

# MC14569B

## Programmable Divide-By-N Dual 4-Bit Binary/BCD Down Counter

The MC14569B is a programmable divide-by-N dual 4-bit binary or BCD down counter constructed with MOS P-channel and N-channel enhancement mode devices (complementary MOS) in a monolithic structure.

This device has been designed for use with the MC14568B phase comparator/counter in frequency synthesizers, phase-locked loops, and other frequency division applications requiring low power dissipation and/or high noise immunity.

- Speed-up Circuitry for Zero Detection
- Each 4-Bit Counter Can Divide Independently in BCD or Binary Mode
- Can be Cascaded With MC14568B, MC14522B or MC14526B for Frequency Synthesizer Applications
- All Outputs are Buffered
- Schmitt Triggered Clock Conditioning

### MAXIMUM RATINGS\* (Voltages Referenced to V<sub>SS</sub>)

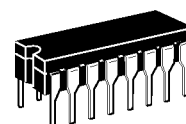
| Symbol                             | Parameter                                          | Value                          | Unit |
|------------------------------------|----------------------------------------------------|--------------------------------|------|
| V <sub>DD</sub>                    | DC Supply Voltage                                  | - 0.5 to + 18.0                | V    |
| V <sub>in</sub> , V <sub>out</sub> | Input or Output Voltage (DC or Transient)          | - 0.5 to V <sub>DD</sub> + 0.5 | V    |
| I <sub>in</sub> , I <sub>out</sub> | Input or Output Current (DC or Transient), per Pin | ± 10                           | mA   |
| P <sub>D</sub>                     | Power Dissipation, per Package†                    | 500                            | mW   |
| T <sub>stg</sub>                   | Storage Temperature                                | - 65 to + 150                  | °C   |
| T <sub>L</sub>                     | Lead Temperature (8-Second Soldering)              | 260                            | °C   |

\* Maximum Ratings are those values beyond which damage to the device may occur.

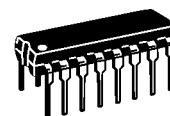
† Temperature Derating:

Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°C

Ceramic "L" Packages: - 12 mW/°C From 100°C To 125°C



**L SUFFIX**  
CERAMIC  
CASE 620



**P SUFFIX**  
PLASTIC  
CASE 648



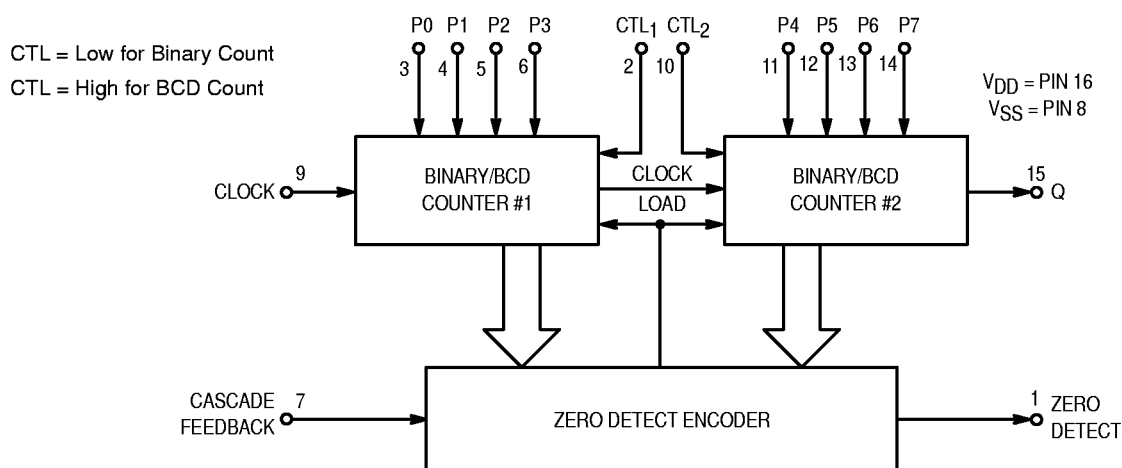
**DW SUFFIX**  
SOIC  
CASE 751G

### ORDERING INFORMATION

|            |         |
|------------|---------|
| MC14XXXBCP | Plastic |
| MC14XXXBCL | Ceramic |
| MC14XXXBDW | SOIC    |

T<sub>A</sub> = - 55° to 125°C for all packages.

### BLOCK DIAGRAM



**ELECTRICAL CHARACTERISTICS** (Voltages Referenced to  $V_{SS}$ )

| Characteristic                                                                                                                                                                                           | Symbol             | $V_{DD}$<br>Vdc | – 55°C                                                                                                            |           | 25°C   |               |           | 125°C  |           | Unit      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|-------------------------------------------------------------------------------------------------------------------|-----------|--------|---------------|-----------|--------|-----------|-----------|
|                                                                                                                                                                                                          |                    |                 | Min                                                                                                               | Max       | Min    | Typ #         | Max       | Min    | Max       |           |
| Output Voltage<br>“0” Level<br>$V_{in} = V_{DD}$ or 0                                                                                                                                                    | $V_{OL}$           | 5.0             | —                                                                                                                 | 0.05      | —      | 0             | 0.05      | —      | 0.05      | Vdc       |
|                                                                                                                                                                                                          |                    | 10              | —                                                                                                                 | 0.05      | —      | 0             | 0.05      | —      | 0.05      |           |
|                                                                                                                                                                                                          |                    | 15              | —                                                                                                                 | 0.05      | —      | 0             | 0.05      | —      | 0.05      |           |
|                                                                                                                                                                                                          | $V_{OH}$           | 5.0             | 4.95                                                                                                              | —         | 4.95   | 5.0           | —         | 4.95   | —         | Vdc       |
|                                                                                                                                                                                                          |                    | 10              | 9.95                                                                                                              | —         | 9.95   | 10            | —         | 9.95   | —         |           |
|                                                                                                                                                                                                          |                    | 15              | 14.95                                                                                                             | —         | 14.95  | 15            | —         | 14.95  | —         |           |
| Input Voltage<br>“0” Level<br>( $V_O = 4.5$ or $0.5$ Vdc)<br>( $V_O = 9.0$ or $1.0$ Vdc)<br>( $V_O = 13.5$ or $1.5$ Vdc)                                                                                 | $V_{IL}$           | 5.0             | —                                                                                                                 | 1.5       | —      | 2.25          | 1.5       | —      | 1.5       | Vdc       |
|                                                                                                                                                                                                          |                    | 10              | —                                                                                                                 | 3.0       | —      | 4.50          | 3.0       | —      | 3.0       |           |
|                                                                                                                                                                                                          |                    | 15              | —                                                                                                                 | 4.0       | —      | 6.75          | 4.0       | —      | 4.0       |           |
|                                                                                                                                                                                                          | $V_{IH}$           | 5.0             | 3.5                                                                                                               | —         | 3.5    | 2.75          | —         | 3.5    | —         | Vdc       |
|                                                                                                                                                                                                          |                    | 10              | 7.0                                                                                                               | —         | 7.0    | 5.50          | —         | 7.0    | —         |           |
|                                                                                                                                                                                                          |                    | 15              | 11                                                                                                                | —         | 11     | 8.25          | —         | 11     | —         |           |
| Output Drive Current<br>( $V_{OH} = 2.5$ Vdc)<br>( $V_{OH} = 4.6$ Vdc)<br>( $V_{OH} = 9.5$ Vdc)<br>( $V_{OH} = 13.5$ Vdc)<br><br>( $V_{OL} = 0.4$ Vdc)<br>( $V_{OL} = 0.5$ Vdc)<br>( $V_{OL} = 1.5$ Vdc) | Source<br>$I_{OH}$ | 5.0             | – 3.0                                                                                                             | —         | – 2.4  | – 4.2         | —         | – 1.7  | —         | mAdc      |
|                                                                                                                                                                                                          |                    | 5.0             | – 0.64                                                                                                            | —         | – 0.51 | – 0.88        | —         | – 0.36 | —         |           |
|                                                                                                                                                                                                          |                    | 10              | – 1.6                                                                                                             | —         | – 1.3  | – 2.25        | —         | – 0.9  | —         |           |
|                                                                                                                                                                                                          |                    | 15              | – 4.2                                                                                                             | —         | – 3.4  | – 8.8         | —         | – 2.4  | —         |           |
|                                                                                                                                                                                                          | Sink<br>$I_{OL}$   | 5.0             | 0.64                                                                                                              | —         | 0.51   | 0.88          | —         | 0.36   | —         | mAdc      |
|                                                                                                                                                                                                          |                    | 10              | 1.6                                                                                                               | —         | 1.3    | 2.25          | —         | 0.9    | —         |           |
|                                                                                                                                                                                                          |                    | 15              | 4.2                                                                                                               | —         | 3.4    | 8.8           | —         | 2.4    | —         |           |
| Input Current                                                                                                                                                                                            | $I_{in}$           | 15              | —                                                                                                                 | $\pm 0.1$ | —      | $\pm 0.00001$ | $\pm 0.1$ | —      | $\pm 1.0$ | $\mu$ Adc |
| Input Capacitance<br>( $V_{in} = 0$ )                                                                                                                                                                    | $C_{in}$           | —               | —                                                                                                                 | —         | —      | 5.0           | 7.5       | —      | —         | pF        |
| Quiescent Current<br>(Per Package)                                                                                                                                                                       | $I_{DD}$           | 5.0             | —                                                                                                                 | 5.0       | —      | 0.005         | 5.0       | —      | 150       | $\mu$ Adc |
|                                                                                                                                                                                                          |                    | 10              | —                                                                                                                 | 10        | —      | 0.010         | 10        | —      | 300       |           |
|                                                                                                                                                                                                          |                    | 15              | —                                                                                                                 | 20        | —      | 0.015         | 20        | —      | 600       |           |
| Total Supply Current**†<br>(Dynamic plus Quiescent,<br>Per Package)<br>( $C_L = 50$ pF on all outputs, all<br>buffers switching)                                                                         | $I_T$              | 5.0<br>10<br>15 | $I_T = (0.58 \mu A/kHz) f + I_{DD}$<br>$I_T = (1.20 \mu A/kHz) f + I_{DD}$<br>$I_T = (1.95 \mu A/kHz) f + I_{DD}$ |           |        |               |           |        |           | $\mu$ Adc |

#Data labelled “Typ” is not to be used for design purposes but is intended as an indication of the IC’s potential performance.

\*\*The formulas given are for the typical characteristics only at 25°C.

†To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) Vfk$$

where:  $I_T$  is in  $\mu A$  (per package),  $C_L$  in pF,  $V = (V_{DD} - V_{SS})$  in volts,  $f$  in kHz is input frequency, and  $k = 0.001$ .

**This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$ .**

**Unused inputs must always be tied to an appropriate logic voltage level (e.g., either  $V_{SS}$  or  $V_{DD}$ ). Unused outputs must be left open.**

**SWITCHING CHARACTERISTICS\*** ( $C_L = 50 \text{ pF}$ ,  $T_A = 25^\circ\text{C}$ )

| Characteristic                                            | Symbol                | $V_{DD}$<br>Vdc | All Types |       |      | Unit          |
|-----------------------------------------------------------|-----------------------|-----------------|-----------|-------|------|---------------|
|                                                           |                       |                 | Min       | Typ # | Max  |               |
| Output Rise Time                                          | $t_{TLH}$             | 5.0             | —         | 100   | 200  | ns            |
|                                                           |                       | 10              | —         | 50    | 100  |               |
|                                                           |                       | 15              | —         | 40    | 80   |               |
| Output Fall Time                                          | $t_{THL}$             | 5.0             | —         | 100   | 200  | ns            |
|                                                           |                       | 10              | —         | 50    | 100  |               |
|                                                           |                       | 15              | —         | 40    | 80   |               |
| Turn—On Delay Time<br>Zero Detect Output<br><br>Q Output  | $t_{PLH}$             | 5.0             | —         | 420   | 700  | ns            |
|                                                           |                       | 10              | —         | 175   | 300  |               |
|                                                           |                       | 15              | —         | 125   | 250  |               |
|                                                           |                       | 5.0             | —         | 675   | 1200 | ns            |
|                                                           |                       | 10              | —         | 285   | 500  |               |
|                                                           |                       | 15              | —         | 200   | 400  |               |
| Turn—Off Delay Time<br>Zero Detect Output<br><br>Q Output | $t_{PHL}$             | 5.0             | —         | 380   | 600  | ns            |
|                                                           |                       | 10              | —         | 150   | 300  |               |
|                                                           |                       | 15              | —         | 100   | 200  |               |
|                                                           |                       | 5.0             | —         | 530   | 1000 | ns            |
|                                                           |                       | 10              | —         | 225   | 400  |               |
|                                                           |                       | 15              | —         | 155   | 300  |               |
| Clock Pulse Width                                         | $t_{WH}$              | 5.0             | 300       | 100   | —    | ns            |
|                                                           |                       | 10              | 150       | 45    | —    |               |
|                                                           |                       | 15              | 115       | 30    | —    |               |
| Clock Pulse Frequency                                     | $f_{cl}$              | 5.0             | —         | 3.5   | 2.1  | MHz           |
|                                                           |                       | 10              | —         | 9.5   | 5.1  |               |
|                                                           |                       | 15              | —         | 13.0  | 7.8  |               |
| Clock Pulse Rise and Fall Time                            | $t_{TLH}$ , $t_{THL}$ | 5.0             | NO LIMIT  |       |      | $\mu\text{s}$ |
|                                                           |                       | 10              |           |       |      |               |
|                                                           |                       | 15              |           |       |      |               |

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

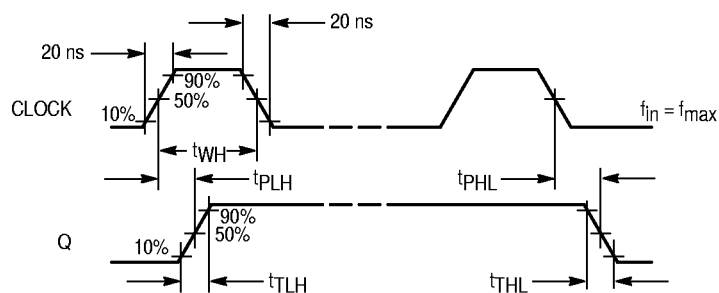
**SWITCHING WAVEFORMS**


Figure 1.

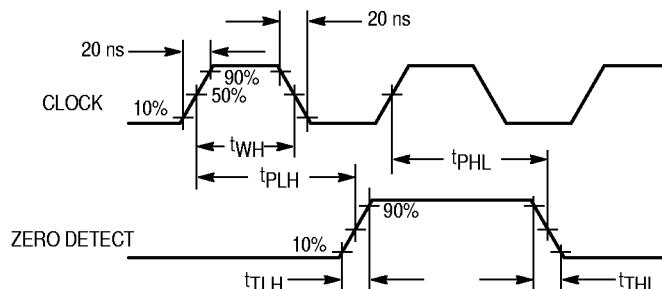


Figure 2.

## PIN DESCRIPTIONS

### INPUTS

**P0, P1, P2, P3 (Pins 3, 4, 5, 6)** — Preset Inputs. Programmable inputs for the least significant counter. May be binary or BCD depending on the control input.

**P4, P5, P6, P7 (Pins 11, 12, 13, 14)** — Preset Inputs. Programmable inputs for the most significant counter. May be binary or BCD depending on the control input.

**Clock (Pin 9)** — Preset data is decremented by one on each positive transition of this signal.

### OUTPUTS

**Zero Detect (Pin 1)** — This output is normally low and goes high for one clock cycle when the counter has decremented to zero.

**Q (Pin 15)** — Output of the last stage of the most significant counter. This output will be inactive unless the preset input P7 has been set high.

### CONTROLS

**Cascade Feedback (Pin 7)** — This pin is normally set high. When low, loading of the preset inputs (P0 through P7) is inhibited, i.e., P0 through P7 are “don't cares.” Refer to Table 1 for output characteristics.

**CTL<sub>1</sub> (Pin 2)** — This pin controls the counting mode of the least significant counter. When set high, counting mode is BCD. When set low, counting mode is binary.

**CTL<sub>2</sub> (Pin 10)** — This pin controls the counting mode of the most significant counter. When set high, counting mode is BCD. When set low, counting mode is binary.

### SUPPLY PINS

**V<sub>SS</sub> (Pin 18)** — Negative Supply Voltage. This pin is usually connected to ground.

**V<sub>DD</sub> (Pin 16)** — Positive Supply Voltage. This pin is connected to a positive supply voltage ranging from 3.0 volts to 18.0 volts.

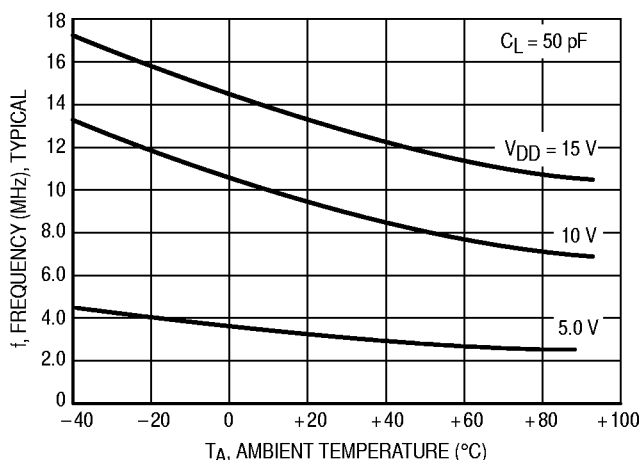
## OPERATING CHARACTERISTICS

The MC14569B is a programmable divide-by-N dual 4-bit down counter. This counter may be programmed (i.e., preset) in BCD or binary code through inputs P0 to P7. For each counter, the counting sequence may be chosen independently by applying a high (for BCD count) or a low (for binary count) to the control inputs CTL<sub>1</sub> and CTL<sub>2</sub>.

The divide ratio N (N being the value programmed on the preset inputs P0 to P7) is automatically loaded into the counter as soon as the count 1 is detected. Therefore, a division ratio of one is not possible. After N clock cycles, one

pulse appears on the Zero Detect output. (See Timing Diagram.) The Q output is the output of the last stage of the most significant counter (See Tables 1 through 5, Mode Controls.)

When cascading the MC14569B to the MC14568B, MC14522B or the MC14526B, the Cascade Feedback input, Q, and Zero Detect outputs must be respectively connected to “0”, Clock, and Load of the following counter. If the MC14569B is used alone, Cascade Feedback must be connected to V<sub>DD</sub>.



### PIN ASSIGNMENT

|                  |   |    |                  |
|------------------|---|----|------------------|
| ZERO DETECT      | 1 | 16 | V <sub>DD</sub>  |
| CTL <sub>1</sub> | 2 | 15 | Q                |
| P0               | 3 | 14 | P7               |
| P1               | 4 | 13 | P6               |
| P2               | 5 | 12 | P5               |
| P3               | 6 | 11 | P4               |
| CASCADE FEEDBACK | 7 | 10 | CTL <sub>2</sub> |
| V <sub>SS</sub>  | 8 | 9  | CLOCK            |

**Table 1. Mode Controls** (Cascade Feedback = Low)

| Counter Control Values |                  | Divide Ratio |     |
|------------------------|------------------|--------------|-----|
| CTL <sub>1</sub>       | CTL <sub>2</sub> | Zero Detect  | Q   |
| 0                      | 0                | 256          | 256 |
| 0                      | 1                | 160          | 160 |
| 1                      | 0                | 160          | 160 |
| 1                      | 1                | 100          | 100 |

NOTE: Data Preset Inputs (P0–P7) are “Don’t Cares” while Cascade Feedback is Low.

**Table 2. Mode Controls** (CTL<sub>1</sub> = Low, CTL<sub>2</sub> = Low, Cascade Feedback = High)

| Preset Inputs         |                      |                      |                      |                      |                     |                     |                     | Divide Ratio |     | Comments                                |
|-----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|--------------|-----|-----------------------------------------|
| P7                    | P6                   | P5                   | P4                   | P3                   | P2                  | P1                  | P0                  | Zero Detect  | Q   |                                         |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 0                   | 0                   | 256          | 256 | Max Count<br>Illegal State<br>Min Count |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 0                   | 1                   | X            | X   |                                         |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 1                   | 0                   | 2            | X   |                                         |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 1                   | 1                   | 3            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| 0                     | 0                    | 0                    | 0                    | 1                    | 1                   | 1                   | 1                   | 15           | X   |                                         |
| 0                     | 0                    | 0                    | 1                    | 0                    | 0                   | 0                   | 0                   | 16           | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| 0                     | 0                    | 1                    | 0                    | 0                    | 0                   | 0                   | 0                   | 32           | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| 0                     | 1                    | 0                    | 0                    | 0                    | 0                   | 0                   | 0                   | 64           | X   | Q Output Active<br>↓                    |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | X   |                                         |
| 0                     | 1                    | 1                    | 1                    | 1                    | 1                   | 1                   | 1                   | 127          | X   |                                         |
| 1                     | 0                    | 0                    | 0                    | 0                    | 0                   | 0                   | 0                   | 128          | 128 |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | •   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | •   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | •   |                                         |
| 1                     | 0                    | 0                    | 0                    | 1                    | 0                   | 0                   | 0                   | 136          | 136 |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | •   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | •   |                                         |
| •                     | •                    | •                    | •                    | •                    | •                   | •                   | •                   | •            | •   |                                         |
| 1                     | 1                    | 1                    | 1                    | 1                    | 1                   | 1                   | 1                   | 255          | 255 |                                         |
| 2 <sup>7</sup><br>128 | 2 <sup>6</sup><br>64 | 2 <sup>5</sup><br>32 | 2 <sup>4</sup><br>16 | 2 <sup>3</sup><br>8  | 2 <sup>2</sup><br>4 | 2 <sup>1</sup><br>2 | 2 <sup>0</sup><br>1 |              |     | Bit Value                               |
| Counter #2<br>Binary  |                      |                      |                      | Counter #1<br>Binary |                     |                     |                     |              |     | Counting<br>Sequence                    |

X = No Output (Always Low)

**Table 3. Mode Controls** (CTL<sub>1</sub> = High, CTL<sub>2</sub> = Low, Cascade Feedback = High)

| Preset Inputs        |    |    |    |                   |    |    |    | Divide Ratio |     | Comments                                |
|----------------------|----|----|----|-------------------|----|----|----|--------------|-----|-----------------------------------------|
| P7                   | P6 | P5 | P4 | P3                | P2 | P1 | P0 | Zero Detect  | Q   |                                         |
| 0                    | 0  | 0  | 0  | 0                 | 0  | 0  | 0  | 160          | 160 | Max Count<br>Illegal State<br>Min Count |
| 0                    | 0  | 0  | 0  | 0                 | 0  | 0  | 1  | X            | X   |                                         |
| 0                    | 0  | 0  | 0  | 0                 | 0  | 1  | 0  | 2            | X   |                                         |
| 0                    | 0  | 0  | 0  | 0                 | 0  | 1  | 1  | 3            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                    | 0  | 0  | 0  | 1                 | 0  | 0  | 1  | 9            | X   |                                         |
| 0                    | 0  | 0  | 1  | 0                 | 0  | 0  | 0  | 10           | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                    | 0  | 0  | 1  | 1                 | 0  | 0  | 1  | 19           | X   |                                         |
| 0                    | 0  | 1  | 0  | 0                 | 0  | 0  | 0  | 20           | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                    | 0  | 1  | 1  | 0                 | 0  | 0  | 0  | 30           | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                    | 1  | 0  | 0  | 0                 | 0  | 0  | 0  | 40           | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                    | 1  | 0  | 1  | 0                 | 0  | 0  | 0  | 50           | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                    | 1  | 1  | 0  | 0                 | 0  | 0  | 0  | 60           | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                    | 1  | 1  | 1  | 0                 | 0  | 0  | 0  | 70           | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 1                    | 0  | 0  | 0  | 0                 | 0  | 0  | 0  | 80           | 80  | Q Output Active<br>↓                    |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| 1                    | 0  | 0  | 1  | 0                 | 0  | 0  | 0  | 90           | 90  |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| 1                    | 1  | 1  | 1  | 0                 | 0  | 0  | 0  | 150          | 150 |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| .                    | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| 1                    | 1  | 1  | 1  | 1                 | 0  | 0  | 1  | 159          | 159 |                                         |
| 80                   | 40 | 20 | 10 | 8                 | 4  | 2  | 1  |              |     | Bit Value                               |
| Counter #2<br>Binary |    |    |    | Counter #1<br>BCD |    |    |    |              |     | Counting<br>Sequence                    |

X = No Output (Always Low)

**Table 4. Mode Controls** (CTL<sub>1</sub> = Low, CTL<sub>2</sub> = High, Cascade Feedback = High)

| Preset Values         |                      |                      |                      |                      |                     |                     |                     | Divide Ratio |     | Comments                                |
|-----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|--------------|-----|-----------------------------------------|
| P7                    | P6                   | P5                   | P4                   | P3                   | P2                  | P1                  | P0                  | Zero Detect  | Q   |                                         |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 0                   | 0                   | 160          | 160 | Max Count<br>Illegal State<br>Min Count |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 0                   | 1                   | X            | X   |                                         |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 1                   | 0                   | 2            | X   |                                         |
| 0                     | 0                    | 0                    | 0                    | 0                    | 0                   | 1                   | 1                   | 3            | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| 0                     | 0                    | 0                    | 0                    | 1                    | 1                   | 1                   | 1                   | 15           | X   |                                         |
| 0                     | 0                    | 0                    | 1                    | 0                    | 0                   | 0                   | 0                   | 16           | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| 0                     | 0                    | 0                    | 1                    | 1                    | 1                   | 1                   | 1                   | 31           | X   |                                         |
| 0                     | 0                    | 1                    | 0                    | 0                    | 0                   | 0                   | 0                   | 32           | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | X   |                                         |
| 0                     | 0                    | 1                    | 1                    | 0                    | 0                   | 0                   | 0                   | 48           | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   | Q Output Active<br>↓                    |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| 0                     | 1                    | 0                    | 0                    | 0                    | 0                   | 0                   | 0                   | 64           | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| 0                     | 1                    | 0                    | 1                    | 0                    | 0                   | 0                   | 0                   | 80           | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| 0                     | 1                    | 1                    | 1                    | 0                    | 0                   | 0                   | 0                   | 112          | X   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| 1                     | 0                    | 0                    | 0                    | 0                    | 0                   | 0                   | 0                   | 128          | 128 |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| 1                     | 0                    | 0                    | 1                    | 0                    | 0                   | 0                   | 0                   | 144          | 144 |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| .                     | .                    | .                    | .                    | .                    | .                   | .                   | .                   | .            | .   |                                         |
| 1                     | 0                    | 0                    | 1                    | 1                    | 1                   | 1                   | 1                   | 159          | 159 |                                         |
| 2 <sup>7</sup><br>128 | 2 <sup>6</sup><br>64 | 2 <sup>5</sup><br>32 | 2 <sup>4</sup><br>16 | 2 <sup>3</sup><br>8  | 2 <sup>2</sup><br>4 | 2 <sup>1</sup><br>2 | 2 <sup>0</sup><br>1 |              |     | Bit Value                               |
| Counter #2<br>BCD     |                      |                      |                      | Counter #1<br>Binary |                     |                     |                     |              |     | Counting<br>Sequence                    |

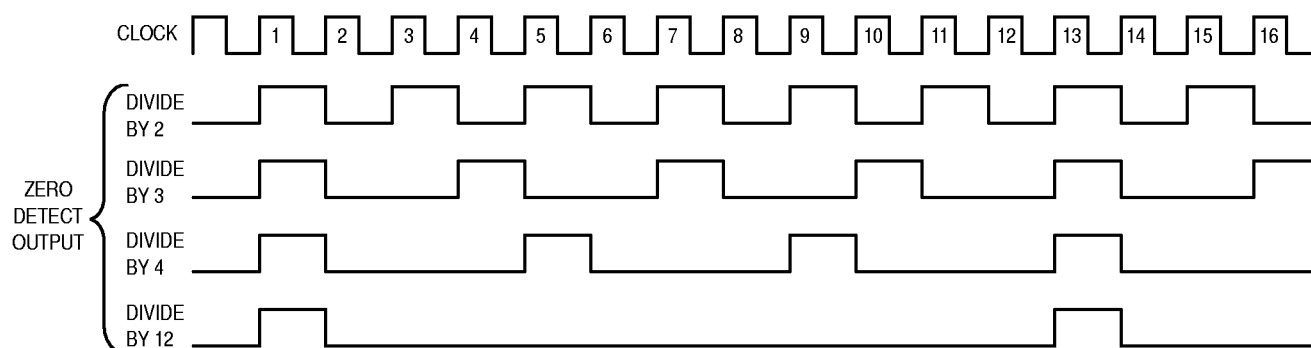
X = No Output (Always Low)

**Table 5. Mode Controls** (CTL<sub>1</sub> = High, CTL<sub>2</sub> = High, Cascade Feedback = High)

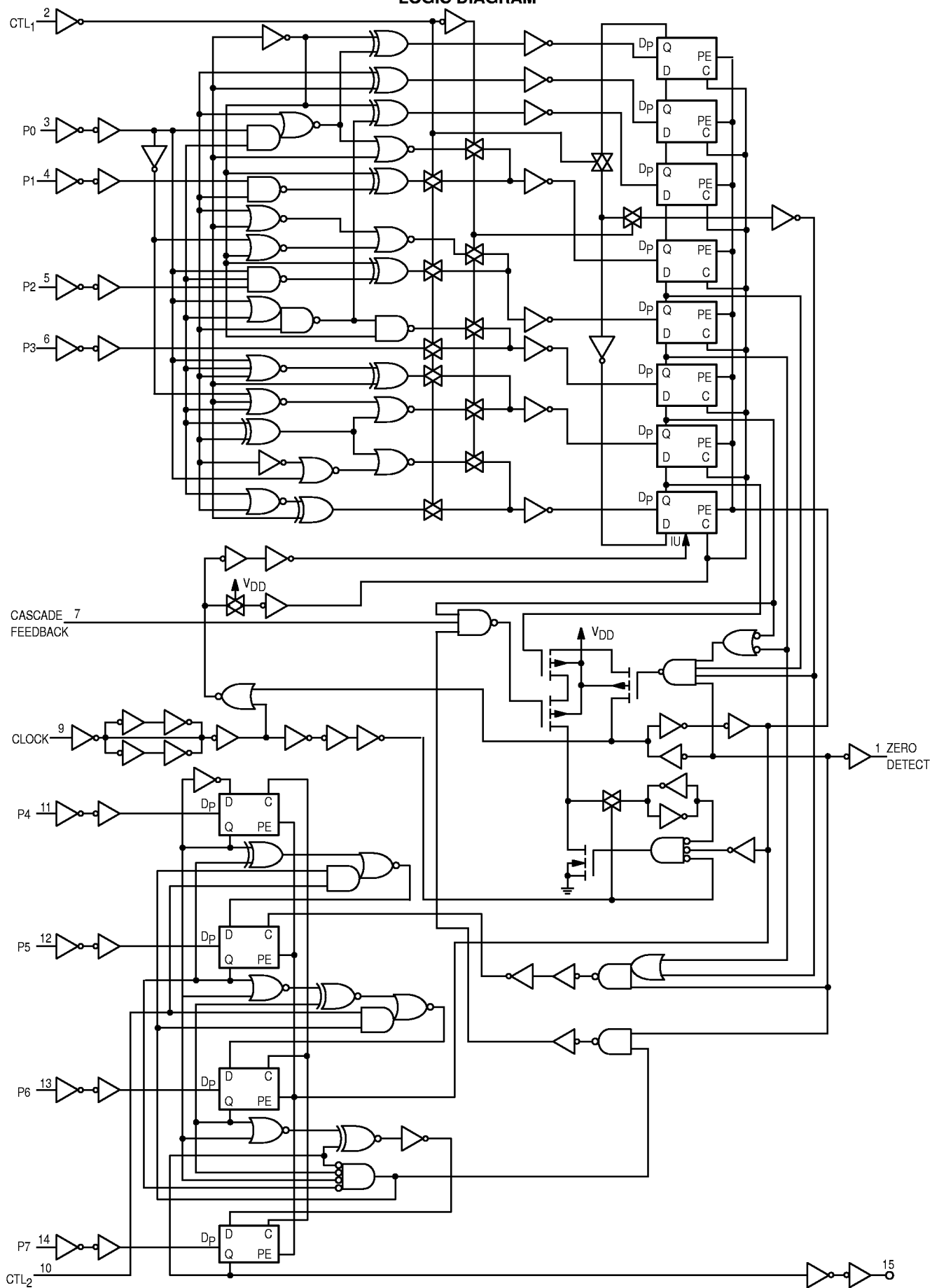
| Preset Values     |    |    |    |                   |    |    |    | Divide Ratio |     | Comments                                |
|-------------------|----|----|----|-------------------|----|----|----|--------------|-----|-----------------------------------------|
| P7                | P6 | P5 | P4 | P3                | P2 | P1 | P0 | Zero Detect  | Q   |                                         |
| 0                 | 0  | 0  | 0  | 0                 | 0  | 0  | 0  | 100          | 100 | Max Count<br>illegal state<br>Min Count |
| 0                 | 0  | 0  | 0  | 0                 | 0  | 0  | 1  | X            | X   |                                         |
| 0                 | 0  | 0  | 0  | 0                 | 0  | 1  | 0  | 2            | X   |                                         |
| 0                 | 0  | 0  | 0  | 0                 | 0  | 1  | 1  | 3            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                 | 0  | 0  | 0  | 1                 | 0  | 0  | 1  | 9            | X   |                                         |
| 0                 | 0  | 0  | 1  | 0                 | 0  | 0  | 0  | 10           | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                 | 0  | 1  | 1  | 0                 | 0  | 0  | 0  | 30           | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                 | 1  | 0  | 0  | 0                 | 0  | 0  | 0  | 40           | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                 | 1  | 0  | 1  | 0                 | 0  | 0  | 0  | 50           | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 0                 | 1  | 1  | 1  | 0                 | 0  | 0  | 0  | 70           | X   | Q Output Active<br>↓                    |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | X   |                                         |
| 1                 | 0  | 0  | 0  | 0                 | 0  | 0  | 0  | 80           | 80  |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| 1                 | 0  | 0  | 1  | 0                 | 0  | 0  | 0  | 90           | 90  |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| .                 | .  | .  | .  | .                 | .  | .  | .  | .            | .   |                                         |
| 1                 | 0  | 0  | 1  | 1                 | 0  | 0  | 1  | 99           | 99  |                                         |
| 80                | 40 | 20 | 10 | 8                 | 4  | 2  | 1  |              |     | Bit Value                               |
| Counter #2<br>BCD |    |    |    | Counter #1<br>BCD |    |    |    |              |     | Counting<br>Sequence                    |

X = No Output (Always Low)

### TIMING DIAGRAM MC14569B



# LOGIC DIAGRAM



## TYPICAL APPLICATIONS

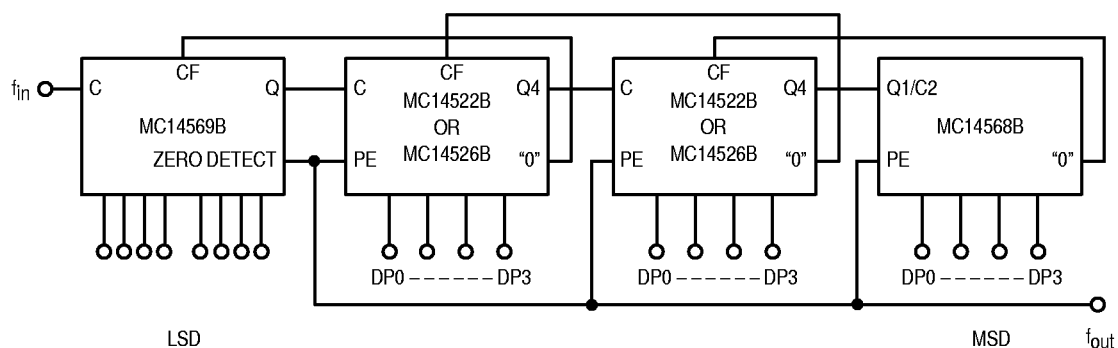


Figure 3. Cascading MC14568B and MC14522B or MC14526B with MC14569B

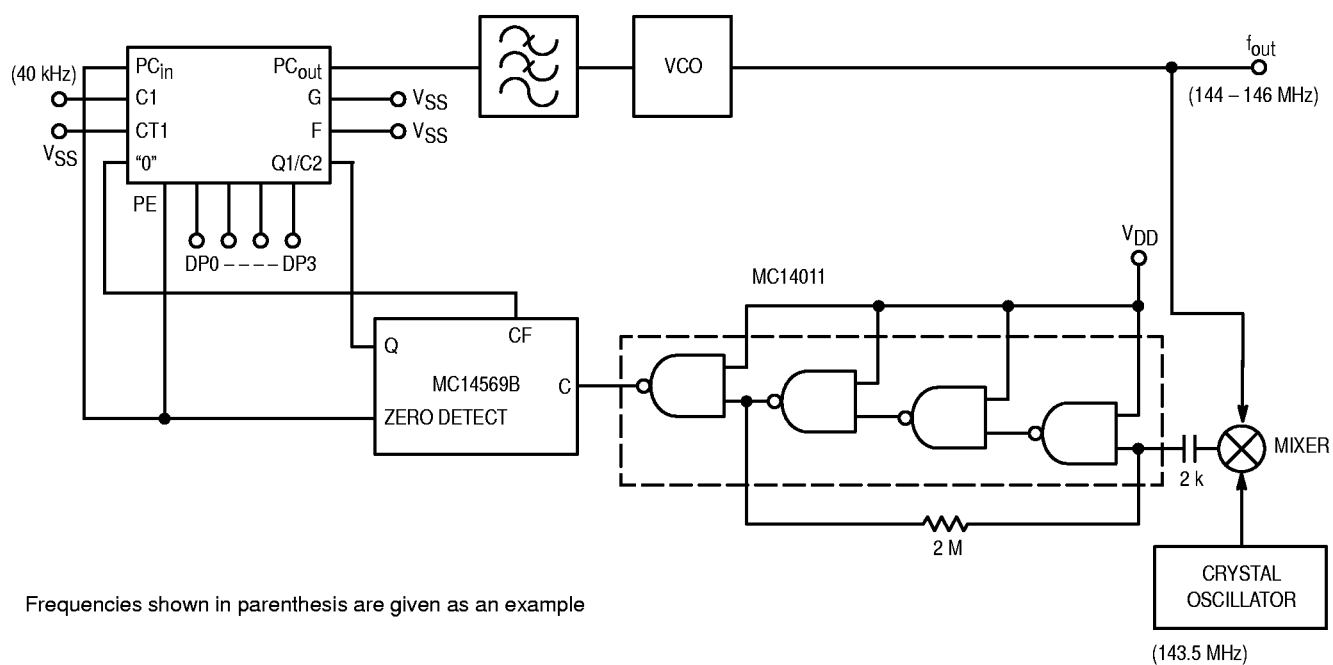
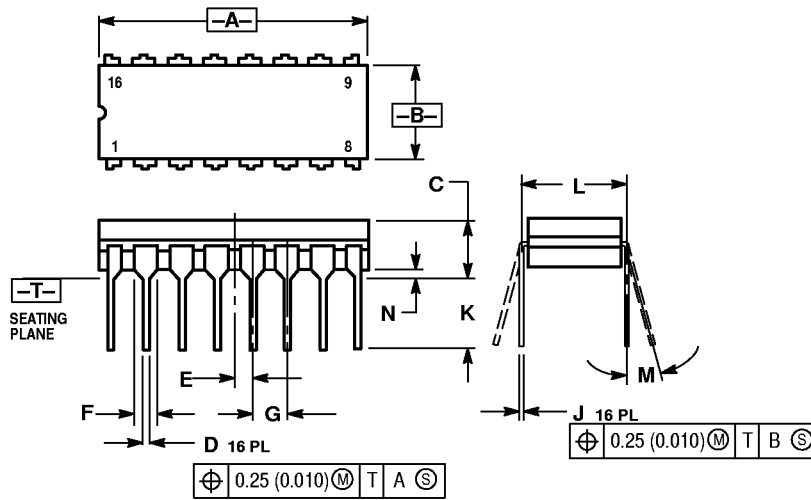


Figure 4. Frequency Synthesizer with MC14568B and MC14569B Using a Mixer  
(Channel Spacing 10 kHz)

## OUTLINE DIMENSIONS

### L SUFFIX CERAMIC DIP PACKAGE CASE 620-10 ISSUE V

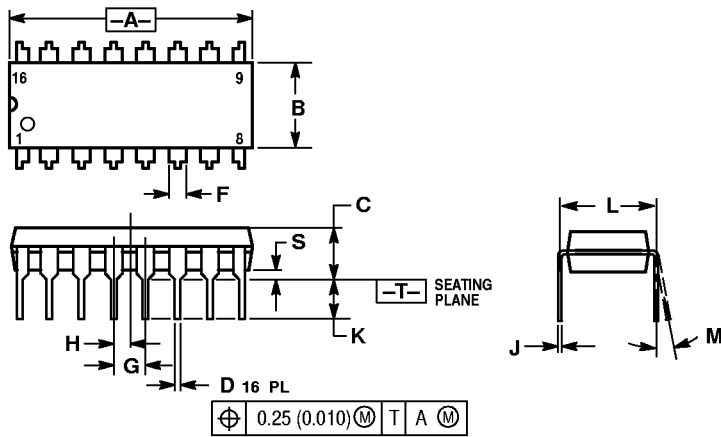


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.750     | 0.785 | 19.05       | 19.93 |
| B   | 0.240     | 0.295 | 6.10        | 7.49  |
| C   | —         | 0.200 | —           | 5.08  |
| D   | 0.015     | 0.020 | 0.39        | 0.50  |
| E   | 0.050 BSC | —     | 1.27 BSC    | —     |
| F   | 0.055     | 0.065 | 1.40        | 1.65  |
| G   | 0.100 BSC | —     | 2.54 BSC    | —     |
| H   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.125     | 0.170 | 3.18        | 4.31  |
| L   | 0.300 BSC | —     | 7.62 BSC    | —     |
| M   | 0°        | 15°   | 0°          | 15°   |
| N   | 0.020     | 0.040 | 0.51        | 1.01  |

### P SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R



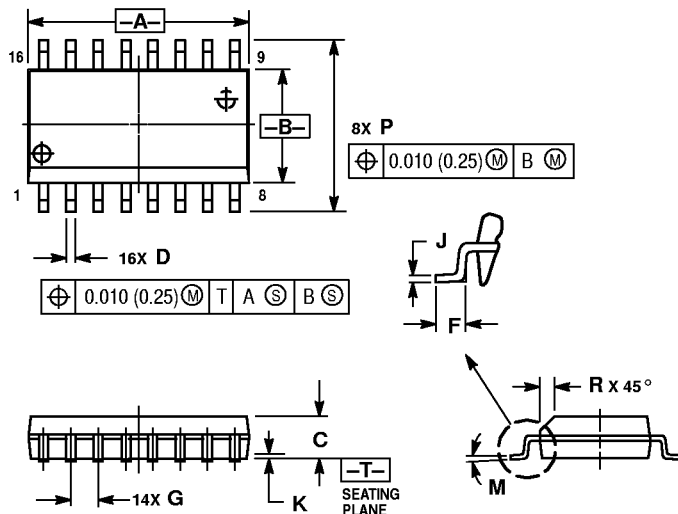
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| D   | 0.015     | 0.021 | 0.39        | 0.53  |
| F   | 0.040     | 0.70  | 1.02        | 1.77  |
| G   | 0.100 BSC | —     | 2.54 BSC    | —     |
| H   | 0.050 BSC | —     | 1.27 BSC    | —     |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.130 | 2.80        | 3.30  |
| L   | 0.295     | 0.305 | 7.50        | 7.74  |
| M   | 0°        | 10°   | 0°          | 10°   |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

## OUTLINE DIMENSIONS

### DW SUFFIX PLASTIC SOIC PACKAGE CASE 751G-02 ISSUE A



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 10.15       | 10.45 | 0.400     | 0.411 |
| B   | 7.40        | 7.60  | 0.292     | 0.299 |
| C   | 2.35        | 2.65  | 0.093     | 0.104 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| E   | 0.50        | 0.90  | 0.020     | 0.035 |
| F   | 1.27 BSC    |       | 0.050 BSC |       |
| G   | 0.25        | 0.32  | 0.010     | 0.012 |
| H   | 0.10        | 0.25  | 0.004     | 0.009 |
| J   | 0°          | 7°    | 0°        | 7°    |
| K   | 10.05       | 10.55 | 0.395     | 0.415 |
| M   | 0.25        | 0.75  | 0.010     | 0.029 |

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MC14569B/D

