Sound Processors for Home Theater Systems

5.1ch Sound Processor

BD3811K1,BD3818KS

No.10081EAT02

●Description

BD3811K1 and BD3818KS are 5.1ch sound processors, with built-in Mode Selector/Input Selector. Functions, including 6-ch Volume, Gain Amp, Bass, Treble, Mixing (BD3818KS), Dynamic Bass Boost (BD3818KS) and Bass Boost (BD3811K1) are integrated into a single chip.

●Features

1) Independent 6 channels for Master Volume (0 to -103dB, 1dB/Step, MUTE, BD3811K1)
(0 to -95dB 1dB/Step, MUTE, BD3818KS)
Implementation of a resistance ladder type circuit reduces residual noise and a shock sound at switching.
2) Low current consumption design achieved by adopting the BiCMOS process
3) Maximum output voltage (BD3818KS): 4.3Vrms (Vcc=7V, VEE=-7V, RL=10kΩ)
Maximum output voltage (BD3811K1): 4.2Vrms (Vcc=7V, VEE=-7V, RL=10kΩ)
4) Built-in Input Gain Amp useful for adjusting the output signal voltages
5) Built-in Operational Amplifier useful for filter construction (BD3818KS)
6) Built-in Dynamic Bass Boost circuit (BD3818KS)
7) 2-wire serial control (BD3818KS for 5V, BD3811K1 for both 3.3V and 5V)
8) Built-in Output Gain Amp useful for adjusting the output signal voltages (BD3811K1)
9) REC output terminal with a REC input/output switch useful for monitoring Equalizer Amp (BD3811K1)
10) Output mute controlled by either serial data or an external control terminal

●Applications

AV receivers, home theater systems and mini-audio systems.

●Line up matrix

Parameter	BD3811K1	BD3818KS
Input Selector	8 inputs	5 inputs
Input Gain	2Step	4 Step or 2 Step
Volume	0 to -103dB 1dB/Step	0 to -95dB 1dB/Step
Bass, Treble	±14dB 2dB/Step	±14dB 2dB/Step
Output Gain	0, 6 to 18dB 2dB/Step	Variable depending on the external resistance
Mixing	No	Yes
Bass Boost	0 to 12dB, 4dB/Step	0 to 12dB, 4dB/Step Dynamic type
Package	QFP80	SQFP80

●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Ratings	Unit
Power Supply Voltage	VCC	7.5 *1	V
	VEE	-7.5	
Input Signal Voltage	VIN	VCC+0.3 to VEE-0.3	V
Power Dissipation	Pd	1200 *2	mW
Operating Temperature range	Topr	-20 to +75	℃
Storage Temperature range	Tastg	-55 to +125	℃

*1 Even in the specified range of Power Supply Voltage, applying voltage only to the VCC side may cause an excessive current to give a permanent damage to the IC.
When starting up power supplies, VEE and VCC should be powered on simultaneously or VEE first; then followed by VCC.

*2 Reduced by 12 mW/℃ over 25℃, when installed on the standard board (size: 70x70x1.6mm).

●Operating range

It must function normally at Ta=25℃.

Part No.	Parameter	Symbol	Ratings			Unit
			Min.	Typ.	Max.	
BD3811K1	Operating Supply Voltage	VCC	5	7	7.3	V
		VEE	-7.3	-7	-5	
BD3818KS	Operating Supply Voltage	VCC	5	7	7.4	V
		VEE	-7.4	-7	-5	

●Electrical characteristics

1) BD3811K1 (Ta=25℃, VCC=7V, VEE=-7V, f=1kHz, Vin=1Vrms, RL=10kΩ, Rg=600Ω, Input ATT=0dB, Input gain=0dB, Master volume=0dB, Output gain=0dB, Bass, Treble and bass boost=0dB, unless otherwise noted.)

	Parameter		Symbol	Limits			Unit	Conditions
				Min.	Typ.	Max.		
Total Output	Circuit Current	VCC	IQ	—	15	30	mA	No signal
		VEE		-30	-15	—		
	Output Voltage Gain 1ch		Gv1	-2	0	2	dB	Measure : Pin55
	Output Voltage Gain 2ch		Gv2	-2	0	2	dB	Measure : Pin57
	Total Harmonic Distortion Ratio 1ch		THD1	—	0.005	0.09	%	Measure : Pin55 BW=400～30kHz
	Total Harmonic Distortion Ratio 2ch		THD2	—	0.005	0.09	%	Measure : Pin57 BW=400～30kHz
	Maximum Output Voltage 1ch		Vomax1	3.4	4.2	—	Vrms	Measure : Pin55 THD=1%
	Maximum Output Voltage 2ch		Vomax2	3.4	4.2	—	Vrms	Measure : Pin57 THD=1%
	Output Noise Voltage 1ch		Vno1	—	2.5	12	μVrms	Measure : Pin 55 Rg=0Ω, Tone: ON BW=IHF-A
				—	2.0	9.0	μVrms	Measure : Pin 55 Rg=0Ω, By Pass mode BW=IHF-A
	Output Noise Voltage 2ch		Vno2	—	2.5	12	μVrms	Measure : Pin 57 Rg=0Ω, Tone: ON BW=IHF-A
				—	2.0	9.0	μVrms	Measure : Pin 57 Rg=0Ω, By Pass mode BW=IHF-A
	Input Impedance 1ch		Rin1	28	47	70	kΩ	Measure : Pin1, 3, 5, 7, 9, 11, 77, 79
	Input Impedance 2ch		Rin2	28	47	70	kΩ	Measure : Pin2, 4, 6, 8, 10, 12, 78, 80
	Cross-talk between Channels 1ch→2ch		CTC12	—	-100	-70	dB	Measure : Pin57(OUT2) Rg=0Ω, BW=IHF-A Reference : Pin55(OUT1)=1Vrms
	Cross-talk between Channels 2ch→1ch		CTC21	—	-100	-70	dB	Measure : Pin55(OUT1) Rg=0Ω, BW=IHF-A Reference : Pin57(OUT2)=1Vrms
	Cross-talk between Selectors 1ch		CTS1	—	-100	-70	dB	Measure : Pin 55 Rg=0Ω, BW=IHF-A
	Cross-talk between Selectors 2ch		CTS2	—	-100	-70	dB	Measure :Pin 57 Rg=0Ω, BW=IHF-A

	Parameter	Symbol	Limits			Unit	Conditions
			Min.	Typ.	Max.		
REC Out	R Output Impedance 1ch	RoutR1	—	100	200	Ω	Measure : Pin 71, 73, 75
	R Output Impedance 2ch	RoutR2	—	100	200	Ω	Measure : Pin 72, 74, 76
	R Voltage Gain 1ch	GVR1	-2	0	2	dB	Measure : Pin 71, 73, 75 RL=47kΩ, Vin =0.4Vrms
	R Voltage Gain 2ch	GVR2	-2	0	2	dB	Measure : Pin 72, 74, 76 RL=47kΩ, Vin =0.4Vrms
	R Total Harmonic Distortion Ratio 1ch	THDR1	—	0.005	0.09	%	Measure : Pin 71, 73, 75 RL=47kΩ, Vin =0.4Vrms BW=400～30kHz
	R Total Harmonic Distortion Ratio 2ch	THDR2	—	0.005	0.09	%	Measure : Pin 72, 74, 76 RL=47kΩ, Vin =0.4Vrms BW=400～30kHz
Volume Output	V Output Voltage Gain 1ch	GVV1	-2	0	2	dB	Measure : Pin 36, 38
	V Output Voltage Gain 2ch	GVV2	-2	0	2	dB	Measure : Pin 35, 37
	V Total Harmonic Distortion Ratio 1ch	THDV1	—	0.005	0.09	%	Measure : Pin 36, 38 BW=400～30kHz
	V Total Harmonic Distortion Ratio 2ch	THDV2	—	0.005	0.09	%	Measure : Pin 35, 37 BW=400～30kHz
	V Output Noise Voltage 1ch	VnoV1	—	1.5	8	μVrms	Measure : Pin 36, 38 Rg=0Ω, BW=IHF－A
	V Output Noise Voltage 2ch	VnoV2	—	1.5	8	μVrms	Measure : Pin 35, 37 Rg=0Ω, BW=IHF－A
	Volume Control Range 1ch	GVR1	-106	-103	-100	dB	Measure : Pin 36, 38, 55 Vin =3Vrms
	Volume Control Range 2ch	GVR2	-106	-103	-100	dB	Measure : Pin 35, 37, 57 Vin =3Vrms
	Volume Setting Error 1 1ch	VE11	-2	0	2	dB	Measure : Pin 36, 38, 55 0 to -53dB , Vin =3Vrms
	Volume Setting Error 1 2ch	VE12	-2	0	2	dB	Measure : Pin 35, 37, 57 0 to -53dB , Vin =3Vrms
	Volume Setting Error 2 1ch	VE21	-3	0	3	dB	Measure : Pin 36, 38, 55 -54 to -103dB , Vin =3Vrms
	Volume Setting Error 2 2ch	VE22	-3	0	3	dB	Measure : Pin 35, 37, 57 -54 to -103dB , Vin =3Vrms
	Maximum Attenuation 1ch	Vmin1	—	-118	-105	dB	Measure : Pin 36, 38, 55 Vin =3Vrms, BW=IHF-A
	Maximum Attenuation 2ch	Vmin2	—	-118	-105	dB	Measure : Pin 35, 37, 57 Vin =3Vrms, BW=IHF-A
Input Attenuation	Input Attenuation Control Range 1ch	GIA1	-20	-18	-16	dB	Measure : Pin 19, 20
	Input Attenuation Control Range 2ch	GIA2	-20	-18	-16	dB	Measure : Pin 17, 18
	Input Attenuation Setting Error 1ch	AE1	-2	0	2	dB	Measure : Pin 19, 20
	Input Attenuation Setting Error 2ch	AE2	-2	0	2	dB	Measure : Pin 17, 18
Input Gain	Input Gain Control Range 1ch	GIG1	4	6	8	dB	Measure : Pin 36, 38, 55 Vin =0.4Vrms
	Input Gain Control Range 2ch	GIG2	4	6	8	dB	Measure : Pin 35, 37, 57 Vin =0.4Vrms
	Input Gain Setting Error 1ch	GIE1	-2	0	2	dB	Measure : Pin 36, 38, 55 Vin =0.4Vrms
	Input Gain Setting Error 2ch	GIE2	-2	0	2	dB	Measure : Pin 35, 37, 57 Vin =0.4Vrms

	Parameter	Symbol	Limits			Unit	Conditions
			Min.	Typ.	Max.		
Treble	Treble Maximum Boost Gain 1ch	GTB1	12	14	16	dB	Measure : Pin 55 f=15kHz, Vin =0.4Vrms
	Treble Maximum Boost Gain 2ch	GTB2	12	14	16	dB	Measure : Pin 57 f=15kHz, Vin =0.4Vrms
	Treble Maximum Cut Gain 1ch	GTC1	-16	-14	-12	dB	Measure : Pin 55 f=15kHz, Vin =0.4Vrms
	Treble Maximum Cut Gain 2ch	GTC2	-16	-14	-12	dB	Measure : Pin 57 f=15kHz, Vin =0.4Vrms
	Treble Step Resolution 1ch	TR1	—	2	—	dB	Measure : Pin 55 f=15kHz, Vin =0.4Vrms
	Treble Step Resolution 2ch	TR2	—	2	—	dB	Measure : Pin 57 f=15kHz, Vin =0.4Vrms
	Treble Gain Setting Error 1ch	TE1	-2	0	2	dB	Measure : Pin 55 f=15kHz, Vin =0.4Vrms
	Treble Gain Setting Error 2ch	TE2	-2	0	2	dB	Measure : Pin 57 f=15kHz, Vin =0.4Vrms
Bass	Bass Maximum Boost Gain 1ch	GBB1	12	14	16	dB	Measure : Pin 55 fo=100Hz, Vin=0.4Vrms
	Bass Maximum Boost Gain 2ch	GBB2	12	14	16	dB	Measure : Pin 57 fo=100Hz, Vin =0.4Vrms
	Bass Maximum Cut Gain 1ch	GBC1	-16	-14	-12	dB	Measure : Pin 55 fo=100Hz, Vin =0.4Vrms
	Bass Maximum Cut Gain 2ch	GBC2	-16	-14	-12	dB	Measure : Pin 57 fo=100Hz, Vin =0.4Vrms
	Bass Step Resolution 1ch	BR1	—	2	—	dB	Measure : Pin 55 fo=100Hz, Vin =0.4Vrms
	Bass Step Resolution 2ch	BR2	—	2	—	dB	Measure : Pin 57 fo=100Hz, Vin =0.4Vrms
	Bass Gain Setting Error 1ch	BE1	-2	0	2	dB	Measure : Pin 55 fo=100Hz, Vin =0.4Vrms
	Bass Gain Setting Error 2ch	BE2	-2	0	2	dB	Measure : Pin 57 fo=100Hz, Vin =0.4Vrms
Bass Boost	Bass Boost Maximum Gain 1ch	GBBB1	10	12	14	dB	Measure : Pin 55 fo=70Hz, Vin =0.4Vrms
	Bass Boost Maximum Gain 2ch	GBBB2	10	12	14	dB	Measure : Pin 57 fo=70Hz, Vin =0.4Vrms
	Bass Boost Step Resolution 1ch	BBR1	—	4	—	dB	Measure : Pin 55 fo=70Hz, Vin =0.4Vrms
	Bass Boost Step Resolution 2ch	BBR2	—	4	—	dB	Measure : Pin 57 fo=70Hz, Vin =0.4Vrms
	Bass Boost Setting Error 1ch	BBE1	-2	0	2	dB	Measure : Pin 55 fo=70Hz, Vin =0.4Vrms
	Bass Boost Setting Error 2ch	BBE2	-2	0	2	dB	Measure : Pin 57 fo=70Hz, Vin =0.4Vrms
Output Gain	Output Gain Control Range 1ch	GOG1	16	18	20	dB	Measure : Pin 36, 38, 55 Vin =0.4Vrms
	Output Gain Control Range 2ch	GOG2	16	18	20	dB	Measure : Pin 35, 37, 57 Vin =0.4Vrms
	Output Gain Setting Error 1ch	GOE1	-2	0	2	dB	Measure : Pin 36, 38, 55 Vin =0.4Vrms
	Output Gain Setting Error 2ch	GOE2	-2	0	2	dB	Measure : Pin 35, 37, 57 Vin =0.4Vrms

* Note: This IC is not designed to be radiation-resistant.

2) BD3818KS (Ta=25℃ VCC=7V, VEE=-7V, f=1kHz, Vin=500mVrms, RL=10kΩ, Rg=600Ω
Input gain=0dB (FL,FR), 12.6dB (C,LS,RS), 15.6dB (SUB), Master volume=0dB, Bass and Treble =0dB,
Gain amp=0dB (C,LS,RS,SUB), C,LS and RS mixing=OFF, unless otherwise noted.)

	Parameter	Symbol	Limits			Unit	Conditions
			Min.	Typ.	Max.		
Total Output	Circuit Current	IQ	—	28	40	mA	No signal
	Output Voltage Gain 1 Line	GV1	3	5	7	dB	Measure : Pin36,39 Vin =0.5Vrms, Line Mode
	Output Voltage Gain 1 DVD	GV1DVD	-2	0	2	dB	Measure : Pin36,39 Vin =0.5Vrms, DVD Mode
	Output Voltage Gain 1 DSP	GV1DSP	10	12	14	dB	Measure : Pin36,39 Vin =0.2Vrms, DSP Mode
	Output Voltage Gain 1 EXT	GV1EXT	-2	0	2	dB	Measure : Pin36,39 Vin =0.5Vrms, EXT Mode
	Output Voltage Gain 2	GV2	10.6	12.6	14.6	dB	Measure : Pin 23,25,27 Vin =0.2Vrms
	Output Voltage Gain 3	GV3	13.6	15.6	17.6	dB	Measure : Pin 21 Vin =0.15Vrms
	Total Harmonic Distortion Ratio 1	THD1	—	0.002	0.03	%	Measure : Pin36,39 BW=400～30kHz Vin =0.5Vrms, Line Mode
	Total Harmonic Distortion Ratio 2	THD2	—	0.003	0.03	%	Measure : Pin 23,25,27 BW=400～30kHz Vin =0.3Vrms
	Total Harmonic Distortion Ratio 3	THD3	—	0.003	0.03	%	Measure : Pin 21 BW=400～30kHz Vin =0.3Vrms
	Maximum Output Voltage	Vomax	3.6	4.3	—	Vrms	Measure : Pin36,39 THD=1%
	Residual Noise Voltage 1	V_{NOR1}	—	2.7	9	μVrms	Measure : Pin36,39 Rg=0Ω,Volume= -∞ BW=IHF-A
	Residual Noise Voltage 2	V_{NOR2}	—	1.0	6	μVrms	Measure : Pin 21,23,25,27 Rg=0Ω, Volume= -∞BW=IHF-A, Output amp=0dB
	Cross-talk between Selectors	CTS	—	-90	-75	dB	Measure : Pin36,39 Rg=0Ω, BW=IHF-A
	Cross-talk between Channels Lch→Rch	CTCLR	—	-90	-75	dB	Measure : Pin36(OUTFR) Rg=0Ω, BW=IHF-A Reference : Pin39(OUTFL)=1Vrms
	Cross-talk between Channels Rch→Lch	CTCRL	—	-90	-75	dB	Measure : Pin39(OUTFL) Rg=0Ω, BW=IHF-A Reference : Pin36(OUTFR)=1Vrms
	Cross-talk between Channels LSch→RSch	CTCLRS	—	-90	-75	dB	Measure : Pin 23(OUTRS) Rg=0Ω, BW=IHF-A Reference :Pin 25(OUTLS) =1Vrms
	Cross-talk between Channels RSch→LSch	CTCRLS	—	-90	-75	dB	Measure : Pin 25(OUTLS) Rg=0Ω, BW=IHF-A Reference :Pin 23(OUTRS) =1Vrms
	Cross-talk between Channels Cch→SUBch	CTCCSU	—	-85	-70	dB	Measure : Pin 21(OUTSUB) Rg=0Ω, BW=IHF-A Reference :Pin 27(OUTC) =1Vrms
	Cross-talk between Channels SUBch→Cch	CTCSUC	—	-90	-75	dB	Measure : Pin 27(OUTC) Rg=0Ω, BW=IHF-A Reference :Pin 21(OUTSUB) =1Vrms

	Parameter	Symbol	Limits			Unit	Conditions
			Min.	Typ.	Max.		
Volume Output	Volume Control Range	VOL	-97	-95	-93	dB	Measure : Pin 21,23,25,27, 36,39 VOUT=3Vrms (VOL=0dB)
	Volume Setting Error 1	VOLE1	-1.5	0	1.5	dB	Measure : Pin 21,23,25,27,36,39 0 to -53dB, VOUT=3Vrms (at VOL=0dB)
	Volume Setting Error 2	VOLE2	-2	0	2	dB	Measure : Pin 21,23,25,27,36,39 -54 to -95dB, VOUT=3Vrms (at VOL=0dB)
	Maximum Attenuation	VOLmin	—	-115	-105	dB	Measure : Pin 21,23,25,27,36,39 BW=IHF-A VOUT=3Vrms (at VOL=0dB)
Treble	Treble Maximum Boost Gain	GTB	12	14	16	dB	Measure : Pin36,39, f=15kHz, Vin=0.1Vrms, Line Mode
	Treble Maximum Cut Gain	GTC	-16	-14	-12	dB	Measure : Pin36,39, f=15kHz, Vin =0.1Vrms, Line Mode
	Treble Step Resolution	TR	—	2	—	dB	Measure : Pin36,39, f=15kHz, Vin =0.1Vrms, Line Mode
	Treble Gain Setting Error	TE	-2	0	2	dB	Measure : Pin36,39, f=15kHz, Vin =0.1Vrms, Line Mode
Bass	Bass Maximum Boost Gain	GBB	12	14	16	dB	Measure : Pin36,39, f=100Hz, Vin =0.1Vrms, Line Mode
	Bass Maximum Cut Gain	GBC	-16	-14	-12	dB	Measure : Pin36,39, f=100Hz, Vin =0.1Vrms, Line Mode
	Bass Step Resolution	BR	—	2	—	dB	Measure : Pin36,39, f=100Hz, Vin =0.1Vrms, Line Mode
	Bass Gain Setting Error	BE	-2	0	2	dB	Measure : Pin36,39, f=100Hz, Vin =0.1Vrms, Line Mode
Input Gain	Input Gain Control Range 1	GIG1	7	9	11	dB	Measure : Pin36,39 Vin =0.1Vrms
	Input Gain Setting Error 1	GE1	-2	0	2	dB	Measure : Pin36,39 Vin =0.1Vrms
	Input Gain Control Range 2	GIG2	13.6	15.6	17.6	dB	Measure : Pin23,25,27 Vin =0.1Vrms
	Input Gain Setting Error 2	GE2	-2	0	2	dB	Measure : Pin23,25,27 Vin =0.1Vrms
	Input Gain Control Range 3	GIG3	16.6	18.6	20.6	dB	Measure : Pin21 Vin =0.1Vrms
	Input Gain Setting Error 3	GE3	-2	0	2	dB	Measure : Pin21 Vin =0.1Vrms
Gain Amp	Gain Amp Control Range	GAG	10	12	14	dB	Measure : Pin 32 Vin =0.2Vrms
	Output Gain Setting Error	GAE	-2	0	2	dB	Measure : Pin 32 Vin =0.2Vrms
Line Out	Line out Voltage Gain	GVLI	6	8	10	dB	Measure : Pin 59,60 Vin =0.3Vrms
	Line out Total Harmonic Distortion Ratio	THDLI	—	0.003	0.03	%	Measure : Pin 59,60 BW=400～30kHz, Vin =0.3Vrms

* Note: This IC is not designed to be radiation-resistant.

●Timing chart

1. Signal Timing Conditions
   - ・Data is read on the rising edge of the clock.
   - ・Latch is read on the falling edge of the clock.
   - ・Latch signal must terminate with the LOW state.

   * To avoid malfunctions, clock and data signals must terminate with the LOW state.

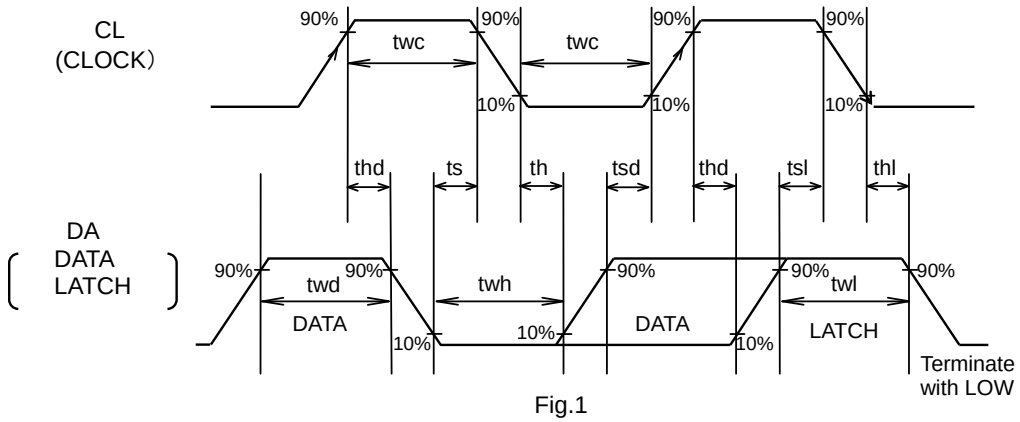


Fig.1

Parameter	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Minimum Clock Width	twc	2.0	-	-	μS
Minimum Data Width	twd	2.0	-	-	μS
Minimum Latch Width	twl	2.0	-	-	μS
LOW Hold Width	twh	2.0	-	-	μS
Data Set-up Time (DATA→CLK)	tsd	1.0	-	-	μS
Data Hold Time (CLK→DATA)	thd	1.0	-	-	μS
Latch Set-up Time (CLK→LATCH)	tsl	1.0	-	-	μS
Latch Hold Time (DATA→LATCH)	thl	1.0	-	-	μS
Latch Low Set-up Time	ts	1.0	-	-	μS
Latch Low Hold Time	th	1.0	-	-	μS

2. External Mute (Pin48) Voltage (BD3811K1)

Parameter	Limits			Unit	Conditions
	Min.	Typ.	Max.(≤Vcc)		
Volume Mute OFF	0	—	1.0	V	Vcc=5 to 7.3V VEE=-5 to -7.3V
Volume Mute ON	2.2	—	5.5		

3. Voltage Conditions for Control Signals

Parameter	Limits						Unit	Conditions
	BD3811K1			BD3818KS				
	Min.	Typ.	Max. (≤Vcc)	Min.	Typ.	Max. (≤Vcc)		
“H” Input Voltage	2.2	—	5.5	3.0	—	5.5	V	Vcc=5 to 7.4V VEE=-5 to -7.4V
“L” Input Voltage	0	—	1.0	0	—	1.5	V	

4. Basic Configuration of Control Data Formats

BD3811K1

← Data input direction

	MSB															LSB
	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Data	Data														Select Address		

・Control Data Formats

← Data input direction

															Select Address		
Data (1)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master Volume Rch							Master Volume Lch							0	0	0
Data (2)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master Volume SRch							Master Volume SLch							0	0	1
Data (3)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master Volume Cch							Master Volume SWch							0	1	0
Data (4)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Input select			REC SW1/ REC IN SW		REC SW3	REC SW2	Input ATT		5.1ch Mode 1		5.1ch Mode2	Input gain	*	0	1	1
Data (5)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Treble				Bass				Tone	Bass boost		Output gain amp			1	0	0

BD3818KS

← Data input direction

	MSB															LSB
	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Data	Data														Select Address		

・Control Data Formats

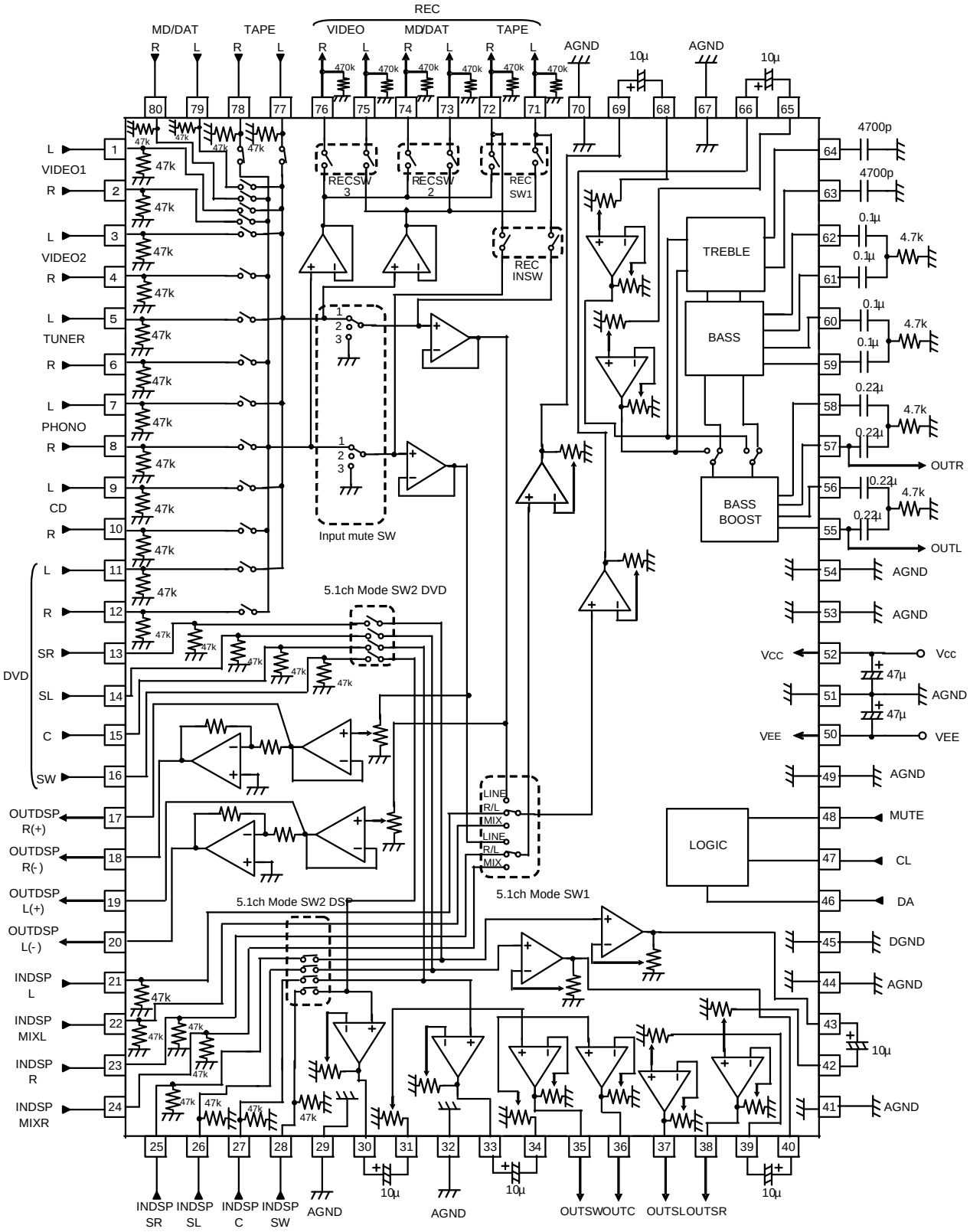
← Data input direction

															Select Address		
Data (1)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Treble				Bass				Tone	*	*	*	0	0	0	0	0
Data (2)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Input select			FLR select		LRS select		C select	SUB select	Input switch	AOUT select	Line	0	1	0	0	0
Data (3)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Mix LRS		Mix C		Mix amp	Gain select		Input gain FLR		Input gain C	Input gain LRS	Input gain SUB	1	0	0	0	0
Data (4)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master volume				FLch			Master volume				FRch			0	0	1
Data (5)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master volume				LSch			Master volume				RSch			0	1	0
Data (6)	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
	Master volume				Cch			Master volume				SUBch			0	1	1

* Indicates 0 or 1.

●Block diagram, application circuit, pin assignment

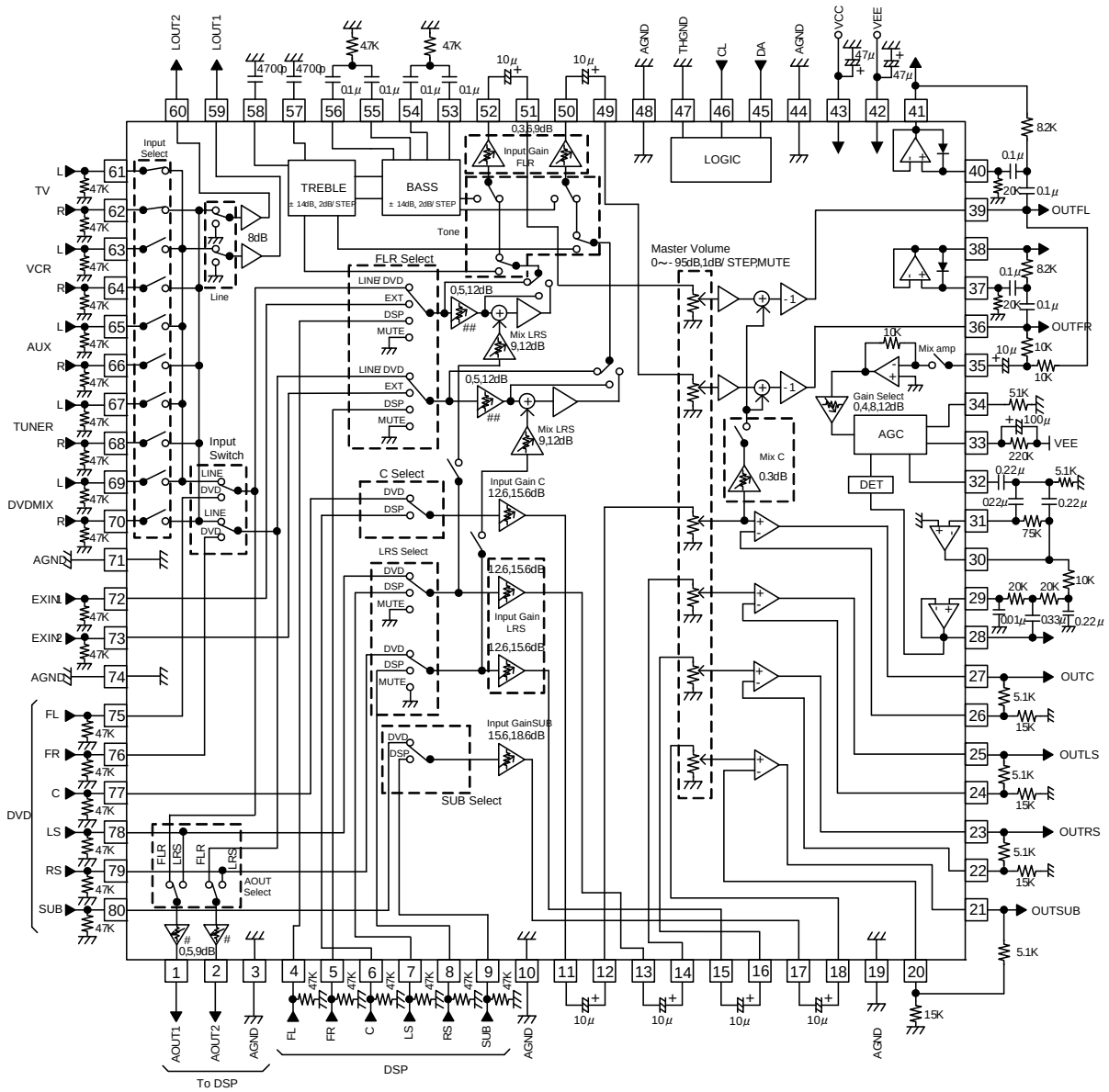
1) BD3811K1



UNIT
RESISTANCE : Ω
CAPACITOR : F

Fig.2

2) BD3818KS



(#)

INPUT	AOUT
LINE	5dB
DVD(FL,FR)	0dB
DVD(LS,RS)	9dB

(##)

INPUT	GAIN
LINE	5dB
DVD	0dB
DSP	12dB
EXT	0dB

UNIT
RESISTANCE : Ω
CAPACITOR : F

Fig.3

●Setting constants for tone control filters

1. Treble filter

fc=1/2π(R2)C (Hz)

G=20log(R1+R2+Zc)/(R2+Zc) (dB)

Zc=1/jωC (Ω)

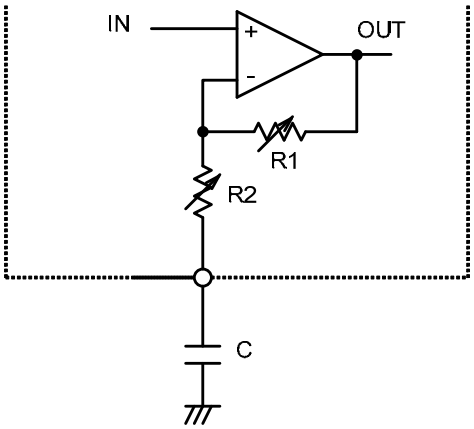


Fig.4

Standard values of R1, R2 (reference)

Treble Boost Amount Cut Amount	Resistance (KΩ)*Typ.	
	R1	R2
0dB	0	20
±2dB	4.1	15.9
±4dB	7.3	12.7
±6dB	10.3	9.7
±8dB	12.3	7.7
±10dB	14.0	6.0
±12dB	15.4	4.6
±14dB	16.5	3.5

*The actual boost cut level may deviate from the standard values in some degree.

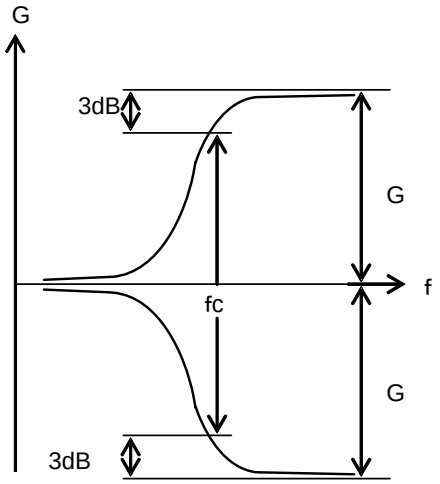
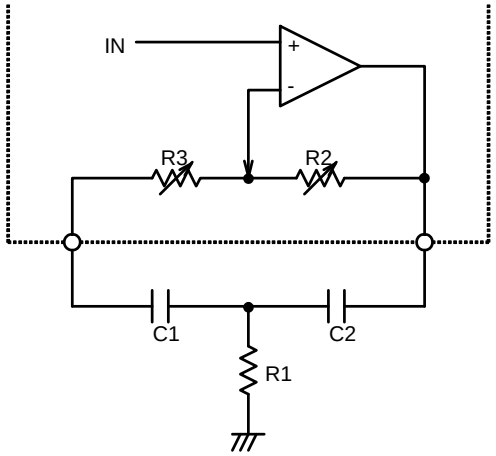


Fig.5

2. Bass filter



$$f_0 = \frac{1}{2\pi\sqrt{R1\ R2 + R3\ C1C2}} \text{ (Hz)}$$

$$Q = \frac{1}{C1+C2}\sqrt{\frac{C1C2R2}{R1}}$$

When C1=C2

$$G = 20\log\frac{\frac{R2+R3}{R1}+2}{\frac{R3}{R1}+2} \text{ (dB)}$$

Standard values of R2, R3 (reference)
(R1=4.7KΩ, C1=C2=0.1μF)

Boost Amount / Cut Amount	Resistance (KΩ)*Typ.	
	R2	R3
0dB	0	41.0
±2dB	10.8	30.2
±4dB	19.3	21.7
±6dB	26.0	15.0
±8dB	31.2	9.8
±10dB	35.4	5.6
±12dB	38.4	2.6
±14dB	41.0	0

*The actual boost/cut levels may deviate from the standard values in some degree.

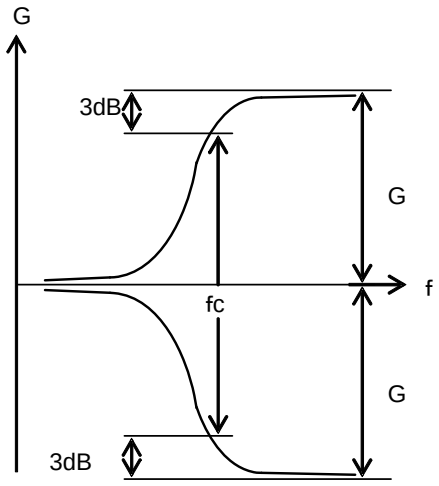


Fig.7

* Bass Filter Feature

To be able to set the f0 and Q factors of Bass characteristics to desired values, part of the Bass Filter is constructed of the external components shown in the upper-left figure.

●Reference data

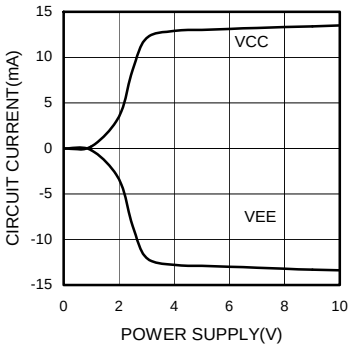


Fig.8 Circuit Current - Power Supply (BD3811K1)

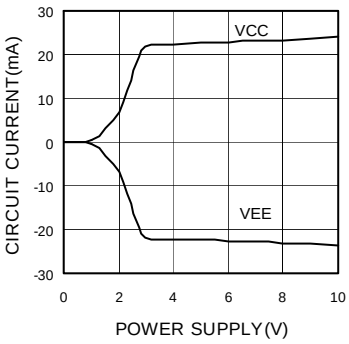


Fig.9 Circuit Current - Power Supply (BD3818KS)

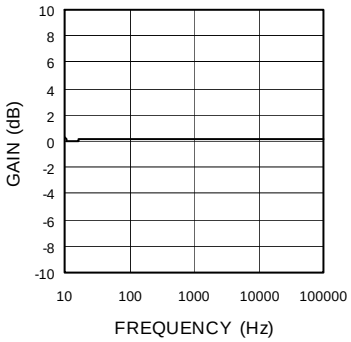


Fig.10 Voltage Gain - Frequency (BD3811K1)

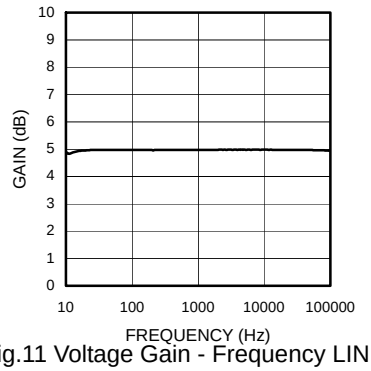


Fig.11 Voltage Gain - Frequency LINE (BD3818KS)

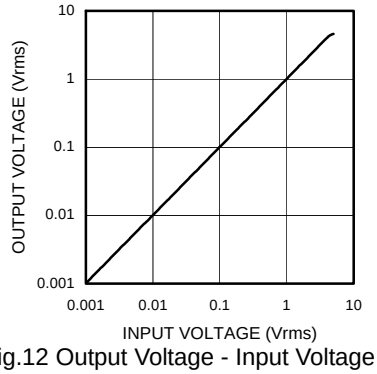


Fig.12 Output Voltage - Input Voltage (BD3811K1)

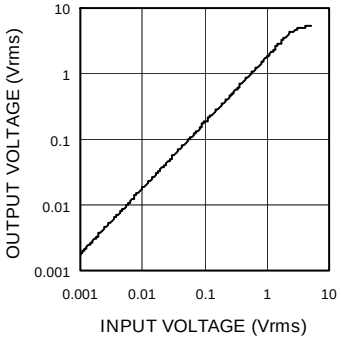


Fig.13 Output Voltage - Input Voltage LINE (BD3818KS)

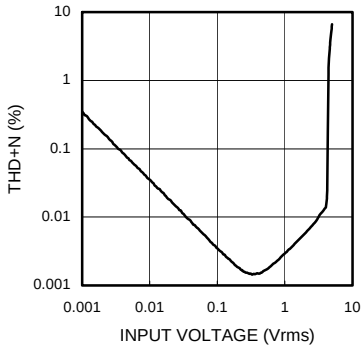


Fig.14 THD+N - Input Voltage (BD3811K1)

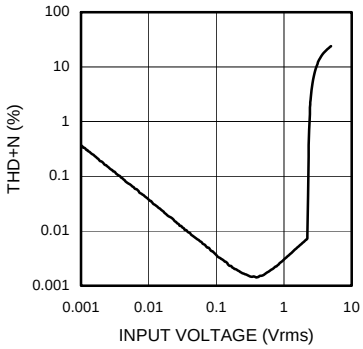


Fig.15 THD+N - Input Voltage LINE(BD3818KS)

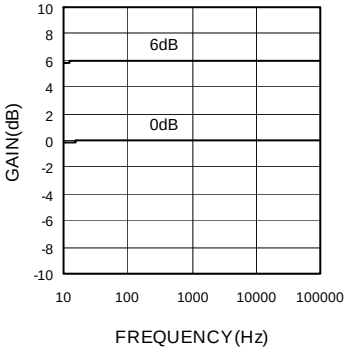


Fig.16 Input Gain - Frequency (BD3811K1)

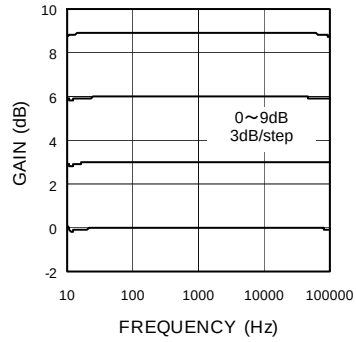


Fig.17 Input Gain - Frequency (BD3818KS)

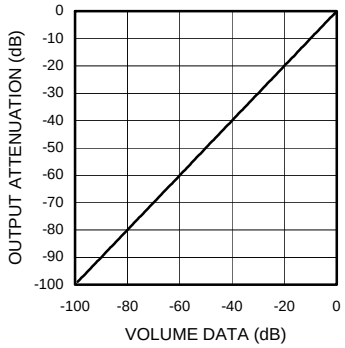


Fig.18 Volume Attenuation - Volume Setting (BD3811K1)

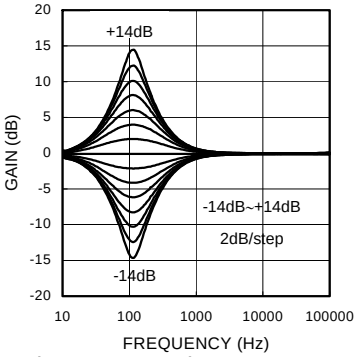


Fig.19 Bass Gain - Frequency

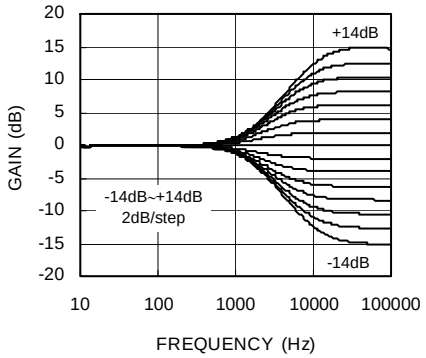


Fig.20 Treble Gain - Frequency

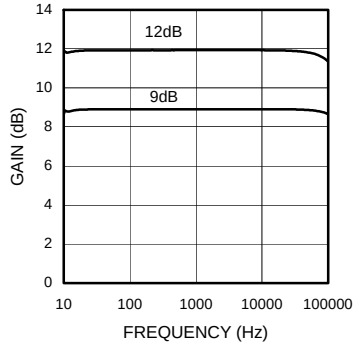


Fig.21 Surround Mixing - Frequency (BD3818KS)

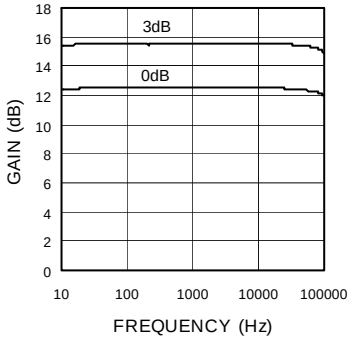


Fig.22 Center Mixing - Frequency (BD3818KS)

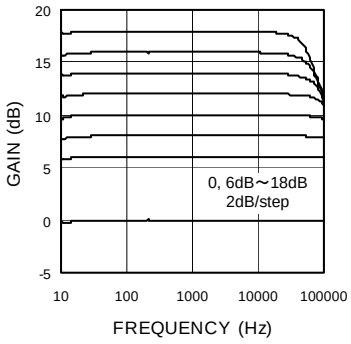


Fig.23 Output Gain – Frequency (BD3811K1)

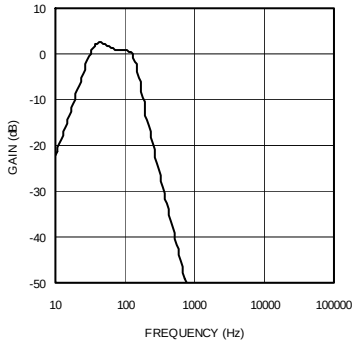


Fig.24 Dynamic Bass – Frequency (BD3818KS)

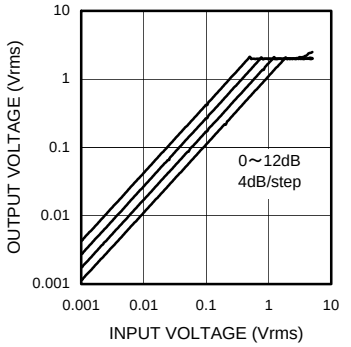


Fig.25 AGC Output Voltage - Input Voltage (BD3818KS)

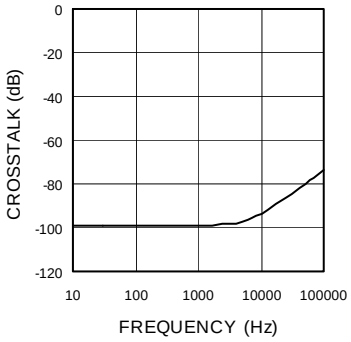


Fig.26 Cross-talk - Frequency (BD3818KS)

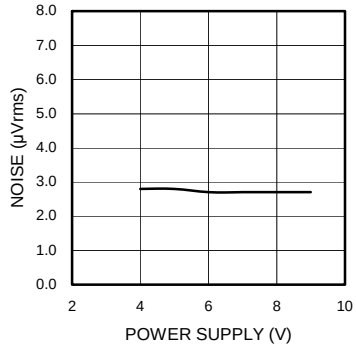


Fig.27 Output Noise Voltage (FL,FR)-Power Supply Voltage (BD3818KS)

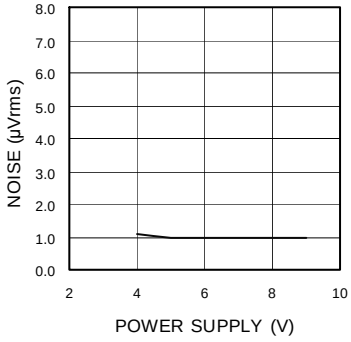


Fig.28 Output Noise Voltage (C,LS,RS,SW)-Power Supply Voltage (BD3818KS)

●Notes for use

1. Numbers and data in entries are representative design values and are not guaranteed values of the items.

2. Although ROHM is confident that the example application circuit reflects the best possible recommendations, be sure to verify circuit characteristics for your particular application. Modification of constants for other externally connected circuits may cause variations in both static and transient characteristics for external components as well as this Rohm IC. Allow for sufficient margins when determining circuit constants.

3. Absolute maximum ratings
   Use of the IC in excess of absolute maximum ratings, such as the applied voltage or operating temperature range (Topr), may result in IC damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure, such as a fuse, should be implemented when using the IC at times where the absolute maximum ratings may be exceeded.

4. VEE potential
   Make the VEE pin voltage such that it is the lowest voltage even when operating below it. Actually confirm that the voltage of each pin does not become a lower voltage than the VEE pin, including transient phenomena.

5. Thermal design
   Perform thermal design, in which there are adequate margins, by taking into account the power dissipation (Pd) in actual states of use.

6. Short circuit between terminals and erroneous mounting
   Pay attention to the assembly direction of the ICs. Wrong mounting direction or shorts between terminals, GND, or other components on the circuits, can damage the IC.

7. Operation in strong electromagnetic field
   Using the ICs in a strong electromagnetic field can cause operation malfunction.

8. Serial control
   For the CL and DA terminals, the patterned and other wirings should be routed not to cause interference with the analog-signal-related lines.

9. Power ON/OFF
   (a) At power ON/OFF, a shock sound will be generated. Therefore, use MUTE on the set.
   (b) When turning on power supplies, VEE and VCC should be powered on simultaneously, or VEE first followed by VCC. If the VCC side is started up first, an excessive current may flow from VCC to VEE.

10. Function switching
    For the CL and DA terminals, the patterned and other wirings should be routed as not to cause interference with the analog-signal-related lines.

11. Ground line
    The ground pin: 47pin (BD3818KS) should be connected to the ground line with as low noise as the AGND pin.

12. Switching noise reduction at switching volume from -3dB to -4dB (BD3811K1 only)
    In order to reduce a switching noise at the switching volume from -3dB to -4dB, the -4dB-step switch should be switched first, and then the -1dB-step switch by -1dB.

●Thermal derating characteristics

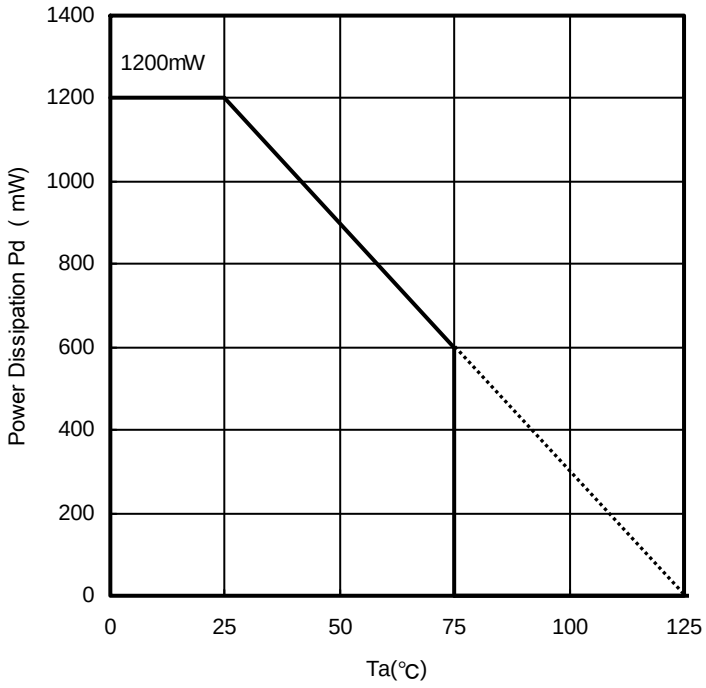


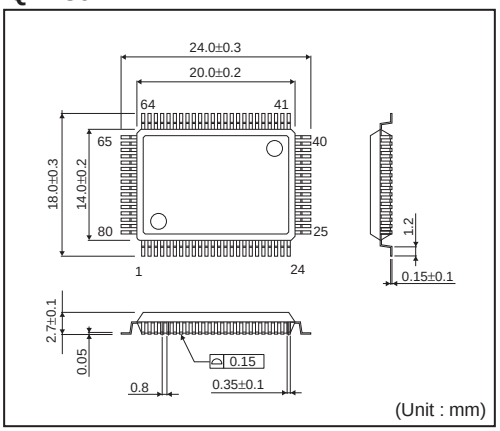
Fig.29

BD3811K1, BD3818KS
ROHM standard board packaging time value
Board size: 70 x 70 x 1.6mm Raw material: FR4 glass epoxy board (copper area 3% or below)

●Ordering part number

B	D		3	8	1	1		K	1	-		
Part No.			Part No. 3811 3818					Package K1: QFP80 KS: SQFP80			Packaging and forming specification None: Tray,	

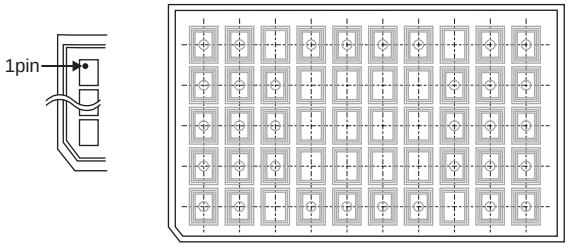
QFP80



(Unit : mm)

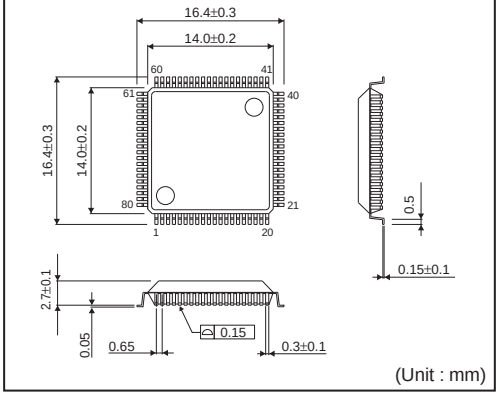
<Tape and Reel information>

Container	Tray (with dry pack)
Quantity	500pcs
Direction of feed	Direction of product is fixed in a tray



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

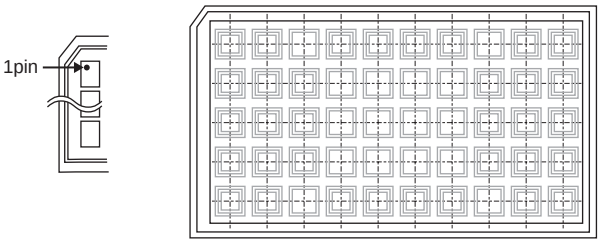
SQFP80



(Unit : mm)

<Tape and Reel information>

Container	Tray (with dry pack)
Quantity	500pcs
Direction of feed	Direction of product is fixed in a tray



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

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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

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [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.

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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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