

# 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  $\mu$ 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)
HD74HC4020P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—
HD74HC4020FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)

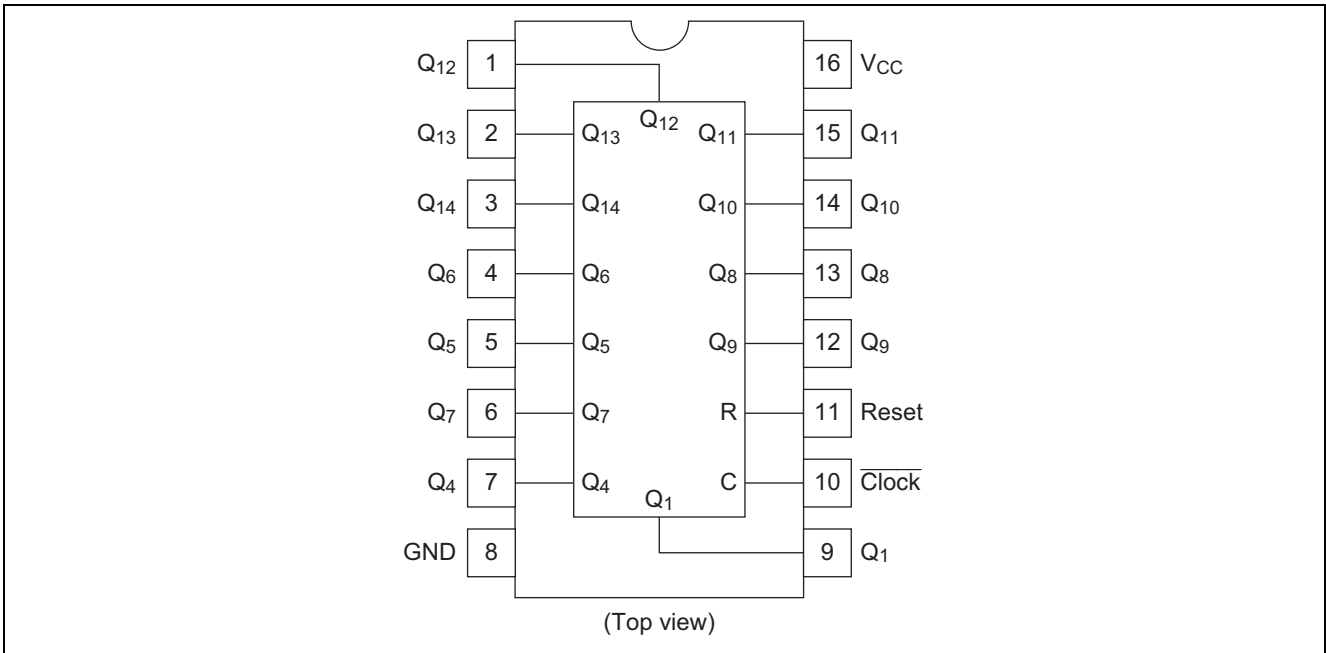
Note: Please consult the sales office for the above package availability.

### Function Table

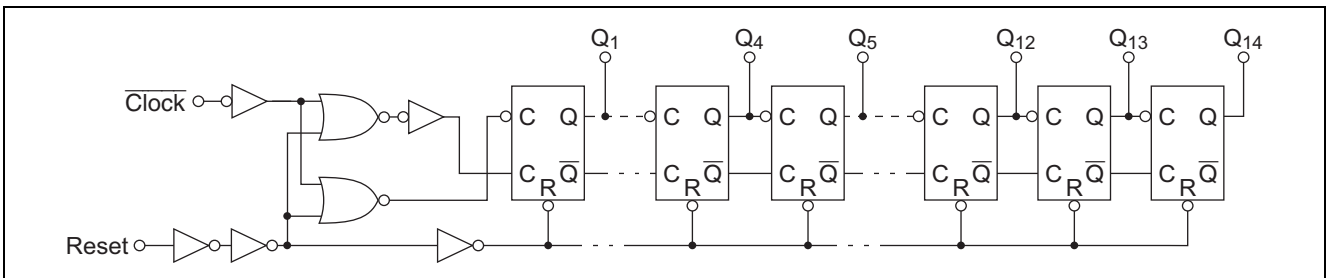
Clock	Reset	Outputs State
	L	No change
	L	Advance to next state
X	H	All output are low

Note: 1. X: Don't care

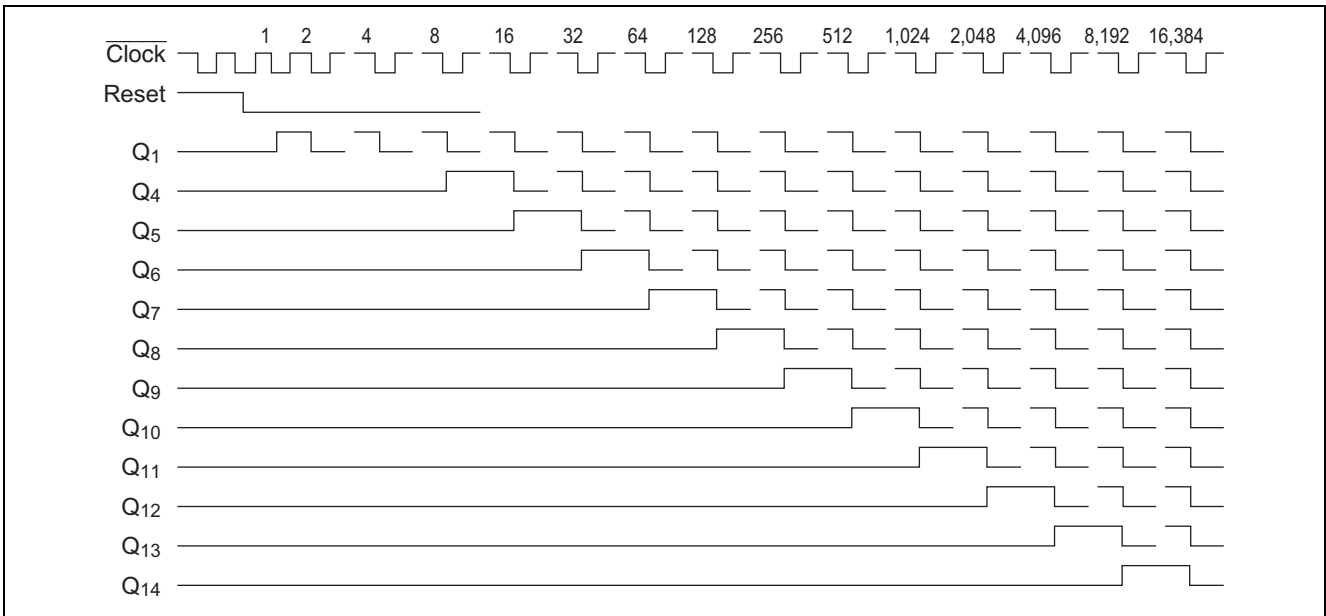
### Pin Arrangement



### 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	$I_{IK}, I_{OK}$	$\pm 20$	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.

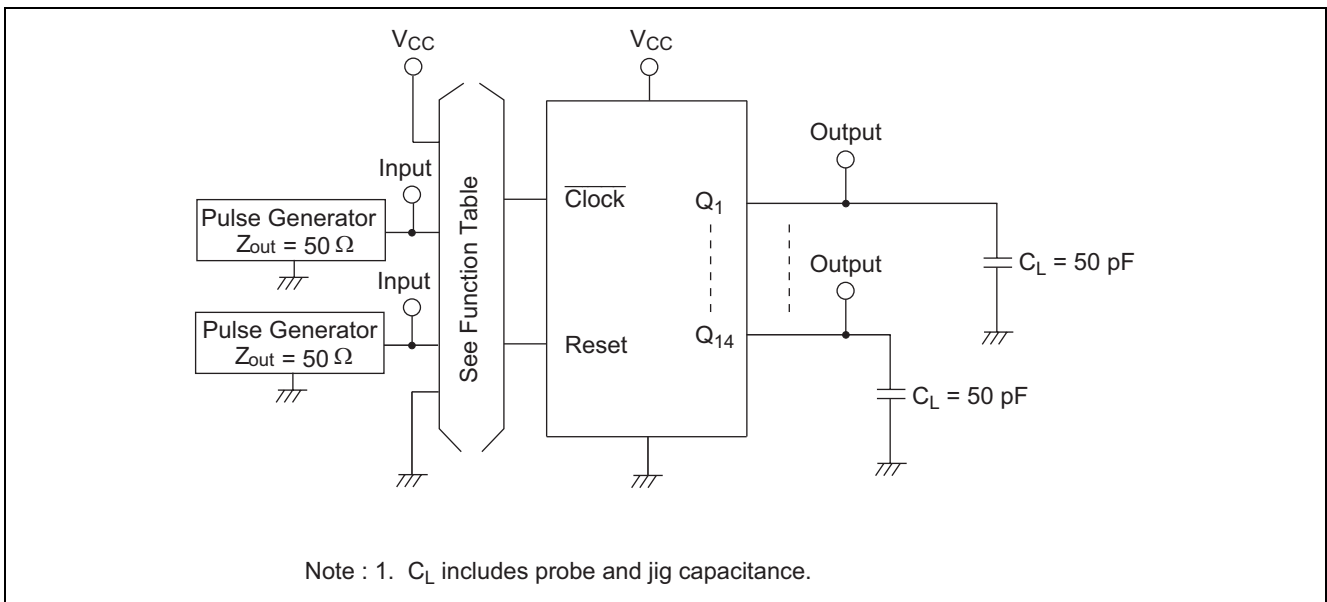
### Electrical Characteristics

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  $t_r = t_f = 6 \text{ ns}$ )

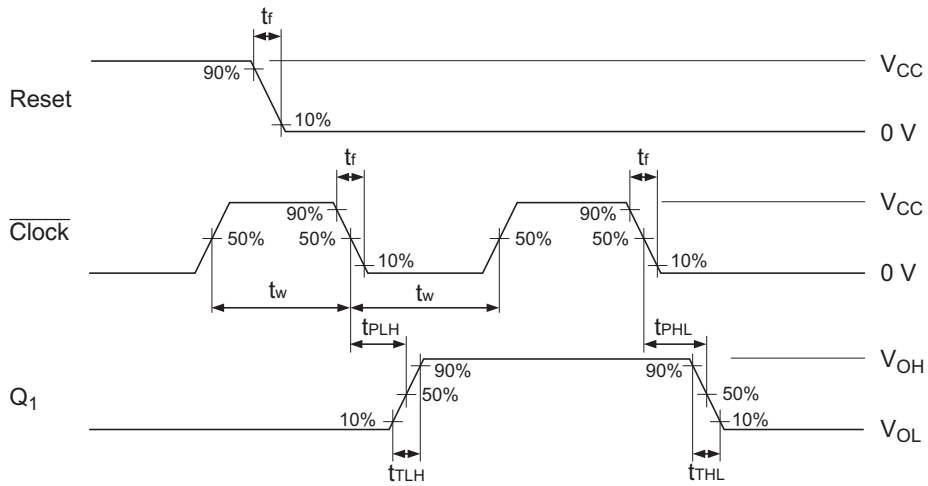
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Maximum clock frequency	$f_{max}$	2.0	—	—	5	—	4	MHz		
		4.5	—	—	25	—	20			
		6.0	—	—	29	—	24			
Propagation delay time	$t_{PLH}$	2.0	—	—	175	—	220	ns	Clock to $Q_1$	
		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			
	$t_{PLH}$	$t_{PHL}$	2.0	—	—	200	—	250	ns	Reset to output
			4.5	—	18	40	—	50		
			6.0	—	—	34	—	43		
	$t_{PLH}$	$t_{PHL}$	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	$t_{TLH}$ $t_{THL}$	2.0	—	—	75	—	95	ns		
		4.5	—	5	15	—	19			
		6.0	—	—	13	—	16			
Input capacitance	$C_{in}$	—	—	5	10	—	10	pF		

Test Circuit



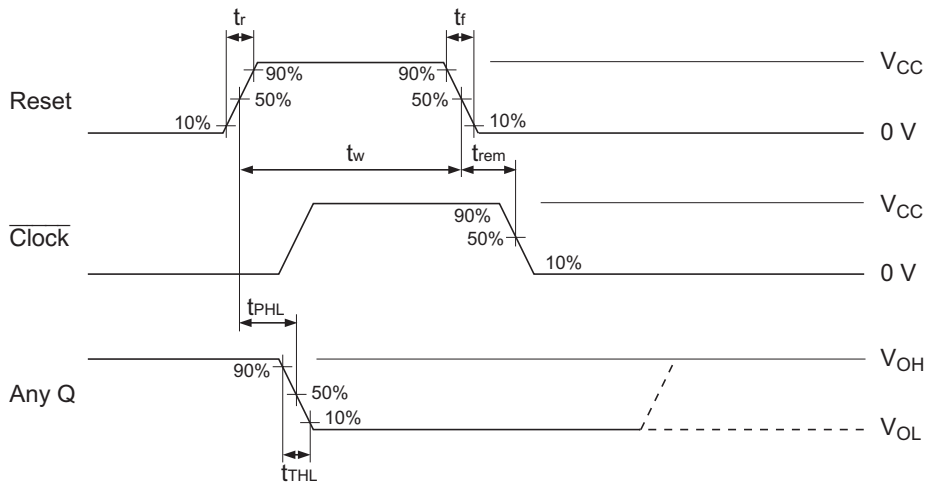
Waveforms

• Waveform – 1



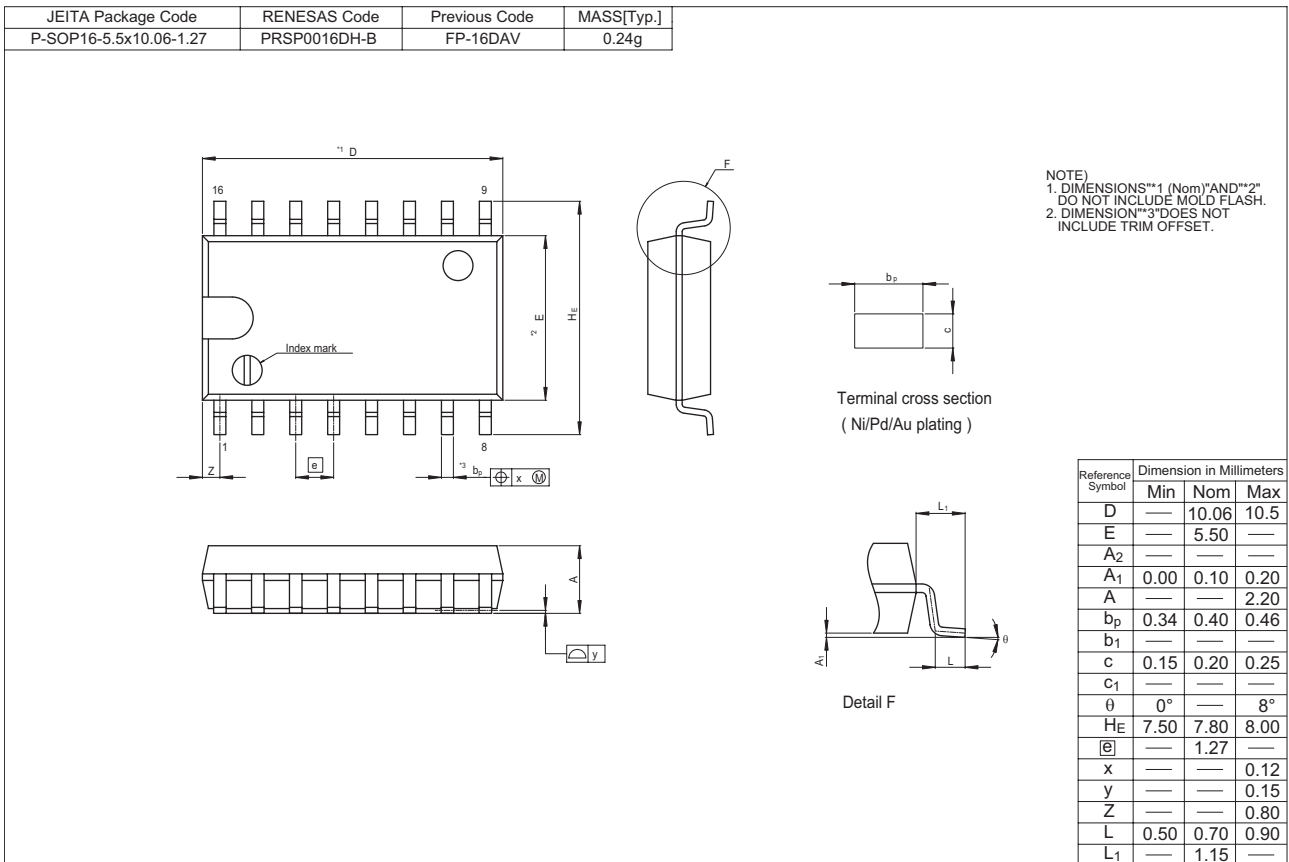
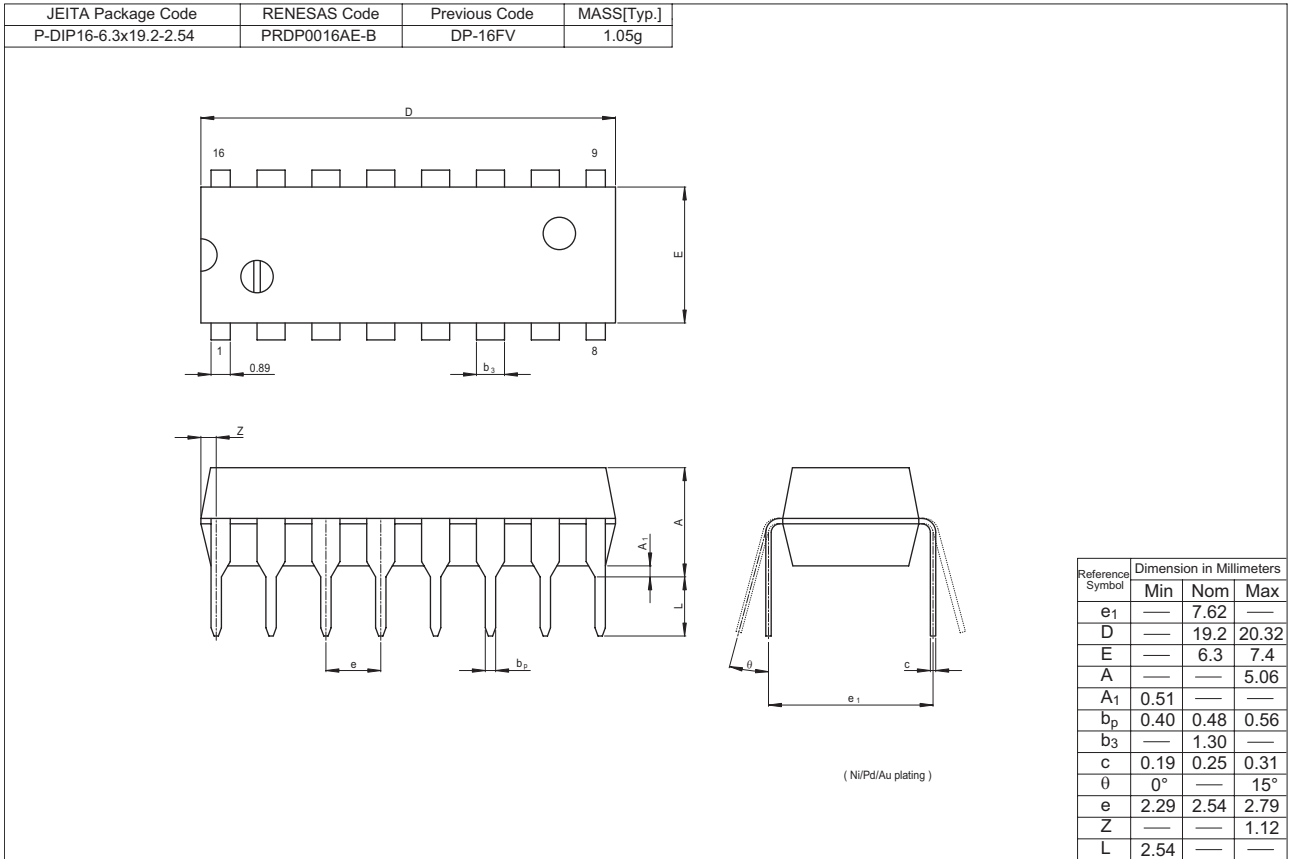
Note : 1. Waveform :  $PRR \leq 1 \text{ MHz}$ ,  $Z_o = 50 \Omega$ ,  $t_r \leq 6 \text{ ns}$ ,  $t_f \leq 6 \text{ ns}$

• 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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