10WAnti-crackling monoDAudio amplifier

9WMonoABAudio amplifier

-Features

・Anti-clipping function (Anti-Clipping Function, ACF) ・Filter-free digital modulation, direct speaker drive

・Output Power

10W (Class D,V_{DD}=8.5V, R_L=4Ω, THD+N=10%) 9W (Class AB,V_{DD}=8.5V, R_L=4Ω, THD+N=10%) ・haveD Class andABTwo working modes

・Overcurrent protection function

・Overheat protection function

・Undervoltage abnormal protection function

・Lead-free and halogen-free packaging,SOP8L-PP

-application

・Bluetooth Speaker

・2.1Channel small speaker

・iphone/ipod/ipod docking ・Tablet, Laptop

・Small sizeLCDTV/Monitor

・Portable Speakers

・loudspeaker

・Trolley Speaker

・Portable game console

・MP4,GPS

-Overview

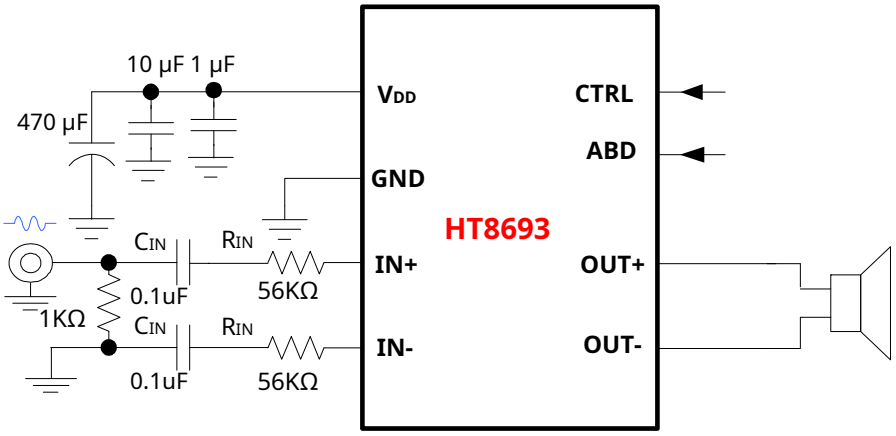
HT8693It is aDClass andABAn audio power amplifier with two working modes.DIn class mode,VDD=8.5V, THD+N=10%,4Ω Under load, it can continuously output10Wpower; ABIn class mode,VDD=8.5V,THD+N=10%,4ΩUnder load, it can continuously output9Wpower.

HT8693existDAnti-clipping distortion in similar working mode (ACF) output control function, which can detect and suppress the output signal clipping distortion (breaking) caused by excessive amplitude of input music and voice signals. Sound), significantly improve the sound quality, create a comfortable listening experience, and protect the speaker from overload damage. At the same time, the chip also hasACF-OffMode is configurable.

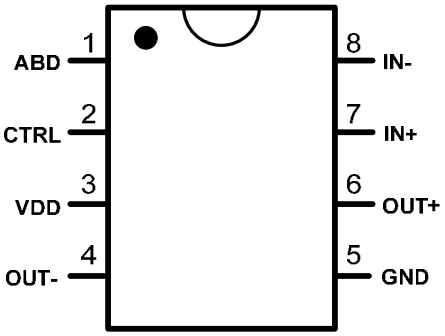
HT8693Can achieveABClass andDThe free switching function of the class is affected byDClass AmplifierEMIWhen you are bothered by interference, you can switch toABAudio amplifier mode.

also,HT8693The built-in shutdown function minimizes the standby current, and also integrates functions such as output overcurrent protection, on-chip overtemperature protection and power supply undervoltage abnormal protection.

-Typical application diagram



-Pin Information



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-Pin Definition*1

SOP8L-PP Pin Number	Pinout name	I/O	Function
1	ABD	I	ABClass Mode andDClass Mode Controller
2	CTRL	I	ACFMode and shutdown mode control terminal
3	VDD	Power	power supply
4	OUT-	O	Inverting output terminal (BTL-)
5	GND	Ground	land
6	OUT+	O	Non-inverting output terminal (BTL+)
7	IN+	A	Non-inverting input terminal (differential +)
8	IN-	A	Inverting input terminal (differential -)

Note1 I:Input O:Output A:Analog terminal

When greater thanVDDThe voltage applied toPNProtected port (ESDProtection circuit byPMOSandNMOSWhenPMOSA leakage current will flow through the circuit.

-Ordering Information

H T 8 6 9 3 XX

Package

Product number	Package	Top surface mark	range of working temperature	Packaging and delivery form
HT8693SP	SOP8L-PP	HT8693SP UVWXYZ*2	- 40℃～85℃ (Extended Industrial Grade)	Tube 100Sheet/Tube

Note2:WXYZ/UVWXYZRandomly coded for internal production tracking.

Note3：Unless otherwise specified, the data content on the following pages is forSOP8L-PPPackageHT8693Model product.

-Electrical characteristics

-Extreme working conditions*1

parameter	symbol	Minimum	Maximum	unit
Supply voltage range	V_{DD}	- 0.3	9.3	V
Input signal voltage range (IN+, IN-)	V_{IN}	V_{SS}-0.6	V_{DD}+0.6	V
Input signal voltage range (exceptIN+, IN-outside)	V_{IN}	V_{SS}-0.3	V_{DD}+0.3	V
Operating temperature range	T_A	- 40	85	℃
Operating junction temperature range	T_J	- 40	150	℃
Storage temperature	T_{STG}	- 50	150	℃

Note1:To ensure device reliability and life, the above absolute maximum ratings must not be exceeded. Otherwise, the chip may be immediately permanently damaged or its reliability may be greatly deteriorated.

In possibly more thanVDD/GNDFor applications where the voltage is too high, it is recommended to use an external diode to ensure that the voltage does not exceed the absolute maximum rating.

-Recommended operating conditions

parameter	symbol	condition	Minimum	Typical Value	Maximum	unit
voltage*2	V_{DD}		3		9.0	V
Working temperature	T_a		- 40	25	85	℃
Speaker impedance	R_L			4		Ω

Note2: VDDThe rise time should exceed1μs.

-Electrical characteristics*3

V_{SS}=0V, Ta=25°C, C_{IN}=0.1uF, R_{IN}= 56k,Unless otherwise specified

parameter	symbol	condition	Minimum	Typical Value	Maximum	unit
V_{DD}Power supply start threshold	V_{UVL}			2.3		V
V_{DD}Power supply shutdown threshold	V_{UVLL}			2.2		V
Power-on start-up time (or from off Wake-up time	t_{STUP}			280		ms
Carrier modulation frequency	f_{PWM}			430		kHz
DClass overcurrent protection value	Imax				5	A
Digital Input/Output						
ABDInput high level	V_{IH}		1.5			V
ABDInput low level	V_{IL}				0.4	V
CTRLInternal pull-down resistor	R_{CTRL}	Class D		125		KΩ
		Class AB		+ ∞		
ABDInternal pull-up resistor	R_{ABD}			250		KΩ
ACF Function						
Class D ACFAttenuation Gain	Aa		- 16		0	dB
ACF-OffMode Setting Threshold	V_{MOD1}		0.75V_{DD}		V_{DD}	V
ACF-1Mode Setting Threshold*4	V_{MOD2}		0.45 V_{DD}		0.70 V_{DD}	V
ACF-2Mode Setting Threshold*4	V_{MOD3}		0.10 V_{DD}		0.40 V_{DD}	V
SDShutdown Mode Setting Threshold	V_{MOD4}		V_{SS}		0.06 V_{DD}	V
SDShutdown recovery voltage*5	V_{CTRL_ON}		0.8			V

Note3:The electrical characteristics in this section vary depending on the components andPCBThe layout varies.

Note4: ACF-1andACF-2Mode only forDClass mode is effective inABIn the class mode, the corresponding level mode is stillACF-Off. Note5: SDThe shutdown recovery voltage refers to the voltage when the chip goes from shutdown to startup.CTRLThe voltage value of the terminal.

V_{DD}= 8.5V

parameter	symbol	condition		Minimum	Typical Value	Maximum	unit
Class D Channel V_{SS}=0V, Av=26dB, Ta=25°C, C_{IN}=0.1uF, ACF-OffMode, unless otherwise specified							
Output Power	P_O	R_L=4Ω	f=1kHz, THD+N=10%		10.0		W
		R_L=8Ω			5.3		
		R_L=4Ω,	f=1kHz, THD+N=1%		8.0		
		R_L=8Ω			4.3		
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.15		%
		P_O=1.0W			0.25		%
		P_O=3.0W			0.25		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			160		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=26dB, THD+N = 1%			91		dB
Offset voltage	V_{OS}				±6.5		mV
efficiency	η	R_L=4Ω+22uH, THD+N = 10%			90		%
		R_L=8Ω+33uH, THD+N = 10%			94		%
Quiescent Current	I_{DD}	No Load	Input Grounded		10.5		mA
		With Load*6			14		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		0.5		μA
		With Load*6			0.5		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF-1 ON			1.75		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			26.1		dB
Class AB Channel V_{SS}=0V, Av=20dB, Ta=25°C, C_{IN}=0.1uF,Unless otherwise specified							
Output Power	P_O	R_L=4Ω,	f=1kHz, THD+N=10%		9.2		W
		R_L=8Ω			5.2		W
		R_L=4Ω	f=1kHz, THD+N=1%		7.4		W
		R_L=8Ω			4.2		W
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.14		%
		P_O=1W			0.12		%
		P_O=3W			0.12		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			75		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=20dB, THD+N = 1%			97		dB
Offset voltage	V_{OS}				±3		mV
efficiency	η	R_L=4Ω,	f=1kHz, THD+N=10%		80		%
		R_L=8Ω			83.5		%
		R_L=4Ω	f=1kHz, THD+N=1%		72		%
		R_L=8Ω,			76		%
Quiescent Current	I_{DD}	No Load	Input Grounded		31		mA
		With Load*6			31		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		34		μA
		With Load*6			34		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF OFF			0.8		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			18.8		dB

Note6:Load here using4ohm+22uHTo simulate the speaker, the same below.

V_{DD}= 7.2V

parameter	symbol	condition		Minimum	Typical Value	Maximum	unit
Class D Channel V_{SS}=0V, Av=26dB, Ta=25°C, C_{IN}=0.1uF, ACF-OffMode, unless otherwise specified							
Output Power	P_O	R_L=4Ω	f=1kHz, THD+N=10%		7.0		W
		R_L=8Ω			3.8		
		R_L=4Ω,	f=1kHz, THD+N=1%		5.7		
		R_L=8Ω			3.1		
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.22		%
		P_O=1.0W			0.17		%
		P_O=3.0W			0.27		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			150		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=26dB, THD+N = 1%			91		dB
Offset voltage	V_{OS}				±14		mV
Quiescent Current	I_{DD}	No Load	Input Grounded		7.5		mA
		With Load*6			12		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		0.5		μA
		With Load*6			0.5		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF-1 ON			1.50		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			26.1		dB
Class AB Channel V_{SS}=0V, Av=20dB, Ta=25°C, C_{IN}=0.1uF,Unless otherwise specified							
Output Power	P_O	R_L=4Ω,	f=1kHz, THD+N=10%		6.7		W
		R_L=8Ω			3.7		W
		R_L=4Ω	f=1kHz, THD+N=1%		5.4		W
		R_L=8Ω			3.0		W
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.08		%
		P_O=1W			0.10		%
		P_O=3W			0.13		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			75		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=20dB, THD+N = 1%			96		dB
Offset voltage	V_{OS}				±3		mV
Quiescent Current	I_{DD}	No Load	Input Grounded		25		mA
		With Load*6			25		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		28		μA
		With Load*6			28		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF OFF			0.65		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			18.9		dB

V_{DD}= 6.5V

parameter	symbol	condition		Minimum	Typical Value	Maximum	unit
Class D Channel V_{SS}=0V, Av=26dB, Ta=25°C, C_{IN}=0.1uF, ACF-OffMode, unless otherwise specified							
Output Power	P_O	R_L=4Ω	f=1kHz, THD+N=10%		5.7		W
		R_L=8Ω			3.1		
		R_L=4Ω,	f=1kHz, THD+N=1%		4.6		
		R_L=8Ω			2.5		
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.28		%
		P_O=1.0W			0.15		%
		P_O=3.0W			0.30		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			150		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=26dB, THD+N = 1%			90		dB
Offset voltage	V_{OS}				±16		mV
efficiency	η	R_L=4Ω+22uH, THD+N = 10%			90		%
		R_L=8Ω+33uH, THD+N = 10%			94		%
Quiescent Current	I_{DD}	No Load	Input Grounded		6.5		mA
		With Load*6			11		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		0.5		μA
		With Load*6			0.5		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF-1 ON			1.35		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			26.1		dB
Class AB Channel V_{SS}=0V, Av=20dB, Ta=25°C, C_{IN}=0.1uF,Unless otherwise specified							
Output Power	P_O	R_L=4Ω,	f=1kHz, THD+N=10%		5.5		W
		R_L=8Ω			3.1		W
		R_L=4Ω	f=1kHz, THD+N=1%		4.4		W
		R_L=8Ω			2.5		W
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.08		%
		P_O=1W			0.10		%
		P_O=3W			0.13		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			73		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=20dB, THD+N = 1%			95		dB
Offset voltage	V_{OS}				±3		mV
efficiency	η	R_L=4Ω,	f=1kHz, THD+N=10%		80		%
		R_L=8Ω			84		%
		R_L=4Ω	f=1kHz, THD+N=1%		72.5		%
		R_L=8Ω,			76		%
Quiescent Current	I_{DD}	No Load	Input Grounded		twenty four		mA
		With Load*6			twenty four		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		25		μA
		With Load*6			25		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF OFF			0.58		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			19.1		dB

V_{DD}= 5.0V

parameter	symbol	condition		Minimum	Typical Value	Maximum	unit
Class D Channel V_{SS}=0V, Av=26dB, Ta=25°C, C_{IN}=0.1uF, ACF-OffMode, unless otherwise specified							
Output Power	P_O	R_L=4Ω	f=1kHz, THD+N=10%		3.35		W
		R_L=8Ω			1.85		
		R_L=4Ω,	f=1kHz, THD+N=1%		2.72		
		R_L=8Ω			1.5		
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.13		%
		P_O=1.0W			0.15		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			150		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=26dB, THD+N = 1%			87		dB
Offset voltage	V_{OS}				±15		mV
Quiescent Current	I_{DD}	No Load	Input Grounded		5.5		mA
		With Load*6			9		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		0.5		μA
		With Load*6			0.5		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF-1 ON			1.0		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			26.2		dB
Class AB Channel V_{SS}=0V, Av=20dB, Ta=25°C, C_{IN}=0.1uF,Unless otherwise specified							
Output Power	P_O	R_L=4Ω,	f=1kHz, THD+N=10%		3.2		W
		R_L=8Ω			1.8		W
		R_L=4Ω	f=1kHz, THD+N=1%		2.6		W
		R_L=8Ω			1.45		W
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.08		%
		P_O=1W			0.11		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			70		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=20dB, THD+N = 1%			93		dB
Offset voltage	V_{OS}				±3		mV
Quiescent Current	I_{DD}	No Load	Input Grounded		twenty one		mA
		With Load*6			twenty one		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		19		μA
		With Load*6			19		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF OFF			0.42		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			19.4		dB

V_{DD}= 3.6V

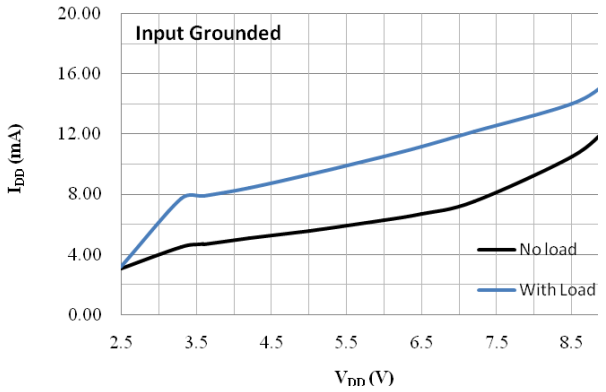
parameter	symbol	condition		Minimum	Typical Value	Maximum	unit
Class D Channel V_{SS}=0V, Av=26dB, Ta=25°C, C_{IN}=0.1uF, ACF-OffMode, unless otherwise specified							
Output Power	P_O	R_L=4Ω	f=1kHz, THD+N=10%		1.7		W
		R_L=8Ω			0.95		
		R_L=4Ω,	f=1kHz, THD+N=1%		1.4		
		R_L=8Ω			0.75		
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.14		%
		P_O=1.0W			0.16		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			140		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=26dB, THD+N = 1%			85		dB
Offset voltage	V_{OS}				±13		mV
efficiency	η	R_L=4Ω+22uH, THD+N = 10%			88		%
		R_L=8Ω+33uH, THD+N = 10%			93		%
Quiescent Current	I_{DD}	No Load	Input Grounded		4.5		mA
		With Load*6			7.8		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		0.5		μA
		With Load*6			0.5		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF-1 ON			0.70		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			26.2		dB
Class AB Channel V_{SS}=0V, Av=20dB, Ta=25°C, C_{IN}=0.1uF,Unless otherwise specified							
Output Power	P_O	R_L=4Ω,	f=1kHz, THD+N=10%		1.65		W
		R_L=8Ω			0.9		W
		R_L=4Ω	f=1kHz, THD+N=1%		1.3		W
		R_L=8Ω			0.75		W
Total Harmonic Distortion plus Noise	THD+N	P_O=0.1W	R_L=4Ω, f=1kHz		0.09		%
		P_O=1W			0.13		%
Output Noise	V_N	f=20Hz~20kHz, AWeighting			70		μV_{rms}
Signal-to-Noise Ratio	SNR	AWeighted,Av=20dB, THD+N = 1%			90		dB
Offset voltage	V_{OS}				±3		mV
efficiency	η	R_L=4Ω,	f=1kHz, THD+N=10%		79		%
		R_L=8Ω			84		%
		R_L=4Ω	f=1kHz, THD+N=1%		72		%
		R_L=8Ω,			76		%
Quiescent Current	I_{DD}	No Load	Input Grounded		19		mA
		With Load*6			19		mA
Shutdown current	I_{SD}	No Load	CTRL=V_{SS}		13.5		μA
		With Load*6			13.5		μA
Maximum input signal	V_{IN_max}	f_{IN}= 1kHz, THD+N≤10%, ACF OFF			0.30		Vrms
System Gain	A_{V0}	R_{IN}=56 kΩ			19.6		dB

-Typical characteristic curve

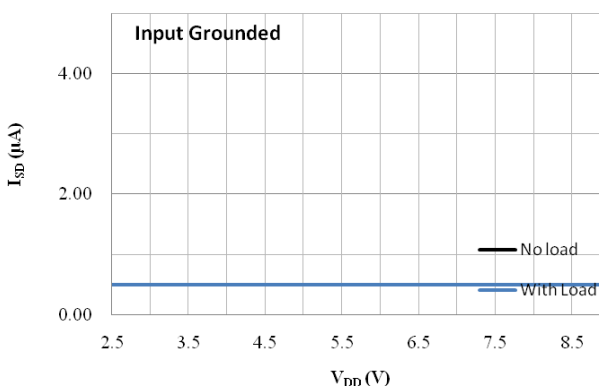
Class D Channel

Condition: Class D mode, V_{DD}= 2.5~8.5V, f_{IN}= 1kHz, R_{IN}= 56k, ACF off, Output = Load + Filter, Load = 4ohm, Filter = 100ohm + 47nF, unless otherwise specified

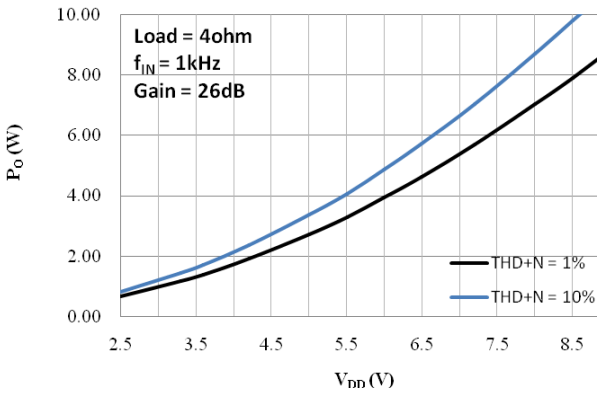
V_{DD} vs I_{DD}



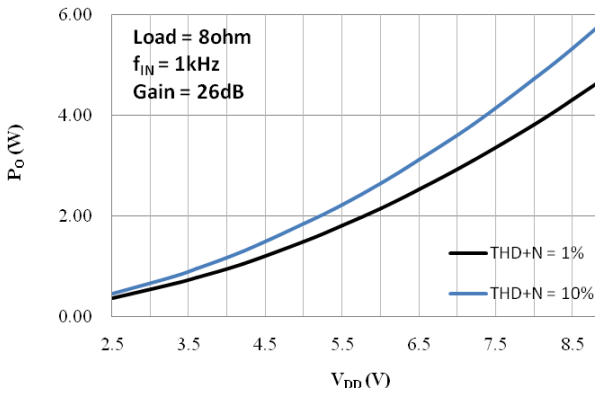
V_{DD} vs I_{SD}



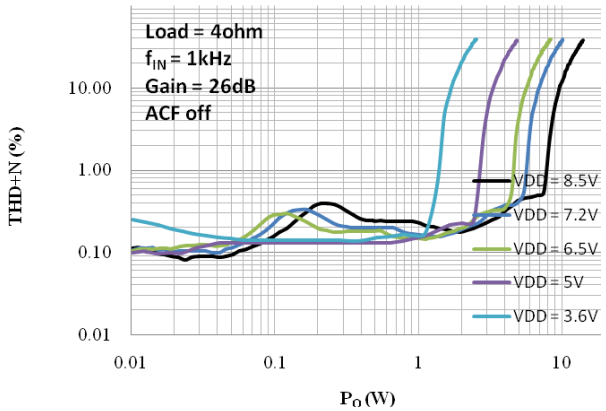
V_{DD} vs P_O



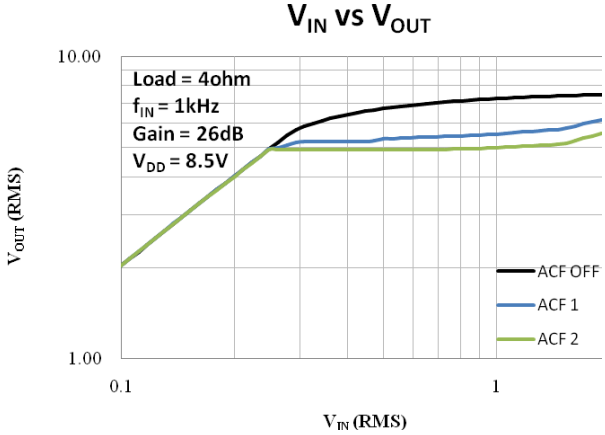
V_{DD} vs P_O



P_O vs THD+N



V_{IN} vs V_{OUT}



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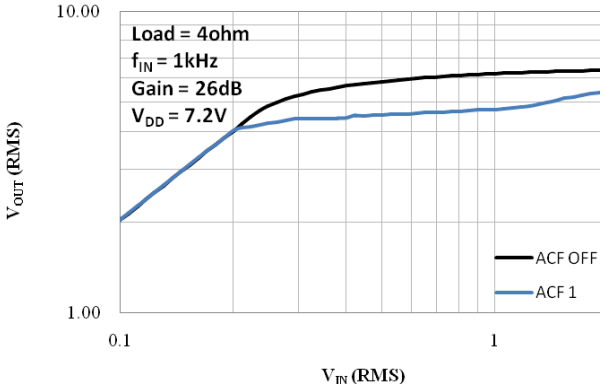
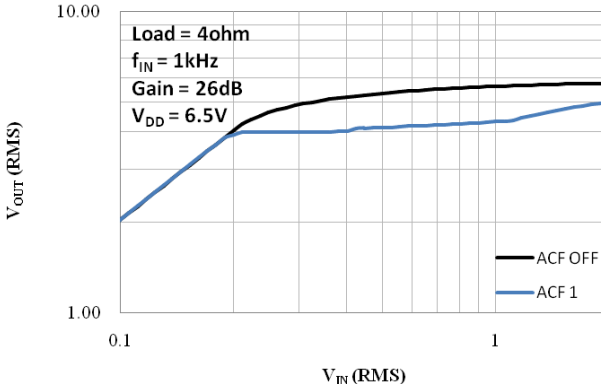
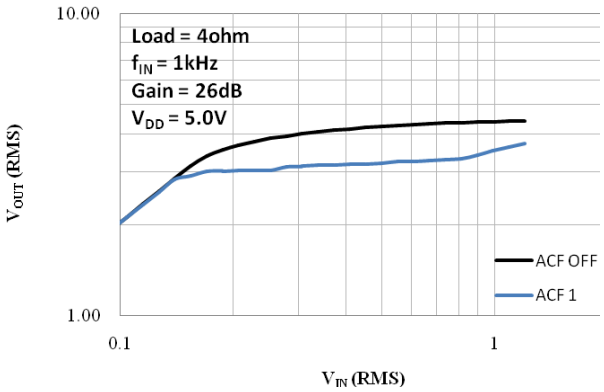


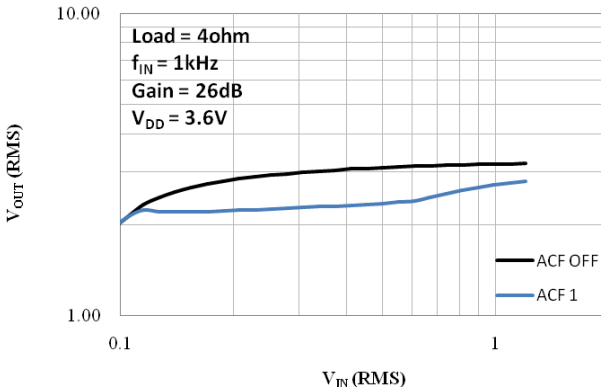
V_{IN} vs V_{OUT}



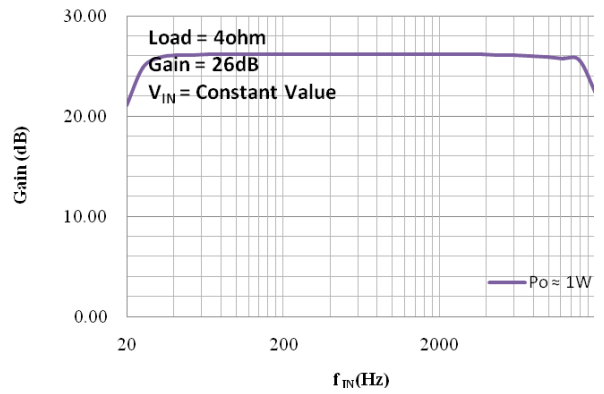
V_{IN} vs V_{OUT}



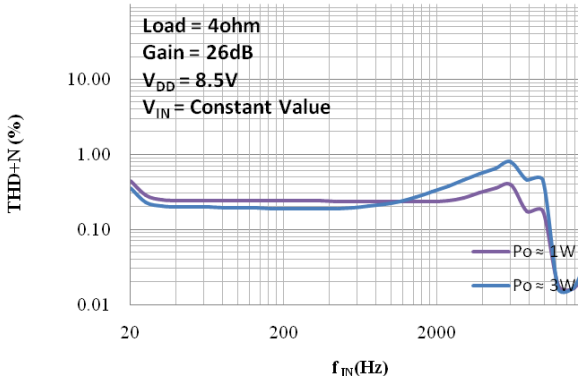
V_{IN} vs V_{OUT}



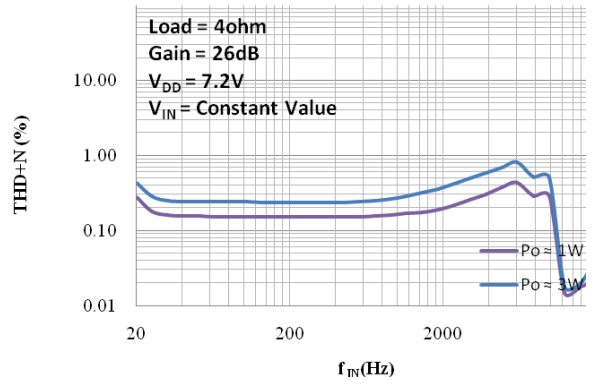
f_{IN} vs Gain



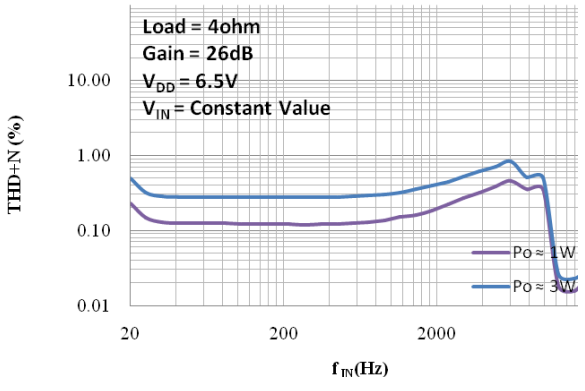
f_{IN} vs THD+N



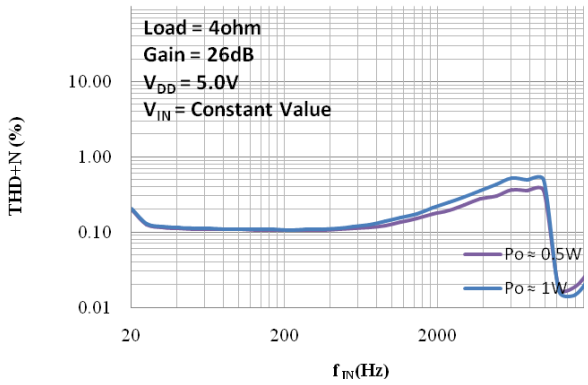
f_{IN} vs THD+N



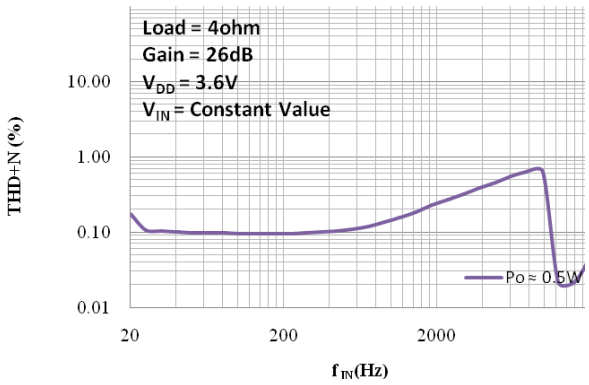
f_{IN} vs THD+N



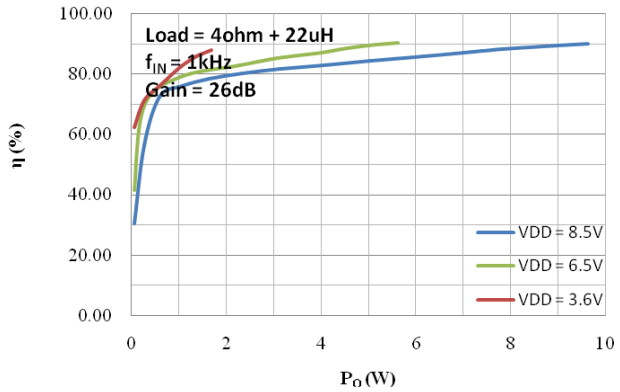
f_{IN} vs THD+N



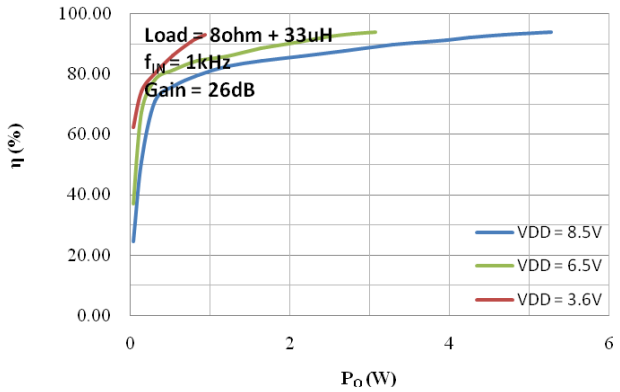
f_{IN} vs THD+N



P_O vs η



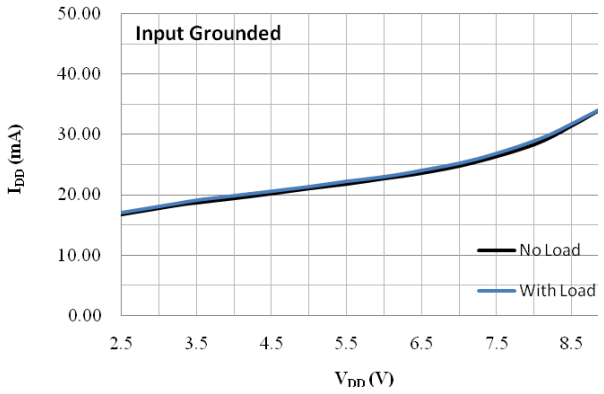
P_O vs η



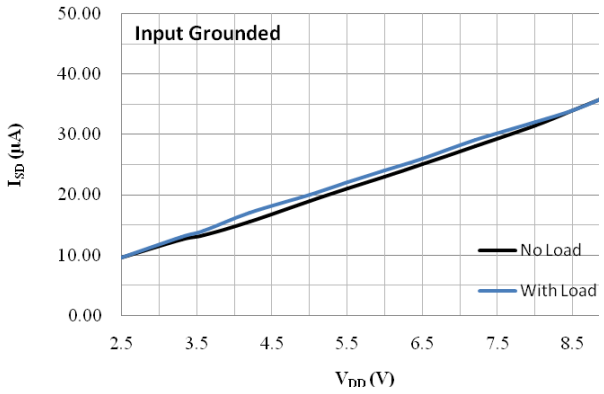
Class AB Channel

Condition: Class AB mode, V_{DD}= 2.5~8.5V, f_{IN}= 1kHz, R_{IN}= 56k, Output = Load = 4ohm, unless otherwise specified.

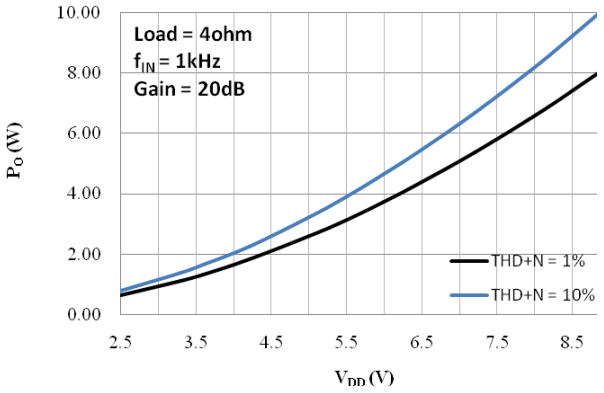
V_{DD} vs I_{DD}



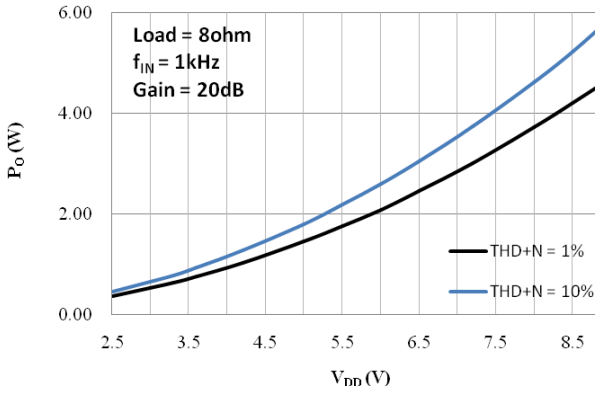
V_{DD} vs I_{SD}



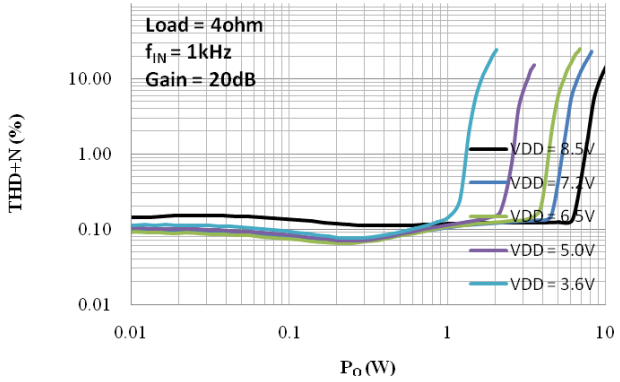
V_{DD} vs P_O



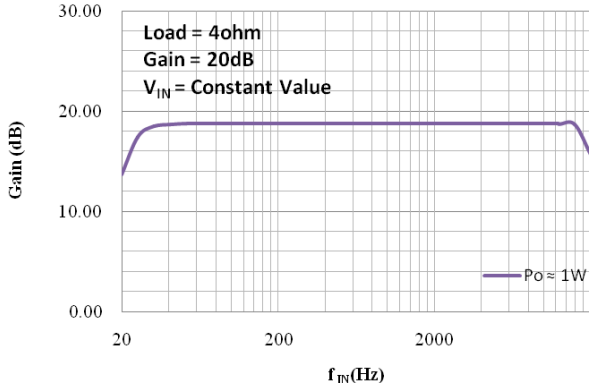
V_{DD} vs P_O



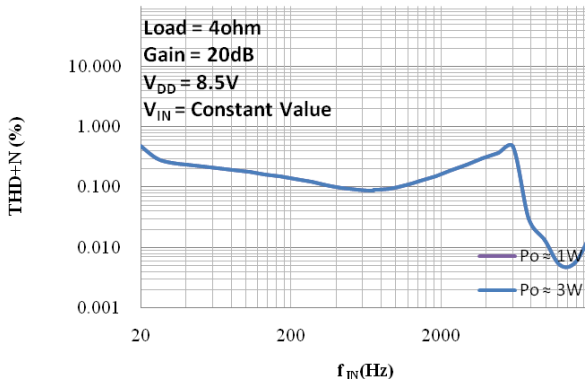
P_O vs THD+N



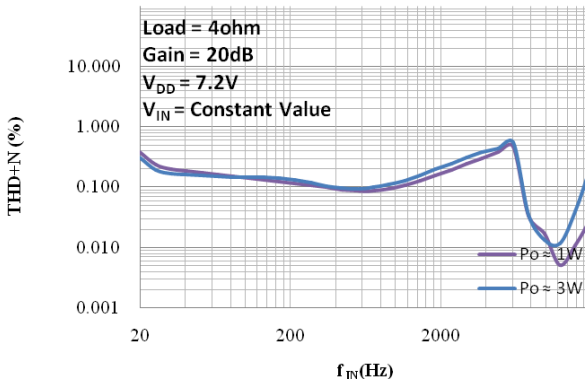
f_{IN} vs Gain



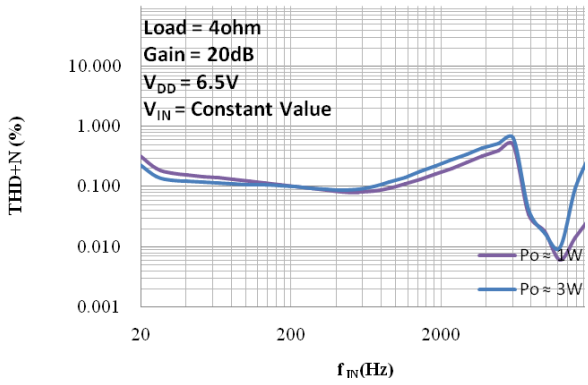
f_{IN} vs THD+N



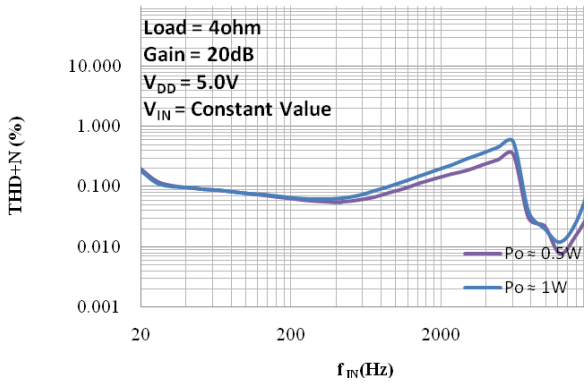
f_{IN} vs THD+N



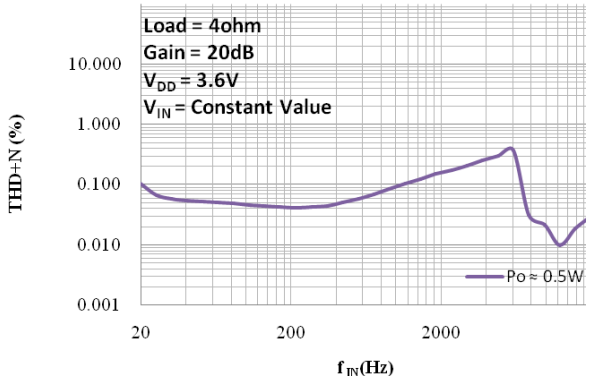
f_{IN} vs THD+N



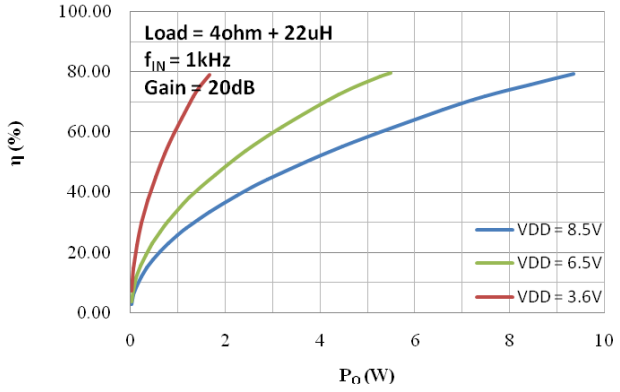
f_{IN} vs THD+N



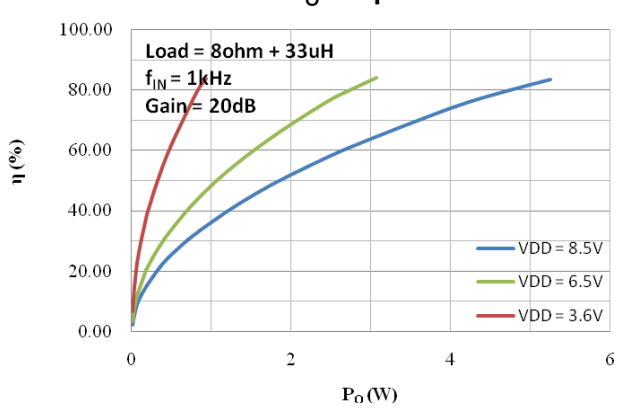
f_{IN} vs THD+N



P_O vs η



P_O vs η



-Functional description and application information

-Input Configuration

HT8693Accepts analog differential or single-ended audio signal input and generatesPWMThe pulse output signal drives the speaker.

For differential input, use a DC blocking capacitor$C_{IN}$and input resistanceR_{IN}Enter intoIN+andIN-System gainAv=11/50k R_{IN}（D class mode) orAv=500k/R_{IN}（ABclass mode), inputRCHigh pass filter cutoff frequencyf_c-1 (2πR_{IN}/C_{IN}).

For single-ended input,C_{IN}Coupling toIN+end.IN-The input resistor and capacitor must be connected to theC_{IN},R_{IN}same value) to ground. GainAv and cutoff frequencyf_cSame as differential input.

Pay attention to the output impedance of the system's front-end circuitZ_{OUT}Should not exceed600Ω.

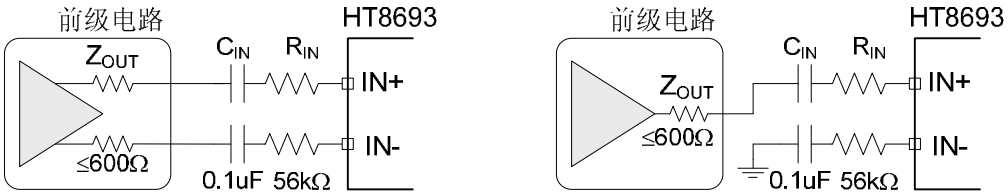


chart1(1)Differential input;　　(2)Single-ended input

-Amplifier Output

Generally speaking, the output terminal can be directly connected to the load speaker.EMIIf the requirements are higher, you can choose to add ferrite beads orLCfilter.

In addition, if the power supply voltage is large (>8.5V), the ripple is serious, or the input signal amplitude is large (≥1.0Vrms), or the load speaker impedance is small (<4Ω), it is necessary to appropriately increase the power supply capacitance (at least100uFabove), and addSnubberCircuit and Schottky diode (as shown in2), to prevent chip abnormality.

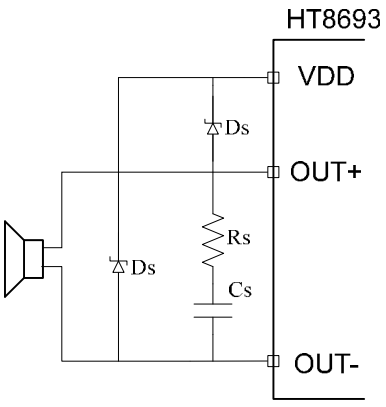


chart2Output Connections

Recommended parameters:

Rs: 1.5 ~ 2Ω;

Cs: 330pF~680pF;

Ds:Average forward current≥2A;Forward surge peak current≥6A;Forward Voltage(I_F=2A）≤0.5V.

-ABDMode Settings

existABDThe input terminal is high level.HT8693InClass DMode, system gainAv=1150k/R_{IN}.

existABDThe input is low level.HT8693InClass ABMode, system gainAv=500k/R_{IN}.

have to be aware of is,ABDThe pin supports floating, and there is an internal pull-up resistor with a resistance of approximately250kohm.

-CTRLMode Settings

Class DIn mode,CTRLDifferent voltage values can be input to achieve4Working mode, namely anti-top cutting mode1（ACF-1), anti-top clipping mode2（ACF-2), anti-top clipping function off mode (ACF-Off) and chip shutdown mode (SD), see the table below for details.

sheet1 CTRLInput voltage for different pin modes

parameter name	symbol	Minimum	Typical Value	Maximum	unit
ACF-OffMode setting threshold voltage	V_{MOD1}	0.75V_{DD}		V_{DD}	V
ACF-1Mode setting threshold voltage	V_{MOD2}	0.45V_{DD}		0.70V_{DD}	V
ACF-2Mode setting threshold voltage	V_{MOD3}	0.10V_{DD}		0.40V_{DD}	V
SD Mode setting threshold voltage	V_{MOD4}	VSS		0.06V_{DD}	V

In configurationCTRLWhen the external voltage is applied to the terminal, it should be noted that there is an internal120KohmPull-down resistor, as shown below.ABIn class mode, there is no pull-down resistor.

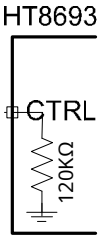


chart3 CTRLInternal resistance

in addition,SDAfter shutting down, re-enable the chip.CTRLThe end needs to be at least0.8Vvoltage.

-CTRLMode Function Description

(one)ACF ONmodel

existACF-1,ACF-2In this mode, when the circuit detects that the input signal amplitude is too large and the output is clipped,HT8693By automatically adjusting the system gain, the output is controlled to achieve a maximum power level without clipping distortion, thereby greatly improving the sound quality. In addition, when the power supply voltage drops,HT8693It can also automatically attenuate the output gain to achieve the sameV_{DD}The drop value matches the maximum non-clipping output level.

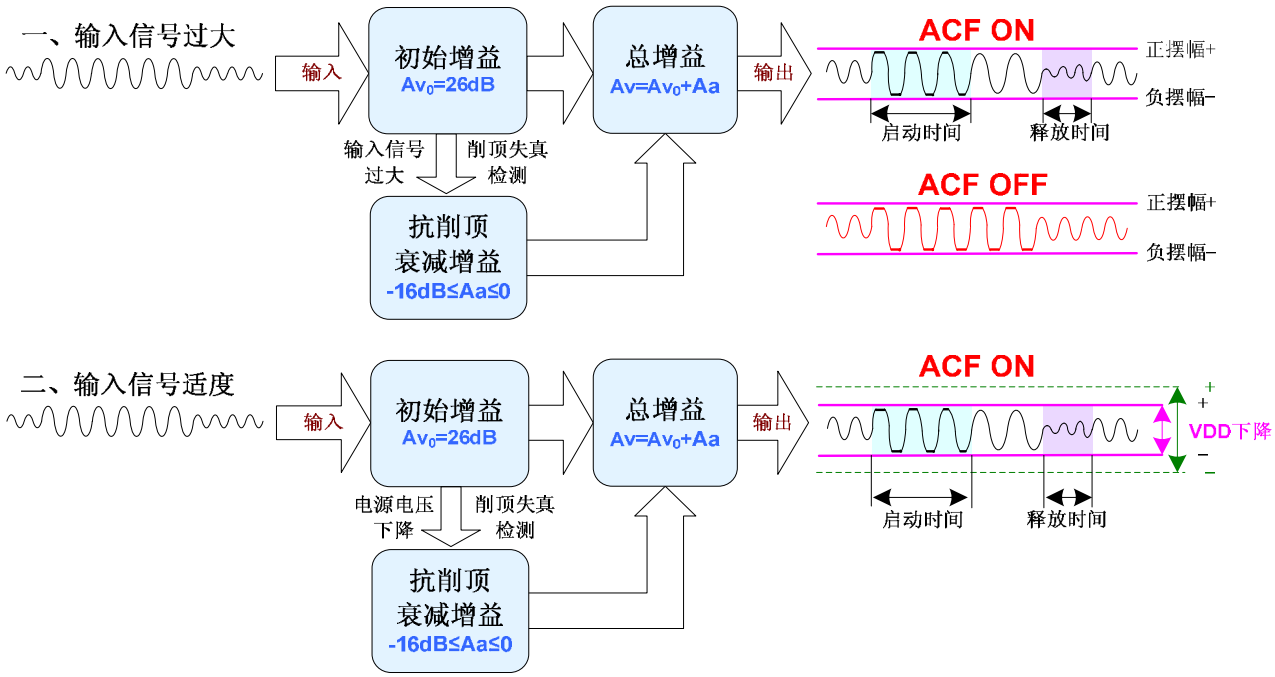


chart4 ACFWorking principle diagram

ACF ONStartup time in mode (Attack time) refers to the condition where a sufficiently large signal is suddenly input to produce output clipping.ACF Start adjusting the gain of the amplifier until the gain changes fromA_{V0}Attenuation to target attenuation gain3dBThe time interval from when the input condition first causes clipping to appear to when the gain exits the attenuation state and returns toA_{V0}time interval.HT8693The maximum attenuation gain is16dB.

Release time (Release time)

ACF-1andACF-2Modes have different attack and release times (see table below).

sheet2 ACF-1andACF-2Mode Difference

model	Start Time	Release time
ACF-1	50ms	64ms
ACF-2	2.5ms	1200ms

(two)ACF OFFmodel

existACF-OffMode,ACFThe function is turned off.HT8693No output clipping condition is detected, and no automatic adjustment is performed on the system gain. The system gain remains at$A_V=A_{V0}$=26dBConstant.HT8693The sound quality may deteriorate due to output distortion.

(three)SDmodel

In shutdown mode (low-power standby), the chip turns off all functions and reduces power consumption to a minimum, and the output is in a weak low level state (internaly connected to ground through a high resistance).

-Click-and-Pop Elimination

HT8693The built-in control circuit achieves comprehensive noise suppression, effectively suppressing transient clicks and pops that occur during system power-on, power-off, shutdown and wake-up operations.Click-Pop)noise.

To achieve better click-pop noise elimination, it is generally recommended to use0.1μFor smaller DC blocking capacitorC_{IN}.at the same timePOP Noise can also be minimized by the following timing control measures for shutdown mode during power-up and power-down:

・When the power supply is powered on, keep the shutdown mode, and then release the shutdown mode after the power supply is stable enough. ・

When the power is turned off, set it to shutdown mode in advance.

-Protective function

HT8693It has the following protection functions: output overcurrent protection, on-chip overtemperature protection, and power supply undervoltage protection.

(1) Overcurrent protection

When a short circuit is detected between one output terminal and the power supply, ground, or another output terminal, the overcurrent protection is activated and the output terminal switches to a high impedance state to prevent the chip from burning and damaging. After the short circuit is eliminated, the chip can be shut down, wake up once, or power on again to exit the protection mode.

(2) Overtemperature protection

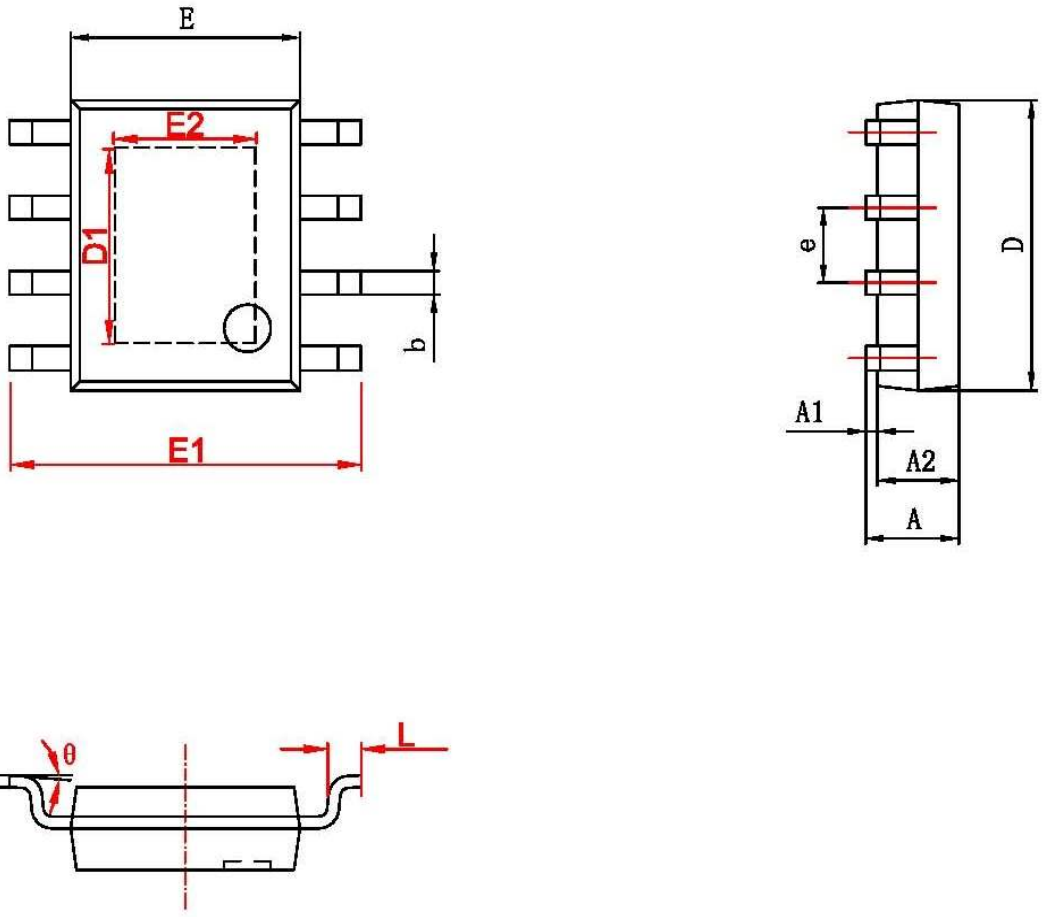
When the chip temperature exceeds150℃, the over-temperature protection starts, and the positive and negative output terminals switch to a weak low level state (internaly connected to ground through a high resistance) to prevent the chip from being damaged by thermal breakdown.

(3) Undervoltage protection

When the power supply is detectedV_{DD}Lower thanV_{UVLL}, start undervoltage protection, the output end is in a weak low level state (internal grounding through high resistance) When testing arriveV_{DD}Higher thanV_{UVL}, the protection mode is automatically released after the startup timeT_{STUP}Then enter normal working state.

-Package Outline

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°

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