

## DM74LS09

### Quad 2-Input AND Gates with Open-Collector Outputs

#### General Description

This device contains four independent gates each of which performs the logic AND function. The open-collector outputs require external pull-up resistors for proper logical operation.

#### Pull-Up Resistor Equations

$$R_{MAX} = \frac{V_{CC} (Min) - V_{OH}}{N_1 (I_{OH}) + N_2 (I_{IH})}$$

$$R_{MIN} = \frac{V_{CC} (Max) - V_{OL}}{I_{OL} - N_3 (I_{IL})}$$

Where:

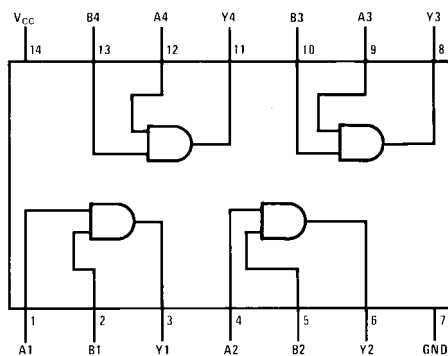
- $N_1 (I_{OH})$  = total maximum output high current for all outputs tied to pull-up resistor
- $N_2 (I_{IH})$  = total maximum input high current for all inputs tied to pull-up resistor
- $N_3 (I_{IL})$  = total maximum input low current for all inputs tied to pull-up resistor

#### Ordering Code:

| Order Number | Package Number | Package Description                                                         |
|--------------|----------------|-----------------------------------------------------------------------------|
| DM74LS09M    | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow |
| DM74LS09N    | N14A           | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide       |

Devices also available in Tape and Reel.

#### Connection Diagram



#### Function Table

$Y = AB$

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | L      |
| L      | H | L      |
| H      | L | L      |
| H      | H | H      |

H = HIGH Logic Level  
L = LOW Logic Level

DM74LS09 Quad 2-Input AND Gates with Open-Collector Outputs

**Absolute Maximum Ratings**(Note 1)

|                                      |                 |
|--------------------------------------|-----------------|
| Supply Voltage                       | 7V              |
| Input Voltage                        | 7V              |
| Output 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 <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     |
| V <sub>OH</sub> | HIGH Level Output Voltage      |      |     | 5.5  | V     |
| I <sub>OL</sub> | LOW Level Output Current       |      |     | 8    | mA    |
| T <sub>A</sub>  | Free Air Operating Temperature | 0    |     | 70   | °C    |

**Electrical Characteristics**

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

| Symbol           | Parameter                         | Conditions                                                            | Min | Typ<br>(Note 2) | Max   | Units |
|------------------|-----------------------------------|-----------------------------------------------------------------------|-----|-----------------|-------|-------|
| V <sub>I</sub>   | Input Clamp Voltage               | V <sub>CC</sub> = Min, I <sub>I</sub> = –18 mA                        |     |                 | –1.5  | V     |
| I <sub>CEX</sub> | HIGH Level<br>Output Current      | V <sub>CC</sub> = Min, V <sub>O</sub> = 5.5V<br>V <sub>IH</sub> = Min |     |                 | 100   | μA    |
| V <sub>OL</sub>  | LOW Level<br>Output Voltage       | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max<br>V <sub>IL</sub> = Max |     | 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>CCH</sub> | Supply Current with Outputs HIGH  | V <sub>CC</sub> = Max                                                 |     | 2.4             | 4.8   | mA    |
| I <sub>CCL</sub> | Supply Current with Outputs LOW   | V <sub>CC</sub> = Max                                                 |     | 4.4             | 8.8   | mA    |

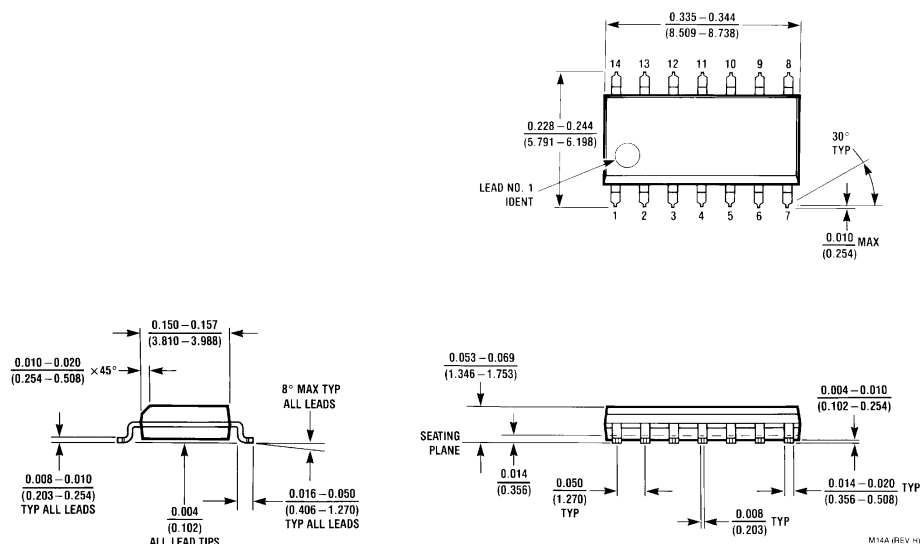
**Note 2:** All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

**Switching Characteristics**

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

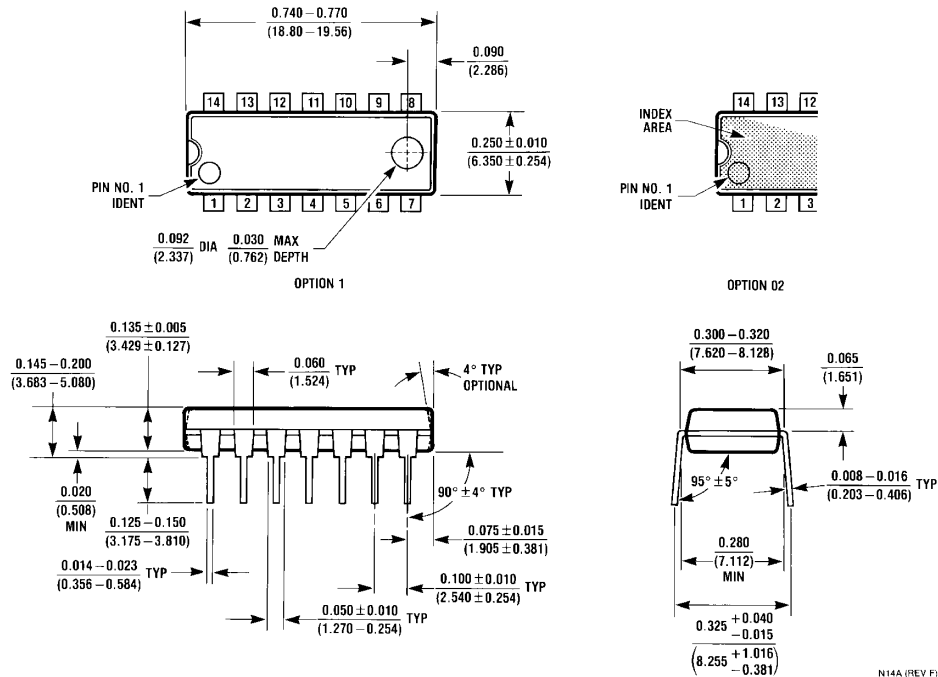
| Symbol           | Parameter                                          | R <sub>L</sub> = 2 kΩ  |     |                        |     | Units |
|------------------|----------------------------------------------------|------------------------|-----|------------------------|-----|-------|
|                  |                                                    | 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 | 5                      | 20  | 8                      | 45  | ns    |
| t <sub>PHL</sub> | Propagation Delay Time<br>HIGH-to-LOW Level Output | 4                      | 15  | 6                      | 27  | ns    |

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



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow  
Package Number M14A**

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



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N14A

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