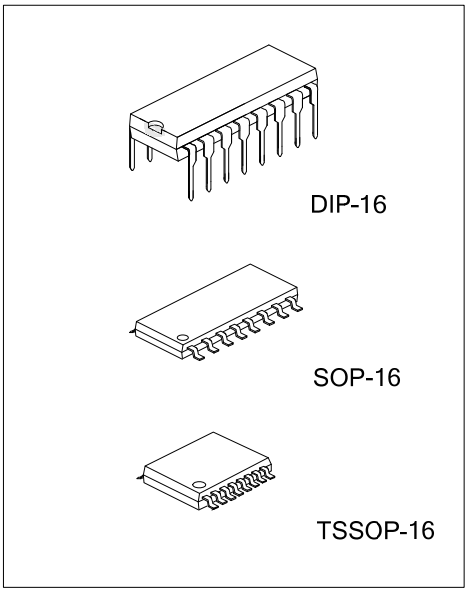
U74HC4053

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

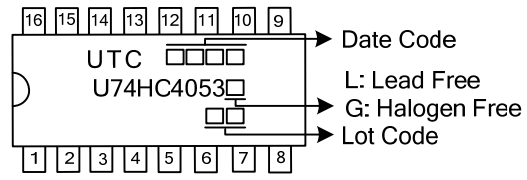
Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74HC4053L-D16-T	U74HC4053G-D16-T	DIP-16	Tube
-	U74HC4053G-S16-R	SOP-16	Tape Reel
-	U74HC4053G-P16-R	TSSOP-16	Tape Reel

U74HC4053L-D16-T
(1)Packing Type
(2)Package Type
(3)Green Package

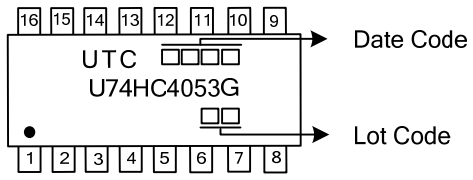
(1) T: Tube, R: Tape Reel
(2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16
(3) L: Lead Free, G: Halogen Free and Lead Free

■ MARKING

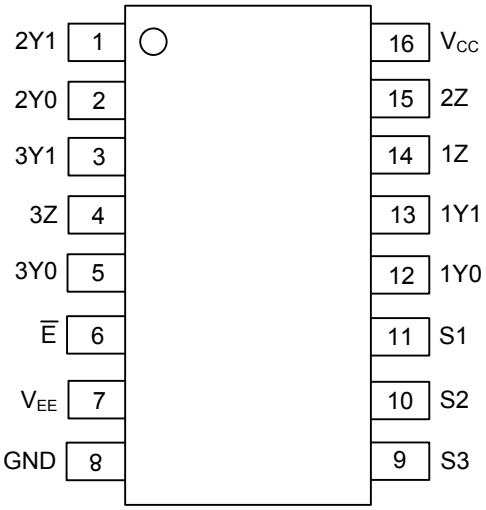
DIP-16



SOP-16 / TSSOP-16



■ PIN CONFIGURATION

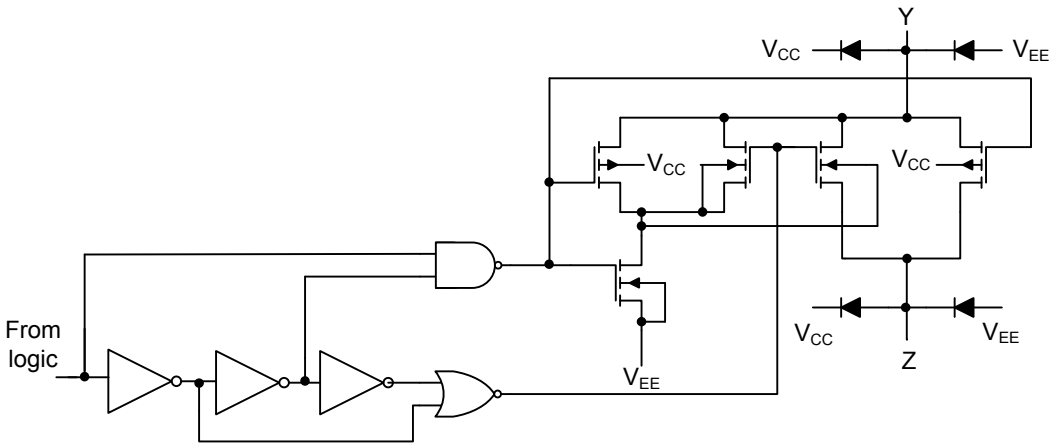


■ FUNCTION TABLE

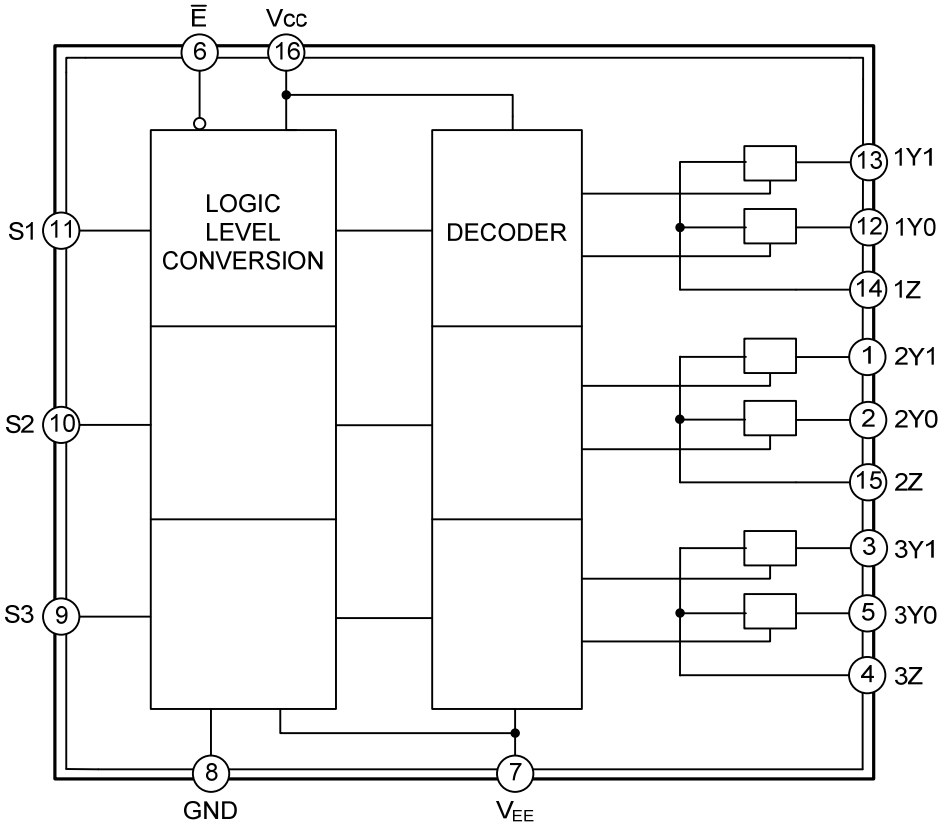
INPUT($\overline{E}$)	INPUT(Sn)	CHANNEL ON
L	L	nY0 to nZ
L	H	nY1 to nZ
H	X	none

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

■ SCHEMATIC DIAGRAM(one switch)



■ FUNCTION DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	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 Ta>70°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
			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.

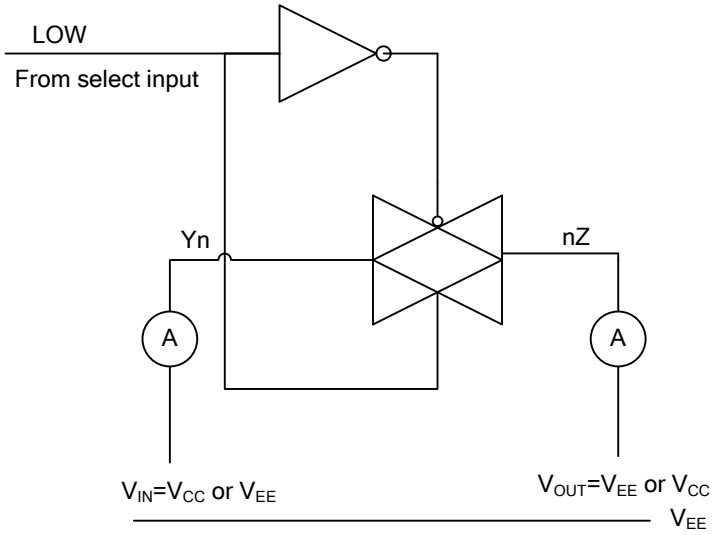
■ DYNAMIC CHARACTERISTICS (Ta=25°C, GND=0V, t_R=t_F=6ns, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS			MIN	TYP	MAX	UNIT
Propagation Delay Form V_{IS} to V_{OS}		t_{PHL}/t_{PLH}	R_L=∞ 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	$\overline{E}$ to V_{OS}	t_{PZH}/t_{PZL}	R_L=1kΩ, 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
			R_L=1kΩ, C_L=15pF	V_{EE}=0V	V_{CC}=5.0V		17		ns
	Sn to V_{OS}		R_L=1kΩ, C_L=50pF	V_{EE}=0V	V_{CC}=2.0V		75	220	ns
					V_{CC}=4.5V		25	44	ns
					V_{CC}=6.0V		20	37	ns
				V_{EE}=-4.5V	V_{CC}=4.5V		15	31	ns
			R_L=1kΩ, C_L=15pF	V_{EE}=0V	V_{CC}=5.0V		21		ns
Turn-OFF Time	$\overline{E}$ to V_{OS}	t_{PHZ}/t_{PLZ}	R_L=1kΩ, 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
			R_L=1kΩ, C_L=15pF	V_{EE}=0V	V_{CC}=5.0V		18		ns
	Sn to V_{OS}		R_L=1kΩ, C_L=50pF	V_{EE}=0V	V_{CC}=2.0V		60	210	ns
					V_{CC}=4.5V		20	42	ns
					V_{CC}=6.0V		16	36	ns
				V_{EE}=-4.5V	V_{CC}=4.5V		15	29	ns
			R_L=1kΩ, C_L=15pF	V_{EE}=0V	V_{CC}=5.0V		17		ns

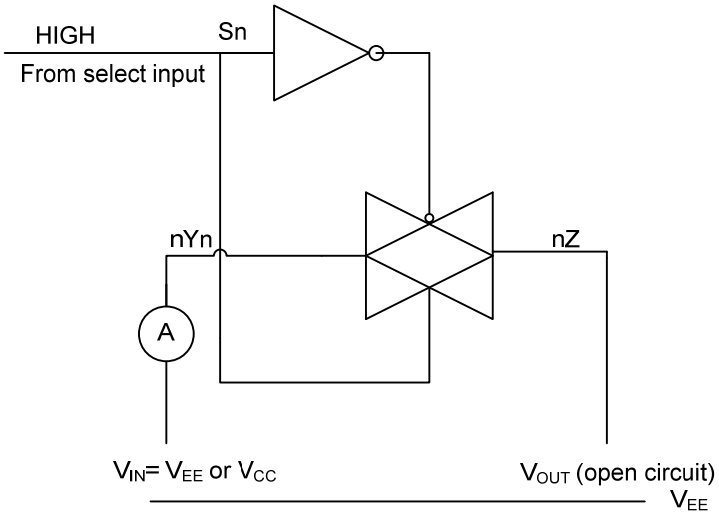
Note: V_{IS} is the input voltage at a nYn or nZ terminal, whichever is assigned as an input.
V_{OS} is the output voltage at a nYn or nZ terminal, whichever is assigned as an output.

■ TEST CIRCUITS AND WAVEFORMS

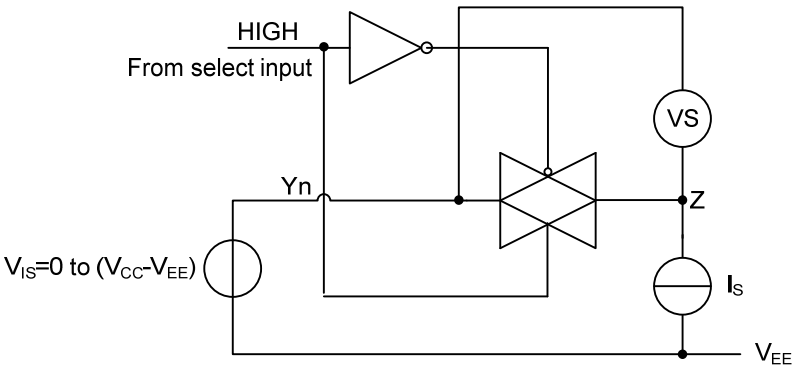
For OFF-state current



For ON-state current

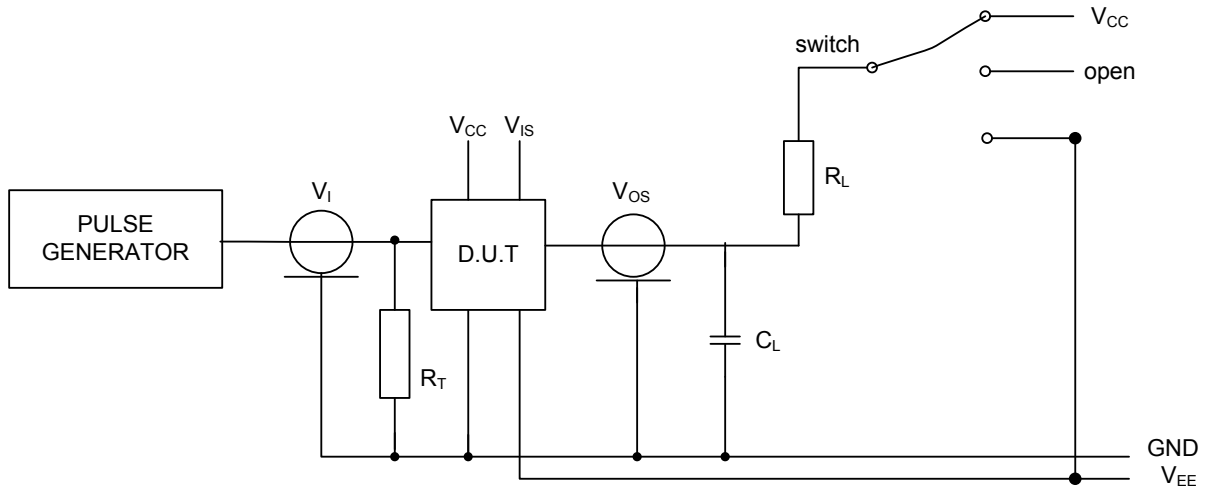


For R_{ON}



■ 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

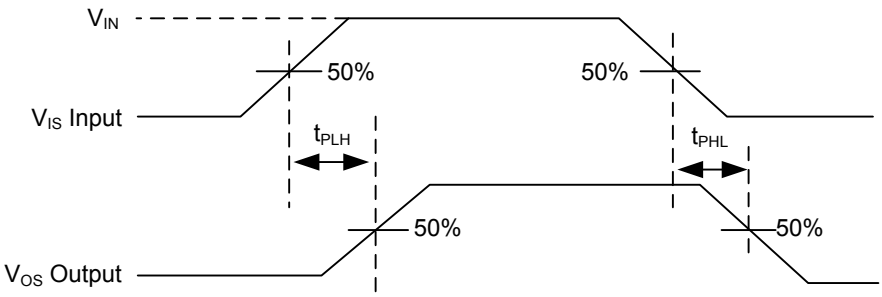
C_L = load capacitance including jig and probe capacitance.

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

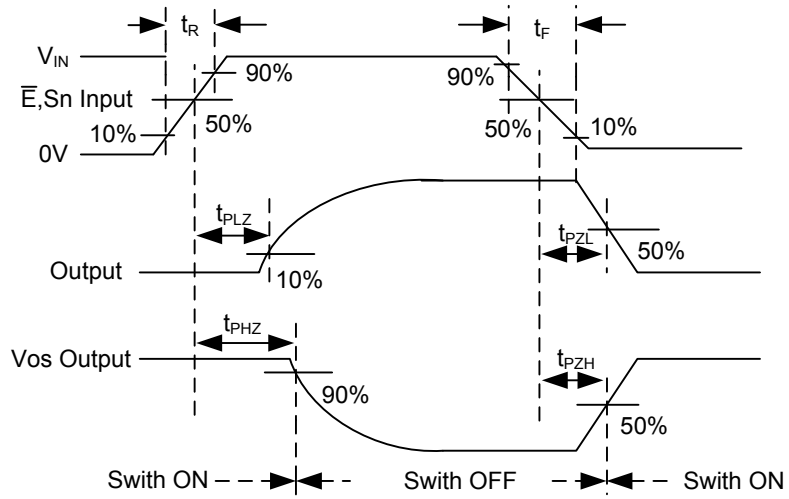
t_R=t_F=6 ns; when measuring f_{MAX}, there is no constraint to tr and tf with 50% duty factor(<2ns).

■ TEST CIRCUITS AND WAVEFORMS(Cont.)

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



The turn-on and turn-off times Waveform



Note: V_I=GND to V_{CC}

Input pulse definition