



U74HC4052

CMOS IC

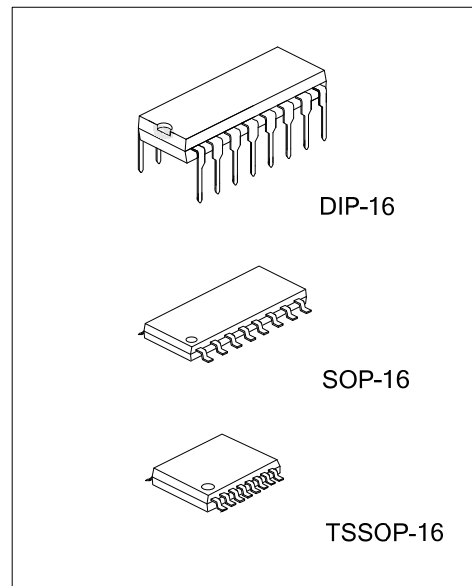
DUAL 4-CHANNEL ANALOG MULTIPLEXER, DEMULTIPLEXER

DESCRIPTION

The **U74HC4052** provides common select logic. Each multiplexer has four independent inputs/outputs and a common input/output.

FEATURES

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

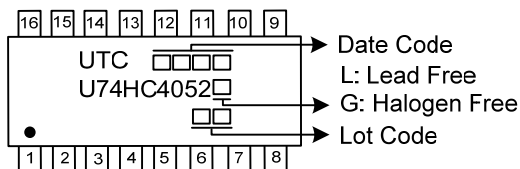


ORDERING INFORMATION

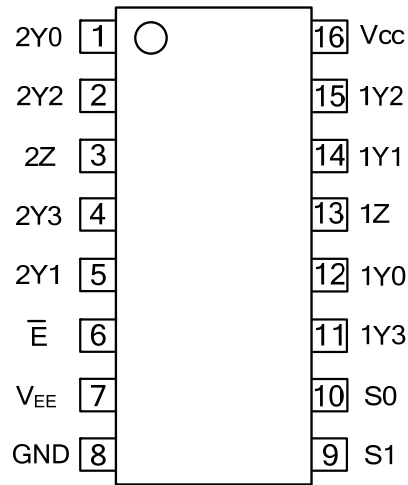
| Ordering Number | | Package | Packing |
|------------------|------------------|----------|-----------|
| Lead Free | Halogen Free | | |
| U74HC4052L-D16-T | U74HC4052G-D16-T | DIP-16 | Tube |
| U74HC4052L-S16-R | U74HC4052G-S16-R | SOP-16 | Tape Reel |
| U74HC4052L-P16-R | U74HC4052G-P16-R | TSSOP-16 | Tape Reel |

| | |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <p>U74HC4052G-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

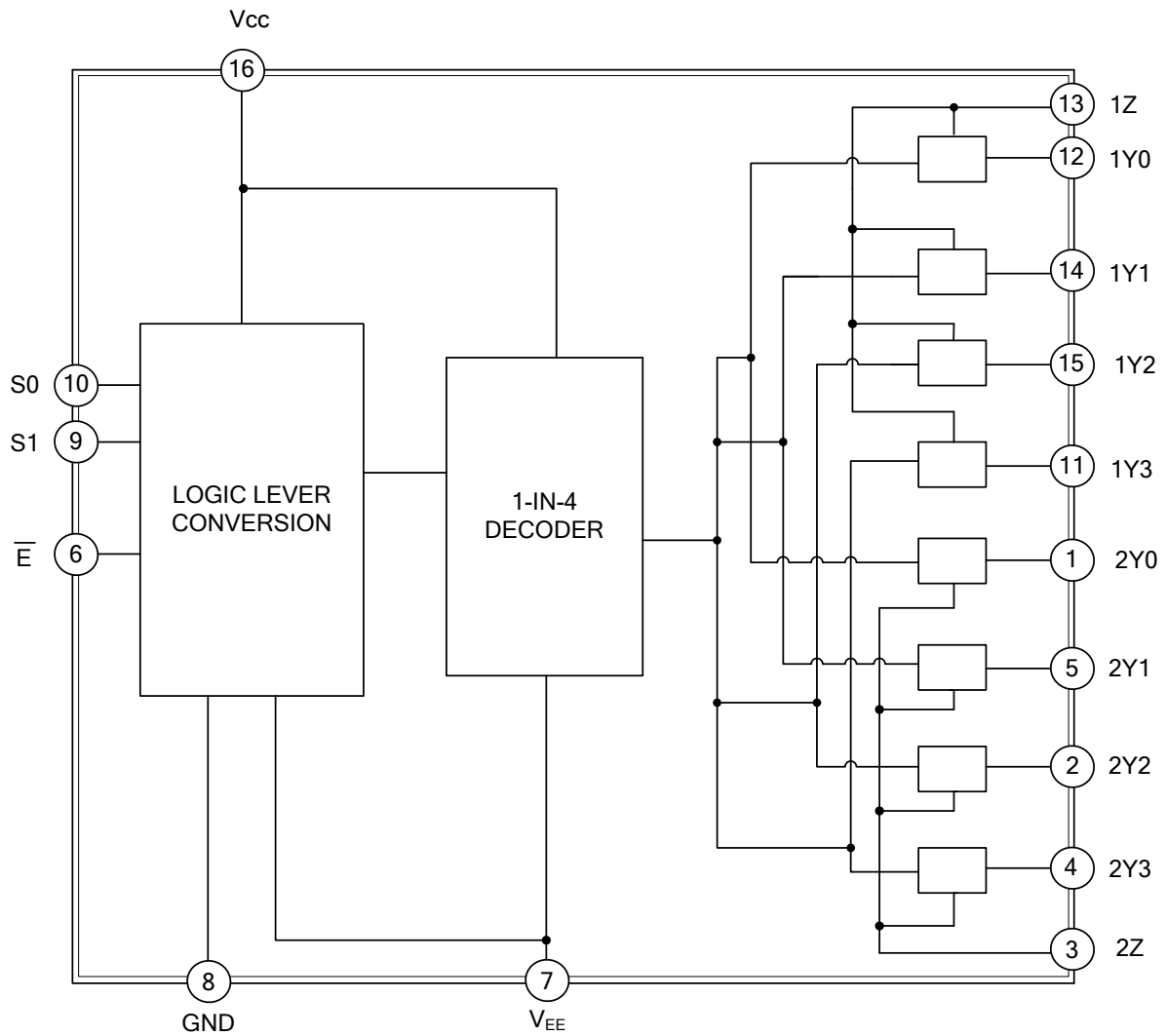


■ FUNCTION TABLE (each gate)

| INPUT(E) | INPUT(S1) | INPUT(S0) | CHANNEL BETWEEN |
|----------|-----------|-----------|-----------------|
| L | L | L | nY0 and nZ |
| L | L | H | nY1 and nZ |
| L | H | L | nY2 and nZ |
| L | H | H | nY3 and nZ |
| H | X | X | none |

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

■ FUNCTIONAL DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------------------------|----------|-----------|------------|------------------|
| Supply Voltage | | V_{CC} | -0.5~11 | V |
| V_{CC} or GND Current | | I_{CC} | ±50 | mA |
| V_{EE} Current | | I_{EE} | ±20 | mA |
| Input Clamp Current | | I_{IK} | ±20 | mA |
| Switch Diode Current | | I_{SK} | ±20 | mA |
| Switch Current | | I_S | ±25 | mA |
| Power Dissipation | | P_D | 500 | mW |
| Derate above $T_A > 70^\circ\text{C}$ | DIP-16 | | 12 | mW/K |
| | SOP-16 | | 8 | mW/K |
| Derate above $T_A > 60^\circ\text{C}$ | TSSOP-16 | | 5.5 | mW/K |
| Storage Temperature | | T_{STG} | -65 ~ +150 | $^\circ\text{C}$ |

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 | V_{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_S | | V_{EE} | | V_{CC} | V |
| Input Transition Rise or Fall Rate | t_R, t_F | $V_{CC}=2.0\text{V}$ | | 6.0 | 1000 | ns |
| | | $V_{CC}=4.5\text{V}$ | | 6.0 | 500 | ns |
| | | $V_{CC}=6.0\text{V}$ | | 6.0 | 400 | ns |
| | | $V_{CC}=10.0\text{V}$ | | 6.0 | 250 | ns |
| Operating Temperature | T_A | | -40 | | +85 | $^\circ\text{C}$ |

■ STATIC CHARACTERISTICS ($T_A=25^\circ\text{C}$)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|---------------------------------|---------------|-------------------------------------------------------------------------------------------|---------------------------------------|-----|------|------|---------------|
| High-Level Input Voltage | V_{IH} | $V_{CC}=2.0\text{V}$ | 1.5 | 1.2 | | V | |
| | | $V_{CC}=4.5\text{V}$ | 3.15 | 2.4 | | V | |
| | | $V_{CC}=6.0\text{V}$ | 4.2 | 3.2 | | V | |
| | | $V_{CC}=9.0\text{V}$ | 6.3 | 4.7 | | V | |
| Low-Level Input Voltage | V_{IL} | $V_{CC}=2.0\text{V}$ | | 0.8 | 0.5 | V | |
| | | $V_{CC}=4.5\text{V}$ | | 2.1 | 1.35 | V | |
| | | $V_{CC}=6.0\text{V}$ | | 2.8 | 1.8 | V | |
| | | $V_{CC}=9.0\text{V}$ | | 4.3 | 2.7 | V | |
| Analog switch OFF-state current | $I_{S(OFF)}$ | $V_{CC}=10\text{V}, V_{EE}=0\text{V}, V_{IN}=V_{IH}$ or V_{IL} $ V_S =V_{CC}-V_{EE}$ | per channel | | | ±1 | μA |
| | | | all channels | | | ±2 | μA |
| Analog switch ON-state current | $I_{S(ON)}$ | $V_{CC}=10\text{V}, V_{EE}=0\text{V}, V_{IN}=V_{IH}$ or V_{IL} $ V_S =V_{CC}-V_{EE}$ | | | | ±2.0 | μA |
| Input Leakage Current | $I_{I(LEAK)}$ | $V_{CC}=6\text{V}, V_{EE}=0\text{V}, V_{IN}=V_{CC}$ or GND | | | | ±1.0 | μA |
| | | $V_{CC}=10\text{V}, V_{EE}=0\text{V}, V_{IN}=V_{CC}$ or GND | | | | ±2.0 | μA |
| Quiescent Supply Current | I_Q | $V_{IN}=V_{CC}$ or GND $V_{IS}=V_{EE}$ or V_{CC} $V_{OS}=V_{CC}$ or V_{EE} | $V_{CC}=6\text{V}, V_{EE}=0\text{V}$ | | | 80 | μA |
| | | | $V_{CC}=10\text{V}, V_{EE}=0\text{V}$ | | | 160 | μA |

■ STATIC CHARACTERISTICS(Cont.) (T_A=25°C)

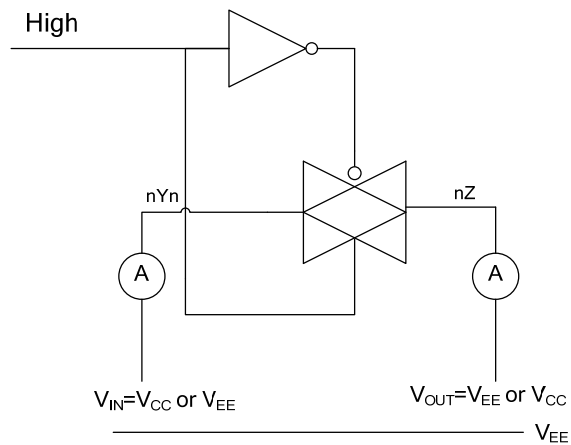
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|-----------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|---|
| ON-Resistance | PEAK | R _{ON(PEAK)} | V _{CC} =2V, V _{EE} =0V, I _S =100uA, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} , | | | | Ω |
| | | | V _{CC} =4.5V, V _{EE} =0V, I _S =1mA, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} , | | 100 | 225 | Ω |
| | | | V _{CC} =6V, V _{EE} =0V, I _S =1mA, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} | | 90 | 200 | Ω |
| | | | V _{CC} =4.5V, V _{EE} =-4.5V, I _S =1mA, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} | | 70 | 165 | Ω |
| | RAIL | R _{ON(RAIL)} | V _{CC} =2V, V _{EE} =0V, I _S =100uA, V _{IS} =V _{EE} , V _{IN} =V _{IH} or V _{IL} , | | 150 | | Ω |
| | | | V _{CC} =4.5V, V _{EE} =0V, I _S =1mA, V _{IS} =V _{EE} , V _{IN} =V _{IH} or V _{IL} , | | 80 | 175 | Ω |
| | | | V _{CC} =6V, V _{EE} =0V, I _S =1mA, V _{IS} =V _{EE} , V _{IN} =V _{IH} or V _{IL} | | 70 | 150 | Ω |
| | | | V _{CC} =4.5V, V _{EE} =-4.5V, I _S =1mA, V _{IS} =V _{EE} , V _{IN} =V _{IH} or V _{IL} | | 60 | 130 | Ω |
| | | | V _{CC} =2V, V _{EE} =0V, I _S =100uA, V _{IS} =V _{CC} , V _{IN} =V _{IH} or V _{IL} , | | 150 | | Ω |
| | | | V _{CC} =4.5V, V _{EE} =0V, I _S =1mA, V _{IS} =V _{CC} , V _{IN} =V _{IH} or V _{IL} , | | 90 | 200 | Ω |
| | | | V _{CC} =6V, V _{EE} =0V, I _S =1mA, V _{IS} =V _{CC} , V _{IN} =V _{IH} or V _{IL} | | 80 | 175 | Ω |
| | | | V _{CC} =4.5V, V _{EE} =-4.5V, I _S =1mA, V _{IS} =V _{CC} , V _{IN} =V _{IH} or V _{IL} | | 65 | 150 | Ω |
| Maximum On-Resistance Difference Between Any Two Channels | ΔR _{ON} | V _{CC} =2V, V _{EE} =0V, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} , | | | | Ω | |
| | | V _{CC} =4.5V, V _{EE} =0V, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} , | | 9 | | Ω | |
| | | V _{CC} =6V, V _{EE} =0V, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} | | 8 | | Ω | |
| | | V _{CC} =4.5V, V _{EE} =-4.5V, V _{IS} =V _{CC} to V _{EE} , V _{IN} =V _{IH} or V _{IL} | | 6 | | Ω | |

■ DYNAMIC CHARACTERISTICS (T_A=25°C, GND=0V; t_R=t_F=6ns; C_L=50pF)

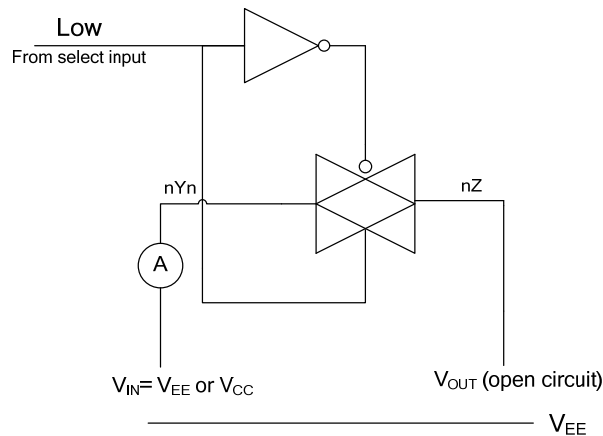
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------------------------------------------|------------------------------------|-------------------------------------------------------------------|-----|-----|-----|------|
| Propagation Delay From V _{IS} to V _{OS} | t _{PHL} /t _{PLH} | V _{CC} =2V, V _{EE} =0V, R _L =∞ | | 14 | 75 | ns |
| | | V _{CC} =4.5V, V _{EE} =0V, R _L =∞ | | 5 | 15 | ns |
| | | V _{CC} =6V, V _{EE} =0V, R _L =∞ | | 4 | 13 | ns |
| | | V _{CC} =4.5V, V _{EE} =-4.5V, R _L =∞ | | 4 | 10 | ns |
| Turn-ON Time \bar{E} Sn to V _{OS} | t _{PZH} /t _{PZL} | V _{CC} =2V, V _{EE} =0V, R _L =∞ | | 105 | 405 | ns |
| | | V _{CC} =4.5V, V _{EE} =0V, R _L =∞ | | 38 | 81 | ns |
| | | V _{CC} =6V, V _{EE} =0V, R _L =∞ | | 30 | 69 | ns |
| | | V _{CC} =4.5V, V _{EE} =-4.5V, R _L =∞ | | 26 | 58 | ns |
| Turn-OFF Time \bar{E} Sn to V _{OS} | t _{PHZ} /t _{PLZ} | V _{CC} =2V, V _{EE} =0V, R _L =1k | | 74 | 315 | ns |
| | | V _{CC} =4.5V, V _{EE} =0V, R _L =1k | | 27 | 63 | ns |
| | | V _{CC} =6V, V _{EE} =0V, R _L =1k | | 22 | 54 | ns |
| | | V _{CC} =4.5V, V _{EE} =-4.5V, R _L =1k | | 22 | 48 | ns |

■ TEST CIRCUIT AND WAVEFORMS

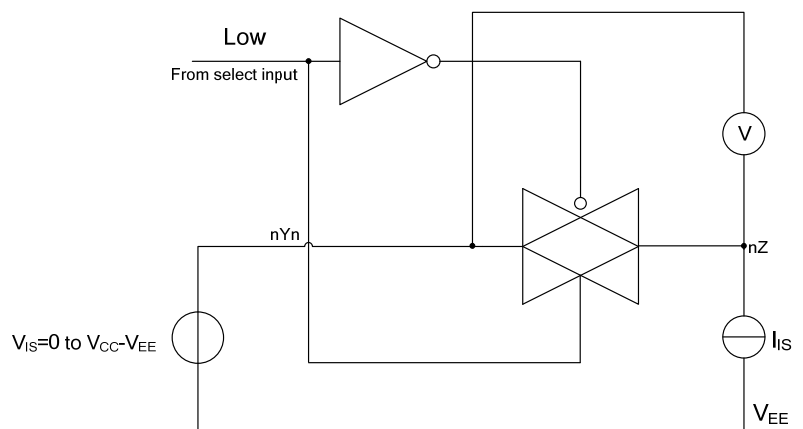
Test circuit for measuring OFF-state current



Test circuit for measuring ON-state current

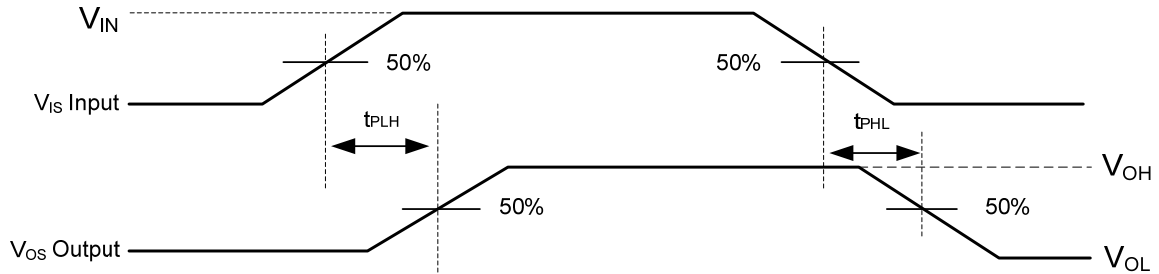


Test circuit for measuring RON

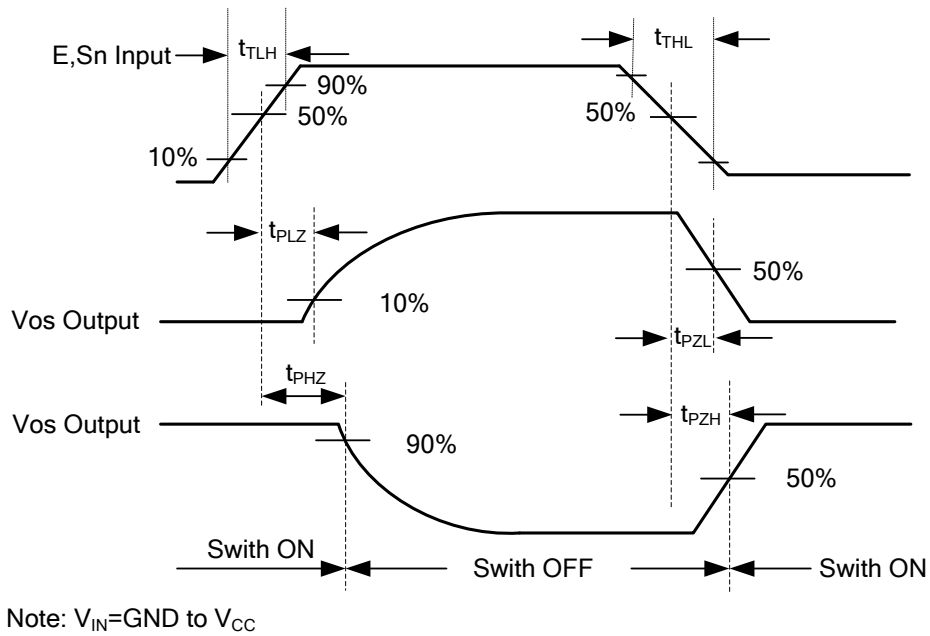


■ TEST CIRCUIT AND WAVEFORMS(Cont.)

Waveforms showing the Input (V_{IS}) to Output (V_{OS}) propagation delays

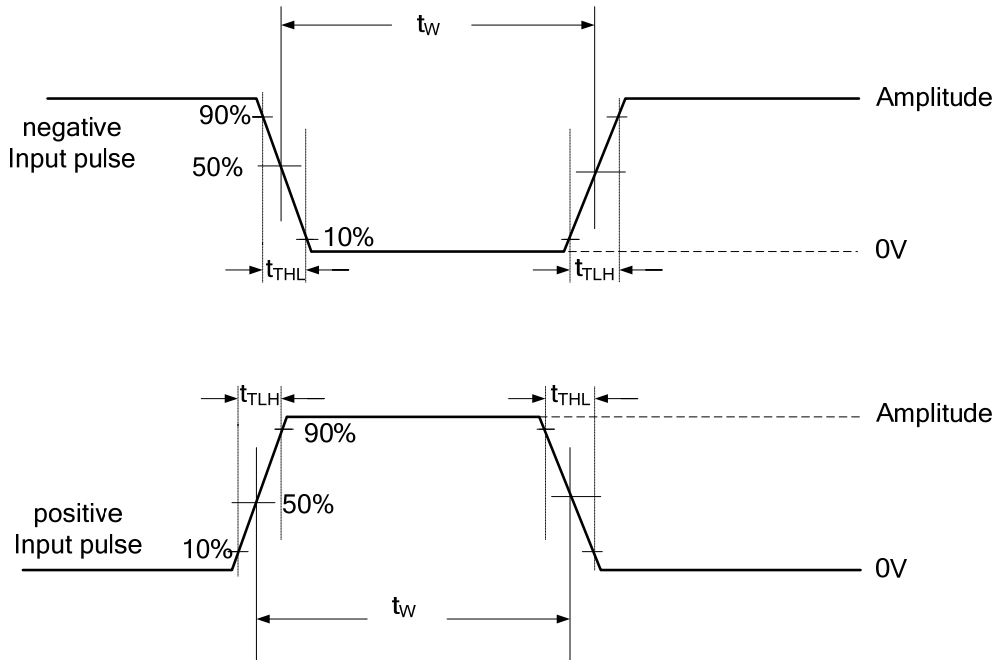


Waveforms showing the turn-on and turn-off times.

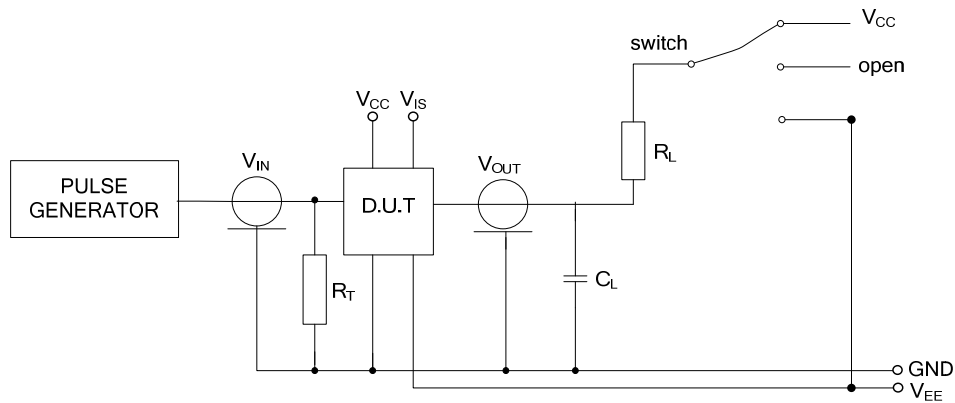


■ TEST CIRCUIT AND WAVEFORMS(Cont.)

Input pulse definitions



Test circuit for measuring AC performance.



| TEST | SWITCH | V _{IS} |
|------------------|-----------------|-----------------|
| t _{PZH} | V _{EE} | V _{CC} |
| t _{PZL} | V _{CC} | V _{EE} |
| t _{PHZ} | V _{EE} | V _{CC} |
| t _{PLZ} | V _{CC} | V _{EE} |
| other | open | pulse |

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_{THL}=t_{TLH}=6 ns; when measuring f_{MAX}, there is no constraint to t_{THL} and t_{TLH} with 50% duty factor.

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