



HEF4052(LX)

Dual 4-channel Analog Multiplexer/Demultiplexer

Product Specification

Specification Revision History:

Version	Date	Description
2022-06-A1	2022-06	New
2023-04-B1	2023-04	Update the template



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1、General Description

The HEF4052 is a dual 4-channel analogue multiplexer/demultiplexer with common channel select logic. Each multiplexer/demultiplexer has four independent inputs/outputs (nY0 to nY3) and a common input/output (nZ). The common channel select logic includes two select inputs (S1 and S2) and an active LOW enable input ($\bar{E}$). Both multiplexers/demultiplexers contain four bidirectional analog switches, each with one side connected to an independent input/output (nY0 to nY3) and the other side connected to a common input/output (nZ). With $\bar{E}$ LOW, one of the four switches is selected (low-impedance ON-state) by S1 and S2. With $\bar{E}$ HIGH, all switches are in the high-impedance OFF-state, independent of S1 and S2. If break before make is needed, then it is necessary to use the enable input.

V_{DD} and V_{SS} are the supply voltage connections for the digital control inputs (S1 and S2, and $\bar{E}$). The V_{DD} to V_{SS} range is 3V to 9V. The analog inputs/outputs (nY0 to nY3, and nZ) can swing between V_{DD} as a positive limit and V_{EE} as a negative limit. $V_{DD}-V_{EE}$ may not exceed 9V. Unused inputs must be connected to V_{DD} , V_{SS} , or another input. For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to V_{SS} (typically ground). V_{EE} and V_{SS} are the supply voltage connections for the switches.

Features:

- Wide supply voltage range from 3V to 9V
- Fully static operation
- 5V and 9V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -40°C to +125°C
- Packaging information: SOP16/TSSOP16



Ordering Information:

Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
HEF4052BT(LX)	SOP16	HEF4052BT	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 10.0mm×3.9mm Pin spacing:1.27mm
HEF4052BTT(LX)	TSSOP16	HEF4052	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing:0.65mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

2、Block Diagram And Pin Description

2.1、Block Diagram

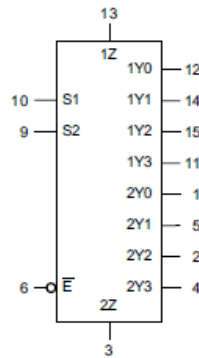


Figure 1. Logic symbol

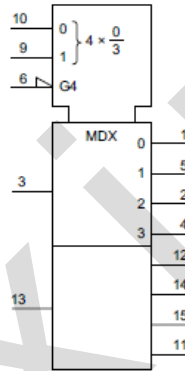


Figure 2. IEC logic symbol

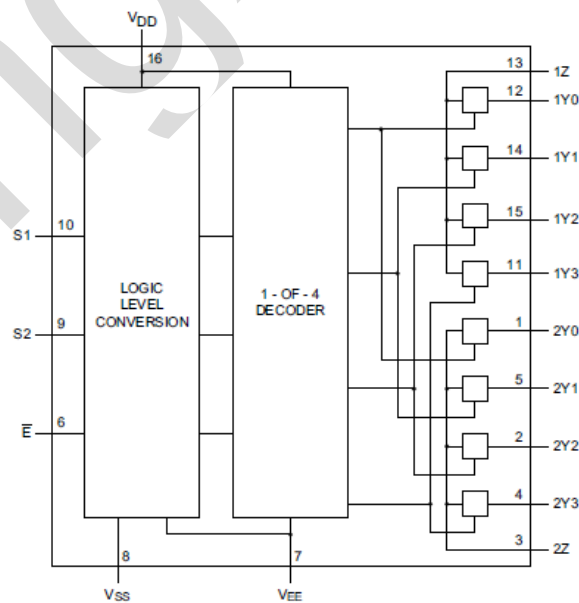


Figure 3. Functional diagram

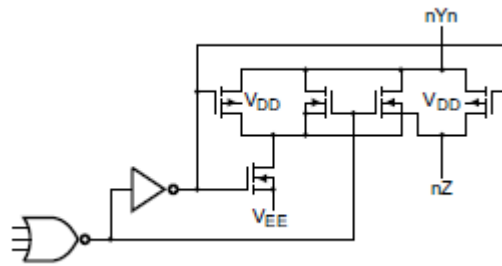


Figure 4. Schematic diagram (one switch)

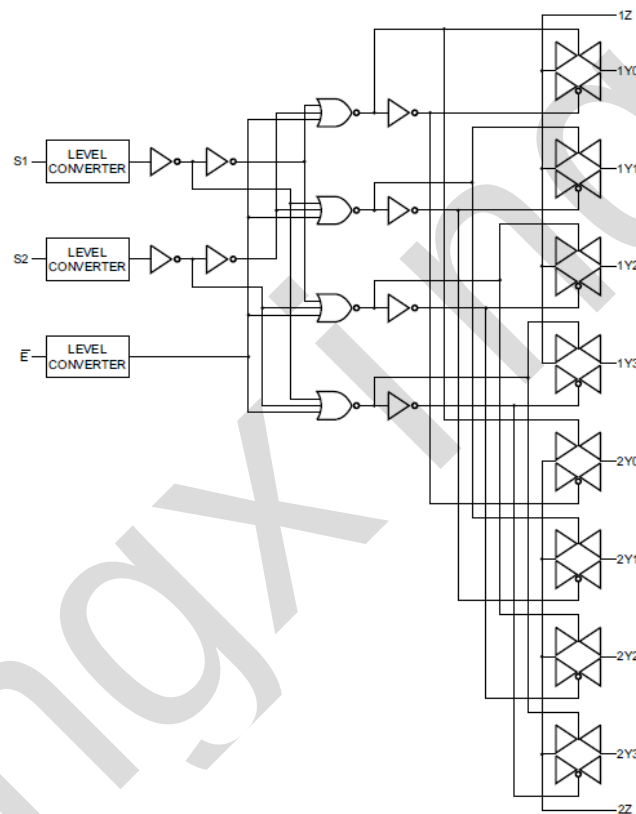
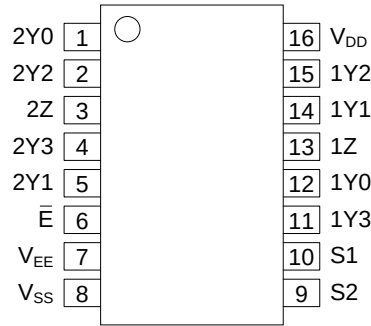


Figure 5. Logic diagram



2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	2Y0	independent input or output
2	2Y2	independent input or output
3	2Z	common output or input
4	2Y3	independent input or output
5	2Y1	independent input or output
6	$\bar{E}$	enable input (active LOW)
7	V_{EE}	supply voltage
8	V_{SS}	ground (0V)
9	S2	select input
10	S1	select input
11	1Y3	independent input or output
12	1Y0	independent input or output
13	1Z	common output or input
14	1Y1	independent input or output
15	1Y2	independent input or output
16	V_{DD}	supply voltage

2.4、Function Table

Input			Channel ON
$\bar{E}$	S2	S1	
L	L	L	nY0 to nZ
L	L	H	nY1 to nZ
L	H	L	nY2 to nZ
L	H	H	nY3 to nZ
H	X	X	switches off

Note: H=HIGH voltage level; L=LOW voltage level; X=don't care.



3、Electrical Parameter

3.1、Absolute Maximum Ratings

(Voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Max.	Unit
supply voltage	V _{DD}	-		-0.5	+12	V
power supply range	V _{DD} -V _{EE}	-		-0.5	+12	V
static current	I _Q	V _{DD} -V _{EE} =12V		-	2	uA
input voltage	V _I	-		-0.5	V _{DD} +0.5	V
output high voltage current	I _{IH}	V _{DD} =5V, V _I =V _{DD}		-	1	uA
output low voltage current	I _{IL}	V _{DD} =5V, V _I =0V		-	1	uA
input and output voltage rage	V _{IO}	-		V _{EE} -0.5	V _{DD} +0.5	V
input clamping current	I _{IK}	V _I <-0.5V or V _I >V _{DD} +0.5V		-	±20	mA
input and output clamp current	I _{IOK}	V _{IO} <V _{EE} -0.5V or V _{IO} >V _{DD} +0.5V		-	±20	mA
switch conduction current	I _T	V _O =-0.5V to V _{DD} +0.5V		-	±25	mA
VDD or GND current	I _{DD} , I _{GND}	-		-	±50	mA
storage temperature	T _{stg}	-		-65	+150	℃
total power dissipation	P _{tot}	-		-	500	mW
Soldering temperature	T _L	10s	SOP/TSSOP	260		℃

3.2、Recommended Operating Conditions

($T_{amb}=25^{\circ}C$; $R_L=10k\Omega$; $C_L=50pF$; $\bar{E}=V_{DD}$; $V_{is}=V_{DD}=5V$.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{DD}	-	3	5	9	V
ambient temperature	T_{amb}	in free air	-40	-	+125	°C
supply voltage	V_{EE}	-	-6.0	-	0	V
supply voltage	$V_{DD}-V_{EE}$	-	3.0	-	9.0	V
input voltage	V_I	-	0	-	V_{DD}	V
input and output voltage	V_{IO}	-	V_{EE}	-	V_{DD}	V
Input rise and fall time	t_r, t_f	-	-	-	1000	ns
		-	-	-	500	ns
		-	-	-	400	ns
input capacitance	C_I	-	-	-	7.5	pF



3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

($T_{amb}=25^{\circ}\text{C}$, voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions (V)		$T_{amb}=25^{\circ}\text{C}$			Unit
				Min.	Typ.	Max.	
supply current	I_{DD}	$V_I=V_{DD}$ or $V_{SS}, I_O=0\text{A}$	$V_{DD}=5\text{V}$	-	-	20	μA
			$V_{DD}=9\text{V}$	-	-	40	μA
HIGH-level input voltage	V_{IH}	$ I_O <1\mu\text{A}$	$V_{DD}=5\text{V}$	3.5	-	-	V
			$V_{DD}=9\text{V}$	7.0	-	-	V
LOW-level input voltage	V_{IL}	$ I_O <1\mu\text{A}$	$V_{DD}=5\text{V}$	-	-	1.5	V
			$V_{DD}=9\text{V}$	-	-	3.0	V
input leakage current	I_I	$V_I=0\text{V}$ or $9\text{V}, V_{DD}=9\text{V}$		-	-	1.0	μA
3 state output leakage current	I_{OZ}	$V_{DD}=9\text{V}$	output to V_{DD}	-	-	1.6	μA
			output to V_{SS}	-	-	-1.6	μA
ON resistance (rail)	R_{ON}	$V_I=0\text{V}$ to $V_{DD}-V_{EE}$	$V_{DD}-V_{EE}=5\text{V}$	-	350	2500	Ω
			$V_{DD}-V_{EE}=9\text{V}$	-	80	245	Ω
		$V_I=0\text{V}$	$V_{DD}-V_{EE}=5\text{V}$	-	115	340	Ω
			$V_{DD}-V_{EE}=9\text{V}$	-	50	160	Ω
		$V_I=V_{DD}-V_{EE}$	$V_{DD}-V_{EE}=5\text{V}$	-	120	365	Ω
			$V_{DD}-V_{EE}=9\text{V}$	-	65	200	Ω
ON resistance mismatch between channels	ΔR_{ON}	$V_I=0\text{V}$ to $V_{DD}-V_{EE}$	$V_{DD}-V_{EE}=5\text{V}$	-	25	-	Ω
			$V_{DD}-V_{EE}=9\text{V}$	-	10	-	Ω
OFF-state leakage current	$I_{S(OFF)}$	$V_{SS}=V_{EE}, V_{DD}-V_{EE}=9\text{V}$	all channel off; $\bar{E}=V_{DD}$	-	-	1.0	μA
			any channel; $\bar{E}=V_{SS}$	-	-	1.0	μA

Note: On resistance waveform and test circuit see Figure 13 and Figure 14.

3.3.2、DC Characteristics 2

($T_{amb}=-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, voltages are referenced to V_{SS} (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions (V)		$T_{amb}=-40^{\circ}\text{C}$		$T_{amb}+85^{\circ}\text{C}$		$T_{amb}+125^{\circ}\text{C}$		Unit
				Min.	Max.	Min.	Max.	Min.	Max.	
supply current	I_{DD}	$V_I=V_{DD}$ or $V_{SS}, I_O=0\text{A}$	$V_{DD}=5\text{V}$	-	20	-	150	-	150	μA
			$V_{DD}=9\text{V}$	-	40	-	300	-	300	μA
HIGH-level input voltage	V_{IH}	$ I_O <1\mu\text{A}$	$V_{DD}=5\text{V}$	3.5	-	3.5	-	3.5	-	V
			$V_{DD}=9\text{V}$	7.0	-	7.0	-	7.0	-	V
LOW-level input voltage	V_{IL}	$ I_O <1\mu\text{A}$	$V_{DD}=5\text{V}$	-	1.5	-	1.5	-	1.5	V
			$V_{DD}=9\text{V}$	-	3.0	-	3.0	-	3.0	V
input leakage current	I_I	$V_I=0\text{V}$ or $9\text{V}, V_{DD}=9\text{V}$		-	1.0	-	1.0	-	1.0	μA
3 state output leakage current	I_{OZ}	$V_{DD}=9\text{V}$	output to V_{DD}	-	1.6	-	12.0	-	12.0	μA
			output to V_{SS}	-	-1.6	-	-12.0	-	-12.0	μA



3.3.3、AC Characteristics 1

($T_{amb}=25^{\circ}\text{C}$, $V_{EE}=V_{SS}=0\text{V}$, $t_r, t_f \leq 20\text{ns}$, $C_L=50\text{pF}$, $R_L=10\text{k}\Omega$, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH to LOW propagation delay time	t_{PHL}	Yn to Z; Z to Yn; see Figure 7	$V_{DD}=5V$	-	10	20	ns
			$V_{DD}=9V$	-	5	10	ns
		Sn to Yn, Z; see Figure 8	$V_{DD}=5V$	-	150	305	ns
			$V_{DD}=9V$	-	65	135	ns
LOW to HIGH propagation delay	t_{PLH}	Yn to Z; Z to Yn; see Figure 7	$V_{DD}=5V$	-	10	20	ns
			$V_{DD}=9V$	-	5	10	ns
		Sn to Yn, Z; see Figure 8	$V_{DD}=5V$	-	150	300	ns
			$V_{DD}=9V$	-	75	150	ns
HIGH to OFF-state propagation delay	t_{PHZ}	$\bar{E}$ to Yn, Z; see Figure 9	$V_{DD}=5V$	-	95	190	ns
			$V_{DD}=9V$	-	90	180	ns
LOW to OFF-state propagation delay	t_{PLZ}	$\bar{E}$ to Yn, Z; see Figure 9	$V_{DD}=5V$	-	100	205	ns
			$V_{DD}=9V$	-	90	180	ns
OFF-state to HIGH propagation delay	t_{PZH}	$\bar{E}$ to Yn, Z; see Figure 9	$V_{DD}=5V$	-	130	260	ns
			$V_{DD}=9V$	-	55	115	ns
OFF-state to LOW propagation delay	t_{PZL}	$\bar{E}$ to Yn, Z; see Figure 9	$V_{DD}=5V$	-	120	240	ns
			$V_{DD}=9V$	-	50	100	ns

3.3.4、AC Characteristics 2

($T_{amb}=25^{\circ}\text{C}$, $V_{EE}=V_{SS}=0\text{V}$, $V_I=0.5V_{DD}$ (p-p), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Square wave distortion	d _{sin}	see Figure 10; R _L =10kΩ; C _L =15pF; channel ON; f _i =1kHz	V _{DD} =5V	0.25	-	-	%
			V _{DD} =9V	0.04	-	-	%
any two channel crosstalk	f _{ct}	V _{DD} =9V, see note2		1	-	-	MHz
crosstalk voltage ($\bar{E}$ to Sn or Yn to Z)	V _{ct}	see Figure 11; R _L =10kΩ; C _L =15pF; $\bar{E}$ or Sn=V _{DD} (square-wave)		50	-	-	mV
OFF frequency	f _{OFF}	V _{DD} =9V, see note3		1	-	-	MHz
conduction frequency	f _{ON}	V _{DD} =5V, see note4		13	-	-	MHz
		V _{DD} =9V, see note4		40	-	-	MHz

Note:

[1] f_i is biased at $0.5V_{DD}$; $V_I=0.5V_{DD}$ (p-p).

[2] $R_L=1\text{k}\Omega$; $20\log V_{os}/V_{is}=-50\text{dB}$, see Figure 12.

[3] $R_L=1\text{k}\Omega$; $C_L=5\text{pF}$, channel off, $20\log V_{os}/V_{is}=-50\text{dB}$, see Figure 10.

[4] $R_L=1\text{k}\Omega$; $C_L=5\text{pF}$, channel on, $20\log V_{os}/V_{is}=-3\text{dB}$, see Figure 10.

4、Testing Circuit

4.1、AC Testing Circuit 1

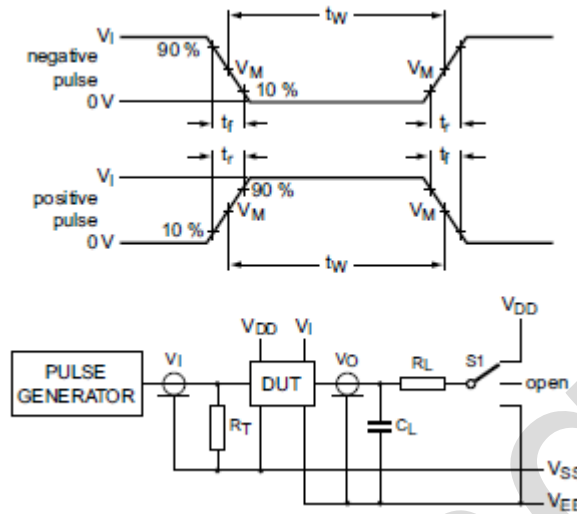


Figure 6. Test circuit for switching times

Definitions for test circuit:

DUT=Device Under Test.

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.

R_L =Load resistance.

4.2、AC Testing Waveforms

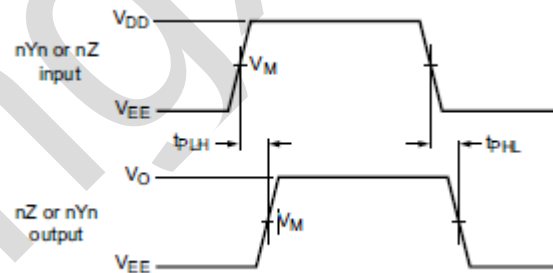


Figure 7. nYn, nZ to nZ, nYn propagation delays

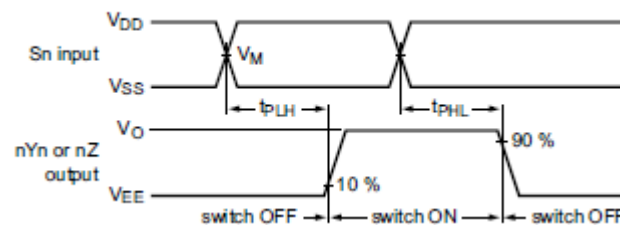


Figure 8. S_n to nYn, nZ propagation delays

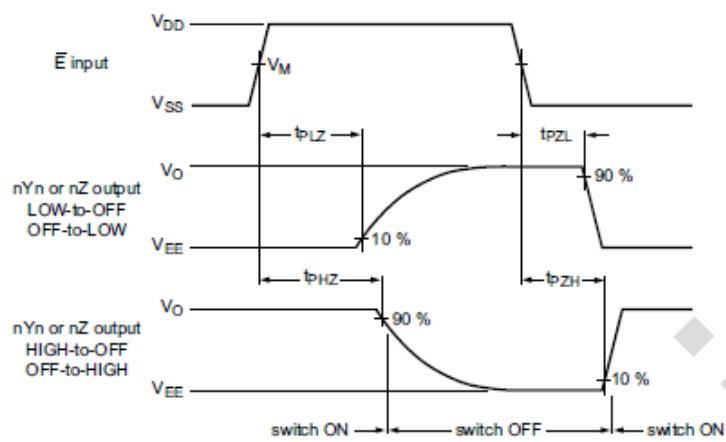


Figure 9. Enable and disable times

4.3、AC Testing Circuit 2

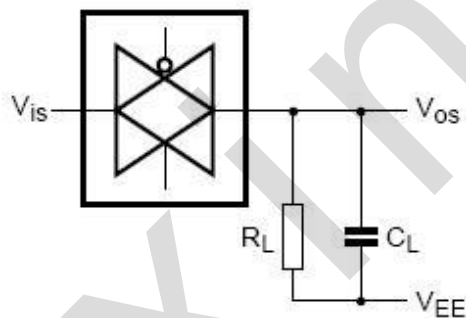


Figure 10. Square wave distortion degree of cut-off frequency and conduction frequency test pattern

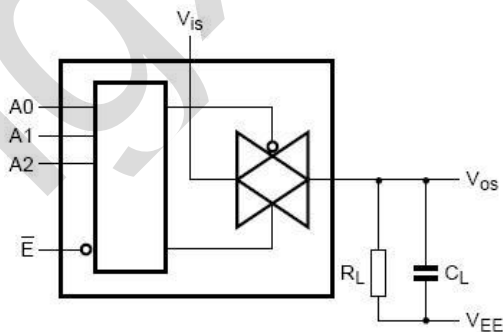


Figure 11. Crosstalk logical input/output test

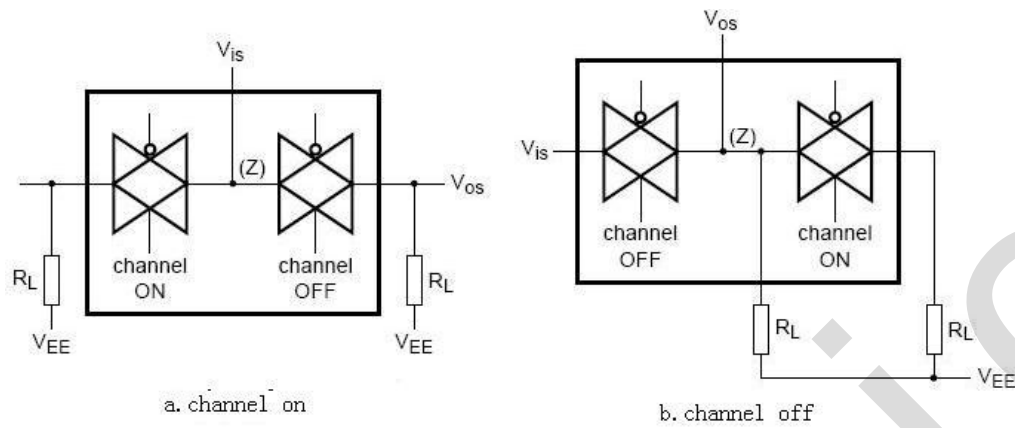


Figure 12. Inter channel Crosstalk

4.4、On Resistance Waveform And Test Circuit

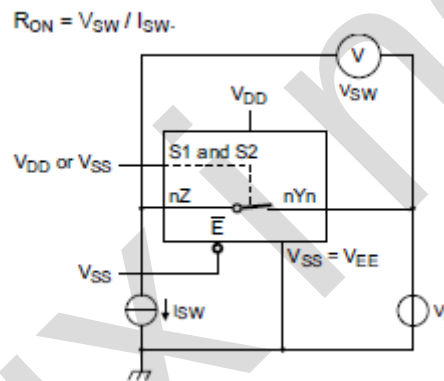


Figure 13. Test circuit for measuring R_{ON}

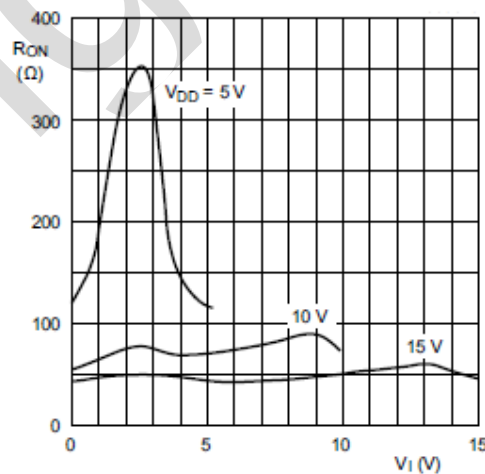


Figure 14. Typical R_{ON} as a function of input voltage



4.5、Measurement Points

Supply voltage	Input	Output
V_{DD}	V_M	V_M
3V to 9V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$

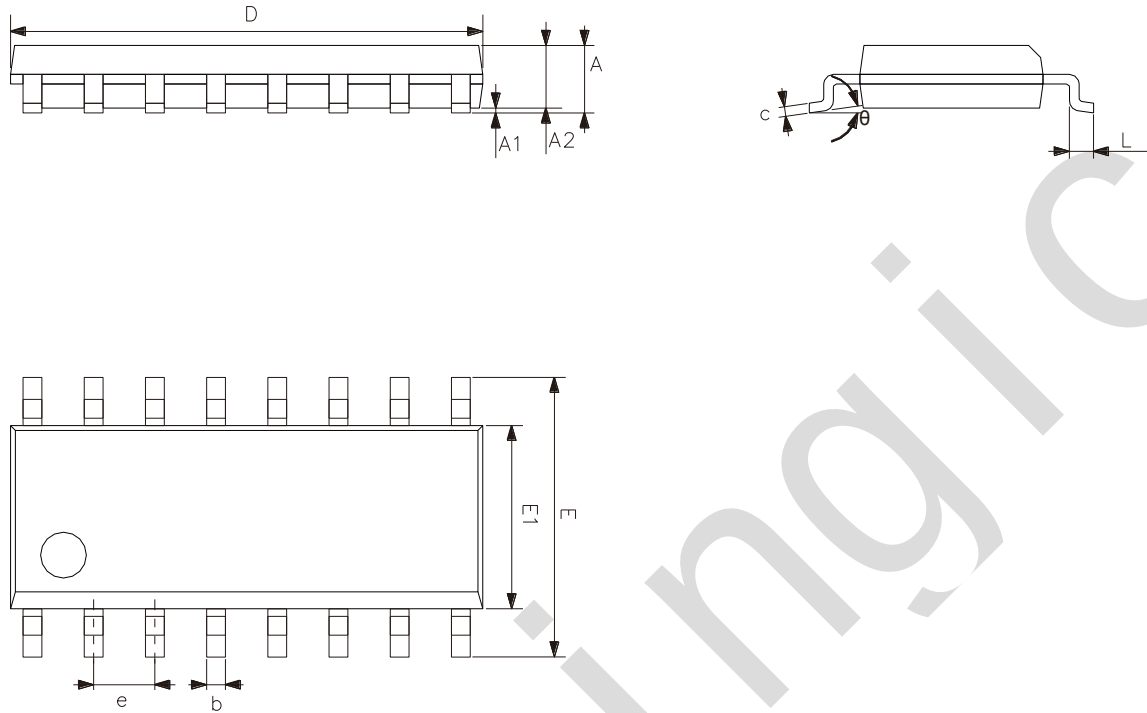
4.6、Test Data

Test	Input		Load		Switch
	V_{is}	t_r, t_f	C_L	R_L	
t_{PHL}	V_{EE}	20ns	50pF	10k Ω	V_{DD}
t_{PLH}	V_{DD}	20ns	50pF	10k Ω	V_{EE}
t_{PZH}, t_{PHZ}	V_{DD}	20ns	50pF	10k Ω	V_{EE}
t_{PZL}, t_{PLZ}	V_{EE}	20ns	50pF	10k Ω	V_{DD}
others	pulse	20ns	50pF	10k Ω	open



5、Package Information

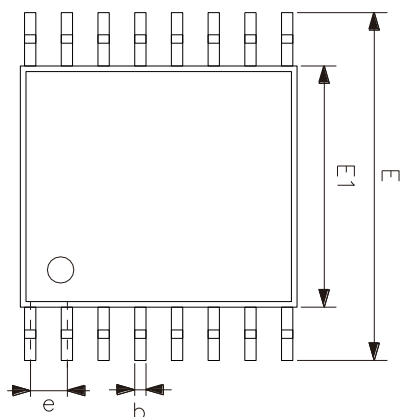
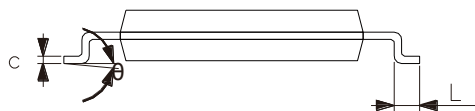
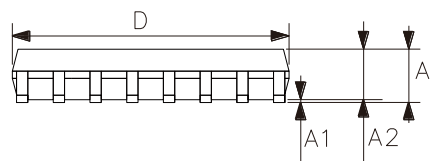
5.1、SOP16



Symbol	Dimensions (mm)	
	Min.	Max.
A	1.35	1.80
A1	0.10	0.25
A2	1.25	1.55
b	0.33	0.51
c	0.19	0.25
D	9.50	10.10
E	5.80	6.30
E1	3.70	4.10
e	1.27	
L	0.35	0.89
θ	0°	8°



5.2、TSSOP16



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
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.									

6.2、Notes

We Recommend you to read this chapter carefully before using this product.

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This product is not suitable for critical equipment such as life-saving, life-sustaining or safety equipment. It is also not suitable for applications that may result in personal injury, death, or serious property or environmental damage due to product malfunction or failure. Lingxing will not be liable for any damages incurred by the customers at their own risk for such applications.

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