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

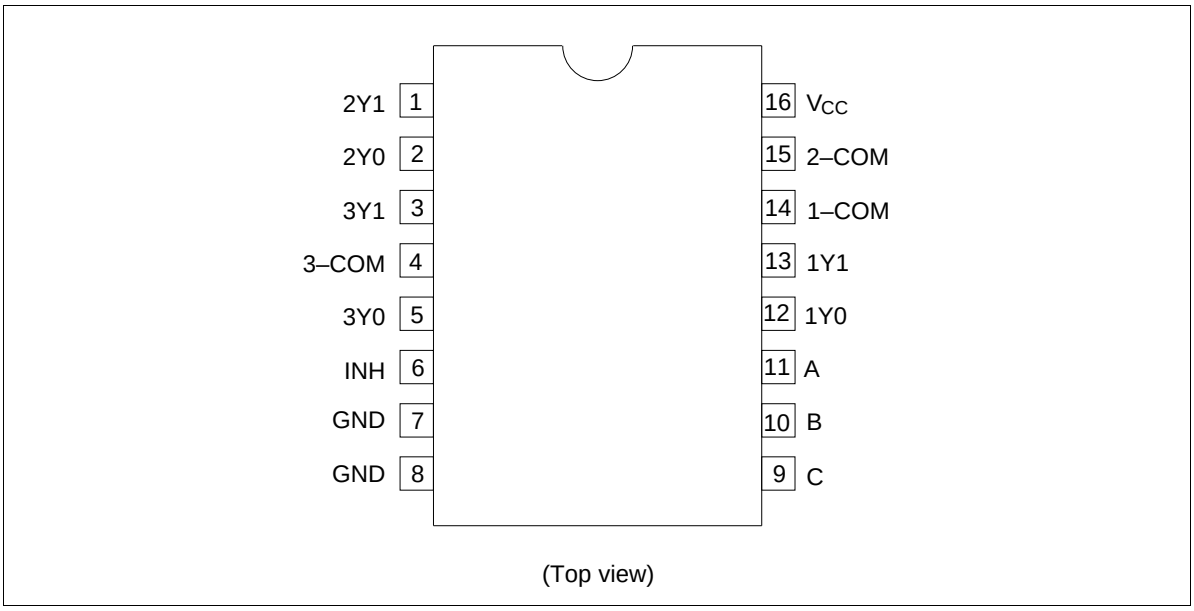
Function Table

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

Hitachi semiconductor

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 Ta = 25°C (in still air)*[3]	P_T	785	mW	SOP
		500		TSSOP
Storage temperature	Tstg	–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 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.

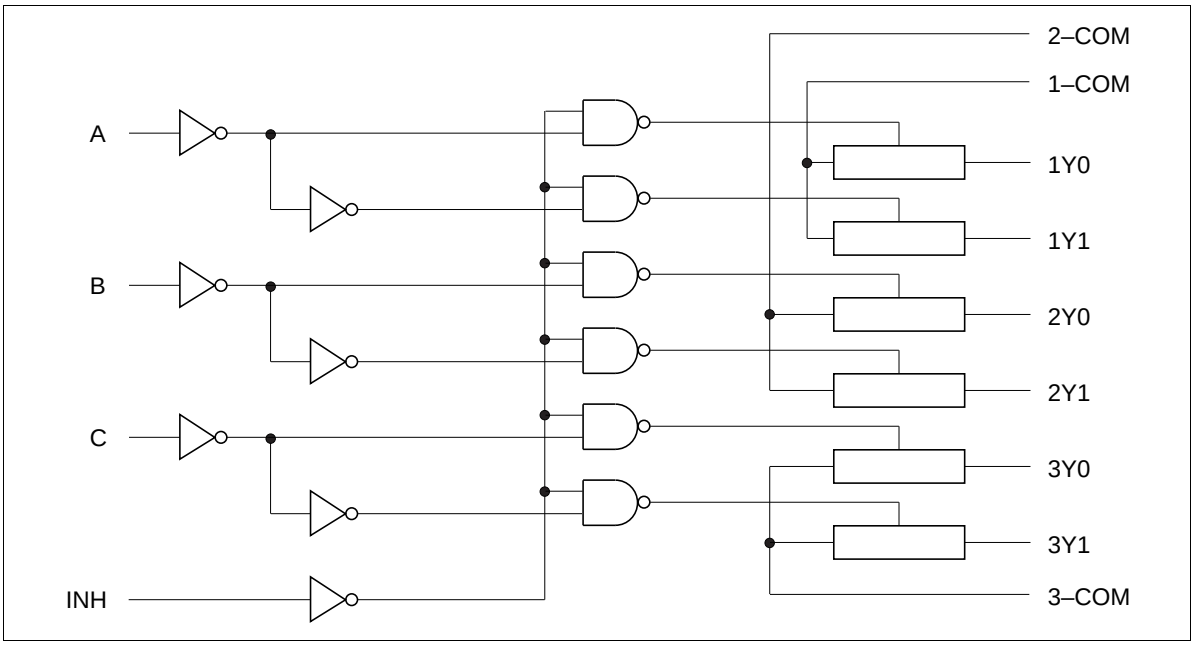
Recommended Operating Conditions

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	$V_{I/O}$	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	Ta	–40	85	°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

			Ta = 25°C			Ta = –40 to 85°C			
Item	**Symbol**	**V_{CC} (V)**	**Min**	**Typ**	**Max**	**Min**	**Max**	**Unit**	**Test Conditions**
Input voltage	V_{IH}	2.0	—	—	—	1.5	—	V	
		2.3 to 2.7	—	—	—	$V_{CC} \times 0.7$	—		
		3.0 to 3.6	—	—	—	$V_{CC} \times 0.7$	—		
		4.5 to 5.5	—	—	—	$V_{CC} \times 0.7$	—		
	V_{IL}	2.0	—	—	—	—	0.5		
		2.3 to 2.7	—	—	—	—	$V_{CC} \times 0.3$		
		3.0 to 3.6	—	—	—	—	$V_{CC} \times 0.3$		
		4.5 to 5.5	—	—	—	—	$V_{CC} \times 0.3$		
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	Is (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	Is (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 ± 0.2 V**

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

- **V_{CC} = 3.3 ± 0.3 V**

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

Switching Characteristics (cont)

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

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

Switching Characteristics (cont)

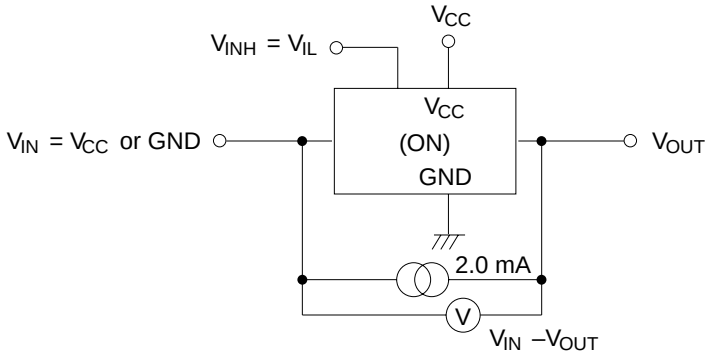
			Ta = 25°C						
Item	**Symbol**	**V_{CC} (V)**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**	**FROM (Input)**	**TO (Output)**
Control input capacitance	C_{IC}	—	—	4.5	—	pF			
Common terminal capacitance	C_{IS}	—	—	12.5	—	pF			
Switch terminal capacitance	$C_{I/O}$	—	—	7.0	—	pF			
Feedthrough capacitance	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 Adijust 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 $I_{IN/OUT}$ when f_{in} is 1 MHz (squave 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	—				

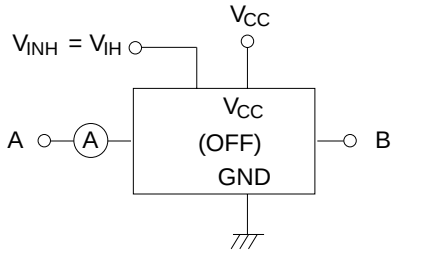
Test Circuits

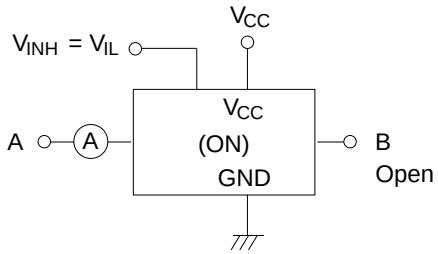
R_{ON}: On-state switch resistance



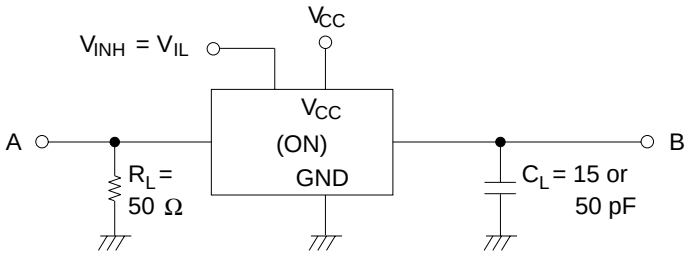
$$R_{ON} = \frac{V_{IN} - V_{OUT}}{2 \times 10^{-3}} (\Omega)$$

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

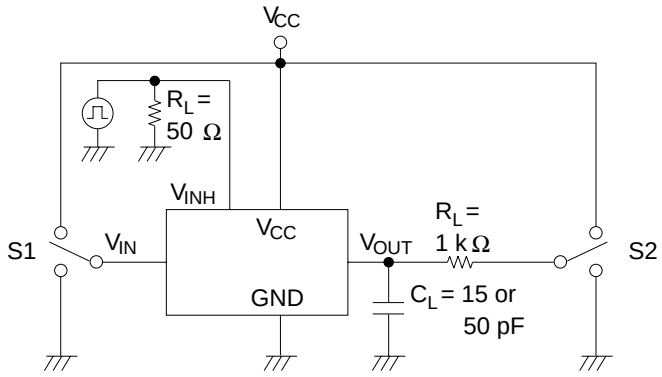




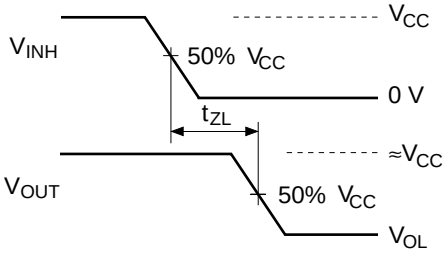
t_{PLH}, t_{PHL}: Propagation delay time (from switch input to switch output)

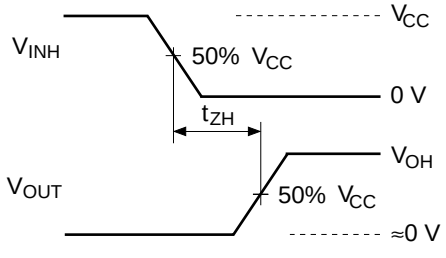


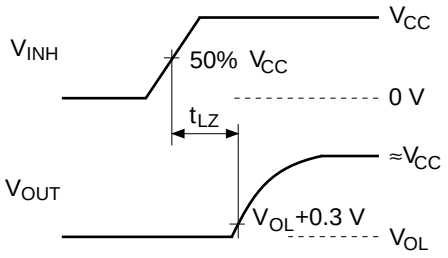
Switching time

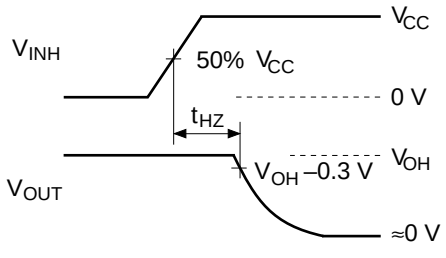


TEST	S1	S2
t_{LZ} /t_{ZL}	GND	Vcc
t_{HZ}/t_{ZH}	Vcc	GND

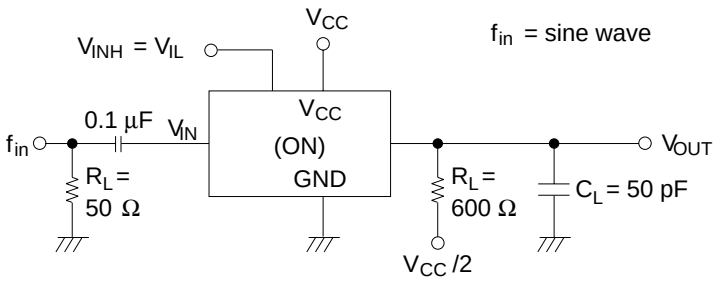




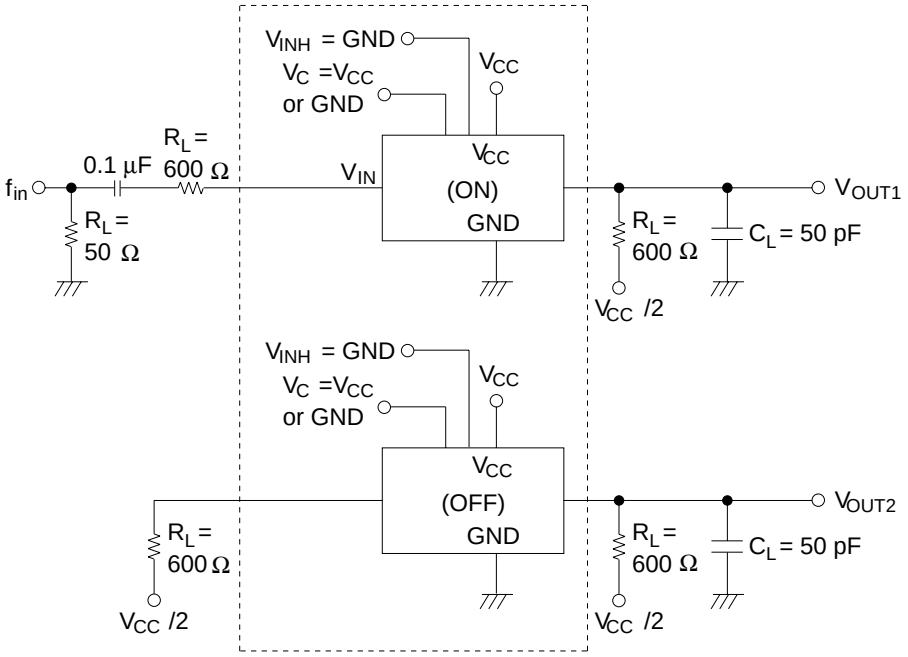




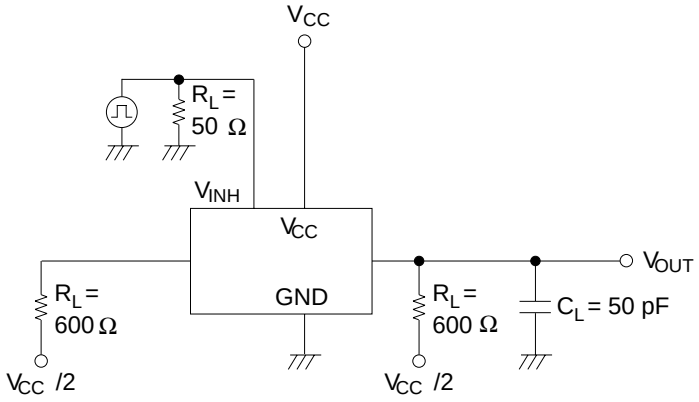
Frequency response (Switch ON)



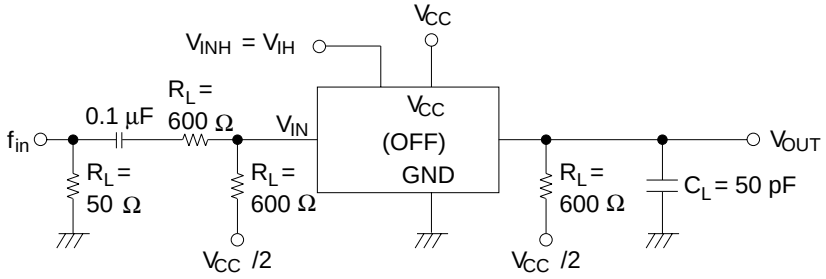
Crosstalk (Between any switches)



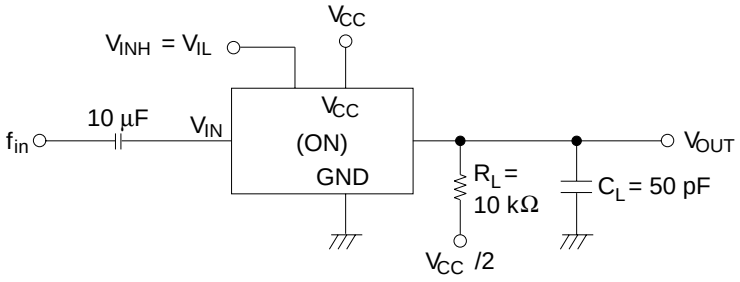
Crosstalk (Control input to signal output)



Feedthrough attenuation (Switch OFF)

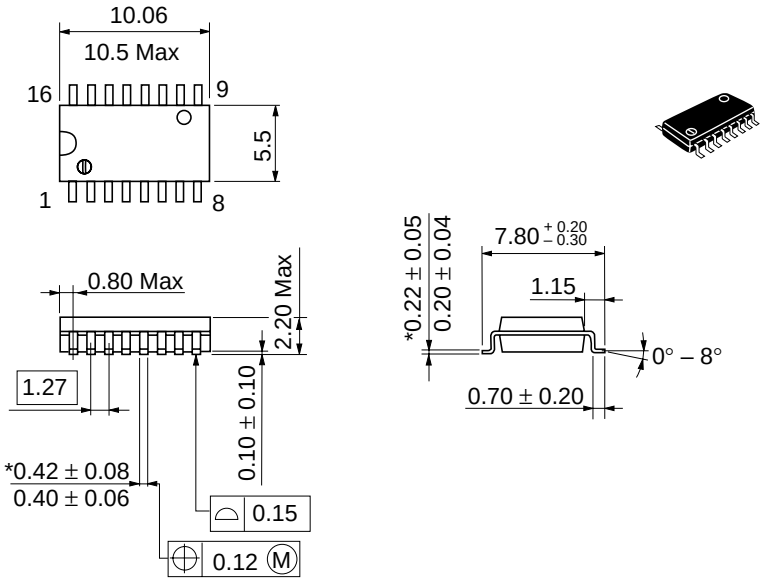


Sine-wave distortion



Package Dimensions

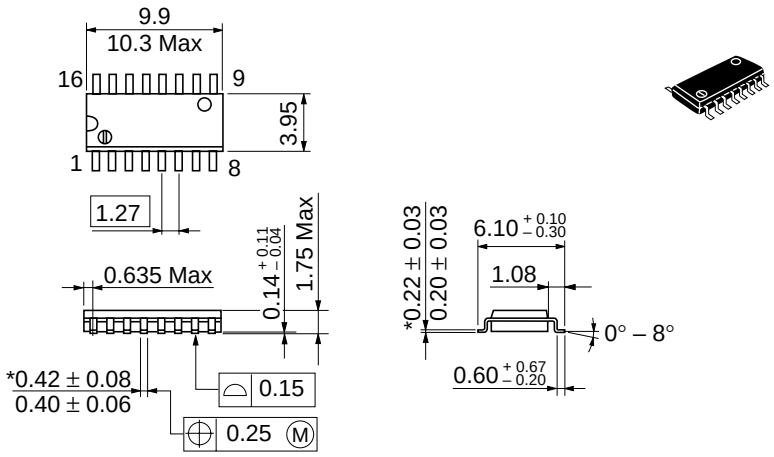
Unit: mm



*Dimension including the plating thickness
Base material dimension

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

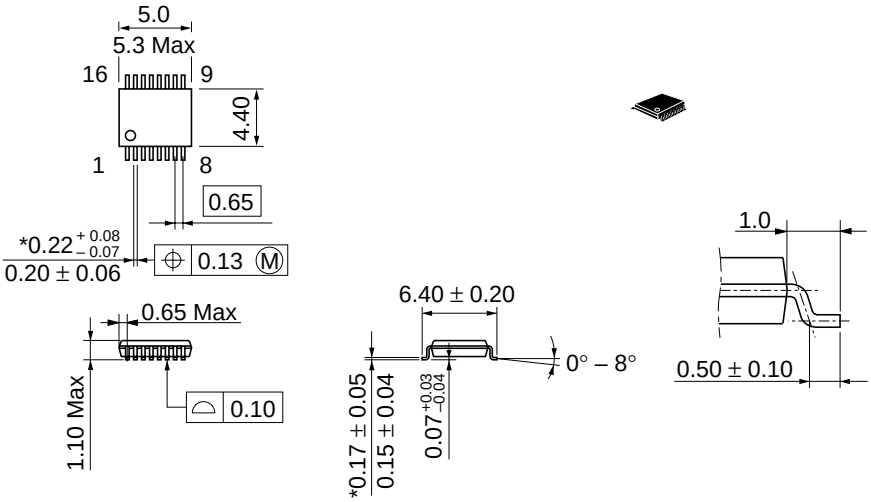
Unit: mm



*Dimension including the plating thickness
Base material dimension

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

Unit: mm



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

*Dimension including the plating thickness
Base material dimension

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