FAIRCHILD SEMICONDUCTOR™

October 1987
Revised January 2004

MM74C373 • MM74C374
3-STATE Octal D-Type Latch • 3-STATE Octal D-Type Flip-Flop

General Description

The MM74C373 and MM74C374 are integrated, complementary MOS (CMOS), 8-bit storage elements with 3-STATE outputs. These outputs have been specially designed to drive high capacitive loads, such as one might find when driving a bus, and to have a fan out of 1 when driving standard TTL. When a high logic level is applied to the OUTPUT DISABLE input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

The MM74C373 is an 8-bit latch. When $\overline{\text{LATCH ENABLE}}$ is high, the Q outputs will follow the D inputs. When $\overline{\text{LATCH ENABLE}}$ goes low, data at the D inputs, which meets the set-up and hold time requirements, will be retained at the outputs until $\overline{\text{LATCH ENABLE}}$ returns high again.

The MM74C374 is an 8-bit, D-type, positive-edge triggered flip-flop. Data at the D inputs, meeting the set-up and hold time requirements, is transferred to the Q outputs on positive-going transitions of the CLOCK input.

Both the MM74C373 and the MM74C374 are being assembled in 20-pin dual-in-line packages with 0.300” pin centers.

Features

- Wide supply voltage range: 3V to 15V
- High noise immunity: 0.45 V_{CC} (typ.)
- Low power consumption
- TTL compatibility:
  Fan out of 1driving standard TTL
- Bus driving capability
- 3-STATE outputs
- Eight storage elements in one package
- Single CLOCK/$\overline{\text{LATCH}}$ $\overline{\text{ENABLE}}$ and OUTPUT DISABLE control inputs
- 20-pin dual-in-line package with 0.300” centers takes half the board space of a 24-pin package

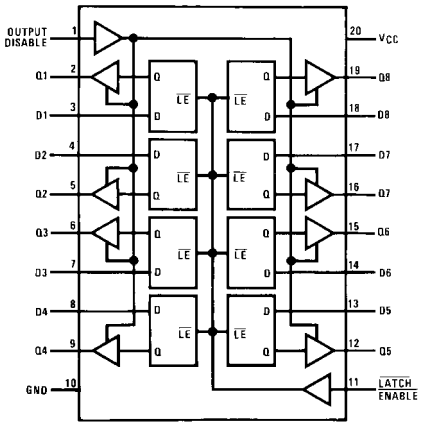
Ordering Code:

Order Number	Package Number	Package Description
MM74C373M (Note 1)	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74C373N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74C374N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Note 1: Devices also available in Tape and Reel. Specify by appending the suffix letter “X” to the ordering code.

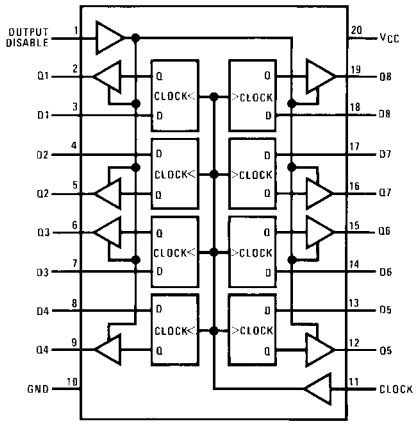
Connection Diagrams

MM74C373



Top View

MM74C374



Top View

Truth Tables

MM74C373

Output Disable	$\overline{\text{LATCH ENABLE}}$	D	Q
L	H	H	H
L	H	L	L
L	L	X	Q
H	X	X	Hi-Z

L = LOW logic level
H = HIGH logic level
X = Irrelevant

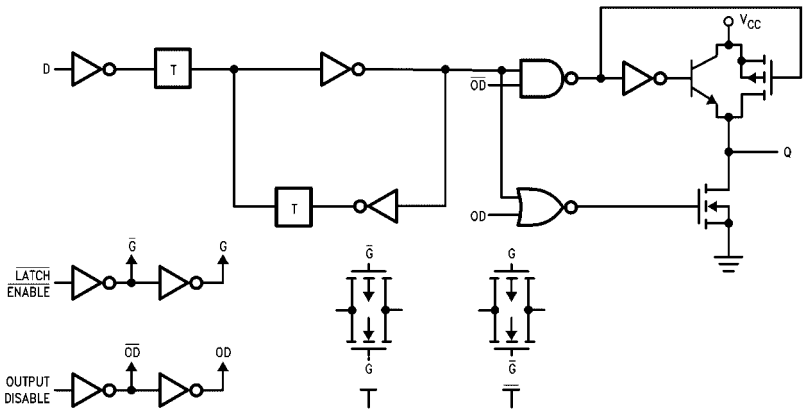
MM74C374

Output Disable	Clock	D	Q
L	⌐	H	H
L	⌐	L	L
L	L	X	Q
L	H	X	Q
H	X	X	Hi-Z

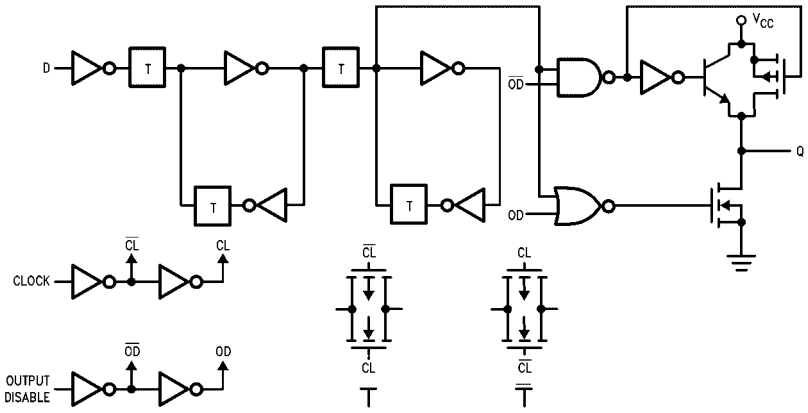
⌐ = LOW-to-HIGH logic level transition
Q = Preexisting output level
Hi-Z = High impedance output state

Block Diagrams

MM74C373 (1 of 8 Latches)



MM74C374 (1 of 8 Flip-Flops)



Absolute Maximum Ratings(Note 2)

Voltage at Any Pin	−0.3V to V_{CC} + 0.3V
Operating Temperature Range (T_A)	
MM74C373	−55°C to +125°C
Storage Temperature Range (T_S)	−65°C to +150°C
Power Dissipation	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating V_{CC} Range	3V to 15V
Absolute Maximum V_{CC}	18V
Lead Temperature (T_L)	
(Soldering, 10 seconds)	260°C

Note 2: "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 table of "Electrical Characteristics" provides conditions for actual device operation.

DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise noted

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			
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5V			1.5	V
		V_{CC} = 10V			2.0	
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 5V, I_O = −10 μA	4.5			V
		V_{CC} = 10V, I_O = −10 μA	9.0			
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5V, I_O = 10 μA			0.5	V
		V_{CC} = 10V, I_O = 10 μA			1.0	
$I_{IN(1)}$	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_{OZ}	3-STATE Leakage Current	V_{CC} = 15V, V_O = 15V		0.005	1.0	μA
		V_{CC} = 15V, V_O = 0V	−1.0	−0.005		
I_{CC}	Supply Current	V_{CC} = 15V		0.05	300	μA
CMOS/LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 4.75V	V_{CC} − 1.5			V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 4.75V			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 4.75V, I_O = −360 μA	V_{CC} − 0.4			V
		V_{CC} = 4.75V, I_O = −1.6 mA	2.4			
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 4.75V, I_O = 1.6 mA			0.4	V
OUTPUT DRIVE (Short Circuit Current)						
I_{SOURCE}	Output Source Current	V_{CC} = 5V, V_{OUT} = 0V	−12	−24		mA
		T_A = 25°C (Note 3)				
I_{SOURCE}	Output Source Current	V_{CC} = 10V, V_{OUT} = 0V	−24	−48		mA
		T_A = 25°C (Note 3)				
I_{SINK}	Output Sink Current	V_{CC} = 5V, V_{OUT} = V_{CC}	6	12		mA
	(N-Channel)	T_A = 25°C (Note 3)				
I_{SINK}	Output Sink Current	V_{CC} = 10V, V_{OUT} = V_{CC}	24	48		mA
	(N-Channel)	T_A = 25°C (Note 3)				

Note 3: These are peak output current capabilities. Continuous output current is rated at 12 mA max.

AC Electrical Characteristics (Note 4)

MM74C373, $T_A = 25°C$, $C_L = 50$ pF, $t_r = t_f = 20$ ns, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd0}, t_{pd1}	Propagation Delay,	$V_{CC} = 5V$, $C_L = 50$ pF		165	330	
	$\overline{\text{LATCH}}$ $\overline{\text{ENABLE}}$ to Output	$V_{CC} = 10V$, $C_L = 50$ pF		70	140	ns
		$V_{CC} = 5V$, $C_L = 150$ pF		195	390	
		$V_{CC} = 10V$, $C_L = 150$ pF		85	170	
t_{pd0}, t_{pd1}	Propagation Delay Data	$\overline{\text{LATCH}}$ $\overline{\text{ENABLE}} = V_{CC}$				
	In to Output	$V_{CC} = 5V$, $C_L = 50$ pF		155	310	
		$V_{CC} = 10V$, $C_L = 50$ pF		70	140	ns
		$V_{CC} = 5V$, $C_L = 150$ pF		185	370	
		$V_{CC} = 10V$, $C_L = 150$ pF		85	170	
t_{SET-UP}	Minimum Set-Up Time Data In	$t_{HOLD} = 0$ ns				
	to CLOCK/$\overline{\text{LATCH}}$ $\overline{\text{ENABLE}}$	$V_{CC} = 5V$		70	140	ns
		$V_{CC} = 10V$		35	70	
f_{MAX}	Maximum $\overline{\text{LATCH}}$ $\overline{\text{ENABLE}}$	$V_{CC} = 5V$	3.5	6.7		MHz
	Frequency	$V_{CC} = 10V$	4.5	9.0		
t_{PWH}	Minimum $\overline{\text{LATCH}}$ $\overline{\text{ENABLE}}$	V_{CC} 5V		75	150	ns
	Pulse Width	$V_{CC} = 10V$		55	110	
t_r, t_f	Maximum $\overline{\text{LATCH}}$ $\overline{\text{ENABLE}}$	$V_{CC} = 5V$		NA		µs
	Rise and Fall Time	$V_{CC} = 10V$		NA		
t_{1H}, t_{0H}	Propagation Delay OUTPUT	$R_L = 10k$, $C_L = 5$ pF				
	DISABLE to High Impedance	$V_{CC} = 5V$		105	210	ns
	State (from a Logic Level)	$V_{CC} = 10V$		60	120	
t_{H1}, t_{H0}	Propagation Delay OUTPUT	$R_L = 10k$, $C_L = 50$ pF				
	DISABLE to Logic Level	$V_{CC} = 5V$		105	210	ns
	(from High Impedance State)	$V_{CC} = 10V$		45	90	
t_{THL}, t_{TLH}	Transition Time	$V_{CC} = 5V$, $C_L = 50$ pF		65	130	
		$V_{CC} = 10V$, $C_L = 50$ pF		35	70	ns
		$V_{CC} = 5V$, $C_L = 150$ pF		110	220	
		$V_{CC} = 10V$, $C_L = 150$ pF		70	140	
C_{LE}	Input Capacitance	$\overline{\text{LE}}$ Input (Note 5)		7.5	10	pF
C_{OD}	Input Capacitance	OUTPUT DISABLE		7.5	10	pF
		Input (Note 5)				
C_{IN}	Input Capacitance	Any Other Input (Note 5)		5	7.5	pF
C_{OUT}	Output Capacitance	High Impedance		10	15	pF
		State (Note 5)				
C_{PD}	Power Dissipation Capacitance	Per Package (Note 6)		200		pF

Note 4: AC Parameters are guaranteed by DC correlated testing.

Note 5: Capacitance is guaranteed by periodic testing.

Note 6: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note AN-90.

AC Electrical Characteristics (Note 7)

MM74C374, $T_A = 25°C$, $C_L = 50$ pF, $t_r = t_f = 20$ ns, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd0}, t_{pd1}	Propagation Delay,	$V_{CC} = 5V$, $C_L = 50$ pF		150	300	
	CLOCK to Output	$V_{CC} = 10V$, $C_L = 50$ pF		65	130	ns
		$V_{CC} = 5V$, $C_L = 150$ pF		180	360	
		$V_{CC} = 10V$, $C_L = 150$ pF		80	160	
t_{SET-UP}	Minimum Set-Up Time Data In	$t_{HOLD} = 0$ ns				
	to CLOCK/$\overline{\text{LATCH}}$ $\overline{\text{ENABLE}}$	$V_{CC} = 5V$		70	140	ns
		$V_{CC} = 10V$		35	70	
t_{PWH}, t_{PWL}	Minimum CLOCK Pulse Width	$V_{CC} = 5V$		70	140	ns
		$V_{CC} = 10V$		50	100	
f_{MAX}	Maximum CLOCK Frequency	$V_{CC} = 5V$	3.5	7.0		MHz
		$V_{CC} = 10V$	5	10		
t_{1H}, t_{0H}	Propagation Delay OUTPUT	$R_L = 10k$, $C_L = 50$ pF				
	DISABLE to High Impedance	$V_{CC} = 5V$		105	210	ns
	State (from a Logic Level)	$V_{CC} = 10V$		60	120	
t_{H1}, t_{H0}	Propagation Delay OUTPUT	$R_L = 10k$, $C_L = 50$ pF				
	DISABLE to Logic Level	$V_{CC} = 5V$		105	210	ns
	(from High Impedance State)	$V_{CC} = 10V$		45	90	
t_{THL}, t_{TLH}	Transition Time	$V_{CC} = 5V$, $C_L = 50$ pF		65	130	
		$V_{CC} = 10V$, $C_L = 50$ pF		35	70	ns
		$V_{CC} = 5V$, $C_L = 150$ pF		110	220	
		$V_{CC} = 10V$, $C_L = 150$ pF		70	140	
t_r, t_f	Maximum CLOCK Rise	$V_{CC} = 5V$	15	>2000		µs
	and Fall Time	$V_{CC} = 10V$	5	>2000		
C_{CLK}	Input Capacitance	CLOCK Input (Note 8)		7.5	10	pF
C_{OD}	Input Capacitance	OUTPUT DISABLE		7.5	10	pF
		Input (Note 8)				
C_{IN}	Input Capacitance	Any Other Input (Note 8)		5	7.5	pF
C_{OUT}	Output Capacitance	High Impedance		10	15	pF
		State (Note 8)				
C_{PD}	Power Dissipation Capacitance	Per Package (Note 9)		250		pF

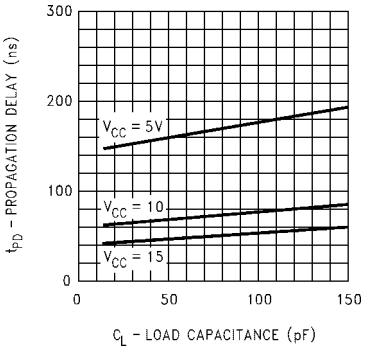
Note 7: AC Parameters are guaranteed by DC correlated testing.

Note 8: Capacitance is guaranteed by periodic testing.

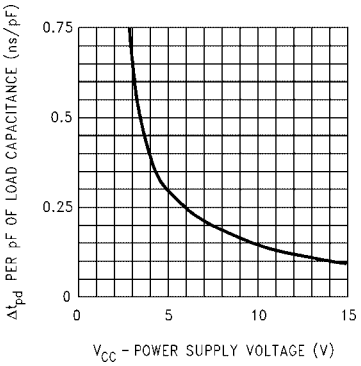
Note 9: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note AN-90.

Typical Performance Characteristics

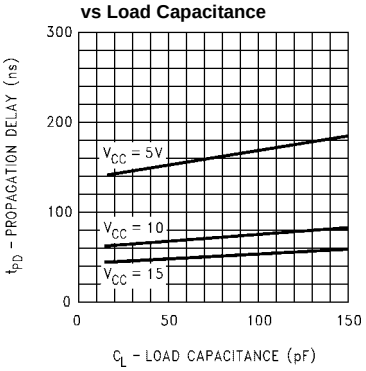
MM74C373
Propagation Delay, LATCH ENABLE to Output vs Load Capacitance



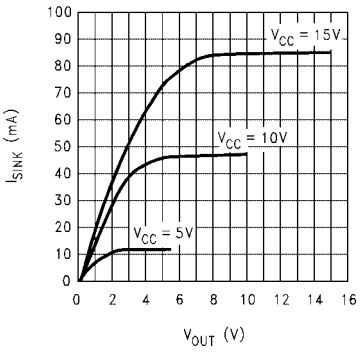
MM74C373, MM74C374
Change in Propagation Delay per pF of Load Capacitance (Δt_{PD}/pF) vs Power Supply Voltage



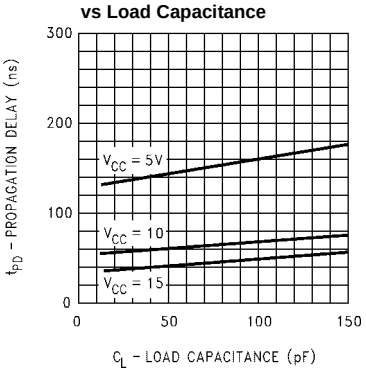
MM74C373
Propagation Delay, Data In to Output vs Load Capacitance



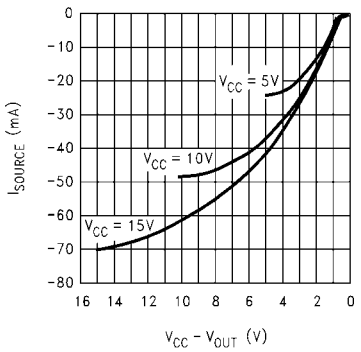
MM74C373, MM74C374
Output Sink Current vs V_{OUT}



MM74C373
Propagation Delay, CLOCK to Output vs Load Capacitance

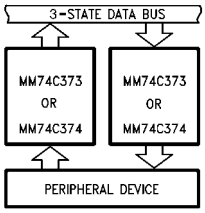


MM74C373, MM74C374
Source Current vs $V_{CC} - V_{OUT}$

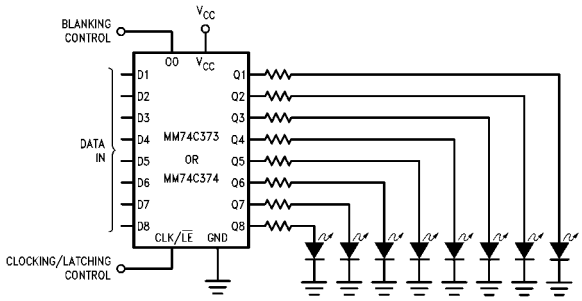


Typical Applications

Data Bus Interfacing Element

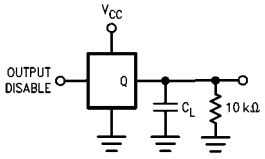


Simple, Latching, Octal, LED Indicator Driver with Blanking for Use as Data Display, Bus Monitor, μP Front Panel Display, Etc.

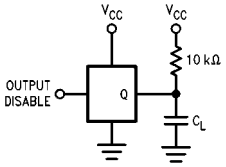


3-STATE Test Circuits and Switching Time Waveforms

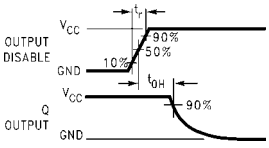
t_{1H}, t_{H1}



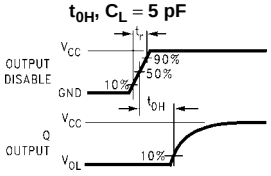
t_{0H}, t_{H0}



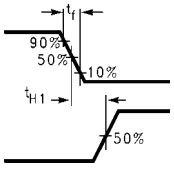
t_{1H}, C_L = 5 pF



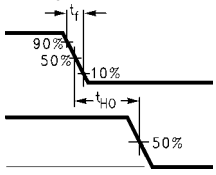
t_{0H}, C_L = 5 pF



t_{H1}, C_L = 50 pF

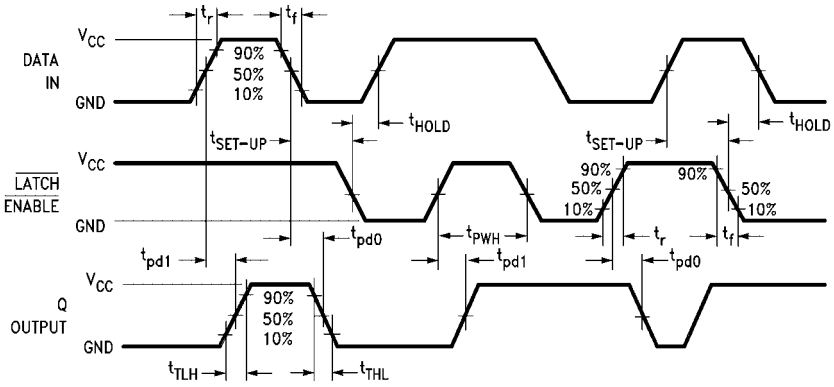


t_{H0}, C_L = 50 pF



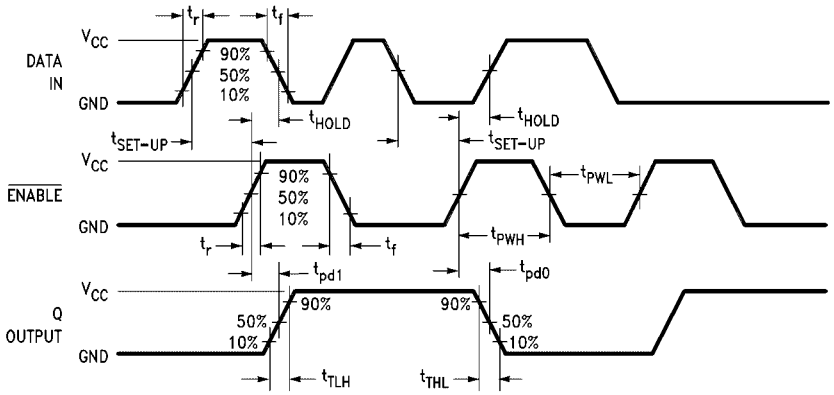
Switching Time Waveforms

MM74C373



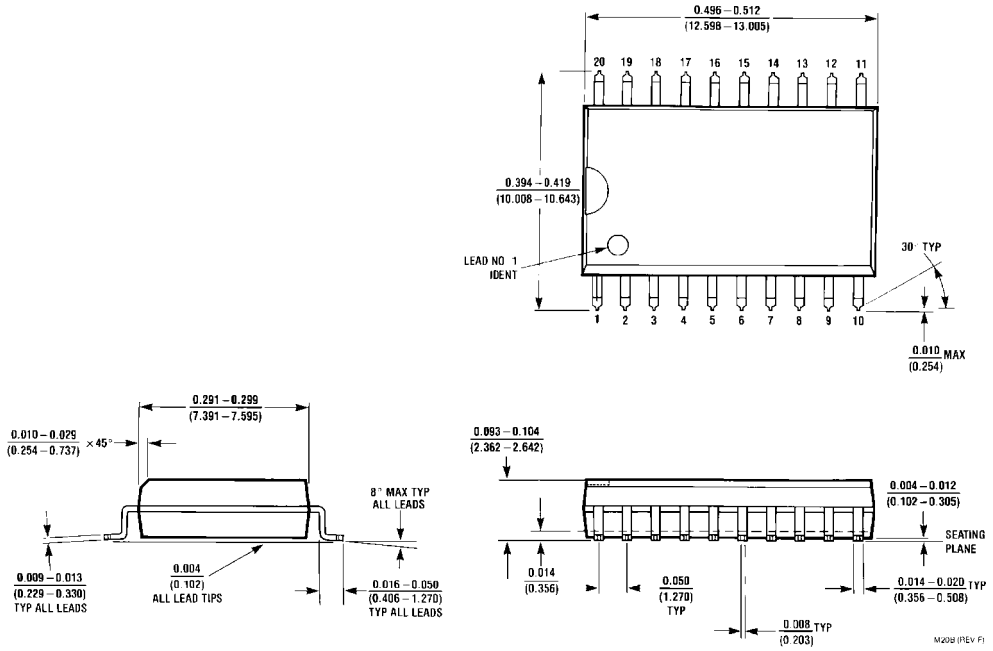
Output Disable = GND

MM74C374



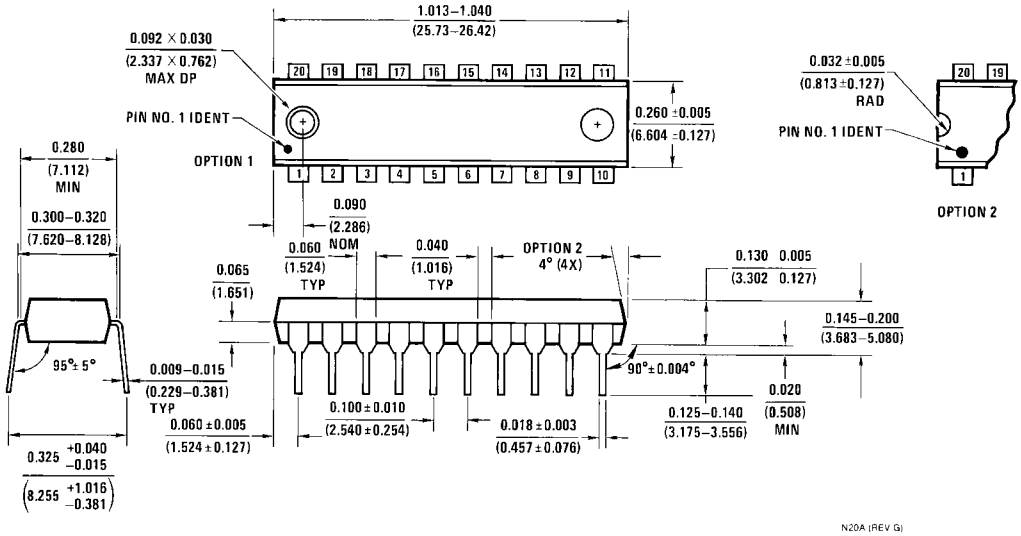
Output Disable = GND

Physical Dimensions inches (millimeters) unless otherwise noted



20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B

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



20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N20A