

HD74LS93

4-bit Binary Counter

REJ03D0423-0200

Rev.2.00

Feb.18.2005

The HD74LS93 contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and three-state binary counter for divide-by-eight. To use this maximum count length of this counter, the B input is connected to the Q_A output. The input count pulses are applied to input A and the outputs are described in the appropriate function table.

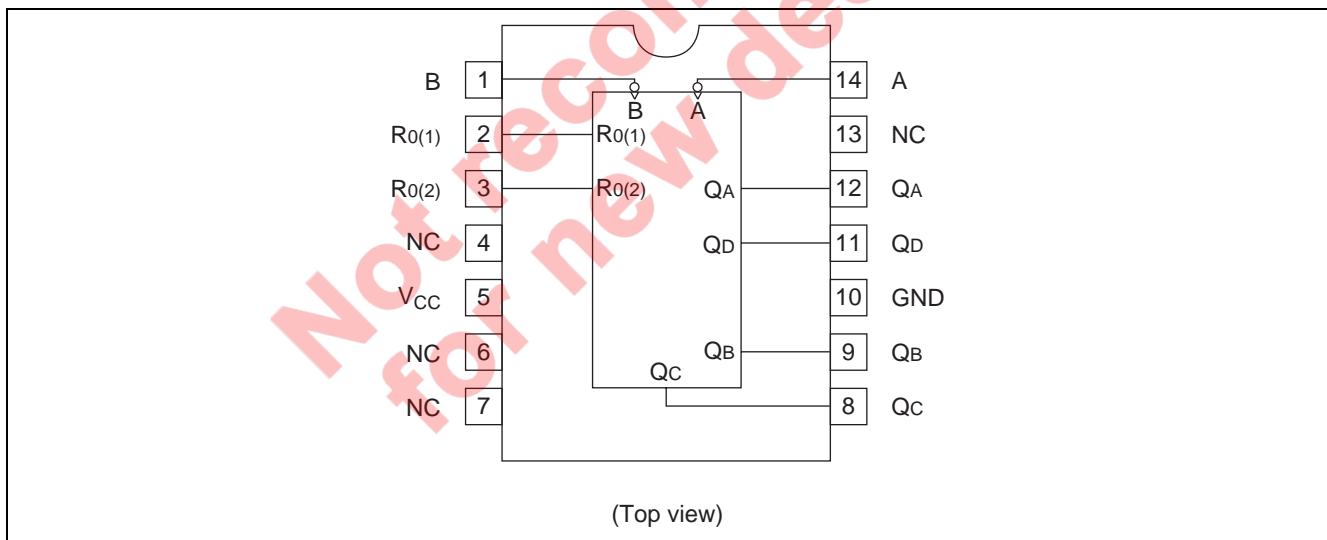
Features

- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LS93P	DILP-14 pin	PRDP0014AB-B (DP-14AV)	P	—
HD74LS93FPEL	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.

Pin Arrangement



Function Table

• Reset / Count Function Table

Reset inputs		Outputs			
R ₀₍₁₎	R ₀₍₂₎	Q _D	Q _C	Q _B	Q _A
H	H	L	L	L	L
L	X	Count			
X	L	Count			

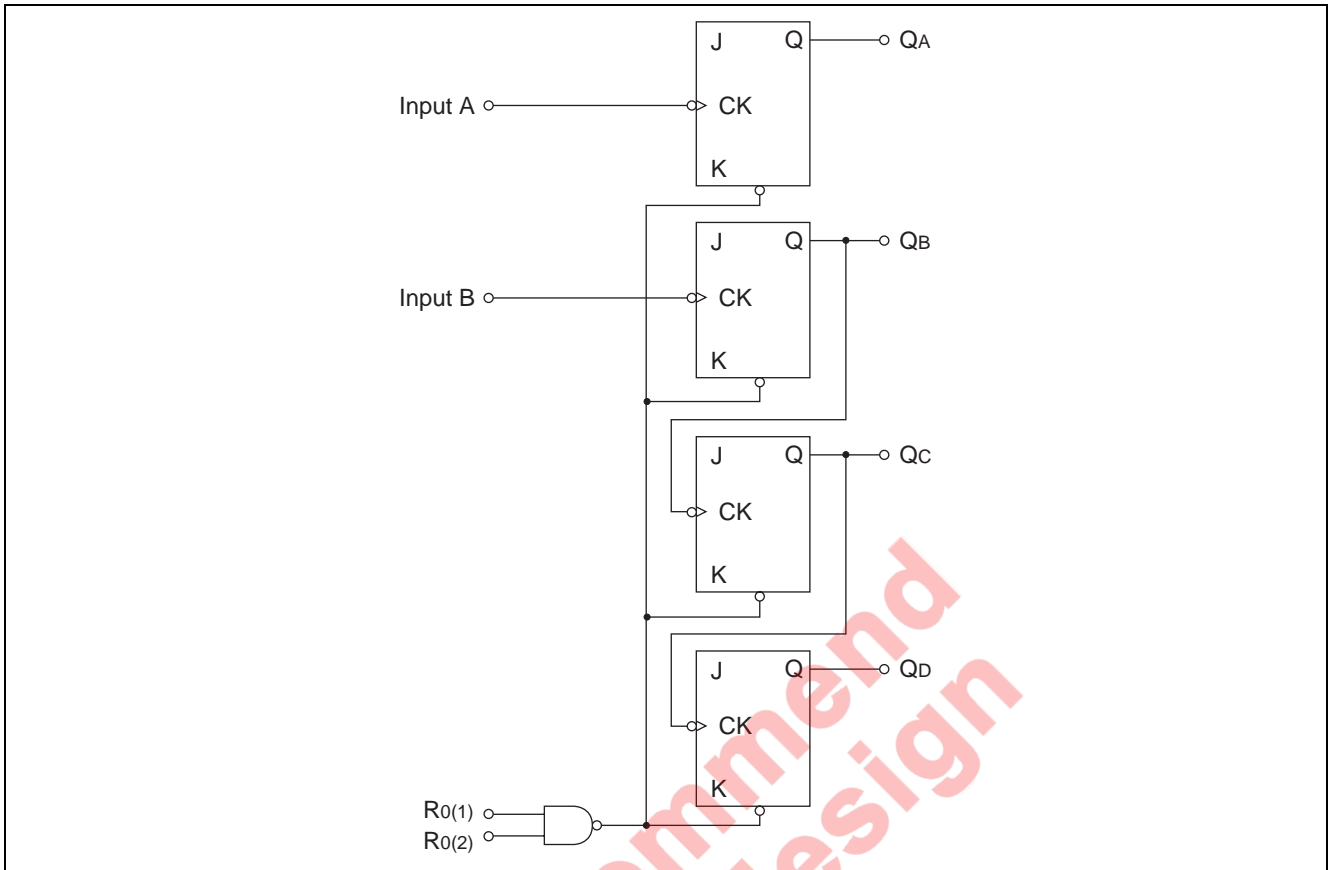
Note: H; high level, L; low level, X; irrelevant

• BCD Count Sequence (Notes 1)

Count	Outputs			
	Q _D	Q _C	Q _B	Q _A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	H
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

- Notes: 1. Output QA is connected to input B for BCD count.
 2. H; high level, L; low level

Block Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage	V_{CC}	7	V
Input voltage	R Inputs	V_{IN}	7
	A, B Inputs	V_{IN}	5.5
Power dissipation	P_T	400	mW
Storage temperature	T_{stg}	-65 to +150	°C

Note: Voltage value, unless otherwise noted, are with respect to network ground terminal.

Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	
Supply voltage	V_{CC}	4.75	5.00	5.25	V	
Output current	I_{OH}	—	—	-400	μA	
	I_{OL}	—	—	8	mA	
Operating temperature	T_{opr}	-20	25	75	°C	
Count frequency	A input	f_{count}	0	—	32	MHz
	B input		0	—	16	
Pulse width	A input	t_w	15	—	—	ns
	B input		30	—	—	
	Reset input		15	—	—	
Setup time	t_{su}	25	—	—	ns	

Electrical Characteristics

(Ta = -20 to +75 °C)

Item	Symbol	min.	typ.*	max.	Unit	Condition	
Input voltage	V _{IH}	2.0	—	—	V		
	V _{IL}	—	—	0.8	V		
Output voltage	V _{OH}	2.7	—	—	V	V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -400 μA	
	V _{OL}	—	—	0.4	V	V _{CC} = 4.75 V, V _{IH} = 2 V, V _{IL} = 0.8 V	
—		—	0.5				
Input current	Any reset	I _{IL}	—	—	-0.4	mA	V _{CC} = 5.25 V, V _I = 0.4 V
	A input		—	—	-2.4		
	B input		—	—	-1.6		
	Any reset	I _{IH}	—	—	20	μA	V _{CC} = 5.25 V, V _I = 2.7 V
	A input		—	—	40		
	B input		—	—	40		
	Any reset	I _I	—	—	0.1	mA	V _{CC} = 5.25 V
A input	—		—	0.2			
B input	—		—	0.2			
Short-circuit output current	I _{OS}	-20	—	-100	mA	V _{CC} = 5.25 V	
Supply current	I _{CC} ***	—	9	15	mA	V _{CC} = 5.25 V	
Input clamp voltage	V _{IK}	—	—	-1.5	V	V _{CC} = 4.75 V, I _{IN} = -18 mA	

Notes: * V_{CC} = 5 V, Ta = 25°C

** Q_A output is tested at specified I_{OL} plus the limit value of I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability.

*** I_{CC} is measured with all outputs open, both R₀ inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.

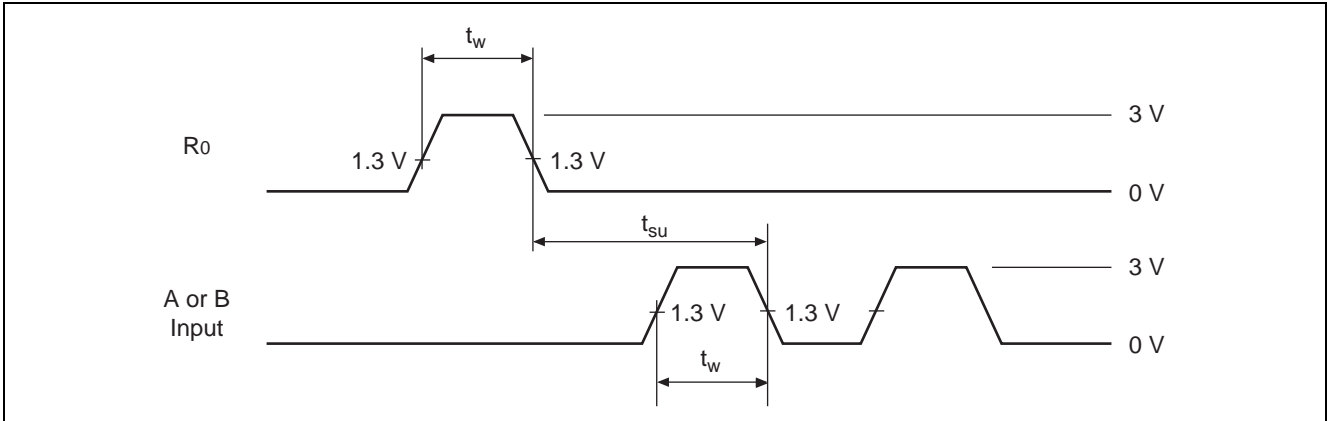
Switching Characteristics

(V_{CC} = 5 V, Ta = 25°C)

Item	Symbol	Inputs	Outputs	min.	typ.	max.	Unit	Condition
Maximum count frequency	f _{max}	A	Q _A	32	42	—	MHz	C _L = 15 pF, R _L = 2 kΩ
		B	Q _B	16	—	—		
Propagation delay time	t _{PLH}	A	Q _A	—	10	16	ns	
	t _{PHL}			—	12	18		
	t _{PLH}	A	Q _D	—	46	70		
	t _{PHL}			—	46	70		
	t _{PLH}	B	Q _B	—	10	16		
	t _{PHL}			—	14	21		
	t _{PLH}	B	Q _C	—	21	32		
	t _{PHL}			—	23	35		
	t _{PLH}	B	Q _D	—	34	51		
	t _{PHL}			—	34	51		
t _{PHL}	Set-to-0	Q _A to Q _D	—	26	40			

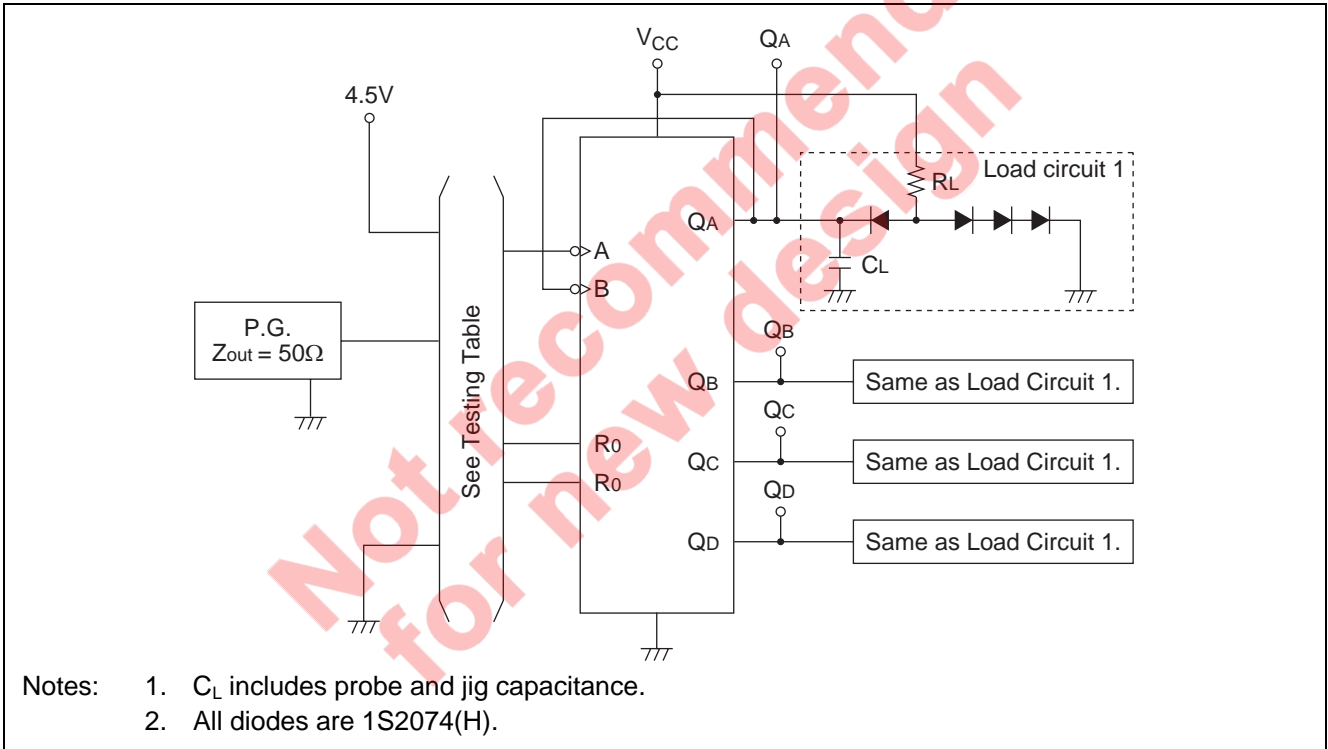
Note: Refer to Test Circuit and Waveform of the Common Item "TTL Common Matter (Document No.: REJ27D0005-0100)".

Timing Definition



Testing Method

Test Circuit



Testing Table

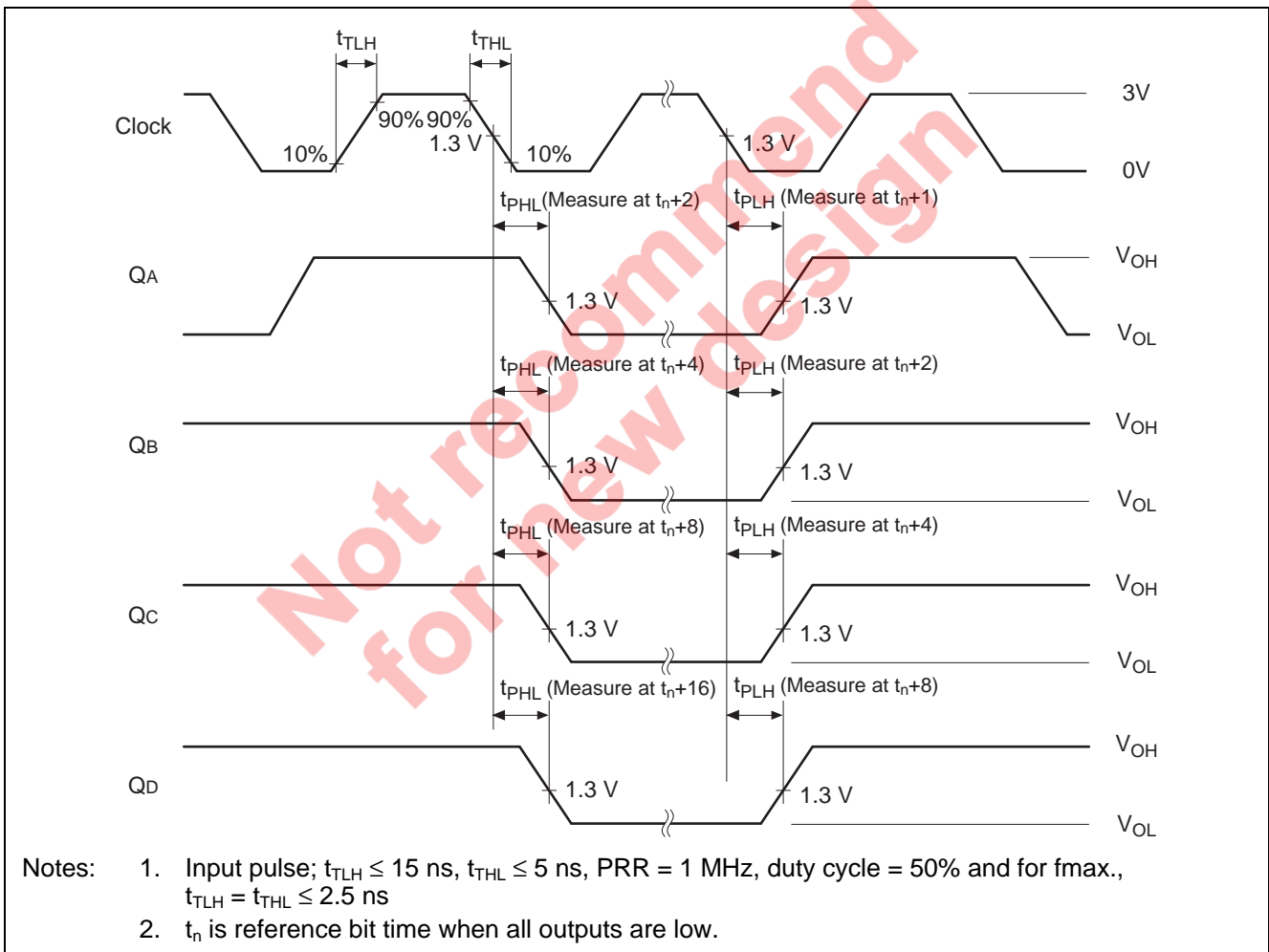
Item	From input to output	Inputs			Outputs			
		A	B	R ₀	Q _A	Q _B	Q _C	Q _D
f _{max}	A → Q	IN	to Q _A	GND	Out	Out	Out	Out
	B → Q	4.5 V	IN	GND	—	Out	Out	Out
t _{PLH} t _{PHL}	A → Q _A	IN	to Q _A	GND	Out	—	—	—
	A → Q _D	IN	to Q _A	GND	—	—	—	Out
	B → Q _B	4.5 V	IN	GND	—	Out	—	—
	B → Q _C	4.5 V	IN	GND	—	—	Out	—
	B → Q _D	4.5 V	IN	GND	—	—	—	Out
	R ₀ ** → Q	IN*	to Q _A	IN	Out	Out	Out	Out

* For initialized.

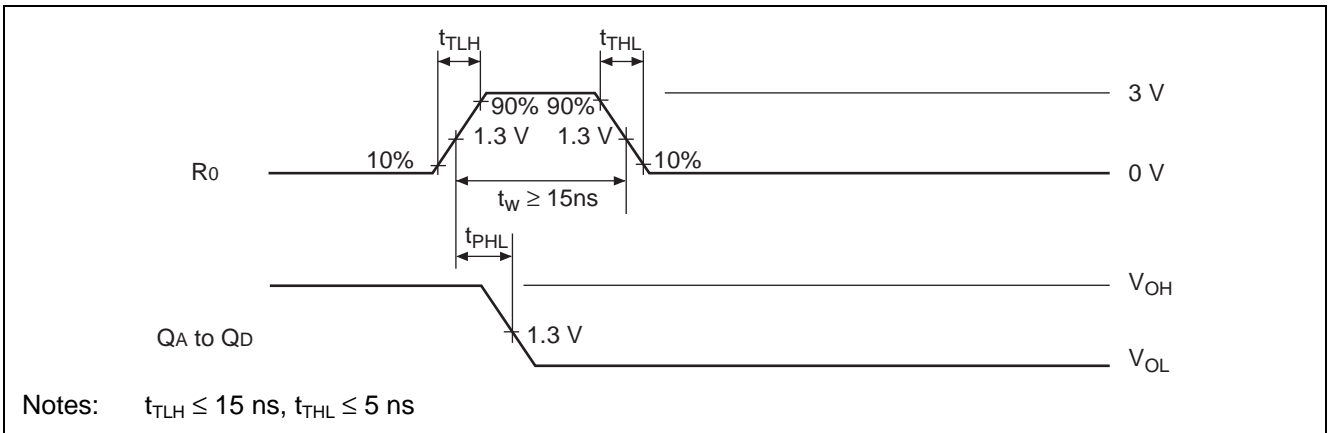
** Measured with each input and unused inputs at 4.5 V.

Waveform

1. f_{max}, t_{PLH}, t_{PHL} (Clock → Q)

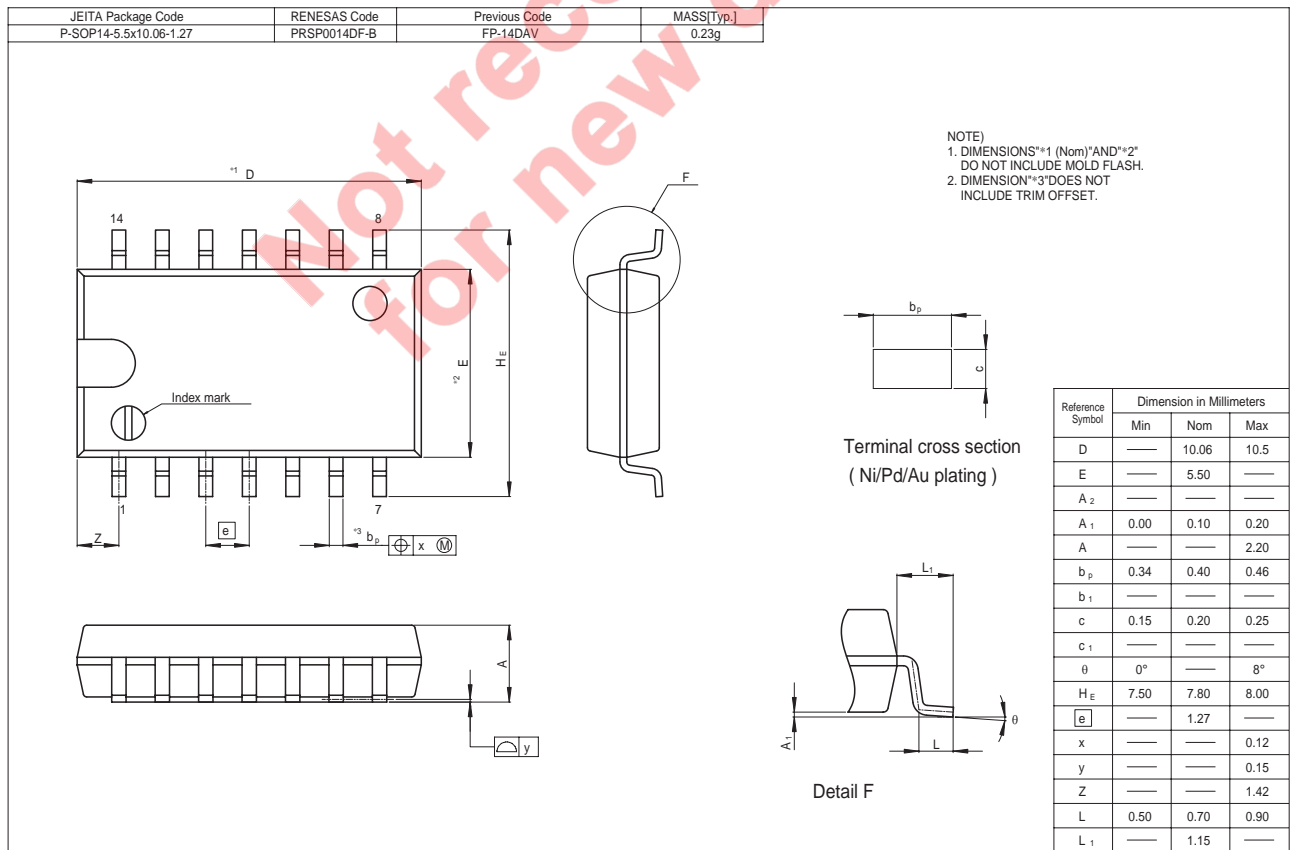
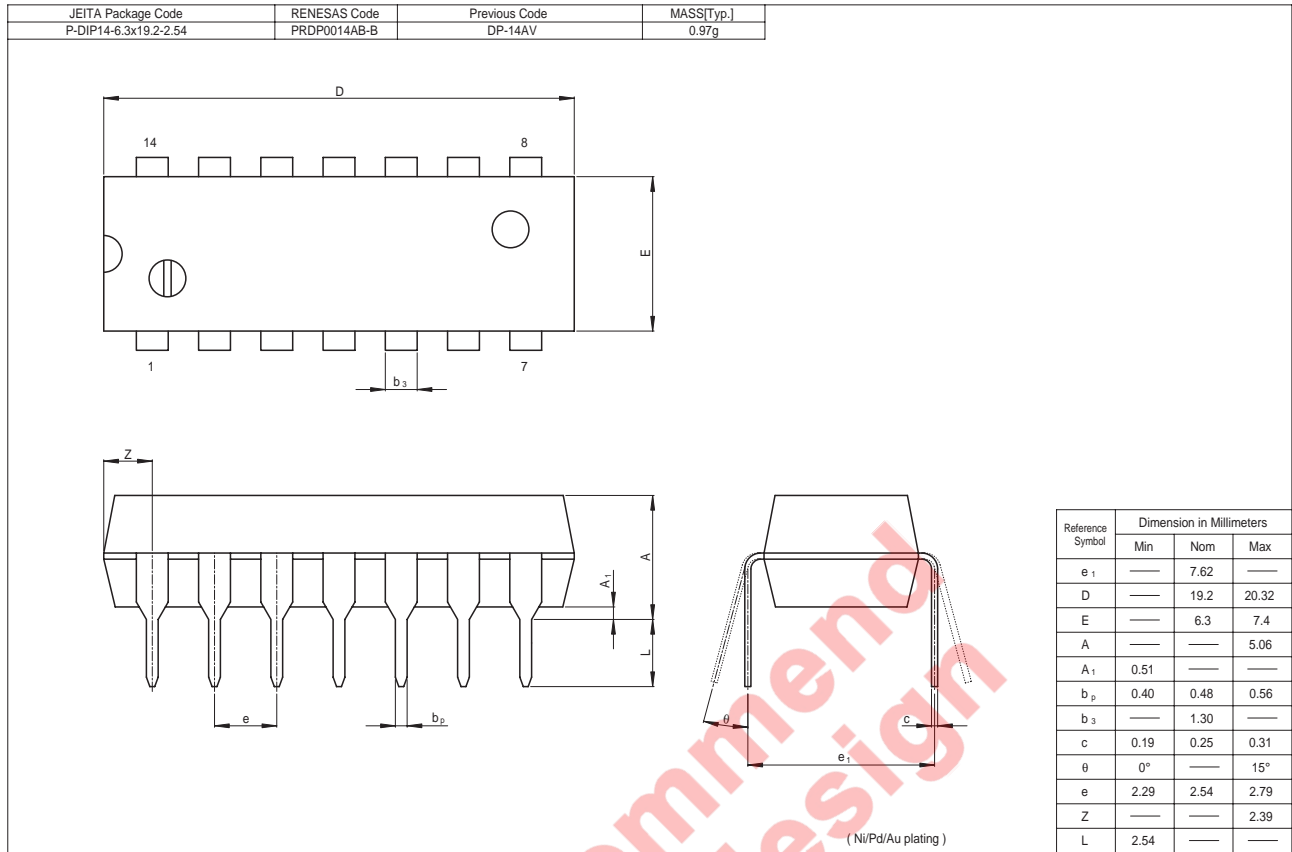


2. $t_{PHL} (R_0 \rightarrow Q)$



Not recommend
for new design

Package Dimensions



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