



钜地半导体
Tudi Semiconductor

Product Specification

TUDI-BA2901F

Ground Sense Comparator

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用芯智造 · 卓越品质

semiconductor device
manufacturer

- Design
- research and development
- production
- and sales



Features

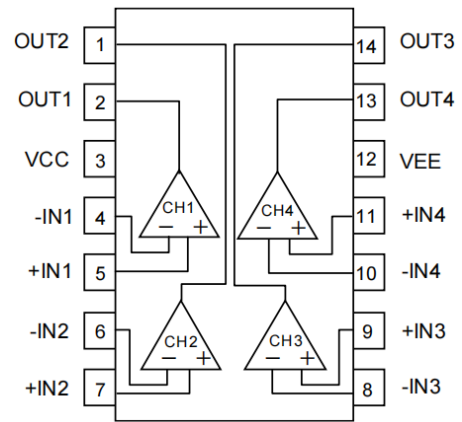
- Operable with a Single Power Supply
- Wide Operating Supply Voltage
- Standard Pin Assignments
- Input and Output are Ground Sense Operated
- Open Collector
- Wide Temperature Range

Application

- General Use
- Current Monitor
- Battery Monitor
- Multi vibrator

General Description

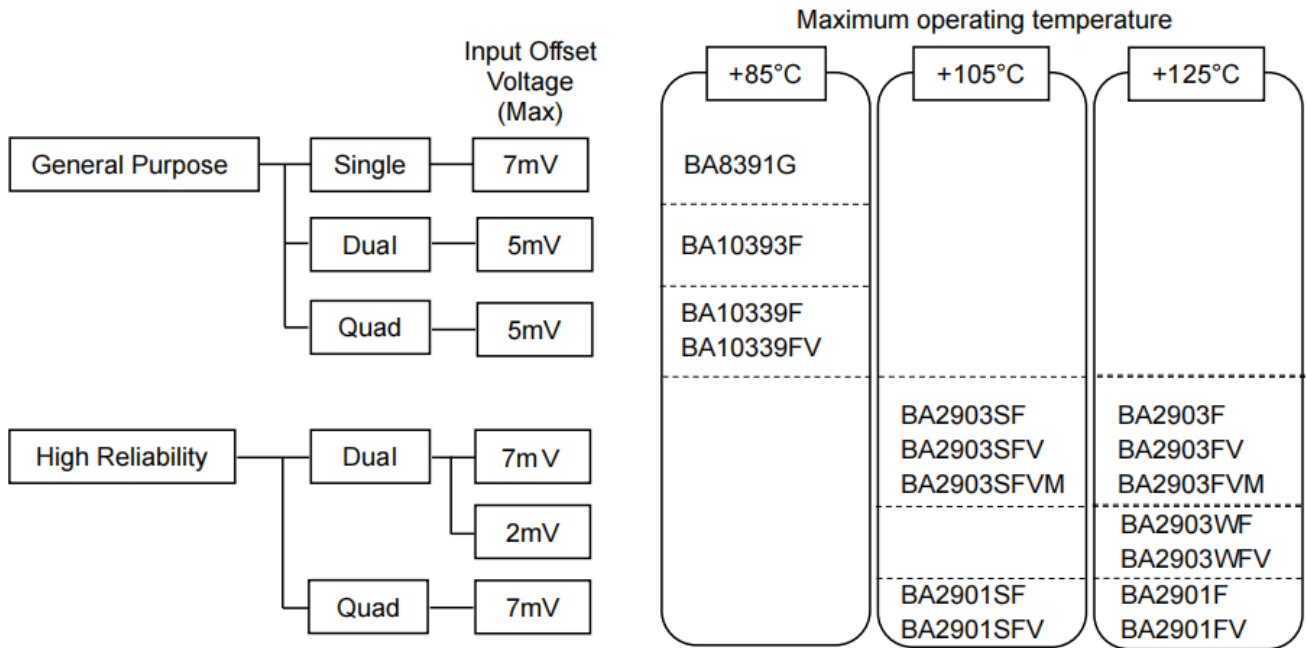
General purpose BA8391G/BA10393F/BA10339xx and high reliability BA2903xxxx/BA2901xxx integrate one, two or four independent high gain voltage comparator. Operating supply voltage range of BA8391G/BA1039 3F/BA2903xxxx/BA2901xxx is wide(2V to 36V). And can be used in a variety of applications because current consumption is small. BA2903Wxx is a low input offset voltage products.(2mV max)



BA2901



Selection Guide



Simplified Schematic

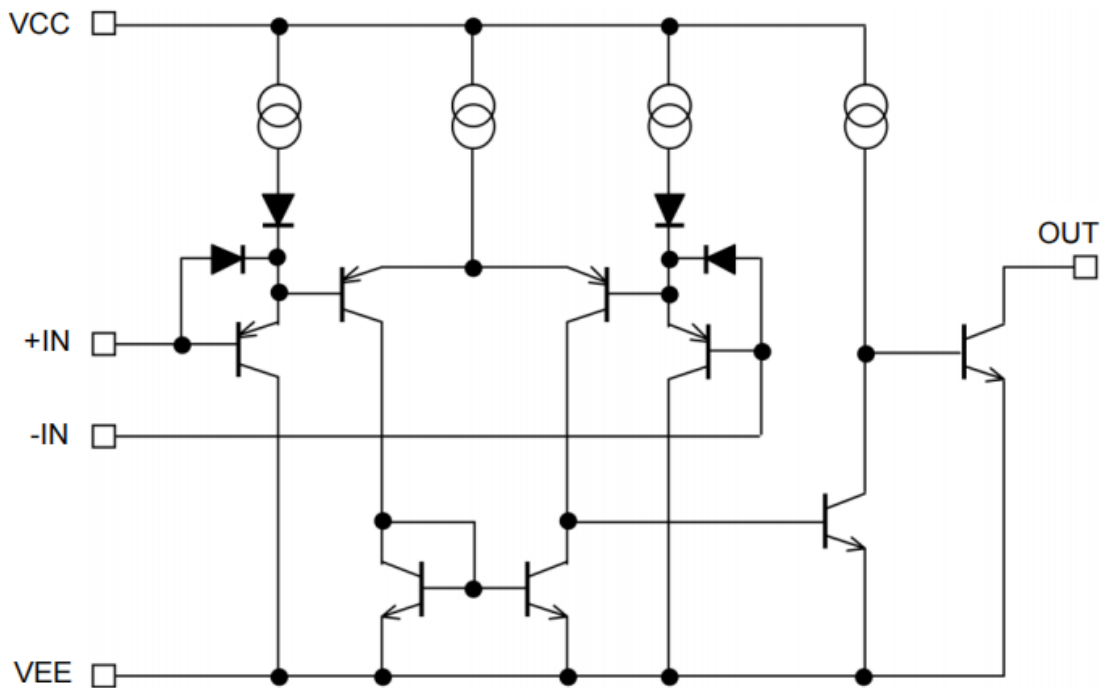


Figure 1. Simplified Schematic (one channel only)



Line-up

Operating Temperature Range	Input Offset Voltage (Max)	Supply Current (Typ)	Package		Orderable Part Number
-40°C to +85°C	7mV	0.3mA	SSOP5	Reel of 3000	BA8391G-TR
	5mV	0.4mA	SOP8	Reel of 2500	BA10393F-E2
		0.8mA	SOP14	Reel of 2500	BA10339F-E2
			SSOP-B14	Reel of 2500	BA10339FV-E2
-40°C to +105°C	7mV	0.6mA	SOP8	Reel of 2500	BA2903SF-E2
			SSOP-B8	Reel of 2500	BA2903SFV-E2
			MSOP8	Reel of 3000	BA2903SFVM-TR
		0.8mA	SOP14	Reel of 2500	BA2901SF-E2
			SSOP-B14	Reel of 2500	BA2901SFV-E2
-40°C to +125°C		0.6mA	SOP8	Reel of 2500	BA2903F-E2
			SSOP-B8	Reel of 2500	BA2903FV-E2
			MSOP8	Reel of 3000	BA2903FVM-TR
	2mV		SOP8	Reel of 2500	BA2903WF-E2
			SSOP-B8	Reel of 2500	BA2903WFV-E2
	7mV	0.8mA	SOP14	Reel of 2500	BA2901F-E2
			SSOP-B14	Reel of 2500	BA2901FV-E2

Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol		Rating	Unit
			BA8391G	
Supply Voltage	VCC-VEE		+36	V
Power Dissipation	P _D	SSOP5	0.67 (Note 1,2)	W
Differential Input Voltage (Note 3)	V _{ID}		+36	V
Input Common-mode Voltage Range	V _{ICM}		(VEE-0.3) to (VEE+36)	V
Input Current (Note 4)	I _I		-10	mA
Operating Supply Voltage	V _{opr}		+2.0 to +36.0 (±1.0 to ±18.0)	V
Operating Temperature Range	T _{opr}		-40 to +85	°C
Storage Temperature Range	T _{stg}		-55 to +150	°C
Maximum Junction Temperature	T _{jmax}		+150	°C

(Note 1) To use at temperature above T_A=25°C reduce 5.4mW.

(Note 2) Mounted on a FR4 glass epoxy PCB(70mm×70mm×1.6mm).

(Note 3) The voltage difference between inverting input and non-inverting input is the differential input voltage.

Then input terminal voltage is set to more than VEE.

(Note 4) Excessive input current will flow if a differential input voltage in excess of approximately 0.6V is applied between the input unless some limiting resistance is used.

Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.



Absolute Maximum Ratings - continued

Parameter	Symbol	Rating		Unit
		BA10393F	BA10339xx	
Supply Voltage	VCC-VEE	+36		V
Power Dissipation	P _D	SOP8	0.62 (Note 5,8)	-
		SOP14	-	0.49 (Note 6,8)
		SSOP-B14	-	0.70 (Note 7,8)
Differential Input Voltage (Note 9)	V _{ID}	(VEE to VCC)		V
Input Common-mode Voltage Range	V _{ICM}	(VEE-0.3) to VCC		V
Input Current (Note 10)	I _I	-10		mA
Operating Supply Voltage	V _{opr}	+2.0 to +36.0 (±1.0 to ±18.0)	+3.0 to +36.0 (±1.5 to ±18.0)	V
Operating Temperature Range	T _{opr}	-40 to +85		°C
Storage Temperature Range	T _{stg}	-55 to +125		°C
Maximum Junction Temperature	T _{jmax}	+125		°C

(Note 5) To use at temperature above T_A=25°C reduce 6.2mW.

(Note 6) To use at temperature above T_A=25°C reduce 4.9mW.

(Note 7) To use at temperature above T_A=25°C reduce 7.0mW.

(Note 8) Mounted on a FR4 glass epoxy PCB(70mm×70mm×1.6mm).

(Note 9) The voltage difference between inverting input and non-inverting input is the differential input voltage.

Then input terminal voltage is set to more than VEE.

(Note 10) Excessive input current will flow if a differential input voltage in excess of approximately 0.6V is applied between the input unless some limiting resistance is used.

Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Parameter	Symbol		Rating				Unit
			BA2903Sxxx	BA2901Sxx	BA2903xxx	BA2901xx	
Supply Voltage	VCC-VEE		+36				V
Power Dissipation	P _D	SOP8	0.77 (Note 11,16)	-	0.77 (Note 11,16)	-	W
		SSOP-B8	0.68 (Note 12,16)	-	0.68 (Note 12,16)	-	
		MSOP8	0.58 (Note 13,16)	-	0.58 (Note 13,16)	-	
		SOP14	-	0.61 (Note 14,16)	-	0.61 (Note 14,16)	
		SSOP-B14	-	0.87 (Note 15,16)	-	0.87 (Note 15,16)	
Differential Input Voltage (Note 17)	V _{ID}		36				V
Input Common-mode Voltage Range	V _{ICM}		(VEE-0.3) to (VEE+36)				V
Input Current (Note 18)	I _I		-10				mA
Operating Supply Voltage	V _{opr}		+2.0 to +36.0 (±1.0 to ±18.0)				V
Operating Temperature Range	T _{opr}		-40 to +105		-40 to +125		°C
Storage Temperature Range	T _{stg}		-55 to +150				°C
Maximum Junction Temperature	T _{jmax}		+150				°C

(Note 11) To use at temperature above T_A=25°C reduce 6.2mW.

(Note 12) To use at temperature above T_A=25°C reduce 5.5mW.

(Note 13) To use at temperature above T_A=25°C reduce 4.7mW.

(Note 14) To use at temperature above T_A=25°C reduce 4.9mW.

(Note 15) To use at temperature above T_A=25°C reduce 7.0mW.

(Note 16) Mounted on a FR4 glass epoxy PCB(70mm×70mm×1.6mm).

(Note 17) The voltage difference between inverting input and non-inverting input is the differential input voltage.

Then input terminal voltage is set to more than VEE.

(Note 18) Excessive input current will flow if a differential input voltage in excess of approximately 0.6V is applied between the input unless some limiting resistance is used.

Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.



Electrical Characteristics

OBA8391G (Unless otherwise specified VCC=+5V, VEE=0V, T_A=25°C)

Parameter	Symbol	Temperature Range	Limit			Unit	Conditions
			Min	Typ	Max		
Input Offset Voltage (Note 19,20)	V _{IO}	25°C	-	2	7	mV	OUT=1.4V
		Full range	-	-	15		VCC=5 to 36V, OUT=1.4V
Input Offset Current (Note 19,20)	I _{IO}	25°C	-	5	50	nA	OUT=1.4V
		Full range	-	-	200		
Input Bias Current (Note 20,21)	I _B	25°C	-	50	250	nA	OUT=1.4V
		Full range	-	-	500		
Input Common-mode Voltage Range	V _{ICM}	25°C	0	-	VCC-1.5	V	-
Large Signal Voltage Gain	A _V	25°C	25	100	-	V/mV	VCC=15V, OUT=1.4 to 11.4V
			88	100	-	dB	R _L =15kΩ, V _{RL} =15V
Supply Current (Note 20)	I _{CC}	25°C	-	0.3	0.7	mA	OUT=Open
		Full range	-	-	1.3		OUT=Open, VCC=36V
Output Sink Current (Note 22)	I _{SINK}	25°C	6	16	-	mA	+IN=0V, -IN=1V OUT=1.5V
Output Saturation Voltage (Note 20) (Low Level Output Voltage)	V _{OL}	25°C	-	150	400	mV	+IN= 0V, -IN=1V
		Full range	-	-	700		I _{SINK} =4mA
Output Leakage Current (Note 20) (High Level Output Current)	I _{LEAK}	25°C	-	0.1	-	nA	+IN=1V, -IN=0V OUT=5V
		Full range	-	-	1	μA	+IN=1V, -IN=0V OUT=36V
Response Time	t _{RE}	25°C	-	1.3	-	μs	R _L =5.1kΩ, V _{RL} =5V IN=100mV _{P-P} , Overdrive=5mV
			-	0.4	-		R _L =5.1kΩ, V _{RL} =5V, IN=TTL Logic Swing, V _{REF} =1.4V

(Note 19) Absolute value

(Note 20) Full range T_A=-40°C to +85°C

(Note 21) Current Direction: Because the first stage is composed with PNP transistor, input bias current flows out of IC.

(Note 22) Please determine the output current value in consideration of the power dissipation of the IC under high temperature environment.

When the output terminal is continuously shorted, output current may be reduced by the temperature rise of the IC.



Electrical Characteristics - continued

OBA10393F (Unless otherwise specified VCC=+5V, VEE=0V, T_A=25°C)

Parameter	Symbol	Temperature Range	Limit			Unit	Conditions
			Min	Typ	Max		
Input Offset Voltage (Note 23)	V _{IO}	25°C	-	1	5	mV	OUT=1.4V
Input Offset Current (Note 23)	I _{IO}	25°C	-	5	50	nA	OUT=1.4V
Input Bias Current (Note 24)	I _B	25°C	-	50	250	nA	OUT=1.4V
Input Common-mode Voltage Range	V _{ICM}	25°C	0	-	VCC-1.5	V	-
Large Signal Voltage Gain	A _v	25°C	50	200	-	V/mV	VCC=15V, OUT=1.4 ~ 11.4V R _L =15kΩ, V _{RL} =15V
			94	106	-	dB	
Supply Current	I _{CC}	25°C	-	0.4	1	mA	R _L =∞, All Comparators
Output Sink Current (Note 25)	I _{SINK}	25°C	6	16	-	mA	-IN=1V, +IN=0V OUT=1.5V
Output Saturation Voltage (Low Level Output Voltage)	V _{OL}	25°C	-	250	400	mV	-IN=1V, +IN=0V I _{SINK} =4mA
Output Leakage Current (High Level Output Current)	I _{LEAK}	25°C	-	0.1	-	nA	-IN=0V, +IN=1V OUT=5V
		25°C	-	-	1	μA	-IN=0V, +IN=1V OUT=36V
Response Time	t _{RE}	25°C	-	1.3	-	μs	R _L =5.1kΩ, V _{RL} =5V IN=100mV _{P-P} , Overdrive=5mV
			-	0.4	-		R _L =5.1kΩ, V _{RL} =5V, IN=TTL Logic Swing, V _{REF} =1.4V

(Note 23) Absolute value

(Note 24) Current Direction: Because the first stage is composed with PNP transistor, input bias current flows out of IC.

(Note 25) Please determine the output current value in consideration of the power dissipation of the IC under high temperature environment.
When the output terminal is continuously shorted, output current may be reduced by the temperature rise of the IC.

OBA10339 xx(Unless otherwise specified VCC=+5V, VEE=0V, T_A=25°C)

Parameter	Symbol	Temperature Range	Limit			Unit	Conditions
			Min	Typ	Max		
Input Offset Voltage (Note 26)	V _{IO}	25°C	-	1	5	mV	OUT=1.4V
Input Offset Current (Note 26)	I _{IO}	25°C	-	5	50	nA	OUT=1.4V
Input Bias Current (Note 27)	I _B	25°C	-	50	250	nA	OUT=1.4V
Input Common-mode Voltage Range	V _{ICM}	25°C	0	-	VCC-1.5	V	-
Large Signal Voltage Gain	A _v	25°C	50	200	-	V/mV	VCC=15V, OUT=1.4 ~ 11.4V R _L =15kΩ, V _{RL} =15V
			94	106	-	dB	
Supply Current	I _{CC}	25°C	-	0.8	2	mA	R _L =∞, All Comparators
Output Sink Current (Note 28)	I _{SINK}	25°C	6	16	-	mA	-IN=1V, +IN=0V OUT=1.5V
Output Saturation Voltage (Low Level Output Voltage)	V _{OL}	25°C	-	250	400	mV	-IN=1V, +IN=0V I _{SINK} =4mA
Output Leakage Current (High Level Output Current)	I _{LEAK}	25°C	-	0.1	-	nA	-IN=0V, +IN=1V OUT=5V
		25°C	-	-	1	μA	-IN=0V, +IN=1V OUT=36V
Response Time	t _{RE}	25°C	-	1.3	-	μs	R _L =5.1kΩ, V _{RL} =5V IN=100mV _{P-P} , Overdrive=5mV
			-	0.4	-		R _L =5.1kΩ, V _{RL} =5V, IN=TTL Logic Swing, V _{REF} =1.4V

(Note 26) Absolute value

(Note 27) Current Direction: Because the first stage is composed with PNP transistor, input bias current flows out of IC.

(Note 28) Please determine the output current value in consideration of the power dissipation of the IC under high temperature environment.
When the output terminal is continuously shorted, output current may be reduced by the temperature rise of the IC.



Electrical Characteristics - continued

OBA2903xxx, BA2903S xxx (Unless otherwise specified VCC=+5V, VEE=0V, T_A=25°C)

Parameter	Symbol	Temperature Range	Limit			Unit	Conditions
			Min	Typ	Max		
Input Offset Voltage (Note 29,30)	V _{IO}	25°C	-	2	7	mV	OUT=1.4V
		Full range	-	-	15		VCC=5 to 36V, OUT=1.4V
Input Offset Current (Note 29,30)	I _{IO}	25°C	-	5	50	nA	OUT=1.4V
		Full range	-	-	200		
Input Bias Current (Note 30,31)	I _B	25°C	-	50	250	nA	OUT=1.4V
		Full range	-	-	500		
Input Common-mode Voltage Range	V _{ICM}	25°C	0	-	VCC -1.5	V	-
Large Signal Voltage Gain	A _V	25°C	25	100	-	V/mV	VCC=15V, OUT=1.4 to 11.4V R _L =15kΩ, V _{RL} =15V
			88	100	-	dB	
Supply Current (Note 30)	I _{CC}	25°C	-	0.6	1	mA	OUT=Open
		Full range	-	-	2.5		OUT=Open, VCC=36V
Output Sink Current (Note 32)	I _{SINK}	25°C	6	16	-	mA	+IN=0V, -IN=1V OUT=1.5V
Output Saturation Voltage (Note 30) (Low Level Output Voltage)	V _{OL}	25°C	-	150	400	mV	+IN=0V, -IN= 1V I _{SINK} =4mA
		Full range	-	-	700		
Output Leakage Current (Note 30) (High Level Output Current)	I _{LEAK}	25°C	-	0.1	-	nA	+IN=1V, -IN=0V OUT=5V
		Full range	-	-	1	μA	+IN=1V, -IN=0V OUT=36V
Response Time	t _{RE}	25°C	-	1.3	-	μs	R _L =5.1kΩ, V _{RL} =5V IN=100mV _{P-P} , Overdrive=5mV
			-	0.4	-		R _L =5.1kΩ, V _{RL} =5V, IN=TTL Logic Swing, V _{REF} =1.4V

(Note 29) Absolute value

(Note 30) BA2903S : Full range -40°C to +105°C, BA2903: Full range -40°C to +125°C

(Note 31) Current Direction: Because the first stage is composed with PNP transistor, input bias current flows out of IC.

(Note 32) Please determine the output current value in consideration of the power dissipation of the IC under high temperature environment.

When the output terminal is continuously shorted, output current may be reduced by the temperature rise of the IC.



Electrical Characteristics - continued

OBA2903Wxx (Unless otherwise specified VCC=+5V, VEE=0V, T_A=25°C)

Parameter	Symbol	Temperature Range	Limit			Unit	Conditions
			Min	Typ	Max		
Input Offset Voltage (Note 33)	V _{IO}	25°C	-	0.5	2	mV	OUT=1.4V
Input Offset Current (Note 33)	I _{IO}	25°C	-	5	50	nA	OUT=1.4V
Input Bias Current (Note 34,35)	I _B	25°C	-	50	250	nA	OUT=1.4V
		Full range	-	-	500		
Input Common-mode Voltage Range	V _{ICM}	25°C	0	-	VCC -1.5	V	-
Large Signal Voltage Gain	A _V	25°C	25	100	-	V/mV	VCC=15V, OUT=1.4 to 11.4V R _L =15kΩ, V _{RL} =15V
			88	100	-	dB	
Supply Current (Note 34)	I _{CC}	25°C	-	0.6	1	mA	OUT=Open
		Full range	-	-	2.5		OUT=Open, VCC=36V
Output Sink Current (Note 36)	I _{SINK}	25°C	6	16	-	mA	+IN=0V, -IN=1V OUT=1.5V
Output Saturation Voltage (Note 34) (Low Level Output Voltage)	V _{OL}	25°C	-	150	400	mV	+IN=0V, -IN= 1V I _{SINK} =4mA
		Full range	-	-	700		
Output Leakage Current (Note 34) (High Level Output Current)	I _{LEAK}	25°C	-	0.1	-	nA	+IN=1V, -IN=0V OUT=5V
		Full range	-	-	1	μA	+IN=1V, -IN=0V OUT=36V
Response Time	t _{RE}	25°C	-	1.3	-	μs	R _L =5.1kΩ, V _{RL} =5V IN=100mV _{P-P} , Overdrive=5mV
			-	0.4	-		R _L =5.1kΩ, V _{RL} =5V, IN=TTL Logic Swing, V _{REF} =1.4V

(Note 33) Absolute value

(Note 34) BA2903W: Full range -40°C to +125°C

(Note 35) Current Direction: Because the first stage is composed with PNP transistor, input bias current flows out of IC.

(Note 36) Please determine the output current value in consideration of the power dissipation of the IC under high temperature environment.
When the output terminal is continuously shorted, output current may be reduced by the temperature rise of the IC.



Electrical Characteristics - continued

OBA2901xx, BA2901S xx (Unless otherwise specified VCC=+5V, VEE=0V, Ta=25°C)

Parameter	Symbol	Temperature Range	Limit			Unit	Conditions
			Min	Typ	Max		
Input Offset Voltage (Note 37,38)	V _{IO}	25°C	-	2	7	mV	OUT=1.4V
		Full range	-	-	15		VCC=5 to 36V, OUT=1.4V
Input Offset Current (Note 37,38)	I _{IO}	25°C	-	5	50	nA	OUT=1.4V
		Full range	-	-	200		
Input Bias Current (Note 38,39)	I _B	25°C	-	50	250	nA	OUT=1.4V
		Full range	-	-	500		
Input Common-mode Voltage Range	V _{ICM}	25°C	0	-	VCC-1.5	V	-
Large Signal Voltage Gain	A _V	25°C	25	100	-	V/mV	VCC=15V, OUT=1.4 to 11.4V R _L =15kΩ, V _{RL} =15V
			88	100	-	dB	
Supply Current (Note 38)	I _{CC}	25°C	-	0.8	2	mA	OUT=Open
		Full range	-	-	2.5		OUT=Open, VCC=36V
Output Sink Current (Note 40)	I _{SINK}	25°C	6	16	-	mA	+IN=0V, V _{IN} =1V OUT=1.5V
Output Saturation Voltage (Note 38) (Low Level Output Voltage)	V _{OL}	25°C	-	150	400	mV	+IN=0V, -IN=1V I _{SINK} =4mA
		Full range	-	-	700		
Output Leakage Current (Note 38) (High Level Output Current)	I _{LEAK}	25°C	-	0.1	-	nA	+IN=1V, -IN=0V OUT=5V
		Full range	-	-	1	μA	+IN=1V, -IN=0V OUT=36V
Response Time	t _{RE}	25°C	-	1.3	-	μs	R _L =5.1kΩ, V _{RL} =5V V _{IN} =100mV _{P-P} , Overdrive=5mV
			-	0.4	-		R _L =5.1kΩ, V _{RL} =5V, V _{IN} =TTL Logic Swing, V _{REF} =1.4V

(Note 37) Absolute value

(Note 38) BA2901S : Full range -40°C to 105°C, BA2901 : Full range -40°C to +125°C

(Note 39) Current Direction : Because the first stage is composed with PNP transistor, input bias current flows out of IC.

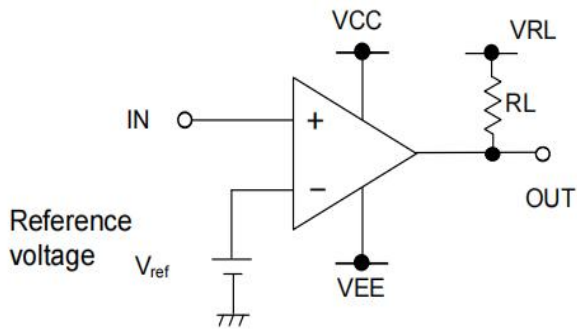
(Note 40) Please determine the output current value in consideration of the power dissipation of the IC under high temperature environment.

When the output terminal is continuously shorted, output current may be reduced by the temperature rise of the IC.

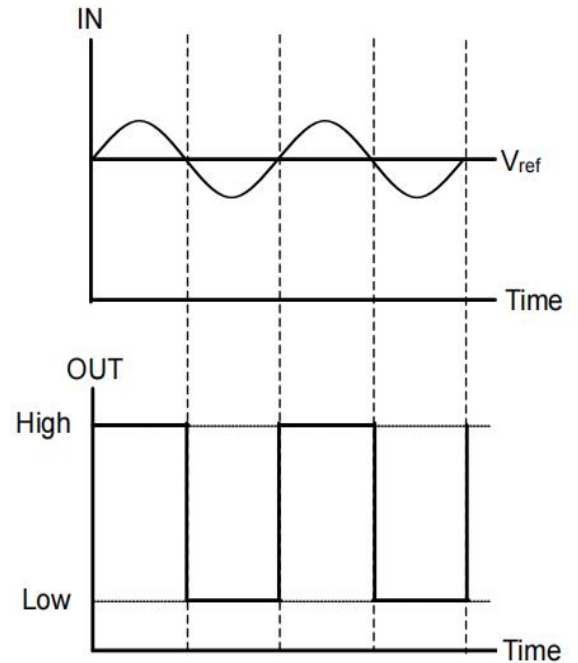


Example of Circuit

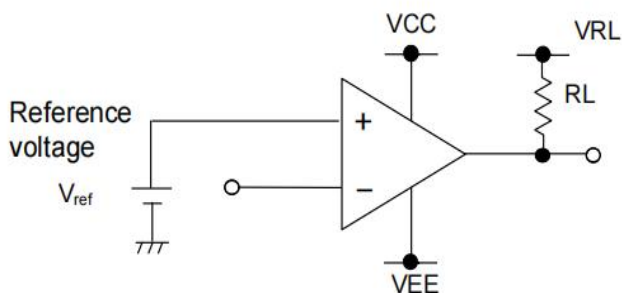
Reference voltage is V_{IN-}



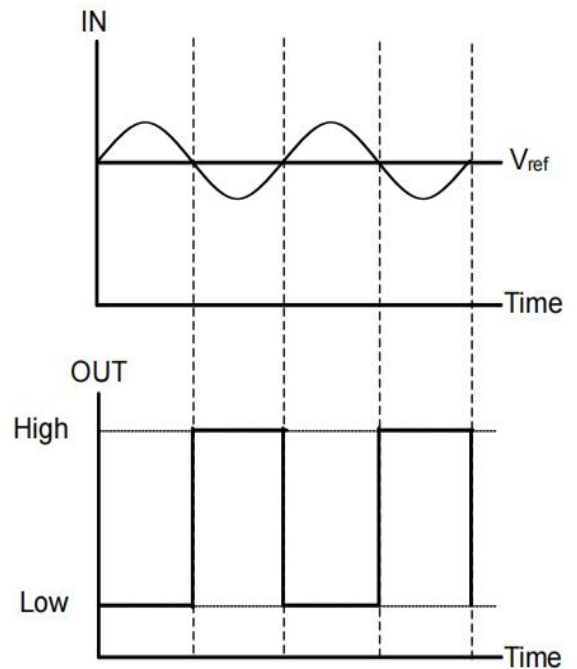
While input voltage is bigger than reference voltage, output voltage is high. While input voltage is smaller than reference voltage, output voltage is low.



Reference voltage is V_{IN+}



While input voltage is smaller than reference voltage, output voltage is high. While input voltage is bigger than reference voltage, output voltage is low.

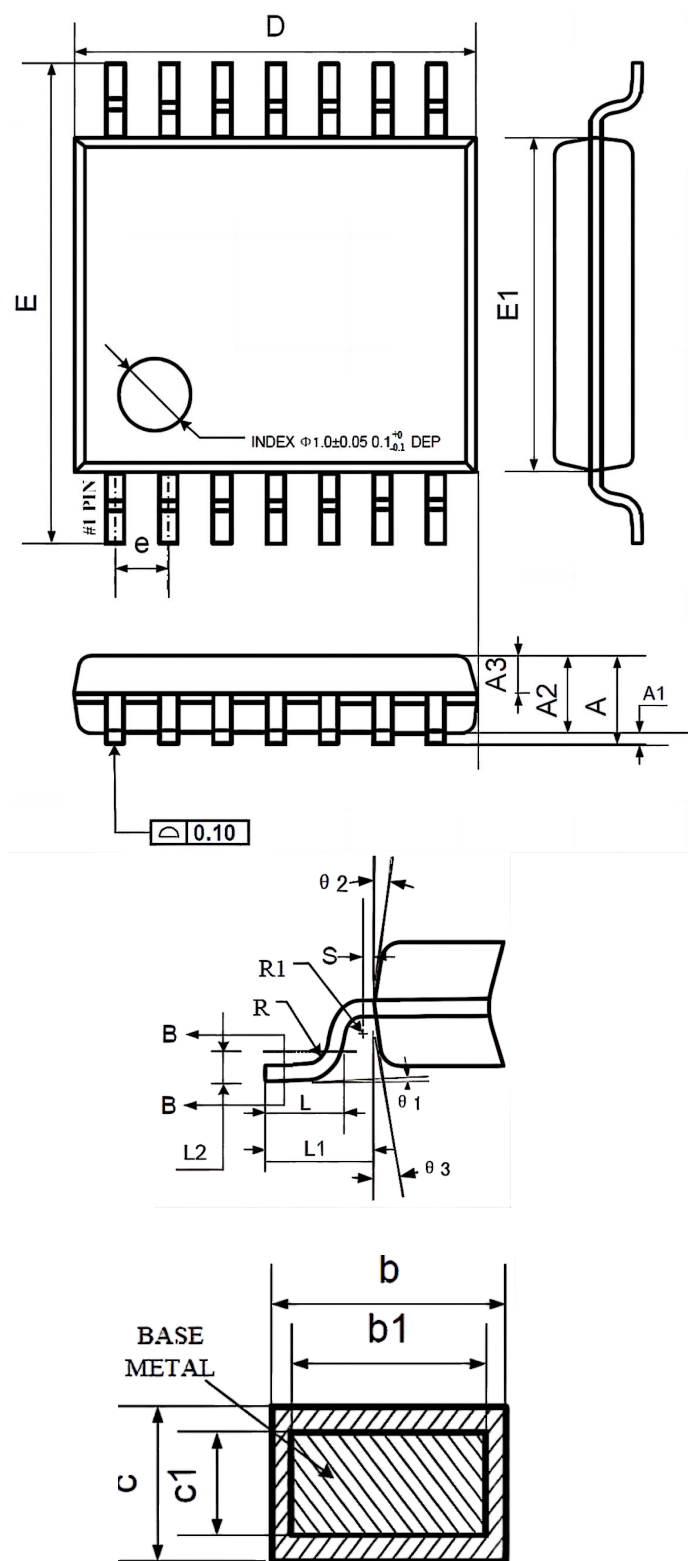




Order information

Order Number	Package	Package Quantity	Marking On The park
BA2901FV-E2-TUDI	TSSOP14	Tape,Reel,2500	BA2901FV-E2

Package TSSOP14



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	—	0.28
b1	0.20	0.22	0.24
C	0.10	—	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	—	—
R1	0.09	—	—
S	0.20	—	—
$\theta 1$	0°	—	8°
$\theta 2$	10°	12°	14°
$\theta 3$	10°	12°	14°



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