

SN74HCS174-Q1 Automotive Hex D-Type Flip-Flops with Clear and Schmitt-Trigger Inputs

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
- Wide operating voltage range: 2 V to 6 V
- Schmitt-trigger inputs allow for slow or noisy input signals
- Low power consumption
 - Typical I_{CC} of 100 nA
 - Typical input leakage current of ± 100 nA
- ± 7.8 -mA output drive at 6 V

2 Applications

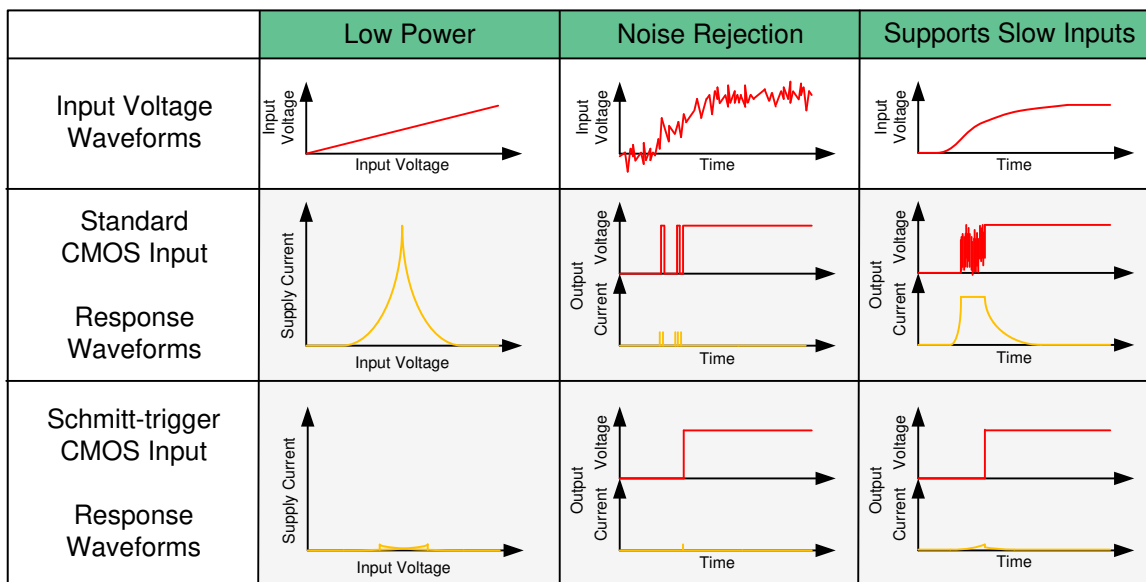
- Parallel data synchronization
- Parallel data storage
- Shift register
- Pattern generators

3 Description

The SN74HCS174-Q1 contains six positive-edge-triggered D-type flip-flops with shared clock (CLK) and clear ($\overline{\text{CLR}}$) inputs.

Device Information

PART NUMBER	PACKAGE ⁽¹⁾	BODY SIZE (NOM)
SN74HCS174PW-Q1	TSSOP (16)	5.00 mm x 4.40 mm
SN74HCS174D-Q1	SOIC (16)	9.90 mm x 3.90 mm



Benefits of Schmitt-trigger inputs



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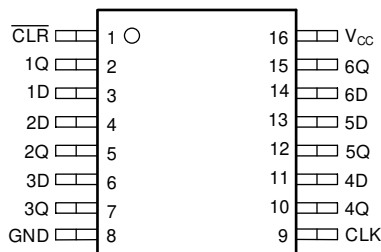
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4 Revision History

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

DATE	REVISION	NOTES
August 2020	*	Initial Release

5 Pin Configuration and Functions



D or PW Package 16-Pin SOIC or TSSOP Top View

Pin Functions

PIN		I/O ⁽¹⁾	DESCRIPTION
SOIC or TSSOP NO.	NAME		
1	CLR	I	Clear all channels, active low
2	1Q	O	Channel 1, Q output
3	1D	I	Channel 1, D input
4	2D	I	Channel 2, D input
5	2Q	O	Channel 2, Q output
6	3D	I	Channel 3, D input
7	3Q	O	Channel 3, Q output
8	GND	—	Ground
9	CLK	I	Clock all channels, rising edge triggered
10	4Q	O	Channel 4, Q output
11	4D	I	Channel 4, D input
12	5Q	O	Channel 5, Q output
13	5D	I	Channel 5, D input
14	6D	I	Channel 6, D input
15	6Q	O	Channel 6, Q output
16	V _{CC}	—	Positive supply

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
I _{IK}	Input clamp current ⁽²⁾	V _I < –0.5 V or V _I > V _{CC} + 0.5 V		±20 mA
I _{OK}	Output clamp current ⁽²⁾	V _I < –0.5 V or V _I > V _{CC} + 0.5 V		±20 mA
I _O	Continuous output current	V _O = 0 to V _{CC}		±35 mA
	Continuous current through V _{CC} or GND			±70 mA
T _J	Junction temperature ⁽³⁾			150 °C
T _{stg}	Storage temperature	–65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Rating* 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 Condition*. 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.
- (3) Guaranteed by design.

6.2 ESD Ratings

		VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per AEC Q100-002 ⁽¹⁾ HBM ESD Classification Level 2	±4000
		Charged device model (CDM), per AEC Q100-011 CDM ESD Classification Level C6	±1500

- (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)

		MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	2	5	6	V
V _I	Input voltage	0		V _{CC}	V
V _O	Output voltage	0		V _{CC}	V
T _A	Ambient temperature	–40		125	°C

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74HCS174-Q1		UNIT
		PW (TSSOP)	D (SOIC)	
		16 PINS	16 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	141.2	122.2	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	78.8	80.9	°C/W
R _{θJB}	Junction-to-board thermal resistance	85.8	80.6	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	27.7	40.4	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	85.5	80.3	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	N/A	°C/W

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

6.5 Electrical Characteristics

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

PARAMETER		TEST CONDITIONS		V_{CC}	MIN	TYP	MAX	UNIT
V_{T+}	Positive switching threshold			2 V	0.7		1.5	V
				4.5 V	1.7		3.15	
				6 V	2.1		4.2	
V_{T-}	Negative switching threshold			2 V	0.3		1.0	V
				4.5 V	0.9		2.2	
				6 V	1.2		3.0	
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$) ⁽¹⁾			2 V	0.2		1.0	V
				4.5 V	0.4		1.4	
				6 V	0.6		1.6	
V_{OH}	High-level output voltage	$V_I = V_{IH}$ or V_{IL}	$I_{OH} = -20\ \mu\text{A}$	2 V to 6 V	$V_{CC} - 0.1$	$V_{CC} - 0.002$		V
			$I_{OH} = -6\ \text{mA}$	4.5 V	4.0	4.3		
			$I_{OH} = -7.8\ \text{mA}$	6 V	5.4	5.75		
V_{OL}	Low-level output voltage	$V_I = V_{IH}$ or V_{IL}	$I_{OL} = 20\ \mu\text{A}$	2 V to 6 V		0.002	0.1	V
			$I_{OL} = 6\ \text{mA}$	4.5 V		0.18	0.30	
			$I_{OL} = 7.8\ \text{mA}$	6 V		0.22	0.33	
I_I	Input leakage current	$V_I = V_{CC}$ or 0		6 V		± 100	± 1000	nA
I_{CC}	Supply current	$V_I = V_{CC}$ or 0, $I_O = 0$		6 V		0.1	2	μA
C_i	Input capacitance			2 V to 6 V			5	pF

(1) Guaranteed by design.

6.6 Timing Characteristics

$C_L = 50\ \text{pF}$; over operating free-air temperature range (unless otherwise noted). See [Parameter Measurement Information](#).

PARAMETER			V _{CC}	Operating free-air temperature (T _A)				UNIT
				25°C		−40°C to 125°C		
				MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency		2 V	60	40	MHz		
			4.5 V	180	130			
			6 V	200	145			
t _w	Pulse duration	CLR low	2 V	8	12	ns		
			4.5 V	5	6			
			6 V	5	6			
		CLK high or low	2 V	8	12			
			4.5 V	5	6			
			6 V	5	6			
t _{su}	Setup time	Data	2 V	12	18	ns		
			4.5 V	5	6			
			6 V	5	6			
		CLR inactive	2 V	12	18			
			4.5 V	5	6			
			6 V	5	6			
t _h	Hold time	Data after CLK↑	2 V	0	0	ns		
			4.5 V	0	0			
			6 V	0	0			

6.7 Switching Characteristics

$C_L = 50$ pF; over operating free-air temperature range (unless otherwise noted). See [Parameter Measurement Information](#).

PARAMETER		FROM	TO	V _{CC}	Operating free-air temperature (T _A)						UNIT
					25°C			−40°C to 125°C			
					MIN	TYP	MAX	MIN	TYP	MAX	
f _{max}	Max switching frequency			2 V	60			40			MHz
				4.5 V	180			130			
				6 V	200			145			
t _{pd}	Propagation delay	CLR	Any	2 V	15		27	35			ns
				4.5 V	8		13	18			
				6 V	7		11	16			
		CLK	Any	2 V	15		27	35			
				4.5 V	8		13	18			
				6 V	7		11	16			
t _t	Transition-time		Any output	2 V	9			17			ns
				4.5 V	5			8			
				6 V	4			7			

6.8 Operating Characteristics

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

PARAMETER		TEST CONDITIONS	V_{CC}	MIN	TYP	MAX	UNIT
C_{pd}	Power dissipation capacitance per gate	No load	2 V to 6 V		10		pF

6.9 Typical Characteristics

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

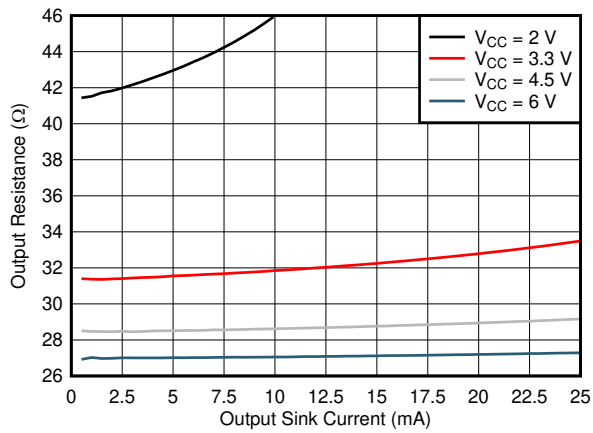


Figure 6-1. Output driver resistance in LOW state.

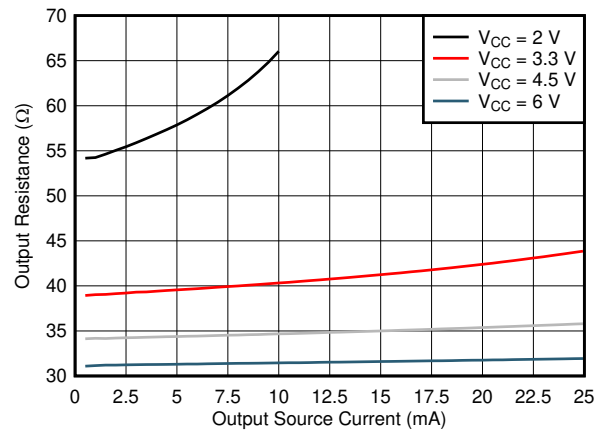


Figure 6-2. Output driver resistance in HIGH state.

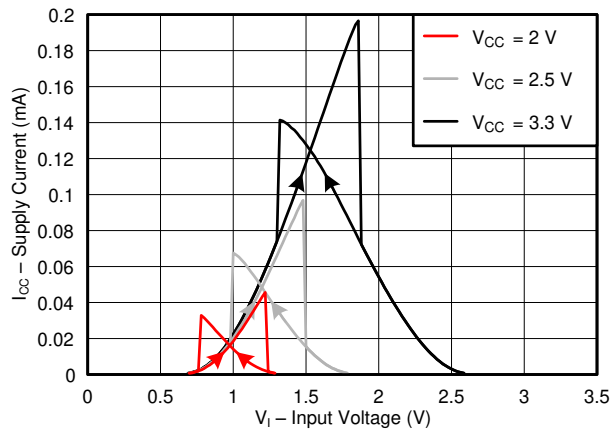


Figure 6-3. Supply current across input voltage, 2-, 2.5-, and 3.3-V supply

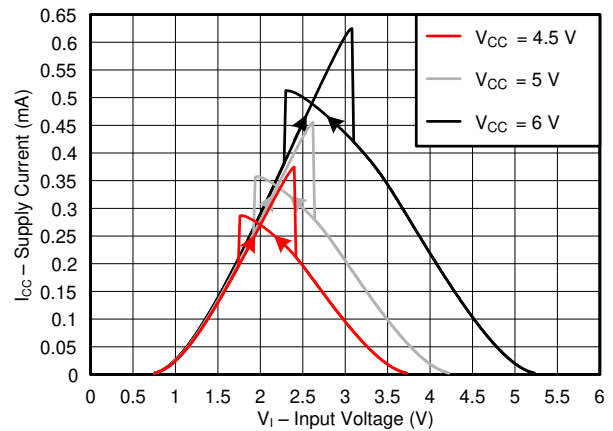


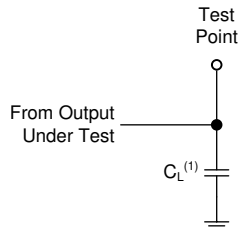
Figure 6-4. Supply current across input voltage, 4.5-, 5-, and 6-V supply

7 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_t < 2.5 \text{ ns}$.

For clock inputs, $f_{\max}$ is measured when the input duty cycle is 50%.

The outputs are measured one at a time with one input transition per measurement.



(1) C_L includes probe and test-fixture capacitance.

Figure 7-1. Load Circuit for Push-Pull Outputs

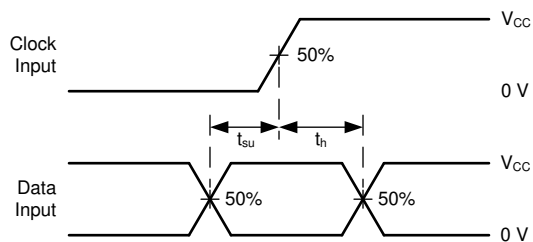


Figure 7-3. Voltage Waveforms, Setup and Hold Times

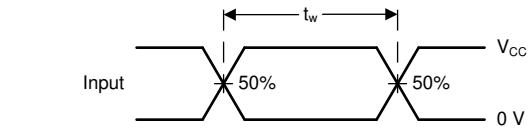
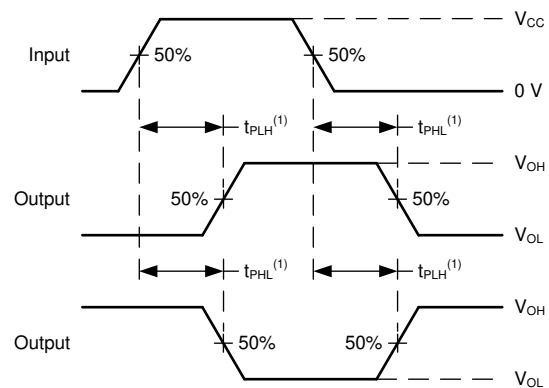
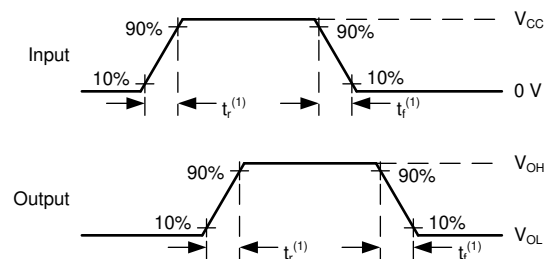


Figure 7-2. Voltage Waveforms, Pulse Duration



(1) The greater between t_{PLH} and t_{PHL} is the same as t_{pd} .

Figure 7-4. Voltage Waveforms Propagation Delays



(1) The greater between t_r and t_f is the same as t_t .

Figure 7-5. Voltage Waveforms, Input and Output Transition Times

8 Detailed Description

8.1 Overview

The SN74HCS174-Q1 is a positive-edge-triggered hex D-type flip-flop with direct clear ($\overline{\text{CLR}}$) input. Information at the data (D) inputs meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock (CLK) pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going edge of CLK. When CLK is at either the high or low level, the D input has no effect at the output.

8.2 Functional Block Diagram

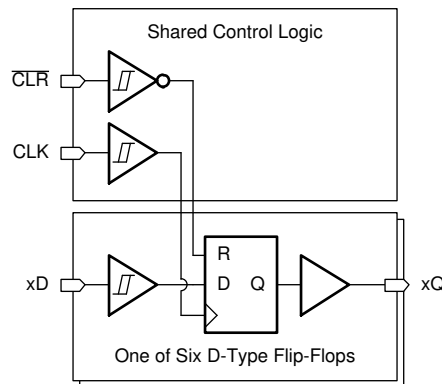


Figure 8-1. Logic Diagram (Positive Logic) for SN74HCS174-Q1

8.3 Feature Description

8.3.1 Balanced CMOS Push-Pull Outputs

This device includes balanced CMOS push-pull outputs. The term "balanced" indicates that the device can sink and source similar currents. The drive capability of this device may create fast edges into light loads so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. It is important for the output power of the device to be limited to avoid damage due to overcurrent. The electrical and thermal limits defined in the *Absolute Maximum Ratings* must be followed at all times.

Unused push-pull CMOS outputs should be left disconnected.

8.3.2 CMOS Schmitt-Trigger Inputs

This device includes inputs with the Schmitt-trigger architecture. These inputs are high impedance and are typically modeled as a resistor in parallel with the input capacitance given in the *Electrical Characteristics* table from the input to ground. The worst case resistance is calculated with the maximum input voltage, given in the *Absolute Maximum Ratings* table, and the maximum input leakage current, given in the *Electrical Characteristics* table, using Ohm's law ($R = V \div I$).

The Schmitt-trigger input architecture provides hysteresis as defined by ΔV_T in the *Electrical Characteristics* table, which makes this device extremely tolerant to slow or noisy inputs. While the inputs can be driven much slower than standard CMOS inputs, it is still recommended to properly terminate unused inputs. Driving the inputs with slow transitioning signals will increase dynamic current consumption of the device. For additional information regarding Schmitt-trigger inputs, please see [Understanding Schmitt Triggers](#).

8.3.3 Latching Logic

This device includes latching logic circuitry. Latching circuits commonly include D-type latches and D-type flip-flops, but include all logic circuits that act as volatile memory.

When the device is powered on, the state of each latch is unknown. There is no default state for each latch at start-up.

The output state of each latching logic circuit only remains stable as long as power is applied to the device within the supply voltage range specified in the *Recommended Operating Conditions* table.

8.3.4 Clamp Diode Structure

The inputs and outputs to this device have both positive and negative clamping diodes as depicted in [Electrical Placement of Clamping Diodes for Each Input and Output](#).

CAUTION

Voltages beyond the values specified in the *Absolute Maximum Ratings* table can cause damage to the device. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

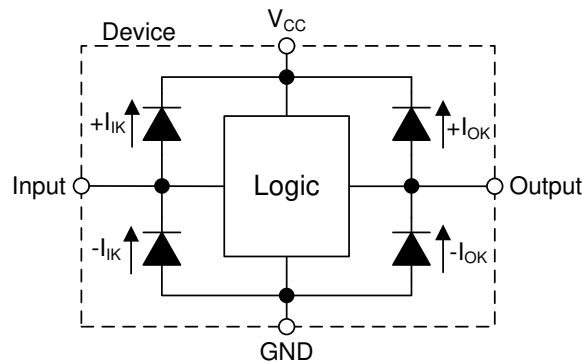


Figure 8-2. Electrical Placement of Clamping Diodes for Each Input and Output

8.4 Device Functional Modes

[Function Table](#) lists the functional modes of the SN74HCS174-Q1.

Table 8-1. Function Table

INPUTS ⁽¹⁾			OUTPUT ⁽²⁾
CLR	CLK	D	Q
L	X	X	L
H	↑	H	H
H	↑	L	L
H	L	X	Q ₀

(1) H = High voltage level, L = Low voltage level, X = Don't care, ↑ = Low to High transition

(2) Q₀ = Previous output state (High or Low)

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. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The SN74HCS174-Q1 contains multiple D-type flip-flops that are operated by the same clock. By connecting multiple channels together in series, a shift register can be formed. This produces a delay of a specific number of clock cycles for incoming data. The application schematic shown below gives an example of using three channels of the SN74HCS174-Q1 to produce a delay of three clock cycles.

Because this device includes Schmitt-trigger inputs, the clear pin ($\overline{\text{CLR}}$) can be directly connected to the RC circuit shown to clear the outputs at system power on.

9.2 Typical Application

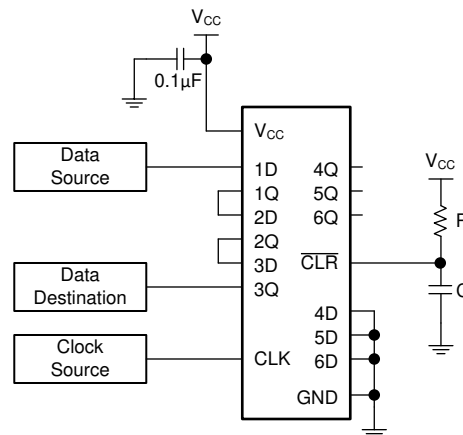


Figure 9-1. Typical application block diagram

9.2.1 Design Requirements

9.2.1.1 Power Considerations

Ensure the desired supply voltage is within the range specified in the *Recommended Operating Conditions*. The supply voltage sets the device's electrical characteristics as described in the *Electrical Characteristics*.

The positive voltage supply must be capable of sourcing current equal to the total current to be sourced by all outputs of the SN74HCS174-Q1 plus the maximum static supply current, I_{CC} , listed in *Electrical Characteristics* and any transient current required for switching. The logic device can only source as much current as is provided by the positive supply source. Be sure not to exceed the maximum total current through V_{CC} listed in the *Absolute Maximum Ratings*.

The ground must be capable of sinking current equal to the total current to be sunk by all outputs of the SN74HCS174-Q1 plus the maximum supply current, I_{CC} , listed in *Electrical Characteristics*, and any transient current required for switching. The logic device can only sink as much current as can be sunk into its ground connection. Be sure not to exceed the maximum total current through GND listed in the *Absolute Maximum Ratings*.

The SN74HCS174-Q1 can drive a load with a total capacitance less than or equal to 50 pF while still meeting all of the datasheet specifications. Larger capacitive loads can be applied, however it is not recommended to exceed 50 pF.

The SN74HCS174-Q1 can drive a load with total resistance described by $R_L \geq V_O / I_O$, with the output voltage and current defined in the *Electrical Characteristics* table with V_{OH} and V_{OL} . When outputting in the high state, the output voltage in the equation is defined as the difference between the measured output voltage and the supply voltage at the V_{CC} pin.

Total power consumption can be calculated using the information provided in [CMOS Power Consumption and Cpd Calculation](#).

Thermal increase can be calculated using the information provided in [Thermal Characteristics of Standard Linear and Logic \(SLL\) Packages and Devices](#).

CAUTION

The maximum junction temperature, $T_{J(max)}$ listed in the *Absolute Maximum Ratings*, is an additional limitation to prevent damage to the device. Do not violate any values listed in the *Absolute Maximum Ratings*. These limits are provided to prevent damage to the device.

9.2.1.2 Input Considerations

Input signals must cross $V_{t(min)}$ to be considered a logic LOW, and $V_{t+(max)}$ to be considered a logic HIGH. Do not exceed the maximum input voltage range found in the *Absolute Maximum Ratings*.

Unused inputs must be terminated to either V_{CC} or ground. These can be directly terminated if the input is completely unused, or they can be connected with a pull-up or pull-down resistor if the input is to be used sometimes, but not always. A pull-up resistor is used for a default state of HIGH, and a pull-down resistor is used for a default state of LOW. The resistor size is limited by drive current of the controller, leakage current into the SN74HCS174-Q1, as specified in the *Electrical Characteristics*, and the desired input transition rate. A 10-k Ω resistor value is often used due to these factors.

The SN74HCS174-Q1 has no input signal transition rate requirements because it has Schmitt-trigger inputs.

Another benefit to having Schmitt-trigger inputs is the ability to reject noise. Noise with a large enough amplitude can still cause issues. To know how much noise is too much, please refer to the $\Delta V_{T(min)}$ in the *Electrical Characteristics*. This hysteresis value will provide the peak-to-peak limit.

Unlike what happens with standard CMOS inputs, Schmitt-trigger inputs can be held at any valid value without causing huge increases in power consumption. The typical additional current caused by holding an input at a value other than V_{CC} or ground is plotted in the *Typical Characteristics*.

Refer to the *Feature Description* section for additional information regarding the inputs for this device.

9.2.1.3 Output Considerations

The positive supply voltage is used to produce the output HIGH voltage. Drawing current from the output will decrease the output voltage as specified by the V_{OH} specification in the *Electrical Characteristics*. The ground voltage is used to produce the output LOW voltage. Sinking current into the output will increase the output voltage as specified by the V_{OL} specification in the *Electrical Characteristics*.

Push-pull outputs that could be in opposite states, even for a very short time period, should never be connected directly together. This can cause excessive current and damage to the device.

Two channels within the same device with the same input signals can be connected in parallel for additional output drive strength.

Unused outputs can be left floating. Do not connect outputs directly to V_{CC} or ground.

Refer to *Feature Description* section for additional information regarding the outputs for this device.

9.2.2 Detailed Design Procedure

1. Add a decoupling capacitor from V_{CC} to GND. The capacitor needs to be placed physically close to the device and electrically close to both the V_{CC} and GND pins. An example layout is shown in the *Layout* section.

2. Ensure the capacitive load at the output is ≤ 50 pF. This is not a hard limit, however it will ensure optimal performance. This can be accomplished by providing short, appropriately sized traces from the SN74HCS174-Q1 to the receiving device(s).
3. Ensure the resistive load at the output is larger than $(V_{CC} / I_{O(max)}) \Omega$. This will ensure that the maximum output current from the *Absolute Maximum Ratings* is not violated. Most CMOS inputs have a resistive load measured in megaohms; much larger than the minimum calculated above.
4. Thermal issues are rarely a concern for logic gates, however the power consumption and thermal increase can be calculated using the steps provided in the application report, [CMOS Power Consumption and Cpd Calculation](#).

9.2.3 Application Curve

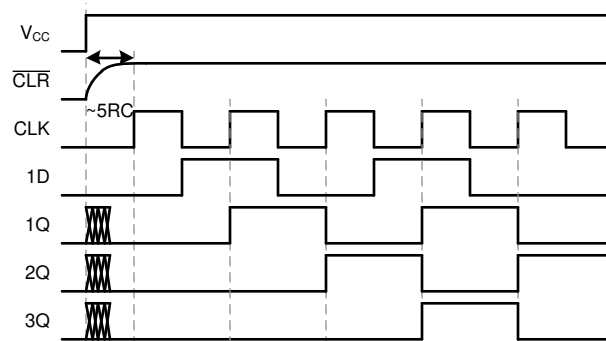


Figure 9-2. Application timing diagram

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. A 0.1- μF capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- μF and 1- μF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in given example layout image.

11 Layout

11.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. 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 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.

11.2 Layout Example

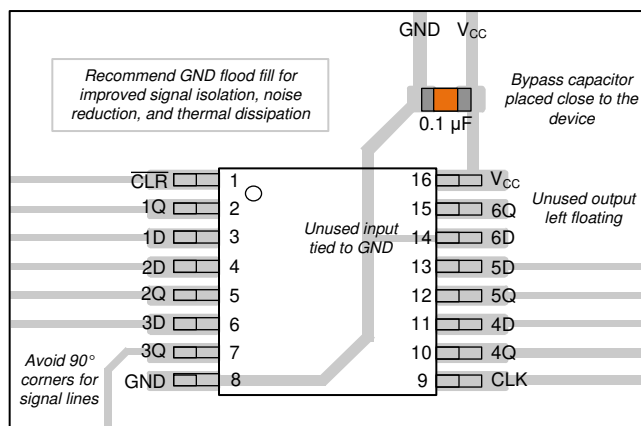


Figure 11-1. Example layout for the SN74HCS174-Q1 in the PW package.

12 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.

12.1 Documentation Support

12.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [HCMOS Design Considerations application report](#) (SCLA007)
- Texas Instruments, [CMOS Power Consumption and \$C_{pd}\$ Calculation application report](#) (SDYA009)
- Texas Instruments, [Designing With Logic application report](#)

12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [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.

12.3 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.

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12.4 Trademarks

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All other trademarks are the property of their respective owners.

12.5 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.

12.6 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 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
SN74HCS174QDRQ1	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HCS174Q	Samples
SN74HCS174QPWRQ1	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HCS174Q	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 SN74HCS174-Q1 :

- Catalog: [SN74HCS174](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION



*All dimensions are nominal

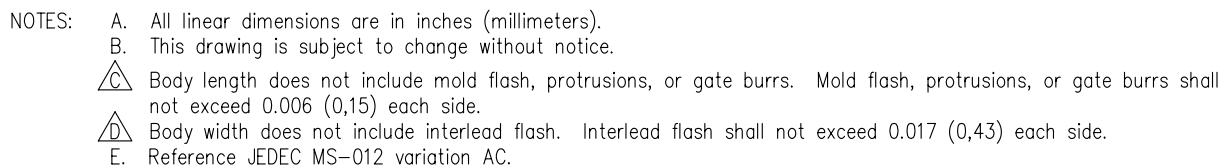
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74HCS174QDRQ1	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74HCS174QPWRQ1	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HCS174QDRQ1	SOIC	D	16	2500	356.0	356.0	35.0
SN74HCS174QPWRQ1	TSSOP	PW	16	2000	356.0	356.0	35.0





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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. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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