

# MM74HC139

## Dual 2-To-4 Line Decoder

### Features

- Typical propagation delays:
  - Select to outputs (4 delays): 18ns
  - Select to output (5 delays): 28ns
  - Enable to output: 20ns
- Low power: 40µW quiescent supply power
- Fanout of 10 LS-TTL devices
- Input current maximum 1µA, typical 10pA

### General Description

The MM74HC139 decoder utilizes advanced silicon-gate CMOS technology, and is well suited to memory address decoding or data routing applications. It possesses the high noise immunity and low power consumption usually associated with CMOS circuitry, yet has speeds comparable to low power Schottky TTL logic.

The MM74HC139 contain two independent one-of-four decoders each with a single active low enable input (G1, or G2). Data on the select inputs (A1, and B1 or A2, and B2) cause one of the four normally high outputs to go LOW.

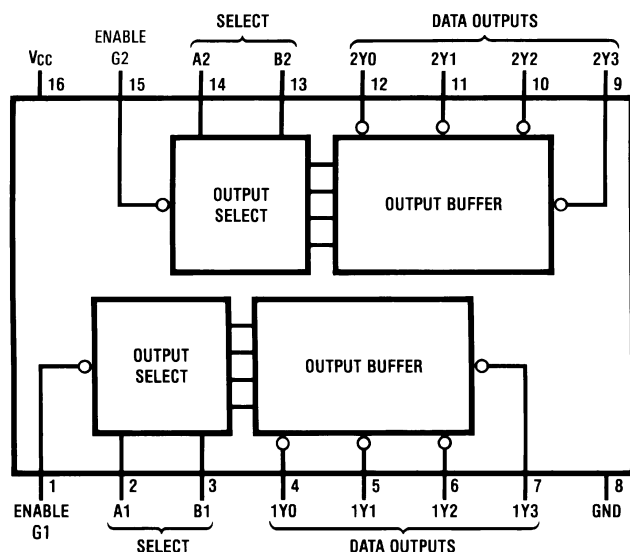
The decoder's outputs can drive 10 low power Schottky TTL equivalent loads, and are functionally as well as pin equivalent to the 74LS139. All inputs are protected from damage due to static discharge by diodes to  $V_{CC}$  and ground.

### Ordering Information

| Order Number | Package Number | Package Description                                                          |
|--------------|----------------|------------------------------------------------------------------------------|
| MM74HC139M   | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |

Device also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering number.

### Connection Diagram



### Truth Table

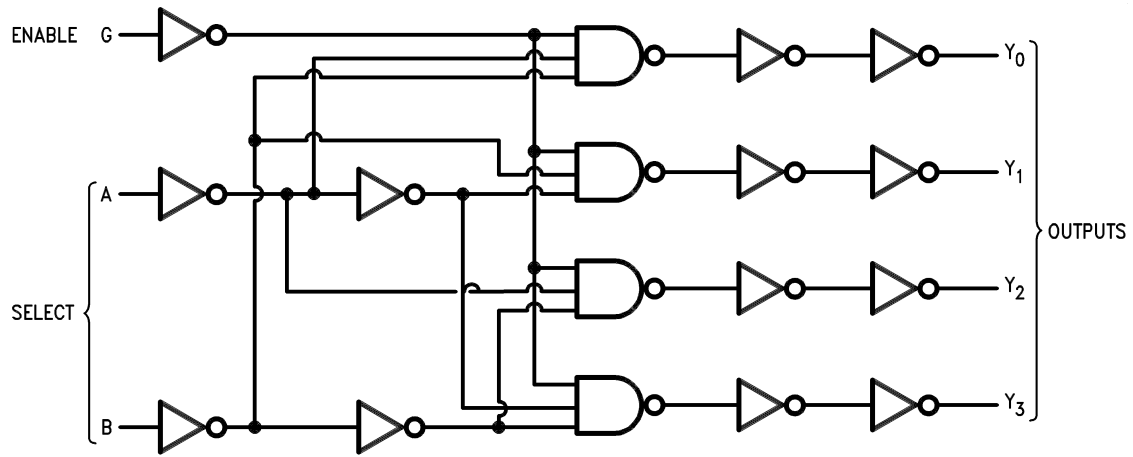
| Inputs |        |   | Outputs |    |    |    |
|--------|--------|---|---------|----|----|----|
| Enable | Select |   |         |    |    |    |
| G      | B      | A | Y0      | Y1 | Y2 | Y3 |
| H      | X      | X | H       | H  | H  | H  |
| L      | L      | L | L       | H  | H  | H  |
| L   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

## Logic Diagram



(1 of 2)

## Absolute Maximum Ratings<sup>(1)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol           | Parameter                               | Rating                  |
|------------------|-----------------------------------------|-------------------------|
| $V_{CC}$         | Supply Voltage                          | −0.5 to +7.0V           |
| $V_{IN}$         | DC Input Voltage                        | −1.5 to $V_{CC} + 1.5V$ |
| $V_{OUT}$        | DC Output Voltage                       | −0.5 to $V_{CC} + 0.5V$ |
| $I_{IK}, I_{OK}$ | Clamp Diode Current                     | ±20mA                   |
| $I_{OUT}$        | DC Output Current, per pin              | ±25mA                   |
| $I_{CC}$         | DC $V_{CC}$ or GND Current, per pin     | ±50mA                   |
| $T_{STG}$        | Storage Temperature Range               | −65°C to +150°C         |
| $P_D$            | Power Dissipation                       | 500mW                   |
| $T_L$            | Lead Temperature (Soldering 10 seconds) | 260°C                   |

### Note:

1. Unless otherwise specified all voltages are referenced to ground.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol            | Parameter                                                                         | Min. | Max.               | Units |
|-------------------|-----------------------------------------------------------------------------------|------|--------------------|-------|
| $V_{CC}$          | Supply Voltage                                                                    | 2    | 6                  | V     |
| $V_{IN}, V_{OUT}$ | DC Input or Output Voltage                                                        | 0    | $V_{CC}$           | V     |
| $T_A$             | Operating Temperature Range                                                       | −40  | +85                | °C    |
| $t_r, t_f$        | Input Rise or Fall Times<br>$V_{CC} = 2.0V$<br>$V_{CC} = 4.5V$<br>$V_{CC} = 6.0V$ |      | 1000<br>500<br>400 | ns    |

**DC Electrical Characteristics<sup>(2)</sup>**

| Symbol          | Parameter                         | Conditions                                                                            | V <sub>CC</sub> | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = −40<br>to 85°C | T <sub>A</sub> = −55<br>to 125°C | Units |
|-----------------|-----------------------------------|---------------------------------------------------------------------------------------|-----------------|-----------------------|-------------------|---------------------------------|----------------------------------|-------|
|                 |                                   |                                                                                       |                 | Typ.                  | Guaranteed Limits |                                 |                                  |       |
| V <sub>IH</sub> | Minimum HIGH Level Input Voltage  |                                                                                       | 2.0V            |                       | 1.5               | 1.5                             | 1.5                              | V     |
|                 |                                   |                                                                                       | 4.5V            |                       | 3.15              | 3.15                            | 3.15                             |       |
|                 |                                   |                                                                                       | 6.0V            |                       | 4.2               | 4.2                             | 4.2                              |       |
| V <sub>IL</sub> | Maximum LOW Level Input Voltage   |                                                                                       | 2.0V            |                       | 0.5               | 0.5                             | 0.5                              | V     |
|                 |                                   |                                                                                       | 4.5V            |                       | 1.35              | 1.35                            | 1.35                             |       |
|                 |                                   |                                                                                       | 6.0V            |                       | 1.8               | 1.8                             | 1.8                              |       |
| V <sub>OH</sub> | Minimum HIGH Level Output Voltage | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> :<br> I <sub>OUT</sub>   ≤ 20μA  | 2.0V            | 2.0                   | 1.9               | 1.9                             | 1.9                              | V     |
|                 |                                   |                                                                                       | 4.5V            | 4.5                   | 4.4               | 4.4                             | 4.4                              |       |
|                 |                                   |                                                                                       | 6.0V            | 6.0                   | 5.9               | 5.9                             | 5.9                              |       |
|                 |                                   | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> :<br> I <sub>OUT</sub>   ≤ 4.0mA | 4.5V            | 4.2                   | 3.98              | 3.84                            | 3.7                              |       |
|                 |                                   | I <sub>OUT</sub>   ≤ 5.2mA                                                            | 6.0V            | 5.7                   | 5.48              | 5.34                            | 5.2                              |       |
| V <sub>OL</sub> | Maximum LOW Level Output Voltage  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> :<br> I <sub>OUT</sub>   ≤ 20μA  | 2.0V            | 0                     | 0.1               | 0.1                             | 0.1                              | V     |
|                 |                                   |                                                                                       | 4.5V            | 0                     | 0.1               | 0.1                             | 0.1                              |       |
|                 |                                   |                                                                                       | 6.0V            | 0                     | 0.1               | 0.1                             | 0.1                              |       |
|                 |                                   | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> :<br> I <sub>OUT</sub>   ≤ 4.0mA | 4.5V            | 0.2                   | 0.26              | 0.33                            | 0.4                              |       |
|                 |                                   | I <sub>OUT</sub>   ≤ 5.2mA                                                            | 6.0V            | 0.2                   | 0.26              | 0.33                            | 0.4                              |       |
| I <sub>IN</sub> | Maximum Input Current             | V <sub>IN</sub> = V <sub>CC</sub> or GND                                              | 6.0V            |                       | ±0.1              | ±1.0                            | ±1.0                             | μA    |
| I <sub>CC</sub> | Maximum Quiescent Supply Current  | V <sub>IN</sub> = V <sub>CC</sub> or GND,<br>I <sub>OUT</sub> = 0μA                   | 6.0V            |                       | 8.0               | 80                              | 160                              | μA    |

**Note:**

2. For a power supply of 5V ±10% the worst case output voltages (V<sub>OH</sub>, and V<sub>OL</sub>) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5V and 4.5V respectively. (The V<sub>IH</sub> value at 5.5V is 3.85V.) The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occur for CMOS at the higher voltage and so the 6.0V values should be used.

**AC Electrical Characteristics**

$V_{CC} = 5V$ ,  $T_A = 25^\circ C$ ,  $C_L = 15\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$ .

| Symbol                | Parameter                                                                | Conditions | Typ. | Guaranteed Limit | Units |
|-----------------------|--------------------------------------------------------------------------|------------|------|------------------|-------|
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation Delay, Binary Select to any Output 4 levels of delay |            | 18   | 30               | ns    |
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation Delay, Binary Select to any Output 5 levels of delay |            | 28   | 38               | ns    |
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation Delay, Enable to any Output                          |            | 19   | 30               | ns    |

**AC Electrical Characteristics**

$C_L = 50\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$  (unless otherwise specified).

| Symbol                              | Parameter                                                               | Conditions | V <sub>CC</sub> | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = −40<br>to 85°C | T <sub>A</sub> = −55<br>to 125°C | Units |
|-------------------------------------|-------------------------------------------------------------------------|------------|-----------------|-----------------------|-------------------|---------------------------------|----------------------------------|-------|
|                                     |                                                                         |            |                 | Typ.                  | Guaranteed Limits |                                 |                                  |       |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay Binary Select to any Output 4 levels of delay | (3)        | 2.0V            | 110                   | 175               | 219                             | 254                              | ns    |
|                                     |                                                                         |            | 4.5V            | 22                    | 35                | 44                              | 51                               |       |
|                                     |                                                                         |            | 6.0V            | 18                    | 30                | 38                              | 44                               |       |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay Binary Select to any Output 5 levels of delay | (4)        | 2.0V            | 165                   | 220               | 275                             | 320                              | ns    |
|                                     |                                                                         |            | 4.5V            | 33                    | 44                | 55                              | 64                               |       |
|                                     |                                                                         |            | 6.0V            | 28                    | 38                | 47                              | 54                               |       |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Maximum Propagation Delay Enable to any Output                          |            | 2.0V            | 115                   | 175               | 219                             | 254                              | ns    |
|                                     |                                                                         |            | 4.5V            | 23                    | 35                | 44                              | 51                               |       |
|                                     |                                                                         |            | 6.0V            | 19                    | 30                | 38                              | 44                               |       |
| t <sub>TLH</sub> , t <sub>TLH</sub> | Maximum Output Rise and Fall Time                                       |            | 2.0V            | 30                    | 75                | 95                              | 110                              | ns    |
|                                     |                                                                         |            | 4.5V            | 8                     | 15                | 19                              | 22                               |       |
|                                     |                                                                         |            | 6.0V            | 7                     | 13                | 16                              | 19                               |       |
| C <sub>IN</sub>                     | Maximum Input Capacitance                                               |            |                 | 3                     | 10                | 10                              | 10                               | pF    |
| C <sub>PD</sub>                     | Power Dissipation Capacitance <sup>(5)</sup>                            | (5)        |                 | 75                    |                   |                                 |                                  | pF    |

**Notes:**

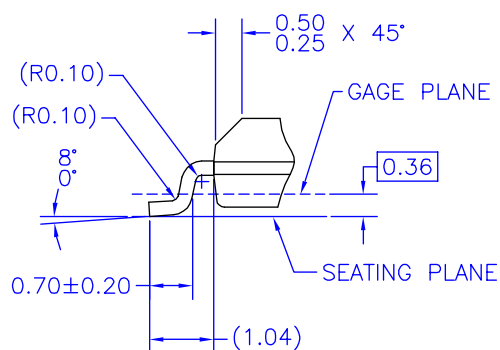
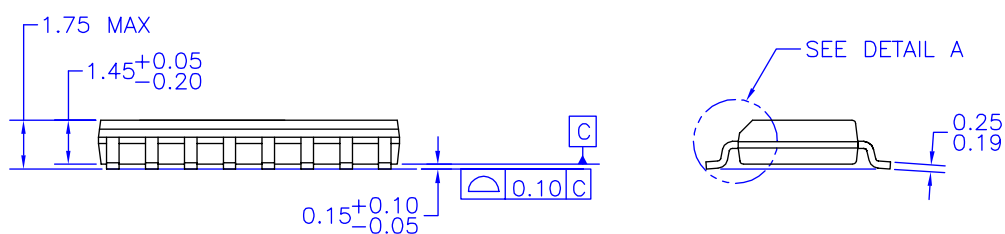
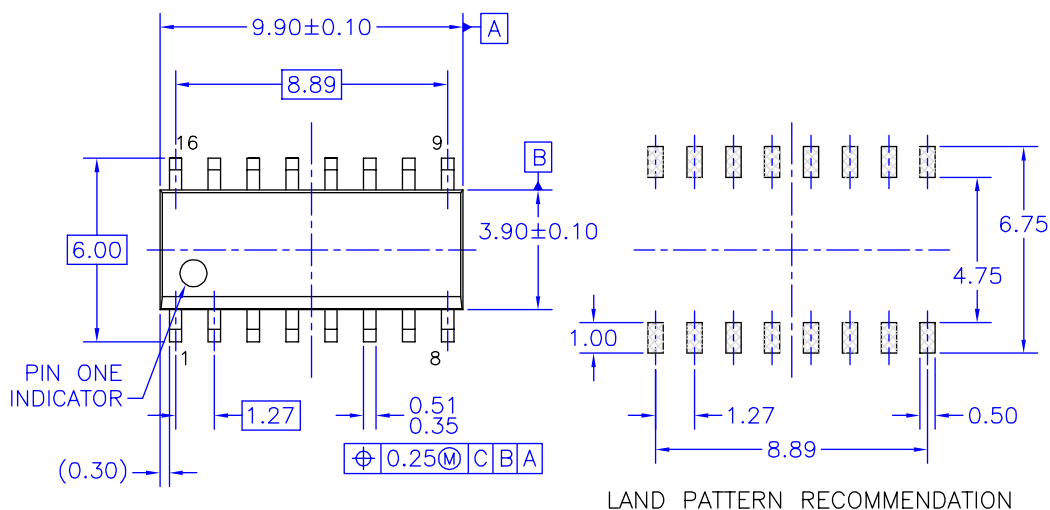
3. 4 levels of delay are A to Y1, Y3 and B to Y2, Y3.

4. 5 levels of delay are A to Y0, Y2 and B to Y0, Y1.

5.  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

## Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



DETAIL A  
SCALE: 2:1

NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AC, ISSUE C, DATED MAY 1990.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) STANDARD LEAD FINISH:  
200 MICROINCHES / 5.08 MICRONS MIN.  
LEAD/TIN (SOLDER) ON COPPER.

M16AREVK

**Figure 1. 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M16A**

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| Green FPS <sup>™</sup>              | POWEREDGE <sup>®</sup>                       | SuperSOT <sup>™</sup> -8               |                                                                                       |

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### Definition of Terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                               |
|--------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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