

SN74LV393A-Q1 双路 4 位二进制计数器

1 特性

- V_{CC} 工作范围为 2V 至 5.5V
- 5V 时 t_{pd} 最大值为 9.5ns
- V_{OLP} (输出接地反弹) 典型值小于 0.8V ($V_{CC} = 3.3V$, $T_A = 25^\circ C$)
- V_{OHV} (输出 V_{OH} 下冲) 典型值大于 2.3V ($V_{CC} = 3.3V$, $T_A = 25^\circ C$ 时)
- 所有端口上均支持以混合模式电压运行
- I_{off} 支持局部关断模式运行
- 闩锁性能超过 250mA, 符合 JESD 17 规范

2 应用

- 同步反相时钟输入
- 对开关进行去抖
- 对数字信号进行反相

3 说明

'LV393A 器件包含八个触发器和额外的门控, 可在单个封装中实现两个独立的 4 位计数器。这些器件旨在 2V 至 5.5V V_{CC} 下运行。

封装信息

器件型号	封装 ⁽¹⁾	封装尺寸 (标称值)
SN74LV393A-Q1	PW (TSSOP, 14)	5mm x 4.4mm

(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。

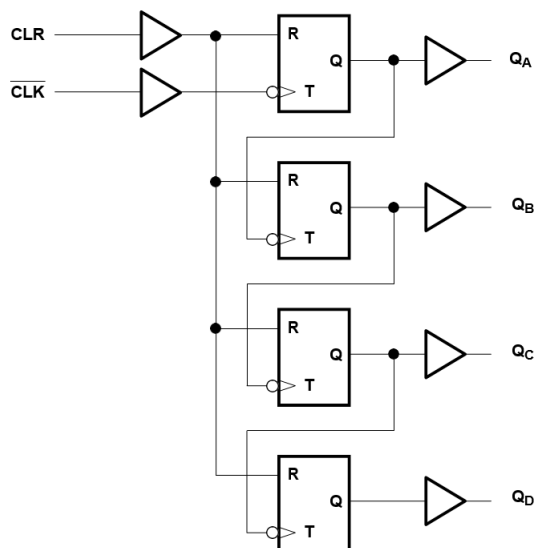


图 3-1. 逻辑图, 每个计数器 (正逻辑)



Table of Contents

1 特性	1	6.13 Operating Characteristics.....	8
2 应用	1	7 Parameter Measurement Information	9
3 说明	1	8 Detailed Description	10
4 Revision History	2	8.1 Overview.....	10
5 Pin Configuration and Functions	3	8.2 Functional Block Diagram.....	10
6 Specifications	4	8.3 Device Functional Modes.....	10
6.1 Absolute Maximum Ratings.....	4	9 Application and Implementation	11
6.2 ESD Ratings.....	4	9.1 Power Supply Recommendations.....	11
6.3 Recommended Operating Conditions.....	5	9.2 Layout.....	11
6.4 Thermal Information.....	5	10 Device and Documentation Support	12
6.5 Electrical Characteristics.....	6	10.1 Device Support.....	12
6.6 Timing Requirements, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	6	10.2 接收文档更新通知.....	12
6.7 Timing Requirements, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	6	10.3 支持资源.....	12
6.8 Timing Requirements, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	6	10.4 Trademarks.....	12
6.9 Switching Characteristics, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$	6	10.5 静电放电警告.....	12
6.10 Switching Characteristics, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	7	10.6 术语表.....	12
6.11 Switching Characteristics, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	7	11 Mechanical, Packaging, and Orderable Information	12
6.12 Noise Characteristics.....	7		

4 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision C (February 2008) to Revision D (March 2023)	Page
• 添加了应用、封装信息表、引脚功能表、ESD 等级表、热性能信息表、器件功能模式、应用和实施部分、电源相关建议部分、布局部分、器件和文档支持部分以及机械、封装和可订购信息部分.....	1

5 Pin Configuration and Functions

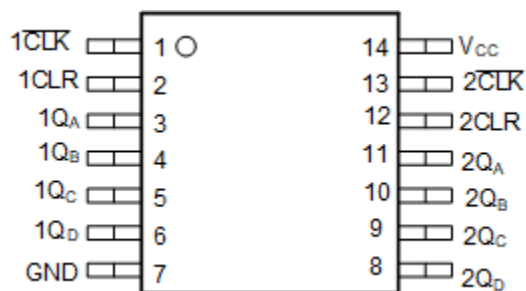


图 5-1. PW Package, 14-Pin TSSOP (Top View)

表 5-1. Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	NO.		
1CLK/	1	I	Counter 1 Clock Input
1CLR	2	I	Counter 1 Clear Input
1QA	3	O	Counter 1 A Output
1QB	4	O	Counter 1 B Output
1QC	5	O	Counter 1 B Output
1QD	6	O	Counter 1 B Output
GND	7	G	Ground
2QD	8	O	Counter 2 D Output
2QC	9	O	Counter 2 C Output
2QB	10	O	Counter 2 B Output
2QA	11	O	Counter 2 A Output
2CLR	12	I	Counter 2 Clear Input
2CLK/	13	I	Counter 2 Clock Input
VCC	14	P	VCC

(1) I = Input, O = Output, I/O = Input or Output, G = Ground, P = Power.

6 Specifications

6.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage		- 0.5	7	V
V _I	Input voltage ⁽¹⁾		- 0.5	7	V
V _O	Output voltage range applied in high or low state ^{(1) (2)}		- 0.5	V _{CC} + 0.5	V
V _O	Output voltage range applied in power-off state ⁽¹⁾		- 0.5	7	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	mA
	Continuous current through V _{CC} or GND			±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, 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.

- The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- This value is limited to 7 V maximum.

6.2 ESD Ratings

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-Body Model (MIL-STD-883, Method 3015) ⁽¹⁾	±2000	V
		Machine Model (C = 200 pF, R = 0)	±200	

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

6.3 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	
I _{OL}	Low-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	
Δ t / Δ v	Input transition rise or fall rate	V _{CC} = 2.3 V to 2.7 V		200	ns/V
		V _{CC} = 3 V to 3.6 V		100	
		V _{CC} = 4.5 V to 5.5 V		20	

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

6.4 Thermal Information

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

(1) For more information about traditional and new thermal metrics, see [Semiconductor and IC Package Thermal Metrics](#).

6.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V _{CC}	MIN	TYP	MAX	UNIT
V _{OH}	I _{OH} = - 50 μA	2 V to 5.5 V	V _{CC} - 0.1			V
	I _{OH} = - 2 mA	2.3 V	2			
	I _{OH} = -6 mA	3 V	2.48			
	I _{OH} = -12 mA	4.5 V	3.8			
V _{OL}	I _{OL} = 50 μA	2 V to 5.5 V			0.1	V
	I _{OL} = 2 mA	2.3 V			0.4	
	I _{OL} = 6 mA	3 V			0.44	
	I _{OL} = 12 mA	4.5 V			0.55	
I _I	V _I = 5.5 V or GND	0 V to 5.5 V			±1	μA
I _{cc}	V _I = V _{CC} or GND, I _O =0	5.5 V			20	μA
I _{off}	V _I or V _O = 0 to 5.5 V	0 V			5	μA
C _i	V _I = V _{CC} or GND	3.3 V		1.8		pF

6.6 Timing Requirements, V_{CC} = 2.5 V ± 0.2 V

timing requirements over recommended operating free-air temperature range, V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted)

			T _A = 25°C		SN74LV393A-Q1		UNIT
			MIN	MAX	MIN	MAX	
t _w	Pulse duration	CLK high or low	5		5		ns
		CLR high	5		5		
t _{su}	Setup time	CLR inactive before CLK ↓	6		6		ns

6.7 Timing Requirements, V_{CC} = 3.3 V ± 0.3 V

timing requirements over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted)

			T _A = 25°C		SN74LV393A-Q1		UNIT
			MIN	MAX	MIN	MAX	
t _w	Pulse duration	CLK high or low	5		5		ns
		CLR high	5		5		
t _{su}	Setup time	CLR inactive before CLK ↓	5		5		ns

6.8 Timing Requirements, V_{CC} = 5 V ± 0.5 V

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted)

			T _A = 25°C		SN74LV393A-Q1		UNIT
			MIN	MAX	MIN	MAX	
t _w	Pulse duration	CLK high or low	5		5		ns
		CLR high	5		5		
t _{su}	Setup time	CLR inactive before CLK ↓	4		4		ns

6.9 Switching Characteristics, V_{CC} = 2.5 V ± 0.2 V

over operating free-air temperature range, V_{CC} = 2.5 V ± 0.2 V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	T _A = 25°C			SN74LV393A-Q1		UNIT
				MIN	TYP	MAX	MIN	MAX	
f _{max}			C _L = 50 pF	30	70		25		MHz

6.9 Switching Characteristics, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ (continued)

over operating free-air temperature range, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	TA = 25°C			SN74LV393A-Q1		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	CLK	Q_A	$C_L = 50\text{ pF}$		9.3 ¹	21.3 ¹	1	24.5	ns
		Q_B			10.9 ¹	23.9 ¹	1	27.5	
		Q_C			12.3 ¹	26.1 ¹	1	30	
		Q_D			13.4 ¹	27.8 ¹	1	32	
t_{PHL}	CLR	Q_n			9.1 ¹	17.4 ¹	1	20	

- On products compliant to MIL-PRF-38535, this parameter is not production tested.

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

over operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	TA = 25°C			SN74LV393A-Q1		UNIT
				MIN	TYP	MAX	MIN	MAX	
f_{max}			$C_L = 50\text{ pF}$	45	105		35		MHz
t_{pd}	CLK	Q_A	$C_L = 50\text{ pF}$		6.7 ¹	16.7 ¹	1	19	ns
		Q_B			7.8 ¹	19.3 ¹	1	22	
		Q_C			8.7 ¹	21.5 ¹	1	24.5	
		Q_D			9.5 ¹	23.2 ¹	1	26.5	
t_{PHL}	CLR	Q_n			6.8 ¹	15.8 ¹	1	18	

- On products compliant to MIL-PRF-38535, this parameter is not production tested.

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

over operating free-air temperature range, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	TA = 25°C			SN74LV393A-Q1		UNIT
				MIN	TYP	MAX	MIN	MAX	
f_{max}			$C_L = 50\text{ pF}$	85	150		75		MHz
t_{pd}	CLK	Q_A	$C_L = 50\text{ pF}$		4.9 ¹	10.5 ¹	1	12	ns
		Q_B			5.6 ¹	11.8 ¹	1	13.5	
		Q_C			6.2 ¹	13.2 ¹	1	15	
		Q_D			6.6 ¹	14.5 ¹	1	16.5	
t_{PHL}	CLR	Q_n			5.2 ¹	10.1 ¹	1	11.5	

- On products compliant to MIL-PRF-38535, this parameter is not production tested.

6.12 Noise Characteristics

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

PARAMETER ⁽¹⁾		SN74LV393A-Q1			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.3	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		- 0.2	- 0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		2.8		V
$V_{IH(D)}$	High-level dynamic input voltage		2.31		V
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	V

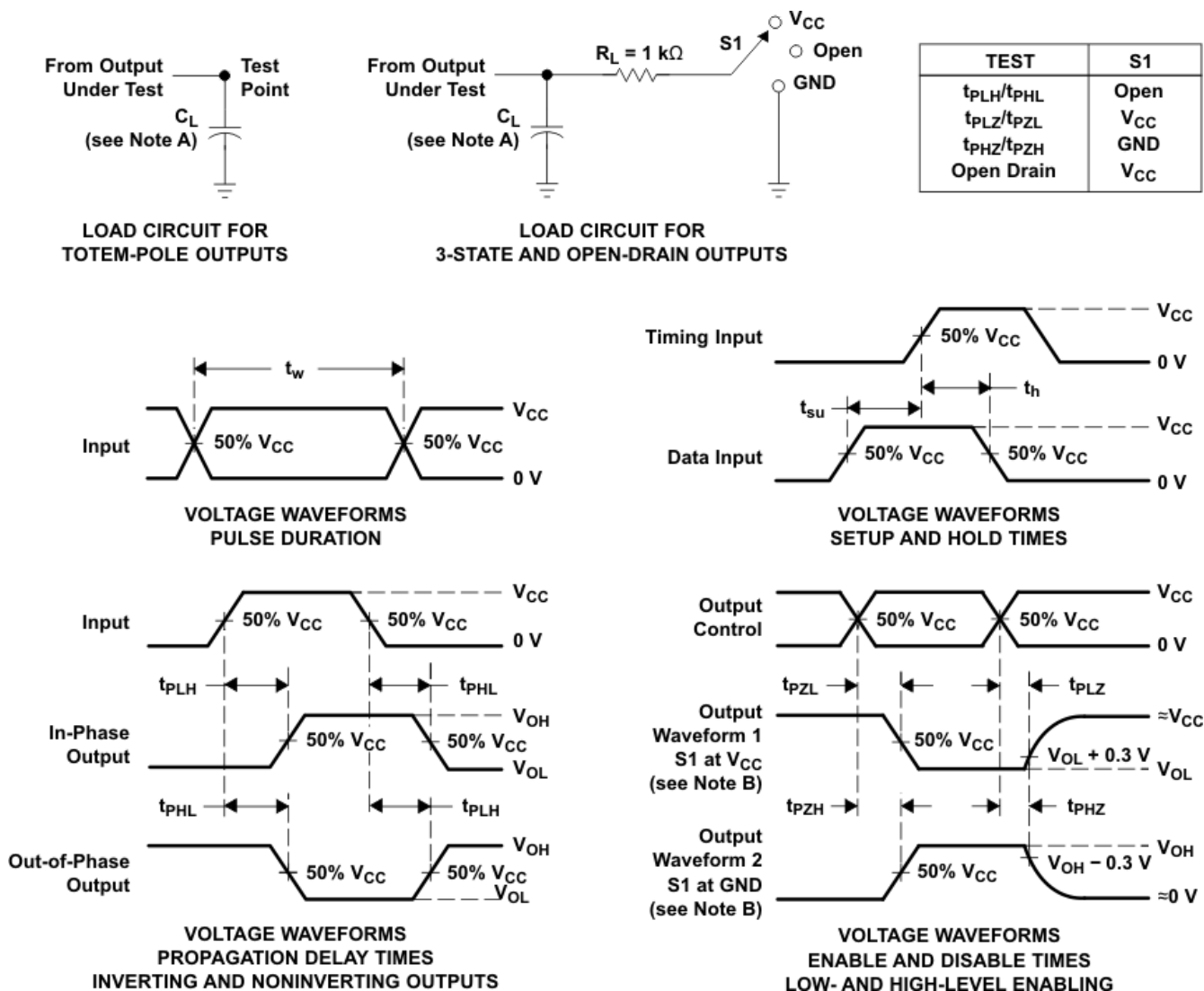
- Characteristics for surface-mount packages only.

6.13 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	15.2	pF
			5 V	17.3	

7 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: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 3\text{ ns}$, and $t_f \leq 3\text{ ns}$.
- 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 7-1. Load Circuit and Voltage Waveforms

8 Detailed Description

8.1 Overview

These devices comprise two independent 4-bit binary counters, each having a clear (CLR) and a clock ($\overline{\text{CLK}}$) input. These devices change state on the negative-going transition of the $\overline{\text{CLK}}$ pulse. N-bit binary counters can be implemented with each package, providing the capability of divide by 256. The 'LV393A devices have parallel outputs from each counter stage so that any submultiple of the input count frequency is available for system timing signals.

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 devices when they are powered down.

8.2 Functional Block Diagram

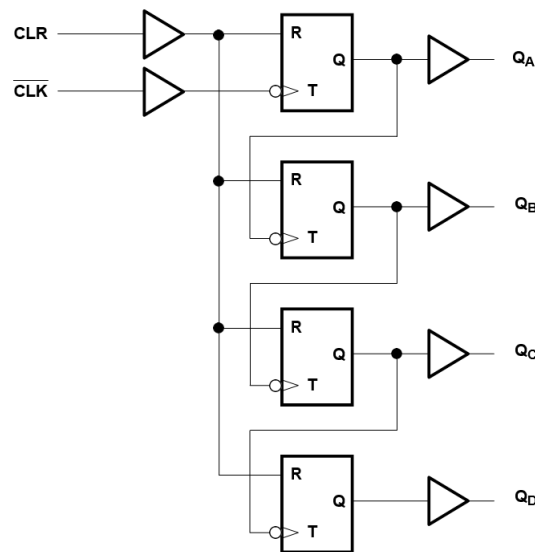


图 8-1. Logic Diagram, Each Counter (Positive Logic)

8.3 Device Functional Modes

表 8-1. Function Table

INPUTS		FUNCTION
$\overline{\text{CLK}}$	CLR	
↑	L	No change
↓	L	Advance to next stage
X	H	All outputs L

9 Application and Implementation

备注

以下应用部分中的信息不属于 TI 元件规格，TI 不担保其准确性和完整性。TI 的客户负责确定元件是否适合其用途，以及验证和测试其设计实现以确认系统功能。

9.1 Power Supply Recommendations

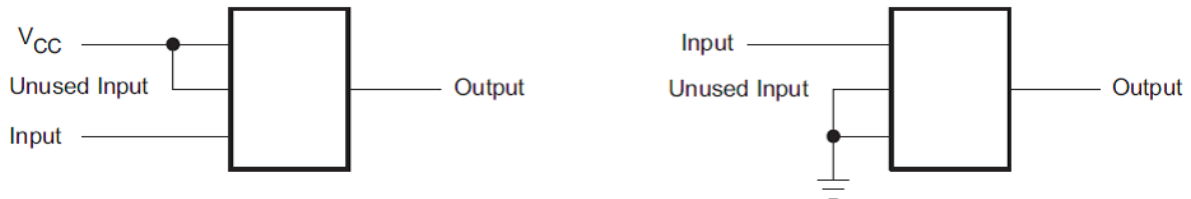
The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Absolute Maximum Ratings* section. Each V_{CC} terminal must have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends a 0.1- μ F capacitor; if there are multiple V_{CC} terminals, then TI recommends a 0.01- μ F or 0.022- μ F capacitor for each power terminal. Multiple bypass capacitors can be paralleled to reject different frequencies of noise. Frequencies of 0.1 μ F and 1 μ F are commonly used in parallel. The bypass capacitor must be installed as close as possible to the power terminal for best results.

9.2 Layout

9.2.1 Layout Guidelines

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when only 3 of the 4-buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or V_{CC} , whichever makes more sense for the logic function or is more convenient.

9.2.1.1 Layout Example



10 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

10.1 Device Support

10.1.1 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 10-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN74LV393A-Q1	Click here	Click here	Click here	Click here	Click here

10.2 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。

10.3 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》。

10.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

10.5 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。

10.6 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。

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 (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
SN74LV393ATPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 105	LV393AT	Samples
SN74LV393ATPWRQ1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 105	LV393AT	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.

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.

OTHER QUALIFIED VERSIONS OF SN74LV393A-Q1 :

- Catalog : [SN74LV393A](#)
- Enhanced Product : [SN74LV393A-EP](#)

NOTE: Qualified Version Definitions:

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

TAPE AND REEL INFORMATION


*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
SN74LV393ATPWRG4Q1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV393ATPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV393ATPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

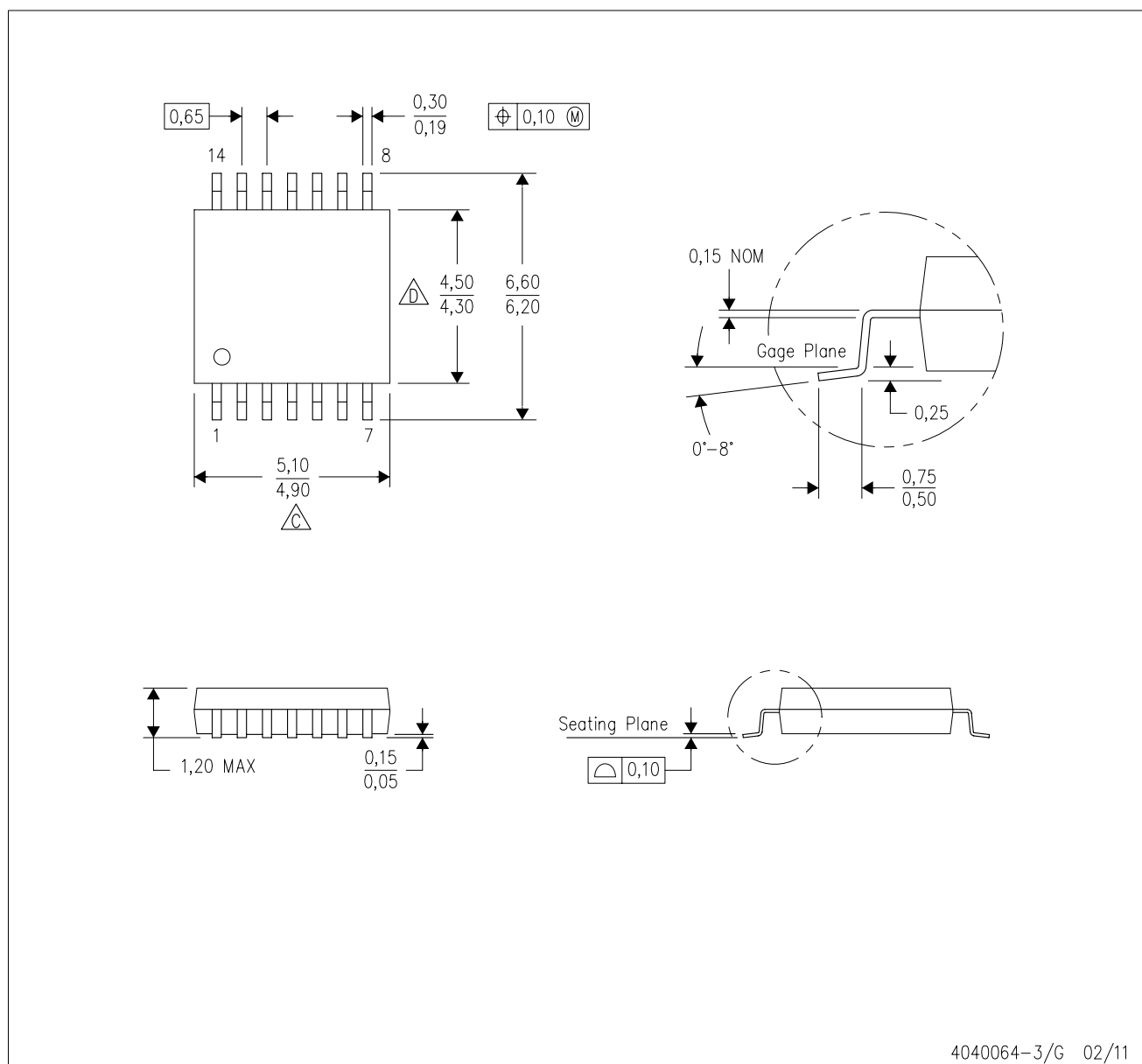


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV393ATPWRG4Q1	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74LV393ATPWRQ1	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74LV393ATPWRQ1	TSSOP	PW	14	2000	353.0	353.0	32.0

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- 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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