

# 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	Vcc	9	V
Power dissipation	Pd	170*	mW
Operating temperature	Topr	-40~+85	°C
Storage temperature	Tstg	-55~+125	°C

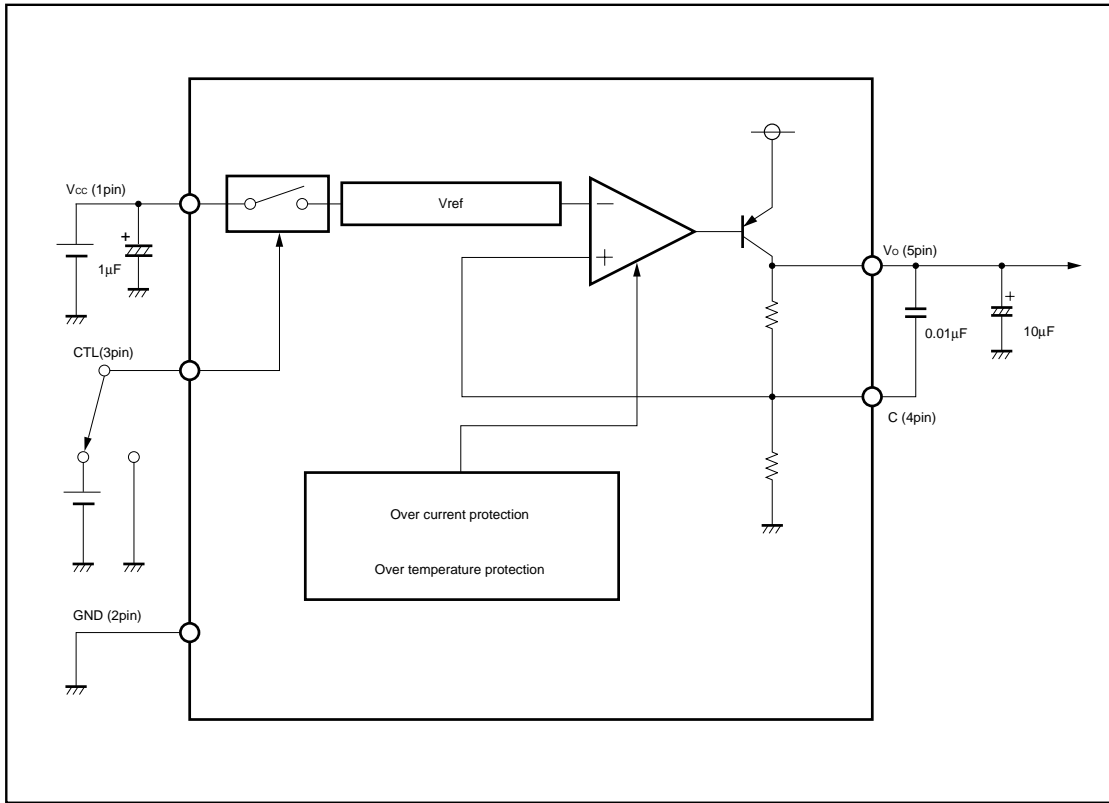
\* Reduced by 1.7mW for each increase in  $T_a$  of 1°C over 25°C

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

Parameter	Symbol	Limits	Unit
Operating power supply voltage	Vcc (input)	2.5~7.0	V

Regulator IC

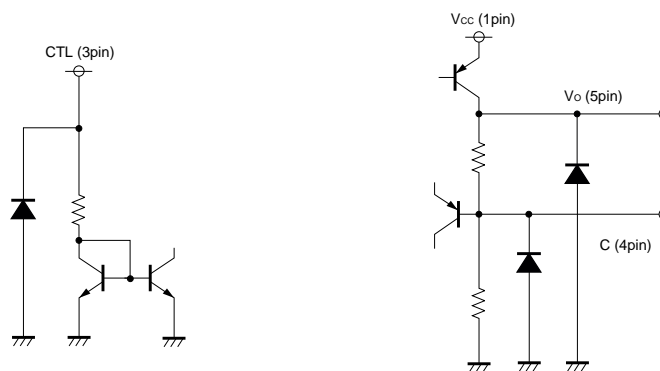
●Block diagram



●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 <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	2.73	2.80	2.87	V	I <sub>o</sub> =50mA* <sup>1</sup>
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA* <sup>1</sup>
Input regulation	Reg.I	-	3	30	mV	I <sub>o</sub> =10mA, V <sub>cc</sub> =3.8~7V* <sup>1</sup>
Output noise voltage	e <sub>n</sub>	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF* <sup>2</sup>
Ripple rejection 1	R.R1	50	58	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF* <sup>2</sup>
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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 <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	2.828	2.90	2.973	V	I <sub>o</sub> =50mA* <sup>1</sup>
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA* <sup>1</sup>
Input regulation	Reg.I	-	3	30	mV	V <sub>cc</sub> =3.9~7V
Output noise voltage	e <sub>n</sub>	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF* <sup>2</sup>
Ripple rejection 1	R.R1	45	58	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF* <sup>2</sup>
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	2.925	3.00	3.075	V	I <sub>o</sub> =50mA* <sup>1</sup>
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA* <sup>1</sup>
Input regulation	Reg.I	-	3	30	mV	I <sub>o</sub> =10mA, V <sub>cc</sub> =4.0~7V* <sup>1</sup>
Output noise voltage	en	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF* <sup>2</sup>
Ripple rejection 1	R.R1	50	58	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF* <sup>2</sup>
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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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BA032LBSG (unless otherwise noted, Ta=25°C, Vcc=4.2V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	3.12	3.20	3.28	V	I <sub>o</sub> =50mA* <sup>1</sup>
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA* <sup>1</sup>
Input regulation	Reg.I	-	3	30	mV	I <sub>o</sub> =10mA, V <sub>cc</sub> =4.2~7V* <sup>1</sup>
Output noise voltage	en	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF* <sup>2</sup>
Ripple rejection 1	R.R1	50	58	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF* <sup>2</sup>
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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 <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	3.218	3.30	3.382	V	I <sub>o</sub> =50mA*1
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA*1
Input regulation	Reg.I	-	3	30	mV	V <sub>cc</sub> =4.3~7V
Output noise voltage	en	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF*2
Ripple rejection 1	R.R1	45	58	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF*2
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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 <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	3.51	3.60	3.69	V	I <sub>o</sub> =50mA*1
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA*1
Input regulation	Reg.I	-	3	30	mV	V <sub>cc</sub> =4.6~7V
Output noise voltage	en	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF*2
Ripple rejection 1	R.R1	45	56	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF*2
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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 <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	3.705	3.80	3.895	V	I <sub>o</sub> =50mA* <sup>1</sup>
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA* <sup>1</sup>
Input regulation	Reg.I	-	3	30	mV	I <sub>o</sub> =10mA, V <sub>cc</sub> =4.8~7V* <sup>1</sup>
Output noise voltage	en	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF* <sup>2</sup>
Ripple rejection 1	R.R1	50	56	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF* <sup>2</sup>
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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 <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	3.90	4.00	4.10	V	I <sub>o</sub> =50mA* <sup>1</sup>
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA* <sup>1</sup>
Input regulation	Reg.I	-	3	30	mV	V <sub>cc</sub> =5.0~7V
Output noise voltage	en	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF* <sup>2</sup>
Ripple rejection 1	R.R1	45	56	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF* <sup>2</sup>
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =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, Ta=25°C, Vcc=6.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Coniditions
Standby current	I <sub>ccs</sub>	-	0	10	μA	V <sub>ctl</sub> =0V
Circuit current	I <sub>cca</sub>	-	65	150	μA	V <sub>ctl</sub> =3V, no output load
<Output block>						
Output voltage	V <sub>o</sub>	4.875	5.00	5.125	V	I <sub>o</sub> =50mA*1
Dropout voltage	ΔV <sub>d</sub>	-	90	150	mV	I <sub>o</sub> =50mA, V <sub>cc</sub> =0.95V <sub>o</sub>
Output current capability	I <sub>o</sub>	150	280	-	mA	-
Load regulation	Reg.L	-	40	80	mV	I <sub>o</sub> =1~50mA*1
Input regulation	Reg.I	-	3	30	mV	V <sub>cc</sub> =6.0~7V
Output noise voltage	e <sub>n</sub>	-	56	-	μV	I <sub>o</sub> =10mA, C=0.01μF*2
Ripple rejection 1	R.R1	45	54	-	dB	I <sub>o</sub> =10mA, f=400Hz
Ripple rejection 2	R.R2	-	66	-	dB	I <sub>o</sub> =10mA, f=400Hz, C=0.01μF*2
<Power-save block>						
CTL OFF voltage	V <sub>off</sub>	-	-	0.6	V	-
CTL ON voltage	V <sub>on</sub>	2.4	-	-	V	-
CTL inflow current	I <sub>ctl</sub>	-	6.0	15	μA	V <sub>ctl</sub> =3V

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

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●Application example

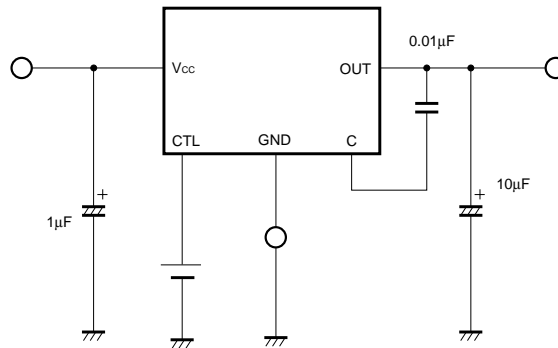
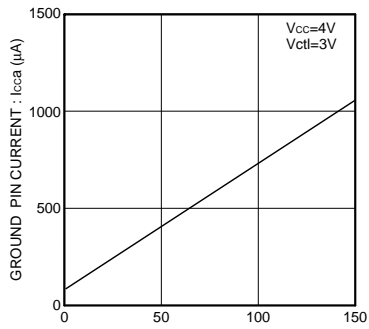


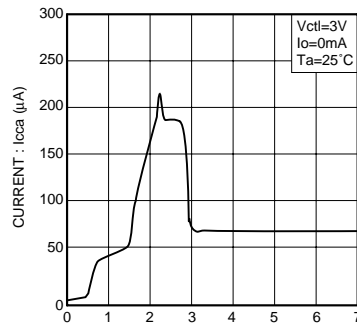
Fig.1

Regulator IC

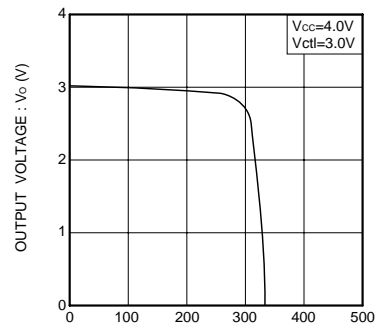
●Electrical characteristic curves (BA030LBSG)



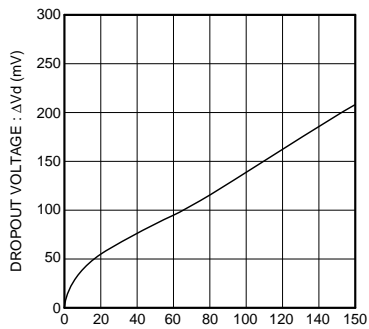
LOAD CURRENT :  $I_O$  (mA)  
Fig.2  $I_{CC}$  vs.  $I_O$



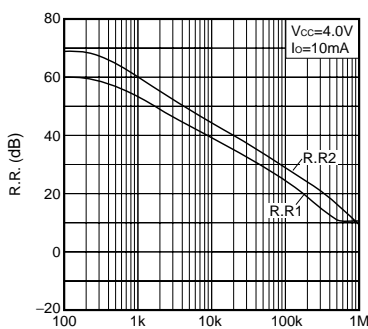
SUPPLY VOLTAGE :  $V_{CC}$  (V)  
Fig.3  $I_{CC}$  vs.  $V_{CC}$



LOAD CURRENT :  $I_O$  (mA)  
Fig.4  $I_O$  vs.  $V_O$

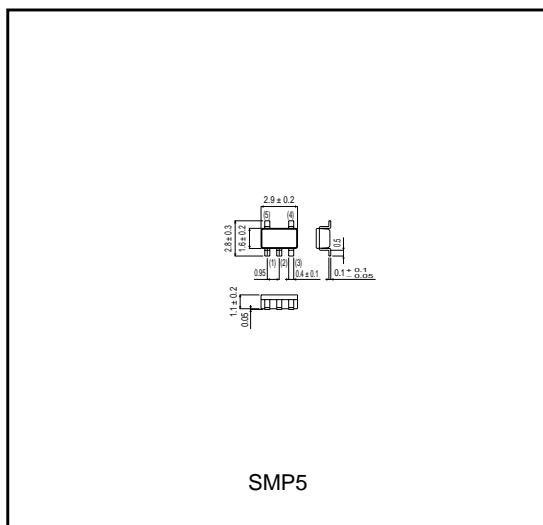


OUTPUT CURRENT :  $I_O$  (mA)  
Fig.5  $\Delta V_d$  vs.  $I_O$



FREQUENCY : f (Hz)  
Fig.6 R.R. vs. f characteristics

●External dimensions (Units : mm)





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