

# Vocal fader IC

## BA3837 / BA3837F / BA3838F

The BA3837, BA3837F and BA3838F are ICs with an internal secondary active LPF for vocal cancellation functions and mixing amplifier functions with high degrees of vocal cancellation. Three control pins are used to switch between modes: the key controller input mode, through mode, vocal fader mode, sound multiplexing mode and mute mode. By offering these functions on a single chip, these ICs can significantly reduce the number of external components.

●Applications

Karaoke functions on stereo systems, portable stereos and VCRs

●Features

- 1) Single-chip IC with vocal fader, to erase vocals from commercially available recordings.
- 2) Internal secondary active LPF for high degrees of vocal cancellation (high synchronization rejection).
- 3) Three control pins for switching between 4 modes: through, vocal fader, sound multiplexing and mute.
- 4) Key controller input and internal switches.
- 5) Low noise and low distortion.
- 6) Internal microphone mixing amplifier.
- 7) Available in two packages: DIP 16-pin and SOP 16-pin (BA3838F is available in SOP 16-pin only).

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>cc</sub>	18	V
Power dissipation	DIP16	1000*1	mV
	SOP16	550*2	
Operating temperature	Topr	- 40 ~ + 85	°C
Storage temperature	Tstg	- 55 ~ + 125	°C

\*1 Reduced by 10 mW for each increase in Ta of 1°C over 25°C.

\*2 Reduced by 5.5mW for each increase in Ta of 1°C over 25°C.

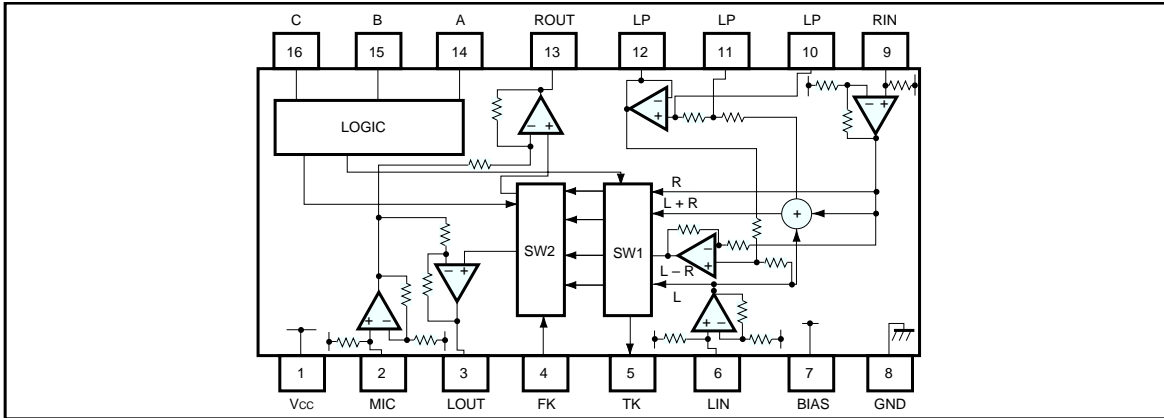
●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Power supply voltage*1	V <sub>cc</sub>	5.4	—	10	V	Ta = - 40°C ~ + 85°C
Power supply voltage*1	V <sub>cc</sub>	5.4	—	13	V	Ta = - 40°C ~ + 60°C
Power supply voltage*2	V <sub>cc</sub>	4.0	—	15	V	Ta = 25°C

\*1 BA3837 and BA3837F

\*2 BA3838F

●Block diagram



● Pin descriptions

Pin No.	Pin name	Equivalent circuit	Function
1	Vcc		
2	MIC IN		Mixing input pin for microphone sound
3	LOUT		Lch output pin
4	FK		Input pin for key controller signals
5	TK	<p>BA3837 / BA3837F</p> <p>BA3838F</p>	Output pin for key controller signals

Pin No.	Pin name	Equivalent circuit	Function
6	LIN		L signal input pin
7	BIAS		Signal bias circuit pin
8	GND		
9	RIN		R signal input pin
10	LPF1		LPF time constant pin
11	LPF2		LPF time constant pin

Pin No.	Pin name	Equivalent circuit	Function
12	LPF3		LPF output pin
13	ROUT		R output pin
14	CONTA		Mode switching pin A
15	CONTB		Mode switching pin B
16	CONTC		Mode switching pin C

## ●Electrical characteristics

BA3837 / F (unless otherwise noted, Ta = 25°C, Vcc = 10V, f<sub>IN</sub> = 1kHz, V<sub>IN</sub> = 150mV, R<sub>L</sub> = 100kΩ)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I <sub>Q</sub>	1.6	2.4	3.3	mA	Through mode
Maximum output voltage	V <sub>OM</sub>	2.3	2.8	—	V <sub>rms</sub>	THD = 1%, through mode
L / R gain	G <sub>VT</sub>	10	14	17	dB	Through mode
Low frequency gain	G <sub>VF</sub>	10	14	17	dB	f <sub>in</sub> = 50kHz, vocal fader mode
Microphone gain	G <sub>VM</sub>	5	8	11	dB	—
Crosstalk	CT	54	70	—	dB	f <sub>in</sub> = 1kHz
Mute attenuation	MU	73	80	—	dB	f <sub>in</sub> = 1kHz
Vocal suppression rate	SV	28	33	—	dB	Vocal fader mode
Total harmonic distortion	THD	—	0.02	0.07	%	Through mode, BW : 400Hz - 30kHz
Noise level	V <sub>N</sub>	—	15	22	μV <sub>rms</sub>	R <sub>g</sub> = 0, DIN AUDIO
Input impedance	R <sub>IN</sub>	35	50	65	kΩ	LIN, RIN, MICIN, FK
Control pin threshold (high)	V <sub>thH</sub>	4.7	—	—	V	—
Control pin threshold (low)	V <sub>thL</sub>	—	—	0.3	V	—
Output switching DC differential	ΔDC	—	7	26	mV	Maximum output voltage differential between L, R and TK modes

○ Not designed for radiation resistance.

Mode table (A = pin14, B = pin15, C = pin16)

A	B	C	LOUT	ROUT	TK	Mode	Key controller mode
0	0	0	MUTE	MUTE	MUTE	Mute	—
0	0	1	VF	VF	VF	Vocal fader mode	—
0	1	0	L	L	L	Sound multiplexing mode	—
0	1	1	L	R	L	Through mode	—
1	0	0	MUTE	MUTE	MUTE	Mute	●
1	0	1	KC	KC	VF	Vocal fader mode	●
1	1	0	KC	KC	L	Sound multiplexing mode	●
1	1	1	KC	KC	L + R	L + R	●

0 : 0V    1 : 5V

VF : vocal fader output

KC : signal passed through key controller

(1) Microphone output is not muted during muting (ABC = 000 or 100).

(2) Gain and relative phase: See block diagram.

1. L / R input and output in the through mode are synchronous with a gain of 14dB.
2. L / R input and TK output in the key controller mode are synchronous with a gain of 8dB.
3. FK input and L / R output in the key controller mode are synchronous with a gain of 6dB.
4. MIC input and L / R output are negative phase with a gain of 8dB.

BA3838F (unless otherwise noted, Ta = 25°C, Vcc = 10V, f<sub>IN</sub> = 1kHz, V<sub>IN</sub> = 150mV, R<sub>I</sub> = 100Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I <sub>Q</sub>	1.9	2.7	3.6	mA	Through mode
Maximum output voltage	V <sub>om</sub>	2.3	2.8	—	V <sub>rms</sub>	THD = 1%, through mode
L / R gain	G <sub>VT</sub>	10	14	17	dB	Through mode
Low frequency gain	G <sub>VF</sub>	10	14	17	dB	f <sub>IN</sub> = 50kHz, vocal fader mode
Microphone gain	G <sub>VM</sub>	5	8	11	dB	—
Crosstalk	CT	54	70	—	dB	f <sub>IN</sub> = 1kHz
Vocal suppression rate	SV	28	33	—	dB	Vocal fader mode
Total harmonic distortion	THD	—	0.02	0.07	%	Through mode, BW : 400Hz - 30kHz
Noise level	V <sub>N</sub>	—	15	22	μV <sub>rms</sub>	R <sub>g</sub> = 0, DIN AUDIO, through mode
Input impedance	R <sub>IN</sub>	35	50	65	kΩ	LIN, RIN, MICIN, FK
Control pin threshold (high)	V <sub>thH</sub>	4.7	—	—	V	—
Control pin threshold (low)	V <sub>thL</sub>	—	—	0.3	V	—
Output switching DC differential	ΔDC	—	7	46	mV	Maximum output voltage differential between L, R and TK modes

○ Not designed for radiation resistance.

Mode table (A = pin14, B = pin15, C = pin16)

A	B	C	LOUT	ROUT	TK	Mode	Key controller mode
0	0	0	R	R	R	Sound multiplexing mode (ROUT)	—
0	0	1	VF	VF	VF	Vocal fader mode	—
0	1	0	L	L	L	Sound multiplexing (LOUT)	—
0	1	1	L	R	L	Through mode	—
1	0	0	KC	KC	R	Sound multiplexing (R)	●
1	0	1	KC	KC	VF	Vocal fader mode	●
1	1	0	KC	KC	L	Sound multiplexing mode (L)	●
1	1	1	KC	KC	L + R	L + R	●

0 : 0V 1 : 5V

VF : vocal fader output

KC : signal passed through key controller

\* Gain and relative phase: See block diagram.

- Gain of L / R input and output in the through mode: 14 dB (synchronous)
- Gain of L / R input and TK output in the key controller mode: 8dB (synchronous)
- Gain of FK input and L / R output in the key controller mode: 6dB (synchronous)
- MIC input and L / R output are negative phase with a gain of 8dB.

● Measurement circuit (BA3838F)

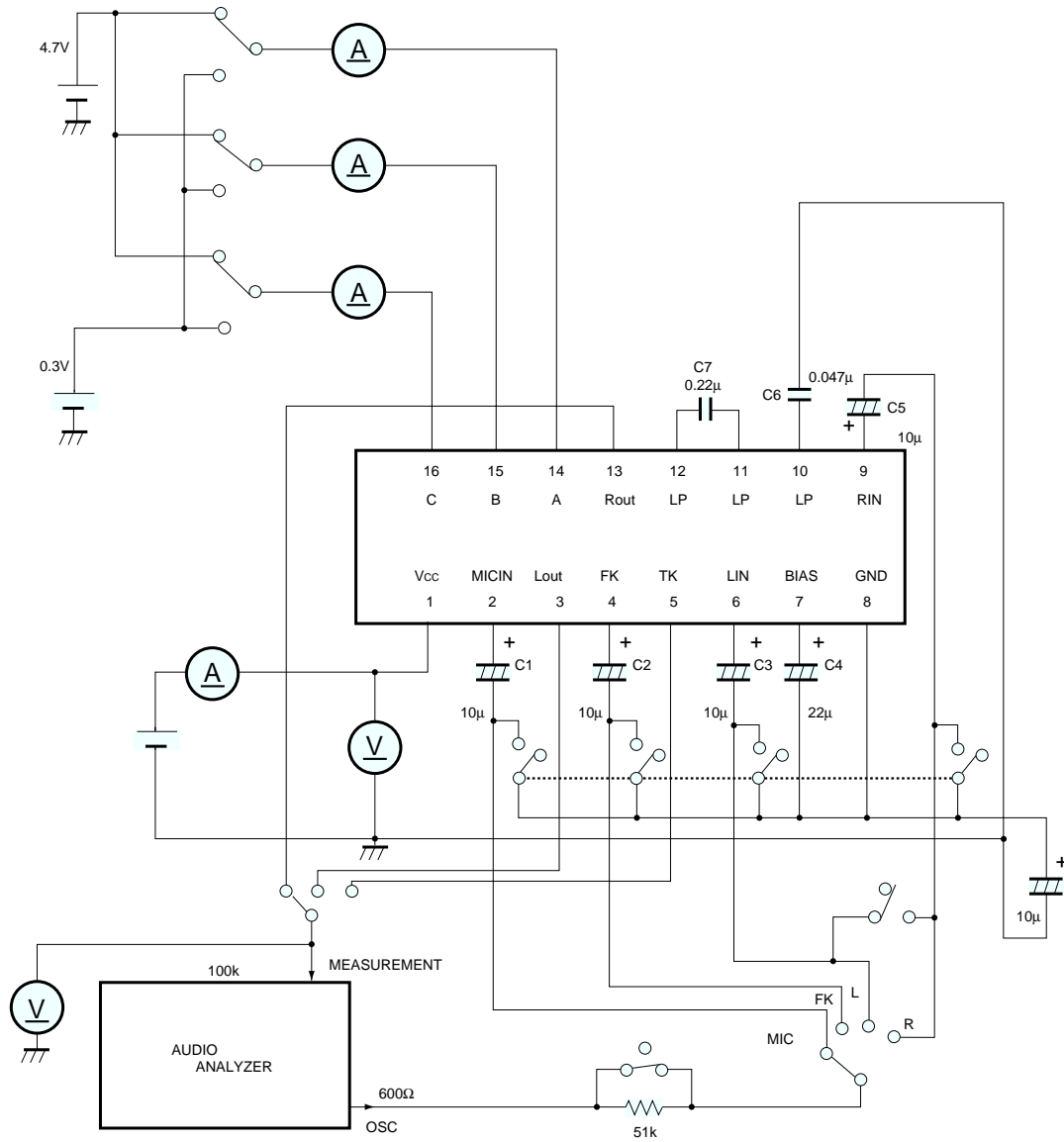


Fig. 1



●Application example (BA3838F)

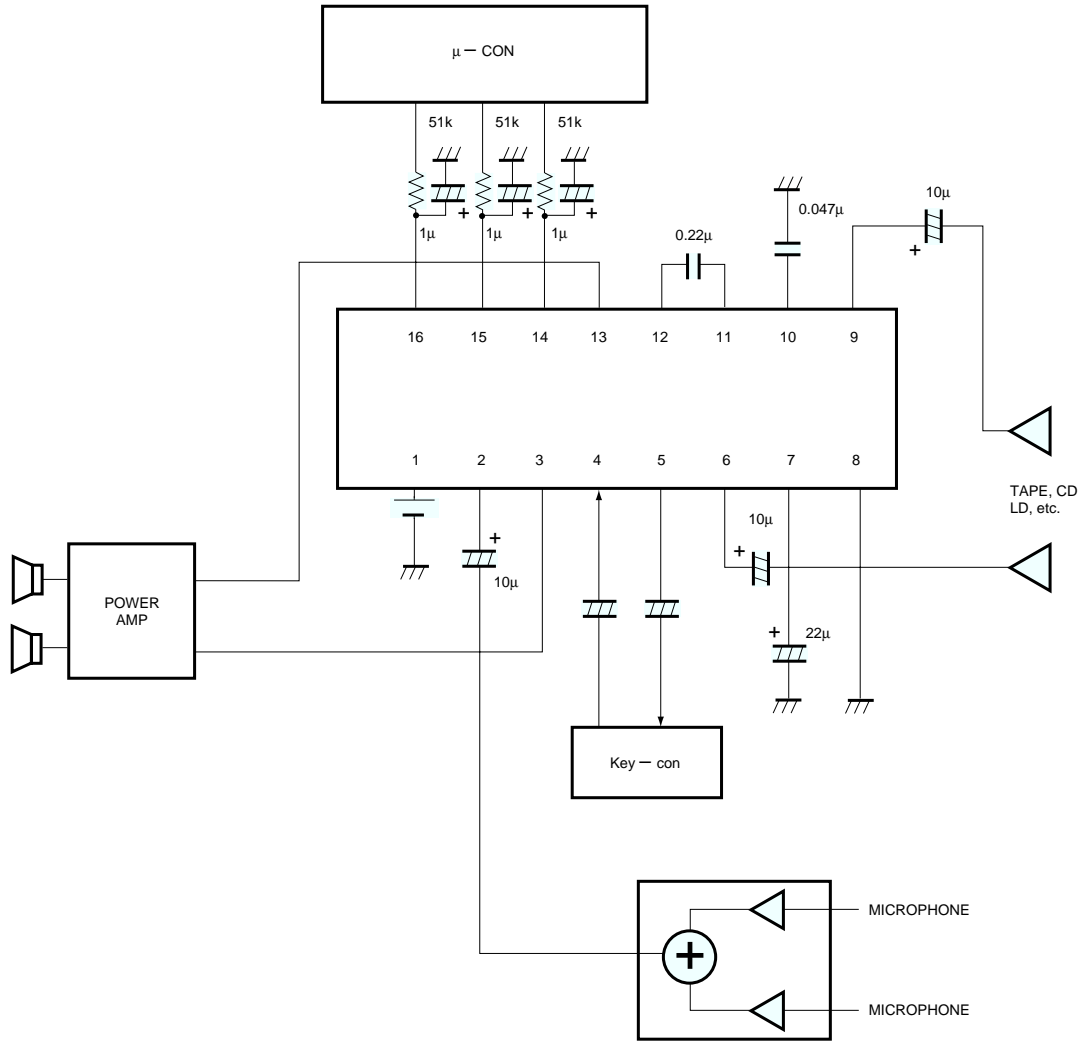


Fig. 2

## ● Operation notes

- (1) The example in the diagram “Application example” is recommended with confidence. However, be sure to comply with these precautions and verify characteristics during actual use. Also, when changing an attached circuit constant, be sure to allow sufficient margins by taking into account both static and transient characteristics, including variation in these ICs and the attached components.
- (2) The low pass filter cutoff frequency is determined by the internal circuitry and by  $C_6$  and  $C_7$  in Fig. 1. With the constant used in Fig. 1, the cutoff frequency ( $f_c$ ) is roughly 150Hz. This cutoff frequency can be changed by changing  $C_6$  and  $C_7$ . When  $C_6$  is multiple  $a$ , and  $C_7$  is multiple  $b$ , respectively, the cutoff frequency is calculated thus:
 
$$f_c = \frac{150}{\sqrt{ab}} \text{ (Hz)}$$
 The value of  $Q$  is:  $Q = \frac{1}{2} \sqrt{\frac{C_7}{C_6}}$   
 (Currently,  $Q \cong 1$ )
- (3) For the gain and relative phase of the input pin (LIN, RIN, MICIN and FK) inputs and output pin (LOUT, ROUT and TK) outputs, refer to “Gain and relative phase,” on page 2 / 10.
- (4) Electrical characteristics are measured at a load resistance ( $R_L$ ) of roughly 100k $\Omega$ . As using an extremely low load resistance (below 10k $\Omega$ ) will result in slight variation in maximum output voltage and total harmonic distortion, caution must be used when designing connections with the subsequent stage.
- (5) The pin 7 bias voltage is roughly  $V_{cc} / 2$ . Because this is also the input and output pin voltage, select coupling capacitor polarity according to relative potential and the characteristics of the components to which the coupling capacitor is to be connected.
- (6) When outputting L + R from LOUT and ROUT in an application in which the key controller is left unconnected, attach a 10 $\mu$ F electrolytic capacitor between pins 4 and 5, with pin 5 being positive (L + R mode: ABC = 111).
- (7) Connecting a capacitance load to pin 5 (TK) of BA3837 / F can worsen noise characteristics. When connecting a capacitance load higher than 10 $\mu$ F, insert 1k $\Omega$  in series (Figs. 1 and 2). The pin 5 output impedance is roughly 5 $\Omega$  (1kHz). In the BA3838F it is roughly 400 $\Omega$  (1kHz).
- (8) The vocal fader works by canceling out the synchronous component of the signal, leaving the low components in place. Consequently, the vocal fader may not be very effective with certain recordings.
- (9) In cases where output DC differential can cause noise when switching between modes, use a time constant for the timing of control pin switching, or take some other measure.
- (10) Operating supply voltage may vary according to ambient temperature. Using this IC outside the recommended supply voltage range may result in increased crosstalk or mute attenuation.

## ● Electrical characteristic curves

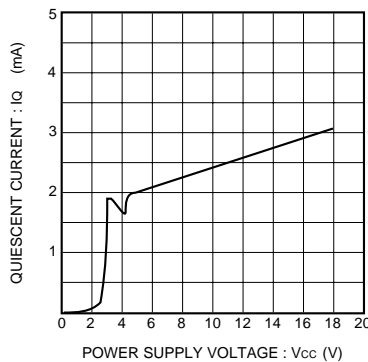
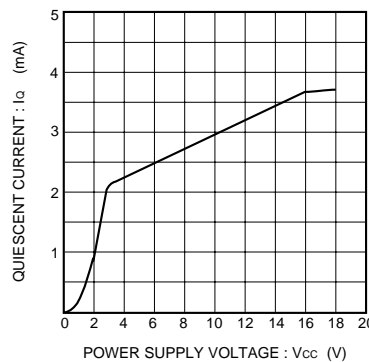
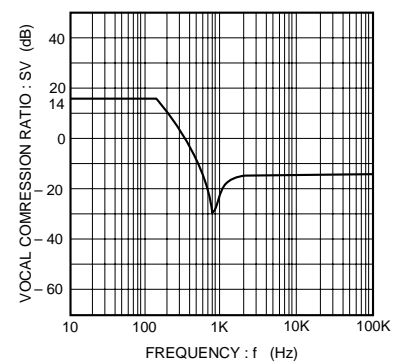
Fig. 3  $I_q$  vs.  $V_{cc}$  characteristics (BA3837 / F)Fig. 4  $I_q$  vs.  $V_{cc}$  characteristics (BA3838F)

Fig. 5 SV vs. frequency characteristics

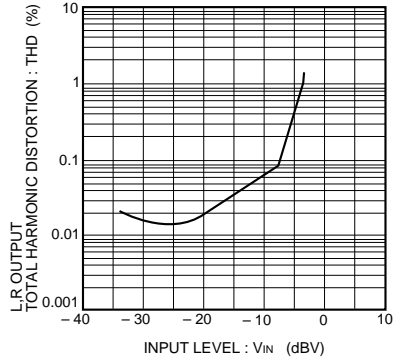


Fig. 6 THD vs.  $V_{IN}$  characteristics

● External dimensions (Units: mm)

