

18W内置升压单声道D类音频功放

18W Boosted Mono Class D Amplifier

■ FEATURES

- Spread spectrum technology
- Output Power
18W ($V_{BAT}=3.7V$, $R_L=4\Omega$, THD+N=10%, $f_{IN} = 1kHz$)
16W ($V_{BAT}=3.7V$, $R_L=4\Omega$, THD+N=1%, $f_{IN} = 1kHz$)
8W ($V_{BAT}=3.3V$, $R_L=8\Omega$, THD+N=1%, $f_{IN} = 1kHz$)
- Power Supply V_{BAT} : 3.0V~12V
- High Efficiency Class H Boost Converter
 - Multiple boost voltages automatically adjust Class D audio amplifier
 - Extends the playing time in battery supply applications
 - Adjustable switch peak current limit to avoid over-pulling on battery current
- Over Current Protection, Thermal Protection, over voltage protection function included
- Pb-Free Packages, ETSSOP20
- 扩频技术
- 输出功率
18W ($V_{BAT}=3.7V$, $R_L=4\Omega$, THD+N=10%, $f_{IN} = 1kHz$)
16W ($V_{BAT}=3.7V$, $R_L=4\Omega$, THD+N=1%, $f_{IN} = 1kHz$)
8W ($V_{BAT}=3.3V$, $R_L=8\Omega$, THD+N=1%, $f_{IN} = 1kHz$)
- V_{BAT} 供电范围: 3.0V至12V
- 高效H类升压功能
- 自适应功放功率的升压轨, 延长电池播放时间
- 可调节最大限流值, 有效防止电池拉死
- 保护功能:过流/过热/过压保护功能
- 无铅封装, ETSSOP20

■ APPLICATIONS

- Bluetooth/Wi-Fi Speakers
- Portable Speakers
- 蓝牙/ Wi-Fi音箱
- 便携式音箱
- Smart speakers
- Smart Home
- 智能音箱
- 智能家居

■ DESCRIPTION

HTA8111, integrated with a boost converter, is a mono Class D audio amplifier that drives up to continuous 18W (10% THD+N, 1kHz) into 4ohm speaker from a Li-battery voltage.

HTA8111 integrates an adaptive boost converter that generates a Class D amplifier supply rail tracking the audio signal, which will significantly improve the efficiency and extends the playing time in battery supply applications. Configurable current limit is adopted to avoid accidental large peak current.

HTA8111 integrates Spread Spectrum Control technology to achieve advanced EMI suppression. The Gain of HTA8111 is 32dB.

As for protection function, over current protection function for speaker output terminals, over temperature protection function and over voltage protection for boost converter output are also prepared.

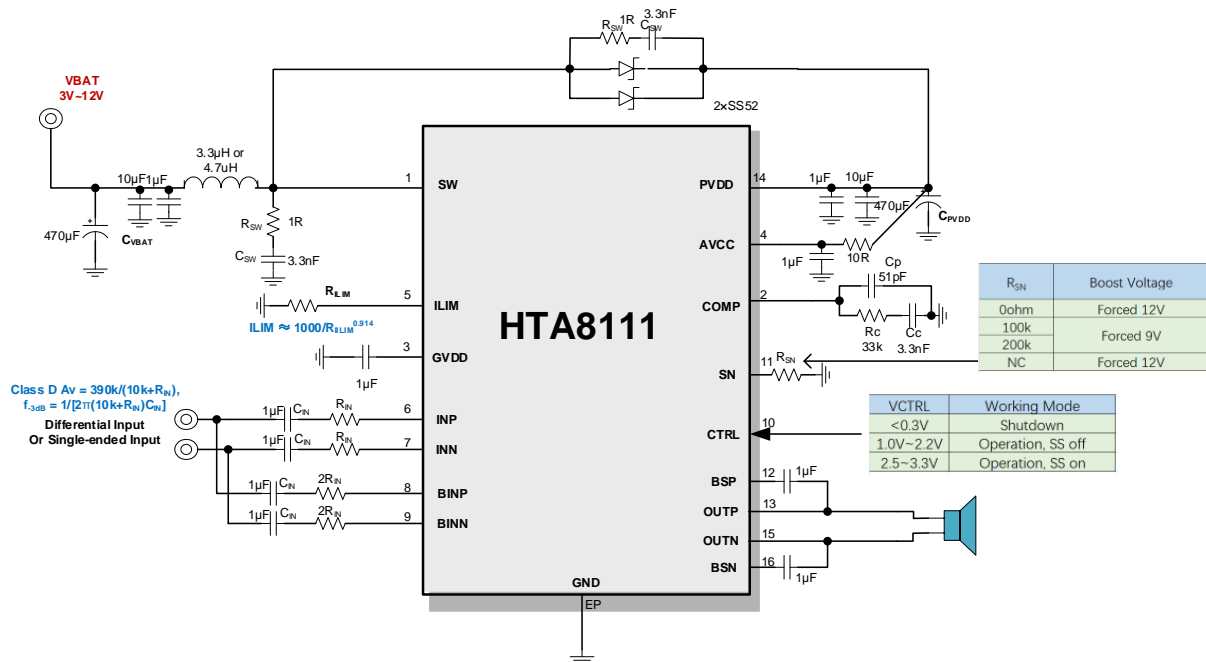
HTA8111是一款内置升压的单声道D类音频功率放大器，由锂电池供电时，THD+N=10%，能连续输出18W功率（4Ω负载）。

HTA8111内置可动态调节的升压，可以提供一个适应不同输出功率的电压给D类功放，其可大幅提高系统效率，延长电池续航时间。HTA8111可配置升压限流值，以防止过大的电流尖峰。

HTA8111具有先进的扩频功能来抑制EMI。HTA8111的增益为32dB。

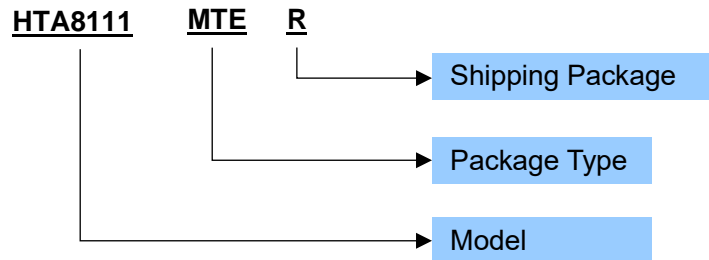
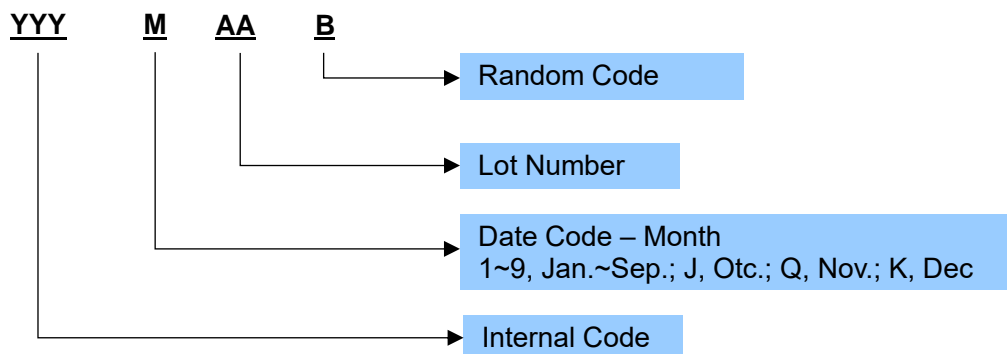
此外，HTA8111集成了输出端过流保护、片内过温保护、升压过压保护等功能。

■ TYPICAL APPLICATION

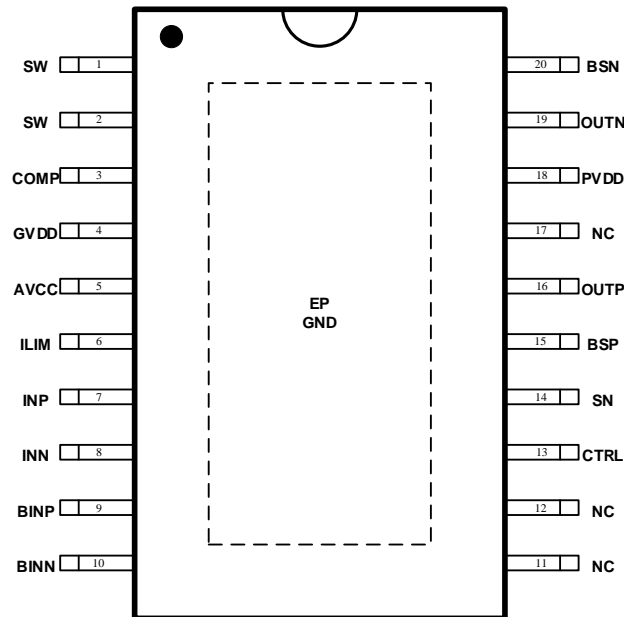


ORDERING INFORMATION

Part Number	Package Type	Marking	Operating Temperature Range	Shipping Package / MOQ
HTA8111MTER	ETSSOP20 (MTE)	HTA8111 YYYMAAB ¹	-40℃~85℃	Tape and Reel (R) / 3000pcs

Part Number

Production Tracking Code


■ TERMINAL CONFIGURATION



HTA8111 Top View

■ TERMINAL FUNCTION

Terminal No.	Name	I/O ¹	Description
1, 2	SW	I	Boost and rectifying switch input. 升压整流开关输入端
3	COMP	O	Output of the internal error amplifier, the loop compensation network should be connected between this pin and the GND pin. 环路补偿脚, 接补偿电路到GND。
4	GVDD	O	Voltage regulator, connect 1uF to GND. 电压调节器, 接1uF到地。
5	AVCC	P	Analog power supply. 模拟供电
6	ILIM	I	Adjustable switch peak current limit. An external resistor should be connected between this pin and GND. 最大限流值设置端, 外部接电阻到地。
7	INP	I	Positive input (differential+) for audio amplifier. 功放输入正端
8	INN	I	Negative input (differential-) for audio amplifier. 功放输入负端
9	BINP	I	Audio positive input (differential+) for adaptive boost converter. 自适应升压的音频输入正端
10	BINN	I	Audio negative input (differential-) for adaptive boost converter. 自适应升压的音频输入负端
11,12,17	NC	-	No connection. 内部无连接
13	CTRL	I	Mode Control Terminal. 模式控制脚
14	SN	I	Boost converter output voltage selection. 升压电压选择
15	BSP	BST	Connection point for the OUTP bootstrap capacitor, which is used to create a power supply for the high-side gate drive for OUTP. OUTP自举电容位
16	OUTP	O	Positive pin for differential speaker amplifier output. 输出正端
18	PVDD	P	Power Supply for internal power circuitry. 功率电源
19	OUTN	O	Negative pin for differential speaker amplifier. 输出负端
20	BSN	BST	Connection point for the OUTN bootstrap capacitor, which is used to create a power supply for the high-side gate drive for OUTN. OUTN自举电容位
EP	GND	G	Provides both electrical and thermal connection from the device to the board. A matching ground pad must be provided on the PCB and the device connected to it via solder. For proper electrical operation, this ground pad must be connected to the system ground. 既是地, 又是散热PAD

¹ I: Input; O: Output; G: Ground; P: Power; BST: BOOT Strap;

■ SPECIFICATIONS¹

● Absolute Maximum Ratings²

PARAMETER	Symbol	MIN	TYP	MAX	UNIT
AVCC voltage	AVDD	-0.3		14	V
PVDD voltage	PVDD	-0.3		14	V
SW voltage	V _{SW}			16	V
Input Voltages (INP, INN, BINP, BINN, CTRL)	V _I	-0.3		5.8	V
Moisture Sensitivity Level (MSL)			MSL3		
Ambient Operating Temperature	T _A	-25		85	°C
Junction Temperature	T _J	-40		125	°C
Storage Temperature	T _{STG}	-40		125	°C

● Recommended Operating Conditions

PARAMETER	Symbol	CONDITION	MIN	TYP	MAX	UNIT
Power supply voltage for V _{BAT}	V _{BAT}		3		12	V
Ambient Operating Temperature	T _a		-25	25	85	°C
Input Voltages (INP, INN, BINP, BINN, CTRL)	V _I		0		3.3	V
Minimum Speaker Load in PBTL Mode	R _L		2.8			Ω

● Electrical Specification³

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
BOOST Converter						
Maximum Boost converter output voltage	PVDD			12		V
Boost converter frequency	f _{SW}			440		kHz
Boost on threshold output voltage V _{RMS} (R _{SN} = 0Ω or 100k)	V _{B_TH1}	PVDD from 6V to 7V		2.2		V
	V _{B_TH2}	PVDD from 7V to 9V		4.2		V
	V _{B_TH3}	PVDD from 9V to 12V		5.3		V
Boost on threshold voltage V _{RMS} (R _{SN} = 200k or NC)	V _{B_TH1}	PVDD from bypass to 9V		4.8		V
	V _{B_TH2}	V _{out} from 9V to 12V		5.3		V
Boost shut off time	t _{BOOST_OFF}			5.4		ms
MOSFET on-resistance	R _{ds(on)}	Including wire bond		35		mohm
Peak switch current limit	I _{LIM}				10	A

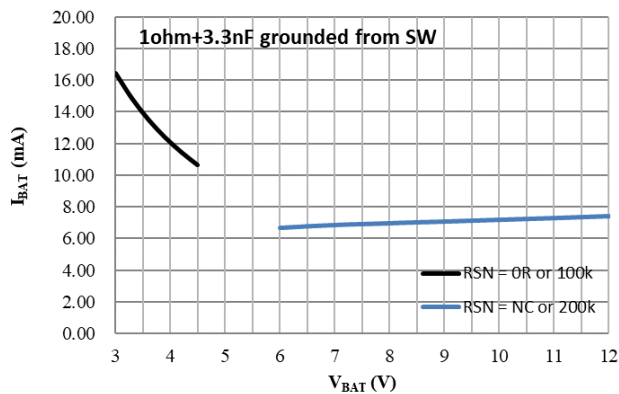
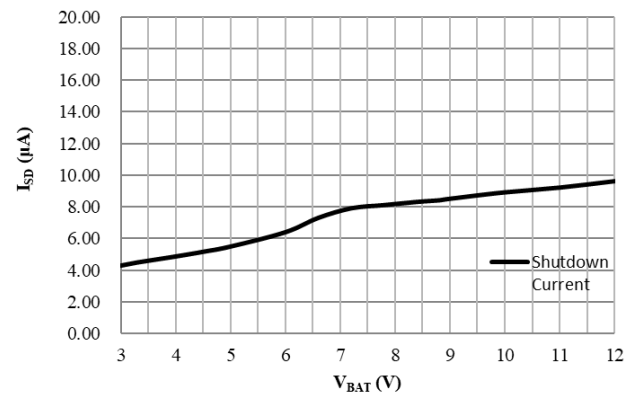
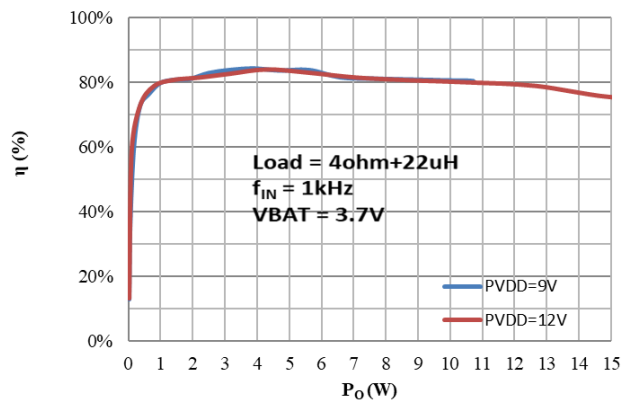
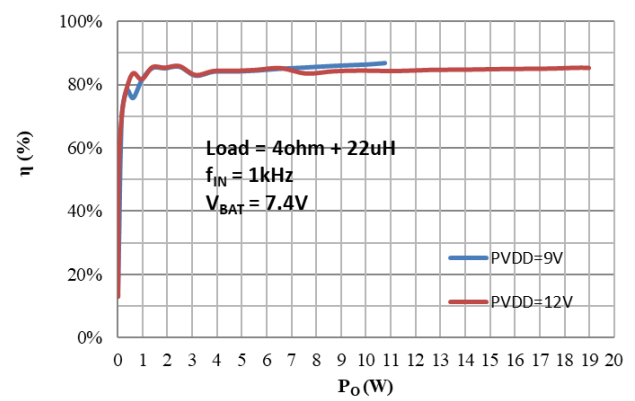
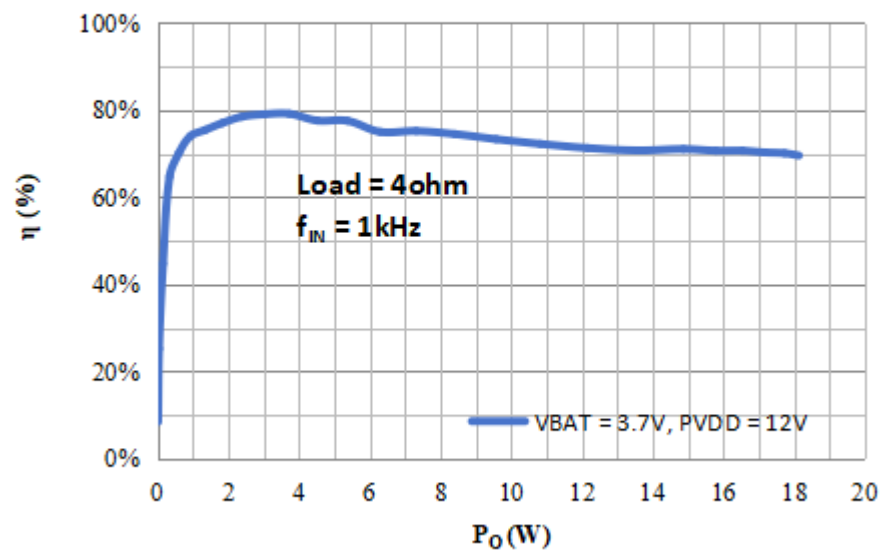
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Class D Channel V _{SS} =0V, V _{BAT} =3.7V, T _a =25°C, C _{IN} =1uF, unless otherwise specified						
Carrier clock frequency	f _{PWM}			360		kHz
Over current protection	I _{max}				6	A
System Gain	Gain	External R _{IN} =0Ω		32		dB
Start-up time (power-on or shutdown release)	t _{STUP}			45		ms
Consumption current in shutdown mode	I _{SD}	V _{BAT} = 3.7V		4.6		μA
		V _{BAT} = 7.4V		8		uA
Total Harmonic Distortion plus Noise	THD+N	P _O =1.0W, R _L =4Ω, f=1kHz		0.03		%
Output Noise	V _N	f=20Hz~20kHz, A weighted, A _v =26dB		130		μV _{rms}

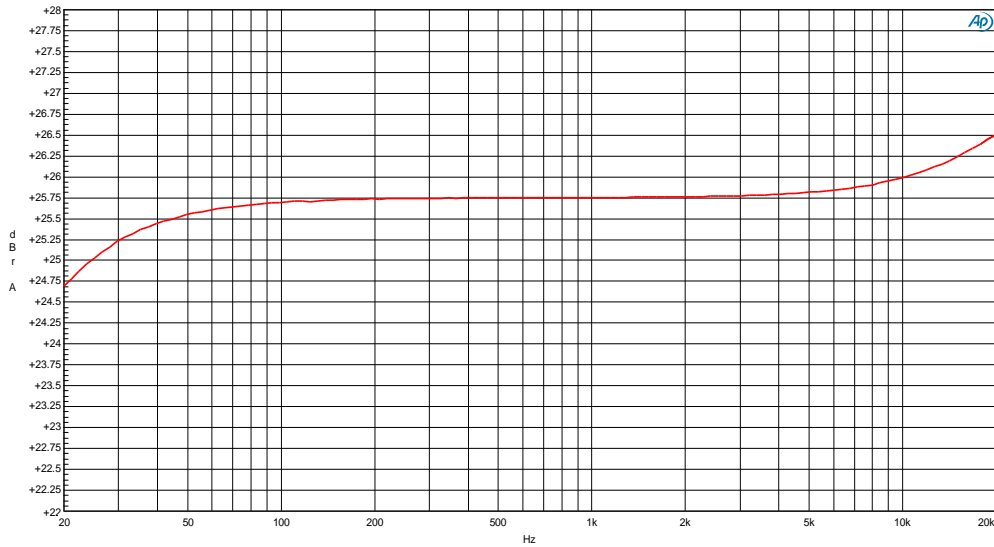
¹ Depending on parts and PCB layout, characteristics may be changed.

² 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 under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

³ Depending on parts and pattern layout, characteristics may be changed.

Output offset voltage	V _{OS}				±2		mV
Quiescent current	I _{BAT}	VBAT = 3.7V, R _{SN} = 0R or 100k			13		mA
		VBAT = 7.4V, R _{SN} = NC or 200k			6		mA
Output Power	P _O	PVDD=12V	VBAT=3.7V, f=1kHz, R _L =4Ω THD+N=10%		18		W
		PVDD=9V			11		
		PVDD=12V	VBAT=3.7V, f=1kHz, R _L =4Ω THD+N=1%		16		
		PVDD=9V			9		
		PVDD=12V	VBAT=3.3V, f=1kHz, R _L =8Ω THD+N=1%		8		
		PVDD=9V			4.7		
		PVDD=12V	VBAT=7.4V, f=1kHz, R _L =4Ω THD+N=10%		18		
		PVDD=9V			11		
		PVDD=12V	VBAT=7.4V, f=1kHz, R _L =4Ω THD+N=1%		16		
		PVDD=9V			9		
Efficiency (Class D + Boost)	η	VBAT=3.7V, R _L =4Ω+22uH, THD+N = 10%, PVDD=9V			80		%
		VBAT=3.7V, R _L =4Ω+22uH, THD+N = 10%, PVDD=12V			73		%
		VBAT=7.4V, R _L =4Ω+22uH, THD+N = 10%, PVDD=9V			89		%
		VBAT=7.4V, R _L =4Ω+22uH, THD+N = 10%, PVDD=12V			86		%

TYPICAL OPERATING CHARACTERISTICS
Quiescent Current

Shutdown Current

 P_O vs η

 P_O vs η

 P_O vs η




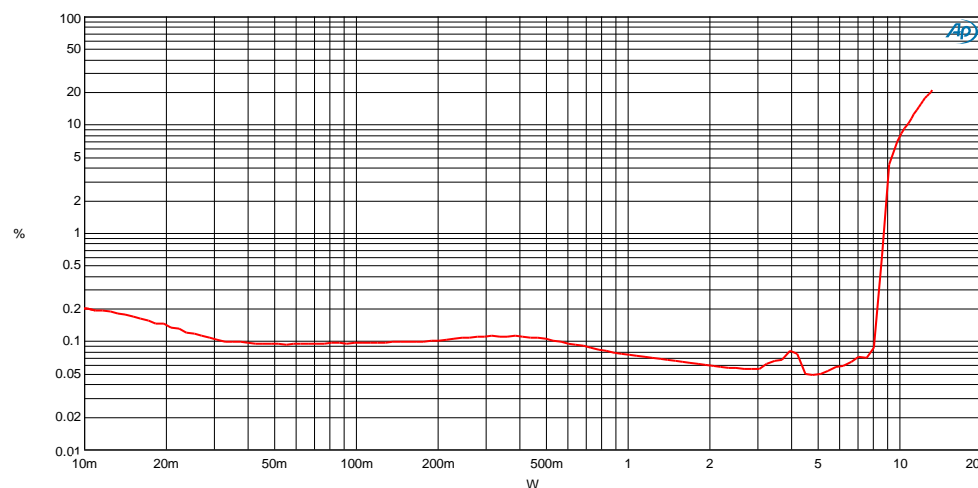
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer Level A	Left	

Frequency Response
 $C_{IN}=1\mu F$, $R_{EIN} = 9.1k$

V_{BAT} = 3.7V, R_L = 4ohm, f_{IN} = 1kHz, R_{LIM} = 180k, unless otherwise specified

Audio Precision

06/30/22 16:53:44



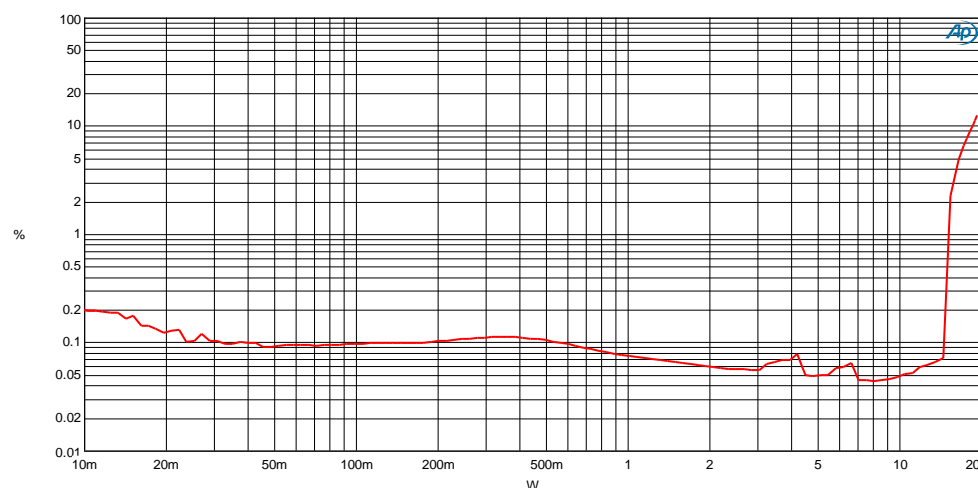
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer.THD+N Ratio A	Left	

Po vs THD+N.ats2

Output power vs
THD+N, PVDD = 9V

Audio Precision

06/30/22 17:06:44



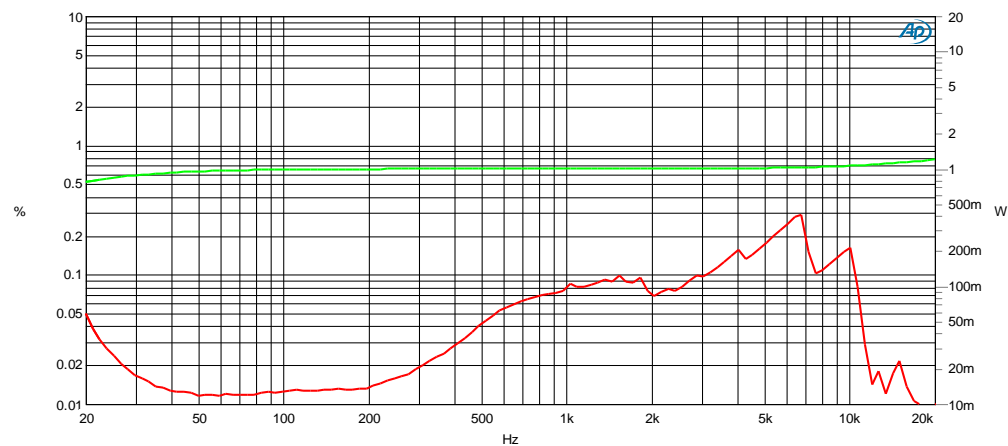
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer.THD+N Ratio A	Left	

Po vs THD+N.ats2

Output power vs
THD+N, PVDD =
12V

Audio Precision

06/30/22 15:07:39



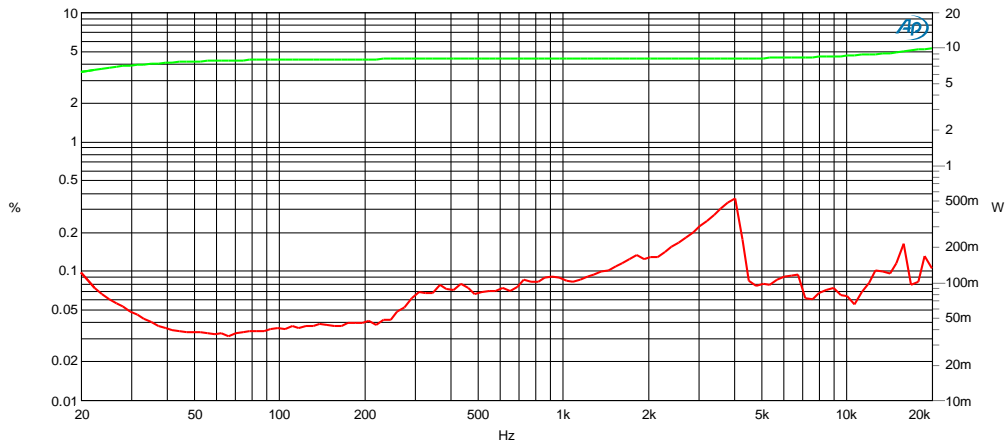
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer.THD+N Ratio A	Left	
1	2	Green	Solid	2	Analyzer.Level A	Right	

f vs THD+N.ats2

frequency vs
THD+N, Po≈1W

Audio Precision

06/30/22 15:24:13



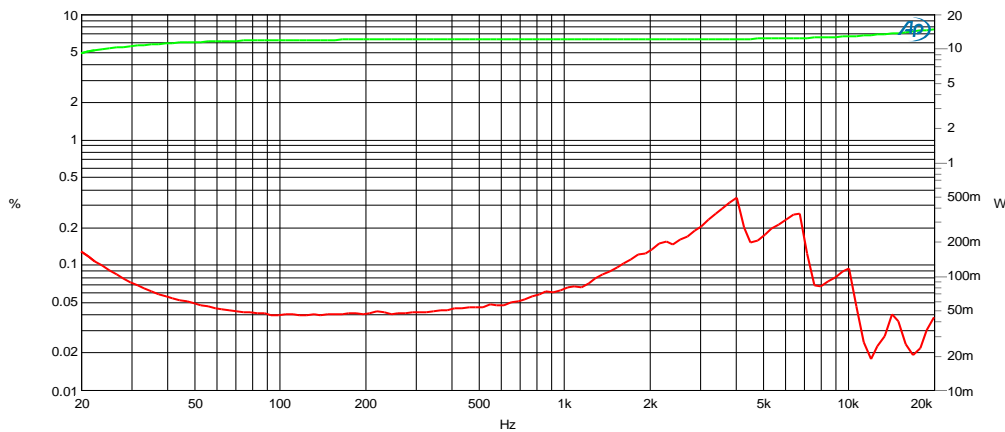
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer:THD+N Ratio A	Left	
	2	Green	Solid	2	Analyzer:Level A	Right	

f vs THD+N.ats2

frequency vs
THD+N, $P_o \approx 8W$

Audio Precision

06/30/22 15:43:45



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer:THD+N Ratio A	Left	
1	2	Green	Solid	2	Analyzer:Level A	Right	

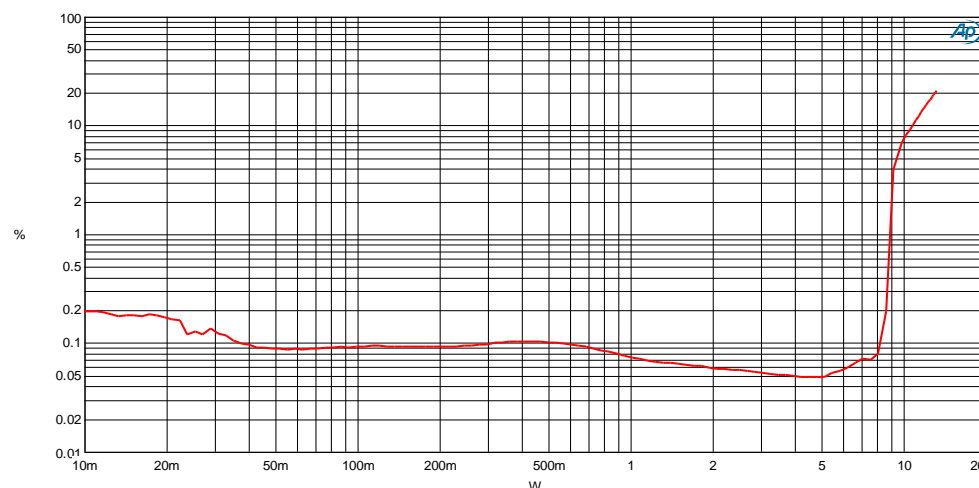
f vs THD+N.ats2

frequency vs
THD+N, $P_o \approx 12W$,
PVDD=12V

V_{BAT} = 7.4V, R_L = 4ohm, f_{IN} = 1kHz, R_{LIM} = 180k

Audio Precision

06/30/22 16:50:07



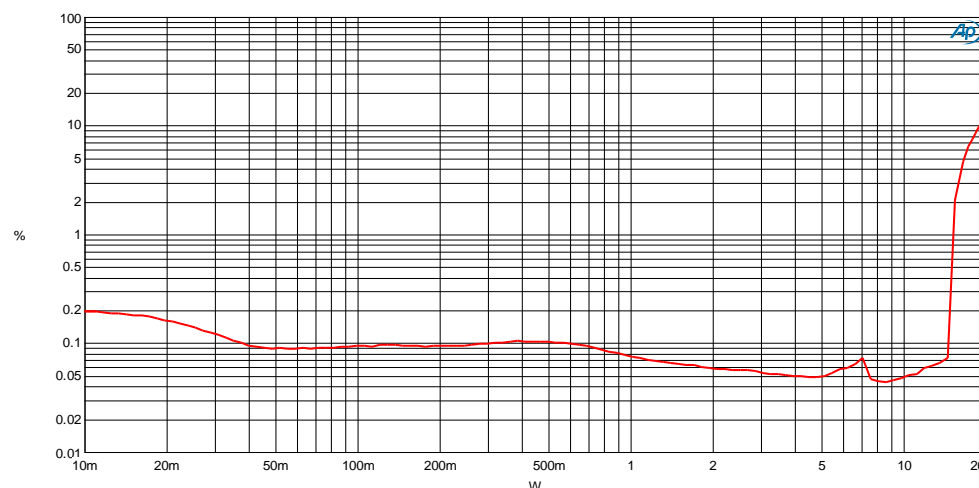
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer.THD+N Ratio A	Left	

Po vs THD+N.ats2

Output power vs
THD+N, PVDD = 9V

Audio Precision

06/30/22 16:40:51



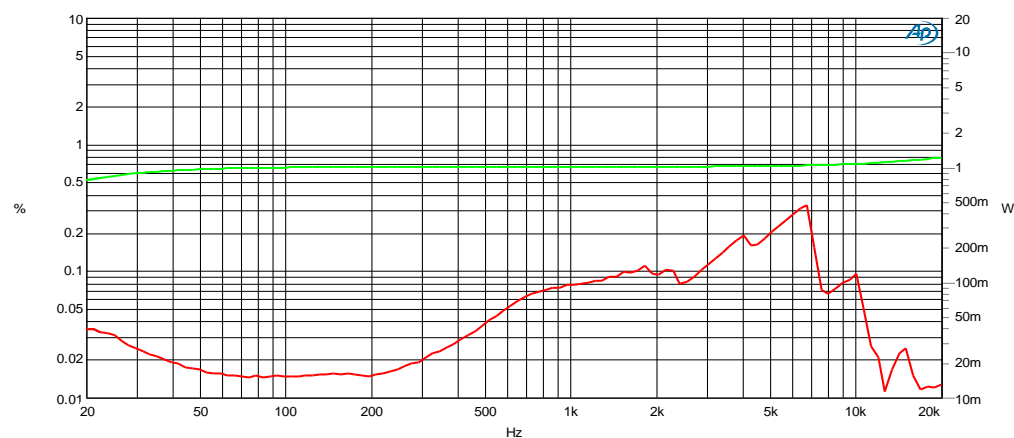
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer.THD+N Ratio A	Left	

Po vs THD+N.ats2

Output power vs
THD+N, PVDD =
12V

Audio Precision

06/30/22 15:51:17



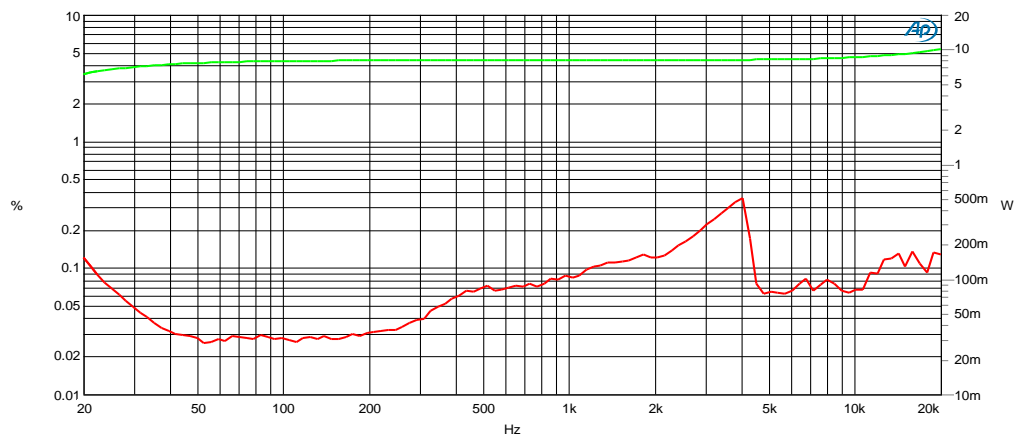
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer.THD+N Ratio A	Left	
1	2	Green	Solid	2	Analyzer.Level A	Right	

f vs THD+N.ats2

frequency vs
THD+N, Po≈1W

Audio Precision

06/30/22 16:03:09



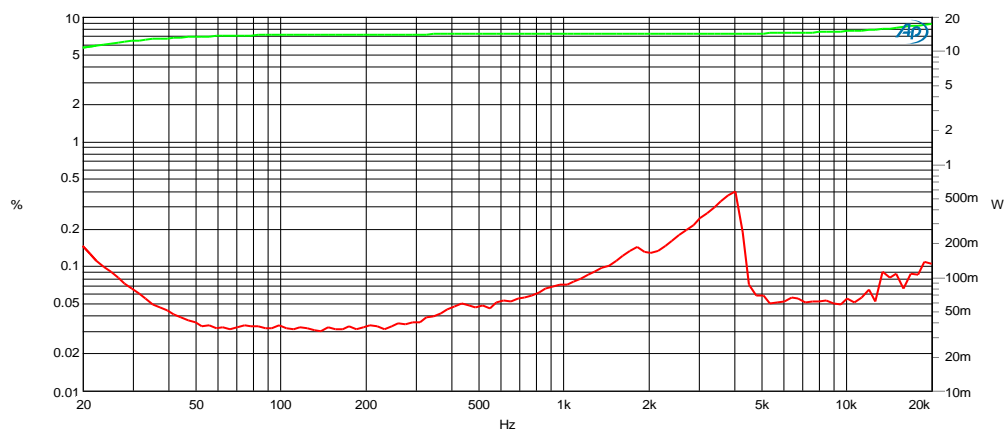
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer:THD+N Ratio A	Left	
1	2	Green	Solid	2	Analyzer:Level A	Right	

f vs THD+N.ats2

frequency vs
THD+N, $P_o \approx 8W$

Audio Precision

06/30/22 16:35:23



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Analyzer:THD+N Ratio A	Left	
1	2	Green	Solid	2	Analyzer:Level A	Right	

f vs THD+N.ats2

frequency vs
THD+N, $P_o \approx 14W$,
PVDD=12V

APPLICATION INFORMATION

1 Boost Converter

HTA8111 consists of a boost converter and an audio amplifier. The boost converter takes the supply voltage, VBAT, and increases it to a higher output voltage to drives the audio amplifier. This improves loudness over non-boosted solutions. An external inductor and diode should be added for the boost converter.

For HTA8111, the boost converter is adaptive and generates a Class D amplifier supply rail tracking the audio signal, which will significantly improve the efficiency and extends the playing time in battery supply applications. When the output audio signal exceeds a preset voltage threshold (Boost on Threshold Voltage V_{B_TH}), the output voltage of boost converter jumped into the higher preset voltage. When the audio output voltage is lower than the threshold voltage, the output voltage of boost converter drops to the lower preset voltage automatically. The output voltage is selected by SN terminal, see as the following table, where R_{SN} represents the resistor connected from SN terminal to GND.

HTA8111 包含一个升压和一个音频功放。其中升压电路将输入的电池电压 VBAT 升压至更高的电压，以提供给功放。该方法可提升功放的输出功率。该升压需要外部放置电感和二极管。

对于 HTA8111, 其升压是自适应的跟随音乐信号的, 以有效提升电池应用下的播放时间。当输出信号超过一个阈值时, 升压跳转至一个更高的预设电压 (V_{B_TH}); 当输出信号小于该阈值时, 升压下降到低档位的预设电压。输出电压的选择是通过 SN 脚设置的, 如下表, 其中, R_{SN} 为 SN 脚到地的电阻。

Table 1 Mode Selection for Boost Converter

Application	R_{SN}	Boost Voltage
Powered by one battery 单节锂电供电	0ohm	6V→7V→9V→12V
	100k	6V→7V→9V
Powered by two batteries in series 双节锂电串联供电	200k	Bypass→9V
	NC	Bypass→9V→12V

1.1 ILIM

To avoid an accidental large peak current, an internal cycle-by-cycle current limit is adopted. The low-side switch is turned off immediately as soon as the switch current touches the limit (I_{LIM}). The peak switch current limit can be set by a resistor (R_{ILIM}) at the ILIM pin to ground. The following figure details the R_{ILIM} settings.

在 ILIM 脚外接电阻(R_{ILIM})到地, 可设置升压的输入最大峰值电流。具体设置如下图。

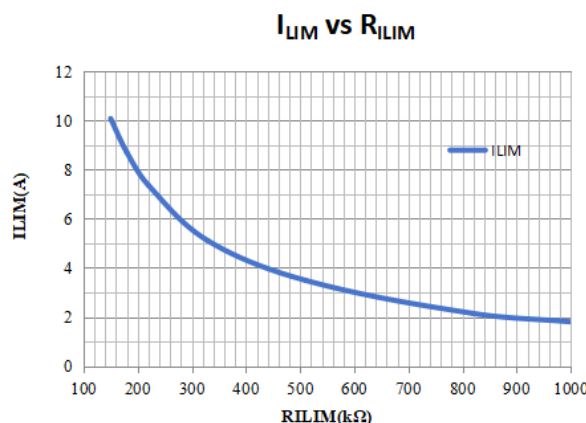


Figure 1 Switch Current Limit Setting

1.2 COMP

The HTA8111 requires external compensation for the stability of boost converter. The COMP pin is the output of the internal error amplifier. An external resistor 33k in serial with a ceramic capacitor 3.3nF connected from the COMP pin to GND can be applied in most cases.

1.3 BOOST Converter Input and Output Capacitor C_{IN} , C_{OUT}

For the capacitor maintaining the supply voltage, the value of the boost capacitor is determined by the minimum value of working capacitance required for stability and the maximum voltage ripple allowed on PVDD in the application. It acts as a charge reservoir, providing energy faster than the board supply, thus helping to prevent any droop in the supply voltage.

For the decoupling capacitor, a low equivalent-series-resistance (ESR) ceramic capacitor is needed. This choice of capacitor and placement helps with higher frequency transients, spikes, or digital hash on the line. Additionally, placing this decoupling capacitor close to the HTA8111 is important, as any parasitic resistance or inductance between the device and the capacitor causes efficiency loss.

Over all, 1uF//10uF//470uF (paralleled) is highly recommended to be placed in both input and output terminal as closely to the pin as possible.

1.4 Inductor Selection and Placement

Inductor current rating is determined by the requirements of the load. The inductance is determined by two factors: the minimum value required for stability and the maximum ripple current permitted in the application. $L \geq 2.2\mu\text{H}$, $\text{DCR} < 0.1\text{ohm}$ is recommended for general application circuit. The inductor should be placed as close to the SW pin as possible with direct and wide traces. The saturation current (I_{SAT}) of the inductor should be larger than the switch current limit (I_{LIM}).

1.5 Schottky Diode Selection and Placement

A Schottky Diode with $V_{RRM} > 16\text{V}$, $V_{FM} < 0.5\text{V}$ is recommended for general application circuit. The diode should be placed as close to the SW and PVDD capacitor as possible with direct and wide traces. The I_F of the diode should be larger than the maximum output current from PVDD.

1.6 RC

Adding an RC snubber across the SW pin and the power ground can help reduce the radiation EMI levels. The RC snubber should be placed as close as possible to the switching node and the power ground.

HTA8111 升压需要外部补偿电路以维持升压稳定性。对于大多数应用，COMP 外部需要接电阻 33k 串联 3.3nF 电容到地。

对于储能电容，电容值由应用中稳定所需的最小工作电容值和 PVDD 上允许的最大电压纹波决定。较大的储能电容有助于防止电源电压下降。

对于滤波电容器，低等效串联电阻(ESR)的陶瓷电容器较为合适。这种电容的选择和布局有助于提高线路上的瞬态尖峰和噪声。此外，将这种滤波电容靠近 HTA8111 非常重要，因为芯片和电容之间的任何寄生电阻或电感都会导致效率损失。

我们建议，在 VBAT 和 PVDD 端至少放置一组 1uF 和 10uF 滤波电容到地，用于吸收纹波和稳定电压，并尽可能靠近芯片引脚。另外，VBAT 和 PVDD 端需各放置一个不小于 470uF 的储能电容。这些电容应以最短的路径连接至安静可靠的地，以有效滤波。

电感的电流参数由功放的最大功率决定；而电感的感值则由可允许的最大峰值电流决定。通常而言，为保证芯片的正常工作，建议使用 $L \geq 2.2\mu\text{H}$, $\text{DCR} < 0.1\text{ohm}$ 。

电感需要尽可能靠近 SW 引脚，并且与 SW 在同一 PCB 层尽可能短的直接相连。

电感的建议饱和电流应大于输入最大峰值电流 (I_{LIM})。

肖特基二极管的建议参数: $V_{RRM} > 16\text{V}$, $V_{FM} < 0.5\text{V}$ ，并依据不同功率选择不同 I_F ，并需要大于 PVDD 最大输出电流。该肖特基二极管应尽可能靠近电感和 PVDD 端电解电容放置。

SW 端加 RC 到地，可有效减少辐射干扰，RC 电路需尽可能靠近 SW 和 GND。

2 Analog Signal Input Configuration

HTA8111 is an amplifier with analog input (single-ended or differential).

For a differential operation, input signals into INP and INN pins via DC-cut capacitors (C_{IN}) and external input resistors R_{EIN} . See as figure 2. The system gain can be calculated by $Gain \approx 20 \times \log\left(\frac{R_F}{R_{IIN} + R_{EIN}}\right)$, where $R_F = 390k$, $R_{IIN} = 10k$. And the high pass cut-off frequency of input signal can be calculated by $f_c = \frac{1}{2\pi(R_{IIN} + R_{EIN}) \times C_{IN}}$.

For a single-ended operation, input signals to INP pin via a DC-cut capacitor (C_{IN}) and external input resistor (R_{EIN}). INN pin should be connected to ground via a DC-cut capacitor and external input resistor (R_{EIN}) (with the same value of C_{IN} and R_{IN}). See as figure 3. The Gain and high pass Cut-off frequency are the same as the above case.

2.1 BINP and BINN pin

For HTA8111, BINP and BINN terminals are designed to receive audio signals to determine the output voltage of adaptive boost converter. Input signals to BINP and BINN (or only BINP if in single-ended operation) with C_{IN} and R_{BIN} , where $R_{BIN} = 2R_{EIN}$.

HTA8111 接受模拟差分或单端音频信号输入，产生 PWM 脉冲输出信号驱动扬声器。

对差分输入，通过隔直电容 C_{IN} 和输入电阻 R_{EIN} 分别输入到 INP 和 INN 端，见图 2。系统增益 $Gain \approx 20 \times \log\left(\frac{R_F}{R_{IIN} + R_{EIN}}\right)$, $R_F = 390k$, $R_{IIN} = 10k$ 。高通滤波器截止频率为 $f_c = \frac{1}{2\pi(R_{IIN} + R_{EIN}) \times C_{IN}}$ 。

对单端输入，则通过 C_{IN} 耦合到 INP 端。INN 端必须通过输入电阻和电容（与 C_{IN} 、 R_{EIN} 值相同）接地，见图 3。增益 Gain 和截止频率 f_c 与差分输入时相同。

对于 HTA8111, BINP 和 BINN 用来接收音频信号以决定动态升压值。将音频信号同时接入 BINP 和 BINN（或仅 BINP,如果是单端输入），如下图，其中 $R_{BIN} = 2R_{EIN}$ 。

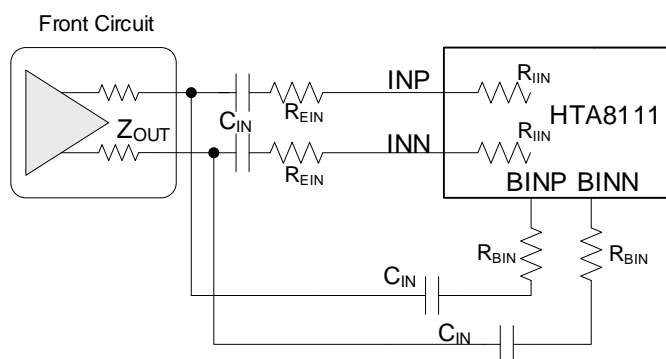


Figure 2 Differential Input configuration

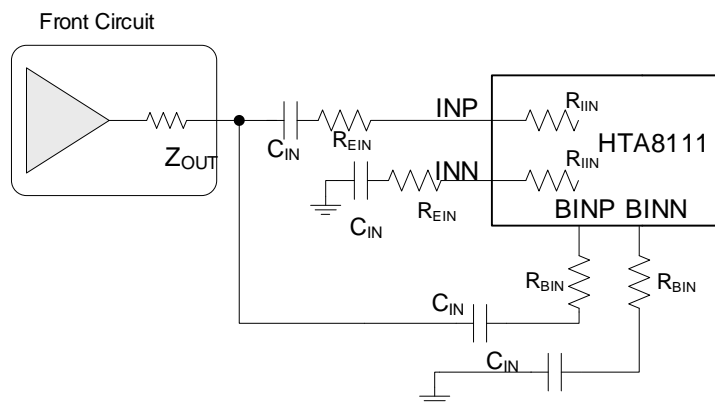


Figure 3 Single-ended Input configuration

3 Output Configuration

HTA8111 can directly drive speakers without any other components. But if EMI is highly concerned, ferrite beads or L-C filter is needed.

一般而言，输出端可直接连接负载喇叭。如对 EMI 的要求较高，则可选择添置铁氧体磁珠或 LC 滤波器。

4 Speaker Amplifier Operating Modes

HTA8111 can work in different modes by setting the CTRL terminal, shown as follow.

HTA8111 在 CTRL 端输入不同电压值，能实现不同工作模式，详见下表。

Table 2 CTRL Terminal Configuration

VCTRL	Working Mode
<0.3V	Shutdown
1.0V~2.2V	Operation, Spread Spectrum Off
2.5V~3.3V	Operation, Spread Spectrum On

In shutdown mode, HTA8111 shuts all circuit down and minimizes the power consumption. And, the output terminals become Weak Low (A high resistance grounded state).

在关断模式（低功耗待机）下，芯片关闭所有功能并将功耗降低到最小，输出端为弱低电平状态（内部通过电阻接地）。

The HTA8111 device has built-in spread spectrum control of the oscillator frequency to improve EMI performance. The spread spectrum scheme is internally fixed.

HTA8111 内置了输出频率的扩频功能，以提升 EMI 性能。

5 GVDD Supply

The GVDD Supply is used to power the gates of the output full bridge transistors. Decouple GVDD with a X5R ceramic 1 μ F capacitor to GND. The GVDD supply is not intended to be used for external supply.

GVDD 电源用于为输出全桥晶体管的栅极供电。使用 X5R 陶瓷 1 μ F 电容器将 GVDD 与 GND 连接。GVDD 电源不用于外部电源。

6 BSP and BSN Capacitors

The full H-bridge output stages use only NMOS transistors. Therefore, they require bootstrap capacitors for the high side of each output to turn on correctly. A 1 μ F ceramic capacitor of quality X5R or better, rated for at least 16 V, must be connected from each output to its corresponding bootstrap input. The bootstrap capacitors connected between the BSx pins and corresponding output function as a floating power supply for the high-side N-channel power MOSFET gate drive circuitry. During each high-side switching cycle, the bootstrap capacitors hold the gate-to-source voltage high enough to keep the high-side MOSFETs turned on.

全 H 桥输出级仅使用 NMOS 晶体管。因此，它们需要引导电容器，以使每个输出的高端正确开启。必须从每个输出端将额定电压至少为 16 V、质量为 X5R 或更高的 1 μ F 陶瓷电容器连接到相应的自举输入端。连接在 BSx 引脚和相应输出之间的自举电容器，用作高端 NMOS 栅极驱动电路的电源。在每个高端开关周期中，自举电容器保持栅极至源极电压足够高，以保持高端 MOSFET 导通。

7 Protection Function

HTA8111 has the protection functions such as Over-Current Protection function, Thermal Protection function, and over voltage protection.

(1) Over-current Protection function

When a short circuit occurs between one output terminal and Ground, PVDD, or the other output, the over-current protection mode starts up. In the over current protection mode, the differential output terminal becomes a high impedance state. Once the short circuit conditions are eliminated, the over current protection mode can be cancelled automatically.

(2) Thermal Protection function

When excessive high temperature of HTA8111 (150℃) is detected, the thermal protection mode starts up. In the thermal protection mode, the differential output terminal becomes Weak Low state (a state grounded through high impedance).

(3) Over-voltage Protection function

The HTA8111 device monitors the voltage on PVDD voltage. When the voltage on PVDD pin exceeds the over-voltage threshold (13V typ), the OVP circuit puts the device into shutdown mode. The device recovers automatically once the over-voltage condition has been removed.

(4) DC Detect Protection.

The HTA8111 has circuitry which will protect the speakers from DC current which might occur due to an internal amplifier error. The DC Detect fault will cause the amplifier to shutdown by changing the state of the outputs to Hi-Z.

A DCE event occurs when the output differential duty-cycle of either channel exceeds 60% for more than 420 msec at the same polarity. This feature protects the speaker from large DC currents or AC currents less than 2 Hz.

HTA8111 具有以下几种保护功能：输出端过流保护、片内过温保护、升压过压保护。

(1) 过流保护

当检测到一输出端对电源、对地、或对另一输出端短路时，过流保护启动，输出端切换至高阻态，防止芯片烧毁损坏。短路情况消除后，通过关断、唤醒一次芯片，或重新上电均能使芯片退出保护模式。

(2) 过温保护

当检测到芯片内温度超过 150℃时，过温保护启动，正负输出端切换至弱低电平状态（内部通过高阻接地），防止芯片被热击穿损坏。

(3) 过压保护

HTA8111 监控 PVDD 电压上的电压。当 PVDD 引脚上的电压超过过电压阈值（13V 典型值）时，OVP 电路将 HTA8111 置于关机模式。一旦消除过电压情况，设备将自动恢复。

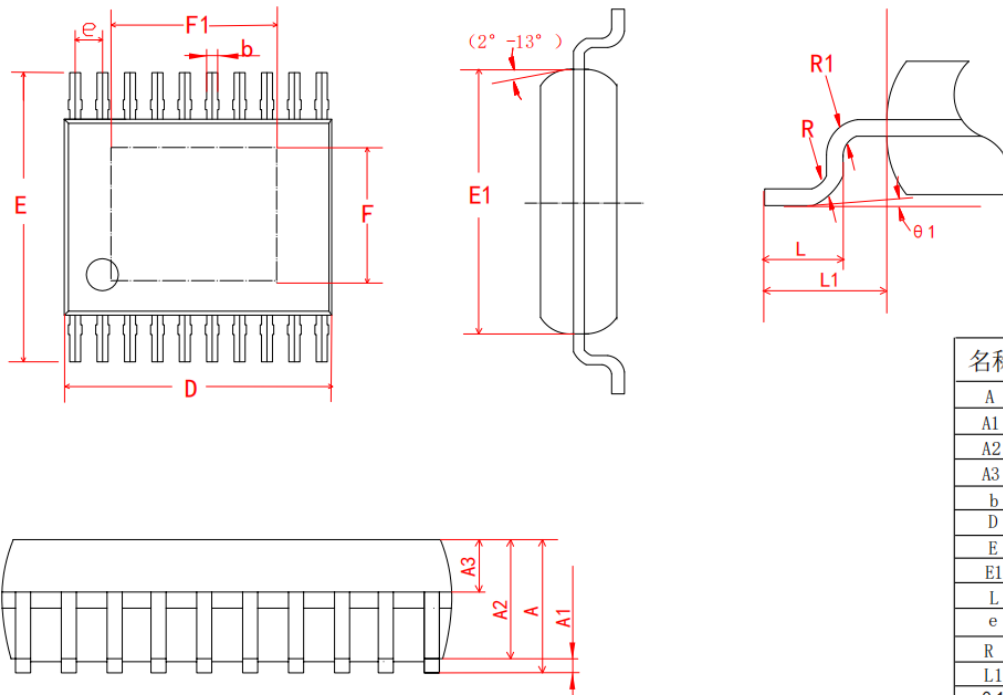
(4) 直流监测保护

HTA8111 具有保护扬声器免受由于内部放大器错误而产生的直流电流影响的电路。直流检测故障时，输出状态更改为 Hi-Z，致放大器关闭。

当任一通道在相同极性下的输出差占空比超过 60%超过 420 毫秒时，就会发生 DCE 事件。此功能可保护扬声器免受大直流电流或小于 2 Hz 的交流电流的影响

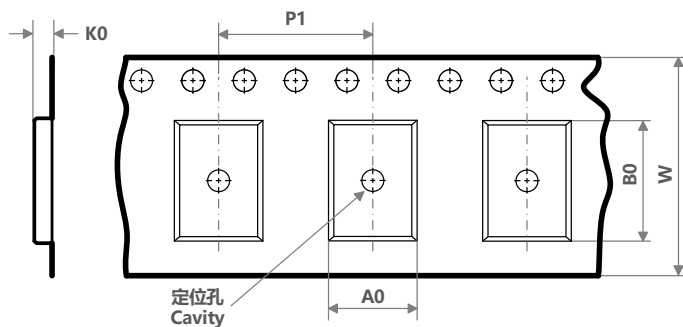
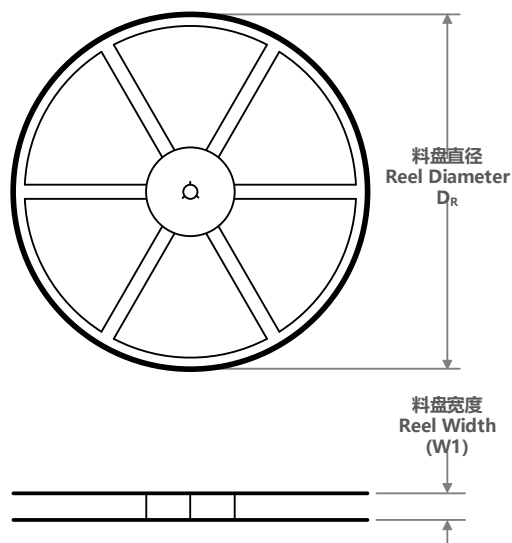
■ PACKAGE OUTLINE

MTE (ETSSOP20)



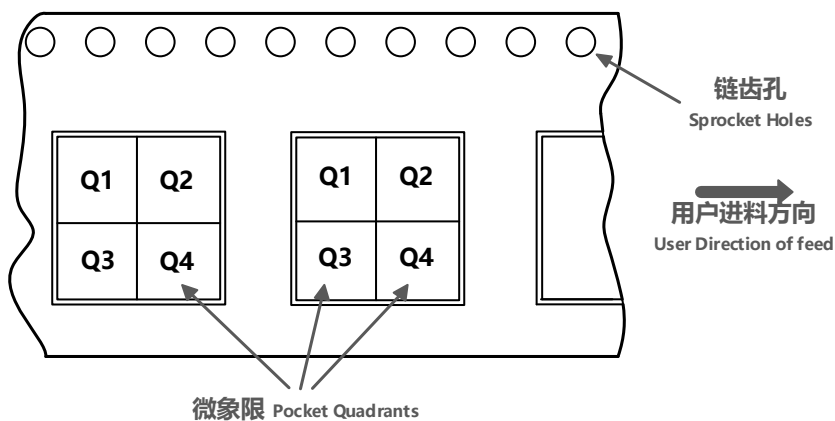
名称	尺寸		
	MIN	NOMINAL	MAX
A	1.0	—	1.10
A1	0.05	—	0.15
A2	0.90	0.95	1.0
A3	0.39	—	0.40
b	0.20	0.22	0.24
D	6.40	6.45	6.50
E	6.25	6.40	6.55
E1	—	4.35	4.40
L	0.50	0.60	0.70
e	0.65		
R	0.09		
L1	1.00REF		
$\theta 1$	0°	—	8°
F	2.99	1.00REF	3.0
F1	4.19	—	4.20

■ TAPE AND REEL INFORMATION

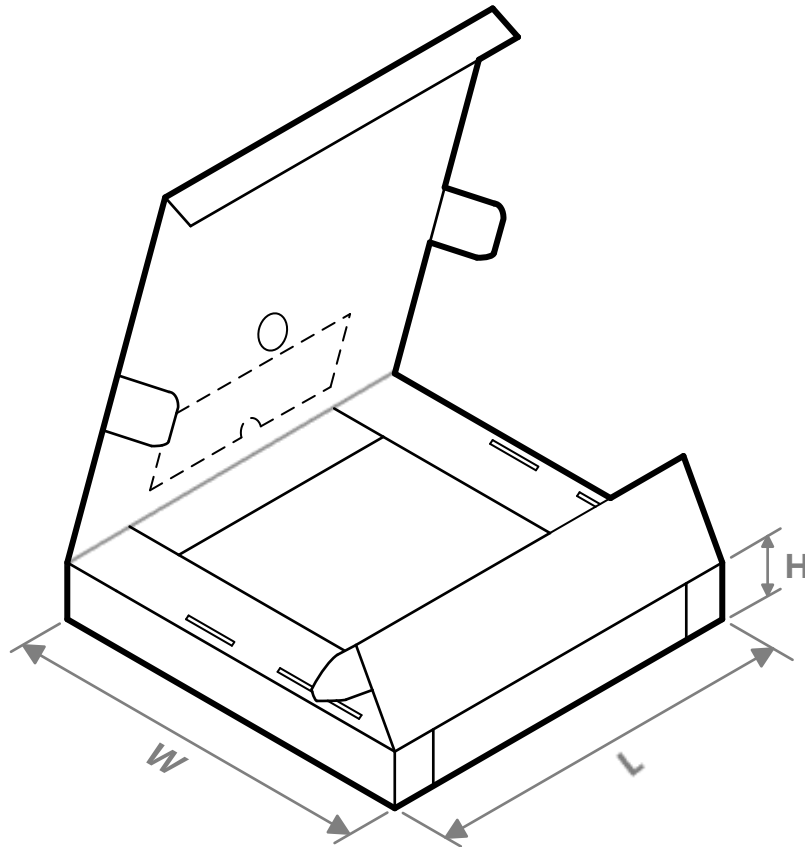


A0	Dimension designed to accommodate the component width; 料槽宽度
B0	Dimension designed to accommodate the component length; 料槽长度
K0	Dimension designed to accommodate the component thickness; 料槽厚度
W	Overall width of the carrier tape; 载带整体宽度
P1	Pitch between successive cavity centers; 相邻槽中心间距

编带 PIN1 方位象限分配 Quadrant Assignments for Pin1 Orientation in Tape



器件料号 Part No.	封装类型 Package Type	封装标识 Package Abbr.	引脚数 Pins	SPQ	料盘直径 D_R (mm)	料盘宽度 W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 象限 Quadrant
HTA8111MTER	ETSSOP	MTE	20	3000	330	16.5	6.65	6.8	1.5	8	16	Q1

TAPE AND REEL BOX INFORMATION


器件料号 Part No.	封装类型 Package Type	封装标识 Package Abbr.	引脚数 Pins	SPQ	长度 Length (mm)	宽度 Width (mm)	高度 Height (mm)
HTA8111MTER	ETSSOP	MTE	20	6000	390	345	55

IMPORTANT NOTICE**注意**

Heroic Electronic Technology (Jiaxing) Co., Ltd (HT) reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any products or services. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

禾润电子科技（嘉兴）股份有限公司（以下简称HT）保留对产品、服务、文档的任何修改、更正、提高、改善和其他改变，或停止提供任何产品和服务的权利。客户在下单和生产前应确保所得到的信息是最新、最完整的。

HT assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using HT components.

HT对相关应用的说明和协助以及客户产品的板级设计不承担任何责任。

HT products are not authorized for use in safety-critical applications (such as life support devices or systems) where a failure of the HT product would reasonably be expected to affect the safety or effectiveness of that devices or systems.

HT的产品并未授权用于诸如生命维持设备等安全性极高的应用中。

The information included herein is believed to be accurate and reliable. However, HT assumes no responsibility for its use; nor for any infringement of patents or other rights of third parties which may result from its use.

本文中的相关信息是精确和可靠的，但HT并不对其负责，也不对任何可能的专利和第三方权利的侵害负责。

Following are URLs and contacts where you can obtain information or supports on any HT products and application solutions:

下面是可以联系到我公司的相关链接和联系方式：

禾润电子科技（嘉兴）股份有限公司
Heroic Electronic Technology (Jiaxing) Co., Ltd.

地址：浙江省嘉兴市南湖区亚太路906号科创CBD园区21号楼11层

Add: 11th floor, Building 21, No. 906, Yatai Road, Jiaxing, Zhejiang Province

Sales: 0573-82586608, sales@heroic.com.cn

Support: 0573-82586151, support@heroic.com.cn

Website: www.heroic.com.cn; wap.heroic.com.cn

Wechat MP: HEROIC_JX

请及时关注禾润官方微信公众号，随时获取最新产品信息和技术资料！

