

# HD74LVC2G53

## 2-channel Analog Multiplexer/Demultiplexer

REJ03D0156-0300

Rev.3.00

Jul.07.2005

### Description

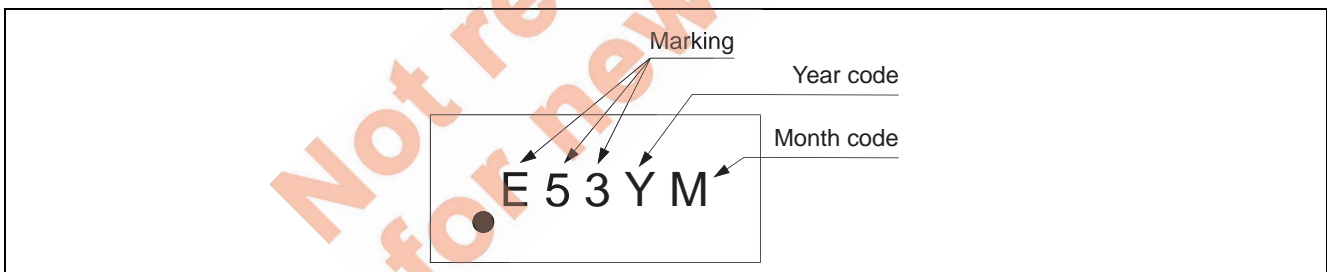
The HD74LVC2G53 has 2-channel analog multiplexer/demultiplexer in an 8 pin package. Applications include signal gating, chopping, modulation, or demodulation (modem), and signal multiplexing for analog to digital and digital to analog conversion systems. Low voltage and high-speed operation is suitable for the battery powered products (e.g., notebook computers), and the low power consumption extends the battery life.

### Features

- The basic gate function is lined up as renesas uni logic series.
- Supply voltage range: 1.65 to 5.5 V
- Operating temperature range: -40 to +85°C
- Control inputs:  $V_{IH}$  (Max.) = 5.5 V (@VCC = 0 V to 5.5 V)
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LVC2G53CPE	WCSP-8 pin	SXBG0008KA-A (TBS-8V)	CP	E (3,000 pcs/reel)
HD74LVC2G53CLE		SXBG0008KB-A (TBS-8AV)	CL	

### Article Indication



### Function Table

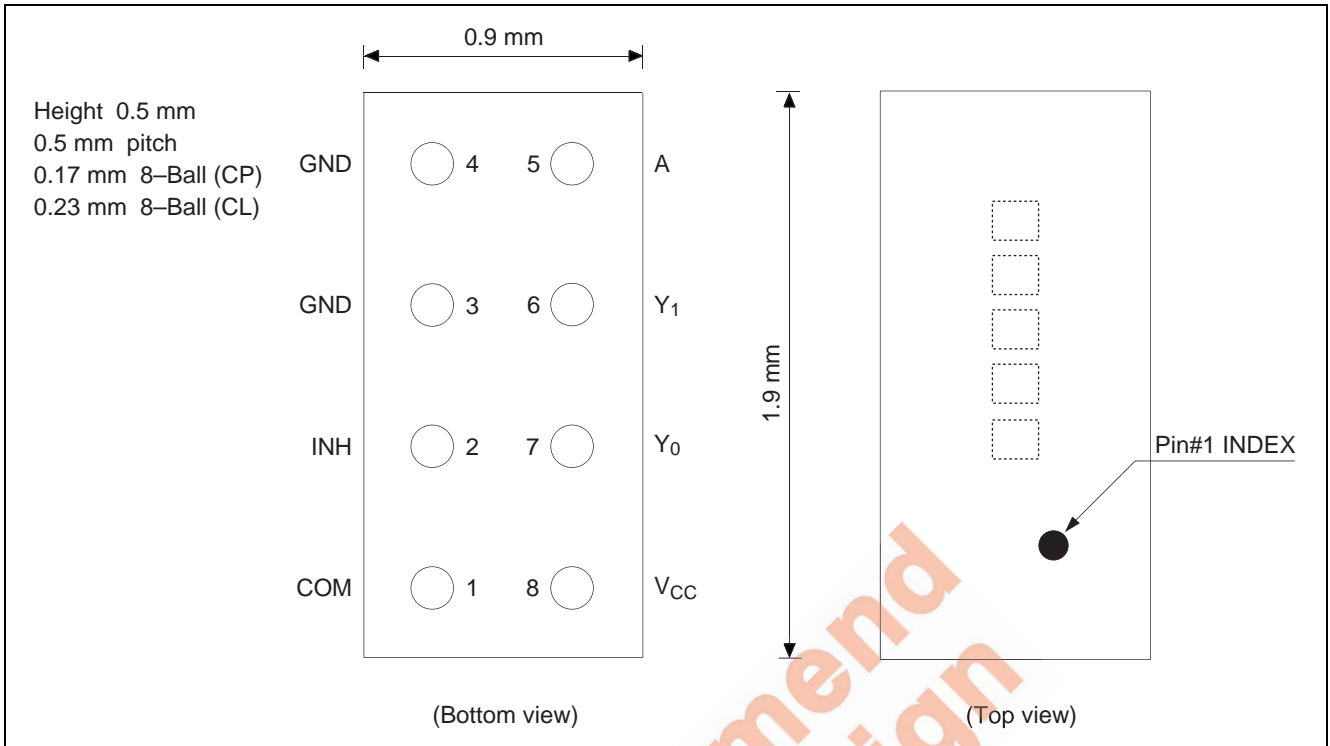
Control inputs		On channel
INH	A	
H	X	None
L	H	$Y_1$
L	L	$Y_0$

H : High level

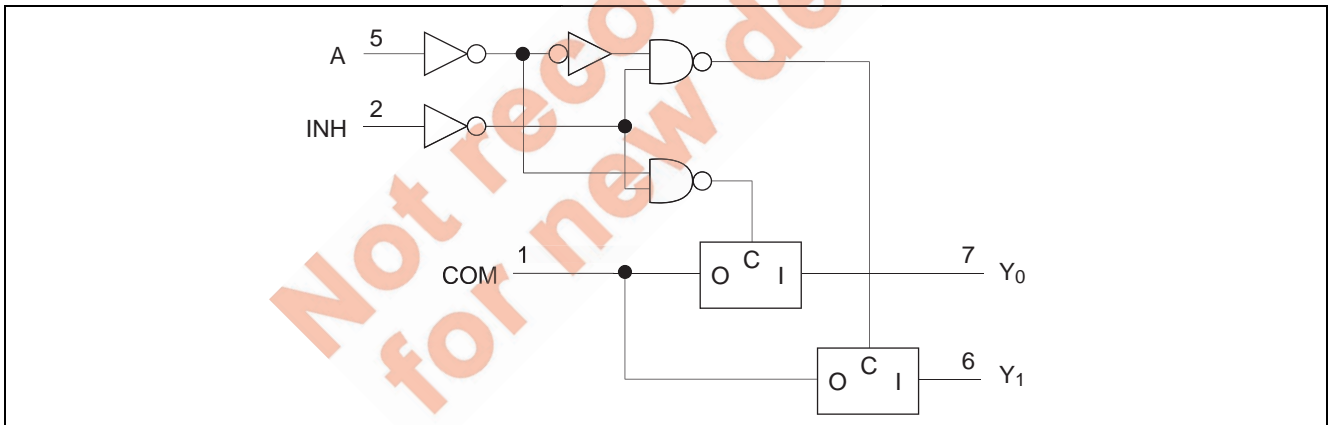
L : Low level

X : Immaterial

### Pin Arrangement



### Logic Diagram



### Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Test Conditions
Supply voltage range	$V_{CC}$	-0.5 to 6.5	V	
Input voltage range <sup>*1</sup>	$V_I$	-0.5 to 6.5	V	
Output voltage range <sup>*1, 2</sup>	$V_O$	-0.5 to $V_{CC} + 0.5$	V	Output : H or L
Input clamp current	$I_{IK}$	-50	mA	$V_I < 0$
Output clamp current	$I_{OK}$	-50	mA	$V_O < 0$
Continuous output current	$I_O$	$\pm 50$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 100$	mA	
Package Thermal impedance	$\theta_{ja}$	140	°C/W	CP
		102		CL
Storage temperature	$T_{stg}$	-65 to 150	°C	

Notes: The absolute maximum ratings are values, which must not individually be exceeded, and furthermore no two of which may be realized at the same time.

1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.

### Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	$V_{CC}$	1.65	5.5	V	
Input voltage range	$V_I$	0	5.5	V	
Output voltage range	$V_O$	0	$V_{CC}$	V	
Input transition rise or fall rate	$\Delta t / \Delta v$	0	20	ns / V	$V_{CC} = 1.65$ to $1.95$ V, 2.3 to 2.7 V
		0	10		$V_{CC} = 3.0$ to $3.6$ V
		0	10		$V_{CC} = 4.5$ to $5.5$ V
Operating free-air temperature	$T_a$	-40	85	°C	

Note: Unused or floating inputs must be held high or low.

**Electrical Characteristics**

- Ta = -40 to 85°C

Item	Symbol	V <sub>CC</sub> (V)	Min	Typ	Max	Unit	Test condition
Input voltage	V <sub>IH</sub>	1.65 to 1.95	V <sub>CC</sub> ×0.65	—	—	V	Control input only.
		2.3 to 2.7	V <sub>CC</sub> ×0.7	—	—		
		3.0 to 3.6	V <sub>CC</sub> ×0.7	—	—		
		4.5 to 5.5	V <sub>CC</sub> ×0.7	—	—		
	V <sub>IL</sub>	1.65 to 1.95	—	—	V <sub>CC</sub> ×0.35		
		2.3 to 2.7	—	—	V <sub>CC</sub> ×0.3		
		3.0 to 3.6	—	—	V <sub>CC</sub> ×0.3		
		4.5 to 5.5	—	—	V <sub>CC</sub> ×0.3		
On-state switch resistance	R <sub>ON</sub>	1.65	—	13	30	Ω	I <sub>S</sub> = 4 mA I <sub>S</sub> = 8 mA I <sub>S</sub> = 24 mA I <sub>S</sub> = 32 mA V <sub>I</sub> =V <sub>CC</sub> or GND
		2.3	—	10	20		
		3.0	—	8.5	17		
		4.5	—	6.5	13		
Peak on resistance	R <sub>ON(P)</sub>	1.65	—	86.5	120	Ω	I <sub>S</sub> = 4 mA I <sub>S</sub> = 8 mA I <sub>S</sub> = 24 mA I <sub>S</sub> = 32 mA V <sub>I</sub> =V <sub>CC</sub> to GND
		2.3	—	23	30		
		3.0	—	13	20		
		4.5	—	8	15		
Difference of on-state resistance between switches	ΔR <sub>ON</sub>	1.65	—	—	7	Ω	I <sub>S</sub> = 4 mA I <sub>S</sub> = 8 mA I <sub>S</sub> = 24 mA I <sub>S</sub> = 32 mA V <sub>I</sub> =V <sub>CC</sub> to GND
		2.3	—	—	5		
		3.0	—	—	3		
		4.5	—	—	2		
Off-state switch leakage current	I <sub>S(OFF)</sub>	5.5	—	—	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> and V <sub>O</sub> = GND or V <sub>I</sub> = GND and V <sub>O</sub> = V <sub>CC</sub> , V <sub>INH</sub> = V <sub>IH</sub>
On-state switch leakage current	I <sub>S(ON)</sub>	5.5	—	—	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>INH</sub> = V <sub>IL</sub> , V <sub>O</sub> = Open
					±0.1*1		
Control input current	I <sub>IN</sub>	5.5	—	—	±1.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND
					±0.1*1		
Quiescent supply current	I <sub>CC</sub>	5.5	—	—	10	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND
					1.0*1		
Control input capacitance	C <sub>IC</sub>	5.0	—	3.5	—	pF	V <sub>C</sub> = V <sub>CC</sub> -0.6 V
Switch terminal capacitance	C <sub>I/O(OFF)</sub>	5.0	—	6.5	—	pF	Y
				10	—		COM
	C <sub>I/O(ON)</sub>			5.0	—		14.0

Note: 1. Ta = 25°C

### Switching Characteristics

- $V_{CC} = 1.8 \pm 0.15 \text{ V}$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time*1	t <sub>PLH</sub> , t <sub>PHL</sub>	—	2.0	ns	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 1.0 kΩ	COM or Yn	Yn or COM
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	3.3	9.0		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 1.0 kΩ	INH	COM or Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	3.2	10.9		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 1.0 kΩ	INH	COM or Yn
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	2.9	10.3		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 1.0 kΩ	A	Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	2.1	9.4		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 1.0 kΩ	A	Yn

- $V_{CC} = 2.5 \pm 0.2 \text{ V}$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time*1	t <sub>PLH</sub> , t <sub>PHL</sub>	—	1.2	ns	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500 Ω	COM or Yn	Yn or COM
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	2.5	6.1		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500 Ω	INH	COM or Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	2.3	9.3		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500 Ω	INH	COM or Yn
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	2.1	7.2		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500 Ω	A	Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	1.4	7.9		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500 Ω	A	Yn

- $V_{CC} = 3.3 \pm 0.3 \text{ V}$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time*1	t <sub>PLH</sub> , t <sub>PHL</sub>	—	0.8	ns	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	COM or Yn	Yn or COM
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	2.2	5.4		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	INH	COM or Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	2.3	8.1		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	INH	COM or Yn
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	1.9	5.8		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	A	Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	1.1	7.2		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	A	Yn

- $V_{CC} = 5.0 \pm 0.5 \text{ V}$

Item	Symbol	Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Max				
Propagation delay time*1	t <sub>PLH</sub> , t <sub>PHL</sub>	—	0.6	ns	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	COM or Yn	Yn or COM
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	1.8	4.5		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	INH	COM or Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	1.6	8.0		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	INH	COM or Yn
Enable time	t <sub>ZH</sub> , t <sub>ZL</sub>	1.3	5.4		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	A	Yn
Disable time	t <sub>HZ</sub> , t <sub>LZ</sub>	1.0	5.0		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	A	Yn

Notes: 1. The propagation delay is calculated RC time constant of typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

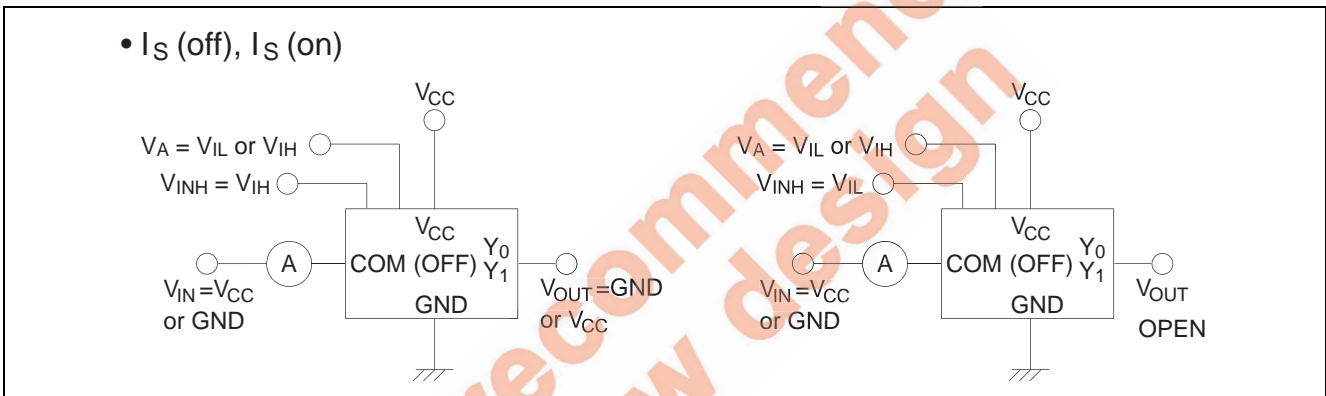
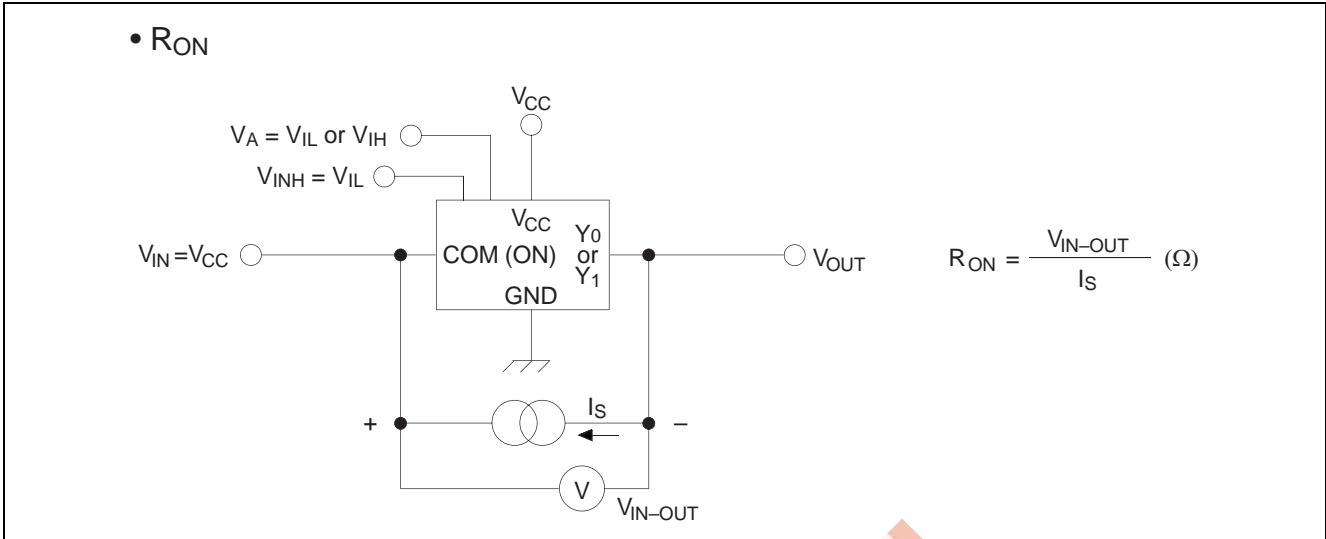
**Analog Switch Characteristics**

Item	V <sub>CC</sub> (V)	Ta = 25°C			Unit	Test conditions	FROM (Input)	TO (Output)
		Min	Typ	Max				
Frequency response (Switch ON)	1.65	—	35	—	MHz	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 600 Ω Adjust fin voltage to obtain 0dBm at output when fin is 1MHz (sine wave).	COM or Y	Y or COM
	2.3	—	120	—				
	3.0	—	190	—				
	4.5	—	215	—				
	1.65	—	>300	—	C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω Increase fin frequency until the dB-meter reads -3 dBm. 20 log(V <sub>O</sub> /V <sub>I</sub> ) = -3 dBm			
	2.3	—	>300	—				
	3.0	—	>300	—				
	4.5	—	>300	—				
Crosstalk (between switches)	1.65	—	-58	—	dB	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 600 Ω Adjust fin voltage to obtain 0dBm at input when fin is 1MHz (sine wave).	COM	Y
	2.3	—	-58	—				
	3.0	—	-58	—				
	4.5	—	-58	—				
	1.65	—	-42	—	C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω			
	2.3	—	-42	—				
	3.0	—	-42	—				
	4.5	—	-42	—				
Crosstalk (Control input to signal output)	1.65	—	35	—	mV	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 600 Ω Adjust RL value to obtain 0A at I <sub>IN/OUT</sub> when fin is 1MHz (square wave)	INH	COM or Y
	2.3	—	50	—				
	3.0	—	70	—				
	4.5	—	100	—				
Feed through attenuation (Switch OFF)	1.65	—	-60	—	dB	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 600 Ω Adjust fin voltage to obtain 0dBm at input when fin is 1MHz (sine-wave)	COM or Y	Y or COM
	2.3	—	-60	—				
	3.0	—	-60	—				
	4.5	—	-60	—				
	1.65	—	-50	—	C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω			
	2.3	—	-50	—				
	3.0	—	-50	—				
	4.5	—	-50	—				
Sine-wave distortion	1.65	—	0.1	—	%	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 10 kΩ fin = 1kHz (sine-wave) V <sub>I</sub> =1.4V <sub>P-P</sub> , V <sub>CC</sub> =1.65V V <sub>I</sub> =2.0V <sub>P-P</sub> , V <sub>CC</sub> =2.3V V <sub>I</sub> =2.5V <sub>P-P</sub> , V <sub>CC</sub> =3.0V V <sub>I</sub> =4.0V <sub>P-P</sub> , V <sub>CC</sub> =4.5V	COM or Y	Y or COM
	2.3	—	0.025	—				
	3.0	—	0.015	—				
	4.5	—	0.01	—				
	1.65	—	0.15	—	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 10 kΩ fin = 10kHz (sine-wave)			
	2.3	—	0.025	—				
	3.0	—	0.015	—				
	4.5	—	0.01	—				

**Operating Characteristics**

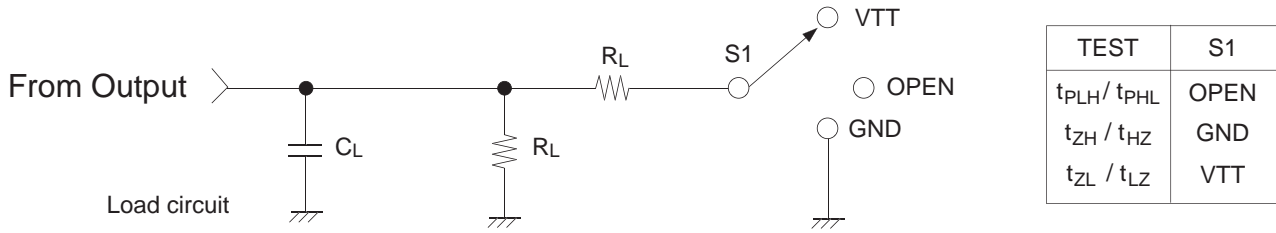
Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C <sub>PD</sub>	1.8	—	9	—	pF	f = 10 MHz
		2.5	—	10	—		
		3.3	—	10	—		
		5.0	—	12	—		

Test Circuit

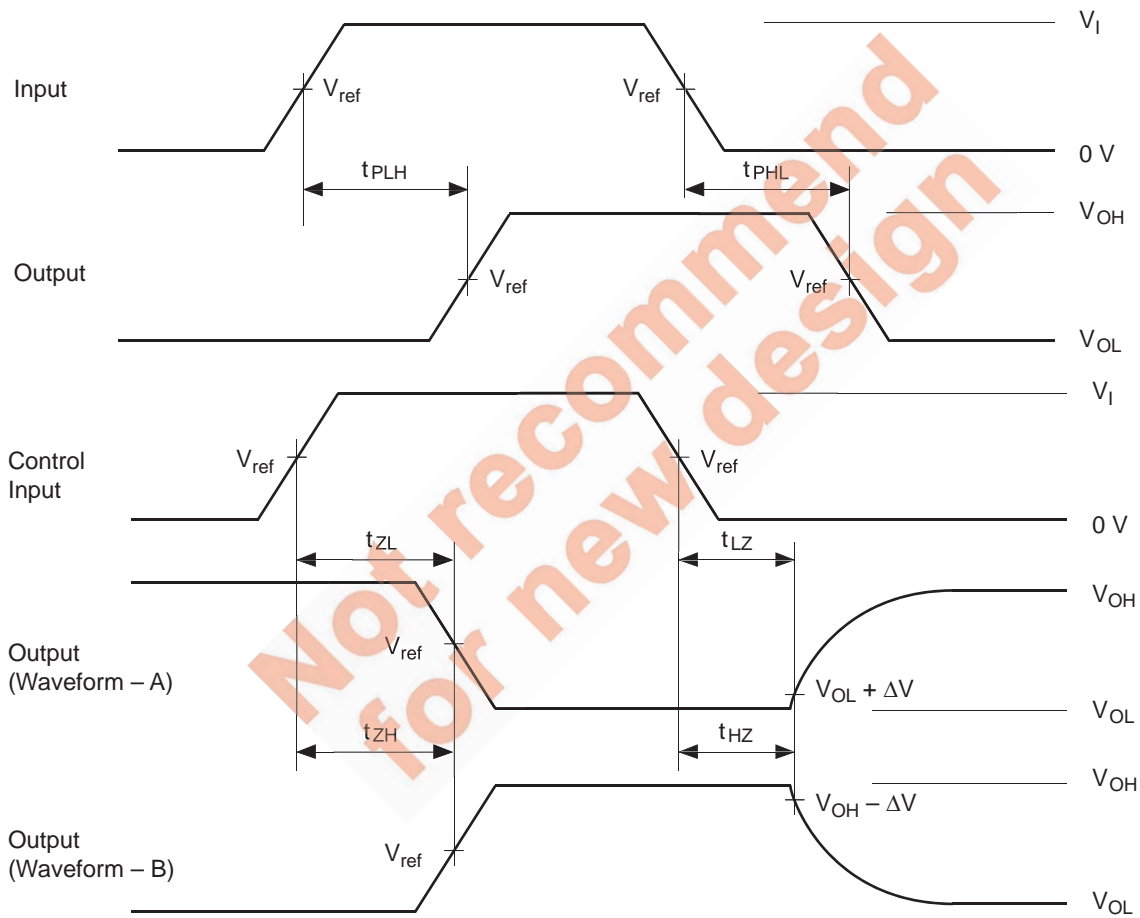


Not recommended for new design

Test Circuit (cont.)



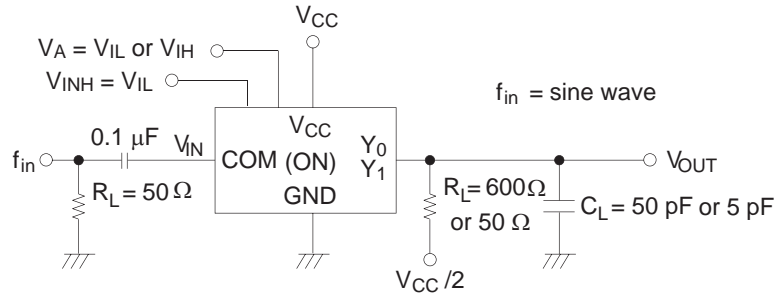
$V_{CC}$ (V)	INPUTS		$V_{ref}$	VTT	$C_L$	$R_L$	$\Delta V$
	$V_I$	$t_r / t_f$					
$1.8 \pm 0.15$	$V_{CC}$	$\leq 2$ ns	$V_{CC} / 2$	$2 \times V_{CC}$	30 pF	1.0 k $\Omega$	0.15 V
$2.5 \pm 0.2$	$V_{CC}$	$\leq 2$ ns	$V_{CC} / 2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
$3.3 \pm 0.3$	$V_{CC}$	$\leq 2.5$ ns	$V_{CC} / 2$	$2 \times V_{CC}$	50 pF	500 $\Omega$	0.3 V
$5.0 \pm 0.5$	$V_{CC}$	$\leq 2.5$ ns	$V_{CC} / 2$	$2 \times V_{CC}$	50 pF	500 $\Omega$	0.3 V



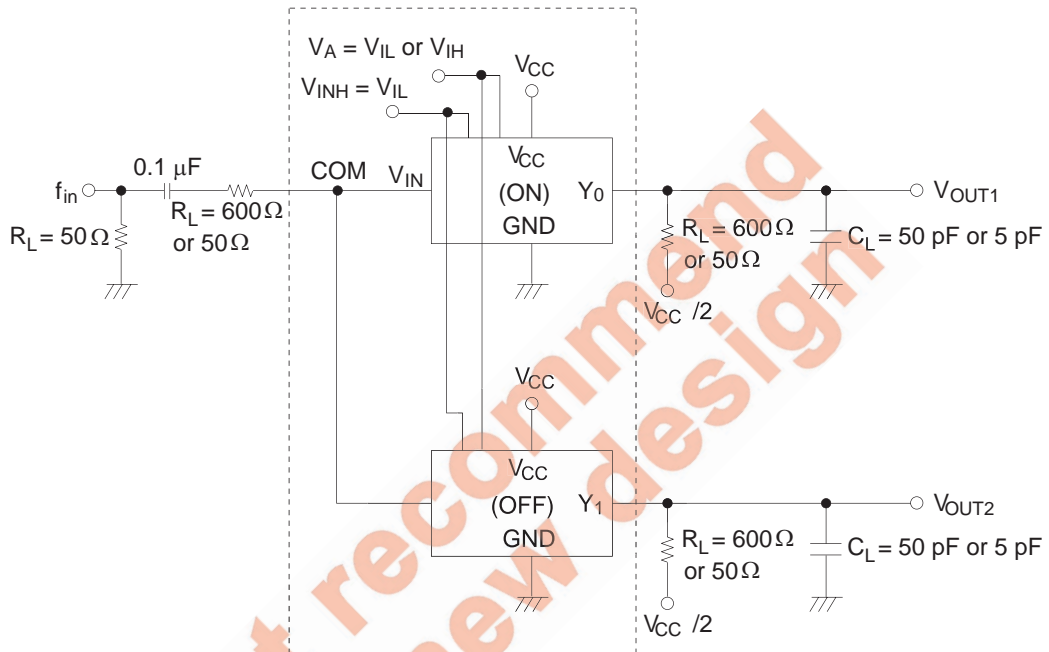
- Notes:
- $C_L$  includes probe and jig capacitance.
  - Waveform-A is for an output with internal conditions such that the output is low except when disabled by the output control.
  - Waveform-B is for an output with internal conditions such that the output is high except when disabled by the output control.
  - All input pulses are supplied by generators having the following characteristics:  
 $PRR \leq 10$  MHz,  $Z_o = 50 \Omega$ .
  - The output are measured one at a time with one transition per measurement.



Frequency response (Switch ON)

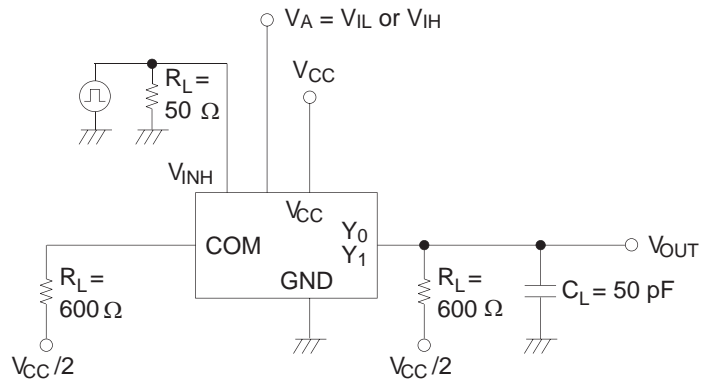


Crosstalk (Between any switches)

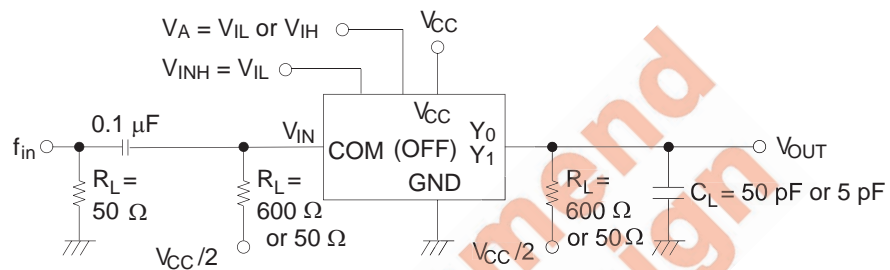


Not recommended for new designs

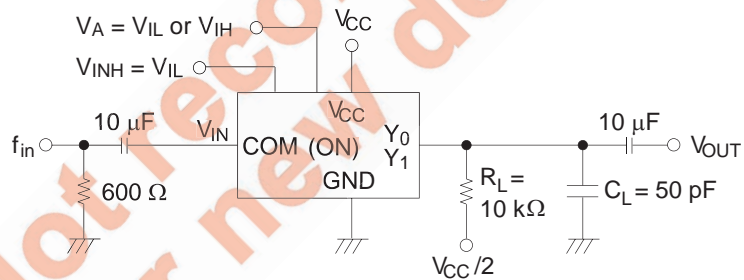
Crosstalk (Control input to signal output)



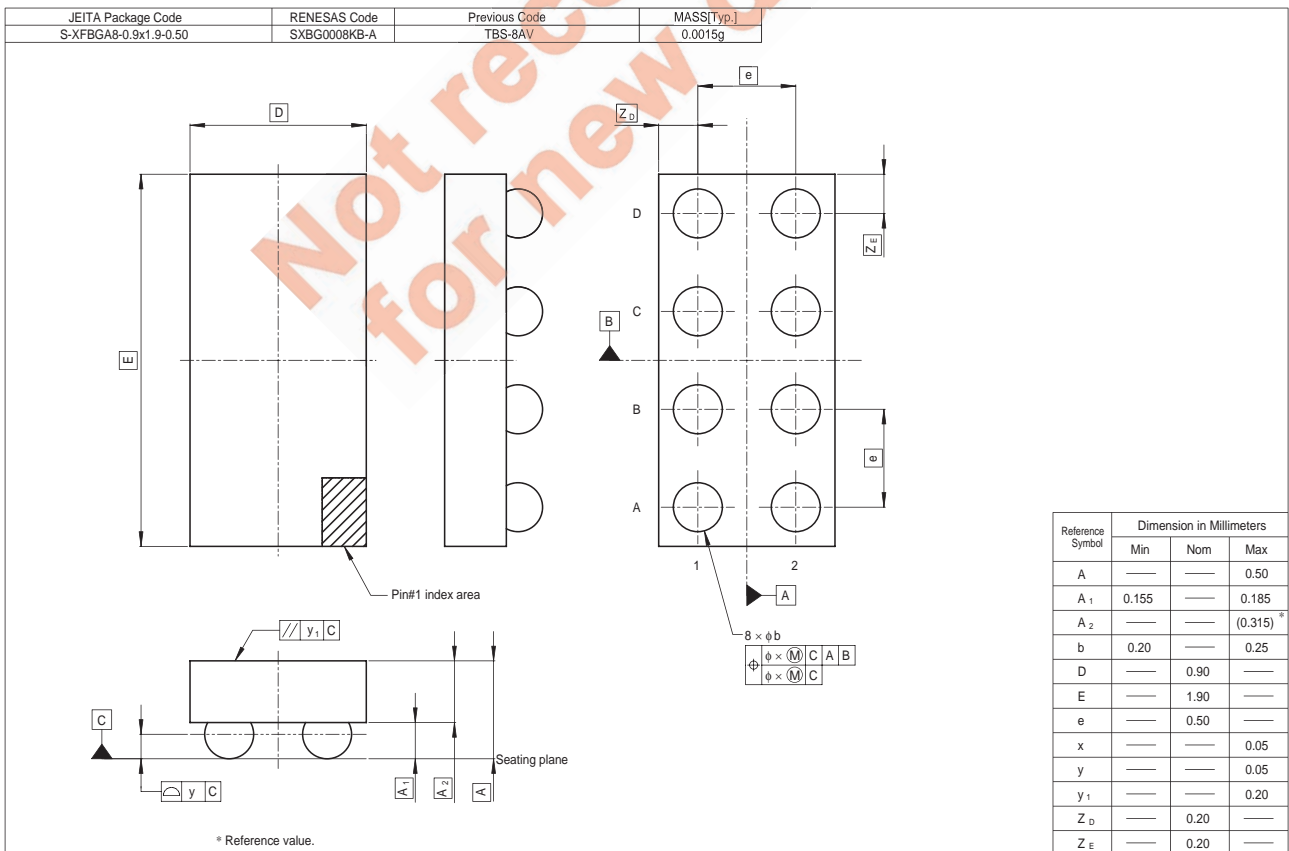
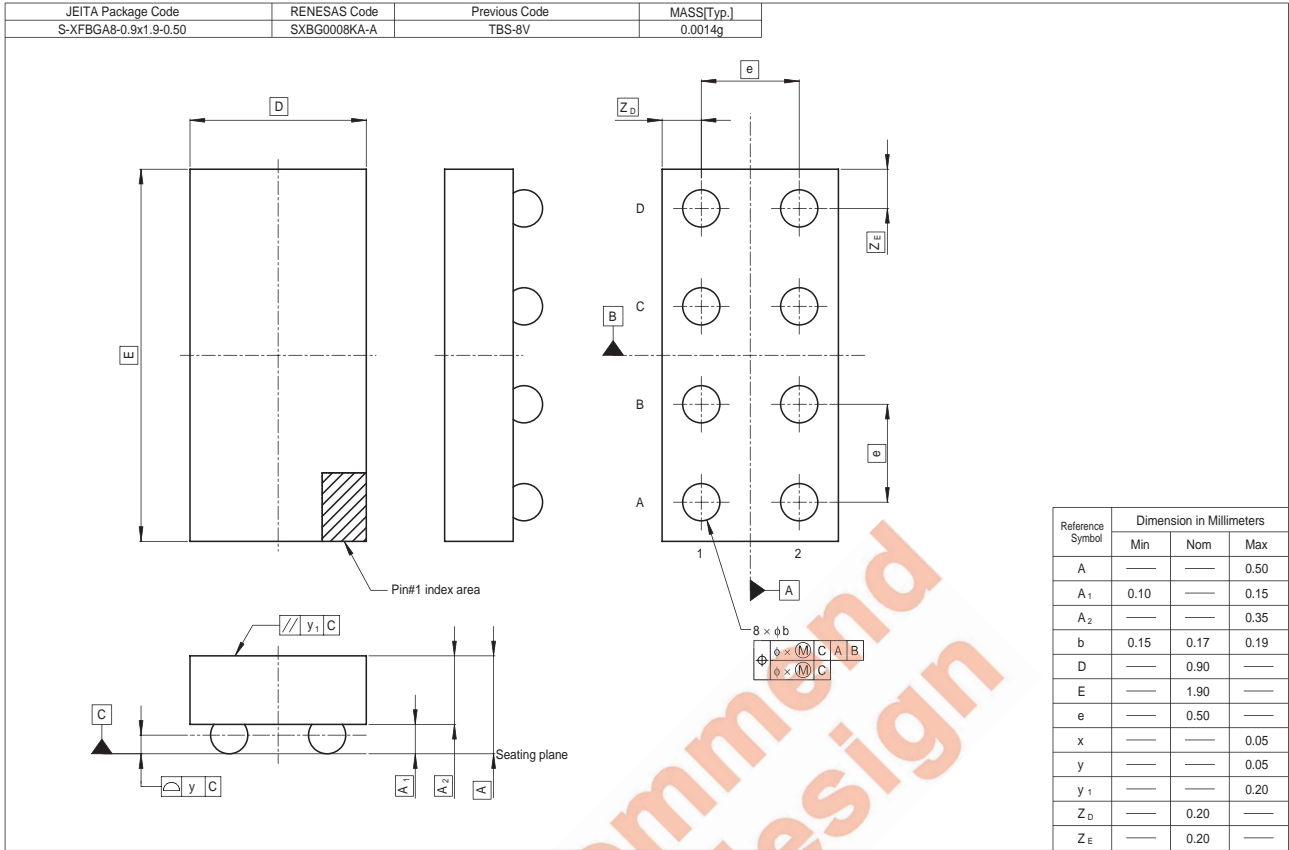
Feedthrough attenuation (Switch OFF)



Sine-wave distortion



Package Dimensions



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