

1、General Description

The TC7SZ08 provides one 2-input AND function. Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of these devices as translators in mixed 3.3V and 5V applications.

Features:

- Wide supply voltage range from 1.65V to 5.5V
- $\pm 24\text{mA}$ output drive ($V_{DD}=3.0\text{V}$)
- CMOS low power consumption
- Input accepts voltages up to 5V
- Specified from -40°C to $+125^{\circ}\text{C}$
- Packaging information: SOT-23-5/SOT-353

2、Block Diagram And Pin Description

2.1、Block Diagram

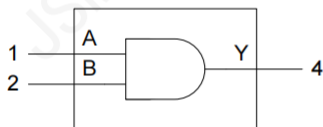


Figure 1. Logic symbol



Figure 2. IEC logic symbol

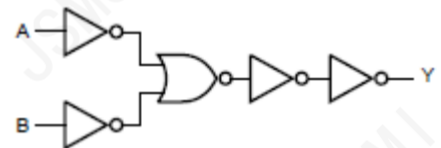
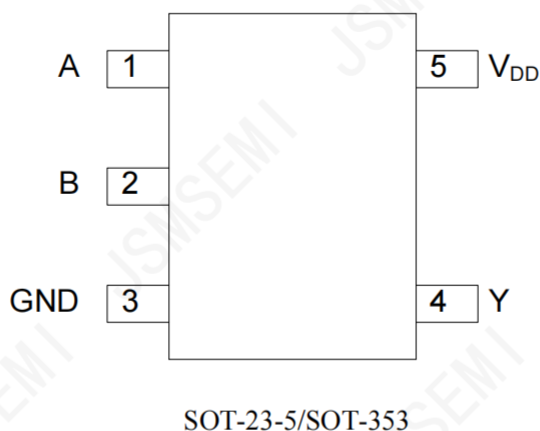


Figure 3. Logic diagram

Ordering Information

Order number	Package	Marking	Operation Temperature Range	MSL Grade	Ship, Quantity	Green
TC7SZ08F-JSM	SOT-23-5	C08K	-40 to 125°C	3	T&R,3000	Rohs
TC7SZ08FU-JSM	SOT-353	CE5	-40 to 125°C	3	T&R,3000	Rohs

2.2、Pin Configurations



2.3、Pin Description

Pin No. SOT23-5/SO T353	Pin Name	Description
1	A	data input
2	B	data input
3	GND	ground (0V)
4	Y	data output
-	n.c.	not connected
5	V _{DD}	supply voltage

2.4、Function Table

Input		Output
A	B	Y
L	L	L
L	H	L
H	L	L
H	H	H

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_{DD}	-	-0.5	+6.5	V
input clamping current	I_{IK}	$V_I < 0V$	-50	-	mA
input voltage	V_I	-	-0.5	+6.5	V
output clamping current	I_{OK}	$V_O > V_{DD}$ or $V_O < 0V$	-	± 50	mA
output voltage	V_O	Active mode	-0.5	$V_{DD}+0.5$	V
		Power-down mode	-0.5	+6.5	V
output current	I_O	$V_O=0V$ to V_{DD}	-	± 50	mA
supply current	I_{DD}	-	-	100	mA
ground current	I_{GND}	-	-100	-	mA
storage temperature	T_{stg}	-	-65	+150	°C
total power dissipation	P_{tot}	-	-	250	mW
soldering temperature	T_L	10s	260		°C

3.2、Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{DD}	-	1.65	-	5.5	V
input voltage	V_I	-	0	-	5.5	V
output voltage	V_O	Active mode	0	-	V_{DD}	V
		Power-down mode; $V_{DD}=0V$	0	-	5.5	V
ambient temperature	T_{amb}	-	-40	-	+125	°C

3.3、Electrical Characteristics

3.3.1、DC Characteristics 1

($T_{amb} = -40^{\circ}\text{C}$ 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}	$V_{DD} = 1.65\text{V to } 1.95\text{V}$		$0.65 \times V_{DD}$	-	-	V
		$V_{DD} = 2.3\text{V to } 2.7\text{V}$		1.7	-	-	V
		$V_{DD} = 2.7\text{V to } 3.6\text{V}$		2.0	-	-	V
		$V_{DD} = 4.5\text{V to } 5.5\text{V}$		$0.7 \times V_{DD}$	-	-	V
LOW-level input voltage	V_{IL}	$V_{DD} = 1.65\text{V to } 1.95\text{V}$		-	-	$0.35 \times V_{DD}$	V
		$V_{DD} = 2.3\text{V to } 2.7\text{V}$		-	-	0.7	V
		$V_{DD} = 2.7\text{V to } 3.6\text{V}$		-	-	0.8	V
		$V_{DD} = 4.5\text{V to } 5.5\text{V}$		-	-	$0.3 \times V_{DD}$	V
HIGH-level output voltage	V_{OH}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = -100\mu\text{A}; V_{DD} = 1.65\text{V to } 5.5\text{V}$	$V_{DD} - 0.1$	-	-	V
			$I_O = -4\text{mA}; V_{DD} = 1.65\text{V}$	1.2	-	-	V
			$I_O = -8\text{mA}; V_{DD} = 2.3\text{V}$	1.9	-	-	V
			$I_O = -12\text{mA}; V_{DD} = 2.7\text{V}$	2.2	-	-	V
			$I_O = -24\text{mA}; V_{DD} = 3.0\text{V}$	2.3	-	-	V
			$I_O = -32\text{mA}; V_{DD} = 4.5\text{V}$	3.8	-	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{IH} \text{ or } V_{IL}$	$I_O = 100\mu\text{A}; V_{DD} = 1.65\text{V to } 5.5\text{V}$	-	-	0.1	V
			$I_O = 4\text{mA}; V_{DD} = 1.65\text{V}$	-	-	0.45	V
			$I_O = 8\text{mA}; V_{DD} = 2.3\text{V}$	-	-	0.3	V
			$I_O = 12\text{mA}; V_{DD} = 2.7\text{V}$	-	-	0.4	V
			$I_O = 24\text{mA}; V_{DD} = 3.0\text{V}$	-	-	0.55	V
			$I_O = 32\text{mA}; V_{DD} = 4.5\text{V}$	-	-	0.55	V
input leakage current	I_I	$V_I = 5.5\text{V or GND}; V_{DD} = 0\text{V to } 5.5\text{V}$		-	-	± 1	μA
power-off leakage current	I_{OFF}	$V_I \text{ or } V_O = 5.5\text{V}; V_{DD} = 0\text{V}$		-	-	± 2	μA
supply current	I_{DD}	$V_I = 5.5\text{V or GND}; I_O = 0\text{A}; V_{DD} = 1.65\text{V to } 5.5\text{V}$		-	-	4	μA
additional supply current	ΔI_{DD}	per pin; $V_I = V_{DD} - 0.6\text{V}; I_O = 0\text{A}; V_{DD} = 2.3\text{V to } 5.5\text{V}$		-	-	500	μA
input capacitance	C_I	$V_{DD} = 3.3\text{V}; V_I = \text{GND to } V_{DD}$		-	5	-	pF

Note: All typical values are measured at $V_{DD} = 3.3\text{V}$ and $T_{amb} = 25^{\circ}\text{C}$.

3.3.2、DC 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
HIGH-level input voltage	V_{IH}	$V_{DD}=1.65\text{V}$ to 1.95V		$0.65 \times V_{DD}$	-	-	V
		$V_{DD}=2.3\text{V}$ to 2.7V		1.7	-	-	V
		$V_{DD}=2.7\text{V}$ to 3.6V		2.0	-	-	V
		$V_{DD}=4.5\text{V}$ to 5.5V		$0.7 \times V_{DD}$	-	-	V
LOW-level input voltage	V_{IL}	$V_{DD}=1.65\text{V}$ to 1.95V		-	-	$0.35 \times V_{DD}$	V
		$V_{DD}=2.3\text{V}$ to 2.7V		-	-	0.7	V
		$V_{DD}=2.7\text{V}$ to 3.6V		-	-	0.8	V
		$V_{DD}=4.5\text{V}$ to 5.5V		-	-	$0.3 \times V_{DD}$	V
HIGH-level output voltage	V_{OH}	$V_I = V_{IH}$ or V_{IL}	$I_O = -100\mu\text{A}; V_{DD}=1.65\text{V}$ to 5.5V	$V_{DD}-0.1$	-	-	V
			$I_O = -4\text{mA}; V_{DD}=1.65\text{V}$	0.95	-	-	V
			$I_O = -8\text{mA}; V_{DD}=2.3\text{V}$	1.7	-	-	V
			$I_O = -12\text{mA}; V_{DD}=2.7\text{V}$	1.9	-	-	V
			$I_O = -24\text{mA}; V_{DD}=3.0\text{V}$	2.0	-	-	V
			$I_O = -32\text{mA}; V_{DD}=4.5\text{V}$	3.4	-	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{IH}$ or V_{IL}	$I_O = 100\mu\text{A}; V_{DD}=1.65\text{V}$ to 5.5V	-	-	0.1	V
			$I_O = 4\text{mA}; V_{DD}=1.65\text{V}$	-	-	0.70	V
			$I_O = 8\text{mA}; V_{DD}=2.3\text{V}$	-	-	0.45	V
			$I_O = 12\text{mA}; V_{DD}=2.7\text{V}$	-	-	0.60	V
			$I_O = 24\text{mA}; V_{DD}=3.0\text{V}$	-	-	0.80	V
			$I_O = 32\text{mA}; V_{DD}=4.5\text{V}$	-	-	0.80	V
input leakage current	I_I	$V_I = 5.5\text{V}$ or GND; $V_{DD}=0\text{V}$ to 5.5V		-	-	± 1	μA
power-off leakage current	I_{OFF}	V_I or $V_O = 5.5\text{V}; V_{DD}=0\text{V}$		-	-	± 2	μA
supply current	I_{DD}	$V_I = 5.5\text{V}$ or GND; $I_O = 0\text{A}; V_{DD}=1.65\text{V}$ to 5.5V		-	-	4	μA
additional supply current	ΔI_{DD}	per pin; $V_I = V_{DD}-0.6\text{V}; I_O = 0\text{A}; V_{DD}=2.3\text{V}$ to 5.5V		-	-	500	μA

3.3.3、AC Characteristics 1

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

Parameter	Symbol	Conditions		Min.	Typ. ^[1]	Max.	Unit
A, B to Y propagation delay	t _{PHL}	see Figure 5	V _{CC} =1.65V to 1.95V	-	12.5	18.8	ns
			V _{CC} =2.3V to 2.7V	-	10.5	15.8	ns
			V _{CC} =2.7V	-	10	15	ns
			V _{CC} =3.0V to 3.6V	-	9.5	14.3	ns
			V _{CC} =4.5V to 5.5V	-	9	13.5	ns
A, B to Y propagation delay	t _{PLH}	see Figure 5	V _{CC} =1.65V to 1.95V	-	14	21	ns
			V _{CC} =2.3V to 2.7V	-	10	15	ns
			V _{CC} =2.7V	-	9.5	14.3	ns
			V _{CC} =3.0V to 3.6V	-	8.5	12.8	ns
			V _{CC} =4.5V to 5.5V	-	7.5	11.3	ns

Note:

[1] Typical values are measured at $T_{amb}=25^{\circ}\text{C}$ and $V_{DD}=1.8\text{V}, 2.5\text{V}, 2.7\text{V}, 3.3\text{V}$ and 5.0V respectively.

3.3.4、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
A, B to Y propagation delay	t_{PHL}	see Figure 5	$V_{CC}=1.65V$ to $1.95V$	-	-	20.8	ns
			$V_{CC}=2.3V$ to $2.7V$	-	-	17.8	ns
			$V_{CC}=2.7V$	-	-	17	ns
			$V_{CC}=3.0V$ to $3.6V$	-	-	16.3	ns
			$V_{CC}=4.5V$ to $5.5V$	-	-	15.5	ns
A, B to Y propagation delay	t_{PLH}	see Figure 5	$V_{CC}=1.65V$ to $1.95V$	-	-	23	ns
			$V_{CC}=2.3V$ to $2.7V$	-	-	17	ns
			$V_{CC}=2.7V$	-	-	16.3	ns
			$V_{CC}=3.0V$ to $3.6V$	-	-	14.8	ns
			$V_{CC}=4.5V$ to $5.5V$	-	-	13.3	ns

4、Testing Circuit

4.1、AC Testing Circuit

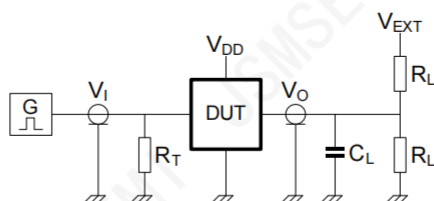


Figure 4. Test circuit for measuring switching times

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.

V_{EXT} =External voltage for measuring switching times.

4.2、AC Testing Waveforms

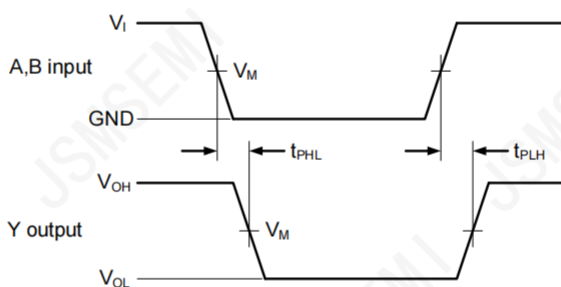


Figure 5. The input A, B to output Y propagation delays

4.3、Measurement Points

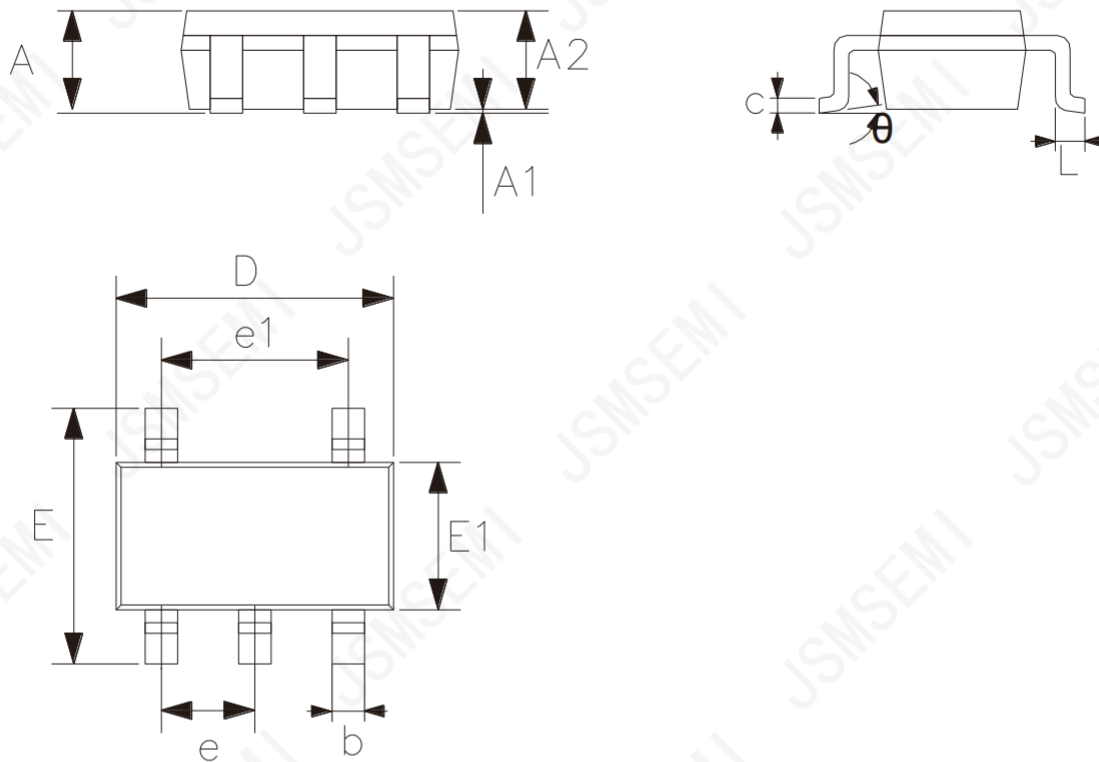
Supply voltage	Input	Output
V_{DD}	V_M	V_M
1.65V to 1.95V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$
2.3V to 2.7V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$
2.7V	1.5V	1.5V
3.0V to 3.6V	1.5V	1.5V
4.5V to 5.5V	$0.5 \times V_{DD}$	$0.5 \times V_{DD}$

4.4、Test Data

Supply voltage	Input		Load		V_{EXT}
V_{DD}	V_I	$t_r = t_f$	C_L	R_L	t_{PLH}, t_{PHL}
1.65V to 1.95V	V_{DD}	$\leq 3ns$	30pF	1k Ω	open
2.3V to 2.7V	V_{DD}	$\leq 3ns$	30pF	500 Ω	open
2.7V	2.7V	$\leq 3ns$	50pF	500 Ω	open
3.0V to 3.6V	2.7V	$\leq 3ns$	50pF	500 Ω	open
4.5V to 5.5V	V_{DD}	$\leq 3ns$	50pF	500 Ω	open

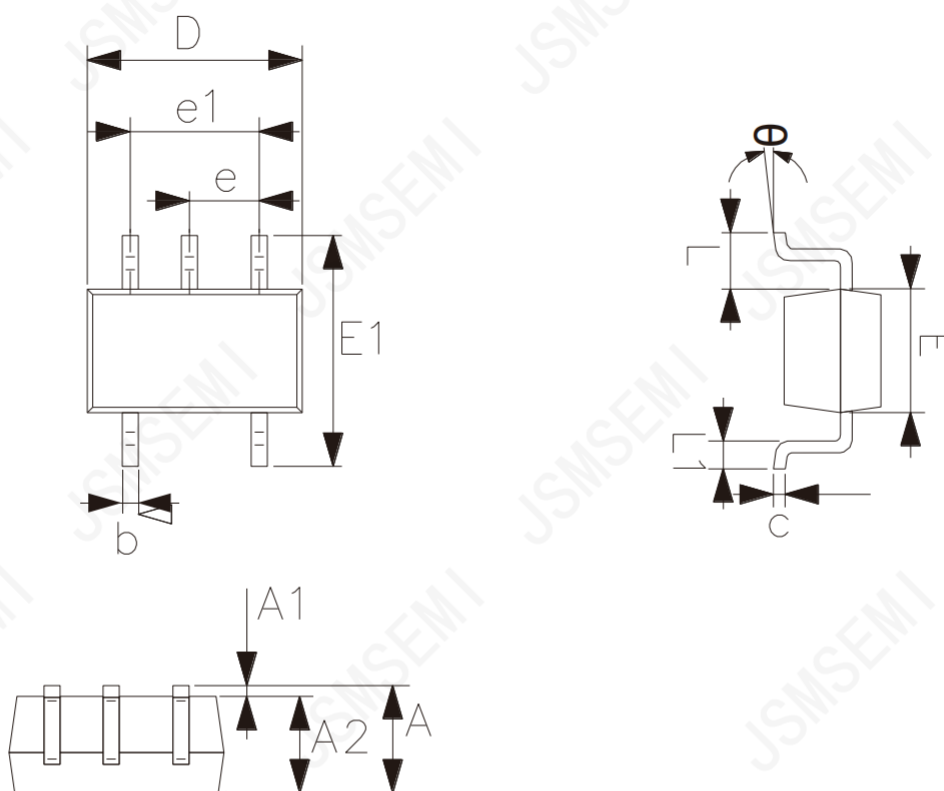
5、Package Information

5.1、SOT23-5



2023/12/A	Dimensions In Millimeters	
Symbol	Min.	Max.
A	—	1.26
A1	0.00	0.12
A2	1.00	1.20
b	0.30	0.50
c	0.10	0.20
D	2.82	3.02
E	2.60	3.00
E1	1.50	1.70
e	0.95	
e1	1.80	2.00
L	0.30	0.60
θ	0°	8°

5.2 SOT353



Symbol	Dimensions (mm)	
	Min.	Max.
A	0.90	1.10
A1	0.00	0.10
A2	0.90	1.00
b	0.15	0.35
c	0.11	0.175
D	2.00	2.20
E	1.15	1.35
E1	2.15	2.45
e	0.65	
e1	1.20	1.40
L	0.525	
L1	0.26	0.46
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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