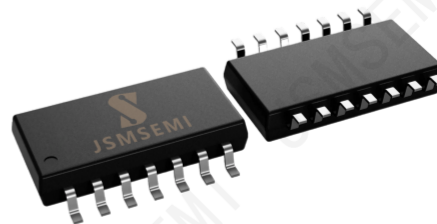


1、General Description

The HEF4011BT,653-JSM is a quad 2-input NAND gate.

The outputs are fully buffered for the highest noise immunity and pattern insensitivity to output impedance.

It operates over a recommended V_{DD} power supply range of 3 to 15V referenced to V_{SS} (usually ground). Unused inputs must be connected to V_{DD} , V_{SS} , or another input.



Features:

- Wide supply voltage range from 3V to 15V
- Fully static operation
- 5V, 10V, and 15V parametric ratings
- Standardized symmetrical output characteristics
- Inputs and outputs are protected against electrostatic effects
- Specified from -40°C to $+125^{\circ}\text{C}$
- Packaging information: SOP14

2、Block Diagram And Pin Description

2.1、Block Diagram

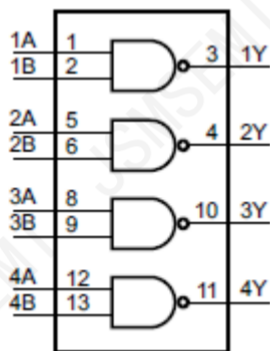


Figure 1. Functional diagram

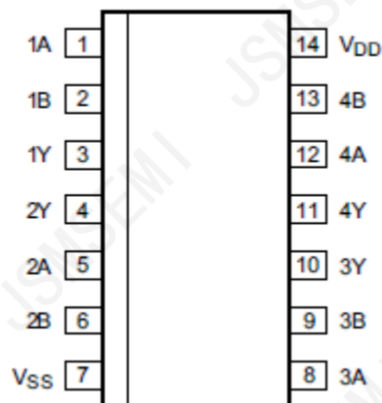


Figure 2. Logic diagram (one gate)

Ordering Information

Order number	Package	Operation Temperature Range	MSL Grade	Ship, Quantity	Green
HEF4011BT,653-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	1Y	data output
4	2Y	data output
5	2A	data input
6	2B	data input
7	V _{SS}	ground (0V)
8	3A	data input
9	3B	data input
10	3Y	data output
11	4Y	data output
12	4A	data input
13	4B	data input
14	V _{DD}	supply voltage

2.4、Function Table

Input		Output
nA	nB	nY
L	L	H
L	H	H
H	L	H
H	H	L

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

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	+18	V
DC input current	I_{IK}	any one input	-	± 10	mA
input voltage	V_I	all inputs	-0.5	$V_{DD}+0.5$	V
storage temperature	T_{stg}	-	-65	+150	°C
total power dissipation	P_{tot}	-	-	500	mW
device dissipation	P	per output transistor	-	100	mW
Soldering temperature	T_L	10s	260		°C

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{DD}	-	3	-	15	V
ambient temperature	T_{amb}	in free air	-40	-	+125	°C

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
		V_O	V_{IN}	V_{DD}	Min.	Typ.	Max.	
supply current	I_{DD}	-	0, 5	5	-	-	1	uA
		-	0, 10	10	-	-	1	uA
		-	0, 15	15	-	-	1	uA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.51	1	-	mA
		0.5	0, 10	10	1.3	2.6	-	mA
		1.5	0, 15	15	3.4	6.8	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.51	-1	-	mA
		2.5	0, 5	5	-1.6	-3.2	-	mA
		9.5	0, 10	10	-1.3	-2.6	-	mA
		13.5	0, 15	15	-3.4	-6.8	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0	0.05	V
		-	0, 10	10	-	0	0.05	V
		-	0, 15	15	-	0	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	5	-	V
		-	0, 10	10	9.95	10	-	V
		-	0, 15	15	14.95	15	-	V
LOW-level input voltage	V_{IL}	4.5	-	5	-	-	1.5	V
		9	-	10	-	-	3	V
		13.5	-	15	-	-	4	V
HIGH-level input voltage	V_{IH}	0.5, 4.5	-	5	3.5	-	-	V
		1, 9	-	10	7	-	-	V
		1.5, 13.5	-	15	11	-	-	V
input leakage current	I_I	-	0, 15	15	-	-	± 1	uA

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
		V_O	V_{IN}	V_{DD}	Min.	Max.	Min.	Max.	Min.	Max.	
supply current	I_{DD}	-	0, 5	5	-	1	-	7.5	-	7.5	μA
		-	0, 10	10	-	1	-	15	-	15	μA
		-	0, 15	15	-	1	-	30	-	30	μA
LOW-level output current	I_{OL}	0.4	0, 5	5	0.61	-	0.42	-	0.36	-	mA
		0.5	0, 10	10	1.5	-	1.1	-	0.9	-	mA
		1.5	0, 15	15	4	-	2.8	-	2.4	-	mA
HIGH-level output current	I_{OH}	4.6	0, 5	5	-0.61	-	-0.42	-	-0.36	-	mA
		2.5	0, 5	5	-1.8	-	-1.3	-	-1.15	-	mA
		9.5	0, 10	10	-1.5	-	-1.1	-	-0.9	-	mA
		13.5	0, 15	15	-4	-	-2.8	-	-2.4	-	mA
LOW-level output voltage	V_{OL}	-	0, 5	5	-	0.05	-	0.05	-	0.05	V
		-	0, 10	10	-	0.05	-	0.05	-	0.05	V
		-	0, 15	15	-	0.05	-	0.05	-	0.05	V
HIGH-level output voltage	V_{OH}	-	0, 5	5	4.95	-	4.95	-	4.95	-	V
		-	0, 10	10	9.95	-	9.95	-	9.95	-	V
		-	0, 15	15	14.95	-	14.95	-	14.95	-	V
LOW-level input voltage	V_{IL}	4.5	-	5	-	1.5	-	1.5	-	1.5	V
		9	-	10	-	3	-	3	-	3	V
		13.5	-	15	-	4	-	4	-	4	V
HIGH-level input voltage	V_{IH}	0.5, 4.5	-	5	3.5	-	3.5	-	3.5	-	V
		1, 9	-	10	7	-	7	-	7	-	V
		1.5, 13.5	-	15	11	-	11	-	11	-	V
input leakage current	I_I	-	0, 15	15	-	± 1	-	± 1	-	± 1	μA

3.3.3、AC Characteristics

($T_{amb}=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$, $t_r, t_f=20\text{ns}$, $C_L=50\text{pF}$, $R_L=200\text{k}\Omega$, unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
propagation delay time	$t_{\text{PHL}}, t_{\text{PLH}}$	see Figure 4	$V_{\text{DD}}=5\text{V}$	-	125	250	ns
			$V_{\text{DD}}=10\text{V}$	-	60	120	ns
			$V_{\text{DD}}=15\text{V}$	-	45	90	ns
transition time	$t_{\text{THL}}, t_{\text{TLH}}$	see Figure 4	$V_{\text{DD}}=5\text{V}$	-	100	200	ns
			$V_{\text{DD}}=10\text{V}$	-	50	100	ns
			$V_{\text{DD}}=15\text{V}$	-	40	80	ns
input capacitance	C_{I}	any input		-	5	7.5	pF

4、Testing Circuit

4.1、AC Testing Circuit

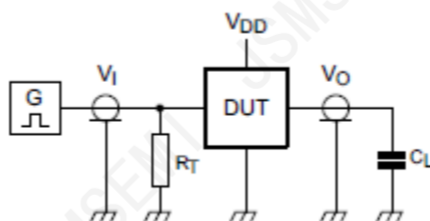


Figure 3. Test circuit for switching times

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.

4.2、AC Testing Waveforms

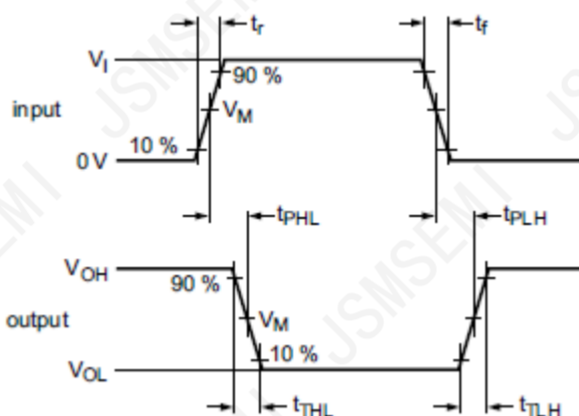


Figure 4. Propagation delay, output transition time

4.3、Measurement Points

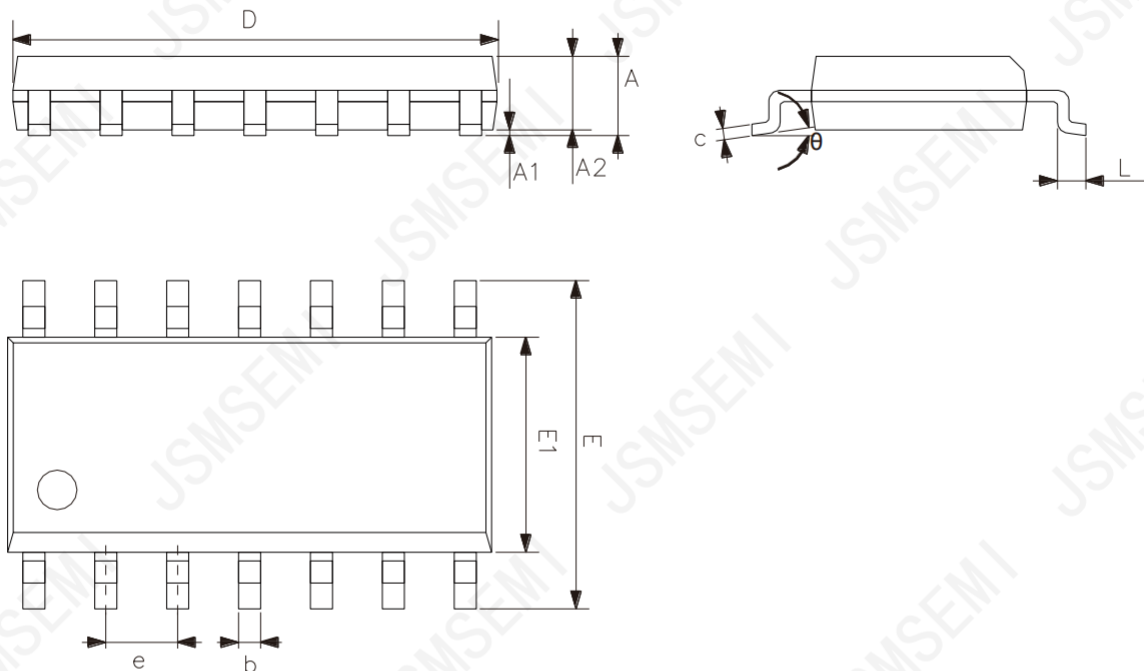
Supply voltage	Input	Output
V_{DD}	V_M	V_M
5V to 15V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$

4.4、Test Data

Supply voltage	Input		Load
V_{DD}	V_I	t_r, t_f	C_L
5V to 15V	V_{SS} or V_{DD}	$\leq 20\text{ns}$	50pF

5、Package Information

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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