HD74LV4053A

Triple 2-channel Analog Multiplexer / Demultiplexer

REJ03D0339–0300Z
(Previous ADE-205-284A (Z))
Rev.3.00
Jul. 21, 2004

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 control inputs V_{IH} (Max.) = 5.5 V (@V_{CC} = 0 V to 5.5 V)
- Ordering Information

Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LV4053AFPEL	SOP–16 pin (JEITA)	FP–16DAV	FP	EL (2,000 pcs/reel)
HD74LV4053ARPEL	SOP–16 pin (JEDEC)	FP–16DNV	RP	EL (2,500 pcs/reel)
HD74LV4053ATELL	TSSOP–16 pin	TTP–16DAV	T	ELL (2,000 pcs/reel)

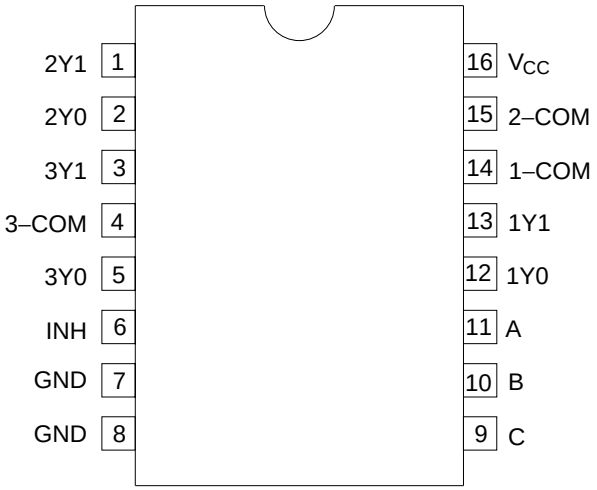
Note: Please consult the sales office for the above package availability.

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 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.

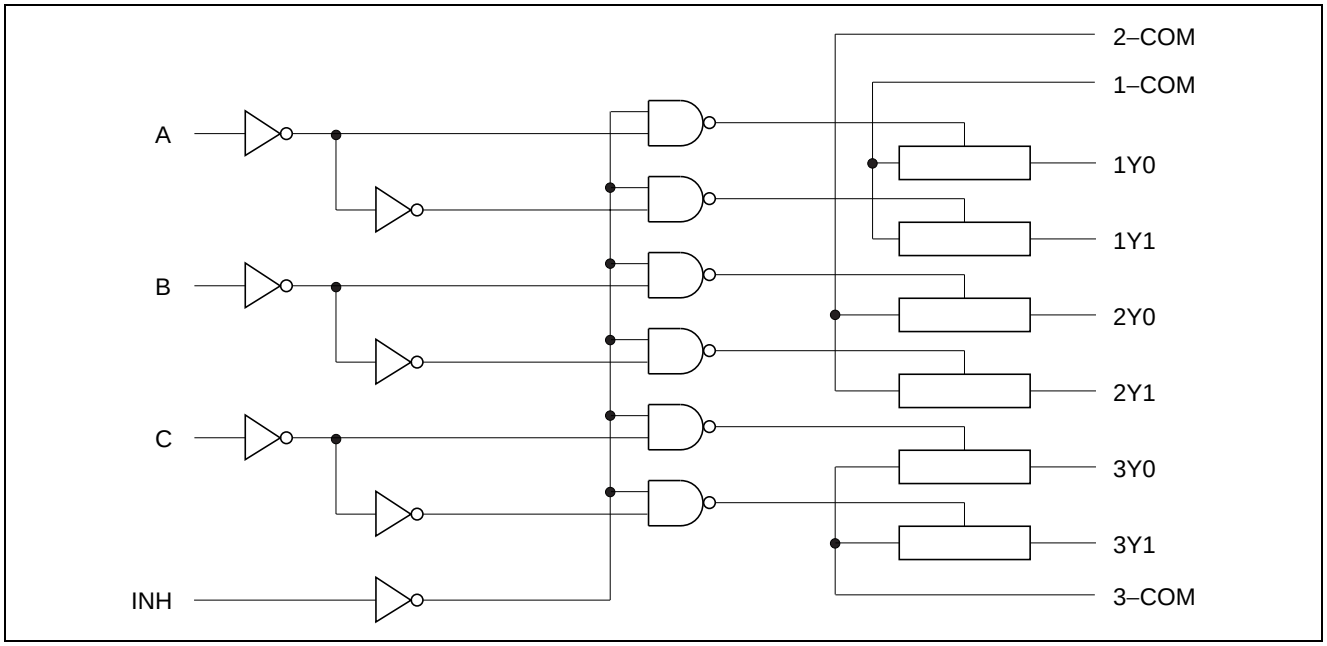
Recommended Operating Conditions

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 control 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	Control input only
		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

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

V_{CC} = 3.3 ± 0.3 V

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

V_{CC} = 5.0 ± 0.5 V

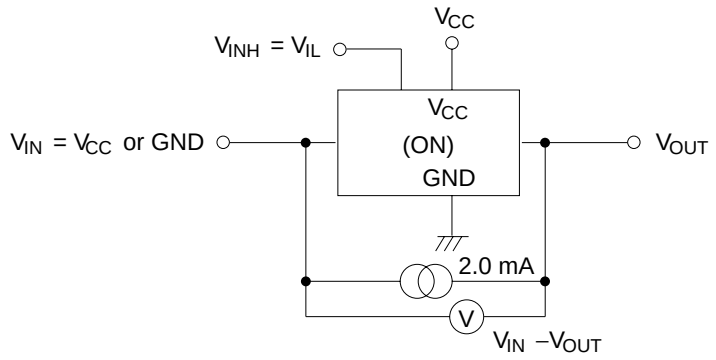
Item	Symbol	Ta = 25°C Min	Typ	Max	Ta = –40 to 85°C Min	Max	Unit	Test Conditions		FROM (Input)	TO (Output)
Propagation delay time	t_{PLH}	—	1.5	4.0	—	7.0	ns	C_L = 15 pF		COM or Yn	Yn or COM
	t_{PHL}	—	3.0	6.0	—	8.0		C_L = 50 pF			
Enable time	t_{ZH}	—	4.0	8.0	—	10.0	ns	R_L = 1 kΩ	C_L = 15 pF	INH	COM or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

Switching Characteristics (cont.)

Item	Symbol	V_{CC} (V)	Ta = 25°C 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 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 $I_{IN/OUT}$ when f_{in} is 1 MHz (square wave).	INH	COM or Yn
		3.0	—	35.0	—				
		4.5	—	65.0	—				
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	—				

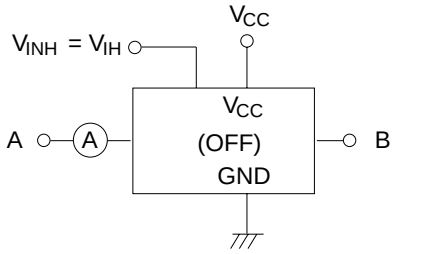
Test Circuits

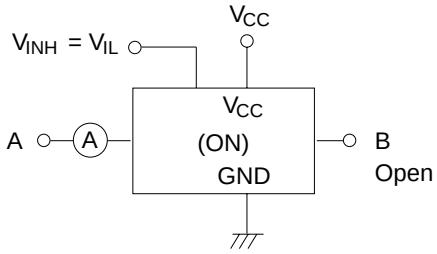
R_{ON}: On-state switch resistance



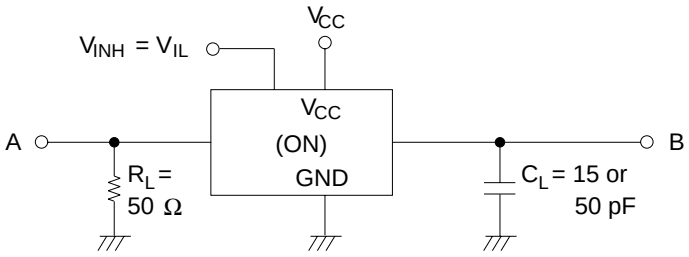
$$R_{ON} = \frac{V_{IN} - V_{OUT}}{2 \times 10^{-3}} (\Omega)$$

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

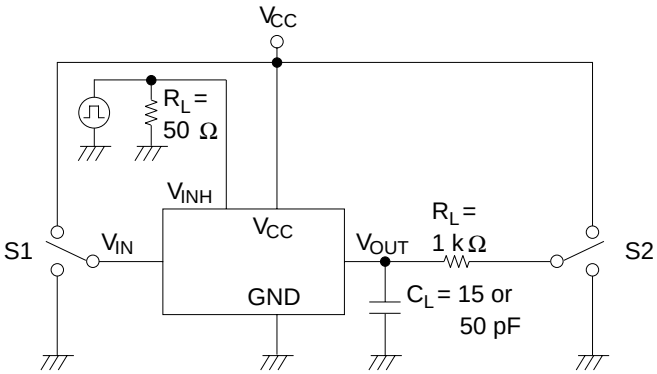




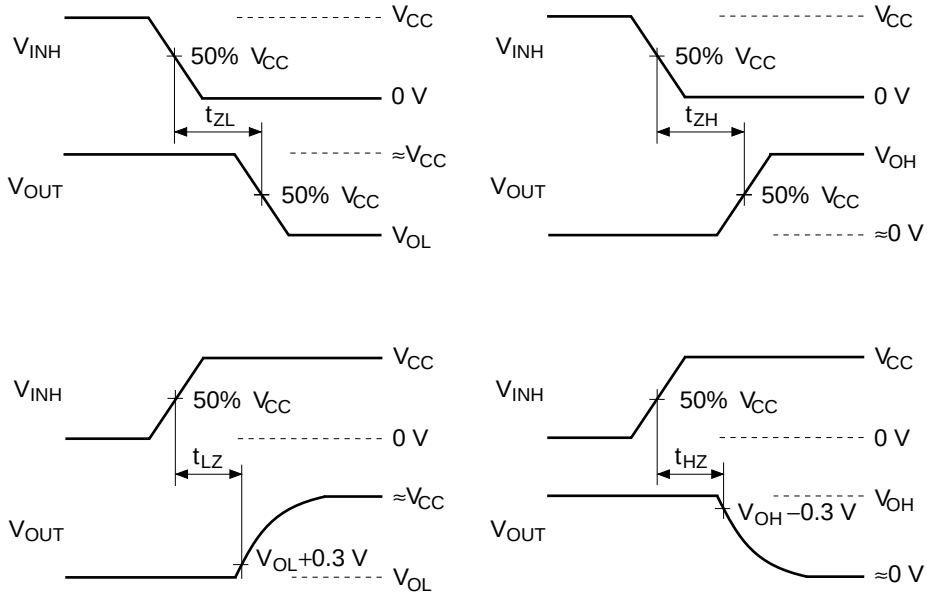
t_{PLH}, t_{PHL}: Propagation delay time (from switch input to switch output)



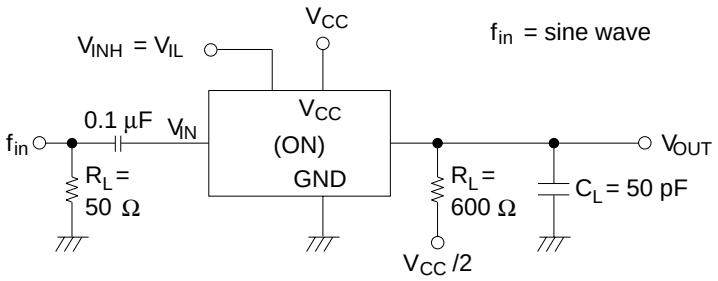
Switching time



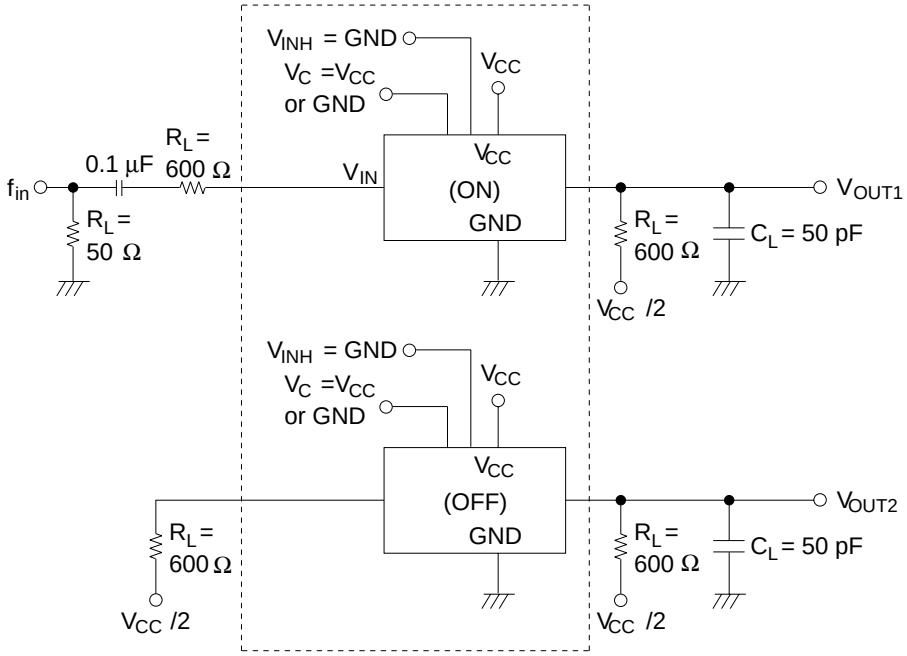
TEST	S1	S2
t_{LZ} /t_{ZL}	GND	VCC
t_{HZ}/t_{ZH}	VCC	GND



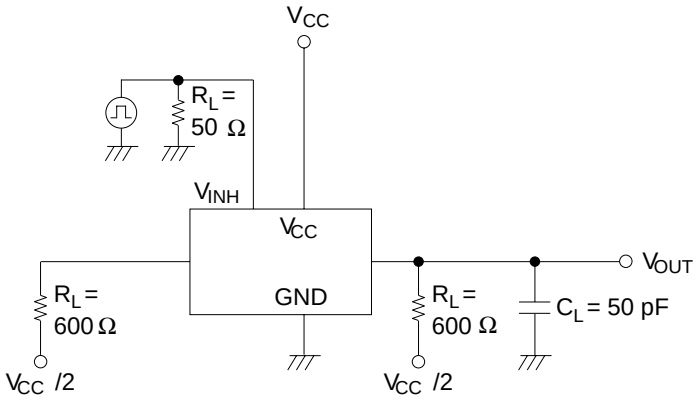
Frequency response (Switch ON)



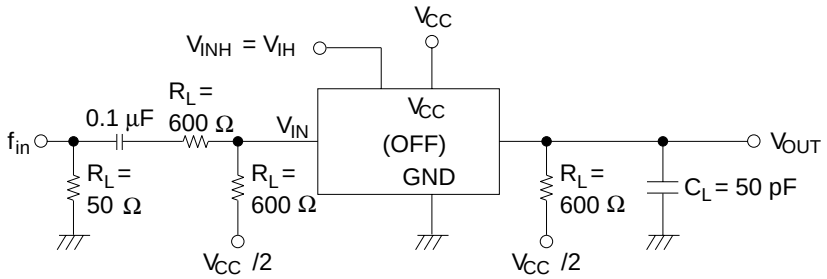
Crosstalk (Between any switches)



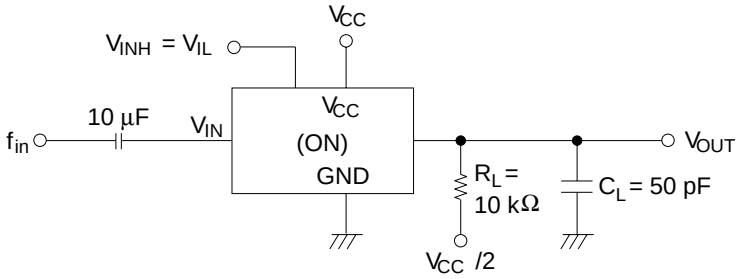
Crosstalk (Control input to signal output)



Feedthrough attenuation (Switch OFF)



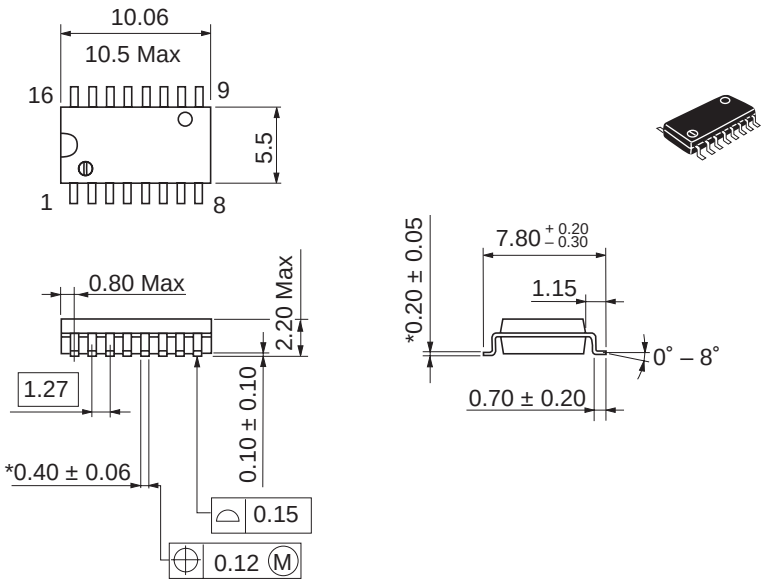
Sine-wave distortion



Package Dimensions

As of January, 2003

Unit: mm

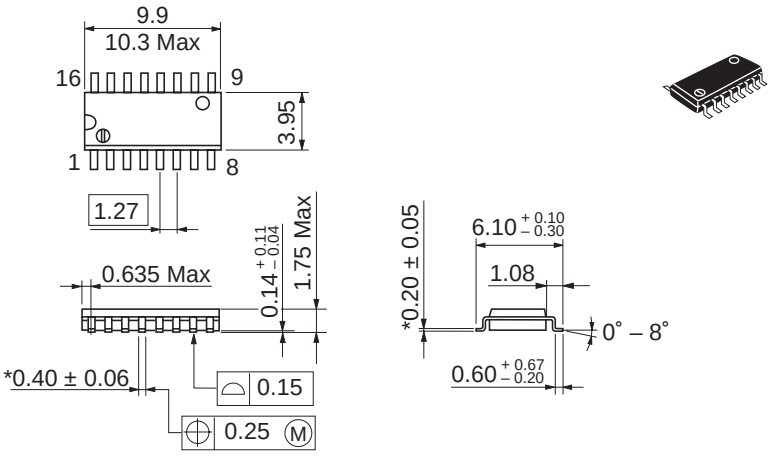


Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm

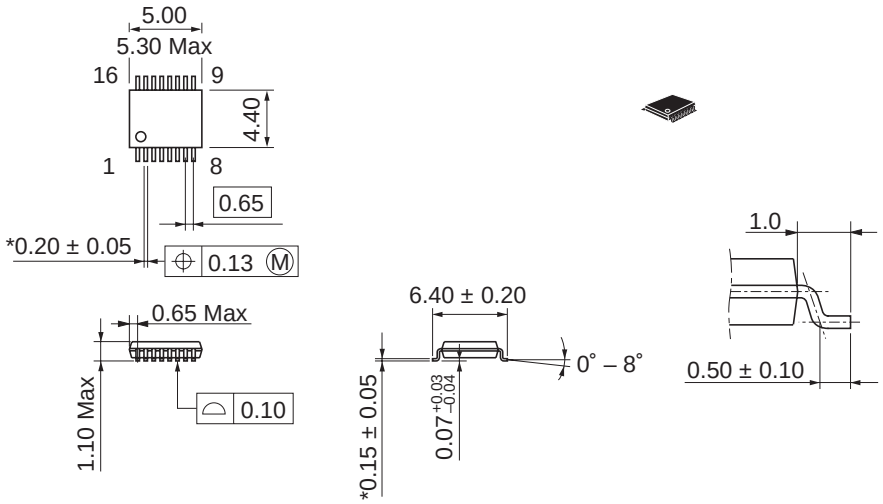


Package Code	FP-16DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.15 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm



*Ni/Pd/Au plating

Package Code	TTP-16DAV
JEDEC	—
JEITA	—
Mass (reference value)	0.05 g

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Colophon .1.0