

# HD74HC74

## Dual D-type Flip-Flops (with Preset and Clear)

REJ03D0549-0300

Rev.3.00

Oct 27, 2008

### Description

The flip-flop has independent data, preset, clear, and clock inputs and Q and  $\bar{Q}$  outputs. The logic level present at the data input is transferred to the output during the positive going transition to the clock pulse. Preset and clear are independent of the clock and accomplished by a low level at the appropriate input.




### Features

- High Speed Operation:  $t_{pd}$  (Clock to Q or  $\bar{Q}$ ) = 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) = 2  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HC74P	DILP-14 pin	PRDP0014AB-B (DP-14AV)	P	—
HD74HC74FPEL	SOP-14 pin (JEITA)	PRSP0014DF-B (FP-14DAV)	FP	EL (2,000 pcs/reel)
HD74HC74RPEL	SOP-14 pin (JEDEC)	PRSP0014DE-A (FP-14DNV)	RP	EL (2,500 pcs/reel)
HD74HC74TELL	TSSOP-14 pin	PTSP0014JA-B (TTP-14DV)	T	ELL (2,000 pcs/reel)

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

### Function Table

Inputs				Outputs	
Preset	Clear	Clock	Data	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	$H^{*1}$	$H^{*1}$
H	H		H	H	L
H	H		L	L	H
H	H	L	X	No change	
H	H	H	X	No change	
H	H		X	No change	

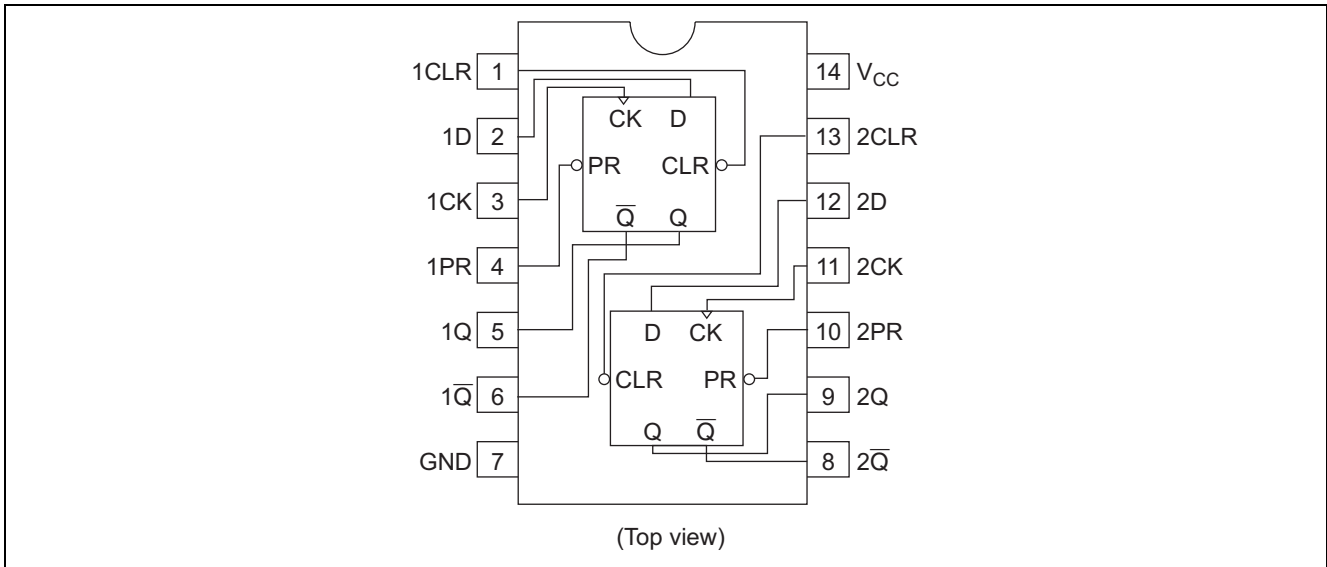
H : High level

L : Low level

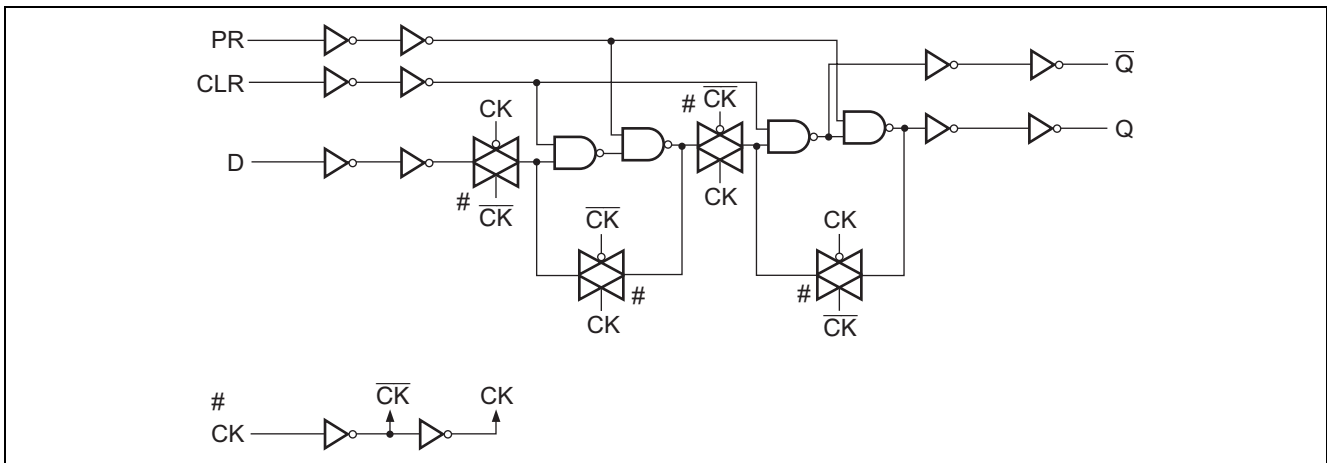
X : Irrelevant

Note: 1. Q and  $\bar{Q}$  will remain High as long as Preset and Clear are Low, but Q and  $\bar{Q}$  are unpredictable, if Preset and Clear go High simultaneously.

### Pin Arrangement



### Logic Diagram (1/2)



### 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	$I_O$	$\pm 25$	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	$^{\circ}C$

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	$V_{CC} = 2.0\text{ V}$
		0 to 500		$V_{CC} = 4.5\text{ V}$
		0 to 400		$V_{CC} = 6.0\text{ V}$

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	—			$I_{OH} = -4\ \text{mA}$
		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	$V_{in} = V_{IH}\text{ or }V_{IL}$	$I_{OL} = 20\ \mu\text{A}$
		4.5	—	0.0	0.1	—	0.1			$I_{OL} = 4\ \text{mA}$
		6.0	—	0.0	0.1	—	0.1			$I_{OL} = 5.2\ \text{mA}$
		4.5	—	—	0.26	—	0.33			
		6.0	—	—	0.26	—	0.33			
Input current	$I_{in}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	$V_{in} = V_{CC}\text{ or GND}$	
Quiescent supply current	$I_{CC}$	6.0	—	—	2.0	—	20	$\mu\text{A}$	$V_{in} = V_{CC}\text{ or GND}, I_{out} = 0\ \mu\text{A}$	

### Switching Characteristics

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

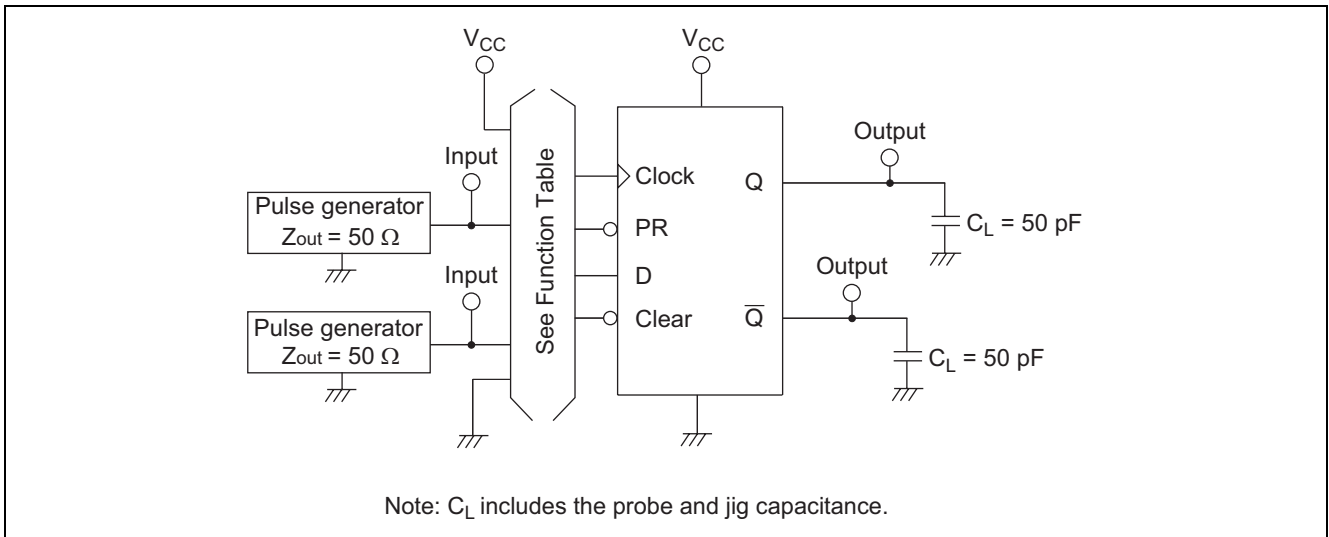
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }+85^\circ\text{C}$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Maximum clock frequency	$f_{max}$	2.0	—	—	5	—	4	MHz		
		4.5	—	35	25	—	20			
		6.0	—	—	29	—	24			
Propagation delay time	$t_{PLH}, t_{PHL}$	2.0	—	—	160	—	200	ns	Clock to Q or $\bar{Q}$	
		4.5	—	14	32	—	40			
		6.0	—	—	27	—	34			
		ns	Preset or Clear to Q or $\bar{Q}$	2.0	—	—	160	—	200	
				4.5	—	13	32	—	40	
				6.0	—	—	27	—	34	
Setup time	$t_{su}$	2.0	100	—	—	125	—	ns	Data to Clock	
		4.5	20	1	—	25	—			
		6.0	17	—	—	21	—			

Switching Characteristics

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

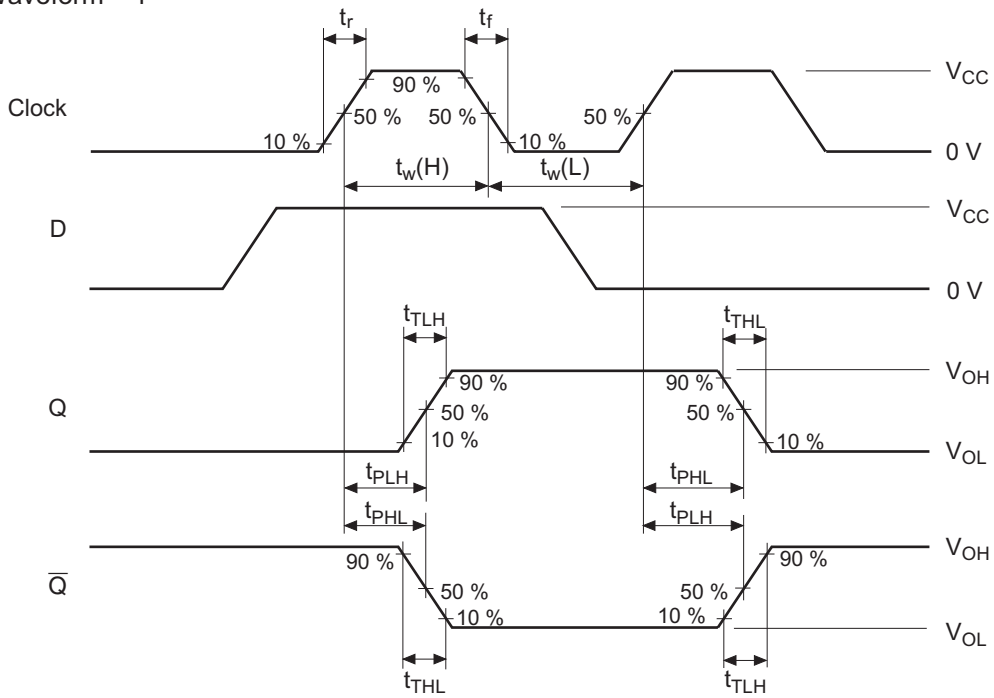
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }+85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Hold time	$t_h$	2.0	5	—	—	5	—	ns	Clock to Data
		4.5	5	0	—	5	—		
		6.0	5	-5	—	5	—		
Removal time	$t_{rem}$	2.0	25	—	—	31	—	ns	Preset, Clear to Clock
		4.5	5	—	—	6	—		
		6.0	4	—	—	5	—		
Pulse width	$t_w$	2.0	80	—	—	100	—	ns	Clock, Preset, Clear
		4.5	16	8	—	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

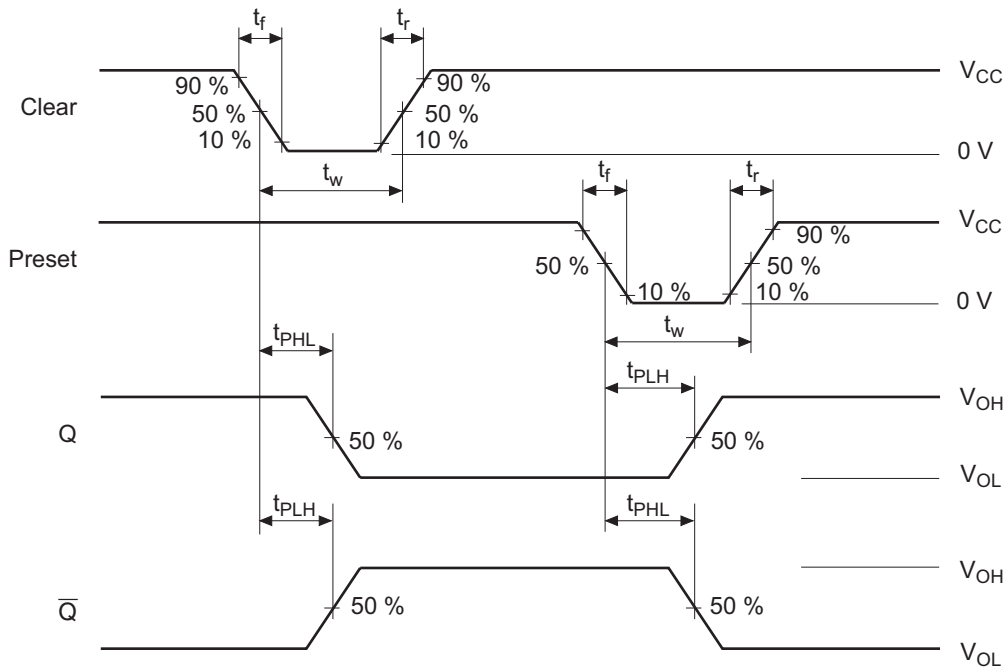


Waveforms

• Waveform – 1



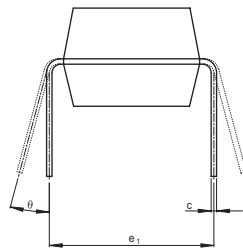
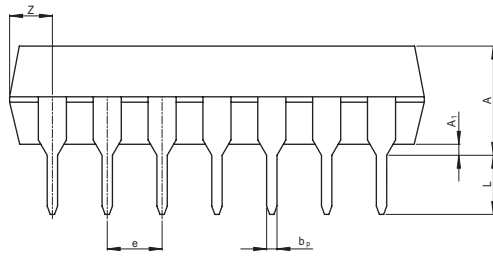
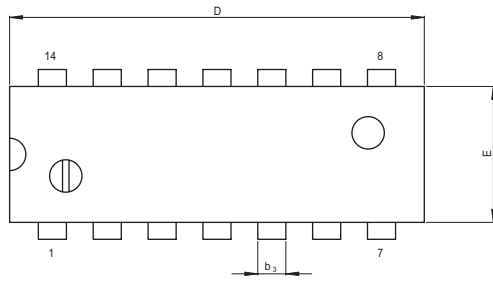
• Waveform – 2



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

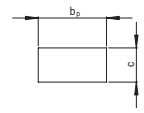
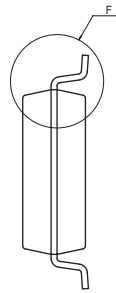
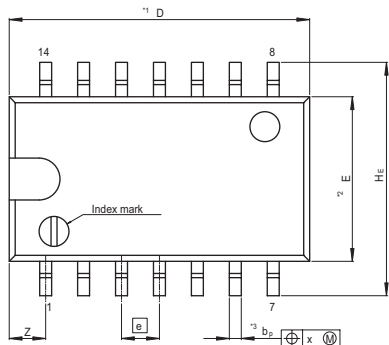
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP14-6.3x19.2-2.54	PRDP0014AB-B	DP-14AV	0.97g



(Ni/Pd/Au plating)

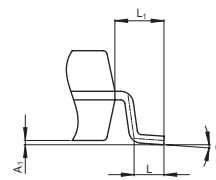
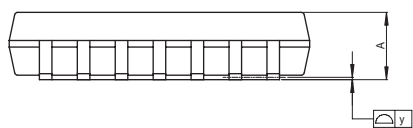
Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e <sub>1</sub>	—	7.62	—
D	—	19.2	20.32
E	—	6.3	7.4
A	—	—	5.06
A <sub>1</sub>	0.51	—	—
b <sub>p</sub>	0.40	0.48	0.56
b <sub>3</sub>	—	1.30	—
c	0.19	0.25	0.31
θ	0°	—	15°
e	2.29	2.54	2.79
Z	—	—	2.39
L	2.54	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-5.5x10.06-1.27	PRSP0014DF-B	FP-14DAV	0.23g



Terminal cross section (Ni/Pd/Au plating)

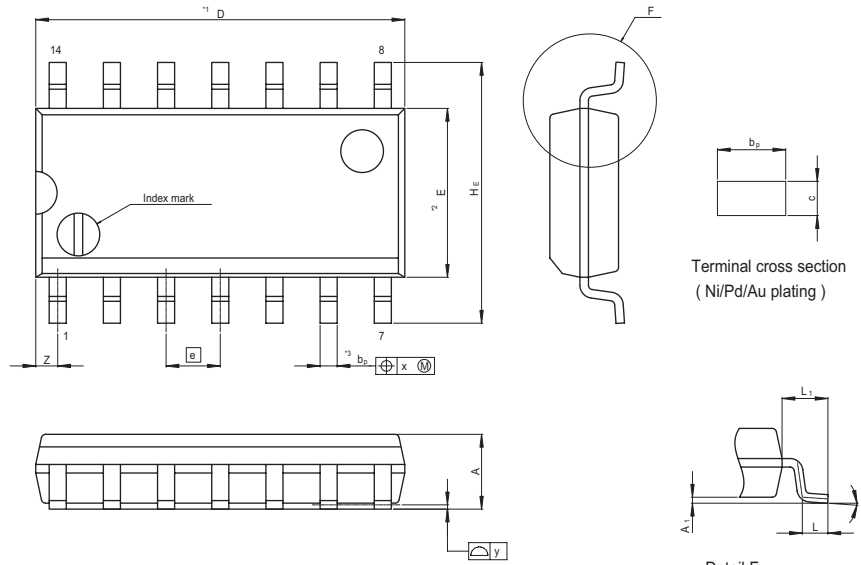
NOTE)  
 1. DIMENSIONS\*\*1 (Nom)\*AND\*\*2\* DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION\*\*3\*DOES NOT INCLUDE TRIM OFFSET.



Detail F

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	10.06	10.5
E	—	5.50	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.00	0.10	0.20
A	—	—	2.20
b <sub>p</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	7.50	7.80	8.00
⓪	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	1.42
L	0.50	0.70	0.90
L <sub>1</sub>	—	1.15	—

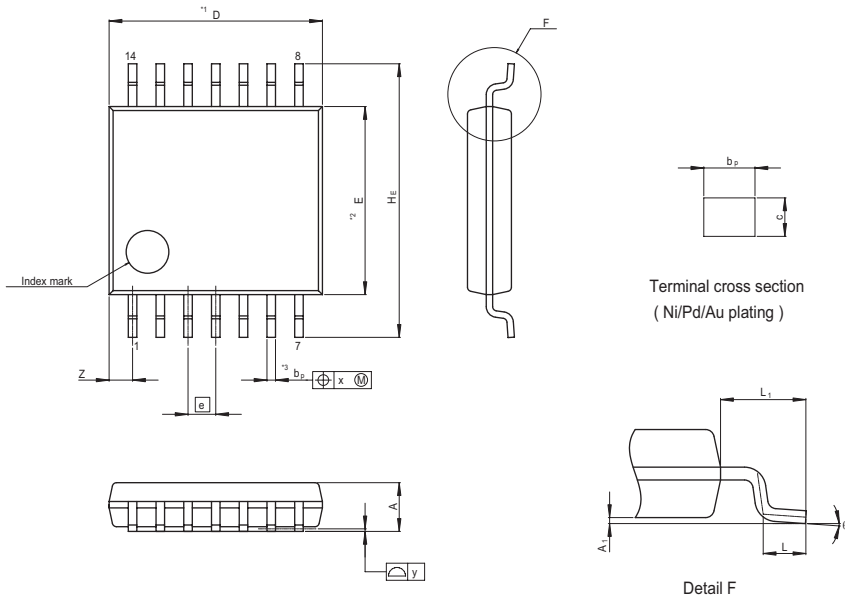
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-3.95x8.65-1.27	PRSP0014DE-A	FP-14DNV	0.13g



NOTE)  
 1. DIMENSIONS\*\*1 (Nom)\*AND\*\*2\*  
 DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION\*\*3\*DOES NOT  
 INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	8.65	9.05
E	—	3.95	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.10	0.14	0.25
A	—	—	1.75
b <sub>P</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	5.80	6.10	6.20
Ⓜ	—	1.27	—
x	—	—	0.25
y	—	—	0.15
Z	—	—	0.635
L	0.40	0.60	1.27
L <sub>1</sub>	—	1.08	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TSSOP14-4.4x5-0.65	PTSP0014JA-B	TTP-14DV	0.05g



NOTE)  
 1. DIMENSIONS\*\*1 (Nom)\*AND\*\*2\*  
 DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION\*\*3\*DOES NOT  
 INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	5.00	5.30
E	—	4.40	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.03	0.07	0.10
A	—	—	1.10
b <sub>P</sub>	0.15	0.20	0.25
b <sub>1</sub>	—	—	—
c	0.10	0.15	0.20
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	6.20	6.40	6.60
Ⓜ	—	0.65	—
x	—	—	0.13
y	—	—	0.10
Z	—	—	0.83
L	0.4	0.5	0.6
L <sub>1</sub>	—	1.0	—

Notes:

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