

SCES614H-OCTOBER 2004-REVISED MAY 2010

# SINGLE-SUPPLY VOLTAGE-LEVEL TRANSLATOR WITH NINE CONFIGURABLE GATE LOGIC FUNCTIONS

Check for Samples: SN74AUP1T98

## FEATURES

- Available in the Texas Instruments NanoStar™ Packages
- Single-Supply Voltage Translator
- 1.8 V to 3.3 V (at  $V_{CC} = 3.3$  V)
- 2.5 V to 3.3 V (at  $V_{CC} = 3.3$  V) •
- 1.8 V to 2.5 V (at  $V_{CC} = 2.5$  V)
- 3.3 V to 2.5 V (at  $V_{CC} = 2.5$  V)
- **Nine Configurable Gate Logic Functions**
- Schmitt-Trigger Inputs Reject Input Noise and **Provide Better Output Signal Integrity**
- Ioff Supports Partial-Power-Down Mode With . Low Leakage Current (0.5 µA)
- Very Low Static and Dynamic Power • Consumption
- Pb-Free Packages Available: SOT-23 (DBV), ٠ SC-70 (DCK), and WCSP (NanoStar)
- Latch-Up Performance Exceeds 100 mA Per JESD 78. Class II
- **ESD Performance Tested Per JESD 22** •
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)
- Related Devices: SN74AUP1T97, SN74AUP1T57, and SN74AUP1T58

### DESCRIPTION/ORDERING INFORMATION

AUP technology is the industry's lowest-power logic technology designed for use in battery-operated or battery backed-up equipment. The SN74AUP1T98 is designed for logic-level translation applications with input switching levels that accept 1.8-V LVCMOS signals, while operating from either a single 3.3-V or 2.5-V  $V_{CC}$  supply.

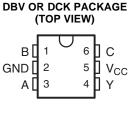
The wide V<sub>CC</sub> range of 2.3 V to 3.6 V allows the possibility of battery voltage drop during system operation and ensures normal operation between this range.

Schmitt-trigger inputs ( $\Delta V_T = 210 \text{ mV}$  between positive and negative input transitions) offer improved noise immunity during switching transitions, which is especially useful on analog mixed-mode designs. Schmitt-trigger inputs reject input noise, ensure integrity of output signals, and allow for slow input signal transition.

The SN74AUP1T98 can be easily configured to perform a required gate function by connecting A, B, and C inputs to V<sub>CC</sub> or ground (see Function Selection table). Up to nine commonly used logic gate functions can be performed.



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DRY OR DSF PACKAGE (TOP VIEW)



YFP OR YZP PACKAGE (TOP VIEW)

1			
В	Á1 1	6 (Áz)	С
GND	函2	5 (52)	V <sub>CC</sub>
B GND A	(ćj) 3	4 (ćz)	Y



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 $I_{off}$  is a feature that allows for powered-down conditions ( $V_{CC} = 0$  V) and is important in portable and mobile applications. When  $V_{CC} = 0$  V, signals in the range from 0 V to 3.6 V can be applied to the inputs and outputs of the device. No damage occurs to the device under these conditions.

The SN74AUP1T98 is designed with optimized current-drive capability of 4 mA to reduce line reflections, overshoot, and undershoot caused by high-drive outputs.

NanoStar package technology is a major breakthrough in IC packaging concepts, using the die as the package.

#### **ORDERING INFORMATION**<sup>(1)</sup>

T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Reel of 3000	SN74AUP1T98YZPR	ТК_
	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YFP	Reel of 3000	SN74AUP1T98YFPR	TK_
–40°C to 85°C	QFN – DRY	Reel of 5000	SN74AUP1T98DRYR	ТК
	uQFN – DSF	Reel of 5000	SN74AUP1T98DSFR	ТК
	SOT (SOT-23) – DBV	Reel of 3000	SN74AUP1T98DBVR	HT6_
	SOT (SC-70) – DCK	Reel of 3000	SN74AUP1T98DCKR	TK_

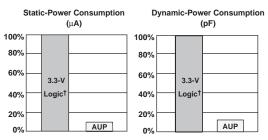
For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

(3) DBV/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site. YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the wafer fab/assembly site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

LOGIC FUNCTION	FIGURE NO.						
2-to-1 data selector	5						
2-input AND gate	6						
2-input OR gate with one inverted input	7						
2-input NAND gate with one inverted input	7						
2-input AND gate with one inverted input	8						
2-input NOR gate with one inverted input	8						
2-input OR gate	9						
Inverter	10						
Noninverted buffer	11						

#### FUNCTION SELECTION TABLE



<sup>†</sup> Single, dual, and triple gates

#### Figure 1. AUP – The Lowest-Power Family

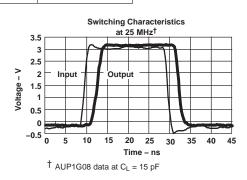


Figure 2. Excellent Signal Integrity

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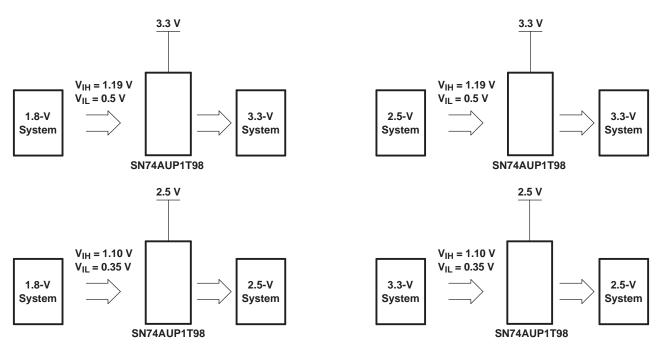


Figure 3. Possible Voltage-Translation Combinations

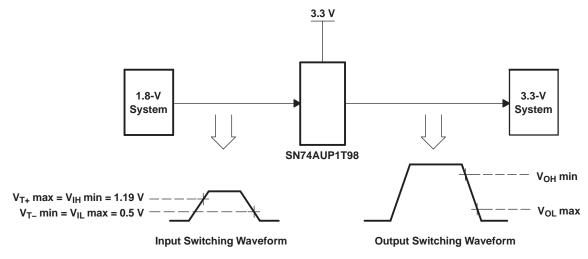
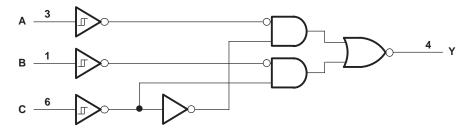


Figure 4. Switching Thresholds for 1.8-V to 3.3-V Translation

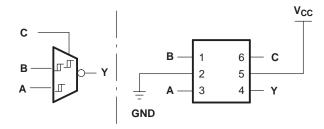
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	FUNCTION TABLE									
	INPUTS		OUTPUT							
С	В	Α	Y							
L	L	L	Н							
L	L	Н	н							
L	н	L	L							
L	н	Н	L							
н	L	L	Н							
н	L	Н	L							
н	н	L	н							
Н	Н	Н	L							

### LOGIC DIAGRAM (POSITIVE LOGIC)



### LOGIC CONFIGURATIONS





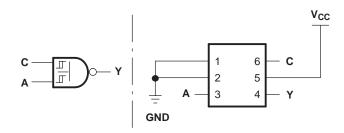


Figure 6. 00: 2-Input NAND Gate



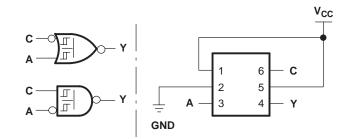


Figure 7. 14+02/14+08: 2-Input NOR Gate With One Inverted Input 2-Input AND Gate With One Inverted Input

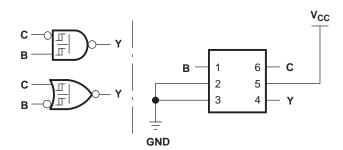


Figure 8. 14+00/14+32: 2-Input NAND Gate With One Inverted Input 2-Input OR Gate With One Inverted Input

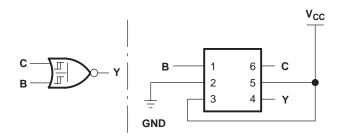


Figure 9. 32: 2-Input NOR Gate

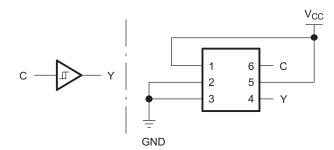


Figure 10. 17/34: Noninverted Buffer



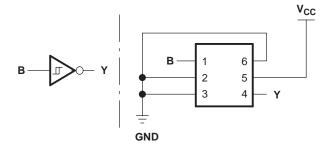


Figure 11. 04/14: Inverter

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### ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted)

			MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage range		-0.5	4.6	V	
VI	Input voltage range <sup>(2)</sup>		-0.5	4.6	V	
Vo	Voltage range applied to any output in the high-impedation	ance or power-off state <sup>(2)</sup>	-0.5	4.6	V	
Vo	Output voltage range in the high or low state <sup>(2)</sup>		-0.5	V <sub>CC</sub> + 0.5	V	
I <sub>IK</sub>	Input clamp current	V <sub>1</sub> < 0		-50	mA	
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0		-50	mA	
lo	Continuous output current			±20	mA	
	Continuous current through V <sub>CC</sub> or GND			±50	mA	
	Continuous current through V <sub>CC</sub> or GND	DBV package		165		
		DCK package		259		
0	Deales as the read issue days of (3)	DRY package		340	0000	
$\theta_{JA}$	Package thermal impedance <sup>(3)</sup>	DSF package		300	°C/W	
		YFP package		123		
		YZP package		123		
T <sub>stg</sub>	Storage temperature range		-65	150	°C	

(1) 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.

(2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

(3) The package thermal impedance is calculated in accordance with JESD 51-7.

### **RECOMMENDED OPERATING CONDITIONS**<sup>(1)</sup>

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage		2.3	3.6	V
VI	Input voltage		0	3.6	V
Vo	Output voltage		0	$V_{CC}$	V
	Liek lovel output ourrent	$V_{CC} = 2.3 V$		-3.1	
IOH	High-level output current	$V_{CC} = 3 V$		-4	mA
	Low lovel output ourrept	$V_{CC} = 2.3 V$		3.1	<b>س</b> ۸
IOL	Low-level output current	$V_{CC} = 3 V$		4	mA
T <sub>A</sub>	Operating free-air temperature		-40	85	°C

 All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. See the TI application report *Implications* of Slow or Floating CMOS Inputs, literature number SCBA004. SCES614H-OCTOBER 2004-REVISED MAY 2010

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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	T <sub>A</sub> = -40 to 85°0	°C C	UNIT	
			MIN	TYP MAX	MIN	MAX		
V <sub>T+</sub>		2.3 V to 2.7 V	0.6	1.1	0.6	1.1		
Positive-going input threshold voltage		3 V to 3.6 V	0.75	1.16	0.75	1.19	V	
V <sub>T-</sub>		2.3 V to 2.7 V	0.35	0.6	0.35	0.6		
Negative-going input threshold voltage		3 V to 3.6 V	0.5	0.85	0.5	0.85	V	
$\Delta V_T$		2.3 V to 2.7 V	0.23	0.6	0.1	0.6		
Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> )		3 V to 3.6 V	0.25	0.56	0.15	0.56	V	
	I <sub>OH</sub> = -20 μA	2.3 V to 3.6 V	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1			
V <sub>OH</sub>	I <sub>OH</sub> = -2.3 mA	2.3 V	2.05		1.97			
	I <sub>OH</sub> = -3.1 mA	2.3 V	1.9		1.85		V	
	I <sub>OH</sub> = -2.7 mA	3 V	2.72		2.67			
	$I_{OH} = -4 \text{ mA}$	3 V	2.6		2.55			
	I <sub>OL</sub> = 20 μA	2.3 V to 3.6 V		0.1		0.1	-	
	I <sub>OL</sub> = 2.3 mA	2.3 V		0.31		0.33		
V <sub>OL</sub>	I <sub>OL</sub> = 3.1 mA	2.3 V		0.44		0.45	V	
	I <sub>OL</sub> = 2.7 mA	3 V		0.31		0.33		
	$I_{OL} = 4 \text{ mA}$	5 V		0.44		0.45		
II All inputs	$V_I = 3.6 V \text{ or GND}$	0 V to 3.6 V		0.1		0.5	μA	
I <sub>off</sub>	$V_{I}$ or $V_{O} = 0$ V to 3.6 V	0 V		0.1		0.5	μA	
$\Delta I_{off}$	$V_{I} \text{ or } V_{O} = 3.6 \text{ V}$	0 V to 0.2 V		0.2		0.5	μA	
I <sub>CC</sub>	$V_I = 3.6 \text{ V or GND}, I_O = 0$	2.3 V to 3.6 V		0.5		0.9	μΑ	
Alee	One input at 0.3 V or 1.1 V, Other inputs at 0 or $V_{CC}$ , $I_{O} = 0$	2.3 V to 2.7 V				4	μA	
ΔI <sub>CC</sub>	One input at 0.45 V or 1.2 V, Other inputs at 0 or V <sub>CC</sub> , $I_0 = 0$	3 V to 3.6 V				12	μΛ	
Ci	$V_{I} = V_{CC}$ or GND	3.3 V		1.5			pF	
Co	$V_{O} = V_{CC} \text{ or } GND$	3.3 V		3			pF	

### SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ ,  $V_I = 1.8 \text{ V} \pm 0.15 \text{ V}$  (unless otherwise noted) (see Figure 12)

PARAMETER FRO	FROM	TO (OUTPUT)	CL	т,	ק = 25°C		T <sub>A</sub> = to 85	40°C 5°C	UNIT				
	(INPUT)	(OUTPUT)		MIN	TYP	MAX	MIN	MAX					
			5 pF	1.8	2.3	2.9	0.5	5 6.8					
			Y	V	N	V	10 pF	2.3	2.8	3.4	1	7.9	
t <sub>pd</sub> A, B, or C	Y	15 pF	2.6	3.1	3.8	1	8.7	ns					
			30 pF	3.8	4.4	5.1	1.5	10.8					



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### SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ ,  $V_1 = 2.5 \text{ V} \pm 0.2 \text{ V}$  (unless otherwise noted) (see Figure 12)

PARAMETER	FROM	TO (OUTPUT)	CL	Т	ק = 25°C		T <sub>A</sub> = to 85	40°C 5°C	UNIT		
	(INPUT)			MIN	TYP	MAX	MIN	MAX			
		, , , , , , , , , , , , , , , , , , ,	5 pF	1.8	2.3	3.1	0.5	6			
4			V	V	V	10 pF	2.2	2.8	3.5	1	7.1
t <sub>pd</sub> A, B, or C	Y	15 pF	2.6	3.2	5.2	1	7.9	ns			
			30 pF	3.7	4.4	5.2	1.5	10			

### SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ ,  $V_I = 3.3 \text{ V} \pm 0.3 \text{ V}$  (unless otherwise noted) (see Figure 12)

PARAMETER	FROM	TO (OUTPUT)	CL	Т	ק = 25°C		T <sub>A</sub> = to 85	40°C 5°C	UNIT			
	(INPUT)	(OUTPUT)		MIN	TYP	MAX	MIN	MAX				
		, , , , , , , , , , , , , , , , , , ,	5 pF	2	2.7	3.5	0.5	5.5				
			N/	V	V	X	10 pF	2.4	3.1	3.9	1	6.5
t <sub>pd</sub> A, B, or C	Y	15 pF	2.8	3.5	4.3	1	7.4	ns				
			30 pF	4	4.7	5.5	1.5	9.5				

### SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $V_I = 1.8 \text{ V} \pm 0.15 \text{ V}$  (unless otherwise noted) (see Figure 12)

PARAMETER		TO (OUTPUT)	CL	Т	ק = 25°C		T <sub>A</sub> = to 85	40°C 5°C	UNIT
	(INPUT)	(001201)	_	MIN	TYP	MAX	MIN	MAX	
		v	5 pF	1.6	2	2.5	0.5	8	
			10 pF	2	2.4	2.9	1	8.5	~~~
t <sub>pd</sub> A, B, or C	Y	15 pF	2.3	2.8	3.3	1	9.1	ns	
			30 pF	3.4	3.9	4.4	1.5	9.8	

### SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $V_1 = 2.5 \text{ V} \pm 0.2 \text{ V}$  (unless otherwise noted) (see Figure 12)

PARAMETER	FROM	TO (OUTPUT)	CL		∖ = 25°C		T <sub>A</sub> = to 85	40°C 5°C	UNIT
	(INPUT)	(001901)		MIN	TYP	MAX	MIN	MAX	
			5 pF	1.6	1.9	2.4	0.5	5.3	
		X	10 pF	2	2.3	2.7	1	6.1	
t <sub>pd</sub> A, B, or C	ř	15 pF	2.3	2.7	3.1	1	6.8	ns	
			30 pF	3.4	3.8	4.2	1.5	8.5	

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## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range,  $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ ,  $V_1 = 3.3 \text{ V} \pm 0.3 \text{ V}$  (unless otherwise noted) (see Figure 12)

PARAMETER	FROM	TO	CL	Т	∖ = 25°C		T <sub>A</sub> = -40°C to 85°C		UNIT		
	(INPUT)	(OUTPUT)	_	MIN	TYP	MAX	MIN	MAX			
t <sub>pd</sub>	A, B, or C	Y	5 pF	1.6	2.1	2.7	0.5	4.7	20		
			10 pF	2	2.4	3	1	5.7			
			r	ř	15 pF	2.3	2.7	3.3	1	6.2	ns
			30 pF	3.4	3.8	4.4	1.5	7.8			

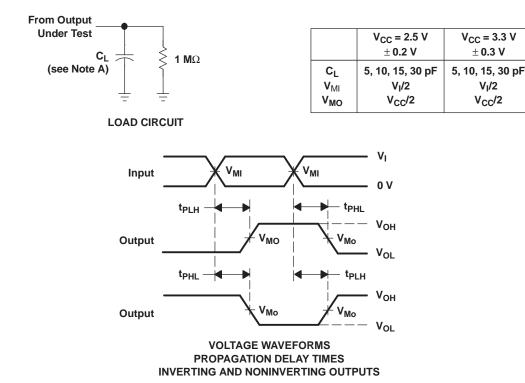
## **OPERATING CHARACTERISTICS**

 $T_A = 25^{\circ}C$ 

PARAMETER		TEST CONDITIONS	V <sub>CC</sub> = 2.5 V	V <sub>CC</sub> = 3.3 V	UNIT
		TEST CONDITIONS	TYP	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance	f = 10 MHz	4	5	pF



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### PARAMETER MEASUREMENT INFORMATION

- NOTES: A.  $C_L$  includes probe and jig capacitance.
  - B. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz, Z<sub>O</sub> = 50  $\Omega$ , slew rate  $\geq$  1 V/ns.
  - C. The outputs are measured one at a time, with one transition per measurement.
  - D.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

### Figure 12. Load Circuit and Voltage Waveforms



21-Oct-2011

### **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)
SN74AUP1T98DBVR	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DBVRE4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DBVRG4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DBVT	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DBVTE4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DBVTG4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DRYR	ACTIVE	SON	DRY	6	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98DSFR	ACTIVE	SON	DSF	6	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AUP1T98YFPR	ACTIVE	DSBGA	YFP	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	
SN74AUP1T98YZPR	ACTIVE	DSBGA	YZP	6	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	

<sup>(1)</sup> The marketing status values are defined as follows:



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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.

<sup>(2)</sup> 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)

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

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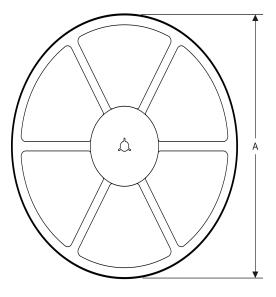
# PACKAGE MATERIALS INFORMATION

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### TAPE AND REEL INFORMATION

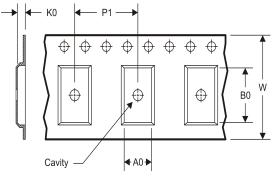
### REEL DIMENSIONS

TEXAS INSTRUMENTS





# 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

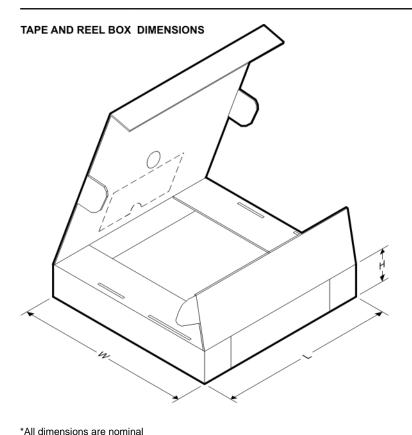
Device		Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AUP1T98DBVR	SOT-23	DBV	6	3000	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUP1T98DBVT	SOT-23	DBV	6	250	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74AUP1T98DCKR	SC70	DCK	6	3000	180.0	8.4	2.25	2.4	1.22	4.0	8.0	Q3
SN74AUP1T98DCKT	SC70	DCK	6	250	180.0	8.4	2.25	2.4	1.22	4.0	8.0	Q3
SN74AUP1T98DRYR	SON	DRY	6	5000	180.0	8.4	1.25	1.6	0.7	4.0	8.0	Q1
SN74AUP1T98DSFR	SON	DSF	6	5000	180.0	8.4	1.16	1.16	0.63	4.0	8.0	Q2
SN74AUP1T98YFPR	DSBGA	YFP	6	3000	178.0	9.2	0.89	1.29	0.62	4.0	8.0	Q1
SN74AUP1T98YZPR	DSBGA	YZP	6	3000	180.0	8.4	1.02	1.52	0.63	4.0	8.0	Q1

TEXAS INSTRUMENTS

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# PACKAGE MATERIALS INFORMATION

1-Mar-2012



All ulmensions are norminal							
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUP1T98DBVR	SOT-23	DBV	6	3000	202.0	201.0	28.0
SN74AUP1T98DBVT	SOT-23	DBV	6	250	202.0	201.0	28.0
SN74AUP1T98DCKR	SC70	DCK	6	3000	202.0	201.0	28.0
SN74AUP1T98DCKT	SC70	DCK	6	250	202.0	201.0	28.0
SN74AUP1T98DRYR	SON	DRY	6	5000	202.0	201.0	28.0
SN74AUP1T98DSFR	SON	DSF	6	5000	202.0	201.0	28.0
SN74AUP1T98YFPR	DSBGA	YFP	6	3000	220.0	220.0	35.0
SN74AUP1T98YZPR	DSBGA	YZP	6	3000	220.0	220.0	34.0

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- 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. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- È. Falls within JEDEC MO-178 Variation AB, except minimum lead width.



# LAND PATTERN DATA



NOTES:

- A. All linear dimensions are in millimeters.B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.



DCK (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- 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. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-203 variation AB.



# **MECHANICAL DATA**

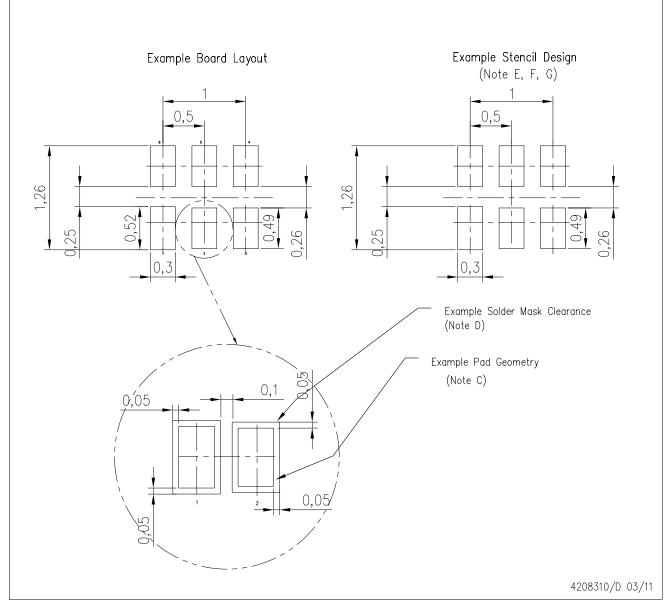


- C. SON (Small Outline No-Lead) package configuration.
- $\Delta$  The exposed lead frame feature on side of package may or may not be present due to alternative lead frame designs.
- E. This package complies to JEDEC MO-287 variation UFAD.
- 🖄 See the additional figure in the Product Data Sheet for details regarding the pin 1 identifier shape.



DRY (S-PUSON-N6)

PLASTIC SMALL OUTLINE NO-LEAD

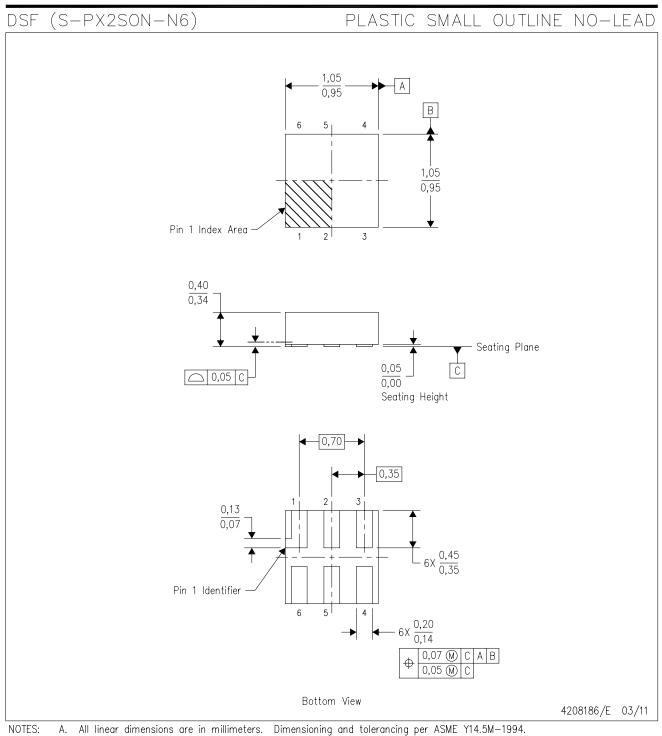


NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
- E. Maximum stencil thickness 0,127 mm (5 mils). All linear dimensions are in millimeters.
- F. 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 stencil design considerations.
- G. Side aperture dimensions over-print land for acceptable area ratio > 0.66. Customer may reduce side aperture dimensions if stencil manufacturing process allows for sufficient release at smaller opening.



# **MECHANICAL DATA**



- - B. This drawing is subject to change without notice.
    C. SON (Small Outline No-Lead) package configuration.
    D. This package complies to JEDEC M0-287 variation X2AAF.





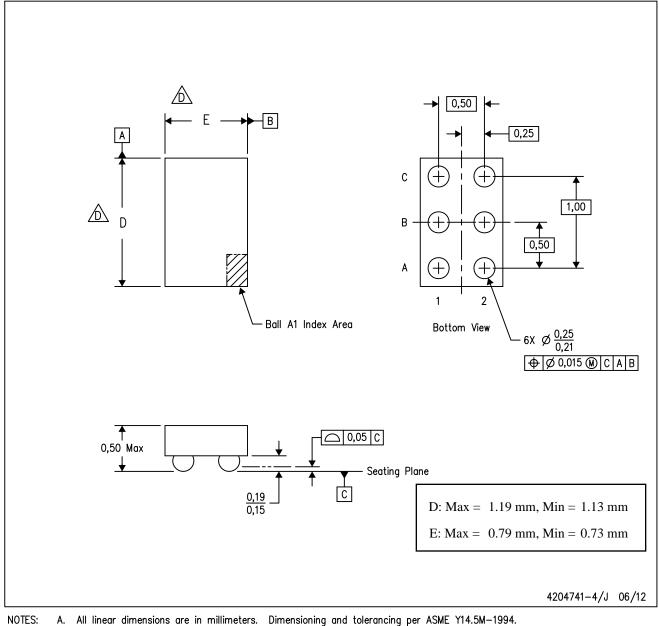
NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads. If 2 mil solder mask is outside PCB vendor capability, it is advised to omit solder mask.
- E. Maximum stencil thickness 0,1016 mm (4 mils). All linear dimensions are in millimeters.
- F. 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 stencil design considerations.
- G. Suggest stencils cut with lasers such as Fiber Laser that produce the greatest positional accuracy.
- H. Component placement force should be minimized to prevent excessive paste block deformation.



YZP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



- A. All linear dimensions are in millimeters. DimensionB. This drawing is subject to change without notice.
- C. NanoFree™ package configuration.
- The package size (Dimension D and E) of a particular device is specified in the device Product Data Sheet version
  - of this drawing, in case it cannot be found in the product data sheet please contact a local TI representative.
- E. This package is a Pb-free solder ball design. Refer to the 6 YEP package (drawing 4204725) for tin-lead (SnPb).

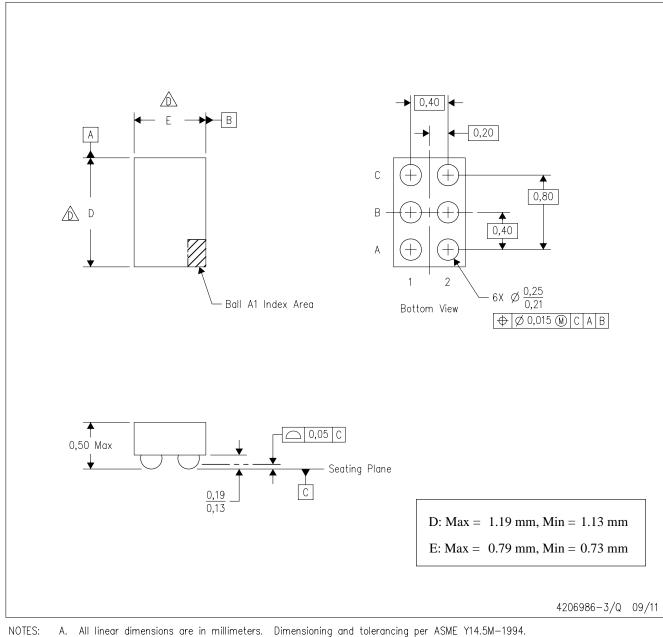
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# **MECHANICAL DATA**

YFP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



- B. This drawing is subject to change without notice.
- C. NanoFree™ package configuration.
- The package size (Dimension D and E) of a particular device is specified in the device Product Data Sheet version of this drawing, in case it cannot be found in the product data sheet please contact a local TI representative.
- E. Reference Product Data Sheet for array population. 2 x 3 matrix pattern is shown for illustration only.
- F. This package contains Pb-free balls.

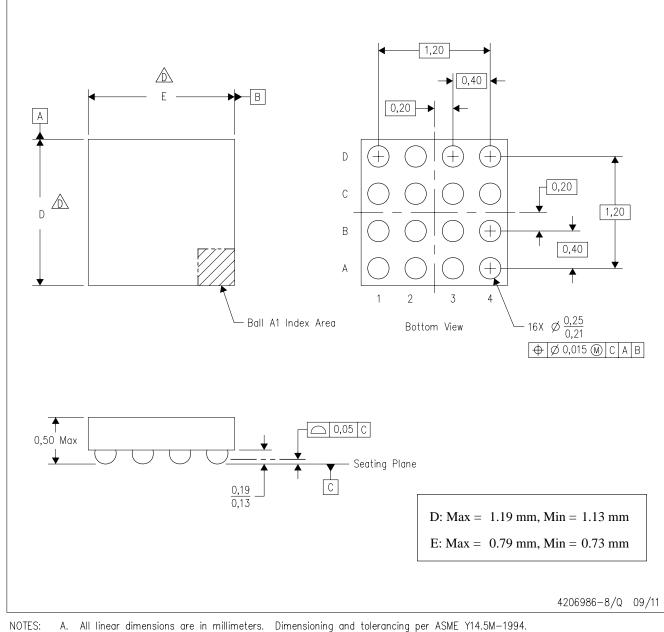
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# **MECHANICAL DATA**

YFP (S-XBGA-N16)

DIE-SIZE BALL GRID ARRAY



A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994. Β. This drawing is subject to change without notice.

- NanoFree™ package configuration. C.
- 🖄 The package size (Dimension D and E) of a particular device is specified in the device Product Data Sheet version of this drawing, in case it cannot be found in the product data sheet please contact a local TI representative.
- E. Reference Product Data Sheet for array population. 4 x 4 matrix pattern is shown for illustration only.
- F. This package contains Pb-free balls.

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