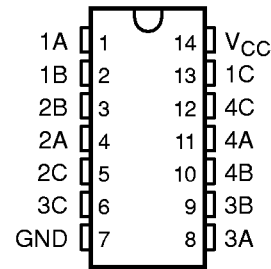


SN54LV4066A, SN74LV4066A QUADRUPLE BILATERAL ANALOG SWITCHES

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- **EPIC™ (Enhanced-Performance Implanted CMOS) Process**
- **High On-Off Output-Voltage Ratio**
- **Low Crosstalk Between Switches**
- **Individual Switch Controls**
- **Extremely Low Input Current**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **Package Options Include Plastic Small-Outline (D, NS), Shrink Small-Outline (DB), Thin Very Small-Outline (DGV), Thin Shrink Small-Outline (PW), Ceramic Flat (W) Packages, and Standard Plastic (N) and Ceramic (J) DIPs**

SN54LV4066A . . . J OR W PACKAGE
SN74LV4066A . . . D, DB, DGV, N, NS, OR PW PACKAGE
(TOP VIEW)



description

This quadruple silicon-gate CMOS analog switch is designed for 2-V to 5.5-V V_{CC} operation.

These switches are designed to handle both analog and digital signals. Each switch permits signals with amplitudes up to 5.5 V (peak) to be transmitted in either direction.

Each switch section has its own enable-input control (C). A high-level voltage applied to C turns on the associated switch section.

Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

The SN54LV4066A is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74LV4066A is characterized for operation from -40°C to 85°C .

FUNCTION TABLE
(each switch)

INPUT CONTROL (C)	SWITCH
L	OFF
H	ON



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**TEXAS
INSTRUMENTS**

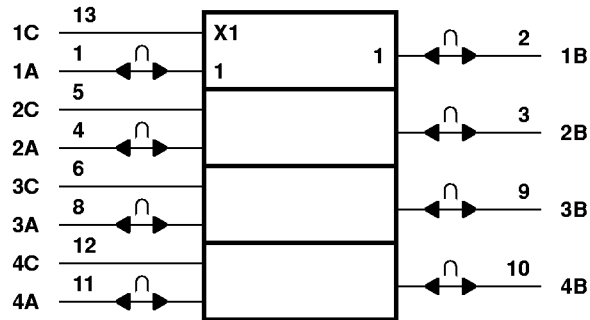
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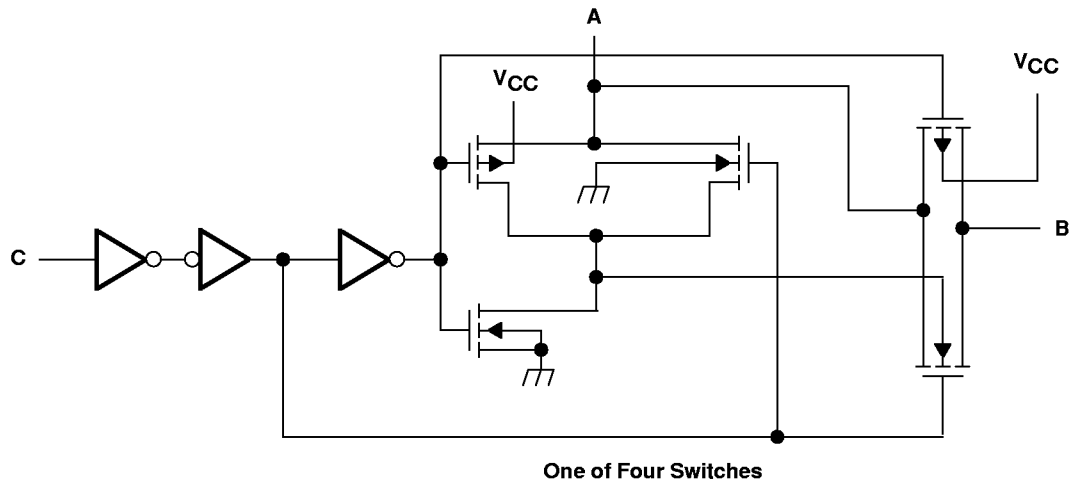
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



SN54LV4066A, SN74LV4066A QUADRUPLE BILATERAL ANALOG SWITCHES

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} (see Note 1)	–0.5 V to 7 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Switch I/O voltage range, V_{IO} (see Note 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Control-input clamp current, I_{IK} ($V_I < 0$)	–20 mA
I/O diode current, I_{IOK} ($V_{IO} < 0$ or $V_{IO} > V_{CC}$)	±50 mA
On-state switch current, I_T ($V_{IO} = 0$ to V_{CC})	±25 mA
Continuous current through V_{CC} or GND	±50 mA
Package thermal impedance, θ_{JA} (see Note 3):	
D package	127°C/W
DB package	158°C/W
DGV package	182°C/W
N package	78°C/W
NS package	127°C/W
PW package	170°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. This value is limited to 7 V maximum.
 3. The package thermal impedance is calculated in accordance with JEDEC 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions (see Note 4)

		SN54LV4066A		SN74LV4066A		UNIT	
		MIN	MAX	MIN	MAX		
V_{CC}	Supply voltage	2‡	5.5	2‡	5.5	V	
V_{IH}	High-level input voltage, control inputs	$V_{CC} = 2$ V	1.5	1.5		V	
		$V_{CC} = 2.3$ V to 2.7 V	$V_{CC} \times 0.7$	$V_{CC} \times 0.7$			
		$V_{CC} = 3$ V to 3.6 V	$V_{CC} \times 0.7$	$V_{CC} \times 0.7$			
		$V_{CC} = 4.5$ V to 5.5 V	$V_{CC} \times 0.7$	$V_{CC} \times 0.7$			
V_{IL}	Low-level input voltage, control inputs	$V_{CC} = 2$ V	0.5	0.5		V	
		$V_{CC} = 2.3$ V to 2.7 V	$V_{CC} \times 0.3$	$V_{CC} \times 0.3$			
		$V_{CC} = 3$ V to 3.6 V	$V_{CC} \times 0.3$	$V_{CC} \times 0.3$			
		$V_{CC} = 4.5$ V to 5.5 V	$V_{CC} \times 0.3$	$V_{CC} \times 0.3$			
V_I	Control input voltage	0	5.5	0	5.5	V	
V_{IO}	Input/output voltage	0	V_{CC}	0	V_{CC}	V	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 2.3$ V to 2.7 V	0	200	0	200	ns/V
		$V_{CC} = 3$ V to 3.6 V	0	100	0	100	
		$V_{CC} = 4.5$ V to 5.5 V	0	20	0	20	
T_A	Operating free-air temperature	–55	125	–40	85	°C	

‡ With supply voltages at or near 2 V, the analog switch on-state resistance becomes very nonlinear. Only digital signals should be transmitted at these low supply voltages.

NOTE 4: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			SN54LV4066A		SN74LV4066A		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
R _{on} On-state switch resistance	I _T = -1 mA, V _I = V _{CC} or GND, V _C = V _{IH} (see Figure 1)	2.3 V		38	180		225		225	Ω
		3 V		29	150		190		190	
		4.5 V		21	75		100		100	
R _{on(p)} Peak on-state resistance	I _T = -1 mA, V _I = V _{CC} to GND, V _C = V _{IH}	2.3 V		143	500		600		600	Ω
		3 V		57	180		225		225	
		4.5 V		31	100		125		125	
ΔR _{on} Difference in on-state resistance between switches	I _T = -1 mA, V _I = V _{CC} to GND, V _C = V _{IH}	2.3 V		6	30		40		40	Ω
		3 V		3	20		30		30	
		4.5 V		2	15		20		20	
I _I Control input current	V _I = V _{CC} or GND	5.5 V			±0.1		±1		±1	μA
I _{soff} Off-state switch leakage current	V _I = V _{CC} and V _O = GND, or V _I = GND and V _O = V _{CC} , V _C = V _{IL} (see Figure 2)	5.5 V			±0.1		±1		±1	μA
I _{son} On-state switch leakage current	V _I = V _{CC} or GND, V _C = V _{IH} (see Figure 3)	5.5 V			±0.1		±1		±1	μA
I _{CC} Supply current	V _I = V _{CC} or GND	5.5 V					20		20	μA
C _{ic} Control input capacitance				1.5						pF
C _{io} Switch input/output capacitance				5.5						pF
C _f Feedthrough capacitance				0.5						pF

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**switching characteristics over recommended operating free-air temperature range,
V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	T _A = 25°C			SN54LV4066A		SN74LV4066A		UNIT	
				MIN	TYP	MAX	MIN	MAX	MIN	MAX		
t _{PLH} , t _{PHL}	Propagati on delay time	A or B	B or A	C _L = 15 pF, (see Figure 4)		1.2	10		16		16	ns
t _{PZH} , t _{PZL}	Switch turn-on time	C	A or B	C _L = 15 pF, R _L = 1 kΩ (see Figure 5)		3.3	15		20		20	ns
t _{PLZ} , t _{PHZ}	Switch turn-off time	C	A or B	C _L = 15 pF, R _L = 1 kΩ (see Figure 5)		6	15		23		23	ns
t _{PLH} , t _{PHL}	Propagati on delay time	A or B	B or A	C _L = 50 pF, (see Figure 4)		2.6	12		18		18	ns
t _{PZH} , t _{PZL}	Switch turn-on time	C	A or B	C _L = 50 pF, R _L = 1 kΩ (see Figure 5)		4.2	25		32		32	ns
t _{PLZ} , t _{PHZ}	Switch turn-off time	C	A or B	C _L = 50 pF, R _L = 1 kΩ (see Figure 5)		9.6	25		32		32	ns

**switching characteristics over recommended operating free-air temperature range,
V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	T _A = 25°C			SN54LV4066A		SN74LV4066A		UNIT	
				MIN	TYP	MAX	MIN	MAX	MIN	MAX		
t _{PLH} , t _{PHL}	Propagati on delay time	A or B	B or A	C _L = 15 pF, (see Figure 4)		0.8	6		10		10	ns
t _{PZH} , t _{PZL}	Switch turn-on time	C	A or B	C _L = 15 pF, R _L = 1 kΩ (see Figure 5)		2.3	11		15		15	ns
t _{PLZ} , t _{PHZ}	Switch turn-off time	C	A or B	C _L = 15 pF, R _L = 1 kΩ (see Figure 5)		4.5	11		15		15	ns
t _{PLH} , t _{PHL}	Propagati on delay time	A or B	B or A	C _L = 50 pF, (see Figure 4)		1.5	9		12		12	ns
t _{PZH} , t _{PZL}	Switch turn-on time	C	A or B	C _L = 50 pF, R _L = 1 kΩ (see Figure 5)		3	18		22		22	ns
t _{PLZ} , t _{PHZ}	Switch turn-off time	C	A or B	C _L = 50 pF, R _L = 1 kΩ (see Figure 5)		7.2	18		22		22	ns

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switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	$T_A = 25^\circ\text{C}$			SN54LV4066A		SN74LV4066A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
tPLH, tPHL Propagation delay time	A or B	B or A	$C_L = 15\text{ pF}$, (see Figure 4)		0.3	4		7		7	ns
tpZH, tpZL Switch turn-on time	C	A or B	$C_L = 15\text{ pF}$, $R_L = 1\text{ k}\Omega$ (see Figure 5)		1.6	7		10		10	ns
tPLZ, tPHZ Switch turn-off time	C	A or B	$C_L = 15\text{ pF}$, $R_L = 1\text{ k}\Omega$ (see Figure 5)		3.2	7		10		10	ns
tPLH, tPHL Propagation delay time	A or B	B or A	$C_L = 50\text{ pF}$, (see Figure 4)		0.6	6		8		8	ns
tpZH, tpZL Switch turn-on time	C	A or B	$C_L = 50\text{ pF}$, $R_L = 1\text{ k}\Omega$ (see Figure 5)		2.1	12		16		16	ns
tPLZ, tPHZ Switch turn-off time	C	A or B	$C_L = 50\text{ pF}$, $R_L = 1\text{ k}\Omega$ (see Figure 5)		5.1	12		16		16	ns

analog switch characteristics over operating free-air temperature range (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V_{CC}	$T_A = 25^\circ\text{C}$			UNIT	
					MIN	TYP	MAX		
Frequency response (switch on)	A or B	B or A	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (sine wave) $20\log_{10}(V_O/V_I) = -3\text{ dB}$ (see Figure 6)	2.3 V	30			MHz	
				3 V	35				
				4.5 V	50				
Crosstalk (between any switches)	A or B	B or A	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (sine wave) (see Figure 7)	2.3 V	-45			dB	
				3 V	-45				
				4.5 V	-45				
Crosstalk (control input to signal output)	C	A or B	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (square wave) (see Figure 8)	2.3 V	15			mV	
				3 V	20				
				4.5 V	50				
Feedthrough attenuation (switch off)	A or B	B or A	$C_L = 50\text{ pF}$, $R_L = 600\ \Omega$, $f_{in} = 1\text{ MHz}$ (see Figure 9)	2.3 V	-40			dB	
				3 V	-40				
				4.5 V	-40				
Sine-wave distortion	A or B	B or A	$C_L = 50\text{ pF}$, $R_L = 10\text{ k}\Omega$, $f_{in} = 1\text{ kHz}$ (sine wave) (see Figure 10)	$V_I = 2\text{ V}_{p-p}$	2.3 V	0.1			
				$V_I = 2.5\text{ V}_{p-p}$	3 V	0.1			
				$V_I = 4\text{ V}_{p-p}$	4.5 V	0.1			

operating characteristics, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance		4.5	pF

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PARAMETER MEASUREMENT INFORMATION

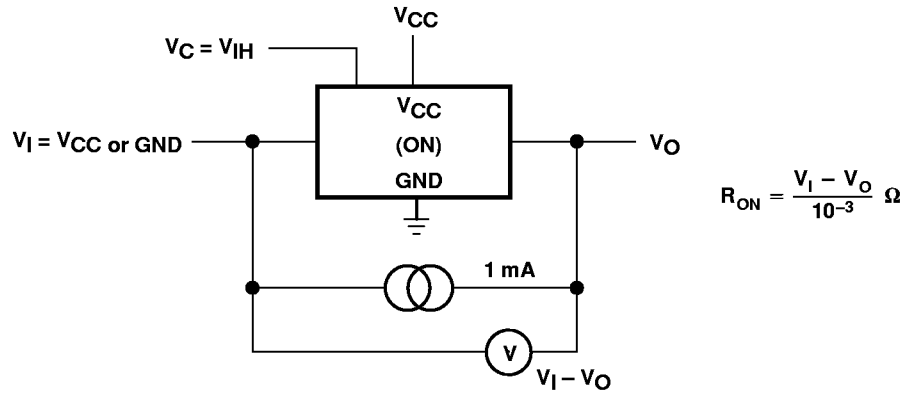


Figure 1. On-State Resistance Test Circuit

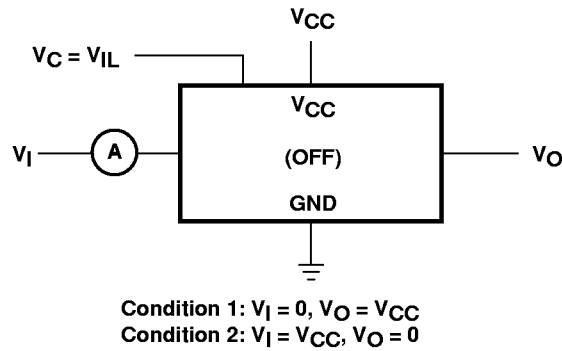


Figure 2. Off-State Switch Leakage-Current Test Circuit

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PARAMETER MEASUREMENT INFORMATION

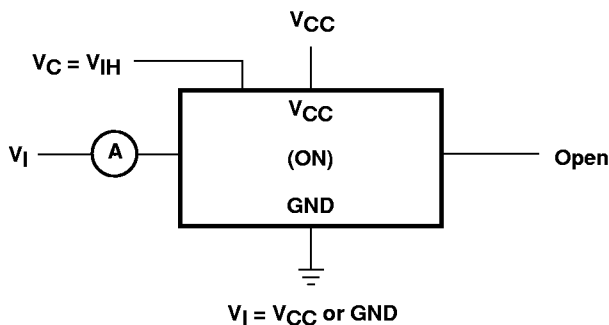


Figure 3. On-State Leakage-Current Test Circuit

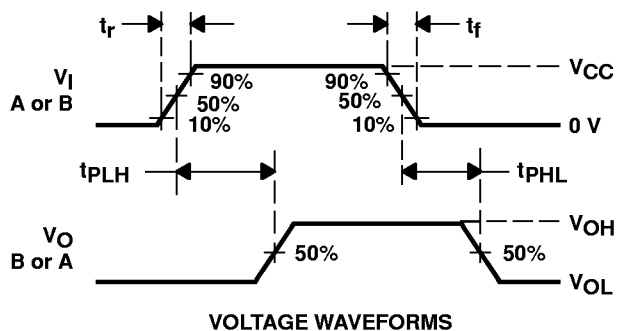
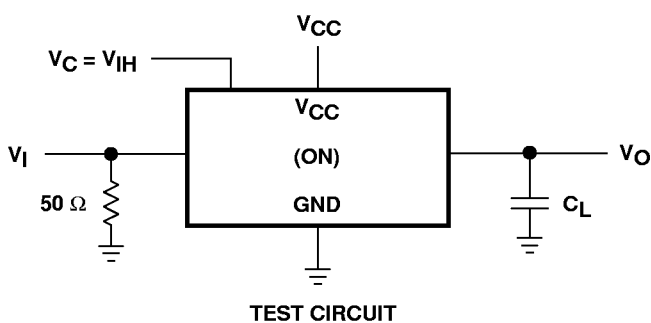
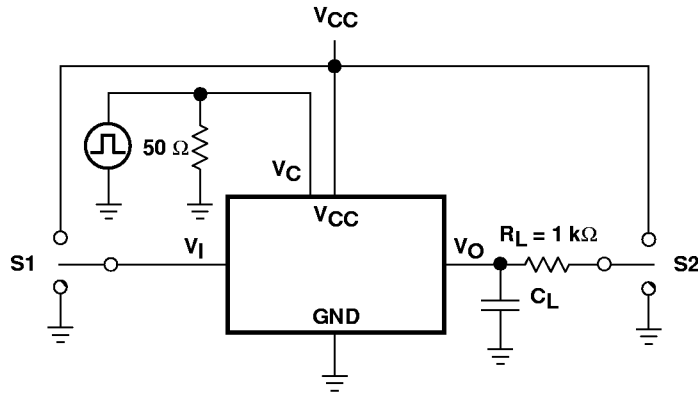


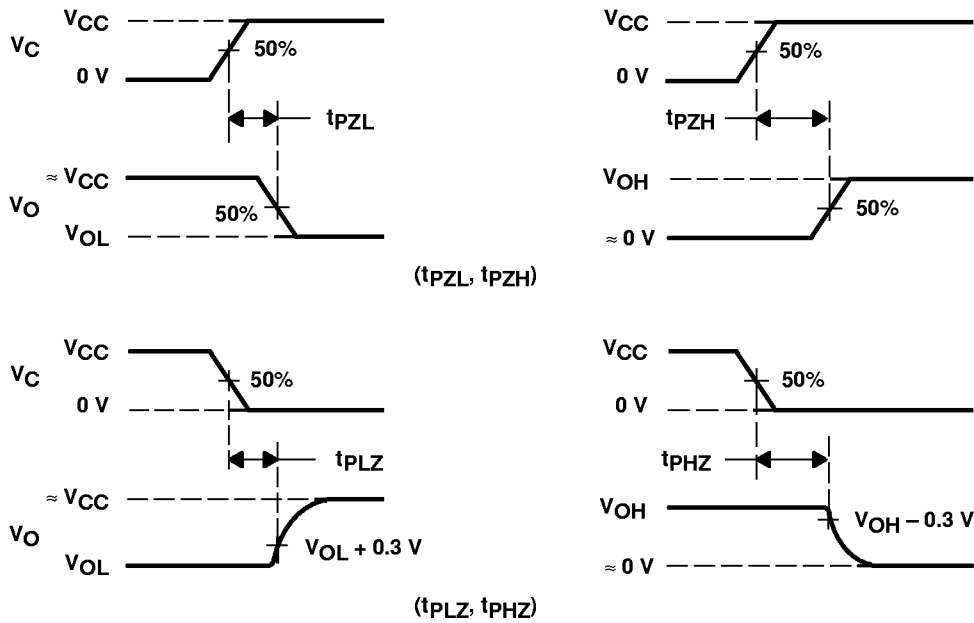
Figure 4. Propagation Delay Time, Signal Input to Signal Output

PARAMETER MEASUREMENT INFORMATION



TEST	S1	S2
t _{PZL}	GND	VCC
t _{PZH}	VCC	GND
t _{PLZ}	GND	VCC
t _{PHZ}	VCC	GND

TEST CIRCUIT



VOLTAGE WAVEFORMS

Figure 5. Switching Time (t_{PZL}, t_{PLZ}, t_{PZH}, t_{PHZ}), Control to Signal Output

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PARAMETER MEASUREMENT INFORMATION

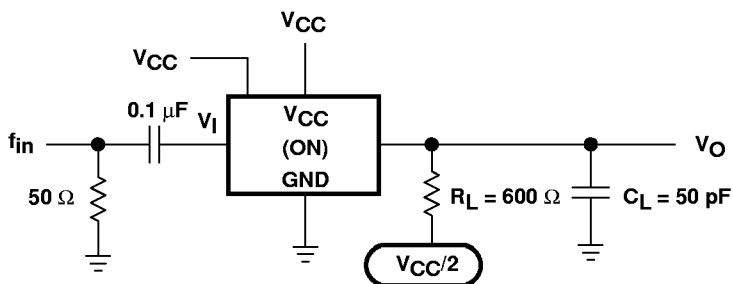


Figure 6. Frequency Response (Switch On)

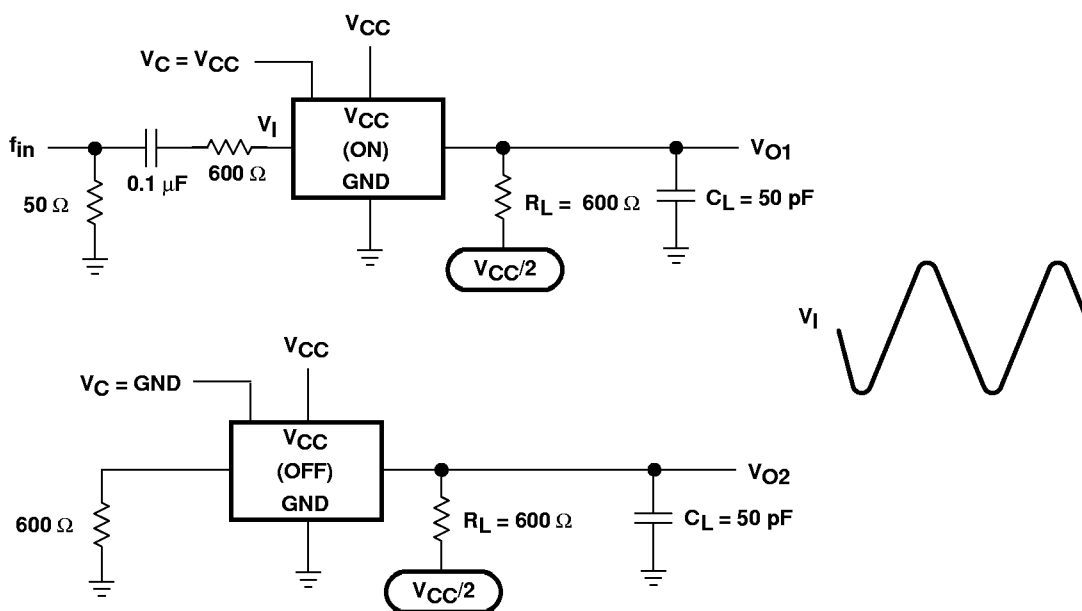


Figure 7. Crosstalk Between Any Two Switches

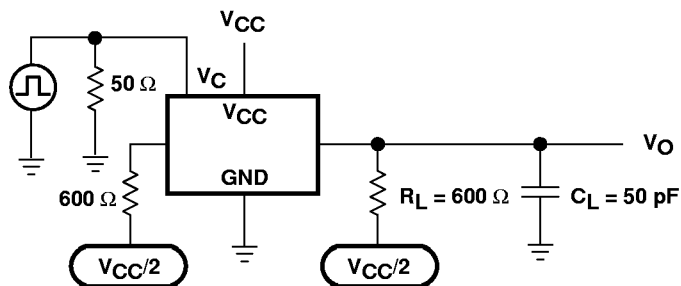


Figure 8. Crosstalk (Control Input – Switch Output)

PARAMETER MEASUREMENT INFORMATION

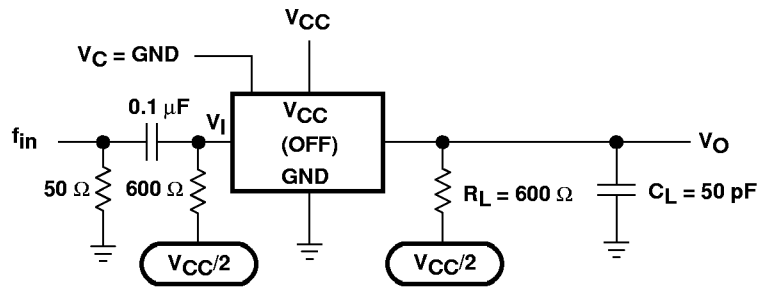


Figure 9. Feedthrough Attenuation (Switch Off)

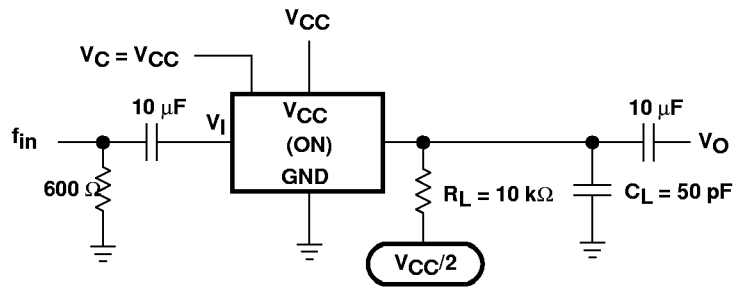


Figure 10. Sine-Wave Distortion

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