

# HD74LV221A

## Dual Monostable Multivibrators

REJ03D0326-0600Z  
(Previous ADE-205-271D (Z))  
Rev.6.00  
Jun. 23, 2004

### Description

The HD74LV221A features output pulse-duration control by three methods. In the first method, the  $\overline{A}$  input is low and the B input goes high. In the second method, the B input is high and the  $\overline{A}$  input goes low. In the third method, the  $\overline{A}$  input is low, the B input is high, and the clear (CLR) input goes high.

The basic pulse duration is programmed by selecting external resistance and capacitance values. The external timing capacitor must be connected between Cext and Rext/Cext (positive) and an external resistor connected between Rext/Cext and  $V_{CC}$ .

To obtain variable pulse durations, connect an external variable resistance between Rext/Cext and  $V_{CC}$ . Pulse duration can be reduced by taking  $\overline{CLR}$  low.

### 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)
- All outputs  $V_O$  (Max.) = 5.5 V (@ $V_{CC}$  = 0 V)
- Output current  $\pm 6$  mA (@ $V_{CC}$  = 3.0 V to 3.6 V),  $\pm 12$  mA (@ $V_{CC}$  = 4.5 V to 5.5 V)
- Ordering Information

| Part Name      | Package Type       | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|----------------|--------------------|--------------|----------------------|--------------------------------|
| HD74LV221AFPEL | SOP-16 pin (JEITA) | FP-16DAV     | FP                   | EL (2,000 pcs/reel)            |
| HD74LV221ARPEL | SOP-16 pin (JEDEC) | FP-16DNV     | RP                   | EL (2,500 pcs/reel)            |
| HD74LV221ATELL | TSSOP-16 pin       | TTP-16DAV    | T                    | ELL (2,000 pcs/reel)           |

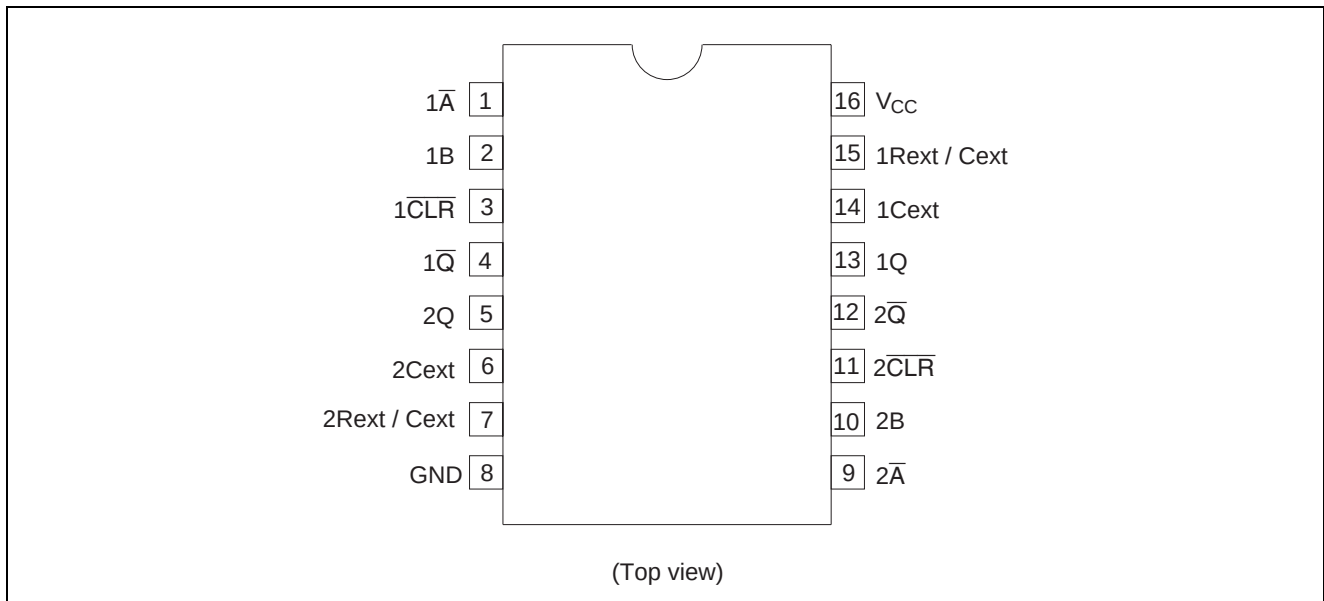
Note: Please consult the sales office for the above package availability.

### Function Table

| Inputs     |                |            | Outputs                   |                          |
|------------|----------------|------------|---------------------------|--------------------------|
| CLR        | $\overline{A}$ | B          | Q                         | $\overline{Q}$           |
| L          | X              | X          | L                         | H                        |
| X          | H              | X          | L                         | H                        |
| X          | X              | L          | L                         | H                        |
| H          | L              | $\uparrow$ | $\text{High level pulse}$ | $\text{Low level pulse}$ |
| H          | $\downarrow$   | H          | $\text{High level pulse}$ | $\text{Low level pulse}$ |
| $\uparrow$ | L              | H          | $\text{High level pulse}$ | $\text{Low level pulse}$ |

Note: H: High level  
L: Low level  
X: Immaterial  
 $\uparrow$ : Low to high transition  
 $\downarrow$ : High to low transition  
 $\text{High level pulse}$ : High level pulse  
 $\text{Low level pulse}$ : Low level pulse

## 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 $V_{CC} + 0.5$<br>-0.5 to 7.0 | V    | Output: H or L<br>$V_{CC}$ : OFF |
| 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 $T_a = 25^\circ\text{C}$ (in still air)* <sup>3</sup> | $P_T$                 | 785<br>500                            | mW   | SOP<br>TSSOP                     |
| Storage temperature                                                                | $T_{stg}$             | -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.

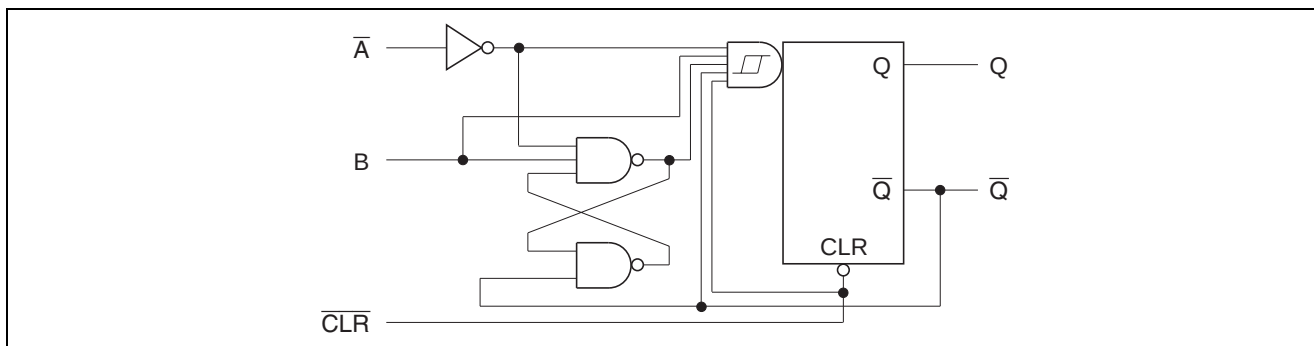
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

## Recommended Operating Conditions

| Item                               | Symbol                     | Min | Typ       | 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 current                     | $I_{OH}$                   | —   | —         | -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      |             | $V_{CC} = 4.5 \text{ to } 5.5 V$ |
|                                    | $I_{OL}$                   | —   | —         | 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       |             | $V_{CC} = 4.5 \text{ to } 5.5 V$ |
| External timing resistance         | $R_{ext}$                  | 5   | —         | —        | k $\Omega$  | $V_{CC} = 2.0 V$                 |
|                                    |                            | 1   | —         | —        |             | $V_{CC} \geq 2.3 V$              |
| External timing capacitance        | $C_{ext}$                  | —   | unlimited | —        | F           |                                  |
| Power-up ramp rate                 | $\Delta t / \Delta V_{CC}$ | 1   | —         | —        | ms/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) | 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                   | V    |                                                                             |
|                                              |                  | 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> = -6 mA                                                     |
|                                              |                  | 4.5                 | 3.8                   | —   | —                     |      | I <sub>OH</sub> = -12 mA                                                    |
|                                              | V <sub>OL</sub>  | Min to Max          | —                     | —   | 0.1                   | V    | I <sub>OL</sub> = 50 μA                                                     |
|                                              |                  | 2.3                 | —                     | —   | 0.4                   |      | I <sub>OL</sub> = 2 mA                                                      |
|                                              |                  | 3.0                 | —                     | —   | 0.44                  |      | I <sub>OL</sub> = 6 mA                                                      |
|                                              |                  | 4.5                 | —                     | —   | 0.55                  |      | I <sub>OL</sub> = 12 mA                                                     |
| Input current                                | I <sub>IN</sub>  | 0 to 5.5            | —                     | —   | ±1                    | μA   | V <sub>IN</sub> = 5.5 V or GND                                              |
| Input current<br>Rext / Cext                 | I <sub>IN</sub>  | 5.5                 | —                     | —   | ±2.5                  | μA   | V <sub>IN</sub> = V <sub>CC</sub> or GND                                    |
| Quiescent supply<br>current                  | I <sub>CC</sub>  | 5.5                 | —                     | —   | 20                    | μA   | V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0                |
| Active state supply<br>current (per circuit) | ΔI <sub>CC</sub> | 2.3                 | —                     | —   | 220                   | μA   | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>Rext/Cext = 0.5 V <sub>CC</sub> |
|                                              |                  | 3.0                 | —                     | —   | 280                   |      |                                                                             |
|                                              |                  | 4.5                 | —                     | —   | 650                   |      |                                                                             |
|                                              |                  | 5.5                 | —                     | —   | 975                   |      |                                                                             |
| Output leakage<br>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                 | —                     | 4.0 | —                     | 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

$$V_{CC} = 2.5 \pm 0.2 \text{ V}$$

| 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 | $t_{PLH}$       | —         | 13.3    | 31.4 | 1.0              | 37.0 | ns            | $C_L = 15 \text{ pF}$                                                                    | A or B       | Q or $\bar{Q}$ |
|                        | $t_{PHL}$       | —         | 15.5    | 36.0 | 1.0              | 42.0 |               | $C_L = 50 \text{ pF}$                                                                    |              |                |
|                        |                 | —         | 10.9    | 25.0 | 1.0              | 29.5 |               | $C_L = 15 \text{ pF}$                                                                    | $\bar{CLR}$  | Q or $\bar{Q}$ |
|                        |                 | —         | 12.5    | 32.8 | 1.0              | 34.5 |               | $C_L = 50 \text{ pF}$                                                                    |              |                |
|                        |                 | —         | 13.5    | 33.4 | 1.0              | 39.0 |               | $C_L = 15 \text{ pF}$                                                                    | $\bar{CLR}$  | Q or $\bar{Q}$ |
|                        |                 | —         | 15.9    | 38.0 | 1.0              | 44.0 |               | $C_L = 50 \text{ pF}$                                                                    | (Trigger)    |                |
| Pulse width            | $t_w$           | 6.0       | —       | —    | 6.5              | —    | ns            | $\bar{A}$ , B or $\bar{CLR}$                                                             |              |                |
| Output pulse width     | $t_{wQ}$        | —         | 170     | 260  | —                | 320  | ns            | $C_L = 50 \text{ pF}$ , $C_{ext} = 28 \text{ pF}$ , $R_{ext} = 2 \text{ k}\Omega$        |              |                |
|                        |                 | 90        | 100     | 110  | 90               | 110  | $\mu\text{s}$ | $C_L = 50 \text{ pF}$ ,<br>$C_{ext} = 0.01 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$ |              |                |
|                        |                 | 0.9       | 1.0     | 1.1  | 0.9              | 1.1  | ms            | $C_L = 50 \text{ pF}$ ,<br>$C_{ext} = 0.1 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$  |              |                |
|                        | $\Delta t_{wQ}$ | —         | $\pm 1$ | —    | —                | —    | %             | $C_L = 50 \text{ pF}$                                                                    |              |                |

$$V_{CC} = 3.3 \pm 0.3 \text{ V}$$

| 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 | $t_{PLH}$       | —         | 9.9     | 20.6 | 1.0              | 24.0 | ns            | $C_L = 15 \text{ pF}$                                                                    | A or B       | Q or $\bar{Q}$ |
|                        | $t_{PHL}$       | —         | 11.6    | 24.1 | 1.0              | 27.5 |               | $C_L = 50 \text{ pF}$                                                                    |              |                |
|                        |                 | —         | 8.3     | 15.8 | 1.0              | 18.5 |               | $C_L = 15 \text{ pF}$                                                                    | $\bar{CLR}$  | Q or $\bar{Q}$ |
|                        |                 | —         | 9.7     | 19.3 | 1.0              | 22.0 |               | $C_L = 50 \text{ pF}$                                                                    |              |                |
|                        |                 | —         | 9.9     | 22.4 | 1.0              | 26.0 |               | $C_L = 15 \text{ pF}$                                                                    | $\bar{CLR}$  | Q or $\bar{Q}$ |
|                        |                 | —         | 11.6    | 25.9 | 1.0              | 29.5 |               | $C_L = 50 \text{ pF}$                                                                    | (Trigger)    |                |
| Pulse width            | $t_w$           | 5.0       | —       | —    | 5.0              | —    | ns            | $\bar{A}$ , B or $\bar{CLR}$                                                             |              |                |
| Output pulse width     | $t_{wQ}$        | —         | 150     | 240  | —                | 300  | ns            | $C_L = 50 \text{ pF}$ , $C_{ext} = 28 \text{ pF}$ , $R_{ext} = 2 \text{ k}\Omega$        |              |                |
|                        |                 | 90        | 100     | 110  | 90               | 110  | $\mu\text{s}$ | $C_L = 50 \text{ pF}$ ,<br>$C_{ext} = 0.01 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$ |              |                |
|                        |                 | 0.9       | 1.0     | 1.1  | 0.9              | 1.1  | ms            | $C_L = 50 \text{ pF}$ ,<br>$C_{ext} = 0.1 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$  |              |                |
|                        | $\Delta t_{wQ}$ | —         | $\pm 1$ | —    | —                | —    | %             | $C_L = 50 \text{ pF}$                                                                    |              |                |

## Switching Characteristics (cont)

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

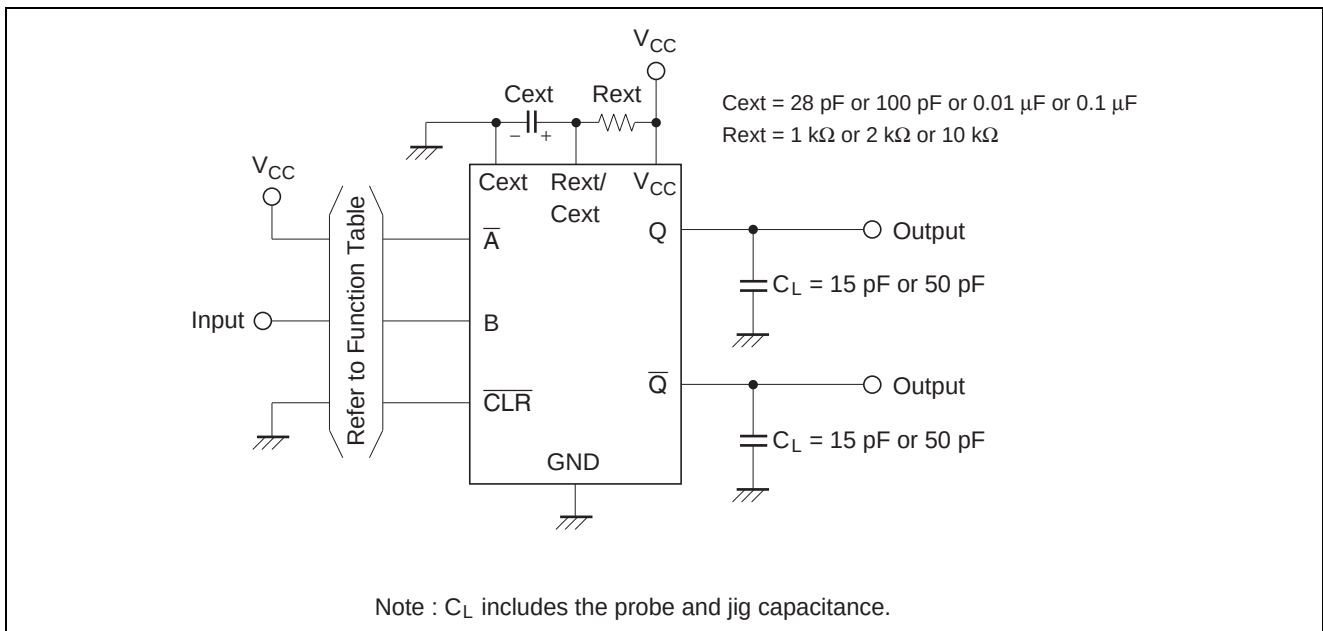
| Item                   | Symbol          | Ta = 25°C |         |      | Ta = -40 to 85°C |      | Unit          | Test Conditions                                                                          | FROM (Input) | TO (Output)    |
|------------------------|-----------------|-----------|---------|------|------------------|------|---------------|------------------------------------------------------------------------------------------|--------------|----------------|
|                        |                 | Min       | Typ     | Max  | Min              | Max  |               |                                                                                          |              |                |
| Propagation delay time | $t_{PLH}$       | —         | 7.3     | 12.0 | 1.0              | 14.0 | ns            | $C_L = 15 \text{ pF}$                                                                    | A or B       | Q or $\bar{Q}$ |
|                        | $t_{PHL}$       | —         | 8.7     | 14.0 | 1.0              | 16.0 |               | $C_L = 50 \text{ pF}$                                                                    |              |                |
|                        |                 | —         | 6.2     | 9.4  | 1.0              | 11.0 |               | $C_L = 15 \text{ pF}$                                                                    | $\bar{CLR}$  | Q or $\bar{Q}$ |
|                        |                 | —         | 7.4     | 11.4 | 1.0              | 13.0 |               | $C_L = 50 \text{ pF}$                                                                    |              |                |
|                        |                 | —         | 7.3     | 12.9 | 1.0              | 15.0 |               | $C_L = 15 \text{ pF}$                                                                    | $\bar{CLR}$  | Q or $\bar{Q}$ |
|                        |                 | —         | 8.6     | 14.9 | 1.0              | 17.0 |               | $C_L = 50 \text{ pF}$                                                                    | (Trigger)    |                |
| Pulse width            | $t_w$           | 5.0       | —       | —    | 5.0              | —    | ns            | $\bar{A}$ , B or $\bar{CLR}$                                                             |              |                |
| Output pulse width     | $t_{wQ}$        | —         | 140     | 200  | —                | 240  | ns            | $C_L = 50 \text{ pF}$ , $C_{ext} = 28 \text{ pF}$ , $R_{ext} = 2 \text{ k}\Omega$        |              |                |
|                        |                 | 90        | 100     | 110  | 90               | 110  | $\mu\text{s}$ | $C_L = 50 \text{ pF}$ ,<br>$C_{ext} = 0.01 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$ |              |                |
|                        |                 | 0.9       | 1.0     | 1.1  | 0.9              | 1.1  | ms            | $C_L = 50 \text{ pF}$ ,<br>$C_{ext} = 0.1 \mu\text{F}$ , $R_{ext} = 10 \text{ k}\Omega$  |              |                |
|                        | $\Delta t_{wQ}$ | —         | $\pm 1$ | —    | —                | —    | %             | $C_L = 50 \text{ pF}$                                                                    |              |                |

## Operating Characteristics

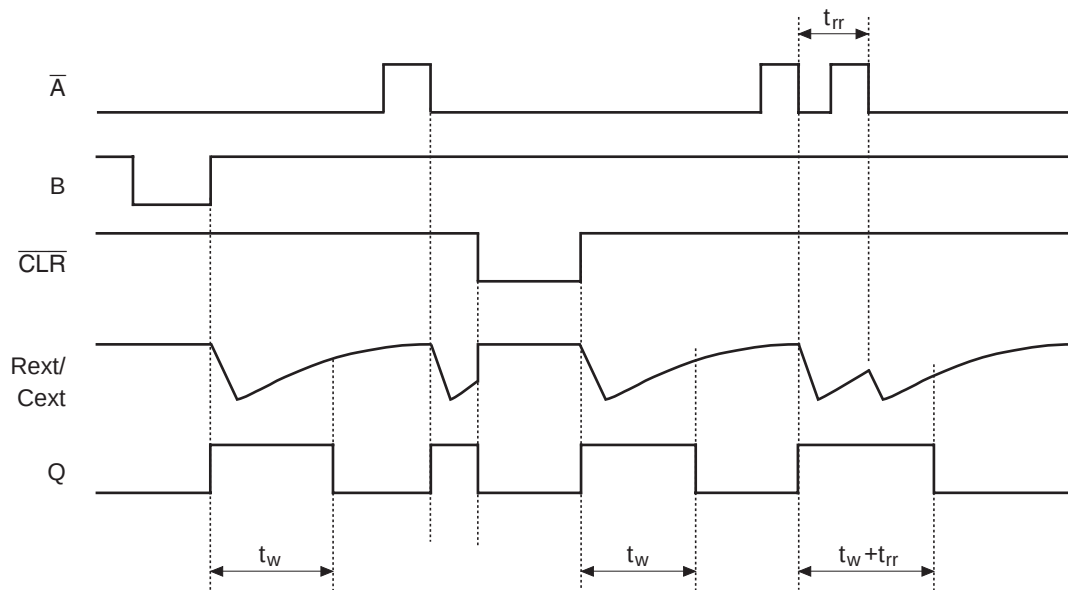
$C_L = 50 \text{ pF}$

| Item                          | Symbol   | $V_{CC} \text{ (V)}$ | Ta = 25°C |      |     | Unit | Test Conditions |
|-------------------------------|----------|----------------------|-----------|------|-----|------|-----------------|
|                               |          |                      | Min       | Typ  | Max |      |                 |
| Power dissipation capacitance | $C_{PD}$ | 3.3                  | —         | 74.0 | —   | pF   | f = 10 MHz      |
|                               |          | 5.0                  | —         | 86.0 | —   |      |                 |

## Test Circuit



## Timing diagram



## Caution in use

In order to prevent any malfunctions due to noise, connect a high frequency performance capacitor between Vcc and GND, and keep the wiring between the External components and Cext, Rext/Cext pins as short as possible.

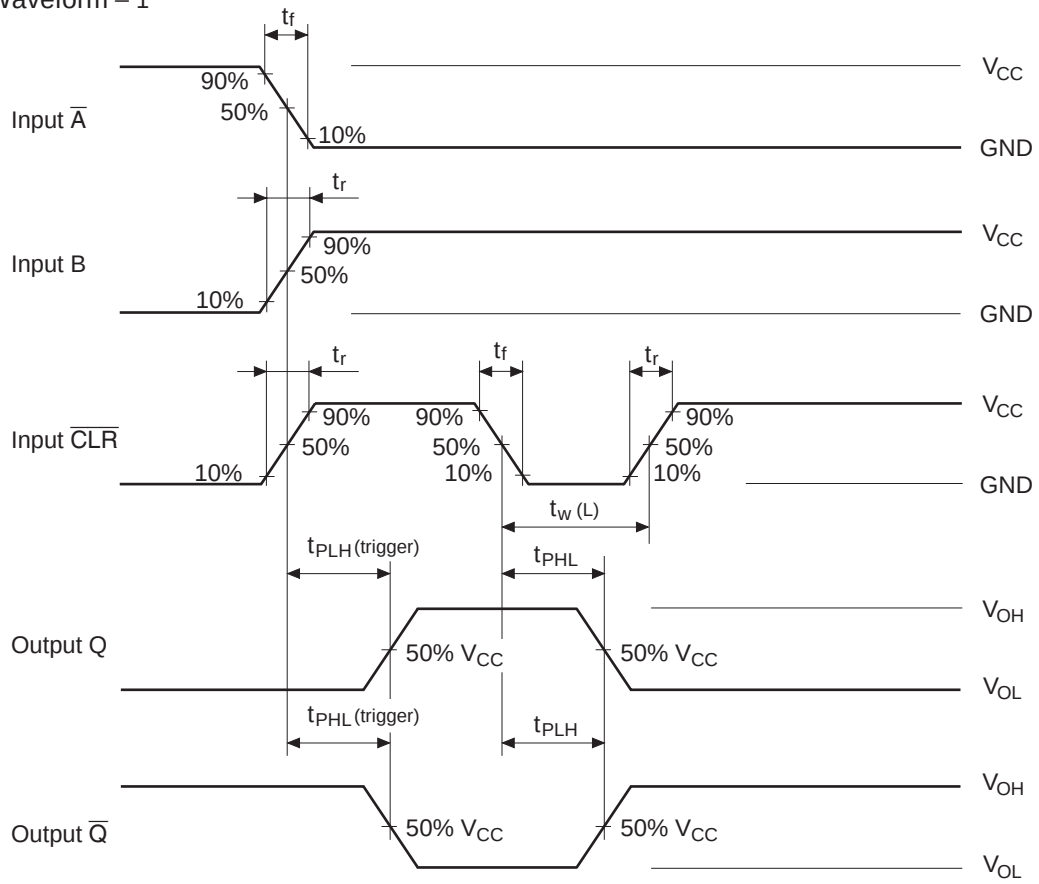
Large values of Cext may cause problems when powering down the HD74LV221A because of the amount of energy stored in the capacitor. When a system containing this device is powered down, the capacitor may discharge from Vcc through the protection diodes at pin 7 or pin 15.

Current through the input protection diodes must be limited to 20 mA; therefore, the turn-off time of the Vcc power supply must not be faster than  $t = V_{cc} \cdot C_{ext} / (20 \text{ mA})$ . For example, if  $V_{cc} = 5 \text{ V}$  and  $C_{ext} = 22 \mu\text{F}$ , the Vcc supply must turn off no faster than  $t = (5 \text{ V}) \cdot (22 \mu\text{F}) / 20 \text{ mA} = 5.5 \text{ ms}$ . This is usually not a problem because power supplies are heavily filtered and cannot discharge at this rate.

When a more rapid decrease of Vcc to zero volts occurs, the HD74LV221A may sustain damage. To avoid this possibility, use an external clamping diode.

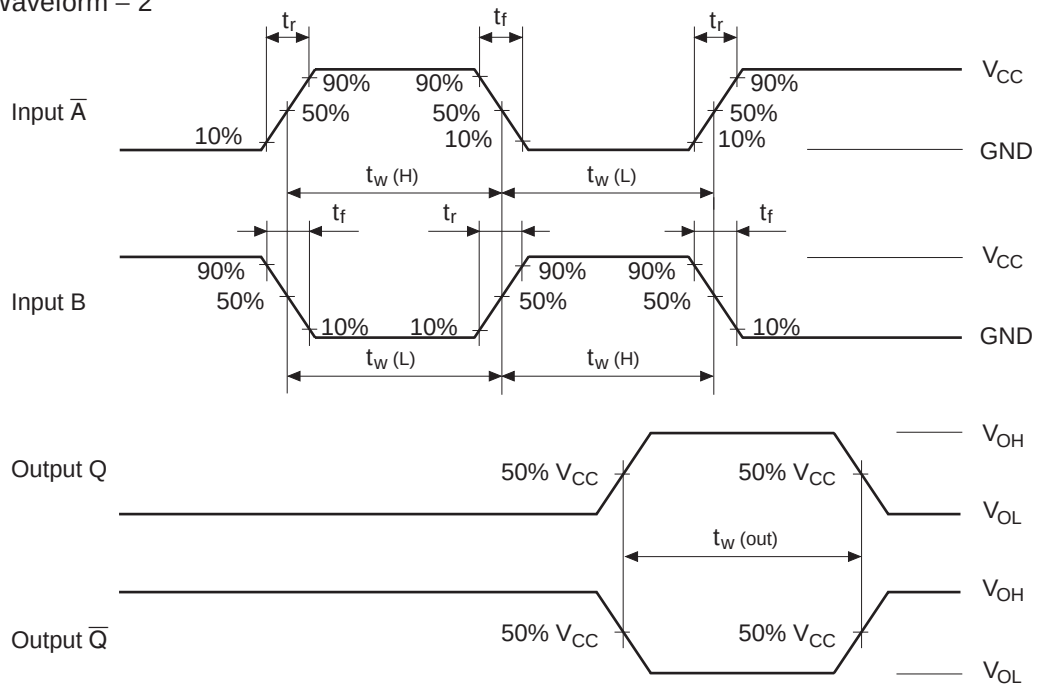
The input pins for unused circuit should be used under conditions to fix the outputs to avoid malfunction caused by noises. Also, it's recommended that Rext / Cext terminals are open and external parts are not connected to.

• Waveform – 1



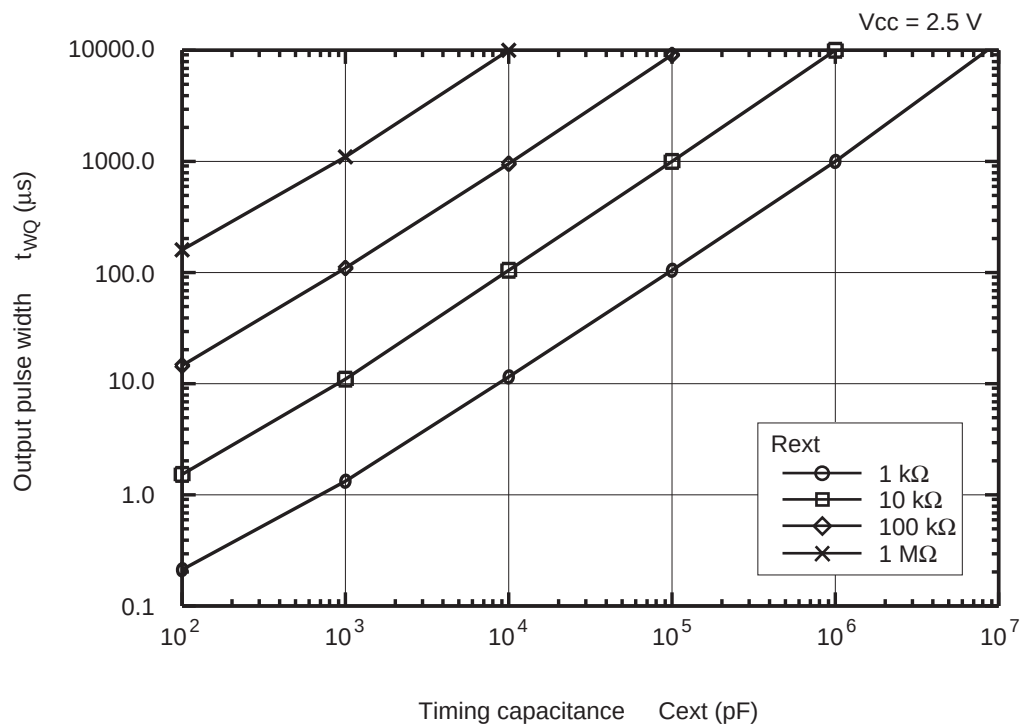


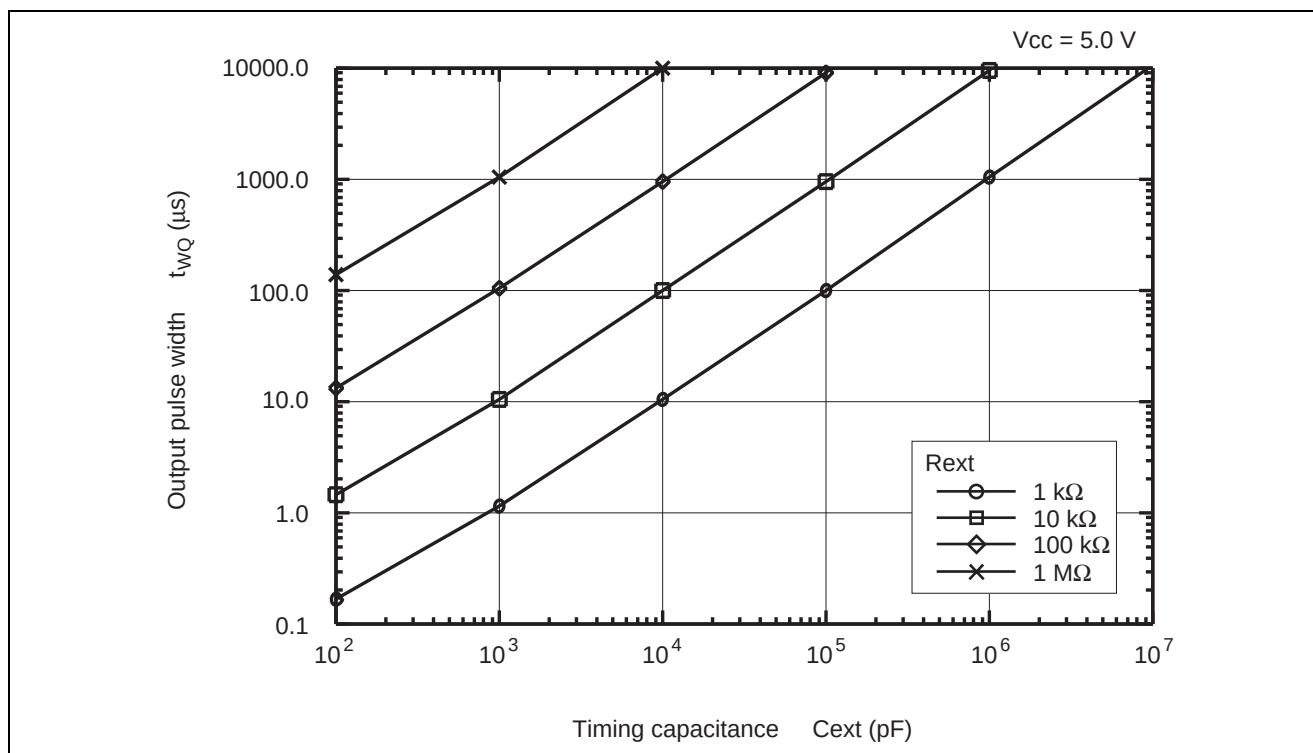
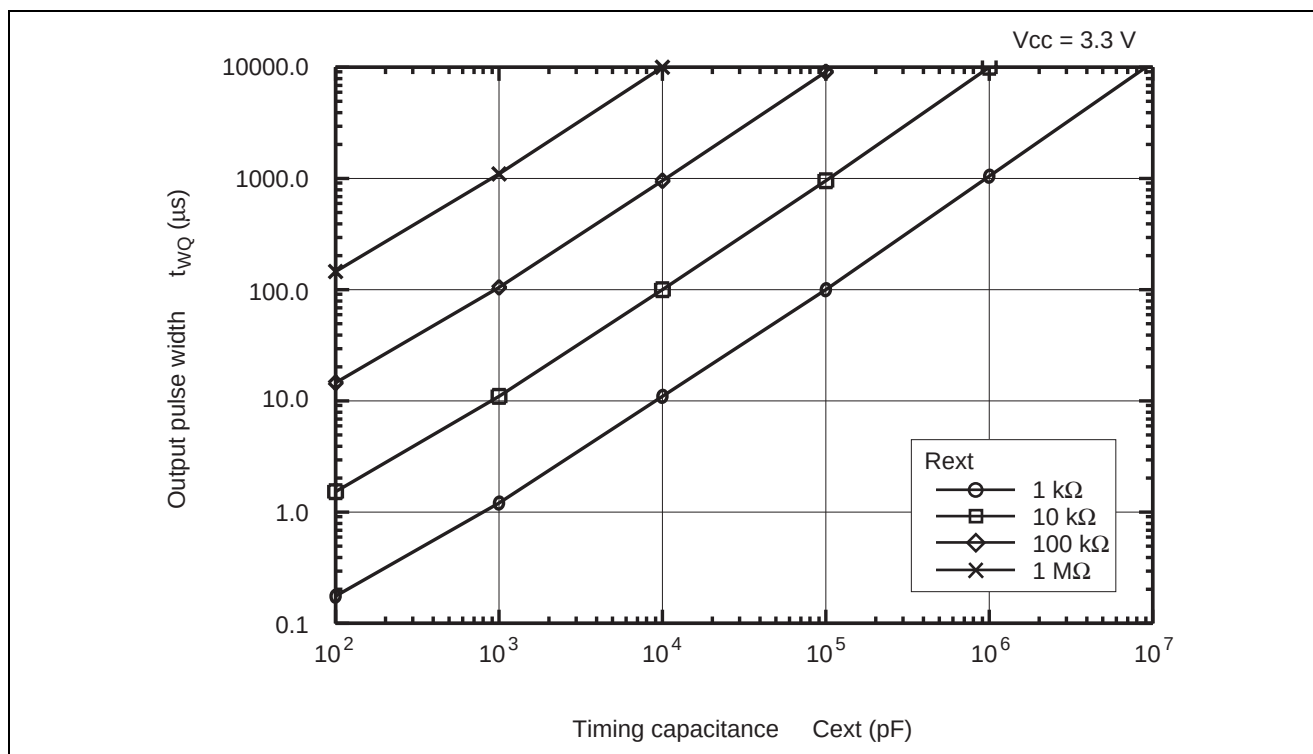
• Waveform – 2

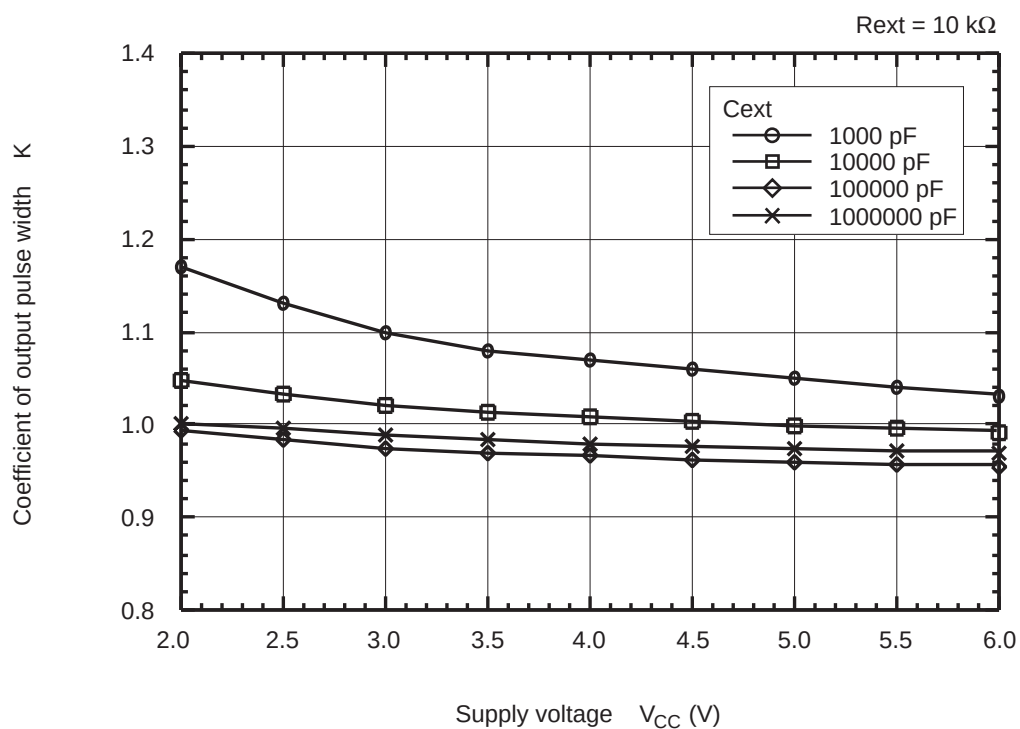
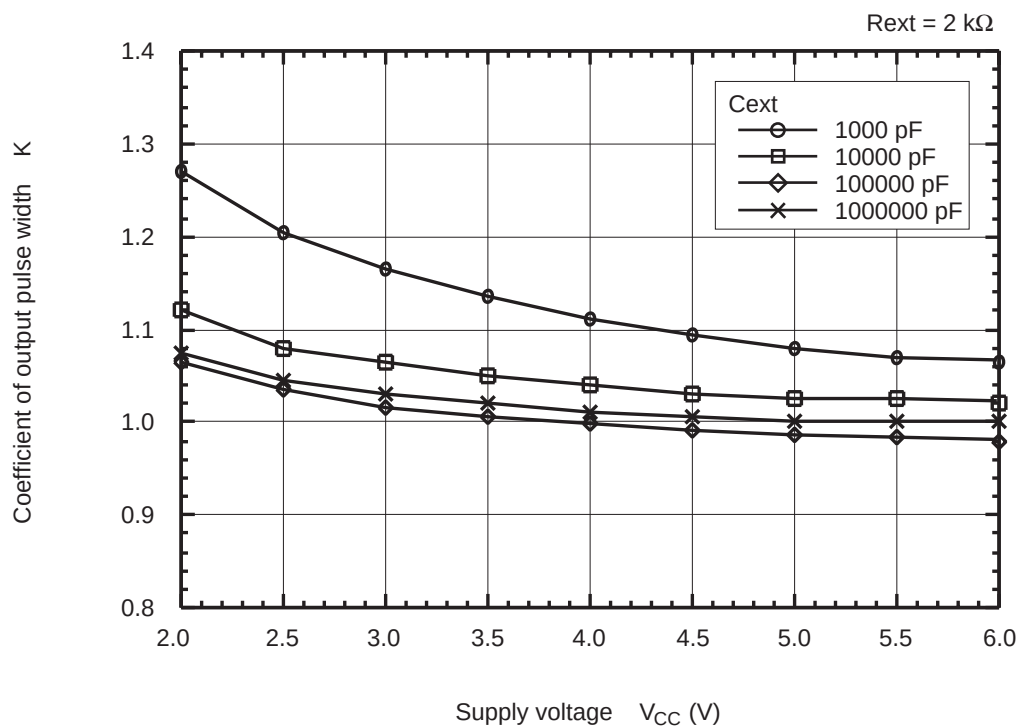


Notes: 1. Input waveform: PRR  $\leq 1$  MHz,  $Z_o = 50 \Omega$ ,  $t_r \leq 3$  ns,  $t_f \leq 3$  ns  
2. The output are measured one at a time with one transition per measurement.

Application Data



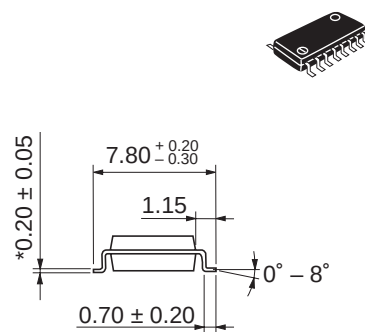
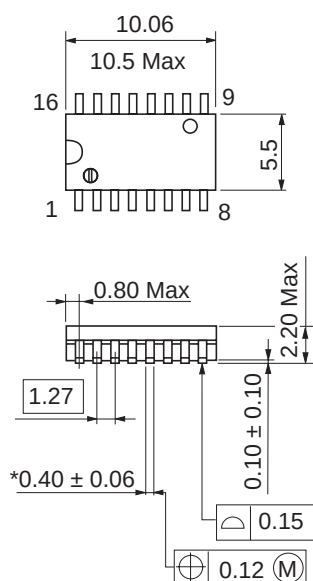




# Package Dimensions

As of January, 2003

Unit: mm

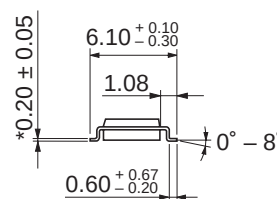
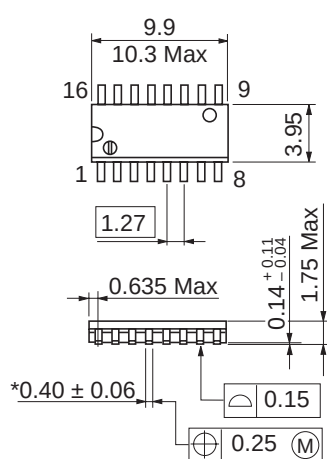


|                        |          |
|------------------------|----------|
| Package Code           | FP-16DAV |
| JEDEC                  | —        |
| JEITA                  | Conforms |
| Mass (reference value) | 0.24 g   |

\*Ni/Pd/Au plating

As of January, 2003

Unit: mm

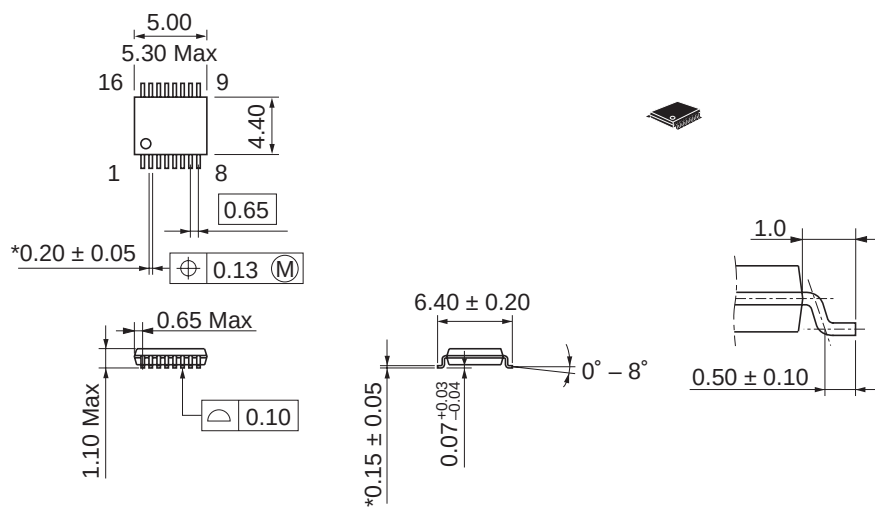


|                        |          |
|------------------------|----------|
| Package Code           | FP-16DNV |
| JEDEC                  | Conforms |
| JEITA                  | Conforms |
| Mass (reference value) | 0.15 g   |

\*Ni/Pd/Au plating

As of January, 2003

Unit: mm



\*Ni/Pd/Au plating

|                        |           |
|------------------------|-----------|
| Package Code           | TTP-16DAV |
| JEDEC                  | —         |
| JEITA                  | —         |
| Mass (reference value) | 0.05 g    |

## Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

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