



## 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.

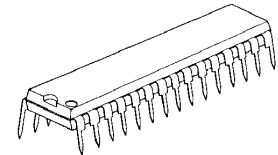
Also the **NJW1132** performs surround and sound enhancement. The sound enhancement regenerates high definitive and nearly real sound.

All of internal status and variables are controlled by I<sup>2</sup>C BUS interface.

### ■ PACKAGE OUTLINE



NJW1132M

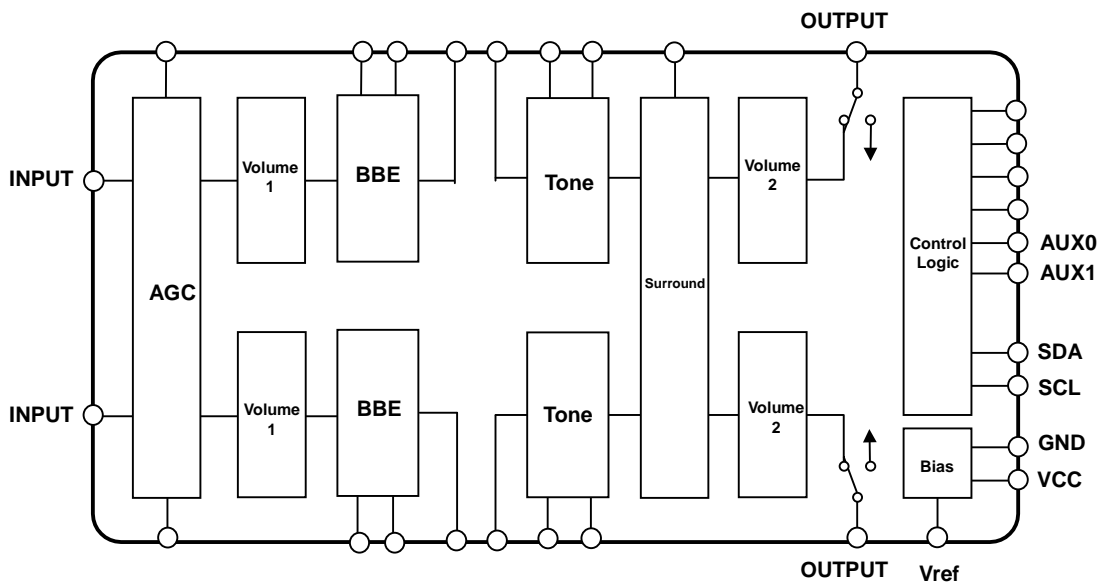


NJW1132L

### ■ FEATURES

- Operating Voltage (8 to 13V)
- I<sup>2</sup>C 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 <sup>2</sup> C BUS SDA	13	SDA	AUX0	18	AUX Output0
I <sup>2</sup> 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 <sup>+</sup>	14	V
Power Dissipation	P <sub>D</sub>	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, RL=47kΩ, Vin=100mVrms/1kHz)**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V <sup>+</sup>		8.0	9.0	13.0	V
Supply Current	I <sub>CC</sub>	No Signal	-	30	50	mA
Reference Voltage	V <sub>REF</sub>	No Signal	4.0	4.5	5.0	V
Maximum Input Voltage	V <sub>IM</sub>	VOL=C3H,THD=1%	2.6	2.8	-	Vrms
Maximum Output Voltage	V <sub>OM1</sub>	OUTPUT VOL=FFH,THD=1%	-	2.5	-	Vrms
Channel Balance	G <sub>CB</sub>	VOL=FFH	-1.5	0.0	1.5	dB
Balance Boost A	BA <sub>BST</sub>	BAL="00000"	-2.0	0.0	2.0	dB
Balance Cut A	BA <sub>CUT</sub>	BAL="11111"	-	-	-70	dB
Balance Boost B	BB <sub>BST</sub>	BAL="00000"	-2.0	0.0	2.0	dB
Balance Cut B	BB <sub>CUT</sub>	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 <sub>NO1</sub>	VOL=FFH BW=400Hz to 30kHz	-	-	-60 (1.0)	dBV (mVrms)
Output Noise 2	V <sub>NO2</sub>	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 <sub>BST</sub>	TREB="1111",f=10kHz	12.5	15.0	17.5	dB
High Frequency Flat	HF <sub>FLT</sub>	TRBE="0000",f=10kHz	-2.0	0.0	2.0	dB
High Frequency Cut	HF <sub>CUT</sub>	TRBE="1111",f=10kHz	-12.5	-15.0	-17.5	dB
Low Frequency Boost	LF <sub>BST</sub>	BASS="1111",f=100Hz	12.5	15.0	17.5	dB
Low Frequency Flat	LF <sub>FLT</sub>	BASS="0000",f=100Hz	-2.0	0.0	2.0	dB
Low Frequency Cut	LF <sub>CUT</sub>	BASS="1111",f=100Hz	-12.5	-15.0	-17.5	dB
High Frequency Cut DC Offset1	HF <sub>DC1</sub>	TREB="1111"→"0000"	-1.0	0.0	1.0	V
High Frequency Boost DC Offset2	HF <sub>DC2</sub>	TREB="1111"→"0000"	-1.0	0.0	1.0	V
Low Frequency Cut DC Offset1	LF <sub>DC1</sub>	BASS="1111"→"0000"	-1.0	0.0	1.0	V
Low Frequency Boost DC Offset2	LF <sub>DC2</sub>	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 <sub>BST</sub>	SUB-TREB="11",f=10kHz	2.0	3.0	4.0	dB
High Frequency Flat	SHF <sub>FLT</sub>	SUB-TREB="00",f=10kHz	-2.0	0.0	2.0	dB
High Frequency Cut	SHF <sub>CUT</sub>	SUB-TREB="11",f=10kHz	-4.0	-3.0	-2.0	dB
Low Frequency Boost	SLF <sub>BST</sub>	SUB-BASS="11",f=100Hz	2.0	3.0	4.0	dB
Low Frequency Flat	SLF <sub>FLT</sub>	SUB-BASS="00",f=100Hz	-2.0	0.0	2.0	dB
Low Frequency Cut	SLF <sub>CUT</sub>	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 <sub>BST1</sub>	Vin=10mVrms	0.0	2.5	5.0	dB
AGC BOOST 2	AGC <sub>BST2</sub>	Vin=50mVrms	5.0	7.0	10.0	dB
AGC FLAT	AGC <sub>FLT</sub>	Vin=200mVrms	-2.5	0.0	2.5	dB
AGC CUT	AGC <sub>CUT</sub>	Vin=2Vrms	-24	-20	-16	dB

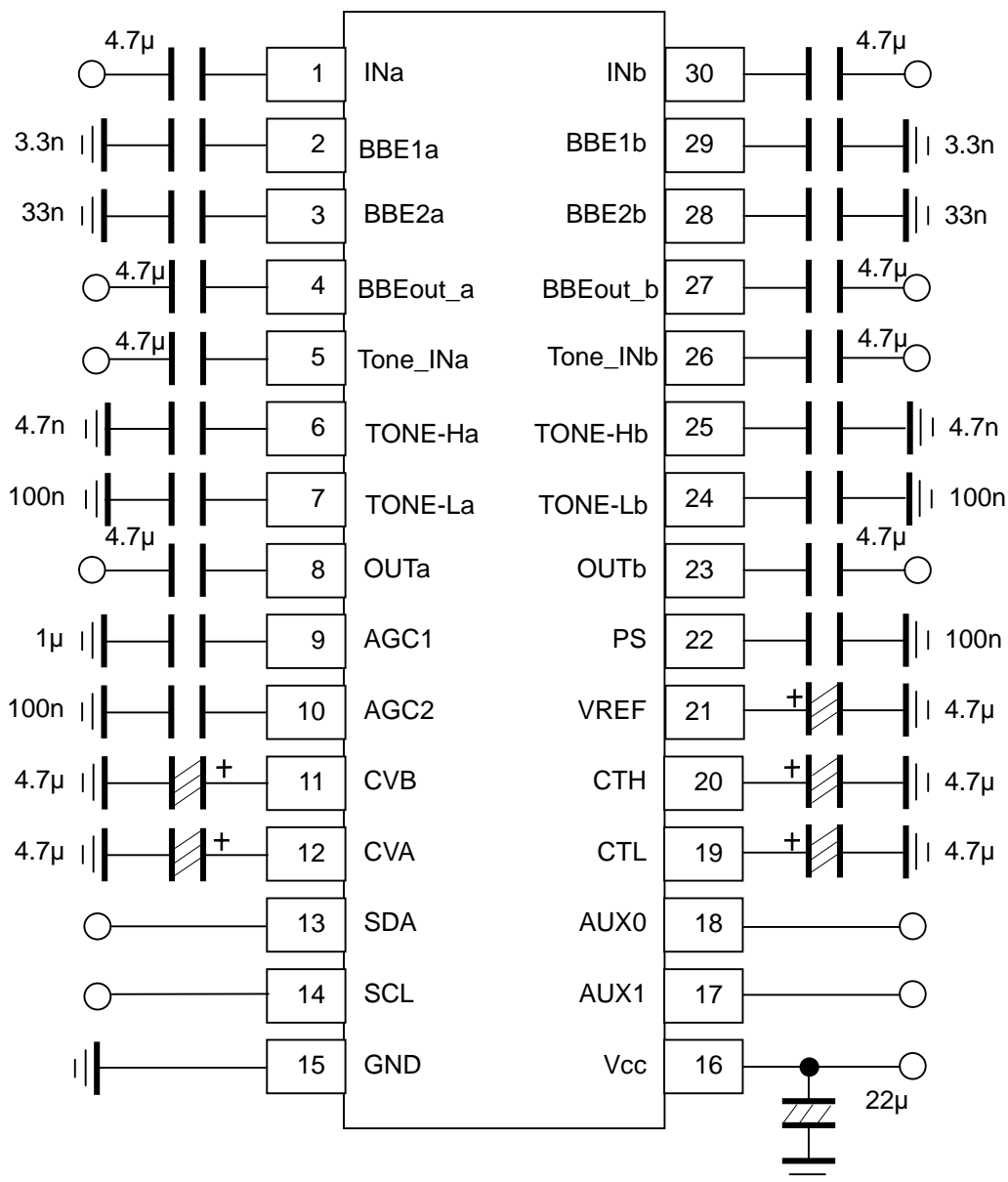
## ● SURROUND CONTROL: MODE=1H (SURROUND-ON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
SURROUND MIX 1	SR <sub>MIX1</sub>	Ain → Bout	-2.0	0.0	2.0	dB
SURROUND MIX 2	SR <sub>MIX2</sub>	Bin → Aout	-2.0	0.0	2.0	dB
SURROUND DEF	SR <sub>DEF</sub>	Ain-Bin(-180deg)	8.0	10.0	12.0	dB
DC Offset	SR <sub>DC</sub>	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 <sub>LOW</sub>	BBE-Low="1111"	-	15.0	-	dB
BBE High Frequency Boost Range	BBE <sub>HIGH</sub>	BBE-High="1111"	-	15.0	-	dB

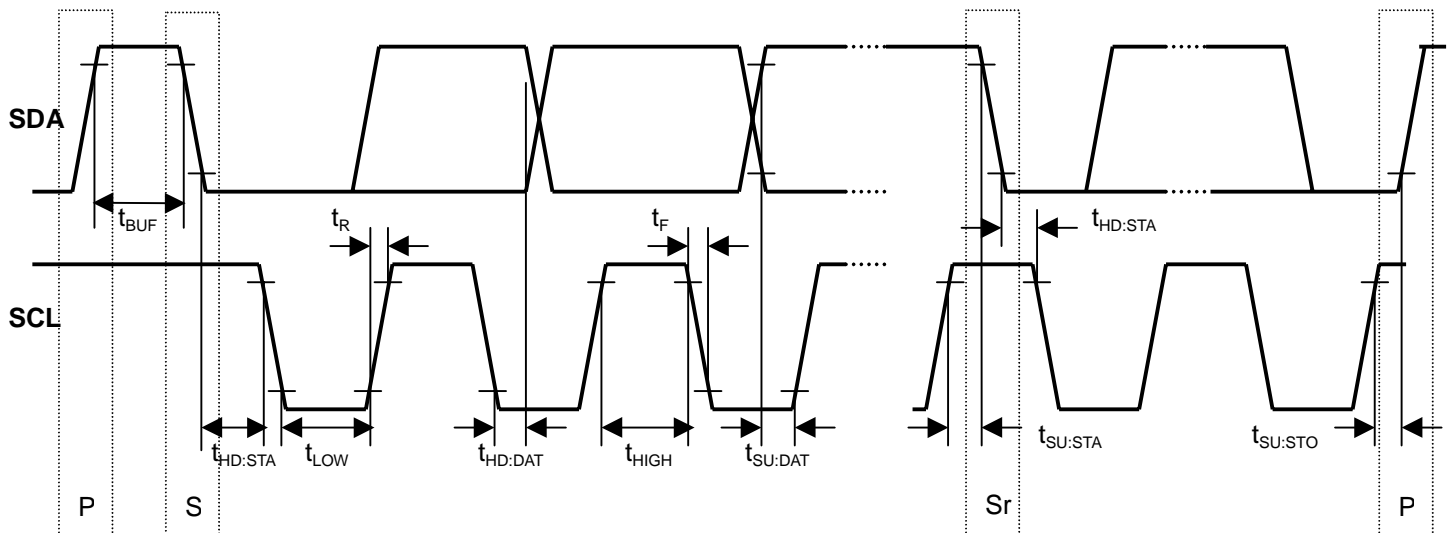
## ■ APPLICATION CIRCUIT



## ■ I<sup>2</sup>C BUS Block CHARACTERISTICS (SDA,SCL)

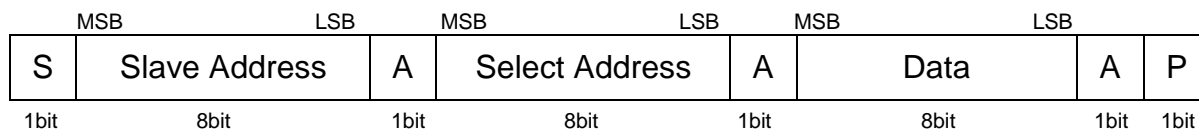
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
High Level Input Voltage	$V_{IH}$	3.0	-	5.0	V
Low Level Input Voltage	$V_{IL}$	0	-	1.5	V
High Level Input Current	$I_{IH}$	-	-	10	$\mu$ A
Low Level Input Current	$I_{IL}$	-	-	10	$\mu$ A
Low Level Output Voltage (3mA at SDA pin)	$V_{OL}$	0	-	0.4	dB
Maximum Output Current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

I<sup>2</sup>C BUS Load Condition: Pull up resistance 4k $\Omega$  (Connected to +5V)  
Load capacitance 200pF (Connected to GND)



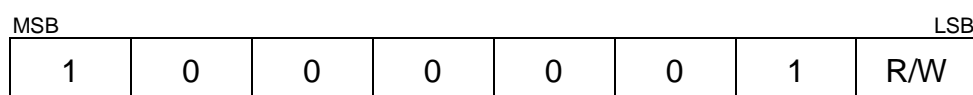
## ■ DEFINITION OF I<sup>2</sup>C REGISTER

### ● I<sup>2</sup>C BUS FORMAT



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

### ● SLAVE ADDRESS



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

Select Address	BIT								REMARKS
	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		
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					
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						
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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