ROHM SEMICONDUCTOR

Datasheet

Dual-Output (Fixed/Variable) LDO Regulators

BA3259HFP BA30E00WHFP

●General Description

The BA3259HFP and BA30E00WHFP are 2-output, low-saturation regulators. These units have both a 3.3 V fixed output as well as a variable output with a voltage accuracy of ±2%, and incorporate an overcurrent protection circuit to prevent IC destruction due to output shorting along with a TSD (Thermal Shut Down) circuit to protect the IC from thermal destruction caused by overloading.

●Features

- Output voltage accuracy: ± 2%.
- Reference voltage accuracy: ± 2%
- Ceramic capacitor can be used to prevent output oscillation (BA3259HFP)
- Low dissipation with two voltage input supported (BA30E00WHFP)
- Built-in thermal shutdown circuit
- Built-in overcurrent protection circuit

●Packages

	W (Typ.) x D (Typ.) x H (Max.)
HRP5	9.395mm x 10.54mm x 2.005mm
HRP7	9.395mm x 10.54mm x 2.005mm

HRP5 HRP7

●Key Specifications

- Input Power Supply Voltage:
  - BA3259HFP 14.0V(Max.)
  - BA30E00WHFP 16.0V(Max.)
- Output Voltage type: V_O1 Fixed
  - V_O2 Variable
- Output Current:
  - BA3259HFP 1A (MAX)
  - BA30E00WHFP 0.6A (MAX)
- Operating temperature range:
  - BA3259HFP 0 to 85℃
  - BA30E00WHFP −25 to 105℃

●Applications

Available to all commercial devices, such as FPD, TV, and PC sets besides DSP power supplies for DVD and CD sets.

●Ordering Information

B A 3 x x x H F P - TR

Part Number

Package
HFP:HRP5
HRP7

Packaging and forming specification
TR: Embossed tape and reel

●Lineup

Maximum Output Current (Max.)	Output Voltage 1 (Typ.)	Output Voltage 2 (Typ.)	Package		Orderable Part Number
1.0A	3.3V	0.8 to 3.3V	HRP5	Reel of 2000	BA3259HFP-TR
0.6A	3.3V	0.8 to 3.3V	HRP7	Reel of 2000	BA30E00WHFP-TR

○Product structure：Silicon monolithic integrated circuit ○This product is not designed protection against radioactive rays.

●Block Diagrams / Standard Example Application Circuits / Pin Configurations / Pin Descriptions

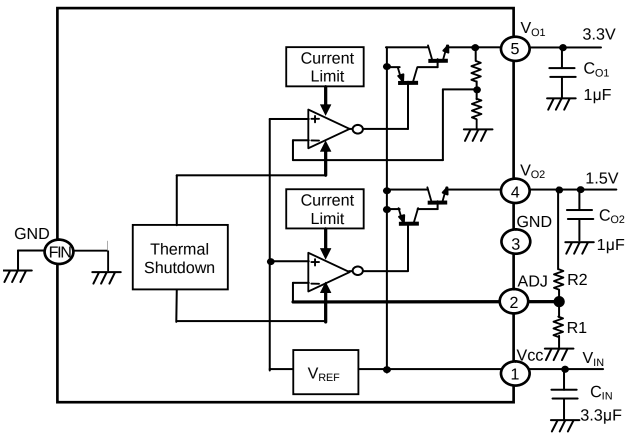


Fig.1 BA3259HFP Block Diagram

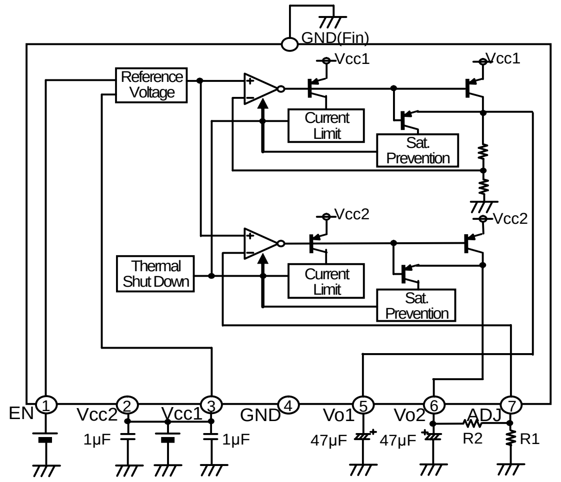


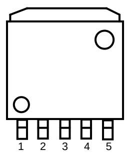
Fig.2 BA30E00WHFP Block Diagram

Pin No.	Pin name	Function
1	V_{CC}	Power supply pin
2	ADJ	Variable output voltage detection pin
3	GND	GND pin
4	Vo2	Variable output pin
5	Vo1	3.3 V output pin
FIN	GND	GND pin

Pin No.	Pin name	Function
1	EN	Output on/off control pin: High active
2	Vcc2	Power supply pin 2
3	Vcc1	Power supply pin 1
4	GND	GND pin
5	Vo1	Power supply pin for 3.3 V output
6	Vo2	Variable output voltage detection pin (0.8 V to 3.3 V)
7	ADJ	Variable output voltage detection pin
FIN	GND	GND pin

PIN	External capacitor setting range
Vcc (1Pin)	Approximately 3.3μF
Vo1 (5Pin)	1 μF to 1000 μF
Vo2 (4Pin)	1 μF to 1000 μF

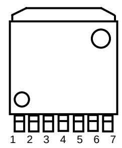
TOP VIEW



HRP5

PIN	External capacitor setting range
Vcc1 (3Pin)	Approximately 1 μF
Vcc2 (2Pin)	Approximately 1 μF
Vo1 (5Pin)	47 μF to 1000 μF
Vo2 (6Pin)	47 μF to 1000 μF

TOP VIEW



HRP7

●Absolute Maximum Ratings

BA3259HFP

Parameter	Symbol	Ratings	Units
Applied voltage	Vcc	15 *1	V
Power dissipation	Pd	2300 *2	mW
Operating temperature range	Topr	0 to 85	℃
Ambient storage temperature range	Tstg	−55 to 150	℃
Maximum junction temperature	Tjmax	150	℃

BA30E00WHFP

Parameter	Symbol	Ratings	Units
Applied voltage	Vcc	18 *1	V
Power dissipation	Pd	2300 *2	mW
Operating temperature range	Topr	−25 to 105	℃
Ambient storage temperature range	Tstg	−55 to 150	℃
Maximum junction temperature	Tjmax	150	℃

*1 Must not exceed Pd.
*2 Derated at 18.4 mW/℃ at Ta>25℃ when mounted on a glass epoxy board (70 mm × 70 mm × 1.6 mm).

●Recommended Operating Ratings

BA3259HFP

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
Input power supply voltage	Vcc	4.75	−	14.0	V
3.3 V output current	Io1	−	−	1	A
Variable output current	Io2	−	−	1	A

BA30E00WHFP

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
Input power supply voltage 1	Vcc1	4.1	−	16.0	V
Input power supply voltage 2	Vcc2	2.8	−	Vcc 1	V
3.3 V output current	Io1	−	−	0.6	A
Variable output current	Io2	−	−	0.6	A

●Electrical Characteristics

○BA3259HFP (Unless otherwise specified, Ta=25℃, Vcc=5 V, R1=R2=5 kΩ)

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Circuit current	I_B	−	3	5	mA	Io1=0mA, Io2=0mA
[3.3 V Output Block]						
Output voltage 1	Vo1	3.234	3.300	3.366	V	Io1=50mA
Minimum I/O voltage difference 1	ΔVd1	−	1.1	1.3	V	Io1=1 A, Vcc=3.8V
Current capability 1	Io1	1.0	−	−	A	
Ripple rejection 1	R.R.1	46	52	−	dB	f=120Hz, ein=0.5Vp-p, Io1=5mA
Input stability 1	ΔVLINE1	−	5	15	mV	Vcc=4.75→14V, Io1=5mA
Load stability 1	ΔVLOAD1	−	5	20	mV	Io1=5mA→1 A
Temperature coefficient of output voltage 1 *3	Tcvo1	−	±0.01	−	%/℃	Io1=5mA, Tj=0℃ to 85℃
[Variable output]						
Reference voltage	VREF	0.784	0.800	0.816	V	Io2=50mA
Minimum I/O voltage difference 2	ΔVd2	−	1.1	1.3	V	Io2=1 A
Current capability 2	Io2	1.0	−	−	A	
Ripple rejection 2	R.R.2	46	52	−	dB	f=120Hz, ein=0.5Vp-p, Io2=5mA
Input stability 2	ΔVLINE2	−	5	15	mV	Vcc=4.75→14V, Io2=5mA
Load stability 2	ΔVLOAD2	−	5	20	mV	Io2=5mA→1 A
Temperature coefficient of output voltage 2 *3	Tcvo2	−	±0.01	−	%/℃	Io2=5mA, Tj=0℃ to 85℃
Variable pin current	IADJ	−	0.05	1.0	μA	VADJ=0.85V

*3 Not 100% tested

●Electrical Characteristics - continued

○BA30E00WHFP (Unless otherwise specified, Ta=25℃, Vcc1=Vcc2=V_{EN}=5 V, R1=50kΩ, R2=62.5kΩ)

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Bias current	Ib	−	0.7	1.6	mA	Io1=0mA, Io2=0mA
Standby current	I_{ST}	−	0	10	µA	V_{EN}=GND
EN pin on voltage	V_{ON}	2.0	−	−	V	Active mode
EN pin off voltage	V_{OFF}	−	−	0.8	V	Standby mode
EN pin current	I_{EN}	−	50	100	µA	V_{EN}=3.3V
[3.3 V output]						
Output voltage 1	Vo1	3.234	3.300	3.366	V	Io1=50mA
Minimum I/O voltage difference 1	ΔVd1	−	0.30	0.60	V	Io1=300mA, Vcc=3.135V
Output current capacity 1	Io1	0.6	−	−	A	
Ripple rejection 1	R.R.1	−	68	−	dB	f=120Hz, ein=1Vp-p, Io1=100mA
Input stability 1	Reg.I1	−	5	30	mV	Vcc1=4.1→16V, Io1=50mA
Load stability 1-1	Reg.L1-1	−	30	90	mV	Io1=0mA→0.6A
Load stability 1-2	Reg.L1-2	−	30	90	mV	Vcc1=3.7V, Io1=0→0.4A
Temperature coefficient of output voltage 1 *3	Tcvo1	−	±0.01	−	%/℃	Io1=5mA, Tj=0℃ to 125℃
[Variable output] (at 1.8 V)						
Reference voltage	V_{ADJ}	0.784	0.800	0.816	V	Io2=50mA
Minimum I/O voltage difference 2	ΔVd2	−	0.30	0.60	V	At Io2=3.3V Io2=300mA, Vcc1=Vcc2=3.135V
Output current capacity 2	Io2	0.6	−	−	A	
Ripple rejection 2	R.R.2	−	66	−	dB	f=120Hz, ein=1Vp-p, Io2=100mA
Input stability 2	Reg.I2	−	5	30	mV	Vcc1=Vcc2=4.1V→16V, Io2=50mA
Load stability 2	Reg.L2	−	30	90	mV	Io2=0mA→0.6A
Temperature coefficient of output voltage 2 *3	Tcvo2	−	±0.01	−	%/℃	Io2=5mA, Tj=0℃ to 125℃

*3　Not 100% tested

● **Typical Performance Curves**

BA3259HFP (Unless otherwise specified, Ta=25℃, Vcc=5 V)

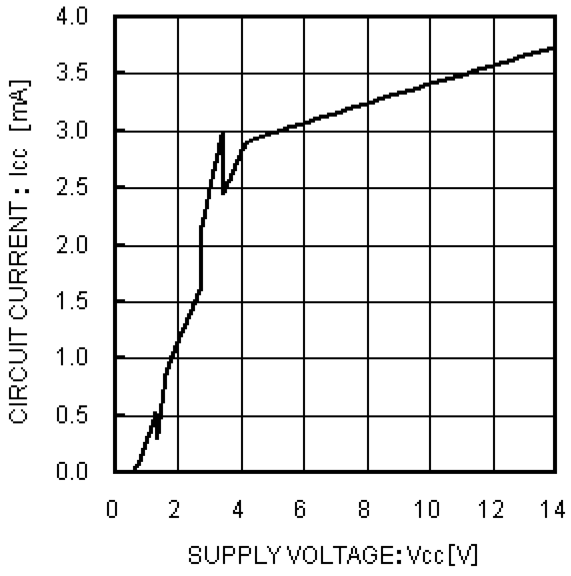


Fig.3
Circuit Current (with no load)

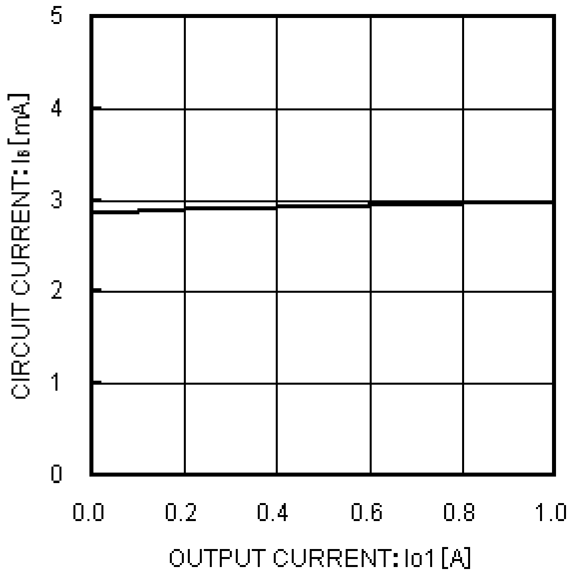


Fig.4
Circuit Current vs Load Current Io

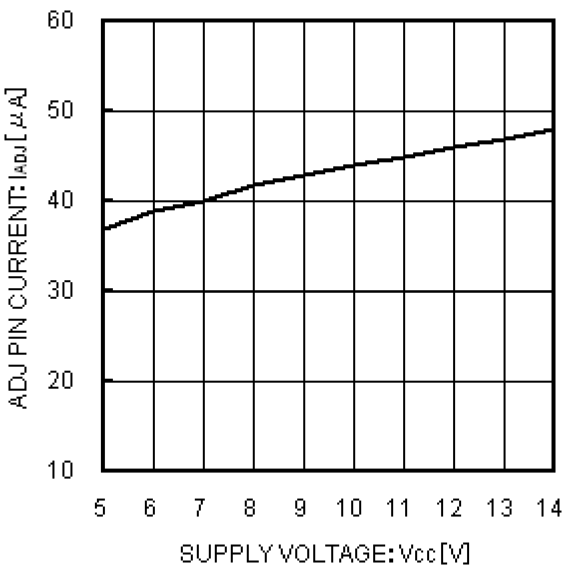


Fig.5
ADJ Pin Outflow Current

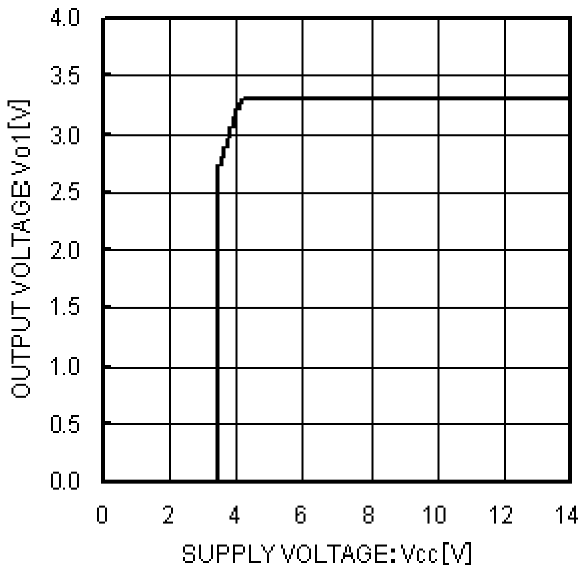


Fig.6
Input Stability
(3.3 V output with no load)

●**Typical Performance Curves - continued**

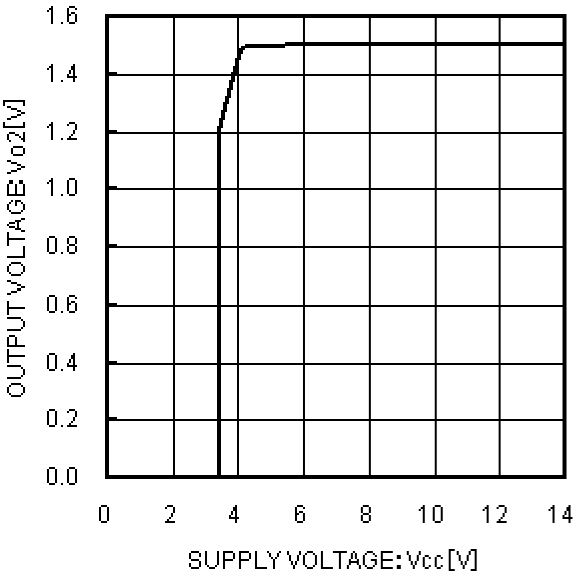


Fig.7
Input Stability
(Variable output with no load)

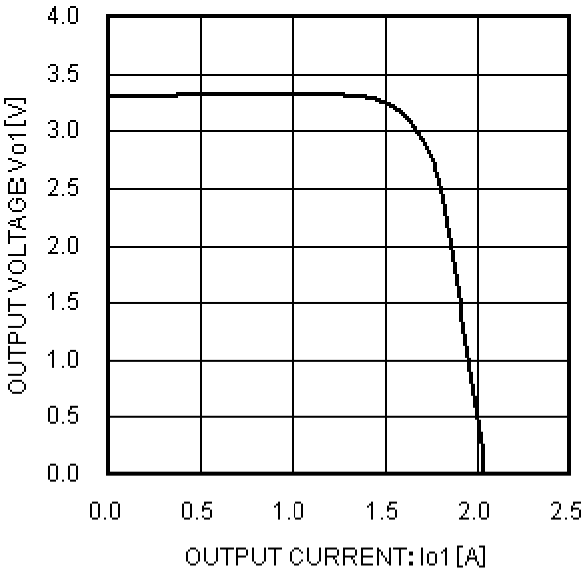


Fig.8
Load Stability
(3.3 V output)

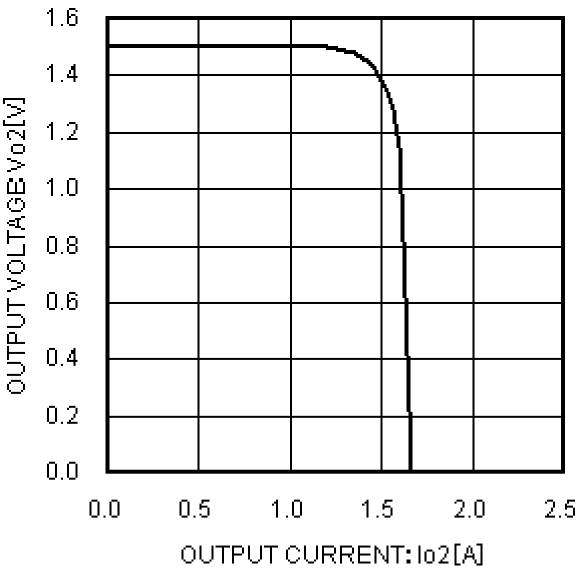


Fig.9
Load Stability
(Variable output: 1.5 V)

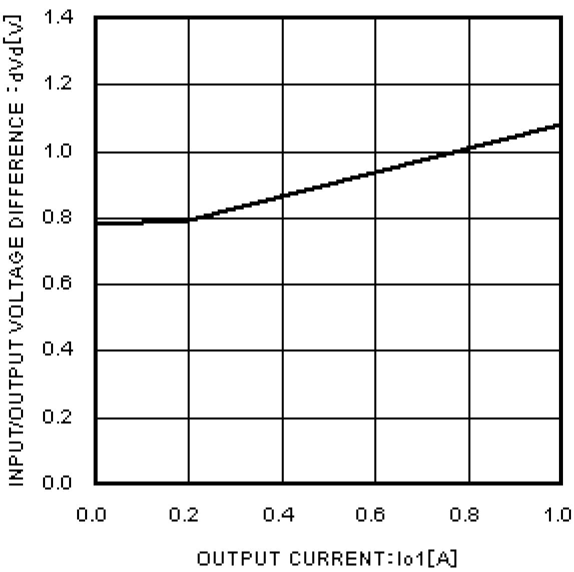


Fig.10
I/O Voltage Difference (3.3 V output)
(3.3 V output, Io1=0 A → 1 A)

●**Typical Performance Curves - continued**

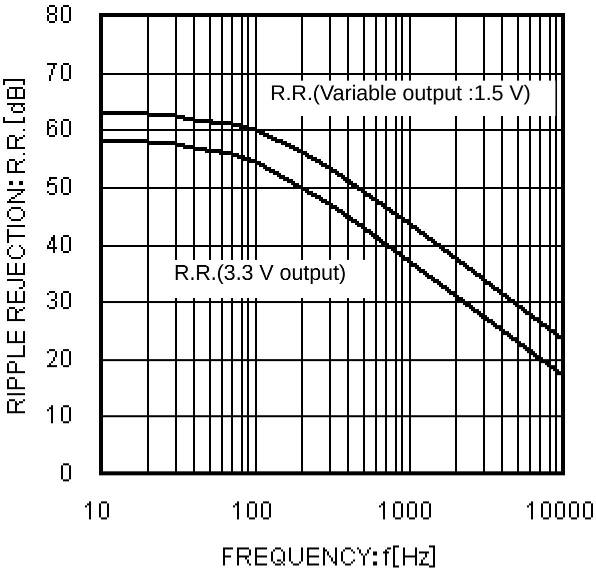


Fig.11
R.R.

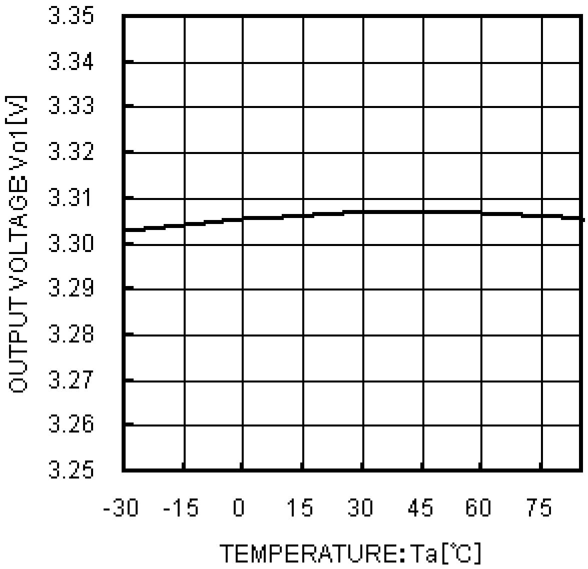


Fig.12
Output Voltage vs Temperature
(3.3 V output)

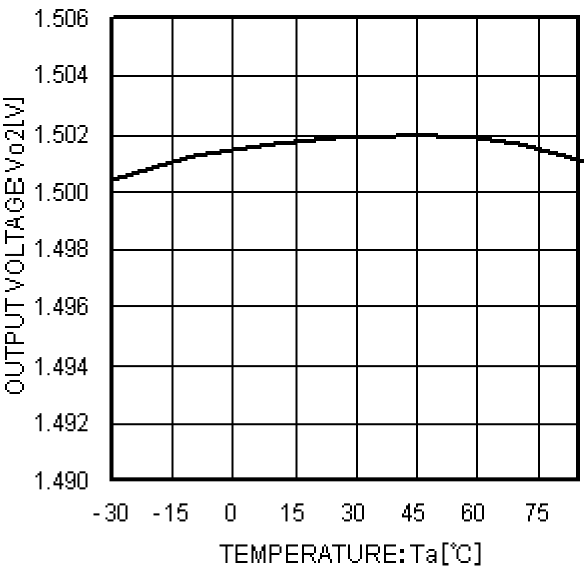


Fig.13
Output Voltage vs Temperature
(Variable output: 1.5 V)

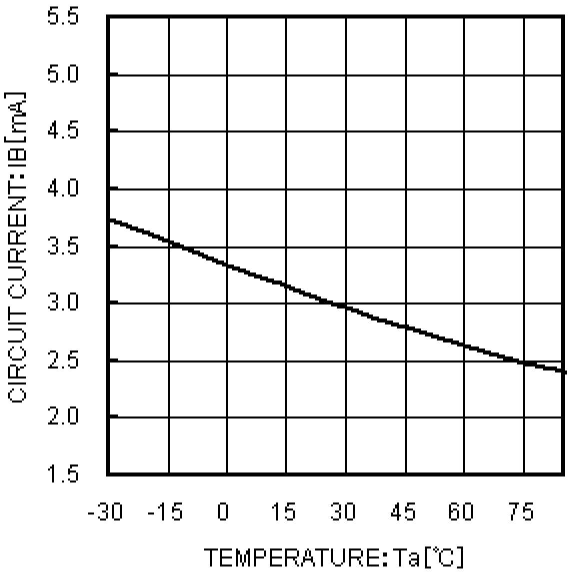


Fig.14
Circuit Current vs Temperature

●**Typical Performance Curves - continued**

BA30E00WHFP (Unless otherwise specified, Ta=25℃, Vcc1=Vcc2=5V)

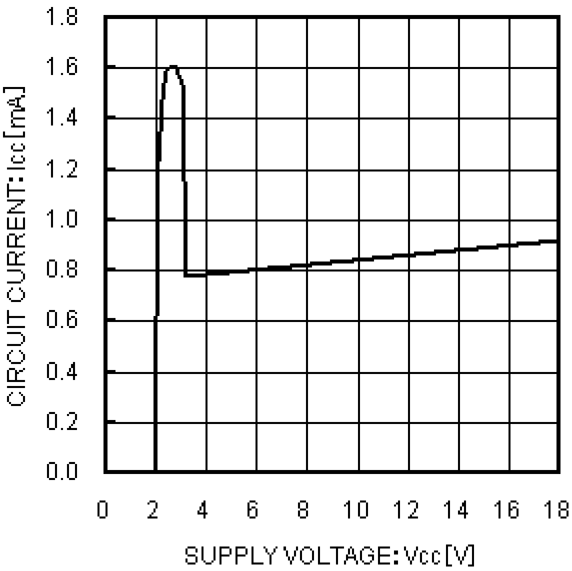


Fig.15
Circuit Current
(with no load)

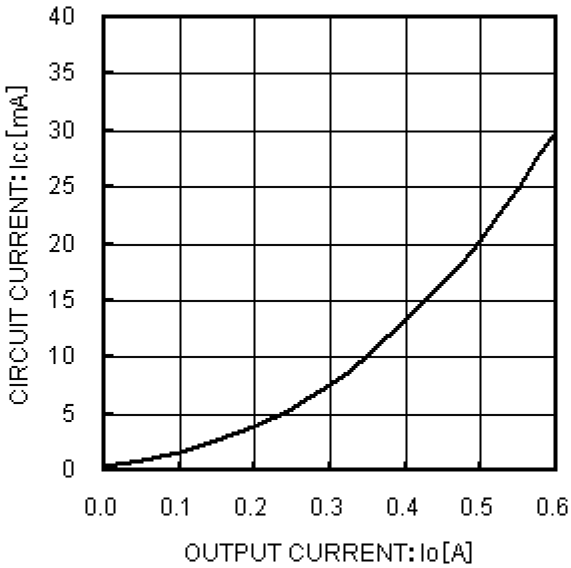


Fig.16
Circuit Current vs Load Current Io
(Io=0 → 600 mA)

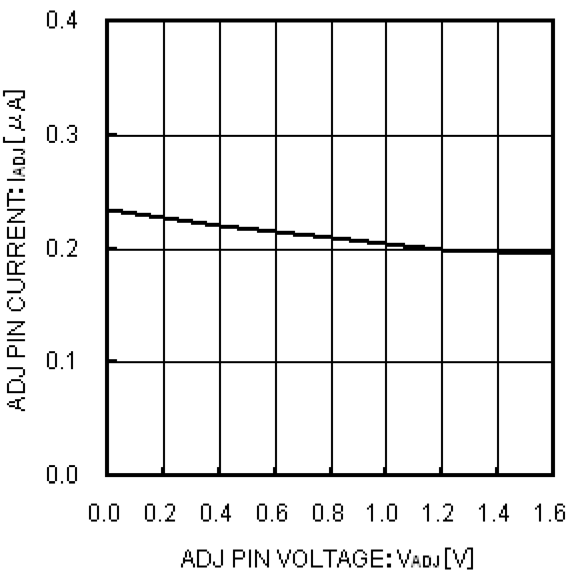


Fig.17
ADJ Pin Source Current

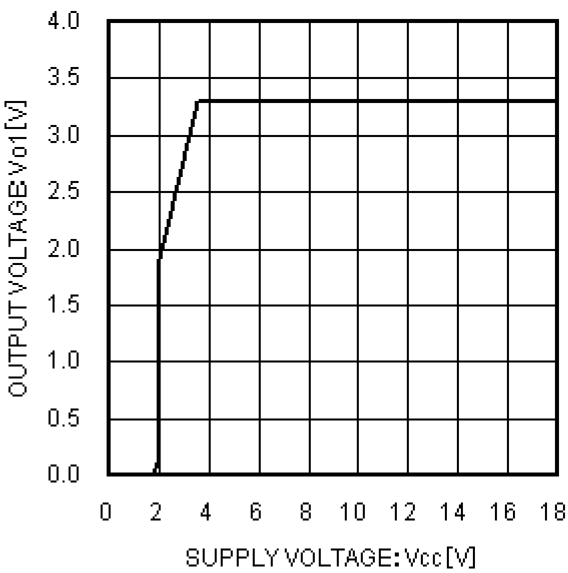


Fig.18
Input Stability
(3.3 V output Io1=600 mA)

●**Typical Performance Curves - continued**

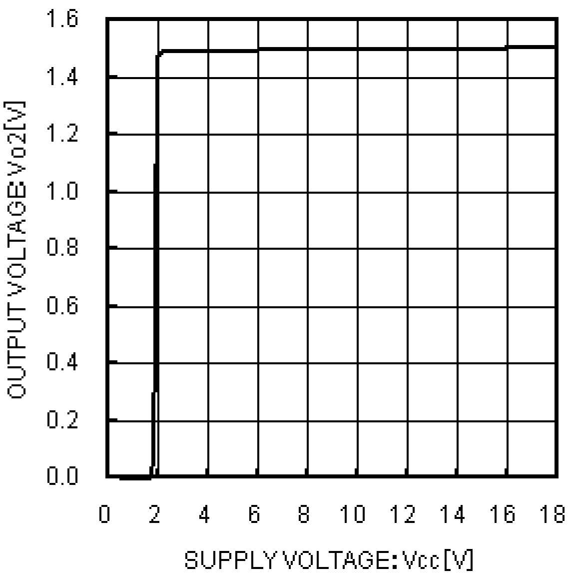


Fig.19
Input Stability
(Variable output: 1.8 V)

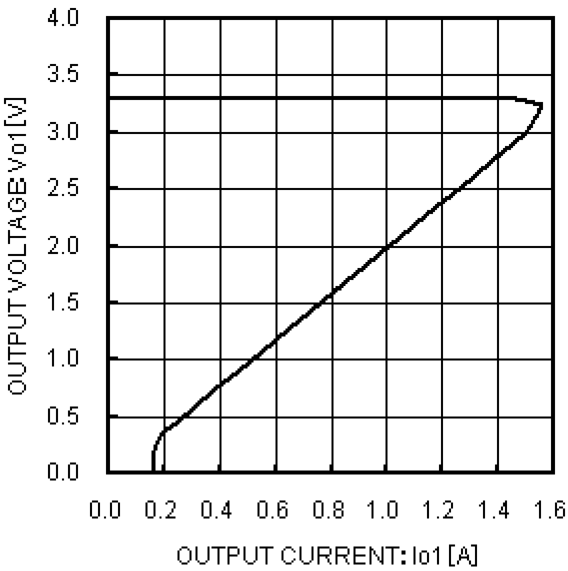


Fig.20
Load Stability
(3.3 V output)

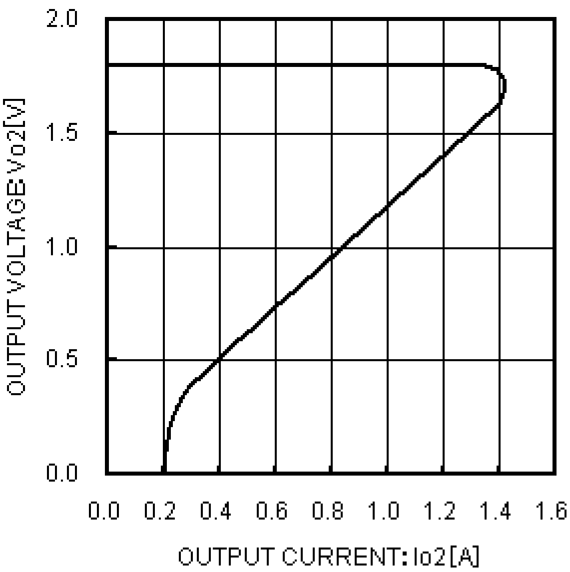


Fig.21
Load Stability
(Variable output: 1.8 V)

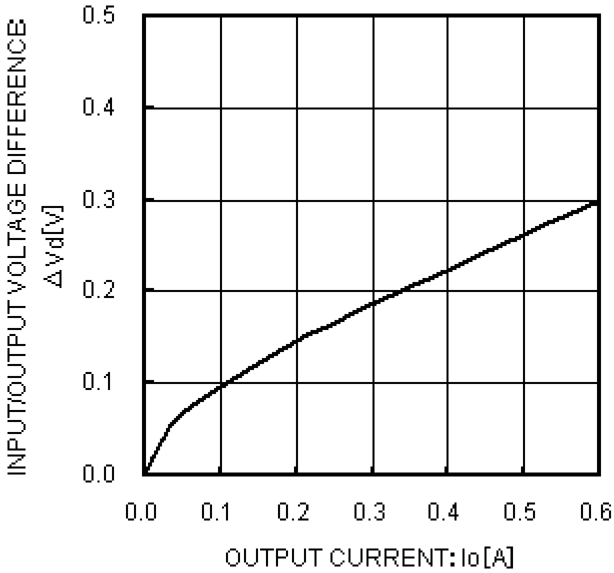


Fig.22
I/O Voltage Difference
(Vcc=3.135 V, 3.3 V output)

●**Typical Performance Curves - continued**

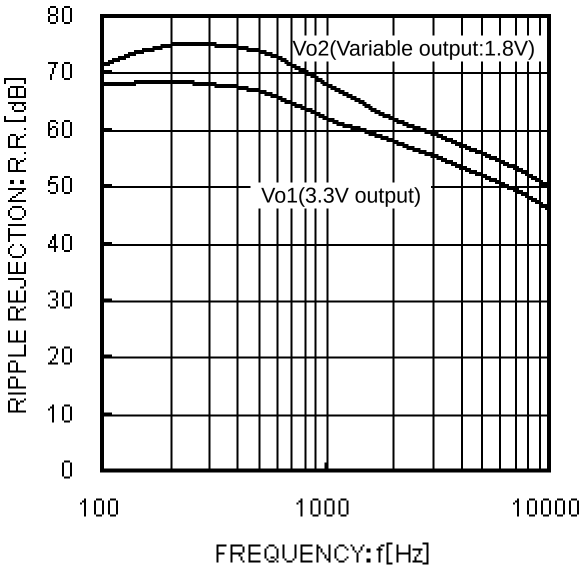


Fig.23
R.R.
(ein=1 Vp-p, Io=100 mA)

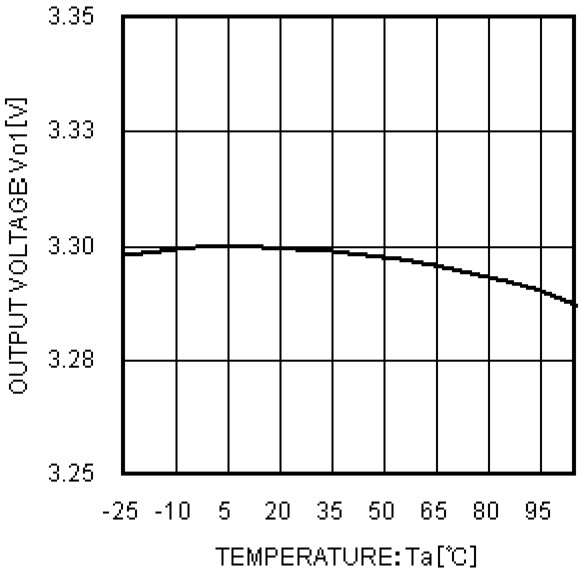


Fig.24
Output Voltage vs Temperature
(3.3 V output)

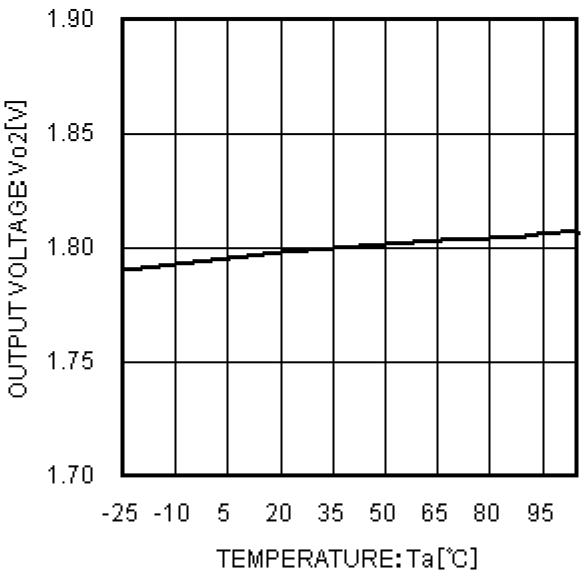


Fig.25
Output Voltage vs Temperature
(Variable output: 1.8 V)

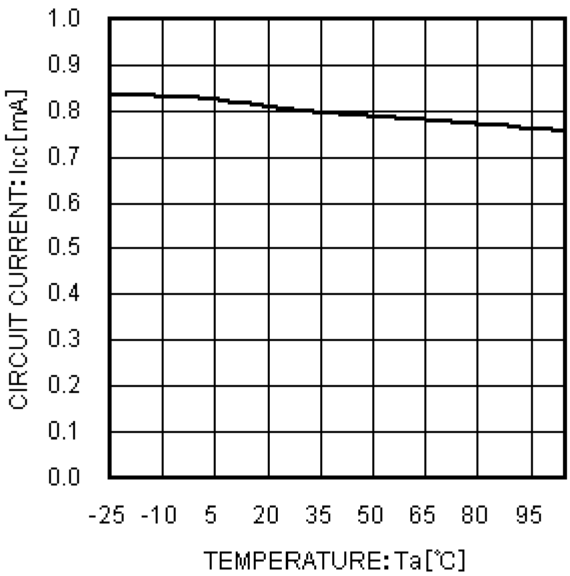


Fig.26
Circuit Current vs Temperature
(Io=0 mA)

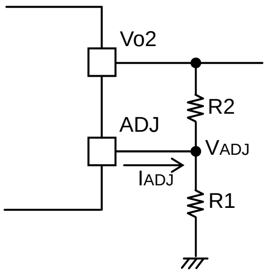
Application Information

●Setting the Output Voltage Vo2

The following output voltage setting method applies to the variable output pin.

$$Vo2 = V_{ADJ} \times \left(1 + \frac{R2}{R1}\right) - R2 \times I_{ADJ}$$

V_{ADJ}: Output feedback reference voltage (0.8 V typ.)
I_{ADJ}: ADJ pin source current (0.05µA typ.: BA3259HFP)
(0.2µA typ.: BA30E00WHFP)



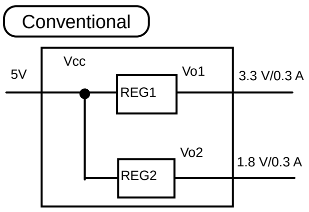
R1
BA3259HFP: 1 kΩ to 10 kΩ
BA30E00HFP: 1 kΩ to 5 kΩ
The above is recommended.

Note:Connect R1 and R2 to make output voltage settings as shown in Fig.1and Fig.2. Keep in mind that the offset voltage caused by the current (I_{ADJ}) flowing out of the ADJ pin will become high if higher resistance is used.

●Function Explanation

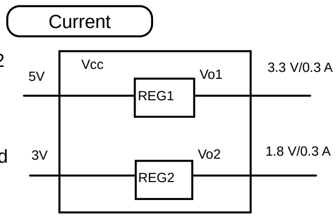
1) Two-input power supply (BA30E00WHFP)
The input voltages (Vcc1 and Vcc2) supply power to two outputs (Vo1 and Vo2, respectively). The power dissipation between the input and output pins can be suppressed for each output according to usage.
Efficiency comparison:
5V single input vs. 5V/3V two inputs

•Regulator with single input and two outputs



Power loss between input and output
(Vcc − Vo1) × Io1 + (Vcc − Vo2) × Io2
= (5 − 3.3) × 0.3 + (5 − 1.8) × 0.3
= 0.51W + 0.96W
= 1.47W
→ Single 5V input results in decreased efficiency

•Regulator with two inputs and two outputs
(Vo2=1.8V, Io1=Io2=0.3A)



Power loss between input and output
(Vcc1 − Vo1) × Io1 + (Vcc2 − Vo2) × Io2
= (5 − 3.3) × 0.3 + (5 − 1.8) × 0.3
= 0.51W + 0.36W
= 0.87W Reduced power loss by 0.6W.
→ Additional 3V input improves efficiency

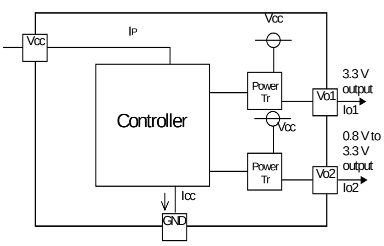
2) Standby function (BA30E00WHFP)
The standby function is operated through the EN pin. Output is turned on at 2.0 V or higher and turned off at 0.8 V or lower.

●Power Dissipation

If the IC is used under the conditions of excess of the power dissipation, the chip temperature will rise, which will have an adverse effect on the electrical characteristics of the IC, such as a reduction in current capability. Furthermore, if the temperature exceeds T_{jmax}, element deterioration or damage may occur. Implement proper thermal designs to ensure that the power dissipation is within the permissible range in order to prevent instantaneous IC damage resulting from heat and maintain the reliability of the IC for long-term operation. Refer to the power derating characteristics curves in Fig.27.

・Power Consumption Pc (W) Calculation Method:

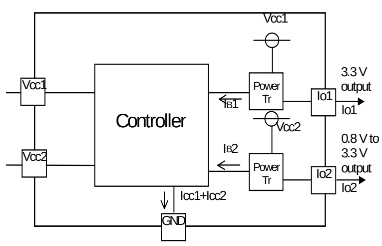
○BA3259HFP



- Power consumption of 3.3 V power transistor
  Pc1=(Vcc − 3.3) × Io1
- Power consumption of Vo2 power transistor
  Pc2=(Vcc − Vo2) × Io2
- Power consumption by circuit current
  Pc3=Vcc × Icc
  ↓
  Pc=Pc1 + Pc2 + Pc3

* Vcc: Applied voltage
Io1: Load current on Vo1 side
Io2: Load current on Vo2 side
Icc: Circuit current

○BA30E00WHFP



- Power consumption of power transistor on Vo1 (3.3 V output)
  Pc1=(Vcc1 − Vo1) × Io1
- Power consumption of power transistor on Vo2 (variable output)
  Pc2=(Vcc2 − Vo2) × Io2
- Power consumption by circuit current
  Pc3=Vcc1 × Icc1 + Vcc2 × Icc2
  ↓
  Pc=Pc1 + Pc2 + Pc3

* Vcc1, Vcc2: Applied voltage
Io1: Load current on 3.3 V output side
Io2: Load current on variable output side
Icc1, Icc2: Circuit currents

The Icc (circuit current) varies with the load.
Refer to the above and implement proper thermal designs so that the IC will not be used under conditions of excess power dissipation Pd under all operating temperatures.

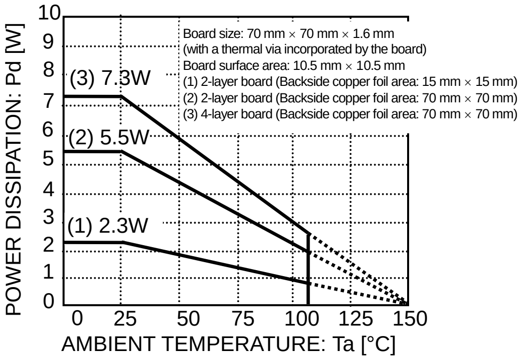


Fig.27 Ambient Temperature vs. Power Dissipation

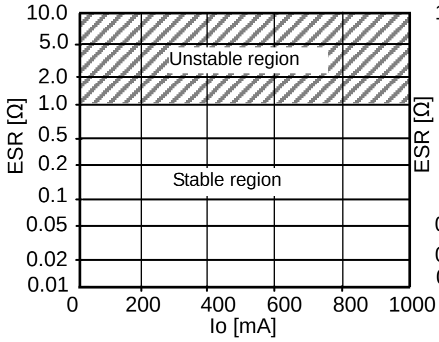


Fig.28 BA3259HFP ESR Characteristics

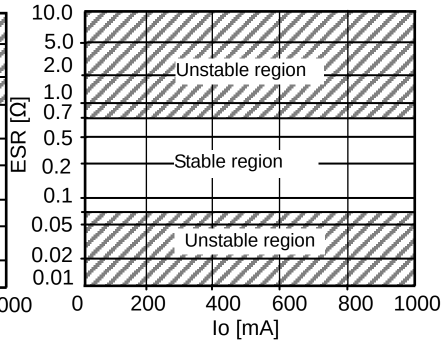


Fig.29 BA30E00WHFP ESR Characteristics

●I/O equivalence circuit

BA3259HFP

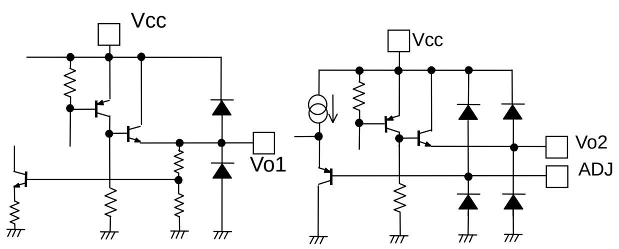


Fig.30 BA3259HFP **I/O equivalence circuit**

BA30E00WHFP

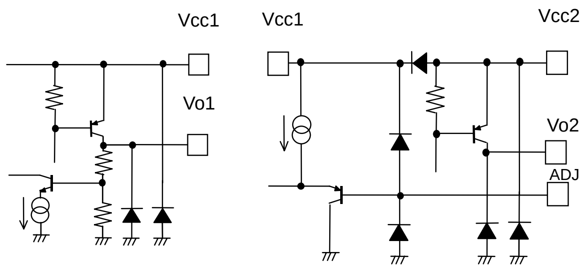


Fig.31 BA30E00WHFP **I/O equivalence circuit**

●Explanation of External Components

○BA3259HFP

1) Vcc (Pin 1)
It is recommended that a ceramic capacitor with a capacitance of approximately 3.3µF is placed between Vcc and GND at a position closest to the pins as possible.

2) Vo (Pins 4 and 5)
Insert a capacitor between Vo and GND in order to prevent output oscillation. The capacitor may oscillate if the capacitance changes as a result of temperature fluctuations. Therefore, it is recommended that a ceramic capacitor with a temperature coefficient of X5R or above and a maximum capacitance change (resulting from temperature fluctuations) of ±10% be used. The capacitance should be between 1µF and 1,000µF. (Refer to Fig.28.)

○BA33E00HFP

1) Vcc1 (Pin 3) and Vcc2 (Pin 2)
Insert capacitors with a capacitance of 1µF between Vcc1 and GND and Vcc2 and GND. The capacitance value will vary depending on the application. Be sure to implement designs with sufficient margins.

2) Vo1 (Pin 5) and Vo2 (Pin 6)
Insert a capacitor between Vo and GND in order to prevent oscillation. The capacitance of the capacitor may greatly vary with temperature changes, making it impossible to completely prevent oscillation. Therefore, use a tantalum aluminum electrolytic capacitor with a low ESR (Equivalent Serial Resistance) that ensures good performance characteristics at low temperatures. The output oscillates if the ESR is too high or too low. Refer to the ESR characteristics in Fig.29 and operate the IC within the stable operating region. If there is a sudden load change, use a capacitor with a higher capacitance. A capacitance between 47µF and 1,000µF is recommended.

●Operational Notes

1) Absolute maximum ratings
An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

2) GND voltage
The potential of GND pin must be minimum potential in all operating conditions.

3) Thermal design
Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

4) Inter-pin shorts and mounting errors
Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if pins are shorted together.

5) Actions in strong electromagnetic field
Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

6) Testing on application boards
When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Always turn the IC's power supply off before connecting it to or removing it from a jig or fixture during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting or storing the IC.

7) Regarding input pin of the IC
This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of these P layers with the N layers of other elements, creating a parasitic diode or transistor. For example, the relation between each potential is as follows:

When GND > PIN A and GND > PIN B, the P-N junction operates as a parasitic diode.
When GND > PIN B, the P-N junction operates as a parasitic transistor.

Parasitic diodes can occur inevitable in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Accordingly, methods by which parasitic diodes operate, such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin, should not be used.

8)Ground wiring patterns
When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the ground potential of application so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

9) Thermal Shutdown Circuit (TSD)
This IC incorporates a built-in thermal shutdown circuit for protection against thermal destruction. Should the junction temperature (Tj) reach the thermal shutdown ON temperature threshold, the TSD will be activated, turning off all output power elements. The circuit will automatically reset once the chip's temperature Tj drops below the threshold temperature. Operation of the thermal shutdown circuit presumes that the IC's absolute maximum ratings have been exceeded. Application designs should never make use of the thermal shutdown circuit.

10) Overcurrent protection circuit
An overcurrent protection circuit is incorporated in order to prevention destruction due to short-time overload currents. Continued use of the protection circuits should be avoided. Please note that current increases negatively impact the temperature.

11) Damage to the internal circuit or element may occur when the polarity of the Vcc pin is opposite to that of the other pins in applications. (I.e. Vcc is shorted with the GND pin while an external capacitor is charged.)
Use a maximum capacitance of 1000 mF for the output pins. Inserting a diode to prevent back-current flow in series with Vcc or bypass diodes between Vcc and each pin is recommended.

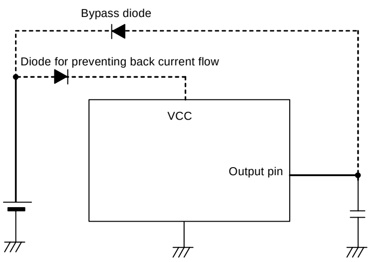


Fig.32 Bypass diode

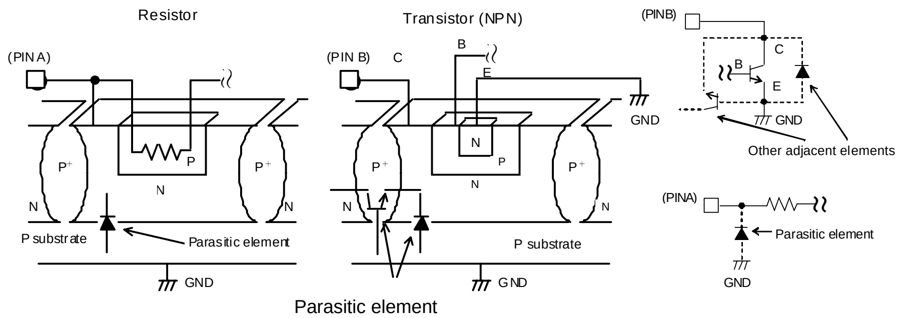


Fig.33 Example of Simple Bipolar IC Architecture

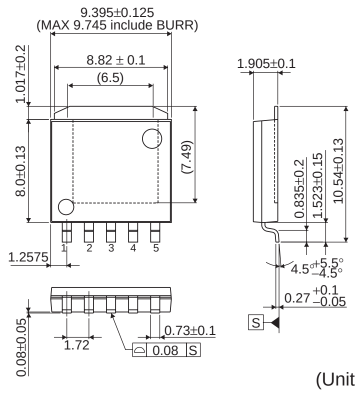
Status of this document

The Japanese version of this document is formal specification. A customer may use this translation version only for a reference to help reading the formal version.

If there are any differences in translation version of this document formal version takes priority.

●Physical Dimension Tape and Reel Information

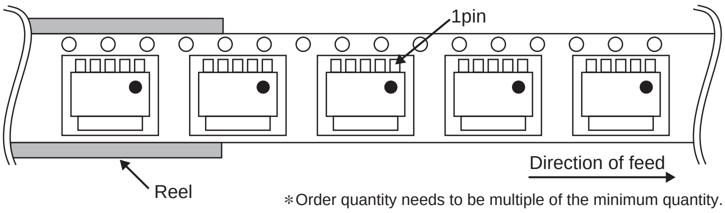
HRP5



(Unit : mm)

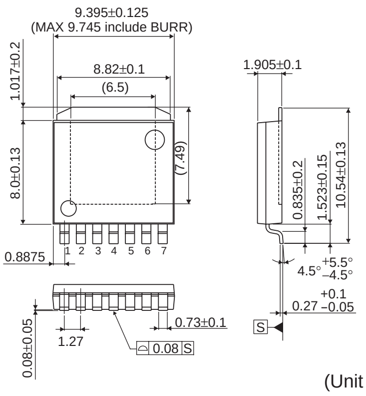
<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2000pcs
Direction of feed	TR (The direction is the 1pin of product is at the upper right when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

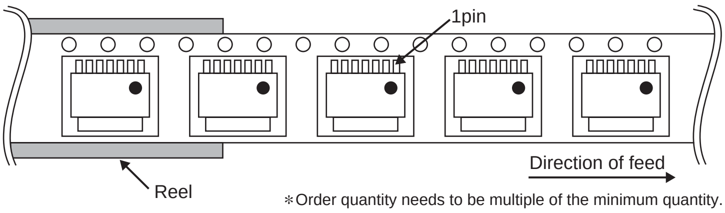
HRP7



(Unit : mm)

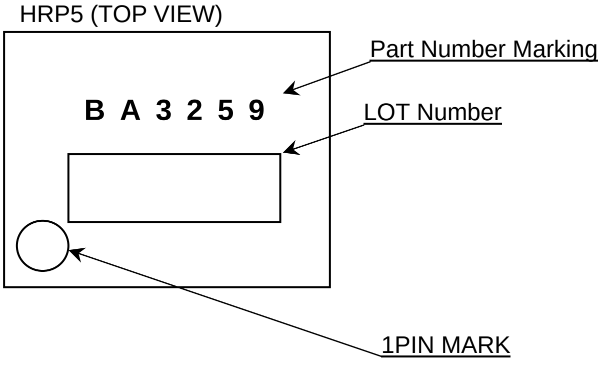
<Tape and Reel information>

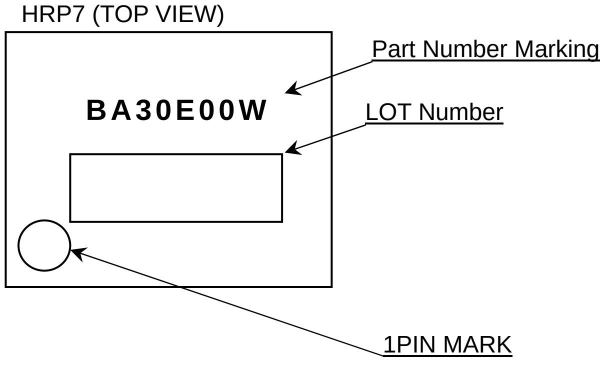
Tape	Embossed carrier tape
Quantity	2000pcs
Direction of feed	TR (The direction is the 1pin of product is at the upper right when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

●Marking Diagrams





●Revision History

Date	Revision	Changes
26.Jun.2012	001	New Release

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JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
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   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

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2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

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    [b] the temperature or humidity exceeds those recommended by ROHM
    [c] the Products are exposed to direct sunshine or condensation
    [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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