

HD74HC4020

14-stage Binary Counter

REJ03D0645-0200
 (Previous ADE-205-531)
 Rev.2.00
 Mar 30, 2006

Description

The HD74HC4020 is a 14 stage counter. This device is incremented on the falling edge (negative transition) of the input clock, and all its output is reset to a low level by applying a logical high on its reset input.



Features

- High Speed Operation: t_{pd} (Clock to Q_1) = 14 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 μ A max
- Low Quiescent Supply Current: I_{CC} (static) = 4 μ A max ($T_a = 25^\circ\text{C}$)
- Ordering Information

| Part Name | Package Type | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|----------------|--------------------|------------------------------|----------------------|--------------------------------|
| HD74HC4020P | DILP-16 pin | PRDP0016AE-B (DP-16FV) | P | — |
| HD74HC4020FPEL | SOP-16 pin (JEITA) | PRSP0016DH-B (FP-16DAV) | FP | EL (2,000 pcs/reel) |

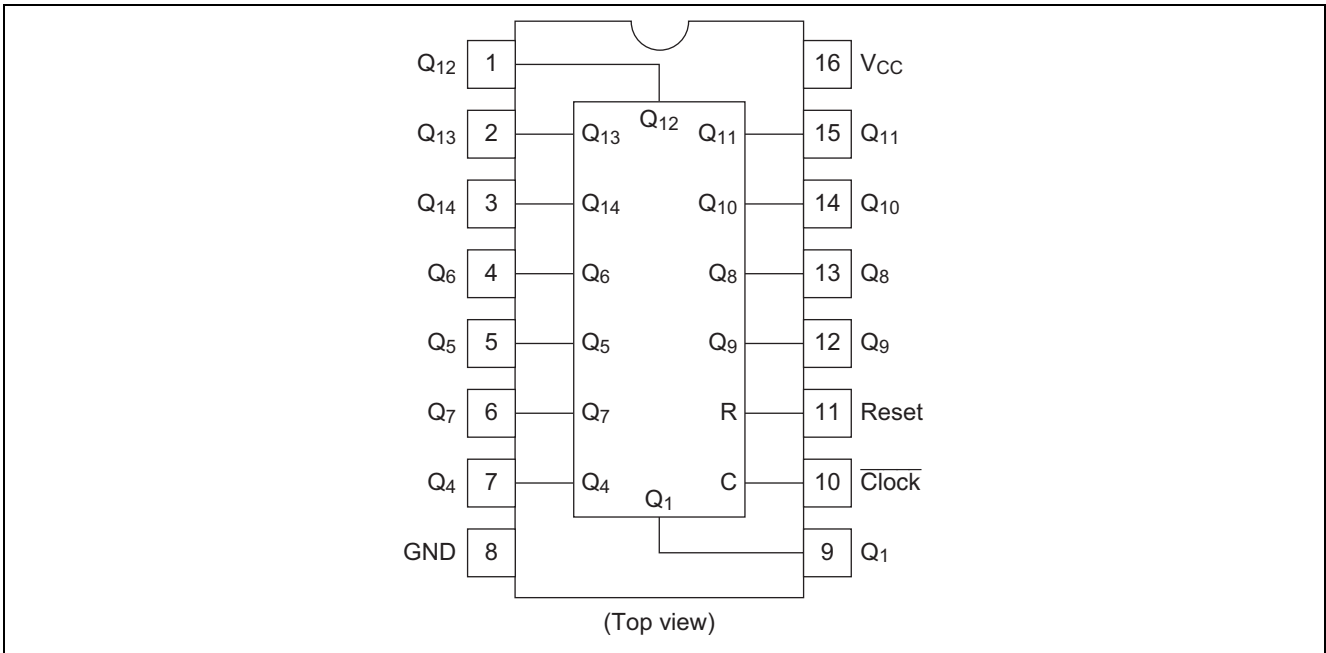
Note: Please consult the sales office for the above package availability.

Function Table

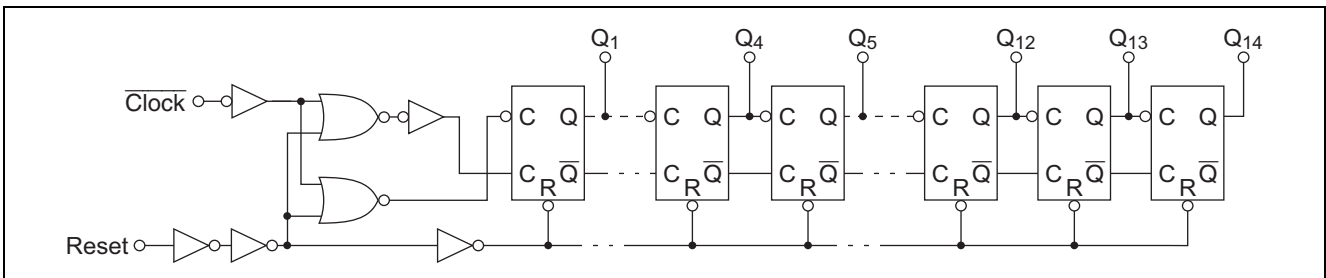
| Clock | Reset | Outputs State |
|---|-------|-----------------------|
|  | L | No change |
|  | L | Advance to next state |
| X | H | All output are low |

Note: 1. X: Don't care

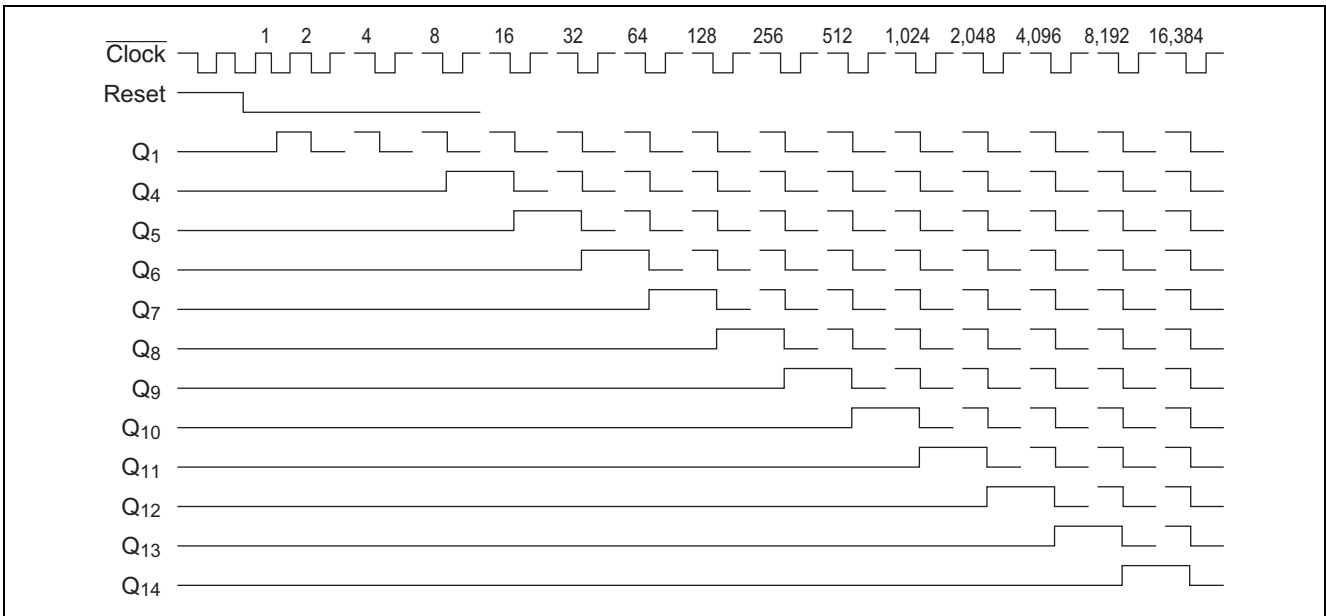
Pin Arrangement



Block Diagram



Timing 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} | ± 20 | mA |
| Output current | I_{OUT} | ± 25 | mA |
| V_{CC} , GND current | I_{CC} or I_{GND} | ± 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 ^{*1} | 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.

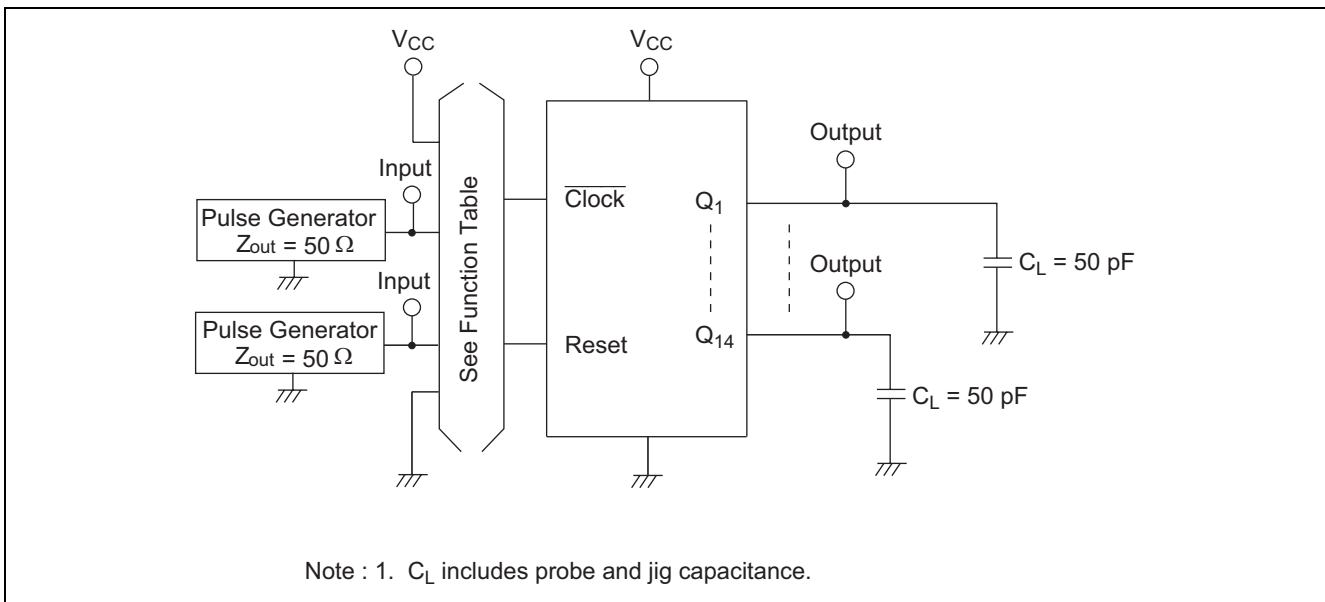
Electrical Characteristics

| 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 | — | — | ± 0.1 | — | ± 1.0 | μA | $V_{in} = V_{CC}$ or GND | | |
| Quiescent supply current | I_{CC} | 6.0 | — | — | 4.0 | — | 40 | μA | $V_{in} = V_{CC}$ or GND, $I_{out} = 0 \mu\text{A}$ | | |

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

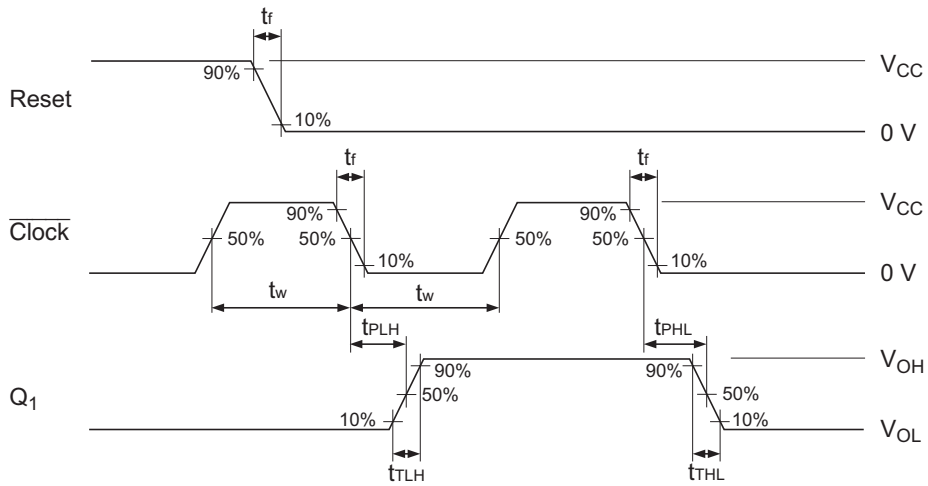
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40 \text{ to } +85^\circ\text{C}$ | | Unit | Test Conditions |
|-------------------------|-----------|--------------|--------------------------|-----|-----|---|-----|------|--------------------|
| | | | Min | Typ | Max | Min | Max | | |
| Maximum clock frequency | f_{max} | 2.0 | — | — | 5 | — | 4 | MHz | |
| | | 4.5 | — | — | 25 | — | 20 | | |
| | | 6.0 | — | — | 29 | — | 24 | | |
| Propagation delay time | t_{PLH} | 2.0 | — | — | 175 | — | 220 | ns | Clock to Q_1 |
| | | 4.5 | — | 14 | 35 | — | 44 | | |
| | | 6.0 | — | — | 30 | — | 37 | | |
| | t_{PHL} | 2.0 | — | — | 175 | — | 220 | ns | Clock to Q_1 |
| | | 4.5 | — | 14 | 35 | — | 44 | | |
| | | 6.0 | — | — | 30 | — | 37 | | |
| | t_{PLH} | 2.0 | — | — | 200 | — | 250 | ns | Reset to output |
| | | 4.5 | — | 18 | 40 | — | 50 | | |
| | | 6.0 | — | — | 34 | — | 43 | | |
| | t_{PHL} | 2.0 | — | — | 100 | — | 125 | ns | Q_n to Q_{n-1} |
| | | 4.5 | — | — | 20 | — | 25 | | |
| | | 6.0 | — | — | 17 | — | 21 | | |
| Removal time | t_{rem} | 2.0 | 100 | — | — | 125 | — | ns | |
| | | 4.5 | 20 | 6 | — | 25 | — | | |
| | | 6.0 | 17 | — | — | 21 | — | | |
| Pulse width | t_w | 2.0 | 80 | — | — | 100 | — | ns | |
| | | 4.5 | 16 | 4 | — | 20 | — | | |
| | | 6.0 | 14 | — | — | 17 | — | | |
| Output rise/fall time | t_{TLH} | 2.0 | — | — | 75 | — | 95 | ns | |
| | | 4.5 | — | 5 | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | C_{in} | — | — | 5 | 10 | — | 10 | pF | |

Test Circuit



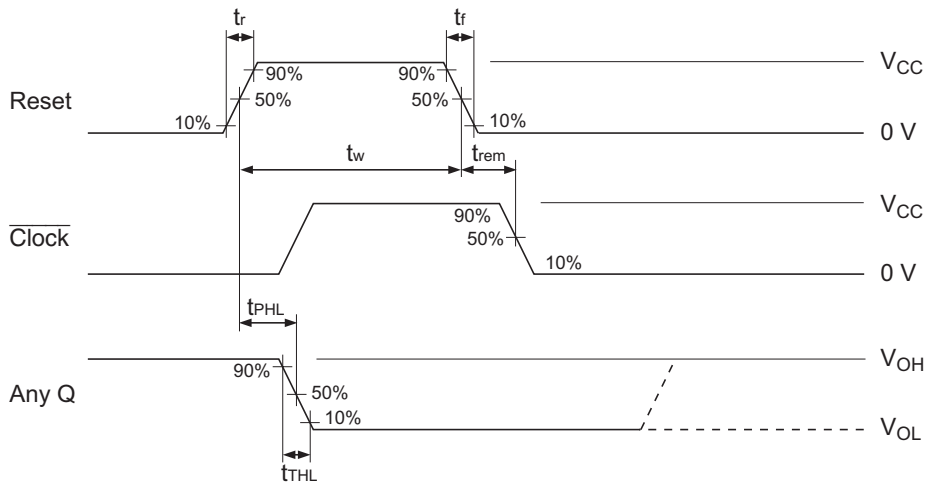
Waveforms

• Waveform – 1



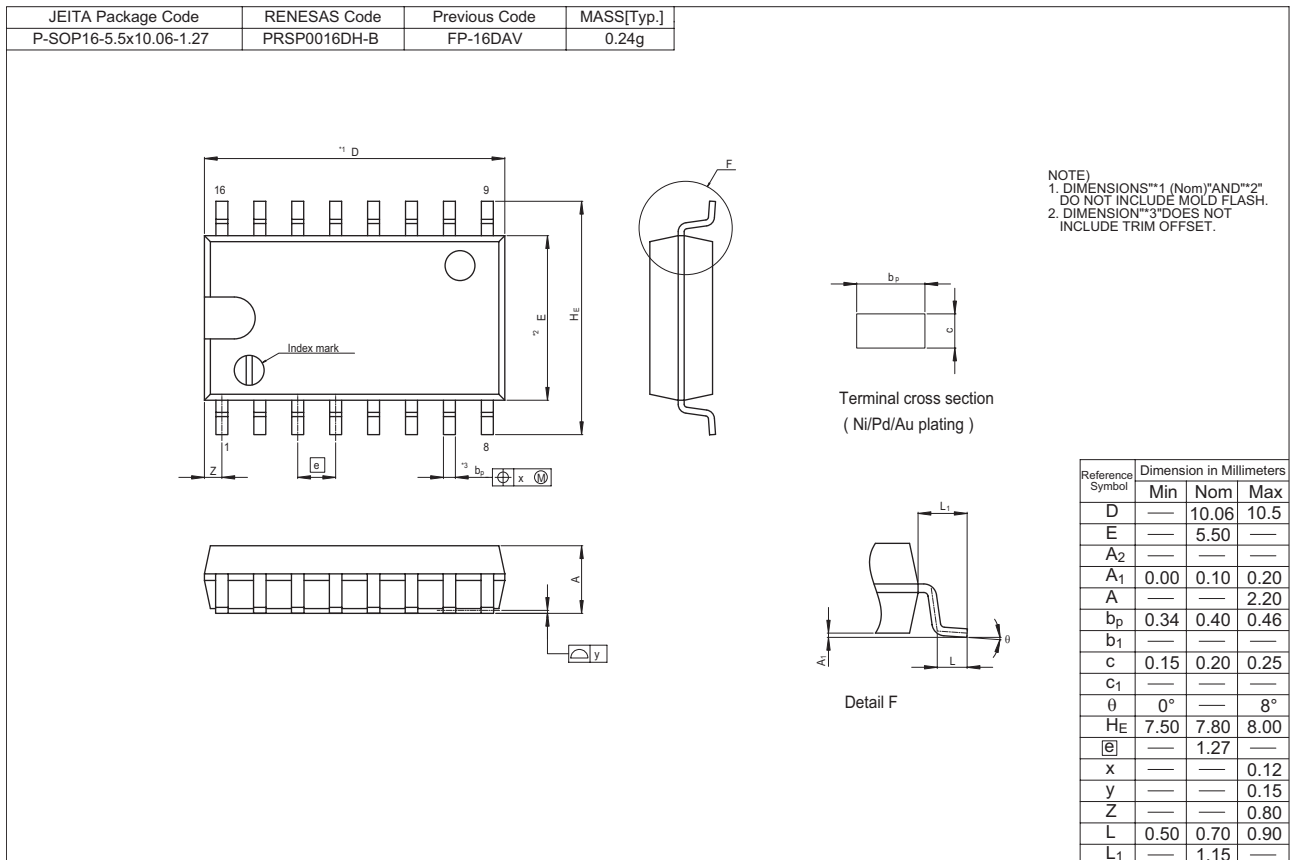
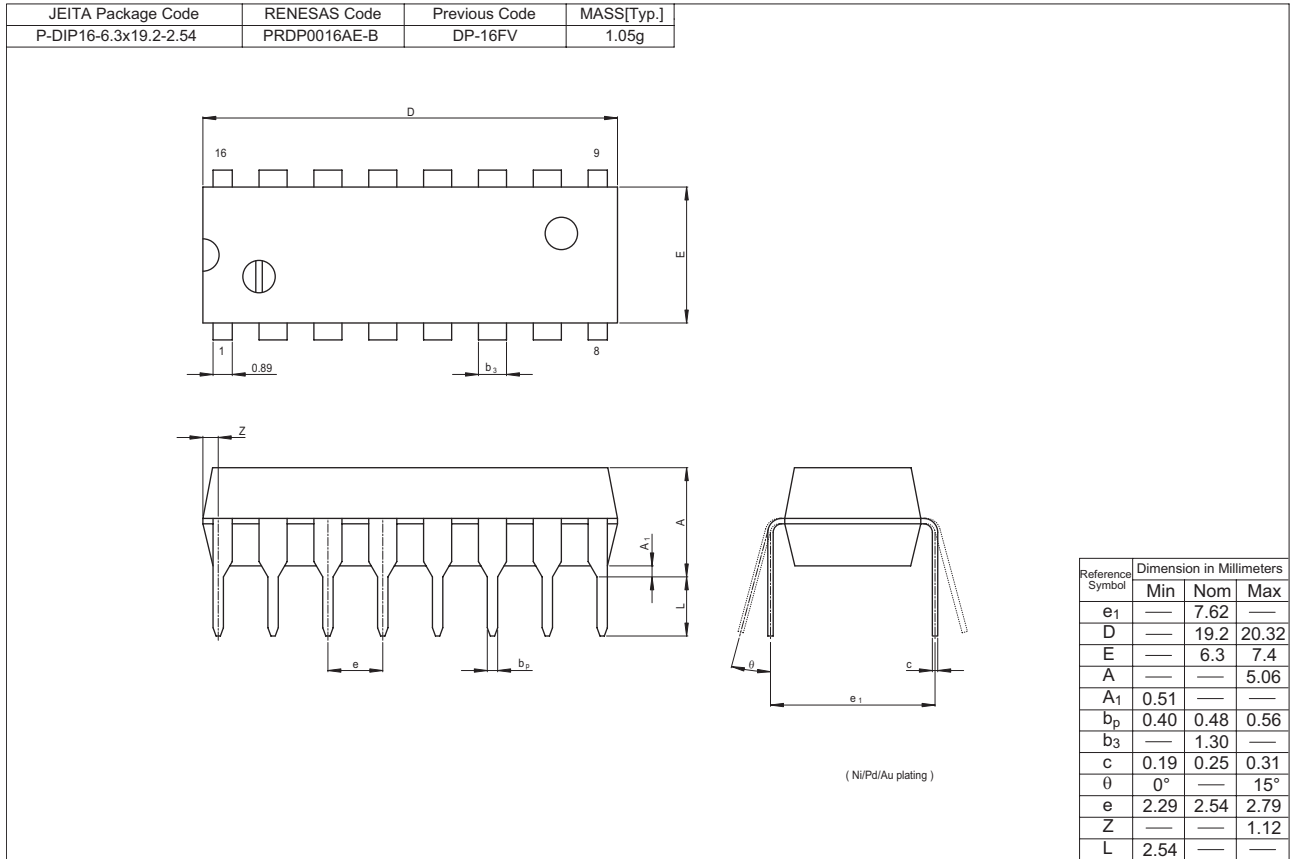
Note : 1. Waveform : $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 6 \text{ ns}$, $t_f \leq 6 \text{ ns}$

• Waveform – 2



Note : 1. Waveform : $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 6 \text{ ns}$, $t_f \leq 6 \text{ ns}$

Package Dimensions



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