

# 74HC244; 74HCT244

Octal buffer/line driver; 3-state

Rev. 03 — 22 December 2005

Product data sheet

## 1. General description

The 74HC244; 74HCT244 is a high-speed Si-gate CMOS device and is pin compatible with Low-power Schottky TTL (LSTTL).

The 74HC244; 74HCT244 has octal non-inverting buffer/line drivers with 3-state outputs. The 3-state outputs are controlled by the output enable inputs  $\overline{1OE}$  and  $\overline{2OE}$ . A HIGH on  $\overline{nOE}$  causes the outputs to assume a high-impedance OFF-state. The 74HC244; 74HCT244 is identical to the 74HC240; 74HCT240 but has non-inverting outputs.

## 2. Features

- Octal bus interface
- Non-inverting 3-state outputs
- Complies with JEDEC standard no. 7A
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-C exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

## 3. Quick reference data

**Table 1: Quick reference data**

$GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $t_r = t_f = 6\text{ ns}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>74HC244</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay nAn to nYn	$V_{CC} = 5\text{ V}$ ; $C_L = 15\text{ pF}$	-	9	-	ns
$C_i$	input capacitance		-	3.5	-	pF
$C_{PD}$	power dissipation capacitance	per buffer; $V_I = GND$ to $V_{CC}$	[1]	-	35	pF
<b>74HCT244</b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay nAn to nYn	$V_{CC} = 5\text{ V}$ ; $C_L = 15\text{ pF}$	-	11	-	ns
$C_i$	input capacitance		-	3.5	-	pF
$C_{PD}$	power dissipation capacitance	per buffer; $V_I = GND$ to $(V_{CC} - 1.5\text{ V})$	[1]	-	35	pF

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

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

**PHILIPS**

$f_i$  = 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;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 4. Ordering information

Table 2: Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
<b>74HC244</b>				
74HC244N	−40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HC244D	−40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HC244DB	−40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HC244PW	−40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HC244BQ	−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
<b>74HCT244</b>				
74HCT244N	−40 °C to +125 °C	DIP20	plastic dual in-line package; 20 leads (300 mil)	SOT146-1
74HCT244D	−40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74HCT244DB	−40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74HCT244PW	−40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74HCT244BQ	−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

5. Functional diagram

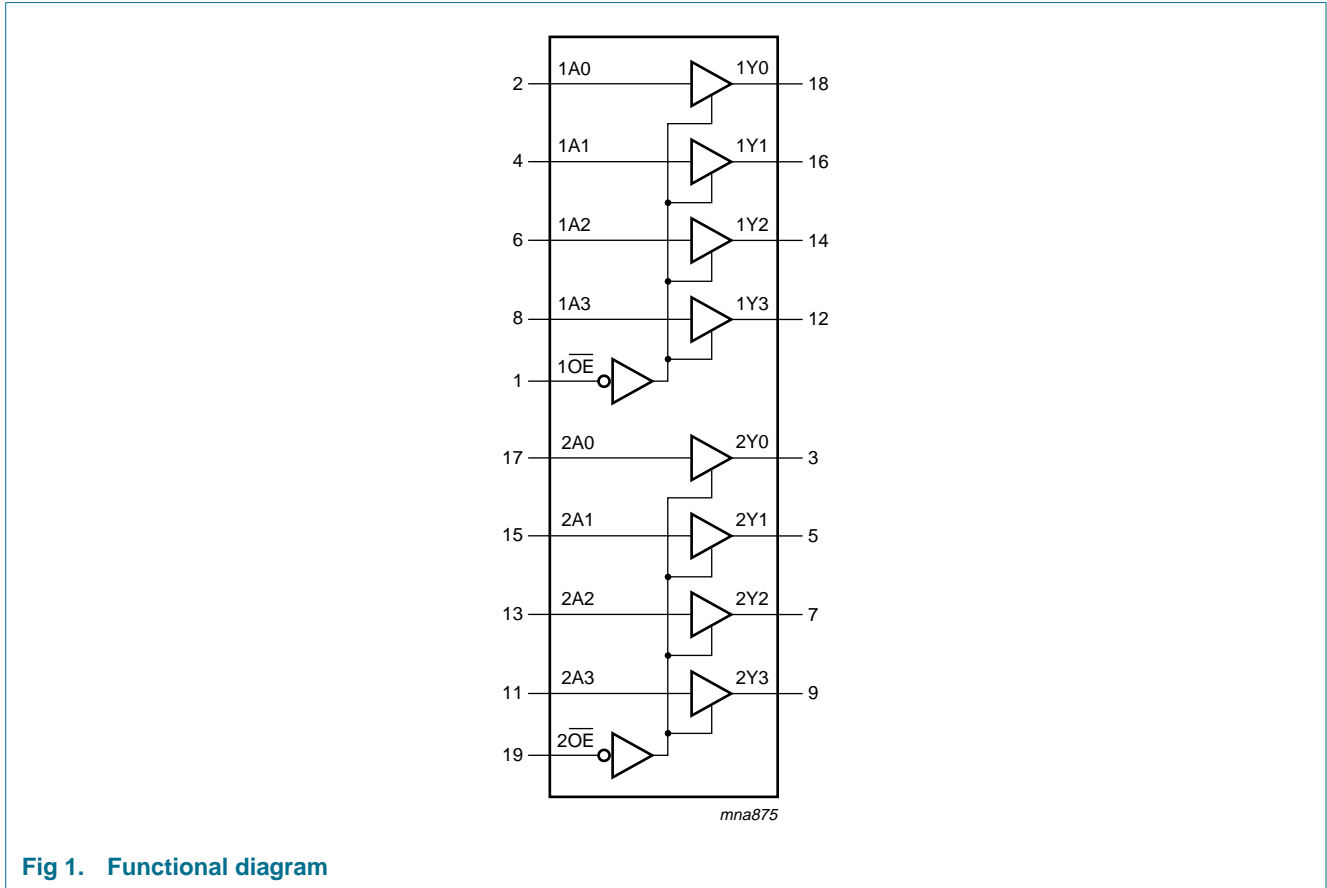


Fig 1. Functional diagram

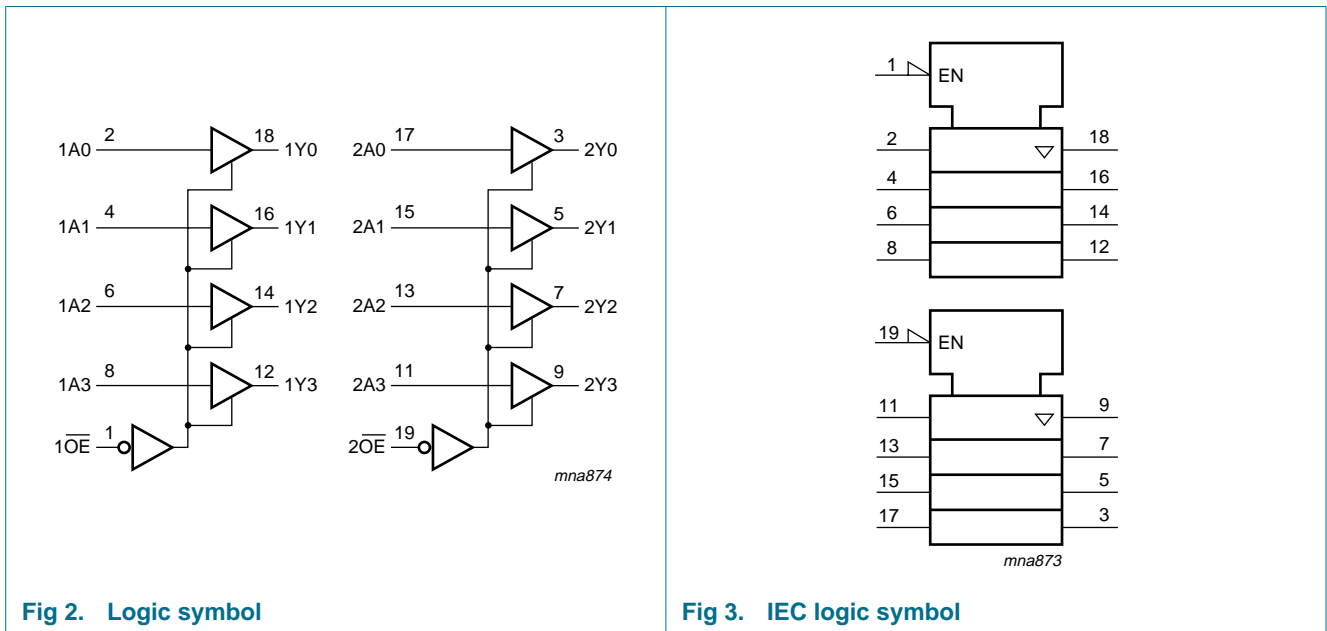
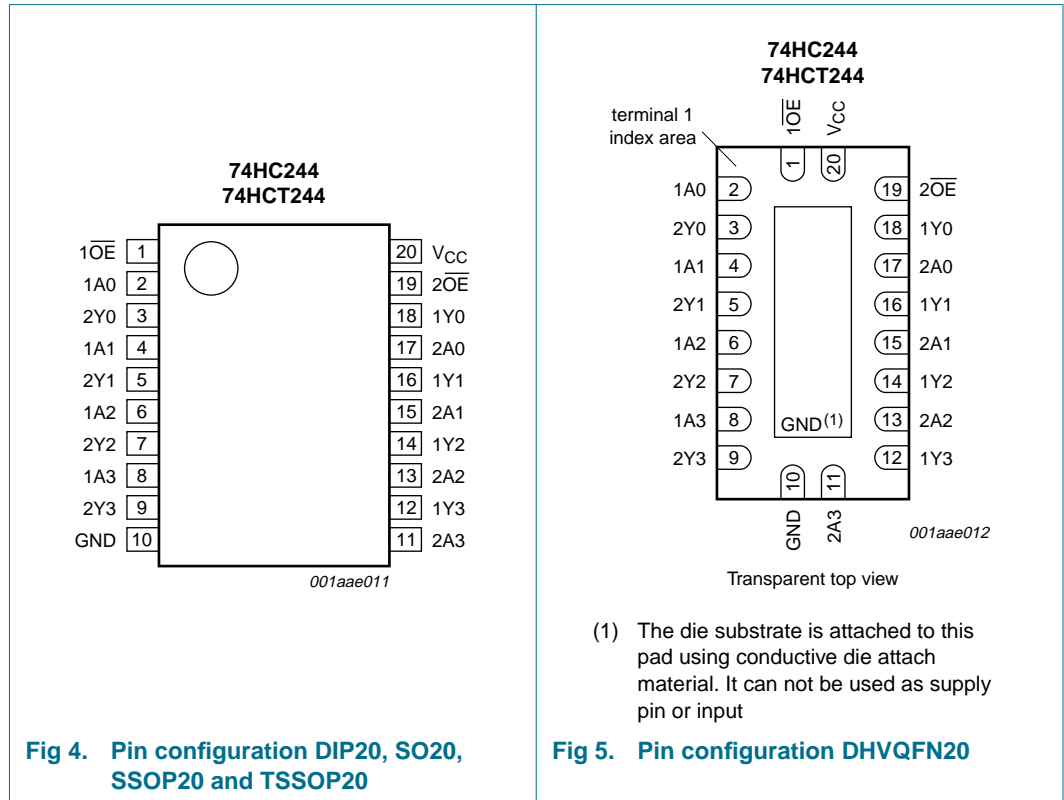


Fig 2. Logic symbol

Fig 3. IEC logic symbol

## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
1OE	1	1 output enable input (active LOW)
1A0	2	1 data input 0
2Y0	3	2 bus output 0
1A1	4	1 data input 1
2Y1	5	2 bus output 1
1A2	6	1 data input 2
2Y2	7	2 bus output 2
1A3	8	1 data input 3
2Y3	9	2 bus output 3
GND	10	ground (0 V)
2A3	11	2 data input 3
1Y3	12	1 bus output 3
2A2	13	2 data input 2
1Y2	14	1 bus output 2

Table 3: Pin description ...continued

Symbol	Pin	Description
2A1	15	2 data input 1
1Y1	16	1 bus output 1
2A0	17	2 data input 0
1Y0	18	1 bus output 0
$\overline{2OE}$	19	2 output enable input (active LOW)
V <sub>CC</sub>	20	supply voltage

## 7. Functional description

### 7.1 Function table

Table 4: Function table [1]

Control	Input	Output
$\overline{nOE}$	nAn	nYn
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.

## 8. Limiting values

Table 5: 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	$V_O = -0.5 \text{ V}$ to $(V_{CC} + 0.5 \text{ V})$	-	±35	mA
I <sub>CC</sub>	quiescent 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				
	DIP20 package		[1] -	750	mW
	SO20 package		[2] -	500	mW
	SSOP20 package		[3] -	500	mW
	TSSOP20 package		[3] -	500	mW
	DHVQFN20 package		[4] -	500	mW

- [1] For DIP20 package:  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.  
 [2] For SO20 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.  
 [3] For SSOP20 and TSSOP20 packages:  $P_{tot}$  derates linearly with 5.5 mW/K above 60 °C  
 [4] For DHVQFN20 packages:  $P_{tot}$  derates linearly with 4.5 mW/K above 60 °C.

## 9. Recommended operating conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>74HC244</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
$T_{amb}$	ambient temperature		-40	25	+125	°C
$t_r, t_f$	input rise and fall time	$V_{CC} = 2.0\text{ V}$	-	-	1000	ns
		$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns
		$V_{CC} = 6.0\text{ V}$	-	-	400	ns
<b>74HCT244</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
$T_{amb}$	ambient temperature		-40	25	+125	°C
$t_r, t_f$	input rise and fall time	$V_{CC} = 4.5\text{ V}$	-	6.0	500	ns

## 10. Static characteristics

**Table 7: Static characteristics 74HC244**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ °C}</math></b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	V
$V_{IL}$	LOW-state input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	V
$V_{OH}$	HIGH-state output voltage	$V_I = V_{IH}$ or $V_{IL}$	-	-	-	
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$	1.9	2.0	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	4.4	4.5	-	V
		$I_O = -20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$	5.9	6.0	-	V
		$I_O = -6.0\text{ mA}; V_{CC} = 4.5\text{ V}$	3.98	4.32	-	V
		$I_O = -7.8\text{ mA}; V_{CC} = 6\text{ V}$	5.48	5.81	-	V

**Table 7: Static characteristics 74HC244 ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>OL</sub>	LOW-state 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	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	V
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	V
		I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6 V	-	0.16	0.26	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6 V	-	-	±0.1	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND	-	-	±0.5	μA
I <sub>CC</sub>	quiescent 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	μA
C <sub>i</sub>	input capacitance		-	3.5	-	pF
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
V <sub>IH</sub>	HIGH-state input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-state input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	1.8	V
V <sub>OH</sub>	HIGH-state 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	1.9	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	-	-	V
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.84	-	-	V
		I <sub>O</sub> = -7.8 mA; V <sub>CC</sub> = 6 V	5.34	-	-	V
V <sub>OL</sub>	LOW-state 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	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	-	0.1	V
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.33	V
		I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6 V	-	-	0.33	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6 V	-	-	±1.0	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND	-	-	±5.0	μA
I <sub>CC</sub>	quiescent 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	-	-	80	μA

**Table 7: Static characteristics 74HC244 ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>IH</sub>	HIGH-state input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	V
		V <sub>CC</sub> = 4.5 V	3.15	-	-	V
		V <sub>CC</sub> = 6.0 V	4.2	-	-	V
V <sub>IL</sub>	LOW-state input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	-	1.8	V
V <sub>OH</sub>	HIGH-state 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	1.9	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	-	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	-	-	V
		I <sub>O</sub> = -6.0 mA; V <sub>CC</sub> = 4.5 V	3.7	-	-	V
V <sub>OL</sub>	LOW-state 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	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	-	0.1	V
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.4	V
I <sub>LI</sub>	input leakage current	I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6 V	-	-	0.4	V
		V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6 V	-	-	±1.0	μA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND	-	-	±10.0	μA
I <sub>CC</sub>	quiescent 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	-	-	160	μA

**Table 8: Static characteristics 74HCT244**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = 25 °C</b>						
V <sub>IH</sub>	HIGH-state input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	V
V <sub>IL</sub>	LOW-state input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	V
V <sub>OH</sub>	HIGH-state 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	-	V
		I <sub>O</sub> = -6.0 mA	3.98	4.32	-	V
V <sub>OL</sub>	LOW-state 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	V
		I <sub>O</sub> = 6.0 mA	-	0.16	0.26	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	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 pins at GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	±0.5	μA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	8.0	μA



**Table 8: Static characteristics 74HCT244 ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\Delta I_{CC}$	additional quiescent supply current	per input pin; $V_I = V_{CC} - 2.1$ V; other inputs at $V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 4.5$ V to 5.5 V		70	252	$\mu$ A
$C_i$	input capacitance		-	3.5	-	pF
<b><math>T_{amb} = -40</math> °C to <math>+85</math> °C</b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	2.0	-	-	V
$V_{IL}$	LOW-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	-	-	0.8	V
$V_{OH}$	HIGH-state output voltage	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5$ V				
		$I_O = -20$ $\mu$ A	4.4	-	-	V
		$I_O = -6.0$ mA	3.84	-	-	V
$V_{OL}$	LOW-state output voltage	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5$ V				
		$I_O = 20$ $\mu$ A	-	-	0.1	V
		$I_O = 6.0$ mA	-	-	0.33	V
$I_{LI}$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	$\pm 1.0$	$\mu$ A
$I_{OZ}$	OFF-state output current	per input pin; $V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; other pins at GND or $V_{CC}$ ; $I_O = 0$ A; $V_{CC} = 5.5$ V			$\pm 5.0$	$\mu$ A
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	80	$\mu$ A
$\Delta I_{CC}$	additional quiescent supply current	per input pin; $V_I = V_{CC} - 2.1$ V; other inputs at $V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 4.5$ V to 5.5 V	-	-	315	$\mu$ A
<b><math>T_{amb} = -40</math> °C to <math>+125</math> °C</b>						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	2.0	-	-	V
$V_{IL}$	LOW-state input voltage	$V_{CC} = 4.5$ V to 5.5 V	-	-	0.8	V
$V_{OH}$	HIGH-state output voltage	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5$ V				
		$I_O = -20$ $\mu$ A	4.4	-	-	V
		$I_O = -6.0$ mA	3.7	-	-	V
$V_{OL}$	LOW-state output voltage	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5$ V				
		$I_O = 20$ $\mu$ A	-	-	0.1	V
		$I_O = 6.0$ mA	-	-	0.4	V
$I_{LI}$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	-	$\pm 1.0$	$\mu$ A
$I_{OZ}$	OFF-state output current	per input pin; $V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; other pins at GND or $V_{CC}$ ; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	$\pm 10.0$	$\mu$ A
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	160	$\mu$ A
$\Delta I_{CC}$	additional quiescent supply current	per input pin; $V_I = V_{CC} - 2.1$ V; other inputs at $V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 4.5$ V to 5.5 V	-	-	343	$\mu$ A

## 11. Dynamic characteristics

**Table 9: Dynamic characteristics 74HC244**
*GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see [Figure 8](#).*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = 25 °C</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay nAn to nYn	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.0 V	-	30	110	ns
		V <sub>CC</sub> = 4.5 V	-	11	22	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	9	-	ns
		V <sub>CC</sub> = 6.0 V	-	9	19	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	3-state output enable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		V <sub>CC</sub> = 2.0 V	-	36	150	ns
		V <sub>CC</sub> = 4.5 V	-	13	30	ns
		V <sub>CC</sub> = 6.0 V	-	10	26	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	3-state output disable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		V <sub>CC</sub> = 2.0 V	-	39	150	ns
		V <sub>CC</sub> = 4.5 V	-	14	30	ns
		V <sub>CC</sub> = 6.0 V	-	11	26	ns
t <sub>THL</sub> , t <sub>TLH</sub>	output transition time	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.0 V	-	14	60	ns
		V <sub>CC</sub> = 4.5 V	-	5	12	ns
		V <sub>CC</sub> = 6.0 V	-	4	10	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub>	[1] -	35	-	pF
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay nAn to nYn	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.0 V	-	-	145	ns
		V <sub>CC</sub> = 4.5 V	-	-	28	ns
		V <sub>CC</sub> = 6.0 V	-	-	24	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	3-state output enable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		V <sub>CC</sub> = 2.0 V	-	-	190	ns
		V <sub>CC</sub> = 4.5 V	-	-	38	ns
		V <sub>CC</sub> = 6.0 V	-	-	33	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	3-state output disable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		V <sub>CC</sub> = 2.0 V	-	-	190	ns
		V <sub>CC</sub> = 4.5 V	-	-	38	ns
		V <sub>CC</sub> = 6.0 V	-	-	33	ns
t <sub>THL</sub> , t <sub>TLH</sub>	output transition time	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.0 V	-	-	75	ns
		V <sub>CC</sub> = 4.5 V	-	-	15	ns
		V <sub>CC</sub> = 6.0 V	-	-	13	ns

**Table 9: Dynamic characteristics 74HC244 ...continued**GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay nAn to nYn	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.0 V	-	-	165	ns
		V <sub>CC</sub> = 4.5 V	-	-	33	ns
		V <sub>CC</sub> = 6.0 V	-	-	28	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	3-state output enable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		V <sub>CC</sub> = 2.0 V	-	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	-	45	ns
		V <sub>CC</sub> = 6.0 V	-	-	38	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	3-state output disable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		V <sub>CC</sub> = 2.0 V	-	-	225	ns
		V <sub>CC</sub> = 4.5 V	-	-	45	ns
		V <sub>CC</sub> = 6.0 V	-	-	38	ns
t <sub>THL</sub> , t <sub>TLH</sub>	output transition time	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 2.0 V	-	-	90	ns
		V <sub>CC</sub> = 4.5 V	-	-	18	ns
		V <sub>CC</sub> = 6.0 V	-	-	15	ns

[1] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ W):P<sub>D</sub> = C<sub>PD</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> × N +  $\Sigma$ (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;C<sub>L</sub> = output load capacitance in pF;V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

 $\Sigma$ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.**Table 10: Dynamic characteristics type 74HCT244**GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF unless otherwise specified; for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = 25 °C</b>						
t <sub>PHL</sub> , t <sub>PLH</sub>	propagation delay nAn to nYn	see <a href="#">Figure 6</a>				
		V <sub>CC</sub> = 4.5 V	-	13	22	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	11	-	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	3-state output enable time n $\overline{OE}$ to nYn	V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 7</a>	-	15	30	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	3-state output disable time n $\overline{OE}$ to nYn	V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 7</a>	-	15	25	ns
t <sub>THL</sub> , t <sub>TLH</sub>	output transition time	V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 6</a>	-	5	12	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to (V <sub>CC</sub> - 1.5 V)	[1] -	35	-	pF

**Table 10: Dynamic characteristics type 74HCT244 ...continued**

$GND = 0\text{ V}$ ;  $t_r = t_f = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$  unless otherwise specified; for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay nAn to nYn	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a>	-	-	28	ns
$t_{PZH}$ , $t_{PZL}$	3-state output enable time nOE to nYn	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a>	-	-	38	ns
$t_{PHZ}$ , $t_{PLZ}$	3-state output disable time nOE to nYn	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a>	-	-	31	ns
$t_{THL}$ , $t_{TLH}$	output transition time	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a>	-	-	15	ns
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay nAn to nYn	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a>	-	-	33	ns
$t_{PZH}$ , $t_{PZL}$	3-state output enable time nOE to nYn	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a>	-	-	45	ns
$t_{PHZ}$ , $t_{PLZ}$	3-state output disable time nOE to nYn	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 7</a>	-	-	38	ns
$t_{THL}$ , $t_{TLH}$	output transition time	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a>	-	-	18	ns

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

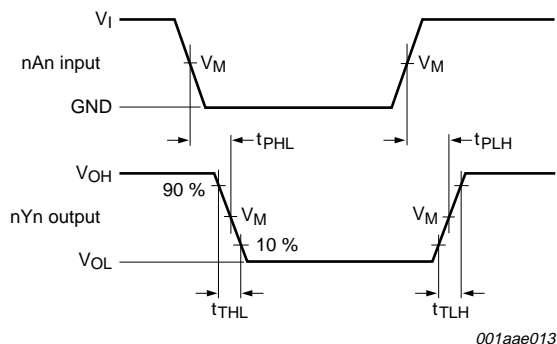
$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

$\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 12. Waveforms



Measurement points are given in [Table 11](#).

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

**Fig 6. Propagation delay input (1An, 2An) to output (1Yn, 2Yn) and transition time output (nYn)**

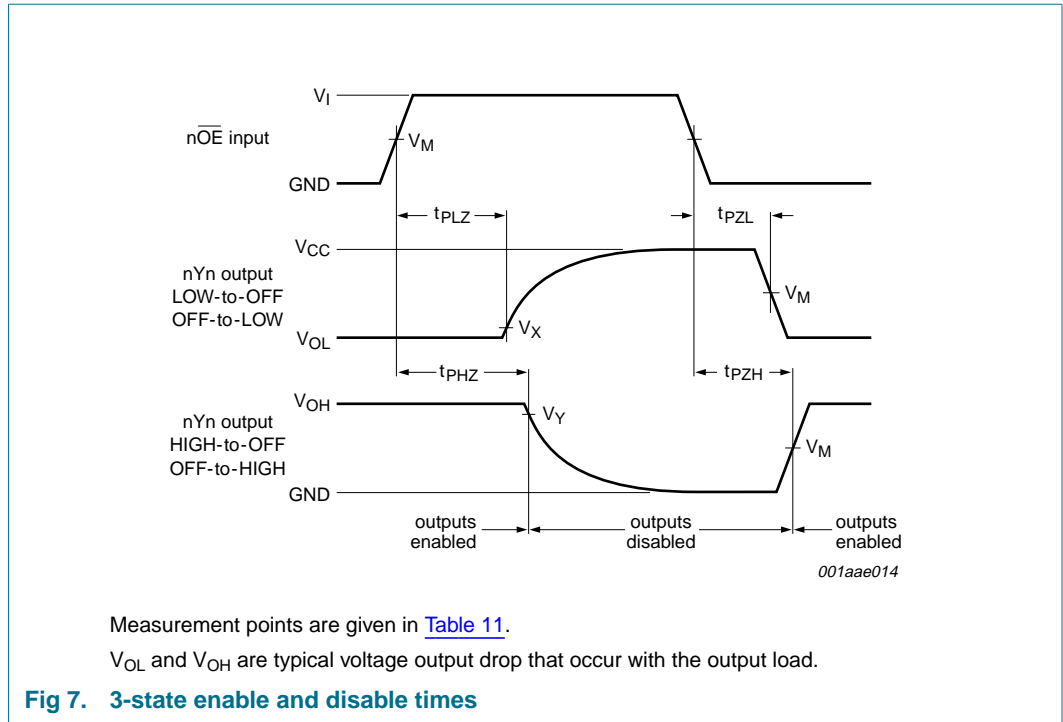
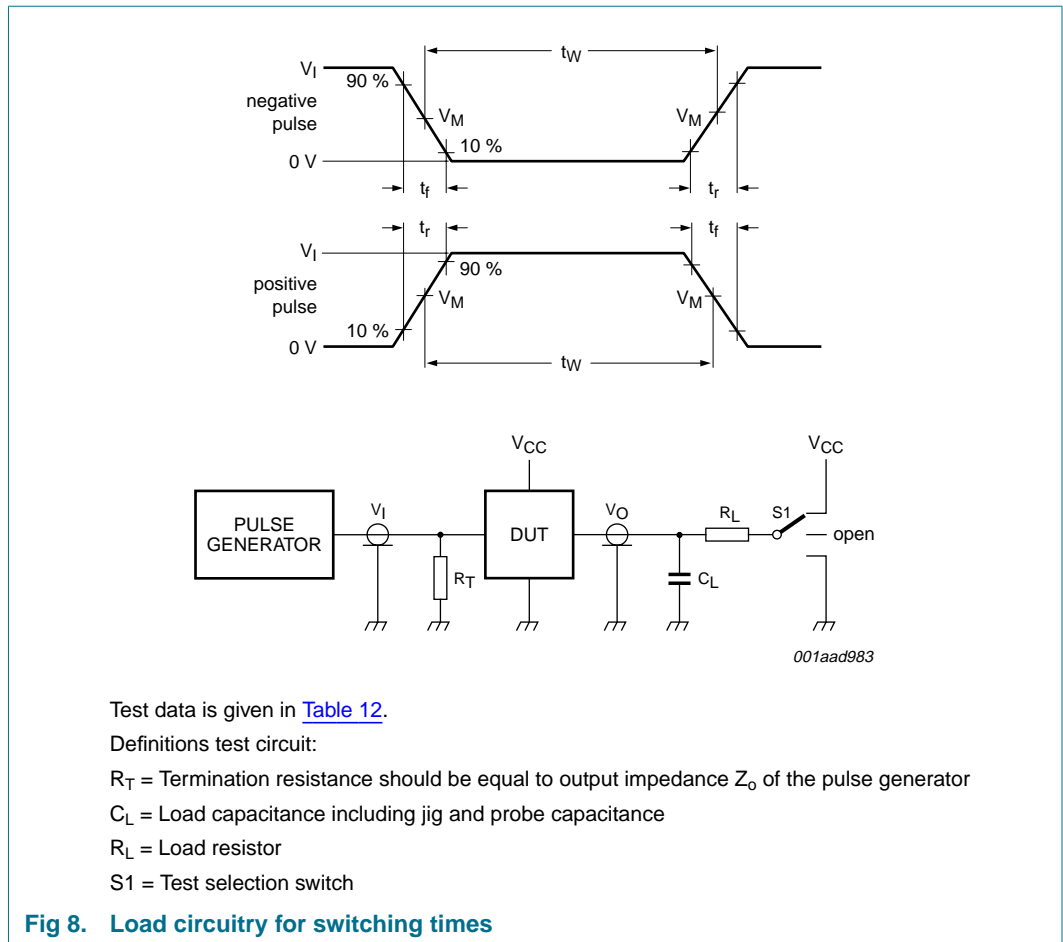


Table 11: Measurement points

Type	Input	Output
	$V_M$	$V_M$
74HC244	$0.5V_{CC}$	$0.5V_{CC}$
74HCT244	1.3 V	1.3 V



**Table 12: 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	$V_{CC}$	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT244	3 V	6 ns	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

13. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1



Fig 9. Package outline SOT146-1 (DIP20)

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

SOT163-1

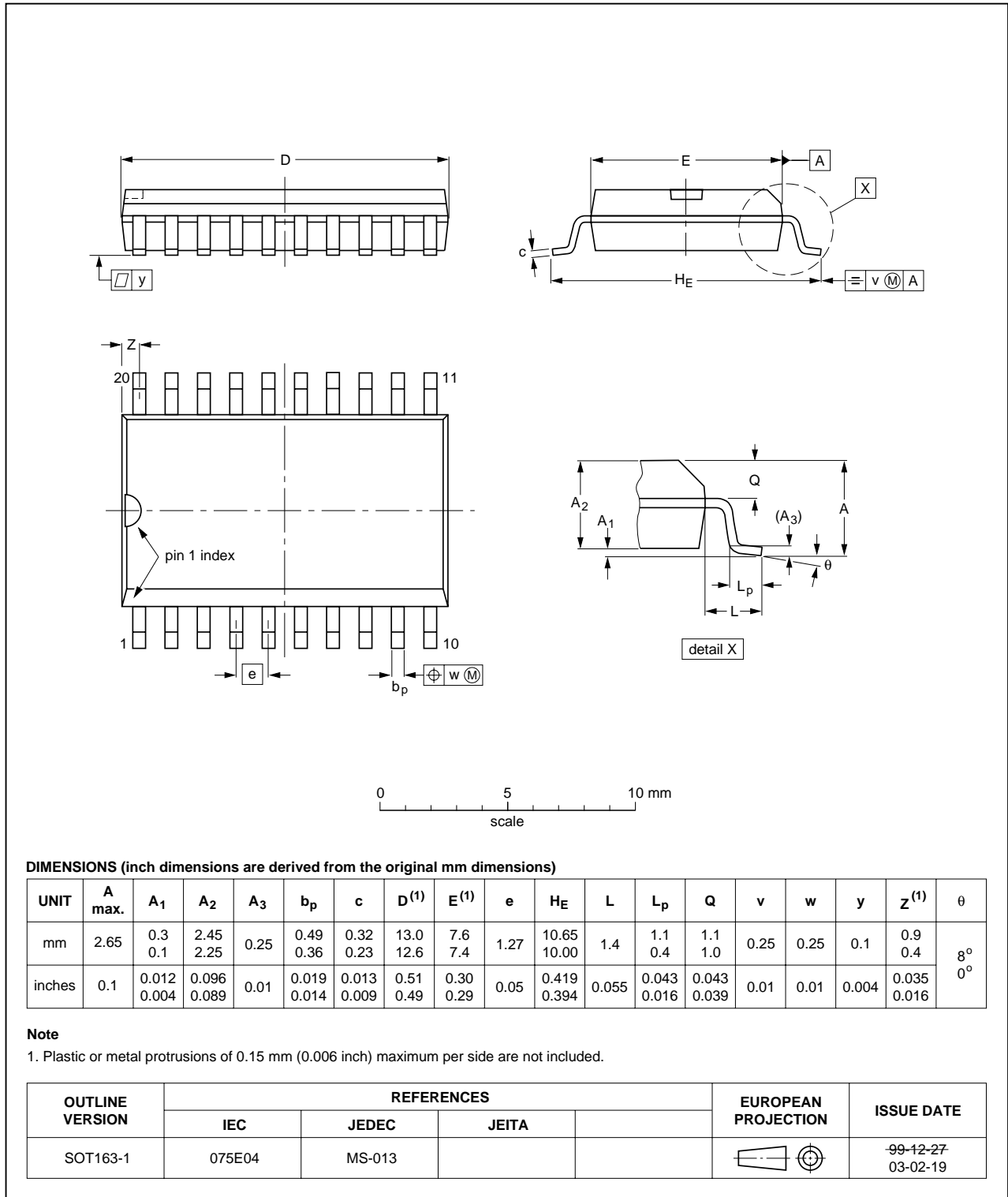


Fig 10. Package outline SOT163-1 (SO20)



SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



Fig 11. Package outline SOT339-1 (SSOP20)

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

SOT360-1

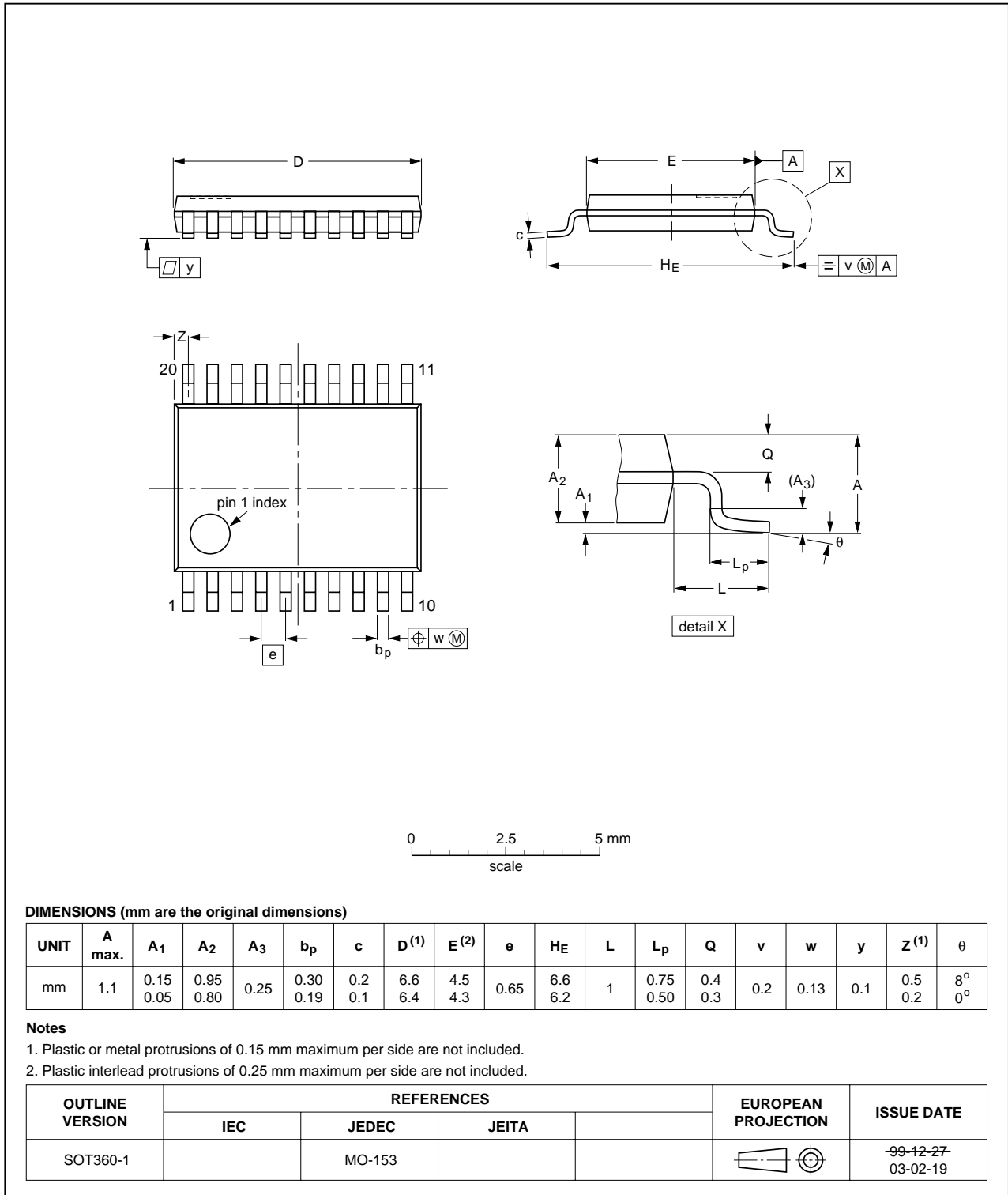


Fig 12. Package outline SOT360-1 (TSSOP20)

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

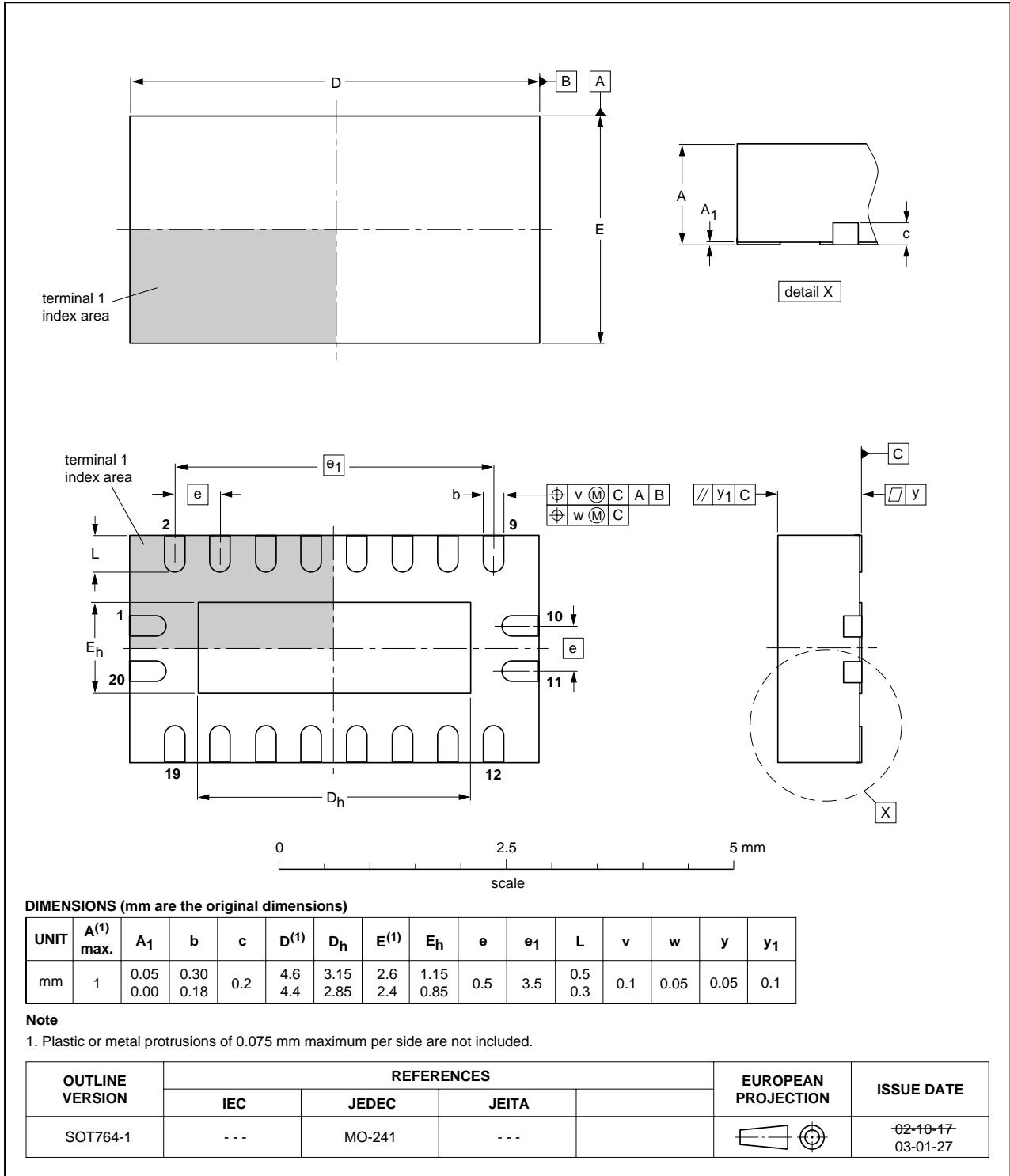


Fig 13. Package outline SOT764-1 (DHVQFN20)

## 14. Abbreviations

Table 13: Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
LSTTL	Low-power Schottky Transistor-Transistor Logic
MM	Machine Model

## 15. Revision history

Table 14: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74HC_HCT244_3	20051222	Product data sheet	-	-	74HC_HCT244_CNV_2
Modifications:					<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li> <li><a href="#">Section 4 "Ordering information"</a>, <a href="#">Section 6 "Pinning information"</a> and <a href="#">Section 13 "Package outline"</a>: Added DHVQFN package information</li> <li><a href="#">Section 10 "Static characteristics"</a>: Added from the family specification</li> </ul>
74HC_HCT244_CNV_2	19901201	Product specification	-	-	-

## 16. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2] [3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 17. Definitions

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