Sound Processor Series for BOOM BOX / Mini-component Stereo

Multi-function Sound Processor Built-in 5-band Equalizer

BH3874AKS2

Pb Free
ROHM Electronic Components

●Description

The BH3874AKS2 is a multi-function sound processor for mini-audio systems. This processor contains functional components such as, a 4ch input selector, vocal fader, volume, surround, 5-band graphic equalizer, dynamic bass, and a 5-band spectrum analyzer, all integrated into a single chip. A soft-switch is provided to reduce the switching noise generated when switching the volume, vocal fader, surround, and dynamic bass.

●Features

1) A serial control function, operated by the microprocessor, can control 4ch input selector, mode selector, volume, surround, graphic equalizer, dynamic bass, and spectrum analyzer.
2) Built-in functions: surround (stereo, simulated stereo), input/output terminals for Dolby Prologic connections, and BPF for the spectrum analyzer display.
3) Low distortion and low noise achieved by the resistance ladder volume adopting the BiCMOS process.
4) Switching function between the dynamic bass circuit and the biamp circuit.

●Applications

Mini-audio systems and micro-audio systems, BOOM BOX, and TVs.

●Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits	Unit
Power Supply Voltage	Vcc	10.0	V
Power Dissipation	Pd	1200 *	mW
Operating Temperature Range	Topr	-20 to +85	°C
Storage Temperature Range	Tstg	-55 to +125	°C

* Reduced by 12 mW/°C over 25°C, when installed on the standard board (Size: 70×70×1.6mm).

●Operating voltage range

Must function normally at Ta=25°C.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Supply Voltage	Vcc	8.0	9.0	9.5	V

●Electrical characteristics

Ta=25°C, VCC=9V, f=1kHz, Rg=600Ω, RL=10kΩ, Vin=300mVrms, Input Selector=Ach,
Mode Selector=THROUGH, Volume=0dB, Surround=0dB, Graphic Equalizer=0dB, Dynamic Bass=0dB,
Spectrum Analyzer=RESET, unless otherwise noted.

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
Circuit Current	IQ	-	40	60	mA	No signal
Maximum Input Voltage	VIM	0.4	0.7	-	Vrms	THD=1%
Maximum Output Voltage	VOM	2.0	2.5	-	Vrms	THD=1%
Voltage Gain	GV	9	11	13	dB	
Total Harmonic Distortion Ratio	THD	-	0.01	0.05	%	Vin=150mVrms, 400Hz-30kHz BPF
Output Noise Voltage *1	VNO	-	35	50	μVrms	Biamp=0dB, DIN AUDIO
Residual Noise Voltage *1	VMNO	-	5	20	μVrms	Rg=0Ω, Volume =-∞, Biamp=0dB, DIN AUDIO
Cross-talk *1	CT	70	80	-	dB	Biamp=0dB, Rg=0Ω, DIN AUDIO
Channel Balance	CB	-1.5	0	1.5	dB	Referenced to Lch
Selector A-C Input Impedance	RIN	35	50	65	kΩ	
Selector D Input Impedance	RIND	10	20	30	kΩ	
Maximum Volume Attenuation *1	ATTMAX	86	95	-	dB	DIN AUDIO
Vocal Fade Suppression Amount	GVF	25	30	-	dB	
Graphic Equalizer Gain Setting Error (At the setting of ±2dB, ±4dB, ±6dB)	VGQBL	-2	0	2	dB	Vin=100mVrms fin=100, 300, 1k, 3k, or 10kHz
Graphic Equalizer Gain Setting Error (At the setting of ±8dB, ±10dB, ±12dB)	VGQBH	-3	0	3	dB	Vin=100mVrms fin=100, 300, 1k, 3k, or 10kHz
Graphic Equalizer Channel Balance	GQCB	-1.5	0	1.5	dB	Referenced to Lch
Dynamic Bass Boost Gain	VBB	15	18	21	dB	Vin=40mVrms, fin=75Hz 23pin=GND
Dynamic Bass Boost Channel Balance	VBCB	-1.5	0	1.5	dB	Referenced to Lch
Input Separation *1	CTIN	80	90	-	dB	DIN AUDIO
Input Mute Attenuation *1	VINMU	80	90	-	dB	DIN AUDIO
Microphone Voltage Gain	GMIC	17	19	21	dB	Vin=100mVrms
Microphone Mute Attenuation *1	VMICMU	80	90	-	dB	Vin=100mVrms, DIN AUDIO
RECOUT Voltage Gain	GREC	9	11	13	dB	
RECOUT Mute Attenuation *1	VRECMU	80	90	-	dB	DIN AUDIO
Input Selector D ATT Amount	D2ATT	-11	-9	-7	dB	
Surround Maximum Voltage Gain	VSUMAX	7	9	11	dB	Vin=100mVrms, fin=10kHz
Simulated Stereo Maximum Voltage Gain L	VMONL	6.5	8.5	10.5	dB	Vin=100mVrms, fin=680Hz
Simulated Stereo Maximum Voltage Gain R	VMONR	11.3	13.3	15.3	dB	Vin=100mVrms, fin=680Hz
Spectrum Analyzer Maximum Output Level	VMAX	4.0	4.8	-	V	Vin=-19dBV
Spectrum Analyzer Output Offset Voltage	VOS	0	30	200	mV	Vin=0Vrms
Spectrum Analyzer Standard Output Level	VST	0.65	1.35	1.7	V	Vin=-37dBV fin=105, 340, 1k, 3.4k, or 10.5kHz
Ripple Rejection *1	RR	31	-	-	dB	VRR=100mVrms fRR=100Hz, DIN AUDIO

For the measurement marked with *1, VP-9690A (average value wave detection, effective value display) DIN AUDIO filter by Matsushita Communication Industrial Co., Ltd is used.

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

●Timing chart

1. Control Signal Timing Conditions

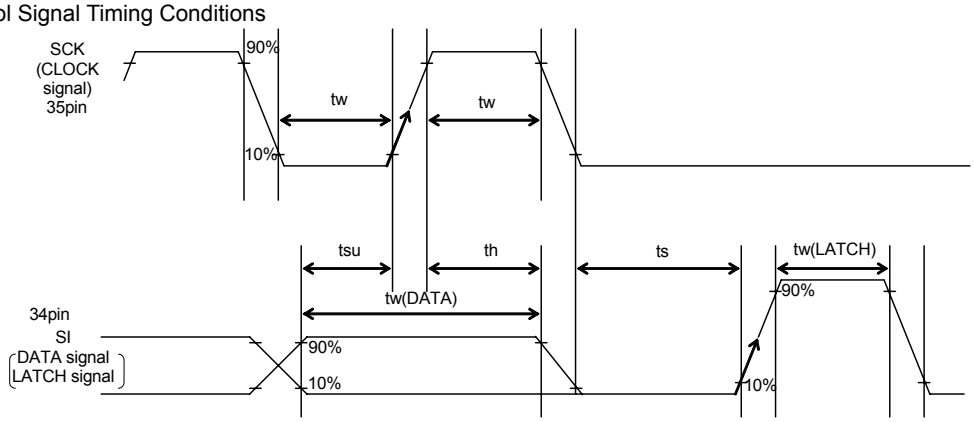


Fig.1

Data (SI) is read on the rising edge of the CLOCK signal.
Data is determined on the rising edge of the LATCH signal.
After sending each serial data, SCK and SI must be set to LOW for the waiting state.
When the CLOCK signal (SCK) is Hi, the LATCH signal is not received.

2. Constants used in the Timing Charts (Ta=25°C)

Parameter	Symbol	Limits			Unit
		Min.	Typ.	Max.	
H Input Voltage	V_{IH}	3.3	5.0	6.0	V
M Input Voltage	V_{IM}	1.8	2.0	2.4	V
L Input Voltage	V_{IL}	-0.3	0	1.2	V
Minimum Clock Width	tw	2.0	-	-	μsec
Minimum Data Width	tw (DATA)	4.0	-	-	μsec
Minimum Latch Width	tw (LATCH)	2.0	-	-	μsec
Set-up Time (DATA→CLOCK)	tsu	1.0	-	-	μsec
Hold Time (CLOCK→DATA)	th	1.0	-	-	μsec
Set-up Time (DATA, CLOCK→LATCH)	ts	1.0	-	-	μsec

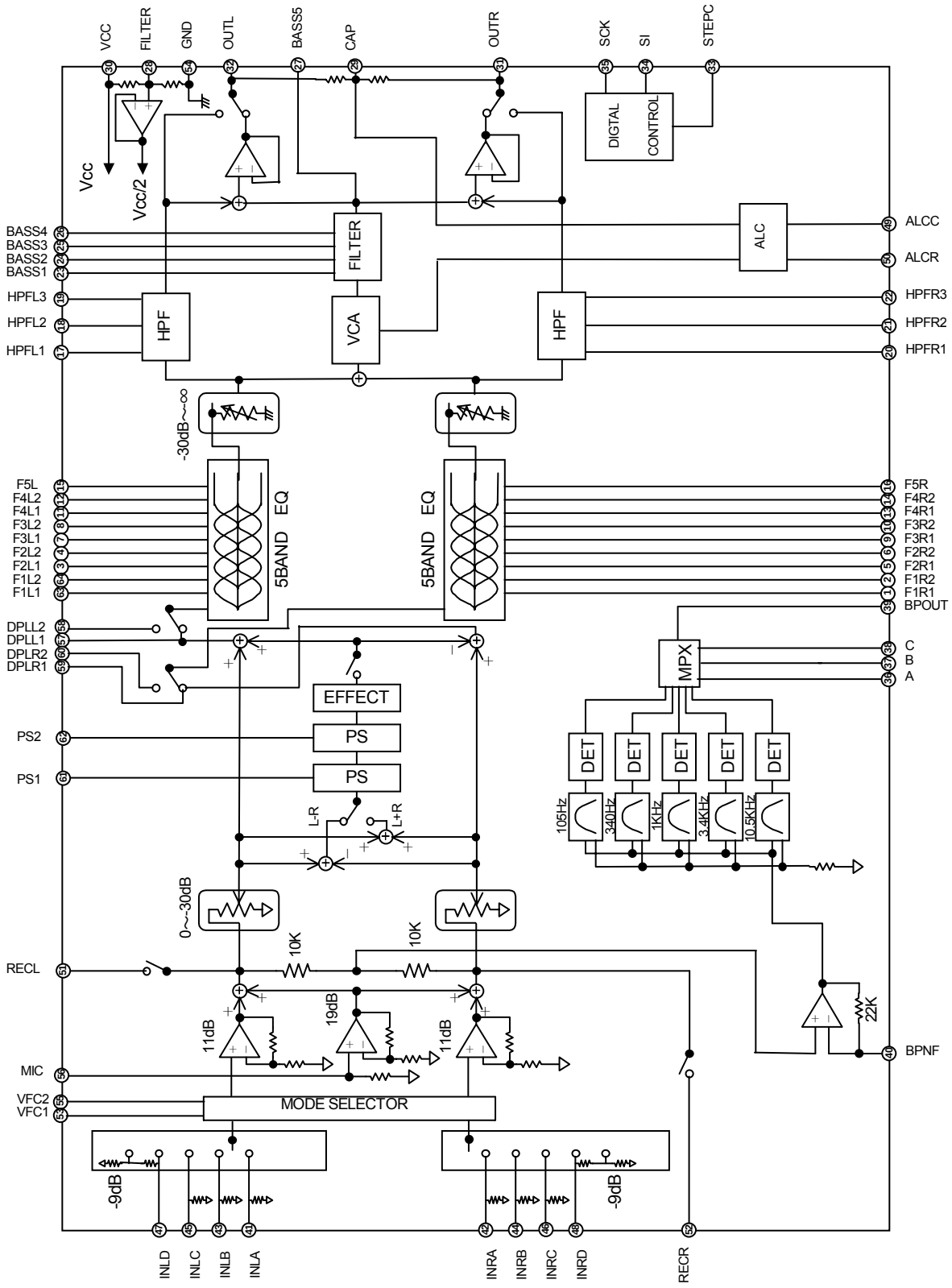
The serial signal SI identifies between DATA and LATCH, based on the difference in voltage levels.
In the application circuits, 3-wire serial data at 0-5V is transformed to 2-wire serial data by voltage conversion, through the external resistance and diode. However, the converted voltage may vary depending on the driving power of the microcomputer or the external components. Therefore, it is recommended to examine all conditions carefully.

3. Serial Data Formats

(1)	D00	D01	D02	D03	D04	D05	D06	D07
	● VOLUME					0	0	0
(2)	D10	D11	D12	D13	D14	D15	D16	D17
	● MODE SELECTOR			MIC	RECOUT	1	0	1
(3)	D20	D21	D22	D23	D24	D25	D26	D27
	● DYNAMIC BASS / Biamp			● SURROUND EFFECT		0	1	1
(4)	D30	D31	D32	D33	D34	D35	D36	D37
	▲ GRAPHIC EQUALIZER f1 / f2				GREQ 0:f1 1:f2	1	0	0
(5)	D40	D41	D42	D43	D44	D45	D46	D47
	▲ GRAPHIC EQUALIZER f3 / f4				GREQ 0:f3 1:f4	0	1	0
(6)	D50	D51	D52	D53	D54	D55	D56	D57
	▲ GRAPHIC EQUALIZER f5				DPL	1	1	0
(7)	D60	D61	D62	D63	D64	D65	D66	D67
	INPUT SELECTOR			SURROUND /STEREO	DYNAMIC BASS /Biamp	0	0	1
(8)	D70	D71	D72	D73	D74	D75	D76	D77
	SPECTRUM ANALYZER			*	*	1	1	1

The functions marked with ● or ▲ are implemented with the noise control measures for the step switching noise. The functions with no mark are not implemented with such measures and, therefore, supplying a mute function is recommended. The mark: ● indicates the adoption of soft-switch technique.

●Block diagram



Output pin for Biamp : 27pin

Input impedance of 58pin and 60pin : 7kΩ

Fig.2

●Application circuit

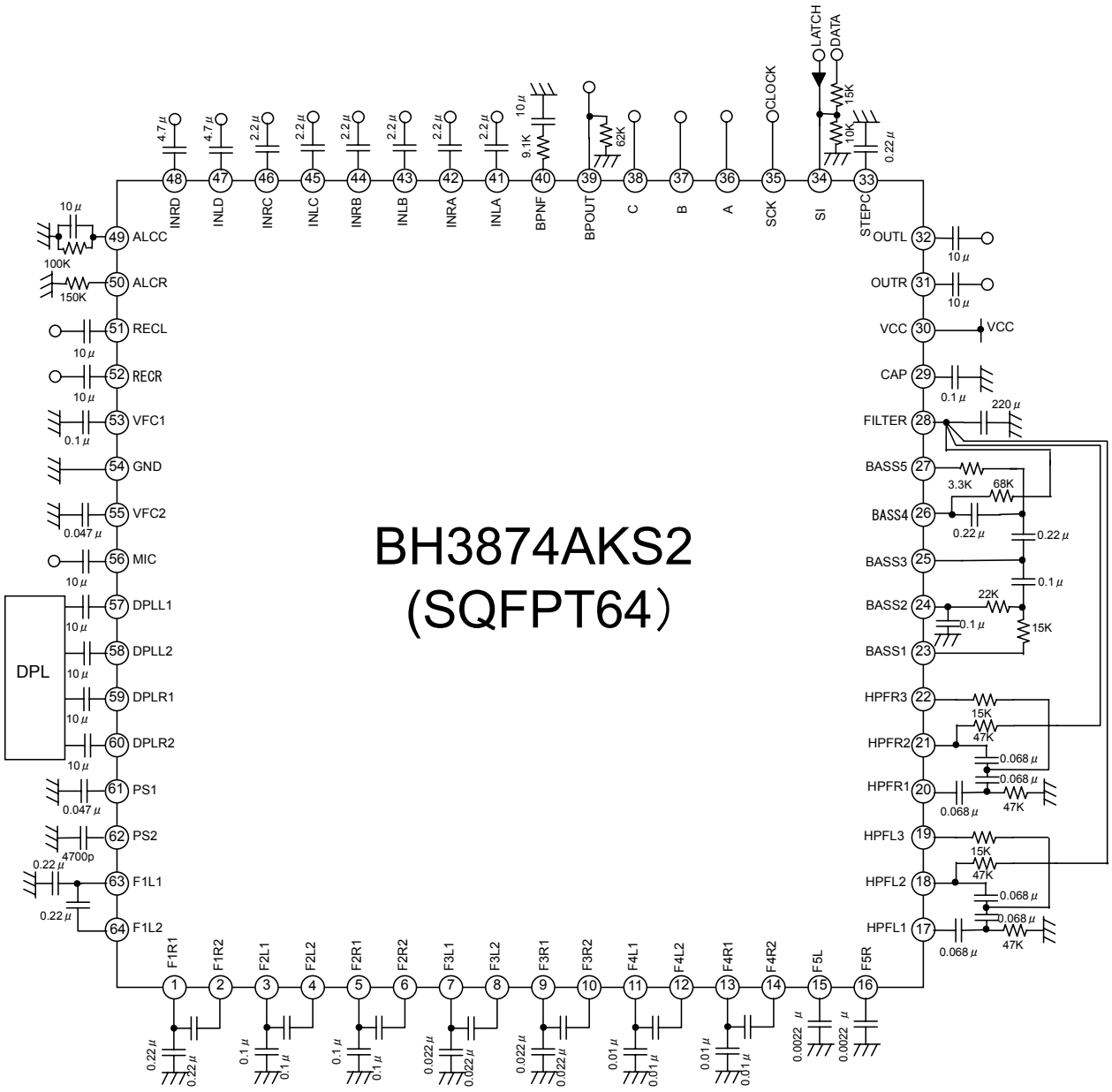


Fig.3

●Reference data

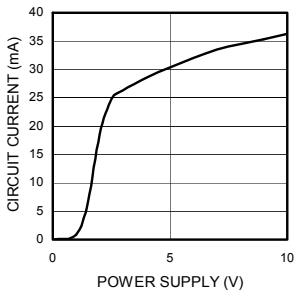


Fig.4 Circuit Current - Power Supply

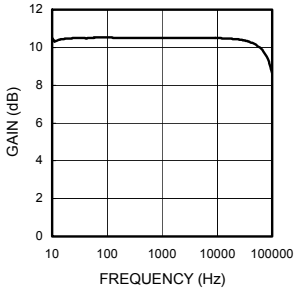


Fig.5 Output Voltage - Frequency

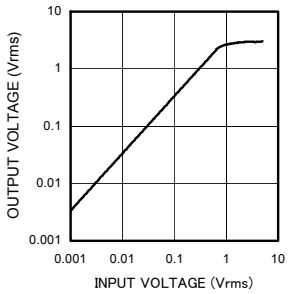


Fig.6 Input/Output Characteristics

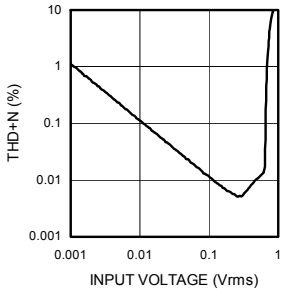


Fig.7 Total Harmonic Distortion - Input Voltage

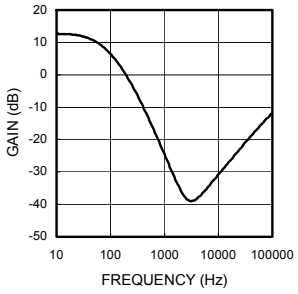


Fig.8 Vocal Fader Suppression Amount

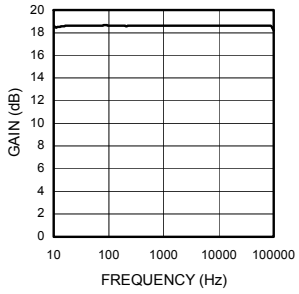


Fig.9 Microphone Voltage Gain - Frequency

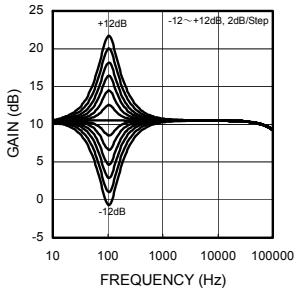


Fig.10 Graphic Equalizer Characteristics 100Hz

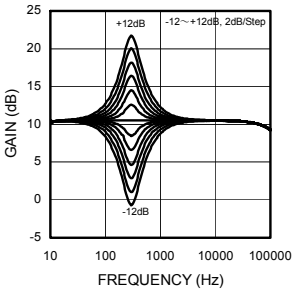


Fig.11 Graphic Equalizer Characteristics 300Hz

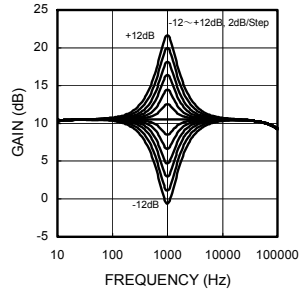


Fig.12 Graphic Equalizer Characteristics 1kHz

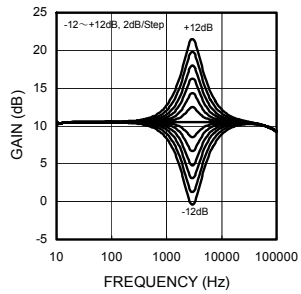


Fig.13 Graphic Equalizer Characteristics 3kHz

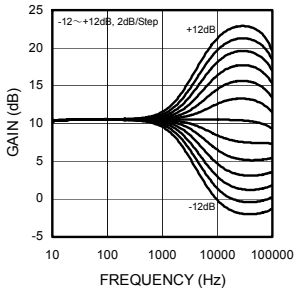


Fig.14 Graphic Equalizer Characteristics 10kHz

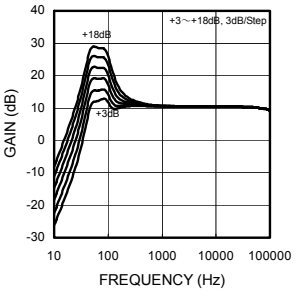


Fig.15 DYNAMIC BASS Characteristics

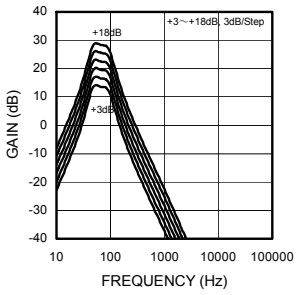


Fig.16 Biamp Characteristics

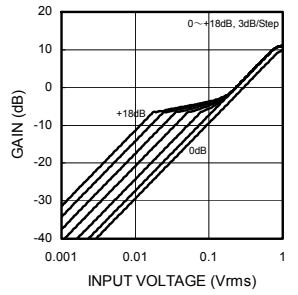


Fig.17 ALC

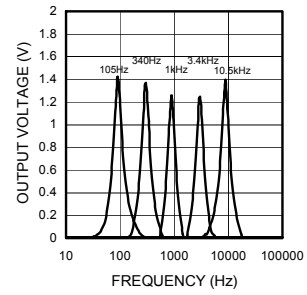
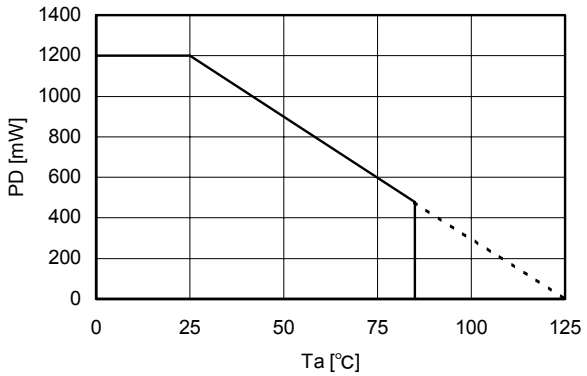


Fig.18 Spectrum Analyzer Output

●**Cautions on 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.
8. Serial control
   Because SC and SI terminals are designed for inputting high-frequency digital signals, wiring and layout patterns should be routed as not to cause interference with the analog-signal-related lines.
9. Ground line
   The IC ground must be connected at one point to the ground line on the set. Common impedance on the ground line may generate noise when switching the functions.
10. Schmidt circuit
    This IC is provided with the Schmidt circuit to provide protection for the logic signal inputs of the DATA (34pin) and CLK (35pin) terminals. Noise control measures against the logic signal lines are enhanced.
11. Power ON/OFF
    It is recommended to activate a mute function on the set to eliminate a pop noise at power ON/OFF.
12. Spectrum analyzer minimum light level
    Output offset voltages may shift due to ambient environment (temperature, stress, etc.). Therefore, when setting the spectrum analyzer minimum light level, an appropriate margin of 30% or more (for the spectrum analyzer output offset voltage: VOS), should be provided.
13. Spectrum analyzer control
    The spectrum analyzers should be controlled in parallel. Controlling them in serial generates noise on the signal outputs. If it is necessary to control in serial, noise measures should be taken into consideration.
14. Serial data input at power ON
    In order to determine the initial state of the IC, serial data should be sent at least two times at power ON.

●Thermal derating characteristic



BH3874AKS2
ROHM standard board packaging time value
Board size: 70×70×1.6mm
Material: Glass epoxy board

Fig.19

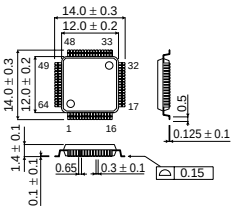
●Selection of order type

B	H	3	8	7	4	A	K	S	2

Part No.
BH3874AKS2

SOFP-T64

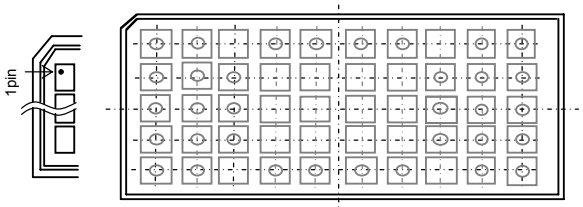
<Dimension>



(Unit:mm)

<Packing information>

Container	Tray(with dry pack)
Quantity	1000pcs
Direction of feed	Direction of product is fixed in a tray.



※Orders are available in complete units only.

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