# 74AVC16244

16-bit buffer/line driver; 3.6 V tolerant; 3-state Rev. 3 — 20 February 2018

**Product data sheet** 

#### **General description** 1

The 74AVC16244 is a 16-bit non-inverting buffer/line driver with 3-state outputs. This device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer. The 3-state outputs are controlled by the output enable inputs nOE. A HIGH level on input nOE causes the outputs to assume a high-impedance OFF-state.

The 74AVC16244 is designed to have an extremely fast propagation delay and a minimum amount of power consumption.

To ensure the high-impedance output state during power-up or power-down, input nOE should be tied to V<sub>CC</sub> through a pull-up resistor (Live Insertion).

A dynamic controlled output (DCO) circuitry is implemented to support termination line drive during transient (see Figure 4).

### **Features and benefits**

- Wide supply voltage range from 1.2 V to 3.6 V
- · Complies with JEDEC standards:
  - JESD8-7 (1.2 V to 1.95 V)
  - JESD8-5 (1.8 V to 2.7 V)
  - JESD8-1A (2.7 V to 3.6 V)
- CMOS low power consumption
- Input/output tolerant up to 3.6 V
- Dynamic Controlled Output (DCO) circuit dynamically changes output impedance, resulting in noise reduction without speed degradation
- Low inductance multiple V<sub>CC</sub> and GND pins to minimize noise and ground bounce
- Supports Live Insertion

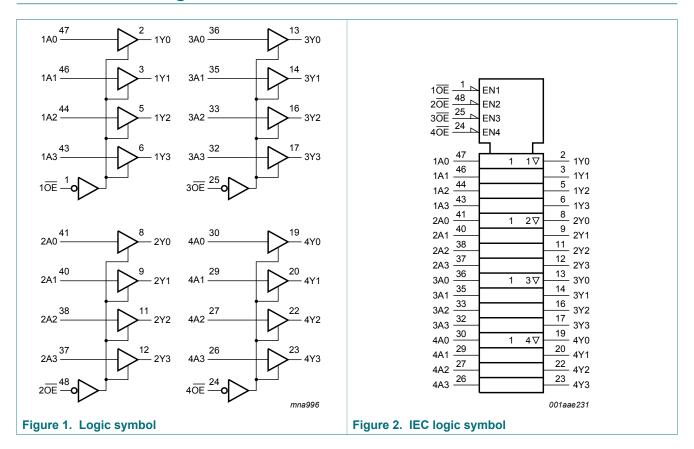
#### 3 **Ordering information**

#### **Table 1. Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74AVC16244DGG	-40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1

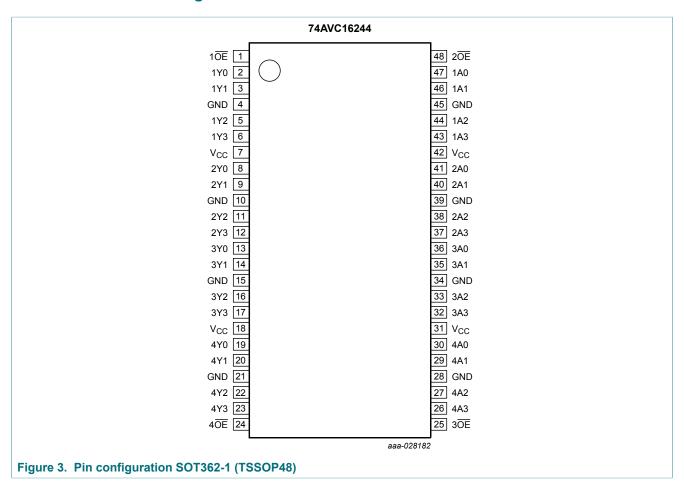


## 4 Functional diagram



## 5 Pinning information

### 5.1 Pinning



### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1 <del>OE</del> , 2 <del>OE</del> , 3 <del>OE</del> , 4 <del>OE</del>	1, 48, 25, 24	output enable inputs (active LOW)
1A0, 1A1, 1A2, 1A3	47, 46, 44, 43	data inputs
2A0, 2A1, 2A2, 2A3	41, 40, 38, 37	data inputs
3A0, 3A1, 3A2, 3A3	36, 35, 33, 32	data inputs
4A0, 4A1, 4A2, 4A3	30, 29, 27, 26	data inputs
1Y0, 1Y1, 1Y2, 1Y3	2, 3, 5, 6	data outputs
2Y0, 2Y1, 2Y2, 2Y3	8, 9, 11, 12	data outputs
3Y0, 3Y1, 3Y2, 3Y3	13, 14, 16, 17	data outputs
4Y0, 4Y1, 4Y2, 4Y3	19, 20, 22, 23	data outputs
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V <sub>CC</sub>	7, 18, 31, 42	supply voltage

# 6 Functional description

#### Table 3. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ X = don't \ care; \ Z = high-impedance \ OFF-state.$ 

Input nOE nAn		Output
n <del>OE</del>	nAn	nYn
L	L	L
L	Н	Н
Н	X	Z

### **Limiting values**

#### Table 4. 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	+4.6	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V		-	-50	mA
VI	input voltage		[1]	-0.5	+4.6	V
I <sub>OK</sub>	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V		-	±50	mA
Vo	output voltage	output HIGH or LOW	[1]	-0.5	V <sub>CC</sub> + 0.5	V
		output 3-state	[1]	-0.5	+4.6	V
Io	output current	$V_O = 0 V \text{ to } V_{CC}$		-	±50	mA
I <sub>CC</sub>	supply current			-	100	mA
I <sub>GND</sub>	ground current			-100	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C	[2]	-	500	mW

<sup>[1]</sup> The input and output voltage ratings may be exceeded if the input and output current ratings are observed. [2] Above 60  $^{\circ}$ C the value of  $P_{tot}$  derates linearly with 5.5 mW/K.

## **Recommended operating conditions**

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
$V_{CC}$	supply voltage	for low-voltage applications	1.2	-	3.6	V
	according to JEDEC Low Standards	according to JEDEC Low Voltage	1.65	-	1.95	V
		Standards	2.3	-	2.7	V
			3.0	-	3.6	V
VI	input voltage		0	-	3.6	V
Vo	output voltage	output HIGH or LOW	0	-	V <sub>CC</sub>	V
		output 3-state	0	-	3.6	V
T <sub>amb</sub>	ambient temperature	in free air	-40	-	+85	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.3 V	0	-	30	ns/V
		V <sub>CC</sub> = 2.3 V to 3.0 V	0	-	20	ns/V
		V <sub>CC</sub> = 3.0 V to 3.6 V	0	-	10	ns/V

### 9 Static characteristics

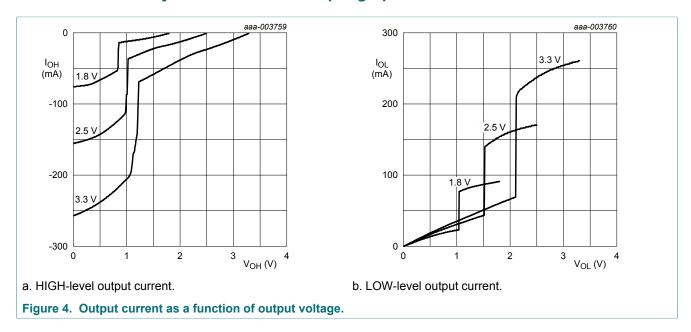
Table 6. Static characteristics

At recommended operating conditions.  $T_{amb}$  = -40 °C to +85 °C; Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
V <sub>IH</sub>	HIGH-level input	V <sub>CC</sub> = 1.2 V	V <sub>CC</sub>	-	-	V
	voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 x V <sub>CC</sub>	0.9	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	1.2	-	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	2.0	1.5	-	V
$V_{IL}$	LOW-level input	V <sub>CC</sub> = 1.2 V	-	-	GND	V
	voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	0.9	0.35 x V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	1.2	0.7	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	1.5	0.8	V
V <sub>OH</sub>	HIGH-level output	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; see <u>Figure 4</u>				
	voltage	$I_{O}$ = -100 $\mu$ A; $V_{CC}$ = 1.65 V to 3.6 V	V <sub>CC</sub> - 0.20	V <sub>CC</sub>	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	V <sub>CC</sub> - 0.45	V <sub>CC</sub> - 0.10	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	V <sub>CC</sub> - 0.55	V <sub>CC</sub> - 0.28	-	V
	I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 3.0 V	V <sub>CC</sub> - 0.70	V <sub>CC</sub> - 0.32	-	V	
$V_{OL}$	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; see <u>Figure 4</u>				
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V	-	GND	0.20	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	0.10	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	0.26	0.55	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 3.0 V	-	0.36	0.70	V
l <sub>l</sub>	input leakage current	per input pin; $V_I = V_{CC}$ or GND; $V_{CC} = 1.65 \text{ V}$ to 3.6 V	-	0.1	2.5	μA
I <sub>OFF</sub>	power-off leakage current	$V_1$ or $V_0 = 3.6 \text{ V}$ ; $V_{CC} = 0.0 \text{ V}$	-	0.1	±10	μA
l <sub>OZ</sub>	OFF-state output	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND				
	current	V <sub>CC</sub> = 1.65 V to 2.7 V	-	0.1	5	μΑ
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.1	10	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A				
		V <sub>CC</sub> = 1.65 V to 2.7 V	-	0.1	20	μΑ
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.2	40	μΑ
Cı	input capacitance		-	5.0	-	pF

<sup>[1]</sup> All typical values are measured at  $T_{amb}$  = 25 °C.

### 9.1 Dynamic controlled output graphs



### 10 Dynamic characteristics

#### **Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 7.

Symbol	Parameter	Conditions	-40 °C to +85 °C			Unit
			Min	Typ <sup>[1]</sup>	Max	
t <sub>pd</sub>	propagation delay	nAn to nYn; see Figure 5				
		V <sub>CC</sub> = 1.2 V	-	2.6	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	1.8	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.7	1.7	3.1	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.6	1.3	1.9	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	1.1	1.7	ns
t <sub>en</sub>	enable time	nOE to nYn; see Figure 6				
		V <sub>CC</sub> = 1.2 V	-	5.2	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	3.3	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.3	2.7	5.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.9	1.9	4.3	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.7	1.7	3.5	ns
t <sub>dis</sub>	disable time	nOE to nYn; see Figure 6				
		V <sub>CC</sub> = 1.2 V	-	5.7	-	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	4.3	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.0	3.2	6.2	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	1.9	4.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.2	1.8	3.5	ns
C <sub>PD</sub>	power dissipation capacitance	per input; $V_I$ = GND to $V_{CC}$ [3]				
		outputs enabled	-	34	-	pF
		outputs disabled	-	1	-	pF

<sup>[1]</sup> Typical values are measured at  $T_{amb}$  = 25 °C and  $V_{CC}$  = 1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V respectively. [2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in Volts

N = number of inputs switching  $\Sigma(C_L \times V_{CC}^2 \times f_0)$  = sum of the outputs.

 $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

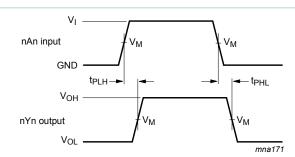
 $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ . [3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).

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

f<sub>i</sub> = input frequency in MHz;

fo = output frequency in MHz

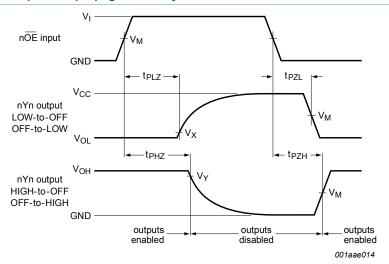
#### 10.1 Waveforms and test circuit



Measurement points are given in Table 8.

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

Figure 5. Inputs nAn to output nYn propagation delays



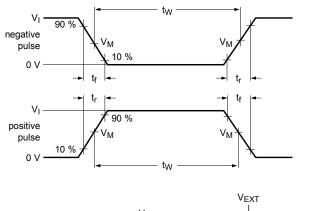
Measurement points are given in Table 8.

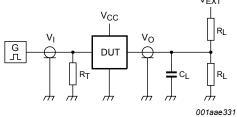
 $V_{\text{OL}}$  and  $V_{\text{OH}}$  are typical voltage output levels that occur with the output load.

Figure 6. 3-state enable and disable times

Table 8. Measurement points

Supply voltage	Input		Output		
V <sub>CC</sub>	VI	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>
≤2.3 V	V <sub>CC</sub>	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	V <sub>OH</sub> - 0.15 V
2.3 V to 2.7 V	V <sub>CC</sub>	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	V <sub>OH</sub> - 0.15 V
3.0 V to 3.6 V	V <sub>CC</sub>	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> - 0.3 V





Test data is given in Table 9.

Definitions for test circuit:

R<sub>L</sub> = Load resistance.

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_T$  = Termination resistance should be equal to output impedance  $Z_0$  of the pulse generator.

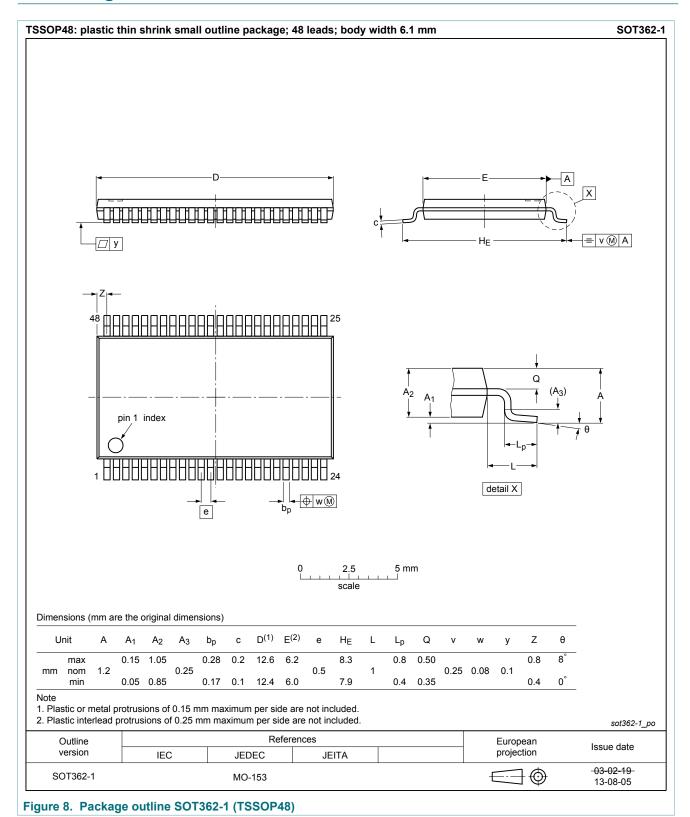
 $V_{EXT}$  = External voltage for measuring switching times.

Figure 7. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input		Load		V <sub>EXT</sub>		
V <sub>CC</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PLZ</sub> , t <sub>PZL</sub>	t <sub>PHZ</sub> , t <sub>PZH</sub>
≤2.3 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1000 Ω	open	2 x V <sub>CC</sub>	GND
2.3 V to 2.7 V	$V_{CC}$	≤ 2.0 ns	30 pF	500 Ω	open	2 x V <sub>CC</sub>	GND
3.0 V to 3.6 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	500 Ω	open	2 x V <sub>CC</sub>	GND

### 11 Package outline



74AVC16244

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### 12 Abbreviations

#### Table 10. Abbreviations

Acronym	Description	
CMOS	Complementary Metal-Oxide Semiconductor	
DCO	Dynamic Controlled Output	
DUT	Device Under Test	

# 13 Revision history

#### Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74AVC16244 v.3	20180220	Product data sheet	-	74AVC16244 v.2	
Modifications:	<ul> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>				
74AVC16244 v.2	19991115	Product specification	-	74AVC16244 v.1	
74AVC16244 v.1	19981211	Product specification	-	-	

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Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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#### 16-bit buffer/line driver; 3.6 V tolerant; 3-state

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