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Kind regards,

Team Nexperia

# 74HC244-Q100; 74HCT244-Q100

Octal buffer/line driver; 3-state

Rev. 1 — 7 August 2012

Product data sheet

## 1. General description

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The 74HC244-Q100; 74HCT244-Q100 is an 8-bit buffer/line driver with 3-state outputs. The device can be used as two 4-bit buffers or one 8-bit buffer. The device 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 include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

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

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - ◆ Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Input levels:
  - ◆ For 74HC244-Q100: CMOS level
  - ◆ For 74HCT244-Q100: TTL level
- Octal bus interface
- Non-inverting 3-state outputs
- Multiple package options
- Complies with JEDEC standard no. 7 A
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pF}$ ,  $R = 0\text{ }\Omega$ )



### 3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC244D-Q100 74HCT244D-Q100	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HC244PW-Q100 74HCT244PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HC244BQ-Q100 74HCT244BQ-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

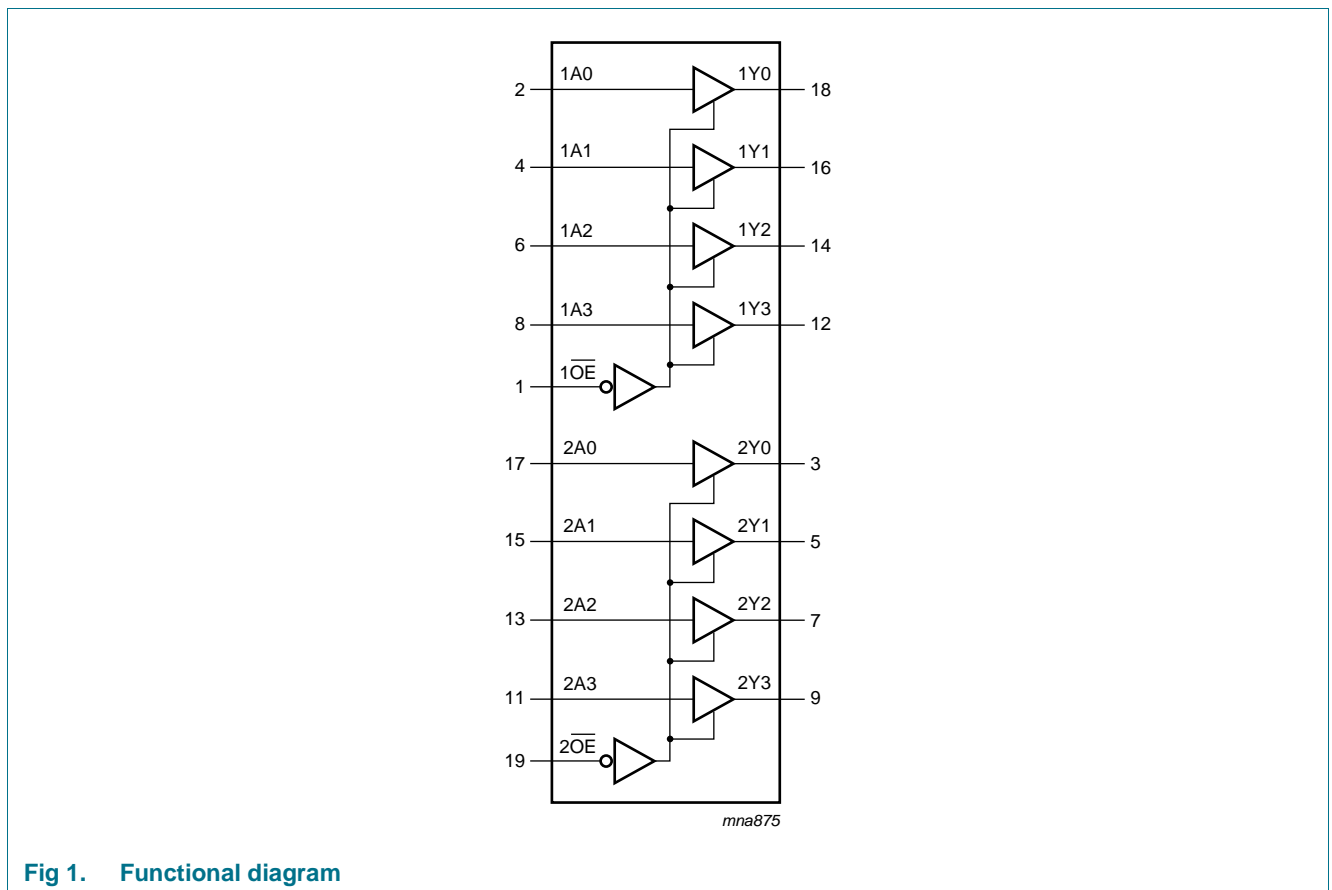


Fig 1. Functional diagram

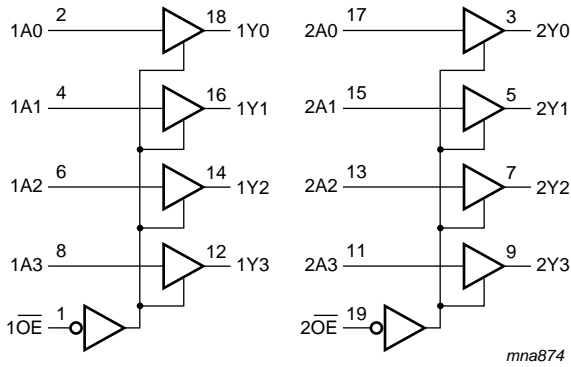


Fig 2. Logic symbol

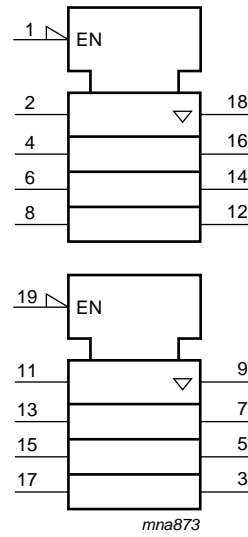


Fig 3. IEC symbol

## 5. Pinning information

### 5.1 Pinning

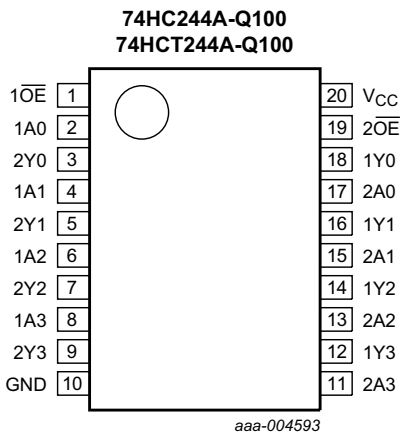
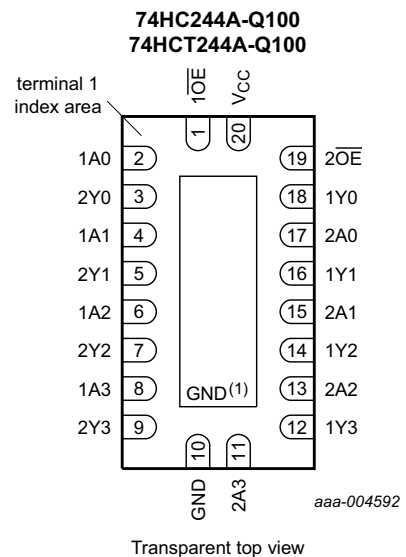


Fig 4. Pin configuration SO20, TSSOP20



(1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

Fig 5. Pin configuration DHVQFN20

## 5.2 Pin description

Table 2. Pin description

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

## 6. Functional description

Table 3. Function table<sup>[1]</sup>

Input		Output	
nOE	nAn	nYn	
L	L	L	
L	H	H	
H	X	Z	

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

## 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	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	±20	mA
I <sub>OK</sub>	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	-	±20	mA
I <sub>O</sub>	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	±35	mA
I <sub>CC</sub>	supply current		-	70	mA
I <sub>GND</sub>	ground current		-70	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation		[1] -	500	mW

[1] For SO20 packages: above 70 °C, P<sub>tot</sub> derates linearly with 8 mW/K.  
 For TSSOP20 package: above 60 °C, P<sub>tot</sub> derates linearly with 5.5 mW/K.  
 For DHVQFN20 packages: above 60 °C, P<sub>tot</sub> derates linearly with 4.5 mW/K.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>74HC244-Q100</b>						
$V_{CC}$	supply voltage		2.0	5.0	6.0	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	ns/V
$T_{amb}$	ambient temperature		-40	-	+125	°C
<b>74HCT244-Q100</b>						
$V_{CC}$	supply voltage		4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 4.5\text{ V}$	-	1.67	139	ns/V
$T_{amb}$	ambient temperature		-40	-	+125	°C

## 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	
<b>74HC244-Q100</b>										
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	1.5	-	1.5	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	3.15	-	3.15	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	4.2	-	4.2	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	-	0.5	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	-	1.35	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	-	1.8	-	1.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$								
		$I_O = -20\ \mu\text{A}; V_{CC} = 2.0\text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20\ \mu\text{A}; V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20\ \mu\text{A}; V_{CC} = 6.0\text{ V}$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_O = -6.0\text{ mA}; V_{CC} = 4.5\text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
	$I_O = -7.8\text{ mA}; V_{CC} = 6.0\text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V	

**Table 6. Static characteristics ...continued**

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>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</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> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 7.8 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>OZ</sub>	OFF-state output current	per input pin; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V; I <sub>O</sub> = 0 A	-	-	±0.5	-	±5.0	-	±10	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
<b>74HCT244-Q100</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -6 mA	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> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 20 μA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 6.0 mA	-	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> = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>OZ</sub>	OFF-state output current	per input pin; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 A	-	-	±0.5	-	±5.0	-	±10	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V; I <sub>O</sub> = 0 A	-	-	8.0	-	80	-	160	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V; I <sub>O</sub> = 0 A	-	70	252	-	315	-	343	μA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$GND = 0\text{ V}$ ; for load circuit see [Figure 8](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Max (85 °C)	Max (125 °C)	
<b>74HC244-Q100</b>								
$t_{pd}$	propagation delay	nAn to nYn; see <a href="#">Figure 6</a> <a href="#">[1]</a>						
		$V_{CC} = 2.0\text{ V}$	-	30	110	145	165	ns
		$V_{CC} = 4.5\text{ V}$	-	11	22	28	33	ns
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	-	9	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	9	19	24	28	ns
$t_{en}$	enable time	nOE to nYn; see <a href="#">Figure 7</a> <a href="#">[2]</a>						
		$V_{CC} = 2.0\text{ V}$	-	36	150	190	225	ns
		$V_{CC} = 4.5\text{ V}$	-	13	30	38	45	ns
		$V_{CC} = 6.0\text{ V}$	-	10	26	33	38	ns
$t_{dis}$	disable time	nOE to nYn or see <a href="#">Figure 7</a> <a href="#">[3]</a>						
		$V_{CC} = 2.0\text{ V}$	-	39	150	190	225	ns
		$V_{CC} = 4.5\text{ V}$	-	14	30	38	45	ns
		$V_{CC} = 6.0\text{ V}$	-	11	26	33	38	ns
$t_t$	transition time	see <a href="#">Figure 6</a> <a href="#">[4]</a>						
		$V_{CC} = 2.0\text{ V}$	-	14	60	75	90	ns
		$V_{CC} = 4.5\text{ V}$	-	5	12	15	18	ns
		$V_{CC} = 6.0\text{ V}$	-	4	10	13	15	ns
$C_{PD}$	power dissipation capacitance	per buffer; $V_I = GND$ to $V_{CC}$ <a href="#">[5]</a>	-	35	-	-	-	pF

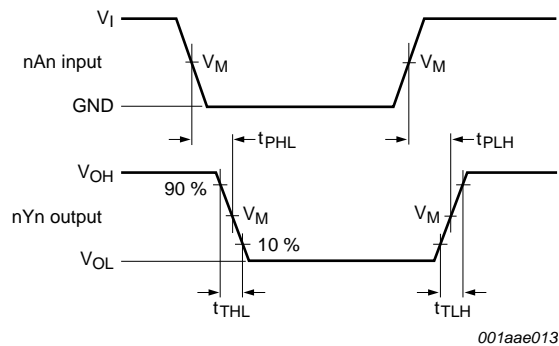


**Table 7. Dynamic characteristics ...continued**  
*GND = 0 V; for load circuit see Figure 8.*

Symbol	Parameter	Conditions	25 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Max (85 °C)	Max (125 °C)	
<b>74HCT244-Q100</b>								
$t_{pd}$	propagation delay	nAn to nYn; see <a href="#">Figure 6</a>	[1]					
		$V_{CC} = 4.5\text{ V}$	-	13	22	28	33	ns
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	-	11	-	-	-	ns
$t_{en}$	enable time	nOE to nYn; $V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a>	[2]	15	30	38	45	ns
$t_{dis}$	disable time	nOE to nYn; $V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a>	[3]	15	25	31	38	ns
$t_t$	transition time	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a>	[4]	5	12	15	18	ns
$C_{PD}$	power dissipation capacitance	per buffer; $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$	[5]	35	-	-	-	pF

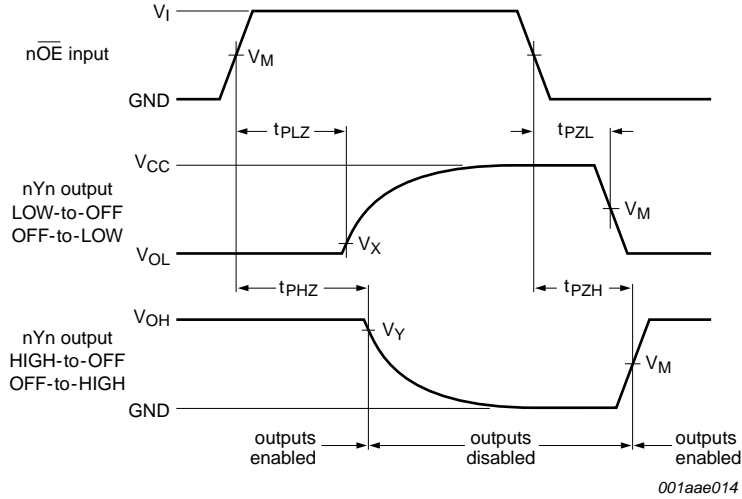
- [1]  $t_{pd}$  is the same as  $t_{PHL}$  and  $t_{PLH}$ .
- [2]  $t_{en}$  is the same as  $t_{PZH}$  and  $t_{PZL}$ .
- [3]  $t_{dis}$  is the same as  $t_{PHZ}$  and  $t_{PLZ}$ .
- [4]  $t_t$  is the same as  $t_{THL}$  and  $t_{TLH}$ .
- [5]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$  where:  
 $f_i$  = input frequency in MHz;  
 $f_o$  = output frequency in MHz;  
 $C_L$  = output load capacitance in pF;  
 $V_{CC}$  = supply voltage in V;  
 $N$  = number of inputs switching;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 11. Waveforms



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. Input (nAn) to output (nYn) propagation delays and output transition times**



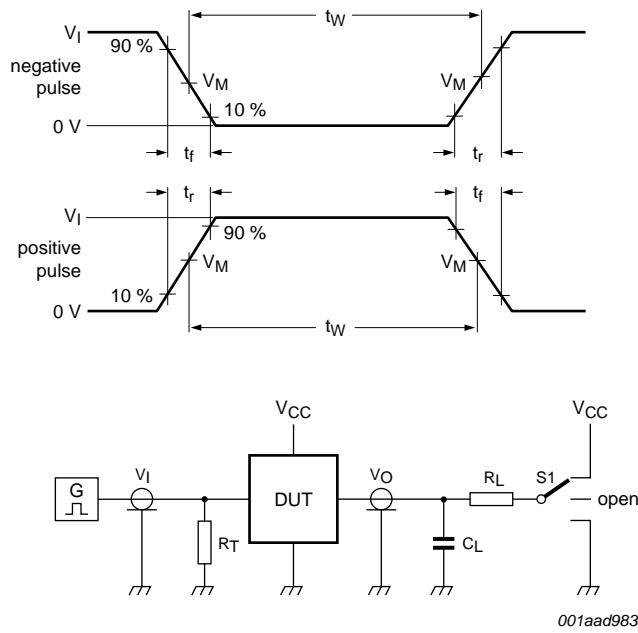
Measurement points are given in [Table 8](#).

$V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 7. 3-state enable and disable times**

**Table 8. Measurement points**

Type	Input	Output		
	$V_M$	$V_M$	$V_X$	$V_Y$
74HC244-Q100	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$
74HCT244-Q100	1.3 V	1.3 V	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$



Test data is given in [Table 9](#).

Definitions test circuit:

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_L$  = Load resistance.

S1 = Test selection switch.

**Fig 8. Test circuit for measuring switching times**

**Table 9. Test data**

Type	Input		Load		S1 position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC244-Q100	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT244-Q100	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

12. Package outline

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

SOT163-1

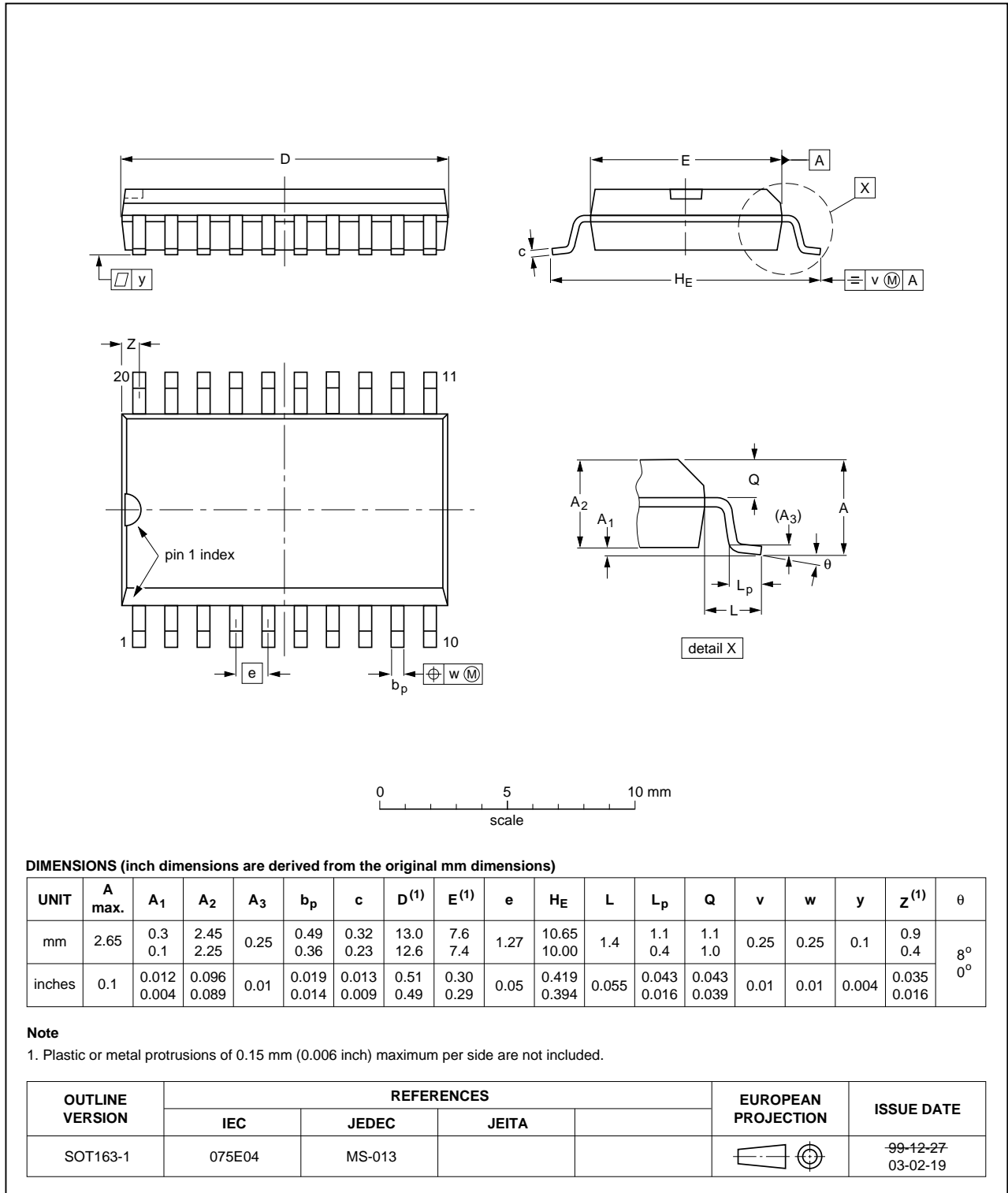


Fig 9. Package outline SOT163-1 (SO20)

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

SOT360-1

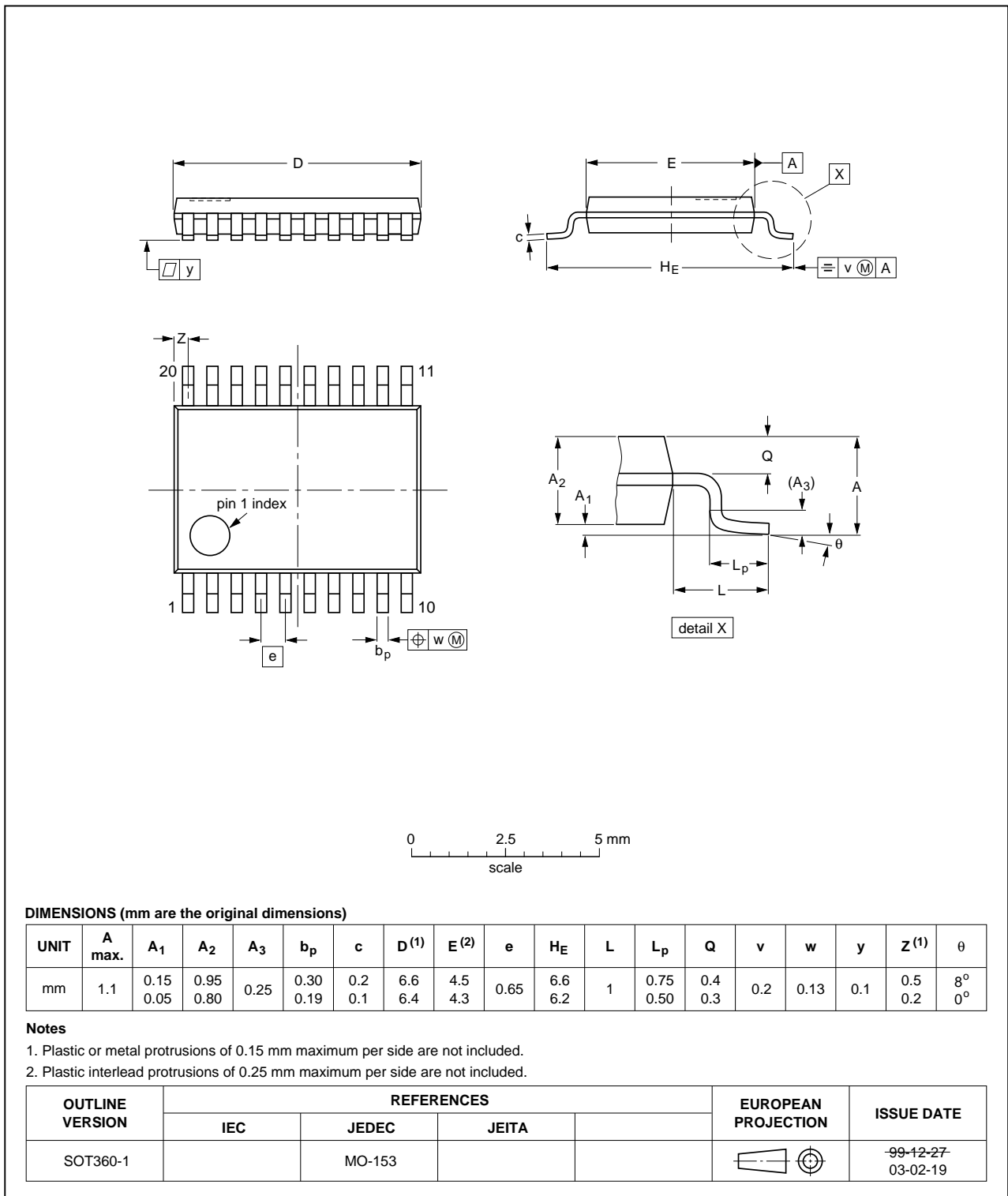
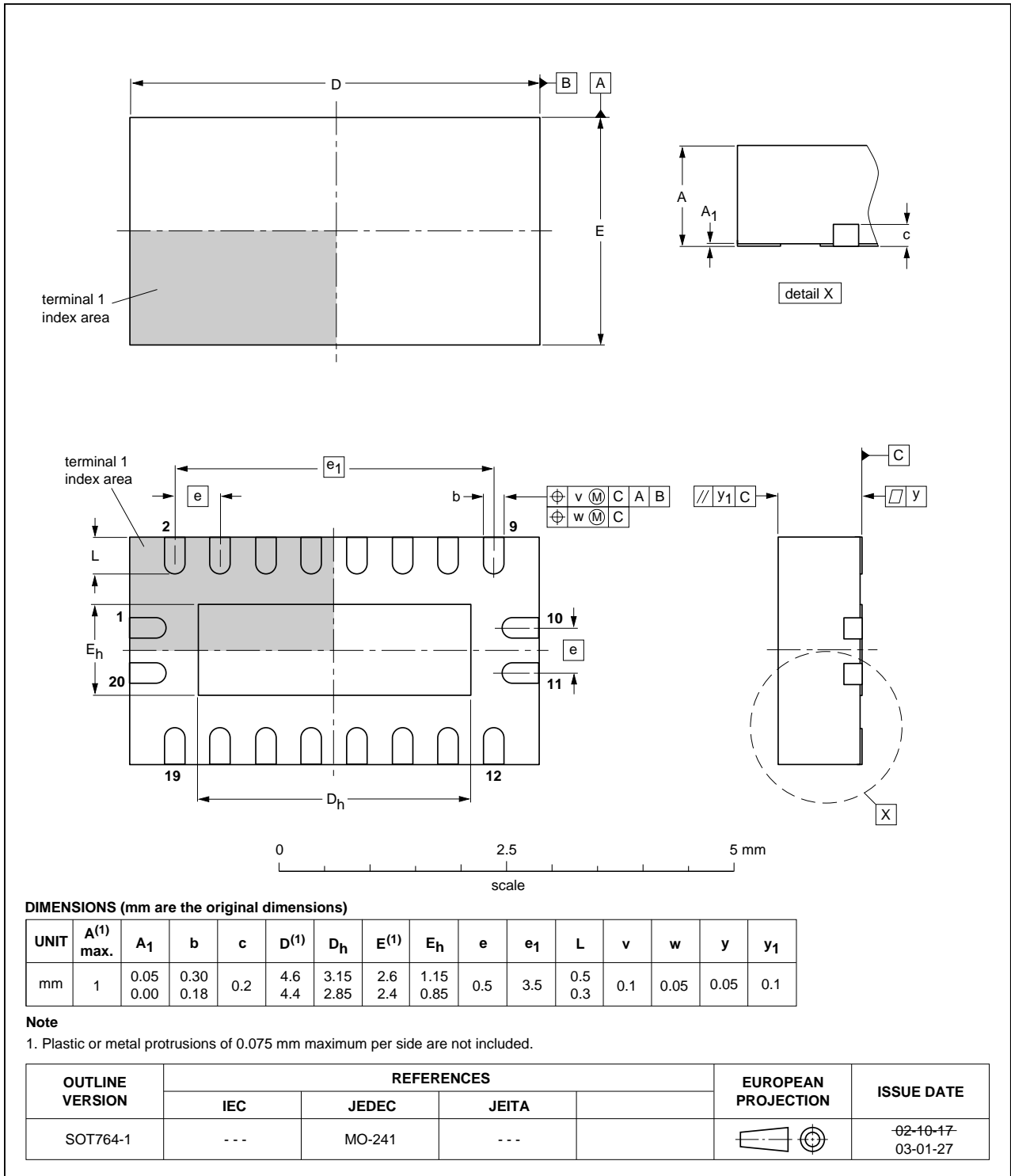


Fig 10. Package outline SOT360-1 (TSSOP20)

**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 11. Package outline SOT764-1 (DHVQFN20)**

## 13. Abbreviations

**Table 10. Abbreviations**

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

## 14. Revision history

**Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT244_Q100 v.1	20120807	Product data sheet	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

### 15.2 Definitions

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