

SN54LVC14A, SN74LVC14A HEX SCHMITT-TRIGGER INVERTERS

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- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Inputs Accept Voltages to 5.5 V
- 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)

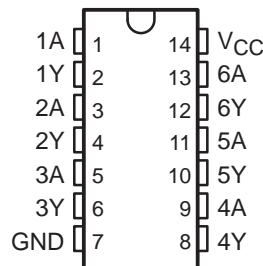
description

The SN54LVC14A hex Schmitt-trigger inverter is designed for 2.7-V to 3.6-V V_{CC} operation, and the SN74LVC14A hex Schmitt-trigger inverter is designed for 1.65-V to 3.6-V V_{CC} operation.

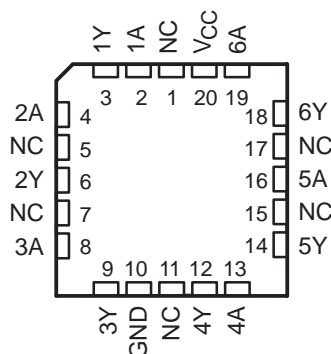
The devices contain six independent inverters, and perform the Boolean function $Y = \bar{A}$.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

SN54LVC14A ... J OR W PACKAGE
SN74LVC14A ... D, DB, DGV, OR PW PACKAGE
(TOP VIEW)



SN54LVC14 ... FK PACKAGE
(TOP VIEW)



NC – No internal connection

ORDERING INFORMATION

| T_A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-------------|---------------|-----------------------|------------------|
| –40°C to 85°C | SOIC – D | Tube | SN74LVC14AD | LVC14A |
| | | Tape and reel | SN74LVC14ADR | |
| | SSOP – DB | Tape and reel | SN74LVC14ADBR | LC14A |
| | TSSOP – PW | Tape and reel | SN74LVC14APWR | LC14A |
| | TVSOP – DGV | Tape and reel | SN74LVC14ADGVR | LC14A |
| –55°C to 125°C | CDIP – J | Tube | SNJ54LVC14AJ | SNJ54LVC14AJ |
| | CFP – W | Tube | SNJ54LVC14AW | SNJ54LVC14AW |
| | LCCC – FK | Tube | SNJ54LVC14AFK | SNJ54LVC14AFK |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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

**TEXAS
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

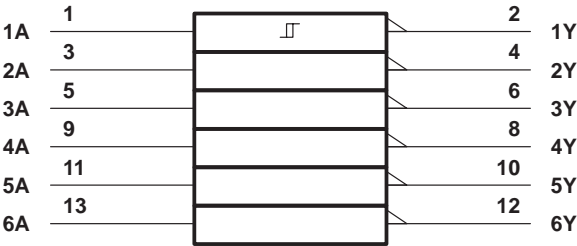
SN54LVC14A, SN74LVC14A
HEX SCHMITT-TRIGGER INVERTERS

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FUNCTION TABLE
(each inverter)

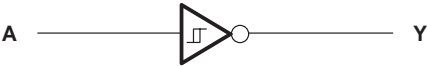
| INPUT A | OUTPUT Y |
|------------|-------------|
| H | L |
| L | H |

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the D, DB, DGV, J, PW, and W packages.

logic diagram, each inverter (positive logic)



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): | |
| D package | 86°C/W |
| DB package | 96°C/W |
| DGV package | 127°C/W |
| PW package | 113°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 51-7.

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recommended operating conditions (see Note 4)

| | | | SN54LVC14A | | SN74LVC14A | | UNIT |
|-----------------|--------------------------------|--------------------------|------------|-----------------|------------|-----------------|------|
| | | | MIN | MAX | MIN | MAX | |
| V _{CC} | Supply voltage | Operating | 2 | 3.6 | 1.65 | 3.6 | V |
| | | Data retention only | 1.5 | | 1.5 | | |
| V _I | Input voltage | | 0 | 5.5 | 0 | 5.5 | V |
| V _O | Output voltage | | 0 | V _{CC} | 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 | | –12 | |
| | | V _{CC} = 3 V | | –24 | | –24 | |
| 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 | | 12 | |
| | | V _{CC} = 3 V | | 24 | | 24 | |
| T _A | Operating free-air temperature | | –55 | 125 | –40 | 85 | °C |

NOTE 4: 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.

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

| PARAMETER | TEST CONDITIONS | V _{CC} | SN54LVC14A | | | SN74LVC14A | | | UNIT |
|---|---|-----------------|----------------------|------|-----|----------------------|------|-----|------|
| | | | MIN | TYP† | MAX | MIN | TYP† | MAX | |
| V _{T+} Positive-going threshold | | 2.7 V | 0.8 | | 2 | 0.8 | | 2 | V |
| | | 3 V | 0.8 | | 2 | 0.8 | | 2 | |
| | | 3.6 V | 0.8 | | 2 | 0.8 | | 2 | |
| V _{T–} Negative-going threshold | | 2.7 V | 0.4 | | 1.4 | 0.4 | | 1.4 | V |
| | | 3 V | 0.6 | | 1.5 | 0.6 | | 1.5 | |
| | | 3.6 V | 0.8 | | 1.8 | 0.8 | | 1.8 | |
| ΔV _T Hysteresis (V _{T+} – V _{T–}) | | 2.7 V | 0.3 | | 1.1 | 0.3 | | 1.1 | V |
| | | 3 V | 0.3 | | 1.2 | 0.3 | | 1.2 | |
| | | 3.6 V | 0.3 | | 1.2 | 0.3 | | 1.2 | |
| V _{OH} | I _{OH} = –100 μA | 1.65 V to 3.6 V | | | | V _{CC} –0.2 | | | V |
| | | 2.7 V to 3.6 V | V _{CC} –0.2 | | | | | | |
| | I _{OH} = –4 mA | 1.65 V | | | | 1.2 | | | |
| | I _{OH} = –8 mA | 2.3 V | | | | 1.7 | | | |
| | I _{OH} = –12 mA | 2.7 V | 2.2 | | | 2.2 | | | |
| | | 3 V | 2.4 | | | 2.4 | | | |
| | I _{OH} = –24 mA | 3 V | 2.2 | | | 2.2 | | | |
| V _{OL} | I _{OL} = 100 μA | 1.65 V to 3.6 V | | | | 0.2 | | | V |
| | | 2.7 V to 3.6 V | 0.2 | | | | | | |
| | I _{OL} = 4 mA | 1.65 V | | | | 0.45 | | | |
| | I _{OL} = 8 mA | 2.3 V | | | | 0.7 | | | |
| | I _{OL} = 12 mA | 2.7 V | 0.4 | | | 0.4 | | | |
| | I _{OL} = 24 mA | 3 V | 0.55 | | | 0.55 | | | |
| I _I | V _I = 5.5 V or GND | 3.6 V | ±5 | | | ±5 | | | μA |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 3.6 V | 10 | | | 10 | | | μA |
| ΔI _{CC} | One input at V _{CC} – 0.6 V, Other inputs at V _{CC} or GND | 2.7 V to 3.6 V | 500 | | | 500 | | | μA |
| C _i | V _I = V _{CC} or GND | 3.3 V | 5 | | | 5 | | | 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 Figure 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | SN54LVC14A | | | | UNIT |
|-----------------|-----------------|----------------|-------------------------|-----|------------------------------------|-----|------|
| | | | V _{CC} = 2.7 V | | V _{CC} = 3.3 V ± 0.3 V | | |
| | | | MIN | MAX | MIN | MAX | |
| t _{pd} | A | Y | 7.5 | | 1 | 6.4 | ns |



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switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figures 1 through 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | SN74LVC14A | | | | | | UNIT | |
|--------------------|-----------------|----------------|-------------------------|------------------------------------|-----|-------------------------|-----|------------------------------------|------|-----|
| | | | V _{CC} = 1.8 V | V _{CC} = 2.5 V ± 0.2 V | | V _{CC} = 2.7 V | | V _{CC} = 3.3 V ± 0.3 V | | |
| | | | TYP | MIN | MAX | MIN | MAX | MIN | | MAX |
| t _{pd} | A | Y | 13.7 | 7.8 | | 7.5 | | 1 | 6.4 | ns |
| t _{sk(o)} | | | | | | | | 1 | | ns |

operating characteristics, T_A = 25°C

| PARAMETER | | TEST CONDITIONS | V _{CC} = 1.8 V | V _{CC} = 2.5 V | V _{CC} = 3.3 V | UNIT |
|-----------------|--|--------------------|-------------------------|-------------------------|-------------------------|------|
| | | | TYP | TYP | TYP | |
| C _{pd} | Power dissipation capacitance per inverter | f = 10 MHz | 11 | 12 | 15 | pF |

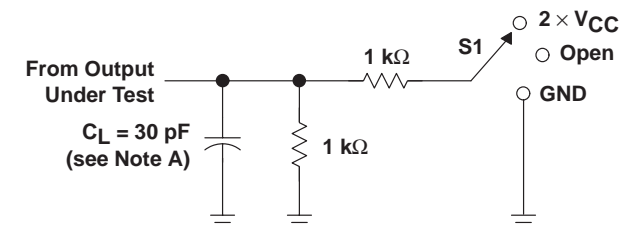


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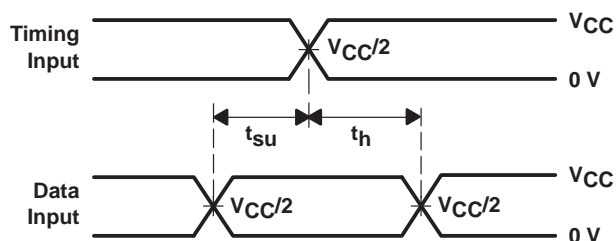
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 1.8 \text{ V}$

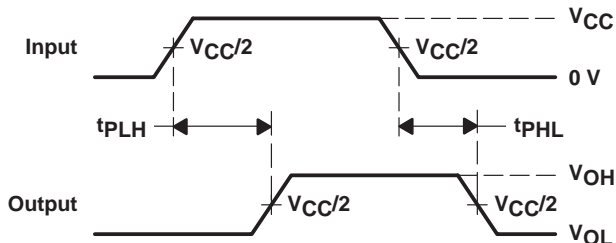


LOAD CIRCUIT

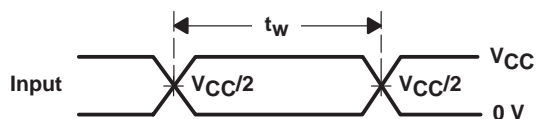
| TEST | S1 |
|-------------------|--------------|
| t_{pd} | Open |
| t_{PLZ}/t_{PZL} | 2 × V_{CC} |
| t_{PHZ}/t_{PHZ} | GND |



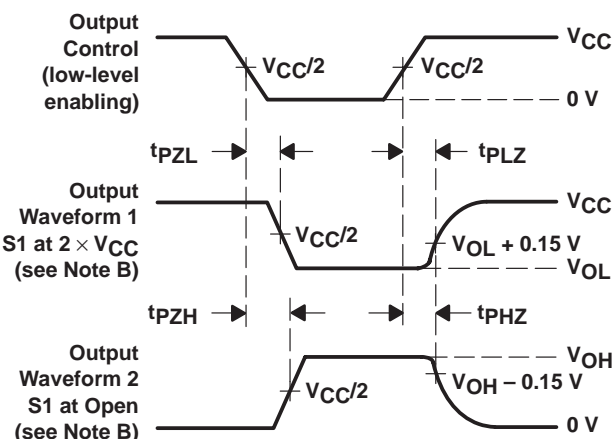
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



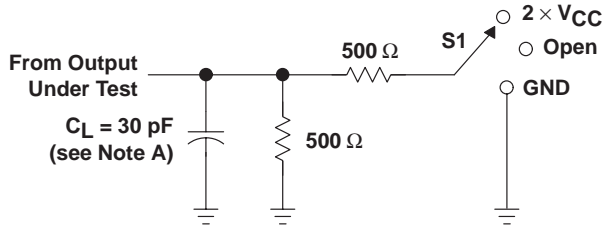
VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2 \text{ ns}$, $t_f \leq 2 \text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

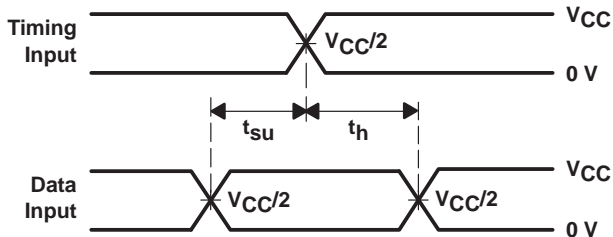
PARAMETER MEASUREMENT INFORMATION

$$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$$

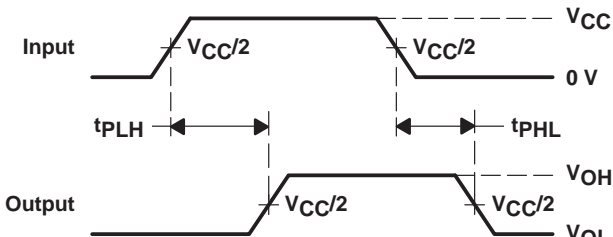


LOAD CIRCUIT

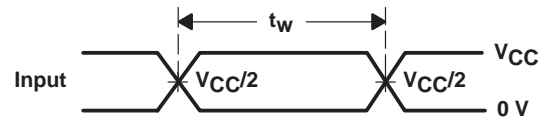
| TEST | S1 |
|-------------------|-------------------|
| t_{pd} | Open |
| t_{PLZ}/t_{PZL} | 2 $\times V_{CC}$ |
| t_{PHZ}/t_{PZH} | GND |



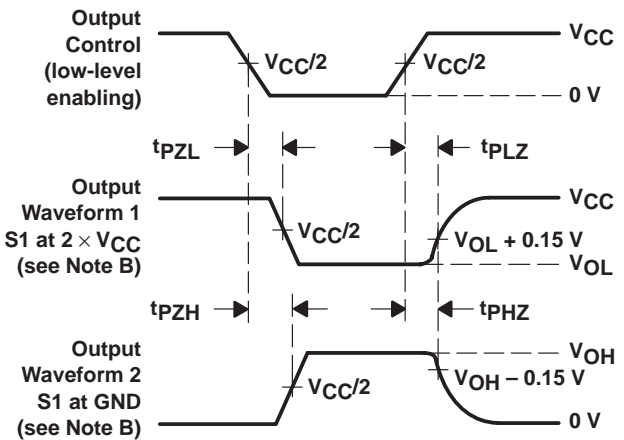
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2 \text{ ns}$, $t_f \leq 2 \text{ ns}$.
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} .

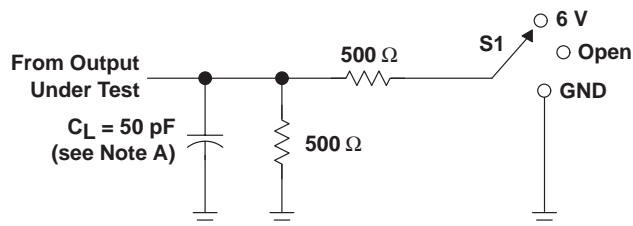
Figure 2. Load Circuit and Voltage Waveforms

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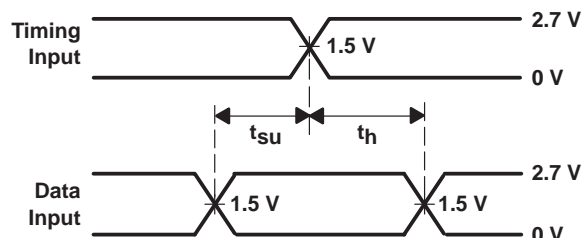
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7\text{ V AND } 3.3\text{ V} \pm 0.3\text{ V}$

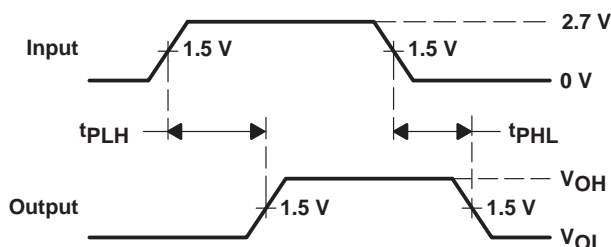


LOAD CIRCUIT

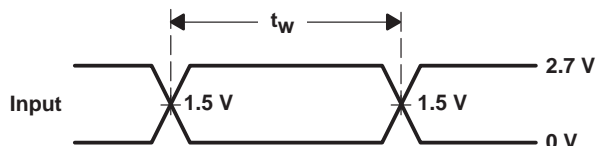
| TEST | S1 |
|-------------------|------|
| t_{pd} | Open |
| t_{PLZ}/t_{PZL} | 6 V |
| t_{PHZ}/t_{PZH} | GND |



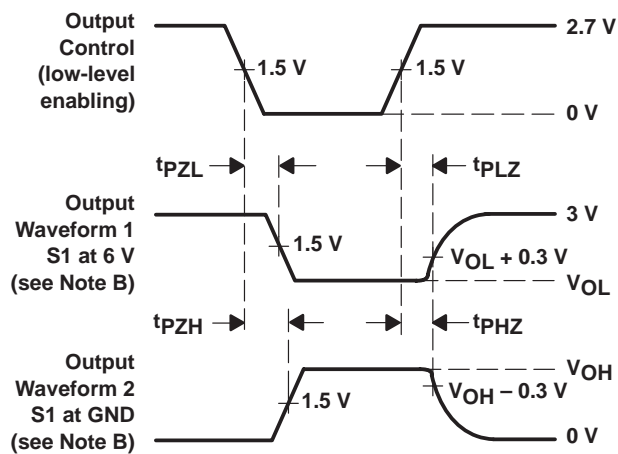
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\text{ }\Omega$, $t_r \leq 2.5\text{ ns}$, $t_f \leq 2.5\text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 3. Load Circuit and Voltage Waveforms

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