

# HD74HC390

## Dual Decade Counters

REJ03D0624-0200  
 (Previous ADE-205-503)  
 Rev.2.00  
 Mar 30, 2006

### Description

The HD74HC390 incorporate dual decade counters, each composed of a divide-by-two and a divide-by-five counter. The divide-by-two and divide-by-five counters can be cascaded to form dual decade, dual bi-quinary, or various combinations up to a single divide-by-100 counter.

The HD74HC390 is incremented on the high to low transition (negative edge) of the clock input, and each has an independent clear input. When clear is set high all four bits of each counter are set to a low level. This enables count truncation and allows the implementation of divide-by-N counter configurations.



### Features

- High Speed Operation:  $t_{pd}$  (Clock A to  $Q_A$ ) = 11 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  to 6 V
- Low Input Current: 1  $\mu$ A max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )
- Ordering Information

| Part Name     | Package Type       | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|---------------|--------------------|------------------------------|----------------------|--------------------------------|
| HD74HC390P    | DILP-16 pin        | PRDP0016AE-B (DP-16FV)       | P                    | —                              |
| HD74HC390FPEL | SOP-16 pin (JEITA) | PRSP0016DH-B (FP-16DAV)      | FP                   | EL (2,000 pcs/reel)            |

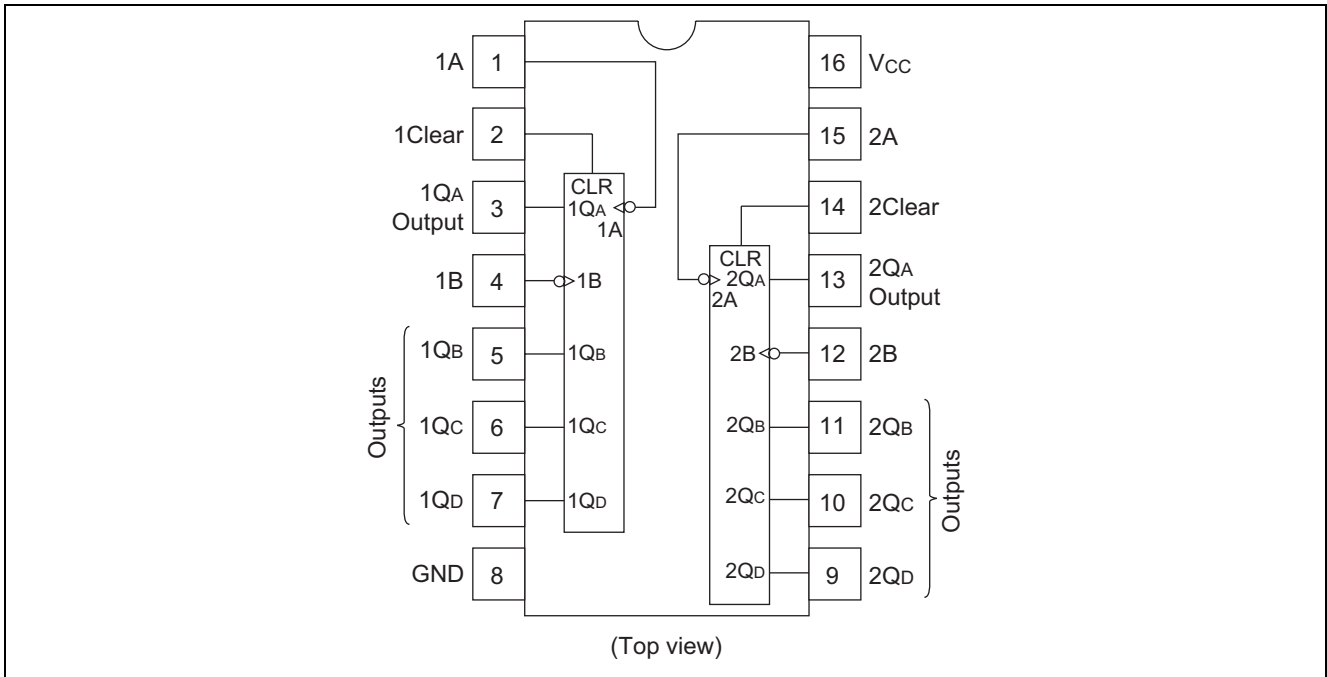
Note: Please consult the sales office for the above package availability.

### Function Table

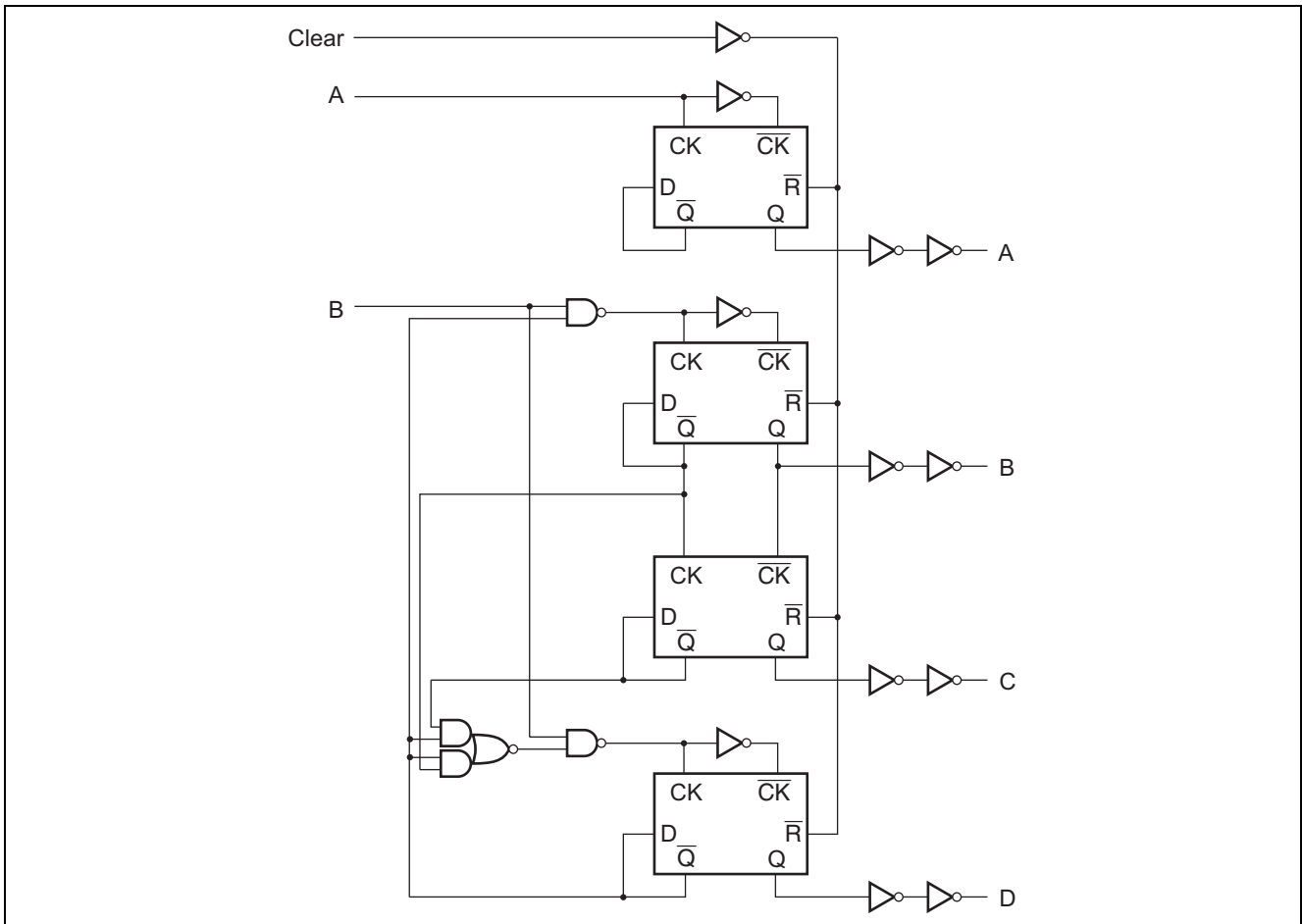
| Clock                                                                               |                                                                                     | Clear | Operation                   |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------|-----------------------------|
| A                                                                                   | B                                                                                   |       |                             |
| X                                                                                   | X                                                                                   | H     | Clear $\div 2$ and $\div 5$ |
|  | X                                                                                   | L     | Increment $\div 2$          |
| X                                                                                   |  | L     | Increment $\div 5$          |

Note: 1. H; High level, L; Low level, X; Irrelevant, Z; High impedance

Pin Arrangement



Logic Diagram



### Absolute Maximum Ratings

| Item                         | Symbol                | Ratings                | Unit |
|------------------------------|-----------------------|------------------------|------|
| Supply voltage range         | $V_{CC}$              | -0.5 to 7.0            | V    |
| Input / Output voltage       | $V_{IN}, V_{OUT}$     | -0.5 to $V_{CC} + 0.5$ | V    |
| Input / Output diode current | $I_{IK}, I_{OK}$      | $\pm 20$               | mA   |
| Output current               | $I_{OUT}$             | $\pm 25$               | mA   |
| $V_{CC}$ , GND current       | $I_{CC}$ or $I_{GND}$ | $\pm 50$               | mA   |
| Power dissipation            | $P_T$                 | 500                    | mW   |
| Storage temperature          | $T_{stg}$             | -65 to +150            | °C   |

Note: 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.

### Recommended Operating Conditions

| Item                                 | Symbol            | Ratings       | Unit | Conditions       |
|--------------------------------------|-------------------|---------------|------|------------------|
| Supply voltage                       | $V_{CC}$          | 2 to 6        | V    |                  |
| Input / Output voltage               | $V_{IN}, V_{OUT}$ | 0 to $V_{CC}$ | V    |                  |
| Operating temperature                | $T_a$             | -40 to 85     | °C   |                  |
| Input rise / fall time <sup>*1</sup> | $t_r, t_f$        | 0 to 1000     | ns   | $V_{CC} = 2.0$ V |
|                                      |                   | 0 to 500      |      | $V_{CC} = 4.5$ V |
|                                      |                   | 0 to 400      |      | $V_{CC} = 6.0$ V |

Note: 1. This item guarantees maximum limit when one input switches.

Waveform: Refer to test circuit of switching characteristics.

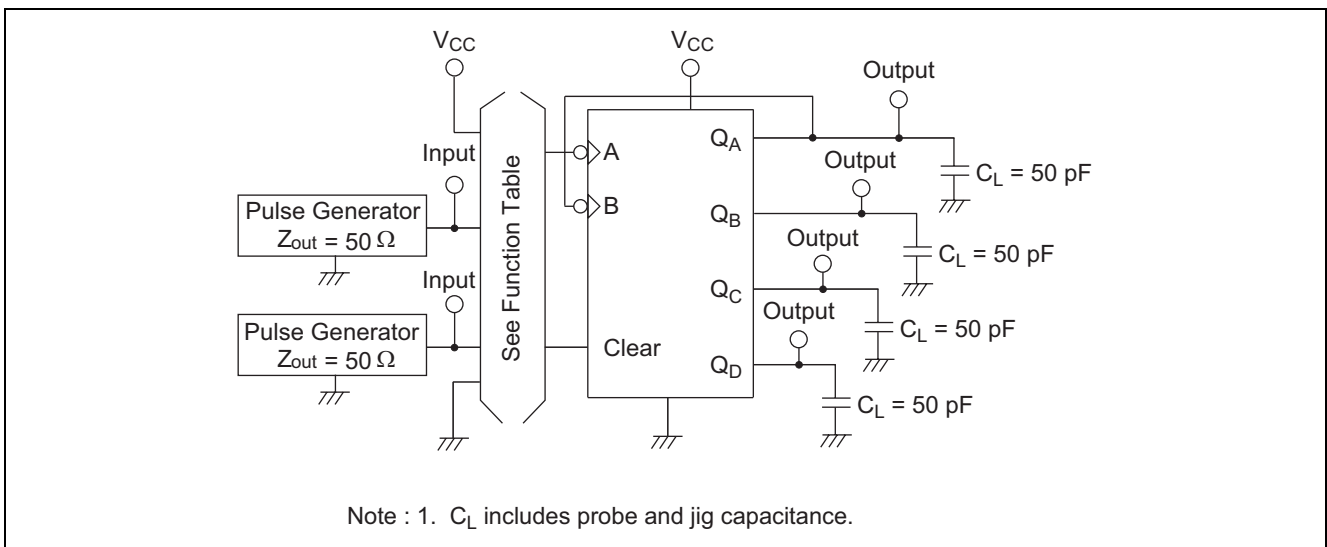
### Electrical Characteristics

| Item                     | Symbol   | $V_{CC}$ (V) | $T_a = 25^\circ\text{C}$ |     |           | $T_a = -40 \text{ to } +85^\circ\text{C}$ |           | Unit          | Test Conditions                                     |                            |
|--------------------------|----------|--------------|--------------------------|-----|-----------|-------------------------------------------|-----------|---------------|-----------------------------------------------------|----------------------------|
|                          |          |              | Min                      | Typ | Max       | Min                                       | Max       |               |                                                     |                            |
| Input voltage            | $V_{IH}$ | 2.0          | 1.5                      | —   | —         | 1.5                                       | —         | V             |                                                     |                            |
|                          |          | 4.5          | 3.15                     | —   | —         | 3.15                                      | —         |               |                                                     |                            |
|                          |          | 6.0          | 4.2                      | —   | —         | 4.2                                       | —         |               |                                                     |                            |
|                          | $V_{IL}$ | 2.0          | —                        | —   | 0.5       | —                                         | 0.5       | V             |                                                     |                            |
|                          |          | 4.5          | —                        | —   | 1.35      | —                                         | 1.35      |               |                                                     |                            |
|                          |          | 6.0          | —                        | —   | 1.8       | —                                         | 1.8       |               |                                                     |                            |
| Output voltage           | $V_{OH}$ | 2.0          | 1.9                      | 2.0 | —         | 1.9                                       | —         | V             | $V_{in} = V_{IH}$ or $V_{IL}$                       | $I_{OH} = -20 \mu\text{A}$ |
|                          |          | 4.5          | 4.4                      | 4.5 | —         | 4.4                                       | —         |               |                                                     | $I_{OH} = -4 \text{ mA}$   |
|                          |          | 6.0          | 5.9                      | 6.0 | —         | 5.9                                       | —         |               |                                                     | $I_{OH} = -5.2 \text{ mA}$ |
|                          |          | 4.5          | 4.18                     | —   | —         | 4.13                                      | —         |               |                                                     |                            |
|                          |          | 6.0          | 5.68                     | —   | —         | 5.63                                      | —         |               |                                                     |                            |
|                          | $V_{OL}$ | 2.0          | —                        | 0.0 | 0.1       | —                                         | 0.1       | V             | $V_{in} = V_{IH}$ or $V_{IL}$                       | $I_{OL} = 20 \mu\text{A}$  |
|                          |          | 4.5          | —                        | 0.0 | 0.1       | —                                         | 0.1       |               |                                                     |                            |
|                          |          | 6.0          | —                        | 0.0 | 0.1       | —                                         | 0.1       |               |                                                     |                            |
|                          |          | 4.5          | —                        | —   | 0.26      | —                                         | 0.33      |               |                                                     | $I_{OH} = 4 \text{ mA}$    |
|                          |          | 6.0          | —                        | —   | 0.26      | —                                         | 0.33      |               |                                                     | $I_{OH} = 5.2 \text{ mA}$  |
| Input current            | $I_{in}$ | 6.0          | —                        | —   | $\pm 0.1$ | —                                         | $\pm 1.0$ | $\mu\text{A}$ | $V_{in} = V_{CC}$ or GND                            |                            |
| Quiescent supply current | $I_{CC}$ | 6.0          | —                        | —   | 4.0       | —                                         | 40        | $\mu\text{A}$ | $V_{in} = V_{CC}$ or GND, $I_{out} = 0 \mu\text{A}$ |                            |

Switching Characteristics ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ )

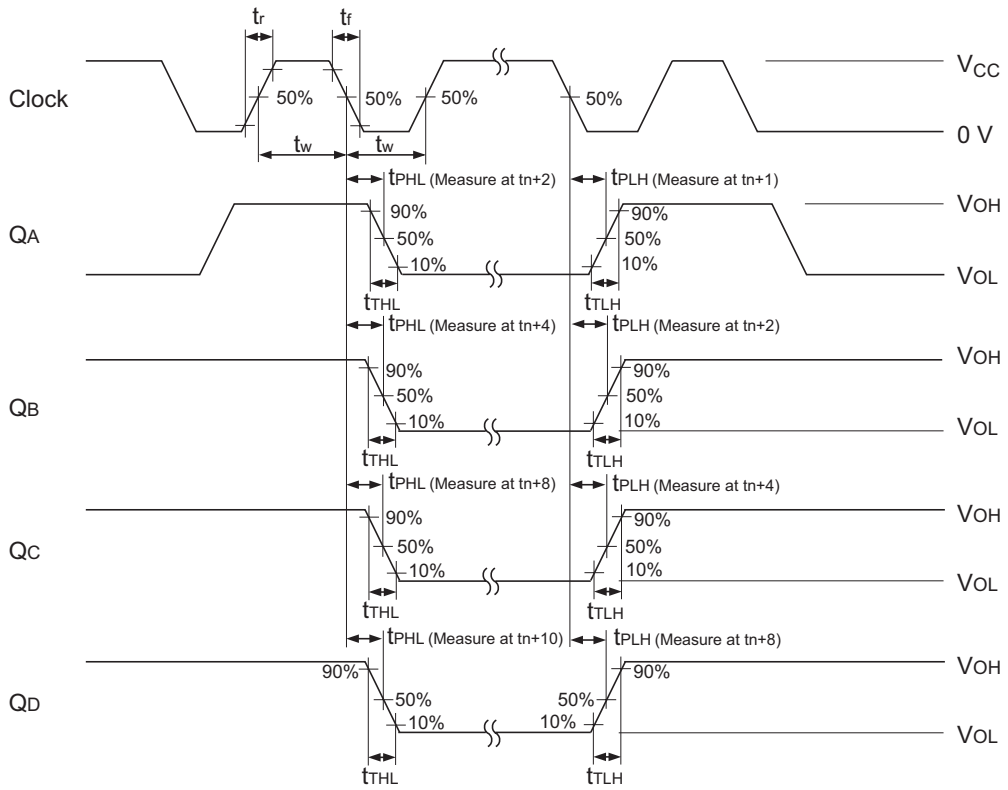
| Item                    | Symbol                 | $V_{CC}$ (V) | $T_a = 25^\circ\text{C}$ |     |     | $T_a = -40 \text{ to } +85^\circ\text{C}$ |     | Unit                          | Test Conditions                                   |
|-------------------------|------------------------|--------------|--------------------------|-----|-----|-------------------------------------------|-----|-------------------------------|---------------------------------------------------|
|                         |                        |              | Min                      | Typ | Max | Min                                       | Max |                               |                                                   |
| Maximum clock frequency | $f_{max}$              | 2.0          | —                        | —   | 5   | —                                         | 4   | MHz                           |                                                   |
|                         |                        | 4.5          | —                        | —   | 27  | —                                         | 21  |                               |                                                   |
|                         |                        | 6.0          | —                        | —   | 32  | —                                         | 25  |                               |                                                   |
| Propagation delay time  | $t_{PLH}$              | 2.0          | —                        | —   | 120 | —                                         | 150 | ns                            | Clock A to $Q_A$                                  |
|                         |                        | 4.5          | —                        | 11  | 24  | —                                         | 30  |                               |                                                   |
|                         |                        | 6.0          | —                        | —   | 20  | —                                         | 26  |                               |                                                   |
|                         | $t_{PHL}$              | 2.0          | —                        | —   | 290 | —                                         | 365 | ns                            | Clock A to $Q_C$<br>( $Q_A$ connected to Clock B) |
|                         |                        | 4.5          | —                        | 32  | 58  | —                                         | 73  |                               |                                                   |
|                         |                        | 6.0          | —                        | —   | 49  | —                                         | 62  |                               |                                                   |
|                         | $t_{PLH}$              | 2.0          | —                        | —   | 130 | —                                         | 165 | ns                            | Clock B to $Q_B$                                  |
|                         |                        | 4.5          | —                        | 16  | 26  | —                                         | 33  |                               |                                                   |
|                         |                        | 6.0          | —                        | —   | 22  | —                                         | 28  |                               |                                                   |
|                         | $t_{PHL}$              | 2.0          | —                        | —   | 185 | —                                         | 230 | ns                            | Clock B to $Q_C$                                  |
|                         |                        | 4.5          | —                        | 20  | 37  | —                                         | 46  |                               |                                                   |
|                         |                        | 6.0          | —                        | —   | 31  | —                                         | 39  |                               |                                                   |
|                         | $t_{PLH}$              | 2.0          | —                        | —   | 130 | —                                         | 165 | ns                            | Clock B to $Q_D$                                  |
|                         |                        | 4.5          | —                        | 15  | 26  | —                                         | 33  |                               |                                                   |
|                         |                        | 6.0          | —                        | —   | 22  | —                                         | 28  |                               |                                                   |
| $t_{PHL}$               | 2.0                    | —            | —                        | 165 | —   | 205                                       | ns  | Clear to $Q_A, Q_B, Q_C, Q_D$ |                                                   |
|                         | 4.5                    | —            | 14                       | 33  | —   | 41                                        |     |                               |                                                   |
|                         | 6.0                    | —            | —                        | 28  | —   | 35                                        |     |                               |                                                   |
| Pulse width             | $t_w$                  | 2.0          | 80                       | —   | —   | 100                                       | —   | ns                            |                                                   |
|                         |                        | 4.5          | 16                       | 8   | —   | 20                                        | —   |                               |                                                   |
|                         |                        | 6.0          | 14                       | —   | —   | 17                                        | —   |                               |                                                   |
| Removal time            | $t_h$                  | 2.0          | 25                       | —   | —   | 31                                        | —   | ns                            |                                                   |
|                         |                        | 4.5          | 5                        | 1   | —   | 6                                         | —   |                               |                                                   |
|                         |                        | 6.0          | 4                        | —   | —   | 5                                         | —   |                               |                                                   |
| Output rise/fall time   | $t_{TLH}$<br>$t_{THL}$ | 2.0          | —                        | —   | 75  | —                                         | 95  | ns                            |                                                   |
|                         |                        | 4.5          | —                        | 5   | 15  | —                                         | 19  |                               |                                                   |
|                         |                        | 6.0          | —                        | —   | 13  | —                                         | 16  |                               |                                                   |
| Input capacitance       | $C_{in}$               | —            | —                        | 5   | 10  | —                                         | 10  | pF                            |                                                   |

Test Circuit



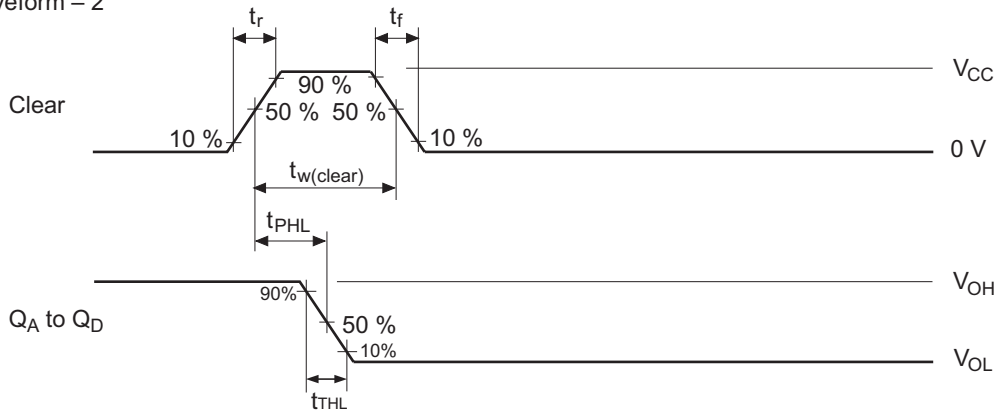
Waveforms

• Waveform – 1



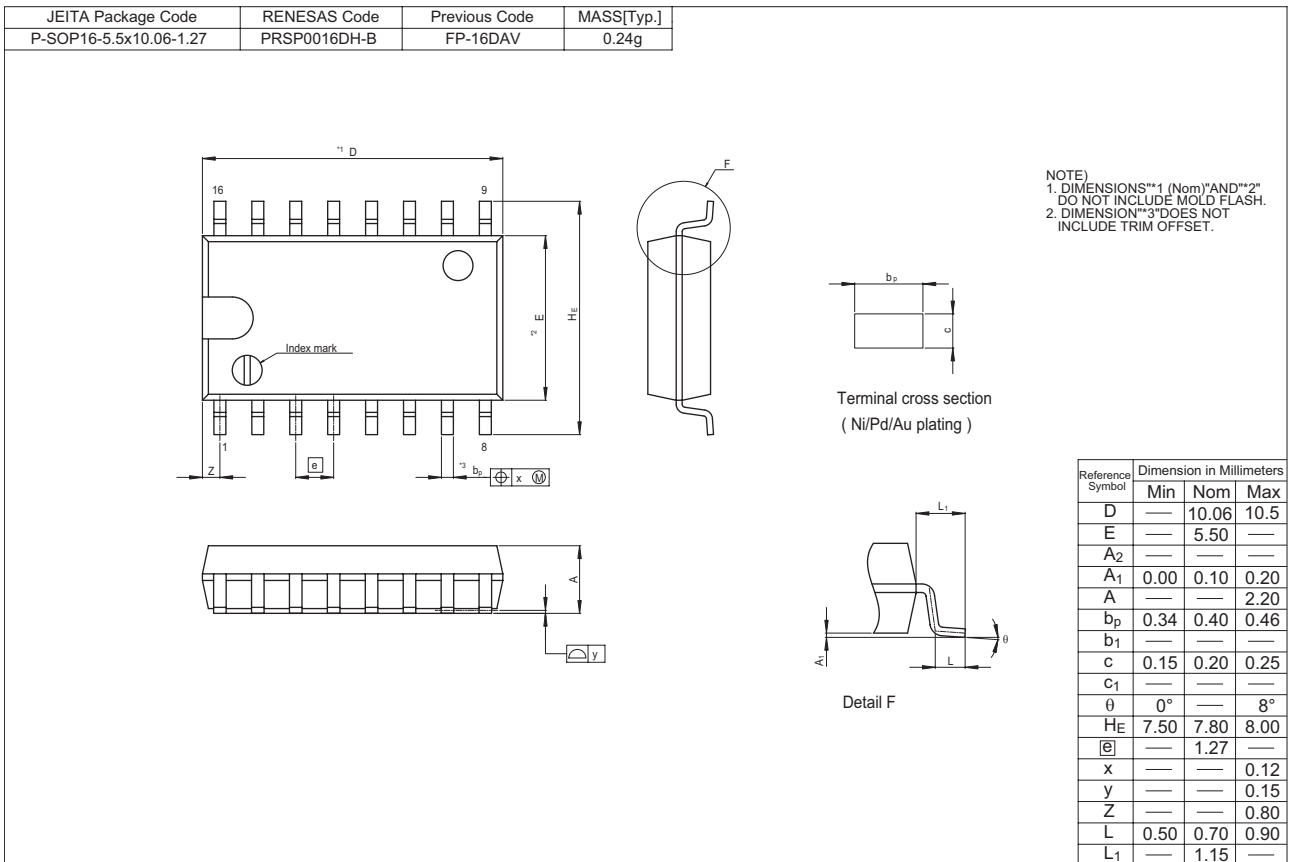
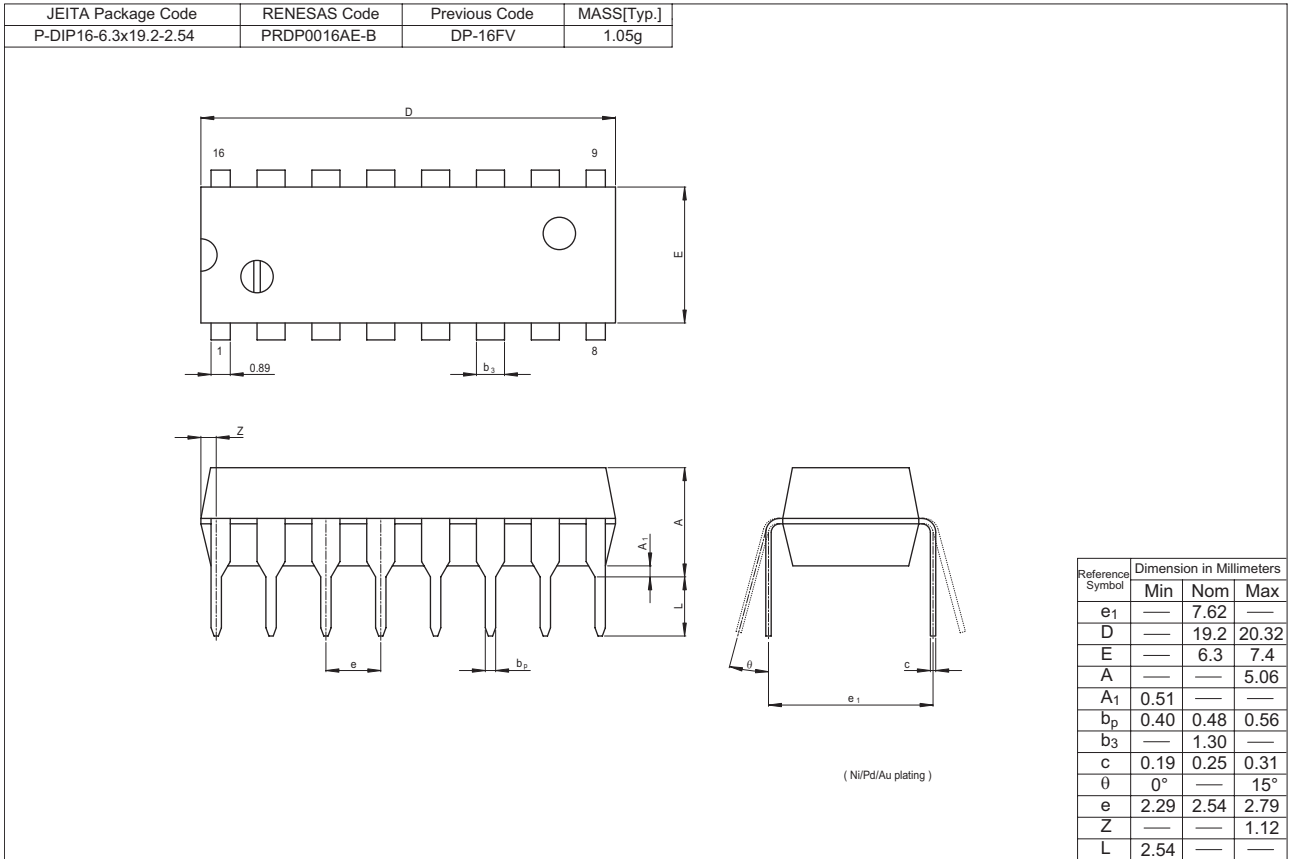
Notes: 1. Input waveform:  $PRR \leq 1 \text{ MHz}$ ,  $Z_o = 50 \Omega$ ,  $t_r \leq 6 \text{ ns}$ ,  $t_f \leq 6 \text{ ns}$   
 2.  $t_n$  is bit time with all outputs at low.

• Waveform – 2



Notes: 1. Input waveform:  $PRR \leq 1 \text{ MHz}$ ,  $Z_o = 50 \Omega$ ,  $t_r \leq 6 \text{ ns}$ ,  $t_f \leq 6 \text{ ns}$   
 2. The output are measured one at a time with one transition per measurement.

Package Dimensions



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