

SN54LV4052A, SN74LV4052A DUAL 4-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

SCLS429H – MAY 1999 – REVISED APRIL 2005

- 2-V to 5.5-V V_{CC} Operation
- Support Mixed-Mode Voltage Operation on All Ports
- Fast Switching
- High On-Off Output-Voltage Ratio
- Low Crosstalk Between Switches
- Extremely Low Input Current
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

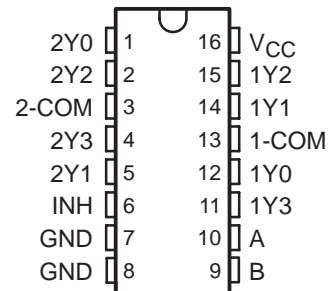
description/ordering information

These dual 4-channel CMOS analog multiplexers/demultiplexers are designed for 2-V to 5.5-V V_{CC} operation.

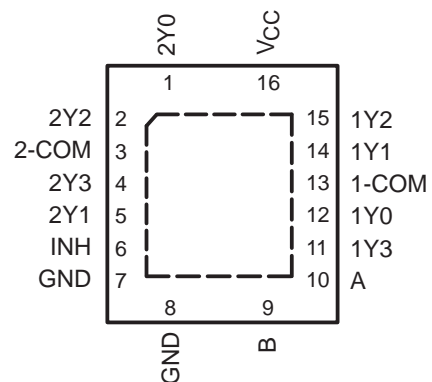
The 'LV4052A devices handle both analog and digital signals. Each channel permits signals with amplitudes up to 5.5 V (peak) to be transmitted in either direction.

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

SN54LV4052A . . . J OR W PACKAGE
SN74LV4052A . . . D, DB, DGV, N, NS, OR PW PACKAGE
(TOP VIEW)



SN74LV4052A . . . RGY PACKAGE
(TOP VIEW)



ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube of 25	SN74LV4052AN	SN74LV4052AN
	QFN – RGY	Reel of 1000	SN74LV4052ARGYR	LW052A
	SOIC – D	Tube of 40	SN74LV4052AD	LV4052A
		Reel of 2500	SN74LV4052ADR	
	SOP – NS	Reel of 2000	SN74LV4052ANSR	74LV4052A
	SSOP – DB	Reel of 2000	SN74LV4052ADBR	LW052A
	TSSOP – PW	Tube of 90	SN74LV4052APW	LW052A
		Reel of 2000	SN74LV4052APWR	
		Reel of 250	SN74LV4052APWT	
	TVSOP – DGV	Reel of 2000	SN74LV4052ADGVR	LW052A
–55°C to 125°C	CDIP – J	Tube of 25	SNJ54LV4052AJ	SNJ54LV4052AJ
	CFP – W	Tube of 150	SNJ54LV4052AW	SNJ54LV4052AW

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



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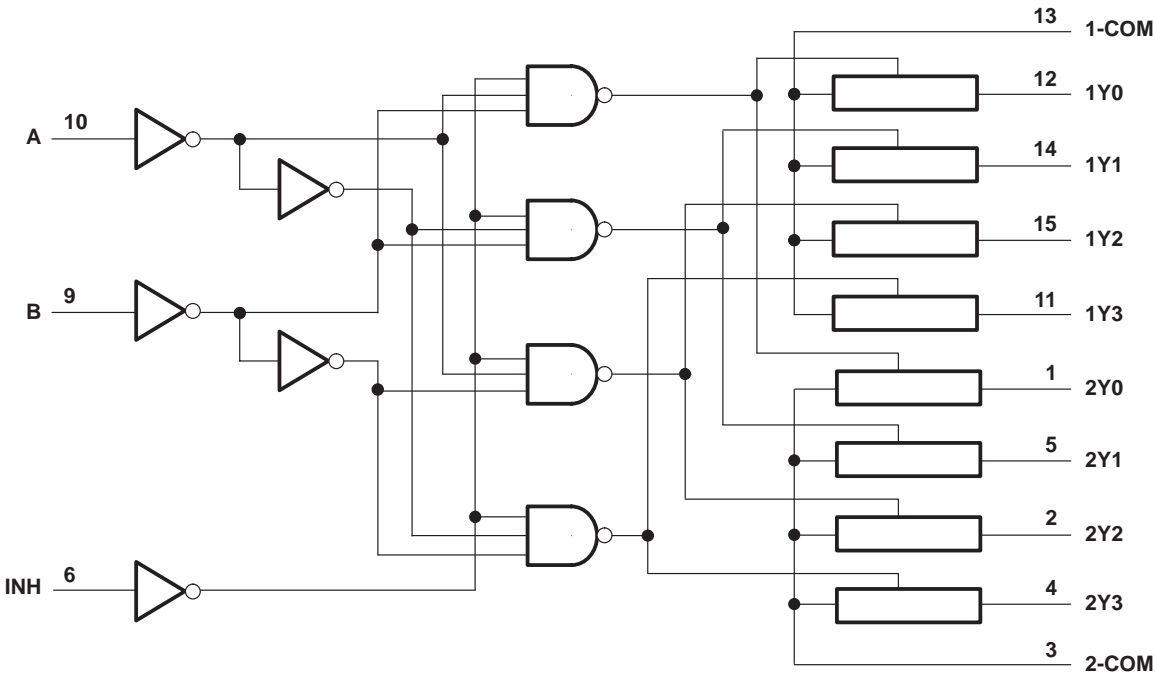
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FUNCTION TABLE

INPUTS			ON CHANNEL
INH	B	A	
L	L	L	1Y0, 2Y0
L	L	H	1Y1, 2Y1
L	H	L	1Y2, 2Y2
L	H	H	1Y3, 2Y3
H	X	X	None

logic diagram (positive logic)



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

Supply voltage range, V_{CC}	–0.5 V to 7.0 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7.0 V
Switch I/O voltage range, V_{IO} (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	–20 mA
I/O diode current, I_{IOK} ($V_{IO} < 0$)	–50 mA
Switch through 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	73°C/W
(see Note 3): DB package	82°C/W
(see Note 3): DGV package	120°C/W
(see Note 3): N package	67°C/W
(see Note 3): NS package	64°C/W
(see Note 3): PW package	108°C/W
(see Note 4): RGY package	39°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 negative-voltage ratings may be exceeded if the input and output current ratings are observed.
 2. This value is limited to 5.5 V maximum.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.
 4. The package thermal impedance is calculated in accordance with JESD 51-5.

recommended operating conditions (see Note 5)

			SN54LV4052A		SN74LV4052A		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		200		200	ns/V
		$V_{CC} = 3$ V to 3.6 V		100		100	
		$V_{CC} = 4.5$ V to 5.5 V		20		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. It is recommended that only digital signals be transmitted at these low supply voltages.

NOTE 5: 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.

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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			SN54LV4052A		SN74LV4052A		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
r _{on} On-state switch resistance	I _T = 2 mA, V _I = V _{CC} or GND, V _{INH} = V _{IL} (see Figure 1)	2.3 V		43	180		225		225	Ω
		3 V		34	150		190		190	
		4.5 V		25	75		100		100	
r _{on(p)} Peak on-state resistance	I _T = 2 mA, V _I = V _{CC} to GND, V _{INH} = V _{IL}	2.3 V		133	500		600		600	Ω
		3 V		63	180		225		225	
		4.5 V		35	100		125		125	
Δr _{on} Difference in on-state resistance between switches	I _T = 2 mA, V _I = V _{CC} to GND, V _{INH} = V _{IL}	2.3 V		1.5	30		40		40	Ω
		3 V		1.1	20		30		30	
		4.5 V		0.7	15		20		20	
I _I Control input current	V _I = 5.5 V or GND	0 to 5.5 V			±0.1		±1		±1	μA
I _{S(off)} Off-state switch leakage current	V _I = V _{CC} and V _O = GND, or V _I = GND and V _O = V _{CC} , V _{INH} = V _{IH} (see Figure 2)	5.5 V			±0.1		±1		±1	μA
I _{S(on)} On-state switch leakage current	V _I = V _{CC} or GND, V _{INH} = V _{IL} (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	f = 10 MHz	3.3 V		2.1						pF
C _{IS} Common terminal capacitance		3.3 V		13.1						pF
C _{OS} Switch terminal capacitance		3.3 V		5.6						pF
C _F Feedthrough capacitance		3.3 V		0.5						pF

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



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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			SN54LV4052A		SN74LV4052A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{PLH} t _{PHL}	Propagation delay time	COM or Y	Y or COM C _L = 15 pF, (see Figure 4)		1.9	10		16		16	ns
t _{PZH} t _{PZL}	Enable delay time	INH	COM or Y C _L = 15 pF, (see Figure 5)		8	18		23		23	ns
t _{PHZ} t _{PLZ}	Disable delay time	INH	COM or Y C _L = 15 pF, (see Figure 5)		8.3	18		23		23	ns
t _{PLH} t _{PHL}	Propagation delay time	COM or Y	Y or COM C _L = 50 pF, (see Figure 4)		3.8	12		18		18	ns
t _{PZH} t _{PZL}	Enable delay time	INH	COM or Y C _L = 50 pF, (see Figure 5)		9.4	28		35		35	ns
t _{PHZ} t _{PLZ}	Disable delay time	INH	COM or Y C _L = 50 pF, (see Figure 5)		12.4	28		35		35	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			SN54LV4052A		SN74LV4052A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{PLH} t _{PHL}	Propagation delay time	COM or Y	Y or COM C _L = 15 pF, (see Figure 4)		1.2	6		10		10	ns
t _{PZH} t _{PZL}	Enable delay time	INH	COM or Y C _L = 15 pF, (see Figure 5)		5.7	12		15		15	ns
t _{PHZ} t _{PLZ}	Disable delay time	INH	COM or Y C _L = 15 pF, (see Figure 5)		6.6	12		15		15	ns
t _{PLH} t _{PHL}	Propagation delay time	COM or Y	Y or COM C _L = 50 pF, (see Figure 4)		2.5	9		12		12	ns
t _{PZH} t _{PZL}	Enable delay time	INH	COM or Y C _L = 50 pF, (see Figure 5)		6.7	20		25		25	ns
t _{PHZ} t _{PLZ}	Disable delay time	INH	COM or Y C _L = 50 pF, (see Figure 5)		9.5	20		25		25	ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	T _A = 25°C			SN54LV4052A		SN74LV4052A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{PLH} t _{PHL} Propagation delay time	COM or Y	Y or COM	C _L = 15 pF, (see Figure 4)		0.7	4		7		7	ns
t _{PZH} t _{PZL} Enable delay time	INH	COM or Y	C _L = 15 pF, (see Figure 5)		4	8		10		10	ns
t _{PHZ} t _{PLZ} Disable delay time	INH	COM or Y	C _L = 15 pF, (see Figure 5)		5	8		10		10	ns
t _{PLH} t _{PHL} Propagation delay time	COM or Y	Y or COM	C _L = 50 pF, (see Figure 4)		1.5	6		8		8	ns
t _{PZH} t _{PZL} Enable delay time	INH	COM or Y	C _L = 50 pF, (see Figure 5)		4.7	14		18		18	ns
t _{PHZ} t _{PLZ} Disable delay time	INH	COM or Y	C _L = 50 pF, (see Figure 5)		6.9	14		18		18	ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	V _{CC}	T _A = 25°C			UNIT
					MIN	TYP	MAX	
Frequency response (switch on)	COM or Y	Y or COM	C _L = 50 pF, R _L = 600 Ω, f _{in} = 1 MHz (sine wave) (see Note 6 and Figure 6)	2.3 V		30		MHz
				3 V		35		
				4.5 V		50		
Crosstalk (between any switches)	COM or Y	Y or COM	C _L = 50 pF, R _L = 600 Ω, f _{in} = 1 MHz (sine wave) (see Note 7 and Figure 7)	2.3 V		–45		dB
				3 V		–45		
				4.5 V		–45		
Crosstalk (control input to signal output)	INH	COM or Y	C _L = 50 pF, R _L = 600 Ω, f _{in} = 1 MHz (square wave) (see Figure 8)	2.3 V		20		mV
				3 V		35		
				4.5 V		65		
Feedthrough attenuation (switch off)	COM or Y	Y or COM	C _L = 50 pF, R _L = 600 Ω, f _{in} = 1 MHz (sine wave) (see Note 7 and Figure 9)	2.3 V		–45		dB
				3 V		–45		
				4.5 V		–45		
Sine-wave distortion	COM or Y	Y or COM	C _L = 50 pF, R _L = 10 kΩ, f _{in} = 1 kHz (sine wave) (see Figure 10)	V _I = 2 V _{p-p}	2.3 V		0.1	%
				V _I = 2.5 V _{p-p}	3 V		0.1	
				V _I = 4 V _{p-p}	4.5 V		0.1	

NOTES: 6. Adjust f_{in} voltage to obtain 0 dBm at output. Increase f_{in} frequency until dB meter reads –3 dB.

7. Adjust f_{in} voltage to obtain 0 dBm at input.

operating characteristics, T_A = 25°C

PARAMETER	TEST CONDITIONS	TYP	UNIT
C _{pd} Power dissipation capacitance	C _L = 50 pF, f = 10 MHz	11.8	pF

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PARAMETER MEASUREMENT INFORMATION

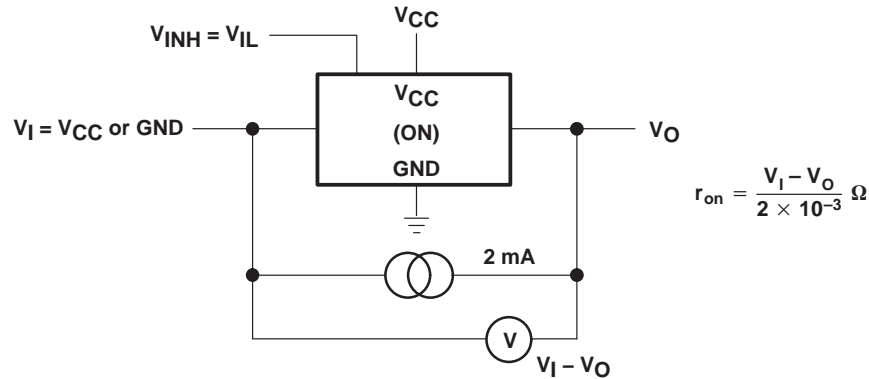


Figure 1. On-State Resistance Test Circuit

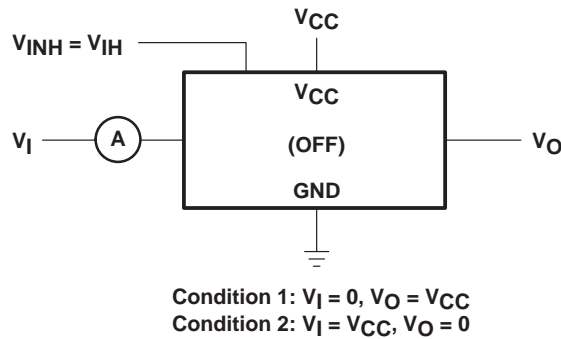


Figure 2. Off-State Switch Leakage-Current Test Circuit

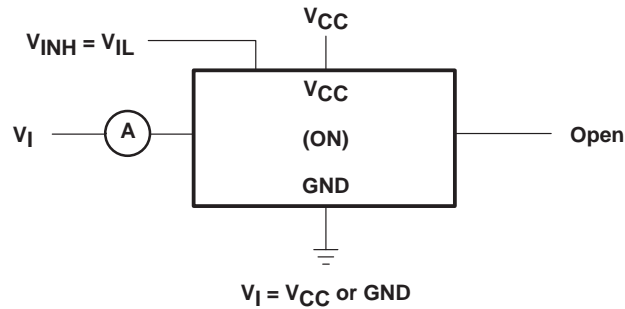


Figure 3. On-State Switch Leakage-Current Test Circuit

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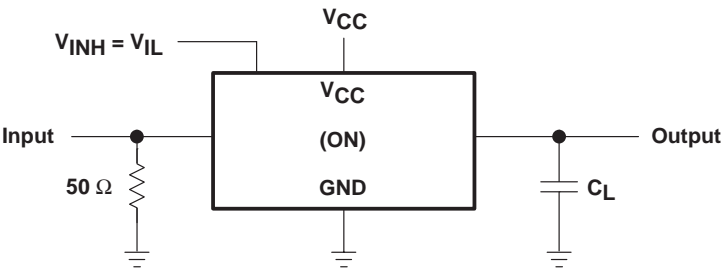
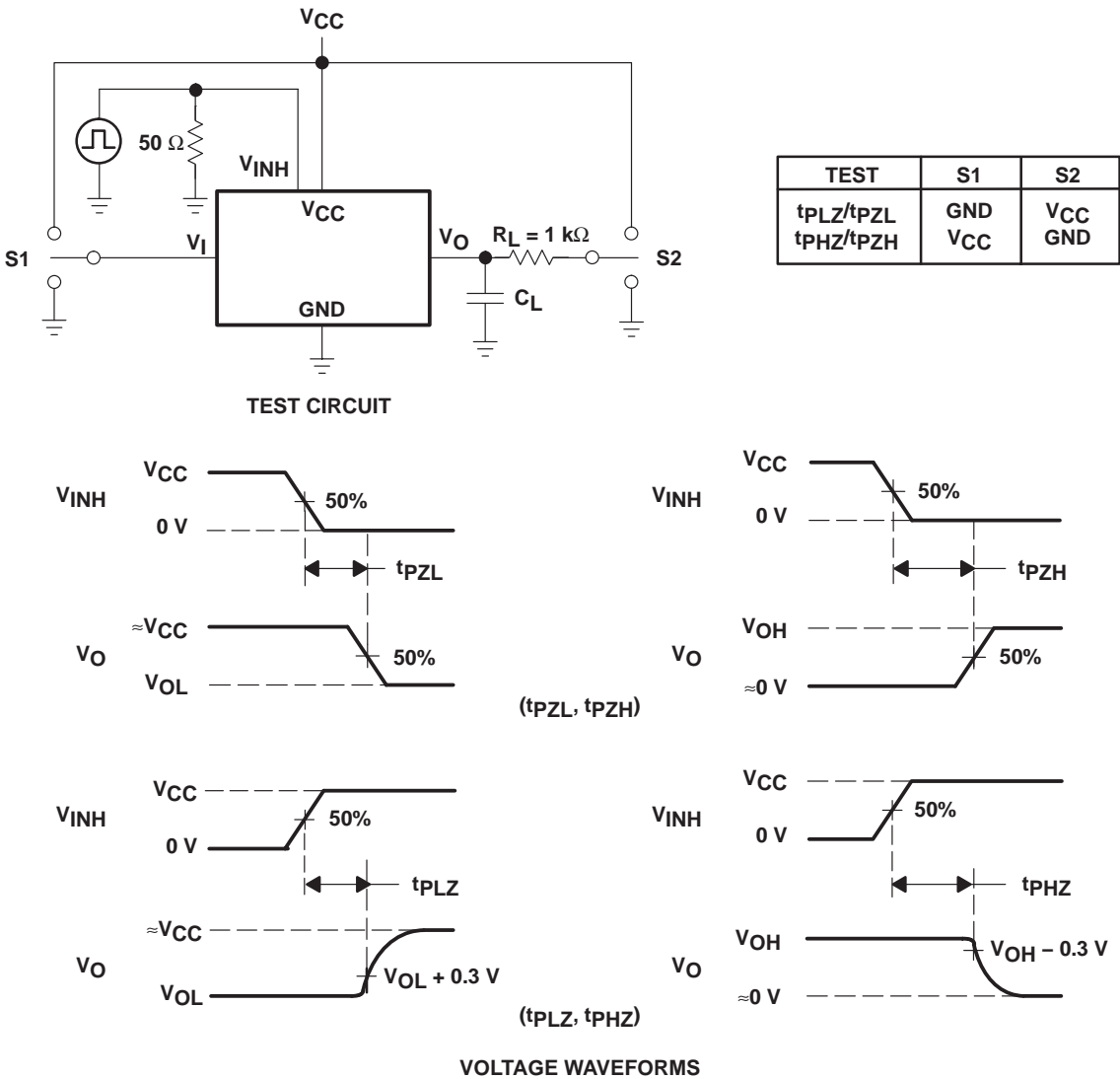
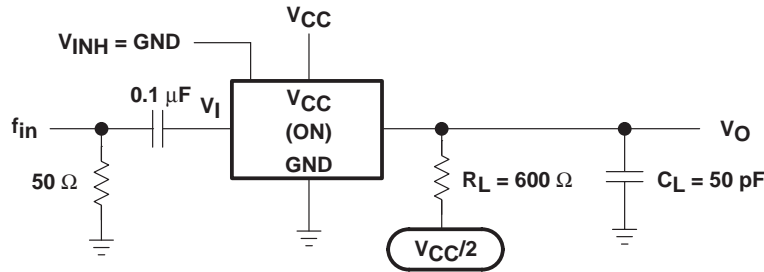


Figure 4. Propagation Delay Time, Signal Input to Signal Output



PARAMETER MEASUREMENT INFORMATION



NOTE A: f_{in} is a sine wave.

Figure 6. Frequency Response (Switch On)

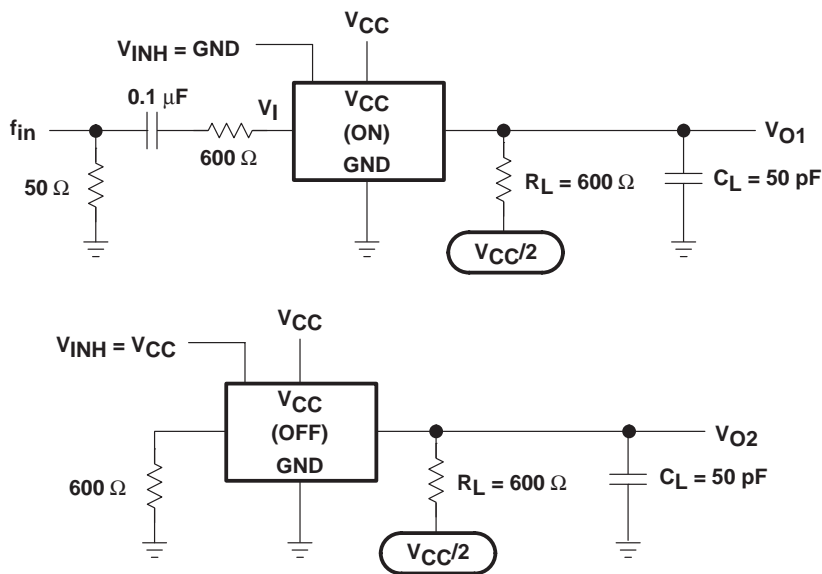


Figure 7. Crosstalk Between Any Two Switches

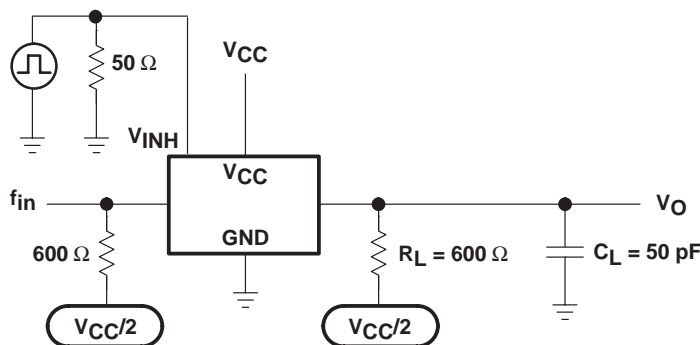


Figure 8. Crosstalk Between Control Input and Switch Output

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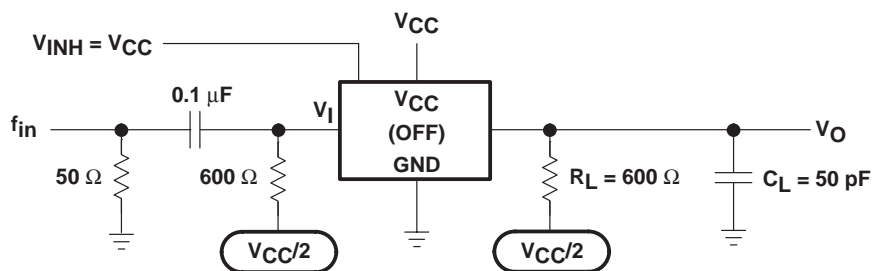


Figure 9. Feedthrough Attenuation (Switch Off)

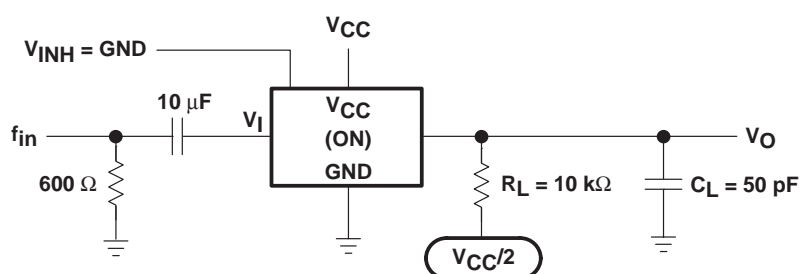


Figure 10. Sine-Wave Distortion

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74LV4052AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ADBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ADBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ADGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ADGVRE4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ADRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74LV4052ANSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ANSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052APWTE4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV4052ARGYR	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

- 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.

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 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 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



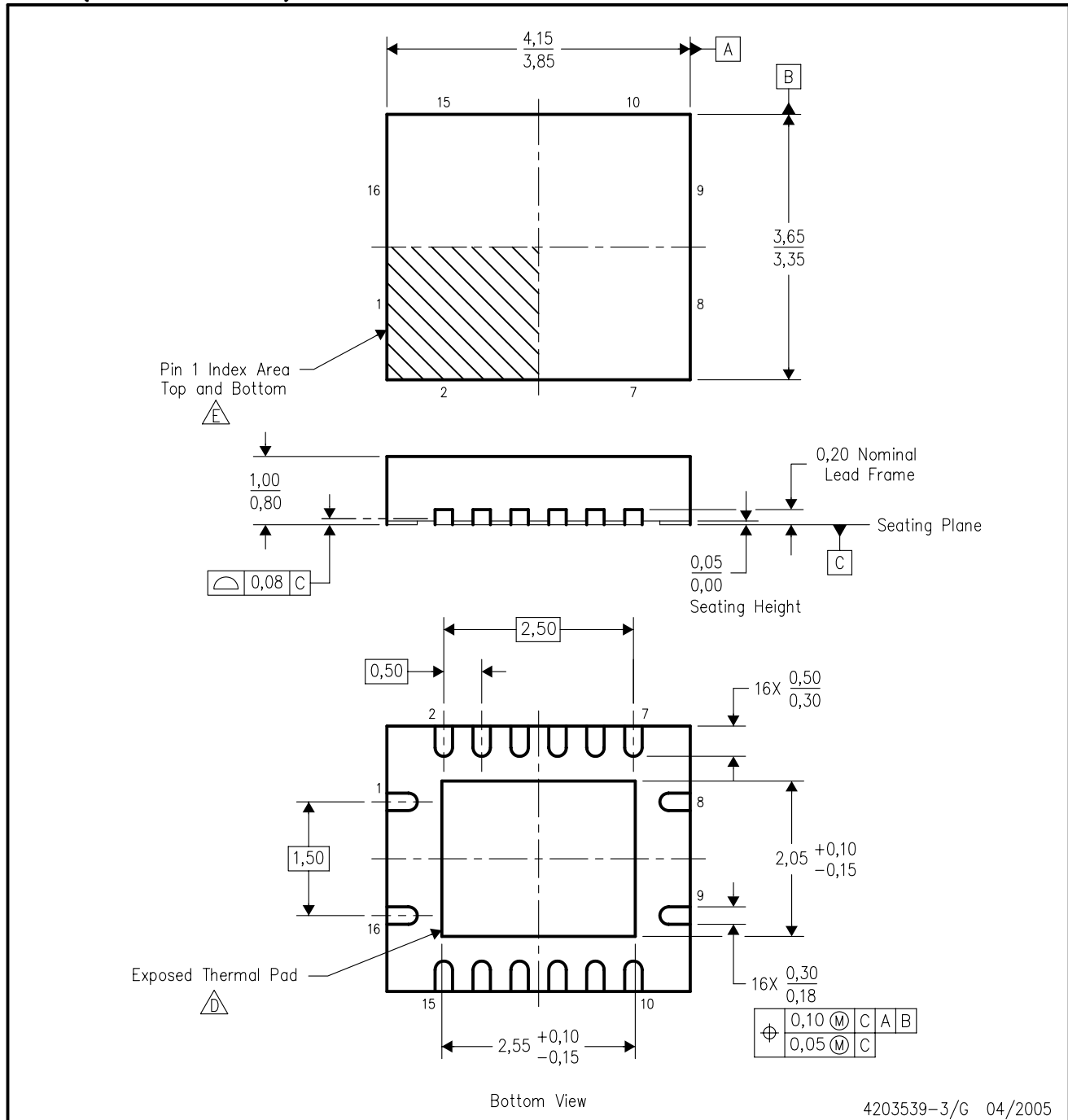
4040047-4/F 07/2004

NOTES:

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

RGY (R-PQFP-N16)

PLASTIC QUAD FLATPACK



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. QFN (Quad Flatpack No-Lead) package configuration.
 - The package thermal pad must be soldered to the board for thermal and mechanical performance.
 - Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
 - F. Package complies to JEDEC MO-241 variation BB.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - 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



- 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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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

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