

SINGLE 3-INPUT POSITIVE OR-AND GATE

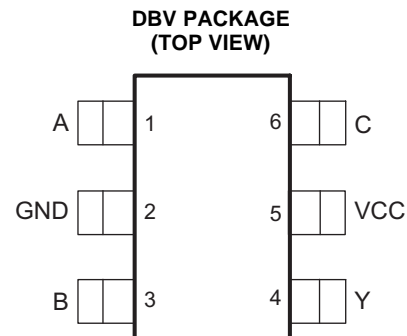
 Check for Samples: [SN74LVC1G3208-EP](#)

FEATURES

- Supports 5-V V_{CC} Operation
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 5 ns at 3.3 V
- Low Power Consumption, 12.5- μ A Max I_{CC}
- \pm 24-mA Output Drive at 3.3 V
- Input Hysteresis Allows Slow Input Transition and Better Switching Noise Immunity at the Input
($V_{hys} = 250$ mV Typ at 3.3 V)
- Can Be Used in Three Combinations:
 - OR-AND Gate
 - OR Gate
 - AND Gate
- I_{off} Supports Partial-Power-Down Mode Operation

SUPPORTS DEFENSE, AEROSPACE, AND MEDICAL APPLICATIONS

- Controlled Baseline
- One Assembly and Test Site
- One Fabrication Site
- Available in Military (-55°C to 125°C) Temperature Ranges ⁽¹⁾
- Extended Product Life Cycle
- Extended Product-Change Notification
- Product Traceability



(1) Custom temperature ranges available

DESCRIPTION/ORDERING INFORMATION

This device is designed for 1.65-V to 5.5-V V_{CC} operation.

The SN74LVC1G3208 is a single 3-input positive OR-AND gate. It performs the Boolean function $Y = (A + B) \cdot C$ in positive logic.

By tying one input to GND or V_{CC} , the SN74LVC1G3208 offers two more functions. When C is tied to V_{CC} , this device performs as a 2-input OR gate ($Y = A + B$). When A is tied to GND, the device works as a 2-input AND gate ($Y = B \cdot C$). This device also works as a 2-input AND gate when B is tied to GND ($Y = A \cdot C$).

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.

Table 1. ORDERING INFORMATION⁽¹⁾

T_A	PACKAGE		ORDERABLE PART NUMBER	TOP-SIDE MARKING	VID NUMBER
-55°C to 125°C	SOT (SOT-23) – DBV	Reel of 250	74LVC1G3208MDBVTEP	CDD5M	V62/13605-01XE

(1) 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.



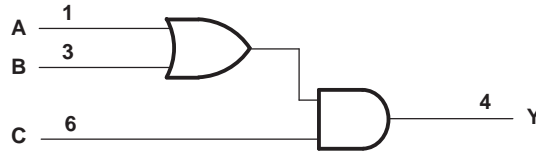
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

FUNCTION TABLE⁽¹⁾

INPUTS			OUTPUT Y
A	B	C	
H	X	H	H
X	H	H	H
X	X	L	L
L	L	H	L

(1) X = Valid H or L

LOGIC DIAGRAM (POSITIVE LOGIC)



FUNCTION SELECTION TABLE

LOGIC FUNCTION	FIGURE
2-Input AND Gate	1
2-Input OR Gate	2
$Y = (A + B) \cdot C$	3

LOGIC CONFIGURATIONS

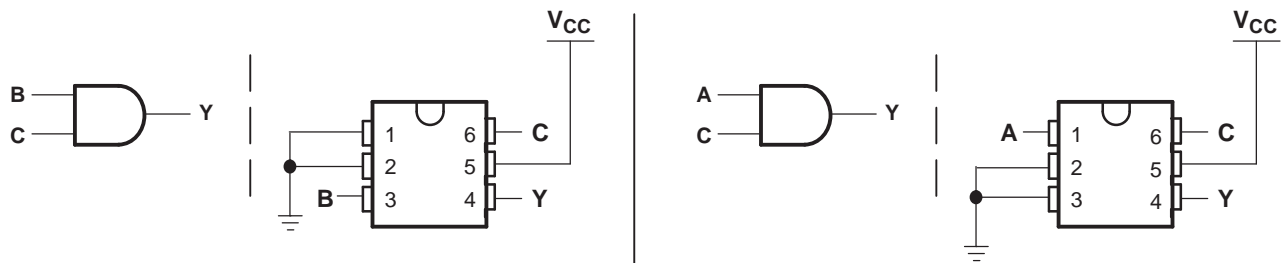


Figure 1. 2-Input AND Gate

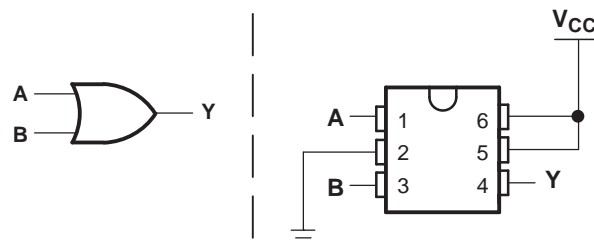


Figure 2. 2-Input OR Gate



Figure 3. $Y = (A + B) \cdot C$

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
V_I Input voltage range ⁽²⁾	-0.5	6.5	V
V_O Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	-0.5	6.5	V
V_O Voltage range applied to any output in the high or low state ^{(2) (3)}	-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			±50 mA
Continuous current through V_{CC} or GND			±100 mA
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.

THERMAL INFORMATION

THERMAL METRIC ⁽¹⁾	SN74LVC1G3208		UNITS
	DBV		
	6 PINS		
θ_{JA} Junction-to-ambient thermal resistance ⁽²⁾	207		°C/W
θ_{JCTop} Junction-to-case (top) thermal resistance ⁽³⁾	148.1		
θ_{JB} Junction-to-board thermal resistance ⁽⁴⁾	50.6		
ψ_{JT} Junction-to-top characterization parameter ⁽⁵⁾	41.2		
ψ_{JB} Junction-to-board characterization parameter ⁽⁶⁾	50.1		
θ_{JCbott} Junction-to-case (bottom) thermal resistance ⁽⁷⁾	N/A		

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).
- (2) The junction-to-ambient thermal resistance under natural convection is obtained in a simulation on a JEDEC-standard, high-K board, as specified in JESD51-7, in an environment described in JESD51-2a.
- (3) The junction-to-case (top) thermal resistance is obtained by simulating a cold plate test on the package top. No specific JEDEC-standard test exists, but a close description can be found in the ANSI SEMI standard G30-88.
- (4) The junction-to-board thermal resistance is obtained by simulating in an environment with a ring cold plate fixture to control the PCB temperature, as described in JESD51-8.
- (5) The junction-to-top characterization parameter, ψ_{JT} , estimates the junction temperature of a device in a real system and is extracted from the simulation data for obtaining θ_{JA} , using a procedure described in JESD51-2a (sections 6 and 7).
- (6) The junction-to-board characterization parameter, ψ_{JB} , estimates the junction temperature of a device in a real system and is extracted from the simulation data for obtaining θ_{JA} , using a procedure described in JESD51-2a (sections 6 and 7).
- (7) The junction-to-case (bottom) thermal resistance is obtained by simulating a cold plate test on the exposed (power) pad. No specific JEDEC standard test exists, but a close description can be found in the ANSI SEMI standard G30-88.

Recommended Operating Conditions⁽¹⁾

			MIN	MAX	UNIT
V _{CC}	Supply voltage	Operating	1.65	5.5	V
		Data retention only	1.5		
V _{IH}	High-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V	1.7		
		V _{CC} = 3 V to 3.6 V	2		
		V _{CC} = 4.5 V to 5.5 V	0.7 × V _{CC}		
V _{IL}	Low-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.35 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V	0.7		
		V _{CC} = 3 V to 3.6 V	0.8		
		V _{CC} = 4.5 V to 5.5 V	1.4		
V _I	Input voltage		0	5.5	V
V _O	Output voltage		0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 1.65 V	–4		mA
		V _{CC} = 2.3 V	–8		
		V _{CC} = 3 V	–16		
			–24		
		V _{CC} = 4.5 V	–32		
I _{OL}	Low-level output current	V _{CC} = 1.65 V	4		mA
		V _{CC} = 2.3 V	8		
		V _{CC} = 3 V	16		
			24		
		V _{CC} = 4.5 V	32		
Δt/Δv	Input transition rise or fall rate	V _{CC} = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V	20		ns/V
		V _{CC} = 3.3 V ± 0.3 V	10		
		V _{CC} = 5 V ± 0.5 V	5		
T _A	Operating free-air temperature		–55	125	°C

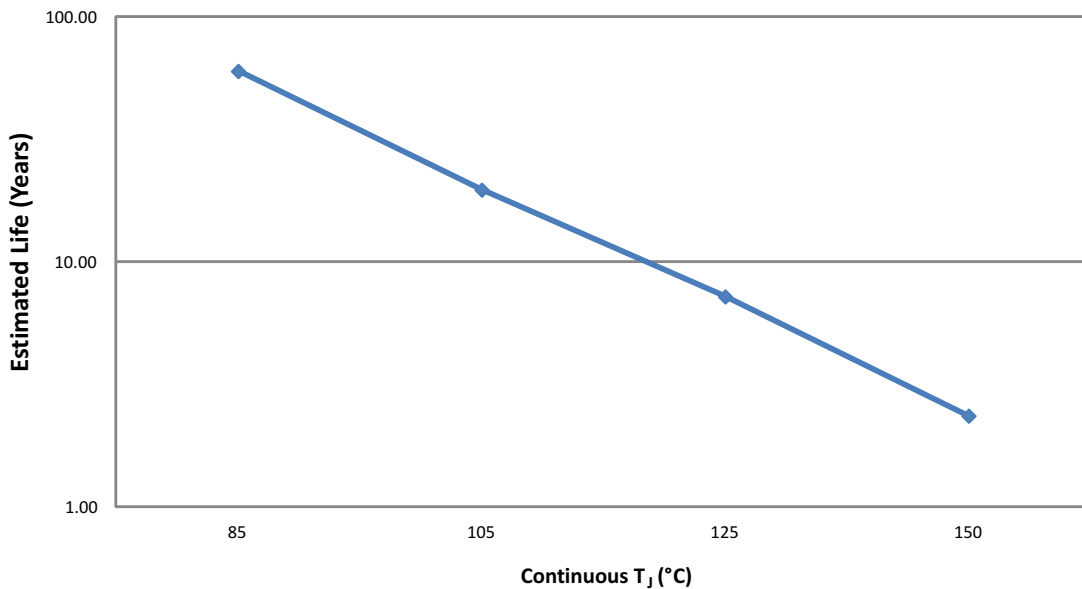
(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	V _{CC}	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{OH}		I _{OH} = -100 µA	1.65 V to 5.5 V	V _{CC} - 0.1			V
		I _{OH} = -4 mA	1.65 V	1.2			
		I _{OH} = -8 mA	2.3 V	1.9			
		I _{OH} = -16 mA	3 V	2.4			
		I _{OH} = -24 mA		2.3			
		I _{OH} = -32 mA	4.5 V	3.8			
V _{OL}		I _{OL} = 100 µA	1.65 V to 5.5 V			0.11	V
		I _{OL} = 4 mA	1.65 V			0.52	
		I _{OL} = 8 mA	2.3 V			0.45	
		I _{OL} = 16 mA	3 V			0.68	
		I _{OL} = 24 mA				1.1	
		I _{OL} = 32 mA	4.5 V			1.1	
I _I	A, B, or C inputs	V _I = 5.5 V or GND	0 to 5.5 V	-12.05		8.6	µA
I _{off}		V _I or V _O = 5.5 V	0	-22		41.5	µA
I _{CC}		V _I = 5.5 V or GND I _O = 0	1.65 V to 5.5 V			12.5	µA
ΔI _{CC}		One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	3 V to 5.5 V			500	µA
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.



- (1) See datasheet for absolute maximum and minimum recommended operating conditions.
- (2) Silicon operating life design goal is 10 years at 105°C junction temperature (does not include package interconnect life).
- (3) Enhanced plastic product disclaimer applies.

Figure 4. 74LVC1G3208-EP Operating Life Derating Chart

Switching Characteristics

only valid for -40°C to 85°C, $C_L = 15$ pF (unless otherwise noted) (see [Figure 5](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$		$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 5\text{ V}$ $\pm 0.5\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A, B, or C	Y	3.7	14	2.5	7	1.7	5	1.3	3.4	ns

Switching Characteristics

only valid for -40°C to 85°C, $C_L = 30$ pF or 50 pF (unless otherwise noted) (see [Figure 6](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$		$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 5\text{ V}$ $\pm 0.5\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A, B, or C	Y	2.5	17.5	1.8	7.6	1.8	5.9	1.3	4.0	ns

Switching Characteristics

over recommended operating free-air temperature range, $C_L = 50$ pF (unless otherwise noted) (see [Figure 6](#))

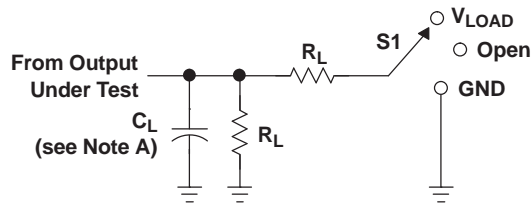
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$		$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 5\text{ V}$ $\pm 0.5\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A, B, or C	Y		17.5		7.6		5.9		4.5	ns

Operating Characteristics

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

PARAMETER	TEST CONDITIONS	$V_{CC} = 1.8\text{ V}$	$V_{CC} = 2.5\text{ V}$	$V_{CC} = 3.3\text{ V}$	$V_{CC} = 5\text{ V}$	UNIT
		TYP	TYP	TYP	TYP	
C_{pd} Power dissipation capacitance	$f = 10\text{ MHz}$	15	15	16	17	pF

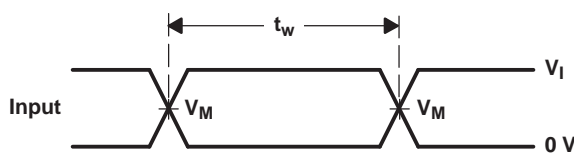
PARAMETER MEASUREMENT INFORMATION



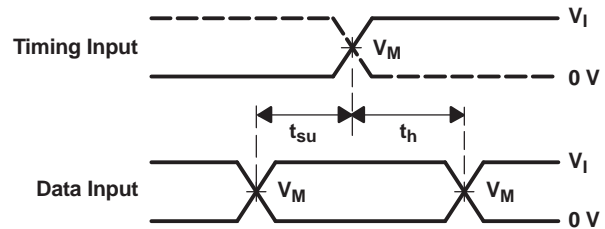
LOAD CIRCUIT

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

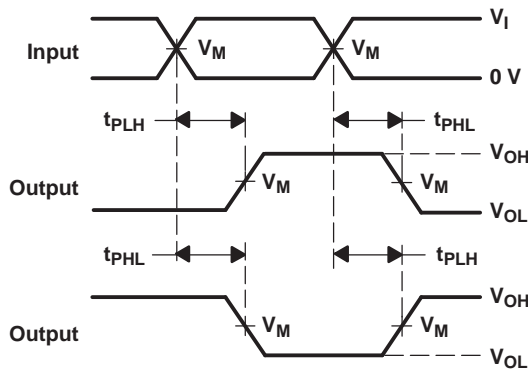
V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	t_r/t_f					
$1.8\text{ V} \pm 0.15\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	15 pF	1 M Ω	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	15 pF	1 M Ω	0.15 V
$3.3\text{ V} \pm 0.3\text{ V}$	3 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	15 pF	1 M Ω	0.3 V
$5\text{ V} \pm 0.5\text{ V}$	V_{CC}	$\leq 2.5\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	15 pF	1 M Ω	0.3 V



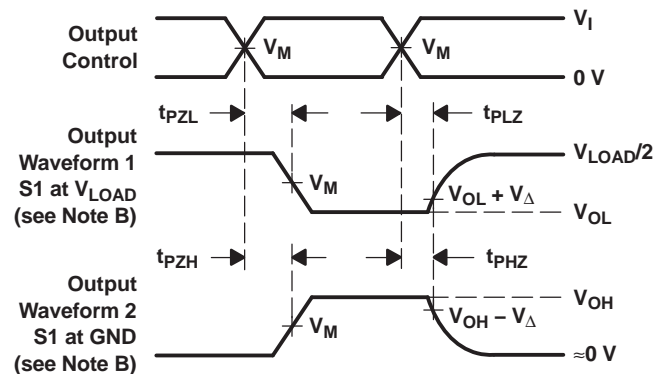
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS

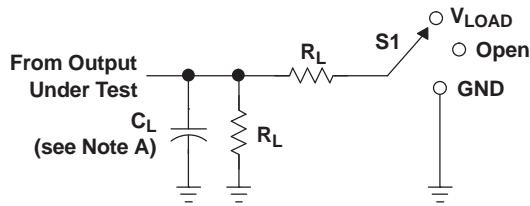


VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- 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 $\leq 10\text{ MHz}$, $Z_O = 50\ \Omega$.
 - 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 5. Load Circuit and Voltage Waveforms

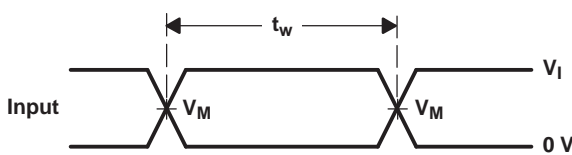
PARAMETER MEASUREMENT INFORMATION



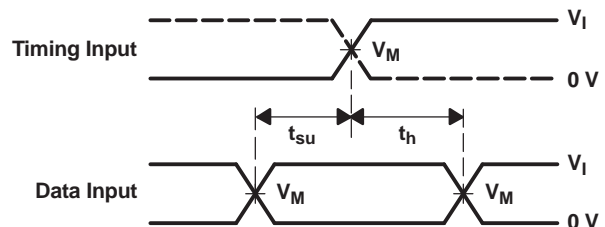
LOAD CIRCUIT

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

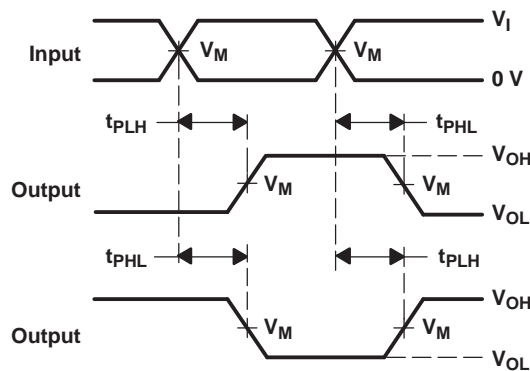
V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	t_r/t_f					
$1.8\text{ V} \pm 0.15\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k Ω	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 Ω	0.15 V
$3.3\text{ V} \pm 0.3\text{ V}$	3 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 Ω	0.3 V
$5\text{ V} \pm 0.5\text{ V}$	V_{CC}	$\leq 2.5\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	50 pF	500 Ω	0.3 V



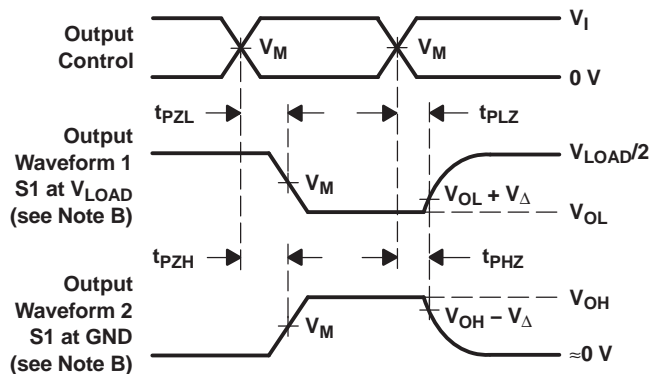
VOLTAGE WAVEFORMS PULSE DURATION



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VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

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- A. C_L includes probe and jig capacitance.
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 - 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 6. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
74LVC1G3208MDBVTEP	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CDD5M	Samples
V62/13605-01XE	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CDD5M	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) 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.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.

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OTHER QUALIFIED VERSIONS OF SN74LVC1G3208-EP :

- Catalog: [SN74LVC1G3208](#)
- Automotive: [SN74LVC1G3208-Q1](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*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
74LVC1G3208MDBVTEP	SOT-23	DBV	6	250	178.0	9.2	3.3	3.2	1.55	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



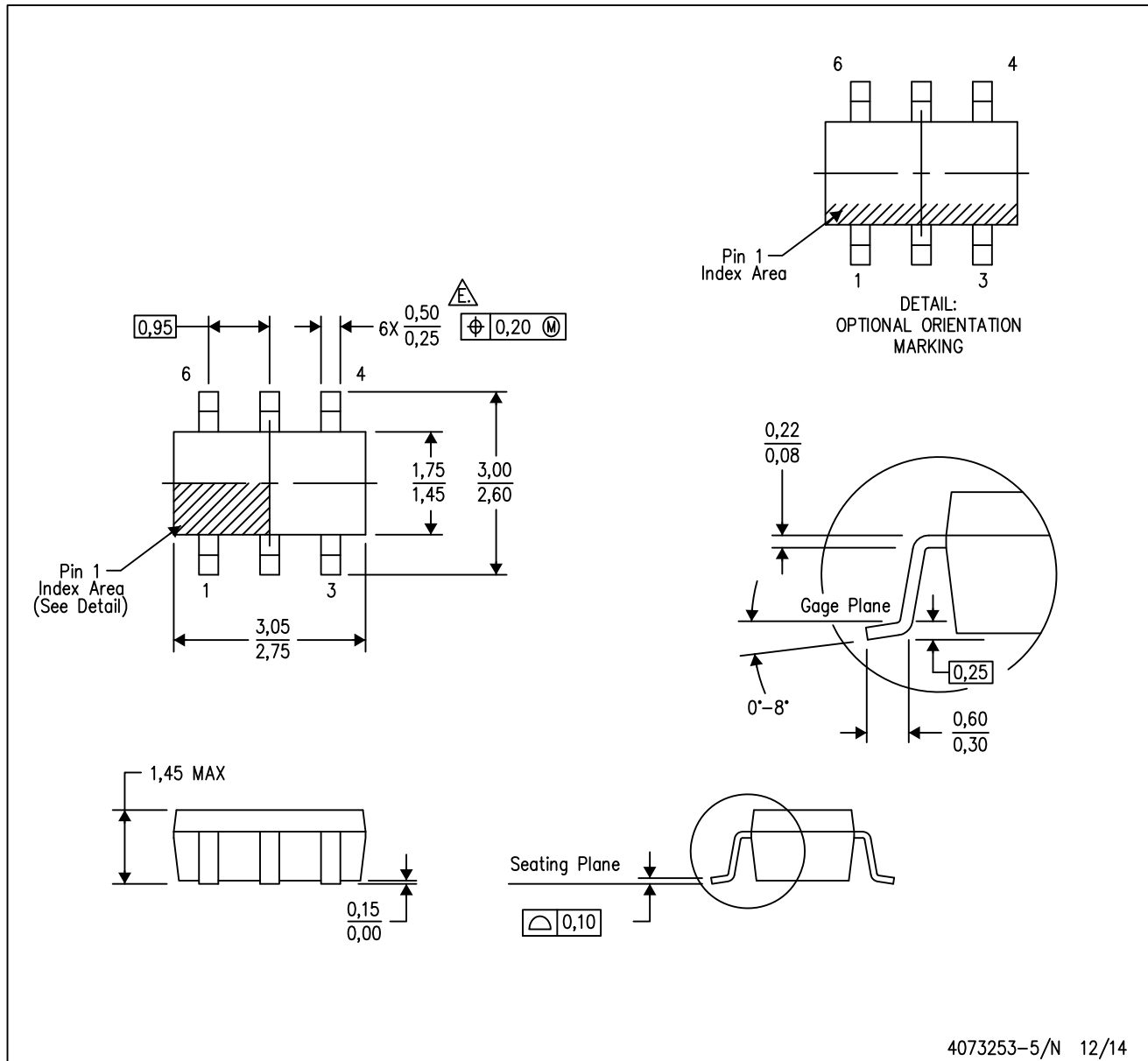
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74LVC1G3208MDBVTEP	SOT-23	DBV	6	250	180.0	180.0	18.0

MECHANICAL DATA

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- 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.
 - Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- ⚠ Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DBV (R-PDSO-G6)

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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