

SN74AHCT594 具有输出寄存器的 8 位移位寄存器

1 特性

- 输入兼容 TTL 电压
- 具有存储功能的 8 位串行输入、并行输出移位寄存器
- 移位寄存器和存储寄存器上的独立直接覆盖清零
- 移位寄存器和存储寄存器的独立时钟
- 门锁性能超过 100mA，符合 JESD 78 II 类规范
- ESD 保护性能超过 JESD 22 规范要求
 - $\pm 3500\text{V}$ 人体放电模型
 - $\pm 200\text{V}$ 机器放电模型

2 应用

- 网络交换机
- 电力基础设施
- PC、笔记本电脑
- 健康与健身、可穿戴设备
- 测试和测量

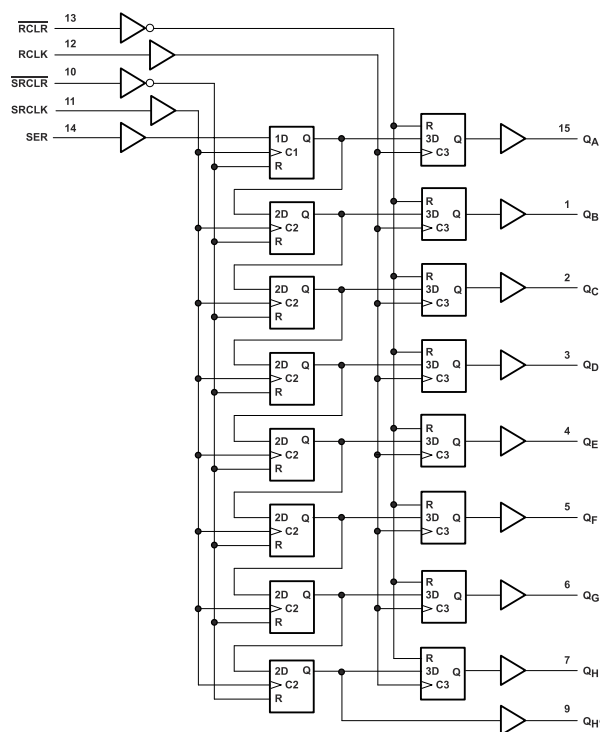
3 说明

SN74AHCT594 器件包含一个可对 8 位 D 类存储寄存器进行馈送的 8 位串行输入、并行输出移位寄存器。

封装信息

器件型号	封装 ⁽¹⁾	封装尺寸 ⁽²⁾	本体尺寸 ⁽³⁾
SN74AHCT594	N (PDIP , 16)	19.3mm x 9.4mm	19.32mm x 6.35mm
	DB (SSOP , 16)	6.2mm x 7.8mm	6.20mm x 5.30mm
	PW (TSSOP , 16)	5mm x 6.4mm	5.00mm x 4.40mm
	NS (SOP , 16)	10.2mm x 7.8mm	10.20mm x 5.30mm
	D (SOIC , 16)	9.9mm x 6mm	9.90mm x 3.90mm

- (1) 如需了解更多信息，请参阅第 11 节。
 (2) 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。
 (3) 本体尺寸 (长 × 宽) 为标称值，不包括引脚。



简化原理图

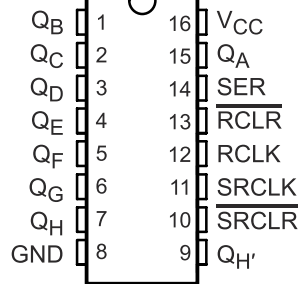


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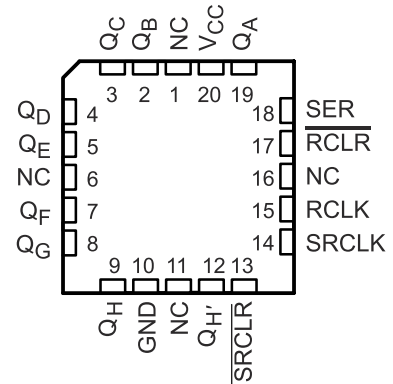
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4 Pin Configuration and Functions

SN54AHCT594 . . . J OR W PACKAGE
SN74AHCT594 . . . D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54AHCT594 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

图 4-1.

PIN		TYPE	DESCRIPTION
NO.	NAME		
1	Q _B	O	Output B
2	Q _C	O	Output C
3	Q _D	O	Output D
4	Q _E	O	Output E
5	Q _F	O	Output F
6	Q _G	O	Output G
7	Q _H	O	Output H
8	GND	—	Ground Pin
9	Q _{H'}	I	QH inverted
10	SRCLR	I	Serial Clear
11	SRCLK	I	Serial Clock
12	RCLK	I	Storage Clock
13	RCLR	I	Storage Clear
14	SER	I	Serial Input
15	Q _A	O	Output A
16	V _{CC}	—	Power pin

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
V_I	Input voltage range ⁽²⁾	−0.5	7	V
V_O	Output voltage range ⁽²⁾	−0.5	$V_{CC} + 0.5$	V
I_{IK}	Input clamp current	$V_I < 0$		−20 mA
I_{OK}	Output clamp current	$V_O < 0$ 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			±75 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 [# 5.3](#). 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
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±3500
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±2000

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250V 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⁾

		SN74AHCT594		UNIT
		MIN	MAX	
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
V_I	Input voltage	0	5.5	V
V_O	Output voltage	0	V_{CC}	V
I_{OH}	High-level output current		−8	mA
I_{OL}	Low-level output current		8	mA
$\Delta t/\Delta v$	Input transition rise and fall time		20	ns/V
T_A	Operating free-air temperature	−40	125	°C

- (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*, (SCBA004).

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74AHCT594					UNIT
		D	DB	N	NS	PW	
		16 PINS					
R _{θJA}	Junction-to-ambient thermal resistance	93.8	129.6	47.5	79.1	135.9	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	54.7	90	34.9	35.4	70.3	
R _{θJB}	Junction-to-board thermal resistance	50.9	92.7	27.5	39.9	81.3	
ψ _{JT}	Junction-to-top characterization parameter	20.8	46.1	19.8	5.4	22.5	
ψ _{JB}	Junction-to-board characterization parameter	50.7	91.7	27.4	39.5	80.8	
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	N/A	N/A	N/A	N/A	

(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}	T _A = 25°C			–40°C to 85°C		–40°C to 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = –50 μA	4.5 V	4.4	4.5		4.4		4.4		V
	I _{OH} = –8 mA		3.94			3.8		3.8		
V _{OL}	I _{OL} = 50 μA	4.5V			0.1		0.1		0.1	V
	I _{OL} = 8 mA				0.36		0.44		0.44	
I _I	V _I = 5.5 V or GND	0 V to 5.5 V			±0.1		±1 ⁽¹⁾		±1 ⁽¹⁾	μA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V			2		20		20	μA
ΔI _{CC} ⁽²⁾	One input at 3.5 V, Other inputs at V _{CC} or GND	5.5 V			2		2.2		2.2	mA
C _i	V _I = V _{CC} or GND	5 V		2	10		10		10	pF

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

(2) 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 Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

PARAMETER			T _A = 25°C		–40°C to 85°C		–40°C to 125°C		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration	RCLK or SRCLK high or low	5		5.5		6.5		ns
		RCLR or SRCLR low	5.2		5.5		6		
t _{su}	Setup time	SER before SRCLK↑	3		3		3.5		ns
		SRCLK↑ before RCLK↑ ⁽¹⁾	5		5		5.5		
		SRCLR low before RCLK↑	5		5		5.5		
		SRCLR high (inactive) before SRCLK↑	2.9		3.3		4		
		RCLR high (inactive) before RCLK↑	3.4		3.8		4.5		
t _h	Hold time	SER after SRCLK↑	2		2		2.5		ns

(1) This setup time allows the storage register to receive stable data from the shift register. The clocks can be tied together, in which case the shift register is one clock pulse ahead of the storage register.

5.7 Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T _A = 25°C			–40°C to 85°C		–40°C to 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f _{max}			C _L = 15 pF	135 ⁽¹⁾	170 ⁽¹⁾		115		115		MHz
			C _L = 50 pF	120	140		95		95		
t _{PLH}	RCLK	Q _A – Q _H	C _L = 15 pF		3.3 ⁽¹⁾	6.2 ⁽¹⁾	1	6.5	1	7.5	ns
t _{PHL}					3.7 ⁽¹⁾	6.5 ⁽¹⁾	1	6.9	1	7.8	
t _{PLH}	SRCLK	Q _{H'}	C _L = 15 pF		3.7 ⁽¹⁾	6.8 ⁽¹⁾	1	7.2	1	8	ns
t _{PHL}					4.1 ⁽¹⁾	7.2 ⁽¹⁾	1	7.6	1	8.5	
t _{PLH}	RCLR	Q _A – Q _H	C _L = 15 pF		4.5 ⁽¹⁾	7.6 ⁽¹⁾	1	8.2	1	9.5	ns
t _{PHL}	SRCLR	Q _{H'}	C _L = 15 pF		4.1 ⁽¹⁾	7.1 ⁽¹⁾	1	7.6	1	8.5	
t _{PLH}	RCLK	Q _A – Q _H	C _L = 50 pF		4.9	7.8	1	8.3	1	9.5	ns
t _{PHL}					5.8	8.9	1	9.7	1	10.5	
t _{PLH}	SRCLK	Q _{H'}	C _L = 50 pF		5.5	8.6	1	9.7	1	10	ns
t _{PHL}					6	9.2	1	10.1	1	11	
t _{PLH}	RCLR	Q _A – Q _H	C _L = 50 pF		6.6	10	1	10.7	1	11.5	ns
t _{PHL}	SRCLR	Q _{H'}	C _L = 50 pF		6	9.2	1	10.1	1	11	ns

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

5.8 Noise Characteristics

V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C⁽¹⁾

PARAMETER		SN74AHCT594			UNIT
		MIN	TYP	MAX	
V _{OL(P)}	Quiet output, maximum dynamic V _{OL}		1		V
V _{OL(V)}	Quiet output, minimum dynamic V _{OL}		–0.6		V
V _{OH(V)}	Quiet output, minimum dynamic V _{OH}		3.8		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.

5.9 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	112	pF

5.10 Typical Characteristics

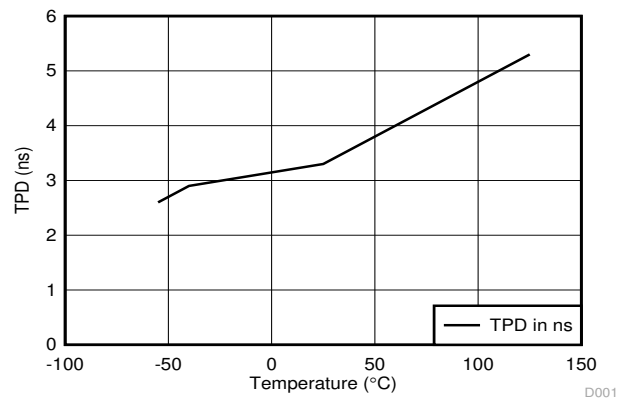
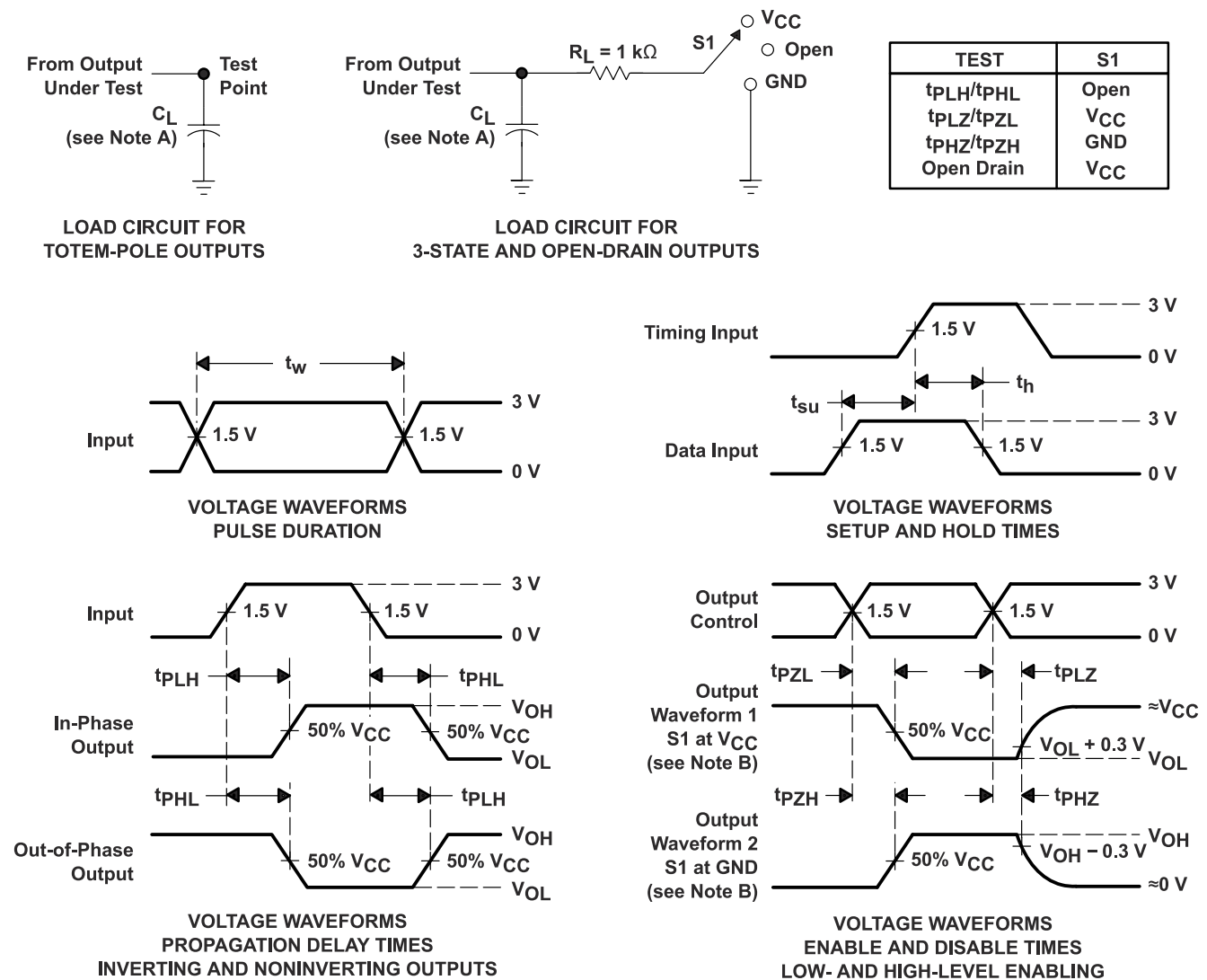


图 5-1. TPD vs Temperature

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. All parameters and waveforms are not applicable to all devices.

图 6-1. Load Circuit and Voltage Waveforms

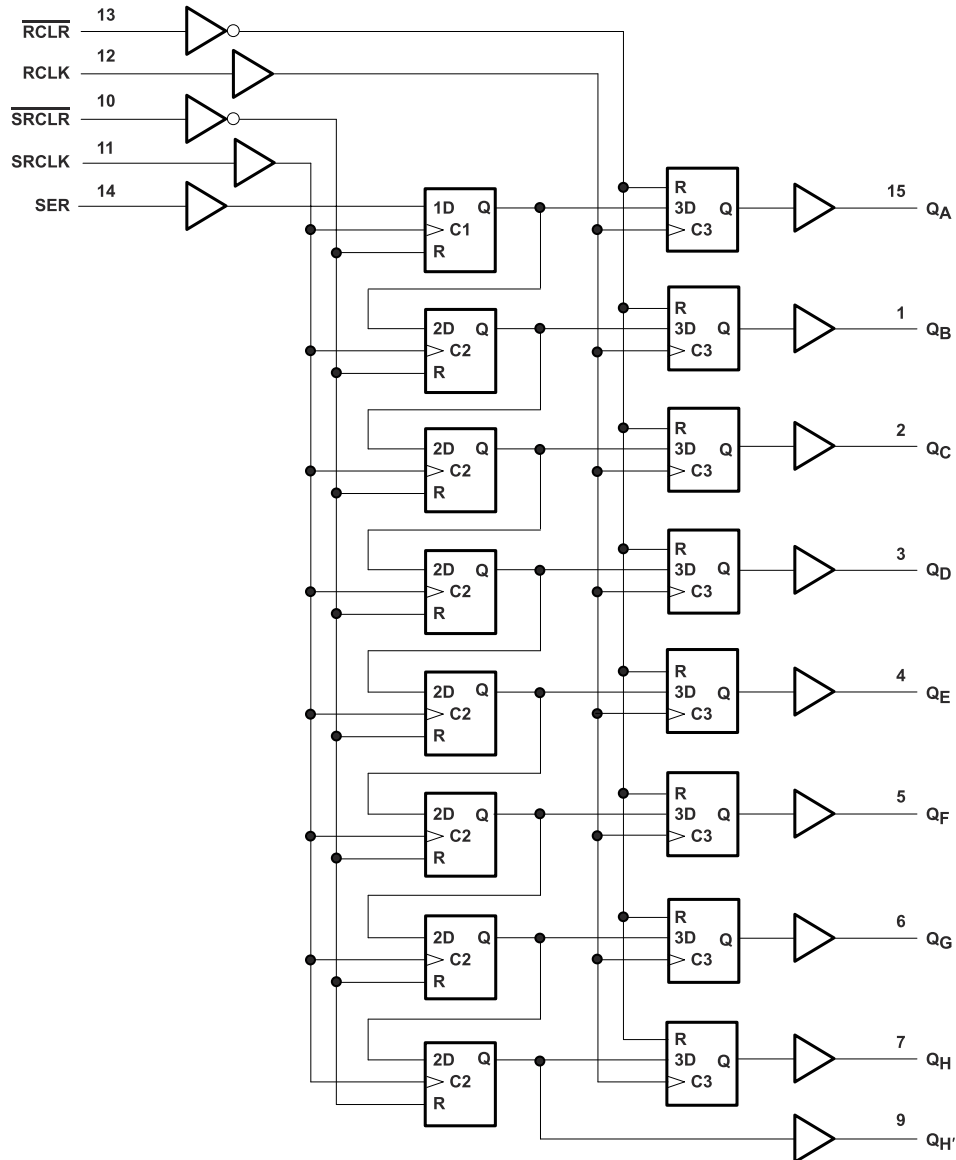
7 Detailed Description

7.1 Overview

The 'AHCT594 devices contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Separate clocks and direct overriding clear ($\overline{\text{SRCLR}}$, $\overline{\text{RCLR}}$) inputs are provided on both the shift and storage registers. A serial ($Q_{H'}$) output is provided for cascading purposes.

Both the shift register (SRCLK) and storage register (RCLK) clocks are positive edge triggered. If both clocks are connected together, the shift register always is one count pulse ahead of the storage register.

7.2 Functional Block Diagram



7.3 Feature Description

- V_{CC} is optimized at 5 V
- Allow Up voltage translation from 3.3 V to 5 V
 - Inputs accept V_{IH} levels of 2 V
- Slow edge rates minimize output ringing
- Inputs are TTL-Voltage compatible

7.4 Device Functional Modes

表 7-1. Function Table

INPUTS					FUNCTION
SER	SRCLK	SRCLR	RCLK	RCLR	
X	X	L	X	X	Shift register is cleared.
L	↑	H	X	X	First stage of shift register goes low. Other stages store the data of previous stage, respectively.
H	↑	H	X	X	First stage of shift register goes high. Other stages store the data of previous stage, respectively.
L	↓	H	X	X	Shift-register state is not changed.
X	X	X	X	L	Storage register is cleared.
X	X	X	↑	H	Shift-register data is stored in the storage register.
X	X	X	↓	H	Storage-register state is not changed.

8 Application and Implementation

备注

以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客户应负责确定器件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

8.1 Application Information

SN74AHCT594 is a low drive CMOS device 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 input switching levels have been lowered to accommodate TTL inputs of 0.8 V V_{IL} and 2 V V_{IH} . This feature makes it ideal for translating up from 3.3 V to 5 V. 图 8-2 shows this type of translation.

8.2 Typical Application

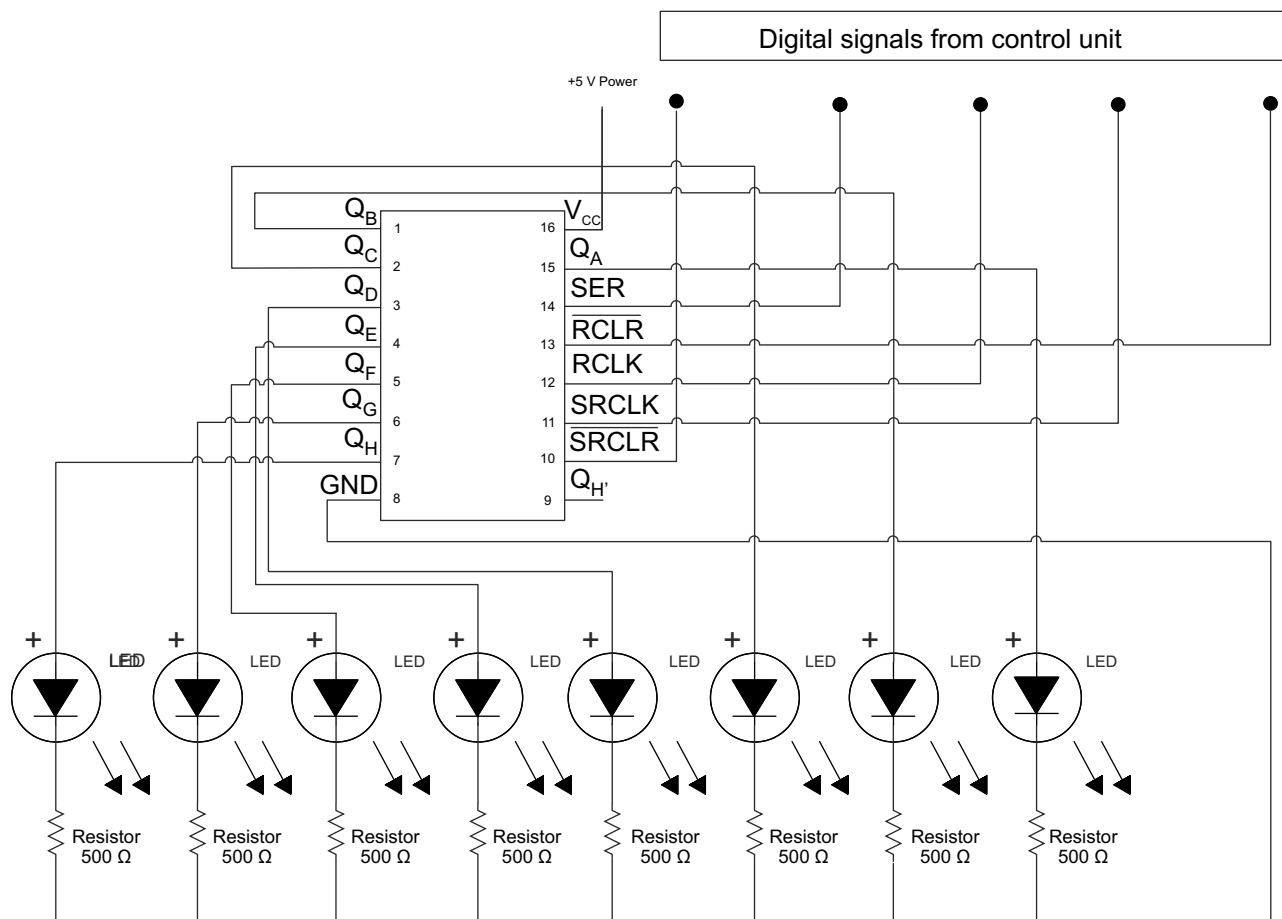


图 8-1. Application Schematic

8.2.1 Design Requirements

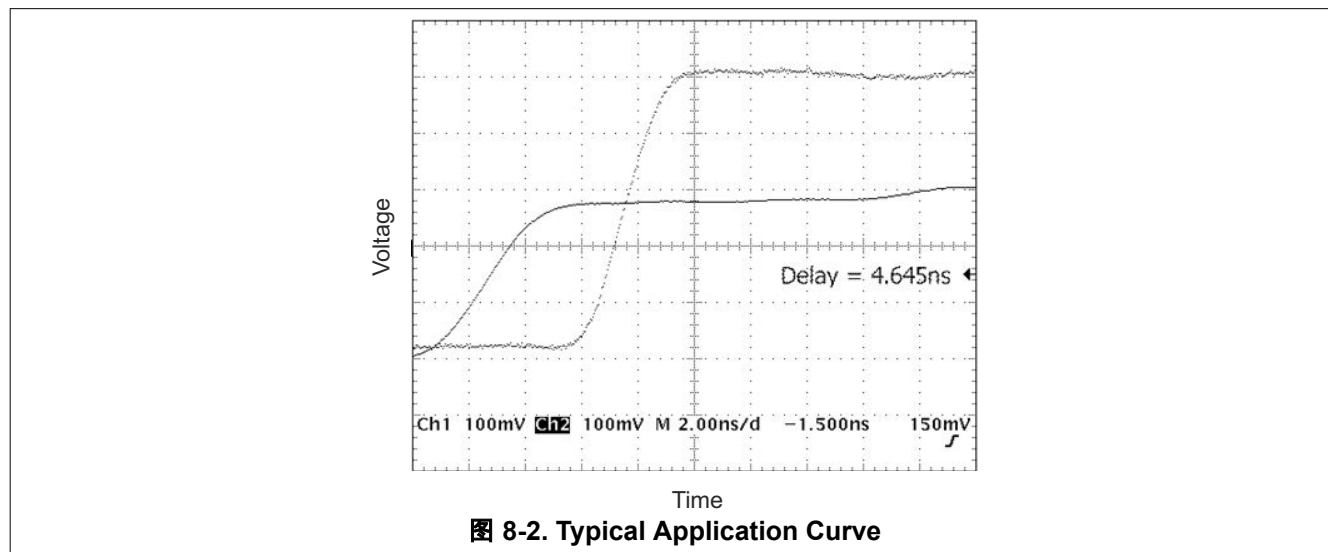
This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads so routing and load conditions should be considered to prevent ringing.

8.2.2 Detailed Design Procedure

- Recommended Input conditions
 - Rise time and fall time specs see ($\Delta t/\Delta V$) in 节 5.3 table.

- Specified High and low levels. See (V_{IH} and V_{IL}) in [§ 5.3](#) 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 75 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 [§ 5.3](#) table.

Each V_{CC} pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 μF is recommended. If there are multiple V_{CC} pins, 0.01 μF or 0.022 μF is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 μF and 1 μF 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 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 input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states.

Specified in [图 8-3](#) are 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 acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the outputs section of the part when asserted. This will not disable the input section of the I/Os so they also cannot float when disabled.

8.4.2 Layout Example

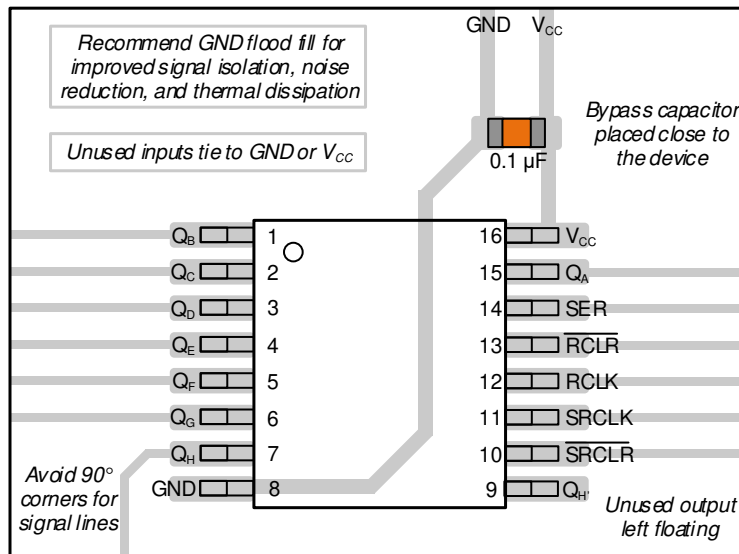


图 8-3. Example Layout for the SN74AHCT594

9 Device and Documentation Support

9.1 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.

表 9-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN74AHCT594	Click here	Click here	Click here	Click here	Click here

9.2 Trademarks

所有商标均为其各自所有者的财产。

9.3 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。

9.4 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。

10 Revision History

Changes from Revision J (April 2024) to Revision K (July 2024)	Page
• Updated thermal values for D package from R θ JA = 80.2 to 93.8, R θ JC(top) = 39.1 to 54.7, R θ JB = 27.7 to 50.9, Ψ JT = 9.9 to 20.8, Ψ JB = 37.4 to 50.7, R θ JC(bot) = N/A, all values in °C/W	5

Changes from Revision I (December 2014) to Revision J (April 2024)	Page
• 在整个数据表中删除了对机器放电模型的引用，并根据现行标准更新了数据表的结构布局.....	1
• Updated R θ JA values: DB = 97.5 to 129.6, PW = 105.7 to 135.9; Updated DB and PW packages for R θ JC(top), R θ JB, Ψ JT, Ψ JB, and R θ JC(bot), all values in °C/W	5
• Updated layout image	13

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
SN74AHCT594D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	-40 to 125	AHCT594	
SN74AHCT594DBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HB594	Samples
SN74AHCT594DR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHCT594	Samples
SN74AHCT594N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-40 to 125	SN74AHCT594N	Samples
SN74AHCT594NSR	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHCT594	Samples
SN74AHCT594PWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HB594	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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OTHER QUALIFIED VERSIONS OF SN74AHCT594 :

- Automotive : [SN74AHCT594-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

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