

BCT8013

2.8W Mono Class D Audio Power Amplifier

GENERAL DESCRIPTION

The BCT8013 is a 2.8W mono filter-less class-D amplifier with high PSRR and differential input that eliminate noise and RF rectification.

Features like greater than 90% efficiency and small PCB area make the BCT8013 Class-D amplifier ideal for portable applications. The output uses a filter-less architecture minimizing the number of external components and PCB area whilst providing a high performance, simple and lower cost system.

The BCT8013 features over current protection and thermal shutdown.

The BCT8013 is available in 9-pin package. This device operates over the -40°C to +85°C extended temperature range.

FEATURES

- 2.8V to 5.5V Single-Supply Operation
- POUT at 10% THD+N, f=1KHz, VDD=5V
RL=4 Ω 2.80W (Typ.)
RL=8 Ω 1.67W (Typ.)
- -75dB PSRR at 1KHz
- High Efficiency up to 90%
- Over current Protection
- Thermal Shutdown
- Temperature Range: -40°C to 85°C
- Available in QFN1.5x1.5-9L package

APPLICATIONS

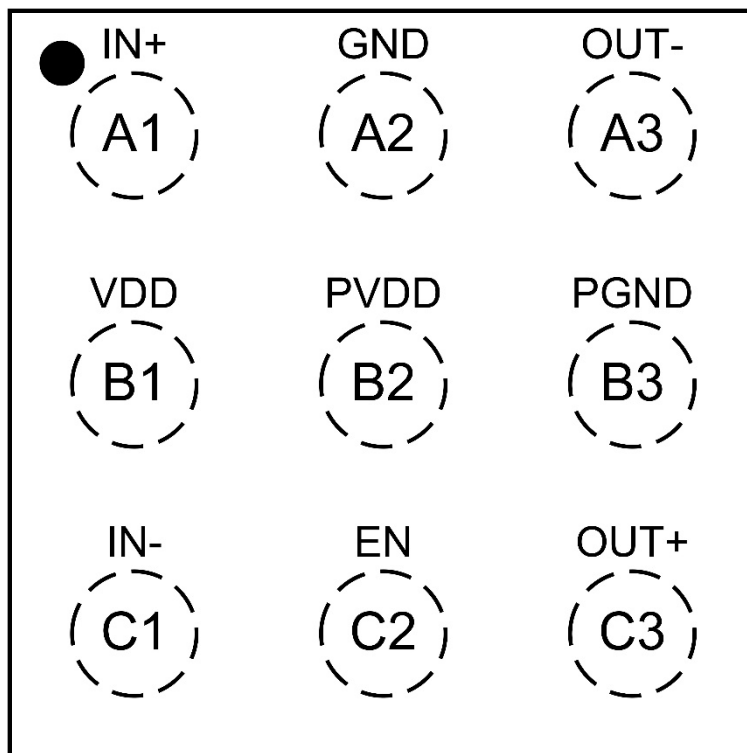
- MP3/MP4
- Smart Speaker
- Portable Instrumentation

ORDERING INFORMATION

Order Number	Package Type	Temperature Range	Marking	QTY/Reel
BCT8013EGL-TR	QFN1.5x1.5-9L	-40°C to +85°C	GA XX	3000

Mark Note: "XX" in Making will be appeared as the batch code.

PIN CONFIGURATION (Top View)

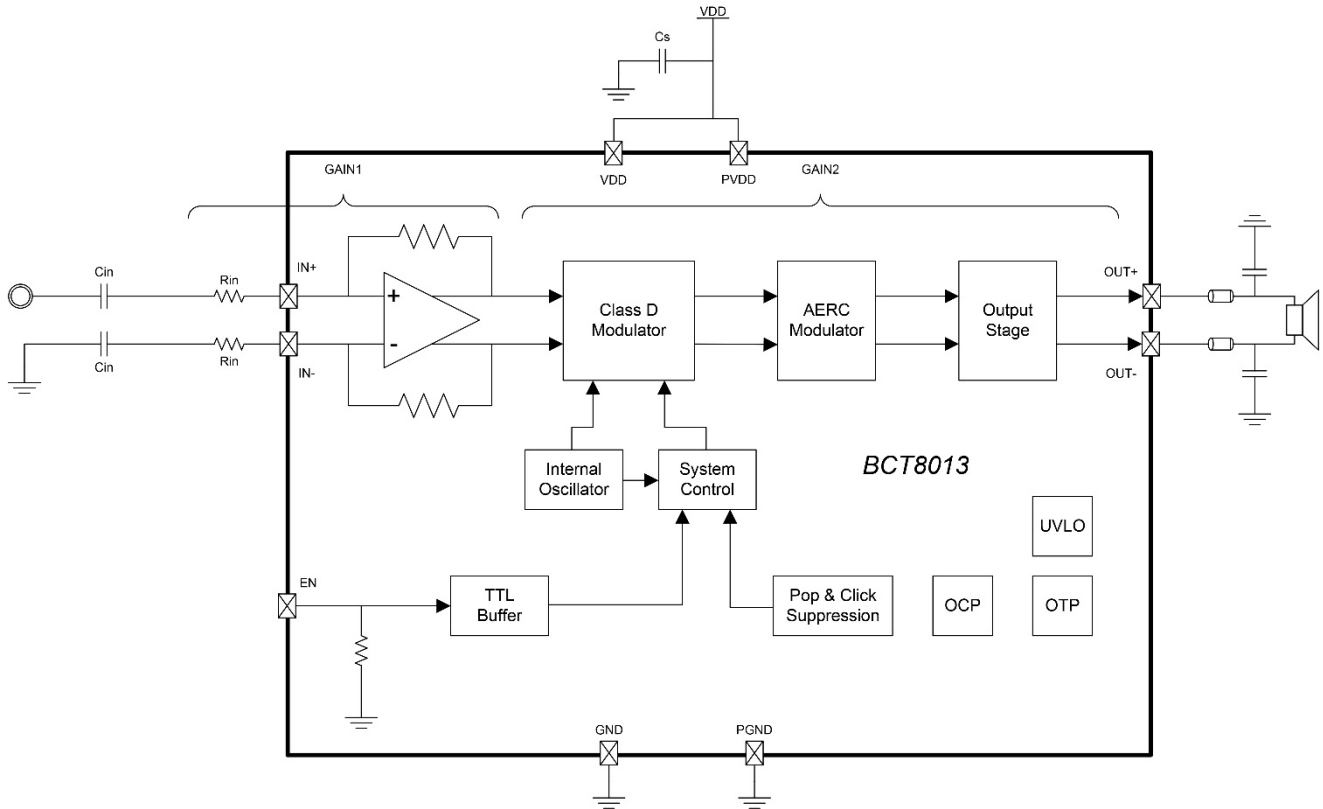


QFN1.5x1.5-9L

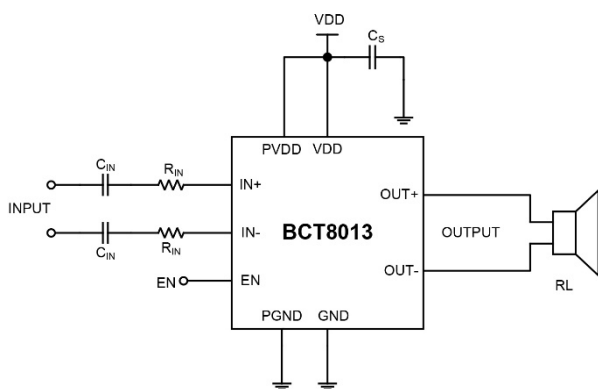
PIN DESCRIPTIONS

Pin #	Name	Description
A1	IN+	Positive Differential Input
A2	GND	Ground
A3	OUT-	Negative BTL Output
B1	VDD	Power Supply
B2	PVDD	Power Supply
B3	PGND	Power Ground
C1	IN-	Negative Differential Input
C2	EN	Terminal to Enable the Chip
C3	OUT+	Positive BTL Output

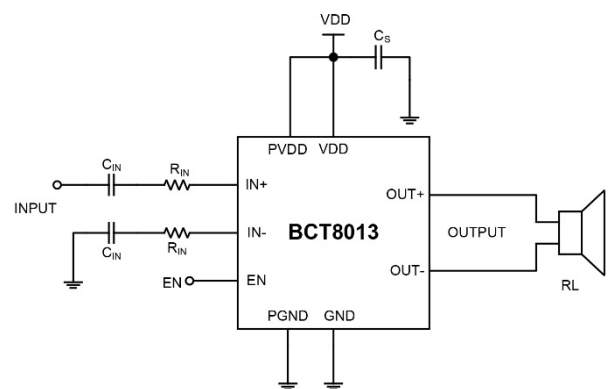
BLOCK DIAGRAM



TYPICAL APPLICATION CIRCUIT



Differential Input Mode



Single End Input Mode

Note: $\text{Gain} = 2 \times 150\text{k} / R_{IN}$



BCT8013

2.8W Mono Class D

Audio Power Amplifier

ABSOLUTE MAXIMUM RATINGS

VDD, PVDD Supply Voltage Range.....	-0.3V to 6V
IN+, IN-, EN Input Voltage Range.....	-0.3V to VDD+0.3V
Package Thermal Resistance θ_{JA}	180°C/W
Operating Temperature Range.....	-40°C to +85°C
Junction Temperature.....	150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10sec).....	260°C
ESD HBM (Human Body Model)	±6KV

NOTE:

1. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute Maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITONS

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications.

Symbol	Parameter	Min.	Max.	Unit
VDD	Supply Voltage	2.8	5.5	V
T _A	Operating Temperature	-40	+85	°C
T _J	Junction Temperature	-40	+125	°C

ELECTRICAL CHARACTERISTICS

Test condition: $T_A=25^{\circ}\text{C}$, $V_{DD}=3.6\text{V}$, $R_L=8\Omega+33\mu\text{H}$, $f=1\text{kHz}$ (unless otherwise noted)

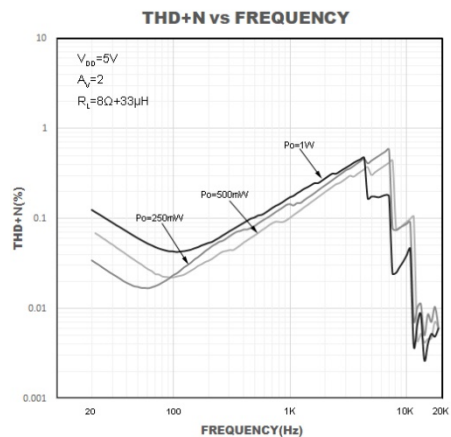
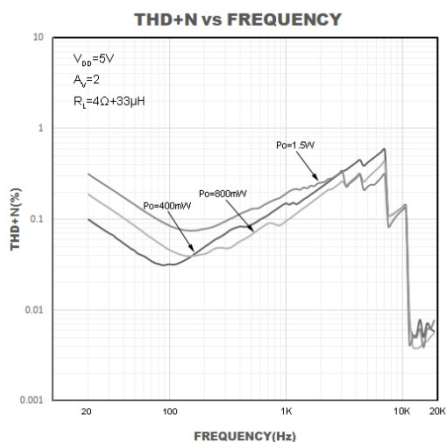
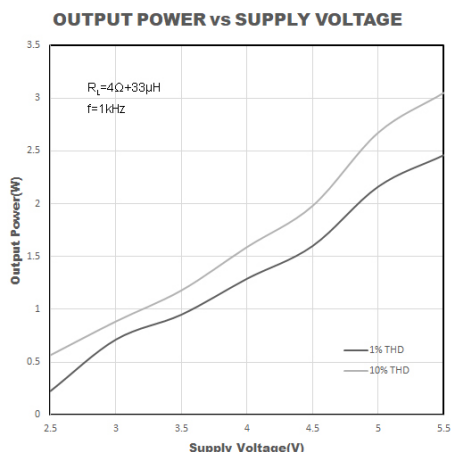
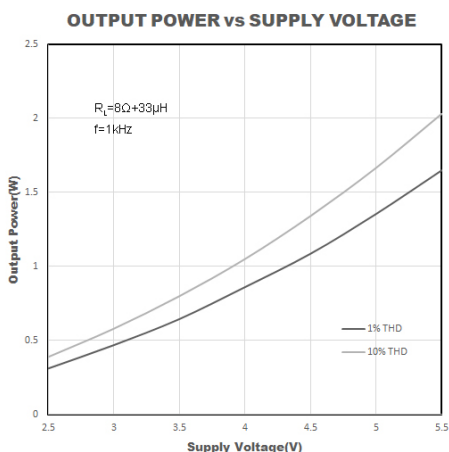
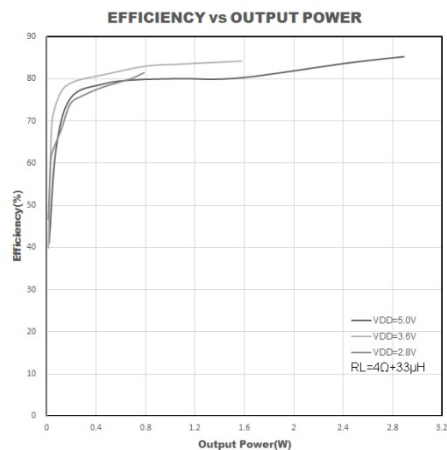
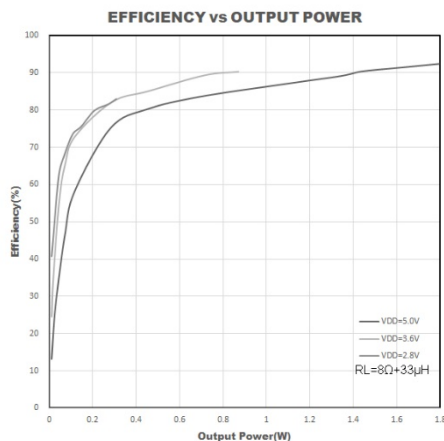
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$ V_{OO} $	Output Offset Voltage	$V_{IN}=0\text{V}$, $A_V=2\text{V/V}$, $V_{DD}=2.8\text{V to } 5.5\text{V}$		5	25	mV
PSRR	Power Supply Ripple Rejection	$V_{DD}=5.0\text{V}$, Inputs AC Short	$f=217\text{Hz}$	-80		dB
			$f=1\text{kHz}$	-75		dB
$ I_{IH} $	Input High Current	$V_{DD}=5.0\text{V}$, $V_I=V_{DD}$			50	μA
$ I_{IL} $	Input Low Current	$V_{DD}=5.0\text{V}$, $V_I=0\text{V}$			1	μA
I_{DD}	Quiescent Current	$V_{DD}=5.0\text{V}$, No load, No Filter		3.6		mA
		$V_{DD}=3.6\text{V}$, No load, No Filter		2		mA
I_{SD}	Shutdown Current	$EN=0\text{V}$		0.1		μA
$R_{DS(ON)}$	Static Drain to Source On-state Resistor	$V_{DD}=5.0\text{V}$		260		$\text{m}\Omega$
$f_{(SW)}$	Switching Frequency	$V_{DD}=2.8\text{V to } 5.5\text{V}$		700		KHz
Gain	Closed-loop Gain		$(2 \times 150\text{k}\Omega)/R_{in}$			V/V
R_{SD}	Shutdown Pull-down Resistor			230		$\text{K}\Omega$
V_{IH}	EN Input High Voltage	$V_{DD}=2.8\text{V to } 5.5\text{V}$	1.4			V
V_{IL}	EN Input LOW Voltage	$V_{DD}=2.8\text{V to } 5.5\text{V}$			0.4	V

OPERATING CHARACTERISTICS

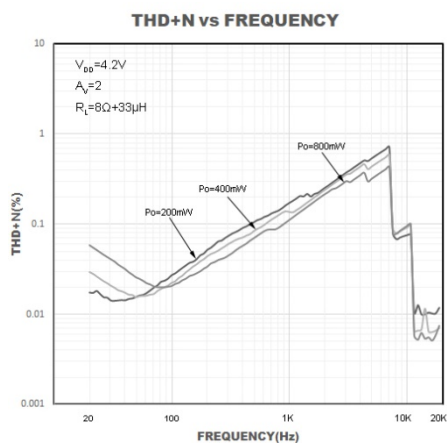
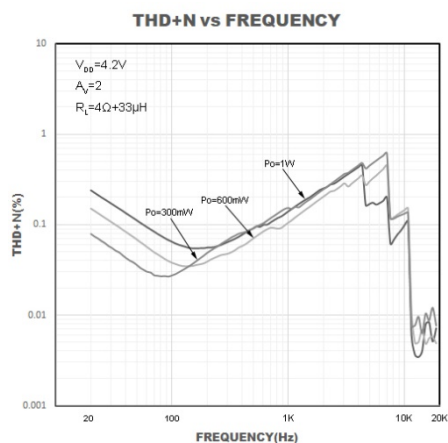
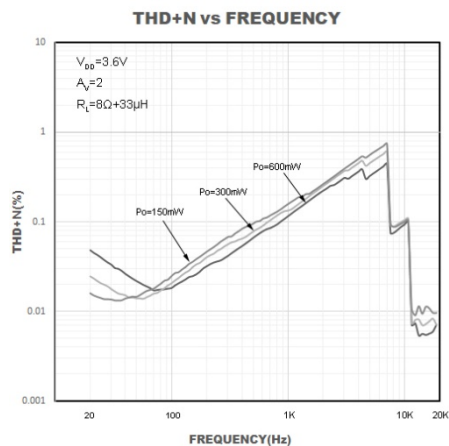
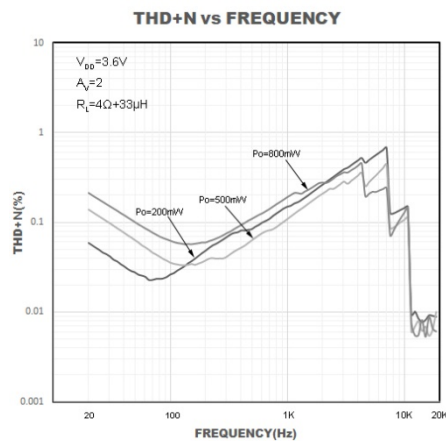
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
P_o	Output Power	THD=10%, $f=1\text{KHz}$, $R_L=4\Omega$	$V_{DD}=5.0\text{V}$	2.8		W
			$V_{DD}=3.6\text{V}$	1.4		W
		THD=1%, $f=1\text{KHz}$, $R_L=4\Omega$	$V_{DD}=5.0\text{V}$	2.2		W
			$V_{DD}=3.6\text{V}$	1.1		W
		THD=10%, $f=1\text{KHz}$, $R_L=8\Omega$	$V_{DD}=5.0\text{V}$	1.66		W
			$V_{DD}=3.6\text{V}$	0.8		W
		THD=1%, $f=1\text{KHz}$, $R_L=8\Omega$	$V_{DD}=5.0\text{V}$	1.3		W
			$V_{DD}=3.6\text{V}$	0.62		W
THD+N	Total Harmonic Distortion Plus Noise	$P_o=0.6\text{W}$, $f=1\text{KHz}$, $R_L=8\Omega$	$V_{DD}=5.0\text{V}$	0.11		%
		$P_o=0.4\text{W}$, $f=1\text{KHz}$, $R_L=8\Omega$	$V_{DD}=4.2\text{V}$	0.16		%
		$P_o=0.4\text{W}$, $f=1\text{KHz}$, $R_L=8\Omega$	$V_{DD}=3.6\text{V}$	0.15		%
η	Efficiency	$P_o=0.6\text{W}$, $f=1\text{KHz}$, $R_L=8\Omega$	$V_{DD}=5.0\text{V}$	90		%
t_{ST}	Start Time			40		ms

PERFORMANCE CHARACTERISTICS

Test condition: $T_A=25^{\circ}\text{C}$, $V_{DD}=3.6\text{V}$, $R_L=8\Omega+33\mu\text{H}$, $f=1\text{kHz}$ (unless otherwise noted)



PERFORMANCE CHARACTERISTICS (continued)



APPLICATION INFORMATION

Input Capacitors (C_{IN})

In the typical application, an input capacitor C_{IN} , is required to allow the amplifier to bias the input signal to the proper DC level for optimum operation. In this case, C_{IN} and the minimum input impedance R_{IN} form is a high-pass filter with the corner frequency determined in the follow equation:

$$f_c = \frac{1}{(2\pi R_{IN} C_{IN})}$$

It is important to consider the value of C_{IN} as it directly affects the low frequency performance of the circuit. For example, when R_{IN} is 150k Ω and the specification calls for a flat bass response are down to 150Hz. Equation is reconfigured as followed:

$$C_{IN} = \frac{1}{(2\pi R_{IN} f_c)}$$

Input Resistance (R_{IN})

The BCT8013 is a differential audio amplifier. The IC integrates two internal input resistors which are 150k Ω . Change external input resistor R_{IN} to setup system gain. Equation is configured as followed:

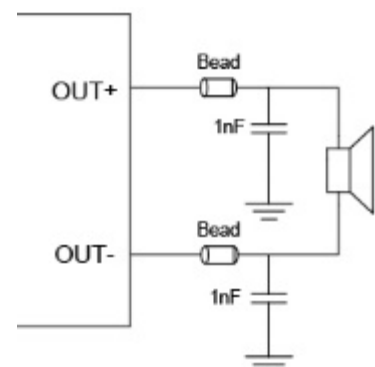
$$GAIN = \frac{2 \times 150k\Omega}{R_{IN}}$$

Decoupling Capacitor (CS)

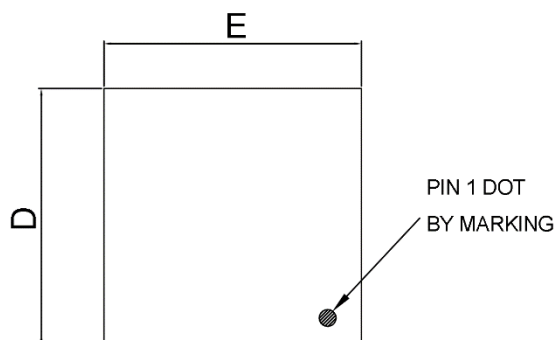
The optimum decoupling is achieved by using two different types of capacitors that target on different types of noise on the power supply leads. For higher frequency transients, spikes, or digital hash on the line, a good low equivalent-series-resistance (ESR) ceramic capacitor, typically 1 μ F. For filtering lower frequency noise signals, a large ceramic capacitor of 10 μ F or greater placed near the audio power amplifier is recommended.

How to Reduce EMI

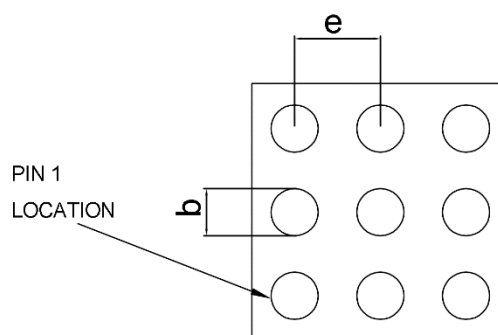
The ferrite filter and capacitor reduce EMI. They are placed as close as possible to the BCT8013 for the best operation.



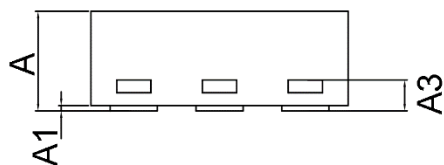
PACKAGE OUTLINE DIMENSIONS (All dimensions in mm.)



TOP VIEW



BOTTOM VIEW



SIDE VIEW

COMMON DIMENSIONS(mm)			
PKG.	UT:ULTRA THIN		
REF.	MIN.	NORM.	MAX.
A	>0.50	0.55	0.60
A1	0.00	-	0.05
A3	0.15 REF.		
D	1.45	1.50	1.55
E	1.45	1.50	1.55
b	0.250	0.275	0.030
e	0.50 BSC		