



October 1987  
Revised January 1999

## 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 LATCH ENABLE is high, the Q outputs will follow the D inputs. When 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 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<sub>CC</sub> (typ.)
- Low power consumption
- TTL compatibility:
  - Fan out of 1 driving standard TTL
- Bus driving capability
- 3-STATE outputs
- Eight storage elements in one package
- Single CLOCK/LATCH 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:

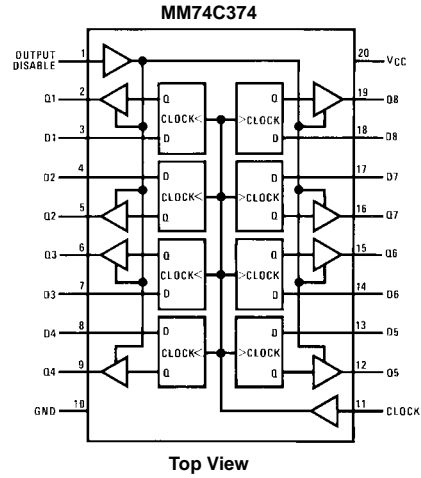
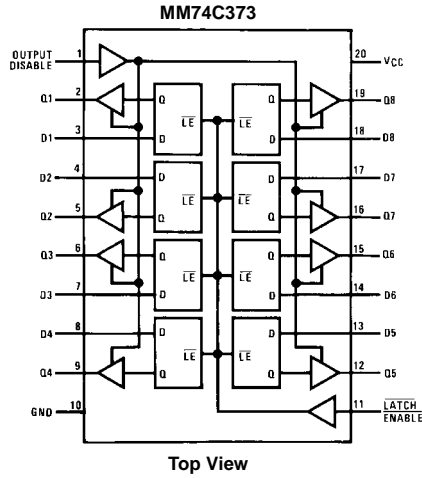
Order Number	Package Number	Package Description
MM74C373M	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74C373N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74C374M	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74C374N	N20A	20-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.

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

## Connection Diagrams

Pin Assignments for DIP and SOIC



## Truth Tables

MM74C373

Output Disable	LATCH ENABLE	D	Q
L	H	H	H
L	H	L	L
L	L	X	Q
H	X	X	Hi-Z

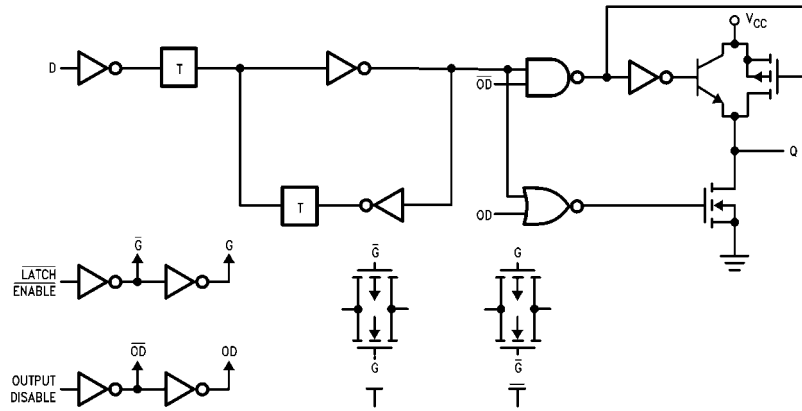
MM74C374

Output Disable	Clock	D	Q
L	↗	H	H
L	↘	L	L
L	L	X	Q
L	H	X	Q
H	X	X	Hi-Z

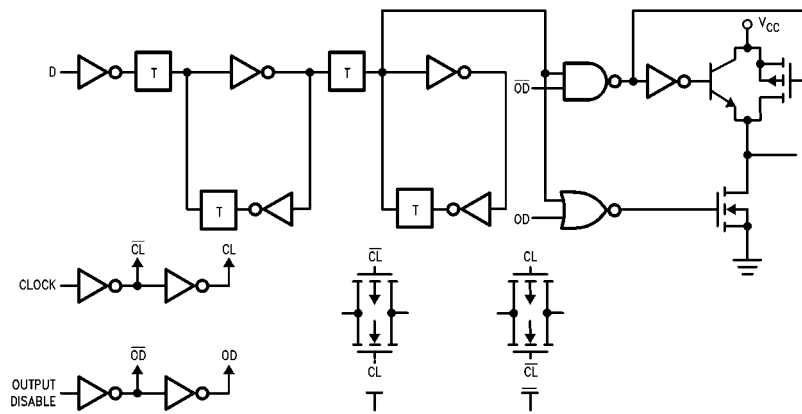
L = LOW logic level  
 H = HIGH logic level  
 X = Irrelevant  
 ↗ = LOW-to-HIGH logic level transition  
 ↘ = Preexisting output level  
 Hi-Z = High impedance output state

## Block Diagrams

MM74C373 (1 of 8 Latches)



MM74C374 (1 of 8 Flip-Flops)



MM74C373 • MM74C374

<b>Absolute Maximum Ratings</b> (Note 1)		Operating $V_{CC}$ Range	3V to 15V
Voltage at Any Pin	-0.3V to $V_{CC} + 0.3V$	Absolute Maximum $V_{CC}$	18V
Operating Temperature Range ( $T_A$ )	-40°C to +85°C	Lead Temperature ( $T_L$ )	260°C
MM74C373	-40°C to +85°C	(Soldering, 10 seconds)	
Storage Temperature Range ( $T_S$ )	-65°C to +150°C		
Power Dissipation		<b>Note 1:</b> "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.	
Dual-In-Line	700 mW		
Small Outline	500 mW		

## DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>CMOS TO CMOS</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5V, I_O = -10 \mu A$ $V_{CC} = 10V, I_O = -10 \mu A$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5V, I_O = 10 \mu A$ $V_{CC} = 10V, I_O = 10 \mu A$			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		0.005	1.0	$\mu A$
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0	-0.005		$\mu A$
$I_{OZ}$	3-STATE Leakage Current	$V_{CC} = 15V, V_O = 15V$ $V_{CC} = 15V, V_O = 0V$	-1.0	0.005 -0.005	1.0	$\mu A$ $\mu A$
$I_{CC}$	Supply Current	$V_{CC} = 15V$		0.05	300	$\mu A$
<b>CMOS/LPTTL INTERFACE</b>						
$V_{IN(1)}$	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	$V_{CC} = 4.75V, I_O = -360 \mu A$ $V_{CC} = 4.75V, I_O = -1.6 mA$	$V_{CC} - 0.4$ 2.4			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 4.75V, I_O = 1.6 mA$			0.4	V
<b>OUTPUT DRIVE (Short Circuit Current)</b>						
$I_{SOURCE}$	Output Source Current	$V_{CC} = 5V, V_{OUT} = 0V$ $T_A = 25^\circ C$ (Note 2)	-12	-24		mA
$I_{SOURCE}$	Output Source Current	$V_{CC} = 10V, V_{OUT} = 0V$ $T_A = 25^\circ C$ (Note 2)	-24	-48		mA
$I_{SINK}$	Output Sink Current (N-Channel)	$V_{CC} = 5V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$ (Note 2)	6	12		mA
$I_{SINK}$	Output Sink Current (N-Channel)	$V_{CC} = 10V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$ (Note 2)	24	48		mA

**Note 2:** These are peak output current capabilities. Continuous output current is rated at 12 mA max.

<b>AC Electrical Characteristics</b> (Note 3)						
MM74C373, $T_A = 25^\circ\text{C}$ , $C_L = 50\text{ pF}$ , $t_r = t_f = 20\text{ ns}$ , unless otherwise noted						
Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd0}$ , $t_{pd1}$	Propagation Delay, LATCH ENABLE to Output	$V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$		165	330	ns
		$V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$		70	140	ns
		$V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$		195	390	ns
		$V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$		85	170	ns
$t_{pd0}$ , $t_{pd1}$	Propagation Delay Data In to Output	LATCH ENABLE = $V_{CC}$				
		$V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$		155	310	ns
		$V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$		70	140	ns
		$V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$		185	370	ns
		$V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$		85	170	ns
$t_{SET-UP}$	Minimum Set-Up Time Data In to CLOCK/LATCH ENABLE	$t_{HOLD} = 0\text{ ns}$				
		$V_{CC} = 5\text{V}$		70	140	ns
		$V_{CC} = 10\text{V}$		35	70	ns
$f_{MAX}$	Maximum LATCH ENABLE Frequency	$V_{CC} = 5\text{V}$	3.5	6.7		MHz
		$V_{CC} = 10\text{V}$	4.5	9.0		MHz
$t_{PWH}$	Minimum LATCH ENABLE Pulse Width	$V_{CC} = 5\text{V}$		75	150	ns
		$V_{CC} = 10\text{V}$		55	110	ns
$t_r$ , $t_f$	Maximum LATCH ENABLE Rise and Fall Time	$V_{CC} = 5\text{V}$		NA		$\mu\text{s}$
		$V_{CC} = 10\text{V}$		NA		$\mu\text{s}$
$t_{1H}$ , $t_{0H}$	Propagation Delay OUTPUT DISABLE to High Impedance State (from a Logic Level)	$R_L = 10\text{k}$ , $C_L = 5\text{ pF}$				
		$V_{CC} = 5\text{V}$		105	210	ns
		$V_{CC} = 10\text{V}$		60	120	ns
$t_{H1}$ , $t_{H0}$	Propagation Delay OUTPUT DISABLE to Logic Level (from High Impedance State)	$R_L = 10\text{k}$ , $C_L = 50\text{ pF}$				
		$V_{CC} = 5\text{V}$		105	210	ns
		$V_{CC} = 10\text{V}$		45	90	ns
$t_{THL}$ , $t_{TLH}$	Transition Time	$V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$		65	130	ns
		$V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$		35	70	ns
		$V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$		110	220	ns
		$V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$		70	140	ns
$C_{LE}$	Input Capacitance	LE Input (Note 4)		7.5	10	pF
$C_{OD}$	Input Capacitance	OUTPUT DISABLE Input (Note 4)		7.5	10	pF
$C_{IN}$	Input Capacitance	Any Other Input (Note 4)		5	7.5	pF
$C_{OUT}$	Output Capacitance	High Impedance State (Note 4)		10	15	pF
$C_{PD}$	Power Dissipation Capacitance	Per Package (Note 5)		200		pF
<p><b>Note 3:</b> AC Parameters are guaranteed by DC correlated testing.</p> <p><b>Note 4:</b> Capacitance is guaranteed by periodic testing.</p> <p><b>Note 5:</b> <math>C_{PD}</math> determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note AN-90.</p>						

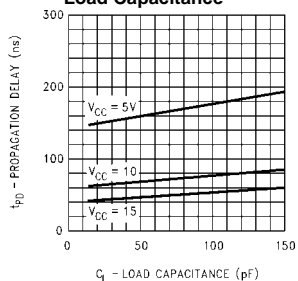
**AC Electrical Characteristics** (Note 6)MM74C374,  $T_A = 25^\circ\text{C}$ ,  $C_L = 50\text{ pF}$ ,  $t_r = t_f = 20\text{ ns}$ , unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd0}$ , $t_{pd1}$	Propagation Delay, CLOCK to Output	$V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$		150	300	ns
		$V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$		65	130	ns
		$V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$		180	360	ns
		$V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$		80	160	ns
$t_{SET-UP}$	Minimum Set-Up Time Data In to CLOCK/LATCH ENABLE	$t_{HOLD} = 0\text{ ns}$ $V_{CC} = 5\text{V}$		70	140	ns
		$V_{CC} = 10\text{V}$		35	70	ns
$t_{PWH}$ , $t_{PWL}$	Minimum CLOCK Pulse Width	$V_{CC} = 5\text{V}$		70	140	ns
		$V_{CC} = 10\text{V}$		50	100	ns
$f_{MAX}$	Maximum CLOCK Frequency	$V_{CC} = 5\text{V}$	3.5	7.0		MHz
		$V_{CC} = 10\text{V}$	5	10		MHz
$t_{1H}$ , $t_{0H}$	Propagation Delay OUTPUT DISABLE to High Impedance State (from a Logic Level)	$R_L = 10\text{k}$ , $C_L = 50\text{ pF}$ $V_{CC} = 5\text{V}$		105	210	ns
		$V_{CC} = 10\text{V}$		60	120	ns
$t_{1L}$ , $t_{0L}$	Propagation Delay OUTPUT DISABLE to Logic Level (from High Impedance State)	$R_L = 10\text{k}$ , $C_L = 50\text{ pF}$ $V_{CC} = 5\text{V}$		105	210	ns
		$V_{CC} = 10\text{V}$		45	90	ns
$t_{THL}$ , $t_{TLH}$	Transition Time	$V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$		65	130	ns
		$V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$		35	70	ns
		$V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$		110	220	ns
		$V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$		70	140	ns
$t_r$ , $t_f$	Maximum CLOCK Rise and Fall Time	$V_{CC} = 5\text{V}$	15	>2000		$\mu\text{s}$
		$V_{CC} = 10\text{V}$	5	>2000		$\mu\text{s}$
$C_{CLK}$	Input Capacitance	CLOCK Input (Note 7)		7.5	10	pF
$C_{OD}$	Input Capacitance	OUTPUT DISABLE Input (Note 7)		7.5	10	pF
$C_{IN}$	Input Capacitance	Any Other Input (Note 7)		5	7.5	pF
$C_{OUT}$	Output Capacitance	High Impedance State (Note 7)		10	15	pF
$C_{PD}$	Power Dissipation Capacitance	Per Package (Note 8)		250		pF

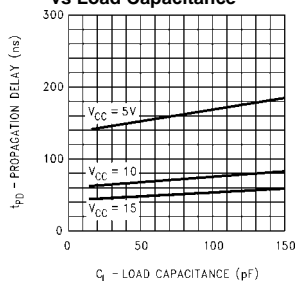
**Note 6:** AC Parameters are guaranteed by DC correlated testing.**Note 7:** Capacitance is guaranteed by periodic testing.**Note 8:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note AN-90.

Typical Performance Characteristics

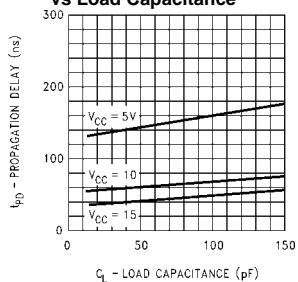
**MM74C373**  
Propagation Delay, LATCH ENABLE to Output vs Load Capacitance



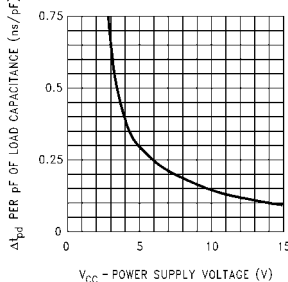
**MM74C373**  
Propagation Delay, Data In to Output vs Load Capacitance



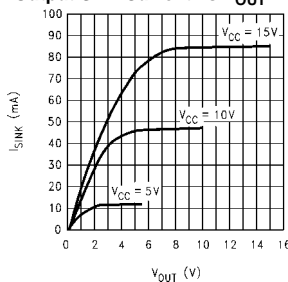
**MM74C373**  
Propagation Delay, CLOCK to Output vs Load Capacitance



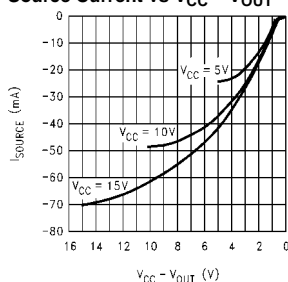
**MM74C373, MM74C374**  
Change in Propagation Delay per pF of Load Capacitance ( $\Delta t_{PD}/pF$ ) vs Power Supply Voltage



**MM74C373, MM74C374**  
Output Sink Current vs  $V_{OUT}$

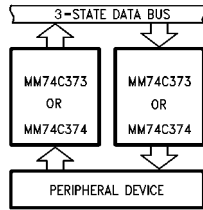


**MM74C373, MM74C374**  
Source Current vs  $V_{CC} - V_{OUT}$

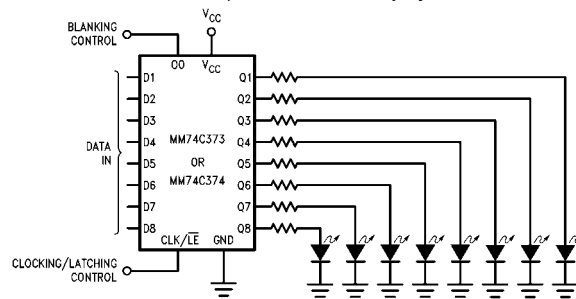


## Typical Applications

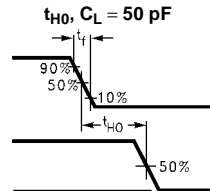
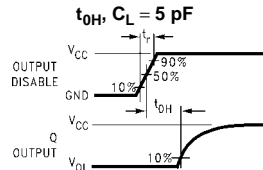
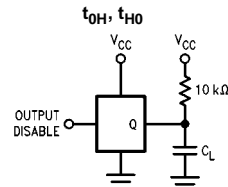
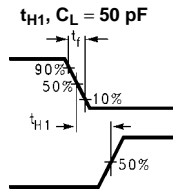
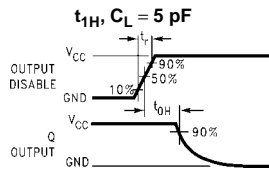
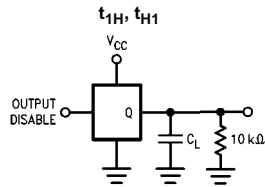
### Data Bus Interfacing Element



### Simple, Latching, Octal, LED Indicator Driver with Blanking for Use as Data Display, Bus Monitor, $\mu$ P Front Panel Display, Etc.



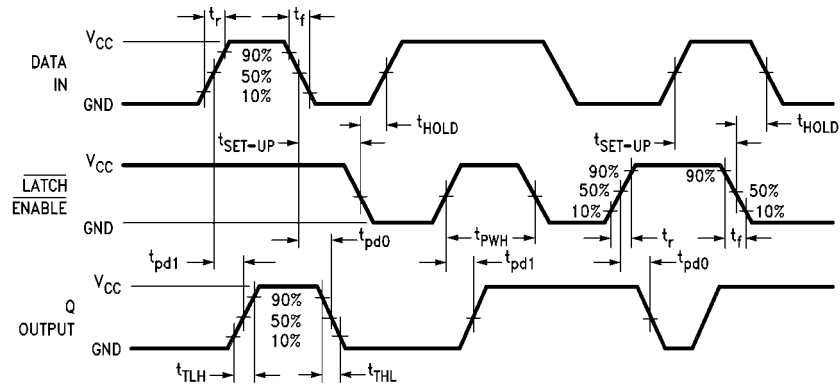
## 3-STATE Test Circuits and Switching Time Waveforms





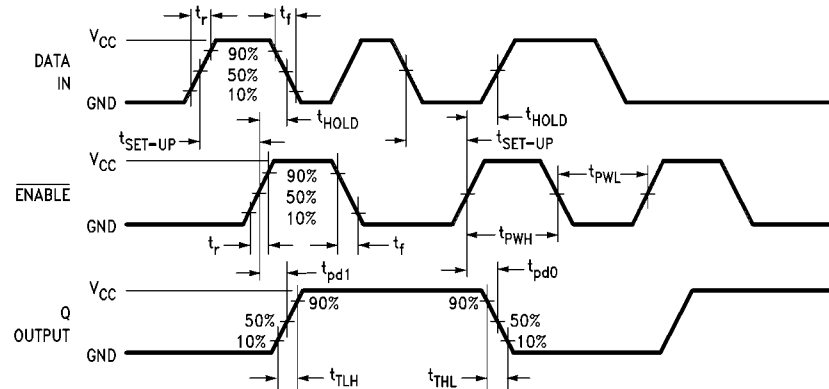
Switching Time Waveforms

MM74C373



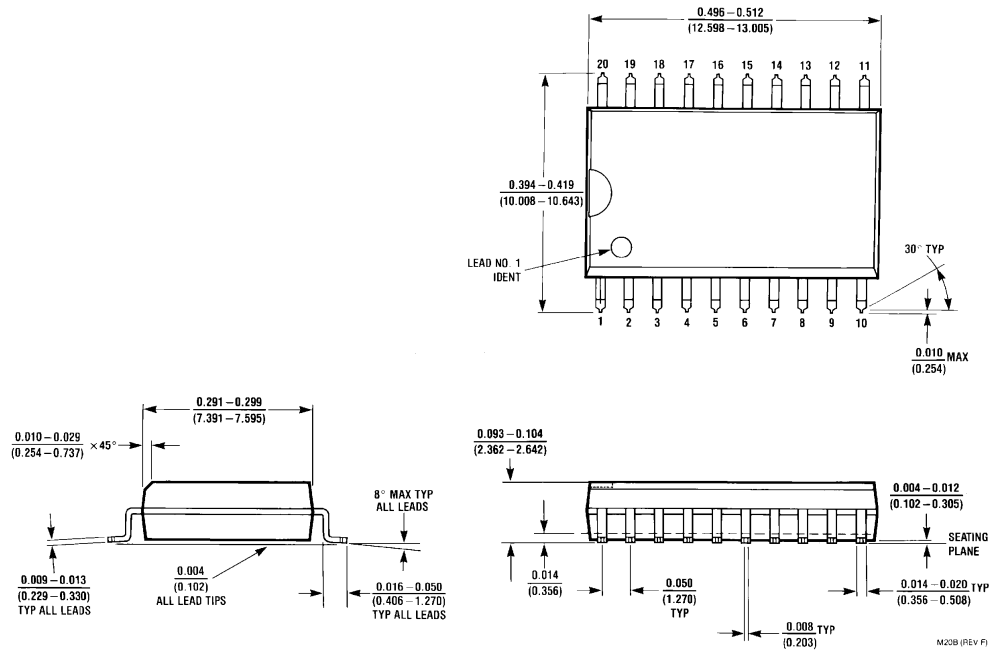
Output Disable = GND

MM74C374



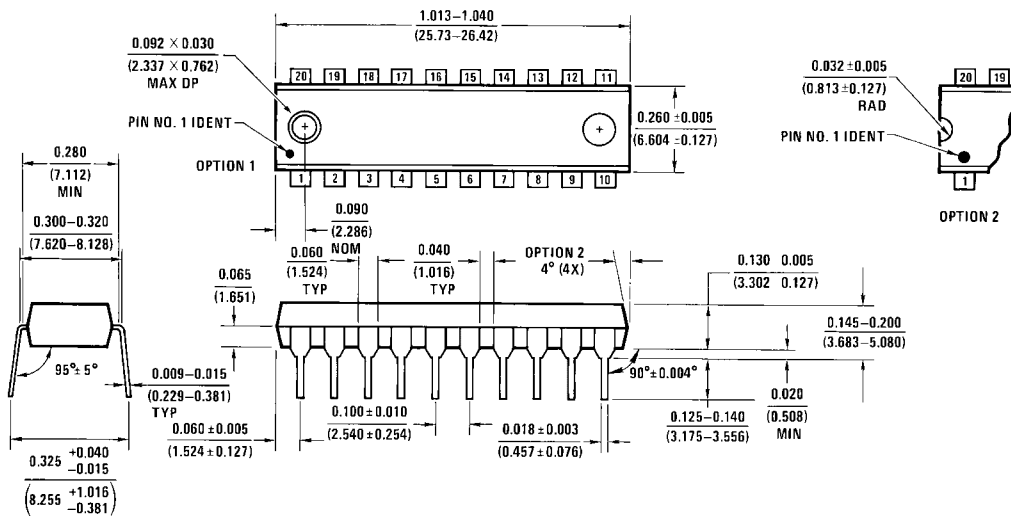
Output Disable = GND

**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)



N20A (REV G)

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

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