AUDIO PROCCESOR with SRS&BBE&ealaBASS

■ GENERAL DESCRIPTION

NJW1177 is a sound processor includes all of the functions required to process the audio signal for TV, such as volume, balance, mute, tone control, AGCfunctions. And also It performs NJRC original dynamic bass boost technology “ealaBASS” provides graceful bass sound with low distortion. All of internal states and variables are controlled by I^2C BUS interface. In addition to SRS and BBE, since NJW1177 builds in ealaBASS, it reproduces clearly, natural and rich bass sound

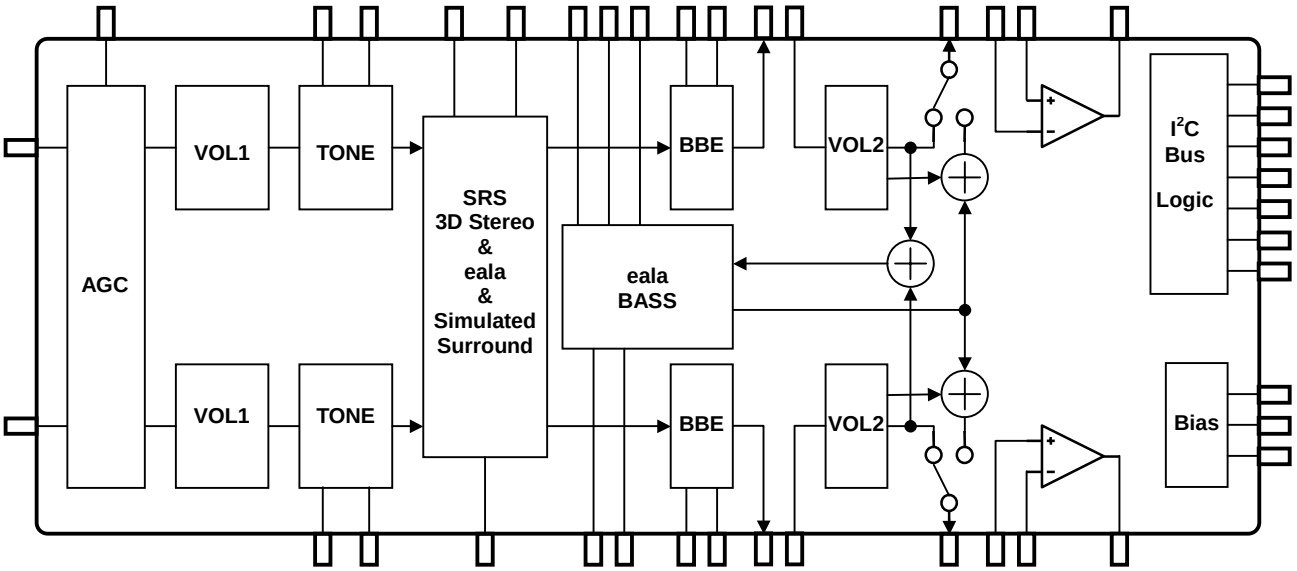
■ PACKAGE OUTLINE

NJW1177V

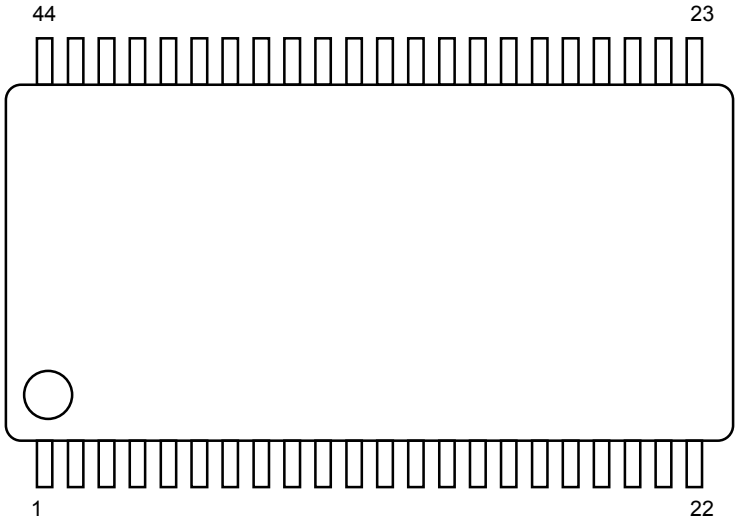
■ FEATURES

- Operating Voltage +7.5 to +13V
- I^2C BUS interface
- BBE Sound Enhancement (Low Boost and High Boost: 15dB max.)
- SRS 3D Stereo
- eala
- eala BASS (Dynamic Bass Boost)
- Simulated Stereo
- AGC Circuit
- Low Noise VCA
- Bi-CMOS technology
- Package Outline SSOP44

■ BLOCK DIAGRAM



■ PIN ASSIGNMENT



No	Symbol	Function	No	Symbol	Function
1	INa	Ach Input	23	V+	Power Supply Input
2	SURROUND FIL	Surround Filter Capacitor	24	AUX1	Auxiliary Output 1
3	TONE-Ha	Ach TONE Treble Filter Capacitor	25	AUX0	Auxiliary Output 0
4	TONE-La	Ach TONE Bass Filter Capacitor	26	VREF	Reference Voltage Stabilizing Capacitor
5	BBEHa	Ach BBE Filter1 (Process)	27	CTL	Pop Noise Capacitor for TONE Bass
6	BBELa	Ach BBE Filter2 (Lo Contour)	28	CTH	Pop Noise Capacitor for TONE Treble
7	SENDa	Ach output for the other accessories	29	CBH	Pop Noise Capacitor for BBE
8	RETURNa	Ach input from the other accessories	30	AMPOUTb	Bch Internal OP-AMP Output
9	ealaBASS LPF1	ealaBASS Filter Capacitor 1	31	AMP-INb	Bch Internal OP-AMP -Input
10	ealaBASS SENSE	ealaBASS Sensitivity Adjustment Resistance	32	AMP+INb	Bch Internal OP-AMP +Input
11	ealaBASS INT	ealaBASS Smoothing Filter Capacitor	33	OUTb	Bch Output
12	OUTa	Ach Output	34	CBB	Pop Noise Capacitor for ealaBASS
13	AMP+INa	Ach Internal OP-AMP +Input	35	ealaBASS LPF2	ealaBASS Filter Capacitor 2
14	AMP-INa	Ach Internal OP-AMP -Input	36	ealaBASS LPF3	ealaBASS Filter Capacitor 3
15	AMPOUTa	Ach Internal OP-AMP Output	37	RETURNb	Bch Input from the other accessories
16	AGC INT	AGC Smoothing Filter Capacitor	38	SENDb	Bch Input for the other accessories
17	CVa	Pop Noise Reduction Capacitor for Volume	39	BBELb	Bch BBE Filter2 (Process)
18	CVb	Pop Noise Reduction Capacitor for Balance	40	BBEHb	Bch BBE Filter1 (Lo Contour)
19	CSR	Pop Noise Reduction Capacitor for Surround	41	TONE-Lb	Bch Tone Bass Filter Capacitor
20	SDA	SDA Data Input (I^2C BUS)	42	TONE-Hb	Bch Tone Treble Filter Capacitor
21	SCL	SCL Data Input (I^2C BUS)	43	SRS FIL	SRS Filter Capacitor
22	GND	GND	44	INb	Bch Input

■ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V^+	15	V
Power Dissipation	P_D	800 NOTE: EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layer, FR-4) mounting	mW
Operating Temperature Range	Topr	-20 to +75	°C
Storage Temperature Range	Tstg	-40 to +125	°C

■ELECTRICAL CHARACRTERISTICS

(Ta=25°C, V^+=9V, Rg=600Ω, R_L=47kΩ, Vin=100mVrms/1kHz unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Voltage	V^+		7.5	9.0	13.0	V
Supply Current	I_{CC}	No Signal	-	15	25	mA
Reference Voltage	V_{REF}	No Signal	4.0	4.5	5.0	V
Maximum Input Voltage	V_{IM}	VOL=-20dB,THD=10%	2.8	3.0	-	Vrms
Maximum Output Voltage	V_{OM}	OUTPUT VOL=0dB,THD=1%	-	2.5	-	Vrms
Channel Balance	G_{CB}	VOL=0dB	-1.0	0.0	1.0	dB
Balance Boost A	BA_{BST}	CHS="0",BAL="11111"	-2.0	0.0	2.0	dB
Balance Cut A	BA_{CUT}	CHS="1",BAL="11111" Vin = 1Vrms	-	-	-70	dB
Balance Boost B	BB_{BST}	CHS="1",BAL="11111"	-2.0	0.0	2.0	dB
Balance Cut B	BB_{CUT}	CHS="0",BAL="11111" Vin = 1Vrms	-	-	-70	dB
Total Harmonic Distortion	THD	Vo=0.5Vrms BW=400Hz ~ 30kHz	-	-	0.3	%
Maximum Gain	G_{VMAX}	VOL= 0dB	-2.0	0.0	2.0	dB
Minimum Gain	G_{VMIN}	VOL= MUTE , Vin = 2Vrms	-	-100	-90	dB
Channel Separation	CS	Vin = 1Vrms, A-weighted	-	-80	-70	dB
Output Noise 1	V_{NO1}	VOL = 0dB A-weighted	- -	-90 (31.6)	-85 (56.2)	dBV (μVrms)
Output Noise 2	V_{NO2}	VOL = MUTE A-weighted	- -	-106 (5.0)	-96 (15.8)	dBV (μVrms)
AUX Output Voltage	V_{AUX}	Logic Output: High	4.5	-	5.0	V
		Logic Output: Low	0		0.3	

BW: Band Width

♦**TONE**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Treble Boost	HF_{BST}	BCT="1",TREB="1111", f=10kHz	12.5	15.0	17.5	dB
Treble Flat	HF_{FLT}	TREB="0000",f=10kHz	-2.0	0.0	2.0	dB
Treble Cut	HF_{CUT}	BCT="0",TREB="1111", f=10kHz	-17.5	-15.0	-12.5	dB
Bass Boost	LF_{BST}	BCB="1",BASS="1111", f=100Hz	12.5	15.0	17.5	dB
Bass Flat	LF_{FLT}	BASS="0000",f=100Hz	-2.0	0.0	2.0	dB
Bass Cut	LF_{CUT}	BCB="0",BASS="1111", f=100Hz	-17.5	-15.0	-12.5	dB

♦**AGC**

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
AGC Boost	AGC_{BST}	Vin=50mVrms, f=1kHz	1.5	3.5	5.5	dB
AGC Flat 1	AGC_{FLT1}	Vin=100mVrms, f=1kHz	-2.5	0.0	2.5	dB
AGC Flat 2	AGC_{FLT2}	Vin=200mVrms, f=1kHz	-2.5	0.0	2.5	dB
AGC Flat 3	AGC_{FLT3}	Vin=300mVrms, f=1kHz	-2.5	0.0	2.5	dB
AGC Flat 4	AGC_{FLT4}	Vin=400mVrms, f=1kHz	-2.5	0.0	2.5	dB
AGC Cut	AGC_{CUT}	Vin=2Vrms, f=1kHz	-14	-10	-6.0	dB

♦**BBE (BBE-ON)**

PARAMETER	SYSMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
BBE Bass Control Range	BBE_{LOW}	BBE-Low="1111", f=50Hz	-	15.0	-	dB
BBE Treble Control Range	BBE_{HIGH}	BBE-High="1111", f=10KHz	-	15.0	-	dB

♦**SIMULATED STEREO** (Simulated Stereo ON, f=1kHz)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Simulated Stereo A	SR_{SIMA}	Ain+Bin → Aout	1.0	3.0	5.0	dB
Simulated Stereo B	SR_{SIMB}	Ain+Bin → Bout	1.0	3.0	5.0	dB

♦**SURROUND EFFECT**(SRS 3D: f=125Hz eala : f=100Hz)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
SRS Gain HIGH 1	SRS_{GH1}	Ain → Aout, Mode=High	9.5	11.5	13.5	dB
SRS Gain HIGH 2	SRS_{GH2}	Ain → Bout, Mode=High	6.5	8.5	10.5	dB
SRS Gain LOW	SRS_{GL}	Ain → Aout, Mode=Low	4.0	6.0	8.0	dB
eala Gain HIGH 1	SR_{GH1}	Ain → Aout, Mode=High	8.0	10.0	12.0	dB
eala Gain HIGH 2	SR_{GH2}	Ain → Bout, Mode=High	4.5	6.5	8.5	dB
eala Gain LOW	SR_{GL}	Ain → Aout, Mode=Low	2.0	4.0	6.0	dB

♦**BassBoost**(f=100Hz)

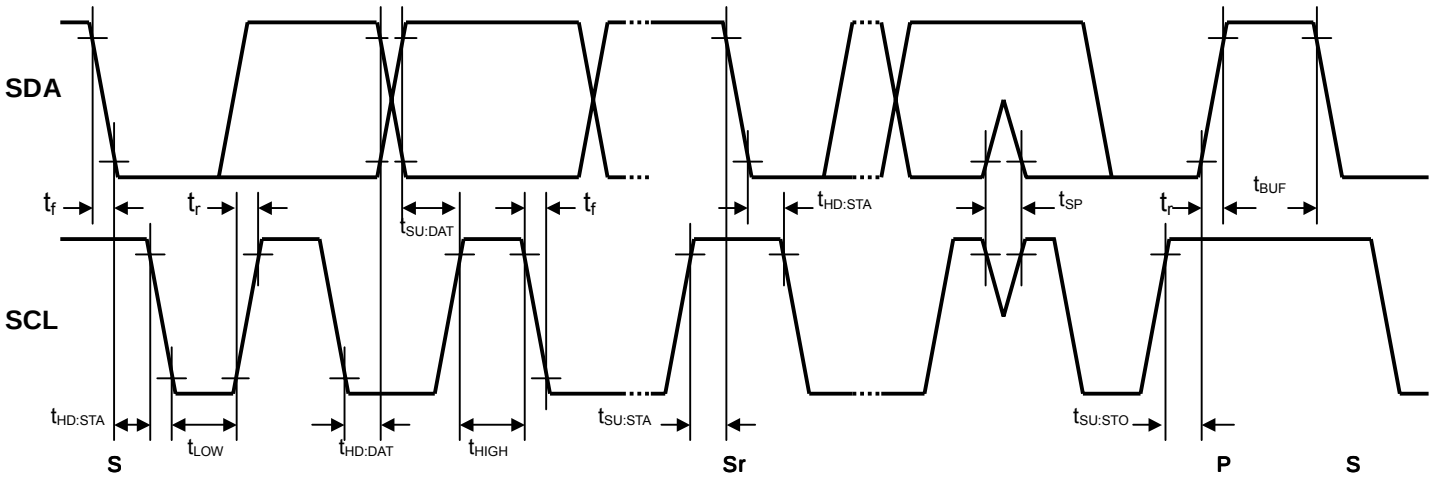
APRAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
BassBoost Gain 1	BB_{GV1}	A+Bin → Aout, BB1="1",BB0="1"	-	9.0	-	dB
BassBoost Gain 2	BB_{GV2}	A+Bin → Aout, BB1="1",BB0="0"	-	6.0	-	dB
BassBoost Gain 3	BB_{GV3}	A+Bin → Aout, BB1="0",BB0="1"	-	3.0	-	dB

■I²C BUS CHARACTERISTICS (SDA, SCL)

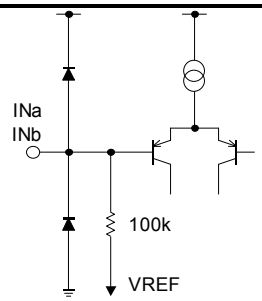
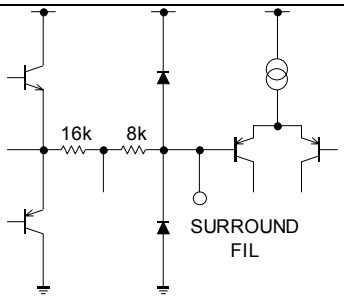
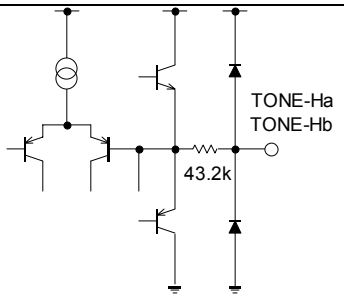
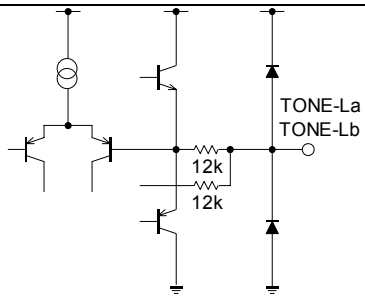
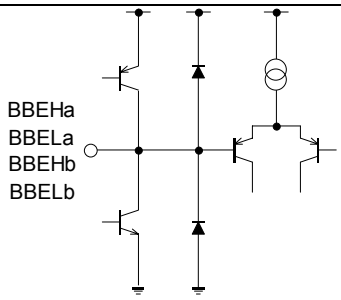
I²C BUS Load Condition: Pull Up Resistance R=4kΩ (Connected to +5V), Load Capacitance C=200pF (Connected to GND)

PARAMETER	SYMBOL	STANDARD			FAST			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Low Level Input Voltage	V_{IL}	0.0	-	1.5	0.0	-	1.5	V
High Level Input Voltage	V_{IH}	2.7	-	5.0	2.7	-	5.0	V
Hysteresis of Schmitt Trigger Inputs	V_{hys}	-	-	-	0.25	-	-	V
LOW level Output Voltage (3mA at SDA pin)	V_{OL}	0	-	0.4	0	-	0.4	V
Output Fall Time From V_{IHmin} to V_{ILmax} with a Bus Capacitance from 10pF to 400pF	t_{of}	-	-	250	$\frac{20}{+0.1C_b}$	-	250	Ns
Pulse width of spikes which must be suppressed by the input filter	t_{SP}	-	-	-	0	-	50	Ns
Input Current each I/O pin with an Input Voltage between 0.1 and $0.9V_{DDmax}$	I_i	-10	-	10	-10	-	10	μA
Capacitance for each I/O pin	C_i	-	-	10	-	-	10	PF
SCL Clock Frequency	f_{SCL}	-	-	100	-	-	400	KHz
Data Transfer Start Minimum Waiting Time	$t_{HD:STA}$	4.0	-	-	0.6	-	-	μs
Low Level Clock Pulse Width	t_{LOW}	4.7	-	-	1.3	-	-	μs
High Level Clock Pulse Width	t_{HIGH}	4.0	-	-	0.6	-	-	μs
Minimum Start Preparation Waiting Time	$t_{SU:STA}$	4.7	-	-	0.6	-	-	μs
Minimum Data Hold Time	$t_{HD:DAT}$	0	-	3.45	0	-	0.9	μs
Minimum Data Preparation Time	$t_{SU:DAT}$	250	-	-	100	-	-	Ns
Rise Time	t_r	-	-	1000	-	-	300	Ns
Fall Time	t_f	-	-	300	-	-	300	Ns
Minimum Stop Preparation Waiting Time	$t_{SU:STO}$	4.0	-	-	0.6	-	-	μs
Data Change Minimum Waiting Time	t_{BUF}	4.7	-	-	1.3	-	-	μs
Capacitive load for each bus line	C_b	-	-	400	-	-	400	PF
Noise Margin at the Low Level	V_{nL}	0.5	-	-	0.5	-	-	V
Noise Margin at the High Level	V_{nH}	1	-	-	1	-	-	V

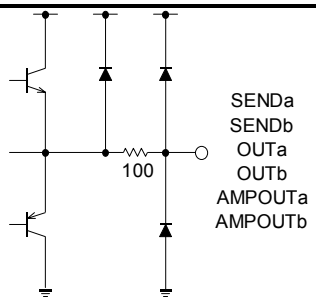
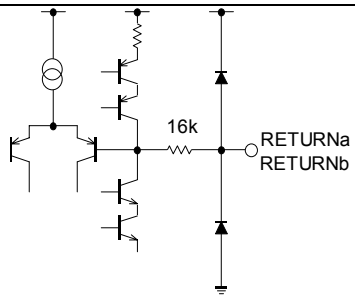
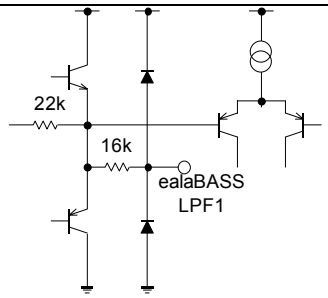
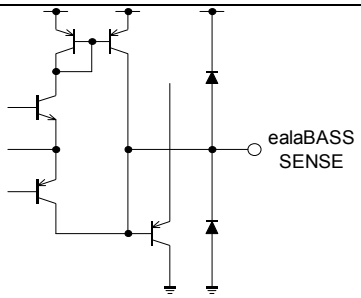
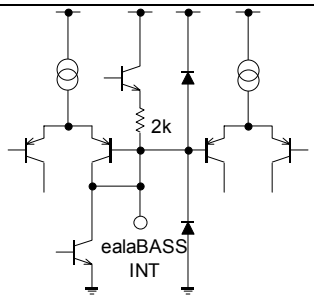
C_b ; total capacitance of one bus line in pF.



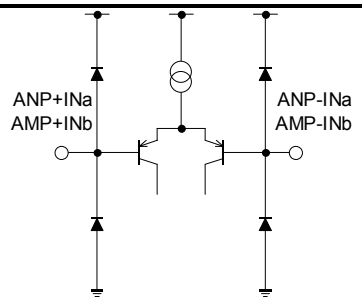
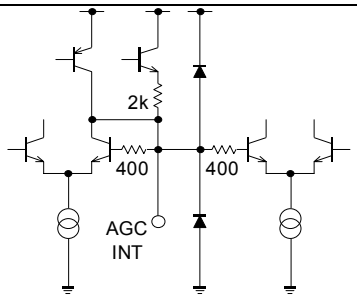
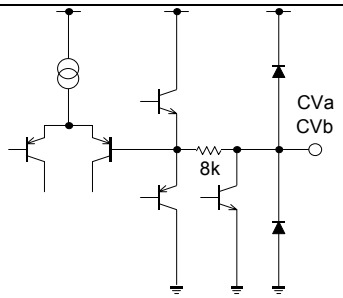
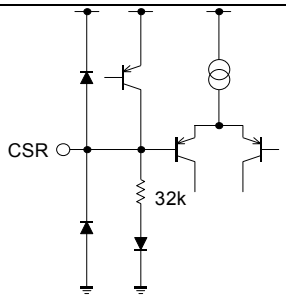
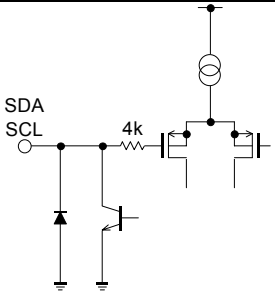
■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
1 44	INa INb	Ach Input Bch Input		V+/2
2	SURROUND FIL	Surround Filter Capacitor		V+/2
3 42	TONE-Ha TONE-Hb	Ach TONE Treble Filter Capacitor Bch TONE Treble Filter Capacitor		V+/2
4 41	TONE-La TONE-Lb	Ach TONE Bass Filter Capacitor Bch TONE Bass Filter Capacitor		V+/2
5 6 40 39	BBEHa BBELa BBEHb BBELb	Ach BBE Filter 1 (Process) Ach BBE Filter 2 (Lo Contour) Bch BBE Filter 1 (Process) Bch BBE Filter 2 (Lo Contour)		V+/2

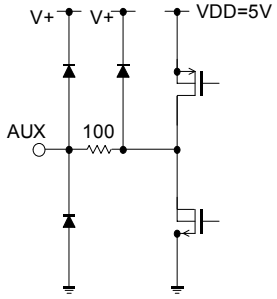
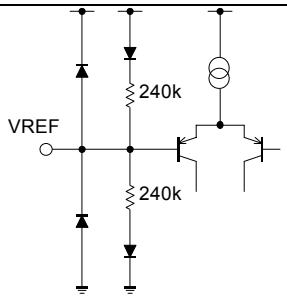
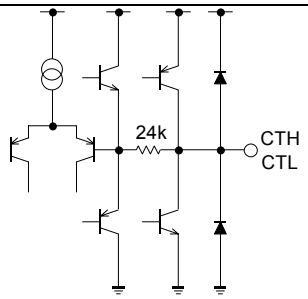
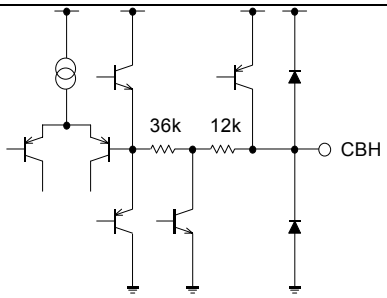
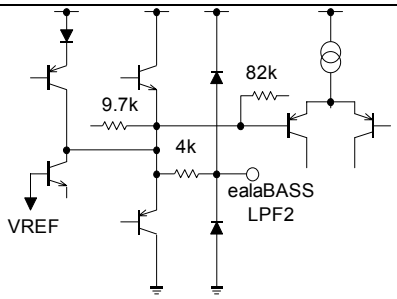
■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
7 38 12 33 15 30	SENDa SENDb OUTa OUTb AMPOUTa AMPOUTb	Ach output for the other accessories Bch output for the other accessories Ach Output Bch Output Ach Internal OP-AMP Output Bch Internal OP-AMP Output		V+/2
8 37	RETURNa RETURNb	Ach Input from the other accessories Bch Input from the other accessories		V+/2
9	ealaBASS LPF1	ealaBASS Filter Capacitor 1		V+/2
10	ealaBASS SENSE	ealaBASS Sensitivity Adjustment Resistance		0V
11	ealaBASS INT	ealaBASS Smoothing Filter Capacitor		0V

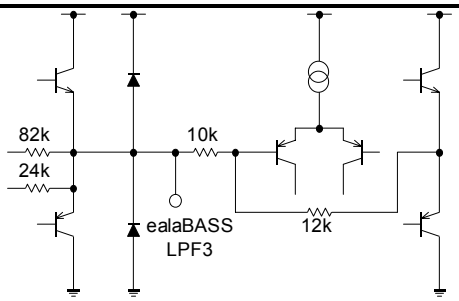
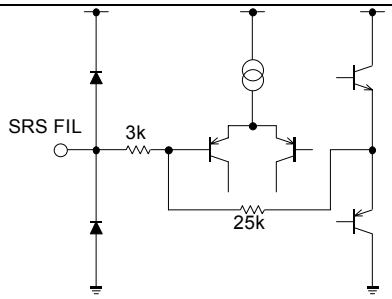
■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
13 32 14 31	AMP+INa AMP+INb AMP-INa AMP-INb	Ach Internal OP-AMP + Input Bch Internal OP-AMP + Input Ach Internal OP-AMP - Input Bch Internal OP-AMP - Input		-
16	AGC INT	AGC Smoothing Filter		1.4V
17 18	CVa CVb	Pop Noise Reduction Capacitor for Volume Pop Noise Reduction Capacitor for Balance		VREF-0.7V (Volume=0dB) (Balance=Center)
19 34	CSR CBB	Pop Noise Reduction Capacitor for Surround Pop Noise Reduction Capacitor for ealaBASS		0.9V (Surround = OFF) (Bass Boost = OFF)
20 21	SDA SCL	SDA Data Input (I^2C BUS) SCL Data Input (I^2C BUS)		-
22 23	GND V+	GND Power Supply Input	-	-

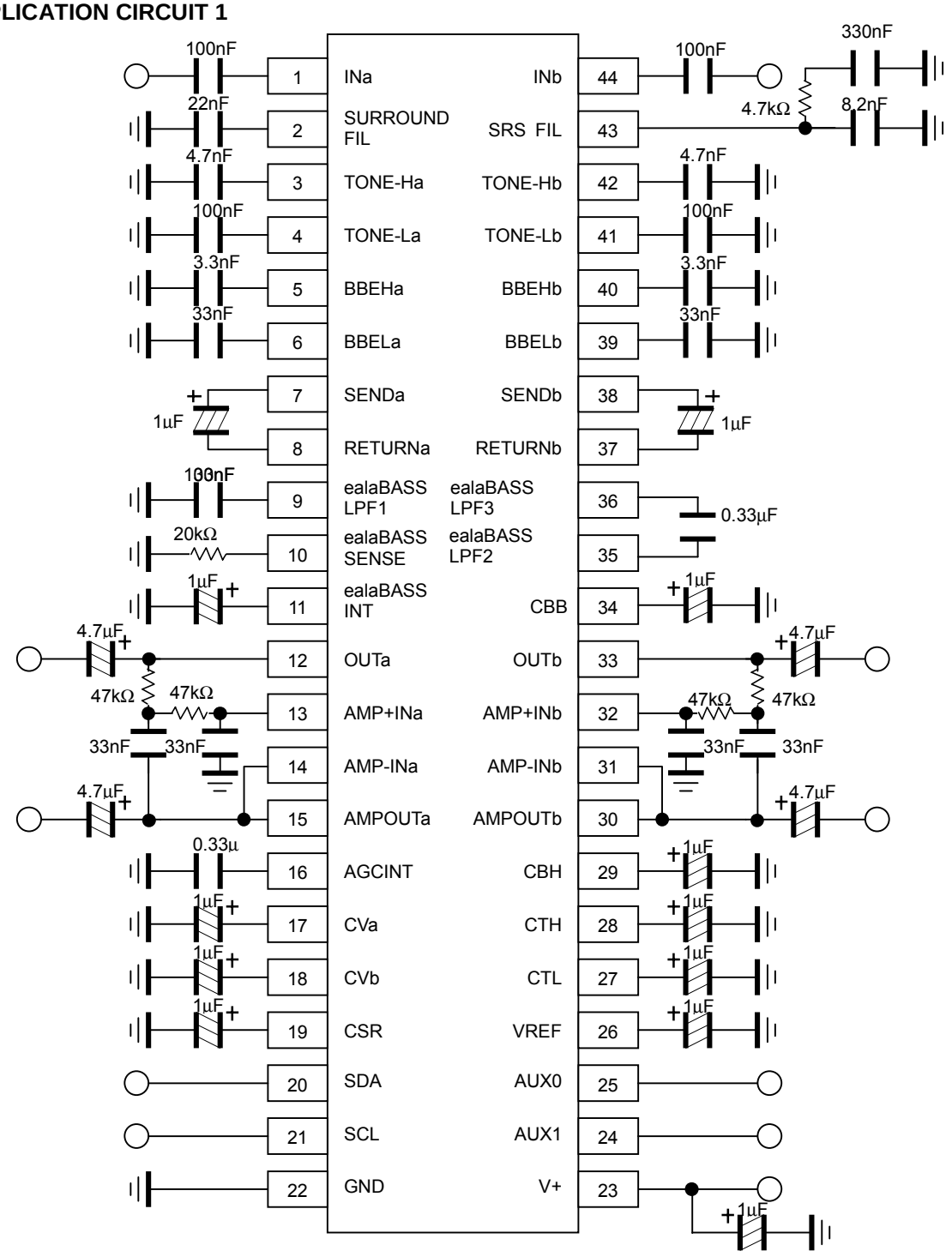
■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
24 25	AUX1 AUX0	Auxiliary Output 1 Auxiliary Output 0		0V / 5V
26	VREF	Reference Voltage Stabilizing Capacitor		V+/2
27 28	CTL CTH	Pop Noise Reduction Capacitor for TONE Bass Pop Noise Reduction Capacitor for TONE Treble		VREF-0.7V (TONE=Flat)
29	CBH	Pop Noise Reduction Capacitor for BBE		VREF-0.7V (BBE=OFF)
35	ealaBASS LPF2	ealaBASS Filter Capacitor 2		V+/2

■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
36	ealaBASS LPF3	ealaBASS Filter Capacitor 3		V+/2
43	SRS FIL	SRS Filter Capacitor		V+/2

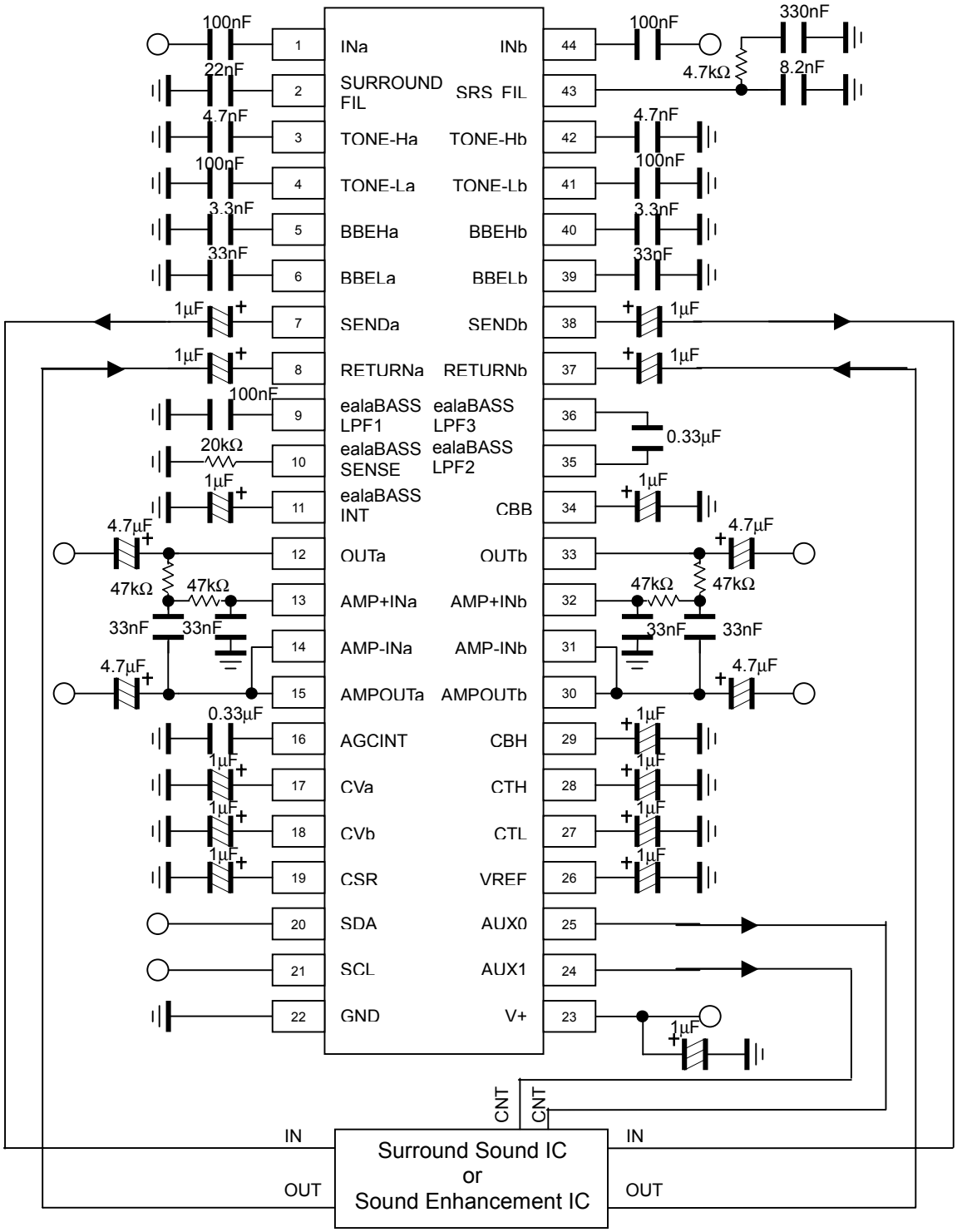
■APPLICATION CIRCUIT 1



(✳) Separate the I²C bus line and Signal line from the following terminals for avoiding digital noise problem and cross talk.

Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
2	SURROUND FIL	6	BBELa	35	ealaBASS LPF2	41	TONE-Lb
3	TONE-Ha	9	ealaBASS LPF1	36	ealaBASS LPF3	42	TONE-Hb
4	TONE-La	10	ealaBASS SENSE	39	BBELb	-	-
5	BBEHa	11	ealaBASS INT	40	BBEHb	-	-

■APPLICATION CIRCUIT 2



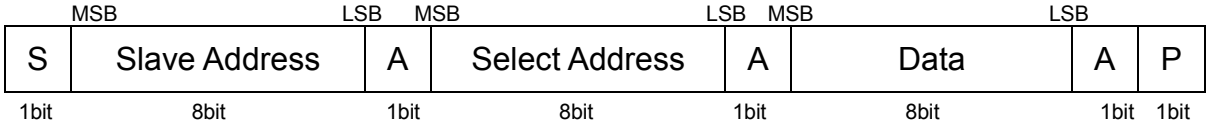
Ex.) BBE Mach3 : NJM2155
SRS TruBass : NJM2192A,
SRS WOW : NJM2700, NJM2195, … , etc

(✳) Separate the I^2C bus line and Signal line from the following terminals for avoiding digital noise problem and cross talk.

Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
2	SURROUND FIL	6	BBELa	35	ealaBASS LPF2	41	TONE-Lb
3	TONE-Ha	9	ealaBASS LPF1	36	ealaBASS LPF3	42	TONE-Hb
4	TONE-La	10	ealaBASS SENSE	39	BBELb	-	-
5	BBEHa	11	ealaBASS INT	40	BBEHb	-	-

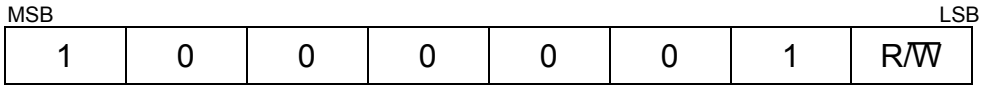
■DEFINITION OF I²C REGISTER

♦I²C BUS FORMAT



S: Starting Term
A: Acknowledge Bit
P: Ending Term

♦SLAVE ADDRESS



R/$\overline{W}$=0: Receive Only
R/$\overline{W}$=1: No Output Data

♦CONTROL REGISTER TABLE

The select address sets each function (Volume, Balance, AGC, Surround, Tone Control, BBE, ealaBASS, AUX).
The auto increment function cycles the select address as follows.
00H→01H→02H→03H→04H→05H→00H

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
00H	VOL							
01H	CHS	BAL					AGC	SUR
02H	BCB	BASS				Don't Care	Don't Care	Don't Care
03H	BCT	TREB				Don't Care	Don't Care	Don't Care
04H	BBE-Low (Lo Contour)				BBE-High (Process)			
05H	ealaBASS		SUR1	SUR0	AGC1	AGC0	AUX1	AUX0

♦CONTROL REGISTER DEFAULT VALUE

Control register default value is all "0".

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
00H	0	0	0	0	0	0	0	0
01H	0	0	0	0	0	0	0	0
02H	0	0	0	0	0	0	0	0
03H	0	0	0	0	0	0	0	0
04H	0	0	0	0	0	0	0	0
05H	0	0	0	0	0	0	0	0

■INSTRUCTION CODE

a)MASTER VOLUME SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
00H	VOL							

♦VOL Attenuation Level setting

The volume control for both Ach and Bch(0.33dB/step).

The volume is consisted of volume1 and volume2 and the level is divided into half to each volume1 and volume2.

b)BALANCE, AGC, SURROUND SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
01H	CHS	BAL					AGC	SUR

- CHS : Channel select for balance control
  - "0" = Ach, (Bch is attenuated)
  - "1" = Bch, (Ach is attenuated)
- BAL : Balance control for both Ach and Bch (1dB/step)
  - The balance is consisted of volume1 and volume2.
- AGC : AGC ON/OFF switch
  - "0" = AGC OFF
  - "1" = AGC ON (Default : 100mVrms)
- SUR : Surround ON/OFF switch
  - "0" = Surround OFF
  - "1" = Surround ON(Default : Surround Effect 1)

c)TONE CONTROL BASS SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
02H	BCB	BASS				Don't Care	Don't Care	Don't Care

- BCB : Boost cut select for BASS control
  - "0" = Cut
  - "1" = Boost
- BASS: BASS Control
  - Cut Level : 0dB to -15dB(1dB/step)
  - Boost Level : 0dB to 15dB(1dB/step)

d)TONE CONTROL TREBLE SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
03H	BCT	TREB				Don't Care	Don't Care	Don't Care

- BCT : Boost cut select for Treble control
  - "0" = Cut
  - "1" = Boost
- TREB: Treble level setting
  - Cut Level : 0dB to -15dB(1dB/step)
  - Boost Level : 0dB to 15dB(1dB/step)

e)BBE SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
04H	BBE-Low(Lo Contour)				BBE-High(Process)			

- BBE-Low: BBE Bass Boost(Lo Contour) setting
  Boost Level : 0dB to 15dB(1dB/step)
- BBE-High: BBE Treble Boost (Process) setting
  Boost Level : 0dB to 15dB(1dB/step)

When all bits are ”0”(00H), BBE becomes off.

f)OUTPUT, AGC LEVEL, SURROUND LEVEL, AND AUXILIARY SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
05H	BB1	BB0	SUR1	SUR0	AGC1	AGC0	AUX1	AUX0

- OUT: Output ON/OFF switch
  “0” = OFF
  “1” = ON

- AGC Level setting by AGC1, AGC0

AGC level	AGC1	AGC0
100mVrms	0	0
200mVrms	0	1
300mVrms	1	0
400mVrms	1	1

- Surround effect and simulated stereo setting by SUR(01H:D0), SUR1(05H:D5),SUR0(05H:D4)

Surround function	SUR1	SUR0	SUR	Remarks
Surround OFF	0	0	0	Surround OFF
eala effect 1	0	1	0	eala effect small
eala effect 2	0	1	1	eala effect large
SRS effect 1	1	0	0	SRS effect small
SRS effect 2	1	0	1	SRS effect large
Simulated stereo	0	0	1	For monaural signal input only

- ealaBASS setting

Function	05H:D7	05H:D6	Remarks
BassBoostOFF	0	0	BassBoostOFF
BassBoost1	0	1	BassBoost effect small
BassBoost2	1	0	BassBoost effect middle
BassBoost3	1	1	BassBoost effect large

- AUX1/AUX0: Output setting for auxiliary port
  “0” = Logic output ”Low”
  “1” = Logic output ”High”

■MASTER VOLUME (Select Address : 00H)

		VOL							
Gain (dB)	HEX	D7	D6	D5	D4	D3	D2	D1	D0
0	FF	1	1	1	1	1	1	1	1
-1	FC	1	1	1	1	1	1	0	0
-2	F9	1	1	1	1	1	0	0	1
-3	F6	1	1	1	1	0	1	1	0
-4	F3	1	1	1	1	0	0	1	1
-5	F0	1	1	1	1	0	0	0	0
-6	ED	1	1	1	0	1	1	0	1
-7	EA	1	1	1	0	1	0	1	0
-8	E7	1	1	1	0	0	1	1	1
-9	E4	1	1	1	0	0	1	0	0
-10	E1	1	1	1	0	0	0	0	1
-11	DE	1	1	0	1	1	1	1	0
-12	DB	1	1	0	1	1	0	1	1
-13	D8	1	1	0	1	1	0	0	0
-14	D5	1	1	0	1	0	1	0	1
-15	D2	1	1	0	1	0	0	1	0
-16	CF	1	1	0	0	1	1	1	1
-17	CC	1	1	0	0	1	1	0	0
-18	C9	1	1	0	0	1	0	0	1
-19	C6	1	1	0	0	0	1	1	0
-20	C3	1	1	0	0	0	0	1	1
-21	C0	1	1	0	0	0	0	0	0
-22	BD	1	0	1	1	1	1	0	1
-23	BA	1	0	1	1	1	0	1	0
-24	B7	1	0	1	1	0	1	1	1
-25	B4	1	0	1	1	0	1	0	0
-26	B1	1	0	1	1	0	0	0	1
-27	AE	1	0	1	0	1	1	1	0
-28	AB	1	0	1	0	1	0	1	1
-29	A8	1	0	1	0	1	0	0	0
-30	A5	1	0	1	0	0	1	0	1
-31	A2	1	0	1	0	0	0	1	0
-32	9F	1	0	0	1	1	1	1	1
-33	9C	1	0	0	1	1	1	0	0
-34	99	1	0	0	1	1	0	0	1
-35	96	1	0	0	1	0	1	1	0
-36	93	1	0	0	1	0	0	1	1
-37	90	1	0	0	1	0	0	0	0
-38	8D	1	0	0	0	1	1	0	1
-39	8A	1	0	0	0	1	0	1	0
-40	87	1	0	0	0	0	1	1	1
-41	84	1	0	0	0	0	1	0	0
-42	81	1	0	0	0	0	0	0	1

■MASTER VOLUME (Select Address : 00H)

		VOL							
Gain (dB)	HEX	D7	D6	D5	D4	D3	D2	D1	D0
-43	7E	0	1	1	1	1	1	1	0
-44	7B	0	1	1	1	1	0	1	1
-45	78	0	1	1	1	1	0	0	0
-46	75	0	1	1	1	0	1	0	1
-47	72	0	1	1	1	0	0	1	0
-48	6F	0	1	1	0	1	1	1	1
-49	6C	0	1	1	0	1	1	0	0
-50	69	0	1	1	0	1	0	0	1
-51	66	0	1	1	0	0	1	1	0
-52	63	0	1	1	0	0	0	1	1
-53	60	0	1	1	0	0	0	0	0
-54	5D	0	1	0	1	1	1	0	1
-55	5A	0	1	0	1	1	0	1	0
-56	57	0	1	0	1	0	1	1	1
-57	54	0	1	0	1	0	1	0	0
-58	51	0	1	0	1	0	0	0	1
-59	4E	0	1	0	0	1	1	1	0
-60	4B	0	1	0	0	1	0	1	1
-61	48	0	1	0	0	1	0	0	0
-62	45	0	1	0	0	0	1	0	1
-63	42	0	1	0	0	0	0	1	0
-64	3F	0	0	1	1	1	1	1	1
-65	3C	0	0	1	1	1	1	0	0
-66	39	0	0	1	1	1	0	0	1
-67	36	0	0	1	1	0	1	1	0
-68	33	0	0	1	1	0	0	1	1
-69	30	0	0	1	1	0	0	0	0
-70	2D	0	0	1	0	1	1	0	1
-71	2A	0	0	1	0	1	0	1	0
-72	27	0	0	1	0	0	1	1	1
-73	24	0	0	1	0	0	1	0	0
-74	21	0	0	1	0	0	0	0	1
-75	1E	0	0	0	1	1	1	1	0
-76	1B	0	0	0	1	1	0	1	1
-77	18	0	0	0	1	1	0	0	0
-78	15	0	0	0	1	0	1	0	1
-79	12	0	0	0	1	0	0	1	0
-80	0F	0	0	0	0	1	1	1	1
-81	0C	0	0	0	0	1	1	0	0
-82	09	0	0	0	0	1	0	0	1
-83	06	0	0	0	0	0	1	1	0
-84	03	0	0	0	0	0	0	1	1
Mute	00	0	0	0	0	0	0	0	0

■**BALANCE** (Select Address : 01H)

Channel Select (CHS)	D7
Ach(Bch is attenuate)	0
Bch(Ach is attenuate)	1

	BAL				
Gain(dB)	D6	D5	D4	D3	D2
0	0	0	0	0	0
-1	0	0	0	0	1
-2	0	0	0	1	0
-3	0	0	0	1	1
-4	0	0	1	0	0
-5	0	0	1	0	1
-6	0	0	1	1	0
-7	0	0	1	1	1
-8	0	1	0	0	0
-9	0	1	0	0	1
-10	0	1	0	1	0
-11	0	1	0	1	1
-12	0	1	1	0	0
-13	0	1	1	0	1
-14	0	1	1	1	0
-15	0	1	1	1	1
-16	1	0	0	0	0
-17	1	0	0	0	1
-18	1	0	0	1	0
-19	1	0	0	1	1
-20	1	0	1	0	0
-21	1	0	1	0	1
-22	1	0	1	1	0
-23	1	0	1	1	1
-24	1	1	0	0	0
-25	1	1	0	0	1
-26	1	1	0	1	0
-27	1	1	0	1	1
-28	1	1	1	0	0
-29	1	1	1	0	1
-30	1	1	1	1	0
Mute	1	1	1	1	1

■TONE CONTROL BASS (Select Address : 02H)

Bass Cut or Boost	BCB D7
Cut	0
Boost	1

		BASS			
Cut Gain(dB)	Boost Gain(dB)	D6	D5	D4	D3
-15	15	1	1	1	1
-14	14	1	1	1	0
-13	13	1	1	0	1
-12	12	1	1	0	0
-11	11	1	0	1	1
-10	10	1	0	1	0
-9	9	1	0	0	1
-8	8	1	0	0	0
-7	7	0	1	1	1
-6	6	0	1	1	0
-5	5	0	1	0	1
-4	4	0	1	0	0
-3	3	0	0	1	1
-2	2	0	0	1	0
-1	1	0	0	0	1
0	0	0	0	0	0

■TONE CONTROL TREBLE (Select Address : 03H)

Treble Cut or Boost	BCT D7
Cut	0
Boost	1

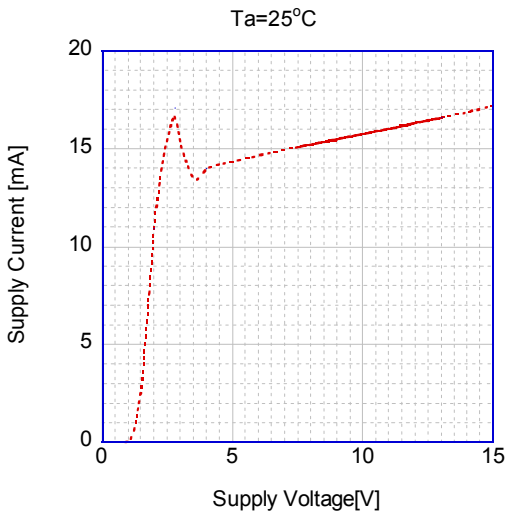
		TREB			
Cut Gain(dB)	Boost Gain(dB)	D6	D5	D4	D3
-15	15	1	1	1	1
-14	14	1	1	1	0
-13	13	1	1	0	1
-12	12	1	1	0	0
-11	11	1	0	1	1
-10	10	1	0	1	0
-9	9	1	0	0	1
-8	8	1	0	0	0
-7	7	0	1	1	1
-6	6	0	1	1	0
-5	5	0	1	0	1
-4	4	0	1	0	0
-3	3	0	0	1	1
-2	2	0	0	1	0
-1	1	0	0	0	1
0	0	0	0	0	0

■BBE Low(Lo Contour) / High(Process) GAIN CODE (Select Address : 04H)

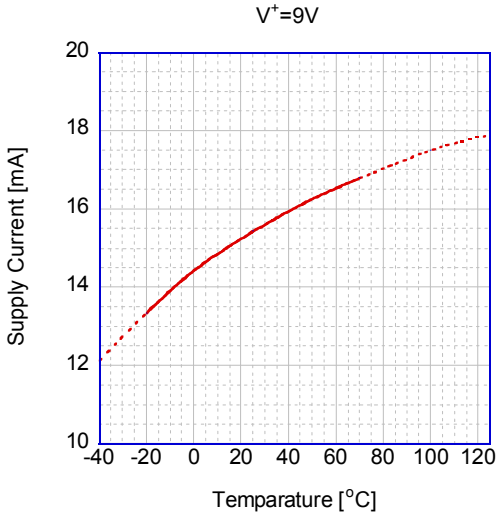
		Lo Contour				Process			
Cut Gain(dB)	Boost Gain(dB)	D7	D6	D5	D4	D3	D2	D1	D0
-15	15	1	1	1	1	1	1	1	1
-14	14	1	1	1	0	1	1	1	0
-13	13	1	1	0	1	1	1	0	1
-12	12	1	1	0	0	1	1	0	0
-11	11	1	0	1	1	1	0	1	1
-10	10	1	0	1	0	1	0	1	0
-9	9	1	0	0	1	1	0	0	1
-8	8	1	0	0	0	1	0	0	0
-7	7	0	1	1	1	0	1	1	1
-6	6	0	1	1	0	0	1	1	0
-5	5	0	1	0	1	0	1	0	1
-4	4	0	1	0	0	0	1	0	0
-3	3	0	0	1	1	0	0	1	1
-2	2	0	0	1	0	0	0	1	0
-1	1	0	0	0	1	0	0	0	1
0	0	0	0	0	0	0	0	0	0

■TYPICAL CHARASTERISTICS

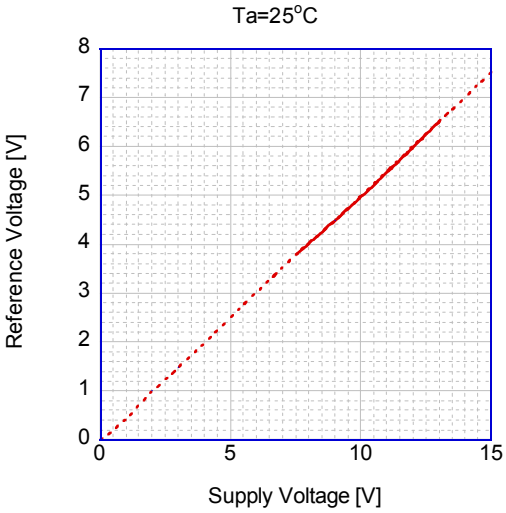
Supply Current vs.Supply Voltage



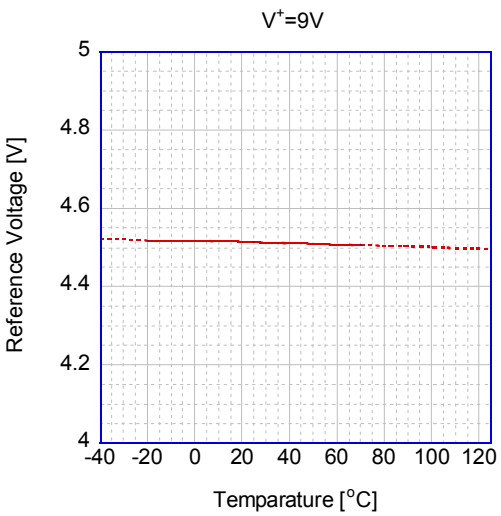
Supply Current vs. Temparature



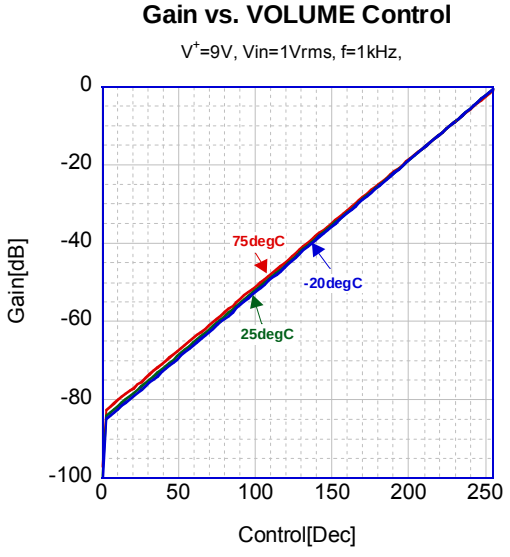
Reference Voltage vs.Supply Voltage



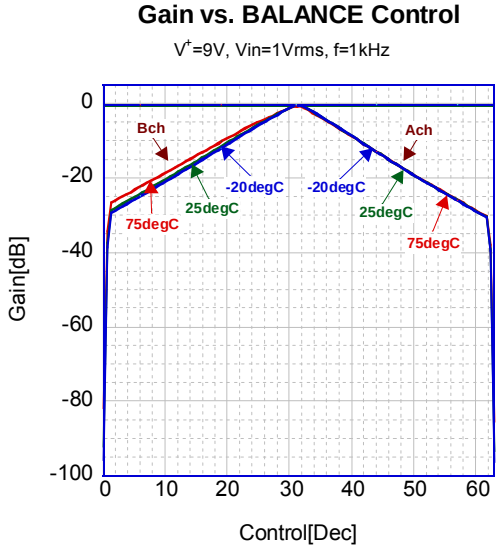
Reference Voltage vs. Temparature



Gain vs. VOLUME Control



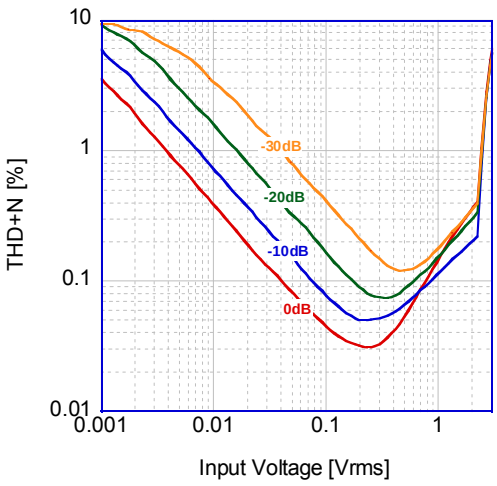
Gain vs. BALANCE Control



■TYPICAL CHARASTERISTICS

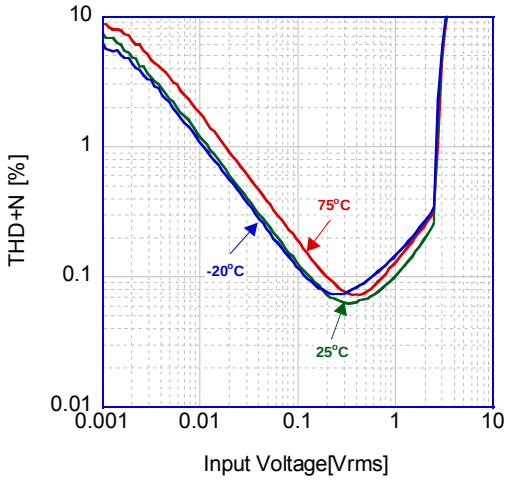
THD+N vs. Input Voltage

V^+=9V, f=1kHz,BW=400Hz-30kHz,Ta=25°C



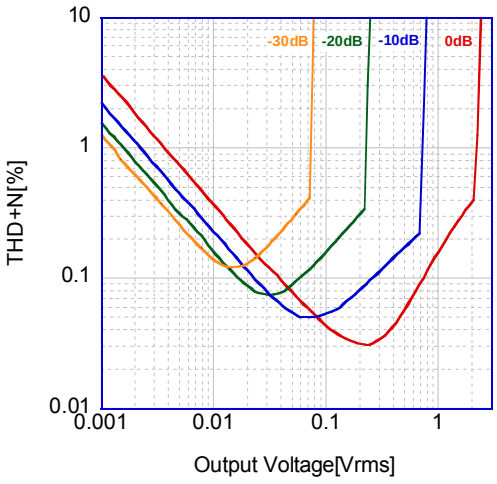
THD+N vs. Input Voltage

V^+=9V, f=1kHz,BW=400Hz-30kHz,Vol=-20dB



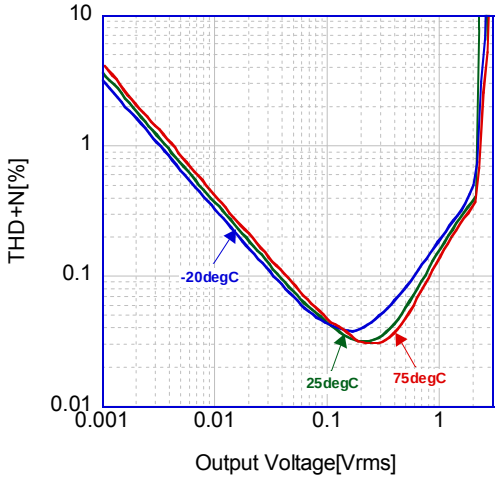
THD+N vs. Output Voltage

V^+=9V, f=1kHz,BW=400Hz-30kHz,Ta=25°C



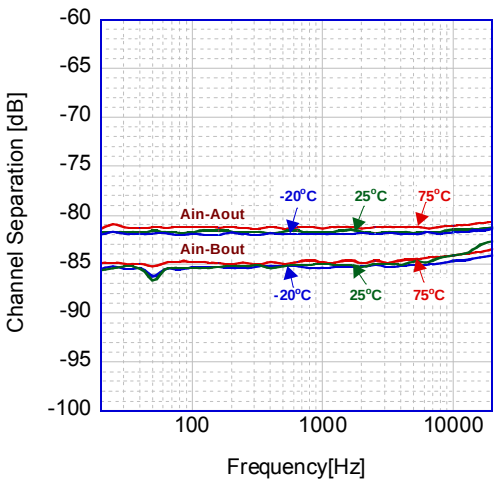
THD+N vs. Output Voltage

Vcc=9V, f=1kHz,BW=400Hz-30kHz,Vol=0dB



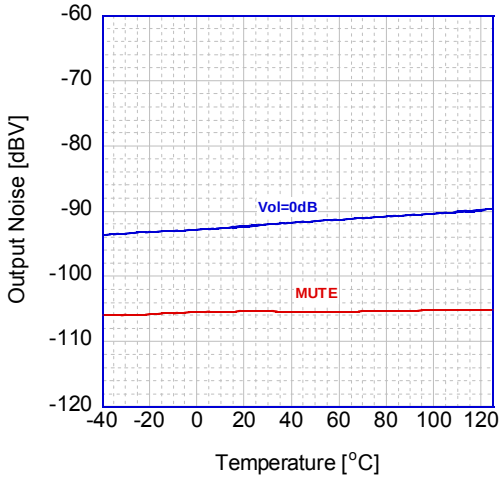
Channel Separation vs Frequency

V^+=9V, Vin=1Vrms,Rg=600Ω,BW=10Hz-30kHz,



Output Noise vs. Temperature

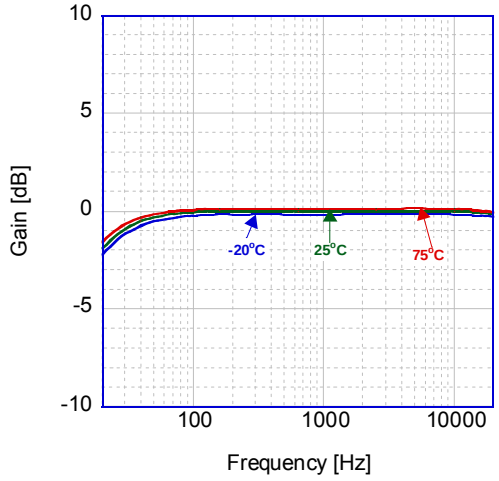
V^+=9V, =1kHz,Rg=600Ω,BW=A-Waight



■TYPICAL CHARASTERISTICS

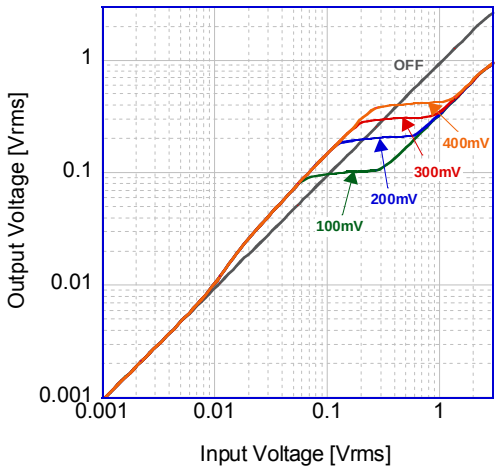
Gain vs. Frequency

V^+=9V, Vin=100mVrms,Vol=0dB



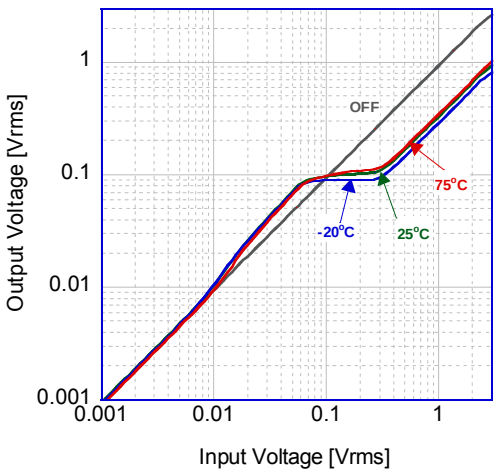
AGC Characteristics

V^+=9V, =1kHz,Ta=25°C



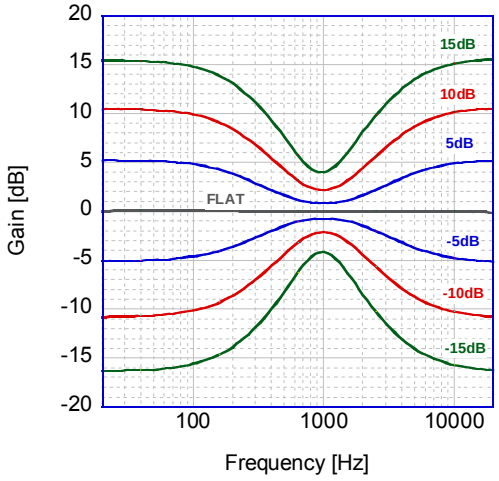
AGC Characteristics

V^+=9V, =1kHz, AGC Level=100mV



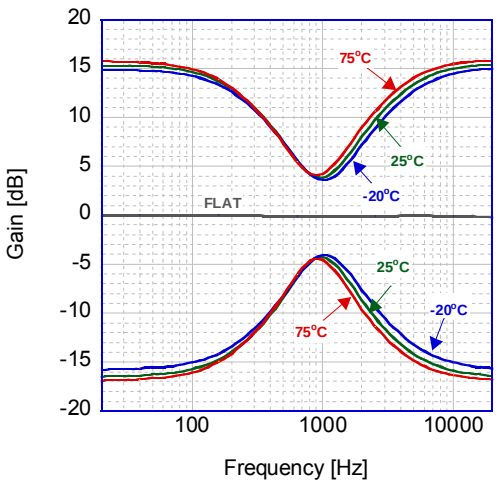
Gain vs. Frequency (Tone)

V^+=9V, Vin=100mVrms,Ta=25°C



Gain vs. Frequency (Tone)

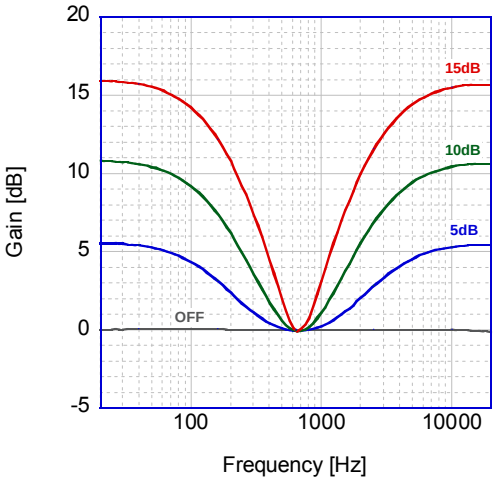
Vcc=9V, Vin=100mVrms,Tone=+15/-15dB



■TYPICAL CHARASTERISTICS

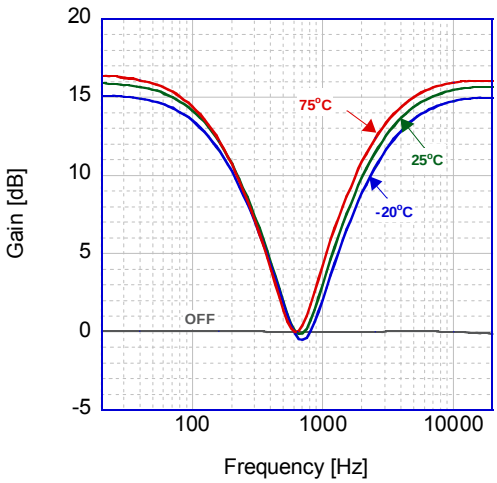
Gain vs. Frequency (BBE)

V^+=9V, Vin=100mVrms,Ta=25°C



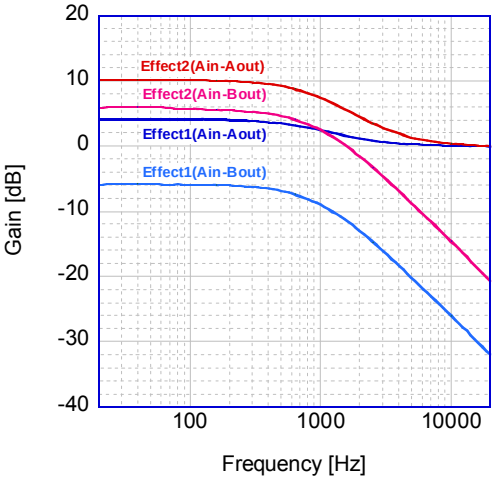
Gain vs. Frequency (BBE)

V^+=9V, Vin=100mVrms, BBE=15dB



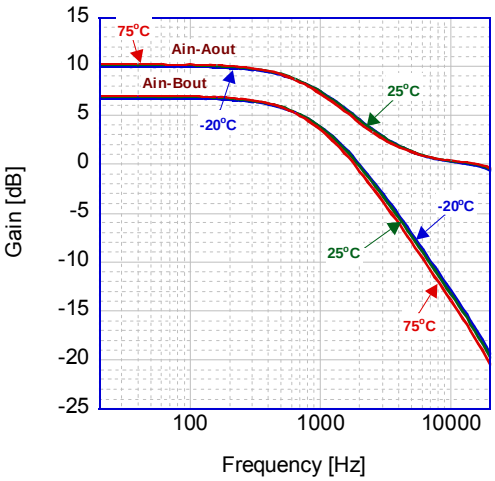
Gain vs. Frequency (eala)

V^+=9V, Vin=100mVrms,Ta=25°C



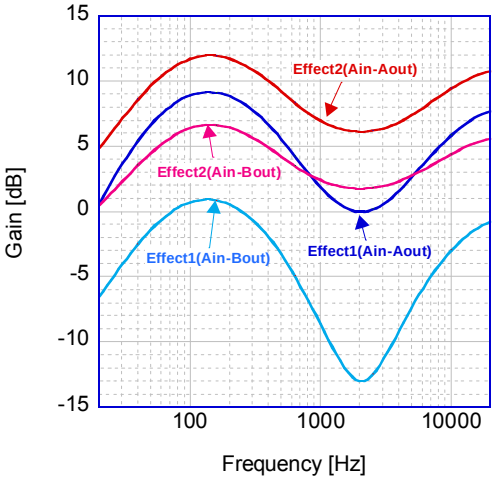
Gain vs. Frequency (eala)

V^+=9V, Vin=100mVrms, eala=Effect2



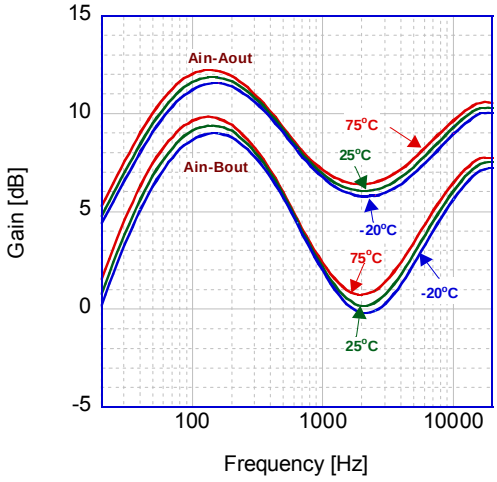
Gain vs. Frequency (SRS)

V^+=9V, Vin=100mVrms, Ta=25°C



Gain vs. Frequency (SRS)

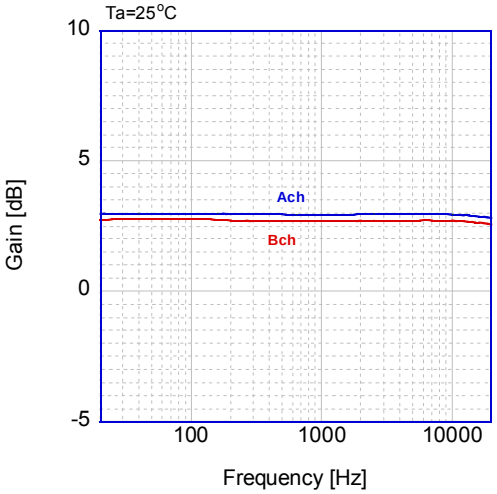
V^+=9V, Vin=100mVrms,SRS=Effect2



■TYPICAL CHARASTERISTICS

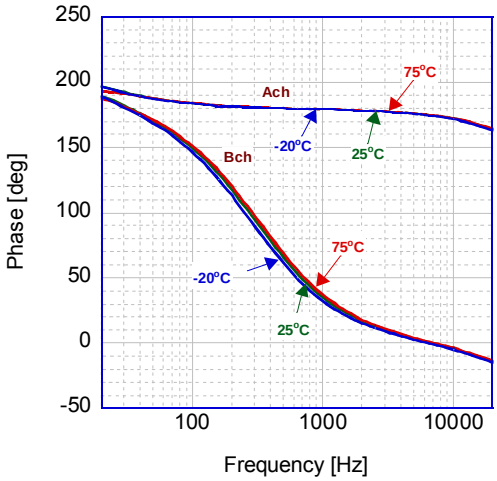
Gain vs. Frequency (Simulated Surround)

V+=9V, Vin=100mVrms,Surround=Simulated,
Ta=25°C



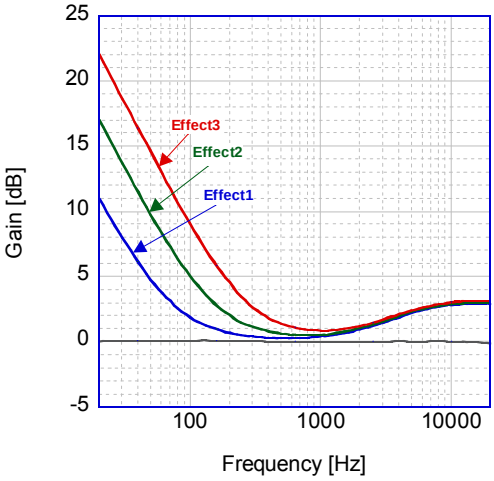
Phase vs. Frequency (Simulated Surround)

V+=9V, Vin=100mVrms,Surround=Simulated,



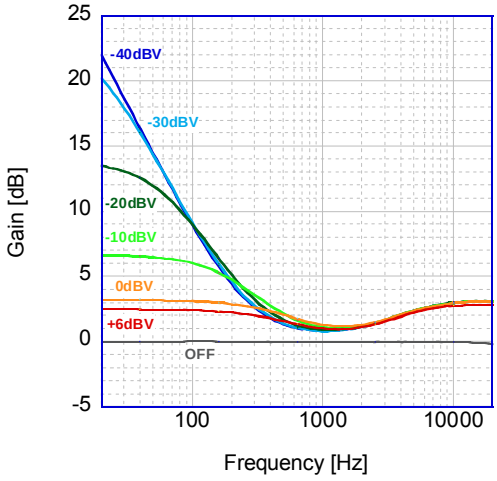
Gain vs. Frequency (ealaBass)

V+=9V, Vin=10mVrms,Ta=25°C



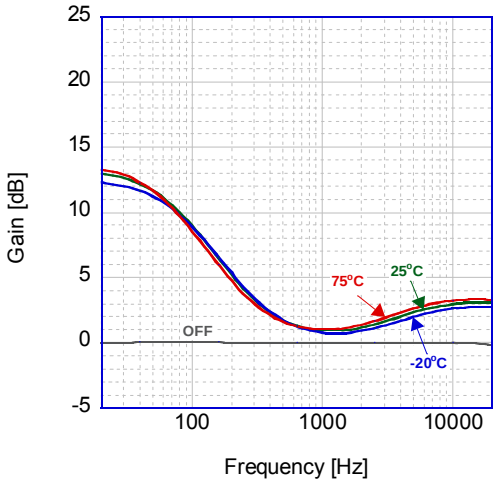
Gain vs. Frequency (ealaBass)

V+=9V,ealaBass=Effect3,Ta=25 °C



Gain vs. Frequency (ealaBass)

V+=9V, Vin=100mVrms,ealaBass=Effect3



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