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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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HD74HC393

Dual 4-bit Binary Counters

REJ03D0625-0200
(Previous ADE-205-504)
Rev.2.00
Mar 30, 2006

Description

The HD74HC393 contain two 4-bit ripple carry binary counters, which can be cascaded to create a single divide-by-256 counter.

The HD74HC393 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} (A to Q_A) = 16 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°C)
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HC393P	DILP-14 pin	PRDP0014AB-B (DP-14AV)	P	—
HD74HC393FPEL	SOP-14 pin (JEITA)	PRSP0014DF-B (FP-14DAV)	FP	EL (2,000 pcs/reel)

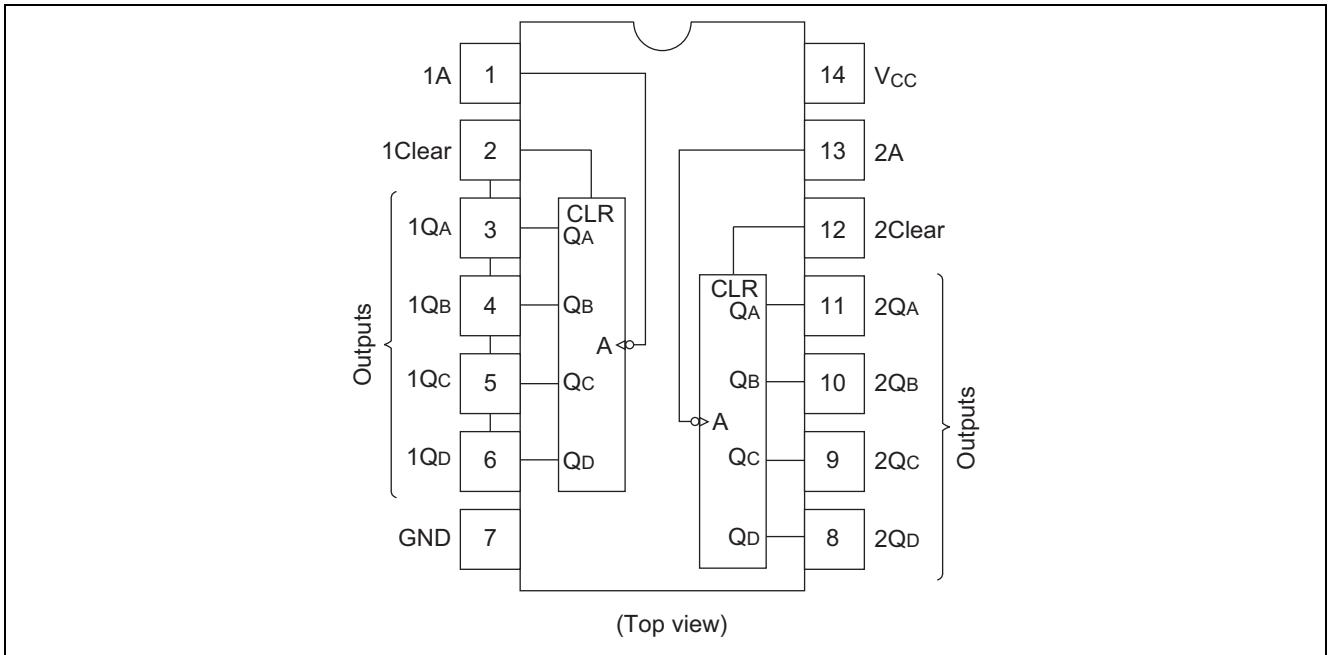
Note: Please consult the sales office for the above package availability.

Function Table

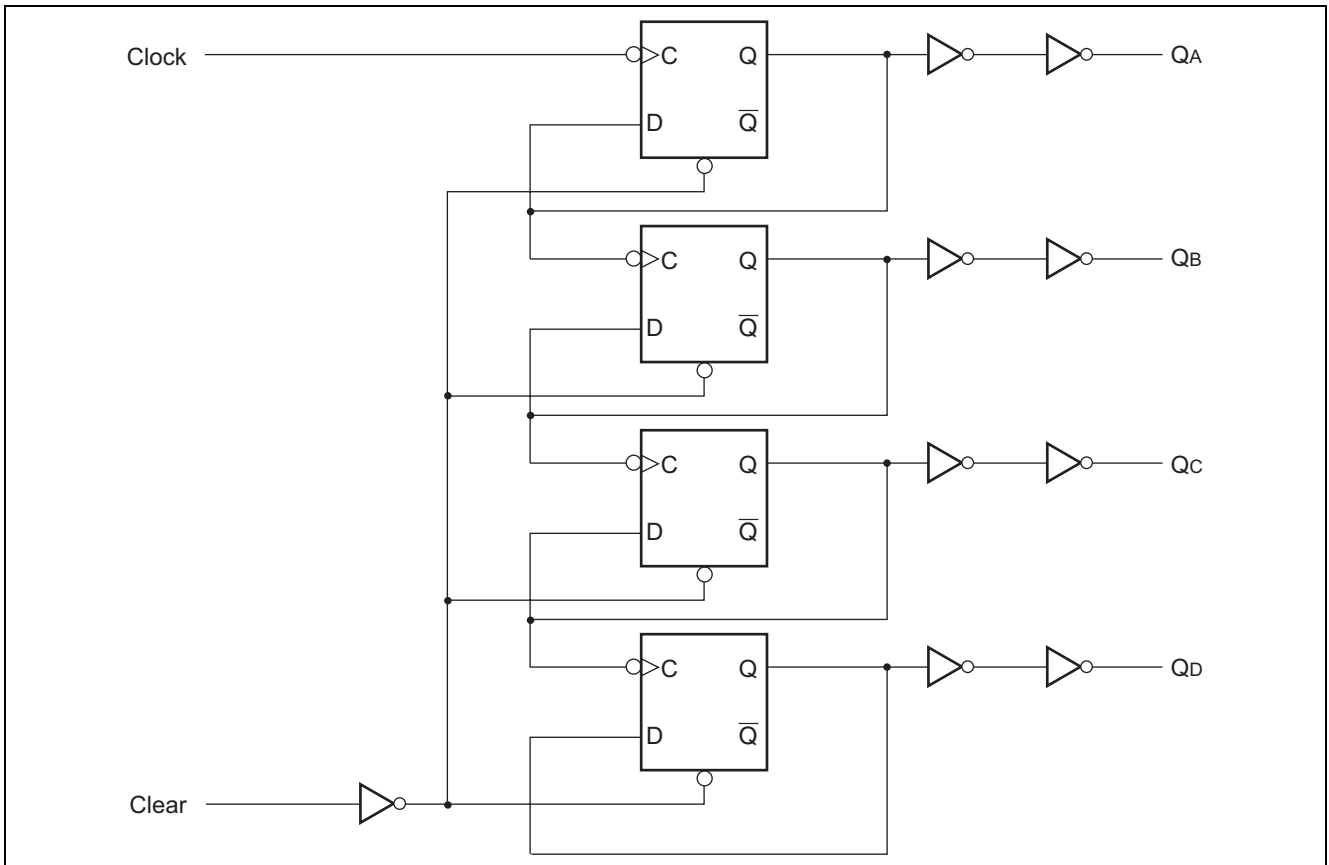
Clock	Clear	Outputs
X	H	L
H	L	No change
L	L	No change
	L	No change
	L	Advance to next state

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

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}	± 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.

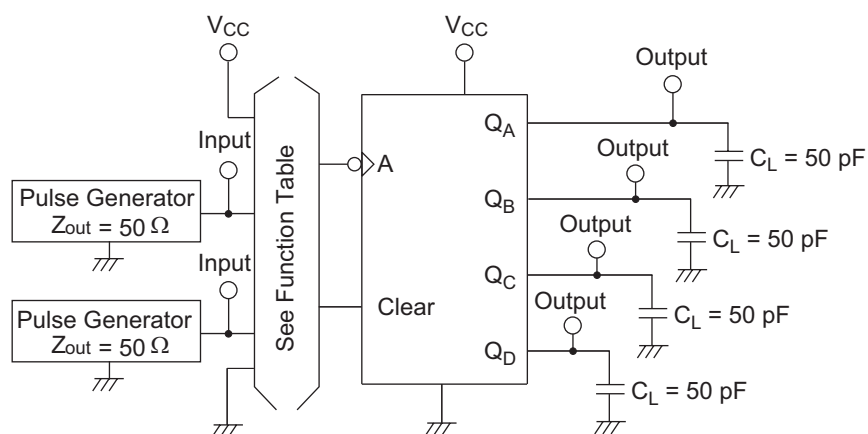
Electrical Characteristics

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	$V_{in} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu\text{A}$
		4.5	4.4	4.5	—	4.4	—			
		6.0	5.9	6.0	—	5.9	—			
		4.5	4.18	—	—	4.13	—			$I_{OH} = -4 \text{ mA}$
		6.0	5.68	—	—	5.63	—			$I_{OH} = -5.2 \text{ mA}$
	V_{OL}	2.0	—	0.0	0.1	—	0.1	V	$V_{in} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu\text{A}$
		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	$V_{in} = V_{CC} \text{ or GND}$	
Quiescent supply current	I_{CC}	6.0	—	—	4.0	—	40	μA	$V_{in} = V_{CC} \text{ or GND}, I_{out} = 0 \mu\text{A}$	

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

Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		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} t_{PHL}	2.0	—	—	120	—	150	ns	Clock to Q_A
		4.5	—	16	24	—	30		
		6.0	—	—	20	—	26		
	t_{PLH} t_{PHL}	2.0	—	—	185	—	230	ns	Clock to Q_B
		4.5	—	20	37	—	46		
		6.0	—	—	31	—	39		
	t_{PLH} t_{PHL}	2.0	—	—	220	—	275	ns	Clock to Q_C
		4.5	—	24	44	—	55		
		6.0	—	—	37	—	47		
	t_{PLH} t_{PHL}	2.0	—	—	260	—	325	ns	Clock to Q_D
		4.5	—	28	52	—	65		
		6.0	—	—	44	—	55		
	t_{PHL}	2.0	—	—	150	—	190	ns	Clear to Q_A, Q_B, Q_C, Q_D
		4.5	—	21	30	—	38		
		6.0	—	—	28	—	33		
Pulse width	t_w	2.0	80	—	—	100	—	ns	Clock, clear
		4.5	16	—	—	20	—		
		6.0	14	—	—	17	—		
Removal time	t_h	2.0	50	—	—	65	—	ns	Clear to clock
		4.5	10	—	—	13	—		
		6.0	9	—	—	11	—		
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	

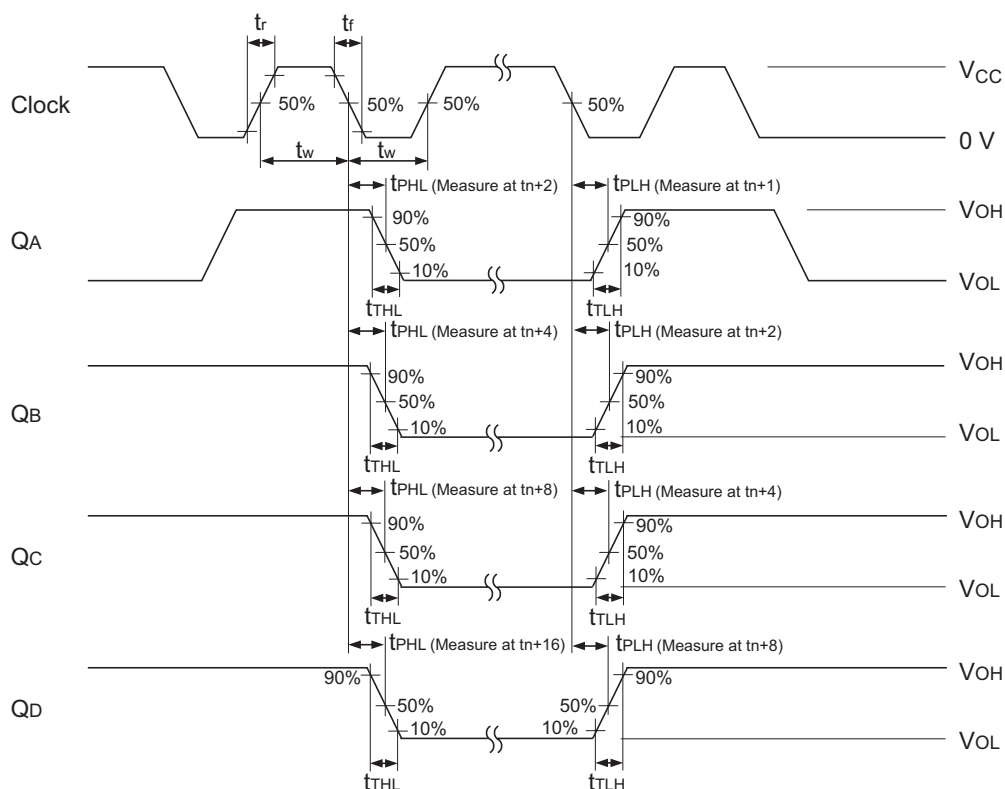
Test Circuit



Note : 1. C_L includes probe and jig capacitance.

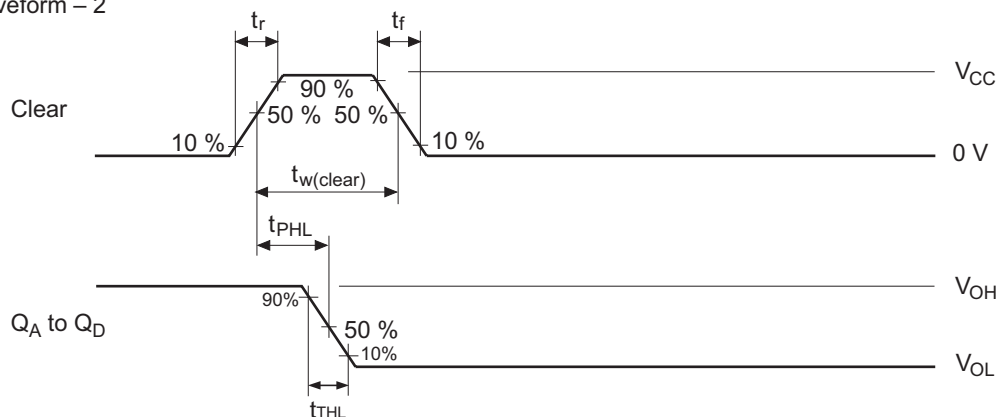
Waveforms

• Waveform – 1



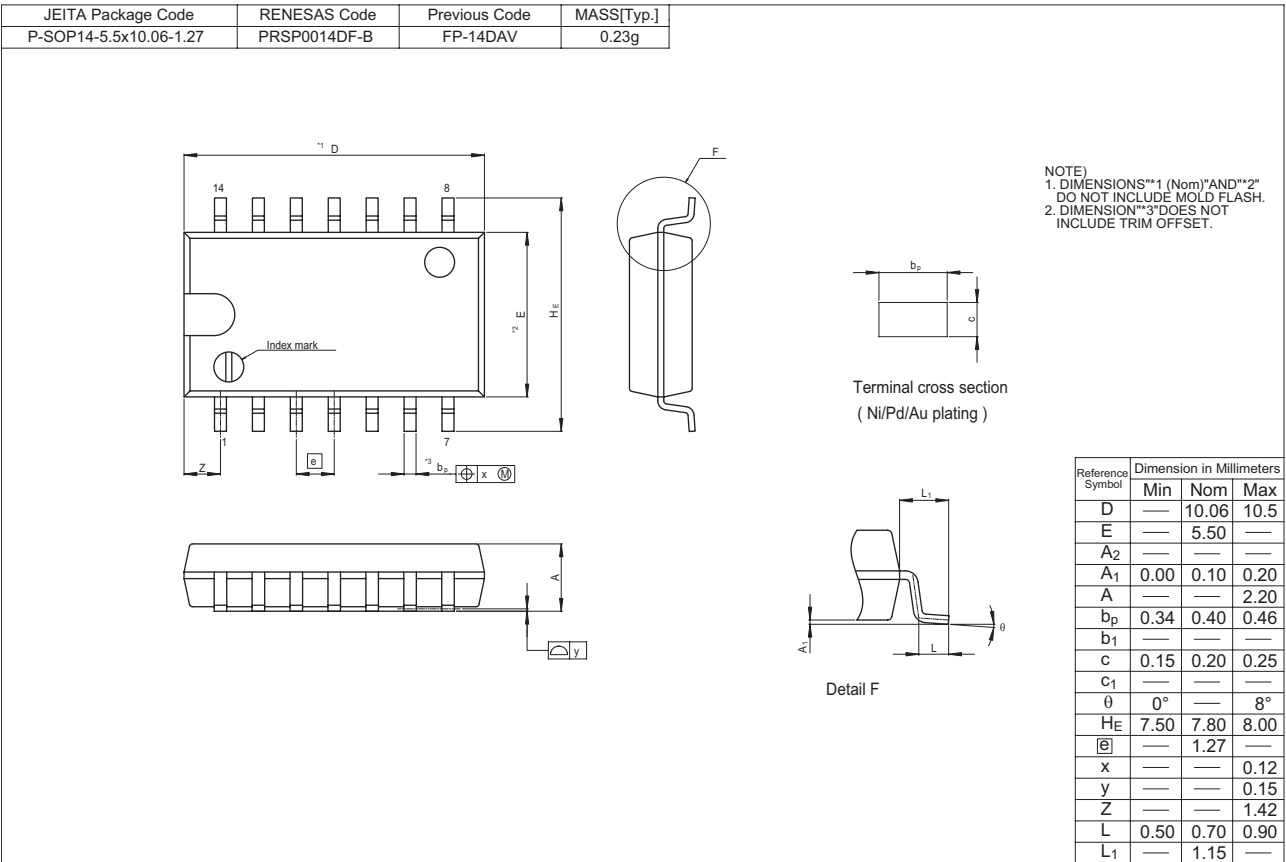
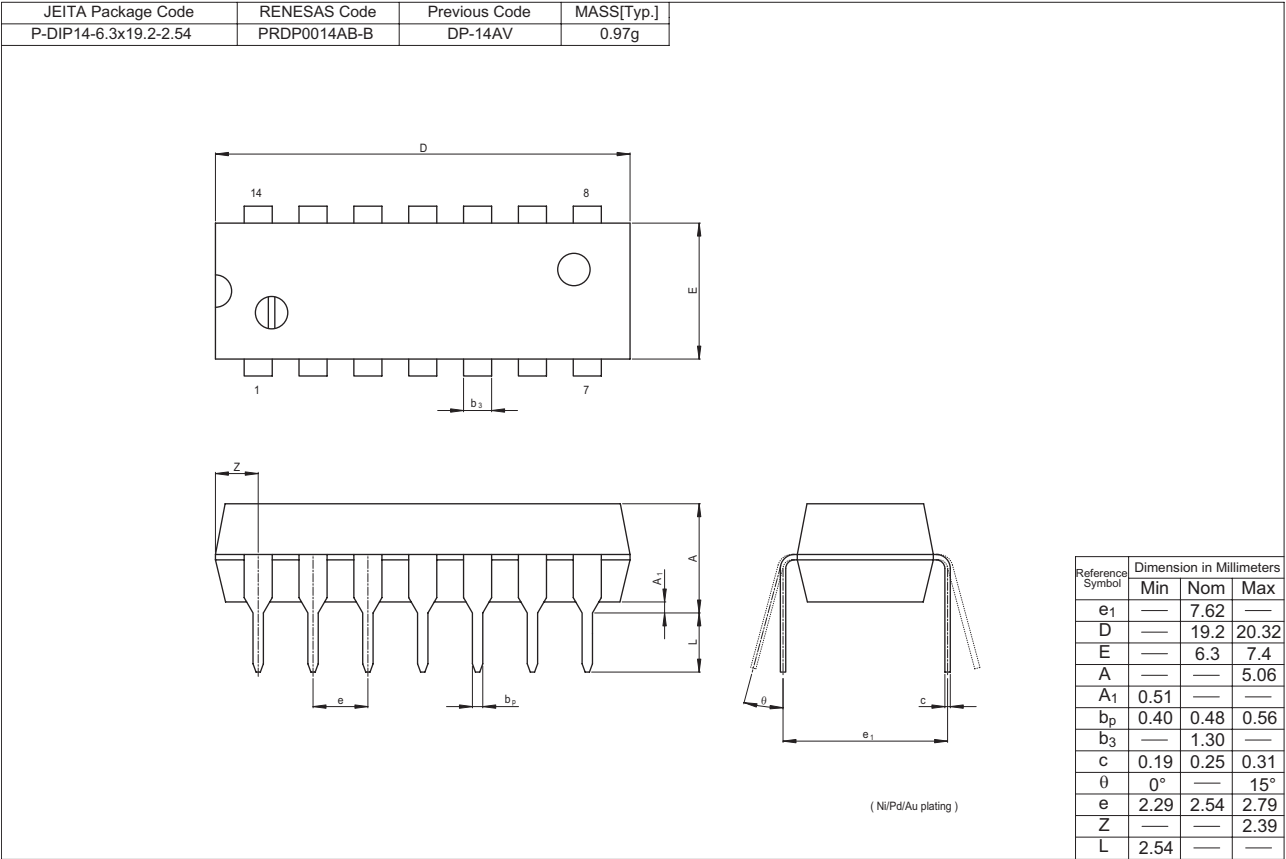
- Notes: 1. Input waveform: $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 6 \text{ ns}$, $t_f \leq 6 \text{ ns}$
 2. t_n is bit time with all outputs at low.

• 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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