

# HD74AC164/HD74ACT164

## Serial-In, Parallel-Out Shift Register

REJ03D0253-0200Z  
 (Previous ADE-205-373 (Z))  
 Rev.2.00  
 Jul.16.2004

### Description

The HD74AC164/HD74ACT164 is a high-speed 8-bit serial-in/parallel-out shift register. Serial data is entered through a 2-input AND gate synchronous with the Low-to-High transition of the clock. The device features an asynchronous Master Reset which clears the register, setting all outputs Low independent of the clock.

### Features

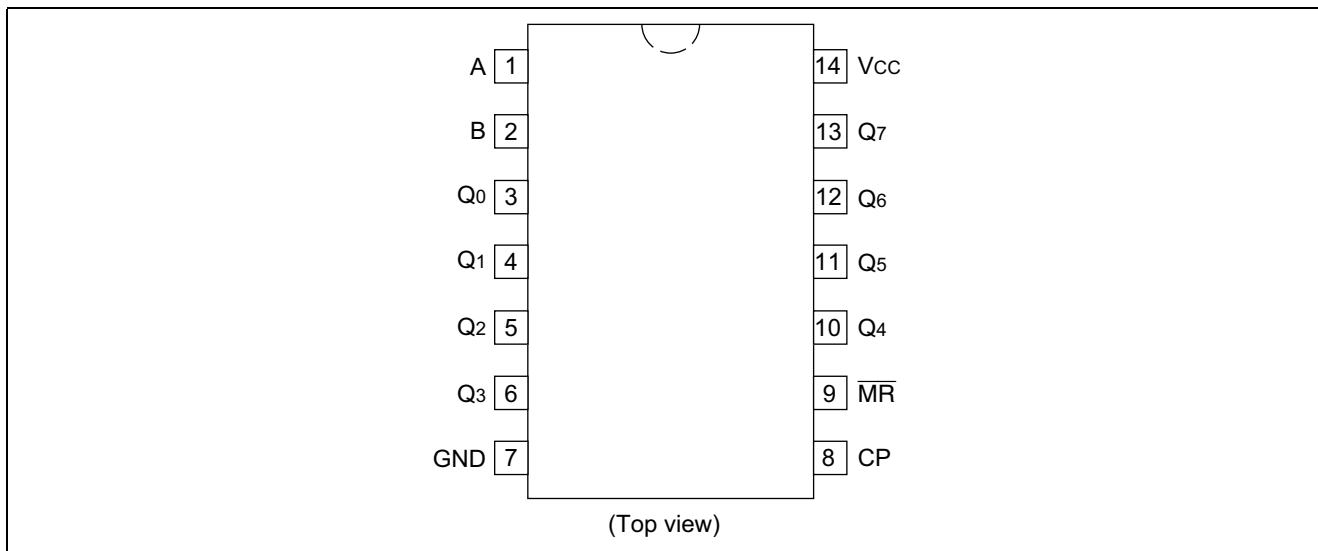
- Outputs Source/Sink 24 mA
- HD74ACT164 has TTL-Compatible Inputs
- Ordering Information

Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC164P	DIP-14 pin	DP-14, -14AV	P	—
HD74AC164FPEL	SOP-14 pin (JEITA)	FP-14DAV	FP	EL (2,000 pcs/reel)
HD74AC164RPEL	SOP-14 pin (JEDEC)	FP-14DNV	RP	EL (2,500 pcs/reel)
HD74AC164TELL	TSSOP-14 pin	TTP-14DV	T	ELL (2,000 pcs/reel)

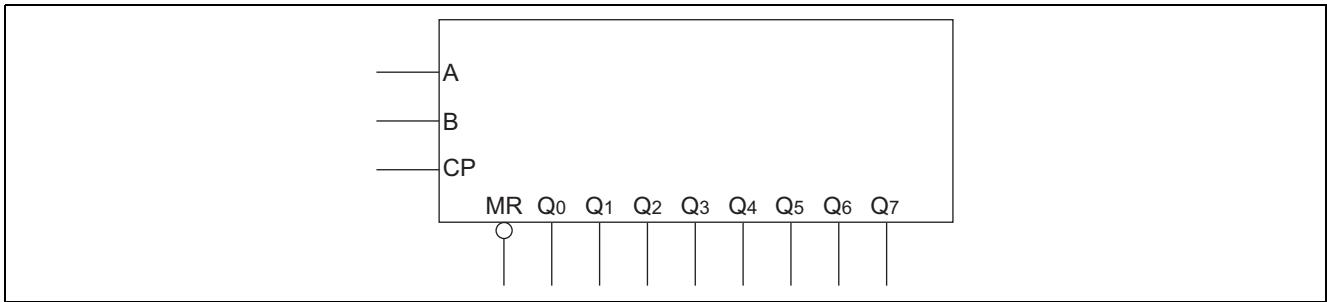
Notes: 1. Please consult the sales office for the above package availability.

2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

### Pin Arrangement



## Logic Symbol



## Pin Names

- A, B Data Inputs
- CP Clock Pulse Input (Active Rising Edge)
- $\overline{MR}$  Master Reset Input (Active Low)
- Q<sub>0</sub> to Q<sub>7</sub> Outputs

## Functional Description

The HD74AC164/HD74ACT164 is an edge-triggered 8-bit shift register with serial data entry and an output from each of the eight stages. Data is entered serially through one of two inputs (A or B); either of these inputs can be used as an active High Enable for data entry through the other inputs. An unused input must be tied High.

Each Low-to-High transition on the Clock (CP) input shifts data one place to the right and enters into Q<sub>0</sub> the logical AND of the two data inputs (A•B) that existed before the rising clock edge. A Low level on the Master Reset (MR) input overrides all other inputs and clears the register asynchronously, forcing all Q outputs Low.

## Mode Select Table

Operating Mode	Inputs			Outputs	
	$\overline{MR}$	A	B	Q <sub>0</sub>	Q <sub>1</sub> to Q <sub>7</sub>
Reset (Clear)	L	X	X	L	L to L
Shift	H	L	L	L	q <sub>0</sub> to q <sub>6</sub>
	H	L	H	L	q <sub>0</sub> to q <sub>6</sub>
	H	H	L	L	q <sub>0</sub> to q <sub>6</sub>
	H	H	H	H	q <sub>0</sub> to q <sub>6</sub>

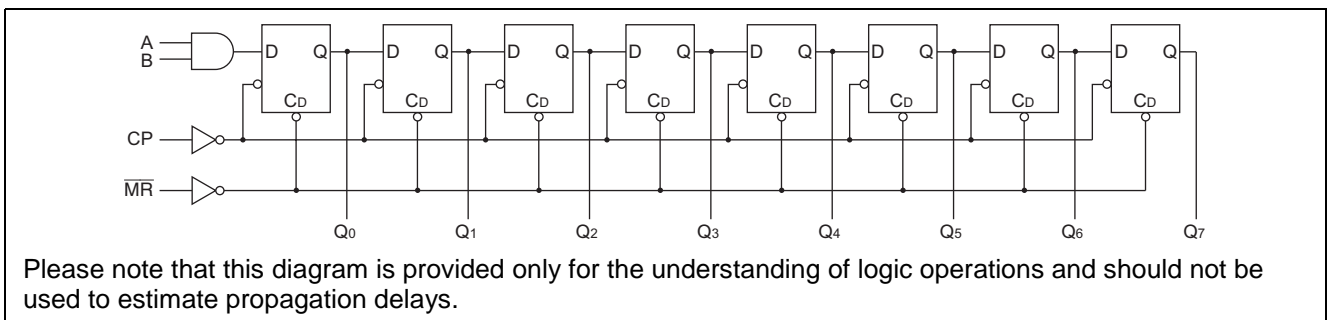
H : High Voltage Level

L : Low Voltage Level

X : Immaterial

q<sub>n</sub> : Lower case letters indicate the state of the referenced input or output one setup time prior to the Low-to-High clock transition.

## Logic Diagram



**Absolute Maximum Ratings**

Item	Symbol	Ratings	Unit	Condition
Supply voltage	$V_{CC}$	-0.5 to 7	V	
DC input diode current	$I_{IK}$	-20	mA	$V_I = -0.5V$
		20	mA	$V_I = V_{CC}+0.5V$
DC input voltage	$V_I$	-0.5 to $V_{CC}+0.5$	V	
DC output diode current	$I_{OK}$	-50	mA	$V_O = -0.5V$
		50	mA	$V_O = V_{CC}+0.5V$
DC output voltage	$V_O$	-0.5 to $V_{CC}+0.5$	V	
DC output source or sink current	$I_O$	$\pm 50$	mA	
DC $V_{CC}$ or ground current per output pin	$I_{CC}, I_{GND}$	$\pm 50$	mA	
Storage temperature	$T_{stg}$	-65 to +150	°C	

**Recommended Operating Conditions: HD74AC164**

Item	Symbol	Ratings	Unit	Condition
Supply voltage	$V_{CC}$	2 to 6	V	
Input and output voltage	$V_I, V_O$	0 to $V_{CC}$	V	
Operating temperature	$T_a$	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) $V_{IN}$ 30% to 70% $V_{CC}$	tr, tf	8	ns/V	$V_{CC} = 3.0V$
				$V_{CC} = 4.5 V$
				$V_{CC} = 5.5 V$

**DC Characteristics: HD74AC164**

Item	Sym- bol	Vcc (V)	$T_a = 25^\circ C$			$T_a = -40$ to $+85^\circ C$		Unit	Condition			
			min.	typ.	max.	min.	max.					
Input Voltage	$V_{IH}$	3.0	2.1	1.5	—	2.1	—	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$			
		4.5	3.15	2.25	—	3.15	—					
		5.5	3.85	2.75	—	3.85	—					
	$V_{IL}$	3.0	—	1.50	0.9	—	0.9		$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$			
		4.5	—	2.25	1.35	—	1.35					
		5.5	—	2.75	1.65	—	1.65					
Output voltage	$V_{OH}$	3.0	2.9	2.99	—	2.9	—	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OUT} = -50 \mu A$			
		4.5	4.4	4.49	—	4.4	—					
		5.5	5.4	5.49	—	5.4	—					
		3.0	2.58	—	—	2.48	—				$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA}$	
		4.5	3.94	—	—	3.80	—					
		5.5	4.94	—	—	4.80	—					
	$V_{OL}$	3.0	—	0.002	0.1	—	0.1		$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OUT} = 50 \mu A$			
		4.5	—	0.001	0.1	—	0.1					
		5.5	—	0.001	0.1	—	0.1					
		3.0	—	—	0.32	—	0.37		$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 24 \text{ mA}$			
		4.5	—	—	0.32	—	0.37					
		5.5	—	—	0.32	—	0.37					
Input leakage current	$I_{IN}$	5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu A$	$V_{IN} = V_{CC}$ or GND			
Dynamic output current*	$I_{OLD}$	5.5	—	—	—	86	—	mA	$V_{OLD} = 1.1 V$			
	$I_{OHD}$	5.5	—	—	—	-75	—	mA	$V_{OHD} = 3.85 V$			
Quiescent supply current	$I_{CC}$	5.5	—	—	8.0	—	80	$\mu A$	$V_{IN} = V_{CC}$ or ground			

\*Maximum test duration 2.0 ms, one output loaded at a time.

**Recommended Operating Conditions: HD74ACT164**

Item	Symbol	Ratings	Unit	Condition
Supply voltage	$V_{CC}$	2 to 6	V	
Input and output voltage	$V_I, V_O$	0 to $V_{CC}$	V	
Operating temperature	$T_a$	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) $V_{IN}$ 0.8 to 2.0 V	$t_r, t_f$	8	ns/V	$V_{CC} = 4.5V$ $V_{CC} = 5.5V$

**DC Characteristics: HD74ACT164**

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ C$			$T_a = -40$ to $+85^\circ C$		Unit	Condition				
			min.	typ.	max.	min.	max.						
Input voltage	$V_{IH}$	4.5	2.0	1.5	—	2.0	—	V	$V_{OUT} = 0.1 V$ or $V_{CC}-0.1 V$				
		5.5	2.0	1.5	—	2.0	—						
	$V_{IL}$	4.5	—	1.5	0.8	—	0.8		$V_{OUT} = 0.1 V$ or $V_{CC}-0.1 V$				
		5.5	—	1.5	0.8	—	0.8						
Output voltage	$V_{OH}$	4.5	4.4	4.49	—	4.4	—	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OUT} = -50 \mu A$				
		5.5	5.4	5.49	—	5.4	—						
		4.5	3.94	—	—	3.80	—			$I_{OH} = -24 mA$			
		5.5	4.94	—	—	4.80	—						
	$V_{OL}$	4.5	—	0.001	0.1	—	0.1		$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OUT} = 50 \mu A$				
		5.5	—	0.001	0.1	—	0.1						
		4.5	—	—	0.32	—	0.37			$I_{OL} = 24 mA$			
		5.5	—	—	0.32	—	0.37						
		Input current	$I_{IN}$	5.5	—	—	$\pm 0.1$			—	$\pm 1.0$	$\mu A$	$V_{IN} = V_{CC}$ or GND
		$I_{CC}$ /input current	$I_{CCT}$	5.5	—	0.6	—			—	1.5	mA	$V_{IN} = V_{CC}-2.1 V$
Dynamic output current*	$I_{OLD}$	5.5	—	—	—	86	—	mA	$V_{OLD} = 1.1 V$				
	$I_{OHD}$	5.5	—	—	—	-75	—	mA	$V_{OHD} = 3.85 V$				
Quiescent supply current	$I_{CC}$	5.5	—	—	8.0	—	80	$\mu A$	$V_{IN} = V_{CC}$ or ground				

\*Maximum test duration 2.0 ms, one output loaded at a time.

**AC Characteristics: HD74AC164**

Item	Symbol	$V_{CC}$ (V)*1	$T_a = +25^\circ C$ $C_L = 50 pF$			$T_a = -40^\circ C$ to $+85^\circ C$ $C_L = 50 pF$		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	$f_{max}$	3.3	125	—	—	100	—	MHz
		5.0	150	—	—	125	—	
Propagation delay CP to $Q_n$	$t_{PLH}$	3.3	1.0	8.5	13.0	1.0	13.5	ns
		5.0	1.0	6.5	10.0	1.0	10.5	
Propagation delay CP to $Q_n$	$t_{PHL}$	3.3	1.0	8.5	13.0	1.0	14.5	
		5.0	1.0	6.5	10.0	1.0	10.5	
Propagation delay MR to $Q_n$	$t_{PHL}$	3.3	1.0	9.5	16.0	1.0	18.0	
		5.0	1.0	7.5	11.5	1.0	13.5	

Note: 1. Voltage Range 3.3 is  $3.3 V \pm 0.3 V$   
Voltage Range 5.0 is  $5.0 V \pm 0.5 V$

**AC Operating Requirements: HD74AC164**

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF		Ta = -40°C to +85°C C <sub>L</sub> = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time A or B to CP	t <sub>SU</sub>	3.3	3.0	5.5	6.0	ns
			5.0	2.0	4.0	
Hold time CP to A or B	t <sub>H</sub>	3.3	-1.5	0.0	0.0	
			5.0	-1.5	0.0	
Pulse width CP or MR	t <sub>W</sub>	3.3	2.0	5.5	7.0	
			5.0	2.0	4.5	
Recovery time MR or CP	t <sub>REC</sub>	3.3	0.0	2.0	2.0	
			5.0	0.0	2.0	2.0

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V  
Voltage Range 5.0 is 5.0 V ± 0.5 V

**AC Characteristics: HD74ACT164**

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF			Ta = -40°C to +85°C C <sub>L</sub> = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	f <sub>max</sub>	5.0	100	—	—	80	—	MHz
Propagation delay CP to Q <sub>n</sub>	t <sub>PLH</sub>	5.0	1.0	9.0	11.5	1.0	12.5	ns
Propagation delay CP to Q <sub>n</sub>	t <sub>PHL</sub>	5.0	1.0	9.0	11.5	1.0	12.5	
Propagation delay MR to Q <sub>n</sub>	t <sub>PHL</sub>	5.0	1.0	9.5	13.0	1.0	14.5	

Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

**AC Operating Requirements: HD74AC164**

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF		Ta = -40°C to +85°C C <sub>L</sub> = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time A or B to CP	t <sub>SU</sub>	5.0	2.5	7.0	8.0	ns
Hold time CP to A or B	t <sub>H</sub>	5.0	0.0	1.5	1.5	
Pulse width CP or MR	t <sub>W</sub>	5.0	4.5	7.0	8.0	
Recovery time MR or CP	t <sub>REC</sub>	5.0	0.0	2.0	2.0	

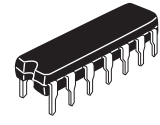
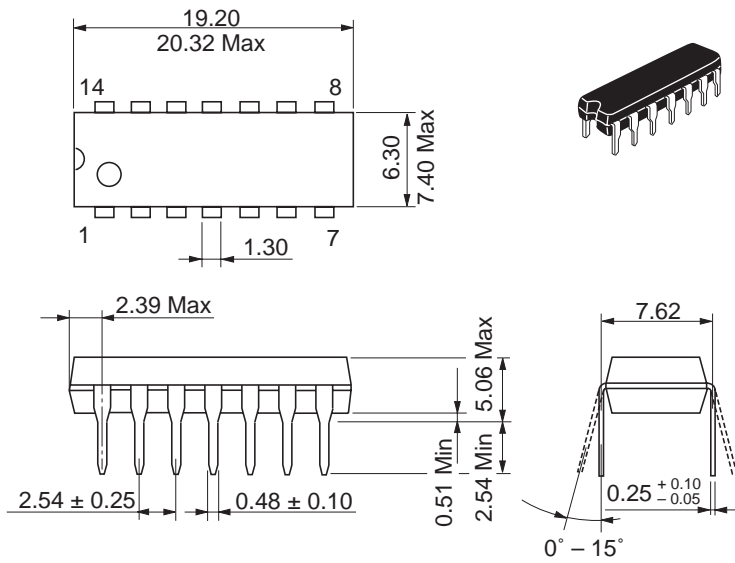
Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

**Capacitance**

Item	Symbol	Typ	Unit	Condition
Input capacitance	C <sub>IN</sub>	4.5	pF	V <sub>CC</sub> = 5.5 V
Power dissipation capacitance	C <sub>PD</sub>	20.0	pF	V <sub>CC</sub> = 5.0 V

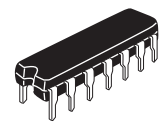
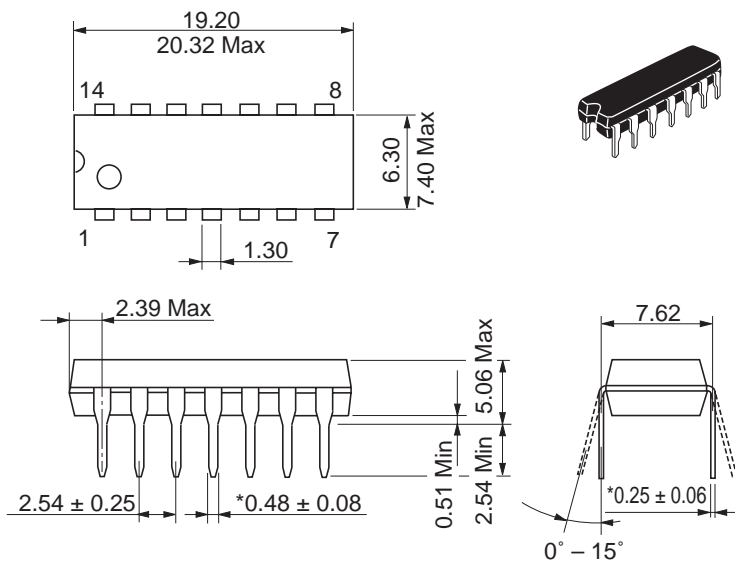
Package Dimensions

As of January, 2003  
Unit: mm



Package Code	DP-14
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.97 g

Unit: mm

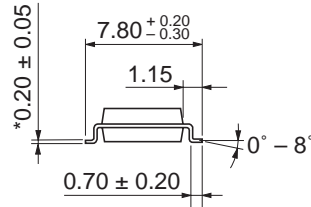
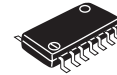
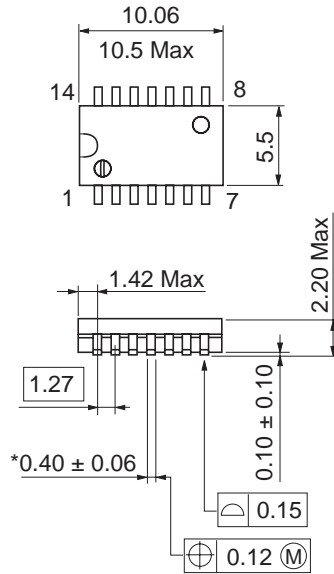


\*Ni/Pd/AU Plating

Package Code	DP-14AV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.97 g

As of January, 2003

Unit: mm

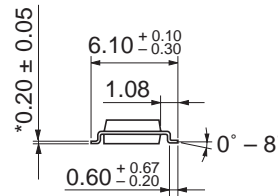
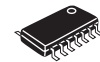
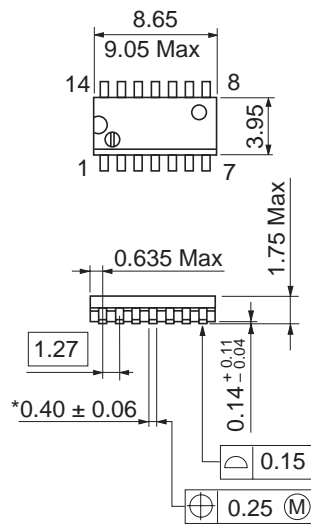


\*Ni/Pd/Au plating

Package Code	FP-14DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.23 g

As of January, 2003

Unit: mm

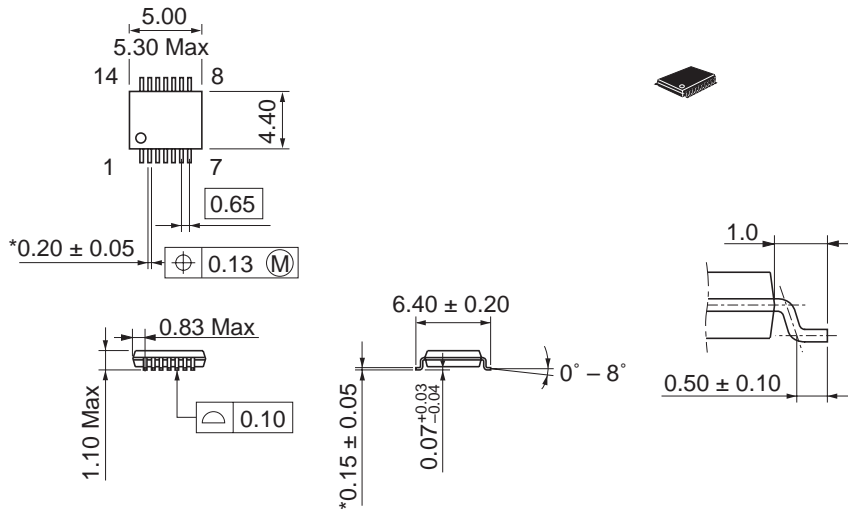


\*Ni/Pd/Au plating

Package Code	FP-14DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.13 g

As of January, 2003

Unit: mm



\*Ni/Pd/Au plating

Package Code	TTP-14DV
JEDEC	—
JEITA	—
Mass (reference value)	0.05 g



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