Product Preview

Low-Voltage CMOS Octal Transceiver/Registered Transceiver With Dual Enable

With 5V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

MC74LCX652

LCX

LOW–VOLTAGE CMOS OCTAL TRANSCEIVER/ REGISTERED TRANSCEIVER WITH DUAL ENABLE

The MC74LCX652 is a high performance, non–inverting octal transceiver/registered transceiver operating from a 2.7 to 3.6V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A V_I specification of 5.5V allows MC74LCX652 inputs to be safely driven from 5V devices. The MC74LCX652 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

Data on the A or B bus will be clocked into the registers as the appropriate clock pin goes from a LOW–to–HIGH logic level. Two Output Enable pins ($\overline{OEBA}$, OEAB) are provided to control the transceiver outputs. In the transceiver mode, data present at the high impedance port may be stored in either the A or the B register or in both. The select controls (SBA, SAB) can multiplex stored and real–time (transparent mode) data. In the isolation mode (both outputs disabled), A data may be stored in the B register or B data may be stored in the A register. When in the real–time mode, it is possible to store data without using the internal registers by simultaneously enabling OEAB and $\overline{OEBA}$. In this configuration, each output reinforces its input (data retention is not guaranteed in this mode).

DW SUFFIX
PLASTIC SOIC
CASE 751E–04

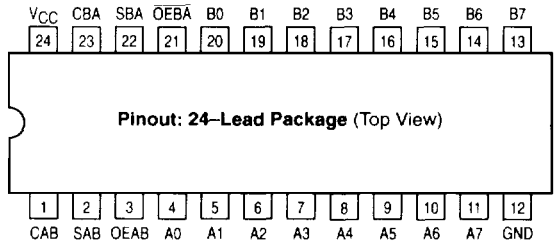
SD SUFFIX
PLASTIC SSOP
CASE 940D–03

DT SUFFIX
PLASTIC TSSOP
CASE 948H–01

- Designed for 2.7 to 3.6V V_{CC} Operation
- 5V Tolerant — Interface Capability With 5V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When V_{CC} = 0V
- LVTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500mA
- ESD Performance: Human Body Model >2000V; Machine Model >200V

PIN NAMES

Pins	Function
A0–A7	Side A Inputs/Outputs
B0–B7	Side B Inputs/Outputs
CAB, CBA	Clock Pulse Inputs
SAB, SBA	Select Control Inputs
$\overline{OEBA}$, OEAB	Output Enable Inputs



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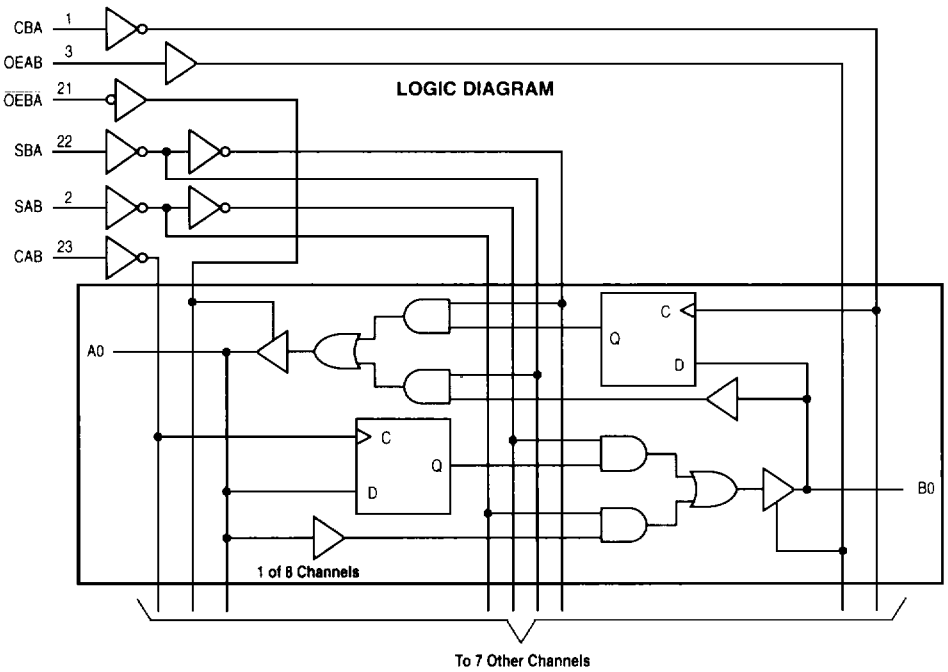


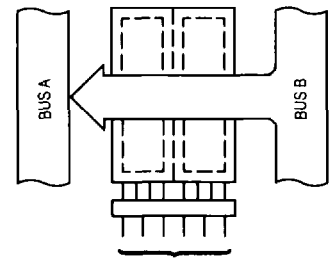
FUNCTION TABLE

Inputs						Storage Registers		Data Ports		Operating Mode
OEAB	OEBA	CAB	CBA	SAB	SBA	Q_A	Q_B	A_n	B_n	
L	H							Input	Input	
		↑	↑	X	X	NC	NC	X	X	Isolation, Hold Storage
		↑	↑	X	X	L H X X	X X L H	L H X X	X X L H	Store A and/or B Data
H	H							Input	Output	
		↕	X*	L	X	NC NC	NC NC	L H	L H	Real Time A Data to B Bus
				H	X	NC	NC	X	$Q_{\bar{A}}$	Stored A Data to B Bus
		↑	X*	L	X	L H	NC NC	L H	L H	Real Time A Data to B Bus; Store A Data
				H	X	L H	NC NC	L H	Q_A Q_A	Stored A Data to B Bus; Store A Data
L	L							Output	Input	
		X*	↕	X	L	NC NC	NC NC	L H	L H	Real Time B Data to A Bus
				X	H	NC	NC	Q_B	X	Stored B Data to A Bus
		X*	↑	X	L	NC NC	L H	L H	L H	Real Time B Data to A Bus; Store B Data
				X	H	NC NC	L H	Q_B Q_B	L H	Stored B Data to A Bus; Store B Data
H	L							Output	Output	
		↕	↕	H	H	NC	NC	Q_B	Q_A	Stored A Data to B Bus, Stored B Data to A Bus

H = High Voltage Level, L = Low Voltage Level; X = Don't Care; ↕ = Low–to–High Clock Transition, ↑ = NOT Low–to–High Clock Transition; NC = No Change, * = The clocks are not internally gated with either the Output Enables or the Source Inputs. Therefore, data at the A or B ports may be clocked into the storage registers, at any time. For I_{CC} reasons, Do Not Float Inputs.

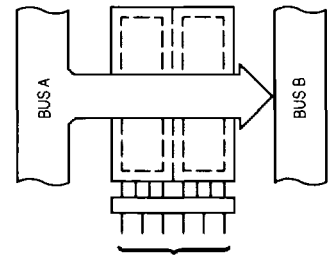
BUS APPLICATIONS

Real Time Transfer – Bus B to Bus A



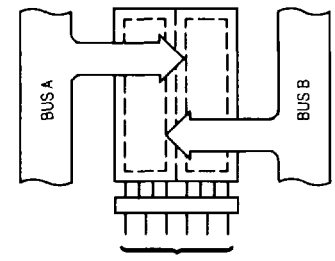
OEAB	$\overline{OEBA}$	CAB	CBA	SAB	SBA
L	L	X	X	X	L

Real Time Transfer – Bus A to Bus B



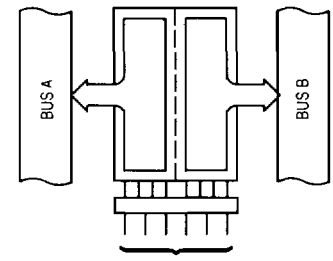
OEAB	$\overline{OEBA}$	CAB	CBA	SAB	SBA
H	H	X	X	L	X

Store Data from Bus A, Bus B or Bus A and Bus B



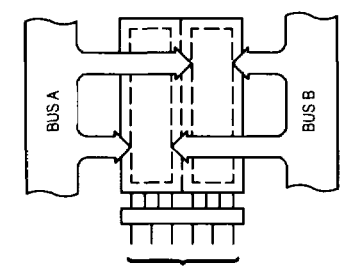
OEAB	$\overline{OEBA}$	CAB	CBA	SAB	SBA
X	H	↑	X	X	X
L	X	X	↑	X	X
L	H	↑	↑	X	X

Transfer A Stored Data to Bus B or Stored Data Bus B to Bus A or Both at the Same Time



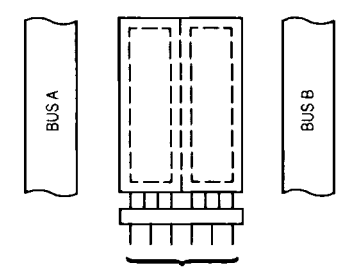
OEAB	$\overline{OEBA}$	CAB	CBA	SAB	SBA
H	H	H or L	X	H	X
L	L	X	H or L	X	H
H	L	H or L	H or L	H	H

Store Bus A in Both Registers or Store Bus B in Both Registers



OEAB	$\overline{OEBA}$	CAB	CBA	SAB	SBA
H	H	↑	↑	L	X
L	L	↑	↑	X	L

Isolation



OEAB	$\overline{OEBA}$	CAB	CBA	SAB	SBA
L	H	H or L	H or L	X	X

ABSOLUTE MAXIMUM RATINGS*

Symbol	Parameter	Value	Condition	Unit
V_{CC}	DC Supply Voltage	−0.5 to +7.0		V
V_I	DC Input Voltage	$-0.5 \le V_I \le +7.0$		V
V_O	DC Output Voltage	$-0.5 \le V_O \le +7.0$	Output in 3–State	V
		$-0.5 \le V_O \le V_{CC} + 0.5$[1]	Output in HIGH or LOW State	V
I_{IK}	DC Input Diode Current	−50	$V_I < GND$	mA
I_{OK}	DC Output Diode Current	−50	$V_O < GND$	mA
		+50	$V_O > V_{CC}$	mA
I_O	DC Output Source/Sink Current	±50		mA
I_{CC}	DC Supply Current Per Supply Pin	±100		mA
I_{GND}	DC Ground Current Per Ground Pin	±100		mA
T_{STG}	Storage Temperature Range	−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.

1. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating Data Retention Only	2.0 1.5	3.3 3.3	3.6 3.6	V
V_I	Input Voltage		0		5.5	V
V_O	Output Voltage	(HIGH or LOW State) (3–State)	0 0		V_{CC} 5.5	V
I_{OH}	HIGH Level Output Current, V_{CC} = 3.0V – 3.6V				−24	mA
I_{OL}	LOW Level Output Current, V_{CC} = 3.0V – 3.6V				24	mA
I_{OH}	HIGH Level Output Current, V_{CC} = 2.7V – 3.0V				−12	mA
I_{OL}	LOW Level Output Current, V_{CC} = 2.7V – 3.0V				12	mA
T_A	Operating Free–Air Temperature		−40		+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate, V_{IN} from 0.8V to 2.0V, V_{CC} = 3.0V		0		10	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = −40°C to +85°C		Unit
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 1)	$2.7V \le V_{CC} \le 3.6V$	2.0		V
V_{IL}	LOW Level Input Voltage (Note 1)	$2.7V \le V_{CC} \le 3.6V$		0.8	V
V_{OH}	HIGH Level Output Voltage	$2.7V \le V_{CC} \le 3.6V$; I_{OH} = −100µA	V_{CC} − 0.2		V
		V_{CC} = 2.7V; I_{OH} = −12mA	2.2		
		V_{CC} = 3.0V; I_{OH} = −18mA	2.4		
		V_{CC} = 3.0V; I_{OH} = −24mA	2.2		
V_{OL}	LOW Level Output Voltage	$2.7V \le V_{CC} \le 3.6V$; I_{OL} = 100µA		0.2	V
		V_{CC} = 2.7V; I_{OL} = 12mA		0.4	
		V_{CC} = 3.0V; I_{OL} = 16mA		0.4	
		V_{CC} = 3.0V; I_{OL} = 24mA		0.55	

1. These values of V_I are used to test DC electrical characteristics only. Functional test should use $V_{IH} \ge 2.4V$, $V_{IL} \le 0.5V$.

DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Characteristic	Condition	T_A = –40°C to +85°C		Unit
			Min	Max	
I_I	Input Leakage Current	2.7V ≤ V_{CC} ≤ 3.6V; 0V ≤ V_I ≤ 5.5V		±5.0	μA
I_{OZ}	3–State Output Current	2.7 ≤ V_{CC} ≤ 3.6V; 0V ≤ V_O ≤ 5.5V; V_I = V_{IH} or V_{IL}		±5.0	μA
I_{OFF}	Power–Off Leakage Current	V_{CC} = 0V; V_I or V_O = 5.5V		10	μA
I_{CC}	Quiescent Supply Current	2.7 ≤ V_{CC} ≤ 3.6V; V_I = GND or V_{CC}		10	μA
		2.7 ≤ V_{CC} ≤ 3.6V; 3.6 ≤ V_I or V_O ≤ 5.5V		±10	μA
ΔI_{CC}	Increase in I_{CC} per Input	2.7 ≤ V_{CC} ≤ 3.6V; V_{IH} = V_{CC} – 0.6V		500	μA

AC CHARACTERISTICS[1] (t_R = t_F = 2.5ns; C_L = 50pF; R_L = 500Ω)

Symbol	Parameter	Waveform	Limits				Unit
			T_A = –40°C to +85°C				
			V_{CC} = 3.0V to 3.6V		V_{CC} = 2.7V		
			Min	Max	Min	Max	
f_{max}	Clock Pulse Frequency	3	150				MHz
t_{PLH} t_{PHL}	Propagation Delay Clock to Output	3	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
t_{PLH} t_{PHL}	Propagation Delay Input to Output	1	1.5 1.5	7.0 7.0	1.5 1.5	8.0 8.0	ns
t_{PLH} t_{PHL}	Propagation Delay Select to Output	1	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
t_{PZH} t_{PZL}	Output Enable Time to High and Low Level	2	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
t_{PHZ} t_{PLZ}	Output Disable Time From High and Low Level	2	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
t_s	Setup Time, HIGH or LOW Data to Clock	3	2.5		2.5		ns
t_h	Hold Time, HIGH or LOW Data to Clock	3	1.5		1.5		ns
t_w	Clock Pulse Width, HIGH or LOW	3	3.3		3.3		ns
t_{OSHL} t_{OSLH}	Output–to–Output Skew (Note 2)			1.0 1.0			ns

1. These AC parameters are preliminary and may be modified prior to release. The maximum AC limits are design targets. Actual performance will be specified upon completion of characterization.
2. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH–to–LOW (t_{OSHL}) or LOW–to–HIGH (t_{OSLH}); parameter guaranteed by design.

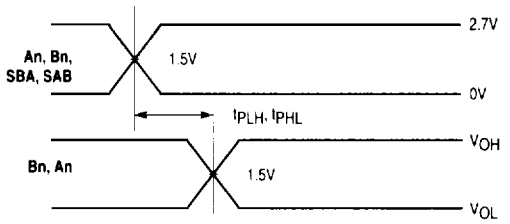
DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = +25°C			Unit
			Min	Typ	Max	
V_{OLP}	Dynamic LOW Peak Voltage[1]	V_{CC} = 3.3V, C_L = 50pF, V_{IH} = 3.3V, V_{IL} = 0V		0.8		V
V_{OLV}	Dynamic LOW Valley Voltage[1]	V_{CC} = 3.3V, C_L = 50pF, V_{IH} = 3.3V, V_{IL} = 0V		0.8		V

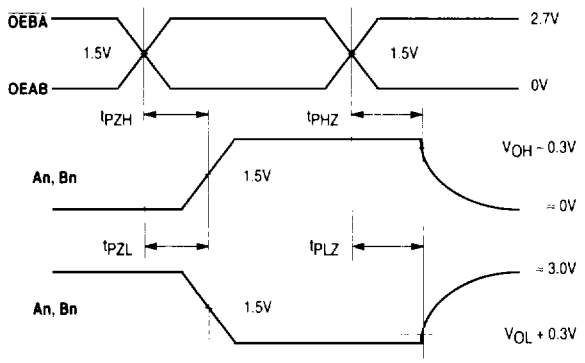
1. Number of outputs defined as "n". Measured with "n–1" outputs switching from HIGH–to–LOW or LOW–to–HIGH. The remaining output is measured in the LOW state. The LCX652 is characterized with 7 outputs switching with 1 output held LOW.

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
C_{PD}	Power Dissipation Capacitance	10MHz, V_{CC} = 3.3V, V_I = 0V or V_{CC}	25	pF
C_{IN}	Input Capacitance	V_{CC} = 3.3V, V_I = 0V or V_{CC}	7	pF
$C_{I/O}$	Input/Output Capacitance	V_{CC} = 3.3V, V_I = 0V or V_{CC}	8	pF

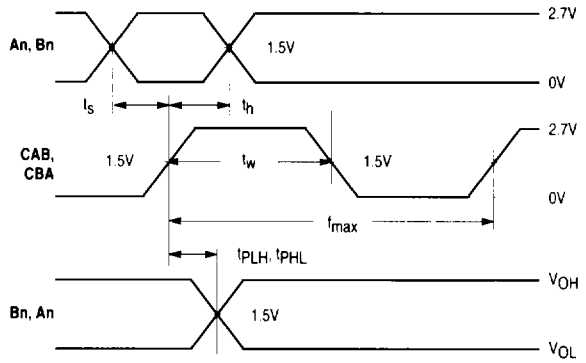


WAVEFORM 1 – SAB to B and SBA to A, An to Bn PROPAGATION DELAYS
$t_R = t_F$ = 2.5ns, 10% to 90%; f = 1MHz; t_W = 500ns



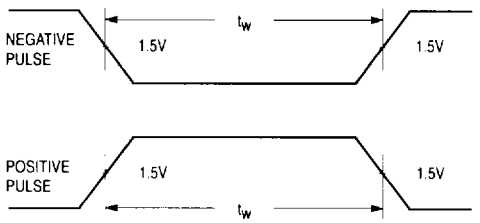
WAVEFORM 2 – $\overline{OEBA}$/OEAB to An/Bn OUTPUT ENABLE AND DISABLE TIMES
$t_R = t_F$ = 2.5ns, 10% to 90%; f = 1MHz; t_W = 500ns

Figure 1. AC Waveforms



WAVEFORM 3 – CLOCK to Bn/An PROPAGATION DELAYS, CLOCK MINIMUM PULSE WIDTH, An/Bn to CLOCK SETUP AND HOLD TIMES

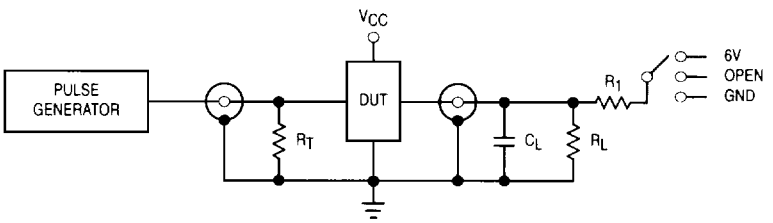
$t_R = t_F$ = 2.5ns, 10% to 90%; f = 1MHz; t_W = 500ns except when noted



WAVEFORM 4 – INPUT PULSE DEFINITION

$t_R = t_F$ = 2.5ns, 10% to 90% of 0V to 2.7V

Figure 2. AC Waveforms



TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V
Open Collector/Drain t_{PLH} and t_{PHL}	6V
t_{PZH}, t_{PHZ}	GND

C_L = 50pF or equivalent (Includes jig and probe capacitance)
$R_L = R_1$ = 500Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

Figure 3. Test Circuit