

Octal 3-State Inverting Bus Transceiver

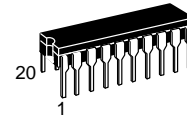
High-Performance Silicon-Gate CMOS

The MC54/74HC640A is identical in pinout to the LS640. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

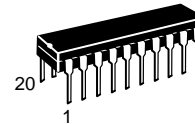
The HC640A is a 3-state transceiver that is used for 2-way asynchronous communication between data buses. The device has an active-low Output Enable pin, which is used to place the I/O ports into high-impedance states. The Direction control determines whether data flows from A to B or from B to A.

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V
- Low Input Current: 1 μ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 276 FETs or 69 Equivalent Gates

MC54/74HC640A



J SUFFIX
CERAMIC PACKAGE
CASE 732-03



N SUFFIX
PLASTIC PACKAGE
CASE 738-03

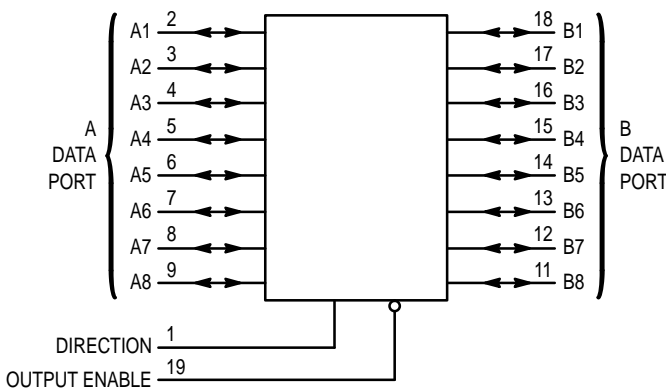


DW SUFFIX
SOIC PACKAGE
CASE 751D-04

ORDERING INFORMATION

MC54HCXXXAJ	Ceramic
MC74HCXXXAN	Plastic
MC74HCXXXADW	SOIC

LOGIC DIAGRAM



PIN 10 = GND
PIN 20 = VCC

PIN ASSIGNMENT

DIRECTION	1 ●	20	V _{CC}
		19	OUTPUT ENABLE
A1	2	18	B1
A2	3	17	B2
A3	4	16	B3
A4	5	15	B4
A5	6	14	B5
A6	7	13	B6
A7	8	12	B7
A8	9	11	B8
GND	10		

FUNCTION TABLE

Control Inputs		Operation
Output Enable	Direction	
L	L	Data Transmitted from Bus B to Bus A (Inverted)
L	H	Data Transmitted from Bus A to Bus B (Inverted)
H	X	Buses Isolated (High-Impedance State)

X = don't care



MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	- 0.5 to + 7.0	V
V _{in}	DC Input Voltage (Referenced to GND), Pin 1 or 19	- 0.5 to V _{CC} + 0.5	V
V _{I/O}	DC I/O Voltage (Referenced to GND)	- 0.5 to V _{CC} + 0.5	V
I _{in}	DC Input Current, per Pin	± 20	mA
I _{I/O}	DC I/O Current, per Pin	± 35	mA
I _{CC}	DC Supply Current, V _{CC} and GND Pins	± 75	mA
P _D	Power Dissipation in Still Air, Plastic or Ceramic DIP† SOIC Package†	750 500	mW
T _{stg}	Storage Temperature	- 65 to + 150	°C
T _L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package) (Ceramic DIP)	260 300	°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. I/O pins must be connected to a properly terminated line or bus.

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.
 † Derating — Plastic DIP: - 10 mW/°C from 65° to 125°C
 Ceramic DIP: - 10 mW/°C from 100° to 125°C
 SOIC Package: - 7 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit	
V _{CC}	DC Supply Voltage (Referenced to GND)	2.0	6.0	V	
V _{in} , V _{out}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V _{CC}	V	
T _A	Operating Temperature, All Package Types	- 55	+ 125	°C	
t _r , t _f	Input Rise and Fall Time (Figure 1)	V _{CC} = 2.0 V V _{CC} = 4.5 V V _{CC} = 6.0 V	0 0 0	1000 500 400	ns

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				- 55 to 25°C	≤ 85°C	≤ 125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{out} = V _{CC} - 0.1 V I _{out} ≤ 20 μA	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	
			6.0	4.2	4.2	4.2	
V _{IL}	Maximum Low-Level Input Voltage	V _{out} = 0.1 V I _{out} ≤ 20 μA	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	
			6.0	1.8	1.8	1.8	
V _{OH}	Minimum High-Level Output Voltage	V _{in} = V _{IH} I _{out} ≤ 20 μA	2.0	1.9	1.9	1.9	V
			4.5	4.4	4.4	4.4	
			6.0	5.9	5.9	5.9	
			V _{in} = V _{IH} I _{out} ≤ 2.4 mA I _{out} ≤ 6.0 mA I _{out} ≤ 7.8 mA	3.0	2.48	2.34	
V _{OL}	Maximum Low-Level Output Voltage	V _{in} = V _{IL} I _{out} ≤ 20 μA	2.0	0.1	0.1	0.1	V
			4.5	0.1	0.1	0.1	
			6.0	0.1	0.1	0.1	
			V _{in} = V _{IL} I _{out} ≤ 2.4 mA I _{out} ≤ 6.0 mA I _{out} ≤ 7.8 mA	3.0	0.26	0.33	
			4.5	0.26	0.33	0.4	
			6.0	0.26	0.33	0.4	

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				- 55 to 25°C	≤ 85°C	≤ 125°C	
I _{in}	Maximum Input Leakage Current	V _{in} = V _{CC} or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I _{OZ}	Maximum Three-State Leakage Current	Output in High-Impedance State V _{in} = V _{IL} or V _{IH} V _{out} = V _{CC} or GND	6.0	± 0.5	± 5.0	± 10	μA
I _{CC}	Maximum Quiescent Supply Current (per Package)	V _{in} = V _{CC} or GND I _{out} = 0 μA	6.0	4.0	40	160	μA

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			- 55 to 25°C	≤ 85°C	≤ 125°C	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, A to B, B to A (Figures 1 and 3)	2.0 3.0 4.5 6.0	75 55 15 13	95 70 19 16	110 80 22 19	ns
t _{PLZ} , t _{PHZ}	Maximum Propagation Delay, Direction or Output Enable to A or B (Figures 2 and 4)	2.0 3.0 4.5 6.0	110 90 22 19	140 110 28 24	165 130 33 28	ns
t _{PZL} , t _{PZH}	Maximum Propagation Delay, Output Enable to A or B (Figures 2 and 4)	2.0 3.0 4.5 6.0	110 90 22 19	140 110 28 24	165 130 33 25	ns
t _{TLH} , t _{THL}	Maximum Output Transition Time, Any Output (Figures 1 and 3)	2.0 3.0 4.5 6.0	60 23 12 10	75 27 15 13	90 32 18 15	ns
C _{in}	Maximum Input Capacitance, Pin 1 or 19	—	10	10	10	pF
C _{out}	Maximum Three-State I/O Capacitance (Output in High-Impedance State)	—	15	15	15	pF

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

CPD	Power Dissipation Capacitance (Per Transceiver Channel)*	Typical @ 25°C, V _{CC} = 5.0 V	
		40	

* Used to determine the no-load dynamic power consumption: P_D = C_{PD} V_{CC}²f + I_{CC} V_{CC}. For load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

SWITCHING WAVEFORMS

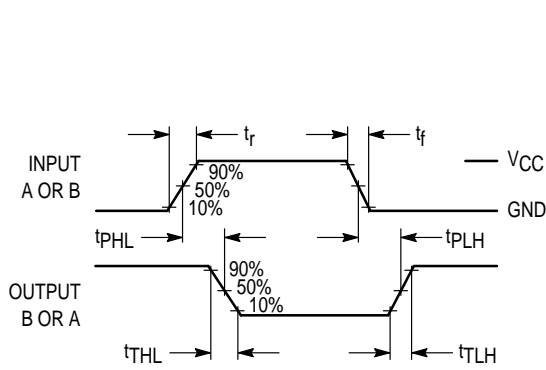


Figure 1.

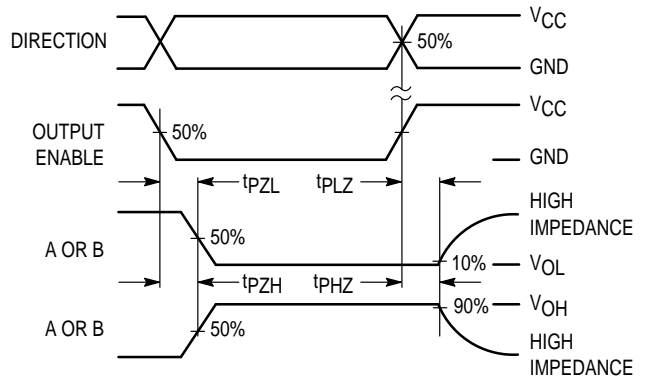
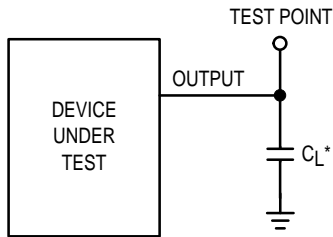


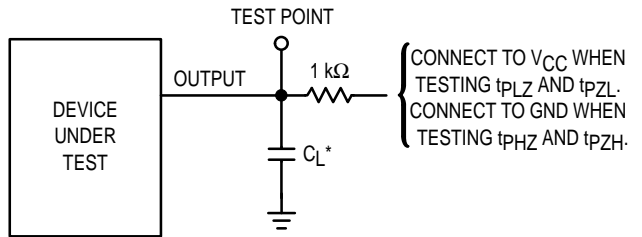
Figure 2.

tTEST CIRCUITS



* Includes all probe and jig capacitance

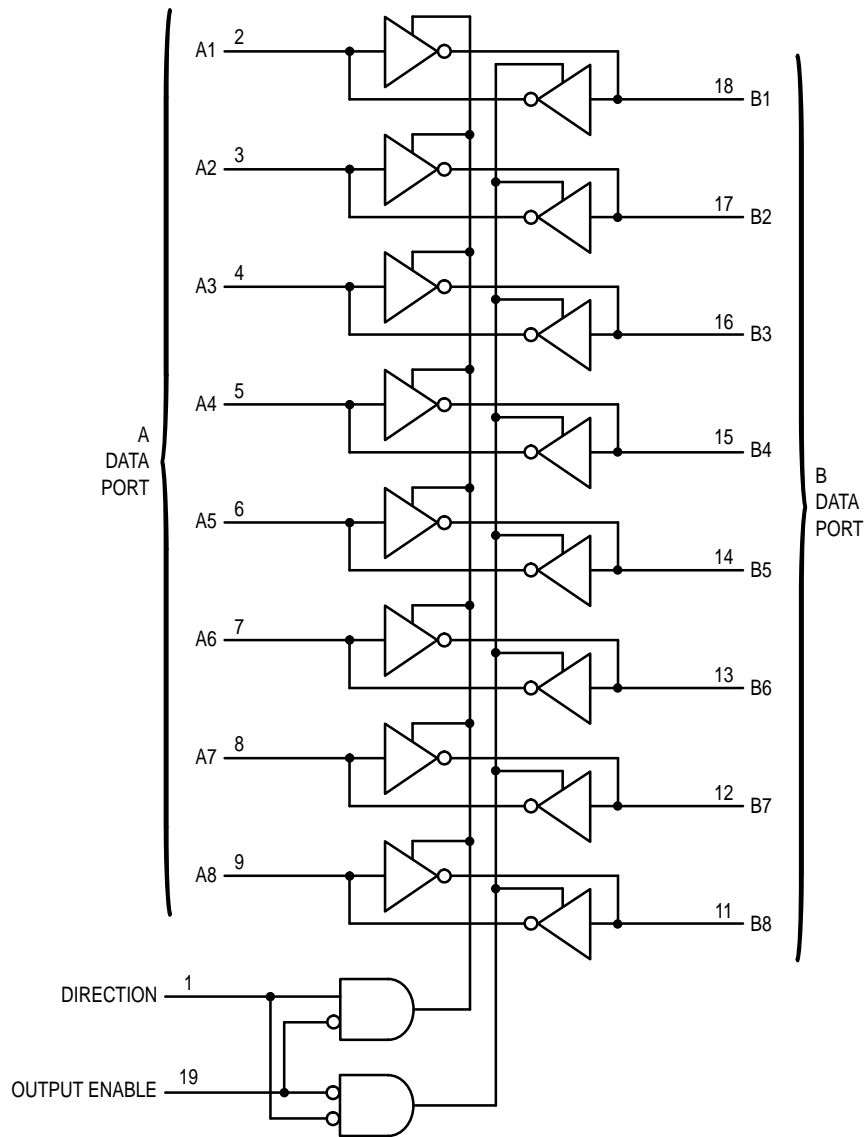
Figure 3.



* Includes all probe and jig capacitance

Figure 4.

EXPANDED LOGIC DIAGRAM



OUTLINE DIMENSIONS

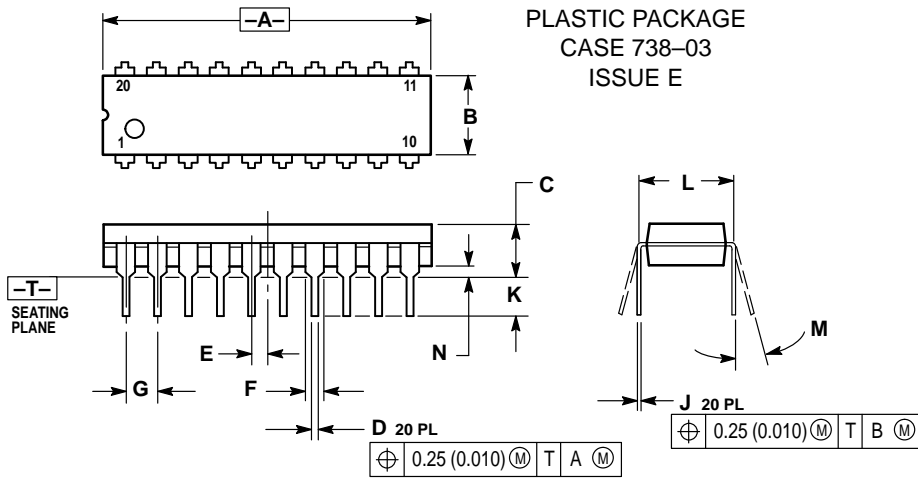
J SUFFIX
CERAMIC PACKAGE
CASE 732-03
ISSUE E



- NOTES:
- LEADS WITHIN 0.25 (0.010) DIAMETER, TRUE POSITION AT SEATING PLANE, AT MAXIMUM MATERIAL CONDITION.
 - DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
 - DIMENSIONS A AND B INCLUDE MENISCUS.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	23.88	25.15	0.940	0.990
B	6.60	7.49	0.260	0.295
C	3.81	5.08	0.150	0.200
D	0.38	0.56	0.015	0.022
F	1.40	1.65	0.055	0.065
G	2.54 BSC		0.100 BSC	
H	0.51	1.27	0.020	0.050
J	0.20	0.30	0.008	0.012
K	3.18	4.06	0.125	0.160
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.25	1.02	0.010	0.040

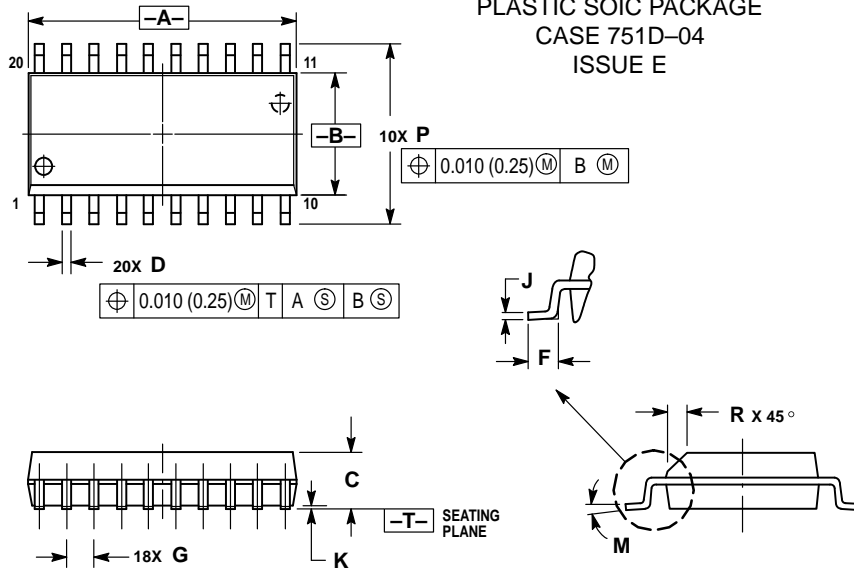
N SUFFIX
PLASTIC PACKAGE
CASE 738-03
ISSUE E



- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: INCH.
 - DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
 - DIMENSION B DOES NOT INCLUDE MOLD FLASH.


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.010	1.070	25.66	27.17
B	0.240	0.260	6.10	6.60
C	0.150	0.180	3.81	4.57
D	0.015	0.022	0.39	0.55
E	0.050 BSC		1.27 BSC	
F	0.050	0.070	1.27	1.77
G	0.100 BSC		2.54 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.140	2.80	3.55
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01

DW SUFFIX
PLASTIC SOIC PACKAGE
CASE 751D-04
ISSUE E



- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: MILLIMETER.
 - DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 - MAXIMUM MOLD PROTRUSION 0.150 (0.006) PER SIDE.
 - DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	12.65	12.95	0.499	0.510
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola 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 consequential or incidental damages. "Typical" parameters which may be provided in Motorola 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. Motorola does not convey any license under its patent rights nor the rights of others. Motorola 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 Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola 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 Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,
3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 81-3-3521-8315

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
– US & Canada ONLY 1-800-774-1848

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

INTERNET: <http://www.mot.com/SPS/>

