内置BOOST升压的2×5.5W立体声音频功率放大器

■ 特点

- 防削顶失真功能(Anti-Clipping Function, ACF)
- 免滤波器数字调制，直接驱动扬声器
- 输出功率

  2×5.5W(V_{BAT} = 4V, PVDD = 7V, R_L=4Ω, THD+N=10%)
- 电源

  -升压输入V_{BAT}：2.5V至5.5V

  -升压输出PVDD：V_{BAT}至7.0V
- BOOST输出电压可调
- AB/D类切换
- 过流/过热/欠压异常保护功能
- 无铅封装，SOP16L-PP

芯片料号	内置输入电阻R_{IN}	工作模式
HT8699RSPEx	17.8K ohm	D类和AB类
HT8699B6SPEx	10 ohm	D类

■ 概述

HT8699是一款内置BOOST升压模块的立体声音频功率放大器。在D类模式下，内置的BOOST升压模块可通过外置电阻调节升压值，即使是锂电池供电，在升压至7V时，10% THD+N，4Ω负载条件下，能连续输出2×5.5W 的功率。

HT8699具有AB类和D类的自由切换功能，在受到D类功放EMI干扰困扰时，可随时切换至AB类音频功放模式。

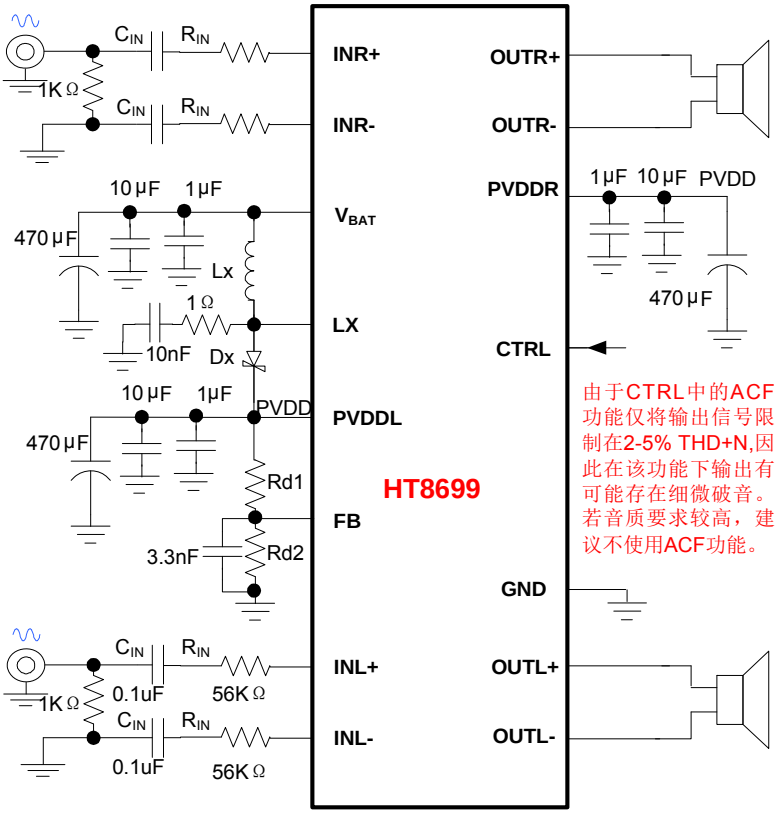
HT8699内部集成免滤波器数字调制技术，能够直接驱动扬声器，并最大程度减小脉冲输出信号的失真和噪音。输出无需滤波网络，极少的外部元器件节省了系统空间和成本，是便携式应用的理想选择。

此外，HT8699内置的关断功能使待机电流最小化，还集成了输出端过流保护、片内过温保护和电源欠压异常保护等功能。

■ 应用

- 蓝牙音箱
- 2.1声道小音箱
- iphone/ipod/ipod docking
- 便携式音箱
- 扩音器
- 便携式游戏机

■ 典型应用图



2×5.5W Stereo Audio Amplifier with Boost Converter

■ FEATURE

- Anti-Clipping Function (ACF)
- Filter-less Modulation, Eliminating Output Filter
- Output Power

  2×5.5W(V_{BAT}=4V, PVDD = 7V, R_L=4Ω, THD+N=10%)
- -BOOST Input V_{BAT}：2.5V to 5.5V

  -BOOST Output PVDD：V_{BAT} to 7.5V
- Adjustable BOOST Output Voltage
- Class AB /Class D available
- Thermal Protection, Over current protection, Low voltage malfunction prevention function included
- Pb-Free Packages，SOP16L-PP

Part No.	Internal Input Resistor R_{IN}	Working Mode
HT8699RSPEx	17.8K ohm	Class D & Class AB
HT8699B6SPEx	10 ohm	Class D

■ APPLICATIONS

- Bluetooth Speakers
- Portable Speakers
- iPhone/iPod/iPod docking
- Megaphone

■ GENERAL DESCRIPTION

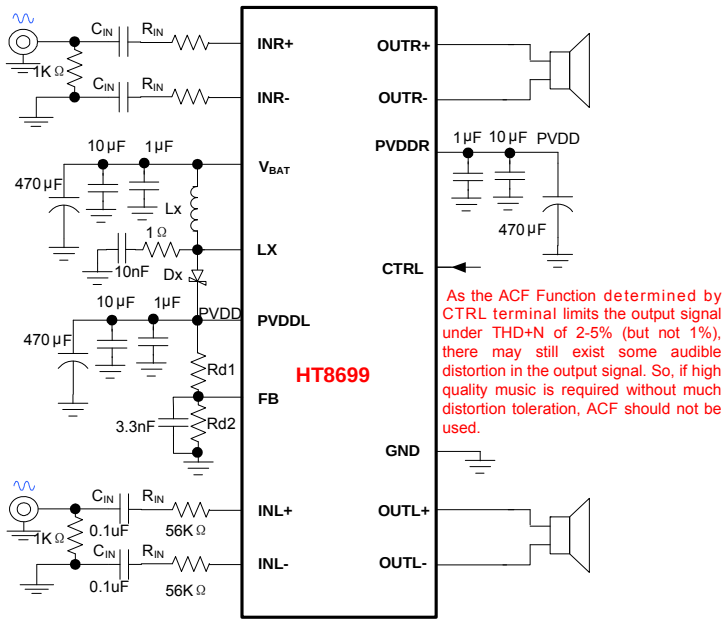
HT8699 integrates a boost converter with a filter-less stereo class D audio power amplifier to provide 2×5.5W continuous power into a 4Ω speaker when operating from a Li-battery voltage boosted to 7V. Meanwhile, the boost output voltage is adjustable.

Class AB amplifier mode is also available for HT8699. Once the EMI Interference from class D and Boost Converter becomes an annoying problem, HT8699 can be switched into Class AB mode.

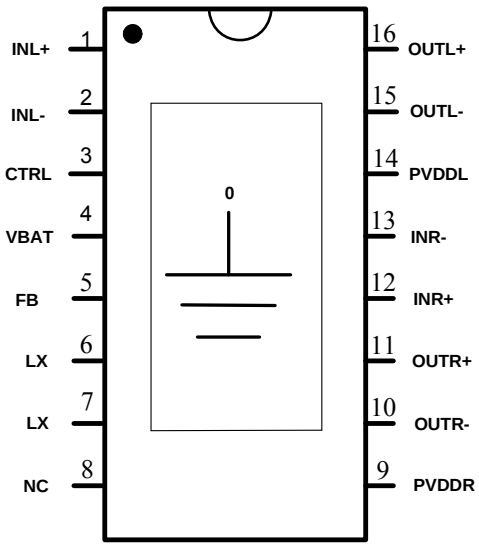
HT8699 has a filter-less modulation circuit which directly drives speakers while realizes low distortion and low noise characteristics. Thanks to filter-less, circuit design with fewer external parts can be made in portable applications.

HT8699 has the independent Shutdown function which can minimize the power consumption at standby and MUTE function. As for protection function, over current protection, over temperature protection function, and low supply voltage malfunction preventing function are also prepared.

■ 典型应用图



■ TERMINAL CONFIGURATION



SOP16L-PP Top View

■ TERMINAL FUNCTION[1]

Terminal No.	Name	I/O	ESD Protection	Function
0	GND	GND	-	Power Ground. Do connect to the system Ground.
1	INL+	I	PN	Left channel positive input (differential +)
2	INL-	I	PN	Left channel negative input (differential -)
3	CTRL	I	PN	Shutdown and ACF control terminal
4	V_{BAT}	Power	PN	Logic Power Supply
5	FB	I	PN	Regulator Feedback Input
6,7	LX	I	-	Internal Switch Input
8	NC			No connection. Connect to GND for better thermal performance
9	PVDDR	Power	-	Boost Converter Output Voltage, Power Supply for Class D Right Channel
10	OUTR-	O	-	Right channel negative output (BTL-)
11	OUTR+	O		Right channel positive output (BTL+)
12	INR+	I	PN	Right channel positive input (differential +)
13	INR-	I	PN	Right channel negative input (differential -)
14	PVDDL	Power	-	Boost Converter Output Voltage, Power Supply for Class D Left Channel
15	OUTL-	O	-	Left channel negative output (BTL-)
16	OUTL+	O		Left channel positive output (BTL+)

[1] I: Input O: Output

■ ORDERING INFORMATION

Part Number	Available Working Mode	Internal Input Resistor R_{IN}[1]	Package Type	Marking	Operating Temperature Range	MOQ/Shipping Package
HT8699RSPER	Class AB & Class D	17.8k ohm	SOP16L-PP	HT8699R$_{SP}$	-40℃～85℃	Tube / 50 PCS
HT8699RSPET	Class AB & Class D	17.8k ohm	SOP16L-PP	HT8699R$_{SP}$	-40℃～85℃	Tape and Reel 2500PCS
HT8699B6SPET	Class D	10ohm	SOP16L-PP	HT8699$_{SP}$	-40℃～85℃	Tube / 50 PCS
HT8699B6SPER	Class D	10ohm	SOP16L-PP	HT8699$_{SP}$	-40℃～85℃	Tape and Reel 2500PCS

■ ELECTRICAL CHARACTERISTIC

● Absolute Maximum Ratings [2]

Item	Symbol	Min.	Max.	Unit
Power supply voltage range	V_{BAT}	-0.3	5.5	V
BOOST converter output voltage range	PVDD	V_{BAT}	7.0	V
Input terminal voltage range (IN+, IN-)	V_{IN}	V_{SS}－0.6	PVDD＋0.6	V
Input terminal voltage range (except IN+, IN-)	V_{IN}	V_{SS}－0.3	PVDD＋0.3	V
Operating Ambient Temperature	T_A	-40	85	℃
Junction Temperature	T_J	-40	150	℃
Storage Temperature	T_{STG}	-50	150	℃

● Recommended Operating Condition

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power Supply Voltage [3]	V_{BAT}		2.5	3.6	5.5	V
BOOST converter output voltage range	PVDD		V_{BAT}	6.0	7.0	V
Operating Ambient Temperature	T_a		-40	25	85	℃
Speaker Impedance	R_L		4			Ω

[1] See Fig. 3 in Page 12 for detail.
[2] Absolute Maximum Ratings is values which must not be exceeded to guarantee device reliability. With a system in which supply voltage might exceed supply voltage of PVDD/GND, external diodes are recommended to be used to assure that the voltage does not exceed the absolute maximum rating.
[3] The rising time of V_{BAT} should be more than 1μs.

● Electrical Specification[1]

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
BOOST Converter						
Boost converter output voltage	PVDD		V_{BAT}	6.0	7.0	V
Boost converter frequency	f_{SW}			420		kHz
Boost converter input current limit	$I_{LIMTRIP}$			4.6		A
Class D Channel V_{SS}=0V, V_{BAT} =3.6V, PVDD = 6.0V, R_{IN} = 56K, Ta=25ºC, C_{IN}=1uF, ACF-Off mode, unless otherwise specified						
Carrier clock frequency	f_{PWM}			420		kHz
Over current protection	Imax				5	A
System Gain	Av_0	External R_{IN}=56 kΩ, for HT8699B6SPEx		26		dB
		External R_{IN}=0, for HT8699RSPEx		27.5		
Start-up time (power-on or shutdown release)	t_{STUP}			260		ms
ACF attenuation gain	Aa		-16		0	dB
Consumption current in shutdown mode	I_{SD}	CTRL=V_{SS}		23		μA
Output Power	P_O	R_L=4Ω, V_{BAT}=3.6V, f=1kHz, THD+N=10%		2×4.5		W
		R_L=8Ω, V_{BAT}=3.6V, f=1kHz, THD+N=10%		2×2.6		
		R_L=4Ω, V_{BAT}=3.6V, f=1kHz, THD+N=1%		2×3.7		
		R_L=8Ω, V_{BAT}=3.6V, f=1kHz, THD+N=1%		2×2.1		
Total Harmonic Distortion plus Noise	THD+N	PVDD = 6V, P_O=1.0W, R_L=4Ω, f=1kHz		0.12		%
		PVDD = 6.5V, P_O=1.0W, R_L=4Ω, f=1kHz		0.11		%
		PVDD = 7V, P_O=1.0W, R_L=4Ω, f=1kHz		0.11		%
Output Noise	V_N	f=20Hz~20kHz, A weighted, Av=26dB		155		$μV_{rms}$
Signal to Noise Ratio	SNR	A weighted, Av=26dB, THD+N = 1%		88		dB
Output offset voltage	V_{OS}			±2		mV
Crosstalk	CS	L -> R, f = 1kHz, Po = 1W		-100		dB
		R -> L, f = 1kHz, Po = 1W		-85		
Efficiency (Class D + Boost)	η	V_{BAT}=3.6V, R_L=4Ω+22uH, THD+N = 1%		70		%
		V_{BAT}=3.6V, R_L=8Ω+33uH, THD+N = 1%		77		%
Quiescent current	I_{BAT}	No Load, Input Grounded		27		mA
		With Load[2], Input Grounded		26		mA
Maximum Input Signal	V_{IN}max	f_{IN} = 1kHz, THD+N≤10%, ACF-1 ON		1.5		Vrms

[1] Depending on parts and pattern layout, characteristics may be changed.
[2] 4ohm resistor and 22uH coil are used as an output load in order to simulate a speaker.

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit
Class AB Channel V_{SS}=0V, V_{BAT} =3.6V, Av=20dB, Ta=25ºC, C_{IN}=1uF, HT8699RSPEx, unless otherwise specified							
Output Power	P_O	f=1kHz, THD+N=10%	R_L=4Ω, V_{BAT}=3.6V		1.3		W
			R_L=4Ω, V_{BAT}=4.2V		1.8		W
			R_L=4Ω, V_{BAT}=5.0V		2.65		W
		f=1kHz, THD+N=1%	R_L=4Ω, V_{BAT}=3.6V		1.0		W
			R_L=4Ω, V_{BAT}=4.2V		1.5		W
			R_L=4Ω, V_{BAT}=5.0V		2.1		W
Total Harmonic Distortion plus Noise	THD+N	P_O=0.01W	R_L=4Ω, f=1kHz		0.12		%
		P_O=0.1W			0.1		%
Output Noise	V_N	f=20Hz~20kHz, A weighted Av=20dB			75		μV_{rms}
Signal to Noise Ratio	SNR	A weighted, Av=20dB, THD+N = 1%			90		dB
Output offset voltage	V_{OS}				±4		mV
Efficiency	η	R_L=4Ω+22uH, THD+N = 10%			70		%
		R_L=8Ω+33uH, THD+N = 10%			74.5		%
Quiescent current	I_{BAT}	Input Grounded	No Load		20		mA
			With Load		20		mA
Current consumption in Mute mode	I_{MUTE}	Input Grounded, MUCH = H	No Load		2.0		mA
			With Load		2.0		mA
Current consumption in Shutdown mode	I_{SD}	CTRL=V_{SS}			36		μA
System Gain	Av_0	External R_{IN}=0			21.5		dB
Start-up time (power-on, shutdown release, or shift between Class D and Class AB)	t_{STUP}				260		ms
MISCELLANEOUS							
V_{BAT} start-up threshold voltage	V_{UVLH}				2.5		V
V_{BAT} shut-down threshold voltage	V_{UVLL}				2.2		V

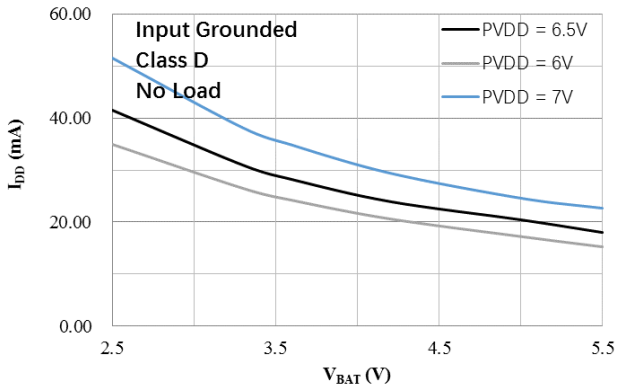
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
SD wake up voltage	V_{CTRL_ON}		0.9			V
CTRL Terminal Voltage for HT8699B6SPEx						
Class D mode in ACF-Off with Boost Converter	V_{MOD1}		0.75× PVDD		PVDD	V
Class D mode in ACF-1 with Boost Converter	V_{MOD2}		0.45× PVDD		0.70× PVDD	V
Class D mode in ACF-2 with Boost Converter	V_{MOD3}		0.10× PVDD		0.40× PVDD	V
SD mode	V_{MOD4}	Shutdown mode	V_{SS}		0.06× (V_{BAT}-V_F[1])	V
Internal pull-down Resistor of CTRL	R_{CTRL}			60		KΩ
CTRL Terminal Voltage for HT8699RSPEx						
Class D mode in ACF-Off with Boost Converter	V_{MOD1}		2.4		VBAT	V
Class D mode in ACF-1 with Boost Converter	V_{MOD2}		1.6		2.2	V
Class AB mode in ACF-off without Boost Converter	V_{MOD3}		0.4		1.4	V
SD mode	V_{MOD4}	Shutdown mode	V_{SS}		0.2	V
Internal pull-down Resistor of CTRL	R_{CTRL}			150		KΩ

[1] V_F is the forward voltage of external diode.

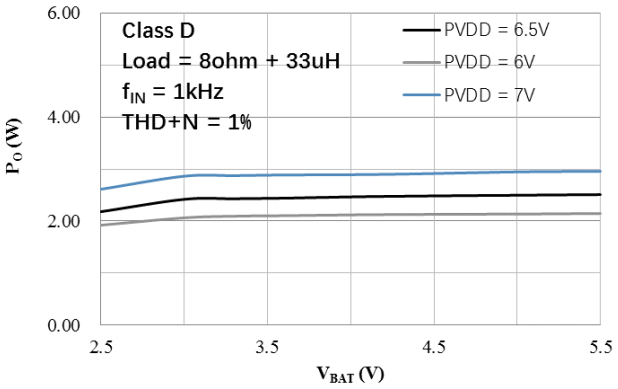
■ TYPICAL OPERATING CHARACTERISTICS

Condition: Class D mode, V_{BAT} = 3.6V, f_{IN} = 1kHz, C_{IN} = 1uF, ACF off, Load = 4ohm+33uH, unless otherwise specified

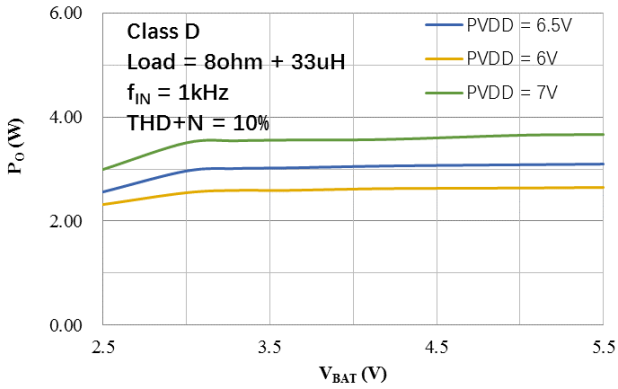
V_{BAT} vs I_{DD}



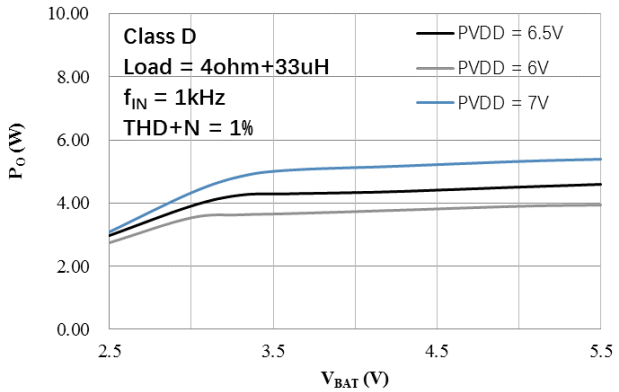
V_{BAT} vs P_O



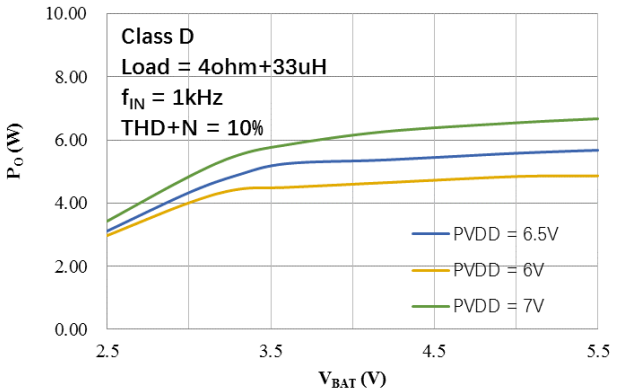
V_{BAT} vs P_O



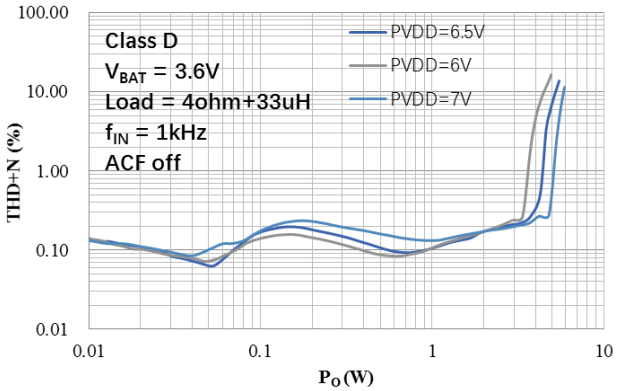
V_{BAT} vs P_O



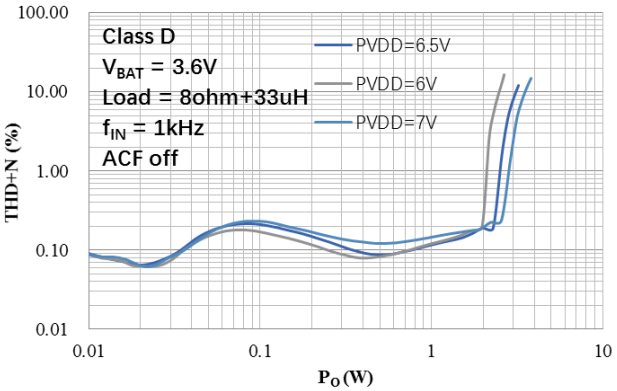
V_{BAT} vs P_O



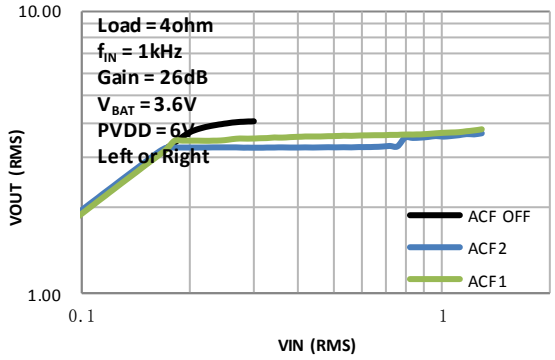
P_O vs THD+N



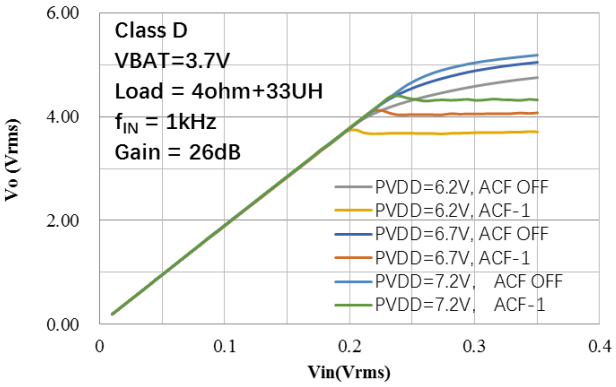
P_O vs THD+N



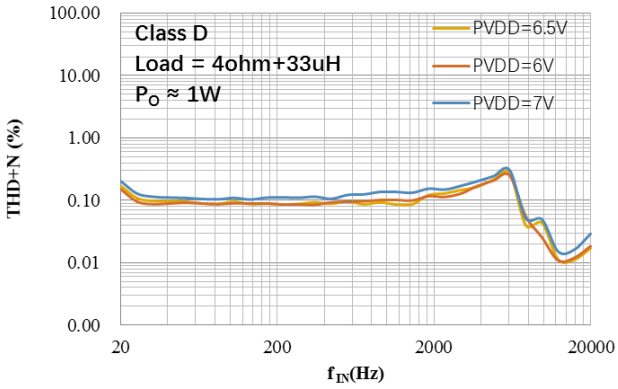
VIN vs VOUT



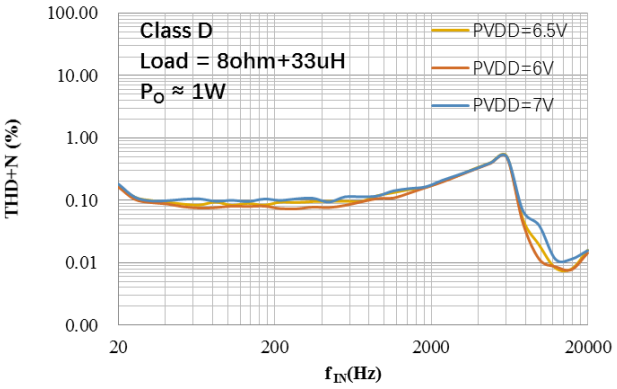
V_{in} vs V_o



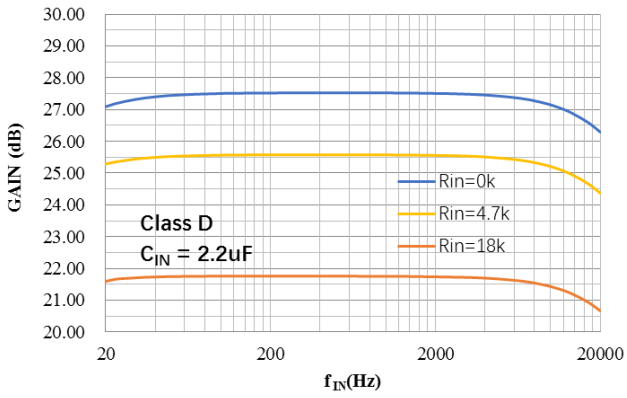
f_{IN} vs THD+N

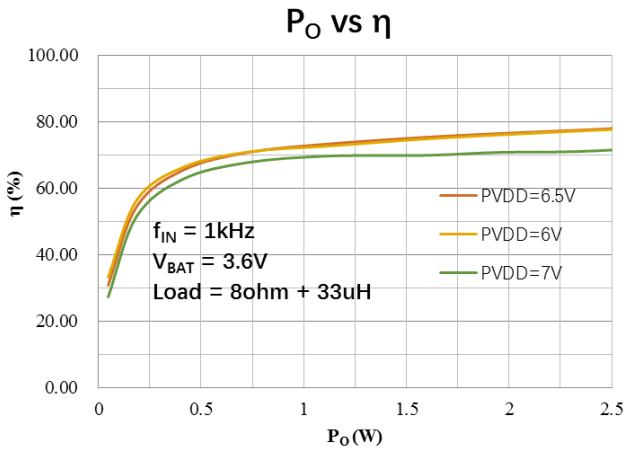


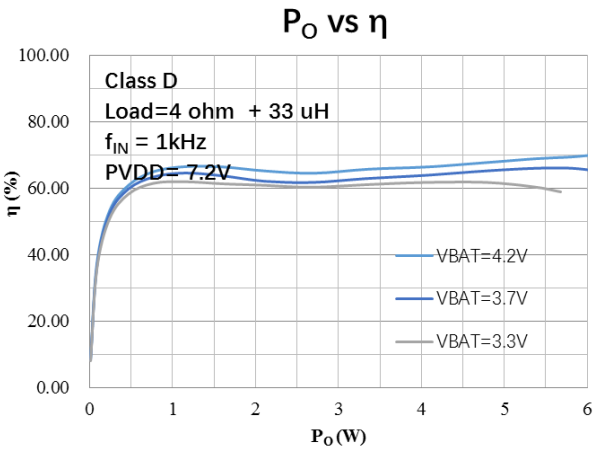
f_{IN} vs THD+N

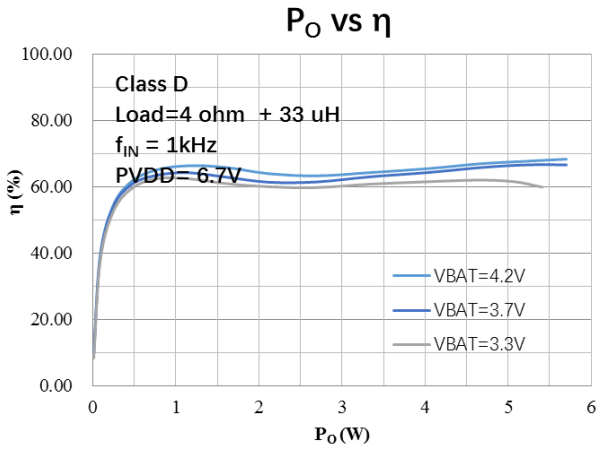


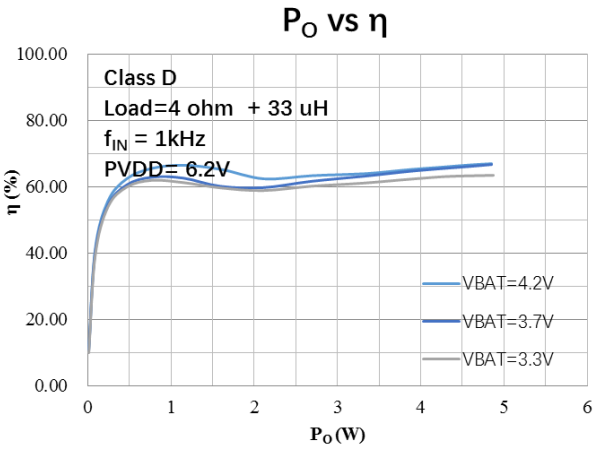
f_{IN} vs Gain




PO vs η
100.00
80.00
60.00
40.00
20.00
0.00
η (%)
0
0.5
1
1.5
2
2.5
PO (W)
fIN = 1kHz
VBAT = 3.6V
Load = 8ohm + 33uH
PVDD=6.5V
PVDD=6V
PVDD=7V


PO vs η
100.00
80.00
60.00
40.00
20.00
0.00
η (%)
0
1
2
3
4
5
6
PO (W)
Class D
Load=4 ohm + 33 uH
fIN = 1kHz
PVDD= 7.2V
VBAT=4.2V
VBAT=3.7V
VBAT=3.3V

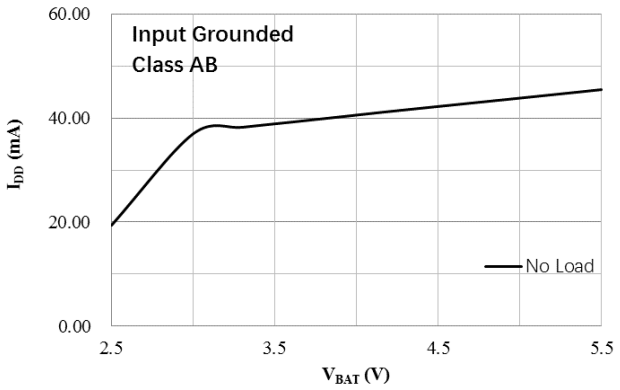

PO vs η
100.00
80.00
60.00
40.00
20.00
0.00
η (%)
0
1
2
3
4
5
6
PO (W)
Class D
Load=4 ohm + 33 uH
fIN = 1kHz
PVDD= 6.7V
VBAT=4.2V
VBAT=3.7V
VBAT=3.3V


PO vs η
100.00
80.00
60.00
40.00
20.00
0.00
η (%)
0
1
2
3
4
5
6
PO (W)
Class D
Load=4 ohm + 33 uH
fIN = 1kHz
PVDD= 6.2V
VBAT=4.2V
VBAT=3.7V
VBAT=3.3V

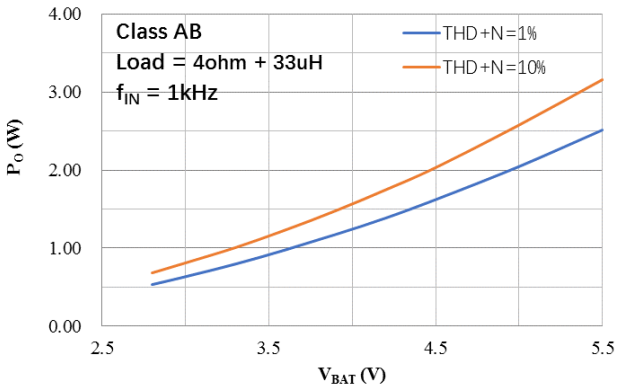
Class AB Channel

Condition: Class AB mode (HT8698RSPEx), V_{BAT} = 3.6V, f_{IN} = 1kHz, Load = 4ohm, unless otherwise specified

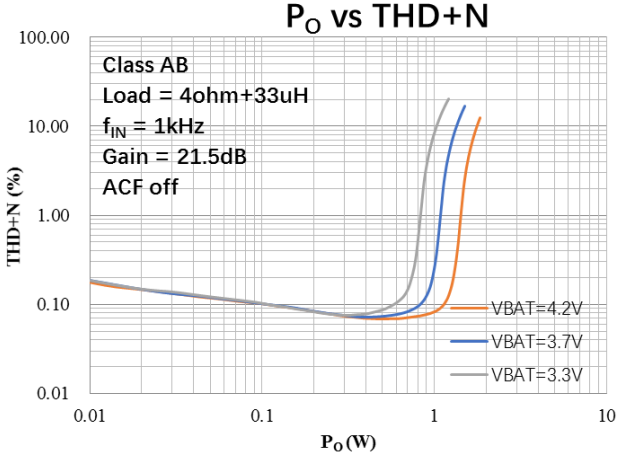
V_{BAT} vs I_{DD}



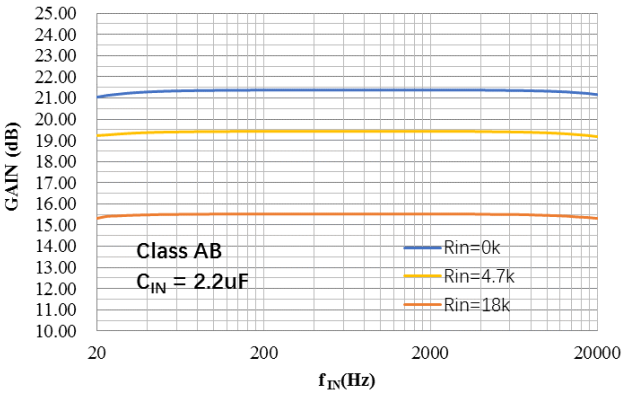
V_{BAT} vs P_O



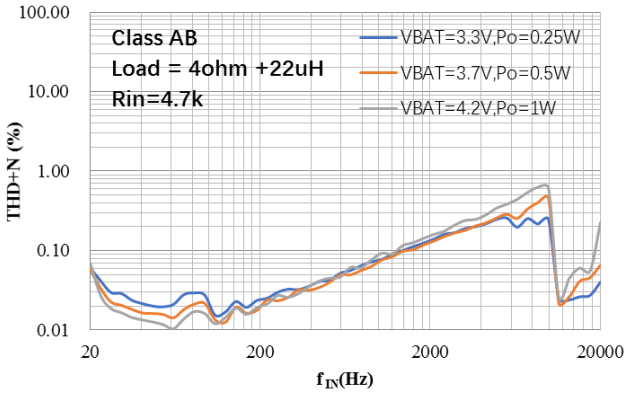
P_O vs THD+N



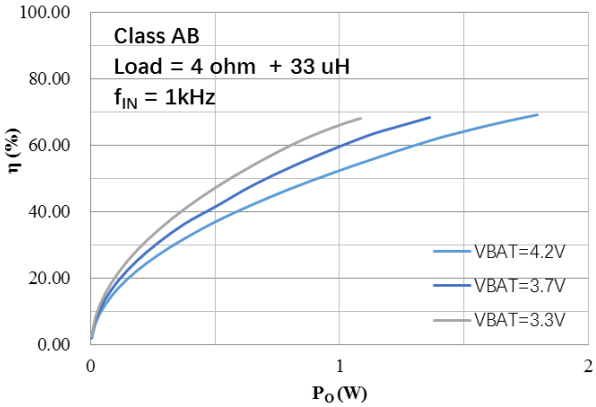
f_{IN} vs Gain



f_{IN} vs THD+N



P_O vs η



■ APPLICATION INFORMATION

- **BOOST Converter**

(1) Setting Output Voltage

The output voltage is set by a resistive voltage divider from the output voltage to FB terminal, which is shown below. The output voltage can be calculated by PVDD = 1.24*(Rd1+Rd2)/Rd2.

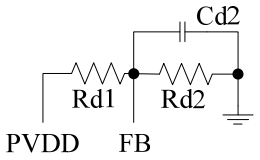


Fig. 1 FB Terminal Configuration

Some typical output voltages can be got by following settings.

Table 1. Output Voltage Setting

PVDD	Rd1	Rd2	Cd2
5.0V	120K	39.5K	3.3nF
6.0V	120k	31k	3.3nF
6.5V	120K	28K	3.3nF
7.0V	120K	25.5K	3.3nF

(2) LX Terminal

It is strongly recommended to place an RC circuit from the terminal of LX to Ground, shown as following, so that the ripple current of Boost Converter can be decreased. Meanwhile, the total consumption current of the system will be larger so that the efficiency of the system will be lower. Specifications in this file is measured under the condition with RC.

Notes: RC should be placed as closely to LX pin as possible.

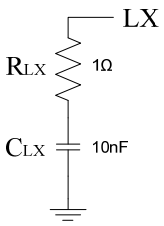


Fig. 2 LX Terminal Configuration

(3) Capacitor Selection

The input and output capacitor (C_{IN} and C_{OUT}) is required to maintain the DC voltage. Low ESR capacitors are preferred to reduce the output voltage ripple. 1uF//10uF//220uF (paralleled) is highly recommended to be placed in both input and output terminal as closely to the pin as possible. If possible, 470uF is better than 220uF.

(4) Inductor Selection

Inductance value is decided based on different condition. L≥10uH, DCR<1ohm, I_{SAT}≥5A is recommended for general application circuit.

(5) Schottky Diode Selection

V_{RRM} > 12V, V_{FM}<0.5V, I_F≥4 A is recommended for general application circuit.

(6) Layout Consideration

1. The power traces, consisting of the GND, LX, V_{BAT} and PVDD trace should be kept short, direct, wide,

and as closely to the pin as possible. The switching node LX should be paid more attention for EMI and reliability consideration.

2. Place C_{IN} and C_{OUT} near V_{BAT} and PVDD as closely as possible to maintain voltage steady and filter out the pulsing current.
3. The resistive divider R should be connected to pin directly as closely as possible. FB is a sensitive node. Please keep it away from switching node, LX.
4. The GND of the IC, C_{IN} and C_{OUT} should be connected close together directly to ground plane.

● Analog Signal Input Configuration

HT8699 is an amplifier with analog input (single-ended or differential). For a differential operation, input signals into IN+ and IN- pins via DC-cut capacitors (C_{IN}) and external input resistors R_{IN}. The input signal gain is calculated by $Gain \approx R_F / (External\ R_{IN} + Internal\ R_{IN})$. And the high pass cut-off frequency of input signal can be calculated by $f_c = \frac{1}{2\pi(External\ R_{IN} + External\ R_{IN}) \times C_{IN}}$.

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

Part No.	Working Mode	Internal R_{IN}(ohm)	R_F(ohm)
HT8699B6SPEx	Class D mode	10	1200K
HT8699RSPEx	Class D mode	17.8k	420K
HT8699RSPEx	Class AB mode	17.8k	210K

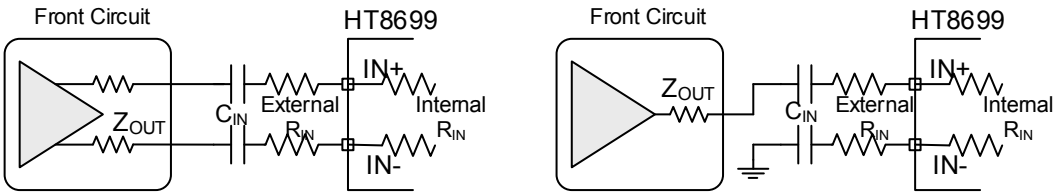


Fig. 3 (1) Differential Input; (2) Single-ended Input

● Output Configuration

As mentioned, HT8699 can directly drive speakers without any other components. But there are exceptions. Once HT8699 works in class D mode, the cable lined to the speaker is very long, and EMI is concerned, ferrite beads or L-C filter is needed.

● CTRL Terminal Mode Control

HT8699 can work in different modes by setting the CTRL terminal, shown as follow.

Table. 2 CTRL Terminal Mode Control for HT8699RSPEx

MODE	SYMBOL	CTRL Voltage			
		MIN.	TYP.	MAX.	UNIT
Class D mode in ACF-Off with Boost Converter	V_{MOD1}	2.4		VBAT	V
Class D mode in ACF-1 with Boost Converter	V_{MOD2}	1.6		2.2	V
Class AB mode in ACF-off without Boost Converter	V_{MOD3}	0.4		1.4	V
SD(Shutdown) Mode	V_{MOD4}	VSS		0.2	V

Notes: ACF-1 and ACF-2 mode can only be worked in class D mode. A 150kΩ pull-down resistor (R_{CTRL}) are inside of the CTRL terminal, shown as follows.

Table. 3 CTRL Terminal Mode Control for HT8699B6SPEx

MODE	SYMBOL	CTRL Voltage			
		MIN.	TYP.	MAX.	UNIT
Class D mode in ACF-Off with Boost Converter	V_{MOD1}	0.75× PVDD		PVDD	V
Class D mode in ACF-1 with Boost Converter	V_{MOD2}	0.45× PVDD	0.66× PVDD	0.70× PVDD	V
Class D mode in ACF-2 with Boost Converter	V_{MOD3}	0.10× PVDD	0.33× PVDD	0.40× PVDD	V
SD(Shutdown) Mode	V_{MOD4}	GND		0.06× × (V_{BAT}-V_F[1])	V

Notes: ACF-1 and ACF-2 mode can only be worked in class D mode. A 60kΩ pull-down resistor (R_{CTRL}) are inside of the CTRL terminal, shown as follows.

Fig. 4 CTRL Terminal

- **Anti-Clipping Function (ACF) and mode Configuration**

(1) ACF ON Mode

In ACF-ON modes, HT8699 attenuates system gain to an appropriate value when an excessive input is applied, so as not to cause the clipping at the differential signal output. In this way, the output audio signal is controlled in order to obtain a maximum output level without distortion. And HT8699 also follows to the clips of the output waveform due to the decrease in the power-supply voltage.

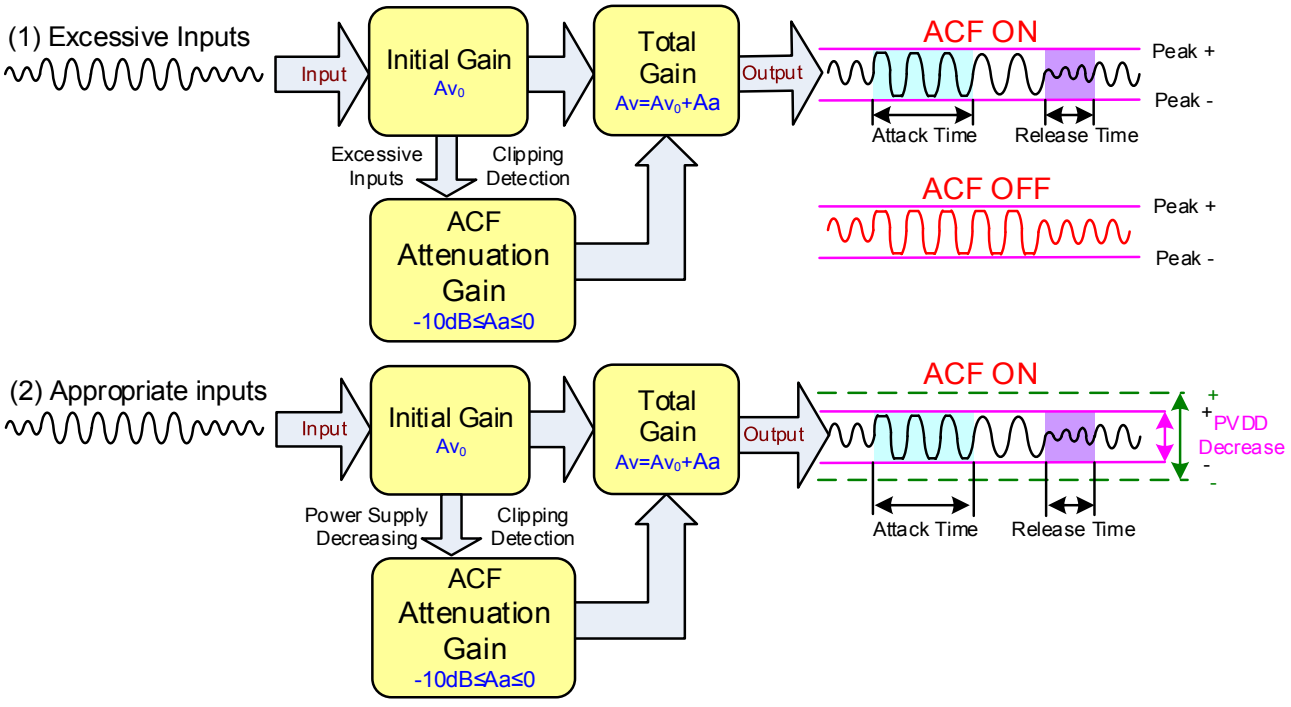


Fig. 5 the ACF Function Operation Outline

[1] V_F is the forward voltage of external diode.

The Attack time of ACF Function is a time interval until system gain falls to target attenuation gain -3dB when a big enough signal input. And, the Release Time is a time from target attenuation gain to not working of ACF. The maximum attenuation gain is 16dB.

Table 4 Attack time and Release time

ACF mode	Attack time	Release time
ACF-1	6.7ms/dB	67ms/dB
ACF-2	0.1ms/dB	400ms/dB

Note: As the ACF Function limits the output signal under THD+N of 2-5% (but not 1%), there may still exist some audible distortion in the output signal. So, if high quality music is required without much distortion toleration, ACF should not be used.

(2) ACF OFF Mode

In ACF-Off mode, ACF function is disenabled. HT8699 will not detect output clipping and the system gain is kept to be $Av=Av_0$. The audio quality would worsen due to clipping distortion.

(3) SD Mode

In shutdown mode, HT8699 shuts all circuit down and minimizes the power consumption. And, the output terminals become Weak Low (A high resistance grounded state).

- **Pop-Click Noise Reduction**

The Pop-Click Noise Reduction Function of HT8699 works in the cases of Power-on, Power-off, Shutdown on, and Shutdown off. To achieve a more excellent noise reduction performance, it is recommended to use a DC-cut capacitor (C_{IN}) of 0.1μF or less.

Besides, POP noise can be minimal according to the following procedure of shutdown control.

・During power-on, Shutdown mode is not cancelled until the power supply is stabilized enough.
・Before Power-off, set Shutdown mode first.

The pop-click noise: Power-on/-off > Shutdown on/off.

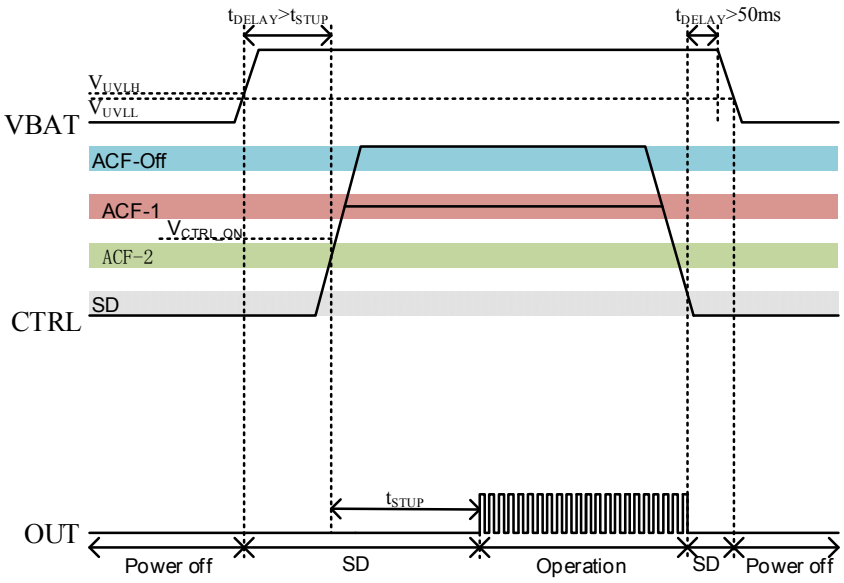


Fig. 6 Pop-Click Noise Reduction by Shutdown

- **Protection Function**

HT8699 has the protection functions such as Thermal Protection function, and Low Voltage Malfunction Prevention function.

(1) Over-current Protection function

When a short circuit occurs between one output terminal, 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.

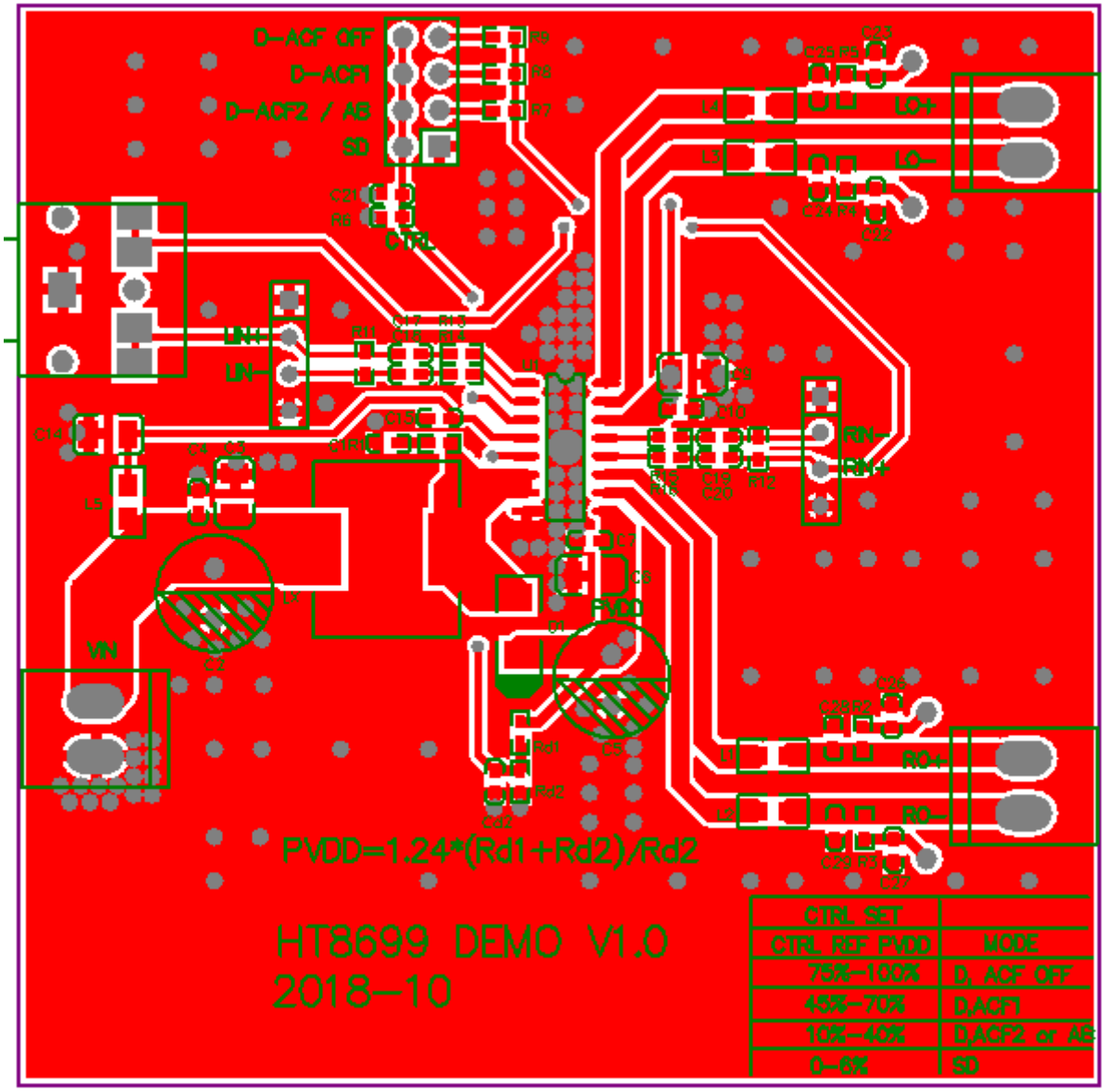
(2) Thermal Protection function

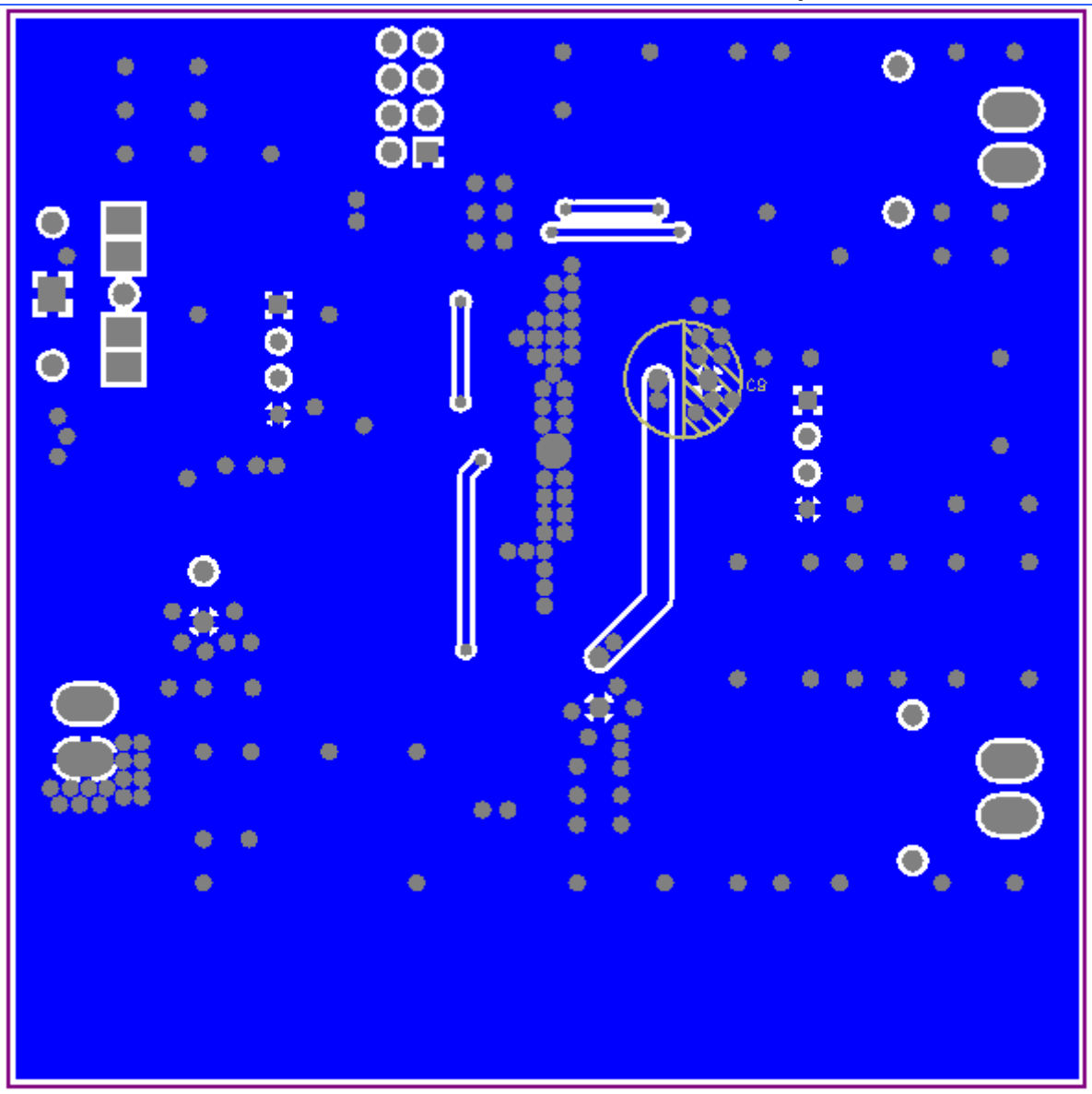
When excessive high temperature of HT8699 (150℃) is detected, the thermal protection mode starts up. In the thermal protection mode, the differential output terminal becomes Weak Low state (a state grounded through high impedance).

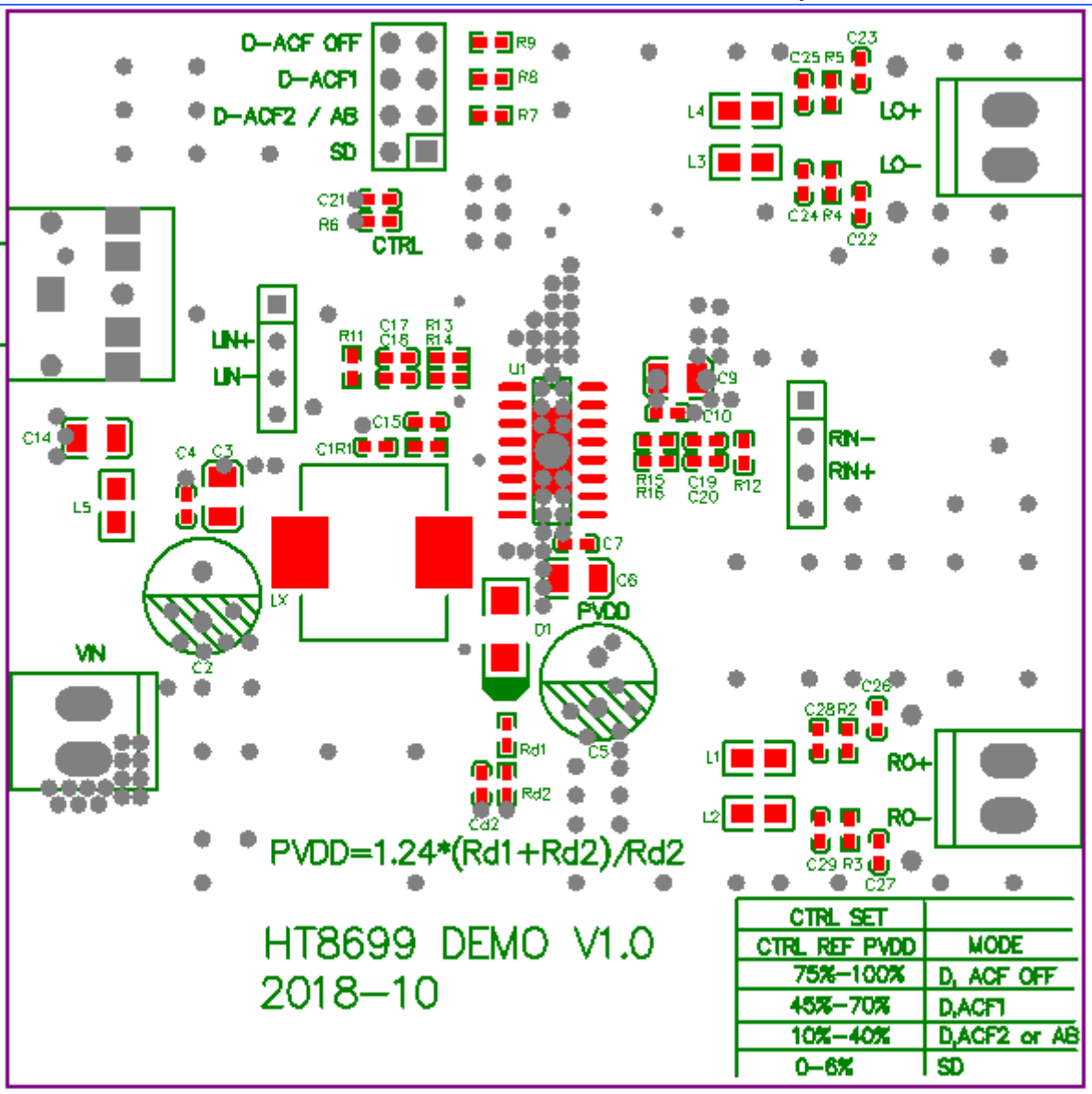
(3) Low voltage Malfunction Prevention function

This is the function to establish the low voltage protection mode when Vbat terminal voltage becomes lower than the detection voltage (V_{UVLL}) for the low voltage malfunction prevention. And the protection mode is canceled when Vbat terminal voltage becomes higher than the threshold voltage (V_{UVLH}). In the low voltage protection mode, the differential output pin becomes Weak Low state (a state grounded through high impedance). HT8699 will start up within the start-up time (T_{STUP}) when the low voltage protection mode is cancelled

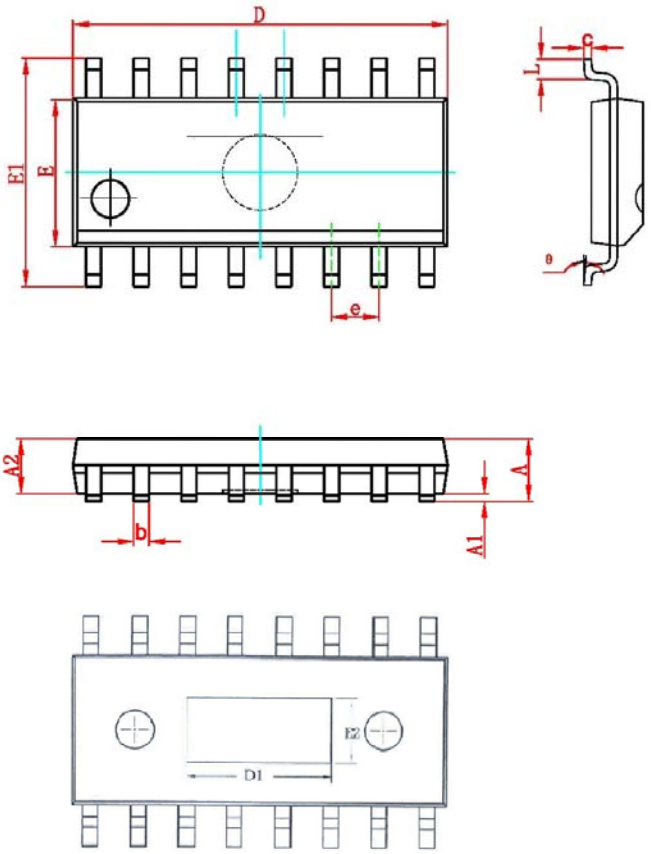
PCB Layout


D-ACF OFF
D-ACF1
D-ACF2 / AB
SD
CTRL
LIN+
LIN-
VIN
PVDD
LO+
LO-
RO+
RO-
RIN-
RIN+
PVDD=1.24*(Rd1+Rd2)/Rd2
HT8699 DEMO V1.0
2018-10
CTRL SET
CTRL REF PVDD
MODE
75%-100%
D_ACF OFF
43%-70%
D_ACF1
10%-40%
D_ACF2 or AB
0-6%
SD




D-ACF OFF
D-ACF1
D-ACF2 / AB
SD
CTRL
LIN+
LIN-
RIN-
RIN+
LO+
LO-
RO+
RO-
VIN
PVDD
LX
U1
L1
L2
L3
L4
L5
C1
C2
C3
C4
C5
C6
C7
C9
C10
C14
C15
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
R1
R2
R3
R4
R5
R6
R7
R8
R9
R11
R12
R13
R14
R15
R16
D1
Rd1
Rd2
Cd2
PVDD=1.24*(Rd1+Rd2)/Rd2
HT8699 DEMO V1.0
2018-10
CTRL SET
CTRL REF PVDD
MODE
75%-100%
D, ACF OFF
45%-70%
D,ACF1
10%-40%
D,ACF2 or AB
0-6%
SD

■ PACKAGE OUTLINE



Symbol	Dimensions (mm)	
	Min	Max
A	-	1.75
A1	0.05	0.15
A2	1.30	1.50
b	0.39	0.48
c	0.21	0.26
D	9.70	10.10
D1	4.57(REF)	
E	3.70	4.10
E1	5.80	6.20
E2	2.41(REF)	
e	1.27(BSC)	
L	0.50	0.80
θ	0°	8°

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