

# HD74HC595

## 8-bit Shift Register/Latch (with 3-state outputs)

REJ03D0634-0200  
 (Previous ADE-205-514)  
 Rev.2.00  
 Mar 30, 2006

### Description

This device each contains an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has parallel 3-state outputs. Separate clocks are provided for both the shift register and the storage register. The shift register has a direct-overriding clear, serial input, and serial output pins for cascading.

Both the shift register and storage register clocks are positive-edge triggered. If the user wishes to connect both clocks together, the shift register state will always be one clock pulse ahead of the storage register.



### Features

- High Speed Operation:  $t_{pd}$  (RCK to Q) = 17 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 15 LSTTL Loads ( $Q_A$  to  $Q_H$  outputs)
- 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

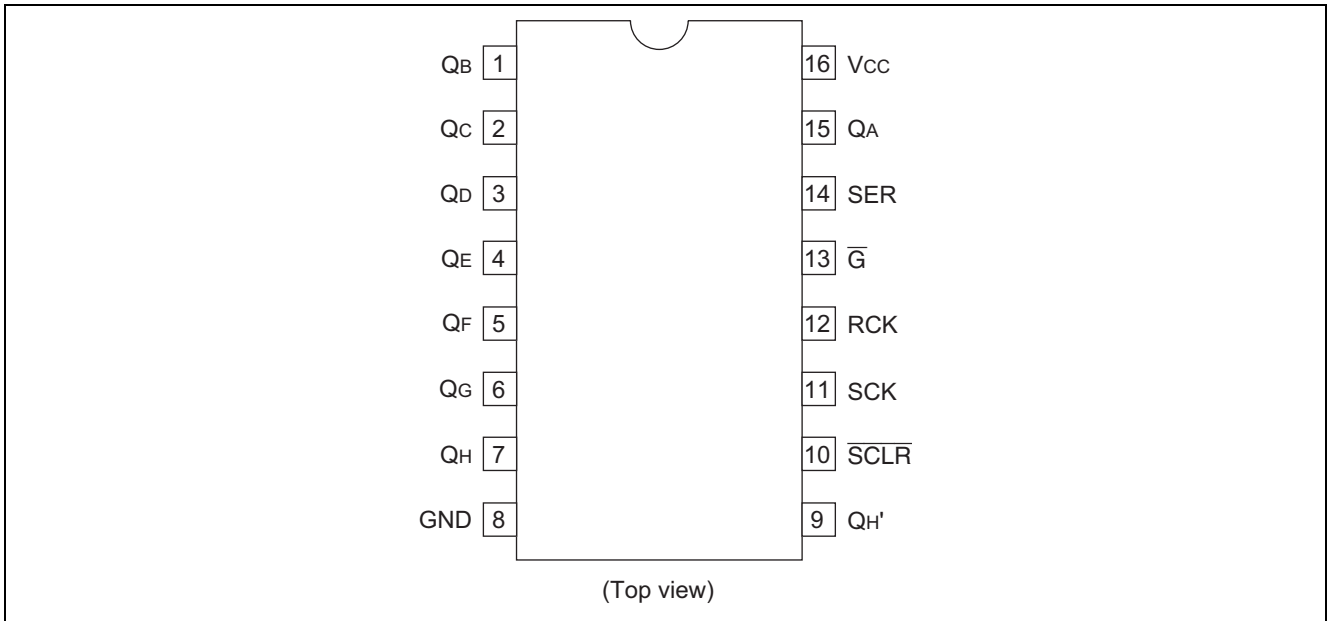
Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HC595P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—
HD74HC595FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)

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

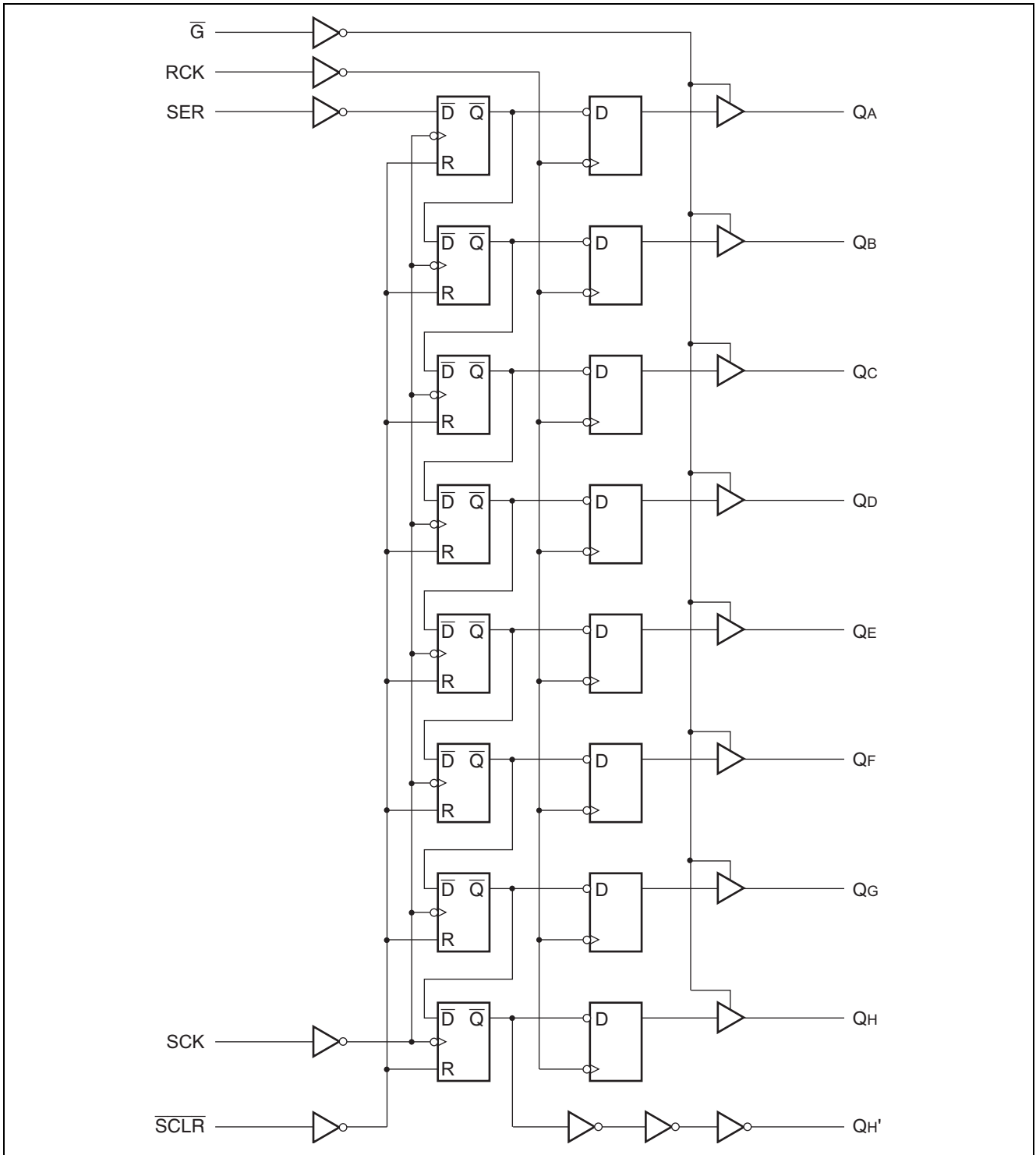
### Function Table

Inputs				Function
RCK	SCK	SCLR	$\bar{G}$	
X	X	X	H	$Q_A$ to $Q_H$ high impedance
X	X	L	X	Shift register cleared $Q_H' = L$
X		H	X	Shift register clocked $Q_n = Q_{n-1}$ , $Q_A = SER$
	X	H	X	Contents of shift register transferred to output latches

## 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	$I_{IK}, I_{OK}$	$\pm 20$	mA
Output current	$I_{OUT}$	$\pm 35$	mA
$V_{CC}$ , GND current	$I_{CC}$ or $I_{GND}$	$\pm 75$	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	$^{\circ}C$	
Input rise / fall time <sup>*1</sup>	$t_r, t_f$	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.

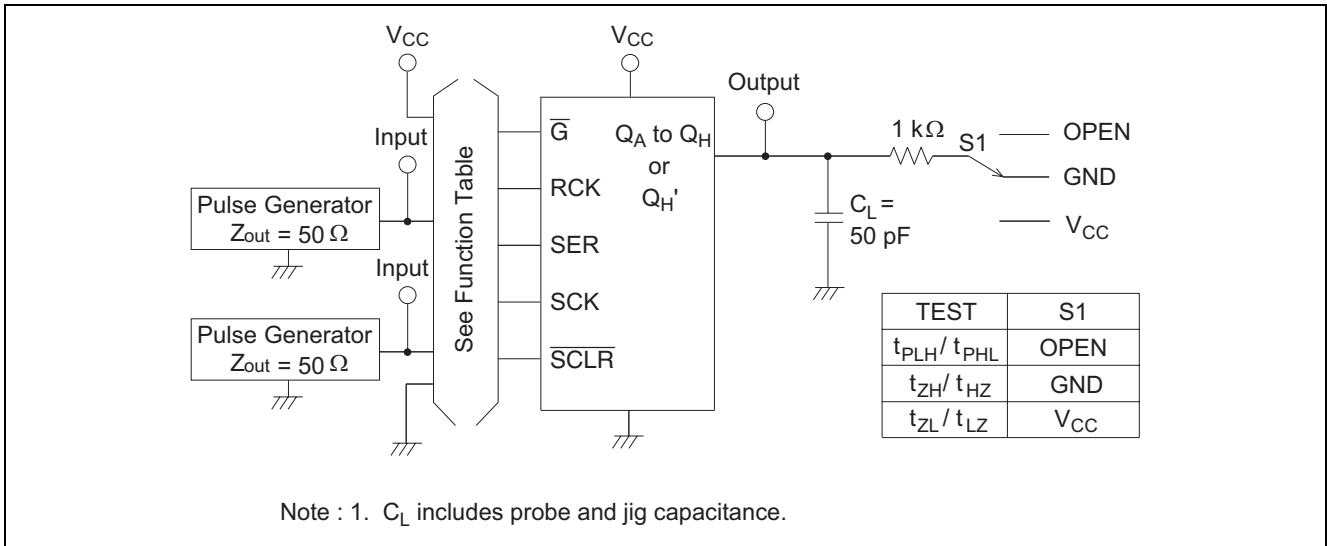
## Electrical Characteristics

Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to+85°C		Unit	Test Conditions				
			Min	Typ	Max	Min	Max						
Input voltage	V <sub>IH</sub>	2.0	1.5	—	—	1.5	—	V					
		4.5	3.15	—	—	3.15	—						
		6.0	4.2	—	—	4.2	—						
	V <sub>IL</sub>	2.0	—	—	0.5	—	0.5				V		
		4.5	—	—	1.35	—	1.35						
		6.0	—	—	1.8	—	1.8						
Output voltage	V <sub>OH</sub>	2.0	1.9	2.0	—	1.9	—	V	Q <sub>A</sub> to Q <sub>H</sub> Vin = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA			
		4.5	4.4	4.5	—	4.4	—			I <sub>OH</sub> = -6 mA			
		6.0	5.9	6.0	—	5.9	—			I <sub>OH</sub> = -7.8 mA			
		4.5	4.18	—	—	4.13	—						
		6.0	5.68	—	—	5.63	—						
	V <sub>OL</sub>	2.0	—	0.0	0.1	—	0.1		V	Q <sub>A</sub> to Q <sub>H</sub> Vin = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA		
		4.5	—	0.0	0.1	—	0.1						
		6.0	—	0.0	0.1	—	0.1						
		4.5	—	—	0.26	—	0.33				I <sub>OL</sub> = 6 mA		
		6.0	—	—	0.26	—	0.33				I <sub>OL</sub> = 7.8 mA		
Output voltage	V <sub>OH</sub>	2.0	1.9	2.0	—	1.9	—	V		Q' <sub>H</sub> Vin = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA		
		4.5	4.4	4.5	—	4.4	—						
		6.0	5.9	6.0	—	5.9	—						
		4.5	4.18	—	—	4.13	—				I <sub>OH</sub> = -4 mA		
		6.0	5.68	—	—	5.63	—				I <sub>OH</sub> = -5.2 mA		
	V <sub>OL</sub>	2.0	—	0.0	0.1	—	0.1		V	Q' <sub>H</sub> Vin = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA		
		4.5	—	0.0	0.1	—	0.1						
		6.0	—	0.0	0.1	—	0.1						
		4.5	—	—	0.26	—	0.33				I <sub>OL</sub> = 4 mA		
		6.0	—	—	0.26	—	0.33				I <sub>OL</sub> = 5.2 mA		
Off-state output current	I <sub>OZ</sub>	6.0	—	—	±0.5	—	±5.0	μA		Vin = V <sub>IH</sub> or V <sub>IL</sub> , Vout = V <sub>CC</sub> or GND			
Input current	I <sub>in</sub>	6.0	—	—	±0.1	—	±1.0	μA		Vin = V <sub>CC</sub> or GND			
Quiescent supply current	I <sub>CC</sub>	6.0	—	—	4.0	—	40	μA		Vin = V <sub>CC</sub> or GND, I <sub>out</sub> = 0 μA			

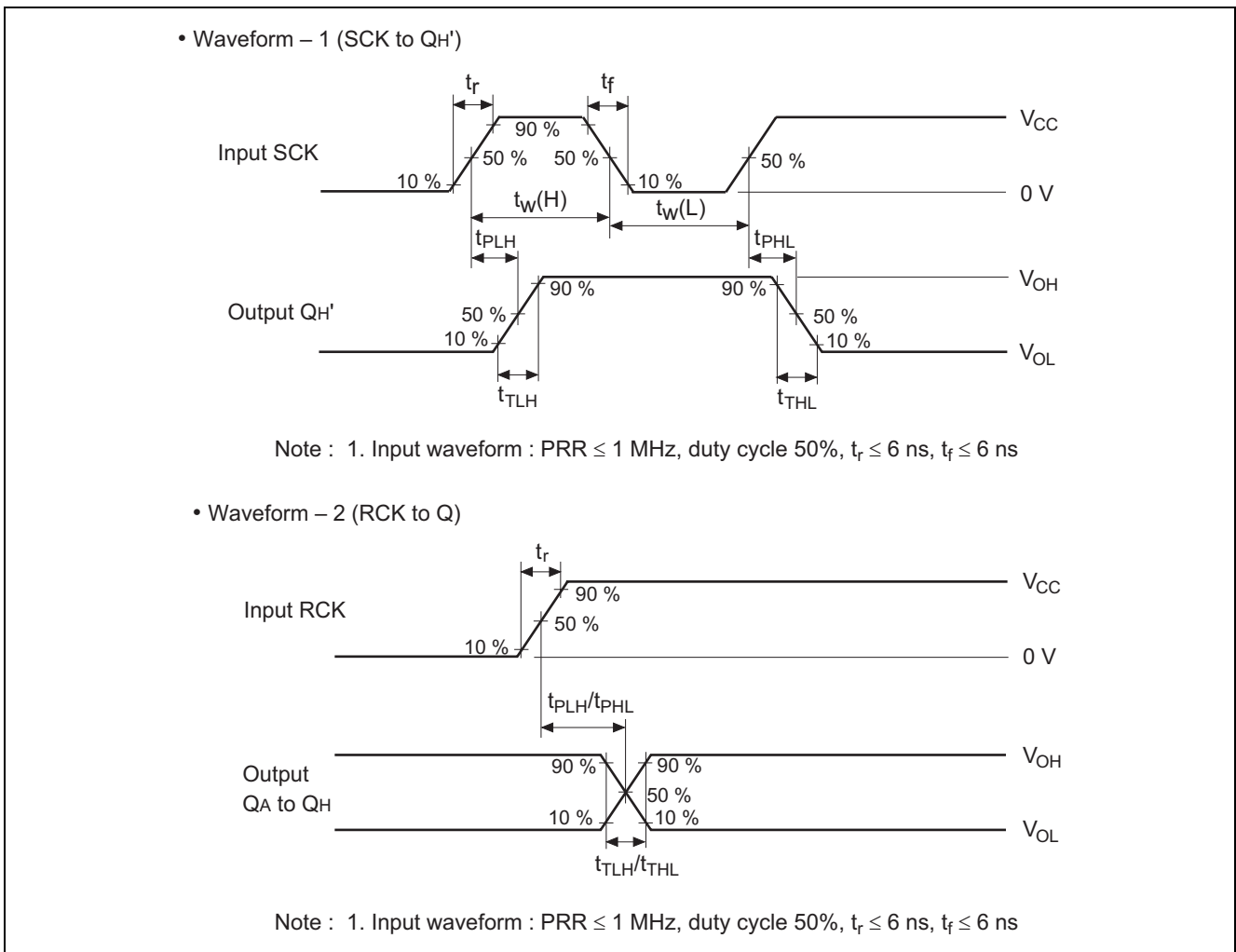
Switching Characteristics ( $C_L = 50$  pF, Input  $t_r = t_f = 6$  ns)

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40$ 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	—	—	27	—	21		
		6.0	—	—	31	—	24		
Propagation delay time	$t_{PLH}$	2.0	—	—	115	—	145	ns	SCK to $Q_H'$
		4.5	—	12	23	—	29		
		6.0	—	—	20	—	25		
	$t_{PHL}$	2.0	—	—	150	—	190	ns	RCK to Q
		4.5	—	17	30	—	38		
		6.0	—	—	26	—	33		
	$t_{PLH}$	2.0	—	—	175	—	220	ns	$\overline{\text{SCLR}}$ to $Q_H'$
		4.5	—	20	35	—	44		
		6.0	—	—	30	—	37		
Output enable time	$t_{ZL}$	2.0	—	—	150	—	190	ns	
		4.5	—	13	30	—	38		
		6.0	—	—	26	—	33		
Output disable time	$t_{LZ}$	2.0	—	—	150	—	190	ns	
		4.5	—	15	30	—	38		
		6.0	—	—	26	—	33		
Setup time	$t_{su}$	2.0	100	—	—	125	—	ns	SER to SCK
		4.5	20	1	—	25	—		
		6.0	17	—	—	21	—		
	$t_{su}$	2.0	200	—	—	250	—	ns	SCK to RCK
		4.5	40	8	—	50	—		
		6.0	34	—	—	43	—		
Pulse width	$t_w$	2.0	80	—	—	100	—	ns	
		4.5	16	8	—	20	—		
		6.0	14	—	—	17	—		
Removal time	$t_{rem}$	2.0	100	—	—	125	—	ns	
		4.5	20	—	—	25	—		
		6.0	17	—	—	21	—		
Hold time	$t_h$	2.0	5	—	—	5	—	ns	
		4.5	5	1	—	5	—		
		6.0	5	—	—	5	—		
Output rise/fall time	$t_{TLH}$	2.0	—	—	75	—	95	ns	$Q_H'$
		4.5	—	5	15	—	19		
		6.0	—	—	13	—	16		
	$t_{THL}$	2.0	—	—	60	—	75	ns	Q
		4.5	—	4	12	—	15		
		6.0	—	—	10	—	13		
Input capacitance	$C_{in}$	—	—	5	10	—	5	pF	

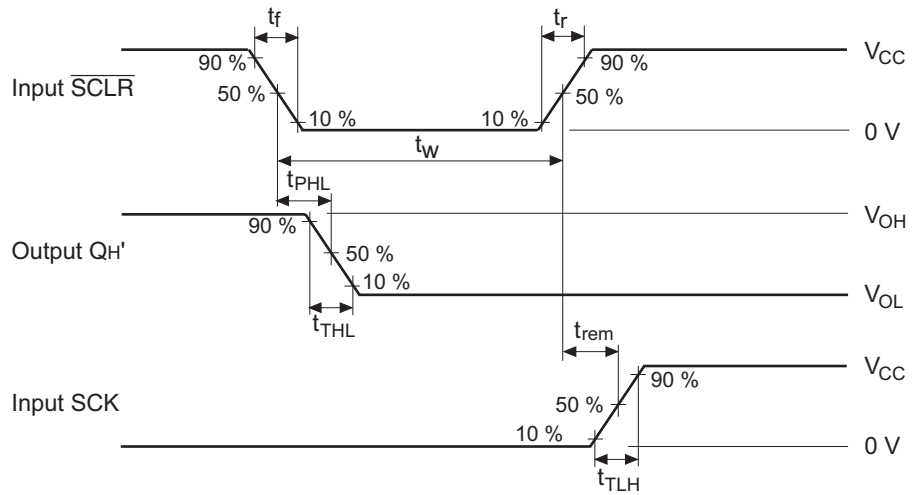
Test Circuit



Waveforms

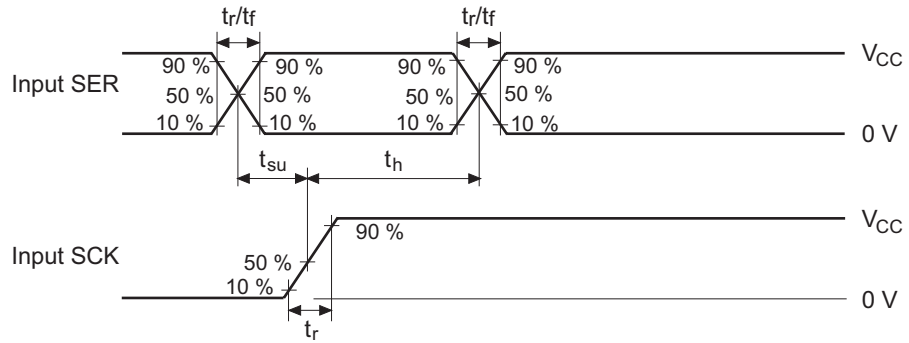


• Waveform – 3 ( $\overline{\text{SCLR}}$  to QH')



Note : 1. Input waveform : PRR  $\leq$  1 MHz, duty cycle 50%,  $t_r \leq$  6 ns,  $t_f \leq$  6 ns

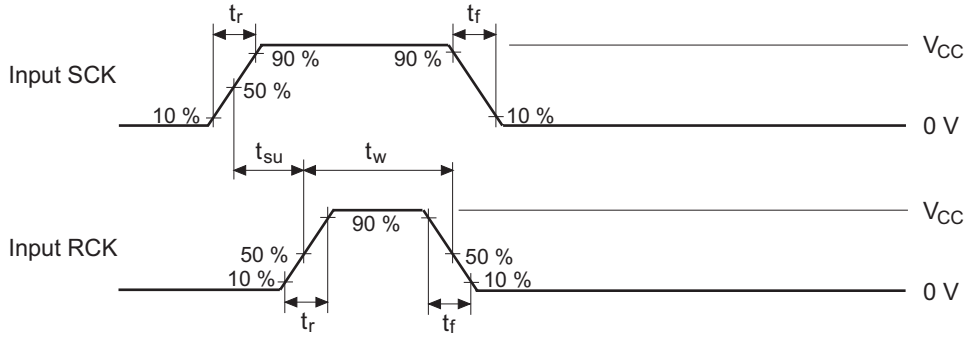
• Waveform – 4 (SER to SCK)



Note : 1. Input waveform : PRR  $\leq$  1 MHz, duty cycle 50%,  $t_r \leq$  6 ns,  $t_f \leq$  6 ns

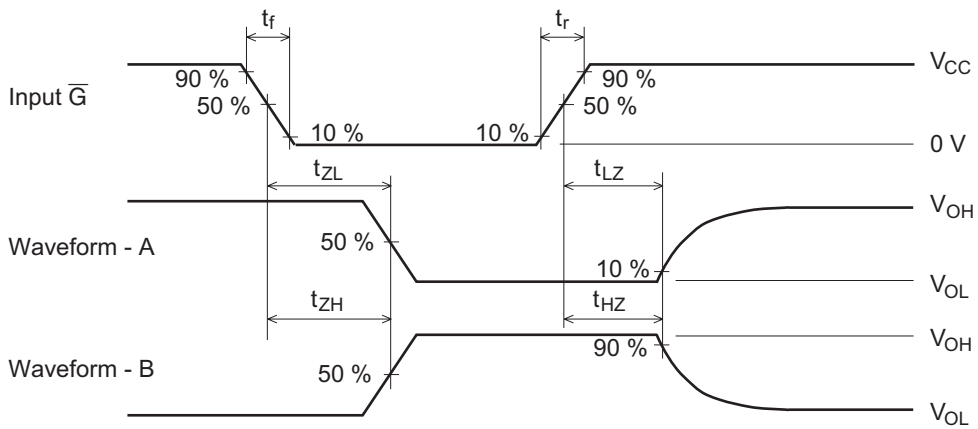


• Waveform – 5 (SCK to RCK)



Note : 1. Input waveform : PRR  $\leq$  1 MHz, duty cycle 50%,  $t_r \leq$  6 ns,  $t_f \leq$  6 ns

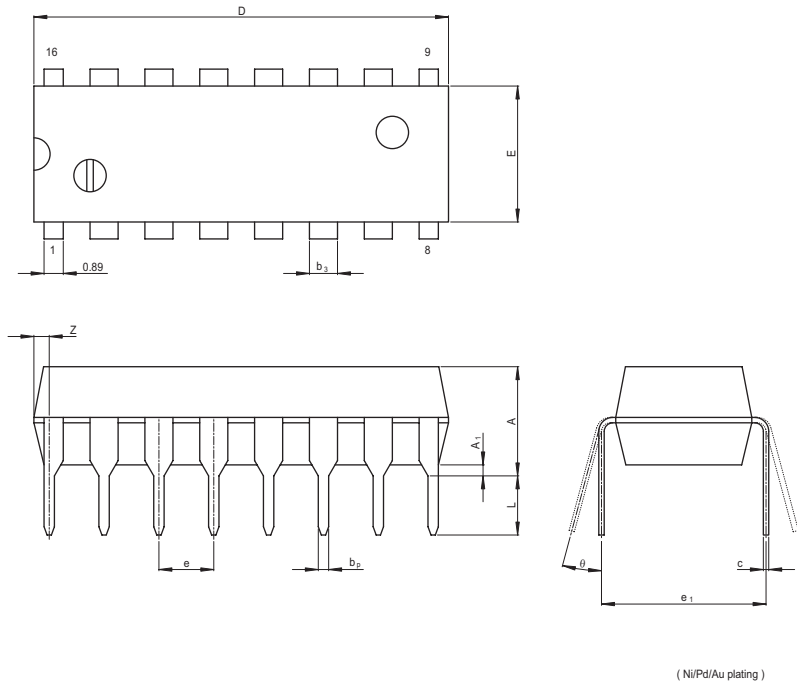
• Waveform – 6 ( $t_{zL}$ ,  $t_{zH}$ ,  $t_{LZ}$ ,  $t_{HZ}$ )



- Notes :
1. Input waveform : PRR  $\leq$  1 MHz, duty cycle 50%,  $t_r \leq$  6 ns,  $t_f \leq$  6 ns
  2. Waveform - A is for an output with internal conditions such that the output is low except when disabled by the output control.
  3. Waveform - B is for an output with internal conditions such that the output is high except when disabled by the output control.
  4. The output are measured one at a time with one transition per measurement.

Package Dimensions

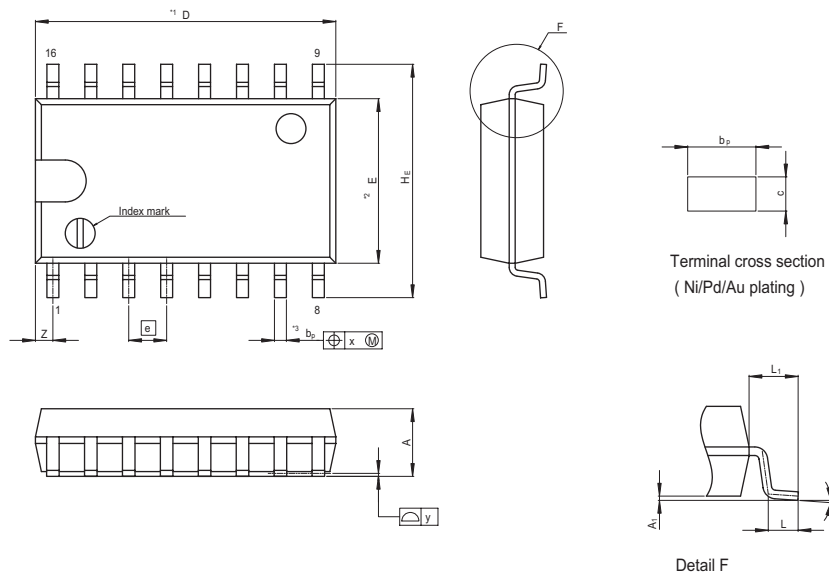
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP16-6.3x19.2-2.54	PRDP0016AE-B	DP-16FV	1.05g



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	—	—	1.12
L	2.54	—	—

( Ni/Pd/Au plating )

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.5x10.06-1.27	PRSP0016DH-B	FP-16DAV	0.24g



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

Terminal cross section  
 ( Ni/Pd/Au plating )

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°
HE	7.50	7.80	8.00
ⓐ	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.80
L	0.50	0.70	0.90
L <sub>1</sub>	—	1.15	—

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