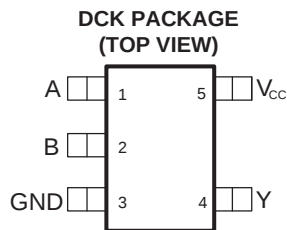


Low-Power Single 2-Input Positive-AND Gate

Check for Samples: [SN74AUP1G08-Q1](#)

FEATURES

- AEC-Q100 Qualified with the Following Results:
 - Device Temperature Grade 1: –40°C to 125°C Ambient Operating Temperature Range
 - Device HBM ESD Classification Level H2
 - Device CDM ESD Classification Level C3B
- Available in the Texas Instruments NanoStar™ Package
- Low Static-Power Consumption:
 $I_{CC} = 0.9 \mu A$ Max
- Low Dynamic-Power Consumption:
 $C_{pd} = 4.3$ pF Typ at 3.3 V
- Low Input Capacitance: $C_i = 1.5$ pF Typ
- Low Noise: Overshoot and Undershoot < 10% of V_{CC}
- I_{off} Supports Partial-Power-Down Mode Operation
- Schmitt-Trigger Action Allows Slow Input Transition and Better Switching Noise Immunity at the Input ($V_{hys} = 250$ mV, Typ at 3.3 V)
- Wide Operating V_{CC} Range of 0.8 V to 3.6 V
- Optimized for 3.3-V Operation
- 3.6-V Input/Output (I/O) Tolerant to Support Mixed-Mode Signal Operation
- $t_{pd} = 4.3$ ns Max at 3.3 V
- Suitable for Point-to-Point Applications
- Latch-Up Performance Exceeds 100 mA Per JESD-78, Class II



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

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DESCRIPTION

The AUP family is TI's premier solution to the low-power needs of the industry in battery-powered portable applications. This family ensures a very low static- and dynamic-power consumption across the entire V_{CC} range of 0.8 V to 3.6 V, resulting in increased battery life (see Figure 1). This product also maintains excellent signal integrity (see the very low undershoot and overshoot characteristics shown in Figure 2).

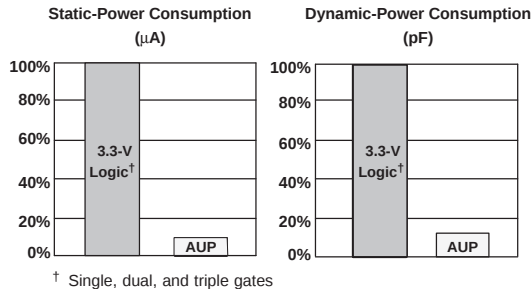


Figure 1. AUP – The Lowest-Power Family

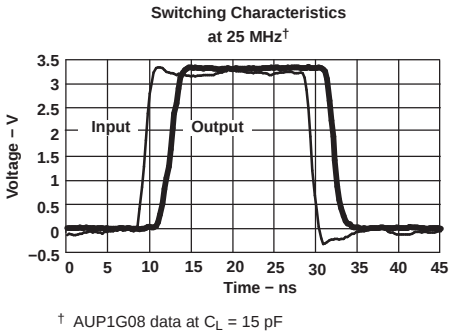


Figure 2. Excellent Signal Integrity

This single 2-input positive-AND gate performs the Boolean function: $Y = A \bullet B$ or $Y = \overline{\overline{A} + \overline{B}}$ in positive logic. NanoStar package technology is a major breakthrough in integrated circuit (IC) packaging concepts, because it uses the die as the package.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ORDERING INFORMATION⁽¹⁾

T_A	ORDERABLE PART NUMBER ⁽²⁾	TOP-SIDE MARKING
-40°C to 125°C	SN74AUP1G08QDCKRQ1	SIT

- (1) 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.

FUNCTION TABLE

INPUTS		OUTPUT Y
A	B	
L	L	L
L	H	L
H	L	L
H	H	H

LOGIC DIAGRAM (POSITIVE LOGIC)



ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

		MIN	MAX	UNIT
V _{CC}	Supply voltage range	−0.5	4.6	V
V _I	Input voltage range ⁽²⁾	−0.5	4.6	V
V _O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	−0.5	4.6	V
V _O	Output voltage range in the high or low state ⁽²⁾	−0.5	V _{CC} + 0.5	V
I _{IK}	Input clamp current	V _I < 0		−50 mA
I _{OK}	Output clamp current	V _O < 0		−50 mA
I _O	Continuous output current			±20 mA
Continuous current through V _{CC} or GND				±50 mA
T _{stg}	Storage temperature range	−65	150	°C
ESD ratings	Human body model (HBM) AEC-Q100 classification level H2			2 kV
	Charged device model (CDM) AEC-Q100 classification level C3B			750 V

- (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.

THERMAL INFORMATION

THERMAL METRIC ⁽¹⁾		SN74AUP1G08-Q1	UNIT
		DCK (5 PINS)	
θ _{JA}	Junction-to-ambient thermal resistance	304.7	°C/W
θ _{JCTop}	Junction-to-case (top) thermal resistance	115.3	
θ _{JB}	Junction-to-board thermal resistance	80.3	
ψ _{JT}	Junction-to-top characterization parameter	3.5	
ψ _{JB}	Junction-to-board characterization parameter	79.4	
θ _{JCbot}	Junction-to-case (bottom) thermal resistance	N/A	

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

RECOMMENDED OPERATING CONDITIONS			MIN	MAX	UNIT
V _{CC}	Supply voltage		0.8	3.6	V
V _{IH}	High-level input voltage	V _{CC} = 0.8 V	V _{CC}		V
		V _{CC} = 1.1 V to 1.95 V	0.65 × V _{CC}		
		V _{CC} = 2.3 V to 2.7 V	1.6		
		V _{CC} = 3 V to 3.6 V	2		
V _{IL}	Low-level input voltage	V _{CC} = 0.8 V	0		V
		V _{CC} = 1.1 V to 1.95 V	0.35 × V _{CC}		
		V _{CC} = 2.3 V to 2.7 V	0.7		
		V _{CC} = 3 V to 3.6 V	0.9		
V _I	Input voltage		0	3.6	V
V _O	Output voltage		0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 0.8 V	−20		μA
		V _{CC} = 1.1 V	−1.1		mA
		V _{CC} = 1.4 V	−1.7		
		V _{CC} = 1.65	−1.9		
		V _{CC} = 2.3 V	−3.1		
		V _{CC} = 3 V	−4		
I _{OL}	Low-level output current	V _{CC} = 0.8 V	20		μA
		V _{CC} = 1.1 V	1.1		mA
		V _{CC} = 1.4 V	1.7		
		V _{CC} = 1.65 V	1.9		
		V _{CC} = 2.3 V	3.1		
		V _{CC} = 3 V	4		
Δt/Δv	Input transition rise or fall rate	V _{CC} = 0.8 V to 3.6 V	200		ns/V
T _A	Operating free-air temperature		−40	125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See 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)

Not recommended operating for air temperature range (unless otherwise noted)										
PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			T _A = –40°C to 85°C		T _A = 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = –20 μA	0.8 V to 3.6 V	V _{CC} – 0.1			V _{CC} – 0.1		V _{CC} – 0.1		V
	I _{OH} = –1.1 mA	1.1 V	0.75 × V _{CC}			0.7 × V _{CC}		0.7 × V _{CC}		
	I _{OH} = –1.7 mA	1.4 V	1.11			1.03		1.03		
	I _{OH} = –1.9 mA	1.65 V	1.32			1.3		1.3		
	I _{OH} = –2.3 mA	2.3 V	2.05			1.97		1.97		
	I _{OH} = –3.1 mA		1.9			1.85		1.85		
	I _{OH} = –2.7 mA	3 V	2.72			2.67		2.67		
	I _{OH} = –4 mA		2.6			2.55		2.55		

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			T _A = –40°C to 85°C		T _A = 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OL}	I _{OL} = 20 µA	0.8 V to 3.6 V			0.1		0.1		0.1	V
	I _{OL} = 1.1 mA	1.1 V			0.3 × V _{CC}		0.3 × V _{CC}		0.3 × V _{CC}	
	I _{OL} = 1.7 mA	1.4 V			0.31		0.37		0.37	
	I _{OL} = 1.9 mA	1.65 V			0.31		0.35		0.35	
	I _{OL} = 2.3 mA	2.3 V			0.31		0.33		0.33	
	I _{OL} = 3.1 mA				0.44		0.45		0.45	
	I _{OL} = 2.7 mA	3 V			0.31		0.33		0.33	
	I _{OL} = 4 mA				0.44		0.45		0.45	
I _I	A or B input	V _I = GND to 3.6 V			0.1		0.5		0.5	µA
I _{off}	V _I or V _O = 0 V to 3.6 V	0 V			0.2		0.6		0.8	µA
ΔI _{off}	V _I or V _O = 0 V to 3.6 V	0 V to 0.2 V			0.2		0.6		0.8	µA
I _{CC}	V _I = GND or (V _{CC} to 3.6 V), I _O = 0	0.8 V to 3.6 V			0.5		0.9		1.2	µA
ΔI _{CC}	V _I = V _{CC} – 0.6 V ⁽¹⁾ , I _O = 0	3.3 V			40		50		23	µA
C _i	V _I = V _{CC} or GND	0 V		1.5						pF
		3.6 V		1.5						
C _o	V _O = GND	0 V		3						pF

(1) One input at V_{CC} – 0.6 V, other input at V_{CC} or GND.

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, C_L = 5 pF (unless otherwise noted) (see Figure 3 and Figure 4)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			T _A = –40°C to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t _{pd}	A or B	Y	0.8 V		18				ns
			1.2 V ± 0.1 V	2.6	7.3	12.8	2.1	15.6	
			1.5 V ± 0.1 V	1.4	5.2	8.7	0.9	10.3	
			1.8 V ± 0.15 V	1	4.2	6.6	0.5	8.2	
			2.5 V ± 0.2 V	1	3	4.4	0.5	5.5	
			3.3 V ± 0.3 V	1	2.4	3.5	0.5	4.3	

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, C_L = 10 pF (unless otherwise noted) (see Figure 3 and Figure 4)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	T _A = 25°C			T _A = –40°C to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t _{pd}	A or B	Y	0.8 V		21				ns
			1.2 V ± 0.1 V	1.5	8.5	14.7	1	17.2	
			1.5 V ± 0.1 V	1	6.2	10	0.5	11.3	
			1.8 V ± 0.15 V	1	5	7.7	0.5	9	
			2.5 V ± 0.2 V	1	3.6	5.2	0.5	6.1	
			3.3 V ± 0.3 V	1	2.9	4.2	0.5	4.7	

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $C_L = 15$ pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	A or B	Y	0.8 V		24				ns
			1.2 V $\pm$ 0.1 V	3.6	9.9	16.3	3.1	19.9	
			1.5 V $\pm$ 0.1 V	2.3	7.2	11.1	1.8	13.2	
			1.8 V $\pm$ 0.15 V	1.6	5.8	8.7	1.1	10.6	
			2.5 V $\pm$ 0.2 V	1	4.3	5.9	0.5	7.3	
			3.3 V $\pm$ 0.3 V	1	3.4	4.8	0.5	5.9	

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $C_L = 30$ pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

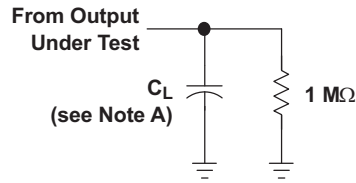
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		$T_A = 125^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A or B	Y	0.8 V		32.8						ns
			1.2 V $\pm$ 0.1 V	4.9	13.1	20.9	4.4	25.5	4.4	27.8	
			1.5 V $\pm$ 0.1 V	3.4	9.5	14.2	2.9	16.9	2.9	18	
			1.8 V $\pm$ 0.15 V	2.5	7.7	11	2	13.5	2	19.7	
			2.5 V $\pm$ 0.2 V	1.8	5.7	7.6	1.3	9.4	1.3	11	
			3.3 V $\pm$ 0.3 V	1.5	4.7	6.2	1	7.5	1	8.7	

OPERATING CHARACTERISTICS

$T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	$f = 10$ MHz	0.8 V	4	pF
			1.2 V $\pm$ 0.1 V	4	
			1.5 V $\pm$ 0.1 V	4	
			1.8 V $\pm$ 0.15 V	4	
			2.5 V $\pm$ 0.2 V	4.1	
			3.3 V $\pm$ 0.3 V	4.3	

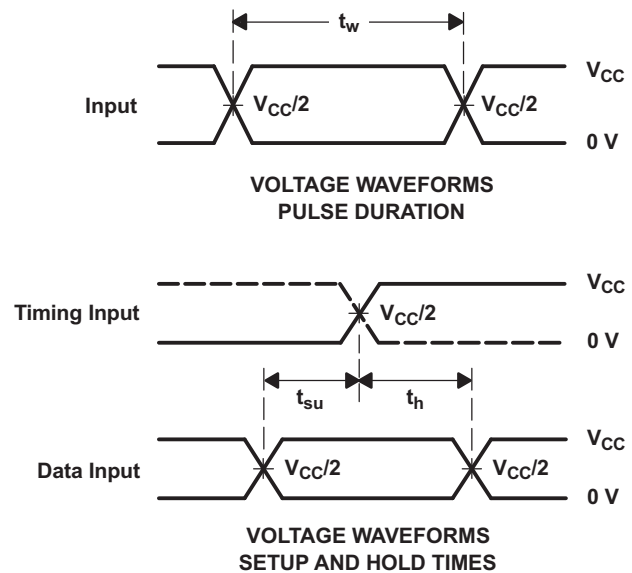
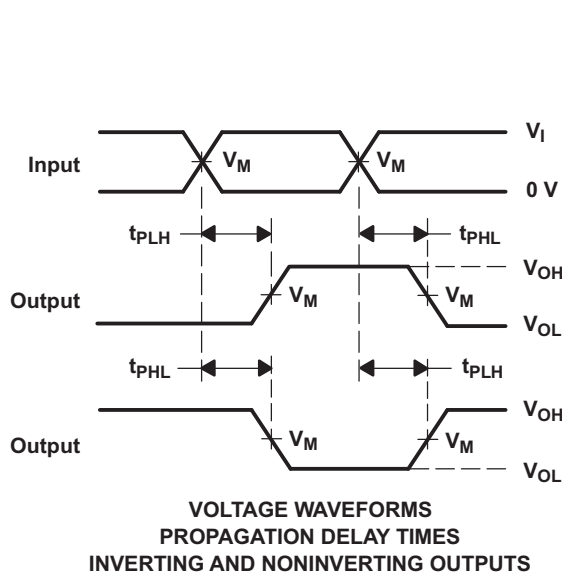
PARAMETER MEASUREMENT INFORMATION (Propagation Delays, Setup and Hold Times, and Pulse Duration)



LOAD CIRCUIT

$T_A = -25^{\circ}\text{C to } 85^{\circ}\text{C}$

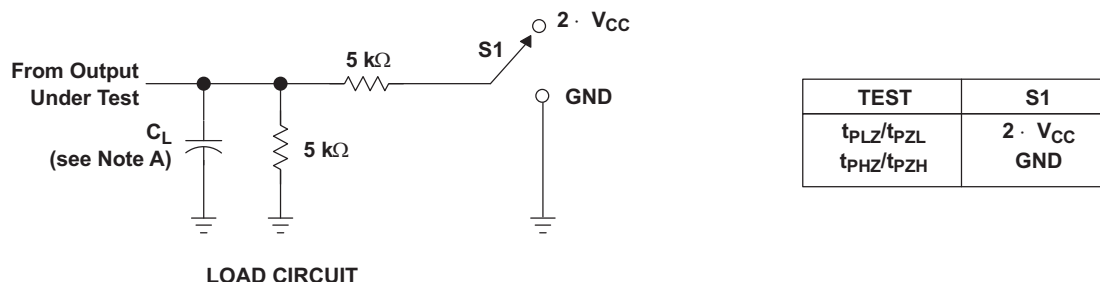
	$V_{CC} = 0.8 \text{ V}$	$V_{CC} = 1.2 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.5 \text{ V}$ $\pm 0.1 \text{ V}$	$V_{CC} = 1.8 \text{ V}$ $\pm 0.15 \text{ V}$	$V_{CC} = 2.5 \text{ V}$ $\pm 0.2 \text{ V}$	$V_{CC} = 3.3 \text{ V}$ $\pm 0.3 \text{ V}$
C_L	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF
V_M	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
V_I	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}



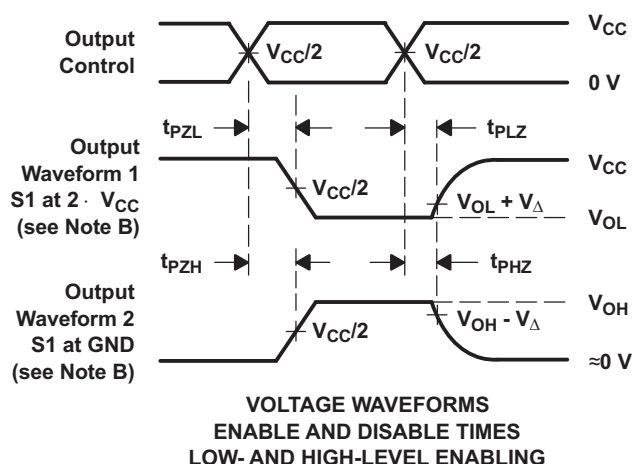
- NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: $\text{PRR} \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, slew rate $\geq 1 \text{ V/ns}$.
C. The outputs are measured one at a time, with one transition per measurement.
D. t_{PLH} and t_{PHL} are the same as t_{pd} .
E. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (Enable and Disable Times)


 $T_A = -25^\circ\text{C to } 85^\circ\text{C}$

	$V_{CC} = 0.8\text{ V}$	$V_{CC} = 1.2\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.5\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$
C_L	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF
V_M	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
V_I	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}
V_Δ	0.1 V	0.1 V	0.1 V	0.15 V	0.15 V	0.3 V



- 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 $\leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, slew rate $\geq 1\text{ V/ns}$.
 - D. The outputs are measured one at a time, with one 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. All parameters and waveforms are not applicable to all devices.

Figure 4. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AUP1G08IDCKRQ1	PREVIEW	SC70	DCK	5	3000	TBD	Call TI	Call TI	-40 to 125		
SN74AUP1G08QDCKRQ1	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	-40 to 125	SIT	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) **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/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 SN74AUP1G08-Q1 :

- Catalog: [SN74AUP1G08](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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
SN74AUP1G08QDCKRQ 1	SC70	DCR	5	3000	180.0	8.4	2.47	2.3	1.25	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS

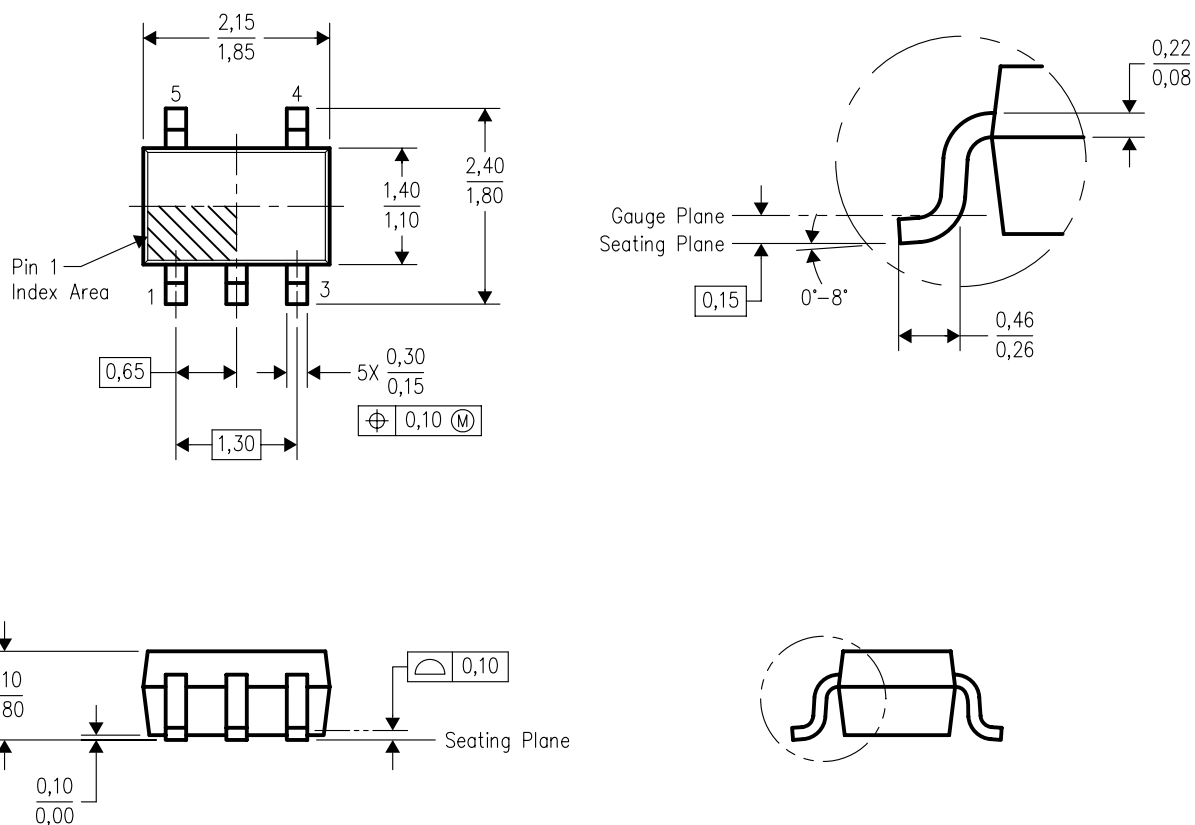


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUP1G08QDCKRQ1	SC70	DCK	5	3000	202.0	201.0	28.0

DCK (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE

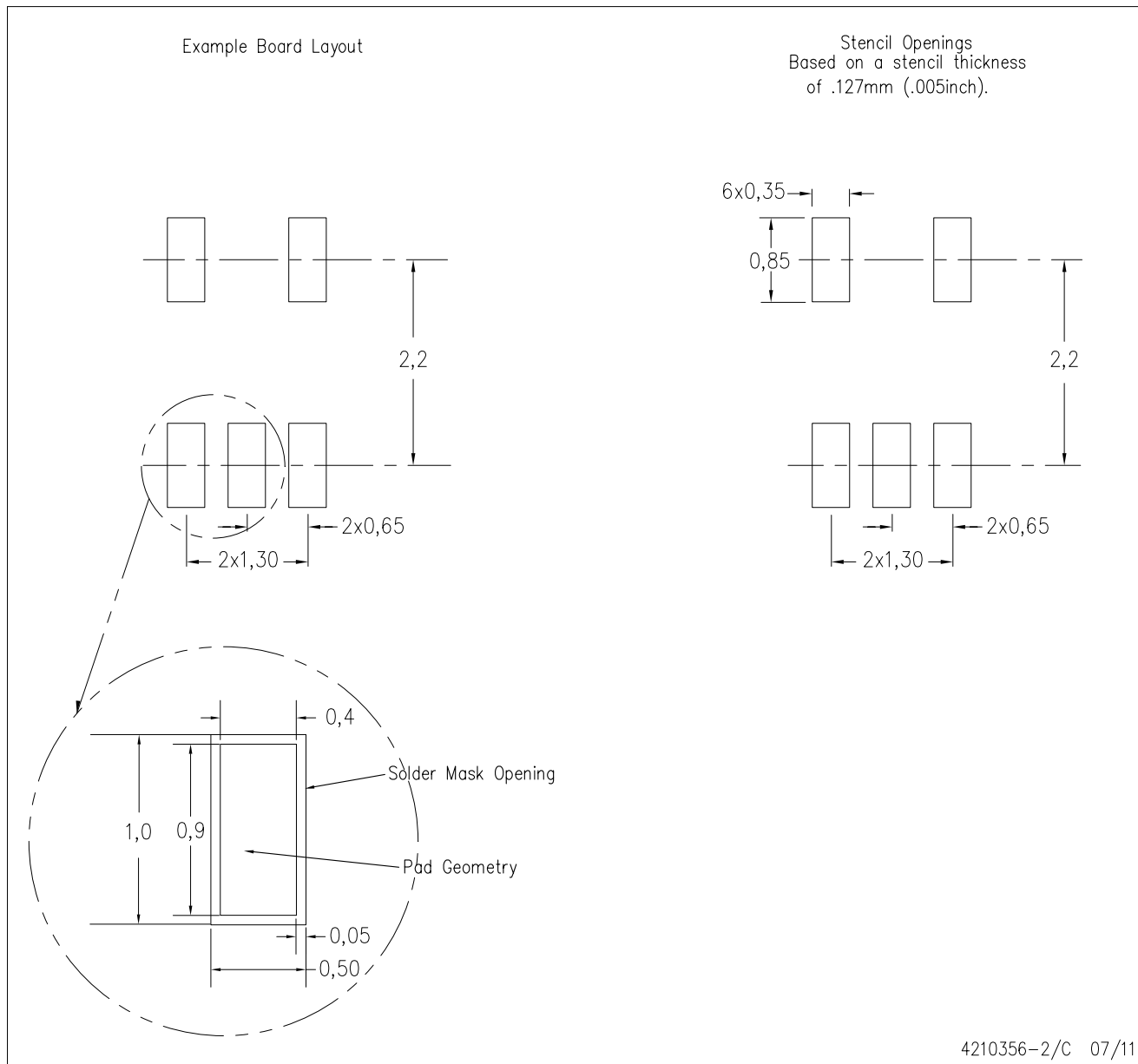


4093553-3/G 01/2007

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - Falls within JEDEC MO-203 variation AA.

DCK (R-PDSO-G5)

PLASTIC SMALL OUTLINE



- 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.

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