

MC74VHC125

Quad Bus Buffer with 3-State Control Inputs

The MC74VHC125 is a high speed CMOS quad bus buffer fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

The MC74VHC125 requires the 3-state control input (\overline{OE}) to be set High to place the output into the high impedance state.

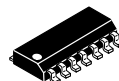
The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7 V, allowing the interface of 5 V systems to 3 V systems.

- High Speed: $t_{PD} = 3.8\text{ns}$ (Typ) at $V_{CC} = 5\text{V}$
- Low Power Dissipation: $I_{CC} = 4\ \mu\text{A}$ (Max) at $T_A = 25^\circ\text{C}$
- 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: Human Body Model; $> 2000\text{V}$,
Machine Model; $> 200\text{V}$
- Chip Complexity: 72 FETs or 18 Equivalent Gates
- These Devices are Pb-Free and are RoHS Compliant

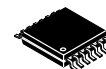


ON Semiconductor®

<http://onsemi.com>



14-LEAD SOIC
D SUFFIX
CASE 751A

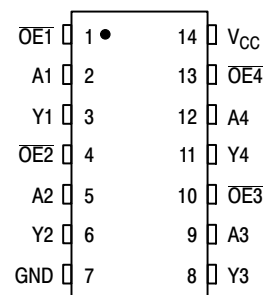


14-LEAD TSSOP
DT SUFFIX
CASE 948G



14-LEAD SOIC EIAJ
M SUFFIX
CASE 965

PIN CONNECTION AND MARKING DIAGRAM (Top View)



DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 6 of this data sheet.

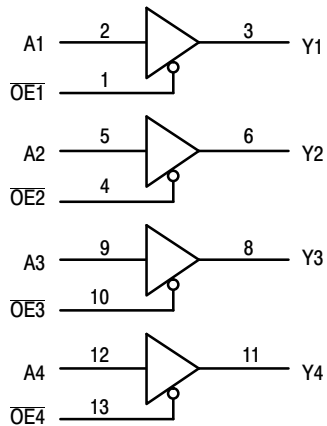
ORDERING INFORMATION

Device	Package	Shipping
MC74VHC125DG	SOIC	55 Units/Rail
MC74VHC125DTR2G	TSSOP	2500 Units/Reel
MC74VHC125MG	SOIC EIAJ	50 Units/Rail
MC74VHC125DR2G	SOIC	2500 Units/Reel
MC74VHC125MELG	SOEIAJ	2000 Units/Reel

MC74VHC125

LOGIC DIAGRAM

Active-Low Output Enables



FUNCTION TABLE

VHC125		
Inputs		Output
A	\overline{OE}	Y
H	L	H
L	L	L
X	H	Z

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	-0.5 to +7.0	V
V_{in}	DC 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
I_{OK}	Output Diode Current	± 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 Packages† TSSOP Package†	500 450	mW
T_{stg}	Storage Temperature	-65 to +150	°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 $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$. 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.

** Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum-rated conditions is not implied.

† Derating - SOIC Packages: - 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	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, All Package Types	-55	+125	°C
t_r, t_f	Input Rise and Fall Time $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	0 0	100 20	ns/V

MC74VHC125

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} (V)	T _A = 25°C			T _A ≤ 85°C		T _A ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V _{IH}	Minimum High-Level Input Voltage		2.0	1.5			1.5		1.5		V
			3.0	2.1			2.1		2.1		
			4.5	3.15			3.15		3.15		
			5.5	3.85			3.85		3.85		
V _{IL}	Maximum Low-Level Input Voltage		2.0			0.5		0.5		0.5	V
			3.0			0.9		0.9		0.9	
			4.5			1.35		1.35		1.35	
			5.5			1.65		1.65		1.65	
V _{OH}	Minimum High-Level Output Voltage V _{IN} = V _{IH} or V _{IL}	V _{IN} = V _{IH} or V _{IL} I _{OH} = -50 μA	2.0	1.9	2.0		1.9		1.9		V
		3.0	2.9	3.0		2.9		2.9			
		4.5	4.4	4.5		4.4		4.4		4.4	
		V _{IN} = V _{IH} or V _{IL} I _{OH} = -4 mA I _{OH} = -8 mA	3.0	2.58			2.48		2.34		V
4.5	3.94			3.80		3.66		3.66			
V _{OL}	Maximum Low-Level Output Voltage V _{IN} = V _{IH} or V _{IL}	V _{IN} = V _{IH} or V _{IL} I _{OL} = 50 μA	2.0		0.0	0.1		0.1		0.1	V
		3.0		0.0	0.1		0.1		0.1		
		4.5		0.0	0.1		0.1		0.1		
		V _{IN} = V _{IH} or V _{IL} I _{OL} = 4 mA I _{OL} = 8 mA	3.0			0.36		0.44		0.52	V
4.5			0.36		0.44		0.52	0.52			
I _{OZ}	Maximum 3-State Leakage Current	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND	5.5			±0.2 5		±2.5		±2.5	μA
I _{IN}	Maximum Input Leakage Current	V _{IN} = 5.5V or GND	0 to 5.5			±0.1		±1.0		±1.0	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND	5.5			4.0		40		40	μA

MC74VHC125

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

Symbol	Parameter	Test Conditions	$T_A = 25^\circ\text{C}$			$T_A = \leq 85^\circ\text{C}$		$T_A = \leq 125^\circ\text{C}$		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH} , t_{PHL}	Maximum Propagation Delay, A to Y	$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 15$ pF		5.6	8.0	1.0	9.5	1.0	12.0	ns
		$C_L = 50$ pF		8.1	11.5	1.0	13.0	1.0	16.0	
		$V_{CC} = 5.0 \pm 0.5\text{V}$ $C_L = 15$ pF		3.8	5.5	1.0	6.5	1.0	8.5	
		$C_L = 50$ pF		5.3	7.5	1.0	8.5	1.0	10.5	
t_{PZL} , t_{PZH}	Maximum Output Enable Time, OE to Y	$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 15$ pF		5.4	8.0	1.0	9.5	1.0	11.5	ns
		$R_L = 1$ k Ω $C_L = 50$ pF		7.9	11.5	1.0	13.0	1.0	15.0	
		$V_{CC} = 5.0 \pm 0.5\text{V}$ $C_L = 15$ pF		3.6	5.1	1.0	6.0	1.0	7.5	
		$R_L = 1$ k Ω $C_L = 50$ pF		5.1	7.1	1.0	8.0	1.0	9.5	
t_{PLZ} , t_{PHZ}	Maximum Output Disable Time, OE to Y	$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 50$ pF		9.5	13.2	1.0	15.0	1.0	18.0	ns
		$R_L = 1$ k Ω								
		$V_{CC} = 5.0 \pm 0.5\text{V}$ $C_L = 50$ pF		6.1	8.8	1.0	10.0	1.0	12.0	
		$R_L = 1$ k Ω								
t_{OSLH} , t_{OSHL}	Output-to-Output Skew	$V_{CC} = 3.3 \pm 0.3\text{V}$ $C_L = 50$ pF (Note 1)			1.5		1.5		1.5	ns
		$V_{CC} = 5.0 \pm 0.5\text{V}$ $C_L = 50$ pF (Note 1)			1.0		1.0		1.0	
C_{in}	Maximum Input Capacitance			4	10		10		10	pF
C_{out}	Maximum Three-State Output Capacitance (Output in High Impedance State)			6						pF

C_{PD}	Power Dissipation Capacitance (Note 2)	Typical @ 25°C, $V_{CC} = 5.0$ V				pF
		14				

- Parameter guaranteed by design. $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$, $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$.
- 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: $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}/4$ (per buffer). C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

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

Symbol	Characteristic	$T_A = 25^\circ\text{C}$		Unit
		Typ	Max	
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	0.3	0.8	V
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	-0.3	-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

MC74VHC125

SWITCHING WAVEFORMS

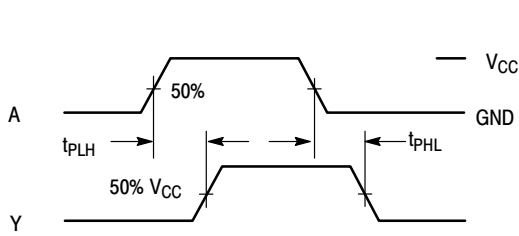


Figure 1.

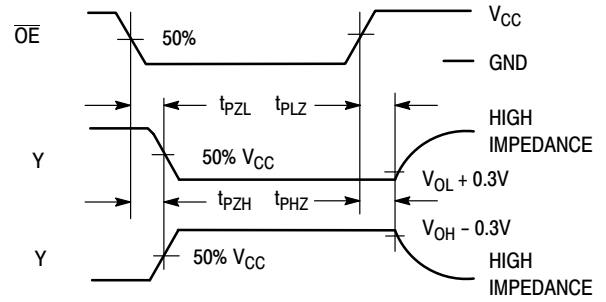
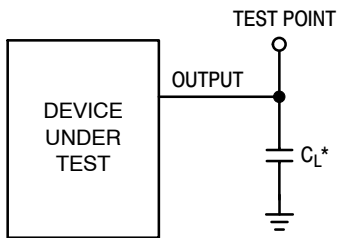
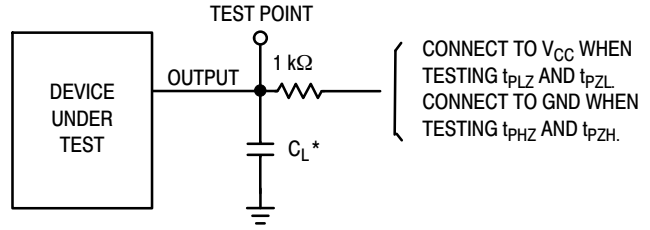


Figure 2.



*Includes all probe and jig capacitance

Figure 3. Test Circuit



*Includes all probe and jig capacitance

Figure 4. Test Circuit

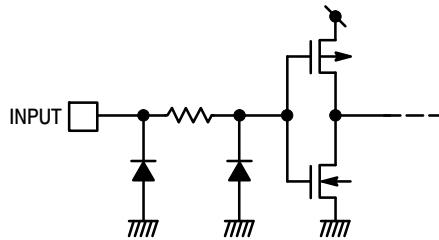
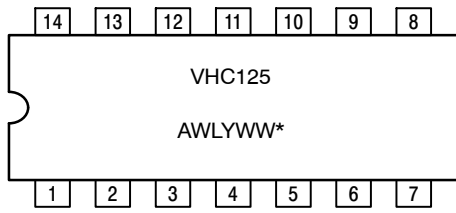


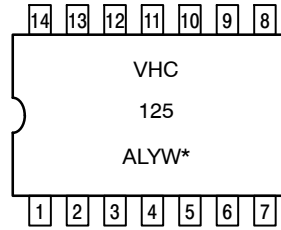
Figure 5. Input Equivalent Circuit

MC74VHC125

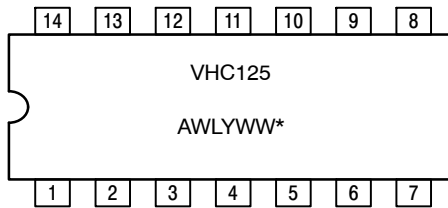
MARKING DIAGRAMS (Top View)



**14-LEAD SOIC
D SUFFIX
CASE 751A**



**14-LEAD TSSOP
DT SUFFIX
CASE 948G**



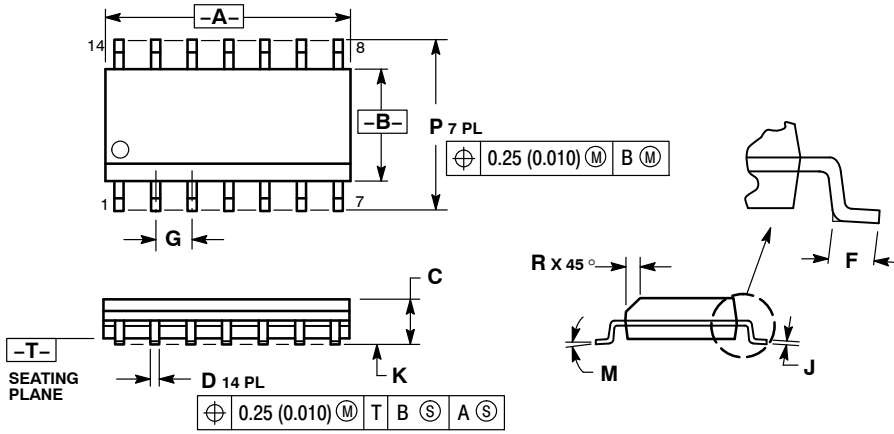
**14-LEAD SOIC EIAJ
M SUFFIX
CASE 965**

*See Applications Note AND8004/D for date code and traceability information.

MC74VHC125

PACKAGE DIMENSIONS

SOIC-14
CASE 751A-03
ISSUE J

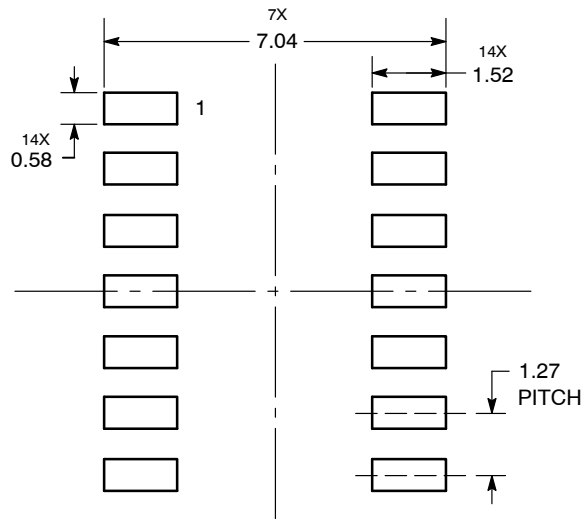


NOTES:

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.

DIM	MILLIMETERS		INCHES	
	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

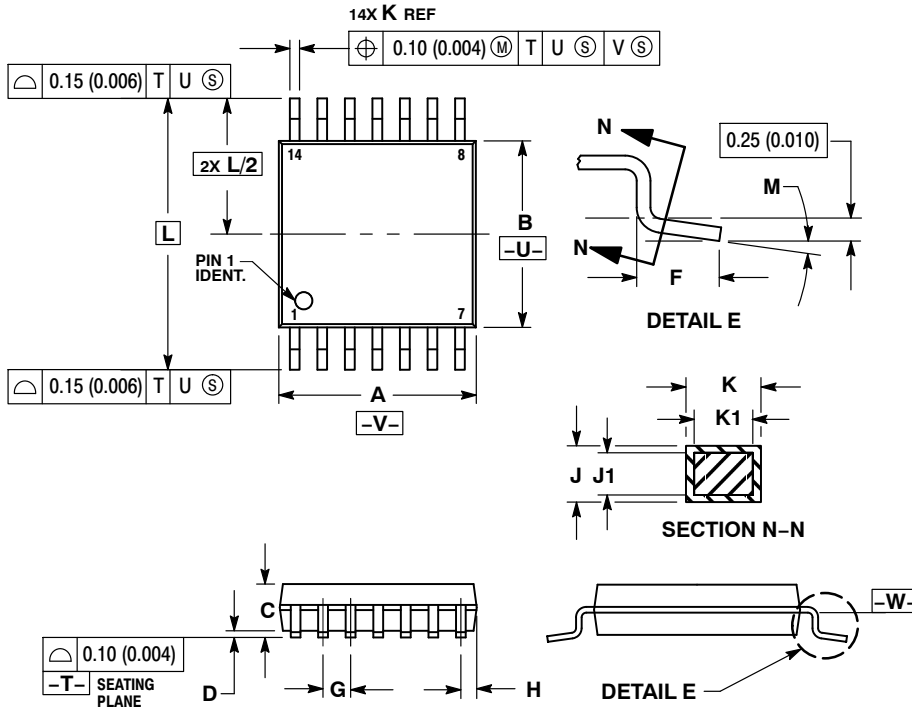


DIMENSIONS: MILLIMETERS

MC74VHC125

PACKAGE DIMENSIONS

TSSOP-14
CASE 948G-01
ISSUE B

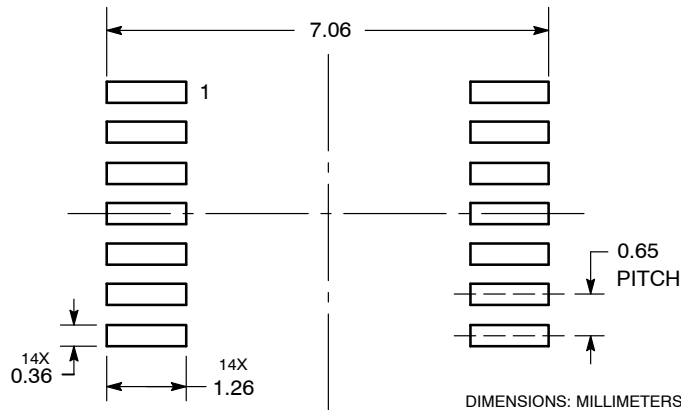


NOTES:

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 -V-.

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°

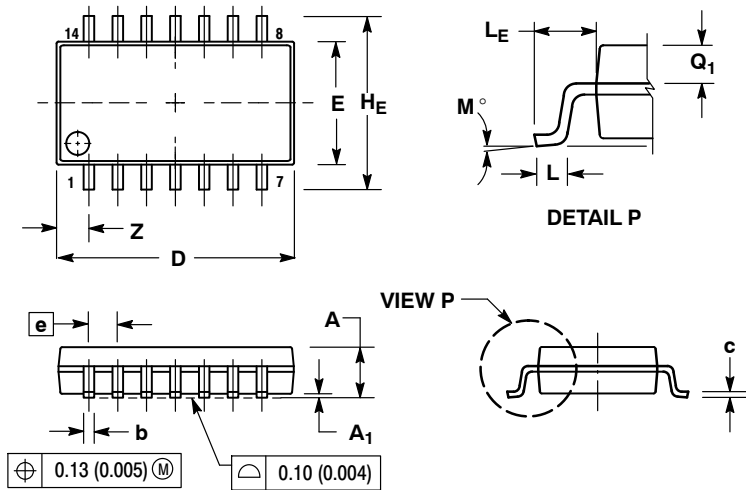
SOLDERING FOOTPRINT



MC74VHC125

PACKAGE DIMENSIONS

SOEIAJ-14
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).

DIM	MILLIMETERS		INCHES	
	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	
HE	7.40	8.20	0.291	0.323
L	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

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5773-3850

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local Sales Representative