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SN54LVC646A, SN74LVC646A
OCTAL BUS TRANSCEIVERS AND REGISTERS
WITH 3-STATE OUTPUTS
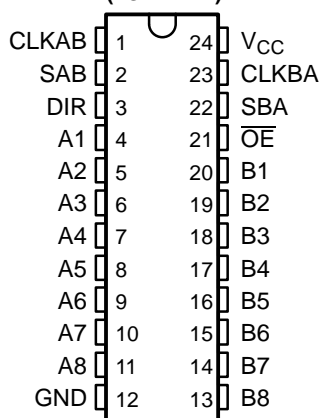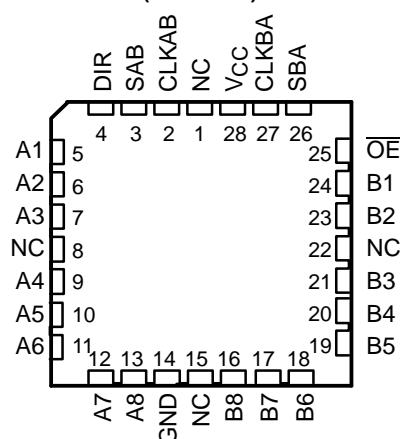SCAS302J−JANUARY 1993−REVISED AUGUST 2005

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°C**
- **Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at V_{CC} = 3.3 V, T_A = 25°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)

CLKAB	1	24	V_{CC}
SAB	2	23	CLKBA
DIR	3	22	SBA
A1	4	21	$\overline{OE}$
A2	5	20	B1
A3	6	19	B2
A4	7	18	B3
A5	8	17	B4
A6	9	16	B5
A7	10	15	B6
A8	11	14	B7
GND	12	13	B8

SN54LVC646A . . . FK PACKAGE
(TOP VIEW)

Top pins: DIR (4), SAB (3), CLKAB (2), NC (1), V_{CC} (28), CLKBA (27), SBA (26)

Left		Right	
A1	5	25	$\overline{OE}$
A2	6	24	B1
A3	7	23	B2
NC	8	22	NC
A4	9	21	B3
A5	10	20	B4
A6	11	19	B5

Bottom pins: A7 (12), A8 (13), GND (14), NC (15), B8 (16), B7 (17), B6 (18)

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[1]		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, symboliztion, and PCB design guidelines are available at www.ti.com/sc/package.

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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 ($\overline{\text{OE}}$) 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 $\overline{\text{OE}}$ is low. In the isolation mode ($\overline{\text{OE}}$ 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, $\overline{\text{OE}}$ 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
$\overline{\text{OE}}$	DIR	CLKAB	CLKBA	SAB	SBA	A1−A8	B1−B8	
X	X	↑	X	X	X	Input	Unspecified[1]	Store A, B unspecified[1]
X	X	X	↑	X	X	Unspecified[1]	Input	Store B, A unspecified[1]
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 $\overline{\text{OE}}$ 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.
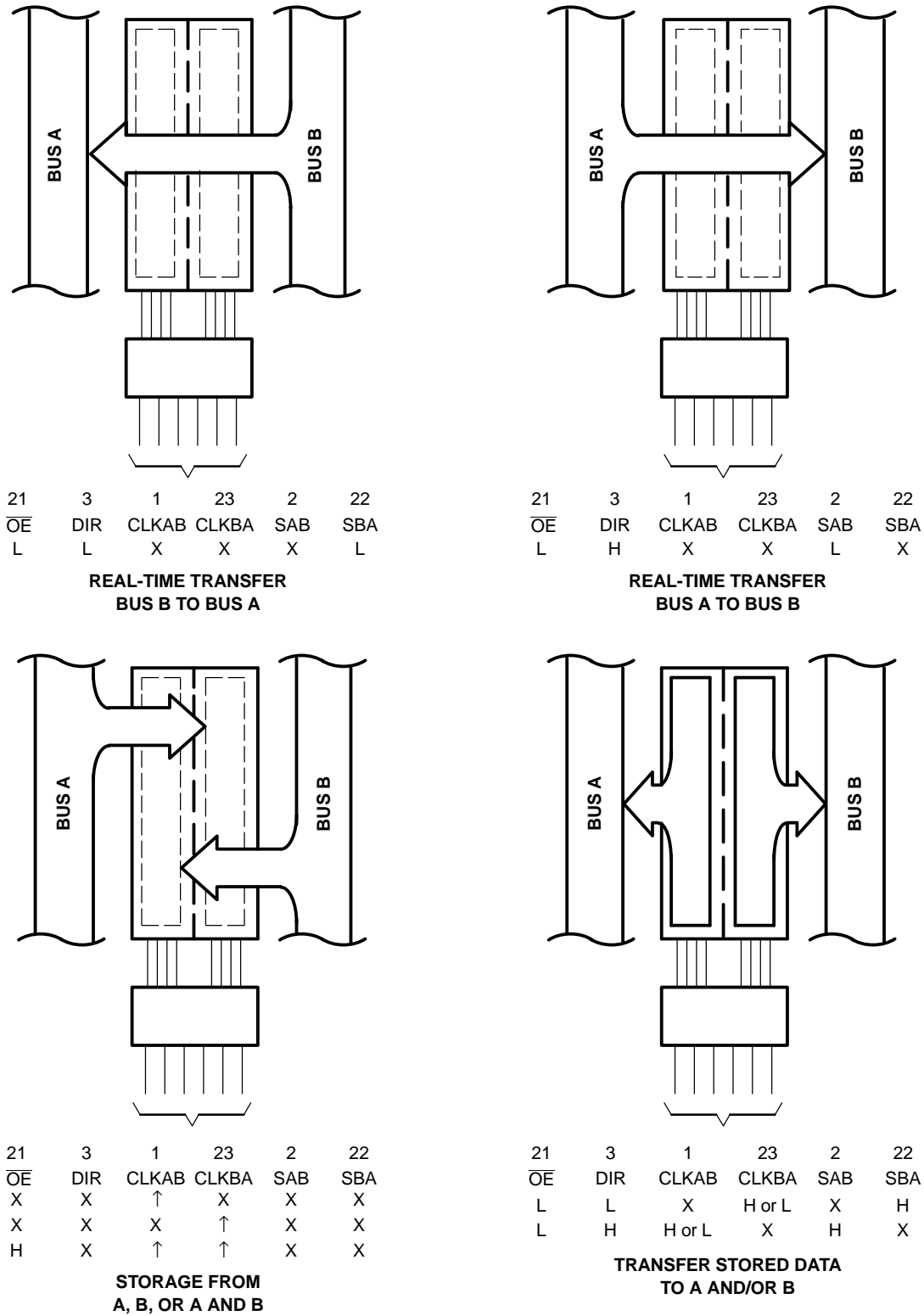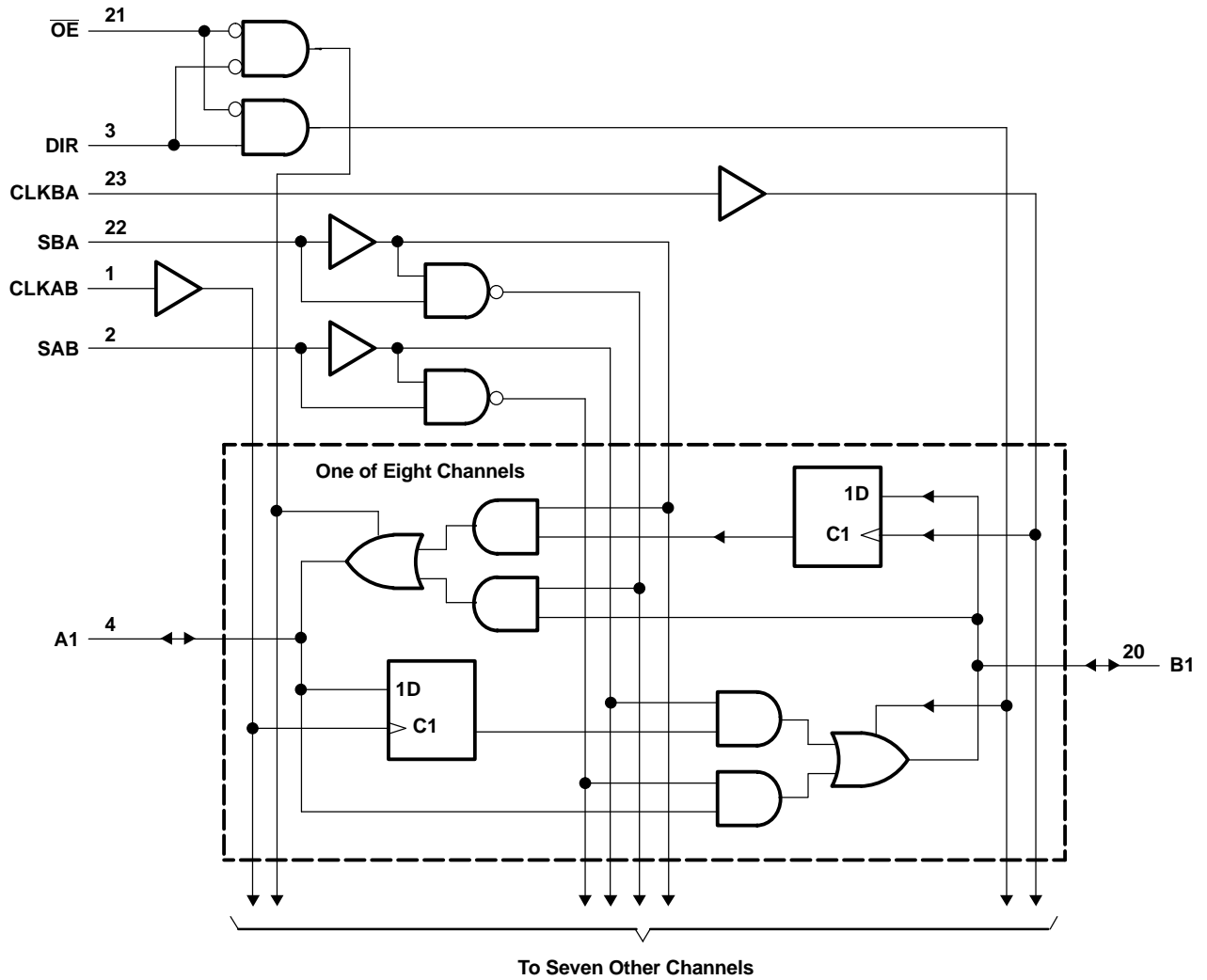
![Texas Instruments logo, www.ti.com]

21	3	1	23	2	22
$\overline{OE}$	DIR	CLKAB	CLKBA	SAB	SBA
L	L	X	X	X	L

**REAL-TIME TRANSFER
BUS B TO BUS A**

21	3	1	23	2	22
$\overline{OE}$	DIR	CLKAB	CLKBA	SAB	SBA
L	H	X	X	L	X

**REAL-TIME TRANSFER
BUS A TO BUS B**

21	3	1	23	2	22
$\overline{OE}$	DIR	CLKAB	CLKBA	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
$\overline{OE}$	DIR	CLKAB	CLKBA	SAB	SBA
L	L	X	H or L	X	H
L	H	H or L	X	H	X

**TRANSFER STORED DATA
TO A AND/OR B**

Figure 1. Bus-Management Functions

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LOGIC DIAGRAM (POSITIVE LOGIC)

$\overline{OE}$ 21

DIR 3

CLKBA 23

SBA 22

CLKAB 1

SAB 2

One of Eight Channels

1D
C1

A1 4

1D
C1

20 B1

To Seven Other Channels

Pin numbers shown are for the DB, DW, JT, NS, PW, and W packages.

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Absolute Maximum Ratings[1]

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[2]		−0.5	6.5	V
V_O	Voltage range applied to any output in the high-impedance or power-off state[2]		−0.5	6.5	V
V_O	Voltage range applied to any output in the high or low state[2][3]		−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
θ_{JA}	Package thermal impedance[4]	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[1]

			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 V to 1.95 V			$0.65 \times V_{CC}$		V
		V_{CC} = 2.3 V to 2.7 V			1.7		
		V_{CC} = 2.7 V to 3.6 V	2		2		
V_{IL}	Low-level input voltage	V_{CC} = 1.65 V to 1.95 V				$0.35 \times V_{CC}$	V
		V_{CC} = 2.3 V to 2.7 V				0.7	
		V_{CC} = 2.7 V to 3.6 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 V				−4	mA
		V_{CC} = 2.3 V				−8	
		V_{CC} = 2.7 V		−12		−12	
		V_{CC} = 3 V		−24		−24	
I_{OL}	Low-level output current	V_{CC} = 1.65 V				4	mA
		V_{CC} = 2.3 V				8	
		V_{CC} = 2.7 V		12		12	
		V_{CC} = 3 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.

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Electrical Characteristics

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

PARAMETER		TEST CONDITIONS		V_{CC}	SN54LVC646A			SN74LVC646A			UNIT
					MIN	TYP[1]	MAX	MIN	TYP[1]	MAX	
V_{OH}		$I_{OH} = -100 \ \mu A$		1.65 V to 3.6 V				$V_{CC} - 0.2$			V
				2.7 V to 3.6 V	$V_{CC} - 0.2$						
		$I_{OH} = -4 \ mA$		1.65 V				1.2			
		$I_{OH} = -8 \ mA$		2.3 V				1.7			
		$I_{OH} = -12 \ mA$		2.7 V	2.2			2.2			
				3 V	2.4			2.4			
		$I_{OH} = -24 \ mA$		3 V	2.2			2.2			
V_{OL}		$I_{OL} = 100 \ \mu A$		1.65 V to 3.6 V						0.2	V
				2.7 V to 3.6 V			0.2				
		$I_{OL} = 4 \ mA$		1.65 V						0.45	
		$I_{OL} = 8 \ mA$		2.3 V						0.7	
		$I_{OL} = 12 \ mA$		2.7 V			0.4			0.4	
		$I_{OL} = 24 \ mA$		3 V			0.55			0.55	
I_I	Control inputs	$V_I = 0$ to 5.5 V		3.6 V			±5			±5	μA
I_{off}		V_I or $V_O = 5.5$ V		0						±10	μA
I_{OZ}[2]		$V_O = 0$ to 5.5 V		3.6 V			±15			±10	μA
I_{CC}		$V_I = V_{CC}$ or GND	$I_O = 0$	3.6 V			10			10	μA
		$3.6 \ V \le V_I \le 5.5 \ V$[3]					10			10	
ΔI_{CC}		One input at $V_{CC} - 0.6$ V, Other inputs at V_{CC} or GND		2.7 V to 3.6 V			500			500	μA
C_i	Control inputs	$V_I = V_{CC}$ or GND		3.3 V		4.5			4.5		pF
C_{io}	A or B port	$V_O = V_{CC}$ or GND		3.3 V		7.5			7.5		pF

(1) All typical values are at $V_{CC} = 3.3$ V, $T_A = 25°C$.
(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
		$V_{CC} = 2.7$ V		$V_{CC} = 3.3$ V $\pm$ 0.3 V		
		MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		150		150	MHz
t_w	Pulse duration	3.3		3.3		ns
t_{su}	Setup time, data before CLK↑	1.6		1.5		ns
t_h	Hold time, data after CLK↑	1.7		1.7		ns

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WITH 3-STATE OUTPUTS
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Timing Requirements

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

		SN74LVC646A								UNIT
		V_{CC} = 1.8 V $\pm$ 0.18 V		V_{CC} = 2.5 V $\pm$ 0.2 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V $\pm$ 0.3 V		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		(1)		(1)		150		150	MHz
t_w	Pulse duration	(1)		(1)		3.3		3.3		ns
t_{su}	Setup time, data before CLK↑	(1)		(1)		1.6		1.5		ns
t_h	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_{CC} = 2.7 V		V_{CC} = 3.3 V $\pm$ 0.3 V		
			MIN	MAX	MIN	MAX	
f_{max}			150		150		MHz
t_{pd}	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_{en}	$\overline{OE}$	A		10.2	1	8.2	ns
t_{dis}	$\overline{OE}$	A		8.9	1	7.5	ns
t_{en}	DIR	B		10.4	1	8.3	ns
t_{dis}	DIR	B		8.7	1	7.9	ns

Switching Characteristics

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

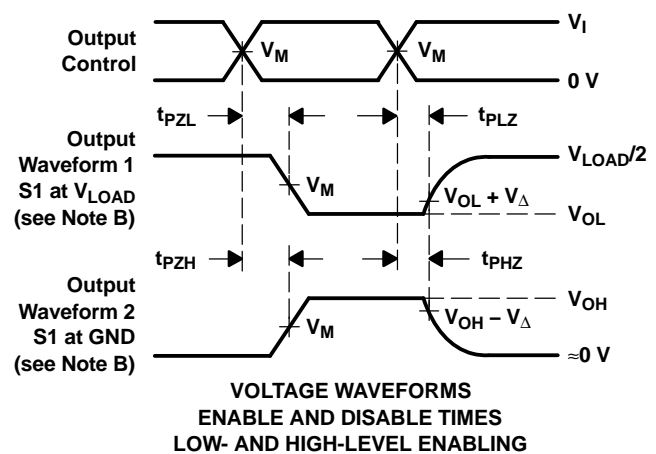| PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74LVC646A								UNIT
			V_{CC} = 1.8 V $\pm$ 0.15 V		V_{CC} = 2.5 V $\pm$ 0.2 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V $\pm$ 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f_{max}			(1)		(1)		150		150		MHz
t_{pd}	A or B	B or A	(1)	(1)	(1)	(1)		7.9	1	7.4	ns
	CLK	A or B	(1)	(1)	(1)	(1)		8.8	1	8.4	
	SBA or SAB		(1)	(1)	(1)	(1)		9.9	1	8.6	
t_{en}	$\overline{OE}$	A	(1)	(1)	(1)	(1)		10.2	1	8.2	ns
t_{dis}	$\overline{OE}$	A	(1)	(1)	(1)	(1)		8.9	1	7.5	ns
t_{en}	DIR	B	(1)	(1)	(1)	(1)		10.4	1	8.3	ns
t_{dis}	DIR	B	(1)	(1)	(1)	(1)		8.7	1	7.9	ns

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

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Operating Characteristics

$T_A = 25°C$

PARAMETER		TEST CONDITIONS	V_{CC} = 1.8 V	V_{CC} = 2.5 V	V_{CC} = 3.3 V	UNIT
			TYP	TYP	TYP	
Cpd	Power dissipation capacitance per transceiver	Outputs enabled	f = 10 MHz	(1)	(1)	75	pF
		Outputs disabled		(1)	(1)	9	

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

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PARAMETER MEASUREMENT INFORMATION

LOAD CIRCUIT
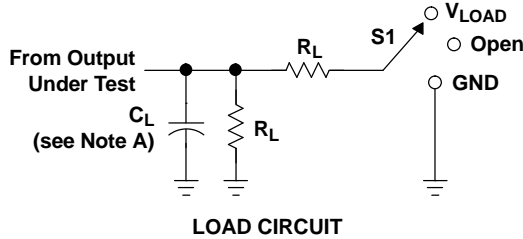
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
1.8 V ± 0.15 V	V_{CC}	≤2 ns	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 kΩ	0.15 V
2.5 V ± 0.2 V	V_{CC}	≤2 ns	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 Ω	0.15 V
2.7 V	2.7 V	≤2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
3.3 V ± 0.3 V	2.7 V	≤2.5 ns	1.5 V	6 V	50 pF	500 Ω	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
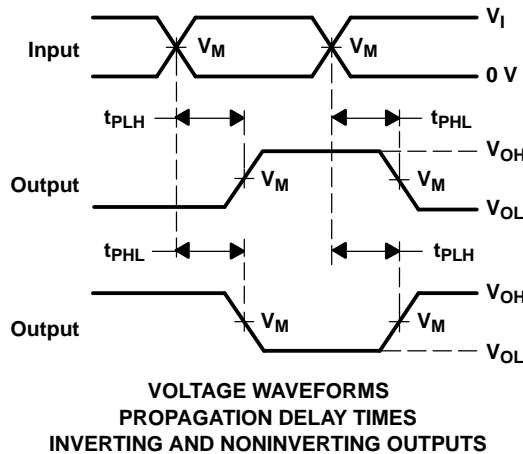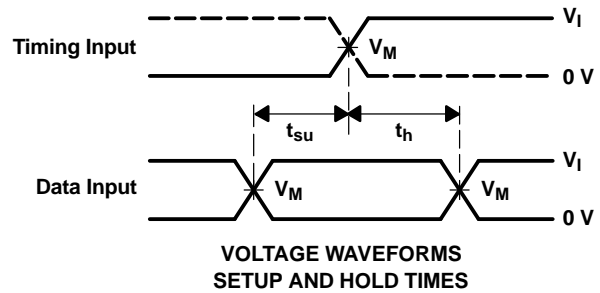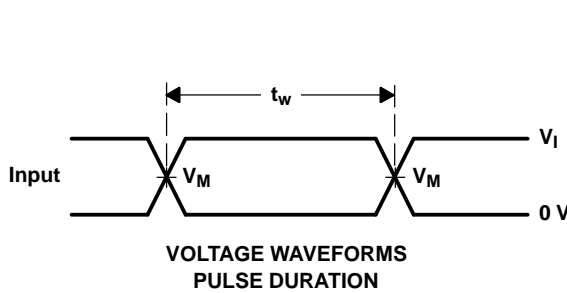
NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, $Z_O = 50$ Ω.
D. The outputs are measured one at a time, with one transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PLH} and t_{PHL} are the same as t_{pd}.
H. 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/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9762601QKA	LIFEBUY	CFP	W	24	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9762601QKA SNJ54LVC646AW	
SN74LVC646ADBR	ACTIVE	SSOP	DB	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LC646A	Samples
SN74LVC646ADW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVC646A	Samples
SN74LVC646ADWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVC646A	Samples
SN74LVC646APW	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LC646A	Samples
SN74LVC646APWR	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LC646A	Samples
SNJ54LVC646AW	LIFEBUY	CFP	W	24	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9762601QKA SNJ54LVC646AW	

(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.

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

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

![Texas Instruments logo] **PACKAGE MATERIALS INFORMATION**

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
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	367.0	367.0	38.0
SN74LVC646APWR	TSSOP	PW	24	2000	367.0	367.0	38.0

W (R−GDFP−F24)   CERAMIC DUAL FLATPACK

Base And Seating Plane

$\dfrac{0.375\ (9,53)}{0.340\ (8,64)}$

$\dfrac{0.045\ (1,14)}{0.026\ (0,66)}$

$\dfrac{0.006\ (0,15)}{0.004\ (0,10)}$

$\dfrac{0.090\ (2,29)}{0.045\ (1,14)}$

$\dfrac{0.360\ (9,14)}{0.240\ (6,10)}$

$\dfrac{0.395\ (10,03)}{0.360\ (9,14)}$

$\dfrac{0.360\ (9,14)}{0.240\ (6,10)}$

$\dfrac{0.019\ (0,48)}{0.015\ (0,38)}$

1   24

$\dfrac{0.640\ (16,26)}{0.490\ (12,45)}$

0.050 (1,27)
TYP

$\dfrac{0.030\ (0,76)}{0.015\ (0,38)}$

12   30° TYP   13

$\dfrac{1.115\ (28,32)}{0.840\ (21,34)}$

4040180−5/F   04/14
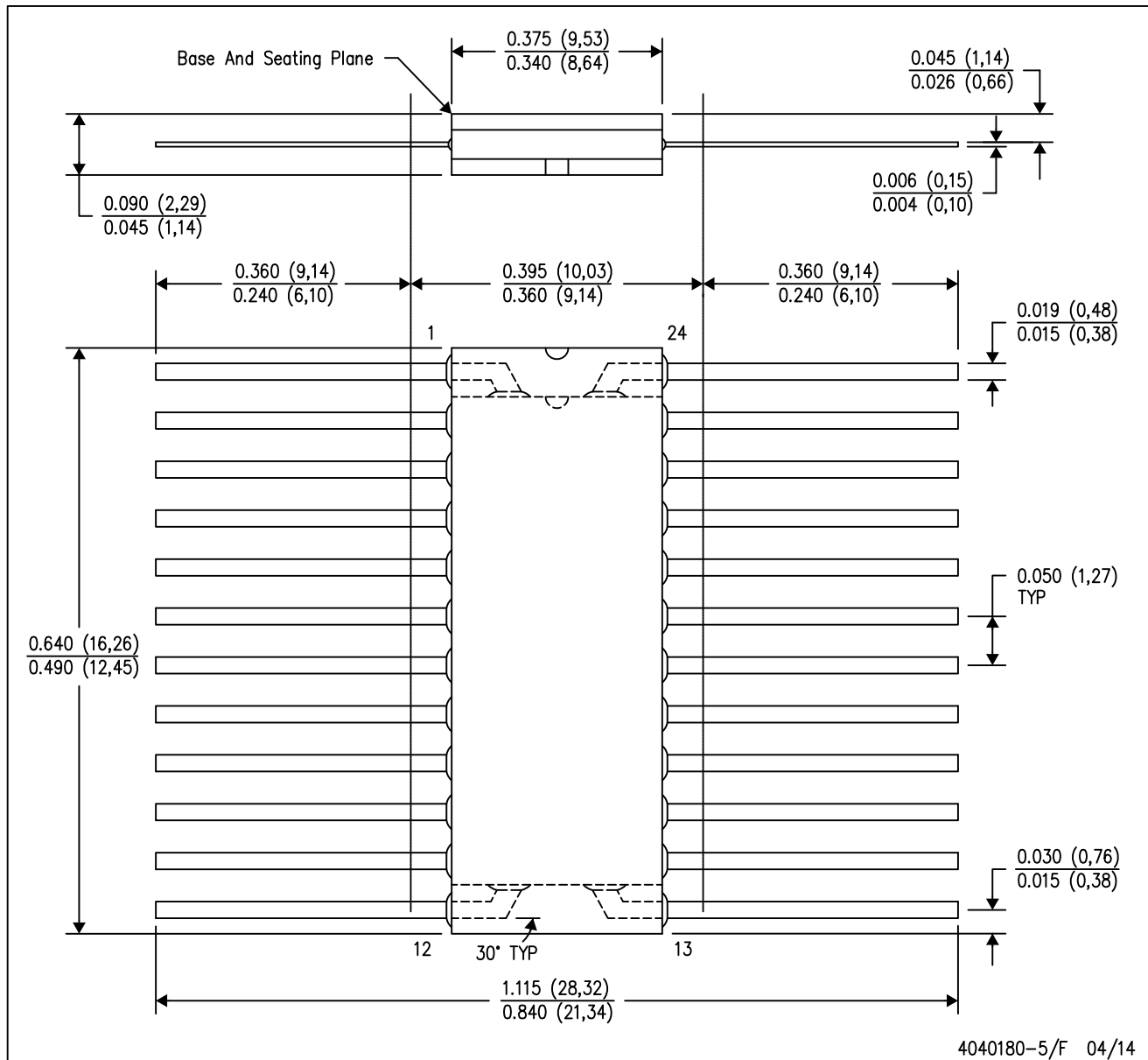
NOTES: A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
         C.   This package can be hermetically sealed with a ceramic lid using glass frit.
         D.   Index point is provided on cap for terminal identification only.
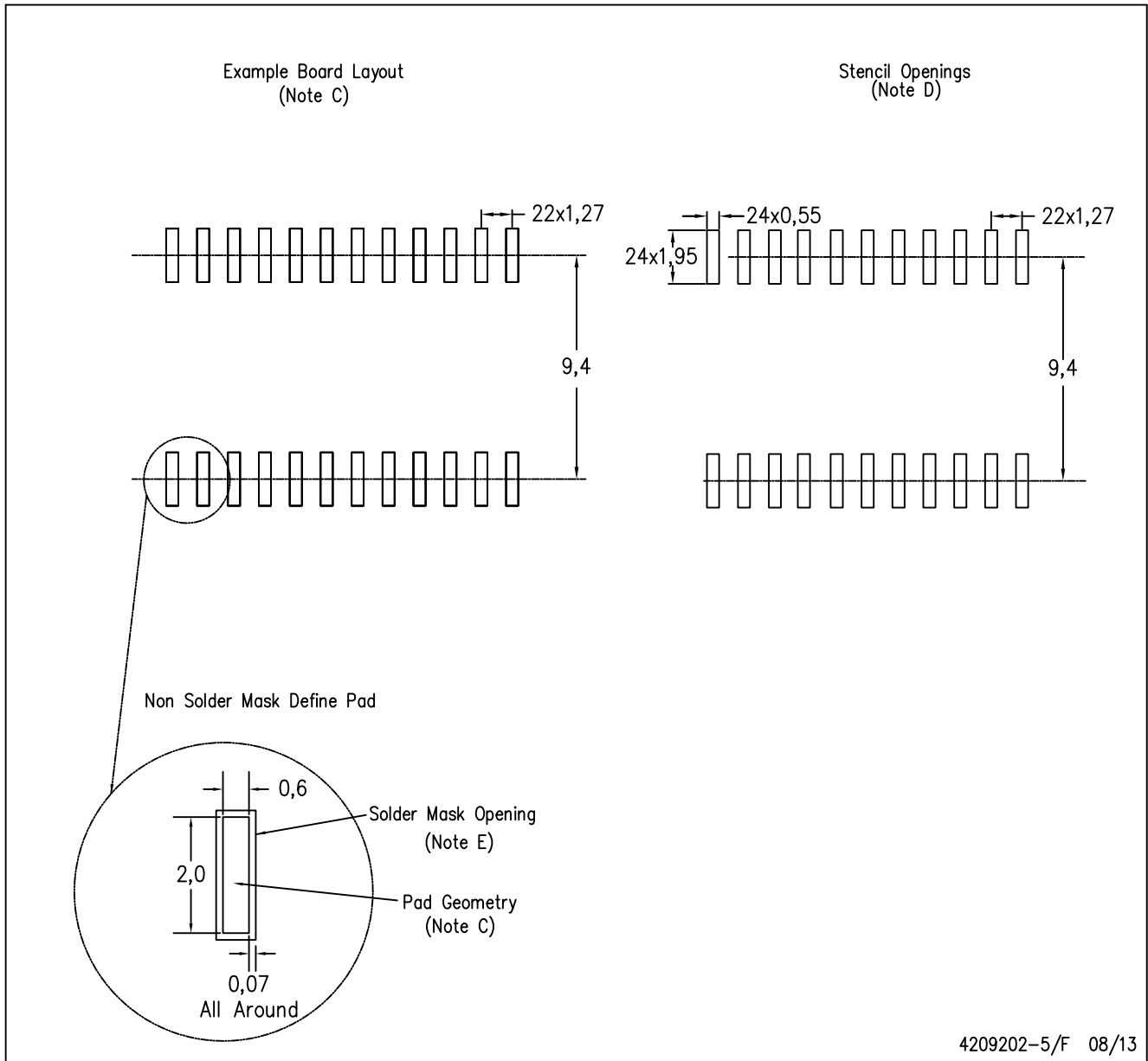   E.   Falls within Mil−Std 1835 GDFP2−F20

DW (R−PDSO−G24)   PLASTIC SMALL OUTLINE

0.614 (15,60)
0.598 (15,20)

24   13

0.419 (10,63)
0.393 (9,97)

0.299 (7,60)
0.291 (7,40)

1   12

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.104 (2,65) Max

0.012 (0,30)
0.004 (0,10)

0.013 (0,33)
0.008 (0,20)

⌂ 0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)   0°–8°

0.050 (1,27)
0.016 (0,40)

4040000−5/G 01/11

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.
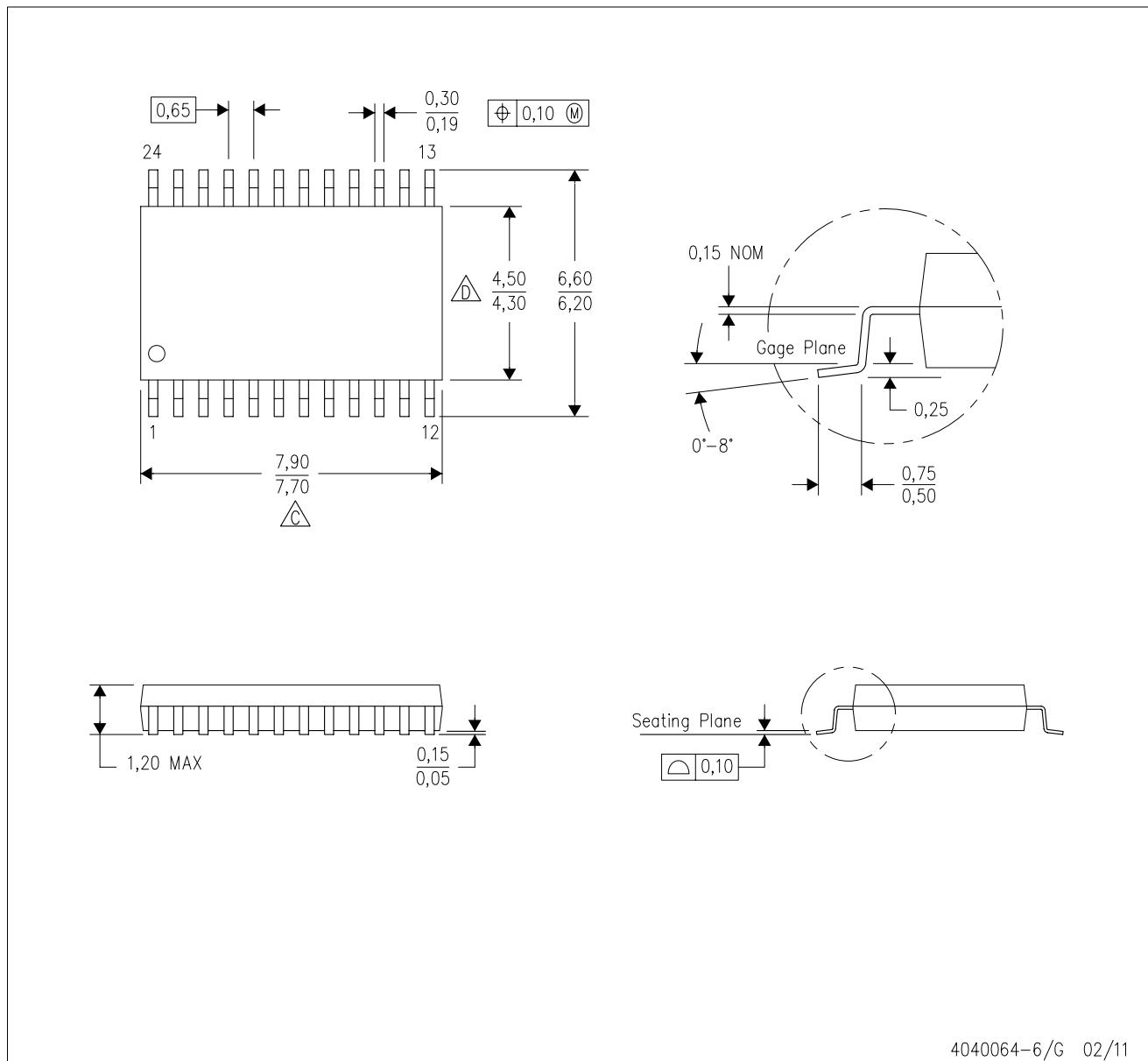
DW (R−PDSO−G24)   PLASTIC SMALL OUTLINE

Example Board Layout
(Note C)

Stencil Openings
(Note D)

22x1,27

24x0,55   22x1,27

24x1,95

9,4

9,4

Non Solder Mask Define Pad

0,6

2,0

Solder Mask Opening
(Note E)

Pad Geometry
(Note C)

0,07
All Around

4209202−5/F   08/13

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.

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PW (R−PDSO−G24)   PLASTIC SMALL OUTLINE

0,65

0,30
0,19

⊕ | 0,10 Ⓜ

24 ⎪⎪⎪⎪⎪⎪⎪⎪⎪⎪⎪⎪ 13

◬D 4,50 / 4,30   6,60 / 6,20

1 ⎪⎪⎪⎪⎪⎪⎪⎪⎪⎪⎪⎪ 12

7,90 / 7,70

◬C

0,15 NOM

Gage Plane

0°−8°

0,25

0,75 / 0,50
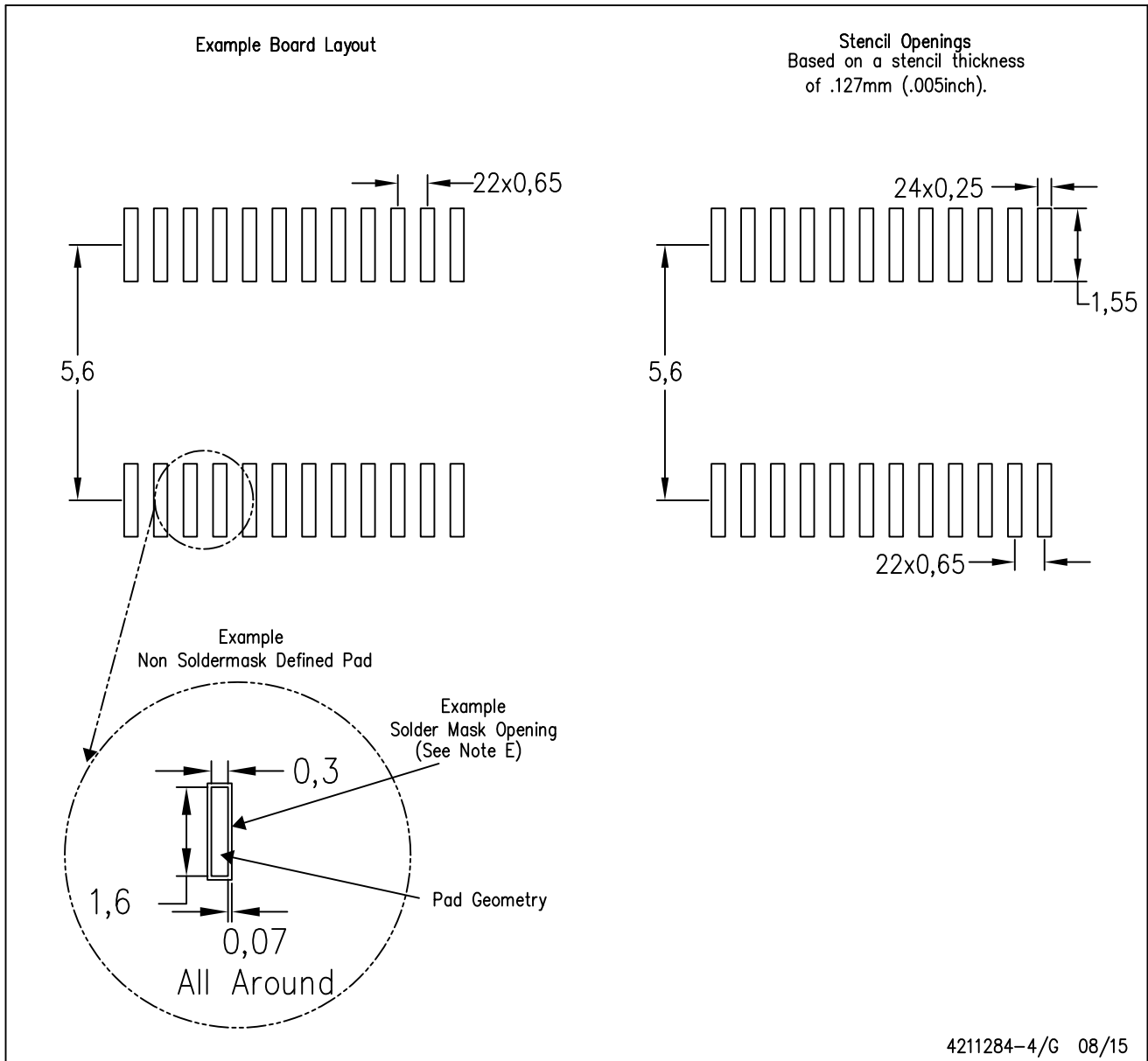
1,20 MAX

0,15 / 0,05

Seating Plane

◺ | 0,10

4040064−6/G 02/11

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.
       ◬C Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall
            not exceed 0,15 each side.
       ◬D Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
        E. Falls within JEDEC MO−153

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PW (R−PDSO−G24)   PLASTIC SMALL OUTLINE

Example Board Layout

Stencil Openings
Based on a stencil thickness
of .127mm (.005inch).

22x0,65

24x0,25

5,6

5,6

1,55

22x0,65

Example
Non Soldermask Defined Pad

Example
Solder Mask Opening
(See Note E)

0,3

1,6

Pad Geometry

0,07

All Around

4211284−4/G   08/15

NOTES: A.   All linear dimensions are in millimeters.
         B.   This drawing is subject to change without notice.
         C.   Publication IPC−7351 is recommended for alternate 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 for other stencil recommendations.
         E.   Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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DB (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN

0,65   0,38 / 0,22   ⊕ 0,15 Ⓜ

28   15

0,25 / 0,09

5,60 / 5,00   8,20 / 7,40

Gage Plane

0,25

0°−8°   0,95 / 0,55

1   14

A

2,00 MAX   0,05 MIN

Seating Plane

△ 0,10

DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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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