



## U74HC4052

CMOS IC

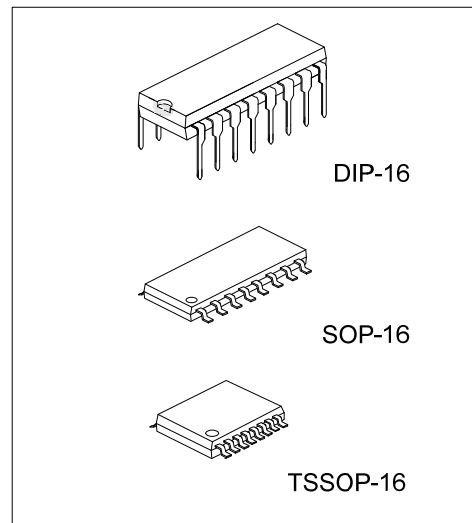
### DUAL 4-CHANNEL ANALOG MULTIPLEXER, DEMULTIPLEXER

#### 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

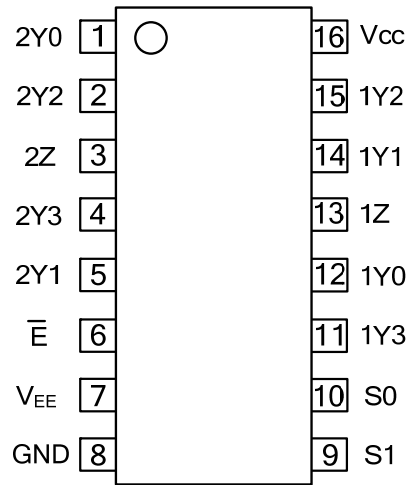


#### ORDERING INFORMATION

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>U74HC4052L-D16-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Lead Plating</p>	<p>(1) R: Tape Reel, T: Tube</p> <p>(2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16</p> <p>(3) G: Halogen Free, L: Lead Free</p>
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■ PIN CONFIGURATION

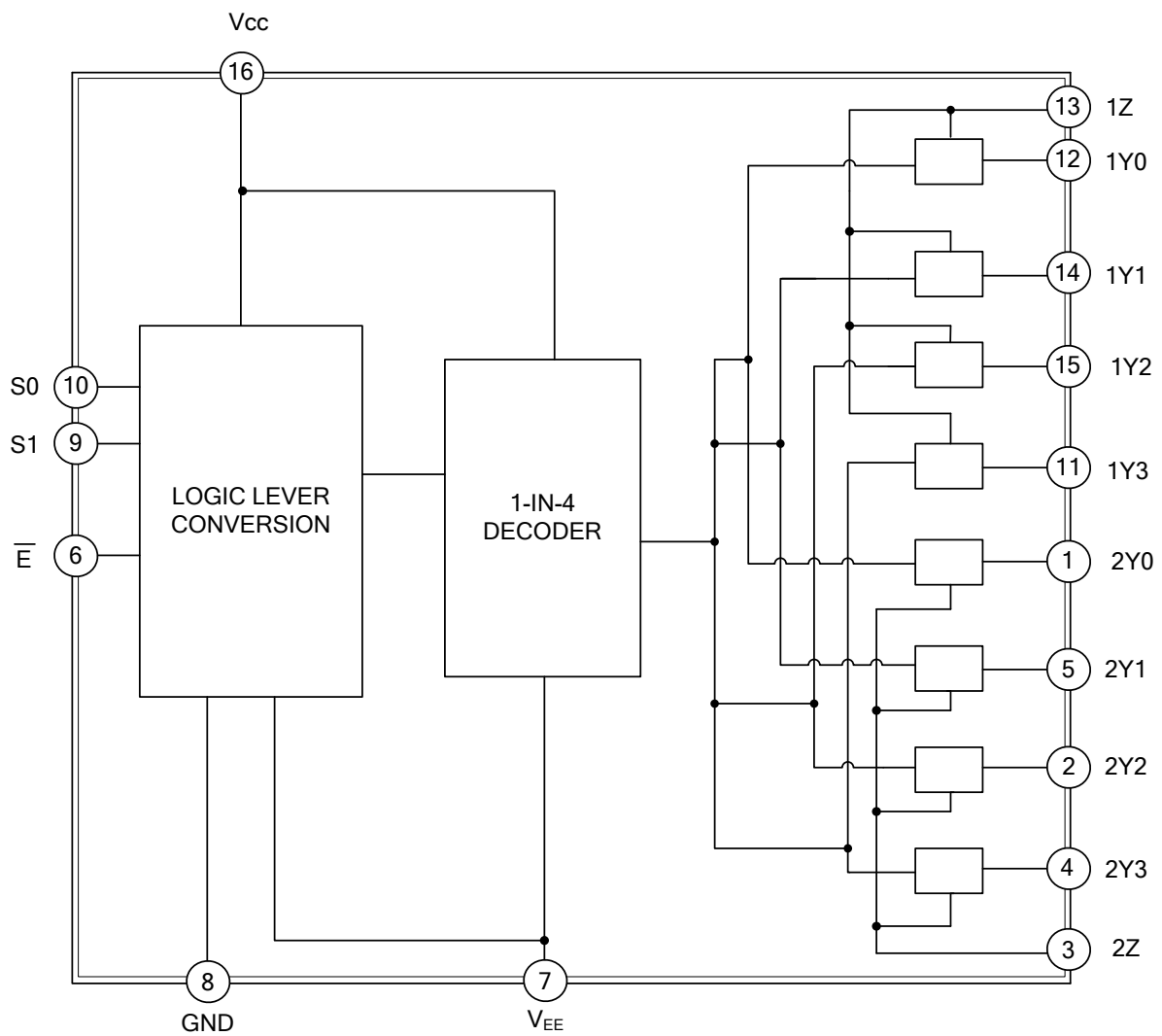


■ FUNCTION TABLE (each gate)

INPUT( $\bar{E}$ )	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	$I_{CC}$	$\pm 50$	mA	
$V_{EE}$ Current	$I_{EE}$	$\pm 20$	mA	
Input Clamp Current	$I_{IK}$	$\pm 20$	mA	
Switch Diode Current	$I_{SK}$	$\pm 20$	mA	
Switch Current	$I_S$	$\pm 25$	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			$\pm 1$	$\mu\text{A}$
			all channels			$\pm 2$	$\mu\text{A}$
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}$				$\pm 2.0$	$\mu\text{A}$
Input Leakage Current	$I_{I(LEAK)}$	$V_{CC}=6\text{V}, V_{EE}=0\text{V}, V_{IN}=V_{CC}$ or GND				$\pm 1.0$	$\mu\text{A}$
		$V_{CC}=10\text{V}, V_{EE}=0\text{V}, V_{IN}=V_{CC}$ or GND				$\pm 2.0$	$\mu\text{A}$
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	$\mu\text{A}$
			$V_{CC}=10\text{V}, V_{EE}=0\text{V}$			160	$\mu\text{A}$

■ STATIC CHARACTERISTICS(Cont.) (T<sub>a</sub>=25°C)

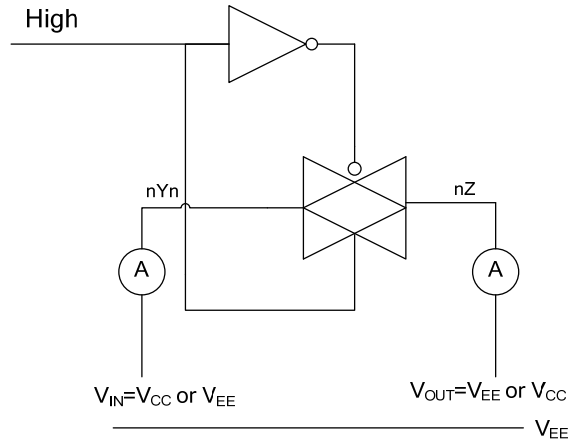
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
ON-Resistance	PEAK	R <sub>ON(PEAK)</sub>	V <sub>CC</sub> =2V, V <sub>EE</sub> =0V, I <sub>S</sub> =100uA, V <sub>IS</sub> =V <sub>CC</sub> to V <sub>EE</sub> , V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,				Ω
			V <sub>CC</sub> =4.5V, V <sub>EE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

■ DYNAMIC CHARACTERISTICS (T<sub>a</sub>=25°C, GND=0V; t<sub>R</sub>=t<sub>F</sub>=6ns; C<sub>L</sub>=50pF)

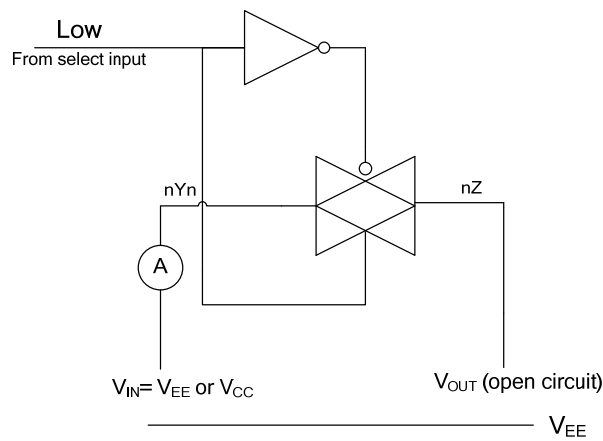
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay From V <sub>IS</sub> to V <sub>O</sub>	t <sub>PHL</sub> /t <sub>PLH</sub>	V <sub>CC</sub> =2V, V <sub>EE</sub> =0V, R <sub>L</sub> =∞		14	75	ns
		V <sub>CC</sub> =4.5V, V <sub>EE</sub> =0V, R <sub>L</sub> =∞		5	15	ns
		V <sub>CC</sub>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

■ TEST CIRCUIT AND WAVEFORMS

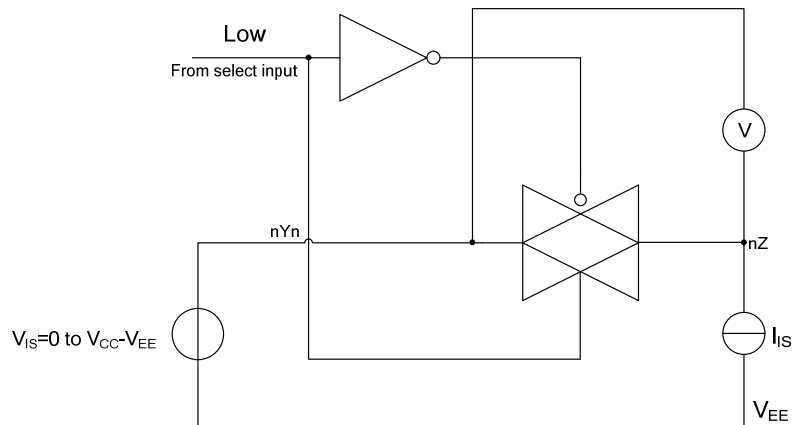
Test circuit for measuring OFF-state current



Test circuit for measuring ON-state current

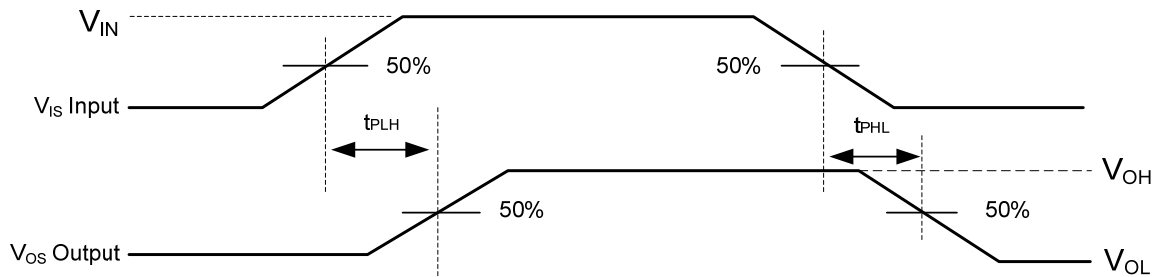


Test circuit for measuring RON

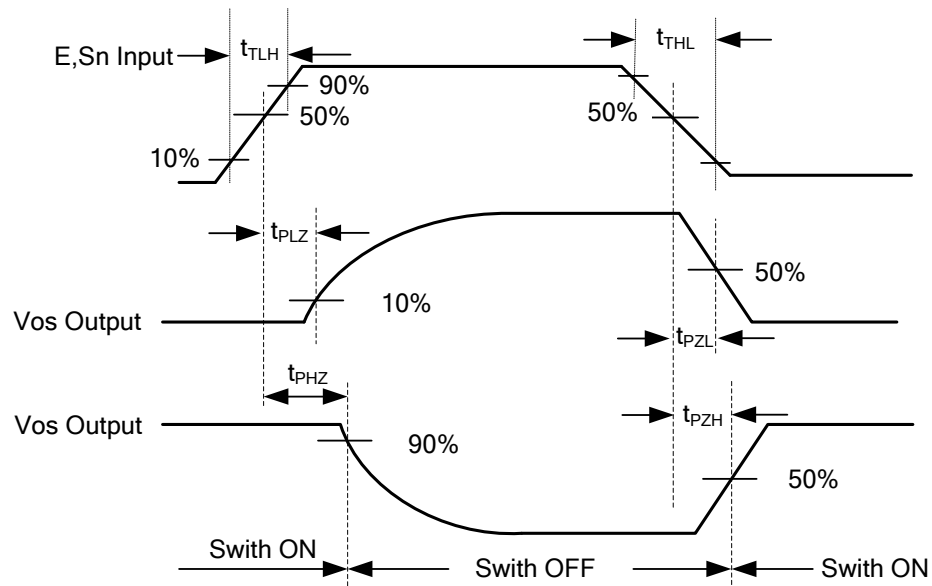


■ TEST CIRCUIT AND WAVEFORMS(Cont.)

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



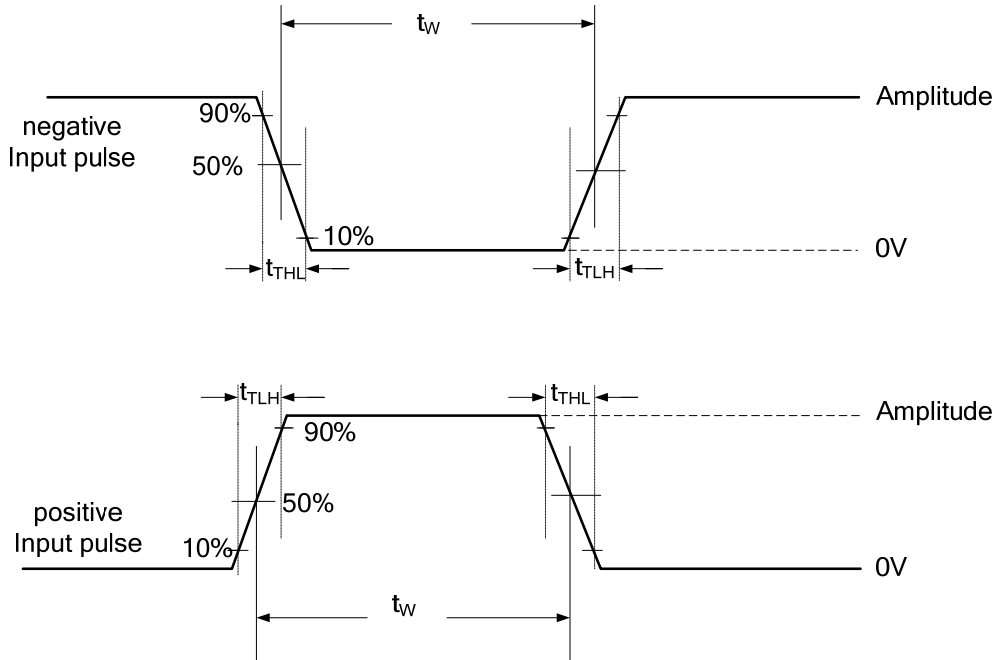
Waveforms showing the turn-on and turn-off times.



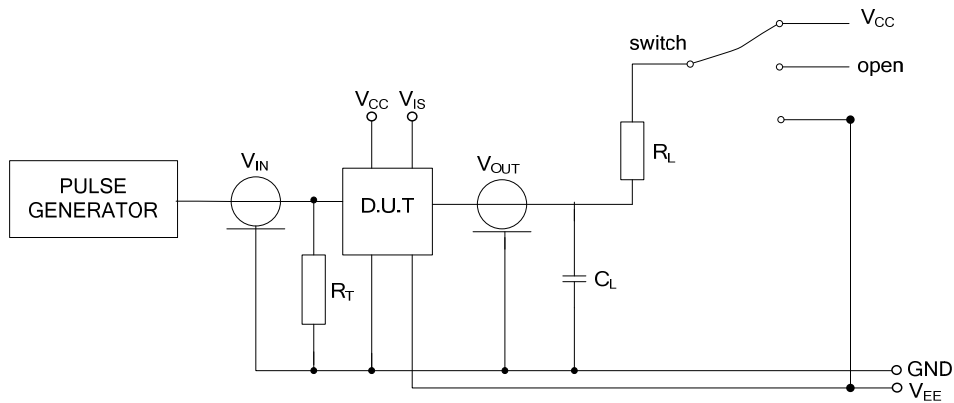
Note:  $V_{IN} = \text{GND to } V_{CC}$

## ■ TEST CIRCUIT AND WAVEFORMS(Cont.)

### input pulse definitions



### Test circuit for measuring AC performance.



TEST	SWITCH	V <sub>IS</sub>
t <sub>PZH</sub>	V <sub>EE</sub>	V <sub>CC</sub>
t <sub>PZL</sub>	V <sub>CC</sub>	V <sub>EE</sub>
t <sub>PHZ</sub>	V <sub>EE</sub>	V <sub>CC</sub>
t <sub>PLZ</sub>	V <sub>CC</sub>	V <sub>EE</sub>
other	open	pulse

NOTE: Definitions for test circuit:

R<sub>L</sub> = load resistance

C<sub>L</sub> = load capacitance including jig and probe capacitance.

R<sub>T</sub> = termination resistance should be equal to the output impedance Z<sub>O</sub> of the pulse generator.

t<sub>THL</sub>=t<sub>TLH</sub>=6 ns; when measuring f<sub>MAX</sub>, there is no constraint to t<sub>THL</sub> and t<sub>TLH</sub> with 50% duty factor.

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