MC14014B, MC14021B

8-Bit Static Shift Register

The MC14014B and MC14021B 8−bit static shift registers are constructed with MOS P−channel and N−channel enhancement mode devices in a single monolithic structure. These shift registers find primary use in parallel−to−serial data conversion, synchronous and asynchronous parallel input, serial output data queueing; and other general purpose register applications requiring low power and/or high noise immunity.

Features

- Synchronous Parallel Input/Serial Output (MC14014B)
- Asynchronous Parallel Input/Serial Output (MC14021B)
- Synchronous Serial Input/Serial Output
- Full Static Operation
- “Q” Outputs from Sixth, Seventh, and Eighth Stages
- Double Diode Input Protection
- 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
- MC14014B Pin−for−Pin Replacement for CD4014B
- MC14021B Pin−for−Pin Replacement for CD4021B
- 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	±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.

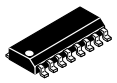
1. Temperature Derating: “D/DW” Package: –7.0 mW/°C From 65°C To 125°C

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 $V_{SS} \le (V_{in}$ or $V_{out}) \le V_{DD}$.

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.

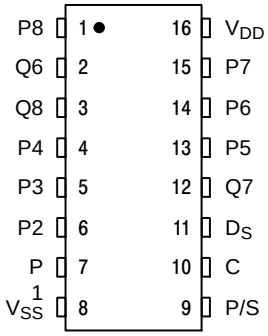
ON Semiconductor®

http://onsemi.com

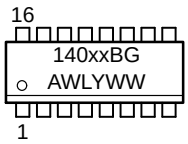


SOIC−16
D SUFFIX
CASE 751B

PIN ASSIGNMENT



MARKING DIAGRAM



xx = Specific Device Code
A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G = Pb−Free Indicator

ORDERING INFORMATION

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

© Semiconductor Components Industries, LLC, 2014

TRUTH TABLE

SERIAL OPERATION:

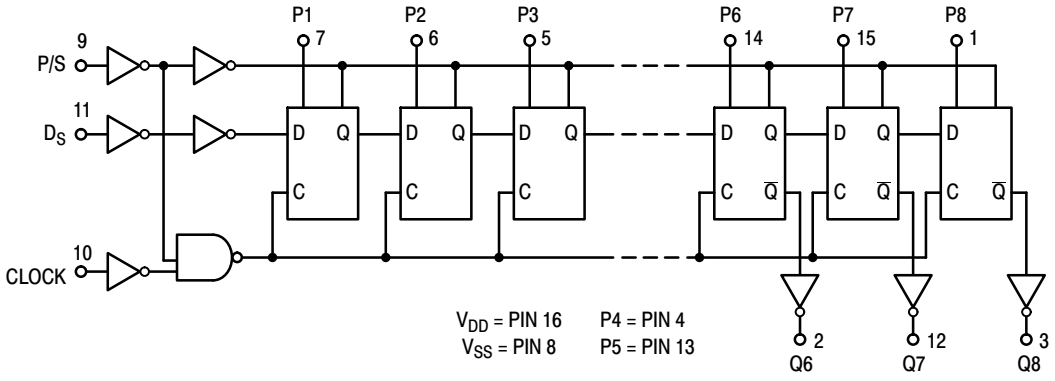
t	Clock	D_S	P/S	Q6 t=n+6	Q7 t=n+7	Q8 t=n+8
n	↗	0	0	0	?	?
n+1	↗	1	0	1	0	?
n+2	↗	0	0	0	1	0
n+3	↗	1	0	1	0	1
	↘	X	0	Q6	Q7	Q8

PARALLEL OPERATION:

Clock		D_S	P/S	P_n	$*Q_n$
MC14014B	MC14021B				
↗	X	X	1	0	0
↗	X	X	1	1	1

*Q6, Q7, & Q8 are available externally
X = Don't Care

LOGIC DIAGRAM



ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

Characteristic	Symbol	V_{DD} Vdc	−55°C Min	−55°C Max	25°C Min	25°C Typ (Note 2)	25°C Max	125°C Min	125°C Max	Unit
Output Voltage “0” Level	V_{OL}	5.0	−	0.05	−	0	0.05	−	0.05	Vdc
V_{in} = V_{DD} or 0		10	−	0.05	−	0	0.05	−	0.05	
		15	−	0.05	−	0	0.05	−	0.05	
V_{in} = 0 or V_{DD} “1” Level	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 “0” Level	V_{IL}									Vdc
(V_O = 4.5 or 0.5 Vdc)		5.0	−	1.5	−	2.25	1.5	−	1.5	
(V_O = 9.0 or 1.0 Vdc)		10	−	3.0	−	4.50	3.0	−	3.0	
(V_O = 13.5 or 1.5 Vdc)		15	−	4.0	−	6.75	4.0	−	4.0	
(V_O = 0.5 or 4.5 Vdc) “1” Level	V_{IH}	5.0	3.5	−	3.5	2.75	−	3.5	−	Vdc
(V_O = 1.0 or 9.0 Vdc)		10	7.0	−	7.0	5.50	−	7.0	−	
(V_O = 1.5 or 13.5 Vdc)		15	11	−	11	8.25	−	11	−	
Output Drive Current	I_{OH}									mAdc
(V_{OH} = 2.5 Vdc) Source		5.0	–3.0	−	–2.4	–4.2	−	–1.7	−	
(V_{OH} = 4.6 Vdc)		5.0	–0.64	−	–0.51	–0.88	−	−0.36	−	
(V_{OH} = 9.5 Vdc)		10	–1.6	−	−1.3	–2.25	−	–0.9	−	
(V_{OH} = 13.5 Vdc)		15	–4.2	−	−3.4	−8.8	−	−2.4	−	
(V_{OL} = 0.4 Vdc) Sink	I_{OL}	5.0	0.64	−	0.51	0.88	−	0.36	−	mAdc
(V_{OL} = 0.5 Vdc)		10	1.6	−	1.3	2.25	−	0.9	−	
(V_{OL} = 1.5 Vdc)		15	4.2	−	3.4	8.8	−	2.4	−	
Input Current	I_{in}	15	−	±0.1	−	±0.00001	±0.1	−	±1.0	μAdc
Input Capacitance (V_{in} = 0)	C_{in}	−	−	−	−	5.0	7.5	−	−	pF
Quiescent Current (Per Package)	I_{DD}	5.0	−	5.0	−	0.005	5.0	−	150	μAdc
		10	−	10	−	0.010	10	−	300	
		15	−	15	−	0.015	15	−	600	
Total Supply Current (Notes 3 & 4) (Dynamic plus Quiescent, Per Package) (C_L = 50 pF on all outputs, all buffers switching)	I_T	5.0	I_T = (0.75 μA/kHz) f + I_{DD}							μAdc
		10	I_T = (1.50 μA/kHz) f + I_{DD}							
		15	I_T = (2.25 μA/kHz) f + I_{DD}							

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:

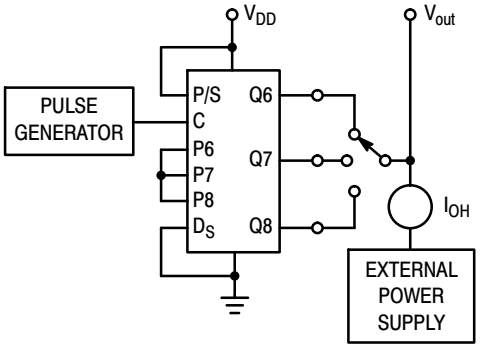
$$I_T(C_L) = I_T(50\ pF) + (C_L - 50)\ Vfk$$

where: I_T is in μA (per package), C_L in pF, V = (V_{DD} − V_{SS}) in volts, f in kHz is input frequency, and k = 0.0015.

SWITCHING CHARACTERISTICS (Note 5) (C_L = 50 pF, T_A = 25°C)

Characteristic	Symbol	V_{DD} Vdc	Min	Typ (Note 6)	Max	Unit
Output Rise and Fall Time	t_{TLH},					ns
t_{TLH}, t_{THL} = (1.5 ns/pF) C_L + 25 ns	t_{THL}	5.0	–	100	200	
t_{TLH}, t_{THL} = (0.75 ns/pF) C_L + 12.5 ns		10	–	50	100	
t_{TLH}, t_{THL} = (0.55 ns/pF) C_L + 9.5 ns		15	–	40	80	
Propagation Delay Time (Clock to Q, P/S to Q)	t_{PLH},					ns
t_{PHL}, t_{PLH} = (1.7 ns/pF) C_L + 315 ns	t_{PHL}	5.0	–	400	800	
t_{PHL}, t_{PLH} = (0.66 ns/pF) C_L + 137 ns		10	–	170	340	
t_{PHL}, t_{PLH} = (0.5 ns/pF) C_L + 90 ns		15	–	115	230	
Clock Pulse Width	t_{WH}	5.0	400	150	–	ns
		10	175	75	–	
		15	135	40	–	
Clock Frequency	f_{cl}	5.0	–	3.0	1.5	MHz
		10	–	6.0	3.0	
		15	–	8.0	4.0	
Parallel/Serial Control Pulse Width	t_{WH}	5.0	400	150	–	ns
		10	175	75	–	
		15	135	40	–	
Setup Time	t_{su}	5.0	200	100	–	ns
P/S to Clock		10	100	50	–	
		15	80	40	–	
Hold Time	t_h	5.0	20	– 2.5	–	ns
Clock to P/S		10	20	– 10	–	
		15	25	0	–	
Setup Time	t_{su}	5.0	350	150	–	ns
Data (Parallel or Serial) to		10	80	50	–	
Clock or P/S		15	60	30	–	
Hold Time	t_h	5.0	45	0	–	ns
Clock to D_S		10	35	0	–	
		15	35	5	–	
Hold Time	t_h	5.0	50	25	–	ns
Clock to P_n		10	45	20	–	
		15	45	20	–	
Input Clock Rise Time	$t_{r(cl)}$	5.0	–	–	15	μs
		10	–	–	5	
		15	–	–	4	

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



Preset output under test to a logic “1” level.

Figure 1. Output Source Current Test Circuit

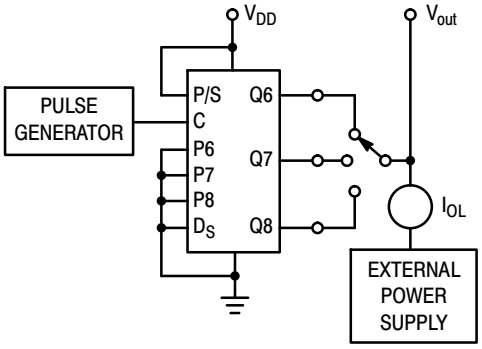


Figure 2. Output Sink Current Test Circuit

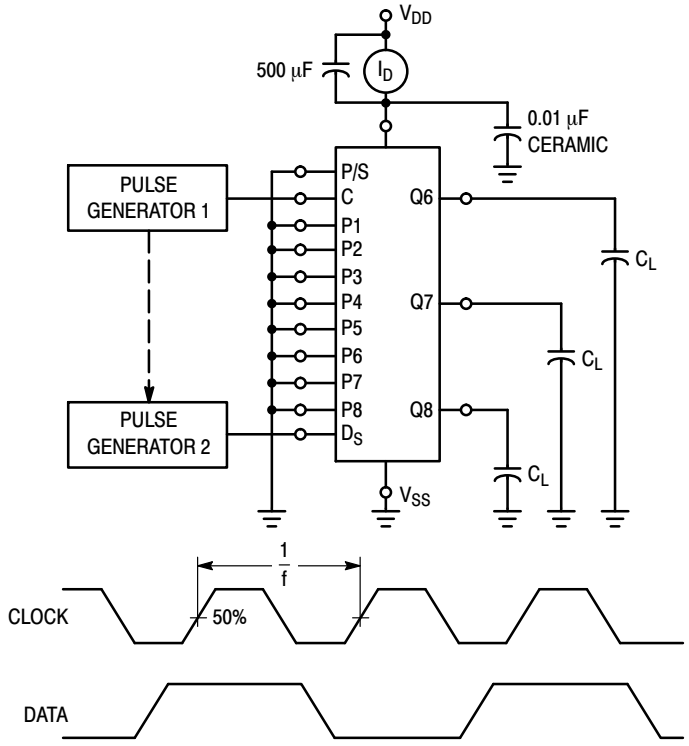


Figure 3. Power Dissipation Test Circuit and Waveform

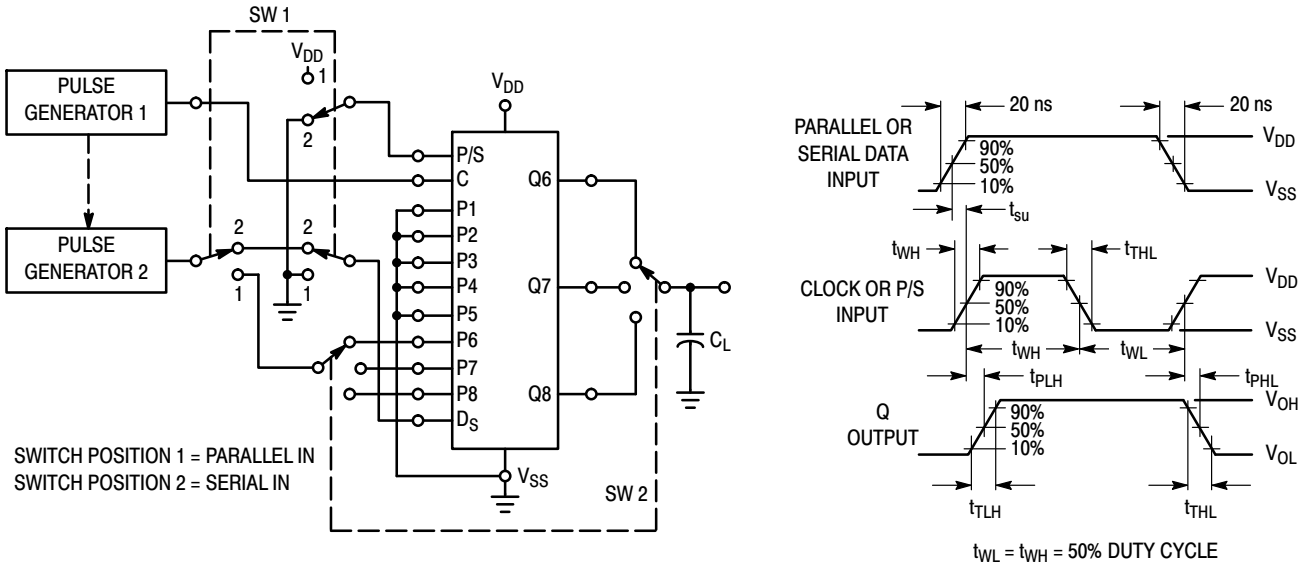


Figure 4. Switching Time Test Circuit and Waveforms

ORDERING INFORMATION

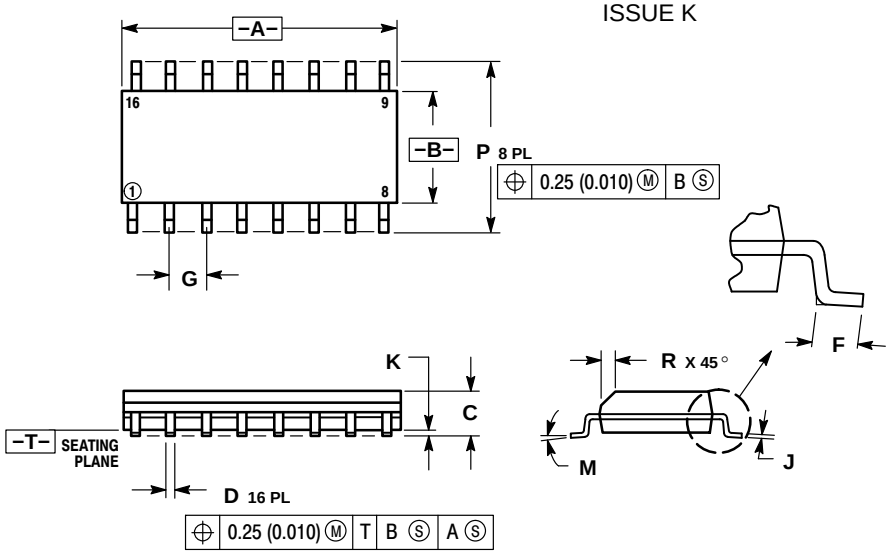
Device	Package	Shipping†
MC14014BDG	SOIC−16 (Pb−Free)	48 Units / Rail
MC14014BDR2G	SOIC−16 (Pb−Free)	2500 Units / Tape & Reel
NLV14014BDR2G*	SOIC−16 (Pb−Free)	2500 Units / Tape & Reel
MC14021BDG	SOIC−16 (Pb−Free)	48 Units / Rail
MC14021BDR2G	SOIC−16 (Pb−Free)	2500 Units / Tape & Reel
NLV14021BDR2G*	SOIC−16 (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.

PACKAGE DIMENSIONS

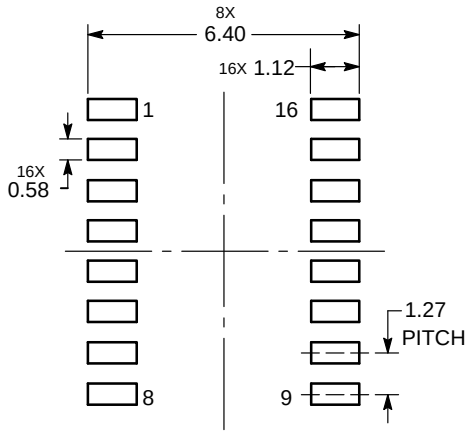
SOIC−16
D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B−05
ISSUE K



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.

	MILLIMETERS		INCHES	
DIM	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



DIMENSIONS: MILLIMETERS

ON Semiconductor and the ON are registered trademarks of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries. SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative