TYPE	Silicon Monolithic Integrated Circuit
Product Name	Sound Generator for Cellular Phone
Product No	BU8772KN
Physical Dimensions	Fig. 1 Mechanical dimension
Block Diagram	Fig. 2 Block diagram

Features

- ○16 harmonies generator available at the same time.
  128 sounds + drum set 47 sounds generation.
- ○FIFO buffer and sequencer reduce the burden of CPU.
- ○Integrated FIFO buffer for "Down load music data".
- ○Adjustable parameter for the generation of harmony.
- ○Selectable parameter of wave form (Square or special rectangle) to sound
- ○Stereo sound available.
- ○Integrated stereo sound DAC .
- ○Integrated 2-dimensional filter (Fc=20Khz)
- ○Power down mode supported.
- ○CPU control through integrated serial port.
- ○QFN28V Package

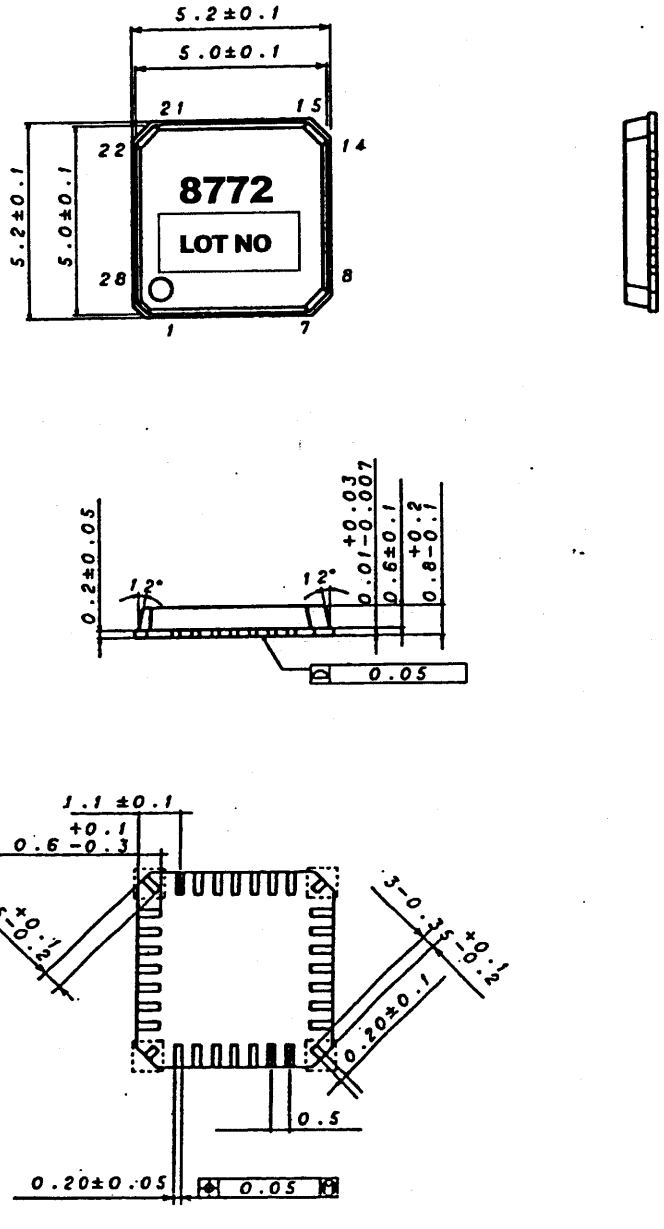
□ This chip don't be designed to protect against the radioactivity.

Application example
The application circuit is recommended for use. Make sure to confirm the adequacy of the characteristics.
When using the circuit with changes to the external circuit constants, make sure to leave an adequate margin for external components including static and transitional characteristics as well as dispersion of the IC.
Note that ROHM cannot provide adequate confirmation of patents.

The product described in this specification is designed to be used with ordinary electronic equipment or devices (such as audio-visual equipment office-automation equipment, communications devices, electrical appliances, and electronic toys.)
Should you intend to use this product with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment , aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

ROHM assumes no responsibility for the use of any circuits described herein, conveys no license under
Any patent or other right, and makes no representations that the circuits are free from patent infringement.

●Outline dimensions diagram



Notice) We don't recommend bonding inside dotted line.

(Unit: mm)

Figure 1. Outline Dimensions Diagram (plastic mold)

●Block diagram

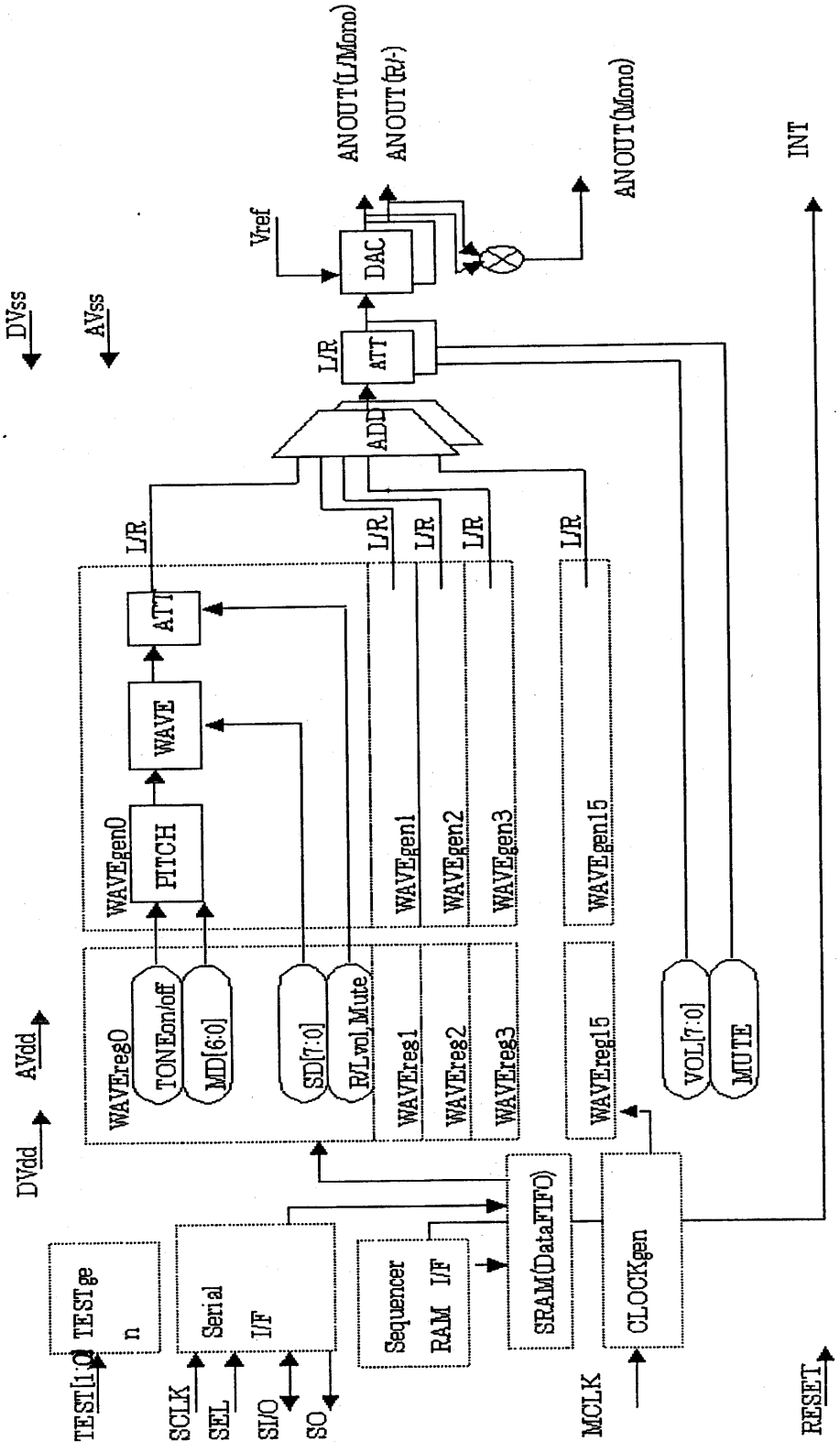


Figure 2. Block Diagram

Description of circuit blocks

●Test block

This block includes IC testing circuits.
When the TEST [1:0] pin's state is "H, H", this block is in normal mode.
When it is in any another state, this block is in IC test mode.

●Serial interface block

This block includes interface circuits that interface with the system chip.
During a write operation, serial data synchronized with SCLK is received at the SI/O pin, then it is converted to parallel data that is expanded in the WAVEreg block or SRAM block.
During a read operation, data from the WAVEreg block is converted to serial data and is output from the SI/O pin in sync with SCLK.

●Clock gen block

This is the clock generator that supplies a clock to the sequencer block and WAVEgen block. Division parameters are generated to maintain a constant output frequency from each WAVEgen block's internal divider/counter to enable support for various master clocks (MCLK) as master clock signals supplied via the MCLK pin and divided into system clocks for the sequencer block, WAVEgen block, etc.

●SRAM (FIFO)

This buffer is used for sound source data. It has an FIFO configuration.
The buffer's capacity is 512 byte.
The write point (WP) and read point (RP) are both hardware-controlled.
NearlyEmpty and NearlyFull are included as interrupt sources to prevent overflow and underflow errors.
Both WP and RP can be reset and the FIFO memory devices can be emptied by writing "1" to the SequenceControlReg's Reset bit.

●Sequencer block

This block analyzes and converts message data.
When a melody is played, this block analyzes the RAM read data and performs the settings required for the melody in the WAVEreg block to set the desired timing.
This block includes an assign function that dynamically assigns to the WAVEgen block.

●RAM interface block

This block controls the SRAM memory.
It generates and controls the write and read pointers that are used to configure the FIFO buffer.

●Timing gen block

This block controls the play timing. It control the timing of access to the WAVEreg block.

●WAVE registers

These are the control registers for the WAVEgen block.
The sequencer controls the WAVEgen registers.
The control registers for the WAVEgen block cannot be accessed directly by the CPU.
However, common control of sound sources can be controlled directly by the CPU.

●WAVEgen block

This block sets generation of sound (melody) waveforms.
Up to 16 sounds can be generated at the same time.
Waveforms are generated according to the WAVEreg block's register setting data.
The 16 sound sources are generated from a tone palette of 128 voices plus a drum set.
Each sound source is controlled by a sequencer to reduce the CPU's processing load.
Equal temperament is used to produce a scale from A (110.34 Hz) to C8 (4173.983 Hz).
The equal temperament's standard pitch for A is based on a reference clock frequency of 440 Hz.
Pitch is proportionate to the MCLK frequency.

●DAC

This is stereo D/A converter.
The analog output level is increased to support the level generated by up to 16 WAVEgen registers.
The DAC block's dynamic range is 2/3 VDD (as a Vpp value).
The amplitude required for 16-tone synthesis should be set so as not to exceed this dynamic range.

●LPF

This is a secondary LPF (Low Pass Filter).
It is a smoothing filter that eliminates high-frequency components from analog waveforms generated by the DAC block.
The final analog waveform is output via the ANOUT pin.
The ANOUT pin's minimum load resistance is 100 [KΩ].

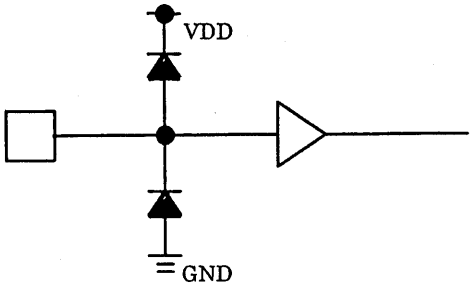
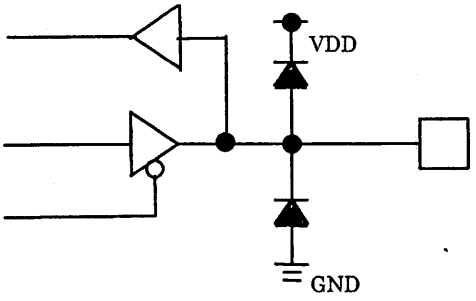
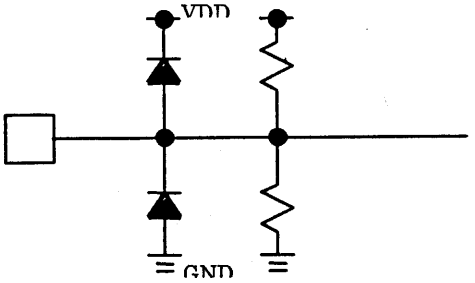
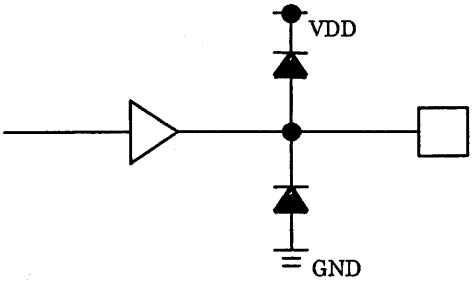
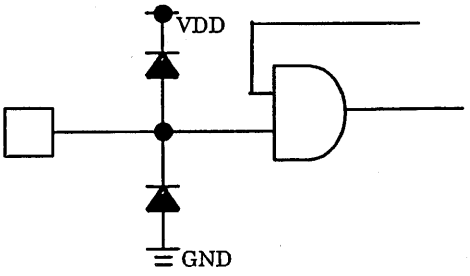
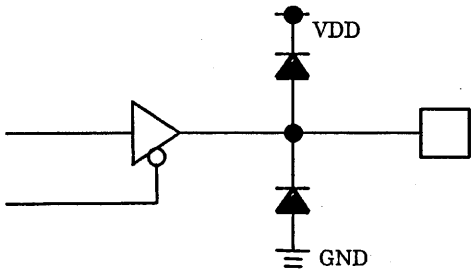
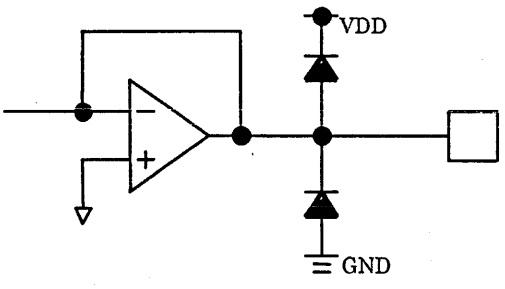
●Description of pin functions

Pin No.	Symbol	Description of function	Attribute	Circuit type	Remarks
24	TEST0	Input pin for IC tests Connect to Vdd	In	A	Used as Connect to Vdd
26	TEST1	Input pin for IC tests Connect to Vdd	In	A	Used as Connect to Vdd
9	SO	Data Out pin for serial interface Hi-Z,when SEL is High	Out	G	
10	SI/O	Data I/O pin for serial interface	In/Out	B	
12	SCLK	Clock input pin for serial interface	In	A	
13	SEL	Select input pin for serial interface (active low)	In	A	
23	MCLK	System clock input pin Can be set within range from 12 MHz to 20 MHz. Scale precision within this range is approximately 0.2%.	In	F	
17	LEDOUT	Out put pin for timing of LED	Out	C	
19	RESET	Reset input pin (active low)	In	A	
20	INT	. Interrupt pin for this IC (active low)	Out	B	Used as CMOS (C) output during operation
14	DVDD	Digital power supply pin	—	—	
27	AVDD	Analog power supply pin	—	—	
16	DVss	Digital ground pin	—	—	
3	AVss	Analog ground pin	—	—	
1	VREF	AC (signal) ground pin Connect a 1-uF bypass capacitor between VREF and GND.	Ana	E	
2	ANOUT (L)	Analog output pin. Potential is approximately the same as Avss except during play mode. Becomes Hi-z when reset.	Ana	D	
28	ANOUT (R)	Analog output pin. Potential is approximately the same as Avss except during play mode. Becomes Hi-z when reset.	Ana	D	
5	ANOUT (mono)	Analog output pin. Potential is approximately the same as Avss except during play mode. Becomes Hi-z when reset.	Ana	D	

Continue

6, 15	For Test	Output for test	—	—	Used as not Connect
7, 8 21, 22	For Test	Input for test	–	–	Used as Connect to Vdd
4, 11 18, 25	NC	—	–	–	

●I/O circuit diagram

Input circuits		Output circuits	
A		B	
E		C	
F		G	
		D	

●ABSOLUTE MAXIMUM RATINGS (unless otherwise noted, Ta = 25℃)

Parameter	Symbol	Rating	Unit	. Remarks
Maximum supply voltage	VDD	-0.3 ~ +4.5	V	
Voltage applied to pin	VIN	DVSS-0.3 ~ DVDD+0.3	V	
Input current	IIN	-1 ~ +1	mA	
Allowable dissipation	Pd	370(Note)	mW	
. Storage temperature range	Tstg	-50 ~ 125	℃	
Operating temperature range	Topr	-40 ~ 85	℃	

Note: Reduce to 3.7 mW/℃ when Ta = 25℃ or above.

●RECOMMENDED OPERATING POWER SUPPLY VOLTAGE RANGE

(Unless otherwise noted, Ta = 25℃)

Parameter	Symbol	rating			Unit	Remarks
		Min	Typ	Max		
Power supply voltage	VDD	2.7	3.0	3.6	V	
Ambient temperature	Ta	-40	25	85	℃	
MCLK input frequency	FMCLK	12	—	20	MHz	Scale precision is approximately 0.2%.
SCLK input frequency	FSCLK	500	—	MCLK	KHz	
MCLK duty	DMCLK	40	50	60	%	
SCLK duty	DSCLK	40	50	60	%	
ANOUT pin's load resistance	ZAN	100	-	-	kΩ	

●ELECTRICAL CHARACTERISTICS (1 of 3)

(Unless otherwise noted, Ta = 25℃)

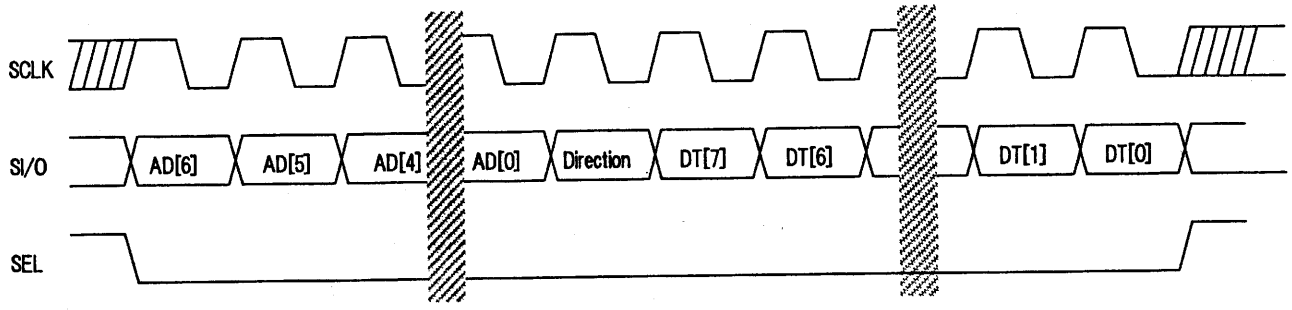
Parameter	Symbol	rating			Unit	Conditions
		Min	Typ	Max		
Digital DC characteristics						
High-level input voltage	VIH	0.7VDD	—	—	V	
Low-level input voltage	VIL	—	—	0.3VDD	V	
High-level input current	IIH			10	μA	VIH=VDD
Low-level input current	IIL	-10	—	—	μA	VIH=GND
High-level output voltage	VOH	VDD-0.3	—	—	V	IOH=-0.8mA
Low-level output voltage	VOL	—	—	GND+0.3	V	IOL=0.8mA
Analog DC characteristics						
VREF pin voltage	VAGND	0.475VDD	0.5VDD	0.525VDD	V	IOUT=0A (no load)
ANOUT pin voltage	VOUT	0.47VDD	0.5VDD	0.53VDD	V	IOUT=0A (no load)
General characteristics						
VREF pin rise time	TRVR	—	25	40	mS	When CVREF = 1uF and RESET = L->H
Analog (ANOUT pin) characteristics						
ANOUT amplitude	VMAX	—	0.667VDD	-	Vp-p	Theoretical value for dynamic range
Power consumption Vdd=3.0[v],MCLK=12[Mhz]						
Analog Idd	IDD1		0.8	2.2	mA	Playing
Digital Idd	IDD2		17	22	mA	Playing
Analog Idd	IDD3			1	μA	Standby mode
Digital Idd	IDD4			1	μA	Standby mode

●ELECTRICAL CHARACTERISTICS (2 of 3)

(Unless otherwise noted, Ta = 25℃)

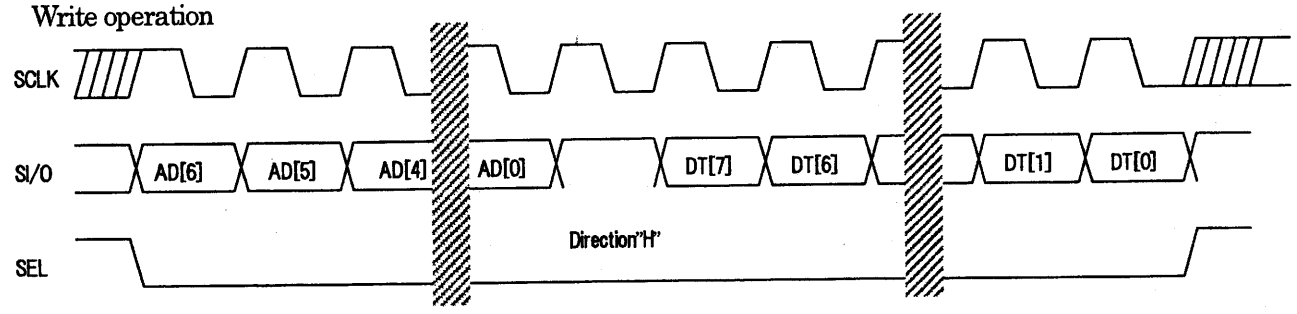
Parameter	Symbol	rating			Unit	Conditions
		Min	Typ	Max		
Serial interface format						
Character bit length	Ncha	16	-	—	bit	MSB first
Serial interface timing characteristics						
SCLK input frequency	FSCLK	500	—	MCLK	KHz	
SCLK duty	DSCLK	40	50	60	%	
Data setup time	Tsc	25	—	—	nS	To FallingEdge of SCLK
Data hold time	Thc	25	—	—	nS	To FallingEdge of SCLK

1. Serial interface timing chart

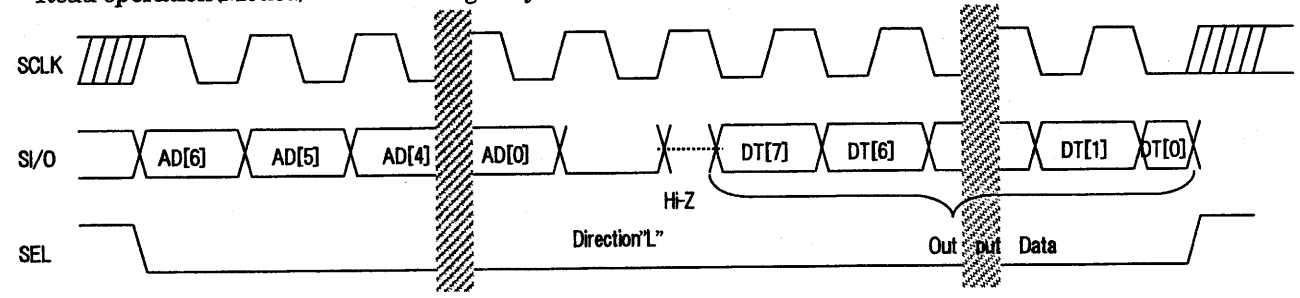


When direction is "1": Write operation
When direction is "0": Read operation

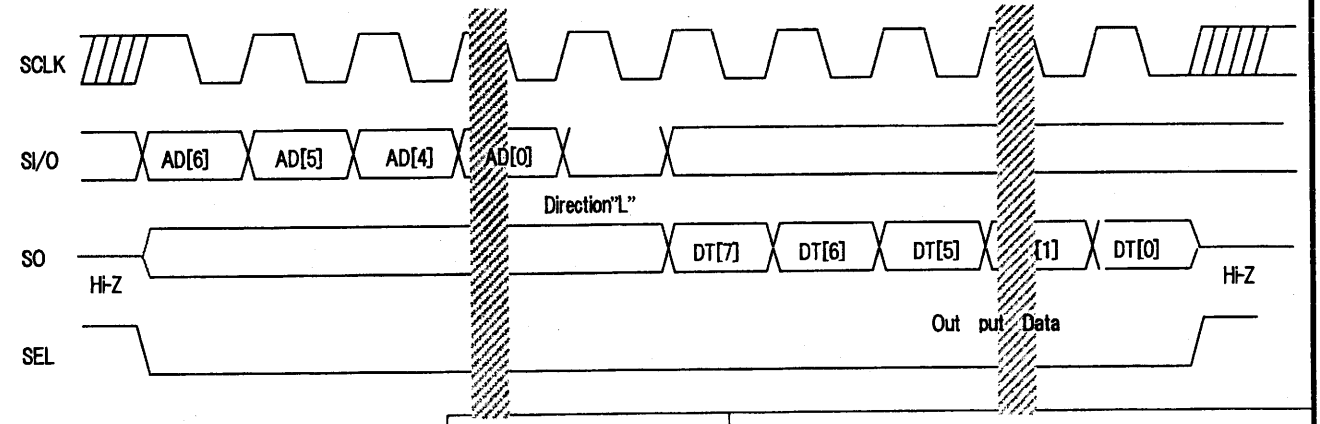
Write operation



Read operation(Mode1) It is changed by Pmode bit (bit[3] of Address0x0)



Read operation(Mode2) It is changed by Pmode bit (bit[3] of Address0x0)

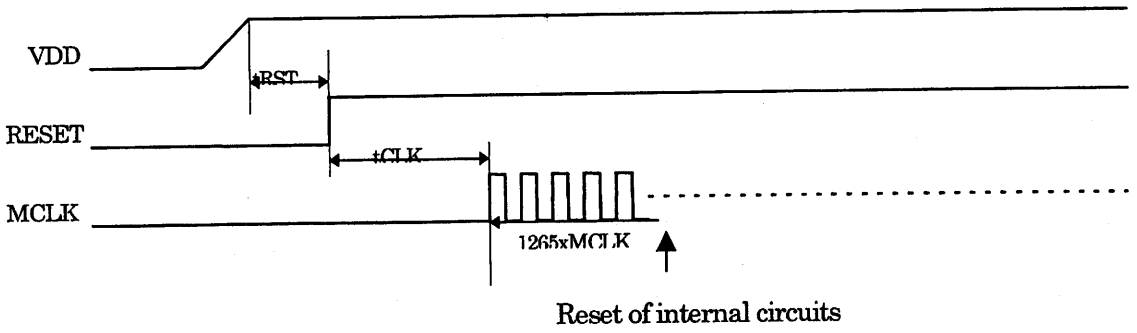


● ELECTRICAL CHARACTERISTICS (3 of 3)

(Unless otherwise noted, Ta = 25℃)

Parameter	Symbol	rating			Unit	Conditions
		Min	Typ	Max		
Reset sequence						
VDD=>RESET time	TRST	10	—	—	ms	
RESET=>MCLK time	TCLK	0	—	—	ms	MCLK waveform must be normal

<Pin reset sequence>



* RESET, supply low-level voltage, when POWER ON.

●Description of sequencer

This sequencer uses the timing information in the melody data to control the timing of sound sources.
To take full advantage of the sound sources, this sequence also has an assign function which dynamically assigns data to sound sources.
This function enables high-quality musical expressions.

[General operation]

1) Fetches melody data stored in FIFO directives and assigns them to empty sound sources.
2) Tones are generated when information from melody data is set to any WAVEgen setup register.
3) Controls tone generation, turns tone OFF at tone end timing, and releases the sound source.
4) Decide the order of priority that registers to Wave.gen in consideration of Track No, Voice No.

The following table shows a map of control registers in the WAVEgen block.

WAVEgen block control registers

Number	Reg Name	D7	D6	D5	D4	D3	D2	D1	D0
0	WAVE0gen Setup	SD7	SD6	SD5	SD4	SD3	SD2	SD1	SD0
1			MD6	MD5	MD4	MD3	MD2	MD1	MD0
2		TONEon	ENVtrg	LV5	LV4	LV3	LV2	LV1	LV0
3		MUTE	×	RV5	RV4	RV3	RV2	RV1	RV0
4	WAVE1gen Setup	SD7	SD6	SD5	SD4	SD3	SD2	SD1	SD0
5			MD6	MD5	MD4	MD3	MD2	MD1	MD0
6		TONEon	ENVtrg	LV5	LV4	LV3	LV2	LV1	LV0
7		MUTE	×	RV5	RV4	RV3	RV2	RV1	RV0
..	. . .								
60	WAVE15gen Setup	SD7	SD6	SD5	SD4	SD3	SD2	SD1	SD0
61			MD6	MD5	MD4	MD3	MD2	MD1	MD0
62		TONEon	ENVtrg	LV5	LV4	LV3	LV2	LV1	LV0
63		MUTE	×	RV5	RV4	RV3	RV2	RV1	RV0

SD [7:0] Tone data
MD [6:0]: Scale data
LV [5:0]: Left-channel volume data
RV [5:0]: Right-channel volume data
TONEon Tone ON/OFF control
ENVtrg Envelope start trigger
MUTE Mute sound sources

●Sound source control

Overall control of sound sources is performed directly by the CPU.

1. Description of registers

The common control register is controlled directly by the CPU.

A map of its registers is shown below.

Map of Common Control Register for Sound sources

Address	Reg Name	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x00	Common setup	W	x	SE	Ring		Pmode	AN1/2	Mono	TMute
0x01	WAVE VOL	W	VOL7	VOL6	VOL5	VOL4	VOL3	VOL2	VOL1	VOL0
0x02	INT Mask	W	INTPol			LEDenb				
0x03	Status	R	Empty	NearEP	NearFL	LED	III Format	Empty Area	Full Area	BUSY
		W	Clear	Clear	Clear	Clear	Clear			
0x04	Sequ Control	W	Reset	Stnby	Anout Disable	Anout Mono Disable				Start
0x05	FIFO Control	W	Nearly Full setup				Nearly Empty setup			
0x06	FIFOwindow	W	Data [7:0]							
0x07	Time reg (1)	W	Time Setup data (1)							
0x08	Time reg (2)	W	Time setup data (2)							
0x09	WaveSel	W					Wave Select [3:0]			
0x0A	Wave Window	W	SD [7:0] Tone							
0x0B		W		MD [6:0] Key						
0x0C		W			Lvol [5:0]					
0x0D		W			Rvol [5:0]					
0x0E		W	Tone on/off	Mute						
0x0F	Test	W	For Test							
0x10~0x7F	Reserved		Reserved							

Address 0x00 Common setup register
(Write)

Bit6: SE SE Mode
'H' write operation.
The sequencer can use Wave.gen[8:15] only.
The other can be control from CPU directly.
'L' write operation
The sequencer can use Wave.gen[0:15]. (Default setting)

Bit5: Ring Ringer Mode
'H' write operation.
Increase of output.
'L' write operation
Normally (Default setting)

Bit4: Don't write 'H'.

Bit3: Pmode Select Port Mode
"H" write operation sets serial port as "Mode2".
"L" write operation sets serial port as "Mode1".
(Default setting)

Bit2: AN1/2 Select data format
"H" write operation sets input data format as "B".
"H" write operation sets ,when all Wave.gen are control from CPU directly.
"L" write operation sets input data format as "A".
(Default setting)

[For further description of formats, see the next section.]

Bit1: Mono Monaural setting bit
"H" write operation sets output as monaural.
"L" write operation sets output as stereo.
(Default setting)

#When monaural mode, Monaural output is ANOUT(L).ANOUT(R) is mute.

Bit0: Tmute Mute sound sources
"H" write operation sets mute for melody.
"L" write operation clears mute for melody.
(Default setting)

Address 0x01 Wave Vol register
(Write)

Bit[7:0]:VOL[7:0] Total volume

Address 0x02 INT Mask register
(Write)

Bit7: INT Polarity Interrupt output polarity
"H" write operation sets interrupt output signal enable "H".
"L" write operation sets interrupt output signal enable "L".
(Default setting)

Reset from only an input pin it assumed to be effective.
An influence is not received from address 0x04 bit[7] firm ware reset.

Bit4: LED Int enb LED interrupt enable
"H" write operation sets LED interrupts as valid.
"L" write operation masks LED interrupts. (Default setting)

Address 0x03 Status register

(Read)

Bit7: Empty FIFO Empty bit (interrupt source)
"H" indicates that melody data FIFO is empty.

Bit6: Nearly Empty FIFO Nearly Empty bit (interrupt source)
"H" indicates that remaining data in melody data
FIFO has reached to the level set in the FIFO control register.

Bit5: Nearly Full FIFO Nearly Full bit (interrupt source)
"H" indicates that remaining data in melody data
FIFO has reached the level set in the FIFO control register.

Bit4: LED LED bit (interrupt source)
"H" indicates that Voice0 sounds are generated in melody data.

Bit3: Ill Format Illegal format bit (interrupt source)
"H" indicates that performance data format of halfway "Empty" it detects.
"H" indicates that abnormal completion of a sequencer and the action from
a transmission sequence is necessary.

Bit2: Empty Area
"H" indicates that a remainder melody data pointer exists in the area of Empty.

Bit1: Full Area
"H" indicates that a remainder melody data pointer exists in the area of Full.

Bit0: BUSY Busy bit
"H" indicates that melody data output or sequencer operation is in progress.

(Write)

Bit7: Empty Clear FIFO Empty Clear bit
Writing "1" clears the Empty bit.

Bit6: Nearly Empty Clear FIFO Nearly Empty Clear bit
Writing "1" clears the Nearly Empty bit.
Any interrupt signal is negated.

Bit5: Nearly Full Clear FIFO Nearly Full Clear bit
Writing "1" clears the Nearly Full bit.
Any interrupt signal is negated.

Bit4: LED Clear LED Clear bit
Writing "1" clears the LED bit.
Any interrupt signal is negated

Bit3: Ill Format Clear Illegal format Clear bit
Writing "1" clears the Illegal format bit.

Address 0x04 Sequence Control register

(Write)

Bit7: Reset Firmware reset "H" write operation resets this sequencer.
When end of performance, this bit sets.

Bit6: Standby Standby mode "H" write operation sets this IC to standby mode.
"L" write operation releases standby mode.
If this bit operation is executed during play mode, correct playback of the current song is not guaranteed.

Bit5: Anout Dis Anout Disable bit "H" write operation sets Hi-z at Anout(L/R/Mono).
"L" write operation become to output at Anout(L/R/Mono).
(Default setting)

If this bit operation is executed during play mode, correct playback of the current song is not guaranteed.

Bit4: Anout Mono Dis Anout Mono Disable bit "H" write operation sets Hi-z at Anout(Mono).
"L" write operation become to output at Anout(Mono).
(Default setting)

If this bit operation is executed during play mode, correct playback of the current song is not guaranteed.

Bit0: Start Sequencer start bit. "H" write operation starts the sequencer.
"L" write operation stops the sequencer.

If this bit operation is executed during play mode, correct playback of the current song is not guaranteed.

Address 0x05 FIFO Control register
(Write)

Bit[7:4] NearlyFullSetup
"1000" sets remaining space at 1/16 of FIFO capacity
"0100" sets remaining space at 1/8 of FIFO capacity (default setting).
"0010" sets remaining space at 1/4 of FIFO capacity.
"0001" sets remaining space at 1/2 of FIFO capacity.
Others- Don't Use ! !

Bit[3:0] NearlyEmptySetup
"1000" sets remaining data at 1/16 of FIFO capacity
"0100" sets remaining data at 1/8 of FIFO capacity (default setting).
"0010" sets remaining data at 1/4 of FIFO capacity.
"0001" sets remaining data at 1/2 of FIFO capacity.
Others- Don't Use ! !

Address 0x06 FIFO Window register
(Write)

Bit[7:0] FIFO Window Melody data FIFO window
Writing to this register fills the FIFO.
The write pointer is incremented after each write operation

Address 0x07 time setup register (1)
(Write)

Bit[7:0] time setup Minute circumference ratio is set up to make 128KHz needed for a sound resource from MCLK.

When MCLK=12Mhz Setting value = 0x5E (default setting)
MCLK=14Mhz Setting value = 0x6D
MCLK=16Mhz Setting value = 0x7D
MCLK=18Mhz Setting value = 0x8D
MCLK=20Mhz Setting value = 0x9C

Calculation style) MCLK/128Khz = Setting value

Address 0x08 time setup register (2)
(Write)

Bit[7:0] time setup Minute circumference ratio is set up to make 22.05KHz needed for a sound resource from MCLK.

When MCLK=12Mhz Setting value = 0x10 (default setting)
MCLK=14Mhz Setting value = 0x3D
MCLK=16Mhz Setting value = 0x6B
MCLK=18Mhz Setting value = 0x98
MCLK=20Mhz Setting value = 0xC6

Calculation style) MCLK/(22.05Khz*2) = Setting value
In MCLK is 12Mhz~20Mhz.Bit[9] become fixation "1".
Accordingly setting unnecessary.
Setting only bit[7:0].

Address 0x09 Wave Select register
(Write)

Bit[3:0] Wave Select
"0000"-Selects a Wave.gen0 (default setting)
"0001"- Selects a Wave.gen1
"0010"- Selects a Wave.gen2
"0011"- Selects a Wave.gen3
"0100"- Selects a Wave.gen4
"0101"- Selects a Wave.gen5
"0110"- Selects a Wave.gen6
"0111"- Selects a Wave.gen7
"1000"- Selects a Wave.gen8
"1001"- Selects a Wave.gen9
"1010"- Selects a Wave.gen10
"1011"- Selects a Wave.gen11
"1100"- Selects a Wave.gen12
"1101"- Selects a Wave.gen13
"1110"- Selects a Wave.gen14
"1111"- Selects a Wave.gen15

Address 0x0A~0x0E Wave.gen register
(Write)

Inside Wave reg can be gained access directly.

Address 0x0F TEST register
(Write)

Address 0x10~0x7F Reserved
Don't Touch ! !

2. Melody data format

The CPU indicates the format of the data stored in RAM (FIFO).
Select from either of two data formats.
Select whether to use AN1 or AN2 bit.

[Format A]

Note message format (7 bytes)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Delta Time							
Track Number 0~255							
Voice Number			Key[5:0]				
Tone (Expansion code *Length of 6 Byte)							
	Key[6]		L-Volume				
Mute	Extension		R-Volume				
Length of sound [Delta Time]							

[Format B]

Note on message format (6 bytes)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Delta Time							
Track Number						Voice Number	
ToneON/Off	Key[6:0]						
Tone (Expansion code)							
-	L-Volume						
Mute	-	R-Volume					

Note off message format (3 bytes)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Delta Time							
Track Number						Voice Number	
ToneON/Off	Key[6:0]						

Description of format

Delta Time : Each setting in the Δ time register is called 1 Δ time, which indicates the amount of time that has elapsed since the previous event.

Track Number : Indicates the sequence in which tracks are played (0, 1, 2, etc.)

Voice Number : Indicates voice number in current track

Key[6:0] : Indicates the key (scale) of sounds being generated

Sound length : Indicates the length of a generated sound. This is expressed as the Δtime.
When sound length is 0xFF, it is based on the extension of the sound length being done in the rest,
and pronunciation at this time is protected 【 any case 】, too.

Tone (Expansion code) : 0x00~0xFC make to indicate the tone of the sound source
: 0xFD~0xFF make an expansion code.
Expansion code is length of 6 byte.

[NOP Message]

	0xFD
+1Byte	0x00
+1Byte	0x00

[Δtime Message]

	0xFE
+1Byte	Δtime (U)
+1Byte	Δtime (L)

Setting in Δtime that was turned into be common in performance data.
Accordingly, Track number and voice number disregarded.
The information of a performance data overall is made.
Integer9bit+decimal7bit, Total 16bit with unit [ms].
Range is 0.125 to 511[ms].

[TimeBase Message]

	0xFF
+1Byte	0x00
+1Byte	TimeBase

Whether each track is what times were shown with "Δtime message" is set up.
Accordingly, Track number disregarded and the information of each track number is made.
Sound length of Format A is controlled by this message.
Yet, only track0 to 15, "Time base" is handled as 110b in the track15 of after.
Appropriate sound length setting requires.

TimeBase[2:0]
- 000b = x64
- 001b = x32
- 010b = x16
- 011b = x8
- 100b = x4
- 101b = x2
- 110b = x1
- other = Don't use !!

L-Volume : Volume of left channel
R-Volume : Volume of right channel
Mute : Mute setting
Tone On/Off : Tone ON/OFF control 1: Tone on 0: Tone off
Extension : 0: NOP
1: It is shown that the extension of the sound length is done in the rest.
The control which is equal to the time when sound head is 0xFF is done.

[Notes]

(1) Format A is the format in which the tone OFF status is calculated based on the sound length and control is performed in the sequencer.
Format B is the format in which the tone OFF status is calculated on the data generation side and control is performed using messages.

2. Standby general operation

Address0x4,Sequence control register bit[6];
"H" write operation sets this IC to standby mode.

When standby mode:

MCLK(input) is gated .
Analog block sleep .
All control register not move (without Sequence control register bit[6]).

Normal from standby mode:

Address0x4,Sequence control register bit[6];
"L" write operation sets this IC to normal mode from standby mode.

[Transition from the performance state to the suspension state]

step1 Address 0x4 write operation data 0x00 (Sequencer stop)
step2 Address 0x4 write operation data 0x40 (Standby mode set)

Forego procedure is necessary.

[Notice for using "formatB"]
At "formatB" unable to change volume during NOTEON.
When NOTEON message inputs for changing volume, BU8772KN asign onother wave generator.
Therefore several sounds are generated at same TrackNo and Key. So, without NOTEOFF message for them, The wave generator ever NOTEON.
When translates to "formatB", don't input to BU8772KN data for changing volume, or input them as NOP Message.

[Notice for using "formatA"]
When same TrackNo,VoiceNo and Key data is already NOTEON, BU8772KN treat next data as extention for length of sound.
When translates to "formatA", set other TrackNo(VoiceNo) for each tone data, or set other Key for each tone data of same TrackNo,VoiceNo. Especially, notice for specific effect sounds.

4. Tone data table

The tone data table is shown below.

These correspond to the tones in the melody data format.

SD[7:0]	Instrument	SD[7:0]	Instrument	SD[7:0]	Instrument
0x00	Acoustic Grand Piano	0x30	String Ensembles 1	0x60	FX1(rain)
0x01	Bright Acoustic Piano	0x31	String Ensembles 2	0x61	FX2(soundtrack)
0x02	Electric Grand Piano	0x32	Synth Strings 1	0x62	FX3(crystal)
0x03	Honky-tonk Piano	0x33	Synth Strings 2	0x63	FX4(atmosphere)
0x04	Electric Piano 1	0x34	Choir Aahs	0x64	FX5(brightness)
0x05	Electric Piano 2	0x35	Voice Oohs	0x65	FX6(goblins)
0x06	Harpsichord	0x36	Synth Voice	0x66	FX7(echoes)
0x07	Clavi	0x37	Orchestra Hit	0x67	FX8(sci-fi)
0x08	Celesta	0x38	Trumpet	0x68	Sitar
0x09	Glockenspiel	0x39	Trombone	0x69	Banjo
0x0A	Music Box	0x3A	Tuba	0x6A	Shamisen
0x0B	Vibraphone	0x3B	Muted Trumpet	0x6B	Koto
0x0C	Marimba	0x3C	French Horn	0x6C	Kalimba
0x0D	Xylophone	0x3D	Brass Section	0x6D	Bagpipe
0x0E	Tubular Bells	0x3E	Synth Brass 1	0x6E	Fiddle
0x0F	Dulcimer	0x3F	Synth Brass 2	0x6F	Shanai
0x10	Drawbar Organ	0x40	Soprano Sax	0x70	Tinkle Bell
0x11	Percussive Organ	0x41	Alto Sax	0x71	Agogo
0x12	Rock Organ	0x42	Tenor Sax	0x72	Steel Drum
0x13	Church Organ	0x43	Baritone Sax	0x73	Woodblock
0x14	Reed Organ	0x44	Oboe	0x74	Taiko Drum
0x15	Accordion	0x45	English Horn	0x75	Melodic Tom
0x16	Harmonica	0x46	Bassoon	0x76	Synth Drum
0x17	Tango Accordion	0x47	Clarinet	0x77	Reverse Cymbal
0x18	Acoustic Guitar (nylon)	0x48	Piccolo	0x78	Guitar Fret Noise
0x19	Acoustic Guitar (steel)	0x49	Flute	0x79	Breath Noise
0x1A	Electric Guitar (jazz)	0x4A	Recorder	0x7A	Seashore
0x1B	Electric Guitar (jazz)	0x4B	Pan Flute	0x7B	Bird Tweet
0x1C	Electric Guitar (jazz)	0x4C	Blow Bottle	0x7C	Telephone Ring
0x1D	Overdrive Guitar	0x4D	Shakuhachi	0x7D	Helicopter
0x1E	Distortion Guitar	0x4E	Whistle	0x7E	Applause
0x1F	Guitar Harmonics	0x4F	Ocarina	0x7F	Gun Shot
0x20	Acoustic Bass	0x50	Lead1(square)		
0x21	Electric Bass (finger)	0x51	Lead2(sawtooth)		
0x22	Electric Bass (pick)	0x52	Lead3(calliope)		
0x23	Fretless Bass	0x53	Lead4(chiff)		
0x24	Slap Bass 1	0x54	Lead5(charang)		
0x25	Slap Bass 2	0x55	Lead6(voice)		
0x26	Synth Bass 1	0x56	Lead7(fifths)		
0x27	Synth Bass 2	0x57	Lead8(bass+lead)		
0x28	Violin	0x58	Pad1(new age)		
0x29	Viola	0x59	Pad2(warm)		
0x2A	Cello	0x5A	Pad3(polysynth)		
0x2B	Contrabass	0x5B	Pad4(choir)		
0x2C	Tremolo Strings	0x5C	Pad5(bowed)		
0x2D	Pizzicato Strings	0x5D	Pad6(metallic)		
0x2E	Orchestral Harp	0x5E	Pad7(halo)		
0x2F	Timpani	0x5F	Pad8(sweep)		

SD[7:0]	Instrument	SD[7:0]	Instrument	SD[7:0]	Instrument
0x80	Acoustic Bass Drum	0xB0	Cursor move sound (Long)	0xE0	Special rectangle(no ENV)
0x81	Bass Drum	0xB1	Beep(Normal)	0xE1	Sin(1.6s)
0x82	Side Stick	0xB2	Beep(Outer space)	0xE2	Sin(0.8s)
0x83	Acoustic Snare	0xB3	Siren1	0xE3	Sin(no ENV)
0x84	Hand Clap	0xB4	Character power up	0xE4	Reserved
0x85	Electric Snare	0xB5	Character get	0xE5	Reserved
0x86	Low Floor Tom	0xB6	Up	0xE6	Reserved
0x87	Closed Hi-hat	0xB7	Down	0xE7	Reserved
0x88	High Floor Tom	0xB8	Luffin'	0xE8	Reserved
0x89	Pedal Hi-hat	0xB9	Scream	0xE9	Reserved
0x8A	Low Tom	0xBA	Pretty	0xEA	Reserved
0x8B	Open Hi-hat	0xBB	Mystery	0xEB	Reserved
0x8C	Low Mid Tom	0xBC	Robot	0xEC	Reserved
0x8D	High Mid Tom	0xBD	Foot step	0xED	Reserved
0x8E	Crash Cymbal1	0xBE	Character rotation	0xEE	Reserved
0x8F	High Tom	0xBF	Character jump	0xEF	Reserved
0x90	Ride Cymbal 1	0xC0	Laser gun(Short)	0xF0	Reserved
0x91	Chinese Cymbal	0xC1	Hit1(hard)	0xF1	Reserved
0x92	Ride Bell	0xC2	Hit2(noise)	0xF2	Reserved
0x93	Tambourine	0xC3	Bomb(Short)	0xF3	Reserved
0x94	Splash Cymbal	0xC4	Bomb(Long)	0xF4	Reserved
0x95	Cowbell	0xC5	Monster damage	0xF5	Reserved
0x96	Crash Cymbal2	0xC6	Robot damage	0xF6	Reserved
0x97	Vibra-slap	0xC7	Character fade out	0xF7	Reserved
0x98	Ride Cymbal2	0xC8	Engine	0xF8	Reserved
0x99	High Bongo	0xC9	Approach (fade in)	0xF9	Reserved
0x9A	Low Bongo	0xCA	Take off(fade out)	0xFA	Reserved
0x9B	Mute Hi Conga	0xCB	Space(filer drown)	0xFB	Reserved
0x9C	Open Hi Conga	0xCC	Science(Hi drown)	0xFC	Reserved
0x9D	Low Conga	0xCD	Bubble	0xFD	Reserved
0x9E	High Timbale	0xCE	Drop	0xFE	Reserved
0x9F	Low Timbale	0xCF	Reserved	0xFF	Reserved
0xA0	High Agogo	0xD0	Reserved		
0xA1	Low Agogo	0xD1	Reserved		
0xA2	Cabasa	0xD2	Reserved		
0xA3	Maracas	0xD3	Reserved		
0xA4	Short Whistle	0xD4	Reserved		
0xA5	Long Whistle	0xD5	Reserved		
0xA6	Short Guiro	0xD6	Reserved		
0xA7	Long Guiro	0xD7	Reserved		
0xA8	Claves	0xD8	Reserved		
0xA9	Hi Wood Block	0xD9	Reserved		
0xAA	Low Wood Block	0xDA	Reserved		
0xAB	Mute Cuica	0xDB	Reserved		
0xAC	Open Cuica	0xDC	Reserved		
0xAD	Mute Triangle	0xDD	Reserved		
0xAE	Open Triangle	0xDE	Special rectangle (1.6s)		
0xAF	Cursor move sound(Short)	0xDF	Special rectangle (0.8s)		

Note: The following assignments set Compact MIDI format compatibility for the above tones.
Tone bank 2 & tone data 0 to 63 are assigned to 0x00 to 0x3F in SD [7:0].
Tone bank 3 & tone data 0 to 63 are assigned to 0x40 to 0x7F in SD [7:0].
Tone bank 52 & tone data 0 to 31 are assigned to 0xAF to 0xCE in SD [7:0].
Tone bank 62 & tone data 0 & Key date 0 to 46 are assigned to 0x80 to 0xAE in SD [7:0].

5. KEY date (KEY)

The KEY data table is shown below.

These correspond to the KEY in the melody data format.

Key[6:0]	Real KEY	Remarks*MIDI	Remark*Compact MIDI	
			OCTSFT	KEY
0	A[27.5Hz]	21	-2	0
1	A#	22		1
～	～	～		～
61		82		61
62		83		62
12	A[55Hz]	33	-1	0
13	A#	34		1
～	～	～		～
73		94		61
74		95		62
24	A[110Hz]	45	0	0
25	A#	46		1
～	～	～		～
85		106		61
86		107		62
36	A[220Hz]	57	1	0
37	A#	58		1
～	～	～		～
97		118		61
98		119		62

[The pronunciation area of the endorse toward each timbre]

NO.	Instrument	The pronunciation area of the endorse									
		MIDI Key		BU8772 Key		CompactMIDI Key					
		KEY Lower limit	KEY Upper limit	KEY Lower limit	KEY Upper limit	KEY Lower limit			KEY Upper limit		
						OCTSFT	KEY	Hex	OCTSFT	KEY	Hex
0	Acoustic Grand Piano	21	95	0	74	-2	0	80	0	50	32
1	Bright Acoustic Piano	21	95	0	74	-2	0	80	0	50	32
2	Electric Grand Piano	21	95	0	74	-2	0	80	0	50	32
3	Honkey-tonk Piano	21	95	0	74	-2	0	80	0	50	32
4	Electric Piano1	28	95	7	74	-2	7	87	0	50	32
5	Electric Piano2	28	95	7	74	-2	7	87	0	50	32
6	Harpsichord	41	89	20	68	-1	8	C8	0	44	2C
7	Clavi	36	95	15	74	-1	3	C3	0	50	32
8	Celesta	60	95	39	74	0	15	F	0	50	32
9	Glockenspiel	72	83	51	62	0	27	1B	0	38	26

10	Music Box	60	84	39	63	0	15	F	0	39	27
11	Vibraphone	53	89	32	68	0	8	8	0	44	2C
12	Marimba	48	84	27	63	0	3	3	0	39	27
13	Xylophone	65	95	44	74	0	20	14	0	50	32
14	Tubular Bells	60	77	39	56	0	15	F	0	32	20
15	Dulcimer	60	84	39	63	0	15	F	0	39	27
16	Drawbar Organ	36	95	15	74	-1	3	C3	0	50	32
17	Percussive Organ	36	95	15	74	-1	3	C3	0	50	32
18	Rock Organ	36	95	15	74	-1	3	C3	0	50	32
19	Church Organ	21	95	0	74	-2	0	80	0	50	32
20	Reed Organ	36	83	15	62	-1	3	C3	0	38	26
21	Accordion	53	83	32	62	0	8	8	0	38	26
22	Harmonica	60	83	39	62	0	15	F	0	38	26
23	Tango Accordion	53	89	32	68	0	8	8	0	44	2C
24	Acoustic Guitar (nylon)	40	84	19	63	-1	7	C7	0	39	27
25	Acoustic Guitar (steel)	40	84	19	63	-1	7	C7	0	39	27
26	Electric Guitar (jazz)	40	86	19	65	-1	7	C7	0	41	29
27	Electric Guitar (clean)	40	86	19	65	-1	7	C7	0	41	29
28	Electric Guitar (muted)	40	86	19	65	-1	7	C7	0	41	29
29	Overdriven Guitar	40	83	19	62	-1	7	C7	0	38	26
30	Distortion Guitar	40	86	19	65	-1	7	C7	0	41	29
31	Guitar harmonics	40	86	19	65	-1	7	C7	0	41	29
32	Acoustic Bass	28	55	7	34	-2	7	87	0	10	A
33	Electric Bass (finger)	28	55	7	34	-2	7	87	0	10	A
34	Electric Bass (pick)	28	55	7	34	-2	7	87	0	10	A
35	Fretless Bass	28	55	7	34	-2	7	87	0	10	A
36	Slap Bass1	28	55	7	34	-2	7	87	0	10	A
37	Slap Bass2	28	55	7	34	-2	7	87	0	10	A
38	Synth Bass1	28	55	7	34	-2	7	87	0	10	A
39	Synth Bass2	28	55	7	34	-2	7	87	0	10	A
40	Violin	55	95	34	74	0	10	A	0	50	32
41	Viola	48	84	27	63	0	3	3	0	39	27
42	Cello	36	72	15	51	-1	3	C3	0	27	1B
43	Contrabass	28	55	7	34	-2	7	87	0	10	A
44	Tremolo Strings	28	96	7	75	-2	7	87	0	51	33
45	Pizzicato Strings	28	96	7	75	-2	7	87	0	51	33
46	Orchestral Harp	23	103	2	82	-2	2	82	0	58	3A
47	Timpani	36	57	15	36	-1	3	C3	0	12	C
48	String Ensemble1	28	96	7	75	-2	7	87	0	51	33
49	String Ensemble2	28	96	7	75	-2	7	87	0	51	33
50	Synth String1	36	96	15	75	-1	3	C3	0	51	33
51	Synth String2	36	83	15	62	-1	3	C3	0	38	26
52	Choir Aahs	48	83	27	62	0	3	3	0	38	26
53	Voice Oohs	48	79	27	58	0	3	3	0	34	22
54	Synth Vox	48	84	27	63	0	3	3	0	39	27
55	Orchestra Hit	48	72	27	51	0	3	3	0	27	1B
56	Trumpet	58	94	37	73	0	13	D	0	49	31
57	Trombone	34	75	13	54	-1	1	C1	0	30	1E
58	Tuba	29	55	8	34	-2	8	88	0	10	A
59	Muted Trumpet	58	82	37	61	0	13	D	0	37	25
60	French Horn	41	77	20	56	-1	8	C8	0	32	20
61	Brass Section	36	77	15	56	-1	3	C3	0	32	20
62	Synth Brass1	36	83	15	62	-1	3	C3	0	38	26

63	Synth Brass2	36	95	15	74	-1	3	C3	0	50	32
64	Soprano Sax	54	87	33	66	0	9	9	0	42	2A
65	Alto Sax	49	80	28	59	0	4	4	0	35	23
66	Tenor Sax	42	75	21	54	-1	9	C9	0	30	1E
67	Baritone Sax	37	68	16	47	-1	4	C4	0	23	17
68	Oboe	58	83	37	62	0	13	D	0	38	26
69	English Horn	52	81	31	60	0	7	7	0	36	24
70	Bassoon	34	72	13	51	-1	1	C1	0	27	1B
71	Clarinet	50	83	29	62	0	5	5	0	38	26
72	Piccolo	74	95	53	74	0	29	1D	0	50	32
73	Flute	60	96	39	75	0	15	F	0	51	33
74	Recorder	60	96	39	75	0	15	F	0	51	33
75	Pan Flute	60	96	39	75	0	15	F	0	51	33
76	Blown Bottle	60	83	39	62	0	15	F	0	38	26
77	Shakuhachi	55	84	34	63	0	10	A	0	39	27
78	Whistle	60	96	39	75	0	15	F	0	51	33
79	Ocarina	60	84	39	63	0	15	F	0	39	27
80	Lead1 (square)	21	95	0	74	-2	0	80	0	50	32
81	Lead2 (sawtooth	21	95	0	74	-2	0	80	0	50	32
82	Lead3 (calliope)	48	96	27	75	0	3	3	0	51	33
83	Lead4 (chiff)	48	96	27	75	0	3	3	0	51	33
84	Lead5 (charang)	48	91	27	70	0	3	3	0	46	2E
85	Lead6 (voice)	48	84	27	63	0	3	3	0	39	27
86	Lead7 (fifths)	36	96	15	75	-1	3	C3	0	51	33
87	Lead8 (bass + lead)	21	91	0	70	-2	0	80	0	46	2E
88	Pad1 (new age)	36	96	15	75	-1	3	C3	0	51	33
89	Pad2 (warm)	36	96	15	75	-1	3	C3	0	51	33
90	Pad3 (polysynth)	36	96	15	75	-1	3	C3	0	51	33
91	Pad4 (choir)	48	84	27	63	0	3	3	0	39	27
92	Pad5 (bowed)	48	96	27	75	0	3	3	0	51	33
93	Pad6 (metallic)	21	91	0	70	-2	0	80	0	46	2E
94	Pad7 (halo)	36	96	15	75	-1	3	C3	0	51	33
95	Pad8 (sweep)	36	96	15	75	-1	3	C3	0	51	33
96	Fx1 (rain)	36	96	15	75	-1	3	C3	0	51	33
97	Fx2 (soundtrack)	36	84	15	63	-1	3	C3	0	39	27
98	Fx3 (crystal)	60	95	39	74	0	15	F	0	50	32
99	Fx4 (atmosphere)	36	96	15	75	-1	3	C3	0	51	33
100	Fx5 (brightness)	36	96	15	75	-1	3	C3	0	51	33
101	Fx6 (goblins)	36	96	15	75	-1	3	C3	0	51	33
102	Fx7 (echoes)	36	83	15	62	-1	3	C3	0	38	26
103	Fx8 (sci-fi)	36	83	15	62	-1	3	C3	0	38	26
104	Sitar	48	77	27	56	0	3	3	0	32	20
105	Banjo	48	84	27	63	0	3	3	0	39	27
106	Shamisen	50	79	29	58	0	5	5	0	34	22
107	Koto	55	84	34	63	0	10	A	0	39	27
108	Kalimba	48	79	27	58	0	3	3	0	34	22
109	Bag pipe	36	77	15	56	-1	3	C3	0	32	20
110	Fiddle	55	91	34	70	0	10	A	0	46	2E
111	Shanai	48	72	27	51	0	3	3	0	27	1B
112	Tinkle Bell	72	77	51	56	0	27	1B	0	32	20
113	Agogo	60	72	39	51	0	15	F	0	27	1B
114	Steel Drums	52	76	31	55	0	7	7	0	31	1F
115	Woodblock	36	84	15	63	-1	3	C3	0	39	27

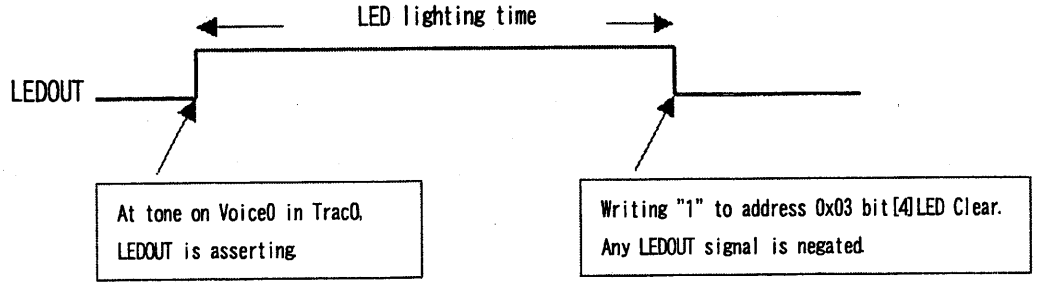
116	Taiko	36	72	15	51	-1	3	C3	0	27	1B
117	Melodic Tom	36	94	15	73	-1	3	C3	0	49	31
118	Synth Drum	36	94	15	73	-1	3	C3	0	49	31
119	Reverse Cymbal	36	84	15	63	-1	3	C3	0	39	27
120	Guitar Fret Noise	36	72	15	51	-1	3	C3	0	27	1B
121	Breath Noise	36	72	15	51	-1	3	C3	0	27	1B
122	Seashore	36	72	15	51	-1	3	C3	0	27	1B
123	Bird Tweet	36	72	15	51	-1	3	C3	0	27	1B
124	Telephone Ring	36	72	15	51	-1	3	C3	0	27	1B
125	Helicopter	36	72	15	51	-1	3	C3	0	27	1B
126	Applause	36	72	15	51	-1	3	C3	0	27	1B
127	Gunshot	36	72	15	51	-1	3	C3	0	27	1B
128	Acoustic Bass Drum	60	60	0	0	0	15	F	0	15	F
129	Bass Drum1	60	60	1	1	0	15	F	0	15	F
130	Side Stick	60	60	2	2	0	15	F	0	15	F
131	Acoustic Snare	60	60	3	3	0	15	F	0	15	F
132	Hand Clap	60	60	4	4	0	15	F	0	15	F
133	Electric Snare	60	60	5	5	0	15	F	0	15	F
134	Low Floor Tom	60	60	6	6	0	15	F	0	15	F
135	Closed Hi-Hat	60	60	7	7	0	15	F	0	15	F
136	High Floor Tom	60	60	8	8	0	15	F	0	15	F
137	Pedal Hi-Hat	60	60	9	9	0	15	F	0	15	F
138	Low Tom	60	60	10	10	0	15	F	0	15	F
139	Open Hi-Hat	60	60	11	11	0	15	F	0	15	F
140	Low-Mid Tom	60	60	12	12	0	15	F	0	15	F
141	Hi-Mid Tom	60	60	13	13	0	15	F	0	15	F
142	Crash Cymbal1	60	60	14	14	0	15	F	0	15	F
143	High Tom	60	60	15	15	0	15	F	0	15	F
144	Ride Cymbal1	60	60	16	16	0	15	F	0	15	F
145	Chinese Cymbal	60	60	17	17	0	15	F	0	15	F
146	Ride Bell	60	60	18	18	0	15	F	0	15	F
147	Tambourine	60	60	19	19	0	15	F	0	15	F
148	Splash Cymbal	60	60	20	20	0	15	F	0	15	F
149	Cowbell	60	60	21	21	0	15	F	0	15	F
150	Crash Cymbal2	60	60	22	22	0	15	F	0	15	F
151	Vibraslap	60	60	23	23	0	15	F	0	15	F
152	Ride Cymbal2	60	60	24	24	0	15	F	0	15	F
153	Hi Bongo	60	60	25	25	0	15	F	0	15	F
154	Low Bongo	60	60	26	26	0	15	F	0	15	F
155	Mute Hi Conga	60	60	27	27	0	15	F	0	15	F
156	Open Hi Conga	60	60	28	28	0	15	F	0	15	F
157	Low Conga	60	60	29	29	0	15	F	0	15	F
158	High Timbale	60	60	30	30	0	15	F	0	15	F
159	Low Timbale	60	60	31	31	0	15	F	0	15	F
160	High Agogo	60	60	32	32	0	15	F	0	15	F
161	Low Agogo	60	60	33	33	0	15	F	0	15	F
162	Cabasa	60	60	34	34	0	15	F	0	15	F
163	Maracas	60	60	35	35	0	15	F	0	15	F
164	Short Whistle	60	60	36	36	0	15	F	0	15	F
165	Long Whistle	60	60	37	37	0	15	F	0	15	F
166	Short Guiro	60	60	38	38	0	15	F	0	15	F
167	Long Guiro	60	60	39	39	0	15	F	0	15	F
168	Clavas	60	60	40	40	0	15	F	0	15	F

169	Hi Wood Block	60	60	41	41	0	15	F	0	15	F
170	Low Wood Block	60	60	42	42	0	15	F	0	15	F
171	Mute Cuica	60	60	43	43	0	15	F	0	15	F
172	Open Cuica	60	60	44	44	0	15	F	0	15	F
173	Mute Triangle	60	60	45	45	0	15	F	0	15	F
174	Open Triangle	60	60	46	46	0	15	F	0	15	F
175	Cursor move sound 1 (Short)	60	60	39	39	0	15	F	0	15	F
176	Cursor move sound 2 (Long)	60	60	39	39	0	15	F	0	15	F
177	Beep (Normal)	60	60	39	39	0	15	F	0	15	F
178	Beep (Outer space)	60	60	39	39	0	15	F	0	15	F
179	Siren 1	60	60	39	39	0	15	F	0	15	F
180	Character Power up	60	60	39	39	0	15	F	0	15	F
181	Character get	60	60	39	39	0	15	F	0	15	F
182	Up	60	60	39	39	0	15	F	0	15	F
183	Down	60	60	39	39	0	15	F	0	15	F
184	Luffin'	60	60	39	39	0	15	F	0	15	F
185	Scream	60	60	39	39	0	15	F	0	15	F
186	Pretty	60	60	39	39	0	15	F	0	15	F
187	Mystery	60	60	39	39	0	15	F	0	15	F
188	Robot	60	60	39	39	0	15	F	0	15	F
189	Foot step	60	60	39	39	0	15	F	0	15	F
190	Character rotation	60	60	39	39	0	15	F	0	15	F
191	Character jump	60	60	39	39	0	15	F	0	15	F
192	Laser gun (Short)	60	60	39	39	0	15	F	0	15	F
193	Hit 1 (Hard)	60	60	39	39	0	15	F	0	15	F
194	Hit 2 (Noise)	60	60	39	39	0	15	F	0	15	F
195	Bomb (Short)	60	60	39	39	0	15	F	0	15	F
196	Bomb (Long)	60	60	39	39	0	15	F	0	15	F
197	Monster damage	60	60	39	39	0	15	F	0	15	F
198	Robot damage	60	60	39	39	0	15	F	0	15	F
199	Character fade out	60	60	39	39	0	15	F	0	15	F
200	Engine	60	60	39	39	0	15	F	0	15	F
201	Approach (Fade in)	60	60	39	39	0	15	F	0	15	F
202	Take off (Fade out)	60	60	39	39	0	15	F	0	15	F
203	Space (Filer drown)	60	60	39	39	0	15	F	0	15	F
204	Science (Hidrown)	60	60	39	39	0	15	F	0	15	F
205	Bubble	60	60	39	39	0	15	F	0	15	F
206	Drop	60	60	39	39	0	15	F	0	15	F
207	Reserved	-	-	-	-	-	-	-	-	-	-
208	Reserved	-	-	-	-	-	-	-	-	-	-
209	Reserved	-	-	-	-	-	-	-	-	-	-
210	Reserved	-	-	-	-	-	-	-	-	-	-
211	Reserved	-	-	-	-	-	-	-	-	-	-
212	Reserved	-	-	-	-	-	-	-	-	-	-
213	Reserved	-	-	-	-	-	-	-	-	-	-
214	Reserved	-	-	-	-	-	-	-	-	-	-
215	Reserved	-	-	-	-	-	-	-	-	-	-
216	Reserved	-	-	-	-	-	-	-	-	-	-
217	Reserved	-	-	-	-	-	-	-	-	-	-
218	Reserved	-	-	-	-	-	-	-	-	-	-
219	Reserved	-	-	-	-	-	-	-	-	-	-
220	Reserved	-	-	-	-	-	-	-	-	-	-
221	Reserved	-	-	-	-	-	-	-	-	-	-

222	Special rectangle (1.6s)	21	108	0	87	-2	0	80	0	63	3F
223	Special rectangle (0.8s)	21	108	0	87	-2	0	80	0	63	3F
224	Special rectangle (no ENV)	21	108	0	87	-2	0	80	0	63	3F
225	Sin wave (1.6s)	21	108	0	87	-2	0	80	0	63	3F
226	Sin wave (0.8s)	21	108	0	87	-2	0	80	0	63	3F
227	Sin wave (no ENV)	21	108	0	87	-2	0	80	0	63	3F
228	Reserved	-	-	-	-	-	-	-	-	-	-
229	Reserved	-	-	-	-	-	-	-	-	-	-
230	Reserved	-	-	-	-	-	-	-	-	-	-
231	Reserved	-	-	-	-	-	-	-	-	-	-
232	Reserved	-	-	-	-	-	-	-	-	-	-
233	Reserved	-	-	-	-	-	-	-	-	-	-
234	Reserved	-	-	-	-	-	-	-	-	-	-
235	Reserved	-	-	-	-	-	-	-	-	-	-
236	Reserved	-	-	-	-	-	-	-	-	-	-
237	Reserved	-	-	-	-	-	-	-	-	-	-
238	Reserved	-	-	-	-	-	-	-	-	-	-
239	Reserved	-	-	-	-	-	-	-	-	-	-
240	Reserved	-	-	-	-	-	-	-	-	-	-
241	Reserved	-	-	-	-	-	-	-	-	-	-
242	Reserved	-	-	-	-	-	-	-	-	-	-
243	Reserved	-	-	-	-	-	-	-	-	-	-
244	Reserved	-	-	-	-	-	-	-	-	-	-
245	Reserved	-	-	-	-	-	-	-	-	-	-
246	Reserved	-	-	-	-	-	-	-	-	-	-
247	Reserved	-	-	-	-	-	-	-	-	-	-
248	Reserved	-	-	-	-	-	-	-	-	-	-
249	Reserved	-	-	-	-	-	-	-	-	-	-
250	Reserved	-	-	-	-	-	-	-	-	-	-
251	Reserved	-	-	-	-	-	-	-	-	-	-
252	Reserved	-	-	-	-	-	-	-	-	-	-
253	Reserved	-	-	-	-	-	-	-	-	-	-
254	Reserved	-	-	-	-	-	-	-	-	-	-
255	Reserved	-	-	-	-	-	-	-	-	-	-

5. Synchronous melody LED control

LEDOUT is asserted when the performance date of a main melody tone on.
It is negated when writing "1" clears the LED bit.
In this IC, a main melody is fixation Voice0 of Track0.



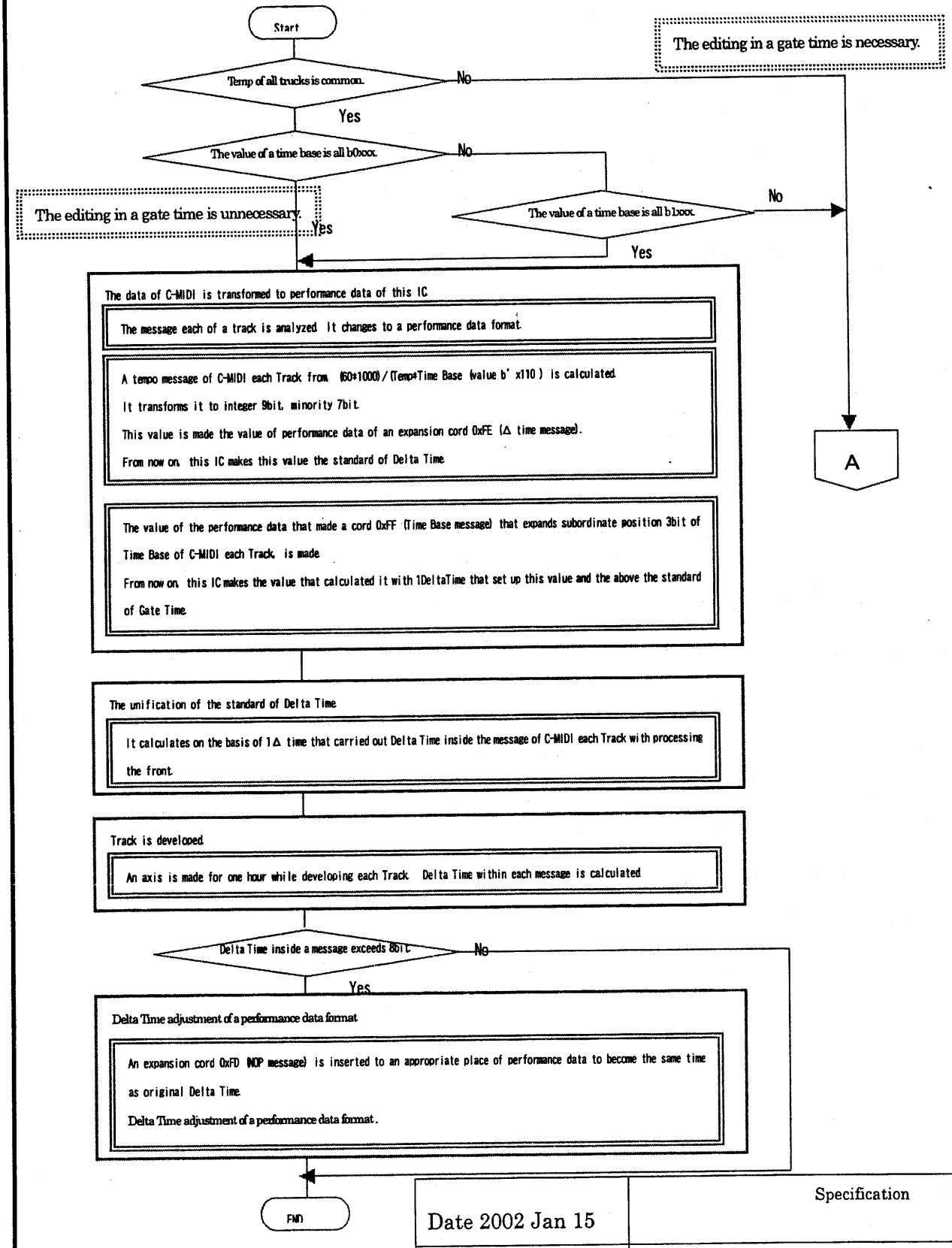
The firmware can recognize LEDOUT output by LED interrupt.
The firmware can be control LED lighting time until interrupt clear.

By carrying out this control, it enables LED lighting synchronous melody.

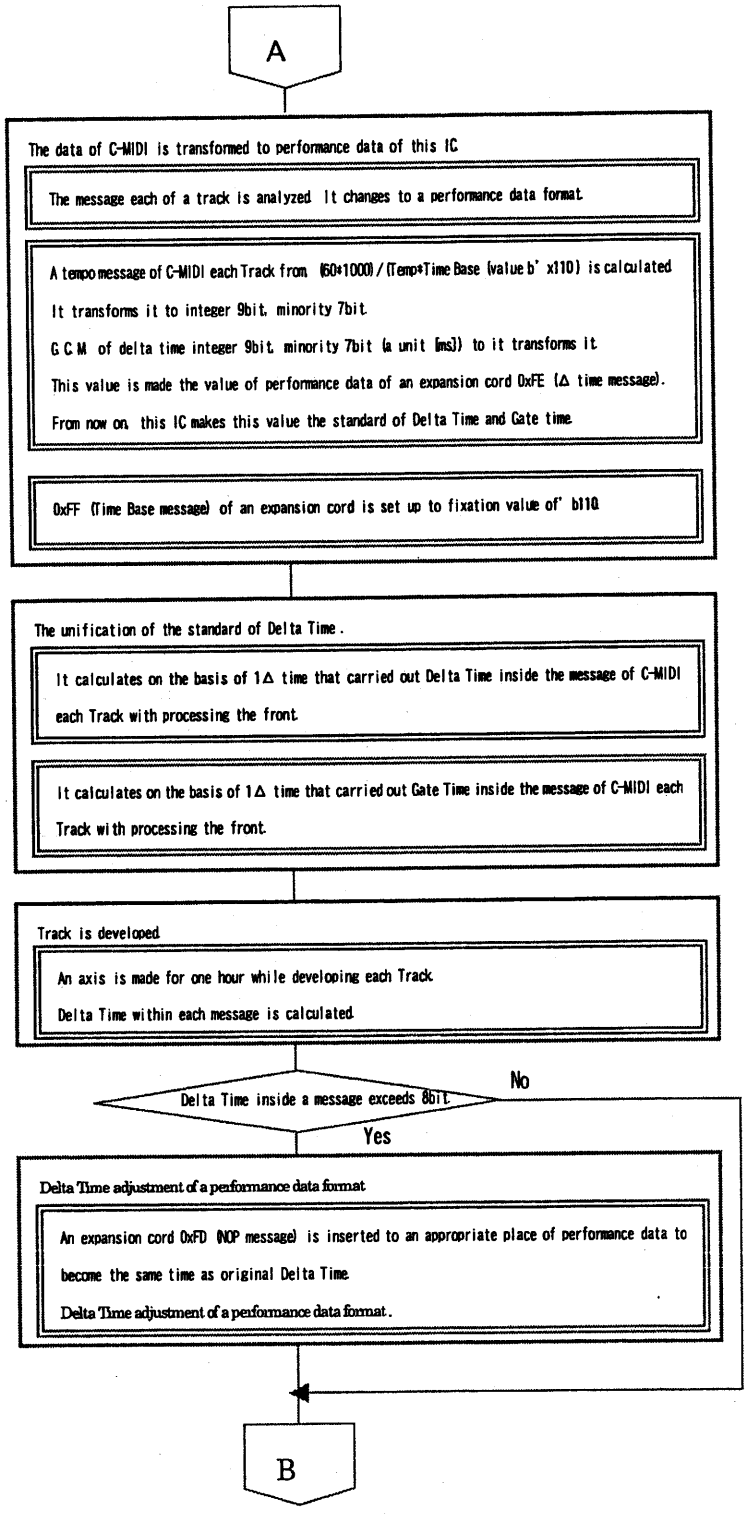
Compact MIDI format processing flow example

Making AN1/2' L' address 0x00: bit [2] a performance data format selects the format A.

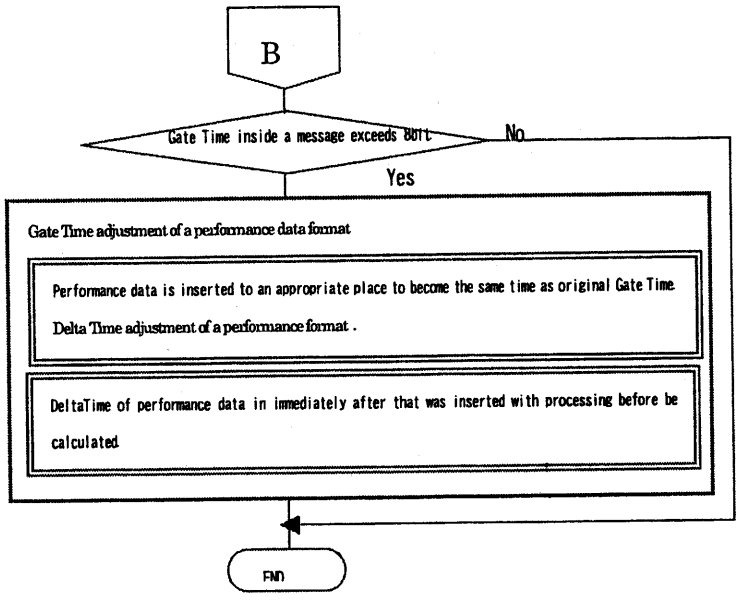
Case of TrackNo0~15.



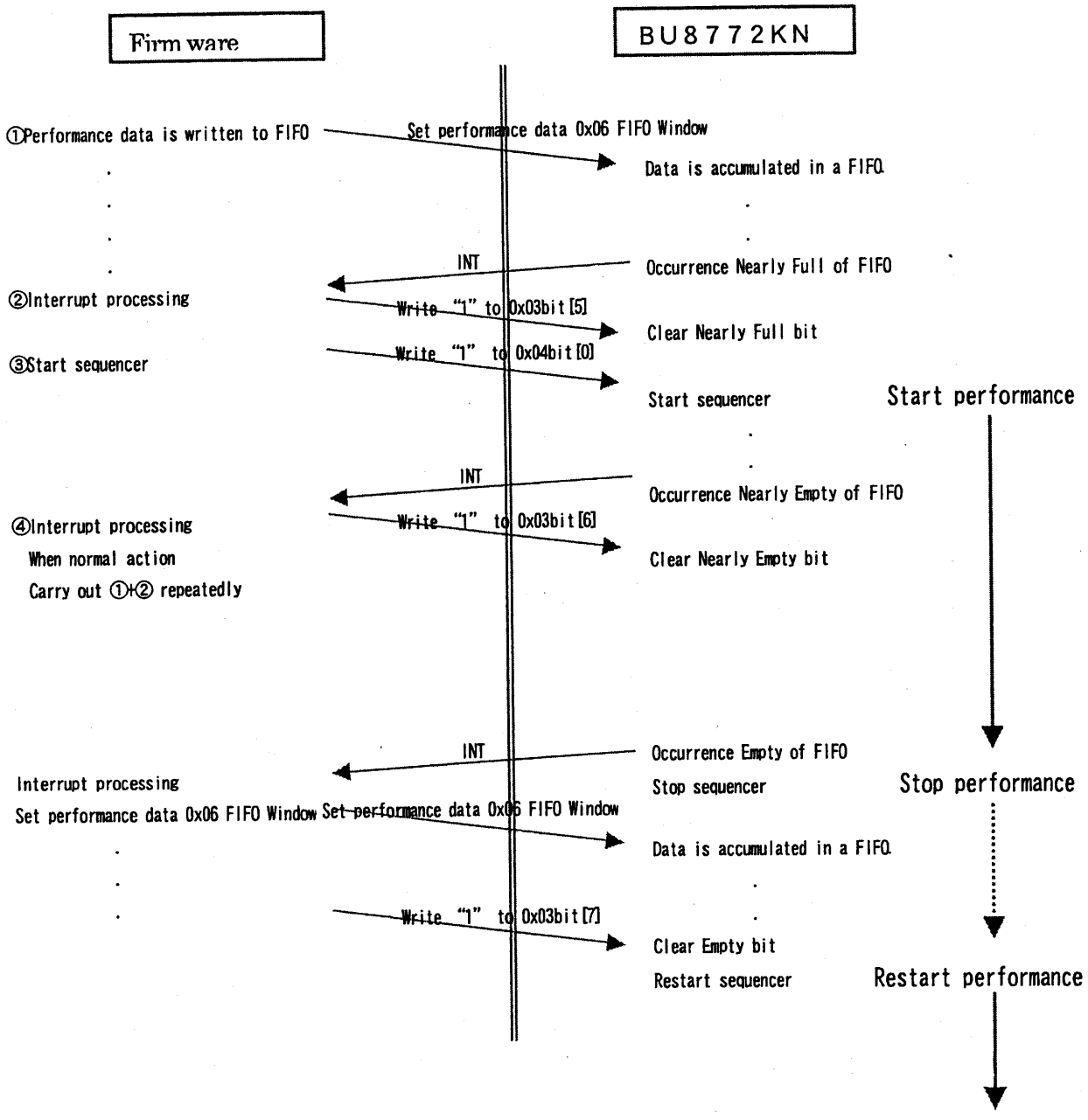
After Truck16, And temp and Time Base are not common.



Continuation...

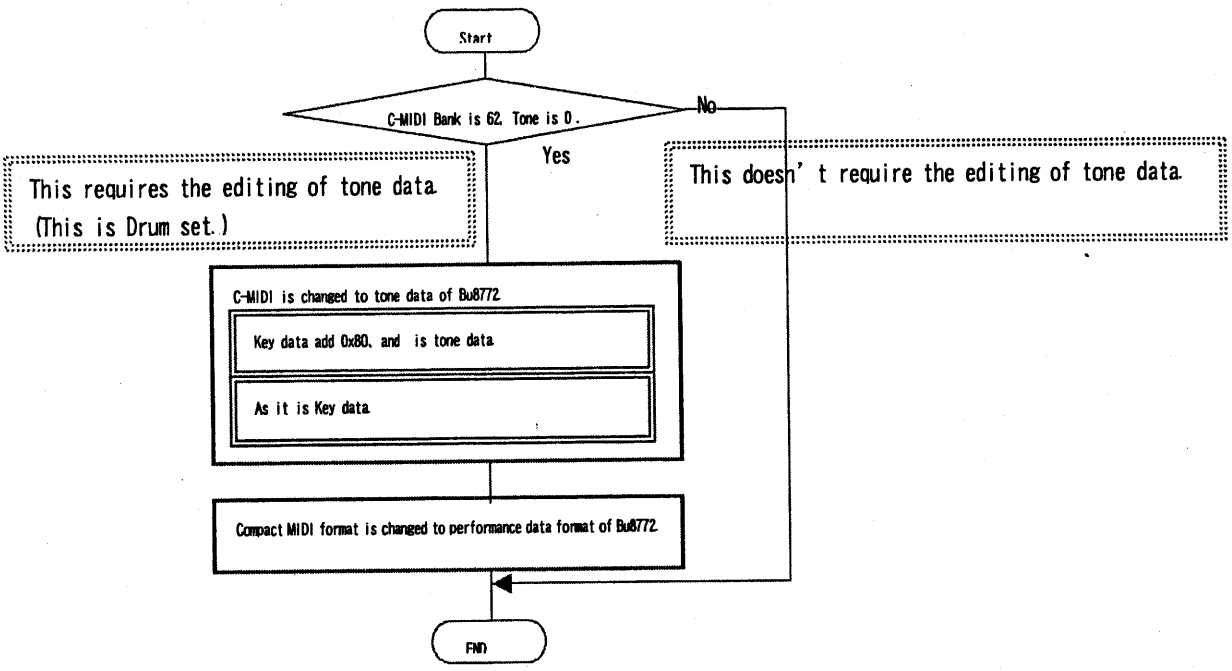


For example .
Performance data control of FIFO empty .



[meno]
Performance data is processed every format block.
If Bu8772 detects empty of FIFO with a block each exception actually.
Sequencer stop, Performance discontinuation, sets 0x03bit[3] illegal format.
It must carry out setting after Firm Ware reset 0x03bit[3].
It is Clear of FIFO. And The sequencer prepares restart.
Accordingly, it's desirable to transmit every a format block.

For example
To play Drum set of Compact MIDI.



NOTICE

1. BU8772KN don't always generates identical sound volumes every TONEON with following specific effect sounds. Don't use them for playing repeatedly with request relative volume. [ ] indicates VoiceNo.
   Up[182], Down[183], Robot [188], Bubble [205]

2. When TONEOFF after short play time, the noise seems to adds to release sounds with following specific effect sounds. This is caused by keeping waves at TONEOFF. But, it is true that the release sounds different from the original sounds. These conditions are following. [ ] indicates VoiceNo.
   (1) play time more than 1000ms is desirable
   LongGuiro[167], Beep(normal)[177], PowerUp[180], Up[182], Down[183], Bomb(short)[195], Robot damage [198]
   (2) play time more than 500ms is desirable
   Beep(Outer space)[178], Character get [181], Luffin' [184], Mystery [187], Character jump [191], Laser gun (Short) [192], Hit2 (Noise) [194], Character fade out [199], Bubble [205], Drop [206]
   (3) play time more than 150ms is desirable
   specific effect sounds without forego sounds

3. Notice for using ANOUT(L) as monaural
   The noise level of ANOUT(L) and ANOUT(MONO) get high when Address0x00,common setup register,Bit1 (MONO) is 'H'. We recommend the following methods when ANOUT(L) uses at monaural.
   (1) Address0x00,common setup register,Bit1 write 'L'. (Stereo mode)
   (2) Input right and left volumes to BU8772KN as monaural. (Level L-volume and R-volume)

< Specifications (Precautions and Prohibitions) >

● Safety Precautions

1) The products are designed and produced for application in ordinary electronic equipment (AV equipment, OA equipment, telecommunication equipment, home appliances, amusement equipment, etc.).
If the products are to be used in devices requiring extremely high reliability (medical equipment, transport equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or operational error may endanger human life and sufficient fail-safe measures, please consult with the Company's sales staff in advance. If product malfunctions may result in serious damage, including that to human life, sufficient fail-safe measures must be taken, including the following:

[a] Installation of protection circuits or other protective devices to improve system safety
[b] Installation of redundant circuits in the case of single-circuit failure

2) The products are designed for use in a standard environment and not in any special environments. Application of the products in a special environment can deteriorate product performance. Accordingly, verification and confirmation of product performance, prior to use, is recommended if used under the following conditions:
[a] Use in various types of liquid, including water, oils, chemicals, and organic solvents
[b] Use outdoors where the products are exposed to direct sunlight, or in dusty places
[c] Use in places where the products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
[d] Use in places where the products are exposed to static electricity or electromagnetic waves
[e] Use in proximity to heat-producing components, plastic cords, or other flammable items
[f] Use involving sealing or coating the products with resin or other coating materials
[g] Use involving unclean solder or use of water or water-soluble cleaning agents for cleaning after soldering
[h] Use of the products in places subject to dew condensation

3) The products are not radiation resistant.

4) The Company is not responsible for any problems resulting from use of the products under conditions not recommended herein.

5) The Company should be notified of any product safety issues. Moreover, product safety issues should be periodically monitored by the customer.

● Precautions Regarding Application Examples and External Circuits

1) If change is made to the constant of an external circuit, allow a sufficient margin due to variations of the characteristics of the products and external components, including transient characteristics, as well as static characteristics. Please be informed that the Company has not conducted investigations on whether or not particular changes in the application examples or external circuits would result in the infringement of patent rights of a third party

2) The application examples, their constants, and other types of information contained herein are applicable only when the products are used in accordance with standard methods. Therefore, if mass production is intended, sufficient consideration to external conditions must be made.

< Specifications (Precautions and Prohibitions) >

● Precautions Regarding Foreign Exchange and Foreign Trade Control Law

1) The Company has not determined whether or not the products are considered "a controlled product or technology " as specified in the Foreign Exchange and Foreign Trade Control Law.
Accordingly, if exportation of the products, either separately or integrated in another company's products, is intended, or giving the products to persons who are not residents is planed, additional steps are required, based upon the appropriate regulations.

● Prohibitions Regarding Industrial Property

1) These Specifications contain information related to the Company's industrial property. Any use of them other than pertaining to the usage of appropriate products is not permitted. Duplication of these Specifications and its disclosure to a third party without the Company's permission is prohibited.

2) Information and data on products, including application examples, contained in these specifications are simply for reference; the Company does not guarantee any industrial property rights, intellectual property rights, or any other rights of a third party regarding this information or data. Accordingly, the Company does not bear any responsibility for:
[a] infringement of the intellectual property rights of a third party
[b] any problems incurred by the use of the products listed herein.

3) The Company prohibits the purchaser of its products to exercise or use the intellectual property rights, industrial property rights, or any other rights that either belong to or are controlled by the Company, other than the right to use, sell, or dispose of the products.

● Precautions on Use of Products

1) Verification and confirmation of performance characteristics of products, after on-board mounting, is advised.

2) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

3) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the remainder of flux may negatively affect product performance and reliability.

4) In principle, the reflow soldering method must be used for surface mount device ; if flow soldering method is preferred, please consult with the Company in advance.

● Precautions Regarding Product Storage

1) Product performance and soldered connections may deteriorate if the products are stored in the following places:
[a] Where the products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
[b] Where the temperature or humidity exceeds those recommended by the Company

2) The guaranteed period of solder connections and product performance is within one year from shipment by the Company, provided that the above-mentioned storage conditions have been satisfied.

● Other Matters

1) Please sign these Specifications and return one copy to the Company.
If a copy is not returned within three months after the issued date specified on the front page of these Specifications, the Company will consider the Specifications accepted.
2) If any matter related to these Specifications needs to be clarified, discussions shall be held promptly between the two parties concerned to determine the issue.