

STRUCTURE: Silicon monolithic integrated circuits
 PRODUCT: Stereo Class-D Power Amplifier For Speaker
 TYPE: **BD5431EFS**
 PACKAGE: HTSSOP-A44
 FEATURES:

- 1) Differential Analog / PWM inputs
- 2) High efficiency and low heat generation eliminates external heat-sinks
- 3) Eliminates pop noise generated when the power supply goes on/off, or when the power supply is suddenly shut off
- 4) High quality muting performance is realized by using the soft-switching technology
- 5) Incorporates a master/slave function that enables synchronous operation when several units are used simultaneously
- 6) Allows the internal PWM sampling clock frequency to be adjusted

○Absolute maximum ratings (Ta=25°C)

Item	Symbol	Limit	Unit	Conditions
Supply voltage	V _{CC}	+20	V	Pin7、8、15、16、29、30、37、38、40 ※1 ※2
Power dissipation	P _d	2.0	W	※3
		4.5	W	※4
Input voltage for signal pin	V _{IN}	-0.2 ~ +7.2	V	Pin1、2、3、4 ※1
Input voltage for control pin	V _{CONT}	-0.2 ~ V _{CC} +0.2	V	Pin20、24 ※1
Input voltage for clock pin	V _{OSC}	-0.2 ~ +7.2	V	Pin23 ※1
Operating temperature range	T _{opr}	-40 ~ +85	°C	
Storage temperature range	T _{stg}	-55 ~ +150	°C	
Maximum junction temperature	T _{jmax}	+150	°C	

※1 The voltage that can be applied, based on GND(Pin11, 12, 33, 34, 43)

※2 Do not, however exceed P_d and T_{jmax}=150°C.

※3 70mm × 70mm × 1.6mm, FR4, 1-layer glass epoxy board (Copper on bottom layer 0%)
Derating in done at 16mW/°C for operating above Ta=25°C. There are thermal vias on the board.

※4 70mm × 70mm × 1.6mm, FR4, 2-layer glass epoxy board (Copper on bottom layer 100%)
Derating in done at 36mW/°C for operating above Ta=25°C. There are thermal vias on the board.

○Operating conditions (Ta=25°C)

Item	Symbol	Limit	Unit	Conditions
Supply voltage	V _{CC}	+10 ~ +16.5	V	Pin7、8、15、16、29、30、37、38、40 ※1
Load impedance	R _L	4 ~ 16	Ω	※5

※5 Do not, however exceed P_d.

※ No radiation-proof design

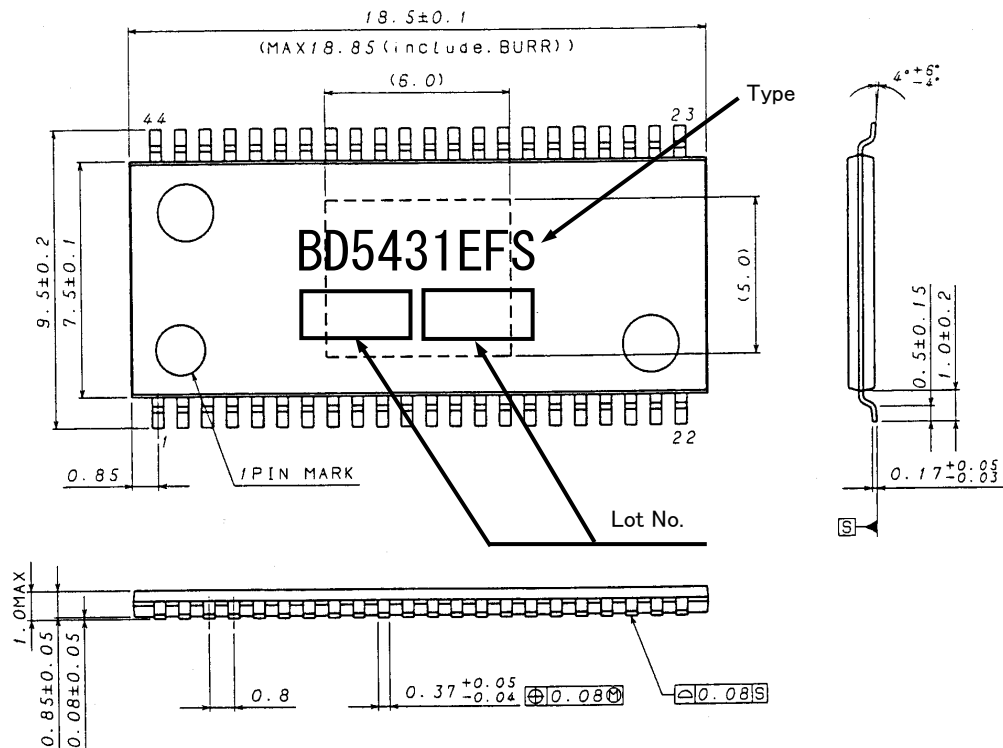
○Electrical characteristics

(Unless otherwise specified Ta=25°C, Vcc=12V, f=1kHz differential analog input, Rg=0Ω, RL=8Ω, MUTEX=H, MS=L)

Item	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
Whole circuit						
Circuit current 1 (Sampling mode)	I _{CC1}	–	25	50	mA	
Circuit current 2 (Mute mode)	I _{CC2}	–	10	20	mA	MUTEX=L
Control circuit						
H level input voltage	V _{IH}	2.3	–	12	V	MUTEX, MS
L level input voltage	V _{IL}	0	–	0.8	V	MUTEX, MS
Audio circuit						
Voltage gain	G _v	22	23.5	25	dB	P _O =1W, 20log(V _{out} /V _{in})
Maximum output power 1	P _{O1}	–	10	–	W	R _L =8Ω, THD+n=10% ※1
Maximum output power 2	P _{O2}	–	17	–	W	R _L =4Ω, THD+n=10% ※1
Total harmonic distortion	THD	–	0.1	–	%	P _O =1W, BW=20Hz~20kHz ※1
Crosstalk	CT	60	75	–	dB	P _O =1W, R _g =0Ω, BW=IHF-A
Output noise voltage (Sampling mode)	V _{NO}	–	60	160	μ Vrms	R _g =0Ω, BW=IHF-A
Residual noise voltage (Mute mode)	V _{NOM}	–	1	10	μ Vrms	MUTEX=L, R _g =0Ω, BW=IHF-A
Internal sampling clock frequency	F _{OSC}	180	250	320	kHz	

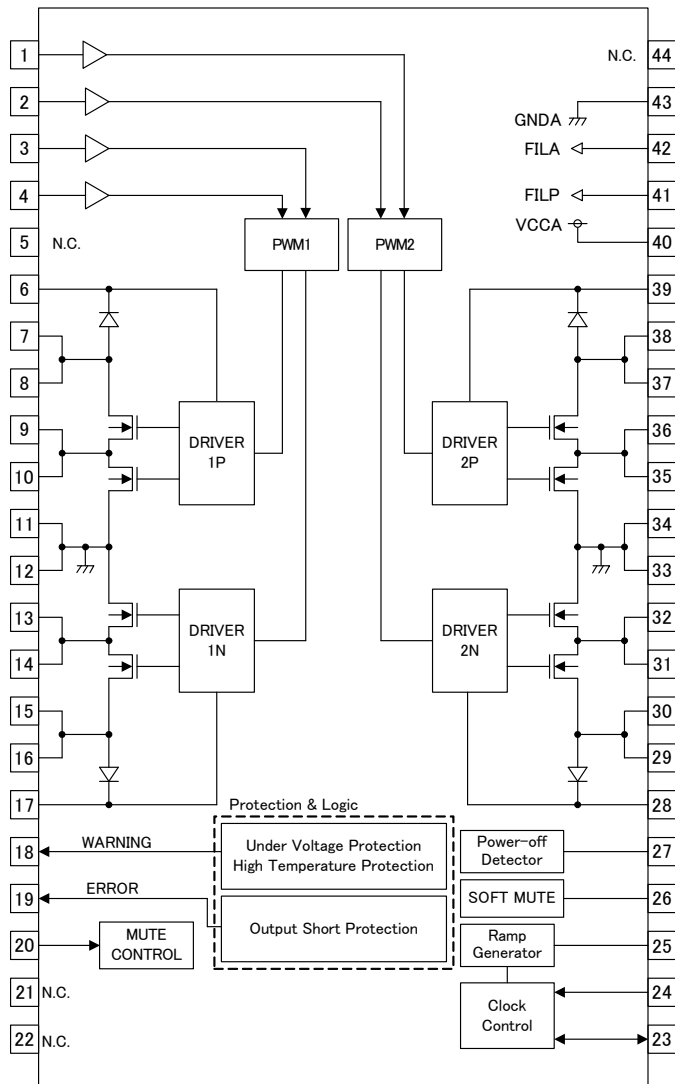
※1 These items show the typical performance of device and depend on board layout, parts, power supply.
The standard value is in mounting device and parts on surface of ROHM's board directly.

○Package outline



(UNIT: mm)
PKG: HTSSOP-A44
Drawing No.: EX195-5002

○Block diagram



○Pin No. / Pin name

Pin No.	Pin name	Pin No.	Pin name
1	IN2N	44	N.C.
2	IN2P	43	GND
3	IN1N	42	FILA
4	IN1P	41	FILP
5	N.C.	40	VCCA
6	BSP1P	39	BSP2P
7	VCCP1P	38	VCCP2P
8		37	
9	OUT1P	36	OUT2P
10		35	
11	GNDP1	34	GNDP2
12		33	
13	OUT1N	32	OUT2N
14		31	
15	VCCP1N	30	VCCP2N
16		29	
17	BSP1N	28	BSP2N
18	WARNING	27	VHOLD
19	ERROR	26	TM
20	MUTEX	25	ROSC
21	N.C.	24	MS
22	N.C.	23	OSC

N.C. : Non Connection.

Operation Notes

(1) Absolute maximum ratings

Use of the IC in excess of absolute maximum ratings such as the applied voltage or operating temperature range 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 use of the IC in a special mode where the absolute maximum ratings may be exceeded is anticipated.

(2) Power supply lines

As return of current regenerated by back EMF of output coil happens, take steps such as putting capacitor between power supply and GND as a electric pathway for the regenerated current. Be sure that there is no problem with each property such as emptied capacity at lower temperature regarding electrolytic capacitor to decide capacity value. If the connected power supply does not have sufficient current absorption capacity, regenerative current will cause the voltage on the power supply line to rise, which combined with the product and its peripheral circuitry may exceed the absolute maximum ratings. It is recommended to implement a physical safety measure such as the insertion of a voltage clamp diode between the power supply and GND pins.

(3) GND potential

Ensure a minimum GND pin potential in all operating conditions.

(4) Setting of heat

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions. This IC exposes its frame of the backside of package. Note that this part is assumed to use after providing heat dissipation treatment to improve heat dissipation efficiency. Try to occupy as wide as possible with heat dissipation pattern not only on the board surface but also the backside.

Class-D power amplifier is High efficiency and low heat generation by comparison with conventional Analog power amplifier. However, In case it is operated continuously by maximum output power, Power dissipation(Pdiss) may exceed package dissipation. Please consider about heat design that Power dissipation(Pdiss) does not exceed Package dissipation(Pd) in average power(Poav). (Tjmax : Maximum junction temperature=150°C、Ta : Peripheral temperature[°C]、θja : Thermal resistance of package[°C/W]、Poav: Average power[W]、η : Efficiency)

$$\text{Package dissipation: } P_d \text{ (W)} = (T_{j\max} - T_a) / \theta_{ja}$$

$$\text{Power dissipation: } P_{\text{diss}} \text{ (W)} = P_{\text{oav}} * (1 / \eta - 1)$$

(5) Actions in strong magnetic field

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

(6) Thermal shutdown circuit

This product is provided with a built-in thermal shutdown circuit. When the thermal shutdown circuit operates, the output transistors are placed under open status. The thermal shutdown circuit is primarily intended to shut down the IC avoiding thermal runaway under abnormal conditions with a chip temperature exceeding Tjmax = 150°C, and is not intended to protect and secure an electrical appliance.

(7) Shorts between pins and misinstallation

When mounting the LSI on a board, pay adequate attention to orientation and placement discrepancies of the LSI. If it is misinstalled and the power is turned on, the LSI may be damaged. It also may be damaged if it is shorted by a foreign substance coming between pins of the LSI or between a pin and a power supply or a pin and a GND.

(8) Power supply on/off

In case power supply is started up, MUTEX(Pin20) always should be set LOW, And in case power supply is shut down, it should be set LOW likewise. Then it is possible to eliminate pop noise when power supply is turned on/off. And also, all power supply terminals should start up and shut down together.

(9) WARNING terminal(Pin18), ERROR terminal(Pin19)

A WARNING flag is outputted when Under Voltage Protection and High Temperature Protection are operated. A Error flag is outputted when Output Short Protection and Output DC Voltage Protection are operated. These flags are the function which the condition of this product is shown in. The use which aimed at the protection except for this product is prohibition.

(10) N.C. terminal(Pin5, 21, 22, 44)

N.C. terminal(Non Connection Pin) does not connect to the inside circuit. Therefore, please open or connect to GND.

Notes

No copying or reproduction of this document, in part or in whole, is permitted without the consent of ROHM Co.,Ltd.

The content specified herein is subject to change for improvement without notice.

The content specified herein is for the purpose of introducing ROHM's products (hereinafter "Products"). If you wish to use any such Product, please be sure to refer to the specifications, which can be obtained from ROHM upon request.

Examples of application circuits, circuit constants and any other information contained herein illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

Great care was taken in ensuring the accuracy of the information specified in this document. However, should you incur any damage arising from any inaccuracy or misprint of such information, ROHM shall bear no responsibility for such damage.

The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM and other parties. ROHM shall bear no responsibility whatsoever for any dispute arising from the use of such technical information.

The Products specified in this document are intended to be used with general-use electronic equipment or devices (such as audio visual equipment, office-automation equipment, communication devices, electronic appliances and amusement devices).

The Products specified in this document are not designed to be radiation tolerant.

While ROHM always makes efforts to enhance the quality and reliability of its Products, a Product may fail or malfunction for a variety of reasons.

Please be sure to implement in your equipment using the Products safety measures to guard against the possibility of physical injury, fire or any other damage caused in the event of the failure of any Product, such as derating, redundancy, fire control and fail-safe designs. ROHM shall bear no responsibility whatsoever for your use of any Product outside of the prescribed scope or not in accordance with the instruction manual.

The Products are not designed or manufactured to be used with any equipment, device or system which requires an extremely high level of reliability the failure or malfunction of which may result in a direct threat to human life or create a risk of human injury (such as a medical instrument, transportation equipment, aerospace machinery, nuclear-reactor controller, fuel-controller or other safety device). ROHM shall bear no responsibility in any way for use of any of the Products for the above special purposes. If a Product is intended to be used for any such special purpose, please contact a ROHM sales representative before purchasing.

If you intend to export or ship overseas any Product or technology specified herein that may be controlled under the Foreign Exchange and the Foreign Trade Law, you will be required to obtain a license or permit under the Law.



Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact us.

ROHM Customer Support System

<http://www.rohm.com/contact/>