芯伯乐®
XINBOLE

Product Specification

XBLW SN74HC175

Quad D-type flip-flop with reset

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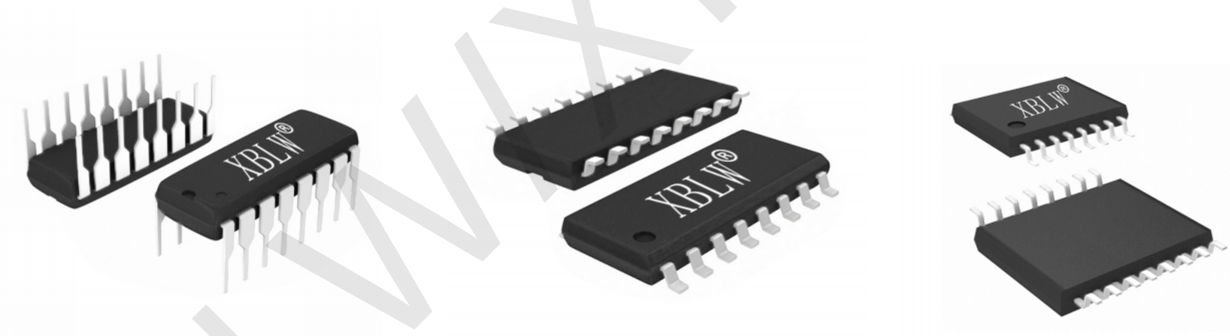
RoHS

Description

The SN74HC175 is a quad positive-edge triggered D-type flip-flop with individual data inputs (Dn) and complementary outputs (Qn and $\overline{Qn}$).

Features

- Four edge-triggered D-type flip-flops
- Asynchronous master reset
- Specified from -40℃ to +125℃
- Packaging information:DIP-16/SOP-16/TSSOP-16



DIP-16 SOP-16 TSSOP-16

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBLW SN74HC175N	DIP-16	74HC175N	Tube	1000Pcs/Box
XBLW SN74HC175DTR	SOP-16	74HC175	Tape	2500Pcs/Reel
XBLW SN74HC175TDTR	TSSOP-16	74HC175	Tape	3000Pcs/Reel

Block Diagram

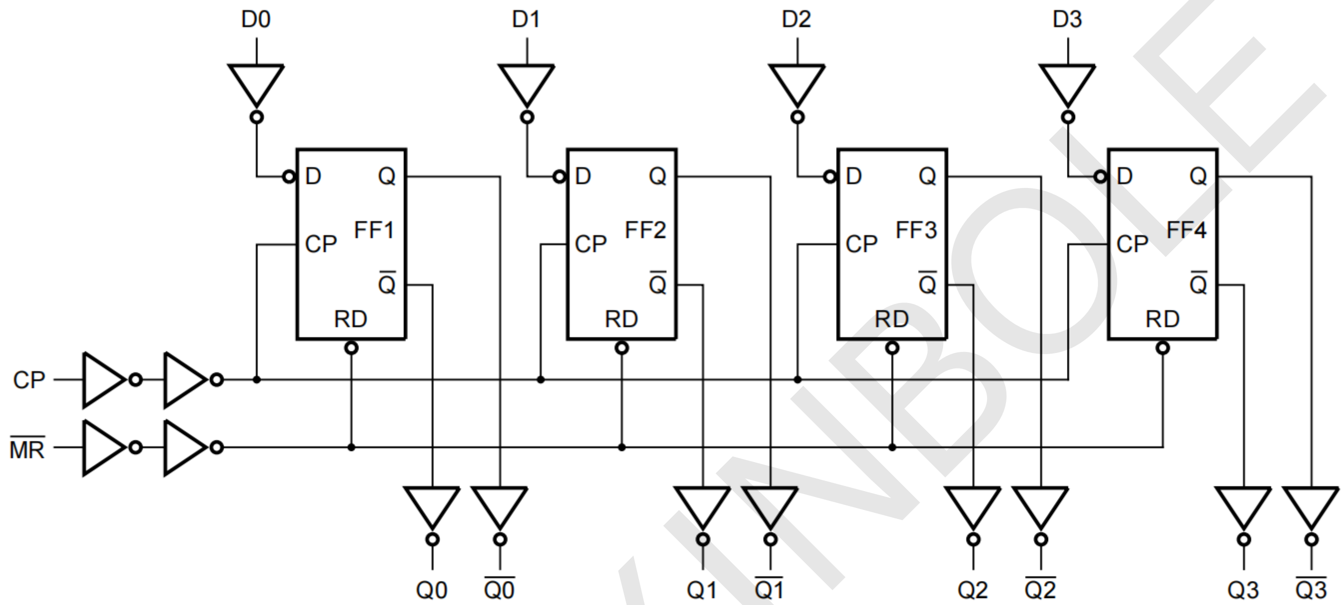
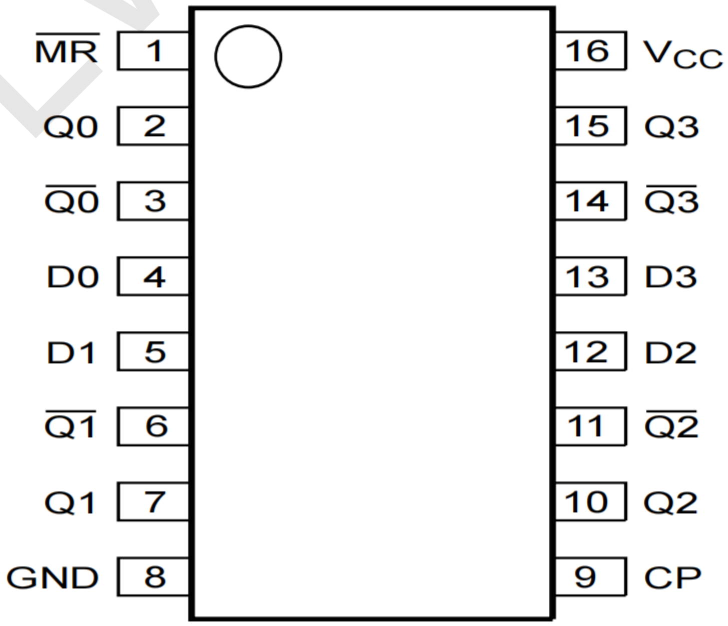


Figure 1. Logic diagram

Pin Configurations



Pin Description

Pin No.	Pin Name	Description
1	$\overline{MR}$	asynchronous master reset input (active LOW)
2	Q0	flip-flop output
3	$\overline{Q0}$	complementary flip-flop output
4	D0	data input
5	D1	data input
6	$\overline{Q1}$	complementary flip-flop output
7	Q1	flip-flop output
8	GND	ground (0V)
9	CP	clock input (LOW-to-HIGH edge-triggered)
10	$\overline{Q2}$	flip-flop output
11	Q2	complementary flip-flop output
12	D2	data input
13	D3	data input
14	$\overline{Q3}$	complementary flip-flop output
15	Q3	flip-flop output
16	V_{CC}	positive supply voltage

Function table

Operating mode	Inputs			Outputs	
	$\overline{MR}$	CP	Dn	Qn	$\overline{Qn}$
reset (clear)	L	X	X	L	H
load "1"	H	↑	h	H	L
load "0"	H	↑	l	L	H

Note:
H=HIGH voltage level; L=LOW voltage level;
X=don't care; ↑=LOW-to-HIGH clock transition;
h=HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition; l=LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition.

Electrical Parameter

Absolute Maximum Ratings

(T_{amb}=25℃, voltages are referenced to GND (ground=0V), unless otherwise specified)

Characteristic	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V_{CC}	-		-0.5	+7.0	V
input clamping current	I_{IK}	V_I<-0.5V or V_I>V_{CC}+0.5V		-	+20	mA
output clamping current	I_{OK}	V_O<-0.5V or V_O>V_{CC}+0.5V		-	±20	mA
output current	I_O	V_O=-0.5V to (V_{CC}+0.5V)		-	±25	mA
supply current	I_{CC}	-		-	+50	mA
ground current	I_{GND}	-		-50	-	mA
storage temperature	T_{stg}	-		-65	+150	℃
total power dissipation	P_{tot}	-		-	500	mW
soldering temperature	T_L	10s	DIP		245	℃
			SOP/TSSOP		260	℃

Recommended Operating Conditions

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{CC}	-	2.0	5.0	6.0	V
input voltage	V_I	-	0	-	V_{CC}	V
output voltage	V_O	-	0	-	V_{CC}	V
ambient temperature	T_{amb}	-	-40	-	+125	℃

DC Characteristics 1

(T_{amb}=25℃, voltages are referenced to GND (ground=0V), unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	1.2	-	V
		V_{CC}=4.5V		3.15	2.4	-	V
		V_{CC}=6.0V		4.2	3.2	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	0.8	0.5	V
		V_{CC}=4.5V		-	2.1	1.35	V
		V_{CC}=6.0V		-	2.8	1.8	V
HIGH-level output voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	2.0	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	4.5	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	6.0	-	V
			I_O=-4mA; V_{CC}=4.5V	3.98	4.32	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.48	5.81	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	0	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	0	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	0	0.1	V
			I_O=4mA; V_{CC}=4.5V	-	0.15	0.26	V
			I_O=5.2mA; V_{CC}=6.0V	-	0.16	0.26	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	± 1	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	1	uA

DC Characteristics 2

(T_{amb}=-40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
HIGH-level output voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
			I_O=-4mA; V_{CC}=4.5V	3.84	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.34	-	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
			I_O=4mA; V_{CC}=4.5V	-	-	0.33	V
			I_O=5.2mA; V_{CC}=6.0V	-	-	0.33	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±2	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	2	uA

DC Characteristics 3

(T_{amb}=-40°C to +125°C, voltages are referenced to GND (ground=0V), unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level input voltage	V_{IH}	V_{CC}=2.0V		1.5	-	-	V
		V_{CC}=4.5V		3.15	-	-	V
		V_{CC}=6.0V		4.2	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=2.0V		-	-	0.5	V
		V_{CC}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.8	V
HIGH-level output voltage	V_{OH}	V_I=V_{IH} or V_{IL}	I_O=-20uA; V_{CC}=2.0V	1.9	-	-	V
			I_O=-20uA; V_{CC}=4.5V	4.4	-	-	V
			I_O=-20uA; V_{CC}=6.0V	5.9	-	-	V
			I_O=-4mA; V_{CC}=4.5V	3.7	-	-	V
			I_O=-5.2mA; V_{CC}=6.0V	5.2	-	-	V
LOW-level output voltage	V_{OL}	V_I=V_{IH} or V_{IL}	I_O=20uA; V_{CC}=2.0V	-	-	0.1	V
			I_O=20uA; V_{CC}=4.5V	-	-	0.1	V
			I_O=20uA; V_{CC}=6.0V	-	-	0.1	V
			I_O=4mA; V_{CC}=4.5V	-	-	0.4	V
			I_O=5.2mA; V_{CC}=6.0V	-	-	0.4	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=6.0V		-	-	±4	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=6.0V		-	-	4	uA

AC Characteristics 1

(T_{amb}=25°C, GND=0V, C_L=50pF, unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}/t_{PHL}	CP to Qn, $\overline{Qn}$; see Figure 4	V_{CC}=2.0V	-	55	175	ns
			V_{CC}=4.5V	-	50	35	ns
			V_{CC}=5.0V C_L= 15pF	-	17	-	ns
			V_{CC}=6.0V	-	16	30	ns
HIGH to LOW propagation delay	t_{PHL}	$\overline{MR}$ to Qn, $\overline{Qn}$; see Figure 6	V_{CC}=2.0V	-	50	150	ns
			V_{CC}=4.5V	-	18	30	ns
			V_{CC}=5.0V C_L= 15pF	-	15	-	ns
			V_{CC}=6.0V	-	14	26	ns
transition time	t_t	Qn output; see Figure 4	V_{CC}=2.0V	-	19	75	ns
			V_{CC}=4.5V	-	7	15	ns
			V_{CC}=6.0V	-	6	13	ns
pulse width	t_W	CP input HIGH or LOW; see Figure 4	V_{CC}=2.0V	80	22	-	ns
			V_{CC}=4.5V	16	8	-	ns
			V_{CC}=6.0V	14	6	-	ns
		$\overline{MR}$ input LOW; see Figure 6	V_{CC}=2.0V	80	19	-	ns
			V_{CC}=4.5V	16	7	-	ns
			V_{CC}=6.0V	14	6	-	ns
recovery time	t_{rec}	$\overline{MR}$ to CP; see Figure 6	V_{CC}=2.0V	5	-33	-	ns
			V_{CC}=4.5V	5	-12	-	ns
			V_{CC}=6.0V	5	-10	-	ns
set-up time	t_{su}	Dn to CP; see Figure 4	V_{CC}=2.0V	80	3	-	ns
			V_{CC}=4.5V	16	1	-	ns
			V_{CC}=6.0V	14	1	-	ns
hold time	t_h	Dn to CP; see Figure 4	V_{CC}=2.0V	25	2	-	ns
			V_{CC}=4.5V	5	0	-	ns
			V_{CC}=6.0V	4	0	-	ns
maximum frequency	f_{max}	CP input; see Figure 4	V_{CC}=2.0V	6	25	-	ns
			V_{CC}=4.5V	30	75	-	ns
			V_{CC}=5.0V C_L= 15pF	-	83	-	ns
			V_{CC}=6.0V	35	89	-	ns

AC Characteristics 2

(T_{amb}=-40℃ to +85℃ GND=0V CL=50pF unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}/t_{PHL}	CP to Qn, $\overline{Qn}$; see Figure 4	V_{CC}=2.0V	-	-	220	ns
			V_{CC}=4.5V	-	-	44	ns
			V_{CC}=6.0V	-	-	37	ns
HIGH to LOW propagation delay	t_{PHL}	$\overline{MR}$ to Qn, $\overline{Qn}$; see Figure6	V_{CC}=2.0V	-	-	190	ns
			V_{CC}=4.5V	-	-	38	ns
			V_{CC}=6.0V	-	-	33	ns
transition time	t_t	Qn output; see Figure 4	V_{CC}=2.0V	-	-	95	ns
			V_{CC}=4.5V	-	-	19	ns
			V_{CC}=6.0V	-	-	16	ns
pulse width	t_W	CP input HIGH or LOW; see Figure 4	V_{CC}=2.0V	100	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	17	-	-	ns
		$\overline{MR}$ input LOW; see Figure 6	V_{CC}=2.0V	100	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	17	-	-	ns
recovery time	t_{rec}	$\overline{MR}$ to CP; see Figure 6	V_{CC}=2.0V	5	-	-	ns
			V_{CC}=4.5V	5	-	-	ns
			V_{CC}=6.0V	5	-	-	ns
set-up time	t_{su}	Dn to CP; see Figure 4	V_{CC}=2.0V	100	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	17	-	-	ns
hold time	t_h	Dn to CP; see Figure 4	V_{CC}=2.0V	30	-	-	ns
			V_{CC}=4.5V	6	-	-	ns
			V_{CC}=6.0V	5	-	-	ns
maximum frequency	f_{max}	CP input; see Figure 4	V_{CC}=2.0V	4.8	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	28	-	-	ns

AC Characteristics 3

(T_{amb}=-40℃ to +125℃ GND=0V C_L=50pF unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay	t_{PLH}/t_{PHL}	CP to Qn, $\overline{Qn}$; see Figure 4	V_{CC}=2.0V	-	-	265	ns
			V_{CC}=4.5V	-	-	53	ns
			V_{CC}=6.0V	-	-	45	ns
HIGH to LOW propagation delay	t_{PHL}	$\overline{MR}$ to Qn, $\overline{Qn}$; see Figure 6	V_{CC}=2.0V	-	-	225	ns
			V_{CC}=4.5V	-	-	45	ns
			V_{CC}=6.0V	-	-	38	ns
transition time	t_t	Qn output; see Figure 4	V_{CC}=2.0V	-	-	110	ns
			V_{CC}=4.5V	-	-	22	ns
			V_{CC}=6.0V	-	-	19	ns
pulse width	t_W	CP input HIGH or LOW; see Figure 4	V_{CC}=2.0V	120	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	20	-	-	ns
		$\overline{MR}$ input LOW; see Figure 6	V_{CC}=2.0V	120	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	20	-	-	ns
recovery time	t_{rec}	$\overline{MR}$ to CP; see Figure 6	V_{CC}=2.0V	5	-	-	ns
			V_{CC}=4.5V	5	-	-	ns
			V_{CC}=6.0V	5	-	-	ns
set-up time	t_{su}	Dn to CP; see Figure 4	V_{CC}=2.0V	120	-	-	ns
			V_{CC}=4.5V	24	-	-	ns
			V_{CC}=6.0V	20	-	-	ns
hold time	t_h	Dn to CP; see Figure 4	V_{CC}=2.0V	40	-	-	ns
			V_{CC}=4.5V	8	-	-	ns
			V_{CC}=6.0V	7	-	-	ns
maximum frequency	f_{max}	CP input; see Figure 4	V_{CC}=2.0V	4	-	-	ns
			V_{CC}=4.5V	20	-	-	ns
			V_{CC}=6.0V	24	-	-	ns

Testing Circuit

AC Testing Circuit

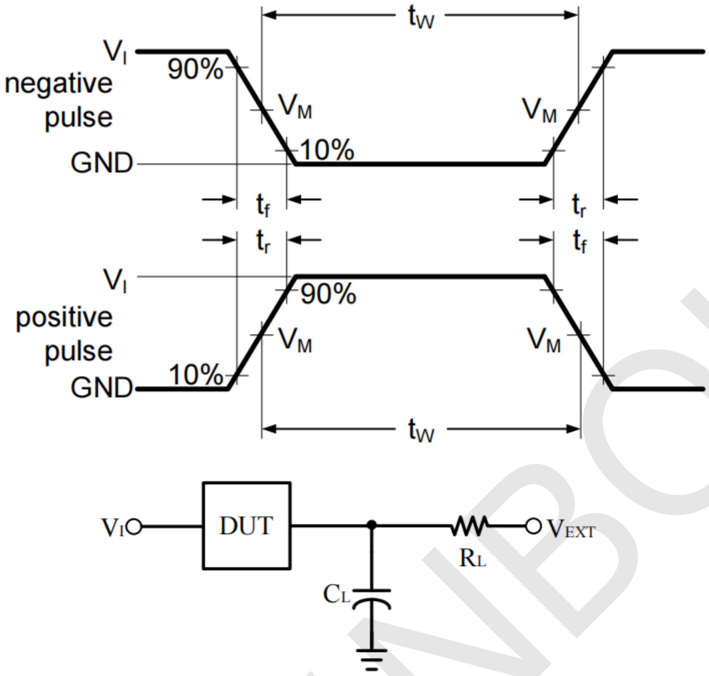


Figure 3. Test circuit for measuring switching times

Definitions for test circuit:
C_L includes probe and jig capacitance

AC Testing Waveforms

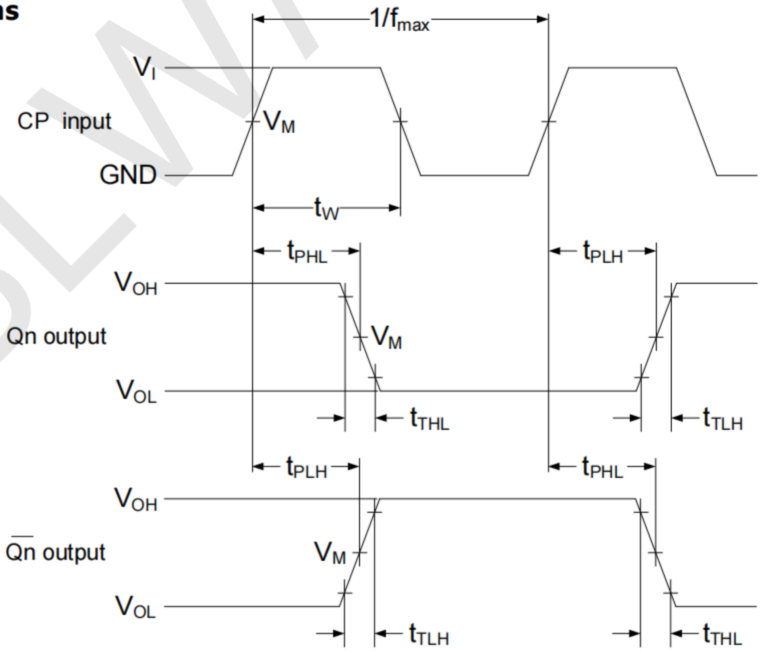


Figure 4. Input to output propagation delay, output transition time, clock input pulse width and maximum frequency

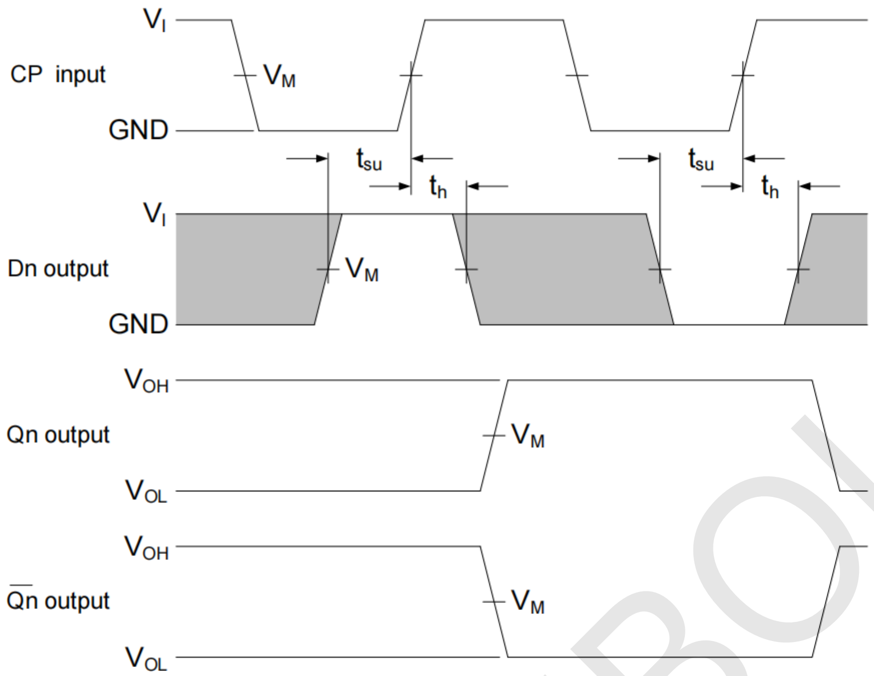


Figure 5. Data set-up and hold times for data input

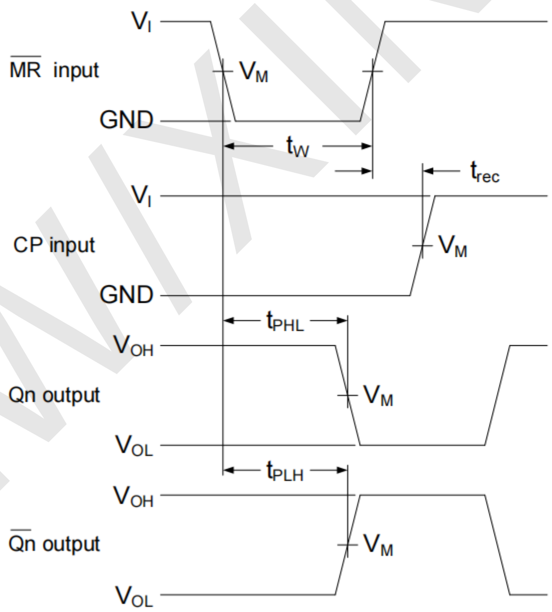


Figure 6. Master reset to output propagation delays, master reset pulse width and master reset to clock recovery time

Measurement Points

Type	Input		Output
	V_I	V_M	V_M
SN74HC175	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$

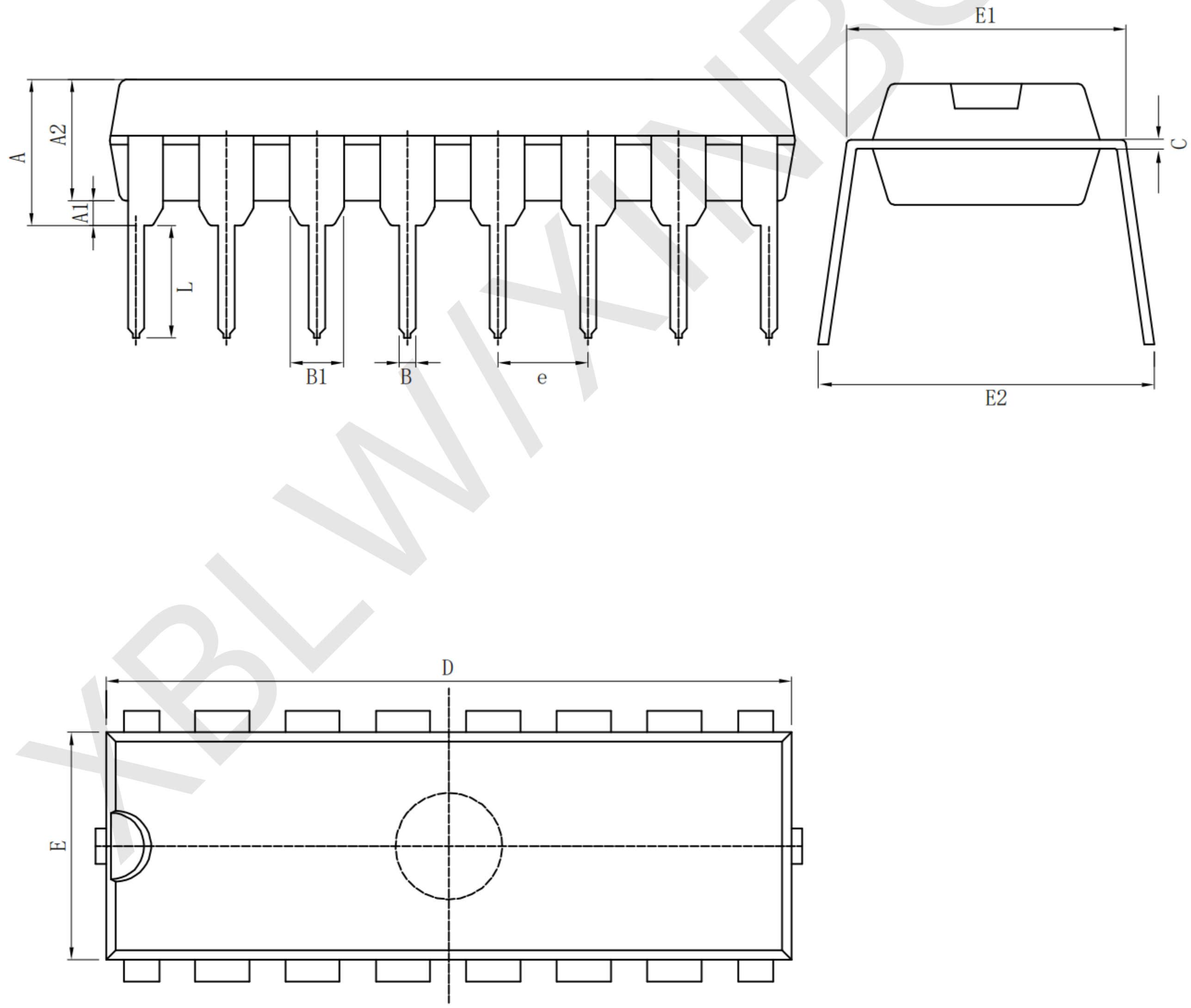
Test Data

Type	Input		Load		Test
	V_I	t_r ,t_f	C_L	R_L	
SN74HC175	V_{CC}	3.0ns	15pF, 50pF	1kΩ	t_{PLH}, t_{PHL}

Package Informatio

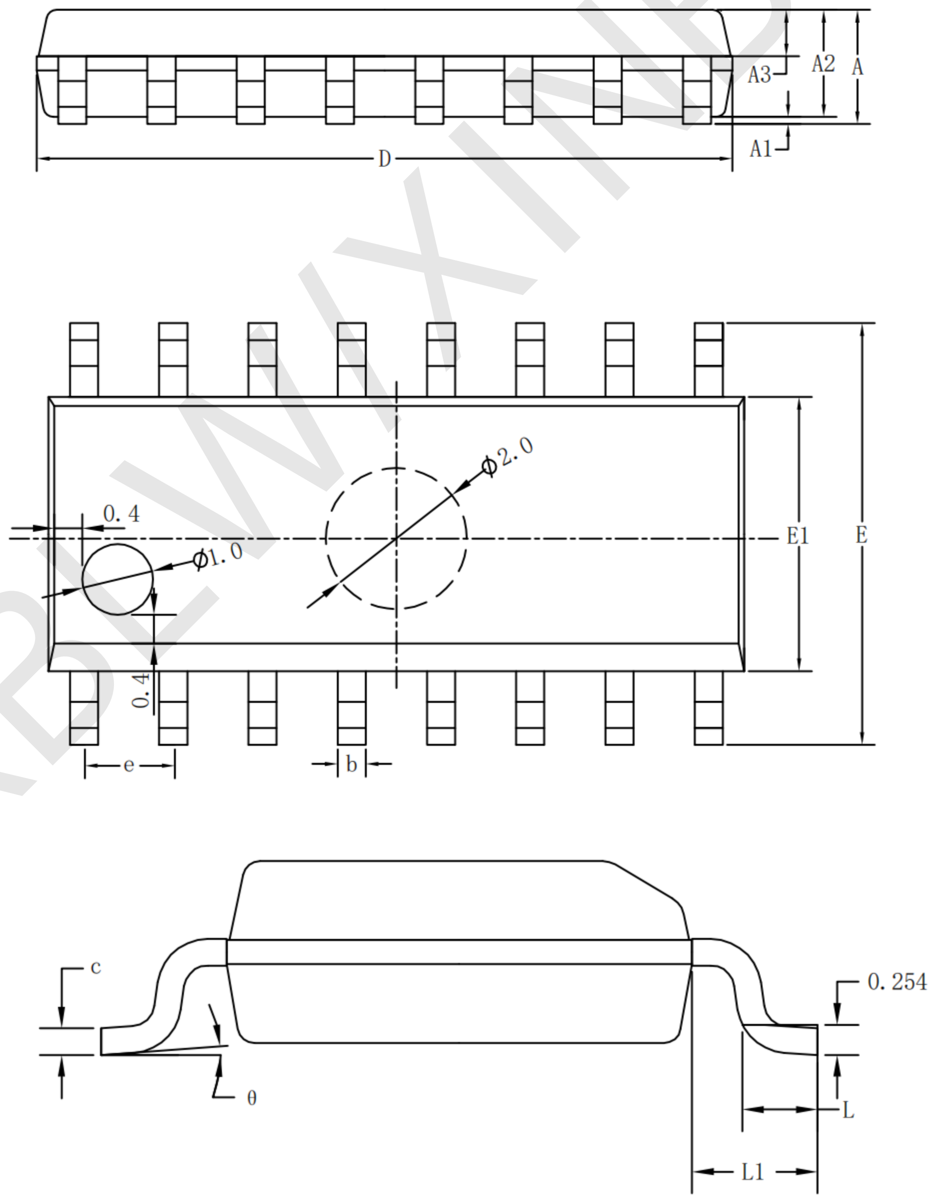
· DIP-16

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	3.710	4.310	A	0.146	0.170
A1	0.510		A1	0.020	
A2	3.200	3.600	A2	0.126	0.142
B	0.380	0.570	B	0.015	0.022
B1	1.524(BSC)		B1	0.060(BSC)	
C	0.204	0.360	C	0.008	0.014
D	18.80	19.20	D	0.740	0.756
E	6.200	6.600	E	0.244	0.260
E1	7.320	7.920	E1	0.288	0.312
e	2.540(BSC)		e	0.100(BSC)	
L	3.000	3.600	L	0.118	0.142
E2	8.400	9.000	E2	0.331	0.354



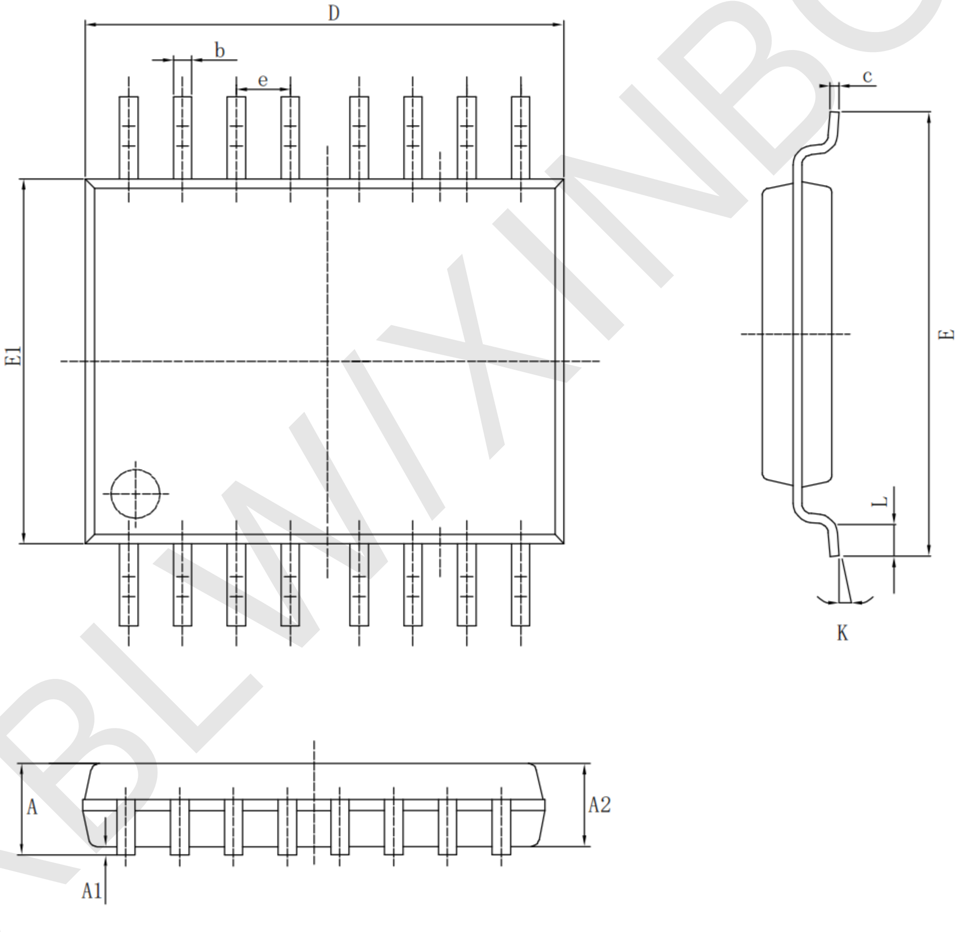
· SOP-16

Size / Symbol	Dimensions In Millimeters			Size / Symbol	Dimensions In Inches		
	Min(mm)	Nom(mm)	Max(mm)		Min(in)	Nom(in)	Max(in)
A	1.500	1.600	1.700	A	0.059	0.063	0.067
A1	0.100	0.150	0.250	A1	0.004	0.006	0.010
A2	1.400	1.450	1.500	A2	0.055	0.057	0.059
A3	0.600	0.650	0.700	A3	0.024	0.026	0.028
b	0.300	0.400	0.500	b	0.012	0.016	0.020
c	0.150	0.200	0.250	c	0.006	0.008	0.010
D	9.800	9.900	10.00	D	0.386	0.390	0.394
E	5.800	6.000	6.200	E	0.228	0.236	0.244
E1	3.850	3.900	3.950	E1	0.152	0.154	0.156
e	1.27(BSC)			e	0.050(BSC)		
L	0.500	0.600	0.700	L	0.020	0.024	0.028
L1	1.05(BSC)			L1	0.041(BSC)		
θ	0°	4°	8°	θ	0°	4°	8°



· TSSOP-16

Symbol \ Size	Dimensions In Millimeters		Symbol \ Size	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A		1.200	A		0.047
A1	0.050	0.150	A1	0.002	0.006
A2	0.800	1.050	A2	0.031	0.041
b	0.190	0.300	b	0.007	0.012
c	0.090	0.200	c	0.004	0.0089
D	4.900	5.100	D	0.193	0.201
E	6.200	6.600	E	0.244	0.260
E1	4.300	4.480	E1	0.169	0.176
e	0.65(BSC)		e	0.0256(BSC)	
K	0°	8°	K	0°	8°
L	0.450	0.750	L	0.018	0.030



Statement

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