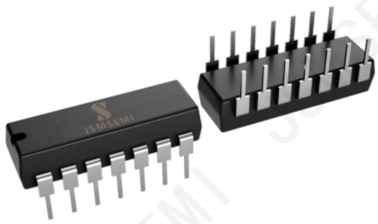
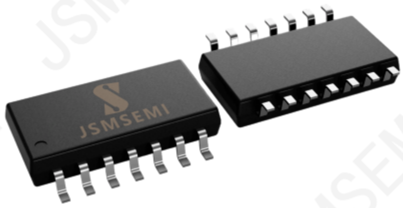
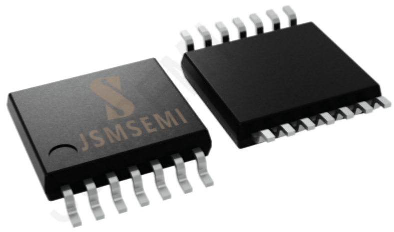
1、General Description

The 74HC/HCT4066 is a quad single pole, single throw analog switch. Each switch features two input/output terminals (nY and nZ) and an active HIGH enable input (nE). When nE is LOW, the analog switch is turned off. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.







Features:

- Input levels nE inputs:
  - For 74HC4066: CMOS level
  - For 74HCT4066: TTL level
- Low ON resistance:
  - 50 Ω (typical) at V_{CC} = 4.5 V
  - 45 Ω (typical) at V_{CC} = 6.0 V
  - 35 Ω (typical) at V_{CC} = 9.0 V
- Specified from -40℃ to +125℃
- Packaging information: DIP14/SOP14/TSSOP14

2、Block Diagram And Pin Description

2.1、Block Diagram

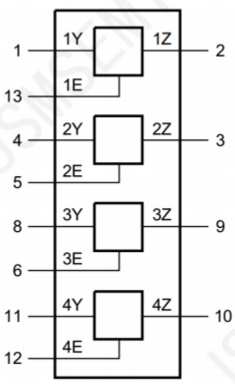


Figure 1. Logic symbol

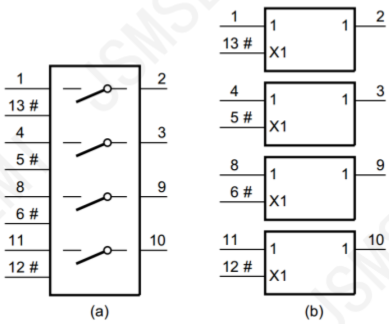


Figure 2. IEC logic symbol

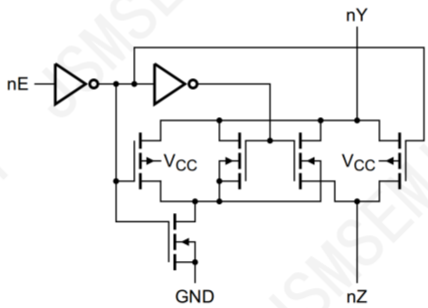


Figure 3. Schematic diagram (one switch)

2.2、Pin Configurations

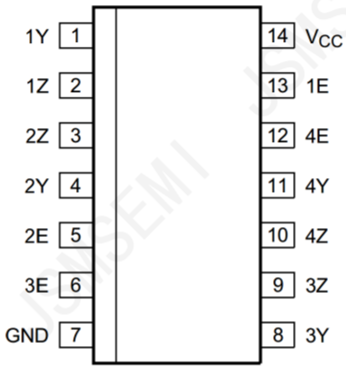


Figure 4. Functional diagram

2.3、Pin Description

Pin No.	Pin Name	Description
1	1Y	independent input or output
2	1Z	independent input or output
3	2Z	independent input or output
4	2Y	independent input or output
5	2E	enable input (active HIGH)
6	3E	enable input (active HIGH)
7	GND	ground (0V)
8	3Y	independent input or output
9	3Z	independent input or output
10	4Z	independent input or output
11	4Y	independent input or output
12	4E	enable input (active HIGH)
13	1E	enable input (active HIGH)
14	V_{CC}	supply voltage

2.4、Function Table

Input	Switch
nE	
H	ON
L	OFF

Note: H=HIGH voltage level; L=LOW voltage level.

3、Electrical Parameter

3.1、Absolute Maximum Ratings

(Voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V_{CC}	-[1]		-0.5	+11.0	V
input clamping current	I_{IK}	V_I<-0.5V or V_I>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
supply current	I_{EE}	-		-	±20	mA
supply current	I_{CC}	-		-	50	mA
ground current	I_{GND}	-		-	-50	mA
storage temperature	T_{stg}	-		-65	+150	℃
total power dissipation	P_{tot}	-		-	500	mW
power dissipation	P	per switch		-	100	mW
soldering temperature	T_L	10s	DIP	245		℃
			SOP/TSSOP	260		℃

Note:

[1] To avoid drawing V_{CC} current out of terminal Z, when switch current flows into terminals Yn, the voltage drop across the bidirectional switch must not exceed 0.4V. If the switch current flows into terminal Z, no V_{CC} current will flow out of terminals Yn, and in this case there is no limit for the voltage drop across the switch, but the voltages at Yn and Z may not exceed V_{CC} or GND.

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
74HC4066						
supply voltage	V_{CC}	-	3.0	5.0	9.0	V
input voltage	V_I	-	0	-	V_{CC}	V
switch voltage	V_{SW}	-	0	-	V_{CC}	V
ambient temperature	T_{amb}	-	-40	-	+125	℃
74HCT4066						
supply voltage	V_{CC}	-	4.5	5.0	5.5	V
input voltage	V_I	-	0	-	V_{CC}	V
switch voltage	V_{SW}	-	GND	-	V_{CC}	V
ambient temperature	T_{amb}	-	-40	-	+125	℃

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

(T_{amb}=-40℃ to +85℃, voltages are reference to GND (ground=0V), unless otherwise specified，unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.[1]	Max.	Unit
ON resistance (peak)	$R_{ON(peak)}$	V_{is}=V_{CC} to GND; I_{SW}=1000uA	V_{CC}=4.5V	-	54	-	Ω
			V_{CC}=6.0V	-	42	-	Ω
			V_{CC}=9.0V	-	32	-	Ω

ON resistance (rail)	$R_{ON(rail)}$	V_{is}=GND; I_{SW}=1000uA	V_{CC}=4.5V	-	35	-	Ω
			V_{CC}=6.0V	-	27	-	Ω
			V_{CC}=9.0V	-	20	-	Ω
		V_{is}=V_{CC}; I_{SW}=1000uA	V_{CC}=4.5V	-	42	-	Ω
			V_{CC}=6.0V	-	35	-	Ω
			V_{CC}=9.0V	-	20	-	Ω
ON resistance mismatch between channels	ΔR_{ON}	V_{is}=V_{CC} to GND	V_{CC}=4.5V	-	5	-	Ω
			V_{CC}=6.0V	-	4	-	Ω
			V_{CC}=9.0V	-	3	-	Ω
74HC4066							
HIGH-level input voltage	V_{IH}	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}=4.5V		-	2.1	1.35	V
		V_{CC}=6.0V		-	2.8	1.80	V
		V_{CC}=9.0V		-	4.3	2.70	V
input leakage current	I_I	V_I=V_{CC} or GND	V_{CC}=6.0V	-	-	±1.0	uA
			V_{CC}=9.0V	-	-	±2.0	uA
OFF-state leakage current	$I_{S(OFF)}$	V_{CC}=9.0V; V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 6	per channel	-	-	±1.0	uA
ON-state leakage current	$I_{S(ON)}$	V_{CC}=9.0V;V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 7		-	-	±1.0	uA
supply current	I_{CC}	V_I=V_{CC} or GND; V_{is}=GND or V_{CC}; V_{os}=V_{CC} or GND	V_{CC}=6.0V	-	-	20.0	uA
			V_{CC}=9.0V	-	-	40.0	uA
input capacitance	C_I	-		-	3.5	-	pF
switch capacitance	C_{SW}	-		-	8	-	pF
74HCT4066							
HIGH-level input voltage	V_{IH}	V_{CC}=4.5V to 5.5V		2.0	1.6	-	V
LOW-level input voltage	V_{IL}	V_{CC}=4.5V to 5.5V		-	1.2	0.8	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=5.5V		-	-	±1.0	uA
OFF-state leakage current	$I_{S(OFF)}$	V_{CC}=5.5V; V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 6	per channel	-	-	±1.0	uA
ON-state leakage current	$I_{S(ON)}$	V_{CC}=5.5V;V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 7		-	-	±1.0	uA
supply current	I_{CC}	V_I=V_{CC} or GND; V_{is}=GND or V_{CC}; V_{os}=V_{CC} or GND; V_{CC}=4.5V to 5.5V		-	-	20.0	uA
additional supply current	ΔI_{CC}	per input; V_I=V_{CC}-2.1V; other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V		-	100	450	uA
input capacitance	C_I	-		-	3.5	-	pF
switch capacitance	C_{SW}	-		-	8	-	pF

Note: [1] All typical values are measured at T_{amb}= 25℃.

3.3.2、DC Characteristics 2

(T_{amb}=-40℃ to +125℃, voltages are reference to GND (ground=0V), unless otherwise specified, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
ON resistance (peak)	$R_{ON(peak)}$	V_{is}=V_{CC} to GND; I_{SW}=1000uA	V_{CC}=4.5V	118	-	142	Ω
			V_{CC}=6.0V	105	-	126	Ω
			V_{CC}=9.0V	88	-	105	Ω
ON resistance (rail)	$R_{ON(rail)}$	V_{is}=GND; I_{SW}=1000uA	V_{CC}=4.5V	95	-	115	Ω
			V_{CC}=6.0V	82	-	100	Ω
			V_{CC}=9.0V	70	-	85	Ω
		V_{is}=V_{CC}; I_{SW}=1000uA	V_{CC}=4.5V	106	-	128	Ω
			V_{CC}=6.0V	94	-	113	Ω
			V_{CC}=9.0V	78	-	95	Ω
74HC4066							
HIGH-level input voltage	V_{IH}	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}=4.5V		-	-	1.35	V
		V_{CC}=6.0V		-	-	1.80	V
		V_{CC}=9.0V		-	-	2.70	V
input leakage current	I_I	V_I=V_{CC} or GND	V_{CC}=6.0V	-	-	±1.0	uA
			V_{CC}=9.0V	-	-	±2.0	uA
OFF-state leakage current	$I_{S(OFF)}$	V_{CC}=9.0V; V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 6	per channel	-	-	±1.0	uA
ON-state leakage current	$I_{S(ON)}$	V_{CC}=9.0V;V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 7		-	-	±1.0	uA
supply current	I_{CC}	V_I=V_{CC} or GND; V_{is}=GND or V_{CC}; V_{os}=V_{CC} or GND	V_{CC}=6.0V	-	-	40.0	uA
			V_{CC}=9.0V	-	-	80.0	uA
74HCT4066							
HIGH-level input voltage	V_{IH}	V_{CC}=4.5V to 5.5V		2.0	-	-	V
LOW-level input voltage	V_{IL}	V_{CC}=4.5V to 5.5V		-	-	0.8	V
input leakage current	I_I	V_I=V_{CC} or GND; V_{CC}=5.5V		-	-	±1.0	uA
OFF-state leakage current	$I_{S(OFF)}$	V_{CC}=5.5V; V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 6	per channel	-	-	±1.0	uA
ON-state leakage current	$I_{S(ON)}$	V_{CC}=5.5V;V_I=V_{IH} or V_{IL}; $\|V_{SW}\|$=V_{CC}-GND; see Figure 7		-	-	±1.0	uA
supply current	I_{CC}	V_I=V_{CC} or GND; V_{is}=GND or V_{CC}; V_{os}=V_{CC} or GND; V_{CC}=4.5V to 5.5V		-	-	40.0	uA
additional supply current	ΔI_{CC}	per input; V_I=V_{CC}-2.1V; other inputs at V_{CC} or GND; V_{CC}=4.5V to 5.5V		-	-	490	uA

3.3.3、AC Characteristics 1

(T_{amb}= -40℃ to +85℃; GND=0V; t_r=t_f=6ns; C_L=50pF; unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.[1]	Max.	Unit
74HC4066							
propagation delay	t_{PHL}, t_{PLH}	nY to nZ or nZ to nY; R_L=∞Ω; see Figure 8	V_{CC}=4.5V	-	3	15	ns
			V_{CC}=6.0V	-	2	13	ns
			V_{CC}=9.0V	-	2	10	ns
turn-on time	t_{PZH}, t_{PZL}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	13	25	ns
			V_{CC}=5.0V; C_L=15pF	-	11	-	ns
			V_{CC}=6.0V	-	10	21	ns
			V_{CC}=9.0V	-	8	16	ns
turn-off time	t_{PHZ}, t_{PLZ}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	16	38	ns
			V_{CC}=5.0V; C_L=15pF	-	13	-	ns
			V_{CC}=6.0V	-	13	33	ns
			V_{CC}=9.0V	-	16	26	ns
74HCT4066							
propagation delay	t_{PHL}, t_{PLH}	nY to nZ or nZ to nY; R_L=∞Ω; see Figure 8	V_{CC}=4.5V	-	3	15	ns
turn-on time	t_{PZH}, t_{PZL}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	12	30	ns
			V_{CC}=5.0V; C_L=15pF	-	12	-	ns
turn-off time	t_{PHZ}, t_{PLZ}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	20	44	ns
			V_{CC}=5.0V; C_L=15pF	-	16	-	ns

Note:

[1] All typical values are measured at T_{amb}= 25℃.

3.3.4、AC Characteristics 2

(T_{amb}=-40℃ to +125℃; GND=0V; t_r=t_f=6ns; C_L=50pF; unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
74HC4066							
propagation delay	t_{PHL}, t_{PLH}	nY to nZ or nZ to nY; R_L=∞Ω; see Figure 8	V_{CC}=4.5V	-	-	18	ns
			V_{CC}=6.0V	-	-	15	ns
			V_{CC}=9.0V	-	-	12	ns
turn-on time	t_{PZH}, t_{PZL}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	-	30	ns
			V_{CC}=6.0V	-	-	26	ns
			V_{CC}=9.0V	-	-	20	ns
turn-off time	t_{PHZ}, t_{PLZ}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	-	45	ns
			V_{CC}=6.0V	-	-	38	ns
			V_{CC}=9.0V	-	-	30	ns
74HCT4066							
propagation delay	t_{PHL}, t_{PLH}	nY to nZ or nZ to nY; R_L=∞Ω; see Figure 8	V_{CC}=4.5V	-	-	18	ns
turn-on time	t_{PZH}, t_{PZL}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	-	36	ns
turn-off time	t_{PHZ}, t_{PLZ}	nE to nY or nZ; see Figure 9	V_{CC}=4.5V	-	-	53	ns

3.3.5、AC Characteristics 3

(T_{amb}= 25℃; GND=0V; C_L=50pF; recommended conditions and typical values.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
total harmonic distortion	THD	f_i=1kHz; R_L=10kΩ; C_L=50pF; see Figure 11	V_{CC}=4.5V; V_I=4.0V (p-p)	-	0.04	-	%
			V_{CC}=9.0V; V_I=8.0V (p-p)	-	0.02	-	%
		f_i=1kHz; R_L=10kΩ; C_L=50pF; see Figure 11	V_{CC}=4.5V; V_I=4.0V (p-p)	-	0.12	-	%
			V_{CC}=9.0V; V_I=8.0V (p-p)	-	0.06	-	%
isolation (OFF-state)	α_{iso}	R_L=600Ω; C_L=50pF; f_i=1MHz; see Figure 12[1]	V_{CC}=4.5V	-	-50	-	dB
			V_{CC}=9.0V	-	-50	-	dB
-3 dB frequency response	$f_{(-3dB)}$	R_L=50Ω; C_L=10pF; see Figure 13[2]	V_{CC}=4.5V	-	180	-	dB
			V_{CC}=9.0V	-	200	-	dB
crosstalk voltage	V_{ct}	between digital input and switch (peak to peak value); R_L=600Ω; C_L=50pF; f_i=1MHz; see Figure 14	V_{CC}=4.5V	-	110	-	mV
			V_{CC}=9.0V	-	220	-	mV
crosstalk	Xtalk	between switches; R_L=600Ω; C_L=50pF; f_i=1MHz; see Figure 15[1]	V_{CC}=4.5V	-	-60	-	dB
			V_{CC}=9.0V	-	-60	-	dB

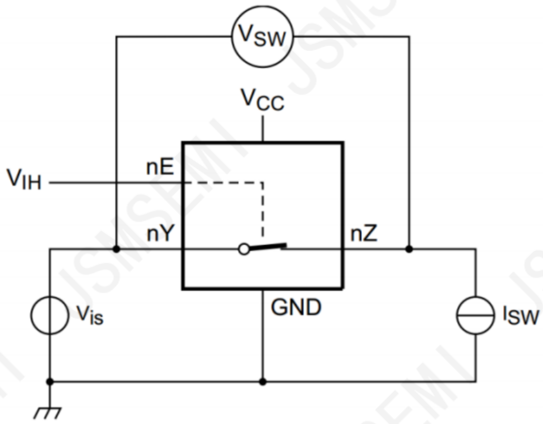
Note：

[1] Adjust input voltage V_{is} to 0 dBm level (0 dBm = 1 mW into 600 Ω).

[2] Adjust input voltage V_{is} to 0 dBm level at V_{os} for 1 MHz (0 dBm = 1 mW into 50 Ω). After set-up, f_i is increased to obtain a reading of -3dB at V_{os}.

4、Testing Circuit

4.1、DC Testing Circuit 1

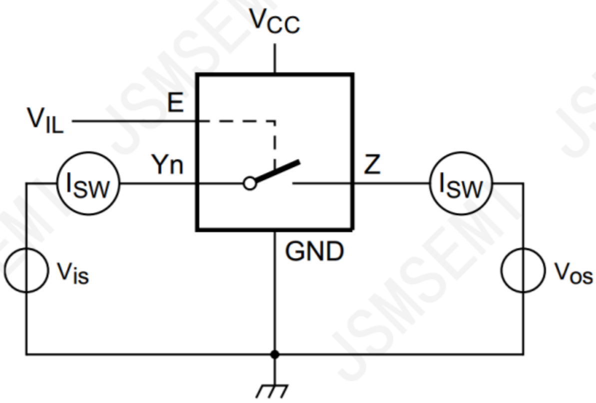


V_{is} =0V to V_{CC}

$R_{ON}=V_{SW}/I_{SW}$

Figure 5. Test circuit for measuring R_{ON}

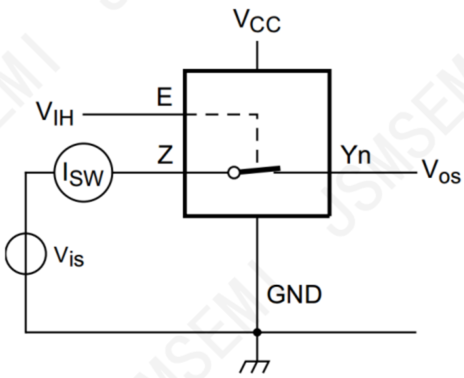
4.2、DC Testing Circuit 2



$V_{is}=V_{CC}$ and V_{os}=GND.

V_{is}=GND and $V_{os}=V_{CC}$.

Figure 6. Test circuit for measuring OFF-state leakage current



$V_{is}=V_{CC}$ and V_{os}=open

V_{is}=GND and V_{os}=open

Figure 7. Test circuit for measuring ON-state leakage current

4.3、AC Testing Waveforms

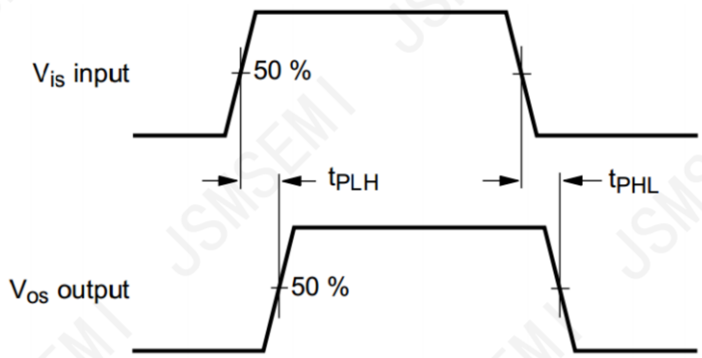


Figure 8. Input (V_{is}) to output (V_{os}) propagation delays

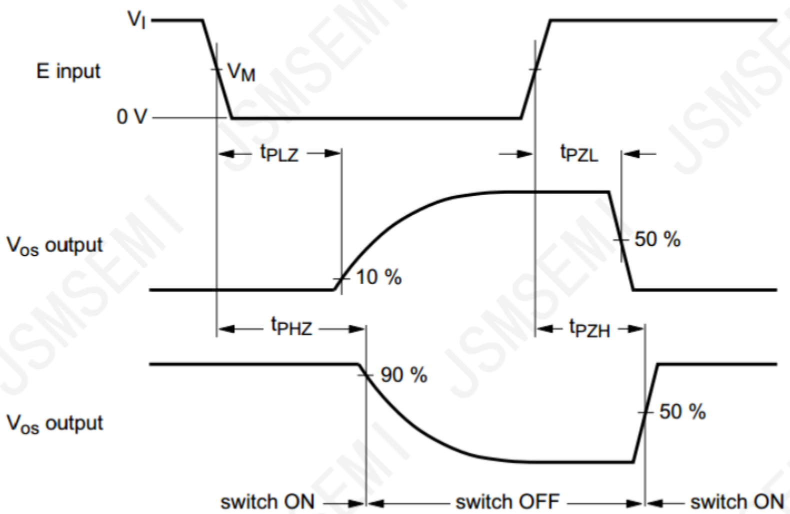


Figure 9. Turn-on and turn-off times

4.4、Measurement Points

Type	V_I	V_M
74HC4066	V_{CC}	$0.5V_{CC}$
74HCT4066	3.0V	1.3V

4.5、AC Testing Circuit 1

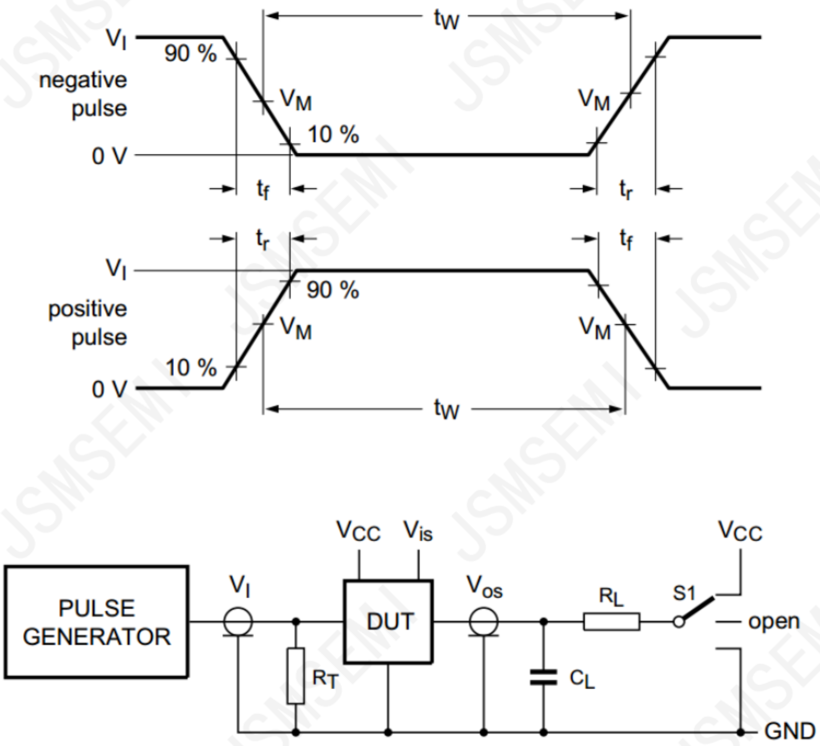


Figure 10. Test circuit for measuring switching times

Definitions for test circuit:

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

C_L = load capacitance including jig and probe capacitance.

R_L = load resistance.

S1 = Test selection switch.

4.6、Test Data

Test	Input			Output		S1 position
	Control E	Switch Yn (Z)	t_r, t_f	Switch Z (Yn)		
	V_I[1]	V_{is}		C_L	R_L	
t_{PHL}, t_{PLH}	GND	GND to V_{CC}	6ns	50pF	-	open
t_{PZH}, t_{PHZ}	GND to V_{CC}	V_{CC}	6ns	50pF,15pF	1kΩ	GND
t_{PZL}, t_{PLZ}	GND to V_{CC}	GND	6ns	50pF,15pF	1kΩ	V_{CC}

Note:

[1] For 74HCT4066: maximum input voltage V_I = 3.0V.

4.7、AC Testing Circuit 2

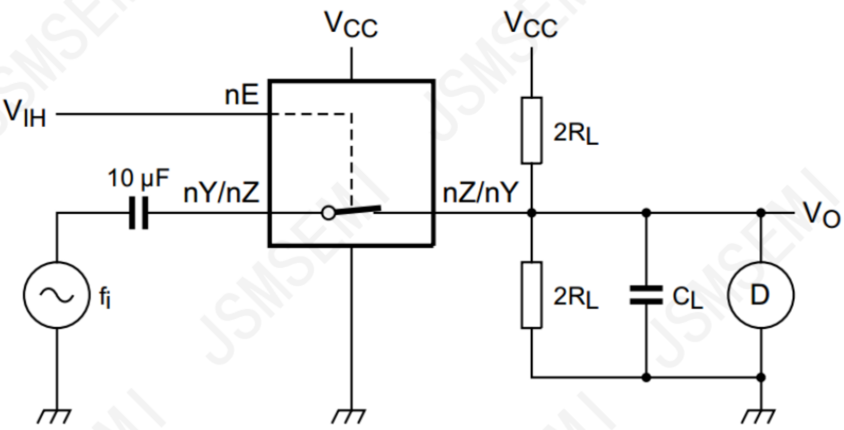
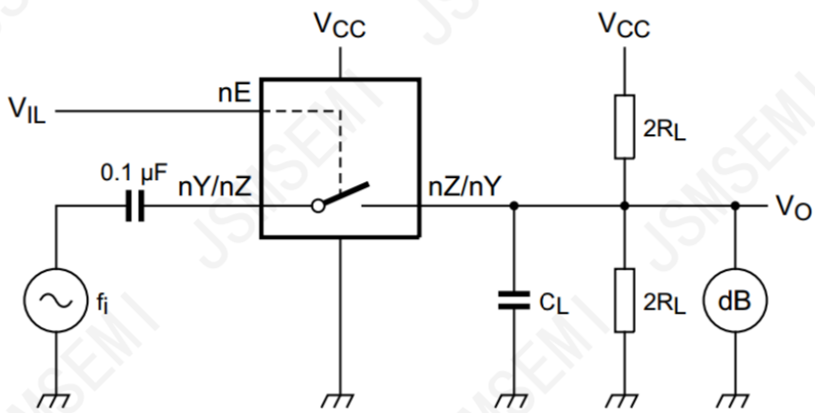
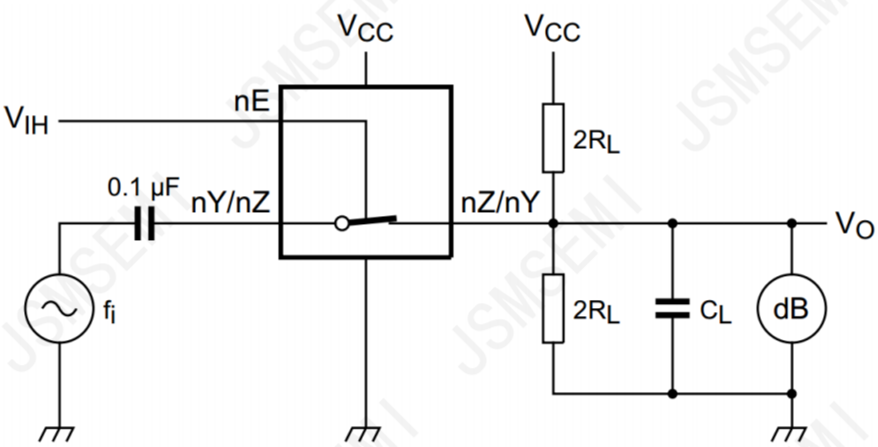


Figure 11. Test circuit for measuring total harmonic distortion



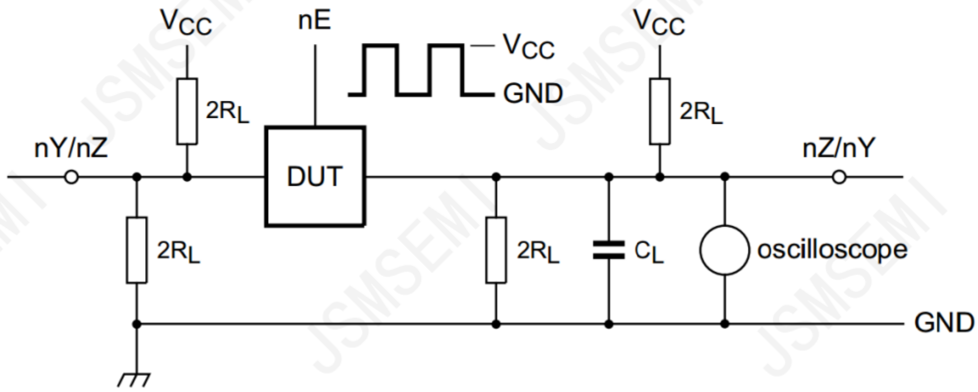
V_{CC}=4.5V; GND=0V; R_L=600Ω; R_{source}=1kΩ.

Figure 12. Isolation (OFF-state) as a function of frequency



V_{CC}=4.5V; GND=0V; R_L=50Ω; R_{source}=1kΩ.

Figure 13. -3 dB frequency response



a. Circuit

b. Crosstalk voltage

Figure 14. Test circuit for measuring crosstalk voltage (between the digital input and the switch)

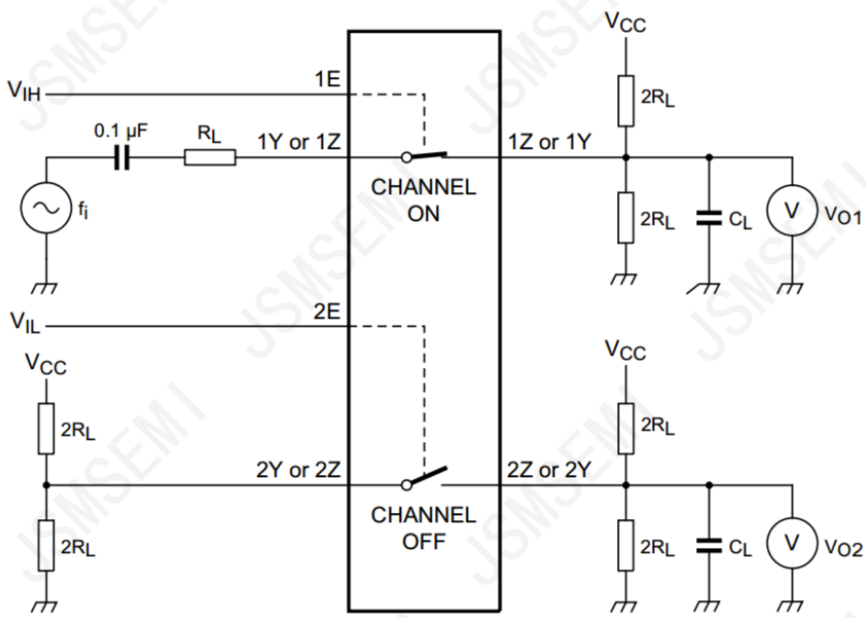
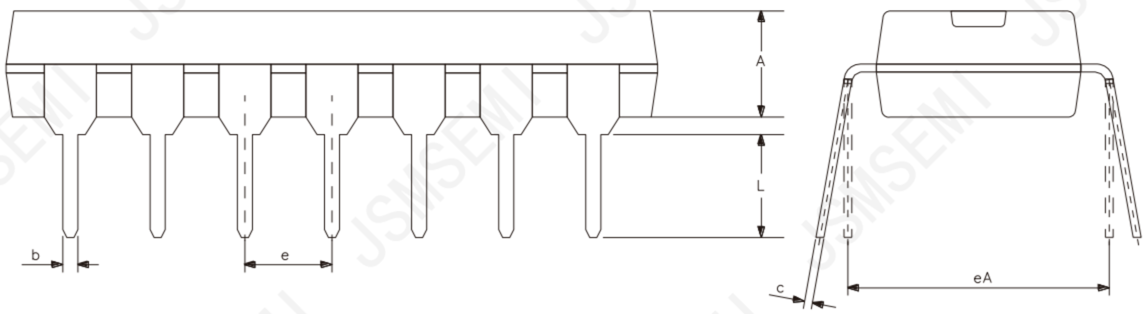
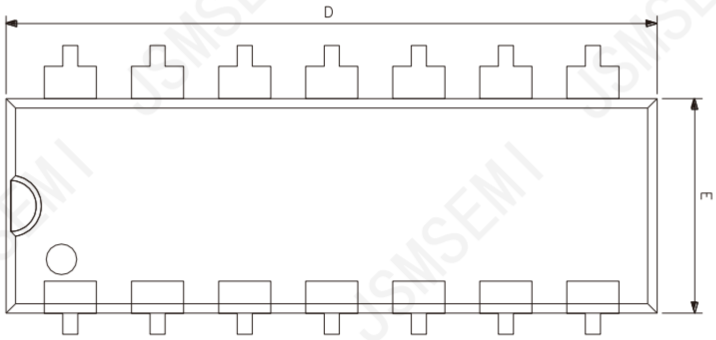


Figure 15. Test circuit for measuring crosstalk (between the switches)

5、Package Information

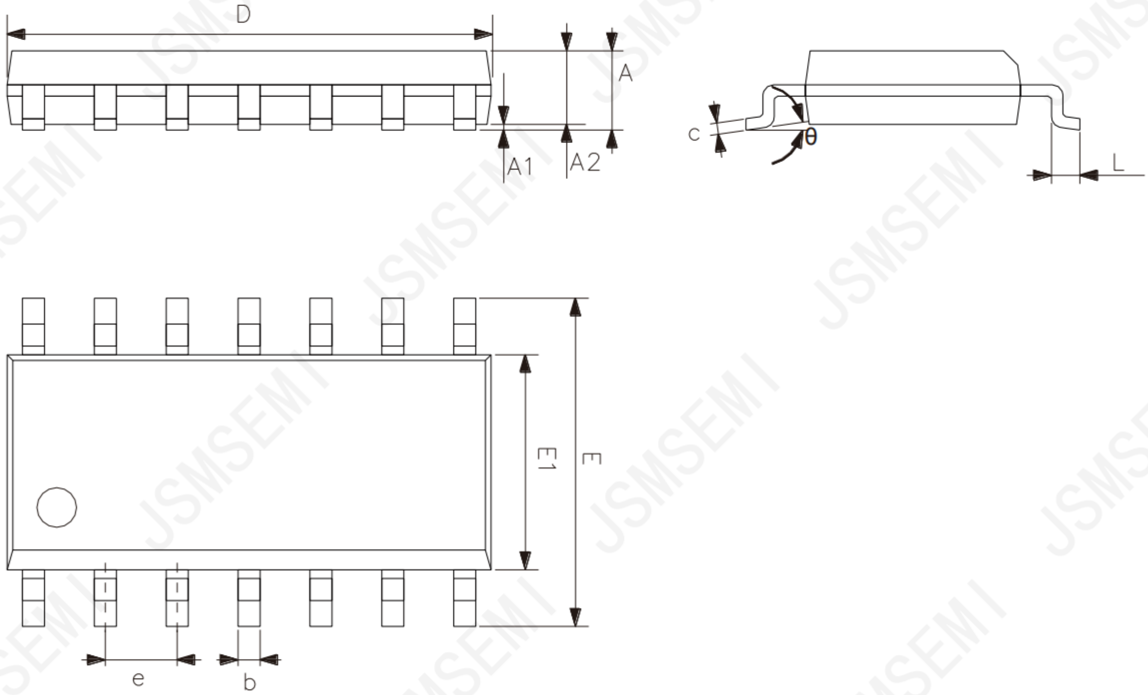
5.1、DIP14





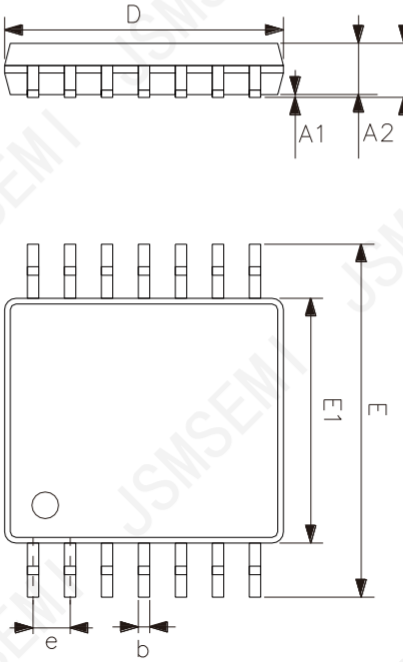
Symbol	Dimensions (mm)	
	Min.	Max.
A	3.05	3.60
b	0.33	0.56
c	0.20	0.36
D	18.80	19.40
E	6.20	6.60
e	2.54	
eA	7.62	10.90
L	2.92	-

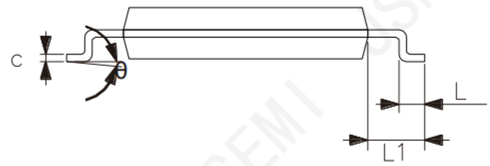
5.2、SOP14



Symbol	Dimensions (mm)	
	Min.	**Max.**
A	1.50	1.75
A1	0.05	0.25
A2	1.30	-
b	0.33	0.50
c	0.19	0.25
D	8.43	8.76
E	5.80	6.25
E1	3.75	4.00
e	1.27	
L	0.40	0.89
θ	0°	8°

5.3、TSSOP14





Symbol	Dimensions (mm)	
	Min.	**Max.**
A	-	1.20
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	4.90	5.10
E1	4.30	4.50
E	6.20	6.60
e	0.65	
L	0.45	0.75
L1	1.00	
θ	0°	8°

6、Statements And Notes

6.1、The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.									

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