August 1986

Revised March 2000

DM74LS138 • DM74LS139

Decoder/Demultiplexer

General Description

be used to minimize the effects of system decoding. When decoders are usually less than the typical access time of the memory. This means that the effective system delay These Schottky-clamped circuits are designed to be used In high-performance memory systems these decoders can used with high-speed memories, the delay times of these high-performance memory-decoding or data-routing applications, requiring very short propagation delay times. 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 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 three enable inputs. Two active-low and one active-high a data input for demultiplexing applications

line decoders in a single package. The active-low enable The DM74LS139 comprises two separate two-line-to-fourinput can be used as a data line in demultiplexing applicaAll 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 sysem design.

Features

Designed specifically for high speed:

Data transmission systems Memory decoders

■ 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 DM74LS139 21 ns

DM74LS138 32 mW Typical power dissipation

DM74LS139 34 mW

DM74LS139

DATA OUTPUTS

SELECT

ENABLE

e GN

G1

G2A

ENABLE G2B

SELECT

| Outnute | | Y2 | Н | I | I | ٦ | I |
|---------|--------|-----|---|---|---|---|---|
| j | 5 | ۲1 | I | I | _ | I | I |
| | | A.0 | I | _ | I | I | I |
| | Select | ٧ | × | _ | I | _ | I |
| Inputs | leS. | В | × | _ | _ | I | I |
| dul | Enable | 9 | I | _ | _ | _ | _ |

I I ェェ I I I I

I I I I I ェ I

I I I I I I

> I I I

I I

I I I

I

76 Y7

Y4 Y5

ΛO

ВА

C

G2 (Note 1)

G

Select

Enable

Inputs

Outputs

DM74LS138

Function Tables

E T T T T

DM74LS139

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I I

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III

I I

L = LOW Level

Note 1: G2 = G2A + G2B

X = Don't Care

Logic Diagrams

16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow

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

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

M16D

DM74LS139SJ

DM74LS139N

DM74LS139M DM74LS138N

N16E

M16A N16E

6-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

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

16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow

Package Description

Package Number

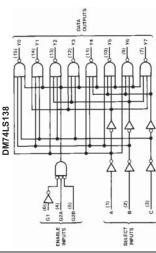
Order Number

DM74LS138M DM74LS138SJ

Ordering Code:

M16A

M16D



| DAYA | |
|------------------------------------|------------------|
| (114) V2 | (10 V5 |
| | |
| 0.1 (6) 178 (4) 178 (228 (5) | FECT B - C - C - |

DATA

A IN

ENABLE GT (1)

(E) [2]

SELECT

ENABLE G2 (15)

DM74LS138 • DM74LS139

273 10

271 2Y0

82 SELECT A2

> ENABLE 62

16 VCC

94

75

٢3

٧2

7

YO

vcc 16

DM74LS138 DATA OUTPUTS

Connection Diagrams

10

5

15

DATA OUTPUTS

DM74LS139

DM74LS138 • DM74LS139 Decoder/Demultiplexer

fairabildania.

Absolute Maximum Ratings (Note 2)

Supply Voltage Input Voltage

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

> >

| aximum ratings. e the conditions | Units | > | > | > | mA | шĄ | ၁့ |
|--|-----------|----------------|--------------------------|-------------------------|---------------------------|--------------------------|--------------------------------|
| Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation. Conditions | Max | 5.25 | | 8.0 | 4.0- | 8 | 20 |
| bles are not guarants dad Operation Conditions operation. | Nom | 5 | | | | | |
| Characteristics tables are no The "Recommended Operation for actual device operation and Conditions | Min | 4.75 | 2 | | | | 0 |
| Operating Free Air Temperature Range 0°C to +70°C The 'Recommended Operating Storage Temperature Range -65°C to +150°C for adual device operation DM74LS138 Recommended Operating Conditions | Parameter | Supply Voltage | HIGH Level Input Voltage | LOW Level Input Voltage | HIGH Level Output Current | LOW Level Output Current | Free Air Operating Temperature |
| Operating Free Air Temperati Storage Temperature Range | Symbol | Vcc | VIH | VIL | нон | lor | TA |

| DM74LS138 • DM74LS139 |
|-----------------------|
|-----------------------|

DM74LS138 • DM74LS139

| M741 6420 . | DMZ4 | | C 4 | 20 |
|-------------|------|----|------------|----|
| M74LS138 • | DM74 | ·L | S 1 | 38 |
| | | | | |

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Units

Max

Typ (Note 6)

Ā

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

Parameter

Symbol

Input Clamp Voltage

Output Voltage

VoH

Output Voltage LOW Level HIGH Level

ر م

DM74LS139 Electrical Characteristics

Free Air Operating Temperature

HIGH Level Output Current LOW Level Output Current

HIGH Level Input Voltage LOW Level Input Voltage

Supply Voltage

ر دد ≝

Symbol

Units

Max 5.25

Nom

Min 4.75

DM74LS139 Recommended Operating Conditions

mA mA ပွ

-0.4 0.8

20 ω

>

3.4

2.7

-1.5

 $V_{CC} = Min, I_1 = -18 \text{ mA}$ V_{CC} = Min, I_{OH} = Max, >

0.5 0.4 20

0.35 0.25

 $I_{OL} = 4 \text{ mA}, V_{CC} = \text{Min}$

 $V_{CC} = Max, V_{I} = 2.7V$ $V_{CC} = Max, V_1 = 0.4V$

 $V_{CC} = Max$, $V_I = 7V$

Input Current @ Max Input Voltage

Units

Max

(Note 3)

ξ

Ξ

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

Parameter

Symbol

DM74LS138 Electrical Characteristics

V_{CC} = Min, I_{OL} = Max $V_{IL} = Max, V_{IH} = Min$

 $V_{IL} = Max, V_{IH} = Min$

mA mA

0.1

mA шĄ шĄ

8.9

Note 7: Not more than one output should be shorted at a time, and the duration should not exceed one second

Note 8: $\ensuremath{\text{I}_{CC}}$ is measured with all outputs enabled and OPEN.

Note 6: All typicals are at $V_{CC} = 5V$, $T_A = 25^{\circ}C$

Supply Current

> шĄ ďΑ

0.5 0.4 20

0.35

3.4 0.25

2.7

V_{CC} = Min, I_{OH} = Max, V_{IL} = Max, V_{IH} = Min $V_{CC} = Min, I_{OL} = Max, V_{IL} = Max, V_{IH} = Min$

HIGH Level Output Voltage

Input Clamp Voltage

I_{OL} = 4 mA, V_{CC} = Min

V_{CC} = Max, V_I = 7V

Input Current @ Max Input Voltage

Output Voltage

LOW Level

Vol

HIGH Level Input Current LOW Level Input Current

 $V_{CC} = Max, V_{I} = 0.4V$ $V_{CC} = Max, V_{I} = 2.7V$

V_{CC} = Max (Note 4) V_{CC} = Max (Note 5)

Short Circuit Output Current

/_{CC} = Min, I_I = -18 mA

DM74LS139 Switching Characteristics

mA mA

-0.36-100 mA

10

6.3

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

Note 5: I_{CC} is measured with all outputs enabled and OPEN.

Note 3: All typicals are at $V_{CC} = 5V$, $T_A = 25^{\circ}C$.

Supply Current

DM74LS138 Switching Characteristics

at $V_{CC} = 5V$ and $T_A = 25$ °C

-20

-20

V_{CC} = Max (Note 7) V_{CC} = Max (Note 8)

Short Circuit Output Current HIGH Level Input Current

LOW Level Input Current

-0.36 -100

| | | From (Input) | | $R_L = 2 \; k\Omega$ | 2 kΩ | | |
|------------------|--------------------------|-------------------|----------|------------------------|------------------------|-------|-------|
| Symbol | Parameter | To (Output) | ال ال | C _L = 15 pF | C _L = 50 pF | 50 pF | Units |
| | | | Min | Max | Min | Max | |
| t _{PLH} | Propagation Delay Time | 41.00 | | 9 | | 7.0 | 9 |
| | LOW-to-HIGH Level Output | Select to Output | | 2 | | 73 | 2 |
| t _{PHL} | Propagation Delay Time | 41.00 | | 23 | | ç | 9 |
| | HIGH-to-LOW Level Output | Select to Output | | /7 | | 0 | 2 |
| tPLH | Propagation Delay Time | | | 9 | | 7.0 | 9 |
| | LOW-to-HIGH Level Output | Eliable to Output | | <u>o</u> | | /7 | 2 |
| t _{PHL} | Propagation Delay Time | | | VC | | 9 | ū |
| | HIGH-to-LOW Level Output | Eliable to Output | | +7 | | f | 2 |

Units

 $C_L = 50 \text{ pF}$

 $C_L = 15 pF$

of Delay Levels

From (Input) To (Output) Min

 $R_L = 2 \ k\Omega$

ns us us ns us us ns us

27

8 27 9 27 9 24 9 28

7 7 က က 2 7 က က

Select to Output Select to Output Select to Output Select to Output

LOW-to-HIGH Level Output HIGH-to-LOW Level Output LOW-to-HIGH Level Output HIGH-to-LOW Level Output LOW-to-HIGH Level Output HIGH-to-LOW Level Output LOW-to-HIGH Level Output HIGH-to-LOW Level Output

Propagation Delay Time

타

Parameter

Symbol

Propagation Delay Time

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Propagation Delay Time

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Enable to Output Enable to Output

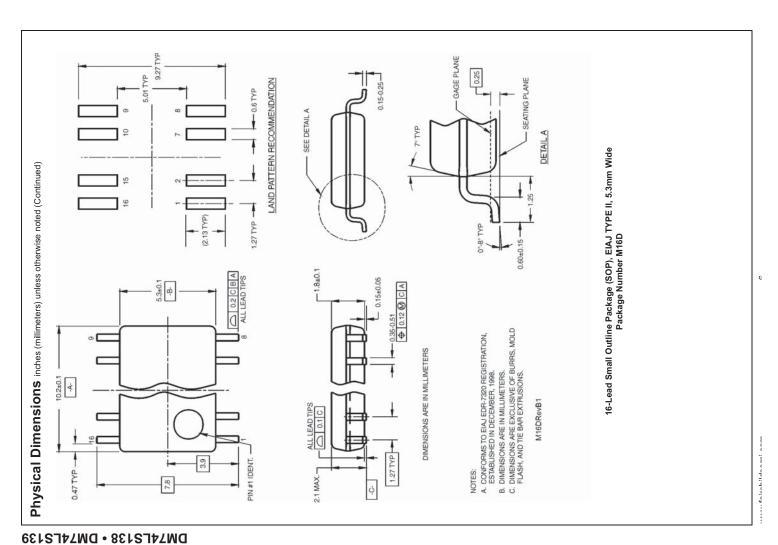
Propagation Delay Time Propagation Delay Time

27

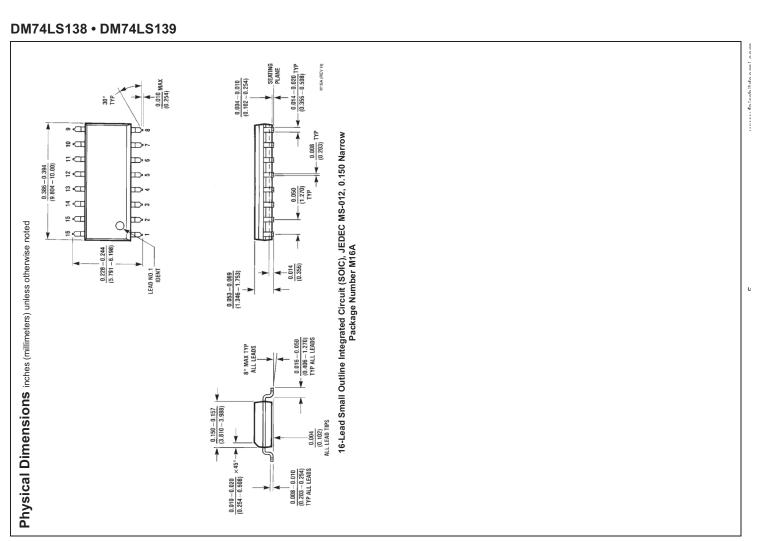
9

Enable to Output Enable to Output

Propagation Delay Time Propagation Delay Time Propagation Delay Time



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

Revised March 2000 August 1986

Dual 1-of-4 Line Data Selectors/Multiplexers DM74LS153

General Description

(1.651)

(7.620 - 8.128)

4° TYP OPTIONAL

1

0.060 (1.524) TYP OPTION 01 2 3 4 5

0.130±0.005 (3.302±0.127)

(3.683 - 5.080)

PIN NO. 1

OPTION 02

PIN NO. 1

AREA

O

1 5

0.250 ± 0.010 (6.350 ± 0.254)

gates. Separate strobe inputs are provided for each of the 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 wo four-line sections

Features

■ Permits multiplexing from N lines to 1 line

 Strobe (enable) line provided for cascading ■ Performs at parallel-to-serial conversion (N lines to n lines)

■ High fan-out, low impedance, totem pole outputs

Typical average propagation delay times 14 ns From data

 Typical power dissipation 31 mW From select

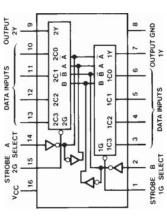
19 ns

From strobe

Ordering Code:

Function Table

Connection Diagram



| | Sel | Select Inputs | | Data I | Jata Inputs | | Strobe | Outpu |
|---|-----|------------------|---|--------|-------------|-----|--------|-------|
| | В | ۷ | တ | ပ | C2 | င္ပ | g | ⋆ |
| | × | × | × | × | × | × | I | _ |
| | _ | _ | _ | × | × | × | _ | _ |
| | _ | _ | I | × | × | × | _ | I |
| | _ | I | × | _ | × | × | ٦ | _ |
| | _ | I | × | I | × | × | _ | Ι |
| | I | _ | × | × | _ | × | _ | _ |
| | I | _ | × | × | I | × | _ | I |
| | I | I | × | × | × | _ | _ | _ |
| | I | I | × | × | × | I | ٦ | I |
| • | | | | | | | | |

¥

Select inputs A and B are common to both sections.

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

device or system, or to affect its safety or effectiveness.

to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the

body, or (b) support or sustain life, and (c) whose failure

DM74LS138 • DM74LS139 Decoder/Demultiplexer

£

0.008 - 0.016 (0.203 - 0.406)

0.280 950 ₹ 20

¥

0.030±0.015 (0.762±0.381)

90° ± 4° TYP

0.100 ± 0.010 (2.540 ± 0.254)

0.050 ± 0.010

0.014 - 0.023 (0.356 - 0.584)

(3.175 - 3.810)

0.020 (0.508) MIN

N16E (REV F)

(0.325 +0.040 (8.255 +1.016

16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N16E

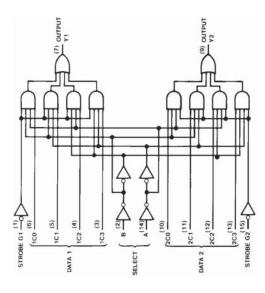
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Logic Diagram



Absolute Maximum Ratings(Note 1)

Supply Voltage Input Voltage

Storage Temperature Range

–65°C to +150° C Operating Free Air Temperature Range

0°C to +70°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 |
|--------|--------------------------------|------|-----|------|-------|
| Vcc | Supply Voltage | 4.75 | 5 | 5.25 | > |
| ΛH | HIGH Level Input Voltage | 2 | | | ۸ |
| VIL | LOW Level Input Voltage | | | 8.0 | ۸ |
| но | HIGH Level Output Current | | | 4.0- | Αm |
| lor | LOW Level Output Current | | | 8 | Αm |
| TA | Free Air Operating Temperature | 0 | | 02 | ၁့ |
| | | | | | |

Electrical Characteristics

| | Units | > | > | > | | > | | mA | Αų | mA | mA | mA |
|--|-----------------|--------------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|---------------------------------------|-----------------------------------|----------------------------|-------------------------------|--------------------------------|--------------------------|
| | Мах | -1.5 | | | 4 | 0.0 | 4.0 | 0.1 | 20 | -0.36 | -100 | 10 |
| | Typ (Note 2) | | 2.4 | 4. | 36.0 | 0.55 | 0.25 | | | | | 6.2 |
| | Min | | 7.0 | 7.7 | | | | | | | -20 | |
| ange (unless otherwise noted) | Conditions | $V_{CC} = Min, I_I = -18 \text{ mA}$ | $V_{CC} = Min, I_{OH} = Max$ | $V_{IL} = Max, V_{IH} = Min$ | $V_{CC} = Min, I_{OL} = Max$ | $V_{IL} = Max, V_{IH} = Min$ | $I_{OL} = 4 \text{ mA}, V_{CC} = Min$ | $V_{CC} = Max, V_I = 7V$ | $V_{CC} = Max, V_I = 2.7V$ | $V_{CC} = Max$, $V_I = 0.4V$ | V _{CC} = Max (Note 3) | $V_{CC} = Max $ (Note 4) |
| over recommended operating free air temperature range (unless otherwise noted) | Parameter | Input Clamp Voltage | HIGH Level | Output Voltage | LOW Level | Output Voltage | | Input Current @ Max Input Voltage | HIGH Level Input Current | LOW Level Input Current | Short Circuit Output Current | Supply Current |
| over recom | Symbol | > | V _{OH} | | Vol | | | - | ≖ | 11 | so _l | ا <mark>د</mark> |

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

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

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

Switching Characteristics

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

| | | From (Input) | | $R_L = 2 \text{ k}\Omega$ | 2 kΩ | | |
|------------------|--------------------------|--|--------------------|---------------------------|-------|------------------------|----------|
| Symbol | Parameter | to (Output) | C _L = , | C _L = 15 pF |) = 1 | C _L = 50 pF | Units |
| | | | Min | Max | Min | Max | |
| t _{PLH} | Propagation Delay Time | > 000 | | 16 | | oc. | 9 |
| | LOW-to-HIGH Level Output | Data to Y | | 2 | | 07 | S |
| t _{PHL} | Propagation Delay Time | > 000 | | 90 | | 30 | 9 |
| | HIGH-to-LOW Level Output | Data to 1 | | 07 | | c c | 2 |
| t _{PLH} | Propagation Delay Time | > 01 | | 90 | | 3.5 | 2 |
| | LOW-to-HIGH Level Output | 2012000 | | 67 | | 9 | 2 |
| t _{PHL} | Propagation Delay Time | > 4 | | 00 | | 45 | c S |
| | HIGH-to-LOW Level Output | - 01 10 10 10 10 10 10 10 10 10 10 10 10 | | 000 | | 5 | 2 |
| t _{PLH} | Propagation Delay Time | > 040.40 | | 70 | | 00 | ç |
| | LOW-to-HIGH Level Output | 01 000 10 | | 47 | | OS. | <u>e</u> |
| t _{PHL} | Propagation Delay Time | Stropo to | | 3.0 | | 70 | ç |
| | HIGH-to-LOW Level Output | 01 000 100 | | 70 | |) t | 2 |
| | | | | | | | |

16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N16E

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

0.004 (0.102) All Lead Tips

0.008-0.010 (0.203-0.254) TYP ALL LEADS

0.014 - 0.020 TYP (0.356 - 0.508) M16A (REV H)

0.014

0.008 (0.203) TYP

0.004 - 0.016 (0.102 - 0.254)

8° MAX TYP ALL LEADS

(3.810 - 3.988)

×45°-

 $0.010 - 0.020 \\ (0.254 - 0.508)$

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2. A critical component in any component of a life support

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 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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fairabilda and ann

Physical Dimensions inches (millimeters) unless otherwise noted

(9.804 - 10.00)

(5.791 - 6.198)

LEAD NO.1