



U74HC4051

CMOS IC

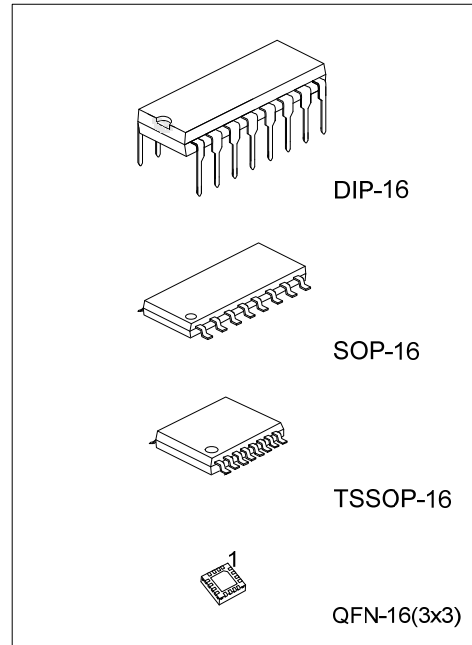
8-CHANNEL ANALOG MULTIPLEXER/ DEMULTIPLEXER

DESCRIPTION

The UTC **U74HC4051** is a high-performance, 8-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

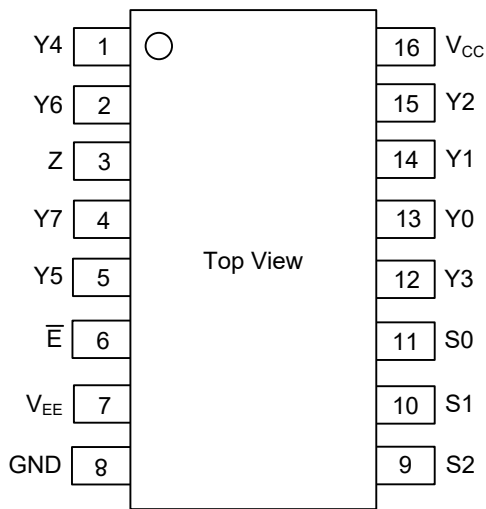
Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74HC4051L-D16-T	U74HC4051G-D16-T	DIP-16	Tube
U74HC4051L-S16-T	U74HC4051G-S16-T	SOP-16	Tube
U74HC4051L-S16-R	U74HC4051G-S16-R	SOP-16	Tape Reel
U74HC4051L-P16-T	U74HC4051G-P16-T	TSSOP-16	Tube
U74HC4051L-P16-R	U74HC4051G-P16-R	TSSOP-16	Tape Reel
U74HC4051L-Q16-3030-R	U74HC4051G-Q16-3030-R	QFN-16(3x3)	Tape Reel

<p>U74HC4051G-D16-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16 Q16-3030: QFN-16(3x3)</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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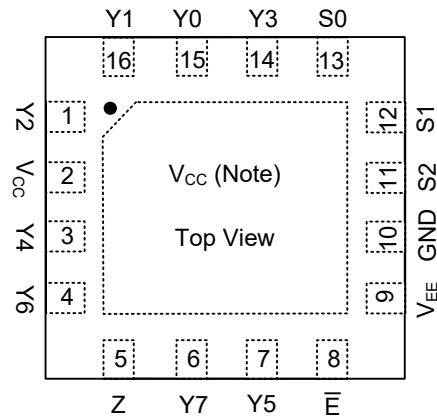
MARKING

PACKAGE	MARKING
DIP-16	<p>Date Code L: Lead Free G: Halogen Free Lot Code</p>
SOP-16 TSSOP-16	<p>Date Code L: Lead Free G: Halogen Free Lot Code</p>
QFN-16(3x3)	<p>L: Lead Free G: Halogen Free Date Code</p>

PIN CONFIGURATION



DIP-16/SOP-16/TSSOP-16



Note: Thermal pad.

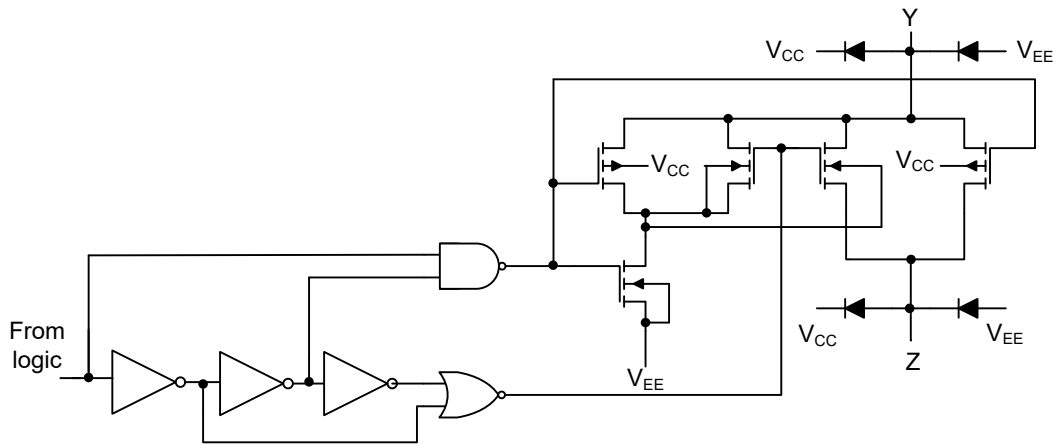
QFN-16(3x3)

FUNCTION TABLE

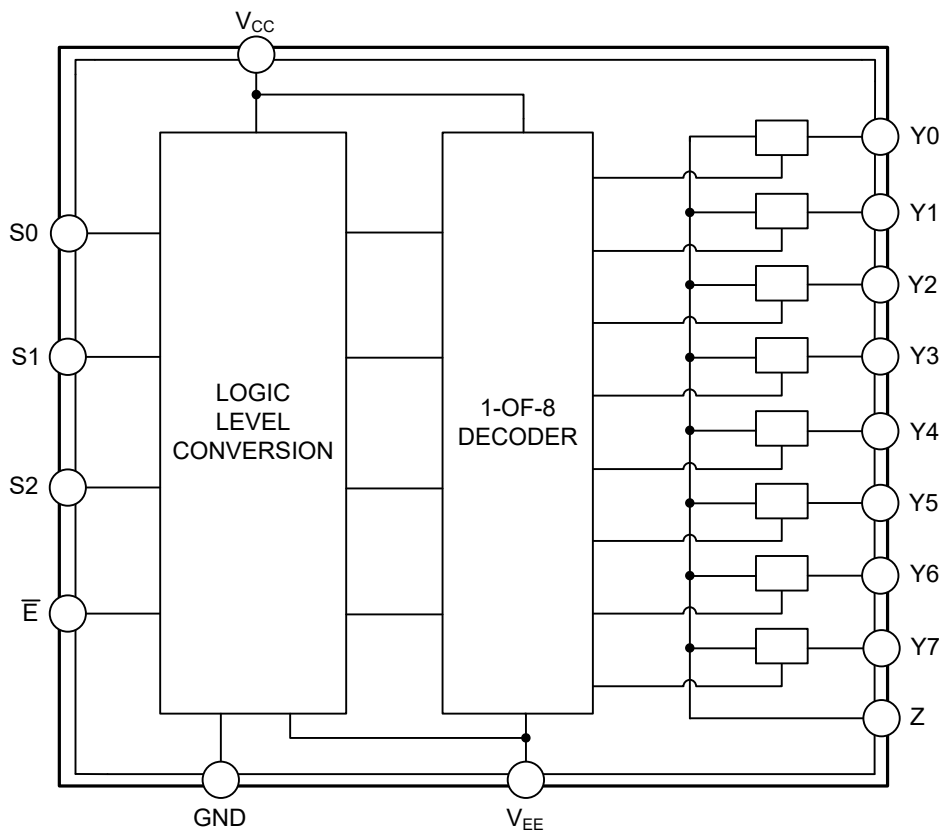
INPUT(\bar{E})	INPUT(S2)	INPUT(S1)	INPUT(S0)	CHANNEL ON
L	L	L	L	Y0 to Z
L	L	L	H	Y1 to Z
L	L	H	L	Y2 to Z
L	L	H	H	Y3 to Z
L	H	L	L	Y4 to Z
L	H	L	H	Y5 to Z
L	H	H	L	Y6 to Z
L	H	H	H	Y7 to Z
H	X	X	X	none

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 ($V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$)		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		500	mW
	TSSOP-16		450	mW
	QFN-16(3×3)		1000	mW
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	$V_{CC}=2.0V$	0		1000	ns
		$V_{CC}=4.5V$	0		500	ns
		$V_{CC}=6.0V$	0		400	ns
		$V_{CC}=10.0V$	0		250	ns

■ 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}$			±0.1	µA
		Per Channel All Channels			±0.4	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}$			±0.4	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	
Input Capacitance	C_i				3.5		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
				$V_{EE}=0V, I_S=0.1mA$ (Note)	$V_{CC}=2.0V$	150		Ω
				$V_{EE}=0V, I_S=1mA$	$V_{CC}=4.5V$	80	140	Ω
	RAIL	$R_{ON(RAIL)}$	$V_{IS}=V_{EE}$ $V_{IN}=V_{IH}$ or V_{IL}	$V_{EE}=0V, I_S=1mA$	$V_{CC}=6.0V$	70	120	Ω
				$V_{EE}=-4.5V, I_S=1mA$	$V_{CC}=4.5V$	60	105	Ω
				$V_{EE}=0V, I_S=0.1mA$ (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 (GND=0V, $t_r=t_f=6ns$, $T_A=25^\circ C$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT	
Minimum Frequency Response (-3dB)	f_{max}	$R_L=50\Omega, C_L=50pF$	$V_{EE}=-2.25V$	$V_{CC}=2.25V$		130	MHz	
			$V_{EE}=-4.5V$	$V_{CC}=4.5V$		180	MHz	
Propagation Delay Form V_{IS} to V_{OS}	t_{PHL}/t_{PLH}	$R_L=\infty, C_L=50pF$	$V_{EE}=0V$	$V_{CC}=2.0V$		14	60	ns
				$V_{CC}=4.5V$		5	12	ns
			$V_{EE}=-4.5V$	$V_{CC}=6.0V$		4	10	ns
				$V_{CC}=4.5V$		4	8	ns
Turn-ON Time	\bar{E} to V_{OS}	$R_L=1k\Omega, C_L=50pF$	$V_{EE}=0V$	$V_{CC}=2.0V$		72	345	ns
				$V_{CC}=4.5V$		29	69	ns
			$V_{EE}=-4.5V$	$V_{CC}=6.0V$		21	59	ns
				$V_{CC}=4.5V$		18	51	ns
	S_n to V_{OS}	$R_L=1k\Omega, C_L=15pF$	$V_{EE}=0V$	$V_{CC}=5.0V$		22		ns
				$V_{CC}=2.0V$		66	345	ns
			$V_{EE}=0V$	$V_{CC}=4.5V$		28	69	ns
				$V_{CC}=6.0V$		19	59	ns
Turn-OFF Time	\bar{E} to V_{OS}	$R_L=1k\Omega, C_L=50pF$	$V_{EE}=0V$	$V_{CC}=2.0V$		58	290	ns
				$V_{CC}=4.5V$		31	58	ns
			$V_{EE}=-4.5V$	$V_{CC}=6.0V$		17	49	ns
				$V_{CC}=4.5V$		18	42	ns
	S_n to V_{OS}	$R_L=1k\Omega, C_L=15pF$	$V_{EE}=0V$	$V_{CC}=5.0V$		18		ns
				$V_{CC}=2.0V$		61	290	ns
			$V_{EE}=0V$	$V_{CC}=4.5V$		25	58	ns
				$V_{CC}=6.0V$		18	49	ns
$V_{EE}=-4.5V$	$V_{CC}=4.5V$		18	42	ns			
	$V_{CC}=5.0V$		19		ns			

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

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

■ TEST CIRCUITS AND WAVEFORMS

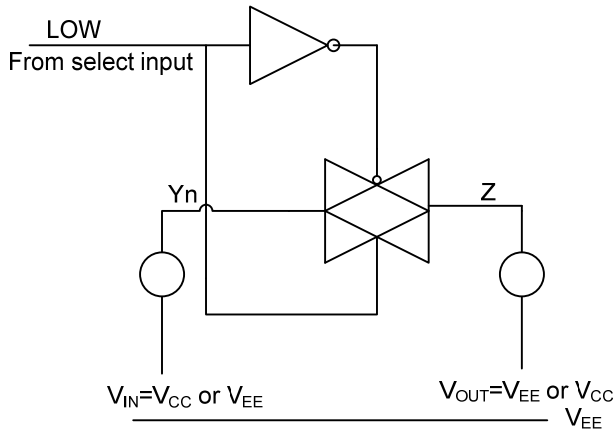


Figure 1. OFF-state current

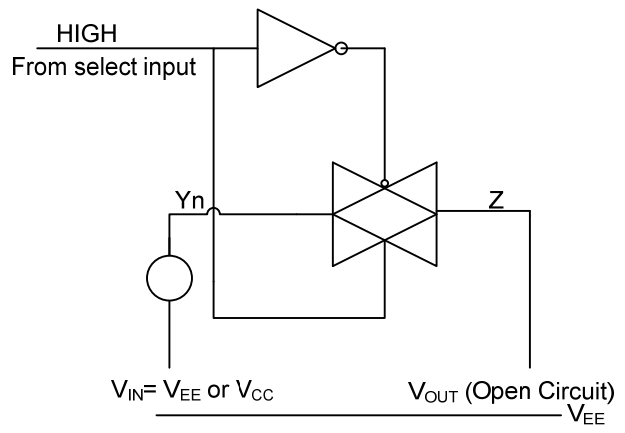


Figure 2. ON-state current

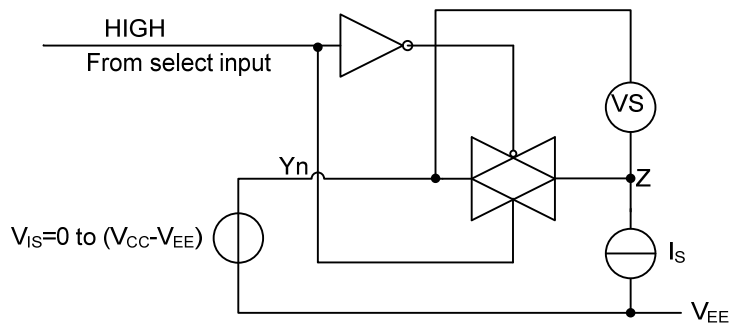


Figure 3. R_{ON}

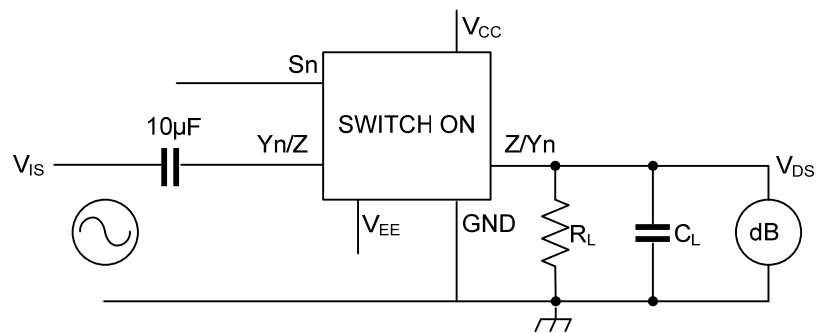


Figure 4. Frequency Response

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

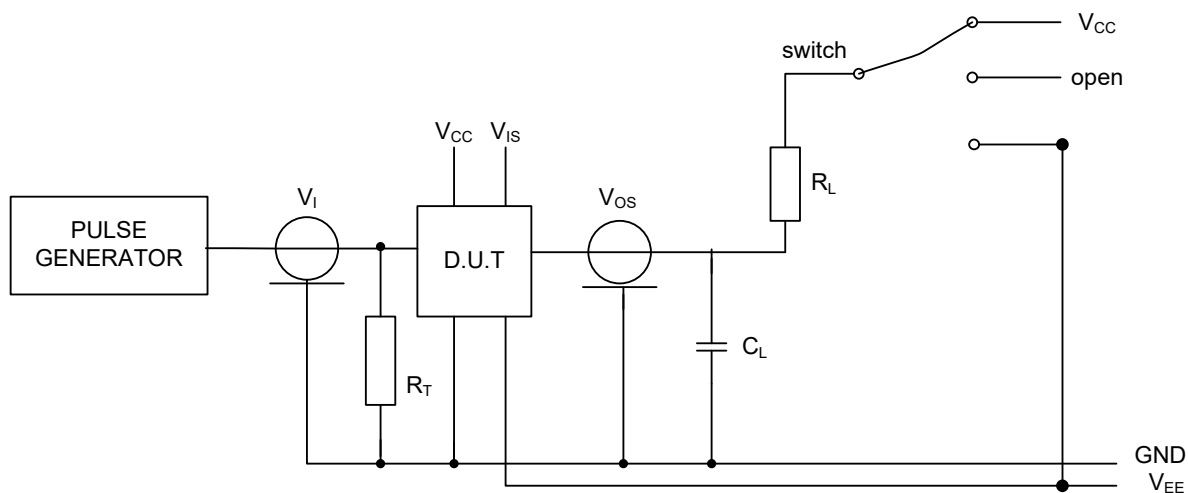


Figure. 5. AC performance

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

Notes: 1. Definitions for test circuit:

R_L = load resistance

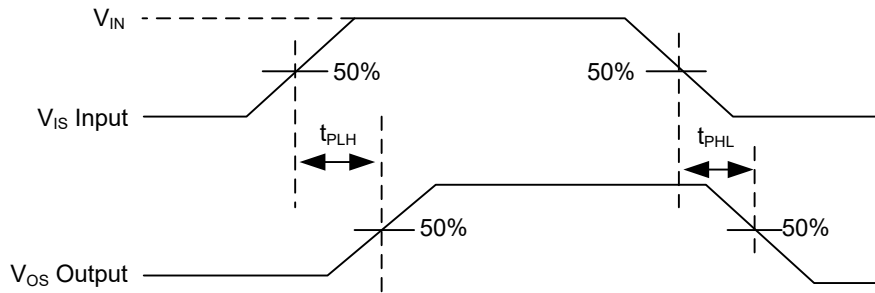
C_L = load capacitance including jig and probe capacitance.

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

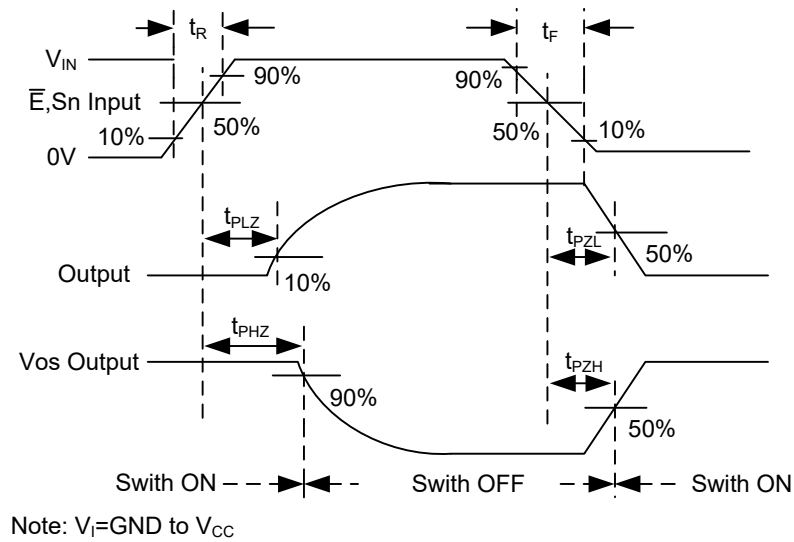
2. $t_R=t_F=6$ ns; when measuring f_{MAX} , there is no constraint to t_r and t_f with 50% duty factor (< 2ns).

■ TEST CIRCUITS AND WAVEFORMS(Cont.)

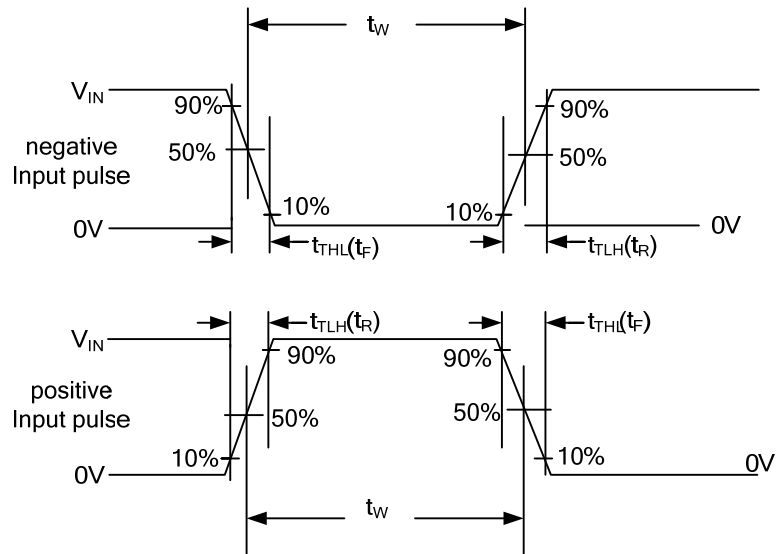
The Input (V_{IS}) to Output (V_{OS}) propagation delays Waveform



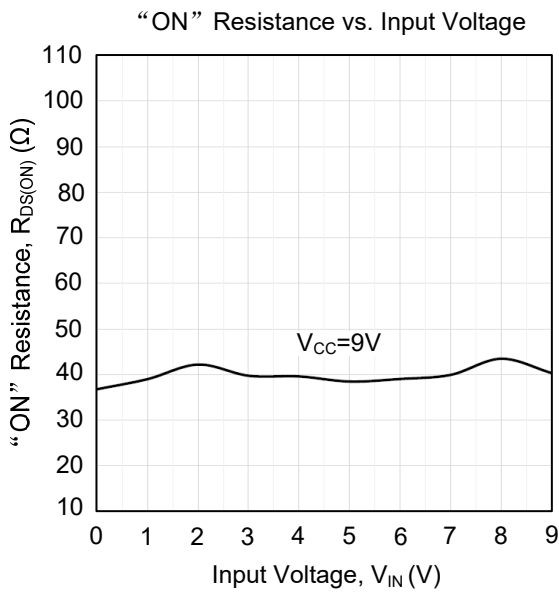
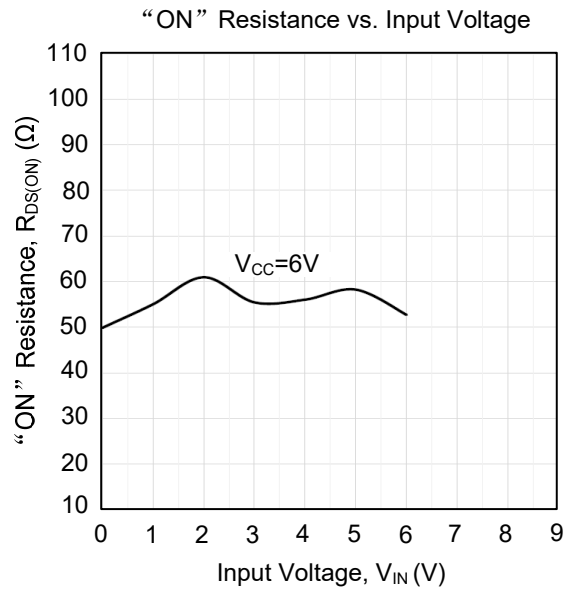
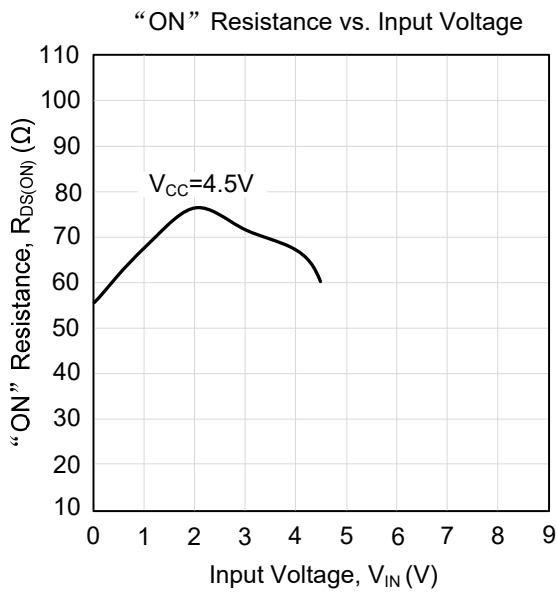
The turn-on and turn-off times Waveform



Input pulse definition



■ TYPICAL CHARACTERISTICS



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