

Octal Bus Transceiver

The MC74VHC245 is an advanced high speed CMOS octal bus transceiver fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

It is intended for two-way asynchronous communication between data buses. The direction of data transmission is determined by the level of the DIR input. The output enable pin (\overline{OE}) can be used to disable the device, so that the buses are effectively isolated.

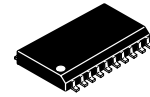
All inputs are equipped with protection circuits against static discharge.

- High Speed: $t_{PD} = 4.0ns$ (Typ) at $V_{CC} = 5V$
- Low Power Dissipation: $I_{CC} = 4\mu A$ (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 2V to 5.5V Operating Range
- Low Noise: $V_{OLP} = 1.2V$ (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300mA
- ESD Performance: HBM > 2000V; Machine Model > 200V
- Chip Complexity: 308 FETs or 77 Equivalent Gates
- **These devices are available in Pb-free package(s). Specifications herein apply to both standard and Pb-free devices. Please see our website at www.onsemi.com for specific Pb-free orderable part numbers, or contact your local ON Semiconductor sales office or representative.**

APPLICATION NOTES

- Do not force a signal on an I/O pin when it is an active output, damage may occur.
- All floating (high impedance) input or I/O pins must be fixed by means of pull up or pull down resistors or bus terminator ICs.
- A parasitic diode is formed between the bus and V_{CC} terminals. Therefore, the VHC245 cannot be used to interface 5V to 3V systems directly.

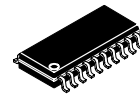
MC74VHC245



DW SUFFIX
20-LEAD SOIC WIDE PACKAGE
CASE 751D-05



DT SUFFIX
20-LEAD TSSOP PACKAGE
CASE 948E-02



M SUFFIX
20-LEAD SOIC EIAJ PACKAGE
CASE 967-01

ORDERING INFORMATION

MC74VHCXXXDW	SOIC WIDE
MC74VHCXXXDT	TSSOP
MC74VHCXXXM	SOIC EIAJ

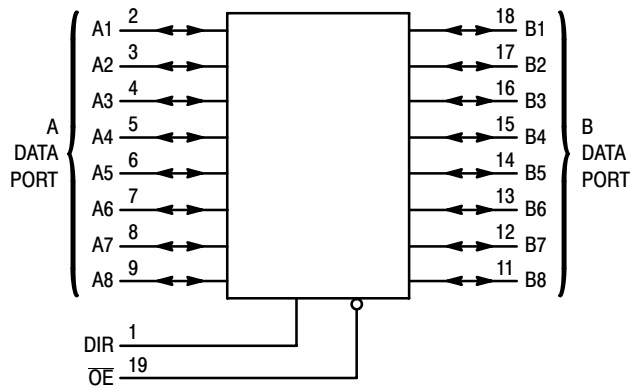


Figure 1. LOGIC DIAGRAM

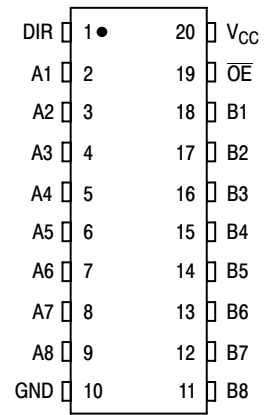


Figure 2. PIN ASSIGNMENT

FUNCTION TABLE

Control Inputs		Operation
\overline{OE}	DIR	
L	L	Data Transmitted from Bus B to Bus A
L	H	Data Transmitted from Bus A to Bus B
H	X	Buses Isolated (High-Impedance State)

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	±75	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 ≤ (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.

* 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	- 40	+ 85	°C
t _r , t _f	Input Rise and Fall Time	V _{CC} = 3.3V ±0.3V V _{CC} = 5.0V ±0.5V	0 100 20	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} V	T _A = 25°C			T _A = - 40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
V _{IH}	Minimum High-Level Input Voltage		2.0 3.0 to 5.5	1.50 V _{CC} × 0.7			1.50 V _{CC} × 0.7		V
V _{IL}	Maximum Low-Level Input Voltage		2.0 3.0 to 5.5			0.50 V _{CC} × 0.3		0.50 V _{CC} × 0.3	V
V _{OH}	Minimum High-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{OH} = - 50µA	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} = - 4mA I _{OH} = - 8mA	3.0 4.5	2.58 3.94			2.48 3.80		
V _{OL}	Maximum Low-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{OL} = 50µA	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} = 4mA I _{OL} = 8mA	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 (DIR, OE)	0 to 5.5			±0.1		±1.0	µA

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} V	T _A = 25°C			T _A = - 40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
I _{OZ}	Maximum Three-State Leakage Current	V _{in} = V _{IL} or V _{IH} V _{out} = V _{CC} or GND	5.5			±0.25		±2.5	μA
I _{CC}	Maximum Quiescent Supply Current	V _{in} = V _{CC} or GND	5.5			4.0		40.0	μA

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

Symbol	Parameter	Test Conditions	T _A = 25°C			T _A = - 40 to 85°C		Unit
			Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, A to B or B to A	V _{CC} = 3.3 ± 0.3V C _L = 15pF		5.8	8.4	1.0	10.0	ns
		C _L = 50pF		8.3	11.9	1.0	13.5	
		V _{CC} = 5.0 ± 0.5V C _L = 15pF		4.0	5.5	1.0	6.5	
		C _L = 50pF		5.5	7.5	1.0	8.5	
t _{PZL} , t _{PZH}	Output Enable Time OE to A or B	V _{CC} = 3.3 ± 0.3V C _L = 15pF		8.5	13.2	1.0	15.5	ns
		R _L = 1 kΩ C _L = 50pF		11.0	16.7	1.0	19.0	
		V _{CC} = 5.0 ± 0.5V C _L = 15pF		5.8	8.5	1.0	10.0	
		R _L = 1 kΩ C _L = 50pF		7.3	10.6	1.0	12.0	
t _{PLZ} , t _{PHZ}	Output Disable Time OE to A or B	V _{CC} = 3.3 ± 0.3V C _L = 50pF		11.5	15.8	1.0	18.0	ns
		R _L = 1 kΩ						
		V _{CC} = 5.0 ± 0.5V C _L = 50pF		7.0	9.7	1.0	11.0	
		R _L = 1 kΩ						
t _{OSLH} , t _{OSHL}	Output to Output Skew	V _{CC} = 3.3 ± 0.3V C _L = 50pF (Note 1)			1.5		1.5	ns
		V _{CC} = 5.0 ± 0.5V C _L = 50pF (Note 1)			1.0		1.0	ns
C _{in}	Maximum Input Capacitance DIR, OE			4	10		10	pF
C _{I/O}	Maximum Three-State I/O Capacitance			8				pF

C _{PD}	Power Dissipation Capacitance (Note 2)	Typical @ 25°C, V _{CC} = 5.0V		pF
		21		

1. Parameter guaranteed by design. t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|.

2. 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} / 8 (per bit). 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 = 3.0ns, C_L = 50pF, V_{CC} = 5.0V)

Symbol	Parameter	T _A = 25°C		Unit
		Typ	Max	
V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	0.9	1.2	V
V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	-0.9	-1.2	V
V _{IHD}	Minimum High Level Dynamic Input Voltage		3.5	V
V _{ILD}	Maximum Low Level Dynamic Input Voltage		1.5	V

SWITCHING WAVEFORMS

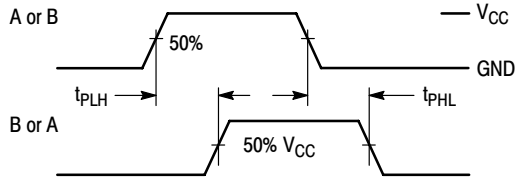


Figure 3.

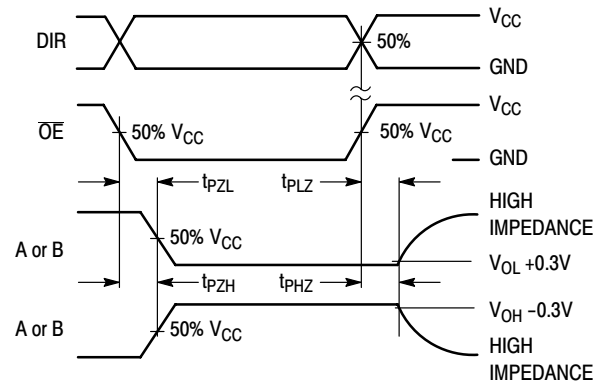
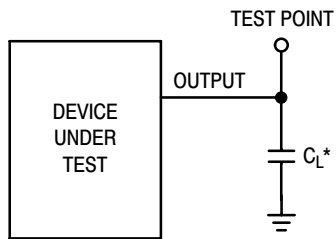


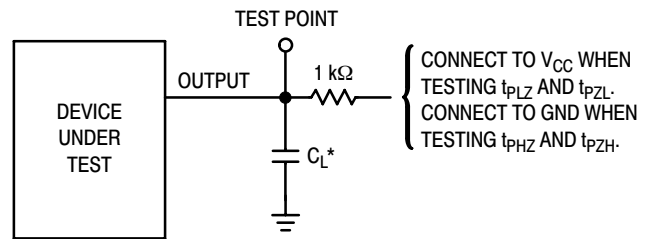
Figure 4.

TEST CIRCUITS



*Includes all probe and jig capacitance

Figure 5.



*Includes all probe and jig capacitance

Figure 6.

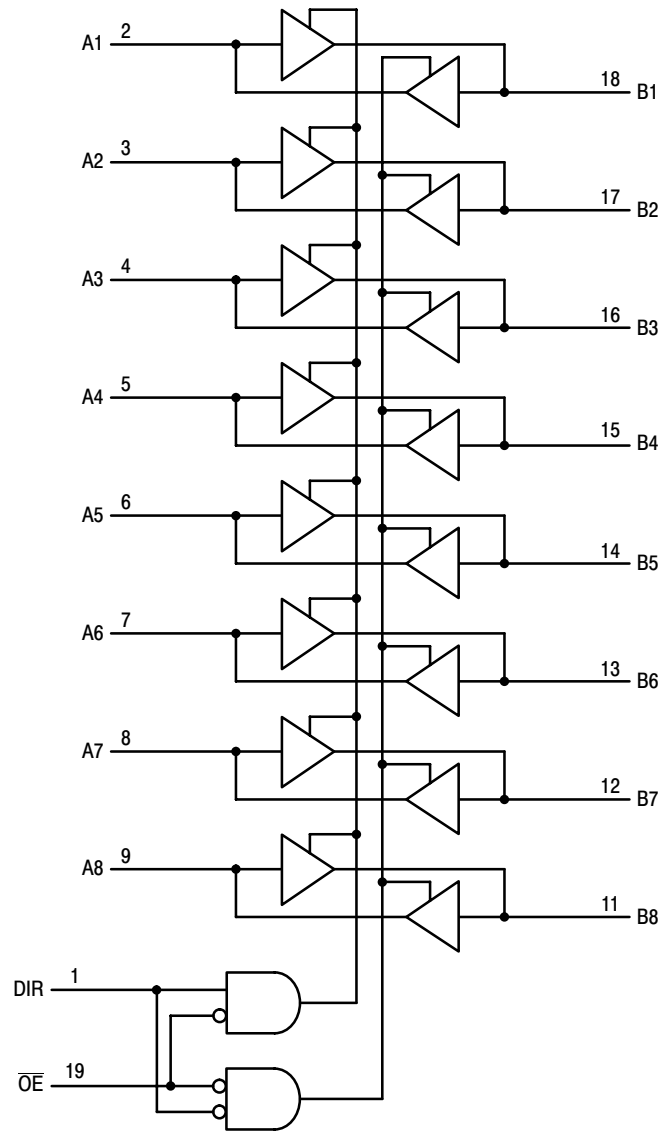


Figure 7. EXPANDED LOGIC DIAGRAM

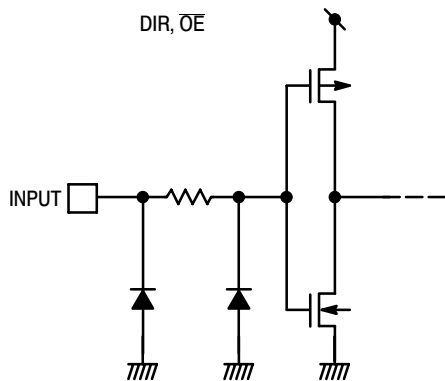


Figure 8. INPUT EQUIVALENT CIRCUIT

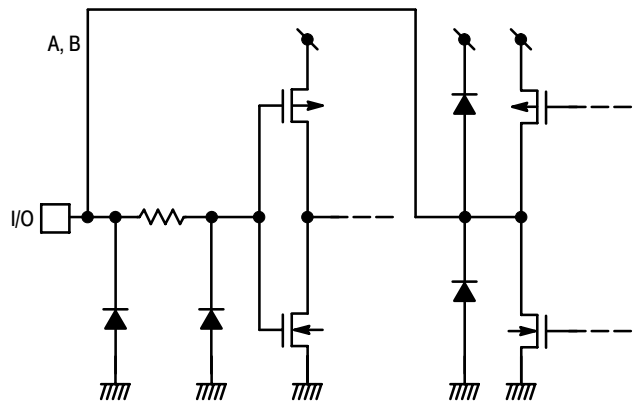
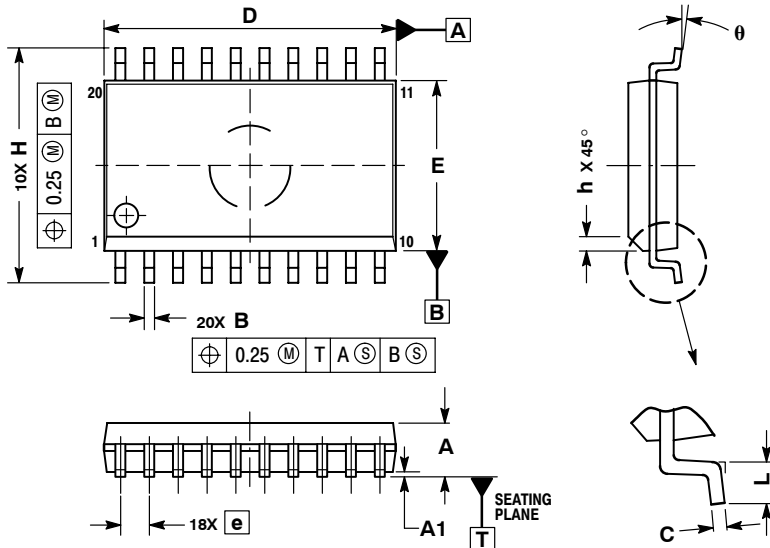


Figure 9. BUS TERMINAL EQUIVALENT CIRCUIT

OUTLINE DIMENSIONS

DW SUFFIX SOIC CASE 751D-05 ISSUE F

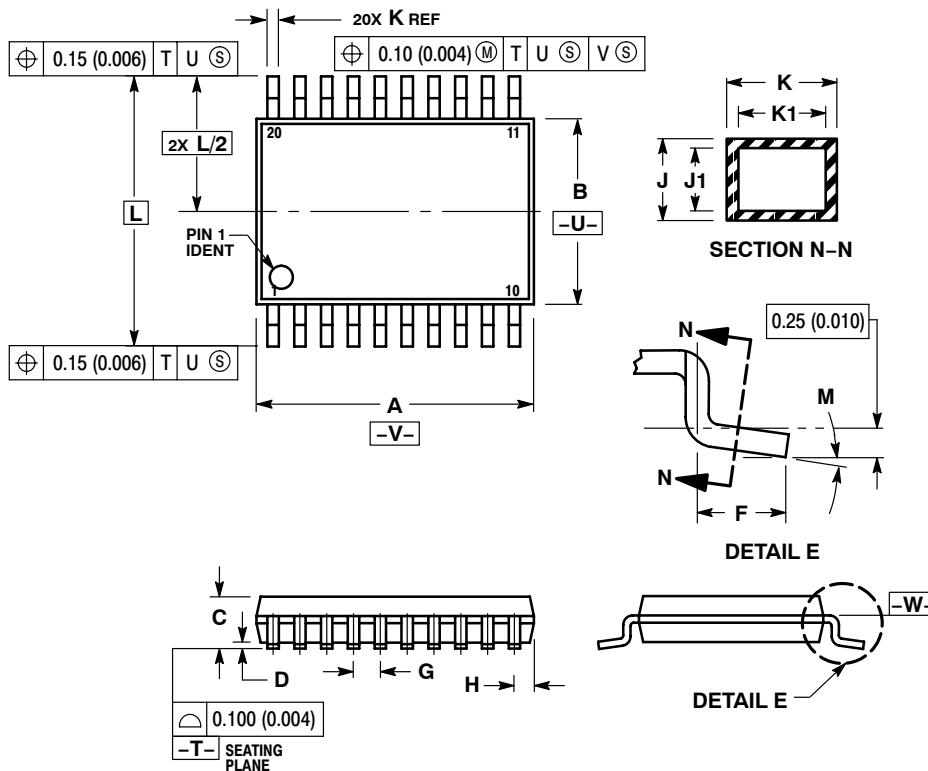


NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
B	0.35	0.49
C	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
theta	0°	7°

DT SUFFIX TSSOP CASE 948E-02 ISSUE A

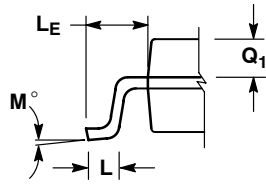
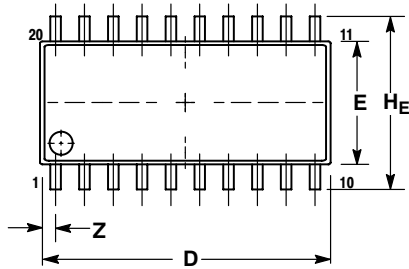


NOTES:

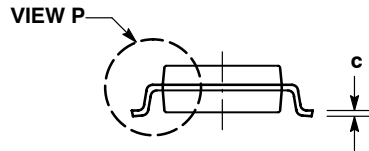
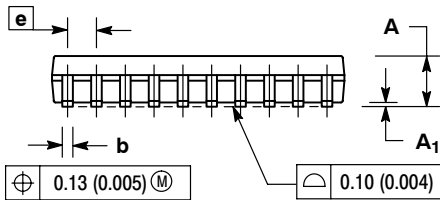
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD 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	6.40	6.60	0.252	0.260
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	0.27	0.37	0.011	0.015
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°

**M SUFFIX
SOIC EIAJ
CASE 967-01
ISSUE O**



DETAIL P



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	0.18	0.27	0.007	0.011
D	12.35	12.80	0.486	0.504
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	---	0.81	---	0.032

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 61312, Phoenix, Arizona 85082-1312 USA
Phone: 480-829-7710 or 800-344-3860 Toll Free USA/Canada
Fax: 480-829-7709 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051
Phone: 81-3-5773-3850

ON Semiconductor Website: <http://onsemi.com>

Order Literature: <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.

MC74VHC245/D