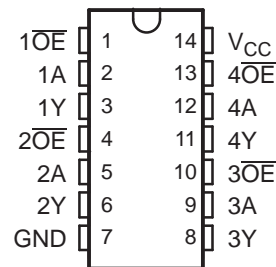


QUADRUPLE BUS BUFFER GATE WITH 3-STATE OUTPUTS

FEATURES

- Qualified for Automotive Applications
- Operates From 1.65 V to 3.6 V
- Specified From –40°C to 125°C
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 4.8 ns at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V 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, $T_A = 25^\circ\text{C}$
- 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)

D OR PW PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

This quadruple bus buffer gate is designed for 1.65-V to 3.6-V V_{CC} operation.

The SN74LVC125A features independent line drivers with 3-state outputs. Each output is disabled when the associated output-enable (\overline{OE}) input is high.

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.

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

ORDERING INFORMATION⁽¹⁾

T_A	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	SOIC – D	Reel of 2500	SN74LVC125AQDRQ1	LC125AQ
	TSSOP – PW	Reel of 2000	SN74LVC125AQPWRQ1	LC125AQ

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

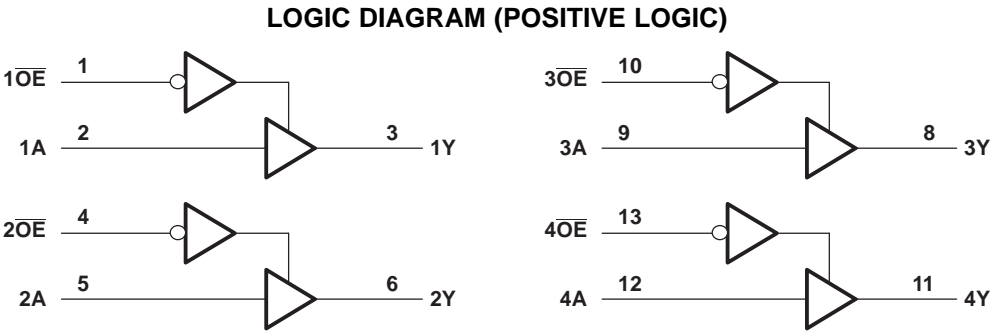
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

FUNCTION TABLE (EACH BUFFER)

INPUTS		OUTPUT Y
\overline{OE}	A	
L	H	H
L	L	L
H	X	Z



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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	–0.5	6.5	V
V _O	Output voltage range ⁽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⁾	D package		86 °C/W
		PW package		113 °C/W
T _{stg}	Storage temperature range	–65	150	°C
P _{tot}	Power dissipation ⁽⁵⁾⁽⁶⁾	T _A = –40°C to 125°C		500 mW

- (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 and output negative-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.
- (5) For the D package: above 70°C, the value of P_{tot} derates linearly with 8 mW/K.
- (6) For the PW package: above 60°C, the value of P_{tot} derates linearly with 5.5 mW/K.

Recommended Operating Conditions⁽¹⁾

			$T_A = 25^{\circ}\text{C}$		$-40^{\circ}\text{C to } 125^{\circ}\text{C}$		UNIT
			MIN	MAX	MIN	MAX	
V_{CC} Supply voltage	Operating		1.65	3.6	1.65	3.6	V
	Data retention only		1.5		1.5		
V_{IH} High-level input voltage	$V_{CC} = 1.65\text{ V to } 1.95\text{ V}$		$0.65 \times V_{CC}$		$0.65 \times V_{CC}$		V
	$V_{CC} = 2.3\text{ V to } 2.7\text{ V}$		1.7		1.7		
	$V_{CC} = 2.7\text{ V to } 3.6\text{ V}$		2		2		
V_{IL} Low-level input voltage	$V_{CC} = 1.65\text{ V to } 1.95\text{ V}$			$0.35 \times V_{CC}$		$0.35 \times V_{CC}$	V
	$V_{CC} = 2.3\text{ V to } 2.7\text{ V}$			0.7		0.7	
	$V_{CC} = 2.7\text{ V to } 3.6\text{ V}$			0.8		0.8	
V_I Input voltage			0	5.5	0	5.5	V
V_O Output voltage			0	V_{CC}	0	V_{CC}	V
I_{OH} High-level output current	$V_{CC} = 1.65\text{ V}$			–4		–4	mA
	$V_{CC} = 2.3\text{ V}$			–8		–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		4	mA
	$V_{CC} = 2.3\text{ V}$			8		8	
	$V_{CC} = 2.7\text{ V}$			12		12	mA
	$V_{CC} = 3\text{ V}$			24		24	
$\Delta t/\Delta v$ Input transition rise or fall rate				8		8	ns/V

(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.

Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V_{CC}	$T_A = 25^{\circ}\text{C}$			$-40^{\circ}\text{C to } 125^{\circ}\text{C}$		UNIT
			MIN	TYP	MAX	MIN	MAX	
V_{OH}	$I_{OH} = -100\text{ }\mu\text{A}$	1.65 V to 3.6 V	$V_{CC} - 0.2$			$V_{CC} - 0.2$		V
	$I_{OH} = -4\text{ mA}$	1.65 V	1.29			1.1		
	$I_{OH} = -8\text{ mA}$	2.3 V	1.9			1.75		
	$I_{OH} = -12\text{ mA}$	2.7 V	2.2			2.1		
		3 V	2.4			2.35		
	$I_{OH} = -24\text{ mA}$	3 V	2.3			2.1		
V_{OL}	$I_{OL} = 100\text{ }\mu\text{A}$	1.65 V to 3.6 V			0.1		0.2	V
	$I_{OL} = 4\text{ mA}$	1.65 V			0.24		0.45	
	$I_{OL} = 8\text{ mA}$	2.3 V			0.3		0.7	
	$I_{OL} = 12\text{ mA}$	2.7 V			0.4		0.5	
	$I_{OL} = 24\text{ mA}$	3 V			0.55		0.7	
I_I	$V_I = 5.5\text{ V or GND}$	3.6 V			± 1		± 10	μA
I_{OZ}	$V_O = V_{CC}\text{ or GND}$	3.6 V			± 1		± 10	μA
I_{CC}	$V_I = V_{CC}\text{ or GND, } I_O = 0$	3.6 V			1		20	μA
ΔI_{CC}	One input at $V_{CC} - 0.6\text{ V}$, Other inputs at $V_{CC}\text{ or GND}$	2.7 V to 3.6 V			500		500	μA
C_i	$V_I = V_{CC}\text{ or GND}$	3.3 V			5			pF

Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 1](#))

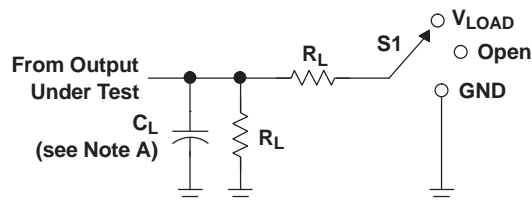
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			–40°C to 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t _{pd}	A	Y	2.7 V	1	3	5.3	1	7	ns
			3.3 V ± 0.3 V	1	2.5	4.6	1	6	
t _{en}	\overline{OE}	Y	2.7 V	1	3.3	6.4	1	8.5	ns
			3.3 V ± 0.3 V	1	2.4	5.2	1	7	
t _{dis}	\overline{OE}	Y	2.7 V	1	2.5	4.8	1	6.5	ns
			3.3 V ± 0.3 V	1	2.4	4.4	1	6	
t _{sk(o)}			3.3 V ± 0.3 V					1.5	ns

Operating Characteristics

T_A = 25°C

PARAMETER		TEST CONDITIONS	V _{CC}	TYP	UNIT
C _{pd}	Power dissipation capacitance per gate	f = 10 MHz	3.3 V	15	pF

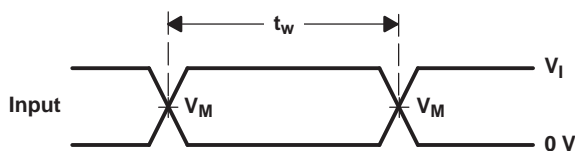
PARAMETER MEASUREMENT INFORMATION



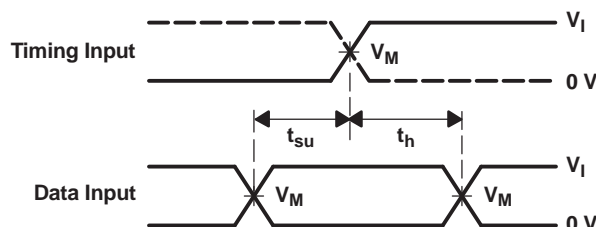
LOAD CIRCUIT

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

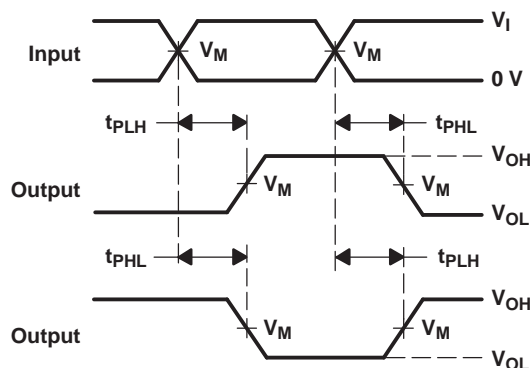
V_{CC}	INPUT		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	t_r/t_f					
2.7 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
3.3 V \pm 0.3 V	2.7 V	≤ 2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V



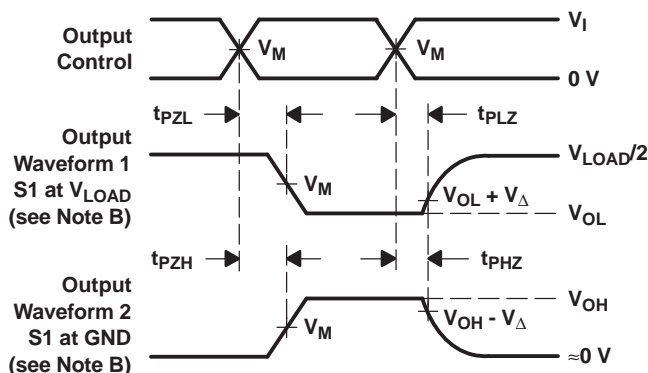
VOLTAGE WAVEFORMS
PULSE DURATION



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:
- 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: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$.
 - 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 1. Load Circuit 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⁾	Samples (Requires Login)
CLVC125AQPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LVC125AQDRG4Q1	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LVC125AQDRQ1	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74LVC125AQPWRQ1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

⁽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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OTHER QUALIFIED VERSIONS OF SN74LVC125A-Q1 :

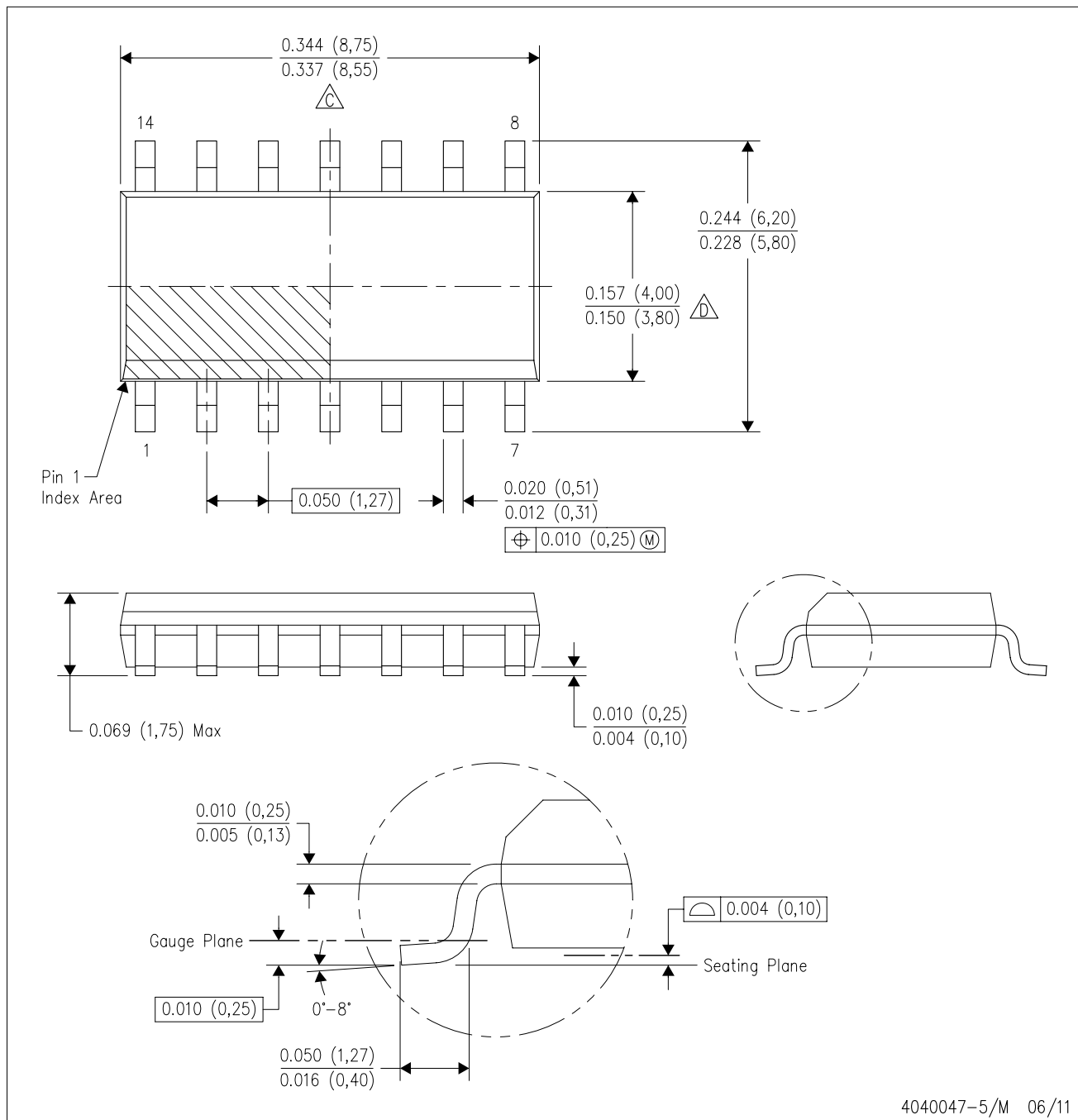
- Catalog: [SN74LVC125A](#)
- Enhanced Product: [SN74LVC125A-EP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

D (R-PDSO-G14)

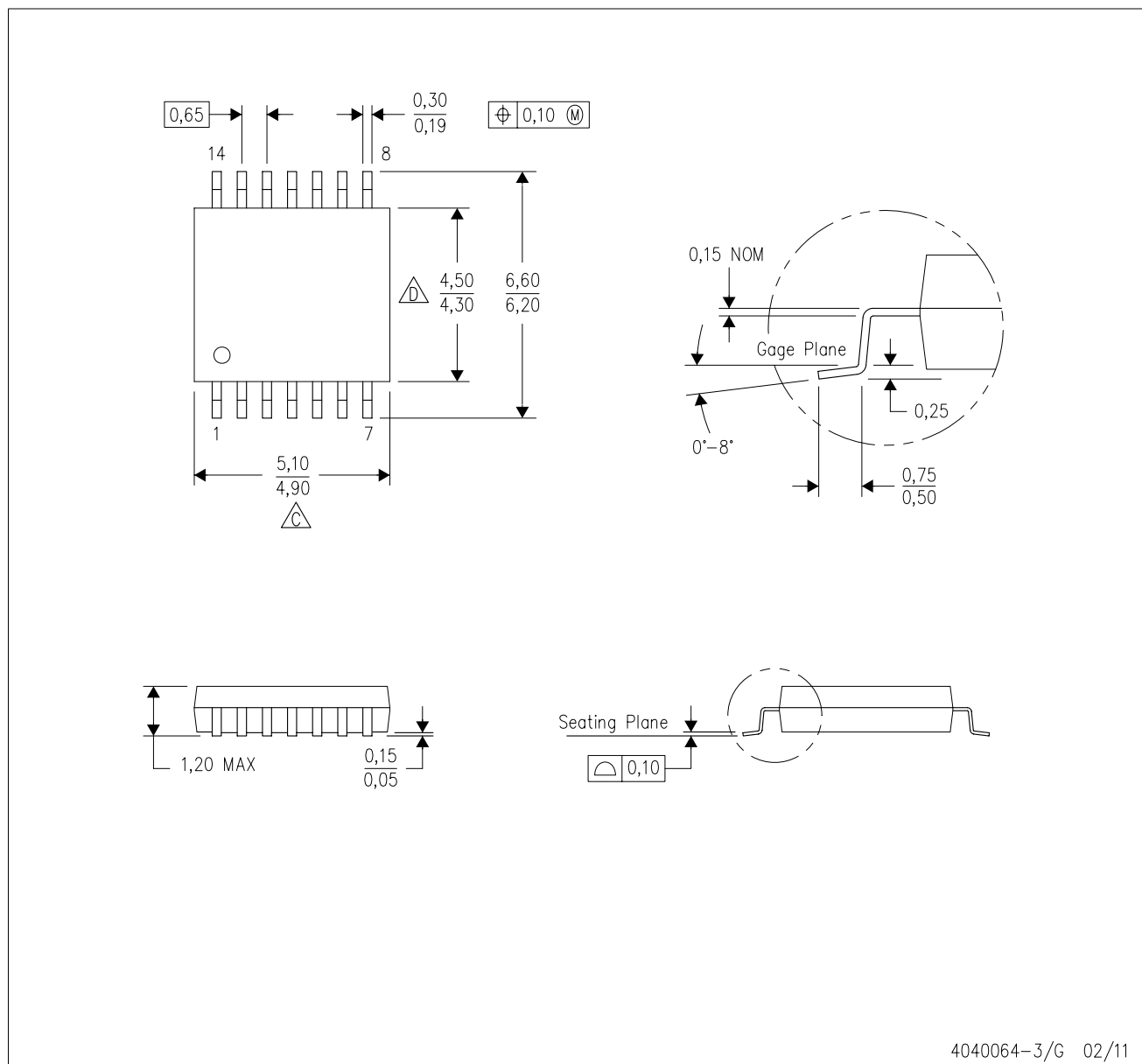
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - 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 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE

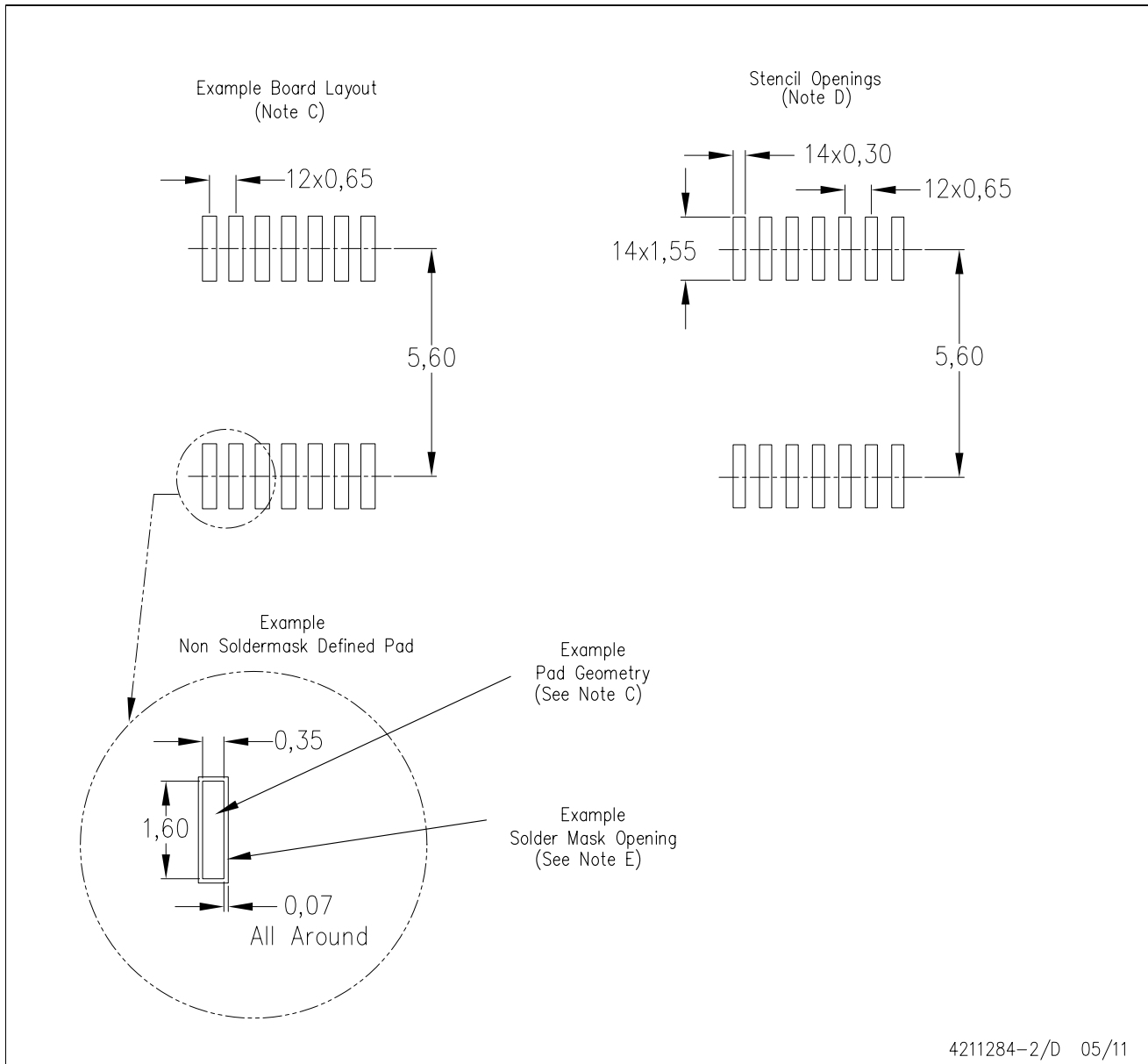


4040064-3/G 02/11

- 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

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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