

Super-mini package regulator IC

BA000LBSG series

The BA000LBSG (the "000" indicates the output voltage value) is a low-saturation series regulator IC employing the super-mini mold package of the SMP5 (2916 package). Equipped with a power-saving function that reduces current consumption, it also offers outstanding ripple rejection and characteristics, and is ideal for cellular telephones and other.

●Applications

Residential / industrial device power supplies for cellular telephone such as the CDMA and GSM, and for other portable.

●Features

- 1) Internal output transistor ($I_o=150\text{mA}$)
- 2) Internal temperature protection circuit
- 3) Power-saving function enables designs with low current consumption
- 4) High level of ripple rejection (R.R.=66dB)
- 5) SMP5 super-mini package enables space-saving designs
- 6) Low I / O voltage differential (90mV Typ. at $I_o=50\text{mA}$)

●Super-mini regulator lineup

Series	Output voltage (V)								
	2.8	2.9	3.0	3.2	3.3	3.6	3.8	4.0	5.0
BA000LBSG	○	○	○	○	○	○	○	○	○

* "000" indicates the output voltage value. (Example : For 2.8V output, BA028LBSG)

●Absolute maximum ratings ($T_a=25^\circ\text{C}$)

Parameter	Symbol	Limits	Unit
Applied voltage	V_{cc}	9	V
Power dissipation	P_d	170*	mW
Operating temperature	T_{opr}	$-40\sim+85$	$^\circ\text{C}$
Storage temperature	T_{stg}	$-55\sim+125$	$^\circ\text{C}$

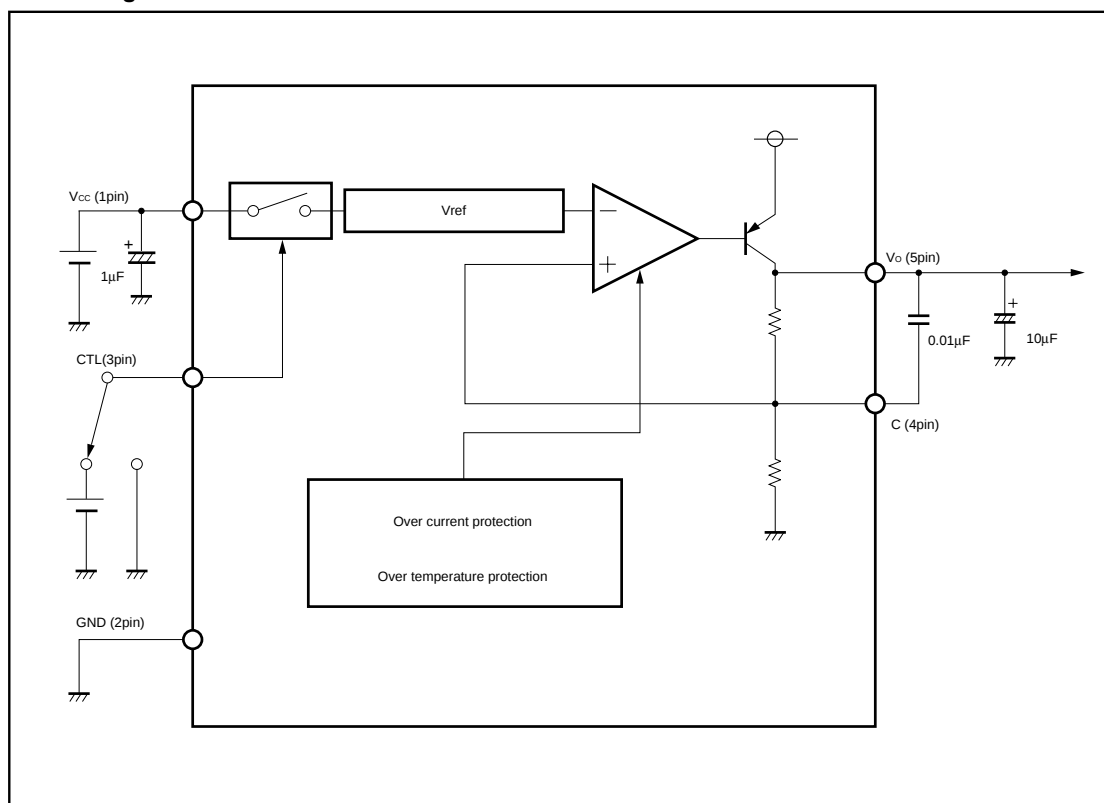
* Reduced by 1.7mW for each increase in T_a of 1°C over 25°C

●Recommended operating conditions ($T_a=25^\circ\text{C}$)

Parameter	Symbol	Limits	Unit
Operating power supply voltage	V_{cc} (input)	2.5~7.0	V

Regulator IC

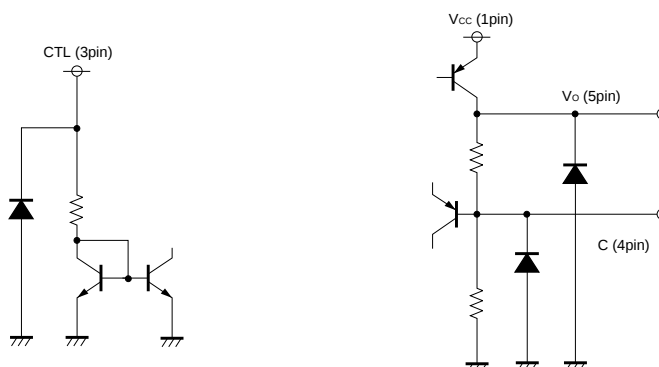
●Block diagram



●Pin descriptions

Pin No.	Pin name	Function
1	Vcc	Power supply
2	GND	Ground
3	CTL	Power-save function
4	C	Ripple improvement
5	OUT	Output

●Input / output circuits



Regulator IC

●Electrical characteristics

BA028LBSG (unless otherwise noted, Ta=25°C, Vcc=3.8V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	2.73	2.80	2.87	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	I _o =10mA, V _{cc} =3.8~7V* ¹
Output noise voltage	e _n	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	50	58	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta=Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

A capacitor (0.01μF) is used between pin 4 and pin 5, to improve ripple rejection.

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BA029LBSG (unless otherwise noted, Ta=25°C, Vcc=3.9V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	2.828	2.90	2.973	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	V _{cc} =3.9~7V
Output noise voltage	e _n	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	45	58	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta=Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

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Regulator IC

BA030LBSG (unless otherwise noted, Ta=25°C, Vcc=4.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	2.925	3.00	3.075	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	I _o =10mA, V _{cc} =4.0~7V* ¹
Output noise voltage	en	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	50	58	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta≒Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

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A capacitor (0.01μF) is used between pin 4 and pin 5, to improve ripple rejection.

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BA032LBSG (unless otherwise noted, Ta=25°C, Vcc=4.2V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	3.12	3.20	3.28	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	I _o =10mA, V _{cc} =4.2~7V* ¹
Output noise voltage	en	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	50	58	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta≒Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

A capacitor (0.01μF) is used between pin 4 and pin 5, to improve ripple rejection.

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Regulator IC

BA033LBSG (unless otherwise noted, Ta=25°C, Vcc=4.3V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	3.218	3.30	3.382	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	V _{cc} =4.3~7V
Output noise voltage	en	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	45	58	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta≒Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

A capacitor (0.01μF) is used between pin 4 and pin 5, to improve ripple rejection.

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BA036LBSG (unless otherwise noted, Ta=25°C, Vcc=4.6V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	3.51	3.60	3.69	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	V _{cc} =4.6~7V
Output noise voltage	en	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	45	56	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta≒Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

A capacitor (0.01μF) is used between pin 4 and pin 5, to improve ripple rejection.

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Regulator IC

BA038LBSG (unless otherwise noted, Ta=25°C, Vcc=4.8V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	3.705	3.80	3.895	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	I _o =10mA, V _{cc} =4.8~7V* ¹
Output noise voltage	en	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	50	56	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta≒Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

A capacitor (0.01μF) is used between pin 4 and pin 5, to improve ripple rejection.

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BA040LBSG (unless otherwise noted, Ta=25°C, Vcc=5.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I _{ccs}	–	0	10	μA	V _{ctl} =0V
Circuit current	I _{cca}	–	65	150	μA	V _{ctl} =3V, no output load
<Output block>						
Output voltage	V _o	3.90	4.00	4.10	V	I _o =50mA* ¹
Dropout voltage	ΔV _d	–	90	150	mV	I _o =50mA, V _{cc} =0.95V _o
Output current capability	I _o	150	280	–	mA	–
Load regulation	Reg.L	–	40	80	mV	I _o =1~50mA* ¹
Input regulation	Reg.I	–	3	30	mV	V _{cc} =5.0~7V
Output noise voltage	en	–	56	–	μV	I _o =10mA, C=0.01μF* ²
Ripple rejection 1	R.R1	45	56	–	dB	I _o =10mA, f=400Hz
Ripple rejection 2	R.R2	–	66	–	dB	I _o =10mA, f=400Hz, C=0.01μF* ²
<Power-save block>						
CTL OFF voltage	V _{off}	–	–	0.6	V	–
CTL ON voltage	V _{on}	2.4	–	–	V	–
CTL inflow current	I _{ctl}	–	6.0	15	μA	V _{ctl} =3V

* In order to measure at Ta≒Tj (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

A capacitor (0.01μF) is used between pin 4 and pin 5, to improve ripple rejection.

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Regulator IC

BA050LBSG (unless otherwise noted, $T_a=25^{\circ}\text{C}$, $V_{CC}=6.0\text{V}$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I_{CCS}	-	0	10	μA	$V_{CTL}=0\text{V}$
Circuit current	I_{CCA}	-	65	150	μA	$V_{CTL}=3\text{V}$, no output load
<Output block>						
Output voltage	V_O	4.875	5.00	5.125	V	$I_O=50\text{mA}^{*1}$
Dropout voltage	ΔV_d	-	90	150	mV	$I_O=50\text{mA}$, $V_{CC}=0.95V_O$
Output current capability	I_O	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	$I_O=1\sim 50\text{mA}^{*1}$
Input regulation	Reg.I	-	3	30	mV	$V_{CC}=6.0\sim 7\text{V}$
Output noise voltage	e_n	-	56	-	μV	$I_O=10\text{mA}$, $C=0.01\mu\text{F}^{*2}$
Ripple rejection 1	R.R1	45	54	-	dB	$I_O=10\text{mA}$, $f=400\text{Hz}$
Ripple rejection 2	R.R2	-	66	-	dB	$I_O=10\text{mA}$, $f=400\text{Hz}$, $C=0.01\mu\text{F}^{*2}$
<Power-save block>						
CTL OFF voltage	V_{OFF}	-	-	0.6	V	-
CTL ON voltage	V_{ON}	2.4	-	-	V	-
CTL inflow current	I_{CTL}	-	6.0	15	μA	$V_{CTL}=3\text{V}$

* In order to measure at $T_a \approx T_j$ (pulse measurement), fluctuations in output resulting from temperature fluctuations are not included.

* Design guaranteed. (Not all products have been inspected.)

A capacitor (0.01 μF) is used between pin 4 and pin 5, to improve ripple rejection.

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●Application example

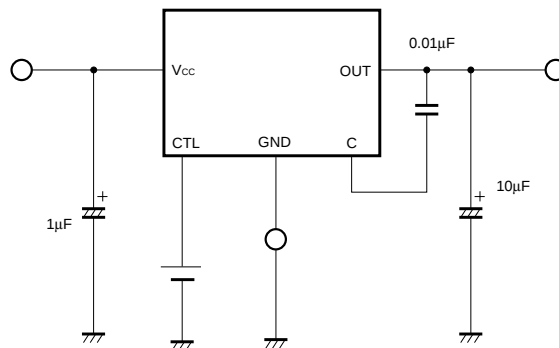


Fig.1

Figure 10 is a graph showing the relationship between Load Current (I_O) and Ground Pin Current (I_{OA}). The x-axis represents Load Current (I_O) in mA, ranging from 0 to 150. The y-axis represents Ground Pin Current (I_{OA}) in μA , ranging from 0 to 1500. The graph is titled $V_{CC}=4V$ and $V_{CL}=3V$. The data points show a linear relationship, starting at approximately (0, 100) and ending at (150, 1050).

Figure 10 is a graph showing the typical transfer characteristics of the 74VHC00. The y-axis represents Current: I_{CCA} (μA) ranging from 0 to 300. The x-axis represents Supply Voltage: V_{CC} (V) ranging from 0 to 7. The curve shows a sharp increase in current starting around 1.5V, peaking at approximately 210 μA at 2.2V, and then dropping to a steady-state value of about 65 μA for voltages above 3.5V. Test conditions: $V_{TTL}=3V$, $I_O=0mA$, $T_A=25^\circ C$.

Figure 10 is a graph showing the Load Regulation of the device. The Y-axis represents the Output Voltage (V_O) in Volts, ranging from 0 to 4. The X-axis represents the Load Current (I_O) in milliamperes (mA), ranging from 0 to 500. The graph shows a constant output voltage of 3.0V for load currents up to approximately 250mA, after which the voltage drops sharply to 0V at 300mA. The supply voltage V_{CC} is 4.0V and the control voltage V_{ctl} is 3.0V.

Output Current I_o (mA)	Dropout Voltage ΔV_d (mV)
0	0
10	30
20	50
40	75
60	100
80	125
100	150
120	175
140	200
150	210

Technical drawing of the SMP5 component, showing three views: front, side, and top. Dimensions are provided in millimeters with tolerances.

Front View Dimensions:

- Overall width: 22 ± 0.3
- Overall height: 12 ± 0.2
- Central slot width: 29 ± 0.2
- Side slot width: 0.8
- Side slot depth: 0.5
- Central slot depth: 0.4 ± 0.1

Side View Dimensions:

- Overall height: 0.1 ± 0.1
- Overall width: 0.1 ± 0.05

Top View Dimensions:

- Overall width: 11 ± 0.2
- Overall height: 0.05

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