

# 74HC299

## 8-bit universal shift register; 3-state

Rev. 7 — 5 August 2024

Product data sheet

### 1. General description

The 74HC299 is an 8-bit universal shift register with 3-state outputs. It contains eight edge-triggered D-type flip-flops and the interstage logic necessary to perform synchronous shift-right, shift-left, parallel load and hold operations. The type of operation is determined by the mode select inputs S0 and S1. Pins I/O0 to I/O7 are flip-flop 3-state buffer outputs which allow them to operate as data inputs in parallel load mode. The serial outputs Q0 and Q7 are used for expansion in serial shifting of longer words. A LOW signal on the asynchronous master reset input  $\overline{MR}$  overrides the Sn and clock CP inputs and resets the flip-flops. All other state changes are initiated by the rising edge of the clock pulse. Inputs can change when the clock is either state, provided that the recommended set-up and hold times are observed. A HIGH signal on the 3-state output enable inputs  $\overline{OE}1$  or  $\overline{OE}2$  disables the 3-state buffers and the I/O outputs assume a high-impedance OFF-state. In this condition, the shift, hold, load and reset operations can still occur. The 3-state buffers are also disabled by HIGH signals on both S0 and S1, when in preparation for a parallel load operation. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

### 2. Features and benefits

- CMOS input levels
- Multiplexed inputs/outputs provide improved bit density
- Four operating modes:
  - Shift left
  - Shift right
  - Hold (store)
  - Load data
- Operates with output enable or at high-impedance OFF-state
- 3-state outputs drive bus lines directly
- Cascadable for n-bit word lengths
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

### 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">74HC299D</a>	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	<a href="#">SOT163-1</a>

4. Functional diagram

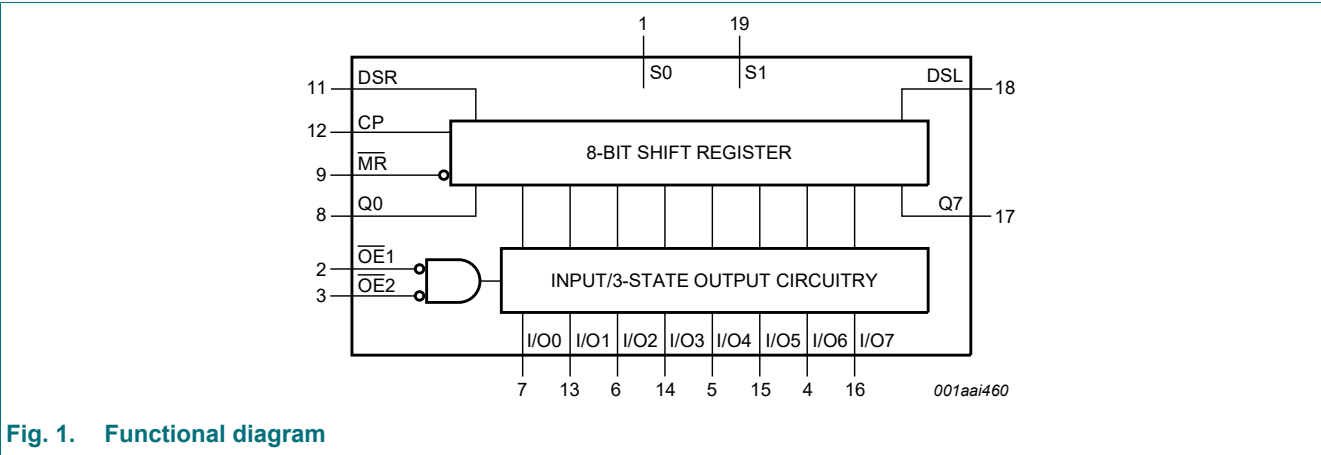


Fig. 1. Functional diagram

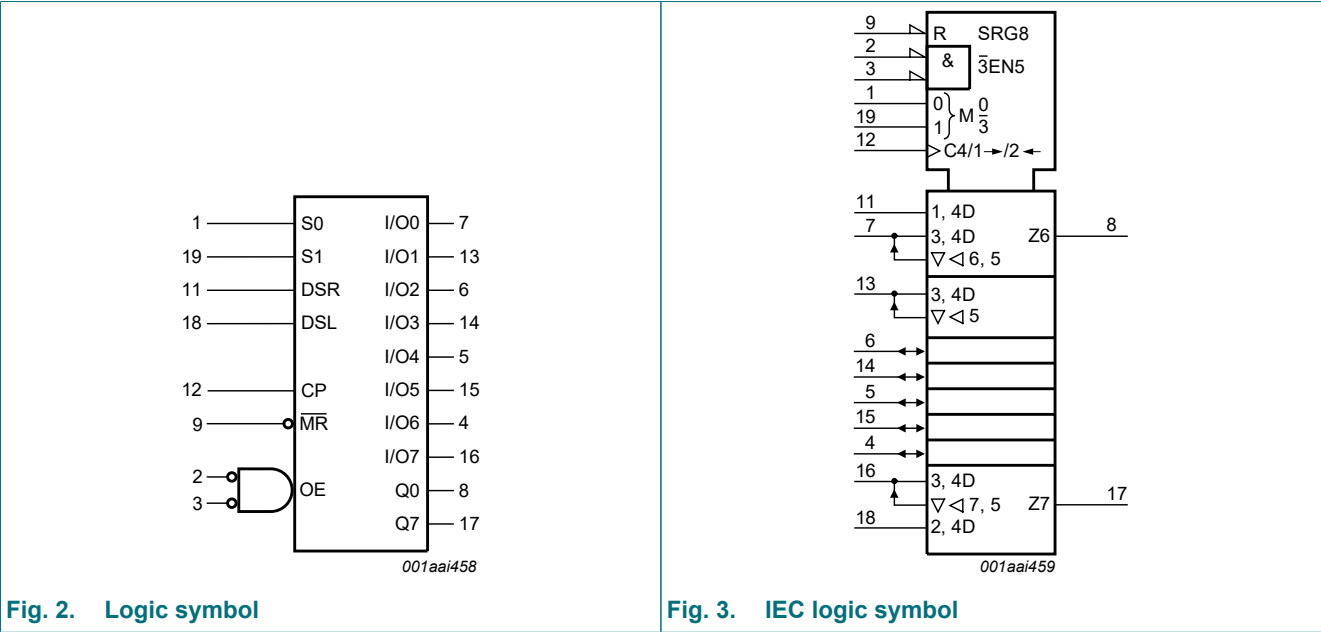


Fig. 2. Logic symbol

Fig. 3. IEC logic symbol

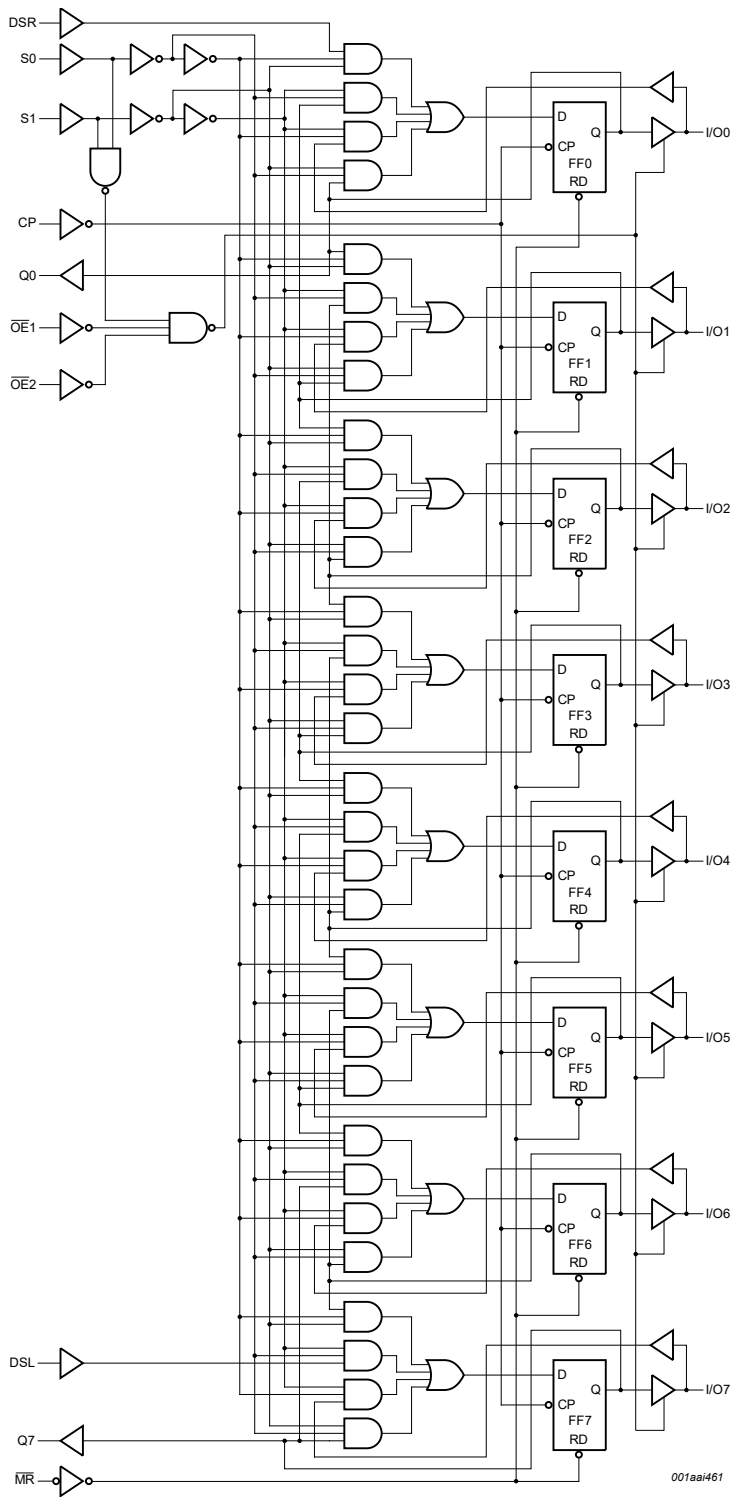
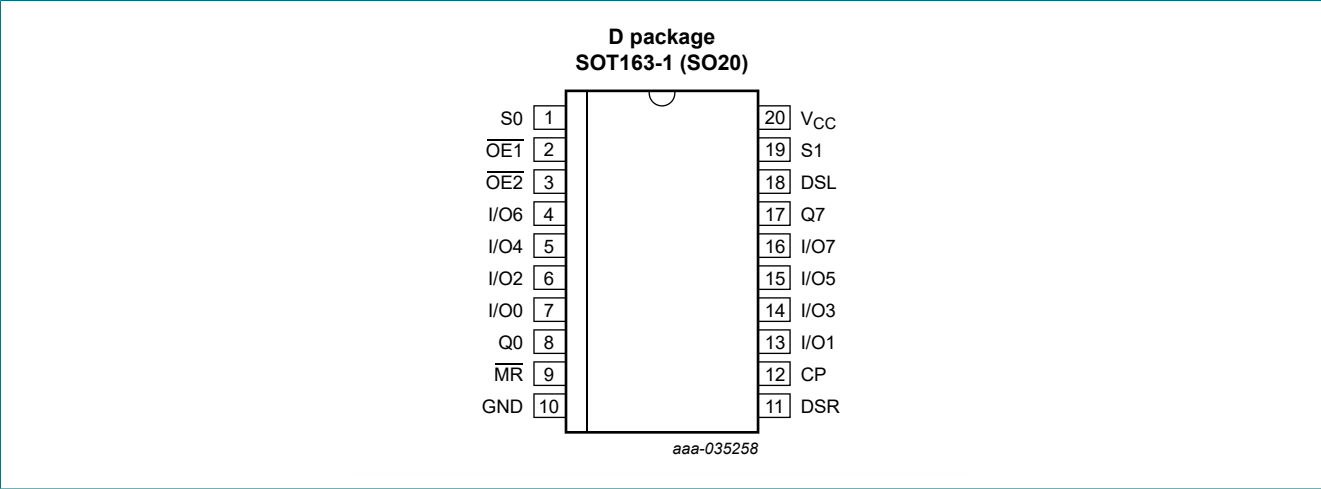


Fig. 4. Logic diagram

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
S0, S1	1, 19	mode select input
OE1, OE2	2, 3	3-state output enable input (active LOW)
I/O0, I/O1, I/O2, I/O3, I/O4, I/O5, I/O6, I/O7	7, 13, 6, 14, 5, 15, 4, 16	parallel data input or 3-state parallel output (bus driver)
Q0, Q7	8, 17	serial output (standard output)
MR	9	asynchronous master reset input (active LOW)
GND	10	ground (0 V)
DSR	11	serial data shift-right input
CP	12	clock input (LOW to HIGH, edge-triggered)
DSL	18	serial data shift-left input
VCC	20	positive supply voltage

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; ↑ = LOW to HIGH CP transition; X = don't care.

Input				Response
MR	S1	S0	CP	
L	X	X	X	asynchronous reset; Q0 to Q7 = LOW
H	H	H	↑	parallel load; I/On → Qn
H	L	H	↑	shift right; DSR → Q0, Q0 → Q1, etc.
H	H	L	↑	shift left; DSL → Q7, Q7 → Q6, etc.
H	L	L	X	hold

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>O</sub>	output current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V			
		standard outputs	-	±25	mA
		bus driver outputs	-	±35	mA
I <sub>CC</sub>	supply current	standard outputs	-	50	mA
		bus driver outputs	-	70	mA
I <sub>GND</sub>	ground current	standard outputs	-50	-	mA
		bus driver outputs	-70	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C [2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
[2] For SOT163-1 (SO20) package: P<sub>tot</sub> derates linearly with 12.3 mW/K above 109 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	ns/V

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		all outputs								
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		standard outputs								
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	V
		bus driver outputs								
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		all outputs								
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		standard outputs								
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
		bus driver outputs								
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1.0	-	±1.0	µA
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 6.0 V; V <sub>O</sub> = V <sub>CC</sub> or GND	-	-	±0.5	-	±5.0	-	±10.0	µA
		V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V	-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
			-	-	8.0	-	80	-	160	µA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF
C <sub>I/O</sub>	input/output capacitance		-	10	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> [1]	-	120	-	-	-	-	-	pF

[1] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> + Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:  
f<sub>i</sub> = input frequency in MHz;  
f<sub>o</sub> = output frequency in MHz;  
Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.  
C<sub>L</sub> = output load capacitance in pF;  
V<sub>CC</sub> = supply voltage in V.

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND (ground = 0 V); for test circuit, see Fig. 9.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	CP to Q0, Q7; see Fig. 5 [1]								
		V <sub>CC</sub> = 2.0 V	-	66	200	-	250	-	300	ns
		V <sub>CC</sub> = 4.5 V	-	24	40	-	50	-	60	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	20	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	19	34	-	43	-	51	ns
		CP to I/On; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	-	66	200	-	250	-	300	ns
		V <sub>CC</sub> = 4.5 V	-	24	40	-	50	-	60	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	20	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	19	34	-	43	-	51	ns
		MR to Q0, Q7 or I/On; see Fig. 6 [2]								
		V <sub>CC</sub> = 2.0 V	-	66	200	-	250	-	300	ns
		V <sub>CC</sub> = 4.5 V	-	24	40	-	50	-	60	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	20	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	19	34	-	43	-	51	ns
t <sub>t</sub>	transition time	bus driver (I/On); see Fig. 5 [3]								
		V <sub>CC</sub> = 2.0 V	-	14	60	-	75	-	90	ns
		V <sub>CC</sub> = 4.5 V	-	5	12	-	15	-	18	ns
		V <sub>CC</sub> = 6.0 V	-	4	10	-	13	-	15	ns
		standard (Q0, Q7); see Fig. 5								
		V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		V <sub>CC</sub> = 6.0 V	-	6	13	-	16	-	19	ns

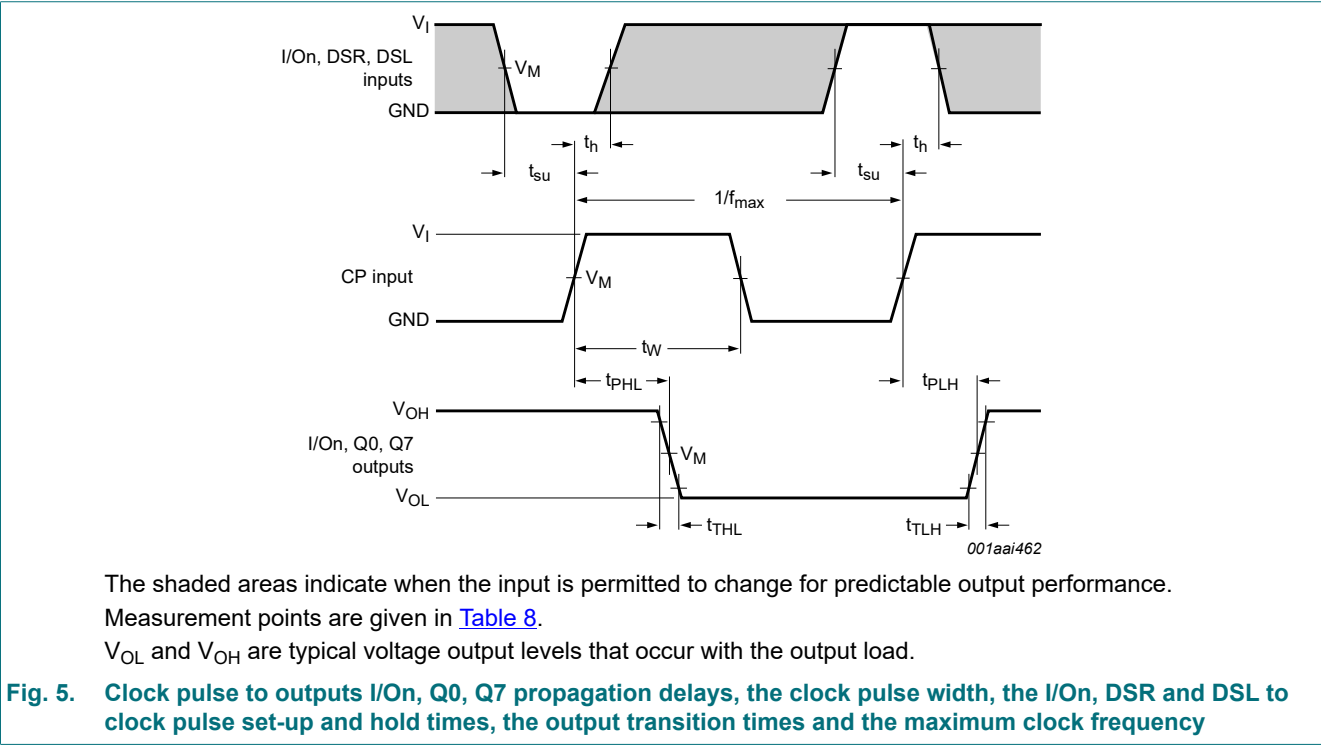
Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
$t_W$	pulse width	CP HIGH or LOW; see <a href="#">Fig. 5</a>								
		$V_{CC} = 2.0 \text{ V}$	80	17	-	100	-	120	-	ns
		$V_{CC} = 4.5 \text{ V}$	16	6	-	20	-	24	-	ns
		$V_{CC} = 6.0 \text{ V}$	14	5	-	17	-	20	-	ns
		MR LOW; see <a href="#">Fig. 6</a>								
		$V_{CC} = 2.0 \text{ V}$	80	19	-	100	-	120	-	ns
		$V_{CC} = 4.5 \text{ V}$	16	7	-	20	-	24	-	ns
		$V_{CC} = 6.0 \text{ V}$	14	6	-	17	-	20	-	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	OE <sub>n</sub> to I/On; see <a href="#">Fig. 8</a> [4]								
		$V_{CC} = 2.0 \text{ V}$	-	50	155	-	195	-	235	ns
		$V_{CC} = 4.5 \text{ V}$	-	18	31	-	39	-	47	ns
		$V_{CC} = 6.0 \text{ V}$	-	14	26	-	33	-	40	ns
$t_{PZL}$	OFF-state to LOW propagation delay	OE <sub>n</sub> to I/On; see <a href="#">Fig. 8</a>								
		$V_{CC} = 2.0 \text{ V}$	-	41	130	-	165	-	195	ns
		$V_{CC} = 4.5 \text{ V}$	-	15	26	-	33	-	39	ns
		$V_{CC} = 6.0 \text{ V}$	-	12	22	-	28	-	33	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	OE <sub>n</sub> to I/On; see <a href="#">Fig. 8</a> [5]								
		$V_{CC} = 2.0 \text{ V}$	-	66	185	-	230	-	280	ns
		$V_{CC} = 4.5 \text{ V}$	-	24	37	-	46	-	56	ns
		$V_{CC} = 6.0 \text{ V}$	-	19	31	-	39	-	48	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	OE <sub>n</sub> to I/On; see <a href="#">Fig. 8</a>								
		$V_{CC} = 2.0 \text{ V}$	-	55	155	-	195	-	235	ns
		$V_{CC} = 4.5 \text{ V}$	-	20	31	-	39	-	47	ns
		$V_{CC} = 6.0 \text{ V}$	-	16	26	-	33	-	40	ns
$t_{rec}$	recovery time	MR to CP; see <a href="#">Fig. 6</a>								
		$V_{CC} = 2.0 \text{ V}$	5	-14	-	5	-	5	-	ns
		$V_{CC} = 4.5 \text{ V}$	5	-5	-	5	-	5	-	ns
		$V_{CC} = 6.0 \text{ V}$	5	-4	-	5	-	5	-	ns
$t_{su}$	set-up time	DSR, DSL to CP; see <a href="#">Fig. 5</a>								
		$V_{CC} = 2.0 \text{ V}$	100	33	-	125	-	150	-	ns
		$V_{CC} = 4.5 \text{ V}$	20	12	-	25	-	30	-	ns
		$V_{CC} = 6.0 \text{ V}$	17	10	-	21	-	26	-	ns
		S0, S1 to CP; see <a href="#">Fig. 7</a>								
		$V_{CC} = 2.0 \text{ V}$	100	33	-	125	-	150	-	ns
		$V_{CC} = 4.5 \text{ V}$	20	12	-	25	-	30	-	ns
		$V_{CC} = 6.0 \text{ V}$	17	10	-	21	-	26	-	ns
		I/On to CP; see <a href="#">Fig. 5</a>								
		$V_{CC} = 2.0 \text{ V}$	125	39	-	155	-	190	-	ns
		$V_{CC} = 4.5 \text{ V}$	25	14	-	31	-	38	-	ns
		$V_{CC} = 6.0 \text{ V}$	21	11	-	26	-	32	-	ns

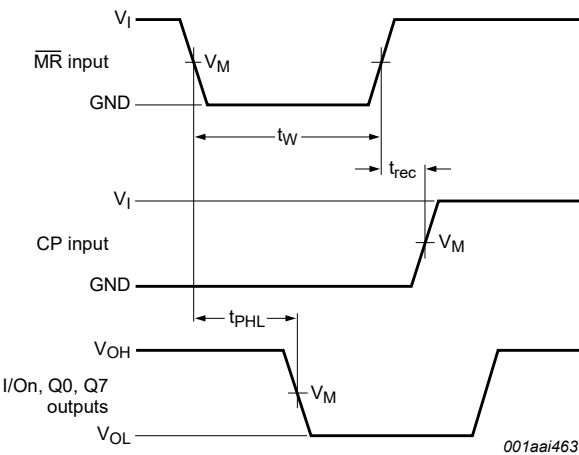


Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>h</sub>	hold time	I/On, DSR, DSL to CP; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	0	-14	-	0	-	0	-	ns
		V <sub>CC</sub> = 4.5 V	0	-5	-	0	-	0	-	ns
		V <sub>CC</sub> = 6.0 V	0	-4	-	0	-	0	-	ns
		S0, S1 to CP; see Fig. 7								
		V <sub>CC</sub> = 2.0 V	0	-28	-	0	-	0	-	ns
		V <sub>CC</sub> = 4.5 V	0	-10	-	0	-	0	-	ns
		V <sub>CC</sub> = 6.0 V	0	-8	-	0	-	0	-	ns
f <sub>max</sub>	maximum frequency	CP input; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	5.0	15	-	4.0	-	3.4	-	MHz
		V <sub>CC</sub> = 4.5 V	25	45	-	20	-	17	-	MHz
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	50	-	-	-	-	-	MHz
		V <sub>CC</sub> = 6.0 V	29	54	-	24	-	20	-	MHz

- [1] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.
- [2] t<sub>pd</sub> is the same as t<sub>PHL</sub>.
- [3] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.
- [4] t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.
- [5] t<sub>dis</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.

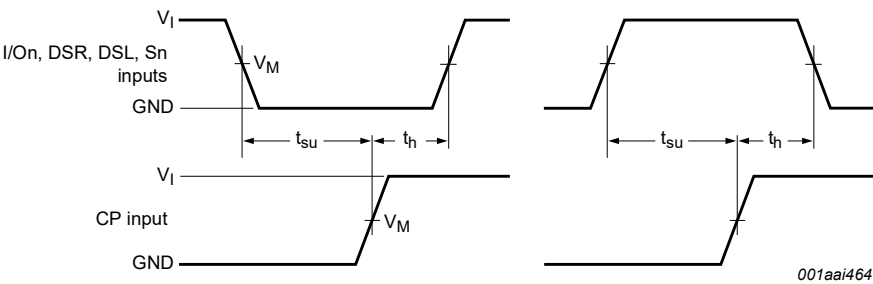
10.1. Waveforms and test circuit





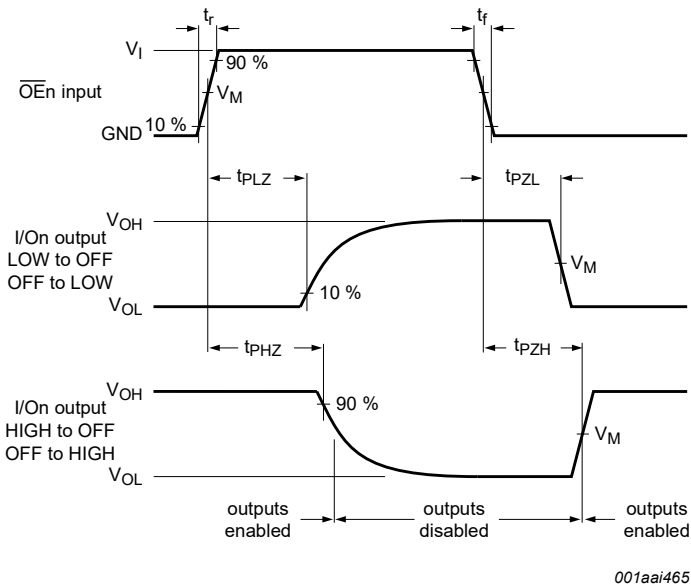
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig. 6.** The master reset pulse width (LOW), the master reset to outputs I/On, Q0, Q7 propagation delays and the master reset to clock pulse removal time



Measurement points are given in [Table 8](#).

**Fig. 7.** Set-up and hold times from the mode control inputs S0, S1 to the clock pulse



Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig. 8.** 3-state enable and disable times for  $\overline{OEn}$  inputs

Table 8. Measurement points

Input		Output
$V_I$	$V_M$	$V_M$
$V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$

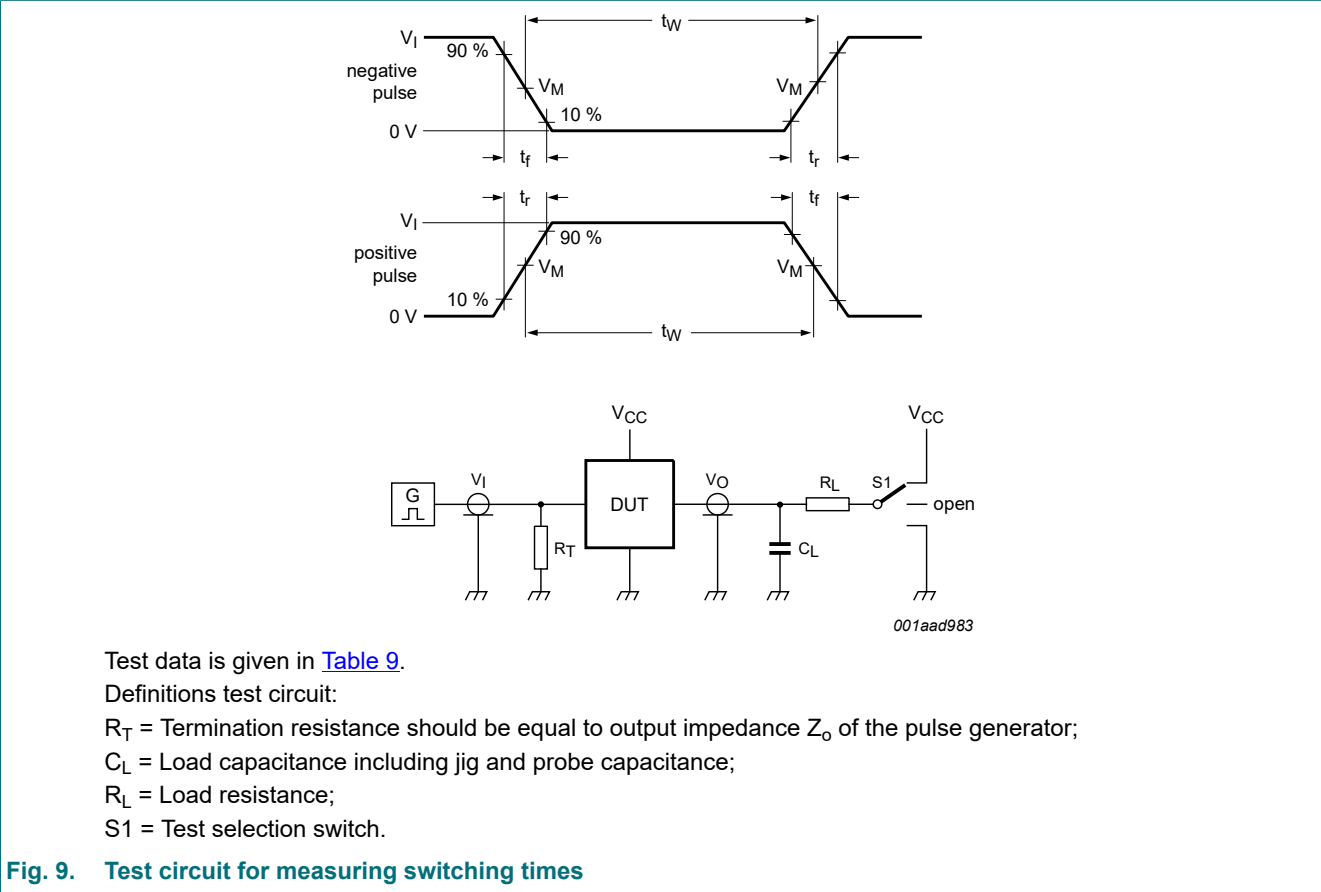


Table 9. Test data

Input		Load		S1 position		
$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
$V_{CC}$	6 ns	15 pF, 50 pF	1 kΩ	open	GND	$V_{CC}$

11. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

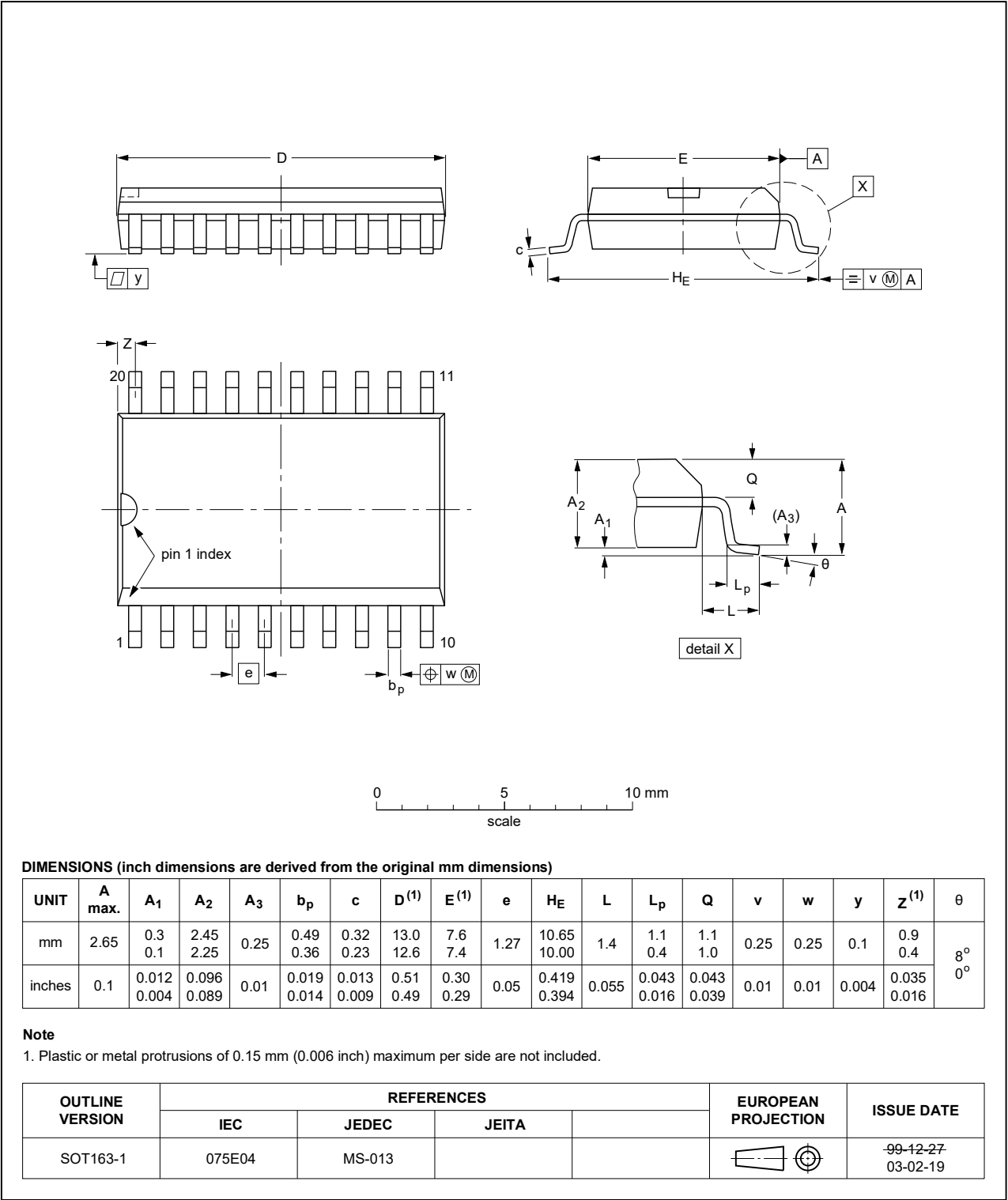


Fig. 10. Package outline SOT163-1 (SO20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC299 v.7	20240805	Product data sheet	-	74HC299 v.6
Modifications:	<ul style="list-style-type: none"><li>Section 2: ESD specification updated according to the latest JEDEC standard.</li></ul>			
74HC299 v.6	20210511	Product data sheet	-	74HC299 v.5
Modifications:	<ul style="list-style-type: none"><li>Type number 74HC299DB (SOT339-1 / SSOP20) removed.</li><li>Section 7: Derating values for P<sub>tot</sub> total power dissipation updated.</li></ul>			
74HC299 v.5	20190117	Product data sheet	-	74HC299 v.4
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Type number 74HC299PW (SOT360-1) removed.</li></ul>			
74HC299 v.4	20160226	Product data sheet	-	74HC_HCT299 v.3
Modifications:	<ul style="list-style-type: none"><li>Type numbers 74HC299N and 74HCT299N (SOT146-1) removed.</li><li>Type number 74HCT299D (SOT163-1) removed.</li><li>Type number 74HCT299DB (SOT339-1) removed.</li><li>Type number 74HCT299PW (SOT360-1) removed.</li></ul>			
74HC_HCT299 v.3	20080728	Product data sheet	-	74HC_HCT299_CNV_2
Modifications:	<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Section 3: Ordering information added</li><li>Section 12: Package outline drawings added</li><li>Section 9 "Static characteristics": Family data added</li><li>Section 11 "Waveforms": Test circuit added</li></ul>			
74HC_HCT299_CNV v.2	19970828	Product specification	-	-

## 14. Legal information

### Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 5 August 2024