

Technical Note

Sound Processor Series for Car Audio 6ch Electronic Volume for 5.1ch Car Theater



BD3433K

No.10085EAT01

Description

The 6ch electronic volume for 5.1ch car theater is an electronic volume device incorporating 6ch input selector (front/rear independently-controlled), input gain amp (front/rear independently-controlled), 6ch independently-controlled electronic volume (capable of soft switching), 6ch output gain amp (2-line outputs), differential input for monophonic signals, electronic volume for monophonic signals (capable of soft switching), and mixing circuit for monophonic signals. It is provided with the high performance functions to achieve low distortion and low noise and, furthermore, to output the 5.6Vrms high voltage. The QFP44 package which realizes savings in space and components is used to be suited for applications such as car audio and car navigation.

Features

- 1) High voltage output of 5.6Vrms achieved
 - Provided with 2 lines of outputs to the built-in power amp and the pre-out
- 2) Volume switching noise is reduced by installing the advanced 6ch independently-controlled electronic volume with soft switching.
- 3) High performance capabilities such as low distortion rate (0.001%), low noise (3µVrms)
- 4) Different signals from the different sources can be outputted to the front and rear sections independently and this provides an option of rear-seat entertainment.
- 5) Incorporate the monophonic differential input circuit suited for inputting navigation voice and telephone speech. These monophonic voices can be mixed with the front output signals.
- 6) Adopting the Bi-CMOS process achieves low current consumption, which contributes to energy-saving design. It has the advantage in quality over scaling down and heat reduction of the internal regulators.
- 7) 3-wire serial interface supported for both of 3.3V and 5V microcomputers

Applications

For car audio equipment, car navigation equipment, and hybrid systems.

● Absolute maximum ratings(Ta=25°C)

Item	Symbol	Terminal	Rating	Unit
	VCC-GND	※ 1	10	
Terminal applied voltage	VEE-GND	※ 1	-10	V
	VLGC	Control terminal (CS/SCK/SDA) %1	5.5	
Power dissipation	Pd	*2	850	mW
Operating Temperature	Topr		-40 ~ +85	°C
Storage Temperature	Tastg		-55 ~ +125	°C

%1 : Maximum applied voltage based on GND.

 $\ensuremath{\overset{\scriptstyle\frown}{\times}}2$: Derating is done 8.5mW/°C for Ta>25°C.

Mounted on (Material: FR4 glass epoxy board (beaten-copper area <3%), size:70mm × 70mm × 1.6mm)

※3 : No radiation-proof design

•Operating conditions (Operating condition at Ta=25°C)

Item	Symbol	Terminal	Condition	MIN	TYP	MAX	Unit
Operating power supply veltage	VCC	VCC-GND	×1	7.0	9	9.5	V
Operating power supply voltage	VEE	VEE-GND	×1	-9.5	-9	-7.0	V

※1: When it is within operating temperature, basic circuit function is guaranteed within operating voltage. However, setting constant and element, voltage setting, and temperature setting are required when in operation. Other than the condition stipulated within the range, the standard value of electrical characteristics could not be guaranteed, while original function is retained.

•Electrical characteristics

Abbreviations :

"Giaj" : Setting value of Input gain adjustor

"Vol.Ex" : Setting value of volume for monaural signal

"Goajb" : Setting value of output gain adjustor B

Measurement condition (Unless specified particularly) :

"Vol" : Setting value of volume (1~6ch)
"Goaja" : Setting value of output gain adjustor A
"Mix" : ON/OFF setting for mixing switch.

Ta=25°C, VCC=9V, VEE=-9V, Vin=1Vrms/1kHz, Load resistance=10k Ω , Load capacitance=10pF, Giaj=0dB, Vol=0dB, Goaja=0dB, Goajb=0dB, Vol.Ex=- ∞ dB, Mix=OFF

General characteristics

Item	Symbol	Condition		TYP	MAX	Unit
Current consumption	ICC		-	10	17	mA
Current consumption			-17	-9	-	
VCO oscillation frequency	Fvco		-	400	-	kHz
Pipple rejection	RRc	Ripple = 0.1Vrms/ 1kHz (Input terminal AC short)	40	85	-	dB
	RRe	Ripple= 0.1Vrms/ 1kHz (Input terminal AC short)	30	70	-	dB
Reset operation voltage	VRS	Initialize all register data by Vcc <vrs vcc="" →="">VRS</vrs>	-	3.4	-	V
Required time for Power on reset	TPOR	Minimum required time to reach 3V after Vcc voltage ON.		-	-	µsec

Logic circuit

Item	Symbol	Terminal	MIN	TYP	MAX	Unit
"H" level input voltage	VIH	CS, SCK, SDA	2.3	-	5.5	V
"L" level input voltage	VIL	CS, SCK, SDA	0	-	1.0	V
Input clock frequency	f _{SCK}	SCK	-	-	1.5	MHz

Volume circuit

Item	Symbol		Cor	ndition			MIN	TYP	MAX	Unit
Voltage gain	GV						-1	0	1	dB
Bandwidth	FW	Frequency 1kHz	, which	drop	-1c	IB towards	100	-	-	kHz
Slew rate	SR						-	1.65	-	V/µsec
Maximum input voltage	VIM	THD+N =	1% , Vo	l = -10)dB		3.8	4.25	-	Vrms
	VOM1		1%				3.8	4.25	-	
Maximum output voltage	VOM2	$V_{0} = \pm 10c$	I 70 IB	Goaja	a=+2	2.5dB	5	5.6	-	Vrms
	VOM3	100		Goajb)=-4	.5dB	2.2	2.5	-	
Input impedance	RI						70k	100k	130k	Ω
Output impedance	RO						-	-	50	Ω
Input gain setting value error	EGI	Output refe Giaj=6, 12	erence i dB, Vin	s Giaj: =0.1V	=0d ′rms	B	-1	0	1	dB
Volume	EV1	odB out ard	Vol=+2 (+23~ at Vin=	23~+1, -1~-20dB ~+1dB =0.1Vrms)		-1.0	0	1.0		
setting value error	EV2		U U D Vol=-21~-40dB			-1.5	0	1.5	dB	
3	EV3	Sto Sta	Vol=-41~-60dB			-2.0	0	2.0		
	EV4		Vol=-61~-79dB			-3.0	0	3.0		
Volume maximum attenuation	VMU	Vol=-∞dB	Vol=-∞dB (mute), BW=20~20kHz				-	-108	-85	dB
Output gain	EGOA	ija= =0dB put dard	Goaja=	Goaja=+2.5dB		-1	0	1	-6	
setting value error	EGOB	Goa Goajb Out stanc	Goajb=	Goajb=-4.5dB		-1	0	1	ав	
Gain balance between channels	СВ						-1	0	1	dB
Cross-talk between channels	СТС	BW=20~2 (Input term	20kHz ninal AC	short))		85	106	-	dB
Output noise voltage	VNO		icht		١	/ol=0dB	-	2.5	10	
Residual output noise voltage	VNR	(Input terminal AC short) Vol=-∞dB		-	2	10	μVrms			
THD+N	THD	BW=20~2	20kHz, ∖	/out=1	l Vrn	ns	-	0.001	0.05	%
	Tss1				0.6	4 msec/dB	-	0.64	-	
Soft switching	Tss2	Soft owitch			1.2	8 msec/dB	-	1.28	-	msec
transition time	Tss3	SOIL SWITCH	ing.ON		2.5	6 msec/dB	-	2.56	-	/dB
	Tss4	5.12 msec/dB			-	5.12	-			

Monaural signal circuit

Common condition unless specified particularly :

Vol=-∞dB, Giaj=Goaja= Goajb=0dB, Vol.Ex=0dB, Mix=ON

Item	Symbol	,	Cond	ition	MIN	TYP	MAX	Unit
Voltage gain	GVe	Phase i	nversion betwe	en input and output	-1.0	0	1.0	dB
Maximum input voltage	VIMe	THD+N	=1%, Vol.Ex=	-10dB	3.8	4.25	-	Vrms
Input impedance	Rle					27	35	kΩ
	EVe1	:0dB ut ard	M Vol=+15~+1, -1~-20dB 영 국 면 (+15~+1dB at Vin=0.1Vrms)		-1.0	0	1.0	
Volume setting value error	EVe2	utpu nda	Vol=-21~-400	В	-1.5	0	1.5	dB
-	EVe3	ol.E Sta	Vol=-41~-600	В	-2.0	0	2.0	
	EVe4	>	> Vol=-61~-63dB		-3.0	0	3.0	
Volume maximum attenuation	VMUe	Vol.Ex=-∞dB (mute) , BW=20~20kHz				-108	-85	dB
Output noise voltage	VNOe	BW=A-Weight (Input terminal AC short) $Vol.Ex = 0dB$ $Vol.Ex = -\infty dB$		Vol.Ex = 0dB	-	4.5	15	
Residual noise voltage	VNRe			Vol.Ex = -∞dB	-	3.5	10	µvrms
THD+N	THDe	BW=20	BW=20~20kHz, Vout=1Vrms			0.002	0.05	%
Common-mode signal rejection ratio	CMRR	BW=20~20kHz		40	60	-	dB	
	Tsse1			0.64 msec/dB	-	0.64	-	
Soft switching	Tsse2	Soft swi	Soft switching:ON 1.28 msec/dB		-	1.28	-	msec
transition time	Tsse3	SULSW		2.56 msec/dB	-	2.56	-	/dB
	Tsse4	5.12 msec/dB		5.12 msec/dB	-	5.12	-	

Timing chart



• When CS is "Low", enable micro computer control data (SCK/SDA). (It doesn't work, when it is "High"),

Data (SDA) reads at a leading edge of clock (SCK).

· Latch reads at a leading edge of CS. (SCK has to be kept as "High" after D0 acquisition)

External Dimension



QFP44 (Unit : mm)

•Terminal Number, Terminal name:

Terminal Number	Terminal name						
1	AGNDE	12	INBFR	23	OUTAFR	34	DGND
2	INAFL	13	AGND4	24	OUTAC	35	SDA
3	INAFR	14	INBC	25	OUTASW	36	SCK
4	AGND1	15	INBSW	26	OUTARL	37	CS
5	INAC	16	AGND5	27	OUTARR	38	TEST
6	INASW	17	INBRL	28	OUTBFL	39	ADJ
7	AGND2	18	INBRR	29	OUTBFR	40	VEE
8	INARL	19	AGND6	30	OUTBC	41	AGNDM
9	INARR	20	SOUTRL	31	OUTBSW	42	VCC
10	AGND3	21	SOUTRR	32	OUTBRL	43	INEX+
11	INBFL	22	OUTAFL	33	OUTBRR	44	INEX-

Block diagram



Notes for use

1. Absolute Maximum Ratings;

It may cause failure if operation is beyond absolute maximum ratings of applied voltage or operating temperature. In case of failure, it is not possible to set short mode or open mode. If particular mode requires beyond absolute maximum ratings, please take a physical safety measure.

2. VEE electrical potential

Please minimize electrical potential of VEE terminal under any operational condition.

3. Thermal design

Please consider power dissipation (Pd) on actual operational condition and provide enough margins for thermal design.

4. Operation in intense electric field

Please note that malfunction may occur if operation is under intense electric field.

Ordering part number



QFP44



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.

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CLASSⅣ	CLASSIII	CLASSⅢ	CLASSI	

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 - [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 Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [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 lonizer, 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.

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

Precaution for Disposition

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- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
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