

## MM74HC154 4-to-16 Line Decoder

### General Description

The MM74HC154 decoder utilizes advanced silicon-gate CMOS technology, and is well suited to memory address decoding or data routing applications. It possesses high noise immunity, and low power consumption of CMOS with speeds similar to low power Schottky TTL circuits.

The MM74HC154 have 4 binary select inputs (A, B, C, and D). If the device is enabled these inputs determine which one of the 16 normally HIGH outputs will go LOW. Two active LOW enables (G1 and G2) are provided to ease cascading of decoders with little or no external logic.

Each output can drive 10 low power Schottky TTL equivalent loads, and is functionally and pin equivalent to the 74LS154. All inputs are protected from damage due to static discharge by diodes to  $V_{CC}$  and ground.

### Features

- Typical propagation delay: 21 ns
- Power supply quiescent current: 80  $\mu$ A
- Wide power supply voltage range: 2–6V
- Low input current: 1  $\mu$ A maximum

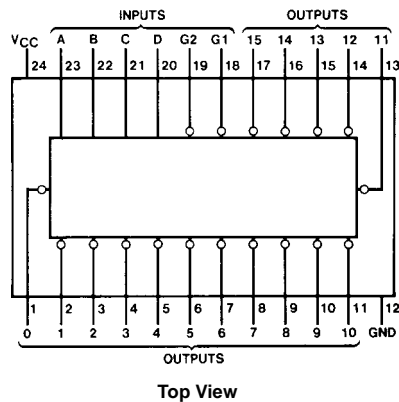
### Ordering Code:

| Order Number | Package Number | Package Description   |
|--------------|----------------|---|
| MM74HC154WM  | M24B           | 24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  |
| MM74HC154MTC | MTC24          | 24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HC154N   | N24C           | 24-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

Pin Assignments for DIP, SOIC and TSSOP

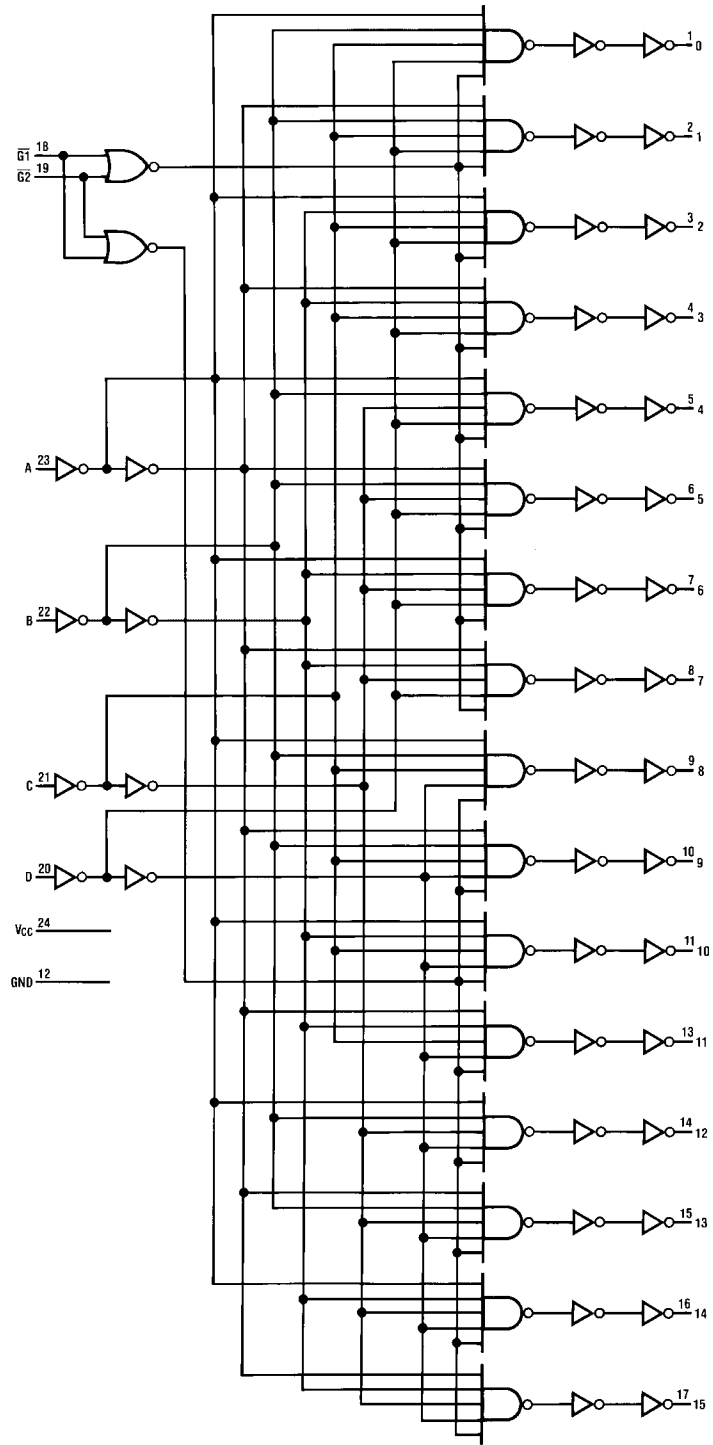


### Truth Table

|                 |                 | Inputs |   |   |   | Low Output (Note 1) |
|-----------------|-----------------|--------|---|---|---|---------------------|
| $\overline{G1}$ | $\overline{G2}$ | D      | C | B | A |                     |
| L               | L               | L      | L | L | L | 0                   |
| L               | L               | L      | L | L | H | 1                   |
| L               | L               | L      | L | H | L | 2                   |
| L               | L               | L      | L | H | H | 3                   |
| L               | L               | L      | H | L | L | 4                   |
| L               | L               | L      | H | L | H | 5                   |
| L               | L               | L      | H | H | L | 6                   |
| L               | L               | L      | H | H | H | 7                   |
| L               | L               | H      | L | L | L | 8                   |
| L               | L               | H      | L | L | H | 9                   |
| L               | L               | H      | L | H | L | 10                  |
| L               | L               | H      | L | H | H | 11                  |
| L               | L               | H      | H | L | L | 12                  |
| L               | L               | H      | H | L | H | 13                  |
| L               | L               | H      | H | H | L | 14                  |
| L               | L               | H      | H | H | H | 15                  |
| L               | H               | X      | X | X | X | —                   |
| H               | L               | X      | X | X | X | —                   |
| H               | H               | X      | X | X | X | —                   |

Note 1: All others HIGH

Logic Diagram



**Absolute Maximum Ratings** (Note 2)

(Note 3)

|  |                         |
|--|-------------------------|
| Supply Voltage ( $V_{CC}$ )                      | -0.5 to +7.0V           |
| DC Input Voltage ( $V_{IN}$ )                    | -1.5 to $V_{CC} + 1.5V$ |
| DC Output Voltage ( $V_{OUT}$ )                  | -0.5 to $V_{CC} + 0.5V$ |
| Clamp Diode Current ( $I_{IK}, I_{OK}$ )         | $\pm 20$ mA             |
| DC Output Current, per pin ( $I_{OUT}$ )         | $\pm 25$ mA             |
| DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ ) | $\pm 50$ mA             |
| Storage Temperature Range ( $T_{STG}$ )          | -65°C to +150°C         |
| Power Dissipation ( $P_D$ )                      |                         |
| (Note 4)   | 600 mW                  |
| S.O. Package only                                | 500 mW                  |
| Lead Temperature ( $T_L$ )                       |                         |
| (Soldering 10 seconds)                           | 260°C                   |

**Recommended Operating Conditions**

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

**Note 2:** Absolute Maximum Ratings are those values beyond which damage to the device may occur.

**Note 3:** Unless otherwise specified all voltages are referenced to ground.

**Note 4:** Power Dissipation temperature derating — plastic "N" package: — 12 mW/°C from 65°C to 85°C.

**DC Electrical Characteristics** (Note 5)

| Symbol   | Parameter                         | Conditions  | $V_{CC}$ | $T_A = 25^\circ C$ |                   | $T_A = -40$ to $85^\circ C$ |         | Units |
|----------|-----------------------------------|---|----------|--------------------|-------------------|-----------------------------|---------|-------|
|          |                                   |   |          | Typ                | Guaranteed Limits |                             |         |       |
| $V_{IH}$ | Minimum HIGH Level Input Voltage  |   | 2.0V     |                    | 1.5               | 1.5                         | V       |       |
|          |                                   |   | 4.5V     |                    | 3.15              | 3.15                        |         |       |
|          |                                   |   | 6.0V     |                    | 4.2               | 4.2                         |         |       |
| $V_{IL}$ | Maximum LOW Level Input Voltage   |   | 2.0V     |                    | 0.5               | 0.5                         | V       |       |
|          |                                   |   | 4.5V     |                    | 1.35              | 1.35                        |         |       |
|          |                                   |   | 6.0V     |                    | 1.8               | 1.8                         |         |       |
| $V_{OH}$ | Minimum HIGH Level Output Voltage | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$ I_{OUT}  \leq 20 \mu A$                          | 2.0V     | 2.0                | 1.9               | 1.9                         | V       |       |
|          |                                   |   | 4.5V     | 4.5                | 4.4               | 4.4                         |         |       |
|          |                                   |   | 6.0V     | 6.0                | 5.9               | 5.9                         |         |       |
|          |                                   | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$ I_{OUT}  \leq 4.0$ mA<br>$ I_{OUT}  \leq 5.2$ mA | 4.5V     | 4.2                | 3.98              | 3.84                        | V       |       |
|          |                                   |   | 6.0V     | 5.7                | 5.48              | 5.34                        |         |       |
|          |                                   |   |          |                    |                   |                             |         |       |
| $V_{OL}$ | Maximum LOW Level Output Voltage  | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$ I_{OUT}  \leq 20 \mu A$                          | 2.0V     | 0                  | 0.1               | 0.1                         | V       |       |
|          |                                   |   | 4.5V     | 0                  | 0.1               | 0.1                         |         |       |
|          |                                   |   | 6.0V     | 0                  | 0.1               | 0.1                         |         |       |
|          |                                   | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$ I_{OUT}  \leq 4.0$ mA<br>$ I_{OUT}  \leq 5.2$ mA | 4.5V     | 0.2                | 0.26              | 0.33                        | V       |       |
|          |                                   |   | 6.0V     | 0.2                | 0.26              | 0.33                        |         |       |
|          |                                   |   |          |                    |                   |                             |         |       |
| $I_{IN}$ | Maximum Input Current             | $V_{IN} = V_{CC}$ or GND  | 6.0V     |                    | $\pm 0.1$         | $\pm 1.0$                   | $\mu A$ |       |
| $I_{CC}$ | Maximum Quiescent Supply Current  | $V_{IN} = V_{CC}$ or GND<br>$I_{OUT} = 0 \mu A$                                     | 6.0V     |                    | 8.0               | 80                          | $\mu A$ |       |

**Note 5:** For a power supply of  $5V \pm 10\%$  the worst case output voltages ( $V_{OH}$ , and  $V_{OL}$ ) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case  $V_{IH}$  and  $V_{IL}$  occur at  $V_{CC} = 5.5V$  and 4.5V respectively. (The  $V_{IH}$  value at 5.5V is 3.85V.) The worst case leakage current ( $I_{IN}$ ,  $I_{CC}$ , and  $I_{OZ}$ ) occur for CMOS at the higher voltage and so the 6.0V values should be used.

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

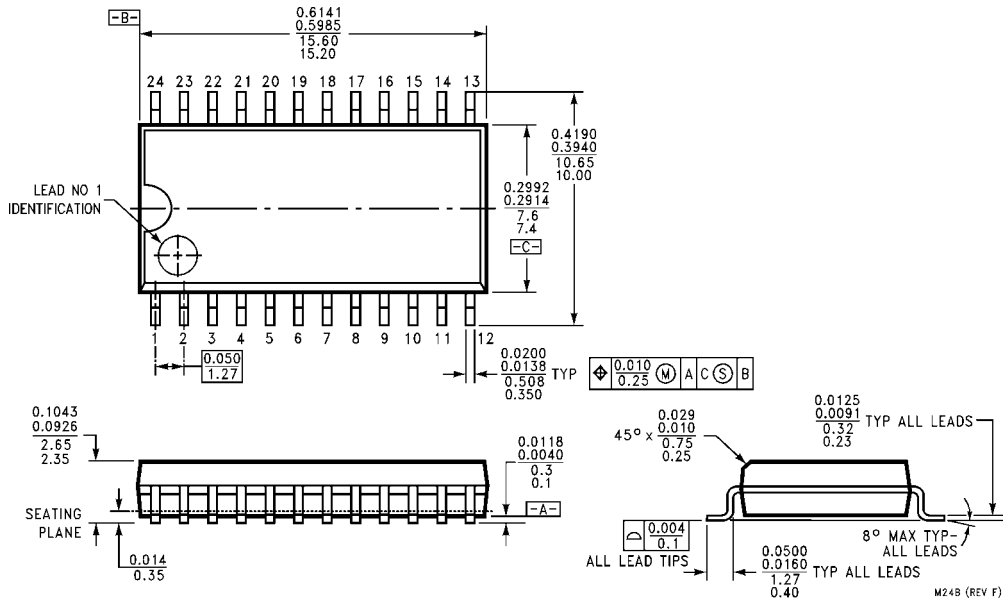
| Symbol                | Parameter  | Conditions | Typ | Guaranteed Limit | Units |
|-----------------------|--|------------|-----|------------------|-------|
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation Delay, $\overline{G1}$ , $\overline{G2}$ or A, B, C, D |            | 21  | 32               | ns    |

**AC Electrical Characteristics** $V_{CC} = 2.0V$  to  $6.0V$ ,  $C_L = 50 \text{ pF}$ ,  $t_r = t_f = 6 \text{ ns}$  (unless otherwise specified)

| Symbol                | Parameter   | Conditions | $V_{CC}$ | $T_A = 25^\circ C$ |                   | $T_A = -40 \text{ to } 85^\circ C$ | Units |
|-----------------------|---|------------|----------|--------------------|-------------------|------------------------------------|-------|
|                       |   |            |          | Typ                | Guaranteed Limits |                                    |       |
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation Delay, $\overline{G1}$ or $\overline{G2}$ or A, B, C, D |            | 2.0V     | 63                 | 160               | 190                                | ns    |
|                       |   |            | 4.5V     | 24                 | 36                | 42                                 |       |
|                       |   |            | 6.0V     | 20                 | 30                | 35                                 |       |
| $t_{TLH}$ , $t_{THL}$ | Maximum Output Rise and Fall Time   |            | 2.0V     | 25                 | 75                | 95                                 | ns    |
|                       |   |            | 4.5V     | 7                  | 15                | 19                                 |       |
|                       |   |            | 6.0V     | 6                  | 13                | 16                                 |       |
| $C_{PD}$              | Power Dissipation Capacitance (Note 6)                                      |            |          | 90                 |                   |                                    | pF    |
| $C_{IN}$              | Maximum Input Capacitance   |            |          | 5                  | 10                | 10                                 | pF    |

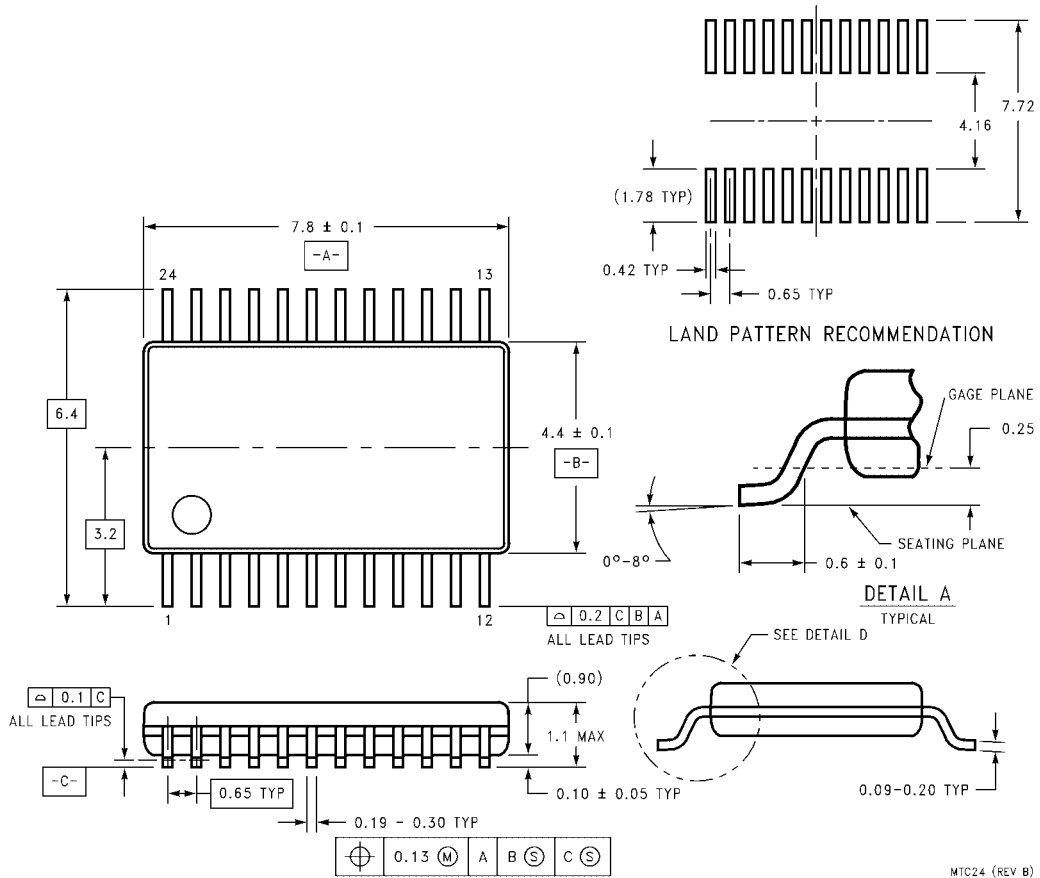
**Note 6:**  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

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



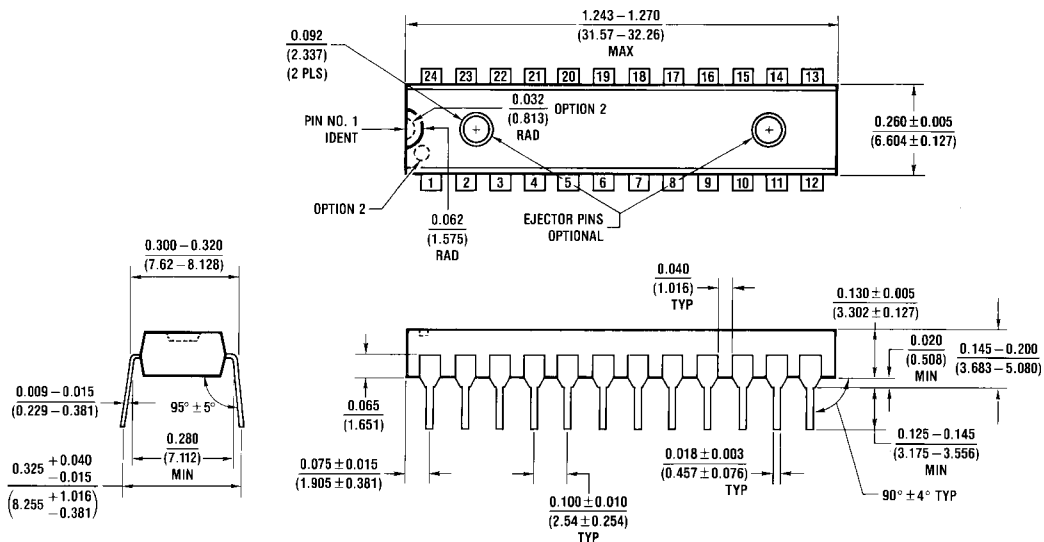
**24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
Package Number M24B**

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



**24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC24**

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



N24C (REV F)

**24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide  
 Package Number N24C**

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