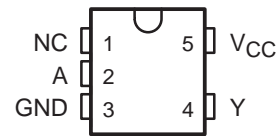- *EPIC*™ **(Enhanced-Performance Implanted CMOS) Submicron Process**
- **Unbuffered Output**
- **I_{off} Feature Supports Partial-Power-Down Mode Operation**
- **Supports 5-V V_{CC} Operation**
- **Package Options Include Plastic Small-Outline Transistor (DBV, DCK) Packages**

DBV OR DCK PACKAGE
(TOP VIEW)

```
        ┌──┐ ┌──┐
NC  [ 1       5 ]  VCC
A   [ 2              
GND [ 3       4 ]  Y
```

NC – No internal connection

description

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

The SN74LVC1GU04 contains one inverter with an unbuffered output, and performs the Boolean function $Y = \overline{A}$.
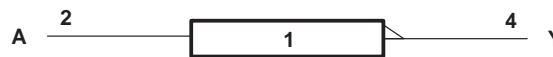
This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

The SN74LVC1GU04 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE

INPUT A	OUTPUT Y
H	L
L	H

logic symbol†

† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)

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SN74LVC1GU04
SINGLE INVERTER

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} .... −0.5 V to 6.5 V
Input voltage range, V_I (see Note 1) .... −0.5 V to 6.5 V
Output voltage range, V_O (see Notes 1 and 2) .... −0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} ($V_I < 0$) .... −50 mA
Output clamp current, I_{OK} ($V_O < 0$) .... −50 mA
Continuous output current, I_O .... ±50 mA
Continuous current through V_{CC} or GND .... ±100 mA
Package thermal impedance, θ_{JA} (see Note 3): DBV package .... 347°C/W
                                     DCK package .... 389°C/W
Storage temperature range, T_{stg} .... −65°C to 150°C

† 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.

NOTES: 1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
            2. The value of V_{CC} is provided in the recommended operating conditions table.
            3. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

			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	$0.65 \times V_{CC}$		V
		V_{CC} = 2.3 V to 2.7 V	1.7		
		V_{CC} = 2.7 V to 3.6 V	2		
		V_{CC} = 4.5 V to 5.5 V	$0.7 \times V_{CC}$		
V_{IL}	Low-level input voltage	V_{CC} = 1.65 V to 1.95 V		$0.35 \times V_{CC}$	V
		V_{CC} = 2.3 V to 2.7 V		0.7	
		V_{CC} = 2.7 V to 3.6 V		0.8	
		V_{CC} = 4.5 V to 5.5 V		$0.3 \times V_{CC}$	
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} = 2.7 V		−12	
		V_{CC} = 3 V		−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} = 2.7 V		12	
		V_{CC} = 3 V		24	
		V_{CC} = 4.5 V		32	
$\Delta t/\Delta v$	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		−40	85	°C

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

PARAMETER	TEST CONDITIONS		V_{CC}	MIN	TYP†	MAX	UNIT
V_{OH}	$I_{OH} = -100\ \mu A$		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			
	$I_{OH} = -12\ mA$		2.7 V	2.2			
	$I_{OH} = -24\ mA$		3 V	2.3			
	$I_{OH} = -32\ mA$		4.5 V	3.8			
V_{OL}	$I_{OL} = 100\ \mu A$		1.65 V to 5.5 V			0.1	V
	$I_{OL} = 4\ mA$		1.65 V			0.45	
	$I_{OL} = 8\ mA$		2.3 V			0.3	
	$I_{OL} = 12\ mA$		2.7 V			0.4	
	$I_{OL} = 24\ mA$		3 V			0.55	
	$I_{OL} = 32\ mA$		4.5 V			0.55	
I_I	$V_I = 5.5$ V or GND		0 to 5.5 V			±5	μA
I_{off}	V_I or $V_O = 5.5$ V		0			±10	μA
I_{CC}	$V_I = 5.5$ V or GND,	$I_O = 0$	1.65 V to 5.5 V			10	μA
ΔI_{CC}	One input at V_{CC} – 0.6 V, Other inputs at V_{CC} or GND		2.7 V to 5.5 V			500	μA
C_i	$V_I = V_{CC}$ or GND		3.3 V				pF

† 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 Figures 1 through 4)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 1.8 V ± 0.15 V		V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 5 V ± 0.5 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	Y											ns

operating characteristics, $T_A = 25°C$

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

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PARAMETER MEASUREMENT INFORMATION
$V_{CC} = 1.8 \text{ V} \pm 0.15 \text{ V}$

LOAD CIRCUIT
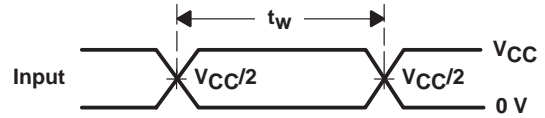
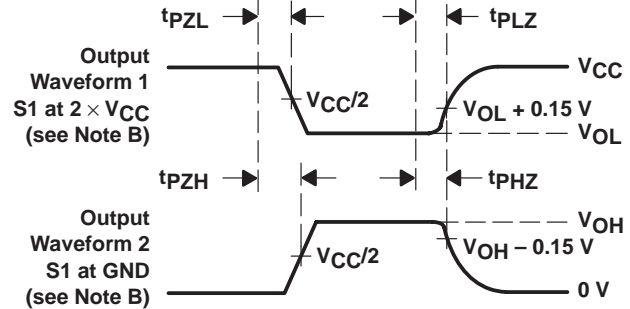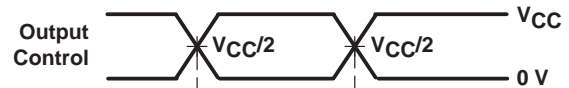| TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND

**VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES**
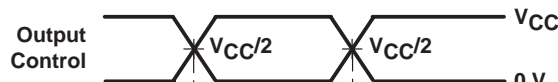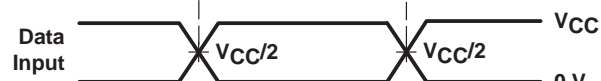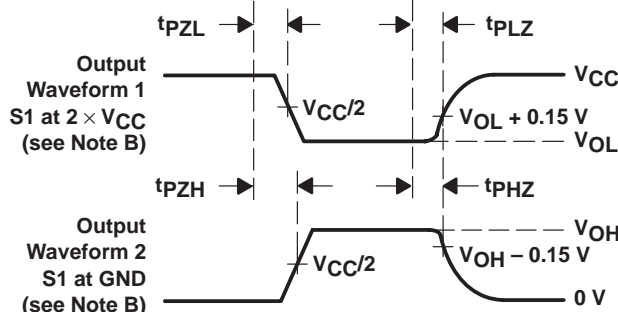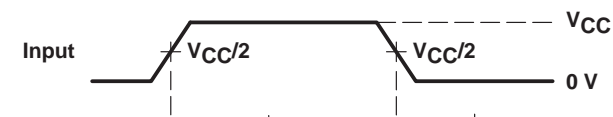
**VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES**

**VOLTAGE WAVEFORMS
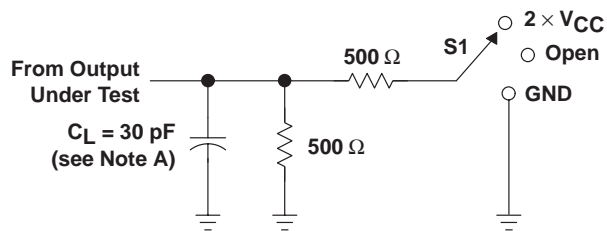PULSE DURATION**

**VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES**

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 ≤ 10 MHz, $Z_O = 50 \ \Omega$, $t_r \le 2$ ns, $t_f \le 2$ 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. t_{PLH} and t_{PHL} are the same as t_{pd}.

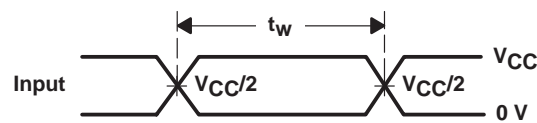**Figure 1. Load Circuit and Voltage Waveforms**

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PARAMETER MEASUREMENT INFORMATION
V_{CC} = 2.5 V $\pm$ 0.2 V

TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND

LOAD CIRCUIT

VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES

VOLTAGE WAVEFORMS
PULSE DURATION

VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

PRODUCT PREVIEW

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 Ω, $t_r \leq$ 2 ns, $t_f \leq$ 2 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}.
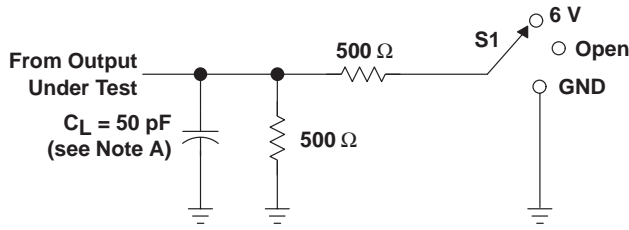G. t_{PLH} and t_{PHL} are the same as t_{pd}.

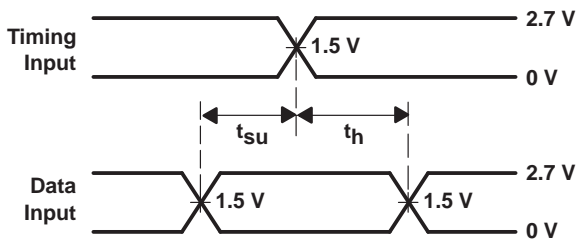**Figure 2. Load Circuit and Voltage Waveforms**

SN74LVC1GU04
SINGLE INVERTER

PARAMETER MEASUREMENT INFORMATION
V_{CC} = 2.7 V AND 3.3 V $\pm$ 0.3 V

LOAD CIRCUIT

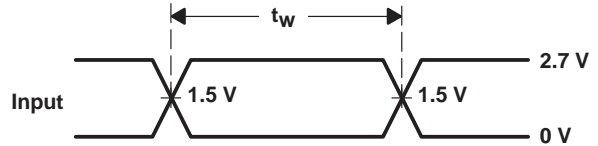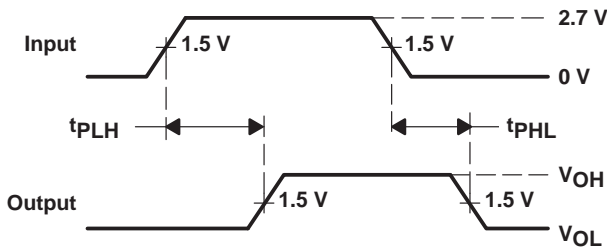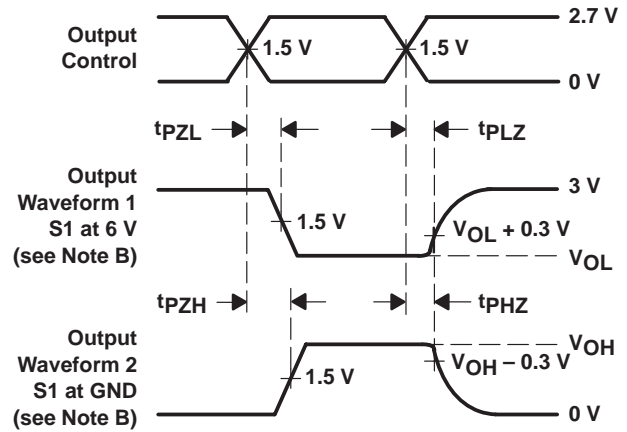| TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND

VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES

VOLTAGE WAVEFORMS
PULSE DURATION

VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
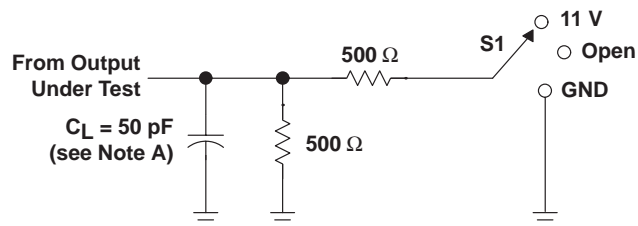
VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

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 Ω, $t_r \leq$ 2.5 ns, $t_f \leq$ 2.5 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. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 3. Load Circuit and Voltage Waveforms
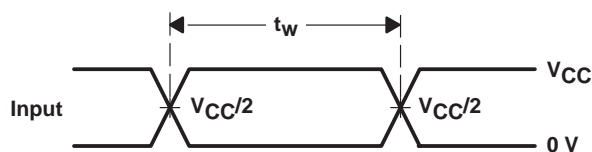
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PARAMETER MEASUREMENT INFORMATION
$V_{CC} = 5\ V \pm 0.5\ V$

LOAD CIRCUIT

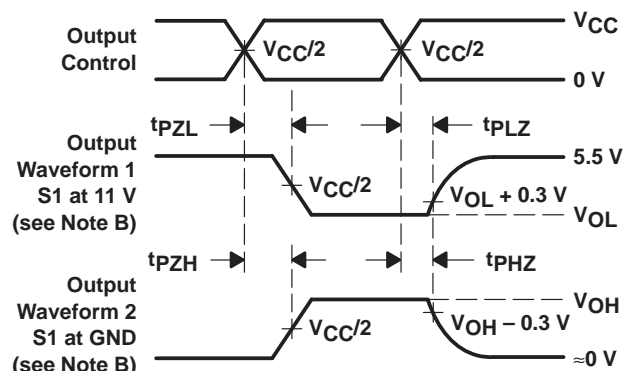| TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	11 V
t_{PHZ}/t_{PZH}	GND

VOLTAGE WAVEFORMS
PULSE DURATION
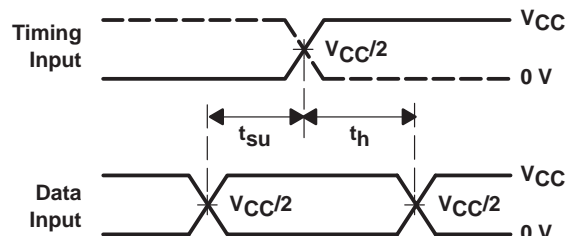
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES
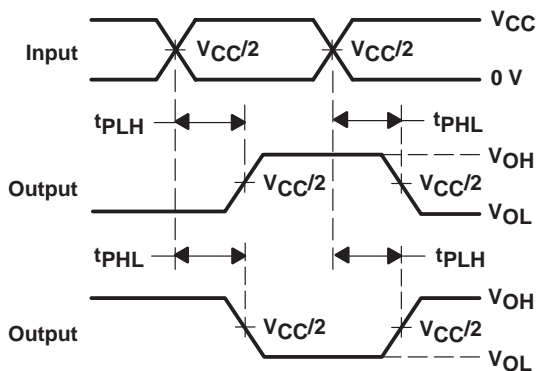
VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS

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 ≤ 10 MHz, $Z_O = 50\ \Omega$, $t_r \le 2.5$ ns, $t_f \le 2.5$ 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. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 4. Load Circuit and Voltage Waveforms

PRODUCT PREVIEW

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