



U74HC4053

CMOS IC

TRIPLE 2-CHANNEL ANALOG MULTIPLEXER/ DEMULTIPLEXER

DESCRIPTION

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

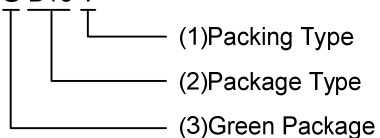
FEATURES

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

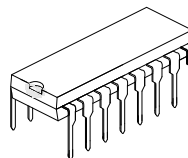
ORDERING INFORMATION

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
U74HC4053L-QAH-R	U74HC4053G-QAH-R	QFN-16(3.5×2.5)	Tape Reel

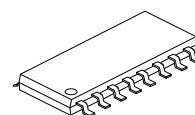
U74HC4053G-D16-T



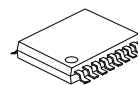
- (1) T: Tube, R: Tape Reel
(2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16
QAH: QFN-16(3.5×2.5)
(3) G: Halogen Free and Lead Free, L: Lead Free



DIP-16



SOP-16



TSSOP-16

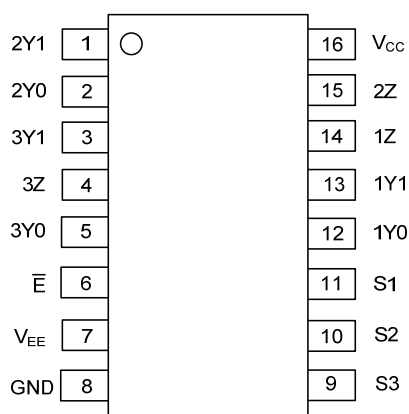


QFN-16(3.5×2.5)

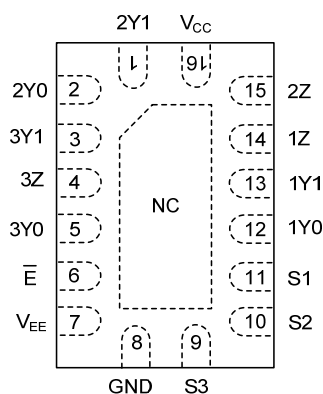
MARKING

PACKAGE	MARKING
DIP-16	
SOP-16 / TSSOP-16	
QFN-16(3.5×2.5)	

PIN CONFIGURATION



DIP-16 / SOP-16 / TSSOP-16



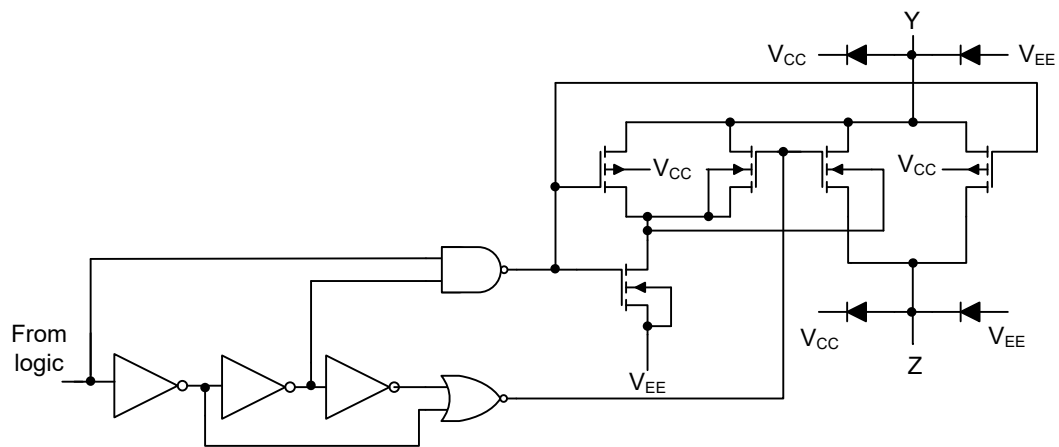
QFN-16(3.5×2.5)
(TOP VIEW)

FUNCTION TABLE

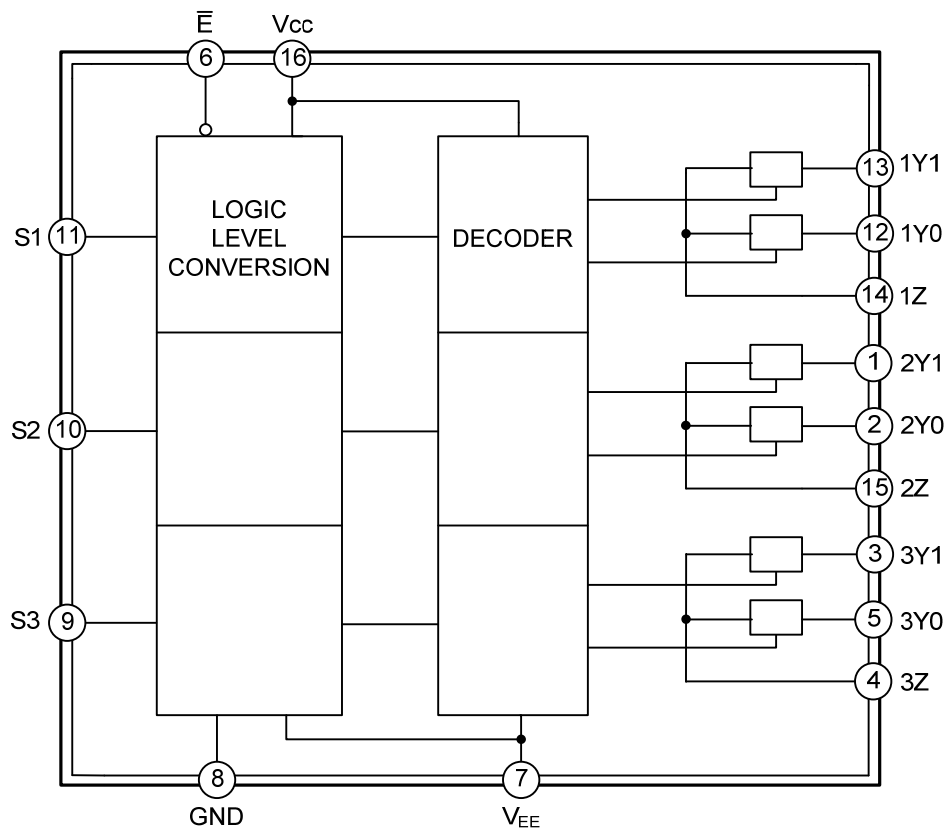
INPUT(E)	INPUT(Sn)	CHANNEL ON
L	L	nY0 to nZ
L	H	nY1 to nZ
H	X	none

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

■ SCHEMATIC DIAGRAM (one switch)



■ FUNCTION DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	CONDITIONS	RATINGS	UNIT
Supply Voltage		V_{CC}		-0.5 ~ +11.0	V
Input Clamping Current		I_{IK}	$V_{IN} < -0.5V$ or $V_{IN} > V_{CC} + 0.5V$	± 20	mA
Switch Clamping Current		I_{SK}	$V_S < -0.5V$ or $V_S > V_{CC} + 0.5V$	± 20	mA
Switch Current		I_{SW}	$V_S = -0.5V$ to $V_{CC} + 0.5V$	± 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
	QFN-16(3.5×2.5)			400	mW
Derate Above $T_A > 70^\circ C$	DIP-16			12	mW/K
	SOP-16/TSSOP-16			8	mW/K
	QFN-16(3.5×2.5)			7	mW/K
Storage Temperature		T_{STG}		-65 ~ +150	$^\circ C$

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		10	V
		$V_{CC}-V_{EE}$	2		10	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	$V_{CC}=2.0V$			1000	ns
		$V_{CC}=4.5V$			500	ns
		$V_{CC}=6.0V$			400	ns
		$V_{CC}=10.0V$			250	ns
Operating Temperature	T_A		-40		+125	$^\circ C$

■ STATIC CHARACTERISTICS ($T_A=25^\circ C$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
High-Level Input Voltage	V_{IH}	$V_{CC}=2.0V$		1.5			V
		$V_{CC}=4.5V$		3.15			V
		$V_{CC}=6.0V$		4.2			V
		$V_{CC}=9.0V$		6.3			V
Low-Level Input Voltage	V_{IL}	$V_{CC}=2.0V$				0.5	V
		$V_{CC}=4.5V$				1.35	V
		$V_{CC}=6.0V$				1.8	V
		$V_{CC}=9.0V$				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

■ STATIC CHARACTERISTICS (Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT	
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	
Input Capacitance		C _I		V _{CC} =5V,V _{EE} =0V		3.5	10	pF	
Switch Capacitance		C _{SW}	Independent pins nYn	V _{CC} =5V,V _{EE} =0V,E=0V		4	35	pF	
			Common pins nZ			5	50	pF	
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
			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		ΔR _{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 ($T_A=25^\circ\text{C}$, $\text{GND}=0\text{V}$, $t_R=t_F=6\text{ns}$, unless otherwise specified)

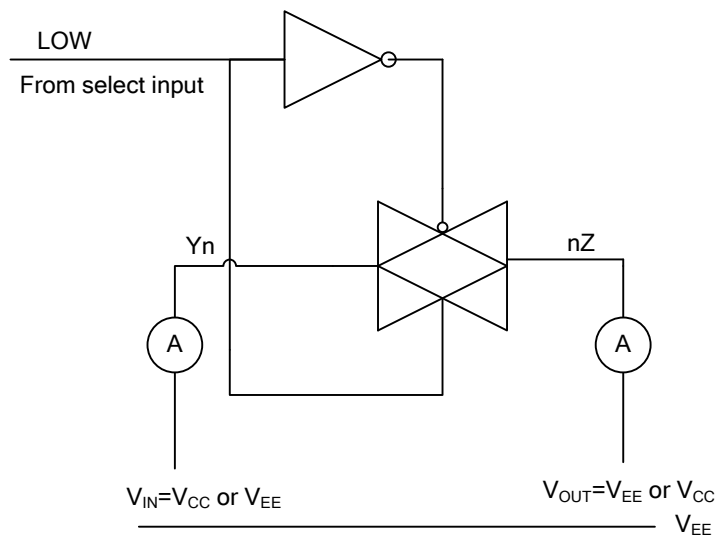
PARAMETER		SYMBOL	TEST CONDITIONS			MIN	TYP	MAX	UNIT	
Propagation Delay Form V _{IS} to V _{OS}		t _{PHL} /t _{PLH}	R _L =∞ C _L =50pF	V _{EE} =0V	V _{CC} =2.0V			60	ns	
					V _{CC} =4.5V			12	ns	
					V _{CC} =6.0V			10	ns	
					V _{EE} =-4.5V	V _{CC} =4.5V			8	ns
Turn-ON Time	E̅ to V _{OS}	t _{PZH} /t _{PZL}	R _L =1kΩ, C _L =50pF	V _{EE} =0V	V _{CC} =2.0V			220	ns	
					V _{CC} =4.5V			44	ns	
					V _{CC} =6.0V			37	ns	
					V _{EE} =-4.5V	V _{CC} =4.5V			31	ns
	S _n to V _{OS}		R _L =1kΩ, C _L =15pF	V _{EE} =0V	V _{CC} =5.0V		17		ns	
						V _{CC} =2.0V			220	ns
						V _{CC} =4.5V			44	ns
						V _{CC} =6.0V			37	ns
		V _{EE} =-4.5V				V _{CC} =4.5V			31	ns
		R _L =1kΩ, C _L =15pF				V _{EE} =0V	V _{CC} =5.0V		21	
Turn-OFF Time	E̅ to V _{OS}	t _{PHZ} /t _{PLZ}	R _L =1kΩ, C _L =50pF	V _{EE} =0V	V _{CC} =2.0V			210	ns	
					V _{CC} =4.5V			42	ns	
					V _{CC} =6.0V			36	ns	
					V _{EE} =-4.5V	V _{CC} =4.5V			29	ns
	S _n to V _{OS}		R _L =1kΩ, C _L =15pF	V _{EE} =0V	V _{CC} =5.0V		18		ns	
						V _{CC} =2.0V			210	ns
						V _{CC} =4.5V			42	ns
						V _{CC} =6.0V			36	ns
		V _{EE} =-4.5V				V _{CC} =4.5V			29	ns
		R _L =1kΩ, C _L =15pF				V _{EE} =0V	V _{CC} =5.0V		17	

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

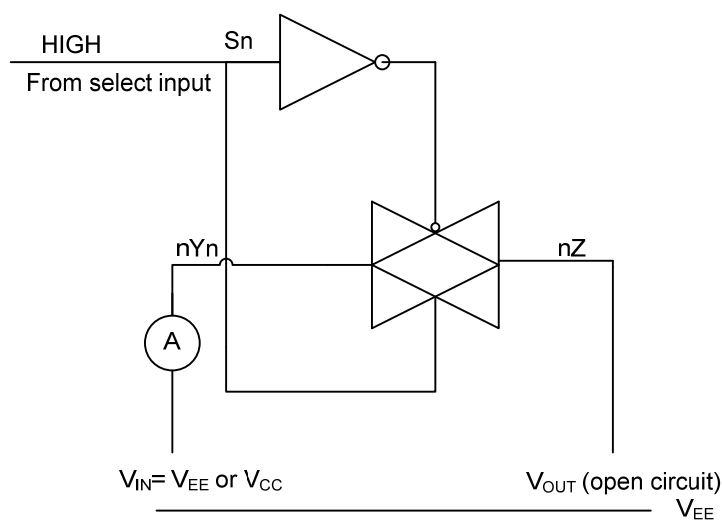
V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

■ TEST CIRCUITS AND WAVEFORMS

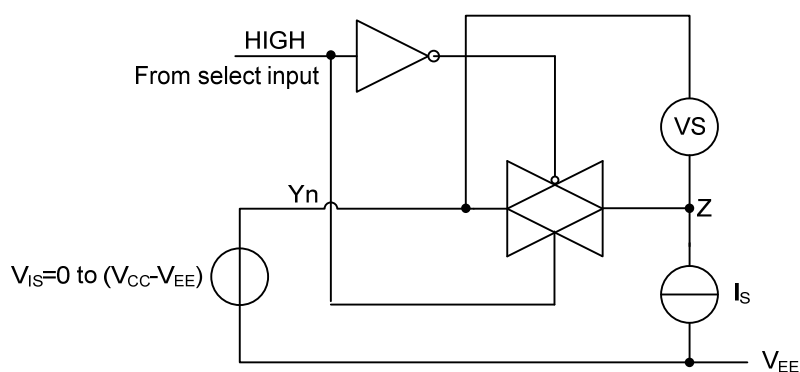
For OFF-state current



For ON-state current

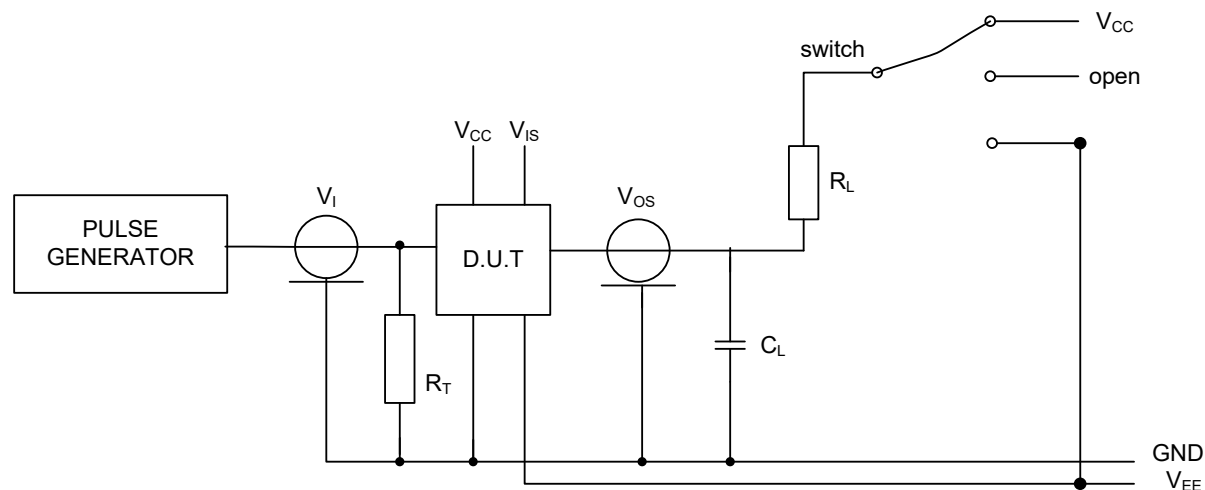


For R_{ON}



■ 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

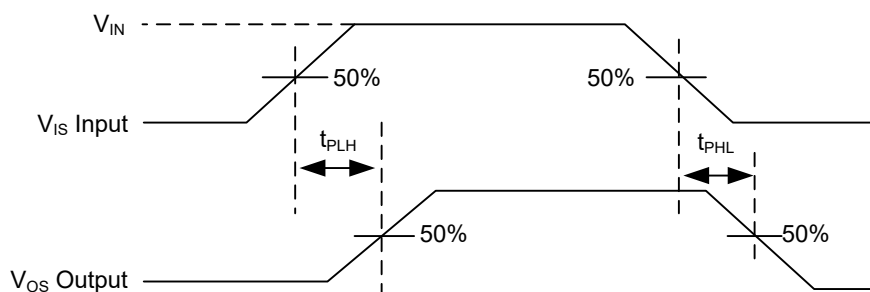
C_L = load capacitance including jig and probe capacitance.

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

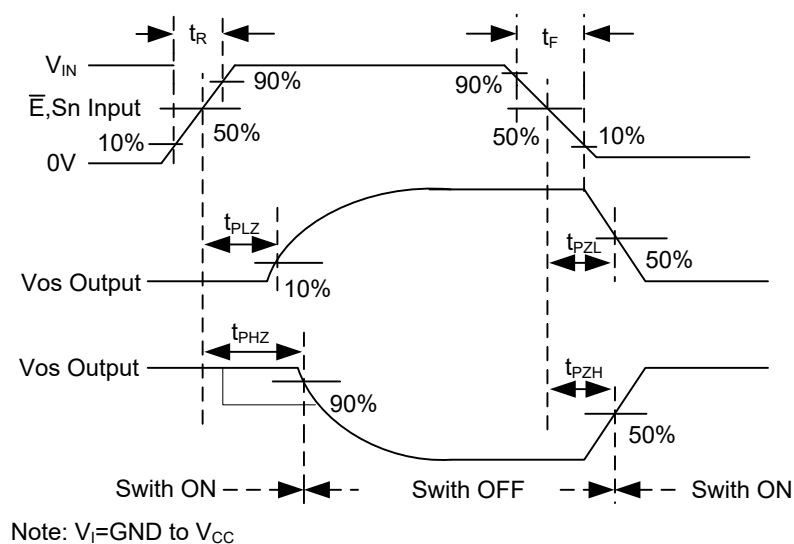
$t_R=t_F=6$ ns; when measuring f_{MAX} , there is no constraint to t_R and t_F with 50% duty factor(<2ns).

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

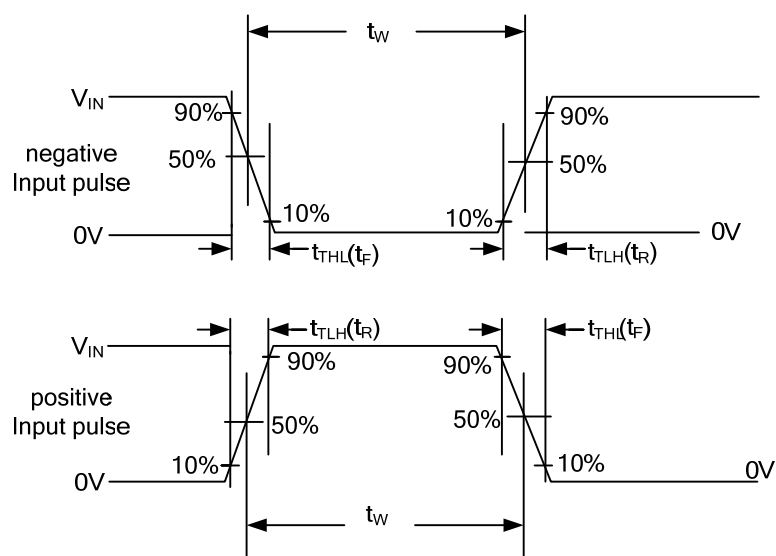
The Input (V_{IS}) to Output (V_{OS}) propagation delays Waveform



The turn-on and turn-off times Waveform



Input pulse definition



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