

**SN54ALS646, SN54ALS648, SN54AS646
SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648
OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS**

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- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- Choice of True or Inverting Data Paths
- Choice of 3-State or Open-Collector Outputs
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (NT) and Ceramic (JT) 300-mil DIPs

DEVICE	OUTPUT	LOGIC
SN54ALS646, SN74ALS646A, 'AS646	3 state	True
SN54ALS648, SN74ALS648A, SN74AS648	3 state	Inverting

description

These devices consist of bus-transceiver circuits with 3-state or open-collector outputs, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the data bus or from the internal storage registers. Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate clock (CLKAB or CLKBA) input. Figure 1 illustrates the four fundamental bus-management functions that can be performed with the octal bus transceivers and registers.

Output-enable (\overline{OE}) and direction-control (DIR) inputs control the transceiver functions. In the transceiver mode, data present at the high-impedance port may be stored in either or both registers.

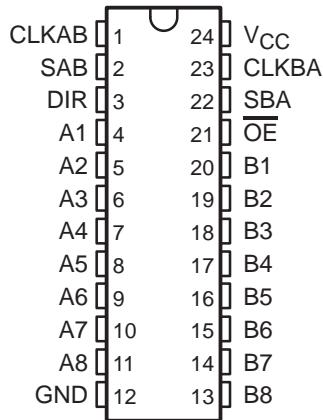
The select-control (SAB and SBA) inputs can multiplex stored and real-time (transparent mode) data. The circuitry used for select control eliminates the typical decoding glitch that occurs in a multiplexer during the transition between stored and real-time data. DIR determines which bus receives data when \overline{OE} is low. In the isolation mode (\overline{OE} high), A data may be stored in one register and/or B data may be stored in the other register.

When an output function is disabled, the input function is still enabled and can be used to store and transmit data. Only one of the two buses, A or B, may be driven at a time.

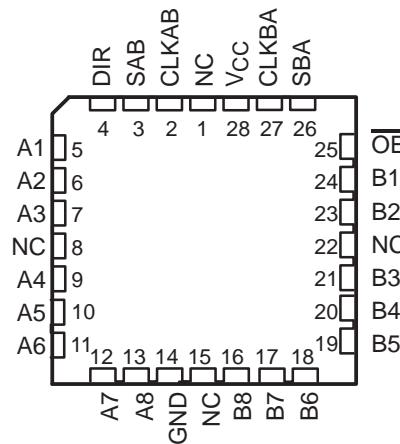
The -1 version of the SN74ALS646A is identical to the standard version, except that the recommended maximum I_{OL} in the -1 version is increased to 48 mA. There are no -1 versions of the SN54ALS646, SN54ALS648, or SN74ALS648A.

The SN54ALS646, SN54ALS648, and SN54AS646 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS646A, SN74ALS648A, SN74AS646, and SN74AS648 are characterized for operation from 0°C to 70°C .

SN54ALS646, SN54ALS648, SN54AS646 . . . JT PACKAGE
SN74ALS646A, SN74ALS648A, SN74AS646,
SN74AS648 . . . DW OR NT PACKAGE
(TOP VIEW)



SN54ALS646, SN54ALS648, SN54AS646 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

**SN54ALS646, SN54ALS648, SN54AS646
SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648**

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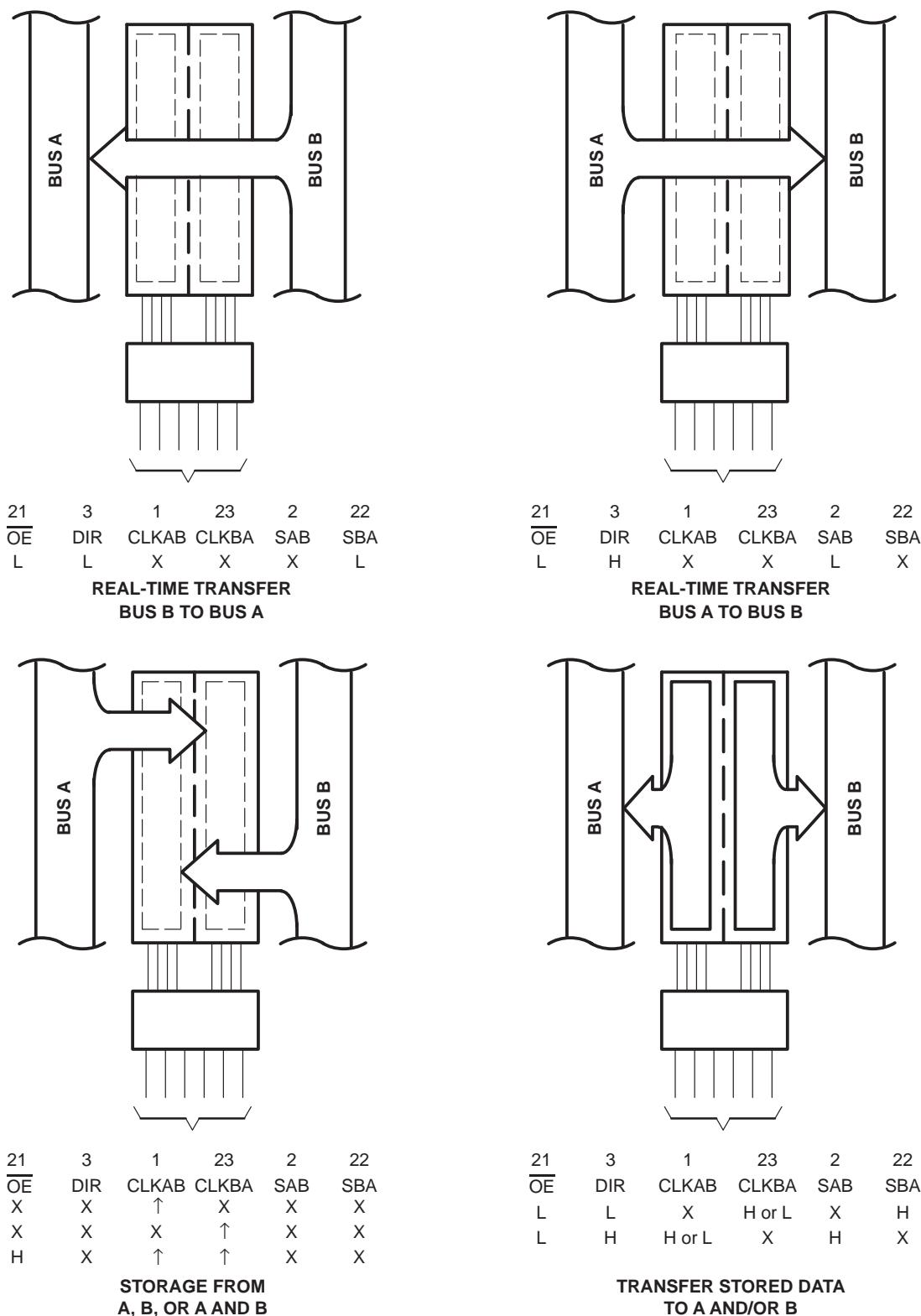


Figure 1. Bus-Management Functions

Pin numbers shown are for the DW, JT, and NT packages.

Function Tables

SN54ALS646, SN54AS646, SN74ALS646A, SN74AS646

INPUTS						DATA I/O		OPERATION OR FUNCTION
<u>OE</u>	DIR	CLKAB	CLKBA	SAB	SBA	A1–A8	B1–B8	
X	X	↑	X	X	X	Input	Unspecified†	Store A, B unspecified†
X	X	X	↑	X	X	Unspecified†	Input	Store B, A unspecified†
H	X	↑	↑	X	X	Input	Input	Store A and B data
H	X	H or L	H or L	X	X	Input disabled	Input disabled	Isolation, hold storage
L	L	X	X	X	L	Output	Input	Real-time B data to A bus
L	L	X	H or 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 or L	X	H	X	Input	Output	Stored A data to B bus

† The data output functions can be enabled or disabled by various signals at OE and DIR. Data input functions are always enabled; i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

SN54ALS648, SN74ALS648A, SN74AS648

INPUTS						DATA I/O		OPERATION OR FUNCTION
<u>OE</u>	DIR	CLKAB	CLKBA	SAB	SBA	A1–A8	B1–B8	
X	X	↑	X	X	X	Input	Unspecified†	Store A, B unspecified†
X	X	X	↑	X	X	Unspecified†	Input	Store B, A unspecified†
H	X	↑	↑	X	X	Input	Input	Store A and B data
H	X	H or L	H or L	X	X	Input disabled	Input disabled	Isolation, hold storage
L	L	X	X	X	L	Output	Input	Real-time <u>B</u> data to A bus
L	L	X	H or L	X	H	Output	Input	Stored <u>B</u> data to A bus
L	H	X	X	L	X	Input	Output	Real-time <u>A</u> data to B bus
L	H	H or L	X	H	X	Input	Output	Stored <u>A</u> data to B bus

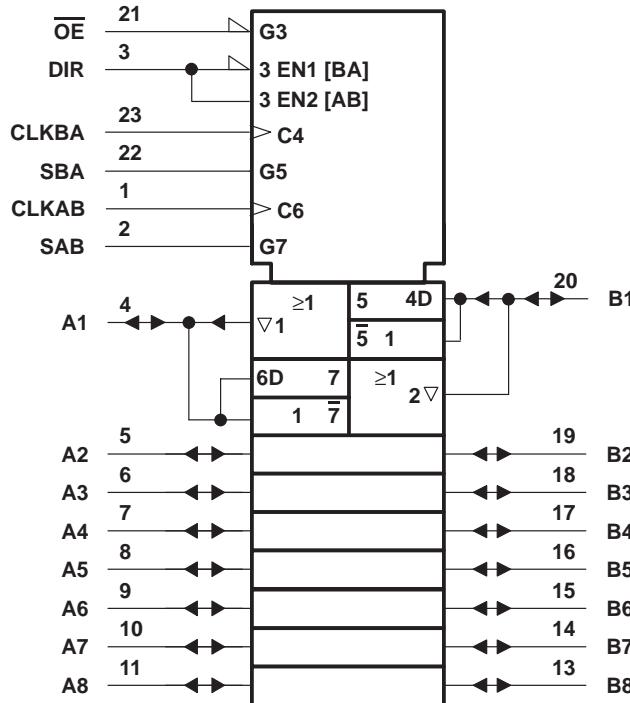
† The data output functions can be enabled or disabled by various signals at OE and DIR. Data input functions are always enabled; i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

SN54ALS646, SN54ALS648, SN54AS646 SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

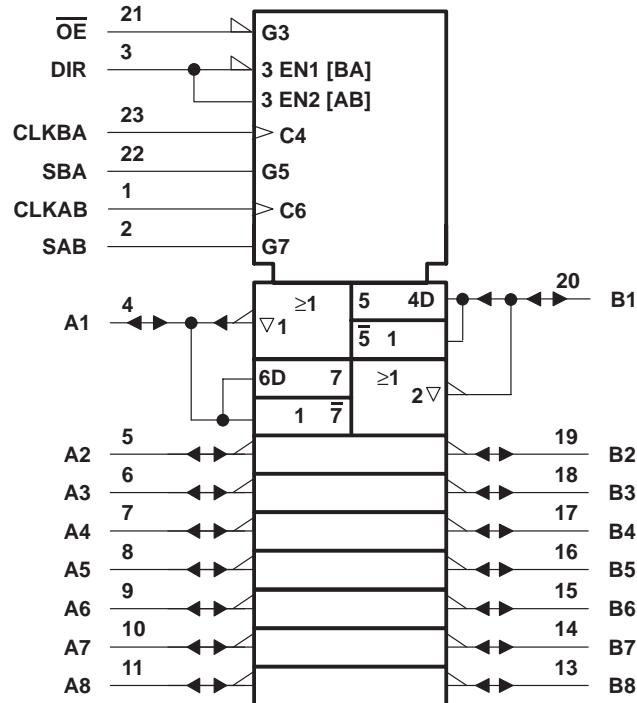
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logic symbols†

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SN74ALS646A, SN74AS646**

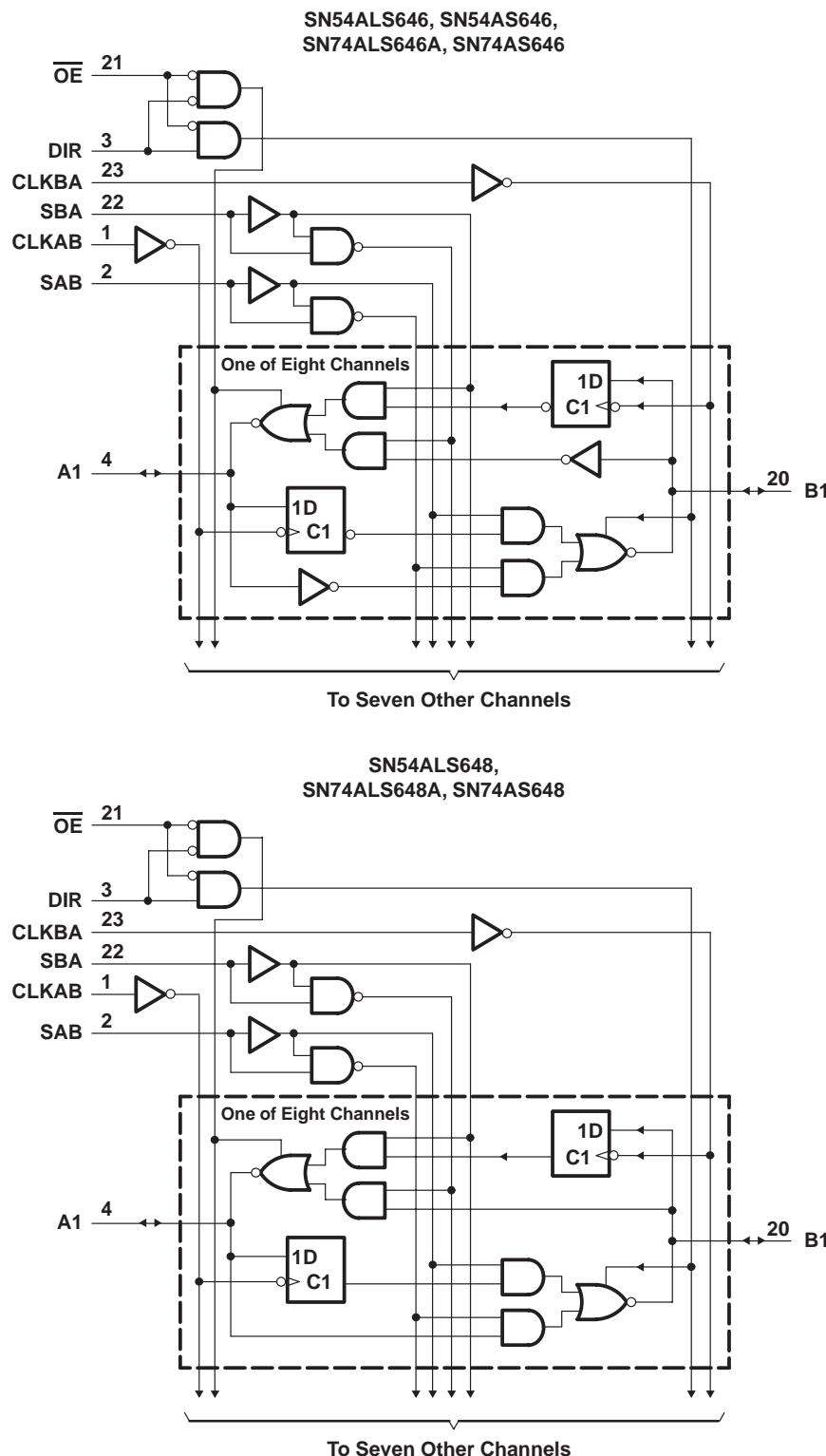


SN54ALS648,
SN74ALS648A, SN74AS648



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the DW, JT, and NT packages.

logic diagrams (positive logic)



Pin numbers shown are for the DW, JT, and NT packages.

SN54ALS646, SN54ALS648, SN54AS646

SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V _{CC}	.....	7 V
Input voltage, V _I : Control inputs	.....	7 V
I/O ports	.....	5.5 V
Operating free-air temperature range, T _A :	SN54ALS646	–55°C to 125°C
	SN74ALS646A	0°C to 70°C
Storage temperature range	.....	–65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

		SN54ALS646			SN74ALS646A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage			0.7			0.8	V
I _{OH}	High-level output current			–12			–15	mA
I _{OL}	Low-level output current			12			24	mA
							48 [‡]	
f _{clock}	Clock frequency	0		35	0		40	MHz
t _w	Pulse duration, CLKBA or CLKAB high or low	14.5			12.5			ns
t _{su}	Setup time, A before CLKAB↑ or B before CLKBA↑	15			10			ns
t _h	Hold time, A after CLKAB↑ or B after CLKBA↑	0			0			ns
T _A	Operating free-air temperature	–55		125	0		70	°C

‡ Applies only to the -1 version and only if V_{CC} is maintained between 4.75 V and 5.25

**SN54ALS646, SN54ALS648, SN54AS646
SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648
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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	SN54ALS646			SN74ALS646A			UNIT
		MIN	TYPT†	MAX	MIN	TYPT†	MAX	
V_{IK}	$V_{CC} = 4.5 \text{ V}$, $I_I = -18 \text{ mA}$			-1.2			-1.2	V
V_{OH}	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$, $I_{OH} = -0.4 \text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
	$V_{CC} = 4.5 \text{ V}$	$I_{OH} = -3 \text{ mA}$	2.4	3.2	2.4	3.2		
		$I_{OH} = -12 \text{ mA}$	2					
		$I_{OH} = -15 \text{ mA}$				2		
V_{OL}	$V_{CC} = 4.5 \text{ V}$	$I_{OL} = 12 \text{ mA}$	0.25	0.4	0.25	0.4		V
		$I_{OL} = 24 \text{ mA}$			0.35	0.5		
		$I_{OL} = 48 \text{ mA}^{\ddagger}$			0.35	0.5		
I_I	Control inputs	$V_I = 7 \text{ V}$		0.1			0.1	mA
	A or B ports	$V_I = 5.5 \text{ V}$		0.1			0.1	
I_{IH}	Control inputs	$V_{CC} = 5.5 \text{ V}$, $V_I = 2.7 \text{ V}$		20			20	μA
	A or B ports \S			20			20	
I_{IL}	Control inputs	$V_{CC} = 5.5 \text{ V}$, $V_I = 0.4 \text{ V}$		-0.2			-0.2	mA
	A or B ports \S			-0.2			-0.2	
I_O^{\dagger}	$V_{CC} = 5.5 \text{ V}$, $V_O = 2.25 \text{ V}$	-20	-112	-30	-112		mA	
I_{CC}	$V_{CC} = 5.5 \text{ V}$	Outputs high	47	76	47	76		mA
		Outputs low	55	88	55	88		
		Outputs disabled	55	88	55	88		

† All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

‡ Applies only to the -1 version and only if V_{CC} is maintained between 4.75 V and 5.25

§ For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.

¶ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

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switching characteristics (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V},$ $C_L = 50 \text{ pF},$ $R1 = 500 \Omega,$ $R2 = 500 \Omega,$ $T_A = \text{MIN to MAX}^\dagger$				UNIT	
			SN54ALS646		SN74ALS646A			
			MIN	MAX	MIN	MAX		
f_{max}			35	40			MHz	
t_{PLH}	CLKBA or CLKAB	A or B	10	35	7	30	ns	
t_{PHL}			5	20	5	17		
t_{PLH}	A or B	B or A	5	22	3	20	ns	
t_{PHL}			3	15	3	12		
t_{PLH}	SBA or SAB‡ (stored data low)	A or B	10	40	7	35	ns	
t_{PHL}			5	23	5	20		
t_{PLH}	SBA or SAB‡ (stored data high)	A or B	8	30	6	25	ns	
t_{PHL}			5	24	5	20		
t_{PZH}	\overline{OE}	A or B	3	20	2	17	ns	
t_{PZL}			5	22	4	20		
t_{PHZ}	\overline{OE}	A or B	1	12	1	10	ns	
t_{PLZ}			1	20	2	16		
t_{PZH}	DIR	A or B	5	38	3	30	ns	
t_{PZL}			5	30	4	25		
t_{PHZ}	DIR	A or B	1	12	1	10	ns	
t_{PLZ}			2	21	2	16		

† For conditions shown MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ These parameters are measured with the internal output state of the storage register opposite that of the bus input.

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V _{CC}	.....	7 V
Input voltage, V _I : Control inputs	.....	7 V
I/O ports	.....	5.5 V
Operating free-air temperature range, T _A :	SN54ALS648	–55°C to 125°C
	SN74ALS648A	0°C to 70°C
Storage temperature range	.....	–65°C to 150°C

[†] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

		SN54ALS648			SN74ALS648A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage			0.7			0.8	V
I _{OH}	High-level output current			–12			–15	mA
I _{OL}	Low-level output current			12			24	mA
f _{clock}	Clock frequency	0		35	0		40	MHz
t _W	Pulse duration, CLKBA or CLKAB high or low	14.5			12.5			ns
t _{su}	Setup time, A before CLKAB↑ or B before CLKBA↑	15			10			ns
t _h	Hold time, A after CLKAB↑ or B after CLKBA↑	0			0			ns
T _A	Operating free-air temperature	–55		125	0		70	°C

SN54ALS646, SN54ALS648, SN54AS646**SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648****OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS**

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	SN54ALS648			SN74ALS648A			UNIT
		MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	$V_{CC} = 4.5 \text{ V}$, $I_I = -18 \text{ mA}$			-1.2			-1.2	V
V_{OH}	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$, $I_{OH} = -0.4 \text{ mA}$	$V_{CC}-2$			$V_{CC}-2$			V
	$V_{CC} = 4.5 \text{ V}$	$I_{OH} = -3 \text{ mA}$	2.4	3.2	2.4	3.2		
		$I_{OH} = -12 \text{ mA}$	2					
		$I_{OH} = -15 \text{ mA}$				2		
V_{OL}	$V_{CC} = 4.5 \text{ V}$	$I_{OL} = 12 \text{ mA}$	0.25	0.4	0.25	0.4		V
		$I_{OL} = 24 \text{ mA}$			0.35	0.5		
I_I	$V_{CC} = 5.5 \text{ V}$	$V_I = 7 \text{ V}$		0.1			0.1	mA
		$V_I = 5.5 \text{ V}$		0.1			0.1	
I_{IH}	$V_{CC} = 5.5 \text{ V}$, A or B ports‡	$V_I = 2.7 \text{ V}$		20			20	μA
				20			20	
I_{IL}	$V_{CC} = 5.5 \text{ V}$, A or B ports‡	$V_I = 0.4 \text{ V}$		-0.2			-0.2	mA
				-0.2			-0.2	
$I_O\$$	$V_{CC} = 5.5 \text{ V}$, $V_O = 2.25 \text{ V}$		-20	-112	-30	-112		mA
I_{CC}	$V_{CC} = 5.5 \text{ V}$	Outputs high	47	76	47	76		mA
		Outputs low	57	88	57	88		
		Outputs disabled	57	88	57	88		

† All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.‡ For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.§ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

**SN54ALS646, SN54ALS648, SN54AS646
SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648
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switching characteristics (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V},$ $C_L = 50\text{ pF},$ $R1 = 500\text{ }\Omega,$ $R2 = 500\text{ }\Omega,$ $T_A = \text{MIN to MAX}^{\dagger}$				UNIT	
			SN54ALS648		SN74ALS648A			
			MIN	MAX	MIN	MAX		
f_{max}			35	40			MHz	
t_{PLH}	CLKBA or CLKAB	A or B	8	39	7	33	ns	
t_{PHL}			5	23	5	20		
t_{PLH}	A or B	B or A	3	20	2	17	ns	
t_{PHL}			2	12	2	10		
t_{PLH}	SBA or SAB‡ (stored data low)	A or B	5	44	5	39	ns	
t_{PHL}			4	26	4	22		
t_{PLH}	SBA or SAB‡ (stored data high)	A or B	6	30	6	25	ns	
t_{PHL}			6	25	6	21		
t_{PZH}	$\overline{\text{OE}}$	A or B	4	25	2	22	ns	
t_{PZL}			4	25	4	22		
t_{PHZ}	$\overline{\text{OE}}$	A or B	1	12	1	10	ns	
t_{PLZ}			2	21	2	15		
t_{PZH}	DIR	A or B	4	35	2	27	ns	
t_{PZL}			3	25	3	19		
t_{PHZ}	DIR	A or B	1	17	1	14	ns	
t_{PLZ}			2	22	2	15		

† For conditions shown MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ These parameters are measured with the internal output state of the storage register opposite that of the bus input.

SN54ALS646, SN54ALS648, SN54AS646 SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC}	7 V
Input voltage, V_I : Control inputs	7 V
I/O ports	5.5 V
Operating free-air temperature range, T_A : SN54AS646	-55°C to 125°C
SN74AS646	0°C to 70°C
Storage temperature range	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

		SN54AS646			SN74AS646			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			2			V
V _{IL}	Low-level input voltage			0.8			0.8	V
I _{OH}	High-level output current			-12			-15	mA
I _{OL}	Low-level output current			32			48	mA
f _{clock} *	Clock frequency	0	75	0	90			MHz
t _w *	Pulse duration	CLKBA or CLKAB high	6		5			ns
		CLKBA or CLKAB low	7		6			
t _{su} *	Setup time, A before CLKAB↑ or B before CLKBA↑	7			6			ns
t _h *	Hold time, A after CLKAB↑ or B before CLKBA	0			0			ns
T _A	Operating free-air temperature	-55	125	0	70			°C

* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	SN54AS646			SN74AS646			UNIT
		MIN	TYPT [†]	MAX	MIN	TYPT [†]	MAX	
V_{IK}	$V_{CC} = 4.5 \text{ V}$, $I_I = -18 \text{ mA}$			-1.2			-1.2	V
V_{OH}	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$, $I_{OH} = -2 \text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
	$V_{CC} = 4.5 \text{ V}$	$I_{OH} = -3 \text{ mA}$	2.4	3.2	2.4	3.2		
		$I_{OH} = -12 \text{ mA}$	2					
		$I_{OH} = -15 \text{ mA}$				2		
V_{OL}	$V_{CC} = 4.5 \text{ V}$	$I_{OL} = 32 \text{ mA}$	0.25	0.5				V
		$I_{OL} = 48 \text{ mA}$				0.35	0.5	
I_I	Control inputs	$V_{CC} = 5.5 \text{ V}$, $V_I = 7 \text{ V}$		0.1			0.1	mA
	A or B ports	$V_{CC} = 5.5 \text{ V}$, $V_I = 5.5 \text{ V}$		0.1			0.1	
I_{IH}	Control inputs	$V_{CC} = 5.5 \text{ V}$, $V_I = 2.7 \text{ V}$		20			20	μA
	A or B ports [‡]			70			70	
I_{IL}	Control input	$V_{CC} = 5.5 \text{ V}$, $V_I = 0.4 \text{ V}$		-0.5			-0.5	mA
	A or B ports [‡]			-0.75			-0.75	
$I_O^{\$}$	$V_{CC} = 5.5 \text{ V}$, $V_O = 2.25 \text{ V}$	-30	-112	-30	-112			mA
I_{CC}	$V_{CC} = 5.5 \text{ V}$	Outputs high	120	195	120	195		mA
		Outputs low	130	211	130	211		
		Outputs disabled	130	211	130	211		

[†] All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$.

[‡] For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.

[§] The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

**SN54ALS646, SN54ALS648, SN54AS646
 SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648
 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS**

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switching characteristics (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $C_L = 50\text{ pF}$, $R1 = 500\text{ }\Omega$, $R2 = 500\text{ }\Omega$, $T_A = \text{MIN to MAX}^{\dagger}$				UNIT	
			SN54AS646		SN74AS646			
			MIN	MAX	MIN	MAX		
f_{max}^*			75	90			MHz	
t_{PLH}	CLKBA or CLKAB	A or B	2	9.5	2	8.5	ns	
t_{PHL}			2	10	2	9		
t_{PLH}	A or B	B or A	2	11.5	2	9	ns	
t_{PHL}			1	8	1	7		
t_{PLH}	SBA or SAB ‡	A or B	2	13.5	2	11	ns	
t_{PHL}			2	11	2	9		
t_{PZH}	$\overline{\text{OE}}$	A or B	2	11	2	9	ns	
t_{PZL}			3	15	3	14		
t_{PHZ}	$\overline{\text{OE}}$	A or B	2	11	2	9	ns	
t_{PLZ}			2	11	2	9		
t_{PZH}	DIR	A or B	3	21	3	16	ns	
t_{PZL}			3	24	3	18		
t_{PHZ}	DIR	A or B	2	12	2	10	ns	
t_{PLZ}			2	12	2	10		

* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

† For conditions shown MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ These parameters are measured with the internal output state of the storage register opposite that of the bus input.



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**SN54ALS646, SN54ALS648, SN54AS646
SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648
OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS**

SDAS039F – DECEMBER 1983 – REVISED JANUARY 1995

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC}	7 V
Input voltage, V_I : Control inputs	7 V
I/O ports	5.5 V
Operating free-air temperature range, T_A : SN74AS648	0°C to 70°C
Storage temperature range	-65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

		SN74AS648			UNIT
		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			48	mA
f_{clock}	Clock frequency	0	90		MHz
t_w	Pulse duration	CLKBA or CLKAB high	5		ns
		CLKBA or CLKAB low	6		
t_{SU}	Setup time, A before CLKAB↑ or B before CLKBA↑		6		ns
t_h	Hold time, A after CLKAB↑ or B before CLKBA		0		ns
T_A	Operating free-air temperature	0	70		°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN74AS648			UNIT
		MIN	TYP‡	NOM	MAX		
V_{IK}		$V_{CC} = 4.5$ V,	$I_I = -18$ mA			-1.2	V
V_{OH}		$V_{CC} = 4.5$ V to 5.5 V,	$I_{OH} = -2$ mA	$V_{CC} - 2$			V
		$V_{CC} = 4.5$ V	$I_{OH} = -3$ mA	2.4	3.2		
			$I_{OH} = -15$ mA	2			
V_{OL}		$V_{CC} = 4.5$ V,	$I_{OL} = 48$ mA	0.35	0.5		V
I_I	Control inputs	$V_{CC} = 5.5$ V	$V_I = 7$ V			0.1	mA
	A or B ports		$V_I = 5.5$ V			0.1	
I_{IH}	Control inputs	$V_{CC} = 5.5$ V,	$V_I = 2.7$ V			20	μ A
	A or B ports§					70	
I_{IL}	Control input	$V_{CC} = 5.5$ V,	$V_I = 0.4$ V			-0.5	mA
	A or B ports§					-0.75	
I_O ¶		$V_{CC} = 5.5$ V,	$V_O = 2.25$ V	-30	-112		mA
I_{CC}		$V_{CC} = 5.5$ V	Outputs high			110	mA
			Outputs low			120	
			Outputs disabled			120	

‡ All typical values are at $V_{CC} = 5$ V, $T_A = 25$ °C.

§ For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.

¶ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS} .

SN54ALS646, SN54ALS648, SN54AS646

SN74ALS646A, SN74ALS648A, SN74AS646, SN74AS648

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

SDAS039F – DECEMBER 1983 – REVISED JANUARY 1995

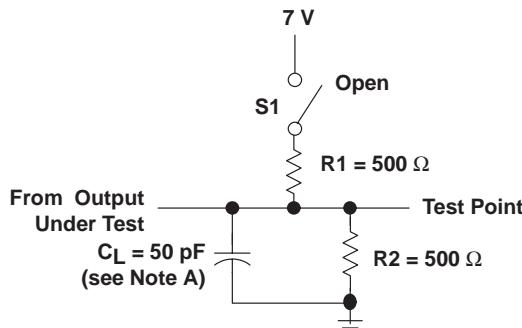
switching characteristics (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V},$ $C_L = 50\text{ pF},$ $R1 = 500\text{ }\Omega,$ $R2 = 500\text{ }\Omega,$ $T_A = \text{MIN to MAX}^\dagger$		UNIT	
			SN74AS648			
			MIN MAX			
			90		MHz	
t_{PLH}	CLKBA or CLKAB	A or B	2	8.5	ns	
t_{PHL}			2	9		
t_{PLH}	A or B	B or A	2	8	ns	
t_{PHL}			1	7		
t_{PLH}	SBA or SAB ‡	A or B	2	11	ns	
t_{PHL}			2	9		
t_{PZH}	\overline{OE}	A or B	2	9	ns	
t_{PZL}			3	15		
t_{PHZ}	\overline{OE}	A or B	2	9	ns	
t_{PLZ}			2	9		
t_{PZH}	DIR	A or B	3	16	ns	
t_{PZL}			3	18		
t_{PHZ}	DIR	A or B	2	10	ns	
t_{PLZ}			2	10		

† For conditions shown MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ These parameters are measured with the internal output state of the storage register opposite that of the bus input.

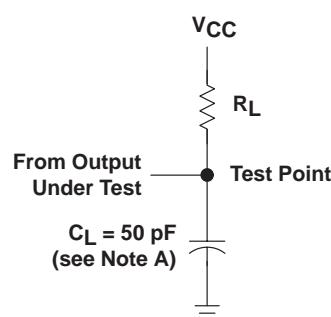
PARAMETER MEASUREMENT INFORMATION



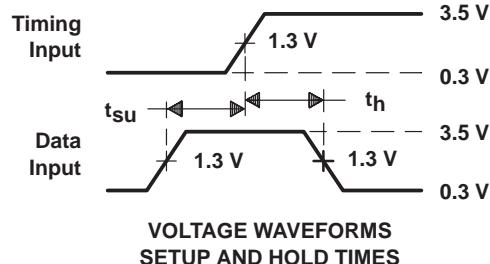
**LOAD CIRCUIT
FOR 3-STATE OUTPUTS**

SWITCH POSITION TABLE

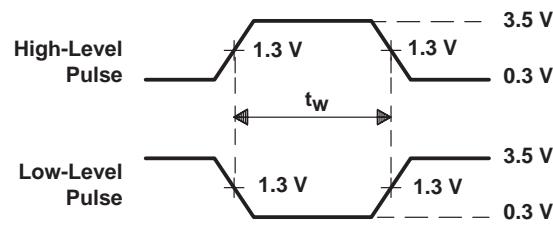
TEST	S1
t _{PLH}	Open
t _{PHL}	Open
t _{PZH}	Open
t _{PZL}	Closed
t _{PHZ}	Open
t _{PLZ}	Closed



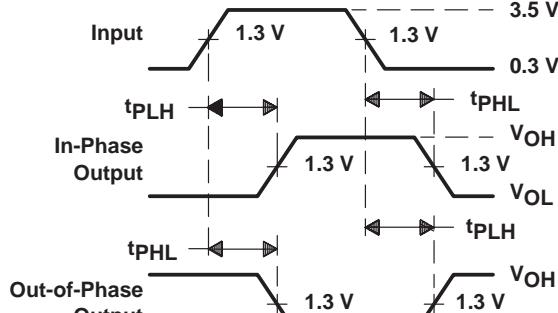
**LOAD CIRCUIT
FOR OPEN-COLLECTOR OUTPUTS**



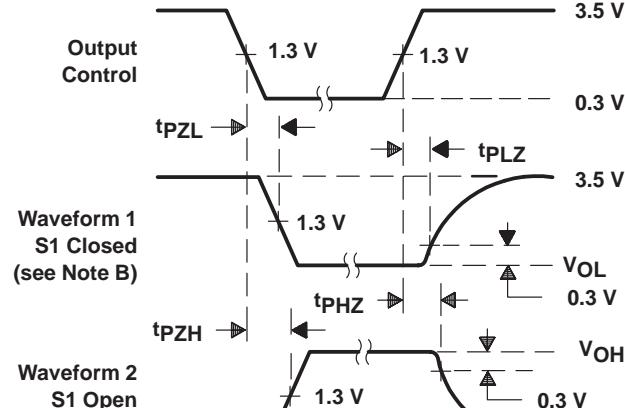
**VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES**



**VOLTAGE WAVEFORMS
PULSE DURATION**



**VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES**



**VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS**

NOTES:

- A. C_L includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: PRR \leq 1 MHz, $Z_O = 50 \Omega$, $t_r \leq 2$ ns, $t_f \leq 2$ ns.
- D. The outputs are measured one at a time with one transition per measurement.

Figure 2. Load Circuits and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-87595013A	ACTIVE	LCCC	FK	28	1	TBD	POST-PLATE	N / A for Pkg Type
5962-8759501KA	ACTIVE	CFP	W	24	1	TBD	A42	N / A for Pkg Type
5962-8759501LA	ACTIVE	CDIP	JT	24	1	TBD	A42	N / A for Pkg Type
5962-89956013A	ACTIVE	LCCC	FK	28	1	TBD	POST-PLATE	N / A for Pkg Type
5962-8995601LA	ACTIVE	CDIP	JT	24	1	TBD	A42	N / A for Pkg Type
5962-9052301LA	ACTIVE	CDIP	JT	24	1	TBD	A42	N / A for Pkg Type
SN54AS646JT	ACTIVE	CDIP	JT	24	1	TBD	A42	N / A for Pkg Type
SN74ALS646A-1DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646A-1DWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646A-1DWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646A-1DWR	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646A-1DWRE4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646A-1DWRG4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646A-1NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS646A-1NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS646ADW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646ADWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646ADWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646ADWR	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646ADWRE4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646ADWRG4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS646ANT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS646ANTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS648ADW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS648ADWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS648ADWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS648ANT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS648ANTE4	ACTIVE	PDIP	NT	24	15	Pb-Free	CU NIPDAU	N / A for Pkg Type

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
(RoHS)								
SN74AS646DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS646DWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS646DWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS646NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS646NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS648DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS648DWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS648DWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS648NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS648NT3	OBsolete	PDIP	NT	24		TBD	Call TI	Call TI
SN74AS648NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ54ALS646FK	ACTIVE	LCCC	FK	28	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54ALS646JT	ACTIVE	CDIP	JT	24	1	TBD	A42	N / A for Pkg Type
SNJ54ALS646W	OBsolete	CFP	W	24		TBD	Call TI	Call TI
SNJ54ALS648FK	OBsolete	LCCC	FK	24		TBD	Call TI	Call TI
SNJ54ALS648JT	ACTIVE	CDIP	JT	24	1	TBD	A42	N / A for Pkg Type
SNJ54ALS648W	OBsolete	CFP	W	24		TBD	Call TI	Call TI
SNJ54AS646FK	ACTIVE	LCCC	FK	28	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54AS646JT	ACTIVE	CDIP	JT	24	1	TBD	A42	N / A for Pkg Type
SNJ54AS646W	ACTIVE	CFP	W	24	1	TBD	A42	N / A for Pkg Type

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder

temperature.

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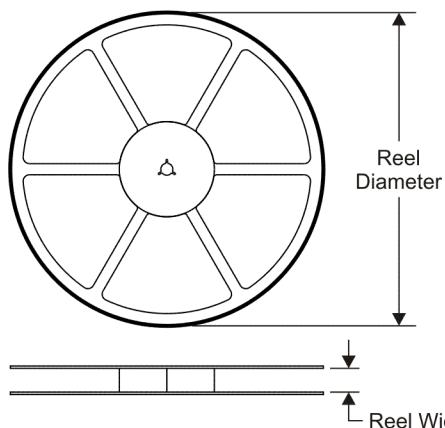
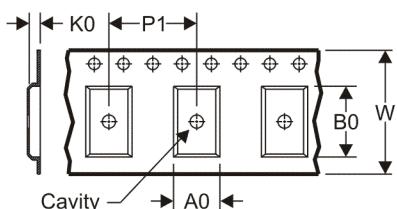
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OTHER QUALIFIED VERSIONS OF SN54ALS646, SN54ALS648, SN54AS646, SN74AS646 :

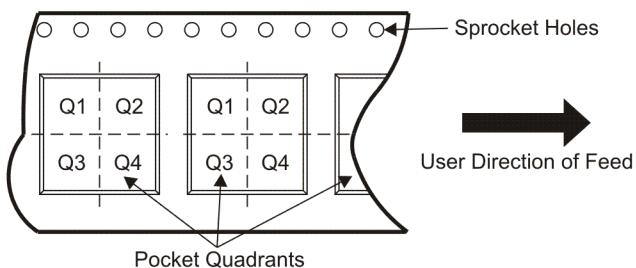
- Catalog: [SN74ALS646](#), [SN74ALS648](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS646A-1DWR	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1
SN74ALS646ADWR	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

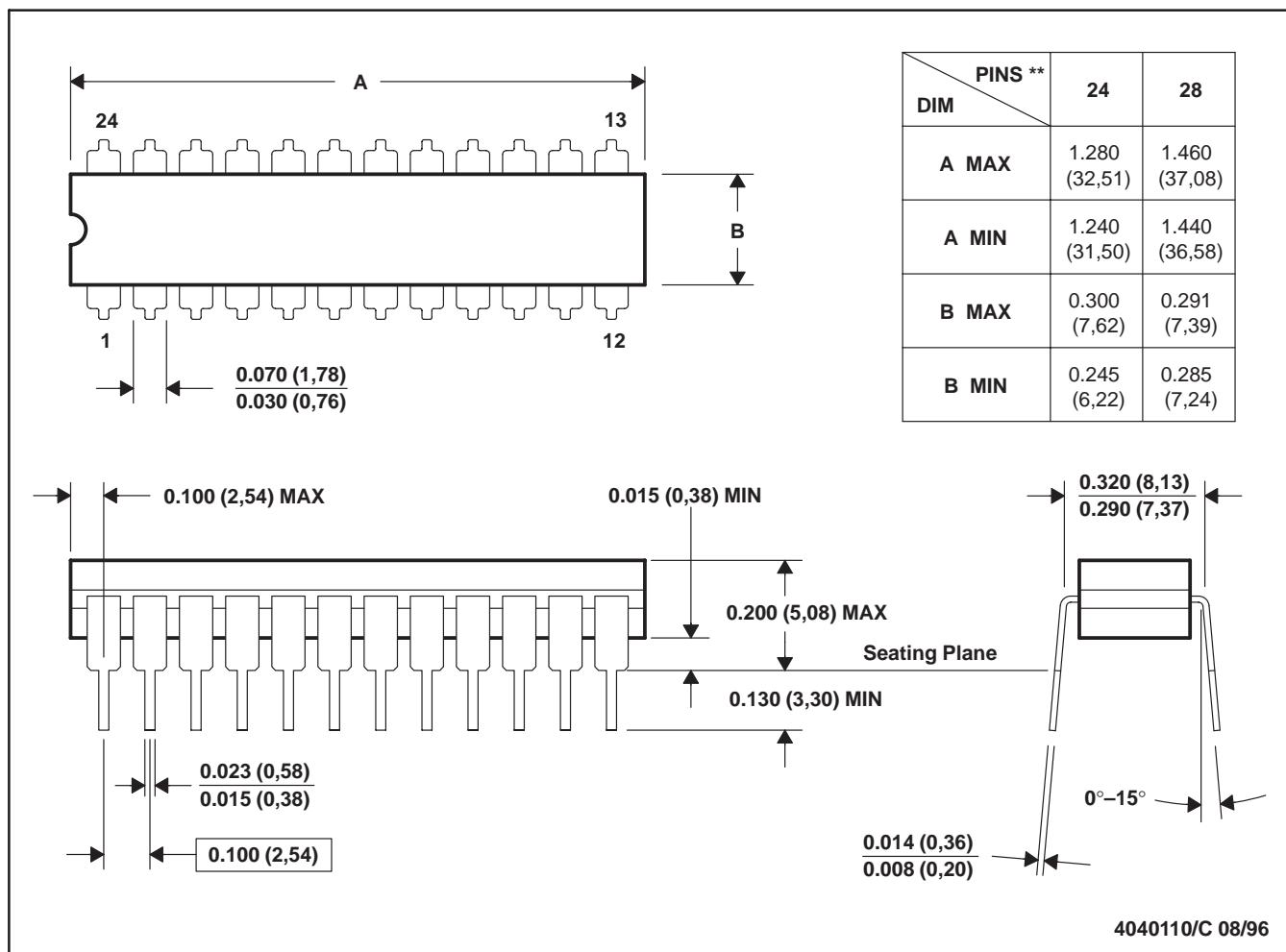
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS646A-1DWR	SOIC	DW	24	2000	346.0	346.0	41.0
SN74ALS646ADWR	SOIC	DW	24	2000	346.0	346.0	41.0

JT (R-GDIP-T**)

24 LEADS SHOWN

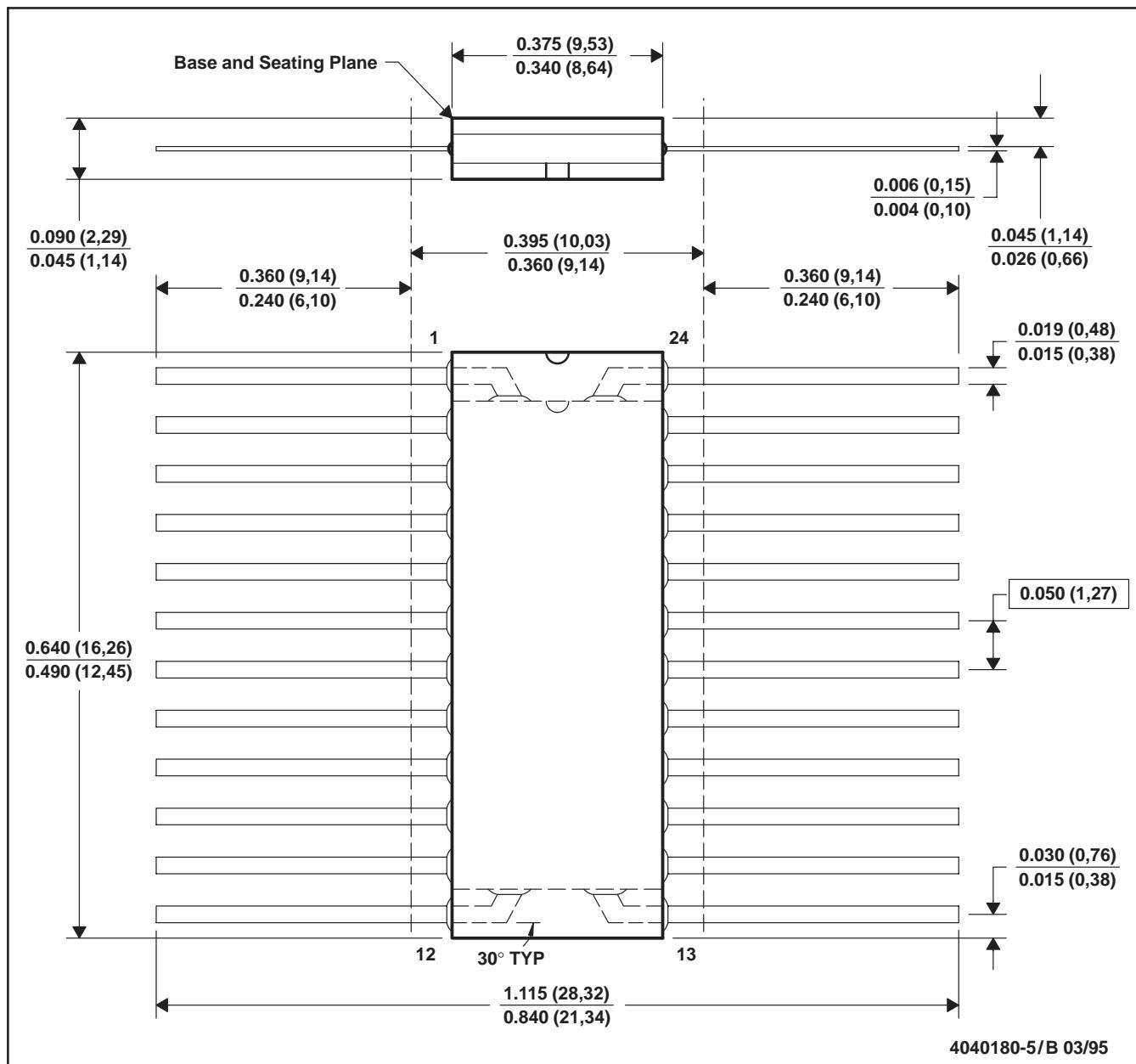
CERAMIC DUAL-IN-LINE



NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. This package can be hermetically sealed with a ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification.
 E. Falls within MIL STD 1835 GDIP3-T24, GDIP4-T28, and JEDEC MO-058 AA, MO-058 AB

W (R-GDFP-F24)

CERAMIC DUAL FLATPACK



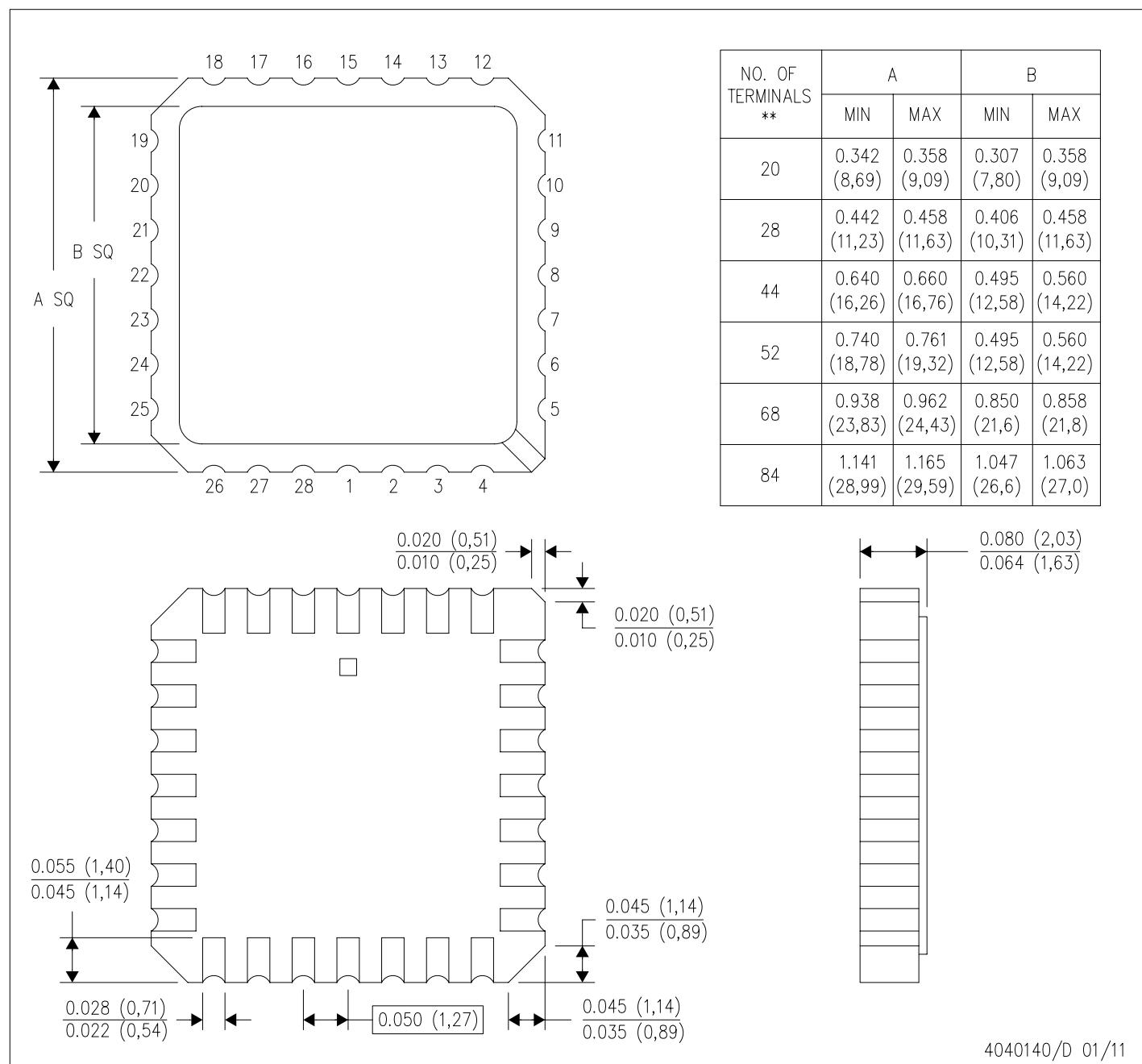
NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Falls within MIL-STD-1835 GDFP2-F24 and JEDEC MO-070AD
- E. Index point is provided on cap for terminal identification only.

FK (S-CQCC-N**)

28 TERMINAL SHOWN

LEADLESS CERAMIC CHIP CARRIER



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a metal lid.
- D. Falls within JEDEC MS-004

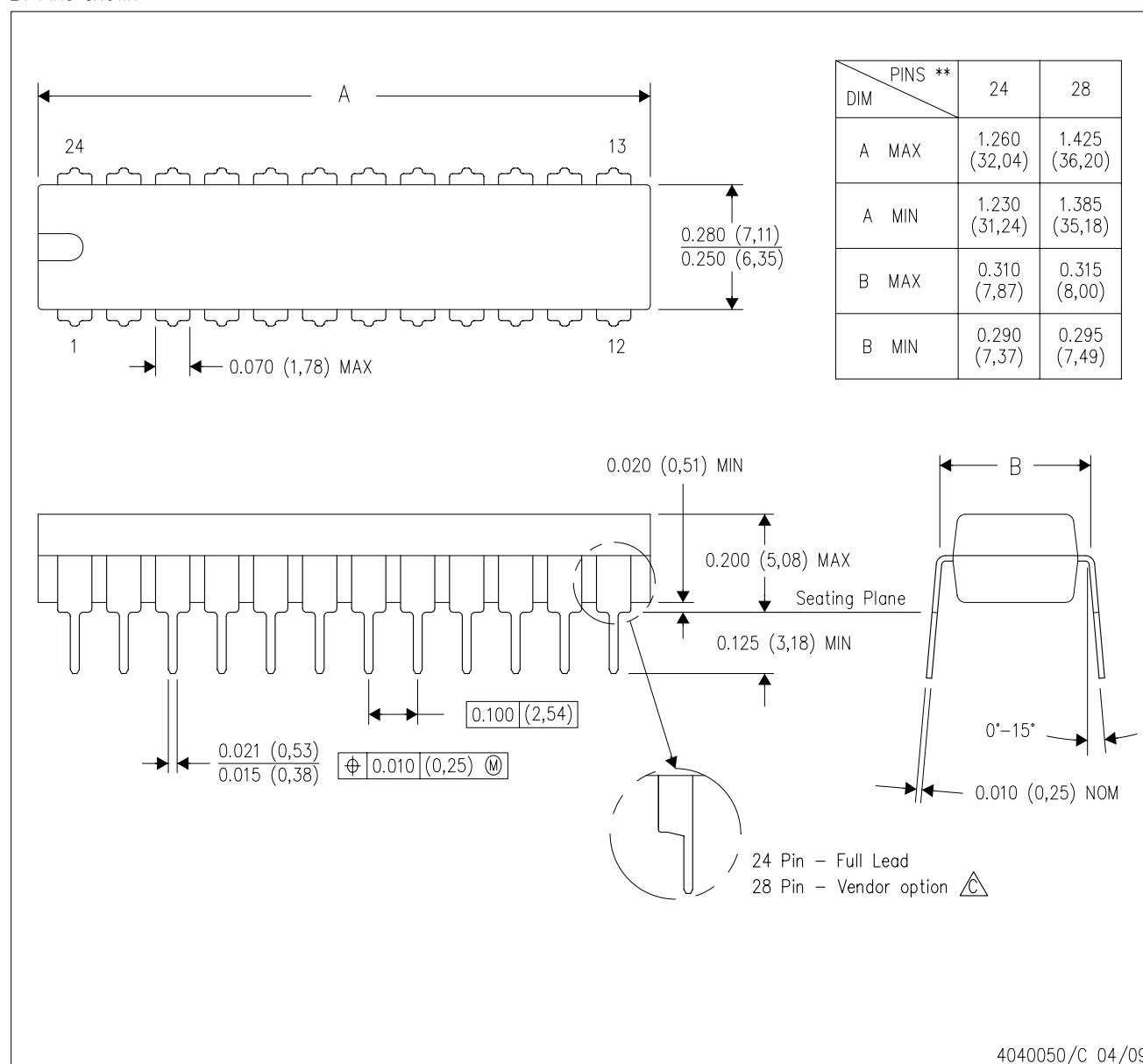
4040140/D 01/11

MECHANICAL DATA

NT (R-PDIP-T**)

24 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



4040050/C 04/09

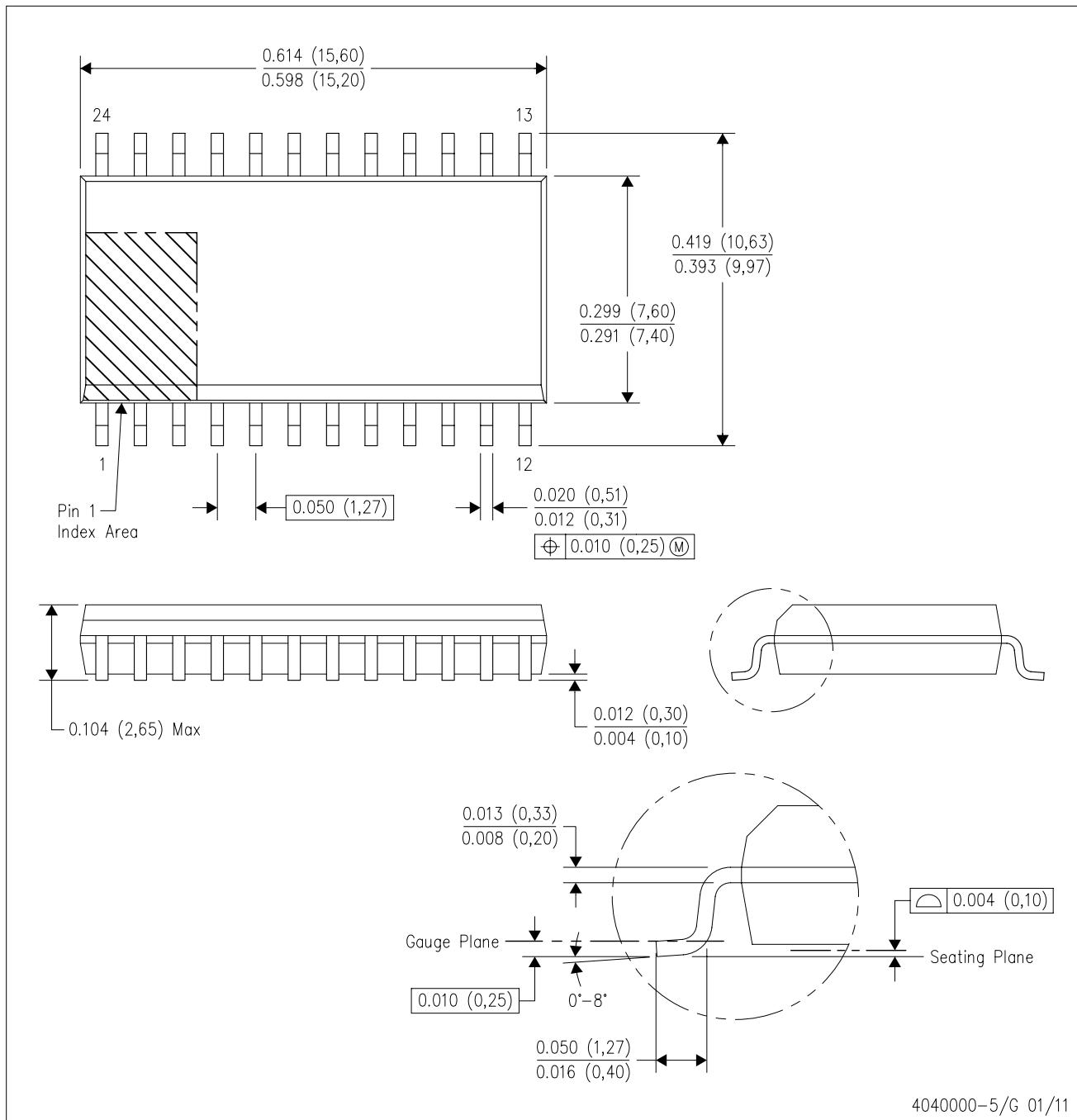
NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

B. This drawing is subject to change without notice.

 The 28 pin end lead shoulder width is a vendor option, either half or full width.

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



NOTES:

- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0.15).
- Falls within JEDEC MS-013 variation AD.

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