SCLS463A - JULY 2002 - REVISED JANUARY 2004

- Controlled Baseline
  - One Assembly/Test Site, One Fabrication Site
- Extended Temperature Performance of Up To −55°C to 125°C
- Enhanced Diminishing Manufacturing Sources (DMS) Support
- Enhanced Product-Change Notification
- Qualification Pedigree<sup>†</sup>
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- High-Current Outputs Drive Up To 15 LSTTL Loads

# DW OR PW PACKAGE (TOP VIEW)

	_	-		
10E [	1	U	20	v <sub>cc</sub>
1A1 [	2		19	] 2OE
2Y4 [	3		18	1Y1
1A2 [	4		17	2A4
2Y3 [	5		16	1Y2
1A3 [	6		15	2A3
2Y2 [	7		14	1Y3
1A4 [	8		13	2A2
2Y1 [	9		12	] 1Y4
GND [	10		11	2A1

### description/ordering information

This octal buffer and line driver is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The SN74HC244 is organized as two 4-bit buffers/drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes noninverted data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

#### ORDERING INFORMATION

TA	PACK	AGE‡	ORDERABLE PART NUMBER	TOP-SIDE MARKING
400C to 4050C	SOP – DW	Tape and reel	SN74HC244QDWREP	SHC244EP
-40°C to 125°C	TSSOP - PW	Tape and reel	SN74HC244QPWREP	SHC244EP
−55°C to 125°C	SOP – DW	Tape and reel	SN74HC244MDWREP	HC244MEP

<sup>&</sup>lt;sup>‡</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

# FUNCTION TABLE (each buffer/driver)

INP	JTS	OUTPUT
OE	Α	Υ
L	Н	Н
L	L	L
Н	Χ	Z

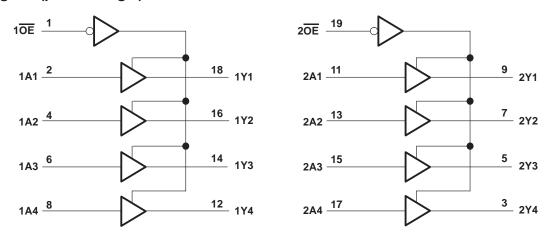


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



<sup>†</sup> Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life.

### logic diagram (positive logic)



### absolute maximum ratings over operating free-air temperature range†

Supply voltage range, V <sub>CC</sub>	0.5 V to 7 V
Input clamp current, I <sub>IK</sub> (V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>CC</sub> ) (see Note 1)	±20 mA
Output clamp current, I <sub>OK</sub> (V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> ) (see Note 1)	±20 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±35 mA
Continuous current through V <sub>CC</sub> or GND	±70 mA
Package thermal impedance, θ <sub>JA</sub> (see Note 2): DW package	58°C/W
PW package	83°C/W
Storage temperature range, T <sub>stq</sub>	65°C to 150°C

<sup>†</sup> 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 input and output voltage ratings may be exceeded if the input and output current ratings are observed.

2. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions

			MIN	NOM	MAX	UNIT
VCC	Supply voltage		2	5	6	V
		V <sub>CC</sub> = 2 V	1.5			
$V_{IH}$	High-level input voltage	$V_{CC} = 4.5 \text{ V}$	3.15			V
		V <sub>CC</sub> = 6 V	4.2			
		V <sub>CC</sub> = 2 V	0		0.5	
$V_{IL}$	Low-level input voltage  Input voltage	V <sub>CC</sub> = 4.5 V	0		1.35	V
		V <sub>CC</sub> = 6 V	0		1.8	
٧ı	Input voltage		0		VCC	V
VO	Output voltage		0		VCC	V
		V <sub>CC</sub> = 2 V	0		1000	
t <sub>t</sub>	Input transition (rise and fall) time	V <sub>CC</sub> = 4.5 V	0		500	ns
		V <sub>CC</sub> = 6 V	0		400	
_		Q-suffix device	-40		125	00
TA	Operating free-air temperature	M-suffix device	-55		125	°C



# SN74HC244-EP **OCTAL BUFFER AND LINE DRIVER** WITH 3-STATE OUTPUTS SCLS463A – JULY 2002 – REVISED JANUARY 2004

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

DADAMETED	TEGT CONDITI	vcc	Т	A = 25°C	;	BAINI BAAV	MAY	LINUT	
PARAMETER	TEST CONDITI	TEST CONDITIONS				MAX	MIN	MAX	UNIT
			2 V	1.9	1.998		1.9		
Voн		$I_{OH} = -20  \mu A$	4.5 V	4.4	4.499		4.4		
	VI = VIH or VIL		6 V	5.9	5.999		5.9		V
		$I_{OH} = -6 \text{ mA}$	4.5 V	3.98	4.3		3.7		
		$I_{OH} = -7.8 \text{ mA}$	6 V	5.48	5.8		5.2		
			2 V		0.002	0.1		0.1	
	VI = VIH or VIL	$I_{OL} = 20 \mu A$	4.5 V		0.001	0.1		0.1	
VoL			6 V		0.001	0.1		0.1	V
		I <sub>OL</sub> = 6 mA	4.5 V		0.17	0.26		0.4	
		$I_{OL} = 7.8 \text{ mA}$	6 V		0.15	0.26		0.4	
lį	$V_I = V_{CC}$ or 0		6 V		±0.1	±100		±1000	nA
loz	$V_O = V_{CC}$ or 0,	$V_I = V_{IH}$ or $V_{IL}$	6 V		±0.01	±0.5		±10	μΑ
Icc	$V_I = V_{CC}$ or 0,	IO = 0	6 V			8		160	μΑ
Ci			2 V to 6 V		3	10		10	pF

# switching characteristics over recommended operating free-air temperature range, $C_L$ = 50 pF (unless otherwise noted) (see Figure 1)

DADAMETED	FROM	то	\ ,	TA	√ = 25°C	;		4 A V		
PARAMETER	(INPUT)	(OUTPUT)	vcc	MIN	TYP	MAX	MIN N	IAX	UNIT	
			2 V		40	115		170		
t <sub>pd</sub>	А	Υ	4.5 V		13	23		34	ns	
·			6 V		11	20		29		
			2 V		75	150		225		
t <sub>en</sub>	ŌĒ	Υ	4.5 V		15	30		45	ns	
			6 V		13	26		38		
			2 V		75	150		225		
<sup>t</sup> dis	ŌĒ	Y	4.5 V		15	30		45	ns	
			6 V		13	26		38		
			2 V		28	60		90		
tţ		Υ	4.5 V		8	12		18	ns	
			6 V		6	10		15		

# SN74HC244-EP **OCTAL BUFFER AND LINE DRIVER** WITH 3-STATE OUTPUTS SCLS463A – JULY 2002 – REVISED JANUARY 2004

# switching characteristics over recommended operating free-air temperature range, $C_L$ = 150 pF (unless otherwise noted) (see Figure 1)

DADAMETER	FROM	то	,,	T <sub>A</sub> = 25°	С	AND MANY	LINUT
PARAMETER	(INPUT)	(OUTPUT)	VCC	MIN TYP	MAX	MIN MAX	UNIT
			2 V	56	165	245	
t <sub>pd</sub>	А	Υ	4.5 V	18	33	49	ns
			6 V	15	28	42	
	ŌĒ		2 V	100	200	300	
ten		Y	4.5 V	20	40	60	ns
			6 V	17	34	51	
			2 V	45	210	315	
t <sub>t</sub>		Υ	4.5 V	17	42	63	ns
			6 V	13	36	53	

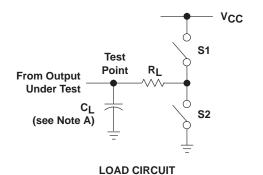
# operating characteristics, $T_A = 25^{\circ}C$

		PARAMETER	TEST CONDITIONS	TYP	UNIT
ı	C <sub>pd</sub>	Power dissipation capacitance per buffer/driver	No load	35	pF

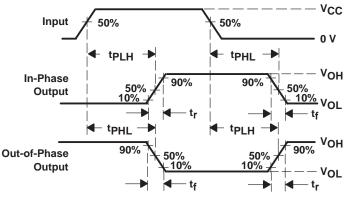


SCLS463A - JULY 2002 - REVISED JANUARY 2004

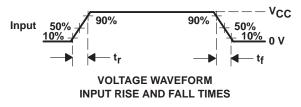
#### PARAMETER MEASUREMENT INFORMATION

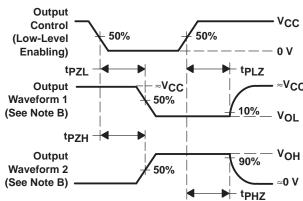


PARAI	METER	RL	CL	S1	S2
	tPZH			Open	Closed
ten	tPZL	1 K22	or 150 pF	Closed	Open
4	tPHZ	1 kΩ	50 pF	Open	Closed
<sup>t</sup> dis	tPLZ	1 K22	30 pr	Closed	Open
t <sub>pd</sub> or	t <sub>t</sub>	-	50 pF or 150 pF	Open	Open



VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES





VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES FOR 3-STATE OUTPUTS

- NOTES: A. C<sub>L</sub> includes probe and test-fixture 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. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz, Z<sub>O</sub> = 50  $\Omega$ , t<sub>f</sub> = 6 ns.
  - D. The outputs are measured one at a time with one input transition per measurement.
  - E. tpLz and tpHz are the same as tdis.
  - F. tpzL and tpzH are the same as ten.
  - G. tpLH and tpHL are the same as tpd.

Figure 1. Load Circuit and Voltage Waveforms







31-May-2014

#### **PACKAGING INFORMATION**

Orderable Device	Status	Package Type	Package Drawing		Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
SN74HC244MDWREP	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC244MEP	Samples
SN74HC244QDWREP	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	SHC244EP	Samples
SN74HC244QPWREP	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	SHC244EP	Samples
SN74HC244QPWREPG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	SHC244EP	Samples
V62/03607-01XE	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC244MEP	Samples
V62/03607-02XE	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	SHC244EP	Samples
V62/03607-02YE	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	SHC244EP	Samples

(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.

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

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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



## PACKAGE OPTION ADDENDUM

31-May-2014

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

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#### OTHER QUALIFIED VERSIONS OF SN74HC244-EP:

Catalog: SN74HC244

Automotive: SN74HC244-Q1

Military: SN54HC244

#### NOTE: Qualified Version Definitions:

- Catalog TI's standard catalog product
- Automotive Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military QML certified for Military and Defense Applications

# PACKAGE MATERIALS INFORMATION

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## TAPE AND REEL INFORMATION





Α0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74HC244MDWREP	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HC244QDWREP	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HC244QPWREP	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

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\*All dimensions are nominal

1									
	Device	Package Type	Package Drawing	Pins SPQ		Length (mm)	Width (mm)	Height (mm)	
	SN74HC244MDWREP	SOIC	DW	20	2000	367.0	367.0	45.0	
	SN74HC244QDWREP	SOIC	DW	20	2000	367.0	367.0	45.0	
	SN74HC244QPWREP	TSSOP	PW	20	2000	367.0	367.0	38.0	

DW (R-PDSO-G20)

## PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.

- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- D. Falls within JEDEC MS-013 variation AC.



# DW (R-PDSO-G20)

# PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Refer to IPC7351 for alternate board design.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



PW (R-PDSO-G20)

## PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO-153



# PW (R-PDSO-G20)

# PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate design.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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#### Как с нами связаться

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