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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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M62463AFP

Dolby Pro Logic Surround Decoder

REJ03F0275-0200

Rev.2.00

Jun 16, 2008

Description

The M62463AFP is a single chip Dolby Pro Logic surround decoder. This LSI has all of required functions for Dolby Pro Logic surround.

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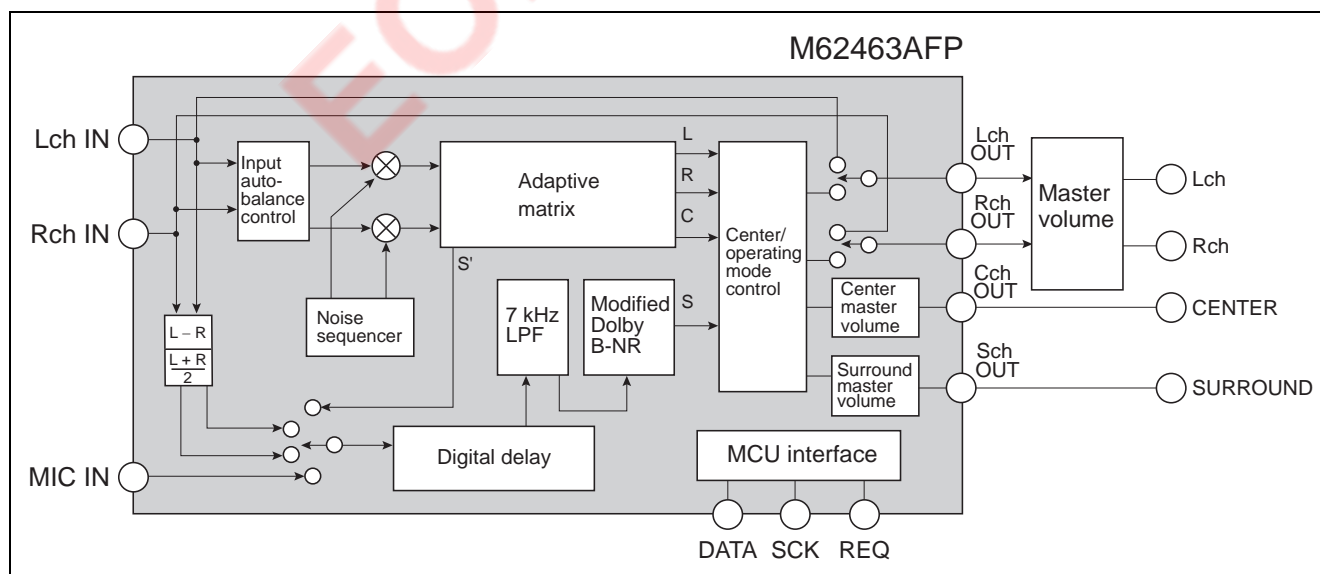
This device available only to licensees of Dolby Lab.

Licensing and application information may be obtained from Dolby Lab.

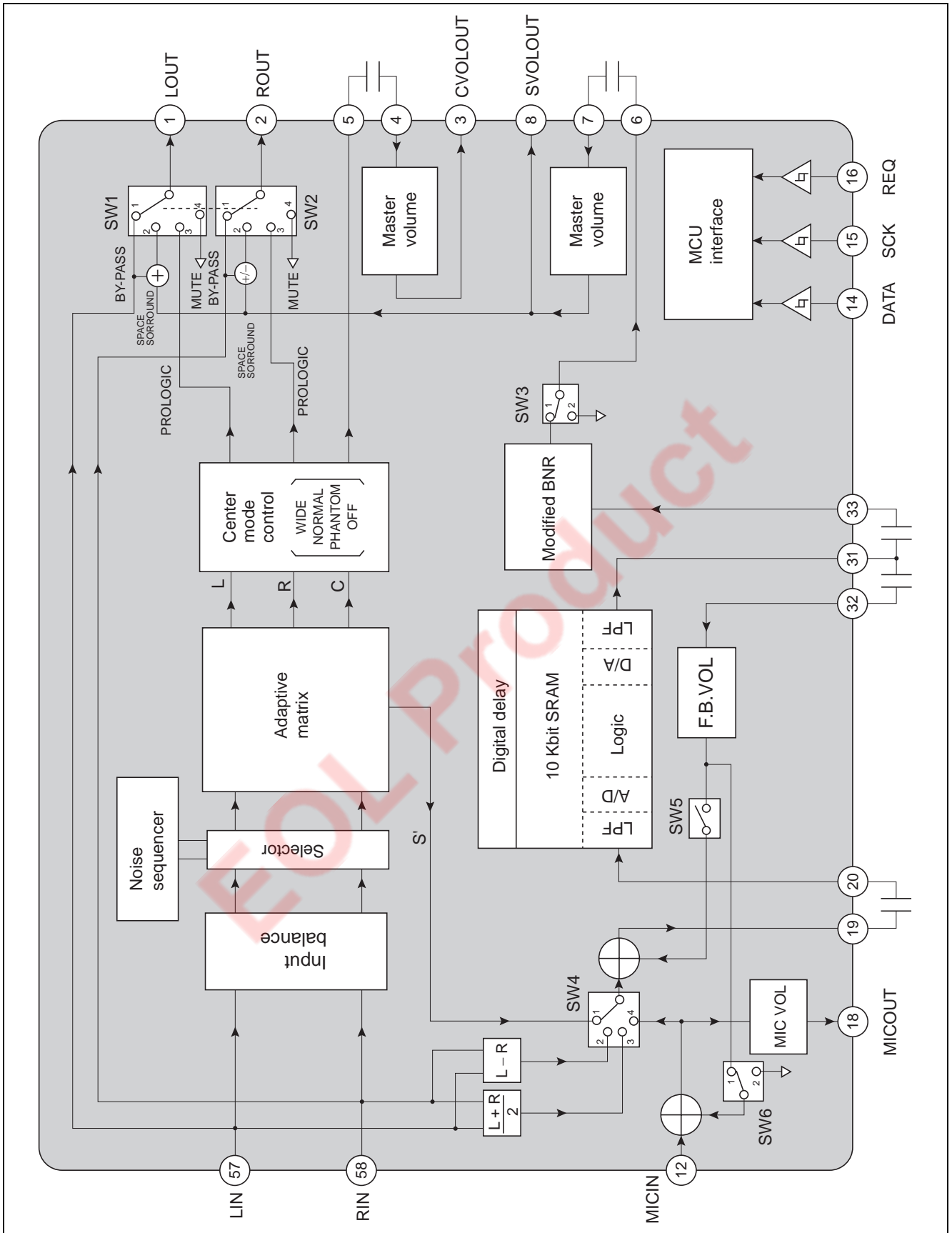
Features

- Includes all functions necessary for Dolby Pro Logic surround
 - Adaptive matrix
 - Input auto-balance
 - Noise sequencer
 - Center mode control ON/OFF, WIDE/NORMAL/PHANTOM
 - Modified Dolby B type noise reduction
 - 4 channel (Lch/Rch/Cch/Sch) / 3 channel (Lch/Rch/Cch)
 - Digital delay Delay time: 15.4 to 51.2 ms
- Cch/Sch master volume: 0 to -87 dB / 1 dB step, $-\infty$
- 3-lines MCU control
- Space surround such as Disco, Hall and Live
- Digital echo for Karaoke function Delay time: 123,184 ms
- Current control oscillation circuit for system clock

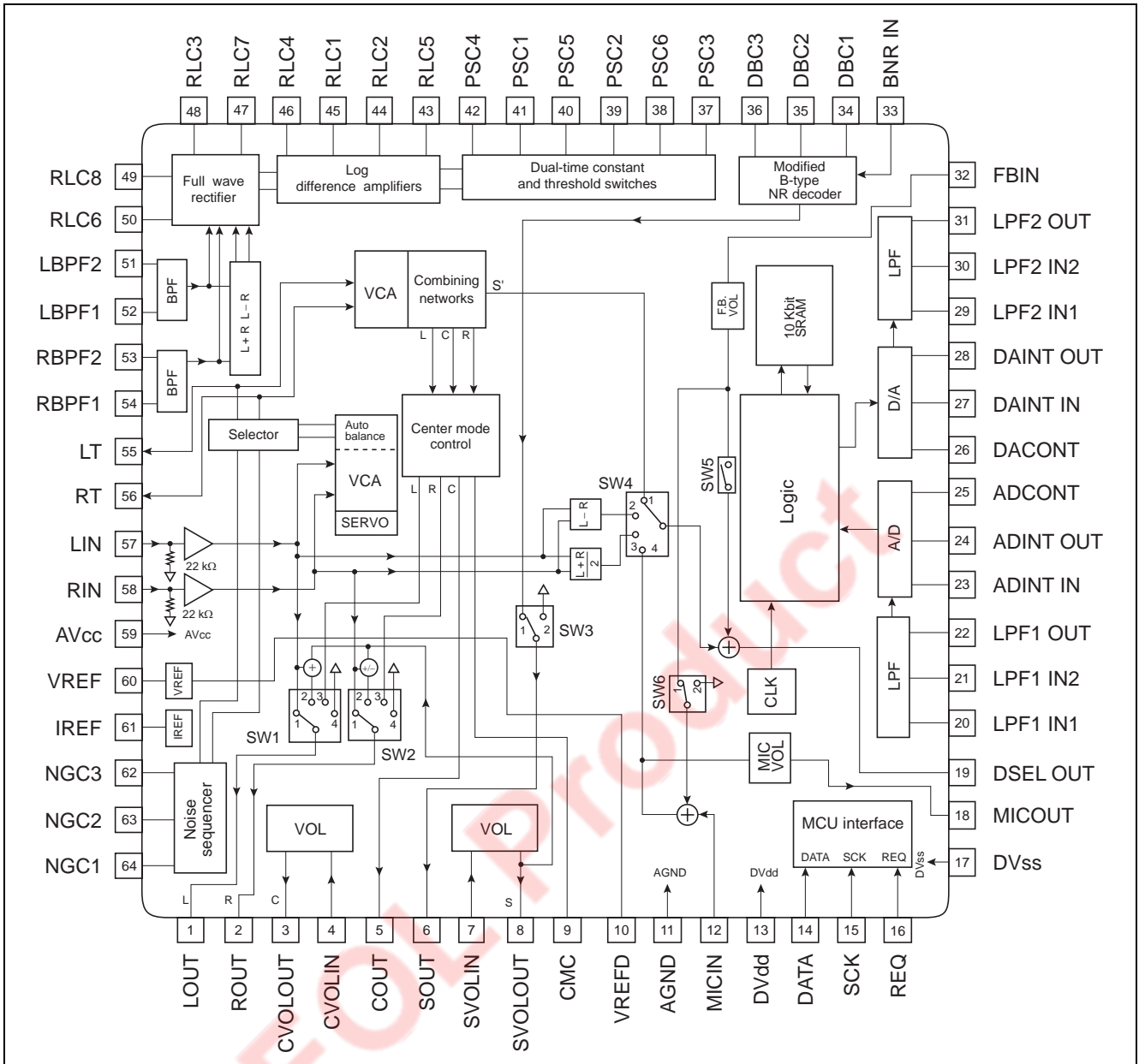
System Configuration



Block Diagram



Pin Arrangement



Functional Description

| Function | | Description |
|----------|---|--|
| 1 | Fundamental function for Dolby Pro Logic surround decoder | Adaptive matrix Input auto-balance Noise sequencer Center mode control ON/OFF WIDE/NORMAL/PHANTOM Modified Dolby B type noise reduction 4 ch (L, R, C, S), 3 ch (L, R, C) mode switch |
| 2 | RAM for digital delay | 10-Kbit RAM |
| 3 | Surround delay time | 15.4, 20.5, 25.6, 29.2 ms (for Dolby Pro Logic surround) 51.2 ms (for space surround) |
| 4 | Circuit for space surround | Digital delay circuit can be used for space surround such as a Disco, Hall or Live, and Karaoke echo |
| 5 | Echo delay time | 123,184 ms |
| 6 | Feedback volume | Delay signal feedback volume -3 to -21 dB / 3 dB step, and $-\infty$ |
| 7 | Microphone volume | Internal microphone volume 0 to -18 dB / 3 dB step, and $-\infty$ |
| 8 | Cch/Sch master volume | 0 to -87 dB / 1 dB step, and $-\infty$ |
| 9 | Bypass switch | Bypass the decode circuit |
| 10 | Output mute | Mute the Lch and Rch output |
| 11 | MCU interface | Controlled by 3-lines serial data from MCU Including the chip address (2-bit) |
| 12 | Current control oscillation circuit | Including the oscillation circuit without external parts |

Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

| Item | Symbol | Ratings | Unit |
|-----------------------|--------|-------------|------|
| Supply voltage | Vcc | 10.5 | V |
| | Vdd | 6.5 | V |
| Power dissipation | Pd | 1 | W |
| Operating temperature | Topr | -20 to +75 | °C |
| Storage temperature | Tstg | -40 to +125 | °C |

Recommended Operating Condition

| Item | Symbol | Min | Typ | Max | Unit | Condition |
|-------------------|-----------------|---------|-----|-----|------|----------------|
| Supply voltage | Vcc | 8 | 9 | 10 | V | |
| | Vdd | 4.5 | 5 | 5.5 | V | |
| Input voltage (L) | V _{IL} | 0 | — | 0.8 | V | 14, 15, 16 pin |
| Input voltage (H) | V _{IH} | Vdd - 1 | — | Vdd | V | 14, 15, 16 pin |

EOL Product

Electrical Characteristics

($T_a = 25^\circ\text{C}$, $V_{cc} = 9\text{ V}$, $V_{dd} = 5\text{ V}$, Cch volume = 0 dB, at C-OUT 0 dBd = 300 mVrms, $f = 1\text{ kHz}$, unless otherwise noted)

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|--------------------|------|-------|------|------------------|--|
| Total | | | | | | |
| Circuit current | I_{CC} | — | 25 | 40 | mA | No signal |
| Circuit current | I_{DD} | — | 13 | 25 | mA | No signal |
| Auto-Balance | | | | | | |
| Capture range | CPR | — | 5 | — | dB | |
| Error correction | CER | — | 4 | — | dB | |
| Adaptive Matrix | | | | | | |
| Output level accuracy relative to Cch | ΔVoL | -0.5 | 0 | 0.5 | dB | L, R, Sch output |
| Matrix rejection | MR | 25 | 40 | — | dB | L, R, C, Sch output |
| Head room | HRAM | 15 | 17 | — | dB | L, R, C, Sch output |
| Total harmonic distortion | THDAM | — | 0.05 | 0.2 | % | L, R, Cch output, 30 kHzLPF |
| S/N ratio | SNAM | 70 | 80 | — | dB | $R_g = 0\ \Omega$, weighted CCIR/ARM, 4 ch mode |
| Noise Sequencer | | | | | | |
| Output noise level | V_{no} | -15 | -12.5 | -10 | dB | L, R, C, Sch output |
| Noise level accuracy relative to Cch | ΔV_{no} | -0.5 | 0 | 0.5 | dB | L, R, Sch output |
| Modified B Noise Reduction (Sch volume = 0 dB, 0 dB reference is 300 mVrms/100 Hz at S-Out) | | | | | | |
| Gain between input and output | VGNR | — | 5.1 | — | dB | $V_{in} = 0\text{ dBd}$, $f = 100\text{ Hz}$ |
| Decode character 1 | DEC1 | -1.6 | -0.1 | 1.4 | dB | $V_{in} = 0\text{ dBd}$, $f = 1.0\text{ kHz}$ |
| Decode character 2 | DEC2 | -3.0 | -1.5 | 0 | | $V_{in} = -15\text{ dBd}$, $f = 1.4\text{ kHz}$ |
| Decode character 3 | DEC3 | -4.9 | -3.4 | -1.9 | | $V_{in} = -20\text{ dBd}$, $f = 1.4\text{ kHz}$ |
| Decode character 4 | DEC4 | -6.8 | -5.3 | -3.8 | | $V_{in} = -40\text{ dBd}$, $f = 5.0\text{ kHz}$ |
| Total harmonic distortion | THDNR | — | 0.07 | 0.3 | % | $V_{in} = 0\text{ dBd}$, $f = 1\text{ kHz}$, 30 kHzLPF |
| Head room | HRNR | 15 | 17 | — | dB | THD = 1% |
| S/N ratio | SNNR | 68 | 78 | — | dB | $R_g = 0\ \Omega$, weighted CCIR/ARM |
| Cch/Sch Master Volume | | | | | | |
| Maximum attenuator | ATTmax | — | -95 | -87 | dB | ATT = $-\infty$, $V_i = 2\text{ Vrms}$ |
| Minimum attenuator | ATTmin | -3.0 | 0 | 3.0 | dB | ATT = 0 dB |
| Volume step | VOLS1 | 0.5 | 1.0 | 1.5 | dB | ATT = 0 to -40 dB |
| | VOLS2 | 0.2 | 1.0 | 1.8 | dB | ATT = -40 to -87 dB |
| Volume cross-talk | CTVOL | 68 | 83 | — | dB | R input/CVOL, SVOL output |
| Output noise voltage | V_{noVOL} | — | 2.6 | 5.2 | μVrms | ATT = $-\infty$ |
| Line (Bypass mode) | | | | | | |
| Total harmonic distortion | THDLN | — | 0.002 | 0.05 | % | L, Rch output, 30 kHzLPF |
| S/N ratio | SNLN | 95 | 100 | — | dB | L, Rch output |
| Line cross-talk | CTLN | 70 | 80 | — | dB | L input/R output, R input/L output |
| Input impedance | Z_i | 11 | 22 | 44 | $k\Omega$ | |

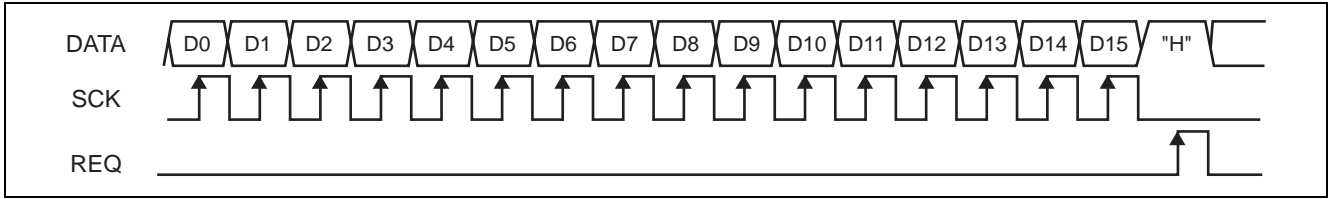
(Ta = 25°C, Vcc = 9 V, Vdd = 5 V, Vin = 200 mVrms, f = 1 kHz, unless otherwise noted)

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions | |
|---------------------------|-----------|------|------|------|-------|--|--------------|
| Digital Delay | | | | | | | |
| Input/output voltage gain | GvD | -8.1 | -5.1 | -2.1 | dB | LIN-LPF2OUT, surround L – R | |
| Delay time | Td | 17.4 | 20.5 | 23.6 | ms | Td = 20.5 ms | |
| Total harmonic distortion | THDD | — | 0.5 | 0.9 | % | 30 kHz LPF | Td = 20.5 ms |
| | | — | 1.2 | 2.2 | | | Td = 51.2 ms |
| | | — | 3.0 | 5.6 | | | Td = 184 ms |
| Output noise voltage | NoD | — | -92 | -80 | dBV | Vin = 0 Vrms JIS-A | Td = 20.5 ms |
| | | — | -84 | -70 | | | Td = 51.2 ms |
| | | — | -80 | -65 | | | Td = 184 ms |
| Maximum output voltage | Vomax | 0.7 | 1.0 | — | Vrms | THD = 10% | |
| LPF cut-off frequency | LPFfc | 6.0 | 7.0 | 8.0 | kHz | Td = 15.4 to 51.2 ms Gv = -3 dB (Dolby Pro Logic mode) | |
| | | — | 3.0 | — | kHz | Td = 123,184 ms (Echo mode) Gv = -3 dB | |
| Feedback Volume | | | | | | | |
| Maximum attenuation | FBATTmax | — | -70 | -60 | dB | ATT = -∞ | |
| Minimum attenuation | FBATTmin | -6.0 | -3.0 | 0 | dB | ATT = -3 dB | |
| Volume step | FBVOLS | — | 3.0 | — | dB | | |
| Microphone Volume | | | | | | | |
| Maximum attenuation | MICATTmax | — | -70 | -60 | dB | ATT = -∞ | |
| Minimum attenuation | MICATTmin | -3.0 | 0 | 3.0 | dB | ATT = 0 dB | |
| Volume step | MICVOLS | — | 3.0 | — | dB | | |
| Output noise voltage | VnoMIC | — | 2.0 | 4.0 | μVrms | ATT = -∞ | |

Serial Data Control Format

(1) Data input format

DATA is read at the rising edge of SCK, and loaded last 16 bits at the rising edge of REQ.



| D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 | D13 | D14 | D15 |
|----|----|--------------------------|----|--------------------|-------------|------------|------------|----|----|-----|-----|-----|--------------|-----|-----|
| L | L | Mode set | | Pro Logic mode | Center mode | | Sch volume | | | | | | | L | H |
| | H | Delay time | | Auto-balance | set to "L" | Cch volume | | | | | | | Chip address | | |
| H | L | Noise sequencer | | Surround/echo mode | | | | | | | | | | | |
| | H | Test mode (user inhibit) | | | | | | | | | | | | | |

(2) Control condition

| No. | Control Mode | Contents |
|-----|--------------------|---|
| 1 | Mode set | Normal stereo/Dolby Pro Logic/space surround or echo/mute |
| 2 | Pro Logic mode | 4 ch Pro Logic/3 ch stereo |
| 3 | Center mode | Wide/Normal/Phantom/OFF |
| 4 | Delay time | 15.4, 20.5, 25.6, 29.2, 51.2 ms (for surround) 123,184 ms (for echo) |
| 5 | Auto-balance | Input auto-balance ON/OFF |
| 6 | Noise sequencer | ON/OFF Lch/Rch/Cch/Sch |
| 7 | Surround/echo mode | Delay input $L - R / (L + R) / 2$ /MICin Feedback volume, microphone volume, delay output mixing |
| 8 | Cch/Sch volume | 0 to -87 dB / 1 dB step, and $-\infty$ |
| 9 | Chip address | Input data effect or not |

(3) Set conditions

Mode Setting (D0 = "L", D1 = "L")

| D2 | D3 | Condition |
|----|----|--------------------------|
| L | L | Normal stereo (bypass) |
| L | H | Dolby Pro Logic surround |
| H | L | Space surround/echo |
| H | H | Output mute |

Pro Logic Mode Setting (D0 = "L", D1 = "L")

| D4 | Condition |
|----|----------------|
| L | 4 ch Pro Logic |
| H | 3 ch stereo |

Center Mode Setting (D0 = "L", D1 = "L")

| D5 | D6 | Condition |
|----|----|-----------|
| L | L | Wide |
| L | H | Normal |
| H | L | Phantom |
| H | H | OFF |

Delay Time Setting (D0 = "L", D1 = "H")

| D2 | D3 | D4 | Delay Time | Sampling Frequency | LPF Cutoff Frequency |
|----|----|----|------------|--------------------|----------------------|
| L | L | L | 15.4 ms | 500 kHz | 7 kHz |
| L | L | H | 20.5 ms | 500 kHz | |
| L | H | L | 25.6 ms | 400 kHz | |
| L | H | H | 29.2 ms | 333 kHz | |
| H | L | L | 51.2 ms | 200 kHz | |
| H | L | H | 123 ms | 83.3 kHz | 3 kHz |
| H | H | L | 184 ms | 55.6 kHz | |

Auto-Balance Setting (D0 = "L", D1 = "H")

| D5 | Condition |
|----|------------------|
| L | Auto-balance OFF |
| H | Auto-balance ON |

Noise Sequencer (D0 = "H", D1 = "L")

| D2 | D3 | D4 | Condition | |
|----|----|----|---------------------|-----|
| L | — | — | Noise sequencer OFF | |
| H | L | L | Noise sequencer ON | Lch |
| | L | H | | Rch |
| | H | L | | Cch |
| | H | H | | Sch |

Surround/Echo Mode (D0 = "H", D1 = "L")

Surround/Echo Mode Switch

| D5 | Condition |
|----|-----------|
| L | Surround |
| H | Echo |

Delay Input

| D6 | Delay Input |
|----|-------------|
| L | L – R |
| H | (L + R) / 2 |

Delay Mixing Polarity

| D7 | Mixing Polarity |
|----|---------------------------------|
| L | L+ delay signal/R+ delay signal |
| H | L+ delay signal/R– delay signal |

Feedback Volume

| D8 | D9 | D10 | Volume |
|----|----|-----|--------|
| L | L | L | –3 dB |
| L | L | H | –6 dB |
| L | H | L | –9 dB |
| L | H | H | –12 dB |
| H | L | L | –15 dB |
| H | L | H | –18 dB |
| H | H | L | –21 dB |
| H | H | H | –∞ |

Microphone Volume

| D11 | D12 | D13 | Volume |
|-----|-----|-----|--------|
| L | L | L | 0 dB |
| L | L | H | –3 dB |
| L | H | L | –6 dB |
| L | H | H | –9 dB |
| H | L | L | –12 dB |
| H | L | H | –15 dB |
| H | H | L | –18 dB |
| H | H | H | –∞ |

Relation Between Mode Setting and Switch Condition

| Mode Setting | Pro Logic Mode (D0 = L, D1 = L) | Surround/Echo Mode (D0 = H, D1 = L) | | Switch Condition | | | | | |
|-----------------------------|------------------------------------|--|----|------------------|-----|-----|-----|-----|-----|
| | D4 | D5 | D6 | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 |
| Normal stereo (bypass) | X | X | X | 1 | 1 | 2 | 4 | OFF | 2 |
| Dolby Pro Logic surround | L | X | X | 3 | 3 | 1 | 1 | OFF | 2 |
| | H | | | | | 2 | | | |
| Space surround/echo | X | L (Surround) | L | 2 | 2 | 1 | 2 | ON | 2 |
| | X | | H | | | | 3 | | |
| | X | H (Echo) | X | 1 | 1 | 2 | 4 | OFF | 1 |
| | X | | X | Delay mixing OFF | | | 4 | | |
| Mute | X | X | X | 4 | 4 | 2 | 4 | OFF | 2 |

Note: X: L or H

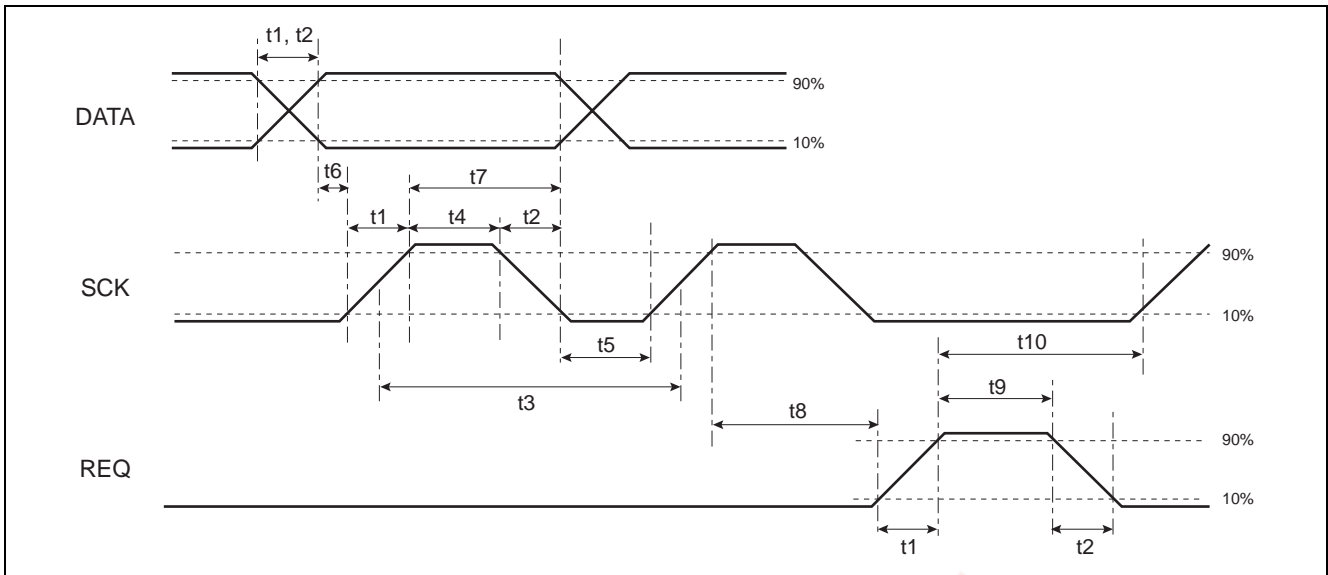
Sch Volume Setting (D0 = "L", D1 = "L"), Cch Volume Setting (D0 = "L", D1 = "H")

| Volume Level | D7 | D8 | D9 | D10 | D11 | Volume Level | D12 | D13 |
|--------------|----|----|----|-----|-----|--------------|-----|-----|
| 0 dB | L | L | L | L | L | 0 dB | L | L |
| -2 dB | L | L | L | L | H | -1 dB | L | H |
| -4 dB | L | L | L | H | L | -2 dB | H | L |
| -6 dB | L | L | L | H | H | -3 dB | H | H |
| -8 dB | L | L | H | L | L | | | |
| -10 dB | L | L | H | L | H | | | |
| -12 dB | L | L | H | H | L | | | |
| -14 dB | L | L | H | H | H | | | |
| -16 dB | L | H | L | L | L | | | |
| -18 dB | L | H | L | L | H | | | |
| -20 dB | L | H | L | H | L | | | |
| -22 dB | L | H | L | H | H | | | |
| -24 dB | L | H | H | L | L | | | |
| -26 dB | L | H | H | L | H | | | |
| -28 dB | L | H | H | H | L | | | |
| -30 dB | L | H | H | H | H | | | |
| -32 dB | H | L | L | L | L | | | |
| -34 dB | H | L | L | L | H | | | |
| -36 dB | H | L | L | H | L | | | |
| -40 dB | H | L | L | H | H | | | |
| -44 dB | H | L | H | L | L | | | |
| -48 dB | H | L | H | L | H | | | |
| -52 dB | H | L | H | H | L | | | |
| -56 dB | H | L | H | H | H | | | |
| -60 dB | H | H | L | L | L | | | |
| -64 dB | H | H | L | L | H | | | |
| -68 dB | H | H | L | H | L | | | |
| -72 dB | H | H | L | H | H | | | |
| -76 dB | H | H | H | L | L | | | |
| -80 dB | H | H | H | L | H | | | |
| -84 dB | H | H | H | H | L | | | |
| -∞ | H | H | H | H | H | | | |

Chip Address

| D14 | D15 | Data Read |
|--------|-----|-----------|
| L | H | Enable |
| Others | | Unable |

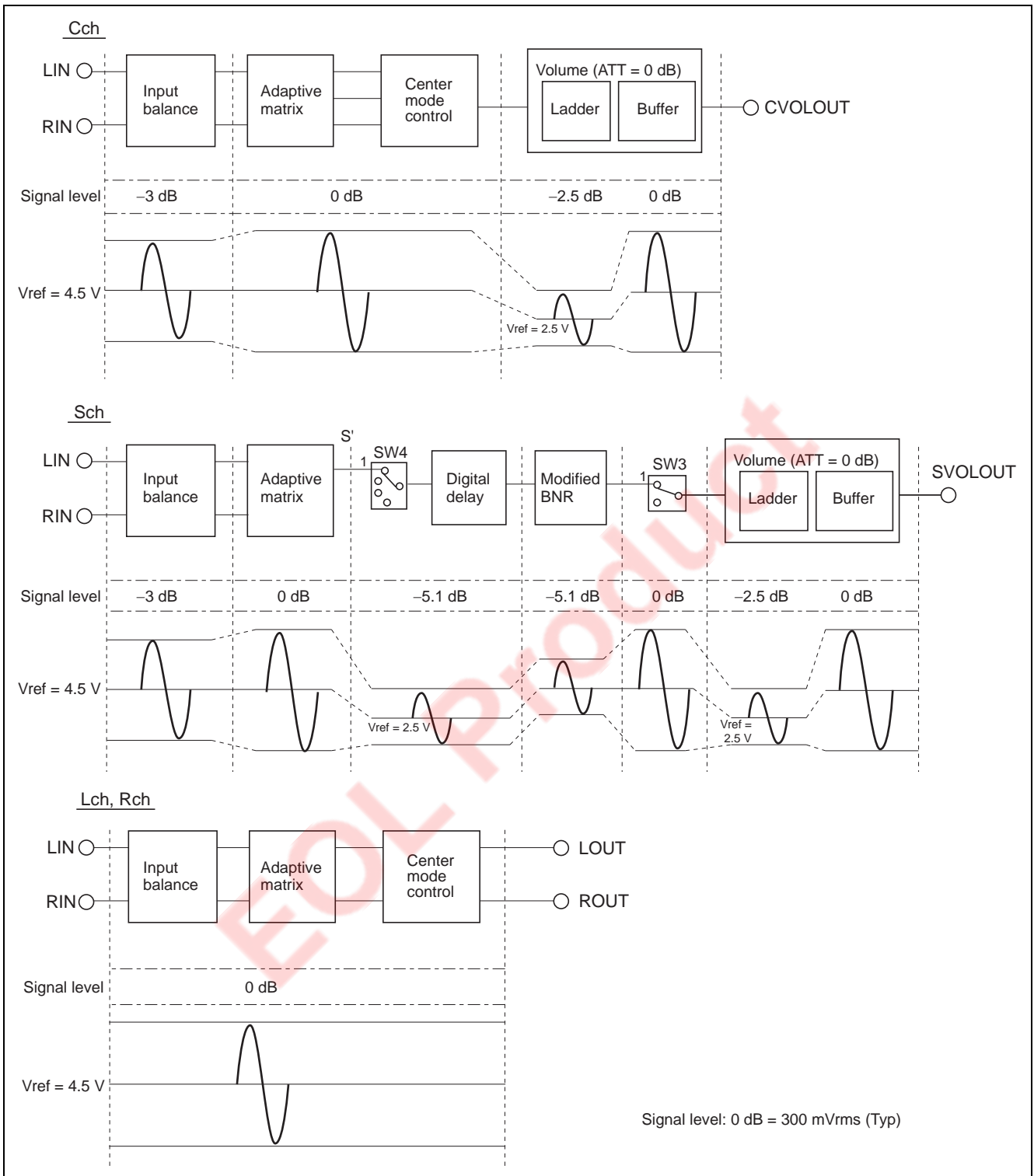
(4) Data timing



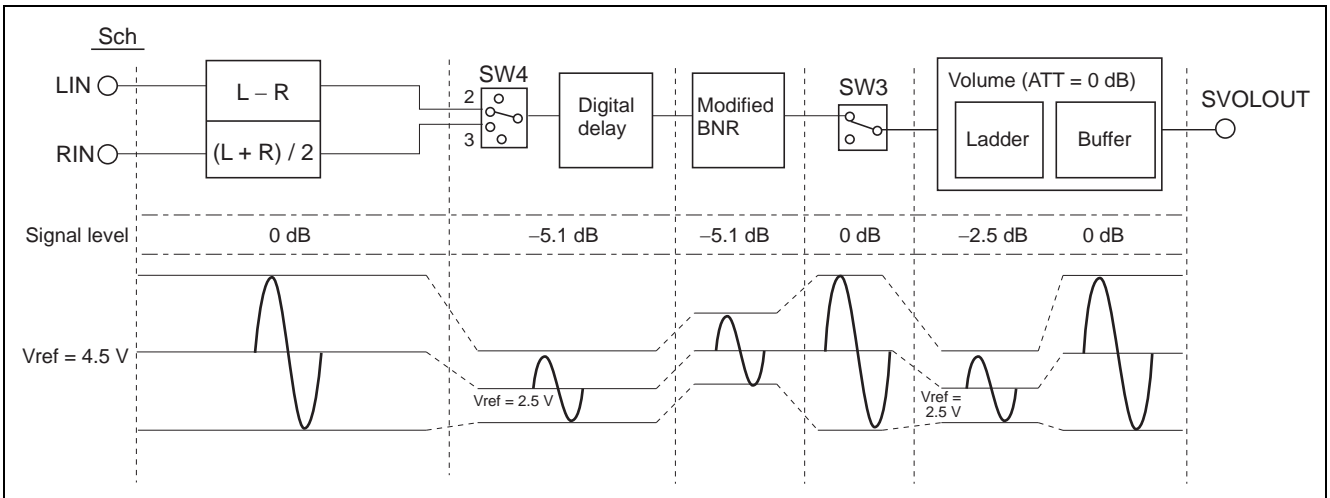
| Symbol | Name | Min | Typ | Max | Unit |
|--------|---------------------|-----|-----|-----|---------------|
| t1 | Signal rise time | — | — | 0.5 | μS |
| t2 | Signal fall time | — | — | 0.5 | μS |
| t3 | SCK clock width | 2 | — | — | μS |
| t4 | SCK "H" pulse width | 0.8 | — | — | μS |
| t5 | SCK "L" pulse width | 0.8 | — | — | μS |
| t6 | DATA setup time | 0.8 | — | — | μS |
| t7 | DATA hold time | 0.8 | — | — | μS |
| t8 | REQ rise hold time | 1.6 | — | — | μS |
| t9 | REQ "H" pulse width | 0.8 | — | — | μS |
| t10 | SCK setup time | 1.6 | — | — | μS |

Level Diagram

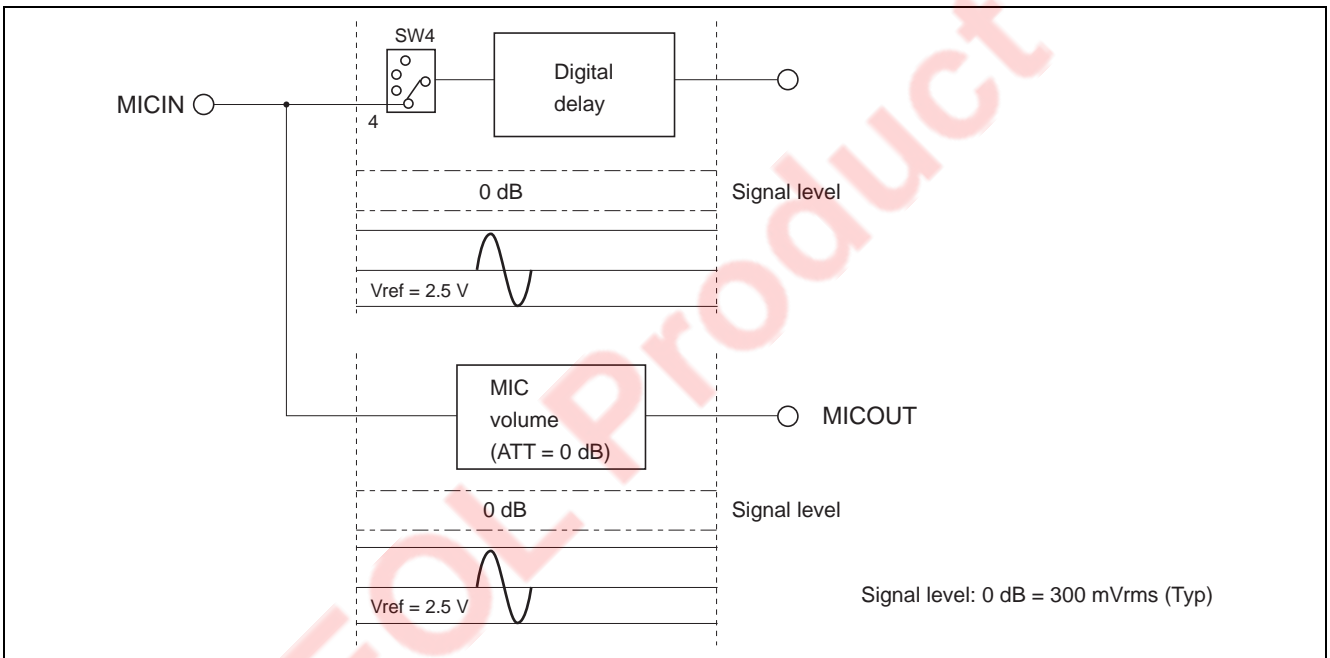
(1) Dolby Pro Logic surround mode



(2) Space surround mode



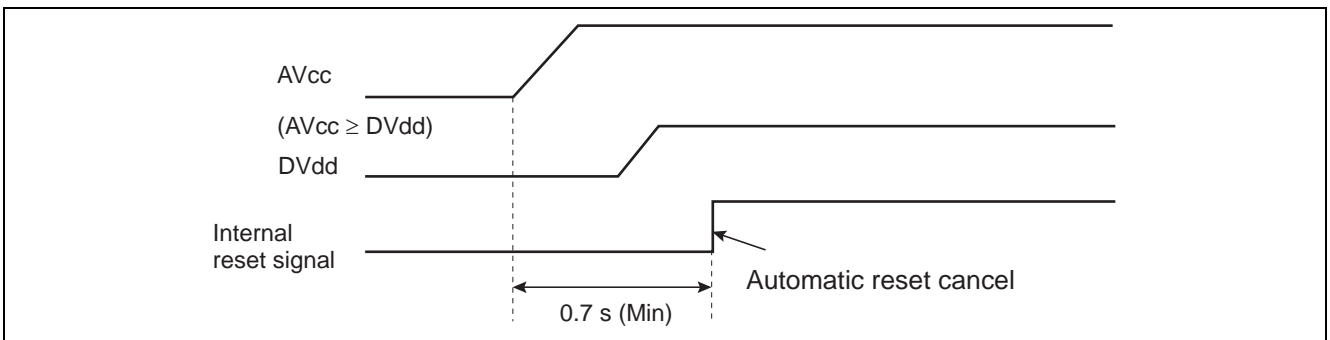
(3) Echo mode



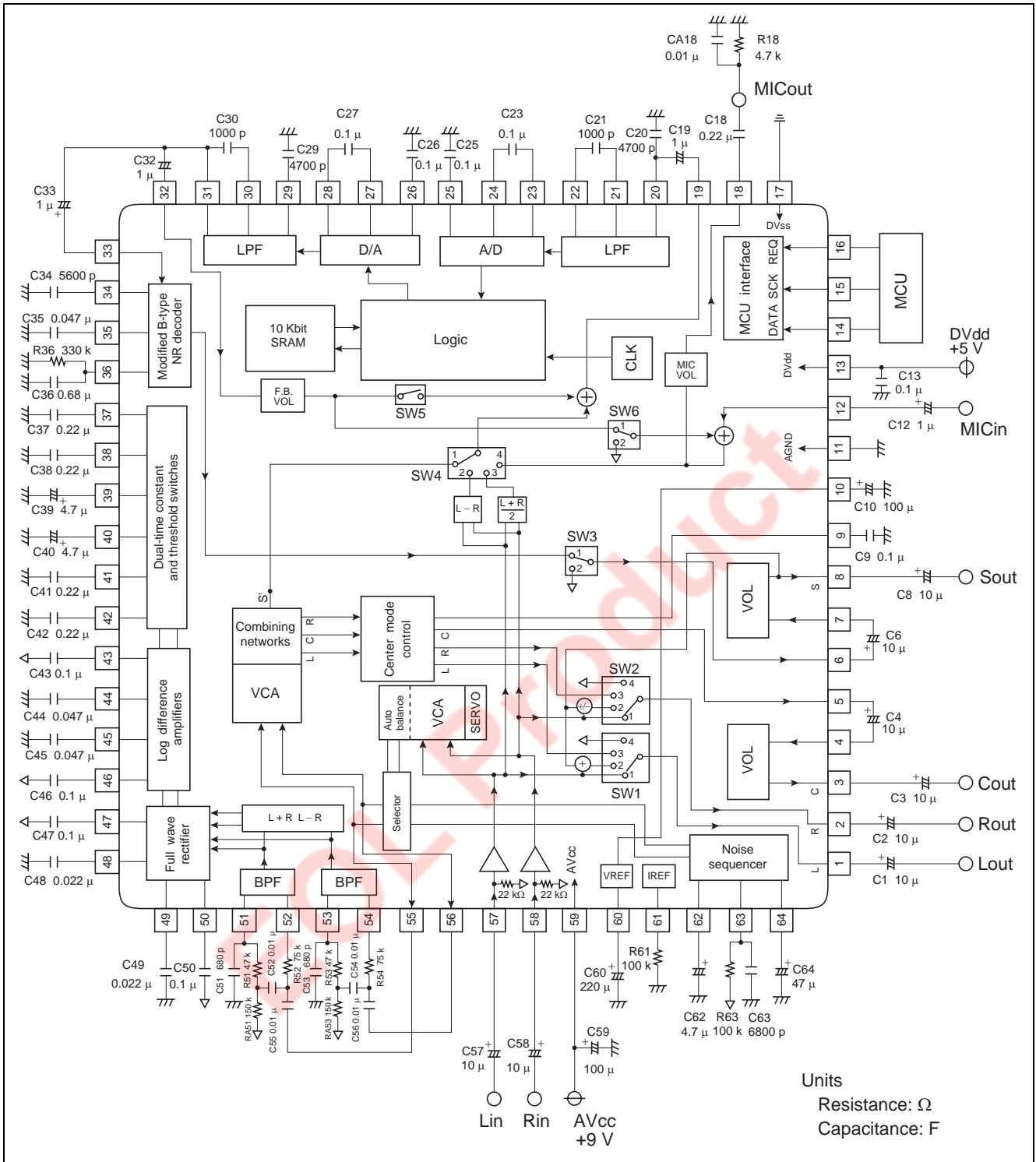
Notice

Relation AVcc and DVdd at power supply

Digital Vdd must be supplied less than 0.7 seconds from analog Vcc supply.

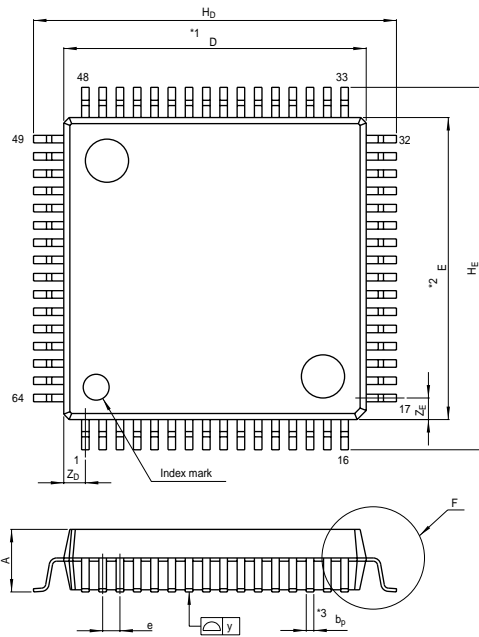


Application Example



Package Dimensions

| | | | |
|--------------------|--------------|---------------|------------|
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
| P-QFP64-14x14-0.80 | PRQP0064GA-A | 64P6N-A | 1.1g |



NOTE)
 1. DIMENSIONS "1" AND "2"
 DO NOT INCLUDE MOLD FLASH.
 2. DIMENSION "3" DOES NOT
 INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters | | |
|------------------|--------------------------|------|------|
| | Min | Nom | Max |
| D | 13.8 | 14.0 | 14.2 |
| E | 13.8 | 14.0 | 14.2 |
| A ₂ | — | 2.8 | — |
| H _D | 16.5 | 16.8 | 17.1 |
| H _E | 16.5 | 16.8 | 17.1 |
| A | — | — | 3.05 |
| A ₁ | 0 | 0.1 | 0.2 |
| b _p | 0.3 | 0.35 | 0.45 |
| c | 0.13 | 0.15 | 0.2 |
| θ | 0° | — | 10° |
| e | 0.65 | 0.8 | 0.95 |
| y | — | — | 0.10 |
| Z _D | — | 1.0 | — |
| Z _E | — | 1.0 | — |
| L | 0.4 | 0.6 | 0.8 |

EOL Product

Notes:

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