Ordering number : EN8263A

SANYO Semiconductors
DATA SHEET

LV1115/M — Bi-CMOS IC Surround Processor ICs for Electronic Volume Control

Overview

The LV1115/M are a sound processor ICs developed for use in TV sets.
They incorporate surround processing function (AViSS), pseudo stereo function, auto gain control, and the major functional blocks of an electronic volume control IC.

Features

- Input gain control (-9dB, -6dB, 0dB, 4dB, 6dB: 5 positions)
- AViSS (ON/OFF/6-stage level control)
- Tone control (BASS: ±20dB, TREBLE: ±18dB [in 2dB steps])
- Master volume control (0dB to -14dB: 1dB steps/-14dB to -80dB: 2dB steps/-∞ = -82dB)
- Balance control
- Through mode/MUTE mode
- Pseudo stereo function (ON/OFF/MONO control)
- Auto gain control function
- I^2C bus control

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		10.5	V
Allowable power dissipation 1	Pd max1	Ta ≤ 70°C *, DIP	700	mW
Allowable power dissipation 2	Pd max2	Ta ≤ 70°C *, MFP	450	mW
Operating temperature	Topr		-25 to +70	°C
Storage temperature	Tstg		-40 to +125	°C

Note *: Mounted on a specified board: 114.3mm×76.1mm×1.6mm, glass epoxy board

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Operating Condtions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		9.0	V
Operating supply voltage 1	V_{CC} opg1	DIP	8.0 to 10.0	V
Operating supply voltage 2	V_{CC} opg2	MFP	8.0 to 9.0	V
Control data				
"H" level voltage	V_{IH}		2.0 to 3.3	V
"L" level voltage	V_{IL}		0.0 to 1.0	V
Pulse width	tϕw		1.0	μs
Hold time	thold		1.0	μs
Operating frequency	fopg		100	kHz

Electrical Characteristics at Ta = 25°C, V_{CC} = 9.0V, fin = 1kHz, V_{IN} = 300mVrms = 0dB, R_L = 10kΩ

(Output=L/R-VROUT, VCA circuit though)

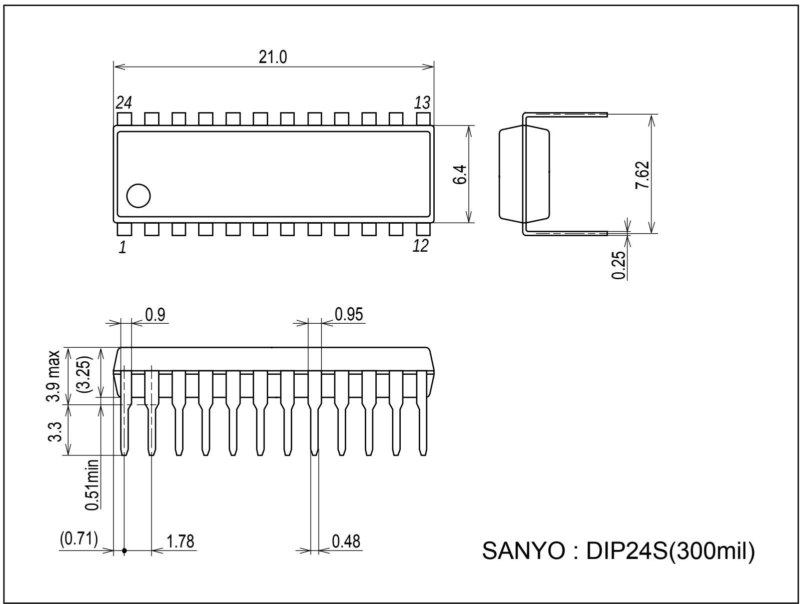
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	ICCO			50		mA
Total through (Total through mode, Volume control: 0dB)						
Voltage gain	VG_T		-1.5	-0.5	+0.5	dB
Maximum output voltage	VO_T	THD=1%	2.00	2.45		Vrms
Total harmonic distortion	THD_T	DIN AUDIO		0.01	0.1	%
Output noise voltage	VNO_T	DIN AUDIO		-94	-85	dBV
Cross talk	CT_T	DIN AUDIO	80	90		dB
Matrix through (Matrix mode, Volume control: 0dB)						
Voltage gain	VG_F		-1.6	-0.6	+0.6	dB
Maximum output voltage	VO_M	THD=1%	1.50	1.85		Vrms
Total harmonic distortion	THD_M	DIN AUDIO		0.05	0.1	%
Output noise voltage	VNO_M	DIN AUDIO		-92	-85	dBV
Cross talk	CT_M	DIN AUDIO	80	90		dB
MONO mode (MONO mode, Volume control: 0dB)						
Maximum output voltage	VO_S	THD=1%	1.50	1.85		Vrms
Total harmonic distortion	THD_S	DIN AUDIO		0.05	0.5	%
Output noise voltage	VNO_S	DIN AUDIO		-92	-85	dBV
Surround (Surround mode-A, Volume control: 0dB)						
Maximum output voltage	VO_S	THD=1%	1.50	1.85		Vrms
Total harmonic distortion	THD_S	DIN AUDIO		0.26	0.5	%
Output noise voltage	VNO_S	DIN AUDIO		-90	-80	dBV
Pseudo stereo (Pseudo mode, Volume control: 0dB)						
Maximum output voltage	VO_S	THD=1%	1.50	1.85		Vrms
Total harmonic distortion	THD_S	DIN AUDIO		0.06	0.5	%
Output noise voltage	VNO_S	DIN AUDIO		-92	-85	dBV
Bass band EQR (Matrix through mode, Volume control: 0dB)						
Control range	Geq_B	Max. Boost/Cut	±17	±20	±23	dB
Step resolution	$Estep_B$		1.0	2.0	3.0	dB
Treble band EQR (Matrix through mode, Volume control: 0dB)						
Control range	Geq_T	Max. Boost/Cut	±15	±18	±21	dB
Step resolution	$Estep_T$		1.0	2.0	3.0	dB

Note: The output wave form becomes big depending on the surround or tone control setting. Please make sure the output waveform is not distorted. If the waveform is distorted, reduce the gain setting of surround, tone control, or input signal level.

Package Dimensions

unit : mm (typ)

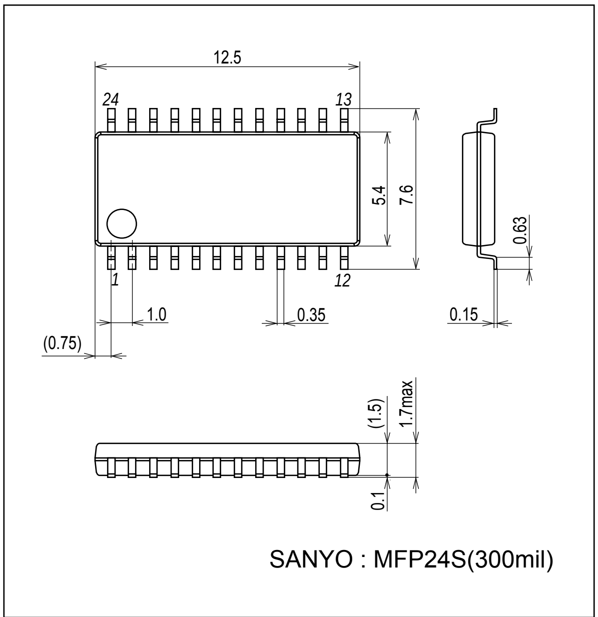
3067B



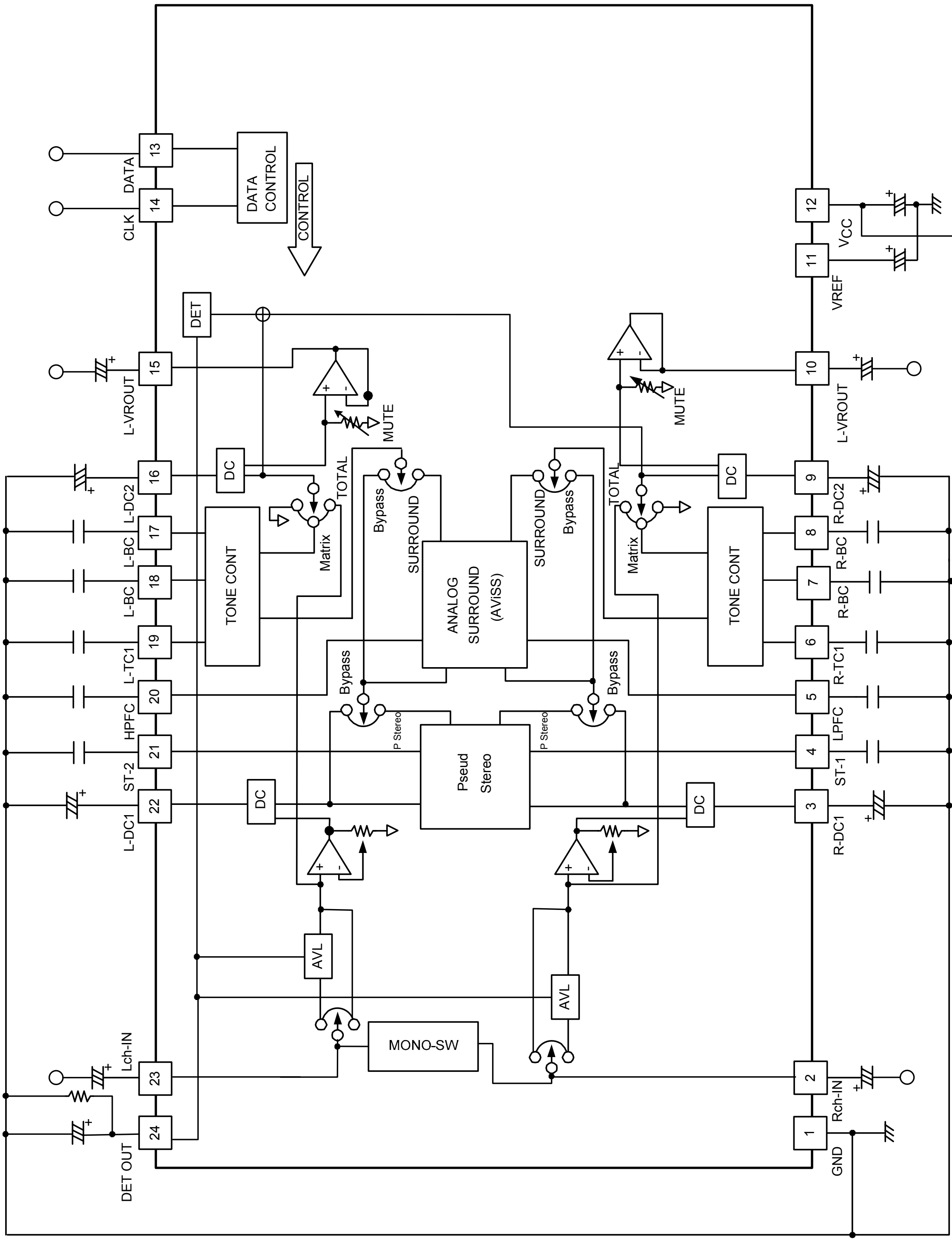
Package Dimensions

unit : mm (typ)

3112B



Block Diagram



I²C BUS Control Signal

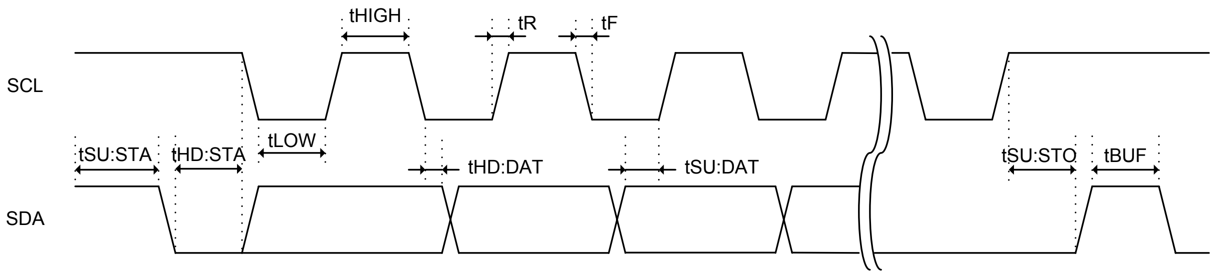
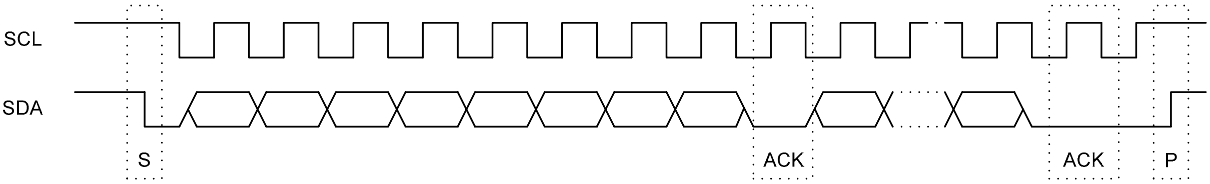


Figure 1. I²C BUS Control Signal timing chart

I²C BUS register

1) The explanation of I²C Bus

I²C Bus (Inter IC Bus) is the bus system which the PHILIPS company developed.
It does controls such as the start, the stop by two control signals of SDA (Serial Data) and SCL (Serial Clock).
The output of each signal is open drain and forms out of wired OR.



S: Start condition
P: Stop condition
ACK: Acknowledge

Data is transmitted in the MSB first.
1 unit is composed of 8 bits and ACK is put back from the slave to confirm.
Slave IC reads data with rising edge of SCL.
Master IC changes data by falling edge in SCL.

2) The control register

Table1 Slave Address

MSB							LSB
1	1	1	0	1	1	1	0

Note; LV1115/M are reception exclusive use. It depends and it uses LSB by the "0" fixation.

Table2 I²C Bus transmission

Function	Sub Address		Data							
	BINARY	HEX	D7	D6	D5	D4	D3	D2	D1	D0
Input Gain/AVL (On-Off) control	0000 0001	01	0	0	Gain			AVL MODE		
Volume control	0000 0010	02	Channel		Volume					
AVL detection level/Surround/MODE control	0000 0011	03	AVL DET LEVEL			Surround			MODE	
Tone control [Bass]	0000 0100	04	0	0	0	Bass				
Tone control [TREBLE]	0000 0101	05	0	0	0	TREBLE				
AVL CONTROL	0000 0110	06	0	0	0	0	0	AVL SLOPE		

Table3 AVL MODE

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
Mute									0	0	*	*	*	0	0	0
AVL ON									0	0	*	*	*	0	0	1
AVL OFF	0	0	0	0	0	0	0	1	0	0	*	*	*	0	1	0
Mute									0	0	*	*	*	0	1	1
Mute									0	0	*	*	*	1	0	0

Table4 Gain control

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
-9dB									0	0	0	1	1	*	*	*
-6dB									0	0	0	1	0	*	*	*
0dB	0	0	0	0	0	0	0	1	0	0	0	0	0	*	*	*
+4dB									0	0	1	1	0	*	*	*
+6dB									0	0	1	1	1	*	*	*

Table5 Mode control

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
Bypass (Total)									*	*	*	*	*	*	0	0
Matrix	0	0	0	0	0	0	1	1	*	*	*	*	*	*	0	1
Mono									*	*	*	*	*	*	1	0
Pseudo Stereo									*	*	*	*	*	*	1	1

Table6 Surround control

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
OFF									*	*	*	0	0	0	*	*
MODE-C									*	*	*	0	1	1	*	*
MODE-B									*	*	*	0	1	0	*	*
MODE-A	0	0	0	0	0	0	1	1	*	*	*	0	0	1	*	*
MODE-F												1	1	1		
MODE-E												1	1	0		
MODE-D									*	*	*	1	0	1	*	*

Note: At the time of forced mono mode, there is not Surround effect.

Note: Output gain = Step1 < Step7

Note: The output wave form becomes big depending on the surround or tone control setting. Please make sure the output waveform is not distorted. If the waveform is distorted, reduce the gain setting of surround, tone control, or input signal level.

Table7 AVL DETECTION LEVEL

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
OFF									0	0	0	*	*	*	*	*
100mV									0	0	1	*	*	*	*	*
200mV									0	1	0	*	*	*	*	*
300mV	0	0	0	0	0	0	1	1	0	1	1	*	*	*	*	*
400mV									1	0	0	*	*	*	*	*
500mV									1	0	1	*	*	*	*	*
600mV									1	1	0	*	*	*	*	*
700mV									1	1	1	*	*	*	*	*

Table8 AVL SLOPE

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
LEVEL1									0	0	0	0	0	0	0	0
LEVEL2									0	0	0	0		0	0	1
LEVEL3	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
LEVEL4									0	0	0	0	0	0	1	1
LEVEL5									0	0	0	0	0	1	0	0
LEVEL6									0	0	0	0	0	1	0	1

Table9 Tone control [Bass control]

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
+20dB									0	0	0	0	1	0	1	0
+18dB									0	0	0	0	1	0	0	1
+16dB									0	0	0	0	1	0	0	0
+14dB									0	0	0	0	0	1	1	1
+12dB									0	0	0	0	0	1	1	0
+10dB									0	0	0	0	0	1	0	1
+8dB									0	0	0	0	0	1	0	0
+6dB									0	0	0	0	0	0	1	1
+4dB									0	0	0	0	0	0	1	0
+2dB									0	0	0	0	0	0	0	1
0dB	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
-2dB									0	0	0	1	0	0	0	1
-4dB									0	0	0	1	0	0	1	0
-6dB									0	0	0	1	0	0	1	1
-8dB									0	0	0	1	0	1	0	0
-10dB									0	0	0	1	0	1	0	1
-12dB									0	0	0	1	0	1	1	0
-14dB									0	0	0	1	0	1	1	1
-16dB									0	0	0	1	1	0	0	0
-18dB									0	0	0	1	1	0	0	1
-20dB									0	0	0	1	1	0	1	0

Note: The output wave form becomes big depending on the surround or tone control setting. Please make sure the output waveform is not distorted. If the waveform is distorted, reduce the gain setting of surround, tone control, or input signal level.

Table10 Tone control [TREBLE control]

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
+18dB									0	0	0	0	1	0	0	1
+16dB									0	0	0	0	1	0	0	0
+14dB									0	0	0	0	0	1	1	1
+12dB									0	0	0	0	0	1	1	0
+10dB									0	0	0	0	0	1	0	1
+8dB									0	0	0	0	0	1	0	0
+6dB									0	0	0	0	0	0	1	1
+4dB									0	0	0	0	0	0	1	0
+2dB									0	0	0	0	0	0	0	1
0dB	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
-2dB									0	0	0	1	0	0	0	1
-4dB									0	0	0	1	0	0	1	0
-6dB									0	0	0	1	0	0	1	1
-8dB									0	0	0	1	0	1	0	0
-10dB									0	0	0	1	0	1	0	1
-12dB									0	0	0	1	0	1	1	0
-14dB									0	0	0	1	0	1	1	1
-16dB									0	0	0	1	1	0	0	0
-18dB									0	0	0	1	1	0	0	1

Note: The output wave form becomes big depending on the surround or tone control setting. Please make sure the output waveform is not distorted. If the waveform is distorted, reduce the gain setting of surround, tone control, or input signal level.

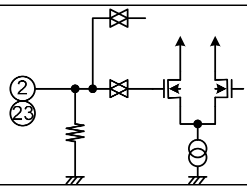
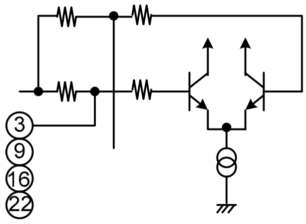
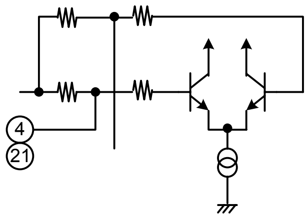
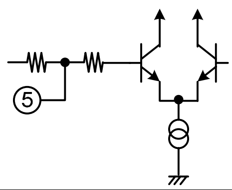
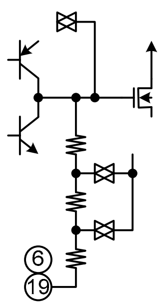
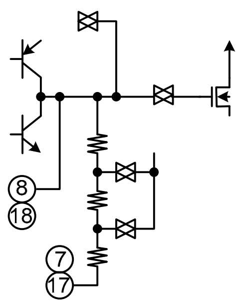
Table11 Volume control

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
0dB									*	*	0	0	0	0	0	0
-1dB									*	*	0	0	0	0	0	1
-2dB									*	*	0	0	0	0	1	0
-3dB									*	*	0	0	0	0	1	1
-4dB									*	*	0	0	0	1	0	0
-5dB									*	*	0	0	0	1	0	1
-6dB									*	*	0	0	0	1	1	0
-7dB									*	*	0	0	0	1	1	1
-8dB									*	*	0	0	1	0	0	0
-9dB									*	*	0	0	1	0	0	1
-10dB									*	*	0	0	1	0	1	0
-11dB									*	*	0	0	1	0	1	1
-12dB									*	*	0	0	1	1	0	0
-13dB									*	*	0	0	1	1	0	1
-14dB									*	*	0	0	1	1	1	0
-16dB									*	*	0	0	1	1	1	1
-18dB									*	*	0	1	0	0	0	0
-20dB									*	*	0	1	0	0	0	1
-22dB									*	*	0	1	0	0	1	0
-24dB									*	*	0	1	0	0	1	1
-26dB									*	*	0	1	0	1	0	0
-28dB									*	*	0	1	0	1	0	1
-30dB									*	*	0	1	0	1	1	0
-32dB									*	*	0	1	0	1	1	1
-34dB	0	0	0	0	0	0	1	0	*	*	0	1	1	0	0	0
-36dB									*	*	0	1	1	0	0	1
-38dB									*	*	0	1	1	0	1	0
-40dB									*	*	0	1	1	0	1	1
-42dB									*	*	0	1	1	1	0	0
-44dB									*	*	0	1	1	1	0	1
-46dB									*	*	0	1	1	1	1	0
-48dB									*	*	0	1	1	1	1	1
-50dB									*	*	1	0	0	0	0	0
-52dB									*	*	1	0	0	0	0	1
-54dB									*	*	1	0	0	0	1	0
-56dB									*	*	1	0	0	0	1	1
-58dB									*	*	1	0	0	1	0	0
-60dB									*	*	1	0	0	1	0	1
-62dB									*	*	1	0	0	1	1	0
-64dB									*	*	1	0	0	1	1	1
-66dB									*	*	1	0	1	0	0	0
-68dB									*	*	1	0	1	0	0	1
-70dB									*	*	1	0	1	0	1	0
-72dB									*	*	1	0	1	0	1	1
-74dB									*	*	1	0	1	1	0	0
-76dB									*	*	1	0	1	1	0	1
-78dB									*	*	1	0	1	1	1	0
-80dB									*	*	1	0	1	1	1	1
-∞dB									*	*	1	1	0	0	0	0

Table12 Volume channel control

	Sub Address								Data							
	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0
L-ch	0	0	0	0	0	0	1	0	0	1	*	*	*	*	*	*
R-ch									1	0	*	*	*	*	*	*
L/R									1	1	*	*	*	*	*	*

Pin Functions

Pin No	Function	Voltage	Internal equivalent circuit	Remarks
1	GND	0		
2	INPUT-R	VREF	Input Impedance ri=25kΩ	
23	INPUT-L			
3	DC1 Cut(R)	VREF	DC offset cancellation capacitor connection pin	
9	DC2 Cut(R)			
16	DC2 Cut(L)			
22	DC1 Cut(L)			
4	ST-1	VREF	Pseudo stereo phase shift capacitor connection pin	
21	ST-2			
5	AViSS LPF	VREF	Capacitor connection pin for surround low pass filter	
6	TREBLE(R)	VREF	Capacitor connection pin for configuring treble filter	
19	TREBLE(L)			
7	BASS-1(R)	VREF	Bass band filter configuration capacitor and resistor connection pins	
8	BASS-1(L)			
17	BASS-2(R)			
18	BASS-2(L)			

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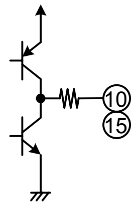
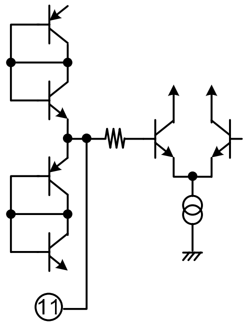
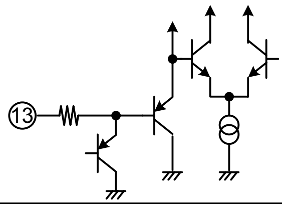
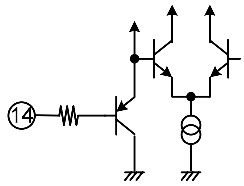
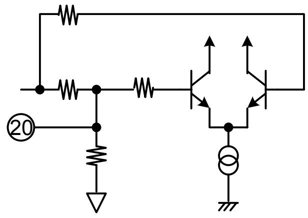
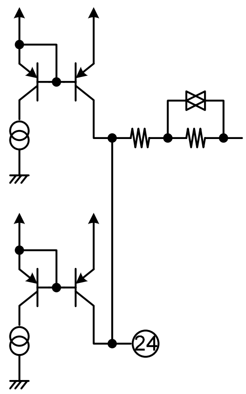
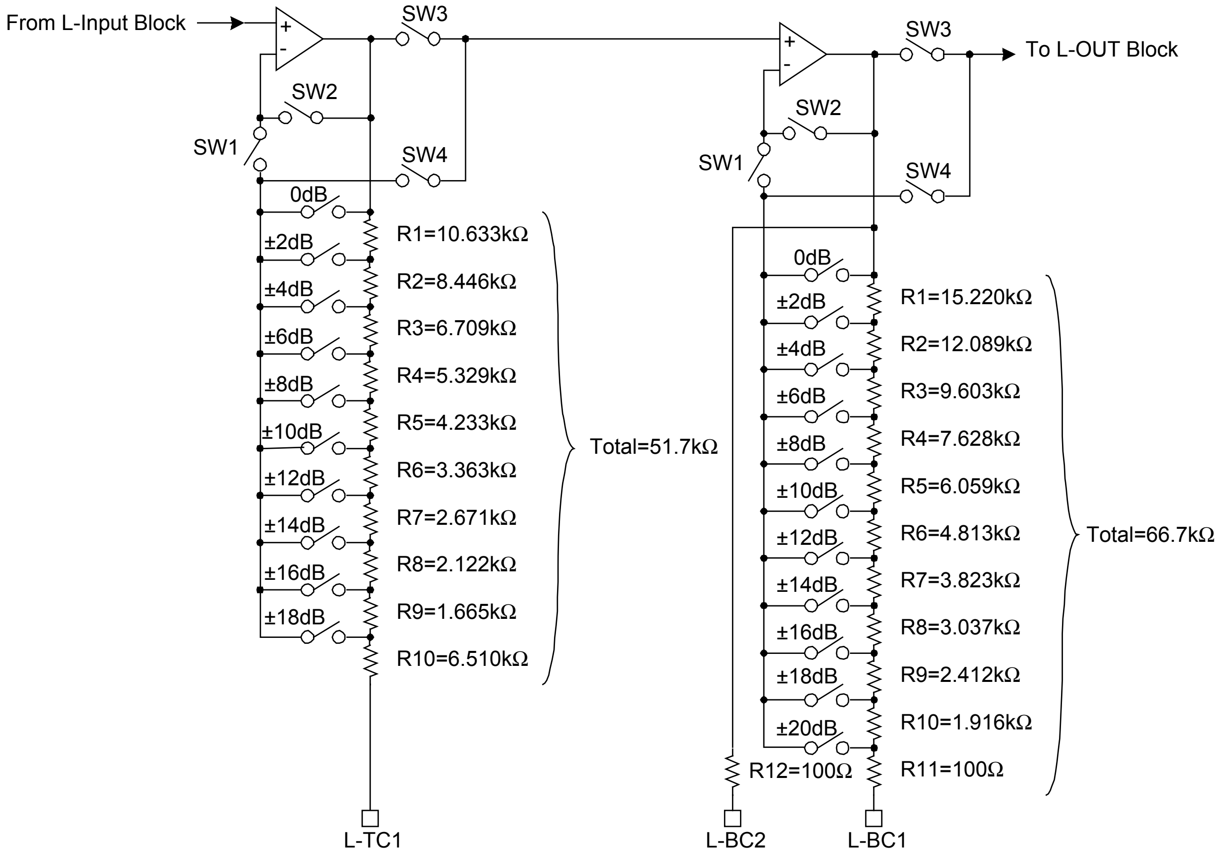
Pin No	Function	Voltage	Internal equivalent circuit	Remarks
10	EVR-OUT(R)	VREF	Output Impedance ro=500Ω	
15	EVR-OUT(L)			
11	VREF	0.5 V_{CC}	Reference voltage	
12	V_{CC}	V_{CC}		
13	I^2C-DATA	0/Hi-Z	I^2C control data input	
14	I^2C-CLK	0/Hi-Z	I^2C control data input	
20	AViSS HPF	VREF		
24	DET-OUT	4.5V	AVL DET OUT	

Treble / Bass Band Block Equivalent Circuit Diagram

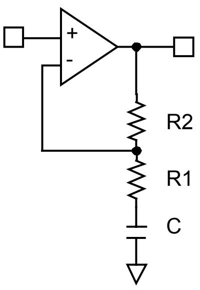


During boost, SW1 and SW3 are ON, during cut, SW2 and SW4 are ON, when 0dB, 0dBSW and SW2 and SW3 are ON.

Tone Circuit Constant Calculation Examples

Treble Band Circuit: The shelving characteristics can be obtained for the treble band.
The equivalent circuit and calculation formula during boost are indicated below.

- Calculation example 1: Specification
  Set frequency: f = 24000Hz
  Gain during maximum boost: G_{+18dB} = 17.5dB
  Let us use R1 = 6.51kΩ and R2 = 45.19kΩ
  The above constants are inserted in the following formula



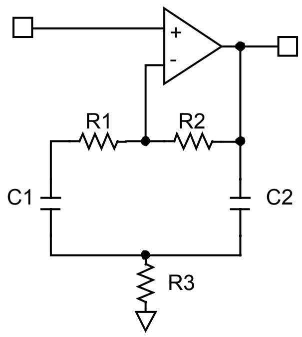
$$G = 20 \times \mathrm{Log}_{10}\left(1 + \frac{R2}{\sqrt{R1^2 + (1/\omega C)^2}}\right)$$

$$C = \frac{1}{2\pi f \sqrt{\left[\dfrac{R2}{10^{G/20}-1}\right]^2 - R1^2}}$$

$$= \frac{1}{2\pi 24000 \sqrt{\left[\dfrac{45190}{7.50 - 1}\right]^2 - 6510^2}} \approx 2700\ \text{(pF)}$$

Bass Band Circuit: The equivalent circuit and the formula for calculating the external RC with a mean frequency of 100Hz are shown below.

- Calculation example 1: specification
  Mean frequency: f0 = 100Hz
  Gain during maximum boost: G_{+20dB} = 20dB
  Let us use R1 = 0kΩ and R2 = 66.7kΩ, and C1 = C2 = C.



We obtain R2 from G = 20dB

$$G = 20 \times \mathrm{Log}_{10}\left(1 + \frac{R2}{2R3}\right)$$

$$R3 = \frac{R2}{2\,(10^{G+20dB/20} - 1)} = \frac{66700}{2\,(10 - 1)} \approx 3.6k\Omega$$

We obtain C from mean frequency f0 = 100Hz

$$f0 = \frac{1}{2\pi\sqrt{(R3R2C1C2)}}$$

$$C = \frac{1}{2\pi f0\sqrt{R3R2}} = \frac{1}{2\pi \times 100\sqrt{66700 \times 3600}} \approx 0.1\mu F$$

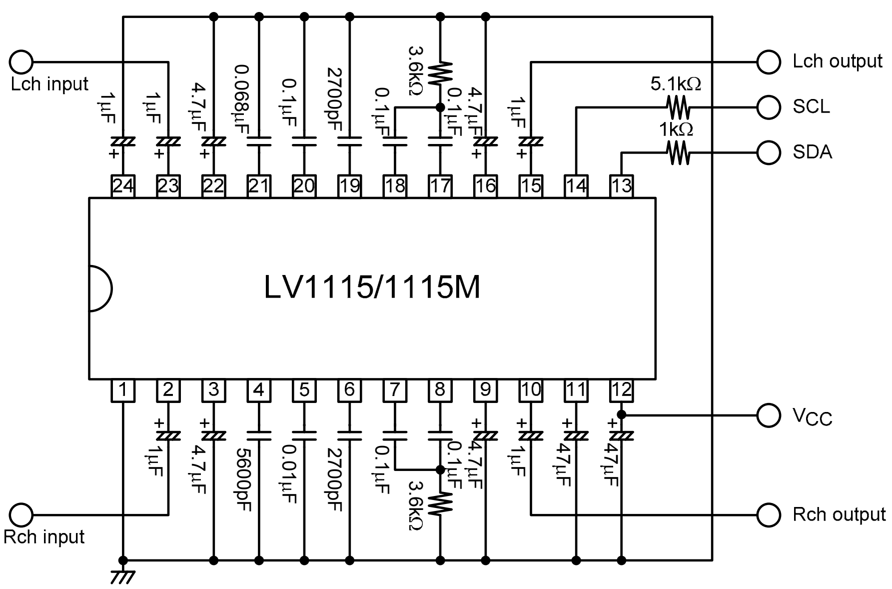
We obtain Q

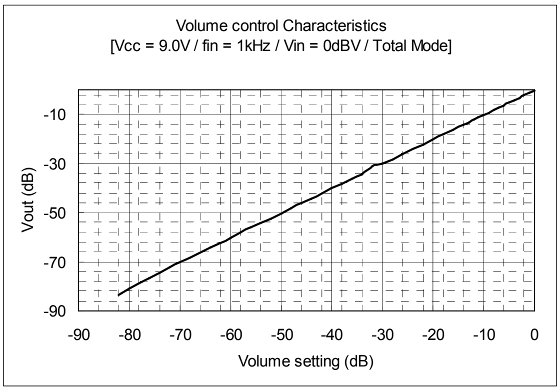
$$Q = \frac{R3R2}{2R3} \times \frac{1}{\sqrt{R3R2}} \approx 2.15$$

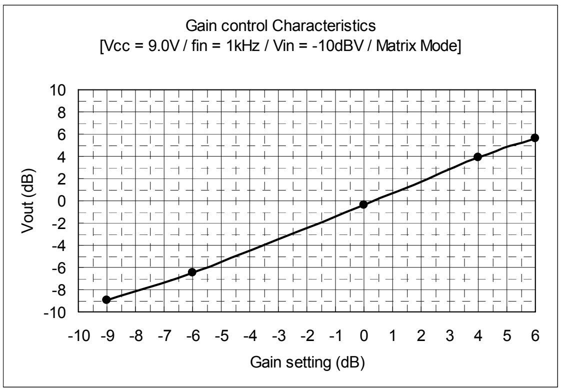
Note item when using

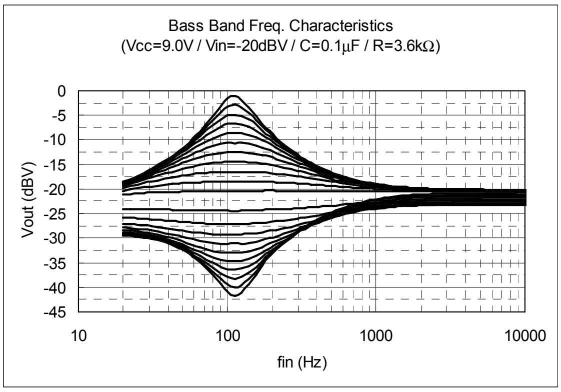
(1) When turning on the power, the setting inside is unsettled. Before setting control data, it does a mute.
(2) To prevent the digital noise of the high frequency influence a terminal (SCL, SDA).
It can be protected by a signal line in the ground pattern or by the shielding cable.
(3) To prevent the noise in changing a mode, please set the mute ON.

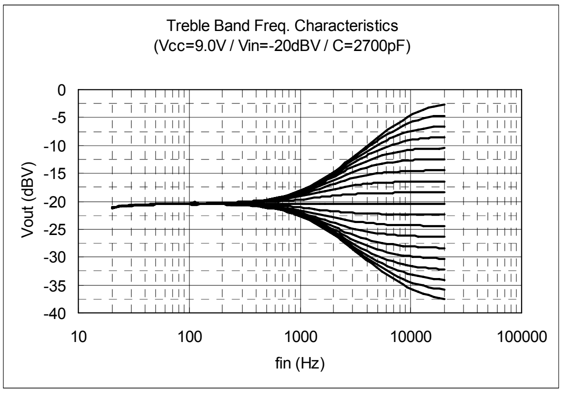
Sample Application Circuit

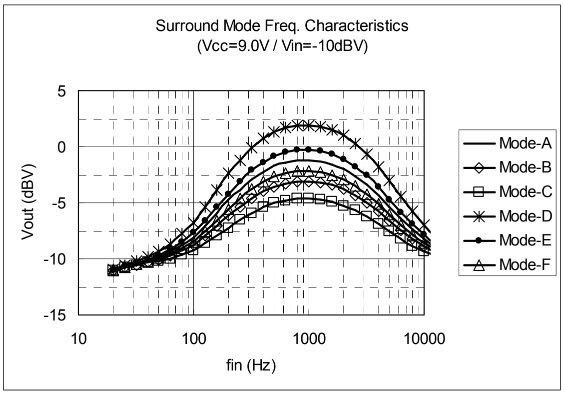


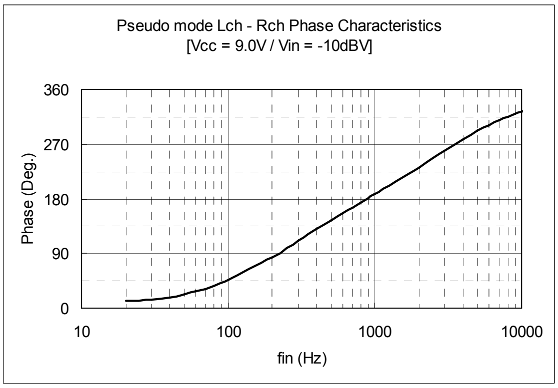

Volume control Characteristics
[Vcc = 9.0V / fin = 1kHz / Vin = 0dBV / Total Mode]
Vout (dB)
Volume setting (dB)

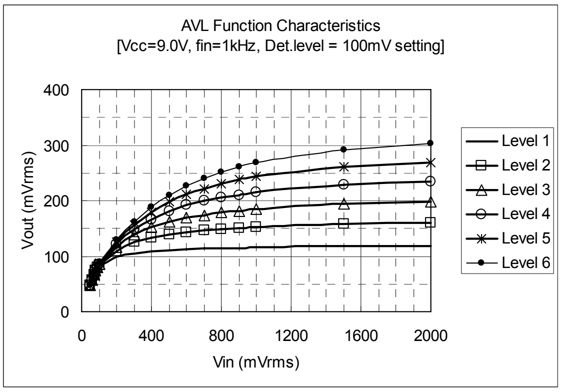

Gain control Characteristics
[Vcc = 9.0V / fin = 1kHz / Vin = -10dBV / Matrix Mode]
Vout (dB)
Gain setting (dB)

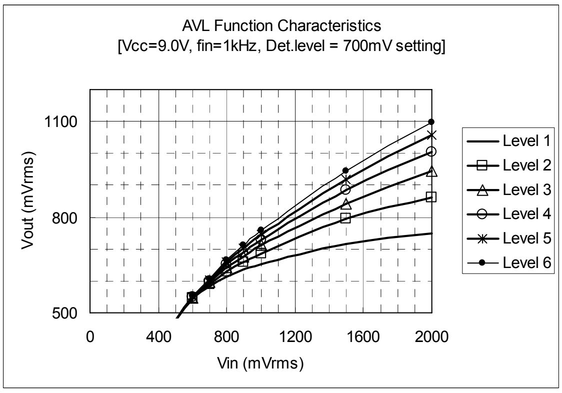

Bass Band Freq. Characteristics
(Vcc=9.0V / Vin=-20dBV / C=0.1μF / R=3.6kΩ)
Vout (dBV)
fin (Hz)

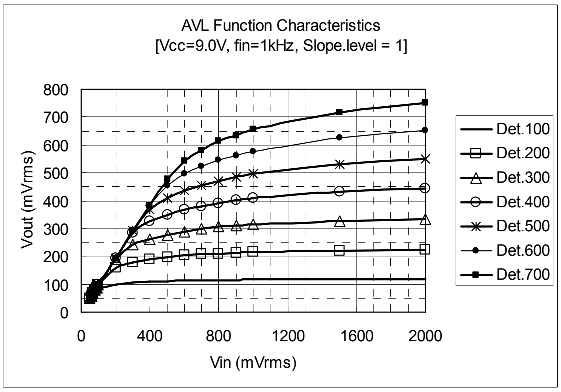

Treble Band Freq. Characteristics
(Vcc=9.0V / Vin=-20dBV / C=2700pF)
Vout (dBV)
fin (Hz)

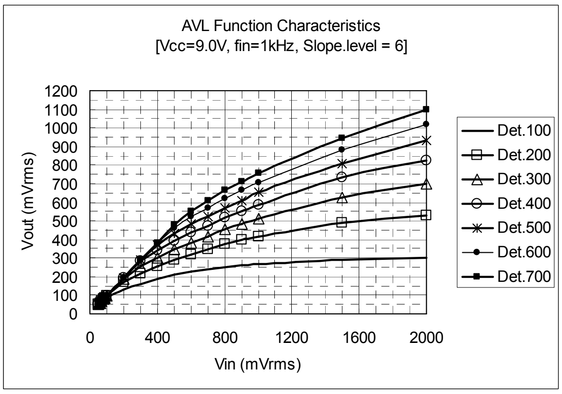

Surround Mode Freq. Characteristics
(Vcc=9.0V / Vin=-10dBV)
Vout (dBV)
fin (Hz)
Mode-A
Mode-B
Mode-C
Mode-D
Mode-E
Mode-F

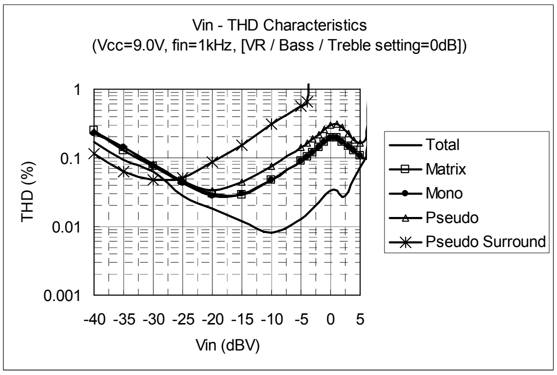

Pseudo mode Lch - Rch Phase Characteristics
[Vcc = 9.0V / Vin = -10dBV]
Phase (Deg.)
fin (Hz)

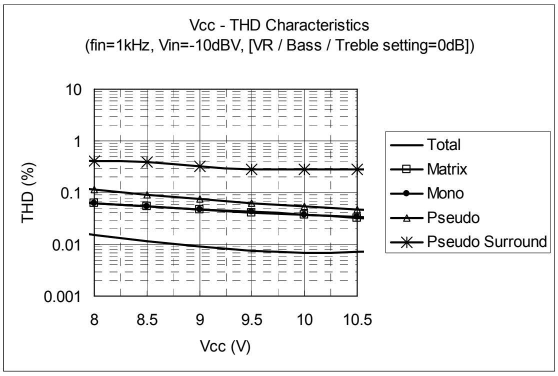

AVL Function Characteristics
[Vcc=9.0V, fin=1kHz, Det.level = 100mV setting]
Vout (mVrms)
Vin (mVrms)
Level 1
Level 2
Level 3
Level 4
Level 5
Level 6

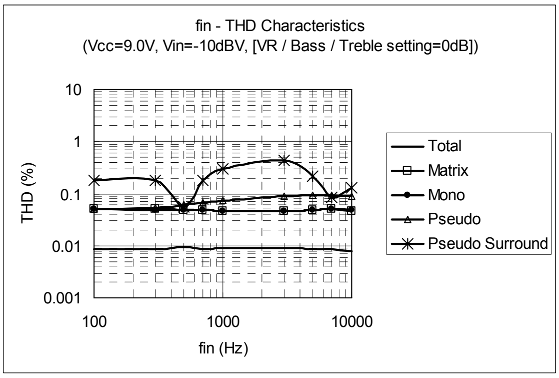

AVL Function Characteristics
[Vcc=9.0V, fin=1kHz, Det.level = 700mV setting]
Vout (mVrms)
Vin (mVrms)
Level 1
Level 2
Level 3
Level 4
Level 5
Level 6

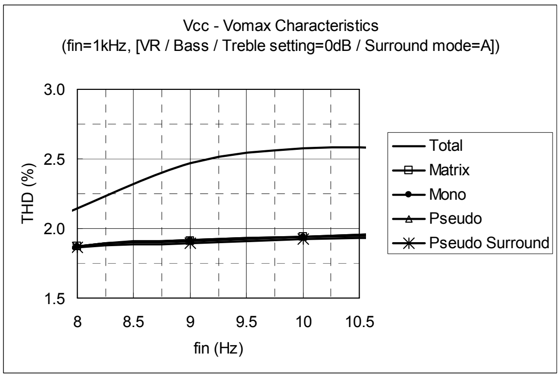

AVL Function Characteristics
[Vcc=9.0V, fin=1kHz, Slope.level = 1]
Vout (mVrms)
Vin (mVrms)
0
100
200
300
400
500
600
700
800
0
400
800
1200
1600
2000
Det.100
Det.200
Det.300
Det.400
Det.500
Det.600
Det.700

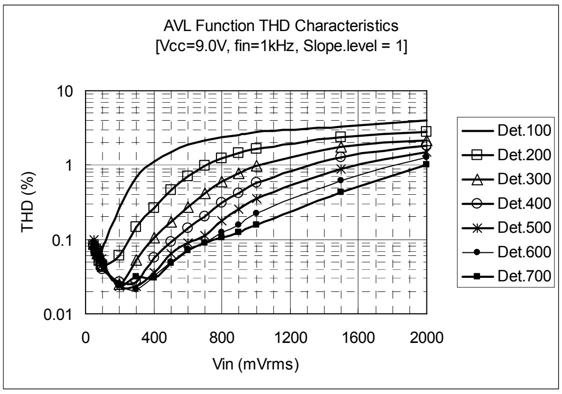

AVL Function Characteristics
[Vcc=9.0V, fin=1kHz, Slope.level = 6]
Vout (mVrms)
Vin (mVrms)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
0
400
800
1200
1600
2000
Det.100
Det.200
Det.300
Det.400
Det.500
Det.600
Det.700

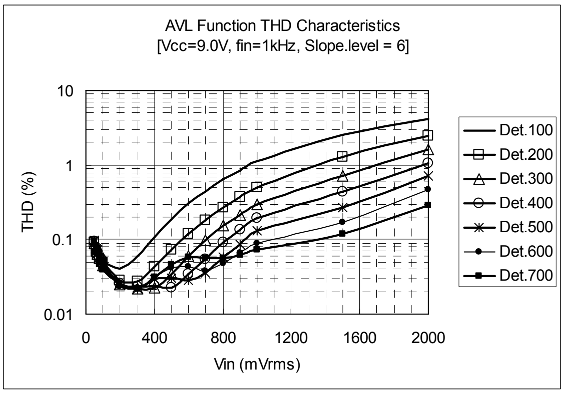

Vin - THD Characteristics
(Vcc=9.0V, fin=1kHz, [VR / Bass / Treble setting=0dB])
THD (%)
Vin (dBV)
1
0.1
0.01
0.001
-40
-35
-30
-25
-20
-15
-10
-5
0
5
Total
Matrix
Mono
Pseudo
Pseudo Surround

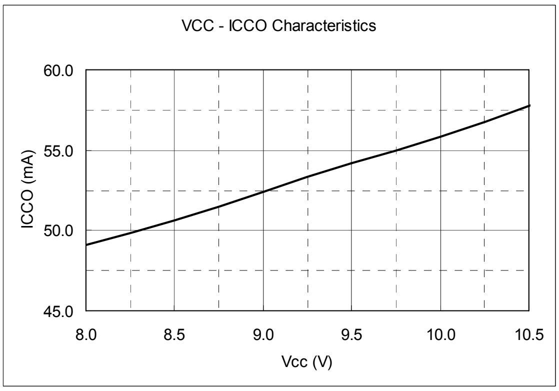

Vcc - THD Characteristics
(fin=1kHz, Vin=-10dBV, [VR / Bass / Treble setting=0dB])
THD (%)
Vcc (V)
10
1
0.1
0.01
0.001
8
8.5
9
9.5
10
10.5
Total
Matrix
Mono
Pseudo
Pseudo Surround

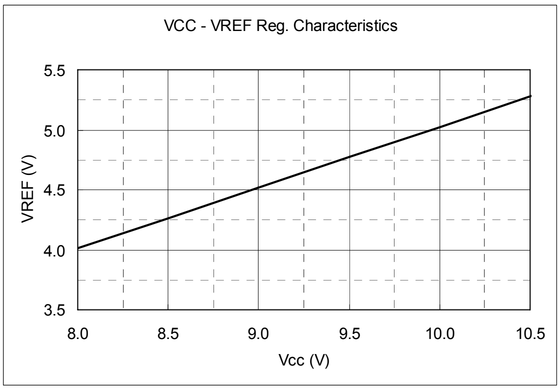

fin - THD Characteristics
(Vcc=9.0V, Vin=-10dBV, [VR / Bass / Treble setting=0dB])
THD (%)
fin (Hz)
10
1
0.1
0.01
0.001
100
1000
10000
Total
Matrix
Mono
Pseudo
Pseudo Surround


Vcc - Vomax Characteristics
(fin=1kHz, [VR / Bass / Treble setting=0dB / Surround mode=A])
THD (%)
fin (Hz)
3.0
2.5
2.0
1.5
8
8.5
9
9.5
10
10.5
Total
Matrix
Mono
Pseudo
Pseudo Surround


AVL Function THD Characteristics
[Vcc=9.0V, fin=1kHz, Slope.level = 1]
THD (%)
Vin (mVrms)
10
1
0.1
0.01
0
400
800
1200
1600
2000
Det.100
Det.200
Det.300
Det.400
Det.500
Det.600
Det.700


AVL Function THD Characteristics
[Vcc=9.0V, fin=1kHz, Slope.level = 6]
THD (%)
Vin (mVrms)
10
1
0.1
0.01
0
400
800
1200
1600
2000
Det.100
Det.200
Det.300
Det.400
Det.500
Det.600
Det.700





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