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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 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_{CC} (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:

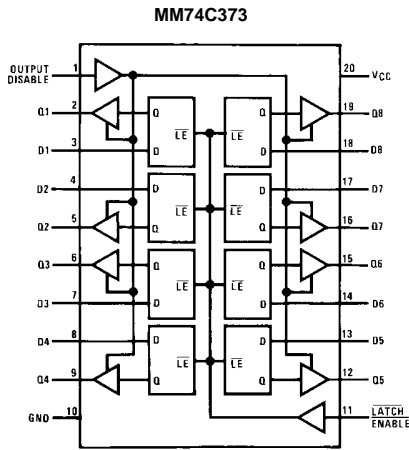
Order Number	Package Number	Package Description
MM74C373M (Note 1)	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74C373N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74C374N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001,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

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

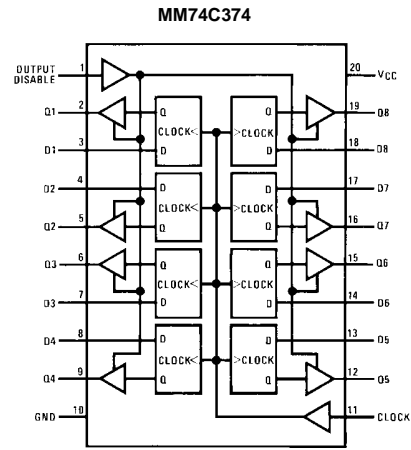
MM74C373 • MM74C374 3-STATE Octal D-Type Latch • 3-STATE Octal D-Type Flip-Flop

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Connection Diagrams



Top View



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

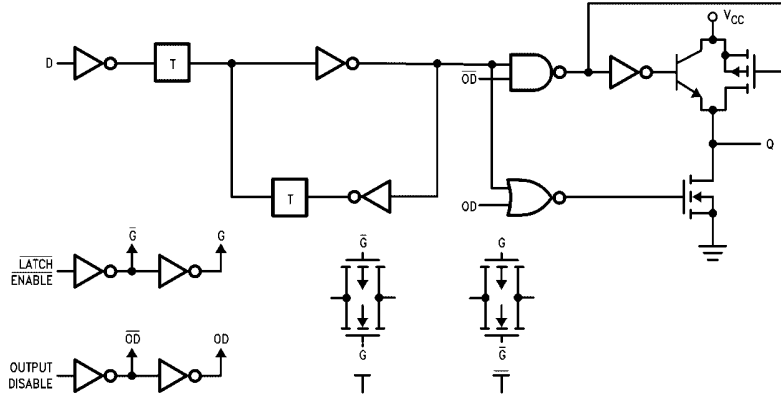
MM74C374

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

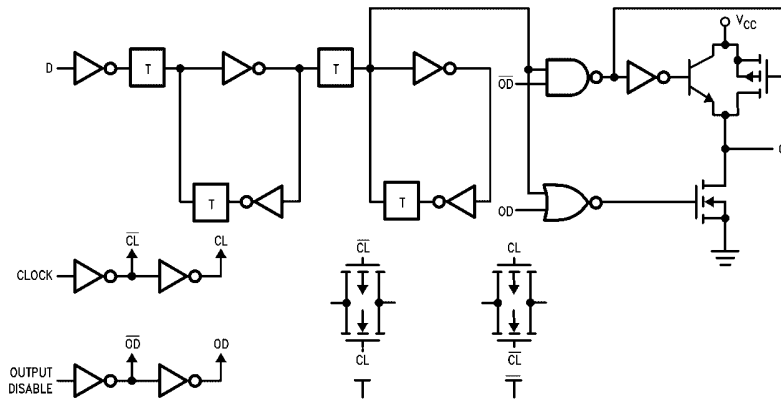
↗ = LOW-to-HIGH logic level transition
 Q = Preexisting output level
 Hi-Z = High impedance output state

Block Diagrams

MM74C373 (1 of 8 Latches)



MM74C374 (1 of 8 Flip-Flops)



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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	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8.0			V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2.0	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
$V_{OUT(0)}$	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
$I_{IN(1)}$	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	$V_{CC} = 15V, V_O = 15V$ $V_{CC} = 15V, V_O = 0V$	-1.0	0.005 -0.005	1.0	μA
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	$V_{CC} = 4.75V, I_O = -360 \mu A$ $V_{CC} = 4.75V, I_O = -1.6 mA$	$V_{CC} - 0.4$ 2.4			V
$V_{OUT(0)}$	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	$V_{CC} = 5V, V_{OUT} = 0V$ $T_A = 25^\circ C$ (Note 3)	-12	-24		mA
I_{SOURCE}	Output Source Current	$V_{CC} = 10V, V_{OUT} = 0V$ $T_A = 25^\circ C$ (Note 3)	-24	-48		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 5V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$ (Note 3)	6	12		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 10V, V_{OUT} = V_{CC}$ $T_A = 25^\circ C$ (Note 3)	24	48		mA
Note 3: These are peak output current capabilities. Continuous output current is rated at 12 mA max.						

AC Electrical Characteristics (Note 4)						
MM74C373, $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, $t_r = t_f = 20\text{ ns}$, unless otherwise noted						
Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd0}, t_{pd1}	Propagation Delay, LATCH ENABLE to Output	$V_{CC} = 5\text{V}, C_L = 50\text{ pF}$ $V_{CC} = 10\text{V}, C_L = 50\text{ pF}$ $V_{CC} = 5\text{V}, C_L = 150\text{ pF}$ $V_{CC} = 10\text{V}, C_L = 150\text{ pF}$		165 70 195 85	330 140 390 170	ns
t_{pd0}, t_{pd1}	Propagation Delay Data In to Output	LATCH ENABLE = V_{CC} $V_{CC} = 5\text{V}, C_L = 50\text{ pF}$ $V_{CC} = 10\text{V}, C_L = 50\text{ pF}$ $V_{CC} = 5\text{V}, C_L = 150\text{ pF}$ $V_{CC} = 10\text{V}, C_L = 150\text{ pF}$		155 70 185 85	310 140 370 170	ns
t_{SET-UP}	Minimum Set-Up Time Data In to CLOCK/LATCH ENABLE	$t_{HOLD} = 0\text{ ns}$ $V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		70 35	140 70	ns
f_{MAX}	Maximum LATCH ENABLE Frequency	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	3.5 4.5	6.7 9.0		MHz
t_{PWH}	Minimum LATCH ENABLE Pulse Width	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		75 55	150 110	ns
t_r, t_f	Maximum LATCH ENABLE Rise and Fall Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		NA NA		μs
t_{1H}, t_{0H}	Propagation Delay OUTPUT DISABLE to High Impedance State (from a Logic Level)	$R_L = 10\text{k}, C_L = 5\text{ pF}$ $V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		105 60	210 120	ns
t_{H1}, t_{H0}	Propagation Delay OUTPUT DISABLE to Logic Level (from High Impedance State)	$R_L = 10\text{k}, C_L = 50\text{ pF}$ $V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		105 45	210 90	ns
t_{THL}, t_{TLH}	Transition Time	$V_{CC} = 5\text{V}, C_L = 50\text{ pF}$ $V_{CC} = 10\text{V}, C_L = 50\text{ pF}$ $V_{CC} = 5\text{V}, C_L = 150\text{ pF}$ $V_{CC} = 10\text{V}, C_L = 150\text{ pF}$		65 35 110 70	130 70 220 140	ns
C_{LE}	Input Capacitance	\overline{LE} Input (Note 5)		7.5	10	pF
C_{OD}	Input Capacitance	OUTPUT DISABLE Input (Note 5)		7.5	10	pF
C_{IN}	Input Capacitance	Any Other Input (Note 5)		5	7.5	pF
C_{OUT}	Output Capacitance	High Impedance State (Note 5)		10	15	pF
C_{PD}	Power Dissipation Capacitance	Per Package (Note 6)		200		pF
<p>Note 4: AC Parameters are guaranteed by DC correlated testing.</p> <p>Note 5: Capacitance is guaranteed by periodic testing.</p> <p>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.</p>						

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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, CLOCK to Output	V _{CC} = 5V, C _L = 50 pF V _{CC} = 10V, C _L = 50 pF V _{CC} = 5V, C _L = 150 pF V _{CC} = 10V, C _L = 150 pF		150 65 180 80	300 130 360 160	ns
t _{SET-UP}	Minimum Set-Up Time Data In to CLOCK/LATCH ENABLE	t _{HOLD} = 0 ns V _{CC} = 5V V _{CC} = 10V		70 35	140 70	ns
t _{PWH} , t _{PWL}	Minimum CLOCK Pulse Width	V _{CC} = 5V V _{CC} = 10V		70 50	140 100	ns
f _{MAX}	Maximum CLOCK Frequency	V _{CC} = 5V V _{CC} = 10V	3.5 5	7.0 10		MHz
t _{1H} , t _{0H}	Propagation Delay OUTPUT DISABLE to High Impedance State (from a Logic Level)	R _L = 10k, C _L = 50 pF V _{CC} = 5V V _{CC} = 10V		105 60	210 120	ns
t _{H1} , t _{H0}	Propagation Delay OUTPUT DISABLE to Logic Level (from High Impedance State)	R _L = 10k, C _L = 50 pF V _{CC} = 5V V _{CC} = 10V		105 45	210 90	ns
t _{THL} , t _{TLH}	Transition Time	V _{CC} = 5V, C _L = 50 pF V _{CC} = 10V, C _L = 50 pF V _{CC} = 5V, C _L = 150 pF V _{CC} = 10V, C _L = 150 pF		65 35 110 70	130 70 220 140	ns
t _r , t _f	Maximum CLOCK Rise and Fall Time	V _{CC} = 5V V _{CC} = 10V	15 5	>2000 >2000		μs
C _{CLK}	Input Capacitance	CLOCK Input (Note 8)		7.5	10	pF
C _{OD}	Input Capacitance	OUTPUT DISABLE Input (Note 8)		7.5	10	pF
C _{IN}	Input Capacitance	Any Other Input (Note 8)		5	7.5	pF
C _{OUT}	Output Capacitance	High Impedance State (Note 8)		10	15	pF
C _{PD}	Power Dissipation Capacitance	Per Package (Note 9)		250		pF

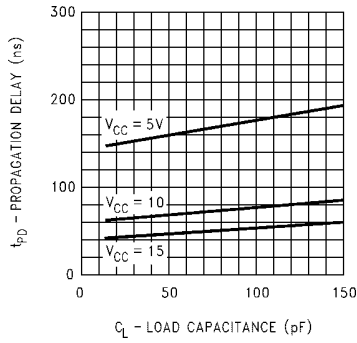
Note 7: AC Parameters are guaranteed by DC correlated testing.

Note 8: Capacitance is guaranteed by periodic testing.

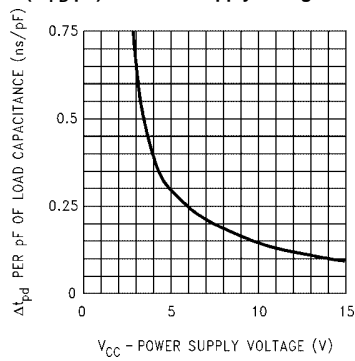
Note 9: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note AN-90.

Typical Performance Characteristics

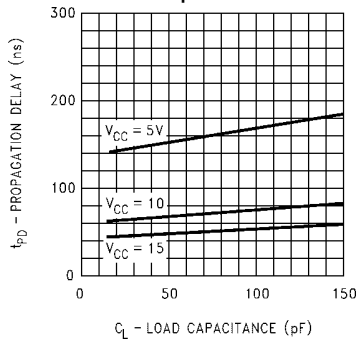
MM74C373
 Propagation Delay, LATCH ENABLE to Output
 vs Load Capacitance



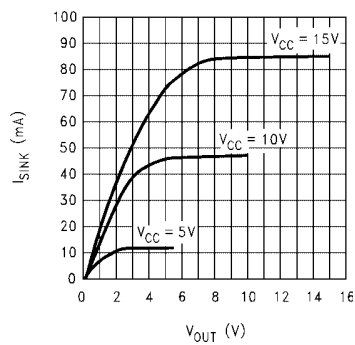
MM74C373, MM74C374
 Change in Propagation Delay
 per pF of Load Capacitance
 ($\Delta t_{pd}/pF$) vs Power Supply Voltage



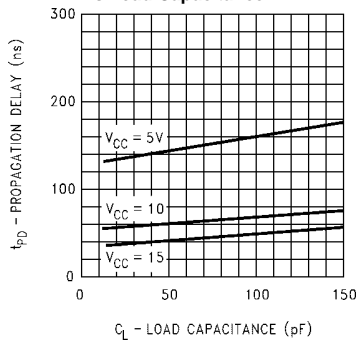
MM74C373
 Propagation Delay, Data In to Output
 vs Load Capacitance



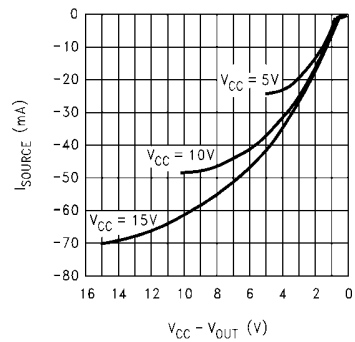
MM74C373, MM74C374
 Output Sink Current vs V_{OUT}



MM74C373
 Propagation Delay, CLOCK to Output
 vs Load Capacitance



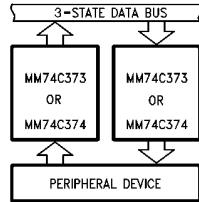
MM74C373, MM74C374
 Source Current vs V_{CC} - V_{OUT}



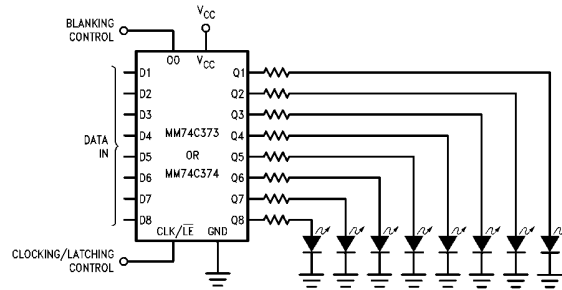
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Typical Applications

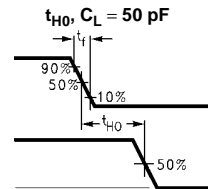
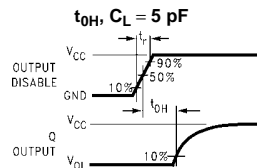
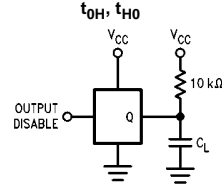
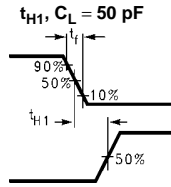
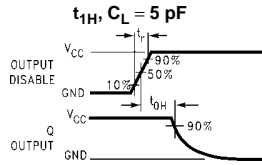
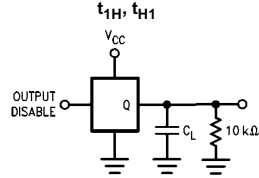
Data Bus Interfacing Element



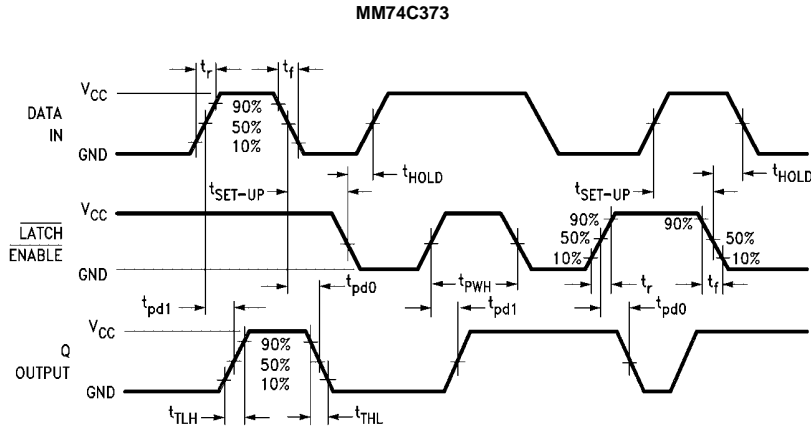
Simple, Latching, Octal, LED Indicator Driver with Blanking for Use as Data Display, Bus Monitor, μ P Front Panel Display, Etc.



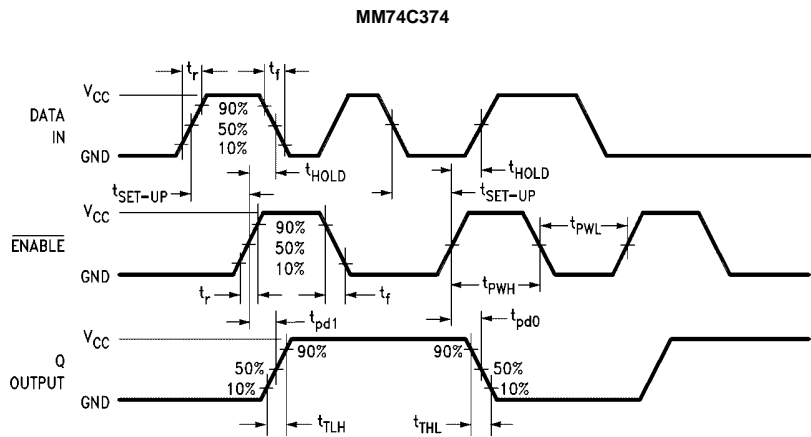
3-STATE Test Circuits and Switching Time Waveforms



Switching Time Waveforms



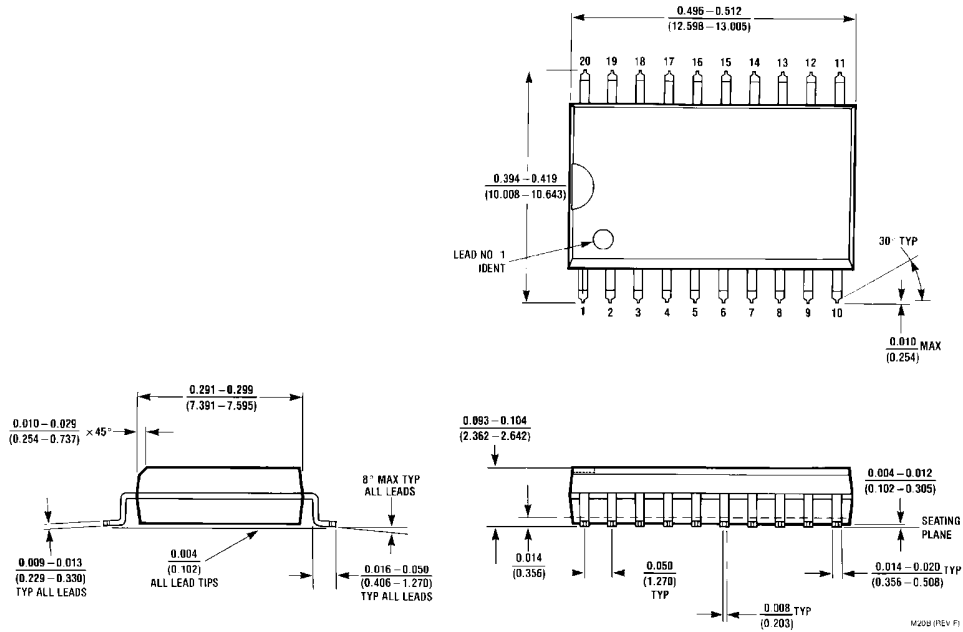
Output Disable = GND



Output Disable = GND

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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

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