

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
74HC244						
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
74HCT244						
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 μW):

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

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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
74HC244				
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
74HCT244				
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

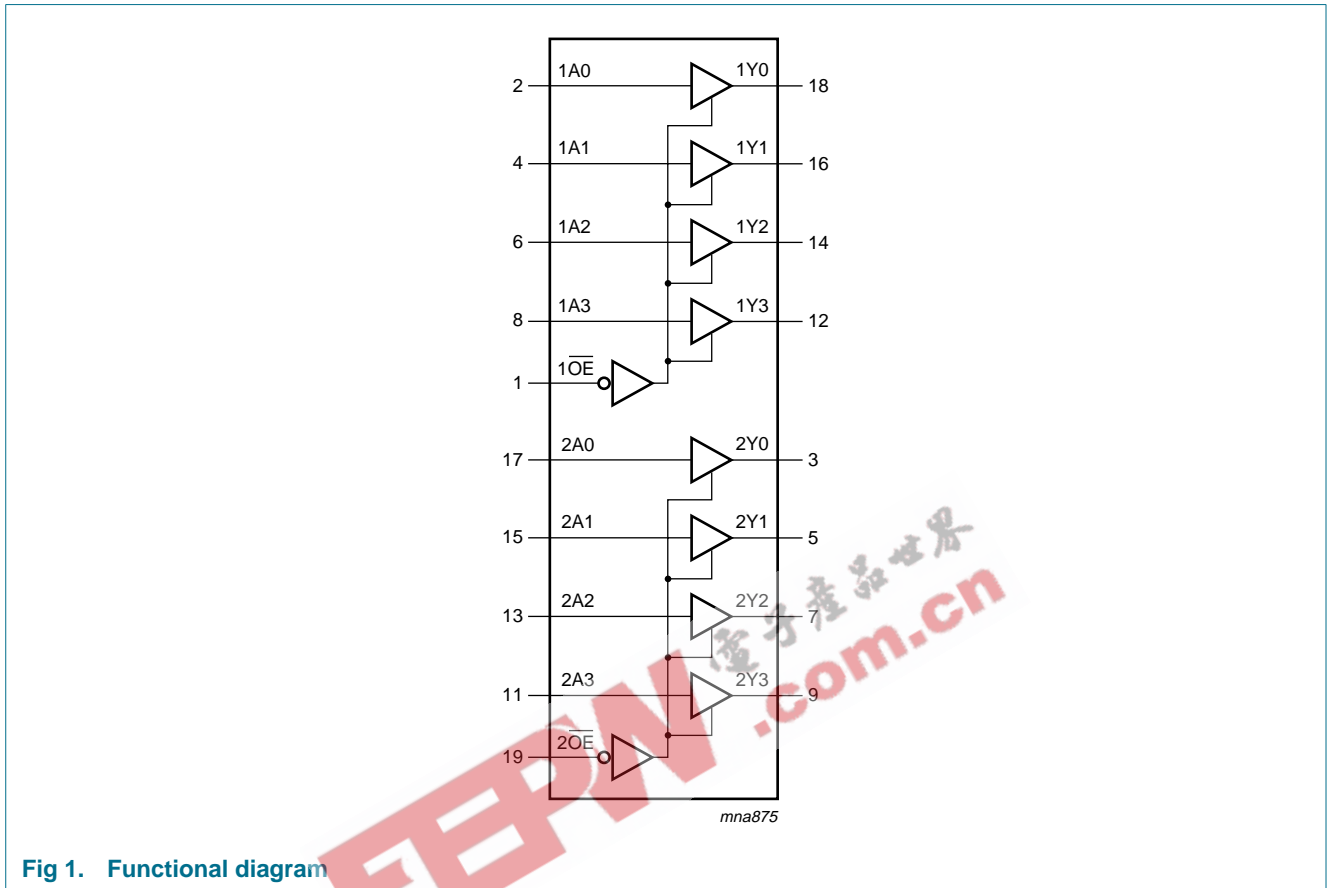


Fig 1. Functional diagram

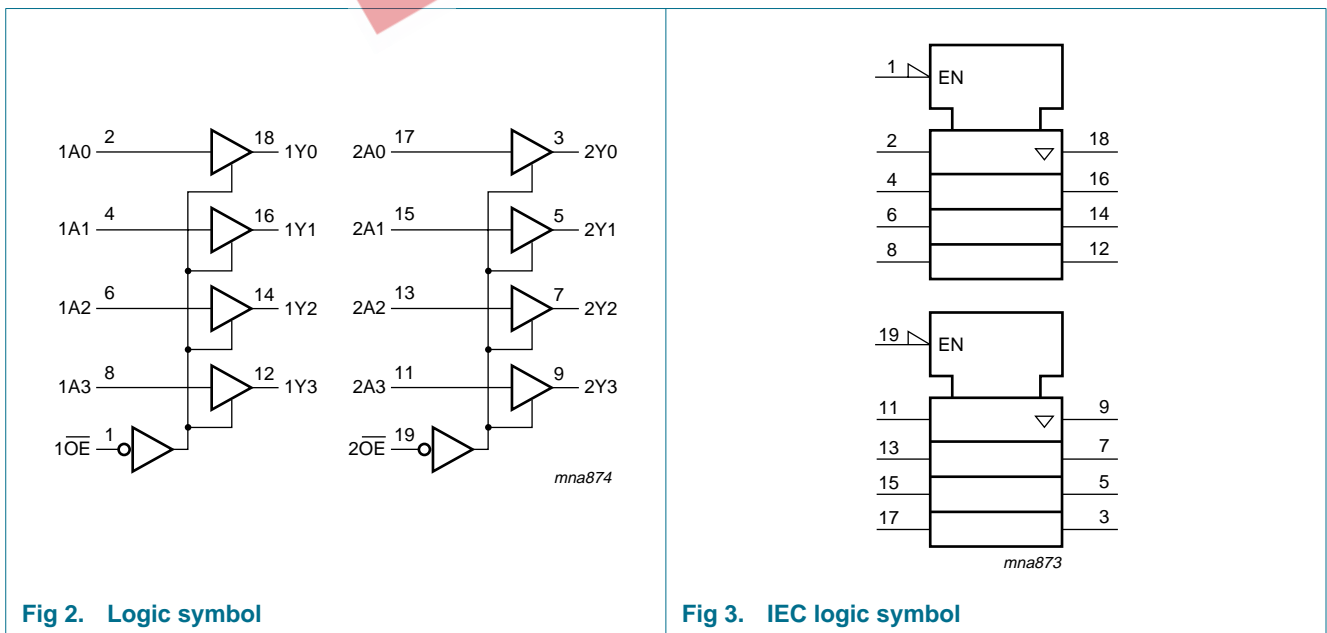


Fig 2. Logic symbol

Fig 3. IEC logic symbol

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 _{CC}	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 _{CC}	supply voltage		-0.5	+7	V
I _{IK}	input clamping current	$V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$	-	±20	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V}$ or $V_O > V_{CC} + 0.5 \text{ V}$	-	±20	mA
I _O	output current	$V_O = -0.5 \text{ V}$ to $(V_{CC} + 0.5 \text{ V})$	-	±35	mA
I _{CC}	quiescent supply current		-	70	mA
I _{GND}	ground current		-	-70	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	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
74HC244						
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
74HCT244						
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}	-	-	-	
		$I_O = -20$ μ A; $V_{CC} = 2.0$ V	1.9	2.0	-	V
		$I_O = -20$ μ A; $V_{CC} = 4.5$ V	4.4	4.5	-	V
		$I_O = -20$ μ 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 _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	V
		I _O = 6.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	V
		I _O = 7.8 mA; V _{CC} = 6 V	-	0.16	0.26	V
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6 V	-	-	±0.1	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND	-	-	±0.5	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V	-	-	8.0	μA
C _i	input capacitance		-	3.5	-	pF
T_{amb} = -40 °C to +85 °C						
V _{IH}	HIGH-state input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-state input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	-	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	-	-	V
		I _O = -6.0 mA; V _{CC} = 4.5 V	3.84	-	-	V
		I _O = -7.8 mA; V _{CC} = 6 V	5.34	-	-	V
V _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = 20 μA; V _{CC} = 2.0 V	-	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	-	0.1	V
		I _O = 6.0 mA; V _{CC} = 4.5 V	-	-	0.33	V
		I _O = 7.8 mA; V _{CC} = 6 V	-	-	0.33	V
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6 V	-	-	±1.0	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND	-	-	±5.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 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
T_{amb} = -40 °C to +125 °C						
V _{IH}	HIGH-state input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-state input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	-	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	-	-	V
		I _O = -6.0 mA; V _{CC} = 4.5 V	3.7	-	-	V
V _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL}				
		I _O = 20 μA; V _{CC} = 2.0 V	-	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	-	0.1	V
		I _O = 6.0 mA; V _{CC} = 4.5 V	-	-	0.4	V
I _{LI}	input leakage current	I _O = 7.8 mA; V _{CC} = 6 V	-	-	0.4	V
		V _I = V _{CC} or GND; V _{CC} = 6 V	-	-	±1.0	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND	-	-	±10.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 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
T_{amb} = 25 °C						
V _{IH}	HIGH-state input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	V
V _{IL}	LOW-state input voltage	V _{CC} = 4.5 V to 5.5 V	-	1.2	0.8	V
V _{OH}	HIGH-state output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V				
		I _O = -20 μA	4.4	4.5	-	V
		I _O = -6.0 mA	3.98	4.32	-	V
V _{OL}	LOW-state output voltage	V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V				
		I _O = 20 μA	-	0	0.1	V
		I _O = 6.0 mA	-	0.16	0.26	V
I _{LI}	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.1	μA
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	-	-	±0.5	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 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
ΔI_{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	μ A
C_i	input capacitance		-	3.5	-	pF
$T_{amb} = -40$ °C to $+85$ °C						
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				
		$I_O = -20$ μ 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				
		$I_O = 20$ μ 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	-	-	± 1.0	μ 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			± 5.0	μ A
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	80	μ A
ΔI_{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	μ A
$T_{amb} = -40$ °C to $+125$ °C						
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				
		$I_O = -20$ μ 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				
		$I_O = 20$ μ 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	-	-	± 1.0	μ 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	-	-	± 10.0	μ A
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	160	μ A
ΔI_{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	μ 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
$T_{amb} = 25$ °C						
t_{PHL} , t_{PLH}	propagation delay nAn to nYn	see Figure 6				
		$V_{CC} = 2.0$ V	-	30	110	ns
		$V_{CC} = 4.5$ V	-	11	22	ns
		$V_{CC} = 5$ V; $C_L = 15$ pF	-	9	-	ns
		$V_{CC} = 6.0$ V	-	9	19	ns
t_{PZH} , t_{PZL}	3-state output enable time nOE to nYn	see Figure 7				
		$V_{CC} = 2.0$ V	-	36	150	ns
		$V_{CC} = 4.5$ V	-	13	30	ns
		$V_{CC} = 6.0$ V	-	10	26	ns
t_{PHZ} , t_{PLZ}	3-state output disable time nOE to nYn	see Figure 7				
		$V_{CC} = 2.0$ V	-	39	150	ns
		$V_{CC} = 4.5$ V	-	14	30	ns
		$V_{CC} = 6.0$ V	-	11	26	ns
t_{THL} , t_{TLH}	output transition time	see Figure 6				
		$V_{CC} = 2.0$ V	-	14	60	ns
		$V_{CC} = 4.5$ V	-	5	12	ns
		$V_{CC} = 6.0$ V	-	4	10	ns
C_{PD}	power dissipation capacitance	$V_I = GND$ to V_{CC}	[1]	-	35	pF
$T_{amb} = -40$ °C to $+85$ °C						
t_{PHL} , t_{PLH}	propagation delay nAn to nYn	see Figure 6				
		$V_{CC} = 2.0$ V	-	-	145	ns
		$V_{CC} = 4.5$ V	-	-	28	ns
		$V_{CC} = 6.0$ V	-	-	24	ns
t_{PZH} , t_{PZL}	3-state output enable time nOE to nYn	see Figure 7				
		$V_{CC} = 2.0$ V	-	-	190	ns
		$V_{CC} = 4.5$ V	-	-	38	ns
		$V_{CC} = 6.0$ V	-	-	33	ns
t_{PHZ} , t_{PLZ}	3-state output disable time nOE to nYn	see Figure 7				
		$V_{CC} = 2.0$ V	-	-	190	ns
		$V_{CC} = 4.5$ V	-	-	38	ns
		$V_{CC} = 6.0$ V	-	-	33	ns
t_{THL} , t_{TLH}	output transition time	see Figure 6				
		$V_{CC} = 2.0$ V	-	-	75	ns
		$V_{CC} = 4.5$ V	-	-	15	ns
		$V_{CC} = 6.0$ V	-	-	13	ns

Table 9: Dynamic characteristics 74HC244 ...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
$T_{amb} = -40\text{ °C to }+125\text{ °C}$						
t_{PHL} , t_{PLH}	propagation delay nAn to nYn	see Figure 6				
		$V_{CC} = 2.0\text{ V}$	-	-	165	ns
		$V_{CC} = 4.5\text{ V}$	-	-	33	ns
		$V_{CC} = 6.0\text{ V}$	-	-	28	ns
t_{PZH} , t_{PZL}	3-state output enable time nOE to nYn	see Figure 7				
		$V_{CC} = 2.0\text{ V}$	-	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	-	45	ns
		$V_{CC} = 6.0\text{ V}$	-	-	38	ns
t_{PHZ} , t_{PLZ}	3-state output disable time nOE to nYn	see Figure 7				
		$V_{CC} = 2.0\text{ V}$	-	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	-	45	ns
		$V_{CC} = 6.0\text{ V}$	-	-	38	ns
t_{THL} , t_{TLH}	output transition time	see Figure 6				
		$V_{CC} = 2.0\text{ V}$	-	-	90	ns
		$V_{CC} = 4.5\text{ V}$	-	-	18	ns
		$V_{CC} = 6.0\text{ V}$	-	-	15	ns

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

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

Table 10: Dynamic characteristics type 74HCT244

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = 25\text{ °C}$						
t_{PHL} , t_{PLH}	propagation delay nAn to nYn	see Figure 6				
		$V_{CC} = 4.5\text{ V}$	-	13	22	ns
		$V_{CC} = 5\text{ V}$; $C_L = 15\text{ pF}$	-	11	-	ns
t_{PZH} , t_{PZL}	3-state output enable time nOE to nYn	$V_{CC} = 4.5\text{ V}$; see Figure 7	-	15	30	ns
t_{PHZ} , t_{PLZ}	3-state output disable time nOE to nYn	$V_{CC} = 4.5\text{ V}$; see Figure 7	-	15	25	ns
t_{THL} , t_{TLH}	output transition time	$V_{CC} = 4.5\text{ V}$; see Figure 6	-	5	12	ns
C_{PD}	power dissipation capacitance	$V_I = GND$ to $(V_{CC} - 1.5\text{ V})$	[1] -	35	-	pF

Table 10: Dynamic characteristics type 74HCT244 ...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
T_{amb} = -40 °C to +85 °C						
t _{PHL} , t _{PLH}	propagation delay nAn to nYn	V _{CC} = 4.5 V; see Figure 6	-	-	28	ns
t _{PZH} , t _{PZL}	3-state output enable time nOE to nYn	V _{CC} = 4.5 V; see Figure 7	-	-	38	ns
t _{PHZ} , t _{PLZ}	3-state output disable time nOE to nYn	V _{CC} = 4.5 V; see Figure 7	-	-	31	ns
t _{THL} , t _{TLH}	output transition time	V _{CC} = 4.5 V; see Figure 6	-	-	15	ns
T_{amb} = -40 °C to +125 °C						
t _{PHL} , t _{PLH}	propagation delay nAn to nYn	V _{CC} = 4.5 V; see Figure 6	-	-	33	ns
t _{PZH} , t _{PZL}	3-state output enable time nOE to nYn	V _{CC} = 4.5 V; see Figure 7	-	-	45	ns
t _{PHZ} , t _{PLZ}	3-state output disable time nOE to nYn	V _{CC} = 4.5 V; see Figure 7	-	-	38	ns
t _{THL} , t _{TLH}	output transition time	V _{CC} = 4.5 V; see Figure 6	-	-	18	ns

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

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

where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

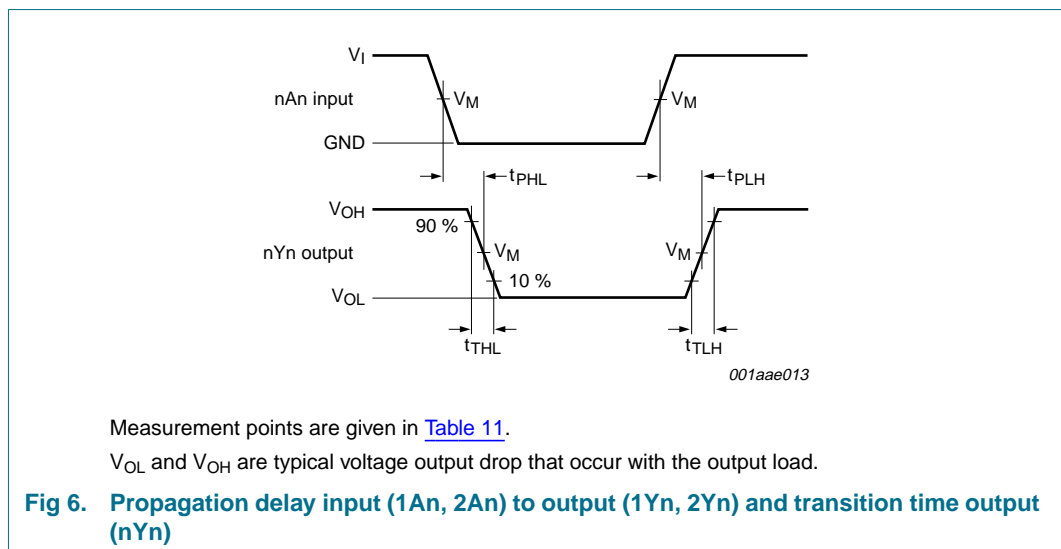
C_L = output load capacitance in pF;

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



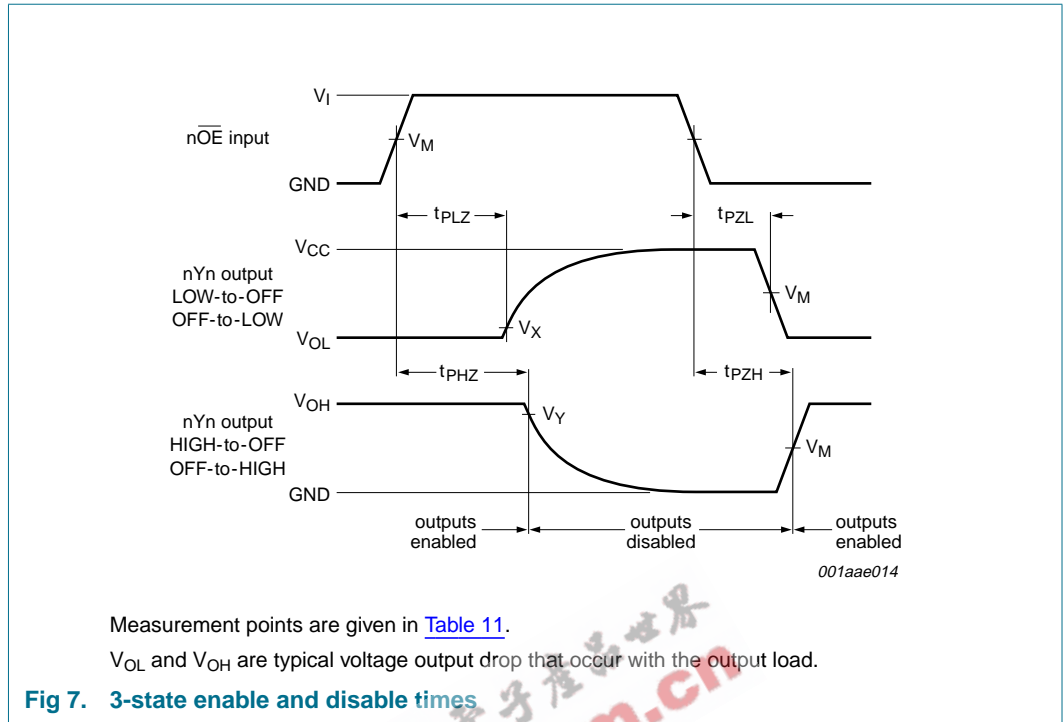


Table 11: Measurement points

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

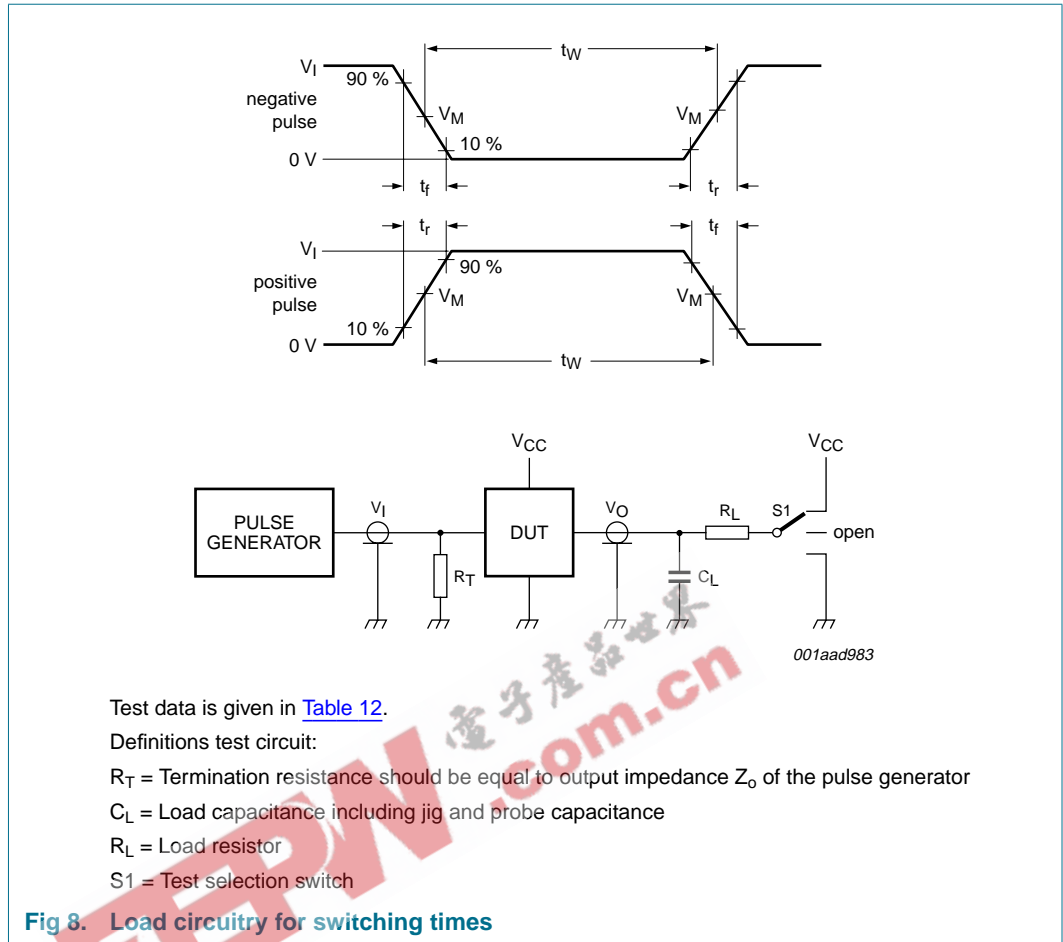


Fig 8. Load circuitry for switching times

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 Ω	open	GND	V_{CC}
74HCT244	3 V	6 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}

13. Package outline

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

SOT146-1

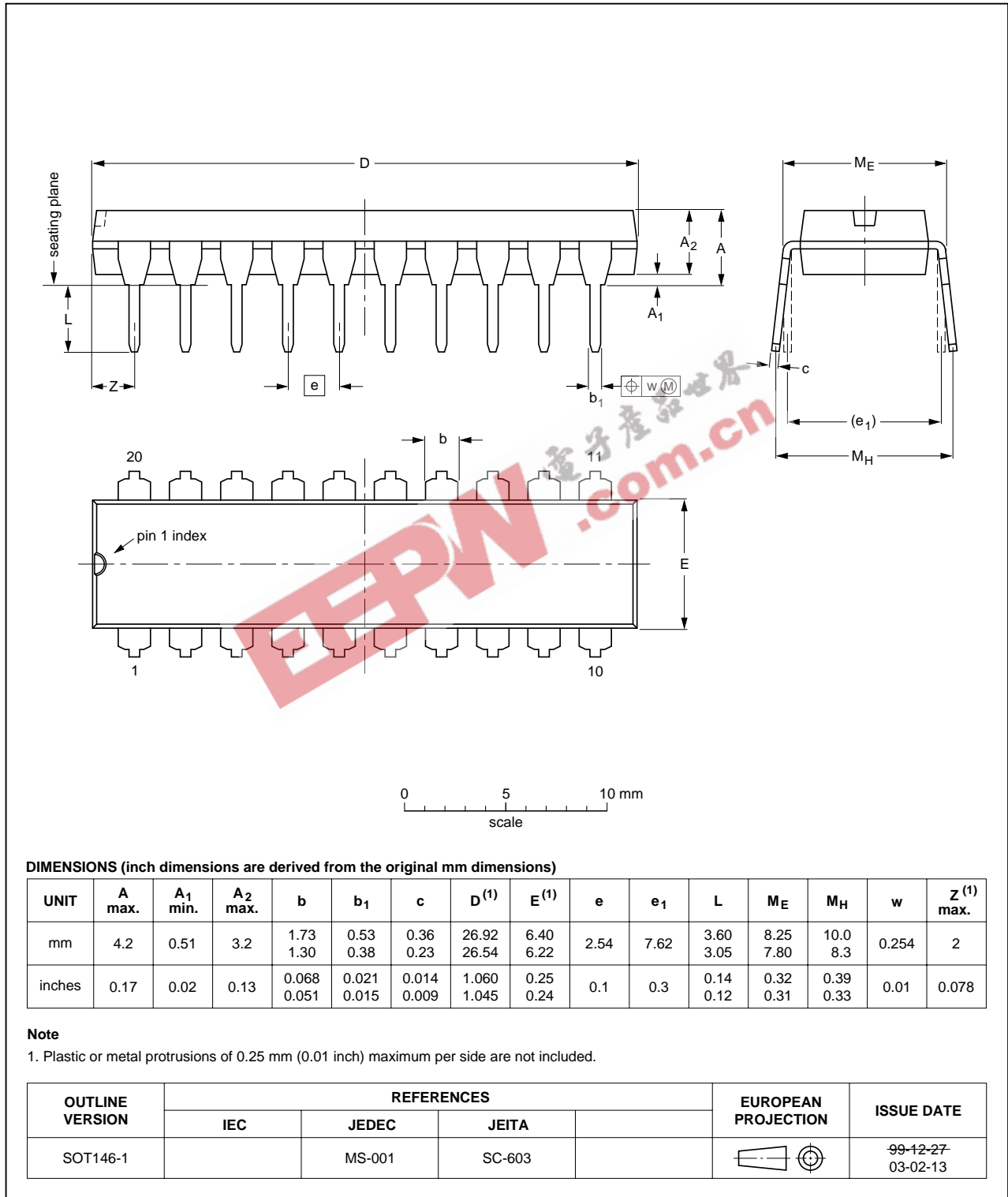


Fig 9. Package outline SOT146-1 (DIP20)

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

SOT163-1

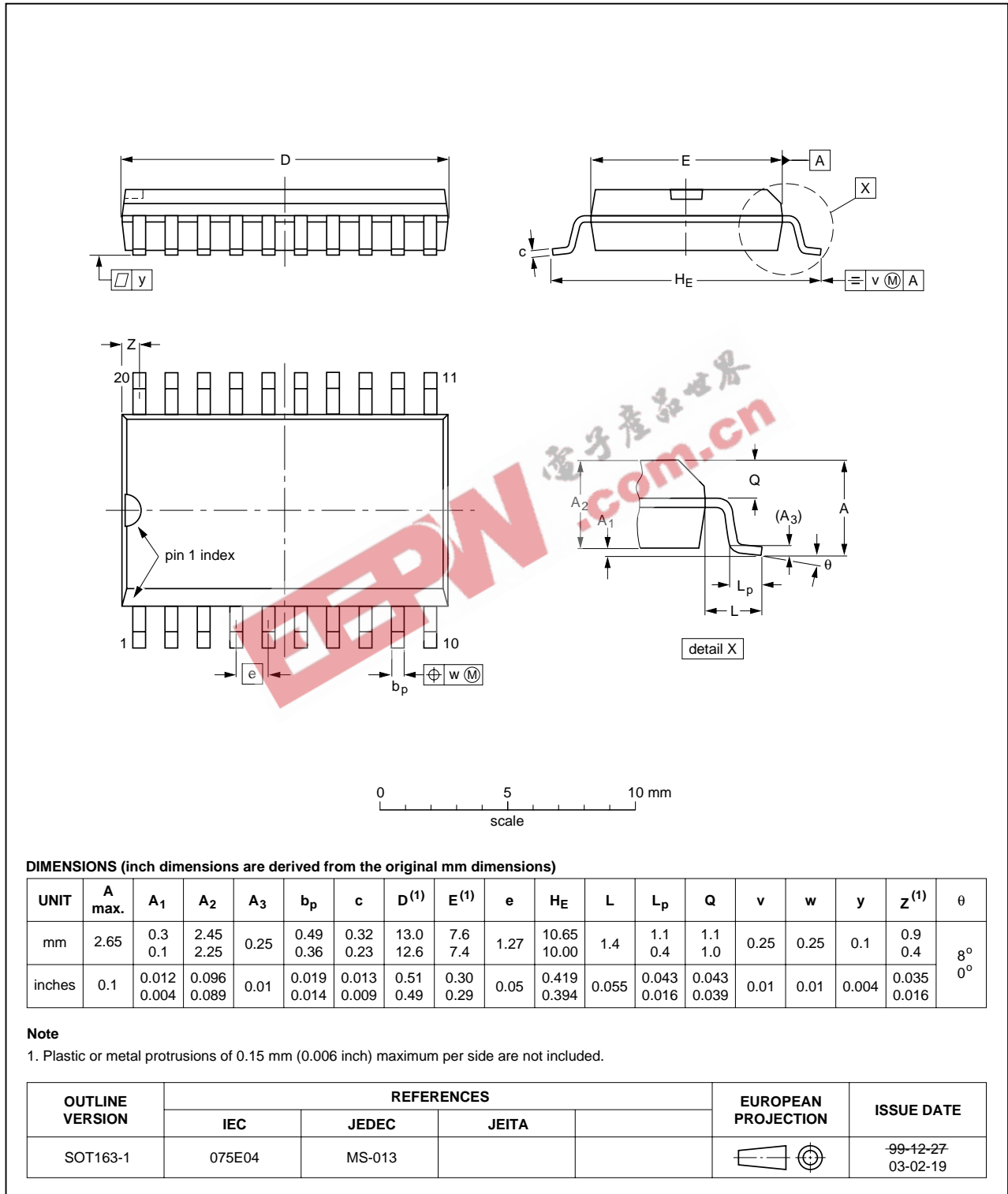


Fig 10. Package outline SOT163-1 (SO20)

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

SOT339-1

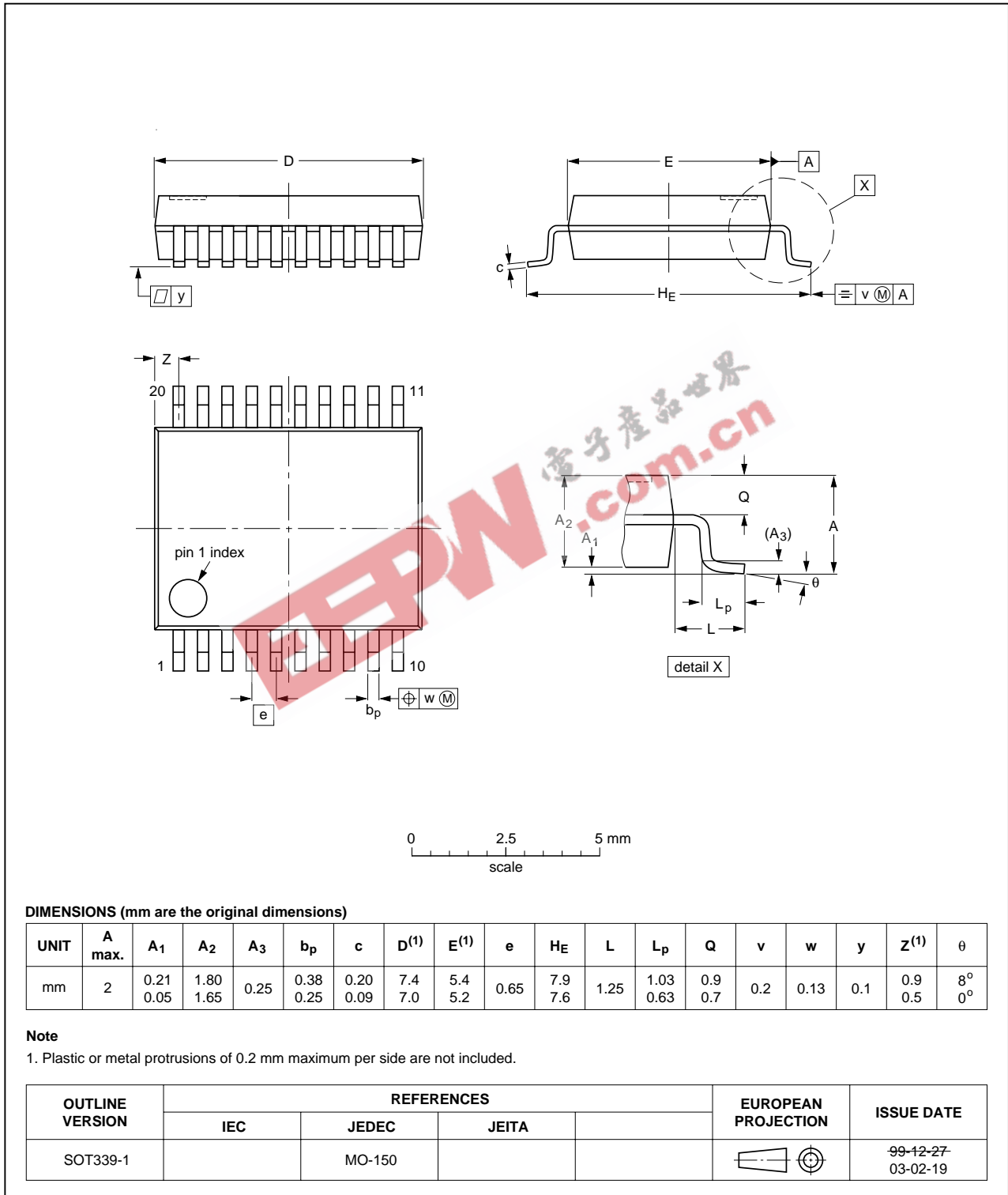


Fig 11. Package outline SOT339-1 (SSOP20)

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

SOT360-1

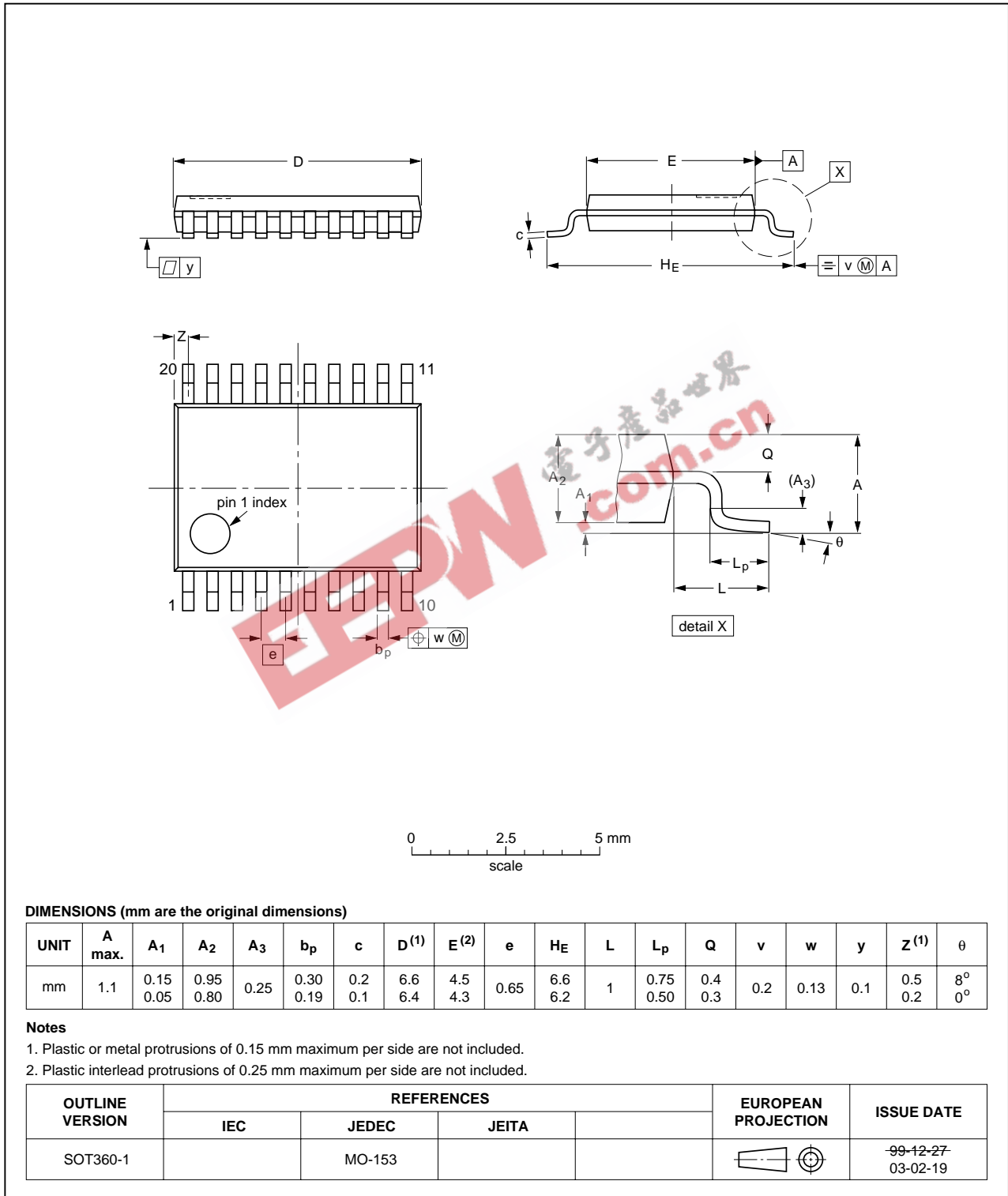


Fig 12. Package outline SOT360-1 (TSSOP20)

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

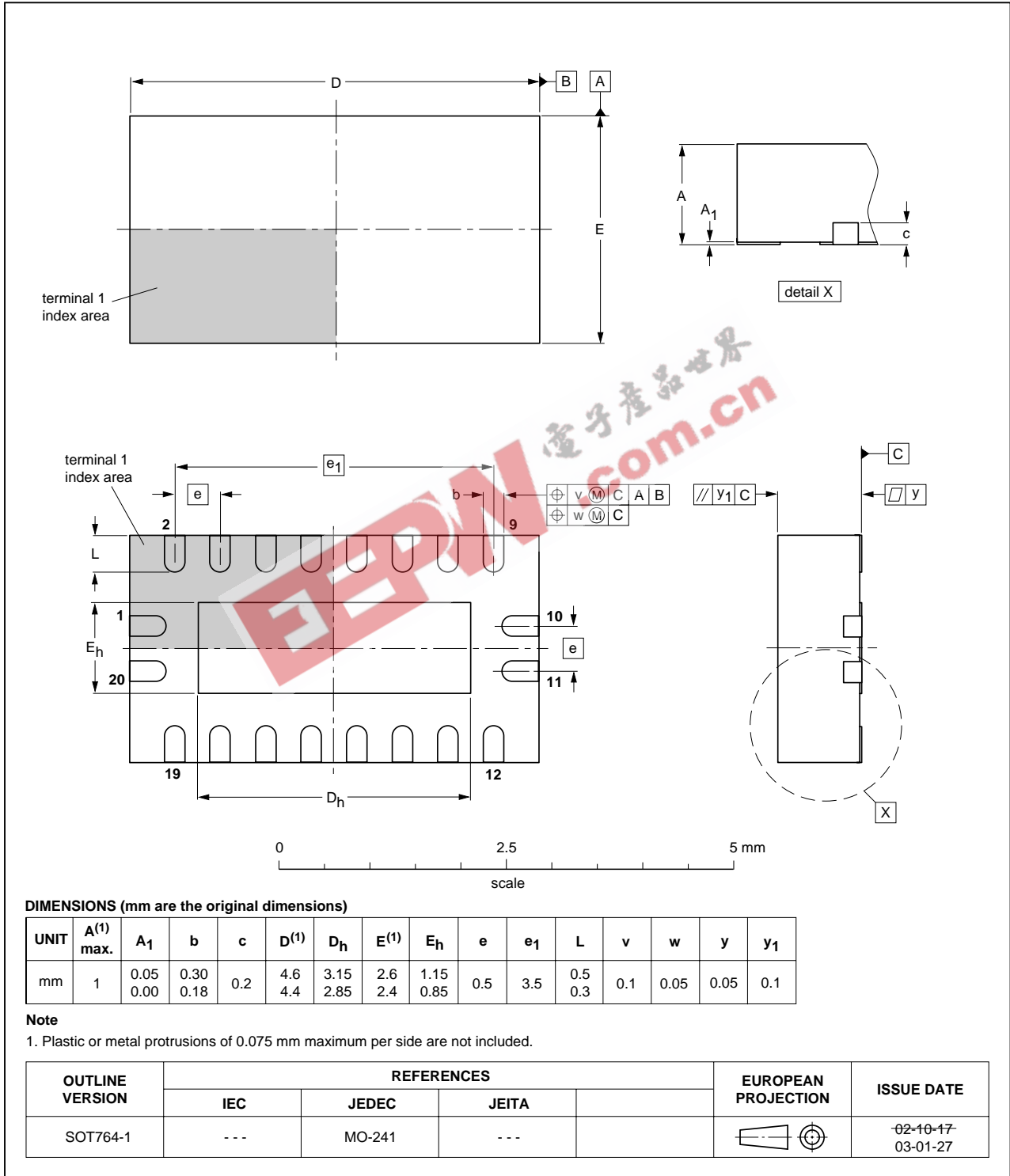


Fig 13. Package outline SOT764-1 (DHVQFN20)

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"> The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. Section 4 "Ordering information", Section 6 "Pinning information" and Section 13 "Package outline": Added DHVQFN package information Section 10 "Static characteristics": Added from the family specification 			
74HC_HCT244_CNV_2	19901201	Product specification	-	-	-

16. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	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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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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