

# Dual Type D Flip-Flop

## MC14013B

The MC14013B dual type D flip-flop is constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. Each flip-flop has independent Data, (D), Direct Set, (S), Direct Reset, (R), and Clock (C) inputs and complementary outputs (Q and  $\bar{Q}$ ). These devices may be used as shift register elements or as type T flip-flops for counter and toggle applications.

### Features

- Static Operation
- Diode Protection on All Inputs
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Logic Edge-Clocked Flip-Flop Design
- Logic State is Retained Indefinitely with Clock Level either High or Low; Information is Transferred to the Output only on the Positive-going Edge of the Clock Pulse
- 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 CD4013B
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free and are 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.

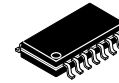
1. Temperature Derating: "D/DW" Packages: -7.0 mW/°C From 65 °C To 125 °C.

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.



SOIC-14  
D SUFFIX  
CASE 751A

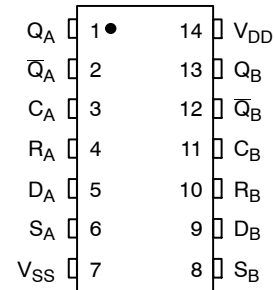


SOEIAJ-14  
F SUFFIX  
CASE 965

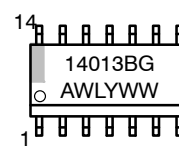


TSSOP-14  
DT SUFFIX  
CASE 948G

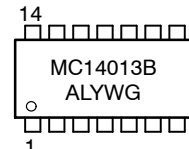
### PIN ASSIGNMENT



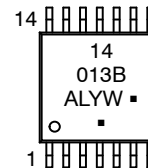
### MARKING DIAGRAMS



SOIC-14



SOEIAJ-14



TSSOP-14

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

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 3.

# MC14013B

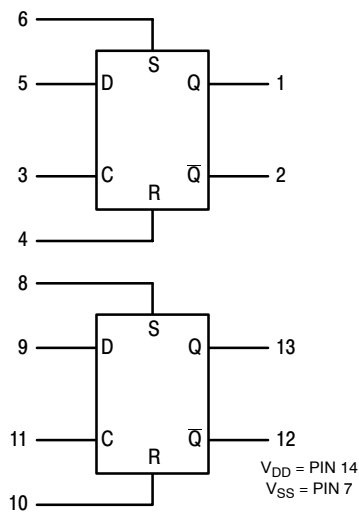
TRUTH TABLE

| Inputs                                                                            |      |       |     | Outputs |   |
|-----------------------------------------------------------------------------------|------|-------|-----|---------|---|
| Clock <sup>†</sup>                                                                | Data | Reset | Set | Q       | Q |
|  | 0    | 0     | 0   | 0       | 1 |
|  | 1    | 0     | 0   | 1       | 0 |
|  | X    | 0     | 0   | Q       | Q |
| X                                                                                 | X    | 1     | 0   | 0       | 1 |
| X                                                                                 | X    | 0     | 1   | 1       | 0 |
| X                                                                                 | X    | 1     | 1   | 1       | 1 |

No  
Change

X = Don't Care  
† = Level Change

BLOCK DIAGRAM



# MC14013B

## ORDERING INFORMATION

| Device          | Package               | Shipping <sup>†</sup> |
|-----------------|-----------------------|-----------------------|
| MC14013BDG      | SOIC-14<br>(Pb-Free)  | 55 Units / Rail       |
| MC14013BDR2G    | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel    |
| NLV14013BDR2G*  | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel    |
| MC14013BDTR2G   | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel    |
| NLV14013BDTR2G* | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel    |

## DISCONTINUED (Note 2)

|              |                        |                    |
|--------------|------------------------|--------------------|
| NLV14013BDG* | SOIC-14<br>(Pb-Free)   | 55 Units / Rail    |
| MC14013BFG   | SOEIAJ-14<br>(Pb-Free) | 50 Units / Rail    |
| MC14013BFELG | SOEIAJ-14<br>(Pb-Free) | 2000 / Tape & Reel |

† 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.

2. **DISCONTINUED:** These devices are not available. Please contact your **onsemi** representative for information. The most current information on these devices may be available on [www.onsemi.com](http://www.onsemi.com).

# MC14013B

## 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>(Note3) | Max  | Min    | Max  |      |
| Output Voltage<br>"0" Level<br>V <sub>in</sub> = V <sub>DD</sub> or 0                                                                                       | 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 |      |
| V <sub>in</sub> = 0 or V <sub>DD</sub><br>"1" Level                                                                                                         | 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>"0" Level<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)                  | 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  |      |
| (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)<br>"1" Level                                   | 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>Source | 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   | –    |      |
| (V <sub>OL</sub> = 0.4 Vdc)<br>(V <sub>OL</sub> = 0.5 Vdc)<br>(V <sub>OL</sub> = 1.5 Vdc)<br>Sink                                                           | 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 | –     | ±0.0000<br>1   | ±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                    | –                                                                                                                                                            | 1.0  | –     | 0.002          | 1.0  | –      | 30   | μAdc |
|                                                                                                                                                             |                 | 10                     | –                                                                                                                                                            | 2.0  | –     | 0.004          | 2.0  | –      | 60   |      |
|                                                                                                                                                             |                 | 15                     | –                                                                                                                                                            | 4.0  | –     | 0.006          | 4.0  | –      | 120  |      |
| Total Supply Current (Notes 4, 5)<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> = (0.75 μA/kHz) f + I <sub>DD</sub><br>I <sub>T</sub> = (1.5 μA/kHz) f + I <sub>DD</sub><br>I <sub>T</sub> = (2.3 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.

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

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

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

$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) V f k$$

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 = 0.002.

# MC14013B

## SWITCHING CHARACTERISTICS (Note 6) ( $C_L = 50 \text{ pF}$ , $T_A = 25^\circ\text{C}$ )

| Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Symbol                   | $V_{DD}$                                                      | Min                                               | Typ (Note 7)                                                   | Max                                                                 | Unit          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------|---------------|
| Output Rise and Fall Time<br>$t_{TLH}$ , $t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$<br>$t_{TLH}$ , $t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$<br>$t_{TLH}$ , $t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | $t_{TLH}$ ,<br>$t_{THL}$ | 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 Q, $\bar{Q}$<br>$t_{PLH}$ , $t_{PHL} = (1.7 \text{ ns/pF}) C_L + 90 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.66 \text{ ns/pF}) C_L + 42 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 25 \text{ ns}$<br><br>Set to Q, $\bar{Q}$<br>$t_{PLH}$ , $t_{PHL} = (1.7 \text{ ns/pF}) C_L + 90 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.66 \text{ ns/pF}) C_L + 42 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 25 \text{ ns}$<br><br>Reset to Q, $\bar{Q}$<br>$t_{PLH}$ , $t_{PHL} = (1.7 \text{ ns/pF}) C_L + 265 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.66 \text{ ns/pF}) C_L + 67 \text{ ns}$<br>$t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 50 \text{ ns}$ | $t_{PLH}$<br>$t_{PHL}$   | 5.0<br>10<br>15<br><br>5.0<br>10<br>15<br><br>5.0<br>10<br>15 | –<br>–<br>–<br><br>–<br>–<br>–<br><br>–<br>–<br>– | 175<br>75<br>50<br><br>175<br>75<br>50<br><br>225<br>100<br>75 | 350<br>150<br>100<br><br>350<br>150<br>100<br><br>450<br>200<br>150 | ns            |
| Setup Times (Note 8)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $t_{su}$                 | 5.0<br>10<br>15                                               | 40<br>20<br>15                                    | 20<br>10<br>7.5                                                | –<br>–<br>–                                                         | ns            |
| Hold Times (Note 8)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | $t_h$                    | 5.0<br>10<br>15                                               | 40<br>20<br>15                                    | 20<br>10<br>7.5                                                | –<br>–<br>–                                                         | ns            |
| Clock Pulse Width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $t_{WL}$ , $t_{WH}$      | 5.0<br>10<br>15                                               | 250<br>100<br>70                                  | 125<br>50<br>35                                                | –<br>–<br>–                                                         | ns            |
| Clock Pulse Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | $f_{cl}$                 | 5.0<br>10<br>15                                               | –<br>–<br>–                                       | 4.0<br>10<br>14                                                | 2.0<br>5.0<br>7.0                                                   | MHz           |
| Clock Pulse Rise and Fall Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $t_{TLH}$<br>$t_{THL}$   | 5.0<br>10<br>15                                               | –<br>–<br>–                                       | –<br>–<br>–                                                    | 15<br>5.0<br>4.0                                                    | $\mu\text{s}$ |
| Set and Reset Pulse Width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | $t_{WL}$ , $t_{WH}$      | 5.0<br>10<br>15                                               | 250<br>100<br>70                                  | 125<br>50<br>35                                                | –<br>–<br>–                                                         | ns            |
| Removal Times<br>Set                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $t_{rem}$                | 5<br>10<br>15                                                 | 80<br>45<br>35                                    | 0<br>5<br>5                                                    | –<br>–<br>–                                                         | ns            |
| Reset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          | 5<br>10<br>15                                                 | 50<br>30<br>25                                    | –35<br>–10<br>–5                                               | –<br>–<br>–                                                         |               |

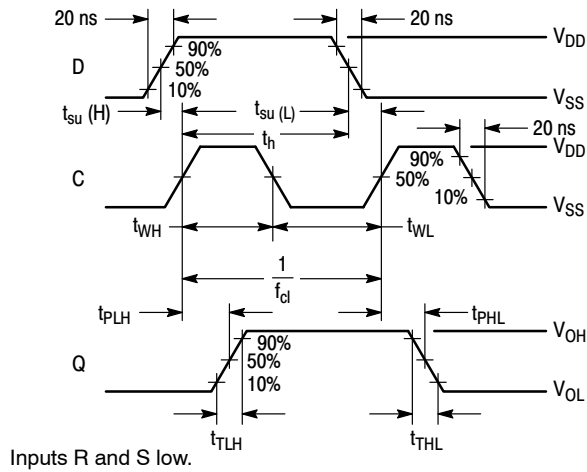
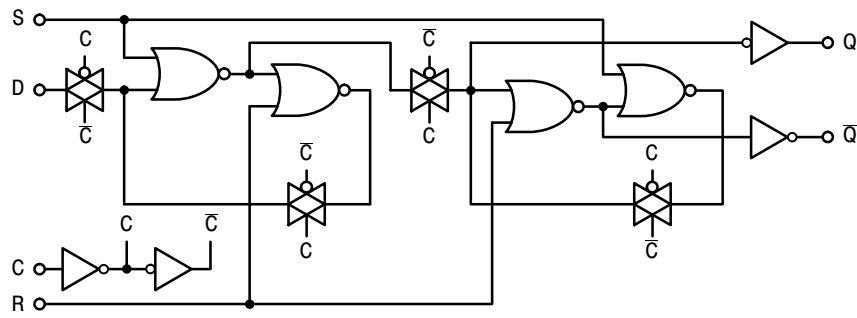
6. The formulas given are for the typical characteristics only at  $25^\circ\text{C}$ .

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

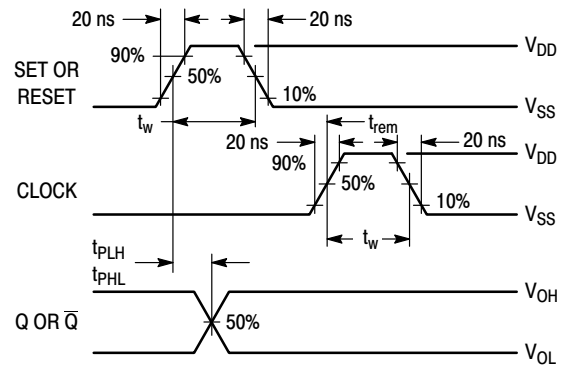
8. Data must be valid for 250 ns with a 5 V supply, 100 ns with 10 V, and 70 ns with 15 V.

# MC14013B

## LOGIC DIAGRAM (1/2 of Device Shown)



**Figure 1. Dynamic Signal Waveforms  
(Data, Clock, and Output)**

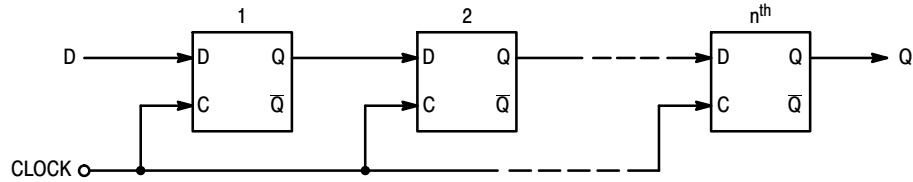


**Figure 2. Dynamic Signal Waveforms  
(Set, Reset, Clock, and Output)**

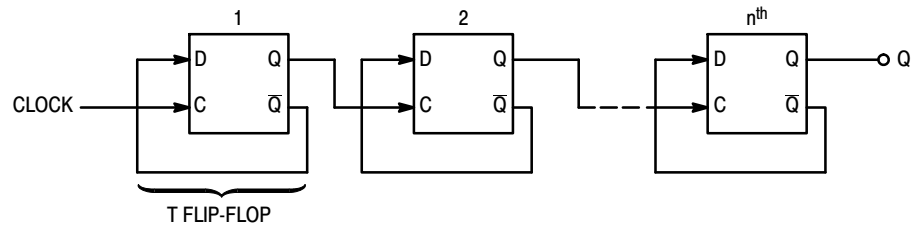
# MC14013B

## TYPICAL APPLICATIONS

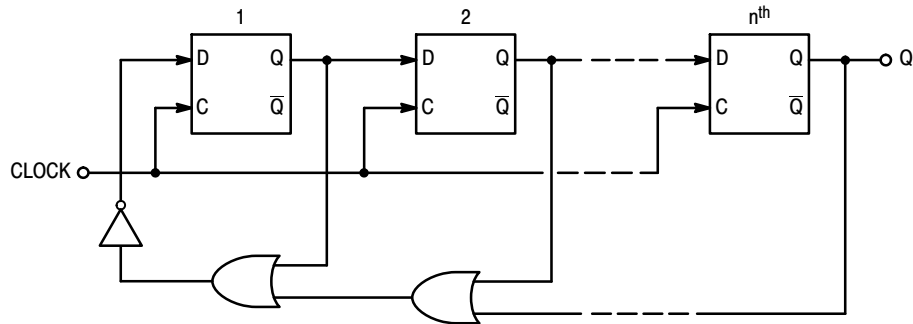
### n-STAGE SHIFT REGISTER



### BINARY RIPPLE UP-COUNTER (Divide-by- $2^n$ )



### MODIFIED RING COUNTER (Divide-by- $(n+1)$ )



## REVISION HISTORY

| Revision | Description of Changes                                                                                                  | Date       |
|----------|-------------------------------------------------------------------------------------------------------------------------|------------|
| 11       | Rebranded the Data Sheet to <b>onsemi</b> format.<br>NLV14013BDG, MC14013BFG, MC14013BFELG OPNs Marked as Discontinued. | 07/11/2025 |

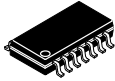
This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

# MC14013B

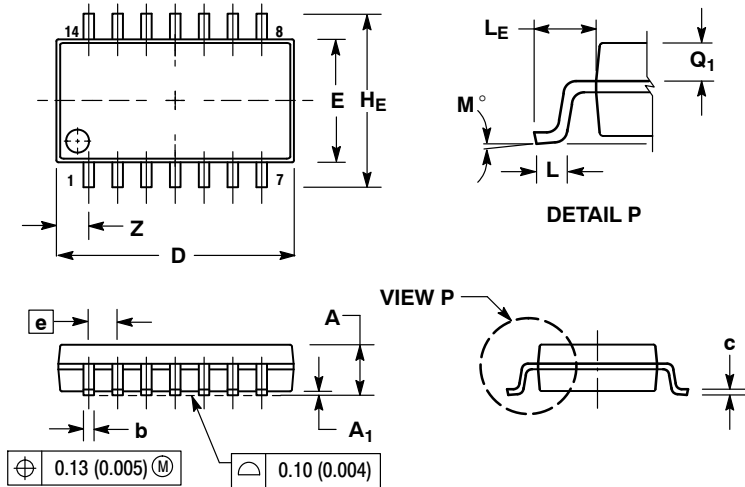
## PACKAGE DIMENSIONS

SOEIAJ-14  
CASE 965-01  
ISSUE B

DATE 29 FEB 2008



SCALE 1:1

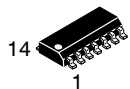


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM   | MILLIMETERS |       | INCHES    |       |
|-------|-------------|-------|-----------|-------|
|       | MIN         | MAX   | MIN       | MAX   |
| A     | ---         | 2.05  | ---       | 0.081 |
| $A_1$ | 0.05        | 0.20  | 0.002     | 0.008 |
| b     | 0.35        | 0.50  | 0.014     | 0.020 |
| c     | 0.10        | 0.20  | 0.004     | 0.008 |
| D     | 9.90        | 10.50 | 0.390     | 0.413 |
| E     | 5.10        | 5.45  | 0.201     | 0.215 |
| e     | 1.27 BSC    |       | 0.050 BSC |       |
| $H_E$ | 7.40        | 8.20  | 0.291     | 0.323 |
| L     | 0.50        | 0.85  | 0.020     | 0.033 |
| $L_E$ | 1.10        | 1.50  | 0.043     | 0.059 |
| M     | 0 °         | 10 °  | 0 °       | 10 °  |
| $Q_1$ | 0.70        | 0.90  | 0.028     | 0.035 |
| Z     | ---         | 1.42  | ---       | 0.056 |

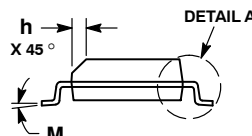
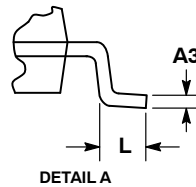
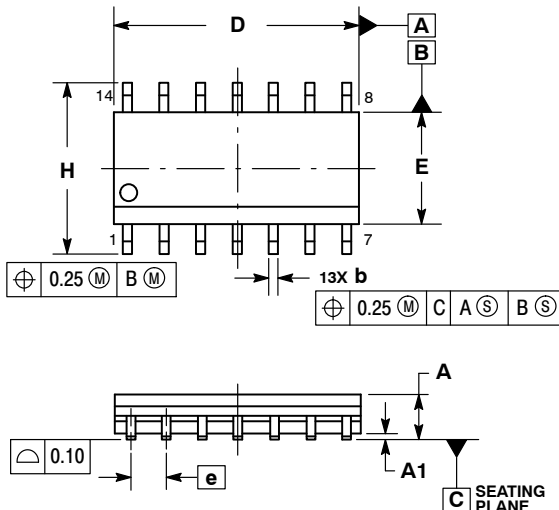




SCALE 1:1

SOIC-14 NB  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016

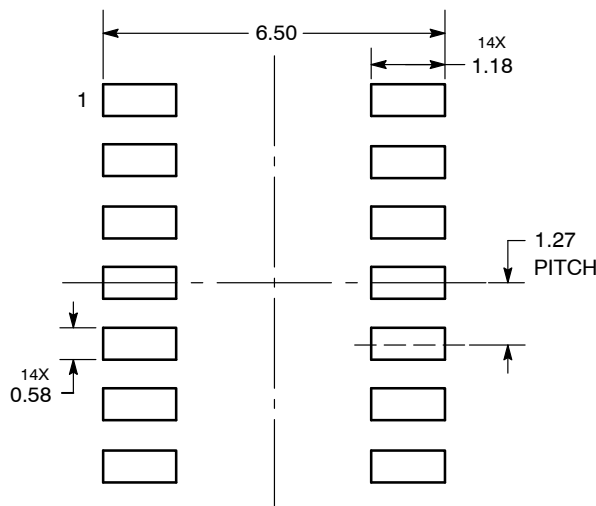


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.054     | 0.068 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A3  | 0.19        | 0.25 | 0.008     | 0.010 |
| b   | 0.35        | 0.49 | 0.014     | 0.019 |
| D   | 8.55        | 8.75 | 0.337     | 0.344 |
| E   | 3.80        | 4.00 | 0.150     | 0.157 |
| e   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 5.80        | 6.20 | 0.228     | 0.244 |
| h   | 0.25        | 0.50 | 0.010     | 0.019 |
| L   | 0.40        | 1.25 | 0.016     | 0.049 |
| M   | 0°          | 7°   | 0°        | 7°    |

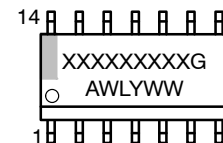
SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

GENERIC  
MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLES ON PAGE 2

|                  |             |                                                                                                                                                                                     |
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SOIC-14  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016

STYLE 1:  
PIN 1. COMMON CATHODE  
2. ANODE/CATHODE  
3. ANODE/CATHODE  
4. NO CONNECTION  
5. ANODE/CATHODE  
6. NO CONNECTION  
7. ANODE/CATHODE  
8. ANODE/CATHODE  
9. ANODE/CATHODE  
10. NO CONNECTION  
11. ANODE/CATHODE  
12. ANODE/CATHODE  
13. NO CONNECTION  
14. COMMON ANODE

STYLE 2:  
CANCELLED

STYLE 3:  
PIN 1. NO CONNECTION  
2. ANODE  
3. ANODE  
4. NO CONNECTION  
5. ANODE  
6. NO CONNECTION  
7. ANODE  
8. ANODE  
9. ANODE  
10. NO CONNECTION  
11. ANODE  
12. ANODE  
13. NO CONNECTION  
14. COMMON CATHODE

STYLE 4:  
PIN 1. NO CONNECTION  
2. CATHODE  
3. CATHODE  
4. NO CONNECTION  
5. CATHODE  
6. NO CONNECTION  
7. CATHODE  
8. CATHODE  
9. CATHODE  
10. NO CONNECTION  
11. CATHODE  
12. CATHODE  
13. NO CONNECTION  
14. COMMON ANODE

STYLE 5:  
PIN 1. COMMON CATHODE  
2. ANODE/CATHODE  
3. ANODE/CATHODE  
4. ANODE/CATHODE  
5. ANODE/CATHODE  
6. NO CONNECTION  
7. COMMON ANODE  
8. COMMON CATHODE  
9. ANODE/CATHODE  
10. ANODE/CATHODE  
11. ANODE/CATHODE  
12. ANODE/CATHODE  
13. NO CONNECTION  
14. COMMON ANODE

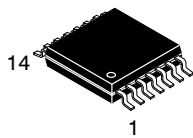
STYLE 6:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE  
4. CATHODE  
5. CATHODE  
6. CATHODE  
7. CATHODE  
8. ANODE  
9. ANODE  
10. ANODE  
11. ANODE  
12. ANODE  
13. ANODE  
14. ANODE

STYLE 7:  
PIN 1. ANODE/CATHODE  
2. COMMON ANODE  
3. COMMON CATHODE  
4. ANODE/CATHODE  
5. ANODE/CATHODE  
6. ANODE/CATHODE  
7. ANODE/CATHODE  
8. ANODE/CATHODE  
9. ANODE/CATHODE  
10. ANODE/CATHODE  
11. COMMON CATHODE  
12. COMMON ANODE  
13. ANODE/CATHODE  
14. ANODE/CATHODE

STYLE 8:  
PIN 1. COMMON CATHODE  
2. ANODE/CATHODE  
3. ANODE/CATHODE  
4. NO CONNECTION  
5. ANODE/CATHODE  
6. ANODE/CATHODE  
7. COMMON ANODE  
8. COMMON ANODE  
9. ANODE/CATHODE  
10. ANODE/CATHODE  
11. NO CONNECTION  
12. ANODE/CATHODE  
13. ANODE/CATHODE  
14. COMMON CATHODE

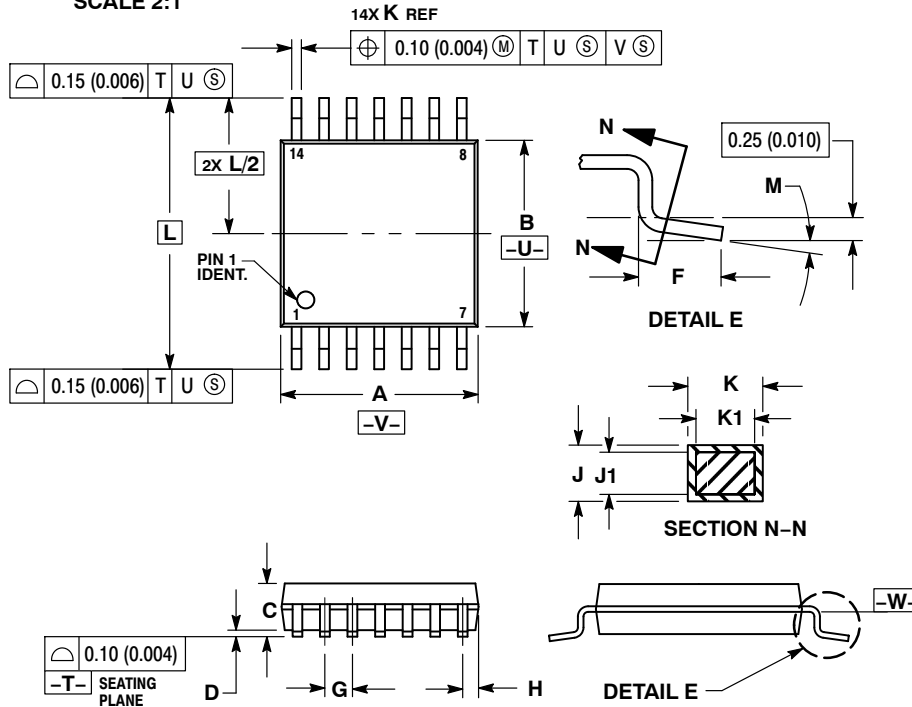
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**TSSOP-14 WB**  
**CASE 948G**  
**ISSUE C**

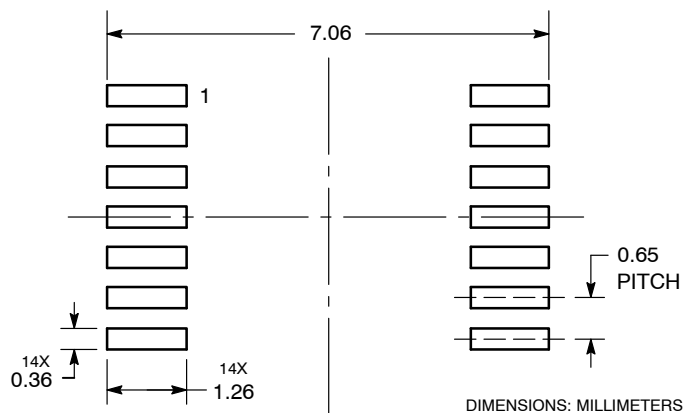
DATE 17 FEB 2016

SCALE 2:1

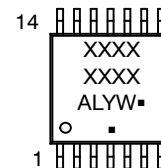

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.50        | 0.60 | 0.020     | 0.024 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

**RECOMMENDED  
SOLDERING FOOTPRINT\***


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

**GENERIC  
MARKING DIAGRAM\***


A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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**DESCRIPTION:** TSSOP-14 WB

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