

# DATA SHEET

## **74F244/74F244B** Octal buffers (3-State)

Product specification

1994 Dec 05

IC15 Data Handbook

**Philips Semiconductors**



**PHILIPS**

# Octal buffers (3-State)

# 74F244/74F244B

## FEATURES

- Octal bus interface
- 3-State output buffer sink 64mA
- 15mA source current
- Guaranteed output skew less than 2.0ns (74F244B)
- Reduced ground bounce (74F244B)
- Reduced I<sub>CC</sub> (74F244B)
- Reduced loading (74F244B I<sub>IL</sub> = 40µA)
- Split lead frame offers increased noise immunity (74F244B)
- Industrial temperature range available (-40°C to +85°C) for 74F244
- 74F244 available in SSOP Type II package

## DESCRIPTION

The 74F244 is an octal buffer that is ideal for driving bus lines of buffer memory address registers. The outputs are all capable of sinking 64mA and sourcing up to 15mA, producing very good capacitive drive characteristics. The device features two output enables,  $\overline{OE}a$  and  $\overline{OE}b$ , each controlling four of the 3-State outputs.

The 74F244B is functionally equivalent to the 74F244. It has been designed to reduce effects of ground noise. Other advantages are noted in the features.

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F244	4.0ns	53mA
74F244B	4.0ns	33mA

## ORDERING INFORMATION

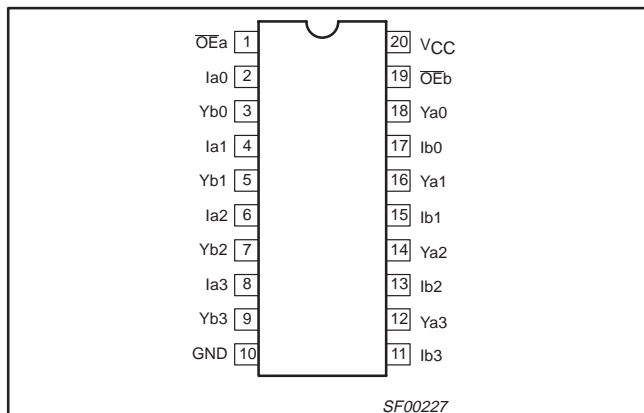
DESCRIPTION	ORDER CODE		PKG DWG #
	COMMERCIAL RANGE V <sub>CC</sub> = 5V ±10%, T <sub>amb</sub> = 0°C to +70°C	INDUSTRIAL RANGE V <sub>CC</sub> = 5V ±10%, T <sub>amb</sub> = -40°C to +85°C	
20-pin plastic DIP	N74F244N, N74F244BN	I74F244N	SOT146-1
20-pin plastic SOL	N74F244D, N74F244BD	I74F244D	SOT163-1
20-pin plastic SSOP II	N74F244DB		SOT339-1

## INPUT AND OUTPUT LOADING AND FAN OUT TABLE

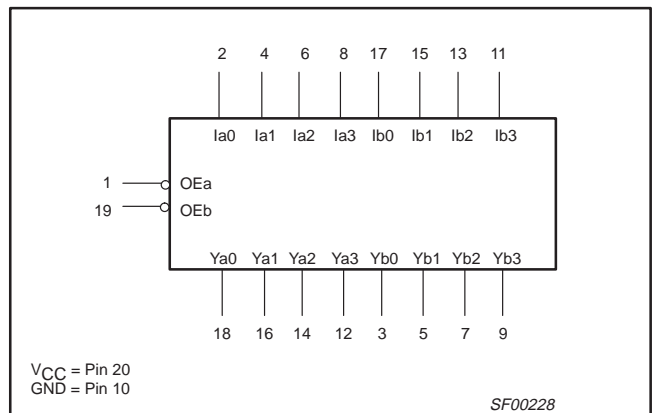
PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
I <sub>a</sub> n, I <sub>b</sub> n	Data inputs (74F244)	1.0/2.67	20µA/1.6mA
	Data inputs (74F244B)	1.0/0.067	20µA/40µA
$\overline{OE}a, \overline{OE}b$	Output enable inputs (active low) (74F244)	1.0/1.67	20µA/1.0mA
	Output enable inputs (active low) (74F244B)	1.0/0.067	20µA/40µA
Y <sub>a</sub> n, Y <sub>b</sub> n	Data outputs	750/106.7	15mA/64mA

NOTE: One (1.0) FAST unit load is defined as: 20µA in the high state and 0.6mA in the low state.

## PIN CONFIGURATION



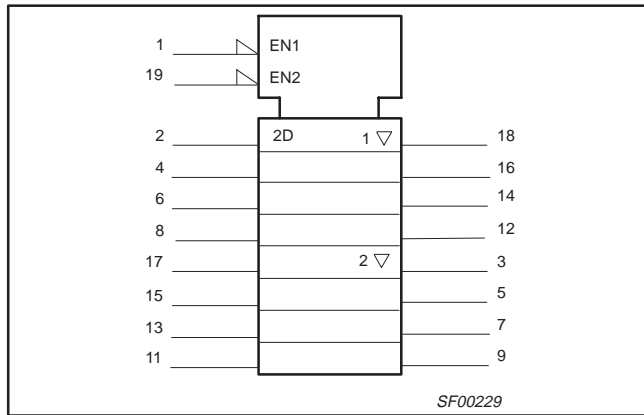
## LOGIC SYMBOL



# Octal buffers (3-State)

74F244/74F244B

## IEC/IEEE SYMBOL



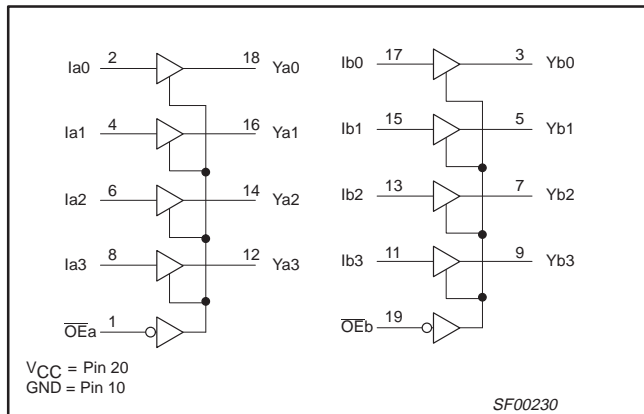
## FUNCTION TABLE

INPUTS				OUTPUTS	
$\overline{OEa}$	la	$\overline{OEb}$	lb	Ya	Yb
L	L	L	L	L	L
L	H	L	H	H	H
H	X	H	X	Z	Z

### NOTES:

- H = High voltage level
- L = Low voltage level
- X = Don't care
- Z = High impedance "off" state

## LOGIC DIAGRAM



## Octal buffers (3-State)

74F244/74F244B

**ABSOLUTE MAXIMUM RATINGS**

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER		RATING	UNIT
V <sub>CC</sub>	Supply voltage		-0.5 to +7.0	V
V <sub>IN</sub>	Input voltage		-0.5 to +7.0	V
I <sub>IN</sub>	Input current		-30 to +5	mA
V <sub>OUT</sub>	Voltage applied to output in high output state		-0.5 to V <sub>CC</sub>	V
I <sub>OUT</sub>	Current applied to output in low output state		128	mA
T <sub>amb</sub>	Operating free air temperature range	Commercial range	0 to +70	°C
		Industrial range (74F244 only)	-40 to +85	°C
T <sub>stg</sub>	Storage temperature range		-65 to +150	°C

**RECOMMENDED OPERATING CONDITIONS**

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5.0	5.5	V
V <sub>IN</sub>	High-level input voltage	2.0			V
V <sub>IL</sub>	Low-level input voltage			0.8	V
I <sub>IK</sub>	Input clamp current			-18	mA
I <sub>OH</sub>	High-level output current			-15	mA
i <sub>ol</sub>	Low-level output current			64	mA
T <sub>amb</sub>	Operating free air temperature range	Commercial range	0	+70	°C
		Industrial range (74F244 only)	-40	+85	°C

## Octal buffers (3-State)

## 74F244/74F244B

**DC ELECTRICAL CHARACTERISTICS**

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER		TEST CONDITIONS <sup>1</sup>			LIMITS			UNIT	
						MIN	TYP <sup>2</sup>	MAX		
V <sub>OH</sub>	High-level output voltage		V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX,	I <sub>OH</sub> = -3mA	±10%V <sub>CC</sub>	2.5			V	
					±5%V <sub>CC</sub>	2.7	3.4		V	
			V <sub>IH</sub> = MIN	I <sub>OH</sub> = -15mA	±10%V <sub>CC</sub>	2.0			V	
					±5%V <sub>CC</sub>	2.0			V	
V <sub>OL</sub>	Low-level output voltage		V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN,	I <sub>OL</sub> = MAX	±10%V <sub>CC</sub>			0.55	V	
					±5%V <sub>CC</sub>		0.42	0.55	V	
V <sub>IK</sub>	Input clamp voltage		V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>				-0.73	-1.2	V	
I <sub>I</sub>	Input current at maximum input voltage		V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V					100	μA	
I <sub>IH</sub>	High-level input current		V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V					20	μA	
I <sub>IL</sub>	Low-level input current	74F244 $\overline{O}Ea, \overline{O}Eb$	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V					-1.0	mA	
		74F244 I <sub>an</sub> , I <sub>bn</sub>						-1.6	mA	
		74F244B all inputs						-40	μA	
I <sub>OZH</sub>	Off-state output current, high-level voltage applied		V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.7V					50	μA	
I <sub>OZL</sub>	Off-state output current, low-level voltage applied		V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5V					-50	μA	
I <sub>OS</sub>	Short-circuit output current <sup>3</sup>		V <sub>CC</sub> = MAX			-100		-225	mA	
I <sub>CC</sub>	Supply current (total)		74F244	I <sub>CCH</sub>	V <sub>CC</sub> = MAX			40	60	mA
				I <sub>CCL</sub>				60	90	mA
				I <sub>CCZ</sub>				60	90	mA
			74F244B	I <sub>CCH</sub>	V <sub>CC</sub> = MAX			20	30	mA
				I <sub>CCL</sub>				50	70	mA
				I <sub>CCZ</sub>				29	40	mA

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

## Octal buffers (3-State)

## 74F244/74F244B

## AC ELECTRICAL CHARACTERISTICS FOR 74F244

SYMBOL	PARAMETER	TEST CONDITION	A PORT LIMITS						UNIT	
			$T_{amb} = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{pF}$ , $R_L = 500\Omega$			$T_{amb} = 0^{\circ}\text{C to } +70^{\circ}\text{C}$ $V_{CC} = +5.0\text{V} \pm 10\%$ $C_L = 50\text{pF}$ , $R_L = 500\Omega$		$T_{amb} = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ $V_{CC} = +5.0\text{V} \pm 10\%$ $C_L = 50\text{pF}$ , $R_L = 500\Omega$		
			MIN	TYP	MAX	MIN	MAX	MIN		MAX
$t_{PLH}$ $t_{PHL}$	Propagation delay I <sub>an</sub> , I <sub>bn</sub> to Y <sub>n</sub>	Waveform 1	2.5 2.5	4.0 4.0	5.2 5.2	2.0 2.0	6.2 6.5	1.5 2.0	7.0 7.0	ns
$t_{PZH}$ $t_{PZL}$	Output enable time to high or low	Waveform 2 Waveform 4	2.0 2.0	4.3 5.0	5.7 7.0	2.0 2.0	6.7 8.0	2.0 2.0	8.0 8.5	ns
$t_{PHZ}$ $t_{PLZ}$	Output disable time from high or low	Waveform 2 Waveform 4	1.5 1.5	2.5 2.5	5.5 5.5	1.0 1.0	6.0 5.5	1.0 1.0	6.0 5.5	ns

## AC ELECTRICAL CHARACTERISTICS FOR 74F244B

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			$T_{amb} = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{pF}$ , $R_L = 500\Omega$			$T_{amb} = 0^{\circ}\text{C to } +70^{\circ}\text{C}$ $V_{CC} = +5.0\text{V} \pm 10\%$ $C_L = 50\text{pF}$ , $R_L = 500\Omega$		
			MIN	TYP	MAX	MIN	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation delay I <sub>an</sub> , I <sub>bn</sub> to Y <sub>n</sub>	Waveform 1	2.5 2.5	4.5 4.5	5.7 6.0	2.0 2.5	6.2 6.5	ns
$t_{PZH}$ $t_{PZL}$	Output enable time to high or low level	Waveform 2 Waveform 4	2.0 3.0	4.0 5.5	6.0 7.5	2.0 3.0	6.5 8.0	ns
$t_{PHZ}$ $t_{PLZ}$	Output disable time from high or low level	Waveform 2 Waveform 4	1.5 1.5	2.5 2.5	5.5 5.5	1.0 1.0	6.0 5.5	ns
$t_{sk(0)}$	Output skew <sup>1,2</sup>	Waveform 3			1.5		2.0	ns

## NOTES:

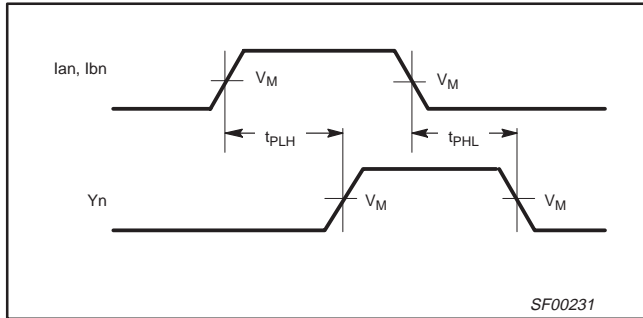
- $|t_{pN} \text{ actual} - t_{pM} \text{ actual}|$  for any output compared to any other output where N and M are either LH or HL.
- Skew times are valid only under same test conditions (temperature,  $V_{CC}$ , loading, etc.).

# Octal buffers (3-State)

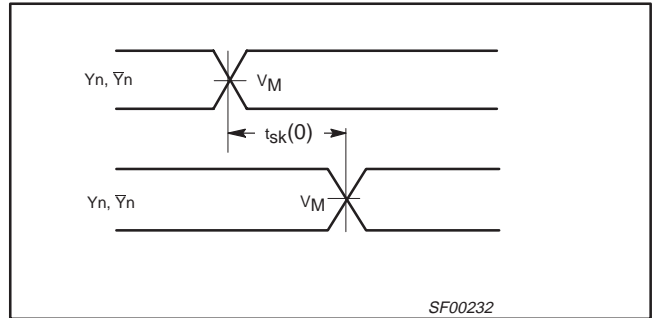
# 74F244/74F244B

## AC WAVEFORMS

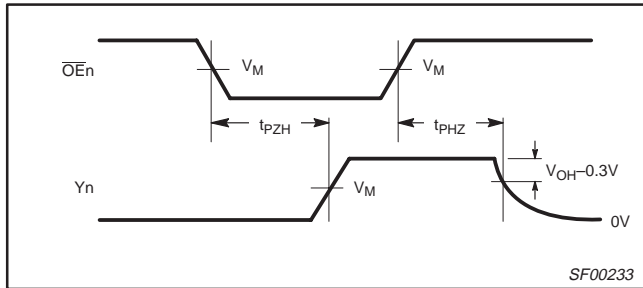
For all waveforms,  $V_M = 1.5V$ .



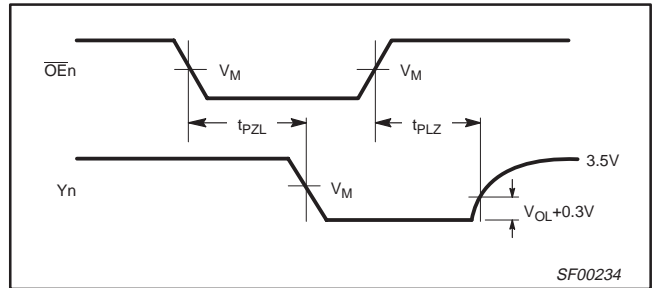
Waveform 1. Propagation Delay for data to outputs



Waveform 3. Output skew



Waveform 2. 3-State output enable time to high level and output disable time from high level



Waveform 4. 3-State output enable time to low level and output disable time from low level

## TEST CIRCUIT AND WAVEFORMS

SWITCH POSITION	
TEST	SWITCH
$t_{PLZ}, t_{PZL}$	closed
All other	open

**Test circuit for 3-State outputs**

**DEFINITIONS:**  
 $R_L$  = Load resistor; see AC electrical characteristics for value.  
 $C_L$  = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value  
 $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

**Input pulse definition**

family	INPUT PULSE REQUIREMENTS					
	amplitude	$V_M$	rep. rate	$t_w$	$t_{TLH}$	$t_{THL}$
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

SF000235

# Octal buffers (3-State)

74F244/74F244B

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 <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> 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	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	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 maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT146-1			SC603			92-11-17 95-05-24

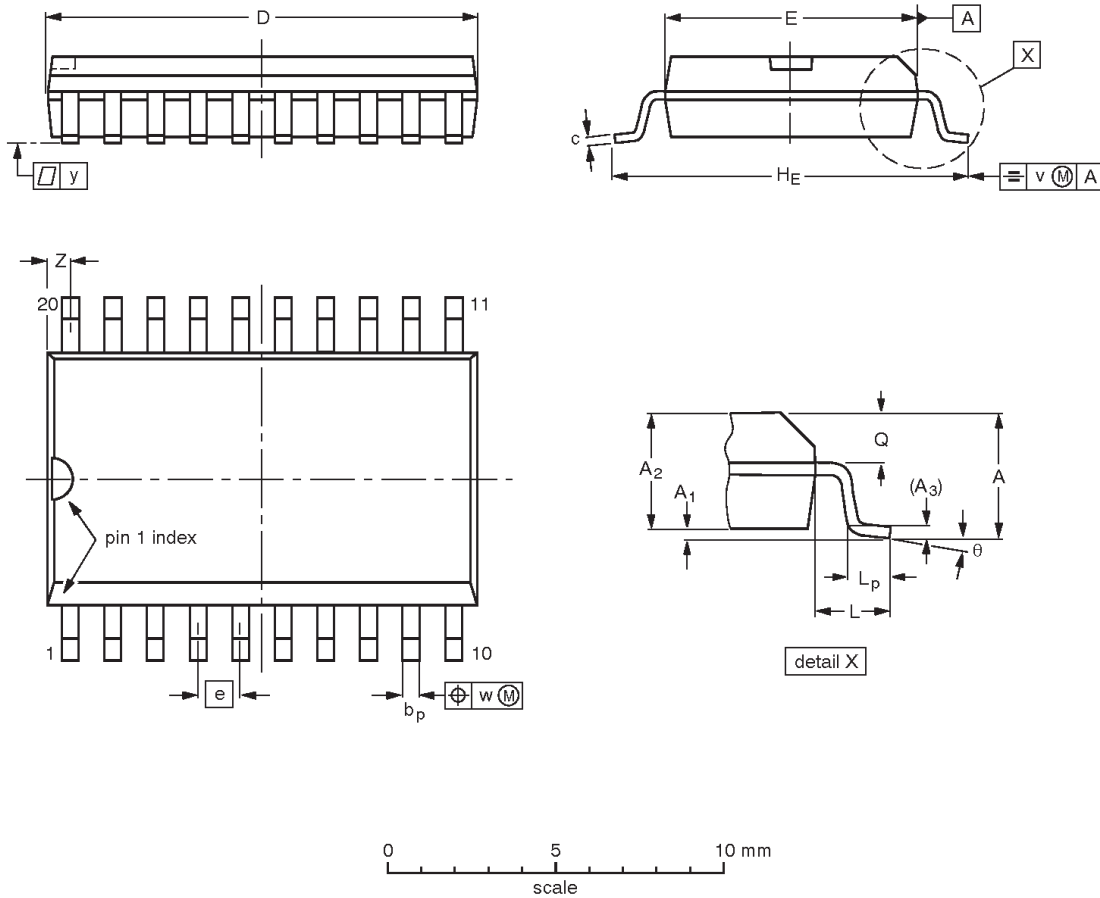


# Octal buffers (3-State)

## 74F244/74F244B

**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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	$\theta$
mm	2.65	0.30 0.10	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° 0°
inches	0.10	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	0.050	0.42 0.39	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 maximum per side are not included.

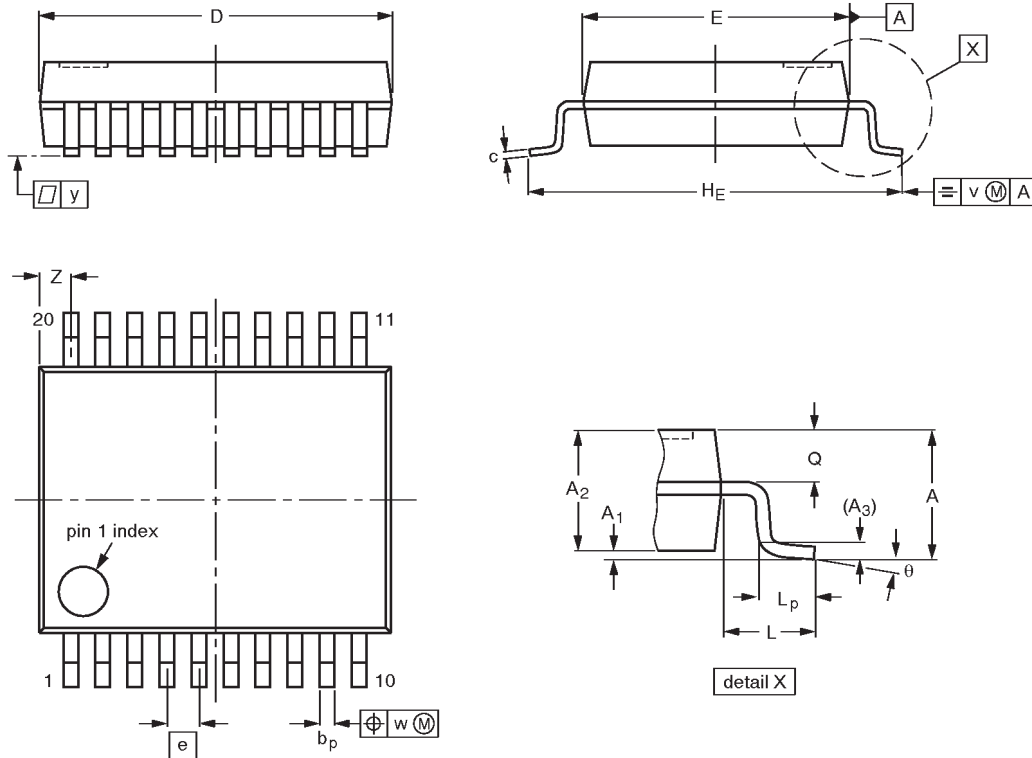
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				92-11-17 95-01-24

# Octal buffers (3-State)

## 74F244/74F244B

**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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.0	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° 0°

**Note**

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT339-1		MO-150AE				93-09-08 95-02-04

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Octal buffers (3-State)

74F244/74F244B

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**NOTES**

Octal buffers (3-State)

74F244/74F244B

**DEFINITIONS**

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	<b>Preproduction Product</b>	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
<i>Product Specification</i>	<b>Full Production</b>	This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product.

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