

# CD4040 12-Stage Ripple Carry Binary Counter/Divider

## 1. General Description

### 1.1 Description

CD4040 is a ripple-carry binary counter. All counter stages are master-slave flip-flops. The state of a counter advances one count on the negative transition of each input pulse; a high level on the RESET line resets the counter to its all zeros state. Schmitt trigger action on the input-pulse line permits unlimited rise and fall times. All inputs and outputs are buffered.

### 1.2 Features

- Medium-speed operation
- Fully static operation
- Buffered inputs and outputs

- Standardized symmetrical output characteristics
- Common reset
- 100% tested for quiescent current at 18V
- Maximum input current of 1 $\mu$ A at 18V and 25 $^{\circ}$ C
- 5V, 10V, and 15V parametric ratings

### 1.3 Device Information

| PART NUMBER | PACKAGE |
|-------------|---------|
| CD4040      | DIP     |
|             | SOP     |
|             | TSSOP   |

## 2. Pin Description and Functional Diagram

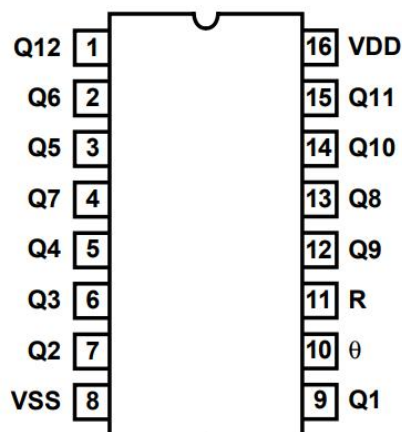


Figure 2.1 Top View

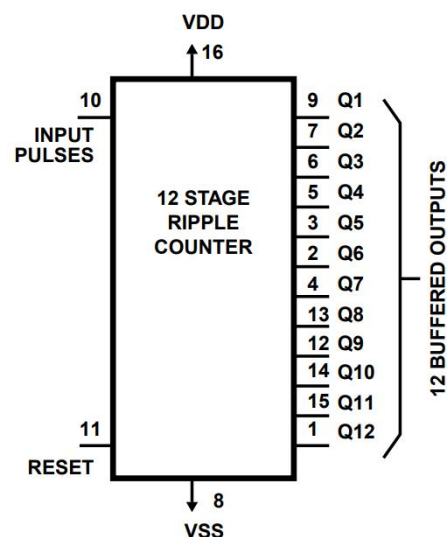


Figure 2.2 Functional Diagram

| PIN No. | NAME     | I/O | FUNCTION                                 |
|---------|----------|-----|------------------------------------------|
| 1       | Q12      | O   | Parallel Output                          |
| 2       | Q6       | O   | Parallel Output                          |
| 3       | Q5       | O   | Parallel Output                          |
| 4       | Q7       | O   | Parallel Output                          |
| 5       | Q4       | O   | Parallel Output                          |
| 6       | Q3       | O   | Parallel Output                          |
| 7       | Q2       | O   | Parallel Output                          |
| 8       | VSS      |     | Ground                                   |
| 9       | Q1       | O   | Parallel Output                          |
| 10      | $\theta$ | I   | Clock Input (HIGH-to-LOW edge triggered) |
| 11      | R        | I   | Reset Input (active HIGH)                |
| 12      | Q9       | O   | Parallel Output                          |
| 13      | Q8       | O   | Parallel Output                          |
| 14      | Q10      | O   | Parallel Output                          |
| 15      | Q11      | O   | Parallel Output                          |
| 16      | VDD      |     | Supply Voltage                           |

## 3. System Diagram

### 3.1 Logic Diagram

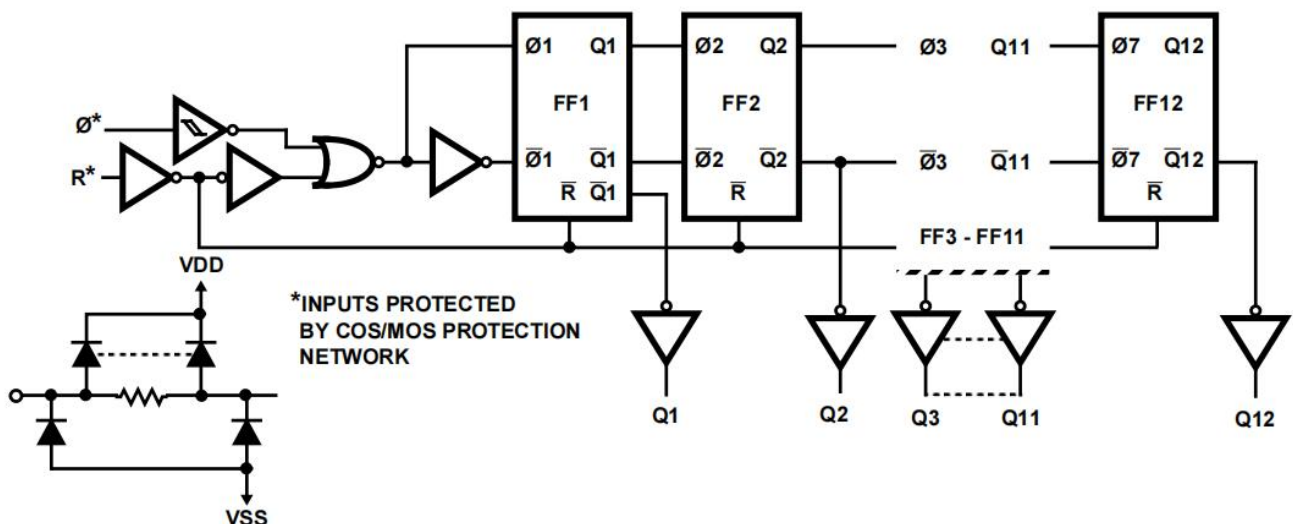


Figure 3.1: CD4040 Logic Diagram



## 4. Specifications

### 4.1 Absolute Maximum Ratings

| Symbol          | Parameter                                                        | MIN  | MAX                  | Unit |
|-----------------|------------------------------------------------------------------|------|----------------------|------|
| V <sub>DD</sub> | DC Supply Voltage Range<br>(Voltage Referenced to VSS Terminals) | -0.5 | 20                   | V    |
| V <sub>I</sub>  | Input Voltage Range, All Inputs                                  | 0.5  | V <sub>DD</sub> +0.5 | V    |
| P <sub>D</sub>  | Power Dissipation                                                |      | 500                  | mW   |
| T <sub>J</sub>  | Junction Temperature                                             |      | 125                  | °C   |
| T <sub>OP</sub> | Operating Temperature                                            | -40  | 85                   | °C   |

Absolute maximum ratings are those values beyond which the device could be permanently damaged. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under normal operating conditions.

### 4.2 Electrical Characteristics

#### 4.2.1 DC Specifications

(T<sub>a</sub>=25°C, voltages are referenced to VSS (ground=0V), unless otherwise specified)

| Symbol          | Parameter                 | Test Condition |                 |                 | MIN   | TYP  | MAX  | Unit |
|-----------------|---------------------------|----------------|-----------------|-----------------|-------|------|------|------|
|                 |                           | V <sub>O</sub> | V <sub>IN</sub> | V <sub>DD</sub> |       |      |      |      |
| I <sub>DD</sub> | Supply Current            | --             | 0,5             | 5               | --    | 0    | 1    | uA   |
|                 |                           | --             | 0,10            | 10              | --    | 0    | 1    | uA   |
|                 |                           | --             | 0,18            | 18              | --    | 0    | 1    | uA   |
| I <sub>OL</sub> | Low Level Output Current  | 0.4            | 0,5             | 5               | 0.5   | 1.5  | --   | mA   |
|                 |                           | 0.5            | 0,10            | 10              | 2     | 4    | --   | mA   |
|                 |                           | 1.5            | 0,15            | 15              | 7     | 15   | --   | mA   |
| I <sub>OH</sub> | High Level Output Current | 4.6            | 0,5             | 5               | -0.5  | -1   | --   | mA   |
|                 |                           | 2.5            | 0,5             | 5               | -2    | -4   | --   | mA   |
|                 |                           | 9.5            | 0,10            | 10              | -1.3  | -2.2 | --   | mA   |
|                 |                           | 13.5           | 0,15            | 15              | -4    | -8   | --   | mA   |
| V <sub>OL</sub> | Low Level Output Voltage  | --             | 0,5             | 5               | --    | 0    | 0.05 | V    |
|                 |                           | --             | 0,10            | 10              | --    | 0    | 0.05 | V    |
|                 |                           | --             | 0,15            | 15              | --    | 0    | 0.05 | V    |
| V <sub>OH</sub> | High Level Output Voltage | --             | 0,5             | 5               | 4.95  | 5    | --   | V    |
|                 |                           | --             | 0,10            | 10              | 9.95  | 10   | --   | V    |
|                 |                           | --             | 0,15            | 15              | 14.95 | 15   | --   | V    |
| V <sub>IL</sub> | Low Level Input Voltage   | 0.5,4.5        | --              | 5               | --    | --   | 1.5  | V    |
|                 |                           | 1,9            | --              | 10              | --    | --   | 3    | V    |
|                 |                           | 1.5,13.5       | --              | 15              | --    | --   | 4    | V    |
| V <sub>IH</sub> | High Level Input Voltage  | 0.5,4.5        | --              | 5               | 3.5   | --   | --   | V    |
|                 |                           | 1,9            | --              | 10              | 7     | --   | --   | V    |
|                 |                           | 1.5,13.5       | --              | 15              | 11    | --   | --   | V    |
| I <sub>IN</sub> | Input Leakage Current     | --             | 0,18            | 18              | --    | 0    | ±1   | uA   |



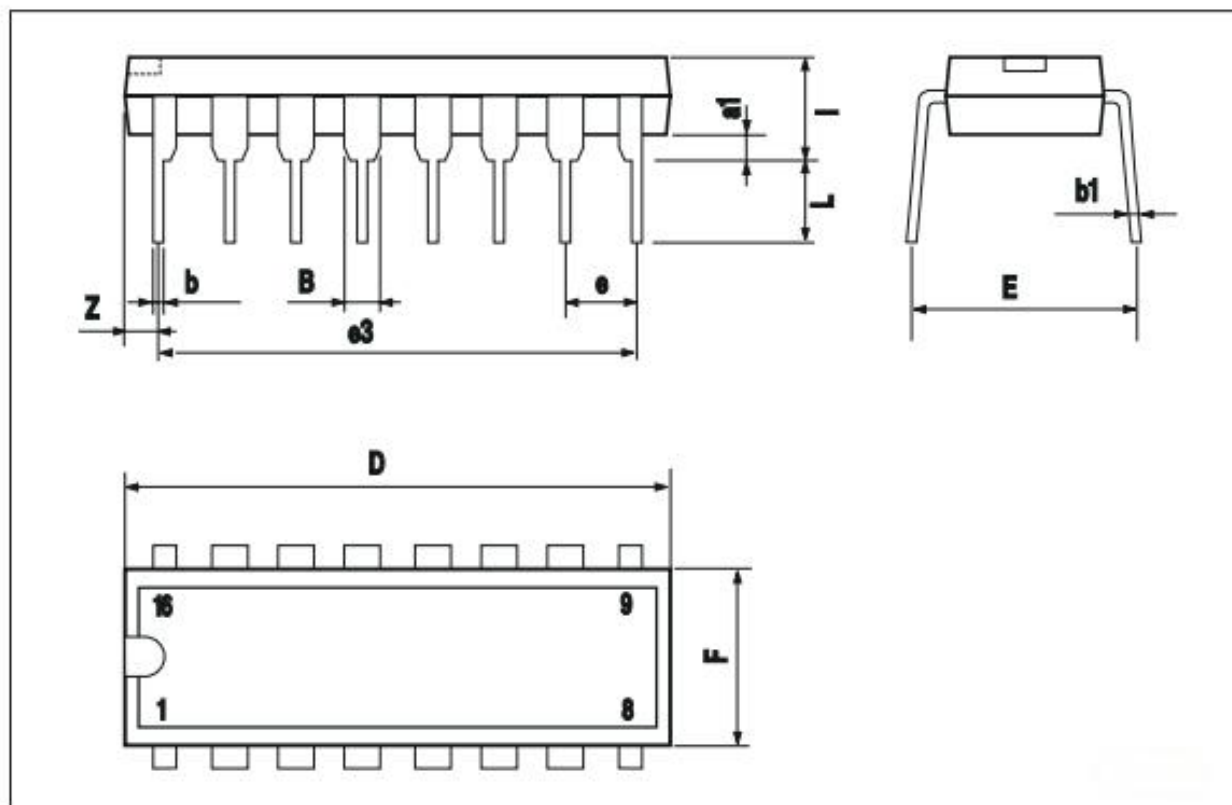
## 5. Ordering Information

| Orderable Device | Package Type | Pins | Packing     | Package Qty |
|------------------|--------------|------|-------------|-------------|
| CD4040ND16ATBE   | DIP          | 16   | Tube        | 25          |
| CD4040NS16ARDQ   | SOP          | 16   | Tape & Reel | 4000        |
| CD4040TS16ARDQ   | TSSOP        | 16   | Tape & Reel | 4000        |

## 6. Package Information

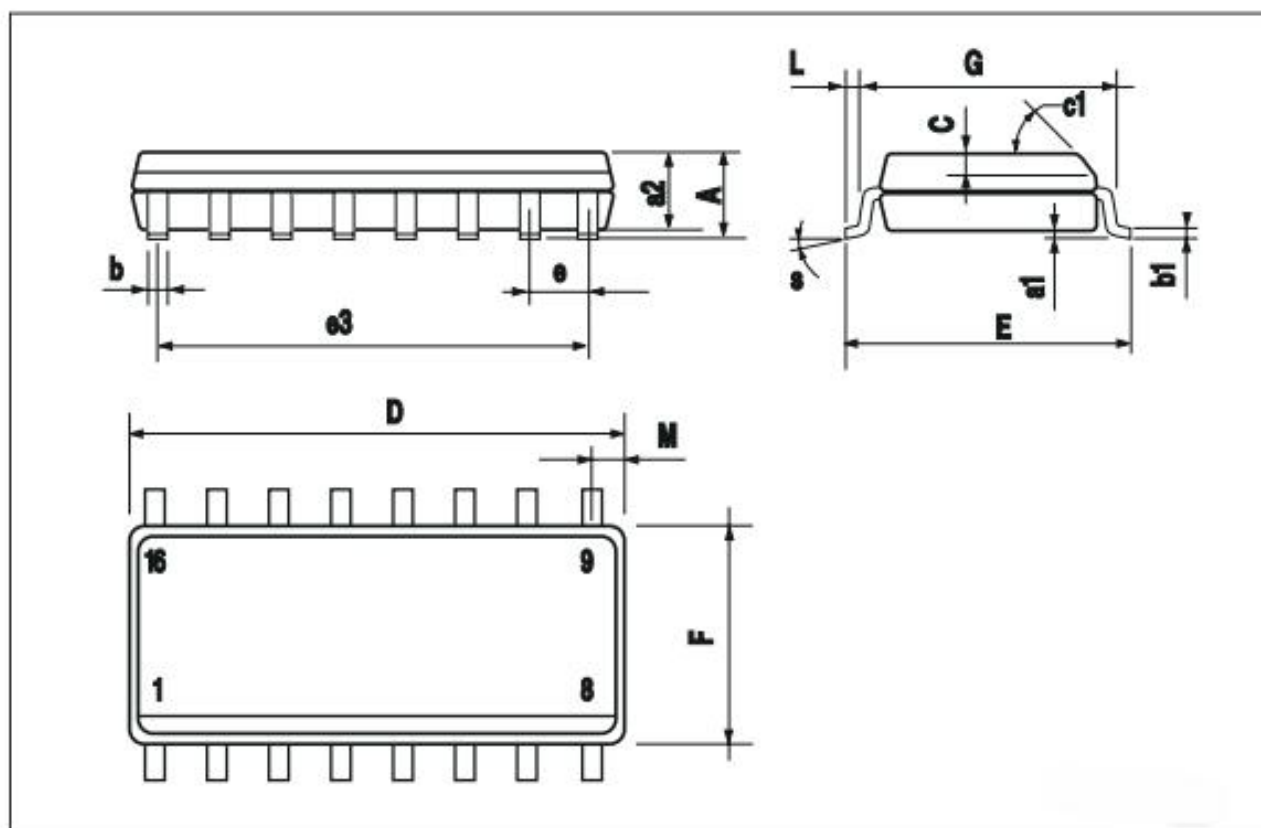
### 6.1 DIP16

| Dim. | mm.  |       |      | inch. |       |       |
|------|------|-------|------|-------|-------|-------|
|      | Min. | Typ.  | Max. | Min.  | Typ.  | Max.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 0.020 |       |
| b1   |      | 0.25  |      |       | 0.010 |       |
| D    |      |       | 20   |       |       | 0.787 |
| E    |      | 8.5   |      |       | 0.335 |       |
| e    |      | 2.54  |      |       | 0.100 |       |
| e3   |      | 17.78 |      |       | 0.700 |       |
| F    |      |       | 7.1  |       |       | 0.280 |
| I    |      |       | 5.1  |       |       | 0.201 |
| L    |      | 3.3   |      |       | 0.130 |       |
| Z    |      |       | 1.27 |       |       | 0.050 |



## 6.2 SOP16

| Dim. | mm.        |      |      | inch. |       |       |
|------|------------|------|------|-------|-------|-------|
|      | Min.       | Typ. | Max. | Min.  | Typ.  | Max.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.25 | 0.004 |       | 0.010 |
| a2   |            |      | 1.64 |       |       | 0.063 |
| b    | 0.35       |      | 0.46 | 0.013 |       | 0.018 |
| b1   | 0.19       |      | 0.25 | 0.007 |       | 0.010 |
| C    |            | 0.5  |      |       | 0.019 |       |
| c1   | 45° (typ.) |      |      |       |       |       |
| D    | 9.8        |      | 10   | 0.385 |       | 0.393 |
| E    | 5.8        |      | 6.2  | 0.228 |       | 0.244 |
| e    |            | 1.27 |      |       | 0.050 |       |
| e3   |            | 8.89 |      |       | 0.350 |       |
| F    | 3.8        |      | 4.0  | 0.149 |       | 0.157 |
| G    | 4.6        |      | 5.3  | 0.181 |       | 0.208 |
| L    | 0.5        |      | 1.27 | 0.019 |       | 0.050 |
| M    |            |      | 0.62 |       |       | 0.024 |
| S    | 8° (max.)  |      |      |       |       |       |



## 6.3 TSSOP16

| Dim. | mm.  |          |      | inch. |            |        |
|------|------|----------|------|-------|------------|--------|
|      | Min. | Typ.     | Max. | Min.  | Typ.       | Max.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2   | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b    | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c    | 0.09 |          | 0.20 | 0.004 |            | 0.0079 |
| D    | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |
| E    | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K    | 0°   |          | 8°   | 0°    |            | 8°     |
| L    | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |

