

# 74AHCT240-Q100

Octal buffer/line driver; inverting; 3-state

Rev. 3 — 29 June 2020

Product data sheet

## 1. General description

The 74AHCT240-Q100 is an 8-bit inverting buffer/line drivers with 3-state outputs. This device can be used as two 4-bit buffers or one 8-bit buffer. It features two output enables (1 $\overline{OE}$  and 2 $\overline{OE}$ ), each controlling four of the 3-state outputs. A HIGH on n $\overline{OE}$  causes the outputs to assume a high-impedance OFF-state. Inputs are over voltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accept voltages higher than  $V_{CC}$
- 74AHCT240-Q100 operates with TTL input levels
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHCT240D-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74AHCT240PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74AHCT240BQ-Q100	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1

### 4. Functional diagram

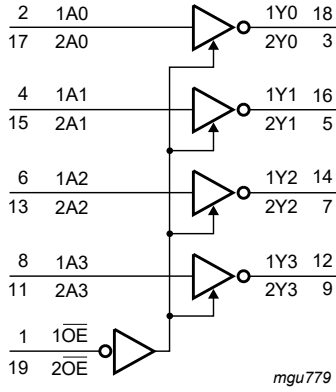


Fig. 1. Logic symbol

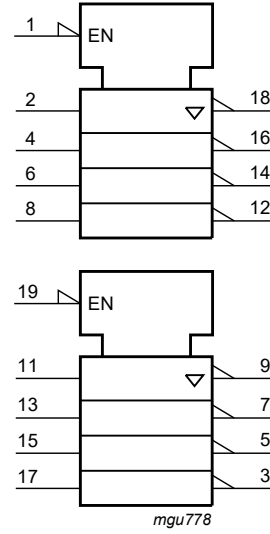


Fig. 2. IEC logic symbol

### 5. Pinning information

#### 5.1. Pinning

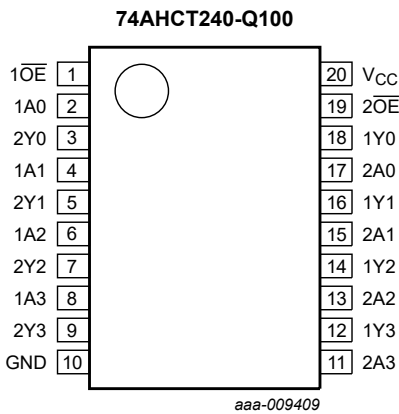
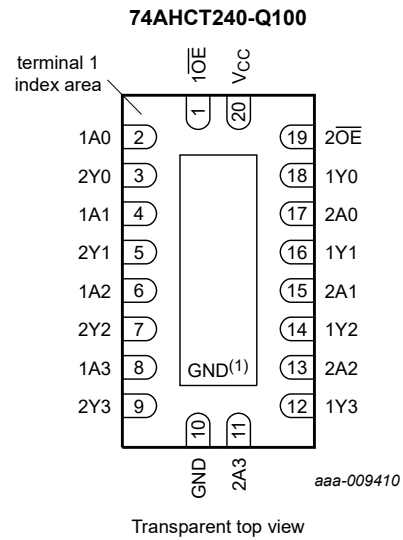


Fig. 3. Pin configuration SOT163-1 (SO20) and SOT360-1 (TSSOP20)



Transparent top view  
 (1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

Fig. 4. Pin configuration SOT764-1 (DHVQFN20)

## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE, 2OE	1, 19	output enable input (active LOW)
1A0, 1A1, 1A2, 1A3	2, 4, 6, 8	data input
2A0, 2A1, 2A2, 2A3	17, 15, 13, 11	data input
1Y0, 1Y1, 1Y2, 1Y3	18, 16, 14, 12	data output
2Y0, 2Y1, 2Y2, 2Y3	3, 5, 7, 9	data output
GND	10	ground (0 V)
V <sub>CC</sub>	20	power supply

## 6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

Control	Input	Output
nOE	nAn	nYn
L	L	H
L	H	L
H	X	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
V <sub>I</sub>	input voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</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	V <sub>O</sub> = -0.5 V to (V <sub>CC</sub> + 0.5 V)	-	±25	mA
I <sub>CC</sub>	supply current		-	75	mA
I <sub>GND</sub>	ground current		-75	-	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 minimum 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.

For SOT360-1 (TSSOP20) package: P<sub>tot</sub> derates linearly with 10.0 mW/K above 100 °C.

For SOT764-1 (DHVQFN20) package: P<sub>tot</sub> derates linearly with 12.9 mW/K above 111 °C.

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		4.5	5.0	5.5	V
$V_I$	input voltage		0	-	5.5	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	-	-	20	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	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	2.0	-	-	2.0	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	0.8	-	0.8	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5\text{ V}$								
		$I_O = -50\ \mu\text{A}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -8.0\text{ mA}$	3.94	-	-	3.80	-	3.70	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5\text{ V}$								
		$I_O = 50\ \mu\text{A}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 8.0\text{ mA}$	-	-	0.36	-	0.44	-	0.55	V
$I_I$	input leakage current	$V_I = 5.5\text{ V or GND}$ ; $V_{CC} = 0\text{ V to }5.5\text{ V}$	-	-	0.1	-	1.0	-	2.0	$\mu\text{A}$
$I_{OZ}$	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$	-	-	$\pm 0.25$	-	$\pm 2.5$	-	$\pm 10.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$ ; $V_{CC} = 5.5\text{ V}$	-	-	4.0	-	40	-	80	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input pin; $V_I = V_{CC} - 2.1\text{ V}$ ; other pins at $V_{CC}$ or GND; $I_O = 0\text{ A}$ ; $V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	-	1.35	-	1.5	-	1.5	mA
$C_I$	input capacitance	$V_I = V_{CC}$ or GND	-	3	10	-	10	-	10	pF
$C_O$	output capacitance		-	4	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nAn to nYn; see Fig. 5 [2]								
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 15 pF	-	3.0	5.8	1.0	6.8	1.0	8.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 50 pF	-	4.4	8.4	1.0	9.5	1.0	11.9	ns
t <sub>en</sub>	enable time	n $\overline{OE}$ to nYn; see Fig. 6 [2]								
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 15 pF	-	3.4	7.5	1.0	9.0	1.0	14.4	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 50 pF	-	4.5	9.5	1.0	11.5	1.0	14.4	ns
t <sub>dis</sub>	disable time	n $\overline{OE}$ to nYn; see Fig. 6 [2]								
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 15 pF	-	3.9	6.1	1.0	6.7	1.0	8.3	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 50 pF	-	6.2	8.7	1.0	9.2	1.0	11.5	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> ; C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz [3]	-	9	-	-	-	-	-	pF

[1] Typical values are measured at nominal supply voltage (V<sub>CC</sub> = 5.0 V).

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>; t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>; t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

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

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

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

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

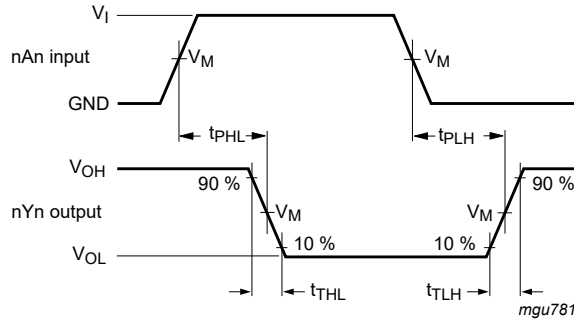
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

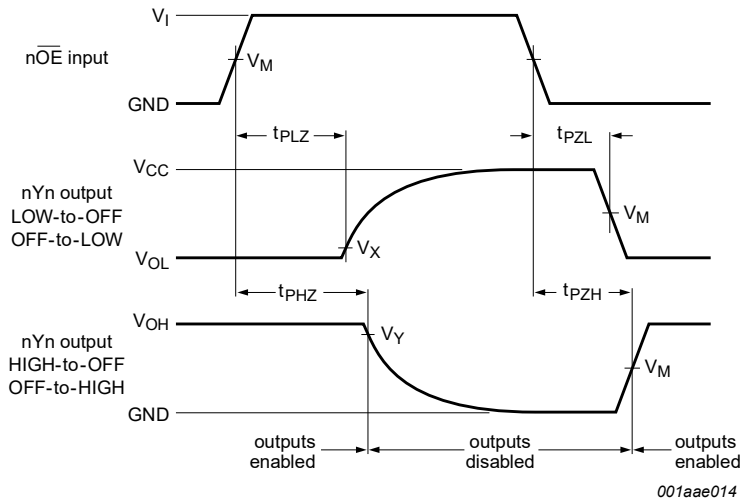
Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

10.1. Waveforms and test circuit



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

**Fig. 5. Propagation delay input (nAn) to output (nYn)**

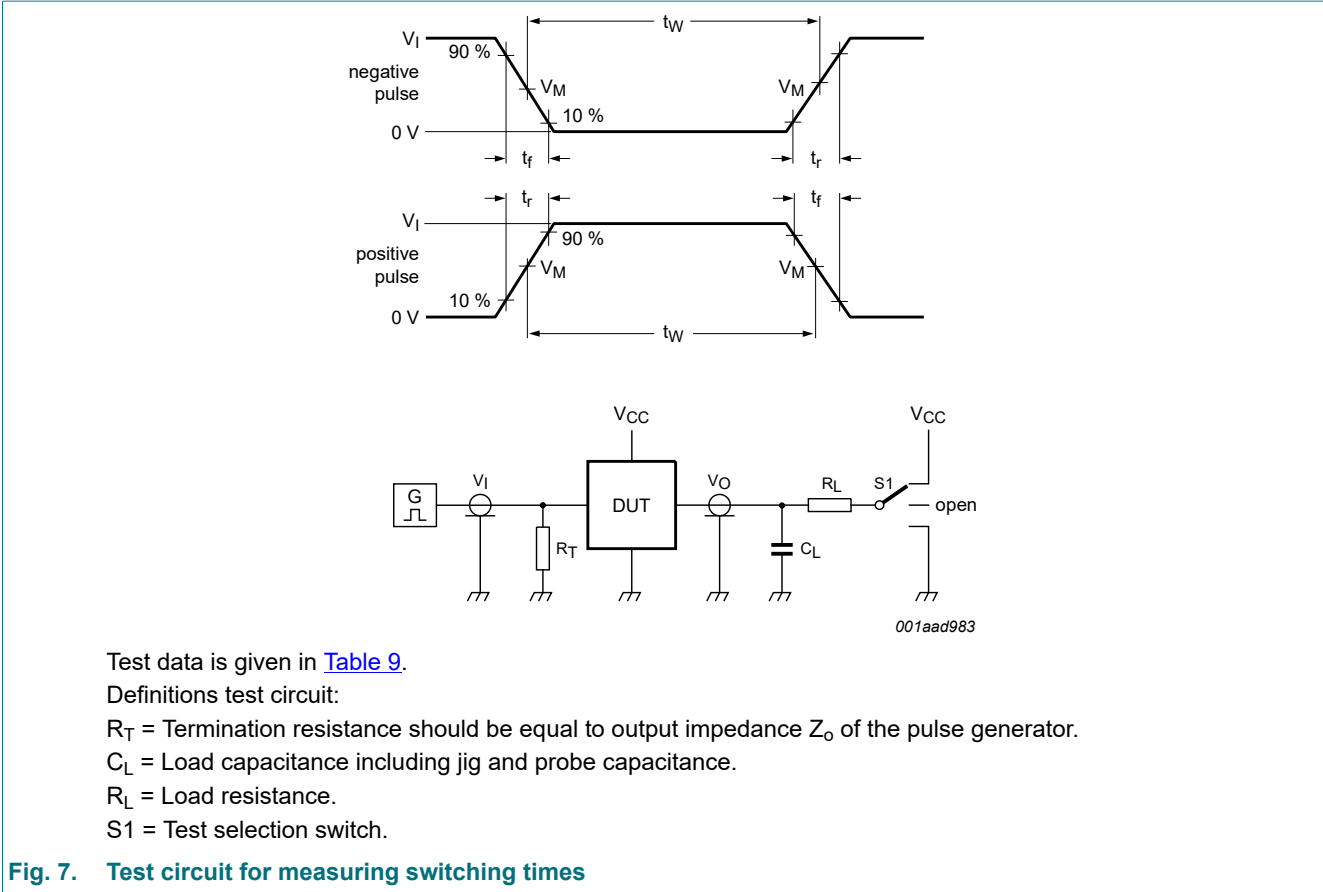


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output drop that occur with the output load.

**Fig. 6. Enable and disable times**

**Table 8. Measurement points**

Input	Output		
$V_M$	$V_M$	$V_X$	$V_Y$
1.5 V	$0.5V_{CC}$	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



**Table 9. Test data**

Input		Load		S1 position		
$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
3.0 V	3.0 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

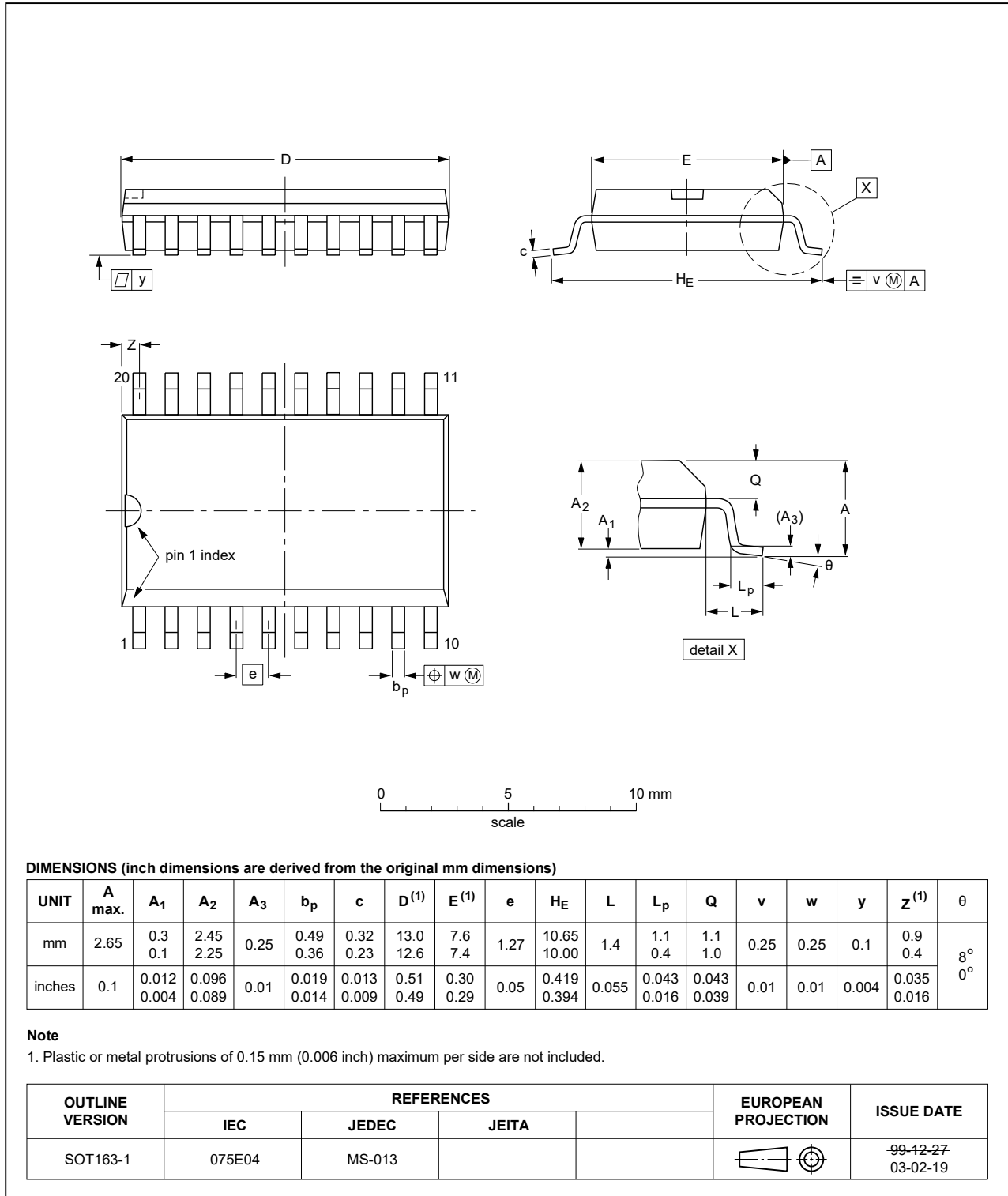


Fig. 8. Package outline SOT163-1 (SO20)



TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

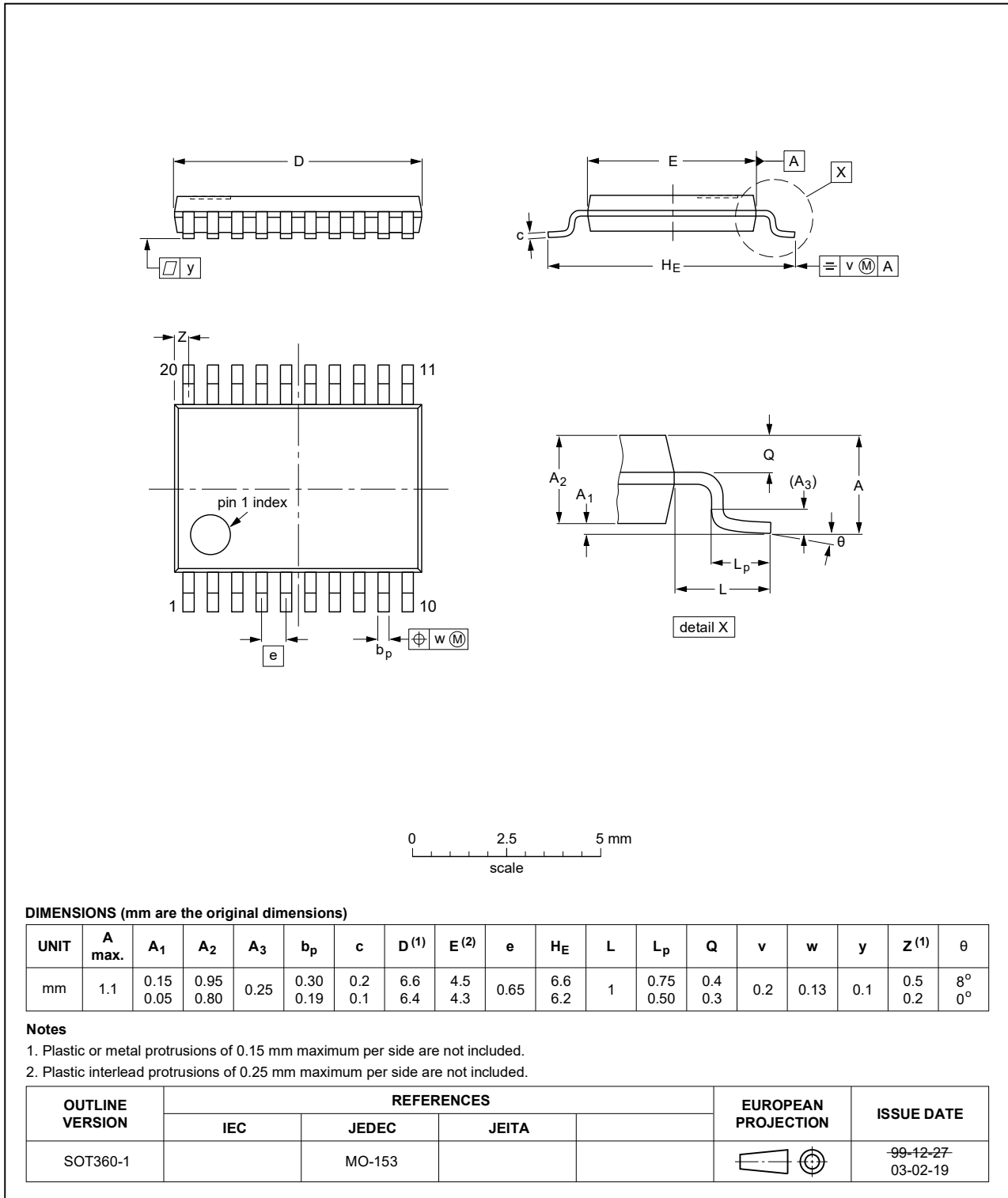


Fig. 9. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1

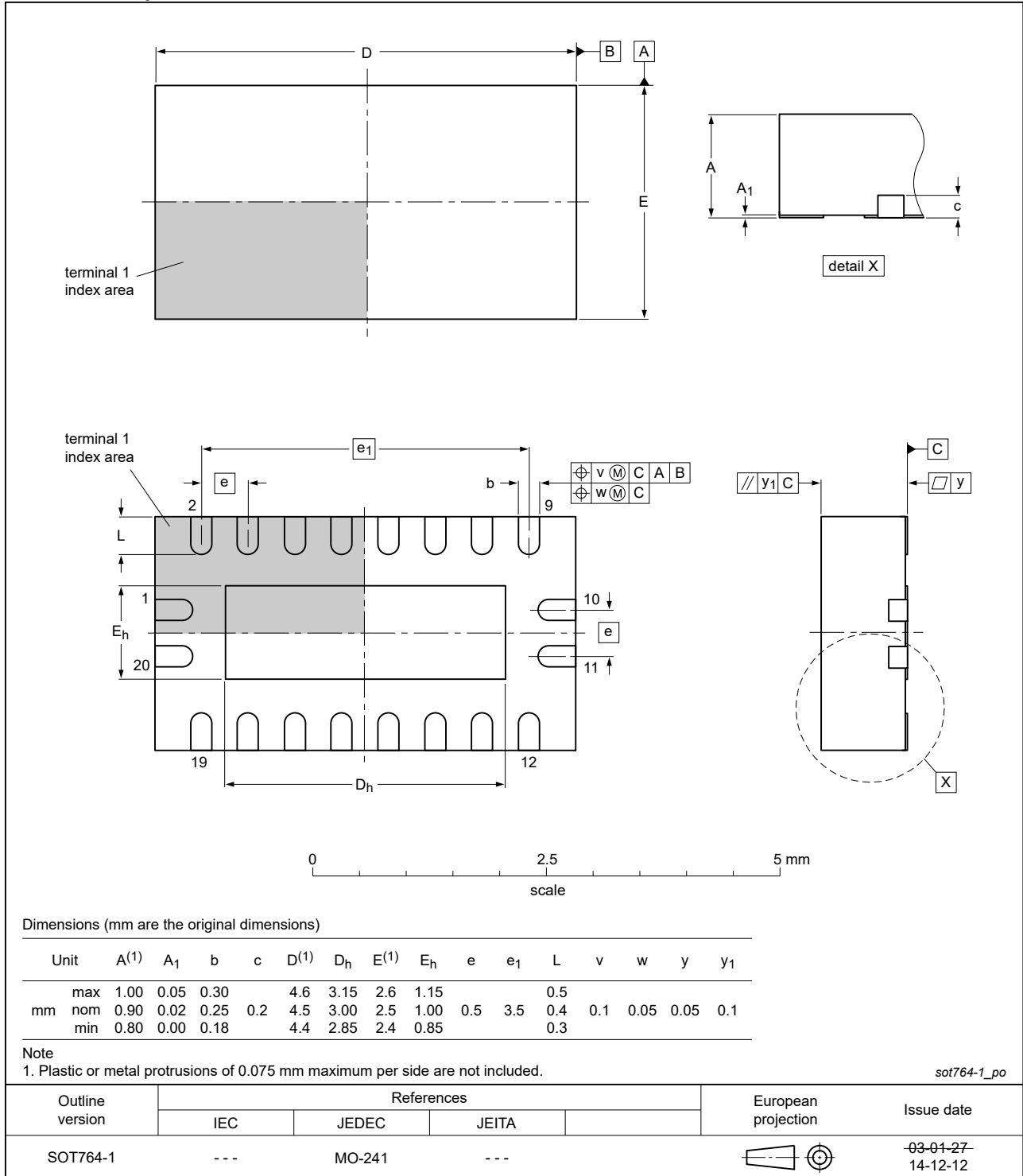


Fig. 10. Package outline SOT764-1 (DHVQFN20)

## 12. Abbreviations

Table 10. Abbreviations

Acronym	Description
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
TTL	Transistor-Transistor Logic

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHCT240_Q100 v.3	20200629	Product data sheet	-	74AHCT240_Q100 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><a href="#">Section 2</a> updated.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li><a href="#">Table 6</a>: <math>I_{OZ}</math> conditions corrected. (errata)</li> </ul>			
74AHCT240_Q100 v.2	20160301	Product data sheet	-	74AHC_AHCT240_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li>Type numbers 74AHC240D-Q100, 74AHC240PW-Q100 and 74AHC240BQ-Q100 removed.</li> </ul>			
74AHC_AHCT240_Q100 v.1	20131106	Product data sheet	-	-

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### 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.
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