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# HD74LV05A

Hex Inverters with Open Drain Outputs

# HITACHI

ADE-205-249 (Z)  
1st Edition  
March 1999

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## Description

The HD74LV05A has six inverters with open drain outputs in a 14-pin package.

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

- $V_{CC} = 2.0\text{ V}$  to  $5.5\text{ V}$  operation
- All inputs  $V_{IH}$  (Max.) =  $5.5\text{ V}$  (@  $V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_O$  (Max.) =  $5.5\text{ V}$  (@  $V_{CC} = 0\text{ V}$ )
- Typical  $V_{OL}$  ground bounce <  $0.8\text{ V}$  (@  $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Typical  $V_{OH}$  undershoot >  $2.3\text{ V}$  (@  $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Output current  $\pm 6\text{ mA}$  (@  $V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 12\text{ mA}$  (@  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

## Function Table

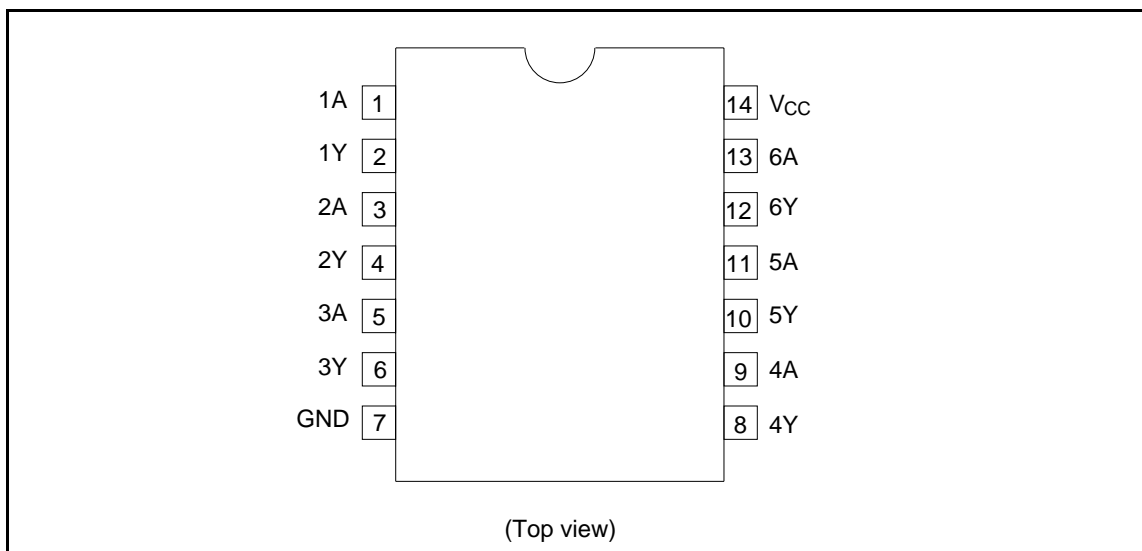
Input A	Output Y
L	H
H	L

Note: H:High level

L:Low level

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## Pin Arrangement



## 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 $V_{CC} + 0.5$ -0.5 to 7.0	V	Output: H or L $V_{CC}$ : OFF
Input clamp current	$I_{IK}$	-20	mA	$V_I < 0$
Output clamp current	$I_{OK}$	$\pm 50$	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	$I_O$	$\pm 25$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 50$	mA	
Maximum power dissipation at $P_T$ $T_a = 25^\circ\text{C}$ (in still air)*3		785 500	mW	SOP 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 if the input and output clamp-current ratings are observed.

2.This value is limited to 5.5 V maximum.

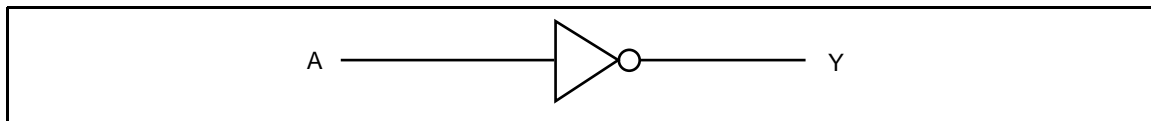
3.The maximum package power dissipation was calculated using a junction temperature of 150 $^\circ\text{C}$ .

**Recommended Operating Conditions**

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	$V_{CC}$	2.0	5.5	V	
Input voltage range	$V_I$	0	5.5	V	
Output voltage range	$V_O$	0	5.5	V	
Output current	$I_{OL}$	—	50	$\mu A$	$V_{CC} = 2.0 V$
		—	2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	6		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	12		$V_{CC} = 4.5 \text{ to } 5.5 V$
Input transition rise or fall rate	$\Delta t/\Delta v$	0	200	ns/V	$V_{CC} = 2.3 \text{ to } 2.7 V$
		0	100		$V_{CC} = 3.0 \text{ to } 3.6 V$
		0	20		$V_{CC} = 4.5 \text{ to } 5.5 V$
Operating free-air temperature	$T_a$	-40	85	$^{\circ}C$	

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

**Logic Diagram**



**DC Electrical Characteristics**

- $T_a = -40 \text{ to } 85^{\circ}C$
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Item	Symbol	$V_{CC} (V)^*$	Min	Typ	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	—	—	$V_{CC} \times 0.3$		
Output voltage	$V_{OL}$	Min to Max	—	—	0.1	V	$I_{OL} = 50 \mu A$
		2.3	—	—	0.4		$I_{OL} = 2 \text{ mA}$
		3.0	—	—	0.44		$I_{OL} = 6 \text{ mA}$
		4.5	—	—	0.55		$I_{OL} = 12 \text{ mA}$
Input current	$I_{IN}$	0 to 5.5	—	—	$\pm 1$	$\mu A$	$V_{IN} = 5.5 V \text{ or } GND$

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Item	Symbol	V <sub>CC</sub> (V)*	Min	Typ	Max	Unit	Test Conditions
Quiescent supply current	I <sub>CC</sub>	5.5	—	—	20	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0
Output leakage current	I <sub>OFF</sub>	0	—	—	5	μA	V <sub>O</sub> = 5.5 V
Input capacitance	C <sub>IN</sub>	3.3	—	2.3	—	pF	V <sub>I</sub> = V <sub>CC</sub> or GND

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

### Switching Characteristics

- V<sub>CC</sub> = 2.5 ± 0.2 V

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T<sub>a</sub> = 25°C

T<sub>a</sub> = -40 to 85°C

Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay	t <sub>PLH</sub>	—	4.7	10.4	1.0	13.0	ns	C <sub>L</sub> = 15 pF	A	Y
		—	9.5	15.2	1.0	18.0		C <sub>L</sub> = 50 pF		
time	t <sub>PHL</sub>	—	5.4	10.4	1.0	13.0		C <sub>L</sub> = 15 pF		
		—	7.9	15.2	1.0	18.0		C <sub>L</sub> = 50 pF		

- V<sub>CC</sub> = 3.3 ± 0.3 V

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T<sub>a</sub> = 25°C

T<sub>a</sub> = -40 to 85°C

Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay	t <sub>PLH</sub>	—	4.0	7.1	1.0	8.5	ns	C <sub>L</sub> = 15 pF	A	Y
		—	7.3	10.6	1.0	12.0		C <sub>L</sub> = 50 pF		
time	t <sub>PHL</sub>	—	4.3	7.1	1.0	8.5		C <sub>L</sub> = 15 pF		
		—	5.8	10.6	1.0	12.0		C <sub>L</sub> = 50 pF		

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

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$T_a = 25^\circ\text{C}$

$T_a = -40 \text{ to } 85^\circ\text{C}$

Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay	$t_{PLH}$	—	3.3	5.5	1.0	6.5	ns	$C_L = 15 \text{ pF}$	A	Y
		—	5.6	7.5	1.0	8.5		$C_L = 50 \text{ pF}$		
time	$t_{PHL}$	—	3.4	5.5	1.0	6.5		$C_L = 15 \text{ pF}$		
		—	4.1	7.5	1.0	8.5		$C_L = 50 \text{ pF}$		

### Operating Characteristics

- $C_L = 50 \text{ pF}$

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$T_a = 25^\circ\text{C}$

Item	Symbol	$V_{CC} \text{ (V)}$	Min	Typ	Max	Unit	Test Conditions
Power dissipation capacitance	$C_{PD}$	3.3	—	9.6	—	pF	$f = 10 \text{ MHz}$
		5.0	—	11.4	—		

### Noise Characteristics

- $C_L = 50 \text{ pF}$

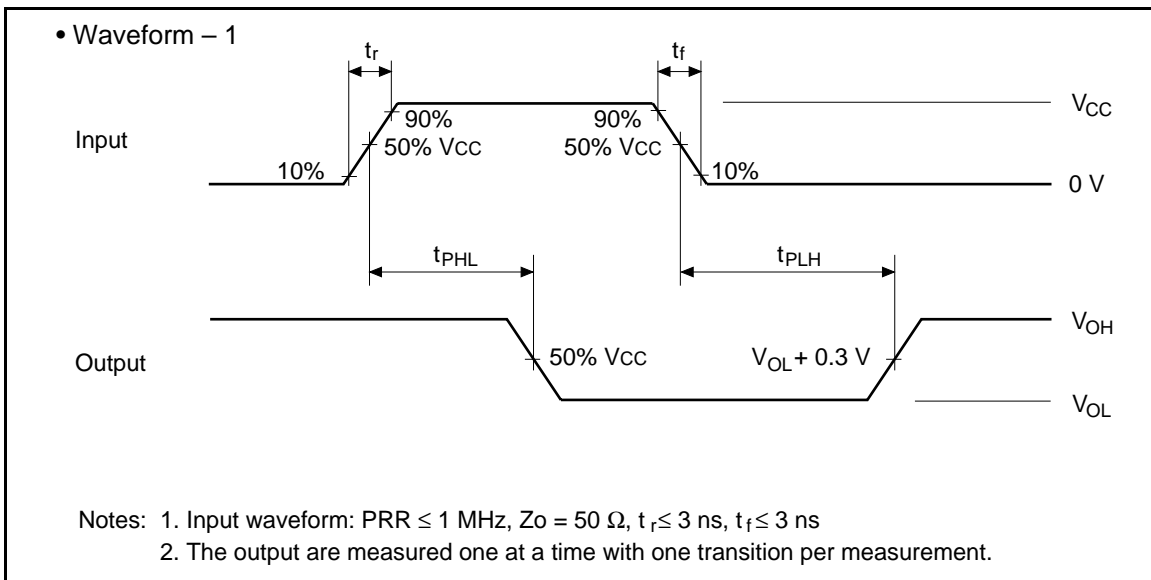
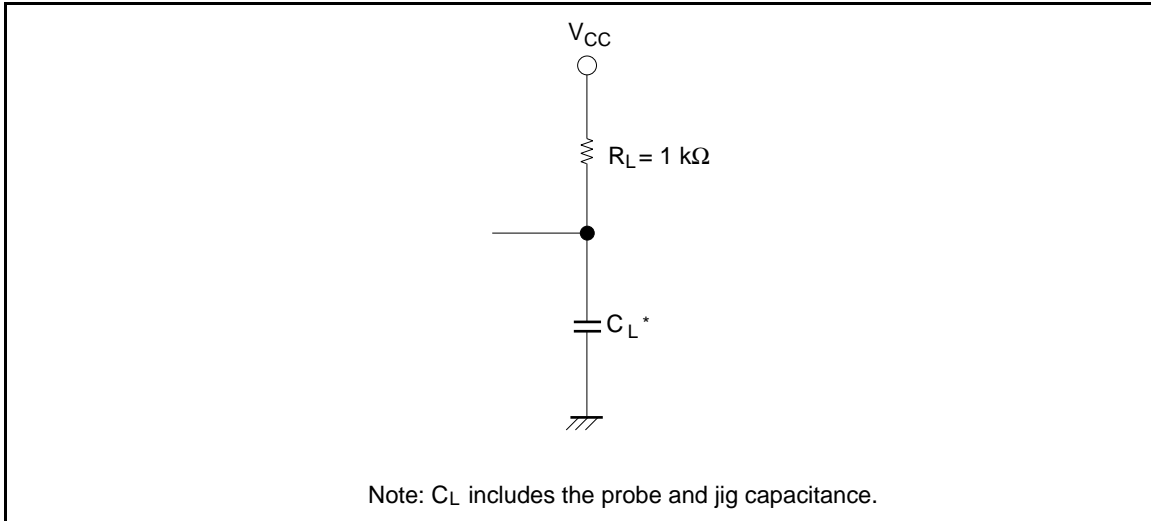
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$T_a = 25^\circ\text{C}$

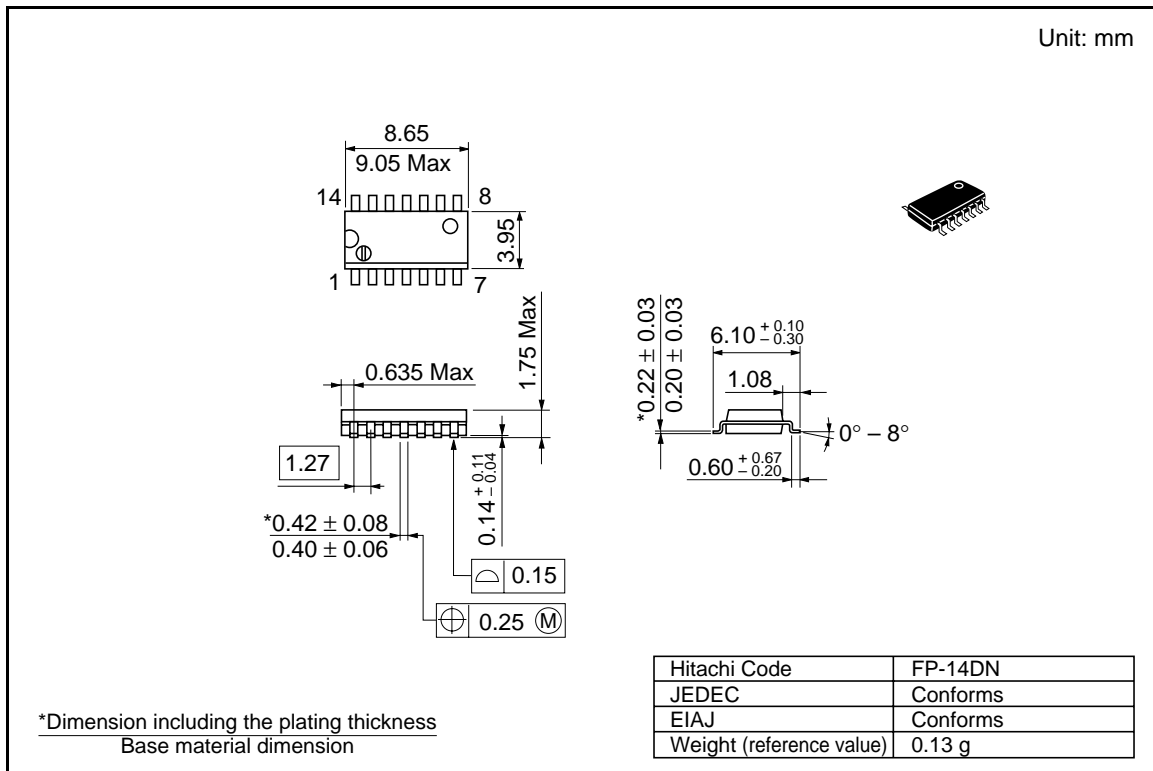
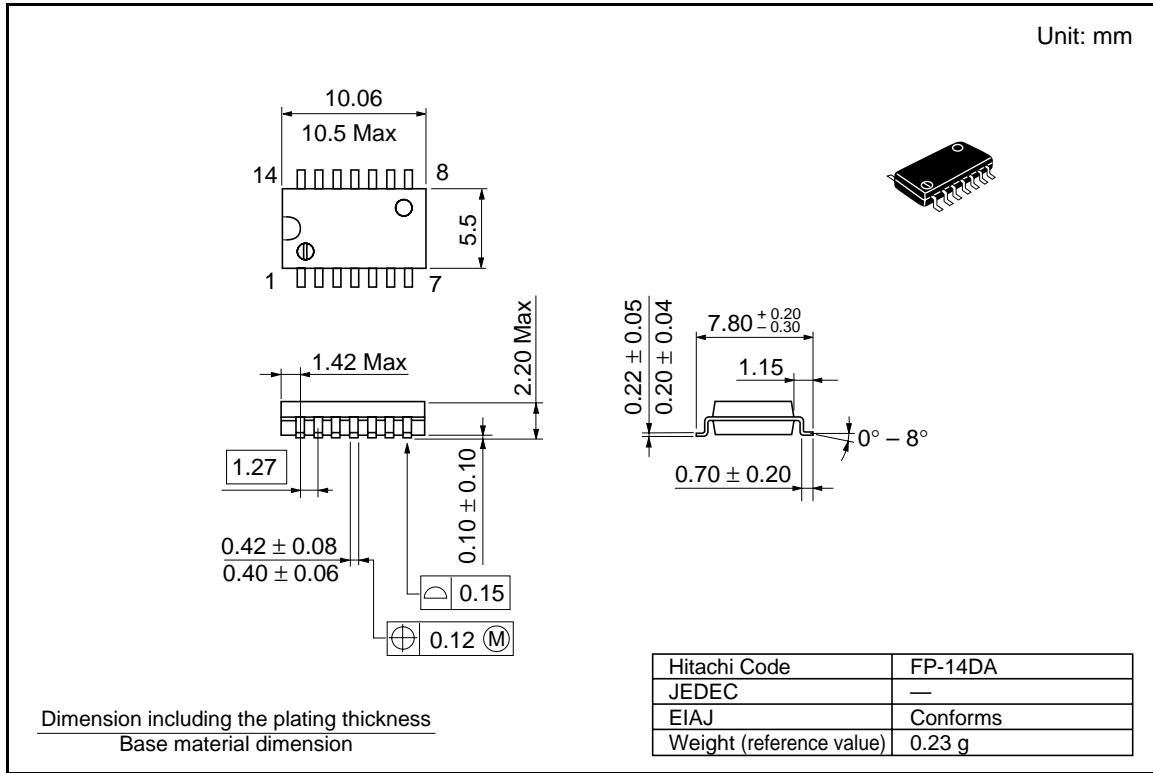
Item	Symbol	$V_{CC} \text{ (V)}$	Min	Typ	Max	Unit	Test Conditions
Quiet output, maximum dynamic $V_{OL}$	$V_{OL(P)}$	3.3	—	0.3	0.8	V	
Quiet output, minimum dynamic $V_{OL}$	$V_{OL(V)}$	3.3	—	-0.1	-0.8		
High-level dynamic input voltage	$V_{IH(D)}$	3.3	2.31	—	—	V	
Low-level dynamic input voltage	$V_{IL(D)}$	3.3	—	—	0.99		

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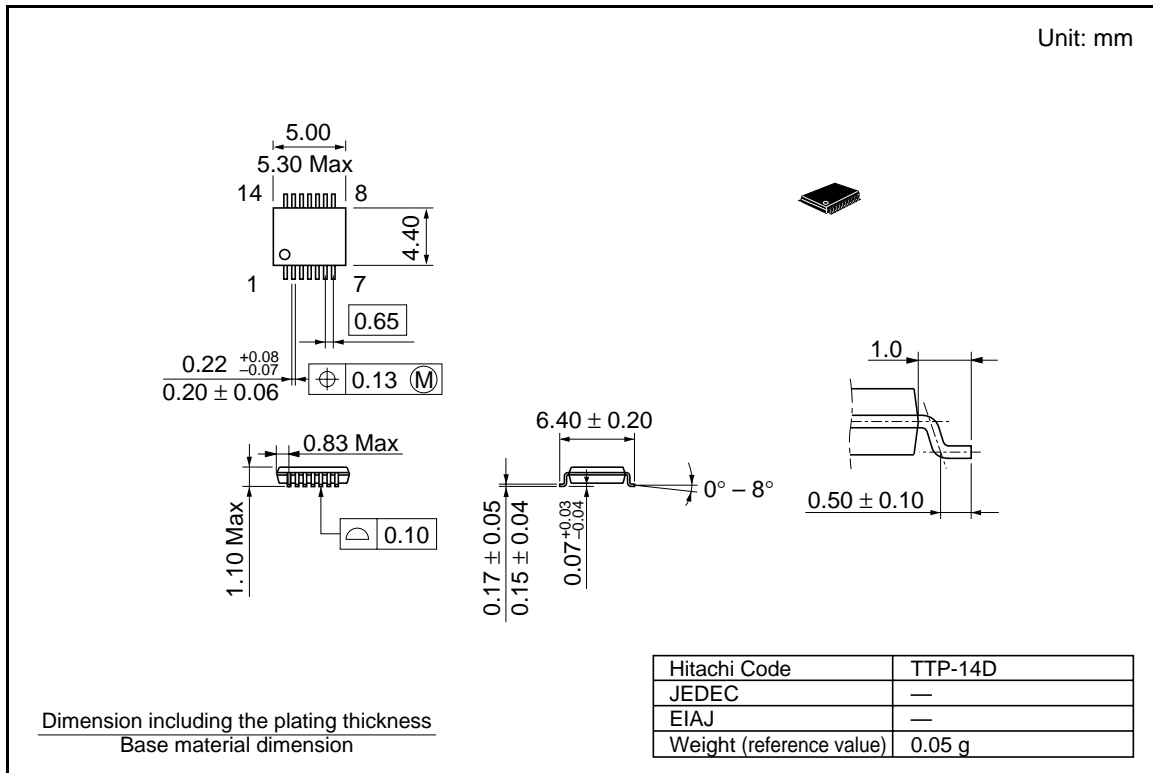
## Test Circuit



Package Dimensions



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