

# MC14018B

## Presetable Divide-By-N Counter

The MC14018B contains five Johnson counter stages which are asynchronously presetable and resettable. The counters are synchronous, and increment on the positive going edge of the clock.

Presetting is accomplished by a logic 1 on the preset enable input. Data on the Jam inputs will then be transferred to their respective  $\bar{Q}$  outputs (inverted). A logic 1 on the reset input will cause all  $\bar{Q}$  outputs to go to a logic 1 state.

Division by any number from 2 to 10 can be accomplished by connecting appropriate  $\bar{Q}$  outputs to the data input, as shown in the Function Selection table. Anti-lock gating is included in the MC14018B to assure proper counting sequence.

### Features

- Fully Static Operation
- Schmitt Trigger on Clock Input
- Capable of Driving Two Low-Power TTL Loads or One Low-Power Schottky TTL Load Over the Rated Temperature Range
- Pin-for-Pin Replacement for CD4018B
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- This Device is Pb-Free and is RoHS Compliant

### MAXIMUM RATINGS (Voltages Referenced to $V_{SS}$ )

| Symbol            | Parameter                                         | Value                  | Unit |
|-------------------|---------------------------------------------------|------------------------|------|
| $V_{DD}$          | DC Supply Voltage Range                           | -0.5 to +18.0          | V    |
| $V_{in}, V_{out}$ | Input or Output Voltage Range (DC or Transient)   | -0.5 to $V_{DD} + 0.5$ | V    |
| $I_{in}, I_{out}$ | Input or Output Current (DC or Transient) per Pin | $\pm 10$               | mA   |
| $P_D$             | Power Dissipation, per Package (Note 1)           | 500                    | mW   |
| $T_A$             | Ambient Temperature Range                         | -55 to +125            | °C   |
| $T_{stg}$         | Storage Temperature Range                         | -65 to +150            | °C   |
| $T_L$             | Lead Temperature (8-Second Soldering)             | 260                    | °C   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Temperature Derating: "D/DW" Packages: -7.0 mW/°C From 65°C To 125°C

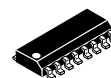
This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  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.



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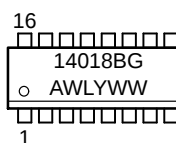


SOIC-16  
D SUFFIX  
CASE 751B

### PIN ASSIGNMENT

|            |   |    |            |
|------------|---|----|------------|
| $D_{in}$   | 1 | 16 | $V_{DD}$   |
| JAM 1      | 2 | 15 | R          |
| JAM 2      | 3 | 14 | C          |
| $\bar{Q}2$ | 4 | 13 | $\bar{Q}5$ |
| $\bar{Q}1$ | 5 | 12 | JAM 5      |
| $\bar{Q}3$ | 6 | 11 | $\bar{Q}4$ |
| JAM 3      | 7 | 10 | PE         |
| $V_{SS}$   | 8 | 9  | JAM 4      |

### MARKING DIAGRAM



A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
G = Pb-Free Indicator

### FUNCTIONAL TRUTH TABLE

| Clock | Reset | Preset Enable | Jam Input | $\bar{Q}_n$   |
|-------|-------|---------------|-----------|---------------|
|       | 0     | 0             | X         | $\bar{Q}_n$   |
|       | 0     | 0             | X         | $\bar{D}_n^*$ |
| X     | 0     | 1             | 0         | 1             |
| X     | 0     | 1             | 1         | 0             |
| X     | 1     | X             | X         | 1             |

\* $\bar{D}_n$  is the Data input for that stage. Stage 1 has Data brought out to Pin 1.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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## ELECTRICAL CHARACTERISTICS (Voltages Referenced to V<sub>SS</sub>)

| Characteristic                                                                                                                                                                                                                                     | Symbol                       | V <sub>DD</sub><br>Vdc | -55°C                                                                                                                                                       |      | 25°C  |                 |      | 125°C |      | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-----------------|------|-------|------|------|
|                                                                                                                                                                                                                                                    |                              |                        | Min                                                                                                                                                         | Max  | Min   | Typ<br>(Note 2) | Max  | Min   | Max  |      |
| Output Voltage<br>V <sub>in</sub> = V <sub>DD</sub> or 0<br><br>V <sub>in</sub> = 0 or V <sub>DD</sub>                                                                                                                                             | “0” Level<br>V <sub>OL</sub> | 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 |      |
|                                                                                                                                                                                                                                                    | “1” Level<br>V <sub>OH</sub> | 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>(V <sub>O</sub> = 4.5 or 0.5 Vdc)<br>(V <sub>O</sub> = 9.0 or 1.0 Vdc)<br>(V <sub>O</sub> = 13.5 or 1.5 Vdc)<br><br>(V <sub>O</sub> = 0.5 or 4.5 Vdc)<br>(V <sub>O</sub> = 1.0 or 9.0 Vdc)<br>(V <sub>O</sub> = 1.5 or 13.5 Vdc)  | “0” Level<br>V <sub>IL</sub> | 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  |      |
|                                                                                                                                                                                                                                                    | “1” Level<br>V <sub>IH</sub> | 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 <sub>OH</sub> = 2.5 Vdc)<br>(V <sub>OH</sub> = 4.6 Vdc)<br>(V <sub>OH</sub> = 9.5 Vdc)<br>(V <sub>OH</sub> = 13.5 Vdc)<br><br>(V <sub>OL</sub> = 0.4 Vdc)<br>(V <sub>OL</sub> = 0.5 Vdc)<br>(V <sub>OL</sub> = 1.5 Vdc) | Source<br>I <sub>OH</sub>    | 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 <sub>OL</sub>      | 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 <sub>in</sub>              | 15                     | –                                                                                                                                                           | ±0.1 | –     | ±0.00001        | ±0.1 | –     | ±1.0 | μAdc |
| Input Capacitance<br>(V <sub>in</sub> = 0)                                                                                                                                                                                                         | C <sub>in</sub>              | –                      | –                                                                                                                                                           | –    | –     | 5.0             | 7.5  | –     | –    | pF   |
| Quiescent Current<br>(Per Package)                                                                                                                                                                                                                 | I <sub>DD</sub>              | 5.0                    | –                                                                                                                                                           | 5.0  | –     | 0.005           | 5.0  | –     | 150  | μAdc |
|                                                                                                                                                                                                                                                    |                              | 10                     | –                                                                                                                                                           | 10   | –     | 0.010           | 10   | –     | 300  |      |
|                                                                                                                                                                                                                                                    |                              | 15                     | –                                                                                                                                                           | 20   | –     | 0.015           | 20   | –     | 600  |      |
| Total Supply Current (Notes 3 & 4)<br>(Dynamic plus Quiescent,<br>Per Package)<br>(C <sub>L</sub> = 50 pF on all outputs, all<br>buffers switching)                                                                                                | I <sub>T</sub>               | 5.0<br>10<br>15        | I <sub>T</sub> = (0.3 μA/kHz) f + I <sub>DD</sub><br>I <sub>T</sub> = (0.7 μA/kHz) f + I <sub>DD</sub><br>I <sub>T</sub> = (1.0 μA/kHz) f + I <sub>DD</sub> |      |       |                 |      |       |      | μAdc |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

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

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

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

where: I<sub>T</sub> is in μA (per package), C<sub>L</sub> in pF, V = (V<sub>DD</sub> – V<sub>SS</sub>) in volts, f in kHz is input frequency, and k = 0.001.

## ORDERING INFORMATION

| Device       | Package              | Shipping <sup>†</sup>    |
|--------------|----------------------|--------------------------|
| MC14018BDG   | SOIC–16<br>(Pb–Free) | 48 Units / Rail          |
| NLV14018BDG* | SOIC–16<br>(Pb–Free) | 48 Units / Rail          |
| MC14018BDR2G | SOIC–16<br>(Pb–Free) | 2500 Units / Tape & Reel |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q100 Qualified and PPAP Capable.

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## SWITCHING CHARACTERISTICS (Note 5) ( $C_L = 50 \text{ pF}$ , $T_A = 25^\circ\text{C}$ )

| Characteristic                                                                                                                                                                                                                                             | Symbol                   | $V_{DD}$<br>$V_{dc}$ | All Types         |                   |                     | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------|-------------------|-------------------|---------------------|------|
|                                                                                                                                                                                                                                                            |                          |                      | Min               | Typ<br>(Note 6)   | Max                 |      |
| Output Rise and Fall Time<br>$t_{TLH}$ , $t_{THL} = (1.35 \text{ ns/pF}) C_L + 32 \text{ ns}$<br>$t_{TLH}$ , $t_{THL} = (0.6 \text{ ns/pF}) C_L + 20 \text{ ns}$<br>$t_{TLH}$ , $t_{THL} = (0.4 \text{ ns/pF}) C_L + 20 \text{ ns}$                        | $t_{TLH}$ , $t_{THL}$    | 5.0<br>10<br>15      | –<br>–<br>–       | 100<br>50<br>40   | 200<br>100<br>80    | ns   |
| Propagation Delay Time<br>Clock to $\bar{Q}$<br>$t_{PLH}$ , $t_{PHL} = (0.90 \text{ ns/pF}) C_L + 265 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.36 \text{ ns/pF}) C_L + 102 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.26 \text{ ns/pF}) C_L + 72 \text{ ns}$ | $t_{PLH}$ ,<br>$t_{PHL}$ | 5.0<br>10<br>15      | –<br>–<br>–       | 310<br>120<br>85  | 620<br>240<br>170   | ns   |
| Reset to $\bar{Q}$<br>$t_{PLH} = (0.90 \text{ ns/pF}) C_L + 325 \text{ ns}$<br>$t_{PLH} = (0.36 \text{ ns/pF}) C_L + 132 \text{ ns}$<br>$t_{PLH} = (0.26 \text{ ns/pF}) C_L + 81 \text{ ns}$                                                               |                          | 5.0<br>10<br>15      | –<br>–<br>–       | 370<br>150<br>100 | 740<br>300<br>200   | ns   |
| Preset Enable to $\bar{Q}$<br>$t_{PLH}$ , $t_{PHL} = (0.90 \text{ ns/pF}) C_L + 325 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.36 \text{ ns/pF}) C_L + 132 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.26 \text{ ns/pF}) C_L + 81 \text{ ns}$                   |                          | 5.0<br>10<br>15      | –<br>–<br>–       | 370<br>150<br>100 | 740<br>300<br>200   | ns   |
| Setup Time<br>Data (Pin 1) to Clock                                                                                                                                                                                                                        | $t_{su}$                 | 5.0<br>10<br>15      | 200<br>100<br>80  | 0<br>0<br>0       | –<br>–<br>–         | ns   |
| Jam Inputs to Preset Enable                                                                                                                                                                                                                                |                          | 5.0<br>10<br>15      | 200<br>100<br>80  | 0<br>0<br>0       | –<br>–<br>–         | ns   |
| Data (Jam Inputs)–to–Preset<br>Enable Hold Time                                                                                                                                                                                                            | $t_h$                    | 5.0<br>10<br>15      | 540<br>500<br>480 | 270<br>250<br>240 | –<br>–<br>–         | ns   |
| Clock Pulse Width                                                                                                                                                                                                                                          | $t_{WH}$                 | 5.0<br>10<br>15      | 400<br>200<br>160 | 200<br>100<br>80  | –<br>–<br>–         | ns   |
| Reset or Preset Enable<br>Pulse Width                                                                                                                                                                                                                      | $t_{WH}$                 | 5.0<br>10<br>15      | 290<br>130<br>110 | 145<br>65<br>55   | –<br>–<br>–         | ns   |
| Clock Rise and Fall Time                                                                                                                                                                                                                                   | $t_{TLH}$ , $t_{THL}$    | 5.0<br>10<br>15      | No Limit          |                   |                     | ns   |
| Clock Pulse Frequency                                                                                                                                                                                                                                      | $f_{cl}$                 | 5.0<br>10<br>15      | –<br>–<br>–       | 2.5<br>6.5<br>8.0 | 1.25<br>3.25<br>4.0 | MHz  |

5. The formulas given are for the typical characteristics only at  $25^\circ\text{C}$ .

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

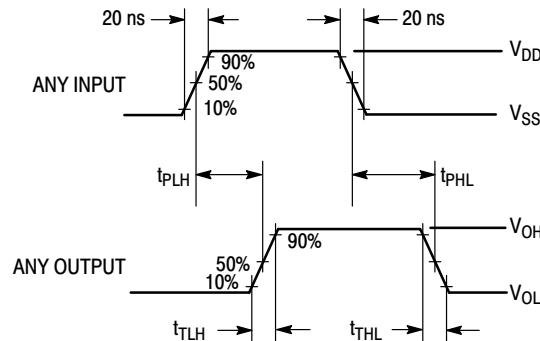
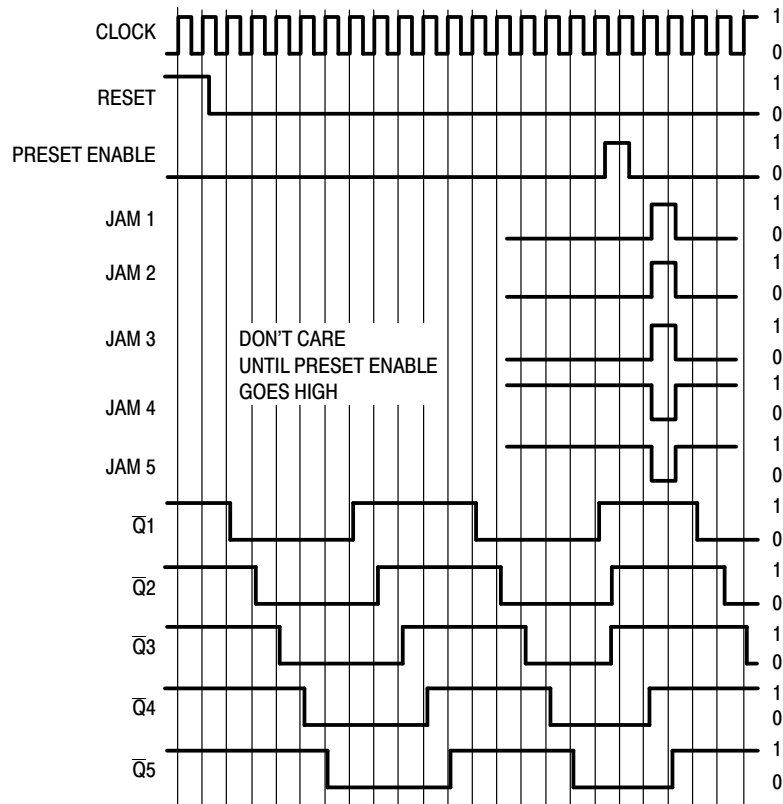


Figure 1. Switching Time Waveforms

# MC14018B

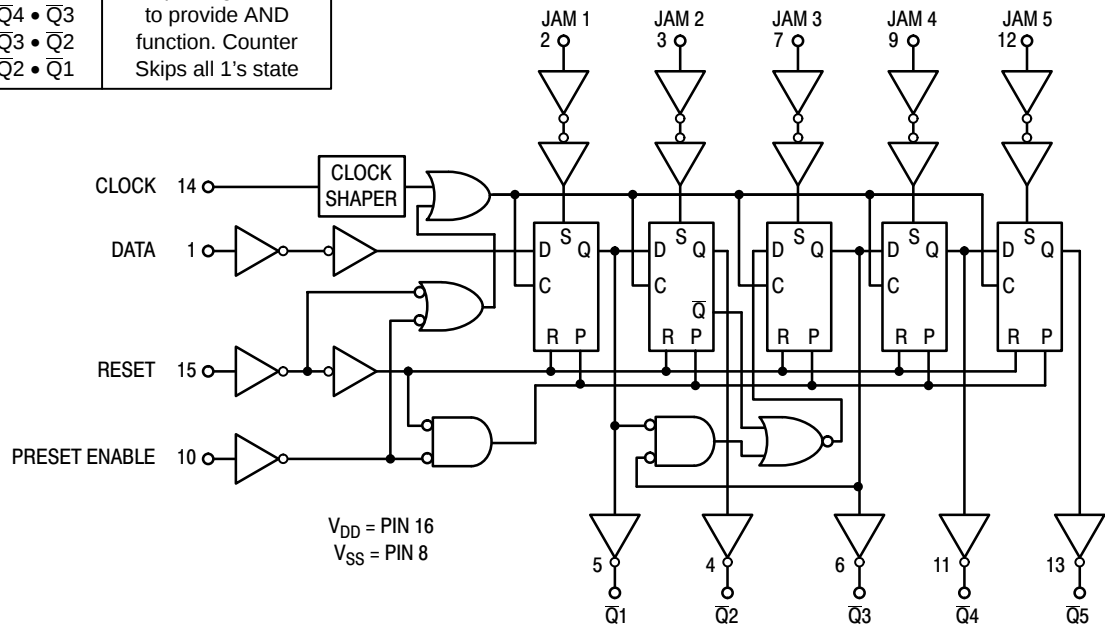
**TIMING DIAGRAM**  
( $\overline{Q}5$  Connected to Data Input)



**FUNCTION SELECTION**

| Counter Mode                                                             | Connect Data Input (Pin 1) to:                                                                                                                           | Comments                                                                 |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Divide by 10<br>Divide by 8<br>Divide by 6<br>Divide by 4<br>Divide by 2 | $\overline{Q}5$<br>$\overline{Q}4$<br>$\overline{Q}3$<br>$\overline{Q}2$<br>$\overline{Q}1$                                                              | No external components needed.                                           |
| Divide by 9<br>Divide by 7<br>Divide by 5<br>Divide by 3                 | $\overline{Q}5 \cdot \overline{Q}4$<br>$\overline{Q}4 \cdot \overline{Q}3$<br>$\overline{Q}3 \cdot \overline{Q}2$<br>$\overline{Q}2 \cdot \overline{Q}1$ | Gate package needed to provide AND function. Counter Skips all 1's state |

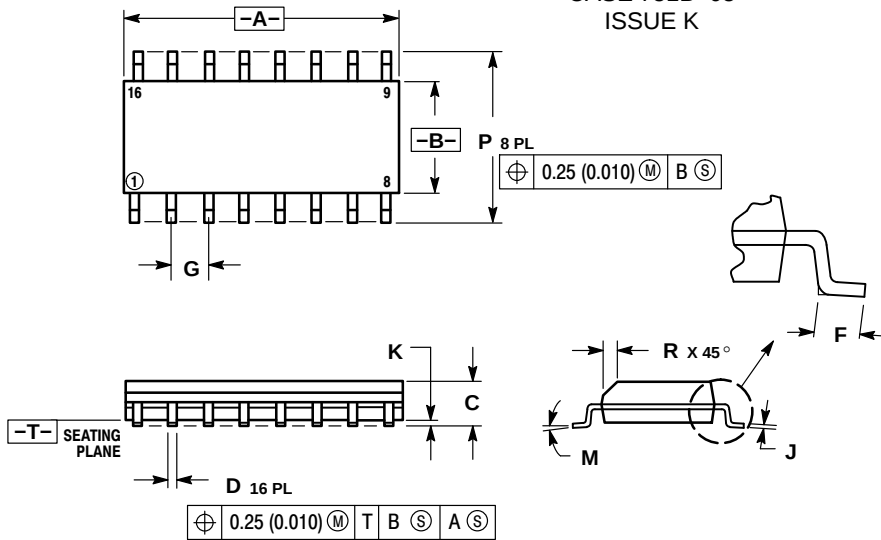
**LOGIC DIAGRAM**



# MC14018B

## PACKAGE DIMENSIONS

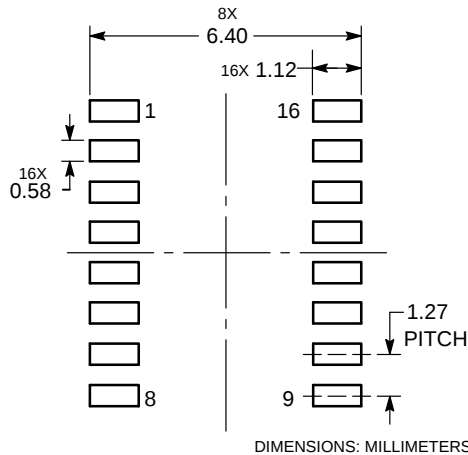
SOIC-16  
D SUFFIX  
PLASTIC SOIC PACKAGE  
CASE 751B-05  
ISSUE K



- 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 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 9.80        | 10.00 | 0.386     | 0.393 |
| B   | 3.80        | 4.00  | 0.150     | 0.157 |
| C   | 1.35        | 1.75  | 0.054     | 0.068 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.40        | 1.25  | 0.016     | 0.049 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.19        | 0.25  | 0.008     | 0.009 |
| K   | 0.10        | 0.25  | 0.004     | 0.009 |
| M   | 0°          | 7°    | 0°        | 7°    |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

## SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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