B-Suffix Series CMOS Gates

MC14001B, MC14011B, MC14023B, MC14025B, MC14071B, MC14073B, MC14081B, MC14082B

The B Series logic gates are constructed with P and N channel enhancement mode devices in a single monolithic structure (Complementary MOS). Their primary use is where low power dissipation and/or high noise immunity is desired.

Features

- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- All Outputs Buffered
- Capable of Driving Two Low-power TTL Loads or One Low-power Schottky TTL Load Over the Rated Temperature Range.
- Double Diode Protection on All Inputs Except: Triple Diode Protection on MC14011B and MC14081B
- Pin-for-Pin Replacements for Corresponding CD4000 Series B Suffix Devices
- These Devices are Pb-Free and are RoHS Compliant
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

MAXIMUM RATINGS (Voltages Referenced to VSS)

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
TL	Lead Temperature (8–Second Soldering)	260	°C
V _{ESD}	ESD Withstand Voltage Human Body Model Machine Model Charged Device Model	> 3000 > 300 N/A	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Temperature Derating:

Plastic "P and 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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MARKING DIAGRAMS



PDIP-14 P SUFFIX CASE 646





SOIC-14 D SUFFIX CASE 751A





TSSOP-14 DT SUFFIX CASE 948G



xx = Specific Device Code 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)

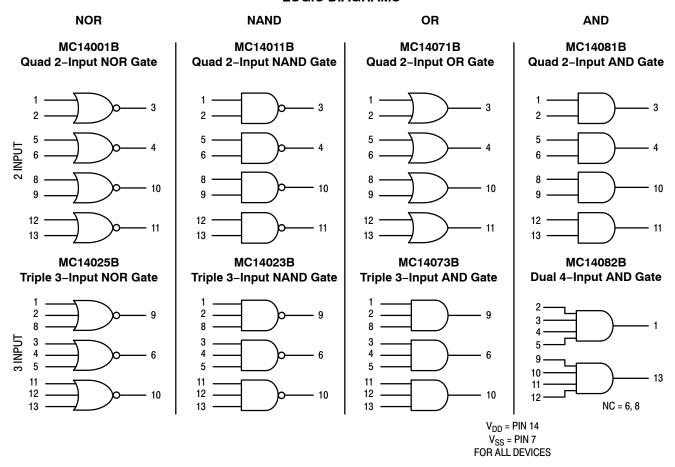
DEVICE INFORMATION

Device	Description
MC14001B	Quad 2-Input NOR Gate
MC14011B	Quad 2-Input NAND Gate
MC14023B	Triple 3-Input NAND Gate
MC14025B	Triple 3-Input NOR Gate
MC14071B	Quad 2-Input OR Gate
MC14073B	Triple 3-Input AND Gate
MC14081B	Quad 2-Input AND Gate
MC14082B	Dual 4-Input AND Gate

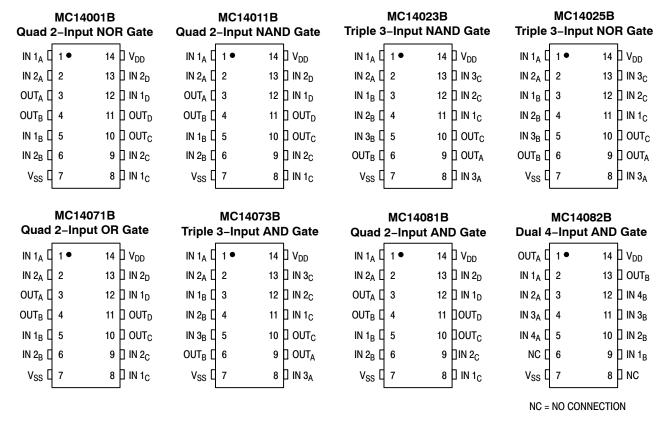
ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

LOGIC DIAGRAMS



PIN ASSIGNMENTS



ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

			V _{DD}	- 55	5°C		25°C		125	i°C	
Characteristic		Symbol	Vdc	Min	Max	Min	Typ ⁽²⁾	Max	Min	Max	Unit
Output Voltage V _{in} = V _{DD} or 0	"0" Level	V _{OL}	5.0 10 15	- - -	0.05 0.05 0.05	- - -	0 0 0	0.05 0.05 0.05	- - -	0.05 0.05 0.05	Vdc
$V_{in} = 0 \text{ or } V_{DD}$	"1" Level	V _{OH}	5.0 10 15	4.95 9.95 14.95	- - -	4.95 9.95 14.95	5.0 10 15	- - -	4.95 9.95 14.95	- - -	Vdc
Input Voltage ($V_O = 4.5 \text{ or } 0.5 \text{ Vdc}$) ($V_O = 9.0 \text{ or } 1.0 \text{ Vdc}$) ($V_O = 13.5 \text{ or } 1.5 \text{ Vdc}$)	"0" Level	V _{IL}	5.0 10 15	- - -	1.5 3.0 4.0	- - -	2.25 4.50 6.75	1.5 3.0 4.0	- - -	1.5 3.0 4.0	Vdc
$(V_O = 0.5 \text{ or } 4.5 \text{ Vdc})$ $(V_O = 1.0 \text{ or } 9.0 \text{ Vdc})$ $(V_O = 1.5 \text{ or } 13.5 \text{ Vdc})$	"1" Level	V _{IH}	5.0 10 15	3.5 7.0 11	- - -	3.5 7.0 11	2.75 5.50 8.25	- - -	3.5 7.0 11	- - -	Vdc
Output Drive Current $ \begin{aligned} &(V_{OH}=2.5 \text{ Vdc})\\ &(V_{OH}=4.6 \text{ Vdc})\\ &(V_{OH}=9.5 \text{ Vdc})\\ &(V_{OH}=13.5 \text{ Vdc}) \end{aligned} $	Source	I _{OH}	5.0 5.0 10 15	- 3.0 - 0.64 - 1.6 - 4.2	- - - -	- 2.4 - 0.51 - 1.3 - 3.4	- 4.2 - 0.88 - 2.25 - 8.8	- - - -	- 1.7 - 0.36 - 0.9 - 2.4	- - - -	mAdc
$(V_{OL} = 0.4 \text{ Vdc})$ $(V_{OL} = 0.5 \text{ Vdc})$ $(V_{OL} = 1.5 \text{ Vdc})$	Sink	I _{OL}	5.0 10 15	0.64 1.6 4.2	- - -	0.51 1.3 3.4	0.88 2.25 8.8	- - -	0.36 0.9 2.4	- - -	mAdc
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 10 15	- - -	0.25 0.5 1.0	- - -	0.0005 0.0010 0.0015	0.25 0.5 1.0	- - -	7.5 15 30	μAdc
Total Supply Current ⁽³⁾ ⁽⁴⁾ (Dynamic plus Quiesce Per Gate, C _L = 50 pF)		I _T	5.0 10 15			$I_{T} = (0.$	3 μΑ/kHz) f + 6 μΑ/kHz) f + 9 μΑ/kHz) f +	+ I _{DD} /N			μAdc

Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.
 The formulas given are for the typical characteristics only at 25°C.
 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_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 = 0.001 x the number of exercised gates per package.

B-SERIES GATE SWITCHING TIMES

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

Characteristic	Symbol	V _{DD} Vdc	Min	Typ ⁽⁶⁾	Max	Unit
Output Rise Time, All B-Series Gates	t _{TLH}					ns
$t_{TLH} = (1.35 \text{ ns/pF}) C_L + 33 \text{ ns}$		5.0	_	100	200	
$t_{TLH} = (0.60 \text{ ns/pF}) C_L + 20 \text{ ns}$		10	_	50	100	
$t_{TLH} = (0.40 \text{ ns/PF}) C_L + 20 \text{ ns}$		15	-	40	80	
Output Fall Time, All B-Series Gates	t _{THL}					ns
$t_{THL} = (1.35 \text{ ns/pF}) C_L + 33 \text{ ns}$		5.0	_	100	200	
$t_{THL} = (0.60 \text{ ns/pF}) C_L + 20 \text{ ns}$		10	_	50	100	
$t_{THL} = (0.40 \text{ ns/pF}) C_L + 20 \text{ ns}$		15	_	40	80	
Propagation Delay Time	t _{PLH} , t _{PHL}					ns
MC14001B, MC14011B only						
t_{PLH} , t_{PHL} = (0.90 ns/pF) C_L + 80 ns		5.0	_	125	250	
t_{PLH} , t_{PHL} = (0.36 ns/pF) C_L + 32 ns		10	_	50	100	
t_{PLH} , t_{PHL} = (0.26 ns/pF) C_L + 27 ns		15	_	40	80	
All Other 2, 3, and 4 Input Gates						
t_{PLH} , $t_{PHL} = (0.90 \text{ ns/pF}) C_L + 115 \text{ ns}$		5.0	_	160	300	
t_{PLH} , t_{PHL} = (0.36 ns/pF) C_L + 47 ns		10	_	65	130	
t_{PLH} , t_{PHL} = (0.26 ns/pF) C_L + 37 ns		15	_	50	100	
8-Input Gates (MC14068B, MC14078B)						
t_{PLH} , $t_{PHL} = (0.90 \text{ ns/pF}) C_L + 155 \text{ ns}$		5.0	_	200	350	
t_{PLH} , $t_{PHL} = (0.36 \text{ ns/pF}) C_L + 62 \text{ ns}$		10	_	80	150	
t_{PLH} , t_{PHL} = (0.26 ns/pF) C_L + 47 ns		15	_	60	110	

^{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.

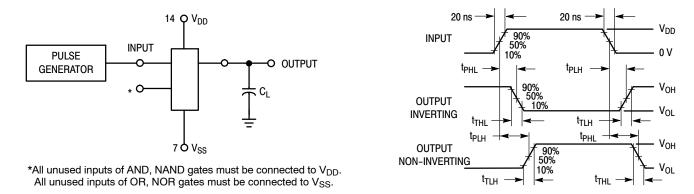
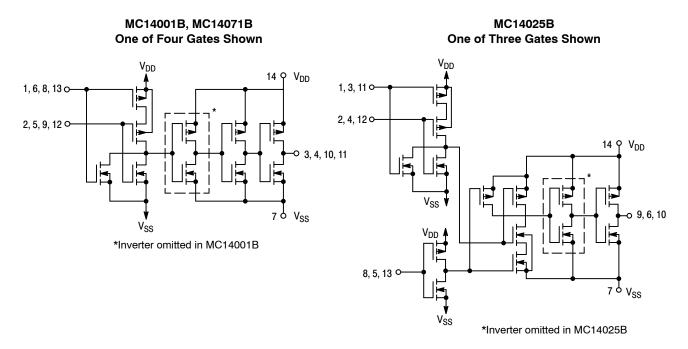
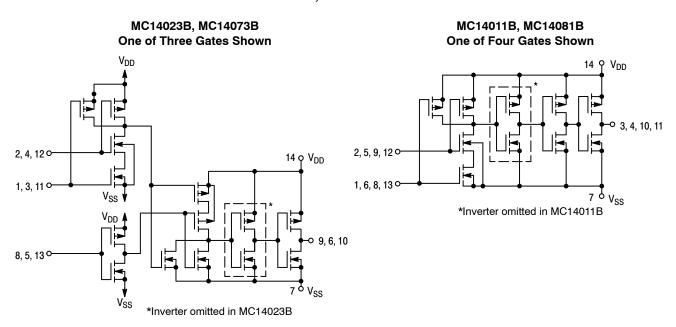


Figure 1. Switching Time Test Circuit and Waveforms

CIRCUIT SCHEMATIC NOR, OR GATES



CIRCUIT SCHEMATIC NAND, AND GATES



TYPICAL B-SERIES GATE CHARACTERISTICS

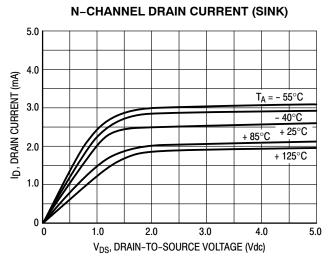


Figure 2. V_{GS} = 5.0 Vdc

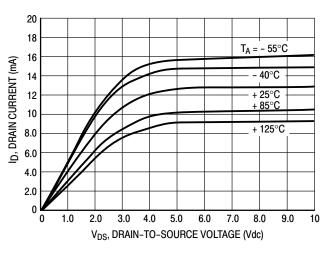


Figure 4. V_{GS} = 10 Vdc

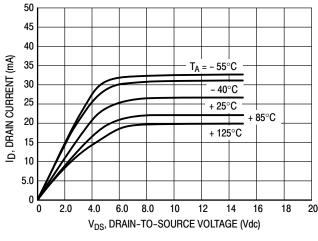


Figure 6. V_{GS} = 15 Vdc

P-CHANNEL DRAIN CURRENT (SOURCE) - 10 - 9.0 - 8.0 $T_A = -55^{\circ}C$ ID, DRAIN CURRENT (mA) - 7.0 - 6.0 - 5.0 + 25°C - 85°C - 4.0 125°C - 3.0 - 2.0 - 1.0 - 1.0 - 2.0 - 3.0 - 4.0 - 5.0 V_{DS}, DRAIN-TO-SOURCE VOLTAGE (Vdc)

Figure 3. $V_{GS} = -5.0 \text{ Vdc}$

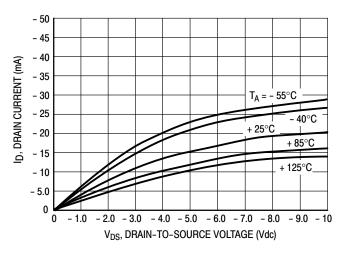


Figure 5. V_{GS} = - 10 Vdc

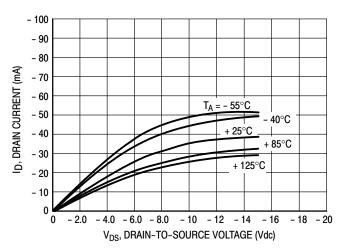


Figure 7. $V_{GS} = -15 \text{ Vdc}$

These typical curves are not guarantees, but are design aids. Caution: The maximum rating for output current is 10 mA per pin.

TYPICAL B-SERIES GATE CHARACTERISTICS (cont'd)

VOLTAGE TRANSFER CHARACTERISTICS

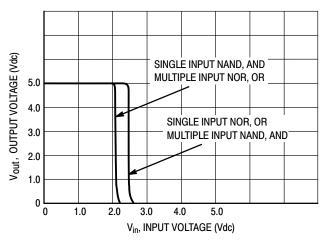


Figure 8. V_{DD} = 5.0 Vdc

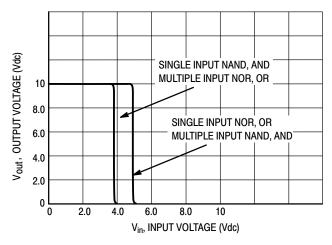


Figure 9. V_{DD} = 10 Vdc

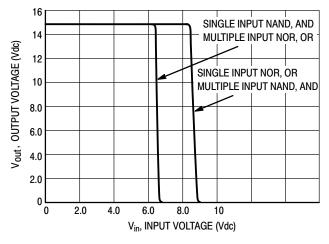


Figure 10. V_{DD} = 15 Vdc

DC NOISE MARGIN

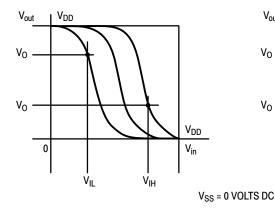
The DC noise margin is defined as the input voltage range from an ideal "1" or "0" input level which does not produce output state change(s). The typical and guaranteed limit values of the input values V_{IL} and V_{IH} for the output(s) to be at a fixed voltage V_O are given in the Electrical Characteristics table. V_{IL} and V_{IH} are presented graphically in Figure 11.

Guaranteed minimum noise margins for both the "1" and "0" levels =

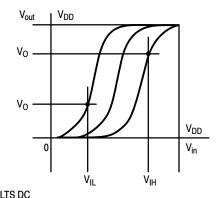
1.0 V with a 5.0 V supply

2.0 V with a 10.0 V supply

2.5 V with a 15.0 V supply



(a) Inverting Function



(b) Non-Inverting Function

Figure 11. DC Noise Immunity

ORDERING INFORMATION

Device	Package	Shipping [†]	
MC14001BCPG	PDIP-14 (Pb-Free)	25 Units / Rail	
MC14001BDG	SOIC-14	55 Units / Rail	
NLV14001BDG*	(Pb-Free)	33 Offits / Hall	
MC14001BDR2G	SOIC-14		
NLV14001BDR2G*	(Pb-Free)	2500 Units / Tape & Reel	
MC14001BDTR2G	TSSOP-14	2500 Offits / Tape & Reef	
NLV14001BDTR2G*	(Pb-Free)		
MC14001BFELG	SOEIAJ-14 (Pb-Free)	2000 Units / Tape & Reel	
MC14011BCPG	PDIP-14 (Pb-Free)	25 Units / Rail	
MC14011BDG	SOIC-14	55 Units / Rail	
NLV14011BDG*	(Pb-Free)	oo omo / nan	
MC14011BDR2G	SOIC-14		
NLV14011BDR2G*	(Pb-Free)	2500 Units / Tape & Reel	
MC14011BDTR2G	TSSOP-14	2300 Offits / Tape & Fleet	
NLV14011BDTR2G*	(Pb-Free)		
MC14011BFG	SOEIAJ-14	50 Units / Rail	
MC14011BFELG	(Pb-Free)	2000 Units / Tape & Reel	
MC14023BCPG	PDIP-14	25 Units / Rail	
MO4 4000DDO	(Pb-Free)	<u> </u>	
MC14023BDG	SOIC-14 (Pb-Free)	55 Units / Rail	
MC14023BDR2G	SOIC-14	OFOO Haita / Tana & Flori	
NLV14023BDR2G*	(Pb-Free)	2500 Units / Tape & Reel	
MC14023BFELG	SOEIAJ-14 (Pb-Free)	2000 Units / Tape & Reel	
MC14025BCPG	PDIP-14	<u> </u>	
WIO 1402JDOFG	(Pb-Free)	25 Units / Rail	
MC14025BDG	SOIC-14	EE Inite / Dail	
NLV14025BDG*	(Pb-Free)	55 Units / Rail	
MC14025BDR2G	SOIC-14	0500 Units / Tarre 9 David	
NLV14025BDR2G*	(Pb-Free)	2500 Units / Tape & Reel	
MC14025BFELG	SOEIAJ-14 (Pb-Free)	2000 Units / Tape & Reel	

ORDERING INFORMATION

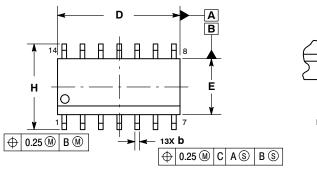
Device	Package	Shipping [†]
MC14071BCPG	PDIP-14 (Pb-Free)	25 Units / Rail
MC14071BDG	SOIC-14	SS Heite / Deil
NLV14071BDG*	(Pb-Free)	55 Units / Rail
MC14071BDR2G	SOIC-14	OFOO Units / Tana & Dool
NLV14071BDR2G*	(Pb-Free)	2500 Units / Tape & Reel
MC14071BDTG		96 Units per Rail
MC14071BDTR2G	TSSOP-14 (Pb-Free)	OFFICE LIGHT / Target 9 Dead
NLV14071BDTR2G*	(12.11-)	2500 Units / Tape & Reel
MC14073BCPG	PDIP-14	1
W014073B01 Q	(Pb-Free)	25 Units / Rail
MC14073BDG	SOIC-14 (Pb-Free)	55 Units / Rail
MC14073BDR2G	SOIC-14 (Pb-Free)	2500 Units / Tape & Reel
MC14081BCPG	PDIP-14 (Pb-Free)	25 Units / Rail
MC14081BDG	SOIC-14	55 Units / Rail
NLV14081BDG*	(Pb-Free)	55 Offits / Hall
MC14081BDR2G	SOIC-14	
NLV14081BDR2G*	(Pb-Free)	OFOO Units / Tana & Dad
MC14081BDTR2G	TSSOP-14	2500 Units / Tape & Reel
NLV14081BDTR2G*	(Pb-Free)	
		<u></u>
MC14082BCPG	PDIP-14 (Pb-Free)	500 Units / Tube
MC14082BDG		55 Heite / Deil
NLV14082BDG*	SOIC-14 (Pb-Free)	55 Units / Rail
MC14082BDR2G	(. 2 ,	2500 Units / Tape & Reel
	•	•

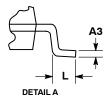
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP

Capable.

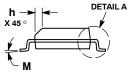
PACKAGE DIMENSIONS

SOIC-14 NB CASE 751A-03 ISSUE K









- NOTES:

 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

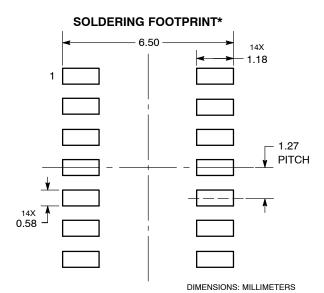
 2. CONTROLLING DIMENSION: MILLIMETERS.

 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.

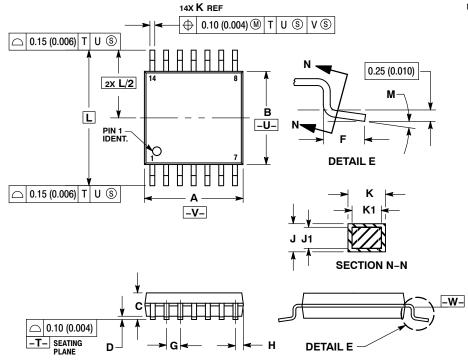
	MILLIN	IETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
Α	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
АЗ	0.19	0.25	0.008	0.010
b	0.35	0.49	0.014	0.019
D	8.55	8.75	0.337	0.344
Е	3.80	4.00	0.150	0.157
е	1.27	BSC	0.050	BSC
Н	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.019
L	0.40	1.25	0.016	0.049
М	0°	7°	0 °	7°



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

PACKAGE DIMENSIONS

TSSOP-14 CASE 948G **ISSUE B**



NOTES:

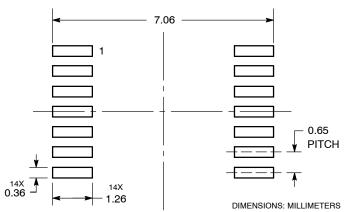
- JIES:

 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-.

	MILLIN	IETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
Α	4.90	5.10	0.193	0.200
В	4.30	4.50	0.169	0.177
С		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
Н	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
Κ	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
Г	6.40 BSC		0.252	BSC
М	0 °	8 °	0 °	8 °

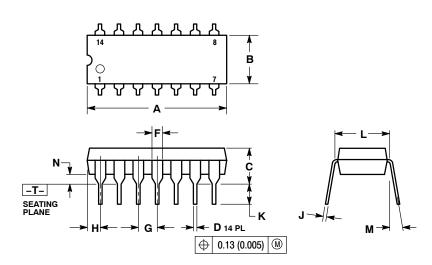
SOLDERING FOOTPRINT*



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

PACKAGE DIMENSIONS

PDIP-14 CASE 646-06 ISSUE P



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
- CONTROLLING DIMENSION: INCH.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.
 ROUNDED CORNERS OPTIONAL.

	INC	HES	MILLIM	ETERS
DIM	MIN	MAX	MIN	MAX
Α	0.715	0.770	18.16	19.56
В	0.240	0.260	6.10	6.60
С	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100	BSC	2.54	BSC
Н	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.290	0.310	7.37	7.87
М		10 °		10 °
N	0.015	0.039	0.38	1.01

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