

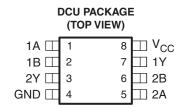
LOW-POWER DUAL 2-INPUT POSITIVE-NAND GATE

Check for Samples: SN74AUP2G00-Q1

FEATURES

- Qualified for Automotive Applications
- Low Static-Power Consumption (I_{CC} = 1.7 μA Maximum)
- Low Dynamic-Power Consumption (C_{pd} = 4.3 pF Typ at 3.3 V)
- Low Input Capacitance (C_i = 1.5 pF Typical)
- Low Noise Overshoot and Undershoot <10% of V_{CC}
- I_{off} Supports Partial-Power-Down Mode Operation
- Wide Operating V_{CC} Range of 0.8 V to 3.6 V
- Optimized for 3.3-V Operation

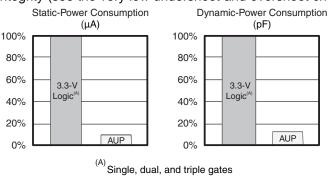
- 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operation
- t_{nd} = 5.9 ns Maximum at 3.3 V
- Suitable for Point-to-Point Applications
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II

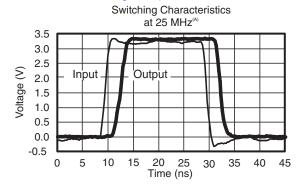


See mechanical drawings for dimensions.

DESCRIPTION/ORDERING INFORMATION

The AUP family is TI's premier solution to the industry's low-power needs 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).





^(A) SN74AUP2Gxx data at $C_1 = 15 pF$.

Figure 1. AUP - The Lowest-Power Family

Figure 2. Excellent Signal Integrity

The SN74AUP2G00 performs the Boolean function $Y = \overline{A \cdot B}$ or $Y = \overline{A} + \overline{B}$ in positive logic.

NanoStar™ package technology is a major breakthrough in IC packaging concepts, using 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.



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.



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ORDERING INFORMATION(1)

T _A	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING	
-40°C to 125°C	VSSOP - DCU	Reel of 3000	SN74AUP2G00QDCURQ1	SBTQ	

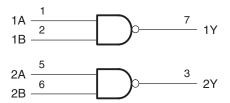
- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

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

FUNCTION TABLE

INP	UTS	OUTPUT
Α	В	Y
L	L	Н
L	Χ	Н
X	L	Н
Н	Н	L

LOGIC DIAGRAM (POSITIVE LOGIC)



Pin number shown are for DCU and DQE packages.



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
VI	Input voltage range ⁽²⁾			4.6	V
Vo	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾			4.6	V
Vo	Output voltage range in the high or low state (2)			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
Io	Continuous output current			±20	mA
	Continuous current through V _{CC} or GND			±50	mA
θ_{JA}	Package thermal impedance, junction to free air	DCU package ⁽³⁾		220	°C/W
T _{stg}	Storage temperature range			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.

ESD PROTECTION

			MAX	UNIT
ESD	Electrostatic discharge rating	Human-Body Model (HBM)	1000	V

⁽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.

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RECOMMENDED OPERATING CONDITIONS(1)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		0.8	3.6	V
		V _{CC} = 0.8 V	V _{CC}		
V	High level input valtage	V _{CC} = 1.1 V to 1.95 V	0.65 × V _{CC}		V
V_{IH}	High-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.6		V
		V _{CC} = 3 V to 3.6 V	2		
		V _{CC} = 0.8 V		0	
V	Low lovel input voltogo	V _{CC} = 1.1 V to 1.95 V		0.35 × V _{CC}	V
V_{IL}	Low-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.7	V
		V _{CC} = 3 V to 3.6 V		0.9	
VI	Input voltage		0	3.6	V
Vo	Output voltage		0	V_{CC}	V
		V _{CC} = 0.8 V		-20	μΑ
	High level autout average	V _{CC} = 1.1 V		-1.1	
		V _{CC} = 1.4 V		-1.7	mA
I _{OH}	High-level output current	V _{CC} = 1.65		-1.9	
		V _{CC} = 2.3 V		-3.1	
		V _{CC} = 3 V		-4	
		V _{CC} = 0.8 V		20	μΑ
		V _{CC} = 1.1 V		1.1	
	Low lovel output ourrent	V _{CC} = 1.4 V		1.7	
l _{OL}	Low-level output current	V _{CC} = 1.65 V		1.9	mA
		V _{CC} = 2.3 V		3.1	
		V _{CC} = 3 V		4	
Δt/Δν	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)

DADAMETED	TEST CONDITIONS	V	T,	_A = 25°C	T _A = -40°C	to 125°C	LINUT
PARAMETER	TEST CONDITIONS	V _{cc}	MIN	TYP MAX	MIN	MAX	UNIT
	I _{OH} = -20 μA	0.8 V to 3.6 V	V _{CC} - 0.1		V _{CC} - 0.1		
	I _{OH} = -1.1 mA	1.1 V	0.75 × V _{CC}		0.7 × V _{CC}		
	$I_{OH} = -1.7 \text{ mA}$	1.4 V	1.11		1.03		
M	I _{OH} = -1.9 mA	1.65 V	1.32		1.3		\ /
V_{OH}	$I_{OH} = -2.3 \text{ mA}$	221/	2.05		1.97		V
	$I_{OH} = -3.1 \text{ mA}$	2.3 V	1.9		1.85		
	$I_{OH} = -2.7 \text{ mA}$	2.1/	2.72		2.67		
	$I_{OH} = -4 \text{ mA}$	3 V	2.6		2.55		
	I _{OL} = 20 μA	0.8 V to 3.6 V		0.1		0.1	
	I _{OL} = 1.1 mA	1.1 V		0.3 × V _{CC}		0.3 × V _{CC}	
	I _{OL} = 1.7 mA	1.4 V		0.31		0.37	
M	I _{OL} = 1.9 mA	1.65 V		0.31		0.35	V
V_{OL}	I _{OL} = 2.3 mA	0.01/		0.31		0.33	V
	I _{OL} = 3.1 mA	2.3 V		0.44		0.45	
	I _{OL} = 2.7 mA	2.1/		0.31		0.33	
	I _{OL} = 4 mA	3 V		0.44		0.45	
I _I A or B input	$V_I = GND \text{ to } 3.6 \text{ V}$	0 V to 3.6 V		0.1		0.5	μА
I _{off}	V_I or $V_O = 0$ V to 3.6 V	0 V		0.2		1.3	μА
ΔI_{off}	V_I or $V_O = 0$ V to 3.6 V	0 V to 0.2 V		0.2		2	μА
Icc	V_I = GND or (V_{CC} to 3.6 V), I_O = 0	0.8 V to 3.6 V		0.5		1.7	μΑ
Δl _{CC}	$V_I = V_{CC} - 0.6 V^{(1)},$ $I_O = 0$	3.3 V		40		50	μА
0	V V as CND	0 V		1.5			
C _i	$V_I = V_{CC}$ or GND	3.6 V		1.5			pF
Co	V _O = GND	0 V		3			pF

⁽¹⁾ One input at $V_{CC} - 0.6 \text{ V}$, other input at V_{CC} or GND

SWITCHING CHARACTERISTICS(1)

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

PARAMETER	FROM	TO (OUTPUT)	V _{cc}	14 - 23 0			T _A = -40	UNIT	
	(INPUT)	(OUTPUT)		MIN	TYP	MAX	MIN	MAX	
			0.8 V		19.8				
			1.2 V ± 0.1 V	2.6	7.8	18.8	2.1	20.9	
	t _{pd} A or B Y	V	1.5 V ± 0.1 V	1.4	5.4	11.8	0.9	12.7	
T _{pd}		Y	1.8 V ± 0.15 V	1	4.3	9	0.5	9.5	ns
			2.5 V ± 0.2 V	1	3	5.9	0.5	6.4	
			3.3 V ± 0.3 V	1	2.4	5.2	0.5	5.7	

⁽¹⁾ Specified by design. Not production tested.

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SWITCHING CHARACTERISTICS(1)

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

PARAMETER	FROM	TO (OUTPUT)	V _{cc}	T	_{\(\)} = 25°C		T _A = -40 125°		UNIT
	(INPUT)	(OUTPUT)		MIN	TYP	MAX	MIN	MAX	
		0.8 V		23.1					
			1.2 V ± 0.1 V	1.5	8.9	21.1	1	22.1	
	A D		1.5 V ± 0.1 V	1	6.3	13.2	0.5	13.7	
t _{pd}	A or B	Y	Y 1.8 V ± 0.15 V 1 5 10	10.1	0.5	10.6	ns		
			2.5 V ± 0.2 V	1	3.6	7.4	0.5	7.9	
			3.3 V ± 0.3 V	1	2.9	5.5	0.5	6	

⁽¹⁾ Specified by design. Not production tested.

SWITCHING CHARACTERISTICS(1)

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

PARAMETER	FROM	TO (OUTPUT)	V _{cc}	T,	λ = 25°C		T _A = -40	0°C to °C	UNIT
	(INPUT)	(OUTPUT)		MIN	TYP	MAX	MIN	MIN MAX	
			0.8 V		24.7				
			1.2 V ± 0.1 V	3.6	9.8	21.7	3.1	24.8	
•		Y	1.5 V ± 0.1 V	2.3	4.6	14	1.8	15.8	
t _{pd}	A or B	Ť	1.8 V ± 0.15 V	1.6	5.5	10.6	1.1	11.7	ns
			2.5 V ± 0.2 V	1	4	7	0.5	7.5	
			3.3 V ± 0.3 V	1	3.3	5.9	0.5	6.4	1

⁽¹⁾ Specified by design. Not production tested.

SWITCHING CHARACTERISTICS

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

PARAMETER	FROM TO (OUTPUT) V _{CC}	_	V			V		;	$T_A = -40$		UNIT
			MIN	TYP	MAX	MIN	MAX				
		$\begin{array}{c} 0.8 \text{ V} \\ \hline 1.2 \text{ V} \pm 0.1 \text{ V} \\ \hline 1.5 \text{ V} \pm 0.1 \text{ V} \\ \hline 1.8 \text{ V} \pm 0.15 \text{ V} \end{array}$	0.8 V		31.8				ns		
			1.2 V ± 0.1 V	4.9	12.6	26.3	4.4	29			
	A or B		1.5 V ± 0.1 V	3.4	9	16.6	2.9	20			
t _{pd}	AOIB		1.8 V ± 0.15 V	2.5	7.3	12.9	2	15.7			
			2.5 V ± 0.2 V	1.8 5.4 8	8.8	1.3	11.4				
			3.3 V ± 0.3 V	1.5	4.5	7	1	9.5			

OPERATING CHARACTERISTICS

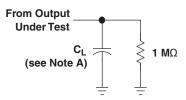
 $T_A = 25$ °C

	PARAMETER	TEST CONDITIONS	V _{cc}	TYP	UNIT
			0.8 V	4	
		f = 10 MHz	1.2 V ± 0.1 V	4	pF
0	Davis dissination consistence		1.5 V ± 0.1 V	4	
C _{pd}	Power dissipation capacitance		1.8 V ± 0.15 V	4	
			2.5 V ± 0.2 V	4.1	
			3.3 V ± 0.3 V	4.3	

Submit Documentation Feedback

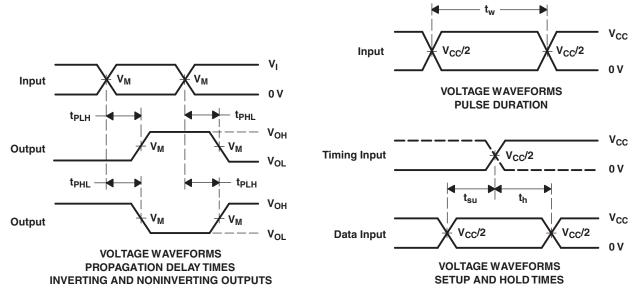


PARAMETER MEASUREMENT INFORMATION (Propagation Delays, Setup and Hold Times, and Pulse Width)



LOAD CIRCUIT

	V _{CC} = 0.8 V	V _{CC} = 1.2 V ± 0.1 V	V _{CC} = 1.5 V ± 0.1 V	V_{CC} = 1.8 V \pm 0.15 V	V_{CC} = 2.5 V \pm 0.2 V	V _{CC} = 3.3 V ± 0.3 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}



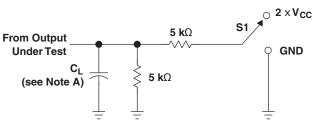
- A. C_L includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_O = 50 \Omega$, for propagation delays $t_r/t_f = 3$ ns, for setup and hold times and pulse width $t_r/t_f = 1.2$ ns.
- D. The outputs are measured one at a time, with one transition per measurement.
- E. t_{PLH} and t_{PHL} are the same as t_{pd} .
- F. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

Instruments

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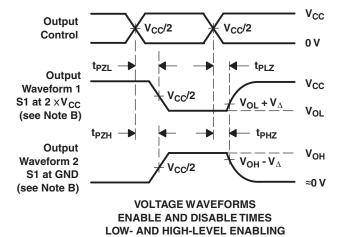
PARAMETER MEASUREMENT INFORMATION (Enable and Disable Times)



TEST	S1
t _{PLZ} /t _{PZL} t _{PHZ} /t _{PZH}	2×V _{CC} GND

LOAD CIRCUIT

	V _{CC} = 0.8 V	V _{CC} = 1.2 V ± 0.1 V	V _{CC} = 1.5 V ± 0.1 V	V_{CC} = 1.8 V \pm 0.15 V	V_{CC} = 2.5 V \pm 0.2 V	V _{CC} = 3.3 V ± 0.3 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 _∆	0.1 V	0.1 V	0.1 V	0.15 V	0.15 V	0.3 V



- 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 MHz, $Z_O = 50 \Omega$, $t_r/t_f = 3$ 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_{PLH} and t_{PHL} are the same as t_{pd}.
- G. All parameters and waveforms are not applicable to all devices.

Figure 4. Load Circuit and Voltage Waveforms

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PACKAGING INFORMATION

Orderable part number	Status	Material type	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material	MSL rating/ Peak reflow	Op temp (°C)	Part marking (6)
SN74AUP2G00QDCURQ1	Active	Production	VSSOP (DCU) 8	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	SBTQ
SN74AUP2G00QDCURQ1.B	Active	Production	VSSOP (DCU) 8	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	SBTQ

⁽¹⁾ Status: For more details on status, see our product life cycle.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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OTHER QUALIFIED VERSIONS OF SN74AUP2G00-Q1:

Catalog: SN74AUP2G00

⁽²⁾ Material type: When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ RoHS values: Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

⁽⁴⁾ Lead finish/Ball material: Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.



PACKAGE OPTION ADDENDUM

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NOTE: Qualified Version Definitions:

 $_{\bullet}$ Catalog - TI's standard catalog product

PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





	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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing			Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AUP2G00QDCURQ 1	VSSOP	DCU	8	3000	180.0	8.4	2.25	3.35	1.05	4.0	8.0	Q3

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*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUP2G00QDCURQ1	VSSOP	DCU	8	3000	202.0	201.0	28.0



SMALL OUTLINE PACKAGE



NOTES:

- 1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

 2. This drawing is subject to change without notice.

 3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not
- exceed 0.15 mm per side.
 4. Reference JEDEC registration MO-187 variation CA.



SMALL OUTLINE PACKAGE



NOTES: (continued)

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



SMALL OUTLINE PACKAGE



NOTES: (continued)

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



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