



SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

LV3328PM

Bi-CMOS LSI

For Car Audio Systems

Electronic Volume IC

Overview

The LV3328PM is an electronic volume and tone IC implements a rich set of audio control functions with a minimal number of external components. Functions include input selection switching function, an input gain, volume, loudness, balance, fader, general-purpose ports and bass/mid/treble control.

Features

- It is possible to eliminate from the external components of equalizer control block by SCF technology.
- Zero-cross switching circuits (Volume control block , Fader control block and General purpose volume block), soft step (3 band equalizer control) and soft mute circuits used for low noise even when input signals are present.
- Low power consumption due to the use of BiCMOS process.

Functions

- Input switching :
Single-end inputs (3 input systems).
Single-end inputs (2 input systems) or differential input (1 input system).
Differential input (1 input system).
- Input gain control :
The input single can be amplified by 0 to +18dB (1dB steps.)
- Loudness control :
Taps are output starting at the -32dB position of the ladder resistor and a loudness function implemented with external capacitor and resistor components.
- Volume control : +10dB to -79dB/-∞ (1dB steps)
L/R independent control.
- Bass control :
The bass control gain can be maximum boost +20dB position and maximum cut -20dB position.
(+20dB to -20dB in 1dB steps.)
The bass control center frequency 60Hz/70Hz/100Hz/120Hz can be selected.
The bass control quality factor 1.0/2.0 can be selected.

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- **Middle control :**
 The middle control gain can be maximum boost +20dB position and maximum cut -20dB position.
 (+20dB to -20dB in 1dB steps.)
 The middle control center frequency 700Hz/1KHz/1.2KHz can be selected.
 The middle control quality factor 1.0/2.0 can be selected.
- **Treble control :**
 The treble control gain can be maximum boost +20dB position and maximum cut -20dB position.
 (+20dB to -20dB in 1dB steps.)
 The treble control center frequency 7KHz/10KHz/11KHz/12KHz can be selected.
 The treble control quality factor 1.0/2.0 can be selected.
- **Fader control :**
 A total of 81 positions from 0 to -79dB in 1dB steps and $-\infty$ dB.
 Independent control each four channels output
- **General-purpose ports control :**
 Mono / stereo selection.
 A total of 81 positions from 0 to -79dB in 1dB steps and $-\infty$ dB.
 Fader-front output mix / general purpose output selection.
 Input switching control block / general purpose input selection .
- **Mute**

Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$, $V_{SS} = 0\text{V}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|---------------------|---|--------------------------|------------------|
| Maximum supply voltage | $V_{DD\text{ max}}$ | V_{DD} | 10 | V |
| Maximum input voltage | $V_{IN\text{ max}}$ | All input pins | $V_{SS}-0.3$ to V_{DD} | V |
| Allowable power dissipation | $P_d\text{ max}$ | $T_a \leq 85^\circ\text{C}$, when mounted on a printed circuit board * | 600 | mW |
| Operating temperature | T_{opr} | | -40 to +85 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | -50 to +125 | $^\circ\text{C}$ |

* Specified circuit board : $114.3 \times 76.1 \times 1.6\text{mm}^3$: glass epoxy board

Allowable Operating Ratings at $T_a = 25^\circ\text{C}$, $V_{SS} = 0\text{V}$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|--------------------------|--------------|-------------------|----------|-----|-----|---------------|
| | | | min | typ | max | |
| Supply voltage | V_{DD} | V_{DD} | 7.0 | 9.0 | 9.5 | V |
| High-level input voltage | V_{IH} | DATA, CLK, LEVDET | 3.0 | | 5.5 | V |
| Low-level input voltage | V_{IL} | DATA, CLK, LEVDET | V_{SS} | | 1.0 | V |
| Input pulse width | $T_{\phi W}$ | CLK | 0.6 | | | μs |
| Setup time | T_{setup} | DATA, CLK | 0.1 | | | μs |
| Hold time | T_{hold} | DATA, CLK | | | 0.9 | μs |
| Operating frequency | fopg | CLK | | | 400 | kHz |

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Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{DD} = 9\text{V}$, $V_{SS} = 0\text{V}$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---------------------------|---------|----------------|----------|----------|----------|------------|
| | | | min | typ | max | |
| Input block | | | | | | |
| Input resistance | Rin | L1-L3, R1-R3 | | 50 | | k Ω |
| | | L4-L7, R4-R7 | | 250 | | k Ω |
| Minimum input gain | Gin min | | -1.0 | 0 | +1.0 | dB |
| Maximum input gain | Gin max | | +17 | +18 | +19 | dB |
| Inter-step setting error | ATerr | | -1.0 | | +1.0 | dB |
| Left/Right balance | BAL | | -0.5 | | +0.5 | dB |
| Volume block | | | | | | |
| Input resistance | Rvr | LVRIN, RVRIN | | 200 | | k Ω |
| Inter-step setting error | ATerr | +10dB to -40dB | -0.5 | | +0.5 | dB |
| Left/Right balance | BAL | +10dB to -40dB | -0.5 | | +0.5 | dB |
| Bass block | | | | | | |
| The maximum gain setting | Gb max | max. boost/cut | ± 18 | ± 20 | ± 22 | dB |
| Inter-step setting error | ATerr | -10dB to +10dB | -1.0 | | +1.0 | dB |
| Left/Right balance | BAL | | -1.0 | | +1.0 | dB |
| Center frequency | f01 | | | 60 | | Hz |
| | f02 | | | 70 | | Hz |
| | f03 | | | 100 | | Hz |
| | f04 | | | 120 | | Hz |
| Quality Factor | Q01 | | | 1.0 | | |
| | Q02 | | | 2.0 | | |
| Mid block | | | | | | |
| The maximum gain setting | Gb max | max. boost/cut | ± 18 | ± 20 | ± 22 | dB |
| Inter-step setting error | ATerr | -10dB to +10dB | -1.0 | | +1.0 | dB |
| Left/Right balance | BAL | | -1.0 | | +1.0 | dB |
| Center frequency | f01 | | | 700 | | Hz |
| | f02 | | | 1 | | kHz |
| | f03 | | | 1.2 | | kHz |
| Quality Factor | Q01 | | | 1.0 | | |
| | Q02 | | | 2.0 | | |
| Treble block | | | | | | |
| The maximum gain setting | Gb max | max. boost/cut | ± 18 | ± 20 | ± 22 | dB |
| Inter-step setting error | ATerr | -10dB to +10dB | -1.0 | | +1.0 | dB |
| Left/Right balance | BAL | | -1.0 | | +1.0 | dB |
| Center frequency | f01 | | | 7 | | kHz |
| | f02 | | | 10 | | kHz |
| | f03 | | | 11 | | kHz |
| | f04 | | | 12 | | kHz |
| Quality Factor | Q01 | | | 1.0 | | |
| | Q02 | | | 2.0 | | |
| General port block | | | | | | |
| Input resistance | Rgp | EXLIN, EXRIN | | 50 | | k Ω |
| Inter-step setting error | ATerr | 0dB to -40dB | -0.5 | | +0.5 | dB |
| Left/Right balance | BAL | 0dB to -40dB | -0.5 | | +0.5 | dB |
| Fader block | | | | | | |
| Input resistance | Rfed | LFIN, RFIN | | 50 | | k Ω |
| Inter-step setting error | ATerr | 0dB to -40dB | -0.5 | | +0.5 | dB |
| Left/Right balance | BAL | 0dB to -40dB | -0.5 | | +0.5 | dB |

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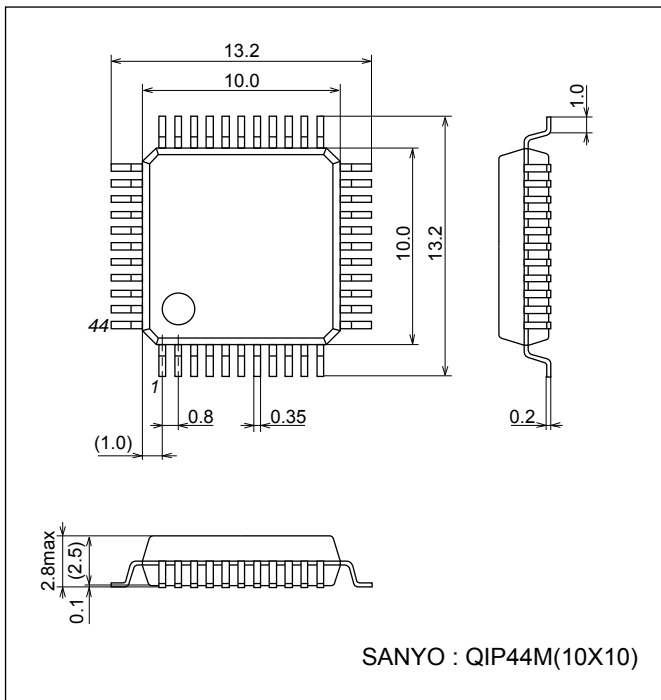
Overall Characteristics at $T_a = 25^\circ\text{C}$, $V_{DD} = 9\text{V}$, $V_{SS} = 0\text{V}$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|------------------------------|-----------|--|---------|------|------|------------------|
| | | | min | typ | max | |
| A loss of insertion | ATT | | -1.0 | | +1.0 | dB |
| Total harmonic distortion | THD | $V_{IN} = 1\text{Vrms}$, $f = 1\text{kHz}$ | | 0.01 | | % |
| Inter-input crosstalk | CT | $V_{IN} = 1\text{Vrms}$, $f = 1\text{kHz}$ | | 80 | | dB |
| Left/Right channel crosstalk | CT | $V_{IN} = 1\text{Vrms}$, $f = 1\text{kHz}$ | | 80 | | dB |
| Maximum attenuation | V_O min | $V_{IN} = 1\text{Vrms}$, $f = 1\text{kHz}$ | | 80 | | dB |
| Output noise voltage | VN | IHF-A, $R_{in} = 1\text{k}\Omega$ | | 11 | | μVrms |
| Current drain | I_{DD} | | | 32 | | mA |
| Input high-level current | I_{IH} | DATA, CLK, $V_{IN} = 5.5\text{V}$ | | | 10 | μA |
| Input low-level current | I_{IL} | DATA, CLK, $V_{IN} = 0\text{V}$ | -10 | | | μA |
| Maximum input voltage | VCL | THD = 1% $R_L = 10\text{k}\Omega$ all controls flat, $f_{IN} = 1\text{kHz}$ | | 2.5 | | Vrms |
| Common-mode rejection ratio | CMRR | $V_{IN} = 1\text{Vrms}$, $f = 1\text{kHz}$ | | 50 | | dB |

Package Dimensions

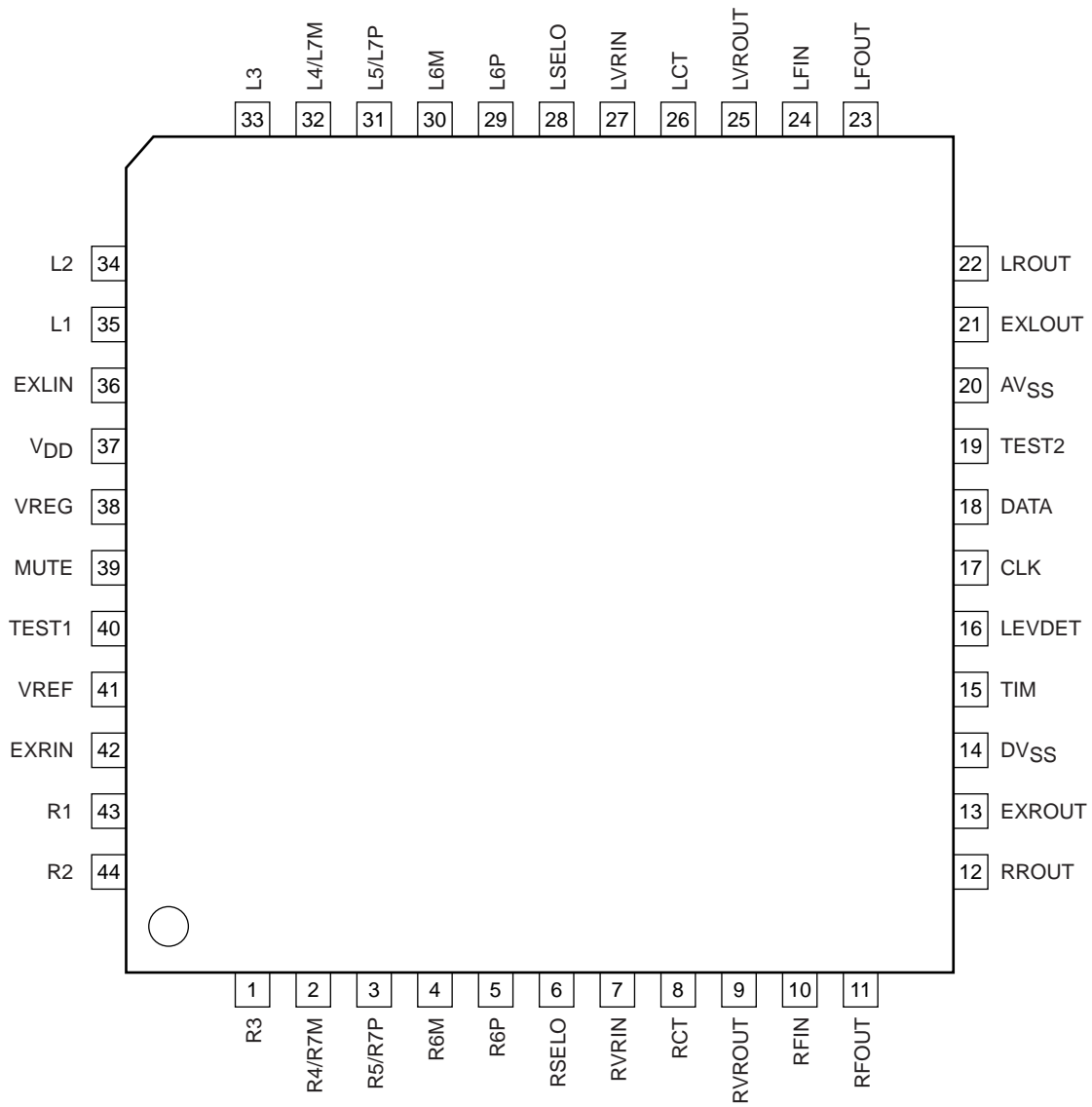
unit : mm (typ)

3148A



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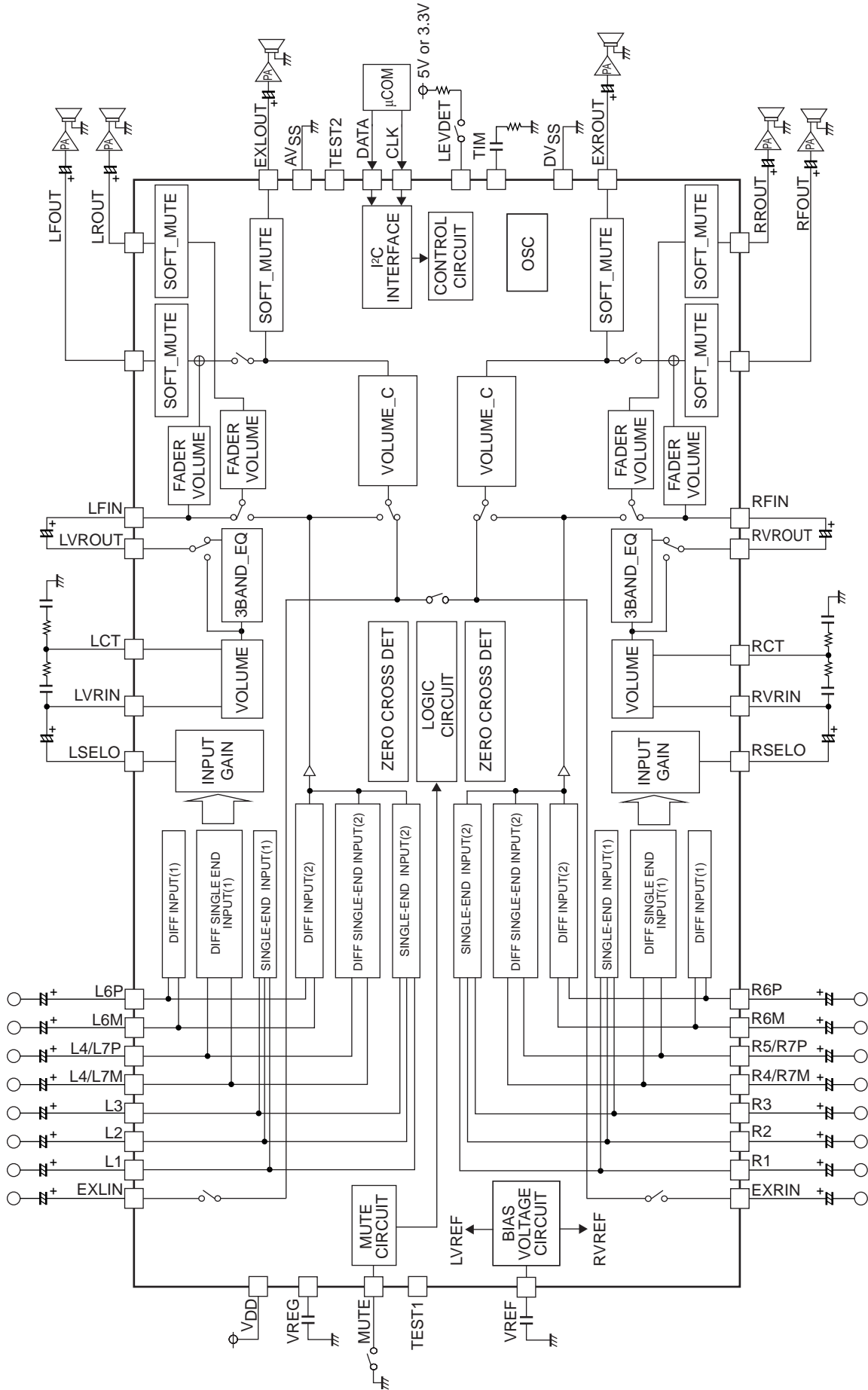
Pin Assignment



PCA01517

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Block Diagram



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Pin Functions

| Pin No. | Pin | Function | Equivalent Circuit |
|---------------------------------|--------------------------------------|---|--------------------|
| 35 34 33 43 44 1 | L1 L2 L3 R1 R2 R3 | Single end input pins. | |
| 32 31 2 3 | L4/L7M L5/L7P R4/R7M R5/R7P | Single end input pins/ Differential input pins When differential input is selected L4→L7M, L5→L7P, R4→R7M, R5→R7P | |
| 30 29 4 5 | L6M L6P R6M R6P | Differential input pins. | |
| 28 6 | LSELO RSELO | Input selector output pins. | |
| 27 7 | LVRIN RVRIN | Main volume input pins. | |
| 26 8 | LCT RCT | Loudness function pins. | |

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| Pin No. | Pin | Function | Equivalent Circuit |
|----------------------|----------------------------------|--|--------------------|
| 25 9 | LVROUT RVROUT | Tone output pins. | |
| 24 10 | LFIN RFIN | Fader block input pins. Drive at low impedance. | |
| 23 22 11 12 | LFOUT LROUT RFOUT RROUT | Fader output pins. Attenuation is possible separately for the front end and rear end. | |
| 41 | VREF | Connect a capacitor of a few tens of uF between VREF and AVSS (VSS) as a 0.5 × VDD voltage generator, current ripple countermeasure. | |
| 38 | VREG | Internal logic voltage pin. | |
| 37 | VDD | Power supply pin. | |
| 20 | AVSS | Analog ground pin. | |
| 14 | DVSS | Digital ground pin | |
| 39 | MUTE | External muting control pin. Setting this pin to VSS level sets forcibly fader volume block to -∞ level. | |
| 15 | TIM | Timer pin when there is no signal in the zero cross circuit. Forcibly set data when there is no zero cross signal, from the time the data is set until the timer ends. | |

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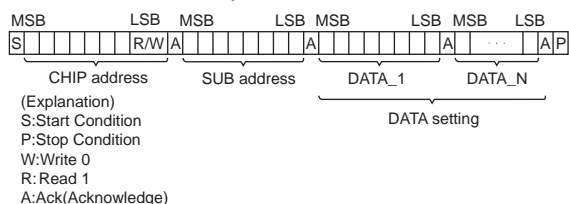
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| Pin No. | Pin | Function | Equivalent Circuit |
|----------|------------------|--|--------------------|
| 17 | CLK | Serial data clock input pin for control. | |
| 18 | DATA | Serial data input pin for control. | |
| 16 | LEVDET | Output level detection pin. When the level detection unused: OPEN | |
| 40 19 | TEST1 TEST2 | TEST pin Normally this pin is OPEN. | |
| 36 42 | EXLIN EXRIN | General-purpose port input pin. | |
| 21 13 | EXLOUT EXROUT | General-purpose port output pin. | |

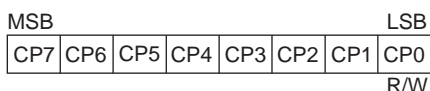
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DATA format : I²C data specification



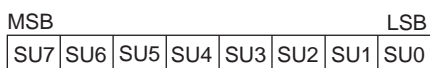
For continuous data transmission, the auto increment function causes data to be written into the sub-address DATA_(N+1). The sub-address of DATA_29 is followed by DATA_1.

CHIP address



| | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|--|
| CP7 | CP6 | CP5 | CP4 | CP3 | CP2 | CP1 | CP0 | |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |

SUB address



| Block | SUB address | | | | | | | | |
|---|-------------|-----|-----|-----|-----|-----|-----|-----|-----|
| | | SU7 | SU6 | SU5 | SU4 | SU3 | SU2 | SU1 | SU0 |
| Input selection (1) | DATA_1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Input selection (2) | DATA_2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Input gain control (Lch) | DATA_3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Input gain control (Rch) | DATA_4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Volume control (Lch) | DATA_5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Volume control(Rch) | DATA_6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| BASS f0 Q setting(Lch) | DATA_7 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| BASS f0 Q setting(Rch) | DATA_8 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| MID f0 Q setting(Lch) | DATA_9 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| MID f0 Q setting(Rch) | DATA_10 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| TREBLE f0 Q setting(Lch) | DATA_11 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| TREBLE f0 Q setting(Rch) | DATA_12 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| BASS control (Lch) | DATA_13 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| BASS control (Rch) | DATA_14 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| MID control (Lch) | DATA_15 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| MID control (Rch) | DATA_16 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| TREBLE control (Lch) | DATA_17 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| TREBLE control (Rch) | DATA_18 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| General-purpose volume control (Lch) | DATA_19 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| General-purpose volume control (Rch) | DATA_20 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Fader control (LFOUT) | DATA_21 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Fader control (LROUT) | DATA_22 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| Fader control (RFOUT) | DATA_23 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| Fader control (RROUT) | DATA_24 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| General-purpose input, mixing, output level detection, FAD_rear | DATA_25 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Loudness, Tone-pass select, EXTOUT output signal setting | DATA_26 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| Zero crossing control | DATA_27 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| Soft step/soft mute | DATA_28 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| TEST control | DATA_29 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |

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DATA

| | | | | | | | |
|-----|----|----|----|----|----|----|-----|
| MSB | | | | | | | LSB |
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

DATA_1(input selection(1))

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
|----|----|----|----|----|----|----|----|---------------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | INMUTE |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | L1(R1):INPUT(1) setting |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | L2(R2):INPUT(1) setting |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | L3(R3):INPUT(1) setting |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | L4(R4):INPUT(1) setting |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | L5(R5):INPUT(1) setting |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | L6(R6):INPUT(1) setting |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | L7(R7):INPUT(1) setting*1 |

*1: The input is switched to the difference stereo input.(object chanel...L4(L7M),L5(L7P),R4(R7M),R5(R7P))

DATA_2(input selection(2))

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
|----|----|----|----|----|----|----|----|---------------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | INMUTE |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | L1(R1):INPUT(2) setting |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | L2(R2):INPUT(2) setting |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | L3(R3):INPUT(2) setting |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | L4(R4):INPUT(2) setting |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | L5(R5):INPUT(2) setting |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | L6(R6):INPUT(2) setting |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | L7(R7):INPUT(2) setting*2 |

*2: The input is switched to the difference stereo input. (object chanel...L4(L7M),L5(L7P),R4(R7M),R5(R7P))

DATA_3,DATA_4(input gain control)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_3:Lch side DATA_4:Rch side |
|----|----|----|----|----|----|----|----|------------------------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | +1dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | +2dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | +3dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | +4dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | +5dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | +6dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | +7dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | +8dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | +9dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | +10dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | +11dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | +12dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | +13dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | +14dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | +15dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | +16dB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | +17dB |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | +18dB |

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DATA_5,DATA_6(volume control):10dB to -40dB

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_5:Lch side DATA_6:Rch side |
|----|----|----|----|----|----|----|----|------------------------------------|
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 10dB |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 9dB |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 8dB |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 7dB |
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 6dB |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 5dB |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 4dB |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 3dB |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 2dB |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1dB |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -2dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -3dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -4dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -5dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -6dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -7dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -8dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -9dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -10dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -11dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -12dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -13dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -14dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -15dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -16dB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -17dB |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | -18dB |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | -19dB |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -20dB |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -21dB |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | -22dB |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | -23dB |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | -24dB |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | -25dB |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | -26dB |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | -27dB |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | -28dB |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | -29dB |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | -30dB |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | -31dB |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -32dB |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -33dB |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | -34dB |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | -35dB |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | -36dB |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | -37dB |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | -38dB |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | -39dB |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | -40dB |

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DATA_5,DATA_6(volume control):-41dB to -∞

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_5:Lch side DATA_6:Rch side |
|----|----|----|----|----|----|----|----|------------------------------------|
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | -41dB |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | -42dB |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | -43dB |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | -44dB |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | -45dB |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | -46dB |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | -47dB |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -48dB |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -49dB |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | -50dB |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | -51dB |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | -52dB |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | -53dB |
| 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | -54dB |
| 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | -55dB |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | -56dB |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | -57dB |
| 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | -58dB |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | -59dB |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | -60dB |
| 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | -61dB |
| 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -62dB |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -63dB |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -64dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -65dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -66dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -67dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | -68dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | -69dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | -70dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | -71dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | -72dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | -73dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | -74dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | -75dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | -76dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | -77dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | -78dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | -79dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | -∞ |

LV3328PM

DATA_7,DATA_8(BASS f0,Q setting)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_7:Lch side DATA_8:Rch side |
|----|----|----|----|----|----|----|----|------------------------------------|
| 0 | 0 | * | * | 0 | 0 | 0 | 0 | f0:60Hz |
| 1 | 0 | * | * | 0 | 0 | 0 | 0 | f0:70Hz |
| 0 | 1 | * | * | 0 | 0 | 0 | 0 | f0:100Hz |
| 1 | 1 | * | * | 0 | 0 | 0 | 0 | f0:120Hz |
| | | | | | | | | |
| * | * | 0 | 0 | 0 | 0 | 0 | 0 | Q:1.00 |
| * | * | 1 | 0 | 0 | 0 | 0 | 0 | Q:2.00 |

DATA_9,DATA_10(MID f0,Q setting)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_9:Lch side DATA_10:Rch side |
|----|----|----|----|----|----|----|----|-------------------------------------|
| 0 | 0 | * | * | 0 | 0 | 0 | 0 | f0:700Hz |
| 1 | 0 | * | * | 0 | 0 | 0 | 0 | f0:1kHz |
| 0 | 1 | * | * | 0 | 0 | 0 | 0 | f0:1.2kHz |
| | | | | | | | | |
| * | * | 0 | 0 | 0 | 0 | 0 | 0 | Q:1.00 |
| * | * | 1 | 0 | 0 | 0 | 0 | 0 | Q:2.00 |

DATA_11,DATA_12(TREBLE f0,Q setting)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_11:Lch side DATA_12:Rch side |
|----|----|----|----|----|----|----|----|--------------------------------------|
| 0 | 0 | * | * | 0 | 0 | 0 | 0 | f0:7kHz |
| 1 | 0 | * | * | 0 | 0 | 0 | 0 | f0:10kHz |
| 0 | 1 | * | * | 0 | 0 | 0 | 0 | f0:11kHz |
| 1 | 1 | * | * | 0 | 0 | 0 | 0 | f0:12kHz |
| | | | | | | | | |
| * | * | 0 | 0 | 0 | 0 | 0 | 0 | Q:1.00 |
| * | * | 1 | 0 | 0 | 0 | 0 | 0 | Q:2.00 |

LV3328PM

DATA_13,DATA_14(TONE block BASS control)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_13:Lch side DATA_14:Rch side |
|----|----|----|----|----|----|----|----|--------------------------------------|
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | GAIN:+20dB |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+19dB |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+18dB |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+17dB |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+16dB |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+15dB |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+14dB |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+13dB |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+12dB |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+11dB |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+10dB |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+9dB |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+8dB |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+7dB |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+6dB |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+5dB |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+4dB |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+3dB |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+2dB |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+1dB |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:0dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-1dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-2dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-3dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-4dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-5dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-6dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-7dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-8dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-9dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-10dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-11dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-12dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-13dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-14dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-15dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-16dB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-17dB |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-18dB |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-19dB |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | GAIN:-20dB |

LV3328PM

DATA_15,DATA_16(TONE block MID control)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_15:Lch side DATA_16:Rch side |
|----|----|----|----|----|----|----|----|--------------------------------------|
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | GAIN:+20dB |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+19dB |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+18dB |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+17dB |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+16dB |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+15dB |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+14dB |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+13dB |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+12dB |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+11dB |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+10dB |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+9dB |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+8dB |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+7dB |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+6dB |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+5dB |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+4dB |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+3dB |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+2dB |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+1dB |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:0dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-1dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-2dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-3dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-4dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-5dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-6dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-7dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-8dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-9dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-10dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-11dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-12dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-13dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-14dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-15dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-16dB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-17dB |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-18dB |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-19dB |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | GAIN:-20dB |

LV3328PM

DATA_17,DATA_18(TONE block treble control)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_17:Lch side DATA_18:Rch side |
|----|----|----|----|----|----|----|----|--------------------------------------|
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | GAIN:+20dB |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+19dB |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+18dB |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+17dB |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | GAIN:+16dB |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+15dB |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+14dB |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+13dB |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | GAIN:+12dB |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+11dB |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+10dB |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+9dB |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | GAIN:+8dB |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+7dB |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+6dB |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+5dB |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | GAIN:+4dB |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+3dB |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+2dB |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | GAIN:+1dB |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:0dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-1dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-2dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GAIN:-3dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-4dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-5dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-6dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | GAIN:-7dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-8dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-9dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-10dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | GAIN:-11dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-12dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-13dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-14dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | GAIN:-15dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-16dB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-17dB |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-18dB |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | GAIN:-19dB |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | GAIN:-20dB |

LV3328PM

DATA_19,DATA_20(General-purpose volume control):0dB to -54dB

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_19:Lch side DATA_20:Rch side |
|----|----|----|----|----|----|----|----|--------------------------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -2dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -3dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -4dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -5dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -6dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -7dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -8dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -9dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -10dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -11dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -12dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -13dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -14dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -15dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -16dB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -17dB |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | -18dB |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | -19dB |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -20dB |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -21dB |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | -22dB |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | -23dB |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | -24dB |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | -25dB |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | -26dB |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | -27dB |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | -28dB |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | -29dB |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | -30dB |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | -31dB |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -32dB |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -33dB |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | -34dB |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | -35dB |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | -36dB |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | -37dB |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | -38dB |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | -39dB |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | -40dB |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | -41dB |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | -42dB |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | -43dB |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | -44dB |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | -45dB |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | -46dB |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | -47dB |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -48dB |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -49dB |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | -50dB |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | -51dB |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | -52dB |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | -53dB |
| 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | -54dB |

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DATA_19,DATA_20(General-purpose volume control):-55dB to -∞

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_19:Lch side DATA_20:Rch side |
|----|----|----|----|----|----|----|----|--------------------------------------|
| 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | -55dB |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | -56dB |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | -57dB |
| 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | -58dB |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | -59dB |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | -60dB |
| 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | -61dB |
| 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -62dB |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -63dB |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -64dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -65dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -66dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -67dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | -68dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | -69dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | -70dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | -71dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | -72dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | -73dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | -74dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | -75dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | -76dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | -77dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | -78dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | -79dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | -∞ |

DATA_21,DATA_22,DATA_23,DATA_24(Fader control):0dB to -25dB

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_21:LFOUT, DATA_22:LROUT DATA_23:RFOUT, DATA_24:RROUT |
|----|----|----|----|----|----|----|----|--|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -2dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -3dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -4dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -5dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -6dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -7dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -8dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -9dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -10dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -11dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -12dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -13dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -14dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -15dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -16dB |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -17dB |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | -18dB |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | -19dB |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -20dB |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -21dB |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | -22dB |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | -23dB |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | -24dB |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | -25dB |

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DATA_21,DATA_22,DATA_23,DATA_24(Fader control):-26dB to $-\infty$

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_21:LFOUT, DATA_22:LROUT DATA_23:RFOUT, DATA_24:RROUT |
|----|----|----|----|----|----|----|----|--|
| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | -26dB |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | -27dB |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | -28dB |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | -29dB |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | -30dB |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | -31dB |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -32dB |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -33dB |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | -34dB |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | -35dB |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | -36dB |
| 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | -37dB |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | -38dB |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | -39dB |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | -40dB |
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | -41dB |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | -42dB |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | -43dB |
| 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | -44dB |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | -45dB |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | -46dB |
| 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | -47dB |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -48dB |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -49dB |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | -50dB |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | -51dB |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | -52dB |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | -53dB |
| 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | -54dB |
| 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | -55dB |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | -56dB |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | -57dB |
| 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | -58dB |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | -59dB |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | -60dB |
| 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | -61dB |
| 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -62dB |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | -63dB |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -64dB |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -65dB |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -66dB |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -67dB |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | -68dB |
| 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | -69dB |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | -70dB |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | -71dB |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | -72dB |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | -73dB |
| 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | -74dB |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | -75dB |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | -76dB |
| 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | -77dB |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | -78dB |
| 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | -79dB |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | $-\infty$ |

LV3328PM

DATA_25 (General-purpose input switch, Mixing, Output level detection, FADER_Rear input switch)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_25 |
|----|----|----|----|----|----|----|----|--|
| 0 | * | * | * | * | * | * | * | General-purpose input mode switch:stereo mode |
| 1 | * | * | * | * | * | * | * | General-purpose input mode switch:MONO |
| | | | | | | | | |
| * | 0 | 0 | * | * | * | * | * | Lch/Rch mixing : OFF |
| * | 1 | 0 | * | * | * | * | * | Lch mixing : ON, Rch mixing : OFF |
| * | 0 | 1 | * | * | * | * | * | Lch mixing : OFF, Rch mixing : ON |
| * | 1 | 1 | * | * | * | * | * | Lch/Rch mixing : ON |
| | | | | | | | | |
| * | * | * | 0 | 0 | * | * | * | General-purpose input select:EXLIN/EXRIN |
| * | * | * | 1 | 0 | * | * | * | General-purpose input select:EXRIN only select |
| * | * | * | 0 | 1 | * | * | * | General-purpose input select:EXLIN only select |
| | | | | | | | | |
| * | * | * | * | * | 0 | * | * | Output level detection : OFF |
| * | * | * | * | * | 1 | * | * | Output level detection : ON |
| | | | | | | | | |
| * | * | * | * | * | * | 0 | 0 | FADER_REAR_L/Rch input1 select |
| * | * | * | * | * | * | 1 | 0 | FADER_REAR_Lch:input2, Rch:input1 select |
| * | * | * | * | * | * | 0 | 1 | FADER_REAR_Lch:input1, Rch:input2 select |
| * | * | * | * | * | * | 1 | 1 | FADER_REAR_L/Rch input2 select |

DATA_26 (Loudness control, TONE pass switch, EXTOUT output signal select)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_26 |
|----|----|----|----|----|----|----|----|--|
| 0 | 0 | * | * | * | * | 0 | 0 | Loudness:OFF |
| 1 | 0 | * | * | * | * | 0 | 0 | Loudness:ON |
| | | | | | | | | |
| * | * | 0 | 0 | * | * | 0 | 0 | The tone block pass operation is not done. |
| * | * | 1 | 0 | * | * | 0 | 0 | Tone block pass operation execution only of Lch side. |
| * | * | 0 | 1 | * | * | 0 | 0 | Tone block pass operation execution only of Rch side. |
| * | * | 1 | 1 | * | * | 0 | 0 | Tone block pass operation execution of Lch and Rch side. |
| | | | | | | | | |
| * | * | * | * | 0 | * | 0 | 0 | EXTOUT outputs signal Lch: EXTIN |
| * | * | * | * | 1 | * | 0 | 0 | EXTOUT outputs signal Lch: input 2 |
| * | * | * | * | * | 0 | 0 | 0 | EXTOUT outputs signal Rch: EXTIN |
| * | * | * | * | * | 1 | 0 | 0 | EXTOUT outputs signal Rch: input 2 |

DATA_27 (Zero cross control)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_27 |
|----|----|----|----|----|----|----|----|---|
| 0 | * | * | * | * | 0 | 0 | 0 | Zerocross control:OFF |
| 1 | * | * | * | * | 0 | 0 | 0 | Zerocross control:ON |
| | | | | | | | | |
| * | 0 | 0 | * | * | 0 | 0 | 0 | Zerocross detection:Input GAIN(LSELO) |
| * | 1 | 0 | * | * | 0 | 0 | 0 | Zerocross detection:Main volume(LVROUT) |
| * | 0 | 1 | * | * | 0 | 0 | 0 | Zerocross detection:Fader(LFOUT) |
| * | 1 | 1 | * | * | 0 | 0 | 0 | Zerocross detection:Fader(LROUT) |
| | | | | | | | | |
| * | * | * | 0 | 0 | 0 | 0 | 0 | Zerocross detection:Input GAIN(RSELO) |
| * | * | * | 1 | 0 | 0 | 0 | 0 | Zerocross detection:Main volume(RVROUT) |
| * | * | * | 0 | 1 | 0 | 0 | 0 | Zerocross detection:Fader(RFOUT) |
| * | * | * | 1 | 1 | 0 | 0 | 0 | Zerocross detection:Fader(RROUT) |

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DATA_28 (Soft_step/Soft_mute control)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_28 |
|----|----|----|----|----|----|----|----|---------------------|
| 0 | * | * | * | * | * | * | * | Soft_mute mode:OFF |
| 1 | * | * | * | * | * | * | * | Soft_mute mode:ON |
| | | | | | | | | |
| * | 0 | * | * | * | * | * | * | Mute select:OFF |
| * | 1 | * | * | * | * | * | * | Mute select:ON |
| | | | | | | | | |
| * | * | 0 | * | * | * | * | * | Soft_step:OFF |
| * | * | 1 | * | * | * | * | * | Soft_step:ON |
| | | | | | | | | |
| * | * | * | 0 | * | * | * | * | Usually mode |
| * | * | * | 1 | * | * | * | * | TEST mode |
| | | | | | | | | |
| * | * | * | * | 0 | 0 | * | * | Mute time:0.64ms |
| * | * | * | * | 1 | 0 | * | * | Mute time:5.12ms |
| * | * | * | * | 0 | 1 | * | * | Mute time:40ms |
| * | * | * | * | 1 | 1 | * | * | Mute time:80ms |
| | | | | | | | | |
| * | * | * | * | * | * | 0 | 0 | Soft_step time:10ms |
| * | * | * | * | * | * | 1 | 0 | Soft_step time:20ms |
| * | * | * | * | * | * | 0 | 1 | Soft_step time:40ms |
| * | * | * | * | * | * | 1 | 1 | Soft_step time:80ms |

DATA_29 (TEST control)

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | DATA_29 |
|----|----|----|----|----|----|----|----|----------------------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Setting at operation use usually |

Usage Cautions

(1) Request to send the initial data at power ON

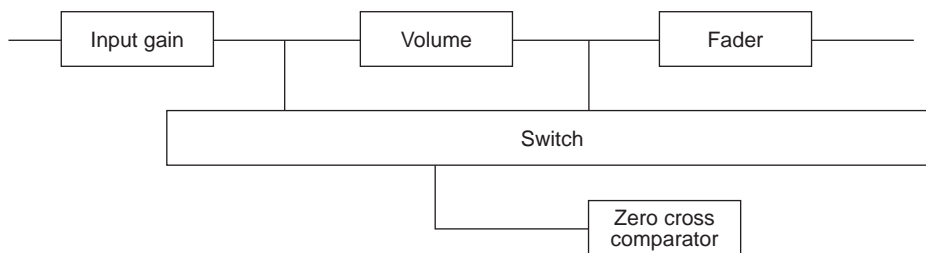
- Though the circuit initializing the IC inside at power ON is incorporated, be sure to send data to all sub-address as the initial data at power ON.
- At power ON, muting or other measures must be taken externally till the data is set.

Reference data

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|--------|-------------------------|-----|-----|-----|------|
| VDD power rise time | Trise | 0V → 5V power rise time | 30 | - | - | μs |
| VDD voltage when power ON reset is canceled | Vpor | | - | 5 | - | V |

(2) Description of zero cross switching circuit operation

The LV3328PM have a function to switch zero cross comparator signal detection locations, enabling the selection of the optimum detection location for blocks whose data is to be updated. Basically, the switching noise can be minimized by inputting the signal immediately following the block whose data is to be updated to the zero cross comparator, so it is necessary to switch the detection location every time.



LV3328PM zero cross detection circuit

(3) Zero Cross Switching Control method

The zero cross switching control method consists of setting the zero cross control bits to the zero cross detection mode, and specifying the detection blocks before transmitting the data.

The I²C data is held at rise of the ACK clock. For zero-cross operation, this operation begins at rise of ACK clock of the first data.

On detecting zero cross, all of holding data are switched. (Without zero cross, data is switched at rise of ACK clock.)

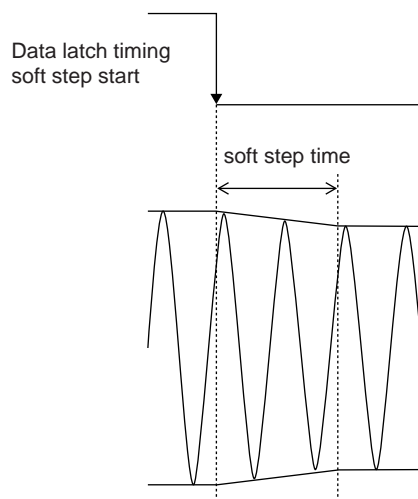
(4) Zero cross timer setting

If the input signal becomes lower than the zero cross comparator detection sensitivity, or if only low-frequency signals are input, zero cross detection continues to be impossible, and data is not latched during this time. The zero cross timer can set a time for forcible latch during such a status when zero cross detection is not possible.

(5) Soft step operation

The LV3328PM have a soft step function at 3 band equalizer control block for low switching noise.

The Soft step time can be selected by send to I²C control. (10ms, 20ms, 40ms, 80ms)

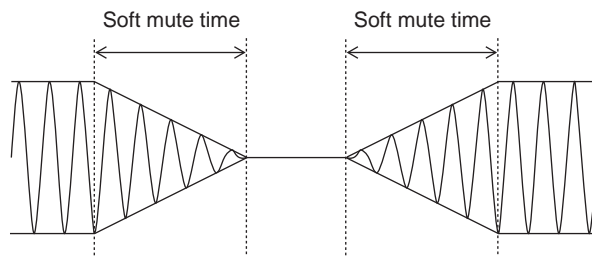


(6) Soft mute operation

The LV3328PM have a soft mute function for low switching noise, when this mute function set operation. (mute/unmute function select)

The Soft mute time can be selected by send to I²C control. (0.6ms, 5ms, 40ms, 80ms)

A soft mute function can be implemented by set to soft mute on. (Set to mute on/off)



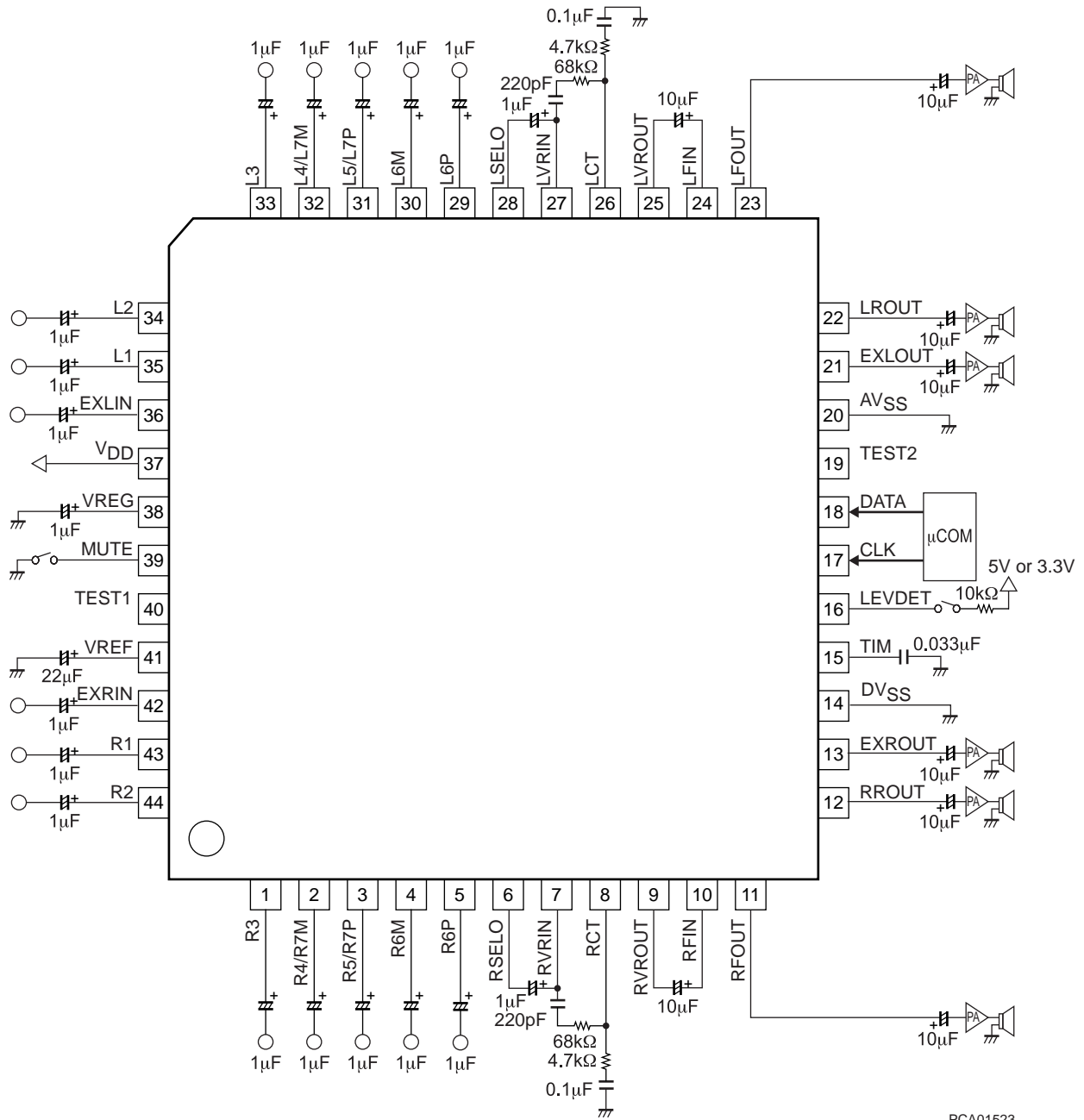
(7) Cautions for input switching (method to reduce the switching noise at a time of channel setting)

When switching the input channel, carry out soft muting beforehand. After completion of muting, carry out channel switching. Then, cancel muting (canceling through soft muting), and complete input switching (recommendation by SANYO).

Note also that, regardless of whether each input channel is set to ON or OFF, the external input voltage is less than the maximum input voltage (VCL) in all input channels.

LV3328PM

Application Circuit Example



PCA01523

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