HD74AC175

Quad D-Type Flip-Flop

REJ03D0257–0200Z
(Previous ADE-205-377 (Z))
Rev.2.00
Jul.16.2004

Description

The HD74AC175 is a high-speed quad D flip-flop. The device is useful for general flip-flop requirements where clock and clear inputs are common. The information on the D inputs is stored during the Low-to-High clock transition. Both true and complemented outputs of each flip-flop are provided. A Master Reset input resets all flip-flops, independent of the Clock or D inputs, when Low.

Features

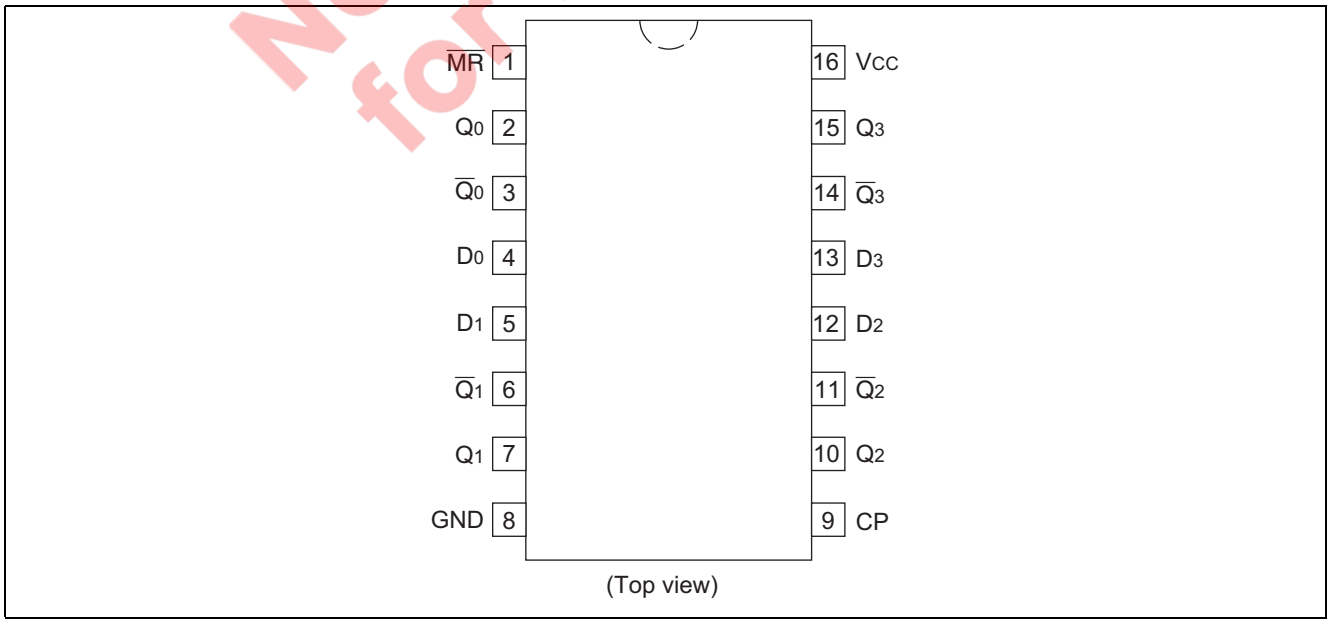
- Edge-Triggered D-Type Inputs
- Buffered Positive Edge-Triggered Clock
- Asynchronous Common Reset
- True and Complement Output
- Outputs Source/Sink 24 mA

- Ordering Information

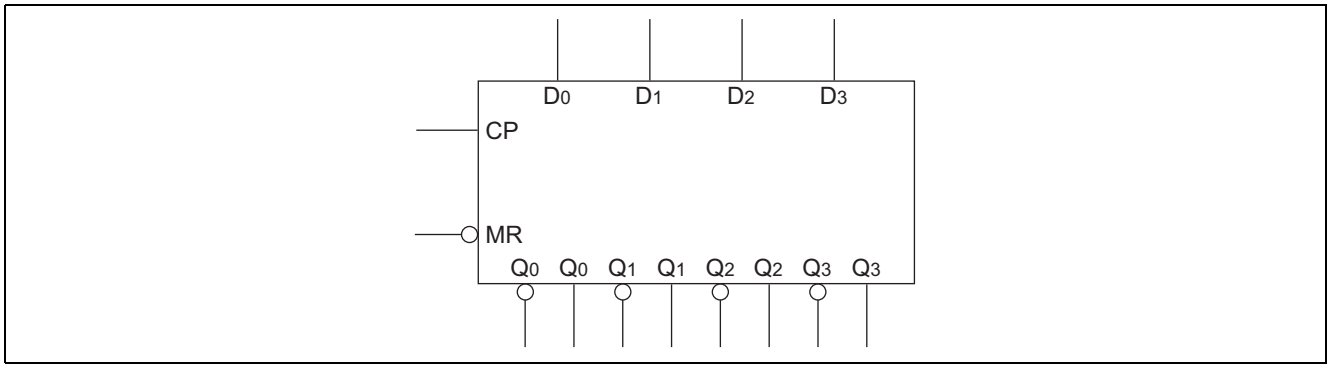
Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC175AFPEL	SOP-16 pin (JEITA)	FP-16DAV	FP	EL (2,000 pcs/reel)
HD74AC175ARPEL	SOP-16 pin (JEDEC)	FP-16DNV	RP	EL (2,500 pcs/reel)
HD74AC175TELL	TSSOP-16 pin	TTP-16DAV	T	ELL(2,000 pcs/reel)

Notes: 1. Please consult the sales office for the above package availability.
2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

Pin Arrangement



Logic Symbol



Pin Names

D_0 to D_3	Data Inputs
CP	Clock Pulse Input
$\overline{MR}$	Master Reset Input
Q_0 to Q_3	True Outputs
$\overline{Q}_0$ to $\overline{Q}_3$	Complement Outputs

Functional Description

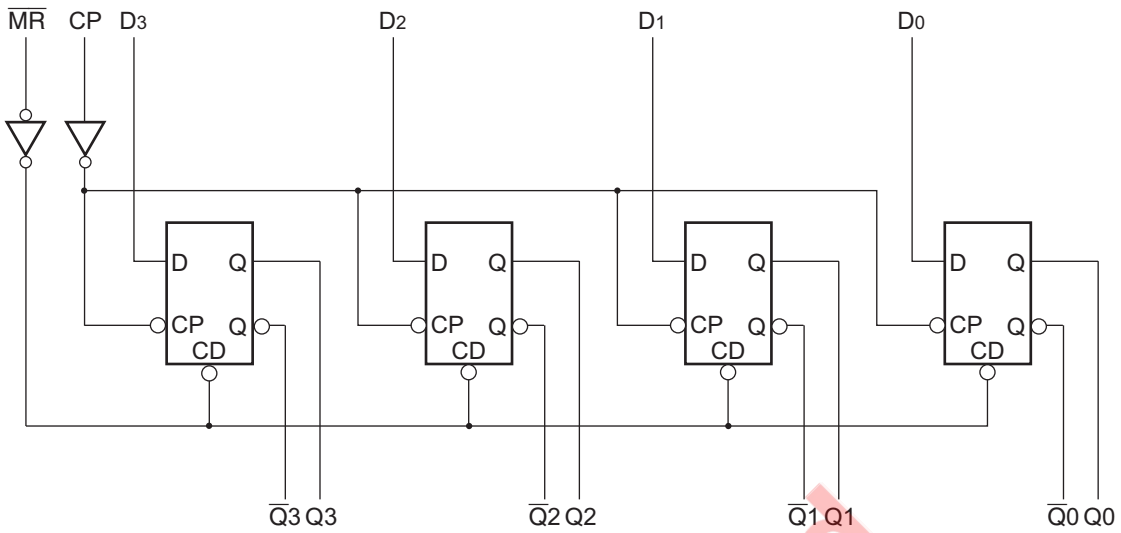
The HD74AC175 consists of four edge-triggered D flip-flops with individual D inputs and Q and $\overline{Q}$ outputs. The Clock and Master Reset are common. The four flip-flops will store the state of their individual D inputs on the Low-to-High clock (CP) transition, causing individual Q and $\overline{Q}$ outputs to follow. A Low input on the Master Reset ($\overline{MR}$) will force all Q outputs Low and $\overline{Q}$ outputs High independent of Clock or Data inputs. The HD74AC175 is useful for general logic applications where a common Master Reset and Clock are acceptable.

Truth Table

Inputs	Outputs	
@ t_n, $\overline{MR}$ = H	@ t_{n+1}	
Dn	Qn	$\overline{Q}$n
L	L	H
H	H	L

H : High Voltage Level
L : Low Voltage Level
t_n : Bit Time before Clock Pulse
t_{n+1} : Bit Time after Clock Pulse

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC}	–0.5 to 7	V	
DC input diode current	I_{IK}	–20	mA	V_I = –0.5V
		20	mA	V_I = Vcc+0.5V
DC input voltage	V_I	–0.5 to Vcc+0.5	V	
DC output diode current	I_{OK}	–50	mA	V_O = –0.5V
		50	mA	V_O = Vcc+0.5V
DC output voltage	V_O	–0.5 to Vcc+0.5	V	
DC output source or sink current	I_O	±50	mA	
DC V_{CC} or ground current per output pin	I_{CC}, I_{GND}	±50	mA	
Storage temperature	Tstg	–65 to +150	°C	

Recommended Operating Conditions

Item	Symbol	Ratings	Unit	Condition
Supply voltage	V_{CC}	2 to 6	V	
Input and output voltage	V_I, V_O	0 to V_{CC}	V	
Operating temperature	Ta	–40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V_{IN} 30% to 70% V_{CC}	tr, tf	8	ns/V	V_{CC} = 3.0V
				V_{CC} = 4.5 V
				V_{CC} = 5.5 V

DC Characteristics

Item	Sym-bol	Vcc (V)	Ta = 25°C			Ta = –40 to +85°C		Unit	Condition	
			min.	typ.	max.	min.	max.			
Input Voltage	V_{IH}	3.0	2.1	1.5	—	2.1	—	V	V_{OUT} = 0.1 V or V_{CC} –0.1 V	
		4.5	3.15	2.25	—	3.15	—			
		5.5	3.85	2.75	—	3.85	—			
	V_{IL}	3.0	—	1.50	0.9	—	0.9		V_{OUT} = 0.1 V or V_{CC} –0.1 V	
		4.5	—	2.25	1.35	—	1.35			
		5.5	—	2.75	1.65	—	1.65			
Output voltage	V_{OH}	3.0	2.9	2.99	—	2.9	—	V	V_{IN} = V_{IL} or V_{IH} I_{OUT} = –50 µA	
		4.5	4.4	4.49	—	4.4	—			
		5.5	5.4	5.49	—	5.4	—			
		3.0	2.58	—	—	2.48	—		V_{IN} = V_{IL} or V_{IH}	I_{OH} = –12 mA
		4.5	3.94	—	—	3.80	—			I_{OH} = –24 mA
		5.5	4.94	—	—	4.80	—			I_{OH} = –24 mA
	V_{OL}	3.0	—	0.002	0.1	—	0.1		V_{IN} = V_{IL} or V_{IH} I_{OUT} = 50 µA	
		4.5	—	0.001	0.1	—	0.1			
		5.5	—	0.001	0.1	—	0.1			
		3.0	—	—	0.32	—	0.37		V_{IN} = V_{IL} or V_{IH}	I_{OL} = 12 mA
		4.5	—	—	0.32	—	0.37			I_{OL} = 24 mA
		5.5	—	—	0.32	—	0.37			I_{OL} = 24 mA
Input leakage current	I_{IN}	5.5	—	—	±0.1	—	±1.0	µA	V_{IN} = V_{CC} or GND	
Dynamic output current*	I_{OLD}	5.5	—	—	—	86	—	mA	V_{OLD} = 1.1 V	
	I_{OHD}	5.5	—	—	—	–75	—	mA	V_{OHD} = 3.85 V	
Quiescent supply current	I_{CC}	5.5	—	—	8.0	—	80	µA	V_{IN} = V_{CC} or ground	

*Maximum test duration 2.0 ms, one output loaded at a time.

AC Characteristics

Item	Symbol	V_{CC} (V)*[1]	Ta = +25°C C_L = 50 pF			Ta = –40°C to +85°C C_L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Maximum clock frequency	f_{max}	3.3	149	—	—	139	—	MHz
		5.0	187	—	—	187	—	
Propagation delay CP to Q_n or $\overline{Q}_n$	t_{PLH}	3.3	1.0	9.5	12.0	1.0	13.5	ns
		5.0	1.0	7.0	9.0	1.0	9.5	
Propagation delay CP to Q_n or $\overline{Q}_n$	t_{PHL}	3.3	1.0	8.5	13.0	1.0	14.5	ns
		5.0	1.0	6.0	9.5	1.0	10.5	
Propagation delay $\overline{MR}$ to $\overline{Q}_n$	t_{PLH}	3.3	1.0	7.5	12.5	1.0	13.5	ns
		5.0	1.0	5.5	9.0	1.0	10.0	
Propagation delay $\overline{MR}$ to Q_n	t_{PHL}	3.3	1.0	8.5	11.0	1.0	12.5	ns
		5.0	1.0	6.0	8.5	1.0	9.0	

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

AC Operating Requirements

Item	Symbol	V_{CC} (V)*[1]	Ta = +25°C, C_L = 50 pF		Ta = –40°C to +85°C, C_L = 50 pF	Unit
			Typ	Guaranteed Minimum		
Set-up time, HIGH or LOW D_n to CP	t_{su}	3.3	2.0	4.5	4.5	ns
		5.0	1.0	3.0	3.0	
Hold time, HIGH or LOW D_n to CP	t_h	3.3	0	1.0	1.0	ns
		5.0	0	1.0	1.0	
CP pulse width HIGH or LOW	t_w	3.3	2.5	4.5	4.5	ns
		5.0	2.0	3.5	3.5	
$\overline{MR}$ pulse width, LOW	t_w	3.3	2.5	4.5	5.0	ns
		5.0	2.0	3.5	3.5	
Recovery time $\overline{MR}$ to CP	t_{rec}	3.3	–2.0	0.0	0.0	ns
		5.0	–1.0	0.0	0.0	

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V
Voltage Range 5.0 is 5.0 V ± 0.5 V

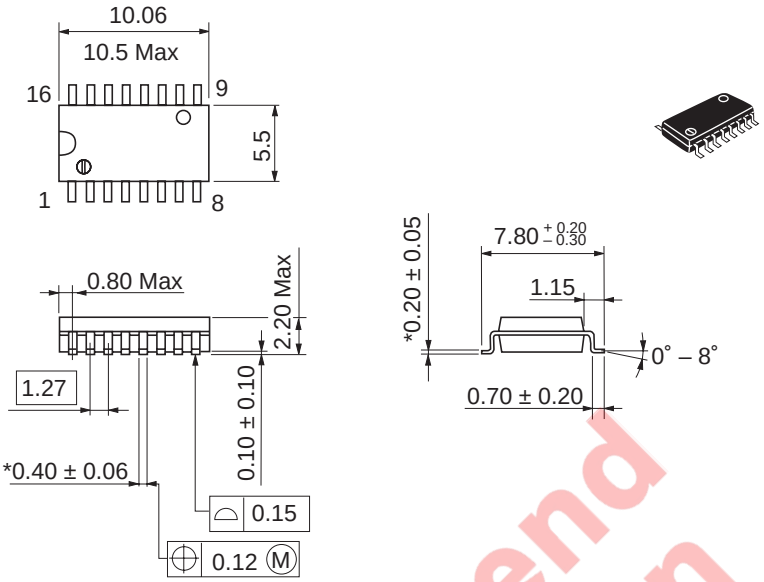
Capacitance

Item	Symbol	Typ	Unit	Condition
Input capacitance	C_{IN}	4.5	pF	V_{CC} = 5.5 V
Power dissipation capacitance	C_{PD}	45.0	pF	V_{CC} = 5.0 V

Package Dimensions

As of January, 2003

Unit: mm

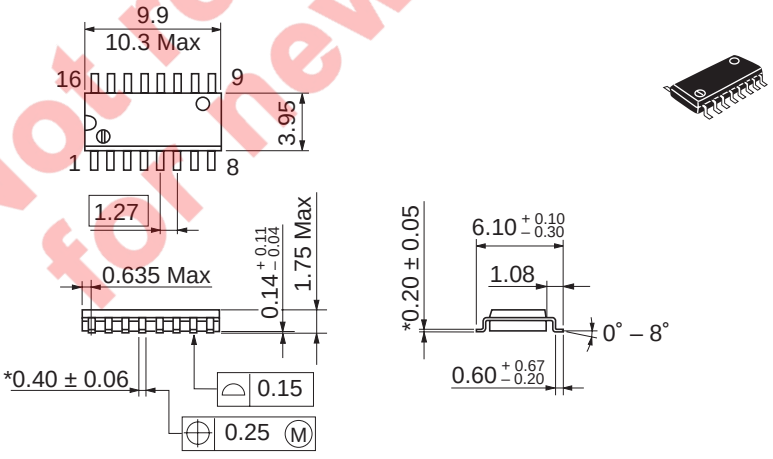


Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm

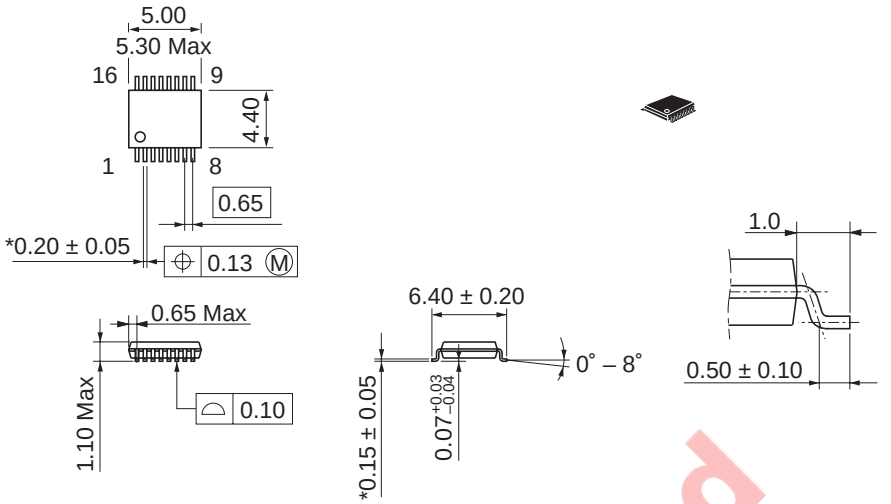


Package Code	FP-16DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.15 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm



Package Code	TTP-16DAV
JEDEC	—
JEITA	—
Mass (reference value)	0.05 g

*Ni/Pd/Au plating

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