



SOUND PROCESSOR with SOUND ENHANCEMENT

■ GENERAL DESCRIPTION

The **NJW1132** is a sound processor with sound enhancement (BBE). It includes all of functions processing audio signal for TV, such as tone control, balance, volume, mute, and AGC functions.

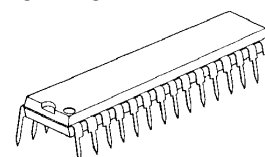
Also the **NJW1132** performs surround and sound enhancement. The sound enhancement regenerates high definitive and nearly real sound.

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

■ PACKAGE OUTLINE



NJW1132M

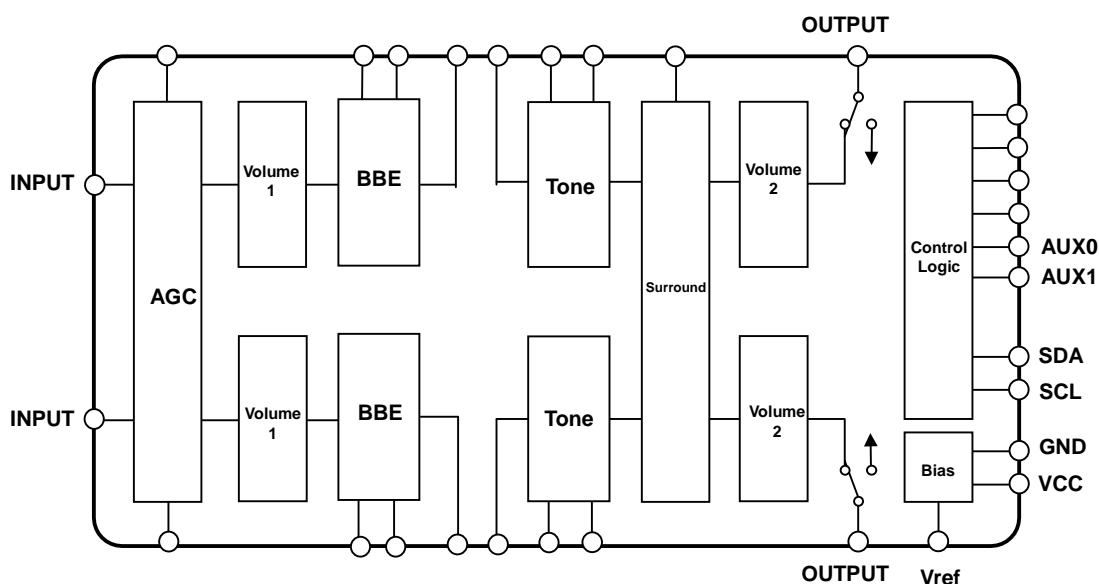


NJW1132L

■ FEATURES

- Operating Voltage (8 to 13V)
- I²C BUS Interface
- BBE Sound Enhancement (Low Boost and High Boost: 15dB max.)
- The AGC circuit reduces volume difference among input sources.
- Matrix Surround
- Bi-CMOS Technology
- Package Outline SDIP30,SDMP30

■ BLOCK DIAGRAM



■ PIN FUNCTION

Ach Input	1	INa	INb	30	Bch Input
Ach BBE Filter1	2	BBE1a	BBE1b	29	Bch BBE Filter1
Ach BBE Filter2	3	BBE2a	BBE2b	28	Bch BBE Filter2
Ach BBE Output	4	BBEout_a	BBEout_b	27	Bch BBE Output
Ach Tone Input	5	Tone_INa	Tone_INb	26	Bch Tone Input
Ach High Frequency	6	TONE-Ha	TONE-Hb	25	Bch High Frequency
Ach Low Frequency	7	TONE-La	TONE-Lb	24	Bch Low Frequency
Ach Output (0dB)	8	OUTa	OUTb	23	Bch Output(0dB)
AGC1	9	AGC1	PS	22	Phase Shift
AGC2	10	AGC2	VREF	21	Reference Voltage
DAC Output for Bch Volume & Balance	11	CVB	CTH	20	DAC Output for Tone High Frequency
DAC Output for Ach Volume & Balance	12	CVA	CTL	19	DAC Output for Tone Low Frequency
I ² C BUS SDA	13	SDA	AUX0	18	AUX Output0
I ² C BUS SCL	14	SCL	AUX1	17	AUX Output1
GND	15	GND	Vcc	16	Power Supply

SDIP30, SDMP30

■ ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V ⁺	14	V
Power Dissipation	P _D	700	mW
Operating Temperature Range	Topr	-20 to +75	°C
Storage Temperature Range	Tstg	-40 to +125	°C

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V ⁺		8.0	9.0	13.0	V
Supply Current	I _{CC}	No Signal	-	30	50	mA
Reference Voltage	V _{REF}	No Signal	4.0	4.5	5.0	V
Maximum Input Voltage	V _{IM}	VOL=C3H, THD=1%	2.6	2.8	-	Vrms
Maximum Output Voltage	V _{OM1}	OUTPUT VOL=FFH, THD=1%	-	2.5	-	Vrms
Channel Balance	G _{CB}	VOL=FFH	-1.5	0.0	1.5	dB
Balance Boost A	BA _{BST}	BAL="00000"	-2.0	0.0	2.0	dB
Balance Cut A	BA _{CUT}	BAL="11111"	-	-	-70	dB
Balance Boost B	BB _{BST}	BAL="00000"	-2.0	0.0	2.0	dB
Balance Cut B	BB _{CUT}	BAL="11111"	-	-	-70	dB
Total Harmonic Distortion	THD	Vo=0.5Vrms BW=400Hz to 30kHz	-	-	0.5	%
Mute Level	MUTE	VOL=00H	-	-	-70	dB
Channel Separation	CS	Vin=2Vrms	-	-	-70	dB
Output Noise 1	V _{NO1}	VOL=FFH BW=400Hz to 30kHz	-	-	-60 (1.0)	dBV (mVrms)
Output Noise 2	V _{NO2}	VOL=00H BW=400Hz to 30kHz	-	-90 (31.6)	-82 (79.4)	dBV (uVrms)

● TONE CONTROL

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
High Frequency Boost	HF _{BST}	TREB="1111", f=10kHz	12.5	15.0	17.5	dB
High Frequency Flat	HF _{FLT}	TRBE="0000", f=10kHz	-2.0	0.0	2.0	dB
High Frequency Cut	HF _{CUT}	TRBE="1111", f=10kHz	-12.5	-15.0	-17.5	dB
Low Frequency Boost	LF _{BST}	BASS="1111", f=100Hz	12.5	15.0	17.5	dB
Low Frequency Flat	LF _{FLT}	BASS="0000", f=100Hz	-2.0	0.0	2.0	dB
Low Frequency Cut	LF _{CUT}	BASS="1111", f=100Hz	-12.5	-15.0	-17.5	dB
High Frequency Cut DC Offset1	HF _{DC1}	TREB="1111" → "0000"	-1.0	0.0	1.0	V
High Frequency Boost DC Offset2	HF _{DC2}	TREB="1111" → "0000"	-1.0	0.0	1.0	V
Low Frequency Cut DC Offset1	LF _{DC1}	BASS="1111" → "0000"	-1.0	0.0	1.0	V
Low Frequency Boost DC Offset2	LF _{DC2}	BASS="1111" → "0000"	-1.0	0.0	1.0	V

● SUB-TONE CONTROL

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
High Frequency Boost	SHF _{BST}	SUB-TREB="11", f=10kHz	2.0	3.0	4.0	dB
High Frequency Flat	SHF _{FLT}	SUB-TREB="00", f=10kHz	-2.0	0.0	2.0	dB
High Frequency Cut	SHF _{CUT}	SUB-TREB="11", f=10kHz	-4.0	-3.0	-2.0	dB
Low Frequency Boost	SLF _{BST}	SUB-BASS="11", f=100Hz	2.0	3.0	4.0	dB
Low Frequency Flat	SLF _{FLT}	SUB-BASS="00", f=100Hz	-2.0	0.0	2.0	dB
Low Frequency Cut	SLF _{CUT}	SUB-BASS="11", f=100Hz	-4.0	-3.0	-2.0	dB

● AGC CONTROL: AGC=1H (AGC-ON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
AGC BOOST 1	AGC _{BST1}	Vin=10mVrms	0.0	2.5	5.0	dB
AGC BOOST 2	AGC _{BST2}	Vin=50mVrms	5.0	7.0	10.0	dB
AGC FLAT	AGC _{FLT}	Vin=200mVrms	-2.5	0.0	2.5	dB
AGC CUT	AGC _{CUT}	Vin=2Vrms	-24	-20	-16	dB

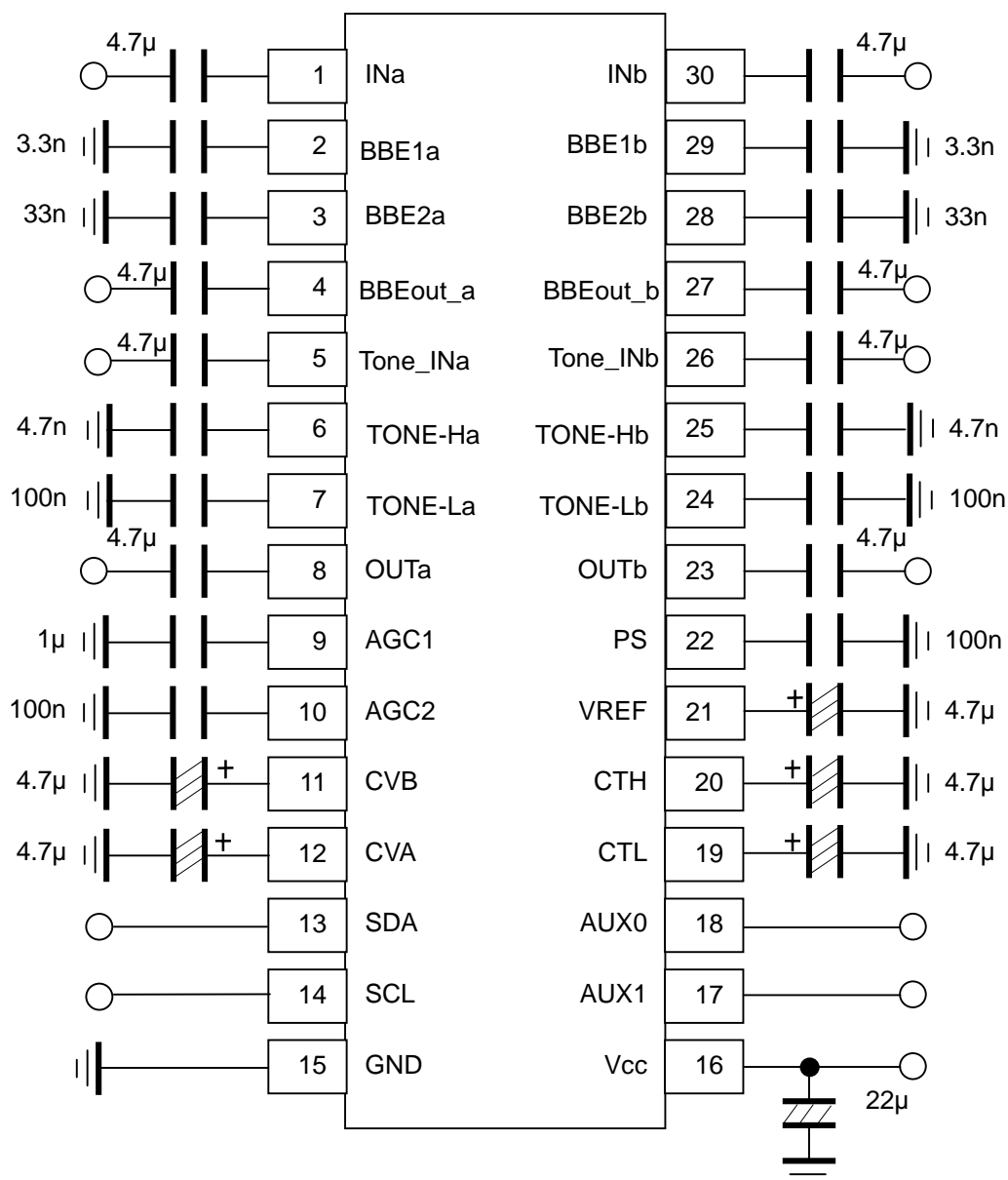
● SURROUND CONTROL: MODE=1H (SURROUND-ON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
SURROUND MIX 1	SR _{MIX1}	Ain → Bout	-2.0	0.0	2.0	dB
SURROUND MIX 2	SR _{MIX2}	Bin → Aout	-2.0	0.0	2.0	dB
SURROUND DEF	SR _{DEF}	Ain-Bin(-180deg)	8.0	10.0	12.0	dB
DC Offset	SR _{DC}	MODE="0" → "1"	-1.0	0.0	1.0	V

● BBE =1H (BBE-ON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
BBE low Frequency Boost Range	BBE _{LOW}	BBE-Low="1111"	-	15.0	-	dB
BBE High Frequency Boost Range	BBE _{HIGH}	BBE-High="1111"	-	15.0	-	dB

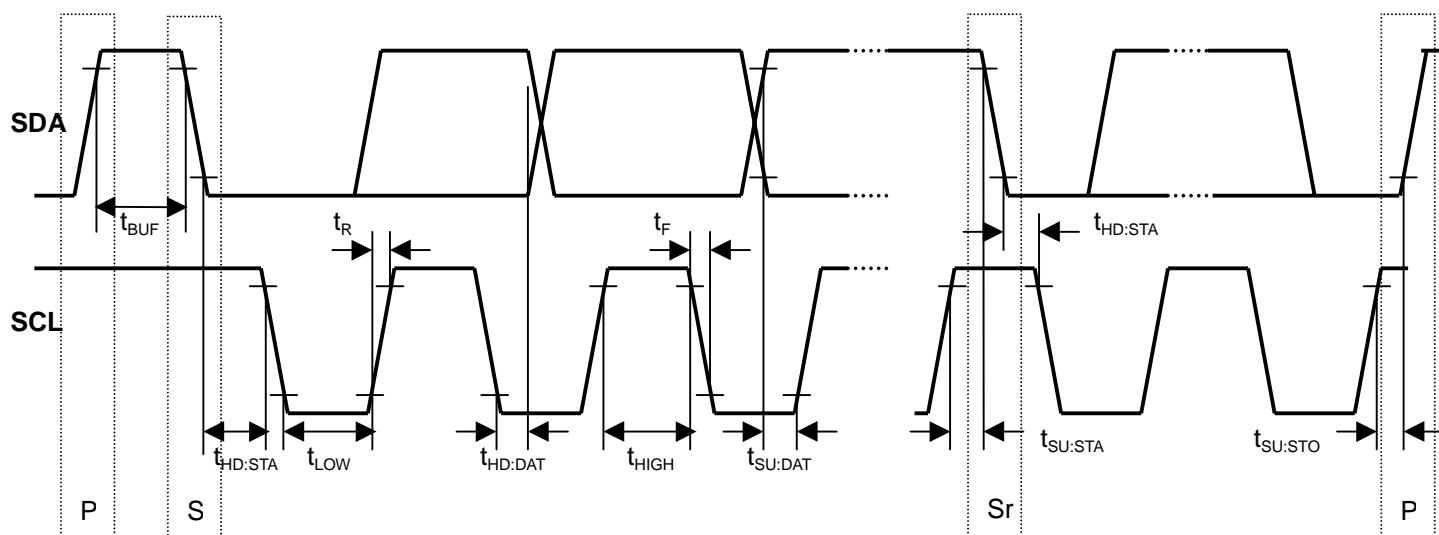
■ APPLICATION CIRCUIT



■ I²C BUS Block CHARACTERISTICS (SDA,SCL)

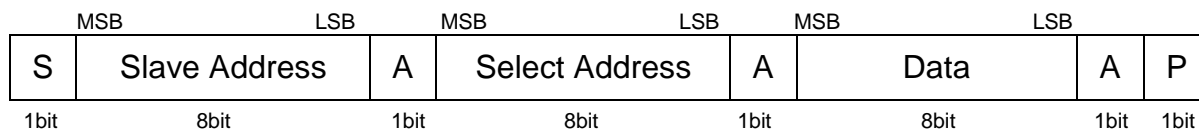
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
High Level Input Voltage	V_{IH}	3.0	-	5.0	V
Low Level Input Voltage	V_{IL}	0	-	1.5	V
High Level Input Current	I_{IH}	-	-	10	μA
Low Level Input Current	I_{IL}	-	-	10	μA
Low Level Output Voltage (3mA at SDA pin)	V_{OL}	0	-	0.4	dB
Maximum Output Current	I_{OL}	-3.0	-	-	mA
Maximum Clock Frequency	f_{SCL}	0	-	100	kHz
Data Change Minimum Waiting Time	t_{BUF}	4.7	-	-	μS
Data Transfer Start Minimum Waiting Time	$t_{HD:STA}$	4.0	-	-	μS
Low Level Clock Pulse Width	t_{LOW}	4.7	-	-	μS
High Level Clock Pulse Width	T_{HIGH}	4.0	-	-	μS
Minimum Start Preparation Waiting Time	$t_{SU:STA}$	4.7	-	-	μS
Minimum Data Hold Time	$t_{HD:DAT}$	5.0	-	-	μS
Minimum Data Preparation Time	$t_{SU:DAT}$	250	-	-	nS
Rise Time	t_R	-	-	1.0	μS
Fall Time	t_F	-	-	300	nS
Minimum Stop Preparation Waiting Time	$t_{SU:STO}$	4.7	-	-	μS

I²C BUS Load Condition: Pull up resistance 4k Ω (Connected to +5V)
Load capacitance 200pF (Connected to GND)



■ 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: Receive Only

● CONTROL REGISTER TABLE

Select Address	BIT							
	D7	D6	D5	D4	D3	D2	D1	D0
00H	VOL							
01H	CHS	BAL					AGC	SUR
02H	BCB	BASS				BCSB	SUB-BASS	
03H	BCT	TREB				BCST	SUB-TREB	
04H	BBE-Low				BBE-High			
05H	OUT	*			Reserved*		AUX1	AUX0

* : Don't care.

● CONTROL REGISTER DEFAULT VALUE

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

● CONTROL COMMAND TABLE

CONTROL COMMAND TABLE										
Select	BIT								REMARKS	
Address	D7	D6	D5	D4	D3	D2	D1	D0		
00H	VOL								VOL : Volume control for both Ach and Bch (0.33dB/step) Ex.) FFH=0dB FEH=-0.33dB FDH=-0.66dB FCH=-1.0dB : : 03H=-84dB 00H=MUTE The Volume is consisted of volume1 and volume 2. The volume level is divided into half to each volum1 and volume2. Ex.) volume level = -30dB (volume 1 =-15dB,volume 2=-15dB)	
		F				F				
		F				E				
		F				D				
		F				C				
		:				:				
		:				:				
		0				3				
		0				2				
		0				1				
		0				0				
01H	CHS	BAL					AGC	SUR		CHS : Channel select for Balance control "0"=Ach "1"=Bch BAL : Balance control for both Ach and Bch (1dB/step) Ex.) "00000"=0dB "00001"=-1dB : : "11110"=-30dB "11111"=MUTE The Balance is consisted of volume1 and volume 2. The Balance level is divided into half to each volum1 and volume2. AGC : AGC switch "0"=AGC OFF "1"=AGC ON SUR : Surround mode switch "0"=Surround OFF "1"=Surround ON
	0/1	0	0	0	0	0	0/1	0/1		
		0	0	0	0	1				
		0	0	0	1	0				
		0	0	0	1	1				
		:								
		:								
		:								
		1	1	1	0	0				
		1	1	1	0	1				
		1	1	1	1	0				
	1	1	1	1	1					
02H	BCB	BASS				BCSB	SUB-BASS		BCB : Boost-cut select for Bass control "0"=Cut "1"=Boost BASS : Bass control (1dB/step) Ex.) "0000"=0dB "0001"=1dB : : "1110"=14dB "1111"=15dB BCSB : Boost-cut select for Sub-Bass control "0"=Cut "1"=Boost SUB-BASS : Sub-Bass control (1dB/step) "00"=0dB "01"=1dB "10"=2dB "11"=3dB	
	0/1	0	0	0	0	0/1	0	0		
		0	0	0	1		0	1		
		0	0	1	0		1	0		
		0	0	1	1		1	1		
		:								
		:								
		:								
		1	1	0	0					
		1	1	0	1					
		1	1	1	0					
	1	1	1	1						
03H	BCT	TREB				BCST	SUB-TREB		BCT : Boost-cut select for Treble control "0"=Cut "1"=Boost TREB : Treble control (1dB/step) Ex.) "0000"=0dB "0001"=1dB : : "1110"=14dB "1111"=15dB BCST : Boost-cut select for Sub-Treble control "0"=Cut "1"=Boost SUB-TREB : Sub-Treble control (1dB/step) "00"=0dB "01"=1dB "10"=2dB "11"=3dB	
	0/1	0	0	0	0	0/1	0	0		
		0	0	0	1		0	1		
		0	0	1	0		1	0		
		0	0	1	1		1	1		
		:								
		:								
		:								
		1	1	0	0					
		1	1	0	1					
		1	1	1	0					
	1	1	1	1						

● CONTROL COMMAND TABLE

Select Address	BIT								REMARKS
	D7	D6	D5	D4	D3	D2	D1	D0	
04H	BBE-Low				BBE-High				BBE-Low : Boost level control for BBE Lo-Contour (1dB/step) Ex.) "0000"=0dB "0001"=1dB : "1110"=14dB "1111"=15dB BBE-High : Boost level control for BBE Process (1dB/step) Ex.) "0000"=0dB "0001"=1dB : "1110"=14dB "1111"=15dB When all bits are "0"(=00H), BBE becomes off.
	0	0	0	0	0	0	0	0	
	0	0	0	1	0	0	0	1	
	0	0	1	0	0	0	1	0	
			:				:		
			:				:		
			:				:		
	1	1	0	1	1	1	0	1	
	1	1	1	0	1	1	1	0	
	1	1	1	1	1	1	1	1	
05H	OUT	SEL			Reserved		AUX1	AUX2	OUT : ON / OFF switch for OUTPUT "0"=OFF "1"=ON AUX1/AUX2 : Auxiliary port ON/OFF "0"=OFF "1"=ON
	0/1	don't care			don't care		0/1	0/1	

■NOTE

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