



U74HC4053

CMOS IC

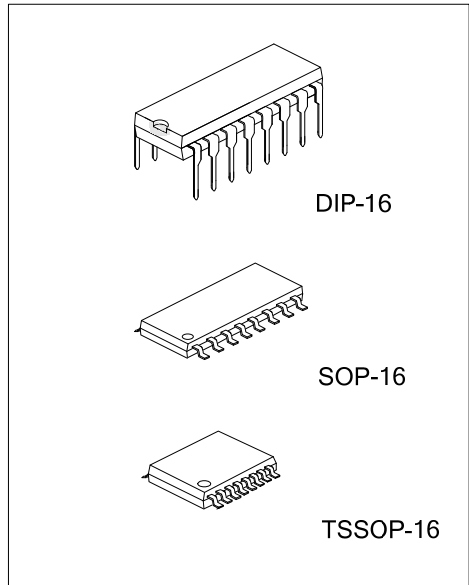
TRIPLE 2-CHANNEL ANALOG MULTIPLEXER/ DEMULTIPLEXER

DESCRIPTION

The UTC **U74HC4053** is a high-performance, triple 2-channel analog multiplexer/de-multiplexer.

FEATURES

- * Wide analog input voltage range from -5V to +5V
- * Low ON-state resistance
- * Logic level translation: to enable 5V logic to communicate with ±5V analog signals
- * Typical “break before make” built in

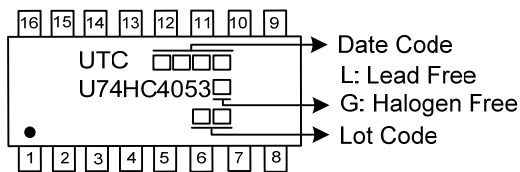


ORDERING INFORMATION

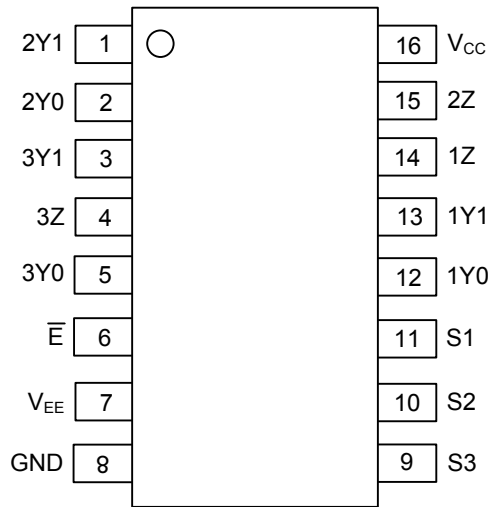
| Ordering Number | | Package | Packing |
|------------------|------------------|----------|-----------|
| Lead Free | Halogen Free | | |
| U74HC4053L-D16-T | U74HC4053G-D16-T | DIP-16 | Tube |
| U74HC4053L-S16-R | U74HC4053G-S16-R | SOP-16 | Tape Reel |
| U74HC4053L-P16-R | U74HC4053G-P16-R | TSSOP-16 | Tape Reel |

| | |
|---|--|
| <p>U74HC4053G-D16-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p> | <p>(1) T: Tube, R: Tape Reel (2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16 (3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---|--|

MARKING



■ PIN CONFIGURATION

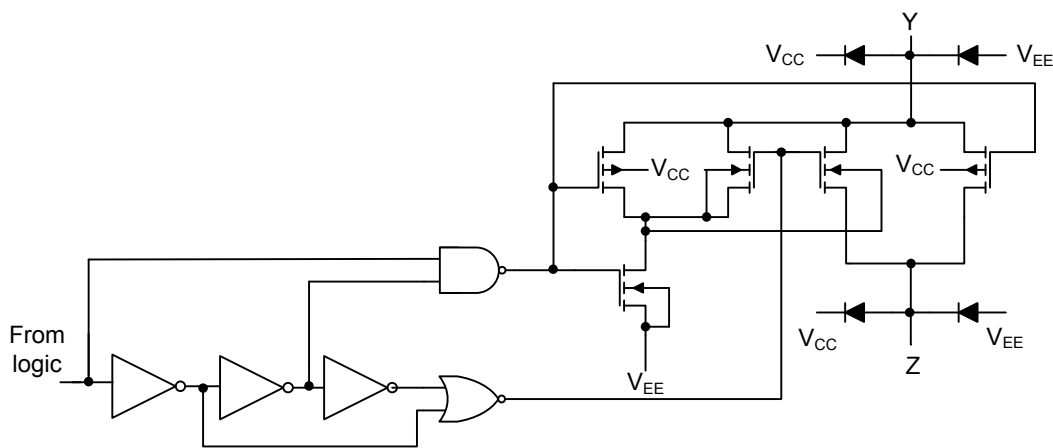


■ FUNCTION TABLE

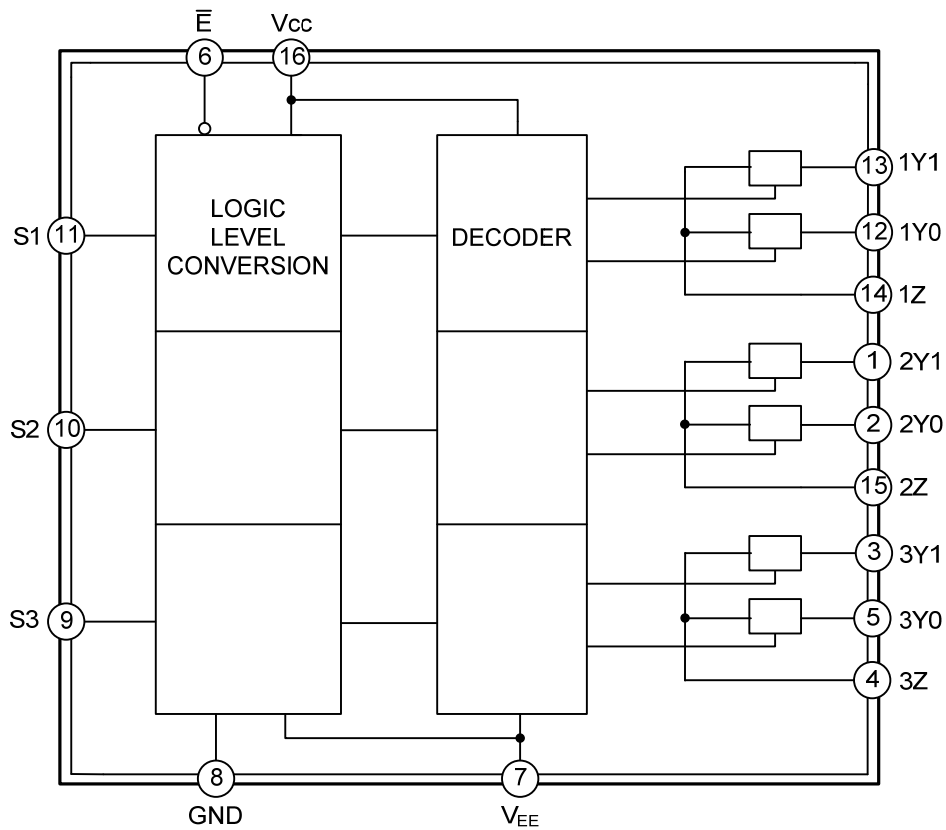
| INPUT(\bar{E}) | INPUT(S_n) | CHANNEL ON |
|--------------------|----------------|------------|
| L | L | nY0 to nZ |
| L | H | nY1 to nZ |
| H | X | none |

Note: H=High voltage level; L=Low voltage level; X=don't care

■ SCHEMATIC DIAGRAM(one switch)



FUNCTION DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATINGS | UNIT | |
|--|-----------------|--------------|------|------|
| Supply Voltage | V_{CC} | -0.5 ~ +11.0 | V | |
| Input Clamping Current ($V_{IN} < -0.5V$ or $V_{IN} > V_{CC} + 0.5V$) | I_{IK} | ±20 | mA | |
| Switch Clamping Current ($V_S < -0.5V$ or $V_S > V_{CC} + 0.5V$) | I_{SK} | ±20 | mA | |
| Switch Current ($V_S = -0.5V$ to $V_{CC} + 0.5V$) | I_S | ±25 | mA | |
| Negative Supply Current | I_{EE} | -20 | mA | |
| Ground Supply Current | I_{GND} | -50 | mA | |
| Quiescent Supply Current | I_{CC} | 50 | mA | |
| Power Dissipation | DIP-16 | P_D | 750 | mW |
| | SOP-16/TSSOP-16 | | 500 | mW |
| Derate above $T_a > 70^\circ C$ | DIP-16 | | 12 | mW/K |
| | SOP-16/TSSOP-16 | | 8 | mW/K |
| Operating Temperature | T_{OPR} | -40 ~ +125 | °C | |
| Storage Temperature | T_{STG} | -65 ~ +150 | °C | |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------------------|-----------------|-----------------|----------|-----|----------|------|
| Supply Voltage Difference | ΔV_{CC} | $V_{CC}-GND$ | 2.0 | 5.0 | 10.0 | V |
| | | $V_{CC}-V_{EE}$ | 2.0 | 5.0 | 10.0 | v |
| Input Voltage | V_{IN} | | GND | | V_{CC} | V |
| Switch Voltage | V_{SW} | | V_{EE} | | V_{CC} | V |
| Input Rise and Fall Times | t_R, t_F | $V_{CC}=2.0V$ | | 6.0 | 1000 | ns |
| | | $V_{CC}=4.5V$ | | 6.0 | 500 | ns |
| | | $V_{CC}=6.0V$ | | 6.0 | 400 | ns |
| | | $V_{CC}=10.0V$ | | 6.0 | 250 | ns |

■ STATIC CHARACTERISTICS (Ta=25°C)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------------------------|---------------|---|-------------------------|-----|------|------|
| High-Level Input Voltage | V_{IH} | $V_{CC}=2.0V$ | 1.5 | 1.2 | | V |
| | | $V_{CC}=4.5V$ | 3.15 | 2.4 | | V |
| | | $V_{CC}=6.0V$ | 4.2 | 3.2 | | V |
| | | $V_{CC}=9.0V$ | 6.3 | 4.7 | | V |
| Low-Level Input Voltage | V_{IL} | $V_{CC}=2.0V$ | | 0.8 | 0.5 | V |
| | | $V_{CC}=4.5V$ | | 2.1 | 1.35 | V |
| | | $V_{CC}=6.0V$ | | 2.8 | 1.8 | V |
| | | $V_{CC}=9.0V$ | | 4.3 | 2.7 | V |
| Analog Switch OFF-state Current | $I_{S(OFF)}$ | $V_{CC}=10V, V_{EE}=0V, V_I=V_{IH}$ or V_{IL} $ V_S =V_{CC}-V_{EE}$ | Per Channel | | ±0.1 | μA |
| | | | All Channels | | ±0.1 | μA |
| Analog Switch ON-state Current | $I_{S(ON)}$ | $V_{CC}=10V, V_{EE}=0V, V_I=V_{IH}$ or V_{IL} $ V_S =V_{CC}-V_{EE}$ | | | ±0.1 | μA |
| Input Leakage Current | $I_{I(LEAK)}$ | $V_{EE}=0V$ $V_I=V_{CC}$ or GND | $V_{CC}=6V$ | | ±0.1 | μA |
| | | | $V_{CC}=10V$ | | ±0.2 | μA |
| Quiescent Supply Current | I_Q | $V_I=V_{CC}$ or GND $V_{IS}=V_{EE}$ or V_{CC} $V_{OS}=V_{CC}$ or V_{EE} | $V_{CC}=6V, V_{EE}=0V$ | | 8 | μA |
| | | | $V_{CC}=10V, V_{EE}=0V$ | | 16 | μA |

■ STATIC CHARACTERISTICS (Cont.)

| PARAMETER | | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|--|----------------------|--|--|---|-----|-----|----------|----------|
| ON-state Resistance | PEAK | $R_{ON(PEAK)}$ | $V_{IS}=V_{CC}$ to V_{EE} $V_{IN}=V_{IH}$ or V_{IL} | $V_{EE}=0V, I_S=0.1mA$ (Note) $V_{CC}=2.0V$ | | | | Ω |
| | | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=4.5V$ | | 100 | 180 | Ω |
| | | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=6.0V$ | | 90 | 160 | Ω |
| | | | | $V_{EE}=-4.5V, I_S=1mA$ $V_{CC}=4.5V$ | | 70 | 130 | Ω |
| | RAIL | $R_{ON(RAIL)}$ | $V_{IS}=V_{EE}$ $V_{IN}=V_{IH}$ or V_{IL} | $V_{EE}=0V, I_S=0.1mA$ (Note) $V_{CC}=2.0V$ | | 150 | | Ω |
| | | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=4.5V$ | | 80 | 140 | Ω |
| | | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=6.0V$ | | 70 | 120 | Ω |
| | | | | $V_{EE}=-4.5V, I_S=1mA$ $V_{CC}=4.5V$ | | 60 | 105 | Ω |
| | | $R_{ON(RAIL)}$ | $V_{IS}=V_{CC}$ $V_{IN}=V_{IH}$ or V_{IL} | $V_{EE}=0V, I_S=0.1mA$ (Note) $V_{CC}=2.0V$ | | 150 | | Ω |
| | | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=4.5V$ | | 90 | 160 | Ω |
| | | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=6.0V$ | | 80 | 140 | Ω |
| | | | | $V_{EE}=-4.5V, I_S=1mA$ $V_{CC}=4.5V$ | | 65 | 120 | Ω |
| Maximum ON-state Resistance Variation Between Any Two Channels | $\Delta R_{ON(MAX)}$ | $V_{IS}=V_{CC}$ to V_{EE} $V_{IN}=V_{IH}$ or V_{IL} | $V_{EE}=0V, I_S=0.1mA$ (Note) $V_{CC}=2.0V$ | | | | Ω | |
| | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=4.5V$ | | 9 | | Ω | |
| | | | $V_{EE}=0V, I_S=1mA$ $V_{CC}=6.0V$ | | 8 | | Ω | |
| | | | $V_{EE}=-4.5V, I_S=1mA$ $V_{CC}=4.5V$ | | 6 | | Ω | |

Note: At supply voltages ($V_{CC} - V_{EE}$) approaching 2.0 V the analog switch ON-resistance becomes extremely non-linear. Therefore it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.

■ DYNAMIC CHARACTERISTICS ($T_a=25^\circ C$, $GND=0V$, $t_R=t_F=6ns$, unless otherwise specified)

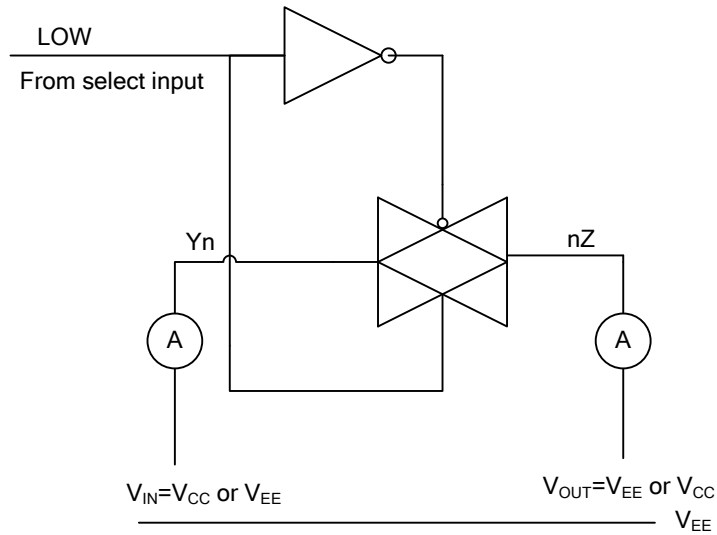
| PARAMETER | | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|-----------------------|--------------------------|------------------------------|------------------------------|-----|-----|-----|------|
| Propagation Delay Form V_{IS} to V_{OS} | | t_{PHL}/t_{PLH} | $R_L=\infty$ $C_L=50pF$ | $V_{EE}=0V$ $V_{CC}=2.0V$ | | 15 | 60 | ns |
| | | | | $V_{CC}=4.5V$ | | 5 | 2 | ns |
| | | | | $V_{CC}=6.0V$ | | 4 | 10 | ns |
| | | | | $V_{EE}=-4.5V$ $V_{CC}=4.5V$ | | 4 | 8 | ns |
| Turn-ON Time | \bar{E} to V_{OS} | t_{PZH}/t_{PZL} | $R_L=1k\Omega, C_L=50pF$ | $V_{EE}=0V$ $V_{CC}=2.0V$ | | 60 | 220 | ns |
| | | | | $V_{CC}=4.5V$ | | 20 | 44 | ns |
| | | | | $V_{CC}=6.0V$ | | 16 | 37 | ns |
| | | | | $V_{EE}=-4.5V$ $V_{CC}=4.5V$ | | 15 | 31 | ns |
| | S_n to V_{OS} | t_{PZH}/t_{PZL} | $R_L=1k\Omega, C_L=15pF$ | $V_{EE}=0V$ $V_{CC}=5.0V$ | | 17 | | ns |
| | | | | $V_{EE}=0V$ $V_{CC}=2.0V$ | | 75 | 220 | ns |
| | | | | $V_{CC}=4.5V$ | | 25 | 44 | ns |
| | | | | $V_{CC}=6.0V$ | | 20 | 37 | ns |
| Turn-OFF Time | \bar{E} to V_{OS} | t_{PHZ}/t_{PLZ} | $R_L=1k\Omega, C_L=50pF$ | $V_{EE}=0V$ $V_{CC}=2.0V$ | | 63 | 210 | ns |
| | | | | $V_{CC}=4.5V$ | | 21 | 42 | ns |
| | | | | $V_{CC}=6.0V$ | | 17 | 36 | ns |
| | | | | $V_{EE}=-4.5V$ $V_{CC}=4.5V$ | | 15 | 29 | ns |
| | S_n to V_{OS} | t_{PHZ}/t_{PLZ} | $R_L=1k\Omega, C_L=15pF$ | $V_{EE}=0V$ $V_{CC}=5.0V$ | | 18 | | ns |
| | | | | $V_{EE}=0V$ $V_{CC}=2.0V$ | | 60 | 210 | ns |
| | | | | $V_{CC}=4.5V$ | | 20 | 42 | ns |
| | | | | $V_{CC}=6.0V$ | | 16 | 36 | ns |
| $R_L=1k\Omega, C_L=15pF$ | t_{PHZ}/t_{PLZ} | $R_L=1k\Omega, C_L=50pF$ | $V_{EE}=-4.5V$ $V_{CC}=4.5V$ | | 15 | 29 | ns | |
| | | | $V_{EE}=0V$ $V_{CC}=5.0V$ | | 17 | | ns | |

Note: V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.

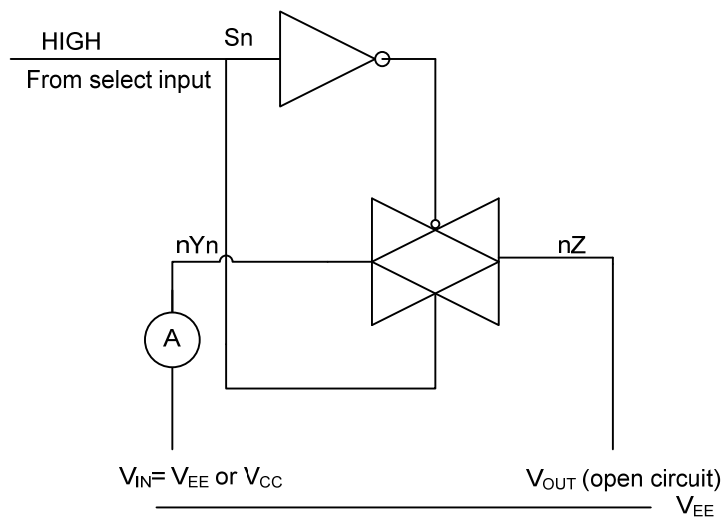
V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

■ TEST CIRCUITS AND WAVEFORMS

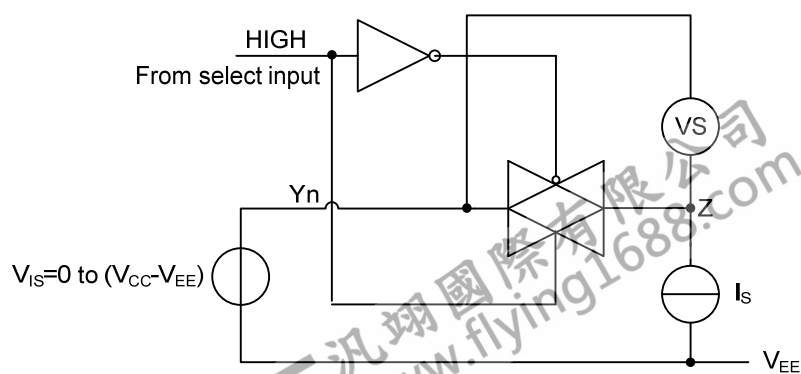
For OFF-state current



For ON-state current

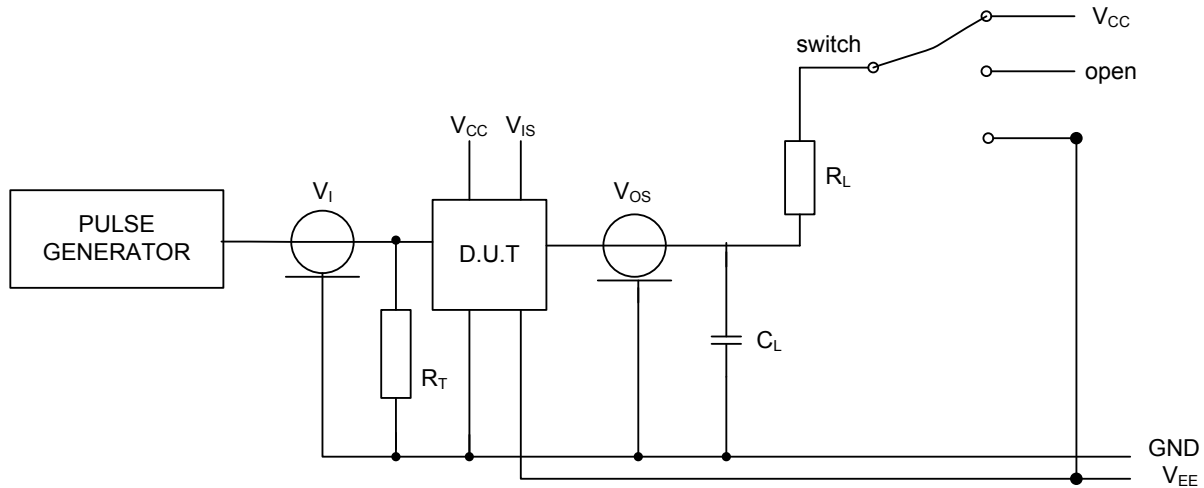


For Ron



■ TEST CIRCUITS AND WAVEFORMS (Cont.)

For AC performance



| TEST | SWITCH | INPUT | |
|-----------|----------|----------|------------|
| | | V_{IS} | t_r, t_f |
| t_{PZH} | V_{EE} | V_{CC} | 6ns |
| t_{PZL} | V_{CC} | V_{EE} | 6ns |
| t_{PHZ} | V_{EE} | V_{CC} | 6ns |
| t_{PLZ} | V_{CC} | V_{EE} | 6ns |
| t_{PLH} | open | pulse | 6ns |
| t_{PHL} | open | pulse | 6ns |

Note: Definitions for test circuit:

R_L = load resistance

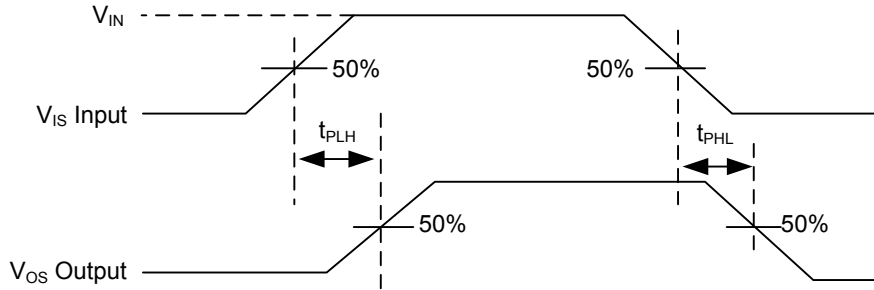
C_L = load capacitance including jig and probe capacitance.

R_T = termination resistance should be equal to the output impedance Z_O of the pulse generator.

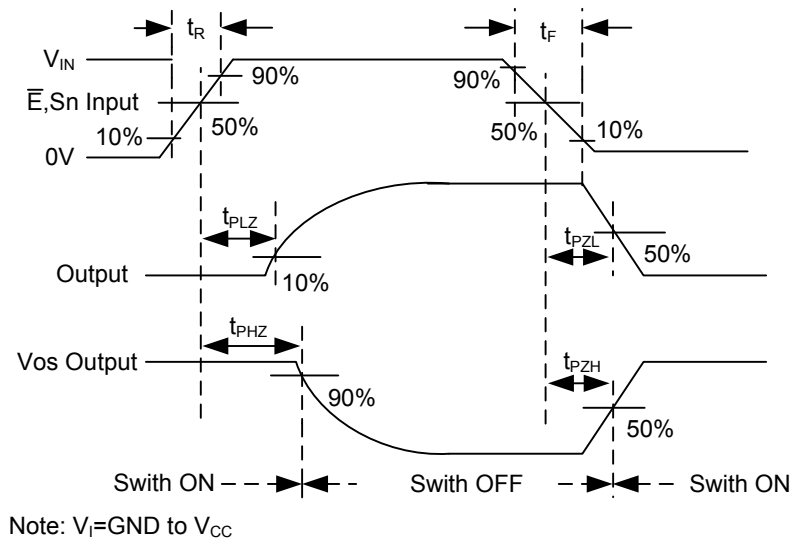
$t_r=t_f=6$ ns; when measuring f_{MAX} , there is no constraint to t_r and t_f with 50% duty factor (<2ns).

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

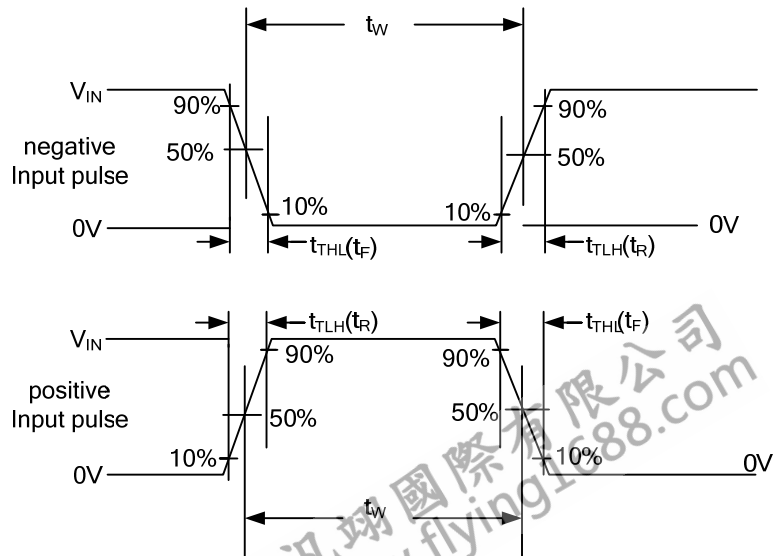
The Input (V_{IS}) to Output (V_{OS}) propagation delays Waveform



The turn-on and turn-off times Waveform



Input pulse definition



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. UTC reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.