MC74HCU04A

Hex Unbuffered Inverter
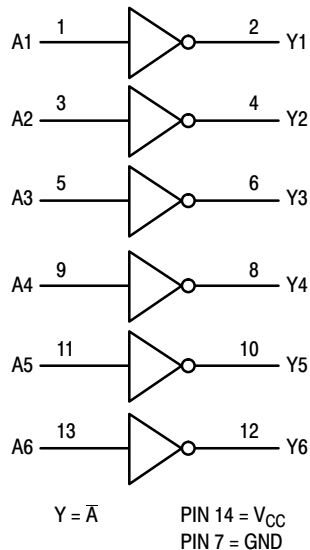
High−Performance Silicon−Gate CMOS

The MC74HCU04A is identical in pinout to the LS04 and the MC14069UB. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

This device consists of six single−stage inverters. These inverters are well suited for use as oscillators, pulse shapers, and in many other applications requiring a high−input impedance amplifier. For digital applications, the HC04A is recommended.

Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V; 2.5 to 6.0 V in Oscillator Configurations
- Low Input Current: 1 μA
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance With the JEDEC Standard No. 7.0 A Requirements
- Chip Complexity: 12 FETs or 3 Equivalent Gates
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable
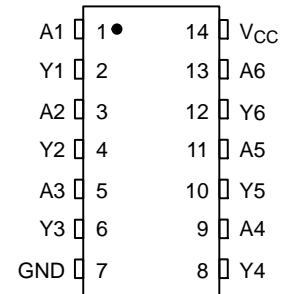- These Devices are Pb−Free, Halogen Free and are RoHS Compliant

ON Semiconductor®

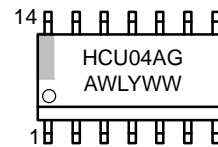http://onsemi.com

SOIC−14 NB
D SUFFIX
CASE 751A

TSSOP−14
DT SUFFIX
CASE 948G

PIN ASSIGNMENT

A1	1 ●		14	V$_{CC}$
Y1	2		13	A6
A2	3		12	Y6
Y2	4		11	A5
A3	5		10	Y5
Y3	6		9	A4
GND	7		8	Y4

MARKING DIAGRAMS

HCU04AG
AWLYWW

HCU
04A
ALYW▪
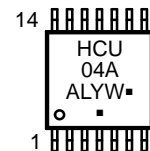
SOIC−14 NB   **TSSOP−14**

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)

FUNCTION TABLE

Inputs A	Outputs Y
L	H
H	L

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

LOGIC DIAGRAM

A1 1 ▷○ 2 Y1
A2 3 ▷○ 4 Y2
A3 5 ▷○ 6 Y3
A4 9 ▷○ 8 Y4
A5 11 ▷○ 10 Y5
A6 13 ▷○ 12 Y6

Y = $\overline{A}$

PIN 14 = V$_{CC}$
PIN 7 = GND

MC74HCU04A

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 SOIC Package† TSSOP Package†	500 450	mW
T_{stg}	Storage Temperature	–65 to +150	°C
T_L	Lead Temperature, 1 mm from case for 10 Seconds SOIC or TSSOP Package	260	°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 $\leq$ (V_{in} or V_{out}) $\leq$ 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.

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.
†Derating: SOIC Package: –7 mW/°C from 65° to 125°C
          TSSOP Package: – 6.1 mW/°C from 65° to 125°C

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, All Package Types	–55	+125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	–	No Limit	ns

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit			Unit
				–55 to 25°C	$\leq$ 85°C	$\leq$ 125°C	
V_{IH}	Minimum High–Level Input Voltage		2.0 3.0 4.5 6.0	1.7 2.5 3.6 4.8	1.7 2.5 3.6 4.8	l.7 2.5 3.6 4.8	V
V_{IL}	Maximum Low–Level Input Voltage		2.0 3.0 4.5 6.0	0.3 0.5 0.8 1.1	0.3 0.5 0.8 1.1	0.3 0.5 0.8 1.1	V
V_{OH}	Minimum High–Level Output Voltage	V_{in} = GND $|I_{out}|$ $\leq$ 20 μA	2.0 4.5 6.0	1.8 4.0 5.5	1.8 4.0 5.5	1.8 4.0 5.5	V
		V_{in} = GND $|I_{out}|$ $\leq$ 2.4 mA $|I_{out}|$ $\leq$ 4.0 mA $|I_{out}|$ $\leq$ 5.2 mA	3.0 4.5 6.0	2.36 3.86 5.36	2.26 3.76 5.26	2.20 3.70 5.20	

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.
1. For V_{CC} = 2.0 V, V_{out} = 0.2 V or V_{CC} – 0.2 V.

MC74HCU04A

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND) (continued)

Symbol	Parameter	Test Conditions	V$_{CC}$ V	Guaranteed Limit			Unit
				−55 to 25°C	≤ 85°C	≤ 125°C	
V$_{OL}$	Maximum Low−Level Output Voltage	V$_{in}$ = V$_{CC}$ |I$_{out}$| ≤ 20 μA	2.0 4.5 6.0	0.2 0.5 0.5	0.2 0.5 0.5	0.2 0.5 0.5	V
		V$_{in}$ = V$_{CC}$ |I$_{out}$| ≤ 2.4 mA |I$_{out}$| ≤ 4.0 mA |I$_{out}$| ≤ 5.2 mA	3.0 4.5 6.0	0.32 0.32 0.32	0.32 0.37 0.37	0.32 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$_{out}$ = 0 μA	6.0	1	10	40	μA

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.
1. For V$_{CC}$ = 2.0 V, V$_{out}$ = 0.2 V or V$_{CC}$ − 0.2 V.

AC ELECTRICAL CHARACTERISTICS (C$_L$ = 50 pF, Input t$_r$ = t$_f$ = 6 ns)

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 to Output Y (Figures 1 and 2)	2.0 3.0 4.5 6.0	70 40 14 12	90 45 18 15	105 50 21 18	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)*	15	pF

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.
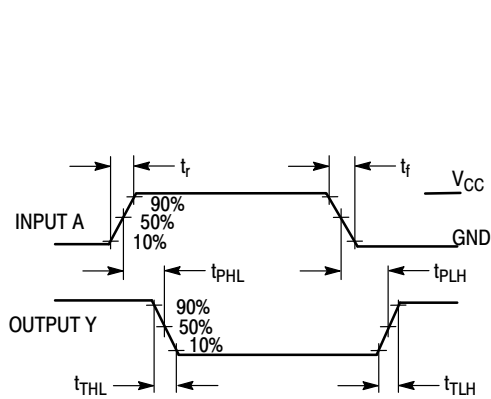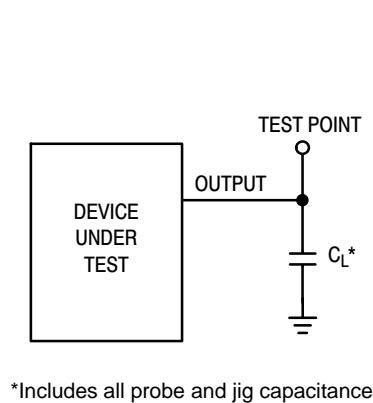2. Used to determine the no−load dynamic power consumption: P$_D$ = C$_{PD}$ V$_{CC}$^{2}f + I$_{CC}$ V$_{CC}$.

*Includes all probe and jig capacitance

Figure 1. Switching Waveforms

Figure 2. Test Circuit
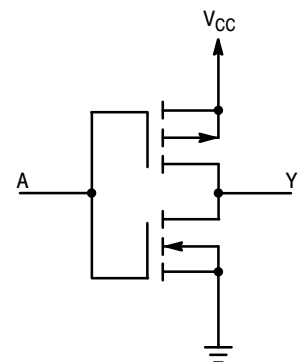
Figure 3. Logic Detail
(1/6 of Device Shown)

MC74HCU04A

TYPICAL APPLICATIONS

$R_2 >> R_1$
$C_1 < C_2$
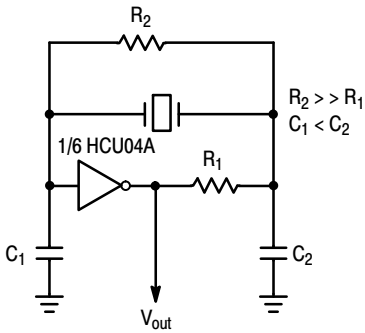
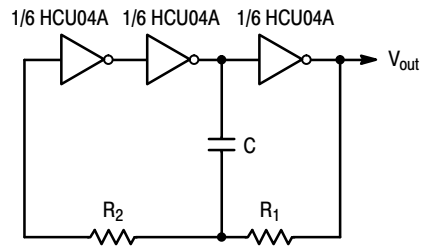**Figure 4. Crystal Oscillator**

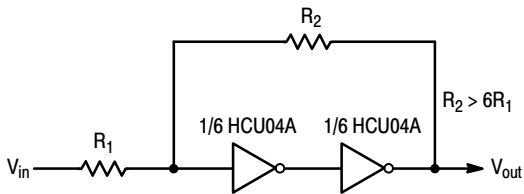

Figure 5. Stable RC Oscillator

$R_2 > 6R_1$

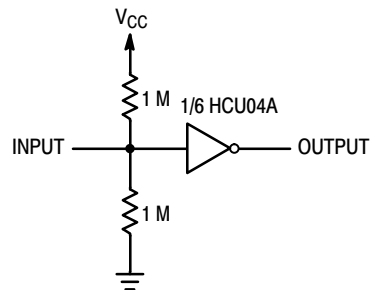**Figure 6. Schmitt Trigger**

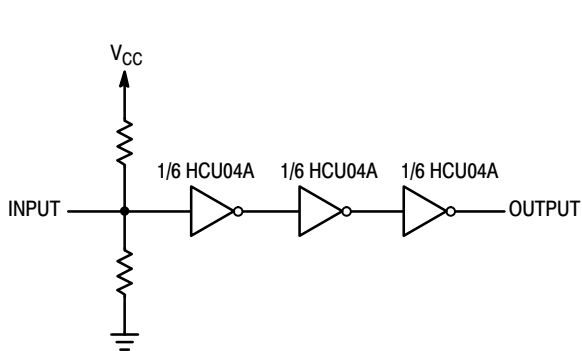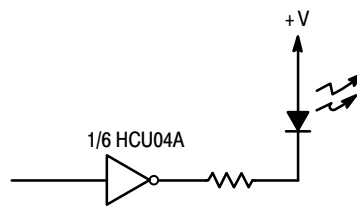**Figure 7. High Input Impedance Single–Stage Amplifier with a 2 to 6 V Supply Range**

Figure 8. Multi–Stage Amplifier

For reduced power supply current, use high–efficiency LEDs such as the Hewlett–Packard HLMP series or equivalent.

Figure 9. LED Driver

MC74HCU04A

ORDERING INFORMATION

Device	Package	Shipping†
MC74HCU04ADG	SOIC−14 NB (Pb−Free)	55 Units / Rail
NLV74HCU04ADG*	SOIC−14 NB (Pb−Free)	55 Units / Rail
MC74HCU04ADR2G	SOIC−14 NB (Pb−Free)	2500 / Tape & Reel
NLV74HCU04ADR2G*	SOIC−14 NB (Pb−Free)	2500 / Tape & Reel
MC74HCU04ADTR2G	TSSOP−14 (Pb−Free)	2500 / Tape & Reel
NLV74HCU04ADTR2G*	TSSOP−14 (Pb−Free)	2500 / 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.

SOIC−14 NB
CASE 751A−03
ISSUE L

DATE 03 FEB 2016

14

1

SCALE 1:1

DETAIL A

DETAIL A

SEATING PLANE
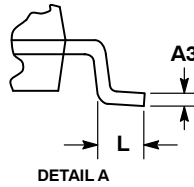
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
A3	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
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	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
M	0 °	7 °	0 °	7 °

SOLDERING FOOTPRINT*

6.50

14X
1.18

1

1.27
PITCH

14X
0.58
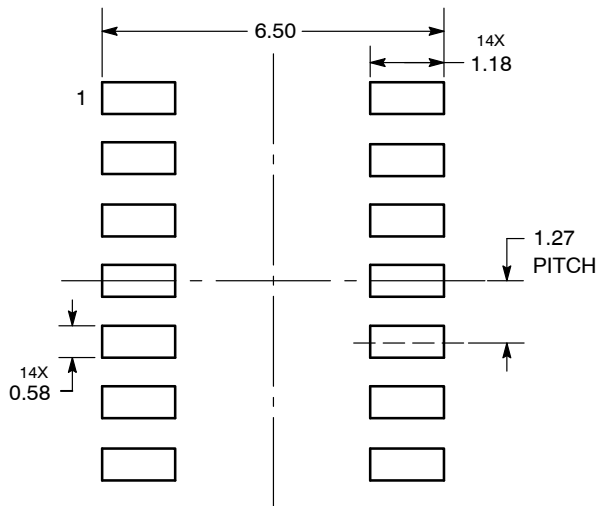
DIMENSIONS: MILLIMETERS

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

GENERIC MARKING DIAGRAM*

14

XXXXXXXXXG
AWLYWW

1

XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot " ▪", may or may not be present.

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42565B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	SOIC−14 NB		PAGE 1 OF 2

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

STYLE 2:
           CANCELLED

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

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

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

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

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

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

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DESCRIPTION:	SOIC−14 NB		PAGE 2 OF 2

TSSOP−14 WB
CASE 948G
ISSUE C

DATE 17 FEB 2016

14

SCALE 2:1

1

14X K REF

$\oplus$ | 0.10 (0.004) Ⓜ | T U Ⓢ V Ⓢ

△ | 0.15 (0.006) | T U Ⓢ

2X L/2

L

PIN 1
IDENT.

△ | 0.15 (0.006) | T U Ⓢ

A

−V−

14   8

1   7

B
−U−

DETAIL E

N

0.25 (0.010)

M

N

F

SECTION N−N

K

K1

J J1

C

△ | 0.10 (0.004)

**−T− SEATING
PLANE**

D   G   H

DETAIL E

−W−

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−.

DIM	MILLIMETERS		INCHES	
	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 °

**GENERIC
MARKING DIAGRAM***

14

XXXX
XXXX
ALYW▪

1

A	= Assembly Location
L	= Wafer Lot
Y	= Year
W	= Work Week
▪	= Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot " ▪", may or may not be present.

SOLDERING FOOTPRINT

7.06

1

0.65
PITCH

14X
0.36

14X
1.26

DIMENSIONS: MILLIMETERS

DOCUMENT NUMBER:	**98ASH70246A**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	**TSSOP−14 WB**		**PAGE 1 OF 1**