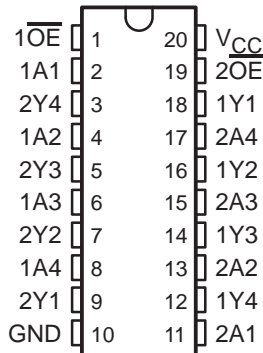


# SN54HC244, SN74HC244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SCLS130D – DECEMBER 1982 – REVISED AUGUST 2003

- Wide Operating Voltage Range of 2 V to 6 V
- High-Current Outputs Drive Up To 15 LSTTL Loads
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- Low Power Consumption, 80- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 11$  ns
- $\pm 6$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max

SN54HC244 . . . J OR W PACKAGE  
SN74HC244 . . . DB, DW, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54HC244 . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

These octal buffers and line drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The 'HC244 devices are 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

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube of 20	SN74HC244N	SN74HC244N
	SOIC – DW	Tube of 25	SN74HC244DW	HC244
		Reel of 2000	SN74HC244DWR	
	SOP – NS	Reel of 2000	SN74HC244NSR	HC244
	SSOP – DB	Reel of 2000	SN74HC244DBR	HC244
	TSSOP – PW	Tube of 70	SN74HC244PW	HC244
Reel of 2000		SN74HC244PWR		
Reel of 250		SN74HC244PWT		
-55°C to 125°C	CDIP – J	Tube of 20	SNJ54HC244J	SNJ54HC244J
	CFP – W	Tube of 85	SNJ54HC244W	SNJ54HC244W
	LCCC – FK	Tube of 55	SNJ54HC244FK	SNJ54HC244FK

† 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).



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.

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**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2003, Texas Instruments Incorporated  
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN54HC244, SN74HC244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SCLS130D – DECEMBER 1982 – REVISED AUGUST 2003

FUNCTION TABLE  
(each buffer/driver)

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

## logic diagram (positive logic)



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

Supply voltage range, $V_{CC}$	-0.5 V to 7 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1)	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	$\pm 35$ mA
Continuous current through $V_{CC}$ or GND	$\pm 70$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
DB package	70°C/W
DW package	58°C/W
N package	69°C/W
NS package	60°C/W
PW package	83°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 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.

# SN54HC244, SN74HC244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SCLS130D – DECEMBER 1982 – REVISED AUGUST 2003

## recommended operating conditions (see Note 3)

		SN54HC244			SN74HC244			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	2	5	6	2	5	6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V		1.5	1.5		V	
		V <sub>CC</sub> = 4.5 V		3.15	3.15			
		V <sub>CC</sub> = 6 V		4.2	4.2			
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V			0.5		0.5	V
		V <sub>CC</sub> = 4.5 V			1.35		1.35	
		V <sub>CC</sub> = 6 V			1.8		1.8	
V <sub>I</sub>	Input voltage	0		V <sub>CC</sub>	0		V <sub>CC</sub>	V
V <sub>O</sub>	Output voltage	0		V <sub>CC</sub>	0		V <sub>CC</sub>	V
Δt/Δv	Input transition rise/fall time	V <sub>CC</sub> = 2 V			1000		1000	ns
		V <sub>CC</sub> = 4.5 V			500		500	
		V <sub>CC</sub> = 6 V			400		400	
T <sub>A</sub>	Operating free-air temperature	-55		125	-40		85	°C

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

## 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			SN54HC244		SN74HC244		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2 V	1.9	1.998		1.9		1.9	V	
			4.5 V	4.4	4.499		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		
		I <sub>OH</sub> = -6 mA	4.5 V	3.98	4.3		3.7		3.84		
		I <sub>OH</sub> = -7.8 mA	6 V	5.48	5.8		5.2		5.34		
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		I <sub>OL</sub> = 6 mA	4.5 V		0.17	0.26		0.4		0.33	
		I <sub>OL</sub> = 7.8 mA	6 V		0.15	0.26		0.4		0.33	
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0		6 V		±0.1	±100		±1000		±1000	nA
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or 0, V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>		6 V		±0.01	±0.5		±10		±5	μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0		6 V			8		160		80	μA
C <sub>i</sub>			2 V to 6 V		3	10		10		10	pF

**SN54HC244, SN74HC244**  
**OCTAL BUFFERS AND LINE DRIVERS**  
**WITH 3-STATE OUTPUTS**

SCLS130D – DECEMBER 1982 – REVISED AUGUST 2003

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC244		SN74HC244		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y	2 V		40	115		170		145	ns
			4.5 V		13	23		34		29	
			6 V		11	20		29		25	
$t_{en}$	$\overline{OE}$	Y	2 V		75	150		225		190	ns
			4.5 V		15	30		45		38	
			6 V		13	26		38		32	
$t_{dis}$	$\overline{OE}$	Y	2 V		75	150		225		190	ns
			4.5 V		15	30		45		38	
			6 V		13	26		38		32	
$t_t$		Y	2 V		28	60		90		75	ns
			4.5 V		8	12		18		15	
			6 V		6	10		15		13	

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

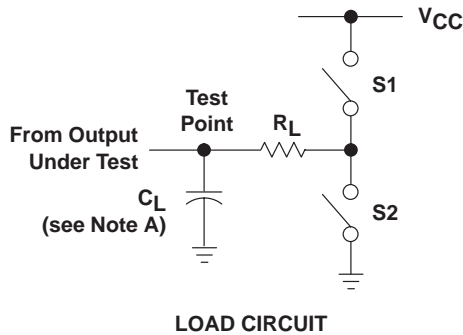
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC244		SN74HC244		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y	2 V		56	165		245		210	ns
			4.5 V		18	33		49		42	
			6 V		15	28		42		35	
$t_{en}$	$\overline{OE}$	Y	2 V		100	200		300		250	ns
			4.5 V		20	40		60		50	
			6 V		17	34		51		43	
$t_t$		Y	2 V		45	210		315		265	ns
			4.5 V		17	42		63		53	
			6 V		13	36		53		45	

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

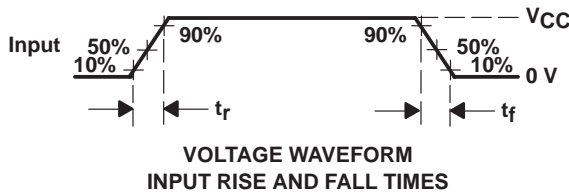
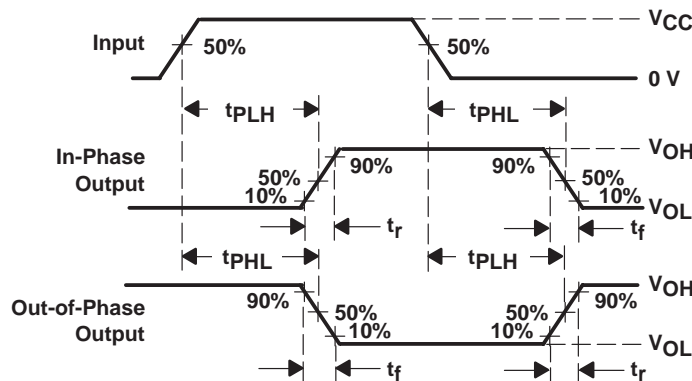
PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance per buffer/driver	No load	35	pF



PARAMETER MEASUREMENT INFORMATION



PARAMETER	$R_L$	$C_L$	S1	S2
$t_{en}$	1 k $\Omega$	50 pF or 150 pF	Open	Closed
			Closed	Open
$t_{dis}$	1 k $\Omega$	50 pF	Open	Closed
			Closed	Open
$t_{pd}$ or $t_t$	—	50 pF or 150 pF	Open	Open



- NOTES:
- A.  $C_L$  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,  $Z_O = 50 \Omega$ ,  $t_r = 6$  ns,  $t_f = 6$  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.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
5962-8409601VRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
5962-8409601VSA	ACTIVE	CFP	W	20	25	TBD	Call TI	N / A for Pkg Type	
84096012A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Call TI	
8409601RA	ACTIVE	CDIP	J	20	1	TBD	Call TI	Call TI	
8409601SA	ACTIVE	CFP	W	20	1	TBD	Call TI	Call TI	
JM38510/65705B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
JM38510/65705BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
JM38510/65705BSA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type	
M38510/65705B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
M38510/65705BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
M38510/65705BSA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type	
SN54HC244J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
SN74HC244ADBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI	
SN74HC244APWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI	
SN74HC244DBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI	
SN74HC244DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244DBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244DBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
SN74HC244DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74HC244N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI	
SN74HC244NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
SN74HC244NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244NSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244NSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI	
SN74HC244PWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWT	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWTE4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244PWTG4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74HC244QDWRG4Q1	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SNJ54HC244FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ54HC244J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	
SNJ54HC244W	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type	

(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.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54HC244, SN54HC244-SP, SN74HC244 :**

- Catalog: [SN74HC244](#), [SN54HC244](#)
- Automotive: [SN74HC244-Q1](#), [SN74HC244-Q1](#)
- Enhanced Product: [SN74HC244-EP](#), [SN74HC244-EP](#)
- Military: [SN54HC244](#)
- Space: [SN54HC244-SP](#)

NOTE: Qualified Version Definitions:



- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**TAPE AND REEL INFORMATION**

\*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
SN74HC244DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74HC244DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HC244DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74HC244NSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1
SN74HC244PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74HC244PWT	TSSOP	PW	20	250	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC244DBR	SSOP	DB	20	2000	367.0	367.0	38.0
SN74HC244DWR	SOIC	DW	20	2000	600.0	144.0	84.0
SN74HC244DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74HC244NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74HC244PWR	TSSOP	PW	20	2000	367.0	367.0	38.0
SN74HC244PWT	TSSOP	PW	20	250	367.0	367.0	38.0



W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within Mil-Std 1835 GDFP2-F20

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

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.

4040049/E 12/2002

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



4209202-4/E 07/11

- 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

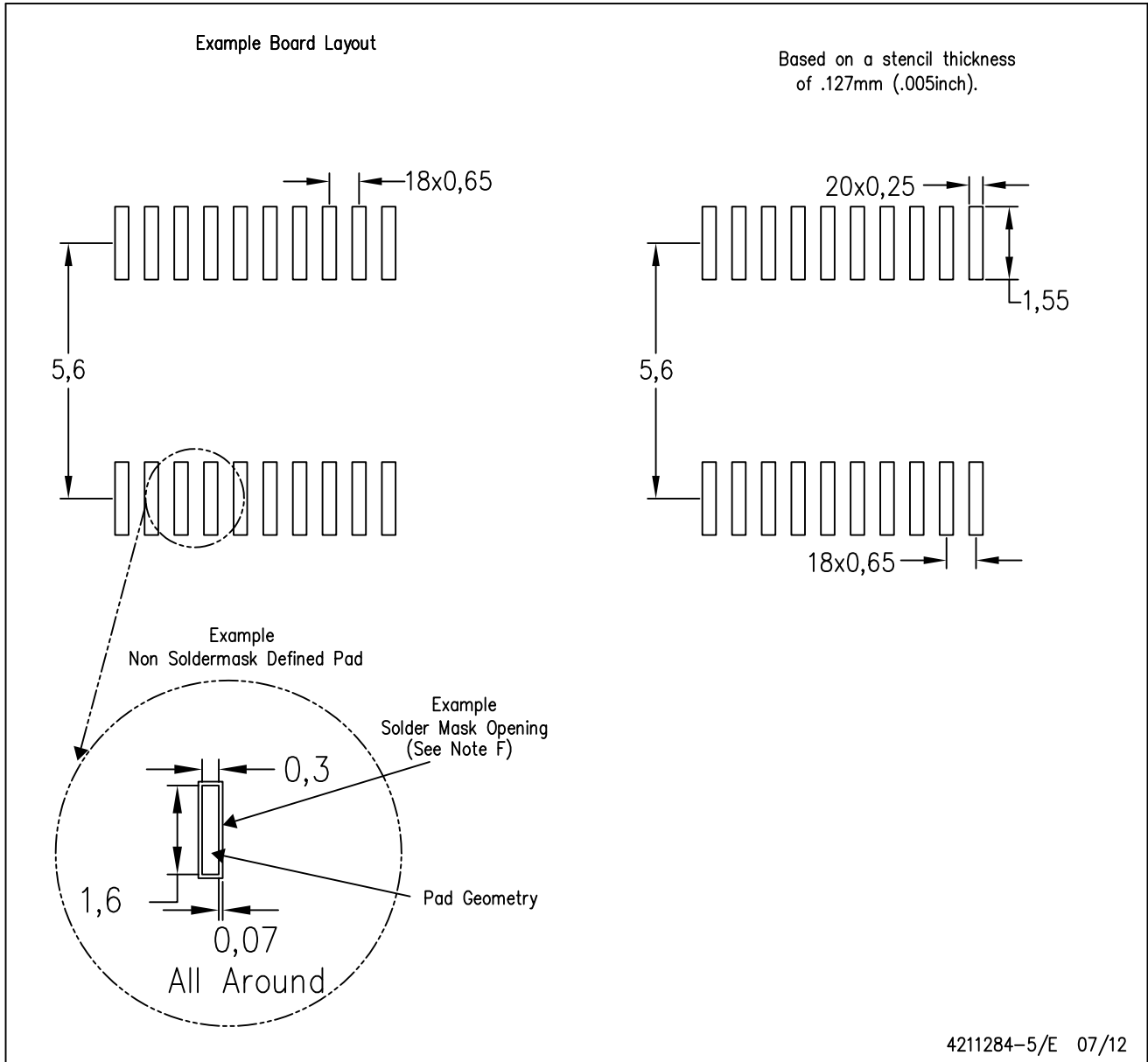


4040064-5/G 02/11

- 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.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  - D. 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.

## MECHANICAL DATA

**NS (R-PDSO-G\*\*)**

**PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)