

## DM74LS155 • DM74LS156

### Dual 2-Line to 4-Line Decoders/Demultiplexers

#### General Description

These TTL circuits feature dual 1-line-to-4-line demultiplexers with individual strobes and common binary-address inputs in a single 16-pin package. When both sections are enabled by the strobes, the common address inputs sequentially select and route associated input data to the appropriate output of each section. The individual strobes permit activating or inhibiting each of the 4-bit sections as desired. Data applied to input C1 is inverted at its outputs and data applied at C2 is true through its outputs. The inverter following the C1 data input permits use as a 3-to-8-line decoder, or 1-to-8-line demultiplexer, without external gating. Input clamping diodes are provided on these circuits to minimize transmission-line effects and simplify system design.

#### Features

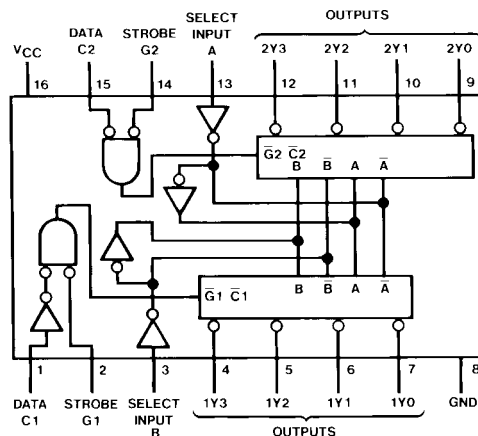
- Applications:
  - Dual 2-to-4-line decoder
  - Dual 1-to-4-line demultiplexer
  - 3-to-8-line decoder
  - 1-to-8-line demultiplexer
- Individual strobes simplify cascading for decoding or demultiplexing larger words
- Input clamping diodes simplify system design
- Choice of outputs:
  - Totem-pole (DM74LS155)
  - Open-collector (DM74LS156)

#### Ordering Code:

| Order Number | Package Number | Package Description                                                         |
|--------------|----------------|-----------------------------------------------------------------------------|
| DM74LS155M   | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow |
| DM74LS155N   | N16E           | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide       |
| DM74LS156M   | M16A           | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow |
| DM74LS156N   | 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



## Function Tables

3-Line-to-8-Line Decoder or 1-Line-to-8-Line Demultiplexer

| Inputs     |   |   |                   | Outputs |     |     |     |     |     |     |     |
|------------|---|---|-------------------|---------|-----|-----|-----|-----|-----|-----|-----|
| Select     |   |   | Strobe<br>Or Data | (0)     | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| C (Note 1) | B | A | G (Note 2)        | 2Y0     | 2Y1 | 2Y2 | 2Y3 | 1Y0 | 1Y1 | 1Y2 | 1Y3 |
| X          | X | X | H                 | H       | H   | H   | H   | H   | H   | H   | H   |
| L          | L | L | L                 | L       | H   | H   | H   | H   | H   | H   | H   |
| L          | L | H | L                 | H       | L   | H   | H   | H   | H   | H   | H   |
| L          | H | L | L                 | H       | H   | L   | H   | H   | H   | H   | H   |
| L          | H | H | L                 | H       | H   | H   | L   | H   | H   | H   | H   |
| H          | L | L | L                 | H       | H   | H   | H   | L   | H   | H   | H   |
| H          | L | H | L                 | H       | H   | H   | H   | H   | L   | H   | H   |
| H          | H | L | L                 | H       | H   | H   | H   | H   | H   | L   | H   |
| H          | H | H | L                 | H       | H   | H   | H   | H   | H   | H   | L   |

2-Line-to-4-Line Decoder or 1-Line-to-4-Line Demultiplexer

| Inputs |        |      |    | Outputs |     |     |     |
|--------|--------|------|----|---------|-----|-----|-----|
| Select | Strobe | Data |    | 1Y0     | 1Y1 | 1Y2 | 1Y3 |
| B      | A      | G1   | C1 |         |     |     |     |
| X      | X      | H    | X  | H       | H   | H   | H   |
| L      | L      | L    | H  | L       | H   | H   | H   |
| L      | H      | L    | H  | H       | L   | H   | H   |
| H      | L      | L    | H  | H       | H   | L   | H   |
| H      | H      | L    | H  | H       | H   | H   | L   |
| X      | X      | X    | L  | H       | H   | H   | H   |

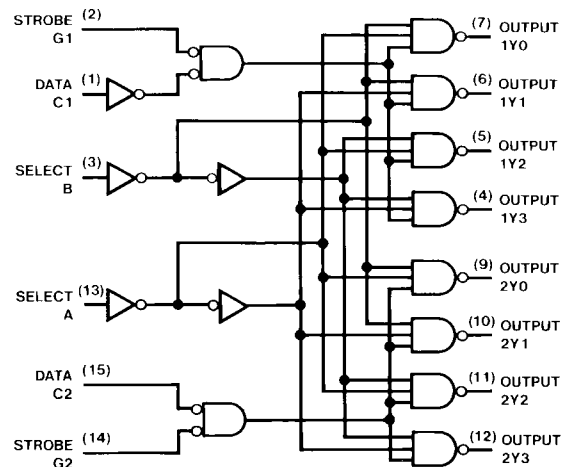
| Inputs |        |      |    | Outputs |     |     |     |
|--------|--------|------|----|---------|-----|-----|-----|
| Select | Strobe | Data |    | 2Y0     | 2Y1 | 2Y2 | 2Y3 |
| B      | A      | G2   | C2 |         |     |     |     |
| X      | X      | H    | X  | H       | H   | H   | H   |
| L      | L      | L    | L  | L       | H   | H   | H   |
| L      | H      | L    | L  | H       | L   | H   | H   |
| H      | L      | L    | L  | H       | H   | L   | H   |
| H      | H      | L    | L  | H       | H   | H   | L   |
| X      | X      | X    | H  | H       | H   | H   | H   |

H = HIGH level  
L = LOW level  
X = don't care

**Note 1:** C = inputs C1 and C2 connected together

**Note 2:** G = inputs G1 and G2 connected together

## Logic Diagram



**Absolute Maximum Ratings**(Note 3)

|                                      |                 |
|--------------------------------------|-----------------|
| 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 3:** 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.

**DM74LS155 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     |
| $V_{OH}$ | HIGH Level Output Current      |      |     | –0.4 | mA    |
| $I_{OL}$ | LOW Level Output Current       |      |     | 8    | mA    |
| $T_A$    | Free Air Operating Temperature | 0    |     | 70   | °C    |

**DM74LS155 Electrical Characteristics**

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

| Symbol   | Parameter                         | Conditions                                                                               | Min | Typ<br>(Note 4) | 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         | $V_{CC} = \text{Min}, I_{OH} = \text{Max}$<br>$V_{IL} = \text{Max}, V_{IH} = \text{Min}$ | 2.7 | 3.4             |       | V     |
| $V_{OL}$ | LOW Level Output Voltage          | $V_{CC} = \text{Min}, I_{OL} = \text{Max}$<br>$V_{IL} = \text{Max}, V_{IH} = \text{Min}$ |     | 0.35            | 0.5   | V     |
|          |                                   | $I_{OL} = 4 \text{ mA}, V_{CC} = \text{Min}$                                             |     | 0.25            | 0.4   |       |
| $I_I$    | 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    | μA    |
| $I_{IL}$ | 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 5)                                                           | –20 |                 | –100  | mA    |
| $I_{CC}$ | Supply Current                    | $V_{CC} = \text{Max}$ (Note 6)                                                           |     | 6.1             | 10    | mA    |

**Note 4:** All typicals are at  $V_{CC} = 5V, T_A = 25^\circ \text{C}$ .

**Note 5:** Not more than one output should be shorted at a time, and the duration should not exceed one second.

**Note 6:**  $I_{CC}$  is measured with all outputs OPEN, A, B, and C1 inputs at 4.5V, and C2, G1, and G2 inputs GROUNDED.

**DM74LS155 Switching Characteristics**

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

| Symbol           | Parameter                                          | From (Input)<br>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<br>LOW-to-HIGH Level Output | A, B, C2, G1<br>or G2 to Y  |                        | 18  |                        | 22  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>HIGH-to-LOW Level Output | A, B, C2, G1<br>or G2 to Y  |                        | 27  |                        | 35  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>LOW-to-HIGH Level Output | A or B<br>to Y              |                        | 18  |                        | 24  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>HIGH-to-LOW Level Output | A or B<br>to Y              |                        | 27  |                        | 35  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>LOW-to-HIGH Level Output | C1<br>to Y                  |                        | 20  |                        | 24  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>HIGH-to-LOW Level Output | C1<br>to Y                  |                        | 27  |                        | 35  | ns    |

## DM74LS156 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     |
| $V_{OH}$ | HIGH Level Output Voltage      |      |     | 5.5  | V     |
| $I_{OL}$ | LOW Level Output Current       |      |     | 8    | mA    |
| $T_A$    | Free Air Operating Temperature | 0    |     | 70   | °C    |

## DM74LS156 Electrical Characteristics

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

| Symbol    | Parameter                         | Conditions                                                                               | Min | Typ<br>(Note 7) | Max   | Units         |
|-----------|-----------------------------------|------------------------------------------------------------------------------------------|-----|-----------------|-------|---------------|
| $V_I$     | Input Clamp Voltage               | $V_{CC} = \text{Min}, I_I = -18 \text{ mA}$                                              |     |                 | -1.5  | V             |
| $I_{CEX}$ | HIGH Level<br>Output Current      | $V_{CC} = \text{Min}, V_O = 5.5 \text{ V}$<br>$V_{IL} = \text{Max}, V_{IH} = \text{Min}$ |     |                 | 100   | $\mu\text{A}$ |
| $V_{OL}$  | LOW Level<br>Output Voltage       | $V_{CC} = \text{Min}, I_{OL} = \text{Max}$<br>$V_{IL} = \text{Max}, V_{IH} = \text{Min}$ |     | 0.35            | 0.5   | V             |
|           |                                   | $I_{OL} = 4 \text{ mA}, V_{CC} = \text{Min}$                                             |     | 0.25            | 0.4   |               |
| $I_I$     | Input Current @ Max Input Voltage | $V_{CC} = \text{Max}, V_I = 7 \text{ V}$                                                 |     |                 | 0.1   | mA            |
| $I_{IH}$  | HIGH Level Input Current          | $V_{CC} = \text{Max}, V_I = 2.7 \text{ V}$                                               |     |                 | 20    | $\mu\text{A}$ |
| $I_{IL}$  | LOW Level Input Current           | $V_{CC} = \text{Max}, V_I = 0.4 \text{ V}$                                               |     |                 | -0.36 | mA            |
| $I_{CC}$  | Supply Current                    | $V_{CC} = \text{Max}$ (Note 8)                                                           |     | 6.1             | 10    | mA            |

**Note 7:** All typicals are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ \text{C}$ .

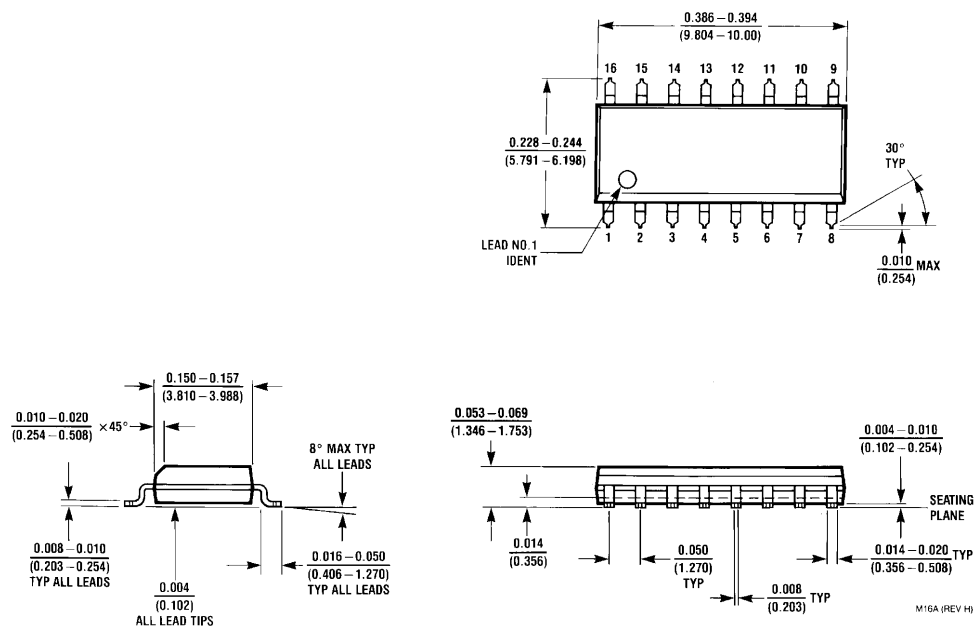
**Note 8:**  $I_{CC}$  is measured with all outputs OPEN, A, B, and C1 inputs at 4.5V, and C2, G1, and G2 GROUNDED.

## DM74LS156 Switching Characteristics

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

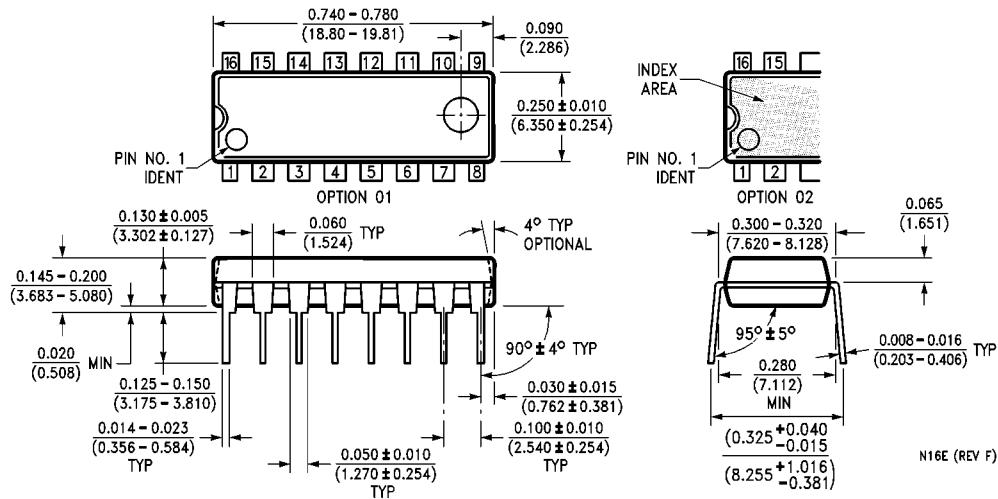
| Symbol           | Parameter                                          | From (Input)<br>To (Output) | R <sub>L</sub> = 2 kΩ  |     |                        |     | Units |
|------------------|----------------------------------------------------|-----------------------------|------------------------|-----|------------------------|-----|-------|
|                  |                                                    |                             | C <sub>L</sub> = 15 pF |     | C <sub>L</sub> = 50 pF |     |       |
|                  |                                                    |                             | Min                    | Max | Min                    | Max |       |
| t <sub>PLH</sub> | Propagation Delay Time<br>LOW-to-HIGH Level Output | A, B, C2, G1<br>or G2 to Y  |                        | 28  |                        | 53  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>HIGH-to-LOW Level Output | A, B, C2, G1<br>or G2 to Y  |                        | 33  |                        | 43  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>LOW-to-HIGH Level Output | A or B<br>to Y              |                        | 28  |                        | 53  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>HIGH-to-LOW Level Output | A or B<br>to Y              |                        | 33  |                        | 43  | ns    |
| t <sub>PLH</sub> | Propagation Delay Time<br>LOW-to-HIGH Level Output | C1<br>to Y                  |                        | 28  |                        | 53  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>HIGH-to-LOW Level Output | C1<br>to Y                  |                        | 34  |                        | 43  | 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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