

# HD74LV245A

## Octal Bus Transceivers with 3-state Outputs

REJ03D0329-0300Z  
 (Previous ADE-205-247A (Z))  
 Rev.3.00  
 Jun. 24, 2004

### Description

The HD74LV245A has eight buffers with three-state outputs in a 20-pin package. When DIR is high, data is transferred from the A inputs to the B outputs, and when DIR is low, data is transferred from the B inputs to the A outputs. The A and B buses are separated by making the enable input (OE) high level. Low-voltage operation is suitable for 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  $V_{IH}(\text{Max.}) = 5.5\text{ V}$  (@  $V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_O(\text{Max.}) = 5.5\text{ V}$  (@  $V_{CC} = 0\text{ V}$ )
- 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  $\pm 8\text{ mA}$  (@  $V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 16\text{ mA}$  (@  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

### Ordering Information

Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LV245AFPEL	SOP-20 pin (JEITA)	FP-20DAV	FP	EL (2,000 pcs/reel)
HD74LV245ARPEL	SOP-20 pin (JEDEC)	FP-20DBV	RP	EL (1,000 pcs/reel)
HD74LV245ATELL	TSSOP-20 pin	TTP-20DAV	T	ELL (2,000 pcs/reel)

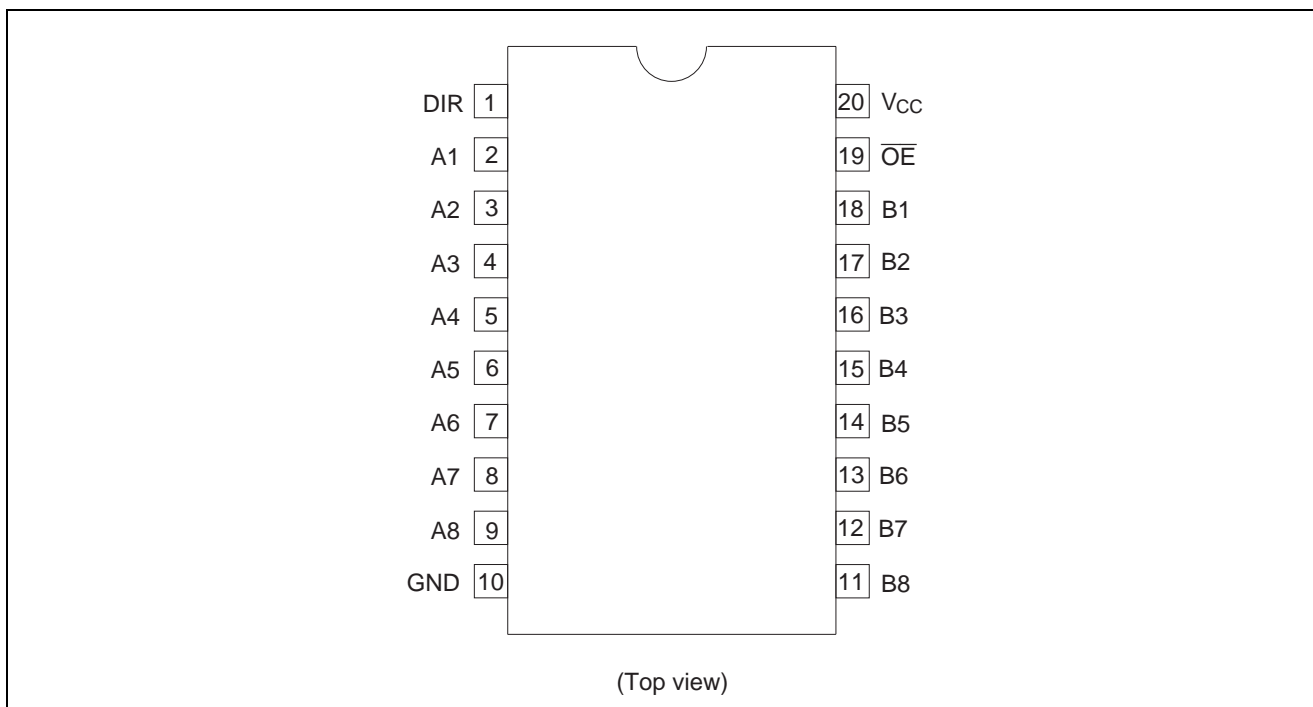
Note: Please consult the sales office for the above package availability.

### Function Table

Inputs		Operation
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

Note: H: High level  
 L: Low level  
 X: Immaterial

Pin Arrangement



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V	
Input voltage range* <sup>1</sup>	$V_I$	-0.5 to 7.0	V	
Output voltage range* <sup>1, *2</sup>	$V_O$	-0.5 to $V_{CC} + 0.5$ -0.5 to 7.0	V	Output: H or L $V_{CC}$ : OFF or Output: Z
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	$I_O$	$\pm 35$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 70$	mA	
Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* <sup>3</sup>	$P_T$	835 757	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.

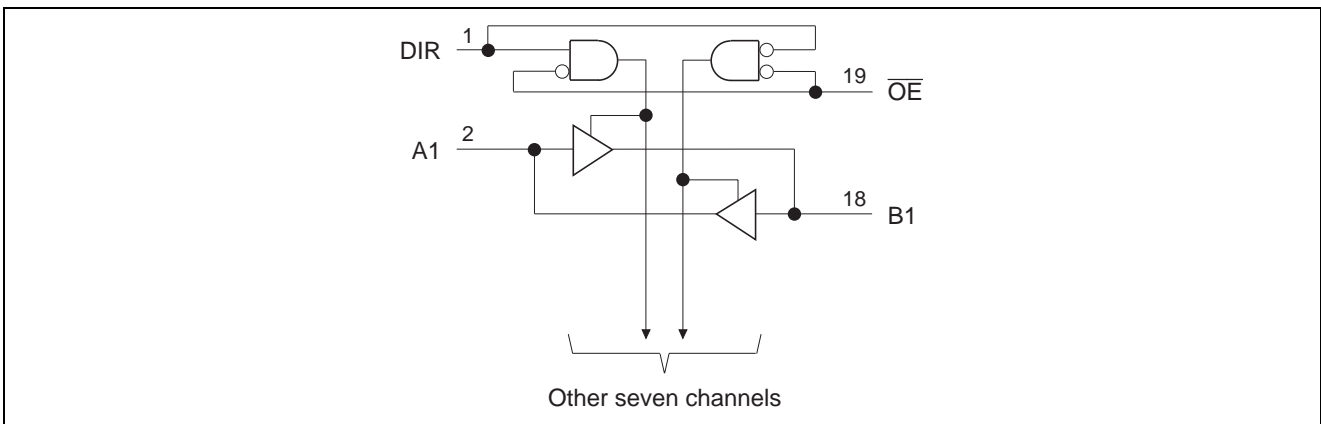
1. The input and output voltage ratings may be exceeded even if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The data above are measured by  $\Delta V_{BE}$  method mounting on glass epoxy board (40 × 40 × 1.6 mm) with 10% of wiring density.

**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	$V_{CC}$	V	Output: H or L
		0	5.5		High impedance state
Output current	$I_{OH}$	—	-50	$\mu A$	$V_{CC} = 2.0 V$
		—	-2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	-8		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	-16		$V_{CC} = 4.5 \text{ to } 5.5 V$
	$I_{OL}$	—	50	$\mu A$	$V_{CC} = 2.0 V$
		—	2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	8		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	16		$V_{CC} = 4.5 \text{ to } 5.5 V$
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

Ta = -40 to 85°C

Item	Symbol	V <sub>CC</sub> (V)* <sup>1</sup>	Min	Typ	Max	Unit	Test Conditions		
Input voltage	V <sub>IH</sub>	2.0	1.5	—	—	V			
		2.3 to 2.7	V <sub>CC</sub> × 0.7	—	—				
		3.0 to 3.6	V <sub>CC</sub> × 0.7	—	—				
		4.5 to 5.5	V <sub>CC</sub> × 0.7	—	—				
	V <sub>IL</sub>	2.0	—	—	0.5				
		2.3 to 2.7	—	—	V <sub>CC</sub> × 0.3				
		3.0 to 3.6	—	—	V <sub>CC</sub> × 0.3				
		4.5 to 5.5	—	—	V <sub>CC</sub> × 0.3				
Output voltage	V <sub>OH</sub>	Min to Max	V <sub>CC</sub> - 0.1	—	—	V	I <sub>OH</sub> = -50 μA		
		2.3	2.0	—	—		I <sub>OH</sub> = -2 mA		
		3.0	2.48	—	—		I <sub>OH</sub> = -8 mA		
		4.5	3.8	—	—		I <sub>OH</sub> = -16 mA		
	V <sub>OL</sub>	Min to Max	—	—	0.1		I <sub>OL</sub> = 50 μA		
		2.3	—	—	0.4		I <sub>OL</sub> = 2 mA		
		3.0	—	—	0.44		I <sub>OL</sub> = 8 mA		
		4.5	—	—	0.55		I <sub>OL</sub> = 16 mA		
	Input current	I <sub>IN</sub>	0 to 5.5	—	—		±1	μA	V <sub>IN</sub> = 5.5 V or GND
	Off-state output current	I <sub>OZ</sub> * <sup>2</sup>	5.5	—	—		±5	μA	V <sub>O</sub> = V <sub>CC</sub> or GND
	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>I</sub> or V <sub>O</sub> = 0 V to 5.5 V
Input capacitance	C <sub>IN</sub>	3.3	—	3.0	—	pF	V <sub>I</sub> = V <sub>CC</sub> or GND		
Output capacitance	C <sub>O</sub>	3.3	—	5.5	—	pF	V <sub>O</sub> = V <sub>CC</sub> or GND		

Notes: 1. For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.  
 2. For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

Switching Characteristics

V<sub>CC</sub> = 2.5 ± 0.2 V

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	t <sub>PLH</sub>	—	8.3	13.0	1.0	15.0	ns	C <sub>L</sub> = 15 pF	A or B	B or A
	t <sub>PHL</sub>	—	11.2	15.9	1.0	18.0		C <sub>L</sub> = 50 pF		
Enable time	t <sub>ZH</sub>	—	11.8	19.9	1.0	22.0	ns	C <sub>L</sub> = 15 pF	OE	A or B
	t <sub>ZL</sub>	—	14.1	22.7	1.0	26.0		C <sub>L</sub> = 50 pF		
Disable time	t <sub>HZ</sub>	—	11.8	18.1	1.0	20.0	ns	C <sub>L</sub> = 15 pF	OE	A or B
	t <sub>LZ</sub>	—	17.6	23.1	1.0	25.0		C <sub>L</sub> = 50 pF		

V<sub>CC</sub> = 3.3 ± 0.3 V

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	t <sub>PLH</sub>	—	5.9	8.4	1.0	10.0	ns	C <sub>L</sub> = 15 pF	A or B	B or A
	t <sub>PHL</sub>	—	7.9	11.9	1.0	13.5		C <sub>L</sub> = 50 pF		
Enable time	t <sub>ZH</sub>	—	8.2	13.2	1.0	15.5	ns	C <sub>L</sub> = 15 pF	OE	A or B
	t <sub>ZL</sub>	—	9.9	16.7	1.0	19.0		C <sub>L</sub> = 50 pF		
Disable time	t <sub>HZ</sub>	—	9.6	16.5	1.0	19.5	ns	C <sub>L</sub> = 15 pF	OE	A or B
	t <sub>LZ</sub>	—	13.9	19.8	1.0	22.0		C <sub>L</sub> = 50 pF		

V<sub>CC</sub> = 5.0 ± 0.5 V

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	t <sub>PLH</sub>	—	4.3	5.5	1.0	6.5	ns	C <sub>L</sub> = 15 pF	A or B	B or A
	t <sub>PHL</sub>	—	5.6	7.5	1.0	8.5		C <sub>L</sub> = 50 pF		
Enable time	t <sub>ZH</sub>	—	5.7	8.5	1.0	10.0	ns	C <sub>L</sub> = 15 pF	OE	A or B
	t <sub>ZL</sub>	—	7.0	10.6	1.0	12.0		C <sub>L</sub> = 50 pF		
Disable time	t <sub>HZ</sub>	—	7.8	12.8	1.0	14.2	ns	C <sub>L</sub> = 15 pF	OE	A or B
	t <sub>LZ</sub>	—	10.9	14.7	1.0	16.0		C <sub>L</sub> = 50 pF		

Output-skew Characteristics

C<sub>L</sub> = 50 pF

Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C		Ta = -40 to 85°C		Unit
			Min	Max	Min	Max	
Output skew	t <sub>sk(O)</sub>	2.3 to 2.7	—	2.0	—	2.0	ns
			—	1.5	—	1.5	
			—	1.0	—	1.0	

Note: Skew between any outputs of the same package switching in the same direction. This parameter is warranted but not production tested.

Operating Characteristics

$C_L = 50 \text{ pF}$

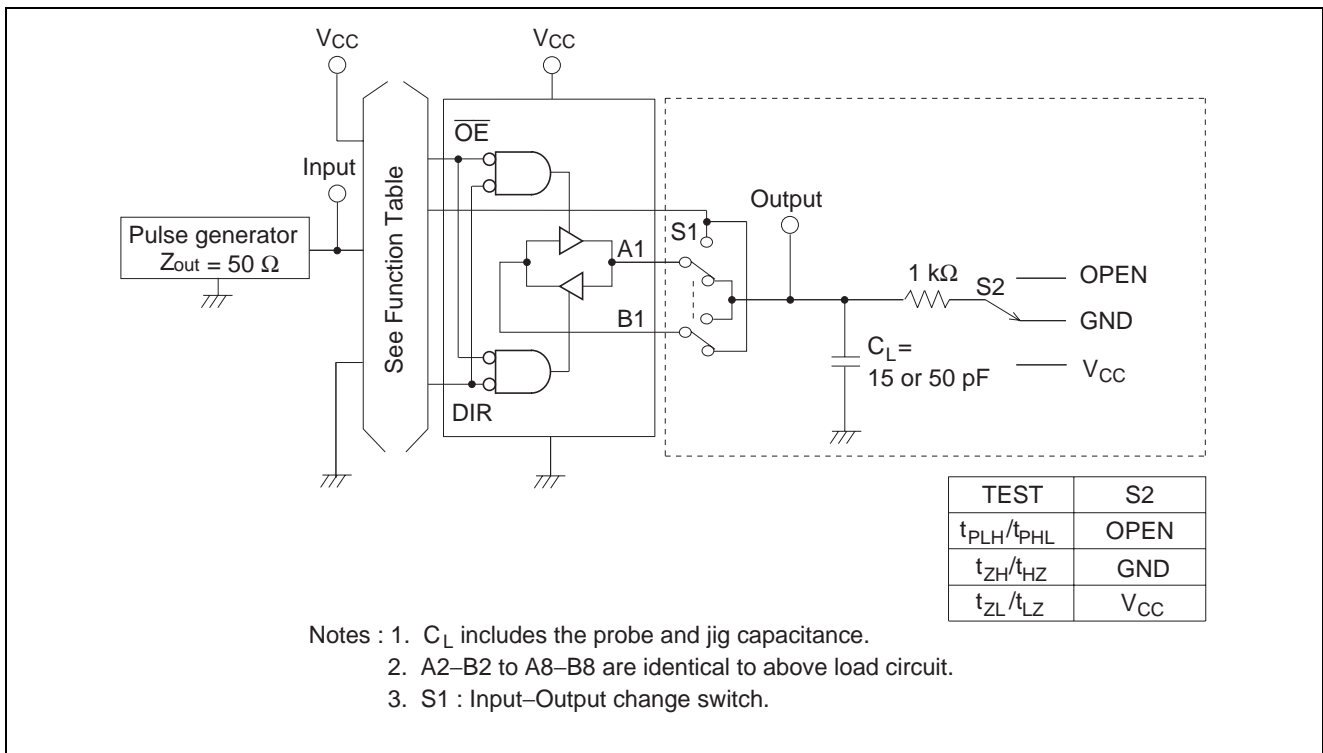
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	$C_{PD}$	3.3	—	20.0	—	pF	$f = 10 \text{ MHz}$
		5.0	—	25.0	—		

Noise Characteristics

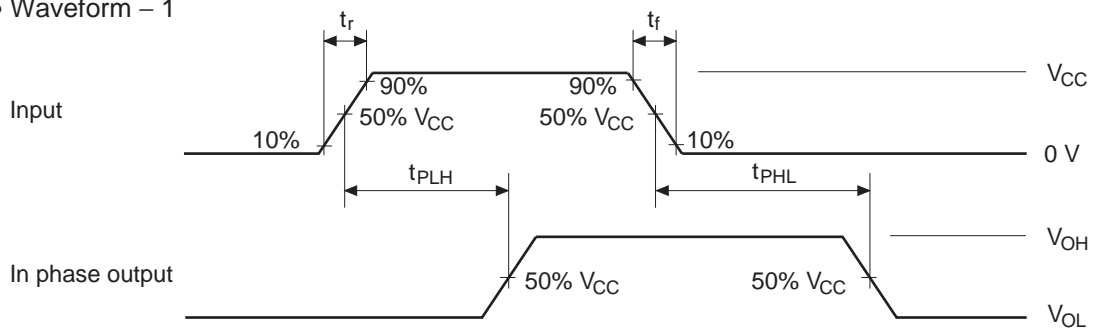
$C_L = 50 \text{ pF}$

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic $V_{OL}$	$V_{OL(P)}$	3.3	—	0.5	0.8	V	
Quiet output, minimum dynamic $V_{OL}$	$V_{OL(V)}$	3.3	—	-0.4	-0.8	V	
Quiet output, minimum dynamic $V_{OH}$	$V_{OH(V)}$	3.3	—	2.9	—	V	
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	V	

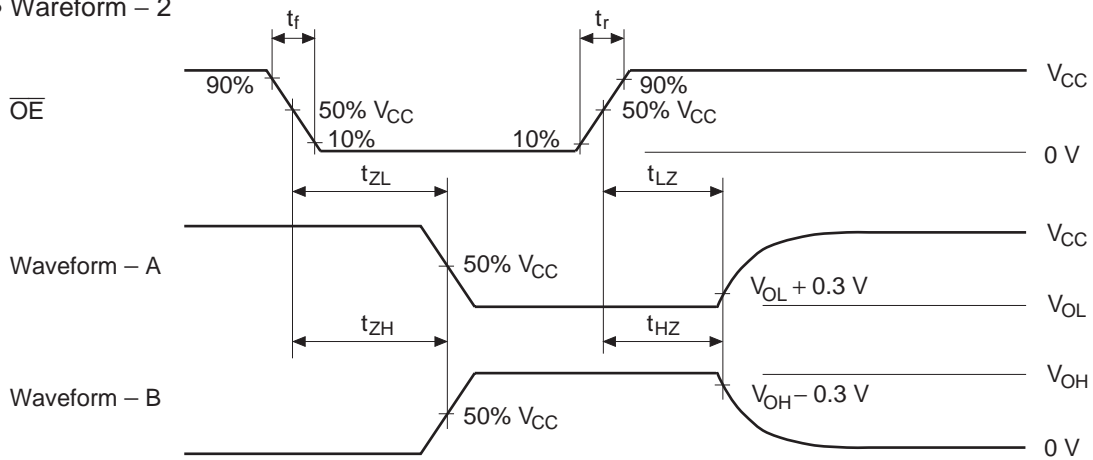
Test Circuit



• Waveform – 1

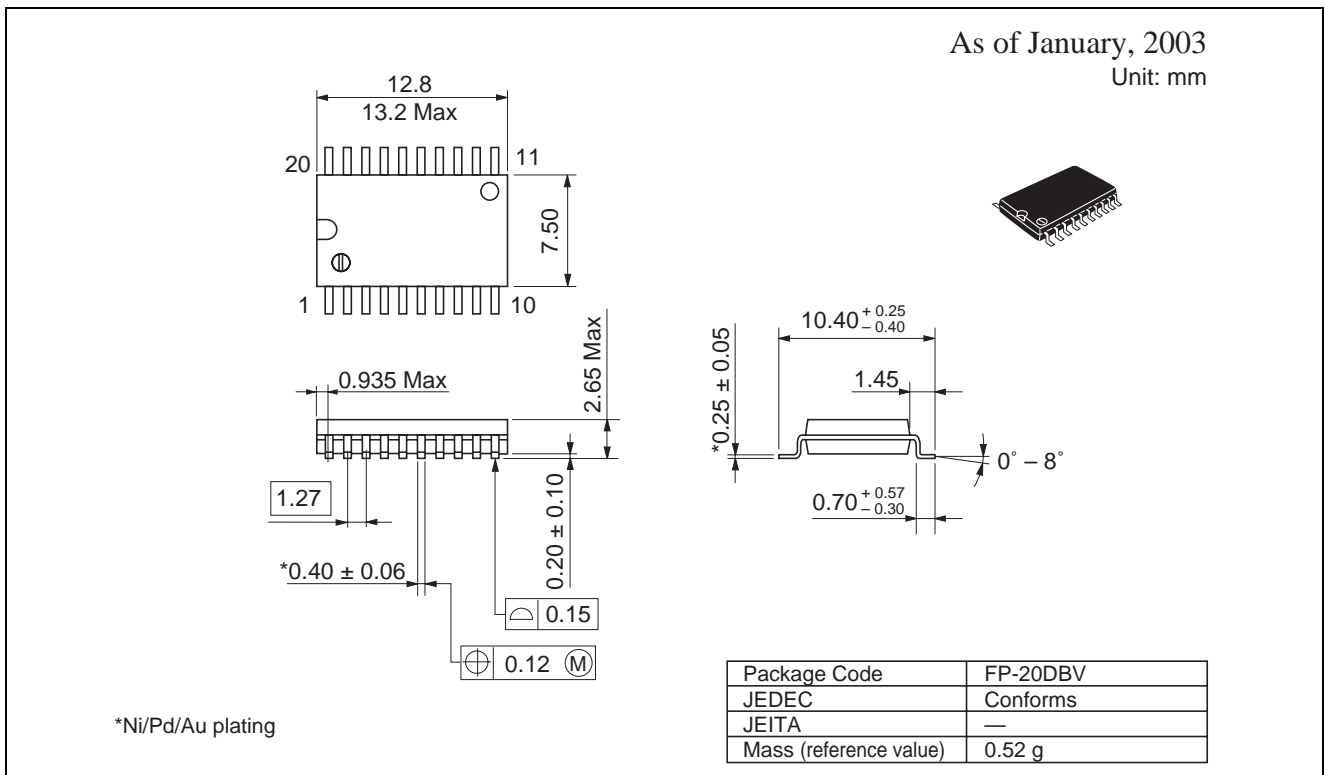
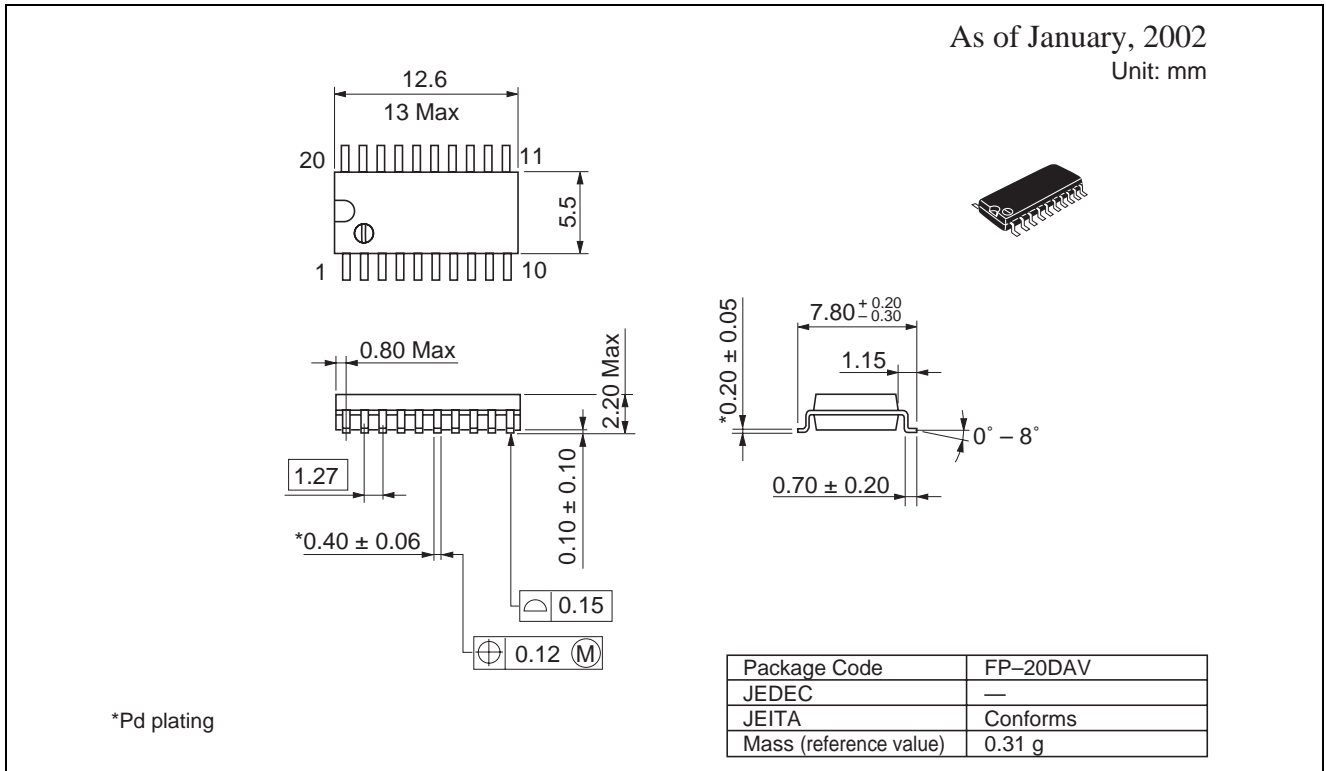


• Waveform – 2



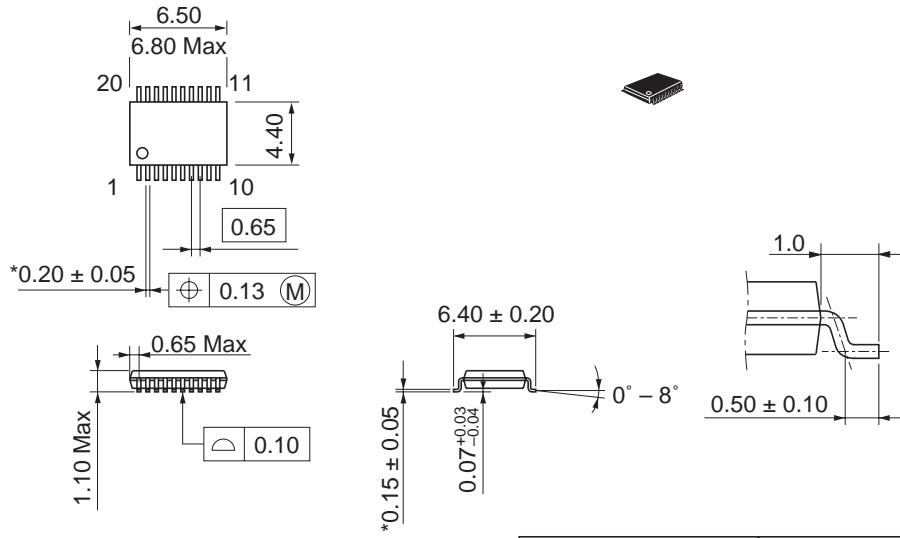
- Notes:
1. Input waveform:  $PRR \leq 1 \text{ MHz}$ ,  $Z_o = 50 \Omega$ ,  $t_r \leq 3 \text{ ns}$ ,  $t_f \leq 3 \text{ ns}$
  2. Waveform–A is for an output with internal conditions such that the output is low except when disabled by the output control.
  3. Waveform–B is for an output with internal conditions such that the output is high except when disabled by the output control.
  4. The output are measured one at a time with one transition per measurement.

Package Dimensions





As of January, 2002  
Unit: mm



\*Pd plating

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

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