



September 1983
Revised February 1999

MM74HC175 Quad D-Type Flip-Flop With Clear

General Description

The MM74HC175 high speed D-type flip-flop with complementary outputs utilizes advanced silicon-gate CMOS technology to achieve the high noise immunity and low power consumption of standard CMOS integrated circuits, along with the ability to drive 10 LS-TTL loads.

Information at the D inputs of the MM74HC175 is transferred to the Q and \bar{Q} outputs on the positive going edge of the clock pulse. Both true and complement outputs from each flip flop are externally available. All four flip-flops are controlled by a common clock and a common CLEAR. Clearing is accomplished by a negative pulse at the CLEAR input. All four Q outputs are cleared to a logical "0" and all four \bar{Q} outputs to a logical "1."

The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

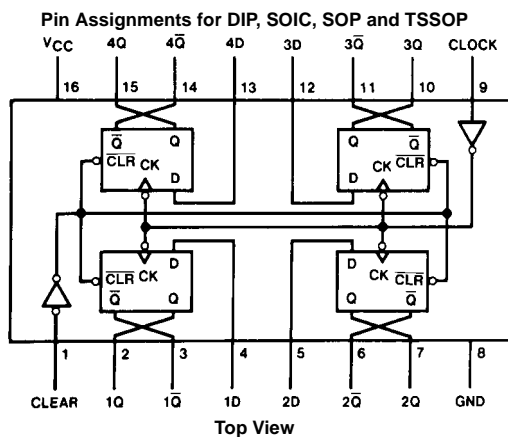
- Typical propagation delay: 15 ns
- Wide operating supply voltage range: 2–6V
- Low input current: 1 μ A maximum
- Low quiescent supply current: 80 μ A maximum (74HC)
- High output drive current: 4 mA minimum (74HC)

Ordering Code:

Order Number	Package Number	Package Description
MM74HC175M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HC175SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HC175MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HC175N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

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

Connection Diagram



Truth Table

(Each Flip-Flop)

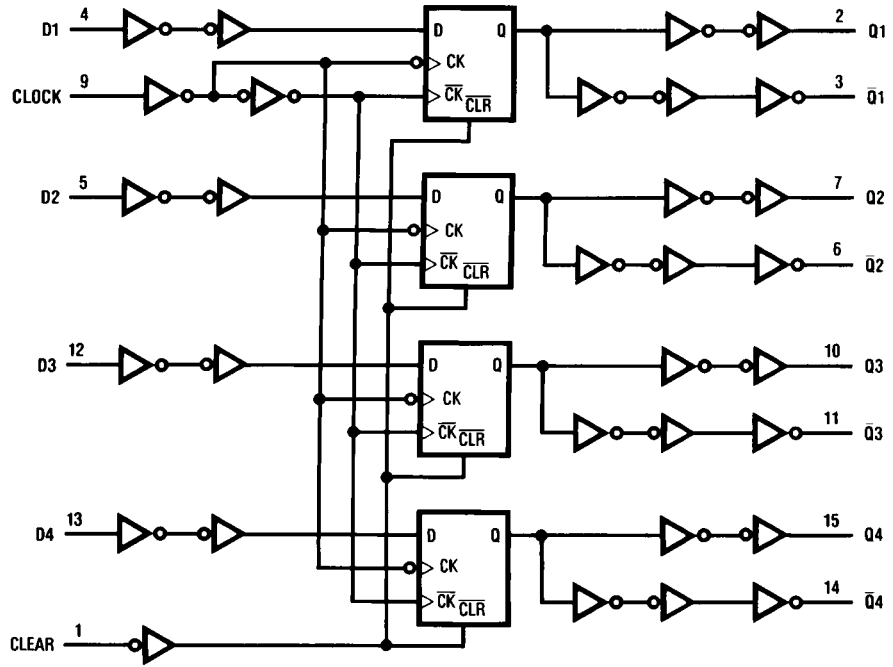
Clear	Inputs			Outputs	
	Clear	Clock	D	Q	\bar{Q}
L	X	X	X	L	H
H	\uparrow	H	H	H	L
H	\uparrow	L	L	L	H
H	L	X	Q_0	\bar{Q}_0	

H = HIGH Level (steady state)
L = LOW Level (steady state)
X = Irrelevant
 \uparrow = Transition from LOW-to-HIGH level
 Q_0 = The level of Q before the indicated steady-state input conditions were established

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Logic Diagram



Absolute Maximum Ratings (Note 1)				Recommended Operating Conditions				
(Note 2)								
Supply Voltage (V_{CC})	-0.5 to +7.0V			Min	Max	Units		
DC Input Voltage (V_{IN})	-1.5 to $V_{CC} + 1.5V$			2	6	V		
DC Output Voltage (V_{OUT})	-0.5 to $V_{CC} + 0.5V$							
Clamp Diode Current (I_{IK}, I_{OK})	± 20 mA			0	V_{CC}	V		
DC Output Current, per pin (I_{OUT})	± 25 mA			Operating Temperature Range (T_A)				
DC V_{CC} or GND Current, per pin (I_{CC})	± 50 mA			-40	+85	$^{\circ}C$		
Storage Temperature Range (T_{STG})	-65 $^{\circ}C$ to +150 $^{\circ}C$			Input Rise or Fall Times				
Power Dissipation (P_D)				(t_r, t_f) $V_{CC} = 2.0V$		1000	ns	
(Note 3)	600 mW			$V_{CC} = 4.5V$		500	ns	
S.O. Package only	500 mW			$V_{CC} = 6.0V$		400	ns	
Lead Temperature (T_L)				Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.				
(Soldering 10 seconds)	260 $^{\circ}C$			Note 2: Unless otherwise specified all voltages are referenced to ground.				
				Note 3: Power Dissipation temperature derating — plastic "N" package: -12 mW/ $^{\circ}C$ from 65 $^{\circ}C$ to 85 $^{\circ}C$.				
DC Electrical Characteristics (Note 4)								
Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^{\circ}C$			Units	
				Guaranteed Limits				
V_{IH}	Minimum HIGH Level Input Voltage		2.0V		1.5	1.5	1.5	V
			4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V_{IL}	Maximum LOW Level Input Voltage		2.0V		0.5	0.5	0.5	V
			4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V_{OH}	Minimum HIGH Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 20 \mu A$	2.0V	2.0	1.9	1.9	1.9	V
			4.5V	4.5	4.4	4.4	4.4	V
			6.0V	6.0	5.9	5.9	5.9	V
		$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 4.0$ mA $ I_{OUT} \leq 5.2$ mA	4.5V	4.2	3.98	3.84	3.7	V
			6.0V	5.7	5.48	5.34	5.2	V
V_{OL}	Maximum LOW Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 20 \mu A$	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
		$V_{IN} = V_{IH}$ or V_{IL} $ I_{OUT} \leq 4.0$ mA $ I_{OUT} \leq 5.2$ mA	4.5V	0.2	0.26	0.33	0.4	V
			6.0V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		± 0.1	± 1.0	± 1.0	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$	6.0V		8	80	160	μA
Note 4: For a power supply of 5V $\pm 10\%$ the worst case output voltages (V_{OH} , and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.								

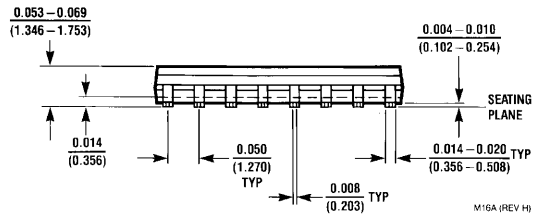
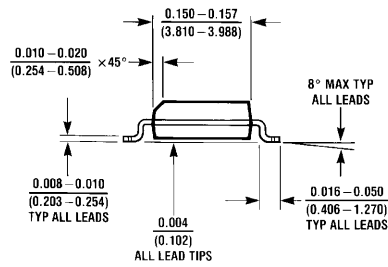
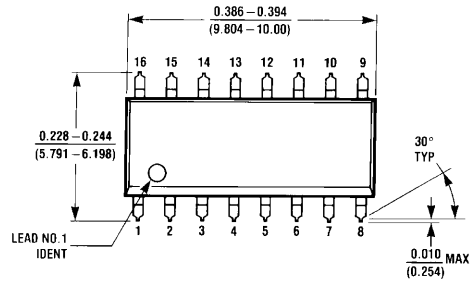
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AC Electrical Characteristics						
V _{CC} = 5V, T _A = 25°C, C _L = 15 pF, t _r = t _f = 6 ns						
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units	
f _{MAX}	Maximum Operating Frequency		60	35	MHz	
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Clock to Q or \bar{Q}		15	25	ns	
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Reset to Q or \bar{Q}		13	21	ns	
t _{REC}	Minimum Removal Time, Clear to Clock			20	ns	
t _S	Minimum Setup Time, Data to Clock			20	ns	
t _H	Minimum Hold Time, Data from Clock			0	ns	
t _W	Minimum Pulse Width, Clock or Clear		10	16	ns	

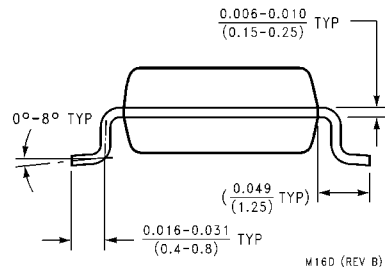
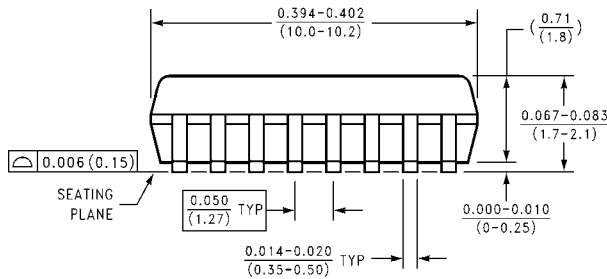
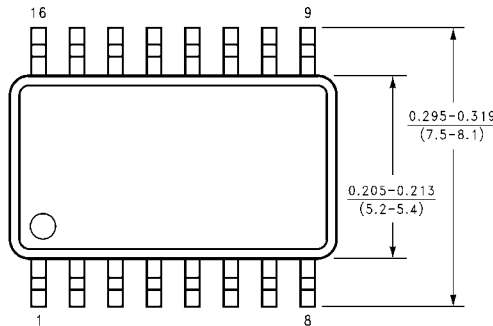
AC Electrical Characteristics								
V _{CC} = 2.0V to 6.0V, C _L = 50 pF, t _r = t _f = 6 ns (unless otherwise specified)								
Symbol	Parameter	Conditions	V _{CC}	T _A = 25°C	T _A = -40 to 85°C	T _A = -55 to 125°C	Units	
				Typ	Guaranteed Limits			
f _{MAX}	Maximum Operating Frequency		2.0V	12	6	5	4	MHz
			4.5V	60	30	24	20	MHz
			6.0V	70	35	28	24	MHz
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Clock to Q or \bar{Q}		2.0V	80	150	190	225	ns
			4.5V	15	30	38	45	ns
			6.0V	13	26	32	38	ns
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Reset to Q or \bar{Q}		2.0V	64	125	158	186	ns
			4.5V	14	25	32	37	ns
			6.0V	12	21	27	32	ns
t _{REM}	Minimum Removal Time Clear to Clock		2.0V		100	125	150	ns
			4.5V		20	25	30	ns
			6.0V		17	21	25	ns
t _S	Minimum Setup Time Data to Clock		2.0V		100	125	150	ns
			4.5V		20	25	30	ns
			6.0V		17	21	25	ns
t _H	Minimum Hold Time Data from Clock		2.0V		0	0	0	ns
			4.5V		0	0	0	ns
			6.0V		0	0	0	ns
t _W	Minimum Pulse Width Clear or Clock		2.0V	30	80	100	120	ns
			4.5V	9	16	20	24	ns
			6.0V	8	14	17	20	ns
t _r , t _f	Maximum Input Rise and Fall Time		2.0V		1000	1000	1000	ns
			4.5V		500	500	500	ns
			6.0V		400	400	400	ns
t _{TLH} , t _{THL}	Maximum Output Rise and Fall Time		2.0V	30	75	95	110	ns
			4.5V	9	15	19	22	ns
			6.0V	8	13	16	19	ns
C _{PD}	Power Dissipation Capacitance (Note 5)	(per package)		150				pF
C _{IN}	Maximum Input Capacitance			5	10	10	10	pF

Note 5: C_{PD} determines the no load dynamic power consumption, P_D=C_{PD} V_{CC}²f+I_{CC} V_{CC}, and the no load dynamic current consumption, I_S=C_{PD} V_{CC} f+I_{CC}.

Physical Dimensions inches (millimeters) unless otherwise noted



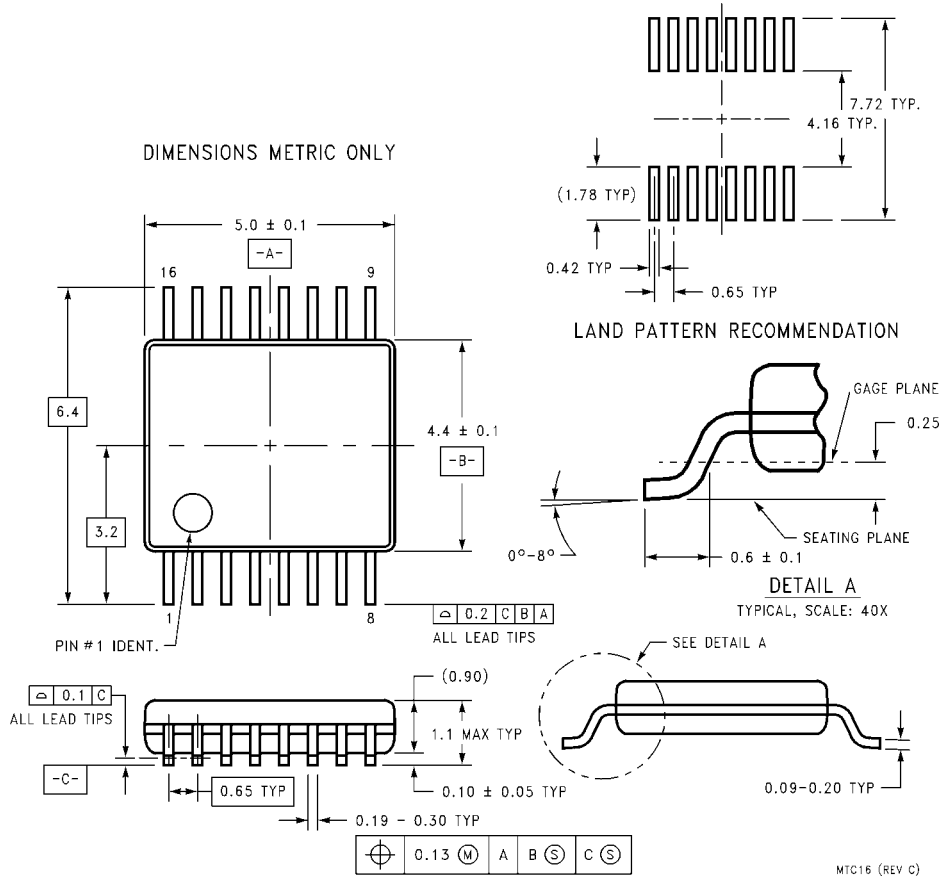
**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M16A**



**16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D**

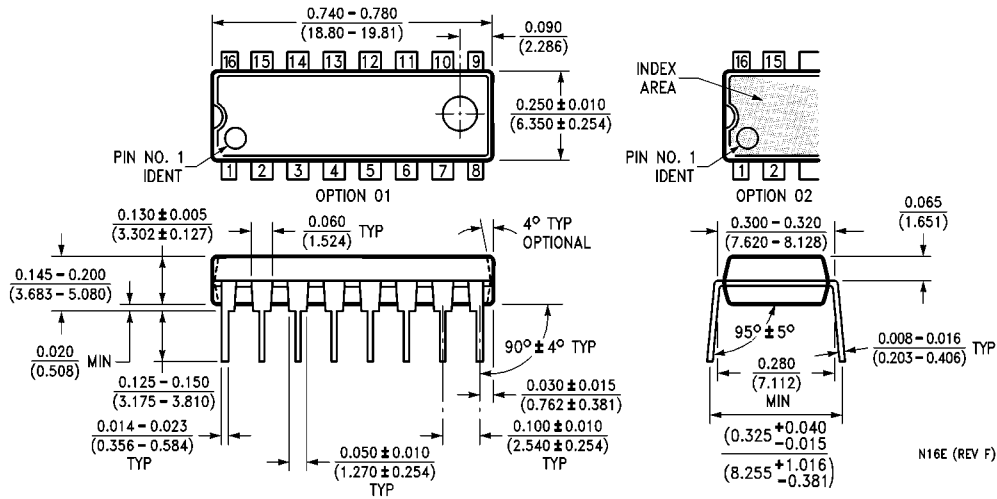
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Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



**16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC16**

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

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