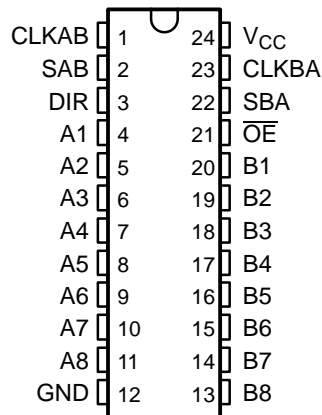


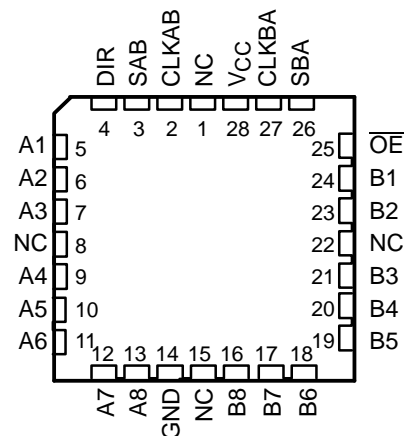
## FEATURES

- Operate From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 7.4 ns at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  
<0.8 at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  
>2 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Support Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

SN54LVC646A . . . JT OR W PACKAGE  
SN74LVC646A . . . DB, DW, NS, OR PW PACKAGE  
(TOP VIEW)



SN54LVC646A . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

## DESCRIPTION/ORDERING INFORMATION

The SN54LVC646A octal bus transceiver and register is designed for 2.7-V to 3.6-V  $V_{CC}$  operation, and the SN74LVC646A octal bus transceiver and register is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

### ORDERING INFORMATION

$T_A$	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SOIC – DW	Tube of 25	SN74LVC646ADW	LVC646A
		Reel of 2000	SN74LVC646ADWR	
	SOP – NS	Reel of 2000	SN74LVC646ANSR	LVC646A
	SSOP – DB	Reel of 2000	SN74LVC646ADBR	LC646A
	TSSOP – PW	Tube of 60	SN74LVC646APW	LC646A
		Reel of 2000	SN74LVC646APWR	
		Reel of 250	SN74LVC646APWT	
-55°C to 125°C	CDIP – JT	Tube of 15	SNJ54LVC646AJT	SNJ54LVC646AJT
	CFP – W	Tube of 85	SNJ54LVC646AW	SNJ54LVC646AW
	LCCC – FK	Tube of 42	SNJ54LVC646AFK	SNJ54LVC646AFK

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

# SN54LVC646A, SN74LVC646A OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

SCAS302J—JANUARY 1993—REVISED AUGUST 2005

## DESCRIPTION/ORDERING INFORMATION (CONTINUED)

These devices consist of bus-transceiver circuits, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or from the internal 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 are performed with the 'LVC646A devices.

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

The select-control (SAB and SBA) inputs can multiplex stored and real-time (transparent mode) data. DIR determines which bus receives data when  $\overline{OE}$  is low. In the isolation mode ( $\overline{OE}$  high), A data is stored in one register and B data can be stored in the other register.

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

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

These devices are fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

**FUNCTION TABLE**

INPUTS						DATA I/O		OPERATION OR FUNCTION
$\overline{OE}$	DIR	CLKAB	CLKBA	SAB	SBA	A1–A8	B1–B8	
X	X	↑	X	X	X	Input	Unspecified <sup>(1)</sup>	Store A, B unspecified <sup>(1)</sup>
X	X	X	↑	X	X	Unspecified <sup>(1)</sup>	Input	Store B, A unspecified <sup>(1)</sup>
H	X	↑	↑	X	X	Input	Input	Store 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

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

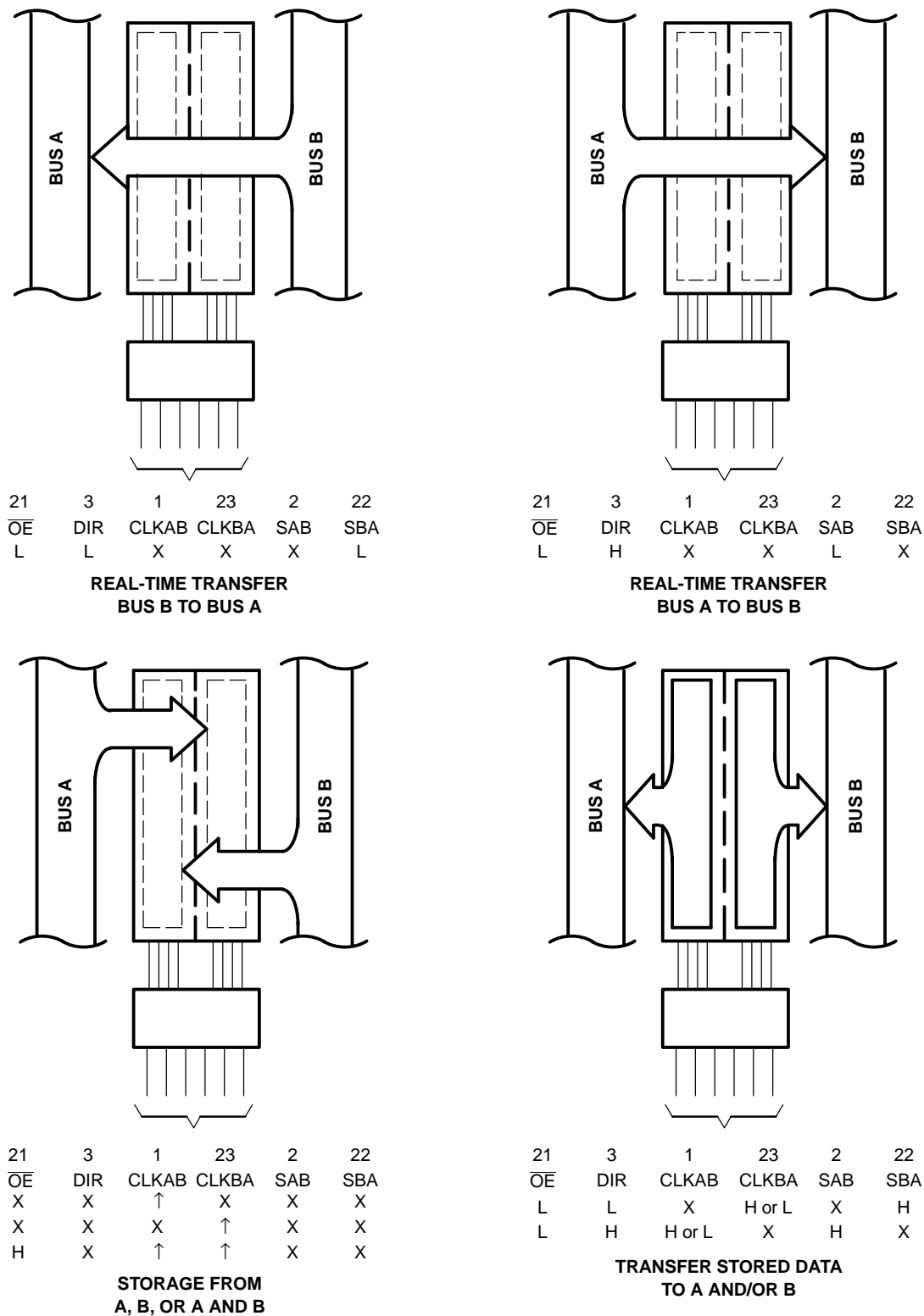
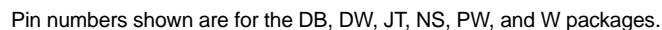


Figure 1. Bus-Management Functions

## SCAS302J–JANUARY 1993–REVISED AUGUST 2005



## Absolute Maximum Ratings<sup>(1)</sup>

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

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage range	−0.5	6.5	V
$V_I$	Input voltage range <sup>(2)</sup>	−0.5	6.5	V
$V_O$	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	−0.5	6.5	V
$V_O$	Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>	−0.5	$V_{CC} + 0.5$	V
$I_{IK}$	Input clamp current	$V_I < 0$		−50 mA
$I_{OK}$	Output clamp current	$V_O < 0$		−50 mA
$I_O$	Continuous output current		±50	mA
	Continuous current through $V_{CC}$ or GND		±100	mA
$\theta_{JA}$	Package thermal impedance <sup>(4)</sup>	DB package	63	°C/W
		DW package	46	
		NS package	65	
		PW package	88	
$T_{stg}$	Storage temperature range	−65	150	°C

- (1) 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.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of  $V_{CC}$  is provided in the recommended operating conditions table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions<sup>(1)</sup>

			SN54LVC646A		SN74LVC646A		UNIT
			MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage	Operating	2	3.6	1.65	3.6	V
		Data retention only	1.5		1.5		
$V_{IH}$	High-level input voltage	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$			$0.65 \times V_{CC}$		V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$			1.7		
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2		2		
$V_{IL}$	Low-level input voltage	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$			$0.35 \times V_{CC}$		V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$				0.7	
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$		0.8		0.8	
$V_I$	Input voltage		0	5.5		5.5	V
$V_O$	Output voltage	High or low state	0	$V_{CC}$		$V_{CC}$	V
		3-state	0	5.5		5.5	
$I_{OH}$	High-level output current	$V_{CC} = 1.65 \text{ V}$				−4	mA
		$V_{CC} = 2.3 \text{ V}$				−8	
		$V_{CC} = 2.7 \text{ V}$		−12		−12	
		$V_{CC} = 3 \text{ V}$		−24		−24	
$I_{OL}$	Low-level output current	$V_{CC} = 1.65 \text{ V}$				4	mA
		$V_{CC} = 2.3 \text{ V}$				8	
		$V_{CC} = 2.7 \text{ V}$		12		12	
		$V_{CC} = 3 \text{ V}$		24		24	
$\Delta t/\Delta v$	Input transition rise or fall rate			10		10	ns/V
$T_A$	Operating free-air temperature		−55	125	−40	85	°C

- (1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

# SN54LVC646A, SN74LVC646A

## OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

SCAS302J—JANUARY 1993—REVISED AUGUST 2005

## Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	SN54LVC646A			SN74LVC646A			UNIT
				MIN	TYP <sup>(1)</sup>	MAX	MIN	TYP <sup>(1)</sup>	MAX	
V <sub>OH</sub>		I <sub>OH</sub> = −100 μA	1.65 V to 3.6 V				V <sub>CC</sub> − 0.2			V
			2.7 V to 3.6 V	V <sub>CC</sub> − 0.2						
		I <sub>OH</sub> = −4 mA	1.65 V				1.2			
		I <sub>OH</sub> = −8 mA	2.3 V				1.7			
		I <sub>OH</sub> = −12 mA	2.7 V	2.2			2.2			
			3 V	2.4			2.4			
		I <sub>OH</sub> = −24 mA	3 V	2.2			2.2			
V <sub>OL</sub>		I <sub>OL</sub> = 100 μA	1.65 V to 3.6 V				0.2			V
			2.7 V to 3.6 V	0.2						
		I <sub>OL</sub> = 4 mA	1.65 V				0.45			
		I <sub>OL</sub> = 8 mA	2.3 V				0.7			
		I <sub>OL</sub> = 12 mA	2.7 V	0.4			0.4			
		I <sub>OL</sub> = 24 mA	3 V	0.55			0.55			
I <sub>I</sub>	Control inputs	V <sub>I</sub> = 0 to 5.5 V	3.6 V	±5			±5			μA
I <sub>off</sub>		V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0				±10			μA
I <sub>OZ</sub> <sup>(2)</sup>		V <sub>O</sub> = 0 to 5.5 V	3.6 V	±15			±10			μA
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND	3.6 V	10			10			μA
		3.6 V ≤ V <sub>I</sub> ≤ 5.5 V <sup>(3)</sup>		10			10			
ΔI <sub>CC</sub>		One input at V <sub>CC</sub> − 0.6 V, Other inputs at V <sub>CC</sub> or GND	2.7 V to 3.6 V	500			500			μA
C <sub>i</sub>	Control inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V	4.5			4.5			pF
C <sub>io</sub>	A or B port	V <sub>O</sub> = V <sub>CC</sub> or GND	3.3 V	7.5			7.5			pF

(1) All typical values are at  $V_{CC} = 3.3 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

(2) For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

(3) This applies in the disabled state only.

## Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 2](#))

		SN54LVC646A				UNIT
		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		
		MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	150		150		MHz
t <sub>w</sub>	Pulse duration	3.3		3.3		ns
t <sub>su</sub>	Setup time, data before CLK↑	1.6		1.5		ns
t <sub>h</sub>	Hold time, data after CLK↑	1.7		1.7		ns

## Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 2](#))

		SN74LVC646A								UNIT
		$V_{CC} = 1.8\text{ V}$ $\pm 0.18\text{ V}$		$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	(1)		(1)		150		150		MHz
t <sub>w</sub>	Pulse duration	(1)		(1)		3.3		3.3		ns
t <sub>su</sub>	Setup time, data before CLK↑	(1)		(1)		1.6		1.5		ns
t <sub>h</sub>	Hold time, data after CLK↑	(1)		(1)		1.7		1.7		ns

(1) This information was not available at the time of publication.

## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 2](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVC646A				UNIT
			V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	
f <sub>max</sub>			150		150		MHz
t <sub>pd</sub>	A or B	B or A	7.9		1	7.4	ns
	CLK	A or B	8.8		1	8.4	
	SBA or SAB		9.9		1	8.6	
t <sub>en</sub>	$\overline{\text{OE}}$	A	10.2		1	8.2	ns
t <sub>dis</sub>	$\overline{\text{OE}}$	A	8.9		1	7.5	ns
t <sub>en</sub>	DIR	B	10.4		1	8.3	ns
t <sub>dis</sub>	DIR	B	8.7		1	7.9	ns

## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 2](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74LVC646A								UNIT
			V <sub>CC</sub> = 1.8 V ± 0.15 V		V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			(1)		(1)		150		150		MHz
t <sub>pd</sub>	A or B	B or A	(1)	(1)	(1)	(1)	7.9		1	7.4	ns
	CLK	A or B	(1)	(1)	(1)	(1)	8.8		1	8.4	
	SBA or SAB		(1)	(1)	(1)	(1)	9.9		1	8.6	
t <sub>en</sub>	OE	A	(1)	(1)	(1)	(1)	10.2		1	8.2	ns
t <sub>dis</sub>	OE	A	(1)	(1)	(1)	(1)	8.9		1	7.5	ns
t <sub>en</sub>	DIR	B	(1)	(1)	(1)	(1)	10.4		1	8.3	ns
t <sub>dis</sub>	DIR	B	(1)	(1)	(1)	(1)	8.7		1	7.9	ns

(1) This information was not available at the time of publication.

# SN54LVC646A, SN74LVC646A OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

SCAS302J—JANUARY 1993—REVISED AUGUST 2005



## Operating Characteristics

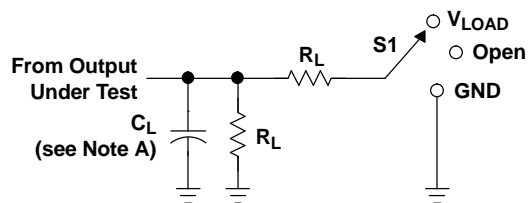
$T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	$V_{CC} = 1.8\text{ V}$	$V_{CC} = 2.5\text{ V}$	$V_{CC} = 3.3\text{ V}$	UNIT
			TYP	TYP	TYP	
Cpd	Power dissipation capacitance per transceiver	Outputs enabled	(1)	(1)	75	pF
		Outputs disabled	(1)	(1)	9	

(1) This information was not available at the time of publication.



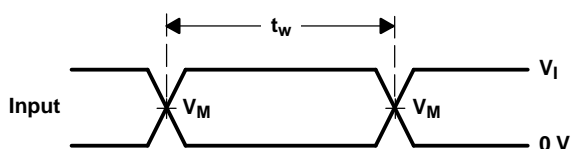
## PARAMETER MEASUREMENT INFORMATION



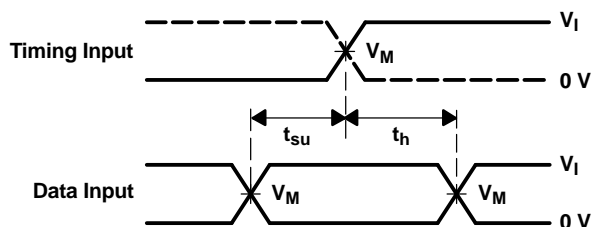
LOAD CIRCUIT

TEST	$S_1$
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

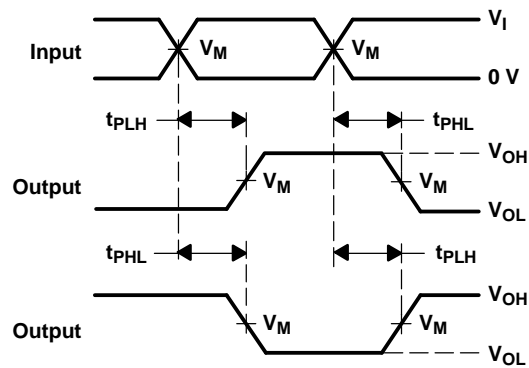
$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$1.8\text{ V} \pm 0.15\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
2.7 V	2.7 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
$3.3\text{ V} \pm 0.3\text{ V}$	2.7 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V



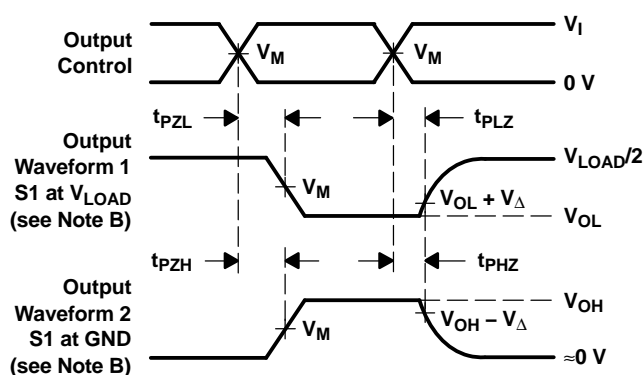
VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES  
LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 2. Load Circuit and Voltage Waveforms

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVC646ADBR	ACTIVE	SSOP	DB	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LC646A	<a href="#">Samples</a>
SN74LVC646ADW	ACTIVE	SOIC	DW	24	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVC646A	<a href="#">Samples</a>
SN74LVC646ADWG4	ACTIVE	SOIC	DW	24	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVC646A	<a href="#">Samples</a>
SN74LVC646APW	ACTIVE	TSSOP	PW	24	60	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LC646A	<a href="#">Samples</a>
SN74LVC646APWR	ACTIVE	TSSOP	PW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LC646A	<a href="#">Samples</a>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54LVC646A, SN74LVC646A :**

- Catalog: [SN74LVC646A](#)
- Military: [SN54LVC646A](#)
- Space: [SN54LVC646A-SP](#)

**NOTE:** Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**TAPE AND REEL INFORMATION**


\*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
SN74LVC646ADBR	SSOP	DB	24	2000	330.0	16.4	8.2	8.8	2.5	12.0	16.0	Q1
SN74LVC646APWR	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC646ADBR	SSOP	DB	24	2000	853.0	449.0	35.0
SN74LVC646APWR	TSSOP	PW	24	2000	853.0	449.0	35.0



## PACKAGE OUTLINE

## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

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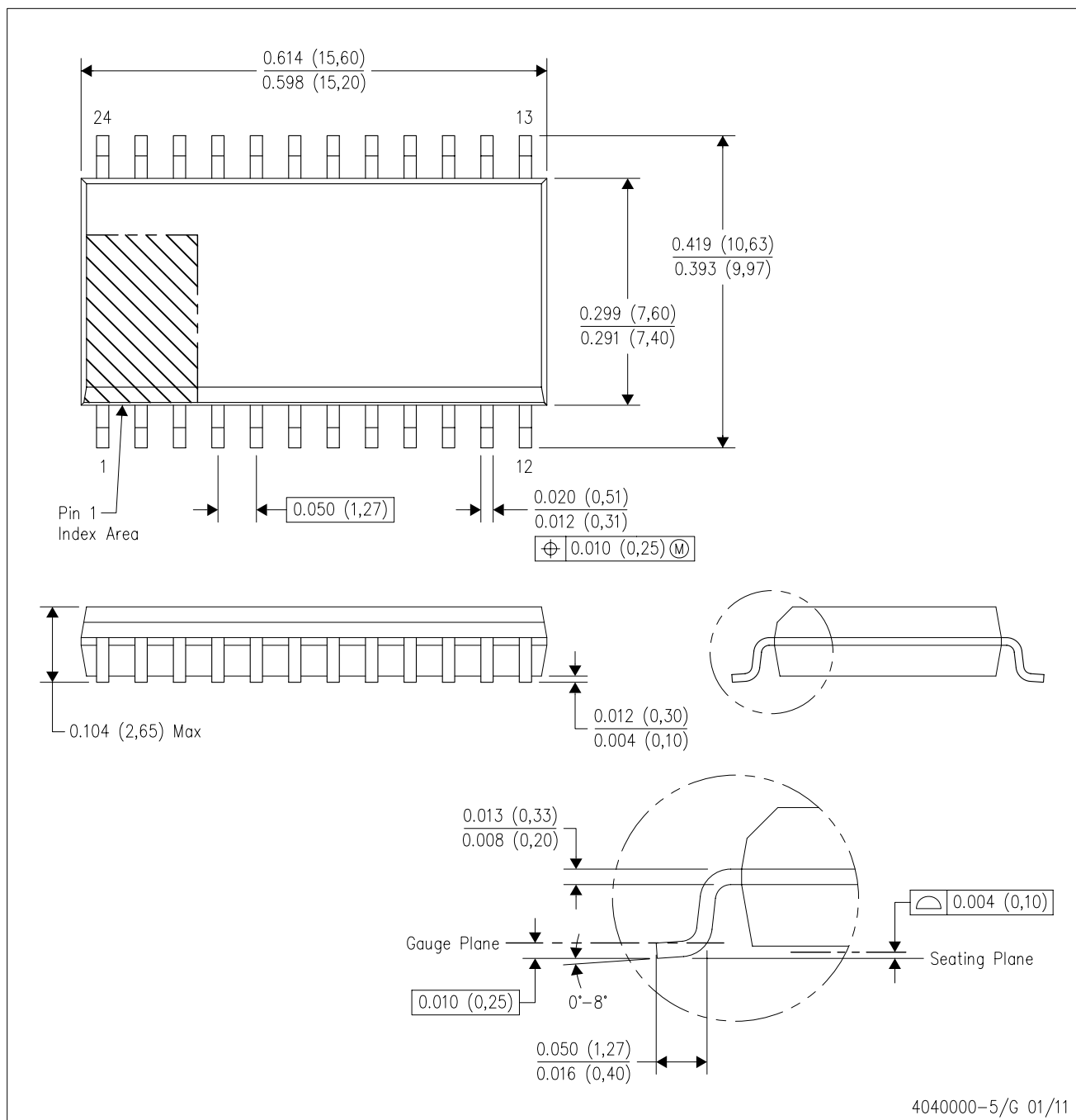
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.



DW (R-PDSO-G24)

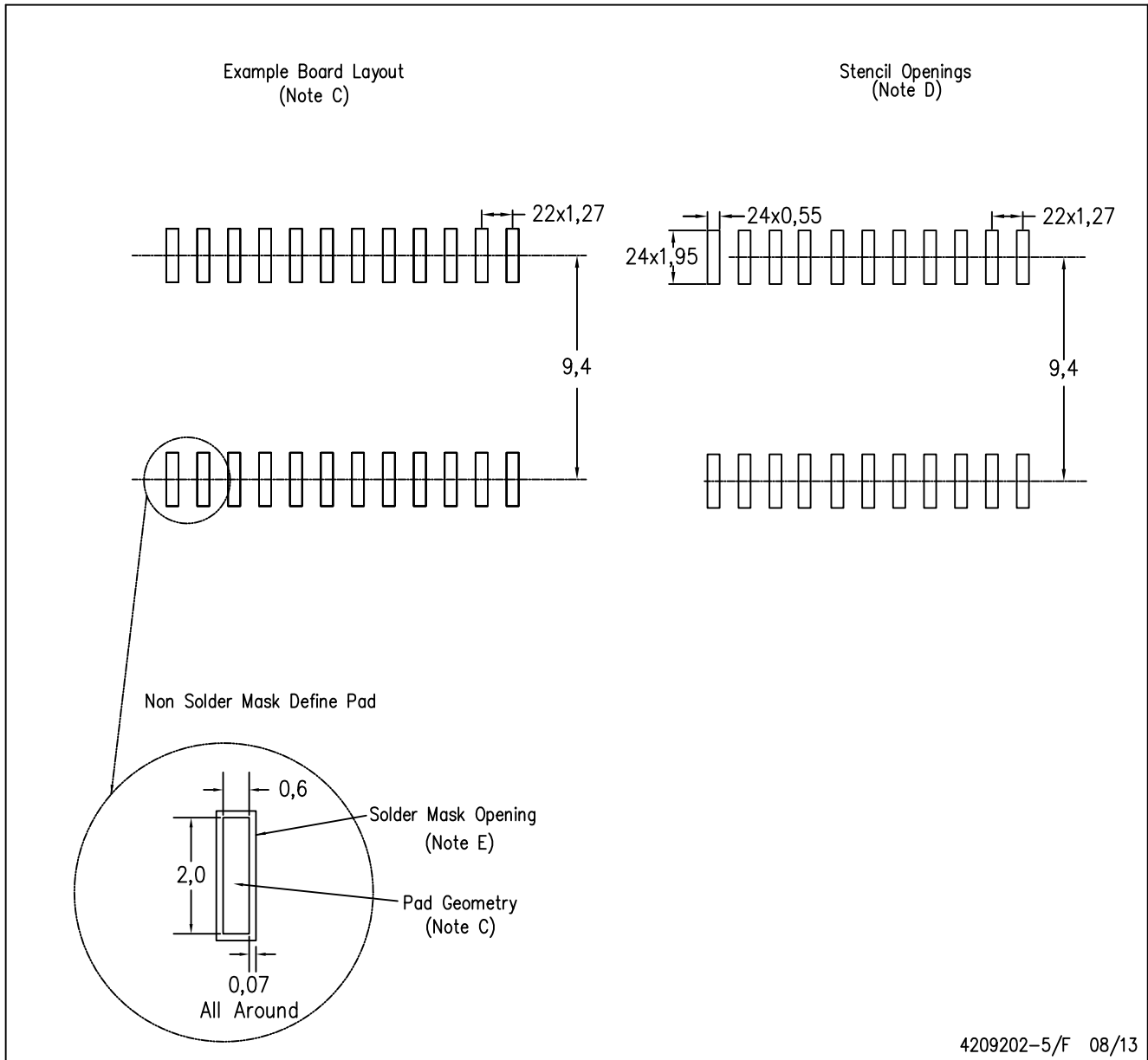
PLASTIC SMALL OUTLINE



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

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

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