



# 74HC9115

Nine wide Schmitt trigger buffer; open drain outputs

Rev. 4 — 9 November 2023

Product data sheet

## 1. General description

The 74HC9115 is a 9-bit buffer with Schmitt trigger inputs and open drain outputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ . Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

## 2. Features and benefits

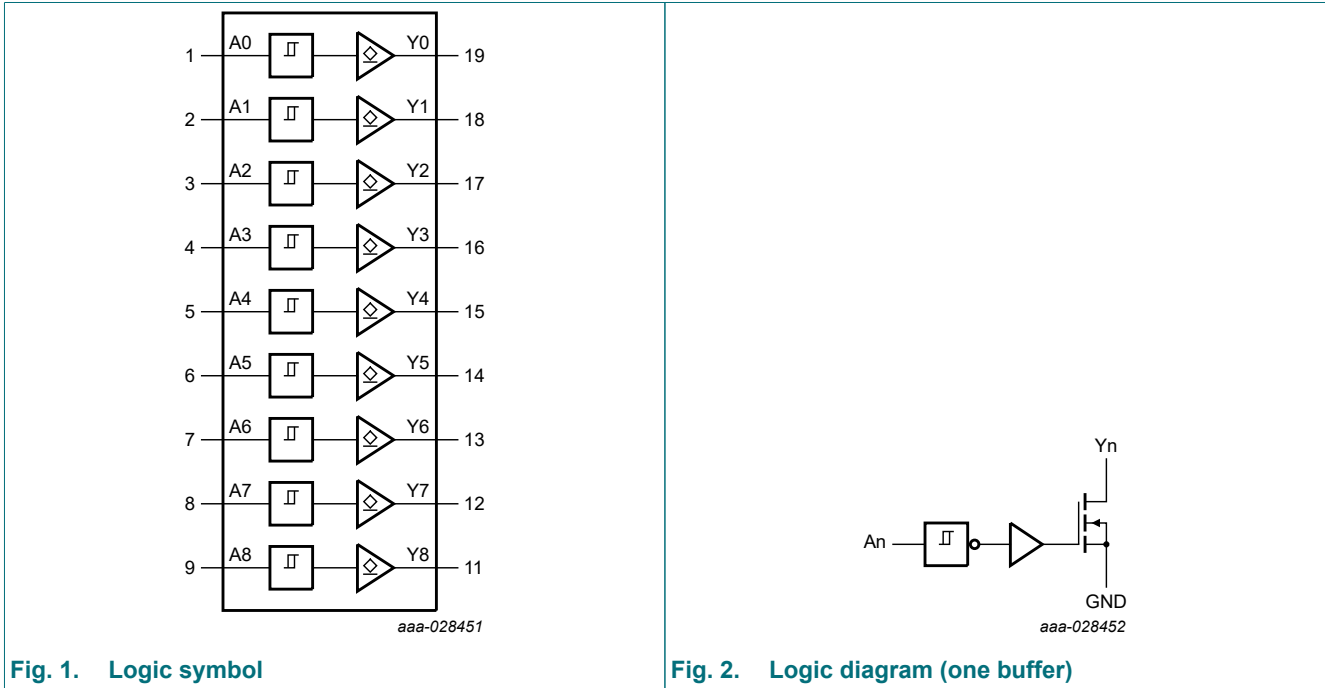
- Wide operating voltage 2.0 V to 6.0 V
- Schmitt trigger action on all data inputs
- CMOS low power dissipation
- High noise immunity
- Unlimited input rise and fall times
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM JESD22-A114-A exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

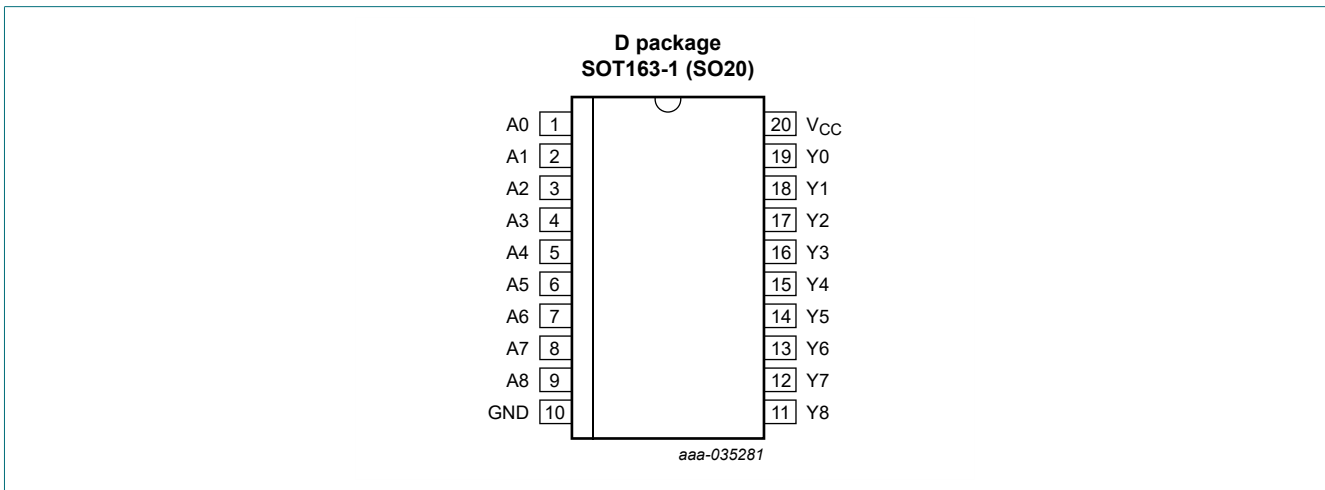
Type number	Package			Version
	Temperature range	Name	Description	
<a href="#">74HC9115D</a>	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	<a href="#">SOT163-1</a>

### 4. Functional diagram



### 5. Pinning information

#### 5.1. Pinning



## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
A0, A1, A2, A3, A4, A5, A6, A7, A8	1, 2, 3, 4, 5, 6, 7, 8, 9	data inputs
GND	10	ground (0 V)
Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8	19, 18, 17, 16, 15, 14, 13, 12, 11	data outputs
V <sub>CC</sub>	20	supply voltage

## 6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

Input	Output
A <sub>n</sub>	Y <sub>n</sub>
L	L
H	Z

## 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	+7.0	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 [1]	-	±25	mA
I <sub>CC</sub>	supply current		-	50	mA
I <sub>GND</sub>	ground current		-50	-	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	+25	+125	°C

## 9. Static characteristics

**Table 6. Static characteristics**

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

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		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
		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
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		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
		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
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
I <sub>CC</sub>	supply current	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
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

GND = 0 V; C<sub>L</sub> = 50 pF; for test circuit see Fig. 4.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	An to Yn; see Fig. 3 [1]								
		V <sub>CC</sub> = 2.0 V	-	36	115	-	140	-	165	ns
		V <sub>CC</sub> = 4.5 V	-	13	22	-	28	-	33	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	12	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	10	19	-	24	-	28	ns
t <sub>THL</sub>	HIGH to LOW output transition time	Yn; see Fig. 3								
		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
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub> [2]	-	5	-	-	-	-	-	pF

[1] t<sub>pd</sub> is the same as t<sub>PLZ</sub> and t<sub>PZL</sub>.

[2] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

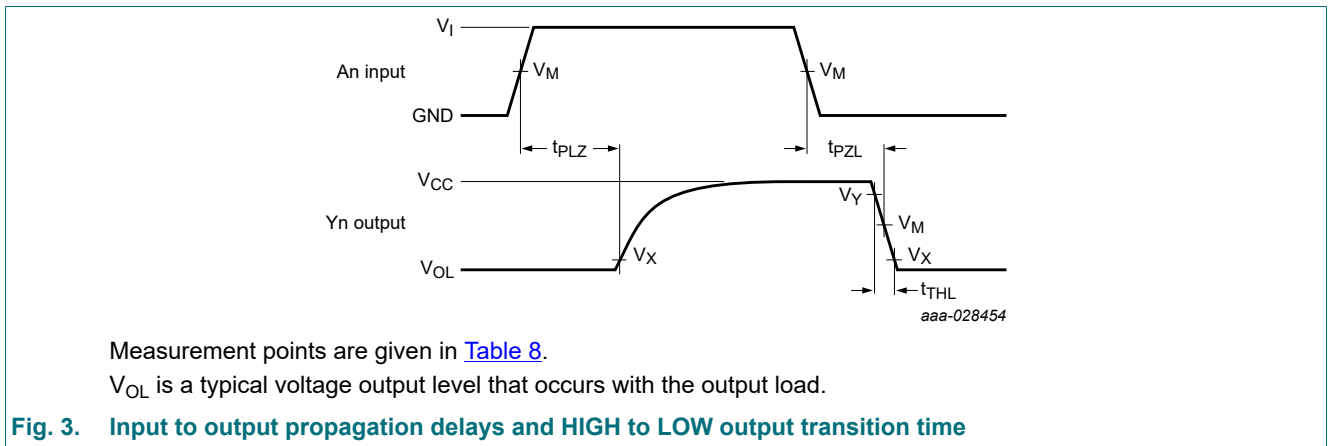
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

∑ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

### 10.1. Waveforms and test circuit



**Table 8. Measurement points**

Input	Output		
V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>	0.1 × V <sub>CC</sub>	0.9 × V <sub>CC</sub>

Nine wide Schmitt trigger buffer; open drain outputs

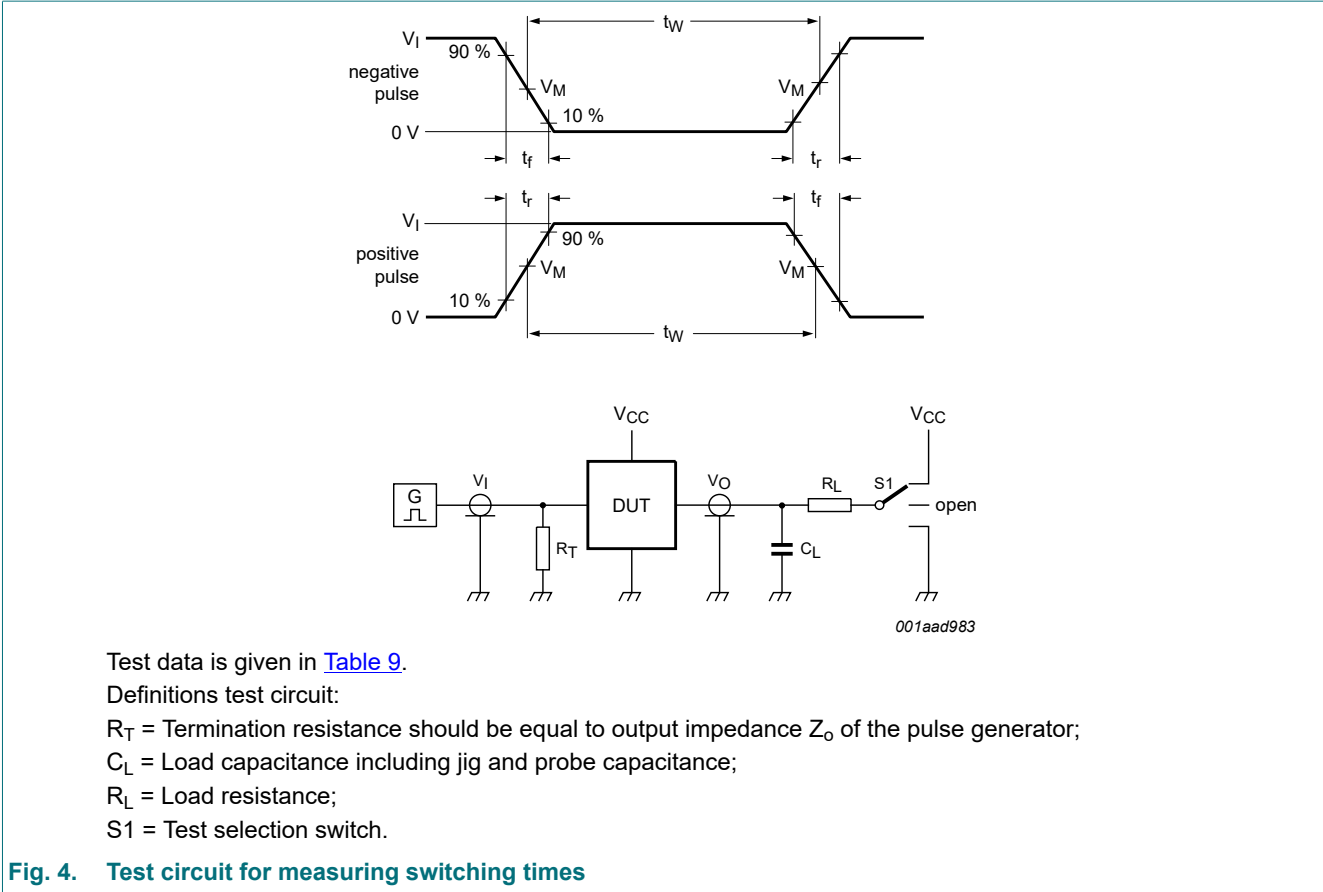


Fig. 4. Test circuit for measuring switching times

Table 9. Test data

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

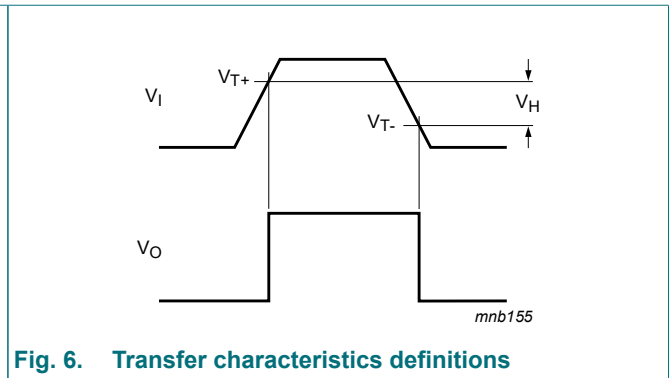
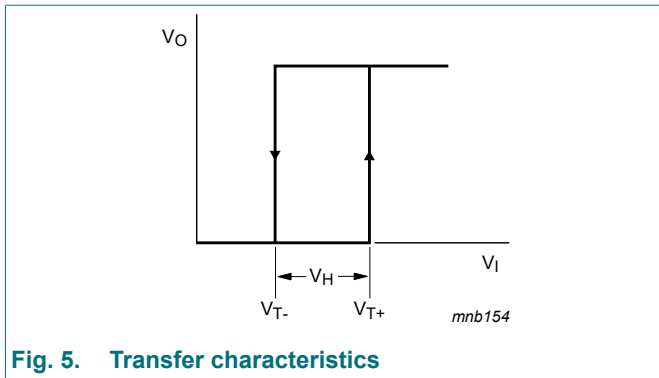
## 11. Transfer characteristics

**Table 10. Transfer characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Fig. 5 and Fig. 6.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>T+</sub>	positive-going threshold voltage	V <sub>CC</sub> = 2.0 V	0.70	1.13	1.50	0.70	1.50	0.70	1.50	V
		V <sub>CC</sub> = 4.5 V	1.75	2.37	3.15	1.75	3.15	1.75	3.15	V
		V <sub>CC</sub> = 6.0 V	2.30	3.11	4.20	2.30	4.20	2.30	4.20	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>CC</sub> = 2.0 V	0.30	0.70	1.10	0.30	1.10	0.30	1.10	V
		V <sub>CC</sub> = 4.5 V	1.35	1.80	2.40	1.35	2.40	1.35	2.40	V
		V <sub>CC</sub> = 6.0 V	1.8	2.43	3.30	1.80	3.30	1.80	3.30	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 2.0 V	0.2	0.43	0.80	0.18	0.80	0.15	0.80	V
		V <sub>CC</sub> = 4.5 V	0.4	0.57	1.00	0.40	1.00	0.40	1.00	V
		V <sub>CC</sub> = 6.0 V	0.5	0.68	1.10	0.50	1.10	0.50	1.10	V

### 11.1. Transfer characteristics waveforms



## 12. Package outline

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

SOT163-1

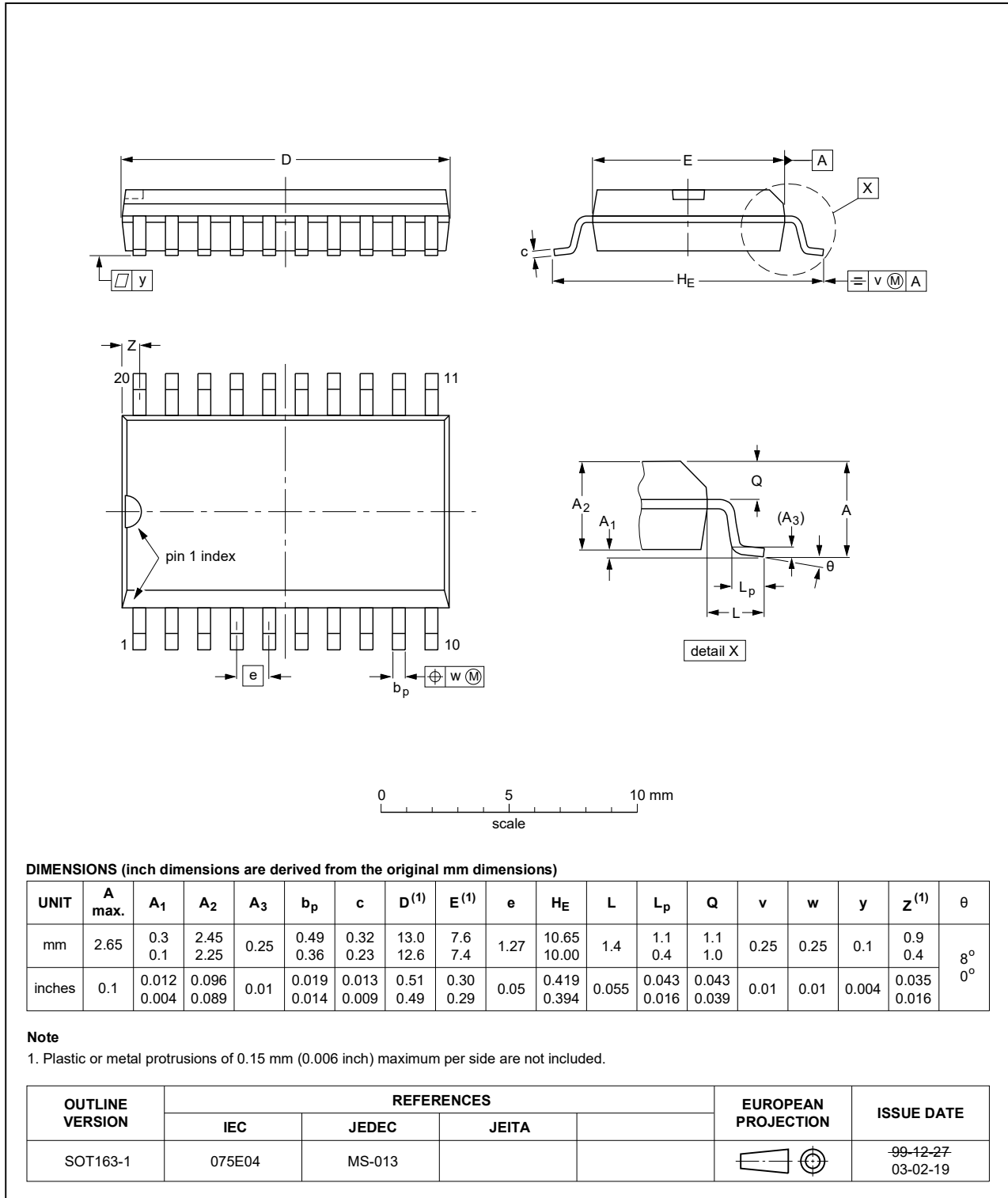


Fig. 7. Package outline SOT163-1 (SO20)



## 13. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

## 14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC9115 v.4	20231109	Product data sheet	-	74HC9115 v.3
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74HC9115 v.3	20180410	Product data sheet	-	74HC_HCT9115 v.2
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 numbers 74HC9115N, 74HCT9115N and 74HCT9115D have been removed from this data sheet.</li> </ul>			
74HC_HCT9115 v.2	19901201	Product specification	-	74HC_HCT9115 v.1
74HC_HCT9115 v.1	19880301	Product specification	-	-

## 15. Legal information

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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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