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April 1st, 2010
Renesas Electronics Corporation

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M65851FP

Single Chip Karaoke Processor

REJ03F0172-0201
Rev.2.01
Jan 25, 2008

Description

The M65851FP is an LSI that not only contains circuits (echo and key control) necessary for Karaoke but also improves other peripheral functions.

This IC has full peripheral functions including vocal cut, phase shifter, equalizer, detection of intervals between songs, digital surround, and Karaoke scoring. It is therefore suitable not only for dedicated Karaoke units but also for radio cassette tape recorders, TV, VCR, and miniature unit audio systems with Karaoke function.

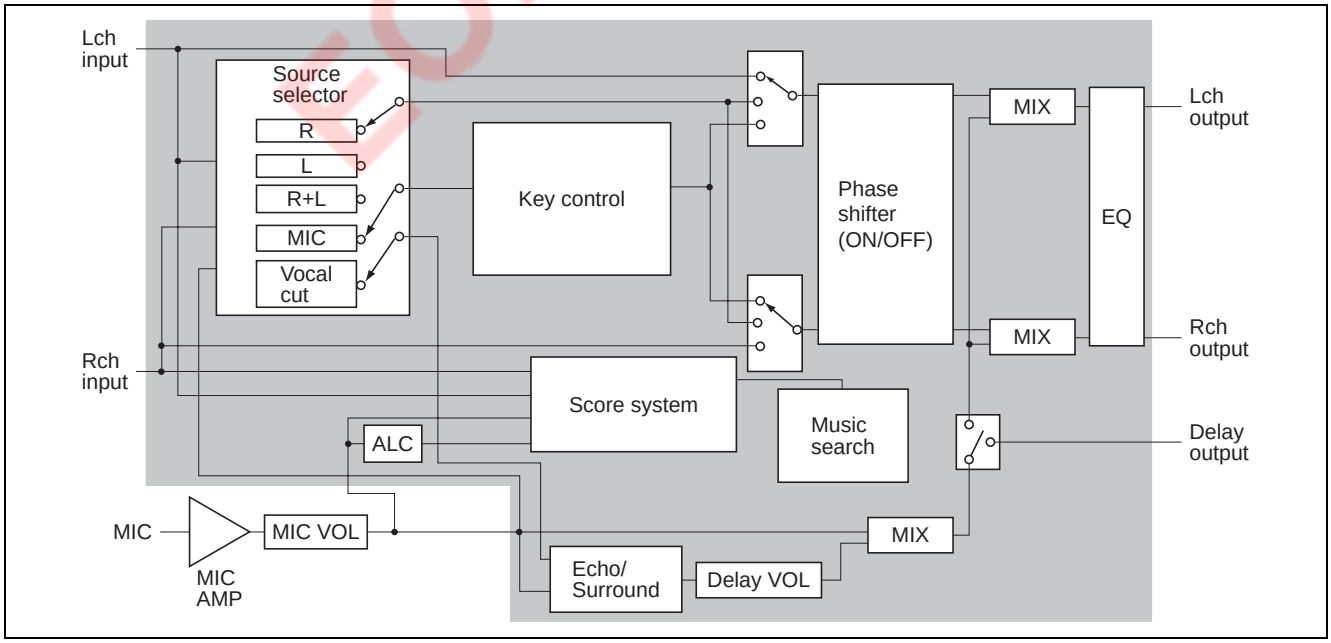
Features

- Capable of composing echo and key control circuits necessary for Karaoke system with a single chip
- Echo circuit is capable of supporting digital surround by adopting 16 Kbit RAM built-in digital delay
- 17 steps of –8 to +8 for key control (1 step is equivalent to a half tone)
- Karaoke entertainment functions such as Karaoke scoring, vocal cut, equalizer, phase shifter, detection of intervals between songs, and magic voice functions
- Generation of unnecessary radiation is avoided because clock's built-in current-control oscillation circuit keeps clock effects inside the clock
- Built-in automatic reset circuit activated with power turned on
- 5 V single power supply

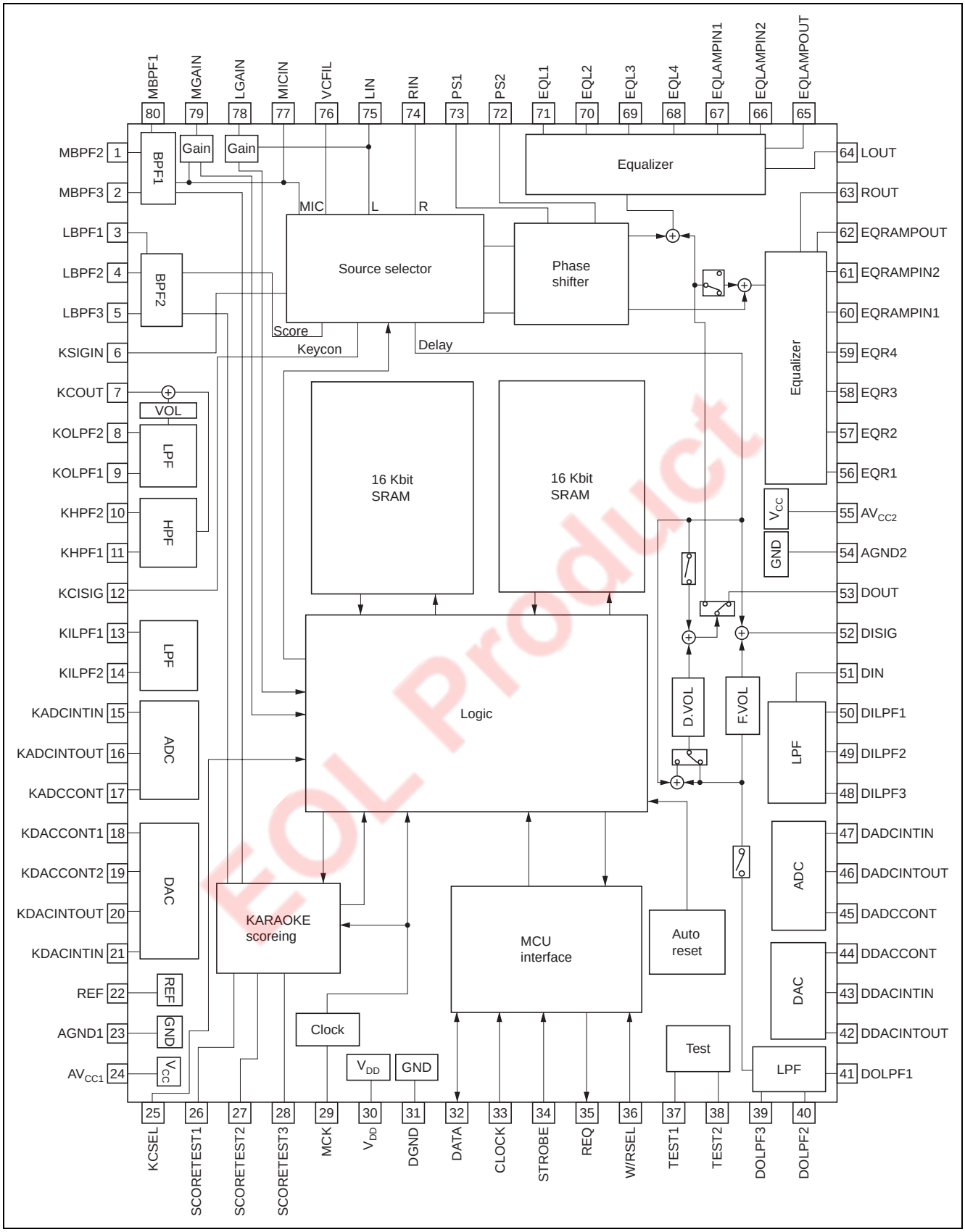
Recommended Operating Condition

- Supply voltage range: V_{CC} = 4.5 to 5.5 V
- Rated supply voltage: V_{CC} = 5 V

System Configuration



Block Diagram

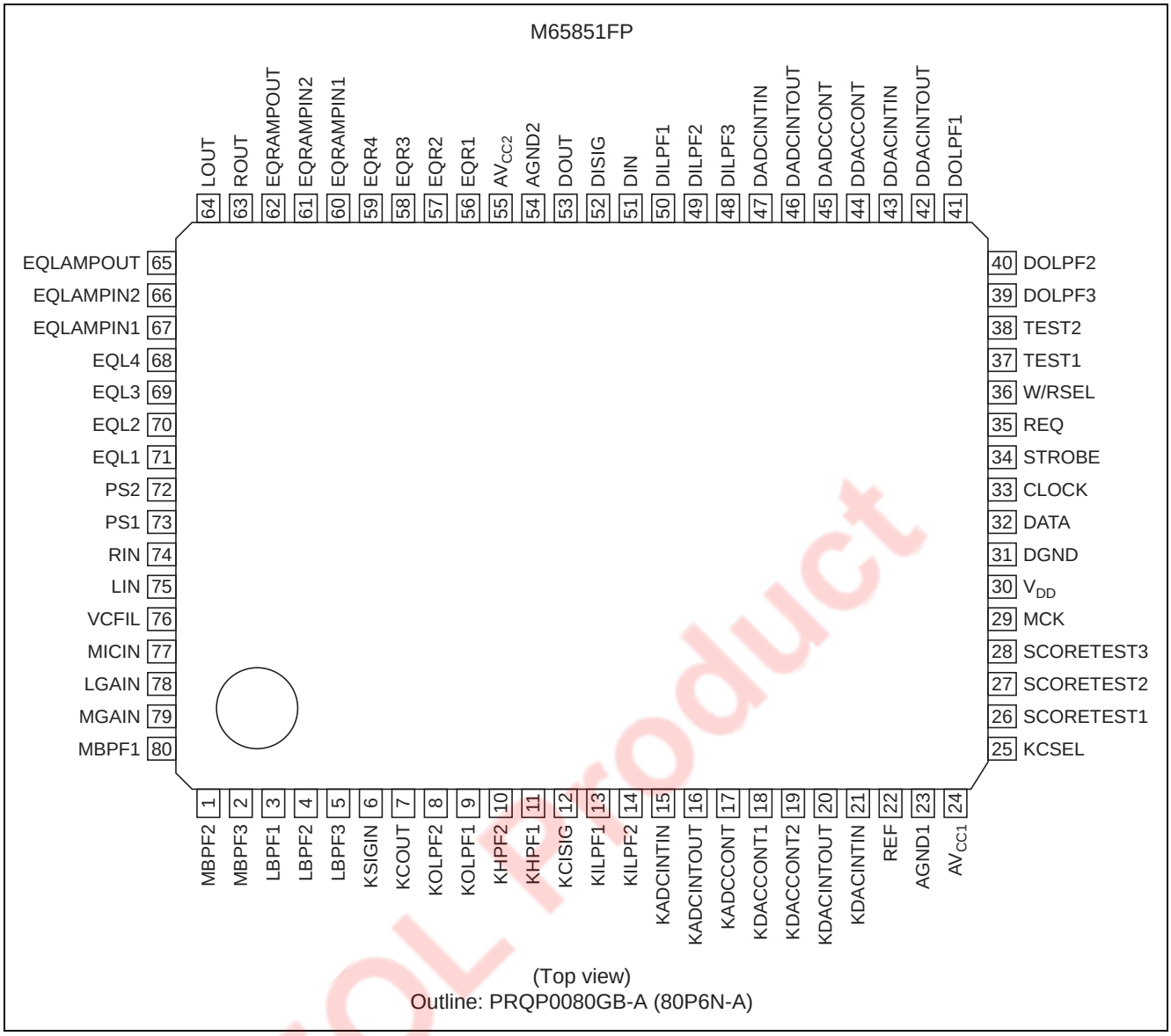


Function List

M65851FP provides the following functions and can configurate all Karaoke functions with only a single chip.

Function	Explanation	Usable or Not		Remarks
		Key Set Mode	Not Key Set Mode	
Digital echo	Built in 16 K SRAM Delay time (changeable) 100 ms, 130 ms 150 ms, 200 ms	○	○	At key set mode Capable of use echo or surround Not key set mode Capable of use both echo and surround
Digital key control	Built in 16 K SRAM –8 to +8 17 steps	○	×	
Digital surround	Built in 16 K SRAM Digital Surround 10 ms to 50 ms 5 kinds	△ Switch with the Echo	○	
Phase shifter surround	Changeable the effect thanks to the external R	○	○	Capable of use both key control and echo
Equalizer	Bass/Treble –12 dB to +12 dB/2 dB 13 steps changeable	○	○	Bass: Resonance type Treble: Filter type
Source selector	Provided all multiple voice soft, L, R, (L+R)/2, Vocal cut L-R (for digital surround) Key control bypass	○	○	
Scoring function	Scoring the MIC vocal input	○	○	Compare the reference vocal and MIC vocal frequency
Help vocal function	At the MIC vocal is nothing, reference vocal is mixed output.	○	○	
Voice key control	Input the MIC voice to key control (change voice tone)	○	×	At key set mode capable to use voice key control or key control
Music search	Detect to line input level	○	○	At music input is nothing, key control level is reset automatically
Others	MCU interface Current control type oscillation circuit Automatic mute Automatic reset	○	○	

Pin Arrangement



(Top view)
Outline: PRQP0080GB-A (80P6N-A)

Pin Description

Pin No.	Symbol	Name	I/O	Function	
1	MBPF2	Microphone band pass filter 2	I	Composes band pass filter for Karaoke scoring (For microphone signal)	
2	MBPF3	Microphone band pass filter 3	O		
3	LBPF1	Line band pass filter 1	—	Composes band pass filter for Karaoke scoring (For reference signal)	
4	LBPF2	Line band pass filter 2	I		
5	LBPF3	Line band pass filter 3	O		
6	KSIGIN	Key controlled signal input	I	Key controlled signal input	
7	KCOUT	Key control output	O	Key control signal output	
8	KOLPF2	Low-pass filter 2 output	O	Post-filter after D/A conversion for key control	
9	KOLPF1	Low-pass filter 1 input	I		
10	KHPF2	High-pass filter 2 output	O	High-pass passage filter for high-pass through	
11	KHPF1	High-pass filter 1 input	I		
12	KCISIG	Key control signal output	—	Output by selecting from L, L+R/2, L-R, and microphone input	
13	KILPF1	Low-pass filter 1 input	I	Pre-filter after D/A conversion for key control	
14	KILPF2	Low-pass filter 2 output	O		
15	KADCINTIN	A/D integrator input	I	Composes an A/D conversion integrator with external C	
16	KADCINTOUT	A/D integrator output	O		
17	KADCCONT	A/D control	—		
18	KDACCONT1	D/A control 1	—	Composes a D/A conversion integrator with external C	
19	KDACCONT2	D/A control 2	—		
20	KDACINTOUT	D/A integrator output	O		
21	KDACINTIN	D/A integrator input	I		
22	REF	Reference	—	Analog reference voltage ≈ $1/2V_{CC}$	
23	AGND1	Analog GND 1	—		
24	AV_{CC1}	Analog power supply 1	—	5 V	
25	KCSEL	Key control selector	I: CMOS 20 kΩ↓	Controls the key selector key control mode or not	
26	SCORETEST1	Score test selector 1	I: CMOS 20 kΩ↓	Score test selector; normally set to L level	
27	SCORETEST2	Score test selector 2	I: CMOS 20 kΩ↓		
28	SCORETEST3	Score test selector 3	O: CMOS	Score test selector; normally no connect	
29	MCK	Clock control	—	External R controls built-in clock generator circuit	
30	V_{DD}	Digital power supply	—		
31	DGND	Digital GND	—		
32	DATA	Serial data	I: CMOS Schmitt 50 kΩ↓ O: CMOS	Microcomputer interface	Serial data input/output
33	CLOCK	Clock control	I: CMOS Schmitt 50 kΩ↓		Shift clock output
34	STROBE	Strobe	I: CMOS Schmitt 50 kΩ↓		Strobe output
35	REQ	Request	O: CMOS		Request output
36	W/RSEL	Write-read selector	I: CMOS Schmitt 50 kΩ↓		Control the selector write/read
37	TEST1	Test signal control input 1	I: CMOS 20 kΩ↓	Test input pin; normally set to L	
38	TEST2	Test signal control input 2	I: CMOS 20 kΩ↓		
39	DOLPF3	Low-pass filter 3 output	O	Post-filter after D/A conversion for digital delay	
40	DOLPF2	Low-pass filter 2 input	I		
41	DOLPF1	Low-pass filter1 input	—		

Pin Description (cont.)

Pin No.	Symbol	Name	I/O	Function
42	DDACINTOUT	D/A integrator output	O	Composes a D/A conversion integrator with external
43	DDACINTIN	D/A integrator input	I	
44	DDACCONT	D/A control	—	
45	DADCCONT	A/D control	—	Composes a A/D conversion integrator with external
46	DADCINTOUT	A/D integrator output	O	
47	DADCINTIN	A/D integrator input	I	
48	DILPF3	Low-pass filter 3 output	O	Pre-filter before A/D conversion for digital delay
49	DILPF2	Low-pass filter 2 input	I	
50	DILPF1	Low-pass filter 1 input	—	
51	DIN	Delay select signal input	I	Outputs after selection of echo/surround input signal
52	DISIG	Delay select signal output	O	
53	DOUT	Delay signal output	O	Delay signal output
54	AGND2	Analog GND 2	—	
55	AV_{CC2}	Analog power supply 2	—	
56	EQR1	Rch equalizer adjustment C1	—	Composes external C for the adjustment of Rch equalizer characteristics (bass and treble)
57	EQR2	Rch equalizer adjustment C2	—	
58	EQR3	Rch equalizer adjustment C3	—	
59	EQR4	Rch equalizer adjustment C4	—	
60	EQRAMPIN1	Rch equalizer input 1	I	
61	EQRAMPIN2	Rch equalizer input 2	I	
62	EQRAMPOUT	Rch equalizer output	O	
63	ROUT	Rch output	O	Rch mixing output
64	LOUT	Lch output	O	Lch mixing output
65	EQLAMPOUT	Lch equalizer output	O	Composes external C for the adjustment of Lch equalizer characteristics (bass and treble)
66	EQLAMPIN2	Lch equalizer input 2	I	
67	EQLAMPIN1	Lch equalizer input 1	I	
68	EQL4	Lch equalizer adjustment C4	—	
69	EQL3	Lch equalizer adjustment C3	—	
70	EQL2	Lch equalizer adjustment C2	—	
71	EQL1	Lch equalizer adjustment C1	—	
72	PS2	Phase shift input 2	I	Determines a constant at time of phase shift
73	PS1	Phase shift input 1	I	
74	RIN	Rch line input	I	Rch line input
75	LIN	Lch line input	I	Lch line input
76	VCFIL	Vocal cut filter	I	Process frequencies lower than the vocal band
77	MICIN	Microphone input	I	Microphone input
78	LGAIN	Line input gain control	I	Set gain for the no music detection
79	MGAIN	Microphone input gain control	I	Set gain for the microphone detection
80	MBPF1	Microphone band pass filter 1	—	Composes band pass filter for Karaoke scoring (For microphone signal)

Absolute Maximum Ratings

Item	Symbol	Ratings	Units	Test Conditions
Supply voltage	V_{CC}	6.0	V	
Circuit current	Vi	–0.3 to V_{CC} + 0.3	V	
Input voltage	Pd	815	W	
Operating temperature	Topr	–20 to +75	°C	
Storage temperature	Tstg	–40 to +125	°C	

Recommended Operating Condition

Item	Symbol	Limits			Units	Test Conditions
		Min	Typ	Max		
Analog supply voltage	V_{CC}	4.5	5	5.5	V	
Digital supply voltage	V_{DD}	4.5	5	5.5	V	
Analog-digital voltage margin	V_{CC}–V_{DD}	–0.3	0	0.3	V	
L input level	V_{IL}	0	—	$0.3V_{DD}$	V	Pin 25, 26, 27, 28, 37, 38
		0	—	0.8	V	Pin 32, 33, 34, 36
H input level	V_{IH}	$0.7V_{DD}$	—	V_{DD}	V	Pin 25, 26, 27, 28, 37, 38
		V_{DD}–1	—	V_{DD}	V	Pin 32, 33, 34, 36

Electrical Characteristics

(V_{CC} = 5 V, f = 1 kHz, Vi = 100 mVrms, F0, Ta = 25°C, Unless otherwise noted)

Item		Symbol	Limits			Units	Test Conditions
			Min	Typ	Max		
Total	Circuit current	I_{CC}	25	60	90	mA	No signal provided
	Clock frequency	fck	6.8	8	9.2	MHz	
	Pull down resistance	R_{ID}	10	20	40	kΩ	Pin 25, 26, 27, 28, 37, 38
			25	50	100	kΩ	Pin 32, 33, 34, 36
	“H” output current	I_{OH}	—	–20	–10	mA	Pin 32, 35, V_{OH} = 4.0 V
	“L” output current	I_{OL}	20	34	—	mA	Pin 32, 35, V_{OL} = 1.0 V
Key control	Gain between input and output	G_V	–3	0	+3	dB	V_{OL} = 0 dB
	Output distortion	THD	—	1.3	3	%	V_O = 100 mVrms, 30 kHz LPF
	Output noise voltage	No	—	–80	–65	dBV	JIS-A
	Maximum output voltage	Vomax	0.7	1.0	—	Vrms	THD = 10%
	Maximum volume attenuation	$V_{OLATTmax}$	—	–60	–40	dB	Gain = –∞
Digital delay	Delay time	Td	4.2	10.2	16.2	ms	Sets 10 ms with microcomputer
			8.4	15.4	22.4		Sets 15 ms with microcomputer
			13.5	20.5	27.5		Sets 20 ms with microcomputer
			19.7	28.7	37.7		Sets 30 ms with microcomputer
			40.2	49.2	58.2		Sets 50 ms with microcomputer
			86.3	98.3	110.3		Sets 100 ms with microcomputer
			116	131	146		Sets 130 ms with microcomputer
			128	148	168		Sets 150 ms with microcomputer
			177	197	217		Sets 200 ms with microcomputer
	Gain between input and output	G_V	–3	0	+3	dB	V_{OL} = 0 dB

Electrical Characteristics (cont.)

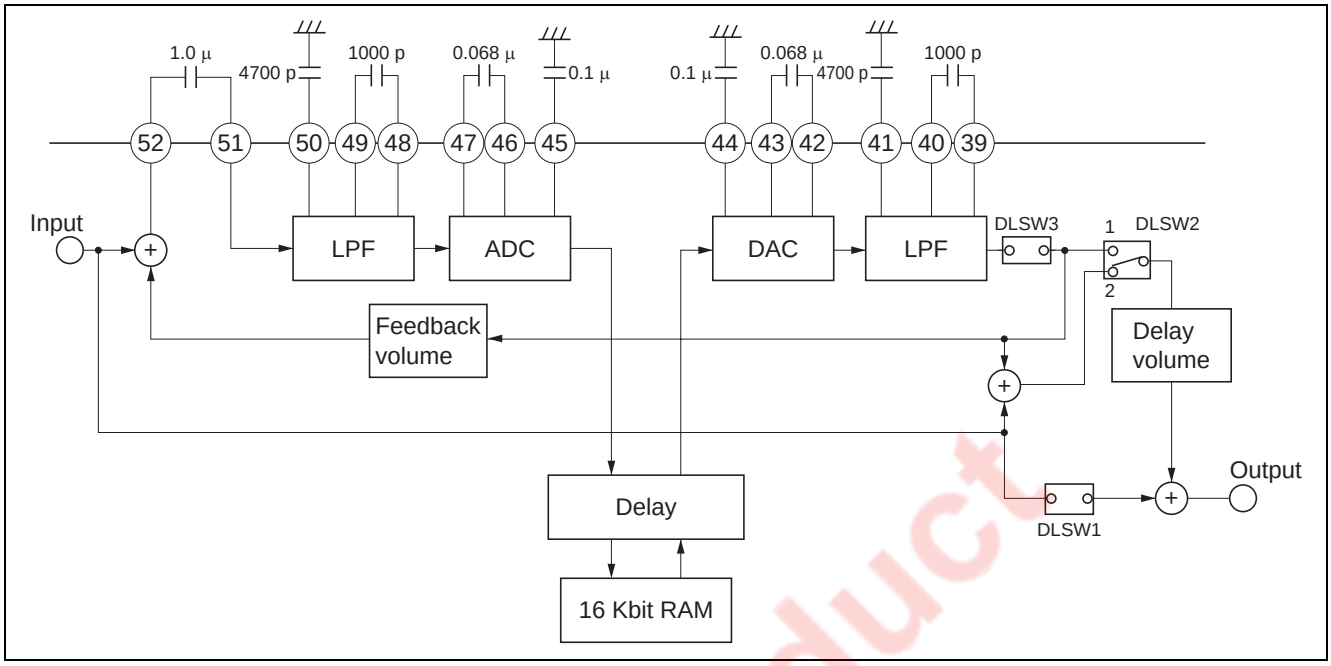
(V_{CC} = 5 V, f = 1 kHz, Vi = 100 mVrms, F0, Ta = 25°C, Unless otherwise noted)

Item		Symbol	Limits			Units	Test Conditions
			Min	Typ	Max		
Digital delay	Output distortion	THD	—	0.3	0.6	%	Td = 10, 15, 20 ms, 30 kHz LPF
			—	0.5	1.0		Td = 30 ms, 30 kHz LPF
			—	0.7	1.4		Td = 50 ms, 30 kHz LPF
			—	1.0	2.0		Td = 100 ms, 30 kHz LPF
			—	1.5	3.0		Td = 150 ms, 30 kHz LPF
			—	2.0	4.0		Td = 200 ms, 30 kHz LPF
	Maximum output voltage	Vomax	0.7	1.0	—	Vrms	30 kHz LPF, THD = 10%
	Output noise voltage	No	—	–92	–80	dBV	Td = 10, 15, 20, 30, 50 ms, Vi = 0 mVrms JIS–A
			—	–87	–72		Td = 100 ms, Vi = 0 mVrms JIS–A
			—	–85	–70		Td = 130, 150 ms, Vi = 0 mVrms JIS–A
			—	–82	–67		Td = 200 ms, Vi = 0 mVrms JIS–A
	Maximum volume attenuation	$V_{OLATTmax}$	—	–60	–40	dB	Delay volume, Gain = –∞
			—	–60	–40		Feedback volume, Gain = –∞
Line	Gain between input and output	G_V	–3	0	+3	dB	30 kHz LPF, upon key control through
	Output distortion	THD	–	0.05	0.1	%	30 kHz LPF, upon key control through
	Maximum output voltage	Vomax	1.2	1.8	—	Vrms	30 kHz LPF, THD = 10% upon key control through
	Output noise voltage	No	—	–95	–88	dBV	JIS–A, upon key control through
	Channel separation	CS	—	–70	–50	dB	upon key control through, Lin = 400 Hz, Rout JIS-A
	Input impedance	Zi	10	20	40	kΩ	
	Vocal removal ratio	Grej	14	18	—	dB	Vocal cut
EQ	Maximum bass boost volume	GBBmax	9	12	15	dB	f = 100 Hz
	Maximum bass cut volume	GBCmax	–15	–12	–9		f = 100 Hz
	Maximum treble boost volume	GTBmax	9	12	15		f = 10 kHz
	Maximum treble cut volume	GTCmax	–15	–12	–9		f = 10 kHz

Delay Block

Delay block provides a delay signal which using digital echo or digital surround.

Constitution



Function

1. Delay time
   Capable to set the follow delay time;

Mode	Delay Time
Echo	100, 130, 150, 200 ms
Surround	10, 15, 20, 30, 50 ms

2. Switch mode

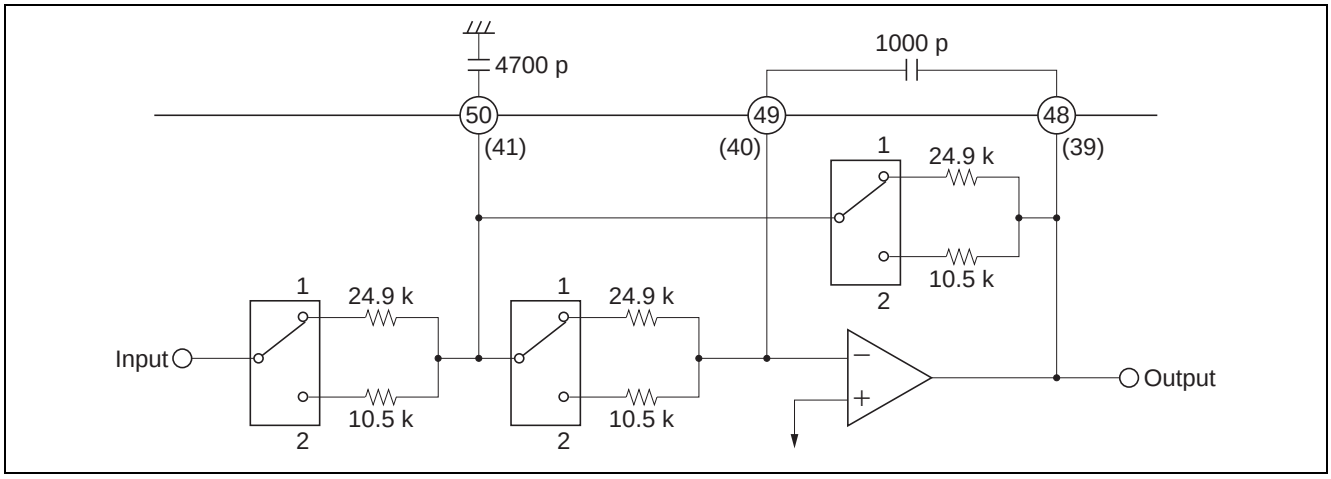
Mode		DLSW1	DLSW2
Echo	1	ON	1
	2	OFF	2
Surround		OFF	1

— Echo “1”
Set the echo volume using the delay volume
(Change the delay signal gain)

— Echo “2”
Set the microphone volume using the delay volume
(Change the delay signal + input signal gain)

Delay Signal Mute	DLSW3
Mute OFF	ON
Mute ON	OFF

3. Input/output LPF
   Input/output LPF is formed following block.



Mode	Switch Conditions	Cut Off Frequency
Echo	1	3.0 kHz
Surround	2	7.0 kHz

4. Volume

Volume	Mode
Delay volume	+6 dB to –12 dB/3 dB step and –∞ 8 level
Feedback volume	–2 dB to –6 dB/1 dB step and –8 dB, –10dB, –∞ 8 level

Key Control Block

It can be changed the key of Karaoke accompaniment.

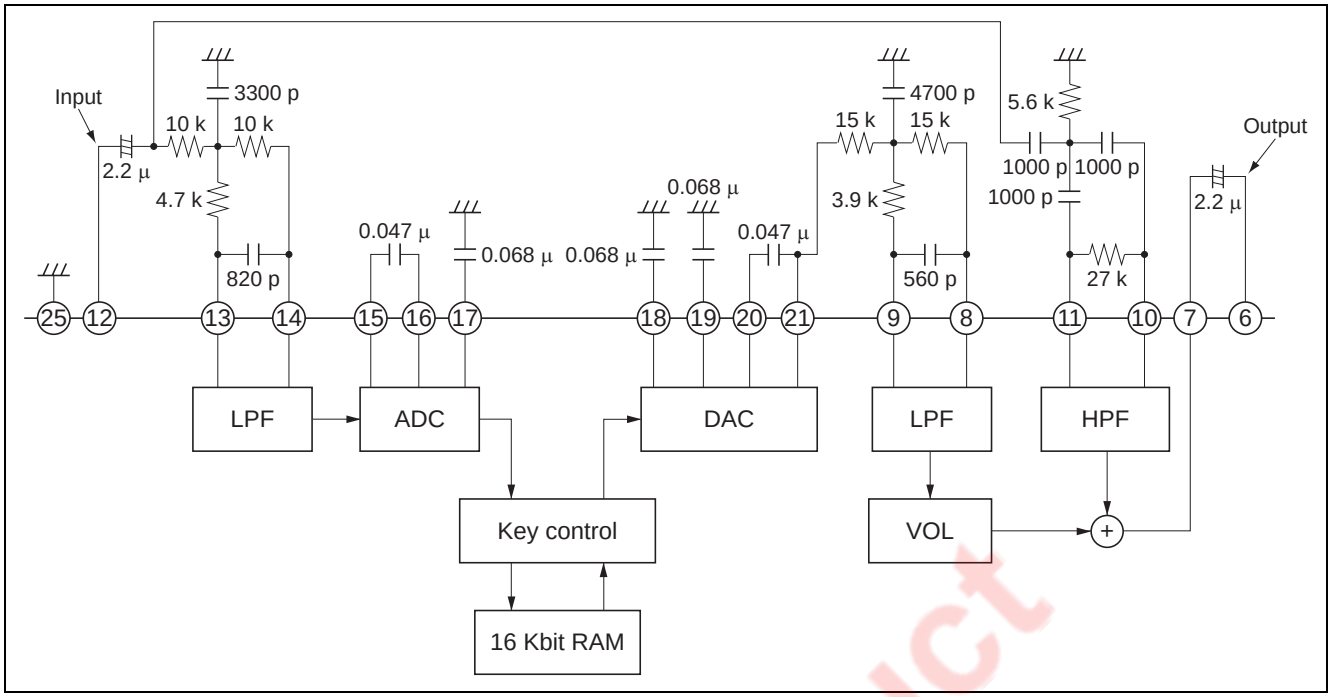
And it can change a microphone voice which like a monkey voice.

It also can use digital echo block at not key set mode.

Key Control Condition, Key Control Set Mode or Not

Pin 25 KCSEL	Key Control Condition
L	Key control set mode
H	Not key control set mode

Constitution



Function

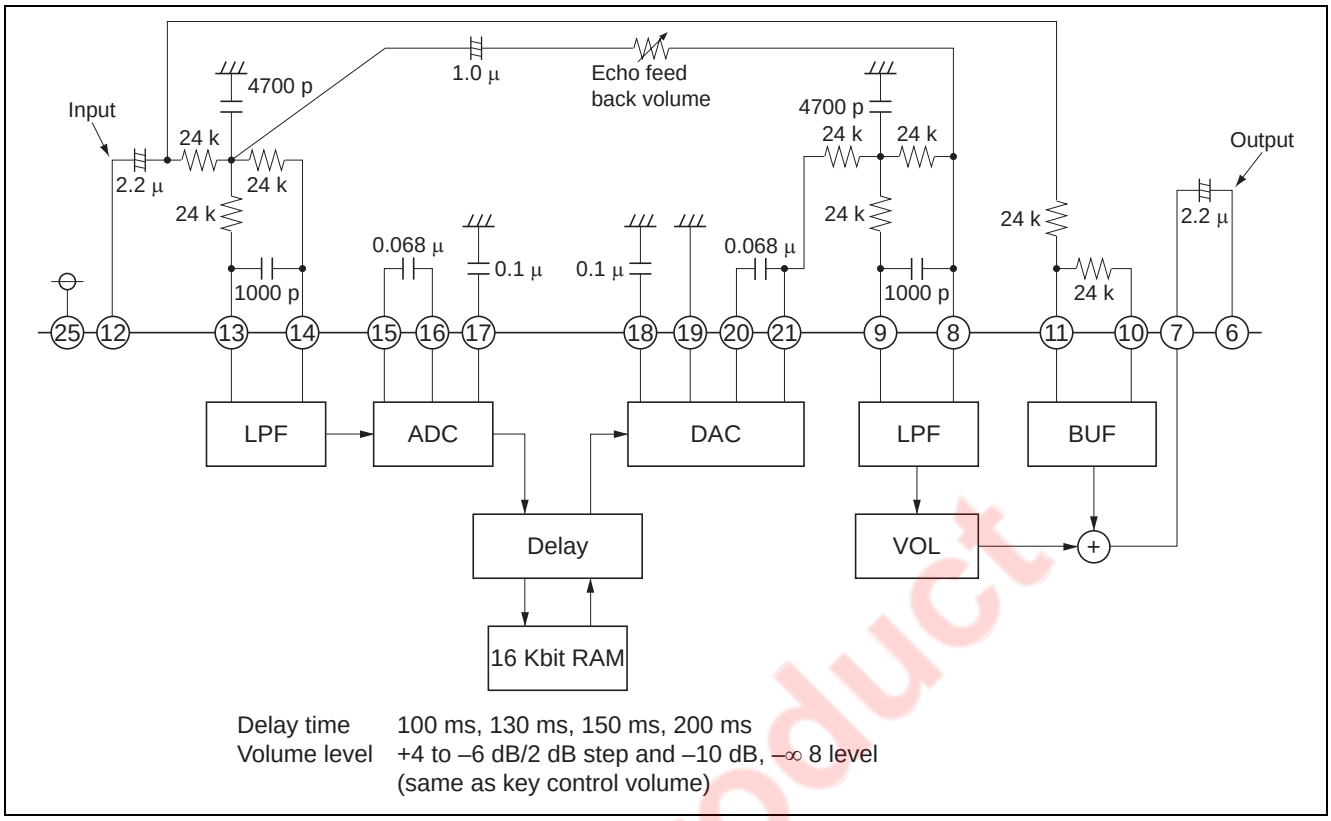
1. Key change level

Key Change Level (1step is half tone)	Key Up									Key Down							
	+8	+7	+6	+5	+4	+3	+2	+1	0	–1	–2	–3	–4	–5	–6	–7	–8

2. Volume
   It set the key control signal gain.
   +4 dB to 6 dB/2 dB step and –10 dB, –∞ 8 level
3. Key control level automatic reset
   When music search detects no signal, key control level is automatic changed normal (0) level.
   (Provides ON/OFF switch with MCU interface)

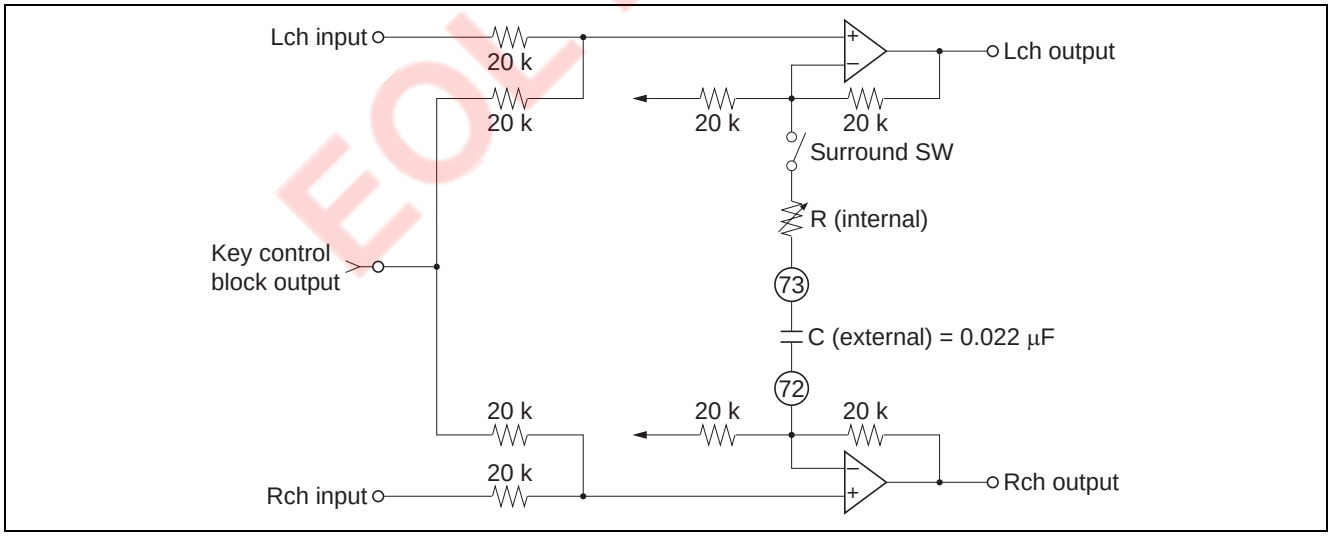
Echo Block (Using Key Control Block)

At not key control set mode, digital echo is able to use, when the following block using.



Phase Shifter Block

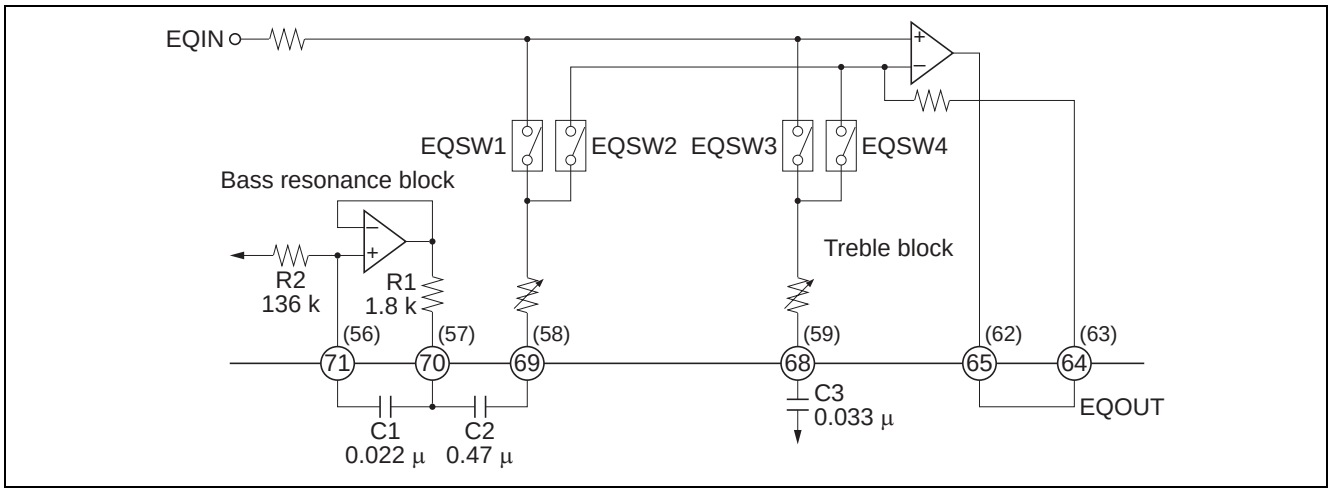
Following is the phase shifter block, which makes phase surround effect.



Switch Conditions		Surround Effect
Surround SW ON	R = 13 kΩ	Max
	R = 16 kΩ	Typ
	R = 20 kΩ	Min
Surround SW OFF		Noting

Equalizer Block

Following is the equalizer block, which can control the both gain bass and treble.



Bass block is resonance type which is used simulated inductor amplifier. Treble block is filter type. These can be set –12 dB to +12 dB/2 dB step.

Following is a center frequency "f_O", "Q" (bass resonance block).

$$f_O = \frac{1}{2\pi \sqrt{C1 \bullet C2 \bullet R1 \bullet R2}} \quad (Hz)$$

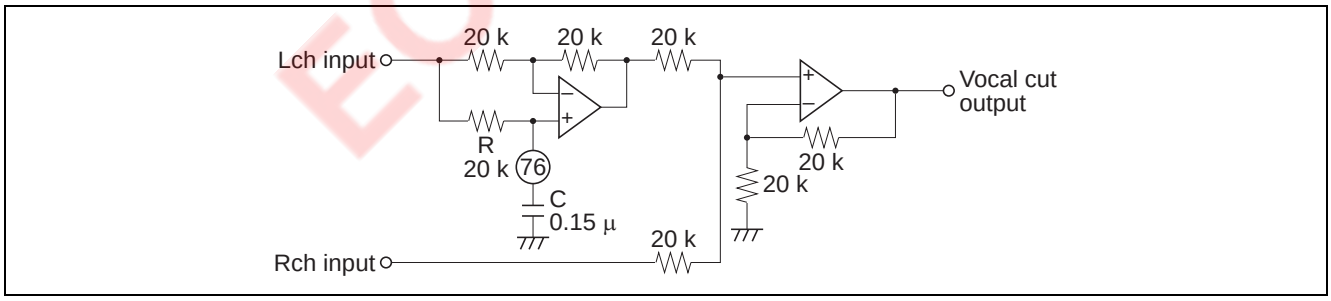
$$Q = \sqrt{(C1 \bullet R2) / (C2 \bullet R1)}$$

Vocal Cut Block

The sound components of the same phase and same sound volume in the L and R channels are attenuated.

This made also allows components with lower frequency than the vocal band to pass through the filter, to compensate insufficient low-frequency sound.

Constitution



LPF is formed by the internal R (20 kΩ) and the external C, when C = 0.15 µF, cut off frequency is 53 Hz.

$$f_{VC} = \frac{1}{2\pi CR} = 53.0 \text{ Hz}$$

Scoring Function

Scoring function judge the MIC vocal input.

Scoring Output Form

MIC input is judged from 0 to 99 level.

Constitution

Scoring function is constituted following two ways.

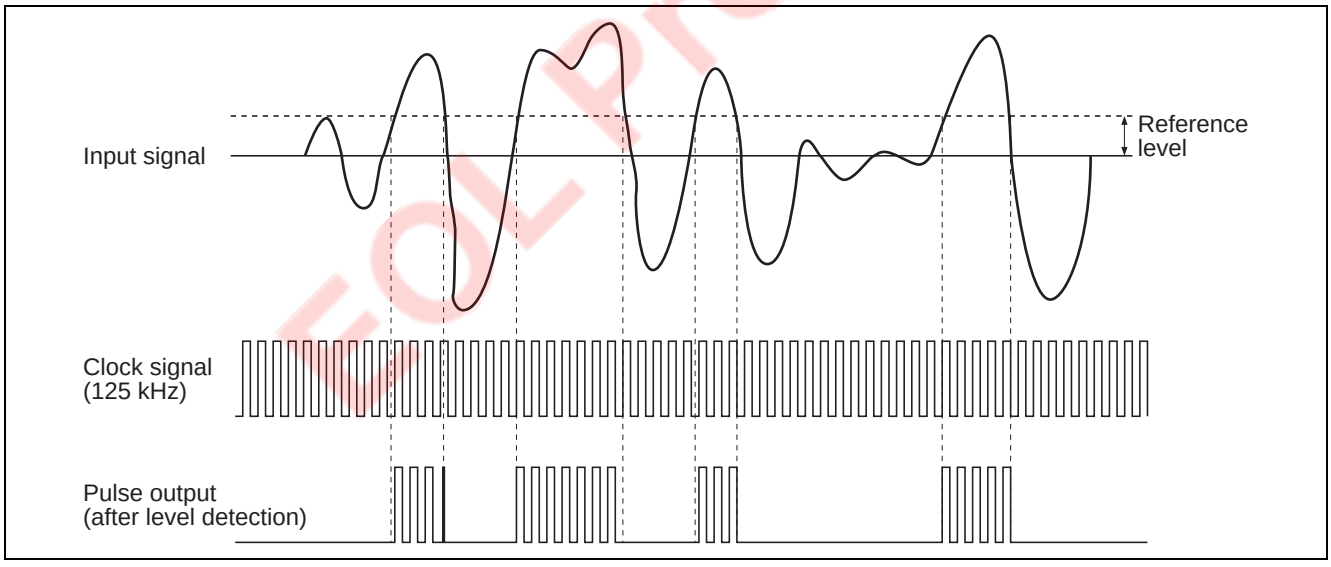
Judgment Conditions	Function	Ratio
1. Compare the frequency	Compare the frequency reference voice and microphone voice	75%
2. Vocal level judgment	Vocal level judgment (as vocal is bigger than reference level, judgment is good)	25%

Music Search

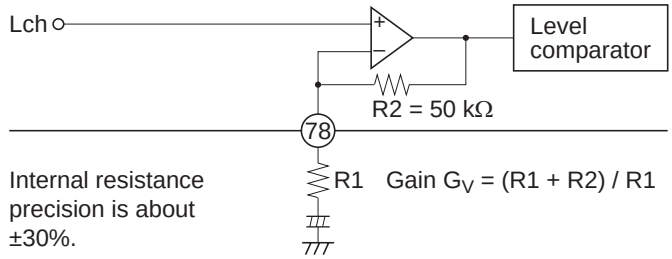
Music search is constituted following.

(1) Input signal reference level comparison
(2) Music detection
(3) No music detection

1. Input signal reference level comparison
   Input signal reference level comparison is constituted amplifier and level comparison.
   When input signal is bigger than reference level, level comparison output the pulse which added internal clock.



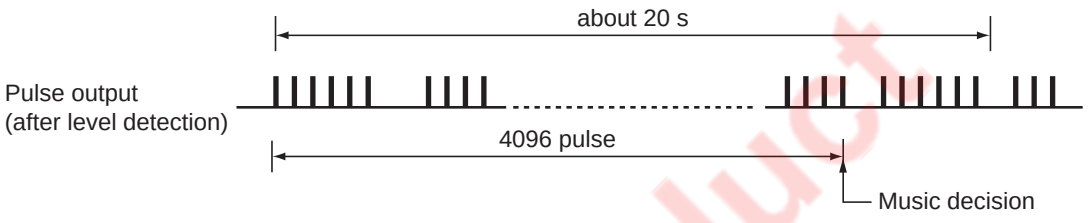
The reference level can be changed, thanks to the following internal R2 and external R1 which determine the amplifier gain.



2. Music detection

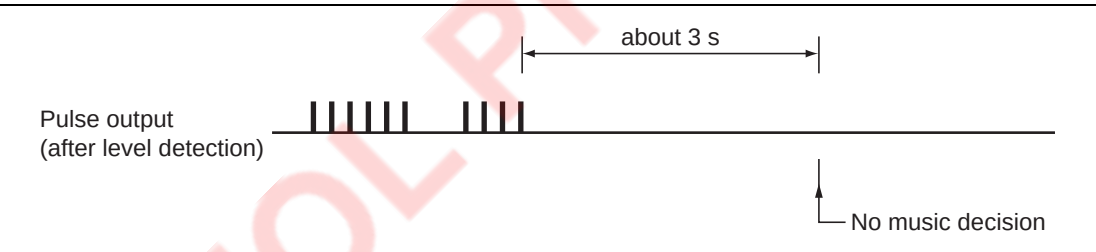
To search a music interval, it is necessary to judge if it is a music or not. This judgment is made by monitoring the 20 seconds and counting the pulse signal (after level detection). The pulse signal counts is bigger than fixed counts, it is judged as a music.

Pulse counter is reset whenever monitor 20 seconds or judged no music decision.



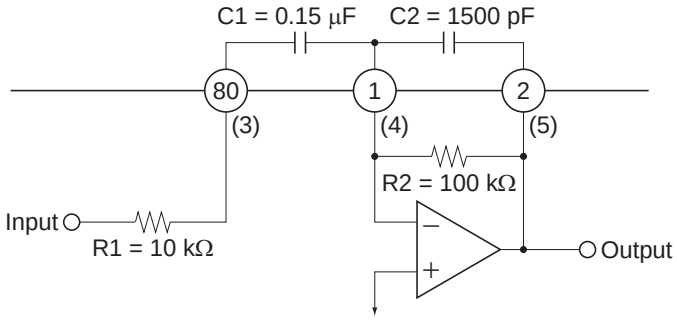
3. No music detection

After music decision “2. Music detection”, no music is judged when no pulse in level detection at 3 seconds. But if there is not no pulse when monitoring the 3 seconds, no music decision counter is reset.



Signal Input Circuit

Signal input circuit is constituted the following band pass filter, which cuts the input signal to vocal band width.



Low level cut off frequency fcl and high level cut off frequency fch is

$fcl = 1/2\pi\ C1R1 = 106\ Hz fch = 1/2\pi\ C2R2 = 1.1\ kHz$

and, the gain of amplifier G_V is

$G_V = R2/R1 = 20\ dB.$

Same as the band pass filter is constituted microphone signal input.

Automatic Vocal Support

In case using the Karaoke system, when microphone input level is nothing, then audio source vocal appears and help the microphone songs.
(It can set only following conditions, audio source selector sets Lch monaural or vocal cut)

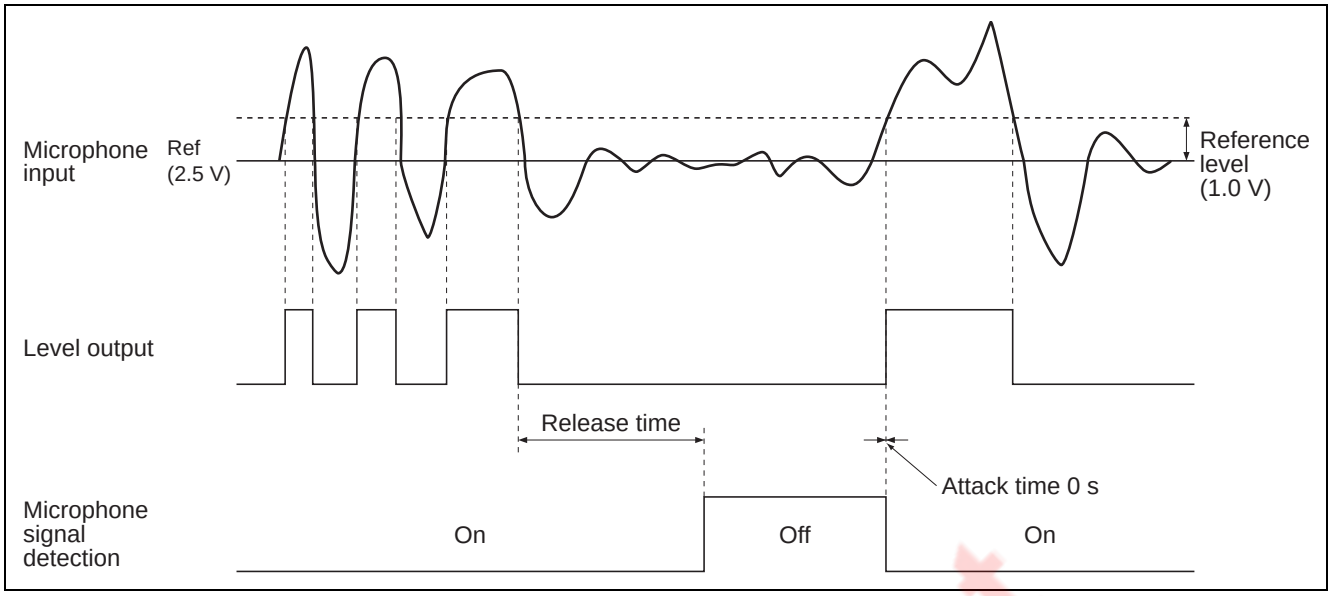
Microphone Input Level	Source Selector Mode		
On	Lch monaural	Vocal cut	Others
Off	(L+R)/2	(L+R)/2	Same as microphone input

Changing time from microphone input level changed to source selector changed is following.

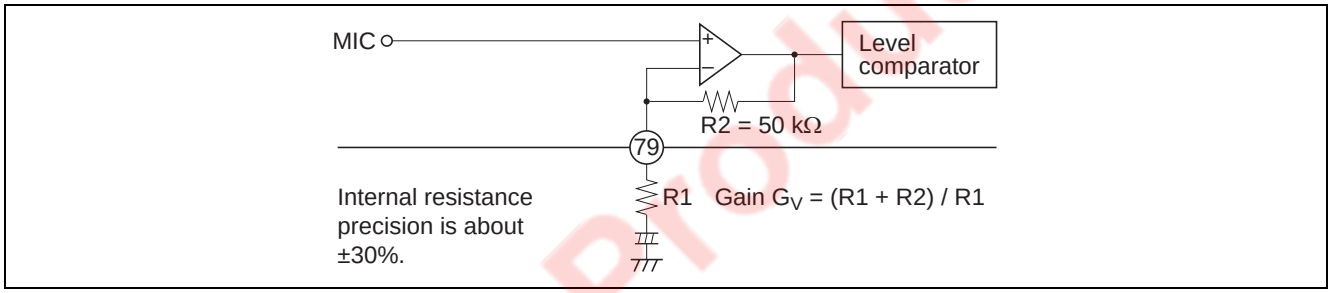
Attack time (Off → On) 0 s

Release time (On → Off) 1 s or 2 s

The Timing of Microphone Input Signal Detection



Following is the microphone input signal judgment block, which includes amplifier so reference level can regulate.



Oscillation Circuit

This IC incorporates a current control type clock oscillator circuit in it, thus providing circuit configuration just by connecting a R for current control pin 29 (CLKCNT).

Fully internal clock supply prevents occurrence of undesired radiation without affecting any external circuit.

The oscillator frequency fck is following.

fck = 8 MHz

Reset

This IC is automatically reset when the power is turned on, and is automatically canceled nearly 120 ms later.

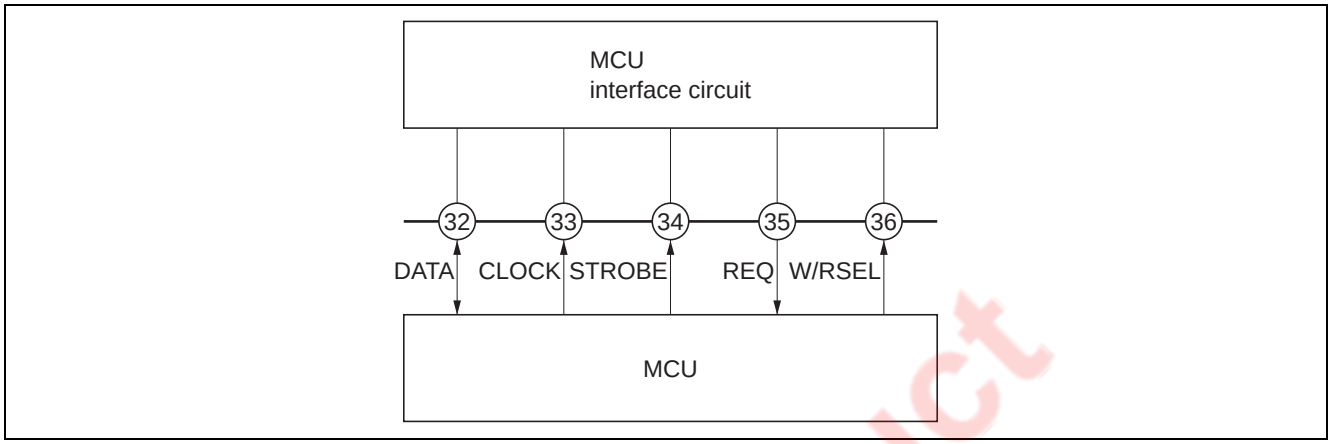
Function		First Set
Echo	Delay time	150 ms
Key control		No changing
Phase shifter		OFF
Equalizer		OFF
Source selector		Stereo (Key control by pass)
Scoring function		OFF

MCU Interface

Constitutions

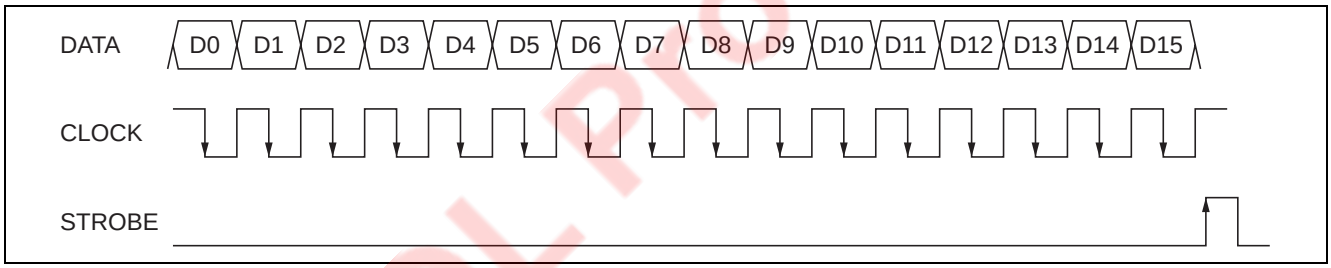
MCU interface is constituted serial bass interface, so the selection, data input or output, is changed by pin 36 input level.

Pin 36 W/RSEL	Conditions
L	MCU → IC (Data input)
H	IC → MCU (Data output)



Data Input

1. Data input format



2. Mode creations
   D0 to D1 select the following each block, and D2 to D13 create the particular setting. D14 and D15 are chip address, so this IC can use only when D14 = "L" and D15 = "H".

D0	D1	D2 to D13	D14	D15
L	L	Echo/Surround mode	Chip address	
L	H	Key control mode	L	H
H	L	Equalizer/Phase sifter mode		
H	H	Line mixing/Others mode		

(1) Echo/Surround mode

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
L	L	Echo/ Surround	Echo delay time		Surround delay time			Delay volume			Feedback volume			L	H

Item	D2	D3	D4	D5	D6	D7	Function	
Echo/Surround Switch	L	—	—	—	—	—	Echo	On not key control set mode sets H level
	H	—	—	—	—	—	Surround	
Echo delay time	—	L	L	—	—	—	100 ms	
	—	H	L	—	—	—	130 ms	
	—	L	H	—	—	—	150 ms	
	—	H	H	—	—	—	200 ms	
Surround delay time	—	—	—	H	L	L	10 ms	
	—	—	—	L	H	L	15 ms	
	—	—	—	H	H	L	20 ms	
	—	—	—	L	L	H	30 ms	
	—	—	—	H	L	H	50 ms	

Item	D8	D9	D10	D11	D12	D13	Function
Delay volume	H	H	H	—	—	—	+6 dB
	H	H	L	—	—	—	+3 dB
	H	L	H	—	—	—	0 dB
	H	L	L	—	—	—	–3 dB
	L	H	H	—	—	—	–6 dB
	L	H	L	—	—	—	–9 dB
	L	L	H	—	—	—	–12 dB
	L	L	L	—	—	—	–∞
Feedback volume	—	—	—	H	H	H	–2 dB
	—	—	—	H	H	L	–3 dB
	—	—	—	H	L	H	–4 dB
	—	—	—	H	L	L	–5 dB
	—	—	—	L	H	H	–6 dB
	—	—	—	L	H	L	–8 dB
	—	—	—	L	L	H	–10 dB
	—	—	—	L	L	L	–∞

(2) Key control mode

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
L	H	Auto reset	VSC/ VMC	Key change level					Key control volume			Delay volume select	Delay signal mute	L	H

Item	D2	D3	D4	D5	D6	D7	D8	Function
Automatic key control reset	L	—	—	—	—	—	—	Automatic reset OFF
	H	—	—	—	—	—	—	Automatic reset ON
Key control mode selector	—	L	—	—	—	—	—	VMC mode
	—	H	—	—	—	—	—	VSC mode
Key change level	—	—	H	H	L	L	L	+8
	—	—	H	L	H	H	H	+7
	—	—	H	L	H	H	L	+6
	—	—	H	L	H	L	H	+5
	—	—	H	L	H	L	L	+4
	—	—	H	L	L	H	H	+3
	—	—	H	L	L	H	L	+2
	—	—	H	L	L	L	H	+1
	—	—	L	L	L	L	L	0
	—	—	L	L	L	L	H	–1
	—	—	L	L	L	H	L	–2
	—	—	L	L	L	H	H	–3
	—	—	L	L	H	L	L	–4
	—	—	L	L	H	L	H	–5
	—	—	L	L	H	H	L	–6
	—	—	L	L	H	H	H	–7
	—	—	L	H	L	L	L	–8

Item	D9	D10	D11	Function
Key control volume set (when not key control mode, it use a echo volume)	H	H	H	+4 dB
	H	H	L	+2 dB
	H	L	H	0 dB
	H	L	L	–2 dB
	L	H	H	–4 dB
	L	H	L	–6 dB
	L	L	H	–10 dB
	L	L	L	–∞

Item	D12	D13	Function
Delay volume selector	L	—	Using an echo volume
	H	—	Using a microphone volume
Delay signal mute	—	L	Mute OFF
	—	H	Mute ON

(3) Equalizer/Phase shifter mode

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
H	L	Automatic vocal support		Phase shifter		Equalizer treble				Equalizer bass				L	H

Item	D2	D3	D4	D5	Function
Automatic vocal support (It can use only echo mode)	L	—	—	—	OFF
	H	—	—	—	ON
	—	L	—	—	Release time 1 s
	—	H	—	—	Release time 2 s
Phase shifter surround mode	—	—	L	L	OFF
	—	—	H	L	Surround effect Minimum
	—	—	L	H	Surround effect Typical
	—	—	H	H	Surround effect Maximum

Equalizer Treble Mode

D6	D7	D8	D9	Volume (dB)
H	H	H	L	+12
H	H	L	H	+10
H	H	L	L	+8
H	L	H	H	+6
H	L	H	L	+4
H	L	L	H	+2
L	L	L	L	0
L	L	L	H	–2
L	L	H	L	–4
L	L	H	H	–6
L	H	L	L	–8
L	H	L	H	–10
L	H	H	L	–12

Equalizer Bass Mode

D10	D11	D12	D13	Volume (dB)
H	H	H	L	+12
H	H	L	H	+10
H	H	L	L	+8
H	L	H	H	+6
H	L	H	L	+4
H	L	L	H	+2
L	L	L	L	0
L	L	L	H	–2
L	L	H	L	–4
L	L	H	H	–6
L	H	L	L	–8
L	H	L	H	–10
L	H	H	L	–12

(4) Line mixing/Others mode

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
H	H	Source selector			Key control by pass	Key control mixing	Delay mixing		Scoring function				Voice key control	L	H

Item	D2	D3	D4	D5	D6	Function	
Source selector	L	L	L	—	—	Stereo	Delay block input L-R
			H	—	—		Delay block input (L+R)/2
	L	H	—	—	—	Lch monaural	
	H	L	—	—	—	Rch monaural	
	H	H	—	—	—	Vocal cut	
Key control by pass	—	—	—	L	—	Bypass OFF (Though the key control circuit)	
	—	—	—	H	—	Bypass ON (By pass the key control circuit)	
Key control mixing ON/OFF selector	—	—	—	—	L	Mixing OFF (SSSW10 = “2”)	
	—	—	—	—	H	Mixing ON (SSSW10 = “1”)	

Relationships Source Selector and Key Control Bypass Mode

D2	D3	Key Control Mixing Bypass ON	Key Control Mixing Bypass OFF
L	L	Stereo	(L+R)/2
L	H	Lch monaural	Lch monaural
H	L	Rch monaural	Rch monaural
H	H	Vocal cut	Vocal cut

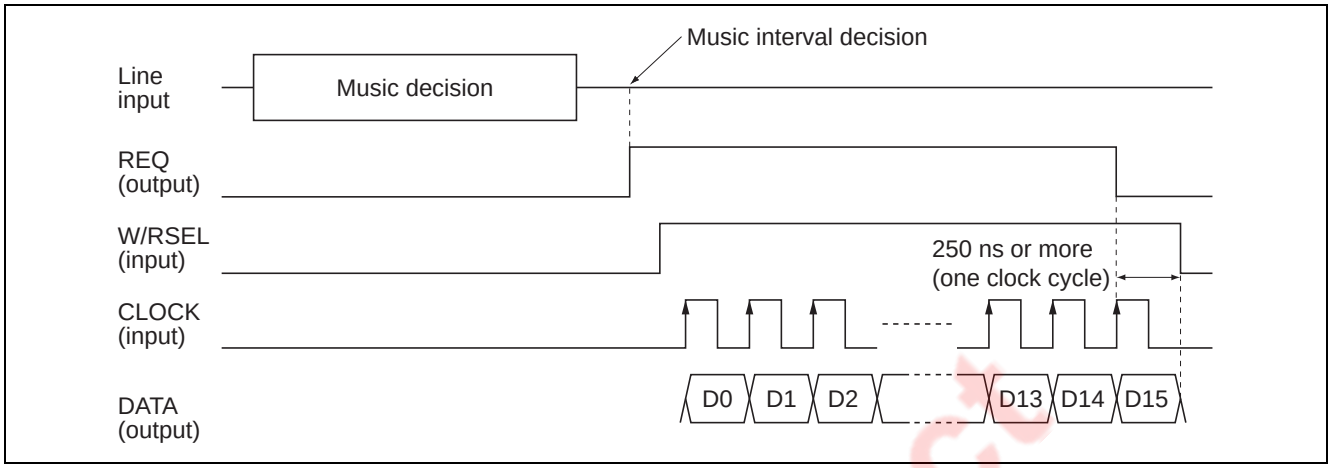
Item	D7	D8	D9	D10	D11	D12	D13	Function	
Delay signal mixing ON/OFF selector	L	—	—	—	—	—	—	Mixing OFF	
	H	L	—	—	—	—	—	Mixing ON (L, R same phase)	
	H	H	—	—	—	—	—	Mixing ON (L, R reverse phase)	
Scoring function	—	—	L	—	—	—	—	Scoring function OFF	
	—	—	H	—	—	—	—	Scoring function ON	
	—	—	—	L	—	—	—	Score output after no music decision	
	—	—	—	H	—	—	—	Score can output always timing	
	—	—	—	—	L	—	—	Internal music detection decides the scoring start/stop timing *	
	—	—	—	—	H	L	—	MCU data decides the scoring start/stop timing *	Scoring stop
	—	—	—	—	H	H	—		Scoring start
Voice key control	—	—	—	—	—	—	L	OFF	
	—	—	—	—	—	—	H	ON	

Notes: * Scoring function start/stop mode

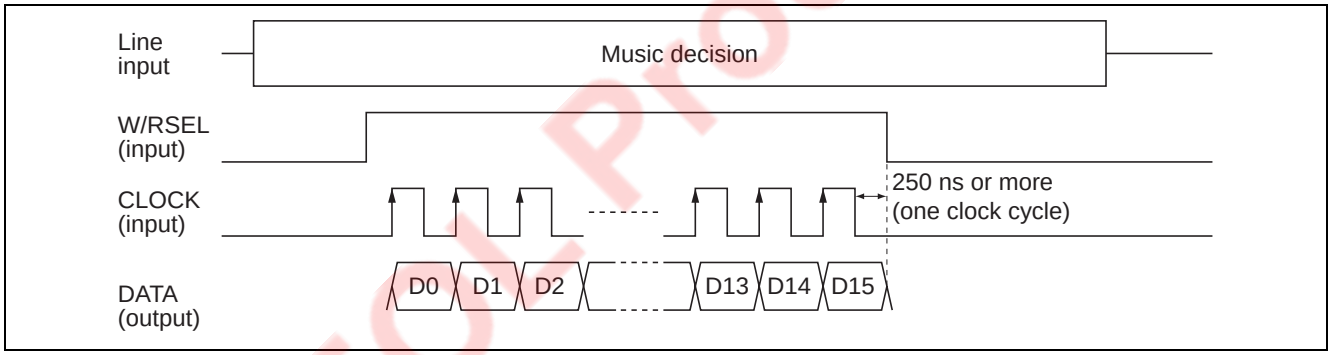
1. Decide the internal music detection (D11 = “L”)
2. Decide the MCU data (D11 = “H”)
   When D12 is “L” level scoring is stopping, and change “H” level, scoring is start until D12 changes “L” level.

Data Output (Score Result Output)

1. Internal music detection decides the scoring output timing
   When Karaoke song is over and then music detection judgment the no music detection, scoring is over and output the “H” pulse to REQ.
   After REQ is “H” level and then W/RSEL changes from “L” to “H”, this IC changes a output mode and it can output the score result.



2. MCU data decides the scoring result data output timing
   W/RSEL changes from “L” to “H”, so this IC changes output mode, and then score result data can output the same period of the clock.



3. Data format

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
								Music interval decision	(MSB)	Score result output (binary output)					(LSB)

D8: Music interval decision — Music decision = “H”, music interval decision = “L”

D9 to D15: Score result output — an example 78 points

D9	D10	D11	D12	D13	D14	D15
H	L	L	H	H	H	L

Caution

Input/Output Signal Level

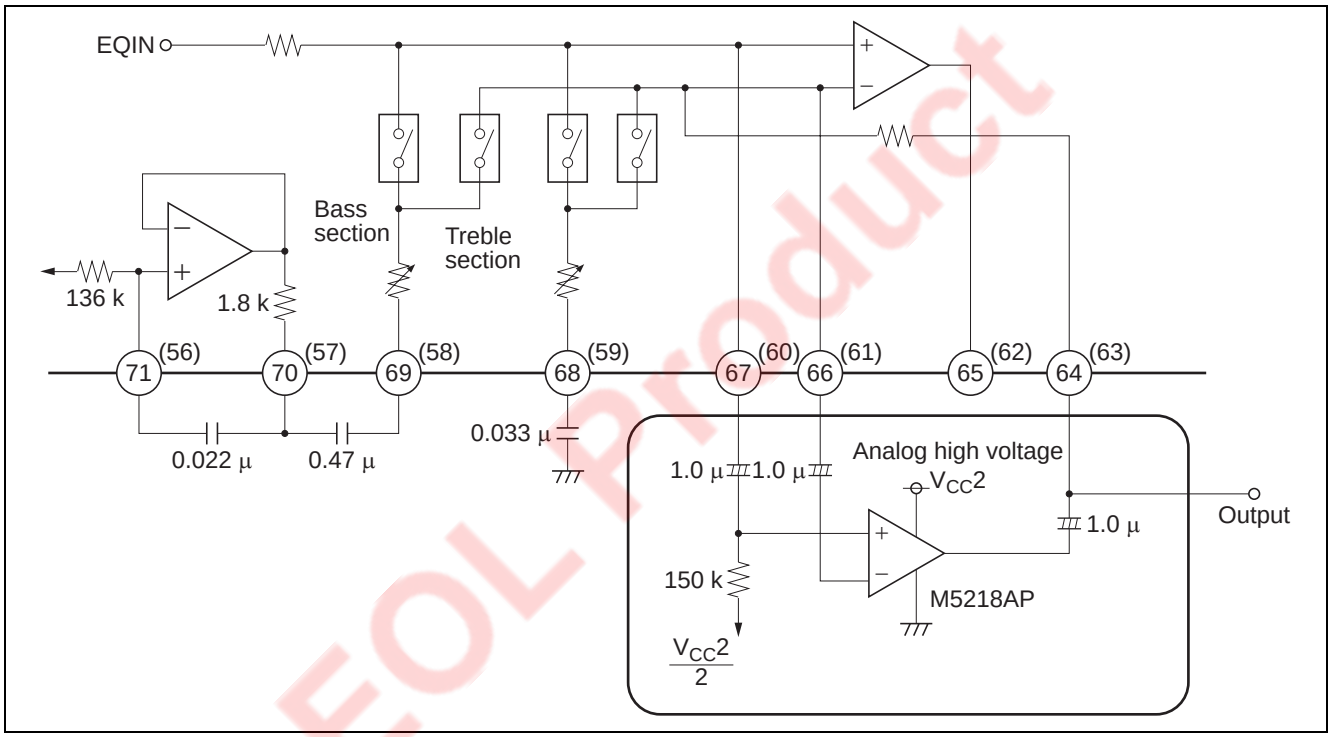
When using phase shifter, echo mixing and equalizer, this IC is limited the following functions. So, please determine the level of the each functions.

Input Base Level	Equalizer Gain Mode	Hand Room	S/N
150 mVrms	0 dB	10.6 dB	78.5 dB
100 mVrms	+6 dB	8.1 dB	75 dB
100 mVrms	+12 dB	2.1 dB	75 dB
50 mVrms	+12 dB	8.1 dB	69 dB

Improvement of Head Room

As stated above, equalizer gain level is bigger, head room becomes also narrow.

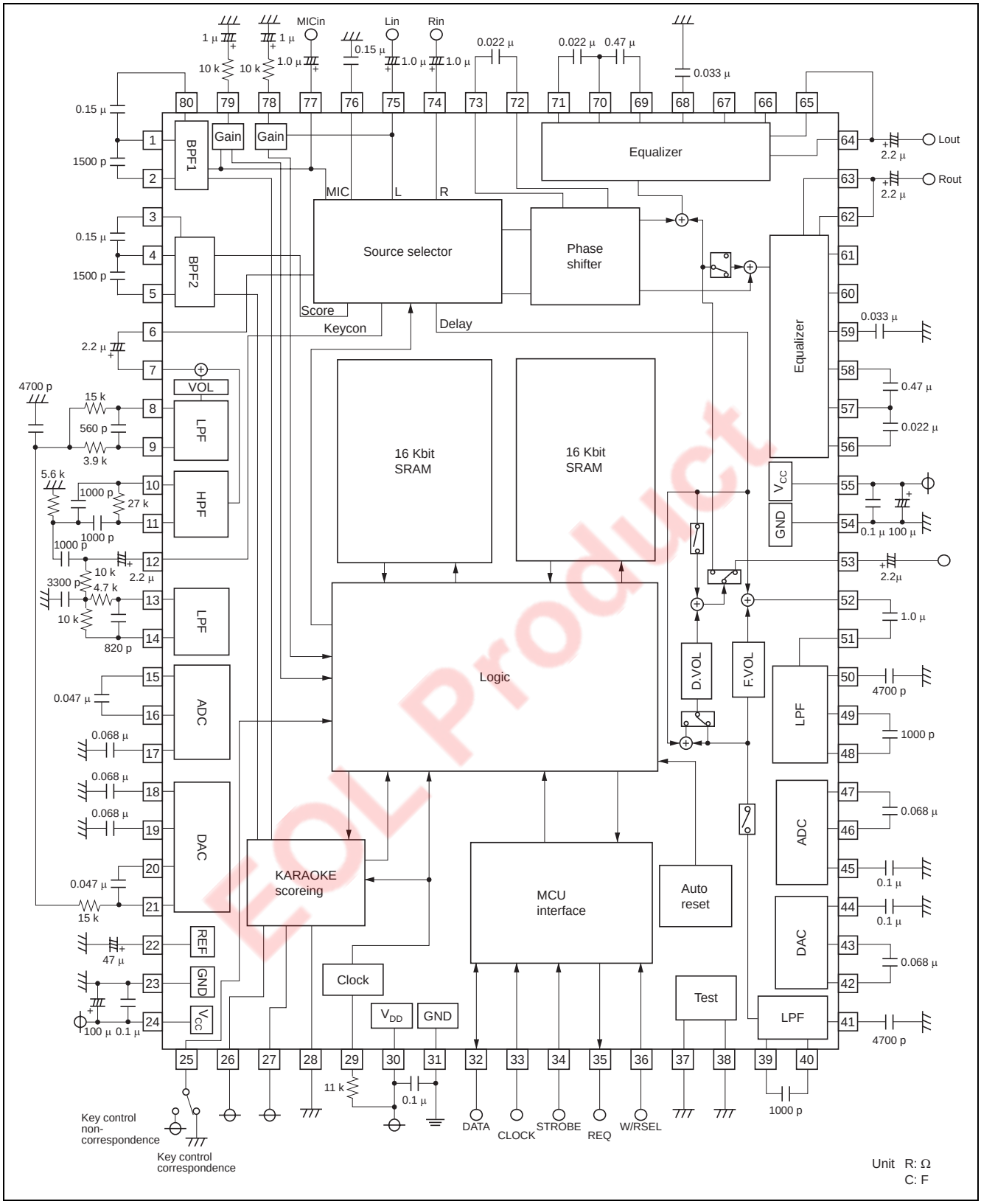
So It can be improvement that latest op-amp which using equalizer use external op-amp.



Following the relations supply voltage, input signal level, head room and S/N. (external op-amp: M5218AP)

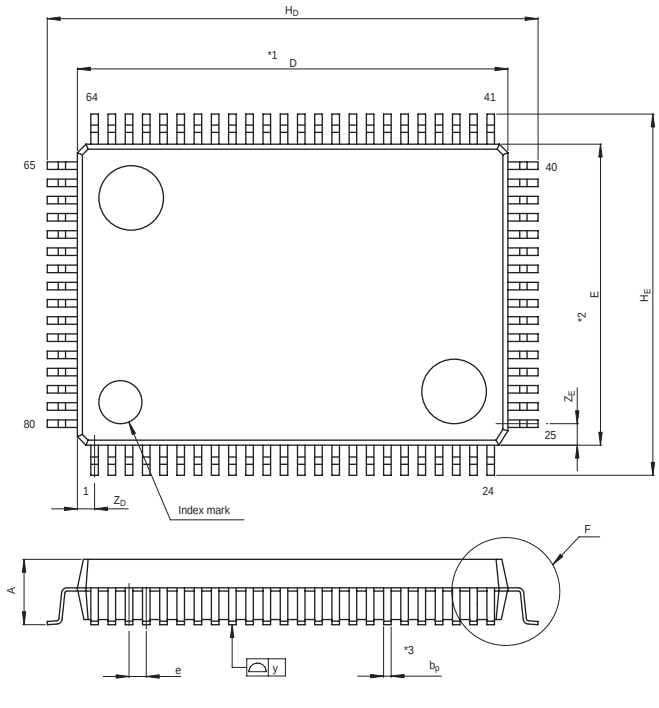
V_{CC2}	Input Level	Equalizer Gain Level	Head Room	S/N
9 V	150 mVrms	+6 dB	8.1 dB	78.5 dB
		+12 dB	2.1 dB	78.5 dB
	100 mVrms	+6 dB	11.6 dB	75 dB
		+12 dB	5.6 dB	75 dB
15 V	150 mVrms	+6 dB	10.6 dB (effect M65851FP)	78.5 dB
		+12 dB	8.1 dB	78.5 dB
	100 mVrms	+6 dB	14.1 dB (effect M65851FP)	75 dB
		+12 dB	11.6 dB	75 dB
20 V	150 mVrms	+12 dB	10.6 dB (effect M65851FP)	78.5 dB
	100 mVrms	+12 dB	14.1 dB (effect M65851FP)	75 dB

Application Example



Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-QFP80-14x20-0.80	PRQP0080GB-A	80P6N-A	1.6g



NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	19.8	20.0	20.2
E	13.8	14.0	14.2
A_2	—	2.8	—
H_D	22.5	22.8	23.1
H_E	16.5	16.8	17.1
A	—	—	3.05
A_1	0	0.1	0.2
b_p	0.3	0.35	0.45
c	0.13	0.15	0.2
θ	0°	—	10°
e	0.65	0.8	0.95
y	—	—	0.10
Z_D	—	0.8	—
Z_E	—	1.0	—
L	0.4	0.6	0.8

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Colophon .7.2