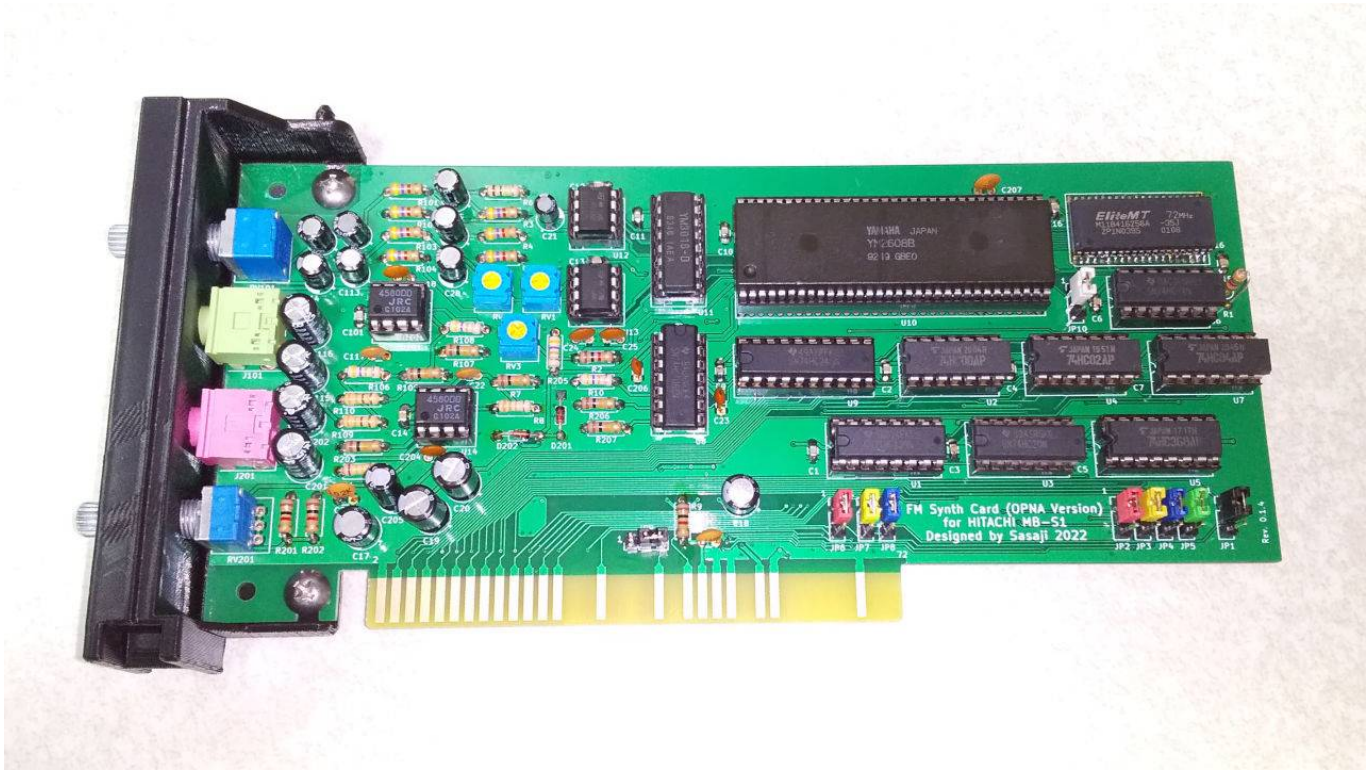
FM Synthesis Card（OPNA Version）for HITACHI MB-S1

Designed by Sasaji 2022 Rev. 0.1.4

This is the extension card for HITACHI MB-S1 and Limeligt. This is designed the circuit to drive the FM Synthesis IC (YM2608B(OPNA)).



Implementation

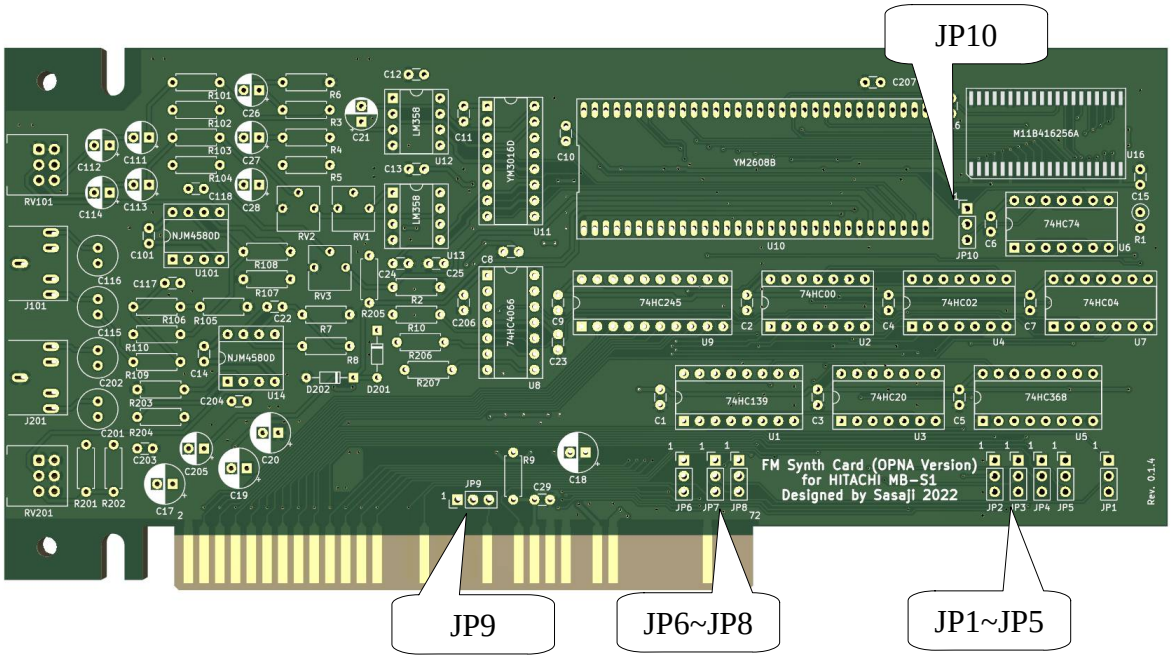
Installation

I/OPorts

The I/O ports are decided by Jumper setting. See detail Setting Jumper section.

		Jumper 1-2	Jumper 2-3
YM2608B FM1ch~3ch, SSG, Rhythm	Address	$FFE7	$FF1F
	Data	$FFE6	$FF1E
YM2608B FM4ch~6ch, ADPCM	Address	$FFEF	$FF17
	Data	$FFEE	$FF16

Setting Jumper



I/O Addresses of FM Synth (JP1～JP8)

- Pin number are #1,#2 and #3 from the top.

		JP1～JP6	**JP7, JP8 (*3)**
I/O addresses $FF1E and $FF1F (*1)		Short 2-3	Short 2-3
	Also use I/O addresses at $FF16 and $FF17 to control FM4～6ch	Short 2-3	Short 1-2
I/O addresses $FFE6 and $FFE7 (*2)		Short 1-2	Short 2-3
	Also use I/O addresses at $FFEE and $FFEF to control FM4～6ch	Short 1-2	Short 1-2

(*1) Don’t use on B mode of MB-S1/30 and 40 because duplicate addresses of the FD interface.
(*2) Select this if you use as Extended PSG.
(*3) The jumpers JP7 and JP8 must be at the same shorting position.

Connecting Interrupt Signal of FM Synth (JP9)

- Pin number are #1,#2 and #3 from the left.

		Short 1-2	**Short 2-3**
JP9	Connect to	IRQ	FIRQ

The Master Clock of FM Synth (JP10)

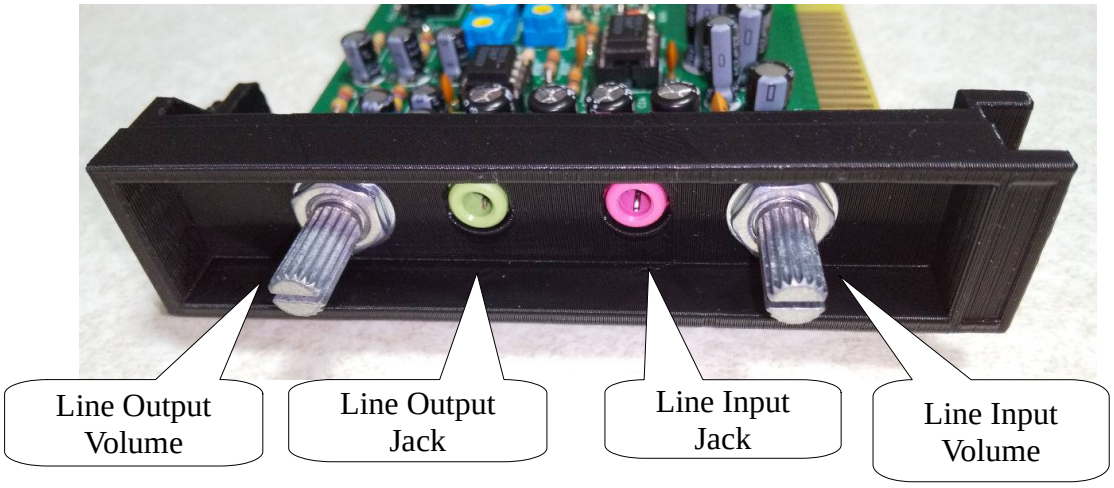
- Pin number are #1,#2 and #3 from the top.

		Short 1-2	**Short 2-3**
JP10	Clock	4MHz	8MHz

Reference: Meaning of each jumper

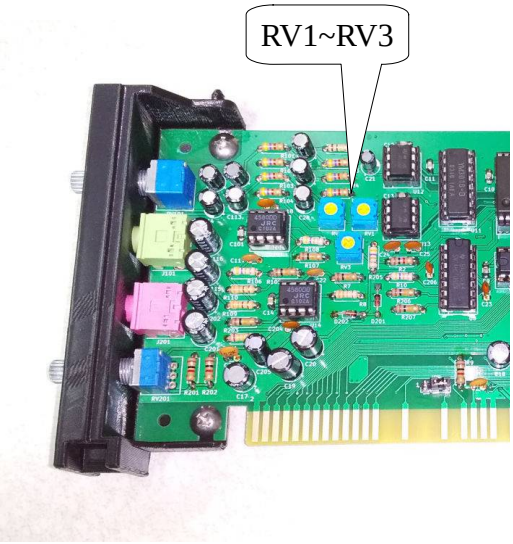
	Short 1-2	**Short 2-3**	**Purpose**
JP1	A3	$\overline{A3}$	Make the CHIP SELECT signal for FM Synth IC.
JP2	A4	$\overline{A4}$	
JP3	A5	$\overline{A5}$	
JP4	A6	$\overline{A6}$	
JP5	$\overline{A7}$	A7	
JP6	$\overline{TMG2}$	$\overline{EX\ I/O}$	
JP7	Connect between JP1 pin2 and U10 A1(pin61)	Connect between JP1 pin2 and U4 pin2	Select the A1 signal of FM Synth IC.
JP8	Connect between GND and U4 pin2	Connect between GND and U10 A1(pin61)	
JP9	$\overline{IRQ}$	$\overline{FIRQ}$	Interrupt of FM Synth
JP10	U6 pin9 (4MHz)	U6 pin5 (8MHz)	The master clock of FM Synth.

The Back Cover



Setting Volume

Balance of FM and SSG



Adjust RV1 - RV3 on the board.

RV1: Left sound on FM

RV2: Right sound on FM

RV3:SSG

Usual position is 50 – 70%.

- When adjusted the RV1 - RV3, the volume of the built-in speaker and line out also changes.

The volume of line output

Adjust the volume appropriately according to the connected device.

- Small headphones (earphones): about 50%
- Line input of another device: about 20%

When using a large speaker, it is necessary to connect it via a drive circuit (amplifier).

- The PSG sound and BEEP on the main unit are not output from this terminal.

The volume of line input

Adjust the volume appropriately according to the connected device.

- Line output of another device: about 20%
- Headphone output of another device: about 50%

When using a mic for PC, it is necessary to connect it via a drive circuit (amplifier).

- During recording, the audio from the main unit and line out are muted. And a little noise is recorded.

Installing

Need the extension board (Riser card) to install to the main unit.

Parts Number：MPC-EX01S(MB-S1/10,20), MPC-EX03S, MPC-EX05S(MB-S1/30,40)

Attention

This board is a prototype. No consideration is given to noise generated during use and deterioration over time.

Parts List

Parts number #1 to #99 are mandatory.

Parts number #101 to #199 are used on the line output circuit.

Parts number #201 to #299 are used on the line input circuit.

Parts Number	Parts Name	Qty.	Description	
C1~C16, C101	Ceramic Capacitor	17	0.1uF, 10V～	Power, Bypass
C22, C117, C118, C204	Ceramic Capacitor	4	100pF, 16V～	Analog
C23, C206	Ceramic Capacitor	2	47pF, 10V～	Analog
C24, C25, C207	Ceramic Capacitor	3	2200pF, 10V～	Analog
C29, C203	Ceramic Capacitor	2	1000pF, 16V～	Analog
C17, C18	Electrolytic Capacitor	2	47uF, 16V～	Power, Bypass
C19, C20	Electrolytic Capacitor	2	100uF, 25V～	Power, Bypass
C21	Electrolytic Capacitor	1	10uF, 16V～	Analog
C26~C28, C111~C114	Electrolytic Capacitor	7	22uF, 16V～	Analog
C205	Electrolytic Capacitor	1	22uF, 25V～	Analog
C115, C116, C201, C202	Electrolytic Capacitor (No polarity)	4	22uF, 16V～	Analog
R1	Carbon Registor	1	4.7KΩ, 1/4W～	Digital, Pullup
R2, R9, R201, R202	Carbon Registor	4	1KΩ, 1/4W～	Analog
R3~R5, R101~R104	Carbon Registor	7	4.7KΩ, 1/4W～	Analog
R6	Carbon Registor	1	100KΩ, 1/4W～	Analog
R7, R105, R107, R203, R206, R207	Carbon Registor	6	10KΩ, 1/4W～	Analog
R8	Carbon Registor	1	33KΩ, 1/4W～	Analog
R10, R106, R108, R205	Carbon Registor	4	47KΩ, 1/4W～	Analog
R109, R110	Carbon Registor	2	330Ω, 1/4W～	Analog
R204	Carbon Registor	1	240KΩ, 1/4W～	Analog

RV1~RV3	Potentiometer	3	10KΩ (Tokyo Cosmos GF063P etc.)	Analog
RV101	Potentiometer	1	10KΩ, 2 Interlocking (Alps RK079 etc.)	Analog
RV201	Potentiometer	1	10KΩ, 1 or 2 Interlocking (Alps RK079 etc.)	Analog
D201, D202	Diode	2	1N4148	Analog
U1	CMOS Logic IC	1	74HC139, DIP16	Digital
U2	CMOS Logic IC	1	74HC00, DIP14	Digital
U3	CMOS Logic IC	1	74HC20, DIP14	Digital
U4	CMOS Logic IC	1	74HC02, DIP14	Digital
U5	CMOS Logic IC	1	74HC368, DIP16	Digital
U6	CMOS Logic IC	1	74HC74, DIP14	Digital
U7	CMOS Logic IC	1	74HC04, DIP14	Digital
U8	CMOS Logic IC	1	74HC4066, DIP14	Digital
U9	CMOS Logic IC	1	74HC245, DIP20	Digital
U10	FM Synth IC	1	YM2608B, shrink DIP64	Digital and Analog
U11	DAC	1	YM3016D, DIP16	Analog
U12, U13	Opamp	2	LM358, DIP8 (+5V)	Analog
U14, U101	Opamp	2	NJM4580DD, DIP8 (±12V)	Analog
U16	DRAM	1	M11B416256A, SOIC40	Digital
J101, J201	Audio Jack	2	Stereo (PJ-317)	Analog
JP1~JP10	Jumper	10	Pin Header 3pin x1 2.54mm pitch straight	
	Jumper pin	10	To short pin headers.	

Options

Parts Number	**Parts Name**	**Qty.**	**Description**	
	IC Socket	4	DIP8	
	IC Socket	6	DIP14	
	IC Socket	3	DIP16	
	IC Socket	1	DIP20	
	IC Socket	1	Shrink DIP64	

Attention to build the board

Secure the back cover and board with two truss pin screws (B type, grooved) M3.5 x 8mm.

The back cover is fragile, so be careful and do not use too much force when tightening the screws.

When omitting the line output circuit

No need for #100 series parts.

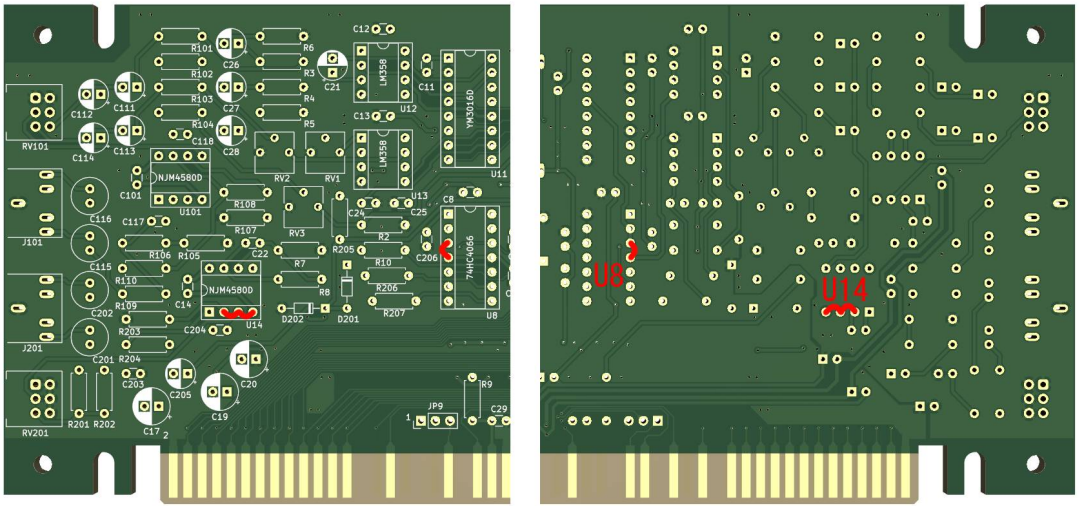
When omitting the line input circuit

No need for #200 series parts.

Connect pin2 and pin3 of U14 to pin4 (GND).

U8 (74HC4066) can be omitted. If omitted:

- Connect pin3 and pin4 on U8.
- Also need not R10.



Treat either the front or the back on the board.

No warranty

We are not responsible for any damage caused by this card.

You use this card at your own risk.

Web

This document and CAD data are opened on the web.

http://s-sasaji.ddo.jp/bml3mk5/s1exmemfm.htm#opna

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