Octal Bus Buffer

Inverting

The MC74VHC540 is an advanced high speed CMOS inverting octal 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 MC74VHC540 features inputs and outputs on opposite sides of the package and two AND-ed active-low output enables. When either $\overline{\text{OE1}}$ or $\overline{\text{OE2}}$ are high, the terminal outputs are in 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 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

Features

- High Speed: $t_{PD} = 3.7 \text{ ns}$ (Typ) at $V_{CC} = 5.0 \text{ V}$
- Low Power Dissipation: $I_{CC} = 4.0 \mu A$ (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 2.0 V to 5.5 V Operating Range
- Low Noise: V_{OLP} = 1.2 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: 124 FETs or 31 Equivalent Gates
- These Devices are Pb-Free and are RoHS Compliant

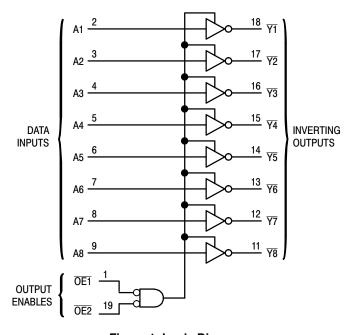


Figure 1. Logic Diagram



ON Semiconductor®

http://onsemi.com

MARKING DIAGRAMS







TSSOP-20 DT SUFFIX CASE 948E



A = Assembly Location

WL, L = Wafer Lot YY, Y = Year WW, W = Work Week G or ■ = Pb-Free Package

PIN ASSIGNMENT

OE1	1●	20] v _{cc}
A1 [2	19] OE2
A2 [3	18] <u>Y1</u>
A3 [4	17] <u>Y2</u>
A4 [5	16] Y 3
A5 [6	15] <u>Y4</u>
A6 [7	14] <u>Y5</u>
A7 [8	13] <u>∀6</u>
A8 [9	12] Y 7
GND [10	11] <u>78</u>
			-

FUNCTION TABLE

	Inputs	Output V	
OE1	OE2	Α	Output \overline{Y}
L	L	L	Н
L	L	Н	L
Н	X	Х	Z
X	Н	X	Z

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

MAXIMUM RATINGS*

Symbol	Parameter	r	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 GN	ID 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

^{*} 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			Max	Unit
V _{CC}	DC Supply Voltage			5.5	V
V _{in}	DC Input Voltage			5.5	V
V _{out}	DC Output Voltage			V_{CC}	V
T _A	Operating Temperature, All Package Types			+ 125	°C
t _r , t _f	•	$V_{CC} = 3.3V \pm 0.3V$ $V_{CC} = 5.0V \pm 0.5V$	0	100 20	ns/V

DC ELECTRICAL CHARACTERISTICS

			V _{CC}	V _{CC} T _A = 25°C		;	T _A = - 55	to 125°C	
Symbol	Parameter	Test Conditions	V	Min	Тур	Max	Min	Max	Unit
V _{IH}	Minimum High-Level Input Voltage		2.0 3.0 to 5.5	1.50 V _{CC} x 0.7			1.50 V _{CC} x 0.7		٧
V _{IL}	Maximum Low-Level Input Voltage		2.0 3.0 to 5.5			0.50 V _{CC} x 0.3		0.50 V _{CC} x 0.3	٧
V _{OH}	Minimum High-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -50 \mu A$	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5		1.9 2.9 4.4		٧
		$V_{in} = V_{IH} \text{ or } V_{IL} \\ I_{OH} = -4mA \\ I_{OH} = -8mA$	3.0 4.5	2.58 3.94			2.48 3.80		
V _{OL}	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 50 \mu A$	2.0 3.0 4.5		0.0 0.0 0.0	0.1 0.1 0.1		0.1 0.1 0.1	٧
		$V_{in} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 4mA$ $I_{OL} = 8mA$	3.0 4.5			0.36 0.36		0.44 0.44	

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.

DC ELECTRICAL CHARACTERISTICS

		Vcc			T _A = 25°C		T _A = - 55	to 125°C	
Symbol	Parameter	Test Conditions	v	Min	Тур	Max	Min	Max	Unit
l _{in}	Maximum Input Leakage Current	V _{in} = 5.5V or GND	0 to 5.5			± 0.1		± 1.0	μА
l _{OZ}	Maximum Three-State Leakage Current	$V_{in} = V_{IL} \text{ or } V_{IH}$ $V_{out} = V_{CC} \text{ or GND}$	5.5			± 0.25		± 2.5	μА
Icc	Maximum Quiescent Supply Current	V _{in} = V _{CC} or GND	5.5			4.0		40.0	μА

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

					T _A = 25°C		T _A = - 55	5 to 125°C	
Symbol	Parameter	Test Condi	tions	Min	Тур	Max	Min	Max	Unit
t _{PLH} , t _{PHL}	Maximum Propagation Delay, A to \(\overline{Y} \)	$V_{CC} = 3.3 \pm 0.3 V$	$C_L = 15pF$ $C_L = 50pF$		4.8 7.3	7.0 10.5	1.0 1.0	8.5 12.0	ns
	(Figures 1 and 3)	$V_{CC} = 5.0 \pm 0.5 V$	$C_L = 15pF$ $C_L = 50pF$		3.7 5.2	5.0 7.0	1.0 1.0	6.0 8.0	
t _{PZL} , t _{PZH}	Output Enable Time, OEn to Y	$\begin{aligned} V_{CC} &= 3.3 \pm 0.3 V \\ R_L &= 1 k \Omega \end{aligned}$	C _L = 15pF C _L = 50pF		6.8 9.3	10.5 14.0	1.0 1.0	12.5 16.0	ns
	(Figures 2 and 4)	$V_{CC} = 5.0 \pm 0.5V$ $R_L = 1k\Omega$	C _L = 15pF C _L = 50pF		4.7 6.2	7.2 9.2	1.0 1.0	8.5 10.5	
t _{PLZ} , t _{PHZ}	Output Disable Time, OEn to Y	$\begin{aligned} V_{CC} &= 3.3 \pm 0.3 V \\ R_L &= 1 k \Omega \end{aligned}$	C _L = 50pF		11.2	15.4	1.0	17.5	ns
	(Figures 2 and 4)	$V_{CC} = 5.0 \pm 0.5V$ $R_L = 1k\Omega$	C _L = 50pF		6.0	8.8	1.0	10.0	
t _{OSLH} , t _{OSHL}	Output to Output Skew	V _{CC} = 3.3 ± 0.3V (Note 1)	C _L = 50pF			1.5			ns
		V _{CC} = 5.0 ± 0.5V (Note 1)	C _L = 50pF			1.0			ns
C _{in}	Maximum Input Capacitance				4	10		10	pF
C _{out}	Maximum Three-State Output Capacitance (Output in High Impedance State)				6				pF

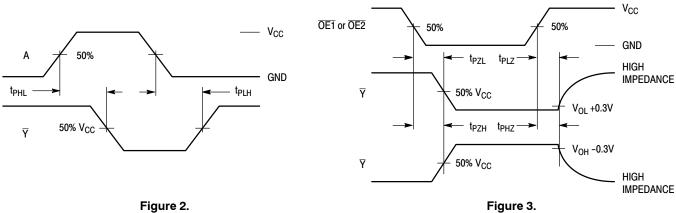
		Typical @ 25°C, V _{CC} = 5.0V	
C_{PD}	Power Dissipation Capacitance (Note 2)	17	pF

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

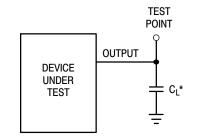
		T _A = 25°C		
Symbol	Parameter	Тур	Max	Unit
V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	0.9	1.2	V
V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	- 0.9	- 1.2	V
V _{IHD}	Minimum High Level Dynamic Input Voltage		3.5	V
V_{ILD}	Maximum Low Level Dynamic Input Voltage		1.5	V

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} • 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}.

SWITCHING WAVEFORMS

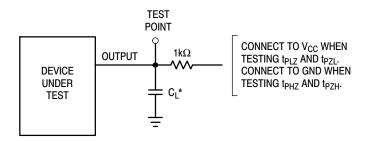


TEST CIRCUITS



*Includes all probe and jig capacitance

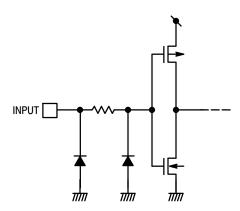
Figure 4.



*Includes all probe and jig capacitance

Figure 5.

INPUT EQUIVALENT CIRCUIT



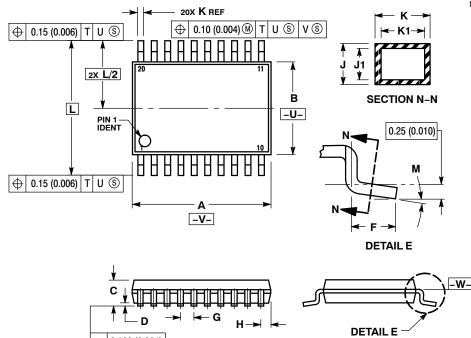
ORDERING INFORMATION

Device	Package	Shipping [†]
MC74VHC540DWR2G	SOIC-20 (Pb-Free)	1000 Units / Tape & Reel
MC74VHC540DTR2G	TSSOP-20 (Pb-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 Specification Brochure, BRD8011/D.

PACKAGE DIMENSIONS

TSSOP-20 **DT SUFFIX** CASE 948E-02 **ISSUE C**



☐ 0.100 (0.004)

-T- SEATING PLANE

- NOTES:
 1. DIMENSIONING AND TOLERANCING PER
 - ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION:

 - 2. CONTHOLLING DIMENSION.
 MILLIMETER.
 3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
 MOLD FLASH OR GATE BURRS SHALL NOT

 - 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.

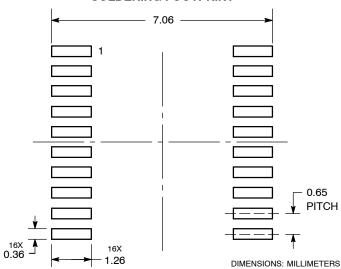
 5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL DIMENSION AT MAXIMUM MATERIAL CONDITION.
 - CONDITION.

 6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.

 7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

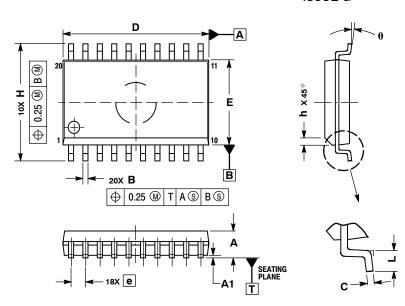
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	6.40	6.60	0.252	0.260
В	4.30	4.50	0.169	0.177
С		1.20		0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65	BSC	0.026 BSC	
Н	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
Ĺ	6.40	BSC	C 0.252 BSC	
M	0°	8°	0°	8°

SOLDERING FOOTPRINT



PACKAGE DIMENSIONS

SOIC-20 **DW SUFFIX** CASE 751D-05 ISSUE G



NOTES:

- 1. DIMENSIONS ARE IN MILLIMETERS.
 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
- PROTHUSION.

 MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
 DIMENSION B DOES NOT INCLUDE DAMBAR
 PROTRUSION. ALLOWABLE PROTRUSION SHALL
 BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS					
DIM	MIN	MAX				
Α	2.35	2.65				
A1	0.10	0.25				
В	0.35	0.49				
С	0.23	0.32				
D	12.65	12.95				
Е	7.40	7.60				
е	1.27	BSC				
Н	10.05	10.55				
h	0.25	0.75				
Ĺ	0.50	0.90				
θ	0 °	7 °				

ON Semiconductor and una 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 loca Sales Representative