

# 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

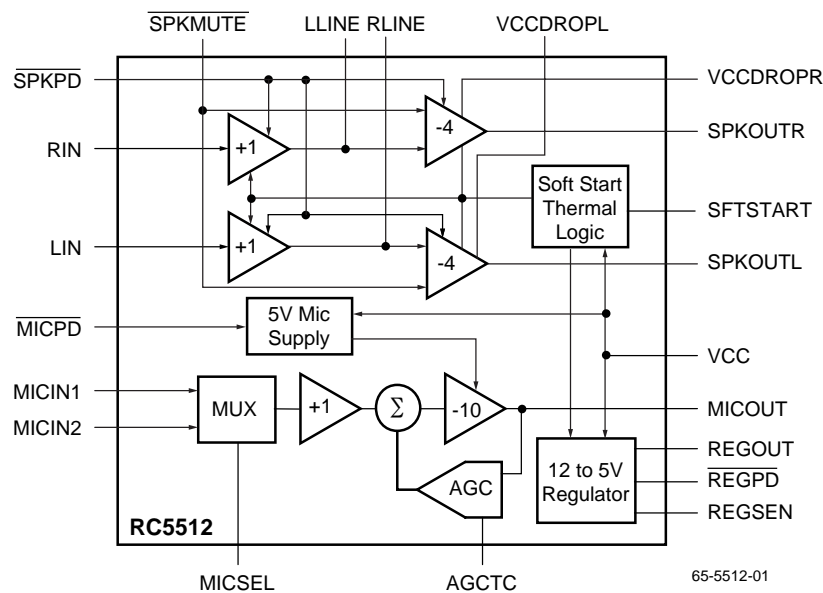
### Description

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.

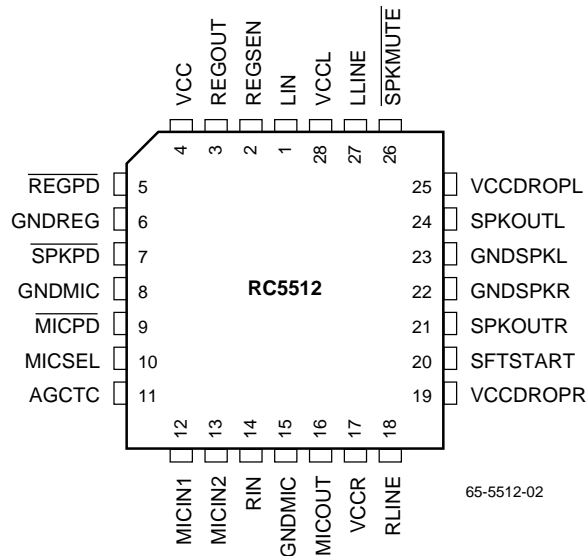
The output drivers can deliver up to 2 watts peak and 4 watts peak into 8Ω and 4Ω speakers, respectively, from a 12V source. The drivers use class AB amplifiers and maintain a low bias current. The power-down function is designed to save power and to turn on/off the driver without generating *popping* 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 Ratings<sup>1</sup>

(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 <sub>total</sub>	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
<b>Line Driver</b>		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 <sub>UT</sub> = 4VP-P		0.3		%
Vo	Output Voltage	RL = 600Ω		±4		V
THD	Total Harmonic Distortion	VO <sub>UT</sub> = 4VP-P		0.01		%
PSRR	Power Supply Rejection Ratio	f = 100Hz, ΔV <sub>CC</sub> = 0.85Vrms	80	86		dB
SNR	Signal-to-Noise Ratio	VIN = 2.8Vrms		85		dB
<b>Speaker Driver</b>		f = 1KHz, RL = 8Ω unless otherwise specified				
I <sub>spk</sub>	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 <sub>UT</sub> = 4VP-P		0.5		%
Vo	Output Voltage	RL = 4 Ω or 8Ω, VCC = 12V		±4		V <sub>pK</sub>

### Electrical Characteristics (continued)

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

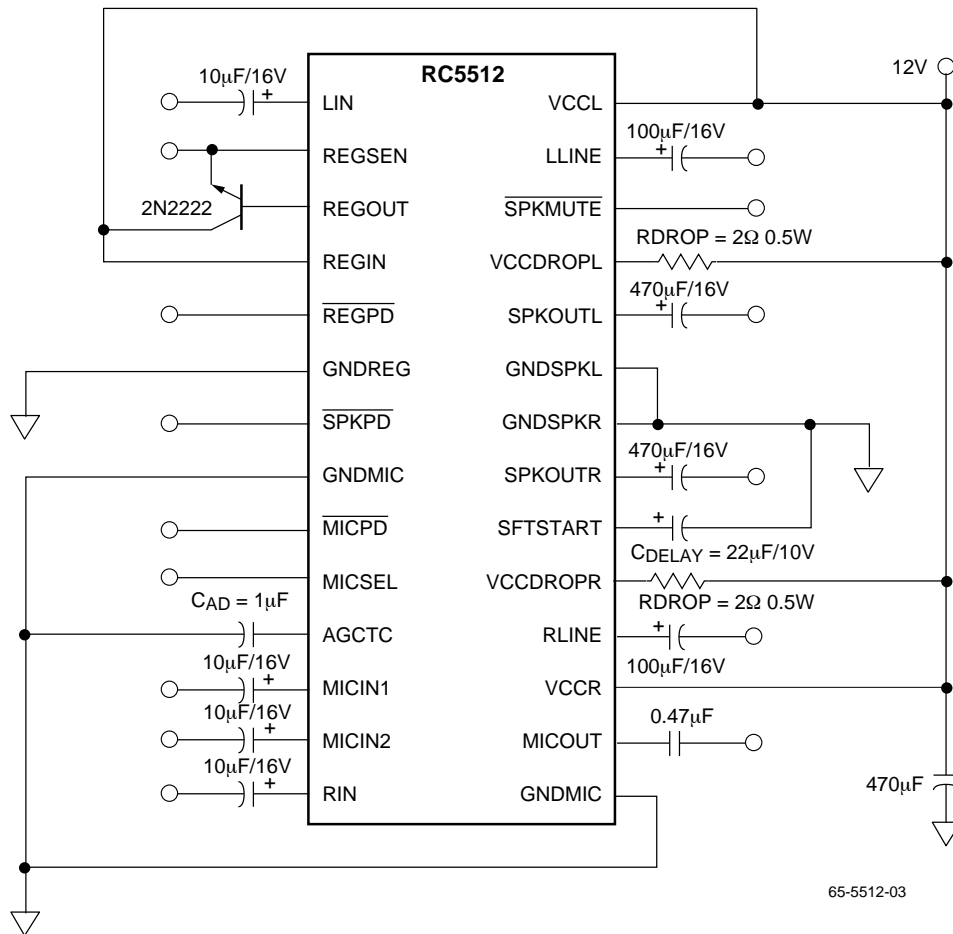
Parameter		Conditions	Min.	Typ.	Max.	Units
SNR	Signal-to-Noise Ratio	V <sub>IN</sub> = 2.8Vrms		85		dB
Po	Power Output Per Channel Peak	RL = 4Ω, VCC = 12V		4		W
CS	Channel Separation L/R Input Referenced	V <sub>IN</sub> = 0.5 Vrms	66			dB
XTALK	Cross Talk L/R to Mic Input Referenced	V <sub>IN</sub> = 0.5 Vrms	90			dB
XTALK	Cross Talk L/R to Reg Input Referenced	V <sub>IN</sub> = 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
<b>Microphone Amplifier</b>		f = 1KHz, RL = 10KΩ unless otherwise specified				
Imicamp	Microphone Amp Supply Current	V <sub>IN</sub> = 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 <sub>IN</sub> = 1Vrms at 1KHz	70			dB
PSRR	Input Referenced	f = 100Hz, ΔVCC = 1.6Vp-p	70			dB
<b>Voltage Regulator</b>						
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
<b>Soft Start</b>						
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:**

1. 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.
2. 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.

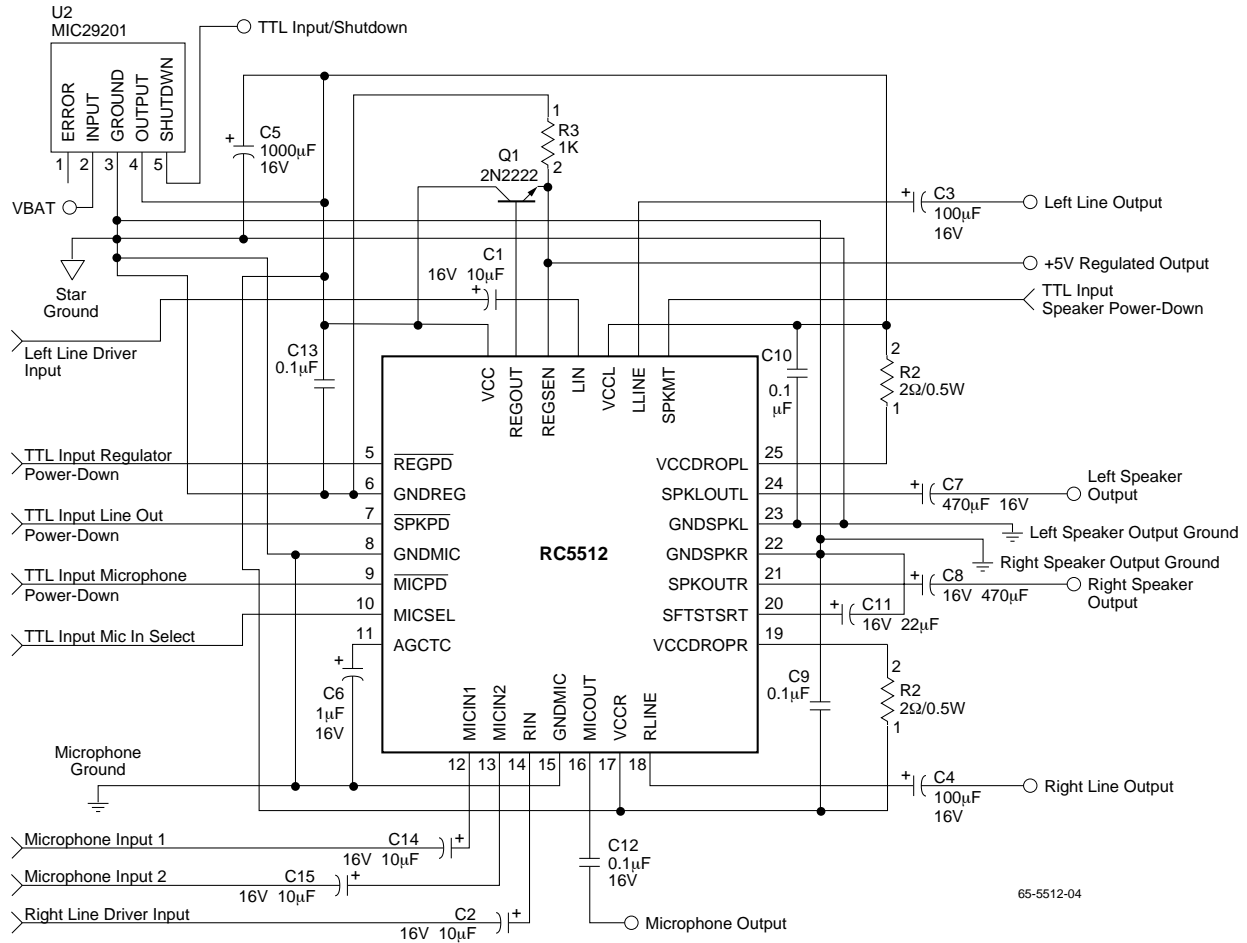


Figure 2. RC5512 Portable PC Application.

**Notes:**



**Notes:**

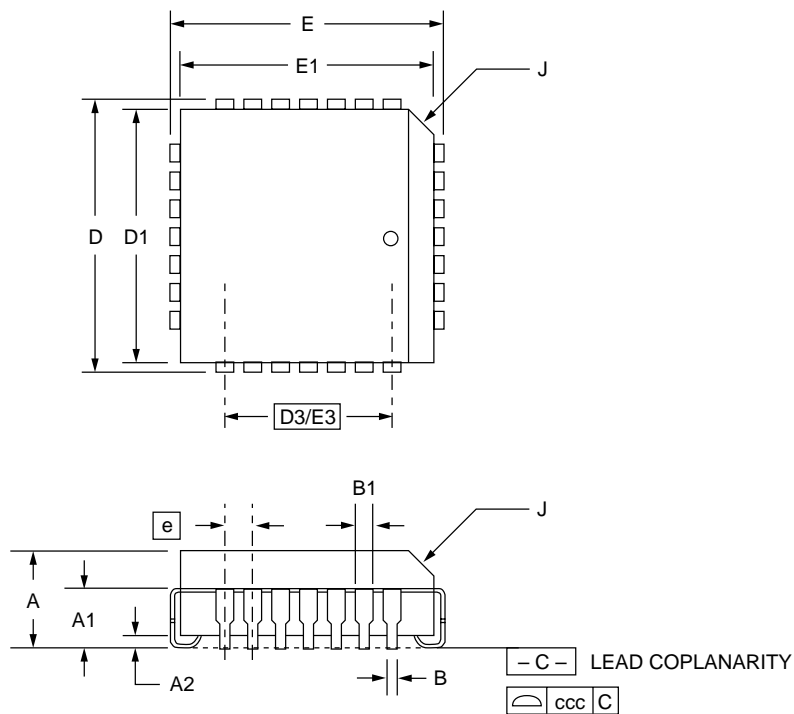
**Notes:**

# 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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