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 $1\overline{OE}$ and $2\overline{OE}$. A HIGH on $n\overline{OE}$ 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 °C to +85 °C and from –40 °C to +125 °C

3. Quick reference data

Table 1: Quick reference data

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
74HC244							
t_{PHL}, t_{PLH}	propagation delay nAn to nYn	V_{CC} = 5 V; C_L = 15 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 V; C_L = 15 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 V)	[1]	-	35	-	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in µW):
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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;
$\sum(C_L \times V_{CC}^2 \times f_o)$ = 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

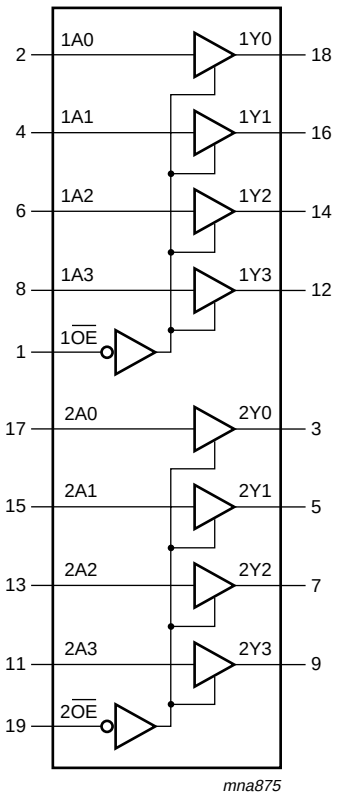


Fig 1. Functional diagram

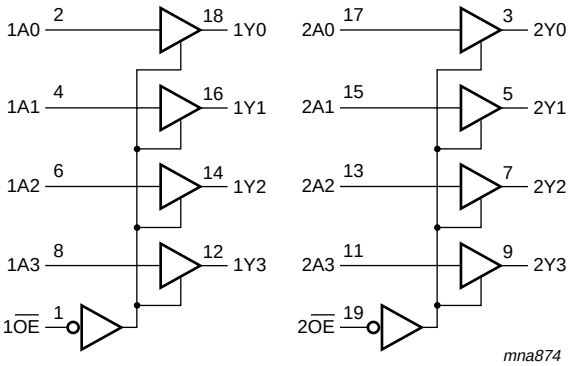


Fig 2. Logic symbol

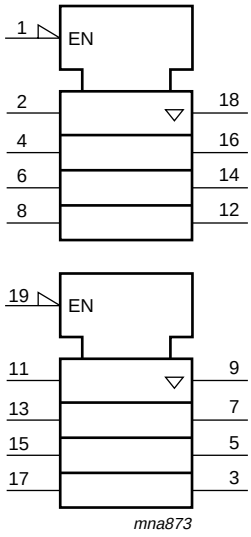


Fig 3. IEC logic symbol

6. Pinning information

6.1 Pinning

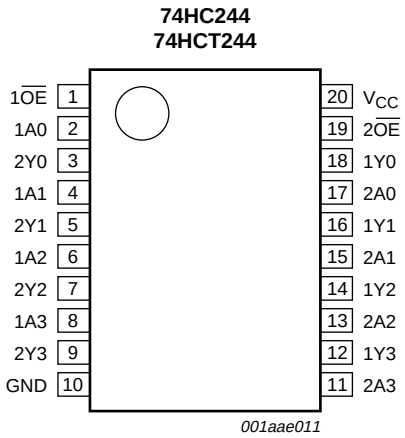
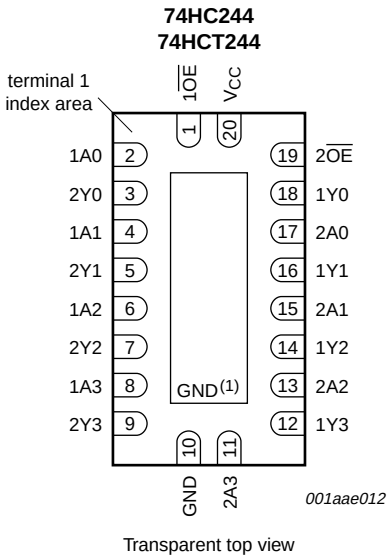


Fig 4. Pin configuration DIP20, SO20, SSOP20 and TSSOP20



Transparent top view

(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as supply pin or input

Fig 5. Pin configuration DHVQFN20

6.2 Pin description

Table 3: Pin description

Symbol	Pin	Description
1$\overline{OE}$	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
$2\overline{OE}$	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
$n\overline{OE}$	**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	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V		-	±20	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V		-	±20	mA
I_O	output current	$V_O = -0.5$ V to $(V_{CC} + 0.5$ 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 µA; V_{CC} = 2.0 V	1.9	2.0	-	V
		I_O = –20 µA; V_{CC} = 4.5 V	4.4	4.5	-	V
		I_O = –20 µA; 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
		I_O = −7.8 mA; V_{CC} = 6 V	5.2	-	-	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_O = 7.8 mA; V_{CC} = 6 V	-	-	0.4	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	-	-	±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	µA
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				
		$I_O = -20$ µA	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				
		$I_O = 20$ µA	-	-	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	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			±5.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	80	µA
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	µA
$T_{amb} = -40$ °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				
		$I_O = -20$ µA	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				
		$I_O = 20$ µA	-	-	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	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	-	-	±10.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	160	µA
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	µA

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 $n\overline{OE}$ 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 $n\overline{OE}$ 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 $n\overline{OE}$ 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 $n\overline{OE}$ 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 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 +125 °C						
t_{PHL}, t_{PLH}	propagation delay nAn to nYn	see Figure 6				
		V_{CC} = 2.0 V	-	-	165	ns
		V_{CC} = 4.5 V	-	-	33	ns
		V_{CC} = 6.0 V	-	-	28	ns
t_{PZH}, t_{PZL}	3-state output enable time $n\overline{OE}$ to nYn	see Figure 7				
		V_{CC} = 2.0 V	-	-	225	ns
		V_{CC} = 4.5 V	-	-	45	ns
		V_{CC} = 6.0 V	-	-	38	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $n\overline{OE}$ to nYn	see Figure 7				
		V_{CC} = 2.0 V	-	-	225	ns
		V_{CC} = 4.5 V	-	-	45	ns
		V_{CC} = 6.0 V	-	-	38	ns
t_{THL}, t_{TLH}	output transition time	see Figure 6				
		V_{CC} = 2.0 V	-	-	90	ns
		V_{CC} = 4.5 V	-	-	18	ns
		V_{CC} = 6.0 V	-	-	15	ns

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in µW):
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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;
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = 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
T_{amb} = 25 °C							
t_{PHL}, t_{PLH}	propagation delay nAn to nYn	see Figure 6					
		V_{CC} = 4.5 V		-	13	22	ns
		V_{CC} = 5 V; C_L = 15 pF		-	11	-	ns
t_{PZH}, t_{PZL}	3-state output enable time $n\overline{OE}$ to nYn	V_{CC} = 4.5 V; see Figure 7		-	15	30	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $n\overline{OE}$ to nYn	V_{CC} = 4.5 V; see Figure 7		-	15	25	ns
t_{THL}, t_{TLH}	output transition time	V_{CC} = 4.5 V; see Figure 6		-	5	12	ns
C_{PD}	power dissipation capacitance	V_I = GND to (V_{CC} − 1.5 V)	[1]	-	35	-	pF

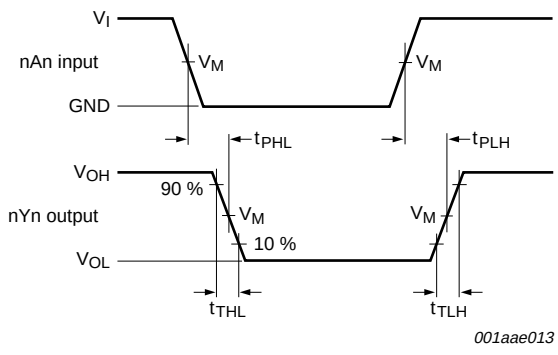
Table 10: Dynamic characteristics type 74HCT244 *…continued*

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 $n\overline{OE}$ to nYn	V_{CC} = 4.5 V; see Figure 7	-	-	38	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $n\overline{OE}$ 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 $n\overline{OE}$ to nYn	V_{CC} = 4.5 V; see Figure 7	-	-	45	ns
t_{PHZ}, t_{PLZ}	3-state output disable time $n\overline{OE}$ 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):
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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;
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

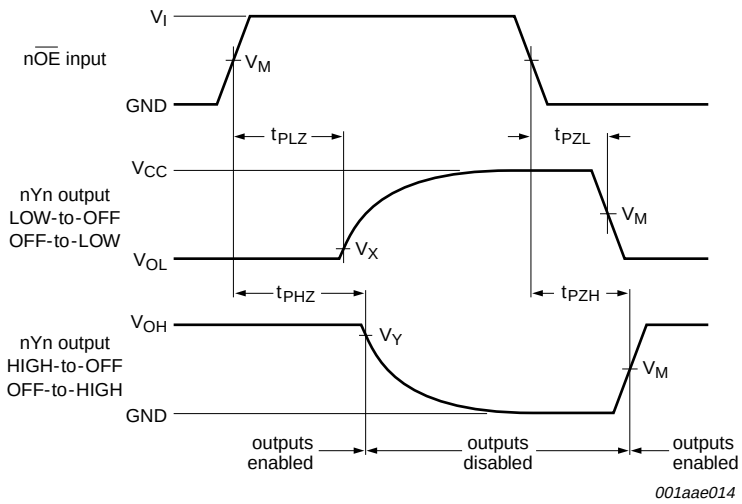
12. Waveforms



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)



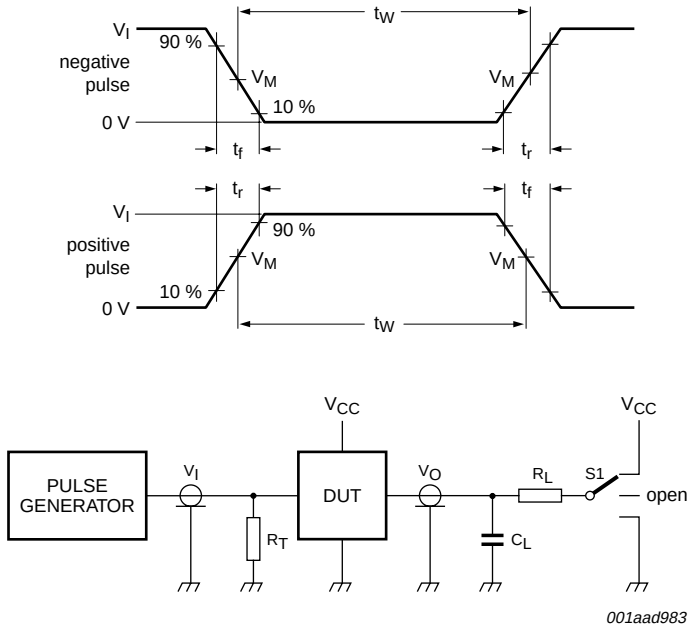
Measurement points are given in Table 11.

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

Fig 7. 3-state enable and disable times

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



Test data is given in Table 12.

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 resistor

S1 = Test selection switch

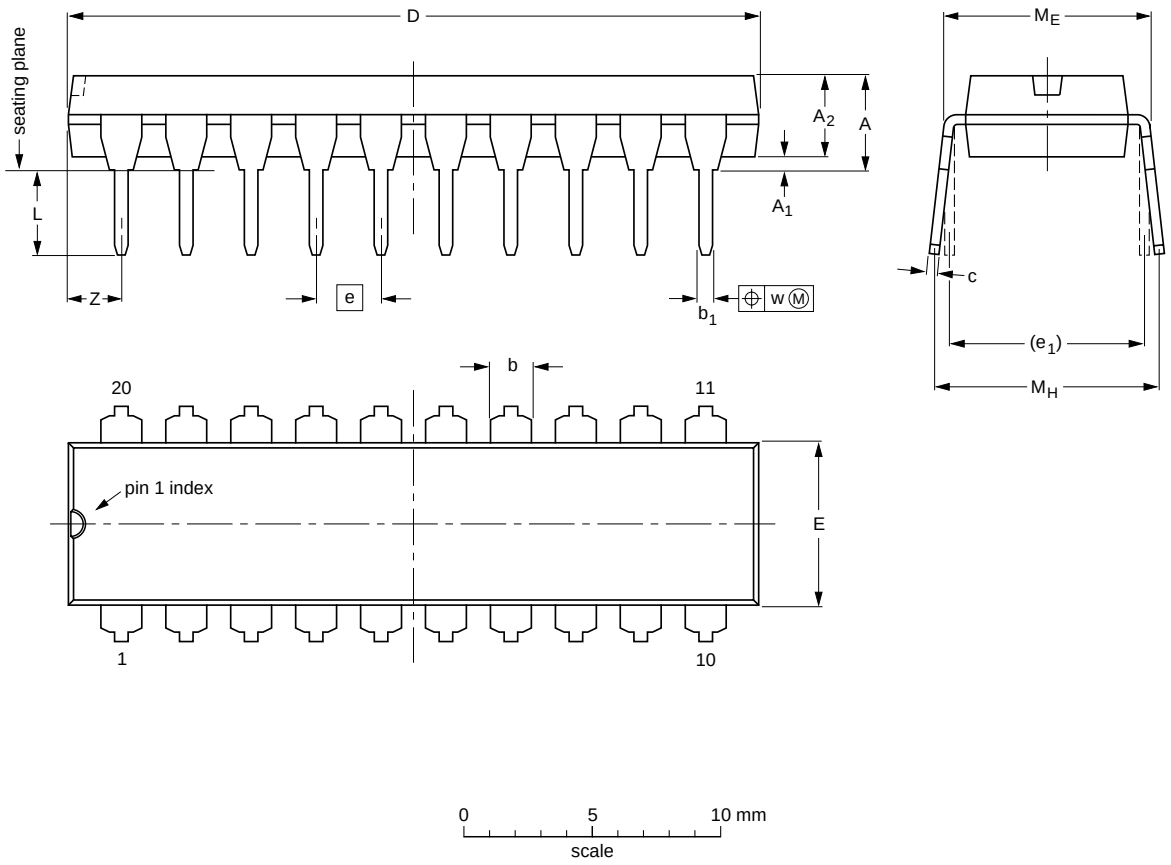
Fig 8. Load circuitry for switching times

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

13. Package outline

DIP20: plastic dual in-line package; 20 leads (300 mil) **SOT146-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2
inches	0.17	0.02	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

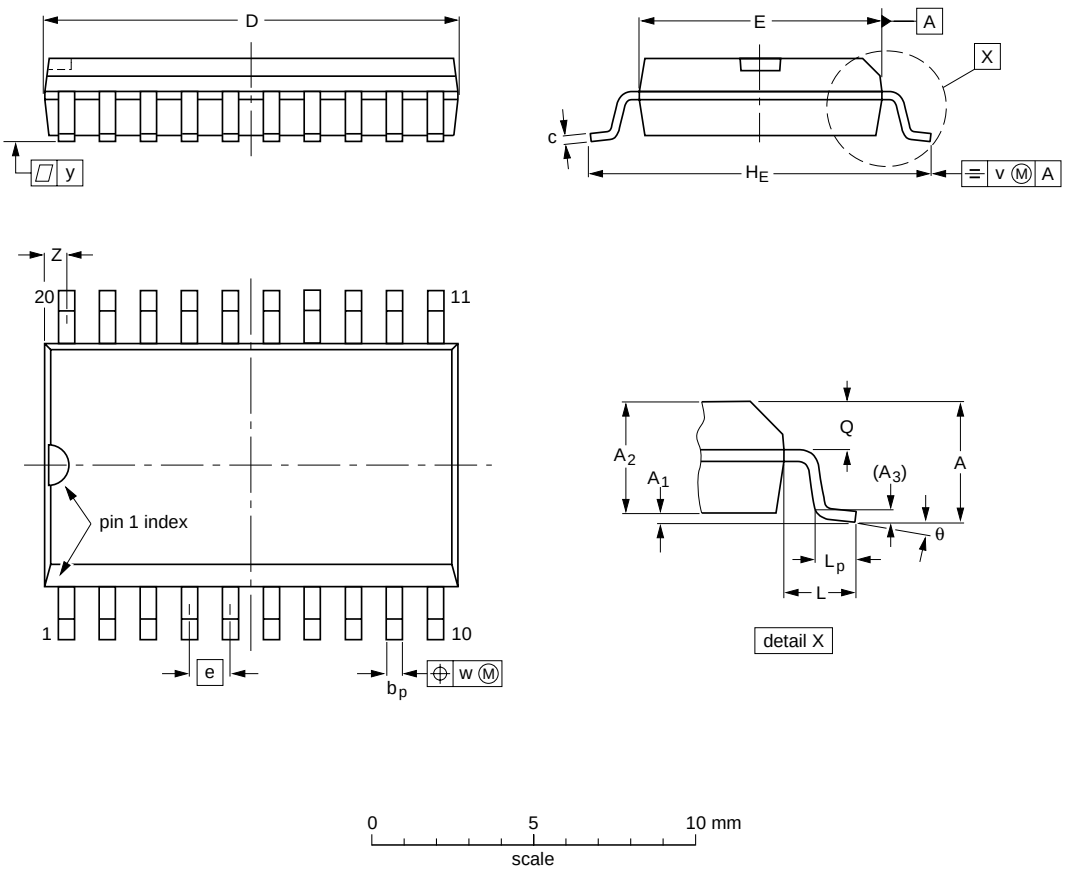
Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT146-1		MS-001	SC-603			~~99-12-27~~ 03-02-13

Fig 9. Package outline SOT146-1 (DIP20)

SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

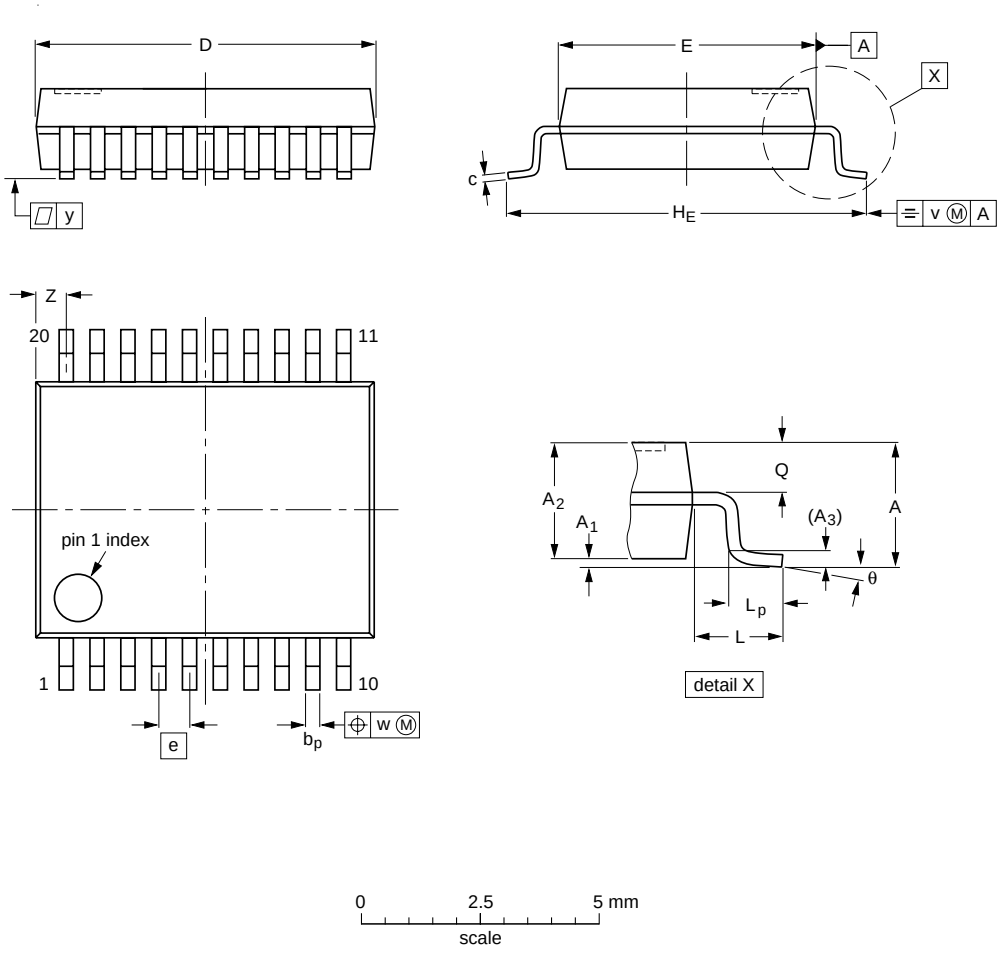
Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				~~99-12-27~~ 03-02-19

Fig 10. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm **SOT339-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8^o 0^o

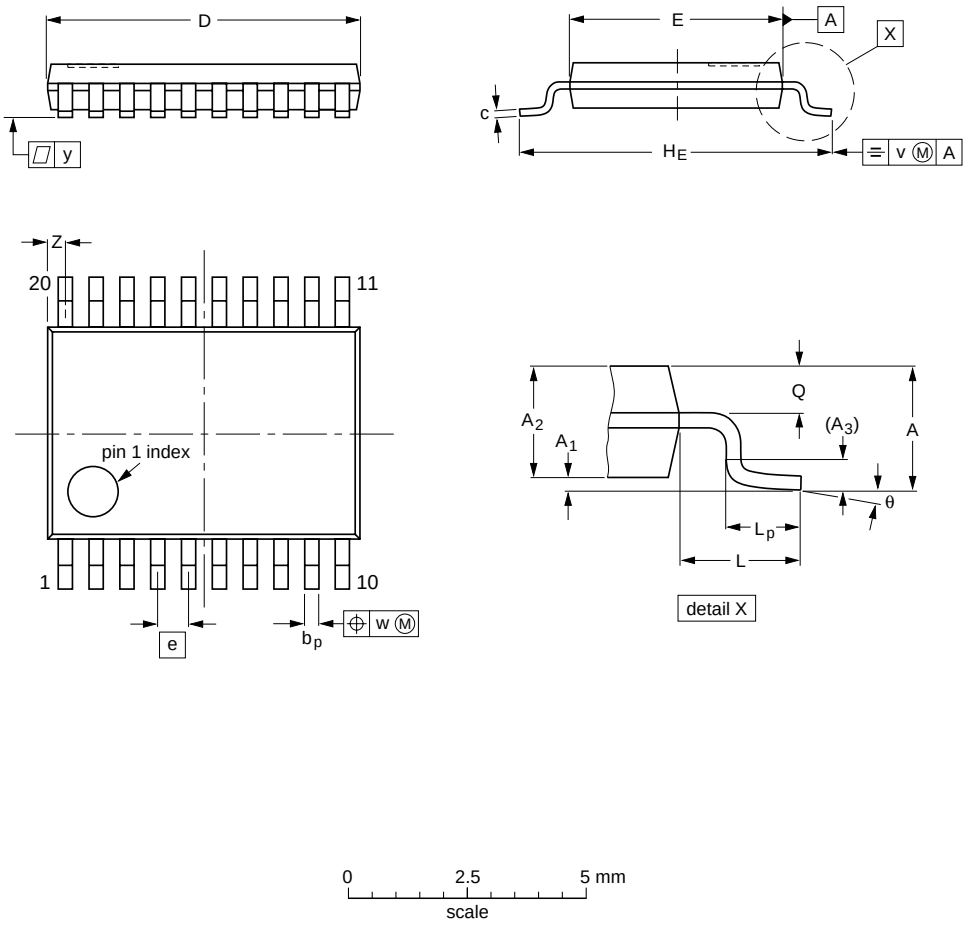
Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT339-1		MO-150				~~99-12-27~~ 03-02-19

Fig 11. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm **SOT360-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8^o 0^o

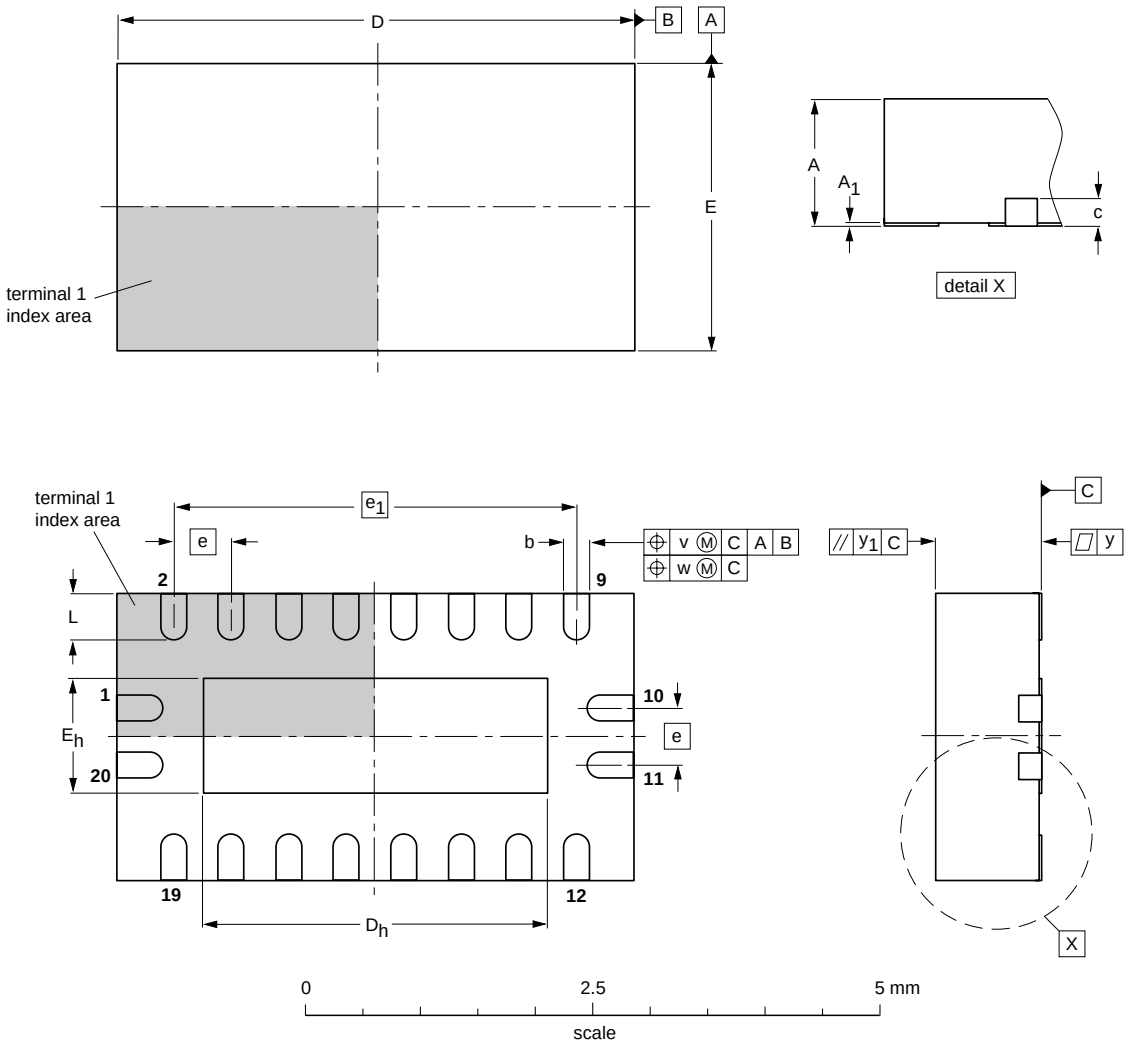
Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT360-1		MO-153				~~99-12-27~~ 03-02-19

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**



DIMENSIONS (mm are the original dimensions)

UNIT	A(1) max.	A_1	b	c	D(1)	D_h	E(1)	E_h	e	e_1	L	v	w	y	y_1
mm	1	0.05 0.00	0.30 0.18	0.2	4.6 4.4	3.15 2.85	2.6 2.4	1.15 0.85	0.5	3.5	0.5 0.3	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT764-1	- - -	MO-241	- - -			~~02-10-17~~ 03-01-27

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:	• 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.
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.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

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

[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.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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21. Contents

Date of release: 22 December 2005
Document number: 74HC_HCT244_3

Published in The Netherlands