

## CD40106BC Hex Schmitt Trigger

### General Description

The CD40106BC Hex Schmitt Trigger is a monolithic complementary MOS (CMOS) integrated circuit constructed with N and P-channel enhancement transistors. The positive and negative-going threshold voltages,  $V_{T+}$  and  $V_{T-}$ , show low variation with respect to temperature (typ 0.0005V/°C at  $V_{DD} = 10V$ ), and hysteresis,  $V_{T+} - V_{T-} \geq 0.2 V_{DD}$  is guaranteed.

All inputs are protected from damage due to static discharge by diode clamps to  $V_{DD}$  and  $V_{SS}$ .

### Features

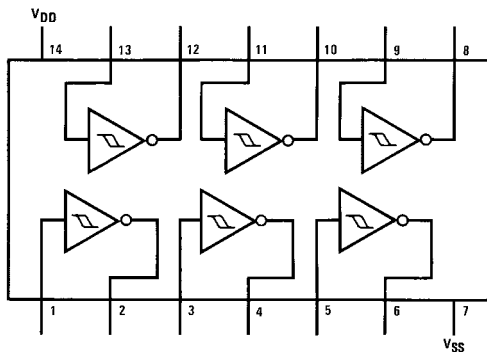
- Wide supply voltage range: 3V to 15V
- High noise immunity:  $0.7 V_{DD}$  (typ.)
- Low power TTL compatibility:  
Fan out of 2 driving 74L or 1 driving 74LS
- Hysteresis:  $0.4 V_{DD}$  (typ.),  
 $0.2 V_{DD}$  guaranteed
- Equivalent to MM74C14

### Ordering Code:

| Order Number | Package Number | Package Description  |
|--------------|----------------|--|
| CD40106BCM   | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| CD40106BCN   | N14A           | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide       |

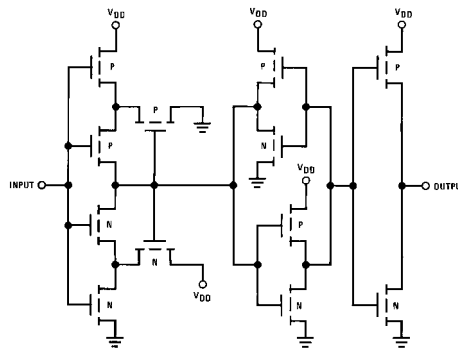
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Connection Diagram



Top View

### Schematic Diagram



**Absolute Maximum Ratings**(Note 1)

(Note 2)

|                                     |                                |
|-------------------------------------|--------------------------------|
| DC Supply Voltage ( $V_{DD}$ )      | -0.5 to +18 $V_{DC}$           |
| Input Voltage ( $V_{IN}$ )          | -0.5 to $V_{DD}$ +0.5 $V_{DC}$ |
| Storage Temperature Range ( $T_S$ ) | -65°C to +150°C                |
| Power Dissipation ( $P_D$ )         |                                |
| Dual-In-Line                        | 700 mW                         |
| Small Outline                       | 500 mW                         |
| Lead Temperature ( $T_L$ )          |                                |
| (Soldering, 10 seconds)             | 260°C                          |

**Recommended Operating Conditions** (Note 2)

|                                       |                        |
|---------------------------------------|------------------------|
| DC Supply Voltage ( $V_{DD}$ )        | 3 to 15 $V_{DC}$       |
| Input Voltage ( $V_{IN}$ )            | 0 to $V_{DD}$ $V_{DC}$ |
| Operating Temperature Range ( $T_A$ ) | -55°C to +125°C        |

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:**  $V_{SS} = 0V$  unless otherwise specified.

**DC Electrical Characteristics** (Note 3)

| Symbol   | Parameter                                | Conditions   | -55°C                 |                      | +25°C                 |                         |                    | +125°C                |                      | Units   |
|----------|--|--|-----------------------|----------------------|-----------------------|-------------------------|--------------------|-----------------------|----------------------|---------|
|          |  |  | Min                   | Max                  | Min                   | Typ                     | Max                | Min                   | Max                  |         |
| $I_{DD}$ | Quiescent Device Current                 | $V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$                                      |                       | 1.0<br>2.0<br>4.0    |                       |                         |                    | 1.0<br>2.0<br>4.0     | 30<br>60<br>120      | $\mu A$ |
| $V_{OL}$ | LOW Level Output Voltage                 | $ I_O  < 1 \mu A$<br>$V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$                 |                       | 0.05<br>0.05<br>0.05 |                       |                         |                    | 0.05<br>0.05<br>0.05  | 0.05<br>0.05<br>0.05 | V       |
| $V_{OH}$ | HIGH Level Output Voltage                | $ I_O  < 1 \mu A$<br>$V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$                 | 4.95<br>9.95<br>14.95 |                      | 4.95<br>9.95<br>14.95 | 5<br>10<br>15           |                    | 4.95<br>0.95<br>14.95 |                      | V       |
| $V_{T-}$ | Negative-Going Threshold Voltage         | $V_{DD} = 5V, V_O = 4.5V$<br>$V_{DD} = 10V, V_O = 9V$<br>$V_{DD} = 15V, V_O = 13.5V$   | 0.7<br>1.4<br>2.1     | 2.0<br>4.0<br>6.0    | 0.7<br>1.4<br>2.1     | 1.4<br>3.2<br>5.0       | 2.0<br>4.0<br>6.0  | 0.7<br>1.4<br>2.1     | 2.0<br>4.0<br>6.0    | V       |
| $V_{T+}$ | Positive-Going Threshold Voltage         | $V_{DD} = 5V, V_O = 0.5V$<br>$V_{DD} = 10V, V_O = 1V$<br>$V_{DD} = 15V, V_O = 1.5V$    | 3.0<br>6.0<br>9.0     | 4.3<br>8.6<br>12.9   | 3.0<br>6.0<br>9.0     | 3.6<br>6.8<br>10.0      | 4.3<br>8.6<br>12.9 | 3.0<br>6.0<br>9.0     | 4.3<br>8.6<br>12.9   | V       |
| $V_H$    | Hysteresis ( $V_{T+} - V_{T-}$ ) Voltage | $V_{DD} = 5V$<br>$V_{DD} = 10V$<br>$V_{DD} = 15V$                                      | 1.0<br>2.0<br>3.0     | 3.6<br>7.2<br>10.8   | 1.0<br>2.0<br>3.0     | 2.2<br>3.6<br>5.0       | 3.6<br>7.2<br>10.8 | 1.0<br>2.0<br>3.0     | 3.6<br>7.2<br>10.8   | V       |
| $I_{OL}$ | LOW Level Output Current (Note 3)        | $V_{DD} = 5V, V_O = 0.4V$<br>$V_{DD} = 10V, V_O = 0.5V$<br>$V_{DD} = 15V, V_O = 1.5V$  | 0.64<br>1.6<br>4.2    |                      | 0.51<br>1.3<br>3.4    | 0.88<br>2.25<br>8.8     |                    | 0.36<br>0.9<br>2.4    |                      | mA      |
| $I_{OH}$ | HIGH Level Output Current (Note 3)       | $V_{DD} = 5V, V_O = 4.6V$<br>$V_{DD} = 10V, V_O = 9.5V$<br>$V_{DD} = 15V, V_O = 13.5V$ | -0.64<br>-1.6<br>-4.2 |                      | -0.51<br>-1.3<br>-3.4 | -0.88<br>-2.25<br>-8.8  |                    | -0.36<br>-0.9<br>-2.4 |                      | mA      |
| $I_{IN}$ | Input Current                            | $V_{DD} = 15V, V_{IN} = 0V$<br>$V_{DD} = 15V, V_{IN} = 15V$                            |                       | -0.1<br>0.1          |                       | $-10^{-5}$<br>$10^{-5}$ | -0.1<br>0.1        |                       | -1.0<br>1.0          | $\mu A$ |

**Note 3:**  $I_{OH}$  and  $I_{OL}$  are tested one output at a time.

### AC Electrical Characteristics (Note 4)

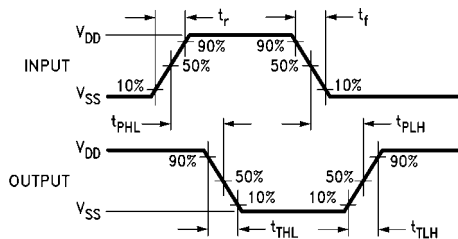
T<sub>A</sub> = 25°C, C<sub>L</sub> = 50 pF, R<sub>L</sub> = 200k, t<sub>r</sub> and t<sub>f</sub> = 20 ns, unless otherwise specified

| Symbol                               | Parameter                                   | Conditions   | Min | Typ             | Max               | Units |
|--------------------------------------|---|--|-----|-----------------|-------------------|-------|
| t <sub>PHL</sub> or t <sub>PLH</sub> | Propagation Delay Time from Input to Output | V <sub>DD</sub> = 5V<br>V <sub>DD</sub> = 10V<br>V <sub>DD</sub> = 15V |     | 220<br>80<br>70 | 400<br>200<br>160 | ns    |
| t <sub>THL</sub> or t <sub>TLH</sub> | Transition Time                             | V <sub>DD</sub> = 5V<br>V <sub>DD</sub> = 10V<br>V <sub>DD</sub> = 15V |     | 100<br>50<br>40 | 200<br>100<br>80  | ns    |
| C <sub>IN</sub>                      | Average Input Capacitance                   | Any Input  |     | 5               | 7.5               | pF    |
| C <sub>PD</sub>                      | Power Dissipation Capacity                  | Any Gate (Note 5)  |     | 14              |                   | pF    |

**Note 4:** AC Parameters are guaranteed by DC correlated testing.

**Note 5:** C<sub>PD</sub> determines the no load ac power consumption of any CMOS device. For complete explanation see 74C Family Characteristics Application Note, AN-90.

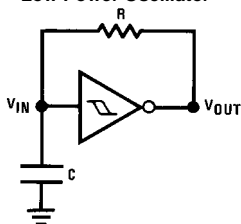
### Switching Time Waveforms



t<sub>r</sub> = t<sub>f</sub> = 20 ns

### Typical Applications

#### Low Power Oscillator



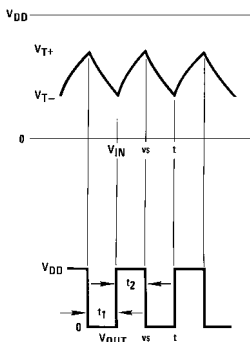
$$t_1 \approx RC \ln \frac{V_{T+}}{V_{T-}}$$

$$t_2 \approx RC \ln \frac{V_{DD} - V_{T-}}{V_{DD} - V_{T+}}$$

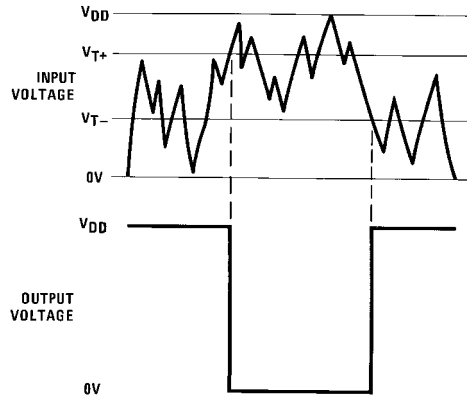
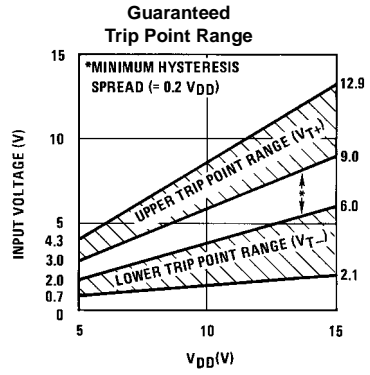
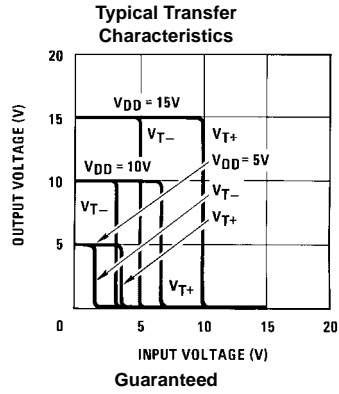
$$f \approx \frac{1}{RC \ln \frac{V_{T+} \cdot (V_{DD} - V_{T-})}{V_{T-} \cdot (V_{DD} - V_{T+})}}$$

Note: The equations assume

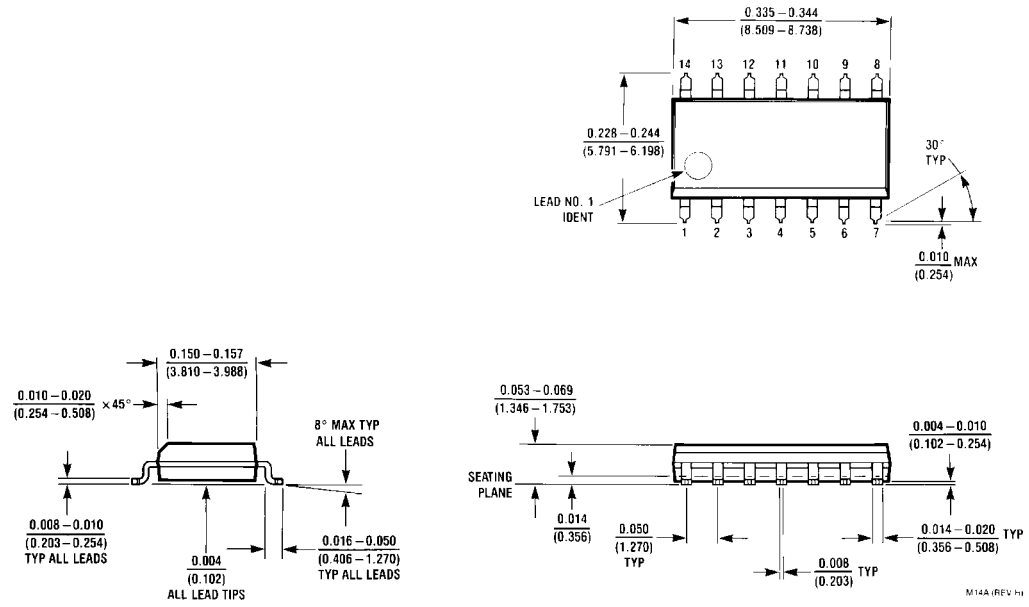
$$t_1 + t_2 \gg t_{PHL} + t_{PLH}$$



Typical Performance Characteristics

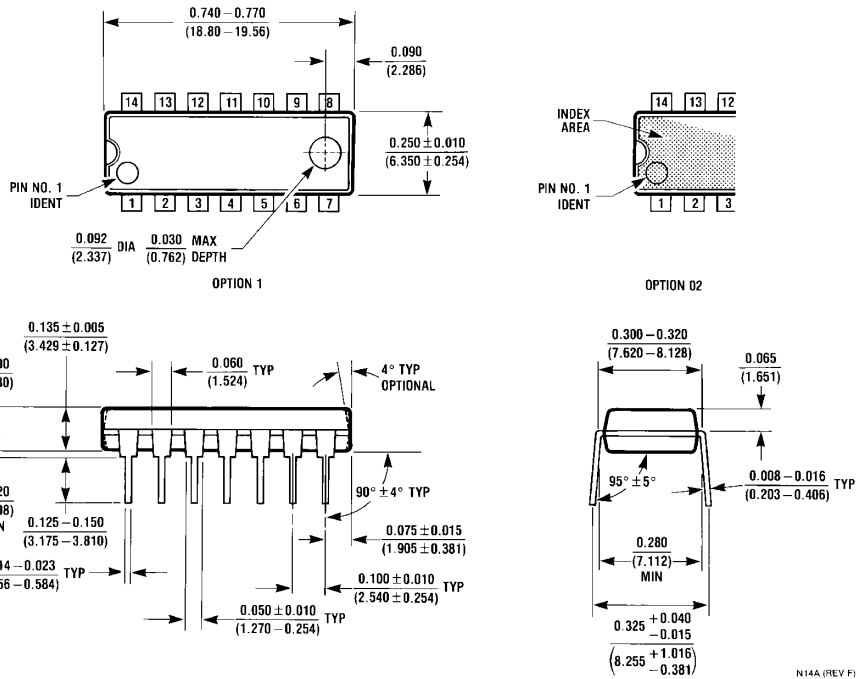


**Physical Dimensions** inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 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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