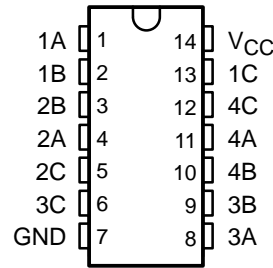


SN74HC4066 QUADRUPLE BILATERAL ANALOG SWITCH

SCLS325G – MARCH 1996 – REVISED JULY 2003

- Wide Operating Voltage Range of 2 V to 6 V
- Typical Switch Enable Time of 18 ns
- Low Power Consumption, 20- μ A Max I_{CC}
- Low Input Current of 1 μ A Max
- High Degree of Linearity
- High On-Off Output-Voltage Ratio
- Low Crosstalk Between Switches
- Low On-State Impedance . . .
50- Ω TYP at $V_{CC} = 6$ V
- Individual Switch Controls

D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)



description/ordering information

The SN74HC4066 is a silicon-gate CMOS quadruple analog switch designed to handle both analog and digital signals. Each switch permits signals with amplitudes of up to 6 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.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube of 25	SN74HC4066N	SN74HC4066N
	SOIC – D	Tube of 50	SN74HC4066D	HC4066
		Reel of 2500	SN74HC4066DR	
		Reel of 250	SN74HC4066DT	
	SOP – NS	Reel of 2000	SN74HC4066NSR	HC4066
	SSOP – DB	Reel of 2000	SN74HC4066DBR	HC4066
	TSSOP – PW	Tube of 90	SN74HC4066PW	HC4066
		Reel of 2000	SN74HC4066PWR	
		Reel of 250	SN74HC4066PWT	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE (each switch)

INPUT CONTROL (C)	SWITCH
L	OFF
H	ON



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

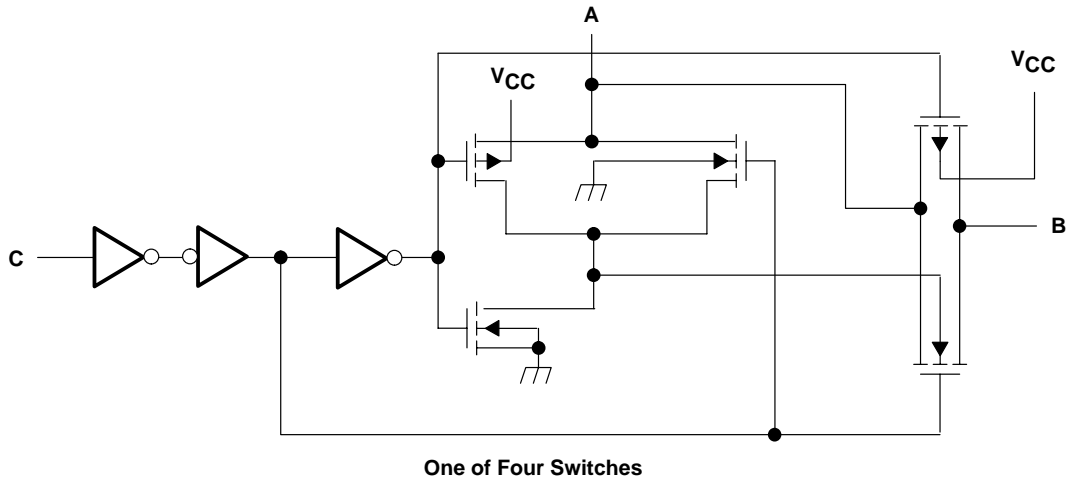
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SN74HC4066 QUADRUPLE BILATERAL ANALOG SWITCH

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logic diagram, each switch (positive logic)



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
Control-input diode current, I_I ($V_I < 0$ or $V_I > V_{CC}$)	± 20 mA
I/O port diode current, I_I ($V_I < 0$ or $V_{I/O} > V_{CC}$)	± 20 mA
On-state switch current ($V_{I/O} = 0$ to V_{CC})	± 25 mA
Continuous current through V_{CC} or GND	± 50 mA
Package thermal impedance, θ_{JA} (see Note 2):		
D package	.....	86°C/W
DB package	.....	96°C/W
N package	.....	80°C/W
NS package	.....	76°C/W
PW package	.....	113°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. All voltages are with respect to ground unless otherwise specified.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

SN74HC4066 QUADRUPLE BILATERAL ANALOG SWITCH

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recommended operating conditions (see Note 3)

		MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	2†	5	6	V
V _{I/O}	I/O port voltage	0		V _{CC}	V
V _{IH}	High-level input voltage, control inputs	V _{CC} = 2 V	1.5	V _{CC}	V
		V _{CC} = 4.5 V	3.15	V _{CC}	
		V _{CC} = 6 V	4.2	V _{CC}	
V _{IL}	Low-level input voltage, control inputs	V _{CC} = 2 V	0	0.3	V
		V _{CC} = 4.5 V	0	0.9	
		V _{CC} = 6 V	0	1.2	
Δt/Δv	Input transition rise/fall time	V _{CC} = 2 V		1000	ns
		V _{CC} = 4.5 V		500	
		V _{CC} = 6 V		400	
T _A	Operating free-air temperature	-40		85	°C

† With supply voltages at or near 2 V, the analog switch on-state resistance becomes very nonlinear. It is recommended that only digital signals be transmitted at these low supply voltages.

NOTE 3: All unused 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.

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
r _{on}	On-state switch resistance I _T = -1 mA, V _I = 0 to V _{CC} , V _C = V _{IH} (see Figure 1)	2 V		150			Ω	
		4.5 V		50	85	106		
		6 V		30				
r _{on(p)}	Peak on-state resistance V _I = V _{CC} or GND, V _C = V _{IH} , I _T = -1 mA	2 V		320			Ω	
		4.5 V		70	170	215		
		6 V		50				
I _I	Control input current	V _C = 0 or V _{CC}	6 V	±0.1	±100	±1000	nA	
I _{soff}	Off-state switch leakage current	V _I = V _{CC} or 0, V _O = V _{CC} or 0, V _C = V _{IL} (see Figure 2)	6 V		±0.1	±5	μA	
I _{son}	On-state switch leakage current	V _I = V _{CC} or 0, V _C = V _{IH} (see Figure 3)	6 V		±0.1	±5	μA	
I _{CC}	Supply current	V _I = 0 or V _{CC} , I _O = 0	6 V		2	20	μA	
C _i	Input capacitance	A or B	5 V	9			pF	
		C		3	10	10		
C _f	Feed-through capacitance	A to B		0.5			pF	
C _O	Output capacitance	A or B	5 V	9			pF	



SN74HC4066

QUADRUPLE BILATERAL ANALOG SWITCH

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switching characteristics over recommended operating free-air temperature range

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V _{CC}	T _A = 25°C			MIN	MAX	UNIT
					MIN	TYP	MAX			
t _{PLH} , t _{PHL} Propagation delay time	A or B	B or A	C _L = 50 pF (see Figure 4)	2 V		10	60		75	ns
				4.5 V		4	12		15	
				6 V		3	10		13	
t _{PZH} , t _{PZL} Switch turn-on time	C	A or B	R _L = 1 kΩ, C _L = 50 pF (see Figure 5)	2 V		70	180		225	ns
				4.5 V		21	36		45	
				6 V		18	31		38	
t _{PLZ} , t _{PHZ} Switch turn-off time	C	A or B	R _L = 1 kΩ, C _L = 50 pF (see Figure 5)	2 V		50	200		250	ns
				4.5 V		25	40		50	
				6 V		22	34		43	
f _I Control input frequency	C	A or B	C _L = 15 pF, R _L = 1 kΩ, V _C = V _{CC} or GND, V _O = V _{CC} /2 (see Figure 6)	2 V		15				MHz
				4.5 V		30				
				6 V		30				
Control feed-through noise	C	A or B	C _L = 50 pF, R _{in} = R _L = 600 Ω, V _C = V _{CC} or GND, f _{in} = 1 MHz (see Figure 7)	4.5 V		15				mV (rms)
				6 V		20				

operating characteristics, V_{CC} = 4.5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS	TYP	UNIT
C _{pd} Power dissipation capacitance per gate	C _L = 50 pF, f = 1 MHz	45	pF
Minimum through bandwidth, A to B or B to A [†] [20 log (V _O /V _I)] = -3 dB	C _L = 50 pF, V _C = V _{CC} , R _L = 600 Ω, (see Figure 8)	30	MHz
Crosstalk between any switches [‡]	C _L = 10 pF, f _{in} = 1 MHz, R _L = 50 Ω, (see Figure 9)	45	dB
Feed through, switch off, A to B or B to A [‡]	C _L = 50 pF, f _{in} = 1 MHz, R _L = 600 Ω, (see Figure 10)	42	dB
Amplitude distortion rate, A to B or B to A	C _L = 50 pF, f _{in} = 1 kHz, R _L = 10 kΩ, (see Figure 11)	0.05%	

[†] Adjust the input amplitude for output = 0 dBm at f = 1 MHz. Input signal must be a sine wave.

[‡] Adjust the input amplitude for input = 0 dBm at f = 1 MHz. Input signal must be a sine wave.



PARAMETER MEASUREMENT INFORMATION

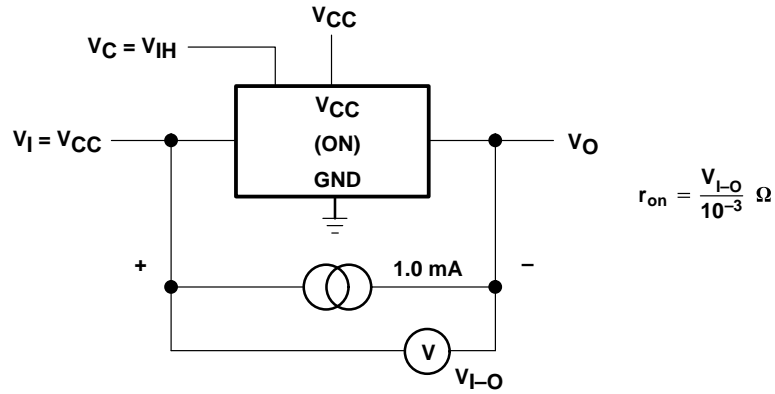


Figure 1. On-State Resistance Test Circuit

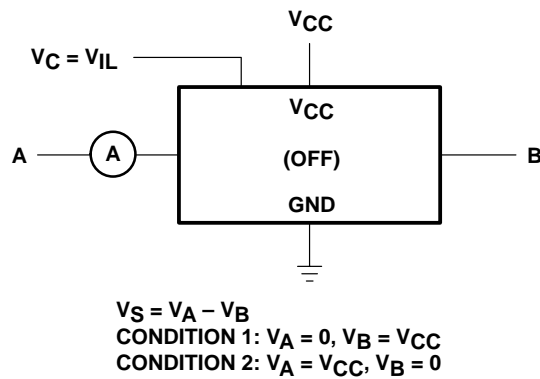


Figure 2. Off-State Switch Leakage-Current Test Circuit

SN74HC4066 QUADRUPLE BILATERAL ANALOG SWITCH

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PARAMETER MEASUREMENT INFORMATION

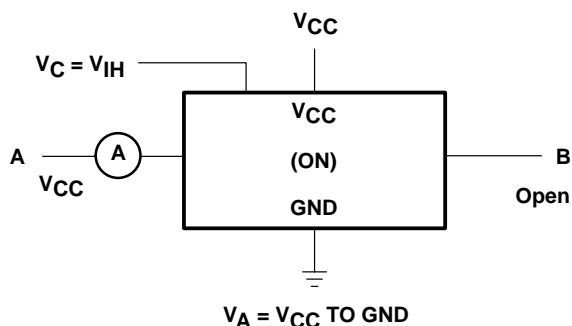


Figure 3. On-State Leakage-Current Test Circuit

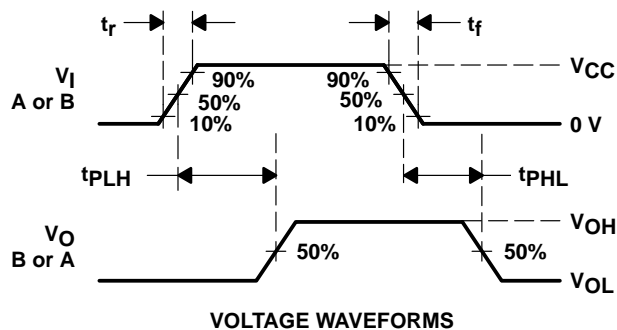
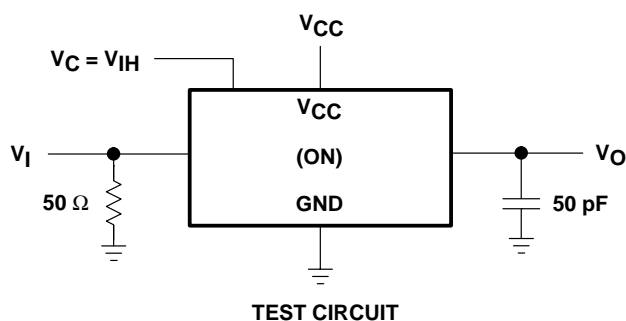
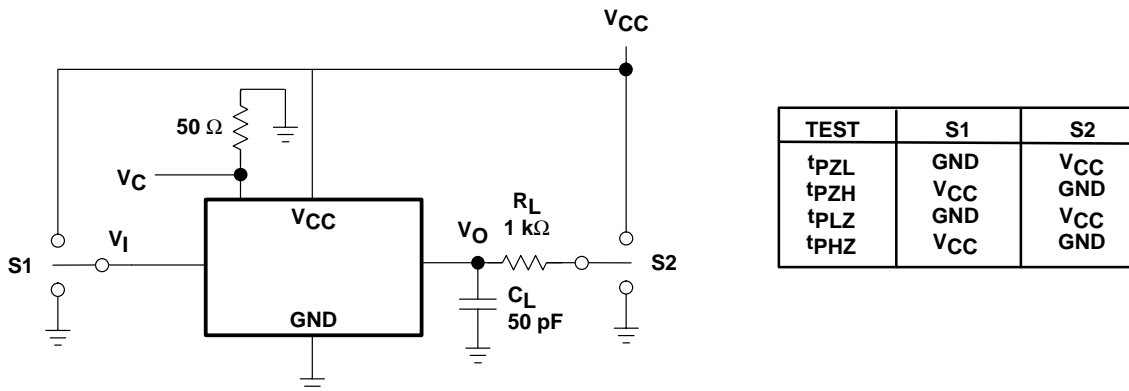


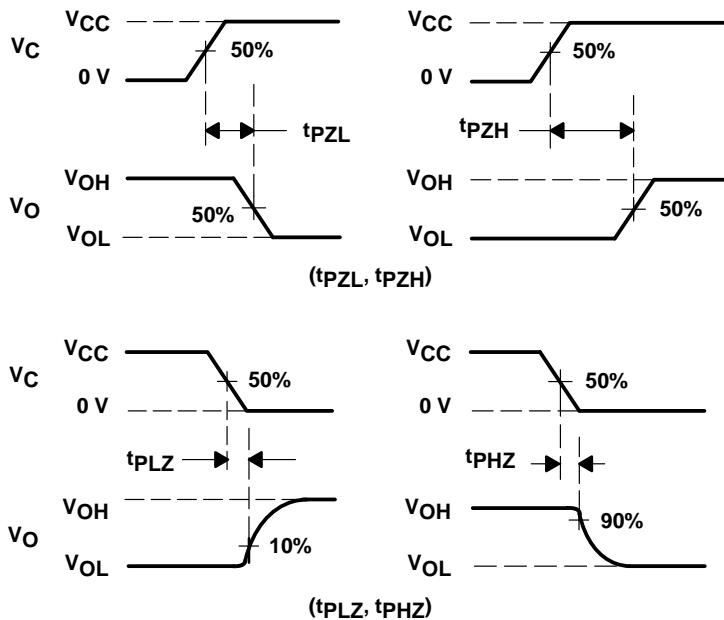
Figure 4. Propagation Delay Time, Signal Input to Signal Output

PARAMETER MEASUREMENT INFORMATION



TEST	S1	S2
t_{PZL}	GND	V_{CC}
t_{PZH}	V_{CC}	GND
t_{PLZ}	GND	V_{CC}
t_{PHZ}	V_{CC}	GND

TEST CIRCUIT



VOLTAGE WAVEFORMS

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

SN74HC4066 QUADRUPLE BILATERAL ANALOG SWITCH

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PARAMETER MEASUREMENT INFORMATION

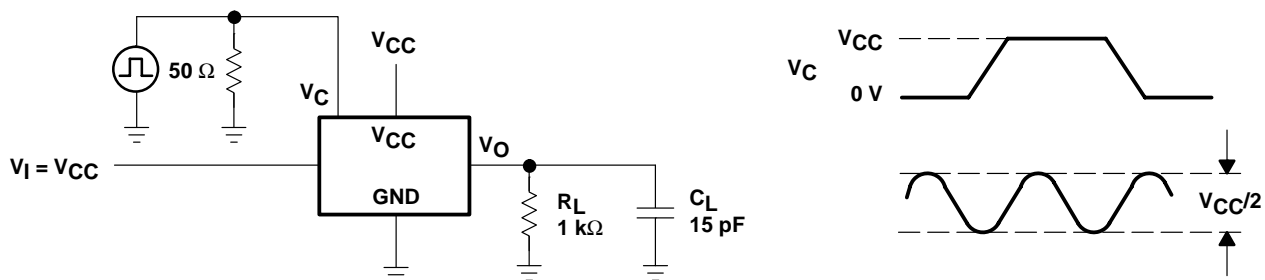


Figure 6. Control-Input Frequency

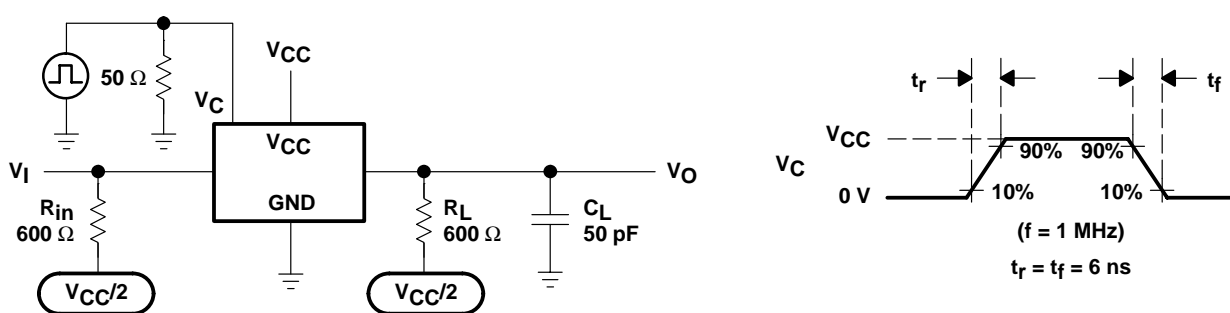


Figure 7. Control Feed-Through Noise

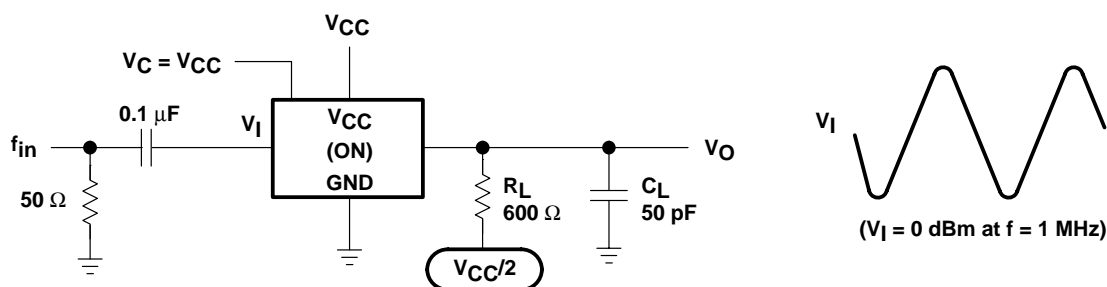


Figure 8. Minimum Through Bandwidth

PARAMETER MEASUREMENT INFORMATION

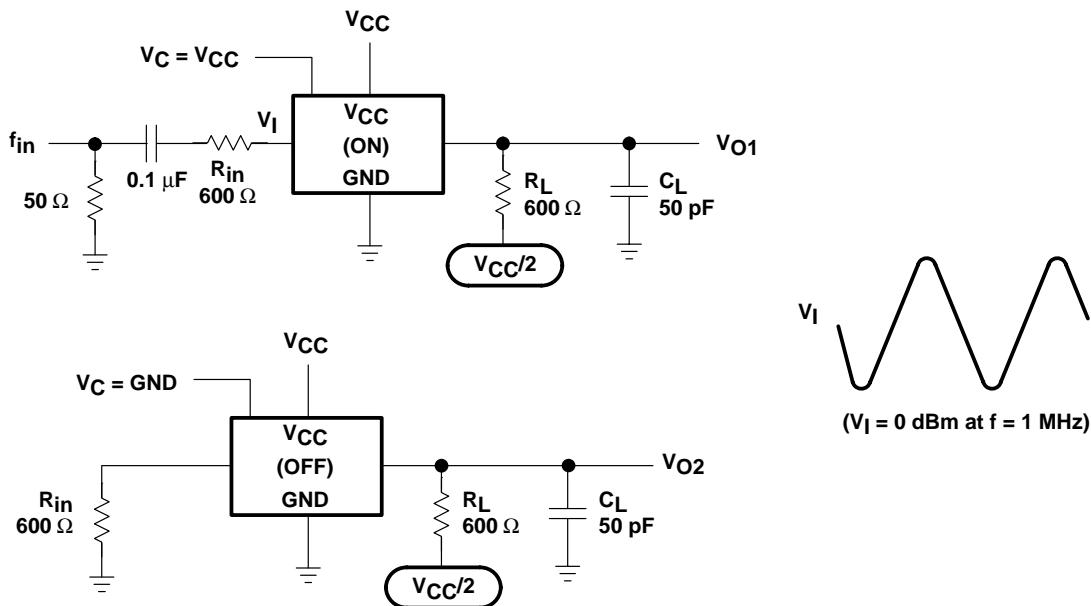


Figure 9. Crosstalk Between Any Two Switches

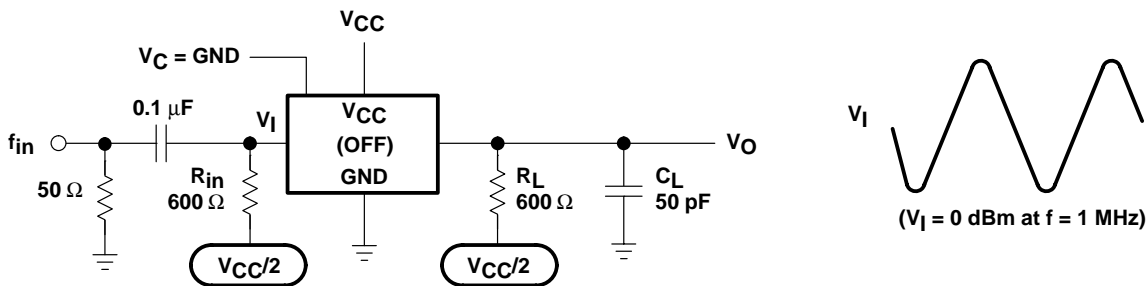


Figure 10. Feed Through, Switch Off

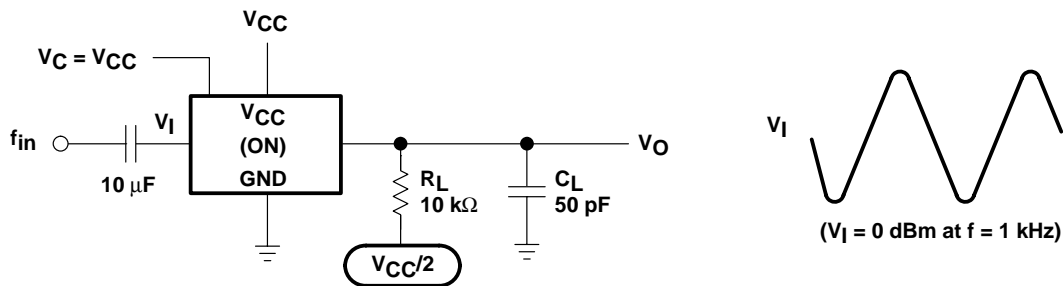


Figure 11. Amplitude-Distortion Rate

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

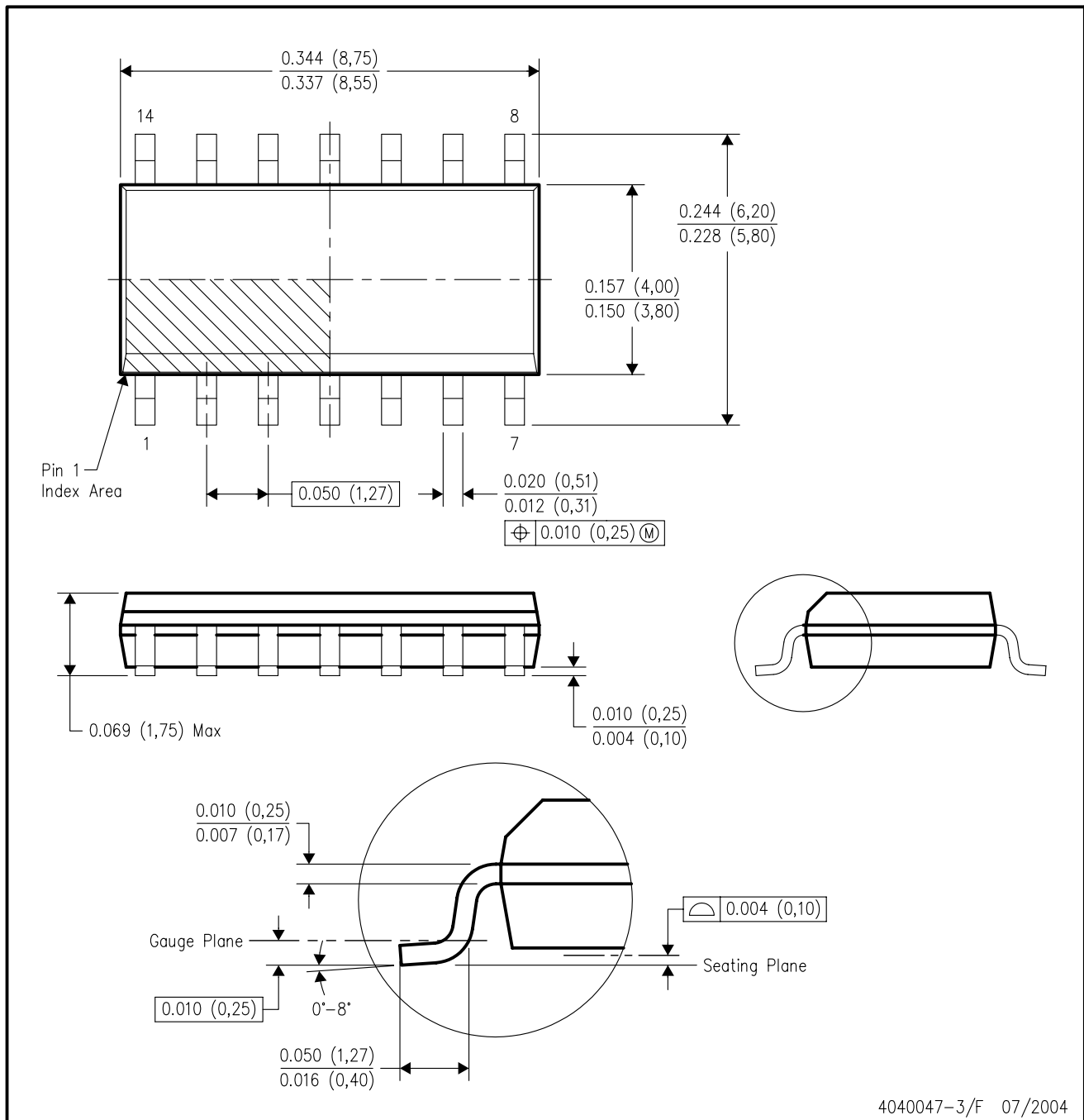
16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



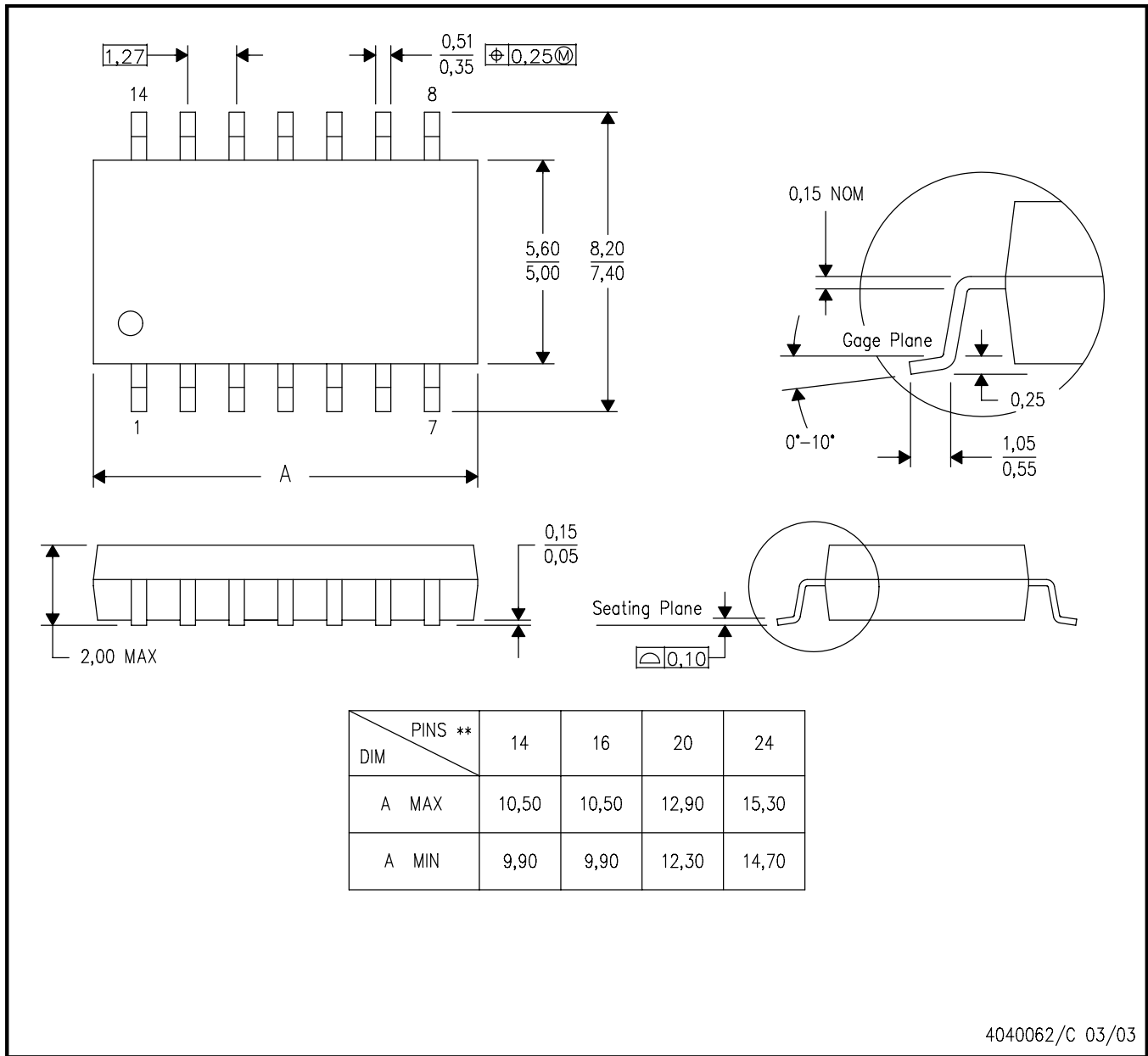
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-012 variation AB.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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