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.

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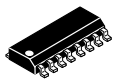
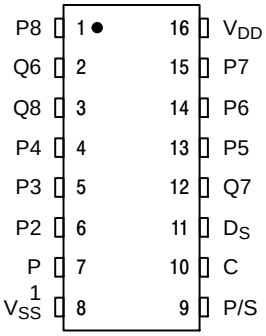
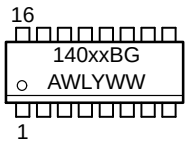


SOIC−16
D SUFFIX
CASE 751B

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.

TRUTH TABLE

SERIAL OPERATION:

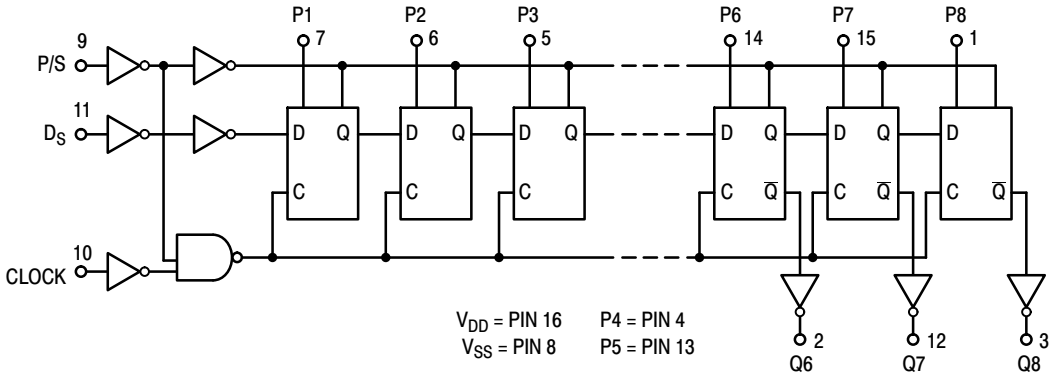
t	Clock	D_S	P/S	Q6 t=n+6	Q7 t=n+7	Q8 t=n+8
n	↑	0	0	0	?	?
n+1	↑	1	0	1	0	?
n+2	↑	0	0	0	1	0
n+3	↑	1	0	1	0	1
	↓	X	0	Q6	Q7	Q8

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:

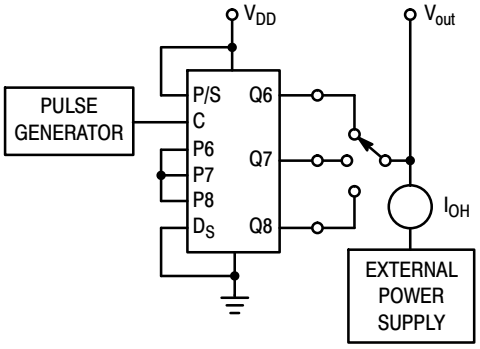
$$I_T(C_L) = I_T(50\ pF) + (C_L - 50)\ Vfk$$

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

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

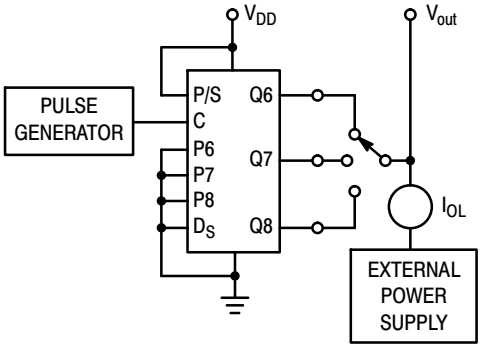


Figure 2. Output Sink Current Test Circuit

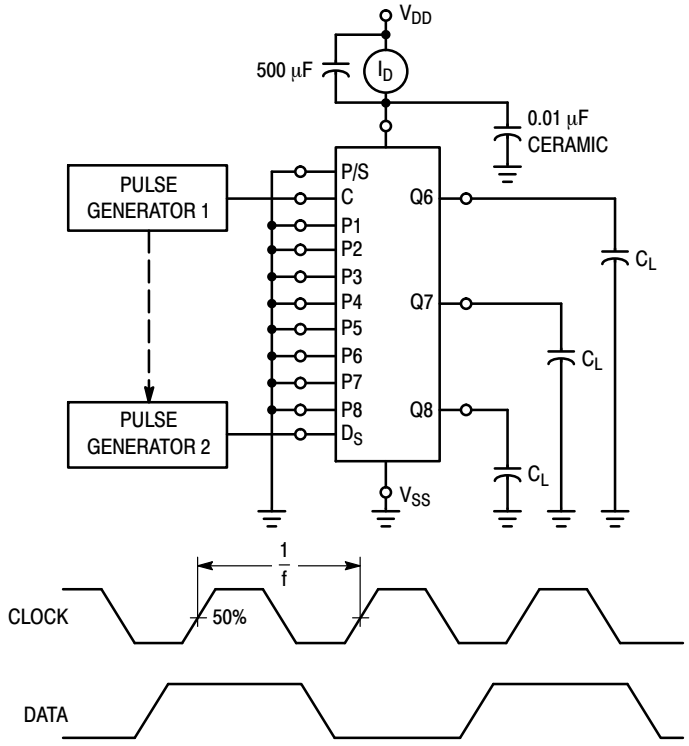


Figure 3. Power Dissipation Test Circuit and Waveform

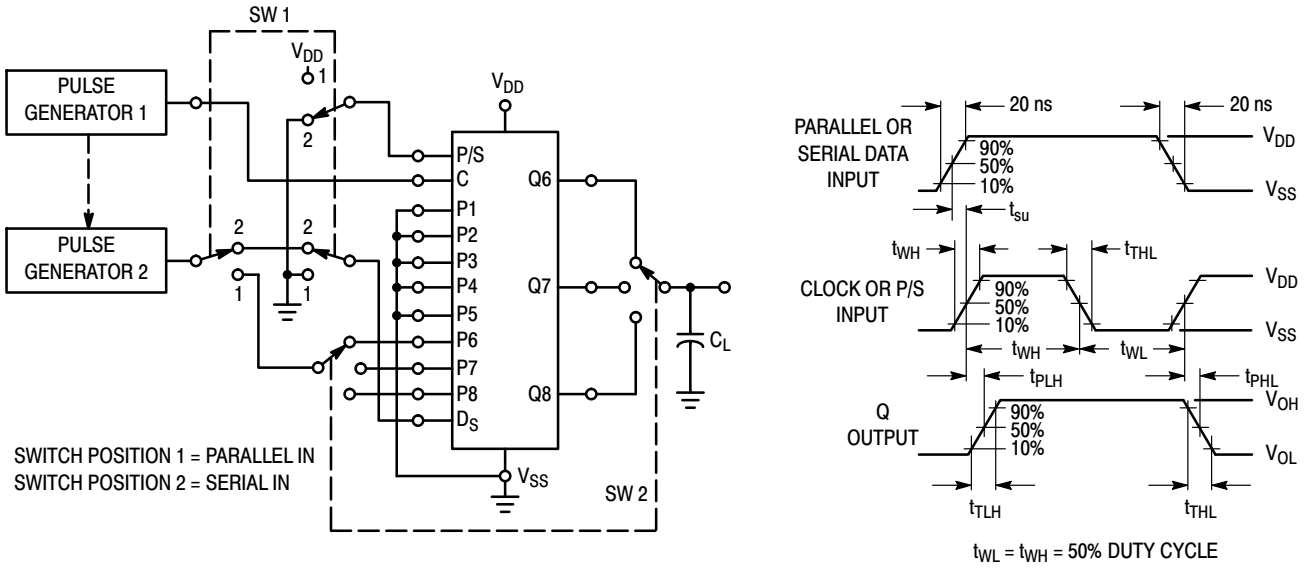


Figure 4. Switching Time Test Circuit and Waveforms

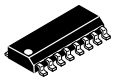
ORDERING INFORMATION

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.

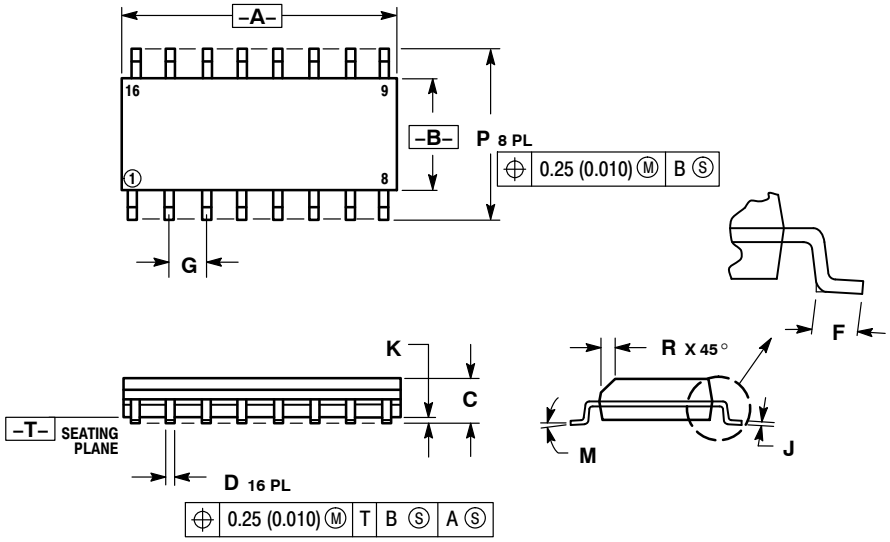
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



SCALE 1:1

SOIC−16
CASE 751B−05
ISSUE K

DATE 29 DEC 2006



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

STYLE 1:
PIN 1.	COLLECTOR
2.	BASE
3.	EMITTER
4.	NO CONNECTION
5.	EMITTER
6.	BASE
7.	COLLECTOR
8.	COLLECTOR
9.	BASE
10.	EMITTER
11.	NO CONNECTION
12.	EMITTER
13.	BASE
14.	COLLECTOR
15.	EMITTER
16.	COLLECTOR

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

STYLE 3:
PIN 1.	COLLECTOR, DYE #1
2.	BASE, #1
3.	EMITTER, #1
4.	COLLECTOR, #1
5.	COLLECTOR, #2
6.	BASE, #2
7.	EMITTER, #2
8.	COLLECTOR, #2
9.	COLLECTOR, #3
10.	BASE, #3
11.	EMITTER, #3
12.	COLLECTOR, #3
13.	COLLECTOR, #4
14.	BASE, #4
15.	EMITTER, #4
16.	COLLECTOR, #4

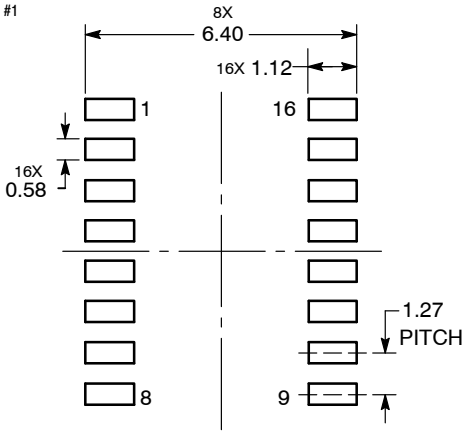
STYLE 4:
PIN 1.	COLLECTOR, DYE #1
2.	COLLECTOR, #1
3.	COLLECTOR, #2
4.	COLLECTOR, #2
5.	COLLECTOR, #3
6.	COLLECTOR, #3
7.	COLLECTOR, #4
8.	COLLECTOR, #4
9.	BASE, #4
10.	EMITTER, #4
11.	BASE, #3
12.	EMITTER, #3
13.	BASE, #2
14.	EMITTER, #2
15.	BASE, #1
16.	EMITTER, #1

STYLE 5:
PIN 1.	DRAIN, DYE #1
2.	DRAIN, #1
3.	DRAIN, #2
4.	DRAIN, #2
5.	DRAIN, #3
6.	DRAIN, #3
7.	DRAIN, #4
8.	DRAIN, #4
9.	GATE, #4
10.	SOURCE, #4
11.	GATE, #3
12.	SOURCE, #3
13.	GATE, #2
14.	SOURCE, #2
15.	GATE, #1
16.	SOURCE, #1

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

STYLE 7:
PIN 1.	SOURCE N-CH
2.	COMMON DRAIN (OUTPUT)
3.	COMMON DRAIN (OUTPUT)
4.	GATE P-CH
5.	COMMON DRAIN (OUTPUT)
6.	COMMON DRAIN (OUTPUT)
7.	COMMON DRAIN (OUTPUT)
8.	SOURCE P-CH
9.	SOURCE P-CH
10.	COMMON DRAIN (OUTPUT)
11.	COMMON DRAIN (OUTPUT)
12.	COMMON DRAIN (OUTPUT)
13.	GATE N-CH
14.	COMMON DRAIN (OUTPUT)
15.	COMMON DRAIN (OUTPUT)
16.	SOURCE N-CH

RECOMMENDED 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.

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DESCRIPTION:	**SOIC−16**	**PAGE 1 OF 1**

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