





SN74LV125AT SCES629B - MAY 2005 - REVISED JULY 2023

SN74LV125AT Quadruple Bus Buffer Gates With 3-State Outputs

1 Features

Texas

INSTRUMENTS

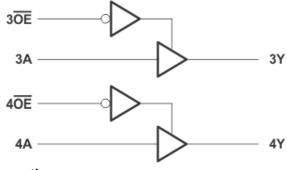
- Inputs Are TTL-Voltage Compatible
- 4.5-V to 5.5-V V_{CC} Operation
- Typical t_{pd} of 3.8 ns at 5 V
- Typical V_{OLP} (Output Ground Bounce) < 0.8 V at $V_{CC} = 5 V, T_A = 25^{\circ}C$
- Typical V_{OHV} (Output V_{OH} Undershoot) > 2.3 V at V_{CC} = 5 V, T_A = 25°C
- Support Mixed-Mode Voltage Operation on All Ports
- Ioff Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17

2 Description

The SN74LV125AT is a quadruple bus buffer gate. This device features independent line drivers with 3-state outputs. Each output is disabled when the associated output-enable (\overline{OE}) input is high.

Package Information								
PART NUMBER PACKAGE ¹ PACKAGE								
	RGY (VQFN, 14)	3.50 mm x 3.50 mm						
	D (SOIC, 14)	8.65 mm × 6 mm						
SN74LV125AT	NS (SO, 14)	10.20 mm x 7.8 mm						
	DB (SSOP, 14)	6.20 mm x 7.8 mm						
	PW (TSSOP, 14)	5.00 mm x 6.4 mm						

- (1) For all available packages, see the orderable addendum at the end of the data sheet.
- The package size (length × width) is a nominal value and (2) includes pins, where applicable.



Simplified Schematic

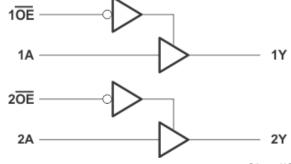






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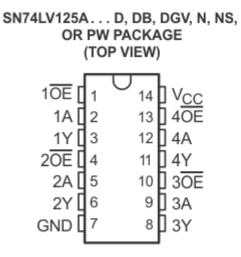
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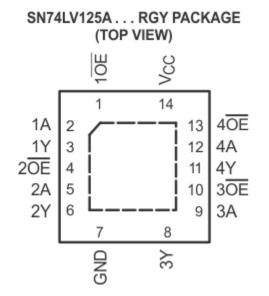
3 Revision History

Cł	hanges from Revision A (May 2023) to Revision B (July 2023)	Page
•	Added Package Information table, Pin Functions table, ESD Ratings table, Thermal Information table, L	Device
	Functional Modes, Device and Documentation Support section, and Mechanical, Packaging, and Order Information section	



4 Pin Configuration and Functions





	PIN	TYPE ⁽¹⁾	DESCRIPTION
NO.	NAME		DESCRIPTION
1	1 0E	I	Output Enable 1, Active Low
2	1A	I	1A Input
3	1Y	0	1Y Output
4	2 0E	I	Output Enable 2, Active Low
5	2A	I	2A Input
6	2Y	0	2Y Output
7	GND	—	Ground Pin
8	3Y	0	3Y Output
9	3A	I	3A Input
10	3 0E	I	Output Enable 3, Active Low
11	4Y	0	4Y Output
12	4A	I	4A Input
13	40E	I	Output Enable 4, Active Low
14	V _{CC}	_	Power Pin

(1) Signal Types: I = Input, O = Output, I/O = Input or Output.



5 Specifications 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

			MIN	MAX	UNIT
V _{CC}	Supply voltage		-0.5	7	V
VI	Input voltage range ⁽²⁾		-0.5	7	V
Vo	Voltage range applied to any output in the high-impedar	nce or power-off state ⁽²⁾	-0.5	7	V
Vo	Output voltage range ⁽²⁾ (3)		-0.5	V _{CC} + 0.5	V
I _{IK}	Input clamp current	V ₁ < 0		-20	mA
I _{ок}	Output clamp current	V ₀ < 0		±50	mA
lo	Continuous output current	$V_{O} = 0$ to V_{CC}		±35	mA
	Continuous current through V_{CC} or GND	·		±70	mA
T _{stg}	Storage temperature		-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 Section 5.3 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) This value is limited to 5.5-V maximum.

5.2 ESD Ratings

			MAX	UNIT
		Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins ⁽¹⁾	±2000	
V _(ESD)	Electrostatic discharge	Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ⁽²⁾	±1000	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.



5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

			SN74LV125A	SN74LV125AT		
			MIN	MAX	UNIT	
V _{CC}	Supply voltage		4.5	5.5	V	
V _{IH}	High-level input voltage	V _{CC} = 4.5 V to 5.5 V	2		V	
V _{IL}	Low-level input voltage	V _{CC} = 4.5 V to 5.5 V		0.8	V	
VI	Input voltage		0	5.5	V	
V	Output veltage	High or low state	0	V _{CC}	V	
Vo	Output voltage	3-state	0	5.5	v	
I _{OH}	High-level output current	V _{CC} = 4.5 V to 5.5 V		–16	mA	
I _{OL}	Low-level output current	V_{CC} = 4.5 V to 5.5 V		16	mA	
$\Delta t/\Delta v$	Input transition rise or fall rate	V _{CC} = 4.5 V to 5.5 V		20	ns/V	
T _A	Operating free-air temperature		-40	125	°C	

 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 (SCBA004).

5.4 Thermal Information

			:	SN74LV125A	Г		
	THERMAL METRIC ⁽¹⁾	D	DB	NS	PW	RGY	UNIT
				14 PINS	•	•	
R_{\thetaJA}	Junction-to-ambient thermal resistance	86	96	76	113	47	°C/W

(1) For more information about traditional and new thermal metrics, see the IC Package Thermal Metrics application report (SPRA953).



5.5 Electrical Characteristics

	PARAMETER	TEST CONDITIONS	Vcc	Τ ₄	T _A = 25°C		–40°C to 85°C		–40°C to 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V	High-level output voltage	I _{OH} = –50 μA	4.5 V	4.4	4.5		4.4		4.4		v
V _{OH}	ngn-level output voltage	I _{OH} = -16 mA	4.5 V	3.8			3.8		3.8		
V _{OL}	Low-level output voltage	I _{OL} = 50 μA	4.5 V		0	0.1		0.1		0.1	v
VOL	Low-level output voltage	I _{OL} = 16 mA	4.5 V			0.55		0.55		0.55	
I	Input leakage current	V ₁ = 5.5 V or GND	0 to 5.5 V			±1		±1		±1	μA
I _{OZ}	Off-State (High-Impedance State) Output Current	$V_{O} = V_{CC}$ or GND	5.5 V			±0.25		±2.5		±2.5	μA
I _{CC}	Static supply current	$V_{I} = V_{CC} \text{ or GND}, I_{O} = 0$	5.5 V			2		20		20	μA
ΔI _{CC} ⁽¹⁾	Additional static supply current	One input at 3.4 V, Other inputs at V _{CC} or GND	5.5 V			1.35		1.5		1.5	
I _{off}	Input/Output Power-Off Leakage Current	V_1 or V_0 = 0 to 5.5 V	0			0.5		5		5	μA
Ci	Input capacitance	V _I = V _{CC} or GND			2						pF

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

(1) This is the increase in supply current for each input at one of the specified TTL voltage levels, rather than 0 V or V_{CC}.

5.6 Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Load Circuit And Voltage Waveforms)

PARAMETER	FROM	то	LOAD	Τ,	↓ = 25°C		–40°C to	85°C	–40°C to	125°C	UNIT
FARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNIT
t _{pd}	A	Y		1.9	3.8	5.5	1	6.5	1	8.5	
t _{en}	ŌE	Y	C _L = 15 pF	2	3.6	5.1	1	6	1	7.5	ns
t _{dis}	ŌE	Y		1.5	3.2	6.8	1	8	1	10	
t _{pd}	A	Y		2.9	5.3	7.5	1	8.5	1	10.5	
t _{en}	ŌE	Y	C ₁ = 50 pF	2.8	5.1	7.1	1	8	1	9.5	n 0
t _{dis}	ŌE	Y	C50 pr	2.8	6.1	8.8	1	10	1	10	ns
t _{sk(o)}						1		1		1	

5.7 Noise Characteristics

 V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C

		SN	74LV125AT		UNIT
		MIN	TYP	MAX	UNIT
V _{OL(P)}	Quiet output, maximum dynamic V _{OL}		1.1	1.5	V
V _{OL(V)}	Quiet output, minimum dynamic V _{OL}		-0.3	-0.8	V
V _{OH(V)}	Quiet output, minimum dynamic V _{OH}		3		V
V _{IH(D)}	High-level dynamic input voltage	2			V
V _{IL(D)}	Low-level dynamic input voltage			0.8	V

(1) Characteristics are for surface-mount packages only.



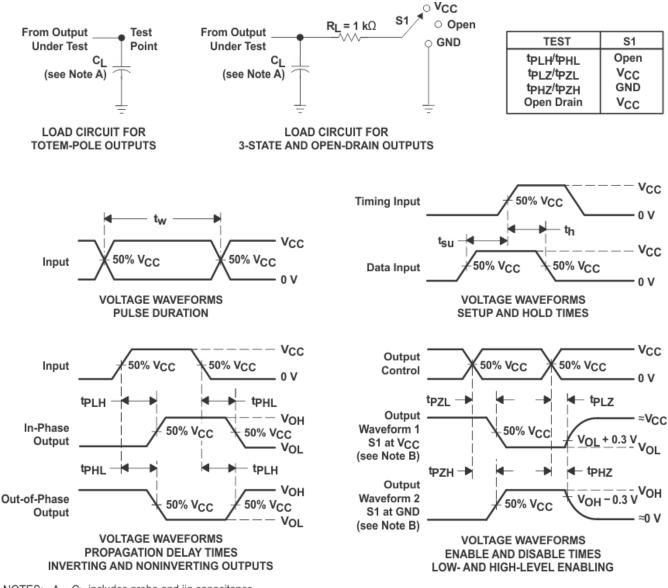
5.8 Operating Characteristics

 V_{CC} = 5 V, T_A = -25°C

PARAMETER			TEST CO	ONDITIONS	TYP	UNIT
C _{pd}	Power dissipation capacitance	Outputs enabled	C _L = 50 pF,	f = 10 MHz	16	pF



6 Parameter Measurement Information



NOTES: A. CL 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 ≤ 1 MHz, Z_Q = 50 Ω, t_f ≤ 3 ns, t_f ≤ 3 ns.
- D. The outputs are measured one at a time, with one input transition per measurement.
- E. tpLz and tpHz are the same as tdis-
- F. t_{PZL} and t_{PZH} are the same as t_{en}.
- G. tPHL and tPLH are the same as tpd.
- H. All parameters and waveforms are not applicable to all devices.

Figure 6-1. Load Circuit And Voltage Waveforms



7 Detailed Description

7.1 Overview

The SN74LV125AT is a quadruple bus buffer gate. This device 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.

This device is 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.

7.2 Functional Block Diagram

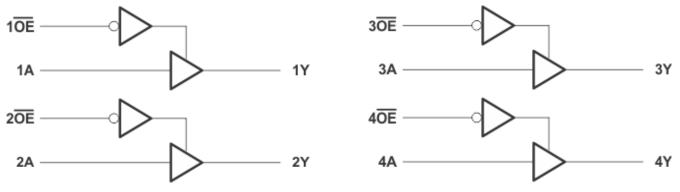


Figure 7-1. Logic Diagram (Positive Logic)

7.3 Device Functional Modes

Table 7-1. Function Table (Each Buffer)

INPU	TS ⁽¹⁾	OUTPUT ⁽²⁾				
OE	Α	Y				
L	Н	Н				
L	L	L				
Н	Х	Z				

(1) H = High Voltage Level, L = Low Voltage Level, X = Don't Care

(2) H = Driving High, L = Driving Low, Z = High Impedance State



8 Device and Documentation Support

8.1 Documentation Support

8.1.1 Related Documentation

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 8-1. Related Links										
PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY					
SN74LV125AT	Click here	Click here	Click here	Click here	Click here					

8.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

8.3 Support Resources

TI E2E[™] support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

8.4 Trademarks

TI E2E[™] is a trademark of Texas Instruments.

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8.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.6 Glossary

TI Glossary This glossary lists and explains terms, acronyms, and definitions.

9 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.



PACKAGING INFORMATION

Orderable Device	Status	Package Type	•	Pins	•	Eco Plan	Lead finish/	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	Ball material	(3)		(4/5)	
				_			(6)				
SN74LV125ATD	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-40 to 85	LV125AT	
SN74LV125ATDBR	ACTIVE	SSOP	DB	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV125AT	Samples
SN74LV125ATDR	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	LV125AT	Samples
SN74LV125ATNSR	ACTIVE	SOP	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV125AT	Samples
SN74LV125ATPWR	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LV125AT	Samples
SN74LV125ATPWT	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 85	LV125AT	
SN74LV125ATRGYR	ACTIVE	VQFN	RGY	14	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	VV125	Samples

⁽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 (CI) 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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STRUMENTS

TAPE AND REEL INFORMATION





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal												
Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LV125ATDBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74LV125ATDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LV125ATDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LV125ATNSR	SOP	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74LV125ATPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV125ATRGYR	VQFN	RGY	14	3000	330.0	12.4	3.75	3.75	1.15	8.0	12.0	Q1



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PACKAGE MATERIALS INFORMATION

7-Dec-2024



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV125ATDBR	SSOP	DB	14	2000	356.0	356.0	35.0
SN74LV125ATDR	SOIC	D	14	2500	356.0	356.0	35.0
SN74LV125ATDR	SOIC	D	14	2500	356.0	356.0	35.0
SN74LV125ATNSR	SOP	NS	14	2000	356.0	356.0	35.0
SN74LV125ATPWR	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74LV125ATRGYR	VQFN	RGY	14	3000	360.0	360.0	36.0

D0014A



PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



NOTES:

- 1. All linear dimensions are in millimeters. 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 0.43 mm, per side.
- 5. Reference JEDEC registration MS-012, variation AB.



D0014A

EXAMPLE BOARD LAYOUT

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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.



D0014A

EXAMPLE STENCIL DESIGN

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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.



MECHANICAL DATA

PLASTIC SMALL-OUTLINE PACKAGE

0,51 0,35 ⊕0,25⊛ 1,27 8 14 0,15 NOM 5,60 8,20 5,00 7,40 \bigcirc Gage Plane ₽ 0,25 7 1 1,05 0,55 0°-10° Δ 0,15 0,05 Seating Plane — 2,00 MAX 0,10PINS ** 14 16 20 24 DIM 10,50 10,50 12,90 15,30 A MAX A MIN 9,90 9,90 12,30 14,70 4040062/C 03/03

NOTES: A. All linear dimensions are in millimeters.

NS (R-PDSO-G**)

14-PINS SHOWN

- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



DB0014A



PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

- 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. Reference JEDEC registration MO-150.



DB0014A

EXAMPLE BOARD LAYOUT

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



DB0014A

EXAMPLE STENCIL DESIGN

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

8. Board assembly site may have different recommendations for stencil design.



PW0014A



PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

- 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.



PW0014A

EXAMPLE BOARD LAYOUT

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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.



PW0014A

EXAMPLE STENCIL DESIGN

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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.



RGY 14

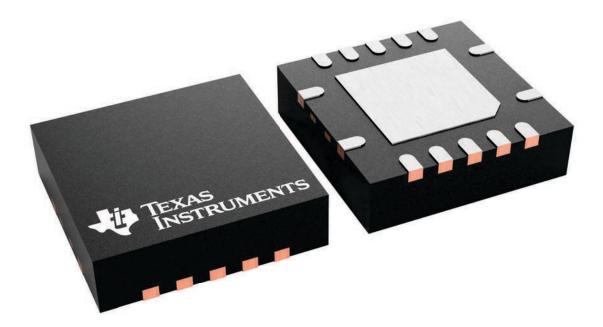
3.5 x 3.5, 0.5 mm pitch

GENERIC PACKAGE VIEW

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary. Refer to the product data sheet for package details.





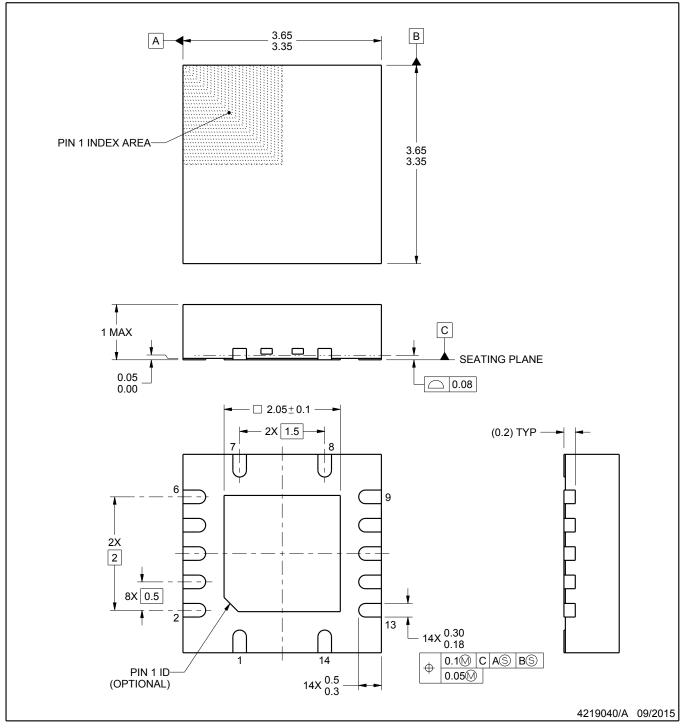
RGY0014A



PACKAGE OUTLINE

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES:

- 1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
 The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

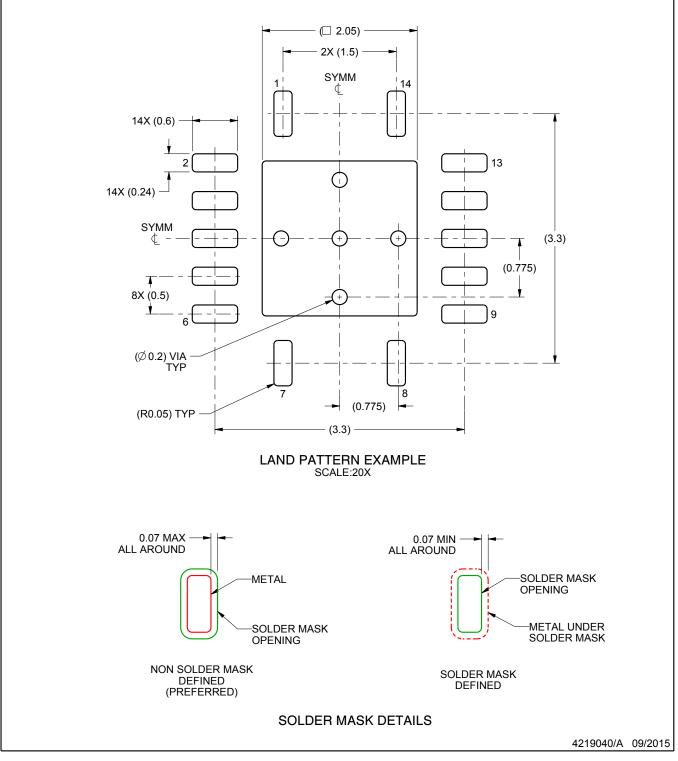


RGY0014A

EXAMPLE BOARD LAYOUT

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

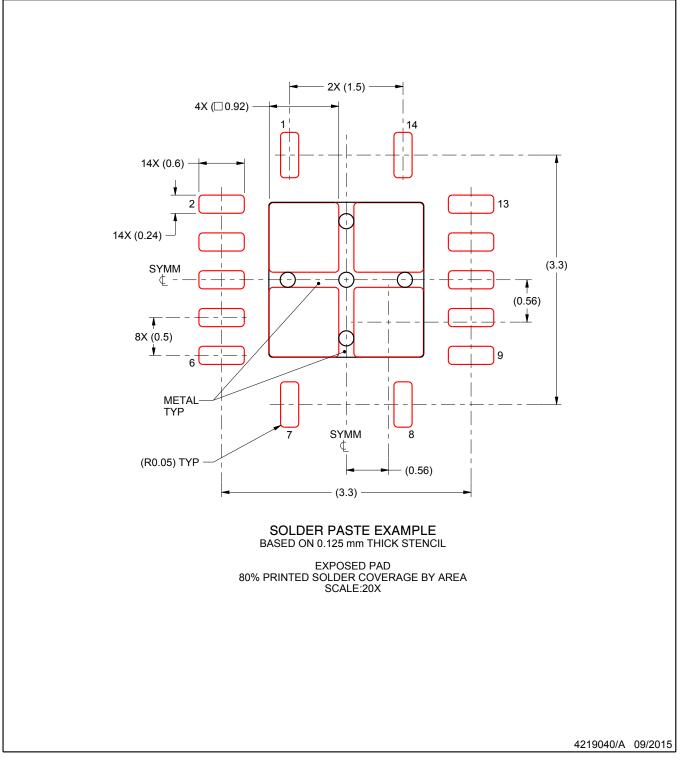


RGY0014A

EXAMPLE STENCIL DESIGN

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.



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