





SN74AHCT08Q-Q1 SGDS021D - FEBRUARY 2002 - REVISED FEBRUARY 2024

SN74AHCT08Q-Q1 Automotive Quadruple 2-Input Positive-AND Gates

1 Features

Texas

INSTRUMENTS

- Qualified for automotive applications
- EPIC[™] (enhanced-performance implanted CMOS) process
- Inputs are TTL-voltage compatible
- ٠ Latch-up performance exceeds 250mA per JESD 17

2 Applications

- Combine power good signals
- Combine enable signals

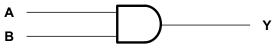
3 Description

The SN74AHCT08Q-Q1 devices are quadruple 2input positive-AND gates. These devices perform the Boolean function $Y = A \times B$ or $Y = \overline{A + B}$ in positive logic.

Package	Information
I achage	mormation

PART NUMBER	PACKAGE ⁽¹⁾	PACKAGE SIZE ⁽²⁾	BODY SIZE ⁽³⁾					
	D (SOIC, 14)	8.65mm × 6mm	8.65mm × 3.91mm					
SN74AHCT08Q-Q1	PW (TSSOP, 14)	5.00mm × 6.4mm	5.00mm × 4.40mm					
	BQA (WQFN, 14)	3.00mm × 2.50mm	3.00mm × 2.50mm					

- For more information, see Section 11. (1)
- (2)The package size (length × width) is a nominal value and includes pins, where applicable.
- (3) The body size (length × width) is a nominal value and does not include pins.



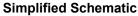






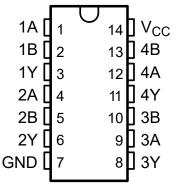
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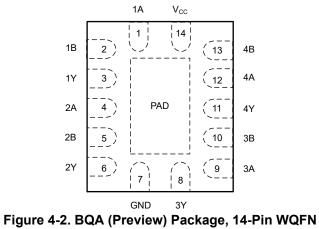
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4 Pin Configuration and Functions







(Top View)

Table	4-1.	Pin	Functions
Table			i uncuona

PIN		ТҮРЕ	DESCRIPTION			
NAME	NO.		DESCRIPTION			
1A	1	Input	Channel 1, Input A			
1B	2	Input	Channel 1, Input B			
1Y	3	Output	Channel 1, Output Y			
2A	4	Input	Channel 2, Input A			
2B	5	Input	Channel 2, Input B			
2Y	6	Output	Channel 2, Output Y			
GND	7	_	Ground			
3Y	8	Output	Channel 3, Output Y			
3A	9	Input	Channel 3, Input A			
3B	10	Input	Channel 3, Input B			
4Y	11	Output	Channel 4, Output Y			
4A	12	Input	Channel 4, Input A			
4B	13	Input	Channel 4, Input B			
V _{cc}	14	_	Positive Supply			
Thermal Pad	(1)	_	The thermal pad can be connected to GND or left floating. Do not connect to any other signal or supply			

(1) BQA package only.



5 Specifications

5.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage range		-0.5	7	V
VI	Input voltage range ⁽²⁾			7	V
Vo	Output voltage range ⁽²⁾	put voltage range ⁽²⁾		V _{CC} + 0.5	V
I _{IK}	Input clamp current	V _I < 0		-20	mA
I _{OK}	Output clamp current	V_{O} < 0 or V_{O} > V_{CC}		±20	mA
I _O	Continuous output current	$V_{O} = 0$ to V_{CC}		±25	mA
	Continuous current through V _{CC} or GND			±50	mA
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, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

5.2 ESD Ratings

			VALUE	UNIT
V	Electrostatic discharge	Human body model (HBM), per AEC Q100-002 HBM ESD Classification Level $2^{(1)}$	±2000	V
V _(ESD)	Electrostatic discharge	Charged device model (CDM), per AEC Q100-011 CDM ESD Classification Level C4B	±1000	V

(1) AEC Q100-002 indicate that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification

5.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
V _{CC}	Supply voltage	4.5	5.5	V
V _{IH}	High-level input voltage	2		V
V _{IL}	Low-level input voltage		0.8	V
VI	Input voltage	0	5.5	V
Vo	Output voltage	0	V _{CC}	V
I _{OH}	High-level output current		-8	mA
I _{OL}	Low-level output current		8	mA
Δt/Δv	Input transition rise or fall rate		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



5.4 Thermal Information

		:	SN74AHCT08Q-Q1			
	THERMAL METRIC ⁽¹⁾	D (SOIC)	PW (TSSOP)	BQA (WQFN)	UNIT	
		14 PINS	14 PINS	14 PINS		
R _{θJA}	Junction-to-ambient thermal resistance	124.6	113	88.3	°C/W	

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

5.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V	۲	= 25°C		-40°C to 125°C		UNIT
PARAMETER	TEST CONDITIONS	V _{cc}	MIN	TYP	MAX	MIN	MAX	UNIT
V _{OH}	I _{OH} = –50 μA	4.5 V	4.4	4.5		4.4		V
♥ OH	I _{OH} =8 mA	4.5 V	3.94			3.8		v
V	I _{OL} = 50 μA	4.5 V			0.1		0.1	V
V _{OL}	I _{OL} = 8 mA	4.5 V			0.36		0.44	v
I	V _I = 5.5 V or GND	0 V to 5.5 V			±0.1		±1	μΑ
I _{CC}	$V_{I} = V_{CC}$ or GND, $I_{O} = 0$	5.5 V			2		20	μA
$\Delta I_{CC}^{(1)}$	One input at 3.4 V, Other inputs at V_{CC} or GND	5.5 V			1.35		1.5	mA
C _i	V _I = V _{CC} or GND	5 V		4	10		10	pF

(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, V_{CC} = 5 V ± 0.5 V

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO	LOAD	T,	_A = 25°C		-40°C to '	125°C	UNIT				
	(INPOT)	(OUTPUT)	CAPACITANCE	MIN	ТҮР	MAX	MIN	MAX	UNIT				
t _{PLH}	A or B	v	C ₁ = 15 pF		5	6.9	1	8	ns				
t _{PHL}	AUB	I		0L = 13 pr	0L – 13 pr		ο _L – 13 pr		5	6.9	1	8	115
t _{PLH}	A or B	v	C _L = 50 pF		5.5	7.9	1	9	ns				
t _{PHL}	7010		0 _L = 50 pr		5.5	7.9	1	9	115				

5.7 Noise Characteristics

 $V_{CC} = 5 V, C_{L} = 50 pF, T_{A} = 25^{\circ}C^{(1)}$

	PARAMETER	SN74A	UNIT		
		MIN	ТҮР	MAX	UNIT
V _{OL(P)}	Quiet output, maximum dynamic V _{OL}		0.4	0.8	V
V _{OL(V)}	Quiet output, minimum dynamic V _{OL}		-0.4	-0.8	V
V _{OH(V)}	Quiet output, minimum dynamic V _{OH}	4.4			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.

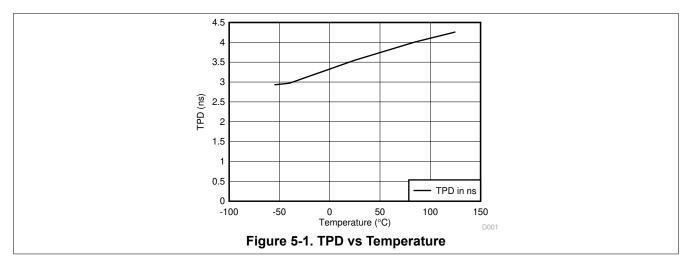


5.8 Operating Characteristics

 V_{CC} = 5 V, T_A = 25°C

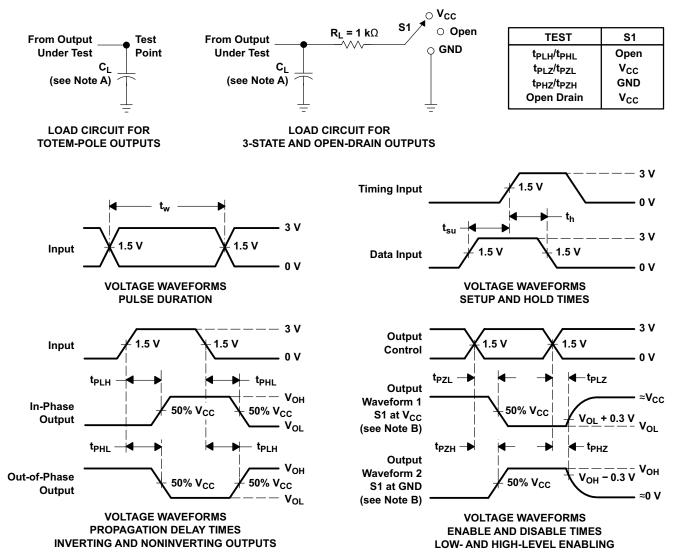
	PARAMETER	TEST	CONDITIONS	TYP	UNIT
C _{pd}	Power dissipation capacitance	No load,	f = 1 MHz	18	pF

5.9 Typical Characteristics





6 Parameter Measurement Information



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 \leq 1 MHz, Z_O = 50 Ω , t_r \leq 3 ns, t_f \leq 3 ns.
- D. The outputs are measured one at a time with one input transition per measurement.
- E. 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 SN74AHCT08Q-Q1 devices are quadruple 2-input positive-AND gates with low drive that will produce slow rise and fall times. This slow transition reduces ringing on the output signal. The device has TTL inputs that allow up translation from 3.3 V to 5 V. The inputs are high impedance when $V_{CC} = 0$ V.

7.2 Functional Block Diagram



7.3 Feature Description

- · Slow rise and fall time on outputs allow for low-noise outputs
- TTL inputs allow up translation from 3.3 V to 5 V

7.4 Device Functional Modes

Table 7-1 is the function table for the SN74AHCT08Q-Q1.

(Each Cata)	Table 7-1. Function Table									
(Each Gale)	(Each Gate)									

INP	UTS	OUTPUT
Α	В	Y
Н	Н	Н
L	х	L
Х	L	L



8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

The SN74AHCT08Q-Q1 devices are low-drive CMOS devices that can be used for a multitude of bus-interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs. The TTL inputs can except voltages down to 3.3 V and translate up to 5 V.

8.2 Typical Application

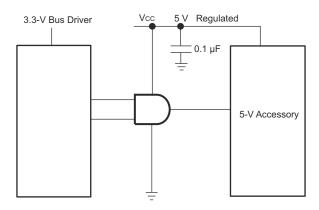


Figure 8-1. Typical Application Diagram

8.2.1 Design Requirements

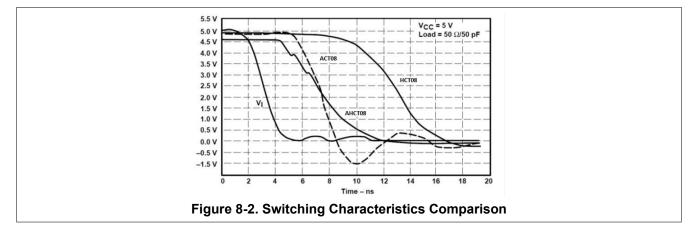
This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads, so routing and load conditions should be considered to prevent ringing.

8.2.2 Detailed Design Procedure

- 1. Recommended input conditions:
 - Rise time and fall time specs: See ($\Delta t/\Delta V$) in the *Recommended Operating Conditions* table.
 - Specified High and low levels: See (V_{IH} and V_{II}) in the *Recommended Operating Conditions* table.
 - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid V_{CC}
- 2. Recommend output conditions:
 - Load currents should not exceed 25 mA per output and 50 mA total for the part
 - Outputs should not be pulled above V_{CC}



8.2.3 Application Curves



8.3 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the *Recommended Operating Conditions* table.

Each V_{CC} pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 μ F is recommended. If there are multiple V_{CC} pins, 0.01 μ F or 0.022 μ F is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 μ F and 1 μ F are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

8.4 Layout

8.4.1 Layout Guidelines

When using multiple bit logic devices, inputs should never float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Figure 8-3 shows the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V_{CC} ; whichever makes more sense or is more convenient. It is generally acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, then it will disable the outputs section of the part when asserted. This will not disable the input section of the IOs, so they cannot float when disabled.

8.4.2 Layout Example

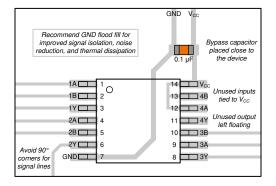


Figure 8-3. Layout example for the SN74AHCT08Q-Q1



9 Device and Documentation Support

9.1 Documentation Support (Analog)

9.1.1 Related Links

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 9-1. Related Links										
PARTS PRODUCT FOLDER		SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY					
SN74AHCT08Q-Q1	Click here	Click here	Click here	Click here	Click here					

9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* 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.

9.3 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.

9.4 Trademarks

EPIC[™] is a trademark of Texas Instruments Incorporated.

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

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9.5 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.

9.6 Glossary

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

10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

С	hanges from Revision C (May 2023) to Revision D (February 2024)	Page
•	Added package size to Package Information table	1
•	Updated RθJA value: D = 86 to 124.6, all values in °C/W	5

С	Changes from Revision B (December 2022) to Revision C (May 2023)						
•	Changed the status of the BQA package from: preview to: active	1					



11 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)	
SN74AHCT08QDRG4Q1	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHCT08Q	Samples
SN74AHCT08QDRQ1	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHCT08Q	Samples
SN74AHCT08QPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HB08Q	Samples
SN74AHCT08QPWRQ1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HB08Q	Samples
SN74AHCT08QWBQARQ1	ACTIVE	WQFN	BQA	14	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHT08Q	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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PACKAGE OPTION ADDENDUM

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

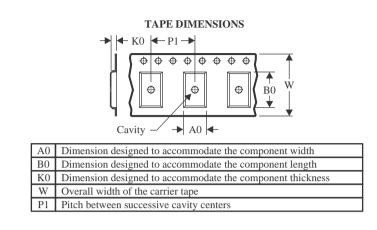


Texas

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
SN74AHCT08QPWRG4Q1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHCT08QPWRG4Q1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHCT08QPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHCT08QPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHCT08QWBQARQ1	WQFN	BQA	14	3000	180.0	12.4	2.8	3.3	1.1	4.0	12.0	Q1



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PACKAGE MATERIALS INFORMATION

11-May-2024



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AHCT08QPWRG4Q1	TSSOP	PW	14	2000	353.0	353.0	32.0
SN74AHCT08QPWRG4Q1	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74AHCT08QPWRQ1	TSSOP	PW	14	2000	353.0	353.0	32.0
SN74AHCT08QPWRQ1	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74AHCT08QWBQARQ1	WQFN	BQA	14	3000	210.0	185.0	35.0

BQA 14

2.5 x 3, 0.5 mm pitch

GENERIC PACKAGE VIEW

WQFN - 0.8 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.





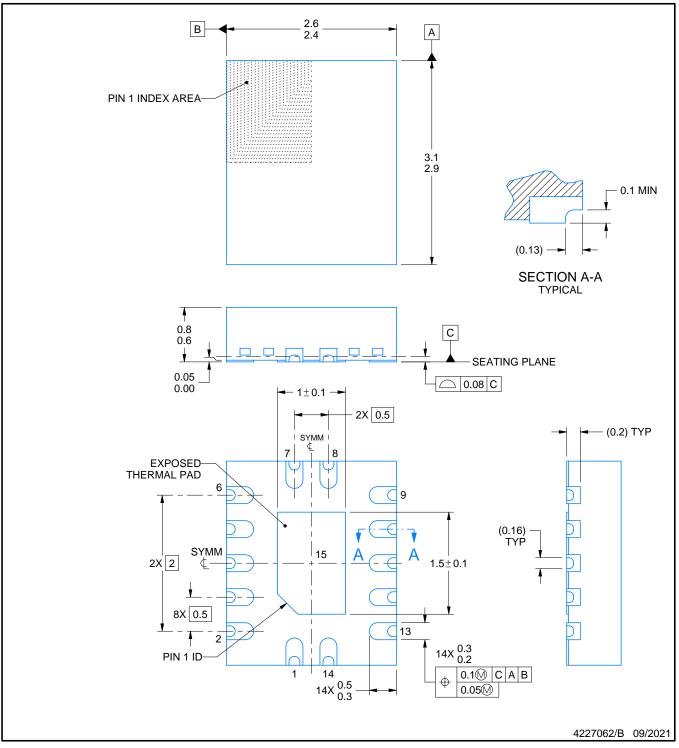
BQA0014B



PACKAGE OUTLINE

WQFN - 0.8 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. 2. This drawing is subject to change without notice.
- 3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

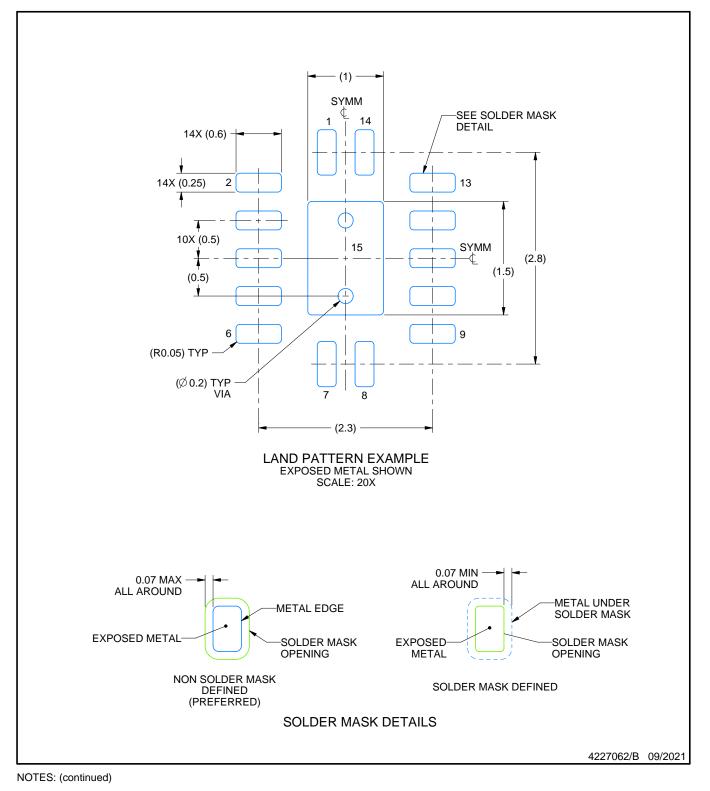


BQA0014B

EXAMPLE BOARD LAYOUT

WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



 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).

5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

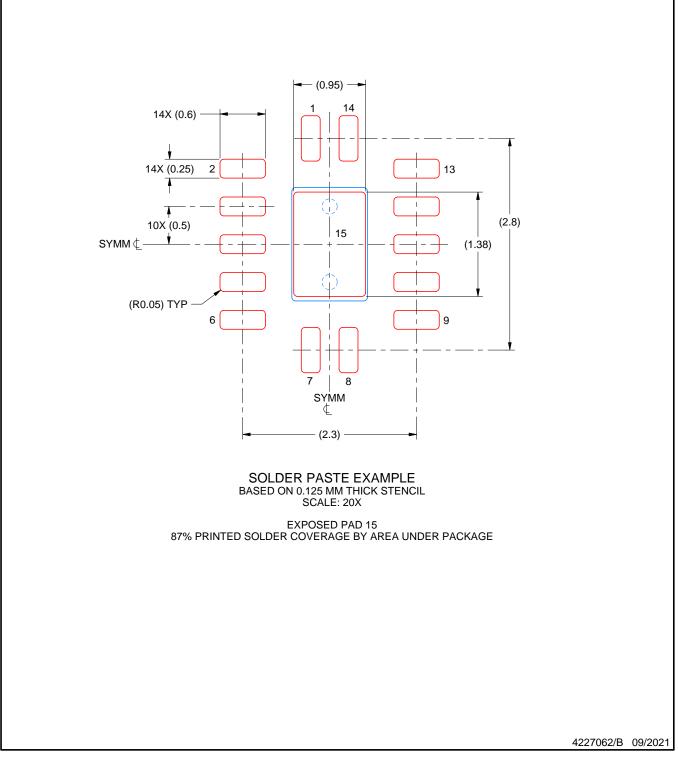


BQA0014B

EXAMPLE STENCIL DESIGN

WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



NOTES: (continued)

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



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.
- 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.
- 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



A. An integration of the information o

Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

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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