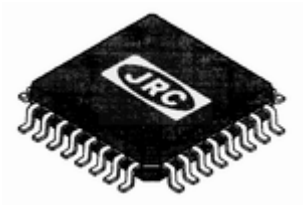
Dolby Pro Logic II / Virtual Dolby Surround Decoder

■Package



NJU26106FR1

■ General Description

The NJU26106 is a digital audio signal decoder that provides the function of Dolby Pro Logic II and Virtual Dolby Surround.

The NJU26106 processes the stereo matrix-encoded signal into spacious sound of 5.1 channels by Dolby Pro Logic II and Bass Management System. Also non matrix-encoded audio signal can be processed into effective spacious sound by Music mode.

The decoded 5-channel signal can be downmixed into 2-channel virtual surround output by the Dolby Virtual technology.

The NJU26106 is suitable for multi-channel products such as AV AMP and Car Audio, or ordinary audio products such as small speaker system.

■ FEATURES

- Software

- 5.1 Channel signal outputs by Dolby Pro Logic II
- 2 Channel outputs by Virtual Dolby Surround
- Movie mode / Music mode
- Available for Center width control, Dimension control, Panorama mode, Music mode and Custom mode
- Master Volume

- Hardware

- 24bit Fixed-point Digital Signal Processing
- Maximum System Clock Frequency : 38MHz Max.
- Digital Audio Interface : 2 Input ports / 3 Output ports
- Digital Audio Format : I^2S 24bit, Left- justified, Right-justified, BCK : 32/64fs
- Master / Slave Mode : Master Mode MCK 1/2 fclk, 1/3 fclk
  ex. MCK = 384Fs(1/2) or MCK = 256Fs(1/3) at fclk=768Fs
- Power Supply : 2.5V
- Input terminal : 3.3V Input tolerant
- Package : QFP32-R1 (Pb-Free)
- Two kinds of micro computer interface : I^2C bus (standard-mode/100kbps)
  : Serial interface (4 lines: clock, enable, input data, output data)

The detail hardware specification is described in the " NJU26100 Series Hardware Data Sheet".

■ Function Block Diagram

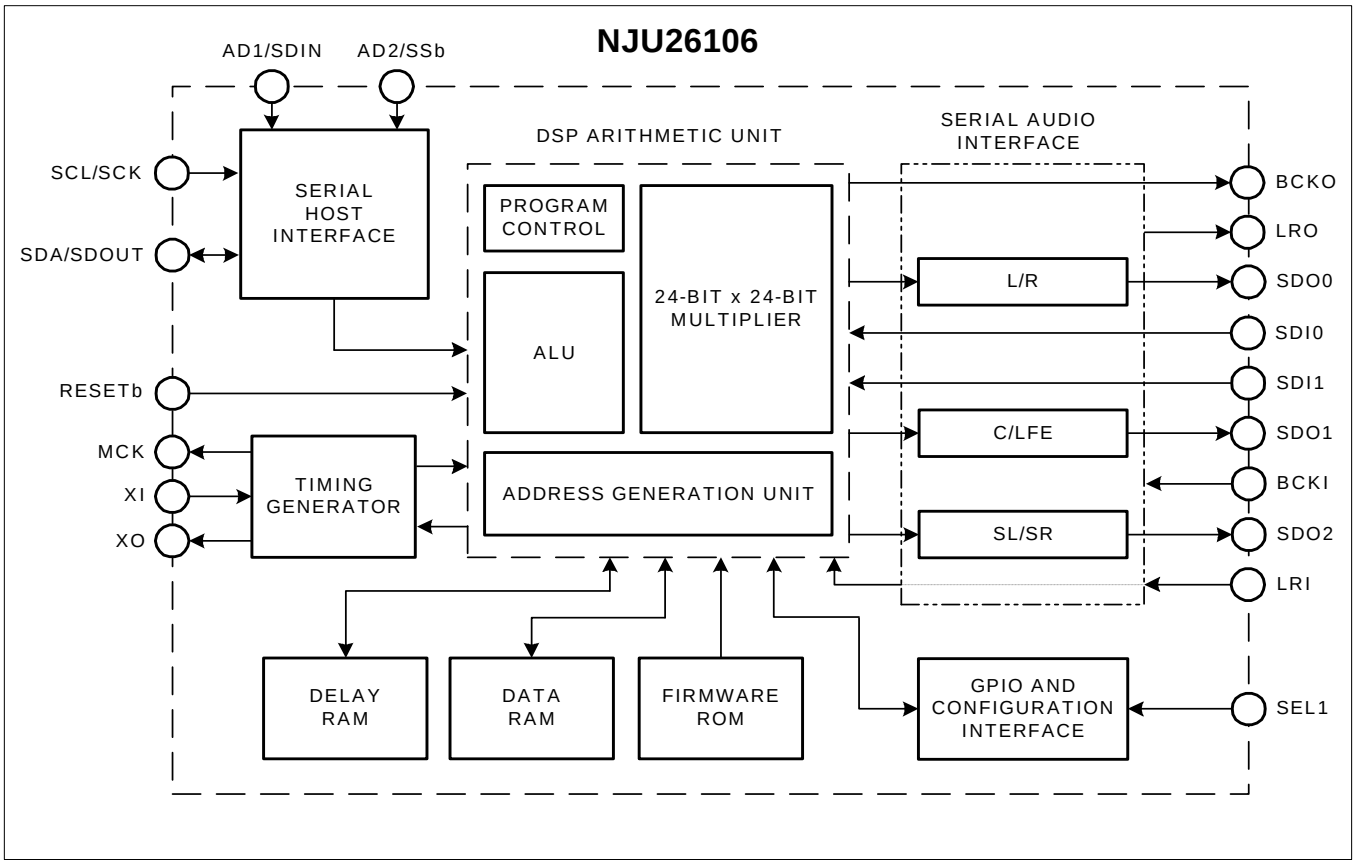


Fig. 1 NJU26106 Block Diagram

■ DSP Block Diagram

ProLogicII and Virtual Dolby Surround Decorder Block Diagram

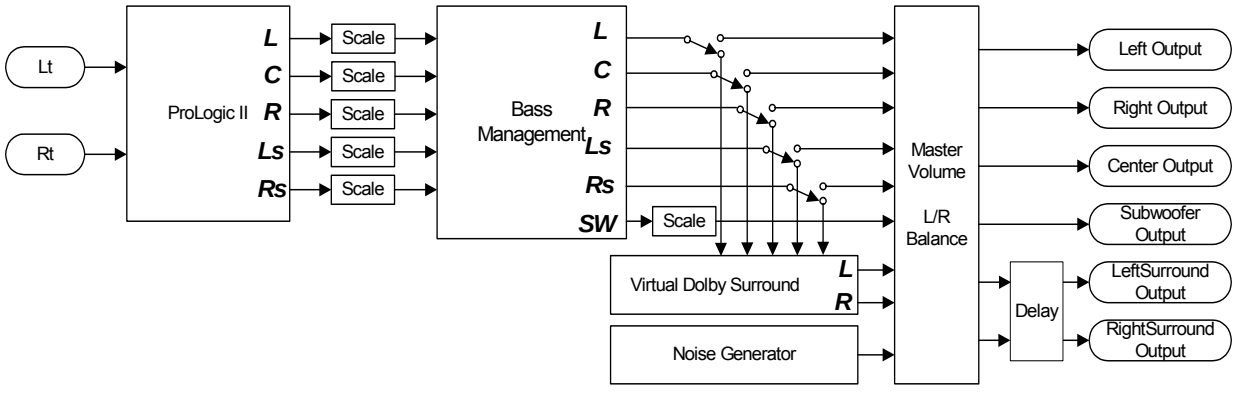


Fig. 2 NJU26106 Function Diagram

■ Pin Configuration

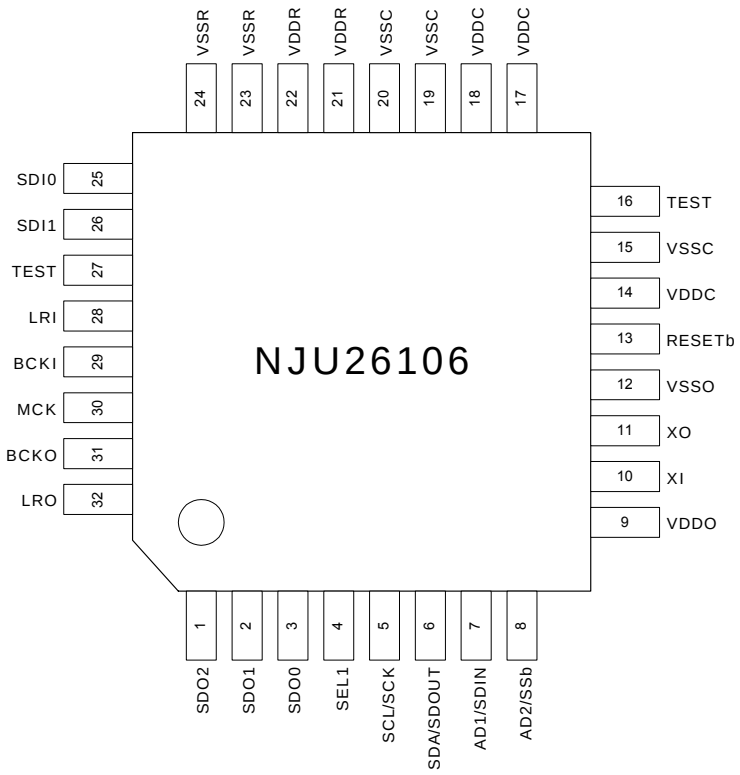


Fig. 3 NJU26106 Pin Configuration

■ Pin Description

Table 1 Pin Description

No.	Symbol	I/O	Description
1	SDO2	O	Audio Data Output SL/SR
2	SDO1	O	Audio Data Output C/SW
3	SDO0	O	Audio Data Output L/R
4	SEL1 *1	I	Select I^2C or Serial bus
5	SCL/SCK	I	I^2C Clock / Serial Clock
6	SDA/SDOUT	I/O	I^2C I/O / Serial Output
7	AD1/SDIN	I	I^2C Address / Serial Input
8	AD2/SSb	I	I^2C Address / Serial Enable
9	VDDO	--	OSC Power Supply +2.5V
10	XI	I	X'tal Clock Input
11	XO	O	OSC Output
12	VSSO	--	OSC GND
13	RESETb	I	RESET (active Low)
14	VDDC	--	Core Power Supply +2.5V
15	VSSC	--	Core GND
16	TEST *2	I/O	OPEN

No.	Symbol	I/O	Description
17 18	VDDC	--	Core Power Supply +2.5V
19 20	VSSC	--	Core GND
21 22	VDDR	--	I/O Power Supply +2.5V
23 24	VSSR	--	I/O GND
25	SDI0	I	Audio Data Input 0 L/R
26	SDI1	I	Audio Data Input 1 L/R
27	TEST	I	Connect to GND
28	LRI	I	LR Clock Input
29	BCKI	I	Bit Clock Input
30	MCK	O	Master Clock Output
31	BCKO	O	Bit Clock Output
32	LRO	O	LR Clock Output

* I : Input,
O : Output,
I/O: Bi-directional

*1 SEL1 : Input

*2 TEST : Bi-directional

■ Digital Audio Interface

The NJU26106 audio interface provides industry standard serial data formats of I^2S, MSB-first left-justified or MSB-first right-justified. The NJU26106 audio interface provides two data inputs, SDI0, SDI1 and three data outputs, SDO0, SDO1, SDO2 as shown in table 2, table 3 and Fig.2. An audio interface input and output data format become the same data format.

The input serial data is selected by the firmaware command. In Virtual Dolby Surround mode, SD0 output generates Lch. and Rch. signal. The other channels are muted. The input serial data is selected by the firmaware command.

Table 2 Serial Audio Input Pin

Pin No.	Symbol	Description
25	SDI0	Audio Data Input 0 L / R
26	SDI1	Audio Data Input 1 L / R

Table 3 Serial Audio Output Pin

Pin No.	Symbol	Description
3	SDO0	Audio Data Output 0 L / R *1
2	SDO1	Audio Data Output 0 C/SW
1	SDO2	Audio Data Output 0 SL/SR

Note: *1 In Virtual Dolby Surround mode, only front Lch/Rch output signal. The other channels are muted.

■ Host Interface

The NJU26106 can be controlled via Serial Host Interface (SHI) using either of two serial bus format : 4-Wire serial bus or I^2C bus.(Table 4) Data transfers are in 8 bit packets (1 byte) when using either format.
Serial Host Interface Pin Description.(Table 5)

Table 4 Serial Host Interface Pin Description

Pin No.	Symbol	Setting	Host Interface
4	SEL1	"Low"	I^2C bus
		"High"	4-Wire serial bus

Table 5 Serial Host Interface Pin Description

Pin No.	Symbol (I^2C bus / Serial)	I^2C bus Format	4-Wire Serial bus Format
5	SCL / SCK	Serial Clock	Serial Clock
6	SDA / SDOUT	Serial Data Input/Output (Open Drain Input/Output)	Serial Data Output (CMOS)
7	AD1 / SDIN	I^2C bus address Bit1	Serial Data Input
8	AD2 / SSb	I^2C bus address Bit2	Serial enable

Note : SDA /SDOUT pin is a bi-directional open drain.
SDA /SDOUT output is normal CMOS output in case of 4-Wire Serial bus mode and SSb="Low".
SDA /SDOUT output is Hi-Z state in case of 4-Wire Serial bus mode and SSb="High". This pin requires a pull-up resister in both 4-Wire serial and I^2C bus mode.

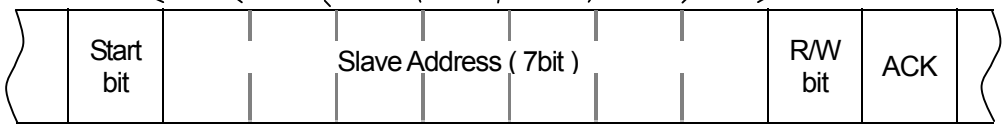
■ I²C bus

When the NJU26106 is configured for I²C bus communication during the Reset initialization sequence. I²C bus interface transfers data to the SDA pin and clocks data to the SCL pin.

AD1 and AD2 pins are used to configure the seven-bit SLAVE address of the serial host interface. (Table 6) This offers additional flexibility to a system design by four different SLAVE addresses of the NJU26106. An address can be arbitrarily set up by the AD1 and AD2 pins. The I²C address of AD1/AD2 is decided by connection of AD1/AD2 pins.

Table 6 I²C bus SLAVE Address

bit7	bit6	bit5	bit4	bit3	AD2 bit2	AD1 bit1	R/W bit0
0	0	1	1	1	0	0	R/W
0	0	1	1	1	0	1	
0	0	1	1	1	1	0	
0	0	1	1	1	1	1	



* SLAVE address is 0 when AD1/2 is “Low”. SLAVE address is 1 when AD1/2 is “High”.

Note : In case of the NJU26106, only single-byte transmission is available. The serial host interface supports “Standard-Mode (100kbps)” I²C bus data transfer.

■ 4-Wire Serial Interface

The serial host interface can be configured for 4-Wire Serial bus communication by setting SEL1 pin =”High” during the Reset initialization sequence.

SHI bus communication is full-duplex; a write byte is shifted into the SDIN pin at the same time that a read byte is shifted out of the SDOUT pin. Data transfers are MSB first and are enabled by setting the Slave Select pin Low (SSb=0). Data is clocked into SDIN on rising transitions of SCK. Data is latched at SDOUT on falling transitions of SCK except for the first byte (MSB) which is latched on the falling transitions of SSb.

SDOUT is Hi-Z in case of SSb = “High”. SDOUT is CMOS output in case of SSb = “Low”. SDOUT needs a pull-up resistor when SDOUT is Hi-Z.

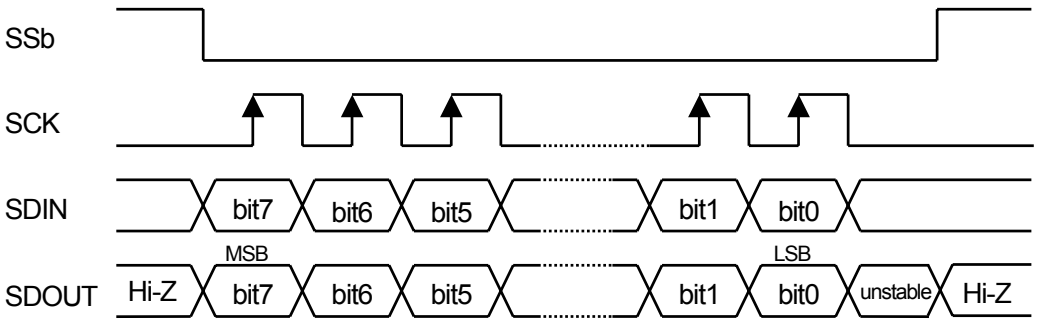


Fig. 4 4-Wire Serial Interface Timing

Note: When the data-clock is less than 8 clocks, the input data is shifted to LSB side and is sent to the DSP core at the transition of SSb=”High”. When the data-clock is more than 8 clocks, the last 8 bit data becomes valid. After sending LSB data, SDOUT transmits the MSB data which is received via SDIN until SSb becomes “High”. SDOUT is Hi-Z in case of SSb = “High”. SDOUT is CMOS output in case of SSb = “Low”. SDOUT needs a pull-up resistor to prevent SDOUT from becoming floating level.

■ NJU26106 Bass Management

1. The specification of Bass Management is the extended version from Dolby.
2. The 4 types of crossover frequencies for speaker are selectable. (Fig. 6, 7)
   100, 150, 200, 250Hz (12dB / Oct.)
3. The 4 types of low frequency destinations are selectable. (Fig. 5)
   Subwoofer, Left / Right, Left Surr / Right Surr, Left / Right + Left Surr / Right Surr

NJU26106 Pro Logic II Bass Management

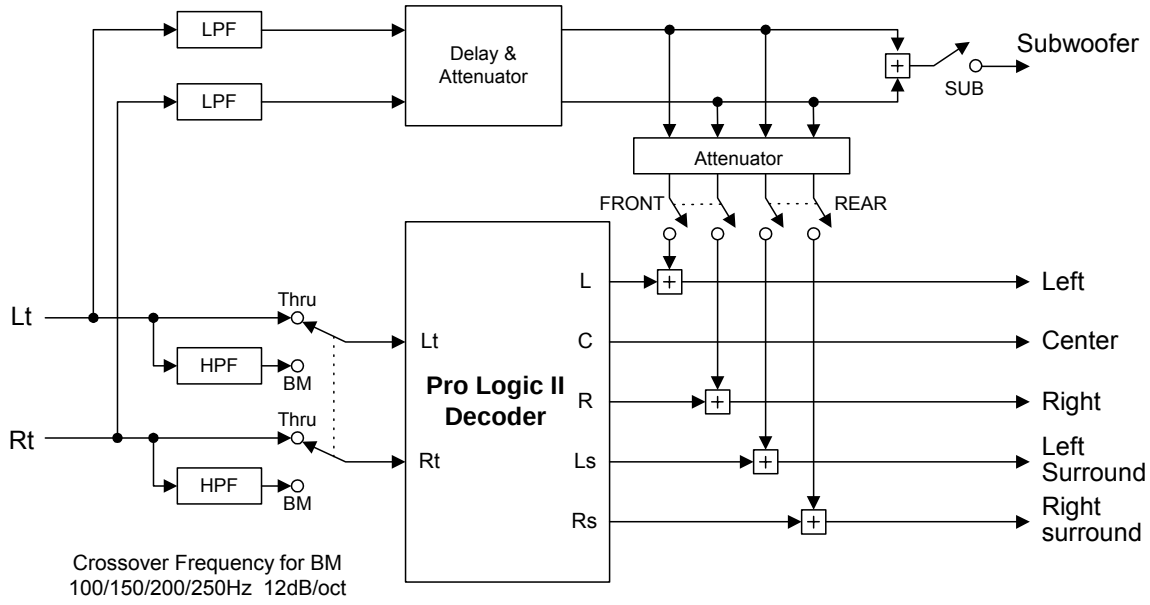


Fig.5 Bass Management Function Block Diagram

NJU26106 High Pass Filter

Cutoff Frequency : 100 / 150 / 200 / 250Hz 12dB / Oct.

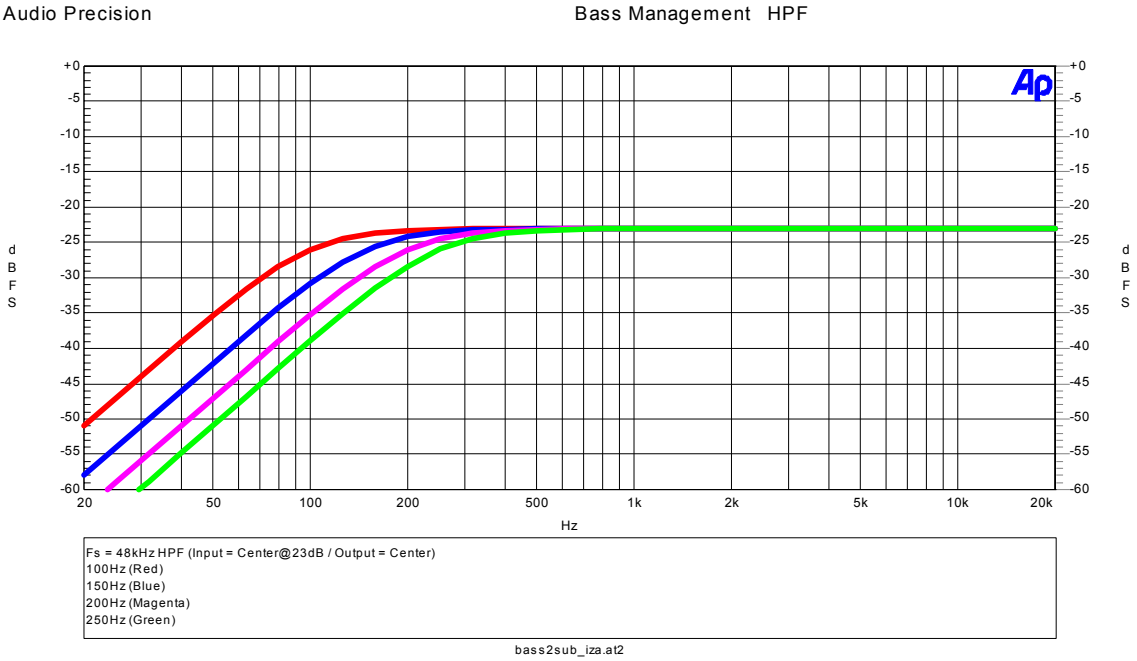


Fig. 6 NJU26106 High Pass Filter

NJU26106 Low Pass Filter

Cutoff Frequency : 100 / 150 / 200 / 250Hz 12dB / Oct.

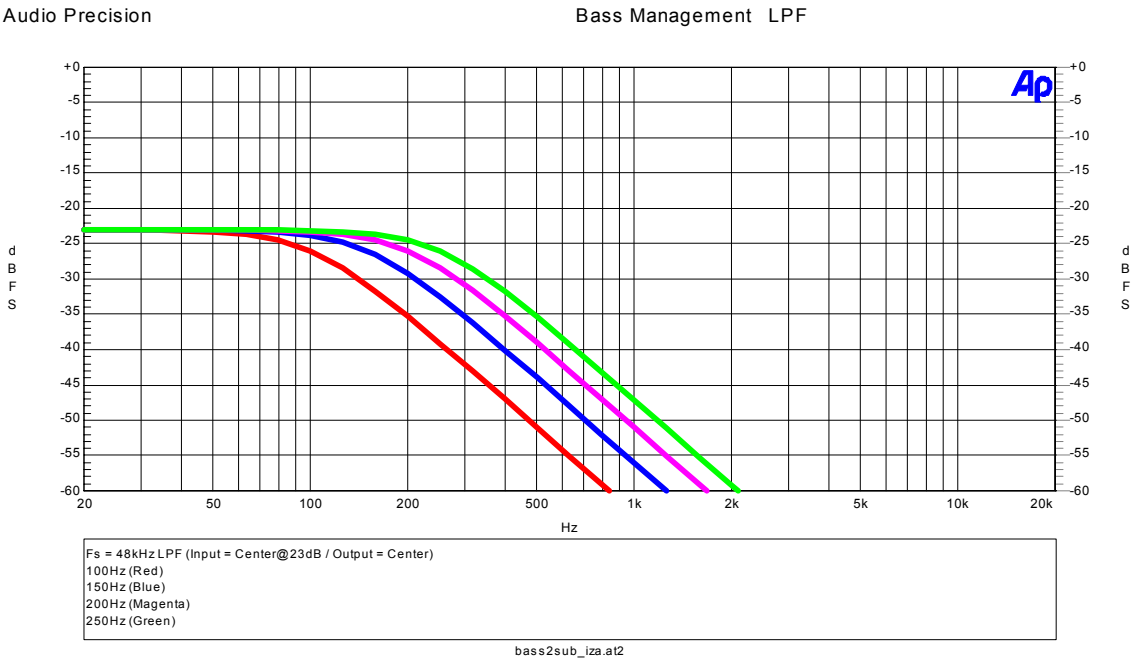


Fig. 7 NJU26106 Low Pass Filter

■ NJU26106 Command Table

Table 7 NJU26106 Command

No.	Command
1	SET_TASK_CMD
2	VDS_ANG_CMD
3	DPL_SUR_CMD
4	CWIDTH_DIM_CMD
5	DPL_MOD_CMD
6	BASS_MGNT_CMD
7	FS_CMD
8	NOISE_CMD
9	DLY_CMD
10	LR_BAL_CMD
11	MST_VOL_CMD
12	LCH_VOL_CMD
13	RCH_VOL_CMD
14	CENT_VOL_CMD
15	SURR_LEFT_VOL_CMD
16	SURR_RIGHT_VOL_CMD
17	SW_VOL_CMD
18	SYS_SET_CMD

Notes : In respect to detail command information, request New Japan Radio Co., Ltd. and permission of a licenser (Dolby) is required.

■ License Information

1. The Word “DOLBY”, “Pro Logic” and the double D mark are trademarks of Dolby Laboratories.
   The NJU26106 can only be delivered to licensees of Dolby Laboratories.
   Please refer to the licensing application manual issued by Dolby Laboratories.