MC14106B

Hex Schmitt Trigger

The MC14106B hex Schmitt Trigger is constructed with MOS P−channel and N−channel enhancement mode devices in a single monolithic structure. These devices find primary use where low power dissipation and/or high noise immunity is desired. The MC14106B may be used in place of the MC14069UB hex inverter for enhanced noise immunity or to “square up” slowly changing waveforms.

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.

Features

- Increased Hysteresis Voltage Over the MC14584B
- 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
- Pin−for−Pin Replacement for CD40106B and MM74C14
- Can Be Used to Replace the MC14584B or MC14069UB
- Pb−Free Packages are Available

MAXIMUM RATINGS (Voltages Referenced to V_{SS})

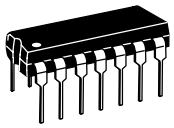
Symbol	Parameter	Value	Unit
V_{DD}	DC Supply Voltage Range	−0.5 to +18.0	V
V_{in}, V_{out}	Input or Output Voltage Range (DC or Transient)	−0.5 to V_{DD} + 0.5	V
I_{in}, I_{out}	Input or Output Current (DC or Transient) per Pin	±10	mA
P_D	Power Dissipation, per Package (Note 1)	500	mW
T_A	Ambient Temperature 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 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

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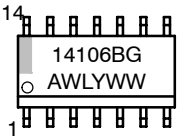
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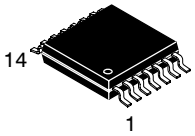


PDIP−14
P SUFFIX
CASE 646

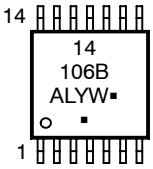


SOIC−14
D SUFFIX
CASE 751A





TSSOP−14
DT SUFFIX
CASE 948G



MARKING DIAGRAMS

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 in the package dimensions section on page 2 of this data sheet.

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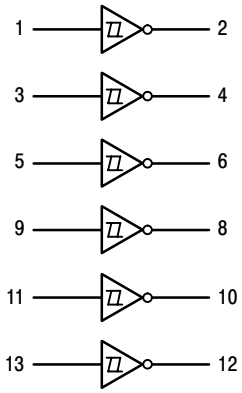


Figure 1. Logic Diagram

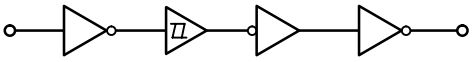


Figure 2. Equivalent Circuit Schematic (1/6 of Circuit Shown)

ORDERING INFORMATION

Device	Package	Shipping†
MC14106BCP	PDIP−14	25 Units / Rail
MC14106BCPG	PDIP−14 (Pb−Free)	
MC14106BD	SOIC−14	55 Units / Rail
MC14106BDG	SOIC−14 (Pb−Free)	
MC14106BDR2	SOIC−14	2500 / Tape & Reel
MC14106BDR2G	SOIC−14 (Pb−Free)	
MC14106BDTR2	TSSOP−14*	
MC14106BDTR2G	TSSOP−14*	

†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.
*This package is inherently Pb−Free.

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

Characteristic	Symbol	V_{DD} Vdc	– 55°C Min	– 55°C Max	25°C Min	25°C Typ (2)	25°C Max	125°C Min	125°C Max	Unit
Output Voltage "0" Level V_{in} = V_{DD}	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
"1" Level V_{in} = 0	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
Hysteresis Voltage	V_H (5)	5.0 10 15	0.3 1.2 1.6	2.0 3.4 5.0	0.3 1.2 1.6	1.1 1.7 2.1	2.0 3.4 5.0	0.3 1.2 1.6	2.0 3.4 5.0	Vdc
Threshold Voltage Positive–Going	V_{T+}	5.0 10 15	2.2 4.6 6.8	3.6 7.1 10.8	2.2 4.6 6.8	2.9 5.9 8.8	3.6 7.1 10.8	2.2 4.6 6.8	3.6 7.1 10.8	Vdc
Negative–Going	V_{T-}	5.0 10 15	0.9 2.5 4.0	2.8 5.2 7.4	0.9 2.5 4.0	1.9 3.9 5.8	2.8 5.2 7.4	0.9 2.5 4.0	2.8 5.2 7.4	Vdc
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 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 (Note 3, 4) (Dynamic plus Quiescent, Per Package) (C_L = 50 pF on all outputs, all buffers switching)	I_T	5.0 10 15	I_T = (1.8 μA/kHz) f + I_{DD} I_T = (3.6 μA/kHz) f + I_{DD} I_T = (5.4 μA/kHz) f + I_{DD}							μAdc

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 = 0.001.
5. $V_H = V_{T+} - V_{T-}$ (But maximum variation of V_H is specified as less that $V_{T+\ max} - V_{T-\ min}$).

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

Characteristic	Symbol	V_{DD} Vdc	Min	Typ (6)	Max	Unit
Output Rise Time	t_{TLH}	5.0	–	100	200	ns
		10	–	50	100	
		15	–	40	80	
Output Fall Time	t_{THL}	5.0	–	100	200	ns
		10	–	50	100	
		15	–	40	80	
Propagation Delay Time	t_{PLH}, t_{PHL}	5.0	–	125	250	ns
		10	–	50	100	
		15	–	40	80	

6. Data labelled “Typ” is not to be used for design purposes but is intended as an indication of the IC’s potential performance.

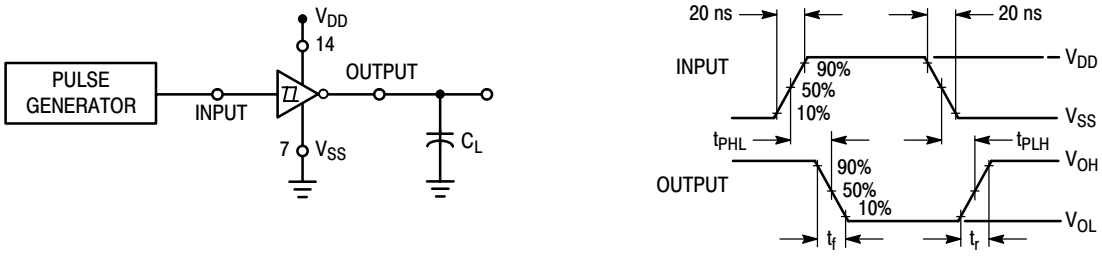


Figure 1. Switching Time Test Circuit and Waveforms

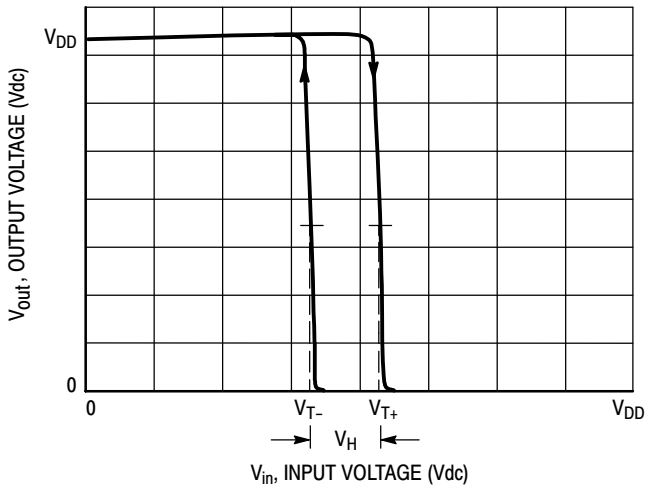
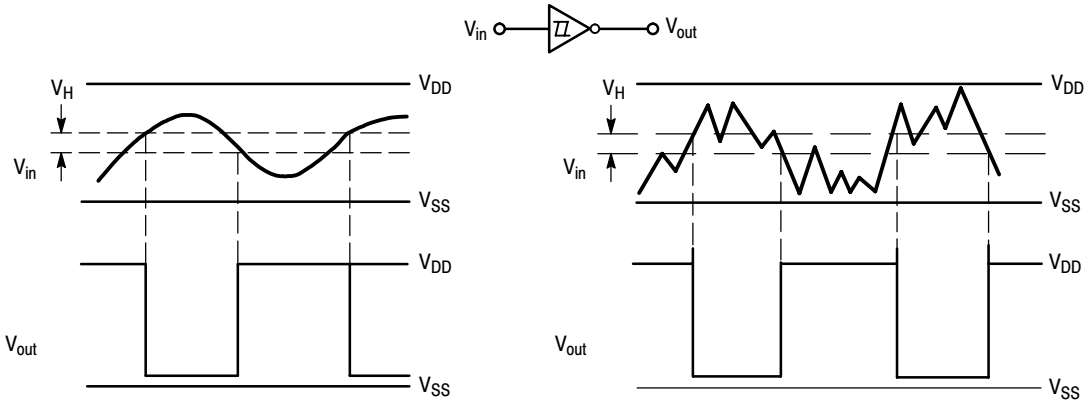


Figure 2. Typical Transfer Characteristics

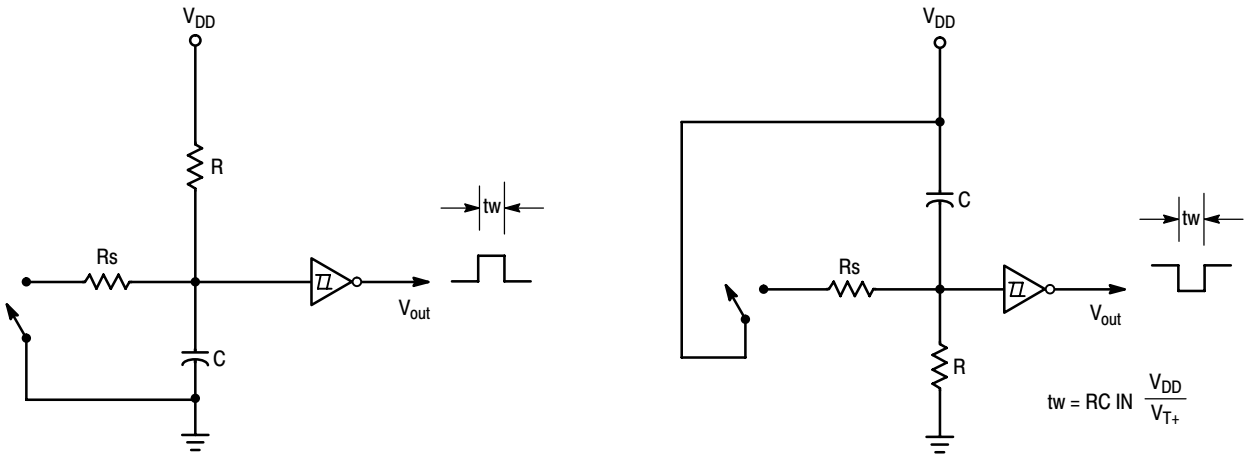
APPLICATIONS



(a) Schmitt Triggers will square up inputs with slow rise and fall times.

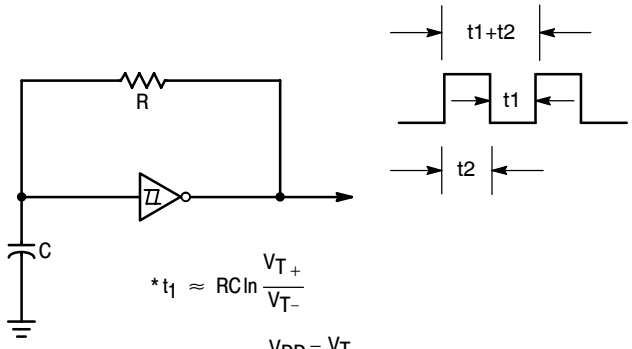
(b) A Schmitt trigger offers maximum noise immunity in gate applications.

Figure 3.



Useful as Pushbutton/Keyboard Debounce Circuit.

Figure 4. Monostable Multivibrator



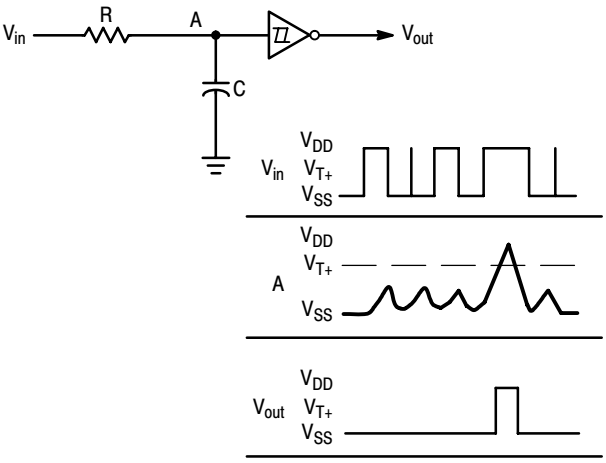
$$*t_1 \approx RC \ln \frac{V_{T+}}{V_{T-}}$$

$$*t_2 \approx RC \ln \frac{V_{DD} - V_{T-}}{V_{DD} - V_{T+}}$$

$$\frac{1}{f} \approx RC \ln \left[\left(\frac{V_{DD} - V_{T-}}{V_{DD} - V_{T+}} \right) \left(\frac{V_{T+}}{V_{T-}} \right) \right]$$

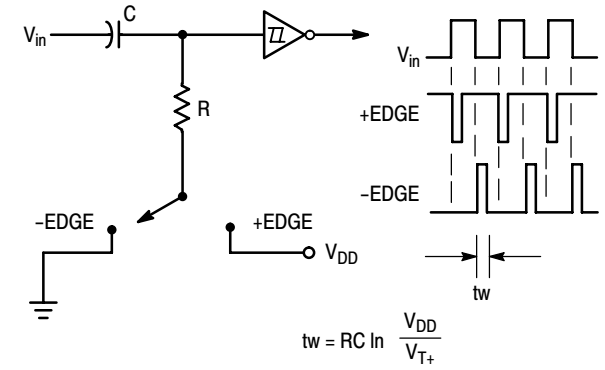
$*t_1 + t_2 \gg t_{PHL} + t_{PLH}$

Figure 5. Astable Multivibrator



Useful in discriminating against short pulse durations.

Figure 6. Integrator



$$tw = RC \ln \frac{V_{DD}}{V_{T+}}$$

Useful as an edge detector circuit.

Figure 7. Differentiator

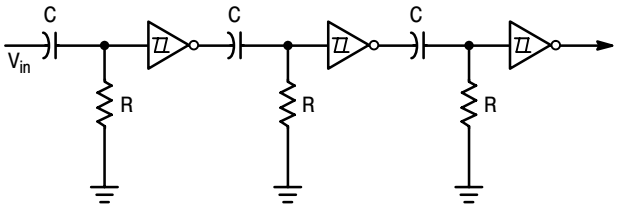
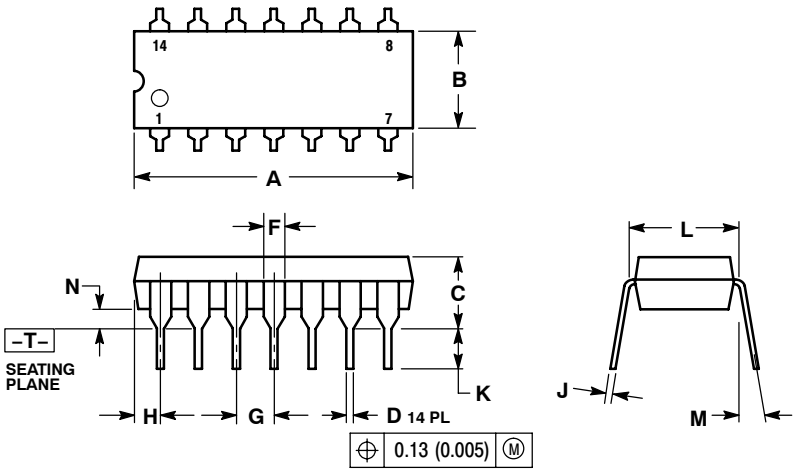


Figure 8. Positive Edge Time Delay Circuit

PACKAGE DIMENSIONS

PDIP−14
CASE 646−06
ISSUE P

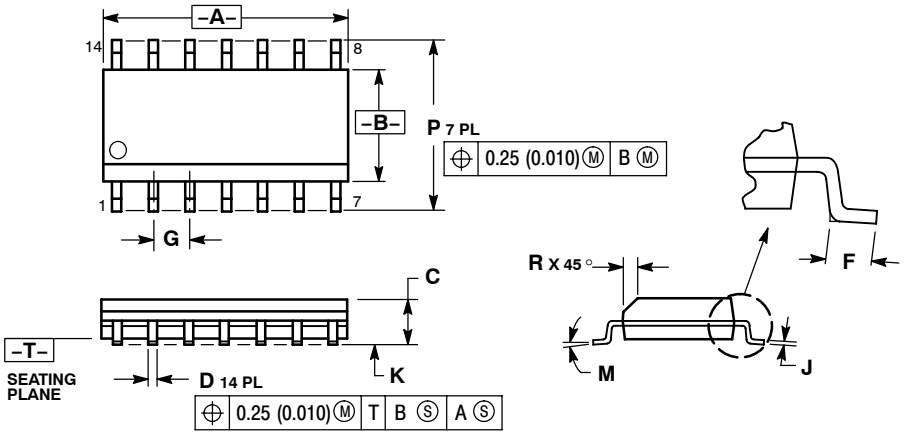


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	19.56
B	0.240	0.260	6.10	6.60
C	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	
H	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
M	−−−	10 °	−−−	10 °
N	0.015	0.039	0.38	1.01

PACKAGE DIMENSIONS

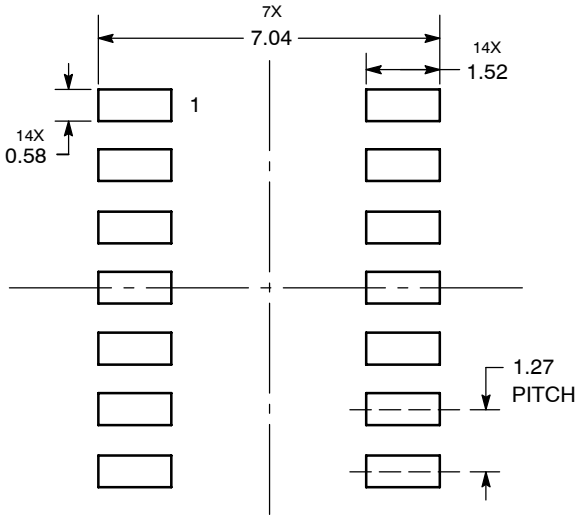
SOIC−14
CASE 751A−03
ISSUE H



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	8.55	8.75	0.337	0.344
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	0.228	0.244
R	0.25	0.50	0.010	0.019

SOLDERING FOOTPRINT*

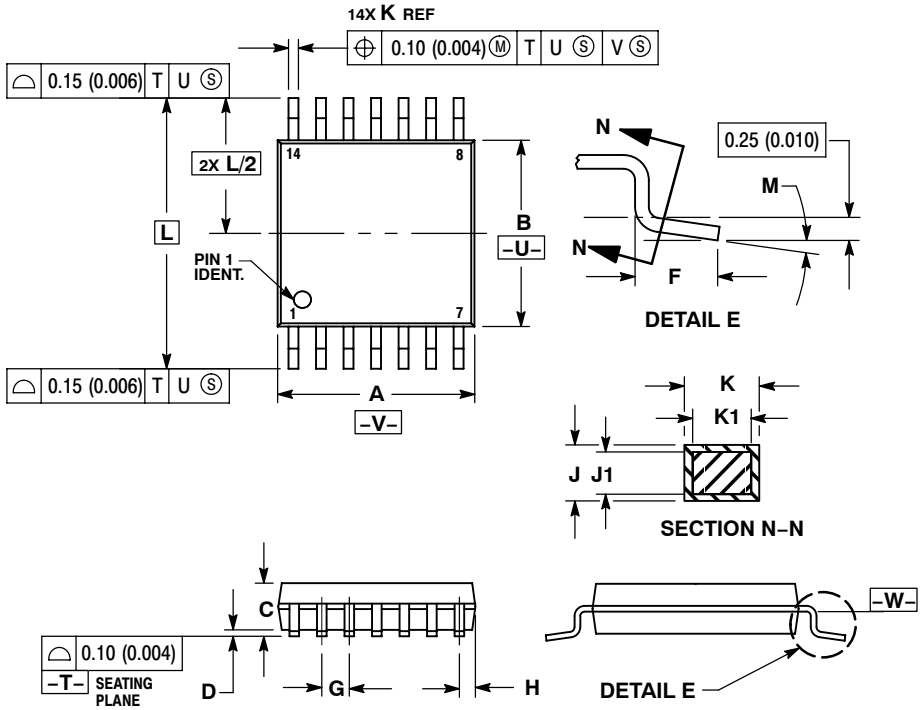


DIMENSIONS: MILLIMETERS

*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

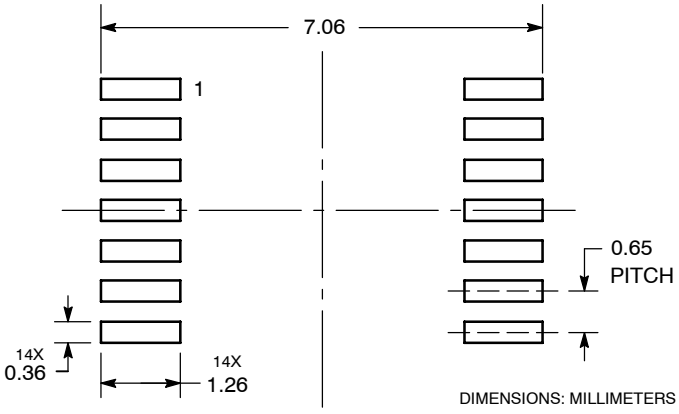
TSSOP−14
CASE 948G−01
ISSUE B



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−.

	MILLIMETERS		INCHES	
DIM	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 °

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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