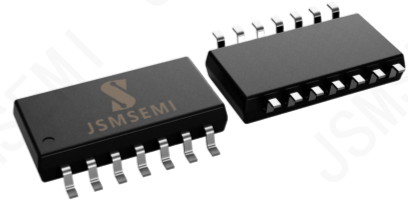


1、 General Description

The SN74HC21DR-JSM provide the 4-input AND function. 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:
For SN74HC21DR-JSM: CMOS level
- Low-power dissipation
- Specified from -40°C to $+125^{\circ}\text{C}$
- Packaging information: SOP14



2、 Block Diagram And Pin Description

2.1、 Block Diagram

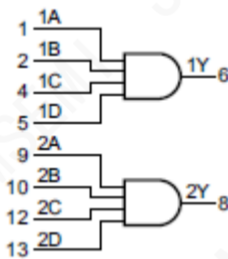


Figure 1. Logic symbol

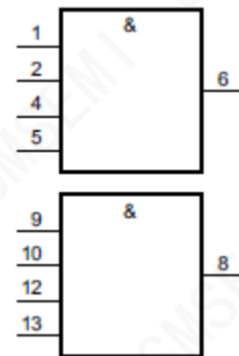


Figure 2. IEC logic symbol

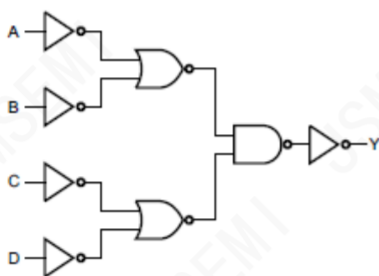


Figure 3. Logic diagram

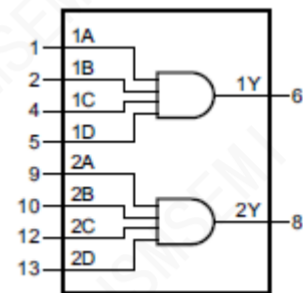
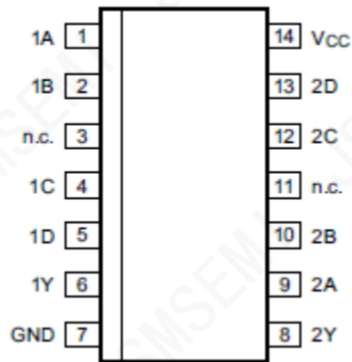


Figure 4. Functional diagram

Ordering Information

Order number	Package	Operation Temperature Range	MSL Grade	Ship, Quantity	Green
SN74HC21DR-JSM	SOP-14	-40 to 125°C	3	T&R,2500	Rohs

2.2、Pin Configurations



2.3、Pin Description

Pin No.	Pin Name	Description
1	1A	data input
2	1B	data input
3	n.c.	not connected
4	1C	data input
5	1D	data input
6	1Y	data output
7	GND	ground (0V)
8	2Y	data output
9	2A	data input
10	2B	data input
11	n.c.	not connected
12	2C	data input
13	2D	data input
14	V _{CC}	supply voltage

2.4、Function Table

Input				Output
nA	nB	nC	nD	nY
L	X	X	X	L
X	L	X	X	L
X	X	L	X	L
X	X	X	L	L
H	H	H	H	H

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 GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Max.	Unit
supply voltage	V_{CC}	-	-0.5	+7	V
input clamping current	I_{IK}	$V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$	-	± 20	mA
output clamping current	I_{OK}	$V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$	-	± 20	mA
output current	I_O	$-0.5V < V_O < V_{CC} + 0.5V$	-	± 25	mA
supply current	I_{CC}	-	-	50	mA
ground current	I_{GND}	-	-50	-	mA
storage temperature	T_{stg}	-	-65	+150	°C
total power dissipation	P_{tot}	-	-	500	mW
soldering temperature	T_L	10s	260		°C

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{CC}	-	2.0	5.0	6.0	V
input voltage	V_I	-	0	-	V_{CC}	V
output voltage	V_O	-	0	-	V_{CC}	V
input transition rise and fall rate	$\Delta t / \Delta V$	$V_{CC} = 2.0V$	-	-	625	ns/V
		$V_{CC} = 4.5V$	-	1.67	139	ns/V
		$V_{CC} = 6.0V$	-	-	83	ns/V
ambient temperature	T_{amb}	-	-40	-	+125	°C

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

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

Parameter	Symbol	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	
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	
HIGH-level output voltage	V_{OH}	$V_I = V_{IH}$ or V_{IL}	$I_O = -20\mu A$; $V_{CC} = 2.0V$	1.9	2.0	-	V
			$I_O = -20\mu A$; $V_{CC} = 4.5V$	4.4	4.5	-	V
			$I_O = -20\mu A$; $V_{CC} = 6.0V$	5.9	6.0	-	V
			$I_O = -4.0mA$; $V_{CC} = 4.5V$	3.98	4.32	-	V
			$I_O = -5.2mA$; $V_{CC} = 6.0V$	5.48	5.81	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{IH}$ or V_{IL}	$I_O = 20\mu A$; $V_{CC} = 2.0V$	-	0	0.1	V
			$I_O = 20\mu A$; $V_{CC} = 4.5V$	-	0	0.1	V
			$I_O = 20\mu A$; $V_{CC} = 6.0V$	-	0	0.1	V
			$I_O = 4.0mA$; $V_{CC} = 4.5V$	-	0.15	0.26	V
			$I_O = 5.2mA$; $V_{CC} = 6.0V$	-	0.16	0.26	V
input leakage current	I_I	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0V$	-	-	± 1	μA	
supply current	I_{CC}	$V_I = V_{CC}$ or GND; $I_O = 0A$; $V_{CC} = 6.0V$	-	-	2.0	μA	
input capacitance	C_I	-	-	3.5	-	pF	

3.3.2、DC Characteristics 2

 ($T_{amb}=-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
HIGH-level input voltage	V_{IH}	$V_{CC}=2.0\text{V}$	1.5	-	-	V	
		$V_{CC}=4.5\text{V}$	3.15	-	-	V	
		$V_{CC}=6.0\text{V}$	4.2	-	-	V	
LOW-level input voltage	V_{IL}	$V_{CC}=2.0\text{V}$	-	-	0.5	V	
		$V_{CC}=4.5\text{V}$	-	-	1.35	V	
		$V_{CC}=6.0\text{V}$	-	-	1.8	V	
HIGH-level output voltage	V_{OH}	$V_I=V_{IH}$ or V_{IL}	$I_O=-20\mu\text{A}; V_{CC}=2.0\text{V}$	1.9	-	-	V
			$I_O=-20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	-	-	V
			$I_O=-20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	-	-	V
			$I_O=-4.0\text{mA}; V_{CC}=4.5\text{V}$	3.84	-	-	V
			$I_O=-5.2\text{mA}; V_{CC}=6.0\text{V}$	5.34	-	-	V
LOW-level output voltage	V_{OL}	$V_I=V_{IH}$ or V_{IL}	$I_O=20\mu\text{A}; V_{CC}=2.0\text{V}$	-	-	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=4.5\text{V}$	-	-	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=6.0\text{V}$	-	-	0.1	V
			$I_O=4.0\text{mA}; V_{CC}=4.5\text{V}$	-	-	0.33	V
			$I_O=5.2\text{mA}; V_{CC}=6.0\text{V}$	-	-	0.33	V
input leakage current	I_I	$V_I=V_{CC}$ or GND; $V_{CC}=6.0\text{V}$	-	-	± 1	μA	
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0\text{A}; V_{CC}=6.0\text{V}$	-	-	20	μA	

3.3.3、DC Characteristics 3

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
HIGH-level input voltage	V_{IH}	$V_{CC}=2.0\text{V}$	1.5	-	-	V	
		$V_{CC}=4.5\text{V}$	3.15	-	-	V	
		$V_{CC}=6.0\text{V}$	4.2	-	-	V	
LOW-level input voltage	V_{IL}	$V_{CC}=2.0\text{V}$	-	-	0.5	V	
		$V_{CC}=4.5\text{V}$	-	-	1.35	V	
		$V_{CC}=6.0\text{V}$	-	-	1.8	V	
HIGH-level output voltage	V_{OH}	$V_I=V_{IH}$ or V_{IL}	$I_O=-20\mu\text{A}; V_{CC}=2.0\text{V}$	1.9	-	-	V
			$I_O=-20\mu\text{A}; V_{CC}=4.5\text{V}$	4.4	-	-	V
			$I_O=-20\mu\text{A}; V_{CC}=6.0\text{V}$	5.9	-	-	V
			$I_O=-4.0\text{mA}; V_{CC}=4.5\text{V}$	3.7	-	-	V
			$I_O=-5.2\text{mA}; V_{CC}=6.0\text{V}$	5.2	-	-	V
LOW-level output voltage	V_{OL}	$V_I=V_{IH}$ or V_{IL}	$I_O=20\mu\text{A}; V_{CC}=2.0\text{V}$	-	-	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=4.5\text{V}$	-	-	0.1	V
			$I_O=20\mu\text{A}; V_{CC}=6.0\text{V}$	-	-	0.1	V
			$I_O=4.0\text{mA}; V_{CC}=4.5\text{V}$	-	-	0.4	V
			$I_O=5.2\text{mA}; V_{CC}=6.0\text{V}$	-	-	0.4	V
input leakage current	I_I	$V_I=V_{CC}$ or GND; $V_{CC}=6.0\text{V}$	-	-	± 1	μA	
supply current	I_{CC}	$V_I=V_{CC}$ or GND; $I_O=0\text{A}; V_{CC}=6.0\text{V}$	-	-	40	μA	

3.3.4、 AC Characteristics 1

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
nA, nB, nC, nD to nY propagation delay	t_{pd}	see Figure 6 ^[1]	$V_{CC}=2.0\text{V}$	-	33	110	ns
			$V_{CC}=4.5\text{V}$	-	12	22	ns
			$V_{CC}=5.0\text{V}; C_L=15\text{pF}$	-	10	-	ns
			$V_{CC}=6.0\text{V}$	-	10	19	ns
transition time	t_t	see Figure 6 ^[2]	$V_{CC}=2.0\text{V}$	-	19	75	ns
			$V_{CC}=4.5\text{V}$	-	7	15	ns
			$V_{CC}=6.0\text{V}$	-	6	13	ns
power dissipation capacitance	C_{PD}	$V_I=\text{GND to } V_{CC}$ ^[3]	-	15	-	pF	

 Note: [1] t_{pd} is the same as t_{PLH} and t_{PHL} .

 [2] t_t is the same as t_{THL} and t_{TLH} .

 [3] C_{PD} is used to determine the dynamic power dissipation (P_D in uW).

 $P_D=C_{PD}\times V_{CC}^2\times f_i+\sum(C_L\times V_{CC}^2\times f_o)$ where:

 f_i =input frequency in MHz;

 f_o =output frequency in MHz;

 C_L =output load capacitance in pF;

 V_{CC} =supply voltage in V; \sum
 $(C_L\times V_{CC}^2\times f_o)$ =sum of outputs.

3.3.5、 AC Characteristics 2

 ($T_{amb}=-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
nA, nB, nC, nD to nY propagation delay	t_{pd}	see Figure 6 ^[1]	$V_{CC}=2.0\text{V}$	-	-	140	ns
			$V_{CC}=4.5\text{V}$	-	-	28	ns
			$V_{CC}=6.0\text{V}$	-	-	24	ns
transition time	t_t	see Figure 6 ^[2]	$V_{CC}=2.0\text{V}$	-	-	95	ns
			$V_{CC}=4.5\text{V}$	-	-	19	ns
			$V_{CC}=6.0\text{V}$	-	-	16	ns

 Note: [1] t_{pd} is the same as t_{PLH} and t_{PHL} .

 [2] t_t is the same as t_{THL} and t_{TLH} .

3.3.6、 AC Characteristics 2

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
nA, nB, nC, nD to nY propagation delay	t_{pd}	see Figure 6 ^[1]	$V_{CC}=2.0\text{V}$	-	-	165	ns
			$V_{CC}=4.5\text{V}$	-	-	33	ns
			$V_{CC}=6.0\text{V}$	-	-	28	ns
transition time	t_t	see Figure 6 ^[2]	$V_{CC}=2.0\text{V}$	-	-	110	ns
			$V_{CC}=4.5\text{V}$	-	-	22	ns
			$V_{CC}=6.0\text{V}$	-	-	19	ns

 Note: [1] t_{pd} is the same-as t_{PLH} and t_{PHL} .

 [2] t_t is the same as t_{THL} and t_{TLH} .

4、Testing Circuit

4.1、AC Testing Circuit

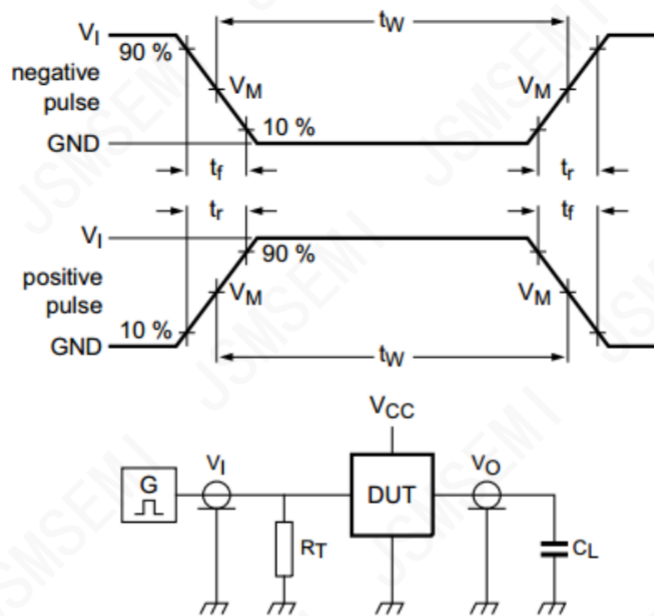


Figure 5. Test circuit for measuring switching times

Definitions for test circuit:

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.

4.2、AC Testing Waveforms

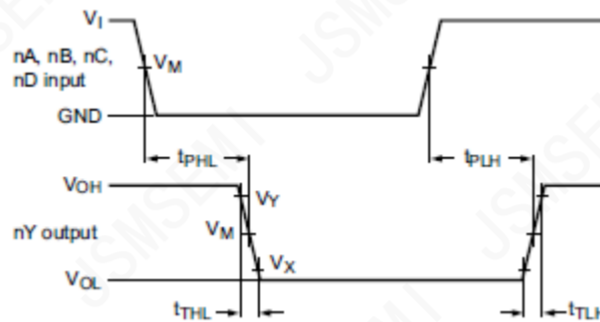


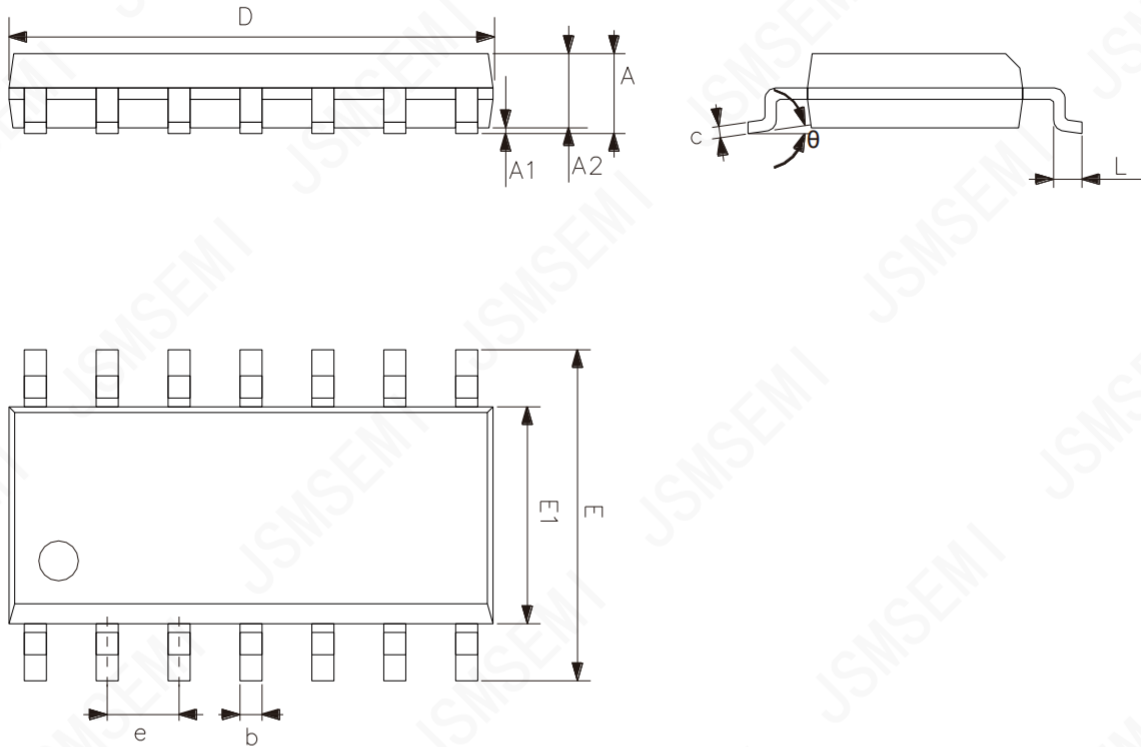
Figure 6. Waveforms showing the input (nA, nB, nC, nD) to output (nY) propagation delays and the output transition times

4.3、Measurement Points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
SN74HC21DR-JSM	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{CC}$	$0.9 \times V_{CC}$

4.4、Test Data

Type	Input		Load	Test
	V_I	t_r, t_f	C_L	
SN74HC21DR-JSM	V_{CC}	6.0ns	15pF, 50pF	t_{PLH}, t_{PHL}

5、Package Information
5.1、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°

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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