

HD74LV4053A

Triple 2-channel Analog Multiplexer / Demultiplexer

HITACHI

ADE-205-284 (Z)
1st Edition
April 1999

Description

The HD74LV4053A handles both analog and digital signals, and enables signals of either type with amplitudes of up to 5.5 V (peak) to be transmitted in either direction (at $V_{CC} = 0\text{ V}$ to 5.5 V).

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

Features

- $V_{CC} = 2.0\text{ V}$ to 5.5 V operation
- All inputs $V_{IH}(\text{Max.}) = 5.5\text{ V}$ (@ $V_{CC} = 0\text{ V}$ to 5.5 V)

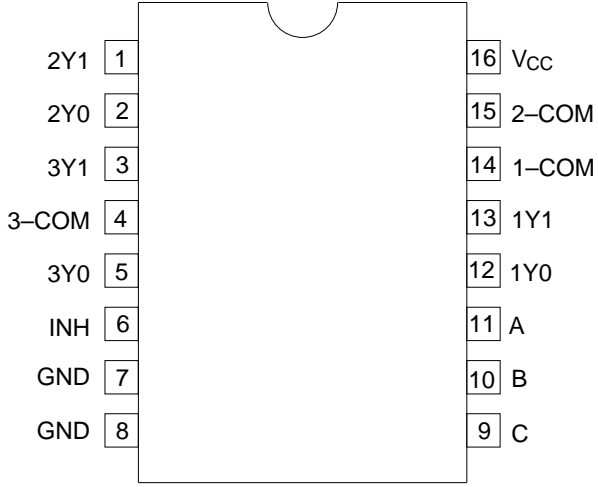
Function Table

Inputs

INH	C	B	A	On Channel
L	L	L	L	1Y0, 2Y0, 3Y0
L	L	L	H	1Y1, 2Y0, 3Y0
L	L	H	L	1Y0, 2Y1, 3Y0
L	L	H	H	1Y1, 2Y1, 3Y0
L	H	L	L	1Y0, 2Y0, 3Y1
L	H	L	H	1Y1, 2Y0, 3Y1
L	H	H	L	1Y0, 2Y1, 3Y1
L	H	H	H	1Y1, 2Y1, 3Y1
H	X	X	X	NONE

Note: H: High level
L: Low level
X: Immaterial

Pin Arrangement



(Top view)

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	V_{CC}	-0.5 to 7.0	V	
Input voltage range* ¹	V_I	-0.5 to 7.0	V	
Output voltage range* ^{1,2}	V_O	-0.5 to $V_{CC} + 0.5$	V	Output: H or L
Input clamp current	I_{IK}	-20	mA	$V_I < 0$
Output clamp current	I_{OK}	± 50	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	I_O	± 25	mA	$V_O = 0$ to V_{CC}
Continuous current through V_{CC} or GND	I_{CC} or I_{GND}	± 50	mA	
Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* ³	P_T	785	mW	SOP
		500		TSSOP
Storage temperature	T_{stg}	-65 to 150	$^\circ\text{C}$	

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 even if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C .

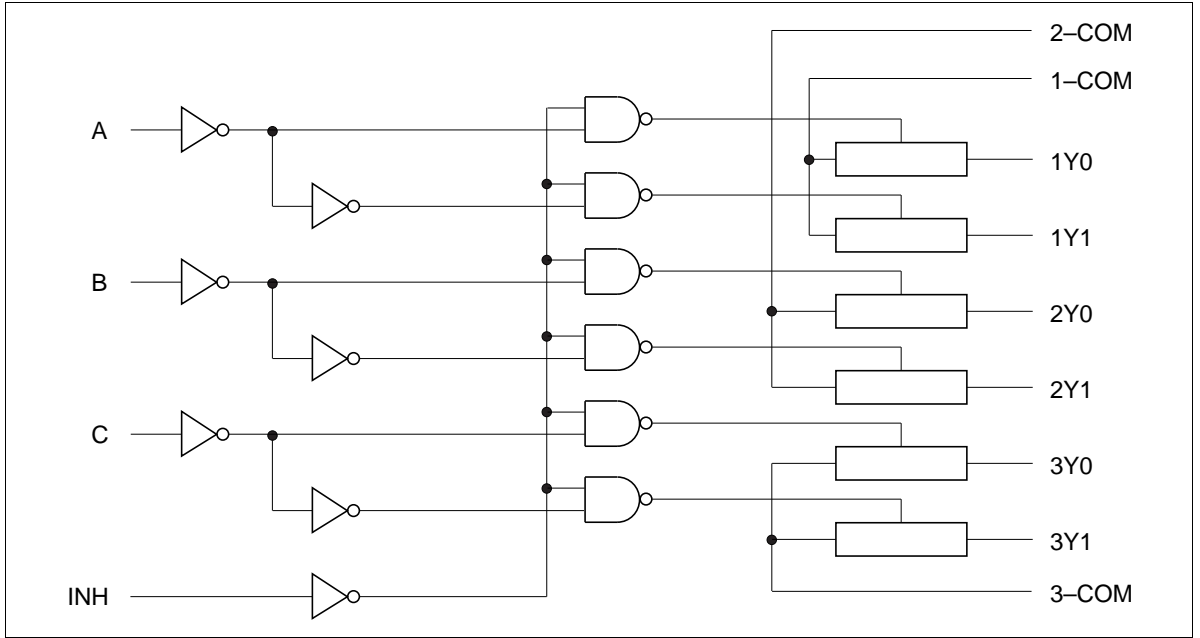
Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	V_{CC}	2.0* ¹	5.5	V	
Input voltage range	V_I	0	5.5	V	
Output voltage range	V_{IO}	0	V_{CC}	V	
Input transition rise or fall rate	$\Delta t / \Delta v$	0	200	ns/V	$V_{CC} = 2.3$ to 2.7 V
		0	100		$V_{CC} = 3.0$ to 3.6 V
		0	20		$V_{CC} = 4.5$ to 5.5 V
Operating free-air temperature	T_a	-40	85	$^\circ\text{C}$	

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

1. With the supply voltage at or around 2 V, the analog switch on-state resistance loses linearity significantly. It is recommended that only digital signals be transmitted at these low supply voltages.

Logic Diagram



DC Electrical Characteristics

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Input voltage	V _{IH}	2.0	—	—	—	1.5	—	V	
		2.3 to 2.7	—	—	—	V _{CC} × 0.7	—		
		3.0 to 3.6	—	—	—	V _{CC} × 0.7	—		
		4.5 to 5.5	—	—	—	V _{CC} × 0.7	—		
	V _{IL}	2.0	—	—	—	—	0.5		
		2.3 to 2.7	—	—	—	—	V _{CC} × 0.3		
		3.0 to 3.6	—	—	—	—	V _{CC} × 0.3		
		4.5 to 5.5	—	—	—	—	V _{CC} × 0.3		
On-state switch resistance	R _{ON}	2.3	—	60	180	—	225	Ω	V _{IN} = V _{CC} or GND V _{INH} = V _{IL} I _T = 2 mA
		3.0	—	50	150	—	190		
		4.5	—	40	75	—	100		
Peak on resistance	R _{ON(P)}	2.3	—	200	500	—	600	Ω	V _{IN} = V _{CC} to GND V _{INH} = V _{IL} I _T = 2 mA
		3.0	—	90	180	—	225		
		4.5	—	50	100	—	125		
Difference of on-state resistance between switches	ΔR _{ON}	2.3	—	20	30	—	40	Ω	V _{IN} = V _{CC} to GND V _{INH} = V _{IL} I _T = 2 mA
		3.0	—	10	20	—	30		
		4.5	—	7	15	—	20		
Off-state switch leakage current	I _s (OFF)	5.5	—	—	±0.1	—	±1.0	μA	V _{IN} = V _{CC} , V _{OUT} = GND or V _{IN} = GND, V _O = V _{CC} , V _{INH} = V _{IH}
On-state switch leakage current	I _s (ON)	5.5	—	—	±0.1	—	±1.0	μA	V _{IN} = V _{CC} or GND V _{INH} = V _{IL}
Input current	I _{IN}	0 to 5.5	—	—	±0.1	—	±1.0	μA	V _{IN} = 5.5 V or GND
Quiescent supply current	I _{CC}	5.5	—	—	—	—	20	μA	V _{IN} = V _{CC} or GND

Note: For conditions shown as Min or Max use the appropriate values under recommended operating conditions.

Switching Characteristics

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

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)	
		Min	Typ	Max	Min	Max					
Propagation delay time	t_{PLH}	—	2.5	10.0	—	16.0	ns	$C_L = 15 \text{ pF}$	COM or Yn	Yn or COM	
	t_{PHL}	—	5.0	12.0	—	18.0					$C_L = 50 \text{ pF}$
Enable time	t_{ZH}	—	7.0	18.0	—	23.0	ns	$R_L = 1 \text{ k}\Omega$	$C_L = 15 \text{ pF}$	INH	COM or Yn
	t_{ZL}	—	9.0	28.0	—	35.0					
Disable time	t_{HZ}	—	9.0	18.0	—	23.0	ns	$R_L = 1 \text{ k}\Omega$	$C_L = 15 \text{ pF}$	INH	COM or Yn
	t_{LZ}	—	13.0	28.0	—	35.0					

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

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)	
		Min	Typ	Max	Min	Max					
Propagation delay time	t_{PLH}	—	2.0	6.0	—	10.0	ns	$C_L = 15 \text{ pF}$	COM or Yn	Yn or COM	
	t_{PHL}	—	4.0	9.0	—	12.0					$C_L = 50 \text{ pF}$
Enable time	t_{ZH}	—	5.0	12.0	—	15.0	ns	$R_L = 1 \text{ k}\Omega$	$C_L = 15 \text{ pF}$	INH	COM or Yn
	t_{ZL}	—	7.0	20.0	—	25.0					
Disable time	t_{HZ}	—	7.0	12.0	—	15.0	ns	$R_L = 1 \text{ k}\Omega$	$C_L = 15 \text{ pF}$	INH	COM or Yn
	t_{LZ}	—	10.0	20.0	—	25.0					

Switching Characteristics (cont)

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

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)	
		Min	Typ	Max	Min	Max					
Propagation delay time	t_{PLH}	—	1.5	4.0	—	7.0	ns	$C_L = 15 \text{ pF}$	COM or Yn	Yn or COM	
	t_{PHL}	—	3.0	6.0	—	8.0					$C_L = 50 \text{ pF}$
Enable time	t_{ZH}	—	4.0	8.0	—	10.0	ns	$R_L = 1 \text{ k}\Omega$	$C_L = 15 \text{ pF}$	INH	COM or Yn
	t_{ZL}	—	5.0	14.0	—	18.0					
Disable time	t_{HZ}	—	5.0	8.0	—	10.0	ns	$R_L = 1 \text{ k}\Omega$	$C_L = 15 \text{ pF}$	INH	COM or Yn
	t_{LZ}	—	8.0	14.0	—	18.0					

Switching Characteristics (cont)

Ta = 25°C

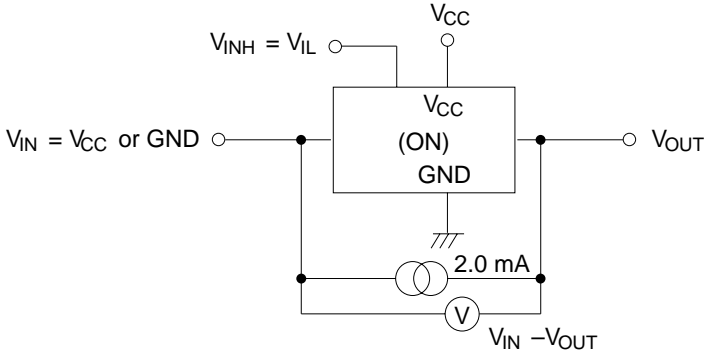
Item	Symbol	V _{CC} (V)	Ta = 25°C			Unit	Test Conditions	FROM (Input)	TO (Output)
			Min	Typ	Max				
Control input capacitance	C _{IC}	—	—	4.5	—	pF			
Common terminal capacitance	C _{IS}	—	—	12.5	—	pF			
Switch terminal capacitance	C _{I/O}	—	—	7.0	—	pF			
Feedthrough capacitance	C _T	—	—	0.5	—	pF			
Power dissipation capacitance	C _{PD}	—	—	9.0	—	pF			
Frequency response (Switch ON)		2.3	—	30.0	—	MHz	C _L = 50 pF, R _L = 600 Ω Adjust f _{in} voltage to obtain 0 dBm at output when f _{in} is 1 MHz (sine wave). Increase f _{in} frequency until the dB-meter reads -3 dBm. 20 log (V _O /V _I) = -3 dBm	COM or Yn	Yn or COM
		3.0	—	35.0	—				
		4.5	—	50.0	—				
Crosstalk (Between any switches)		2.3	—	-45.0	—	dB	C _L = 50 pF, R _L = 600 Ω Adjust f _{in} voltage to obtain 0 dBm at input when f _{in} is 1 MHz (sine wave).	COM	Yn
		3.0	—	-45.0	—				
		4.5	—	-45.0	—				
Crosstalk (Control input to signal output)		2.3	—	20.0	—	mV	C _L = 50 pF, R _L = 600 Ω Adjust R _L value to obtain 0 A at I _{N/OUT} when f _{in} is 1 MHz (square wave).	INH	COM or Yn
		3.0	—	35.0	—				
		4.5	—	65.0	—				

Switching Characteristics (cont)

Ta = 25°C									
Item	Symbol	V_{CC} (V)	Min	Typ	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Feedthrough attenuation (Switch OFF)		2.3	—	-45	—	dB	C _L = 50 pF, R _L = 600 Ω Adjust f _{in} voltage to obtain 0 dBm at input when f _{in} is 1 MHz (sine wave).	COM or Yn	Yn or COM
		3.0	—	-45	—				
		4.5	—	-45	—				
Sine-wave distortion		2.3	—	0.1	—	%	C _L = 50 pF, R _L = 10 kΩ f _{IN} = 1 kHz (sine wave) V _I = 2 V _{P-P} , V _{CC} = 2.3 V V _I = 2.5 V _{P-P} , V _{CC} = 3.0 V V _I = 4 V _{P-P} , V _{CC} = 4.5 V	COM or Yn	Yn or COM
		3.0	—	0.1	—				
		4.5	—	0.1	—				

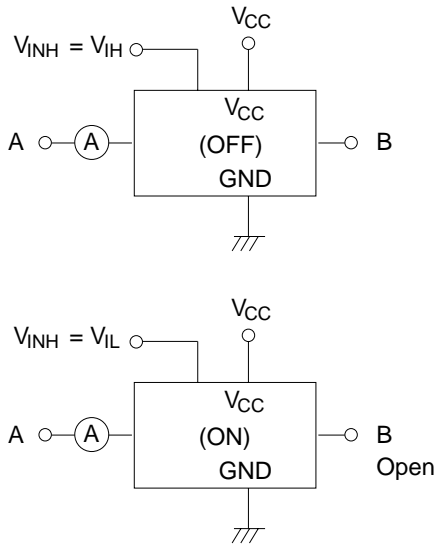
Test Circuits

R_{ON} : On-state switch resistance

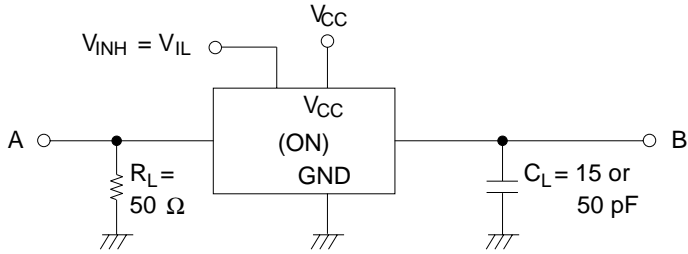


$$R_{ON} = \frac{V_{IN} - V_{OUT}}{2 \times 10^{-3}} (\Omega)$$

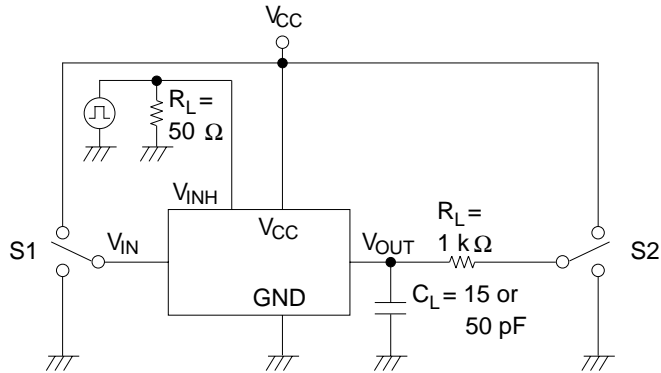
I_s (OFF): Off-state switch leakage current, I_s (ON): On-state switch leakage current



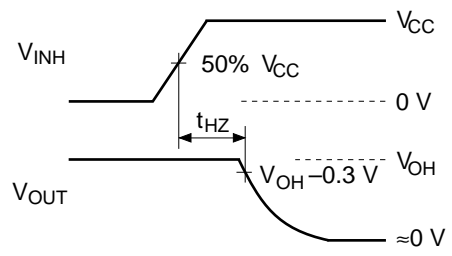
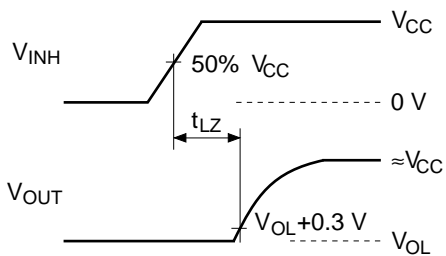
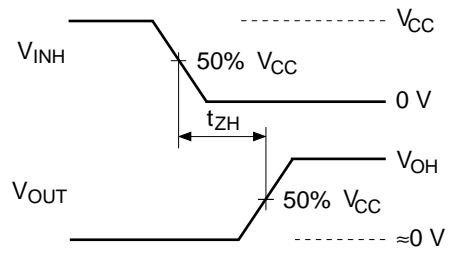
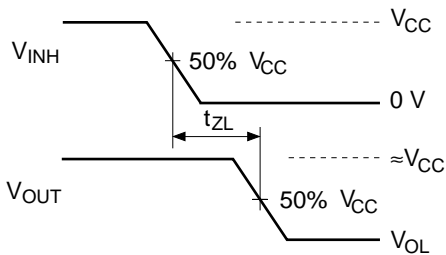
t_{PLH} , t_{PHL} : Propagation delay time (from switch input to switch output)



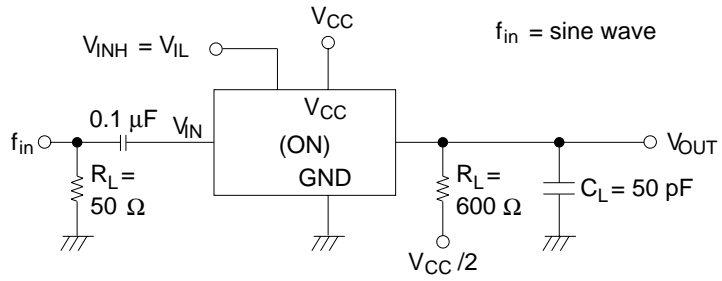
Switching time



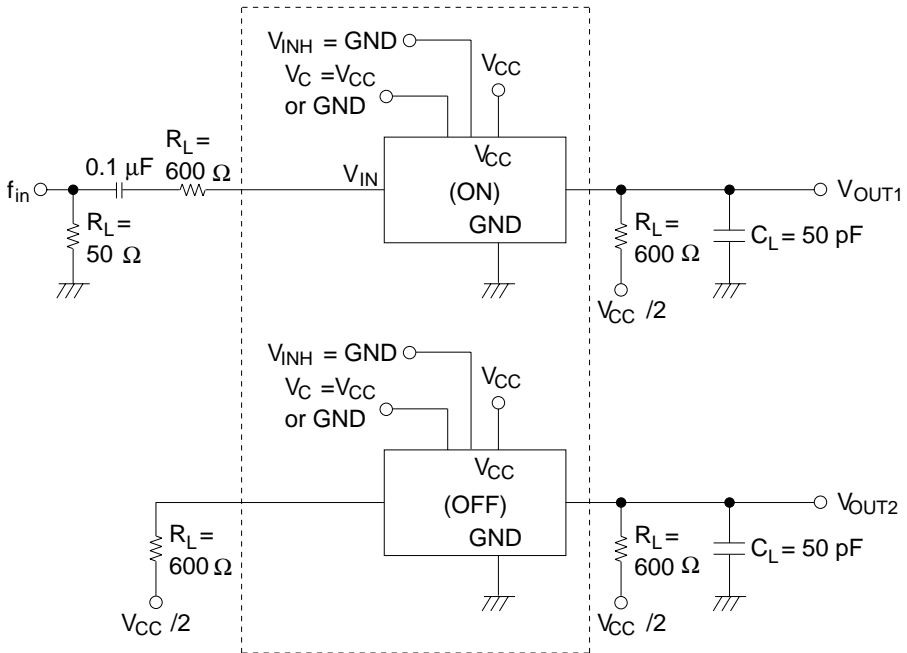
TEST	S1	S2
t_{LZ}/t_{ZL}	GND	VCC
t_{HZ}/t_{ZH}	VCC	GND



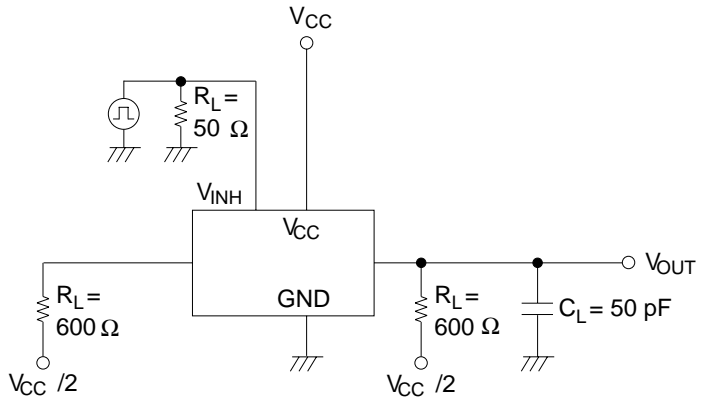
Frequency response (Switch ON)



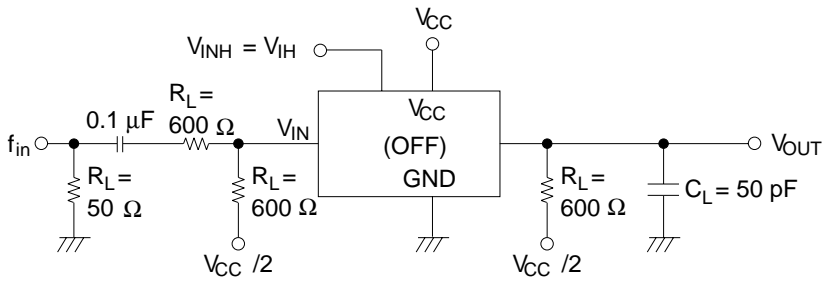
Crosstalk (Between any switches)



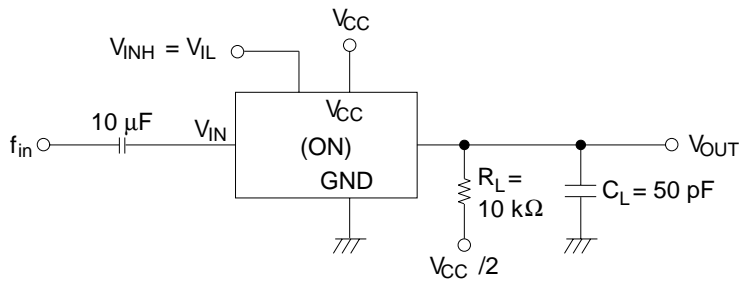
Crosstalk (Control input to signal output)



Feedthrough attenuation (Switch OFF)

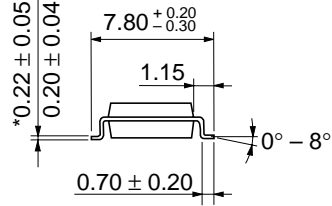
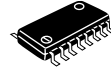
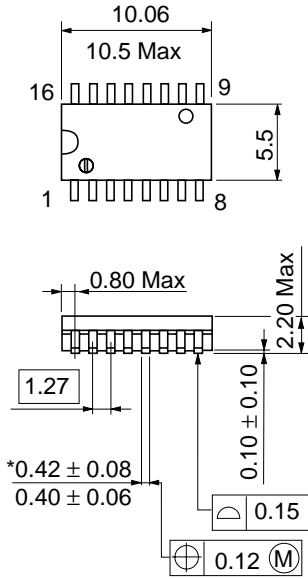


Sine-wave distortion



Package Dimensions

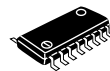
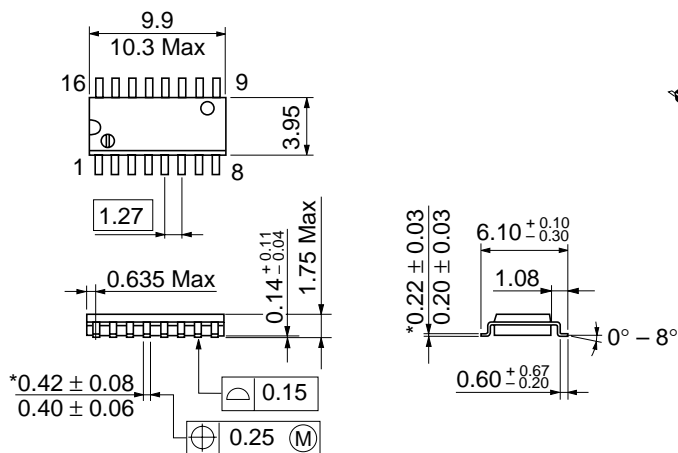
Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g

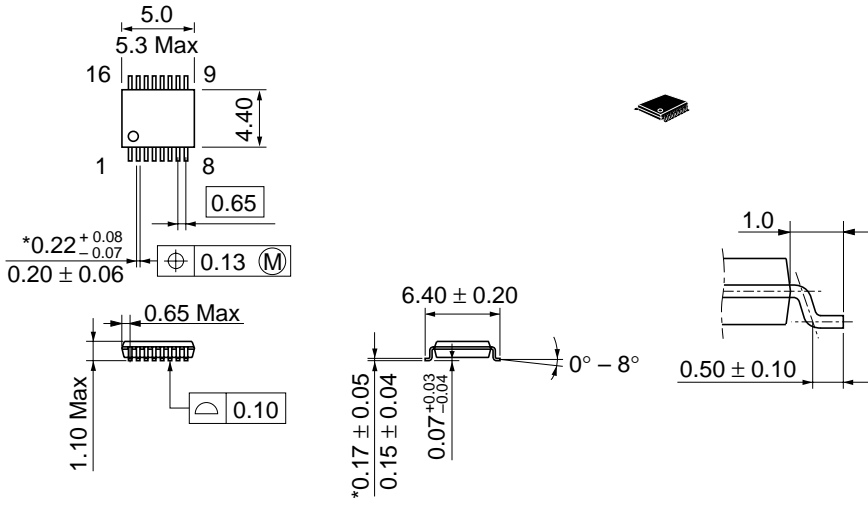
Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	TTP-16DA
JEDEC	—
EIAJ	—
Weight (reference value)	0.05 g

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Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose, CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building, No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
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