

SN74LV594A-Q1 Automotive 8-Bit Parallel-Out Serial Shift Registers

1 Features

- AEC-Q100 qualified for automotive applications:
 - Device temperature grade 1: -40°C to $+125^{\circ}\text{C}$, T_A
 - Device HBM ESD Classification Level 2
 - Device CDM ESD Classification Level C6
- Available in wettable flank QFN (WBQB) package
- 2 V to 5.5 V V_{CC} operation
- Maximum tpd of 6.5 ns at 5 V
- Typical V_{OLP} (output ground bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^{\circ}\text{C}$
- Support mixed-mode voltage operation on all ports
- 8-bit serial-in, parallel-out shift registers with storage
- Independent direct overriding clears on shift and storage registers
- Independent clocks for shift and storage registers
- Latch-up performance exceeds 100 mA per JESD 78, Class II

2 Applications

- [Output expansion](#)
- [LED matrix control](#)
- [7-segment display control](#)

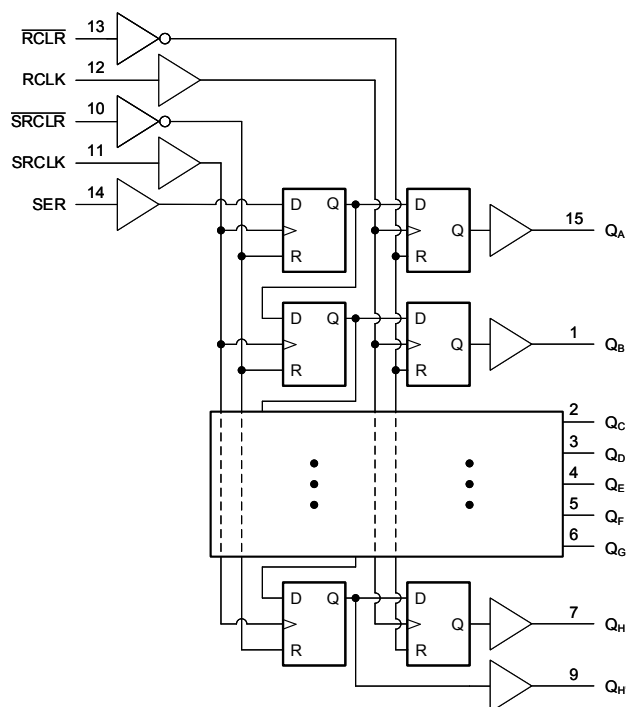
3 Description

The SN74LV594A-Q1 devices are 8-bit shift registers designed for 2-V to 5.5-V V_{CC} operation.

Package Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SN74LV594A-Q1	BQB (WQFN, 16)	3.60 mm × 2.60 mm

- (1) For all available packages, see the orderable addendum at the end of the data sheet.



Logic Diagram (Positive Logic)



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4 Revision History

DATE	REVISION	NOTES
December 2022	*	Initial Release

5 Pin Configuration and Functions

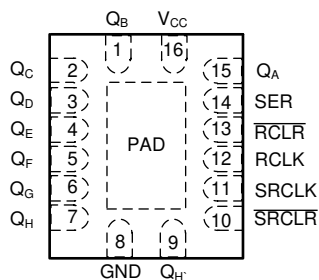


Figure 5-1. D, DB, or PW Package 16-Pin SOIC, SSOP, or TSSOP (Top View)

Table 5-1. Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	NO.		
Q _B	1	O	Output B
Q _C	2	O	Output C
Q _D	3	O	Output D
Q _E	4	O	Output E
Q _F	5	O	Output F
Q _G	6	O	Output G
Q _H	7	O	Output H
GND	8	G	Ground pin
Q _H '	9	O	Q _H inverted
$\overline{\text{SRCLR}}$	10	I	Serial clear
SRCLK	11	I	Serial clock
RCLK	12	I	Storage clock
$\overline{\text{RCLR}}$	13	I	Storage clear
SER	14	I	Serial input
Q _A	15	O	Output A
V _{CC}	16	P	Power pin
Thermal Pad		-	Thermal Pad ⁽¹⁾

(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 ⁽²⁾		-0.5	7	V
V_O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾		-0.5	7	V
V_O	Output voltage ^{(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
T_{stg}	Storage temperature		-65	150	°C

- (1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. *Absolute Maximum Ratings* do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Conditions*. If used outside the Recommended Operating Conditions but within the *Absolute Maximum Ratings*, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
- (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.

6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per AEC Q100-002 HBM ESD Classification Level 2 ⁽¹⁾	V
		Charged device model (CDM), per AEC Q100-011 CDM ESD Classification Level C6	

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

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 input 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	
Δt/Δv	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	
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](#).

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74LV594A-Q1	UNIT
		BQB (WQFN)	
		16 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	86.0	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	82.6	
R _{θJB}	Junction-to-board thermal resistance	54.9	
ψ _{JT}	Junction-to-top characterization parameter	9.5	
ψ _{JB}	Junction-to-board characterization parameter	54.9	
ψ _{JC}	Junction-to-bottom characterization parameter	32.5	

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

6.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	VCC	MIN	TYP	MAX	UNIT
V _{OH}	I _{OH} = −50 μA	2 V to 5.5 V	V _{CC} − 0.1			V
	I _{OH} = −2 μA	2.3 V	2			
	I _{OH} = −6 μA	3 V	2.48			
	I _{OH} = −12 μA	4.5 V	3.8			
V _{OL}	I _{OH} = −50 μA	2 V to 5.5 V	0.1			V
	I _{OH} = −2 μA	2.3 V	0.4			
	I _{OH} = −6 μA	3 V	0.44			
	I _{OH} = −12 μA	4.5 V	0.55			
I _I	V _I = 5.5 V or GND	0 to 5.5 V	±1			μA
I _{CC}	V _I = V _{CC} of GND, I _O = 0	5.5 V	20			μA
I _{off}	V _I or V _O = 0 to 5.5 V	0	5			μA
C _i	V _I = V _{CC} or GND	3.3 V	3.5			pF

6.6 Switching Characteristics: $V_{CC} = 2.5\ V \pm 0.2\ V$

over recommended operating free-air temperature range (unless otherwise noted). See [Figure 6-1](#).

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T _A = 25°C			−40°C TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
f _{max}			C _L = 15 pF	65	80		35		MHz
			C _L = 50 pF	60	70		30		
t _{PLH}	SRCLK	Q _A − Q _H	C _L = 15 pF		6.4	10.6	1	12.5	ns
t _{PHL}					6.3	10.4	1	12.5	
t _{PLH}		Q _{H'}			7.4	12.1	1	15	
t _{PHL}				7.2	11.6	1	15		
t _{PHL}	RCLK	Q _A − Q _H			7.9	12.7	1	15.5	
		Q _{H'}			7.4	11.9	1	15.5	
t _{PLH}	SRCLR	Q _A − Q _H	C _L = 50 pF		9.5	14.1	1	17	ns
t _{PHL}					10.8	15.5	1	19.5	
t _{PLH}		Q _{H'}			10.6	15.7	1	18.5	
t _{PHL}				11.3	16.1	1	20.5		
t _{PHL}	RCLR	Q _A − Q _H			12.1	17.4	1	21	
		Q _{H'}			11.6	16.5	1	20.6	

6.7 Switching Characteristics: $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$

over recommended operating free-air temperature range (unless otherwise noted). See [Figure 6-1](#).

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			$-40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
$f_{\max}$			$C_L = 15\text{ pF}$	80	120		60		MHz
			$C_L = 50\text{ pF}$	55	105		40		
t_{PLH}	SRCLK	$Q_A - Q_H$	$C_L = 15\text{ pF}$		4.6	8	1	10.5	ns
t_{PHL}					4.9	8.2	1	10.5	
t_{PLH}		$Q_{H'}$			5.4	9.1	1	11.5	
t_{PHL}	RCLK	$Q_A - Q_H$			5.5	9.2	1	11.6	
t_{PHL}					6	9.8	1	12.1	
t_{PHL}		$Q_{H'}$			5.6	9.2	1	12	
t_{PLH}	$\overline{\text{SRCLR}}$	$Q_A - Q_H$	$C_L = 50\text{ pF}$				1	12.5	ns
t_{PHL}							1	15	
t_{PLH}		$Q_{H'}$					1	14	
t_{PHL}	$\overline{\text{RCLR}}$	$Q_A - Q_H$					1	15.5	
t_{PHL}							1	16.1	
t_{PHL}		$Q_{H'}$					1	16	

6.8 Switching Characteristics: $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$

over recommended operating free-air temperature range (unless otherwise noted). See [Figure 6-1](#).

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			$-40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
				MIN	TYP	MAX			
$f_{\max}$			$C_L = 15\text{ pF}$	135	170		105		MHz
			$C_L = 50\text{ pF}$	120	140		85		
t_{PLH}	SRCLK	$Q_A - Q_H$	$C_L = 15\text{ pF}$		3.3	6.2	1	8	ns
t_{PHL}					3.7	6.5	1	8.5	
t_{PLH}		$Q_{H'}$			3.7	6.8	1	8.5	
t_{PHL}	RCLK	$Q_A - Q_H$			4.1	7.2	1	9	
t_{PHL}					4.5	7.6	1	9.5	
t_{PHL}		$Q_{H'}$			4.1	7.1	1	9	
t_{PLH}	$\overline{\text{SRCLR}}$	$Q_A - Q_H$	$C_L = 50\text{ pF}$		4.9	7.8	1	9.6	ns
t_{PHL}					5.8	8.9	1	11	
t_{PLH}		$Q_{H'}$			5.5	8.6	1	10.5	
t_{PHL}	$\overline{\text{RCLR}}$	$Q_A - Q_H$			6	9.2	1	11.5	
t_{PHL}					6.6	10	1	12	
t_{PHL}		$Q_{H'}$			6	9.2	1	11.5	

6.9 Timing Requirements: $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$

over recommended operating free-air temperature range. See [Figure 6-1](#).

			$T_A = 25^\circ\text{C}$		$-40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
			MIN	MAX	MIN	MAX	
t_w	Pulse duration	RCLK or SRCLK high or low	7		8.5		ns
		RCKR or SCRCLR low	6		7.5		
t_{su}	Setup time	SER before SRCLK $\uparrow$	5.5		6		ns
		SRCLK $\uparrow$ before RCLK $\uparrow$	8		10		
		SCRCLR low before RCLK $\uparrow$ ⁽¹⁾	8.5		10.5		
		SRCLR high (inactive) before SRCLK $\uparrow$	6		7.5		
		RCLK high (inactive) before RCLK $\uparrow$	6.7		8.5		
t_h	Hold time	SER after SRCLK $\uparrow$	1.5		2		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.

6.10 Timing Requirements: $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$

over recommended operating free-air temperature range. See [Figure 6-1](#).

			$T_A = 25^\circ\text{C}$		$-40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
			MIN	MAX	MIN	MAX	
t_w	Pulse duration	RCLK or SRCLK high or low	5.5		6.5		ns
		RCKR or SCRCLR low	5		6		
t_{su}	Setup time	SER before SRCLK $\uparrow$	3.5		4		ns
		SRCLK $\uparrow$ before RCLK $\uparrow$	8		9.5		
		SCRCLR low before RCLK $\uparrow$ ⁽¹⁾	8		10		
		SRCLR high (inactive) before SRCLK $\uparrow$	4.2		5.5		
		RCLK high (inactive) before RCLK $\uparrow$	4.6		6		
t_h	Hold time	SER after SRCLK $\uparrow$	1.5		2		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.

6.11 Timing Requirements: $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$

over recommended operating free-air temperature range. See [Figure 6-1](#).

			$T_A = 25^\circ\text{C}$		$-40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
			MIN	MAX	MIN	MAX	
t_w	Pulse duration	RCLK or SRCLK high or low	5		6		ns
		RCKR or SCRCLR low	5.2		6.2		
t_{su}	Setup time	SER before SRCLK $\uparrow$	3		3.5		ns
		SRCLK $\uparrow$ before RCLK $\uparrow$	5		6		
		SCRCLR low before RCLK $\uparrow$ ⁽¹⁾	5		5.5		
		SRCLR high (inactive) before SRCLK $\uparrow$	2.9		4		
		RCLK high (inactive) before RCLK $\uparrow$	3.2		4.5		
t_h	Hold time	SER after SRCLK $\uparrow$	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.

6.12 Noise Characteristics

over operating free-air temperature range (unless otherwise noted), $V_{CC} = 3.3\text{ V}$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$ ⁽¹⁾

PARAMETER		MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.5	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.1	–0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		2.8		V
$V_{IH(V)}$	High-level dynamic input voltage	2.31			V
$V_{IL(V)}$	Low-level dynamic input voltage			0.99	V

(1) Characteristics are 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	$f = 10\text{ MHz}$	3.3 V	93	pF
			5 V	112	

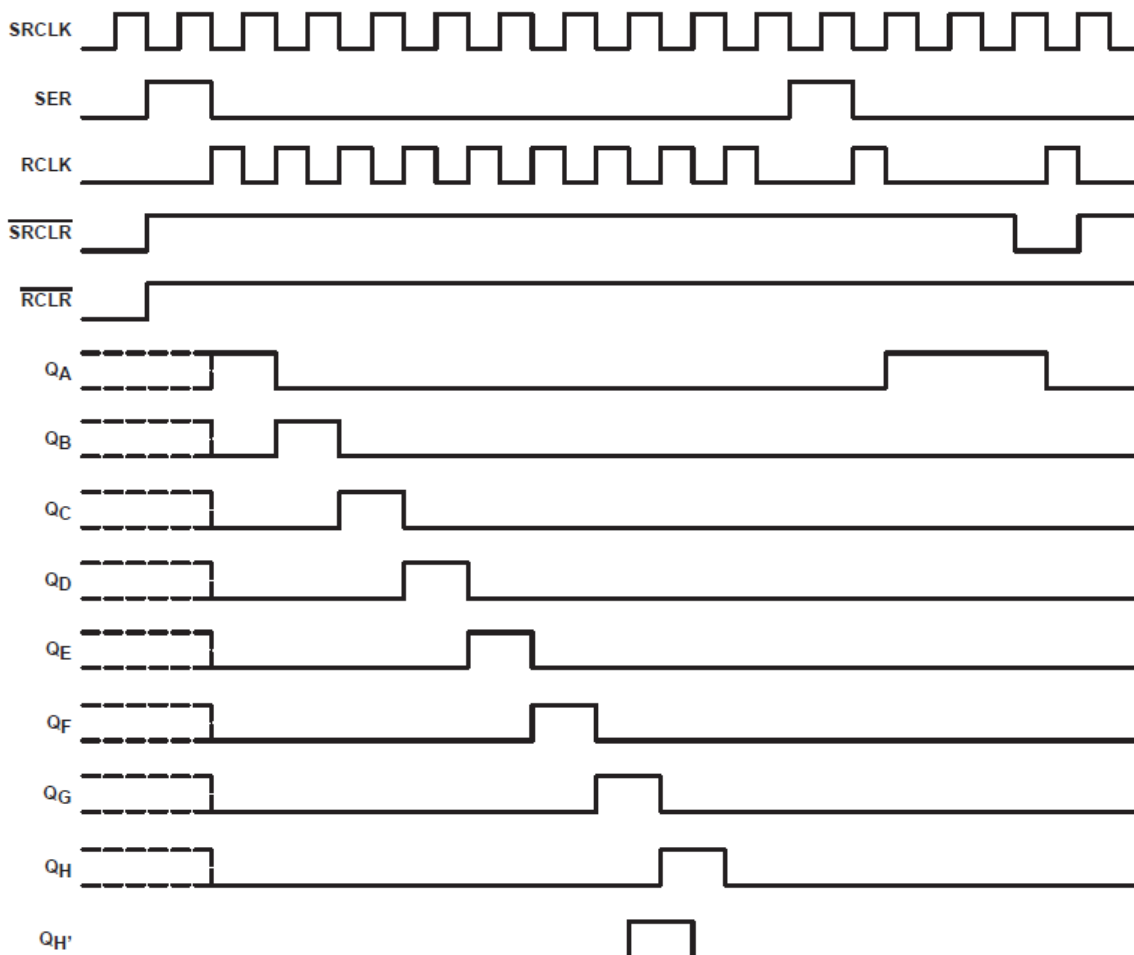


Figure 6-1. Timing Diagram

6.14 Typical Characteristics

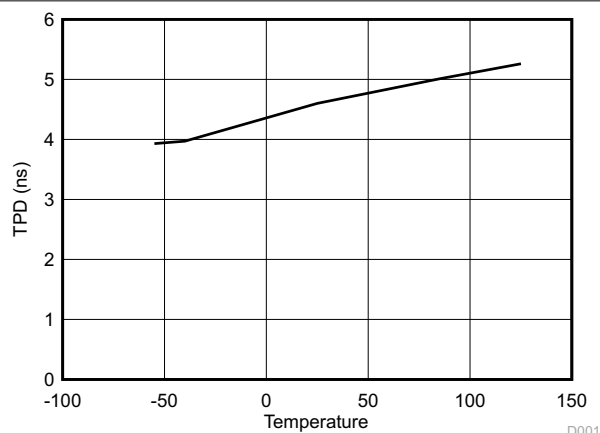


Figure 6-2. TPD vs. Temperature at 3.3 V

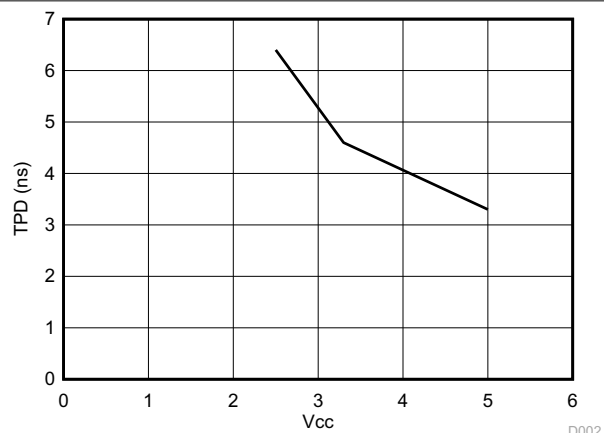
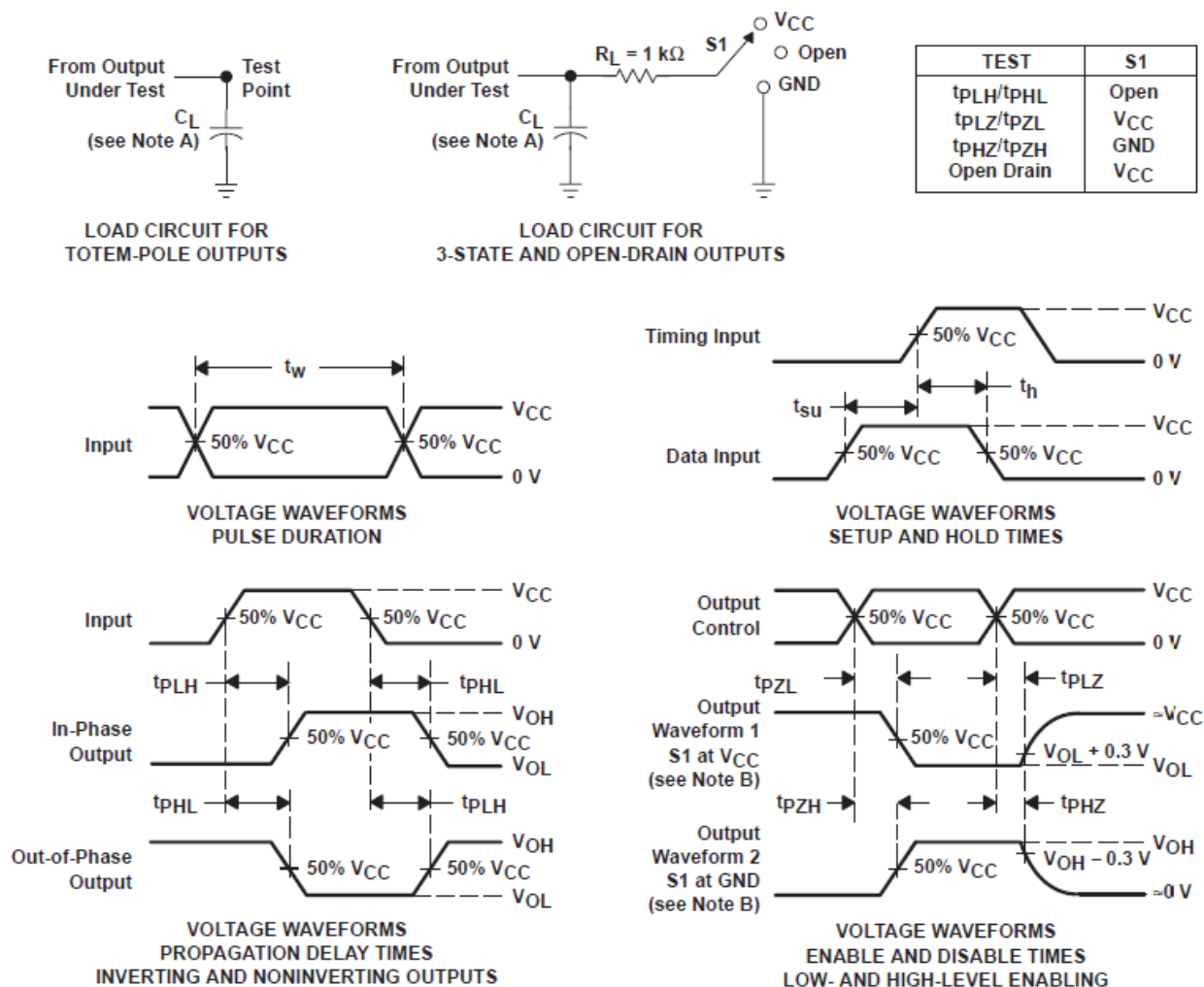


Figure 6-3. TPD vs. Vcc at 25°C

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

Figure 7-1. Load Circuit and Voltage Waveforms

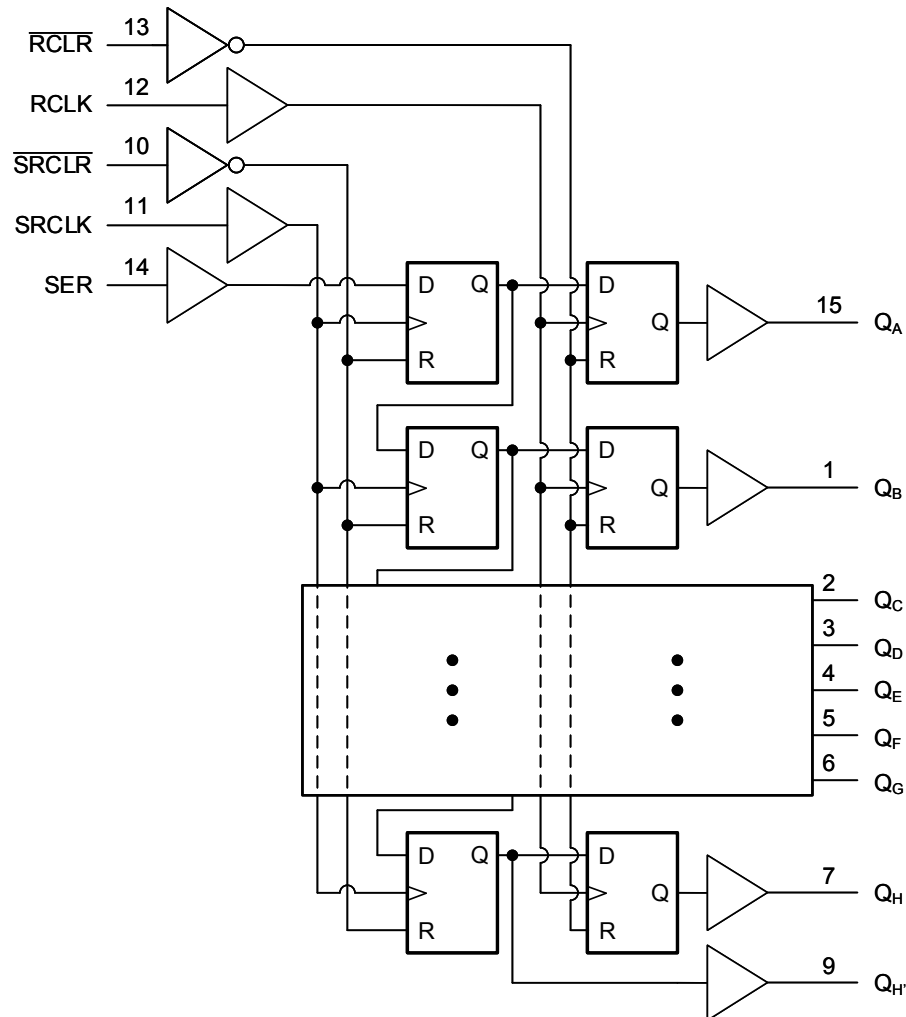
8 Detailed Description

8.1 Overview

The SN74LV594A-Q1 devices are 8-bit shift registers designed for 2-V to 5.5-V V_{CC} operation.

These devices contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Separate clocks (RCLK, SRCLK) and direct overriding clear ($\overline{RCLR}$, $\overline{SRCLR}$) inputs are provided on the shift and storage registers. A serial output ($Q_{H'}$) is provided for cascading purposes. The shift-register (SRCLK) and storage-register (RCLK) clocks are positive-edge triggered. If the clocks are tied together, then the shift register always is one clock pulse ahead of the storage register.

8.2 Functional Block Diagram



8.3 Feature Description

The device's wide operating range allows it to be used in a variety of systems that use different logic levels. The low propagation delay allows fast switching and higher speeds of operation. In addition, the low ground bounce stabilizes the performance of non-switching outputs while another output is switching.

8.4 Device Functional Modes

Table 8-1. 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.

9 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.

9.1 Application Information

The SN74LV594A-Q1 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.

9.2 Typical Application

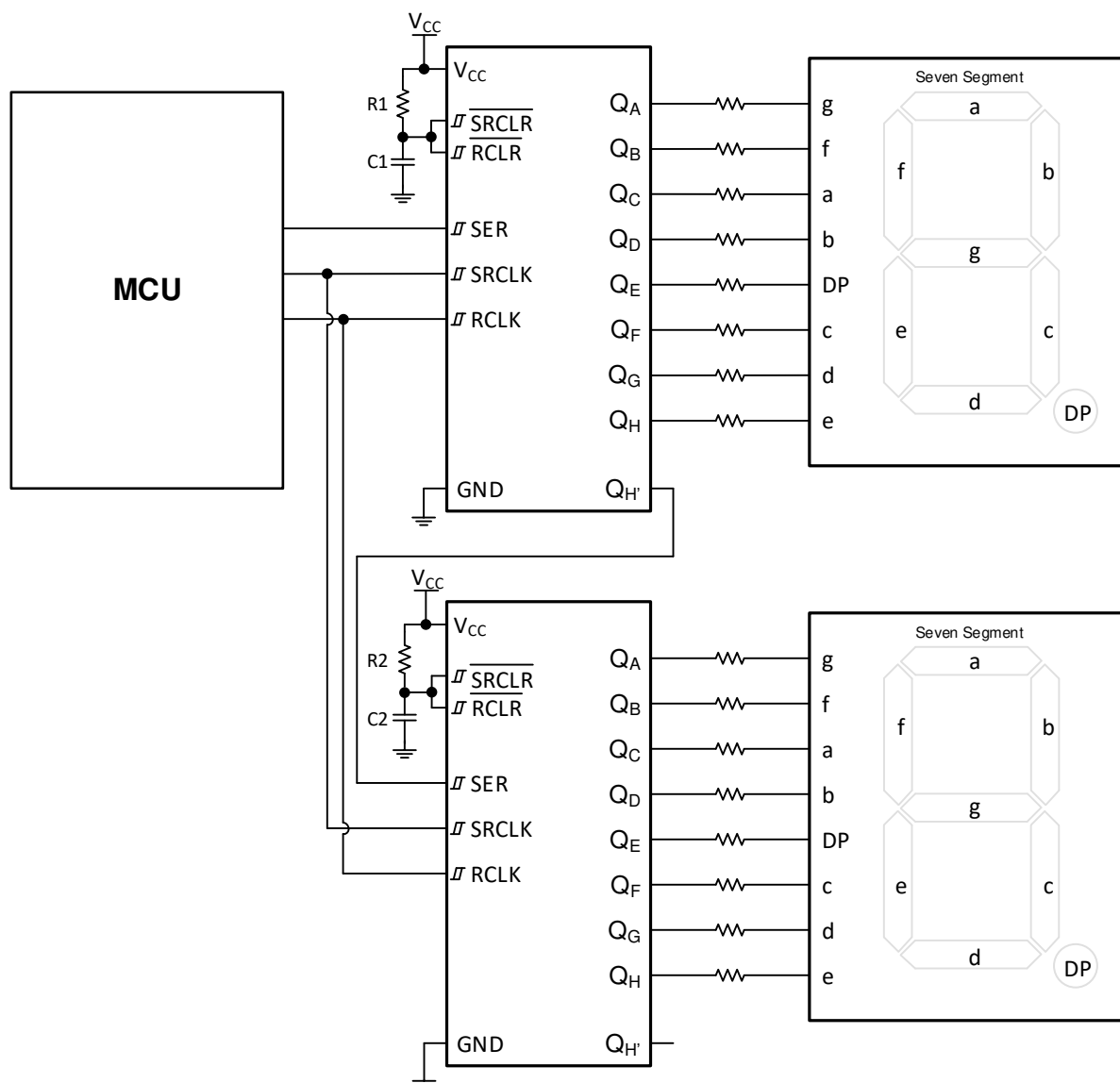


Figure 9-1. Typical Application Schematic

9.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care 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 consider routing and load conditions to prevent ringing.

9.2.2 Detailed Design Procedure

- Recommended input conditions:
 - Rise time and fall time specs. See ($\Delta t/\Delta V$) in [Section 6.3](#).
 - Specified high and low levels. See (V_{IH} and V_{IL}) in [Section 6.3](#).
 - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid V_{CC} .
- Recommended 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} .

9.2.3 Application Curves

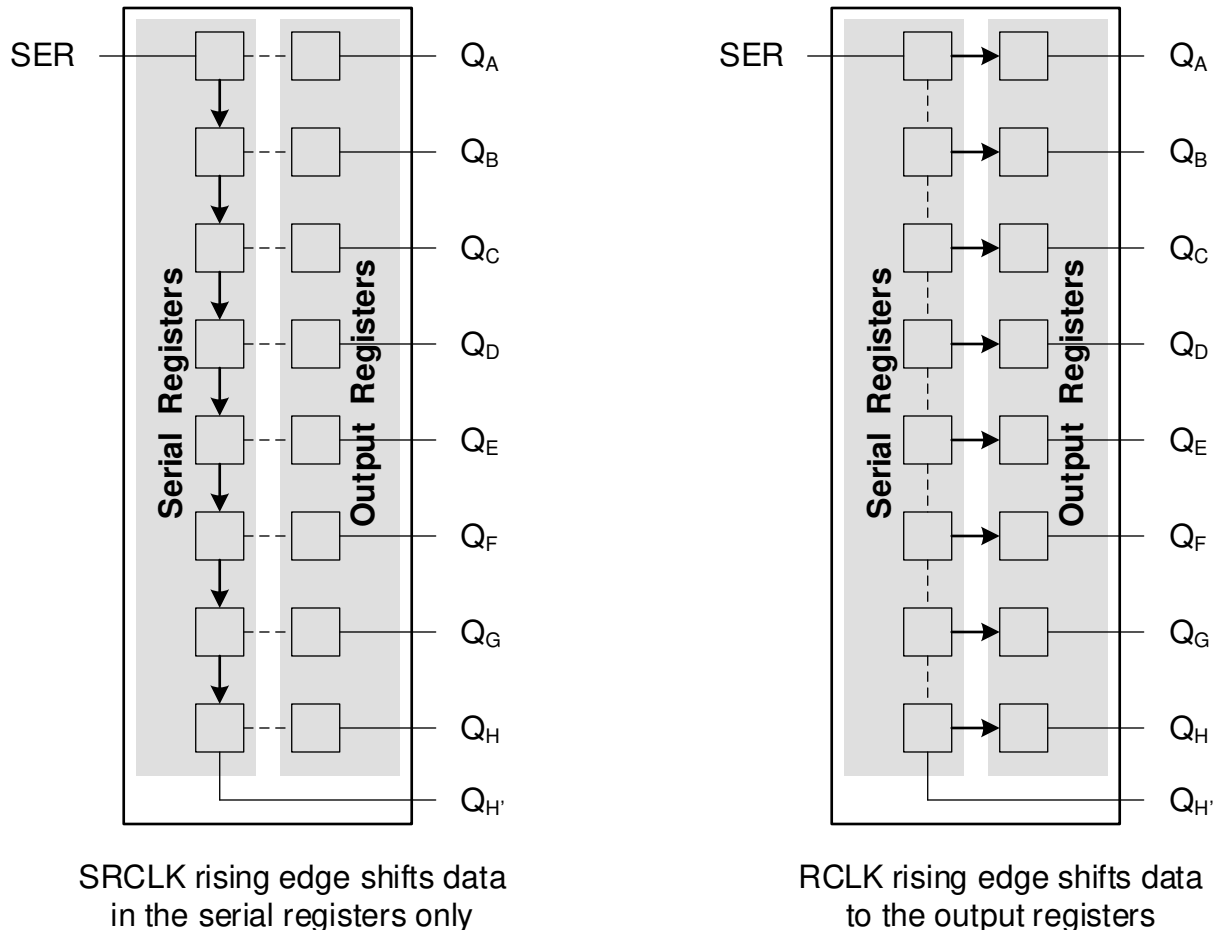


Figure 9-2. Simplified functional diagram showing clock operation

10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the [Recommended Operating Conditions](#). Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends a 0.1- μ F capacitor and 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 should be installed as close as possible to the power terminal for best results.

11 Layout

11.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever 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 three of the four 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 below are 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 make more sense or is more convenient. Floating outputs is generally acceptable, 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 I.O's so they also cannot float when disabled.

11.2 Layout Example

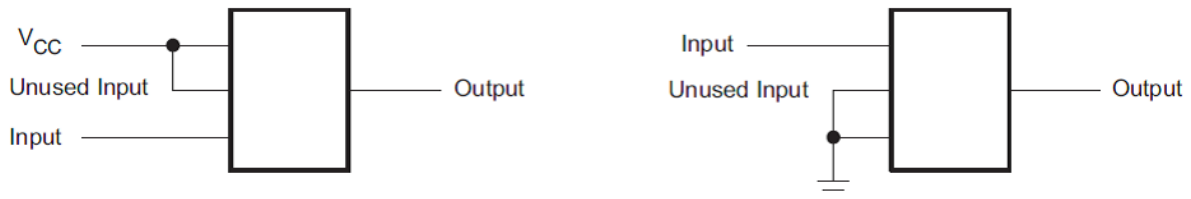


Figure 11-1. Layout Example

12 Device and Documentation Support

12.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.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.

12.2 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](#).

12.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

12.4 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.

12.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

13 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 part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN74LV594AQWBQBRQ1	Active	Production	WQFN (BQB) 16	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV594Q
SN74LV594AQWBQBRQ1.A	Active	Production	WQFN (BQB) 16	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV594Q

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts 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.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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OTHER QUALIFIED VERSIONS OF SN74LV594A-Q1 :

- Catalog : [SN74LV594A](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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
SN74LV594AQBQBRQ1	WQFN	BQB	16	3000	180.0	12.4	2.8	3.8	1.2	4.0	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)
SN74LV594AQBQBRQ1	WQFN	BQB	16	3000	210.0	185.0	35.0

GENERIC PACKAGE VIEW

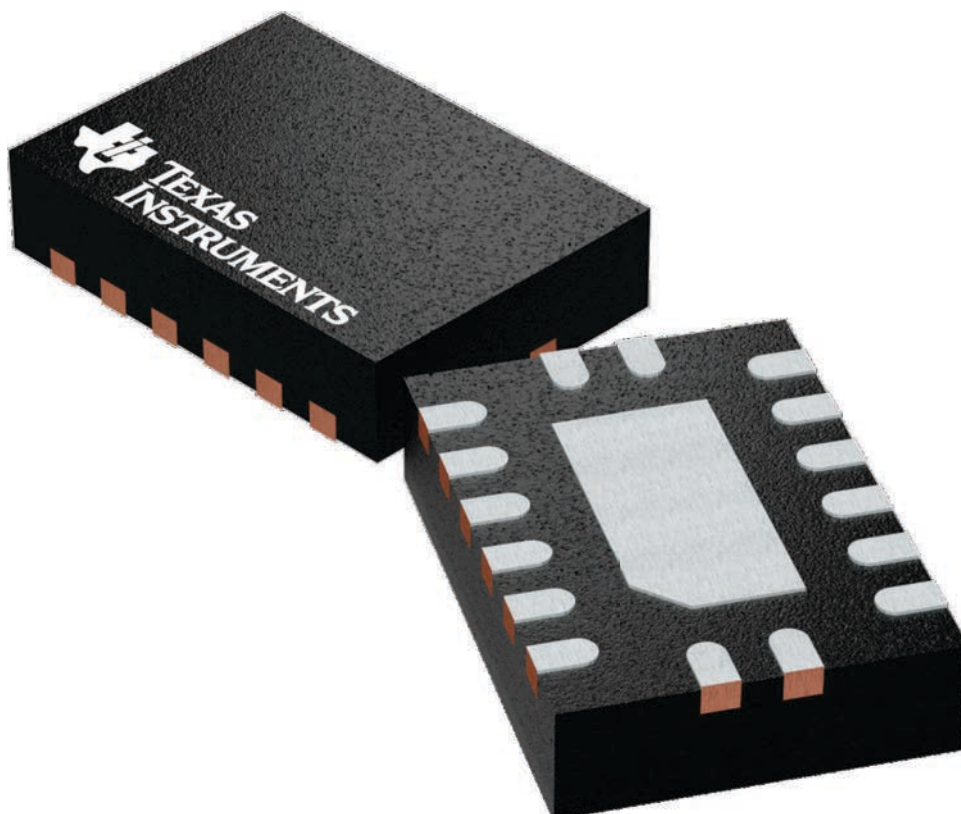
BQB 16

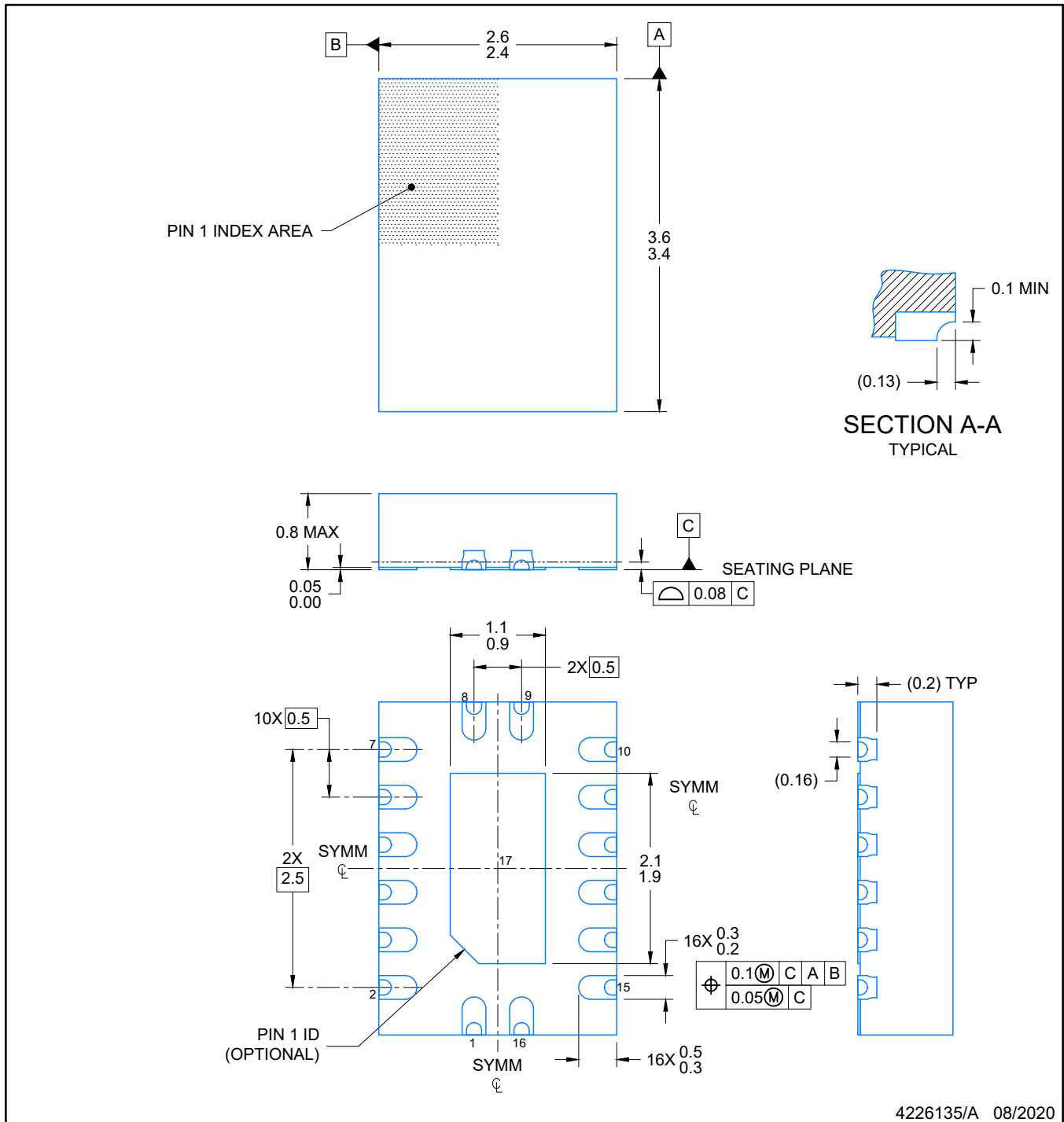
WQFN - 0.8 mm max height

2.5 x 3.5, 0.5 mm pitch

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.

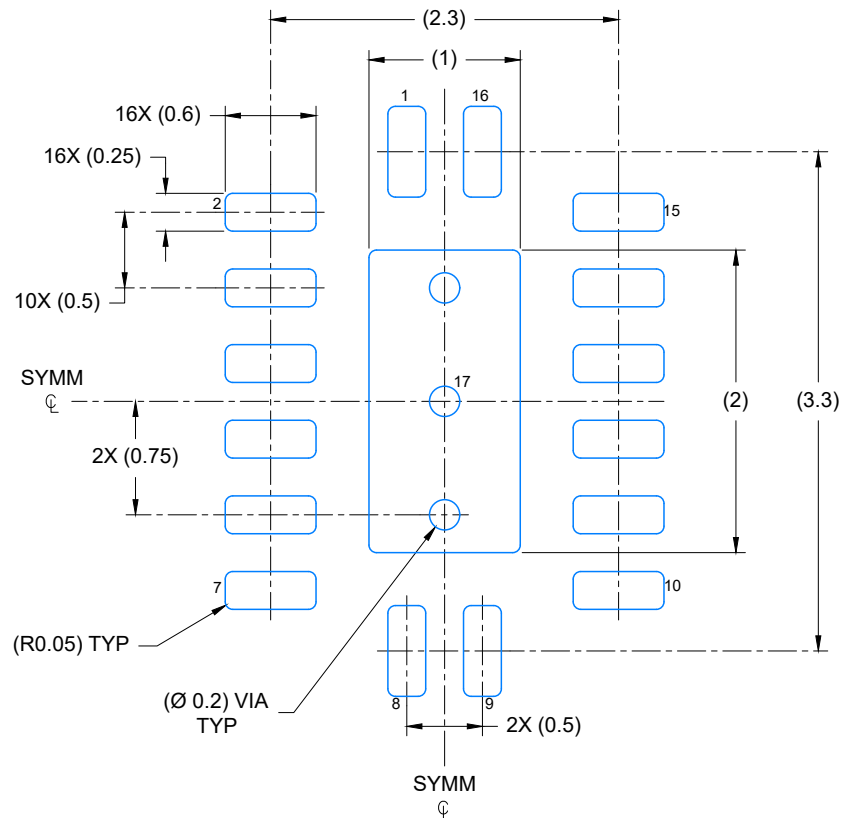




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NOTES:

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 optimal thermal and mechanical performance.

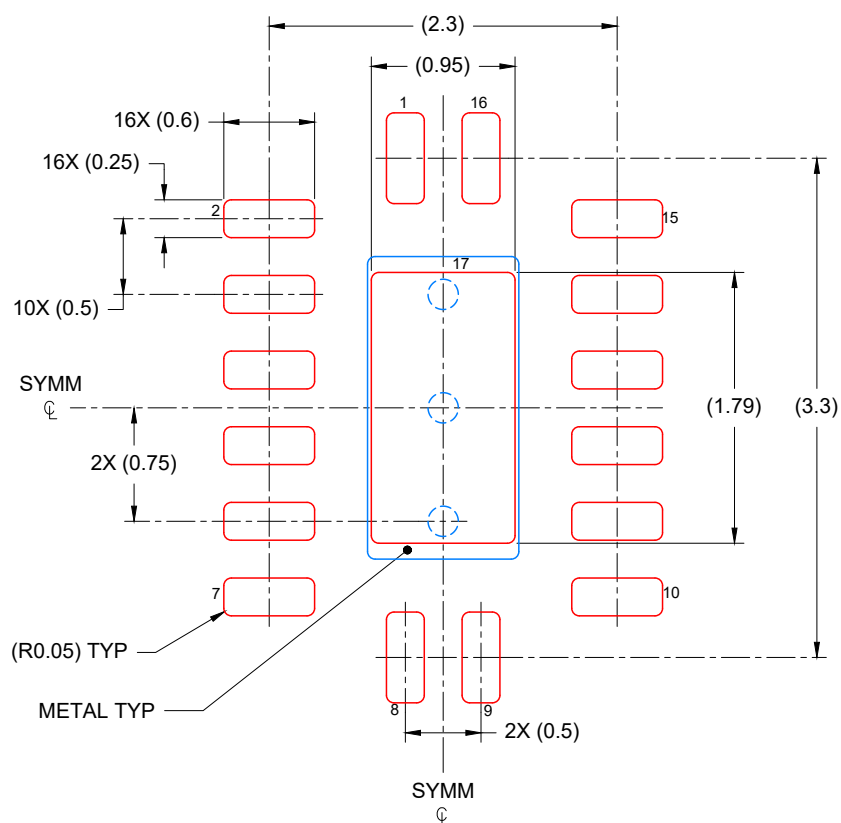


LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X

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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/sluea271).
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.



SOLDER PASTE EXAMPLE BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
85% PRINTED COVERAGE BY AREA
SCALE: 20X

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NOTES: (continued)

6. 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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