

M51132L/FP

2ch Electronic Volume•Balance

REJ03F0026-0100Z

Rev.1.0

Sep.05.2003

Description

The M51132 is a VCA (Voltage Controlled Amplifier) IC developed as an electronic volume control for audio-visual equipment. The IC is used to process small analog signals at the stage before power amplifier. Right/left independent volume control or right/left simultaneous volume control can be selected by DC voltages. Its built-in pass through function, in combination with an ALC amplifier, offers the capability of automatic level control.

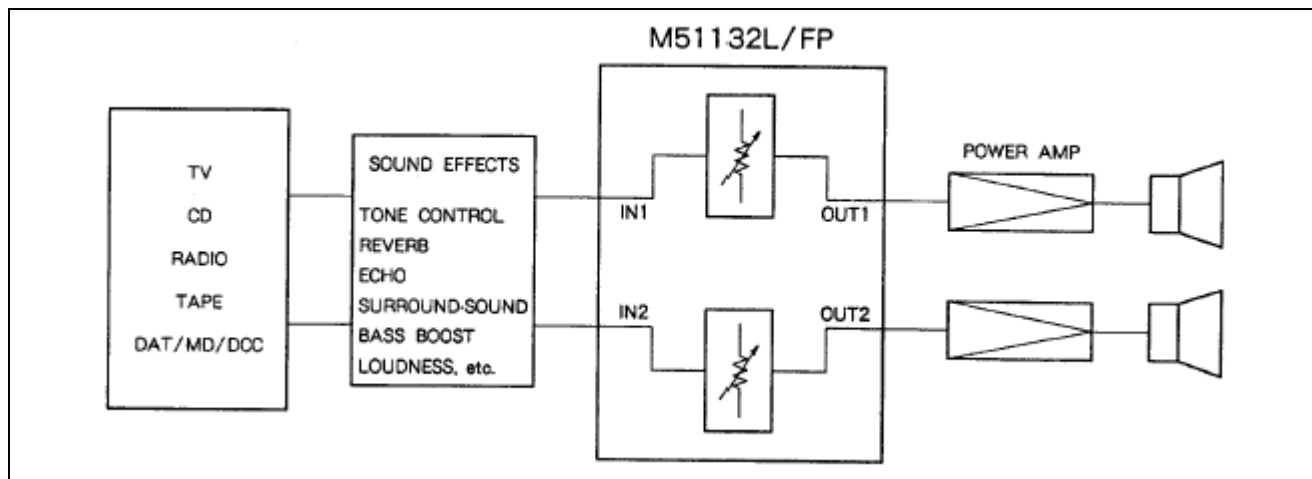
Features

- Two control modes can be selected.
(Left/right independent volume control mode or left/right simultaneous volume + balance control mode.)
- Pass through switch is included to output the input signal as it is, irrespective of the volume/balance control voltages.
- Shock noise reduction pin is provided to reduce pass through switch on/off shock noise.
- Built-in reference supply voltage circuit: output current 10 mA (Typ.)
- Maximum input: 3.4 Vrms (Typ.) (f = 1 kHz, THD = 1%)
- Low distortion: 0.005% (Typ.)
- Good channel separation: 102 dB (Typ.) (f = 1 kHz, Vo = 2 Vrms, IHF-A)

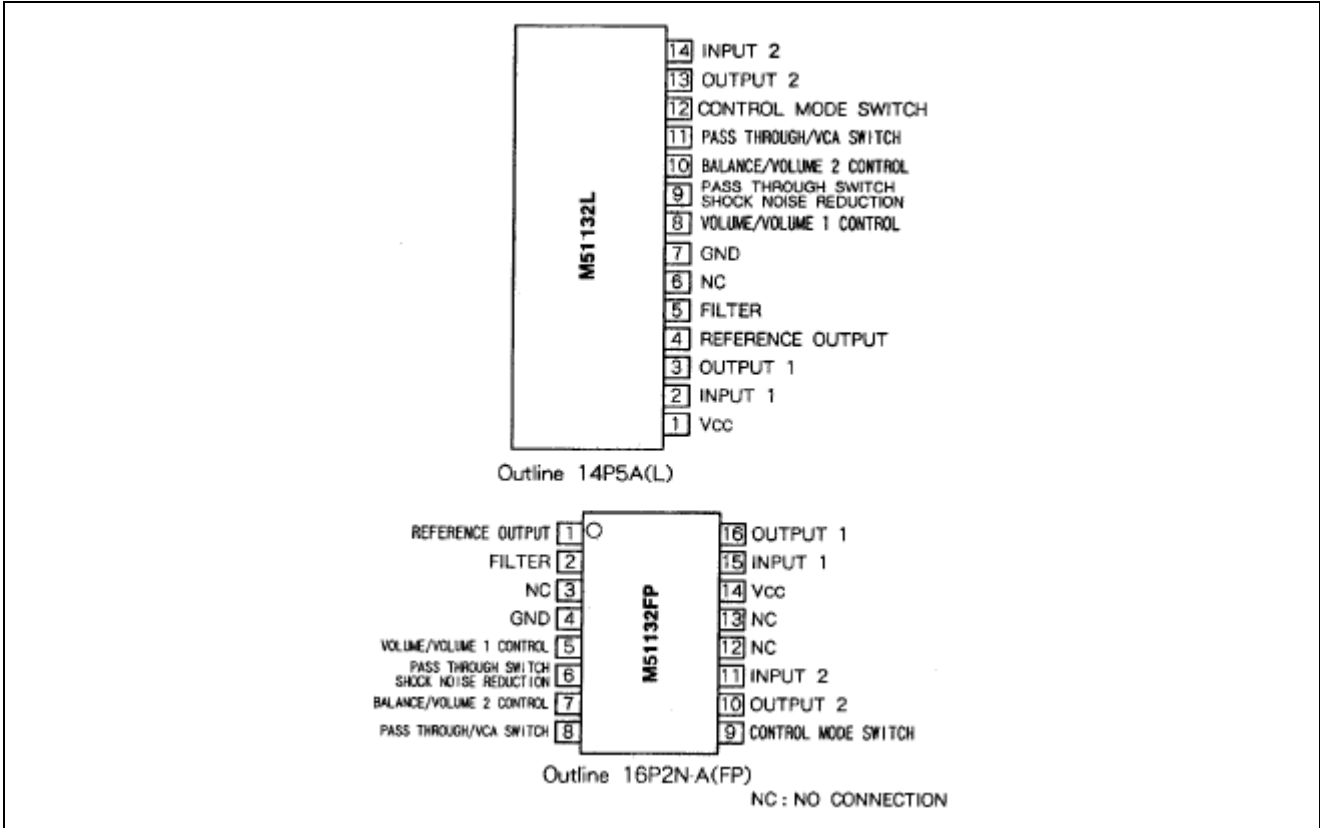
Recommended Operating Conditions

- Supply voltage range: Vcc = 8 to 15 V
- Rated supply voltage: Vcc = 12 V

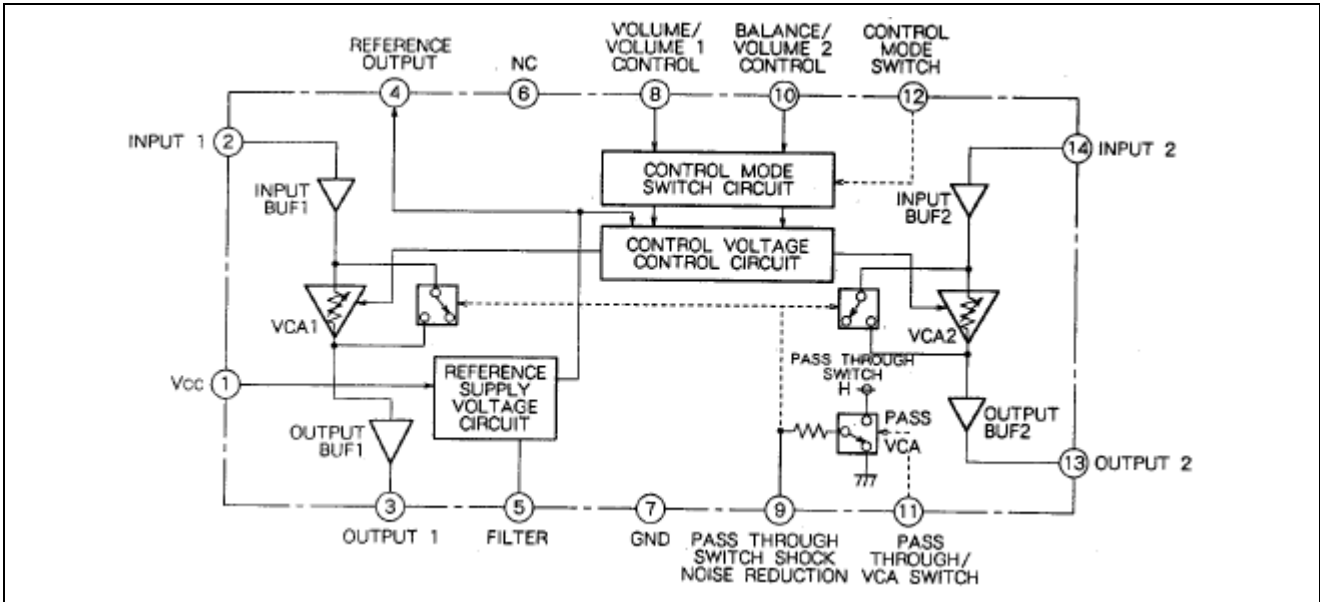
System Configuration



Pin Configuration



IC Internal Block Diagram (M51132L)



Pin Description

| Pin No. | Pin Name | Function | Typical DC Voltage |
|---------|---|--|--|
| 1 | Vcc | DC 8 to 15 V is applied (rated voltage 12 V) | |
| 2 | Input 1 | Maximum input 3.4 Vrms (Typ.) | 5.5 V |
| 3 | Output 1 | | 4.8 V |
| 4 | Reference supply voltage output | Maximum output current 10 mA (Typ.) built-in short circuit protection circuit | 5.2 V |
| 5 | Filter | | 12 V |
| 6 | No connection | Can be used for wire repeater to GND, etc. | |
| 7 | GND | | |
| 8 | Volume/volume 1 control | Left/right simultaneous volume or channel 1 volume is controlled by this value in the range of 0 to 5.2 V DC. | |
| 9 | Pass through switch shock noise reduction | Transit noise to the ear is softened by slowly switching between pass through and VCA with time constant when the pass through switch is turned on/off. The time constant is determined by externally connected capacitor. $T(\text{sec}) = 1.2 \times C \times 20k$ | 5.2 V for pass through and 0 V for VCA |
| 10 | Balance/volume 2 control | Balance or channel 2 volume is controlled with 0 to 5.2 V | |
| 11 | Pass through/VCA switch | Operates as VCA with 0 V, and passes through the input to output with 5.2 V | |
| 12 | Control mode switch | Operates as channel 1 volume at pin 8 and as channel 2 volume at pin 10 with 0 V. Operates as channel 1 and channel 2 simultaneous volume at pin 8 and as balance at pin 10 with 5.2 V. | |
| 13 | Output 2 | | 4.8 V |
| 14 | Input 2 | Maximum input 3.4 Vrms (Typ.) | 5.5 V |

Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

| Item | Symbol | Ratings | Unit | Conditions |
|-----------------------|--------|----------------|-------|--------------------------|
| Supply voltage | Vcc | 15.5 | V | Quiescent |
| Circuit current | Icc | 40 | mA | |
| Power dissipation | Pd | 800(L)/550(FP) | mW | When mounted on PC board |
| Thermal derating | Kθ | 8.0(L)/5.5(FP) | mW/°C | Ta ≥ 25°C |
| Operating temperature | Topr | -20 to +75 | °C | |
| Storage temperature | Tstg | -40 to +125 | °C | |

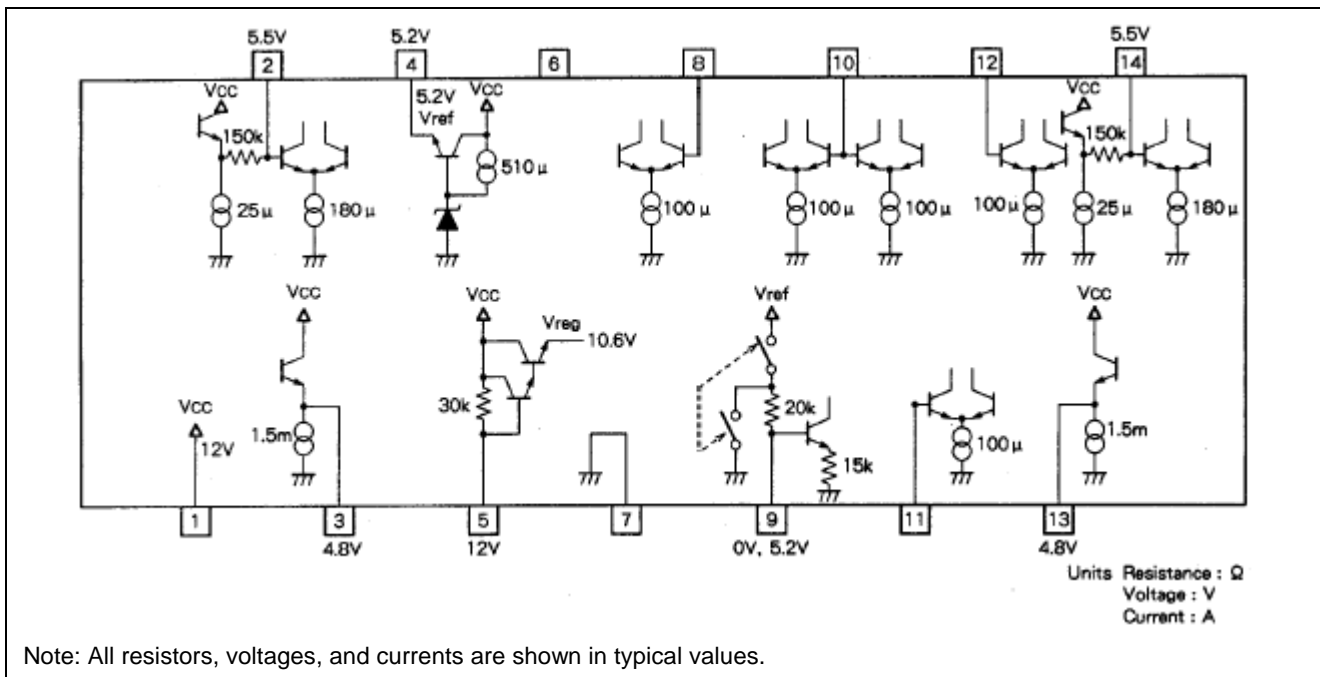
Electrical Characteristics

($T_a = 25^\circ\text{C}$, $V_{cc} = 12\text{ V}$, $f = 1\text{ kHz}$, $V_i = 1\text{ V}_{rms}$, Volume Max, unless otherwise noted)

| Item | Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|------------------------------|-------------------|------|------|------|-------------------|--|
| Circuit current | I _{cco} | 9 | 17 | 30 | mA | In quiescent state, volume: min |
| Attenuation | ATT ₀ | -2 | 0 | +2 | dB | |
| | Att-∞ | — | -105 | -85 | dB | $V_i = 2\text{ V}_{rms}$, IHF-A, volume: min |
| Channel balance | CB | -2 | 0 | +2 | dB | |
| Total harmonic distortion | THD | — | 0.01 | 0.1 | % | 15 kHz, LPF |
| Input resistor | R _i | 5.0 | 150 | — | kΩ | |
| Balance attenuation | BAL | — | -105 | -85 | dB | $V_i = 2\text{ V}_{rms}$, IHF-A |
| Output noise voltage | Nomin | — | 4.8 | 10 | μV _{rms} | R _g = 10 kΩ, in quiescent state, IHF-A, volume: min |
| | Nomax | — | 9 | 20 | μV _{rms} | R _g = 10 kΩ, in quiescent state, IHF-A |
| Maximum input voltage | V _{imax} | 2 | 3.4 | — | V _{rms} | THD = 1%, volume: center |
| Maximum output voltage | V _{omax} | 2 | 3.4 | — | V _{rms} | THD = 1% |
| Crosstalk | C _T | — | -102 | -80 | dB | R _g = 0Ω, $V_i = 2\text{ V}_{rms}$, IHF-A |
| Pass through voltage gain | G _{VP} | -1.2 | +0.8 | +2.8 | DB | Volume: min |
| Pass through channel balance | C _{BP} | -2 | 0 | +2 | dB | Volume: min |

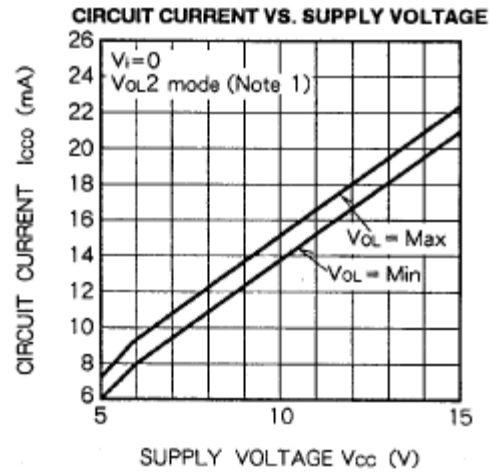
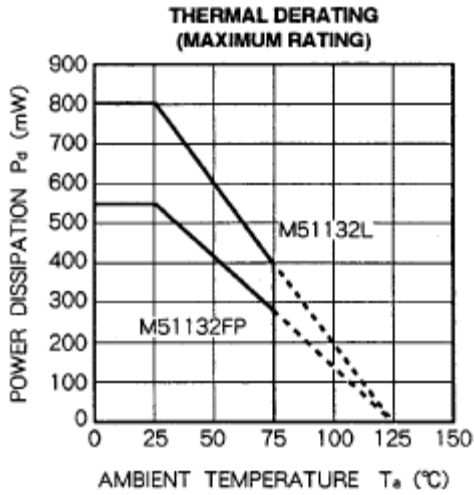
- Notes: 1. The volume max is the condition in which the same voltage as V_r is applied to pin 8.
 2. The volume center is the condition in which the same voltage as $V_r/2$ is applied to pin 8.
 3. The volume min is the condition in which pin 8 is connected to GND.

I/O Interface (M51132L)

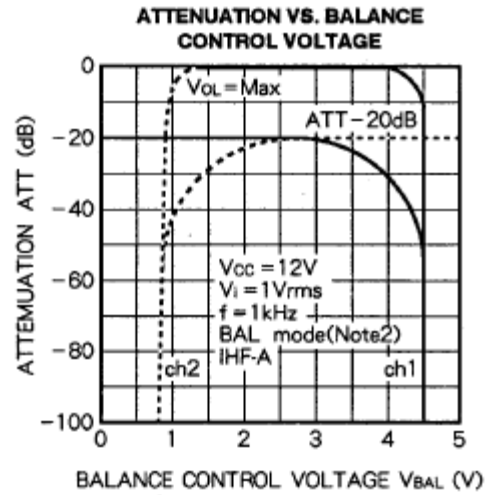
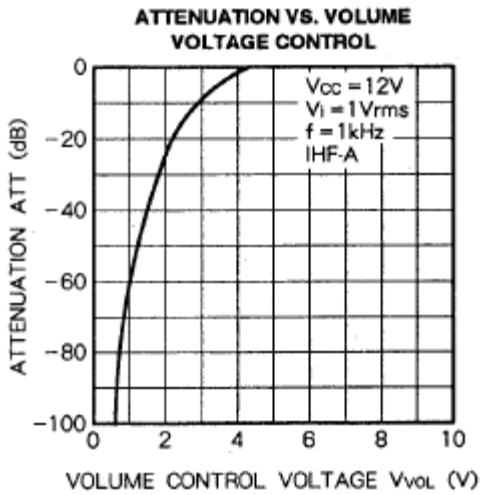


Note: All resistors, voltages, and currents are shown in typical values.

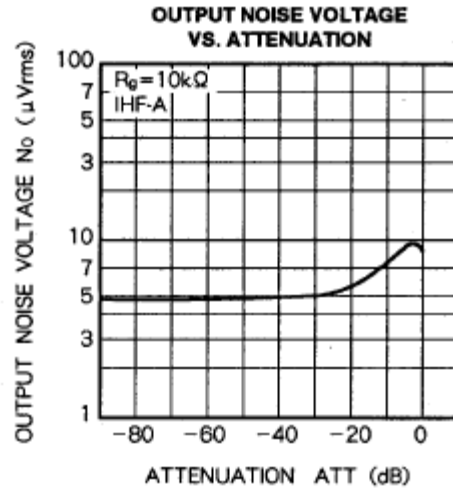
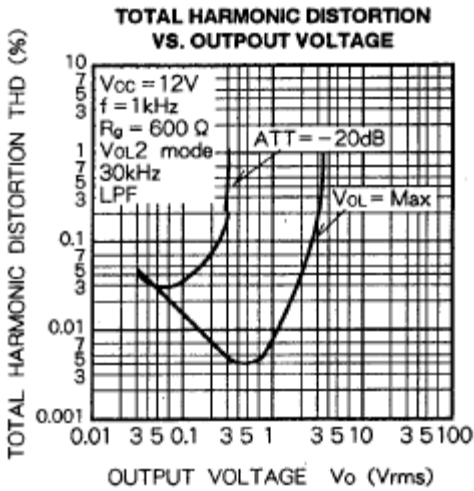
Typical Characteristics

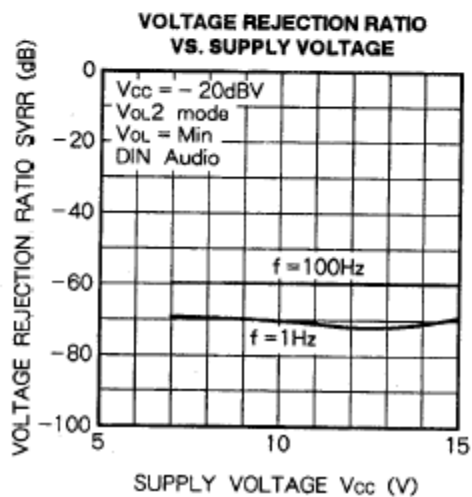
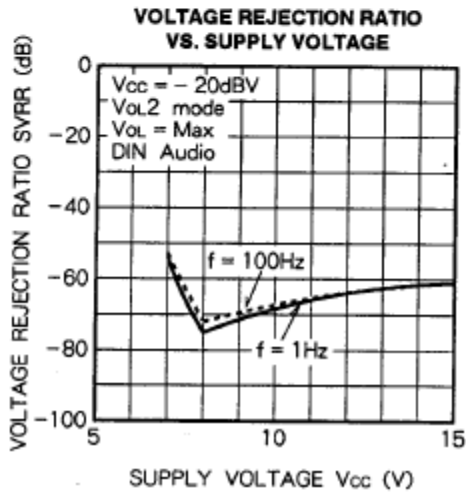
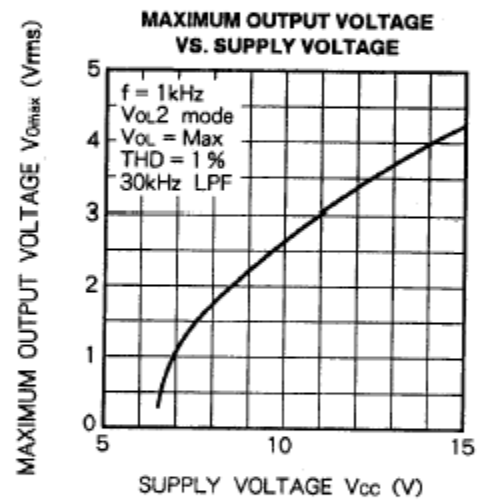
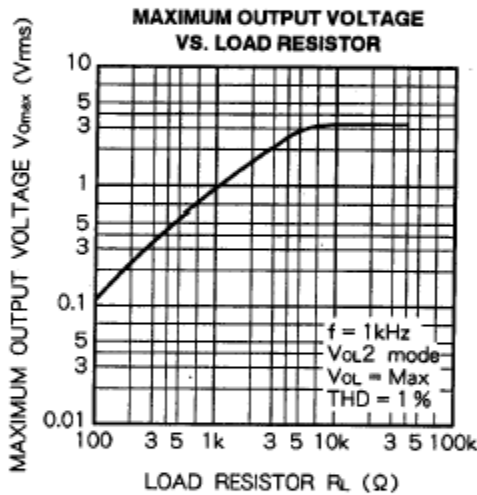
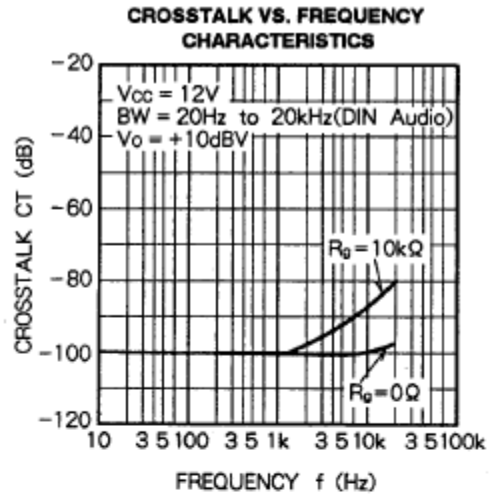
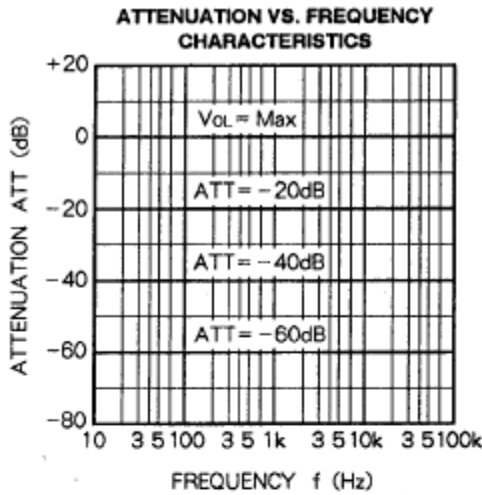


Note 1. V_{OL2} mode is left/right independent volume control mode.

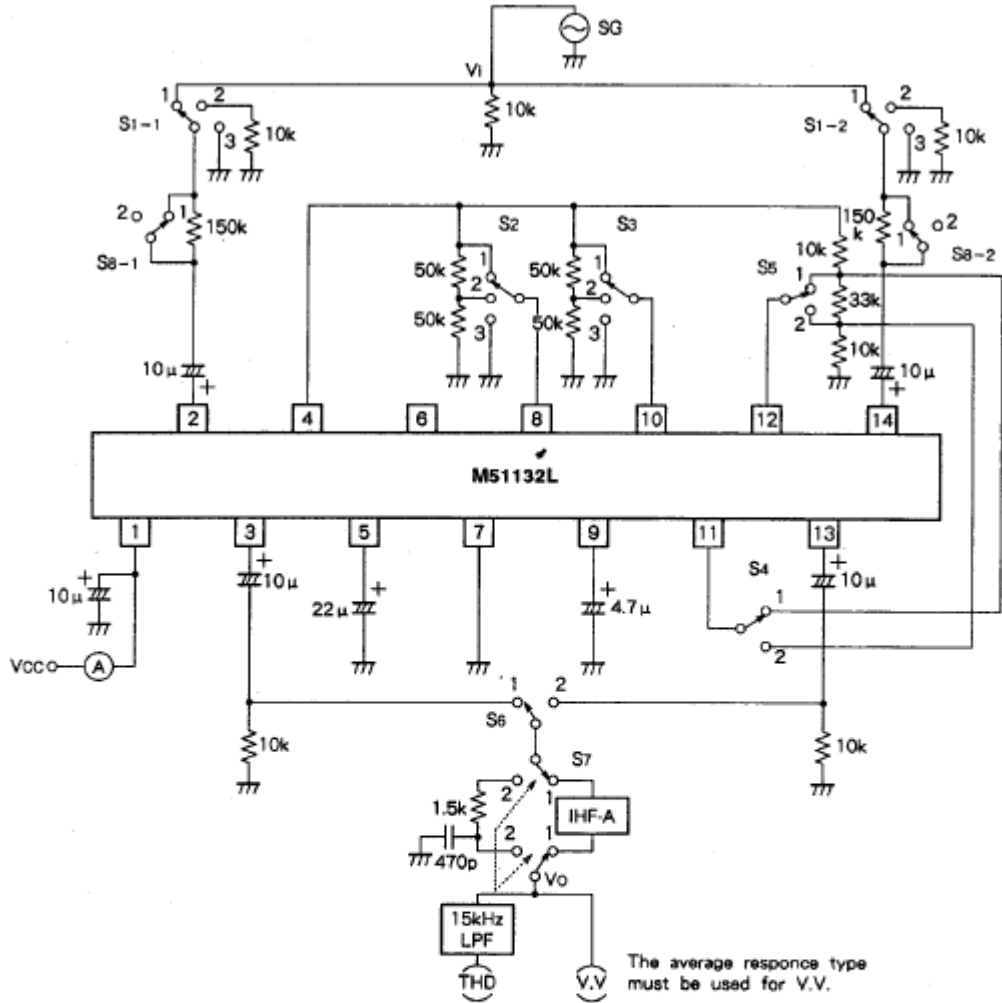


Note 2. BAL mode is left/right simultaneous volume and balance control mode.

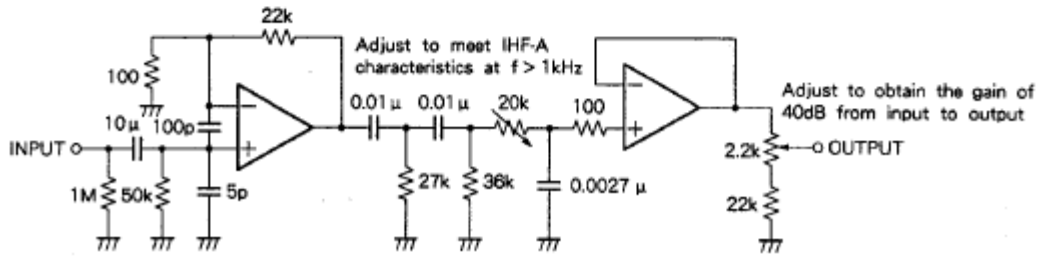




Test Circuit (M51132L)



The IHF-A filter can be replaced with the following circuit.
 Example of IHF-A filter equivalent circuit (Note that the output is multiplied by 100).



Units Resistance : Ω
 Capacitance : F

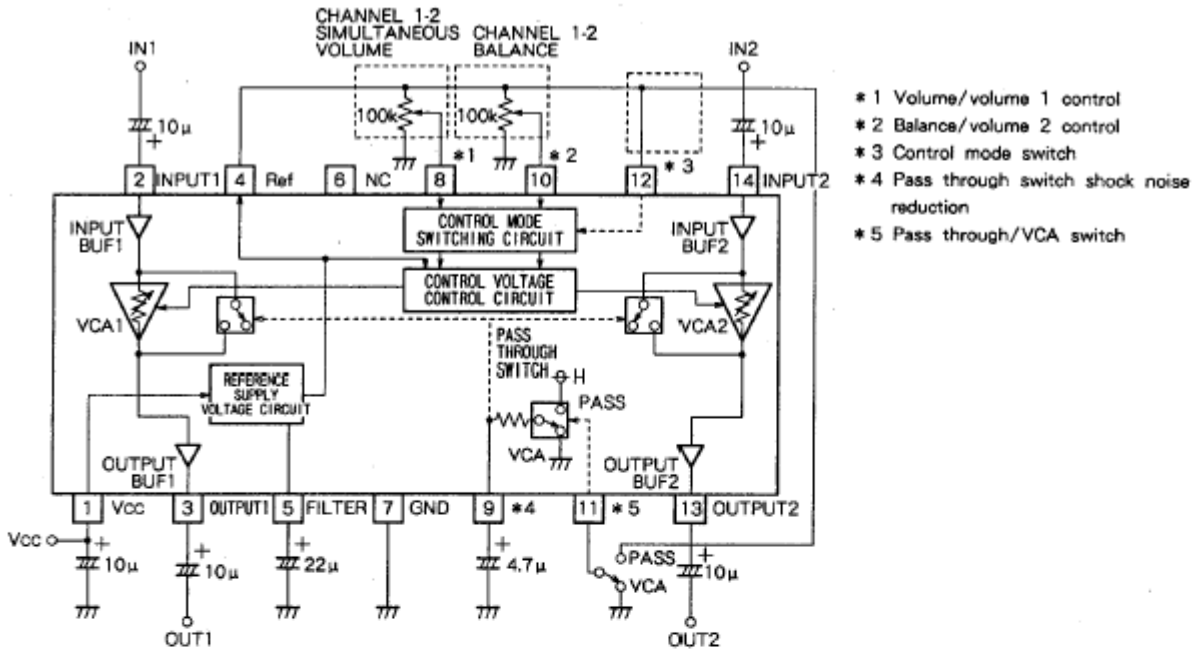
Switch Condition and Test Method

| Item | Symbol | Switch | | | | | | | | | | Test Method |
|------------------------------|-------------------|------------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|------------------|---|
| | | S ₁₋₁ | S ₁₋₂ | S ₂ | S ₃ | S ₄ | S ₅ | S ₆ | S ₇ | S ₈₋₁ | S ₈₋₂ | |
| Circuit current | I _{cco} | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | Measure the current flowing to pin (1) in quiescent state |
| Attenuation | ATT _o | 1 | 1 | 1 | $\frac{1}{2}$ | 2 | $\frac{2}{1}$ | 1/2 | 2 | 1 | 1 | Obtain from the equation ATT(dB) = 20 log(V _o /V _i) |
| | Att-∞ | 1 | 1 | 3 | $\frac{3}{2}$ | 2 | $\frac{2}{1}$ | 1/2 | 1 | 1 | 1 | ATT-∞ is IHF-A in |
| Channel balance | CB | 1 | 1 | 1 | $\frac{1}{2}$ | 2 | $\frac{2}{1}$ | 1→2 | 2 | 1 | 1 | CB(dB) = ATT _{ch1} – ATT _{ch2} |
| Total harmonic distortion | THD | 1 | 1 | 1 | $\frac{1}{2}$ | 2 | $\frac{2}{1}$ | 1/2 | 2 | 1 | 1 | 15 kHz LPF in |
| Input resistor | R _i | 1 | 1 | 1 | 1 | 2 | 2 | $\frac{1}{2}$ | 2 | $\frac{1}{2}$ | 1→2 | Given the output as V _{o1} when S ₈ →1 and the output as V _{o2} when S ₈ →2, R _i (kΩ) = 150/(V _{o1} /V _{o2} – 1) |
| Balance attenuation | BAL | 1 | 1 | 1 | $\frac{1}{3}$ | 2 | 1 | $\frac{1}{2}$ | 1 | 1 | 1 | BAL(dB) = 20 log(V _o /V _i) |
| Output noise voltage | Nomin | 2 | 2 | 3 | $\frac{3}{2}$ | 2 | $\frac{2}{1}$ | 1/2 | 1 | 1 | 1 | IHF-A in |
| | Nomax | 2 | 2 | 1 | $\frac{1}{2}$ | 2 | $\frac{2}{1}$ | 1/2 | 1 | 1 | 1 | IHF-A in |
| Maximum input voltage | V _{imax} | 1 | 1 | 2 | 2 | 2 | $\frac{2}{1}$ | 1/2 | 2 | 1 | 1 | Input signal voltage when the output distortion rate is 1% |
| Maximum output voltage | V _{omax} | 1 | 1 | 1 | $\frac{1}{2}$ | 2 | $\frac{2}{1}$ | 1/2 | 2 | 1 | 1 | Output signal voltage when the output distortion rate is 1% |
| Crosstalk | C _T | $\frac{3}{1}$ | $\frac{1}{3}$ | 1 | 1 | 2 | 2 | $\frac{1}{2}$ | 1 | 1 | 1 | IHF-A in, C _T (dB) = 20 log (V _o (V _{rms})/2(V _{rms})) |
| Pass through voltage gain | G _{VP} | 1 | 1 | 3 | 3 | 1 | 2 | 1/2 | 2 | 1 | 1 | G _{VP} (dB) = 20 log(V _o /V _i) |
| Pass through channel balance | C _{BP} | 1 | 1 | 3 | 3 | 1 | 2 | 1→2 | 2 | 1 | 1 | G _{BP} (dB) = G _{VPch1} – G _{VPch2} |

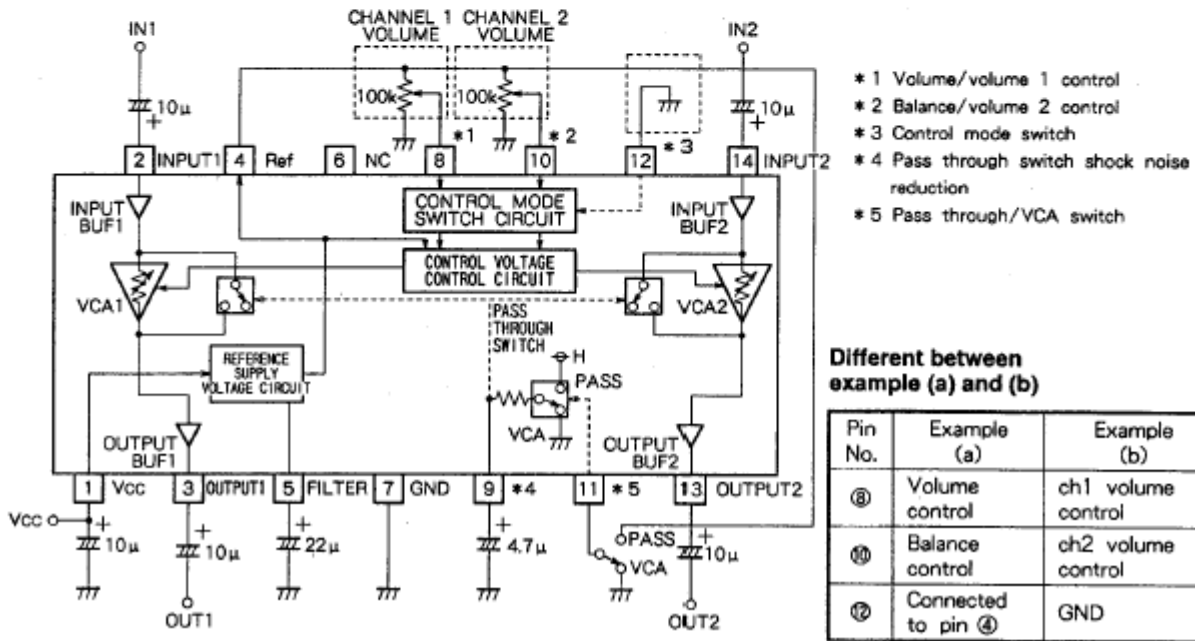
Note: If the parameter is separated into two rows. All the switching conditions in the upper row and all the switching conditions in the lower row are measured.

Application Examples (M51132L)

(a) Control by left/right simultaneous variable volume and balancer



(b) Control by left/right independent volume



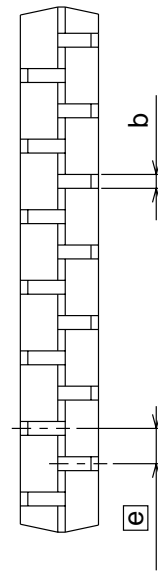
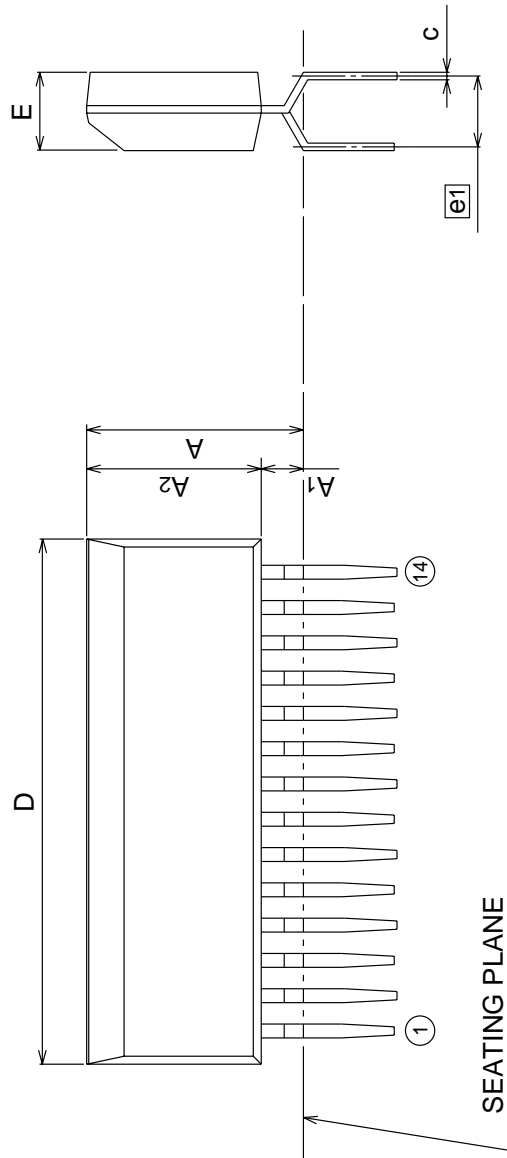
Units Resistance : Ω
 Capacitance : F

Package Dimensions

14P5A

Plastic 14pin 325mil ZIP

| | | | |
|---------------------------------------|-----------------|-------------------|---------------------------|
| EIAJ Package Code ZIP14-P-325-1.27 | JEDEC Code — | Weight(g) 0.74 | Lead Material Cu Alloy |
|---------------------------------------|-----------------|-------------------|---------------------------|



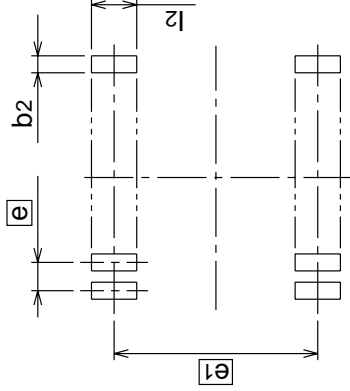
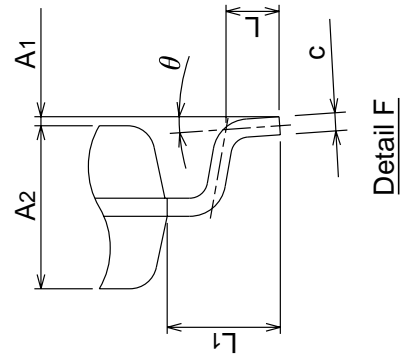
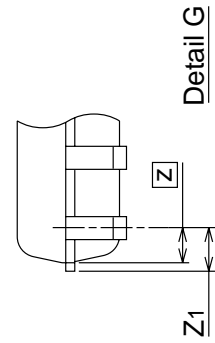
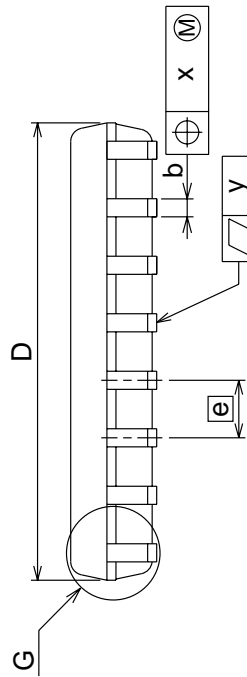
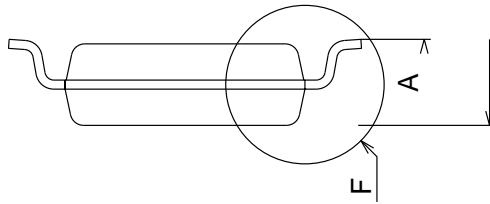
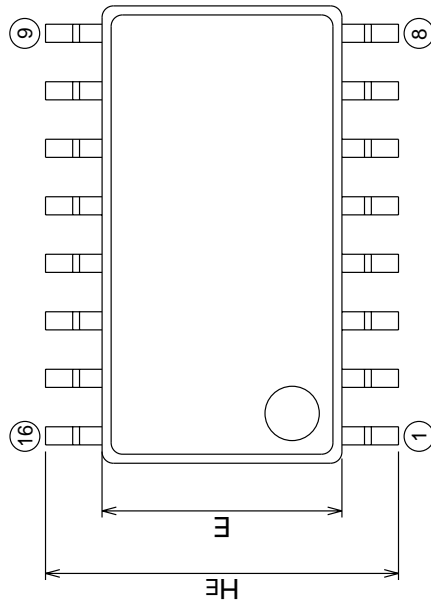
| Symbol | Dimension in Millimeters | | |
|--------|--------------------------|------|------|
| | Min | Nom | Max |
| A | — | — | 8.3 |
| A1 | 0.9 | — | — |
| A2 | — | 6.3 | — |
| b | 0.4 | 0.5 | 0.6 |
| c | 0.22 | 0.27 | 0.34 |
| D | 18.8 | 19.0 | 19.2 |
| E | 2.6 | 2.8 | 3.0 |
| e | — | 1.27 | — |
| e1 | — | 2.54 | — |
| L | 2.8 | — | — |

16P2N-A

(MMP)

Plastic 16pin 300mil SOP

| | | | |
|---------------------------------------|-----------------|------------------|---------------------------|
| EIAJ Package Code SOP16-P-300-1.27 | JEDEC Code — | Weight(g) 0.2 | Lead Material Cu Alloy |
|---------------------------------------|-----------------|------------------|---------------------------|



Recommended Mount Pad

| Symbol | Dimension in Millimeters | | |
|----------|--------------------------|-------|-------|
| | Min | Nom | Max |
| A | — | — | 2.1 |
| A1 | 0 | 0.1 | 0.2 |
| A2 | — | 1.8 | — |
| b | 0.35 | 0.4 | 0.5 |
| c | 0.18 | 0.2 | 0.25 |
| D | 10.0 | 10.1 | 10.2 |
| E | 5.2 | 5.3 | 5.4 |
| e | — | 1.27 | — |
| HE | 7.5 | 7.8 | 8.1 |
| L | 0.4 | 0.6 | 0.8 |
| L1 | — | 1.25 | — |
| Z | — | 0.605 | — |
| Z1 | — | — | 0.755 |
| x | — | — | 0.25 |
| y | — | — | 0.1 |
| θ | 0° | — | 8° |
| b2 | — | 0.76 | — |
| e1 | — | 7.62 | — |
| l2 | 1.27 | — | — |

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