Hex Schmitt Inverter

The MC74VHC14 is an advanced high speed CMOS Schmitt inverter fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

Pin configuration and function are the same as the MC74VHC04 but the inputs have hysteresis and, with its Schmitt trigger function, the VHC14 can be used as a line receiver which will receive slow input signals.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7 V, allowing the interface of 5 V systems to 3 V systems.

- High Speed: $t_{PD} = 5.5 \text{ ns (Typ)}$ at $V_{CC} = 5 \text{ V}$
- Low Power Dissipation: $I_{CC} = 2 \mu A$ (Max) at $T_A = 25^{\circ}C$
- High Noise Immunity: $V_{NIH} = V_{NIL} = 28\% \ V_{CC}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 5.5 V Operating Range
- Low Noise: $V_{OLP} = 0.8 \text{ V (Max)}$
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V: Machine Model > 200 V
- Chip Complexity: 60 FETs or 15 Equivalent Gates
- Pb–Free Package May be Available.* The G–Suffix Denotes a Pb–Free Lead Finish

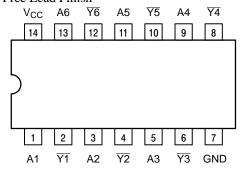


Figure 1. 14-Lead Pinout (Top View)

FUNCTION TABLE

Inputs	Outputs
Α	Y
L	Н
н	L

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

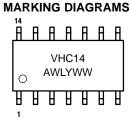


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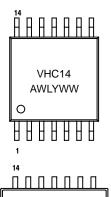


SO-14 D SUFFIX CASE 751A-03





TSSOP-14 DT SUFFIX CASE 948G-01



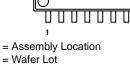
VHC14

ALYW



EIAJ SO-14 M SUFFIX CASE 965-01

> A L, WL



Y = Year W, WW = Work Week

ORDERING INFORMATION

ONDERNING INI ORMINATION						
Device	Package	Shipping [†]				
MC74VHC14D	SO-14	55 Units/Rail				
MC74VHC14DR2	SO-14	2500 / Tape & Reel				
MC74VHC14DT	TSSOP-14	96 Units/Rail				
MC74VHC14DTR2	TSSOP-14	2500 / Tape & Reel				
MC74VHC14DTR2G	TSSOP-14 (Pb-Free)	2500 / Tape & Reel				
MC74VHC14MEL	EIAJ SO-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.

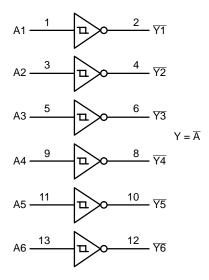


Figure 2. Logic Diagram

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.

MAXIMUM RATINGS (Note 1)

Symbol	Pi	arameter	Value	Unit
V _{CC}	Positive DC Supply Voltage		-0.5 to +7.0	V
V _{IN}	Digital Input Voltage		-0.5 to +7.0	V
V _{OUT}	DC Output Voltage		-0.5 to V _{CC} +0.5	V
I _{IK}	Input Diode Current		-20	mA
l _{ok}	Output Diode Current		±20	mA
l _{OUT}	DC Output Current, per Pin		±25	mA
I _{CC}	DC Supply Current, V_{CC} and GND Pins		±75	mA
P _D	Power Dissipation in Still Air	SOIC Package TSSOP	200 180	mW
T _{STG}	Storage Temperature Range		-65 to +150	°C
V _{ESD}	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4)	>2000 >200 N/A	V
I _{LATCH-UP}	Latch-Up Performance	Above V _{CC} and Below GND at 125°C (Note 5)	±300	mA
$\theta_{\sf JA}$	Thermal Resistance, Junction-to-Ambi	ent SOIC Package TSSOP	143 164	°C/W

^{1.} Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics		Min	Max	Unit
V _{CC}	DC Supply Voltage		2.0	5.5	V
V _{IN}	DC Input Voltage		0	5.5	V
V _{OUT}	DC Output Voltage		0	V _{CC}	V
T _A	Operating Temperature Range, All Package Types		-55	125	°C
t _r , t _f	Input Rise or Fall Time	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	-	No limit No limit	ns/V

^{2.} Tested to EIA/JESD22-A114-A

^{3.} Tested to EIA/JESD22-A115-A

^{4.} Tested to JESD22-C101-A

^{5.} Tested to EIA/JESD78

DC ELECTRICAL CHARACTERISTICS

				v _{cc}	1	T _A = 25°(;	-55 °C ≤ T_A ≤ 125°C		
Symbol	Parameter	Test Conditi	ions	V	Min	Тур	Max	Min	Max	Unit
V _{T+}	Positive Threshold Voltage (Figure 5)			3.0 4.5 5.5			2.20 3.15 3.85		2.20 3.15 3.85	V
V _T	Negative Threshold Voltage (Figure 5)			3.0 4.5 6.0	0.9 1.35 1.65			0.90 1.35 1.65		V
V _H	Hysteresis Voltage (Figure 5)			3.0 4.5 5.5	0.30 0.40 0.50		1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	V
V _{OH}	Minimum High-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -50 \mu\text{A}$		2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5		1.9 2.9 4.4		V
		$V_{in} = V_{IH}$ or V_{IL}	I _{OH} = - 4 mA I _{OH} = - 8 mA	3.0 4.5	2.58 3.94			2.48 3.80		
V _{OL}	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 50 \mu\text{A}$		2.0 3.0 4.5		0.0 0.0 0.0	0.1 0.1 0.1		0.1 0.1 0.1	V
		$V_{in} = V_{IH}$ or V_{IL}	I _{OL} = 4 mA I _{OL} = 8 mA	3.0 4.5			0.36 0.36		0.44 0.44	
I _{in}	Maximum Input Leakage Current	V _{in} = 5.5 V or GND		0 to 5.5			± 0.1		± 1.0	μΑ
I _{CC}	Maximum Quiescent Supply Current	$V_{in} = V_{CC}$ or GND		5.5			2.0		20.0	μА

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$)

				T _A = 25°C			-55°C ≤ T _A ≤ 125°C		
Symbol	Parameter	Test Cond	litions	Min	Тур	Max	Min	Max	Unit
t _{PLH} , t _{PHL}	Maximum Propagation Delay,	$V_{CC} = 3.3 \pm 0.3 \text{ V}$	$C_L = 15 \text{ pF}$ $C_L = 50 \text{ pF}$		8.3 10.8	12.8 16.3	1.0 1.0	15.0 18.5	ns
	A or B to \overline{Y}	$V_{CC} = 5.0 \pm 0.5 \text{ V}$	$C_L = 15 pF$ $C_L = 50 pF$		5.5 7.0	8.6 10.6	1.0 1.0	10.0 12.0	
C _{in}	Maximum Input Capacitance				4	10		10	pF

		Typical @ 25°C, V _{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance (Note 6)	21	pF

^{6.} C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}/6 (per buffer). C_{PD} is used to determine the no–load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

NOISE CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$, $C_L = 50 \text{ pF}$, $V_{CC} = 5.0 \text{ V}$)

		T _A =	25°C	
Symbol	Characteristic	Тур	Max	Unit
V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	0.4	0.8	V
V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	- 0.4	- 0.8	V
V _{IHD}	Minimum High Level Dynamic Input Voltage		3.5	V
V _{ILD}	Maximum Low Level Dynamic Input Voltage		1.5	V

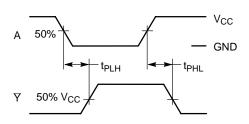
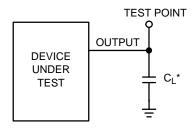


Figure 3. Switching Waveforms



*Includes all probe and jig capacitance

Figure 4. Test Circuit

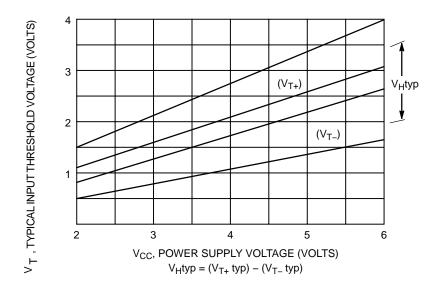
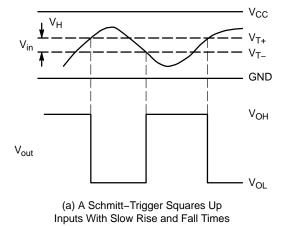


Figure 5. Typical Input Threshold, V_{T+} , V_{T-} versus Power Supply Voltage



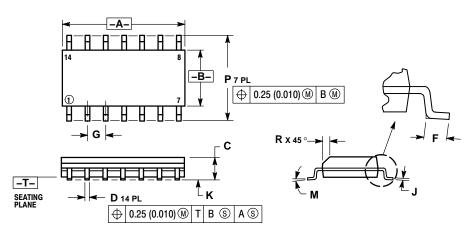
V_{in}
V_{T+}
V_{T-}
GND
Vout

(b) A Schmitt–Trigger Offers Maximum
Noise Immunity

Figure 6. Typical Schmitt-Trigger Applications

PACKAGE DIMENSIONS

SOIC-14 **D SUFFIX** CASE 751A-03 ISSUE F

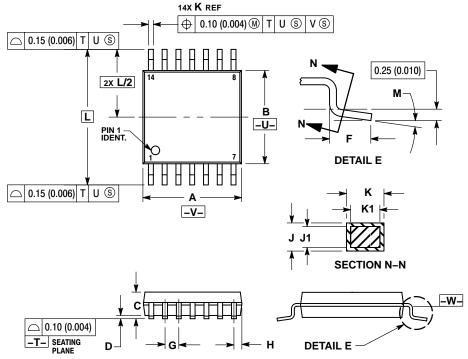


- OTES:
 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006)
- PER SIDE.

 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.

WAXINIOW WATERIAL CONDITION.						
	MILLIN	IETERS	INC	HES		
DIM	MIN	MAX	MIN	MAX		
Α	8.55	8.75	0.337	0.344		
В	3.80	4.00	0.150	0.157		
С	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		

TSSOP-14 **DT SUFFIX** CASE 948G-01 **ISSUE O**



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- 114-3M, 1962.

 CONTROLLING DIMENSION: MILLIMETER.

 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.
- D.25 (0.010) PER SIDE.

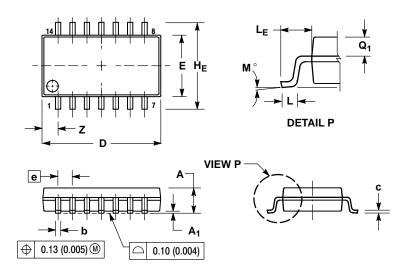
 DIMENSION K DOES NOT INCLUDE DAMBAR
 PROTRUSION. ALLOWABLE DAMBAR
 PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN
 EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION. TERMINAL NUMBERS ARE SHOWN FOR
- REFERENCE ONLY.

 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
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40		0.252	BSC
М	0 °	8°	0°	8°

PACKAGE DIMENSIONS

SO-14 **M SUFFIX** CASE 965-01 **ISSUE O**



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. CONTROLLING DIMENSION: MILLIMETER.
- 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.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- 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		INC	HES
DIM	MIN	MAX	MIN	MAX
Α		2.05		0.081
A ₁	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
C	0.18	0.27	0.007	0.011
D	9.90	10.50	0.390	0.413
Е	5.10	5.45	0.201	0.215
е	1.27	BSC	0.050 BSC	
HE	7.40	8.20	0.291	0.323
0.50	0.50	0.85	0.020	0.033
LE	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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