

HD74AC374/HD74ACT374

Octal D-Type Flip-Flops with 3-State Output

REJ03D0274-0200Z
(Previous ADE-205-395 (Z))
Rev.2.00
Jul.16.2004

Description

The HD74AC374/HD74ACT374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable ($\overline{OE}$) are common to all flip-flops.

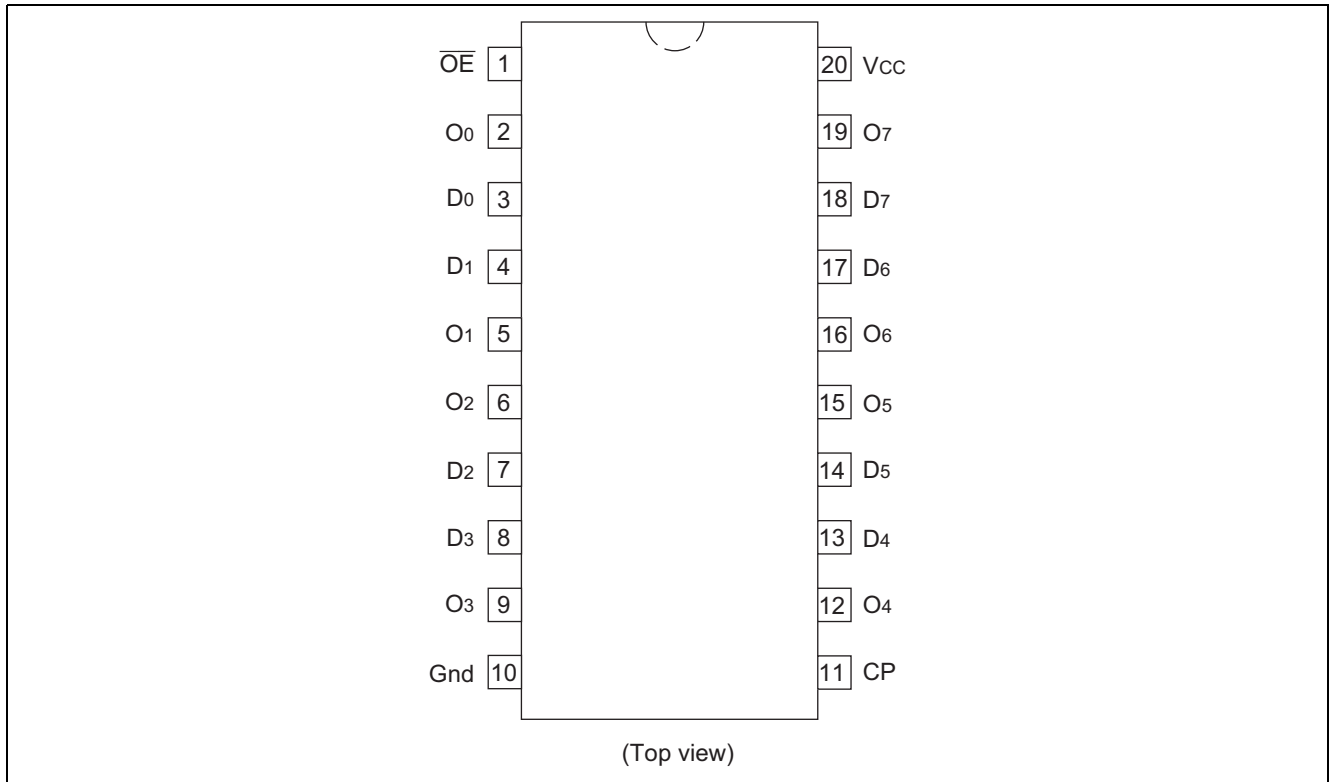
Features

- Buffered Positive Edge-Triggered Clock
- 3-State Outputs for Bus-Oriented Applications
- Outputs Source/Sink 24 mA
- See HD74AC273/HD74ACT273 for Reset Version
- See HD74AC373/HD74ACT373 for Transparent Latch Version
- See HD74AC574/HD74ACT574 for Broadside Pinout Version
- See HD74AC564/HD74ACT564 for Broadside
- Pinout Version with Inverted Outputs
- HD74ACT374 has TTL-Compatible Inputs
- Ordering Information: Ex. HD74AC374

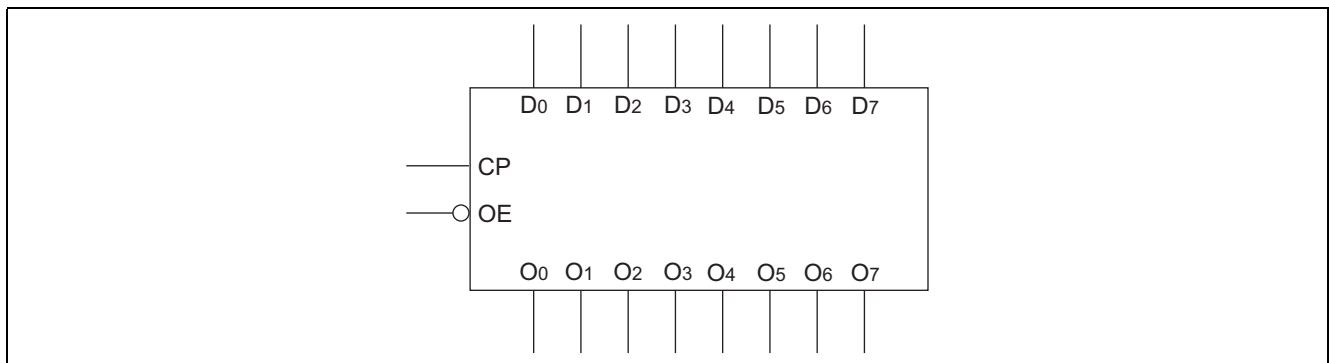
Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC374P	DIP-20 pin	DP-20N, -20NEV	P	—
HD74AC374FPEL	SOP-20 pin (JEITA)	FP-20DAV	FP	EL (2,000 pcs/reel)
HD74AC374RPEL	SOP-20 pin (JEDEC)	FP-20DBV	RP	EL (1,000 pcs/reel)
HD74AC374TELL	TSSOP-20 pin	TTP-20DAV	T	ELL (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

$D_0 - D_7$	Data Inputs
CP	Clock Pulse Input
$\overline{OE}$	3-State Output Enable Input
$O_0 - O_7$	3-State Outputs

Functional Description

The HD74AC374/HD74ACT374 consists of eight edge-triggered flip-flops with individual D-type inputs and 3-state true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the Low-to-High Clock (CP) transition. With the Output Enable ($\overline{OE}$) Low, the contents of the eight flip-flops are available at the outputs. When the $\overline{OE}$ is High, the outputs go to the high impedance state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops.

Truth Table

Inputs			Outputs
D_n	CP	$\overline{OE}$	O_n
H		L	H
L		L	L
X	X	H	Z

H : High Voltage Level

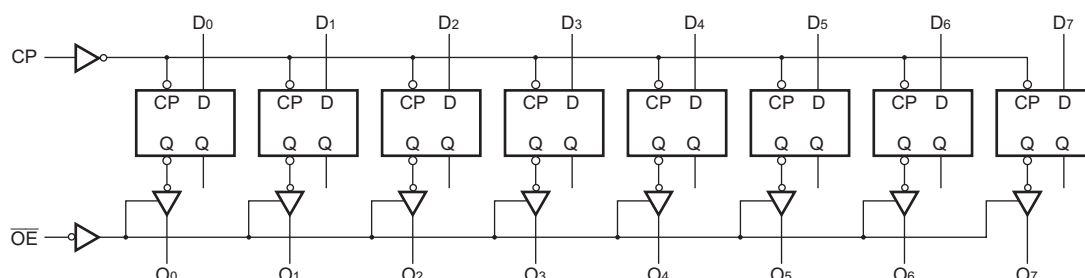
L : Low Voltage Level

X : Immaterial

Z : High Impedance

: Low-to-High Transition

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

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	± 50	mA	
DC V_{CC} or ground current per output pin	I_{CC}, I_{GND}	± 50	mA	
Storage temperature	T_{stg}	-65 to +150	$^{\circ}C$	

Recommended Operating Conditions: HD74AC374

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	$^{\circ}C$	
Input rise and fall time (except Schmitt inputs) V_{IN} 30% to 70% V_{CC}	t_r, t_f	8	ns/V	$V_{CC} = 3.0V$
				$V_{CC} = 4.5V$
				$V_{CC} = 5.5V$

DC Characteristics: HD74AC374

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°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 µA
		4.5	4.4	4.49	—	4.4	—		
		5.5	5.4	5.49	—	5.4	—		
		3.0	2.58	—	—	2.48	—		
		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 µA
		4.5	—	0.001	0.1	—	0.1		
		5.5	—	0.001	0.1	—	0.1		
		3.0	—	—	0.32	—	0.37		
		4.5	—	—	0.32	—	0.37		
		5.5	—	—	0.32	—	0.37		
		3.0	—	—	0.32	—	0.37		
		4.5	—	—	0.32	—	0.37		
		5.5	—	—	0.32	—	0.37		
		3.0	—	—	0.32	—	0.37		
		4.5	—	—	0.32	—	0.37		
		5.5	—	—	0.32	—	0.37		
Input leakage current	I _{IN}	5.5	—	—	±0.1	—	±1.0	µA	V _{IN} = V _{CC} or GND
3 State current	I _{OZ}	5.5	—	—	±0.5	—	±5.0	µA	V _{IN(OE)} = V _{IL} , V _{IH} V _{IN} = V _{CC} or GND V _{OUT} = 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	µA	V _{IN} = V _{CC} or ground

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

Recommended Operating Conditions: HD74ACT374

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	Ta	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V _{IN} 0.8 to 2.0 V	tr, tf	8	ns/V	V _{CC} = 4.5V V _{CC} = 5.5V

DC Characteristics: HD74ACT374

Item	Sym- bol	V _{CC} (V)	Ta = 25°C			Ta = −40 to +85°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 μA			
		5.5	5.4	5.49	—	5.4	—					
		4.5	3.94	—	—	3.80	—		V _{IN} = V _{IL}	I _{OH} = −24 mA		
		5.5	4.94	—	—	4.80	—			I _{OH} = −24 mA		
	V _{OL}	4.5	—	0.001	0.1	—	0.1		V _{IN} = V _{IL} or V _{IH} I _{OUT} = 50 μA			
		5.5	—	0.001	0.1	—	0.1					
		4.5	—	—	0.32	—	0.37		V _{IN} = V _{IL}	I _{OL} = 24 mA		
		5.5	—	—	0.32	—	0.37			I _{OL} = 24 mA		
	Input current	I _{IN}	5.5	—	—	±0.1	—		±1.0	μA	V _{IN} = V _{CC} or GND	
	3 State current	I _{OZ}	5.5	—	—	±0.5	—		±5.0	μA	V _{IN} = V _{IL} , V _{IH} V _{OUT} = 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	μA	V _{IN} = V _{CC} or ground			

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

AC Characteristics: HD74AC374

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF			Ta = -40°C to +85°C C _L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	f _{max}	3.3	60	110	—	60	—	MHz
		5.0	100	155	—	100	—	
Propagation delay CP to O _n	t _{PLH}	3.3	1.0	11.0	13.5	1.0	15.5	ns
		5.0	1.0	8.0	9.5	1.0	10.5	
Propagation delay CP to O _n	t _{PHL}	3.3	1.0	10.0	12.5	1.0	14.0	ns
		5.0	1.0	7.0	9.0	1.0	10.0	
Output enable time	t _{ZH}	3.3	1.0	9.5	11.5	1.0	13.0	ns
		5.0	1.0	7.0	8.5	1.0	9.5	
Output enable time	t _{ZL}	3.3	1.0	9.0	11.5	1.0	13.0	ns
		5.0	1.0	6.5	8.5	1.0	9.5	
Output disable time	t _{HZ}	3.3	1.0	10.5	12.5	1.0	14.5	ns
		5.0	1.0	8.0	11.0	1.0	12.5	
Output disable time	t _{LZ}	3.3	1.0	8.0	11.5	1.0	12.5	ns
		5.0	1.0	6.5	8.5	1.0	10.0	

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 Operating Requirements: HD74AC374

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF		Ta = −40°C to +85°C C _L = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time, HIGH or LOW D _n to CP	t _{su}	3.3	2.0	5.5	6.5	ns
		5.0	1.0	4.0	4.5	
Hold time, HIGH or LOW D _n to CP	t _h	3.3	−1.0	1.0	1.0	ns
		5.0	−4.0	1.5	1.5	
CP pulse width, HIGH or LOW	t _w	3.3	4.0	5.5	6.0	ns
		5.0	2.5	4.0	4.5	

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: HD74ACT374

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF			Ta = -40°C to +85°C C _L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	f _{max}	5.0	100	160	—	90	—	MHz
Propagation delay CP to O _n	t _{PLH}	5.0	1.0	8.5	10.0	1.0	11.5	ns
Propagation delay CP to O _n	t _{PHL}	5.0	1.0	8.0	9.5	1.0	11.0	ns
Output enable time	t _{ZH}	5.0	1.0	8.0	9.5	1.0	10.5	ns
Output enable time	t _{ZL}	5.0	1.0	8.0	9.0	1.0	10.5	ns
Output disable time	t _{HZ}	5.0	1.0	8.5	11.5	1.0	12.5	ns
Output disable time	t _{LZ}	5.0	1.0	7.0	8.5	1.0	10.0	ns

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

AC Operating Requirements: HD74ACT374

Item	Symbol	V _{CC} (V)*1	Ta = +25°C C _L = 50 pF		Ta = −40°C to +85°C C _L = 50 pF	Unit
			Typ	Guaranteed Minimum		
Setup time, HIGH or LOW D _n to CP	t _{su}	5.0	1.0	7.0	5.5	ns
Hold time, HIGH or LOW D _n to CP	t _h	5.0	0.0	1.5	1.5	ns
CP pulse width, HIGH or LOW	t _w	5.0	2.0	7.0	5.0	ns

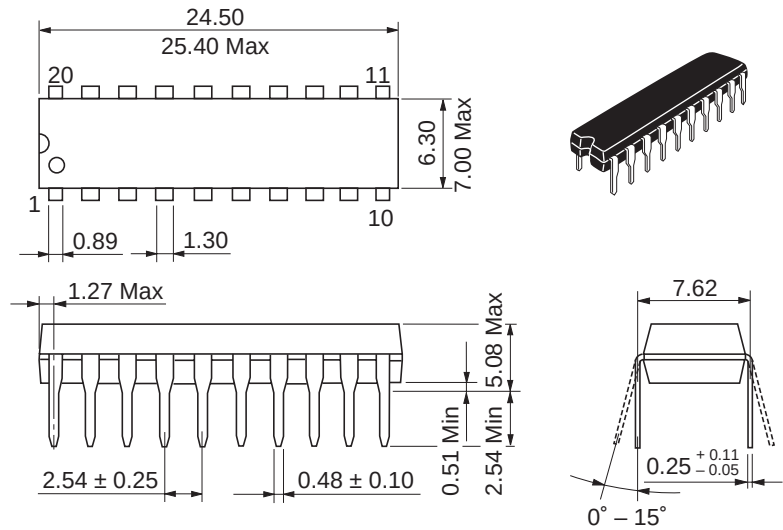
Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

Capacitance

Item	Symbol	Typ	Unit	Condition
Input capacitance	C _{IN}	4.5	pF	V _{CC} = 5.5 V
Power dissipation capacitance	C _{PD}	80.0	pF	V _{CC} = 5.0 V

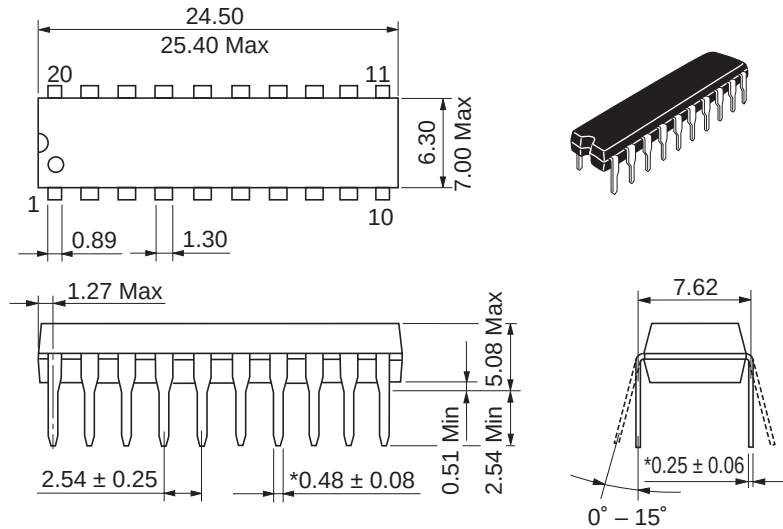
Package Dimensions

As of January, 2003
Unit: mm



Package Code	DP-20N
JEDEC	—
JEITA	Conforms
Mass (reference value)	1.26 g

Unit: mm

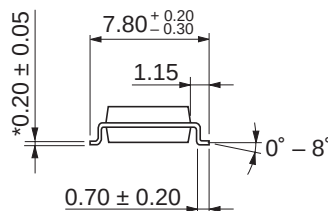
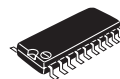
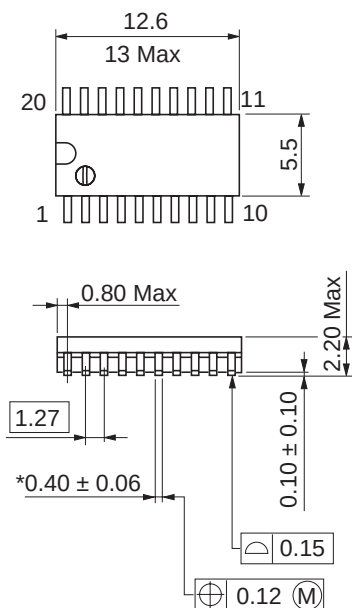


*Ni/Pd/AU Plating

Package Code	DP-20NEV
JEDEC	—
JEITA	Conforms
Mass (reference value)	1.26 g

As of January, 2003

Unit: mm

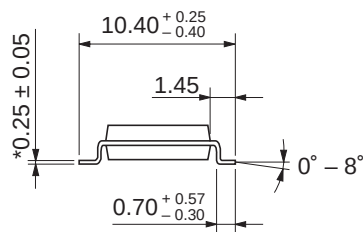
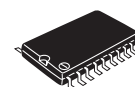
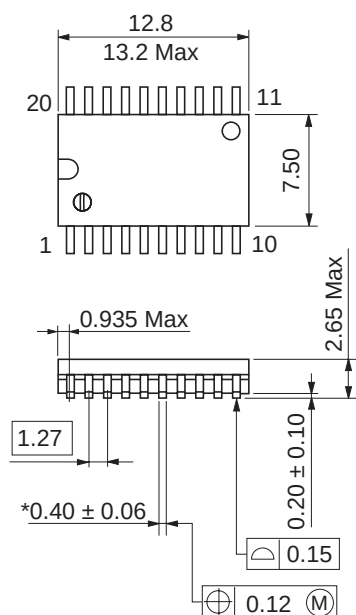


Package Code	FP-20DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.31 g

*Ni/Pd/Au plating

As of January, 2003

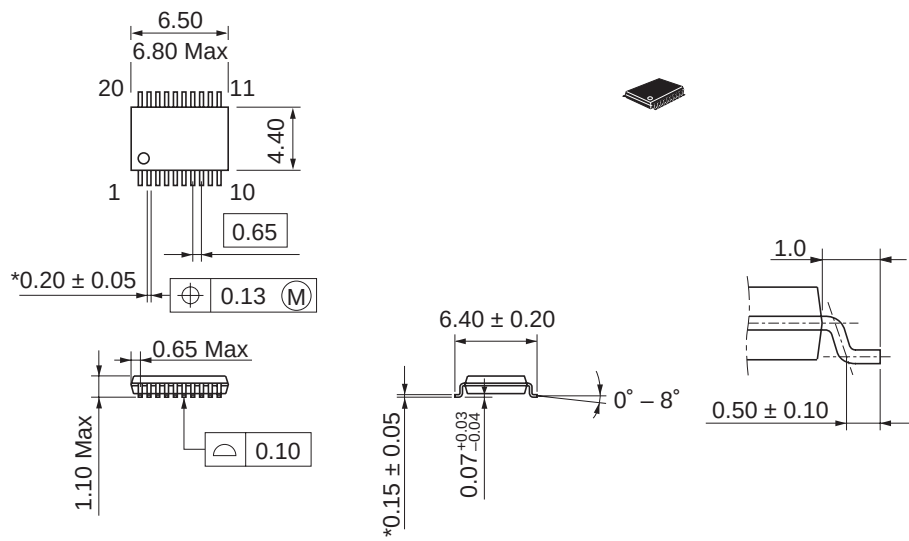
Unit: mm



Package Code	FP-20DBV
JEDEC	Conforms
JEITA	—
Mass (reference value)	0.52 g

*Ni/Pd/Au plating

As of January, 2003
Unit: mm



*Ni/Pd/Au plating

Package Code	TTP-20DAV
JEDEC	—
JEITA	—
Mass (reference value)	0.07 g

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