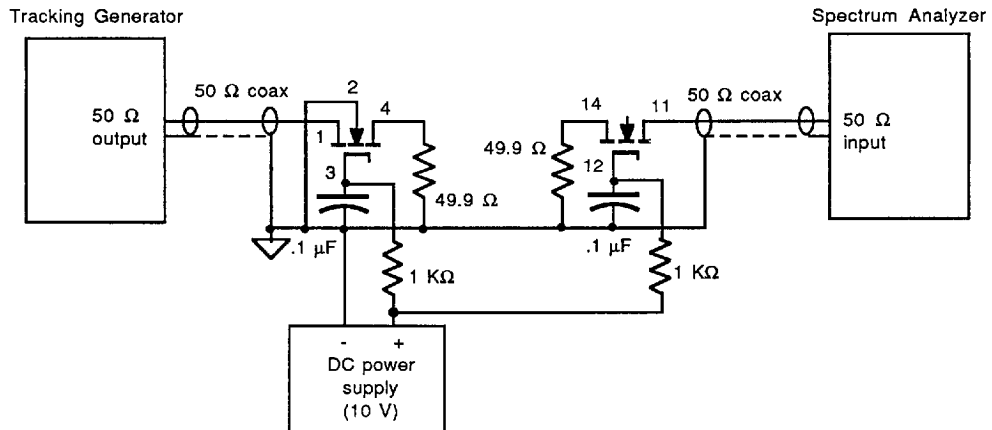
Cross-Talk vs. Frequency



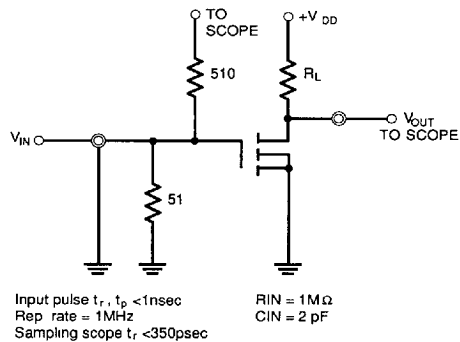
600Ω Cross-Talk Fixture Schematic



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50 Ω Cross-Talk Fixture Schematic

Test Circuit



Switching Waveform

