Quad D flip-flop | 74ALS175

FEATURES

- Four edge-triggered D flip-flops
- Buffered common clock
- Buffered asynchronous master reset
- True and complementary outputs

DESCRIPTION

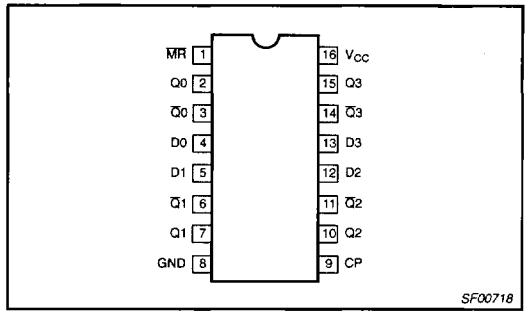
The 74ALS175 is a quad, edge-triggered D-type flip-flops with individual D inputs and both Q and $\overline{Q}$ outputs. The common buffered clock (CP) and master reset ($\overline{MR}$) inputs load and reset (clear) all flip-flops simultaneously.

The register is fully edge-triggered. The state of each D input, one setup time before the Low-to-High clock transition is transferred to the corresponding flip-flop's Q output.

All Q outputs will be forced Low independent of clock or data inputs by a Low voltage level on the $\overline{MR}$ input. The device is useful for applications where both true and complement outputs are required, and the clock and master reset are common to all storage elements.

TYPE	TYPICAL f_{MAX}	TYPICAL SUPPLY CURRENT (TOTAL)
74ALS175	70MHz	7mA

PIN CONFIGURATION



ORDERING INFORMATION

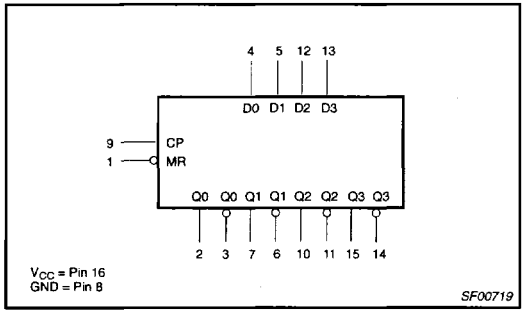
DESCRIPTION	ORDER CODE: COMMERCIAL RANGE V_{CC} = 5V ±10%, T_{amb} = 0°C to +70°C	DRAWING NUMBER
16-pin plastic DIP	74ALS175N	SOT38-4
16-pin plastic SO	74ALS175D	SOT109-1

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

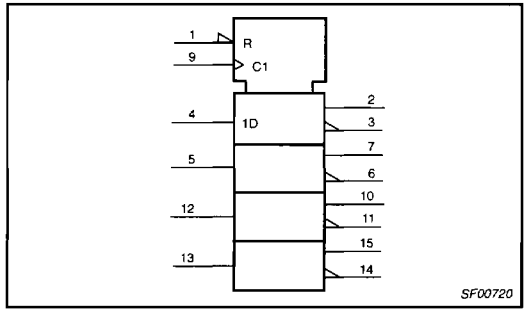
PINS	DESCRIPTION	74ALS (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
D0 – D3	Data inputs	1.0/1.0	20µA/0.1mA
CP	Clock Pulse input (active rising edge)	1.0/1.0	20µA/0.1mA
$\overline{MR}$	Master Reset input (active-Low)	1.0/1.0	20µA/0.1mA
Q0 – Q3	True outputs	20/80	0.4mA/8mA
$\overline{Q}$0 – $\overline{Q}$3	Complementary outputs	20/80	0.4mA/8mA

NOTE: One (1.0) ALS unit load is defined as: 20µA in the High state and 0.1mA in the Low state.

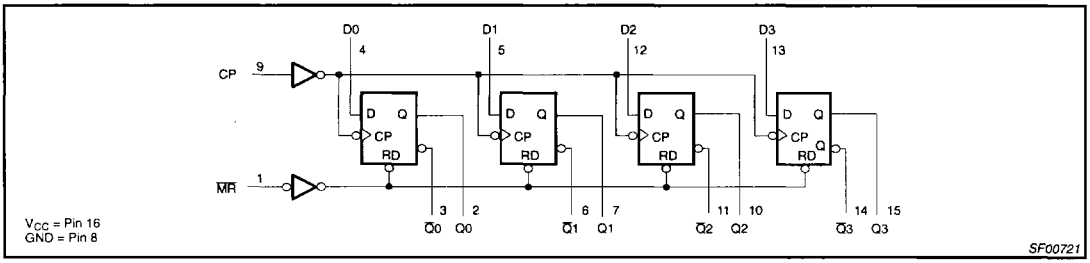
LOGIC SYMBOL



IEC/IEEE SYMBOL



LOGIC DIAGRAM



FUNCTION TABLE

INPUTS			OUTPUTS		OPERATING MODE
$\overline{MR}$	CP	D	Q_n	$\overline{Q}_n$	
L	X	X	L	H	Reset (clear)
H	↑	h	H	L	Load "1"
H	↑	l	L	H	Load "0"

NOTES:
H = High-voltage level
h = High state must be present one setup time before the Low-to-High clock transition
L = Low-voltage level
l = Low state must be present one setup time before the Low-to-High clock transition
X = Don't care
↑ = Low-to-High clock transition

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device.
Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	−0.5 to +7.0	V
V_{IN}	Input voltage	−0.5 to +7.0	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in High output state	−0.5 to V_{CC}	V
I_{OUT}	Current applied to output in Low output state	16	mA
T_{amb}	Operating free-air temperature range	0 to +70	°C
T_{stg}	Storage temperature range	−65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V_{CC}	*Supply voltage*	4.5	5.0	5.5	V
V_{IH}	High-level input voltage	2.0			V
V_{IL}	Low-level input voltage			0.8	V
I_{IK}	Input clamp current			−18	mA
I_{OH}	High-level output current			−0.4	mA
I_{OL}	Low-level output current			8	mA
T_{amb}	Operating free-air temperature range	0		+70	°C

DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS[1]		LIMITS			UNIT
				MIN	TYP[2]	MAX	
V_{OH}	High-level output voltage	V_{CC}±10%, V_{IL} = MAX, V_{IH} = MIN, I_{OH} = MAX		V_{CC} – 2			V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN	I_{OL} = 4mA		0.25	0.4	V
			I_{OL} = 8mA		0.35	0.50	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = I_{IK}			–0.73	–1.5	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7.0V				100	µA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.7V				20	µA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.5V				–0.1	mA
I_O	Output current[3]	V_{CC} = MAX, V_O = 2.25V		–30		–112	mA
I_{CC}	Supply current (total)	V_{CC} = MAX			7	14	mA

NOTES:

1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
3. The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

AC ELECTRICAL CHARACTERISTICS

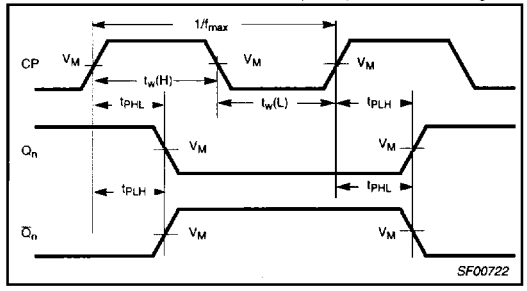
SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			T_{amb} = 0°C to +70°C V_{CC} = +5.0V ± 10% C_L = 50pF, R_L = 500Ω		
			MIN	MAX	
f_{MAX}	Maximum clock frequency	Waveform 1	60		MHz
t_{PLH} t_{PHL}	Propagation delay CP to Qn or CP to $\overline{Q}$n	Waveform 1	3.0 5.0	13.0 16.0	ns
t_{PLH}	Propagation delay, $\overline{MR}$ to Qn	Waveform 2	3.0	13.0	ns
t_{PHL}	Propagation delay, $\overline{MR}$ to $\overline{Q}$n	Waveform 2	8.0	18.0	ns

AC SETUP REQUIREMENTS

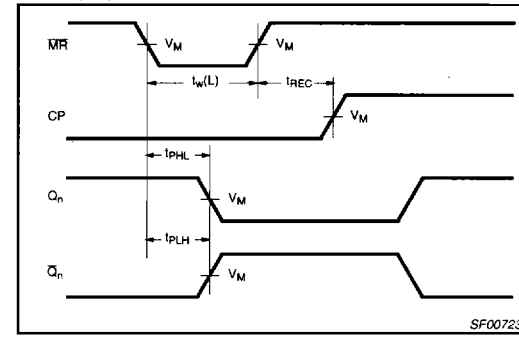
SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			T_{amb} = 0°C to +70°C V_{CC} = +5.0V ± 10% C_L = 50pF, R_L = 500Ω		
			MIN	MAX	
t_{su}(H) t_{su}(L)	Setup time, High or Low Dn to CP	Waveform 3	6.0 6.0		ns
t_h(H) t_h(L)	Hold time, High or Low Dn to CP	Waveform 3	0.0 0.0		ns
t_w(H) t_w(L)	CP pulse width, High or Low	Waveform 1	8.0 8.0		ns
t_w(L)	$\overline{MR}$ pulse width, Low	Waveform 2	6.0		ns
t_{REC}	Recovery time, $\overline{MR}$ to CP	Waveform 2	6.0		ns

AC WAVEFORMS

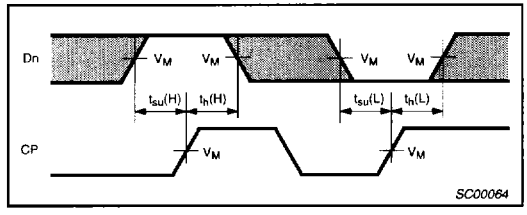
For all waveforms, V_M = 1.3V.
The shaded areas indicate when the input is permitted to change for predictable output performance.



Waveform 1. Propagation Delay for Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency

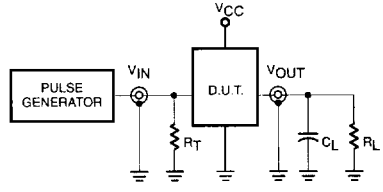


Waveform 2. Master Reset Pulse Width, Master Reset to Output Delay, and Master Reset to Clock Recovery Time

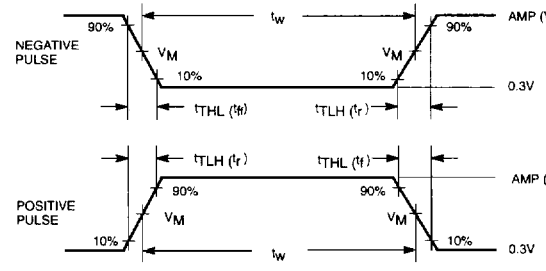


Waveform 3. Data Setup and Hold Times

TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-pole Outputs



Input Pulse Definition

DEFINITIONS:

R_L = Load resistor; see AC electrical characteristics for value.
C_L = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

Family	INPUT PULSE REQUIREMENTS					
	Amplitude	V_M	Rep.Rate	t_w	t_{TLH}	t_{THL}
74ALS	3.5V	1.3V	1MHz	500ns	2.0ns	2.0ns

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