1. General Description

The QS1532 is a high quality PCM synthesizer LSI for General MIDI Sound Modules comparable to Roland's SC-xx series.
Its playback capability is provided by an internal MIDI handler that supports the full GS spec.
Equipped with the HWASS QPCM synthesizer, the QS1532 is capable of generating up to 48 polyphonics at various sample rates, and can also apply effects.
Two kinds of special effects are supported to improve the liveness and reality of the sound, known as Reverb and Chorus in the General MIDI specification.
The QS1532 contains a delay memory of 32k words to implement these features, along with a 32Mbit sound font for GS.

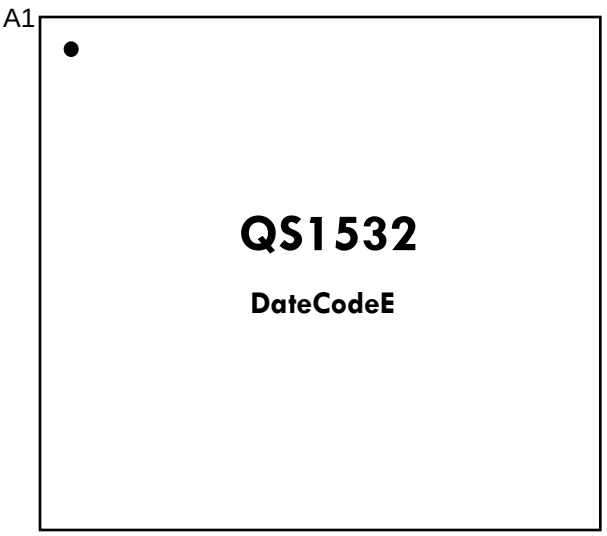
MIDI data is received from the host via MIDI_IN, and are interpreted simultaneously with MIDI messages by the MIDI handler.
Most of control parameters can be adjusted real time during the synthesis of the musical notes according to the GS specification.
The QS1532 is the best solution to put at the heart of your designs for digital pianos, karaoke machines, electric keyboards, and all other sorts of digital musical instruments.

2. Features

- Up to 48 voices generated at 46.875 Khz
- Built in MIDI handler
- Supports Serial and Parallel interface for MIDI
- 4bit and 8bit ADPCM and 16bit PCM decoder
- Fully Supports GS specification
- Support for SPDIF digital out
- Various sampling rate of 8 ~ 44.1Khz
- Supports 16bit/18bit CODAC I/F
- Full support for reverb and chorus function
- 3-Band Digital EQ
- Low power operation voltage 2.7V ~ 3.3V
- Super slim package 81 Ball BGA (8 X 8mm)
- Internal PLL for generating low frequency main clock to prevent EMI : 6 Mhz
- Built in 32M Sound Font ROM (MCP Stack)
- Low power consumption of under 50uA in power down mode
- Application
  - High Quality Karaoke Machine
  - High Performance Digital Piano
  - Effect Module
  - Arcade Game Machine for BGM(Back groud music)
  - Electric Keyboard

3. Pin Rotation and Description

3- 1 Pin Rotation



Package 81P CABGA

8 X 8mm Ball Pitch = 0.8mm

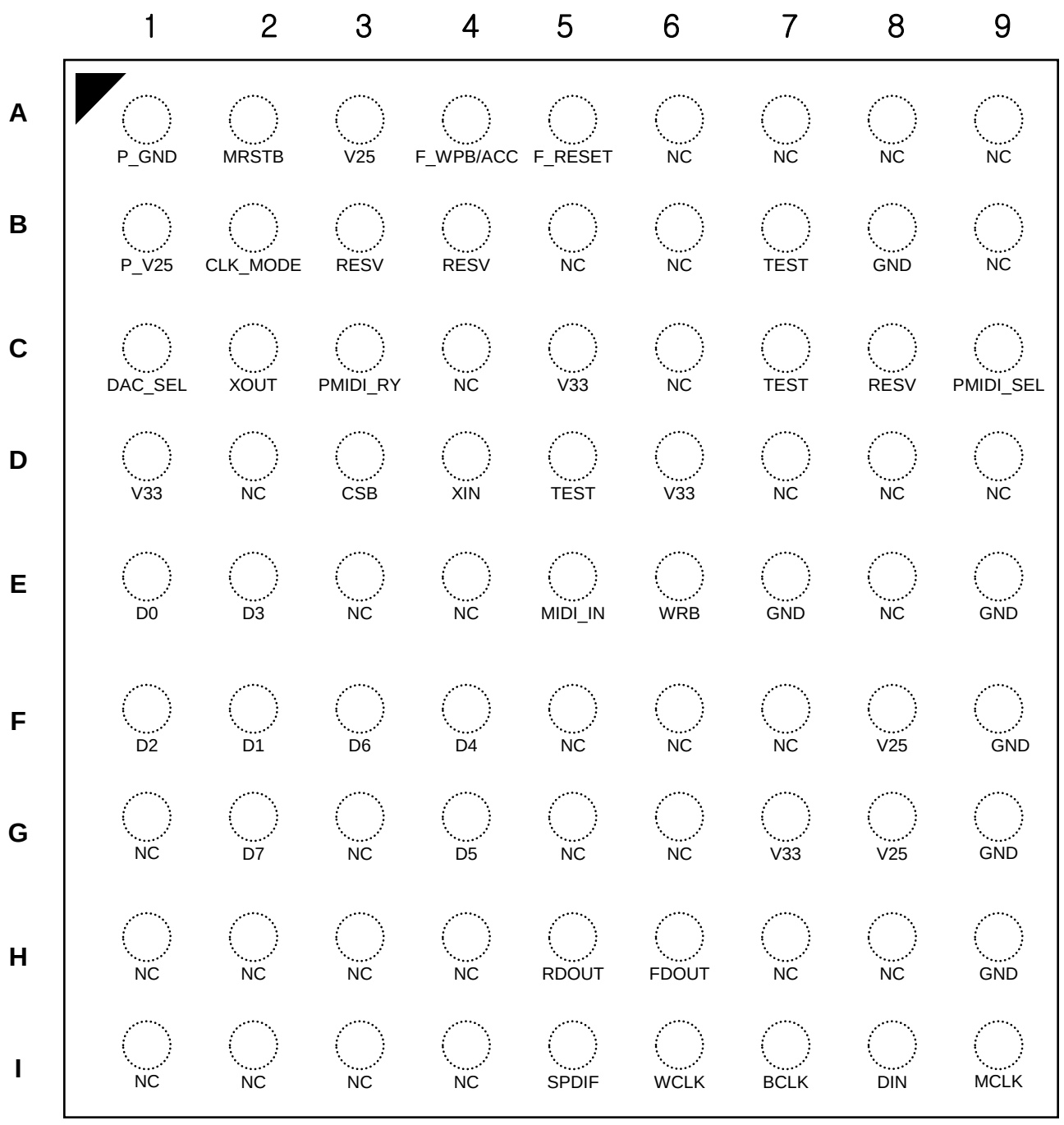
Ball diameter = 0.4mm

3- 2 Pin Description

PAD NAME	PAD Position	I/O	DESCRIPTION
P_GND	A1	P	Internal PLL Analog Ground
F_WPB/ACC	A4	I	NOR FLASH ACC pin(keep this pin 'L' level)
F_RESET	A5	I	Internal NOR FLASH RESET (must be connect to "RESETB(A2))
P_V25	B1	P	Internal PLL Analog Power 2.5V
CLK_MODE	B2	I	2X Clock Select This pin is used to assign a clock source between 2x and PLL mode. if this pin input low level PLL mode be selected. In this mode, XIN is required 6Mhz.
RESETB	A2	I	Master Reset Operates on active Low.
V33	C5,D1 D6,G7	P	Power 3.3V
PMIDI_RY	C3	O	Parallel MIDI Ready The parallel midi data input is valid at 'H' level. This pin output 'L' When midi data is captures to inside.
DAC_SEL	C1	I	DAC Data Width Select 18bit dac at ' L' level and 16bit dac at 'H' level .

PAD NAME	PAD Position	I/O	DESCRIPTION
XOUT	C2	I	The inverting output of XIN
XIN	D4	I	Crystal Input (when internal PLL is selected. XIN is 6Mhz)
V25	A3,F8,G8	P	Power 2.5V
D[0]	E1	I	Parallel MIDI data input[0] for MIDI
D[1]	F2	I	Parallel MIDI data input[1] for MIDI
D[2]	F1	I	Parallel MIDI data input[2] for MIDI
D[3]	E2	I	Parallel MIDI data input[3] for MIDI
D[4]	F4	I	Parallel MIDI data input[4] for MIDI
D[5]	G4	I	Parallel MIDI data input[5] for MIDI
D[6]	F3	I	Parallel MIDI data input[6] for MIDI
D[7]	G2	I	Parallel MIDI data input[7] for MIDI
WRB	E6	I	Parallel MIDI Write Strobe
TEST	D5	I	Test pin for device (keep this pin at "H" level with pull-up resister of 10k ohms)
RESV	B3	I	Reserved for test(keep these pins at "L" level)
RESV	B4	I	
MIDI_IN	E5	I	MIDI Data Input FOR Single wire (31.25K bps)
RESV	C8	O	Reserved for test(keep this pin open)
CSB	D3	I	QS1532H2 Chip Select . Data can be Written when input at 'L' level.
MCLK	I9	O	Serial Data System Clock out for CODAC.
DIN	I8	I	Serial Data Input
SPDIF	I5	O	SPDIF Output
RDOUT	H5	O	Rear Serial Data Output
FDOUT	H6	O	Front Serial Data Output
BCLK	I7	O	Serial Data Bit Clock
WCLK	I6	O	Serial Data Sample Rate Clock
PMIDI_SEL	C9	I	Parallel MIDI selection Serial MIDI interface at 'L' level Parallel MIDI interface at 'H'level
GND	B8,E7,E9F9 G9,H9	P	Ground
Test	C7	I	Test pin for device (keep this pin at "H" level with pull-up resister of 10k ohms)
Test	B7	I	

3- 3. Pin out

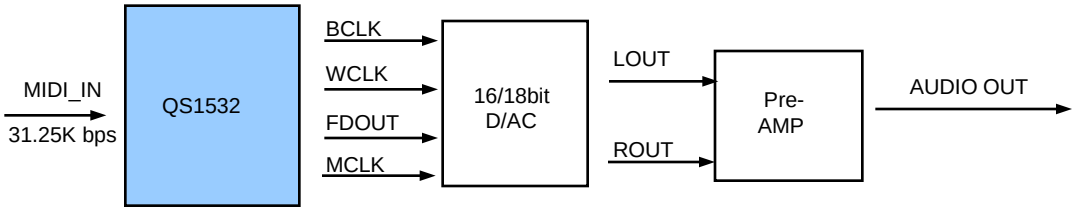


TOP VIEW

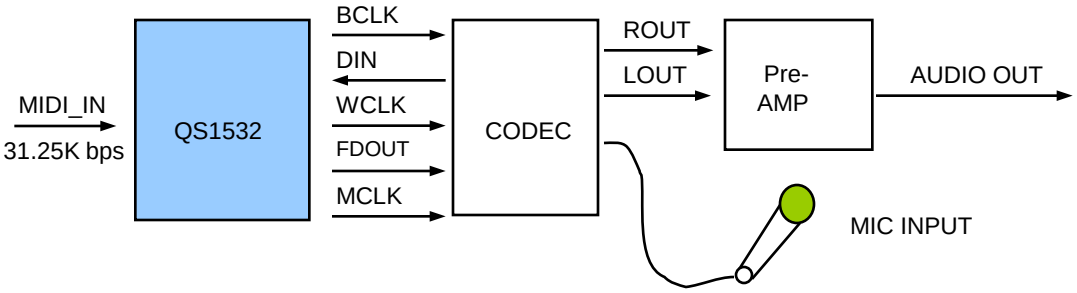
4. Application

4-1. Typical Hardware Configuration

< Usage with DAC Interface >



< Usage with CODEC Interface >



4-2. Recommended parallel interface

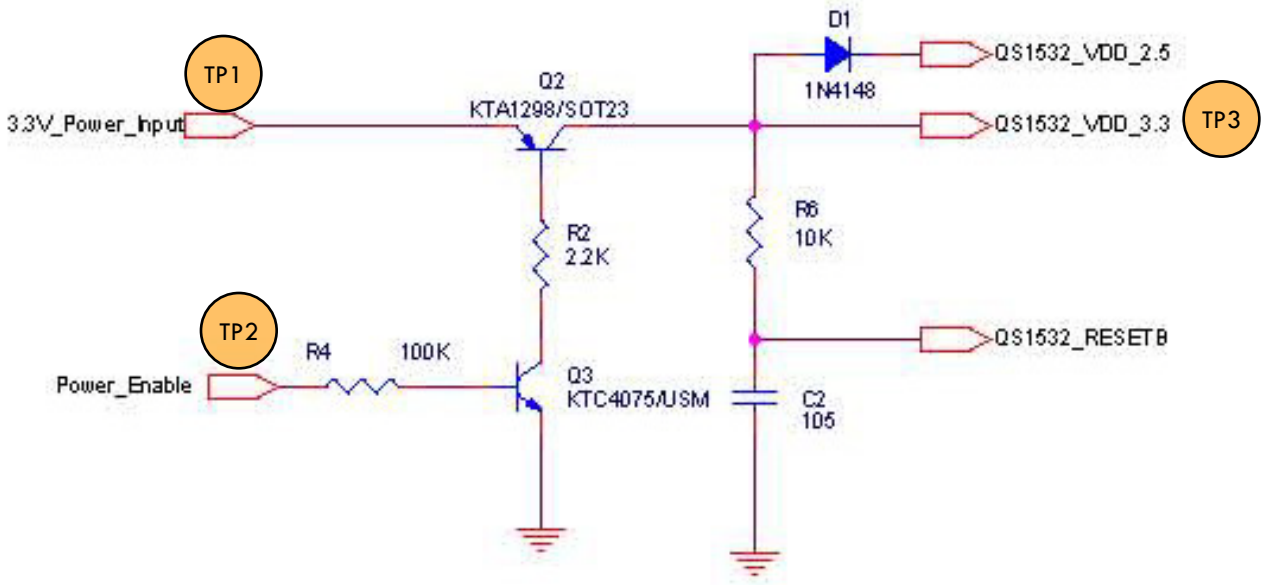
When selecting the parallel interface, the I/O pins CSB,WR,D7 to D0 are used as inputs to input midi data and the PMIDI_RY are used as output to read the status of midi buffer in QS1532.
The parallel inferface becomes effective when the PMIDI_RY output at 'H' level. As this reason, The external micom should have to check it before a midi data is written.

If the external micom couldn't check its pin. the **T**wi(write pulse interval)time must have to longer than 40us to prevent midi buffer overlap. For the detail information refer to "5-1. AC/DC Characteristics"

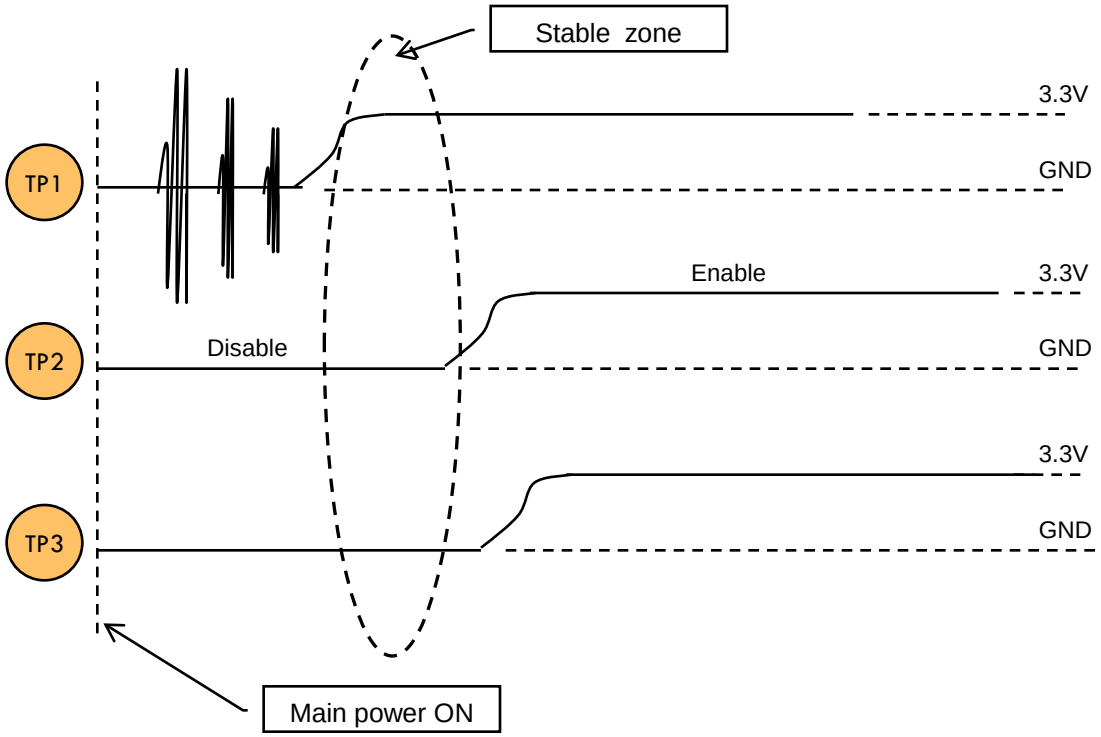
4-3. Recommented Power circuit for QS1532

For prevent unstable reset from power niose, The bypass capacitor of 0.1uF should be placed on as near as possible by QS1532. But the best solution to prevent it is that power of QS1532 supply after set on stable.
(Please refer to "Fig 1 Recommended power circuit" as next page)

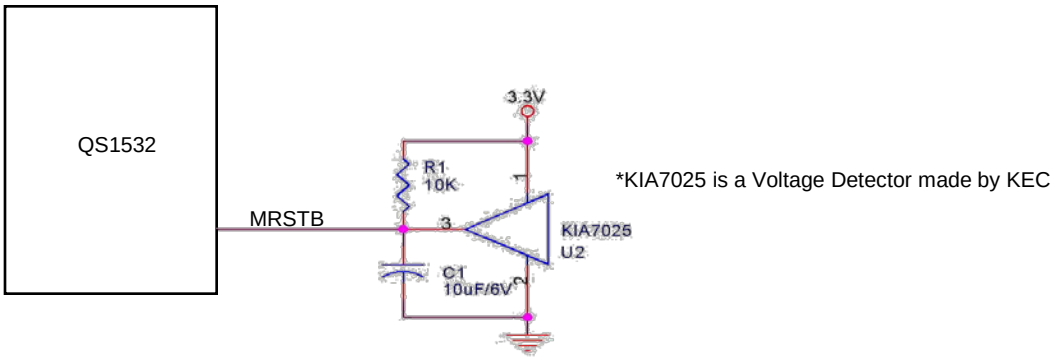
< Fig 1. Recommended power circuit for QS1532>



< Fig 2. Timing diagram >

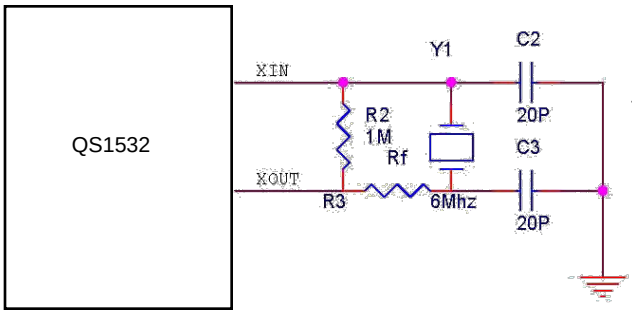


4-3. Recommended System Reset Circuit



*KIA7025 is a Voltage Detector made by KEC

4-4. Recommended System Main Clock



*Y1 = 6Mhz Crystal

Rf = 47 Ohms

5. Electrical Characteristics

5-1. AC/DC Characteristics

Absolute Maximum range

ITEMS	Symbol	Min	Max	Unit
V33 terminal power supply voltage	**V**AIO	VDD-0.3	3.6	V
V25 terminal power supply voltage	**V**ACO	2	2.7	V
Operating ambient temperature	**T**AOP	-20	85	˚C
Carrier temperature	**T**ACA	-50	125	˚C

Recommended operating condition

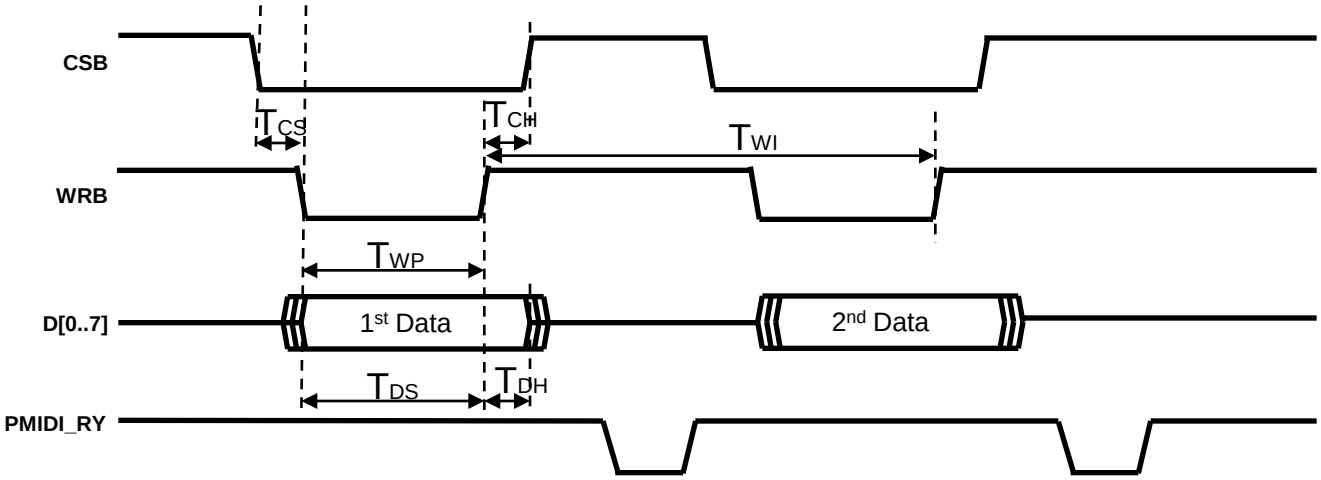
ITEMS	Symbol	Min	Typ	Max	Unit
V33 terminal power supply voltage	**V**RIO	2.7	3.0	3.3	V
V25 terminal power supply voltage	**V**RCO	-	2.5	-	V
Operating ambient temperature	**T**ROP	0		70	˚C

DC Characteristics

ITEMS	Symbol	Min	Typ	Max	Unit
INPUT Voltage “H” Level	**V**IH	V33*0.7		3.6V	V
INPUT Voltage “L” Level	**V**IL			V33*0.2	V
OUTPUT Voltage “H” Level	**V**OH	V33*0.8			V
OUTPUT Voltage “L” Level	**V**OL			0.4	V
Schmitt Width	**V**SH	2		2.7	V
Input Leakage current	**I**L		1		uA
Input capacity	**C**I			10	pF

AC Characteristics

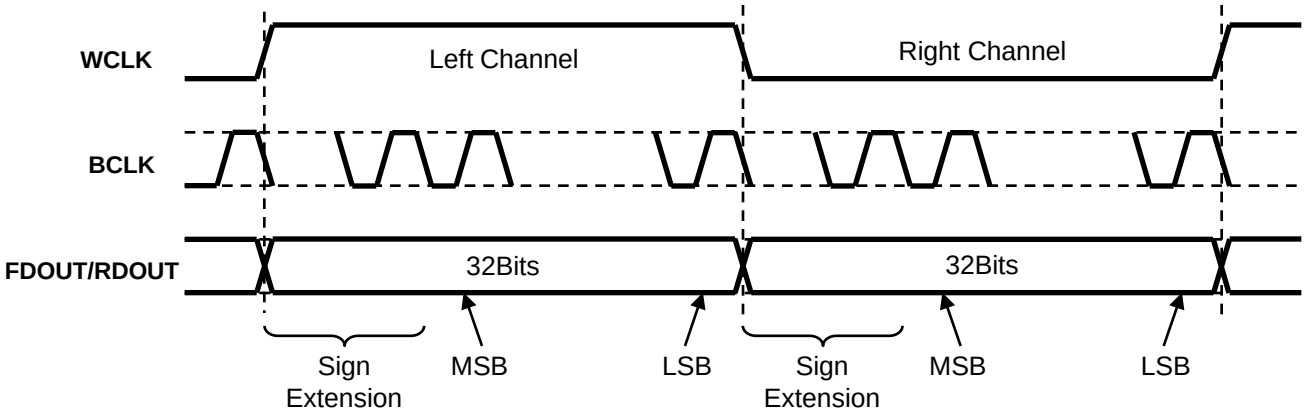
(1) Parallel MIDI Interface Timing



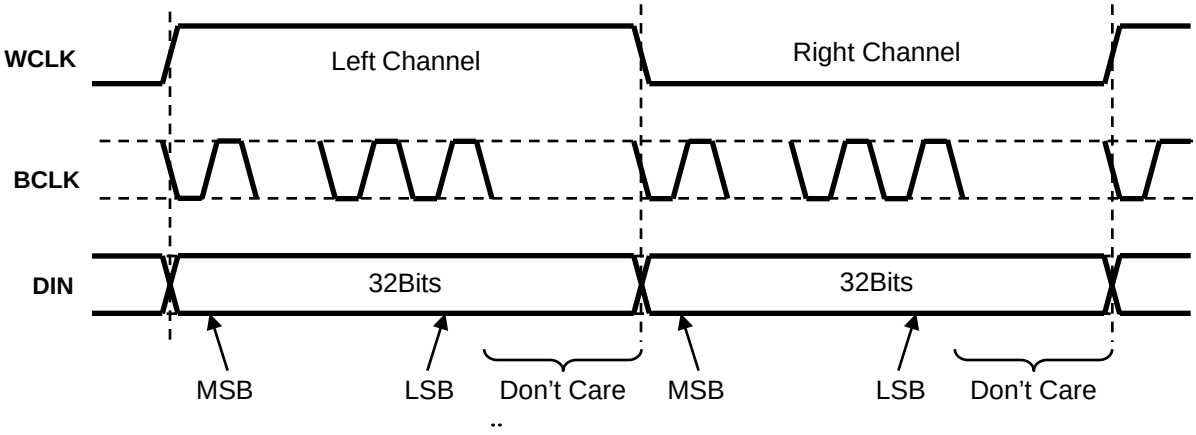
ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Chip Enable Setup Time	**T**CS	0			ns
Chip Enable Hold Time	**T**CH	0			ns
Write Pulse interval	**T**WI	40			μs
Write Pulse Width	**T**WP	25			ns
Data Setup Time	**T**DS	25			ns
Data Hold Time	**T**DH	5			ns

(2) CODEC Interface Timing

- DAC Interface –



- ADC Interface –



ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Left/Right Clock Input	WCLK		46.875		KHz
Bit Clock Input	BCLK		3		MHz

5-2. Power Consumption

ITEMS	Symbol	Min	Max	Unit
V33 section with V33_IO	**ICC**IO		6.5	mA
V25 section with V25_CORE	**ICC**CO		65	mA
Power Down Mode	**ICC**PD		50	uA

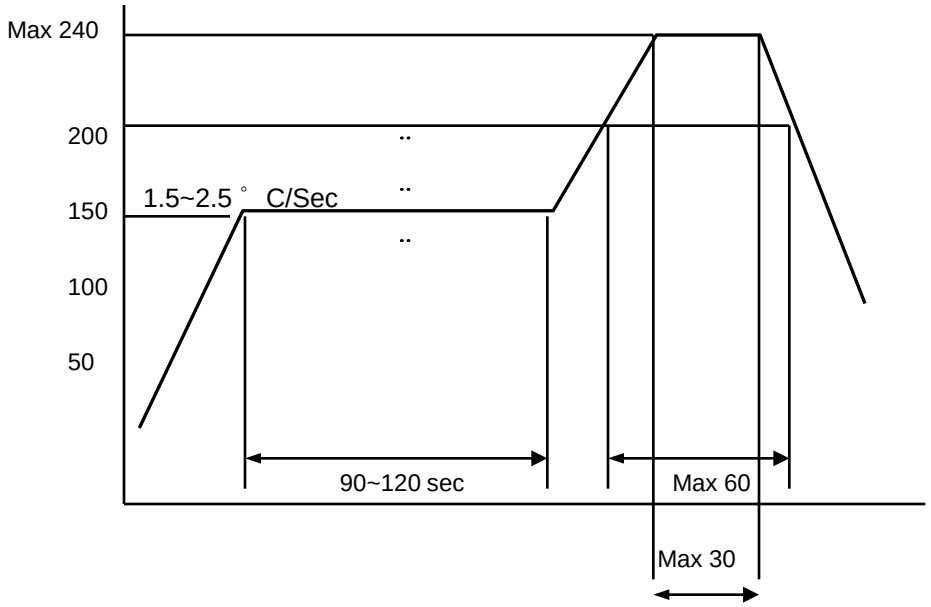
When V33=3.3V V25=2.5V

5-3. Soldering Condition

5-3-1. Soldering Temperature

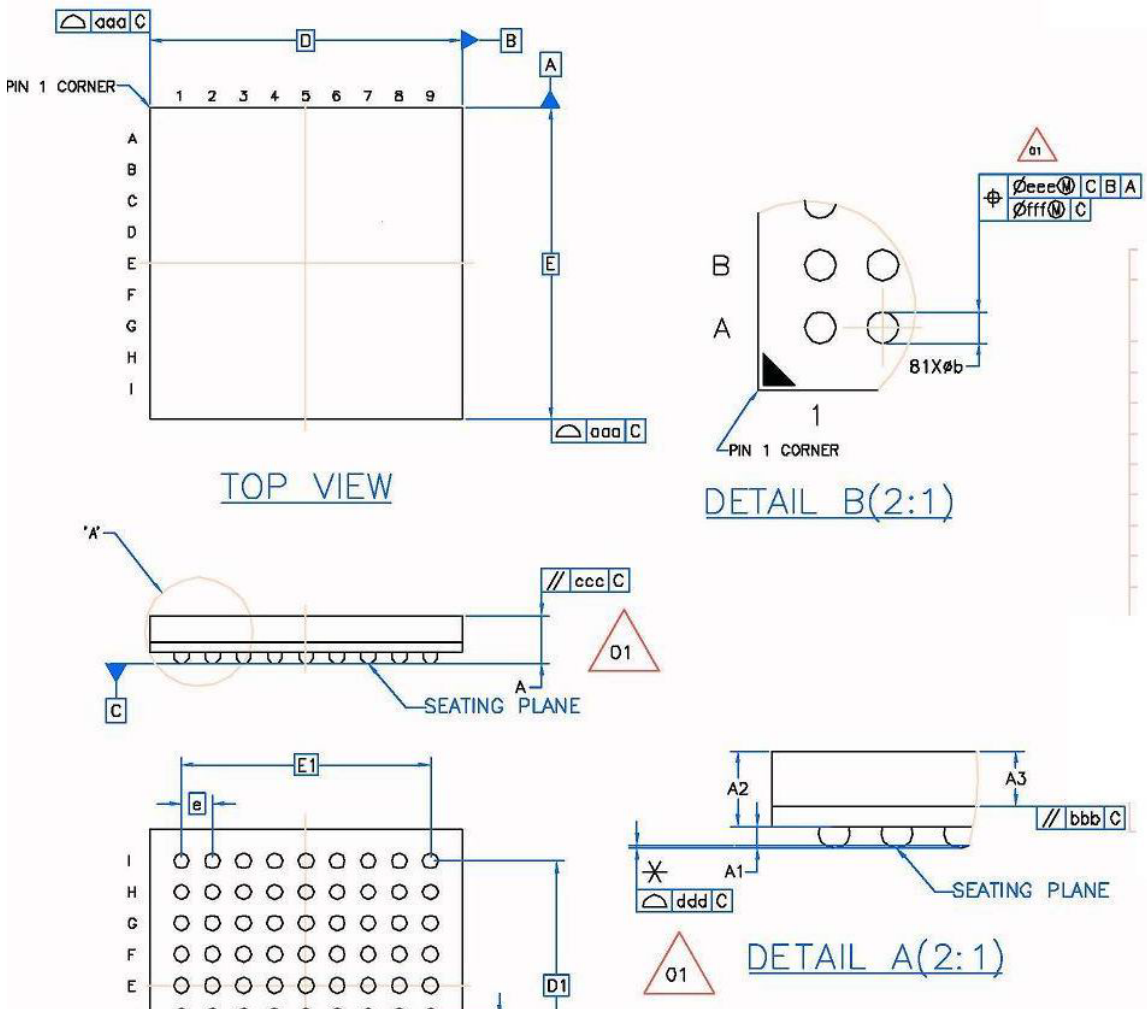
ITEMS	Symbol	Min	TYP	Max	Unit
Soldering Temperature	**T**SOL	-5	240	+5	˚C

5-3-2. Recommended Reflow Profile



6. Physical Dimensions

- Package Out Dimensions -



01

BOTTOM VIEW

SYM BOL	MILLIMETER			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
aaa		0.10			0.0039	
bbb		0.20			0.0079	
ccc		0.20			0.0079	
ddd		0.12			0.0047	
eee		0.15			0.0059	
fff		0.08			0.0031	

ALL DIMENSIONS ARE IN MILLIMETERS

SYM BOL	MILLIMETER			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.34	---	---	0.0528
A1	0.22	0.28	0.34	0.0087	0.0110	0.0134
A2	0.92	0.96	1.00	0.0362	0.0378	0.0394
A3		0.70 BASIC			0.0276 BASIC	
D	7.90	8.00	8.10	0.3110	0.3150	0.3189
D1		6.40 BASIC			0.2520 BASIC	
E	7.90	8.00	8.10	0.3110	0.3150	0.3189
E1		6.40 BASIC			0.2520 BASIC	
e		0.80 BASIC			0.0315 BASIC	
b	0.35	0.40	0.45	0.0138	0.0157	0.0177

A. APPENDIX

A-1. GM SOUND MAP

A-1-1. GM 128 SOUND

	PC#	CC0	Instrument Name		PC#	CC0	Instrument Name
Piano	1	0	Acoustic Grand Piano	Guitar	27	0	Jazz Guitar
		8	Wet Acoustic Grand			8	Hawaiian Guitar
		16	Dry Acoustic Grand		28	0	Clean Electric Guitar
	2	0	Bright Acoustic Piano			8	Chorus Guitar
		8	Wet Bright Acoustic		29	0	Muted Electric Guitar
	3	0	Electric Grand Piano			8	Funk Guitar
		8	Wet Electric Grand			16	Funk Guitar 2
	4	0	Honky-tonk Piano		30	0	Overdriven Guitar
		8	Wet Honky-tonk		31	0	Distortion Guitar
	5	0	Rhodes Piano			8	Feedback Guitar
		8	Detuned Electric Piano 1		32	0	Guitar Harmonics
		16	Electric Piano 1 Variation			8	Guitar Feedback
		24	60's Electric Piano	Bass	33	0	Acoustic Bass
	6	0	Chorused Electric Piano		34	0	Fingered Bass
		8	Detuned Electric Piano 2		35	0	Picked Bass
		16	Electric Piano 2 Variation		36	0	Fretless Bass
	7	0	Harpsichord		37	0	Slap Bass 1
		8	Coupled Harpsichord		38	0	Slap Bass 2
		16	Wet Harpsichord		39	0	Synth Bass 1
		24	Open Harpsichord			1	Synth Bass 101
	8	0	Clavinet			8	Synth Bass 3
Chromatic Percussion	9	0	Celesta		40	0	Synth Bass 2
	10	0	Glockenspiel			8	Synth Bass 4
	11	0	Music Box			16	Rubber Bass
	12	0	Vibraphone	Orchestra Solo	41	0	Violin
		8	Wet Vibraphone			8	Slow Violin
	13	0	Marimba		42	0	Viola
		8	Wet Marimba		43	0	Cello
	14	0	Xylophone		44	0	Contrabass
	15	0	Tubular-bell		45	0	Tremolo Strings
		8	Church Bell		46	0	Pizzicato Strings
		9	Carillon		47	0	Harp
	16	0	Santur		48	0	Timpani
Organ	17	0	Hammond Organ	Orchestra Ensemble	49	0	String Ensemble
		8	Detuned Organ 1			8	Orchestra Strings
		16	60's Organ 1		50	0	Slow String Ensemble
		32	Organ 4		51	0	Synth Strings 1
	18	0	Percussive Organ			8	Synth Strings 3
		8	Detuned Organ 2		52	0	Synth Strings 2
		32	Organ 5		53	0	Choir Aahs
	19	0	Rock Organ			32	Choir Aahs 2
	20	0	Church Organ 1		54	0	Voice Oohs
		8	Church Organ 2		55	0	Synth Voice
		16	Church Organ 3		56	0	Orchestra Hit
	21	0	Reed Organ	Brass	57	0	Trumpet
	22	0	French Accordion		58	0	Trombone
		8	Italian Accordion			1	Trombone 2
	23	0	Harmonica		59	0	Tuba
	24	0	Bandoneon		60	0	Muted Trumpet
Guitar	25	0	Nylon-String Guitar		61	0	French Horns
		8	Ukulele			1	French Horn 2
		16	Open Nylon Guitar		62	0	Brass Section 1
		32	Nylon Guitar 2			8	Brass Section 2
	26	0	Steel-String Guitar		63	0	Synth Brass 1
		8	12-String Guitar			8	Synth Brass 3
		16	Mandolin			16	Analog Brass 1

	PC#	CC0	Instrument Name
Brass	64	0	Synth Brass 2
		8	Synth Brass 4
		16	Analog Brass 2
Reed	65	0	Soprano Sax
	66	0	Alto Sax
	67	0	Tenor Sax
	68	0	Baritone Sax
	69	0	Oboe
	70	0	English Horn
	71	0	Bassoon
	72	0	Clarinet
Pipe	73	0	Piccolo
	74	0	Flute
	75	0	Recorder
	76	0	Pan Flute
	77	0	Bottle Blow
	78	0	Shakuhachi
	79	0	Whistle
	80	0	Ocarina
Synth Lead	81	0	Square Lead
		1	Square Wave
		8	Sine Wave
	82	0	Saw Lead
		1	Saw Wave
		8	Doctor Solo
	83	0	Synth Calliope
	84	0	Chiffer Lead
	85	0	Charang
	86	0	Solo Synth Vox
	87	0	5th Saw Wave
	88	0	Bass & Lead
Synth Pad	89	0	Fantasia Pad
	90	0	Warm Pad
	91	0	Polysynth Pad
	92	0	Space Voice Pad
	93	0	Bowed Glass Pad
	94	0	Metal Pad
	95	0	Halo Pad
	96	0	Sweep Pad
Synth Sound FX	97	0	Ice Rain
	98	0	Soundtrack
	99	0	Crystal
	100	0	Atmosphere
	101	0	Brightness
	102	0	Goblin
	103	0	Echo Drops
		1	Echo Bell
		2	Echo Pan
	104	0	Star Theme
Ethnic	105	0	Sitar
		1	Sitar 2
	106	0	Banjo
	107	0	Shamisen
	108	0	Koto
		8	Taisho Koto
	109	0	Kalimba
	110	0	Bagpipe
	111	0	Fiddle
	112	0	Shanai
Percussive	113	0	Tinkle Bell
	114	0	Agogo
	115	0	Steel Drums
	116	0	Woodblock
		8	Castanets
	117	0	Taiko
		8	Concert Bass Drum
	118	0	Melodic Tom 1
		8	Melodic Tom 2
	119	0	Synth Drum
		8	808 Tom
		9	Electric Percussion
	120	0	Reverse Cymbal
Sound Effect	121	0	Guitar Fret Noise
		1	Guitar Cut Noise
		2	String Slap
	122	0	Breath Noise
		1	Flute Key Click
	123	0	Seashore
		1	Rain
		2	Thunder
		3	Wind
		4	Stream
		5	Bubble
	124	0	Bird
		1	Dog
		2	Horse-Gallop
		3	Bird 2
	125	0	Telephone 1
		1	Telephone 2
		2	Door Creaking
		3	Door Closing
		4	Scratch
		5	Wind Chimes
	126	0	Helicopter
		1	Car-Engine
		2	Car-Stop
		3	Car-Pass
		4	Car-Crash
		5	Siren
		6	Train
		7	Jetplane
		8	Starship
		9	Burst Noise
	127	0	Applause
		1	Laughing
		2	Screaming
		3	Punch
		4	Heart Beat
		5	Footsteps
	128	0	Gun Shot
		1	Machine Gun
		2	Lasergun
		3	Explosion

PC# : Program Number
CC0 : Value of control "0"(Variation Number **)**

A-1-2. PERCUSSION MAP

Note	Key	Standard #1	Standard 2 #2	Room #9	Power #17	Electronic #25	TR-808 #26
D#0	27	High Q	High Q	High Q	High Q	High Q	High Q
E0	28	Slap	Slap	Slap	Slap	Slap	Slap
F0	29	Scratch Push	Scratch Push	Scratch Push	Scratch Push	Scratch Push	Scratch Push
F#0	30	Scratch Pull	Scratch Pull	Scratch Pull	Scratch Pull	Scratch Pull	Scratch Pull
G0	31	Sticks	Sticks	Sticks	Sticks	Sticks	Sticks
G#0	32	Square Click	Square Click	Square Click	Square Click	Square Click	Square Click
A0	33	Metronome Click	Metronome Click	Metronome Click	Metronome Click	Metronome Click	Metronome Click
A#0	34	Metronome Bell	Metronome Bell	Metronome Bell	Metronome Bell	Metronome Bell	Metronome Bell
B0	35	Kick Drum 2	ST2 Kick Drum 2	Room Kick Drum 2	Power Kick Drum 2	Elec Kick Drum 2	808 Kick Drum 2
C1	36	Kick Drum 1	ST2 Kick Drum 1	Room Kick Drum 1	Mondo Kick	Elec BD	808 Bass Drum
C#1	37	Side Stick	Side Stick	Side Stick	Side Stick	Side Stick	808 Rim Shot
D1	38	Snare Drum 1	ST2 Snare Drum 1	Room Snare Drum 1	Gated SD	Elec SD	808 Snare Drum
D#1	39	Hand Clap	Hand Clap	Hand Clap	Hand Clap	Hand Clap	Hand Clap
E1	40	Snare Drum 2	ST2 Snare Drum 2	Room Snare Drum 2	Power Snare Drum 2	Elec Gated SD	808 Snare Drum 2
F1	41	Low Tom 2	Low Tom 2	Room Lo Tom 2	Room Lo Tom 2	Elec Lo Tom 2	808 Low Tom 2
F#1	42	Closed Hi-Hat	Closed Hi-Hat	Closed Hi-Hat	Closed Hi-Hat	Closed Hi-Hat	808 Closed Hi-Hat
G1	43	Low Tom 1	Low Tom 1	Room Lo Tom 1	Room Lo Tom 1	Elec Lo Tom 1	808 Low Tom 1
G#1	44	Pedal Hi-Hat	Pedal Hi-Hat	Pedal Hi-Hat	Pedal Hi-Hat	Pedal Hi-Hat	808 Closed Hi-Hat
A1	45	Mid Tom 2	Mid Tom 2	Room Mid Tom 2	Room Mid Tom 2	Elec Mid Tom 2	808 Mid Tom 2
A#1	46	Open Hi-Hat	Open Hi-Hat	Open Hi-Hat	Open Hi-Hat	Open Hi-Hat	808 Open Hi-Hat
B1	47	Mid Tom 1	Mid Tom 1	Room Mid Tom 1	Room Mid Tom 1	Elec Mid Tom 1	808 Mid Tom 1
C2	48	High Tom 2	High Tom 2	Room Hi Tom 2	Room Hi Tom 2	Elec Hi Tom 2	808 High Tom 2
C#2	49	Crash Cymbal	Crash Cymbal	Crash Cymbal	Crash Cymbal	Crash Cymbal	808 Cymbal
D2	50	High Tom 1	High Tom 1	Room Hi Tom 1	Room Hi Tom 1	Elec Hi Tom 1	808 High Tom 1
D#2	51	Ride Cymbal	Ride Cymbal	Ride Cymbal	Ride Cymbal	Ride Cymbal	Ride Cymbal
E2	52	Chinese Cymbal	Chinese Cymbal	Chinese Cymbal	Chinese Cymbal	Reverse Cymbal	Chinese Cymbal
F2	53	Ride Bell	Ride Bell	Ride Bell	Ride Bell	Ride Bell	Ride Bell
F#2	54	Tambourine	Tambourine	Tambourine	Tambourine	Tambourine	Tambourine
G2	55	Splash Cymbal	Splash Cymbal	Splash Cymbal	Splash Cymbal	Splash Cymbal	Splash Cymbal
G#2	56	Cowbell	Cowbell	Cowbell	Cowbell	Cowbell	808 Cowbell
A2	57	Crash Cymbal 2	Crash Cymbal 2	Crash Cymbal 2	Crash Cymbal 2	Crash Cymbal 2	Crash Cymbal 2
A#2	58	Vibra-Slap	Vibra-Slap	Vibra-Slap	Vibra-Slap	Vibra-Slap	Vibra-Slap
B2	59	Ride Cymbal 2	Ride Cymbal 2	Ride Cymbal 2	Ride Cymbal 2	Ride Cymbal 2	Ride Cymbal 2
C3	60	High Bongo	High Bongo	High Bongo	High Bongo	High Bongo	High Bongo
C#3	61	Low Bongo	Low Bongo	Low Bongo	Low Bongo	Low Bongo	Low Bongo
D3	62	Mute Hi Conga	Mute Hi Conga	Mute Hi Conga	Mute Hi Conga	Mute Hi Conga	808 High Conga
D#3	63	Open Hi Conga	Open Hi Conga	Open Hi Conga	Open Hi Conga	Open Hi Conga	808 Mid Conga
E3	64	Low Conga	Low Conga	Low Conga	Low Conga	Low Conga	808 Low Conga
F3	65	High Timbale	High Timbale	High Timbale	High Timbale	High Timbale	High Timbale
F#3	66	Low Timbale	Low Timbale	Low Timbale	Low Timbale	Low Timbale	Low Timbale
G3	67	High Agogo	High Agogo	High Agogo	High Agogo	High Agogo	High Agogo
G#3	68	Low Agogo	Low Agogo	Low Agogo	Low Agogo	Low Agogo	Low Agogo
A3	69	Cabasa	Cabasa	Cabasa	Cabasa	Cabasa	Cabasa
A#3	70	Maracas	Maracas	Maracas	Maracas	Maracas	808 Maracas
B3	71	Short Hi Whistle	Short Hi Whistle	Short Hi Whistle	Short Hi Whistle	Short Hi Whistle	Short Hi Whistle
C4	72	Long Lo Whistle	Long Lo Whistle	Long Lo Whistle	Long Lo Whistle	Long Lo Whistle	Long Lo Whistle
C#4	73	Short Guiro	Short Guiro	Short Guiro	Short Guiro	Short Guiro	Short Guiro
D4	74	Long Guiro	Long Guiro	Long Guiro	Long Guiro	Long Guiro	Long Guiro
D#4	75	Claves	Claves	Claves	Claves	Claves	808 Claves
E4	76	High Woodblock	High Woodblock	High Woodblock	High Woodblock	High Woodblock	High Woodblock
F4	77	Low Woodblock	Low Woodblock	Low Woodblock	Low Woodblock	Low Woodblock	Low Woodblock
F#4	78	Mute Cuica	Mute Cuica	Mute Cuica	Mute Cuica	Mute Cuica	Mute Cuica
G4	79	Open Cuica	Open Cuica	Open Cuica	Open Cuica	Open Cuica	Open Cuica
G#4	80	Mute Triangle	Mute Triangle	Mute Triangle	Mute Triangle	Mute Triangle	Mute Triangle
A4	81	Open Triangle	Open Triangle	Open Triangle	Open Triangle	Open Triangle	Open Triangle
A#4	82	Shaker	Shaker	Shaker	Shaker	Shaker	Shaker
B4	83	Jingle Bell	Jingle Bell	Jingle Bell	Jingle Bell	Jingle Bell	Jingle Bell
C5	84	Belltree	Belltree	Belltree	Belltree	Belltree	Belltree
C#5	85	Castanets	Castanets	Castanets	Castanets	Castanets	Castanets
D5	86	Mute Surdo	Mute Surdo	Mute Surdo	Mute Surdo	Mute Surdo	Mute Surdo
D#5	87	Open Surdo	Open Surdo	Open Surdo	Open Surdo	Open Surdo	Open Surdo

Note	Key	Dance #27	Jazz #33	Brush #41	Orchestra #49	Sound FX #57
D#0	27	High Q	High Q	High Q	Closed Hi-Hat	-
E0	28	Slap	Slap	Slap	Pedal Hi-Hat	-
F0	29	Scratch Push	Scratch Push	Scratch Push	Open Hi-Hat	-
F#0	30	Scratch Pull	Scratch Pull	Scratch Pull	Ride Cymbal	-
G0	31	Sticks	Sticks	Sticks	Sticks	-
G#0	32	Square Click	Square Click	Square Click	Square Click	-
A0	33	Metronome Click	Metronome Click	Metronome Click	Metronome Click	-
A#0	34	Metronome Bell	Metronome Bell	Metronome Bell	Metronome Bell	-
B0	35	Dance Kick	Jazz BD 2	Jazz BD 2	Concert BD 2	-
C1	36	Elec Kick Drum 2	Jazz BD 1	Jazz BD 1	Concert BD 1	-
C#1	37	Side Stick	Side Stick	Side Stick	Side Stick	-
D1	38	Dance Snare1	Snare Drum 1	Brush Tap	Concert SD	-
D#1	39	Hand Clap	Hand Clap	Brush Slap	Castanets	High Q
E1	40	Dance Snare2	Snare Drum 2	Brush Swirl	Concert SD	Slap
F1	41	Elec Lo Tom 2	Low Tom 2	Low Tom 2	Tympani F	Scratch Push
F#1	42	808 Closed Hi-Hat	Closed Hi-Hat	Closed Hi-Hat	Tympani F#	Scratch Pull
G1	43	Elec Lo Tom 1	Low Tom 1	Low Tom 1	Tympani G	Sticks
G#1	44	808 Closed Hi-Hat	Pedal Hi-Hat	Pedal Hi-Hat	Tympani G#	Square Click
A1	45	Elec Mid Tom 2	Mid Tom 2	Mid Tom 2	Tympani A	Metronome Click
A#1	46	808 Open Hi-Hat	Open Hi-Hat	Open Hi-Hat	Tympani A#	Metronome Bell
B1	47	Elec Mid Tom 1	Mid Tom 1	Mid Tom 1	Tympani B	Guitar Fret Noise
C2	48	Elec Hi Tom 2	High Tom 2	High Tom 2	Tympani C	Guitar Cut Noise Up
C#2	49	Crash Cymbal	Crash Cymbal	Crash Cymbal	Tympani C#	Guitar Cut Noise Down
D2	50	Elec Hi Tom 1	High Tom 1	High Tom 1	Tympani D	Double Bass String Slap
D#2	51	Ride Cymbal	Ride Cymbal	Ride Cymbal	Tympani D#	Flute Key Click
E2	52	Reverse Cymbal	Chinese Cymbal	Chinese Cymbal	Tympani E	Laughing
F2	53	Ride Bell	Ride Bell	Ride Bell	Tympani F	Screaming
F#2	54	Tambourine	Tambourine	Tambourine	Tambourine	Punch
G2	55	Splash Cymbal	Splash Cymbal	Splash Cymbal	Splash Cymbal	Heartbeat
G#2	56	Cowbell	Cowbell	Cowbell	Cowbell	Footsteps 1
A2	57	Crash Cymbal 2	Crash Cymbal 2	Crash Cymbal 2	Concert Cymbal 2	Footsteps 2
A#2	58	Vibra-Slap	Vibra-Slap	Vibra-Slap	Vibra-Slap	Applause
B2	59	Ride Cymbal 2	Ride Cymbal 2	Ride Cymbal 2	Concert Cymbal 1	Door Creaking
C3	60	High Bongo	High Bongo	High Bongo	High Bongo	Door Closing
C#3	61	Low Bongo	Low Bongo	Low Bongo	Low Bongo	Scratch
D3	62	Mute Hi Conga	Mute Hi Conga	Mute Hi Conga	Mute Hi Conga	Wind Chimes
D#3	63	Open Hi Conga	Open Hi Conga	Open Hi Conga	Open Hi Conga	Car Engine
E3	64	Low Conga	Low Conga	Low Conga	Low Conga	Car Brakes
F3	65	High Timbale	High Timbale	High Timbale	High Timbale	Car Passing
F#3	66	Low Timbale	Low Timbale	Low Timbale	Low Timbale	Car Crash
G3	67	High Agogo	High Agogo	High Agogo	High Agogo	Siren
G#3	68	Low Agogo	Low Agogo	Low Agogo	Low Agogo	Train
A3	69	Cabasa	Cabasa	Cabasa	Cabasa	Jet Plane
A#3	70	Maracas	Maracas	Maracas	Maracas	Helicopter
B3	71	Short Hi Whistle	Short Hi Whistle	Short Hi Whistle	Short Hi Whistle	Starship
C4	72	Long Lo Whistle	Long Lo Whistle	Long Lo Whistle	Long Lo Whistle	Gun Shot
C#4	73	Short Guiro	Short Guiro	Short Guiro	Short Guiro	Machine Gun
D4	74	Long Guiro	Long Guiro	Long Guiro	Long Guiro	Laser Gun
D#4	75	Claves	Claves	Claves	Claves	Explosion
E4	76	High Woodblock	High Woodblock	High Woodblock	High Woodblock	Dog Bark
F4	77	Low Woodblock	Low Woodblock	Low Woodblock	Low Woodblock	Horse Gallop
F#4	78	Mute Cuica	Mute Cuica	Mute Cuica	Mute Cuica	Birds Tweet
G4	79	Open Cuica	Open Cuica	Open Cuica	Open Cuica	Rain
G#4	80	Mute Triangle	Mute Triangle	Mute Triangle	Mute Triangle	Thunder
A4	81	Open Triangle	Open Triangle	Open Triangle	Open Triangle	Wind
A#4	82	Shaker	Shaker	Shaker	Shaker	Seashore
B4	83	Jingle Bell	Jingle Bell	Jingle Bell	Jingle Bell	Stream
C5	84	Belltree	Belltree	Belltree	Belltree	Bubble
C#5	85	Castanets	Castanets	Castanets	Castanets	-
D5	86	Mute Surdo	Mute Surdo	Mute Surdo	Mute Surdo	-
D#5	87	Open Surdo	Open Surdo	Open Surdo	Open Surdo	-
E5	88				Applause	-

A-1-3. Detailed MIDI Implementation

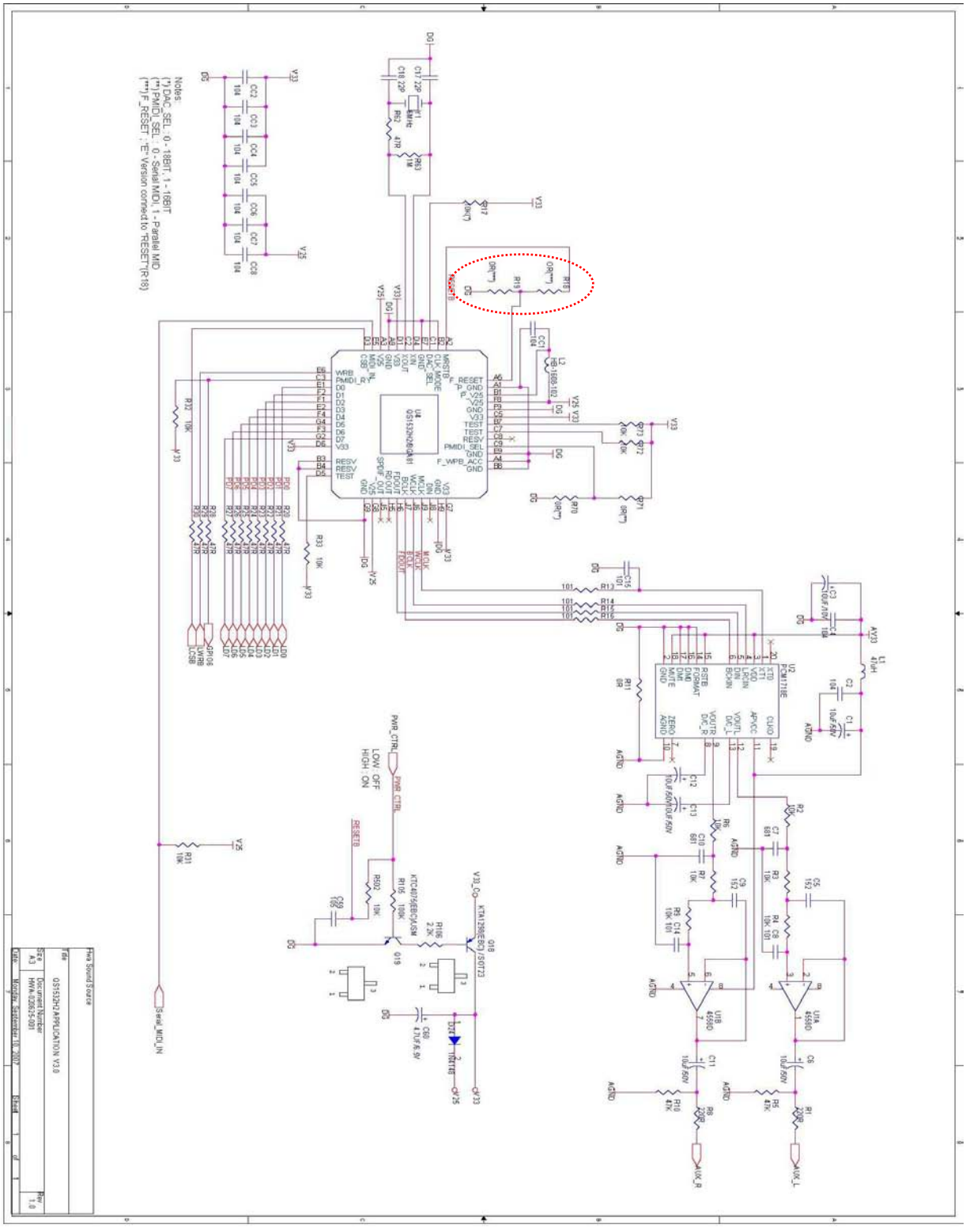
MIDI Message	Hex Code	Description	Compatibility
NOTE ON	9nH kk vv	MIDI channel n(0~15), kk=1~127, vv=1~127, vv=0 means NOTE OFF	MIDI
NOTE OFF	8nH kk vv	MIDI channel n(0~15), kk=1~127, vv is don't care	MIDI
PITCH BEND	EnH bl bh	Pitch bend as specified by bh/bl(14bit) Center = 00H40H	GM
PROGRAM CHANGE	CnH pp	PP= Patch Number(0 ~127)	GM/GS
MIDI RESET	FFH	Reset to power-up condition	MIDI
CTRL 00	BnH 00H dd	Bank Selection : Refer to sound list (CC0)	GS
CTRL 01	BnH 01H dd	Modulation wheel(1~127)	MIDI
CTRL 05	BnH 05H dd	Portamento time.	MIDI
CTRL 06	BnH 06H dd	Data entry : provides data to RPN and NRPN	MIDI
CTRL 07	BnH 07H dd	Volume (default=100)	MIDI
CTRL 10	BnH 0AH dd	Pan (default=64 center)	MIDI
CTRL 11	BnH 0BH dd	Expression (default=127)	MIDI
CTRL 107	BnH 6BH dd	EQ ON /OFF (0~63:OFF) / (64~127:ON)	
CTRL 16	BnH 10H dd	EQ LOW : (55 ~ 73 / Bypass :64)	
CTRL 17	BnH 11H dd	EQ MID : (55 ~ 73 / Bypass : 64)	
CTRL 19	BnH 13H dd	EQ HIGH : (55~73 / Bypass : 64)	
CTRL 64	BnH 40H dd	Sustain (damper) pedal	MIDI
CTRL 65	BnH 41H dd	Portamento ON/OFF	MIDI
CTRL 66	BnH 42H dd	Sostenuto pedal	MIDI
CTRL 67	BnH 43H dd	Soft pedal	MIDI
CTRL 71	BnH 47H dd	NRPN-161 TVF Resonance modify (same as nrpn 99-1/98-33)	GM/GS
CTRL 72	BnH 48H dd	NRPN-230 Env release time modify (same as nrpn 99-1/98-102)	GM/GS
CTRL 73	BnH 49H dd	NRPN-227 Env attack time modify (same as nrpn 99-1/98-99)	GM/GS
CTRL 74	BnH 4AH dd	NRPN-160 TVF cutoff freq modify (same as nrpn 99-1/98-32)	GM/GS
CTRL 75	BnH 4BH dd	NRPN-228 Env decay time modify (same as nrpn 99-1/98-100)	GM/GS
CTRL 76	BnH 4CH dd	NRPN-136 Vibrato rate modify (same as nrpn 99-1/98-8)	GM/GS
CTRL 77	BnH 4DH dd	NRPN-137 Vibrato depth modify (same as nrpn 99-1/98-9)	GM/GS
CTRL 78	BnH 4EH dd	NRPN-138 Vibrato delay modify (same as nrpn 99-1/98-10)	GM/GS
CTRL 80	BnH 50H dd	Reverb Type 0 = Studio 1 1 = Room 1 2 = Room 2 3 = Hall 1 4 = Hall 2 5 = Studio 2 6 = Big Hall1 7 = Big Hall2	GM/GS

MIDI Message	Hex Code	Description	Compatibility
CTRL 81	BnH 51H dd	dd = 0 Industrial Standard Chorus 1 dd = 1 Industrial Standard Chorus 2 dd = 2 White Chorus 1 dd = 3 White Chorus 2 dd = 4 White Chorus 3 **Default setting dd = 5 Flanger 1 dd = 6 Flanger 2 dd = 7 Flanger 3	GM/GS
CTRL 82	BnH 52H 00	Echo 0n / OFF	GS
	BnH 52H 01	Echo delay 48ms	GS
	BnH 52H 02	96ms	GS
	BnH 52H 03	144ms	GS
	BnH 52H 04	192ms	GS
	BnH 52H 05	240ms	GS
CTRL 83	BnH 53H 05	Chorus Out => Reverb in - Feedback (0~127) Codec & MIDI	GS
CTRL 84	BnH 54H dd	Portamento control (On / Off)	GS
CTRL 85	BnH 55H dd	Effect Reverb Damping (0 ~127)	GS
CTRL 86	BnH 56H dd	Effect Reverb Decay (0 ~127)	GS
CTRL 91	BnH 5BH dd	Reverb send level dd= 0~127	GS
CTRL 93	BnH 5DH dd	Chorus send level dd= 0~127	GS
NRPN 0108H	BnH 63H 01H 62H 08H 06H vv	Vibrate rate (vv=40H -> no modify)	GS
NRPN 0109H	BnH 63H 01H 62H 09H 06H vv	Vibrate depth (vv=40H -> no modify)	GS
NRPN 010AH	BnH 63H 01H 62H 0AH 06H vv	Vibrate delay (vv=40H -> no modify)	GS
NRPN 0120H	BnH 63H 01H 62H 20H 06H vv	TVF cutoff freq (vv=40H -> no modify)	GS
NRPN 0121H	BnH 63H 01H 62H 21H 06H vv	TVF resonance (vv=40H -> no modify)	GS
NRPN 0163H	BnH 63H 01H 62H 63H 06H vv	Env attack time (vv=40H -> no modify)	GS
NRPN 0164H	BnH 63H 01H 62H 64H 06H vv	Env decay time (vv=40H -> no modify)	GS
NRPN 0166H	BnH 63H 01H 62H 66H 06H vv	Env release time (vv=40H -> no modify)	GS
NRPN 18rrH	BnH 63H 18H 62H rr 06H vv	Pitch coarse of drum instr. rr is a note vv=40H -> no modify	GS
NRPN 1ArrH	BnH 63H 1AH 62H rr 06H vv	Level of drum instr. rr is a note vv= 00~7FH	GS
NRPN 1CrrH	BnH 63H 1CH 62H rr 06H vv	Pan of drum instr. rr is a note vv=40H -> middle	GS
NRPN 1DrrH	BnH 63H 1DH 62H rr 06H vv	Reverb send level of drum instr. rr is a note vv=00~7FH	GS
NRPN 1ErrH	BnH 63H 1EH 62H rr 06H vv	Chorus send level of drum instr. rr is a note vv=00~7FH	GS
RPN 0000H	BnH 65H 00H 64H 00H 06H vv	Pitch bend sensitivity in semitones(default = 2)	GM
RPN 0001H	BnH 65H 00H 64H 01H 06H vv	Fine tuning in cent(vv=00-100, vv=40H 0, w=7FH+100)	GM
RPN 0002H	BnH 65H 00H 64H 02H 06H vv	Coarse tuning in half tones (vv=00-64, vv=7FH+64)	GM

MIDI Message	Hex Code	Description	Compatibility
CRTL 120	BnH 78H 00H	All sound off	
CTRL 121	BnH 79H 00H	Reset all controllers	
CTRL 123	BnH 7BH 00H	All note off	
Sysex	F0H 7EH 7FH 09H 01H F7H	General MIDI reset	GS
Sysex	F0H 7FH 7FH 04H 01H 00H ll F7H	Master volume (ll=0 to 127, default 127)	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 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 = 64H	GS
Sysex	F0H 41H 00H 42H 12H 40H 01H 34H vv xx F7H	Reverb time	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 3EH vv xx F7H	Chorus depth	GS
Sysex	F0H 41H 00H 42H 12H 40H 01H 3FH vv xx F7H	Chorus send to Reverb	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

A-2. Application schematic

A-2-1. Parallel MIDI schematic



A-2-2. Recommend PCB design for 2 Layer.(As used parallel interface)

