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Class-AB Speaker Amplifiers

1.1W to 1.5W

Monaural Speaker Amplifiers



BH7824FVM, BH7826FVM

No.11090EBT01

●Description

The BH7824FVM and BH7826FVM are speaker amplifier ICs for low-voltage drives and low power consumption audio, specialized for mobile telephones and other mobile audio devices.

●Features

- 1) BTL monaural speaker amplifier
- 2) Capable of high power 500mW/8Ω/BTL output
- 3) Wide power supply voltage range
- 4) Supports active/shutdown modes
- 5) Built-in anti-pop circuit
- 6) Built-in thermal shutdown circuit

●Applications

Mobile telephones, PDAs, notebook computers, DSC, DVC, and other mobile audio devices.

●Product lineup

Part No.	BH7824FVM	BH7826FVM
Input type	Unbalanced input	Balanced input
Supply voltage(V)	2.4 ~ 5.5	2.6 ~ 5.5

●Absolute maximum ratings(Ta=25°C)

Parameter	Symbol	Limits	Unit
Supply voltage	V _{CCmax.}	6.0	V
Power dissipation	P _d	470(*1)	mW
Operating temperature	T _{opr}	-30 ~ +85(*2)	°C
Storage temperature	T _{stg}	-55 ~ +125	°C

*1 Reduced by 4.7 mW/°C at 25°C or higher, when mounted on a 70mm×70mm×1.6mm PCB board.

*2 T_{opr}=70°C ~ 85°C is the range for performing basic operations and does not guarantee characteristics or rated output. Moreover, TSD (Thermal Shutdown) may become operable if input signals occurring in this range are excessive.

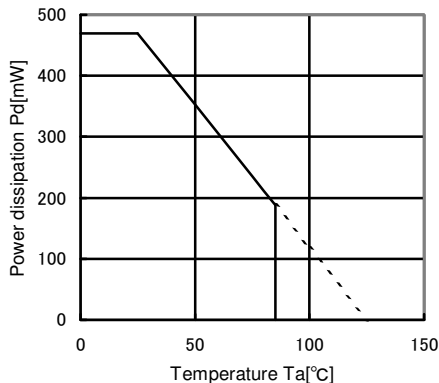


Fig.1 Ta-Pd (when mounted on a PCB board)

● Operating conditions (Ta=25°C)

Parameter	Ratings	
	BH7824FVM	BH7826FVM
Supply voltage	2.4V ~ 5.5V	2.6 ~ 5.5

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

● Electrical characteristics (Unless otherwise noted Ta=25°C, Vcc=3.6V, f=1kHz, RL=8Ω)

Parameter	Symbol	Limits(Typ.)		Unit	Conditions
		BA7824FVM	BA7826FVM		
Circuit current 1	I _{CC1}	3.5	3.5	mA	No signal , Active mode
Circuit current 2	I _{CC2}	0	0	μA	No signal, Suspend mode
Voltage gain 1	G _{V1}	+11.5	+11.5	dB	V _{IN} =-20dBV, 1st Op-amp gain
Voltage gain 2	G _{V2}	0	—	dB	2nd Op-amp gain
Maximum output voltage1	V _{OM1}	+6.0	+6.0	dBV	DSTN=1% ,BTL ^{*1}
Maximum output voltage2	V _{OM2}	—	+5.1	dBV	V _{CC} =3.4V,DSTN=1%,BTL ^{*1}
Output distortion	D _{STN}	0.07	0.2	%	V _{IN} =-20dB, V SE ^{*1}
Output noise level	V _{NO}	-94	-94	dBV	No signal, SE Active mode ^{*2}
Suspend attenuation	G _S	-107	-107	dBV	V _{IN} =-20dB, V BTL ^{*2}
Bias setting voltage	V _{BIAS}	1.8	1.8	V	3pin DC voltage
Suspend hold voltage / H	V _{SH1}	V _{CC} × 0.8 ~ V _{CC}	2.0 ~ V _{CC}	V	Active mode, Hold voltage
Suspend hold voltage / L	V _{SH2}	0 ~ 0.5	0 ~ 0.5	V	Suspend mode, Hold voltage

*1 : B.W.=0.4 ~ 30kHz

*2 : DIN AUDIO

● Measurement circuit

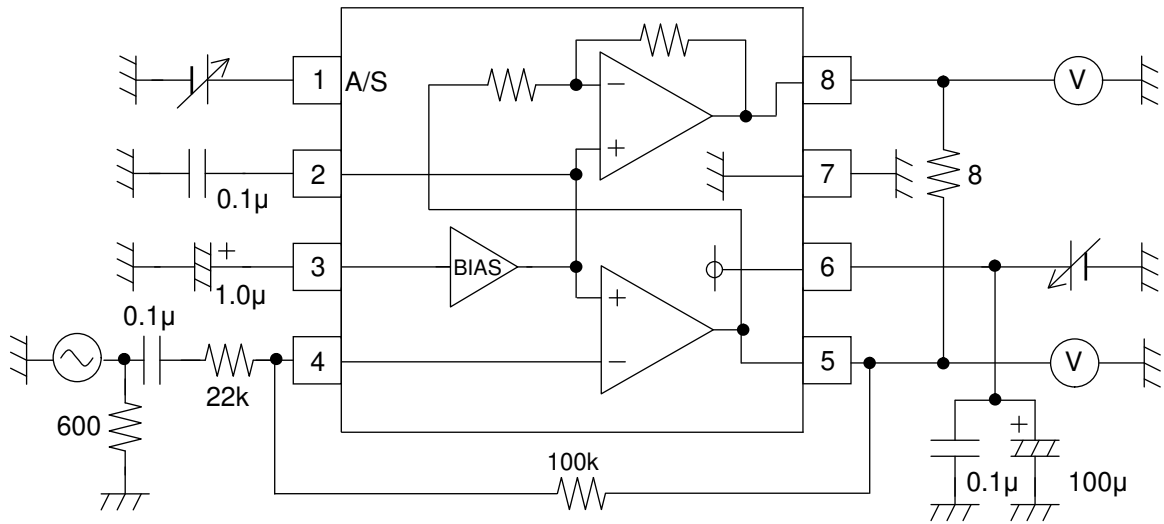


Fig.2 BH7824FVM

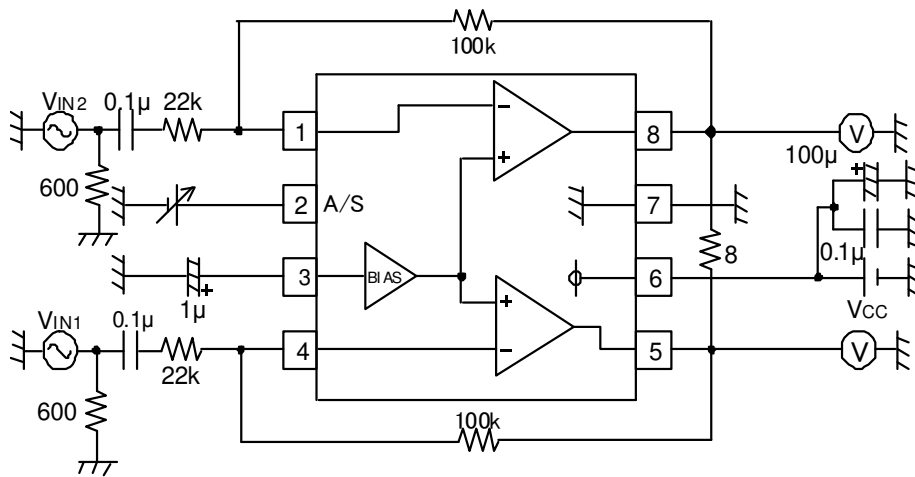


Fig.3 BH7826FVM

●Block diagram

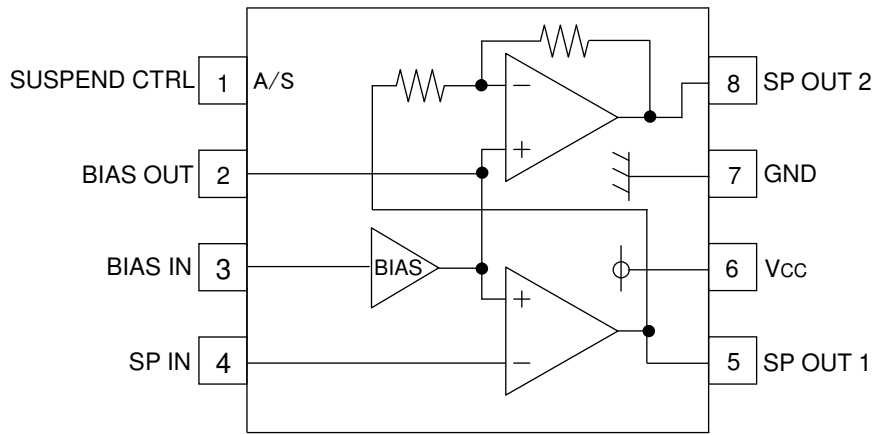


Fig.4 BH7824FVM

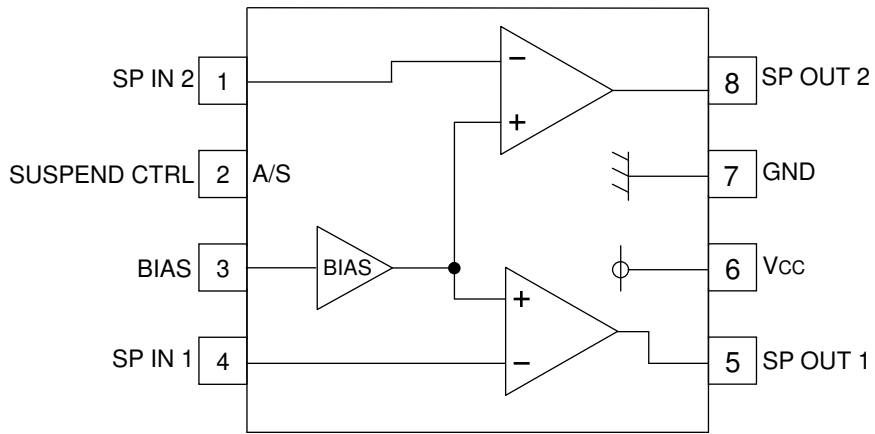
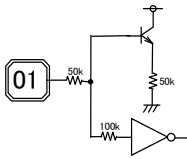
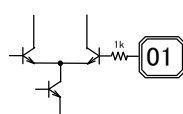
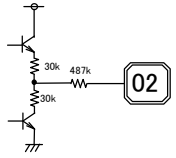
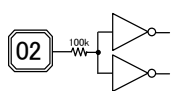
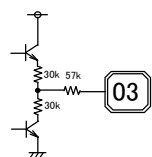
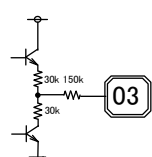
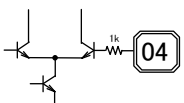
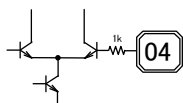
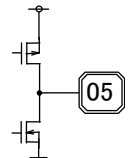
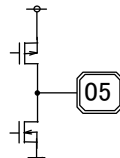
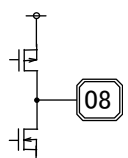
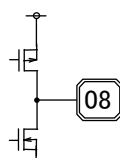


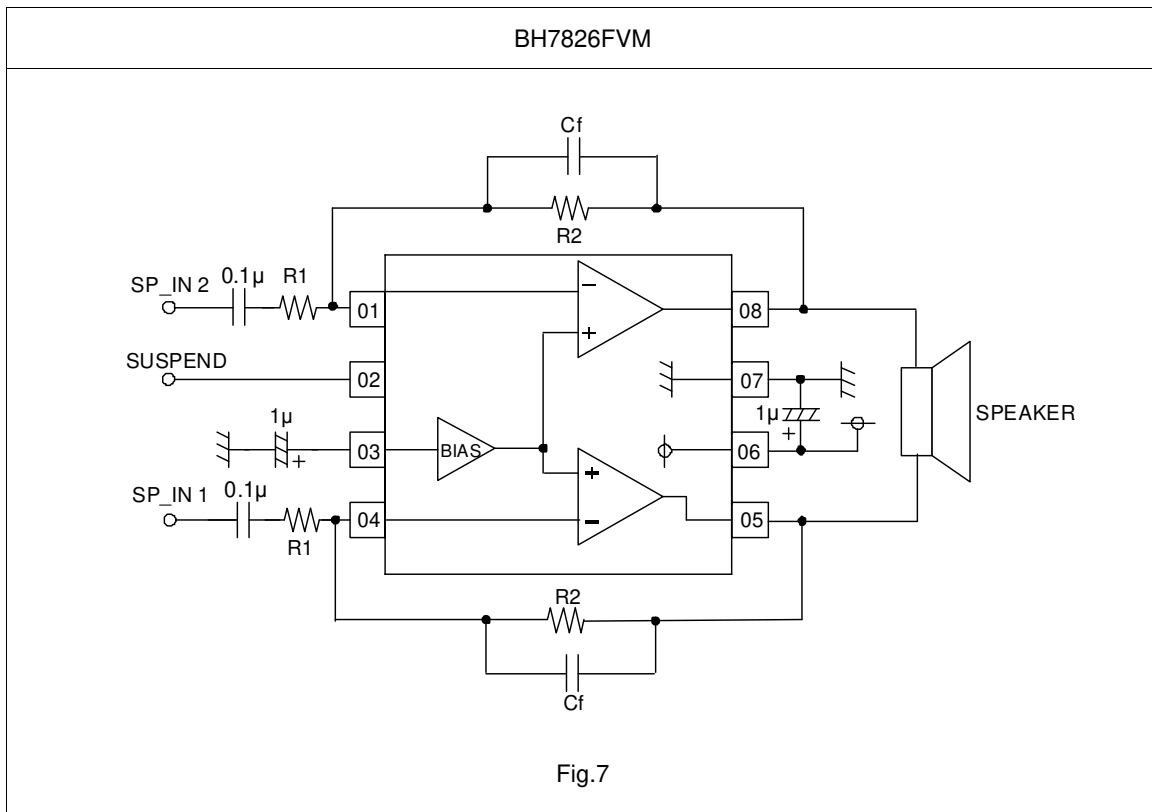
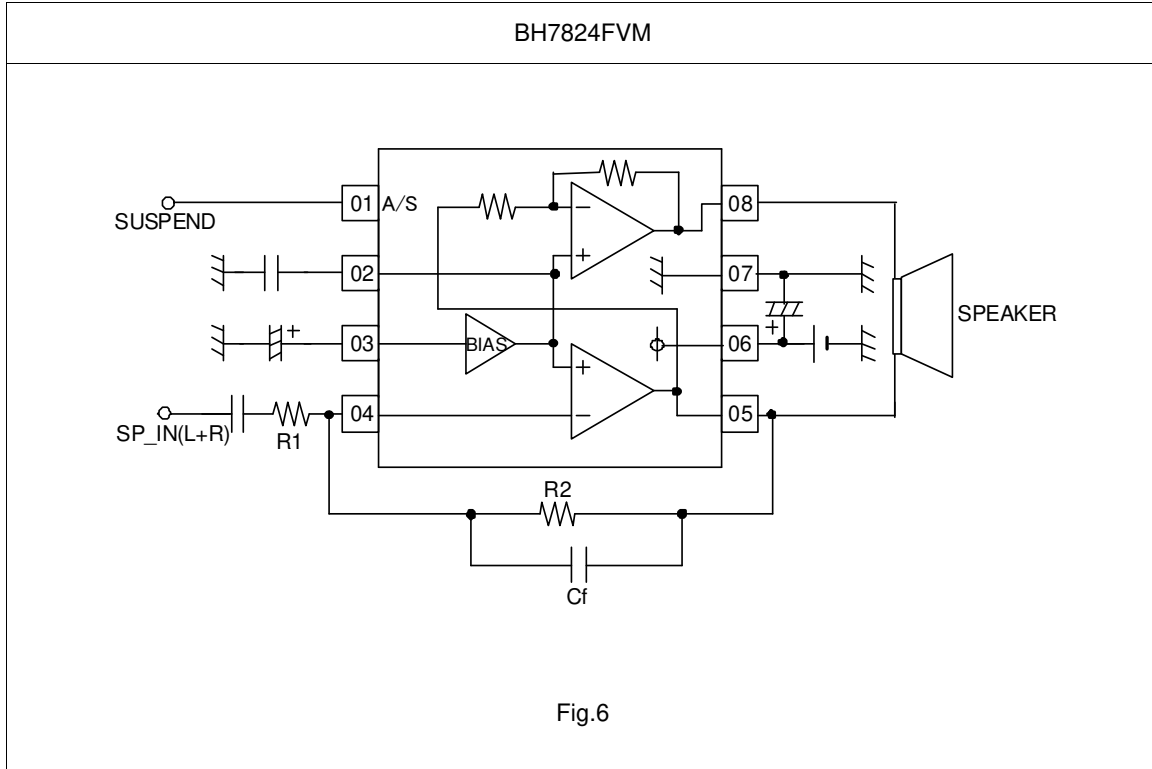
Fig.5 BH7826FVM

●Equivalent circuit

Pin No.	BH7824FVM		BH7826FVM	
	Pin name	Equivalent circuit	Pin name	Equivalent circuit
1	SUSPEND CTRL		SP IN2	
2	BIAS OUT		SUSPEND CTRL	
3	BIAS IN		BIAS IN	
4	SP IN		SP IN1	
5	SP OUT1		SP OUT1	
6	V _{CC}	—	V _{CC}	—
7	GND	—	GND	—
8	SP OUT2		SP OUT2	

Note: Numerical values in figures are design values, and do not guarantee ratings.

● Application circuit



● Functions and Settings of external components

【Function of external components】

① R1

R1 is an input resistor of inverting amplifier which determines closed loop gain with R2.

② R2

R2 is a feedback resistor of inverting amplifier determine closed loop gain with R2. The gain is set by below expression.

$$\text{Gain} = 20 \log \left(\frac{R2}{R1} \right) \text{ [dB]}$$

③ Cf

Cf is feedback capacitor to cut high frequency signals.

It forms a low-pass filter with R2. The cut-off frequency is calculated as below.

$$f_{cL} = \frac{1}{2\pi \times R2 \times Cf} \text{ [Hz]}$$

(注) R1, R2, Cf and f_{cL} has limits in below table. Please set these component values in the ranges.

	Ranges	
Rin	10kΩ ≤ R1 ≤ 120kΩ	
Rf	47kΩ ≤ R2 ≤ 120kΩ	
Cf	Gain > +6dB	Cf ≤ 560pF
	0 < Gain ≤ +6dB	Cf ≤ 270pF
f_{cL}	$f_{cL} \geq 4\text{kHz}$	

④ Cb1 (Cb2 is only BH7824FVM.)

The capacitors stabilize DC bias voltage.

	BH7824FVM	BH7826FVM
Cb1	1μF	1μF
Cb2	0.1μF	—

As Cb1 (or Cb2) becomes larger, power supply rejection ratio is improved but turn on time becomes longer.

As it becomes smaller, turn on time becomes shorter but power supply rejection ratio and cross talk become worse.

⑤ Cin

It is Input coupling capacitor.

The value of the input capacitor directly affects the low frequency performance of the circuit.

The corner frequency of the high pass filter is determined in equation at ③ of next section.

【Configuration of external components】

① Gain

Gain is designed by output power application ask for.

Output power is determined to below.

$$Po[\text{W}] = Vo^2[\text{Vrms}] / RL[\Omega]$$

$$Vo = Gv \cdot Vin$$

$$Gv \geq \sqrt{Po \cdot RL} / Vin$$

② Values of R1 and R2

R1 and R2 are determined to Av.

$$Av = (R2 / R1) \times 2$$

Input impedance (R1) must be probable driven by signal source

③ Input coupling capacitor

Corner frequency of HPF is determined in below.

$$fc[\text{Hz}] = 1 / (2\pi \cdot R1 \cdot Cin)$$

Input coupling is solved by equation of fc.

$$Cin \geq 1 / (2\pi \cdot R1 \cdot fc)$$

【instruction for use carefully】

① Do not connect capacitive load has more than below capacitance between OUT1,2(5,8pin) and GND otherwise oscillation may occurred.

	8, 12Ω Speakers	16Ω speaker
	BH7824FVM / 26FVM	BH7824FVM
Co	Co ≤ 100pF	Co ≤ 47pF

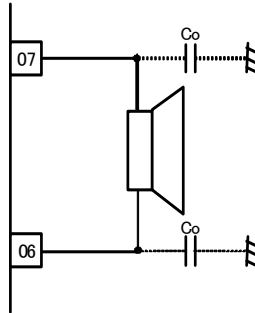
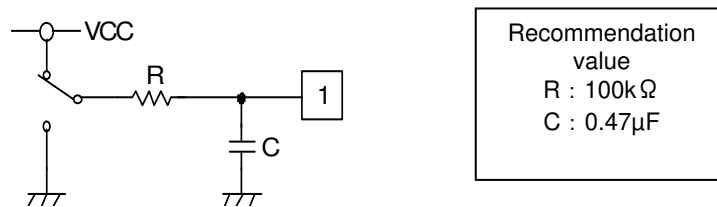


Fig.8 Output connections

② Do not use this IC without a load.

③ This IC is compatible with dynamic speaker loads (8~40Ω : BH7824FVM、8~12Ω : BH7826FVM) and is not compatible with loads other than these mentioned.

④ soft mute setting becomes effective on connecting a resistor and capacitor to the SUSPEND pin (1pin: BH7824FVM, 2pin: BH7826FVM).



Recommendation
value
R : 100kΩ
C : 0.47μF

Fig.9 BH7824FVM application circuit for soft mute

⑤ Place the Vcc decoupling capacitor between VCC(6pin) and GND(7pin) as close to IC as possible.

● Typical characteristics (BH7824FVM)

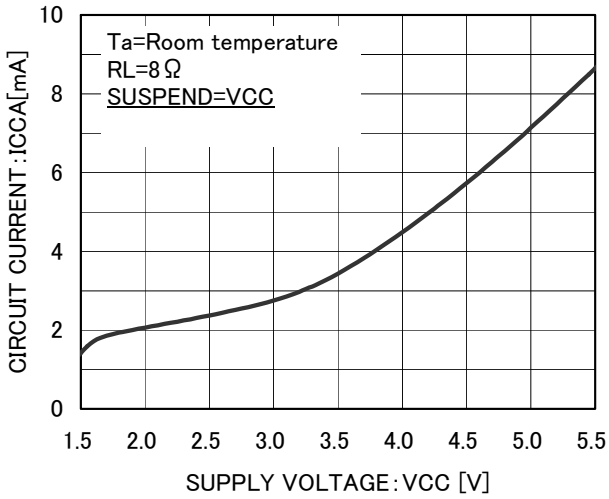


Fig.11 Circuit current (ACTIVE) — Power supply

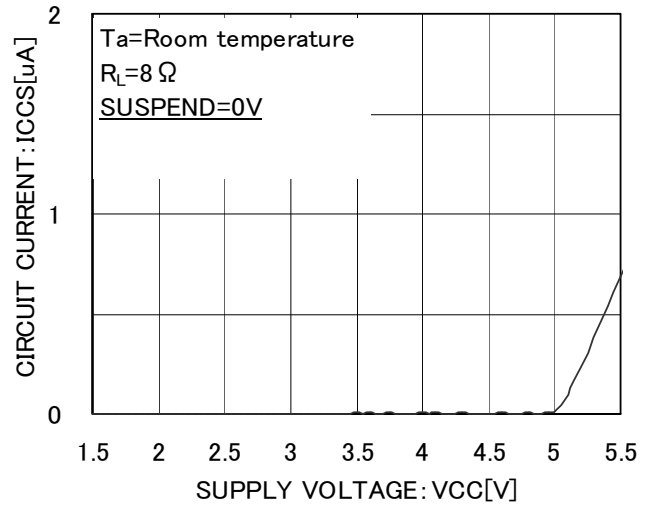


Fig.12 Circuit current (SUSPEND) — Power supply

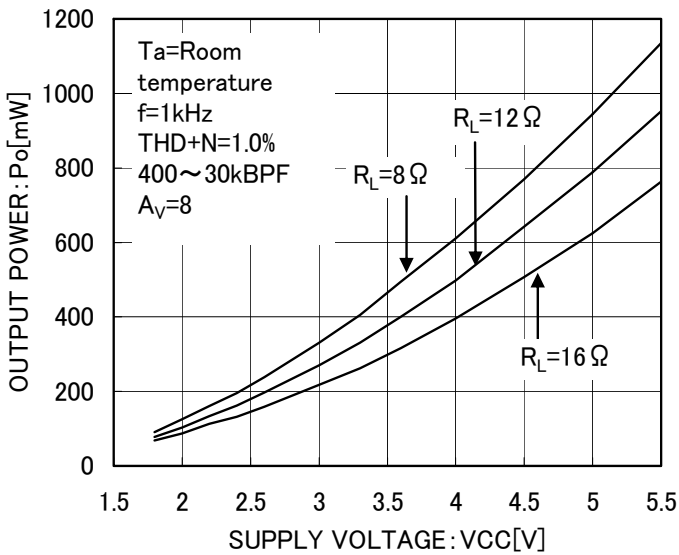


Fig.13 Output power — Power supply

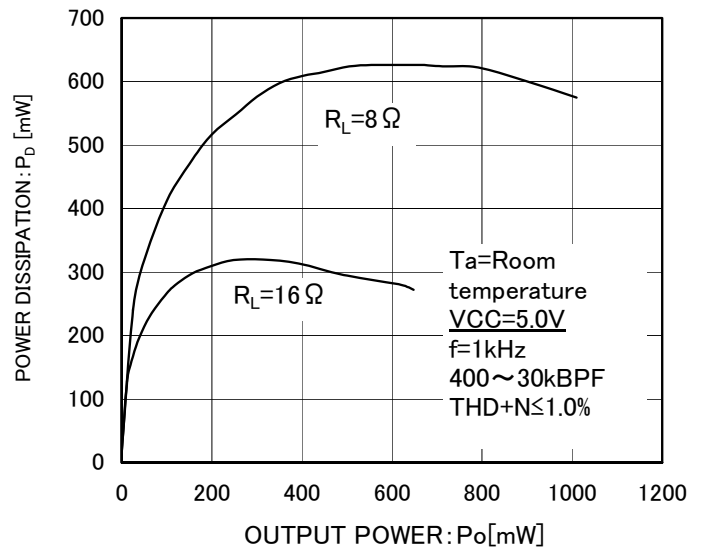


Fig.14 Power dissipation — Output power

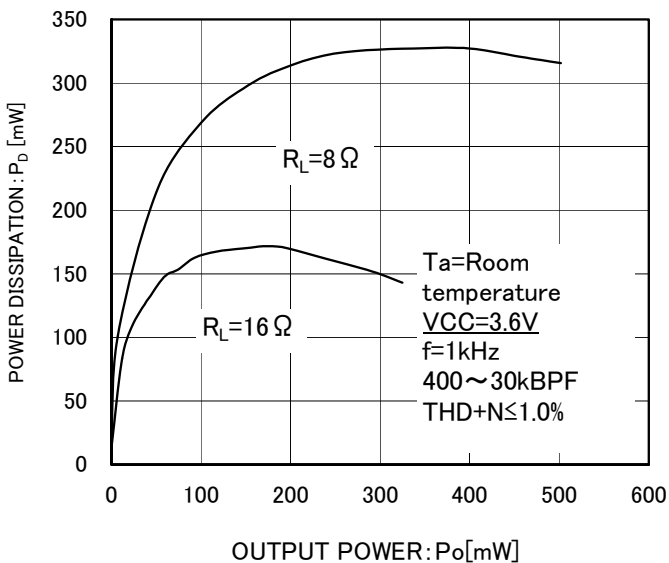


Fig.15 Power dissipation — Output power

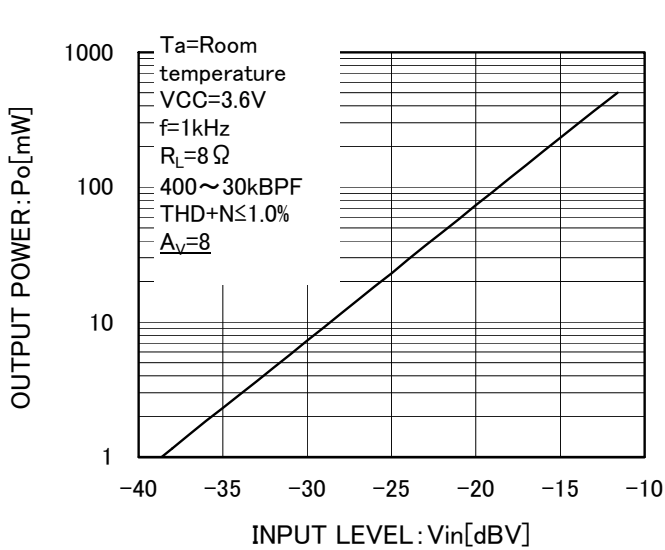


Fig.16 Output Power - Input level

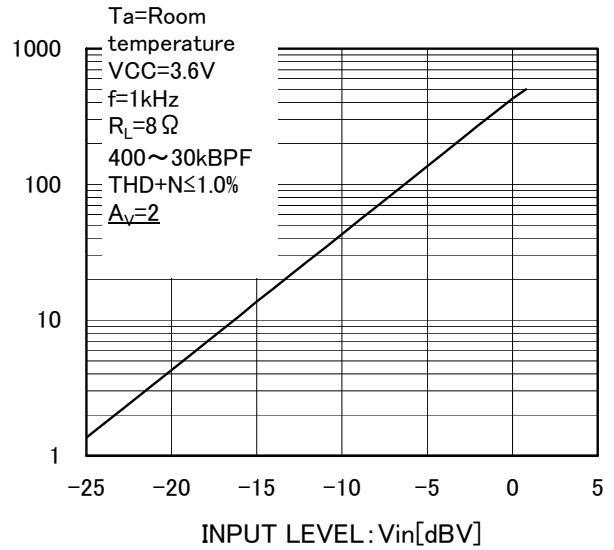


Fig.17 Output Power - Input level

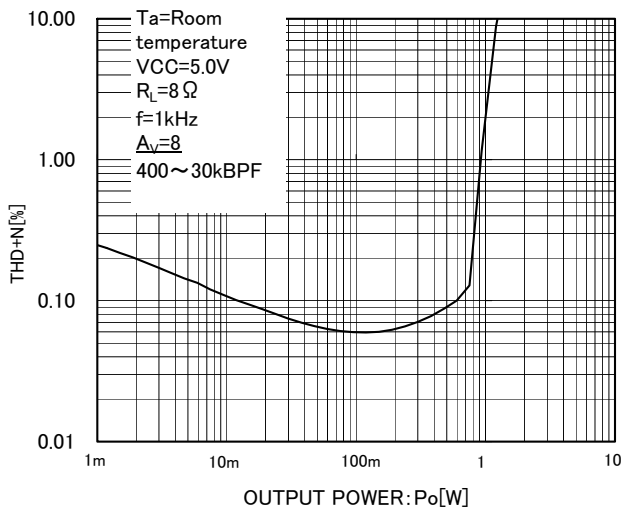


Fig.18 THD + Noise - Output Power

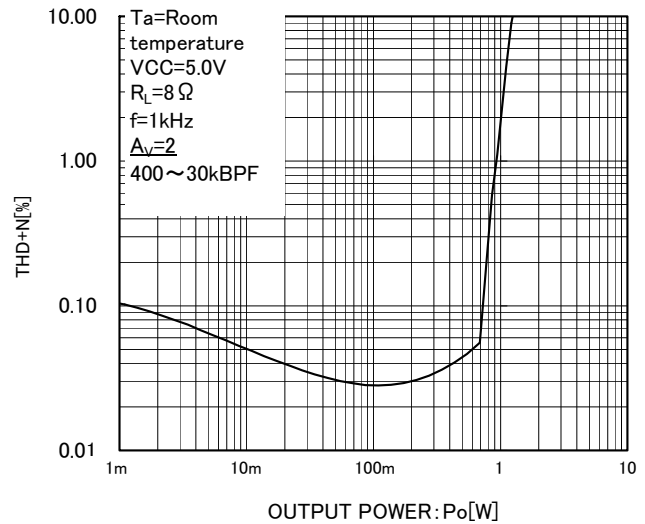


Fig.19 THD + Noise - Output Power

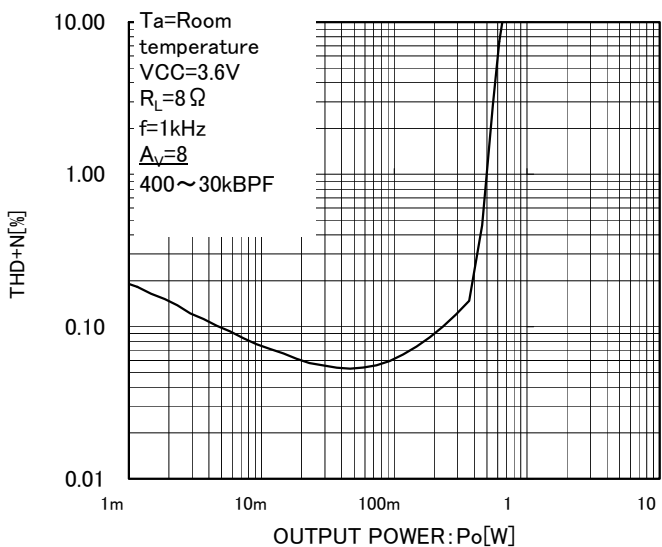


Fig.20 THD + Noise - Output Power

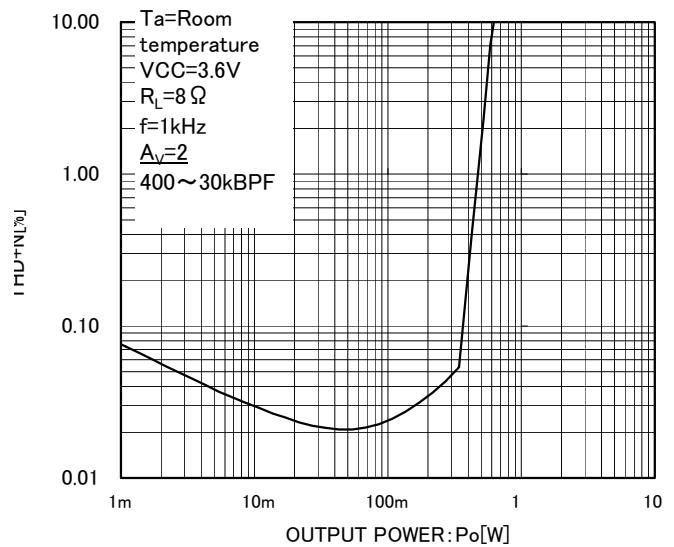


Fig.21 THD + Noise - Output Power

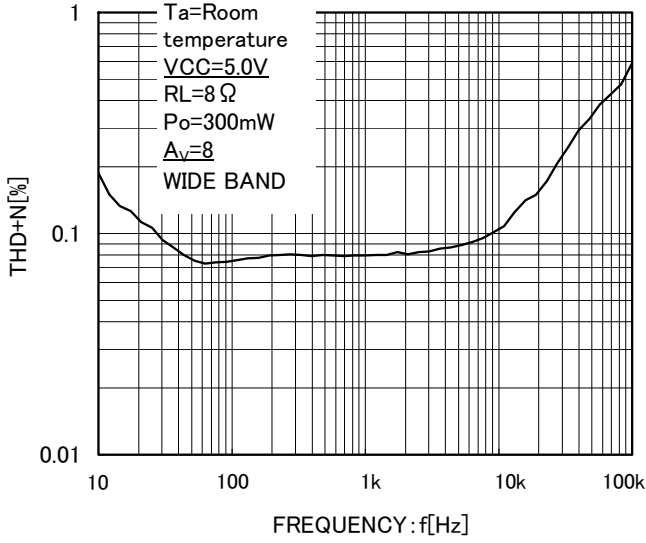


Fig.22 THD + N - Frequency

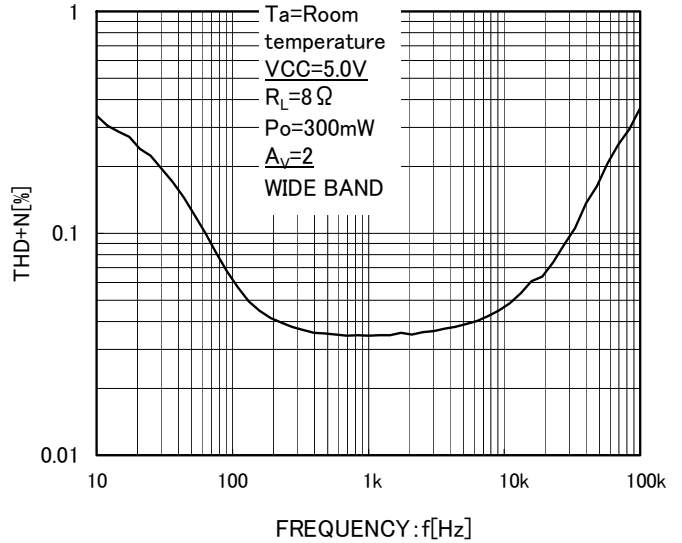


Fig.23 THD + N - Frequency

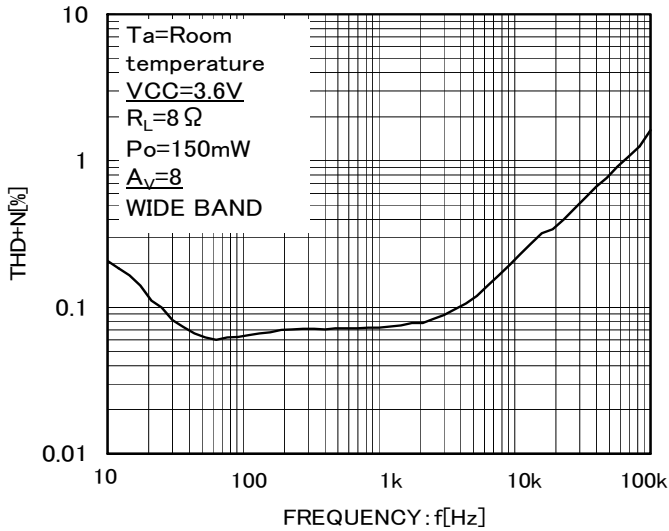


Fig.24 THD + N - Frequency

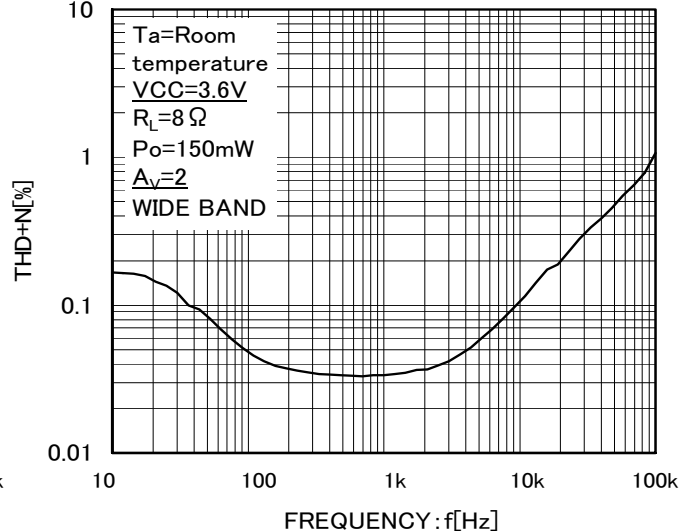


Fig.25 THD + N - Frequency

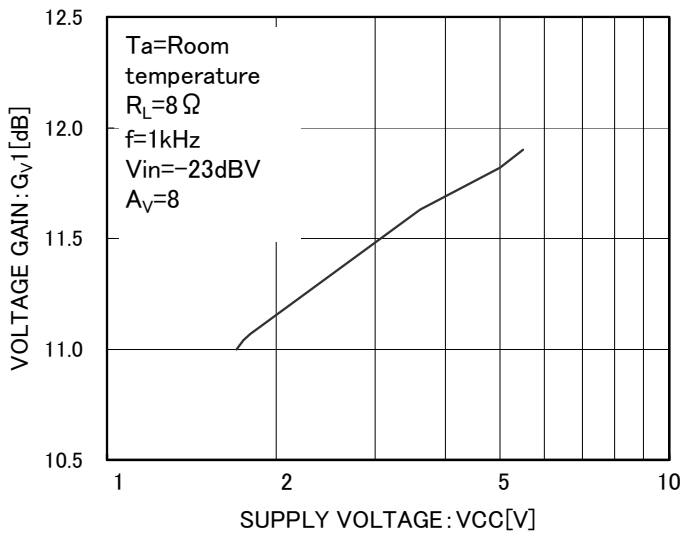


Fig.26 Gain(1stAmp) - Power supply

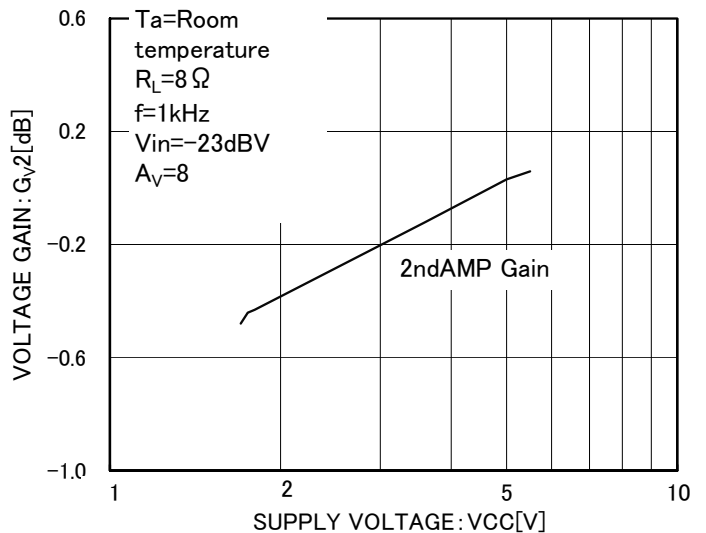


Fig.27 Gain(2ndAmp) - Power supply

※C1: The capacitor connected to SUSPEND terminal

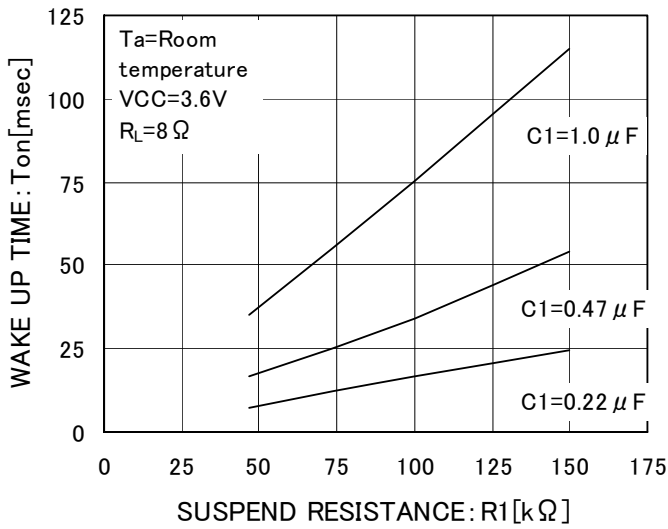


Fig.28 Wake up time — SUSPEND terminal resistance

※C1: The capacitor connected to SUSPEND terminal

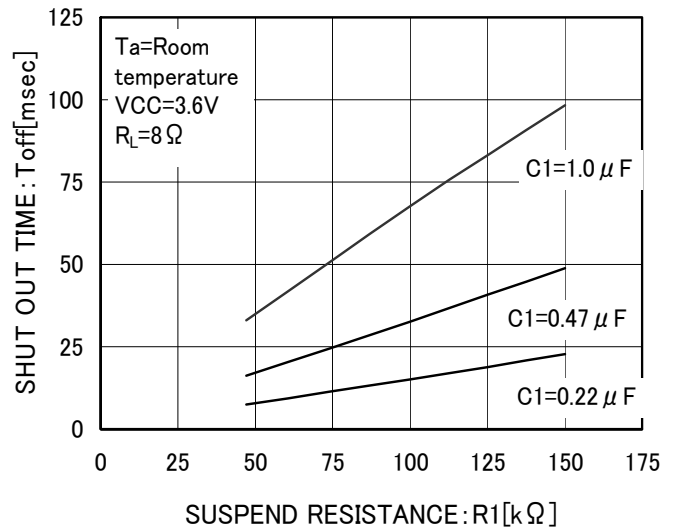


Fig.29 Shut out time — SUSPEND terminal resistance

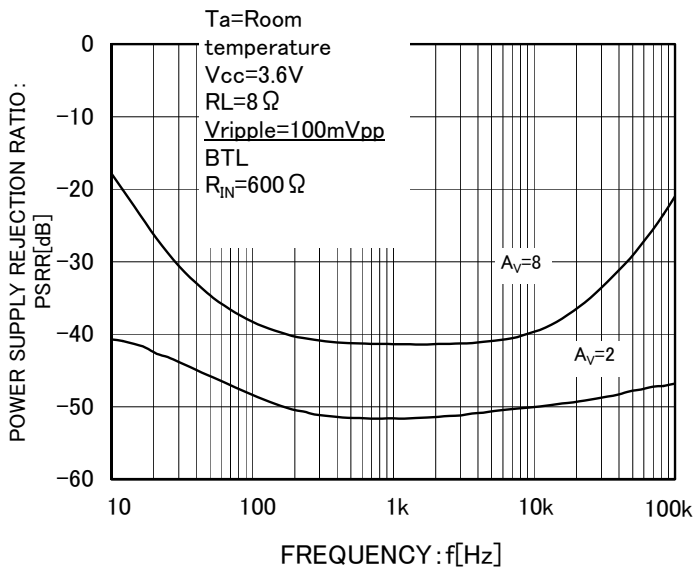


Fig.30 Power Supply Rejection Ratio — Frequency

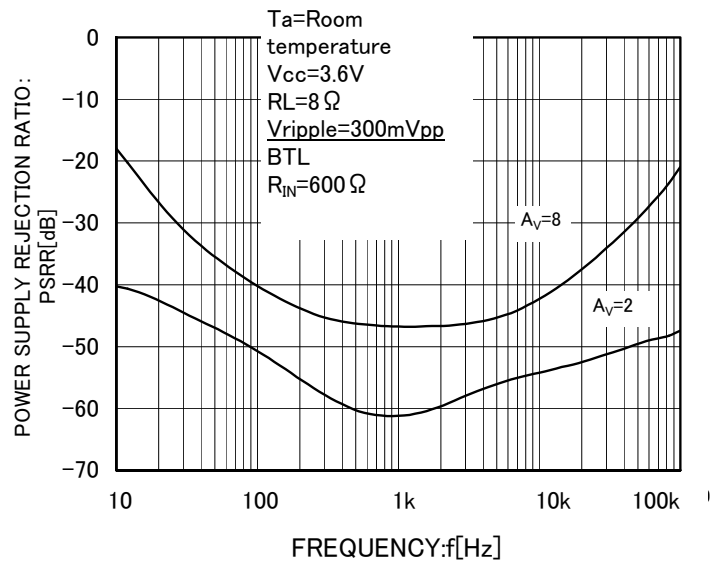
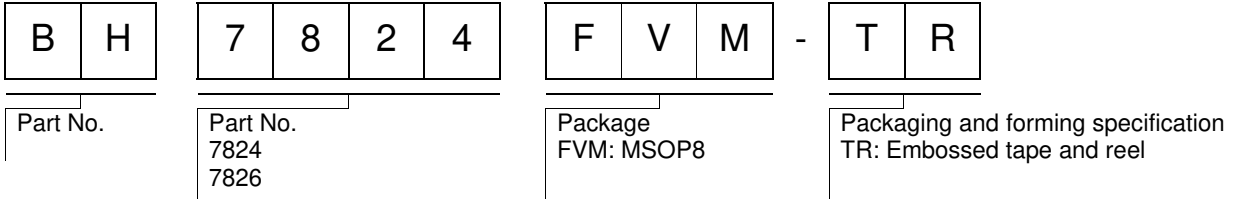


Fig.31 Power Supply Rejection Ratio — Frequency

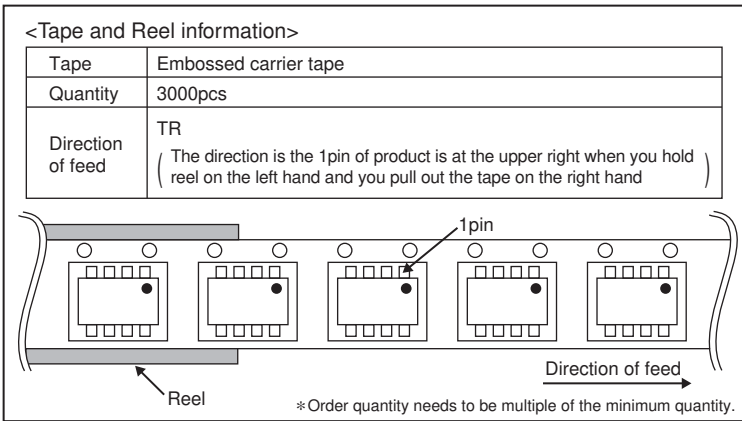
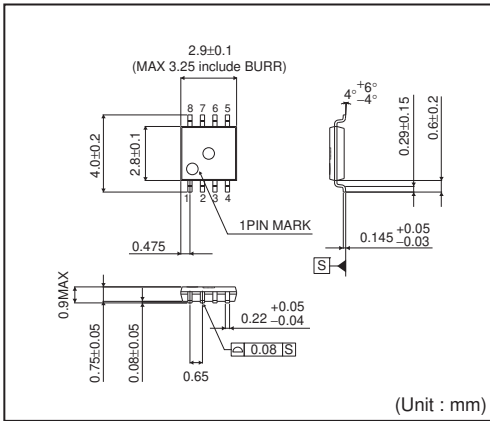
●Notes for use

- 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 (T_{opr}), 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



MSOP8



Notes

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