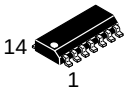
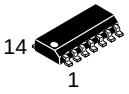
Hex Inverting Schmitt Trigger

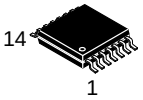
MM74HC14



SOIC−14 NB
CASE 751A−03



SOIC−14
CASE 751EF



TSSOP−14 WB
CASE 948G

General Description

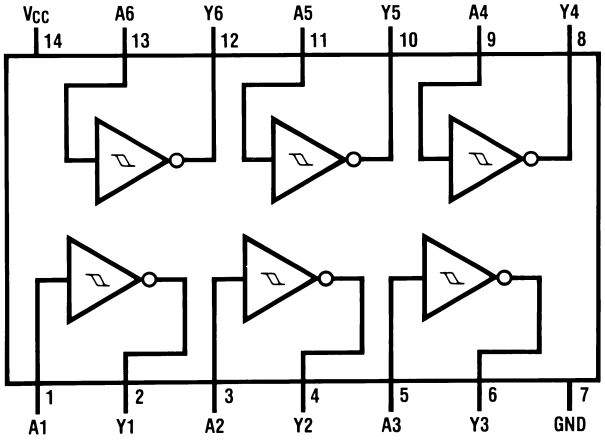
The MM74HC14 utilizes advanced silicon−gate CMOS technology to achieve the low power dissipation and high noise immunity of standard CMOS, as well as the capability to drive 10 LS−TTL loads.

The 74HC logic family is functionally and pinout compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

- Typical Propagation Delay: 13 ns
- Wide Power Supply Range: 2 V – 6 V
- Low Quiescent Current: 20 μA Maximum (74HC Series)
- Low Input Current: 1 μA Maximum
- Fanout of 10 LS−TTL Loads
- Typical Hysteresis Voltage: 0.9 V at V_{CC} = 4.5 V
- These Devices are Pb−Free, Halide Free and are RoHS Compliant

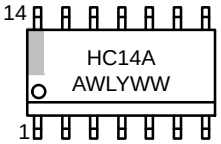
Connection Diagram



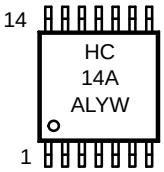
Top View

Figure 1. Pin Assignments for SOIC and TSSOP

MARKING DIAGRAM



SOIC−14



TSSOP−14 WB

HC14A	= Specific Device Code
A	= Assembly Location
WL, L	= Wafer Lot
Y	= Year
WW, W	= Work Week

ORDERING INFORMATION

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

Logic Diagram

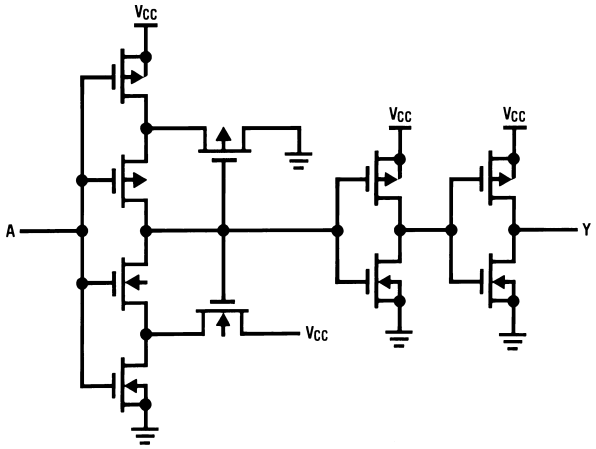


Figure 2. Logic Diagram

ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol	Parameter		Rating
V_{CC}	Supply Voltage		–0.5 to +7.0 V
V_{IN}	DC Input Voltage		–0.5 to V_{CC} + 0.5 V
V_{OUT}	DC Output Voltage		–0.5 to V_{CC} + 0.5 V
I_{IK}, I_{OK}	Clamp Diode Current		±20 mA
I_{OUT}	DC Output Current, per Pin		±25 mA
I_{CC}	DC V_{CC} or GND Current, per Pin		±50 mA
T_{STG}	Storage Temperature Range		–65°C to +150°C
P_D	Power Dissipation	Note 2	600 mW
		S.O. Package Only	500 mW
T_L	Lead Temperature (Soldering 10 Seconds)		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. Unless otherwise specified all voltages are referenced to ground.
2. Power Dissipation temperature derating − plastic “N” package: –12 mW/°C from 65°C to 85°C.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	2	6	V
V_{IN}, V_{OUT}	DC Input or Output Voltage	0	V_{CC}	V
T_A	Operating Temperature Range	–55	+125	°C

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 CHARACTERISTICS (Note 3)

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = 25°C	T_A = −40°C to 85°C	T_A = −55°C to 125°C		Unit
				Typ	Guaranteed Limits			
V_{T+}	Positive Going Threshold Voltage	2.0	Minimum	1.2	1.0	1.0	1.0	V
		4.5		2.7	2.0	2.0	2.0	
		6.0		3.2	3.0	3.0	3.0	
		2.0	Maximum	1.2	1.5	1.5	1.5	
		4.5		2.7	3.15	3.15	3.15	
		6.0		3.2	4.2	4.2	4.2	
V_{T-}	Negative Going Threshold Voltage	2.0	Minimum	0.7	0.3	0.3	0.3	V
		4.5		1.8	0.9	0.9	0.9	
		6.0		2.2	1.2	1.2	1.2	
		2.0	Maximum	0.7	1.0	1.0	1.0	
		4.5		1.8	2.2	2.2	2.2	
		6.0		2.2	3.0	3.0	3.0	
V_H	Hysteresis Voltage	2.0	Minimum	0.5	0.2	0.2	0.2	V
		4.5		0.9	0.4	0.4	0.4	
		6.0		1.0	0.5	0.5	0.5	
		2.0	Maximum	0.5	1.0	1.0	1.0	
		4.5		0.9	1.4	1.4	1.4	
		6.0		1.0	1.5	1.5	1.5	
V_{OH}	Minimum HIGH Level Output Voltage	2.0	$V_{IN} = V_{IH}$ or V_{IL}, $\|I_{OUT}\| = 20\ \mu A$	2.0	1.9	1.9	1.9	V
		4.5		4.5	4.4	4.4	4.4	
		6.0		6.0	5.9	5.9	5.9	
		4.5	$V_{IN} = V_{IH}$ or V_{IL}, $\|I_{OUT}\| = 4.0$ mA	4.2	3.98	3.84	3.7	
		6.0	$V_{IN} = V_{IH}$ or V_{IL}, $\|I_{OUT}\| = 5.2$ mA	5.7	5.48	5.34	5.2	
V_{OL}	Maximum LOW Level Output Voltage	2.0	$V_{IN} = V_{IH}$ or V_{IL}, $\|I_{OUT}\| = 20\ \mu A$	0	0.1	0.1	0.1	V
		4.5		0	0.1	0.1	0.1	
		6.0		0	0.1	0.1	0.1	
		4.5	$V_{IN} = V_{IH}$ or V_{IL}, $\|I_{OUT}\| = 4.0$ mA	0.2	0.26	0.33	0.4	
		6.0	$V_{IN} = V_{IH}$ or V_{IL}, $\|I_{OUT}\| = 5.2$ mA	0.2	0.26	0.33	0.4	
I_{IN}	Maximum Input Current	6.0	$V_{IN} = V_{CC}$ or GND	−	±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	6.0	$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0\ \mu A$	−	2.0	20	40	μA

3. For a power supply of 5 V ±10% the worst case output voltages (V_{OH}, and V_{OL}) occur for HC at 4.5 V. Thus the 4.5 V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC} = 5.5 V and 4.5 V respectively. (The V_{IH} value at 5.5 V is 3.85 V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0 V values should be used.

AC CHARACTERISTICS (V_{CC} = 5 V, T_A = 25°C, C_L = 15 pF, $t_r = t_f$ = 6 ns)

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Unit
t_{PHL}, t_{PLH}	Maximum Propagation Delay		12	22	ns

AC CHARACTERISTICS (V_{CC} = 2.0 V to 6.0 V, C_L = 50 pF, $t_r = t_f$ = 6 ns (unless otherwise specified))

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = 25°C	T_A = −40°C to 85°C	T_A = −55°C to 125°C		Unit
				Typ	Guaranteed Limits			
t_{PHL}, t_{PLH}	Maximum Propagation Delay	2.0		60	125	156	188	ns
		4.5		13	25	31	38	
		6.0		11	21	26	32	
t_{TLH}, t_{THL}	Maximum Output Rise and Fall Time	2.0		30	75	95	110	ns
		4.5		8	15	19	22	
		6.0		7	13	16	19	
C_{PD}	Power Dissipation Capacitance (Note 4)		(per gate)	27	–	–	–	pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

4. C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

TYPICAL PERFORMANCE CHARACTERISTICS

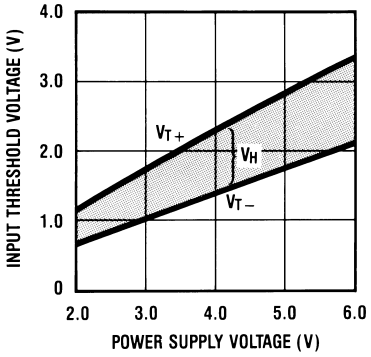


Figure 3. Input Threshold, V_T+, V_T–, vs. Power Supply Voltage

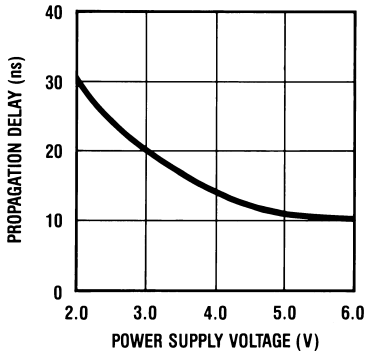
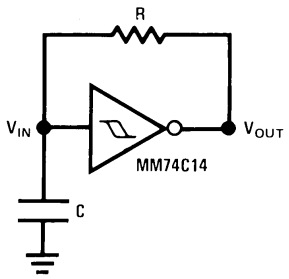


Figure 4. Propagation Delay vs. Power Supply

TYPICAL APPLICATIONS



$$t_1 \approx RC \ln \frac{V_{T+}}{V_{T-}} \quad \text{(eq. 1)}$$

$$t_2 \approx RC \ln \frac{V_{CC} - V_{T-}}{V_{CC} - V_{T+}} \quad \text{(eq. 2)}$$

$$f \approx \frac{1}{RC \ln \frac{V_{T+}(V_{CC} - V_{T-})}{V_{T-}(V_{CC} - V_{T+})}} \quad \text{(eq. 3)}$$

NOTE: The equations assume $t_1 + t_2 >> t_{pd0} + t_{pd1}$

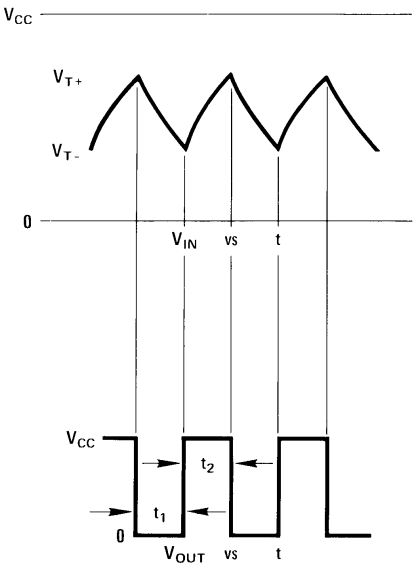


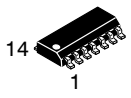
Figure 5. Low Power Oscillator

ORDERING INFORMATION

Part Number	Package	Shipping†
MM74HC14M	SOIC−14, Case 751A−03 (Pb−Free, Halide−Free)	55 Units / Tube
MM74HC14MTC	TSSOP−14, Case 948G−01 (Pb−Free, Halide Free)	96 Units / Tube
MM74HC14MX	SOIC−14, Case 751EF (Pb−Free, Halide−Free)	2500 Units / Tape & Reel
MM74HC14MTCX	TSSOP−14, Case 948G−01 (Pb−Free, Halide 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.

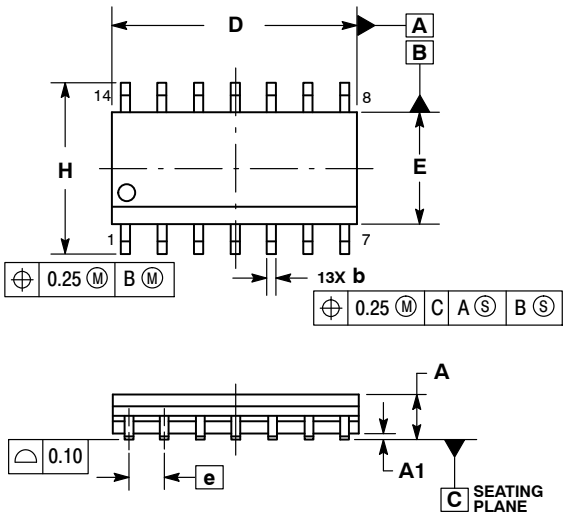
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

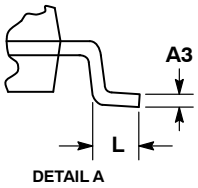


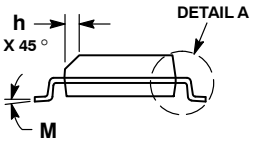
SCALE 1:1

SOIC−14 NB
CASE 751A−03
ISSUE L

DATE 03 FEB 2016



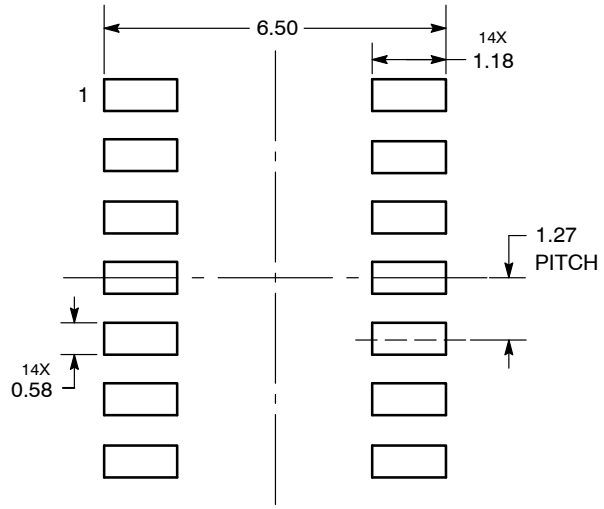




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM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

	MILLIMETERS		INCHES	
DIM	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 °

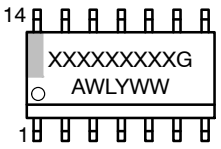
SOLDERING FOOTPRINT*



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*



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. Some products may not follow the Generic Marking.

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**

SOIC−14
CASE 751A−03
ISSUE L

DATE 03 FEB 2016

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

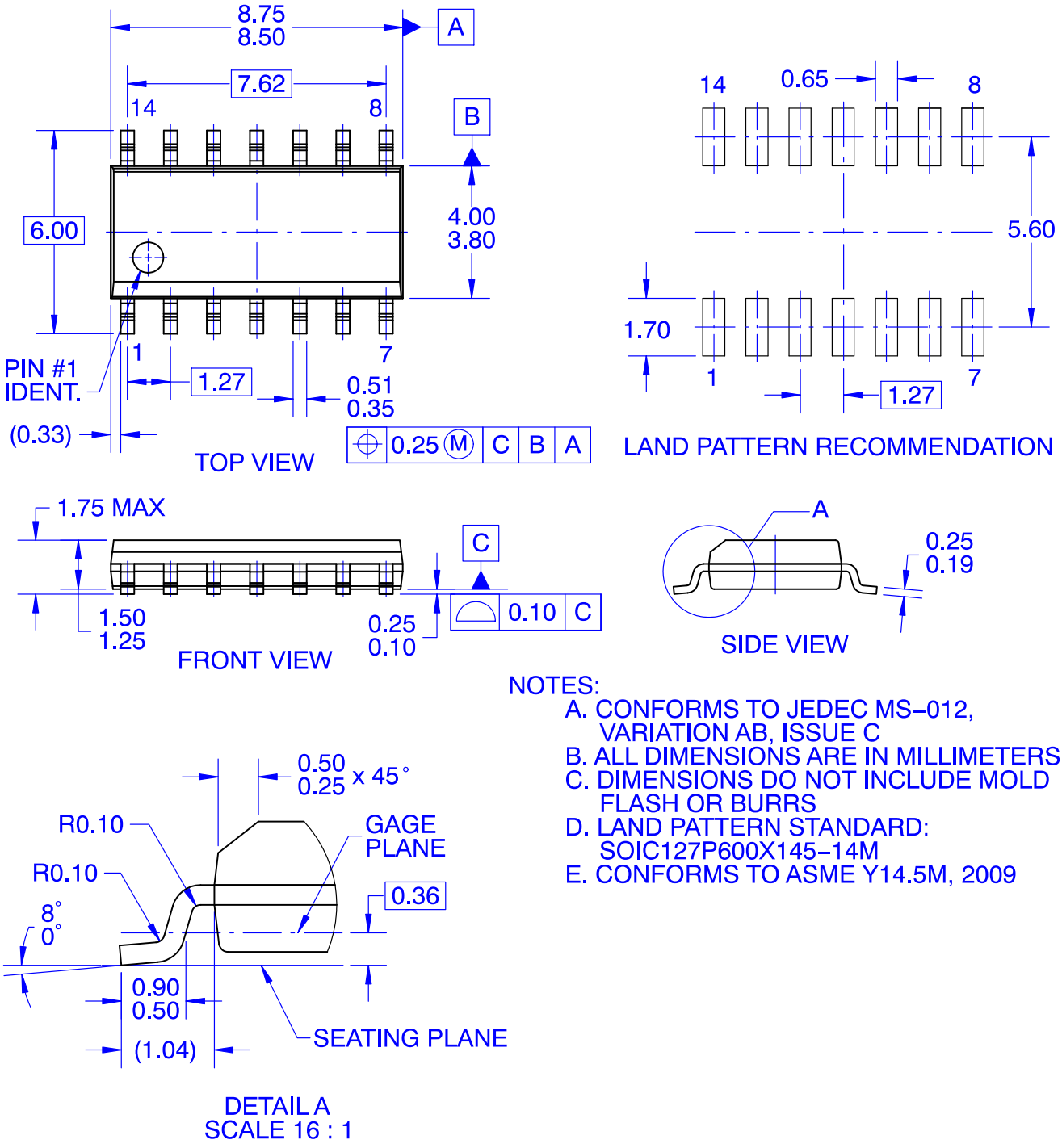
STYLE 6:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. ANODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE

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

SOIC14
CASE 751EF
ISSUE O

DATE 30 SEP 2016



NOTES:
A. CONFORMS TO JEDEC MS–012, VARIATION AB, ISSUE C
B. ALL DIMENSIONS ARE IN MILLIMETERS
C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
D. LAND PATTERN STANDARD: SOIC127P600X145–14M
E. CONFORMS TO ASME Y14.5M, 2009

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