National Semiconductor

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DM74ALS646/74ALS646-1
Octal TRI-STATE® 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 TRI-STATE outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. The high-impedance state and increased high-logic level drive provides this device with the capability of being connected directly to and driving the bus lines in a bus-organized system without the need for interface or pull-up components. They are particularly attractive for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The 'ALS646-1 version features the same performance as the standard version with the addition of increased current drive capability to meet the current requirement of various bus architectures. For all ALS-1 products, the recommended maximum I_{OL} is increased to 48 mA.

The registers in the 'ALS646 are edge-triggered D-type flip-flops. On the positive transition of the clock (CAB or CBA), the input bus data is stored into the appropriate register. The CAB input controls the transfer of data into the A register and the CBA input controls the B register.

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 store and real-time data.

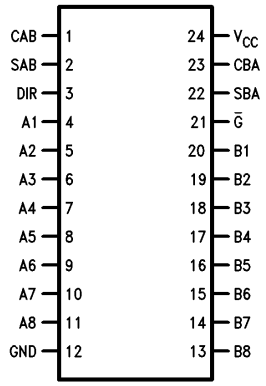
The enable $\overline{G}$ and direction control pins provide four modes of operation: real-time data transfer from bus A to B, real-time data transfer from bus B to A, real-time bus A and/or B data transfer to internal storage, or internally stored data transfer to bus A or B.

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

Features

- Maximum I_{OL} increased to 48 mA for 'ALS646-1 product
- Switching specifications at 50 pF
- Switching specifications guaranteed over full temperature and V_{CC} range
- Advanced oxide-isolated, ion-implanted Schottky TTL process
- TRI-STATE buffer outputs drive bus lines directly
- Multiplexed real-time and stored data
- Independent registers for A and B buses

Connection Diagram



TL/F/9172–1

Order Number DM74ALS646WM, 74ALS646-1WM, DM74ALS646NT or 74ALS646-1NT
See NS Package Number M24B or N24C

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Absolute Maximum Ratings

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	44.5°C/W
M Package	80.5°C/W

Note: This product meets application requirements of 500 temperature cycles from −65°C to +150°C.

Note: *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" table 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		DM74ALS646/ 74ALS646-1			Units
			Min	Nom	Max	
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	ALS646			24	mA
		ALS646-1			48	
f_{CLK}	Clock Frequency		0		40	MHz
t_W	Pulse Duration, Clocks Low or High		12.5			ns
t_{SU}	Data Setup Time, A before CAB or B before CBA		10 ↑			ns
t_H	Data Hold Time, A after CAB or B after CBA		0 ↑			ns
T_A	Free Air Operating Temperature		0		70	°C

↑ = With reference to the low to high transition of the respective clock.

Electrical Characteristics over recommended free air temperature range

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_{IC}	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.2	V
V_{OH}	High Level Output Voltage	V_{CC} = 4.5V to 5.5V	I_{OH} = −0.4 mA	V_{CC} − 2			V
		V_{CC} = Min	I_{OH} = −3 mA	2.4	3.2		
			I_{OH} = Max	2			
V_{OL}	Low Level Output Voltage	V_{CC} = Min	I_{OL} = 12 mA		0.25	0.4	V
			I_{OL} = 24 mA		0.35	0.5	
			I_{OL} = 48 mA		0.35	0.5	
I_I	Input Current at Maximum Input Voltage	V_{CC} = Max	I/O Ports, V_I = 5.5V			100	μA
			Control Inputs, V_I = 7V			100	
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V (Note 1)				20	μA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V, (Note 1)	Control Inputs			−200	μA
			I/O Ports			−200	
I_O	Output Drive Current	V_{CC} = Max, V_O = 2.25V		−30		−112	mA
I_{CC}	Supply Current	V_{CC} = Max	Outputs High		47	76	mA
			Outputs Low		55	88	
			Outputs Disabled		55	88	

Note 1: For I/O ports the TRI-STATE output currents (I_{OZH} and I_{OZL}) are included in the I_{IH} and I_{IL} parameters.

Switching Characteristics over recommended operating free air temperature range (Note 1)

Symbol	Parameter	Conditions	From (Input) To (Output)	DM74ALS646/ 74ALS646-1		Units
				Min	Max	
t_{PLH}	Propagation Delay Time Low to High Level Output	V_{CC} = 4.5V to 5.5V, C_L = 50 pF, $R_1 = R_2 = 500\Omega$, T_A = Min to Max	CBA or CAB to A or B	10	30	ns
t_{PHL}	Propagation Delay Time High to Low Level Output		CBA or CAB to A or B	5	17	ns
t_{PLH}	Propagation Delay Time Low to High Level Output		A or B to B or A	5	20	ns
t_{PHL}	Propagation Delay Time High to Low Level Output		A or B to B or A	3	12	ns
t_{PLH}	Propagation Delay Time Low to High Level Output (with A or B Low) (Note 2)		SBA or SAB to A or B	12	35	ns
t_{PHL}	Propagation Delay Time High to Low Level Output (with A or B Low) (Note 2)		SBA or SAB to A or B	5	20	ns
t_{PLH}	Propagation Delay Time Low to High Level Output (with A or B High) (Note 2)		SBA or SAB to A or B	6	25	ns
t_{PHL}	Propagation Delay Time High to Low Level Output (with A or B High) (Note 2)		SBA or SAB to A or B	5	20	ns
t_{PZH}	Output Enable Time to High Level Output		$\overline{G}$ to A or B	3	17	ns
t_{PZL}	Output Enable Time to Low Level Output		$\overline{G}$ to A or B	5	20	ns
t_{PHZ}	Output Disable Time from High Level Output		$\overline{G}$ to A or B	1	10	ns
t_{PLZ}	Output Disable Time from Low Level Output		$\overline{G}$ to A or B	2	16	ns
t_{PZH}	Output Enable Time to High Level Output		DIR to A or B	6	30	ns
t_{PZL}	Output Enable Time to Low Level Output		DIR to A or B	5	25	ns
t_{PHZ}	Output Disable Time from High Level Output		DIR to A or B	1	10	ns
t_{PLZ}	Output Disable Time from Low Level Output		DIR to A or B	2	16	ns

Note 1: See Section 5 for test waveforms and output load.

Note 2: These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

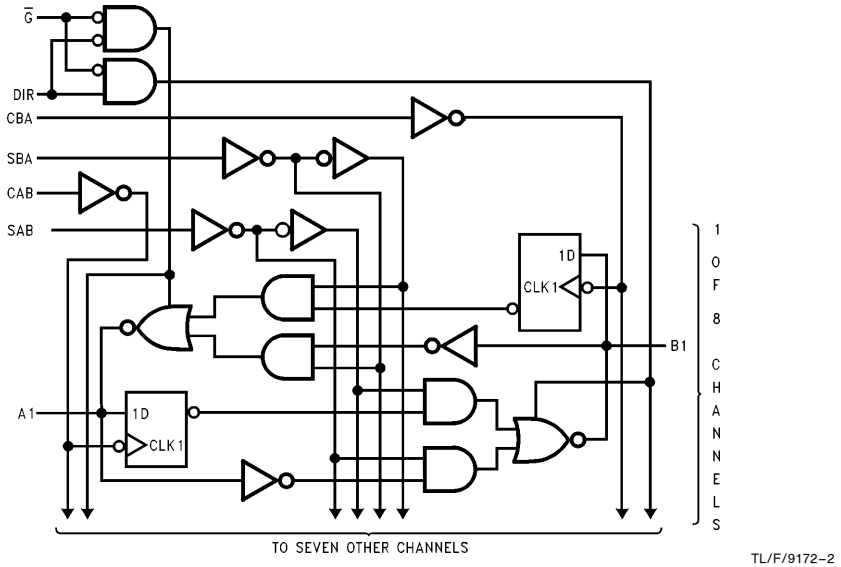
Function Table

Inputs						Data I/O (Note 1)		Operation or Function
$\overline{G}$	DIR	CAB	CBA	SAB	SBA	A1 thru A8	B1 thru B8	
X	X	↑	X	X	X	Input	Not Specified	Store A, B Unspecified
X	X	X	↑	X	X	Not Specified	Input	Store B, A Unspecified
H	X	↑	↑	X	X	Input	Input	Store A and B Data
H	X	H/L	H/L	X	X	Input	Input	Isolation, Hold Storage
L	L	X	X	X	L	Output	Input	Real-Time B Data to a Bus
L	L	X	H/L	X	H	Output	Input	Stored B Data to a Bus
L	H	X	X	L	X	Input	Output	Real-Time A Data to B Bus
L	H	H/L	X	H	X	Input	Output	Stored A Data to B Bus

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.

H = High Logic Level, L = Low Logic Level, X = Don't Care (Either Low or High Logic Levels including transitions), H/L = Either Low or High Logic Level excluding transitions, ↑ = Positive going edge of pulse.

Logic Diagram



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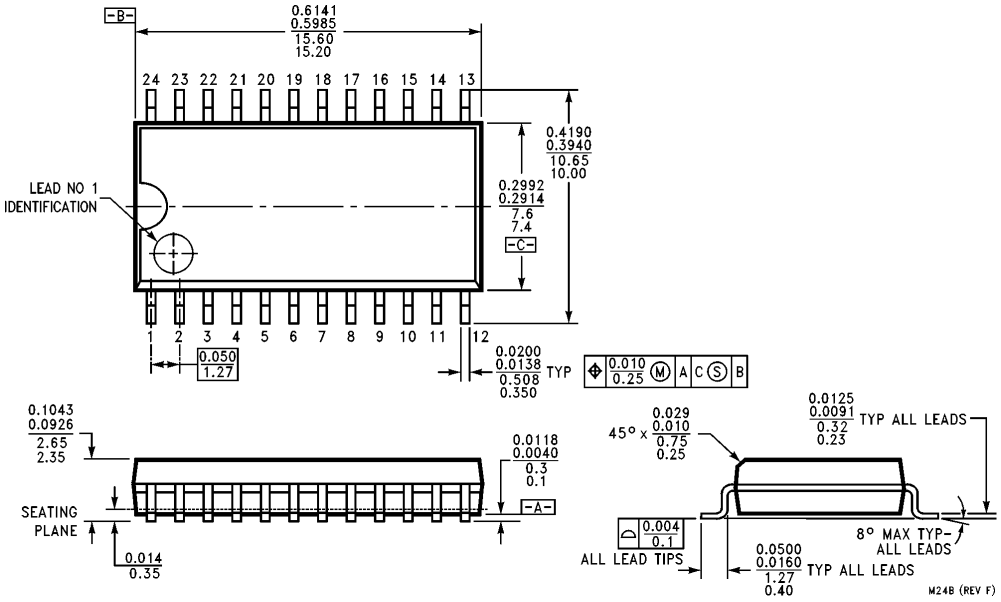
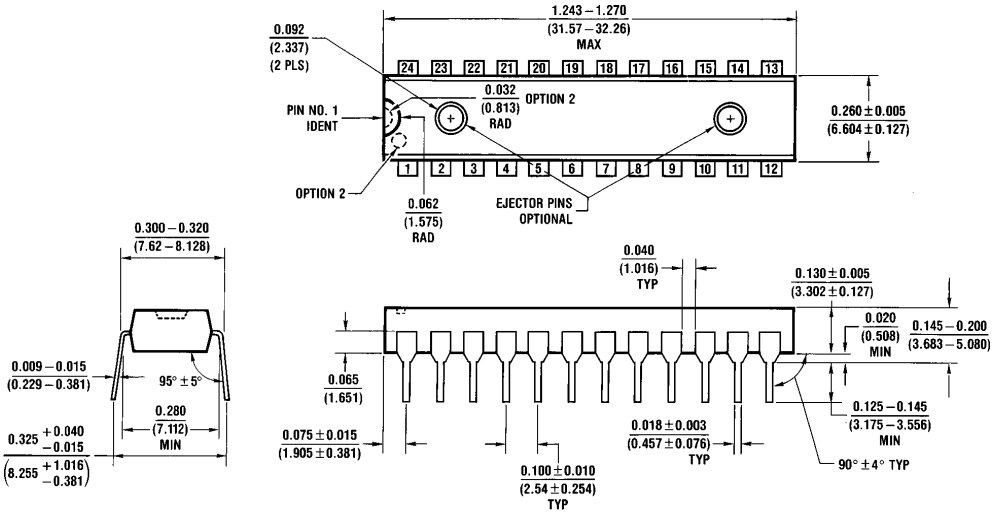
Physical Dimensions inches (millimeters)



S.O. Package (WM)
Order Number DM74ALS646WM or 74ALS646-1WM
NS Package Number M24B

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (NT)
Order Number DM74ALS646NT or 74ALS646-1NT
NS Package Number N24C

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