



AUDIO PROCESSOR

■GENERAL DESCRIPTION

The NJW1142A is a sound processor includes all of the functions required to process the audio signal for TV, such as tone control, balance, volume, mute, and AGC functions.

Also the NJW1142A performs NJRC Surround "eala" which is regenerated 3D surround sound with only two speakers.

All of the internal status and variables are controlled by I²C BUS interface.

■ PACKAGE OUTLINE

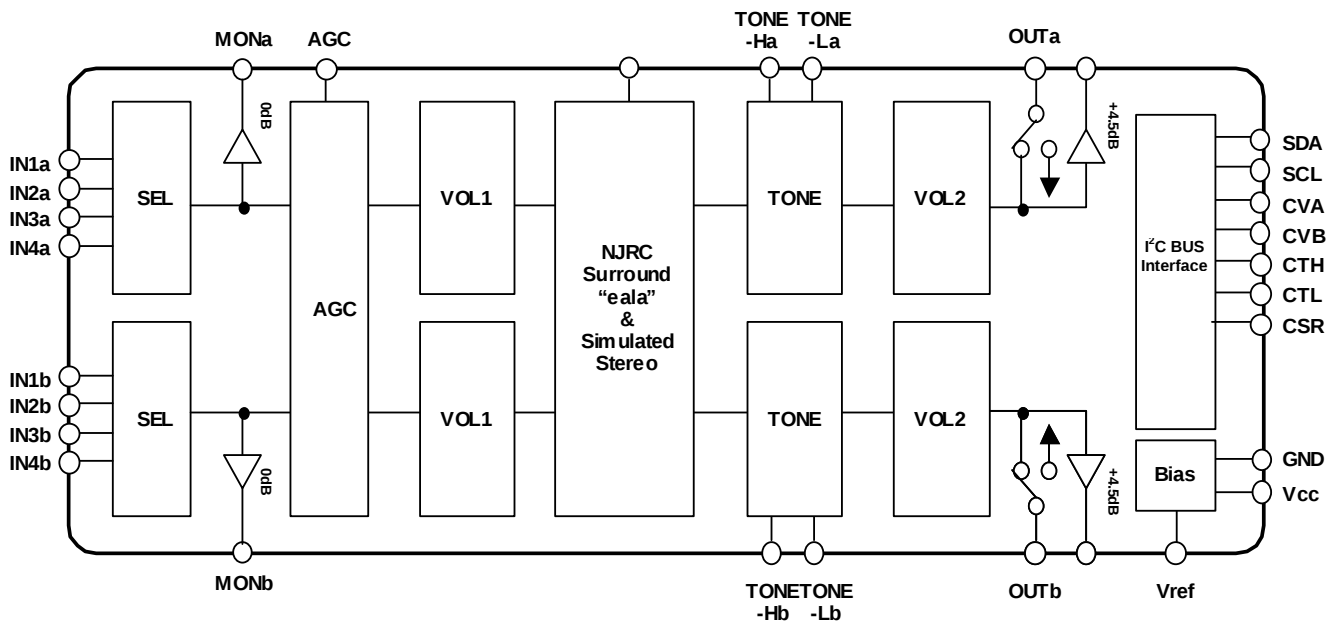


NJW1142AV

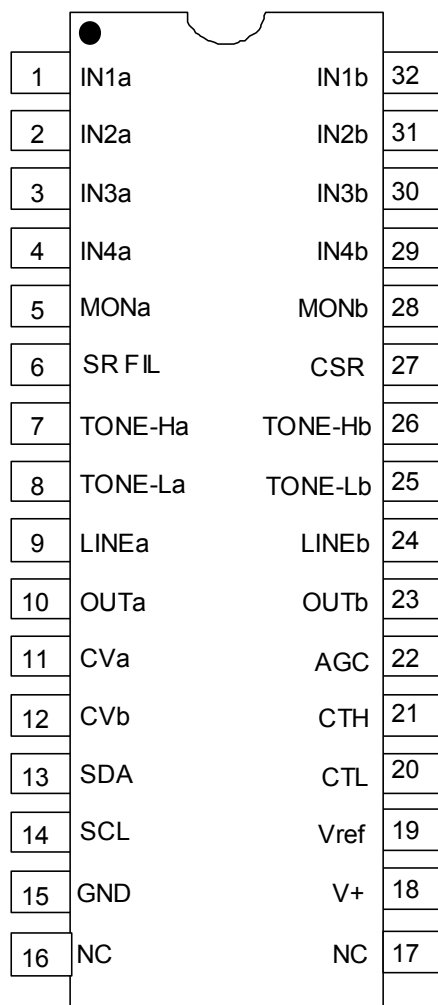
■FEATURES

- Operating Voltage 8 to 10V
- Internal 4 Input Audio Selectors and Monitor Output
- Low Noise VCA
- NJRC Surround "eala"
- Simulated Stereo
- Variable AGC Compression Level via I²C (4-levels)
- Bi-CMOS Technology
- Package Outline SSOP32

■BLOCK DIAGRAM



■PIN CONFIGURATION



No.	Symbol	Function		Symbol	Function
1	IN1a	Ach Input 1	17	NC	No Connect
2	IN2a	Ach Input 2	18	V+	Power Supply Terminal
3	IN3a	Ach Input 3	19	Vref	Reference Voltage
4	IN4a	Ach Input 4	20	CTL	Pop Noise reduction for Bass Control
5	MONa	Ach Monitor Output	21	CTH	Pop Noise reduction for Treble Control
6	SR FIL	Surround Filter	22	AGC	AGC Filter
7	TONE-Ha	Ach Treble Filter	23	OUTb	Bch Output
8	TONE-La	Ach Bass Filter	24	LINEb	Bch LINE Output (+4.5dB)
9	LINEa	Ach LINE Output (+4.5dB)	25	TONE-Lb	Bch Bass Filter
10	OUTa	Ach Output	26	TONE-Hb	Bch Treble Filter
11	CVA	Pop Noise Reduction for Ach Volume & Balance	27	CSR	Pop Noise Reduction for Surround Control
12	CVB	Pop Noise Reduction for Bch Volume & Balance	28	MONb	Bch Monitor Output
13	SDA	SDA Data Input (I ² C BUS)	29	IN4b	Bch Input 4
14	SCL	SCL Clock Input (I ² C BUS)	30	IN3b	Bch Input 3
15	GND	GND Terminal	31	IN2b	Bch Input 2
16	NC	No Connect	32	IN1b	Bch Input 1

■ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V ⁺	12	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 CHARACTERISTICS (Ta=25°C, V⁺=9V, R_g=600Ω, R_L=47kΩ, Vin=100mVrms/1kHz)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V ⁺		8.0	9.0	10.0	V
Supply Current	I _{CC}	No Signal	-	10.0	25.0	mA
Reference Voltage	V _{REF}	No Signal	4.0	4.5	5.0	V
Maximum Input Voltage	V _{IM}	VOL=-20dB, THD=3%	2.8	3.0	-	Vrms
Maximum Output Voltage1	V _{OM1}	OUTPUT VOL=0dB, THD=1%	-	2.5	-	Vrms
Maximum Output Voltage2	V _{OM2}	LINEOUT VOL=0dB, THD=1%	-	2.5	-	Vrms
MON OUT Gain	G _{VMON}	MON OUT	-1.0	0.0	1.0	dB
LINEOUT Gain	G _{VLINE}	LINEOUT, VOL=0dB	2.5	4.5	6.5	dB
Maximum Gain	G _{VMAX}	VOL=0dB	-2.0	0.0	2.0	dB
Minimum Gain	G _{VMIN}	VOL=Mute, Vin=1Vrms BW=400Hz to 30kHz	-	-	-70	dB
Channel Balance	G _{CB}	VOL=0dB	-1.5	0.0	1.5	dB
Balance Level A-A	BAL _{AA}	CHS="0",BAL="11111"	-2.0	0.0	2.0	dB
Balance Level A-B	BAL _{AB}	CHS="1",BAL="11111" Vin = 1Vrms BW=400Hz to 30kHz	-	-	-70	dB
Balance Level B-B	BAL _{BB}	CHS="1",BAL="11111"	-2.0	0.0	2.0	dB
Balance Level B-A	BAL _{BA}	CHS="0",BAL="11111" Vin = 1Vrms BW=400Hz to 30kHz	-	-	-70	dB
Total Harmonic Distortion	THD	Vo=0.5Vrms BW=400Hz to 30kHz	-	-	0.5	%
Input Selector Cross Talk	CT	Vin=1Vrms BW=400Hz to 30kHz	-	-	-70	dB
Channel Separation	CS	Vin=1Vrms BW=400Hz to 30kHz	-	-	-70	dB
Output Noise 1	V _{NO1}	VOL=0dB BW=400Hz to 30kHz	-	-90 (31.6)	-85 (56.2)	dBV (μVrms)
Output Noise 2	V _{NO2}	VOL=Mute BW=400Hz to 30kHz	-	-106 (5.0)	-96 (15.8)	dBV (μVrms)
Output Noise 3	V _{NO3}	LINEOUT, VOL=0dB BW=400Hz to 30kHz	-	-85 (56.2)	-80 (100)	dBV (μVrms)
Output Noise 4	V _{NO4}	LINEOUT, VOL=Mute BW=400Hz to 30kHz	-	-101 (8.9)	-91 (28.2)	dBV (μVrms)

■ELECTRICAL CHARACTERISTICS (Ta=25°C, V⁺=9V, R_g=600Ω, R_L=47kΩ, Vin=100mVrms/1kHz)

• TONE CONTROL (Tone Control-ON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
High Frequency Boost	HF _{BST}	TREBLE=+15dB, f=10kHz	12.5	15.0	17.5	dB
High Frequency Flat	HF _{FLT}	TRBE=0dB, f=10kHz	-2.0	0.0	2.0	dB
High Frequency Cut	HF _{CUT}	TREBLE=-15dB, f=10kHz	-17.5	-15.0	-12.5	dB
Low Frequency Boost	LF _{BST}	BASS=+15dB, f=100Hz	12.5	15.0	17.5	dB
Low Frequency Flat	LF _{FLT}	BASS=0dB, f=100Hz	-2.0	0.0	2.0	dB
Low Frequency Cut	LF _{CUT}	BASS=-15dB, f=100Hz	-17.5	-15.0	-12.5	dB

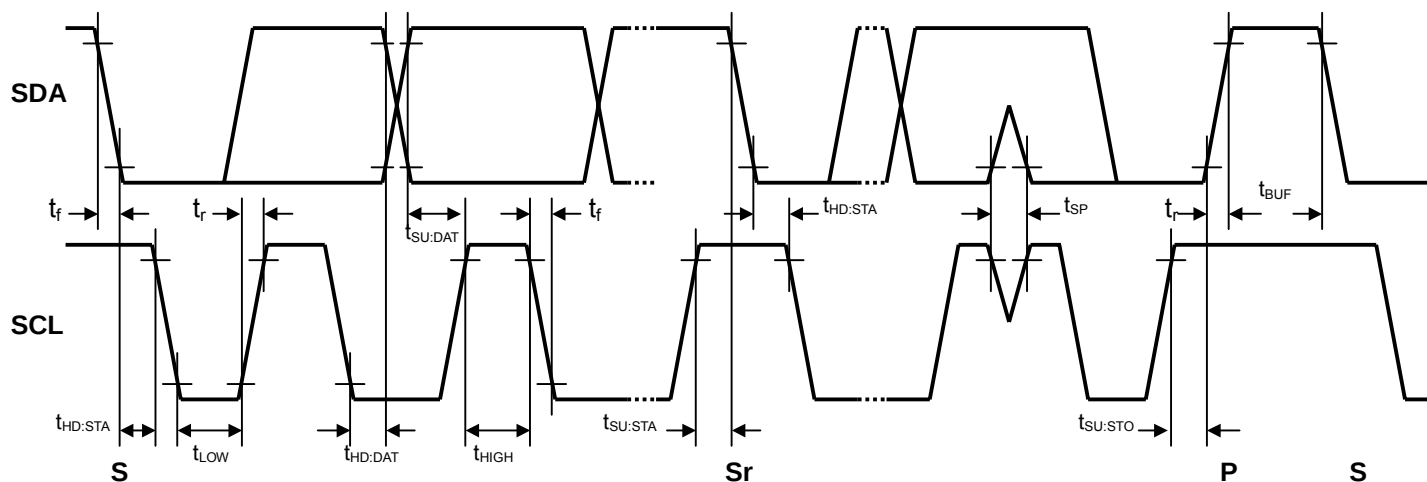
• AGC (AGC-ON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
AGC BOOST	AGC _{BST}	Vin=50mVrms	1.5	3.5	5.5	dB
AGC FLAT 1	AGC _{FLT1}	Vin=300mVrms	-2.5	0.0	2.5	dB
AGC FLAT 2	AGC _{FLT2}	Vin=400mVrms	-2.5	0.0	2.5	dB
AGC FLAT 3	AGC _{FLT3}	Vin=500mVrms	-2.5	0.0	2.5	dB
AGC FLAT 4	AGC _{FLT4}	Vin=600mVrms	-2.5	0.0	2.5	dB
AGC CUT	AGC _{CUT}	Vin=2Vrms	-14	-10	-6.0	dB

• SURROUND (SURROUND-ON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Simulated Stereo A	SR _{SIMA}	Ain+Bin → Aout, f=1kHz	1.0	3.0	5.0	dB
Simulated Stereo B	SR _{SIMB}	Ain+Bin → Bout, f=1kHz	1.0	3.0	5.0	dB
Surround 3D1	SR _{3D1}	Ain → Aout, f=100Hz	8.0	10.0	12.0	dB
Surround 3D2	SR _{3D2}	Ain → Aout, f=10kHz	-2.0	0.0	2.0	dB
Surround 3D3	SR _{3D3}	Ain → Bout, f=100Hz	4.5	6.5	8.5	dB

■ TIMING ON THE I²C BUS (SDA,SCL)



■ CHARACTERISTICS OF I/O STAGES FOR I²C BUS (SDA,SCL)

I²C BUS Load Conditions

STANDARD MODE : Pull up resistance 4k Ω (Connected to +5V), Load capacitance 200pF (Connected to GND)

FAST MODE : Pull up resistance 4k Ω (Connected to +5V), Load capacitance 50pF (Connected to GND)

PARAMETER	SYMBOL	Standard mode			Fast mode			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
Low level output voltage (3mA at SDA pin)	V_{OL}	0	-	0.4	0	-	0.4	V
Input current each I/O pin with an input voltage between 0.1V _{DD} and 0.9V _{DDmax}	I_i	-10	-	10	-10	-	10	μ A

■CHARACTERISTICS OF BUS LINES (SDA,SCL) FOR I²C-BUS DEVICES

PARAMETER	SYMBOL	Standard mode			Fast mode			UNIT
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
SCL clock frequency	f_{SCL}	-	-	100	-	-	400	kHz
Hold time (repeated) START condition.	$t_{HD:STA}$	4.0	-	-	0.6	-	-	μs
Low period of the SCL clock	t_{LOW}	4.7	-	-	1.3	-	-	μs
High period of the SCL clock	t_{HIGH}	4.0	-	-	0.6	-	-	μs
Set-up time for a repeated START condition	$t_{SU:STA}$	4.7	-	-	0.6	-	-	μs
Data hold time ^(NOTE)	$t_{HD:DAT}$	0	-	-	0	-	-	μs
Data set-up time	$t_{SU:DAT}$	250	-	-	100	-	-	ns
Rise time of both SDA and SCL signals	t_r	-	-	1000	-	-	300	ns
Fall time of both SDA and SCL signals	t_f	-	-	300	-	-	300	ns
Set-up time for STOP condition	$t_{SU:STO}$	4.0	-	-	0.6	-	-	μs
Bus free time between a STOP and START condition	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.

NOTE). Data hold time : $t_{HD:DAT}$

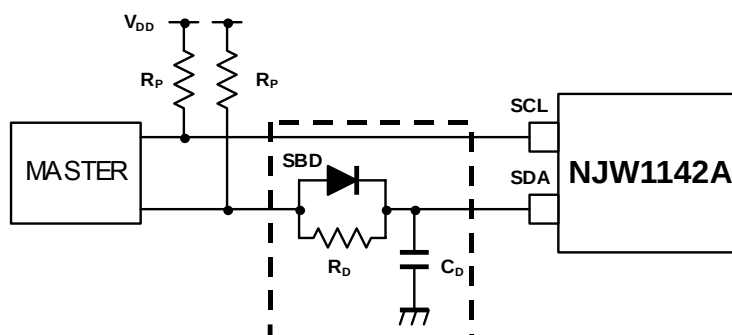
Please hold the Data Hold Time ($t_{HD:DAT}$) to 300ns or more to avoid status of unstable at SCL falling edge.

The SDA block in the NJW1142A does not hold data. Add external data-delay-circuit of the SDA terminal, in case of not providing a hold time of at least 300nsec for the SDA in the master device.

The time-consists of the data-delay-circuit of the SDA terminal are as follows.

- (a) Low level $\rightarrow$ High level : $T_{LH} \approx R_p \cdot C_D$
 (b) High level $\rightarrow$ Low level : $T_{HL} \approx R_D \cdot C_D$

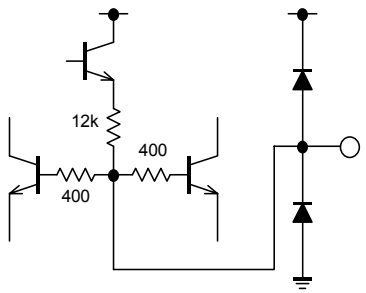
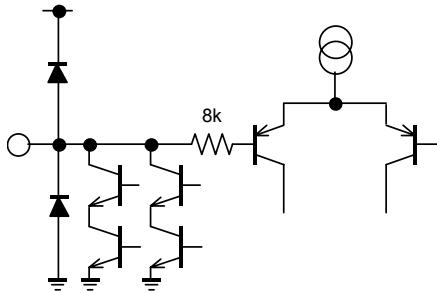
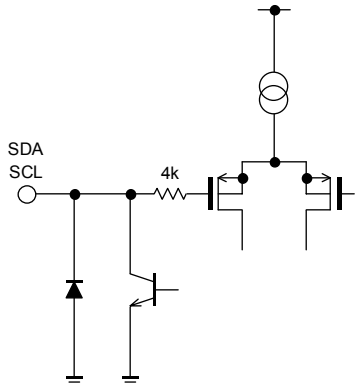
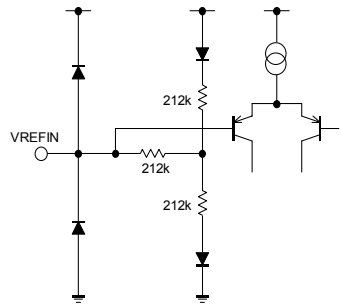
In addition, Schottky barrier diode (SBD) influences a Low level at the Acknowledge. Therefore choose the low forward voltage (V_f) as much as possible.



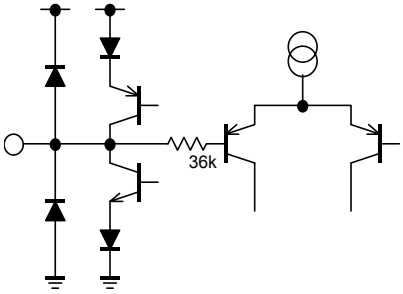
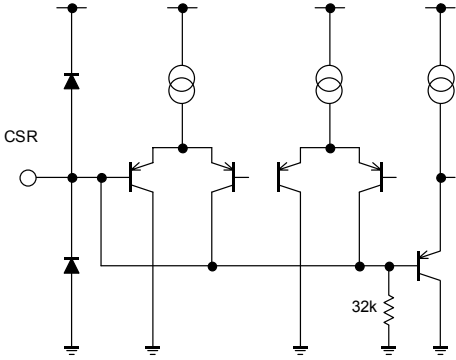
■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
1 2 3 4 29 30 31 32	IN1a IN2a IN3a IN4a IN4b IN3b IN2b IN1b	Ach Input 1 Ach Input 2 Ach Input 3 Ach Input 4 Bch Input 4 Bch Input 3 Bch Input 2 Bch Input 1		V+/2
5 9 10 23 24 28	MONa LINEa OUTa OUTb LINEb MONb	Ach Monitor Output (0dB) Ach LINE Output (4.5dB) Ach Output (0dB) Bch Output (0dB) Bch LINE Output (4.5dB) Bch Monitor Output (0dB)		V+/2
6	SR FIL	Surround Filter		V+/2
7 26	TONE-Ha TONE-Hb	Ach Treble Filter Bch Treble Filter		V+/2
8 25	TONE-La TONE-Lb	Ach Bass Filter Bch Bass Filter		V+/2

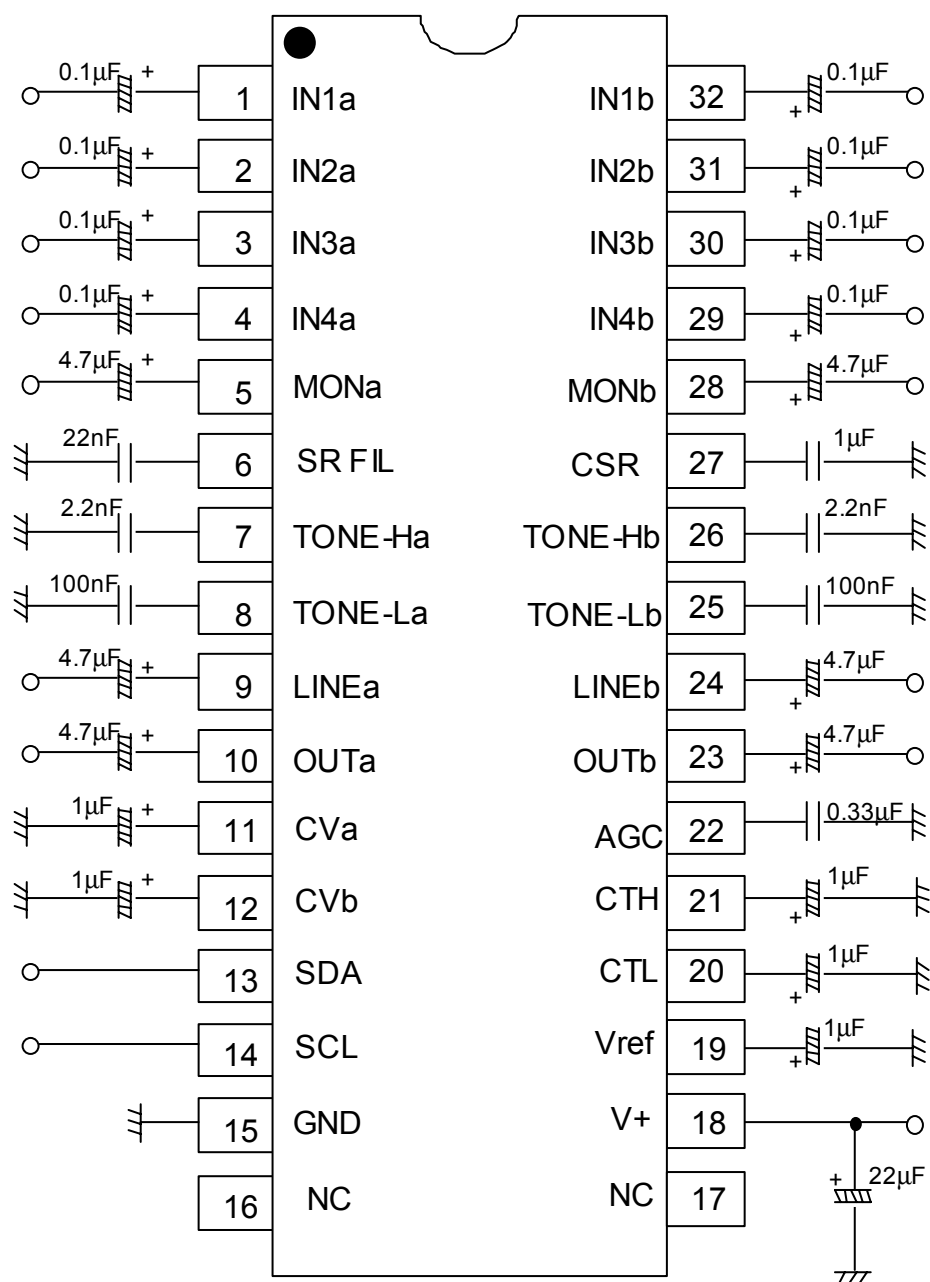
■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
22	AGC	AGC Filter		0.6V
11 12	CVa CVb	Pop Noise Reduction for Ach Volume & Balance Pop Noise Reduction for Bch Volume & Balance		V+/2 - 0.7V
13 14	SDA SCL	SDA Data Input (I ² C BUS) SCL Clock Input (I ² C BUS)		-
15	GND	GND Terminal	_____	0V
18	V+	Power Supply Terminal	_____	V+
19	Vref	Reference Voltage		V+/2

■TERMINAL DESCRIPTION

No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
20 21	CTL CTH	Pop Noise reduction for Bass Control Pop Noise reduction for Treble Control		$V+/2 - 0.7V$
27	CSR	Pop Noise Reduction for Surround Control		0.6V

APPLICATION CIRCUIT



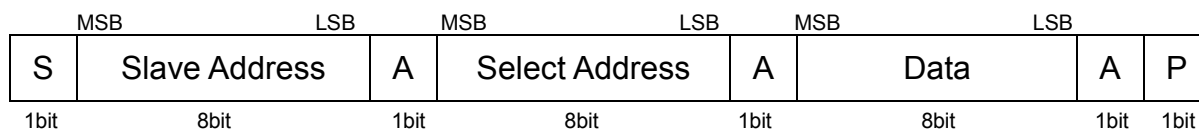
(NOTE)

1. Separate the I²C bus line from the following terminals for avoiding digital noise problem.

Pin No.	Symbol	Pin No.	Symbol	Pin No.	Symbol
6	SS FIL	8	TONE-La	26	TONE-Hb
7	TONE-Ha	25	TONE-Lb	-	-

■ DEFINITION OF I²C REGISTER

◆ I²C BUS FORMAT



S: Starting Term

A: Acknowledge Bit

P: Ending Term

◆ SLAVE ADDRESS

MSB							LSB
1	0	0	0	0	0	1	R/W

R/W=0: Write mode for register setting

R/W=1: Not available

◆ CONTROL REGISTER TABLE

The select address sets each function (Volume, Balance, AGC, Surround, Tone Control, 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					SUR1	SUR0
02H	BCB	BASS				BCSB	SUB-BASS	
03H	BCT	TREB				BCST	SUB-TREB	
04H	Don't Care							
05H	OUT	SEL			AGC1	AGC0	AGC	Don't Care

◆ 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

■ I²C CONTROL COMMAND DESCRIPTION

• MASTER VOLUME CONTROL

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

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.

• BALANCE, AGC AND SURROUND SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
01H	CHS	BAL					SR1	SR0

- 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 and the level is divided into half to each volume1 and volume2.

- “SR1”, “SR0”: Surround Mode select

Surround Mode	SR1 (D1)	SR0 (D0)
Surround Off (Bypass)	0	0
Simulated Stereo	0	1
eala effect large	1	0
eala effect small	1	1

• TONE CONTROL BASS SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
02H	BCB	BASS				BCSB	SUB-BASS	

- BCB: Boost cut select for Bass control

“0”: Cut

“1”: Boost

- BASS: BASS control

Cut Level: -15dB to 0dB (1dB/Step)

Boost Level: 0dB to +15dB (1dB/Step)

- BCSB: Boost cut select for SUB-BASS control

“0”: Cut

“1”: Boost

- SUB-BASS: SUB- BASS control (1dB/Step)

Sub-Cut Level: -3dB to 0dB (1dB/Step)

Sub-Boost Level: 0dB to +3dB (1dB/Step)

• TONE CONTROL TREBLE SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
03H	BCT	TREB				BCST	SUB-TREB	

- BCT: Boost cut select for Treble control
 “0”: Cut
 “1”: Boost
- TREB: Treble control (1dB/step)
 Cut Level: -15dB to 0dB (1dB/Step)
 Boost Level: 0dB to +15dB (1dB/Step)
- BCST: Boost cut select for Sub-Treble control
 “0”: Cut
 “1”: Boost
- SUB-TREB: Sub-Treble control (1dB/step)
 Sub-Cut Level: -3dB to 0dB (1dB/Step)
 Sub-Boost Level: 0dB to +3dB (1dB/Step)

• OUTPUT AND AUXILIARY SETTING

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
05H	OUT	SEL			AGC1	AGC0	AGC	Don't Care

- OUT: ON/OFF Switch for OUTPUT
 “0”: OFF (MUTE)
 “1”: ON

- SEL: Input Selector

Input Select	SEL		
	D6	D5	D4
IN1a and IN1b	0	1	0
IN2a and IN2b	0	1	1
IN3a and IN3b	1	0	0
IN4a and IN4b	1	0	1

- AGC1: AGC Level Setting

AGC Level	AGC1 (D3)	AGC0 (D2)	AGC (D1)
AGC Flat 1 (300mVrms)	0	0	1
AGC Flat 2 (400mVrms)	0	1	1
AGC Flat 3 (500mVrms)	1	0	1
AGC Flat 4 (600mVrms)	1	1	1
AGC Off	*	*	0

* Don't Care

■MASTER VOLUME (Select Address: 00H)

Gain (dB)	HEX	VOL							
		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 (Cont'd)

Gain (dB)	HEX	VOL							
		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 attenuated)	0
Bch (Ach is attenuated)	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 SUB-BASS (Select Address: 02H)

Sub-Bass Cut or Boost	BCSB
	D2
Cut	0
Boost	1

		SUB-BASS	
Cut Gain (dB)	Boost Gain (dB)	D1	D0
-3	3	1	1
-2	2	1	0
-1	1	0	1
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

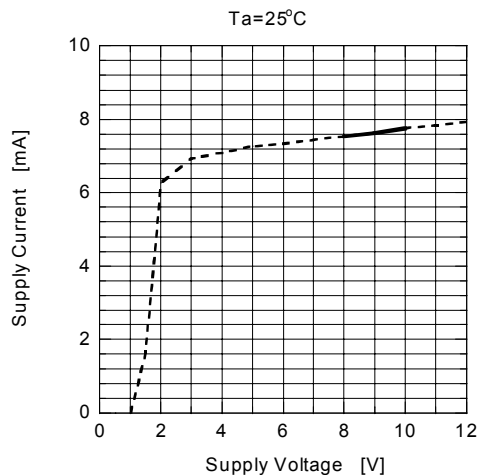
■TONE CONTROL SUB-TREBLE (Select Address: 03H)

Sub-Treble Cut or Boost	BCST
	D2
Cut	0
Boost	1

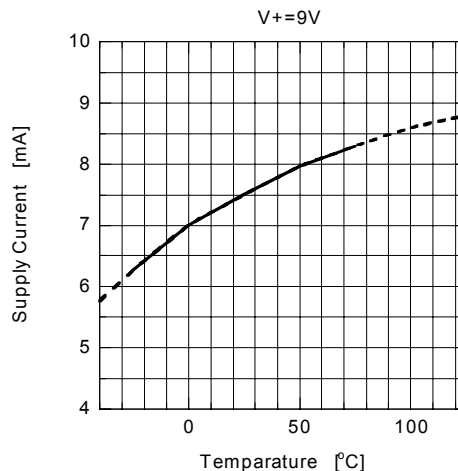
		SUB-TREB	
Cut Gain (dB)	Boost Gain (dB)	D1	D1
-3	3	1	1
-2	2	1	0
-1	1	0	1
0	0	0	0

■TYPICAL CHARACTERISTICS

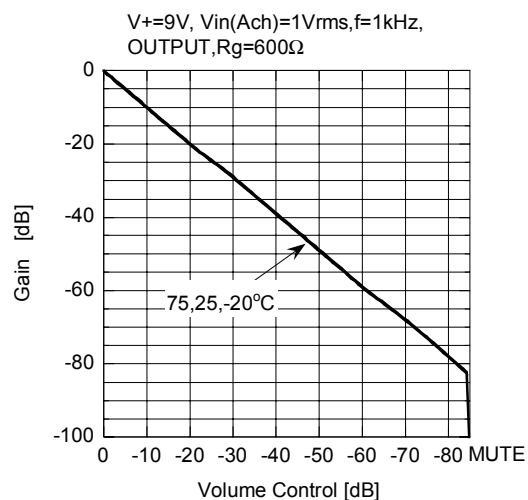
Supply Current vs Supply Voltage



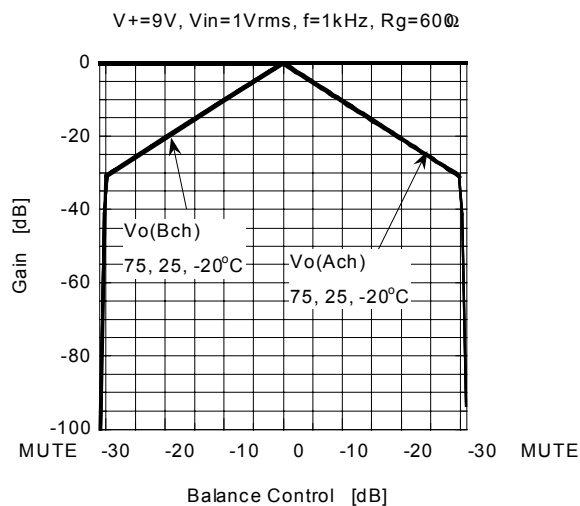
Supply Current vs Temperature



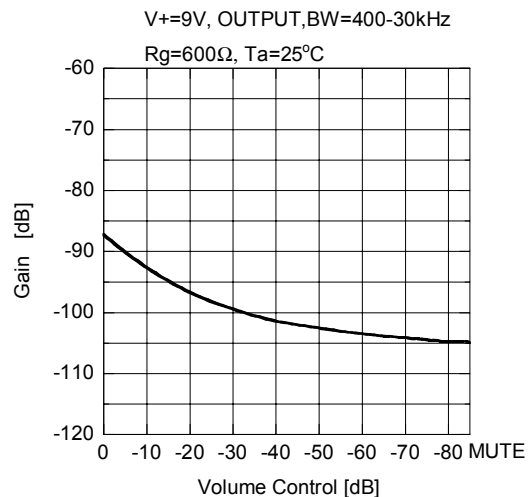
Gain vs Volume Control



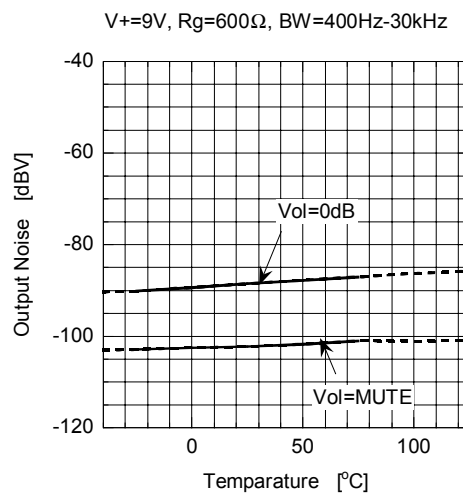
Gain vs Balance Control



Output Noise vs Volume Control



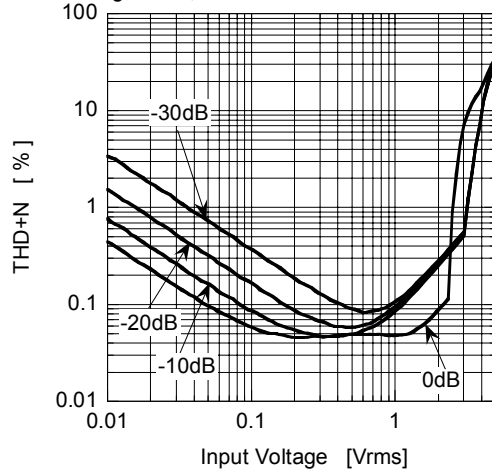
Output Noise vs Temperature



■TYPICAL CHARACTERISTICS

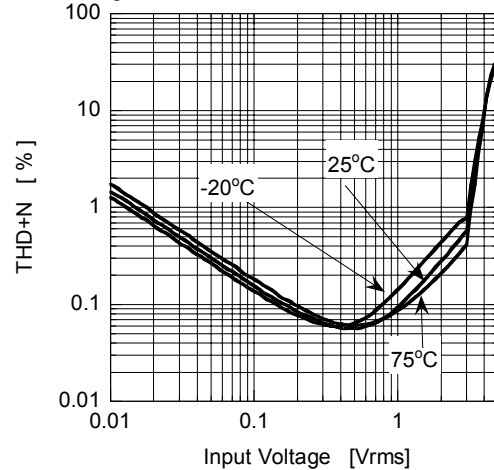
THD+N vs Input Voltage

V+=9V, Vin(Ach), f=1kHz, Vo(Ach)OUTPUT
Rg=600Ω, BW=400Hz-30kHz, Ta=25°C



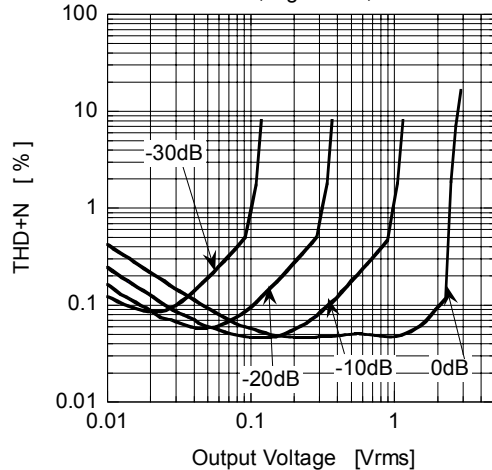
THD+N vs Input Voltage

V+=9V, Vin(Ach), f=1kHz, Vo(Ach)OUTPUT
Rg=600Ω, BW=400Hz-30kHz, Vol=-20dB



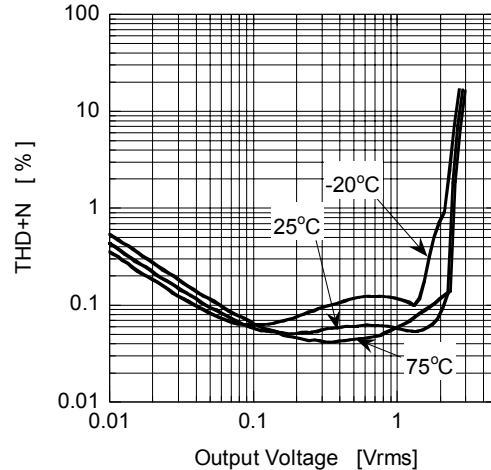
THD+N vs Output Voltage

V+=9V, Vin(Ach), f=1kHz, Vo(Ach)OUTPUT
BW=400Hz-30kHz, Rg=600Ω, Ta=25°C



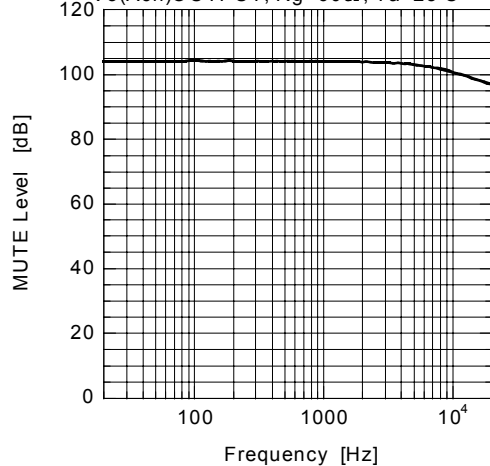
THD+N vs Output Voltage

V+=9V, Vin(Ach), f=1kHz, Vo(Ach)OUTPUT
Rg=600Ω, BW=400Hz-30kHz, Vol=0dB



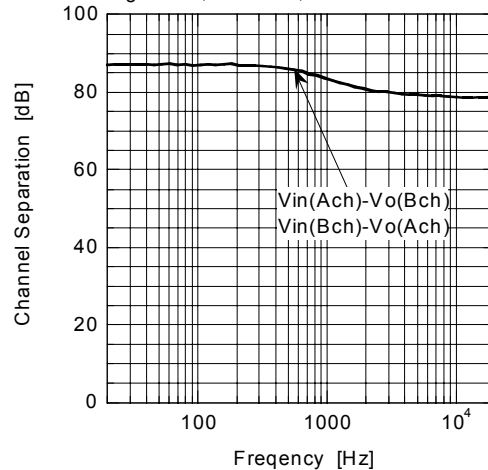
MUTE Level vs Frequency

V+=9V, Vin(Ach)=1Vrms, Vol=MUTE
Vo(Ach)OUTPUT, Rg=600Ω, Ta=25°C



Channel Separation vs Frequency

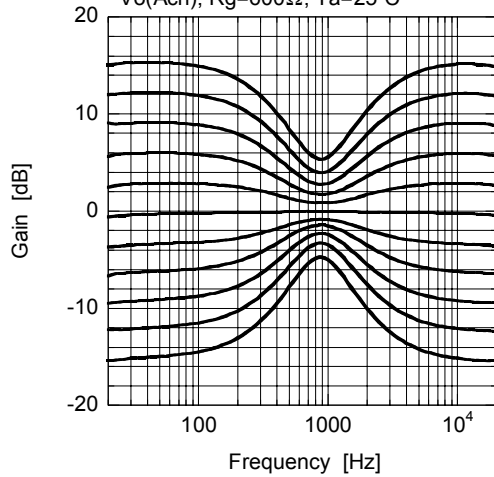
V+=9V, Vin=1Vrms, f=1kHz, Vo=OUTPUT
Rg=600Ω, Vol=0dB, Ta=25°C



■TYPICAL CHARACTERISTICS

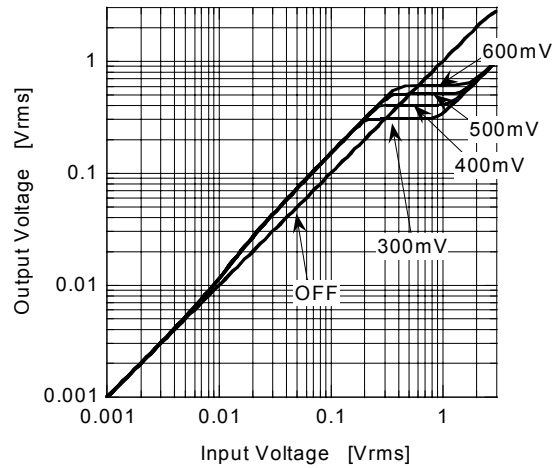
Gain vs Frequency (TONE)

V+=9V, Vin(Ach)=0.1Vrms, Gv: 3dB steps
Vo(Ach), Rg=600Ω, Ta=25°C



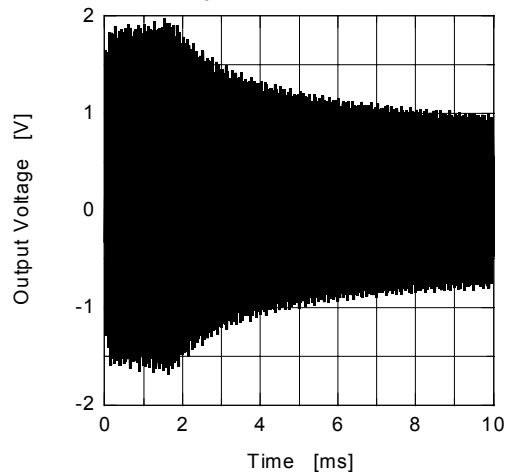
AGC Control

V+=9V, Vin(Ach+Bch), f=1kHz, Vo(Ach) OUTPUT
Rg=600Ω, Ta=25°C



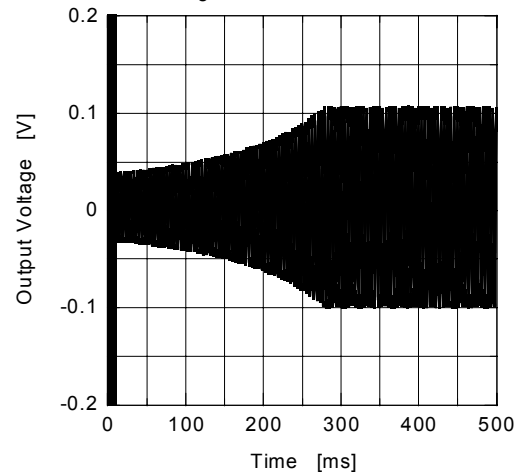
AGC Attack Time (C:20pin=0.33μF)

V+=9V, Vin(Ach+Bch)=1Vrms, f=20kHz, Vo(Ach) OUTPUT
AGC level=0.3V, Rg=600Ω, Ta=25°C



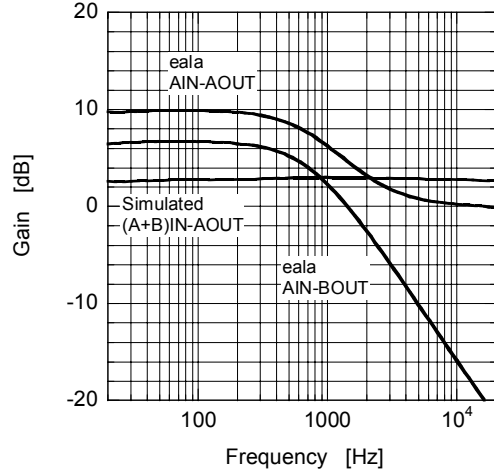
AGC Recovery Time (C:20pin=0.33μF)

V+=9V, Vin(Ach+Bch)=1Vrms, f=10kHz, Vo(Ach) OUTPUT
AGC level=0.3V, Rg=600Ω, Ta=25°C



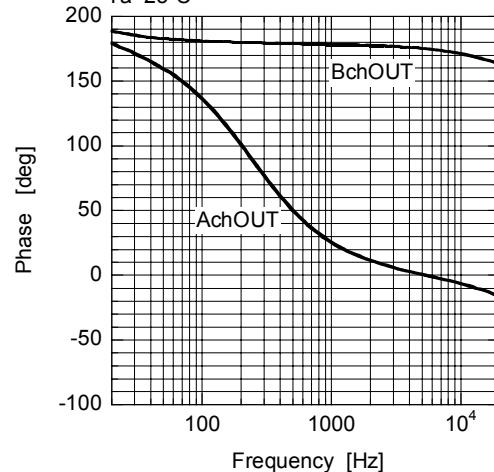
Gain vs Frequency (eala&Simulated)

V+=9V, Vin=0.1Vrms, OUTPUT, Rg=600Ω,
Ta=25°C



Phase vs Frequency (Simulated)

V+=9V, Vin(A+Bch)=0.1Vrms, Rg=600Ω,
Ta=25°C



[CAUTION]
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