

SN74LV86A-Q1 汽车类四路双输入异或门

1 特性

- 符合汽车应用要求
- 工作范围为 2V 至 5.5V V_{CC}
- V_{OLP} (输出接地反弹) 典型值小于 0.8V (V_{CC} = 3.3V、 T_A = 25°C 时)
- V_{OHV} (输出 V_{OH} 下冲) 典型值大于 2.3V (V_{CC} = 3.3V、 T_A = 25°C 时)
- 所有端口上均支持混合模式电压运行

2 说明

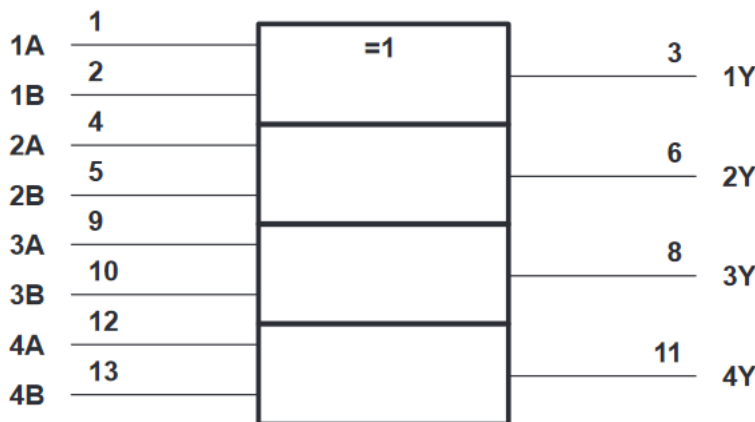
SN74LV86A-Q1 器件是一款四路双输入异或门，旨在 2V 至 5.5V V_{CC} 下运行。

封装信息

器件型号	封装 ¹	封装尺寸 ²
SN74LV86A-Q1	PW (TSSOP , 14)	5.00 mm x 6.4 mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。

(2) 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。



逻辑符号

此符号符合 ANSI/IEEE 标准 91-1984 和 IEC 出版物 617-12。



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3 Revision History

Changes from Revision C (April 2008) to Revision D (August 2023)	Page
• 添加了封装信息表、引脚功能表、ESD 等级表、热信息表、器件功能模式、器件和文档支持部分以及机械、封装和可订购信息 部分.....	1

4 Pin Configuration and Functions

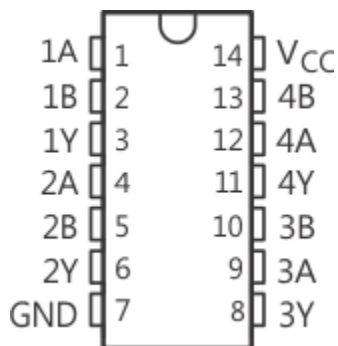


图 4-1. PW Package,
 14-Pin TSSOP
 (Top View)

PIN		TYPE ⁽¹⁾	DESCRIPTION
NO.	NAME		
1	1A	I	1A input
2	1B	I	1B
3	1Y	O	1Y
4	2A	I	2A
5	2B	I	2B
6	2Y	O	2Y
7	GND	—	GND
8	3Y	O	3Y
9	3A	I	3A
10	3B	I	3B
11	4Y	O	4Y
12	4A	I	4A
13	4B	I	4B
14	V _{CC}	—	V _{CC}

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

5 Specifications

5.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage range		- 0.5	7	V
V _I	Input voltage range ⁽²⁾		- 0.5	7	V
V _O	Voltage applied to any output in the high-impedance or power-off state ⁽²⁾		- 0.5	7	V
V _O	Output voltage range ⁽²⁾ ⁽³⁾		- 0.5	V _{CC} + 0.5	V
I _{IK}	Input clamp current	V _I < 0			- 20 mA
I _{OK}	Output clamp current	V _O < 0			- 50 mA
I _O	Continuous output current	V _O = 0 to V _{CC}	- 25	25	mA
Continuous current through V _{CC} or GND			- 50	50	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, 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 negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value is limited to 5.5-V maximum.

5.2 ESD Ratings

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per AEC Q100-002 ⁽¹⁾	±2000	V

- (1) AEC Q100-002 indicates that HBM stressing must 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	2	5.5	V
V _{IH}	High-level input voltage	V _{CC} = 2 V	1.5	V
		V _{CC} = 2.3 V to 2.7 V	V _{CC} × 0.7	
		V _{CC} = 3 V to 3.6 V	V _{CC} × 0.7	
		V _{CC} = 4.5 V to 5.5 V	V _{CC} × 0.7	
V _{IL}	Low-level input voltage	V _{CC} = 2 V	0.5	V
		V _{CC} = 2.3 V to 2.7 V	V _{CC} × 0.3	
		V _{CC} = 3 V to 3.6 V	V _{CC} × 0.3	
		V _{CC} = 4.5 V to 5.5 V	V _{CC} × 0.3	
V _I	Input voltage	0	5.5	V
V _O	Output voltage	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2 V	- 50	μA
		V _{CC} = 2.3 V to 2.7 V	- 2	mA
		V _{CC} = 3 V to 3.6 V	- 6	
		V _{CC} = 4.5 V to 5.5 V	- 12	

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

		MIN	MAX	UNIT
I_{OL}	Low-level output current	$V_{CC} = 2\text{ V}$	50	$\mu\text{ A}$
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	2	mA
		$V_{CC} = 3\text{ V to }3.6\text{ V}$	6	
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	12	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	200	ns/V
		$V_{CC} = 3\text{ V to }3.6\text{ V}$	100	
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	20	
T_A	Operating free-air temperature	- 40	105	$^{\circ}\text{C}$

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See the TI application report, *Implications of Slow or Floating CMOS Inputs*, [SCBA004](#).

5.4 Thermal Information

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

THERMAL METRIC ⁽¹⁾		PW	UNIT
		14 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	113	°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

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

PARAMETER	TEST CONDITIONS	V_{CC}	MIN	TYP	MAX	UNIT
V_{OH}	High level output voltage	$I_{OH} = -50\text{ }\mu\text{ A}$	2 to 5.5 V	$V_{CC} - 0.1$		V
		$I_{OH} = -2\text{ mA}$	2.3 V	2		
		$I_{OH} = -6\text{ mA}$	3 V	2.48		
		$I_{OH} = -12\text{ mA}$	4.5 V	3.8		
V_{OL}	Low level output voltage	$I_{OL} = 50\text{ }\mu\text{ A}$	2 to 5.5 V		0.1	V
		$I_{OL} = 2\text{ mA}$	2.3 V		0.4	
		$I_{OL} = 6\text{ mA}$	3 V		0.44	
		$I_{OL} = 12\text{ mA}$	4.5 V		0.55	
I_I	Input leakage current	$V_I = 5.5\text{ V or GND}$	0 to 5.5 V		± 1	$\mu\text{ A}$
I_{CC}	Supply current	$V_I = V_{CC}\text{ or GND, }I_O = 0$	5.5 V		20	$\mu\text{ A}$
I_{off}	Input/Output Power-Off Leakage Current	$V_I\text{ or }V_O = 0\text{ to }5.5\text{ V}$	0		5	$\mu\text{ A}$
C_i	Input Capacitance	$V_I = V_{CC}\text{ or GND}$	3.3 V	1.4		pF

5.6 Switching Characteristics, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$

over recommended operating free-air temperature range, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^{\circ}\text{C}$			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A or B	Y	$C_L = 50\text{ pF}$		10.5	22.6	1	26.5	ns

5.7 Switching Characteristics, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$

over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A or B	Y	$C_L = 50\text{ pF}$		7.4	14.5	1	16.5	ns

5.8 Switching Characteristics, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$

over recommended operating free-air temperature range, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A or B	Y	$C_L = 50\text{ pF}$		5.3	8.8	1	10	ns

5.9 Noise Characteristics

$V_{CC} = 3.3\text{ V}$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$ ⁽¹⁾

PARAMETER		MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.2	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		- 0.1	- 0.8	
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		3.1		
$V_{IH(D)}$	High-level dynamic input voltage	2.31			
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	

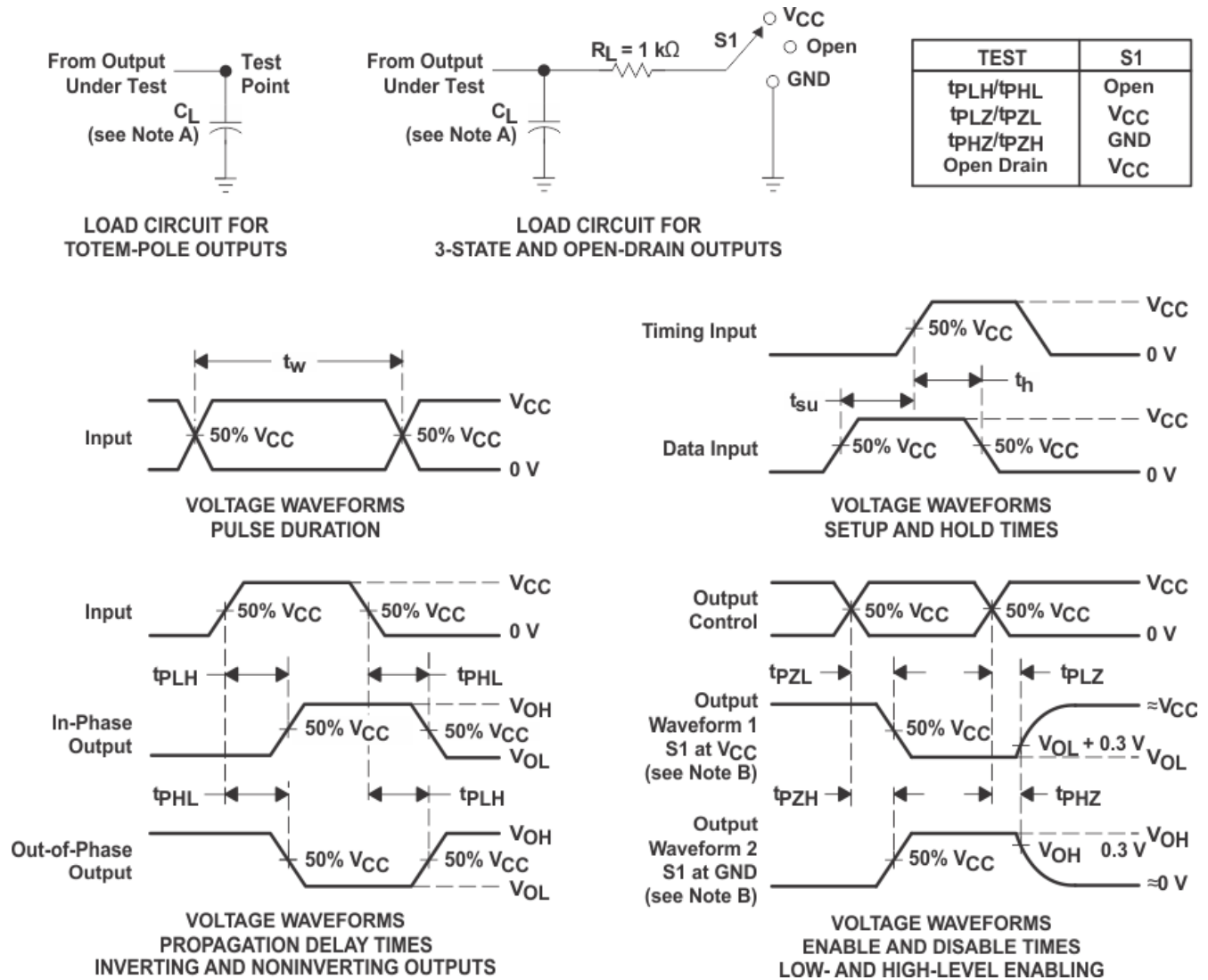
(1) Characteristics are for surface-mount packages only.

5.10 Operating Characteristics

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

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	$C_L = 50\text{ pF}$, $f = 10\text{ MHz}$	3.3 V	8.4	pF
			5 V	8.8	

6 Parameter Measurement Information



- 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: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$.
- D. The outputs are measured one at a time, with one input 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_{PHL} and t_{PLH} are the same as t_{pd} .
- H. All parameters and waveforms are not applicable to all devices.

图 6-1. Load Circuit and Voltage Waveforms

7 Detailed Description

7.1 Overview

The SN74LV86A is a quadruple 2-input exclusive-OR gate designed for 2-V to 5.5-V V_{CC} operation.

This device contains four independent 2-input exclusive-OR gates. It performs the Boolean function $Y = A \oplus B$ or $Y = \overline{A}B + A\overline{B}$ in positive logic.

A common application is as a true/complement element. If one of the inputs is low, the other input is reproduced in true form at the output. If one of the inputs is high, the signal on the other input is reproduced inverted at the output.

7.2 Functional Block Diagram



These are five equivalent exclusive-OR symbols valid for an 'LV86A gate in positive logic; negation can be shown at any two ports.

Logic-Identity Element



The output is active (low) if all inputs stand at the same logic level (i.e., $A = B$).

Even-Parity Element



The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

Odd-Parity Element



The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

图 7-1. Exclusive-OR Logic

7.3 Device Functional Modes

表 7-1. Function Table

INPUTS ⁽¹⁾		OUTPUT ⁽²⁾
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

(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 (Analog)

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.

表 8-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN74LV86A-Q1	Click here	Click here	Click here	Click here	Click here

8.2 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击 [订阅更新](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

8.3 支持资源

[TI E2E™ 支持论坛](#) 是工程师的重要参考资料，可直接从专家获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题可获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [《使用条款》](#)。

8.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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8.5 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

8.6 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

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 (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
SN74LV86ATPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 105	LV86AT	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 (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 SN74LV86A-Q1 :

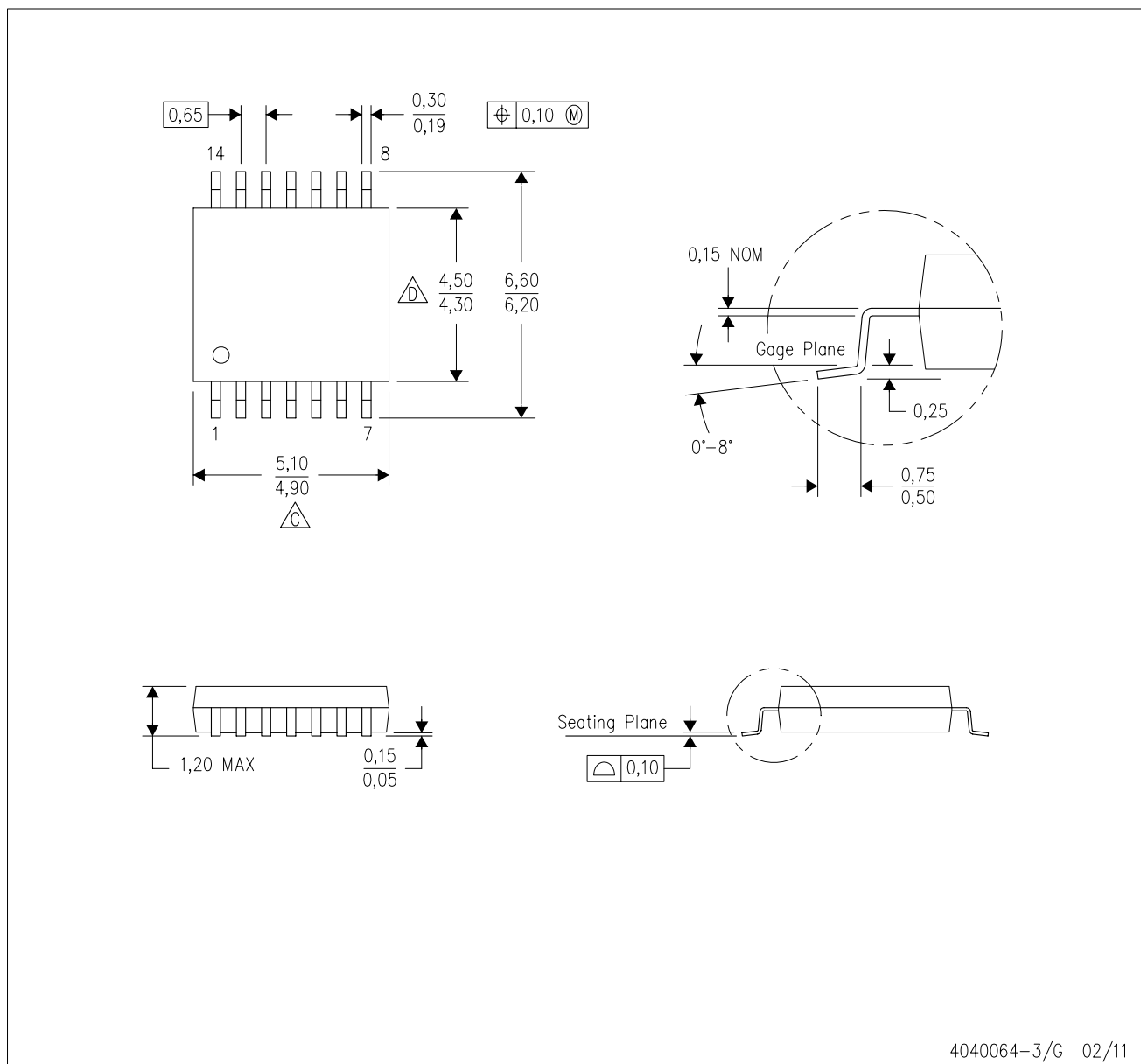
- Catalog : [SN74LV86A](#)
- Enhanced Product : [SN74LV86A-EP](#)

NOTE: Qualified Version Definitions:

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

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE

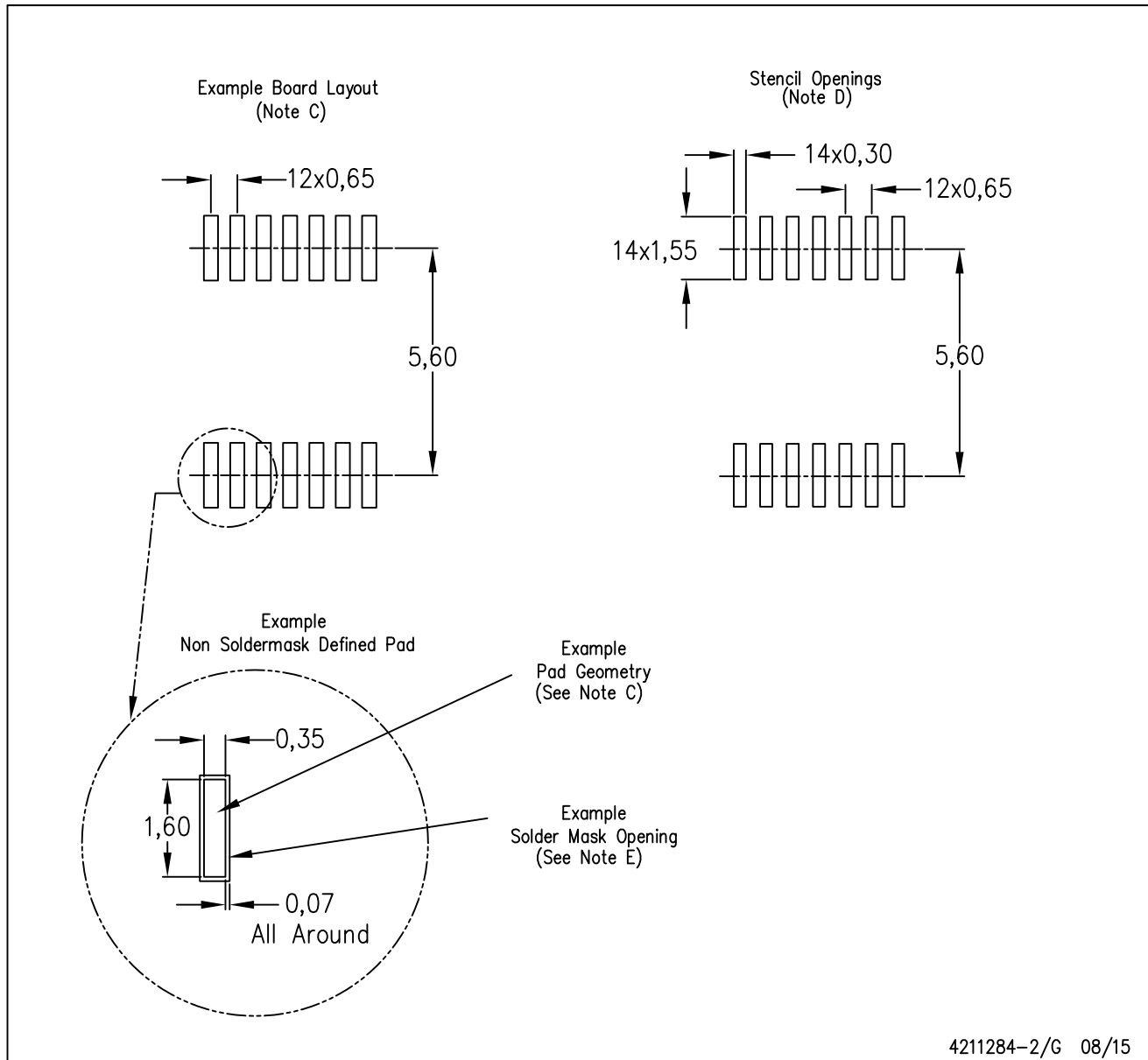


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- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, 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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