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.

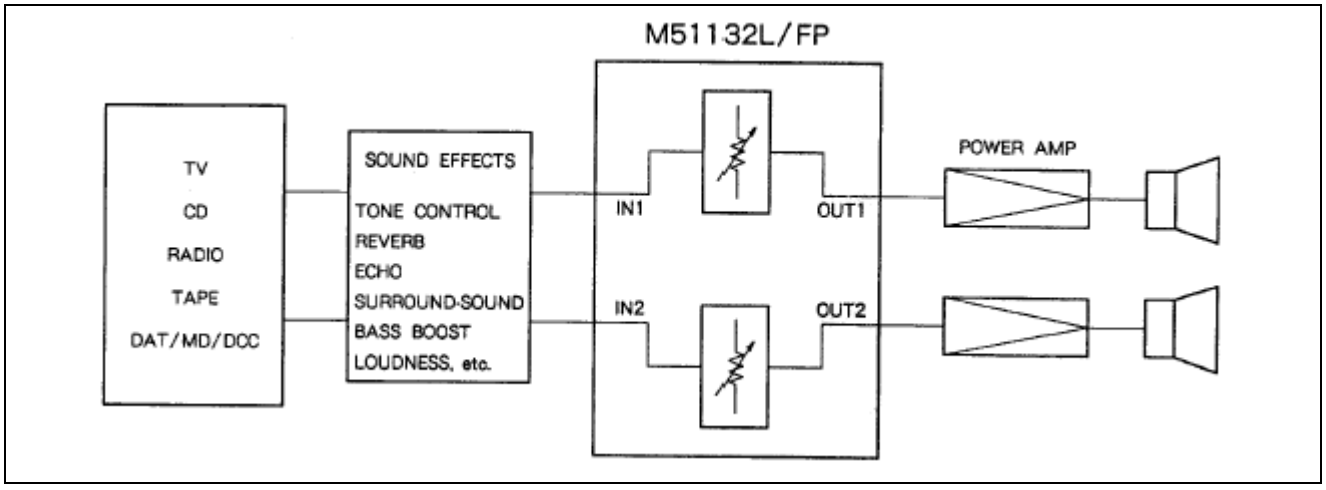
Features

- 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)

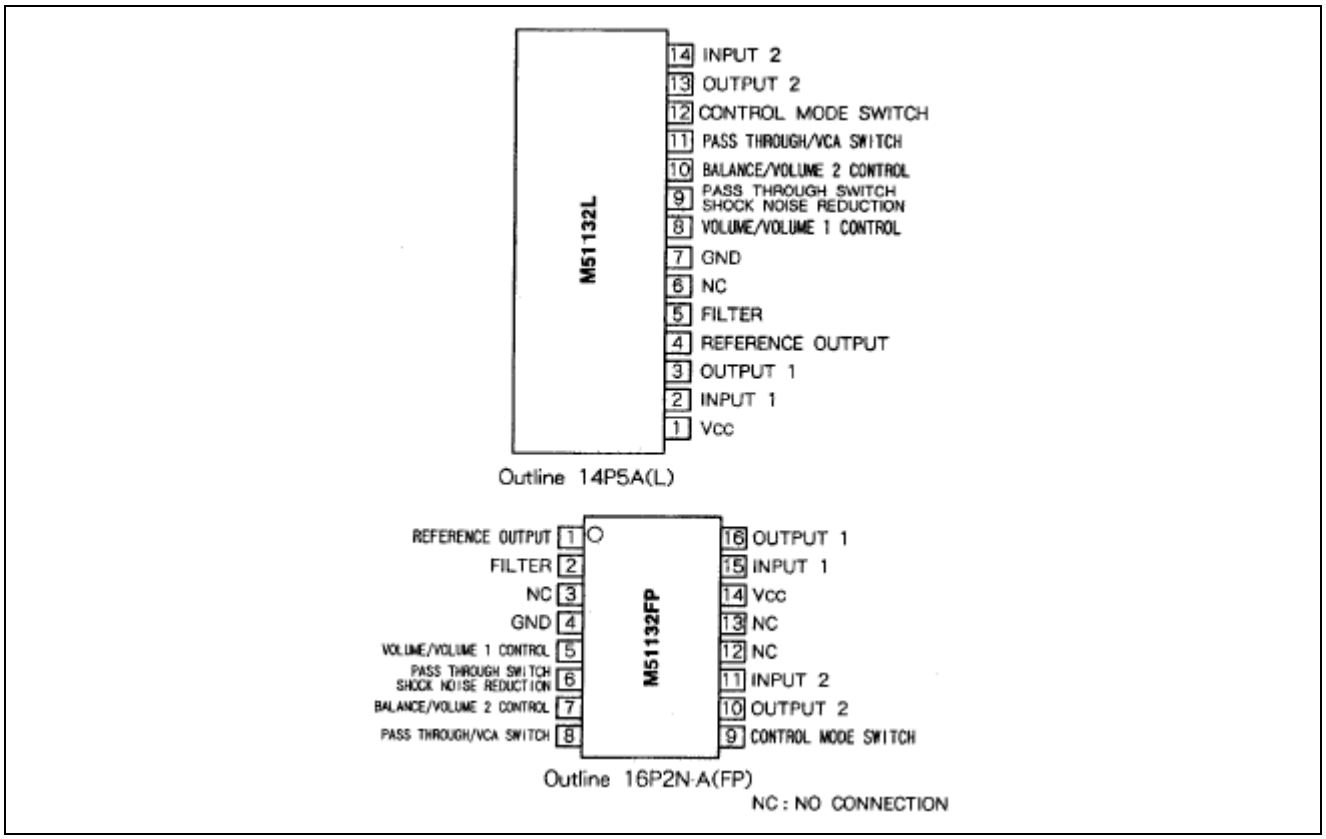
Recommended Operating Conditions

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

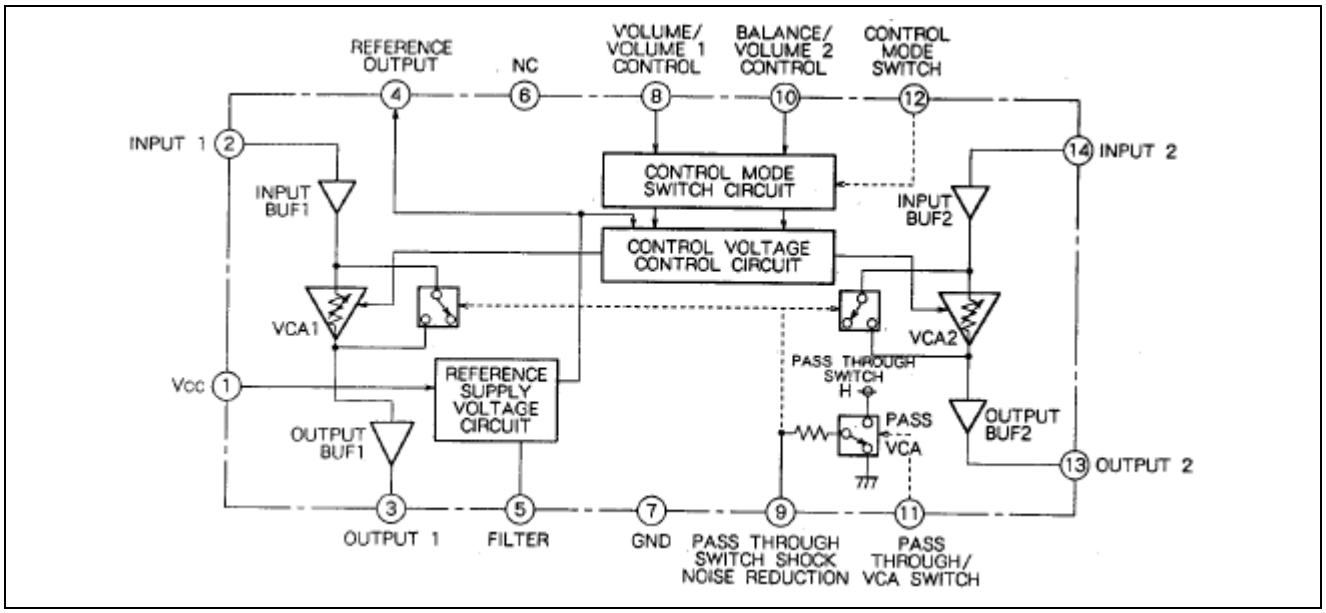
System Configuration



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. $T(sec) = 1.2 \times C \times 20k$	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	

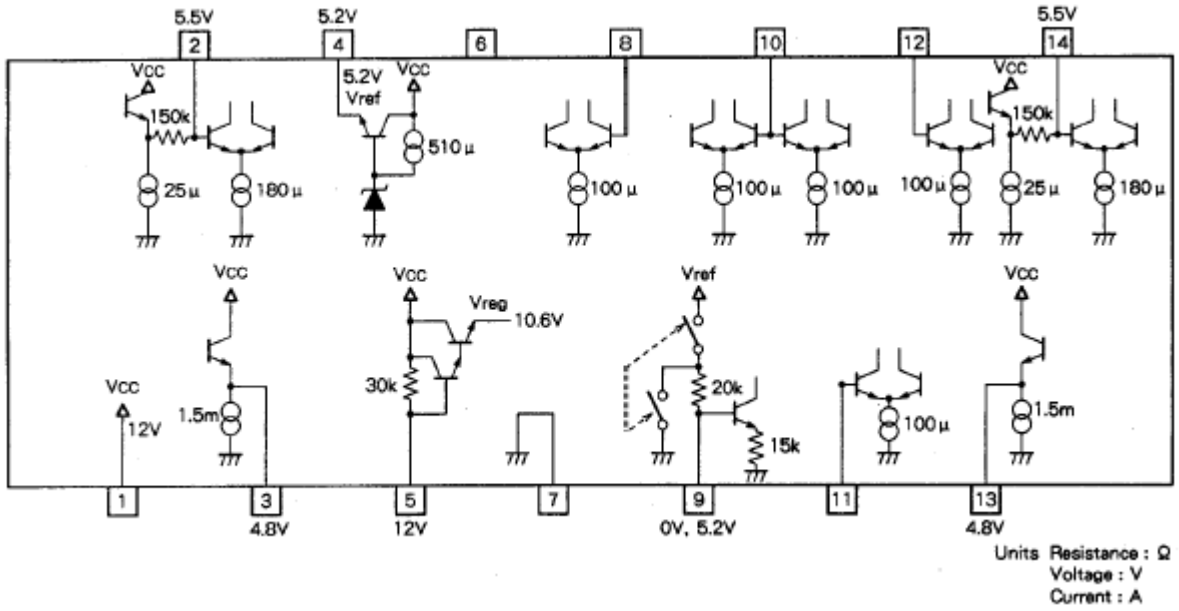
Electrical Characteristics

(Ta = 25°C, Vcc = 12 V, f = 1 kHz, Vi = 1 Vrms, Volume Max, unless otherwise noted)

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Circuit current	Icco	9	17	30	mA	In quiescent state, volume: min
Attenuation	ATTo	–2	0	+2	dB	
	Att-∞	—	–105	–85	dB	Vi = 2 Vrms, IHF-A, volume: min
Channel balance	CB	–2	0	+2	dB	
Total harmonic distortion	THD	—	0.01	0.1	%	15 kHz, LPF
Input resistor	Ri	5.0	150	—	kΩ	
Balance attenuation	BAL	—	–105	–85	dB	Vi = 2 Vrms, IHF-A
Output noise voltage	Nomin	—	4.8	10	μVrms	Rg = 10 kΩ, in quiescent state, IHF-A, volume: min
	Nomax	—	9	20	μVrms	Rg = 10 kΩ, in quiescent state, IHF-A
Maximum input voltage	Vimax	2	3.4	—	Vrms	THD = 1%, volume: center
Maximum output voltage	Vomax	2	3.4	—	Vrms	THD = 1%
Crosstalk	C_T	—	–102	–80	dB	Rg = 0Ω, Vi = 2 Vrms, 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 Vr is applied to pin 8.
2. The volume center is the condition in which the same voltage as Vr/2 is applied to pin 8.
3. The volume min is the condition in which pin 8 is connected to GND.

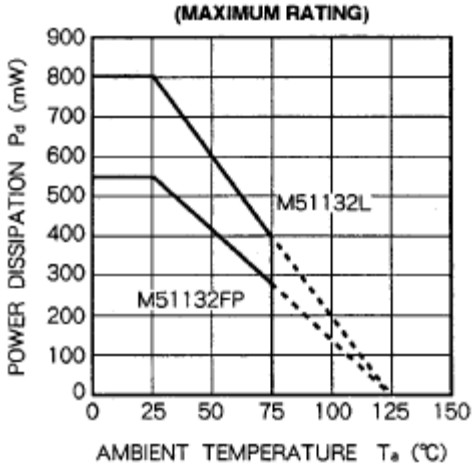
I/O Interface (M51132L)



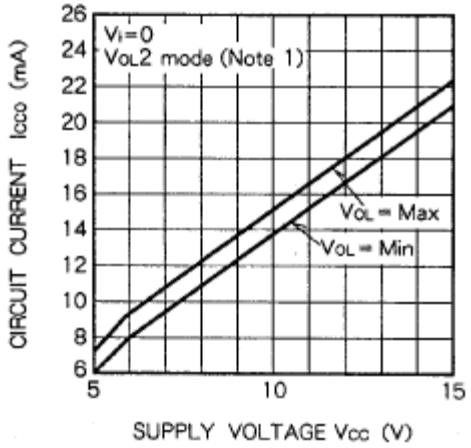
Note: All resistors, voltages, and currents are shown in typical values.

Typical Characteristics

THERMAL DERATING (MAXIMUM RATING)

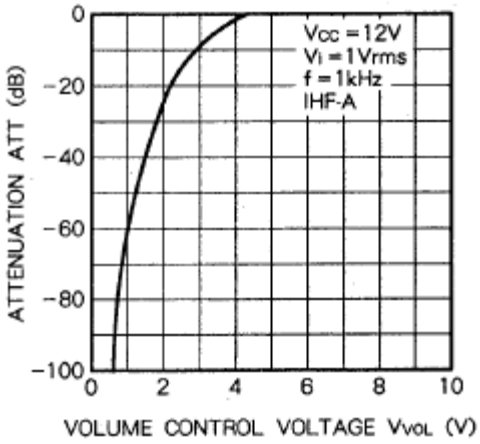


CIRCUIT CURRENT VS. SUPPLY VOLTAGE

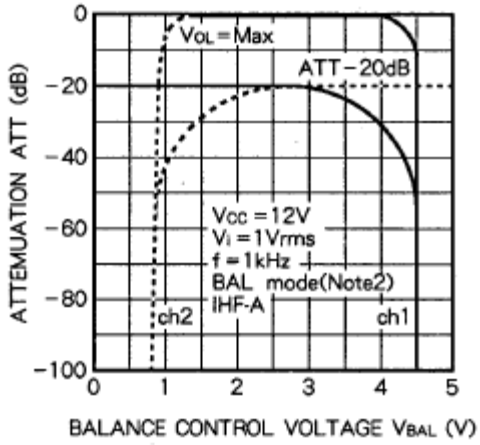


Note 1. VOL2 mode is left/right independent volume control mode.

ATTENUATION VS. VOLUME VOLTAGE CONTROL

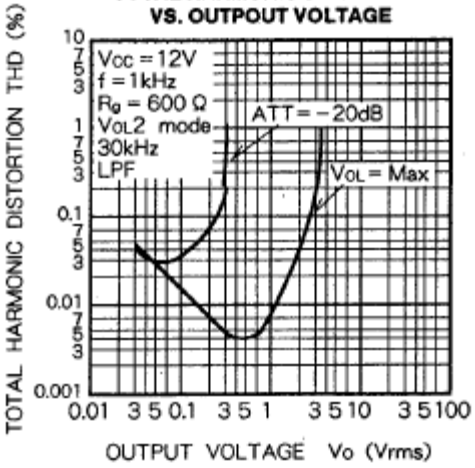


ATTENUATION VS. BALANCE CONTROL VOLTAGE

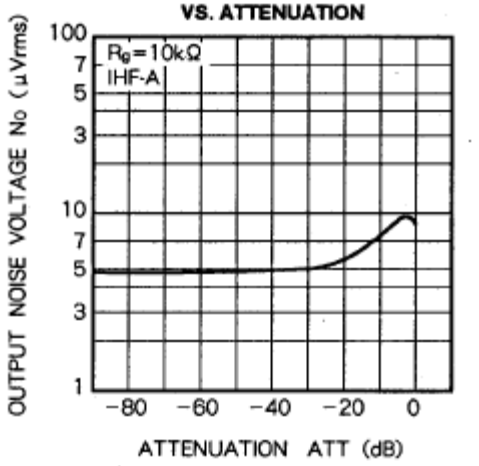


Note 2. BAL mode is left/right simultaneous volume and balance control mode.

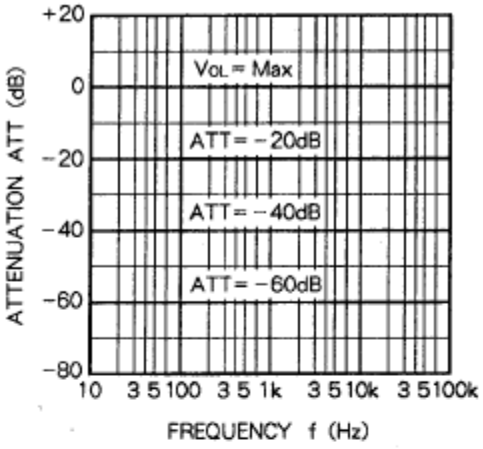
TOTAL HARMONIC DISTORTION VS. OUTPOUT VOLTAGE



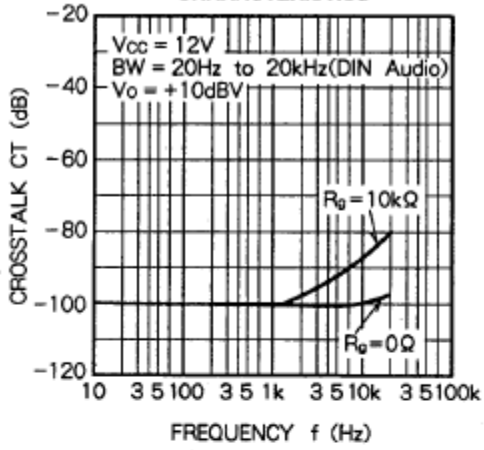
OUTPUT NOISE VOLTAGE VS. ATTENUATION



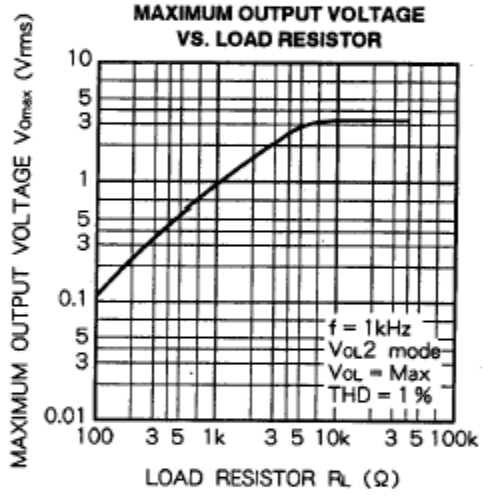
ATTENUATION VS. FREQUENCY CHARACTERISTICS



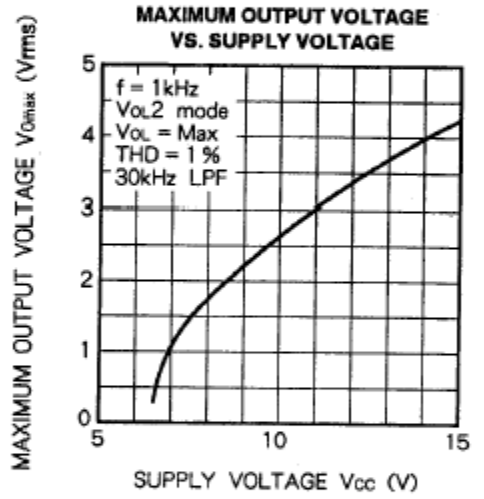
CROSSTALK VS. FREQUENCY CHARACTERISTICS



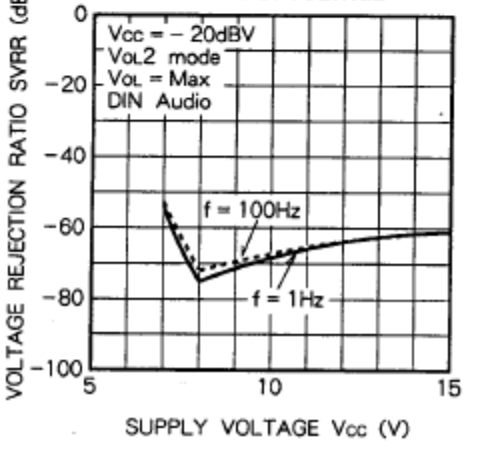
MAXIMUM OUTPUT VOLTAGE VS. LOAD RESISTOR



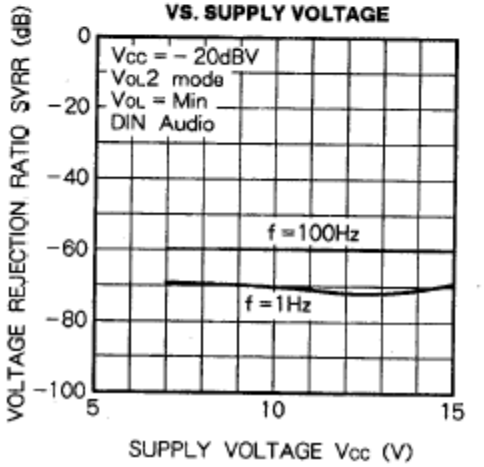
MAXIMUM OUTPUT VOLTAGE VS. SUPPLY VOLTAGE



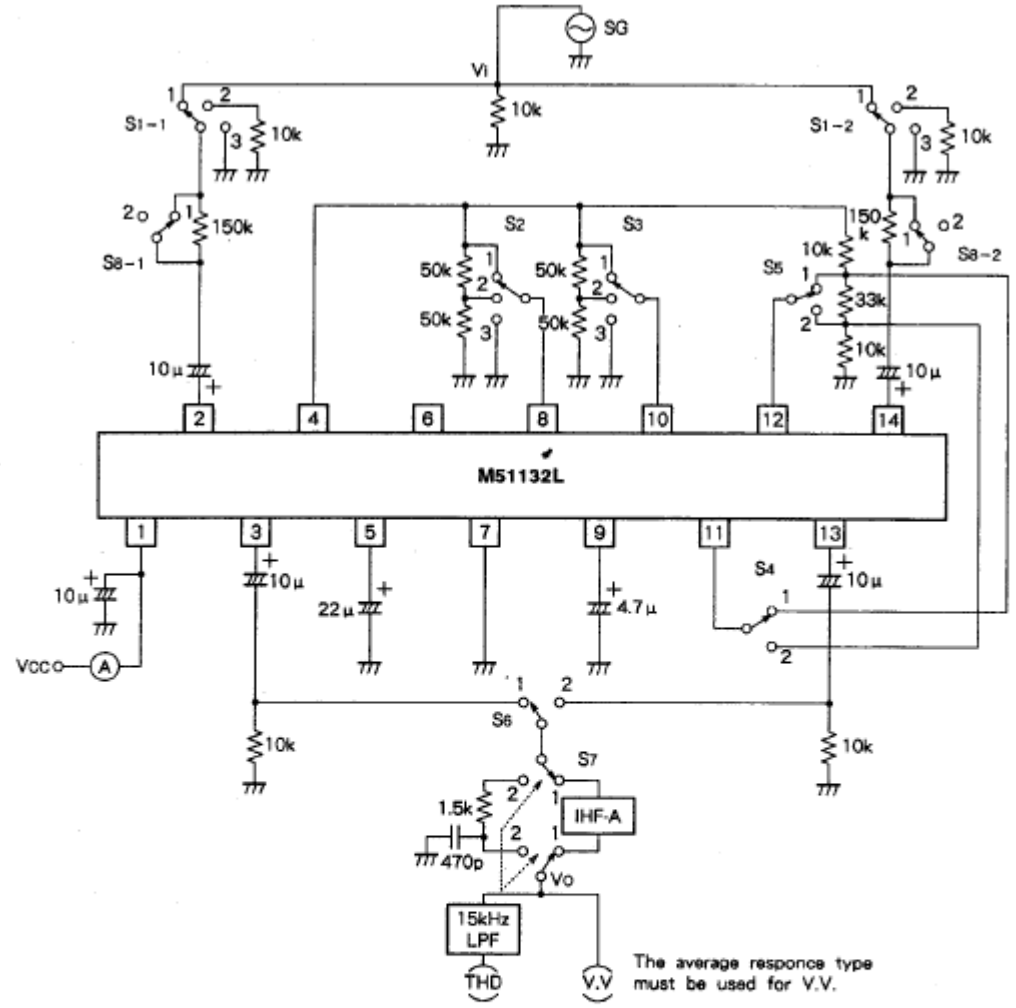
VOLTAGE REJECTION RATIO VS. SUPPLY VOLTAGE



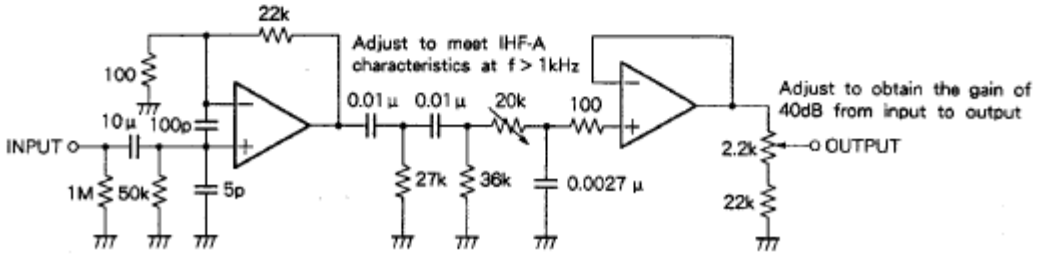
VOLTAGE REJECTION RATIO VS. SUPPLY VOLTAGE



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
Capcitance : F

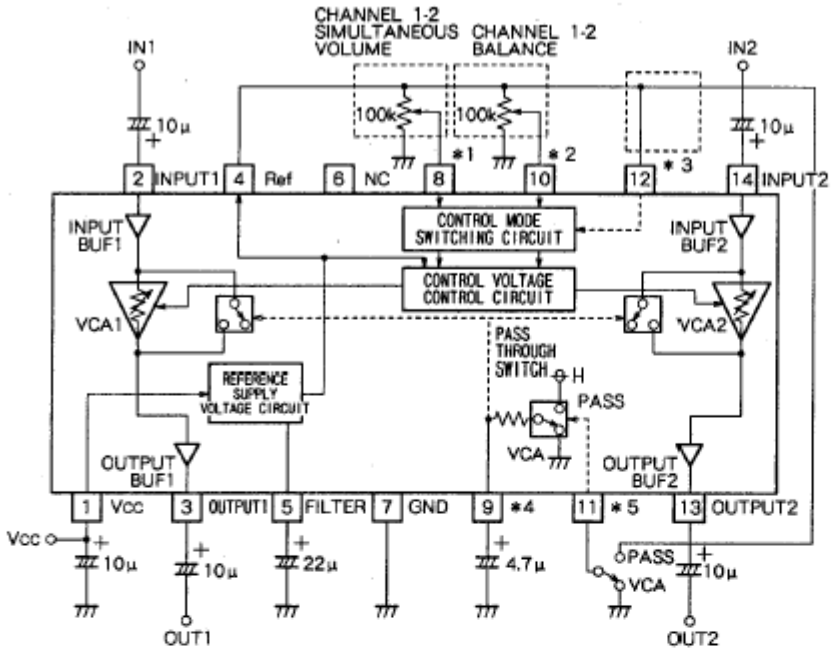
Switch Condition and Test Method

Item	Symbol	Switch S_{1-1}	S_{1-2}	S_2	S_3	S_4	S_5	S_6	S_7	S_{8-1}	S_{8-2}	Test Method
Circuit current	Icco	2	2	3	3	2	2	1	2	1	1	Measure the current flowing to pin (1) in quiescent state
Attenuation	ATTo	1	1	1	1	2	2	1/2	2	1	1	Obtain from the equation ATT(dB) = 20 log(Vo/Vi) ATT-∞ is IHF-A in
					2		1					
	Att-∞	1	1	3	3	2	2	1/2	1	1	1	
					2		1					
Channel balance	CB	1	1	1	1	2	2	1→2	2	1	1	$CB(dB) = ATT_{ch1} - ATT_{ch2}$
					2		1					
Total harmonic distortion	THD	1	1	1	1	2	2	1/2	2	1	1	15 kHz LPF in
					2		1					
Input resistor	Ri	1	1	1	1	2	2	1	2	1→2		Given the output as V_{O1} when S_8→1 and the output as V_{O2} when S_8→2, $Ri(k\Omega) = 150/(V_{O1}/V_{O2} - 1)$
								2			1→2	
Balance attenuation	BAL	1	1	1	1	2	1	1	1	1	1	BAL(dB) = 20 log(Vo/Vi)
					3			2				
Output noise voltage	Nomin	2	2	3	3	2	2	1/2	1	1	1	IHF-A in
					2		1					
	Nomax	2	2	1	1	2	2	1/2	1	1	1	IHF-A in
					2		1					
Maximum input voltage	Vimax	1	1	2	2	2	2	1/2	2	1	1	Input signal voltage when the output distortion rate is 1%
							1					
Maximum output voltage	Vomax	1	1	1	1	2	2	1/2	2	1	1	Output signal voltage when the output distortion rate is 1%
					2		1					
Crosstalk	C_T	3	1	1	1	2	2	1	1	1	1	IHF-A in, $C_T(dB) = 20 \log$ (Vo(Vrms)/2(Vrms))
		1	3					2				
Pass through voltage gain	G_{VP}	1	1	3	3	1	2	1/2	2	1	1	$G_{VP}(dB) = 20 \log(Vo/Vi)$
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.

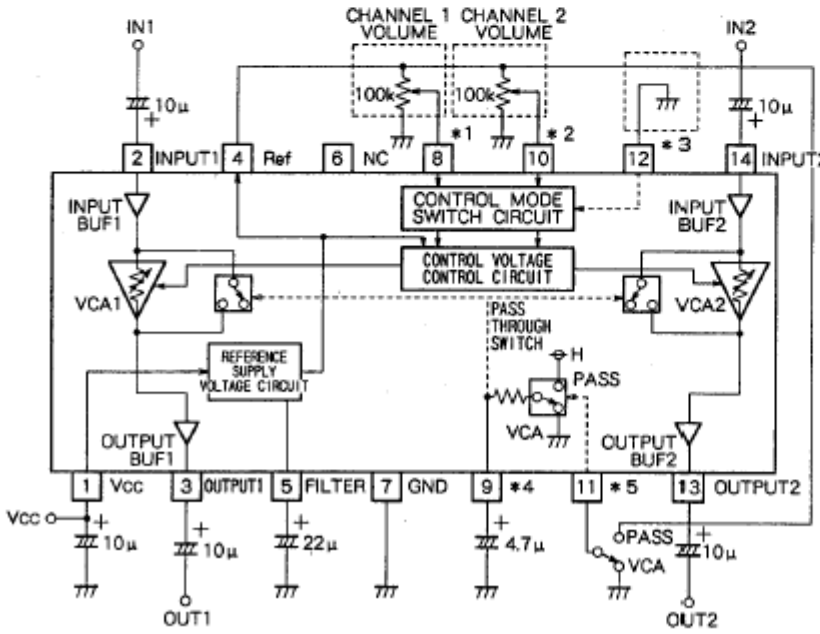
Application Examples (M51132L)

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



*1 Volume/volume 1 control
*2 Balance/volume 2 control
*3 Control mode switch
*4 Pass through switch shock noise reduction
*5 Pass through/VCA switch

(b) Control by left/right independent volume



*1 Volume/volume 1 control
*2 Balance/volume 2 control
*3 Control mode switch
*4 Pass through switch shock noise reduction
*5 Pass through/VCA switch

Different between example (a) and (b)

Pin No.	Example (a)	Example (b)
⑧	Volume control	ch1 volume control
⑩	Balance control	ch2 volume control
⑫	Connected to pin ④	GND

Units Resistance : Ω
Capasitance : F

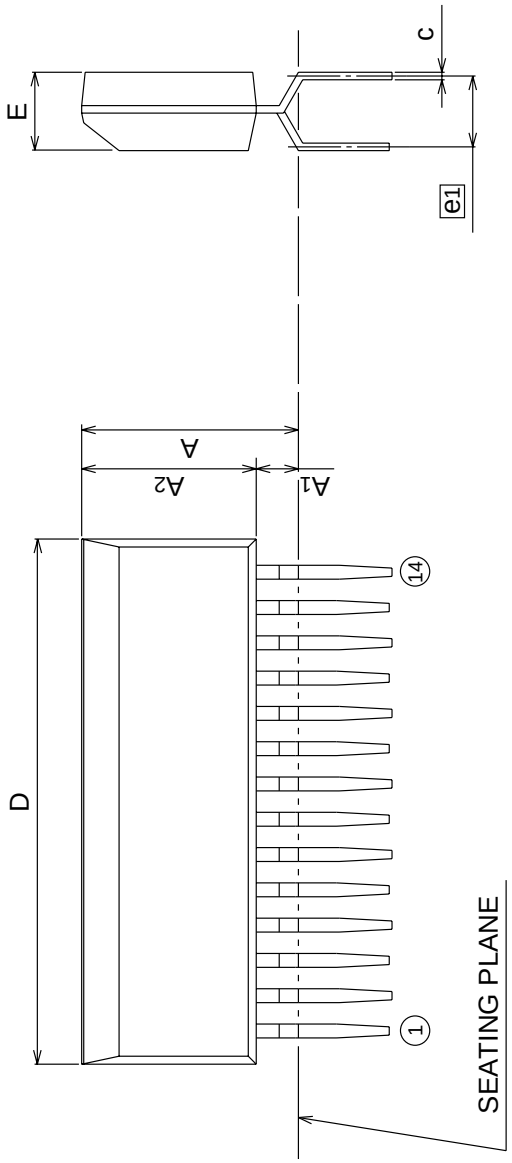
Package Dimensions

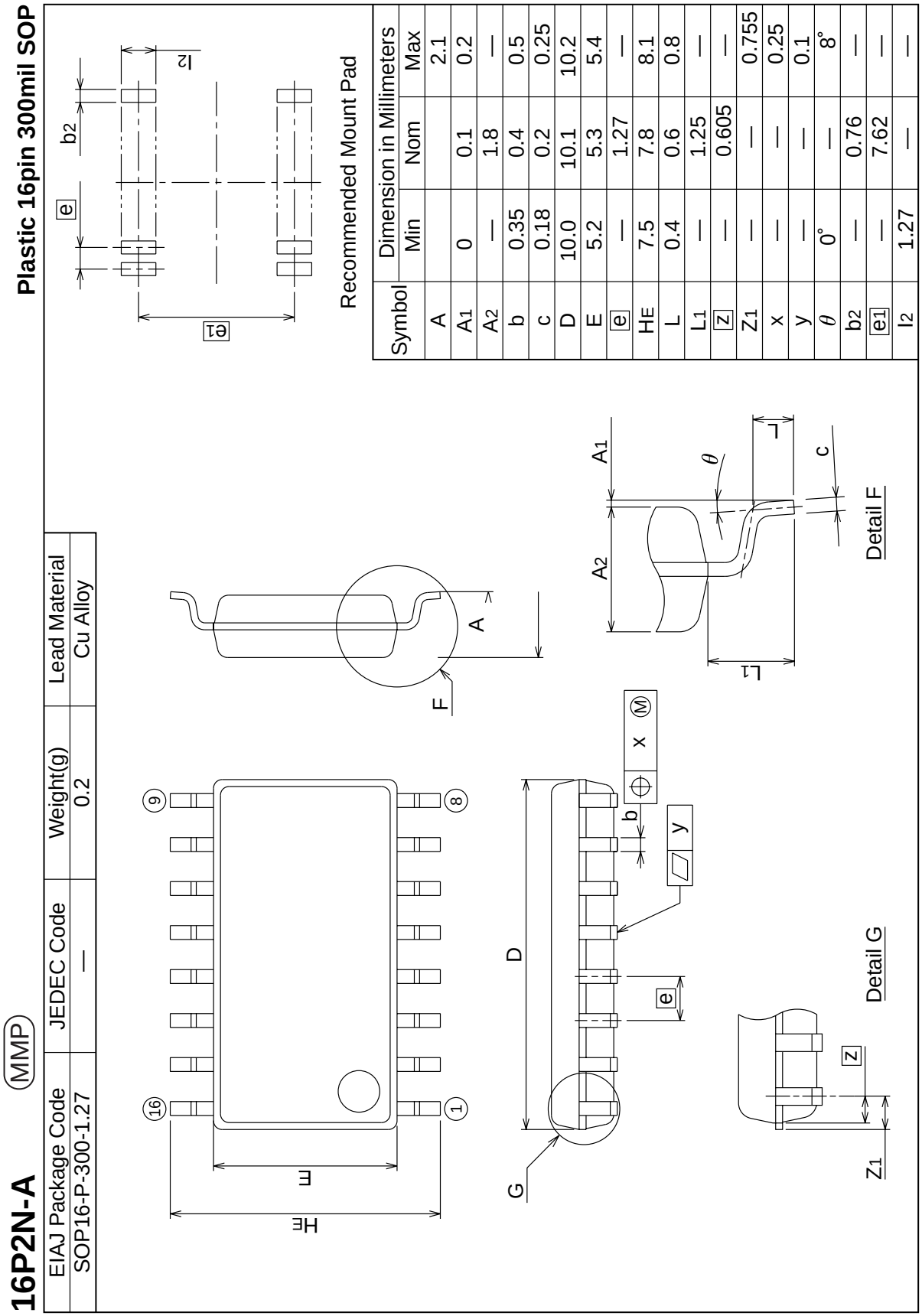
Plastic 14pin 325mil ZIP

14P5A

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

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	8.3
A_1	0.9	—	—
A_2	—	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
Plastic 16pin 300mil SOP
MMP
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
—
—
Detail F
Detail G

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Colophon 1.0