
CleanWave 32[®] SYNTHESIZER ROM (4 Mega Bytes) for SAM9407 series

Part # GMS973201B (SOP44), GMS973201BQ (QFP44)

- ROM includes firmware and PCM data
- Configuration : 2Mx16, industry standard SOP44 package or space saving QFP44
- Full GM implementation with top quality additional sounds
 - ⇒ 128 General MIDI sounds
 - ⇒ 195 Variation sounds including sound effects
 - ⇒ 9 drum sets + 1 SFX set
- Powerful MIDI implementation
- Built-in compatible reverb and chorus
- Built-in 4 bands parametric equalizer, fully controllable by MIDI
- Built-in Spatializer effect on 4 channels with MIDI control
- Microphone echo processing
- Software configurable for best polyphony/feature tradeoff
- Up to 48 voice polyphony with reverb and chorus
- MPU compliant in UART mode when used with SAM9407
- Additional MPU controls for effects and audio routing
- Available reference designs :
 - ⇒ 9503GS : daughter board (QFP44)
 - ⇒ 94PNP : sound board (SOP44)
- Typical applications :
 - ⇒ High quality musical instruments
 - ⇒ Computer Karaoke
 - ⇒ High range PC sound board



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1- CONFIGURATION

1-1 HARDWARE CONFIGURATION

The CleanWave32 ROM can be operated with SAM9407 or SAM9503. It includes wavetable data, sound definitions and firmware.

The minimum configuration is SAM9503 + CleanWave32 + 32kx8 SRAM + stereo DAC.

The maximum configuration is SAM9407 + CleanWave32 + 32kx16 SRAM + stereo Codec.

Other configurations may use additional SRAM/EPROM to mask the CleanWave32 built-in firmware and replace it by user specific firmware.

When using a single 32kx8 SRAM, SRAM access time should be 35ns or less.

The SAM9503/SAM9407 should be operated at 9.6 MHz

1-2 CONFIGURATION PINS

Pins P0 to P3 from SAM9503/SAM9407 are used as configuration pins. They are tested at power-up.

Some applications may not require all sound processing features, which allows more polyphony for the synthesizer.

The firmware will detect automatically the type of SRAM connected. If two 32kx8 SRAMs are detected, then independent echo delay lines will be implemented for microphone. If a single 32Kx8 SRAM is connected (RBS used) echo is not available but microphone can be sent to the synthesizer reverb.

P3	P2	P1	P0	Configuration
-	-	GND	GND	Equalizer in service, 4 bands
-	-	GND	VCC	Equalizer in service, 2 bands (bass, treble)
-	-	VCC	GND	Reserved
-	-	VCC	VCC	No equalizer
GND	GND	-	-	Codec Crystal type (CS4216, CS4218)
GND	VCC	-	-	Sony format type DAC, 16 bits (TDA1545)
VCC	GND	-	-	IIS format type DAC (TDA1305T, PCM1718E)
VCC	VCC	-	-	IIS format type ADC/DAC (TDA1309H, PCM3001)

1-3 CONFIGURATION NRPN

Default configuration set through P0-P3 pin can be overridden using following nrpn messages.

1.31 Nrn 03754H : DAC select

Midi message code (in hexadecimal) : B0H 63h 37h, B0H 62h 54h, B0H 06h vv

vv=42h if Codec crystal type (CS4216, CS4218)

vv=0Dh if Sony format type DAC, 16 bits (TDA1545)

vv=0Ch if IIS format type DAC (TDA1305T, PCM1718E)

vv=0Ch if IIS format type ADC/DAC (TDA1309H, PCM3001)

1.32 Nrn 03755H : Effects on/off

Midi message code (in hexadecimal) : B0H 63h 37h, B0H 62h 55h, B0H 06h vv

Each bit of vv byte is used for selecting an effect ON or OFF as following :

7	6	5	4	3	2	1	0
0	3D	0	0	EQ	EQB	ECH	MIC

When all bits are 0 (all selectable effects OFF), default polyphony is 48 voices.

Each time an effect is ON polyphony will be decreased.

3D bit=1 : Spatializer effect ON, polyphony decreased by 2

EQ bit=1 : Equalizer ON. If EQB=0, equalizer is only 2 band equalizer, polyphony decreased by 4

If EQB=1, equalizer is 4 band equalizer, polyphony decreased by 8

MIC bit=1: Stereo microphone ON, polyphony decreased by 1
ECH bit=1 : Stereo echo on microphone ON, polyphony decreased by 2
With all bits set, polyphony is therefore 35 voices.

Notes :

- Reverb and chorus effects are allways ON and cannot be unselected.
- Sending Nrpn 03755h will do a general reset on board. Must wait 300ms for reset to be performed before sending again any midi informations.
- If both bits 3D and EQ =0, Nrpn 3718H, 3719H, 371AH must be allways=0 (see paragraph 1.3 below), otherwise no sound will be output.

1-4 SPECIAL MIDI CONTROLS

Various features of SAM9503/SAM9407 are controlled by NRPN MIDI messages. For detailed information see also paragraph 2.

NRPN # (High Low)	Description	Power-up default
3700H	Equalizer Low band (bass) 0=-12dB, 40H=0dB, 7FH=+12dB	60H (+6dB)
3701H	Equalizer Med Low band 0=-12dB, 40H=0dB, 7FH=+12dB	40H (0dB)
3702H	Equalizer Med High band 0=-12dB, 40H=0dB, 7FH=+12dB	40H (0dB)
3703H	Equalizer High band (treble) 0=-12dB, 40H=0dB, 7FH=+12dB	60H (+6dB)
3707H	Master Volume 0 to 7FH	7FH
3708H	Equalizer Low cutoff freq 0=0Hz, 7FH=4.7 kHz	0CH
3709H	Equalizer Med Low cutoff freq 0=0Hz, 7FH=4.2 kHz	1BH
370AH	Equalizer Med High cutoff freq 0=0Hz, 7FH=4.2 kHz	72H
370BH	Equalizer High cutoff freq 0=0Hz, 7FH=18.75 kHz	40H
3710H	Input select 0=select microphones 7FH=select AUXL/ AUXR (note 1)	00H (mikes)
3711H	Mike1/AUXL input gain 0=0dB to 7FH=+22.5dB (note 1)	00H (0dB)
3712H	Mike2/AUXR input gain 0=0dB to 7FH=+22.5dB (note 1)	00H (0dB)
3714H	Mike/AUX send to GM chorus 0=no send, 7FH=maximum send	00H
3715H	General Midi reverb send 0=no send,40H=default send,7FH=max	40H
3716H	General Midi chorus send 0=no send,40H=default send,7FH=max	40H
3717H	Mike/AUX send to GM reverb 0=no send, 7FH=maximum send	00H
3718H	Post effects applied on GM 0= Post effects not applied (note 3) 7Fh=Post effects applied	7FH
3719H	Post effects applied on Mike/AUX 0= Post effects not applied (note 3) 7Fh=Post effects applied	7FH
371AH	Post effects applied on Reverb/Chorus 0= Post effects not applied (note 3) 7Fh=Post effects applied	7FH
3720H	Spatializer effect 0= no effect, 7FH= maximum effect	00H
3722H	General Midi volume 0 to 7FH	7FH
3723H	General Midi pan 0=left, 40H=center, 7FH=right	40H (center)
3724H	Mike1/AUXL volume 0 to 7FH	40H
3725H	Mike2/AUXR volume 0 to 7FH	40H
3726H	Mike 1/AUXL pan 0=hard left, 40H=center, 7FH=hard right	00H (left)
3727H	Mike 2/AUXR pan 0=hard left, 40H=center, 7FH=hard right	7FH (right)
3728H	Mike/AUX echo level 0 to 7FH	40H
3729H	Mike/AUX echo time 0=shortest to 7FH=longest (note 2)	40H
372AH	Mike/AUX echo feed-back 0=no feed back to 7FH=maximum feedback (note 2)	40H
372CH	Spatializer effect delay 0=shortest to 7Fh=longest	1DH
372DH	Spatializer effect input 0=stereo 7Fh=mono	00H
372EH	Spatializer effect output mode 0=2 speaker mode 7Fh=4 speaker mode	00H
3751H	Auto - test See paragraph 4 below	
3754H	Override P2-P3 pins DAC select See paragraph 1-3 above	
3755H	Effects on/off See paragraph 1-3 above	
3757H	System Exclusive Devide ID 0 to 1Fh, 20h=all accepted	20H

note 1 : Only with CS4216/CS4218 type DAC/ADC.

note 2 : Feature available only with 2 x 32kx8 RAMs. For single 32k x 8 RAM designs, the microphone reverb is provided by the synthesis reverb. It's character can be adjusted using Sysex messages (see detailed MIDI implementation below).

note 3 : Post effects are spatializer effect + equalizer effect. This Nrpn must be 0 (post effect not applied) if both spatializer and equalizer are unselected using Nrpn 3755H (see paragraph 1.22).

2. MPU401 INTERFACE

If using SAM9407, MPU401 standard parallel interface is available together with serial midi. Furthermore, a special control message mode allows to send control to Dream effects (equalizer, spatializer, microphone, echo ...) With SAM9503, only serial midi is available. All controls described in this paragraph are not available. However, user can control Dream effects using specific Dream NRPN described in paragraph 1.4 or system exclusive message described in paragraph 3.

I/O Interface

The I/O Interface is composed of two byte registers, and one IRQ:

I/O address	Write from PC (OUT)	Read to PC (IN)
MPU_base + 0	DATA8	DATA8
MPU_base +1	CONTROL	STATUS

The byte registers provides compatibility with the standard MPU401 UART mode.

The control message is sent on CONTROL register with one data on DATA8 register. The read back values (if any) are available on DATA8 register.

The IRQ (PC compatible rising edge) is compatible with MPU401 interrupt.

It is floated until the MPU401 interface is switched to UART mode, to minimize potential IRQ conflicts.

IO Status Register:

TE	RF	ID1	ID0	X	X	X	X
----	----	-----	-----	---	---	---	---

TE : Transmit empty.

If 0, data from SAM9407 to PC is pending and IRQ is high

Reading the data at MPU_BASE+0 will set TE to 1 and clear IRQ.

RF : Receiver full.

If 0 then SAM9407 is ready to accept CONTROL or DATA from the PC.

TE and RF are MPU401 compliant. Two additional bits ID1 ID0 are provided. They allow to identify the logical SAM9407 device read DATA8 as follows :

ID1	ID0	Device
0	0	MIDI
0	1	Reserved
1	0	Reserved
1	1	General

Stand alone & UART modes

Stand alone mode:

After power-up, hardware reset or MPU reset control, the board is in stand-alone mode.

In stand-alone mode, SAM9407 plays whatever is received on the MIDI IN serial line, MIDI OUT is disabled.

Stand alone mode enables only 2 controls:

- 3FH to switch to UART mode
3FH control is acknowledged by receiving 0FEH as DATA8 with ID(1,0)=00 (Midi device).

- BEH to sent any control (see list of control message below).
 BEH enable to send only one control, this means that each control sent in stand alone mode should start with BEH control.

UART mode:

UART mode accepts any controls (see list of control message below).

Control 0FFH (MPU reset) switch back to stand alone mode.

This mode is mpu401 uart mode compliant :

Midi messages don't required any CONTROL but only DATA.

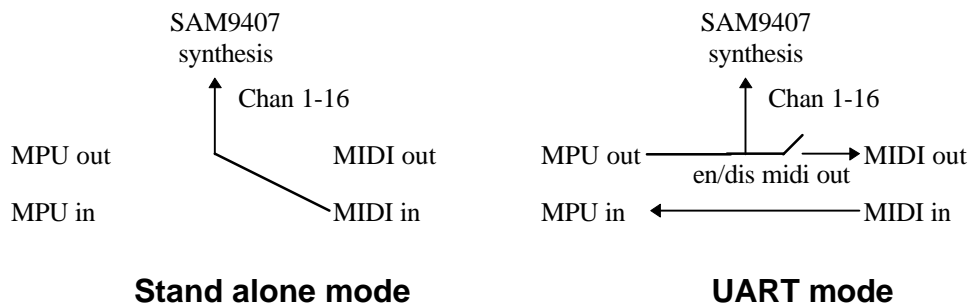
Writing DATA8 will send MIDI data to MIDI OUT and the wavetable synthesis.

MIDI data received from MIDI IN can be read as DATA8 with ID0-1=00.

Detailed MIDI implementation is described in paragraph 3.

MIDI OUT is disabled after any other control than 3FH & 3DH . This means that any dream control should be followed by 3DH control to restore midi out. This has been done to avoid to send data of control messages into MIDI OUT.

Midi message path:



CONTROL MESSAGES OVERVIEW

A device control message consists of one CONTROL byte followed by one DATA8 byte (parameter). After receiving DATA8 byte, operation resumes to the MIDI device.

If using SAM9503 instead of SAM9407, all controls can be accessible also through NRPN (see paragraph 1.4) or system exclusive (see paragraph 3, midi implementation).

Ctrl #	CONTROL NAME	Action	Compatible NRPN/SYSEX
7h	MASTER_VOL	Master volume	Nrpn 3707h
10H	EQ_LBL	Equalizer low band left	Nrpn 3700h
11H	EQ_MLBL	Equalizer med low band left	Nrpn 3701h
12H	EQ_MHBL	Equalizer med high band left	Nrpn 3702h
13H	EQ_HBL	Equalizer high band left	Nrpn 3703h
14H	EQ_LBR	Equalizer low band right	Nrpn 3700h
15H	EQ_MLBR	Equalizer med low band right	Nrpn 3701h
16H	EQ_MHBR	Equalizer med high band right	Nrpn 3702h
17H	EQ_HBR	Equalizer high band right	Nrpn 3703h
18H	EQF_LB	Equalizer low band frequency	Nrpn 3708h
19H	EQF_MLB	Equalizer med low band frequency	Nrpn 3709h
1AH	EQF_MHB	Equalizer med high band frequency	Nrpn 370Ah
1BH	EQF_HB	Equalizer high band frequency	Nrpn 370Bh
20H	AUD_SEL	Mike/Aux input select (1)	Nrpn 3710h
21H	AUD_GAINL	Mike1/AuxL input gain (1)	Nrpn 3711h
22H	AUD_GAINR	Mike2/AuxR input gain (1)	Nrpn 3712h
24H	AUDCHR_SEND	Mike/Aux send to GM chorus	Nrpn 3714h
25H	GMREV_SEND	General Midi Reverb Send	Nrpn 3715h
26H	GMCHR_SEND	General Midi Chorus Send	Nrpn 3716h
27H	AUDREV_SEND	Mike/Aux send to GM reverb	Nrpn 3717h
28H	ECH_LEV	Echo level applied on Mike/Aux (2) (4)	Nrpn 3728h
29H	ECH_TIM	Echo time applied on Mike/Aux (2) (4)	Nrpn 3729h
2AH	ECH_FEED	Echo feedback applied on Mike/Aux (2) (4)	Nrpn 372Ah
30H	SUR_VOL	Spatializer effect volume	Nrpn 3720h
31H	SUR_DEL	Spatializer effect delay	Nrpn 372Ch
32H	SUR_INP	Input mono/stereo select for spatializer	Nrpn 372Dh
33H	SUR_24	2 or 4 speakers output select for spatializer	Nrpn 372Eh
34H	AUDL_VOL	Left Channel Mike/Aux volume (2)	Nrpn 3724h
35H	AUDR_VOL	Right Channel Mike/Aux volume (2)	Nrpn 3725h
36H	AUDL_PAN	Left Channel Mike/Aux pan (2)	Nrpn 3726h
37H	AUDR_PAN	Right Channel Mike/Aux pan (2)	Nrpn 3727h
38H	GM_VOL	General Midi volume	SysEx 40h 00h 04h
39H	GM_PAN	General Midi pan	SysEx 40h 00h 06h
3AH	REV_VOL	Reverb general volume	SysEx 40h 01h 33h
3BH	CHR_VOL	Chorus general volume	SysEx 40h 01h 3Ah
3DH	EN_MIDOUT	Enable midi out	
3FH	UART_MOD	Switch to UART mode	
62h	GM_POST	Post effects applied on general midi (3)	Nrpn 3718h
65h	AUDECH_POST	Post effects applied on Mike/Aux and echo(3)	Nrpn 3719h
66h	EFF_POST	Post effects applied on Reverb-chorus (3)	Nrpn 371Ah
68H	ECH_ONOFF	Echo On/Off	Nrpn 3755h
69H	REV_TYPE	Reverb program select	SysEx 40h 01h 30h
6AH	CHR_TYPE	Chorus program select	SysEx 40h 01h 38h

6BH	EQU_TYPE	Equalizer On/Off	Nrpn 3755h
6EH	SUR_ONOFF	Spatializer On/Off	Nrpn 3755h
6FH	AUD_ONOFF	Mike/Aux On/Off	Nrpn 3755h
74H	CHR_DEL	Chorus delay	SysEx 40h 01h 3Ch
75H	CHR_FEED	Chorus feedback	SysEx 40h 01h 3Bh
76H	CHR_RATE	Chorus rate	SysEx 40h 01h 3Dh
77H	CHR_DEPTH	Chorus depth	SysEx 40h 01h 3Eh
78H	REV_TIME	Reverb time	SysEx 40h 01h 34h
79H	REV_FEED	Reverb feedback	SysEx 40h 01h 35h
BEH	EN_CONTROL	Enable dream control in stand alone mode	
FFh	RESET	Reset UART mode	

Notes:

- (1) Only if CS4216/CS4218 type Codec used (2 stereo audio inputs Codec)
- (2) Assumes ADC used (at least 1 stereo audio input Codec)
- (3) Post effects are spatializer + equalizer
- (4) Only if 2 32Kx8 SRAM

SYSTEM MESSAGES

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
07h	MASTER_VOL	-Data (byte 0-FFh,FFh)	Master volume	
BEH	EN_CONTROL	None	Enable dream control in stand alone mode	
FFh	RESET	None	Reset UART mode	
3FH	UART_MOD	None	Switch to UART mode	Id=00 Data= 0FEh

- MASTER_VOL :

Master volume.

Data range : 0-FFh. Default=0FFh.

- EN_CONTROL:

This control has been implemented to enable to send any control even in **Stand alone mode**.

It enable to send only one control, this means that each control sent in stand alone mode should start with EN_CONTROL control.

- RESET:

Switch SAM9407 in stand alone mode

- UART_MODE:

Switch SAM9407 in UART mode

CONFIG MESSAGES

All the configuration controls reinitialize SAM9407 firmware.
Therefore control 3Fh should be sent if UART mode is required.
General midi reset occurs.

Only configuration controls keep their existing value. All other controls are reset to their default value. User must wait for SAM9407 to send acknowledge byte (ID=11, Data=0) before sending again any informations.

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
6FH	AUD_ONOFF	-Data (byte 0/7Fh,7Fh)	Mike/Aux On/Off	Id=11 Data=0
68H	ECH_ONOFF	-Data(byte 0/7Fh,7Fh)	Echo On/Off	Id=11 Data=0
6BH	EQU_TYPE	-Data(byte 0-2,0)	Equalizer type	Id=11 Data=0
6EH	SUR_ONOFF	-Data (byte 0/7Fh,7Fh)	Spatializer On/Off	Id=11 Data=0

- AUD_ONOFF :

0 Mike/Aux off
7FH (Default) Mike/Aux on, requires 1 extra slot

- ECH_ONOFF :

0 echo applied on Mike/Aux off
07FH echo applied on Mike/Aux on, requires 2 extra slots

Available only if using 2 32Kx8 static RAM.

- EQU_TYPE : Select type of equalizer.

0(Default) 4 band equalizer Requires 8 extra slots.
1 : 2 band equalizer (low, high). Requires 4 extra slots.
2 : no equalizer.

- SUR_ONOFF :

0 : spatializer effect off
7FH (Default) spatializer effect on, requires 2 extra slot

ROUTING MESSAGES

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
62h	GM_POST	-Data(byte 0/7Fh,7Fh)	Post effects applied on general midi	
65h	AUDECH_POST	-Data(byte 0/7Fh,7Fh)	Post effects applied on Mike/Aux and echo	
66h	EFF_POST	-Data(byte 0/7Fh,7Fh)	Post effects applied on Reverb-chorus	

- xxx_POST :

Post effects are spatializer and equalizer.

Post effects can be separately applied on each module. However general settings of post effects (EQ_XXX, EQF_XXX, EQU_TYPE, SUR_VOL, SUR_DEL, SUR_INP and SUR_24) are common for all modules.

Data=0 : post effects not applied on module.

Data=7Fh : post effects applied on module.

Default value = 07Fh for all modules.

Note : If both spatializer and equalizer are OFF (SUR_ONOFF=0, EQU_TYPE=2), all xxx_POST must be 0 (otherwise no sound will be output).

MIDI MESSAGES

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
38H	GM_VOL	-Data(byte 0-FFh,FFh)	General Midi volume	
39H	GM_PAN	-Data(byte 0-7Fh,40h)	General Midi pan	
3DH	EN_MIDOUT	None	Enable midi out	

- EN_MIDOUT :

Each general device control (except 3FH=UART_MOD) disables MIDI out. To enable again MIDI out, EN_MIDOUT must be sent before sending MIDI data to port MPU_base.

- GM_VOL

Range 0-FFh, linear scale.

Default value : GM_VOL=0FFh

- GM_PAN

0=hard left, 40h=center, 7Fh=hard right.

Pseudo logarithmic scale.

Same as GM system exclusive message « 40h 00h 06h »

Default value : GM_PAN=040h

MIKE/AUX & ECHO DEVICE

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
20H	AUD_SEL	-Data(byte 0-7Fh,7Fh)	Mike/Aux input select (1)	
21H	AUD_GAINL	-Data(byte 0-7Fh,0)	Mike1/Aux Left input gain (1)	
22H	AUD_GAINR	-Data(byte 0-7Fh,0)	Mike2/Aux Right input gain (1)	
24H	AUDCHR_SEND	-Data(byte 0-7Fh,0)	Mike/Aux send to GM chorus	
27H	AUDREV_SEND	-Data(byte 0-7Fh,0)	Mike/Aux send to GM reverb	
34H	AUDL_VOL	-Data(byte 0-FFh,80h)	Left Channel Mike/Aux volume (2)	
35H	AUDR_VOL	-Data(byte 0-FFh,80h)	Right Channel Mike/Aux volume (2)	
36H	AUDL_PAN	-Data(byte 0-7Fh,0)	Left Channel Mike/Aux pan (2)	
37H	AUDR_PAN	-Data(byte 0-7Fh,7Fh)	Right Channel Mike/Aux pan (2)	
28H	ECH_LEV	-Data(byte 0-7Fh,0)	Echo level applied on Mike/Aux (2) (3)	
29H	ECH_TIM	-Data(byte 0-7Fh,2Bh)	Echo time applied on Mike/Aux (2) (3)	
2AH	ECH_FEED	-Data(byte 0-7Fh,40h)	Echo feedback applied on Mike/Aux (2) (3)	

(1) Only if CS4216/CS4218 type Codec used (2 stereo audio input Codec)

(2) Assumes ADC used (at least 1 stereo audio input Codec)

(3) Assumes 2 pcs 32Kx8 SRAM used

- AUD_xxx :

These 3 commands can be used only if a Codec with 2 audio stereo inputs and adjustable gain on audio input is used (typically CS4216 or CS4218)

AUD_SEL : 0= select audio stereo input 1 (Mike), 07Fh=select audio stereo input 2 (Aux (default 0h)

AUD_GAINL : 0=+0dB, 07Fh=+22.5dB on audio left input (default 0)

AUD_GAINR : 0=+0dB, 07Fh=+22.5dB on audio right input (default 0)

- ECH_xxx :

Controls for echo applied on Mike/Aux input.

Available only if echo set on with command ECH_ONOFF

ECH_LEV: 0 to 07Fh (Default 0)

ECH_TIM (if ech_type=07Fh only) : 0 =shortest to 7Fh=longest (default 2Bh)

ECH_FEED (if ech_type=07Fh only) : 0=no feedback, 7Fh=maximum feedback (default 40h)

- AUDREV_SEND :

Reverb send level for Mike/Aux

Data=0 to 07Fh (Default=0)

Reverb is same as reverb used for General Midi

- AUDCHR_SEND :

Chorus send level for Mike/Aux

Data=0 to 07Fh (Default=0)

Chorus is same as chorus used for General Midi

REVERB DEVICE

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
69H	REV_TYPE	-Data(byte 0-7,4)	Reverb program select	
3AH	REV_VOL	-Data(byte 0-FFh)	Reverb general volume	
78H	REV_TIME	-Data(byte 0-7Fh)	Reverb time	
79H	REV_FEED	-Data(byte 0-7Fh)	Reverb feedback	
25H	GMREV_SEND	-Data(byte 0-FFh,80h)	General Midi Reverb Send	

- REV_TYPE : Reverb program.
 Same as GM system exclusive message « 40h 01h 30h » or GM control 80.

room1	room2	room3	hall1	hall2	plate	delay	pan delay
0H	1H	2H	3H	4H	5H	6H	7H
Default=4 (hall2)							

REV_VOL: Reverb volume
 Same as GM system exclusive message « 40h 01h 33h »
 Default values:

room1	room2	room3	hall1	hall2	plate	delay	pan delay
90H	90H	90H	C0H	90H	90H	FFH	FFH

- REV_TIME : Reverb time.
 Same as GM system exclusive message « 40h 01h 34h »
 Default values:

room1	room2	room3	hall1	hall2	plate	delay	pan delay
7FH	7FH	7FH	7FH	7FH	7FH	18H	7FH

- REV_FEED : Reverb delay feedback.
 Only if reverb number=6 or 7 (delays)
 This command is same as GM system exclusive message « 40h 01h 35h »
 Default values:

delay	pan delay
22H	26H

-GMREV_SEND: Modify reverb send level for General Midi.
 80H: original reverb send levels of midi sequence not modified
 0 to 7FH : original reverb send levels decreased
 81h to FFH : original reverb send levels increased
 Default=80h

CHORUS DEVICE

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
6AH	CHR_TYPE	-Data(byte 0-7,2)	Chorus program select	
3BH	CHR_VOL	-Data(byte 0-FFh)	Chorus general volume	
74H	CHR_DEL	-Data(byte 0-7Fh)	Chorus delay	
75H	CHR_FEED	-Data(byte 0-7Fh)	Chorus feedback	
76H	CHR_RATE	-Data(byte 0-7Fh)	Chorus rate	
77H	CHR_DEPTH	-Data(byte 0-7Fh)	Chorus depth	
26H	GMCHR_SEND	-Data(byte 0-FFh,80h)	General Midi Chorus Send	

- **CHR_TYPE** : Chorus program.

Same as GM system exclusive message « 40h 01h 38h » or GM control 81.

chorus1	chorus2	chorus3	chorus4	FB chorus	flanger	short del	FB delay
00H	01H	02H	03H	04H	05H	06H	07H

Default= 2 (chorus3)

- **CHR_VOL** : Chorus Volume

Same as GM system exclusive message « 40h 01h 3Ah »

- **CHR_DEL** : Chorus delay

Same as GM system exclusive message « 40h 01h 3Ch »

- **CHR_FEED** : Chorus feedback

Same as GM system exclusive message « 40h 01h 3Bh »

- **CHR_RATE** : Chorus rate

Same as GM system exclusive message « 40h 01h 3Dh »

- **CHR_DEPTH** : Chorus depth

Same as GM system exclusive message « 40h 01h 3Eh »

-**GMCHR_SEND** : Modify chorus send level for General Midi.

Data=080h : original chorus send levels of midi sequence not modified

Data=0 to 07Fh : original chorus send levels decreased

Data=081h to 0ffh : original chorus send levels increased

Default=80h

Default values:

	chorus1	chorus2	chorus3	chorus4	FB chorus	flanger	short del	FB delay
CHR_VOL	90H	90H	90H	90H	90H	90H	FFH	FFH
CHR_DEL	4BH	40H	40H	2BH	7FH	56H	7FH	7FH
CHR_FEED	00H	07H	09H	0CH	48H	7FH	00H	50H
CHR_RATE	03H	09H	03H	09H	02H	01H	00H	00H
CHR_DEPTH	05H	13H	13H	10H	0CH	03H	00H	00H

EQUALIZER DEVICE

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
10H	EQ_LBL	-Level (byte 0-7Fh,60h)	Equalizer low band left	
11H	EQ_MLBL	-Level (byte 0-7Fh,40h)	Equalizer med low band left	
12H	EQ_MHBL	-Level (byte 0-7Fh,40h)	Equalizer med high band left	
13H	EQ_HBL	-Level (byte 0-7Fh,60h)	Equalizer high band left	
14H	EQ_LBR	-Level (byte 0-7Fh,60h)	Equalizer low band right	
15H	EQ_MLBR	-Level (byte 0-7Fh,40h)	Equalizer med low band right	
16H	EQ_MHBR	-Level (byte 0-7Fh,40h)	Equalizer med high band right	
17H	EQ_HBR	-Level (byte 0-7Fh,60h)	Equalizer high band right	
18H	EQF_LB	-Data (byte 0-7Fh,0Ch)	Equalizer low band frequency	
19H	EQF_MLB	-Data (byte 0-7Fh,1Bh)	Equalizer med low band frequency	
1AH	EQF_MHB	-Data (byte 0-7Fh,72h)	Equalizer med high band frequency	
1BH	EQF_HB	-Data (byte 0-7Fh,40h)	Equalizer high band frequency	

EQ_xxx Band level

00H	20H	40H	60H	7FH
-12dB	-6dB	0dB	+6dB	+12dB

Default =060h (+6dB) for LB-HB, =040h(0dB) for MLB-MHB

EQF_xxx : Band frequency (0-7Fh), linear scale

Band	Range	Default
LB	0-4.7Khz	0CH
MLB	0-4.2Khz	1BH
MHB	0-4.2Khz	72H
HB	0-18.75Khz	40H

SPATIALIZER DEVICE

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
30H	SUR_VOL	-Data(byte 0-FFh,0)	Spatializer effect volume	
31H	SUR_DEL	-Data(byte 0-7Fh,2)	Spatializer effect delay	
32H	SUR_INP	-Data(byte 0/7Fh,0)	Input mono/stereo select for Spatializer	
33H	SUR_24	-Data(byte 0/7Fh,0)	2 or 4 speakers output select for Spatializer	

- **SUR_VOL** : Spatializer effect volume.
 Default=0

- **SUR_DEL** : Delay line length
 Default=2

- **SUR_INP** : Input type select
 0 Stereo (default), Stereo wide, Input to delay line is left - right.
 7FH Mono, Pseudo stereo Input to delay line is left + right.

- **SUR_24** : Output type select
 0 2 speakers(default) Spatializer output on main outputs.
 7FH 4 speakers Spatializer output on auxiliary output.

3- DETAILED MIDI IMPLEMENTATION

MIDI MESSAGE	HEX CODE	DESCRIPTION	COMPATIBILITY
NOTE ON	9nH kk vv	Midi channel n(0-15) note ON #kk(1-127), velocity vv(1-127). vv=0 means NOTE OFF	MIDI
NOTE OFF	8nH kk vv	Midi channel n(0-15) note OFF #kk(1-127), vv is don't care.	MIDI
PITCH BEND	EnH bl bh	Pitch bend as specified by bh bl (14 bits) Maximum swing is +/- 1 tone (power-up). Can be changed using « pitch bend sensitivity ». Center position is 00H 40H.	GM
PROGRAM CHANGE	CnH pp	Program (patch) change. Specific action on channel 10 (n=9) : select drumset. Refer to sounds / drumset list. Drumsets can be assigned to other channels (see SYSEX MIDI channel to part assign and part to rhythm allocation)	GM/GS
CHANNEL AFTERTOUCH	DnH vv	vv pressure value. Effect set using Sys. Ex. 40H 2nH 20H-26H	MIDI
MIDI RESET	FFH	Reset to power-up condition	
CTRL 00	BnH 00H cc	Bank select : Refer to sounds list. No action on drumset. cc=64 reserved for dream sound editor	GS/DREAM
CTRL 01	BnH 01H cc	Modulation wheel. Rate and maximum depth can be set using SYSEX	MIDI
CTRL 05	BnH 05H cc	Portamento time.	MIDI
CTRL 06	BnH 06H cc	Data entry : provides data to RPN and NRPN	MIDI
CTRL 07	BnH 07H cc	Volume (default=100)	MIDI
CTRL 10	BnH 0AH cc	Pan (default=64 center)	MIDI
CTRL 11	BnH 0BH cc	Expression (default=127)	MIDI/GM
CTRL 64	BnH 40H cc	Sustain (damper) pedal	MIDI
CTRL 65	BnH 41H cc	Portamento ON/OFF	MIDI
CTRL 66	BnH 42H cc	Sostenuto pedal	MIDI
CTRL 67	BnH 43H cc	Soft pedal	MIDI
CTRL 80	BnH 50H vv	Reverb program vv=00H to 07H (default 04H) 00H : Room1 01H : Room2 02H : Room3 03H : Hall1 04H : Hall2 05H : Plate 06H : Delay 07H : Pan delay	DREAM
CTRL 81	BnH 51H vv	Chorus program vv=00H to 07H (default 02H) 00H : Chorus1 01H : Chorus2 02H : Chorus3 03H : Chorus4 04H : Feedback 05H : Flanger 06H : Short delay 07H : FB delay	DREAM
CTRL 91	BnH 5BH vv	Reverb send level vv=00H to 7FH	GS
CTRL 93	BnH 5DH vv	Chorus send level vv=00H to 7FH	GS
CTRL 120	BnH 78H 00H	All sound off (abrupt stop of sound on channel n)	MIDI
CTRL 121	BnH 79H 00H	Reset all controllers	MIDI
CTRL 123	BnH 7BH 00H	All notes off	MIDI
CTRL 126	BnH 7EH 00H	Mono on	MIDI
CTRL 127	BnH 7FH 00H	Poly on (default power-up)	MIDI
CTRL CC1	BnH ccH vvH	Assignable Controller 1. cc=Controller number (0-5Fh), vv=Control value (0-7Fh). Control number (ccH) can be set on CC1 CONTROLLER NUMBER (Sys. Ex 40 1x 1F). The resulting effect is determined by CC1 controller function (Sys.Ex. 40 2x 40-4A)	GS
CTRL CC2	BnH ccH vvH	Assignable Controller 2. cc=Controller number (00h-5Fh), vv=control value (0-7Fh). Control number can be set on CC2 CONTROLLER NUMBER (Sys.Ex. 40 1x 20). The resulting effect is determined by CC2 controller function (Sys.Ex.40 2x 50-5A).	
RPN 0000H	BnH 65H 00H 64H 00H 06H vv	Pitch bend sensitivity in semitones (default=2)	MIDI/GM
RPN 0001H	BnH 65H 00H 64H 01H 06H vv	Fine tuning in cents (vv=00 -100, vv=40H 0, vv=7FH +100)	MIDI
RPN 0002H	BnH 65H 00H 64H 02H 06H vv	Coarse tuning in half-tones (vv=00 -64, vv=40H 0, vv=7FH +64)	MIDI
NRPN 0108H	BnH 63H 01H 62H 08H 06H vv	Vibrate rate modify (vv=40H -> no modif)	GS
NRPN 0109H	BnH 63H 01H 62H 09H 06H vv	Vibrate depth modify (vv=40H -> no modif)	GS
NRPN 010AH	BnH 63H 01H 62H 0AH 06H vv	Vibrate delay modify (vv=40H -> no modif)	GS
NRPN 0120H	BnH 63H 01H 62H 20H 06H vv	TVF cutoff freq modify(vv=40H -> no modif)	GS
NRPN 0121H	BnH 63H 01H 62H 21H 06H vv	TVF resonance modify (vv=40H -> no modif)	GS
NRPN 0163H	BnH 63H 01H 62H 63H 06H vv	Env. attack time modify(vv=40H ->no modif)	GS
NRPN 0164H	BnH 63H 01H 62H 64H 06H vv	Env. decay time modify(vv=40H -> no modif)	GS
NRPN 0166H	BnH 63H 01H 62H 66H 06H vv	Env. release time modif(vv=40H ->no modif)	GS

NRPN 18rrH	BnH 63H 18H 62H rr 06H vv	Pitch coarse of drum instr. note rr in semitones (vv=40H -> no modif)	GS
NRPN 1ArrH	BnH 63H 1AH 62H rr 06H vv	Level of drum instrument note rr (vv=00 to 7FH)	GS
NRPN 1CrrH	BnH 63H 1CH 62H rr 06H vv	Pan of drum instrument note rr (40H = middle)	GS
NRPN 1DrrH	BnH 63H 1DH 62H rr 06H vv	Reverb send level of drum instrument note rr (vv=00 to 7FH)	GS
NRPN 1ErrH	BnH 63H 1EH 62H rr 06H vv	Chorus send level of drum instrument note rr (vv=00 to 7FH)	GS
NRPN 37xxH	BnH 63H 37H 62H xx 06H vv	Special Synthesis features controls (see §1-4- above)	DREAM
Standard Sysex	F0H 7EH 7FH 09H 01H F7H	General MIDI reset	GM
Standard Sysex	F0H 7FH 7FH 04H 01H 00H 11 F7H	Master volume (11=0 to 127, default 127)	GM
SYSEX	F0H 41H 00H 42H 12H 40H 00H 00H dd dd dd dd xx F7H	Master tune (default dd= 00H 04H 00H 00H) -100.0 to +100.0 cents. Nibblized data should be used (always four bytes). For example, to tune to +100.0 cents, sent data should be 00H 07H 0EH 08H	GS
SYSEX	F0H 41H 00H 42H 12H 40H 00H 04H vv xx F7H	Master volume (default vv=7FH)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 00H 05H vv xx F7H	Master key-shift (default vv=40H, no transpose)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 00H 06H vv xx F7H	Master pan (default vv=40H, center)	
SYSEX	F0H 41H 00H 42H 12H 40H 00H 7FH 00H xx F7H	GS reset	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 30H vv xx F7H	Reverb type (vv=0 to 7), default = 04H 00H : Room1 01H : Room2 02H : Room3 03H : Hall1 04H : Hall2 05H : Plate 06H : Delay 07H : Pan delay	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 31H vv xx F7H	Reverb character, default 04H	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 33H vv xx F7H	Reverb master level, default = 64	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 34H vv xx F7H	Reverb time	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 35H vv xx F7H	Reverb delay feedback. Only if reverb number=6 or 7 (delays)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 38H vv xx F7H	Chorus type (vv=0 to 7), default = 02H 00H : Chorus1 01H : Chorus2 02H : Chorus3 03H : Chorus4 04H : Feedback 05H : Flanger 06H : Short delay 07H : FB delay	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3AH vv xx F7H	Chorus master level, default = 64	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3BH vv xx F7H	Chorus feedback	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3CH vv xx F7H	Chorus delay	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3DH vv xx F7H	Chorus rate	GS
SYSEX	F0H 41H 00H 42H 12H 40H 01H 3EH vv xx F7H	Chorus depth	GS
SYSEX	F0H 41H 00H 42H 12H 40H 1pH 02H nn xx F7H	MIDI channel to part assign, p is part (0 to 15), nn is MIDI channel (0 to 15, 16=OFF). This SYSEX allows to assign several parts to a single MIDI channel or to mute a part. Default assignment : part MIDI channel 0 9 (DRUMS) 1-9 0-8 10-15 10-15	GS

SYSEX	F0H 41H 00H 42H 12H 40H 1pH 15H vv xx F7H	Part to rhythm allocation, p is part (0 to 15), vv is 00 (sound part) or 01 (rhythm part). This SYSEX allows a part to play sound or drumset. There is no limitation of the number of parts playing drumset. Default assignment : part 0 plays drums (default MIDI channel 9) all other parts play sound.	GS
SYSEX	F0H 41H 00H 42H 12H 40H 1nH 40H v1 v2 ... v12 xx F7H	Scale tuning, n is MIDI channel (0 to 15), v1 to v12 are 12 semi-tones tuning values (C, C#, D, ... A#, B), in the range -64 (00H) 0 (40H) +63(7FH) cents. This SYSEX allows non chromatic tuning of the musical scale on a given MIDI channel. Default v1, v2, ... ,v12 = 40H, 40H,...,40H (chromatic tuning). Scale tuning has no effect if the part is assigned to a rhythm channel or if the sound played is not of chromatic type.	GS
SYSEX	F0H 41H 00H 42H 12H 40H 1nH 1AH vv xx F7H	Velocity slope from 00H to 7FH (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 1nH 1BH vv xx F7H	Velocity offset from 00H to 7FH (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 1nH 1FH vv xx F7H	CC1 Controller number (00-5FH) (default = 10H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 1nH 20H vv xx F7H	CC2 Controller number (00-5FH) (default = 11H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 00H vv xx F7H	Mod pitch control (-24,+24 semitone) (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 01H vv xx F7H	Mod tvf cutoff control (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 02H vv xx F7H	Mod Amplitude control (-100%+100%) (default=40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 03H vv xx F7H	Mod lfo1 rate control (default = 40H). n is don't care. Rate is common on all channels	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 04H vv xx F7H	Mod lfo1 pitch depth (0-600 cents) (default=0AH)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 05H vv xx F7H	Mod lfo1 tvf depth (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 06H vv xx F7H	Mod lfo1 tva depth (0-100%) (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 10H vv xx F7H	Bend pitch control (-24,+24 semitone) (default = 42H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 11H vv xx F7H	Bend tvf cutoff control (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 12H vv xx F7H	Bend Amplitude control (-100%+100%) (default=40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 14H vv xx F7H	Bend lfo1 pitch depth (0-600 cents) (default=0AH)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 15H vv xx F7H	Bend lfo1 tvf depth (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 16H vv xx F7H	Bend lfo1 tva depth (0-100%) (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 20H vv xx F7H	CAF pitch control (-24,+24 semitone) (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 21H vv xx F7H	CAF tvf cutoff control (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 22H vv xx F7H	CAF Amplitude control (-100%+100%) (default=40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 24H vv xx F7H	CAF lfo1 pitch depth (0-600 cents) (default=0AH)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 25H vv xx F7H	CAF lfo1 tvf depth (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 26H vv xx F7H	CAF lfo1 tva depth (0-100%) (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 40H vv xx F7H	CC1 pitch control (-24,+24 semitone) (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 41H vv xx F7H	CC1 tvf cutoff control (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 42H vv xx F7H	CC1 Amplitude control (-100%+100%) (default=40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 44H vv xx F7H	CC1 lfo1 pitch depth (0-600 cents) (default=0AH)	GS

SYSEX	F0H 41H 00H 42H 12H 40H 2nH 45H vv xx F7H	CC1 lfo1 tvf depth (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 46H vv xx F7H	CC1 lfo1 tva depth (0-100%) (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 50H vv xx F7H	CC2 pitch control (-24,+24 semitone) (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 51H vv xx F7H	CC2 tvf cutoff control (default = 40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 52H vv xx F7H	CC2 Amplitude control (-100%-+100%) (default=40H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 54H vv xx F7H	CC2 lfo1 pitch depth (0-600 cents) (default=0AH)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 55H vv xx F7H	CC2 lfo1 tvf depth (default = 0H)	GS
SYSEX	F0H 41H 00H 42H 12H 40H 2nH 56H vv xx F7H	CC2 lfo1 tva depth (0-100%) (default = 0H)	GS

notes :

NRPN sending method : CTRL#99=high byte, CTRL#98=low byte, CTRL#6=vv

Example : NRPN 0108H = 40H -> CTRL#99=1, CTRL#98=8, CTRL#6=64

x or xx means « don't care »

MAIN SOUNDS - GENERAL MIDI (all channels except 10)

PC : Program change

PC	GENERAL MIDI	PC	GENERAL MIDI	PC	GENERAL MIDI	PC	GENERAL MIDI
1	(Grand) Piano 1	33	Acoustic Bass	65	Soprano Sax	97	FX 1 (rain)
2	(Bright) Piano 2	34	Finger Bass	66	Alto Sax	98	FX 2 (soundtrack)
3	(El. Grd) Piano 3	35	Picked Bass	67	Tenor Sax	99	FX 3 (crystal)
4	Honky-tonk Piano	36	Fretless Bass	68	Baritone Sax	100	FX4 (atmosphere)
5	El. Piano 1	37	Slap Bass 1	69	Oboe	101	FX 5 (brightness)
6	El. Piano 2	38	Slap Bass 2	70	English Horn	102	FX 6 (goblins)
7	Harpsichord	39	Synth Bass 1	71	Bassoon	103	FX 7 (echoes)
8	Clavi	40	Synth Bass 2	72	Clarinet	104	FX 8 (sci-fi)
9	Celesta	41	Violin	73	Piccolo	105	Sitar
10	Glockenspiel	42	Viola	74	Flute	106	Banjo
11	Music Box	43	Cello	75	Recorder	107	Shamisen
12	Vibraphone	44	Contrabass	76	Pan Flute	108	Koto
13	Marimba	45	Tremolo Strings	77	Blown Bottle	109	Kalimba
14	Xylophone	46	Pizzicato Strings	78	Shakuhachi	110	Bag pipe
15	Tubular Bells	47	Orchestral Harp	79	Whistle	111	Fiddle
16	Santur	48	Timpani	80	Ocarina	112	Shanai
17	Drawbar Organ	49	String Ensemble 1	81	Lead 1 (square)	113	Tinkle Bell
18	Percussive Organ	50	String Ensemble 2	82	Lead 2 (sawtooth)	114	Agogo
19	Rock Organ	51	Synth Strings 1	83	Lead 3 (calliope)	115	Steel Drums
20	Church Organ	52	Synth Strings 2	84	Lead 4 (chiff)	116	Woodblock
21	Reed Organ	53	Choir Aahs	85	Lead 5 (charang)	117	Taiko Drum
22	Accordion (french)	54	Voice Oohs	86	Lead 6 (voice)	118	Melodic Tom
23	Harmonica	55	Synth Voice	87	Lead 7 (fifths)	119	Synth Drum
24	Tango Accordion	56	Orchestra Hit	88	Lead8 (bass+lead)	120	Reverse Cymbal
25	Ac. Guitar (nylon)	57	Trumpet	89	Pad 1 (fantasia)	121	Gt. Fret Noise
26	Ac. Guitar (steel)	58	Trombone	90	Pad 2 (warm)	122	Breath Noise
27	El. Guitar (jazz)	59	Tuba	91	Pad 3 (polysynth)	123	Seashore
28	El. Guitar (clean)	60	Muted Trumpet	92	Pad 4 (choir)	124	Bird Tweet
29	El. Guitar (muted)	61	French Horn	93	Pad 5 (bowed)	125	Teleph. Ring
30	Overdriven Guitar	62	Brass Section	94	Pad 6 (metallic)	126	Helicopter
31	Distortion Guitar	63	Synth Brass 1	95	Pad 7 (halo)	127	Applause
32	Guitar harmonics	64	Synth Brass 2	96	Pad 8 (sweep)	128	Gunshot

SOUND VARIATIONS (all channels except 10)

To select variation : send CTRL 0, then PC

PC : Program change

C0 : controller 0 value (zero for General Midi capital sounds)

Sound names conventions :

w - pan type sound (low notes sent to left, high notes sent to right)

d - other velocity response

v - velocity split type sound

o - special release on sound

PC	GENERAL MIDI	C0	1st VAR	C0	2nd VAR	C0	3rd VAR
1	(Grand) Piano 1					127	Acou Piano 1
2	(Bright) Piano 2						Acou Piano 2
3	(El. Grd) Piano 3						Acou Piano 3
4	Honky-tonk Piano						Elec Piano 1
5	El. Piano 1	8	Detuned EP 1				Elec Piano 2
6	El. Piano 2	8	Detuned EP 2				Elec Piano 3
7	Harpsichord	8	Coupled Hps.				Elec Piano 4
8	Clavi						Honky Tonk
9	Celesta						Elec Org 1
10	Glockenspiel						Elec Org 2
11	Music Box						Elec Org 3
12	Vibraphone						Elec Org 4
13	Marimba						Pipe Org 1
14	Xylophone						Pipe Org 2
15	Tubular Bells	8	Church Bell	9	Carillon		Pipe Org 3
16	Dulcimer (Santur)						Accordion
17	Drawbar Organ	8	Det. Organ 1				Harpsi 1
18	Percussive Organ	8	Det. Organ 2				Harpsi 2
19	Rock Organ						Harpsi 3
20	Church Organ	8	Ch. Organ 2				Clavi 1
21	Reed Organ						Clavi 2
22	Accordion (french)	8	Acc. (Italian)				Clavi 3
23	Harmonica						Celesta 1
24	Tango Accordion						Celesta 2
25	Ac. Guitar (Nylon)	8	Ukulele				Syn Brass 1
26	Ac. Guitar (Steel)	8	12-str. Guitar	16	Mandolin		Syn Brass 2
27	El. Guitar (jazz)	8	Hawaiian Gt.				Syn Brass 3
28	El. Guitar (clean)	8	Chorus Gt.				Syn Brass 4
29	El. Guitar (muted)	8	Funk Gt.				Syn Bass 1
30	Overdriven Guitar						Syn Bass 2
31	Distortion Guitar	8	Feedback Gt.				Syn Bass 3
32	Guitar harmonics	8	Gt. Feedback				Syn Bass 4
33	Acoustic Bass						Fantasy
34	Finger Bass						Harmo Pan
35	Picked Bass						Chorale
36	Fretless Bass						Glasses
37	Slap Bass 1						SoundTrack
38	Slap Bass 2						Atmosphere
39	Synth Bass 1	8	Synth. Bass 3				Warm Bell
40	Synth Bass 2	8	Synth. Bass 4				Funny Vox

PC	GENERAL MIDI	C0	1st VAR	C0	2nd VAR	C0	3rd VAR
41	Violin					127	Echo Bell
42	Viola						Ice Rain
43	Cello						Obeo 2001
44	Contrabass						Echo Pan
45	Tremolo Strings						Doctor Solo
46	Pizzicato Strings						School Daze
47	Orchestral Harp						BellSinger
48	Timpani						Square Wave
49	String Ensemble 1	8	Orchestra				Str Sect 1
50	String Ensemble 2						Str Sect 2
51	Synth Strings 1	8	Syn Strings 3				Str Sect 3
52	Synth Strings 2						Pizzicato
53	Choir Aahs						Violin 1
54	Voice Oohs						Violin 2
55	Synth Voice						Cello 1
56	Orchestra Hit						Cello 2
57	Trumpet						Contrabass
58	Trombone						Harp 1
59	Tuba						Harp 2
60	Muted Trumpet						Guitar 1
61	French Horn						Guitar 2
62	Brass Section	8	Brass 2				Elec Gtr 1
63	Synth Brass 1	8	Syn Brass 3				Elec Gtr 2
64	Synth Brass 2	8	Syn Brass 4				Sitar
65	Soprano Sax						Acou Bass 1
66	Alto Sax						Acou Bass 2
67	Tenor Sax						Elec Bass 1
68	Baritone Sax						Elec Bass 2
69	Oboe						Slap Bass 1
70	English Horn						Slap Bass 2
71	Bassoon						Fretless 1
72	Clarinet						Fretless 2
73	Piccolo						Flute 1
74	Flute						Flute 2
75	Recorder						Piccolo 1
76	Pan Flute						Piccolo 2
77	Blown Bottle						Recorder
78	Shakuhachi						Pan Pipes
79	Whistle						Sax 1
80	Ocarina						Sax 2
81	Lead 1 (square)	1	Square	8	Sine Wave		Sax 3
82	Lead 2 (sawtooth)	1	Saw				Sax 4
83	Lead 3 (calliope)						Clarinet 1
84	Lead 4 (chiff)						Clarinet 2
85	Lead 5 (charang)						Obeo
86	Lead 6 (voice)						Engl Horn
87	Lead 7 (fifths)						Bassoon
88	Lead8 (bass+lead)						Harmonica
89	Pad 1 (new age)						Trumpet 1
90	Pad 2 (warm)						Trumpet 2
91	Pad 3 (polysynth)						Trombone 1
92	Pad 4 (choir)						Trombone 2
93	Pad 5 (bowed)						Fr Horn 1
94	Pad 6 (metallic)						Fr Horn 2
95	Pad 7 (halo)						Tuba
96	Pad 8 (sweep)						Brs Sect 1

PC	GENERAL MIDI	C0	1st VAR	C0	2nd VAR	C0	3rd VAR
97	FX 1 (rain)					127	Brs Sect 2
98	FX 2 (soundtrack)						Vibe 1
99	FX 3 (crystal)						Vibe 2
100	FX4 (atmosphere)						Syn Mallet
101	FX 5 (brightness)						Wind Bell
102	FX 6 (goblins)						Glock
103	FX 7 (echoes)	2	Echo Pan				Tube Bell
104	FX 8 (sci-fi)						Xylophone
105	Sitar						Marimba
106	Banjo						Koto
107	Shamisen						Sho
108	Koto	8	Taisho Koto				Shakuhachi
109	Kalimba						Whistle 1
110	Bag pipe						Whistle 2
111	Fiddle						Bottleblow
112	Shanai						Breathpipe
113	Tinkle Bell						Timpani
114	Agogo						Melodic Drum
115	Steel Drums						Deep Snare
116	Woodblock	8	Castanets				Elec Perc 1
117	Taiko Drum	8	Concert BD				Elec Perc 2
118	Melodic Tom	8	Melo Tom 2				Taiko
119	Synth Drum	8	808 Tom	9	Elec Perc 1		Taiko rim
120	Reverse Cymbal						Cymbal

32* : This variation can also be obtained by sending variation # 24.

SFX VARIATIONS (all channels except 10)

PRG#	General MIDI	CTRL 0= 1	CTRL 0= 2	CTRL 0= 3	CTRL 0= 4	CTRL 0= 5	CTRL 0= 6	CTRL 0= 7	CTRL 0= 8	CTRL 0= 9
121	Gt. Fret Noise	Gt. Cut Noise	String Slap							
122	Breath Noise	Fl. Key Click								
123	Seashore	Rain	Thunder	Wind	Stream	Bubble				
124	Bird Tweet	Dog	Horse Gallop	Bird 2						
125	Teleph. Ring	Teleph. Ring 2	Door Creaking	Door Closing	Scratch	Wind chime				
126	Helicopter	Car Engine Start	Car Breaking	Car Pass	Car Crash	Police Siren	Train	Jet Takeoff	Starship	Burst Noise
127	Applause	Laughing	Screaming	Punch	Heart Beat	Footstep				
128	Gunshot	Machine gun	Lasergun	Explosion						

MT 32 (variation 127)

121	122	123	124	125	126	127	128
Castanets	Triangle	Orche Hit	Telephone	Bird Tweet	One Note Jam	Water Bell	Jungle Tune

DRUM SET TABLE (MIDI CHANNEL 10)

	Prog 1 : STD SET1	Prog 9: ROOM SET	Prog 17 : POWER SET	Prog 25: ELEC. SET	Prog 26: TR808 SET
27 - D#1	High Q				
28 - E1	Slap				
29 - F1	Scratch Push				
30 - F#1	Scratch Pull				
31 - G1	Sticks				
32 - G#1	Square Click				
33 - A1	Metronome Click				
34 - A#1	Metronome Bell				
35 - B1	STD1 Kick2				
36 - C2	STD1 Kick1		Power Kick	Elec Kick	808 BD
37 - C#2	Side Stick				808 Rim shot
38 - D2	STD1 Snare1		Gated Snare	Gated Snare	808 Snare Drum
39 - D#2	Hand Clap				
40 - E2	Snare Drum 2			Elec Snare1	
41 - F2	Low Floor Tom	Power Low Tom2	Power Low Tom2	Elec Low Tom2	808 Low Tom2
42 - F#2	Closed Hi Hat [EXC1]				808 CHH [EXC1]
43 - G2	High Floor Tom	Power Low Tom1	Power Low Tom1	Elec Low Tom1	808 Low Tom2
44 - G#2	Pedal Hi-Hat [EXC1]				808 CHH [EXC1]
45 - A2	Low Tom	Power Mid Tom2	Power Mid Tom2	Elec Mid Tom2	808 Mid Tom2
46 - A#2	Open Hi-Hat [EXC1]				808 OHH [EXC1]
47 - B2	Low-Mid Tom	Power Mid Tom1	Power Mid Tom1	Elec Mid Tom1	808 Mid Tom1
48 - C3	Hi Mid Tom	Power Hi Tom2	Power Hi Tom2	Elec Hi Tom2	808 Hi Tom2
49 - C#3	Crash Cymbal 1				808 Cymbal
50 - D3	High Tom	Power Hi Tom1	Power Hi Tom1	Elec Hi Tom1	808 HiTom1
51 - D#3	Ride Cymbal 1				
52 - E3	Chinese Cymbal			Reverse Cymbal	
53 - F3	Ride Bell				
54 - F#3	Tambourine				
55 - G3	Splash Cymbal				
56 - G#3	Cowbell				808 Cowbell
57 - A3	Crash Cymbal 2				
58 - A#3	Vibraslap				
59 - B3	Ride Cymbal 2				
60 - C4	Hi Bongo				
61 - C#4	Low Bongo				
62 - D4	Mute Hi Conga				808 High Conga
63 - D#4	Open Hi Conga				808 Mid Conga
64 - E4	Low Conga				808 Low Conga
65 - F4	High Timbale				
66 - F#4	Low Timbale				
67 - G4	High Agogo				
68 - G#4	Low Agogo				
69 - A4	Cabasa				
70 - A#4	Maracas				808 Maracas
71 - B4	Short Whistle[EXC2]				
72 - C5	Long Whistle[EXC2]				
73 - C#5	Short Guiro [EXC3]				
74 - D5	Long Guiro [EXC3]				
75 - D#5	Claves				808 Claves
76 - E5	Hi Wood Block				
77 - F5	Low Wood Block				
78 - F#5	Mute Cuica [EXC4]				
79 - G5	Open Cuica [EXC4]				
80 - G#5	Mute Triangle [EXC5]				
81 - A5	Open Triangle[EXC5]				
82 - A#5	Shaker				
83 - B5	Jingle Bell				
84 - C6	Belltree				
85 - C#6	Castanets				
86 - D6	Mute Surdo [EXC6]				
87 - D#6	Open Surdo [EXC6]				
88 - E6					

	Prog 33: JAZZ	Prog 41 : BRUSH	Prog 49 : ORCHESTRA	Prog 57 : SFX SET	Prog 127: CM -64/32
27 - D#1			Closed Hi Hat	*	*
28 - E1			Pedal Hi-Hat	*	*
29 - F1			Open Hi Hat	*	*
30 - F#1			Ride Cymbal	*	*
31 - G1				*	*
32 - G#1				*	*
33 - A1				*	*
34 - A#1				*	*
35 - B1	Jazz BD2	Jazz BD2	Concert BD 2	*	Kick drum
36 - C2	Jazz BD1	Jazz BD1	Concert BD 1	*	Kick drum
37 - C#2				*	Rim Shot
38 - D2		Brush Tap	Concert SD	*	Snare Drum
39 - D#2		Brush Slap	Castanets	High Q	Hand Clap
40 - E2		Brush Swirl	Concert SD	Slap	Elec Snare Drum
41 - F2			Timpani F	Scratch Push	Acoustic Low Tom
42 - F#2			Timpani F#	Scratch Pull	Closed Hi-Hat [Exc1]
43 - G2			Timpani G	Sticks	Acoustic Low Tom
44 - G#2			Timpani G#	Square Click	Open Hi-Hat 2
45 - A2			Timpani A	Metronome Click	Acoustic Middle Tom
46 - A#2			Timpani A#	Metronome Bell	Open Hi-Hat 1 [Exc1]
47 - B2			Timpani B	Guitar Slide	Acoustic Middle Tom
48 - C3			Timpani c	Gt Cut Noise (down)	Acoustic High Tom
49 - C#3			Timpani c#	Gt Cut Noise (up)	Crash Cymbal
50 - D3			Timpani d	Double Bass Slap	Acoustic High Tom
51 - D#3			Timpani d#	Key Click	Ride Cymbal
52 - E3			Timpani e	Laughing	*
53 - F3			Timpani f	Screaming	*
54 - F#3				Punch	Tambourine
55 - G3				Heart Beat	*
56 - G#3				Footsteps1	Cowbell
57 - A3			Concert Cymbal2	Footsteps2	*
58 - A#3				Applause	*
59 - B3			Concert Cymbal1	Door Creaking	*
60 - C4				Door Closing	
61 - C#4				Scratch	
62 - D4				Wind Chime	
63 - D#4				Car Engine Start	
64 - E4				Car Breaking	
65 - F4				Car Pass	
66 - F#4				Car Crash	
67 - G4				Police Siren	
68 - G#4				Train	
69 - A4				Jet Take-off	
70 - A#4				Helicopter	
71 - B4				Starship	
72 - C5				Gun Shot	
73 - C#5				Machinegun	Vibrato Slap
74 - D5				Lasergun	*
75 - D#5				Explosion	Claves
76 - E5				Dog	Laughing
77 - F5				Horse Gallop	Scream
78 - F#5				Birds	Punch
79 - G5				Rain	Heart Beat
80 - G#5				Thunder	Footsteps 1
81 - A5				Wind	Footsteps 2
82 - A#5				Sea Shore	Applauses
83 - B5				Stream	Creaking
84 - C6				Bubble	Door
85 - C#6				*	Scratch
86 - D6				*	Wind Chimes
87 - D#6				*	Car-Engine
88 - E6			Applauses	*	Car-Stop
89 - F6	*				Car-Pass
90 - F#6	*				Car-Crash
91 - G6	*				Siren
92 - G#6	*				Train

93 - A6					JetPlane
94 - A#6					Helicopter
95 - B6					StarShip
96 - C7					Gun Shot
97 - C#7					Machine Gun
98 - D7					Laser Gun
99 - D#7					Explosion
100 - E7					Dog
101 - F7					Horse Gallop
102 - F#7					Birds
103 - G7					Rain
104 - g#7					Thunder
105 - A7					Wind
106 - A#7					SeaShore
107 - B7					Stream
108 - C8					Bubble

Notes :

*: No sound Blank : Same sound as "Standard Set"

[EXC] : Sounds with same EXC number are mutually exclusive

INSTRUMENT REQUIRING 2 VOICES (2 LAYER INSTRUMENT).

PC	C0	Name	Type
4	0	Honky-tonk Piano	chorus
5	8	Detuned EP 1	chorus
	8	Detuned EP 2	chorus
7	8	Coupled Hps.	dual
9	0	Celesta	fm
11	0	Music Box	fm
15	0	Tubular Bells	fm
17	8	Det. Organ 1	chorus
18	8	Det. Organ 2	chorus
19	0	Rock Organ	dual
20	0	Church Organ	dual
	8	Ch. Organ 2	dual
22	0	Accordion (french)	chorus
	8	Acc. (Italian)	chorus
24	0	Tango Accordion	chorus
26	8	12-str. Guitar	dual
28	8	Chorus Gt.	chorus
31	0	Distortion Guitar	dual
	8	Feedback Gt	dual
32	8	Gt. Feedback	fm
37	0	Slap Bass 1	dual
40	0	Synth Bass 2	chorus
	8	Synth Bass 4	dual
49	8	Orchestra	dual
51	8	Synth Strings 3	dual
52		Synth Strings 2	chorus
54		Voice Oohs	dual
55		Synth Voice	dual
56		Orchestra Hit	dual
61		French Horn	chorus
62	8	Brass 2	dual
63		Synth Brass 1	chorus
	8	Synth Brass 3	dual
64		Synth Brass 2	chorus
79		Whistle	fm
80		Ocarina	fm
81		Lead 1 (square)	chorus
	8	Sine Wave	fm
82		Lead 2 (sawtooth)	chorus
83		Lead 3 (calliope)	dual
84		Lead 4 (chiff)	dual
85		Lead 5 (charang)	dual
86		Lead 6 (voice)	dual
87		Lead 7 (fifths)	dual
88		Lead8 (bass+lead)	dual
89		Pad 1 (new age)	dual
91		Pad 3 (polysynth)	dual
93		Pad 5 (bowed)	dual
94		Pad 6 (metallic)	chorus
95		Pad 7 (halo)	dual
97	0	FX 1 (rain)	dual
98	0	FX 2 (soundtrack)	dual
99	0	FX 3 (crystal)	chorus
100	0	FX4 (atmosphere)	dual

101	0	FX 5 (brightness)	dual
102	0	FX 6 (goblins)	dual
103	8	Echo Pan	chorus
104	0	FX 8 (sci-fi)	dual
108	8	Taisho Koto	dual
113	0	Tinkle Bell	fm
117	8	Concert BD	dual
123	0	Seashore	chorus
	1	Rain	chorus
	3	Wind	chorus
	4	Stream	chorus
	5	Bubble	chorus
124	0	Bird	chorus
125	5	Wind chime	chorus
126	7	Jet Takeoff	dual pcm+fm
	8	Starship	dual pcm+fm
	9	Burst Noise	chorus
127	0	Applause	chorus
128	2	Laser gun	fm
	3	Explosion	dual

Drumset instrument

PC	Note	Name	Type
1	34	Metronome bell	dual
49	36	concert bass drum	dual

4. AUTO-TEST

Built-in auto-test program is included which can be used for board production testing.
To start auto-test, send NRPN 3751H = 23H

Sine waveforms at different frequencies will be output to the DAC to indicate the test in progress, as follows :

Test in progress	Output frequency
RAM	1.18 kHz
ROM	876 Hz
PASS (32k x 8)	295 Hz
PASS (32k x 16)	585 Hz

When test is passed, frequency of last sinus indicates size of SRAM detected.

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