Class-AB Speaker Amplifiers

5W+5W
Stereo Speaker Amplifiers

BA5406,BA5417

No.13077EDT02

●Description

The BA5406/BA5417 is a dual OTL monolithic power IC with two built-in, high output speaker amplifier circuits. High output of 5W×2 can be produced when V_{CC}=12 V and R_L=3Ω, and 2.8 W×2 when V_{CC}=9V and R_L=3Ω. The BA5406, which uses a high allowable power dissipation package, has a simple heatsink design. The BA5417 not only exceeds basic characteristics, but also has a built-in soft clip circuit, thermal shutdown and standby circuits.

●Features

BA5406
1) Good low voltage characteristics (Operation from Vcc=5 V)
2) Ripple filter (6pin) also can be used as muting pin (Make 6pin GND potential)
3) Small thermal resistance package and simple heatsink design

BA5417
1) Small pop noise when standby switches ON/OFF
2) Built-in circuit to prevent ripple addition when motor starts
3) Built-in thermal shutdown circuit
4) Built-in standby switch circuit
5) Built-in soft clip circuit

●Applications

Stereo radio cassette players, mini-audio systems, LCD TVs, etc.

●Line up matrix

Part No.	BA5406	BA5417	Units
Supply voltage	5 ~ 15	6 ~ 15	V
Power dissipation	20	15	W
Quiescent current	40	22	mA
Standby current	—	0	μA
Closed loop voltage gain	46	45	dB
Output noise voltage	0.6	0.3	mVrms
Total harmonic distortion	0.3	0.1	%
Ripple rejection	—	55	dB
Package	SIP-M12	HSIP15	—

●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Ratings		Unit
		BA5406	BA5417	
Supply voltage	Vcc	18 *1	20 *1	V
Power dissipation	Pd	20 *2	15 *3	W
Operating temperature	Topr	-20 ~ +75	-20 ~ +75	℃
Storage temperature	Tstg	-30 ~ +125	-55 ~ +150	℃

*1 When no signal
*2 Back metal temperature 75℃
*3 Ta=75°C (Using infinite heatsink)

●Operating range (Ta=25℃)

Parameter	Symbol	Ratings		Unit
		BA5406	BA5417	
Supply voltage	V_{CC}	5.0 ~ 15.0	6.0 ~ 15.0	V

●Electrical characteristics (BA5406 : Unless otherwise noted, Ta=25℃, Vcc=12V) (BA5417 : Unless otherwise noted, Ta=25℃, Vcc=9V)

Parameter		Symbol	Limits		Unit.	Conditions
			BA5406	BA5417		
Quiescent current		I_O	40	22	mA	V_{IN}=0Vms
Rated output power		P_{OUT}	5.0	5.0	W	THD=10%,Vcc=12V, RL=3Ω
Closed loop voltage gain		G_{VC}	46	45	dB	—
Output noise voltage		V_{NO}	0.6	0.3	mVrms	Rg=10kΩ, DIN-Audio
Total harmonic distortion		THD	0.3	0.1	%	P_{OUT}=0.5W, f=1kHz
Ripple rejection		RR	—	55	dB	f_{RR}=100Hz,V_{RR}=-10dBm
Crosstalk		CT	—	65	dB	V_O=0dBm
Standby current		I_{OFF}	—	0	μA	—
Standby pin input current		I_{SIN}	—	0.15	mA	V_{STBY}=V_{CC}
Standby pin control voltage	Activated	V_{STH}	—	3.5 ~ Vcc	V	—
	Not Activated	V_{STL}	—	0 ~ 1.2	V	—

* Note: This IC is not designed to be radiation-resistant.

●**Block diagram**

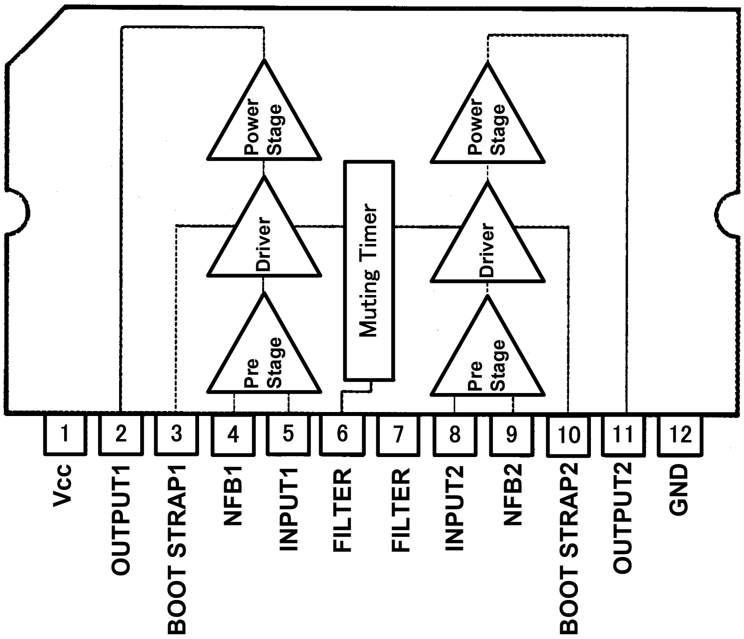


Fig.1 BA5406

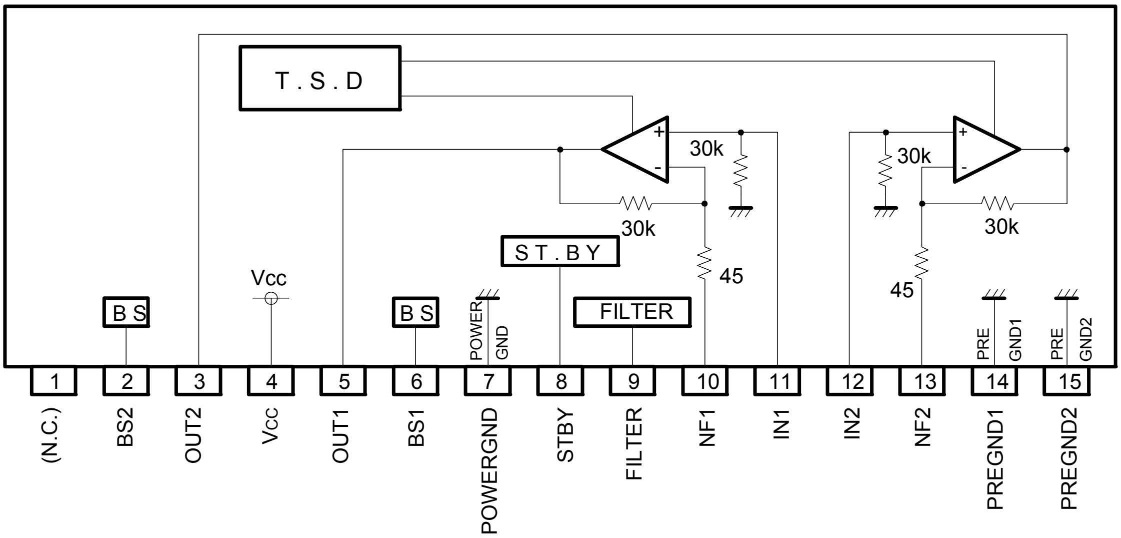


Fig.2 BA5417

●**Measurement circuit**

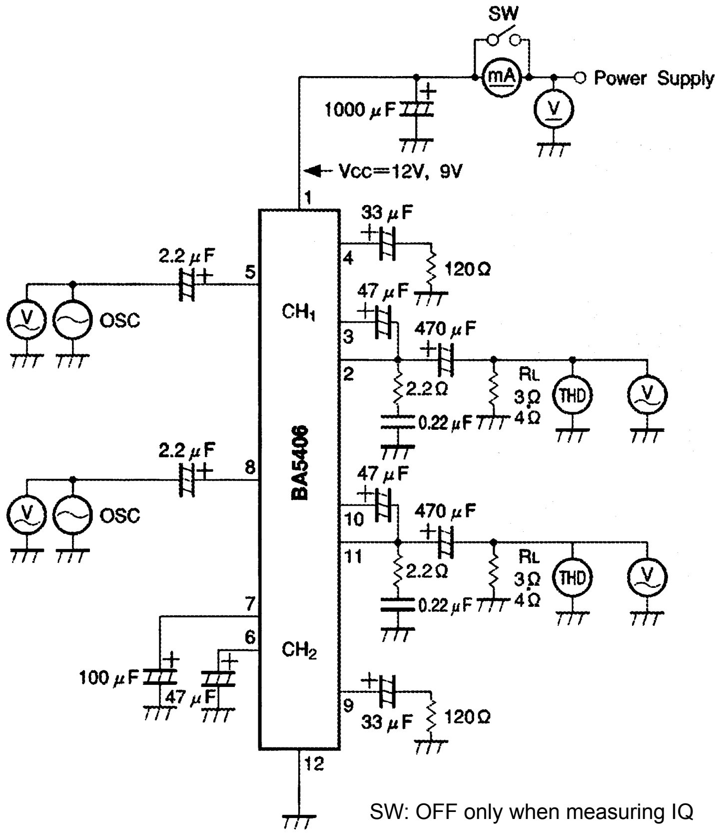


Fig.3 BA5406

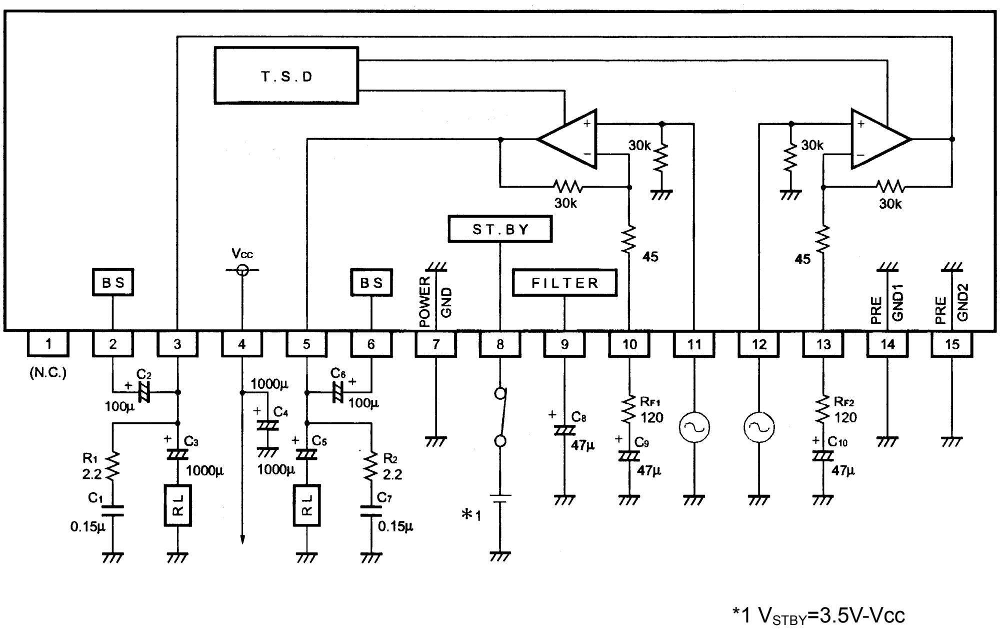


Fig.4 BA5417

●Application circuit

BA5406

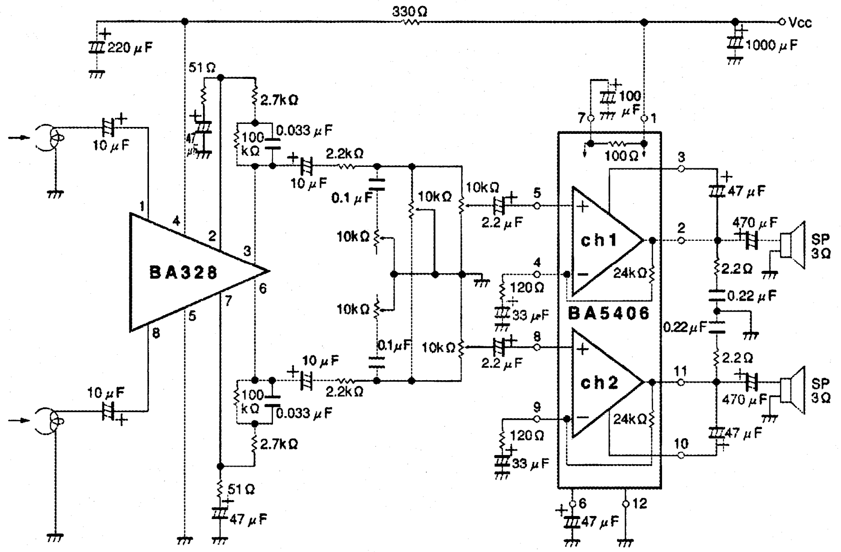


Fig.5

BA5417

OTL mode circuit

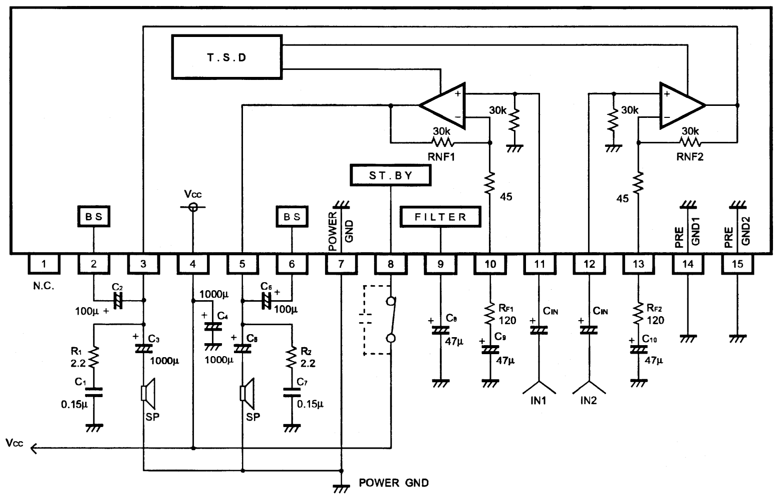


Fig.6

BTL mode circuit

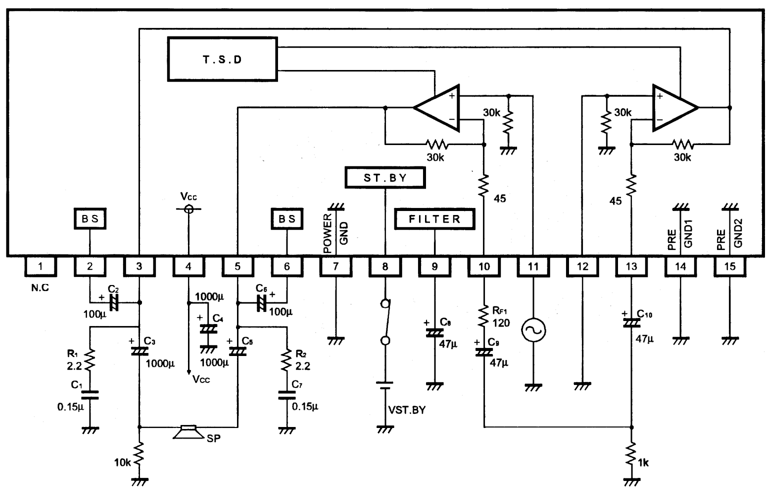


Fig.7

●Reference data

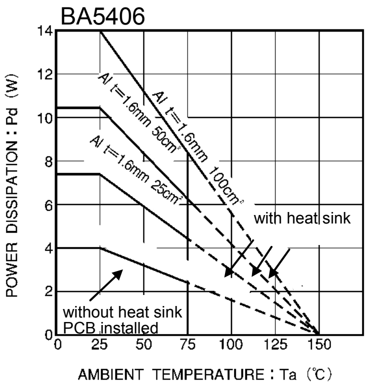


Fig.8 Thermal derating curve

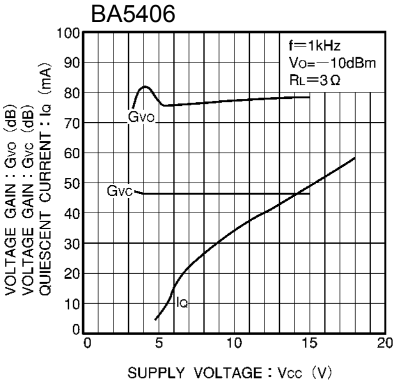


Fig.9 Quiescent current and voltage gain vs Supply voltage

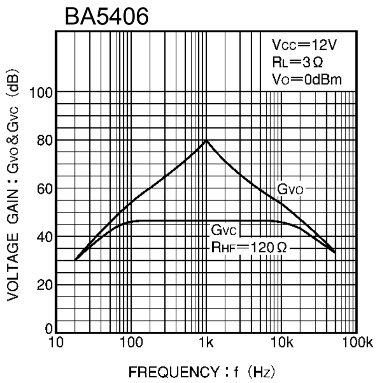


Fig.10 Voltage gain vs frequency

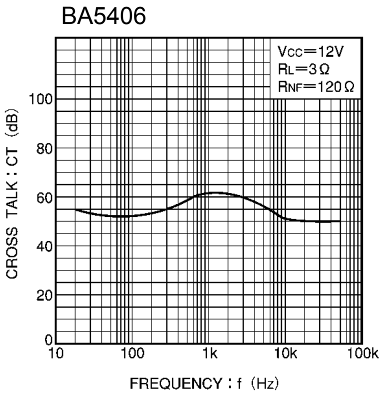


Fig.11Crosstalk vs frequency

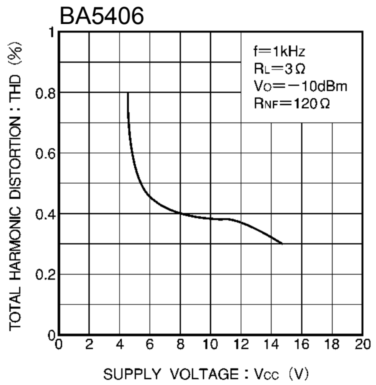


Fig.12 Distortion vs power supply voltage

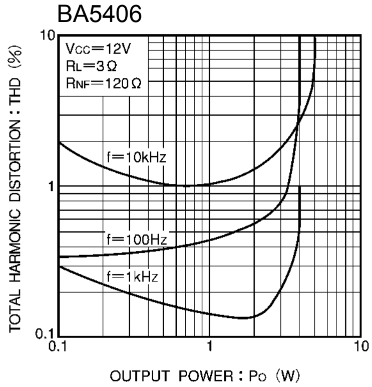


Fig.13 Distortion vs Output power

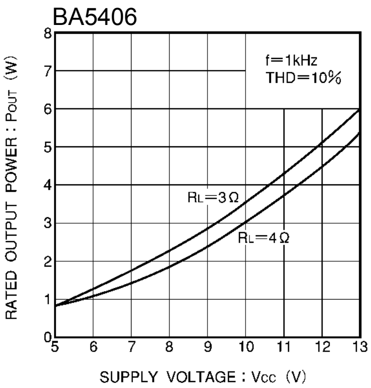


Fig.14 Output power vs power supply voltage

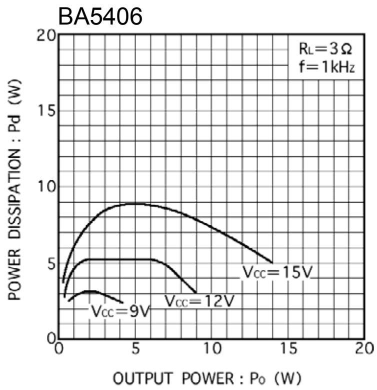


Fig.15 Power dissipation vs Output power(1)

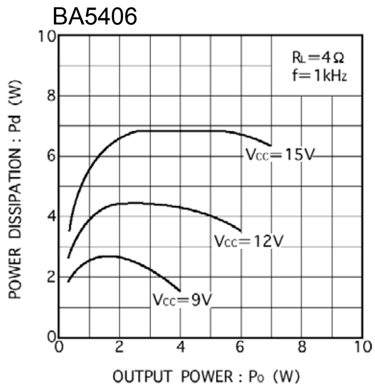


Fig.16 Power dissipation vs Output power(2)

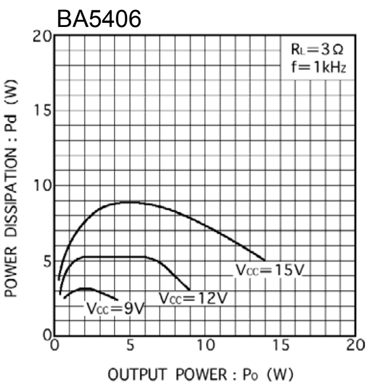


Fig. 17 Power dissipation vs Output power(3)

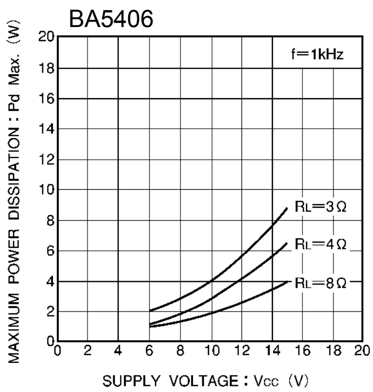


Fig.18 Maximum power dissipation vs Supply voltage

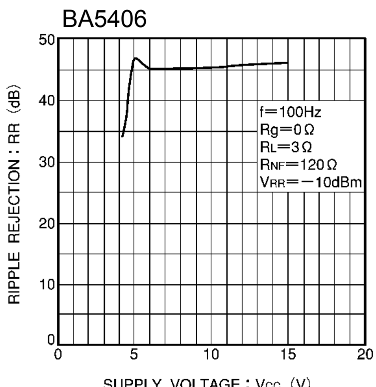


Fig.19 Ripple rejection ratio vs Supply voltage

BA5417 OTL mode

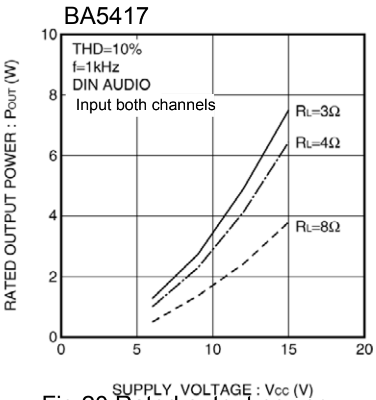


Fig.20 Rated output power vs Supply voltage

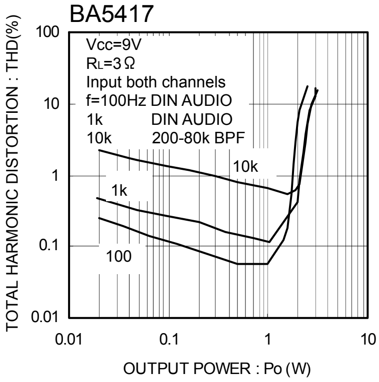


Fig.21 Total harmonic distortion vs Output power

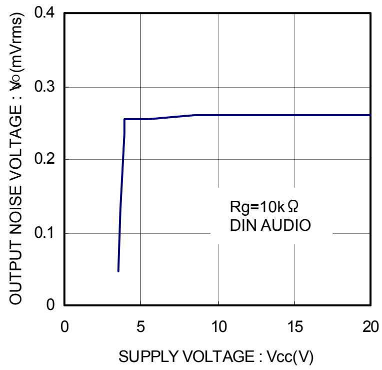


Fig.22 Output noise voltage vs Supply voltage

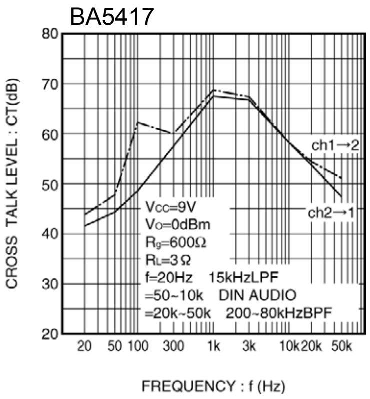


Fig.23 Crosstalk vs. Frequency

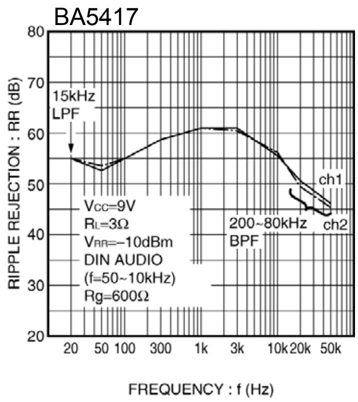


Fig.24 Ripple rejection vs. Frequency

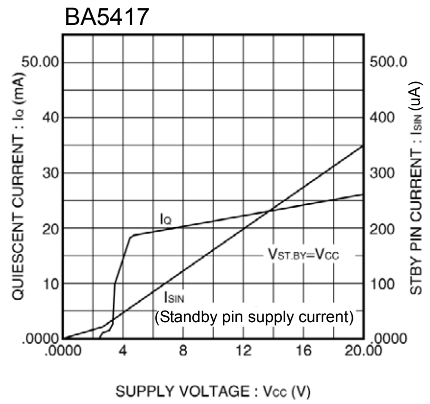


Fig.25 Quiescent, standby pin input current vs. Supply voltage

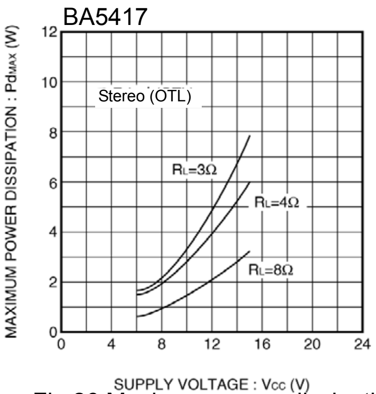


Fig.26 Maximum power dissipation vs. Supply voltage

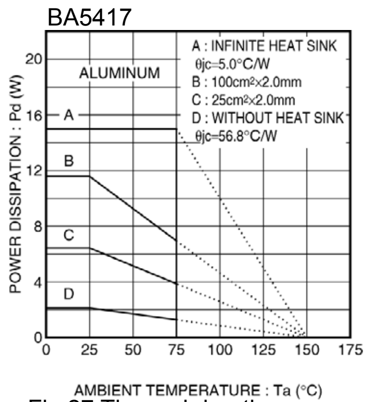


Fig.27 Thermal derating curve

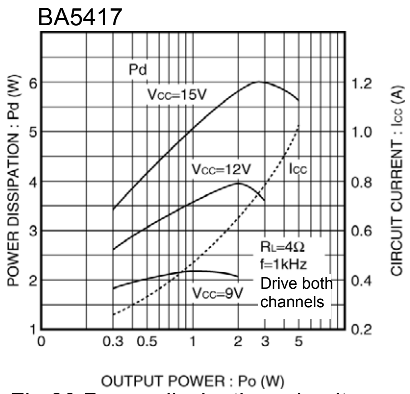


Fig.28 Power dissipation, circuit current vs. Supply Voltage(RL=4Ω)

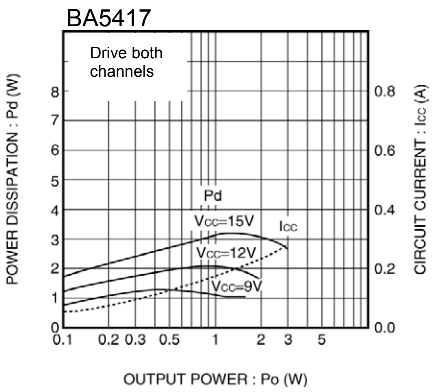


Fig.29 Power dissipation, circuit current vs. Supply Voltage（RL=8Ω）

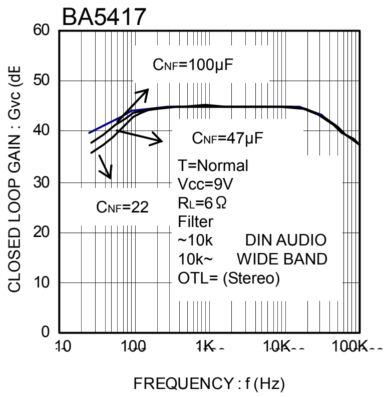


Fig.30 Closed loop gain vs. Frequency

BA5417 BTL mode

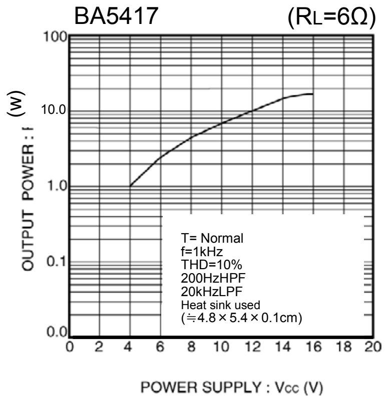


Fig.31 Rated output power vs. Supply Voltage

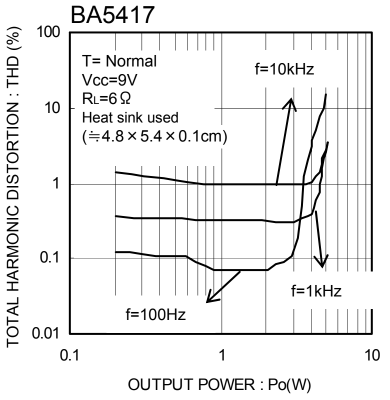


Fig.32 Total harmonic distortion vs. Output power

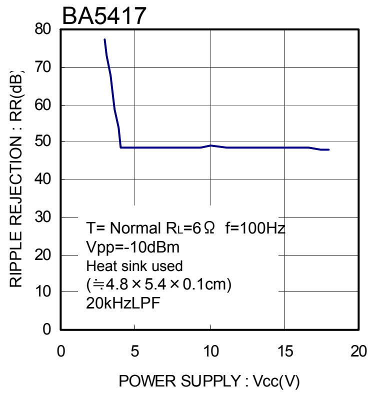


Fig.33 Ripple rejection ratio vs. Supply Voltage

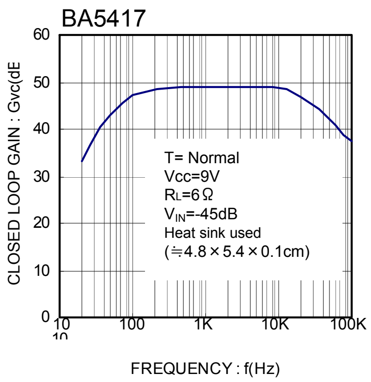


Fig.34 Close loop gain vs. Frequency

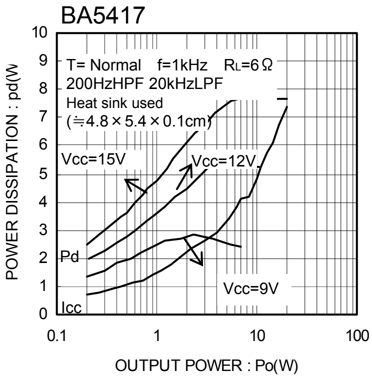


Fig.35 Power dissipation, Supply current vs. Frequency

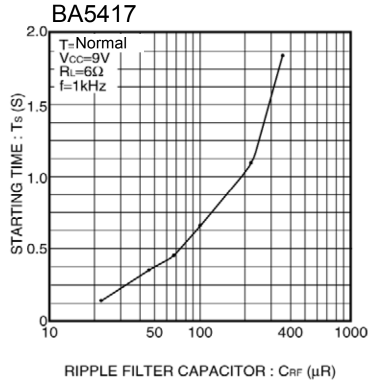


Fig.36 Starting time vs. Ripple filter capacitor

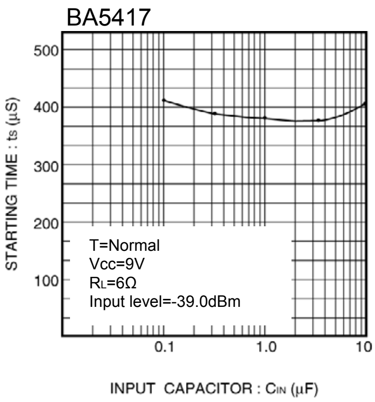


Fig.37 Starting time vs. Input coupling capacitor

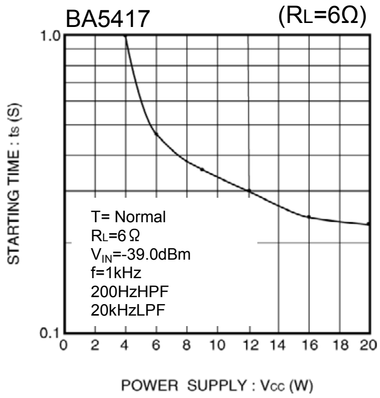


Fig.38 Starting time vs. Supply Voltage

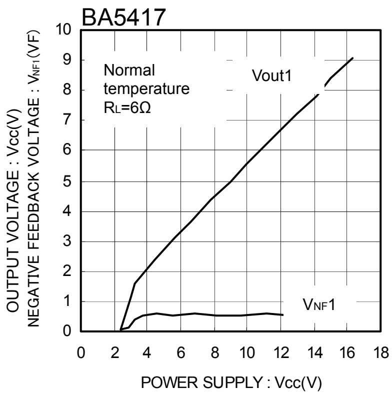


Fig.39 Output voltage, Negative feed back voltage vs. Supply Voltage

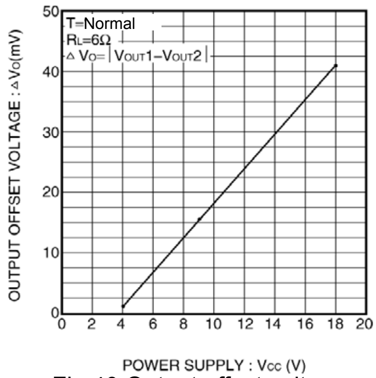


Fig.40 Output offset voltage vs. Supply Voltage

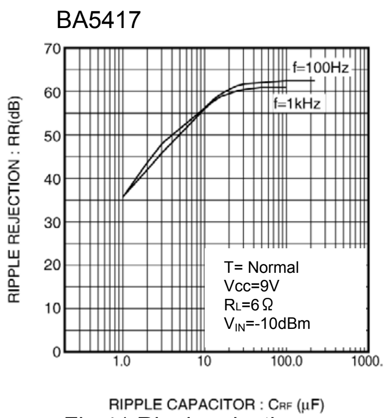


Fig.41 Ripple rejection vs. Ripple filter capacitor

●Notes for use

1) Numbers and data in entries are representative design values and are not guaranteed values of the items.

2) Although ROHM is confident that the example application circuit reflects the best possible recommendations, be sure to verify circuit characteristics for your particular application. Modification of constants for other externally connected circuits may cause variations in both static and transient characteristics for external components as well as this Rohm IC. Allow for sufficient margins when determining circuit constants.

3) Absolute maximum ratings
Use of the IC in excess of absolute maximum ratings, such as the applied voltage or operating temperature range (Topr), may result in IC damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure, such as a fuse, should be implemented when using the IC at times where the absolute maximum ratings may be exceeded.

4) GND potential
Ensure a minimum GND pin potential in all operating conditions. Make sure that no pins are at a voltage below the GND at any time, regardless of whether it is a transient signal or not.

5) Thermal design
Perform thermal design, in which there are adequate margins, by taking into account the permissible dissipation (Pd) in actual states of use.

6) Short circuit between terminals and erroneous mounting
Pay attention to the assembly direction of the ICs. Wrong mounting direction or shorts between terminals, GND, or other components on the circuits, can damage the IC.

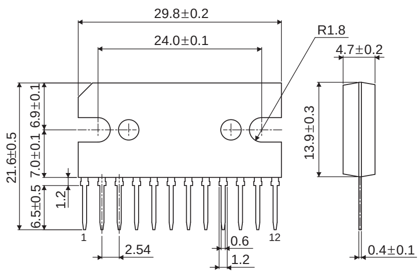
7) Operation in strong electromagnetic field
Using the ICs in a strong electromagnetic field can cause operation malfunction.

●Ordering part number

B	A		5	4	0	6				-		

- Part No.
- Part No.: 5406, 5417
- Package: None: SIP-M12, HSIP15
- Packaging and forming specification: None: Tube

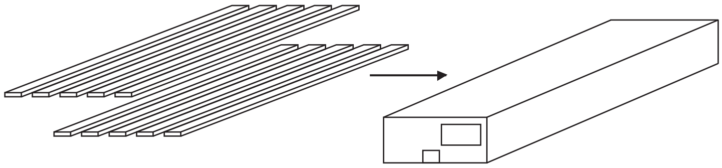
SIP-M12



(Unit : mm)

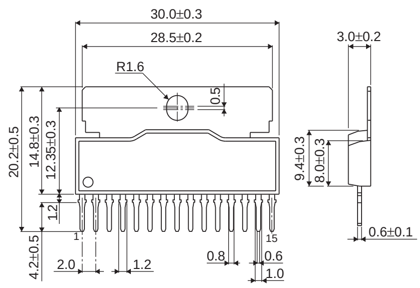
<Tape and Reel information>

Container	Tube
Quantity	300pcs
Direction of feed	Direction of products is fixed in a container tube



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

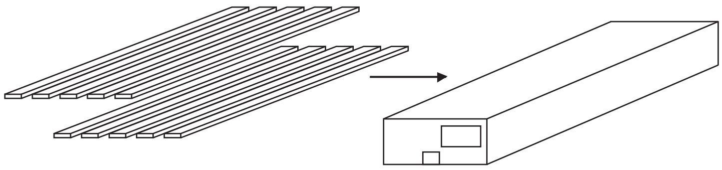
HSIP15



(Unit : mm)

<Tape and Reel information>

Container	Tube
Quantity	300pcs
Direction of feed	Direction of products is fixed in a container tube



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

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [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.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

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

Precautions Regarding Application Examples and External Circuits

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.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

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).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [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.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM’s internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

Precaution Regarding Intellectual Property Rights

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Other Precaution

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General Precaution

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.

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