MC74HC14A

Hex Schmitt-Trigger Inverter

High−Performance Silicon−Gate CMOS

The MC74HC14A is identical in pinout to the LS14, LS04 and the HC04. The device inputs are compatible with Standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

The HC14A is useful to “square up” slow input rise and fall times. Due to hysteresis voltage of the Schmitt trigger, the HC14A finds applications in noisy environments.

Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0 μA
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance With the JEDEC Standard No. 7.0 A Requirements
- Chip Complexity: 60 FETs or 15 Equivalent Gates
- These Devices are Pb−Free, Halogen Free and are RoHS Compliant

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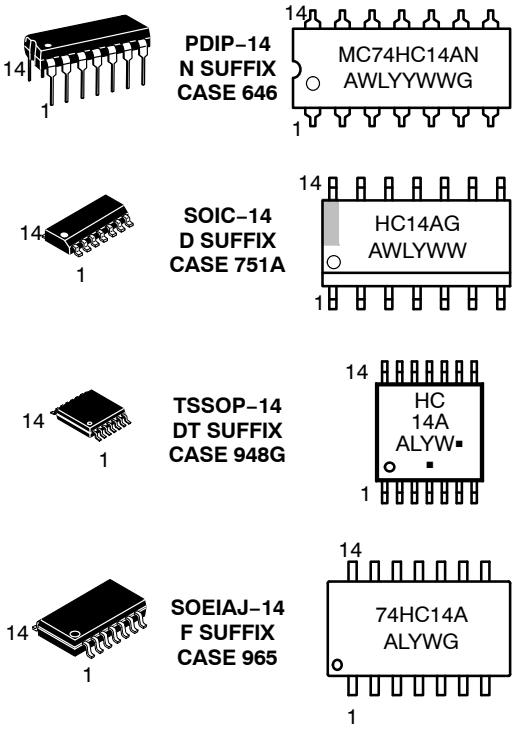
MARKING DIAGRAMS



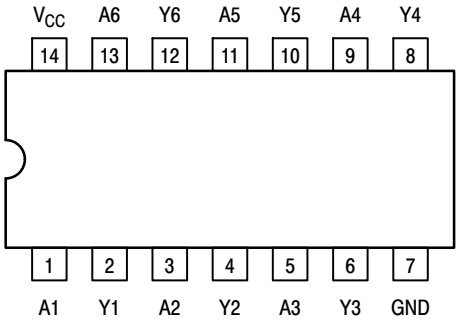
A	= Assembly Location
L, WL	= Wafer Lot
Y, YY	= Year
W, WW	= Work Week
G or ▪	= Pb−Free Package

(Note: Microdot may be in either location)

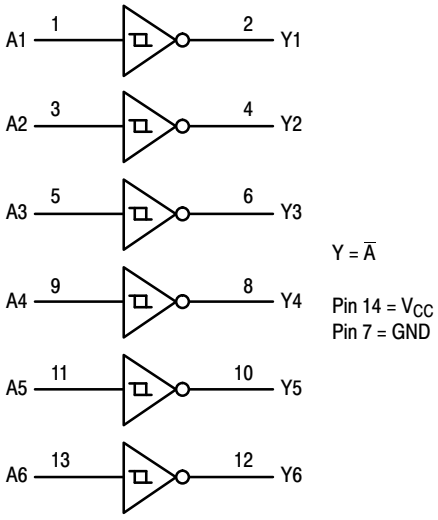
ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

Pinout: 14−Lead Packages (Top View)



LOGIC DIAGRAM



FUNCTION TABLE

Inputs	Outputs
A	**Y**
L	H
H	L

ORDERING INFORMATION

Device	Package	Shipping†
MC74HC14ANG	PDIP−14 (Pb−Free)	25 Units / Rail
MC74HC14ADG	SOIC−14 (Pb−Free)	55 Units / Rail
MC74HC14ADR2G	SOIC−14 (Pb−Free)	2500 / Tape & Reel
MC74HC14ADTG	TSSOP−14*	96 Units / Rail
MC74HC14ADTR2G	TSSOP−14*	2500 / Tape & Reel
MC74HC14AFG	SOEIAJ−14 (Pb−Free)	50 Units / Rail
MC74HC14AFELG	SOEIAJ−14*	2000 / 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.
*This package is inherently Pb−Free.

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	− 0.5 to + 7.0	V
V_{in}	DC Input Voltage (Referenced to GND)	− 0.5 to V_{CC} + 0.5	V
V_{out}	DC Output Voltage (Referenced to GND)	− 0.5 to V_{CC} + 0.5	V
I_{in}	DC Input Current, per Pin	± 20	mA
I_{out}	DC Output Current, per Pin	± 25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 50	mA
P_D	Power Dissipation in Still Air, Plastic DIP† SOIC Package† TSSOP Package†	750 500 450	mW
T_{stg}	Storage Temperature Range	− 65 to + 150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds Plastic DIP, SOIC or TSSOP Package	 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.

†Derating — Plastic DIP: − 10 mW/°C from 65° to 125°C
SOIC Package: − 7 mW/°C from 65° to 125°C
TSSOP Package: − 6.1 mW/°C from 65° 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 GND ≤ (V_{in} or V_{out}) ≤ V_{CC}.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Referenced to GND)		0	V_{CC}	V
T_A	Operating Temperature Range, All Package Types		− 55	+ 125	°C
t_r, t_f	Input Rise/Fall Time (Figure 1)	V_{CC} = 2.0 V V_{CC} = 4.5 V V_{CC} = 6.0 V	0 0 0	No Limit* No Limit* No Limit*	ns

*When V_{in} = 50% V_{CC}, I_{CC} > 1mA

DC CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Condition	V_{CC} V	Guaranteed Limit			Unit
				−55 to 25°C	≤85°C	≤125°C	
V_{T+} max	Maximum Positive−Going Input Threshold Voltage (Figure 3)	V_{out} = 0.1V $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	1.50 2.15 3.15 4.20	1.50 2.15 3.15 4.20	1.50 2.15 3.15 4.20	V
V_{T+} min	Minimum Positive−Going Input Threshold Voltage (Figure 3)	V_{out} = 0.1V $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	1.0 1.5 2.3 3.0	0.95 1.45 2.25 2.95	0.95 1.45 2.25 2.95	V
V_{T-} max	Maximum Negative−Going Input Threshold Voltage (Figure 3)	$V_{out} = V_{CC} - 0.1V$ $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	0.9 1.4 2.0 2.6	0.95 1.45 2.05 2.65	0.95 1.45 2.05 2.65	V
V_{T-} min	Minimum Negative−Going Input Threshold Voltage (Figure 3)	$V_{out} = V_{CC} - 0.1V$ $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	0.3 0.5 0.9 1.2	0.3 0.5 0.9 1.2	0.3 0.5 0.9 1.2	V
$V_H$max Note 1	Maximum Hysteresis Voltage (Figure 3)	V_{out} = 0.1V or V_{CC} − 0.1V $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	1.20 1.65 2.25 3.00	1.20 1.65 2.25 3.00	1.20 1.65 2.25 3.00	V
$V_H$min Note 1	Minimum Hysteresis Voltage (Figure 3)	V_{out} = 0.1V or V_{CC} − 0.1V $\|I_{out}\| \le 20\mu A$	2.0 3.0 4.5 6.0	0.20 0.25 0.40 0.50	0.20 0.25 0.40 0.50	0.20 0.25 0.40 0.50	V
V_{OH}	Minimum High−Level Output Voltage	$V_{in} \le V_{T-}$ min $\|I_{out}\| \le 20\mu A$	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		$V_{in} \le V_{T-}$ min $\|I_{out}\| \le 2.4mA$ $\|I_{out}\| \le 4.0mA$ $\|I_{out}\| \le 5.2mA$	3.0 4.5 6.0	2.48 3.98 5.48	2.34 3.84 5.34	2.20 3.70 5.20	
V_{OL}	Maximum Low−Level Output Voltage	$V_{in} \ge V_{T+}$ max $\|I_{out}\| \le 20\mu A$	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		$V_{in} \ge V_{T+}$ max $\|I_{out}\| \le 2.4mA$ $\|I_{out}\| \le 4.0mA$ $\|I_{out}\| \le 5.2mA$	3.0 4.5 6.0	0.26 0.26 0.26	0.33 0.33 0.33	0.40 0.40 0.40	
I_{in}	Maximum Input Leakage Current	$V_{in} = V_{CC}$ or GND	6.0	±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC}$ or GND I_{out} = 0μA	6.0	1.0	10	40	μA

1. $V_H$min > (V_{T+} min) − (V_{T-} max); $V_H$max = (V_{T+} max) − (V_{T-} min).

AC CHARACTERISTICS (C_L = 50pF, Input $t_r = t_f$ = 6ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			–55 to 25°C	≤85°C	≤125°C	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, Input A or B to Output Y (Figures 1 and 2)	2.0 3.0 4.5 6.0	75 30 15 13	95 40 19 16	110 55 22 19	ns
t_{TLH}, t_{THL}	Maximum Output Transition Time, Any Output (Figures 1 and 2)	2.0 3.0 4.5 6.0	75 27 15 13	95 32 19 16	110 36 22 19	ns
C_{in}	Maximum Input Capacitance		10	10	10	pF

		Typical @ 25°C, V_{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance (Per Inverter)*	22	pF

* Used to determine the no–load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

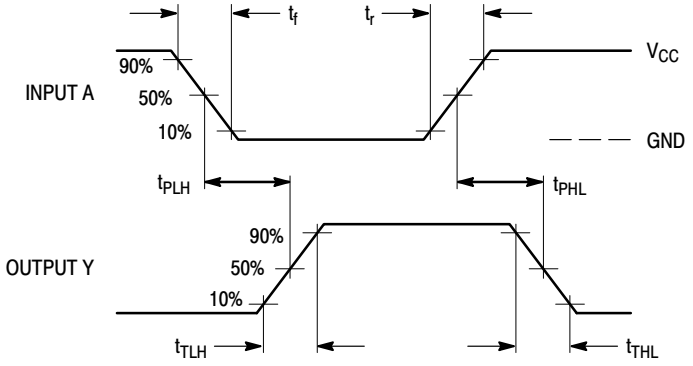
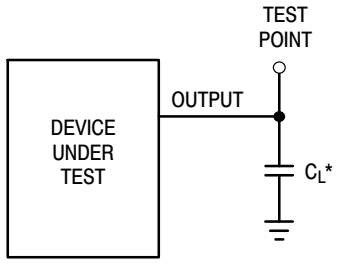


Figure 1. Switching Waveforms



*Includes all probe and jig capacitance

Figure 2. Test Circuit

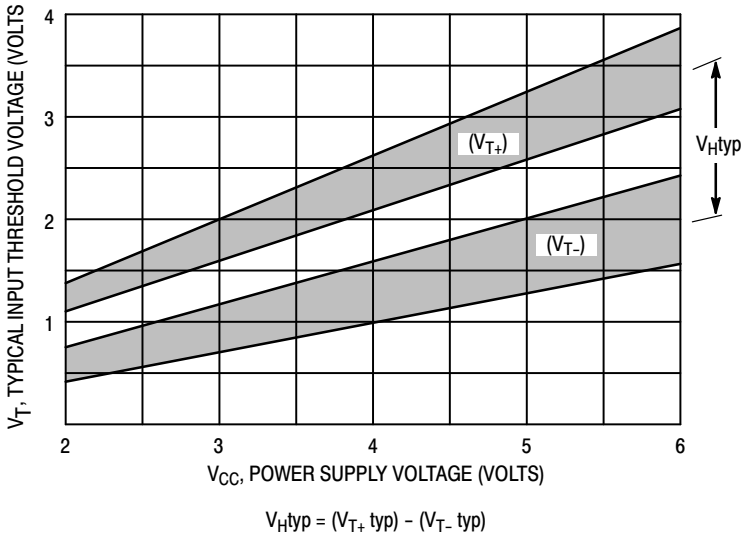


Figure 3. Typical Input Threshold, V_{T+}, V_{T-} versus Power Supply Voltage

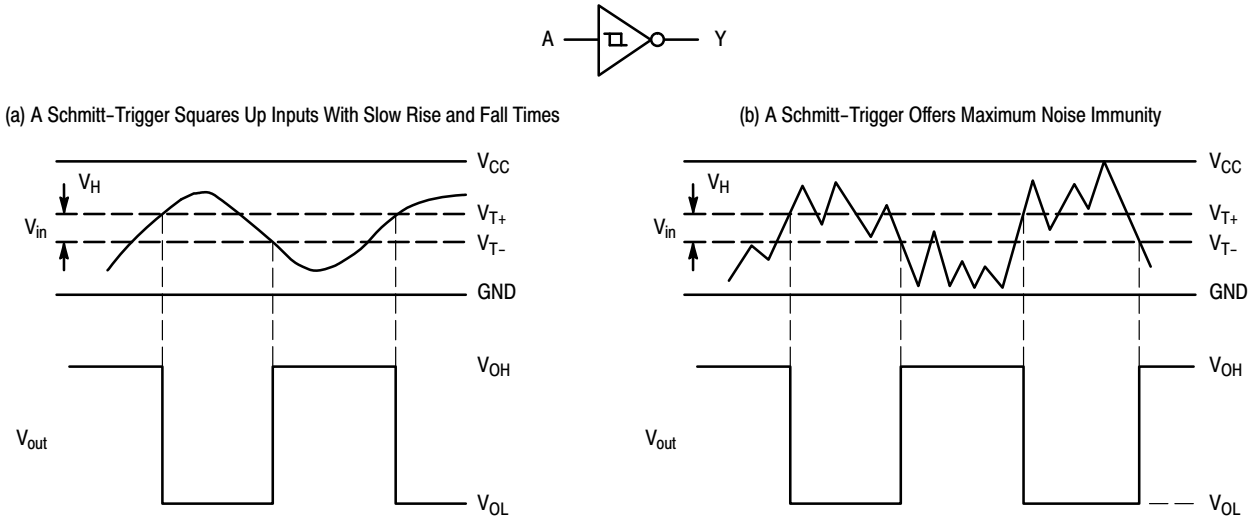
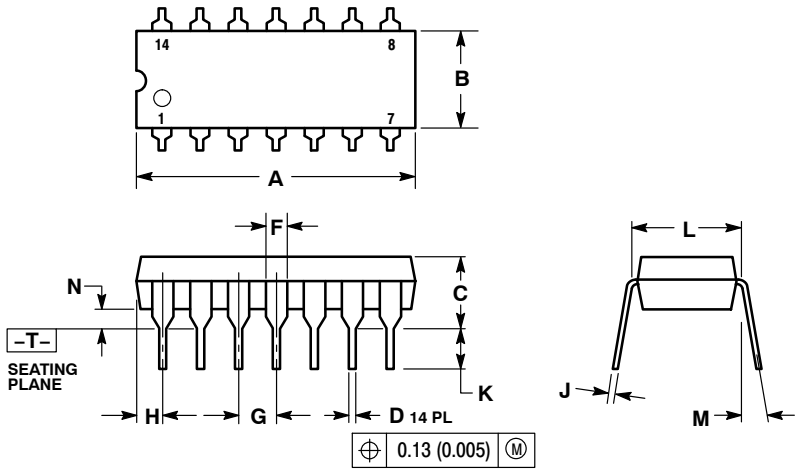


Figure 4. Typical Schmitt–Trigger Applications

PACKAGE DIMENSIONS

PDIP−14
N SUFFIX
CASE 646−06
ISSUE P

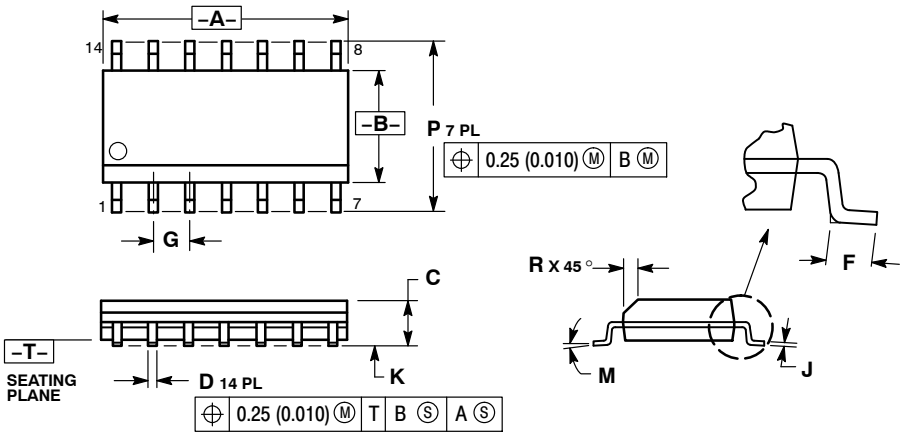


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	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

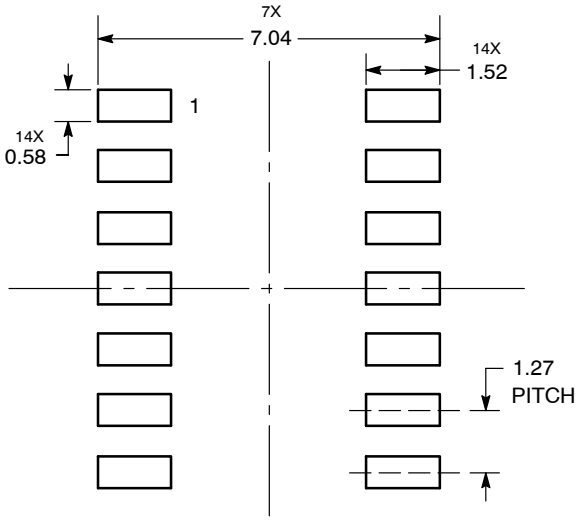
SOIC−14
D SUFFIX
CASE 751A−03
ISSUE J



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

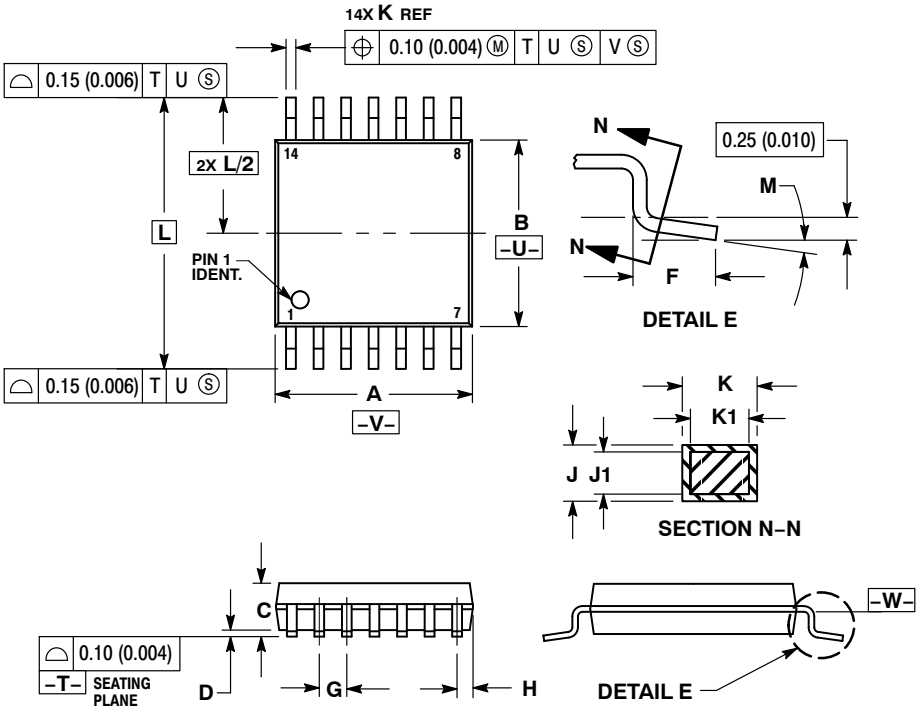
SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

PACKAGE DIMENSIONS

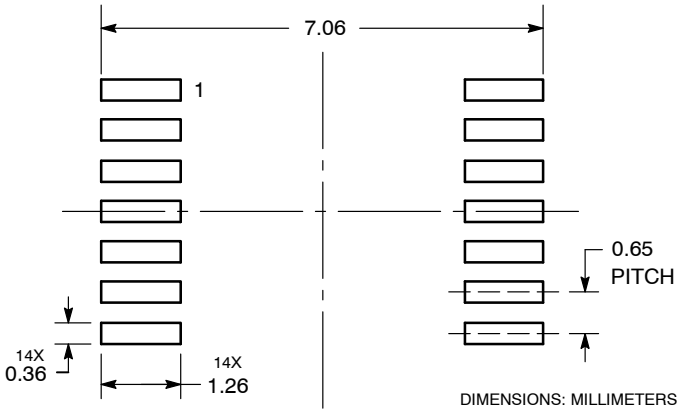
TSSOP−14
DT SUFFIX
CASE 948G−01
ISSUE B



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 °

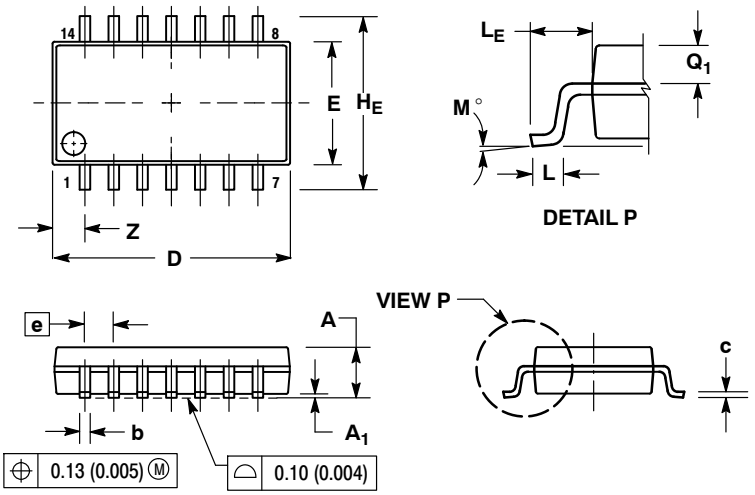
SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

PACKAGE DIMENSIONS

SOEIAJ−14
F SUFFIX
CASE 965−01
ISSUE B



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A_1	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.10	0.20	0.004	0.008
D	9.90	10.50	0.390	0.413
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
H_E	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L_E	1.10	1.50	0.043	0.059
M	0 °	10 °	0 °	10 °
Q_1	0.70	0.90	0.028	0.035
Z	---	1.42	---	0.056

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