4.7W防削顶单声道音频功率放大器

■ 特点

・防削顶失真功能(Anti-Clipping Function, ACF)
・AB类/D类切换
・优异的全带宽EMI抑制性能
・免滤波器数字调制，直接驱动扬声器
・输出功率
1.4W (V_{DD}=3.6V, R_L=4Ω, THD+N=10%, Class D)
2.8W (V_{DD}=5.0V, R_L=4Ω, THD+N=10%, Class D)
4.7W (V_{DD}=6.5V, R_L=4Ω, THD+N=10%, Class D)
2.5W (V_{DD}=5.0V, R_L=4Ω, THD+N=10%, Class AB)
・高信噪比SNR：95dB (V_{DD} = 6.5V, Av = 24dB, THD+N = 1%)
・低静态电流（D类）
2.65mA (V_{DD}=3.6V)
3.25mA (V_{DD}=5.0V)
4.00mA (V_{DD}=6.5V)
・低关断电流：＜1μA
・过流保护及自动恢复功能
・过热保护、欠压异常保护功能
・无铅无卤封装，DFN8L，MSOP8，SOP8和SOP8-PP

■ 应用

・便携式音箱
・iphone/ipod/MP3 docking
・PMP/MP4/MP5播放器
・便携式游戏机
・智能音响
・平板电脑
・导航仪GPS
・手机

■ 概述

HT6881是一款低EMI的，防削顶失真的，单声道免滤波D类音频功率放大器。在6.5V电源，10% THD+N，4Ω负载条件下，输出4.7W功率，在各类音频终端应用中维持高效率并提供AB类放大器的性能。

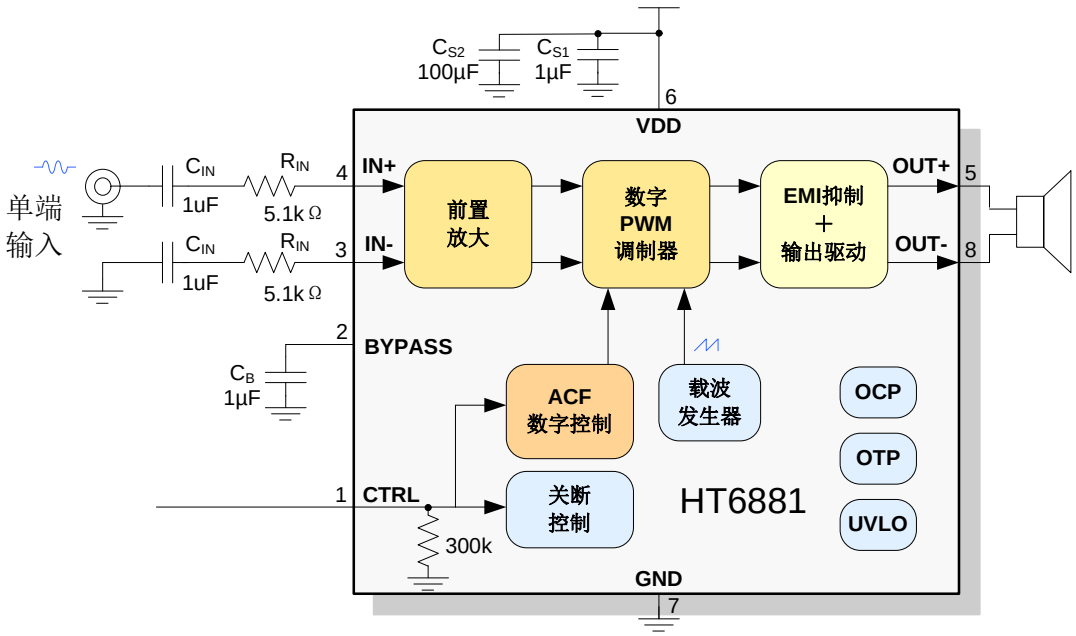
HT6881的最大特点是防削顶失真（ACF）输出控制功能，可检测并抑制由于输入音乐、语音信号幅度过大所引起的输出信号削顶失真（破音），也能自适应地防止在电池应用中由电源电压下降所造成的输出削顶，显著提高音质，创造非常舒适的听音享受，并保护扬声器免受过载损坏。同时芯片具有ACF-Off模式。

HT6881具有独有的电磁辐射（EMI）抑制技术和优异的全带宽低辐射性能，辐射水平在不加任何辅助设计时仍远在FCC Part15 Class B 标准之下，不仅避免了干扰其他敏感电路还降低了系统设计难度。其还能切换至AB类模式，以彻底消除电磁辐射。

HT6881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，HT6881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。

■ 典型应用图



4.7W Anti-Clipping Mono Audio Power Amplifier

FEATURE

- Anti-Clipping Function, ACF
- Both Class D and Class AB are available
- Excellent EMI Suppression Performance
- Filter-less Modulation, Eliminating Output Filter
- Output Power

1.4W (V_{DD}=3.6V, R_L=4Ω, THD+N=10%, Class D)
2.8W (V_{DD}=5.0V, R_L=4Ω, THD+N=10%, Class D)
4.7W (V_{DD}=6.5V, R_L=4Ω, THD+N=10%, Class D)
2.5W (V_{DD}=5.0V, R_L=4Ω, THD+N=10%, Class AB)

- High SNR：95dB (V_{DD} = 6.5V, Av = 24dB, THD+N = 1%)
- Low quiescent current (Class D)
  2.65mA (V_{DD}=3.6V)
  3.25mA (V_{DD}=5.0V)
  4.00mA (V_{DD}=6.5V)
- Low shutdown current：＜1μA
- Over Current Protection and Thermal Protection with Auto Recovery
- Low voltage malfunction prevention function included
- Pb-Free Packages, DFN8L, MSOP8L, SOP8L and SOP8L-PP

APPLICATIONS

- Portable Speakers
- iphone/ipod/MP3 docking
- Tablet PC/Note Book
- Portable Gamers
- Smart Speakers
- GPS
- PMP/MP4/MP5
- Smart phones

GENERAL DESCRIPTION

HT6881 is a Low-EMI, Anti-Clipping, filter-less mono Class D audio power amplifier IC with maximum output power of 4.7W (6.5V power supply, 4Ω load, 10% THD+N). It has a high efficiency with class AB amplifier performance.

HT6881 features Anti-Clipping Function (ACF) which detects and suppresses output signal clippings due to the over level inputs of music or voice signals. The ACF function also can adapt the output clippings caused by power supply voltage down in battery applications. It improves acoustical quality considerably, gives great listening enjoyment, and prevents speaker from overload damaging.

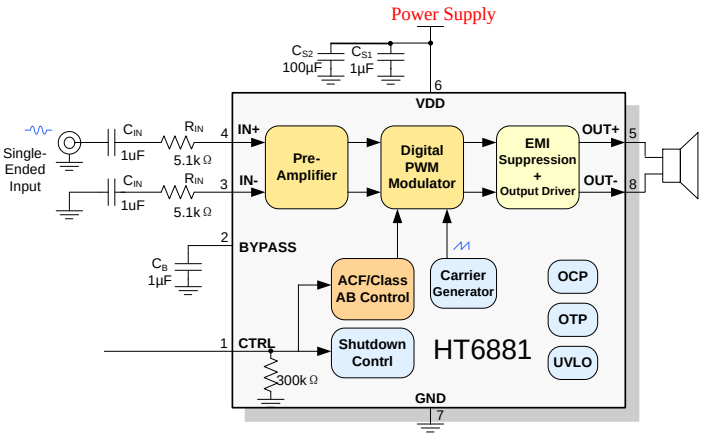
HT6881 has excellent EMI radiation suppression characteristics. The radiation level is well below FCC Part15 Class B standards without any additive design. It keeps from interference with other EMI sensitive circuits, simplifies system design and lowers system cost.

Class AB amplifier mode is also available for HT6881. Once the EMI Interference from class D becomes an annoying problem, HT6881 can be changed into Class AB mode.

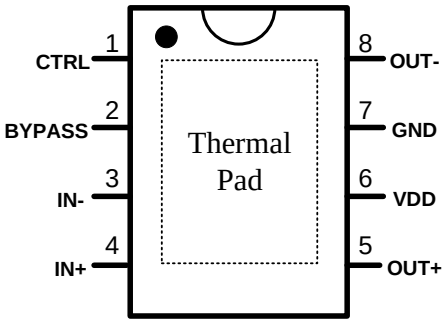
HT6881 has a filter-less modulation circuit which directly drives speakers while realizes low distortion and low noise characteristics. Thanks to filter-less, circuit design with fewer external parts can be made in portable applications.

HT6881 has the independent Shutdown function which can minimize the power consumption at standby function. As for protection function, over current protection function for speaker output terminals, over temperature protection function, and low supply voltage malfunction preventing function are also prepared.

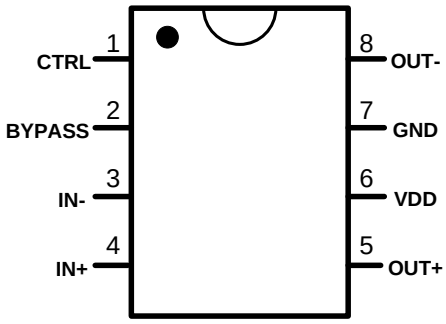
TYPICAL APPLICATION



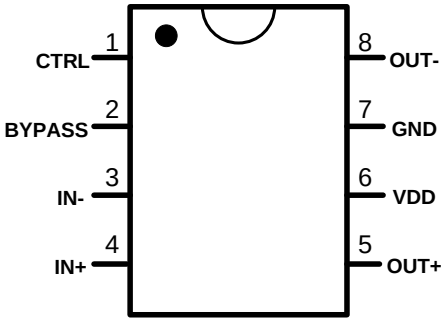
■ TERMINAL CONFIGURATION



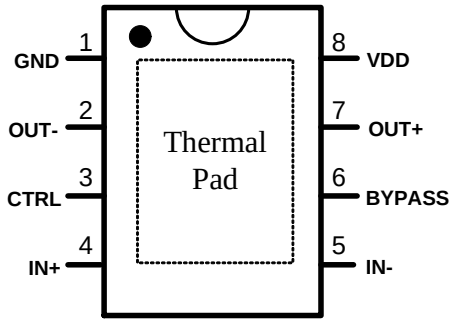
Top View
HT6881D2SPE (SOP8L-PP)



Top View
HT6881D2SPN (SOP8L)



Top View
HT6881D2MSN(MSOP8L)



Top View
HT6881D2SDE (DFN8L)

■ TERMINAL FUNCTION

Terminal No.		Name	I/O*1	ESD composition	Function
DFN8L	SOP8L(-PP) MSOP8L				
3	1	CTRL	I	PN	Mode control terminal
6	2	BYPASS	A	PN	Analog reference terminal
5	3	IN-	A	PN	Negative input terminal (differential -)
4	4	IN+	A	PN	Positive input terminal (differential +)
7	5	OUT+	O	-	Positive output terminal (differential +)
8	6	VDD	Power	-	Power supply
1	7	GND	GND	-	GND
2	8	OUT-	O	-	Negative output terminal (differential -)
Thermal Pad		/	/	/	Connecting to GND plane

*1 I: Input terminal O: Output terminal A: Analog terminal

■ ORDERING INFORMATION

Part Number	Package Type	Marking	Operating Temperature Range	Shipping Package/MOQ
HT6881D2SPET	SOP8L-PP	$HT6881_{SP}$	-40℃～85℃	Tube/100PCS
HT6881D2SPER	SOP8L-PP	$HT6881_{SP}$	-40℃～85℃	Tape and Reel/2500PCS
HT6881D2SPNT	SOP8L	$HT6881L_{SP}$	-40℃～85℃	Tube/100PCS
HT6881D2SPNR	SOP8L	$HT6881L_{SP}$	-40℃～85℃	Tape and Reel/2500PCS
HT6881D2MSNT	MSOP8L	HT6881	-40℃～85℃	Tube/100PCS
HT6881D2MSNR	MSOP8L	HT6881	-40℃～85℃	Tape and Reel/5000PCS
HT6881D2SDER	DFN8L-PP	$HT6881_{SD}$	-40℃～85℃	Tape and Reel/3000PCS

■ ELECTRICAL CHARACTERISTIC

● Absolute Maximum Ratings *2

Item	Symbol	Min.	Max.	Unit
Power supply terminal voltage range (Class D)	V_{DD}	-0.3	7.0	V
Power supply terminal voltage range (Class AB, HT6881)	V_{DD}	-0.3	6.0	V
Power supply terminal voltage range (Class AB, HT6881L)	V_{DD}	-0.3	5.5	V
Input terminal voltage range (IN+, IN-)	V_{IN}	$V_{SS}-0.6$	$V_{DD}+0.6$	V
Input terminal voltage range (except IN+, IN-)	V_{IN}	$V_{SS}-0.3$	$V_{DD}+0.3$	V
Operating Ambient Temperature	T_A	-40	85	℃
Junction Temperature	T_J	-40	150	℃
Storage Temperature	T_{STG}	-50	150	℃

*2 Absolute Maximum Ratings is values which must not be exceeded to guarantee device reliability. With a system in which input voltage might exceed supply voltage of VDD/GND, external diodes are recommended to be used to assure that the voltage does not exceed the absolute maximum rating.

● Recommended Operating Condition

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power Supply Voltage *3	V_{DD}	Class D	2.5	5	6.5	V
		Class AB, HT6881	2.5	5	5.5	V
		Class AB, HT6881L	2.5	5	5.0	V
Operating Ambient Temperature	T_a	t_{SD} (Min.) = 50ms	-20	25	85	℃
		t_{SD} (Min.) = 80ms	-30			
Speaker Impendence	R_L	Class D	2*4	4		Ω
		Class AB	4	4		Ω

*3 The rising time of VDD should be longer than 1μs.
*4 It is recommended to operate at 3.6~5V power supply when HT6881 is driving a 2ohm speaker as load.

● DC Characteristics

V_{SS}=0V, V_{DD}=2.5V~6.5V, Ta= -40ºC~85ºC, unless otherwise specified.

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
VDD power supply start-up threshold voltage	V_{UVLH}			2.10		V
VDD power supply shut-down threshold voltage	V_{UVLL}			1.90		V
ACF-OFF (Class D) mode threshold voltage for terminal CTRL	V_{MOD1}		2.3		V_{DD}	V
ACF-ON (Class D) mode threshold voltage for terminal CTRL	V_{MOD2}		1.6		2.2	V
ACF-OFF (Class AB) mode threshold voltage for terminal CTRL	V_{MOD3}		0.4	1	1.3	
SD mode threshold voltage for terminal CTRL	V_{MOD4}		V_{SS}		0.25	V
Quiescent current	I_{DD}	Class D, VDD=3.6V, No load		2.65		mA
		Class D, VDD=5.0V, No load		3.25		
		Class D, VDD=6.5V, No load		4.00		
		Class AB, VDD=3.6V, No load		6.40		
		Class AB, VDD=5.0V, No load		7.90		
Consumption current in shutdown mode	I_{SD}	CTRL=V_{SS}, Ta=25℃		0.01	1	μA
Voltage of terminal BYPASS	V_{BYPASS}			$V_{DD}/2$		V

*5 The voltage of CTRL terminal must be higher than 0.7V while HT6881 wakes up from shutdown mode or power off mode.

● Analog Characteristics *6

V_{SS}=0V, **V_{DD} =5V,** Av=24.5dB, Ta=25ºC, C_{IN}=1uF, R_{IN}=5.1kΩ, ACF-Off (**Class D**) mode, unless otherwise specified.

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Power	P_O	R_L=4Ω, V_{DD}=3.6V	f=1kHz, THD+N=1%		1.10		W
		R_L=4Ω, V_{DD}=5.0V			2.30		
		R_L=8Ω, V_{DD}=3.6V			0.70		
		R_L=8Ω, V_{DD}=5.0V			1.40		
		R_L=4Ω, V_{DD}=3.6V	f=1kHz, THD+N=10%		1.40		
		R_L=4Ω, V_{DD}=5.0V			2.80		
		R_L=8Ω, V_{DD}=3.6V			0.85		
		R_L=8Ω, V_{DD}=5.0V			1.70		
Total Harmonic Distortion plus Noise (BW: 20kHz)	THD+N	R_L=4Ω, P_O=1W, f=1kHz			0.08		%
Output Noise	V_N	f=20Hz~20kHz, A加权, Av=24.5dB			85		μV_{rms}
Signal /Noise Ratio	SNR	A-Filter, Av=24.5dB, THD+N = 1%			91		dB
Power Supply Rejection ratio	PSRR	f=1kHz			-70		dB
Efficiency	η	R_L=4Ω+22uH, THD+N = 1%			80		%
		R_L=8Ω+33uH, THD+N = 1%			90		%
Output Offset Voltage	V_{OS}				±6		mV
System Gain	Av_0	R_{IN}=5.1 kΩ			24.5		dB
ACF maximum attenuation gain	Aa	ACF-ON (Class D)		-10		0	dB

V_{SS}=0V, **V_{DD} =6.5V**, Av=24.5dB, Ta=25ºC, C_{IN}=1.0uF, R_{IN}=5.1 kΩ, ACF-Off (**Class D**) mode, unless otherwise specified.

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Power	P_O	R_L=4Ω	f=1kHz, THD+N=1%		3.80		W
		R_L=8Ω			2.40		
		R_L=4Ω	f=1kHz, THD+N=10%		4.70		
		R_L=8Ω			2.90		
Total Harmonic Distortion plus Noise (BW: 20kHz)	THD+N	R_L=4Ω, P_O=1W, f=1kHz			0.10		%
Output Noise	V_N	f=20Hz~20kHz, A加权, Av=24.5dB			83		μV_{rms}
Signal /Noise Ratio	SNR	A加权, Av=24.5dB,THD+N = 1%			95		dB
Power Supply Rejection ratio	PSRR	f=1kHz			-70		dB
Efficiency	η	R_L=4Ω+22uH, THD+N = 1%			81		%
		R_L=8Ω+33uH, THD+N = 1%			91		%
Output Offset Voltage	V_{OS}				±7.5		mV
System Gain	Av_0	R_{IN}=5.1 kΩ			24.5		dB
ACF maximum attenuation gain	Aa	ACF-ON (Class D)		-10		0	dB

V_{SS}=0V, **V_{DD} =5.0V**, Av=24dB, Ta=25ºC, C_{IN}=1.0uF, R_{IN}=5.1 kΩ, ACF-Off (**Class AB**) mode, unless otherwise specified.

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Power	P_O	R_L=4Ω	f=1kHz, THD+N=1%		1.95		W
		R_L=8Ω			1.20		
		R_L=4Ω	f=1kHz, THD+N=10%		2.50		
		R_L=8Ω			1.60		
Total Harmonic Distortion plus Noise (BW: 20kHz)	THD+N	R_L=4Ω, P_O=1W, f=1kHz			0.06		%
Output Noise	V_N	f=20Hz~20kHz, A加权, Av=24.5dB			110		μV_{rms}
Signal /Noise Ratio	SNR	A加权, Av=24.5dB,THD+N = 1%			90		dB
Efficiency	η	R_L=4Ω+22uH, THD+N = 1%			66		%
		R_L=8Ω+33uH, THD+N = 1%			69		%
Output Offset Voltage	V_{OS}				±6		mV
System Gain	Av_0	R_{IN}=5.1 kΩ			24		dB

*6 All the values of analog characteristics were obtained by using our evaluation circumstance; Depending upon parts and pattern layout to use, characteristics may be changed.

● AC Characteristics

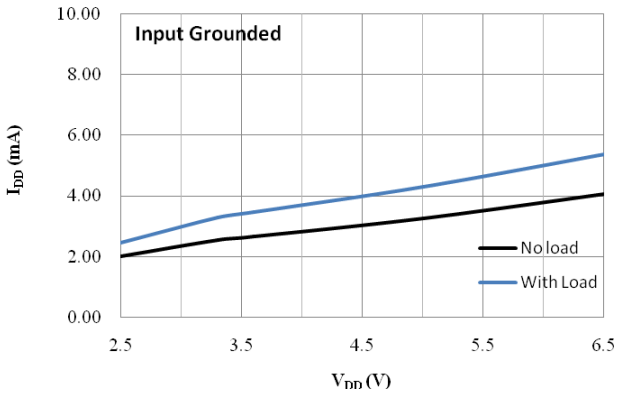
V_{SS}=0V, V_{DD} =2.5 to 6.5V, Ta=－30℃~85℃, unless otherwise specified.

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Start-up time (or wake up from shutdown mode, or switch between Class AB and D)	t_{STUP}			100		ms
ACF Attack time	t_{AT1}	V_{DD}=3.6V, g=10dB		72		ms
ACF Release time	t_{RL1}	V_{DD}=3.6V, g=10dB		720		ms
Each mode setting time (Except shutdown nor switch between Class AB and D)	t_{MOD}		0.1			ms
Carrier clock frequency	f_{PWM}			488		KHz

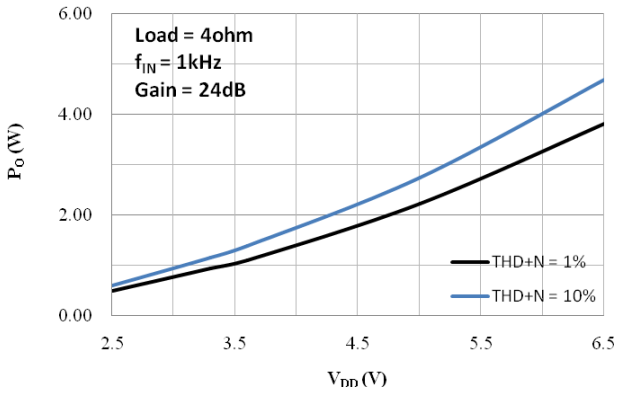
■ TYPICAL OPERATING CHARACTERISTICS

Class D mode

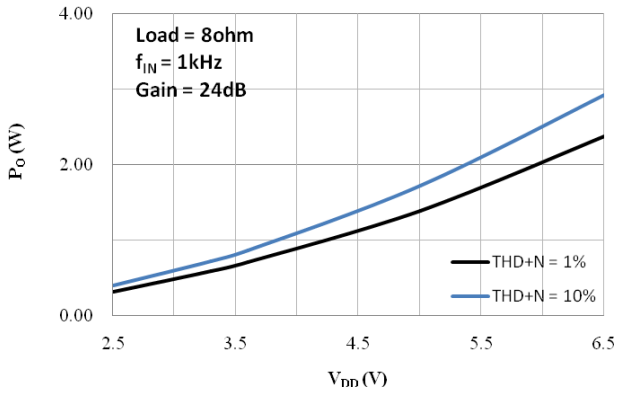
V_{DD} vs I_{DD}



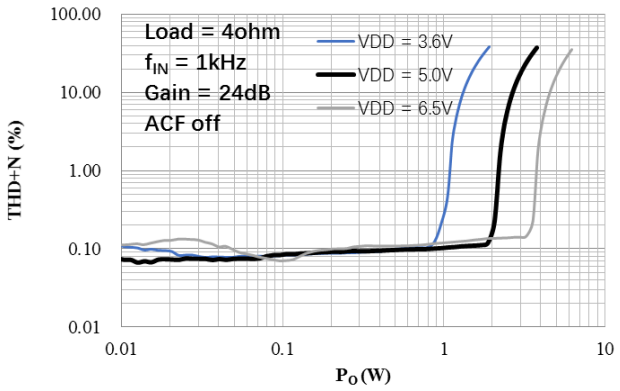
V_{DD} vs P_O



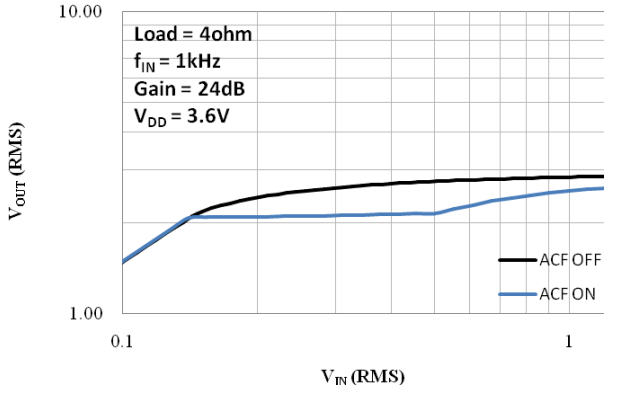
V_{DD} vs P_O



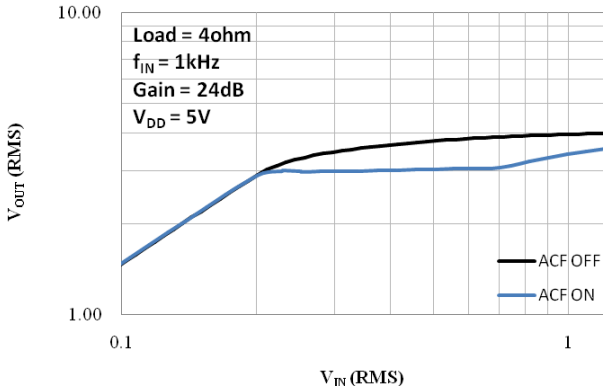
P_O vs THD+N



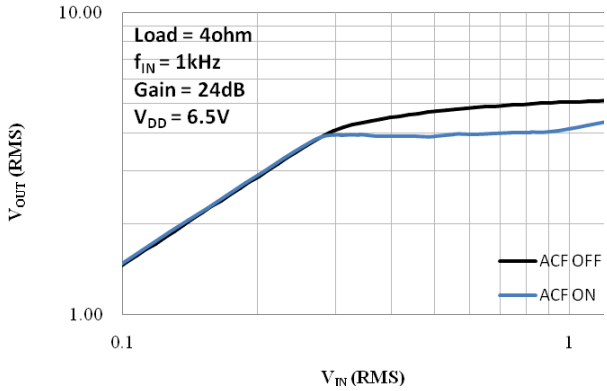
V_{IN} vs V_{OUT}



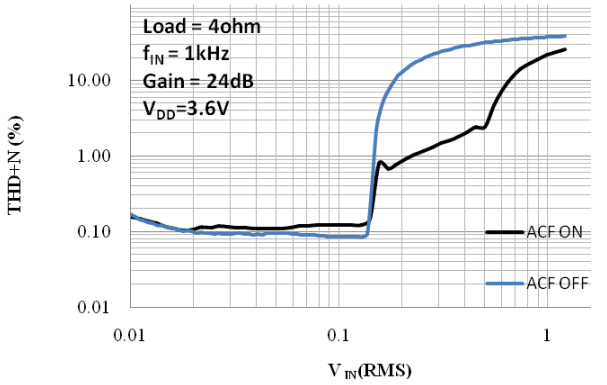
V_{IN} vs V_{OUT}



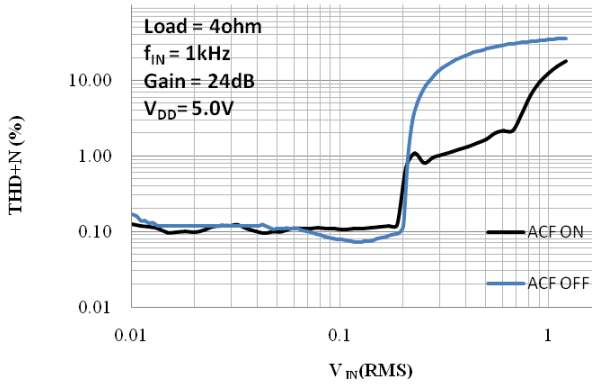
V_{IN} vs V_{OUT}



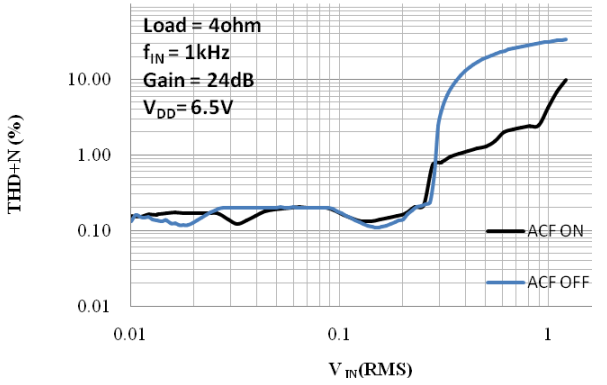
V_{IN} vs THD+N



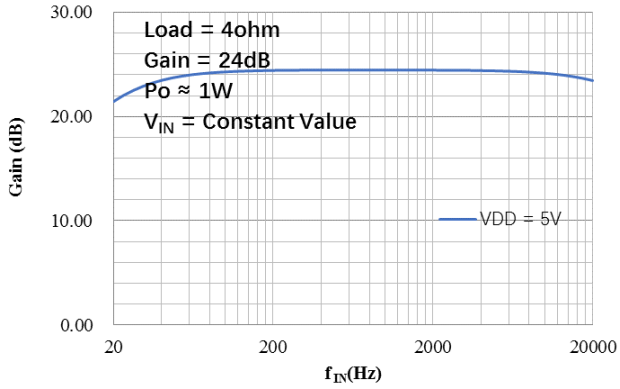
V_{IN} vs THD+N



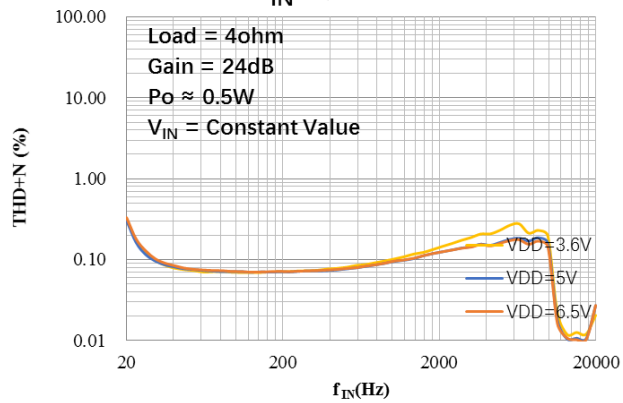
V_{IN} vs THD+N



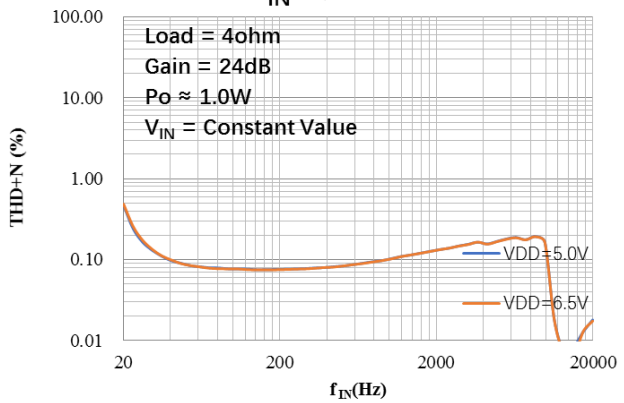
f_{IN} vs Gain

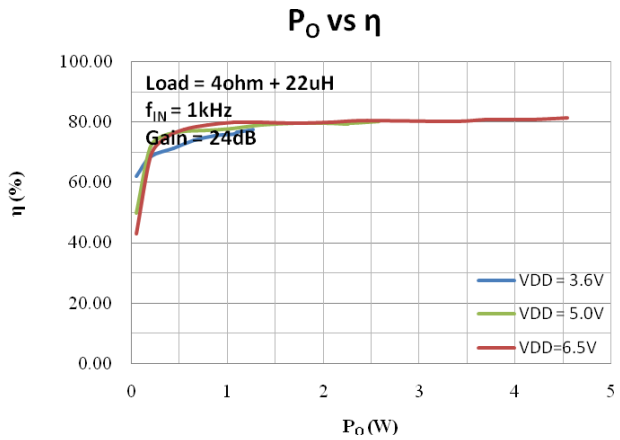


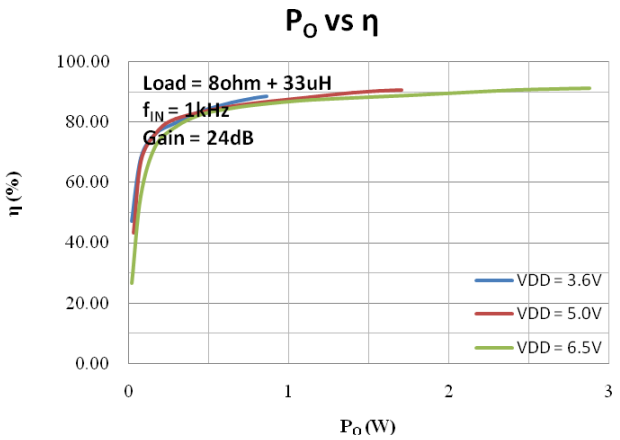
f_{IN} vs THD+N



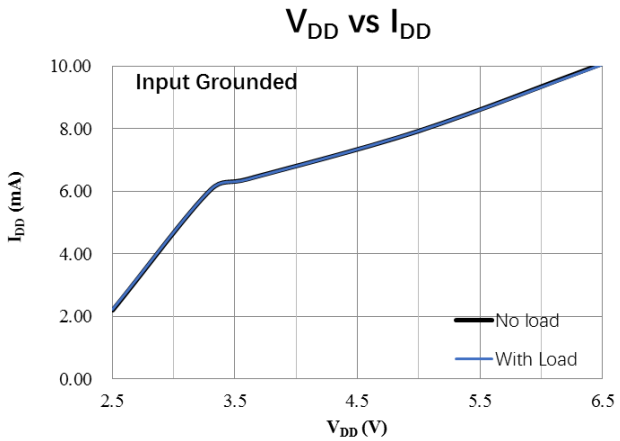
f_{IN} vs THD+N

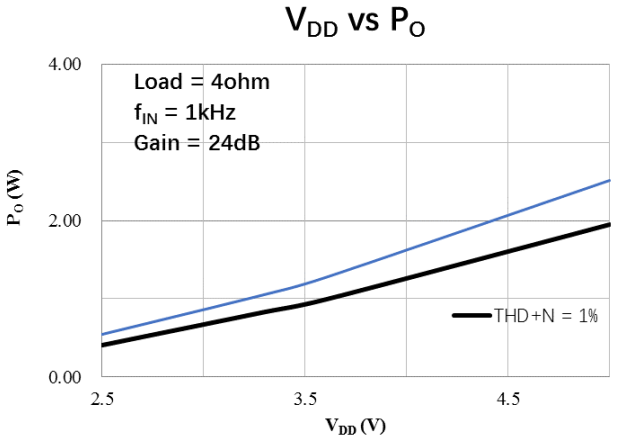


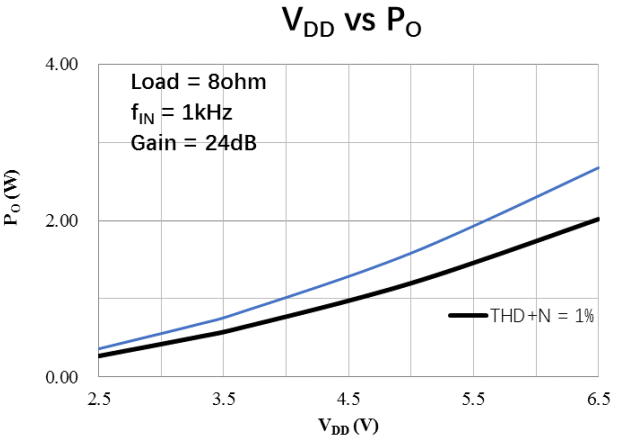


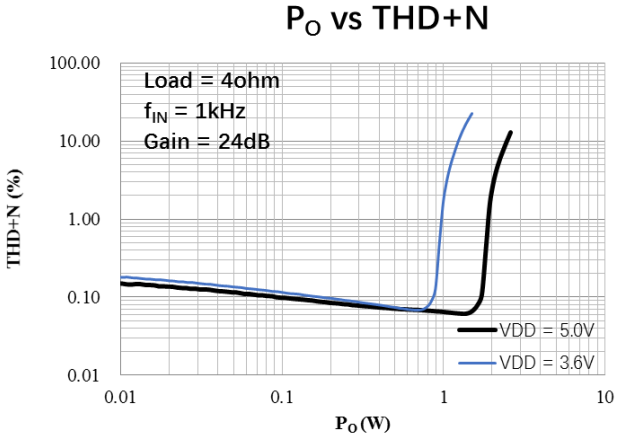


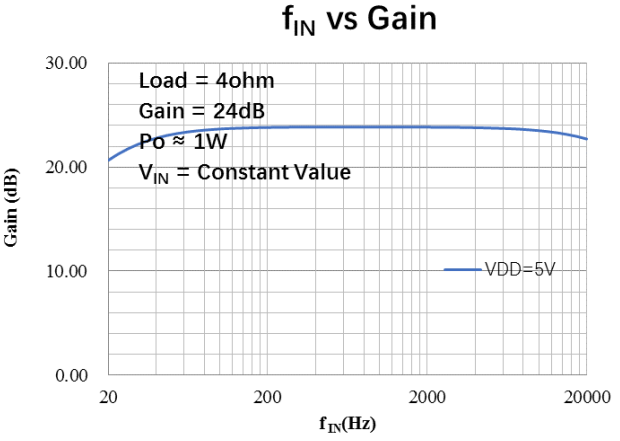
Class AB mode



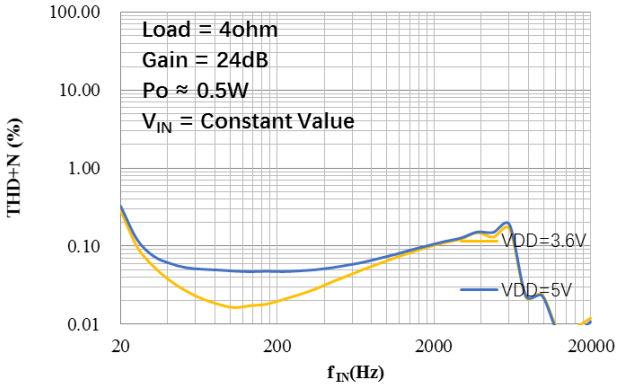








f_{IN} vs THD+N



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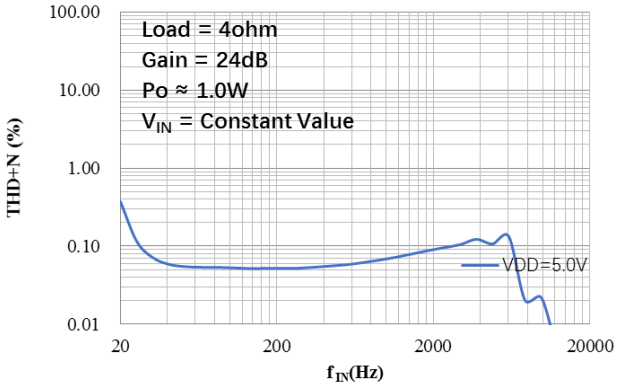
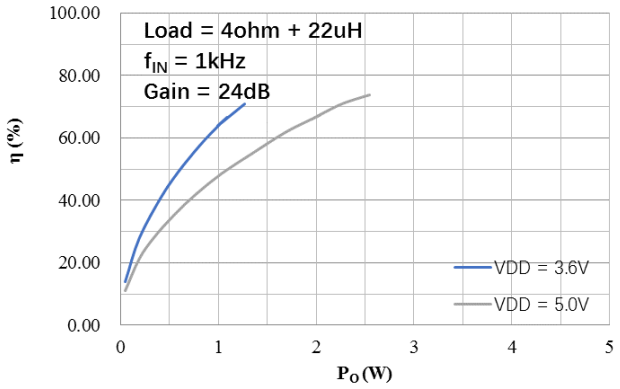
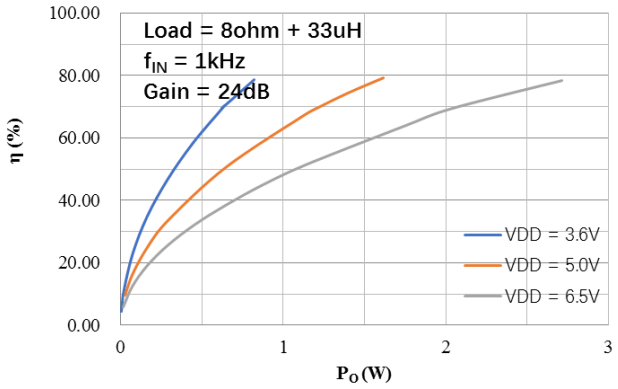


P_O vs η



P_O vs η



■ APPLICATION INFORMATION

● Analog Signal Input Configuration

HT6881 is an amplifier with analog input (single-ended or differential), PWM pulse output (BTL only), and maximum output of 4.7W (RL=4Ω) × 1ch when working in Class D mode. It can also operate in Class AB mode with analog input (single-ended or differential), analog output (BTL Only), and maximum output of 2.5W (RL=4Ω) × 1ch.

For a differential input between IN+ and IN- pins, signals input via DC-cut capacitors (CIN). The input signal gain is calculated by

$$Av = 200k / (7.2k + R_{IN}); \quad Gain = 20 \times \log Av.$$

The real gain of Class AB will be one dB lower than the calculation result. And, the low pass cut-off frequency of input signal, can be calculated by

$$fc = 1 / [2\pi (7.2k + R_{IN}) C_{IN}].$$

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

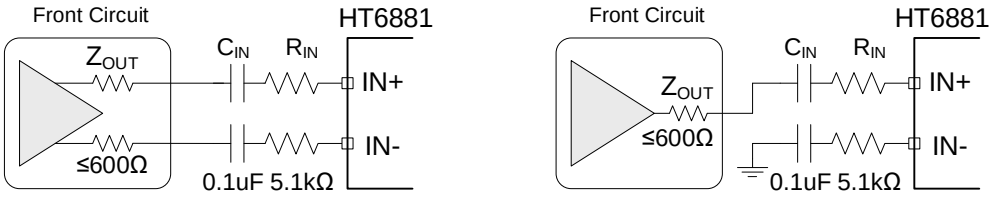


Fig.1 (1) Differential Input; (2) Single-ended Input

● CTRL Terminal Mode Control

Four operating mode, ACF-OFF (Class D), ACF-ON (Class D), ACF-OFF (Class AB) and SD (shutdown), could be implemented while different Setting Voltages input via CTRL terminal (see Table 1).

Table 1 Different Mode Setting Voltages of CTRL Terminal

Item	Symbol	Min.	Typ.	Max.	Unit
ACF-OFF (Class D) mode threshold voltage for terminal CTRL	V_{MOD1}	2.3	3.3	V_{DD}	V
ACF-ON (Class D) mode threshold voltage for terminal CTRL	V_{MOD2}	1.6	1.9	2.2	V
ACF-OFF (Class AB) mode threshold voltage for terminal CTRL	V_{MOD2}	0.4	1	1.4	V
SD mode threshold voltage for terminal CTRL	V_{MOD4}	V_{SS}	0	0.25	V

Note that the voltage of CTRL terminal must be higher than 0.7V while HT6881 wakes up from shutdown mode or power off mode. And there is a 300kohm resistor pull down to the ground in the chip.

MCU Control Setting

By connecting external resistors (R_{CTRL}, R_{CTRL2}, R_{CTRL3} accuracy of 1%) to CTRL terminal, and setting threshold voltage of each mode to CTRL1 and CTRL2 terminal, different modes can be set. Connect the terminal to the ground through a capacitor C_{CTRL} (a ceramic capacitor of 0.1μF or more) to eliminate noise during mode setting.

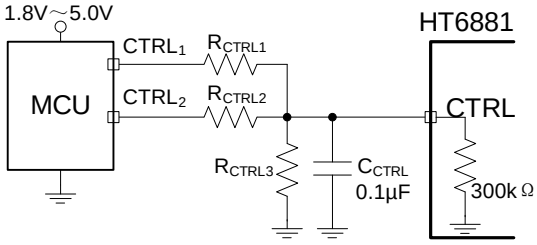


Table 2 Mode Setting

CTRL1	CTRL2	Mode
H	H	ACF-OFF (Class D)
H	L	ACF-ON (Class D)
L	H	ACF-Off (Class AB)
L	L	Shutdown

Fig 2 CTRL terminal control circuit

"H" indicates High level output voltage of microcomputer's I/O port that is input to CTRL1 and CTRL2 terminals and "L" indicates Ground level of the microcomputer. GND level of the microcomputer must be the same as that of HT6881. The control of CTRL terminal is based on I/O port H level output voltage of microcomputer that is connected.

● CTRL Mode Function Detail

(1) ACF-ON (Class D) Mode

In ACF-ON (Class D) mode, HT6881 which operates in Class D, 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 HT6881 also follows to the clips of the output waveform due to the decrease in the power-supply voltage.

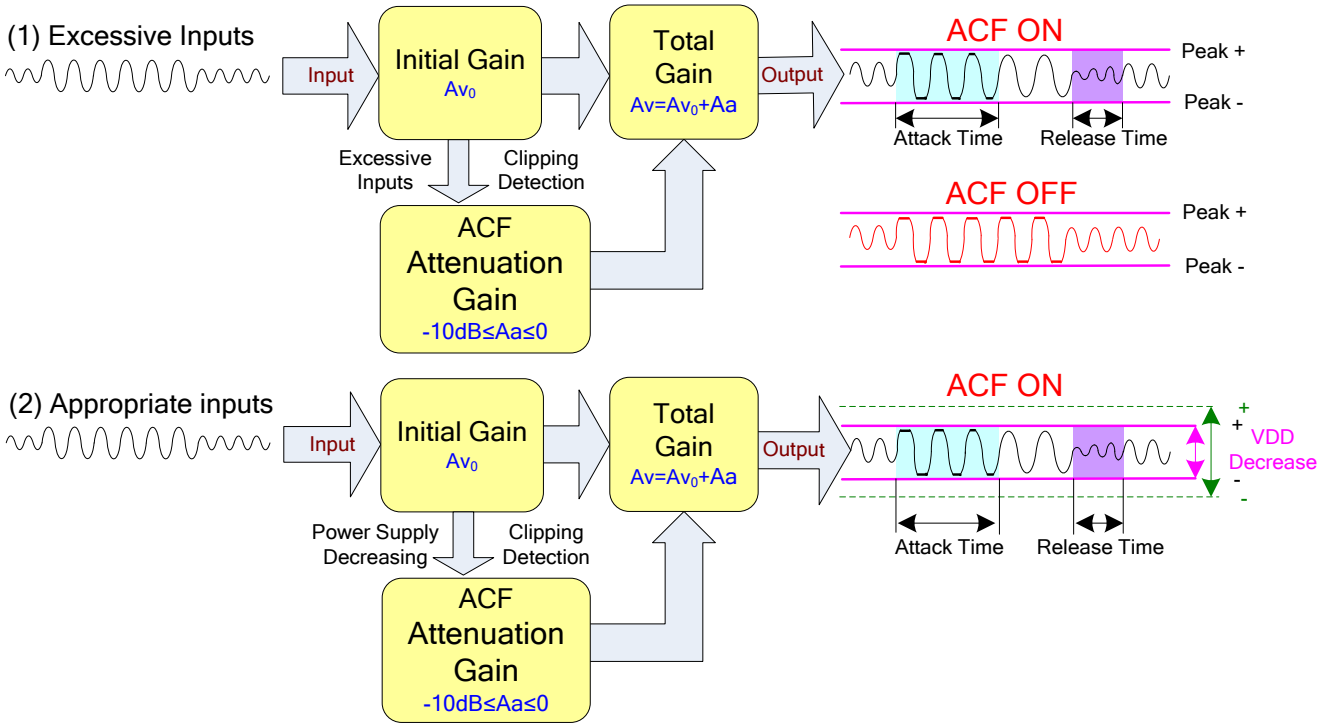


Fig 3 the ACF Function Operation Outline

The Attack time of ACF Function is a time interval until system gain falls to target attenuation gain -3dB when a big enough signal inputs. And, the Release Time is a time from target attenuation gain to not working of ACF. The maximum attenuation gain is 10dB.

Table 4 Attack time and Release time

ACF mode	Attack time	Release time
ACF	72ms	720ms

(2) ACF OFF Mode

In ACF-Off mode, ACF function is disenabled. HT6881 will not detect output clipping and the system gain is kept being $Av=Av_0$. The audio quality would worsen due to clipping distortion. And Class D or Class AB operating mode can be chosen.

(3) SD Mode

In shutdown mode, HT6881 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 HT6881 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 fist.

● Protection Function

HT6881 has the protection functions such as Over-Current Protection function, Thermal Protection function, and Low Voltage Malfunction Prevention function.

(1) Over-current Protection function

When a short circuit occurs between one output terminal and Ground, VDD, 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 HT6881 (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).

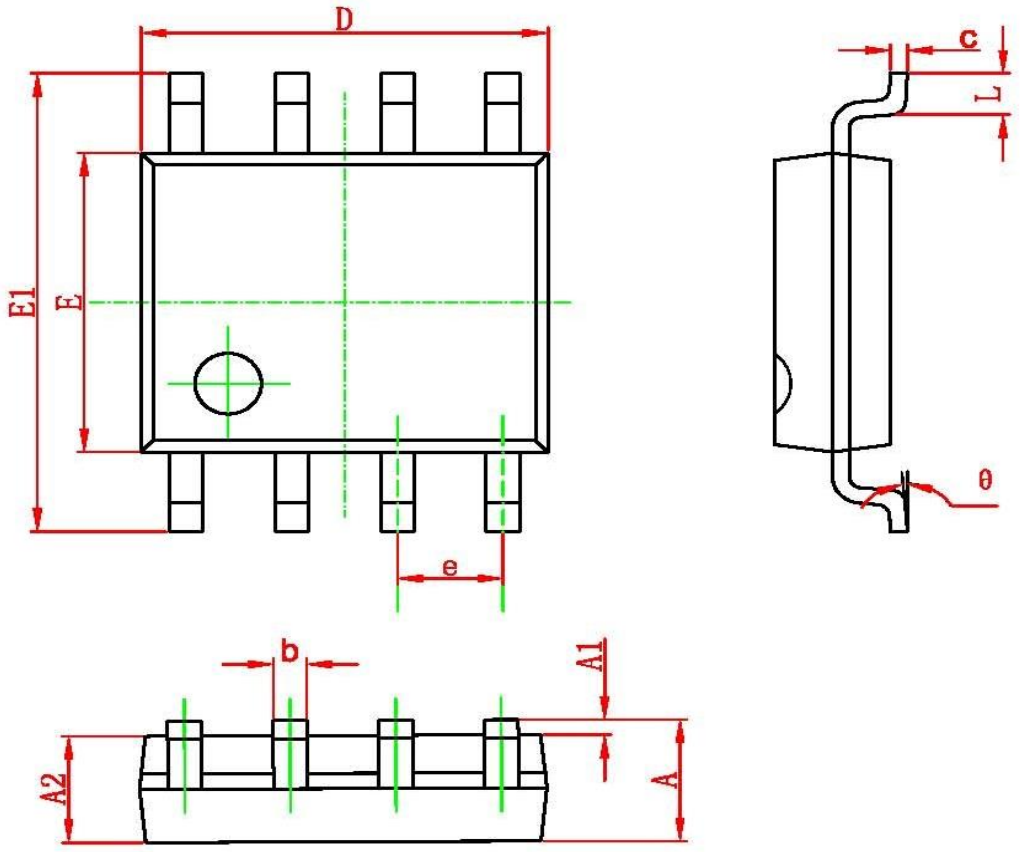
(3) Low voltage Malfunction Prevention function

This is the function to establish the low voltage protection mode when VDD terminal voltage becomes lower than the detection voltage (V_{UVLL}) for the low voltage malfunction prevention. And the protection mode is canceled when VDD 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). HT6881 will start up within the start-up time (T_{STUP}) when the low voltage protection mode is cancelled

■ PACKAGE OUTLINE

- **SOP8L (HT6881D2SPN)**

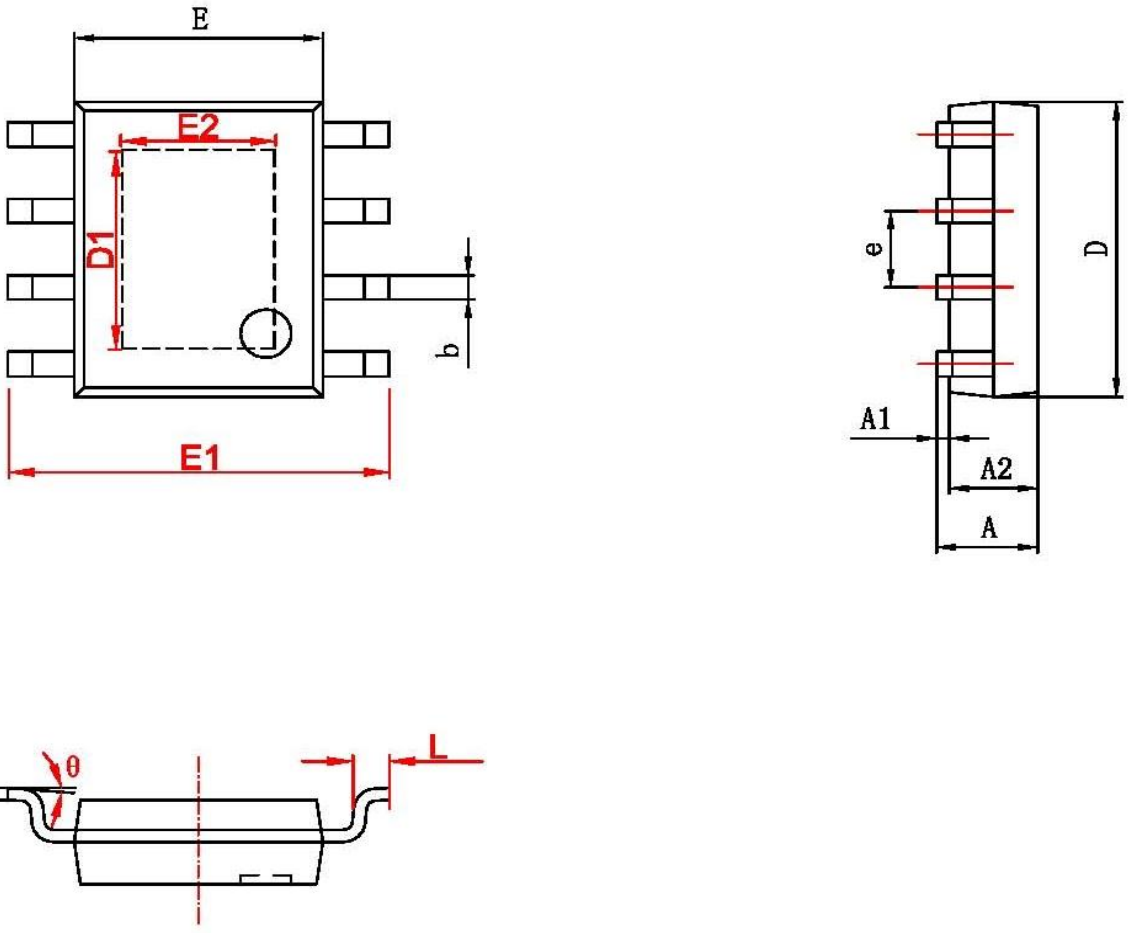
SOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

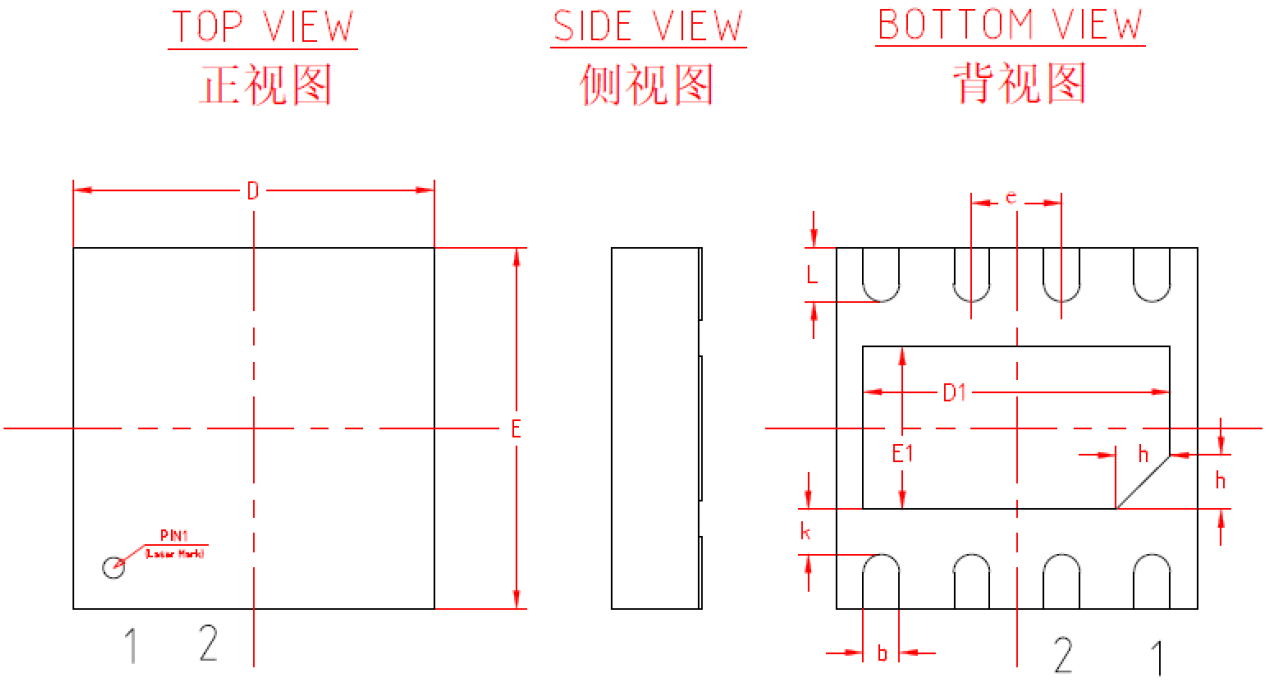
- **SOP8L-PP (HT6881D2SPE)**

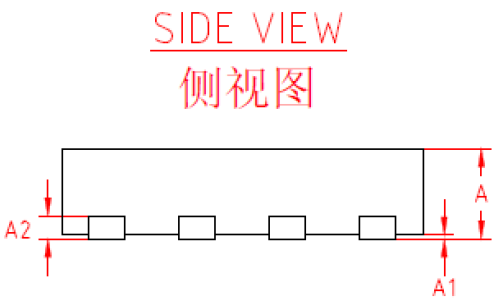
SOP8-PP(EXP PAD) PACKAGE OUTLINE DIMENSIONS



字符	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.002	0.006
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

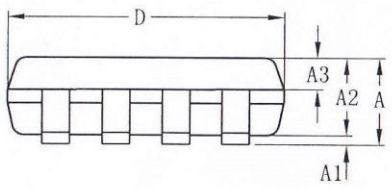
- **DFN8L (HT6881D2SDE)**

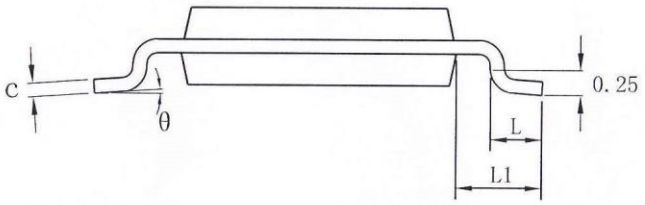


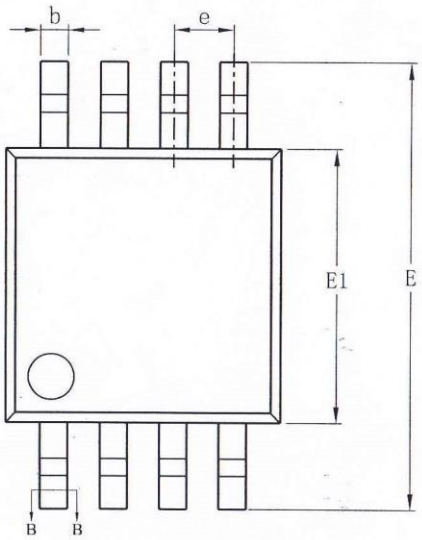


机械尺寸/mm			
字符	最小值	典型值	最大值
A	0.45	0.50	0.55
A1	–	0.02	0.05
A2	0.127 REF		
b	0.15	0.20	0.25
D	1.90	2.00	2.10
D1	1.65	1.7	1.75
E	1.90	2.00	2.10
E1	0.85	0.9	0.95
e	0.500 BSC		
k	0.20	0.25	0.30
L	0.25	0.30	0.40
h	0.25	0.30	0.35

- **MSOP8L (HT6881D2MSN)**







SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.10
A1	0.05	—	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.28	—	0.36
b1	0.27	0.30	0.33
c	0.15	—	0.19
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.65BSC		
L	0.40	—	0.70
L1	0.95REF		
θ	0	—	8°

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