

# MC14076B

## 4-Bit D-Type Register with Three-State Outputs

The MC14076B 4-Bit Register consists of four D-type flip-flops operating synchronously from a common clock. OR gated output-disable inputs force the outputs into a high-impedance state for use in bus organized systems. OR gated data-disable inputs cause the Q outputs to be fed back to the D inputs of the flip-flops. Thus they are inhibited from changing state while the clocking process remains undisturbed. An asynchronous master root is provided to clear all four flip-flops simultaneously independent of the clock or disable inputs.

### Features

- Three-State Outputs with Gated Control Lines
- Fully Independent Clock Allows Unrestricted Operation for the Two Modes: Parallel Load and Do Nothing
- Asynchronous Master Reset
- Four Bus Buffer Registers
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving Two Low-Power TTL Loads or One Low-Power Schottky TTL Load Over the Rated Temperature Range
- 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 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

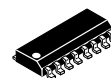
This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$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



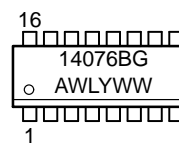
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SOIC-16  
D SUFFIX  
CASE 751B

### MARKING DIAGRAM



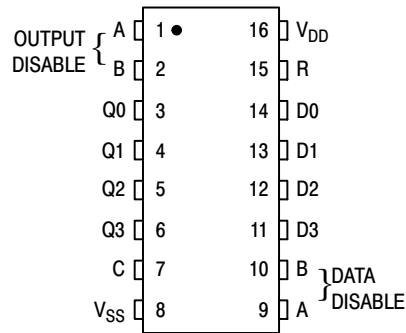
A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

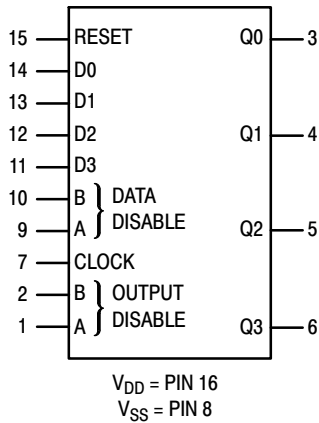
See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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## PIN ASSIGNMENT



## BLOCK DIAGRAM



## FUNCTION TABLE

Inputs					
Reset	Clock	Data Disable		Data D	Output Q
		A	B		
1	X	X	X	X	0
0	0	X	X	X	Q <sub>n</sub>
0	↗	1	X	X	Q <sub>n</sub>
0	↗	X	1	X	Q <sub>n</sub>
0	↗	0	0	0	0
0	↗	0	0	1	1

When either output disable A or B (or both) is (are) high the output is disabled to the high-impedance state; however sequential operation of the flip-flops is not affected.  
X = Don't Care.

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

Characteristic	Symbol	V <sub>DD</sub> Vdc	-55°C		25°C			125°C		Unit	
			Min	Max	Min	Typ (Note 2)	Max	Min	Max		
Output Voltage V <sub>in</sub> = V <sub>DD</sub> or 0	"0" Level	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	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 (V <sub>O</sub> = 4.5 or 0.5 Vdc) (V <sub>O</sub> = 9.0 or 1.0 Vdc) (V <sub>O</sub> = 13.5 or 1.5 Vdc)	"0" Level	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	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 (V <sub>OH</sub> = 2.5 Vdc) (V <sub>OH</sub> = 4.6 Vdc) (V <sub>OH</sub> = 9.5 Vdc) (V <sub>OH</sub> = 13.5 Vdc)	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	–	
			15	–4.2	–	–3.4	–8.8	–	–2.4	–	
	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	–	±0.00001	±0.1	–	±1.0	μAdc	
Input Capacitance (V <sub>in</sub> = 0)	C <sub>in</sub>	–	–	–	–	5.0	7.5	–	–	pF	
Quiescent Current (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) (Dynamic plus Quiescent, Per Package) (C <sub>L</sub> = 50 pF on all outputs, all buffers switching)	I <sub>T</sub>	5.0	I <sub>T</sub> = (0.75 μA/kHz) f + I <sub>DD</sub>							μAdc	
		10	I <sub>T</sub> = (1.50 μA/kHz) f + I <sub>DD</sub>								
		15	I <sub>T</sub> = (2.25 μA/kHz) f + I <sub>DD</sub>								
Three-State Leakage Current	I <sub>TL</sub>	15	–	±0.1	–	±0.0001	±0.1	–	±3.0	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:

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

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 = 0.002.

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

Characteristic	Symbol	$V_{DD}$ Vdc	Min	Typ (Note 6)	Max	Unit
Output Rise and Fall Time $t_{TLH}$ , $t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$ $t_{TLH}$ , $t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$ $t_{TLH}$ , $t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$	$t_{TLH}$ , $t_{THL}$	5.0 10 15	– – –	100 50 40	200 100 80	ns
Propagation Delay Time Clock to Q $t_{PLH}$ , $t_{PHL} = (1.7 \text{ ns/pF}) C_L + 215 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.66 \text{ ns/pF}) C_L + 92 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 65 \text{ ns}$ Reset to Q $t_{PLH}$ , $t_{PHL} = (1.7 \text{ ns/pF}) C_L + 215 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.66 \text{ ns/pF}) C_L + 92 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 65 \text{ ns}$	$t_{PLH}$ , $t_{PHL}$	5.0 10 15  5.0 10 15	– – –  – – –	300 125 90  300 125 90	600 250 180  600 250 180	ns
3-State Propagation Delay, Output "1" or "0" to High Impedance	$t_{PHZ}$ , $t_{PLZ}$	5.0 10 15	– – –	150 60 45	300 120 90	ns
3-State Propagation Delay, High Impedance to "1" or "0" Level	$t_{PZH}$ , $t_{PZL}$	5.0 10 15	– – –	200 80 60	400 160 120	ns
Clock Pulse Width	$t_{WH}$	5.0 10 15	260 110 80	130 55 40	– – –	ns
Reset Pulse Width	$t_{WH}$	5.0 10 15	370 150 110	185 75 55	– – –	ns
Data Setup Time	$t_{su}$	5.0 10 15	30 10 4	15 5 2	– – –	ns
Data Hold Time	$t_h$	5.0 10 15	130 60 50	65 30 25	– – –	ns
Data Disable Setup Time	$t_{su}$	5.0 10 15	220 80 50	110 40 25	– – –	ns
Clock Pulse Rise and Fall Time	$t_{TLH}$ , $t_{THL}$	5.0 10 15	– – –	– – –	15 5 4	$\mu\text{s}$
Clock Pulse Frequency	$f_{cl}$	5.0 10 15	– – –	3.6 9.0 12	1.8 4.5 6.0	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.

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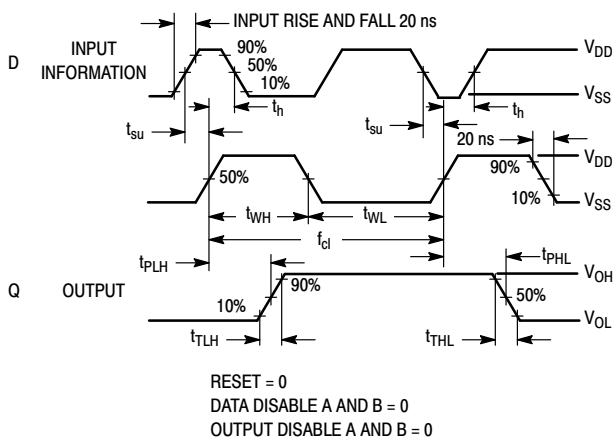


Figure 1. Timing Diagram

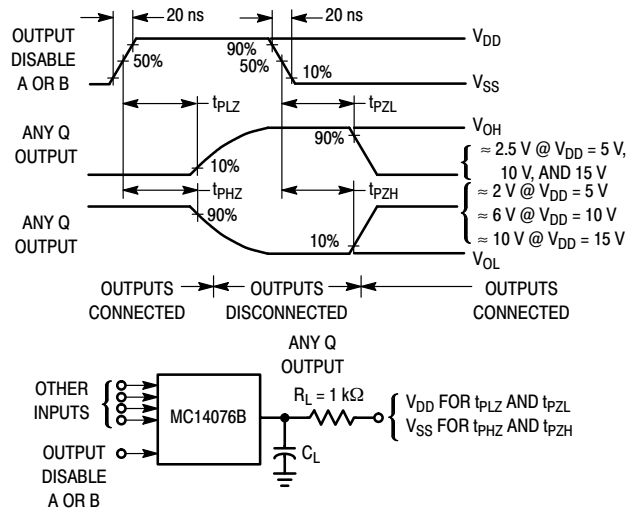
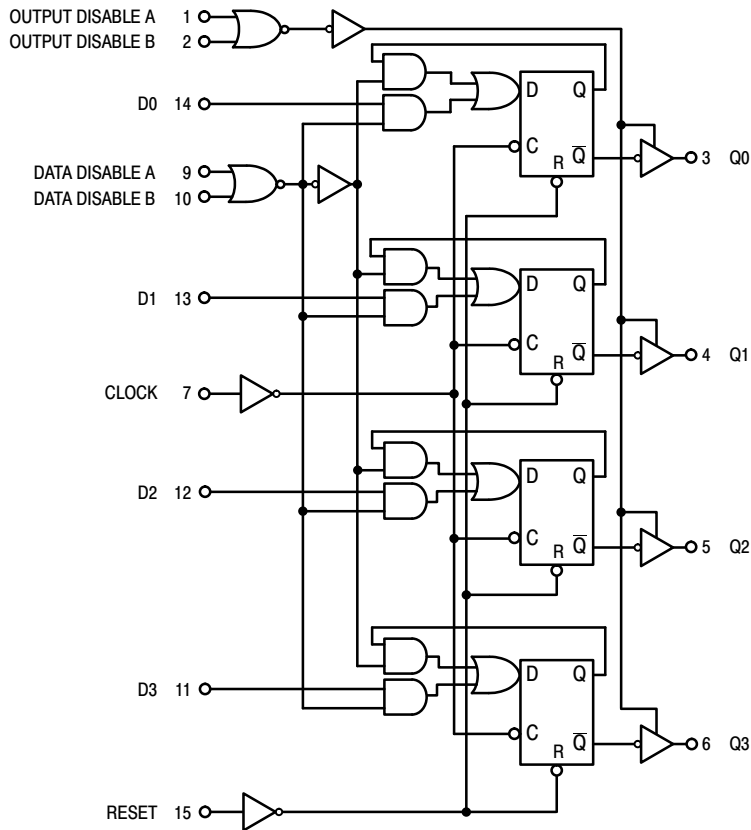


Figure 2. Three-State Propagation Delay Waveshape and Circuit

## EQUIVALENT FUNCTIONAL BLOCK DIAGRAM



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## ORDERING INFORMATION

Device	Package	Shipping†
MC14076BDG	SOIC-16 (Pb-Free)	48 Units / Rail
MC14076BDR2G	SOIC-16 (Pb-Free)	2500 Units / Tape & Reel
NLV14076BDR2G*	SOIC-16 (Pb-Free)	2500 Units / Tape & Reel

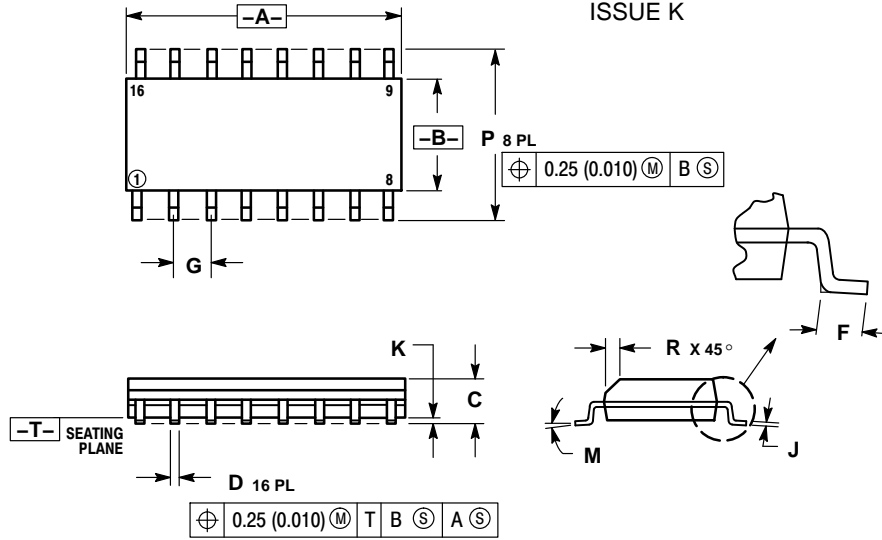
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

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## PACKAGE DIMENSIONS

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

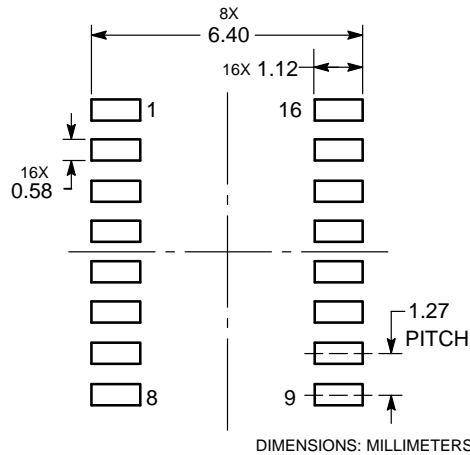


### NOTES:


- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- 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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