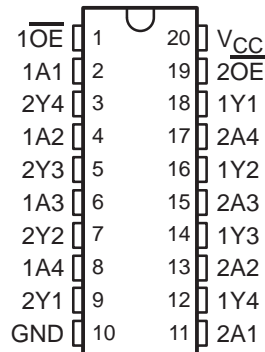


# CD74FCT244, CD74FCT244AT BiCMOS OCTAL BUFFERS/LINE DRIVERS WITH 3-STATE OUTPUTS

SCBS722B – JULY 2000 – REVISED AUGUST 2003

- BiCMOS Technology With Low Quiescent Power
- Buffered Inputs
- Noninverted Outputs
- Input/Output Isolation From  $V_{CC}$
- Controlled Output Edge Rates
- 64-mA Output Sink Current
- Output Voltage Swing Limited to 3.7 V
- SCR Latch-Up-Resistant BiCMOS Process and Circuit Design

CD74FCT244 . . . E, M, OR SM PACKAGE  
CD74FCT244AT . . . E OR M PACKAGE  
(TOP VIEW)



## description/ordering information

The CD74FCT244 and CD74FCT244AT are octal buffer/line drivers with 3-state outputs using a small-geometry BiCMOS technology. The output stages are a combination of bipolar and CMOS transistors that limit the output high level to two diode drops below  $V_{CC}$ . This resultant lowering of output swing (0 V to 3.7 V) reduces the power-bus ringing [a source of electromagnetic interference (EMI)] and minimizes  $V_{CC}$  bounce and ground bounce and their effects during simultaneous output switching. The output configuration also enhances switching speed and is capable of sinking 64 mA.

These devices are organized as two 4-bit buffers/line drivers with separate active-low output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

## ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – E	Tube	CD74FCT244E	CD74FCT244E
	SOIC – M	Tube	CD74FCT244M	74FCT244M
		Tape and reel	CD74FCT244M96	
	SSOP – SM	Tape and reel	CD74FCT244SM96	FCT244SM
	PDIP – E	Tube	CD74FCT244ATE	CD74FCT244ATE
	SOIC – M	Tube	CD74FCT244ATM	74FCT244ATM
Tape and reel		CD74FCT244ATM96		

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

FUNCTION TABLE  
(each buffer/driver)

INPUTS		OUTPUT
$\overline{OE}$	A	Y
L	H	H
L	L	L
H	X	Z



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

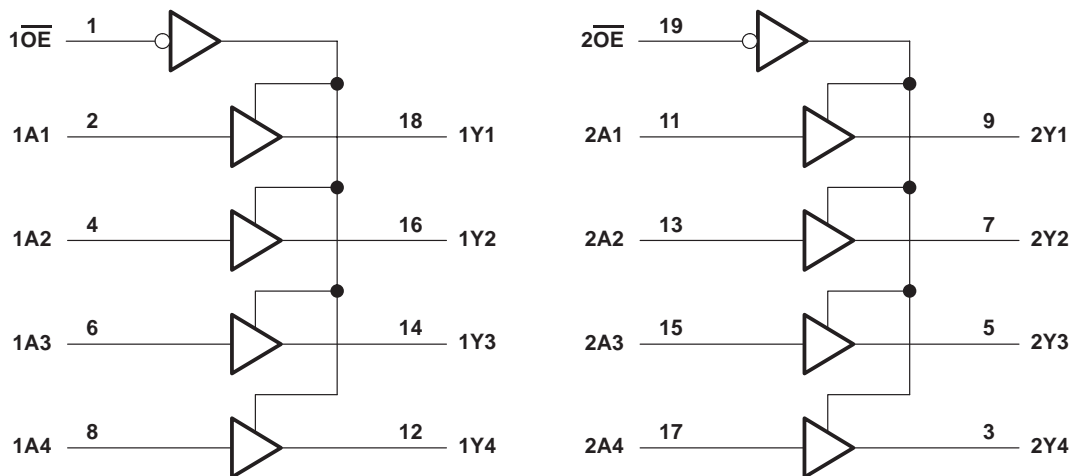
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# CD74FCT244, CD74FCT244AT BiCMOS OCTAL BUFFERS/LINE DRIVERS WITH 3-STATE OUTPUTS

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## logic diagram (positive logic)



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

DC supply voltage range, $V_{CC}$ .....	-0.5 V to 6 V
DC input clamp current, $I_{IK}$ ( $V_I < -0.5$ V) .....	-20 mA
DC output clamp current, $I_{OK}$ ( $V_O < -0.5$ V) .....	-50 mA
DC output sink current per output pin, $I_{OL}$ .....	70 mA
DC output source current per output pin, $I_{OH}$ .....	-30 mA
Continuous current through $V_{CC}$ , $I_{CC}$ .....	140 mA
Continuous current through GND .....	528 mA
Package thermal impedance, $\theta_{JA}$ (see Note 1): E package .....	69°C/W
M package .....	58°C/W
SM package .....	70°C/W
Storage temperature range, $T_{stg}$ .....	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions (see Note 2)

	MIN	MAX	UNIT
$V_{CC}$ Supply voltage	4.75	5.25	V
$V_{IH}$ High-level input voltage	2		V
$V_{IL}$ Low-level input voltage		0.8	V
$V_I$ Input voltage	0	$V_{CC}$	V
$V_O$ Output voltage	0	$V_{CC}$	V
$I_{OH}$ High-level output current		-15	mA
$I_{OL}$ Low-level output current		64	mA
$\Delta t/\Delta v$ Input transition rise or fall rate (slew rate)		10	ns/V
$T_A$ Operating free-air temperature	0	70	°C

NOTE 2: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



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**BiCMOS OCTAL BUFFERS/LINE DRIVERS**  
**WITH 3-STATE OUTPUTS**

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**electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C		MIN	MAX	UNIT
			MIN	MAX			
V <sub>IK</sub>	I <sub>I</sub> = -18 mA	4.75 V		-1.2	-1.2		V
V <sub>OH</sub>	I <sub>OH</sub> = -15 mA	4.75 V	2.4		2.4		V
V <sub>OL</sub>	I <sub>OL</sub> = 64 mA	4.75 V		0.55	0.55		V
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5.25 V		±0.1	±1		μA
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	5.25 V		±0.5	±10		μA
I <sub>OS</sub> †	V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>O</sub> = 0	5.25 V		-60	-60		mA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.25 V		8	80		μA
ΔI <sub>CC</sub> ‡	One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND	5.25 V		1.6	1.6		mA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND			10	10		pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND			15	15		pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 100 ms.

‡ This is the increase in supply current for each input at one of the specified TTL voltage levels, rather than 0 V or V<sub>CC</sub>.

**switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.25 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CD74FCT244			CD74FCT244AT			UNIT
			T <sub>A</sub> = 25°C		T <sub>A</sub> = 25°C				
			TYP	MIN	MAX	TYP	MIN	MAX	
t <sub>pd</sub>	A	Y	4.5	1.5	6.5	3.8	1.5	5.3	ns
t <sub>en</sub>	$\overline{OE}$	Y	6	1.5	8	4.8	1.5	6.5	ns
t <sub>dis</sub>	$\overline{OE}$	Y	5	1.5	7	4.5	1.5	5.8	ns

**noise characteristics, V<sub>CC</sub> = 5 V, C<sub>L</sub> = 50 pF, T<sub>A</sub> = 25°C**

PARAMETER	MIN	TYP	MAX	UNIT
V <sub>OL(P)</sub> Quiet output, maximum dynamic V <sub>OL</sub>		1		V
V <sub>OH(V)</sub> Quiet output, minimum dynamic V <sub>OH</sub>		0.5		V
V <sub>IH(D)</sub> High-level dynamic input voltage	2			V
V <sub>IL(D)</sub> Low-level dynamic input voltage			0.8	V

**operating characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C**

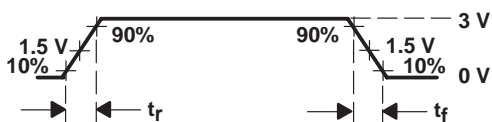
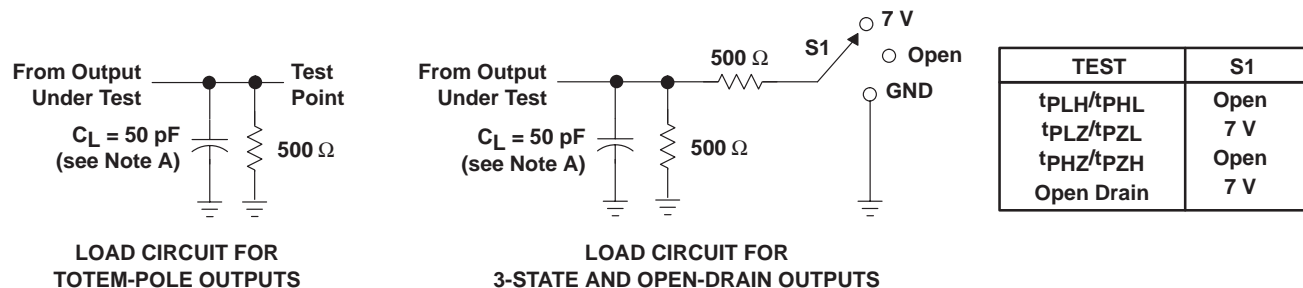
PARAMETER	TEST CONDITIONS	TYP	UNIT
C <sub>pd</sub> Power dissipation capacitance	No load, f = 1 MHz	35	pF



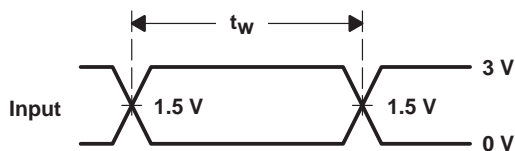
# CD74FCT244, CD74FCT244AT BiCMOS OCTAL BUFFERS/LINE DRIVERS WITH 3-STATE OUTPUTS

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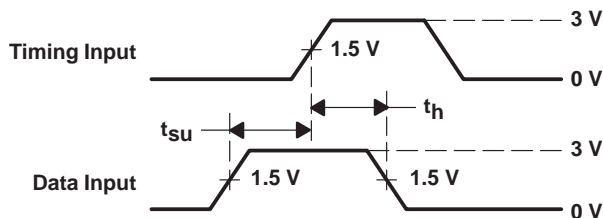
## PARAMETER MEASUREMENT INFORMATION



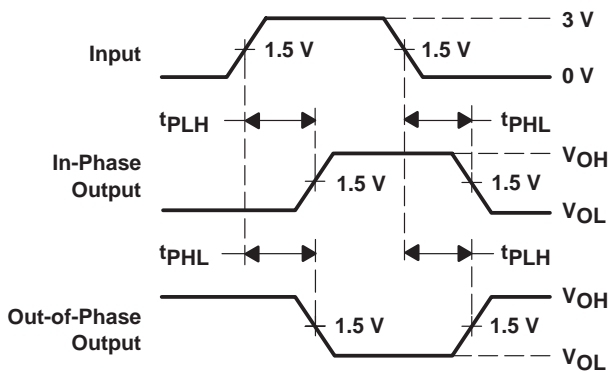
VOLTAGE WAVEFORM  
INPUT RISE AND FALL TIMES



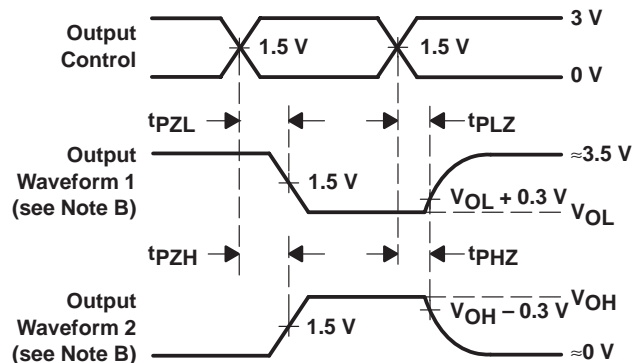
VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES  
LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r$  and  $t_f = 2.5 \text{ ns}$ .
  - D. The outputs are measured one at a time with one input transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CD74FCT244ATE	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	CD74FCT244ATE	<a href="#">Samples</a>
CD74FCT244ATM	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74FCT244ATM	<a href="#">Samples</a>
CD74FCT244ATM96	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74FCT244ATM	<a href="#">Samples</a>
CD74FCT244E	ACTIVE	PDIP	N	20	20	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	CD74FCT244E	<a href="#">Samples</a>
CD74FCT244M	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74FCT244M	<a href="#">Samples</a>
CD74FCT244M96	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	74FCT244M	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD74FCT244ATM96	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
CD74FCT244M96	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74FCT244ATM96	SOIC	DW	20	2000	367.0	367.0	45.0
CD74FCT244M96	SOIC	DW	20	2000	367.0	367.0	45.0



**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD74FCT244ATE	N	PDIP	20	20	506	13.97	11230	4.32
CD74FCT244ATM	DW	SOIC	20	25	507	12.83	5080	6.6
CD74FCT244E	N	PDIP	20	20	506	13.97	11230	4.32
CD74FCT244M	DW	SOIC	20	25	507	12.83	5080	6.6

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

**NOTES:**

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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