Sound Processors for Home Theater Systems

7.1ch Sound Processor with Built-in Micro-step Volume

BD34701KS2

General description

The BD34701KS2 is an 8ch independent volume system. The system is designed in such a way, that it can be used as a 7.1ch surround system. Micro-step volume can reduce the switching shock noise when volume changes, so it can achieve a high-quality set.
8ch dual input selector for zone 2 and multi channel input enable the connection of a number of sources.

Key Specifications

- Total harmonic distortion: 0.0004%(Typ.)
- Maximum output voltage: 4.2Vrms(Typ.)
- Output noise voltage: 1.5uVrms(Typ.)
- Residual output noise voltage: 1.0uVrms(Typ.)
- Cross-talk between channels: -105dB(Typ.)
- Cross-talk between selectors: -105dB(Typ.)

Package	W(Typ.) x D(Typ.) x H(Max.)
SQFP-T52	12.00mm x 12.00mm x 1.50mm

Features

- 8ch input selectors
- Micro-step volume can reduce the switching shock noise when volume changes.
- Zone 2 can support.
- 2-wire serial bus control, corresponding to 3.3/5V.

Applications

- Most suitable for the AV receiver, home theater system

SQFP-T52

Typical Application Circuit

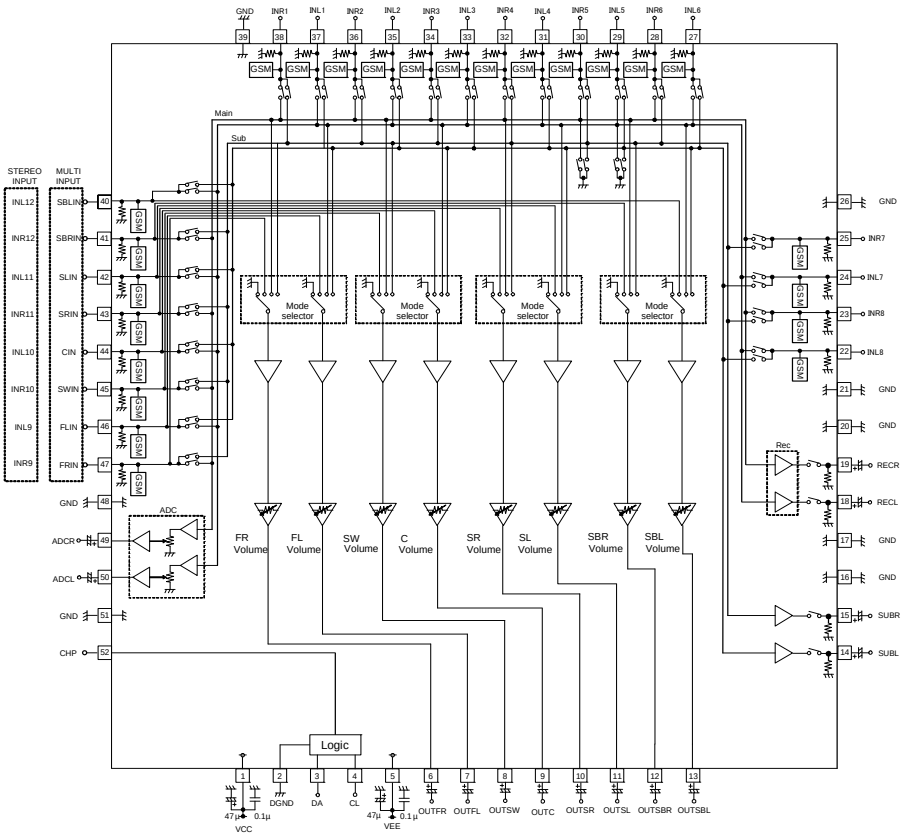


Figure 1. Application Circuit

○Product structure：Silicon monolithic integrated circuit ○This product is not designed protection against radioactive rays

Pin Configuration

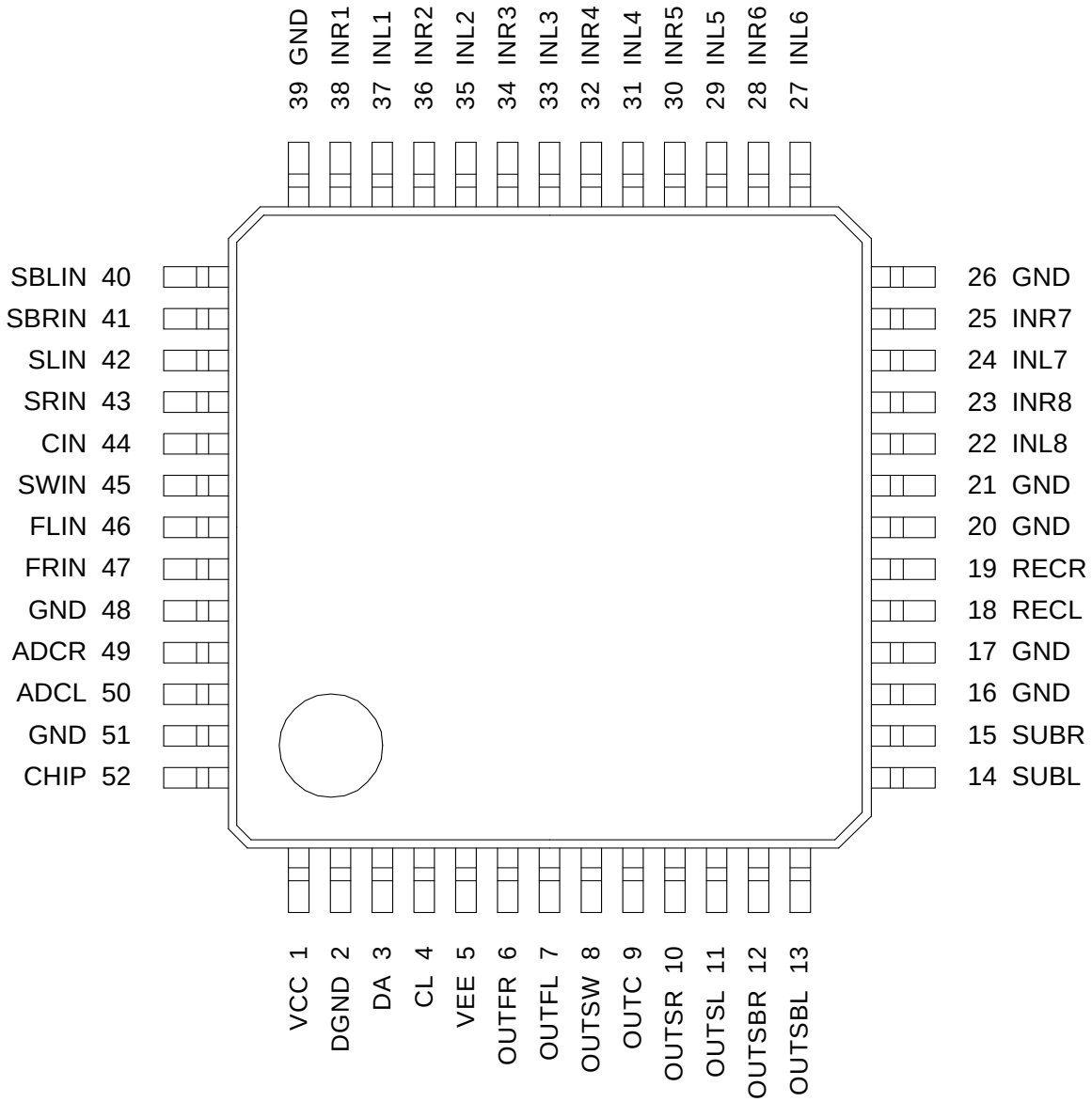


Figure 2. Pin Configuration

Description of terminal

Terminal Number	Symbol	Function	Terminal Number	Symbol	Function
1	VCC	Positive power supply terminal	27	INL6	Lch input terminal 6
2	DGND	Digital ground terminal	28	INR6	Rch input terminal 6
3	DA	Data and latch input terminal	29	INL5	Lch input terminal 5
4	CL	Clock input terminal	30	INR5	Rch input terminal 5
5	VEE	Negative power supply terminal	31	INL4	Lch input terminal 4
6	OUTFR	FRch Output terminal	32	INR4	Rch input terminal 4
7	OUTFL	FLch Output terminal	33	INL3	Lch input terminal 3
8	OUTSW	SWch Output terminal	34	INR3	Rch input terminal 3
9	OUTC	Cch Output terminal	35	INL2	Lch input terminal 2
10	OUTSR	SRch Output terminal	36	INR2	Rch input terminal 2
11	OUTSL	SLch Output terminal	37	INL1	Lch input terminal 1
12	OUTSBR	SBRch Output terminal	38	INR1	Rch input terminal 1
13	OUTSBL	SBLch Output terminal	39	GND	Analog ground terminal
14	SUBL	Lch SUB output terminal	40	SBLIN	SBLch input terminal for DSP
15	SUBR	Rch SUB output terminal	41	SBRIN	SBRch input terminal for DSP
16	GND	Analog ground terminal	42	SLIN	SLch input terminal for DSP
17	GND	Analog ground terminal	43	SRIN	SRch input terminal for DSP
18	RECL	Lch REC output terminal	44	CIN	Cch input terminal for DSP
19	RECR	Rch REC output terminal	45	SWIN	SWch input terminal for DSP
20	GND	Analog ground terminal	46	FLIN	FLch input terminal for DSP
21	GND	Analog ground terminal	47	FRIN	FRch input terminal for DSP
22	INL8	Lch input terminal 8	48	GND	Analog ground terminal
23	INR8	Rch input terminal 8	49	ADCR	Rch output terminal to ADC
24	INL7	Lch input terminal 7	50	ADCL	Lch output terminal to ADC
25	INR7	Rch input terminal 7	51	GND	Analog ground terminal
26	GND	Analog ground terminal	52	CHIP	Chip select

Block Diagram

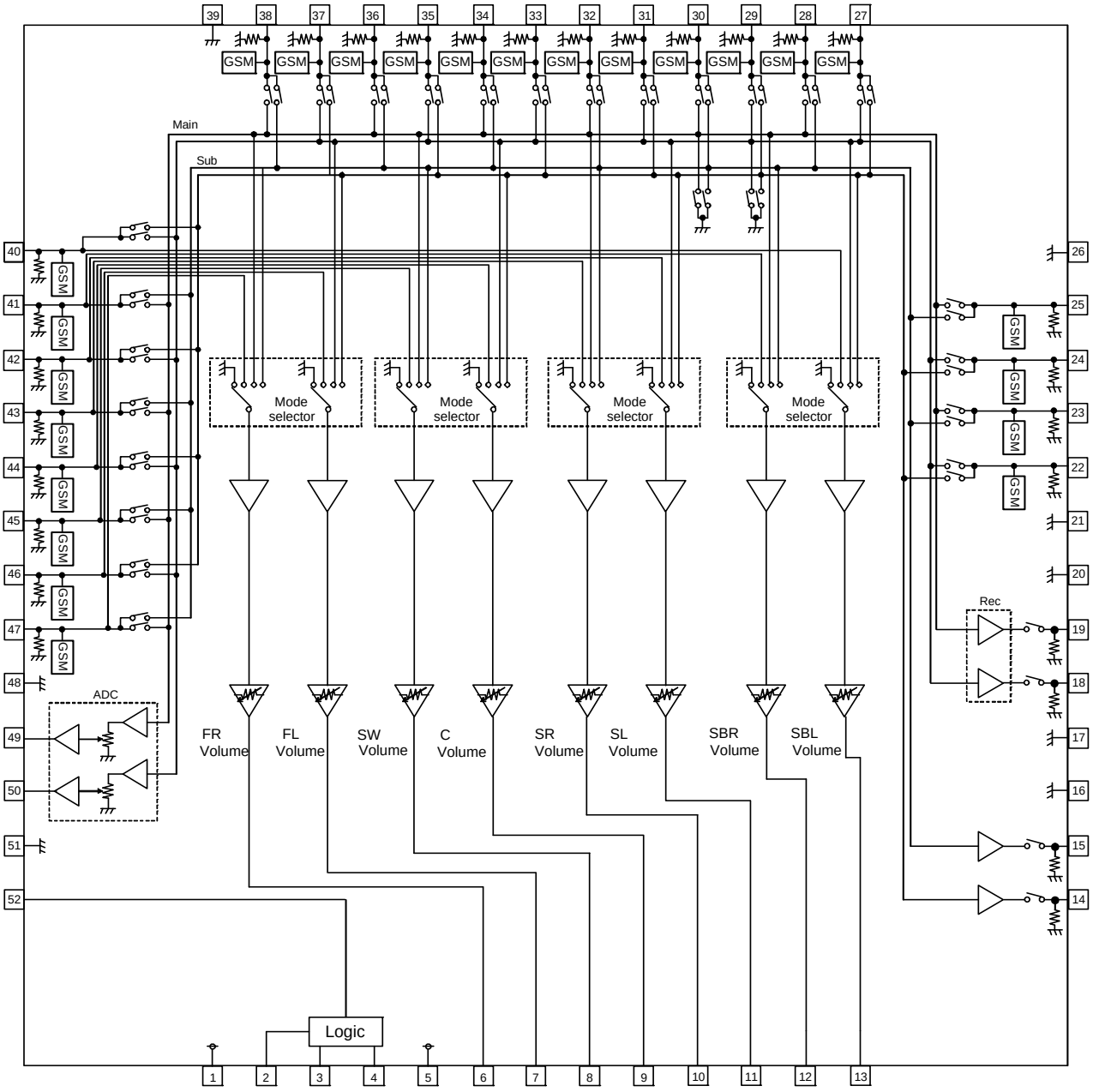


Figure 3. Block Diagram

Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Positive power supply	Vcc	+7.75 (Note1)	V
Negative power supply	Vee	-7.75 (Note1)	V
Power dissipation	Pd	1.30 (Note2)	W
Input voltage	Vin	Vee-0.2 to Vcc+0.2	V
Operating temperature	Topr	-40 to +85 (Note3)	°C
Storage temperature	Tastg	-55 to +125	°C

(Note1) The maximum voltage that can be applied based on GND.
(Note2) This value decreases 13.0mW/°C for Ta=25°C or more. A standard board, 70×70×1.6 mm, shall be mounted.
(Note3) If it within operation voltage range, circuit functions operation is guaranteed within operation temp.
Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Operating Condition

Item	Symbol	Rating	Unit
Positive power supply	Vcc	+6.5 to +7.5 (Note4,5)	V
Negative power supply	Vee	-6.5 to -7.5 (Note4,5)	V

(Note4) Applying a voltage based on GND.
(Note5) Within operation temp range, basic circuit function Operation is guaranteed within operation voltage range.
But please confirm set up of constant and element, voltage set up and temp set up on use.
Please watch out except condition stipulated by electrical characteristics within the range, It cannot guarantee standard value of electrical characteristics. But it retains original function.

Electrical characteristic

Unless specified particularly, Ta=25°C, Vcc=7V, Vee=-7V, f=1kHz, Vin=1Vrms, RL=10kΩ,
Stereo input selector(MAIN, SUB)=IN1, Mode selector(FL, FRch)=MAIN, Mode selector(SW, C, SL, SRch)=MULTI,
Mode selector(SBL, SBRch)=MULTI, Input Att=0dB, Input gain=0dB, Volume=0dB.

	Item	Symbol	Limit			Unit	Conditions
			Min.	Typ.	Max.		
TOTAL	Positive circuit current	Iqp	-	22	44	mA	No signal
	Negative circuit current	Iqn	-44	-22	-	mA	No signal
	Output voltage gain	Gv	-1.5	0	1.5	dB	6 to 13pin output
	Channel balance	CB	-0.5	0	0.5	dB	C Channel reference, 6 to 13pin output
	Total harmonic distortion	THD	-	0.0004	0.02	%	BW=400 to 30kHz 6 to 13pin output
	Maximum output voltage	Vom	3.8	4.2	-	Vrms	THD=1%, VOLUME=+10dB 6 to 13pin output
	Output noise voltage	Vno	-	1.5	10	μVrms	Rg=0Ω, BW=IHF-A 6 to 13pin output
	Residual output noise voltage	Vnor	-	1	8	μVrms	Volume=Mute, Rg=0Ω, BW=IHF-A 6 to 13pin output
	Cross-talk between channels	CT	-	-105	-80	dB	Rg=0Ω, BW=IHF-A 6, 7pin output
	Cross-talk between selectors	CS	-	-105	-80	dB	Rg=0Ω, BW=IHF-A 6, 7pin output
	Input impedance	Rin	32	47	62	kΩ	22 to 25, 27 to 38 40 to 47pin input
VOLUME	Maximum attenuation	ATTmax	-	-115	-100	dB	Volume=Mute, BW=IHF-A
REC OUT	Total harmonic distortion	THDR	-	0.0005	0.02	%	BW=400 to 30kHz, RL=6.8kΩ 14,15,18,19pin output

Typical Performance Curve(s)

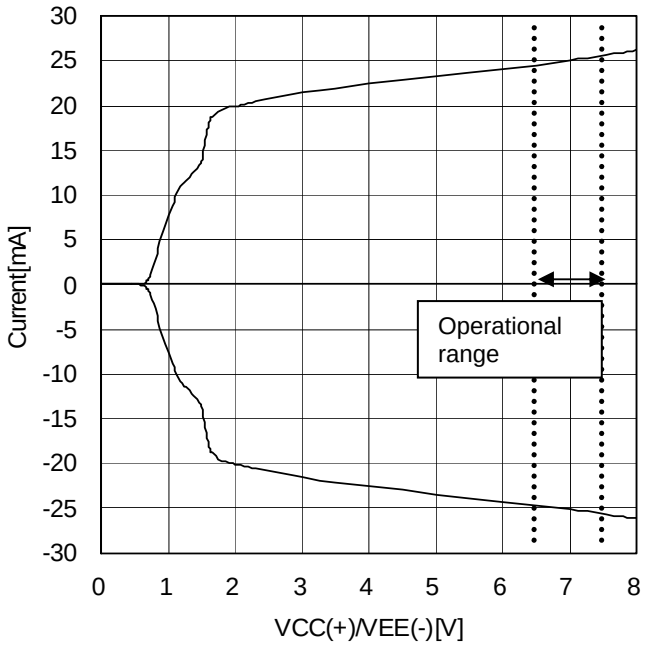


Figure 4. Circuit Currents vs. Circuit Voltage

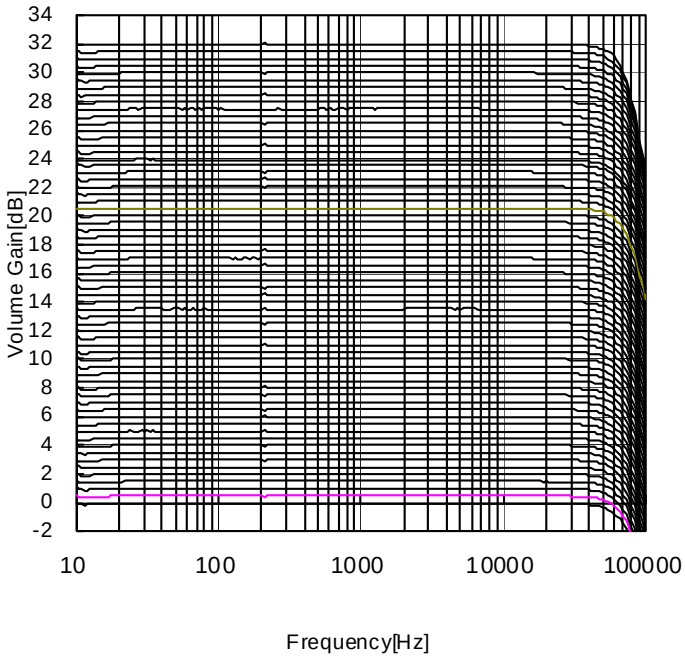


Figure 5. Volume Gain vs. Input Frequency
(32dB to 0 dB setting)

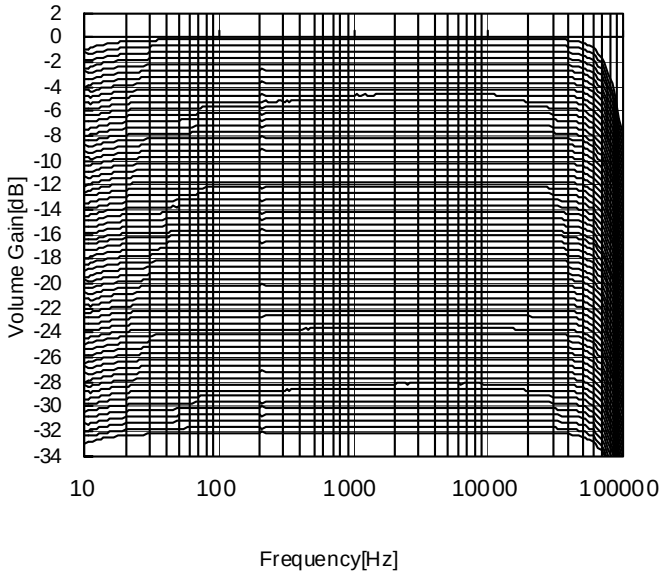


Figure 6. Volume Gain vs. Input Frequency
(0dB to -32 dB setting)

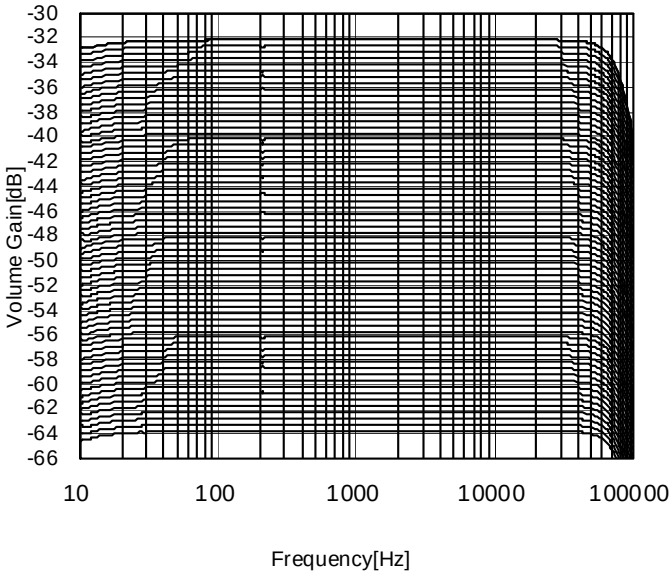


Figure 7. Volume Gain vs. Input Frequency
(-32dB to -64 dB setting)

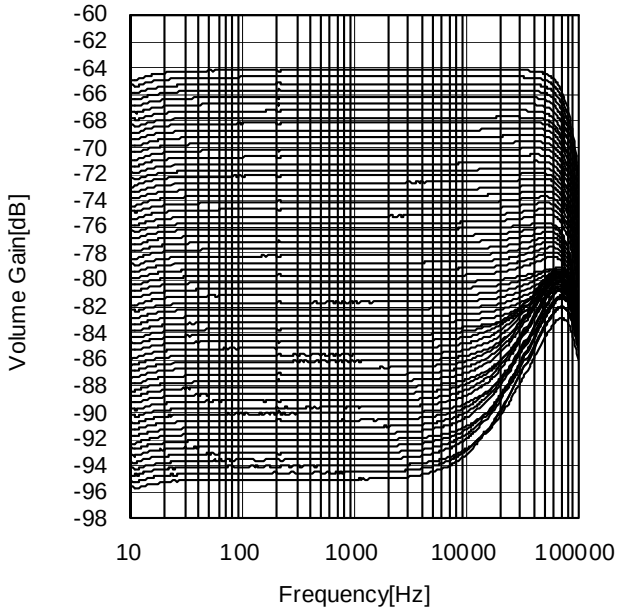


Figure 8. Volume Gain vs. Input Frequency
(-64dB to -95 dB setting)

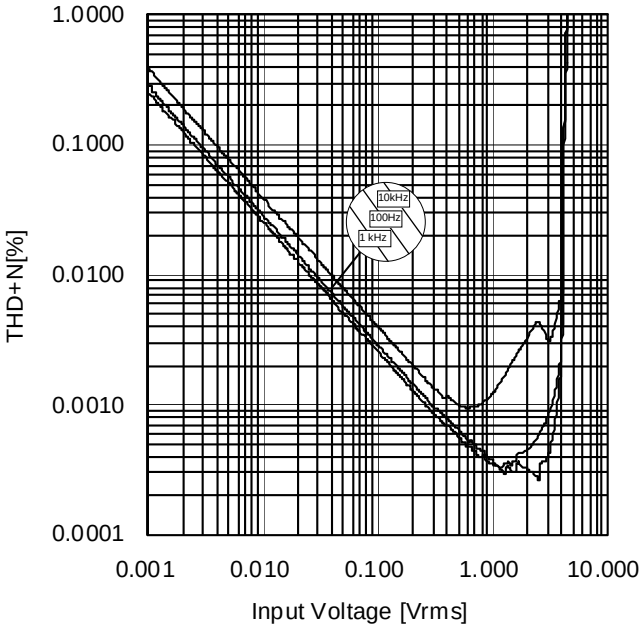


Figure 9. THD + N vs. Input Voltage

Specifications for Control Signal

(1) Timing of control signal

Data is read at a rising edge of clock.
Latch is read at a falling edge of clock. And Data on the latest 16bit are taken in the inside of this IC.
Be sure to set DA and CL to LOW after latching.

1byte=16bit

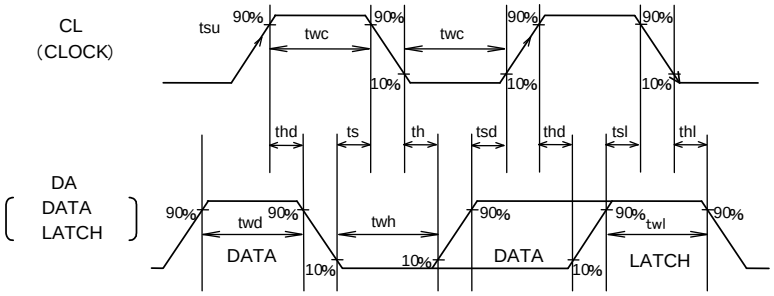


Figure 10. The timing definition of the control signal.

Item	Symbol	Limit			Unit
		Min.	Typ.	Max.	
Clock width	twc	1.0	-	-	µsec
Data width	twd	1.0	-	-	µsec
Latch width	twl	1.0	-	-	µsec
Low hold width	twh	1.0	-	-	µsec
Data setup time (DATA→CLK)	tsd	0.5	-	-	µsec
Data hold time (CLK→DATA)	thd	0.5	-	-	µsec
Latch setup time (CLK→LATCH)	tsl	0.5	-	-	µsec
Latch hold time	thl	0.5	-	-	µsec
Latch Low setup time	ts	0.5	-	-	µsec
Latch Low hold time	th	0.5	-	-	µsec

(2) Voltage of control signal (CL, DA, CHIP)

Item	Conditions	Limit			Unit
		Min.	Typ.	Max. (<Vcc)	
High input voltage	Vcc=+6.5 to +7.5V Vee=-6.5 to -7.5V	2.3	-	5.5	V
Low input voltage		0	-	1.0	V

(3) Basic Structure of Control Data

←Input Direction

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Data												Select Address			

(4) Table of Control Data

←Input Direction

Select Address No.	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
0	Input Selector (MAIN)						REC ON/OFF	0	0	SUB ON/OFF	1	0	0	Chip Select	0	0
1	Input Selector (SUB)						0	0	0	0	0	0	0		0	1
2	Mode Select FL, FRch		Mode Select C, SWch		Mode Select SL, SRch		Mode Select SBL, SBRch		0	ADC ATT			0		1	0
3	Volume channel Select				Volume								0		1	1
7	A→B switch-time				B→A switch-time		Base clock	0	0	System reset	0	0	1		1	1
BD3843FS (6ch Selector IC)													*	1	0	0
BD3841FS (9ch Selector IC)													*	1	0	1
BD3812F (2ch volume IC)													*	1	1	*

・Serial control lines can be shared with BD3843FS(6ch selector IC), BD3841FS(9ch selector IC) and BD3812F(2ch volume IC).
・Initialize all data at every turning on the power supply.

(Example)

←Input direction

Address No.0	L	Address No.1	L	Address No.2	L	Address No.3 FRch	L	Address No.3 FLch	L	≈

≈	Address No.3 SBRch	L	Address No.3 SBLch	L	Address No.7	L

・At the second time after turning on the power supply, eight any data to be changed.

(5) Chip Select Setting Table

CHP terminal condition	D2
0 (LOW)	0
1 (HIGH)	1

BD34701KS2 can be operated in combination with another by setting the CHP terminal.

Select Address No.0 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Input Selector (MAIN)	MUTE	0	0	0	0	0	0	REC ON/OFF	0	0	SUB ON/OFF	1	0	0	Chip Select	0	0
	IN1	0	0	0	0	0	1										
	IN2	0	0	0	0	1	0										
	IN3	0	0	0	0	1	1										
	IN4	0	0	0	1	0	0										
	IN5	0	0	0	1	0	1										
	IN6	0	0	0	1	1	0										
	IN7	0	0	0	1	1	1										
	IN8	0	0	1	0	0	0										
	IN9	0	0	1	0	0	1										
	IN10	0	0	1	0	1	0										
	IN11	0	0	1	0	1	1										
	IN12	0	0	1	1	0	0										
	Prohibition	0	0	1	1	0	1										
		⋮	⋮	⋮	⋮	⋮	⋮										
		1	1	1	1	1	1										
REC ON/OFF	OFF	Input Selector (MAIN)						0									
	ON							1									
SUB ON/OFF	OFF							REC ON/OFF			0						
	ON										1						

: Initial condition

Select Address No.1 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Input Selector (SUB)	MUTE	0	0	0	0	0	0	0	0	0	0	0	0	0	Chip Select	0	1
	IN1	0	0	0	0	0	1										
	IN2	0	0	0	0	1	0										
	IN3	0	0	0	0	1	1										
	IN4	0	0	0	1	0	0										
	IN5	0	0	0	1	0	1										
	IN6	0	0	0	1	1	0										
	IN7	0	0	0	1	1	1										
	IN8	0	0	1	0	0	0										
	IN9	0	0	1	0	0	1										
	IN10	0	0	1	0	1	0										
	IN11	0	0	1	0	1	1										
	IN12	0	0	1	1	0	0										
	Prohibition	0	0	1	1	0	1										
		⋮	⋮	⋮	⋮	⋮	⋮										
		1	1	1	1	1	1										

: Initial condition

Select Address No.2 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Mode Selector FL, FRch	MUTE	0	0	Mode Selector C, SWch		Mode Selector SL, SRch		Mode Selector SBL, SBRch		0	ADC ATT			0	Chip Select	1	0
	MAIN	0	1														
	MULTI	1	0														
	SUB	1	1														
Mode elector C, SWch	MUTE	Mode Selector FL, FRch		0	0												
	MAIN			0	1												
	MULTI			1	0												
	SUB			1	1												
Mode elector SL, SRch	MUTE			Mode Selector C, SWch		0	0										
	MAIN					0	1										
	MULTI					1	0										
	SUB					1	1										
Mode Selector SBL, SBRch	MUTE					Mode Selector SL, SRch		0	0								
	MULTI							0	1								
	SUB							1	0								
	MAIN							1	1								
ADC ATT	MUTE							Mode Selector SBL, SBRch			0	0	0				
	0dB										0	0	1				
	-6dB										0	1	0				
	-6.5dB										0	1	1				
	-7.5dB										1	0	0				
	-9dB										1	0	1				
	-12dB										1	1	0				
	Prohibition										1	1	1				

: Initial condition

Select Address No.3 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Volume channel Select	FR	0	0	0	Volume									0	Chip Select	1	1
	FL	0	0	1													
	SW	0	1	0													
	C	0	1	1													
	SR	1	0	0													
	SL	1	0	1													
	SBR	1	1	0													
	SBL	1	1	1													
Volume	MUTE	Volume Channel Select			1	1	1	1	1	1	1	1	1				
	Prohibition					1	1	1	1	1	1	1	0				
						⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮				
						0	1	0	0	0	0	0	1				
	+32.0dB					0	1	0	0	0	0	0	0				
	+31.5dB					0	0	1	1	1	1	1	1				
	+31.0dB					0	0	1	1	1	1	1	0				
	+30.5dB					0	0	1	1	1	1	0	1				
	+30.0dB					0	0	1	1	1	1	0	0				
	+29.5dB					0	0	1	1	1	0	1	1				
	+29.0dB					0	0	1	1	1	0	1	0				
	+28.5dB					0	0	1	1	1	0	0	1				
	+28.0dB					0	0	1	1	1	0	0	0				
	+27.5dB					0	0	1	1	0	1	1	1				
	+27.0dB					0	0	1	1	0	1	1	0				
	+26.5dB					0	0	1	1	0	1	0	1				
	+26.0dB					0	0	1	1	0	1	0	0				
	+25.5dB					0	0	1	1	0	0	1	1				
	+25.0dB					0	0	1	1	0	0	1	0				
	+24.5dB					0	0	1	1	0	0	0	1				
	+24.0dB					0	0	1	1	0	0	0	0				
	+23.5dB					0	0	1	0	1	1	1	1				
	+23.0dB					0	0	1	0	1	1	1	0				
	+22.5dB					0	0	1	0	1	1	0	1				
	+22.0dB					0	0	1	0	1	1	0	0				
	+21.5dB					0	0	1	0	1	0	1	1				
	+21.0dB					0	0	1	0	1	0	1	0				
	+20.5dB					0	0	1	0	1	0	0	1				
	+20.0dB					0	0	1	0	1	0	0	0				
	+19.5dB					0	0	1	0	0	1	1	1				
	+19.0dB					0	0	1	0	0	1	1	0				
	+18.5dB					0	0	1	0	0	1	0	1				
	+18.0dB					0	0	1	0	0	1	0	0				
	+17.5dB					0	0	1	0	0	0	1	1				
	+17.0dB					0	0	1	0	0	0	1	0				
	+16.5dB					0	0	1	0	0	0	0	1				
	+16.0dB					0	0	1	0	0	0	0	0				
	+15.5dB					0	0	0	1	1	1	1	1				

: Initial condition

Select Address No.3 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Volume	+15.0dB	Volume Channel Select			1	0	0	0	1	1	1	1	0	0	Chip Select	1	1
	+14.5dB					0	0	0	1	1	1	0	1				
	+14.0dB					0	0	0	1	1	1	0	0				
	+13.5dB					0	0	0	1	1	0	1	1				
	+13.0dB					0	0	0	1	1	0	1	0				
	+12.5dB					0	0	0	1	1	0	0	1				
	+12.0dB					0	0	0	1	1	0	0	0				
	+11.5dB					0	0	0	1	0	1	1	1				
	+11.0dB					0	0	0	1	0	1	1	0				
	+10.5dB					0	0	0	1	0	1	0	1				
	+10.0dB					0	0	0	1	0	1	0	0				
	+9.5dB					0	0	0	1	0	0	1	1				
	+9.0dB					0	0	0	1	0	0	1	0				
	+8.5dB					0	0	0	1	0	0	0	1				
	+8.0dB					0	0	0	1	0	0	0	0				
	+7.5dB					0	0	0	0	1	1	1	1				
	+7.0dB					0	0	0	0	1	1	1	0				
	+6.5dB					0	0	0	0	1	1	0	1				
	+6.0dB					0	0	0	0	1	1	0	0				
	+5.5dB					0	0	0	0	1	0	1	1				
	+5.0dB					0	0	0	0	1	0	1	0				
	+4.5dB					0	0	0	0	1	0	0	1				
	+4.0dB					0	0	0	0	1	0	0	0				
	+3.5dB					0	0	0	0	0	1	1	1				
	+3.0dB					0	0	0	0	0	1	1	0				
	+2.5dB					0	0	0	0	0	1	0	1				
	+2.0dB					0	0	0	0	0	1	0	0				
	+1.5dB					0	0	0	0	0	0	1	1				
	+1.0dB					0	0	0	0	0	0	1	0				
	+0.5dB					0	0	0	0	0	0	0	1				
	Prohibition					0	0	0	0	0	0	0	0				
	-0dB				0	0	0	0	0	0	0	0	0				
	-0.5dB					0	0	0	0	0	0	0	1				
	-1.0dB					0	0	0	0	0	0	1	0				
	-1.5dB					0	0	0	0	0	0	1	1				
	-2.0dB					0	0	0	0	0	1	0	0				
	-2.5dB					0	0	0	0	0	1	0	1				
	-3.0dB					0	0	0	0	0	1	1	0				
	-3.5dB					0	0	0	0	0	1	1	1				
	-4.0dB					0	0	0	0	1	0	0	0				
	-4.5dB					0	0	0	0	1	0	0	1				
	-5.0dB					0	0	0	0	1	0	1	0				
	-5.5dB					0	0	0	0	1	0	1	1				
	-6.0dB					0	0	0	0	1	1	0	0				
	-6.5dB					0	0	0	0	1	1	0	1				
	-7.0dB					0	0	0	0	1	1	1	0				
	-7.5dB					0	0	0	0	1	1	1	1				

Select Address No.3 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Volume	-8.0dB	Volume Channel Select			0	0	0	0	1	0	0	0	0	0	Chip Select	1	1
	-8.5dB					0	0	0	1	0	0	0	1				
	-9.0dB					0	0	0	1	0	0	1	0				
	-9.5dB					0	0	0	1	0	0	1	1				
	-10.0dB					0	0	0	1	0	1	0	0				
	-10.5dB					0	0	0	1	0	1	0	1				
	-11.0dB					0	0	0	1	0	1	1	0				
	-11.5dB					0	0	0	1	0	1	1	1				
	-12.0dB					0	0	0	1	1	0	0	0				
	-12.5dB					0	0	0	1	1	0	0	1				
	-13.0dB					0	0	0	1	1	0	1	0				
	-13.5dB					0	0	0	1	1	0	1	1				
	-14.0dB					0	0	0	1	1	1	0	0				
	-14.5dB					0	0	0	1	1	1	0	1				
	-15.0dB					0	0	0	1	1	1	1	0				
	-15.5dB					0	0	0	1	1	1	1	1				
	-16.0dB					0	0	1	0	0	0	0	0				
	-16.5dB					0	0	1	0	0	0	0	1				
	-17.0dB					0	0	1	0	0	0	1	0				
	-17.5dB					0	0	1	0	0	0	1	1				
	-18.0dB					0	0	1	0	0	1	0	0				
	-18.5dB					0	0	1	0	0	1	0	1				
	-19.0dB					0	0	1	0	0	1	1	0				
	-19.5dB					0	0	1	0	0	1	1	1				
	-20.0dB					0	0	1	0	1	0	0	0				
	-20.5dB					0	0	1	0	1	0	0	1				
	-21.0dB					0	0	1	0	1	0	1	0				
	-21.5dB					0	0	1	0	1	0	1	1				
	-22.0dB					0	0	1	0	1	1	0	0				
	-22.5dB					0	0	1	0	1	1	0	1				
	-23.0dB					0	0	1	0	1	1	1	0				
	-23.5dB					0	0	1	0	1	1	1	1				
	-24.0dB					0	0	1	1	0	0	0	0				
	-24.5dB					0	0	1	1	0	0	0	1				
	-25.0dB					0	0	1	1	0	0	1	0				
	-25.5dB					0	0	1	1	0	0	1	1				
	-26.0dB					0	0	1	1	0	1	0	0				
	-26.5dB					0	0	1	1	0	1	0	1				
	-27.0dB					0	0	1	1	0	1	1	0				
	-27.5dB					0	0	1	1	0	1	1	1				
	-28.0dB					0	0	1	1	1	0	0	0				
	-28.5dB					0	0	1	1	1	0	0	1				
	-29.0dB					0	0	1	1	1	0	1	0				
	-29.5dB					0	0	1	1	1	0	1	1				
	-30.0dB					0	0	1	1	1	1	0	0				
	-30.5dB					0	0	1	1	1	1	0	1				
	-31.0dB					0	0	1	1	1	1	1	0				

Select Address No.3 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Volume	-31.5dB	Volume Channel Select			0	0	0	1	1	1	1	1	1	0	Chip Select	1	1
	-32.0dB					0	1	0	0	0	0	0	0				
	-32.5dB					0	1	0	0	0	0	0	1				
	-33.0dB					0	1	0	0	0	0	1	0				
	-33.5dB					0	1	0	0	0	0	1	1				
	-34.0dB					0	1	0	0	0	1	0	0				
	-34.5dB					0	1	0	0	0	1	0	1				
	-35.0dB					0	1	0	0	0	1	1	0				
	-35.5dB					0	1	0	0	0	1	1	1				
	-36.0dB					0	1	0	0	1	0	0	0				
	-36.5dB					0	1	0	0	1	0	0	1				
	-37.0dB					0	1	0	0	1	0	1	0				
	-37.5dB					0	1	0	0	1	0	1	1				
	-38.0dB					0	1	0	0	1	1	0	0				
	-38.5dB					0	1	0	0	1	1	0	1				
	-39.0dB					0	1	0	0	1	1	1	0				
	-39.5dB					0	1	0	0	1	1	1	1				
	-40.0dB					0	1	0	1	0	0	0	0				
	-40.5dB					0	1	0	1	0	0	0	1				
	-41.0dB					0	1	0	1	0	0	1	0				
	-41.5dB					0	1	0	1	0	0	1	1				
	-42.0dB					0	1	0	1	0	1	0	0				
	-42.5dB					0	1	0	1	0	1	0	1				
	-43.0dB					0	1	0	1	0	1	1	0				
	-43.5dB					0	1	0	1	0	1	1	1				
	-44.0dB					0	1	0	1	1	0	0	0				
	-44.5dB					0	1	0	1	1	0	0	1				
	-45.0dB					0	1	0	1	1	0	1	0				
	-45.5dB					0	1	0	1	1	0	1	1				
	-46.0dB					0	1	0	1	1	1	0	0				
	-46.5dB					0	1	0	1	1	1	0	1				
	-47.0dB					0	1	0	1	1	1	1	0				
	-47.5dB					0	1	0	1	1	1	1	1				
	-48.0dB					0	1	1	0	0	0	0	0				
	-48.5dB					0	1	1	0	0	0	0	1				
	-49.0dB					0	1	1	0	0	0	1	0				
	-49.5dB					0	1	1	0	0	0	1	1				
	-50.0dB					0	1	1	0	0	1	0	0				
	-50.5dB					0	1	1	0	0	1	0	1				
	-51.0dB					0	1	1	0	0	1	1	0				
	-51.5dB					0	1	1	0	0	1	1	1				
	-52.0dB					0	1	1	0	1	0	0	0				
	-52.5dB					0	1	1	0	1	0	0	1				
	-53.0dB					0	1	1	0	1	0	1	0				
	-53.5dB					0	1	1	0	1	0	1	1				
	-54.0dB					0	1	1	0	1	1	0	0				
	-54.5dB					0	1	1	0	1	1	0	1				

Select Address No.3 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Volume	-55.0dB	Volume Channel Select			0	0	1	1	0	1	1	1	0	0	Chip Select	1	1
	-55.5dB					0	1	1	0	1	1	1	1				
	-56.0dB					0	1	1	1	0	0	0	0				
	-56.5dB					0	1	1	1	0	0	0	1				
	-57.0dB					0	1	1	1	0	0	1	0				
	-57.5dB					0	1	1	1	0	0	1	1				
	-58.0dB					0	1	1	1	0	1	0	0				
	-58.5dB					0	1	1	1	0	1	0	1				
	-59.0dB					0	1	1	1	0	1	1	0				
	-59.5dB					0	1	1	1	0	1	1	1				
	-60.0dB					0	1	1	1	1	0	0	0				
	-60.5dB					0	1	1	1	1	0	0	1				
	-61.0dB					0	1	1	1	1	0	1	0				
	-61.5dB					0	1	1	1	1	0	1	1				
	-62.0dB					0	1	1	1	1	1	0	0				
	-62.5dB					0	1	1	1	1	1	0	1				
	-63.0dB					0	1	1	1	1	1	1	0				
	-63.5dB					0	1	1	1	1	1	1	1				
	-64.0dB					1	0	0	0	0	0	0	0				
	-64.5dB					1	0	0	0	0	0	0	1				
	-65.0dB					1	0	0	0	0	0	1	0				
	-65.5dB					1	0	0	0	0	0	1	1				
	-66.0dB					1	0	0	0	0	1	0	0				
	-66.5dB					1	0	0	0	0	1	0	1				
	-67.0dB					1	0	0	0	0	1	1	0				
	-67.5dB					1	0	0	0	0	1	1	1				
	-68.0dB					1	0	0	0	1	0	0	0				
	-68.5dB					1	0	0	0	1	0	0	1				
	-69.0dB					1	0	0	0	1	0	1	0				
	-69.5dB					1	0	0	0	1	0	1	1				
	-70.0dB					1	0	0	0	1	1	0	0				
	-70.5dB					1	0	0	0	1	1	0	1				
	-71.0dB					1	0	0	0	1	1	1	0				
	-71.5dB					1	0	0	0	1	1	1	1				
	-72.0dB					1	0	0	1	0	0	0	0				
	-72.5dB					1	0	0	1	0	0	0	1				
	-73.0dB					1	0	0	1	0	0	1	0				
	-73.5dB					1	0	0	1	0	0	1	1				
	-74.0dB					1	0	0	1	0	1	0	0				
	-74.5dB					1	0	0	1	0	1	0	1				
	-75.0dB					1	0	0	1	0	1	1	0				
	-75.5dB					1	0	0	1	0	1	1	1				
	-76.0dB					1	0	0	1	1	0	0	0				
	-76.5dB					1	0	0	1	1	0	0	1				
	-77.0dB					1	0	0	1	1	0	1	0				
	-77.5dB					1	0	0	1	1	0	1	1				
	-78.0dB					1	0	0	1	1	1	0	0				

Select Address No.3 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Volume	-78.5dB	Volume Channel Select			0	1	0	0	1	1	1	0	1	0	Chip Select	1	1
	-79.0dB					1	0	0	1	1	1	1	0				
	-79.5dB					1	0	0	1	1	1	1	1				
	-80.0dB					1	0	1	0	0	0	0	0				
	-80.5dB					1	0	1	0	0	0	0	1				
	-81.0dB					1	0	1	0	0	0	1	0				
	-81.5dB					1	0	1	0	0	0	1	1				
	-82.0dB					1	0	1	0	0	1	0	0				
	-82.5dB					1	0	1	0	0	1	0	1				
	-83.0dB					1	0	1	0	0	1	1	0				
	-83.5dB					1	0	1	0	0	1	1	1				
	-84.0dB					1	0	1	0	1	0	0	0				
	-84.5dB					1	0	1	0	1	0	0	1				
	-85.0dB					1	0	1	0	1	0	1	0				
	-85.5dB					1	0	1	0	1	0	1	1				
	-86.0dB					1	0	1	0	1	1	0	0				
	-86.5dB					1	0	1	0	1	1	0	1				
	-87.0dB					1	0	1	0	1	1	1	0				
	-87.5dB					1	0	1	0	1	1	1	1				
	-88.0dB					1	0	1	1	0	0	0	0				
	-88.5dB					1	0	1	1	0	0	0	1				
	-89.0dB					1	0	1	1	0	0	1	0				
	-89.5dB					1	0	1	1	0	0	1	1				
	-90.0dB					1	0	1	1	0	1	0	0				
	-90.5dB					1	0	1	1	0	1	0	1				
	-91.0dB					1	0	1	1	0	1	1	0				
	-91.5dB					1	0	1	1	0	1	1	1				
	-92.0dB					1	0	1	1	1	0	0	0				
	-92.5dB					1	0	1	1	1	0	0	1				
	-93.0dB					1	0	1	1	1	0	1	0				
	-93.5dB					1	0	1	1	1	0	1	1				
	-94.0dB					1	0	1	1	1	1	0	0				
	-94.5dB					1	0	1	1	1	1	0	1				
	-95.0dB					1	0	1	1	1	1	1	0				
	Prohibition					1	0	1	1	1	1	1	1				
						⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮				
						1	1	1	1	1	1	1	1				

Select Address No.7 Setting Table

Function & Setting		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
A→B switching-time	11msec	0	0	0	B→A switching-time			Base clock	0	0	System Reset	0	0	1	Chip Select	1	1
	5msec	0	0	1													
	7msec	0	1	0													
	14msec	0	1	1													
	3msec	1	0	0													
	2msec	1	0	1													
	Prohibition	1	1	0													
		1	1	1													
B→A switching-time	11msec	A→B switching-time			0	0	0										
	5msec				0	0	1										
	7msec				0	1	0										
	14msec				0	1	1										
	3msec				1	0	0										
	2msec				1	0	1										
	Prohibition				1	1	0										
					1	1	1										
Base clock	x1				B→A switching-time			0									
	×1/2							1									
System Reset	Normal							Base clock			0						
	Reset										1						

: Initial condition

Volume changing needs the time that is following Figure. (Ex. It selected 11msec, 22msec need.)

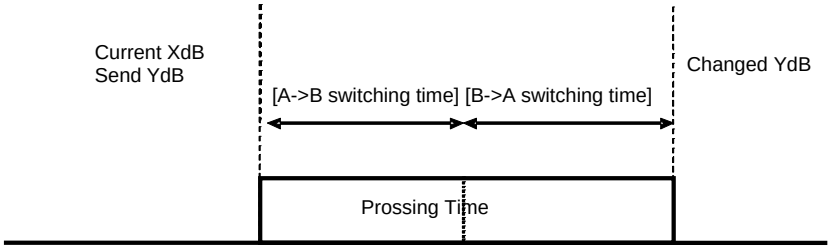


Figure 11. About [A→B switching-time] [B→A switching-time]

Base clock is able to change Internal Oscillator Frequency. For example, when Base clock select ×1/2, A->B and B->A switching time is to be two times. (ex. 11msec->22msec)

○Caution on send data
When send the same channel data among the switching process, internal operation is as below.

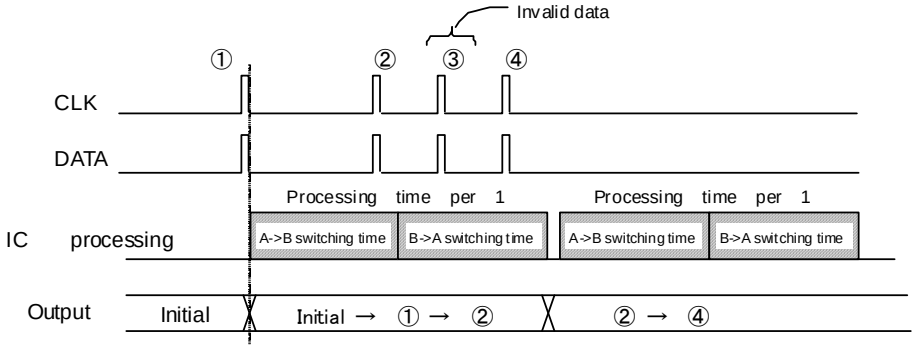


Figure 12. The switching process with send data

②data is sent during A -> B switching time, it is valid.
③data and ④data are sent during B -> A switching time, it is valid at the next processing time.
But ③data is replaced by ④data.

○About pop noise in gain changing
The level of the pop noise sometimes varies in the difference in output DC offset of the inside condition A and B.

Application Circuit Diagram

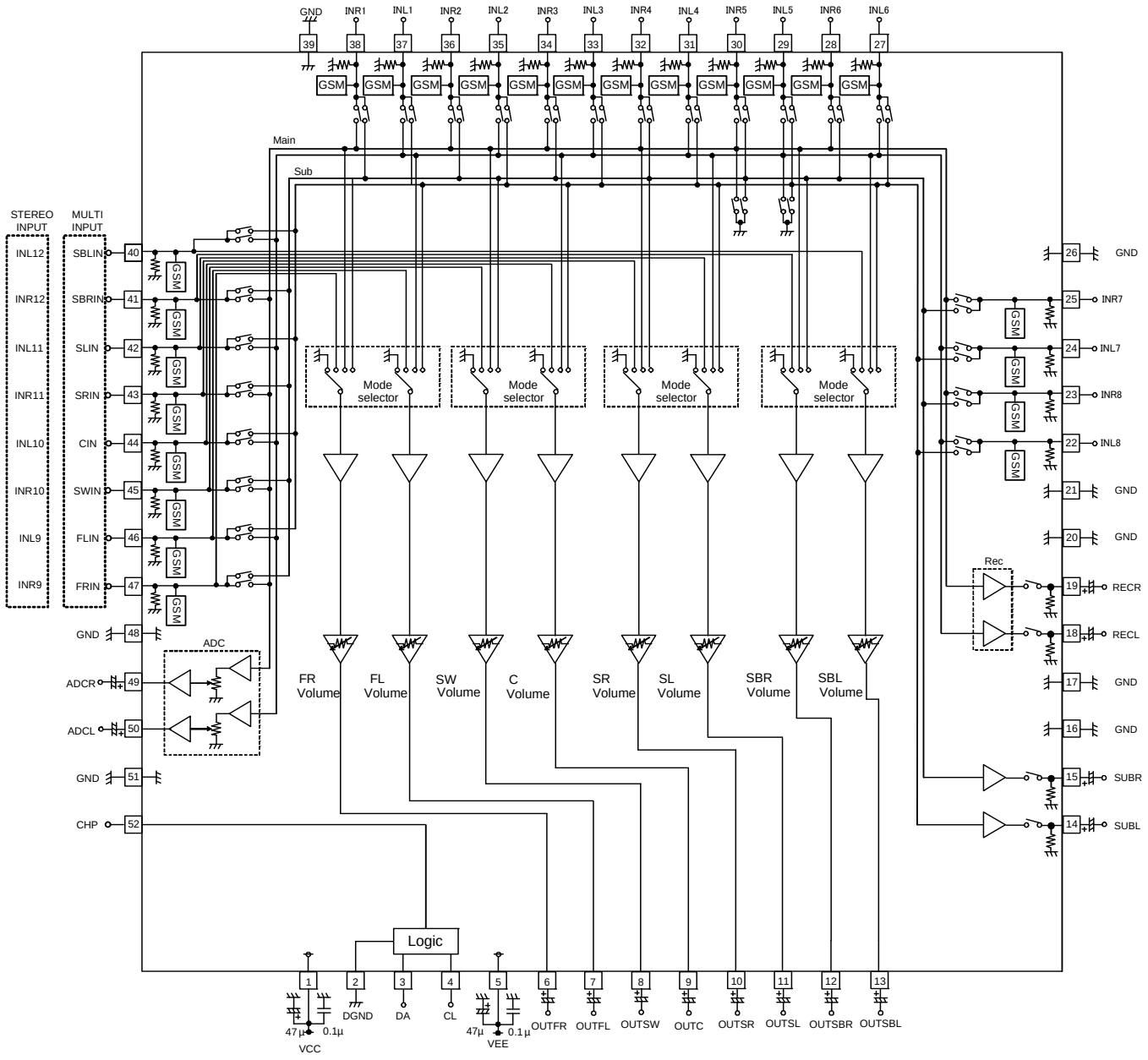


Figure 13. Application Circuit Diagram

Notes on wiring

① GND shall be wired from reference point and thicken.
② Wiring pattern of CL and DA shall be away from that of analog unit and cross-talk shall not be acceptable.
③ Lines of CL and DA of shall not be parallel if possible. The lines shall be shielded, if they are adjacent to each other.
④ Please pay attention the wiring pattern of the input terminal of the input selector to the cross talk. Recommend that wiring period is shielded.
⑤ Please connect the decoupling capacitor of a power supply in the shortest distance as much as possible to VCC and GND, VEE.

Power Dissipation

About the thermal design by the IC
Characteristics of an IC have a great deal to do with the temperature at which it is used, and exceeding absolute maximum ratings may degrade and destroy elements. Careful consideration must be given to the heat of the IC from the two standpoints of immediate damage and long-term reliability of operation.

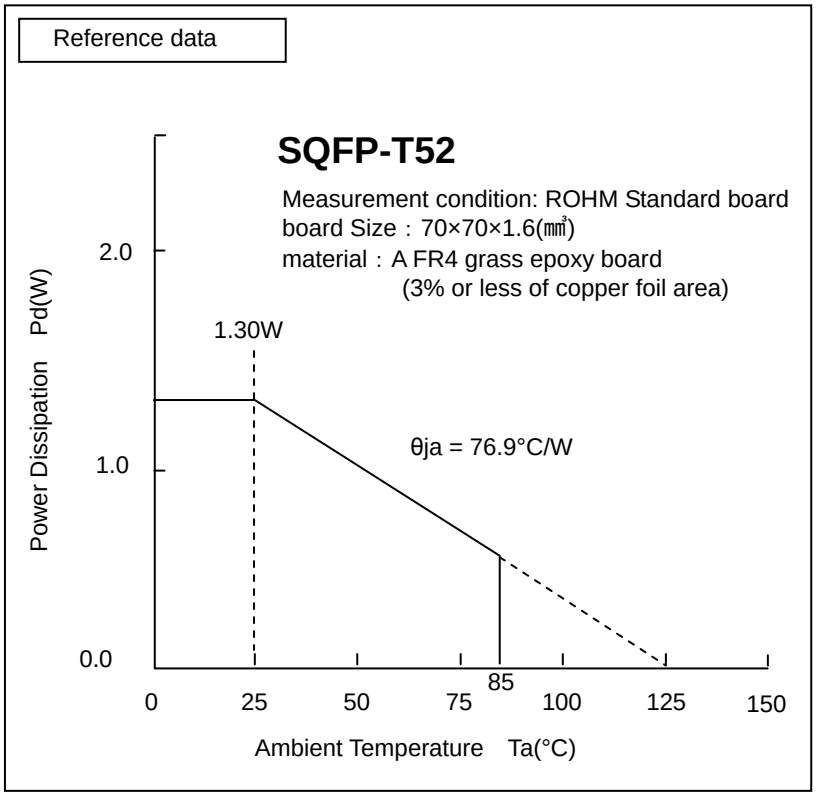
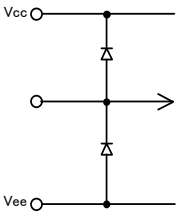
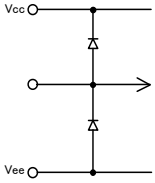
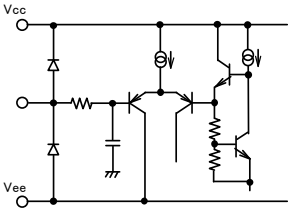
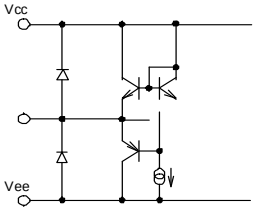
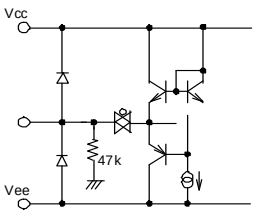


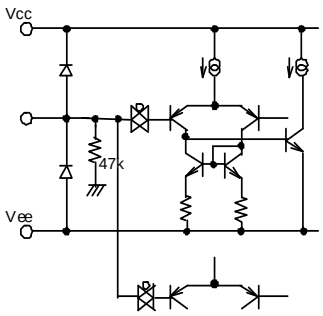
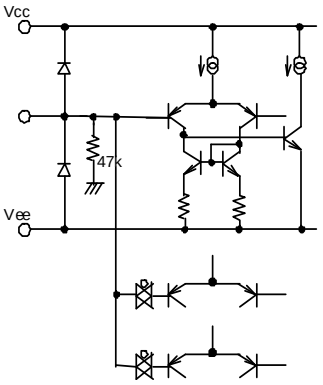
Figure 14. Temperature Derating Curve

Note) Value are actual measurements and are not guaranteed.

Power dissipation values vary according to the board on which the IC is mounted.

I/O equivalence circuit(s)

Terminal Number	Terminal Name	Terminal Voltage (V)	Equivalent Circuit	Description of terminal
16 17 20 21 39 48 51	AGND	0		Analog ground terminals.
1 5	VCC VEE	+7 -7		Positive power supply terminal and
2	DGND	0		Digital ground terminal.
3 4 52	DA CL CHP	-		Input terminals for a clock and data.
6 7 8 9 10 11 12 13 49 50	OUTFR OUTFL OUTSW OUTC OUTSR OUTSL OUTSBR OUTSBL ADCR ADCL	0		Output terminal s for analog sound signal.
14 15 18 19	SUBL SUBR RECL RECR	0		Output terminal s for analog sound signal. (SUB/REC)

Terminal Number	Terminal Name	Terminal Voltage (V)	Equivalent Circuit	Description of terminal
22 23 24 25 27 28 29 30 31 32 33 34 35 36 37 38	INL8 INR8 INL7 INR7 INL6 INR6 INL5 INR5 INL4 INR4 INL3 INR3 INL2 INR2 INL1 INR1	0		Input terminals for stereo sound signal. Input impedance is 47kΩ(Typ.).
40 41 42 43 44 45 46 47	SBLIN SBRIN SLIN SRIN CIN SWIN FLIN FRIN	0		Input terminals for an analog multi sound signal. Input impedance is 47kΩ(Typ.).

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply terminals.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Vee Voltage**
   Ensure that no pins are at a voltage below that of the VEE pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   GND pins which are digital ground(2pin) and analog ground(16,17,20,21,26,39,48,51pin) are not connected inside LSI. These ground pins traces should be routed separately but connected to a single ground at the reference point of the application board. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Thermal Consideration**
   Should by any chance the power dissipation rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. The absolute maximum rating of the Pd stated in this specification is when the IC is mounted on a 70mm x 70mm x 1.6mm glass epoxy board. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the Pd rating.

6. **Recommended Operating Conditions**
   These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

7. **Rush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

8. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

9. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to IC pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

10. **Inter-pin Short and Mounting Errors**
    Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

11. **Unused Input Terminals**
    Because the input impedance of the terminal becomes 47kΩ when the signal input terminal makes a terminal open, the plunge noise from outside sometimes becomes a problem. Please connect the no using input pin to GND. And please open the no using output pin.

Operational Notes – continued 1

12. Regarding the Input Pin of the IC

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When Vee > Pin A and Vee > Pin B, the P-N junction operates as a parasitic diode.
When Vee > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the Vee voltage to an input pin (and thus to the P substrate) should be avoided.

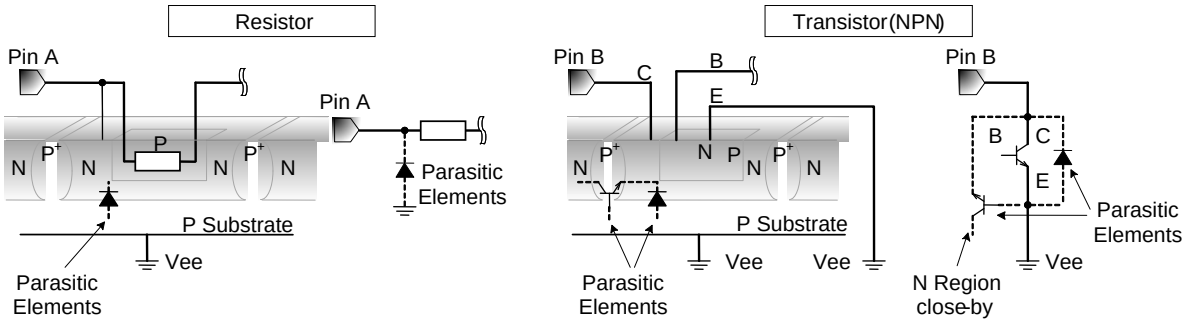


Figure 15. Example of monolithic IC structure

13. Ceramic Capacitor

When using a ceramic capacitor, determine the dielectric constant considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

14. About power ON/OFF

1. At power ON/OFF, a shock sound will be generated and, therefore, use MUTE on the set.
2. When turning on power supplies, Vee and Vcc should be powered on simultaneously or Vee first; then followed by Vcc. If the Vcc side is started up first, an excessive current may pass Vcc through Vee.

15. About function switching

When switching Input Selector, Mode selector or Input Gain, use MUTE on Volume.

16. Volume gain switching

In case of the boost of the volume when changing to the high gain which exceeds +20dB especially, the switching shock noise sometimes becomes big. In this case, we recommend changing every 1 dB step without changing a gain at once. Also, the shock noise sometimes can reduce by making micro-step volume switching time long, too.

Operational Notes – continued 2

17. Output load characteristic

The usages of load for output are below (reference). Please use the load more than 10 kΩ(TYP).

Output terminal

Terminal No.	Terminal Name	Terminal No.	Terminal Name	Terminal No.	Terminal Name	Terminal No.	Terminal Name
6	OUTFR	10	OUTSR	14	SUBL	49	ADCR
7	OUTFL	11	OUTSL	15	SUBR	50	ADCL
8	OUTSW	12	OUTSBR	18	RECL	-	-
9	OUTC	13	OUTSBL	19	RECR	-	-

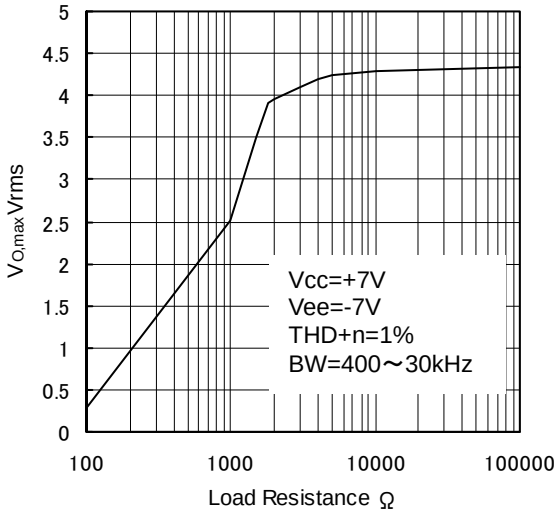
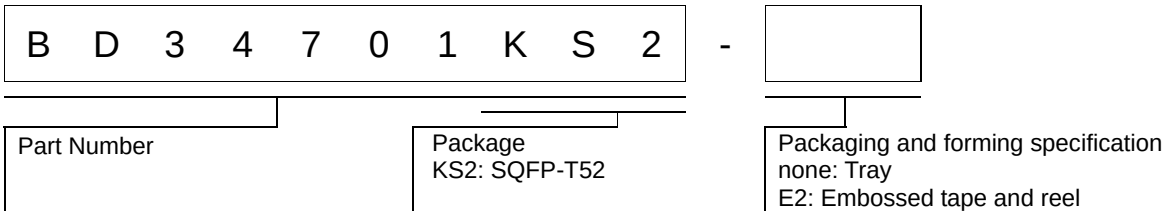
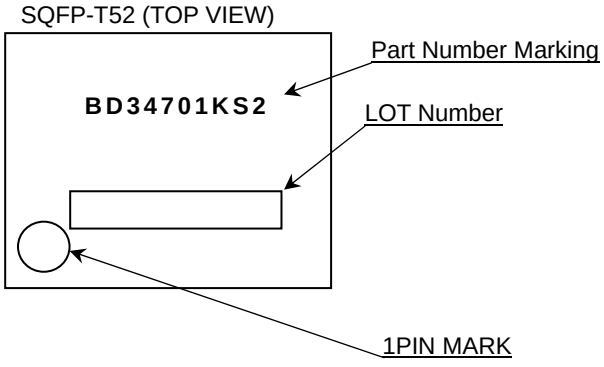


Figure 16. Output load characteristic at Vcc=+7V, Vee=-7V(Reference)

Ordering Information

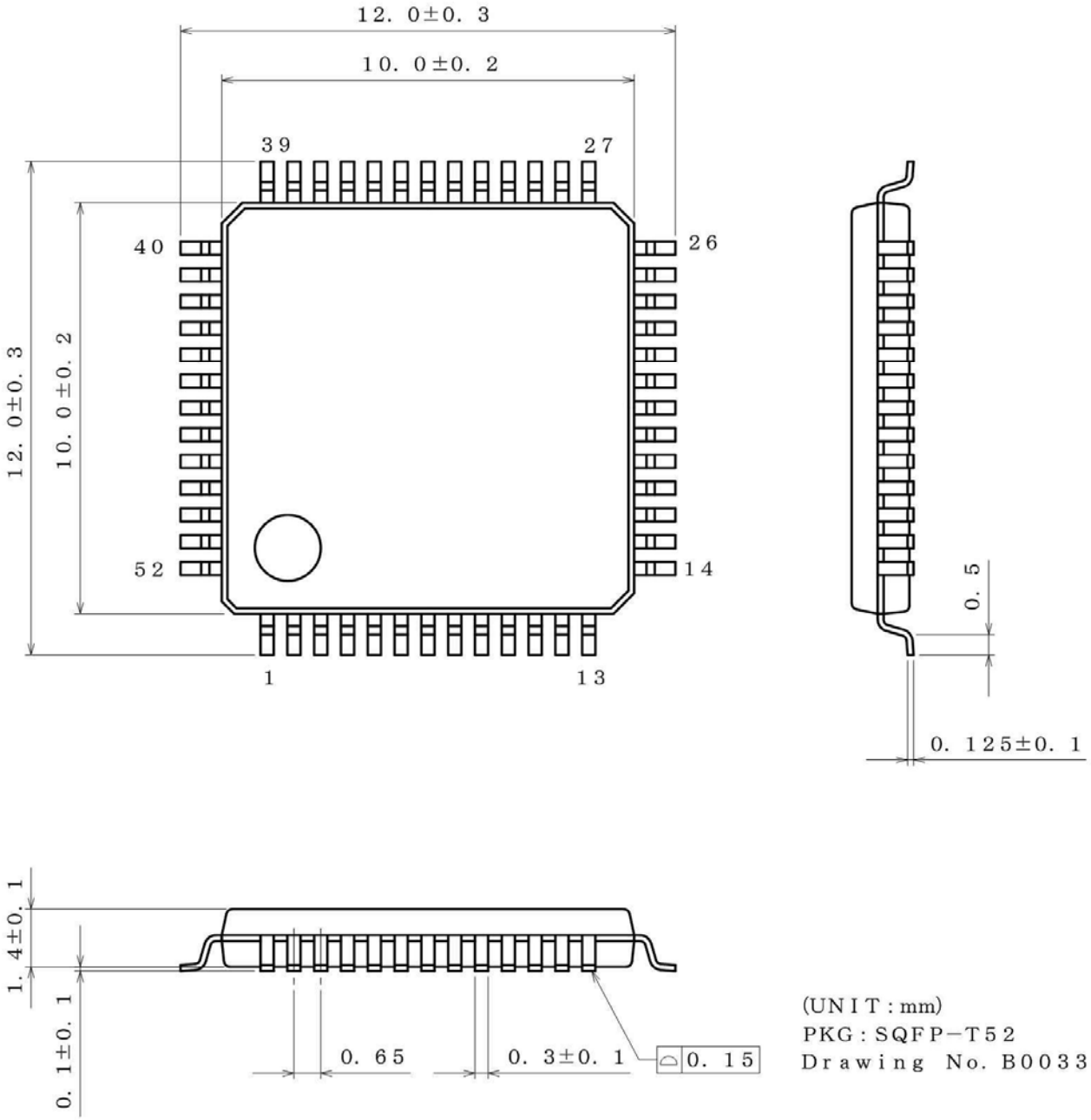


Marking Diagram(TOP VIEW)



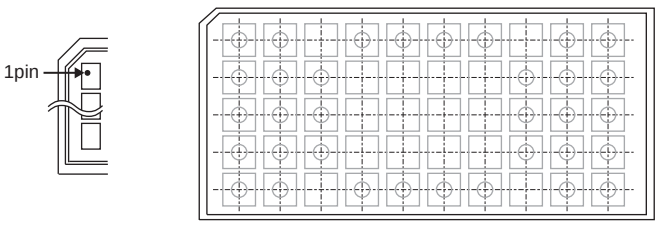
Physical Dimension, Tape and Reel Information

Package Name	SQFP-T52



<Tape and Reel information>

Container	Tray (with dry pack)
Quantity	1000pcs
Direction of feed	Direction of product is fixed in a tray



*Order quantity needs to be multiple of the minimum quantity.

Revision History

Date	Revision	Changes
02.Sep.2013	001	New Release
17.Sep.2003	002	P27. Delete “M” of “SQFP-T52M” in Marking Diagram.

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. 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.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

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

2. In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

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