October 1986
Revised March 2000

DM74AS646 • DM74AS648
Octal Bus Transceiver and Register

General Description

This device incorporates an octal bus transceiver and an octal D-type register configured to enable multiplexed transmission of data from bus to bus or internal register to bus.

This bus transceiver features totem-pole 3-STATE outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. The high-impedance third state and increased high-logic-level drive provide this device with the capability of being connected directly to and driving the bus lines in a bus-organized system without need for interface or pull-up components. It is particularly attractive for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The registers in the DM74AS646, DM74AS648 are edge-triggered D-type flip-flops. On the positive transition of the clock (CAB or CBA), the input bus data is stored.

The SAB and SBA control pins are provided to select whether real-time data or stored data is transferred. A LOW input level selects real-time data, and a HIGH level selects stored data. The select controls have a “make before break” configuration to eliminate a glitch which would normally occur in a typical multiplexer during the transition between stored and real-time data.

The enable $\overline{G}$ and direction control pins provide four modes of operation; real-time data transfer from bus A to B, real-time data transfer from bus B to A, real-time bus A and/or B data transfer to internal storage, or internal store data transfer to bus A or B.

When the enable $\overline{G}$ pin is LOW, the direction pin selects which bus receives data. When the enable $\overline{G}$ pin is HIGH, both buses become disabled yet their input function is still enabled.

Features

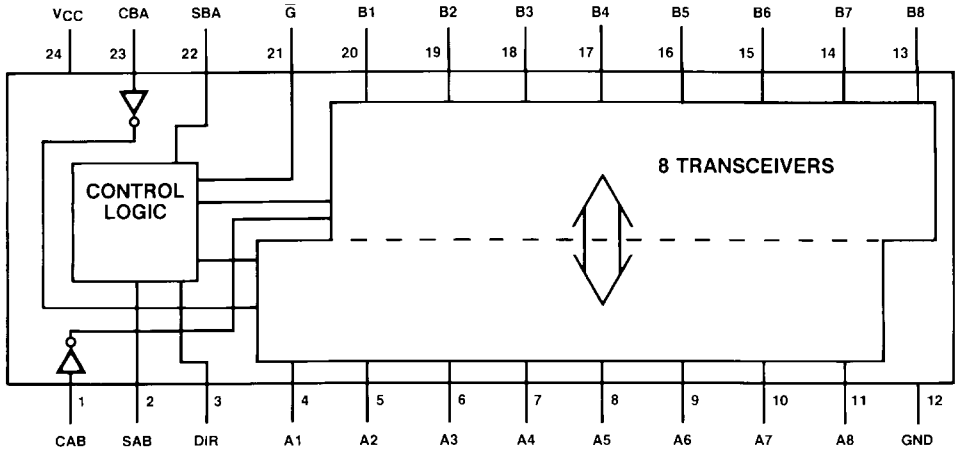
- Switching specifications at 50 pF
- Switching specifications guaranteed over full temperature and V_{CC} range
- Advanced oxide-isolated, ion-implanted Schottky TTL process
- Functionally and pin-for-pin compatible with LS TTL counterpart
- 3-STATE buffer-type outputs drive bus lines directly

Ordering Code:

Order Number	Package Number	Package Description
DM74AS646WM	M24B	24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
DM74AS646NT	N24C	24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-100, 0.300 Wide
DM74AS648WM	M24B	24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
DM74AS648NT	N24C	24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-100, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter “X” to the ordering code.

Connection Diagram



Function Table

Inputs						Data I/O (Note 1)		Operation or Function	
$\overline{G}$	DIR	CAB	CBA	SAB	SBA	A1 thru A8	B1 thru B8	DM74AS646	DM74AS648
H	X	H or L	H or L	X	X	Input	Input	Isolation, Hold Storage	Isolation, Hold Storage
	X	↑	↑	X	X			Store A and B Data	Store A and B Data
L	L	X	X	X	L	Output	Input	Real Time B Data to A Bus	Real Time $\overline{B}$ Data to A Bus
	L	X	H or L	X	H			Stored B Data to A Bus	Stored $\overline{B}$ Data to A Bus
L	H	X	X	L	X	Input	Output	Real Time A Data to B Bus	Real Time $\overline{A}$ Data to B Bus
	H	H or L	X	H	X			Stored A Data to B Bus	Stored $\overline{A}$ Data to B Bus
X	X	↑	X	X	X	Input	Unspecified (Note 1)	Store A, B Unspecified (Note 1)	Store A, B Unspecified (Note 1)
X	X	X	↑	X	X	Unspecified (Note 1)	Input	Store B, A Unspecified (Note 1)	Store B, A Unspecified (Note 1)

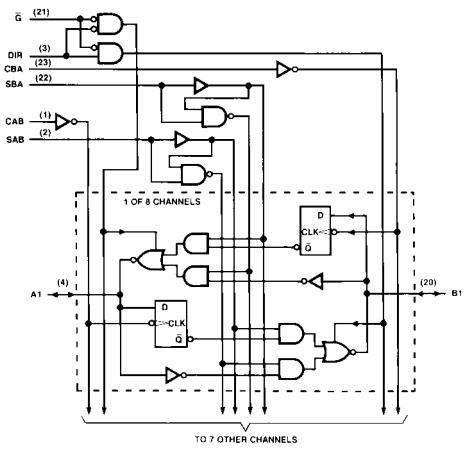
H—HIGH level; L—LOW level; X—irrelevant; ↑—LOW-to-HIGH level transition

Note 1: The data output functions may be enabled or disabled by various signals at the $\overline{G}$ and DIR inputs. Data input functions are always enabled, i.e., data at the bus pins will be stored on every LOW-to-HIGH transition on the clock inputs.

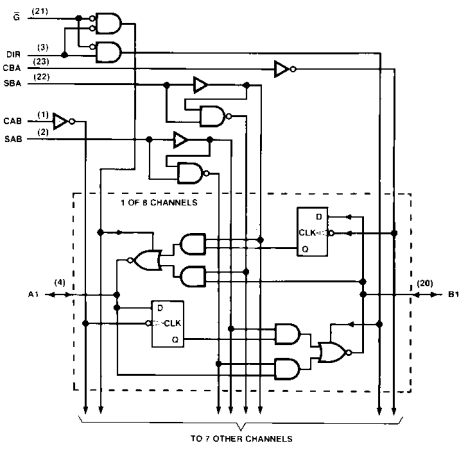
Logic Diagrams

(positive logic)

DM74AS646

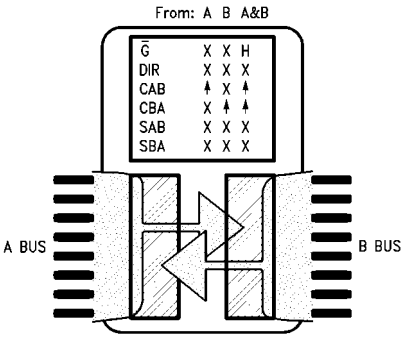


DM74AS648

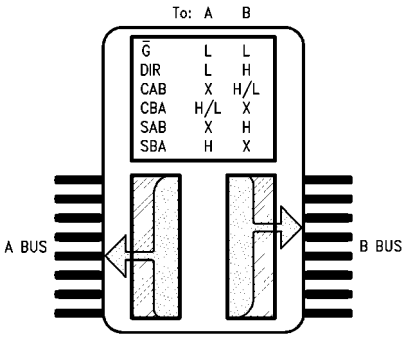


Different Modes of Control for DM74AS646, DM74AS648

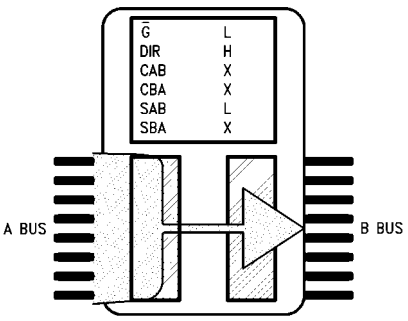
Storage From A, B or A and B



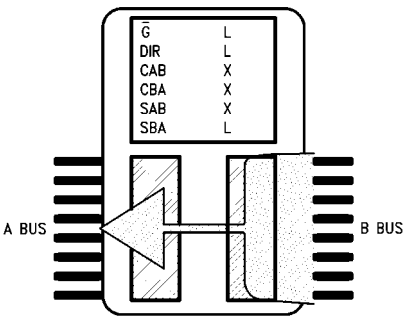
Transfer Stored Data to A or B (Note 2)



Real-Time Transfer Bus A to Bus B (Note 2)



Real-Time Transfer Bus B to Bus A (Note 2)



Note 2: The complement of A and B data are stored and transferred for DM74AS648

Absolute Maximum Ratings(Note 3)

Supply Voltage	7V
Input Voltage	
Control Inputs	7V
I/O Ports	5.5V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Typical θ_{JA}	
N Package	41.1°C/W
M Package	81.5°C/W

Note 3: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter		Min	Nom	Max	Units
V_{CC}	Supply Voltage		4.5	5	5.5	V
V_{IH}	HIGH Level Input Voltage		2			V
V_{IL}	LOW Level Input Voltage				0.8	V
I_{OH}	HIGH Level Output Current				−15	mA
I_{OL}	LOW Level Output Current				48	mA
f_{CLK}	Clock Frequency		0		90	MHz
t_W	Width of Clock Pulse	HIGH	5			ns
		LOW	6			ns
t_{SU}	Data Setup Time (Note 4)		6↑			ns
t_H	Data Hold Time (Note 4)		0↑			ns
T_A	Free Air Operating Temperature		0		70	°C

Note 4: The (↑) arrow indicates the positive edge of the Clock is used for reference.

Electrical Characteristics

over recommended operating free air temperature range. All typical values are measured at V_{CC} = 5V, T_A = 25°C.

Symbol	Parameter	Conditions			Min	Typ	Max	Units
V_{IK}	Input Clamp Voltage	V_{CC} = 4.5V, I_I = −18 mA					−1.2	V
V_{OH}	HIGH Level Output Voltage	V_{CC} = 4.5V, V_{IL} = Max		I_{OH} = Max	2			V
		V_{IH} = Min		I_{OH} = −3 mA	2.4	3.2		
		V_{CC} = 4.5V to 5.5V, I_{OH} = −2 mA			V_{CC} − 2			
V_{OL}	LOW Level Output Voltage	V_{CC} = 4.5V, V_{IL} = Min V_{IH} = 2V, I_{OL} = Max				0.35	0.5	V
I_I	Input Current @ Max Input Voltage	V_{CC} = 5.5V	V_I = 7V	Control Inputs			0.1	mA
			V_I = 5.5V	A or B Ports			0.1	
I_{IH}	HIGH Level Input Current	V_{CC} = 5.5V, V_{IH} = 2.7V		Control Inputs			20	µA
		(Note 5)		A or B Ports			70	
I_{IL}	LOW Level Input Current	V_{CC} = 5.5V, V_{IL} = 0.4V		Control Inputs			−0.5	mA
		(Note 5)		A or B Ports			−0.75	
I_O	Output Drive Current	V_{CC} = 5.5V, V_O = 2.25V			−30		−112	mA
I_{CC}	Supply Current	V_{CC} = 5.5V	DM74AS646	Outputs HIGH		120	195	mA
				Outputs LOW		130	211	
				Outputs Disabled		130	211	
			DM74AS648	Outputs HIGH		110	185	
				Outputs LOW		120	195	
				Outputs Disabled		120	195	

Note 5: For I/O ports, the parameters I_{IH} and I_{IL} include the OFF-State current, I_{OZH} and I_{OZL}.

DM74AS646 Switching Characteristics

Symbol	Parameter	Conditions	From (Input)	To (Output)	Min	Max	Units
f_{MAX}	Maximum Clock Frequency	V_{CC} = 4.5V to 5.5V, $R_1 = R_2 = 500\Omega$, C_L = 50 pF			90		MHz
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		CBA or CAB	A or B	2	8.5	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output				2	9	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		A or B	B or A	2	9	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output				1	7	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		SBA or SAB (Note 6)	A or B	2	11	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output				2	9	ns
t_{PZH}	Output Enable Time to HIGH Level Output		Enable $\overline{G}$	A or B	2	9	ns
t_{PZL}	Output Enable Time to LOW Level Output				3	14	ns
t_{PHZ}	Output Disable Time from HIGH Level Output				2	9	ns
t_{PLZ}	Output Disable Time from LOW Level Output				2	9	ns
t_{PZH}	Output Enable Time to HIGH Level Output		DIR	A or B	3	16	ns
t_{PZL}	Output Enable Time to LOW Level Output				3	18	ns
t_{PHZ}	Output Disable Time from HIGH Level Output				2	10	ns
t_{PLZ}	Output Disable Time from LOW Level Output				2	10	ns

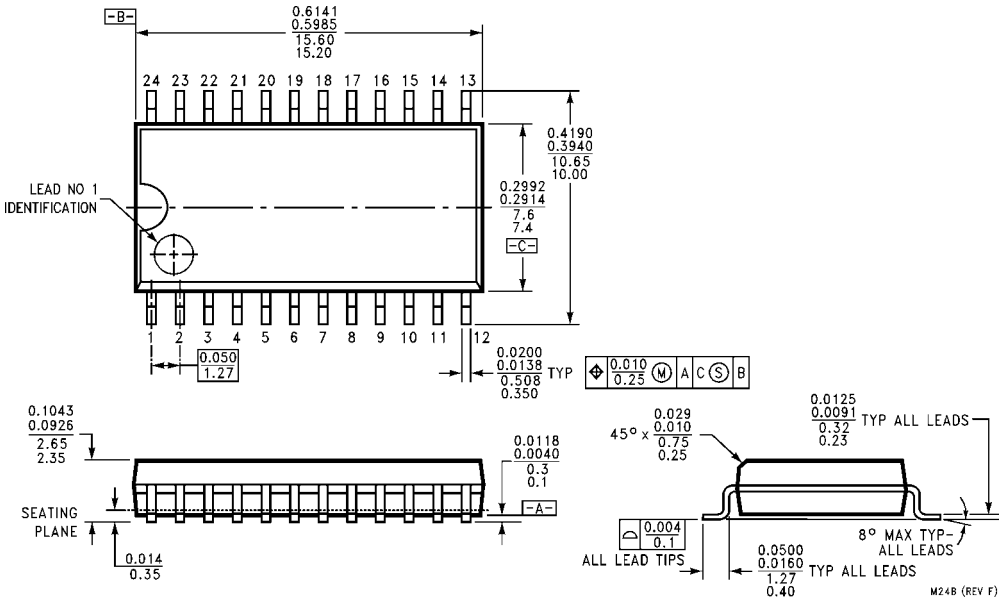
Note 6: These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

DM74AS648 Switching Characteristics

Symbol	Parameter	Conditions	From (Input)	To (Output)	Min	Max	Units
f_{MAX}	Maximum Clock Frequency	V_{CC} = 4.5V to 5.5V,			90		MHz
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	$R_1 = R_2 = 500\Omega$	CAB or CBA	A or B	2	8.5	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	C_L = 50 pF			2	9	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		A or B	B or A	2	8	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output				1	7	ns
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		SBA or SAB (Note 7)	A or B	2	11	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output				2	9	ns
t_{PZH}	Output Enable Time to HIGH Level Output		Enable $\overline{G}$	A or B	2	9	ns
t_{PZL}	Output Enable Time to LOW Level Output				3	15	ns
t_{PHZ}	Output Disable Time from HIGH Level Output				2	9	ns
t_{PLZ}	Output Disable Time from LOW Level Output				2	9	ns
t_{PZH}	Output Enable Time to HIGH Level Output		DIR	A or B	3	16	ns
t_{PZL}	Output Enable Time to LOW Level Output				3	18	ns
t_{PHZ}	Output Disable Time from HIGH Level Output				2	10	ns
t_{PLZ}	Output Disable Time from LOW Level Output				2	10	ns

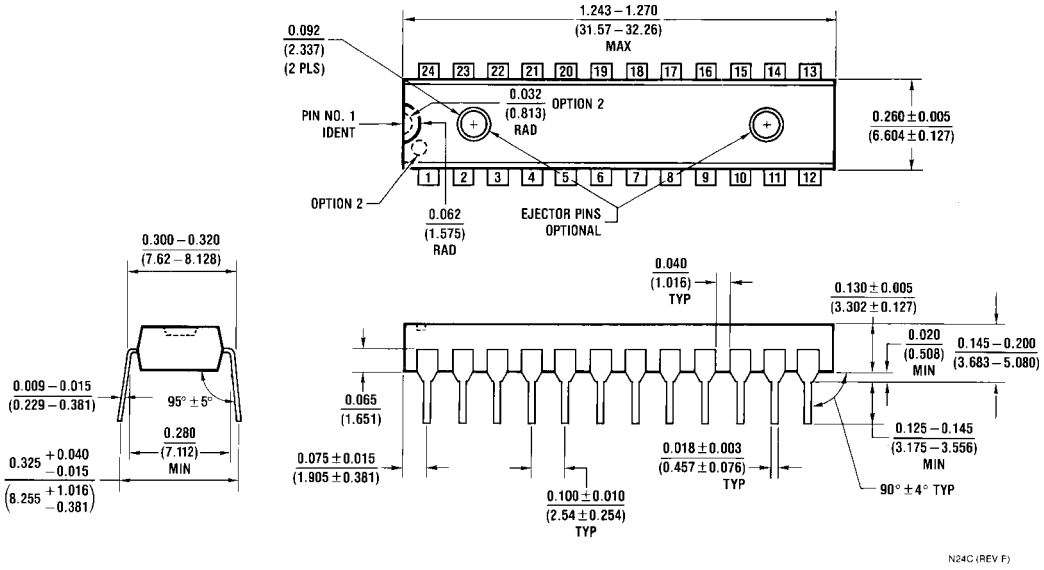
Note 7: These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

Physical Dimensions inches (millimeters) unless otherwise noted



24-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
Package Number M24B

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



24-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-100, 0.300 Wide
Package Number N24C