

RC5512

RAPPER™ Family – 4 Watt Stereo Sound Driver

Features

- Up to 4W/channel
- Drives 8Ω and 4Ω non-powered speakers
- NO-POP: during power-up/power-down and mute control
- Individual control pins to select mute and on/off for headphone, speaker, microphone, and regulator block
- Provides regulated 5V supply for sound codec, etc.
- Line output signal-to-noise ratio of 85dB
- Sleep mode supply current typically 10μA
- Microphone multiplexing
- Total harmonic distortion <0.1%
- Microphone amplifier with AGC 40dB dynamic range
- Internal Thermal Limiting Circuitry

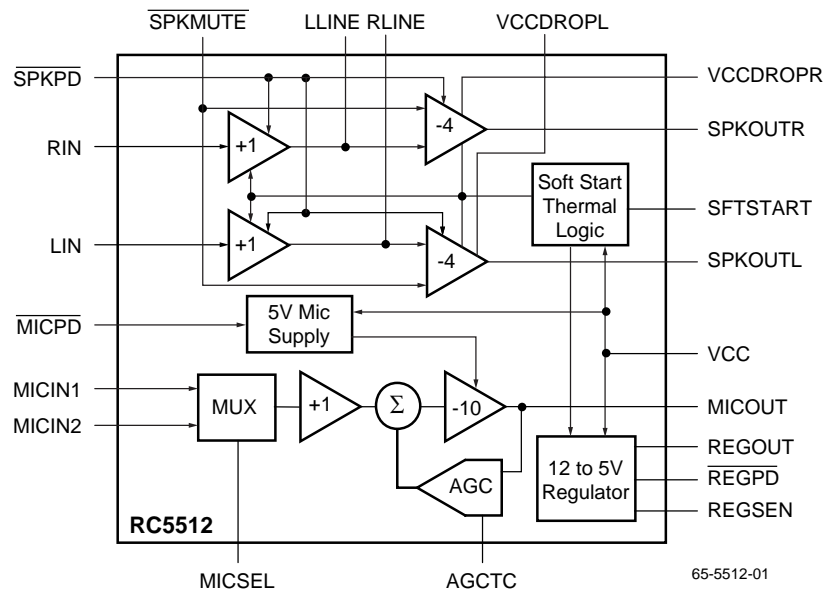
Description

The RC5512 can be used for driving key functions that are needed in all multimedia PCs and sound cards. These functions include directly powering speakers and headphone sets, providing a microphone pre-amplifier with AGC, and having a 12V to 5V regulator that can isolate the noise from the sound channel. Each function can be controlled individually, thus providing power saving features.

Applications

- Multimedia PC motherboards and add-in sound cards
- Portable multimedia personal computers
- Companion chip to Sigma-Delta Sound Codecs
- Sound Channel back-end in Set-top boxes

Block Diagram



Functional Description

The Rapper Stereo Sound Driver is an audio device that can be used on PC motherboards and add-in sound cards. It consists of stereo output drivers for headphone or speakers, a low noise microphone amplifier with AGC, and a regulator to provide a clean 5V supply. The RC5512 has two microphone inputs which are user selectable. Each section can be individually put into a shut-down mode and muted by pulling the appropriate pin low.

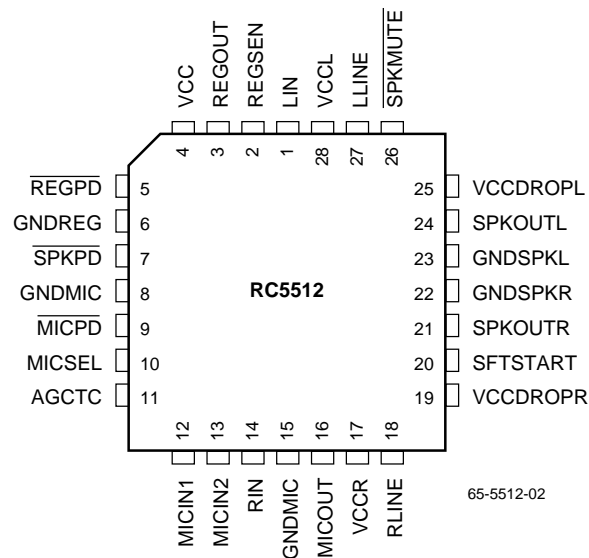
The output drivers can deliver up to 2 watts peak and 4 watts peak into 8 Ω and 4 Ω speakers, respectively, from a 12V source. The drivers use class AB amplifiers and maintain a low bias current. The power-down function is designed to save power and to turn on/off the driver without generating *popping* signals. To prevent popping signals, when the circuit is activated, a delay is provided to these output drivers. These drivers become active only after their outputs have settled. The time constant is user-defined through an external capacitor (CDELAY) on the SFTSTART pin.

The microphone amplifier feeds into an AGC with a dynamic range of 40dB. An external capacitor is used to provide attack and decay features. Attack and decay times can be varied linearly by varying an external capacitor (CAD) on the AGCTC pin. The attack and decay time ratio has been set for pleasant audio quality.

The 12 V to 5V voltage regulator can provide up to 20mA of current without external components. It can provide a noise-free regulated voltage supply to the other devices that complete the sound channel. Use of an external transistor can boost the regulator output to 150mA or higher with the appropriate thermal precautions. The line regulation of 50dB improves the cross talk and the power supply rejection ratio of all other audio blocks that are supplied by the 5V source.

The thermal limiting circuitry activates if the chip temperature typically exceeds 150°C.

Pin Assignments



Pin Definitions

| Pin Name | Pin Number | Description |
|----------|------------|--|
| LIN | 1 | Left Channel Input. |
| REGSEN | 2 | Regulator Sense Point. |
| REGOUT | 3 | Regulator 5V Output. |
| VCC | 4 | 12V Power Supply Input. |
| REGPD | 5 | Regulator Power-Down. |
| GNDREG | 6 | Regulator Ground. |
| SPKPD | 7 | Speaker and Line Driver Power-Down. |
| GNDMIC | 8, 15 | Microphone Ground. |
| MICPD | 9 | Microphone Power-Down. |
| MICSEL | 10 | Microphone Output Select. LOW selects MICIN1, HIGH selects MICIN2. |
| AGCTC | 11 | Attack and Decay Capacitor Pin. |
| MICIN1 | 12 | Microphone Input 1. |
| MICIN2 | 13 | Microphone Input 2. |
| RIN | 14 | Right Channel Input. |
| MICOUT | 16 | Microphone Output. |
| VCCR | 17 | Right Speaker Supply. |
| RLINE | 18 | Right Line Driver Output. |
| VCCDROPR | 19 | Right Speaker Power Drop Supply. |
| SFTSTART | 20 | Soft Start Timing Capacitor. |
| SPKOUTR | 21 | Right Speaker Output. |
| GNDSPKR | 22 | Right Speaker Ground. |
| GNDSPKL | 23 | Left Speaker Ground. |
| SPKOUTL | 24 | Left Speaker Output. |
| VCCDROPL | 25 | Left Speaker Power Drop Supply. |
| SPKMUTE | 26 | Speaker Mute. |
| LLINE | 27 | Left Line Driver Output. |
| VCCL | 28 | Left Speaker Supply. |

Absolute Maximum Ratings¹

(beyond which the device may be damaged)

| Parameter | | Min. | Typ. | Max. | Units |
|-----------|----------------------|------|------|------|-------|
| VCC | Power supply voltage | | | 13.2 | V |

Note:

- Functional operation under any of these conditions is NOT implied. Performance is guaranteed only if Operating Conditions are not exceeded.

Operating Conditions

| Parameter | | Conditions | Min. | Typ. | Max. | Units |
|----------------------|------------------------------------|-------------------------------|------|------|------|-------|
| VCC VCCR VCCL | Power Supply | | 11.2 | 12 | 12.8 | V |
| VCCDROPR VCCDROPL | Right and Left Power Drop Supplies | RDROP = 2Ω (See Figure 1) | 11.2 | 12 | 12.8 | V |
| VIH | Input Voltage Logic High | | 2 | | | V |
| VIL | Input Voltage Logic Low | | | | 0.8 | V |
| | Ambient Temperature | | 0 | | 70 | °C |
| Tc | Maximum Operation Die Temperature | Overthermal Protection | | 150 | | °C |
| I _{total} | Power Supply Current | No load | | 19 | 25 | mA |
| ISD | Shut-Down Current | SPKPD, MICPD, REGPD ≤ 0.4V | | 10 | 75 | μA |
| ESD | ESD Threshold | Human Body Model | 2000 | | | V |

Electrical Characteristics

VCC = 12V ± 6%, unless otherwise specified.

| Parameter | | Conditions | Min. | Typ. | Max. | Units |
|-----------------------|---|--|------|------|------|-----------------|
| Line Driver | | f = 1KHz, RL = 600Ω unless otherwise specified | | | | |
| Zin | Input Impedance | | | 10 | | KΩ |
| Av | Voltage Gain | VIN = 0.5 Vrms | 0.95 | 1.0 | 1.05 | V/V |
| L&R Av | Left and Right Gain Matching | VO _{UT} = 4VP-P | | 0.3 | | % |
| Vo | Output Voltage | RL = 600Ω | | ±4 | | V |
| THD | Total Harmonic Distortion | VO _{UT} = 4VP-P | | 0.01 | | % |
| PSRR | Power Supply Rejection Ratio | f = 100Hz, ΔV _{CC} = 0.85Vrms | 80 | 86 | | dB |
| SNR | Signal-to-Noise Ratio | VIN = 2.8Vrms | | 85 | | dB |
| Speaker Driver | | f = 1KHz, RL = 8Ω unless otherwise specified | | | | |
| I _{spk} | Speaker Driver and Line Driver Supply Current | VIN = 0V | | 9 | | mA |
| Zin | Input Impedance | | 100 | | | KΩ |
| Av | Voltage Gain | VIN = 0.5 Vrms | -3.8 | -4.0 | -4.2 | V/V |
| L&R Av | Left and Right Gain Matching | VO _{UT} = 4VP-P | | 0.5 | | % |
| Vo | Output Voltage | RL = 4 Ω or 8Ω, VCC = 12V | | ±4 | | V _{pK} |

Electrical Characteristics (continued)

VCC = 12V ± 6%, unless otherwise specified.

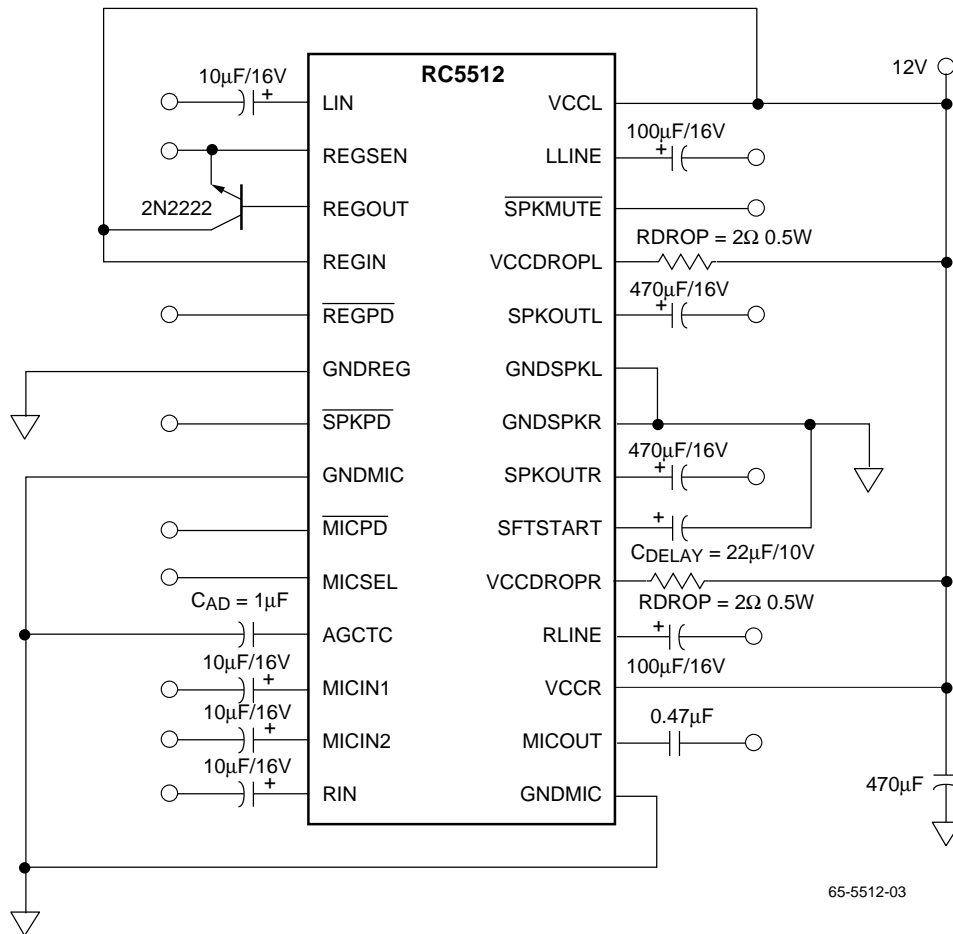
| Parameter | | Conditions | Min. | Typ. | Max. | Units |
|-----------------------------|---|--|------|------|------|-------|
| SNR | Signal-to-Noise Ratio | V _{IN} = 2.8Vrms | | 85 | | dB |
| Po | Power Output Per Channel Peak | RL = 4Ω, VCC = 12V | | 4 | | W |
| CS | Channel Separation L/R Input Referenced | V _{IN} = 0.5 Vrms | 66 | | | dB |
| XTALK | Cross Talk L/R to Mic Input Referenced | V _{IN} = 0.5 Vrms | 90 | | | dB |
| XTALK | Cross Talk L/R to Reg Input Referenced | V _{IN} = 0.5 Vrms | 75 | | | dB |
| THD | Total Harmonic Distortion | fo = 1KHz, Po = 50mW | | 0.1 | | % |
| Noise | | 20Hz - 20KHz, A-Weighted | | 4 | | μVrms |
| PSRR | Power Supply Rejection Ratio Input Referenced | f = 100Hz, ΔVCC = 1.6Vp-p | 70 | 80 | | dB |
| Microphone Amplifier | | f = 1KHz, RL = 10KΩ unless otherwise specified | | | | |
| Imicamp | Microphone Amp Supply Current | V _{IN} = 0V, max gain | | 4 | | mA |
| Zin1 | First Amp Input Impedance | | | 4.5 | | KΩ |
| Av1 | First Amp Gain | | | 1 | | V/V |
| Av2 | Second Amp Gain | | | -10 | | V/V |
| AGC | AGC Dynamic Range | | | 40 | | dB |
| THD | Total Harmonic Distortion | Vin = 5mVP-P, AGC off | | 0.1 | | % |
| Noise | | 20Hz - 20KHz, A-Weighted | | 8 | | μVrms |
| XTALK | XTALK from other blocks at MICOUT | V _{IN} = 1Vrms at 1KHz | 70 | | | dB |
| PSRR | Input Referenced | f = 100Hz, ΔVCC = 1.6Vp-p | 70 | | | dB |
| Voltage Regulator | | | | | | |
| Ireg | Voltage Regulator Supply Current | | | 1.5 | | mA |
| Vreg | Regulator Voltage | | 4.75 | 5 | 5.25 | V |
| Tc | Tempco | | | 0.5 | | mV/°C |
| | Line Regulation | | | 3 | | mV/V |
| | Load Regulation | | | 2 | | mV/mA |
| Io | Output Current | Source | | 20 | | mA |
| | | Source With External 2N2222 | | 150 | | mA |
| | | Sink | | 100 | | μA |
| Soft Start | | | | | | |
| Delay | Anti-Pop Ramp-Up and Ramp-Down time | No Pop condition CDELAY = 22μF on SFTSTART | | 2 | | sec |

Power-Down Function Table

L = $V_{IL} \leq 0.8V$, H = $V_{IH} \geq 2.0V$, X = Don't Care

| SPKPD | MICPD | REGPD | SPKMUTE | Function |
|-------|-------|-------|---------|---|
| L | L | L | X | Chip Disabled |
| H | H | H | H | All Sections Enabled |
| H | L | L | L | Line Driver Enabled, Regulator and Microphone Disabled, Speaker Muted |
| L | H | H | X | Line Driver and Speaker Disabled, Regulator and Microphone Enabled |
| H | L | H | H | Microphone Only Disabled |
| H | H | L | H | Regulator Only Disabled |

Applications Discussion



Notes:

- 4 Watt power represents the peak of the audio level and cannot be sustained without correct package thermal considerations. The average audio signal can be sustained by the RC5512 without extra thermal considerations.
- To improve the thermal resistance of the PLCC 28 package, a heat sink can be used. One possible vendor is: AAVID, P/N CLC12059501.

Figure 1. Rapper™ RC5512, 4 Ohm Speaker, 4 Watt Application with External Pass Transistor for Voltage Regulator.

Portable PC Application

Figure 2 shows an application of the RC5512 for portable PCs when a high current, regulated 12 volts is not available. Because the portable PC's battery voltage can exceed the VCC maximum specification of the RC5512, a low drop out linear regulator with power down has been included. The linear regulator provides 12 volts of regulation even if the battery voltage exceeds 20 volts. In addition, the low drop out linear regulator allows good sound quality even when the battery

voltage drops to 9 volts. The low power down current bias of the regulator minimizes the battery current drain when the RC5512 is in a sleep mode.

Alternatively, if a regulated 12 volt supply is available with a minimum current output of 300mA and sufficient by-pass capacitance, no additional regulation is required.

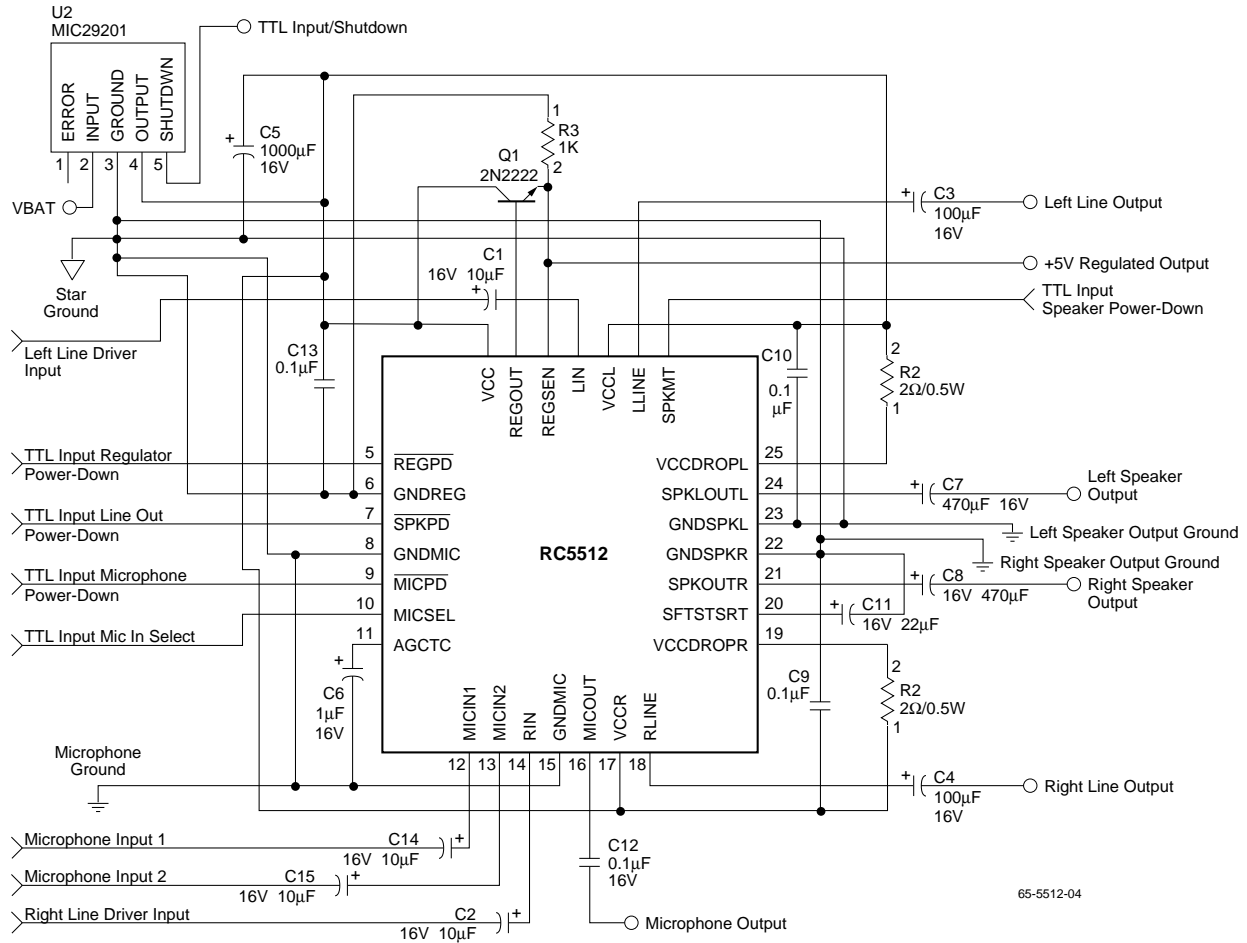


Figure 2. RC5512 Portable PC Application.

Notes:

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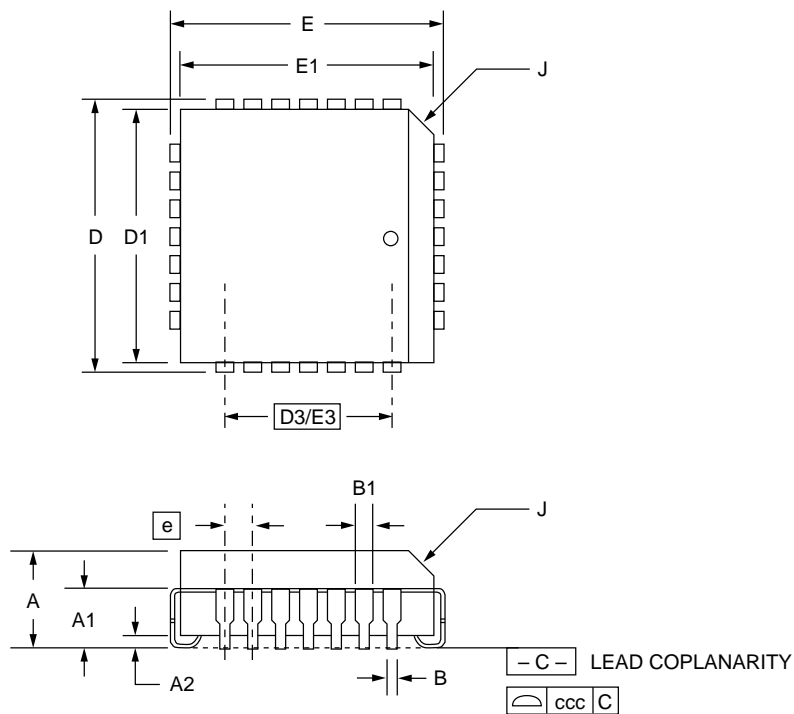
Notes:

Mechanical Dimensions – 28 Lead PLCC Package

| Symbol | Inches | | Millimeters | | Notes |
|--------|----------|------|-------------|-------|-------|
| | Min. | Max. | Min. | Max. | |
| A | .165 | .180 | 4.19 | 4.57 | |
| A1 | .090 | .120 | 2.29 | 3.05 | |
| A2 | .020 | — | .51 | — | |
| B | .013 | .021 | .33 | .53 | |
| B1 | .026 | .032 | .66 | .81 | |
| D/E | .485 | .495 | 12.32 | 12.57 | |
| D1/E1 | .450 | .456 | 11.43 | 11.58 | 3 |
| D3/E3 | .300 BSC | | 7.62 BSC | | |
| e | .050 BSC | | 1.27 BSC | | |
| J | .042 | .048 | 1.07 | 1.22 | 2 |
| ND/NE | 7 | | 7 | | |
| N | 28 | | 28 | | |
| ccc | — | .004 | — | 0.10 | |

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M-1982
2. Corner and edge chamfer (J) = 45°
3. Dimension D1 and E1 do not include mold protrusion. Allowable protrusion is .101" (.25mm)



Ordering Information

| Product Number | Package |
|----------------|---------|
| RC5512V | 28 PLCC |

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