# SAM9793

SINGLE CHIP SYNTHESIZER
WITH EFFECTS, PARALLEL INTERFACE

Synthesizer, Reverb, Chorus on single chip
No external ROM or RAM.

- Single chip all-in-one design, only requires external DAC
    — MIDI control processor, serial and parallel interface
    — Synthesis
    — Compatible effects : reverb + chorus
    — Programmable Spatializer or four channels surround (*)
    — 3DMIDI™ four speakers MIDI (*)
    — 4 bands stereo equalizer.
- State of the art synthesis for best quality/price products
    — 38 voices polyphony + effects
    — On-chip wavetable data, firmware, RAM delay lines
- Synthesizer chipset : SAM9793 + DAC
- Hardware programmable DAC mode
    — I2S 16 to 20 bits
    — Japanese 16 bits
- Typical applications : cost sensitive PC wavetable synthesis / VCD karaoke / musical instruments.
- PQFP100 package : easy mounting
- Ideal for battery operation
    — Low power
    — Power down mode
    — Wide supply voltage range : 3V to 4.5V core, 3V to 5.5V periphery

(*) Four channels surround and 3DMIDI™ require additional DAC
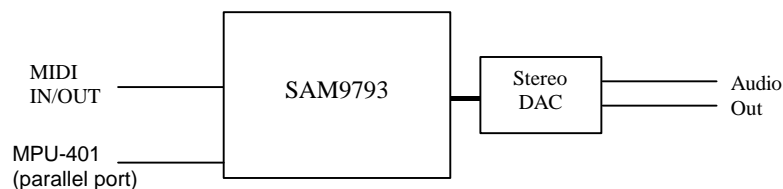
Typical hardware configuration

dream

1- PIN DESCRIPTION

1-1- PINS BY FUNCTION

Power supply group

PIN NAME	PIN #	TYPE	FUNCTION
GND	5,7,14,18,19,21,48,54, 58,67,84,96	PWR	DIGITAL GROUND All pins should be connected to a ground plane
VCC	6,16,46,57,76,85,94	PWR	POWER SUPPLY, 3V to 5.5V All pins should be connected to a VCC plane
VC3	27,52,56,80,86	PWR	CORE POWER SUPPLY, 3V to 4.5V All pins should be connected to nominal 3.3V. If 3.3V is not available, then VC3 can be derived from 5V by two 1N4148 diodes in series.

Serial MIDI, parallel MIDI (MPU-401)

PIN NAME	PIN #	TYPE	FUNCTION
MIDI IN	98	IN	Serial TTL MIDI IN. Connected to the built-in synthesizer at power-up or after MPU reset. Connected to the D0-D7 bus (read mode) when MPU switched to UART mode.
MIDI OUT	45	OUT	Serial TTL MIDI Out, not used at power-up or after MPU reset. Connected to the D0-D7 bus (write mode) when MPU switched to UART mode.
D0-D7	68,70,73,92,93,95, 97,100	I/O	8 bit bi-directional bus, under control of CS/, RD/, WR/
A0	40	IN	Select data(0) or control(1) for write, data(0) or status(1) for read
CS/	49	IN	Chip select, active low
RD/	51	IN	Read, active low. When CS/ and RD/ are low, data(A0=0) or status(A0=1) is read on D0-D7. Read data is acknowledged on the rising edge of WR/
WR/	47	IN	Write, active low. When CS and WR/ are low, data(A0=0 or control(A0=1) are written from the D0-D7 bus to the SAM9793 on the rising edge of WR/.
IRQ	43	TS OUT	A rising edge indicates that a MIDI byte is available for read on D0-D7. Acknowledged by reading the byte. This pin is floated until the SAM9793 is switched to MPU-401 UART mode.

DIGITAL AUDIO GROUP

| PIN NAME	PIN #	TYPE	FUNCTION
CLBD	1	OUT	Digital audio bit clock
WSBD	11	OUT	Digital audio left/right select
DABD0	9	OUT	Digital audio main stereo output
DABD1	10	OUT	Auxiliary digital stereo output. Surround or 3DMIDI™ output.
DACSEL	8	IN	DAC type : 0 = I2S 16 to 20 bits, 1 = Japanese 16 bits

MISCELLANEOUS GROUP

PIN NAME	PIN #	TYPE	FUNCTION
X1-X2	89, 88	-	9.6 MHz crystal connection. An external 9.6 MHz clock can also be used on X1 (3.3V input). X2 cannot be used to drive external circuits, use CKOUT instead.
CKOUT	2	OUT	Buffered X2 output, can be used to drive external DAC master clock (256 x Fs)
LFT	87	-	PLL external RC network
RESET/	90	IN	Reset input, active low. This is a Schmidt trigger input, allowing direct connection of an RC network
PDWN/	91	IN	Power down, active low. When power down is active, then all output pins will be floated. The crystal oscillator will be stopped. To exit from power down, PDWN/ should be high and RESET applied.
TEST0-TEST4	17, 20, 22, 23, 55	IN	Test pins. Should be grounded
RUN	99	OUT	When high, indicates that the synthesizer is up and running.

1-2- PINOUT BY PIN

PIN#	PIN NAME	PIN #	PIN NAME	PIN#	PIN NAME	PIN#	PIN NAME
1	CLBD	31	N.C.	51	RD/	81	N.C.
2	CKOUT	32	N.C.	52	VC3	82	N.C.
3	N.C.	33	N.C.	53	N.C.	83	N.C.
4	N.C.	34	N.C.	54	GND	84	GND
5	GND	35	N.C.	55	TEST4	85	VCC
6	VCC	36	N.C.	56	VC3	86	VC3
7	GND	37	N.C.	57	VCC	87	LFT
8	DACSEL	38	N.C.	58	GND	88	X2
9	DABD0	39	N.C.	59	N.C.	89	X1
10	DABD1	40	A0	60	N.C.	90	RESET/
11	WSBD	41	N.C.	61	N.C.	91	PDWN/
12	N.C.	42	N.C.	62	N.C.	92	D3
13	N.C.	43	IRQ	63	N.C.	93	D4
14	GND	44	N.C.	64	N.C.	94	VCC
15	N.C.	45	MIDI OUT	65	N.C.	95	D5
16	VCC	46	VCC	66	N.C.	96	GND
17	TEST0	47	WR/	67	GND	97	D6
18	GND	48	GND	68	D0	98	MIDI IN
19	GND	49	CS/	69	N.C.	99	RUN
20	TEST1	50	N.C.	70	D1	100	D7
21	GND			71	N.C.		
22	TEST2			72	N.C.		
23	TEST3			73	D2		
24	N.C.			74	N.C.		
25	N.C.			75	N.C.		
26	N.C.			76	VCC		
27	VC3			77	N.C		
28	N.C.			78	N.C.		
29	N.C.			79	N.C.		
30	N.C.			80	VC3.		

Important : Pins marked N.C. should be left unconnected.
All GND/VCC/VC3 pins should be connected

1-3- MECHANICAL DIMENSIONS
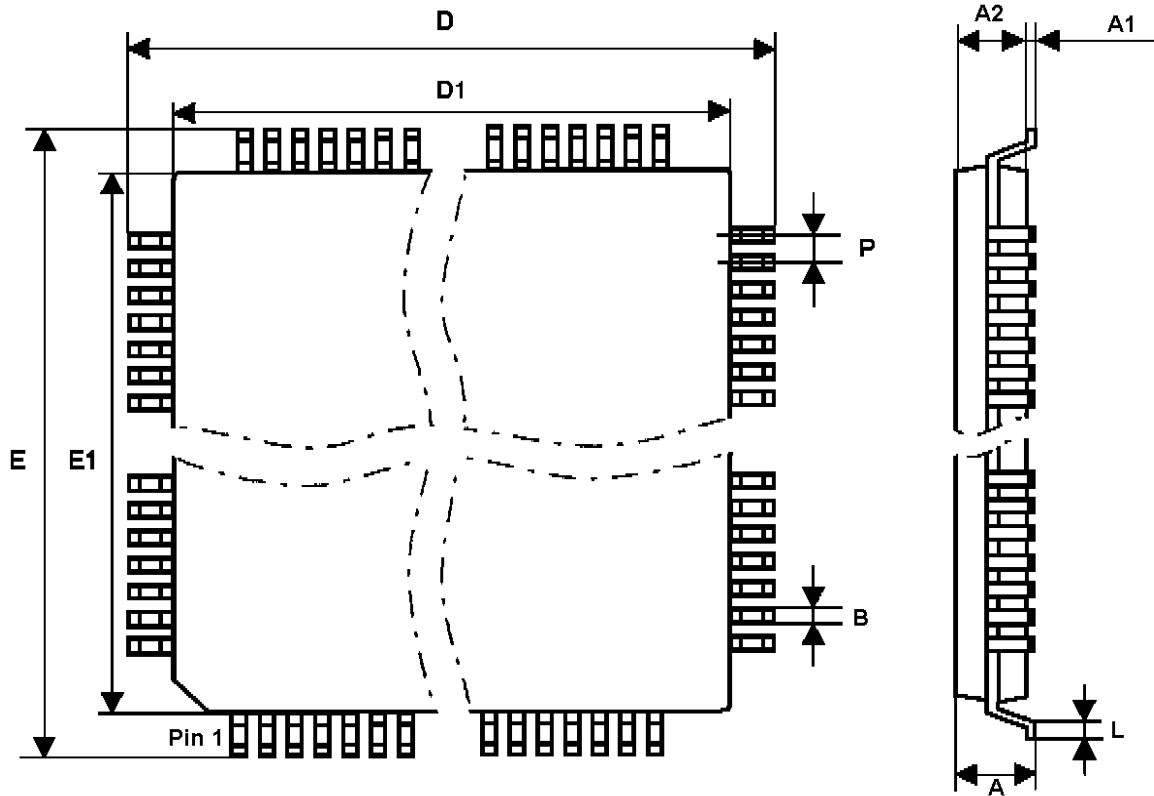
SAM9793
PLASTIC 100 LEAD QUAD FLAT PACK (PQFP100) RECTANGULAR

	MIN.	NOM.	MAX.
A			3.40
A1	0.25		
A2	2.55	2.8	3.05
D		23.90	
D1		20.00	
E		17.90	
E1		14.00	
L	0.65	0.88	1.03
P		0.65	
B	0.22		0.38

All dimensions in mm

2- ABSOLUTE MAXIMUM RATINGS (All voltages with respect to 0V, GND=0V)

Parameter	Symbol	Min	Typ	Max	Unit
Ambient temperature (Power applied)	-	-40	-	+85	°C
Storage temperature	-	-65	-	+150	°C
Voltage on any pin (except X1)	-	-0.5	-	VCC+0.5	V
Supply voltage	VCC	-0.5	-	6.5	V
Supply voltage	VC3	-0.5	-	4.5	V
Maximum IOL per I/O pin	-	-	-	10	MA

3- RECOMMENDED OPERATING CONDITIONS

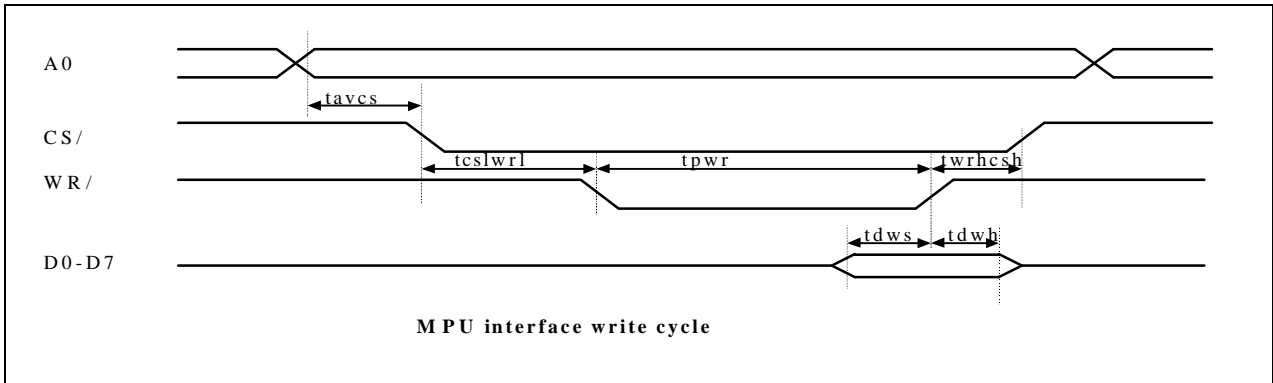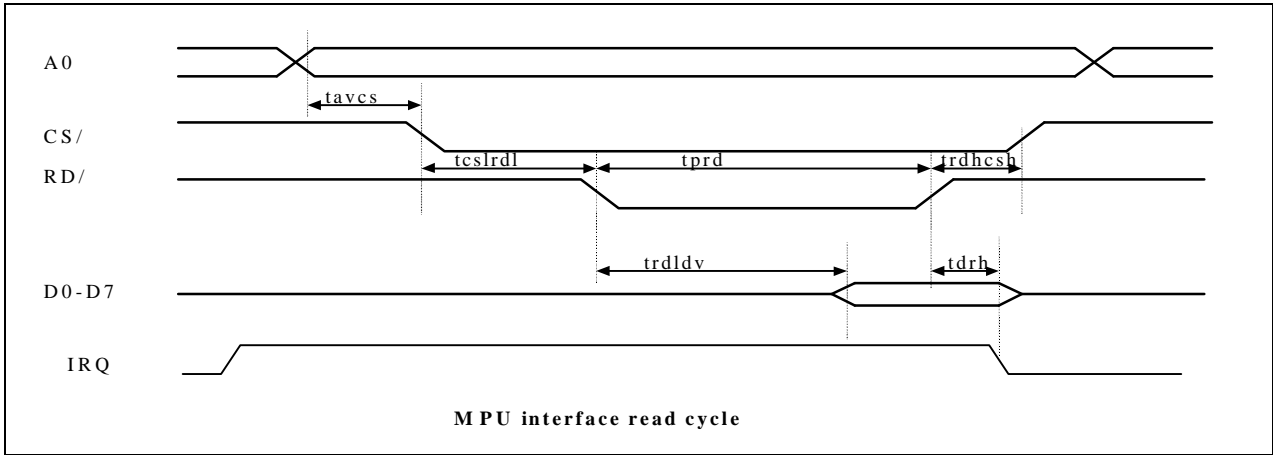| Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage (note 1)	VCC	3	3.3/5.0	5.5	V
Supply voltage	VC3	3	3.3	4.5	V
Operating ambient temperature	tA	0	-	70	°C

note 1 : When using 3.3V VCC supply in a 5V environment, care must be taken that pin voltage does not exceed VCC+0.5V. Pin X1 is powered by VC3 input. If X1 is driven by a 5V device, then a minimum series resistor is required (typ 330 Ohms).

4- D.C. CHARACTERISTICS (TA=25°C, VC3=3.3V±10%)

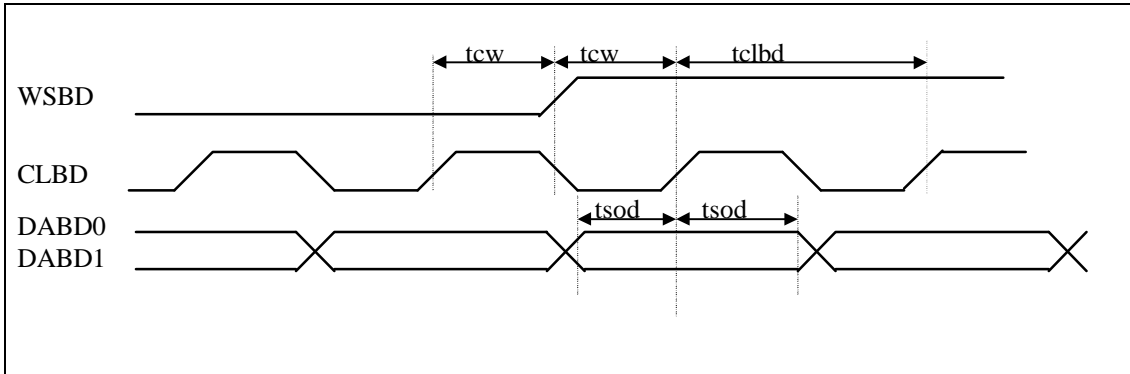| Parameter	Symbol	VCC	Min	Typ	Max	Unit
Low level input voltage	VIL	3.3	-0.5	-	1.0	V
		5.0	-0.5		1.7	
High level input voltage	VIH	3.3	2.3	-	VCC+0.5	V
		5.0	3.3		VCC+0.5	
Low level output voltage IOL=-3.2mA	VOL	3.3	-	-	0.45	V
		5.0			0.45	
High level output voltage IOH=0.8mA	VOH	3.3	2.8	-	-	V
		5.0	4.5			
Power supply current (crystal freq.=9.6MHz)	ICC	3.3	-	20	45	MA
		5.0		30	70	
Power down supply current	-			70	100	µA

5- TIMINGS

5-1- PARALLEL MPU-401 INTERFACE

MPU interface read cycle

MPU interface write cycle

Parameter	Symbol	Min	Typ	Max	Unit
Address valid to chip select low	tavcs	0	-	-	ns
Chip select low to RD/ low	tcslrdl	5	-	-	ns
RD/ high to CS/ high	trdhcsh	5	-	-	ns
RD/ pulse width	tprd	50	-	-	ns
Data out valid from RD/	trdldv	-	-	20	ns
Data out hold from RD/	tdrh	5	-	10	ns
Chip select low to WR/ low	tcslrwrl	5	-	-	ns
WR/ high to CS/ high	twrhcsh	5	-	-	ns
WR/ pulse width	tpwr	50	-	-	ns
Write data setup time	tdws	10	-	-	ns
Write data hold time	tdwh	0	-	-	ns

5-2- DIGITAL AUDIO TIMINGS

Parameter	Symbol	Min	Typ	Max	Unit
CLBD rising to WSBD change	tcw	200	-	-	ns
DABDx valid prior/after CLBD rising	tsod	200	-	-	ns
CLBD cycle time	tclbd	-	416.67	-	ns

DIGITAL AUDIO FRAME FORMAT
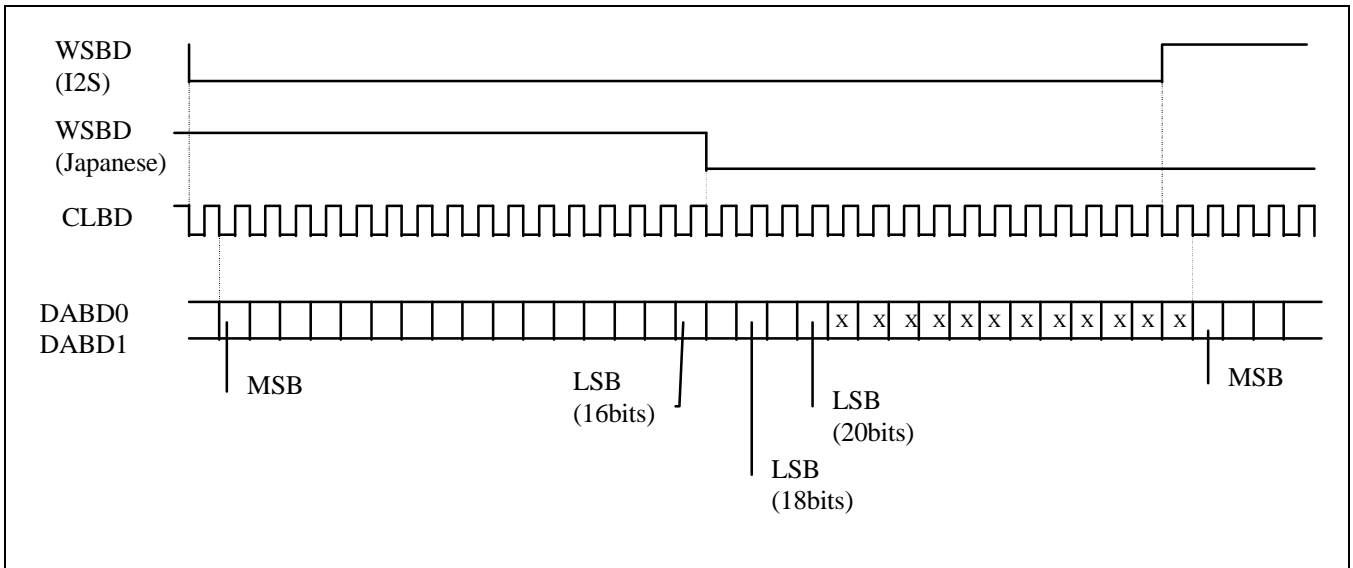
Notes :
- Selection between I2S and Japanese format is through pin DACSEL

6- RESET AND POWER DOWN

During power-up, the RESET/ input should be held low until the crystal oscillator and PLL are stabilized, which can take about 20ms. A typical RC/diode power-up network can be used.
After RESET/, the SAM9793 enters an initialization routine. It will take around 50 ms before a MIDI IN or MPU message can be processed.

If PDWN/ is asserted low, then all I/Os and outputs will be floated, the crystal oscillator and PLL will be stopped. The chip enters a deep power down sleep mode. To exit power down, PDWN/ has to be asserted high, then RESET/ applied.

7- RECOMMENDED BOARD LAYOUT

Like all HCMOS high integration ICs, following simple rules of board layout is mandatory for reliable operations :

• GND, VCC, VC3 distribution, decouplings

All GND, VCC, VC3 pins should be connected. GND + VCC planes are strongly recommended below the SAM9793. The board GND + VCC distribution should be in grid form. For 5V VCC operation, if 3.3V is not available, then VC3 can be connected to VCC by two 1N4148 diodes in series. This guarantees a minimum voltage drop of 1.2V. Recommended VCC decoupling is 0.1µF at each corner of the IC with an additional 10µFT decoupling close to the crystal. VC3 requires a single 0.1 uF decoupling close to the IC.

• Crystal, LFT

The paths between the crystal, the crystal compensation capacitors, the LFT filter R-C-R and the SAM9793 should be short and shielded. The ground return from the compensation capacitors and LFT filter should be the GND plane from SAM9793.

• Analog section

A specific AGND ground plane should be provided, which connects by a single trace to the GND ground. No digital signals should cross the AGND plane. Refer to the Codec vendor recommended layout for correct implementation of the analog section.

8- RECOMMENDED CRYSTAL COMPENSATION AND LFT FILTER
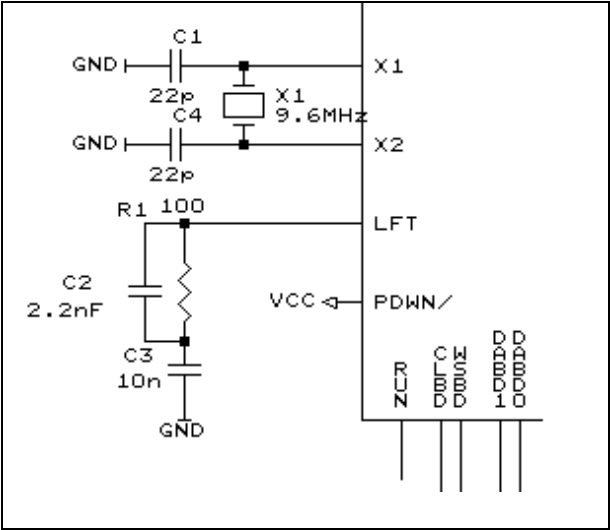
SAM9793 USER'S MANUAL

1- MPU-401 and serial MIDI

The SAM9793 can be controlled both from the parallel MPU-401 interface (D0-D7, CS/, WR/, RD/, INT) and from the serial MIDI interface (MIDI IN).

The MPU-401 Interface consists of two byte registers and one IRQ (interrupt request) line :

I/O address	Write from PC (OUT)	Read to PC (IN)
A0 = 0	DATA8	DATA8
A0 = 1	CONTROL	STATUS

Status Register:

TE	RF	X	X	X	X	X	X

TE : Transmit empty.
    If 0, data from SAM9793 to host is pending and IRQ is high
    Reading the data at A0 = 0 will set TE to 1 and clear IRQ.
RF : Receiver full.
    If 0 then SAM9793 is ready to accept CONTROL or DATA from host.

Stand alone & UART modes

Stand alone mode:
After power-up, hardware reset or MPU reset control, the SAM9793 is in **stand-alone mode**: In this mode, the MPU-401 interface is inactive and the IRQ line is floated. The serial MIDI IN is connected to the synthesis. No signal is sent to serial MIDI OUT.
Stand alone mode accepts two controls :
- 3FH to switch to **UART mode**
  3FH control is acknowledged by receiving 0FEH as DATA8.

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

UART mode:
In UART mode, all data received by serial MIDI IN is sent to the MPU-401 DATA8, all data received in MPU-401 DATA8 is MIDI data sent to the synthesis and serial MIDI OUT
UART mode accepts the standard MPU-401 control :
Control 0FFH (MPU reset) switch back to **stand alone mode**.

Additional non standard controls can be sent to the control port when in UART mode. These additional controls, being independent of the MIDI data flow, allow to easily insert MIDI commands in the middle of a MIDI data flow, thus avoiding MIDI merge type of operations in the host.

WARNING : MIDI OUT is disabled after any control other than 3FH & 3DH . This means that any control sent to the control port should be followed by 3DH control to restore MIDI out.

The following diagram illustrates stand-alone and UART mode :
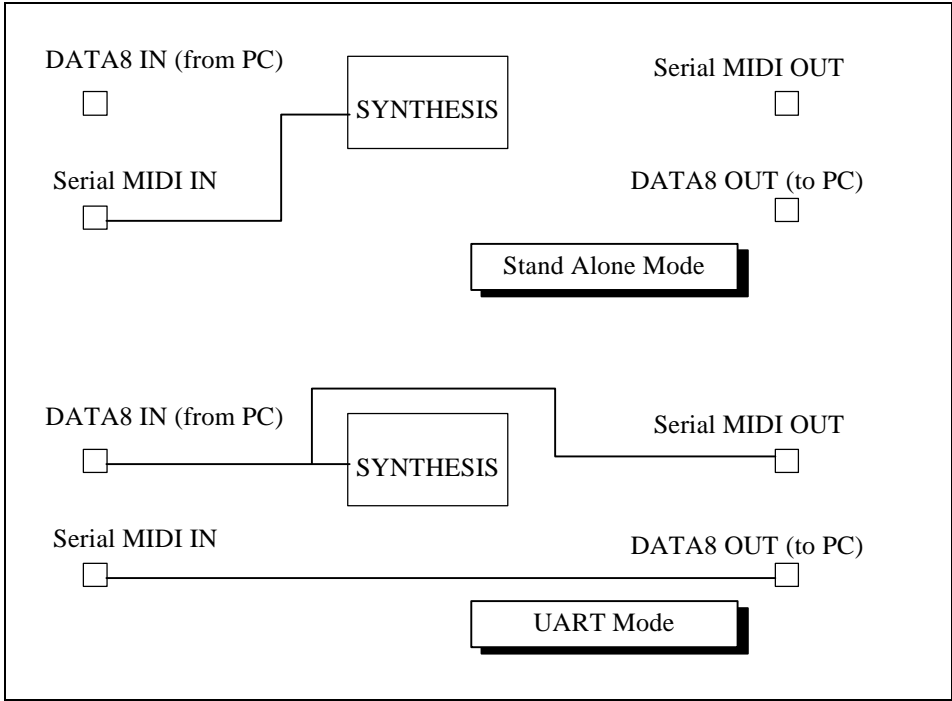
2- CONFIGURATION AND SPECIAL MIDI CONTROLS

2-1 DAC CONFIGURATION

DACSEL	Configuration
GND	IIS format DAC (16 to 22 bits)
VCC	Sony format DAC, 16 bits

2-2 CONFIGURATION NRPN 3755H : OUTPUT MODE SELECT

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

7	6	5	4	3	2	1	0
0	0	0	0	1	OM	0	0

- OM = 0 : Spatializer effect ON. Spatializer parameters can be controlled using NRPN 3720h (volume), 372Ch (delay time), 372Dh (stereo/mono) and 372Eh (2/4 speaker mode) (see paragraph 1.3)

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- OM = 1 : 3DMIDI™ mode, 4 speakers MIDI output . Each MIDI channel can be output to front or rear speakers using NRPN 3800h till 380Fh, reverb and chorus can be routed as well.

NRPN 38xxh = 0h : MIDI channel xxh is front speaker output

NRPN 38xxh = 7Fh : MIDI channel xxh is rear speaker output

NRPN 3810h assign all MIDI channels to front or rear speakers :
NRPN 3810h= 0h : all MIDI channels are front speaker output
NRPN 3810h=07Fh : all MIDI channels are rear speaker output

NRPN 3820h and 3821h control reverb output volume :
NRPN 3820h= 0h to 7Fh : reverb front speaker volume (Default value=07Fh)
NRPN 3821h=0h to 7Fh : reverb rear speaker volume (Default value=0h)

NRPN 3830h and 3831h control chorus output volume :
NRPN 3830h=0h to 7Fh : chorus front speakers volume (Default value=07Fh)
NRPN 3831h=0h to 7Fh : chorus rear speakers volume (Default value=0h)

- Default power-on value : OM = 0 (Spatializer ON)

2-3 SPECIAL MIDI CONTROLS (received on serial MIDI in stand-alone or on MPU-401 data port in UART mode)

NRPN # (High|Low)	Description		Power-up default
3700H	Equalizer Low band (bass)	0=-12dB, 40H=0dB, 7FH=+12dB	60H
3701H	Equalizer Med Low band	0=-12dB, 40H=0dB, 7FH=+12dB	40H
3702H	Equalizer Med High band	0=-12dB, 40H=0dB, 7FH=+12dB	40H
3703H	Equalizer High band (treble)	0=-12dB, 40H=0dB, 7FH=+12dB	60H
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
3713H	Clipping mode select	0=soft clip, 7FH=hard clip	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
3718H	Post effects applied on GM	0= Post effects not applied 7Fh=Post effects applied	7FH
371AH	Post effects applied on Reverb/Chorus	0= Post effects not applied 7Fh=Post effects applied	7FH
3720H	Spatializer effect volume	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
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	
3755H	Effects on/off	See paragraph 1-2 above	
3757H	System Exclusive Device ID	0 to 1Fh, 20h=all accepted	20H
380xH	3DMIDI™ control, x = MIDI channel	0= output channel to front speakers	00H

		7FH= output channel to rear speakers		
3810H	3DMIDI™ global control	0= output all channels to front speakers 7FH= output all channels to rear speakers		00H
3820H	3DMIDI™ reverb volume front speakers	0 to 7FH		7FH
3821H	3DMIDI™ reverb volume rear speakers	0 to 7FH		00H
3830H	3DMIDI™ chorus volume front speakers	0 to 7FH		7FH
3831H	3DMIDI™ chorus volume rear speakers	0 to 7FH		00H

1-4- CONTROLS (received on MPU-401 control port)

Controls can are normally sent in UART mode. Individual controls can also be sent in stand-alone mode if preceeded by control 0BEH.

CONTROL MESSAGES OVERVIEW

A control message consists of one CONTROL byte followed by one DATA8 byte (parameter), followed by a CONTROL 3DH to enable MIDI OUT.

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
25H	GMREV_SEND	General MIDI Reverb Send	Nrpn 3715h
26H	GMCHR_SEND	General MIDI Chorus Send	Nrpn 3716h
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
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 (1)	Nrpn 3718h
66h	EFF_POST	Post effects applied on Reverb-chorus (1)	Nrpn 371Ah
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
6CH	REV_ONOFF	Reverb On/Off	Nrpn 3755h
6DH	CHR_ONOFF	Chorus On/Off	Nrpn 3755h
6EH	SUR_ONOFF	Spatializer On/Off	Nrpn 3755h
6FH	AUD_ONOFF	Mike/Aux On/Off	Nrpn 3756h
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
7Eh	CLIP_MODE	Clipping mode	Nrpn 3713h
BEH	EN_CONTROL	Enable dream control in stand alone mode	
FFh	RESET	Reset UART mode	

Notes:
(1) Post effects are spatializer + equalizer

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 allows to send only one control, which means that each control sent in stand alone mode should start with EN_CONTROL control.
- RESET:
Switch SAM9793 in stand alone mode
- UART_MODE:
Switch SAM9793 in UART mode

CONFIG MESSAGES

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
6EH	SUR_ONOFF	-Data (byte 0/7Fh,7Fh)	Spatializer On/Off	

- SUR_ONOFF :
    40H   MIDI 4 speaker output mode
    7FH (Default)   spatializer effect on

1) SUR_ONOFF=7FH : In this mode, Left channel -Right channel signal (or Left channel +Right channel) goes through a delay line and is output on front or rear speakers.

SUR_INP (control 32h) selects Left -Right or Left+Right mode
SUR_DEL (control 31h) selects delay time
SUR_24 (control 33h) selects output on front or rear speakers

3) SUR_ONOFF=40H : 3DMIDI™, any MIDI channels can be output to front or rear speakers. Reverb and chorus can be simultaneously output on front and rear.

Nrpn 3800h, 3801h ... till 380Fh assign MIDI channels 0, 1 ... till 0Fh to front or rear
   nrpn 38xxh = 0h : MIDI channel xxh is front speaker output
   nrpn 38xxh = 7Fh : MIDI channel xxh is rear speaker output
Nrpn 3810h assign all MIDI channels to front or rear speakers :
   nrpn 3810h= 0h : all MIDI channels are front speaker output

nrpn 3810h=07Fh : all MIDI channels are rear speaker output
Nrpn 3820h and 3821h control reverb output volume :
   nrpn 3820h= 0h to 7Fh : reverb front speaker volume (Default value=07Fh)
   nrpn 3821h=0h to 7Fh : reverb rear speaker volume (Default value=0h)
Nrpn 3830h and 3831h control chorus output volume :
   nrpn 3830h=0h to 7Fh : chorus front speaker volume (Default value=07Fh)
   nrpn 3831h=0h to 7Fh : chorus rear speaker volume (Default value=0h)

SPATIALIZER DEVICE

Spatializer must be set ON for using these 4 controls. Send SUR_ONOFF (control 6Eh)=07Fh.

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,1Dh)	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 time
     Default=1Dh
- 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 front speakers
     7FH   4 speakers   Spatializer output on rear speakers

ROUTING MESSAGES

Ctrl #	CONTROL NAME	Parameters (Data)	Action	Answer
62h	GM_POST	-Data(byte 0/7Fh,7Fh)	Post effects applied on general MIDI	
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

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 MPU port.

- 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

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 control 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

dream

SAM9793

3- DETAILED MIDI IMPLEMENTATION

MIDI messages are received by the built-in wavetable synthesizer from :
- Serial MIDI IN port in stand-alone mode (MPU UART mode = OFF)
- Parallel data port (MPU UART mode = ON)

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.	GS
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).	GS
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	BnN 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 §1-3- above)	DREAM
NRPN 38xxH	BnH 63H 38H 62H xx 06H vv	3DMIDI™ control (See §1-3- above)	DREAM
Standard Sysex	F0H 7EH 7FH 09H 01H F7H	General MIDI reset	GM
Standard Sysex	F0H 7FH 7FH 04H 01H 00H ll F7H	Master volume (ll=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 40 01H 10H vv1 vv2 vv3 vv4 vv5 vv6 vv7 vv8 vv9 vv10 vv11 vv12 vv13 vv14 vv15 vv16 xx F7h	Voice reserve : vv1= Part 10 (Default vv=2) vv2 to vv10 = Part 1 to 9 (Default vv=2) vv11 to vv16= Part 11 to 16 (Default vv=0)	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.	GS

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		Default assignment : part 0 plays drums (default MIDI channel 9) all other parts play sound.	
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 »

dream

4- SOUNDS

4-1- 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

4-2- MT-32 SOUND VARIATION #127
(all channels except 10)

To select variation : send CTRL 0 = 127, <u>then</u> PC
PC : Program change
C0 : controller 0 value (zero for General MIDI capital sounds)

PC#	Instrument name	PC#	Instrument name	PC#	Instrument name	PC#	Instrument name
1	Piano 1	2	Piano 2	3	Piano 3	4	Detuned EP 1
5	E.Piano1	6	E.Piano2	7	Detuned EP2	8	Honky-Tonk
9	Organ 1	10	Organ 2	11	Organ 3	12	Detuned Or. 1
13	Church Org. 2	14	Church Org.	15	Church Org.	16	Accordion Fr.
17	Harpsichord	18	Coupled Hps.	19	Coupled Hps.	20	Clav.
21	Clav.	22	Clav.	23	Celesta	24	Celesta
25	Synth Brass1	26	Synth Brass2	27	Synth Brass3	28	Synth Brass4
29	Synth Bass1	30	Synth Bass2	31	Synth Bass3	32	Synth Bass4
33	Fantasia	34	Syn Calliope	35	Choir Aahs	36	Bowed Glass
37	Soundtrack	38	Atmosphere	39	Crystal	40	Bag Pipe
41	Tinkle Bell	42	Ice Rain	43	Oboe	44	Pan Flute
45	Saw Wave	46	Charang	47	Tubular Bells	48	Square Wave
49	Strings	50	Tremolo Str.	51	Slow Strings	52	Pizzicato Str.
53	Violin	54	Viola	55	Cello	56	Cello
57	Contrabass	58	Harp	59	Harp	60	Nylon-str. Gt
61	Steel-Str. Gt	62	Chorus Gt.	63	Funk Gt.	64	Sitar
65	Acoustic Bs.	66	Fingered Bs.	67	Picked Bs.	68	Fretless Bs.
69	Slap Bs. 1	70	Slap Bs. 2	71	Fretless Bs.	72	Fretless Bs.
73	Flute	74	Flute	75	Piccolo	76	Piccolo
77	Recorder	78	Pan Flute	79	Soprano Sax	80	Alto Sax
81	Tenor Sax	82	Baritone Sax	83	Clarinet	84	Clarinet
85	Oboe	86	English Horn	87	Bassoon	88	Harmonica
89	Trumped	90	Muted Trumpet	91	Trombone	92	Trombone
93	French Horn	94	French Horn	95	Tuba	96	Brass
97	Brass 2	98	Vibraphone	99	Vibraphone	100	Kalimba
101	Tinkle Bell	102	Glockenspiel	103	Tubular-Bell	104	Xylophone
105	Marimba	106	Koto	107	Taisho Koto	108	Shakuhachi
109	Whistle	110	Whistle	111	Bottle Blow	112	Pan Flute
113	Timpani	114	Melo Tom	115	Concert BD	116	Synth Drum
117	Melo Tom	118	Taiko	119	Taiko	120	Reverse Cym.
121	Castanets	122	Tinkle Bell	123	Orchestra Hit	124	Telephone
125	Bird	126	Helicopter	127	Bowed Glass	128	Ice Rain

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4-3- DRUM SET TABLE (MIDI CHANNEL 10)

	Prog 1 : STANDARD SET	Prog 17 : POWER SET	Prog 41 : BRUSH	Prog 49 : ORCHESTRA	Prog 127: CM -64/32 (Partial)
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	Kick drum2		Jazz BD 2		Kick drum
36 - C2	Kick drum1		Jazz BD 1		Kick drum
37 - C#2	Side Stick				Rim Shot
38 - D2	Snare Drum 1	Gated Snare	Brush Tap	Snare Drum 2	Snare Drum
39 - D#2	Hand Clap		Brush Slap	Castanets	Hand Clap
40 - E2	Snare Drum 2		Brush Swirl	Snare Drum 2	Elec Snare Drum
41 - F2	Low Floor Tom			Timpani F	Acoustic Low Tom
42 - F#2	Closed Hi Hat [EXC1]			Timpani F#	Closed Hi-Hat [Exc1]
43 - G2	High Floor Tom			Timpani G	Acoustic Low Tom
44 - G#2	Pedal Hi-Hat [EXC1]			Timpani G#	Open Hi-Hat 2
45 - A2	Low Tom			Timpani A	Acoustic Middle Tom
46 - A#2	Open Hi-Hat [EXC1]			Timpani A#	Open Hi-Hat 1 [Exc1]
47 - B2	Low-Mid Tom			Timpani B	Acoustic Middle Tom
48 - C3	Hi Mid Tom			Timpani c	Acoustic High Tom
49 - C#3	Crash Cymbal 1			Timpani c#	Crash Cymbal
50 - D3	High Tom			Timpani d	Acoustic High Tom
51 - D#3	Ride Cymbal 1			Timpani d#	Ride Cymbal
52 - E3	Chinese Cymbal			Timpani e	*
53 - F3	Ride Bell			Timpani f	*
54 - F#3	Tambourine				Tambourine
55 - G3	Splash Cymbal				*
56 - G#3	Cowbell				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				
63 - D#4	Open Hi Conga				
64 - E4	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				
71 - B4	Short Whistle[EXC2]				
72 - C5	Long Whistle[EXC2]				
73 - C#5	Short Guiro [EXC3]				Vibra Slap
74 - D5	Long Guiro [EXC3]				*
75 - D#5	Claves				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					Applauses
83 - B5					*
84 - C6					*
85 - C#6					*
86 - D6					*
87 - D#6					*
88 - E6				Applauses	*
89 - F6					*

90 - f#6					*
91 - G6					*
92 - G#6					*
93 - A6					*
94 - A#6					Helicopter
95 - B6					*
96 - C7					Gun Shot
97 - C#7					*
98 - D7					*
99 - D#7					*
100 - E7					*
101 - F7					*
102 - F#7					Birds
103 - G7					*
104 - g#7					*
105 - A7					*
106 - A#7					SeaShore

Notes :
*:   No sound   Blank : Same sound as "Standard Set"
[EXC] : Sounds with same EXC number are mutually exclusive

5- AUTO-TEST

A 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
On chip RAM	1.18 kHz
On chip ROM	876 Hz
PASS	295 Hz

If PASS frequency is detected, this means that part is OK.

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APPENDIX

INSTRUMENTS REQUIRING 2 VOICES (2 LAYER INSTRUMENT).

PC	Name
4	Honky-tonk Piano
19	Rock Organ
22	Accordion (french)
24	Tango Accordion
40	Synth Bass 2
52	Synth Strings 2
56	Orchestra Hit
61	French Horn
63	Synth Brass 1
64	Synth Brass 2
81	Lead 1 (square wave)
82	Lead 2 (saw wave)
83	Lead 3 (calliope)
84	Lead 4 (chiff)
85	Lead 5 (charang)
86	Lead 6 (voice)
87	Lead 7 (fifths)
88	Lead8 (bass+lead)
89	Pad 1 (new age)
91	Pad 3 (polysynth)
93	Pad 5 (bowed)
94	Pad 6 (metallic)
95	Pad 7 (halo)
97	FX 1 (rain)
98	FX 2 (soundtrack)
99	FX 3 (crystal)
100	FX4 (atmosphere)
101	FX 5 (brightness)
102	FX 6 (goblins)
104	FX 8 (sci-fi)
123	Seashore
124	Bird
127	Applause

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