

# DM74LS138 • DM74LS139

## General Description

These Schottky-clamped circuits are designed to be used in high-performance memory-decoding or data-routing applications, requiring very short propagation delay times. In high-performance memory systems these decoders can be used to minimize the effects of system decoding. When used with high-speed memories, the delay times of these decoders are usually less than the typical access time of the memory. This means that the effective system delay introduced by the decoder is negligible.

The DM74LS138 decodes one-of-eight lines, based upon the conditions at the three binary select inputs and the three enable inputs. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented with no external inverters, and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

The DM74LS139 comprises two separate two-line-to-four-line decoders in a single package. The active-low enable input can be used as a data line in demultiplexing applications.

All of these decoders/demultiplexers feature fully buffered inputs, presenting only one normalized load to its driving circuit. All inputs are clamped with high-performance Schottky diodes to suppress line-ringing and simplify system design.

## Ordering Code:

Order Number	Package Number	Package Description
DM74LS138M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
DM74LS138SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS138N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
DM74LS139M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
DM74LS139SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
DM74LS139N	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.

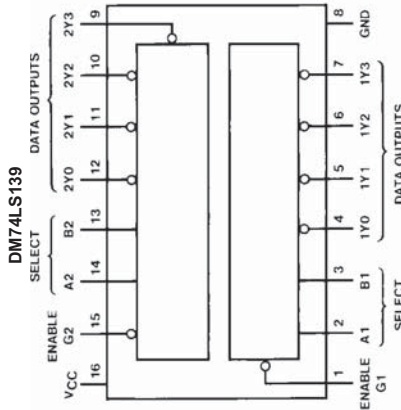
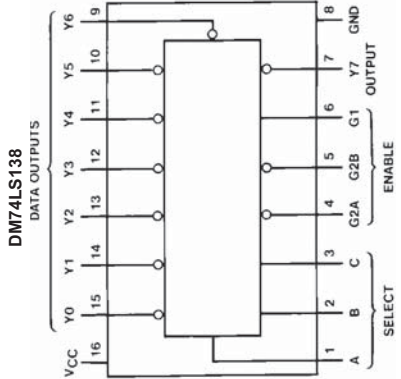
## Features

- Designed specifically for high speed:
  - Memory decoders
  - Data transmission systems
- DM74LS138 3-to-8-line decoders incorporates 3 enable inputs to simplify cascading and/or data reception
- DM74LS139 contains two fully independent 2-to-4-line decoders/demultiplexers
- Schottky clamped for high performance
- Typical propagation delay (3 levels of logic)
 

DM74LS138	21 ns
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- Typical power dissipation
 

DM74LS138	32 mW
DM74LS139	34 mW

## Connection Diagrams



## Function Tables

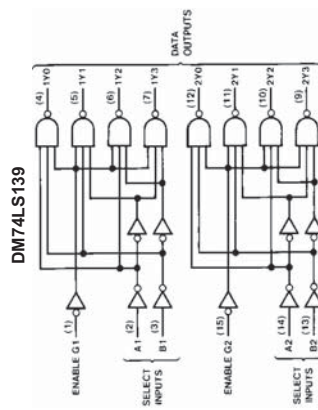
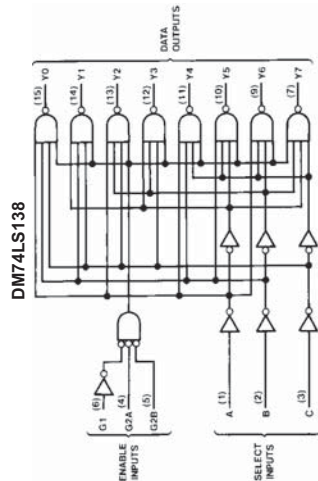
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Inputs			Outputs				
Enable	Select			Y0	Y1	Y2	Y3
G	B	A					
H	X	X		H	H	H	H
L	L	L		L	H	H	H
L	L	H		H	L	H	H
L	H	L		H	H	L	H
L	H	H		H	H	H	L

H = HIGH Level  
L = LOW Level  
X = Don't Care

**Note 1:**  $G2 = G2A + G2B$

## Logic Diagrams



Absolute Maximum Ratings

(Note 2)

Supply Voltage

7V

Input Voltage

7V

Operating Free Air Temperature Range

0°C to +70°C

Storage Temperature Range

−65°C to +150°C

Note 2: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

DM74LS138 Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
V <sub>CC</sub>	Supply Voltage	4.75	5	5.25	V
V <sub>IH</sub>	HIGH Level Input Voltage	2			V
V <sub>IL</sub>	LOW Level Input Voltage			0.8	V
I <sub>OH</sub>	HIGH Level Output Current			−0.4	mA
I <sub>OL</sub>	LOW Level Output Current			8	mA
T <sub>A</sub>	Free Air Operating Temperature	0		70	°C

DM74LS138 Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 3)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = −18 mA			−1.5	V
V <sub>OH</sub>	HIGH Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max, V <sub>IL</sub> = Min	2.7	3.4		V
V <sub>OL</sub>	LOW Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max, V <sub>IH</sub> = Min		0.35	0.5	V
		I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min		0.25	0.4	
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 7V			0.1	mA
I <sub>IH</sub>	HIGH Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V			20	μA
I <sub>IL</sub>	LOW Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V			−0.36	mA
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 4)	−20		−100	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max (Note 5)		6.3	10	mA

Note 3: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 4: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 5: I<sub>CC</sub> is measured with all outputs enabled and OPEN.

DM74LS138 Switching Characteristics

at V<sub>CC</sub> = 5V and T<sub>A</sub> = 25°C

Symbol	Parameter	From (Input) To (Output)	Levels of Delay	R <sub>L</sub> = 2 kΩ				Units
				C <sub>L</sub> = 15 pF		C <sub>L</sub> = 50 pF		
				Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay Time LOW-to-HIGH Level Output	Select to Output	2		18		27	ns
t <sub>PHL</sub>	Propagation Delay Time HIGH-to-LOW Level Output	Select to Output	2		27		40	ns
t <sub>PLH</sub>	Propagation Delay Time LOW-to-HIGH Level Output	Select to Output	3		18		27	ns
t <sub>PHL</sub>	Propagation Delay Time HIGH-to-LOW Level Output	Select to Output	3		27		40	ns
t <sub>PLH</sub>	Propagation Delay Time LOW-to-HIGH Level Output	Enable to Output	2		18		27	ns
t <sub>PHL</sub>	Propagation Delay Time HIGH-to-LOW Level Output	Enable to Output	2		24		40	ns
t <sub>PLH</sub>	Propagation Delay Time LOW-to-HIGH Level Output	Enable to Output	3		18		27	ns
t <sub>PHL</sub>	Propagation Delay Time HIGH-to-LOW Level Output	Enable to Output	3		28		40	ns

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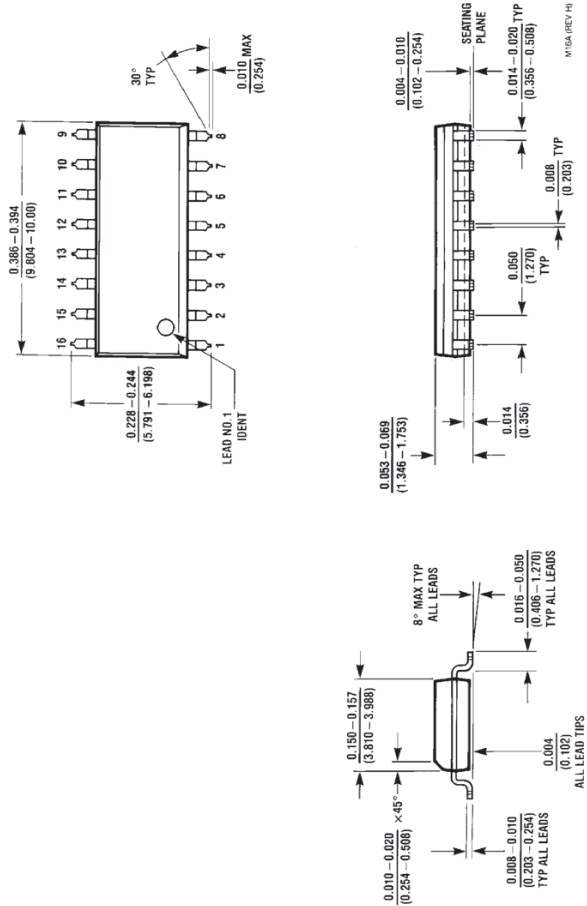
DM74LS139 Recommended Operating Conditions						
Symbol	Parameter	Min	Nom	Max	Units	
V <sub>CC</sub>	Supply Voltage	4.75	5	5.25	V	
V <sub>IH</sub>	HIGH Level Input Voltage	2			V	
V <sub>IL</sub>	LOW Level Input Voltage			0.8	V	
I <sub>OH</sub>	HIGH Level Output Current			−0.4	mA	
I <sub>OL</sub>	LOW Level Output Current			8	mA	
T <sub>A</sub>	Free Air Operating Temperature	0		70	°C	

DM74LS139 Electrical Characteristics						
over recommended operating free air temperature range (unless otherwise noted)						
Symbol	Parameter	Conditions	Min	Typ (Note 6)	Max	Units
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = −18 mA			−1.5	V
V <sub>OH</sub>	HIGH Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max, V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	2.7	3.4		V
V <sub>OL</sub>	LOW Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max, V <sub>IH</sub> = Max, V <sub>IL</sub> = Max, V <sub>IH</sub> = Min		0.35	0.5	V
		I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min		0.25	0.4	
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 7V			0.1	mA
I <sub>IH</sub>	HIGH Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V			20	μA
I <sub>IL</sub>	LOW Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V			−0.36	mA
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 7)	−20		−100	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max (Note 8)		6.8	11	mA

Note 6: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.  
Note 7: Not more than one output should be shorted at a time, and the duration should not exceed one second.  
Note 8: I<sub>CC</sub> is measured with all outputs enabled and OPEN.

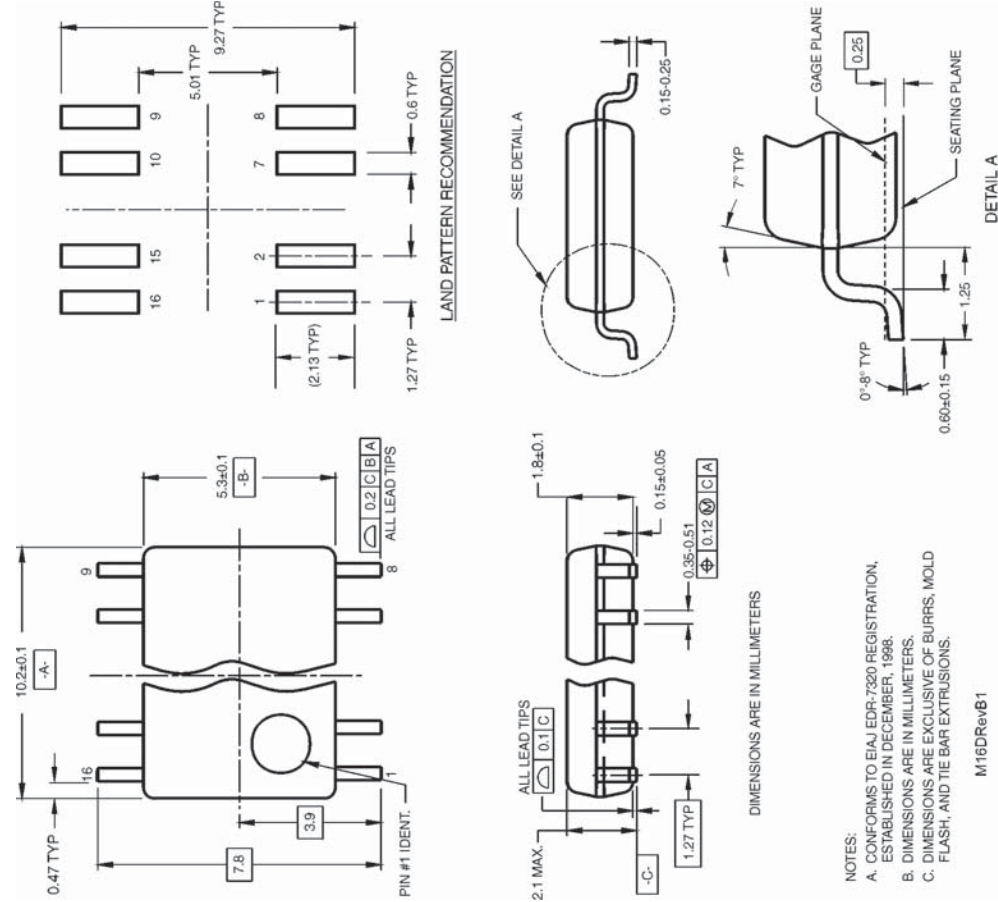
DM74LS139 Switching Characteristics							
at V <sub>CC</sub> = 5V and T <sub>A</sub> = 25°C							
Symbol	Parameter	From (Input) To (Output)	R <sub>L</sub> = 2 kΩ			Units	
			C <sub>L</sub> = 15 pF		C <sub>L</sub> = 50 pF		
			Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay Time LOW-to-HIGH Level Output	Select to Output		18		27	ns
t <sub>PHL</sub>	Propagation Delay Time HIGH-to-LOW Level Output	Select to Output		27		40	ns
t <sub>PLH</sub>	Propagation Delay Time LOW-to-HIGH Level Output	Enable to Output		18		27	ns
t <sub>PHL</sub>	Propagation Delay Time HIGH-to-LOW Level Output	Enable to Output		24		40	ns

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 Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M16D

DM74LS138 • DM74LS139

DM61S74WM • 881S74LM

August 1986  
Revised March 2000



# DM74LS153

## Dual 1-of-4 Line Data Selectors/Multiplexers

### Features

- Permits multiplexing from N lines to 1 line
- Performs at parallel-to-serial conversion
- Strobe (enable) line provided for cascading (N lines to n lines)
- High fan-out, low impedance, totem pole outputs
- Typical average propagation delay times
  - From data 14 ns
  - From strobe 19 ns
  - From select 22 ns
- Typical power dissipation 31 mW

### General Description

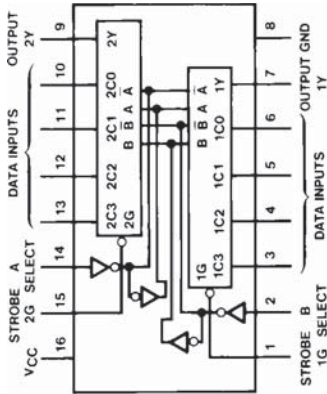
Each of these data selectors/multiplexers contains inverters and drivers to supply fully complementary, on-chip, binary decoding data selection to the AND-OR-invert gates. Separate strobe inputs are provided for each of the two four-line sections.

### Ordering Code:

Order Number	Package Number	Package Description
DM74LS153M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
DM74LS153N	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



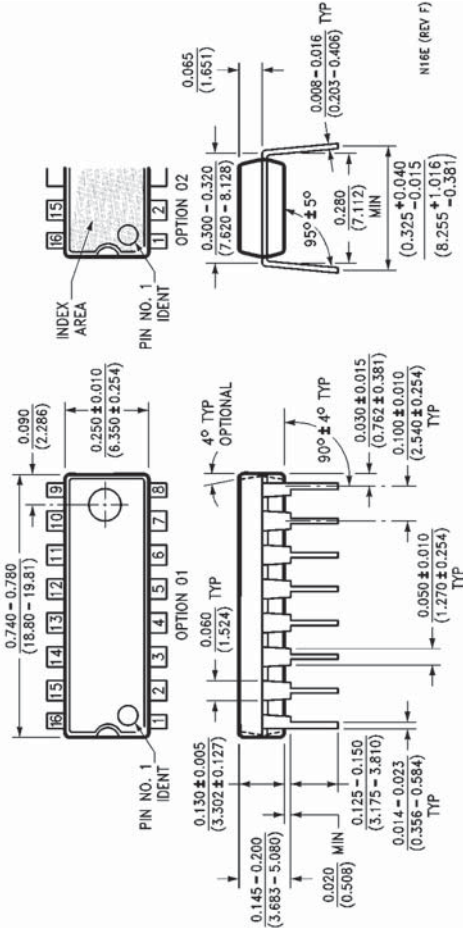
Select inputs A and B are common to both sections.  
H = HIGH Level  
L = LOW Level  
X = Don't Care

### Function Table

Select Inputs		Data Inputs				Strobe	Output
B	A	C0	C1	C2	C3		
X	X	X	X	X	X	G	Y
L	L	L	X	X	X	L	L
L	L	L	X	X	X	L	L
L	L	L	X	X	X	L	H
L	L	L	X	X	X	L	L
L	L	L	X	X	X	L	H
L	L	L	X	X	X	L	L
L	L	L	X	X	X	L	H
L	L	L	X	X	X	L	L
L	L	L	X	X	X	L	H
L	L	L	X	X	X	L	L
L	L	L	X	X	X	L	H
L	L	L	X	X	X	L	L
L	L	L	X	X	X	L	H

### 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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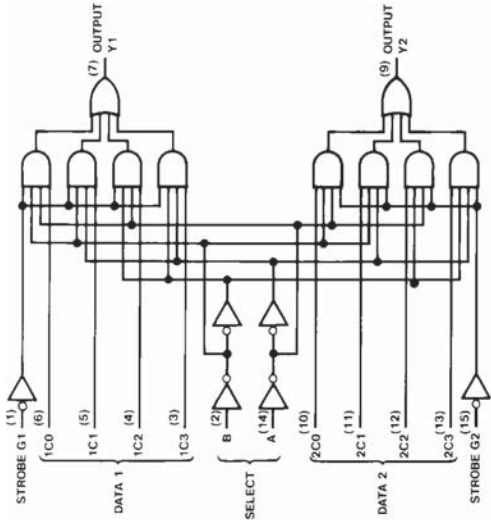
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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Logic Diagram



Absolute Maximum Ratings (Note 1)

Supply Voltage 7V  
Input Voltage 7V  
Operating Free Air Temperature Range 0°C to +70°C  
Storage Temperature Range -65°C to +150°C

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
$V_{CC}$	Supply Voltage	4.75	5	5.25	V
$V_{IH}$	HIGH Level Input Voltage	2			V
$V_{IL}$	LOW Level Input Voltage			0.8	V
$I_{OH}$	HIGH Level Output Current			-0.4	mA
$I_{OL}$	LOW Level Output Current			8	mA
$T_A$	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 2)	Max	Units
$V_I$	Input Clamp Voltage	$V_{CC} = \text{Min}, I_I = -18 \text{ mA}$			-1.5	V
$V_{OH}$	HIGH Level Output Voltage	$V_{CC} = \text{Min}, I_{OH} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$	2.7	3.4		V
$V_{OL}$	LOW Level Output Voltage	$V_{CC} = \text{Min}, I_{OL} = \text{Max}$ $V_{IL} = \text{Max}, V_{IH} = \text{Min}$ $I_{OL} = 4 \text{ mA}, V_{CC} = \text{Min}$		0.35 0.25	0.5 0.4	V
$I_I$	Input Current @ Max Input Voltage	$V_{CC} = \text{Max}, V_I = 7V$			0.1	mA
$I_{IH}$	HIGH Level Input Current	$V_{CC} = \text{Max}, V_I = 2.7V$			20	$\mu\text{A}$
$I_{IL}$	LOW Level Input Current	$V_{CC} = \text{Max}, V_I = 0.4V$			-0.36	mA
$I_{OS}$	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 3)	-20		-100	mA
$I_{CC}$	Supply Current	$V_{CC} = \text{Max}$ (Note 4)		6.2	10	mA

Note 2: All typicals are at  $V_{CC} = 5V, T_A = 25^\circ\text{C}$ .

Note 3: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 4:  $I_{CC}$  is measured with all outputs OPEN and all other inputs GROUNDED.

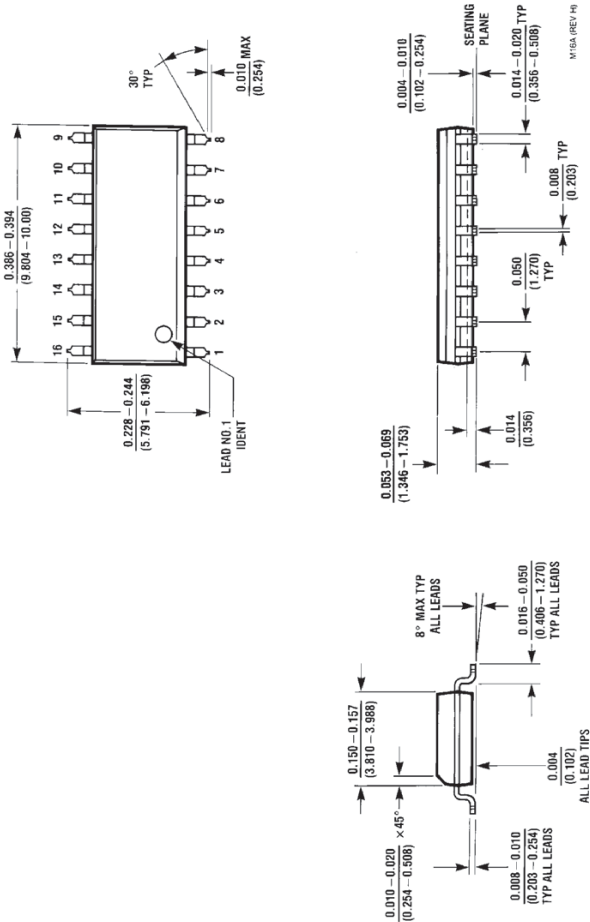
Switching Characteristics

at  $V_{CC} = 5V$  and  $T_A = 25^\circ\text{C}$

Symbol	Parameter	From (Input) to (Output)	$R_L = 2\text{ k}\Omega$						Units
			$C_L = 15\text{ pF}$			$C_L = 50\text{ pF}$			
			Min	Max		Min	Max		
$t_{PLH}$	Propagation Delay Time LOW-to-HIGH Level Output	Data to Y		15			20		ns
$t_{PHL}$	Propagation Delay Time HIGH-to-LOW Level Output	Data to Y		26			35		ns
$t_{PLH}$	Propagation Delay Time LOW-to-HIGH Level Output	Select to Y		29			35		ns
$t_{PHL}$	Propagation Delay Time HIGH-to-LOW Level Output	Select to Y		38			45		ns
$t_{PLH}$	Propagation Delay Time LOW-to-HIGH Level Output	Strobe to Y		24			30		ns
$t_{PHL}$	Propagation Delay Time HIGH-to-LOW Level Output	Strobe to Y		32			40		ns

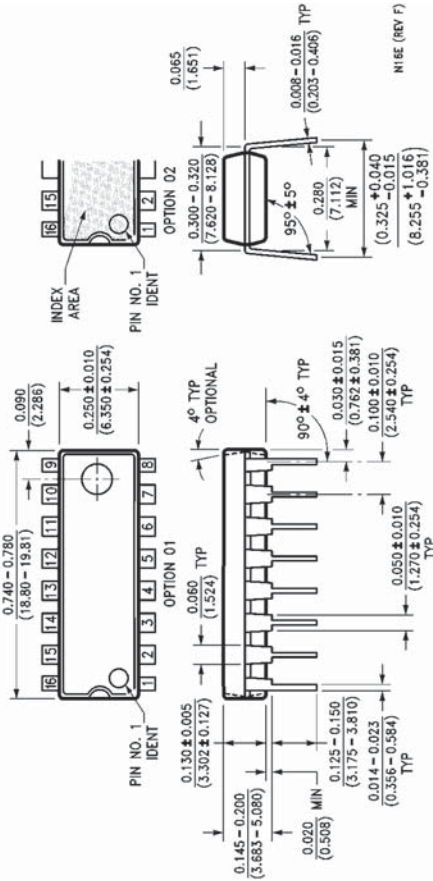


Physical Dimensions inches (millimeters) unless otherwise noted



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

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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.

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