

PRELIMINARY
 Notice ; This is not a final specification.
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MITSUBISHI SOUND PROCESSORS

M62433FP

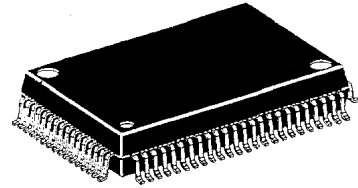
DIGITAL SOUND CONTROLLER

SINGLE CHIP ANALOG SOUND PROCESSOR

FEATURES

- Capable of controlling functions with serial data
 6-input selector
 5band tone control (0, ± 3 , ± 6 , ± 10 dB)
 Bass boost (loudness type) [ON/OFF]
 Surround (using external delay) [ON/OFF]
 Voice cancel (stereo) [ON/OFF]
 Multilingual record switching [L only/R only]
 Electric volume 32steps (0dB ~)
 SW mode for control of DPL and other sound fields 3 lines for Rec output, 2 lines for port output
- Supporting digital delay
- Input/output of adapter supporting karaoke control

PACKAGE



Outline 80P6N

Pitch : 0.8 mm
 Size : 20.0 mm X 14.0mm
 X 2.8mm

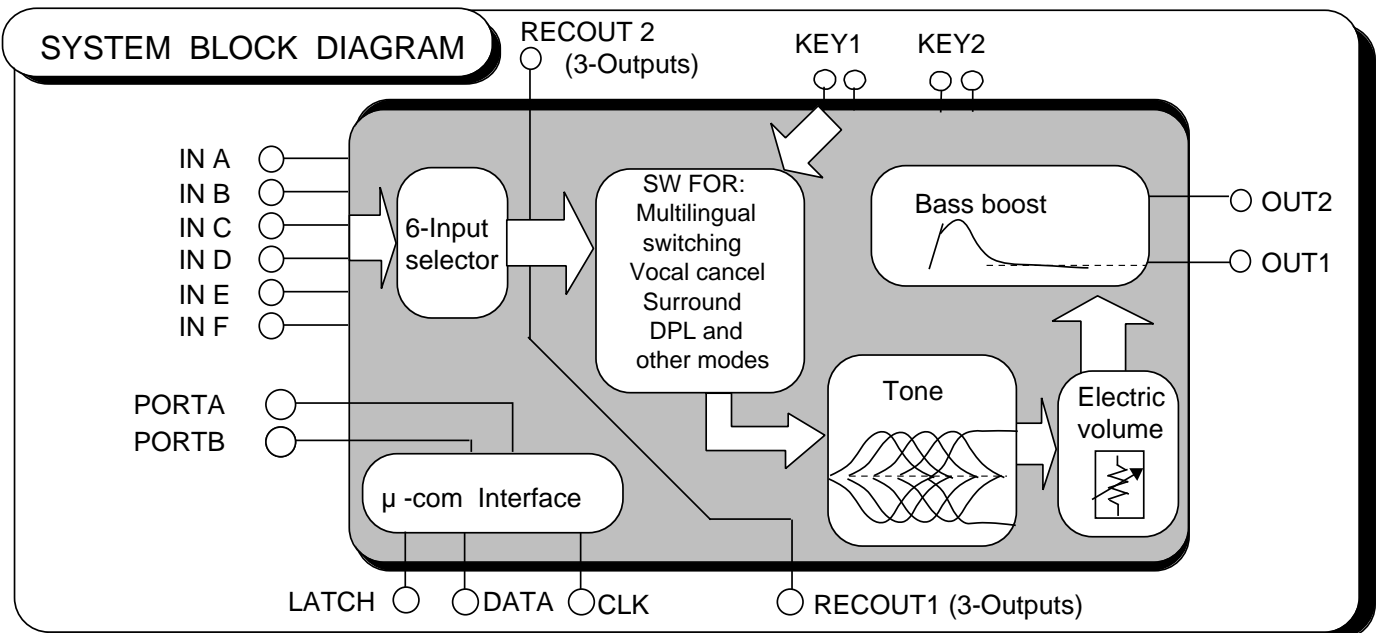
APPLICATION

Home Audio equipment, Radio-Cassette tape recorder, TV

RECOMMENDED OPERATING CONDITIONS

Supply voltage range •••• $\pm 4.5 \sim \pm 7.3$ V
 Rated supply voltage •••• ± 7 V

SYSTEM BLOCK DIAGRAM



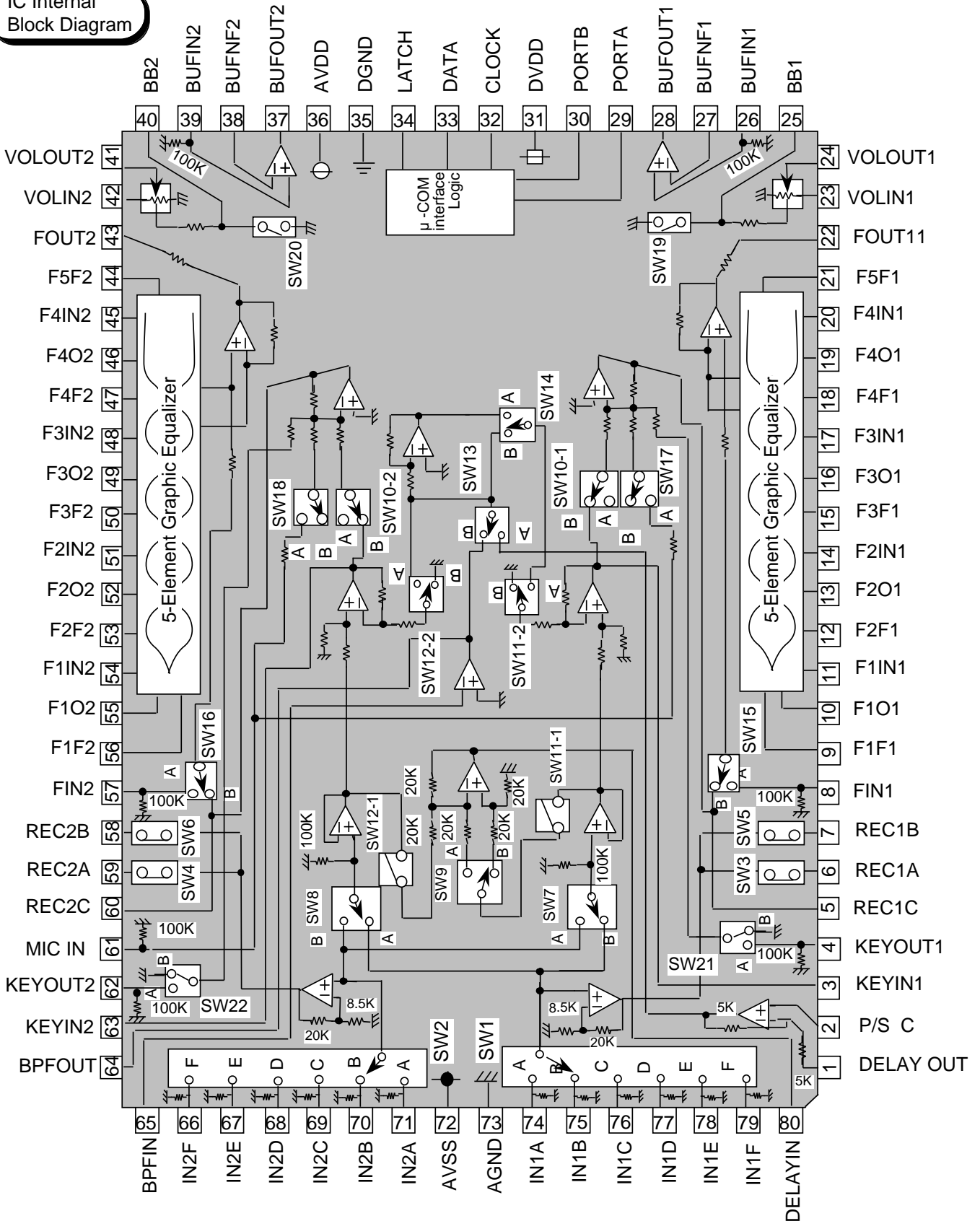
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IC Internal Block Diagram



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Pin Description

| Pin No. | Symbol | Function | |
|----------------------|----------------------------------|---|-------------------------------------|
| 72 | AVSS | Negative power supply to internal analog circuit | |
| 73 | AGND | GND of internal analog circuit | |
| 74,75,76 77,78,79 | IN1A,IN1B,IN1C IN1D,IN1E,IN1F | Input pin at the side of channel1 | |
| 71,70,69 68,67,66 | IN2A,IN2B,IN2C IN2D,IN2E,IN2F | Input pin at the side of channel2 | |
| 80 | DELAYIN | (R-L) output pin for surround. Connected to the input of delay circuit. Total load resistance is 20k | |
| 1 | DELAYOUT | (R-L) input pin for surround. Connected to the output of delay circuit. | |
| 2 | P/S C | Phase shift filter pin for surround | |
| 3,63 | KEYIN1 KEYIN2 | Key control adapter output pin. Connected to the input of key control circuit etc. Total load resistance is 20k | |
| 4,62 | KEYOUT1 KEYOUT2 | Key control adapter input pin. Connected to the output of key control circuit | |
| 64 | BPFOUT | Band-pass filter amplifier output pin for voice cancel | |
| 65 | BPFIN | Band-pass filter amplifier input pin for voice cancel | |
| 5,60 | REC1A REC2A | Rec output pin A | |
| 6,59 | REC1B REC2B | Rec output pin B (with mute SW) | total load resistance ; min. 20K |
| 7,58 | REC1C REC2C | Rec output pin C (with mute SW) | |
| 8,57 | FIN1 FIN2 | Tone input pin (Surround adapter OUT) | |
| 9,46 | F1F1 F1F2 | Pin for connecting resonance impedance (band filter) of the 1st element | |
| 10,45 | F1O1 F1O2 | Output pin of resonance buffer amplifier of the 1st element | |
| 11,54 | F1IN1 F1IN2 | Input pin of resonance buffer amplifier of the 1st element | |
| 12,53 | F2F1 F2F2 | Pin for connecting resonance impedance (band filter) of the 2nd element | |
| 13,52 | F2O1 F2O2 | Output of resonance buffer amplifier of the 2nd element | |

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| Pin No. | Symbol | Function |
|---------|--------------------|--|
| 14,51 | F2IN1 F2IN2 | Input pin of resonance buffer amplifier of the 2nd element |
| 15,50 | F3F1 F3F2 | Pin for connecting resonance impedance (band filter) of the 3rd element |
| 16,49 | F3O1 F3O2 | Output pin of resonance buffer amplifier of the 3rd element |
| 17,48 | F3IN1 F3IN2 | Input pin of resonance buffer amplifier of the 3rd element |
| 18,47 | F4F1 F4F2 | Pin for connecting resonance impedance (band filter) of the 4th element |
| 19,46 | F4O1 F4O2 | Output pin of resonance buffer amplifier of the 4th element |
| 20,45 | F4IN1 F4IN2 | Input pin of resonance buffer amplifier of the 4th element |
| 21,44 | F5F1 F5F2 | Pin for connecting band filter of the 5th element |
| 22,43 | FOUT1 FOUT2 | Tone output pin. Capacitor is combined for connection with the next stage. |
| 23,42 | VOLIN1 VOLIN2 | R-ladder volume input pin |
| 24,41 | VOLOUT1 VOLOUT2 | R-ladder volume output pin |
| 25,40 | BB11 BB12 | Bass boost capacitance connection pin. Sets frequency characteristics. |
| 26,39 | BUFIN1 BUFIN2 | +input pin of bass boost output amplifier |
| 27,38 | BUFNF1 BUFNF2 | -input pin of bass boost output amplifier |
| 28,37 | BUFOUT1 BUFOUT2 | Output pin of bass boost output amplifier |
| 29 | PORTA | Output of port A |
| 30 | PORTB | Output of port B |
| 31 | DVDD | Power supply to internal logic circuit |
| 32 | CLOCK | Clock input pin for serial data transfer |
| 33 | DATA | Input pin of control data. Reads data at the rising edge of clock. |

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| Pin No. | Symbol | Function |
|---------|--------|---|
| 34 | LATCH | Input pin of latch signal. The circuit status changes at the rising edge of latch signal. |
| 35 | DGND | GND pin of internal logic circuits |
| 36 | AVDD | Positive power supply pin of internal analog circuits |
| 61 | MIC IN | Microphone input pin |

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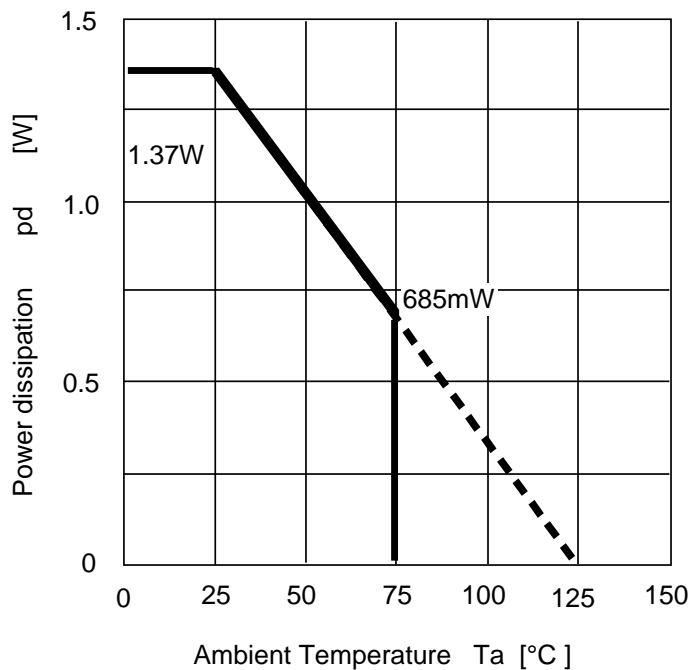
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DIGITAL SOUND CONTROLLER

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Conditions | Ratings | Unit |
|-----------|-----------------------|---------------------------------|------------|-------|
| AVDD,AVSS | Analog Power supply | | ±7.5 | V |
| DVDD | Digital Power supply | | 6.0 | V |
| Pd | Power dissipation | Ta _ 25°C | 1370 | mW |
| Kθ | Thermal derating | Ta > 25°C Attached PC Board* | 13.7 | mW/°C |
| Topr | Operating temperature | | -20 ~ +75 | °C |
| Tstg | Storage temperature | | -55 ~ +125 | °C |

Thermal derating
 (Maximum ratings)



*Note : PC Board

- PC Board Size
140 mm X140 mm
- PC Board Thickness
1.6 mm
- PC Board Material
Epoxy
- Copper Film Thickness
18 μm
- Copper Foil Size
0.25 mm X 50 mm

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RECOMMENDED OPERATING CONDITIONS

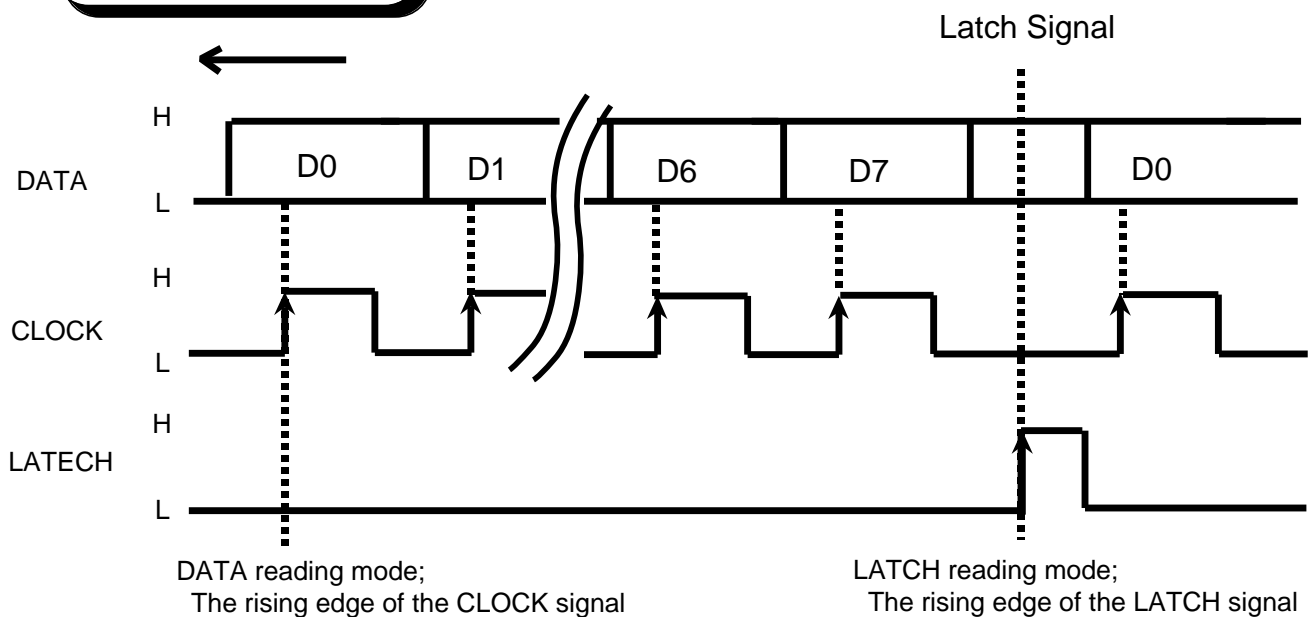
(Ta=25°C, unless otherwise noted)

| Parameter | Symbol | Conditions | MIN | TYP | MAX | Unit |
|-------------------------------------|--------|------------|----------|------|----------|------|
| Analog (+) power supply | AVDD | Note 1 | 4.5 | 7.0 | 7.3 | V |
| Analog (-) power supply | AVSS | Note 1 | -4.5 | -7.0 | -7.3 | V |
| Digital power supply | DVDD | DVDD_AVDD | 4.5 | 5.0 | 5.5 | V |
| Logic "H" Level input voltage | VIH | | DVDD-0.7 | — | VDD | V |
| Logic "L" Level input voltage | VIL | | 0 | — | DGND+0.7 | V |

Note 1: The sequence of the power supply is as follows.

AVDD → AVSS → DVDD

TIMING DIAGRAM



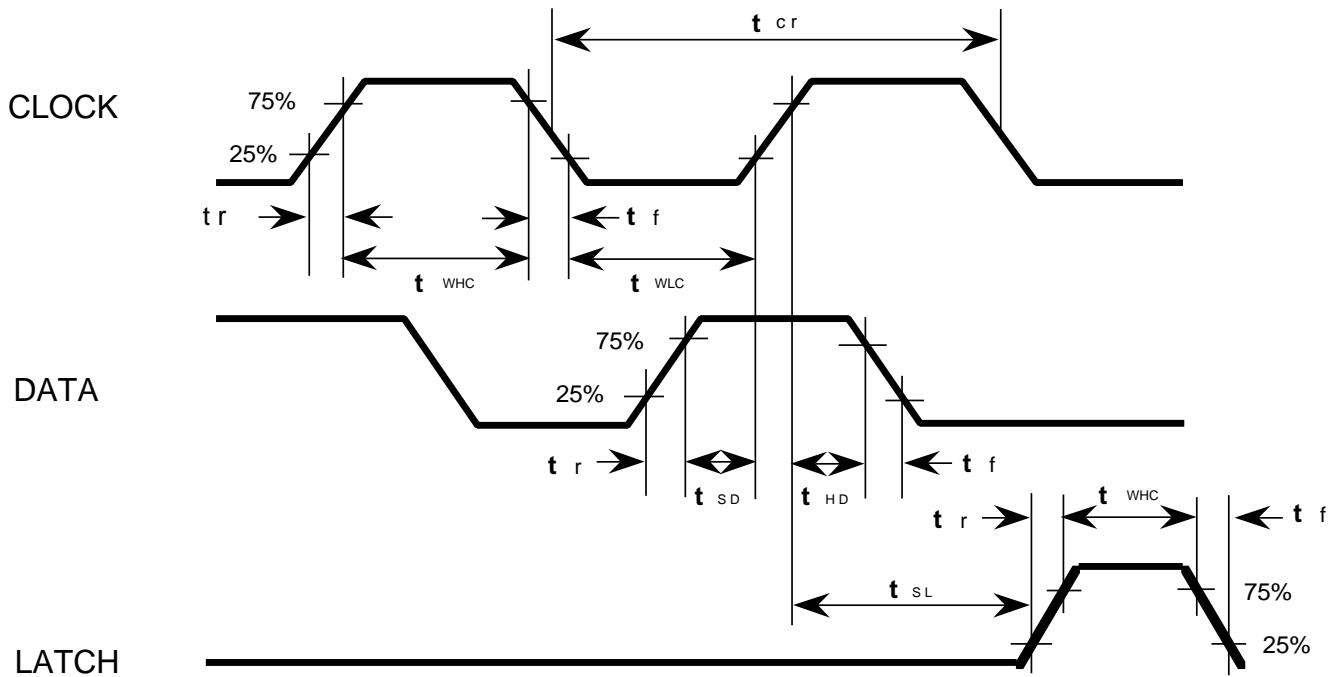
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MITSUBISHI SOUND PROCESSORS

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DIGITAL SOUND CONTROLLER

CLOCK DATA TIMING



DIGITAL CIRCUIT AC CHARACTERISTICS

| Symbol | Parameter | Limits | | | Unit |
|-----------|-----------------------------------|--------|-----|-----|-----------|
| | | Min | typ | Max | |
| t_{cr} | CLOCK cycle time | 4 | - | - | μ sec |
| t_{whc} | CLOCK pulse width (" H " level) | 1.6 | - | - | |
| t_{wlc} | CLOCK pulse width (" L " level) | 1.6 | - | - | |
| t_r | CLOCK, DATA, LATCH rise time | - | - | 0.4 | |
| t_f | CLOCK, DATA, LATCH fall time | - | - | 0.4 | |
| t_{sd} | DATA setup time | 0.8 | - | - | |
| t_{hd} | DATA hold time | 0.8 | - | - | |
| t_{sl} | LATCH setup time | 1 | - | - | |
| t_{whl} | LATCH pulse width | 1.6 | - | - | |

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DATA FORMAT

4 patterns input formats can be selected by setting D6 and D7.

(When the IC is powered up, the internal settings are not fixed.)



(1)

| DO1 | D11 | D21 | D31 | D41 | D51 | D6 | D7 |
|--|--|---|-----------------------------------|-----------------------------------|---|----|----|
| Rec out A S W 3,4 1 : Mute 0 : Pass | Rec out B S W 5,6 1 : Mute 0 : Pass | For the multiplex software S W 7 1 : A side 0 : B side | S W 8 1 : A side 0 : B side | S W 9 1 : A side 0 : B side | S W 10-1 S W 10-2 1 : ON 0 : OFF | 0 | 0 |

(2)

| DO2 | D12 | D22 | D32 | D42 | D52 | D6 | D7 |
|---|------------------------------------|---------------------------------------|------------------------------------|---------------------------------------|---------------------------------------|----|----|
| S W 11-1,2 S W 12-1,2 1:Aside/ON 0:Bside/OFF | S W 13 1 : A side 0 : B side | S W 21,22 1 : A side 0 : B side | S W 14 1 : A side 0 : B side | S W 17,18 1 : A side 0 : B side | S W 15,16 1 : A side 0 : B side | 0 | 1 |

(3)

| DO3 | D13 | D23 | D33 | D43 | D53 | D6 | D7 |
|--|-----|-----|---|-----|-----|----|----|
| ※ For Tone control (element) Refer to the Tone Control 1 Code | | | ※ For Tone control (gain) Refer to the Tone Control 2 Code | | | 1 | 0 |
| Bass Boost SW15,16 A / B | | | | | | | |

(4 - 1)

| DO4-1 | D14-1 | D24-1 | D34-1 | D44-1 | D54-1 | D6-1 | D7-1 |
|--|-------|-------|-------|-------|-------|------|------|
| ※ For Master Volume Refer to the Master Volume Code | | | | | 0 | 1 | 1 |

(4 - 2)

| DO4-2 | D14-2 | D24-2 | D34-2 | D44-2 | D54-2 | D6-2 | D7-2 |
|--|-------|-------|-------|-------|-------|------|------|
| ※ For Input selector Refer to the Input selector Code | | | | | 1 | 1 | 1 |

(5) Tone control 1 code (element)

| | | D03 | D13 | D23 |
|-------------|-----|-----|-----|-----|
| Tone 1 (F1) | | 0 | 0 | 1 |
| Tone 2 (F2) | | 0 | 1 | 0 |
| Tone 3 (F3) | | 0 | 1 | 1 |
| Tone 4 (F4) | | 1 | 0 | 0 |
| Tone 5 (F5) | | 1 | 0 | 1 |
| Bass Boost | ON | 1 | 1 | 0 |
| | OFF | 1 | 1 | 1 |

(6) Tone control 2 code (gain)

| | | D33 | D43 | D53 |
|-------|-------|-----|-----|-----|
| Boost | +0 dB | 0 | 0 | 0 |
| | +3 dB | 0 | 0 | 1 |
| | +6 dB | 0 | 1 | 0 |
| | +9 dB | 0 | 1 | 1 |
| Cut | -0 dB | 1 | 0 | 0 |
| | -3 dB | 1 | 0 | 1 |
| | -6 dB | 1 | 1 | 0 |
| | -9 dB | 1 | 1 | 1 |

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(7) Master volume code

| A T T | D04 | D14 | D24 | D34 | D44 |
|----------|-----|-----|-----|-----|-----|
| — 0.0 dB | 0 | 0 | 0 | 0 | 0 |
| — 2.0 dB | 1 | 0 | 0 | 0 | 0 |
| — 4.0 dB | 0 | 1 | 0 | 0 | 0 |
| — 6.0 dB | 1 | 1 | 0 | 0 | 0 |
| — 8.0 dB | 0 | 0 | 1 | 0 | 0 |
| —10.0 dB | 1 | 0 | 1 | 0 | 0 |
| —12.0 dB | 0 | 1 | 1 | 0 | 0 |
| —14.0 dB | 1 | 1 | 1 | 0 | 0 |
| —16.0 dB | 0 | 0 | 0 | 1 | 0 |
| —18.0 dB | 1 | 0 | 0 | 1 | 0 |
| —20.0 dB | 0 | 1 | 0 | 1 | 0 |
| —22.0 dB | 1 | 1 | 0 | 1 | 0 |
| —24.0 dB | 0 | 0 | 1 | 1 | 0 |
| —26.0 dB | 1 | 0 | 1 | 1 | 0 |
| —28.0 dB | 0 | 1 | 1 | 1 | 0 |
| —30.0 dB | 1 | 1 | 1 | 1 | 0 |
| —32.0 dB | 0 | 0 | 0 | 0 | 1 |
| —34.0 dB | 1 | 0 | 0 | 0 | 1 |
| —36.0 dB | 0 | 1 | 0 | 0 | 1 |
| —38.0 dB | 1 | 1 | 0 | 0 | 1 |
| —40.0 dB | 0 | 0 | 1 | 0 | 1 |
| —44.0 dB | 1 | 0 | 1 | 0 | 1 |
| —48.0 dB | 0 | 1 | 1 | 0 | 1 |
| —52.0 dB | 1 | 1 | 1 | 0 | 1 |
| —56.0 dB | 0 | 0 | 0 | 1 | 1 |
| —60.0 dB | 1 | 0 | 0 | 1 | 1 |
| —64.0 dB | 0 | 1 | 0 | 1 | 1 |
| —68.0 dB | 1 | 1 | 0 | 1 | 1 |
| —72.0 dB | 0 | 0 | 1 | 1 | 1 |
| —76.0 dB | 1 | 0 | 1 | 1 | 1 |
| —80.0 dB | 0 | 1 | 1 | 1 | 1 |
| — | 1 | 1 | 1 | 1 | 1 |

(8) Port output code

| DATA | | Port output |
|--------|---|-------------|
| D 32-2 | 0 | Port A : L |
| | 1 | Port A : H |
| D 44-2 | 0 | Port B : L |
| | 1 | Port B : H |

(9) Multilingual record code

| | D21 | D31 |
|--------------|-----|-----|
| Normal | 0 | 0 |
| Lch only | 0 | 1 |
| Rch only | 1 | 0 |
| R/L Exchange | 1 | 1 |

(10) Input selector code

| Selector | D14-2 | D14-2 | D24-3 |
|----------|-------|-------|-------|
| A | 0 | 0 | 0 |
| B | 0 | 0 | 1 |
| C | 0 | 1 | 0 |
| D | 0 | 1 | 1 |
| E | 1 | 0 | 0 |
| F | 1 | 1 | 0 |
| All off | 1 | 1 | 1 |

(11) The others code

| For voice cancel | |
|------------------|--------------------|
| D41=1 | SW9 : A side |
| D02=1 | SW11,12-1 : ON |
| | SW11,12-2 : A side |
| D12=0 | SW13 : B side |
| D32=0 | SW14 : B side |

| For Surround | |
|--------------|--------------------|
| D41=0 | SW9 : B side |
| D02=1 | SW11,12-1 : ON |
| | SW11,12-2 : A side |
| D12=1 | SW13 : A side |
| D32=1 | SW14 : A side |

| MODE | SW21,22 | SW17,18 | SW10-1 SW10-2 | SW15,16 |
|------------------------------------|---------|---------|------------------|---------|
| NORMAL STEREO | B side | B side | B side | B side |
| STEREO + MIC | B side | A side | B side | B side |
| MIX MODE (Source + Key control) | A side | A side | B side | B side |
| KEY CONTROL MODE | A side | A side | A side | B side |
| DPL MODE | B side | B side | A side | A side |

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ELECTRICAL CHARACTERISTICS

(Ta=25°C, AVDD=7.0V, AVSS=-7.0V, DVDD=5.0V ,f=1kHz
 Tone control & Bass Boost setting :0dB , unless otherwise noted)

(1) Power supply

| Parameter | Symbol | Conditions | Limits | | | Unit |
|----------------------------|--------|---|--------|-----|-----|------|
| | | | Min | typ | Max | |
| Circuit current (Analog +) | Aldd | AVDD=7.0V, AVSS= -7.0V ISINK of 36pin No signal input | - | 40 | 48 | mA |
| Circuit current (Analog -) | AIss | AVDD=7.0V, AVSS= -7.0V ISOURCE of 72pin No signal input | -48 | -40 | - | mA |
| Circuit current (Digital) | Dldd | DVDD= 5V ISINK of 31pin No signal input | - | 0.5 | 1.0 | mA |

(2) Input/Output

| Parameter | Symbol | Conditions | Limits | | | Unit | |
|-------------------------|-----------|--|------------------|------|------|--------|--------|
| | | | Min | typ | Max | | |
| Input impedance | Rin | 66 ~ 71pin, 74 ~ 79Pin, Ta=25°C | 20 | 47 | 100 | K | |
| Maximum input voltage | VIM | (66 ~ 71pin input), (74 ~ 79pin input) 28,37pin output RL =4.7K , THD=1% | 3.0 | 4.0 | — | Vrms | |
| Output terminal voltage | Vodc | 28pin, 37pin, No input signal | -0.1 | 0 | 0.1 | V | |
| | Vrecdc | 5pin, 60pin, No input signal | -0.1 | 0 | 0.1 | V | |
| I/O voltage gain | Gv | Vin=1Vrms, FLAT, (66 ~ 71Pin), (74 ~ 79Pin)-28,37Pin | 10.0 | 12.0 | 14.0 | dB | |
| Output noise voltage | Vono | JIS-A filter No input signal Rg=10K | 28,37pin ATT0 | — | 55.0 | 70.0 | μ Vrms |
| | | FLAT | ATTM | — | 5.0 | 15 | μ Vrms |
| | Vrecno | 6,59pin 7,58pin | — | 20.0 | 30 | μ Vrms | |
| Distortion | THD | 28pin, 37pin, BW=400 ~ 30kHz Vi = -20dBv , RL=4.7K | — | 0.01 | 0.05 | % | |
| | THDrecB,C | (6,59pin), (7,58pin), BW400 ~ 30kHz Vi = -20dBv , RL=20K | — | 0.01 | 0.05 | % | |
| Channel separation | CT | Vo=0.5Vrms , RL=4.7K , JIS-A 28pin—37pin Rg=0K , 61pin GND | — | -75 | -55 | dB | |
| | CTrec | Vo=0.5Vrms , RL=20K , JIS-A 6pin—59pin Rg=0K , 61pin GND | — | -75 | -55 | dB | |

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(3) Tone Control

| Parameter | Symbol | Conditions | Limits | | | Unit | |
|--------------------------------|---------|--|---|-------|------|------|----|
| | | | Min | typ | Max | | |
| Voltage gain (Tone control) | Gboost1 | 3dB | f=1KHz,Vo=1Vrms Input ;8pin,57pin Output ;22pin,43pin | 1.5 | 3 | 4.5 | dB |
| | Gboost2 | 6dB | | 4.5 | 6 | 7.5 | dB |
| | Gboost3 | 10dB | | 8.0 | 10 | 12.0 | dB |
| | Gcut1 | -3dB | | -4.5 | -3 | -1.5 | dB |
| | Gcut2 | -6dB | | -7.5 | -6 | -4.5 | dB |
| | Gcut3 | -10dB | | -12.0 | -10 | -8.0 | dB |
| Balance between channels | BALton | f=1KHz,Vo=1Vrms, Input;8,57Pin Output;22,43Pin +10dB and -10dB | -1.5 | 0 | +1.5 | dB | |

(4) Bass Boost

| Parameter | Symbol | Conditions | Limits | | | Unit |
|------------------------------|--------|--|--------|-----|------|------|
| | | | Min | typ | Max | |
| Voltage gain (Bass boost) | Gboost | f=70Hz,Vo=0.5Vrms Input ; 23,42pin Output ; 27,38pin | -10 | -6 | -2 | dB |
| Balance between channels | BALton | f=70Hz ,Vo=0.5Vrms Input ; 23,42Pin Output ; 27,38pin, Bass boost ON | -2.0 | 0 | +2.0 | dB |

(5) PORT OUTPUT

| Parameter | Symbol | Conditions | Limits | | | Unit |
|--------------------------|--------|------------|--------|-----|-----|------|
| | | | Min | typ | Max | |
| Minimum "H" voltage | VpHA | RL=1.8k | 5.4 | 6.0 | — | V |
| | VpHB | | | | | |
| Maximum "L" leak current | IpLA | | -3 | 0 | 3 | uA |
| | IpLA | | | | | |
| Maximum drive current | IpD | | — | 0.7 | 3 | mA |

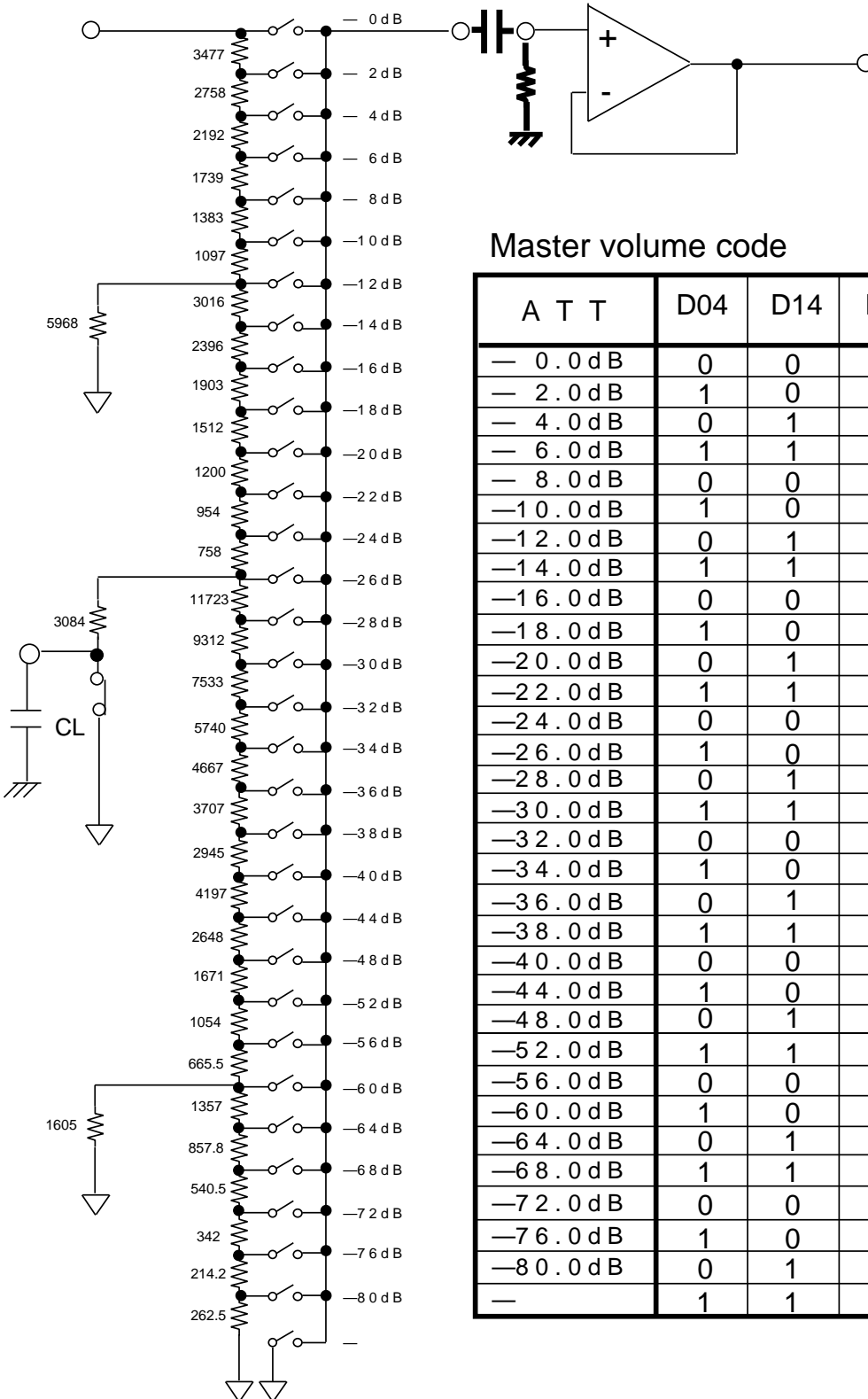
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DIGITAL SOUND CONTROLLER

Master volume circuit



Master volume code

| A T T | D04 | D14 | D24 | D34 | D44 |
|----------|-----|-----|-----|-----|-----|
| - 0.0 dB | 0 | 0 | 0 | 0 | 0 |
| - 2.0 dB | 1 | 0 | 0 | 0 | 0 |
| - 4.0 dB | 0 | 1 | 0 | 0 | 0 |
| - 6.0 dB | 1 | 1 | 0 | 0 | 0 |
| - 8.0 dB | 0 | 0 | 1 | 0 | 0 |
| -10.0 dB | 1 | 0 | 1 | 0 | 0 |
| -12.0 dB | 0 | 1 | 1 | 0 | 0 |
| -14.0 dB | 1 | 1 | 1 | 0 | 0 |
| -16.0 dB | 0 | 0 | 0 | 1 | 0 |
| -18.0 dB | 1 | 0 | 0 | 1 | 0 |
| -20.0 dB | 0 | 1 | 0 | 1 | 0 |
| -22.0 dB | 1 | 1 | 0 | 1 | 0 |
| -24.0 dB | 0 | 0 | 1 | 1 | 0 |
| -26.0 dB | 1 | 0 | 1 | 1 | 0 |
| -28.0 dB | 0 | 1 | 1 | 1 | 0 |
| -30.0 dB | 1 | 1 | 1 | 1 | 0 |
| -32.0 dB | 0 | 0 | 0 | 0 | 1 |
| -34.0 dB | 1 | 0 | 0 | 0 | 1 |
| -36.0 dB | 0 | 1 | 0 | 0 | 1 |
| -38.0 dB | 1 | 1 | 0 | 0 | 1 |
| -40.0 dB | 0 | 0 | 1 | 0 | 1 |
| -44.0 dB | 1 | 0 | 1 | 0 | 1 |
| -48.0 dB | 0 | 1 | 1 | 0 | 1 |
| -52.0 dB | 1 | 1 | 1 | 0 | 1 |
| -56.0 dB | 0 | 0 | 0 | 1 | 1 |
| -60.0 dB | 1 | 0 | 0 | 1 | 1 |
| -64.0 dB | 0 | 1 | 0 | 1 | 1 |
| -68.0 dB | 1 | 1 | 0 | 1 | 1 |
| -72.0 dB | 0 | 0 | 1 | 1 | 1 |
| -76.0 dB | 1 | 0 | 1 | 1 | 1 |
| -80.0 dB | 0 | 1 | 1 | 1 | 1 |
| - | 1 | 1 | 1 | 1 | 1 |

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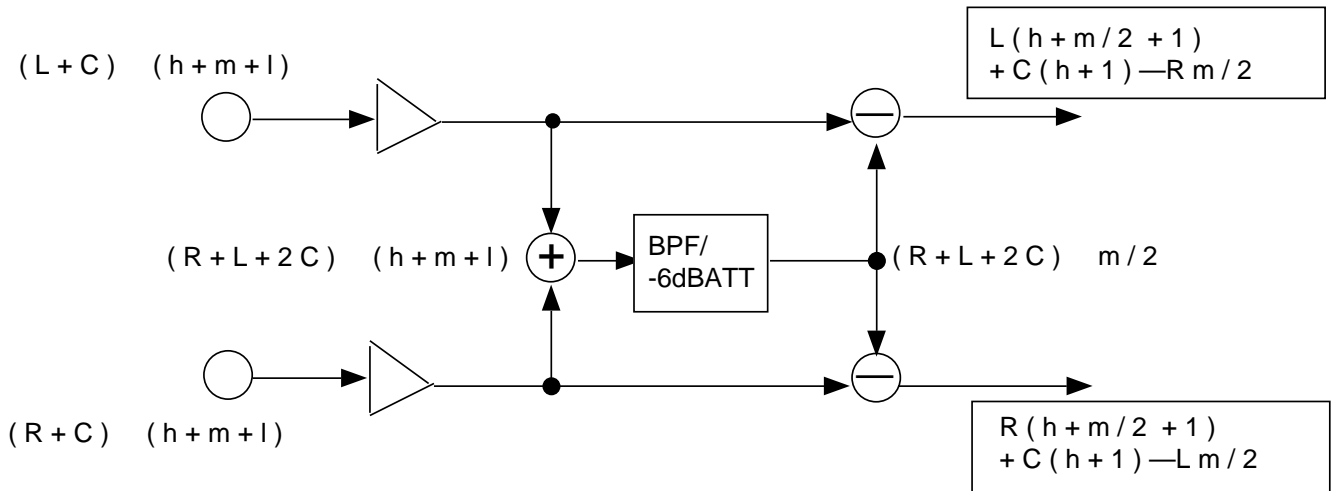
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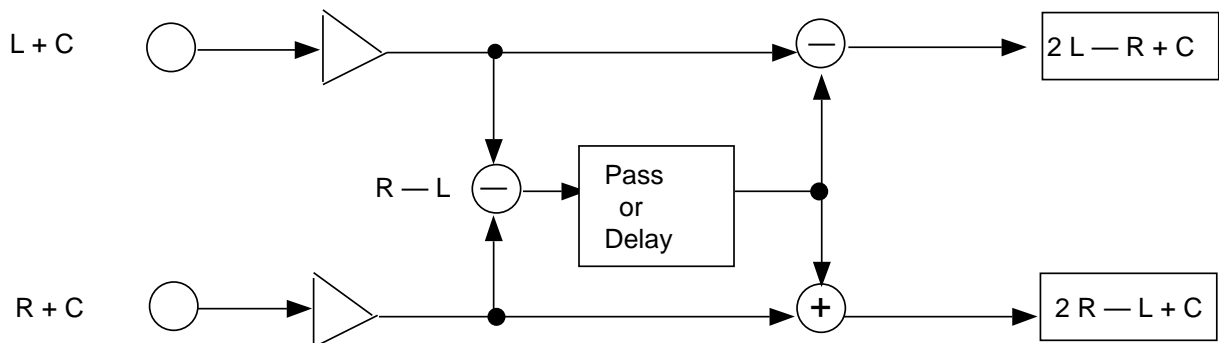
DIGITAL SOUND CONTROLLER

Function description

(1) Voice cancel block equivalent circuit



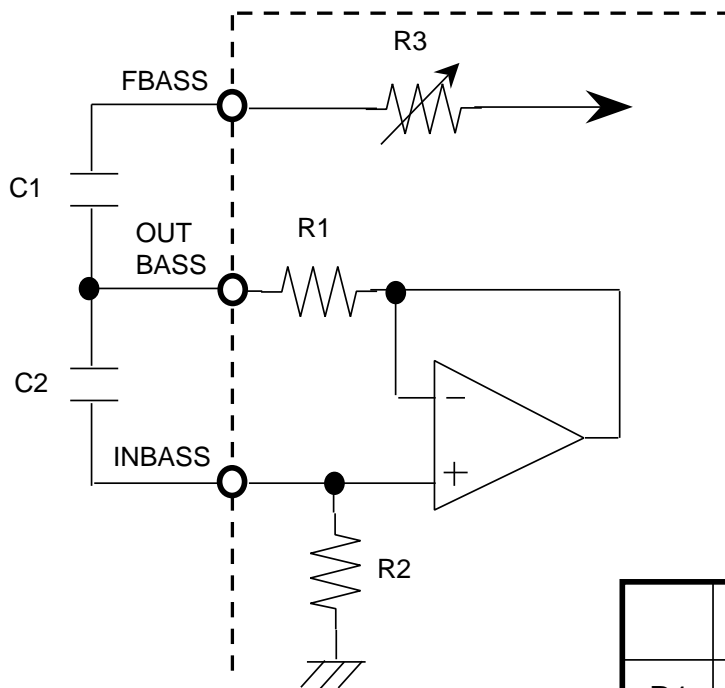
(2) Surround block equivalent circuit



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(3) Tone control equivalent circuit



Center frequency

$$f_0 = 1 / 2 \sqrt{C1 \cdot C2 \cdot R1 \cdot R2} \text{ [Hz]}$$

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

Example; Bass band (f=150Hz)

R1=1.5K , R2=56K

C1=1.5 μ, C2=0.01 μ

| | F1 | F2 | F3 | F4 | F5 |
|----|------|------|------|------|----|
| R1 | 1.0k | 1.0k | 1.0k | 1.0k | — |
| R2 | 300k | 300k | 300k | 150k | — |

Fig.1 The equivalent circuit of tone controller

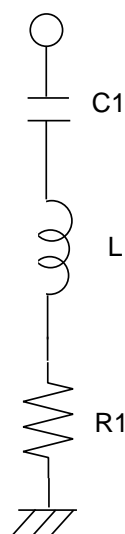


Fig.2 is equivalent to Fig.1
 To convert component constants,
 the equation below is used.

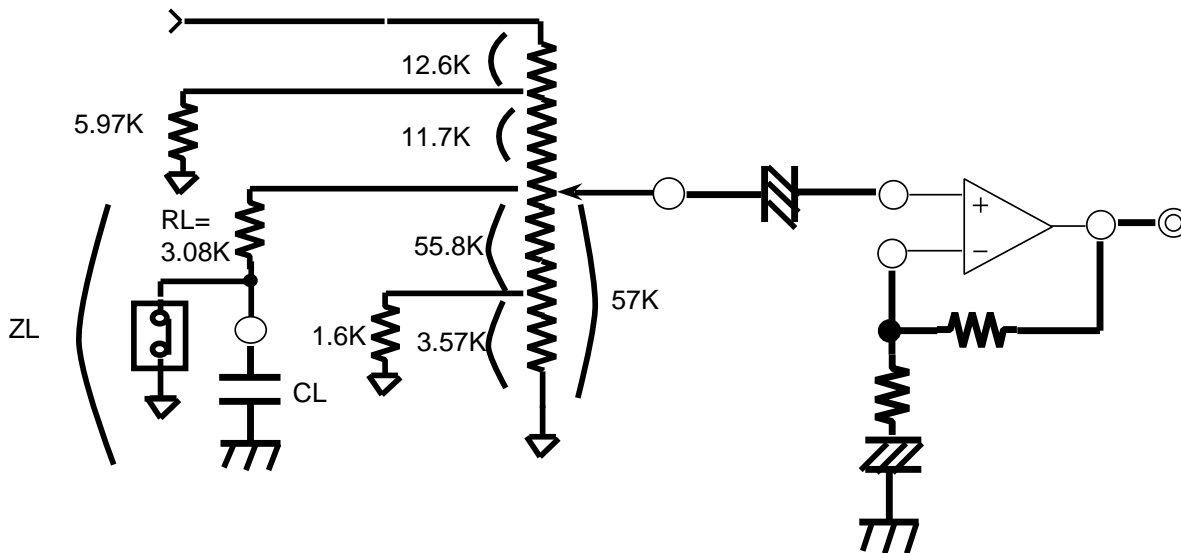
$$L = C2 \cdot R1 \cdot R2$$

Fig.12 The equivalent circuit using L

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(4) Bass boost equivalent circuit



Bass Boost loudness equivalent circuit (Center tap type)

Regard " $RL + \frac{1}{\omega \cdot CL}$ " as "ZL"

Next formula show the frequency characteristic.

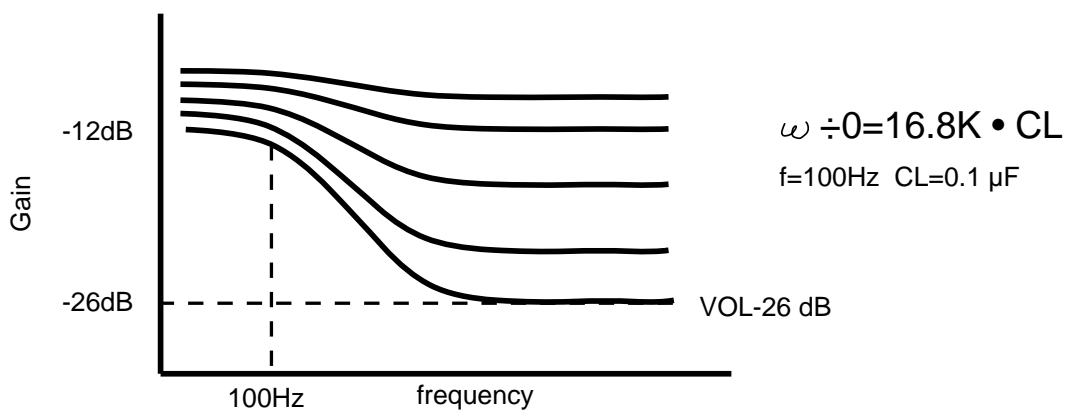
$$G_v = 20 \text{ Log} \left[\frac{ZL // 57K}{11.7K + ZL // 57K} \cdot \frac{5.97K // [11.7K + ZL // 57K]}{12.6K + 5.97K // [11.7K + ZL // 57K]} \right]$$

When a frequency is enough low ,

$$G_v = 20 \text{ Log} \left[\frac{57K}{11.7K + 57K} \cdot \frac{5.97K // [11.7K + 57K]}{12.6K + 5.97K // [11.7K + 57K]} \right] = -11.9 \text{ dB}$$

When a frequency is enough high ,

$$G_v = 20 \text{ Log} \left[\frac{3.08K // 57K}{11.7K + 3.08K // 57K} \cdot \frac{5.97K // [11.7K + 3.08K // 57K]}{12.6K + 5.97K // [11.7K + 3.08K // 57K]} \right] = -26 \text{ dB}$$



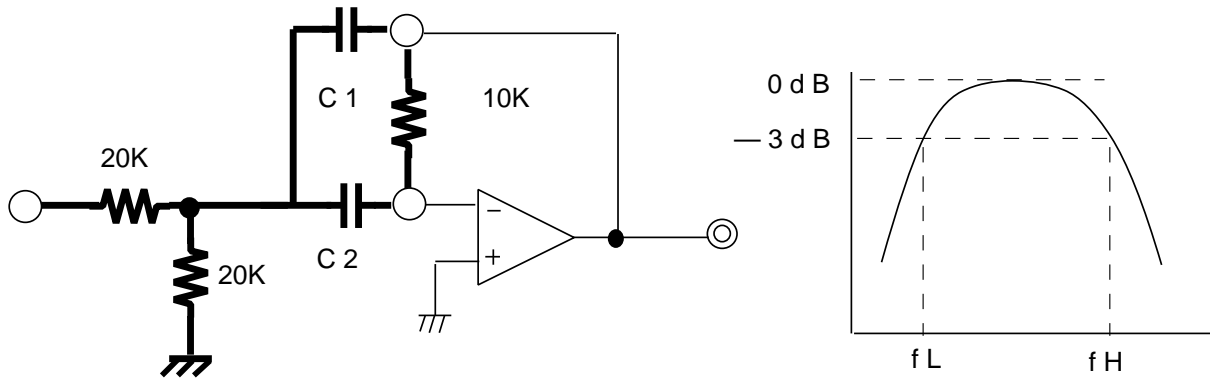
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(3) Band-Pass filter block equivalent circuit



(The equation for band-pass filter)

$$f H \text{ [cut-off frequency]} \quad \frac{1}{2 C 1 \cdot 10 K}$$

High frequency's side

$$f L \text{ [cut-off frequency]} \quad \frac{1}{2 C 2 \cdot 10 K}$$

Low frequency's side

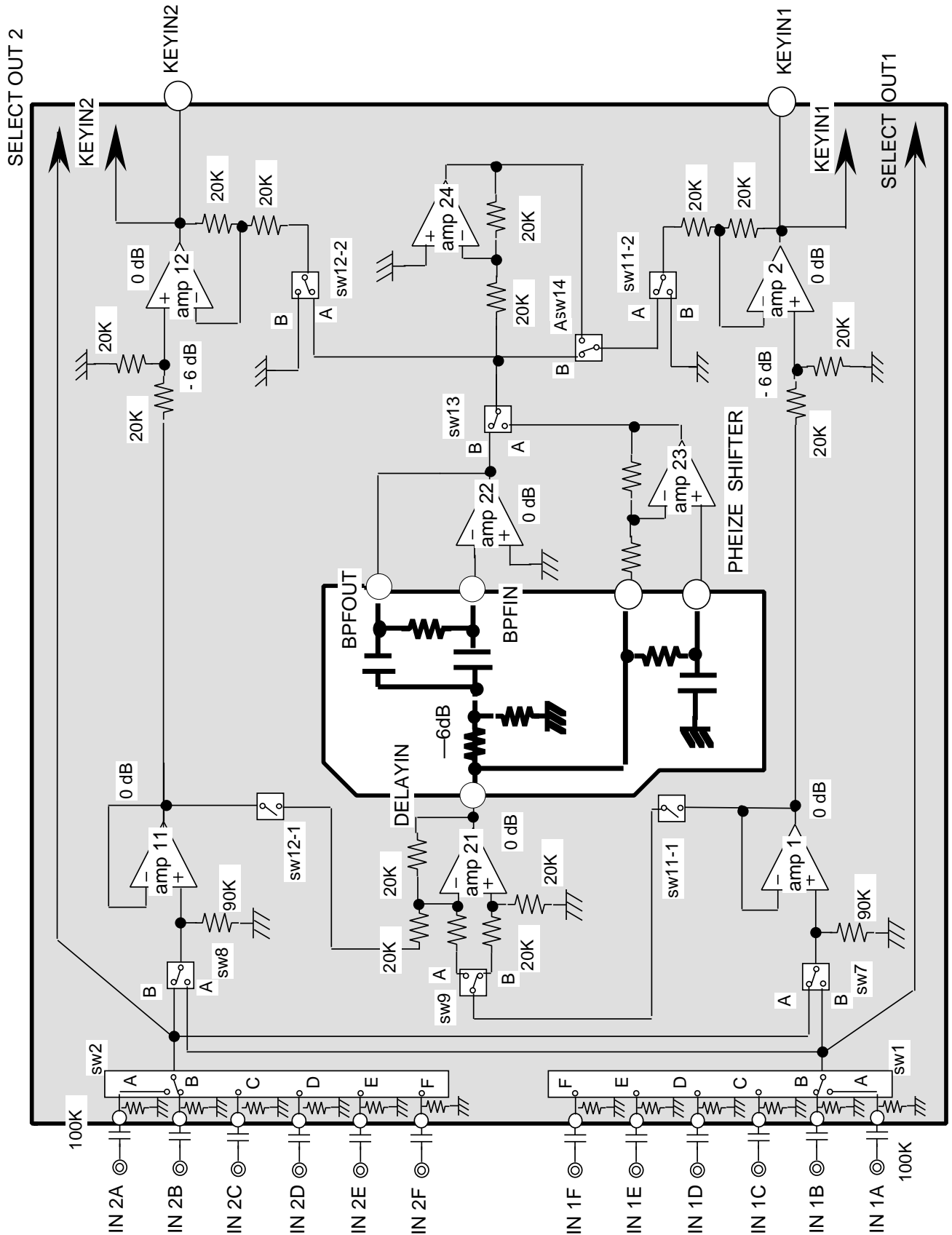
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The block diagram along the signal flow (No.1)

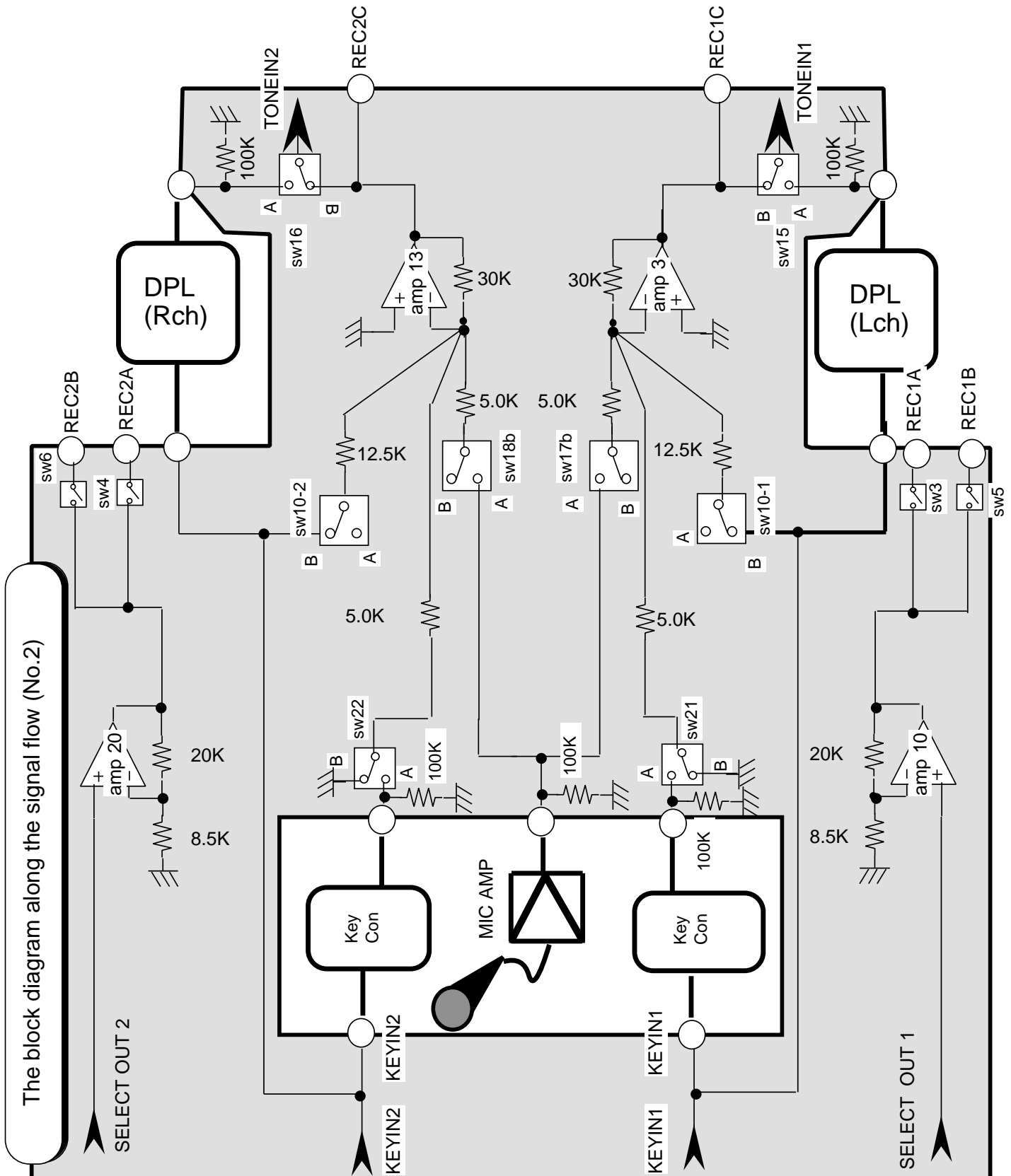


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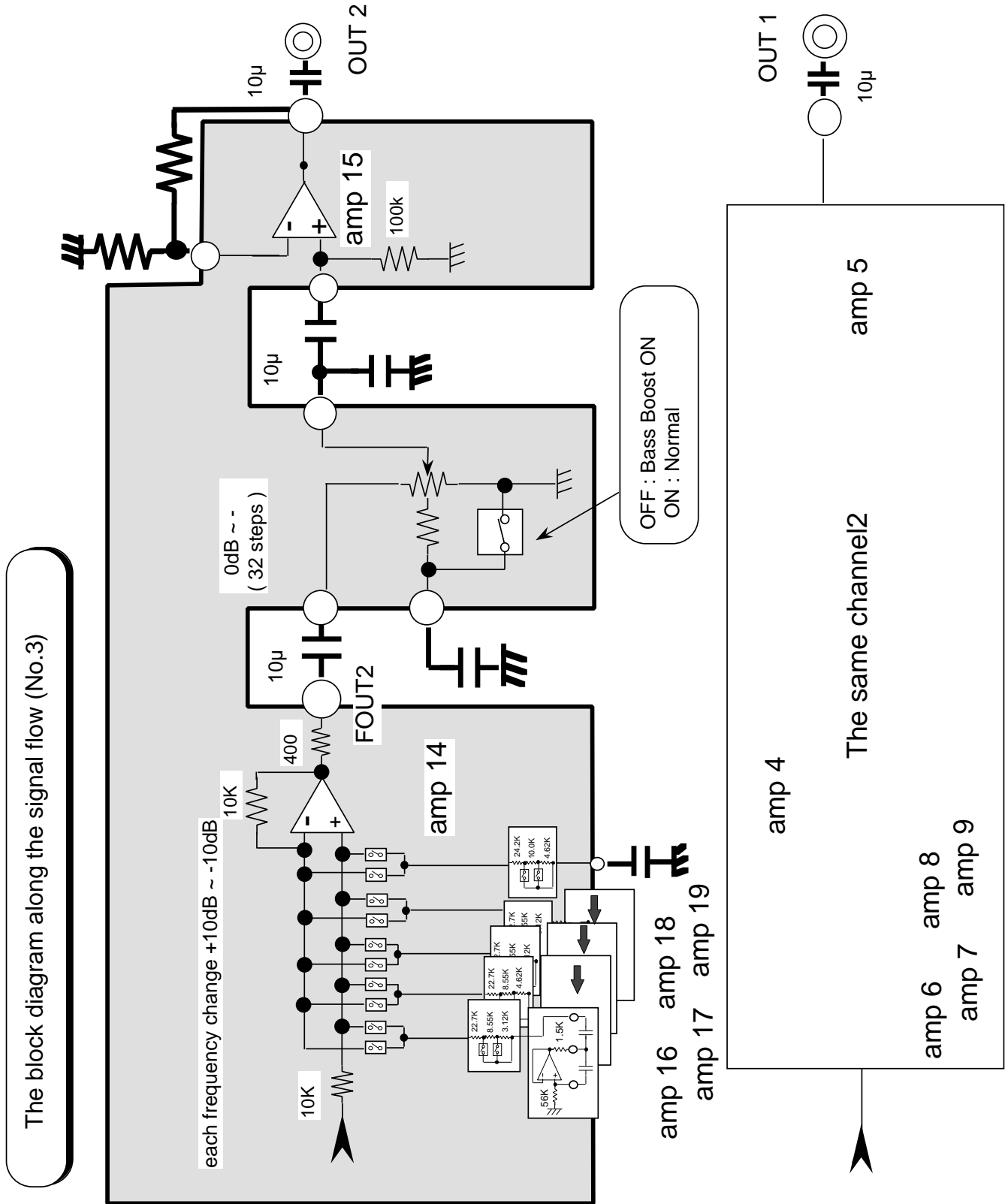


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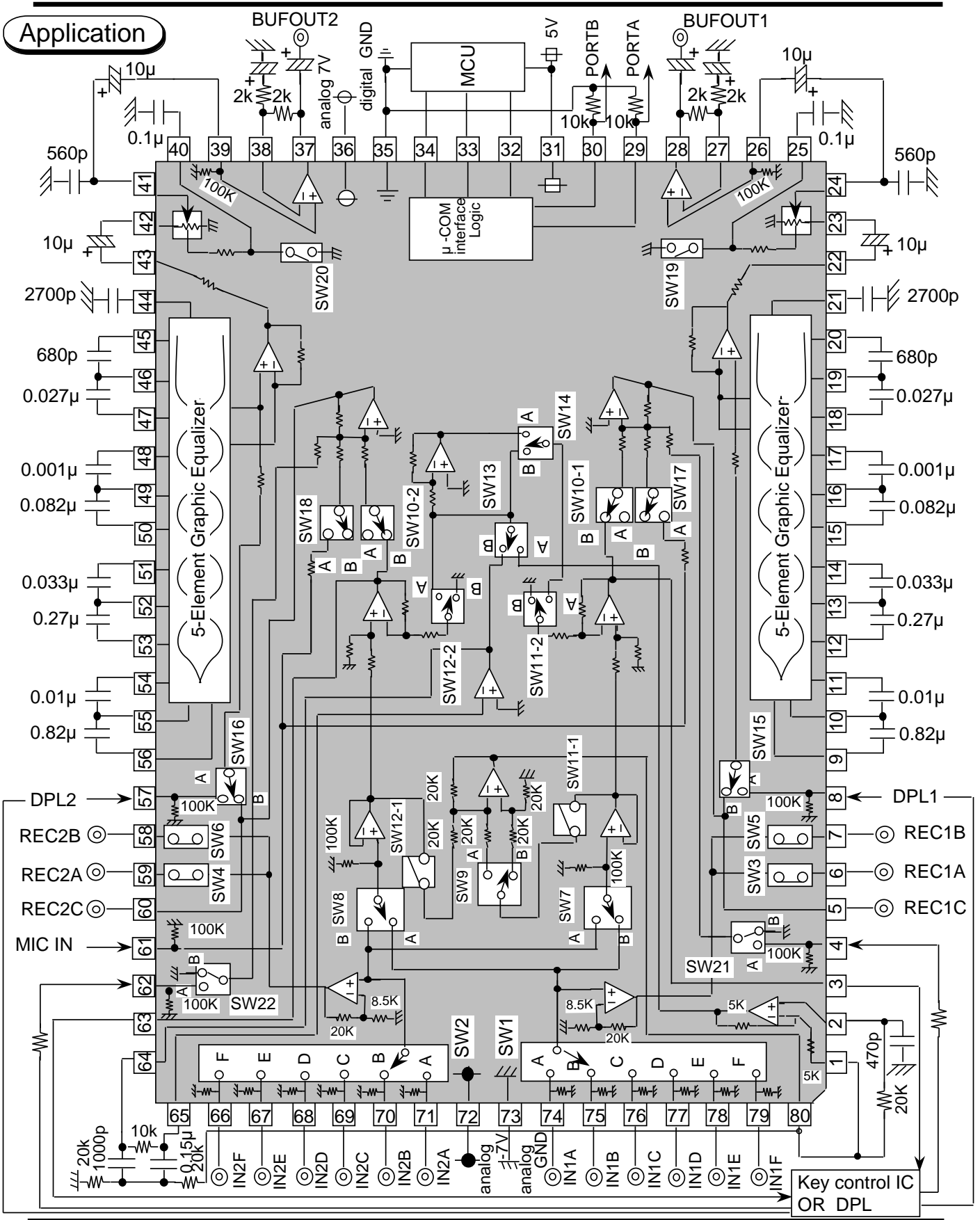


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Application