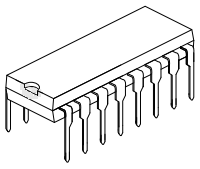
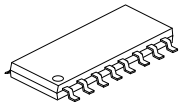
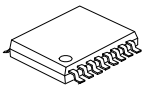
U74HC4051

CMOS IC

8-CHANNEL ANALOG MULTIPLEXER/ DEMULTIPLEXER


DIP-16


SOP-16


TSSOP-16



QFN-16(3x3)

■ 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 ±5V analog signals
* Typical “break before make” built in

■ ORDERING INFORMATION

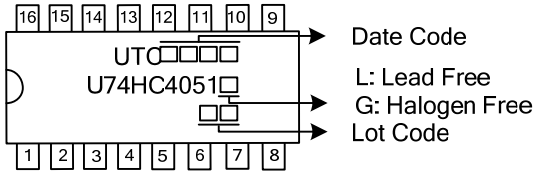
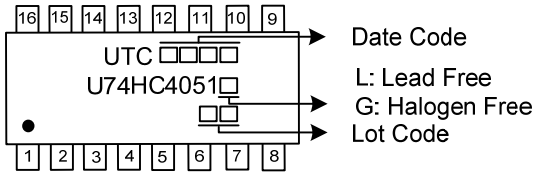
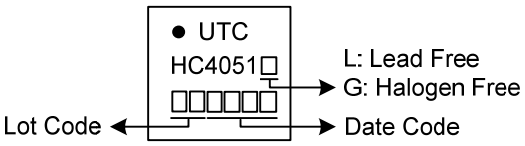
Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74HC4051L-D16-T	U74HC4051G-D16-T	DIP-16	Tube
U74HC4051L-S16-T	U74HC4051G-S16-T	SOP-16	Tube
U74HC4051L-S16-R	U74HC4051G-S16-R	SOP-16	Tape Reel
U74HC4051L-P16-T	U74HC4051G-P16-T	TSSOP-16	Tube
U74HC4051L-P16-R	U74HC4051G-P16-R	TSSOP-16	Tape Reel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

U74HC4051G-D16-T
(1)Packing Type
(2)Package Type
(3)Green Package

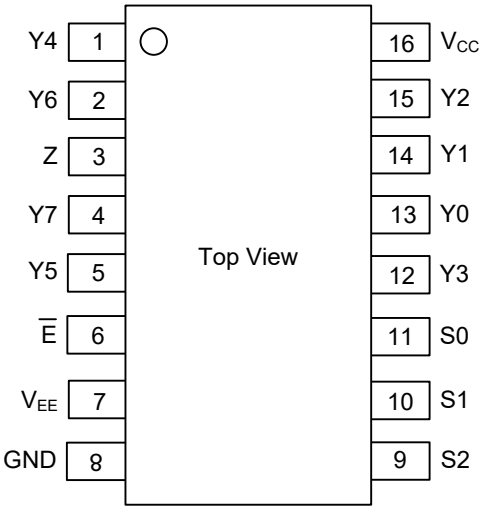
(1) T: Tube, R: Tape Reel
(2) D16: DIP-16, S16: SOP-16, P16: TSSOP-16
Q16-3030: QFN-16(3×3)
(3) G: Halogen Free and Lead Free, L: Lead Free

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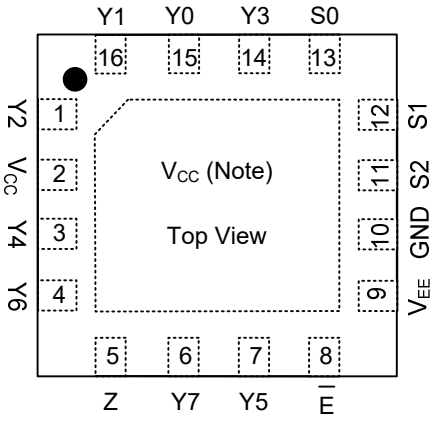
■ MARKING

PACKAGE	MARKING
DIP-16	
SOP-16 TSSOP-16	
QFN-16(3×3)	

■ PIN CONFIGURATION



DIP-16/SOP-16/TSSOP-16



Note: Thermal pad.

QFN-16(3×3)

■ PIN DESCRIPTION

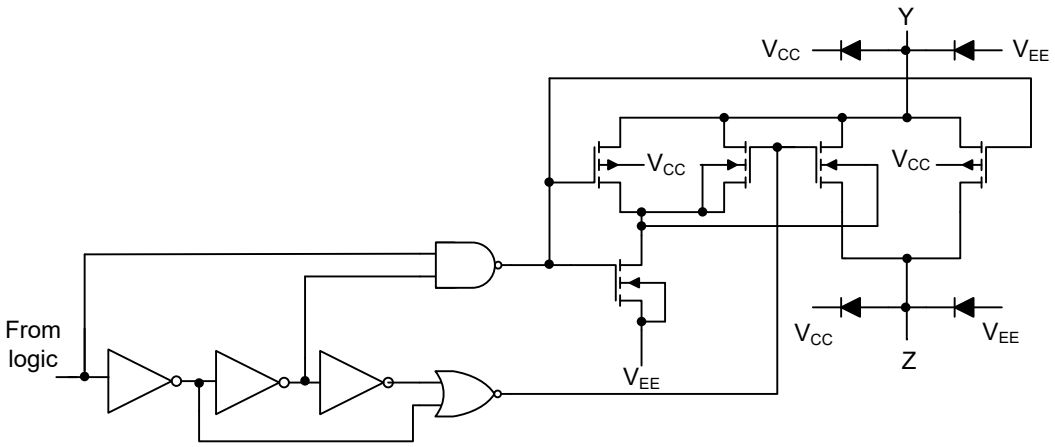
SYMBOL	PIN		DESCRIPTION
	DIP-16 SOP-16 TSSOP-16	QFN-16(3*3)	
Y4	1	3	Channel 4 in / out
Y6	2	4	Channel 6 in / out
Z	3	5	Common out / in
Y7	4	6	Channel 7 in / out
Y5	5	7	Channel 5 in / out
$\overline{E}$	6	8	Enable input (active low)
V_{EE}	7	9	Negative power input
GND	8	10	Ground
S2	9	11	Channel select 2
S1	10	12	Channel select 1
S0	11	13	Channel select 0
Y3	12	14	Channel 3 in / out
Y0	13	15	Channel 0 in / out
Y1	14	16	Channel 1 in / out
Y2	15	1	Channel 2 in / out
V_{CC}	16	2	Positive power input

■ FUNCTION TABLE

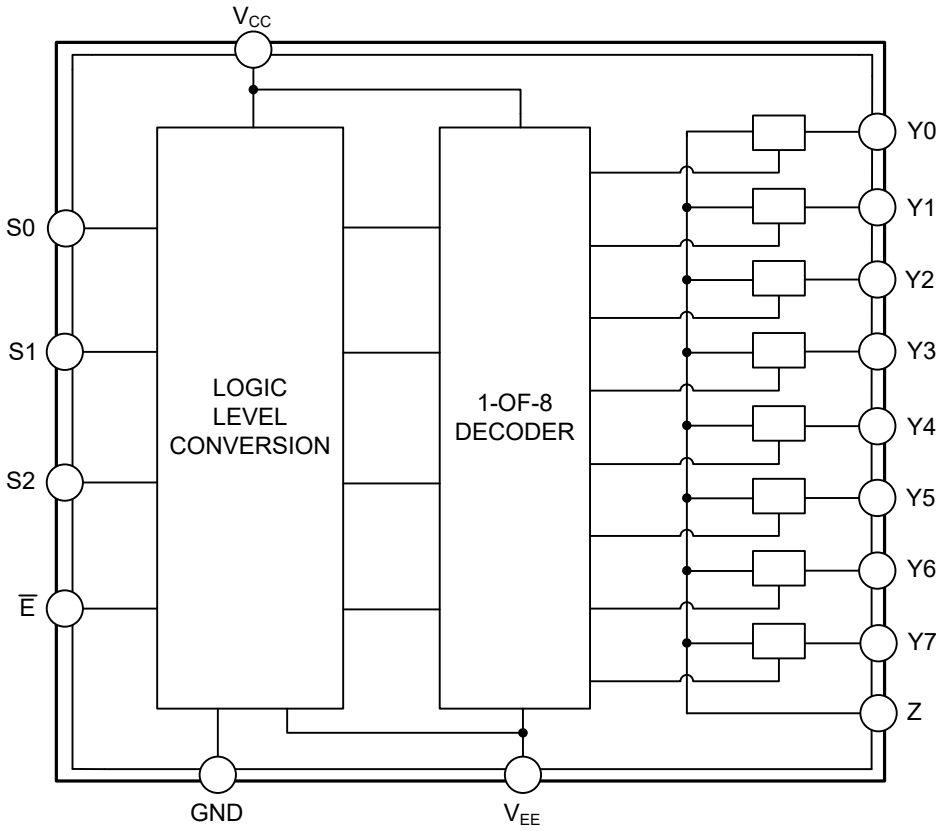
INPUT($\overline{E}$)	INPUT(S2)	INPUT(S1)	INPUT(S0)	CHANNEL ON
L	L	L	L	Y0 to Z
L	L	L	H	Y1 to Z
L	L	H	L	Y2 to Z
L	L	H	H	Y3 to Z
L	H	L	L	Y4 to Z
L	H	L	H	Y5 to Z
L	H	H	L	Y6 to Z
L	H	H	H	Y7 to Z
H	X	X	X	None

Note: H=High voltage level, L=Low voltage level, X=Don't care.

■ SCHEMATIC DIAGRAM (one switch)



■ FUNCTION DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	CONDITIONS	RATINGS	UNIT
Supply Voltage		V_{CC}		-0.5 ~ +11	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_{SW}<-0.5V or V_{SW}>V_{CC}+0.5V	±20	mA
Switch Current		I_{SW}	V_{SW}=-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			500	mW
	QFN-16(3×3)			500	mW
	TSSOP-16			450	mW
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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	DIP-16	θ_{JA}	85	°C/W
	SOP-16		105	°C/W
	QFN-16(3×3)		100	°C/W
	TSSOP-16		120	°C/W

■ 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	°C

■ STATIC CHARACTERISTICS

PARAMETER		SYMBOL	TEST CONDITIONS			T_A=25°C			T_A=-40~+125°C			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
High-Level Input Voltage		V_{IH}	V_{CC}=2.0V			1.5			1.5			V
			V_{CC}=4.5V			3.15			3.15			V
			V_{CC}=6.0V			4.2			4.2			V
			V_{CC}=9.0V			6.3			6.3			V
Low-Level Input Voltage		V_{IL}	V_{CC}=2.0V					0.5			0.5	V
			V_{CC}=4.5V					1.35			1.35	V
			V_{CC}=6.0V					1.8			1.8	V
			V_{CC}=9.0V					2.7			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			±1	μA
				All Channels				±0.4			±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			±4	μA
Input Leakage Current		$I_{I(LEAK)}$	V_{EE}=0V V_I=V_{CC} or GND	V_{CC}=6V				±0.1			±1	μA
				V_{CC}=10V				±0.2			±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			160.	μA
				V_{CC}=10V,V_{EE}=0V				16			320	μA
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		80	180			270	Ω
				V_{EE}=0V, I_S=1mA	V_{CC}=6.0V		60	160			240	Ω
				V_{EE}=-4.5V, I_S=1mA	V_{CC}=4.5V		50	130			195	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		50	140			210	Ω
				V_{EE}=0V, I_S=1mA	V_{CC}=6.0V		40	120			180	Ω
				V_{EE}=-4.5V, I_S=1mA	V_{CC}=4.5V		30	105			160	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		60	160			240	Ω
				V_{EE}=0V, I_S=1mA	V_{CC}=6.0V		50	140			210	Ω
				V_{EE}=-4.5V, I_S=1mA	V_{CC}=4.5V		40	120			180	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°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS			T_A=25°C			T_A=-40~+125°C			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
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			90	ns
					V_{CC}=4.5V			12			18	ns
					V_{CC}=6.0V			10			15	ns
				V_{EE}=-4.5V	V_{CC}=4.5V			8			12	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			345			520	ns
					V_{CC}=4.5V			69			104	ns
					V_{CC}=6.0V			59			88	ns
				V_{EE}=-4.5V	V_{CC}=4.5V			51			77	ns
			R_L=1kΩ, C_L=15pF	V_{EE}=0V	V_{CC}=5.0V		28					ns
	Sn to V_{OS}		R_L=1kΩ, C_L=50pF	V_{EE}=0V	V_{CC}=2.0V			345			520	ns
					V_{CC}=4.5V			69			104	ns
					V_{CC}=6.0V			59			88	ns
				V_{EE}=-4.5V	V_{CC}=4.5V			51			77	ns
			R_L=1kΩ, C_L=15pF	V_{EE}=0V	V_{CC}=5.0V		33					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			290			435	ns
					V_{CC}=4.5V			58			87	ns
					V_{CC}=6.0V			49			74	ns
				V_{EE}=-4.5V	V_{CC}=4.5V			42			72	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			290			435	ns
					V_{CC}=4.5V			58			87	ns
					V_{CC}=6.0V			49			74	ns
				V_{EE}=-4.5V	V_{CC}=4.5V			42			72	ns
			R_L=1kΩ, C_L=15pF	V_{EE}=0V	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.

■ ANALOG CHANNEL SPECIFICATIONS (GND=0V, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Minimum Frequency Response(-3dB)(Note1)	f_{max}	R_L=50Ω, C_L=50pF	V_{CC}=2.25V,V_{EE}=-2.25V		130		MHz
			V_{CC}=4.5V,V_{EE}=-4.5V		170		MHz
Sine-Wave Distortion	THD	R_L=10KΩ, C_L=50pF, f=1kHz	V_{CC}=2.25V,V_{EE}=-2.25V,V_{IS}=4V(p-p)		0.05		%
			V_{CC}=4.5V,V_{EE}=-4.5V,V_{IS}=8V(p-p)		0.04		%
		R_L=10KΩ, C_L=50pF, f=10kHz	V_{CC}=2.25V,V_{EE}=-2.25V,V_{IS}=4V(p-p)		0.12		%
			V_{CC}=4.5V,V_{EE}=-4.5V,V_{IS}=8V(p-p)		0.06		%
Off Isolation(Note 2)	Q_{IRR}	R_L=600Ω, C_L=50pF, f=1MHz	V_{CC}=2.25V,V_{EE}=-2.25V		-50		dB
			V_{CC}=4.5V,V_{EE}=-4.5V		-50		dB

Note: 1. Adjust input voltage V_{IS} to 0 dBm level at V_{OS} for 1 MHz (0 dBm = 1 mW into 50Ω).
2. Adjust input voltage V_{IS} to 0 dBm level (0 dBm = 1 mW into 600Ω).

■ TEST CIRCUITS AND WAVEFORMS

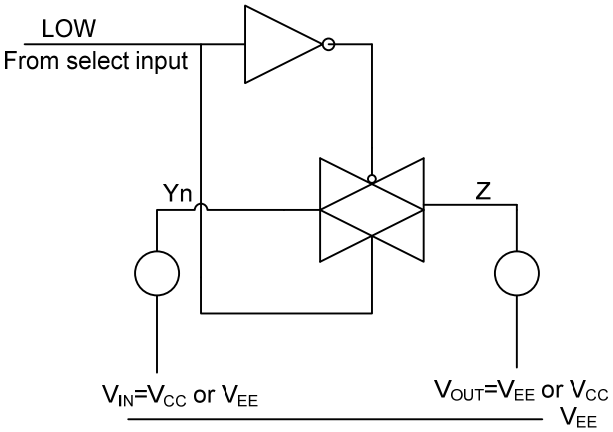


Figure. 1. OFF-state current

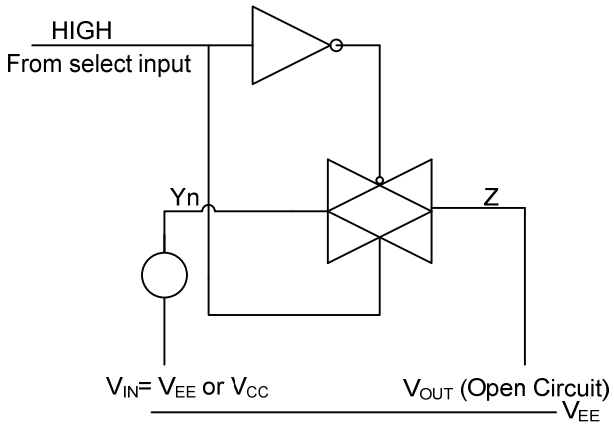


Figure. 2. ON-state current

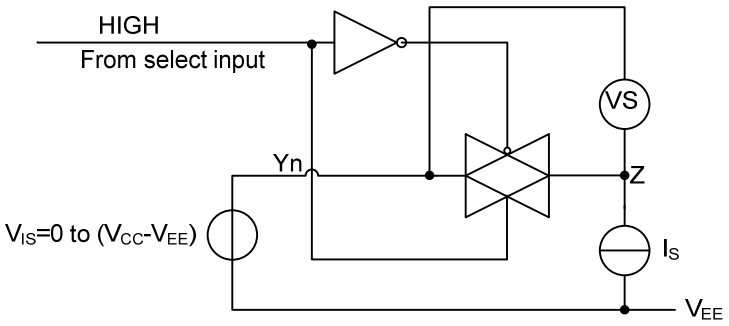


Figure. 3. R_{ON}

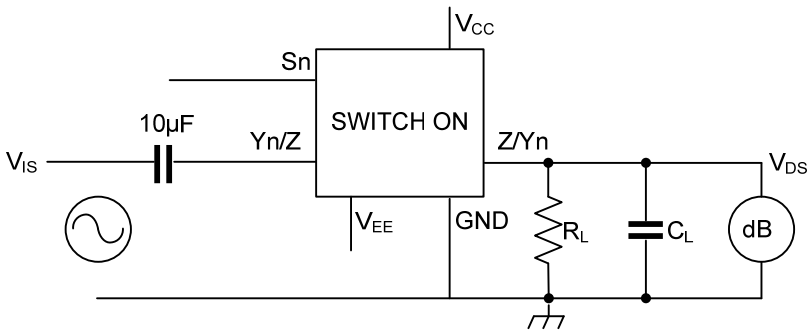


Figure. 4. Frequency Response

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

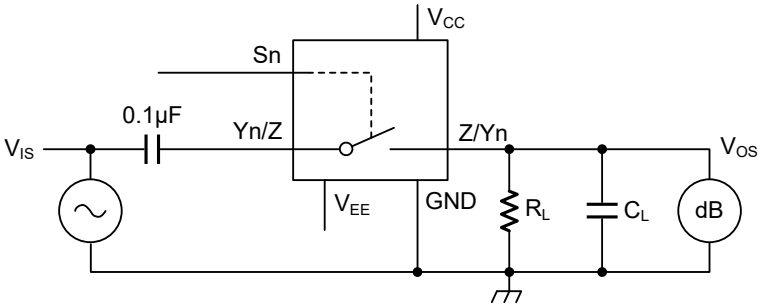


Figure. 5. Off isolation

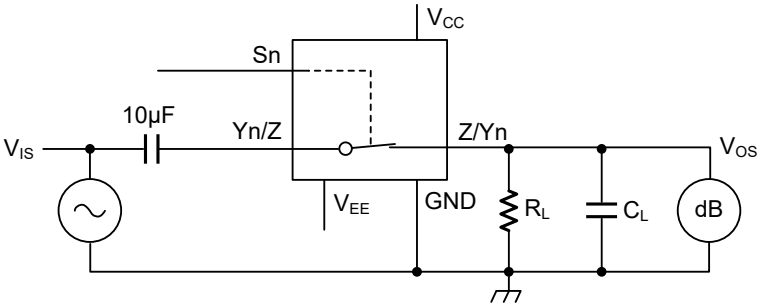


Figure. 6. Sine-wave distortion

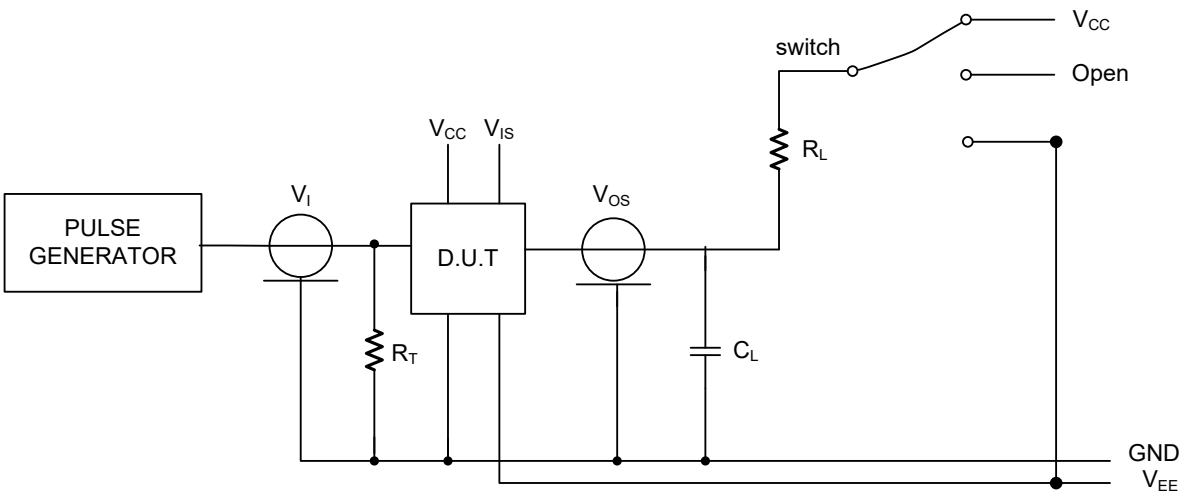


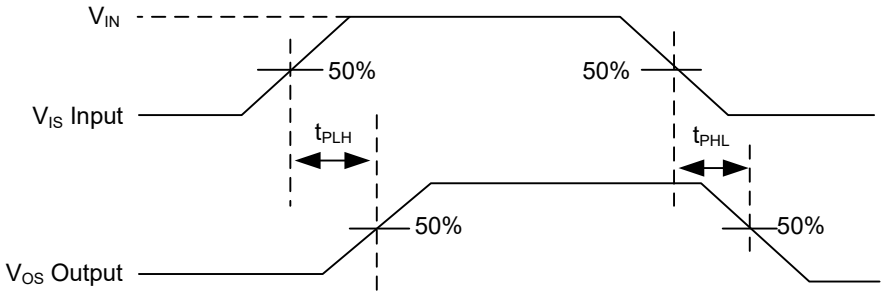
Figure. 7. AC performance

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

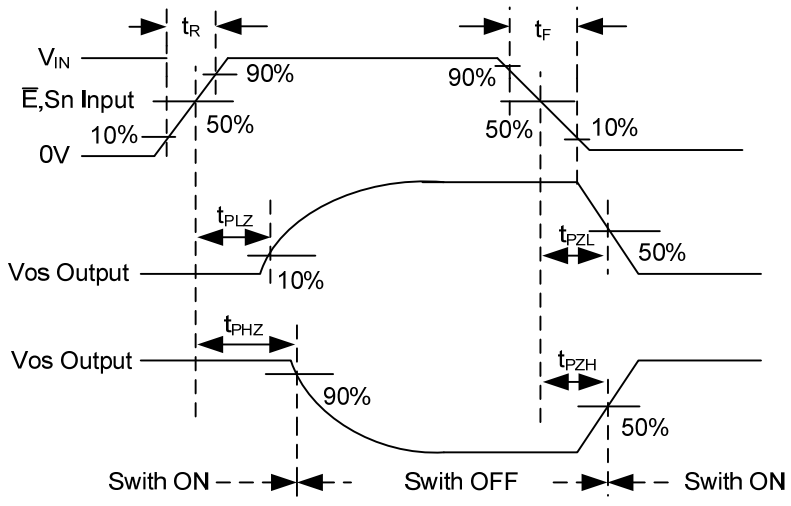
TEST	SWITCH	INPUT	
		V_{IS}	t_R,t_F
t_{PZH}	V_{EE}	V_{CC}	6ns
t_{PZL}	V_{CC}	V_{EE}	6ns
t_{PHZ}	V_{EE}	V_{CC}	6ns
t_{PLZ}	V_{CC}	V_{EE}	6ns
t_{PLH}	Open	Pulse	6ns
t_{PHL}	Open	Pulse	6ns

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 tr and tf with 50% duty factor (< 2ns).

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



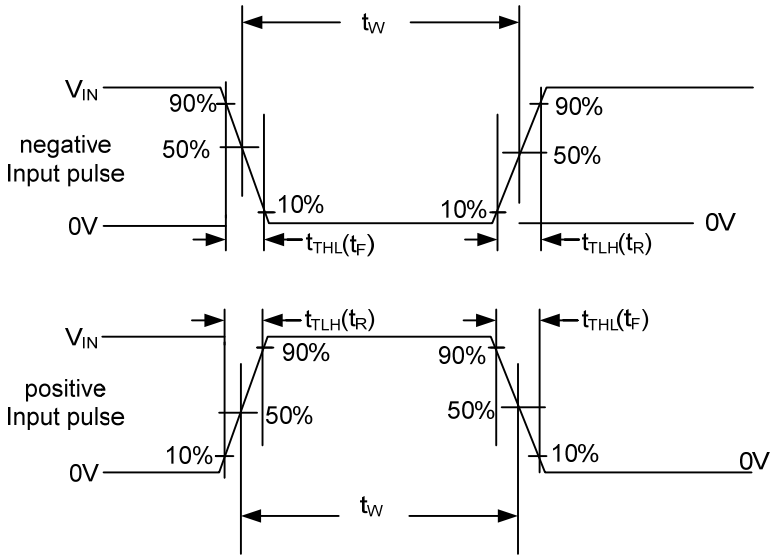
The turn-on and turn-off times Waveform



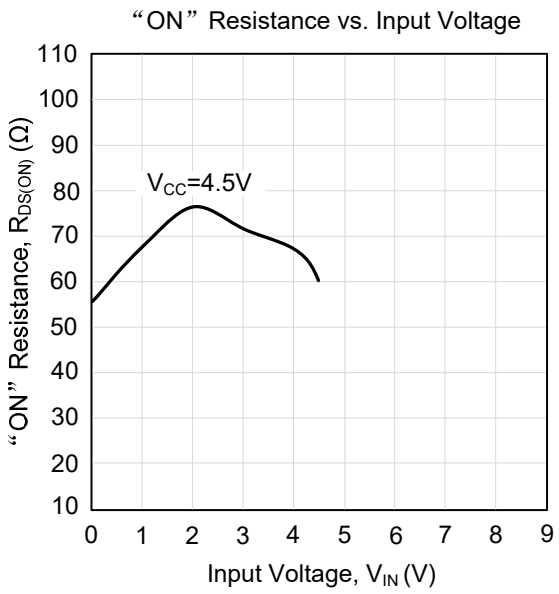
Note: V_I=GND to V_{CC}

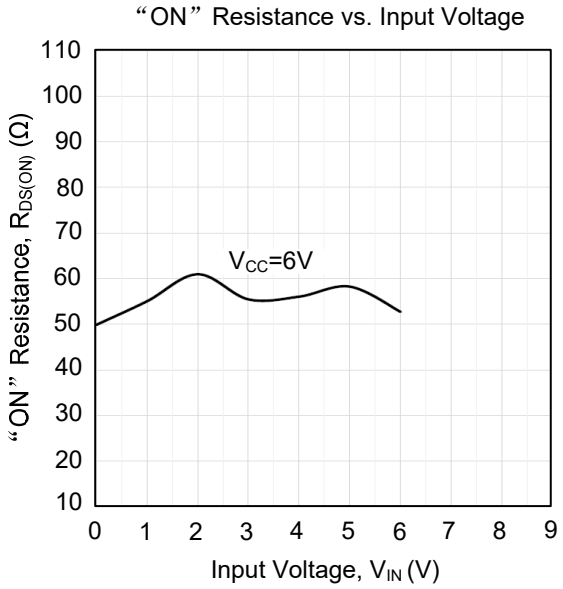
■ TEST CIRCUITS AND WAVEFORMS (Cont.)

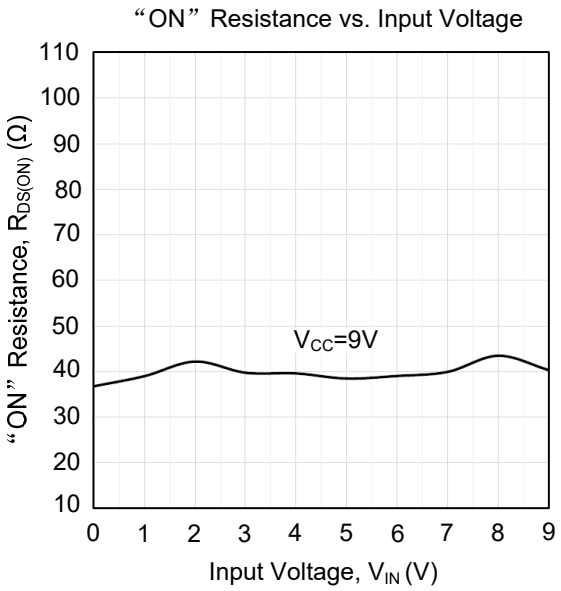
Input pulse definition



■ TYPICAL CHARACTERISTICS







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