

## SNx4HC563 Octal Transparent D-Type Latches With 3-State Outputs

### 1 Features

- Wide operating voltage range of 2 V to 6 V
- High-current 3-state outputs drive bus lines directly or up to 15 LSTTL loads
- Lowpower consumption, 80- $\mu$ A max  $I_{CC}$
- Typical  $t_{pd} = 21$  ns
- $\pm 6$ -mA output drive at 5 V
- Low input current of 1  $\mu$ A max
- Bus-structured pinout

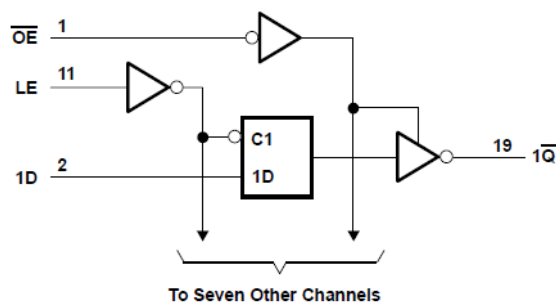
### 2 Description

These 8-bit transparent D-type latches feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

#### Device Information

PART NUMBER	PACKAGE <sup>(1)</sup>	BODY SIZE (NOM)
SN74HC563DW	SOIC (20)	12.80 mm $\times$ 7.50 mm
SN74HC563N	PDIP (20)	25.40 mm $\times$ 6.35 mm

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



**Functional Block Diagram**



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### 3 Revision History

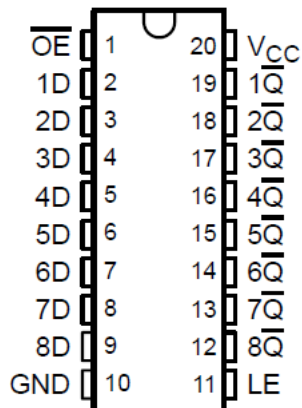
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Revision D (January 2022) to Revision E (July 2022)</b>	<b>Page</b>
• Junction-to-ambient thermal resistance values increased. DW was 58 is now 109.1, N was 69 is now 84.6....	4

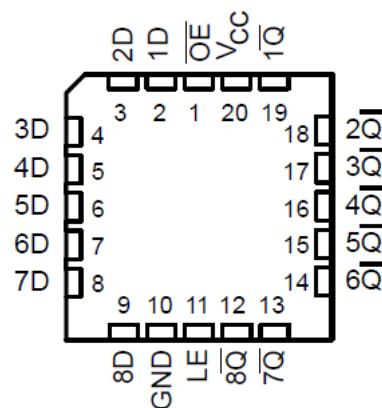
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<b>Changes from Revision C (March 2003) to Revision D (January 2022)</b>	<b>Page</b>
• Updated the numbering, formatting, tables, figures, and cross-references throughout the document to reflect modern data sheet standards.....	1

## 4 Pin Configuration and Functions



**DW or N package**  
**20-Pin SOIC or PDIP**  
**Top View**



**FK Package**  
**20-Pin LCCC**  
**Top View**

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range	-0.5	7	V
I <sub>IK</sub>	Input clamp current <sup>(2)</sup>	V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>CC</sub>		±20 mA
I <sub>OK</sub>	Output clamp current <sup>(2)</sup>	V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub>		±20 mA
I <sub>O</sub>	Continuous output current	V <sub>O</sub> = 0 to V <sub>CC</sub>		±35 mA
	Continuous current through V <sub>CC</sub> or GND			±70 mA
T <sub>J</sub>	Junction temperature			150 °C
T <sub>stg</sub>	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, 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.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 5.2 Recommended Operating Conditions<sup>(1)</sup>

		SN54HC563			SN74HC563			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	2	5	6	2	5	6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5		1.5		V	
		V <sub>CC</sub> = 4.5 V	3.15		3.15			
		V <sub>CC</sub> = 6 V	4.2		4.2			
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V	0.5		0.5		V	
		V <sub>CC</sub> = 4.5 V	1.35		1.35			
		V <sub>CC</sub> = 6 V	1.8		1.8			
V <sub>I</sub>	Input voltage	0	V <sub>CC</sub>		0	V <sub>CC</sub>		V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>		0	V <sub>CC</sub>		V
t <sub>t</sub>	Input transition (rise and fall) time	V <sub>CC</sub> = 2 V	1000		1000		ns	
		V <sub>CC</sub> = 4.5 V	500		500			
		V <sub>CC</sub> = 6 V	400		400			
T <sub>A</sub>	Operating free-air temperature	-55	125		-40	85		°C

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

### 5.3 Thermal Information

THERMAL METRIC		DW (SOIC)	N (PDIP)	UNIT
		20 PINS	20 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance <sup>(1)</sup>	109.1	84.6	°C/W
R <sub>θJC (top)</sub>	Junction-to-case (top) thermal resistance	76	72.5	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	77.6	65.3	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	51.5	55.3	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	77.1	65.2	°C/W
R <sub>θJC (bot)</sub>	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.

## 5.4 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS		V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC563		SN74HC563		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2 V	1.9	1.998		1.9		1.9	V	
			4.5 V	4.4	4.499		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		
		I <sub>OH</sub> = -6 mA	4.5 V	3.98	4.3		3.7		3.84		
			6 V	5.48	5.8		5.2		5.34		
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		I <sub>OL</sub> = 6 mA	4.5 V		0.17	0.26		0.4		0.33	
			6 V		0.15	0.26		0.4		0.33	
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0	6 V		±0.1	±100		±1000		±1000	nA	
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or 0	6 V		±0.01	±0.5		±10		±5	μA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0	6 V			8		160		80	μA	
C <sub>i</sub>		2 V to 6 V		3	10		10		10	pF	

## 5.5 Timing Requirements

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

		V <sub>CC</sub>	T <sub>A</sub> = 25°C		SN54HC563		SN74HC563		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>w</sub>	Pulse duration, LE high	2 V	80		120		100		ns
		4.5 V	16		24		20		
		6 V	14		20		17		
t <sub>su</sub>	Setup time, data before LE↓	2 V	50		75		63		ns
		4.5 V	10		15		13		
		6 V	9		13		11		
t <sub>h</sub>	Hold time, data after LE↓	2 V	5		5		5		ns
		4.5 V	5		5		5		
		6 V	5		5		5		

## 5.6 Switching Characteristics

over recommended operating free-air temperature range,  $C_L = 50$  pF (unless otherwise noted) (see [Parameter Measurement Information](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC563		SN74HC563		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	D	$\bar{Q}$	2 V		77	175		265		220	ns
			4.5 V		26	35		53		44	
			6 V		23	30		45		37	
	LE	Any $\bar{Q}$	2 V		90	175		265		220	
			4.5 V		27	35		53		44	
			6 V		23	30		45		37	
$t_{en}$	$\bar{OE}$	Any $\bar{Q}$	2 V		70	150		225		190	ns
			4.5 V		24	30		45		38	
			6 V		21	26		38		32	
$t_{dis}$	$\bar{OE}$	Any $\bar{Q}$	2 V		47	150		225		190	ns
			4.5 V		23	30		45		38	
			6 V		21	26		38		32	
$t_t$		Any $\bar{Q}$	2 V		28	60		90		75	ns
			4.5 V		8	12		18		15	
			6V		6	10		15		13	

## 5.7 Switching Characteristics

over recommended operating free-air temperature range,  $C_L = 150$  pF (unless otherwise noted) (see [Parameter Measurement Information](#))

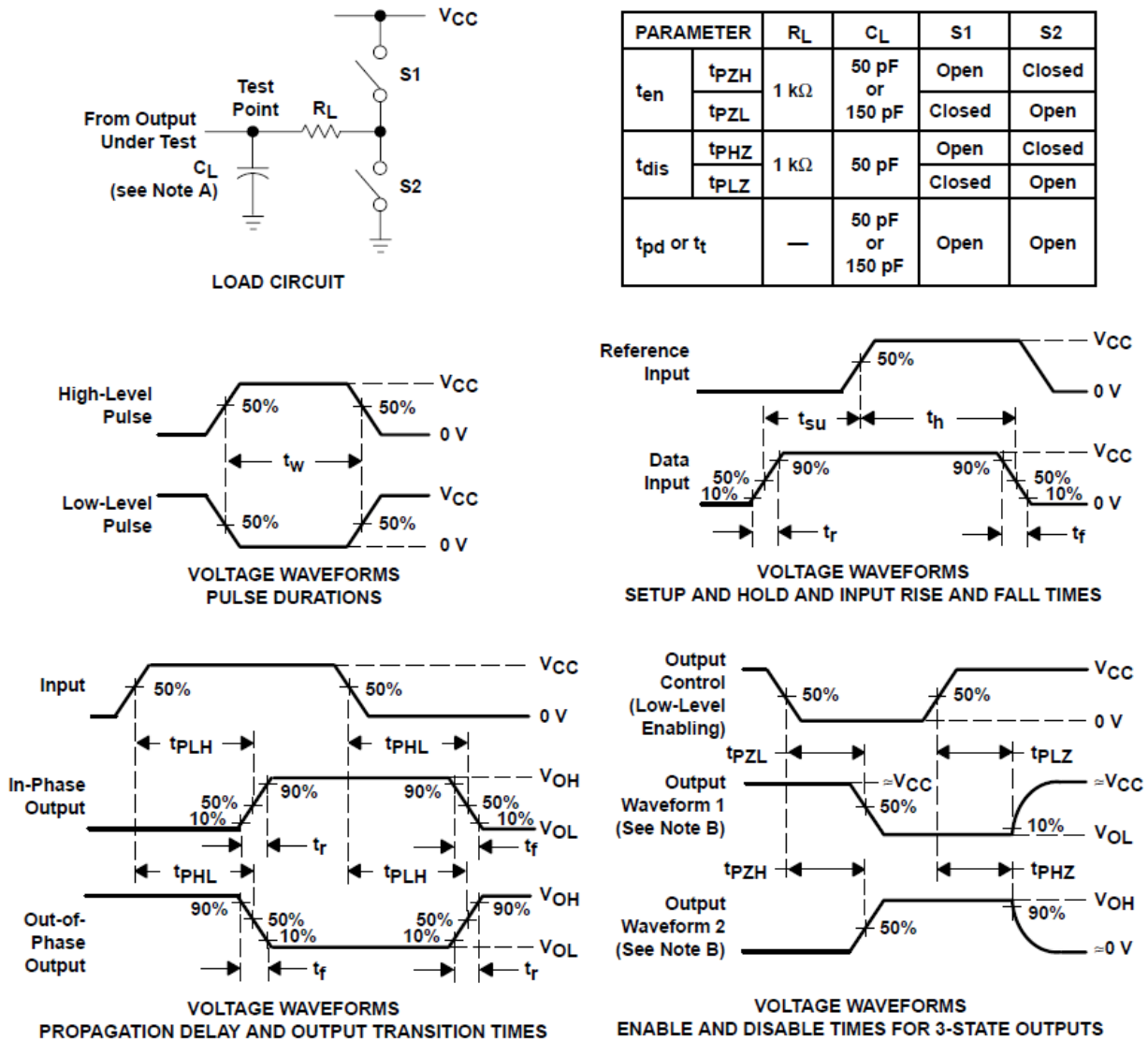
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC563		SN74HC563		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	D	$\bar{Q}$	2 V		95	200		300		250	ns
			4.5 V		33	40		60		50	
			6 V		29	34		51		43	
	LE	Any $\bar{Q}$	2 V		103	225		335		285	
			4.5 V		33	45		67		57	
			6 V		29	38		57		48	
$t_{en}$	$\bar{OE}$	Any $\bar{Q}$	2 V		85	200		300		250	ns
			4.5 V		29	40		60		50	
			6 V		26	34		51		43	
$t_t$		Any $\bar{Q}$	2 V		60	210		315		265	ns
			4.5 V		17	42		63		53	
			6 V		14	36		53		45	

## 5.8 Operating Characteristics

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

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$	Power dissipation capacitance per latch	50	pF

## 6 Parameter Measurement Information



- $C_L$  includes probe and test-fixture capacitance.
- 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.
- Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1$  MHz,  $Z_O = 50 \Omega$ ,  $t_r = 6$  ns,  $t_f = 6$  ns.
- The outputs are measured one at a time with one input transition per measurement.
- $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
- $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
- $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 6-1. Load Circuit and Voltage Waveforms

## 7 Detailed Description

### 7.1 Overview

These 8-bit transparent D-type latches feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

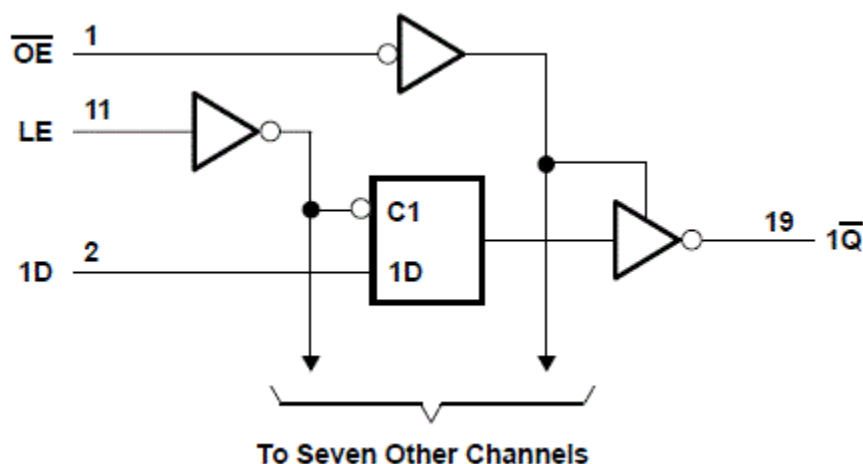
While the latch-enable (LE) input is high, the Q outputs follow the complements of the data (D) inputs. When LE is taken low, the outputs are latched at the inverses of the levels set up at the D inputs.

A buffered output-enable ( $\overline{OE}$ ) input places the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased high logic level provide the capability to drive bus lines without interface or pullup components.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to VCC through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

$\overline{OE}$  does not affect internal operations of the latches. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

### 7.2 Functional Block Diagram



### 7.3 Device Functional Modes

**Table 7-1. Function Table  
(Each Latch)**

INPUTS			OUTPUT Q
$\overline{OE}$	LE	D	
L	H	H	L
L	H	L	H
L	L	X	$\overline{Q}_0$
H	X	X	Z



## 8 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- $\mu\text{F}$  capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- $\mu\text{F}$  and 1- $\mu\text{F}$  capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

## 9 Layout

### 9.1 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.

## 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 Receiving Notification of Documentation Updates

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

### 10.2 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.

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### 10.3 Trademarks

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### 10.4 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.

### 10.5 Glossary

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

## 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
SN74HC563DW	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI	-40 to 85	HC563	
SN74HC563DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC563	Samples
SN74HC563N	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	-40 to 85	SN74HC563N	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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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
SN74HC563DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC563DWR	SOIC	DW	20	2000	367.0	367.0	45.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74HC563N	N	PDIP	20	20	506	13.97	11230	4.32

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - $\triangle D$  The 20 pin end lead shoulder width is a vendor option, either half or full width.



# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

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

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

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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