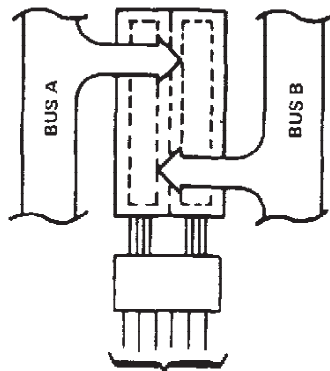




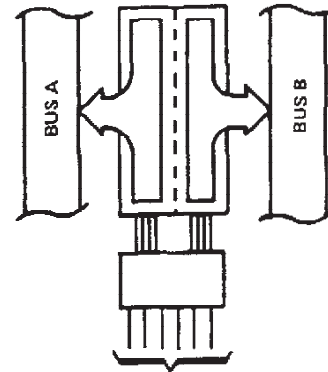
# SN54LS646 THRU SN54LS649, SN74LS646 THRU SN74LS649 OCTAL BUS TRANSCEIVERS AND REGISTERS

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(21)	(3)	(1)	(23)	(2)	(22)
$\bar{G}$	DIR	CAB	CBA	SAB	SBA
X	X	↑	X	X	X
X	X	X	↑	X	X
H	X	↑	↑	X	X

STORAGE FROM  
A, B, OR A AND B



(21)	(3)	(1)	(23)	(2)	(22)
$\bar{G}$	DIR	CAB	CBA	SAB	SBA
L	L	X	HorL	X	H
L	H	HorL	X	H	X

TRANSFER  
STORED DATA  
TO A OR B

Enable ( $\bar{G}$ ) and direction (DIR) pins are provided to control the transceiver functions. In the transceiver mode, data present at the high-impedance port may be stored in either register or in both. The select controls (SAB and SBA) can multiplex stored and real-time (transparent mode) data. The direction control determines which bus will receive data when enable  $\bar{G}$  is active (low). In the isolation mode (control  $\bar{G}$  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 may be used to store and transmit data. Only one of the two buses, A or B, may be driven at a time.

The SN54' family is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74' family is characterized for operation from  $0^{\circ}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE

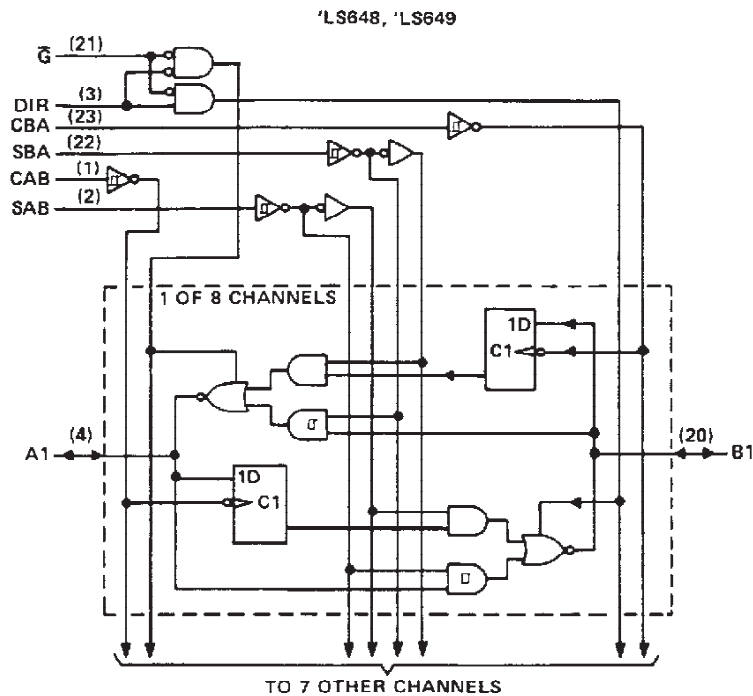
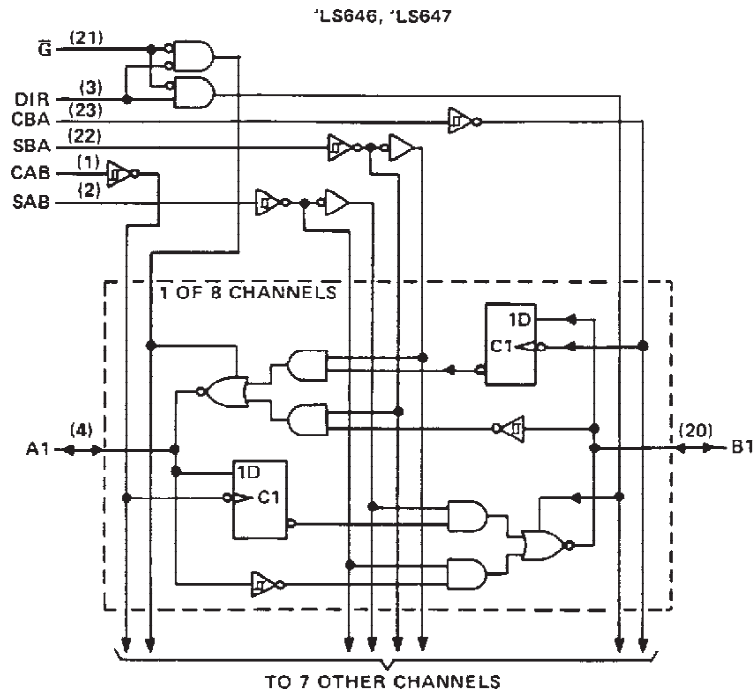
INPUTS						DATA I/O†		OPERATION OR FUNCTION	
$\bar{G}$	DIR	CAB	CBA	SAB	SBA	A1 THRU A8	B1 THRU B8	LS646, LS647	LS648, LS649
X	X	↑	X	X	X	Input	Not specified	Store A, B unspecified	Store A, B unspecified
X	X	X	↑	X	X	Not specified	Input	Store B, A unspecified	Store B, A unspecified
H	X	↑	↑	X	X	Input	Input	Store A and B Data	Store A and B Data
H	X	H or L	H or L	X	X	Input	Input	Isolation, hold storage	Isolation, hold storage
L	L	X	X	X	L	Output	Input	Real-Time B Data to A Bus	Real-Time $\bar{B}$ Data to A Bus
L	L	X	HorL	X	H	Output	Input	Stored B Data to A Bus	Stored $\bar{B}$ Data to A Bus
L	H	X	X	L	X	Input	Output	Real-Time A Data to B Bus	Real-Time $\bar{A}$ Data to B Bus
L	H	H or L	X	H	X	Input	Output	Stored A Data to B Bus	Stored $\bar{A}$ Data to B Bus

† The data output functions may be enabled or disabled by various signals at the  $\bar{G}$  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.

# SN54LS646 THRU SN54LS649, SN74LS646 THRU SN74LS649 OCTAL BUS TRANSCEIVERS AND REGISTERS

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logic diagrams (positive logic)



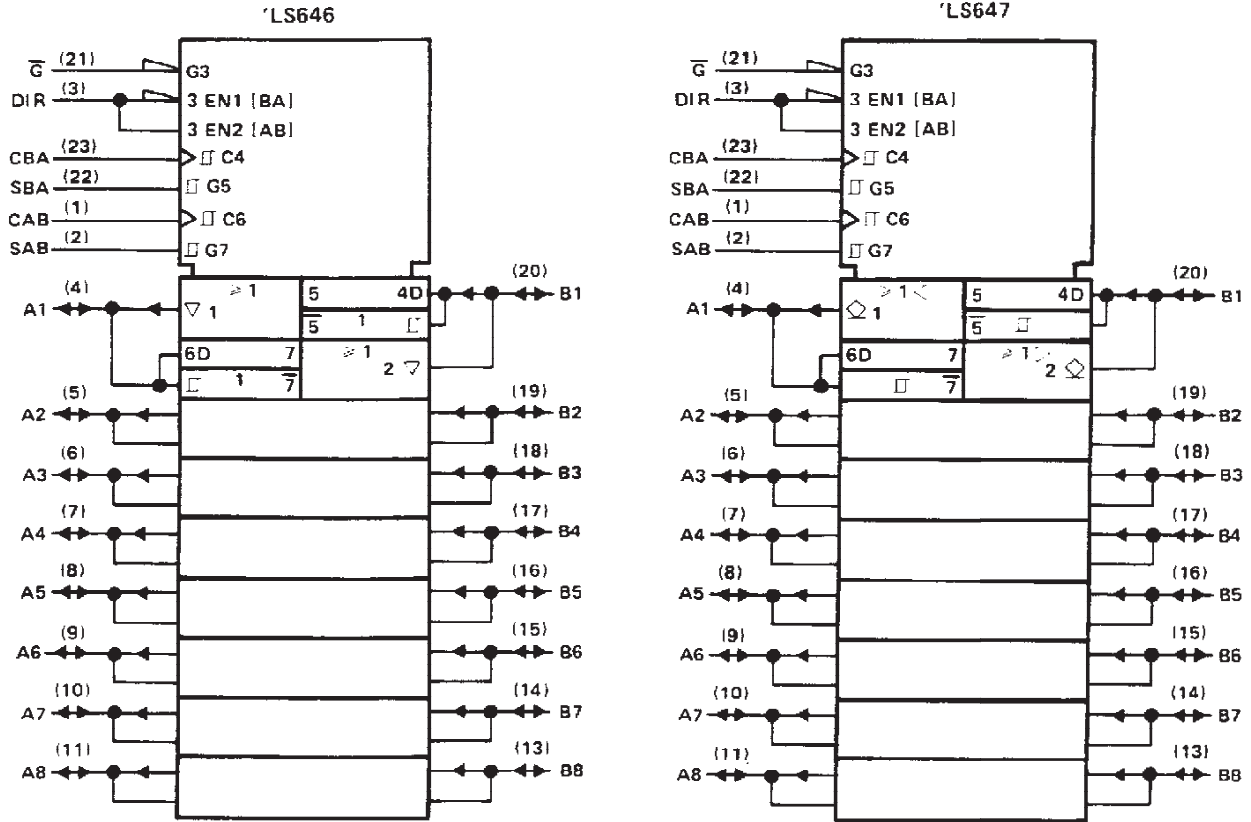
Pin numbers shown are for DW, JT, and NT packages.

# SN54LS646, SN54LS647, SN74LS646, SN74LS647

## OCTAL BUS TRANSCEIVERS AND REGISTERS

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logic symbols †

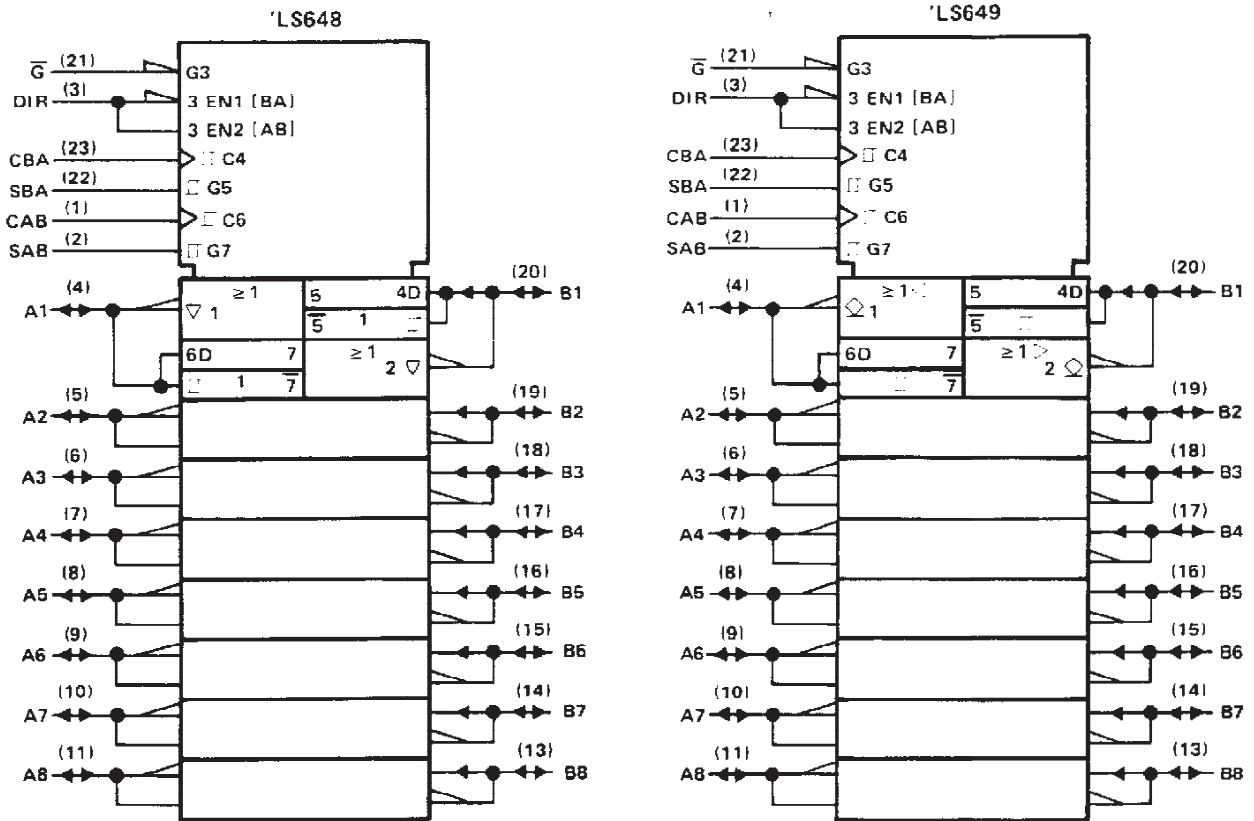


†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12. Pin numbers shown are for DW, JT, and NT packages.

# SN54LS648, SN54LS649, SN74LS648, SN74LS649 OCTAL BUS TRANSCEIVERS AND REGISTERS

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logic symbols† (continued)

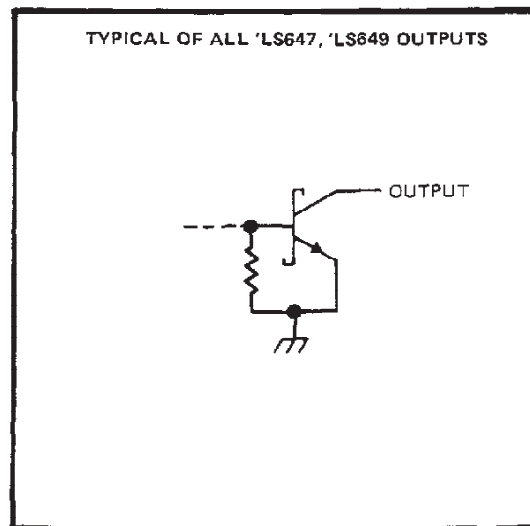
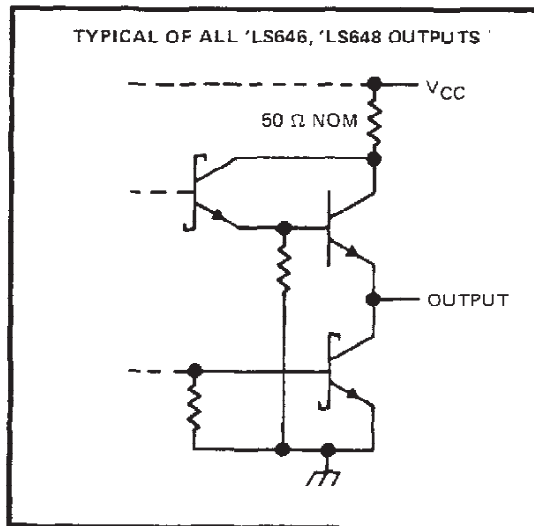
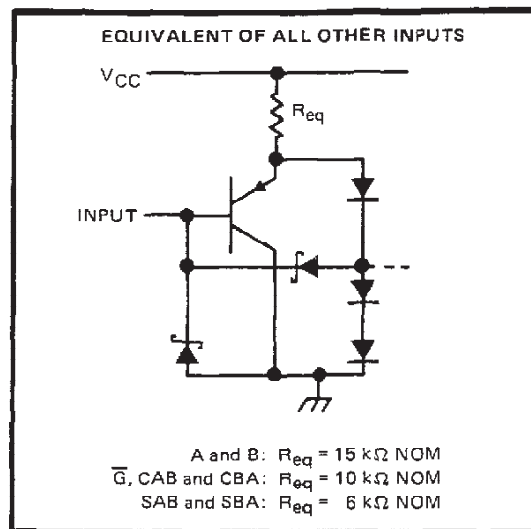
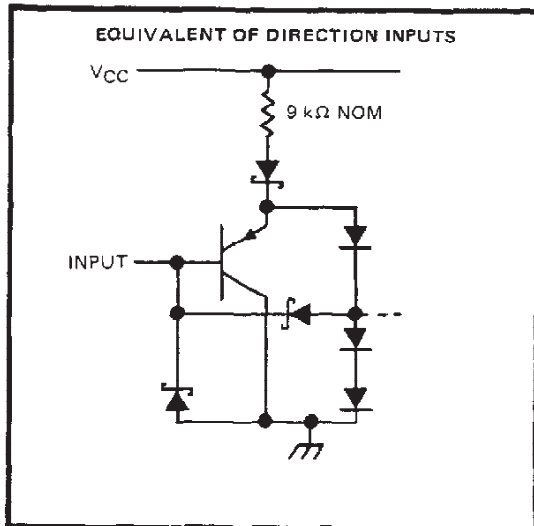


†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for DW, JT, and NT packages.

**SN54LS646 THRU SN54LS649**  
**SN74LS646 THRU SN74LS649**  
**OCTAL BUS TRANSCEIVERS AND REGISTERS**

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schematics of inputs and outputs





# SN54LS646, SN54LS648, SN74LS646, SN74LS648

## OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS646			'LS648			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$t_{PLH}$	CAB or CBA	A or B	$R_L = 667\ \Omega$ , $C_L = 45\ \text{pF}$ , See Note 2	15	25		15	25	ns	
$t_{PHL}$				23	35		24	40	ns	
$t_{PLH}$	A or B	B or A		12	18		12	18	ns	
$t_{PHL}$				13	20		15	25	ns	
$t_{PLH}$	SAB or SBA† with Bus input high	A or B		26	40		37	55	ns	
$t_{PHL}$				21	35		24	40	ns	
$t_{PLH}$	SAB or SBA† with Bus input low	A or B		33	50		26	40	ns	
$t_{PHL}$				14	25		23	40	ns	
$t_{PZH}$	$\overline{G}$	A or B		33	55		30	50	ns	
$t_{PZL}$				42	65		37	55	ns	
$t_{PZH}$	DIR	A or B	28	45		23	40	ns		
$t_{PZL}$			39	60		30	45	ns		
$t_{PHZ}$	$\overline{G}$	A or B	23	35		28	45	ns		
$t_{PLZ}$			22	35		22	35	ns		
$t_{PHZ}$	DIR	A or B	20	30		24	35	ns		
$t_{PLZ}$			19	30		19	30	ns		

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

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



# SN54LS647, SN54LS649, SN74LS647, SN74LS649

## OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

SDLS190A – DECEMBER 1982 – REVISED MAY 2004

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage (control inputs)	7 V
Off-state output voltage (A and B ports)	5.5 V
Operating free-air temperature range: SN54LS647, SN54LS649	– 55°C to 125°C
SN74LS647, SN74LS649	– 0°C to 70°C
Storage temperature range	– 65°C to 150°C

### recommended operating conditions

		SN54LS647 SN54LS649			SN74LS647 SN74LS649			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage	0.5			0.6			V
$V_{OH}$	High-level output voltage	5.5			5.5			V
$I_{OL}$	Low-level output voltage	12			24			mA
$t_w$	Pulse duration	CBA or CAB high		15	15		ns	
		CBA or CAB low		30	30			
		Data high or low		30	30			
$t_{su}$	Setup time before CAB † or CBA †	A or B		15	15		ns	
$t_h$	Hold time after CAB † or CBA †	A or B		0	0		ns	
$T_A$	Operating free-air temperature	– 55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS†	SN54LS647 SN54LS649			SN74LS647 SN74LS649			UNIT	
			MIN	TYP‡	MAX	MIN	TYP‡	MAX		
$V_{IK}$		$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$	– 1.5			– 1.5			V	
Hysteresis ( $V_{T+} - V_{T-}$ )	A or B input	$V_{CC} = \text{MIN}$	0.1	0.4		0.2	0.4		V	
$I_{OH}$		$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = \text{MAX}, V_{OH} = 5.5 \text{ V}$	0.1			0.1			mA	
$V_{OL}$		$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = \text{MAX}$	0.25		0.4	0.25		0.4	V	
$I_I$	A or B	$V_{CC} = \text{MAX}$			$V_I = 5.5 \text{ V}$			0.1	mA	
	All others				$V_I = 7 \text{ V}$			0.1		
$I_{IH}$		$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$	20			20			µA	
$I_{IL}$		$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$	– 0.4			– 0.4			mA	
$I_{CC}$	'LS647	$V_{CC} = \text{MAX}, \text{Outputs open}$	Outputs high		79	130	79		130	mA
			Outputs low		94	150	94		150	
	'LS649	$V_{CC} = \text{MAX}, \text{Outputs open}$	Outputs high		79	130	79		130	
			Outputs low		94	150	94		150	

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

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



# SN54LS647, SN54LS649, SN74LS647, SN74LS649

## OCTAL BUS TRANSCEIVERS AND REGISTERS WITH OPEN-COLLECTOR OUTPUTS

SDLS190A – DECEMBER 1982 – REVISED MAY 2004

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS647			'LS649			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$t_{PLH}$	CAB or CBA	A or B	$R_L = 667\ \Omega$ , $C_L = 45\ \text{pF}$ , See Note 2	22		35	17		30	ns
$t_{PHL}$				28		45	28		45	ns
$t_{PLH}$	A or B	B or A		17		26	15		25	ns
$t_{PHL}$				18		27	20		30	ns
$t_{PLH}$	SAB or SBA† with Bus input high	A or B		33		50	37		55	ns
$t_{PHL}$				29		45	28		45	ns
$t_{PLH}$	SAB or SBA† with Bus input low			39		60	30		45	ns
$t_{PHL}$				19		30	26		40	ns
$t_{PLH}$	G	A or B		25		40	21		40	ns
$t_{PHL}$				33		50	34		50	ns
$t_{PLH}$	DIR		23		35	19		30	ns	
$t_{PHL}$			25		40	27		45	ns	

† These parameters are measured with the internal outputs state of the storage register opposite to that of the bus input.

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
SN74LS646DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
SN74LS646DWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
SN74LS646DWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
SN74LS646NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Purchase Samples</a>
SN74LS646NT3	OBSOLETE	PDIP	NT	24		TBD	Call TI	Call TI	Samples Not Available
SN74LS646NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Purchase Samples</a>
SN74LS647DW	OBSOLETE	SOIC	DW	24		TBD	Call TI	Call TI	Samples Not Available
SN74LS647NT	OBSOLETE	PDIP	NT	24		TBD	Call TI	Call TI	Samples Not Available
SN74LS648NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Purchase Samples</a>
SN74LS648NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Purchase Samples</a>
SN74LS649NT	OBSOLETE	PDIP	NT	24		TBD	Call TI	Call TI	Samples Not Available

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

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

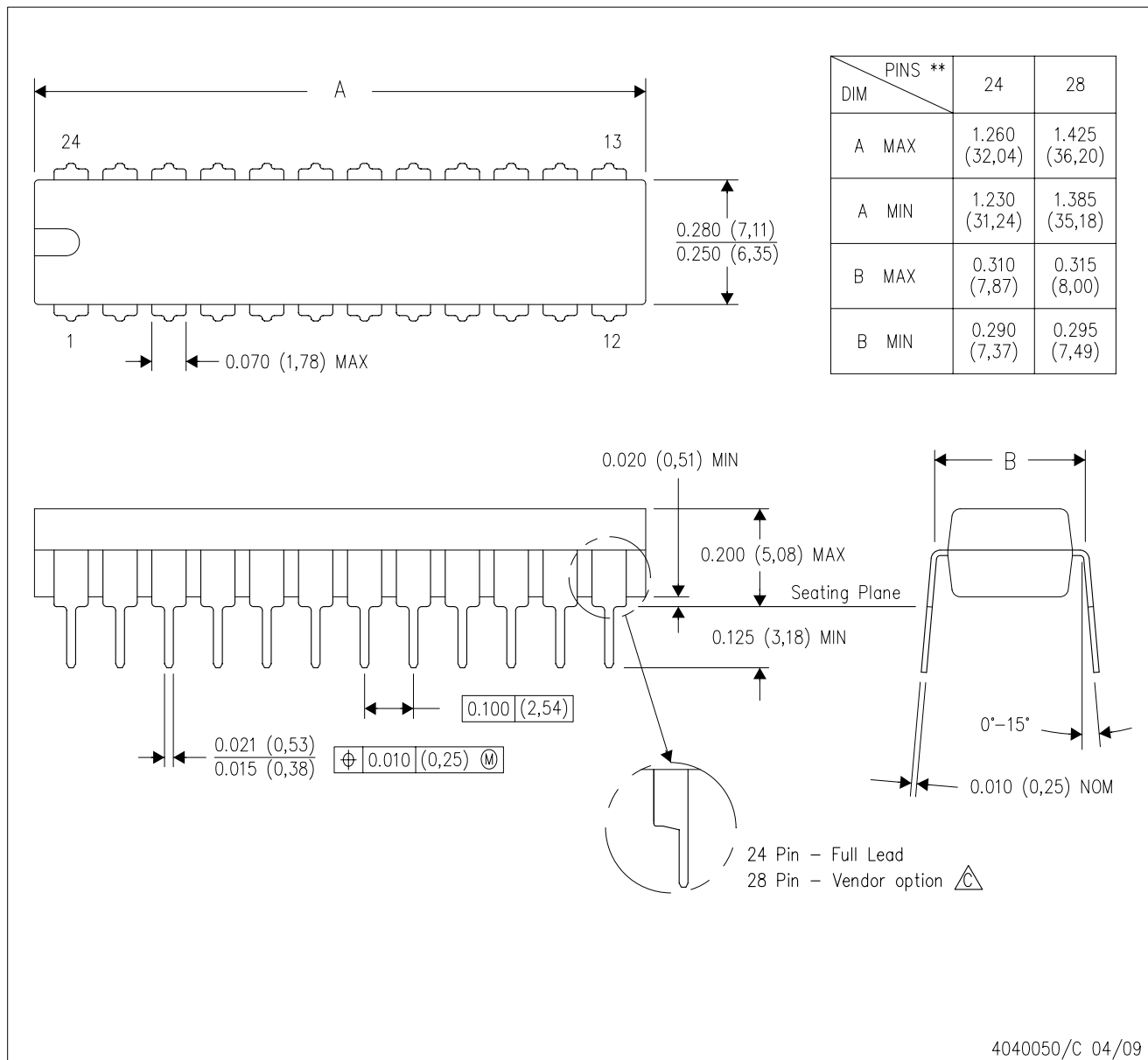
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# MECHANICAL DATA

NT (R-PDIP-T\*\*) 24 PINS SHOWN

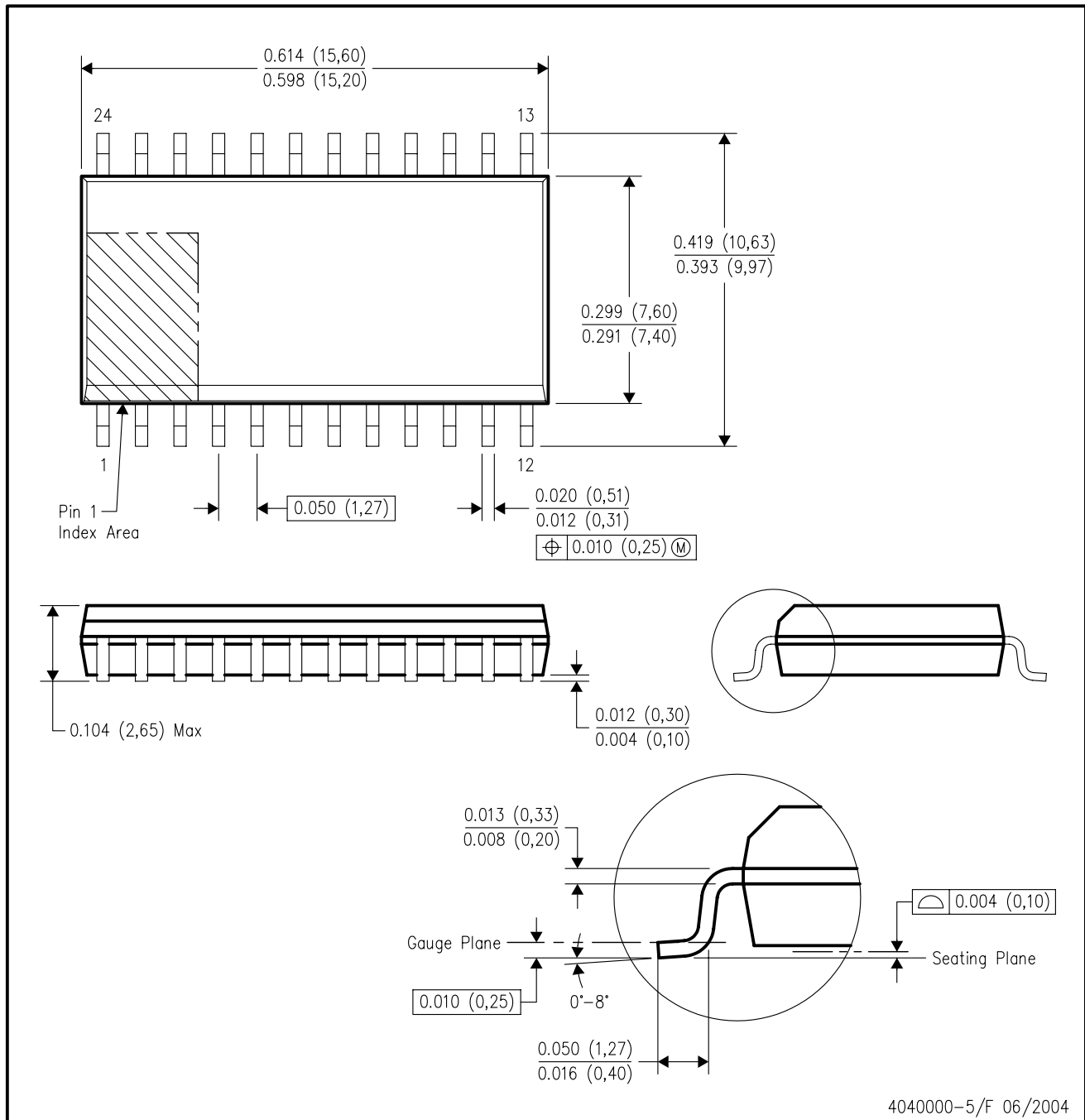
PLASTIC DUAL-IN-LINE PACKAGE



- 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 PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AD.

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>	Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>	Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Energy	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
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Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Space, Avionics & Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>	Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
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