

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

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

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M62440FP

Electric Volume Control with Tone Controller for 4-Speaker Applications

REJ03F0211-0201

Rev.2.01

Mar 31, 2008

Description

The M62440FP is an IC developed for car audio, it has a built-in 4ch input selector, master volume, loudness, tone control and fader volume blocks. All of these blocks are controlled via serial data. Thank to the used zero crossing detector, very low click noise are obtained.

Features

- Built-in zero cross detector prevents click noise
- 4-input selector
- Loudness
- Tone control bass/Mid/Treble
- Master volume/Fader Volume
- Serial data control

Recommended Operating Conditions

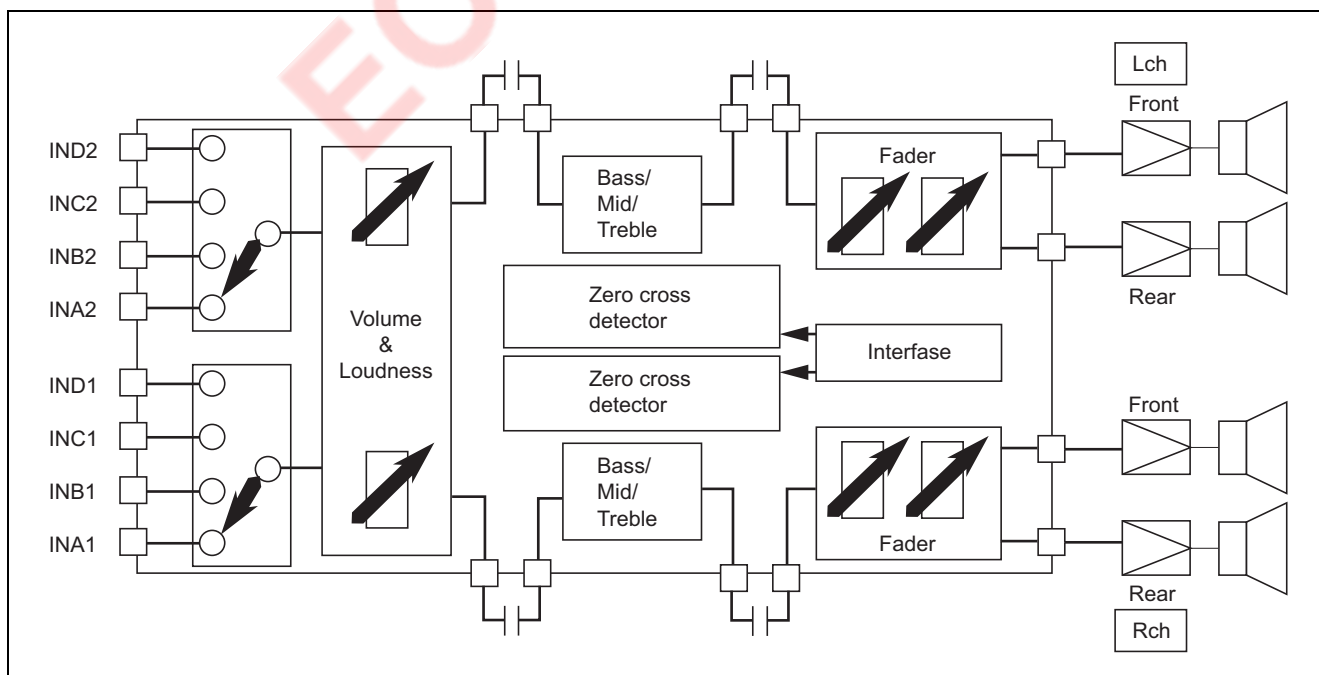
Supply voltage range: $V_{CC} = 6$ to 9 V

$V_{DD} = 4$ to 6 V

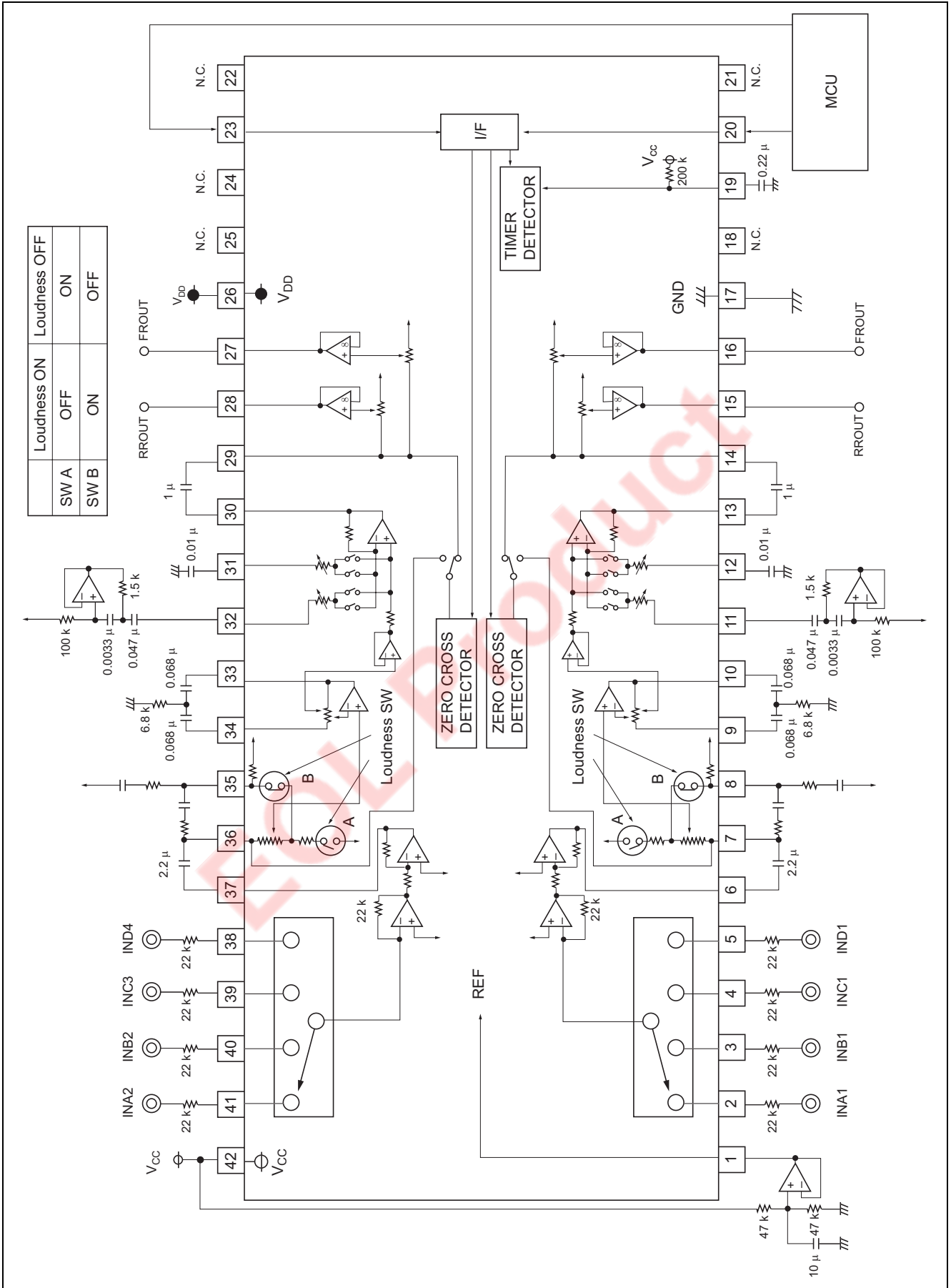
Rated supply voltage: $V_{CC} = 8$ V

$V_{DD} = 5$ V

Block Diagram



Pin Configuration and Application Example

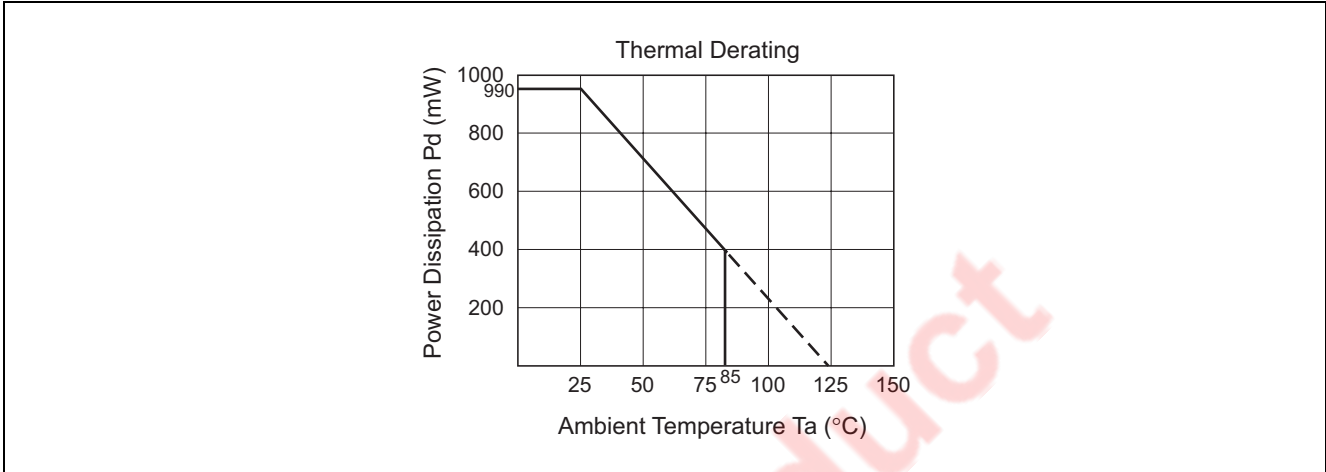


Pin Description

| Pin No. | Symbol | Function |
|---------|-----------------|---|
| 1 | REF | IC signal ground. Apply 1/2 V _{CC} |
| 2 | INA1 | Input pin for channel 1 of the input selector switch block |
| 3 | INB1 | |
| 4 | INC1 | |
| 5 | IND1 | |
| 6 | SELECT OUT1 | |
| 7 | VOL IN1 | Input pin of the volume block |
| 8 | LOUD IN1 | Pin for setting the frequency characteristics of the loudness block |
| 9 | BASSA1 | Pin for setting the frequency characteristics of the tone (Bass) block |
| 10 | BASSB1 | |
| 11 | MID1 | R-ladder terminal of tone (Mid) |
| 12 | TRE1 | R-ladder terminal of tone (Treble) |
| 13 | TONE OUT1 | Output pin of the tone block |
| 14 | FADER IN1 | Input pin of the fader volume |
| 15 | REAR OUT1 | Output pin of the fader volume (Rear) |
| 16 | FRONT OUT1 | Output pin of the fader volume (Front) |
| 17 | GND | Ground |
| 18 | N.C. | Non Connection |
| 19 | TIM1 | Timer setting terminal The relationship between outside parts C and setting time is $T = 13.8 \times 10^4 \cdot C$ (s). |
| 20 | DATA | Input pin of the control data This pin inputs data in synchronization with CLOCK |
| 21 | N.C. | Non Connection |
| 22 | N.C. | Non Connection |
| 23 | CLOCK | Clock input pin for serial data transfer |
| 24 | N.C. | Non Connection |
| 25 | N.C. | Non Connection |
| 26 | V _{DD} | Digital power supply pin, normally +5 V |
| 27 | FRONT OUT2 | Output pin of the fader volume (Front) |
| 28 | REAR OUT2 | Output pin of the fader volume (Rear) |
| 29 | FADER IN2 | Input pin of the fader volume |
| 30 | TONE OUT2 | Output pin of the tone block |
| 31 | TRE2 | R-ladder terminal of tone (Treble) |
| 32 | MID2 | R-ladder terminal of tone (Mid) |
| 33 | BASSB2 | Pin for setting the frequency characteristics of the tone (Bass) block |
| 34 | BASSA2 | |
| 35 | LOUD IN2 | Pin for setting the frequency characteristics of the loudness block |
| 36 | VOL IN2 | Input pin of the volume block |
| 37 | SELECT OUT2 | Output pin of the input selector switch block |
| 38 | IND2 | Input pin for channel 2 of the input selector switch block |
| 39 | INC2 | |
| 40 | INB2 | |
| 41 | INA2 | |
| 42 | V _{CC} | |

Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit | Conditions |
|------------------------|------------------|------------|-------|-----------------------------|
| Supply voltage | V_{CC}, V_{DD} | 10, 7 | V | — |
| Power dissipation | P_d | 990 | mW | $T_a \leq 25^\circ\text{C}$ |
| Thermal derating ratio | $K\theta$ | 9.9 | mW/°C | $T_a \geq 25^\circ\text{C}$ |
| Operating temperature | T_{opr} | -30 to 85 | °C | — |
| Storage temperature | T_{stg} | -55 to 125 | °C | — |



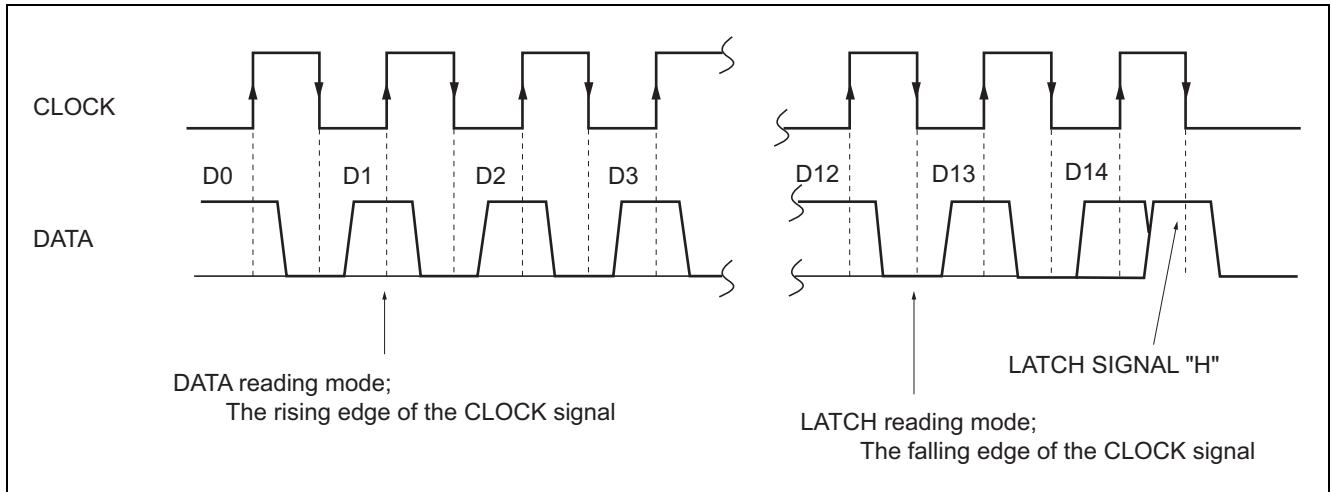
EOL Product

Electrical Characteristics

T_a = 25°C, V_{CC} = 8 V, V_{DD} = 5 V, VOL/FADER = 0 dB, TONE/FLAT, Loudness OFF unless otherwise noted

| Item | Symbol | Limits | | | Unit | Test Conditions |
|------------------------------|------------------------|--------|------|-------|-------------------|--|
| | | Min | Typ | Max | | |
| Circuit current | I _{CC} | — | 20 | 35 | mA | No input signal |
| Pass gain | G _V | -3.5 | 0 | 3.5 | dB | Outside resistor 22 kΩ of pin 2 to 5, pin 38 ~ 41 |
| Maximum attenuation | A _{TT} (VOL) | -32.5 | -30 | -27.5 | dB | V _i = 1 V _{rms} , f = 1 kHz ATT (VOL) = -30 dB |
| Attenuation error | ΔA _{TT} (VOL) | -2.5 | 0 | 2.5 | dB | ATT (VOL) = 0 dB |
| Maximum input voltage | V _{IM} | 1.8 | 2.2 | — | V _{rms} | f = 1 kHz, BW: 400 ~ 30 kHz THD = 1% |
| Bass boost | G (Bass) B | 13 | 16 | 19 | dB | f = 100 Hz |
| Bass cut | G (Bass) C | -15 | -12 | -9 | dB | f = 100 Hz |
| MID boost | G (MID) B | 9 | 12 | 15 | dB | f = 1 kHz |
| MID cut | G (MID) C | -15 | -12 | -9 | dB | f = 1 kHz |
| Treble boost | G (Tre) B | 9 | 12 | 15 | dB | f = 10 kHz |
| Treble cut | G (Tre) C | -15 | -12 | -9 | dB | f = 10 kHz |
| Maximum attenuation | A _{TT} (FED) | — | -90 | -80 | dB | V _i = 1 V _{rms} , f = 1 kHz ATT (FED) = -∞ dB |
| Maximum output voltage | V _{OM} | 1.8 | 2.2 | — | V _{rms} | f = 1 kHz, BW: 400 to 30 kHz THD = 1% |
| Output noise voltage | V _{no1} | — | 10 | 18 | μV _{rms} | R _g = 0, DIN-AUDIO |
| | V _{no2} | — | 3 | 8 | | ATT (VOL) = -30 dB ATT (FED) = -∞ dB R _g = 0, DIN-AUDIO |
| Total harmonic distortion | THD | — | 0.01 | 0.05 | % | f = 1 kHz, V _o = 0.5 V _{rms} BW: 400 Hz to 30 kHz |
| Channel separation | CS | — | -90 | -80 | dB | f = 1 kHz |
| Cross talk of input selector | CT | — | -75 | -65 | dB | f = 1 kHz |
| Voltage gain of loudness | G (LOUD) L | 7.0 | 11.0 | 15.0 | dB | Loudness ON f = 100 Hz, ATT (VOL) = -30 dB |
| | G (LOUD) H | 3.5 | 6.5 | 9.5 | | Loudness ON f = 10 kHz, ATT (VOL) = -30 dB |

Relationship between Data and Clock



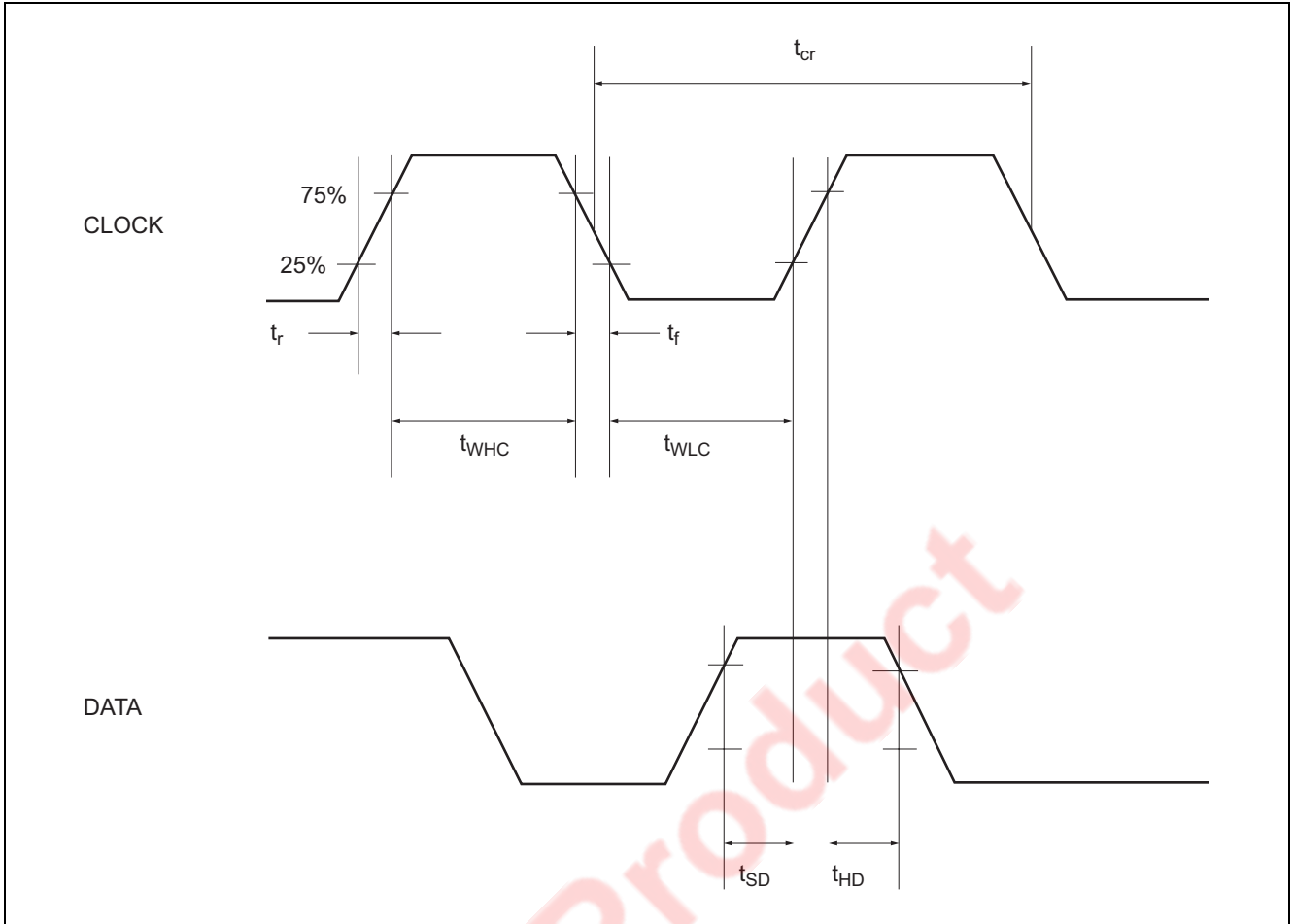
Digital Circuit DC Characteristics

| Item | Symbol | Limits | | | Unit | Test Conditions | |
|-------------------------|----------|--------------|-----|--------------|---------|------------------|------------------|
| | | Min | Typ | Max | | | |
| "L" level input voltage | V_{IL} | 0 | ~ | $0.2 V_{DD}$ | V | DATA, CLOCK pins | |
| "H" level input voltage | V_{IH} | $0.8 V_{DD}$ | ~ | V_{DD} | | | |
| "L" level input current | I_{IL} | -10 | — | 10 | μA | $V_I = 0$ | DATA, CLOCK pins |
| "H" level input current | I_{IH} | — | — | 10 | | $V_I = V_{DD}$ | |

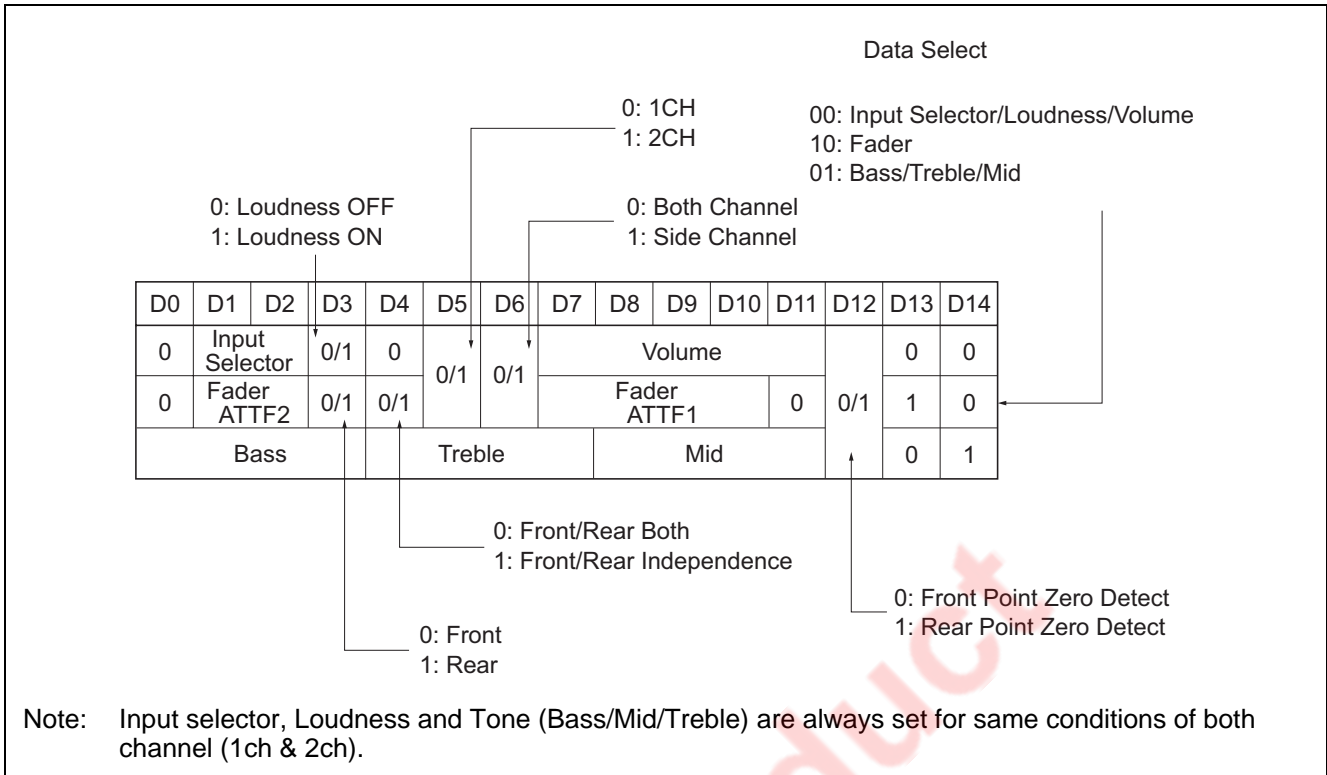
Digital Circuit AC Characteristics

| Item | Symbol | Limits | | | Unit |
|-------------------------------|-----------|--------|-----|-----|---------|
| | | Min | Typ | Max | |
| CLOCK cycle time | t_{cr} | 4 | — | — | μS |
| CLOCK pulse width ("H" level) | t_{WHC} | 1.6 | — | — | |
| CLOCK pulse width ("L" level) | t_{WLC} | 1.6 | — | — | |
| CLOCK rise time | t_r | — | — | 0.4 | |
| CLOCK fall time | t_f | — | — | 0.4 | |
| DATA setup time | t_{SD} | 0.8 | — | — | |
| DATA hold time | t_{HD} | 0.8 | — | — | |

Clock Data Timing



Data Input Format



Volume Code

| ATT V1 | D7 | D8 | D9 |
|--------|----|----|----|
| 0 dB | 1 | 0 | 1 |
| -4 dB | 0 | 0 | 1 |
| -8 dB | 1 | 1 | 0 |
| -12 dB | 0 | 1 | 0 |
| -16 dB | 1 | 0 | 0 |
| -20 dB | 0 | 0 | 0 |
| -24 dB | 0 | 1 | 1 |
| -28 dB | 1 | 1 | 1 |

| ATT V2 | D10 | D11 |
|--------|-----|-----|
| 0 dB | 1 | 1 |
| -1 dB | 0 | 1 |
| -2 dB | 1 | 0 |
| -3 dB | 0 | 0 |

Fader Code

| ATT F1 | D7 | D8 | D9 | D10 |
|--------|----|----|----|-----|
| 0 dB | 1 | 0 | 0 | 1 |
| -8 dB | 1 | 1 | 1 | 0 |
| -16 dB | 0 | 1 | 1 | 0 |
| -24 dB | 1 | 0 | 1 | 0 |
| -32 dB | 0 | 0 | 1 | 0 |
| -40 dB | 1 | 1 | 0 | 0 |
| -48 dB | 0 | 1 | 0 | 0 |
| -56 dB | 1 | 0 | 0 | 0 |
| -∞ dB | 0 | 0 | 0 | 0 |

| ATT F2 | D1 | D2 |
|--------|----|----|
| 0 dB | 1 | 1 |
| -2 dB | 0 | 1 |
| -4 dB | 1 | 0 |
| -6 dB | 0 | 0 |

Tone Code

| Bass | D0 | D1 | D2 | D3 |
|--------|----|----|----|----|
| 16 dB | 0 | 0 | 0 | 1 |
| 14 dB | 1 | 1 | 1 | 0 |
| 12 dB | 0 | 1 | 1 | 0 |
| 10 dB | 1 | 0 | 1 | 0 |
| 8 dB | 0 | 0 | 1 | 0 |
| 6 dB | 1 | 1 | 0 | 0 |
| 4 dB | 0 | 1 | 0 | 0 |
| 2 dB | 1 | 0 | 0 | 0 |
| 0 dB | 0 | 0 | 0 | 0 |
| -2 dB | 1 | 0 | 0 | 1 |
| -4 dB | 0 | 1 | 0 | 1 |
| -6 dB | 1 | 1 | 0 | 1 |
| -8 dB | 0 | 0 | 1 | 1 |
| -10 dB | 1 | 0 | 1 | 1 |
| -12 dB | 0 | 1 | 1 | 1 |

| Treble | D4 | D5 | D6 | D7 |
|--------|----|----|----|----|
| 12 dB | 0 | 1 | 1 | 0 |
| 10 dB | 1 | 0 | 1 | 0 |
| 8 dB | 0 | 0 | 1 | 0 |
| 6 dB | 1 | 1 | 0 | 0 |
| 4 dB | 0 | 1 | 0 | 0 |
| 2 dB | 1 | 0 | 0 | 0 |
| 0 dB | 0 | 0 | 0 | 0 |
| -2 dB | 1 | 0 | 0 | 1 |
| -4 dB | 0 | 1 | 0 | 1 |
| -6 dB | 1 | 1 | 0 | 1 |
| -8 dB | 0 | 0 | 1 | 1 |
| -10 dB | 1 | 0 | 1 | 1 |
| -12 dB | 0 | 1 | 1 | 1 |

| Mid | D8 | D9 | D10 | D11 |
|--------|----|----|-----|-----|
| 12 dB | 0 | 1 | 1 | 0 |
| 10 dB | 1 | 0 | 1 | 0 |
| 8 dB | 0 | 0 | 1 | 0 |
| 6 dB | 1 | 1 | 0 | 0 |
| 4 dB | 0 | 1 | 0 | 0 |
| 2 dB | 1 | 0 | 0 | 0 |
| 0 dB | 0 | 0 | 0 | 0 |
| -2 dB | 1 | 0 | 0 | 1 |
| -4 dB | 0 | 1 | 0 | 1 |
| -6 dB | 1 | 1 | 0 | 1 |
| -8 dB | 0 | 0 | 1 | 1 |
| -10 dB | 1 | 0 | 1 | 1 |
| -12 dB | 0 | 1 | 1 | 1 |

Input Selector

| Input Selector | D1 | D2 |
|----------------|----|----|
| D (5, 38 pin) | 1 | 1 |
| C (4, 39 pin) | 1 | 0 |
| B (3, 40 pin) | 0 | 1 |
| A (2, 41 pin) | 0 | 0 |

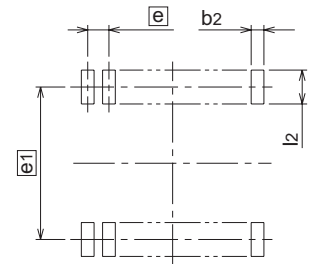
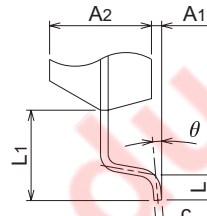
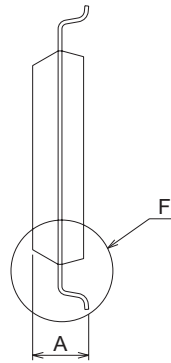
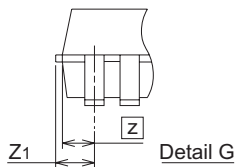
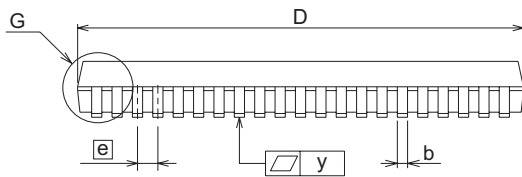
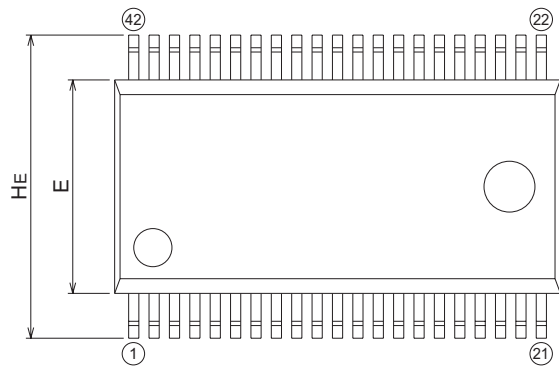
Package Dimensions

42P2R-A



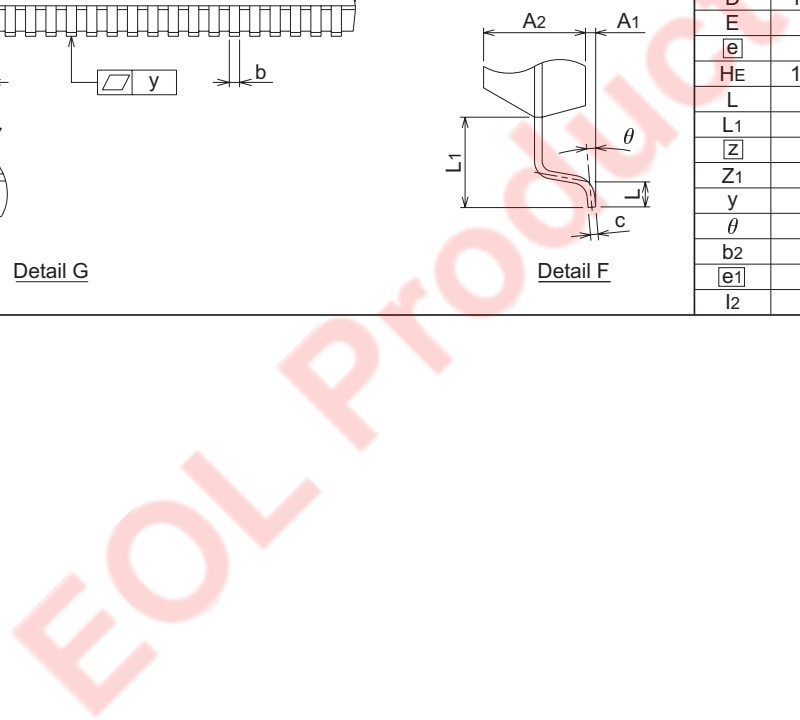
Plastic 42pin 450mil SSOP

| | | | |
|-------------------|------------|-----------|-------------------|
| EIAJ Package Code | JEDEC Code | Weight(g) | Lead Material |
| SSOP42-P-450-0.80 | — | 0.63 | Alloy 42/Cu Alloy |



Recommended Mount Pad

| Symbol | Dimension in Millimeters | | |
|--------|--------------------------|-------|-------|
| | Min | Nom | Max |
| A | — | — | 2.4 |
| A1 | 0.05 | — | — |
| A2 | — | 2.0 | — |
| b | 0.35 | 0.4 | 0.5 |
| c | 0.13 | 0.15 | 0.2 |
| D | 17.3 | 17.5 | 17.7 |
| E | 8.2 | 8.4 | 8.6 |
| e | — | 0.8 | — |
| HE | 11.63 | 11.93 | 12.23 |
| L | 0.3 | 0.5 | 0.7 |
| L1 | — | 1.765 | — |
| Z | — | 0.75 | — |
| Z1 | — | — | 0.9 |
| y | — | — | 0.15 |
| theta | 0° | — | 10° |
| b2 | — | 0.5 | — |
| e1 | — | 11.43 | — |
| l2 | 1.27 | — | — |



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