

# HD74LS221

## Dual Monostable Multivibrators

REJ03D0458-0300

Rev.3.00

Jul.15.2005

This multivibrator features a negative-transition-triggered input and a positive-transition-triggered input either of which can be used as an inhibit input. Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. Schmitt-trigger input circuitry (TTL hysteresis) for B input allows jitter-free triggering from inputs with transition rates as slow as 1 V/s, providing the circuit with excellent noise immunity of typically 1.2 V. A high immunity to  $V_{CC}$  noise of typically 1.5 V is also provided by internal latching circuitry. Once fired, the outputs are independent of further transitions of the A and B inputs and are a function of the timing components, or the output pulses can be terminated by the overriding clear. Input pulses may be of any duration relative to the output pulse. Output rise and fall times are TTL compatible and independent of pulse length.

Typical triggering and clearing sequence are illustrated as a part of the switching characteristics waveforms. Pulse width stability is achieved through internal compensation and is virtually independent of  $V_{CC}$  and temperature.

In most applications, pulse stability will only be limited by the accuracy of external timing components. Jitter-free operation is maintained over the full temperature and  $V_{CC}$  range for more than six decades of timing capacitance (10 pF to 10  $\mu$ F) and more than one decade of timing resistance (2 k $\Omega$  to 100 k $\Omega$ ).

Throughout these ranges, pulse width is defined by the relationship:  $t_{w(out)} = C_{ext} \cdot R_{ext} \cdot \ln 2$ .

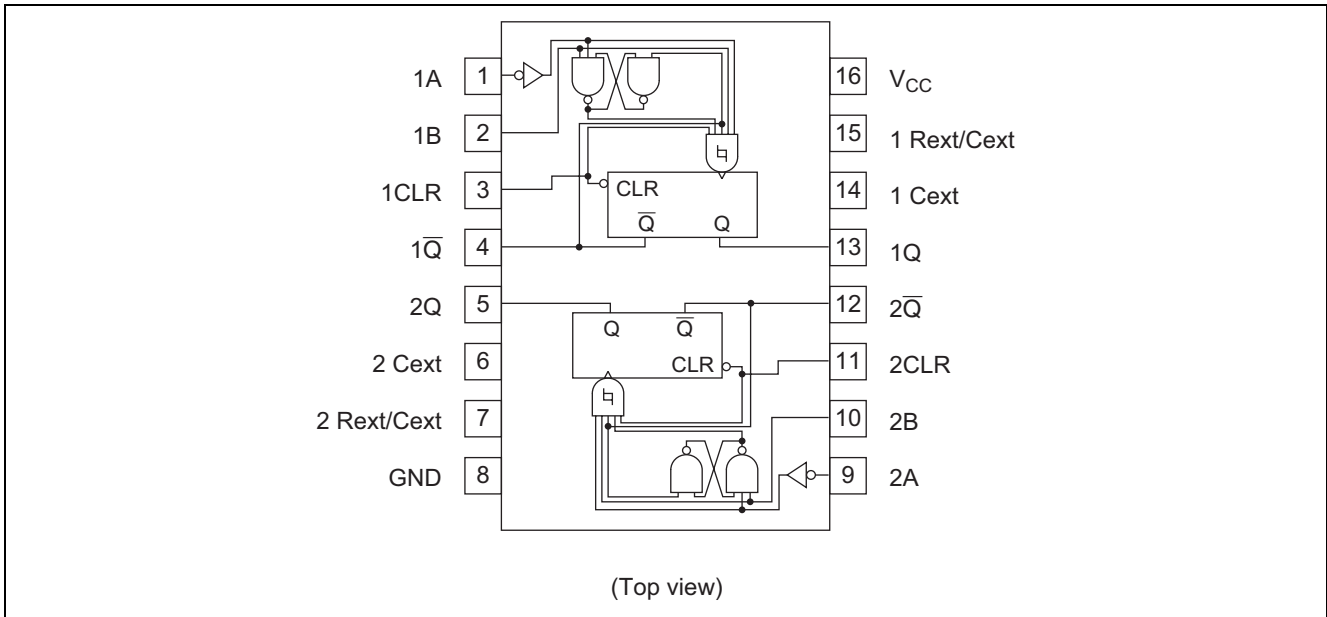
### Features

- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LS221P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—
HD74LS221RPEL	SOP-16 pin (JEDEC)	PRSP0016DG-A (FP-16DNV)	RP	EL (2,500 pcs/reel)

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

Pin Arrangement



Function Table

Inputs			Outputs	
Clear	A	B	Q	Q̄
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎓	⎓
H	↓	H	⎓	⎓
↑	L	H	⎓	⎓

Notes: H; high level, L; low level, X; irrelevant.

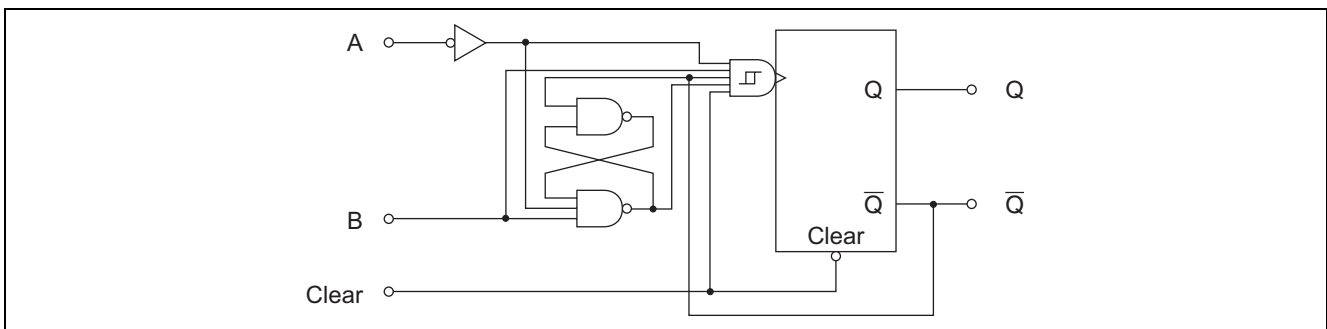
↓; Transition from high to low level.

↑; Transition from low to high level.

⎓; one high-level pulse.

⎓; one low-level pulse.

Block Diagram (1/2)



### Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage	$V_{CC}$	7	V
Input voltage	$V_{IN}$	7	V
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	$\mu A$	
	$I_{OL}$	—	—	8	mA	
Operating temperature	$T_{opr}$	-20	25	75	°C	
Rate of rise or fall of input pulse	Schmitt input, B	dV/dt	1	—	—	V/s
	Logic Input, A		1	—	—	V/ $\mu s$
Input pulse width	A or B	$t_w (in)$	40	—	—	ns
	Clear	$t_w (clear)$	40	—	—	
Setup time	$t_{su}$	15	—	—	ns	
External timing resistance	$R_{ext}$	1.4	—	100	k $\Omega$	
External timing capacitance	$C_{ext}$	0	—	1000	$\mu F$	
Duty cycle	$R_T = 2\text{ k}\Omega$	—	—	50		
	$R_T = 100\text{ k}\Omega$	—	—	90		

### Electrical Characteristics

( $T_a = -20$  to  $+75$  °C)

Item	Symbol	min.	typ.*	max.	Unit	Condition	
Threshold voltage	A	$V_T^+$	—	1.0	2.0	V	$V_{CC} = 4.75\text{ V}$
		$V_T^-$	0.8	1.0	—	V	$V_{CC} = 4.75\text{ V}$
	B	$V_T^+$	—	1.0	2.0	V	$V_{CC} = 4.75\text{ V}$
		$V_T^-$	0.8	0.9	—	V	$V_{CC} = 4.75\text{ V}$
Output voltage	$V_{OH}$	2.7	—	—	V	$V_{CC} = 4.75\text{ V}, I_{OH} = -400\ \mu A$	
	$V_{OL}$	—	—	0.4	V	$V_{CC} = 4.75\text{ V}$	
				0.5	$I_{OL} = 4\text{ mA}$		
						$I_{OL} = 8\text{ mA}$	
Input current	A	$I_{IH}$	—	—	20	$\mu A$	$V_{CC} = 5.25\text{ V}, V_I = 2.7\text{ V}$
		$I_{IL}$	—	—	-0.4	mA	$V_{CC} = 5.25\text{ V}, V_I = 0.4\text{ V}$
	B, Clear	$I_{IL}$	—	—	-0.8	mA	
		$I_I$	—	—	0.1	mA	$V_{CC} = 5.25\text{ V}, V_I = 7\text{ V}$
Short-circuit output current	$I_{OS}$	-20	—	-100	mA	$V_{CC} = 5.25\text{ V}$	
Supply current	$I_{CC}$	—	4.7	11	mA	Quiescent	$V_{CC} = 5.25\text{ V}$
		—	19	27		Triggered	
Input clamp voltage	$V_{IK}$	—	—	-1.5	V	$V_{CC} = 4.75\text{ V}, I_{IN} = -18\text{ mA}$	

Note: \*  $V_{CC} = 5\text{ V}, T_a = 25$  °C

### Switching Characteristics

( $V_{CC} = 5\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

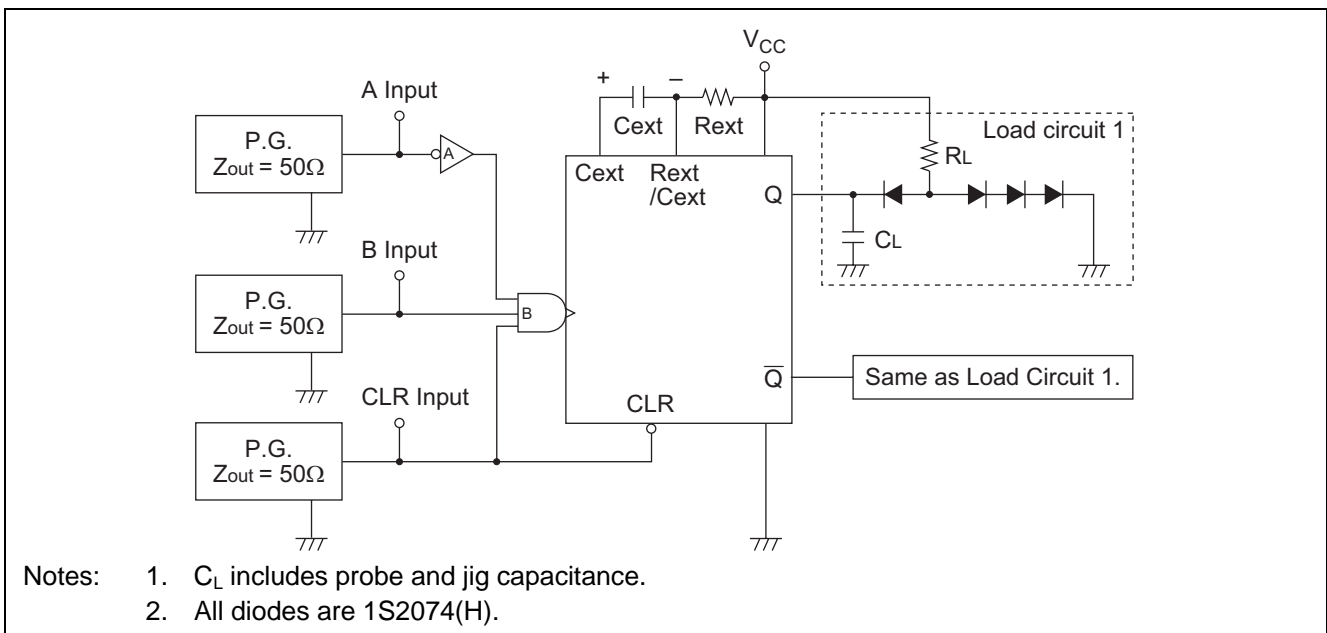
Item	Symbol	Inputs	Outputs	min.	typ.	max.	Unit	Condition
Propagation delay time	$t_{PLH}$	A	Q	—	45	70	ns	$C_{ext} = 80\text{ pF}$ , $R_{ext} = 2\text{ k}\Omega$
		B	Q	—	35	55		
	$t_{PHL}$	A	$\overline{Q}$	—	50	80	ns	
		B	$\overline{Q}$	—	40	65		
Output pulse width	$t_w(\text{out})$	A or B	Q or $\overline{Q}$	70	120	150	ns	$C_{ext} = 80\text{ pF}$ , $R_{ext} = 2\text{ k}\Omega$
				20	47	70		$C_{ext} = 0\text{ pF}$ , $R_{ext} = 2\text{ k}\Omega$
				600	670	750		$C_{ext} = 100\text{ pF}$ , $R_{ext} = 10\text{ k}\Omega$
				6	6.7	7.5	ms	$C_{ext} = 1\text{ }\mu\text{F}$ , $R_{ext} = 10\text{ k}\Omega$

### Caution in use

In order to prevent any malfunctions due to noise, connect a high frequency performance capacitor between  $V_{CC}$  and GND, and keep the wiring between the External components and  $C_{ext}$ ,  $R_{ext}/C_{ext}$  pins as short as possible.

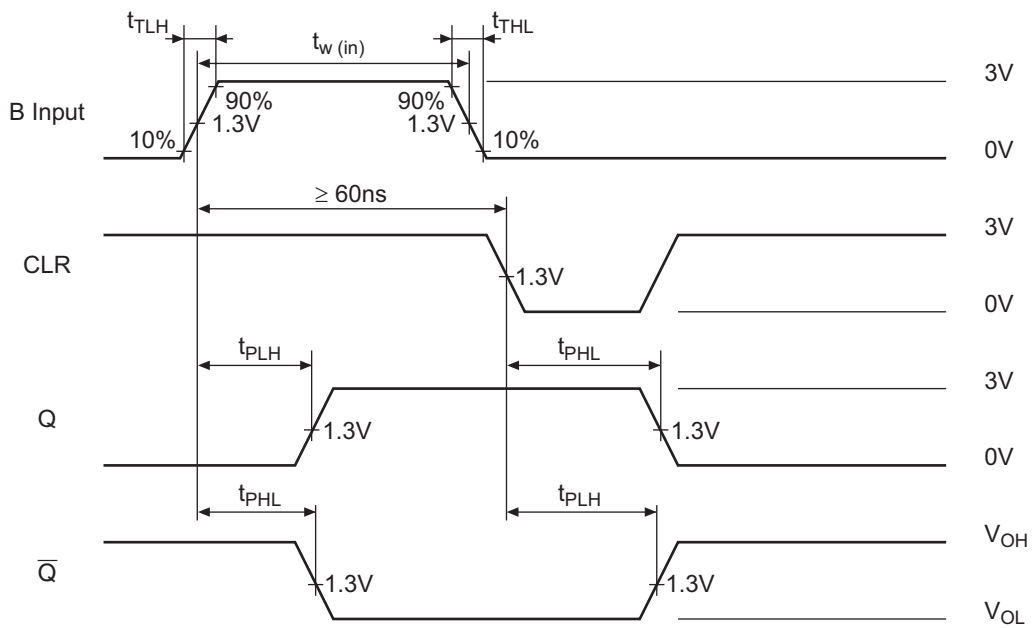
### Testing Method

#### Test Circuit



Waveforms 1

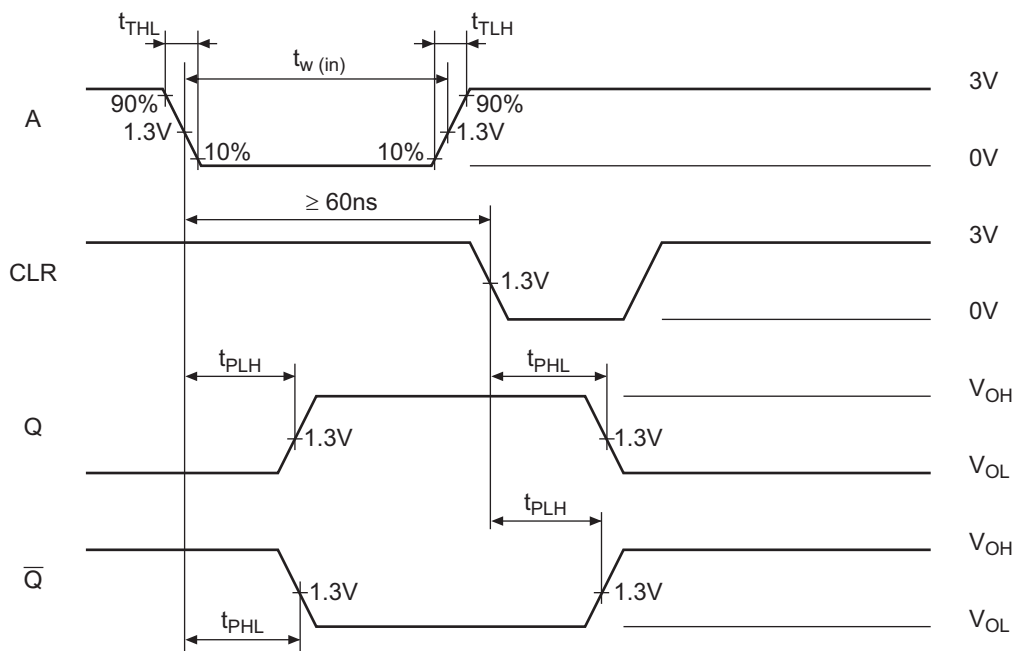
Trigger from B, then clear (A input is low).



Note: Input pulse:  $t_{TLH} \leq 15 ns$ ,  $t_{THL} \leq 6 ns$ , PRR = 1 MHz

Waveforms 2

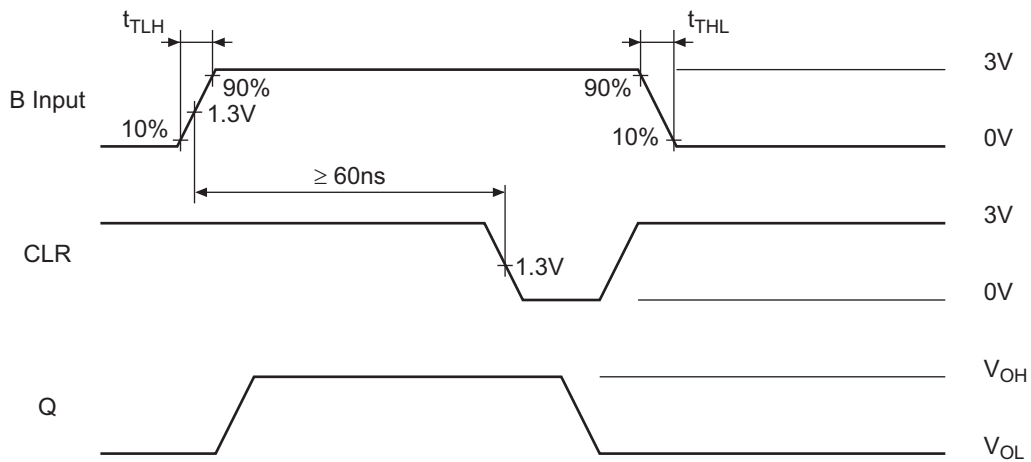
Trigger from A, then clear (B input is high).



Note: Input pulse:  $t_{TLH} \leq 15 ns$ ,  $t_{THL} \leq 6 ns$ , PRR = 1 MHz

Waveforms 3

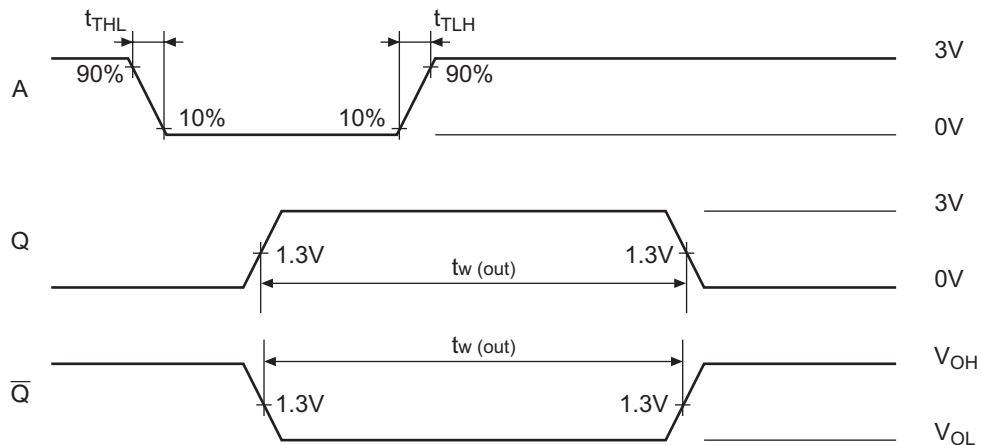
Trigger from B, then clear (A input is low).



Note: Input pulse:  $t_{TLH} \leq 15\text{ ns}$ ,  $t_{THL} \leq 6\text{ ns}$ , PRR = 1 MHz

Waveforms 4

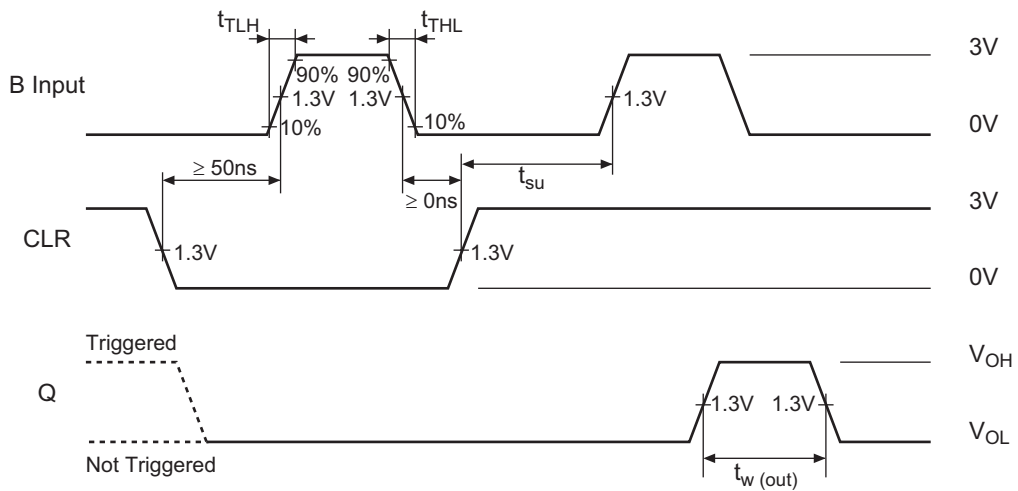
Trigger from A (B and clear input are high).



Note: Input pulse:  $t_{TLH} \leq 15\text{ ns}$ ,  $t_{THL} \leq 6\text{ ns}$ , PRR = 1 MHz

Waveforms 5

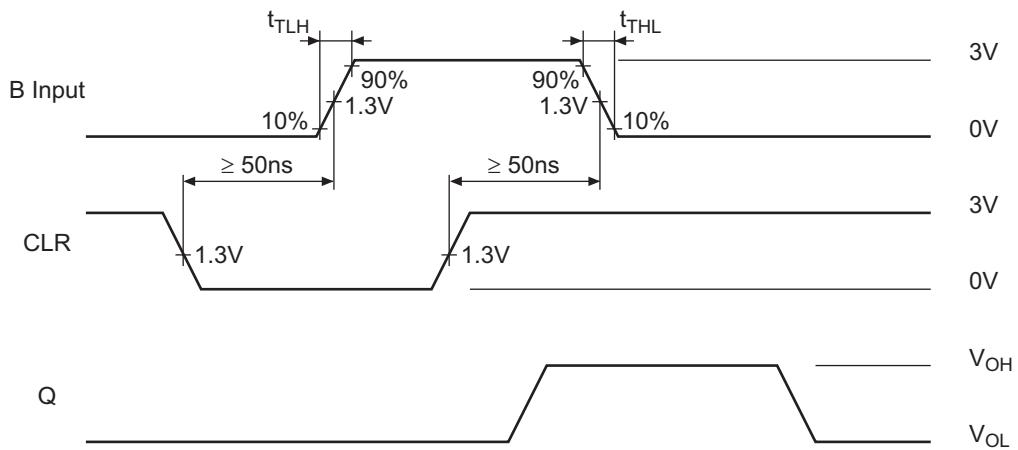
Clear overriding B, then trigger from B.



Note: Input pulse:  $t_{TLH} \leq 15\text{ ns}$ ,  $t_{THL} \leq 6\text{ ns}$ , PRR = 1 MHz

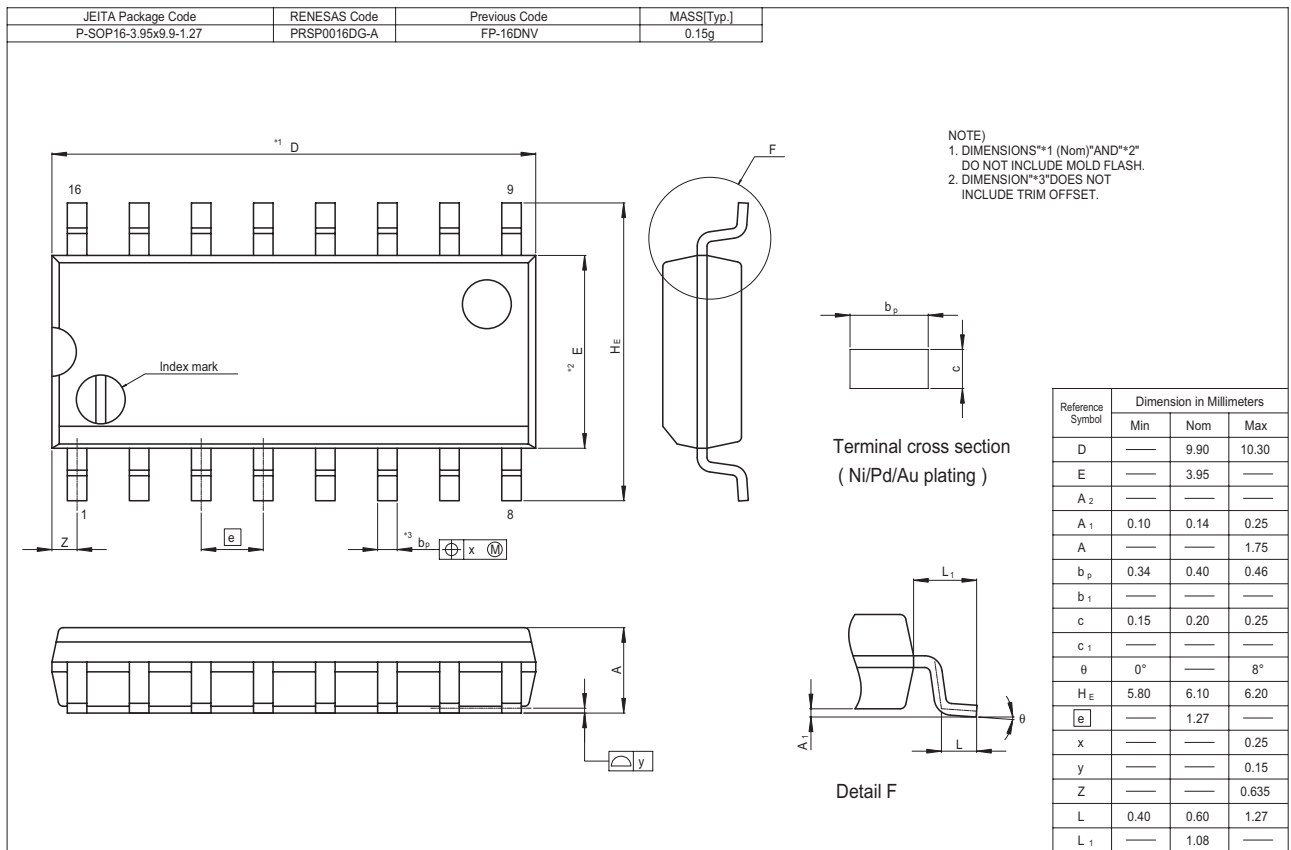
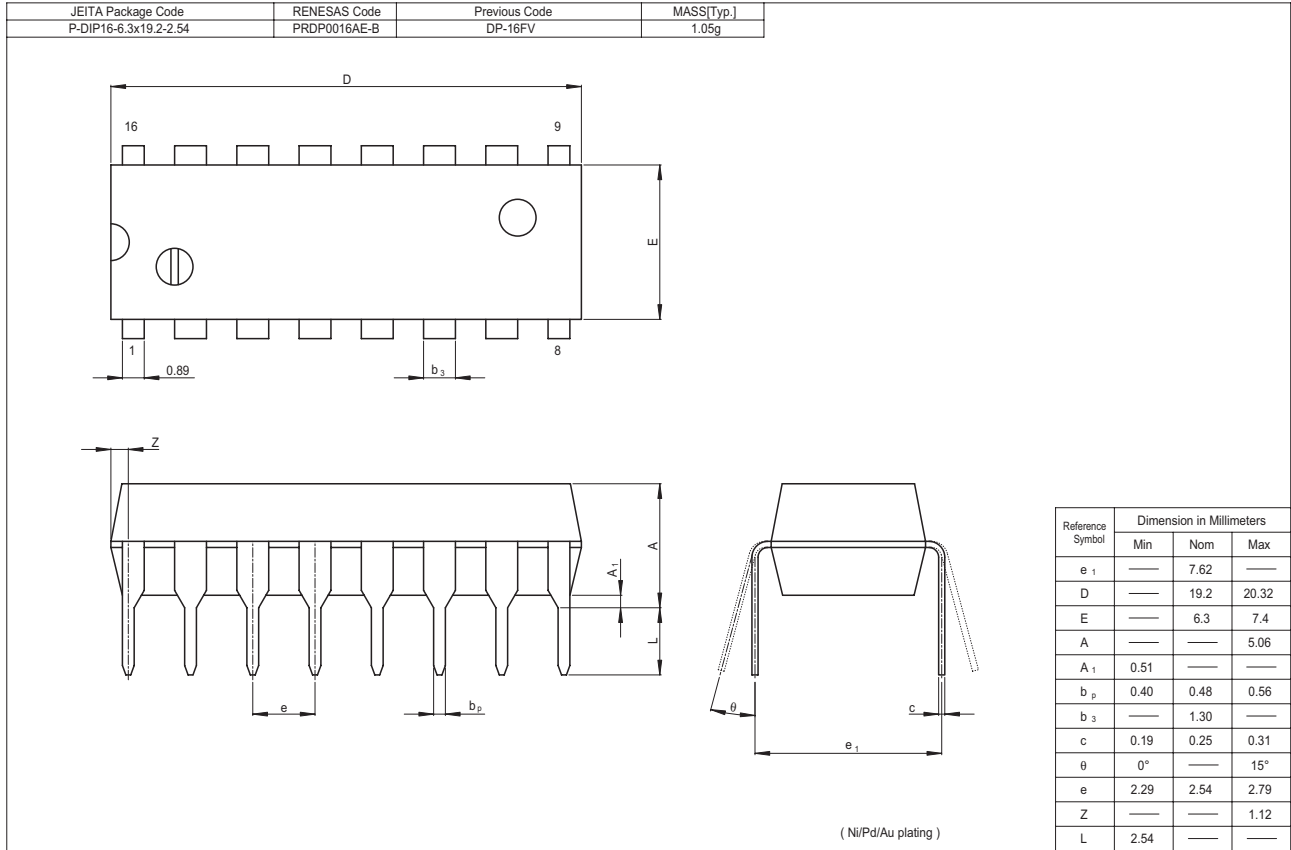
Waveforms 6

Positive transition of Clear.



Note: Input pulse:  $t_{TLH} \leq 15\text{ ns}$ ,  $t_{THL} \leq 6\text{ ns}$ , PRR = 1 MHz

Package Dimensions





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