

Sound Processors for BOOM BOX / Mini-component Stereo

# Sound Processors with Built-in 3-band Equalizers



BD3403FV, BD3861FS, BD3883FS

No.10086EAT01

## ●Description

The Sound Processor has a built-in 3 Band Equalizer and can be controlled with a 2-wire serial. It is suited for a sound quality design which incorporates various functions, ranging from source selectors, such as BOOM BOX, Mini-audio systems and Micro-audio systems to preamplifiers at the front stage of the power amp.

## ●Features

- 1) High S/N, achieved by implementing 2-stage configuration of Front Volume and Rear Volume.
- 2) Provides surround and rear volume with Soft-switch to reduce a shock sound during switching functions(BD3883FS).
- 3) Volume and tone implemented with the resistance ladder circuit (to achieve high performance with low noise and low distortion).
- 4) Uses the BiCMOS process that achieves low-consumption current, which contributes to an energy-saving design. Using the BiCMOS process, has the advantage in quality over the scaling down of the internal regulators and heat controls.
- 5) SSOP-A32 and SSOP-B40 are used for the packages. Input pins and output pins are organized and separately laid out so as to keep the signal flows in one direction which consequently, simplify pattern layout of the set board and decrease the board dimensions.

## ●Applications

BOOM BOX, mini-audio systems, and micro-audio systems.

## ●Product lineup

| Parameter               | BD3403FV                         | BD3861FS   | BD3883FS                         |
|-------------------------|----------------------------------|--|----------------------------------|
| Operating Voltage Range | 6.5 to 9.5V                      | 6.5 to 9.5V  | 6.5 to 9.5V                      |
| Equalizer               | 3 band<br>(BASS, MIDDLE, TREBLE) | 3 band<br>(BASS, MIDDLE, TREBLE)                   | 3 band<br>(BASS, MIDDLE, TREBLE) |
| Front Volume            | 0 to -30dB/2dB step              | 0 to -50dB/2dB step<br>-50 to -70dB/4dB step, -∞dB | 0 to -87dB/1dB step, -∞dB        |
| Rear Volume             | 0 to -59dB/1dB step, -∞dB        | 0 to -59dB/1dB step, -∞dB                          | 0, -10dB                         |
| Input Gain              | 0 to 26dB/2dB step               | 0 to 26dB/2dB step                                 | 0, 6, 12, 16, 20, 23, 26, 29dB   |
| Microphone Input        | ○                                | ○  | -                                |
| Surround                | ○                                | -  | ○                                |
| Package                 | SSOP-B40                         | SSOP-A32   | SSOP-A32                         |

## ●Absolute maximum ratings (Ta=25°C)

| Parameter                   | Symbol           | Ratings            |                    | Unit |
|-----------------------------|------------------|--------------------|--------------------|------|
|                             |                  | BD3403FV           | BD3861FS, BD3883FS |      |
| Power Supply Voltage        | V <sub>cc</sub>  | 10                 | 10                 | V    |
| Power Dissipation           | P <sub>d</sub>   | 900 <sup>*1</sup>  | 950 <sup>*2</sup>  | mW   |
| Input Voltage Range         | V <sub>in</sub>  | GND-0.3 to VCC+0.3 | GND-0.3 to VCC+0.3 | V    |
| Operating Temperature Range | T <sub>opr</sub> | -25 to +75         | -25 to +75         | °C   |
| Storage Temperature Range   | T <sub>stg</sub> | -55 to +125        | -55 to +125        | °C   |

<sup>\*1</sup> Reduced by 9.0 mW/°C over 25°C, when installed on the standard board (size: 70×70×1.6mm) for (BD3403FV).

<sup>\*2</sup> Reduced by 9.5 mW/°C over 25°C, when installed on the standard board (size:70×70×1.6mm) for (BD3861FS, BD3883FS).

## ●Operating voltage range

| Parameter | Symbol          | Ratings    | Unit |
|-----------|-----------------|------------|------|
| BD3403FV  | V <sub>cc</sub> | 6.5 to 9.5 | V    |
| BD3861FS  |                 |            |      |
| BD3883FS  |                 |            |      |

## ●Electrical characteristics

©BD3403FV

$V_{CC}=9V$ ,  $f=1KHz$ ,  $V_{IN}=1V_{rms}$ ,  $R_g=600\Omega$ ,  $R_L=10k\Omega$ ,  $T_a=25^\circ C$ , Input Gain=0dB, VOL=0dB,  
Bass, Middle, Treble=0dB, Surround=OFF, unless otherwise noted.

|               | Parameter                             | Symbol   | Limits |       |       | Unit          | Condition  |
|---------------|---------------------------------------|----------|--------|-------|-------|---------------|--|
|               |                                       |          | Min.   | Typ.  | Max.  |               |  |
| TOTAL         | Circuit Current                       | IQ       | -      | 16.0  | 30.0  | mA            | At no signal   |
|               | Output Voltage Gain                   | GV       | -1.5   | 0.0   | 1.5   | dB            | $GV=20\log(V_{OUT}/V_{IN})$  |
|               | Total Harmonic Distortion ratio       | THD      | -      | 0.02  | 0.08  | %             | 400 to 30kHz BPF   |
|               | Maximum Output Voltage                | VOM      | 2.0    | 2.5   | -     | Vrms          | THD=1%   |
|               | Output Noise Voltage                  | VNO      | -      | 1.8   | 6.0   | $\mu V_{rms}$ | $R_g=0k\Omega$ , IHF-A   |
|               | Cross-talk between Channels           | CT       | -      | 3.0   | 9.0   | $\mu V_{rms}$ | $R_g=0k\Omega$ , IHF-A   |
| INPUT         | 6dBSW Gain                            | GV6      | 5      | 6     | 7     | dB            | $V_{IN}=200mV_{rms}$<br>$GV6=20\log(V_{OUT}/V_{IN})$                                 |
|               | Input Voltage Gain 1                  | Gvmax11  | -1     | *2    | +1    | dB            | $V_{IN}=200mV_{rms}$ , From 0 to 10dB<br>$Gvmax11=20\log(V_{OUT}/V_{IN})$            |
|               | Input Voltage Gain 2                  | Gvmax12  | -1.5   | *2    | +1.5  | dB            | $V_{IN}=200mV_{rms}$<br>From 12 to 26dB<br>$Gvmax12=20\log(V_{OUT}/V_{IN})$          |
|               | Input Gain Switching Step             | Gvmax1st | -      | 2     | -     | dB            | From 0 to 26dB   |
|               | Input Total Harmonic Distortion ratio | THDI     | -      | 0.02  | 0.08  | %             | 400 to 30kHz BPF   |
|               | Input Maximum Output Voltage          | VOMI     | 2.0    | 2.5   | -     | dB            | THD=1%   |
|               | Cross-talk between Selectors          | CS       | -      | -80.0 | -70.0 | dB            | $R_g=0k\Omega$ , IHF-A<br>$CS=20\log(V_{OUT}/V_{IN})$                                |
|               | Input Impedance                       | RI       | 35.0   | 50.0  | 65.0  | k $\Omega$    | $RI=51k \times V_{OUT} / (V_{IN}-V_{OUT})$   |
|               | E Input SW Attenuation                | GRE      | -      | -20.0 | -15.0 | dB            | $GRE=20\log(V_{OUT}/V_{IN})$   |
| INPUT VOLUME  | Input Volume 1                        | GIV1     | -2     | *3    | +2    | dB            | From 0 to -30dB<br>$GIV1=20\log(V_{OUT}/V_{IN})$                                     |
|               | Volume Switching Step 1               | GIVst1   | -      | 2     | -     | dB            | From 0 to -30dB  |
| OUTPUT VOLUME | Output Volume                         | GOV      | -1     | *1    | +1    | dB            | From 0 to -59dB<br>$Gov=20\log(V_{OUT}/V_{IN})$                                      |
|               | Output Switching Step                 | GOVst    | -      | 1     | -     | dB            | From 0 to -59dB  |
|               | Maximum attenuation                   | GminO    | -      | -     | -90.0 | dB            | IHF-A, $GminO=20\log(V_{OUT}/V_{IN})$  |
| SURROUND      | Surround Gain CH1→CH2                 | Gsur1    | 5      | 7     | 9     | dB            | $V_{IN}=200mV_{rms}$ , $f=1kHz$  |
|               | Surround Gain CH2→CH1                 | Gsur2    | 5      | 7     | 9     | dB            | $V_{IN}=200V_{rms}$ , $f=1kHz$   |
| BASS          | Bass Boost Gain                       | GBB      | -2     | *1    | +2    | dB            | $V_{IN}=200mV_{rms}$ , $f=90Hz$ ,<br>From 0 to 14dB<br>$GBB=20\log(V_{OUT}/V_{IN})$  |
|               | Bass Cut Gain                         | GBC      | -2     | *1    | +2    | dB            | $V_{IN}=200mV_{rms}$ , $f=90Hz$ ,<br>From -14 to 0dB<br>$GBC=20\log(V_{OUT}/V_{IN})$ |
|               | Bass Switching Step                   | GBST     | -      | 2     | -     | dB            | $V_{IN}=200mV_{rms}$ , $f=90Hz$  |
| MIDDLE        | Middle Boost Gain                     | GMB      | -2     | *1    | +2    | dB            | $V_{IN}=200mV_{rms}$ , From 0 to 12dB<br>$GMB=20\log(V_{OUT}/V_{IN})$                |
|               | Middle Cut Gain                       | GMC      | -2     | *1    | +2    | dB            | $V_{IN}=200mV_{rms}$ , From -12 to 0dB<br>$GMC=20\log(V_{OUT}/V_{IN})$               |
|               | Middle Switching Step                 | GMST     | -      | 2     | -     | dB            | $V_{IN}=200mV_{rms}$   |
| TREBLE        | Treble Boost Gain                     | GTB      | -2     | *1    | +2    | dB            | $V_{IN}=200mV_{rms}$ , $f=10kHz$<br>From 0 to 12dB<br>$GTB=20\log(V_{OUT}/V_{IN})$   |
|               | Treble Cut Gain                       | GTC      | -2     | *1    | +2    | dB            | $V_{IN}=200mV_{rms}$ , $f=10kHz$<br>From -12 to 0dB<br>$GTC=20\log(V_{OUT}/V_{IN})$  |
|               | Treble Switching Step                 | GTST     | -      | 2     | -     | dB            | $V_{IN}=200mV_{rms}$ , $f=10kHz$   |
| MIC           | Microphone Voltage Gain               | GMIC     | 4.5    | 6.0   | 7.5   | dB            | $V_{IN}=200mV_{rms}$<br>$GMIC=20\log(V_{OUT}/V_{IN})$                                |

\*1 \*2 Typ. is set to the value described in condition.  
Min. and Max. mean the error.

## ⓄBD3861FS

VCC=9V, f=1KHz, VIN=1Vrms, Rg=600Ω, RL=10kΩ, Ta=25°C, Input Gain=0dB, VOL=0dB,  
Bass, Middle, Treble=0dB, unless otherwise noted.

|               | Parameter                       | Symbol   | Limits |       |       | Unit  | Condition   |
|---------------|---------------------------------|----------|--------|-------|-------|-------|---|
|               |                                 |          | Min.   | Typ.  | Max.  |       |   |
| TOTAL         | Circuit Current                 | IQ       | -      | 13.0  | 26.0  | mA    | At no signal  |
|               | Output Voltage Gain             | GV       | -1.5   | 0.0   | 1.5   | dB    | GV=20log(VOUT/VIN)  |
|               | Total Harmonic Distortion       | THD      | -      | 0.02  | 0.08  | %     | 400 to 30kHz BPF  |
|               | Maximum Output Voltage          | VOM      | 2.0    | 2.5   | -     | Vrms  | THD=1%  |
|               | Output Noise Voltage            | VNO      | -      | 8.0   | 15.0  | μVrms | Rg=0kΩ, IHF-A   |
|               | Cross-talk between Channels     | CT       | -      | -80   | -70   | dB    | Rg=0kΩ, IHF-A   |
| INPUT         | 6dB SW Gain                     | GV6      | 5      | 6     | 7     | dB    | VIN=200mVrms<br>GV6=20log(VOUT/VIN)                             |
|               | Input Voltage Gain 1            | Gvmax11  | -1     | *1    | +1    | dB    | VIN=200mVrms<br>From 0 to 10dB<br>Gvmax11=20log(VOUT/VIN)       |
|               | Input Voltage Gain 2            | Gvmax12  | -1.5   | *1    | +1.5  | dB    | VIN=200mVrms, From 12 to 26dB<br>Gvmax12=20log(VOUT/VIN)        |
|               | Input Gain Switching Step       | Gvmax1st | -      | 2     | -     | dB    | From 0 to 26dB  |
|               | Input Total Harmonic Distortion | THDI     | -      | 0.02  | 0.08  | %     | 400 to 30kHz BPF  |
|               | Input Maximum Output Voltage    | VOMI     | 2.0    | 2.5   | -     | dB    | THD=1%  |
|               | Cross-talk between Selectors    | CS       | -      | -80.0 | -70.0 | dB    | Rg=0kΩ, IHF-A<br>CS=20log(VOUT/VIN)                             |
|               | Input Impedance                 | RI       | 35.0   | 50.0  | 65.0  | kΩ    | RI=51kxVOUT/(VIN-VOUT)  |
| INPUT VOLUME  | E Input SW Attenuation          | GRE      | -      | -20.0 | -15.0 | dB    | GRE=20log(VOUT/VIN)   |
|               | Input Volume 1                  | GIV1     | -2     | *1    | +2    | dB    | From 0 to -50dB<br>GIV1=20log(VOUT/VIN)                         |
|               | Input Volume 2                  | GIV2     | -3     | *1    | +3    | dB    | From -54 to -70dB<br>GIV2=20log(VOUT/VIN)                       |
|               | Volume Switching Step 1         | GIVst1   | -      | 2     | -     | dB    | From 0 to -50dB   |
|               | Volume Switching Step 2         | GIVst2   | -      | 4     | -     | dB    | From -54 to -70dB   |
| OUTPUT VOLUME | Maximum attenuation             | GminI    | -      | -     | -90.0 | dB    | IHF-A, GminI=20log(VOUT/VIN)                                    |
|               | Output Volume                   | GOV      | -1     | *1    | +1    | dB    | From 0 to -59dB<br>Gov=20log(VOUT/VIN)                          |
|               | Output Switching Step           | GOVst    | -      | 1     | -     | dB    | From 0 to -59dB   |
| BASS          | Maximum attenuation             | GminO    | -      | -     | -90.0 | dB    | IHF-A<br>GminO=20log(VOUT/VIN)                                  |
|               | Bass Boost Gain                 | GBB      | -2     | *1    | +2    | dB    | VIN=200mVrms, f=90Hz,<br>From 0 to 14dB<br>GBB=20log(VOUT/VIN)  |
|               | Bass Cut Gain                   | GBC      | -2     | *1    | +2    | dB    | VIN=200mVrms, f=90Hz,<br>From -14 to 0dB<br>GBC=20log(VOUT/VIN) |
| MIDDLE        | Bass Switching Step             | GBST     | -      | 2     | -     | dB    | VIN=200mVrms, f=90Hz  |
|               | Middle Boost Gain               | GMB      | -2     | *1    | +2    | dB    | VIN=200mVrms, From 0 to 12dB<br>GMB=20log(VOUT/VIN)             |
|               | Middle Cut Gain                 | GMC      | -2     | *1    | +2    | dB    | VIN=200mVrms, From -12 to 0dB<br>GMC=20log(VOUT/VIN)            |
| TREBLE        | Middle Switching Step           | GMST     | -      | 2     | -     | dB    | VIN=200mVrms  |
|               | Treble Boost Gain               | GTB      | -2     | *1    | +2    | dB    | VIN=200mVrms,<br>f=10kHz From 0 to 12dB<br>GTB=20log(VOUT/VIN)  |
|               | Treble Cut Gain                 | GTC      | -2     | *1    | +2    | dB    | VIN=200mVrms,<br>f=10kHz From -12 to 0dB<br>GTC=20log(VOUT/VIN) |
| MIC           | Treble Switching Step           | GTST     | -      | 2     | -     | dB    | VIN=200mVrms, f=10kHz   |
|               | Microphone Voltage Gain         | GMIC     | 4.5    | 6.0   | 7.5   | dB    | VIN=200mVrms<br>GMIC=20log(VOUT/VIN)                            |

\*1 Typ. is set to the value described in condition.  
Min. and Max. mean the error.

## ⓄBD3883FS

Ta=25°C, VCC=8V, f=1kHz, Vi=200mVrms, RL=10kΩ, Rg=600Ω,

Input Selector=Ach, Input Gain=0dB, Volume=0dB, Bass=0dB, Middle=0dB, Treble=0dB,

Surround=OFF, RECOU=OFF, unless otherwise noted.

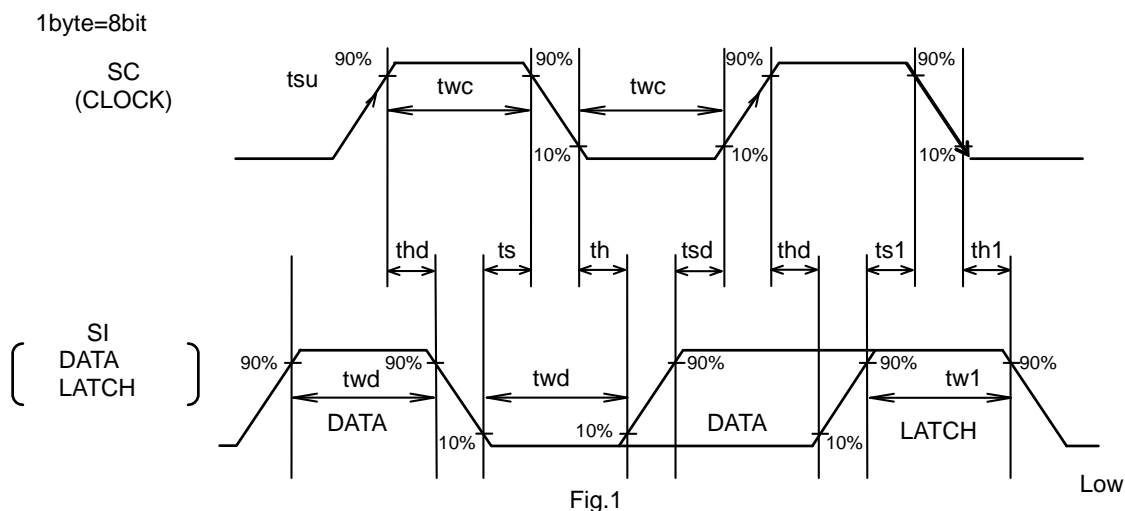
|          | Parameter                    | Symbol | Limits         |      |      | Unit  | Condition                                   |
|----------|------------------------------|--------|----------------|------|------|-------|---|
|          |                              |        | Min.           | Typ. | Max. |       |   |
| TOTAL    | Circuit Current              | IQ     | -              | 8    | 21   | mA    | At no signal                                |
|          | Total Output Voltage Gain    | Gv     | -2             | 0    | 2    | dB    |   |
|          | Total Harmonic Distortion    | THDO   | -              | 0.01 | 0.1  | %     | BW=400 to 30kHz                             |
|          | Maximum Output Voltage       | Vomaxo | 1.6            | 2.1  | -    | Vrms  | THD=1%<br>BW=400 to 30kHz                   |
|          | Total Residual Noise Voltage | Vno    | -              | 2    | 10   | μVrms | Rg=0Ω, Vol=-∞dB<br>BW=IHF-A, REAR ATT=-10dB |
|          | Total Output Noise Voltage   | Vmno   | -              | 4    | 15   | μVrms | Rg=0Ω, Vol=0dB<br>BW=IHF-A                  |
|          | Cross-talk between Channels  | CTC12  | -              | -80  | -70  | dB    | Rg=0Ω, BW=IHF-A<br>VOUT=1Vrms               |
|          | Input Impedance              | Rin    | 70             | 100  | 130  | kΩ    |   |
|          | Output Impedance             | Rout   | -              | -    | 50   | Ω     |   |
| INPUT    | Cross-talk between Selectors | CTS1   | -              | -80  | -70  | dB    | VOUT=1Vrms<br>Rg=0Ω, BW=IHF-A               |
| VOLUME   | Volume Control Range         | VRI    | -90            | -87  | -84  | dB    | BW=IHF-A, Vout=1Vrms                        |
|          | Volume Setting Error 1       | VEI1   | -2             | 0    | 2    | dB    | 0 to -53dB, BW=IHF-A<br>VOUT=1Vrms          |
|          | Volume Setting Error 2       | VEI2   | -3             | 0    | 3    | dB    | -54 to -87dB, BW=IHF-A<br>VOUT=1Vrms        |
|          | Maximum Attenuation          | Vmin   | -              | -    | -90  | dB    | BW=IHF-A VOUT=1Vrms                         |
|          | Volume Input Impedance       | Rvin   | 39             | 56   | 73   | kΩ    |   |
| BASS     | Bass Gain                    | Gb     | -17.5 to +17.5 |      |      | dB    |   |
|          | Bass Gain Setting Error      | BE     | -2.5           | 0    | -2.5 | dB    |   |
| MIDDLE   | Middle Gain                  | Gm     | -14 to +14     |      |      | dB    |   |
|          | Middle Gain Setting Error    | ME     | -2             | 0    | -2   | dB    |   |
| TREBLE   | Treble Gain                  | Gt     | -14 to +14     |      |      | dB    |   |
|          | Treble Gain Setting Error    | TE     | -2             | 0    | 2    | dB    |   |
| SURROUND | Surround In-phase Gain       | Vsur1  | -2             | 0    | 2    | dB    |   |
|          | Surround Single-phase Gain   | Vsur2  | 4.3            | 6.3  | 8.3  | dB    | AC-grounding                                |
|          | Opposite-phase Gain          | Vsur3  | 8              | 10   | 12   | dB    |   |

• This IC is not designed to be radiation-resistant.

●Control signal specifications

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.



| Parameter                     | Symbol | Limits |      |      | Unit |
|-------------------------------|--------|--------|------|------|------|
|                               |        | Min.   | Typ. | Max. |      |
| Minimum Clock Width           | twc    | 2.0    | -    | -    | μs   |
| Minimum Data Width            | twd    | 2.0    | -    | -    | μs   |
| Minimum Latch Width           | tw1    | 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) | ts1    | 1.0    | -    | -    | μs   |
| Latch Hold Time (DATA→LATCH)  | th1    | 1.0    | -    | -    | μs   |
| Latch Low Set-up Time         | ts     | 1.0    | -    | -    | μs   |
| Latch Low Hold Time           | th     | 1.0    | -    | -    | μs   |

2. Voltage Conditions for Control Signals (BD3403FV, BD3861FS)

| Parameter         | Condition                    | Limits |      |      | Unit |
|-------------------|------------------------------|--------|------|------|------|
|                   |                              | Min.   | Typ. | Max. |      |
| “H” Input Voltage | V <sub>cc</sub> =6.5 to 9.5V | 2.6    | -    | 5.5  | V    |
| “L” Input Voltage | V <sub>cc</sub> =6.5 to 9.5V | 0      | -    | 1.1  | V    |

3. Voltage Conditions for Control Signals (BD3883FS)

| Parameter         | Condition                    | Limits |      |      | Unit |
|-------------------|------------------------------|--------|------|------|------|
|                   |                              | Min.   | Typ. | Max. |      |
| “H” Input Voltage | V <sub>cc</sub> =6.5 to 9.5V | 2.2    | -    | 5.5  | V    |
| “L” Input Voltage | V <sub>cc</sub> =6.5 to 9.5V | 0      | -    | 1.0  | V    |

## ●Control data format list

(BD3403FV)

Address 1

|                 |     |                 |     |     |     |                        |     |
|-----------------|-----|-----------------|-----|-----|-----|------------------------|-----|
| D10             | D11 | D12             | D13 | D14 | D15 | D16                    | D17 |
| OUTPUT Volume 1 |     | OUTPUT Volume 2 |     |     |     | Function Select<br>0 0 |     |

Address 2

|              |     |     |     |                           |                          |     |     |
|--------------|-----|-----|-----|---------------------------|--------------------------|-----|-----|
| D20          | D21 | D22 | D23 | D24                       | D25                      | D26 | D27 |
| INPUT Volume |     |     |     | Surround<br>0:OFF<br>1:ON | Function Select<br>0 1 0 |     |     |

Address 3

|                |     |     |                            |                            |                          |     |     |
|----------------|-----|-----|----------------------------|----------------------------|--------------------------|-----|-----|
| D30            | D31 | D32 | D33                        | D34                        | D35                      | D36 | D37 |
| Input Selector |     |     | 6dB SW<br>0: 0dB<br>1:+6dB | IN E MUTE<br>0:OFF<br>1:ON | Function Select<br>0 0 1 |     |     |

Address 4

|                 |     |     |     |                          |                          |     |     |
|-----------------|-----|-----|-----|--------------------------|--------------------------|-----|-----|
| D40             | D41 | D42 | D43 | D44                      | D45                      | D46 | D47 |
| Input Gain/Bass |     |     |     | 0: Input Gain<br>1: Bass | Function Select<br>1 0 1 |     |     |

Address 5

|               |     |     |     |                        |                          |     |     |
|---------------|-----|-----|-----|------------------------|--------------------------|-----|-----|
| D50           | D51 | D52 | D53 | D54                    | D55                      | D56 | D57 |
| Middle/Treble |     |     |     | 0: Middle<br>1: Treble | Function Select<br>0 1 1 |     |     |

(BD3861FS)

Address 1

|               |     |                 |     |     |     |                        |     |
|---------------|-----|-----------------|-----|-----|-----|------------------------|-----|
| D10           | D11 | D12             | D13 | D14 | D15 | D16                    | D17 |
| OUTPUT Volume |     | OUTPUT Volume 2 |     |     |     | Function Select<br>0 0 |     |

Address 2

|              |     |     |     |     |                          |     |     |
|--------------|-----|-----|-----|-----|--------------------------|-----|-----|
| D20          | D21 | D22 | D23 | D24 | D25                      | D26 | D27 |
| INPUT Volume |     |     |     |     | Function Select<br>0 1 0 |     |     |

Address 3

|                |     |     |                           |                            |                          |     |     |
|----------------|-----|-----|---------------------------|----------------------------|--------------------------|-----|-----|
| D30            | D31 | D32 | D33                       | D34                        | D35                      | D36 | D37 |
| Input Selector |     |     | 6dBSW<br>0: 0dB<br>1:+6dB | IN E MUTE<br>0:OFF<br>1:ON | Function Select<br>0 0 1 |     |     |

Address 4

|                 |     |     |     |                          |                          |     |     |
|-----------------|-----|-----|-----|--------------------------|--------------------------|-----|-----|
| D40             | D41 | D42 | D43 | D44                      | D45                      | D46 | D47 |
| Input Gain/Bass |     |     |     | 0: Input Gain<br>1: Bass | Function Select<br>1 0 1 |     |     |

Address 5

|               |     |     |     |                        |                          |     |     |
|---------------|-----|-----|-----|------------------------|--------------------------|-----|-----|
| D50           | D51 | D52 | D53 | D54                    | D55                      | D56 | D57 |
| Middle/Treble |     |     |     | 0: Middle<br>1: Treble | Function Select<br>0 1 1 |     |     |

(BD3883FS)

- Basic Configuration of Control Data Format

← Data input direction

|      |      |    |    |    |    |    |    |    |                |     |
|------|------|----|----|----|----|----|----|----|----------------|-----|
|      | MSB  |    |    |    |    |    |    |    |                | LSB |
|      | D9   | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1             | D0  |
| Data | Data |    |    |    |    |    |    |    | Select Address |     |

- Control Data Formats

← Data input direction

|         |                |    |    |                |                      |                |           |             |                |    |
|---------|----------------|----|----|----------------|----------------------|----------------|-----------|-------------|----------------|----|
|         |                |    |    |                |                      |                |           |             | Select Address |    |
|         | D9             | D8 | D7 | D6             | D5                   | D4             | D3        | D2          | D1             | D0 |
| Data(1) | Input Gain     |    |    | Input Selector |                      |                | Treble fc |             | 0              | 0  |
| Data(2) | Front Volume A |    |    |                |                      | Front Volume B |           | *           | 0              | 1  |
| Data(3) | Bass Gain      |    |    |                | Treble Gain          |                |           |             | 1              | 0  |
| Data(4) | Middle Gain    |    |    |                | Time Constant Select | REC OUT        | Surround  | Rear Volume | 1              | 1  |

O\* indicates 0 or 1.

- By changing the setting of Select Address, four different control formats are selectable. (BD3883FS)
- At power-on sequence, initialize all data.

Example:

← Data input direction

|         |     |         |     |         |     |         |     |
|---------|-----|---------|-----|---------|-----|---------|-----|
| MSB     | LSB | MSB     | LSB | MSB     | LSB | MSB     | LSB |
| Data(1) | L   | Data(2) | L   | Data(3) | L   | Data(4) | L   |

"L" means a "latch."

- After power-on, for the second and subsequent times, only the necessary data can be selected for setting.

Example: When changing the volume:

← Data input direction

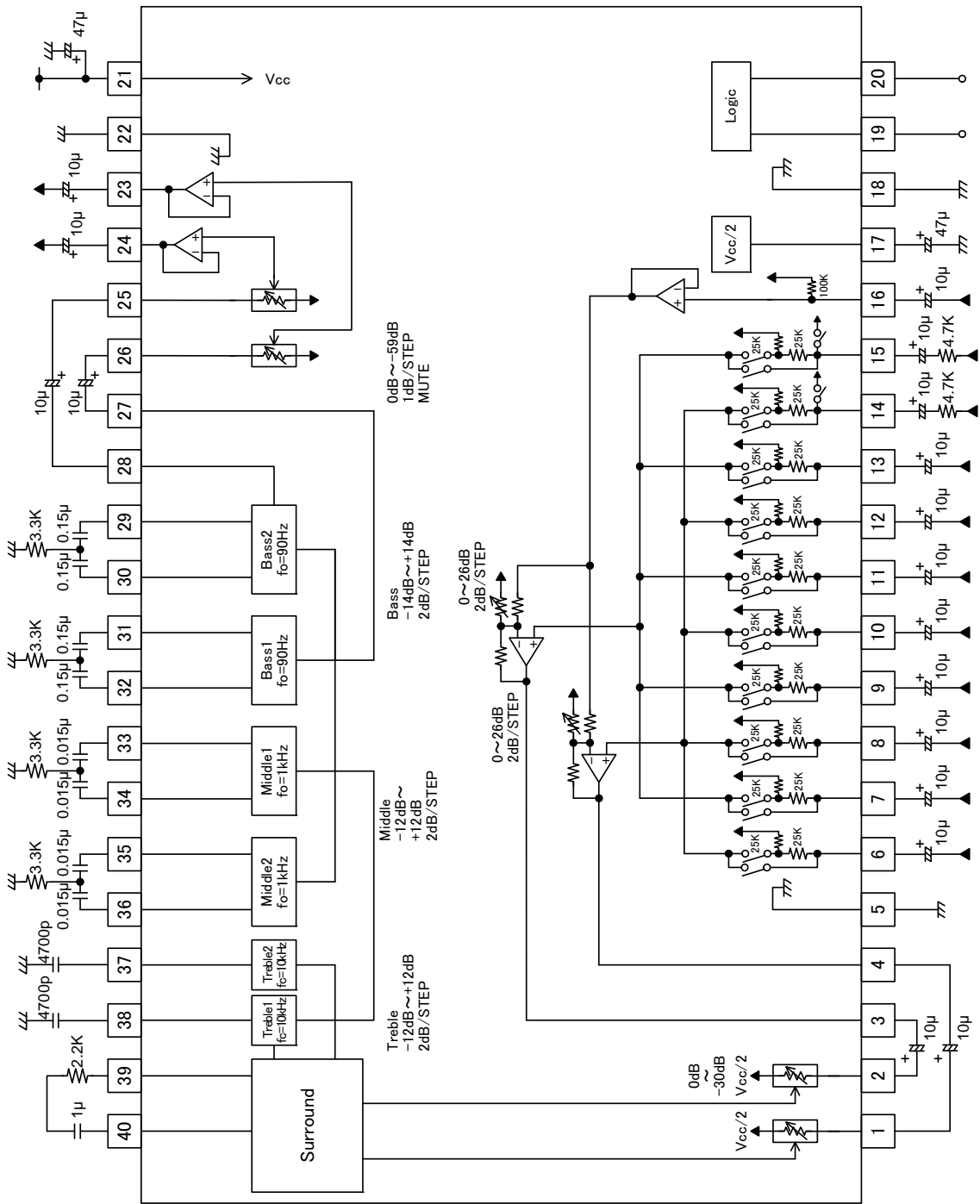
|         |     |
|---------|-----|
| MSB     | LSB |
| Data(2) | L   |

"L" means a "latch."

- RECOUT, Surround and Rear Volume in Data(4) are Soft-switched using time constants. (BD3883FS)

●Block diagram, application circuit, pin assignment

(BD3403FV)



UNIT RESISTANCE : Ω  
CAPACITANCE : F

Fig.2



(BD3861FS)

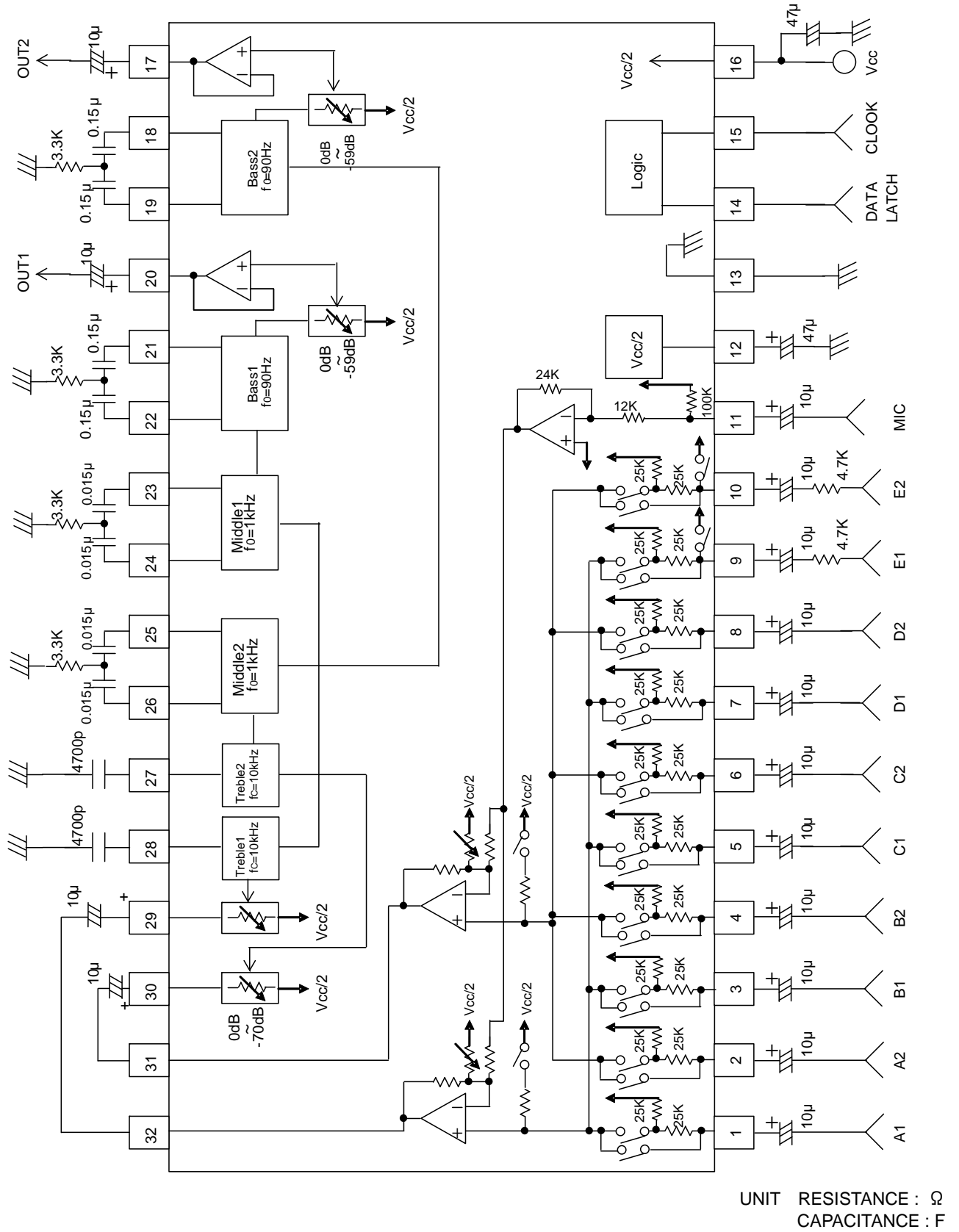


Fig.3

(BD3883FS)  
When using RECOUT:

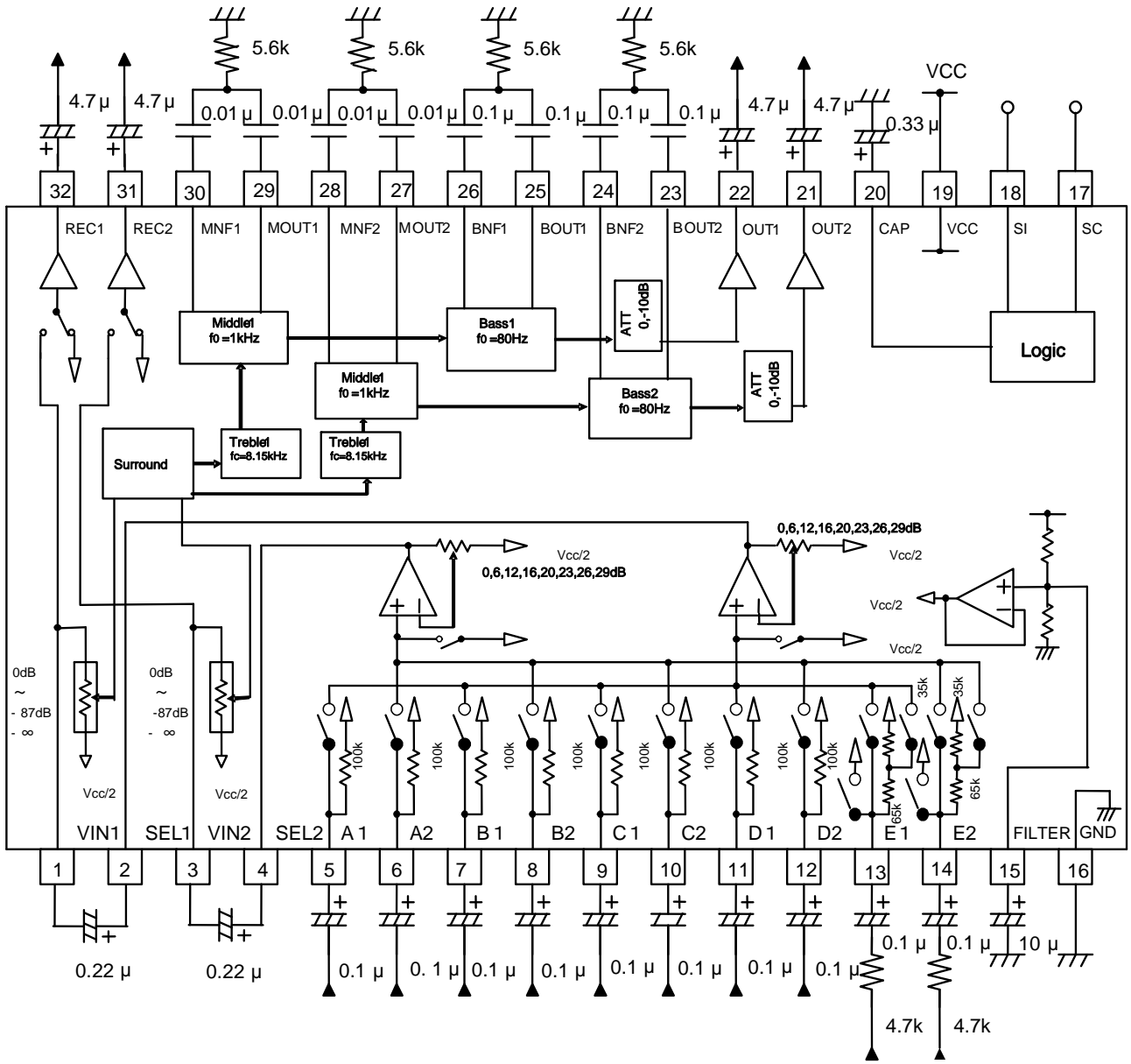
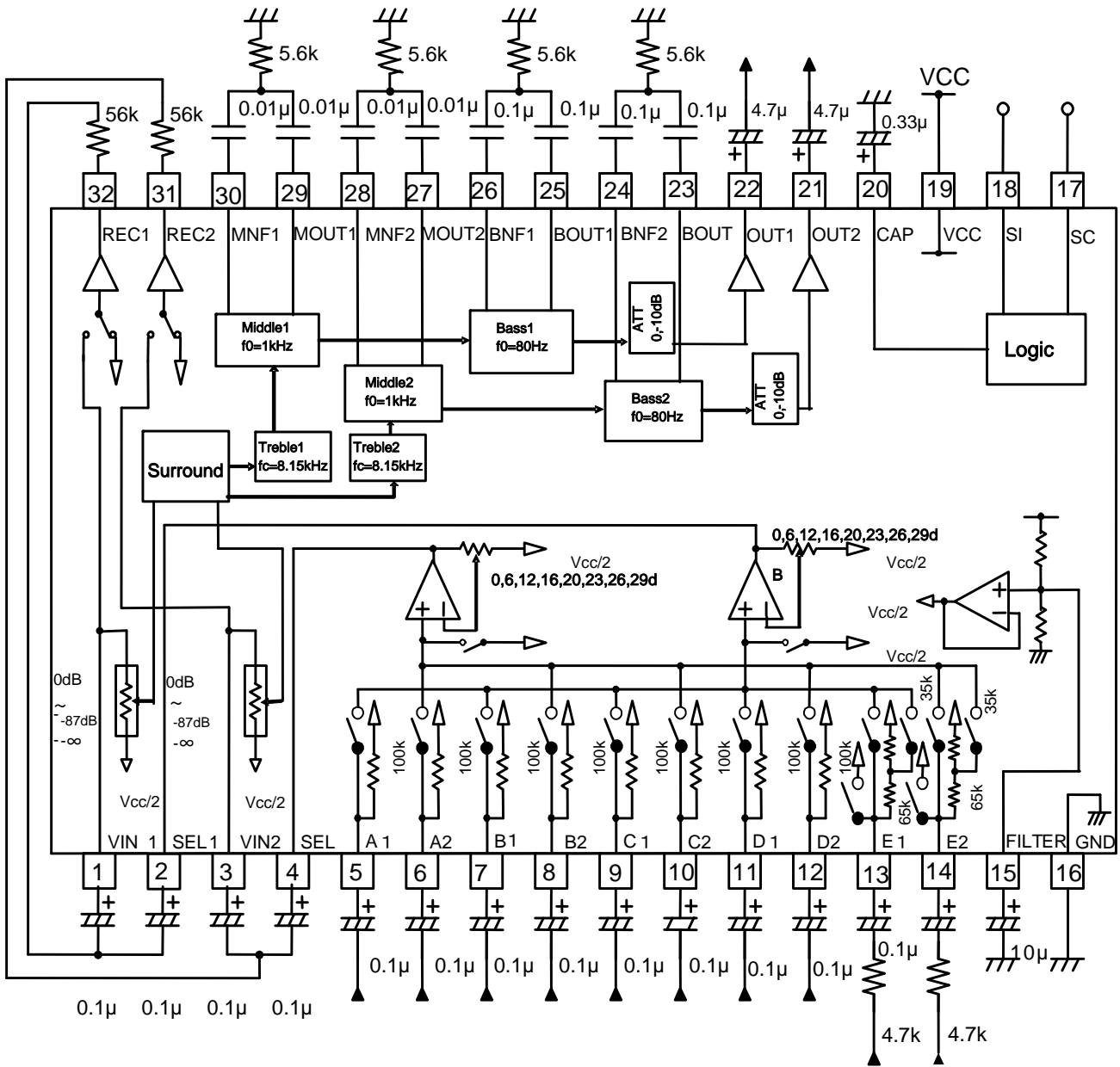


Fig.4

UNIT  
RESISTANCE: Ω  
CAPACITOR: F

(BD3883FS)  
When using 2ndHPF:



UNIT  
RESISTANCE:Ω  
CAPACITOR:F

Fig.5

●Reference data

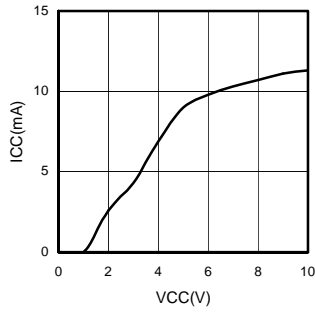


Fig.6 Circuit Current – Supply Voltage (BD3403FV)

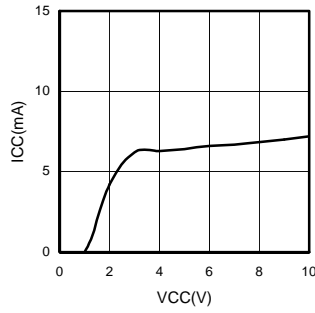


Fig.7 Circuit Current – Supply Voltage (BD3883FS)

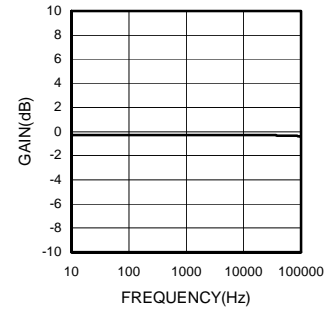


Fig.8 Voltage Gain - Frequency

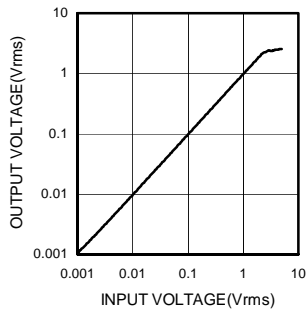


Fig.9 Output Voltage - Input Voltage

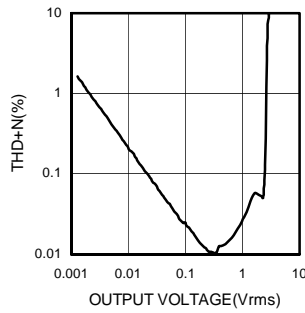


Fig.10 Total Harmonic Distortion ratio - Output Voltage (BD3403FV, BD3861FS)

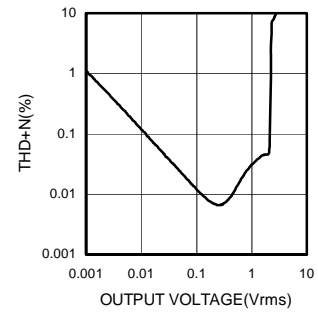


Fig.11 Total Harmonic Distortion ratio - Output Voltage (BD3883FS)

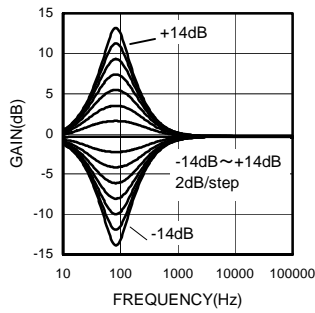


Fig.12 Bass Gain - Frequency (BD3403FV, BD3861FS)

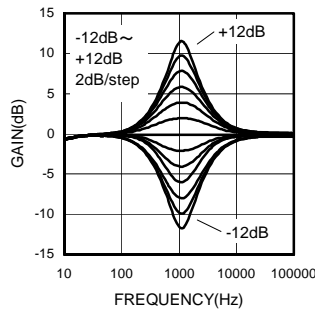


Fig.13 Middle Gain - Frequency (BD3403FV, BD3861FS)

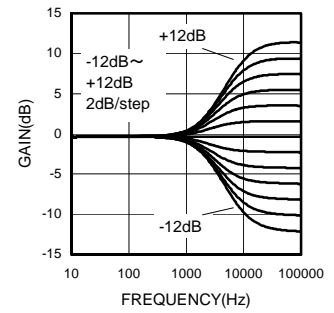


Fig.14 Treble Gain - Frequency (BD3403FV, BD3861FS)

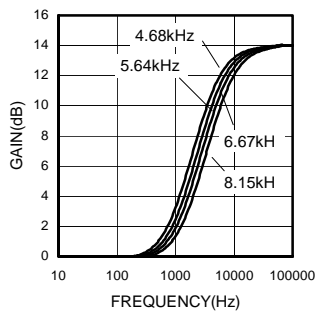


Fig.15 Variable Treble Cut-off Frequency (BD3883FS)

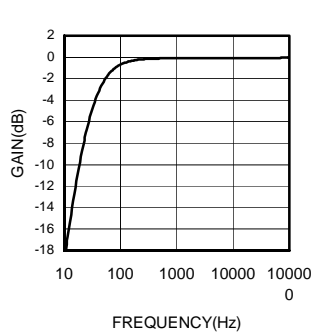


Fig.16 2ndHPF - Frequency (BD3883FS)

### ●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) GND potential  
Ensure a minimum GND pin potential in all operating conditions. Make sure that no pins are at a voltage below the GND at any time, regardless of whether it is a transient signal or not.
- 5) Thermal design  
Perform thermal design, in which there are adequate margins, by taking into account the permissible 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) 2-wire serial control  
Because SC and SI terminals are designed for inputting high-frequency digital signals, wiring and layout patterns should be routed as not to cause interference with the analog-signal-related lines.
- 9) E Input external resistance (BD3883FS)  
To avoid a sudden noise into E Input, external resistance (4.7kΩ) should be connected as close as possible to the IC terminal.
- 10) Function switching  
Action to absorb shock sounds is taken when switching between the Volume, Treble, Middle and Bass functions.
- 11) Power-ON Reset (BD3883FS)  
A built-in circuit for performing initialization inside the IC at Power-ON is provided. Specifically, the initial states are set as described in the table below. In the case of the setting design, however, to be on the safe side, it is recommended that data shall be sent to all the addresses as initial data at power-ON and, until this sending operation is completed, MUTE shall be applied. To avoid malfunctions, serial data signals must be set to the Low state at power-ON/OFF.

| Function       | Initial State |
|----------------|---------------|
| Input Selector | MUTE          |
| Input Gain     | 0 dB          |
| RECOU          | OFF           |
| Volume         | -∞dB          |
| Surround       | OFF           |
| Treble         | 0 dB          |
| Middle         | 0 dB          |
| Bass           | 0 dB          |
| Rear Volume    | 0dB           |

- 12) Step switching noise (BD3883FS)  
For Surround and Rear Volume, an external capacitor C is attached to the CAP pin to control the switching step noise. In the application circuit, a constant value, as an example, is shown by the CAP pin.  
The time constant for charge/discharge of the capacitor C (varying between VBE to 5VBE (2.65V)) controls the slow switching operation.  
The switching time constant T is calculated as the follows:  

$$T=2.55 \times 10^5 \times C$$
VBE has temperature characteristics and may affect the value of the time constant T.

13) Input Selector and Input Gain

When changing Input Selector or Input Gain, the Soft-switching is not applied. Therefore, it is recommended to implement the MUTE function.

⊙MUTE setting example

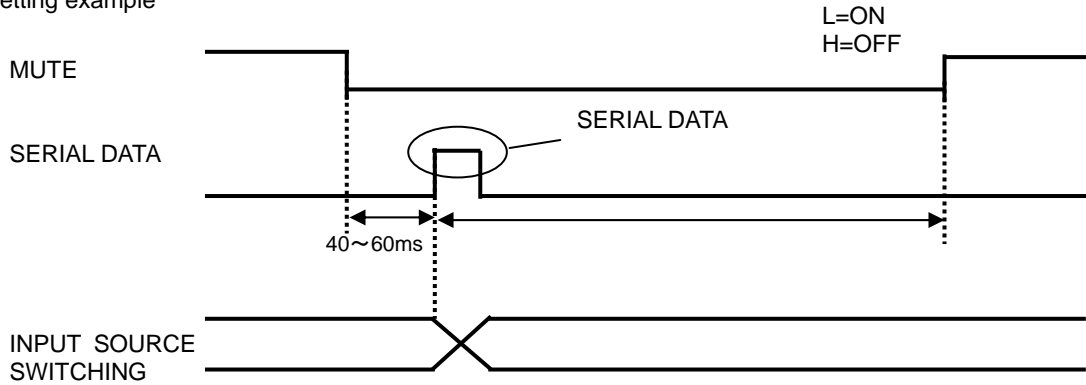


Fig.17

14) Constraints of serial control (BD3883FS)

On Soft-switching of the RECOUT, Surround, and Rear Volume functions, data must not be sent serially to the functions before the switching operation is completed.

If the function for Soft-switch should serially send the data (Data(4)) on the same Select Address, the time interval between the send operations must be set to 500 -600msec.

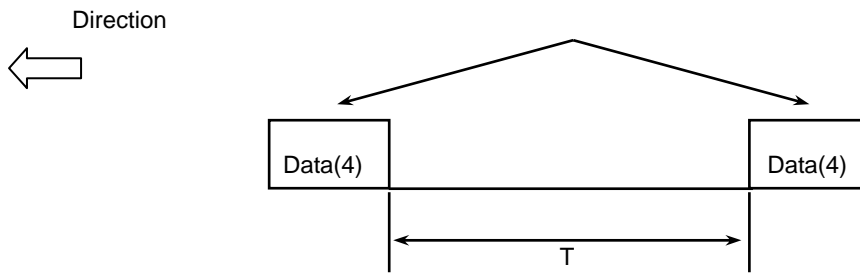


Fig.18

15) Function setting while muting Volume (BD3883FS)

While muting Volume, to avoid increasing residual noise, set Bass, Middle and Treble to 0dB, Surround to OFF, and Rear Volume to -10dB.

● Ordering part number

|   |   |
|---|---|
| B | D |
|---|---|

Part No.

|   |   |   |   |
|---|---|---|---|
| 3 | 4 | 0 | 3 |
|---|---|---|---|

Part No.  
3403  
3861, 3883

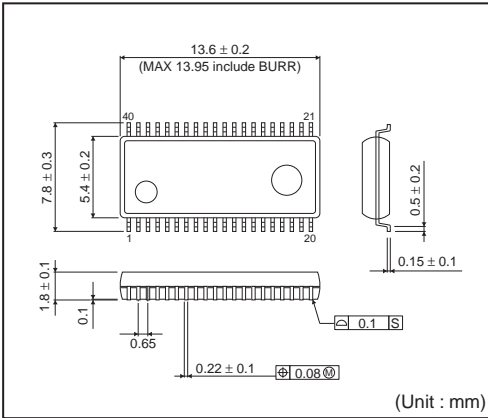
|   |   |
|---|---|
| F | V |
|---|---|

Package  
FV: SSOP-B40  
FS: SSOP-A32

|   |   |
|---|---|
| E | 2 |
|---|---|

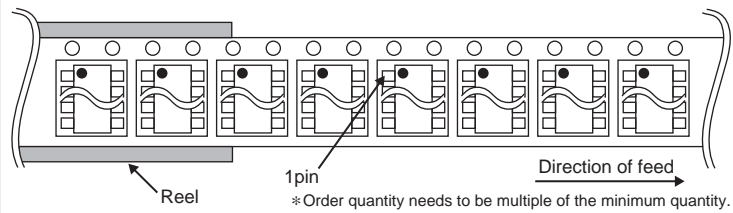
Packaging and forming specification  
E2: Embossed tape and reel

SSOP-B40

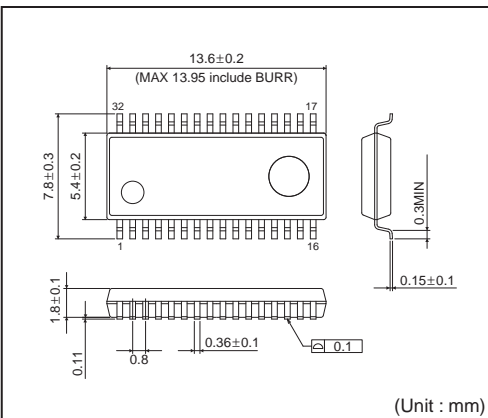


<Tape and Reel information>

|                   |   |
|-------------------|---|
| Tape              | Embossed carrier tape   |
| Quantity          | 2000pcs   |
| Direction of feed | E2<br>( The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand ) |

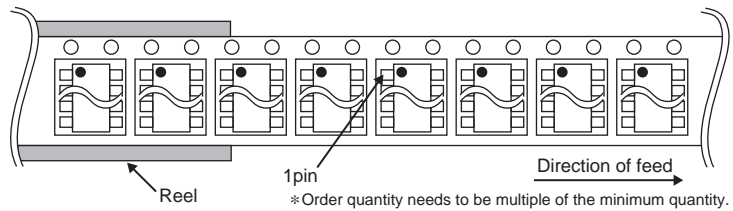


SSOP-A32



<Tape and Reel information>

|                   |   |
|-------------------|---|
| Tape              | Embossed carrier tape   |
| Quantity          | 2000pcs   |
| Direction of feed | E2<br>( The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand ) |



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|-----------|-----------|------------|-----------|
| CLASS III | CLASS III | CLASS II b | CLASS III |
| CLASS IV  |           | CLASS III  |           |

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  - Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
  - Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
  - Sealing or coating our Products with resin or other coating materials
  - 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
  - Use of the Products in places subject to dew condensation
- The Products are not subject to radiation-proof design.
- Please verify and confirm characteristics of the final or mounted products in using the Products.
- 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.
- De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
- Confirm that operation temperature is within the specified range described in the product specification.
- ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

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- 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



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  - [c] the Products are exposed to direct sunshine or condensation
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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.

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