

# 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

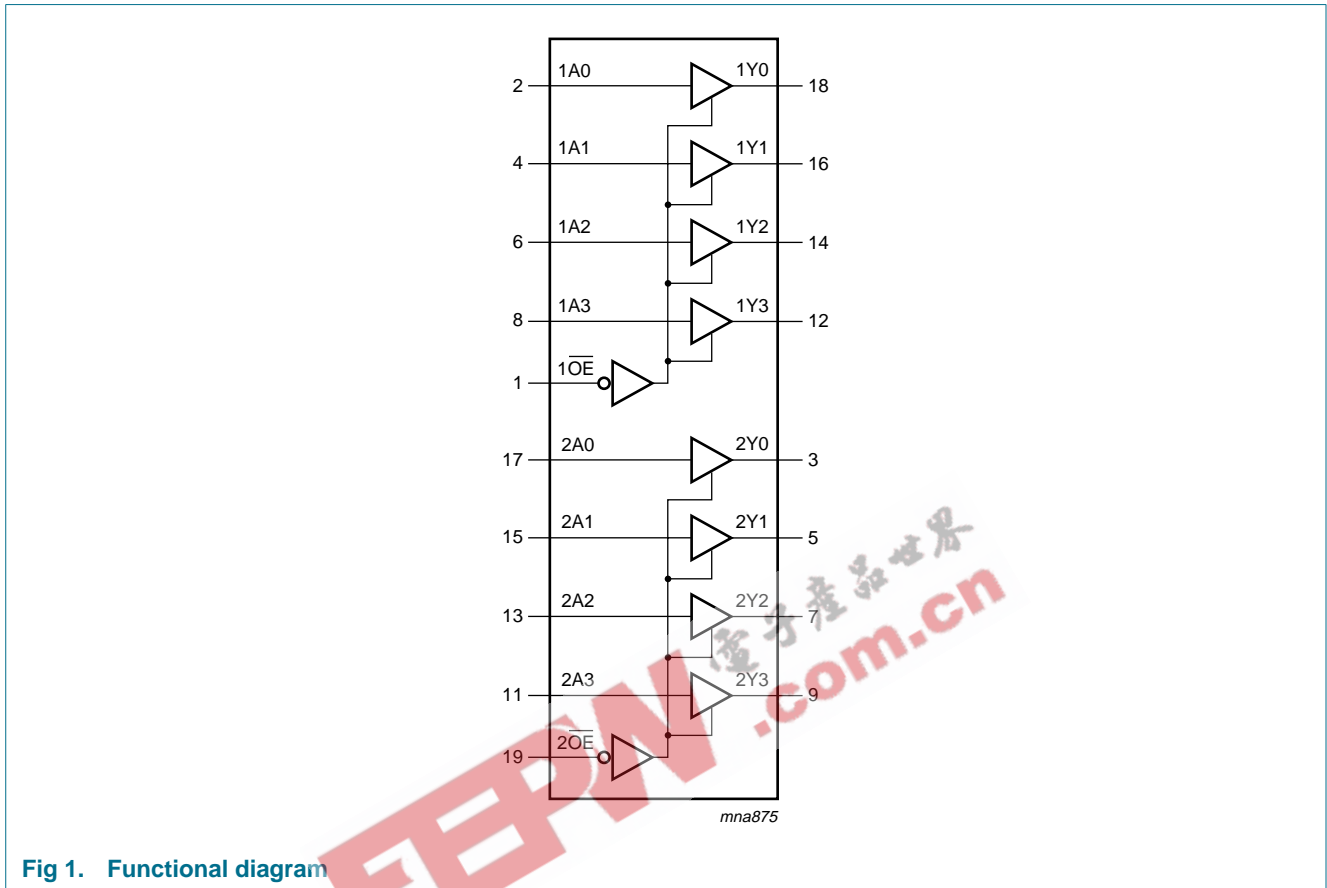


Fig 1. Functional diagram

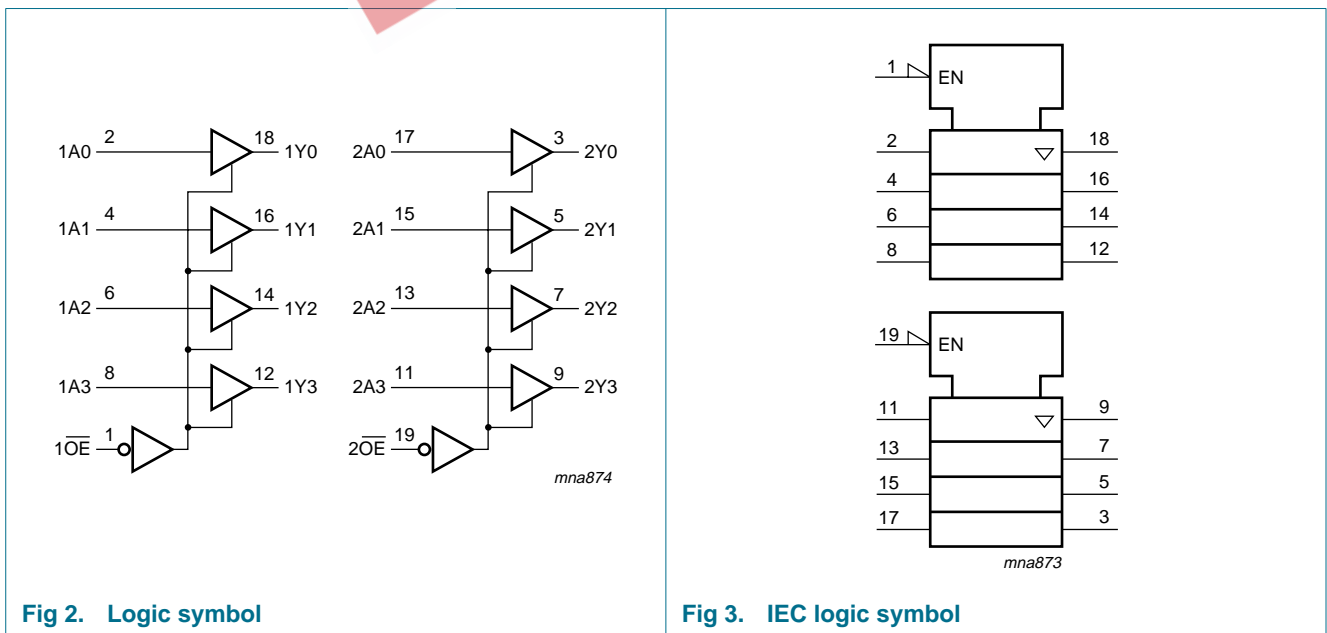
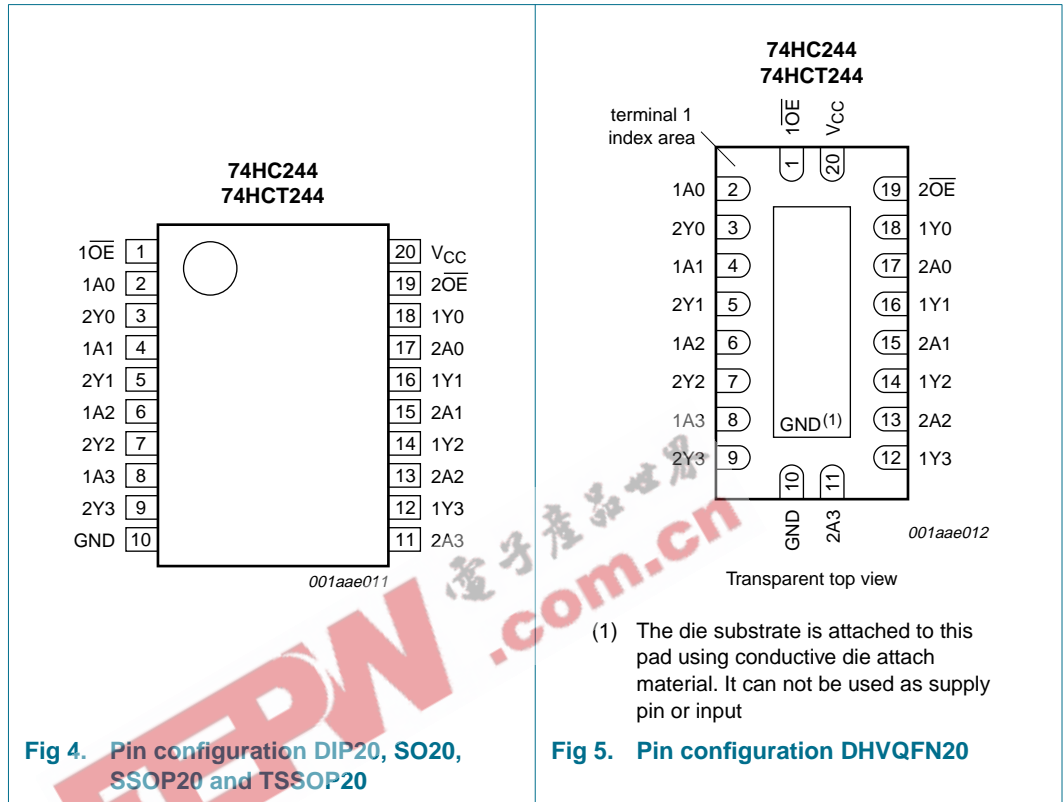


Fig 2. Logic symbol

Fig 3. IEC logic symbol

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
10 $\overline{OE}$	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	$V_{CC} = 2.0$ V	-	-	1000	ns
		$V_{CC} = 4.5$ V	-	6.0	500	ns
		$V_{CC} = 6.0$ 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	$V_{CC} = 4.5$ 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
$T_{amb} = 25$ °C						
$V_{IH}$	HIGH-state input voltage	$V_{CC} = 2.0$ V	1.5	1.2	-	V
		$V_{CC} = 4.5$ V	3.15	2.4	-	V
		$V_{CC} = 6.0$ V	4.2	3.2	-	V
$V_{IL}$	LOW-state input voltage	$V_{CC} = 2.0$ V	-	0.8	0.5	V
		$V_{CC} = 4.5$ V	-	2.1	1.35	V
		$V_{CC} = 6.0$ V	-	2.8	1.8	V
$V_{OH}$	HIGH-state output voltage	$V_I = V_{IH}$ or $V_{IL}$	-	-	-	
		$I_O = -20$ $\mu$ A; $V_{CC} = 2.0$ V	1.9	2.0	-	V
		$I_O = -20$ $\mu$ A; $V_{CC} = 4.5$ V	4.4	4.5	-	V
		$I_O = -20$ $\mu$ A; $V_{CC} = 6.0$ V	5.9	6.0	-	V
		$I_O = -6.0$ mA; $V_{CC} = 4.5$ V	3.98	4.32	-	V
		$I_O = -7.8$ mA; $V_{CC} = 6$ 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**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b><math>T_{amb} = 25\text{ °C}</math></b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay nAn to nYn	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.0\text{ V}$	-	30	110	ns
		$V_{CC} = 4.5\text{ V}$	-	11	22	ns
		$V_{CC} = 5\text{ V}$ ; $C_L = 15\text{ pF}$	-	9	-	ns
		$V_{CC} = 6.0\text{ V}$	-	9	19	ns
$t_{PZH}$ , $t_{PZL}$	3-state output enable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.0\text{ V}$	-	36	150	ns
		$V_{CC} = 4.5\text{ V}$	-	13	30	ns
		$V_{CC} = 6.0\text{ V}$	-	10	26	ns
$t_{PHZ}$ , $t_{PLZ}$	3-state output disable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.0\text{ V}$	-	39	150	ns
		$V_{CC} = 4.5\text{ V}$	-	14	30	ns
		$V_{CC} = 6.0\text{ V}$	-	11	26	ns
$t_{THL}$ , $t_{TLH}$	output transition time	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.0\text{ V}$	-	14	60	ns
		$V_{CC} = 4.5\text{ V}$	-	5	12	ns
		$V_{CC} = 6.0\text{ V}$	-	4	10	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND$ to $V_{CC}$	[1]	-	35	pF
<b><math>T_{amb} = -40\text{ °C to }+85\text{ °C}</math></b>						
$t_{PHL}$ , $t_{PLH}$	propagation delay nAn to nYn	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.0\text{ V}$	-	-	145	ns
		$V_{CC} = 4.5\text{ V}$	-	-	28	ns
		$V_{CC} = 6.0\text{ V}$	-	-	24	ns
$t_{PZH}$ , $t_{PZL}$	3-state output enable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.0\text{ V}$	-	-	190	ns
		$V_{CC} = 4.5\text{ V}$	-	-	38	ns
		$V_{CC} = 6.0\text{ V}$	-	-	33	ns
$t_{PHZ}$ , $t_{PLZ}$	3-state output disable time n $\overline{OE}$ to nYn	see <a href="#">Figure 7</a>				
		$V_{CC} = 2.0\text{ V}$	-	-	190	ns
		$V_{CC} = 4.5\text{ V}$	-	-	38	ns
		$V_{CC} = 6.0\text{ V}$	-	-	33	ns
$t_{THL}$ , $t_{TLH}$	output transition time	see <a href="#">Figure 6</a>				
		$V_{CC} = 2.0\text{ V}$	-	-	75	ns
		$V_{CC} = 4.5\text{ V}$	-	-	15	ns
		$V_{CC} = 6.0\text{ V}$	-	-	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 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_{\text{amb}} = -40 \text{ }^\circ\text{C to } +85 \text{ }^\circ\text{C}</math></b>						
$t_{\text{PHL}}$ , $t_{\text{PLH}}$	propagation delay nAn to nYn	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 6	-	-	28	ns
$t_{\text{PZH}}$ , $t_{\text{PZL}}$	3-state output enable time nOE to nYn	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 7	-	-	38	ns
$t_{\text{PHZ}}$ , $t_{\text{PLZ}}$	3-state output disable time nOE to nYn	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 7	-	-	31	ns
$t_{\text{THL}}$ , $t_{\text{TLH}}$	output transition time	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 6	-	-	15	ns
<b><math>T_{\text{amb}} = -40 \text{ }^\circ\text{C to } +125 \text{ }^\circ\text{C}</math></b>						
$t_{\text{PHL}}$ , $t_{\text{PLH}}$	propagation delay nAn to nYn	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 6	-	-	33	ns
$t_{\text{PZH}}$ , $t_{\text{PZL}}$	3-state output enable time nOE to nYn	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 7	-	-	45	ns
$t_{\text{PHZ}}$ , $t_{\text{PLZ}}$	3-state output disable time nOE to nYn	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 7	-	-	38	ns
$t_{\text{THL}}$ , $t_{\text{TLH}}$	output transition time	$V_{\text{CC}} = 4.5 \text{ V}$ ; see Figure 6	-	-	18	ns

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

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

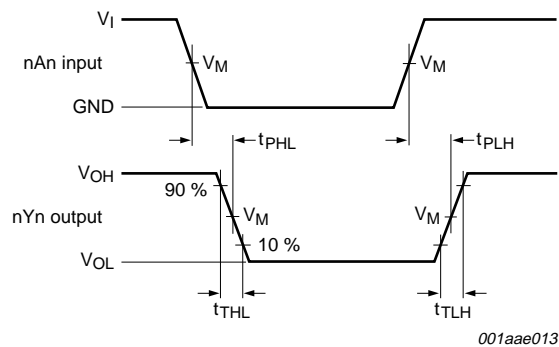
$C_L$  = output load capacitance in pF;

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

$N$  = number of inputs switching;

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

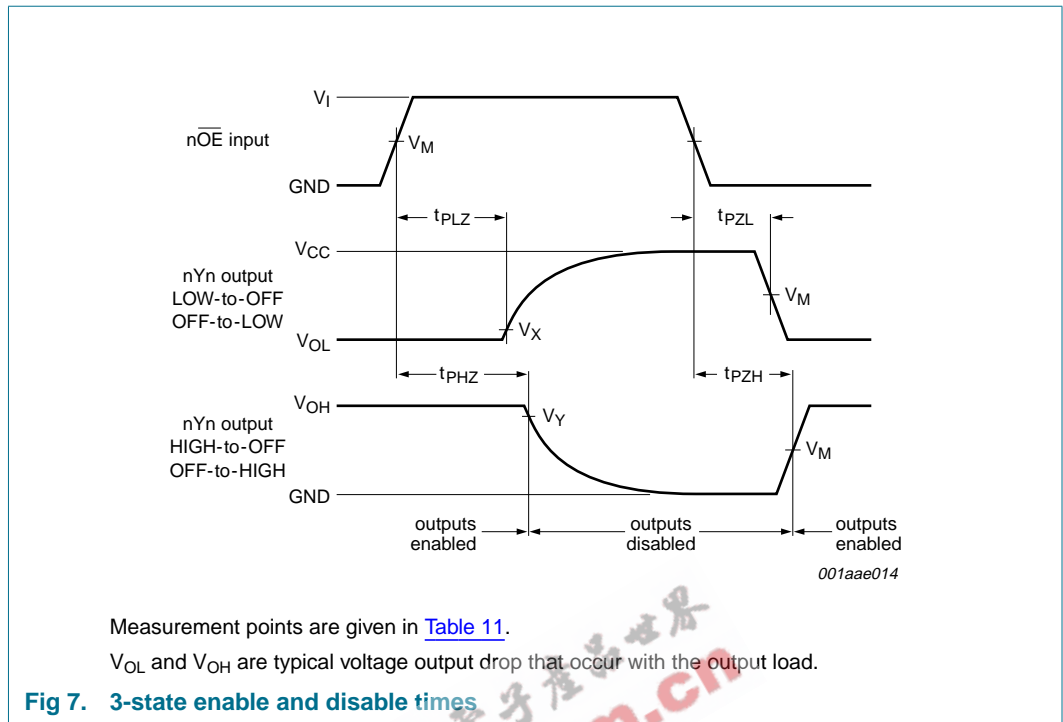
## 12. Waveforms



Measurement points are given in Table 11.

$V_{\text{OL}}$  and  $V_{\text{OH}}$  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

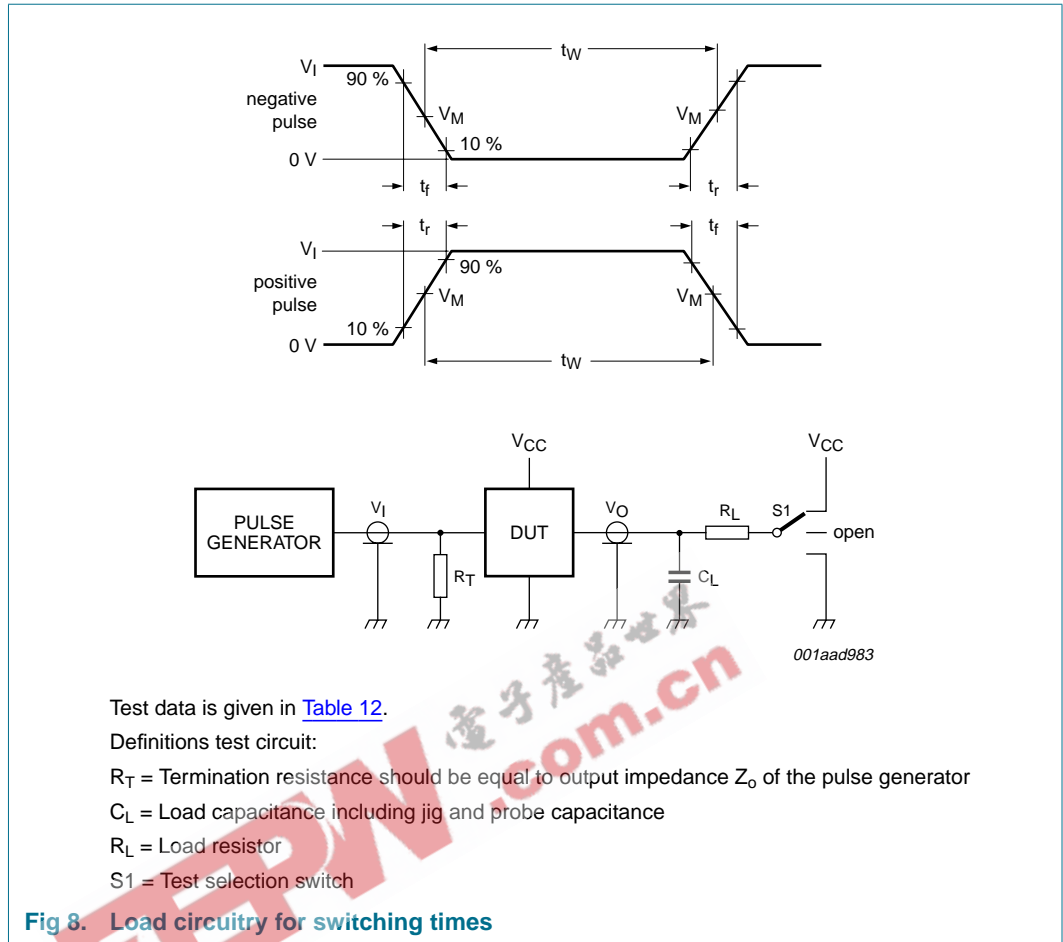


Fig 8. Load circuitry for switching times

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

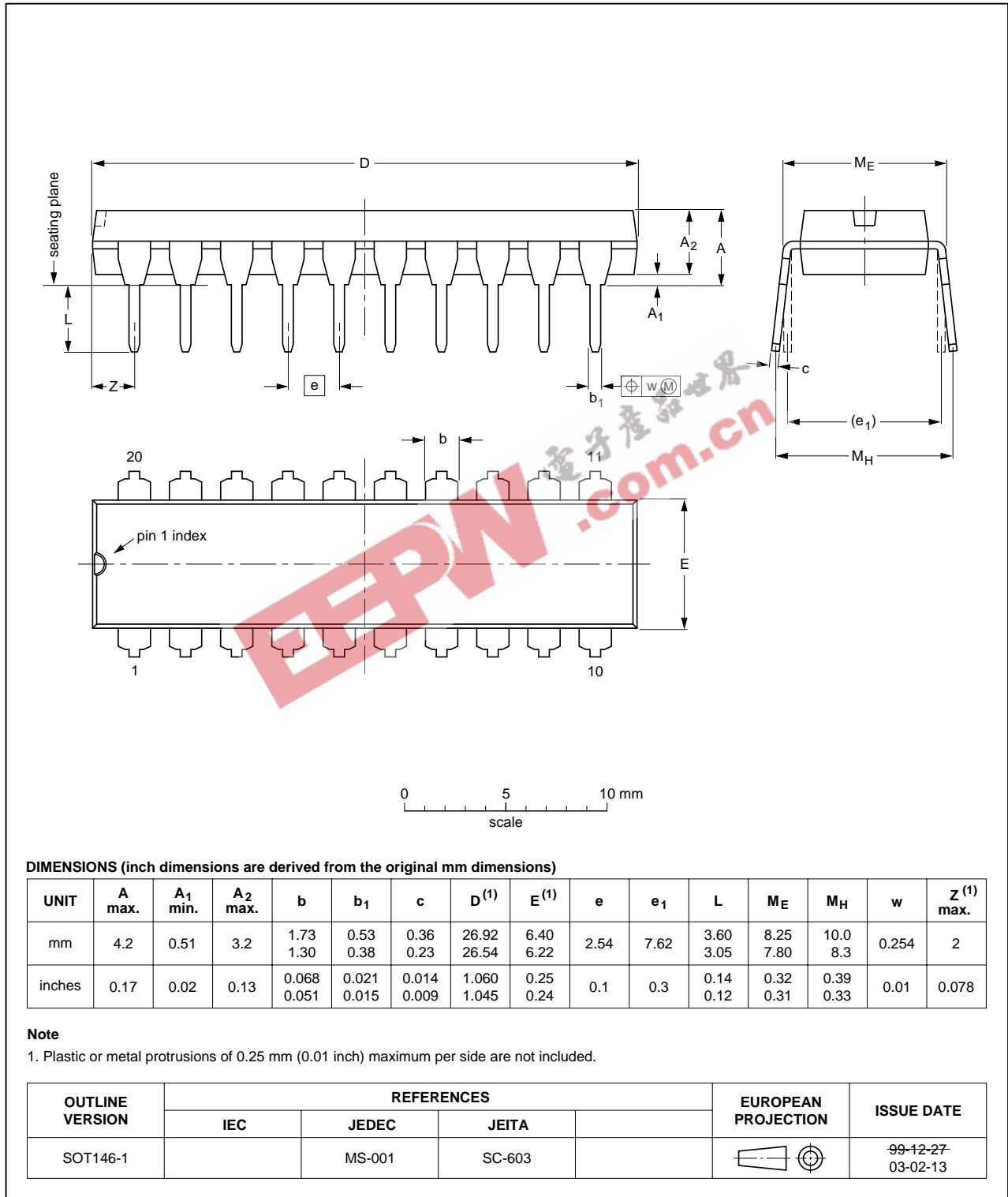


Fig 9. Package outline SOT146-1 (DIP20)

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

SOT163-1

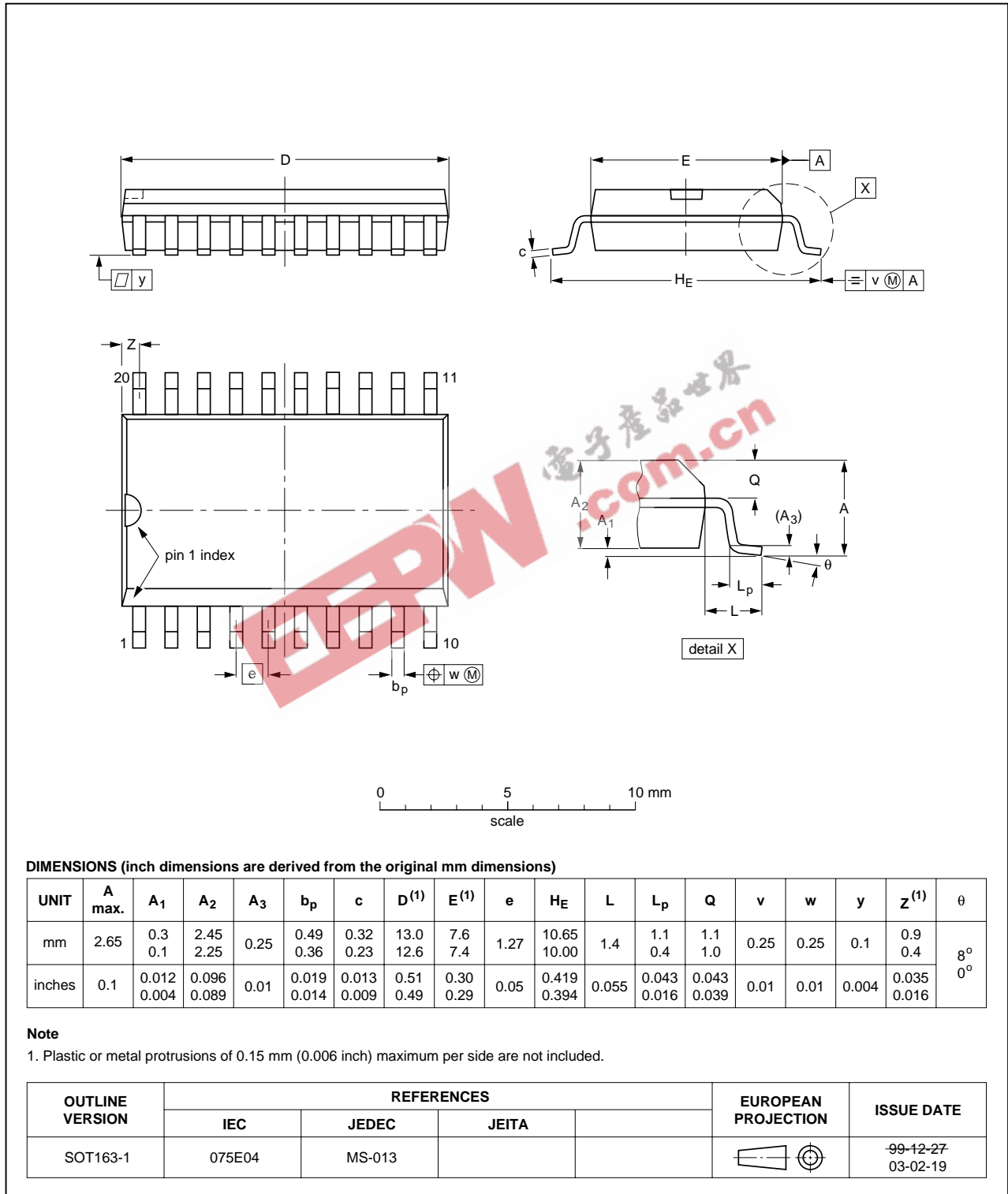


Fig 10. Package outline SOT163-1 (SO20)



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

SOT339-1

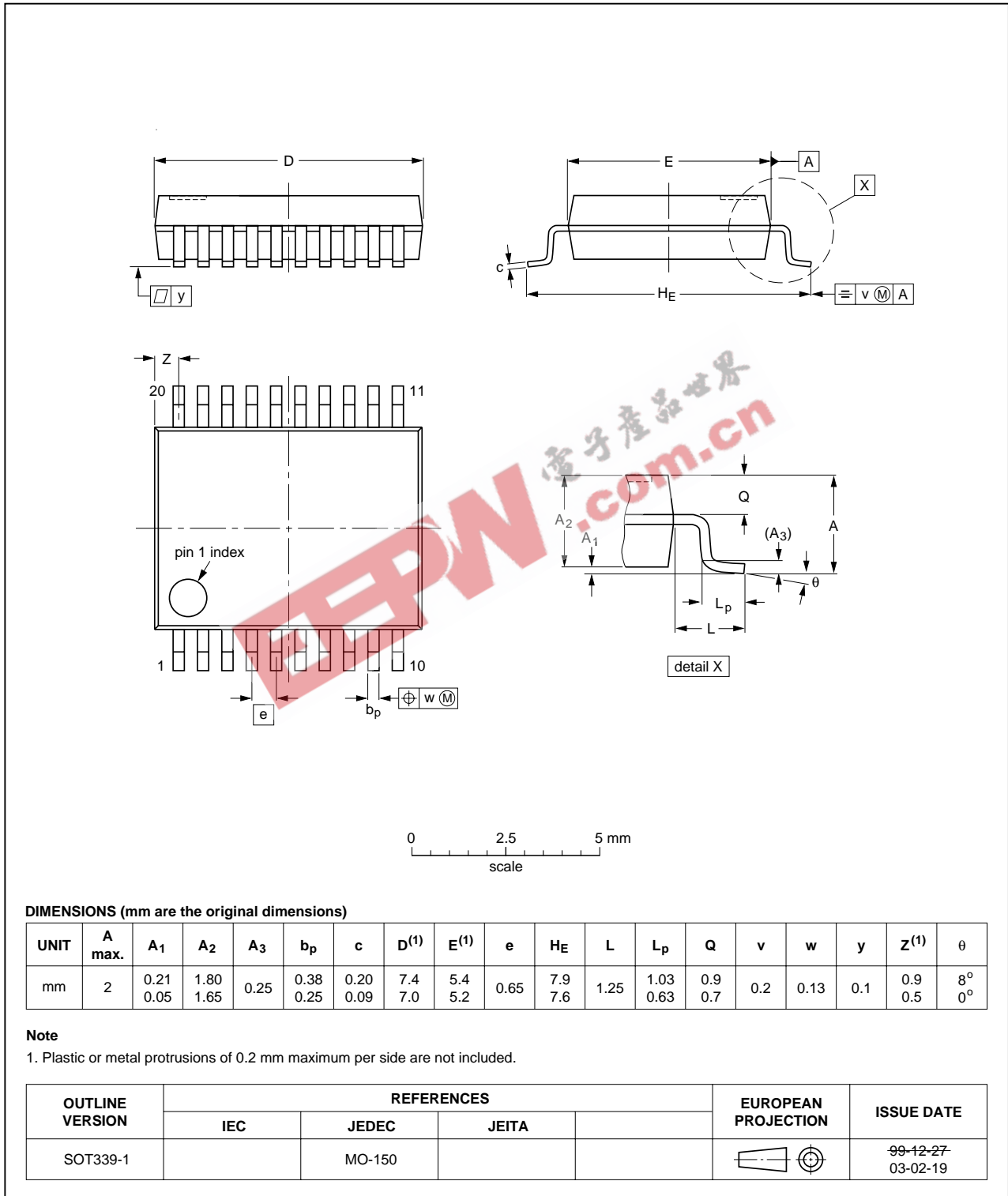


Fig 11. Package outline SOT339-1 (SSOP20)

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

SOT360-1

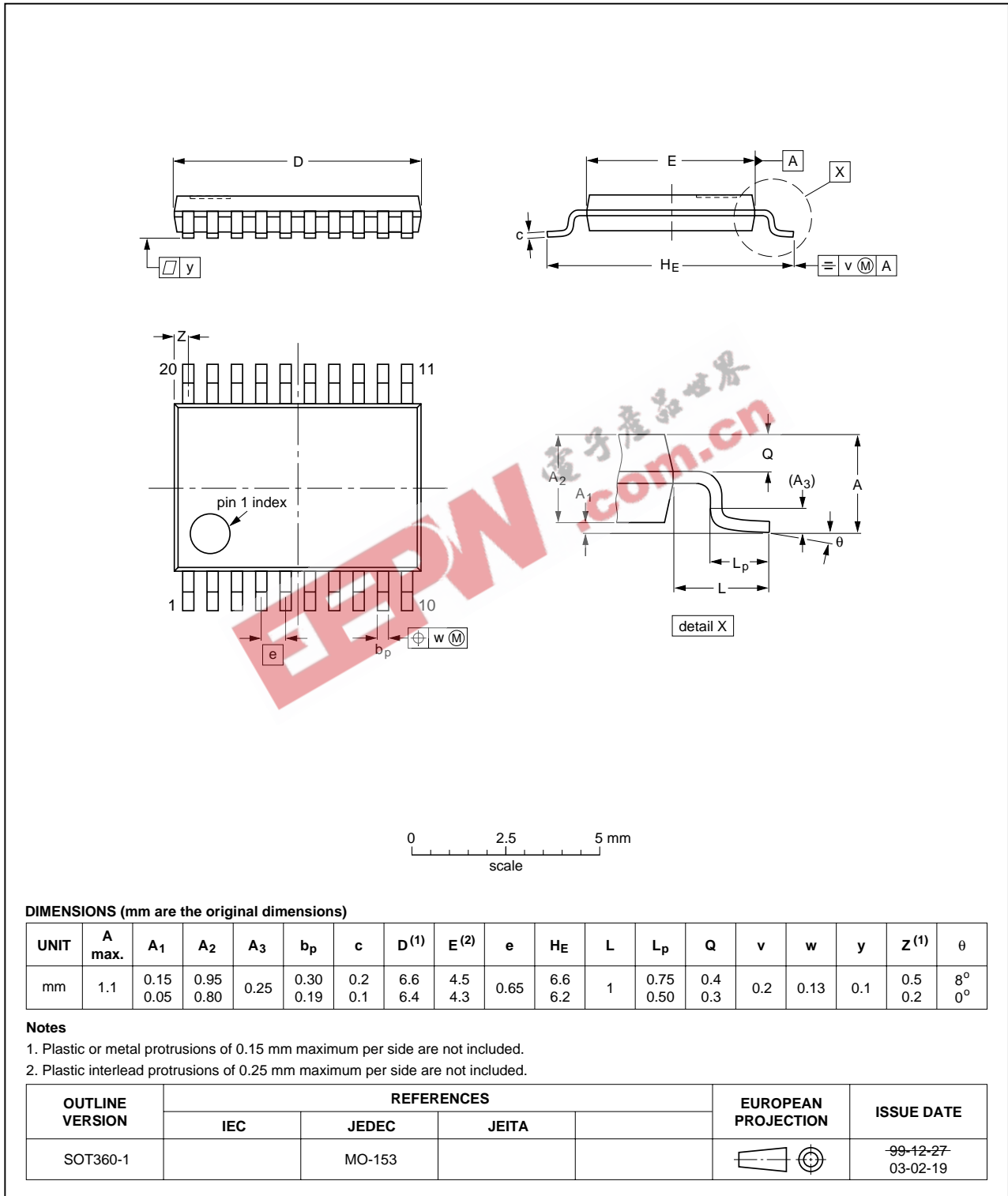


Fig 12. Package outline SOT360-1 (TSSOP20)

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

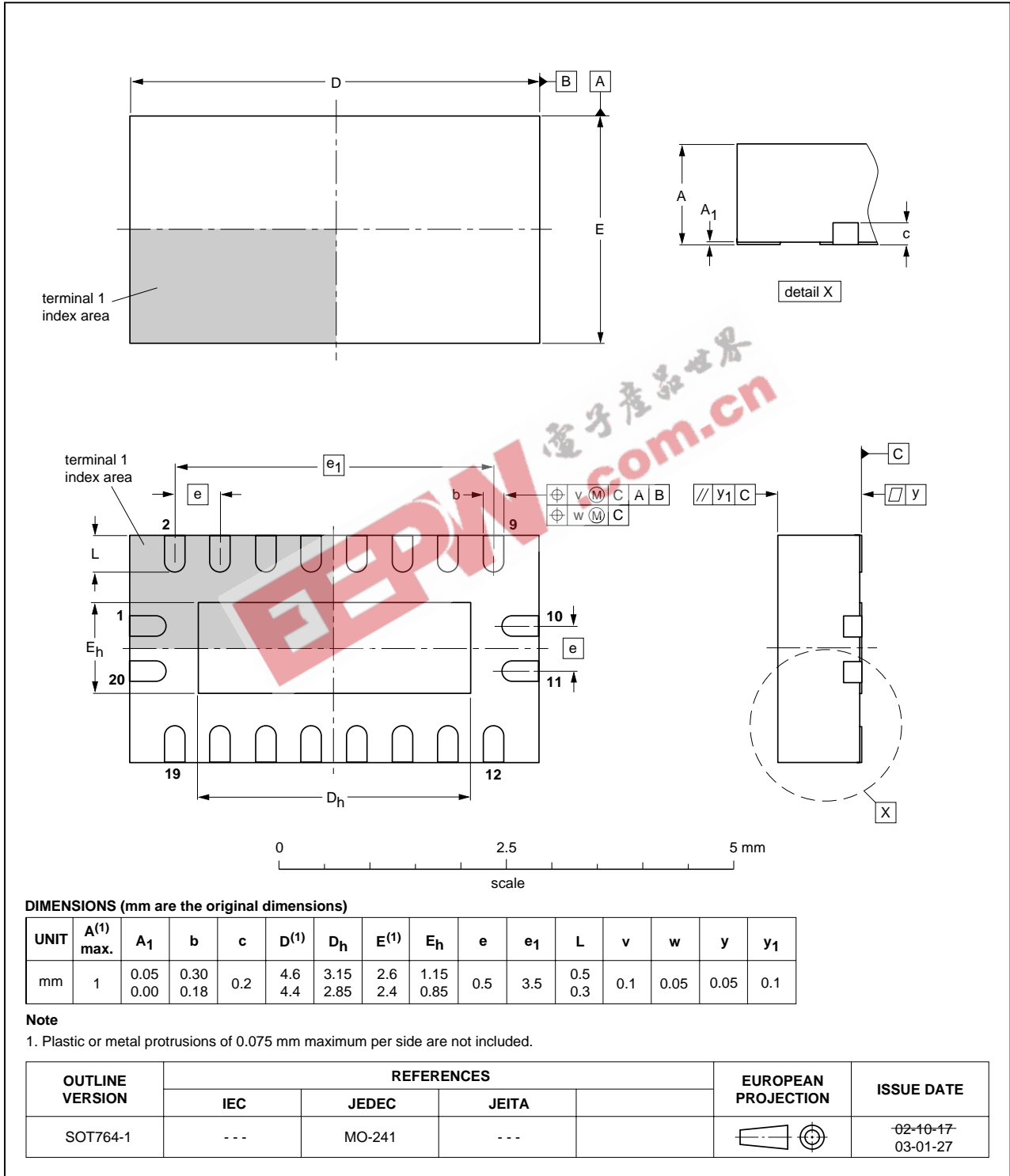


Fig 13. Package outline SOT764-1 (DHVQFN20)

## 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.
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