HD74LV4066A

Quad. Analog Switches / Quad. Multiplexers

HITACHI

ADE-205-285 (Z)
1st Edition
April 1999

Description

The HD74LV4066A 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).
Each switch section has its own enable input control (C). A high-level voltage applied to C turns on the associated switch section.
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)

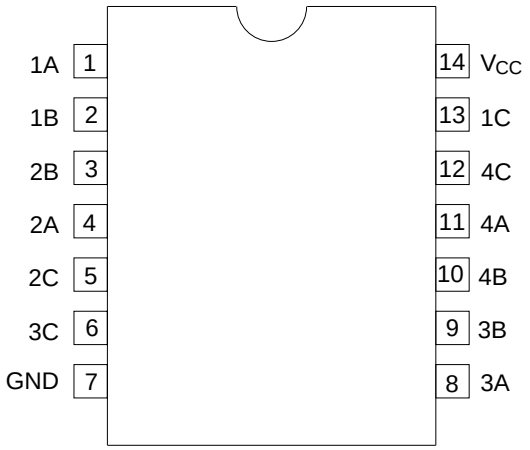
Function Table

Control	Switch
L	OFF
H	ON

Note: H: High level
L: Low level

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.

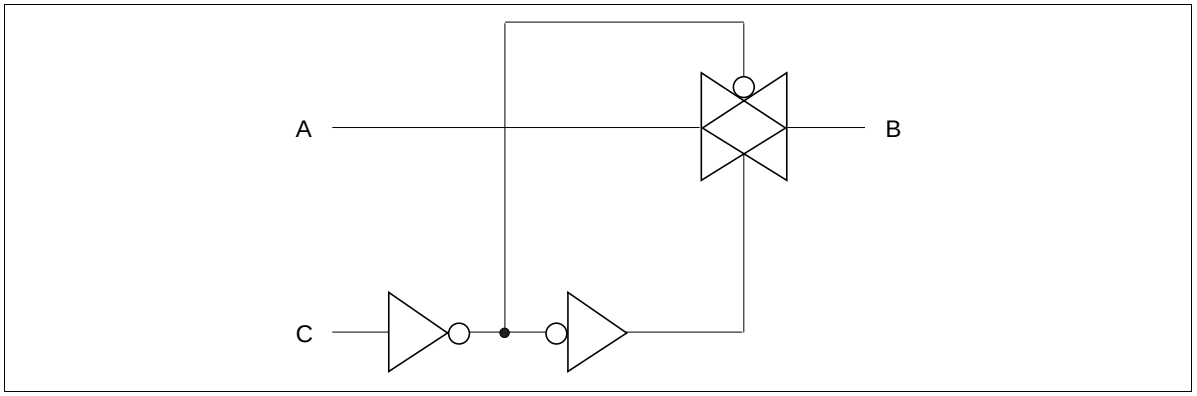
Recommended Operating Conditions

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_C = V_{IH} I_T = 1 mA
		3.0	—	50	150	—	190		
		4.5	—	40	75	—	100		
Peak on resistance	$R_{ON (P)}$	2.3	—	250	500	—	600	Ω	V_{IN} = V_{CC} to GND V_C = V_{IH} I_T = 1 mA
		3.0	—	100	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_C = V_{IH} I_T = 1 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_C = V_{IL}
On-state switch leakage current	Is (ON)	5.5	—	—	±0.1	—	±1.0	μA	V_{IN} = V_{CC} or GND V_C = V_{IH}
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					FROM	TO
Item	**Symbol**	**Min**	**Typ**	**Max**	**Min**	**Max**	**Unit**	**Test Conditions**		**(Input)**	**(Output)**
Propagation delay time	t_{PLH} t_{PHL}	—	2.0	10.0	—	16.0	ns	C_L = 15 pF		A or B	B or A
		—	5.0	12.0	—	18.0		C_L = 50 pF			
Enable time	t_{ZH} t_{ZL}	—	6.0	15.0	—	20.0	ns	R_L = 1 kΩ	C_L = 15 pF	C	A or B
		—	8.0	25.0	—	32.0			C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	7.0	15.0	—	23.0	ns	R_L = 1 kΩ	C_L = 15 pF	C	A or B
		—	11.0	25.0	—	32.0			C_L = 50 pF		

- **V_{CC} = 3.3 ± 0.3 V**

		Ta = 25°C			Ta = –40 to 85°C					FROM	TO
Item	**Symbol**	**Min**	**Typ**	**Max**	**Min**	**Max**	**Unit**	**Test Conditions**		**(Input)**	**(Output)**
Propagation delay time	t_{PLH} t_{PHL}	—	1.5	6.0	—	10.0	ns	C_L = 15 pF		A or B	B or A
		—	4.0	9.0	—	12.0		C_L = 50 pF			
Enable time	t_{ZH} t_{ZL}	—	4.0	11.0	—	15.0	ns	R_L = 1 kΩ	C_L = 15 pF	C	A or B
		—	6.0	18.0	—	22.0			C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	5.0	11.0	—	15.0	ns	R_L = 1 kΩ	C_L = 15 pF	C	A or B
		—	8.0	18.0	—	22.0			C_L = 50 pF		

Switching Characteristics (cont)

- **V_{CC} = 5.0 ± 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}	—	1.0	4.0	—	7.0	ns	C_L = 15 pF		A or B	B or A
		—	3.0	6.0	—	8.0		C_L = 50 pF			
Enable time	t_{ZH} t_{ZL}	—	3.0	7.0	—	10.0	ns	R_L = 1 kΩ	C_L = 15 pF	C	A or B
		—	5.0	12.0	—	16.0			C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	4.0	7.0	—	10.0	ns	R_L = 1 kΩ	C_L = 15 pF	C	A or B
		—	6.0	12.0	—	16.0			C_L = 50 pF		

Switching Characteristics (cont)

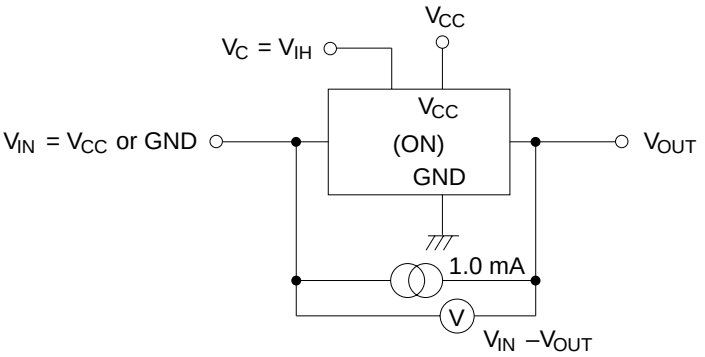
			Ta = 25°C						
Item	**Symbol**	**V_{CC} (V)**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**	**FROM (Input)**	**TO (Output)**
Control input capacitance	C_{IC}	—	—	3.5	—	pF			
Switch terminal capacitance	$C_{I/O}$	—	—	6.0	—	pF			
Feedthrough capacitance	C_T	—	—	0.5	—	pF			
Power dissipation capacitance	C_{PD}	—	—	4.0	—	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 –3dBm. 20 log (V_O/V_I) = –3 dBm	A or B	B or A
		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).	A or B	B or A
		3.0	—	–45.0	—				
		4.5	—	–45.0	—				
Crosstalk (Control input to signal output)		2.3	—	15.0	—	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).	C	A or B
		3.0	—	20.0	—				
		4.5	—	50.0	—				

Switching Characteristics (cont)

Item	Symbol	V_{CC} (V)	Ta = 25°C Min	Typ	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Feedthrough attenuation (Switch OFF)		2.3	—	–40.0	—	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).	A or B	B or A
		3.0	—	–40.0	—				
		4.5	—	–40.0	—				
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	A or B	B or A
		3.0	—	0.1	—				
		4.5	—	0.1	—				

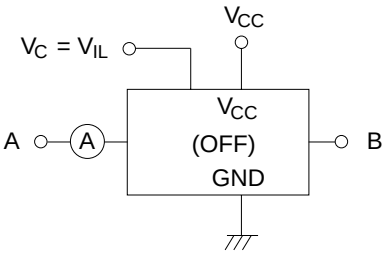
Test Circuits

R_{ON}: On-state switch resistance



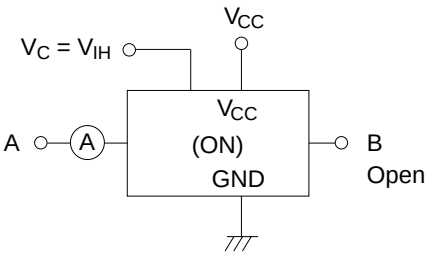
$$R_{ON} = \frac{V_{IN} - V_{OUT}}{10^{-3}} (\Omega)$$

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



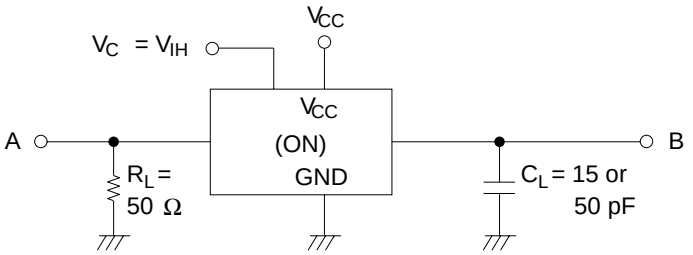
CONDITION 1: V_A = 0, V_B = V_{CC}

CONDITION 2: V_A = V_{CC} , V_B = 0

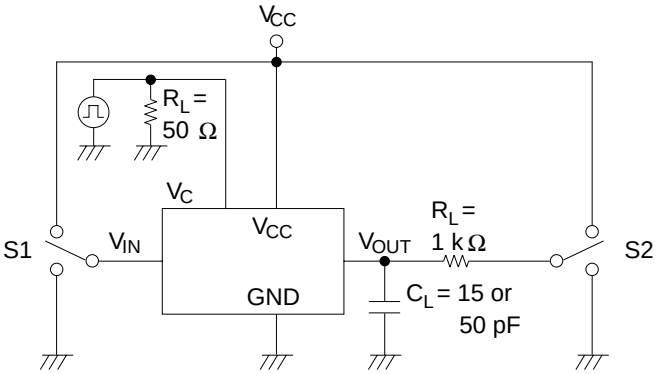


V_A = V_{CC} or GND

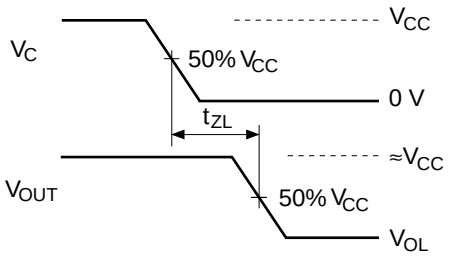
t_{PLH}, t_{PHL}: Propagation delay time (from switch input to switch output)

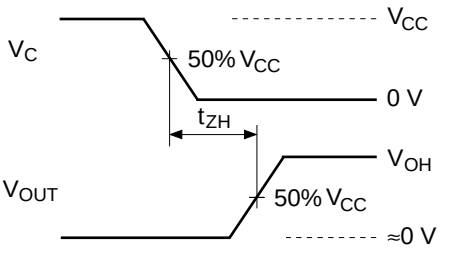


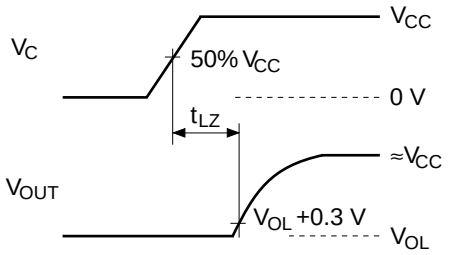
Switching time

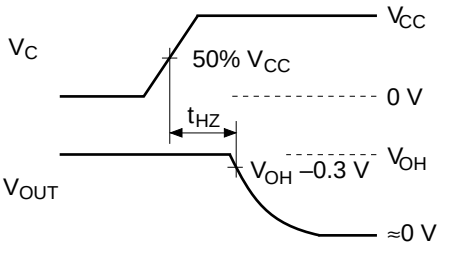


TEST	S1	S2
t_{LZ} /t_{ZL}	GND	VCC
t_{HZ}/t_{ZH}	VCC	GND

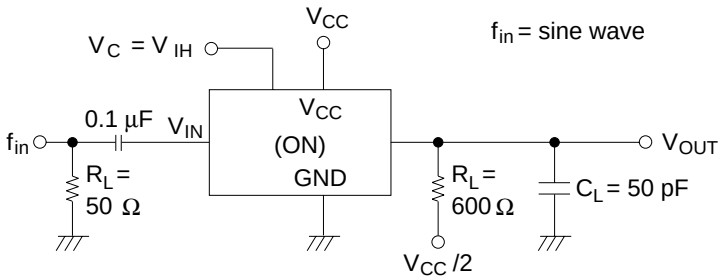




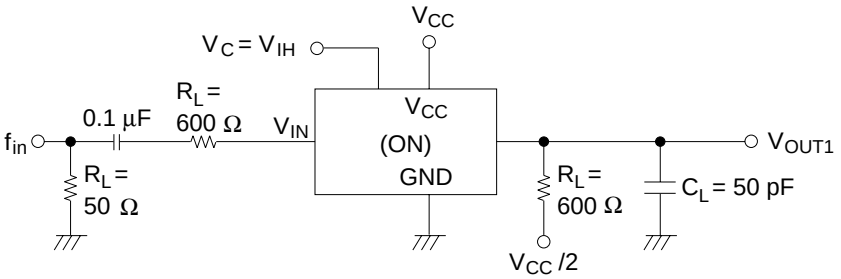


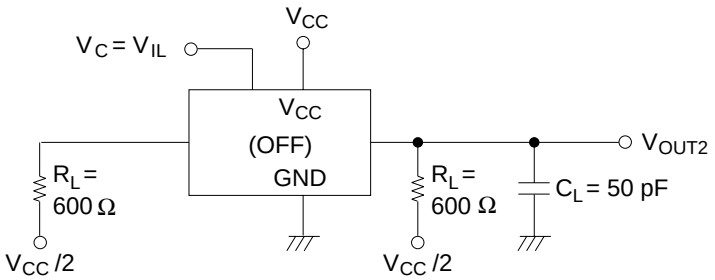


Frequency response (Switch ON)

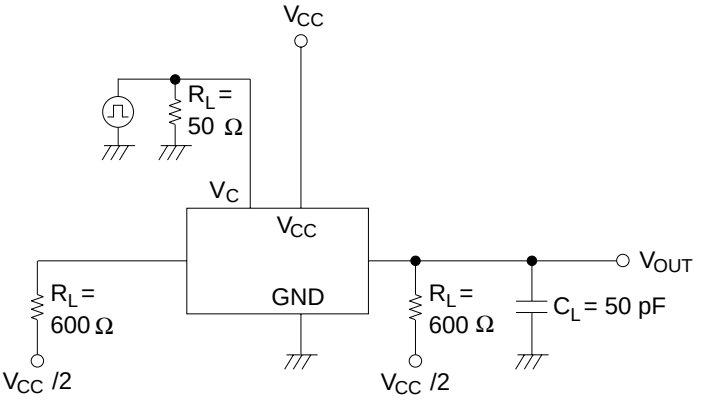


Crosstalk (Between any switches)

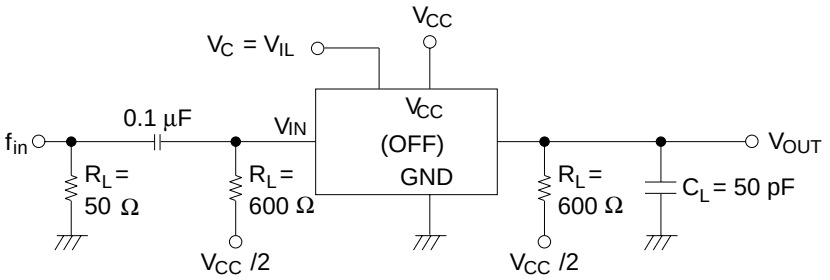




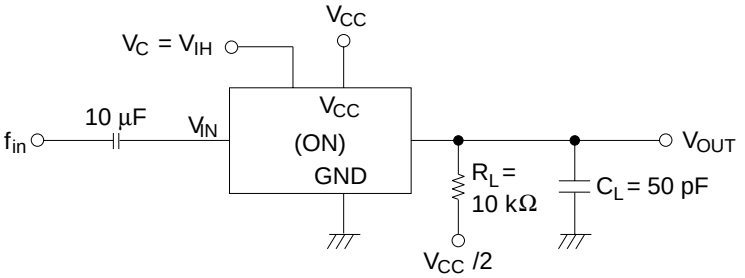
Crosstalk (Control input to signal output)



Feedthrough attenuation (Switch OFF)

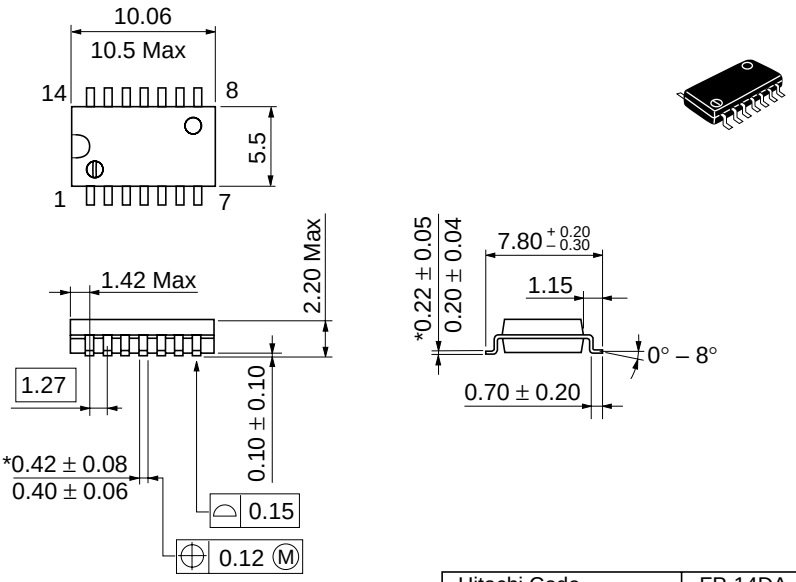


Sine-wave distortion



Package Dimensions

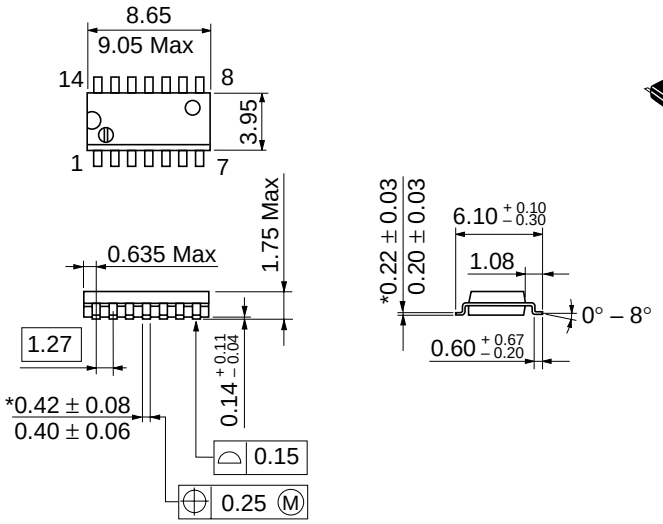
Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.23 g

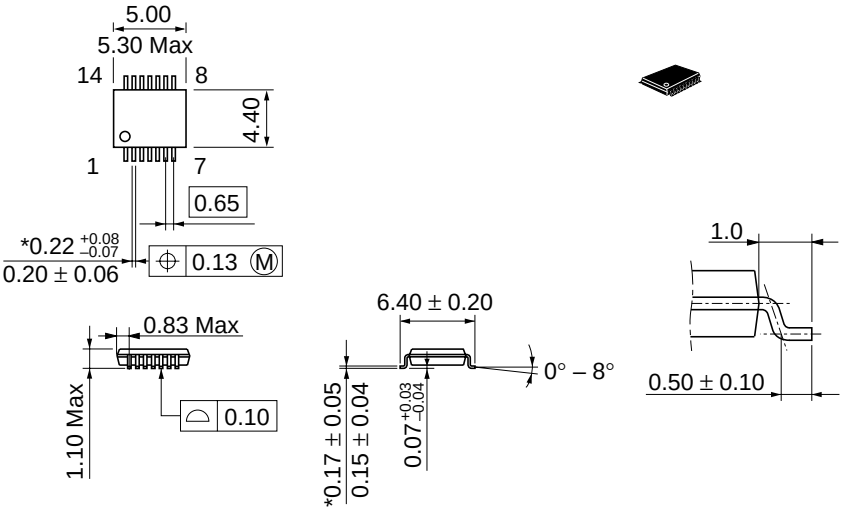
Unit: mm



Hitachi Code	FP-14DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.13 g

*Dimension including the plating thickness
Base material dimension

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	TTP-14D
JEDEC	—
EIAJ	—
Weight (reference value)	0.05 g

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

HITACHI

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

URL
NorthAmerica : http:semiconductor.hitachi.com/
Europe : http://www.hitachi-eu.com/hel/ecg
Asia (Singapore) : http://www.has.hitachi.com.sg/grp3/sicd/index.htm
Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
Asia (HongKong) : http://www.hitachi.com.hk/eng/bo/grp3/index.htm
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

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
Telex: 40815 HITEC HX