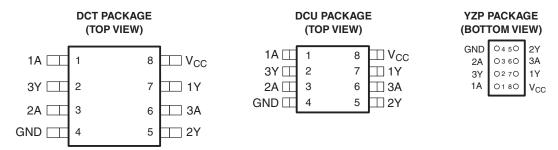


FEATURES

- Available in the Texas Instruments
 NanoFree™ Package
- Supports 5-V V_{CC} Operation
- Inputs Accept Voltages to 5.5 V
- Max t_{nd} of 4.1 ns at 3.3 V
- Low Power Consumption, 10-μA Max I_{CC}
- ±24-mA Output Drive at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C
- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at V_{CC} = 3.3 V, T_Δ = 25°C

- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)



See mechanical drawings for dimensions.

DESCRIPTION/ORDERING INFORMATION

This triple inverter is designed for 1.65-V to 5.5-V V_{CC} operation. The SN74LVC3G04 performs the Boolean function $Y = \overline{A}$.

NanoFree[™] 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.

ORDERING INFORMATION

T _A	PACKAGE ⁽¹⁾⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING(3)	
	NanoFree [™] – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Reel of 3000	SN74LVC3G04YZPR	CC_	
-40°C to 85°C	SSOP - DCT	Reel of 3000	SN74LVC3G04DCTR	C04	
	VSSOP – DCU	Reel of 3000	SN74LVC3G04DCUR	C04	
	V350F - DC0	Reel of 250	SN74LVC3G04DCUT	C04_	

- Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
- (2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
- (3) DCT: The actual top-side marking has three additional characters that designate the year, month, and assembly/test site. DCU: The actual top-side marking has one additional character that designates the assembly/test 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 assembly/test site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).



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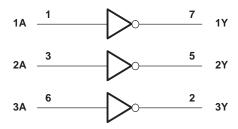
NanoFree is a trademark of Texas Instruments.



FUNCTION TABLE (EACH INVERTER)

INPUT A	OUTPUT Y
Н	L
L	Н

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	6.5	V	
VI	Input voltage range (2)	-0.5	6.5	V		
Vo	Voltage range applied to any output when the output is in the high-impedan	Voltage range applied to any output when the output is in the high-impedance or power-off state (2)				
Vo	Voltage range applied to any output wh	age range applied to any output when the output is in the high or low state ⁽²⁾⁽³⁾ It clamp current $V_1 < 0$				
I _{IK}	Input clamp current	V ₁ < 0		- 50	mA	
I _{OK}	Output clamp current	V _O < 0		– 50	mA	
Io	Continuous output current			±50	mA	
	Continuous current through V _{CC} or GN	D		±100	mA	
		DCT package		220		
θ_{JA}	Package thermal impedance (4)	DCU package		227	°C/W	
		YZP package		102		
T _{stg}	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 value of V_{CC} is provided in the recommended operating conditions table.

⁽⁴⁾ The package thermal impedance is calculated in accordance with JESD 51-7.

SN74LVC3G04 TRIPLE INVERTER GATE

Recommended Operating Conditions⁽¹⁾

			MIN	MAX	UNIT			
V	Cupality voltage	Operating	1.65	5.5	V			
V_{CC}	Supply voltage	Data retention only	1.5		V			
		V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}					
V	High lovel input voltage	V_{CC} = 2.3 V to 2.7 V	1.7		V			
V_{IH}	High-level input voltage	$V_{CC} = 3 V \text{ to } 3.6 V$	2		V			
		V _{CC} = 4.5 V to 5.5 V	0.7 × V _{CC}					
		V _{CC} = 1.65 V to 1.95 V		0.35 × V _{CC}				
V	Low level input valtage	level input voltage						
V_{IL}	Low-level input voltage	V _{CC} = 3 V to 3.6 V		0.8	V			
			0.3 × V _{CC}					
VI	Input voltage		0	5.5	V			
Vo	Output voltage		0	V _{CC}	V			
		V _{CC} = 1.65 V		-4				
	High-level output current	V _{CC} = 2.3 V		-8				
I_{OH}		V 2V		-16	mA			
		V _{CC} = 3 V		-24				
		V _{CC} = 4.5 V		-32				
		V _{CC} = 1.65 V		4				
		V _{CC} = 2.3 V		8				
I_{OL}	Low-level output current			16	mA			
		V _{CC} = 3 V		24				
		V _{CC} = 4.5 V		32				
		$V_{CC} = 1.8 \text{ V} \pm 0.15 \text{ V}, 2.5 \text{ V} \pm 0.2 \text{ V}$		20				
Δt/Δν	Input transition rise or fall rate	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		10	ns/V			
		$V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$		1				
T _A	Operating free-air temperature	<u>'</u>	-40	85	°C			

⁽¹⁾ All unused inputs of the device must be held at V_{CC} 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 _{cc}	MIN TYP ⁽¹⁾ MAX	UNIT		
	$I_{OH} = -100 \mu A$	1.65 V to 5.5 V	V _{CC} - 0.1			
	$I_{OH} = -4 \text{ mA}$	1.65 V	1.2	V		
\ <u>\</u>	$I_{OH} = -8 \text{ mA}$	2.3 V	1.9			
V _{OH}	$I_{OH} = -16 \text{ mA}$	3 V	2.4	V		
	$I_{OH} = -24 \text{ mA}$	3 V	2.3			
	$I_{OH} = -32 \text{ mA}$	4.5 V	3.8			
	I _{OL} = 100 μA	1.65 V to 5.5 V	0.1			
	I _{OL} = 4 mA	1.65 V	0.45	-		
V	I _{OL} = 8 mA	2.3 V	0.3	V		
V _{OL}	I _{OL} = 16 mA	3 V	0.4	V		
	I _{OL} = 24 mA	3 V	0.55			
	I _{OL} = 32 mA	4.5 V	0.55			
I _I A inputs	$V_I = 5.5 \text{ V or GND}$	0 to 5.5 V	±5	μΑ		
I _{off}	V_I or $V_O = 5.5 \text{ V}$	0	±10	μΑ		
I _{CC}	$V_I = 5.5 \text{ V or GND}, \qquad I_O = 0$	1.65 V to 5.5 V	10	μΑ		
ΔI_{CC}	One input at V_{CC} – 0.6 V, Other inputs at V_{CC} or GND	3 V to 5.5 V	500	μΑ		
C _i	$V_I = V_{CC}$ or GND	3.3 V	3.5	pF		

⁽¹⁾ All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = ± 0.1		V _{CC} = : ± 0.2		V _{CC} = ± 0.3		V _{CC} = ± 0.5		UNIT	
	(INPUT)	(001F01)	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
t _{pd}	Α	Υ	3.2	7.9	1.5	4.4	1.4	4.1	1.1	3.2	ns	

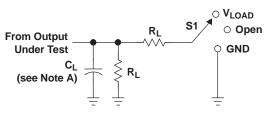
Operating Characteristics

 $T_A = 25^{\circ}C$

	PARAMETER	TEST CONDITIONS	V _{CC} = 1.8 V	V _{CC} = 2.5 V	V _{CC} = 3.3 V	V _{CC} = 5 V	UNIT	
	FARAMETER	TYP		TYP	TYP	TYP	ONII	
C_{pd}	Power dissipation capacitance	f = 10 MHz	16	16	16	18	pF	



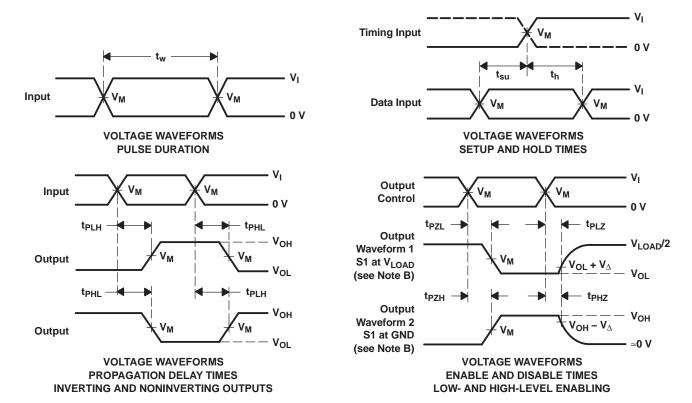
PARAMETER MEASUREMENT INFORMATION



TEST	S1
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	V _{LOAD}
t _{PHZ} /t _{PZH}	GND

LOAD CIRCUIT

V	V _I t _r /t _f		· ·	V	•	D.	V
V _{CC}			V _M	V _{LOAD}	CL	R _L	V_{Δ}
1.8 V \pm 0.15 V	V _{CC}	≤ 2 ns	V _{CC} /2	2×V _{CC}	30 pF	1 k Ω	0.15 V
2.5 V \pm 0.2 V	V _{CC}	≤2 ns	V _{CC} /2	2×V _{CC}	30 pF	500 Ω	0.15 V
3.3 V \pm 0.3 V	3 V	≤2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
5 V ± 0.5 V	V _{CC}	≤2.5 ns	V _{CC} /2	2×V _{CC}	50 pF	500 Ω	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 MHz, $Z_O = 50 \Omega$.
- 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. t_{PLH} and t_{PHL} are the same as t_{pd} .
- H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms







PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74LVC3G04DCTR	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04DCTRE4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04DCTRG4	ACTIVE	SM8	DCT	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04DCUR	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04DCURE4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04DCURG4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04DCUT	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04DCUTE4	ACTIVE	US8	DCU	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC3G04YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM

(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.

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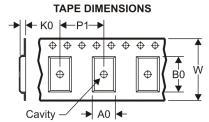
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PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVC3G04DCUR	US8	DCU	8	3000	180.0	9.2	2.25	3.35	1.05	4.0	8.0	Q3
SN74LVC3G04YZPR	DSBGA	YZP	8	3000	180.0	8.4	1.02	2.02	0.63	4.0	8.0	Q1

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*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC3G04DCUR	US8	DCU	8	3000	202.0	201.0	28.0
SN74LVC3G04YZPR	DSBGA	YZP	8	3000	220.0	220.0	34.0

DCT (R-PDSO-G8)

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
- D. Falls within JEDEC MO-187 variation DA.

DCU (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



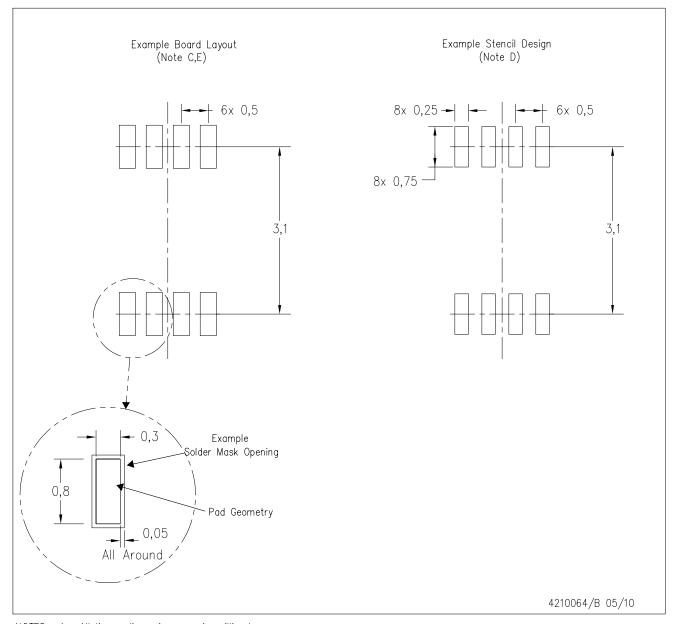
NOTES:

- 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-187 variation CA.



DCU (S-PDSO-G8)

PLASTIC SMALL OUTLINE PACKAGE (DIE DOWN)



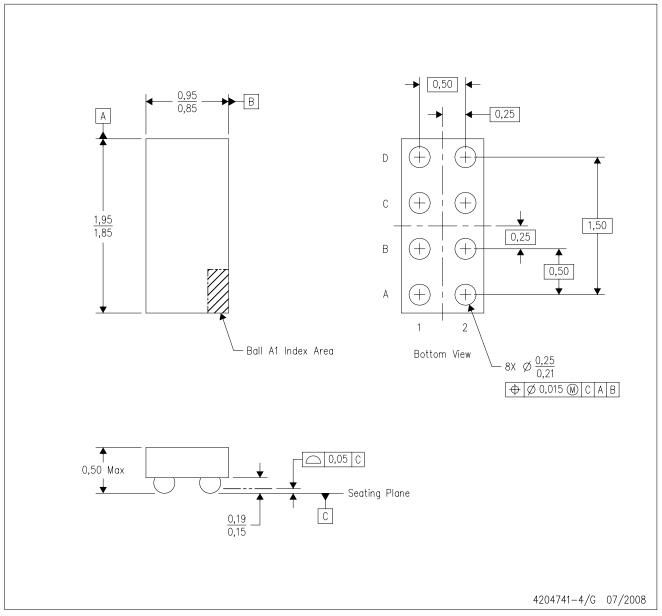
NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. 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.



YZP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



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. NanoFree $^{\text{TM}}$ package configuration.
- D. This package is lead-free. Refer to the 8 YEP package (drawing 4204725) for tin-lead (SnPb).

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