FAIRCHILD SEMICONDUCTOR™

October 1987
Revised January 1999

MM74C175
Quad D-Type Flip-Flop

General Description

The MM74C175 consists of four positive-edge triggered D-type flip-flops implemented with monolithic CMOS technology. Both are true and complemented outputs from each flip-flop are externally available. All four flip-flops are controlled by a common clock and a common clear. Information at the D-type inputs meeting the set-up time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. The clearing operation, enabled by a negative pulse at Clear input, clears all four Q outputs to logical "0" and Q's to logical "1".

All inputs are protected from static discharge by diode clamps to V_{CC} and GND.

Features

- Wide supply voltage range: 3V to 15V
- Guaranteed noise margin: 1.0V
- High noise immunity: 0.45 V_{CC} (typ.)
- Low power TTL compatibility: Fan out of 2 driving 74L

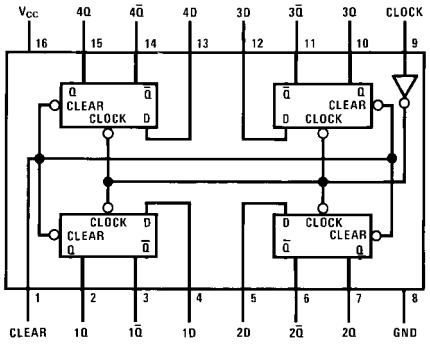
Ordering Code:

Order Number	Package Number	Package Description
MM74C175M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74C175N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Connection Diagram

Pin Assignments for DIP and SOIC



Top View

Truth Table

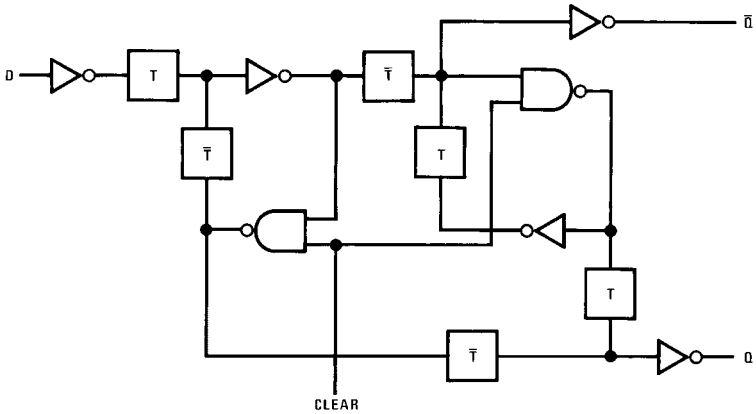
Each Flip-Flop

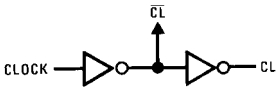
Inputs			Outputs	
Clear	Clock	D	Q	$\overline{Q}$
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	H	X	NC	NC
H	L	X	NC	NC

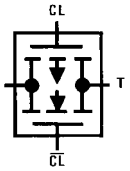
H = HIGH Level
L = LOW Level
X = Irrelevant
↑ = Transition from LOW-to-HIGH level
NC = No Change

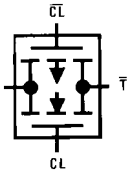
Block Diagrams

Typical One of Four









Absolute Maximum Ratings (Note 1)

Voltage at Any Pin	−0.3V to V_{CC} +0.3V
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating V_{CC} Range	3V to 15V
Absolute Maximum V_{CC}	18V
Lead Temperature	
(Soldering, 10 seconds)	260°C

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The Electrical Characteristics table provides conditions for actual device operation.

DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 5V	3.5			V
		V_{CC} = 10V	8.0			V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5V			1.5	V
		V_{CC} = 10V			2.0	V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 5V, I_O = −10 μA	4.5			V
		V_{CC} = 10V, I_O = −10 μA	9.0			V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5V, I_O = 10 μA			0.5	V
		V_{CC} = 10V, I_O = 10 μA			1.0	V
$I_{IN(1)}$	Logical "1" Input Current	V_{CC} = 15V, V_{IN} = 15V		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	V_{CC} = 15V, V_{IN} = 0V	−1.0	−0.005		μA
I_{CC}	Supply Current	V_{CC} = 15V		0.05	300	μA
CMOS/LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	74C, V_{CC} = 4.75V	V_{CC} − 1.5			V
$V_{IN(0)}$	Logical "0" Input Voltage	74C, V_{CC} = 4.75V			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	74C, V_{CC} = 4.75V, I_O = −360 μA	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	74C, V_{CC} = 4.75V, I_O = 360 μA			0.4	V
OUTPUT DRIVE (See Family Characteristics Data Sheet) (Short Circuit Current)						
I_{SOURCE}	Output Source Current (P-Channel)	V_{CC} = 5V, T_A = 25°C, V_{OUT} = 0V	−1.75	−3.3		mA
I_{SOURCE}	Output Source Current (P-Channel)	V_{CC} = 10V, T_A = 25°C, V_{OUT} = 0V	−8.0	−15		mA
I_{SINK}	Output Sink Current (N-Channel)	V_{CC} = 5V, T_A = 25°C, V_{OUT} = V_{CC}	1.75	3.6		mA
I_{SINK}	Output Sink Current (N-Channel)	V_{CC} = 10V, T_A = 25°C, V_{OUT} = V_{CC}	8.0	16		mA

AC Electrical Characteristics (Note 2)

$T_A = 25°C$, $C_L = 50$ pF, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd}	Propagation Delay Time to	$V_{CC} = 5V$		190	300	ns
	a Logical "0" or Logical "1" from	$V_{CC} = 10V$		75	110	ns
	Clock to Q or $\overline{Q}$					
t_{pd}	Propagation Delay Time to a	$V_{CC} = 5V$		180	300	ns
	Logical "0" from Clear to Q	$V_{CC} = 10V$		70	110	ns
t_{pd}	Propagation Delay Time to a	$V_{CC} = 5V$		230	400	ns
	Logical "1" from Clear to Q	$V_{CC} = 10V$		90	150	ns
t_S	Time Prior to Clock Pulse that	$V_{CC} = 5V$	100	45		ns
	Data Must be Present	$V_{CC} = 10V$	40	16		ns
t_H	Time After Clock Pulse that	$V_{CC} = 5V$	0	−11		ns
	Data Must be Held	$V_{CC} = 10V$	0	−4		ns
t_W	Minimum Clock Pulse Width	$V_{CC} = 5.0V$		130	250	ns
		$V_{CC} = 10V$		45	100	ns
t_W	Minimum Clear Pulse Width	$V_{CC} = 5.0V$		120	250	ns
		$V_{CC} = 10V$		45	100	ns
t_r	Maximum Clock Rise Time	$V_{CC} = 5V$	15	450		µs
		$V_{CC} = 10V$	5.0	125		µs
t_f	Maximum Clock Fall Time	$V_{CC} = 5V$	15	50		µs
		$V_{CC} = 10V$	5.0	50		µs
f_{MAX}	Maximum Clock Frequency	$V_{CC} = 5V$	2.0	3.5		MHz
		$V_{CC} = 10V$	5.0	10		MHz
C_{IN}	Input Capacitance	Clear Input (Note 3)		10		pF
		Any Other Input		5.0		pF
C_{PD}	Power Dissipation Capacitance	Per Package (Note 4)		130		pF

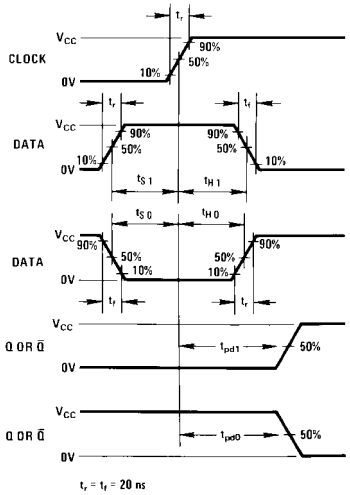
Note 2: AC Parameters are guaranteed by DC correlated testing.

Note 3: Capacitance is guaranteed by periodic testing.

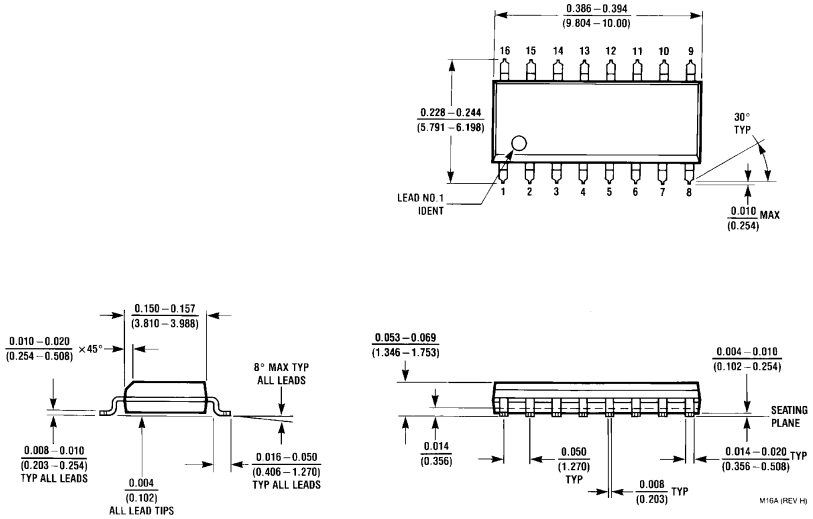
Note 4: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note AN-90.

Switching Time Waveforms

CMOS to CMOS

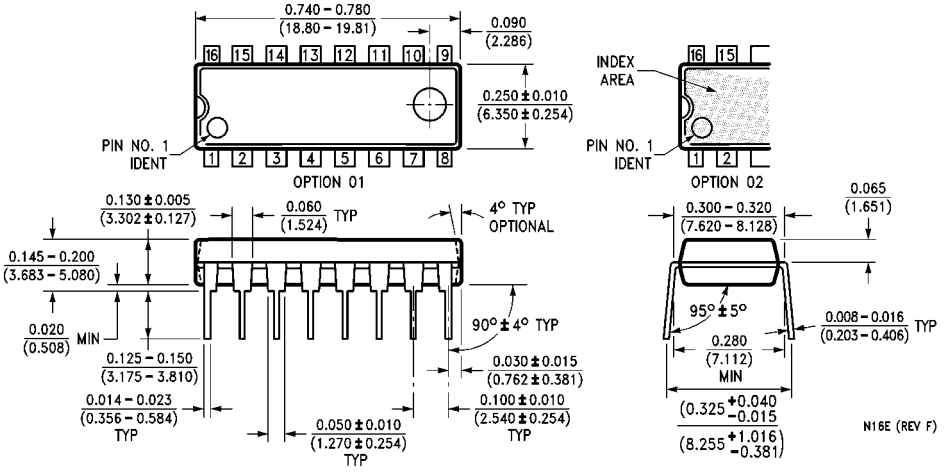


Physical Dimensions inches (millimeters) unless otherwise noted



16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M16A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N16E

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

www.fairchildsemi.com