Spread Spectrum Function, 40X Gain, Filterless 2x30W & 54W(PBTL) Class D Audio Amplifier

General Description

IU86751E is a 2x30W class D audio power amplifier with spread spectrum function. Advanced EMI suppression technology makes it possible to meet EMC requirements by using cheap bead filter at the output port. IU86751E is designed for the system which needs to output high-quality audio power. It uses surface mount technology and only needs a few peripheral devices to make the system have high-quality audio output power.

IU86751E has built-in over-current protection, short-circuit protection and overheating protection, which can effectively protect the chip from damage under abnormal working conditions. It can drive speakers with load as low as 8Ω, and can provide up to 2x16W continuous power; It has a high efficiency of 90%, so that no additional radiator is needed when playing music.

IU86751E offers a slim EQA16 package for customers to choose from, which can save considerable PCB area for customers. Its rated operating temperature range is - 40 ℃ to 85 ℃.

Features

- Output Power
  PO at 1% THD+N, VDD =18V@RL = 4 Ω 2X30W
  PO at 10% THD+N, VDD = 20V@RL = 4 Ω 54W(PBTL)
- Wide Power Supply Range 5V~16V
- Up to 92% Efficiency without Heat Sink
- Fixed 40X Gain, Integrated 10K Input Resistor, 400K Feedback Resistor
- Spread Spectrum Function
- Filterless Function
- The Output Pin is Convenient for Wiring Layout
- Good Short Circuit Protection and Temperature Protection with Automatic Recovery Function
- Good Distortion and Anti Pop Function
- Differential Input

Applications

- LCD TV
- Home Sound System

Package

- EQA16

Typical Applications

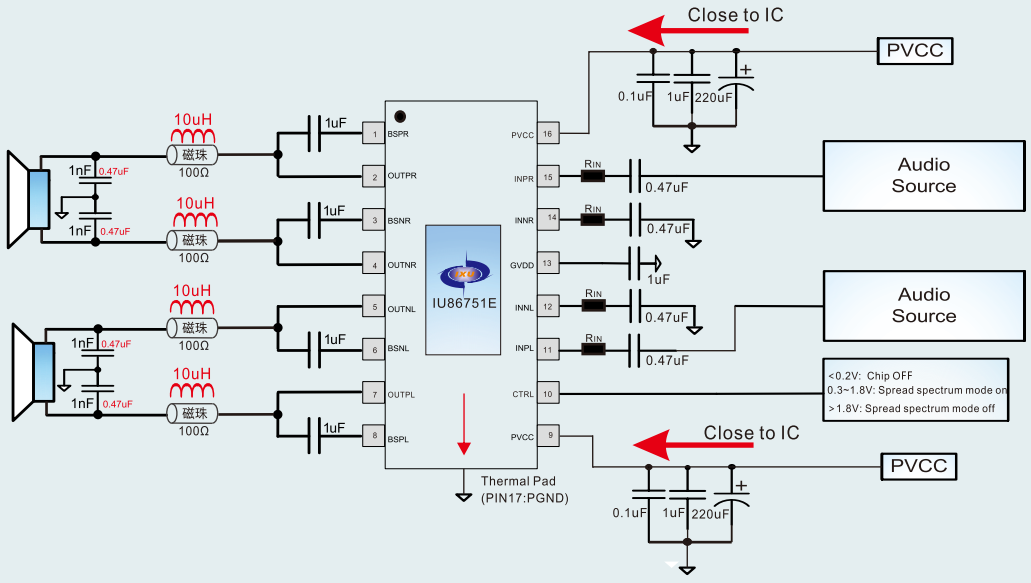


Figure 1 Differential input, typical application of stereo channel

Typical Applications

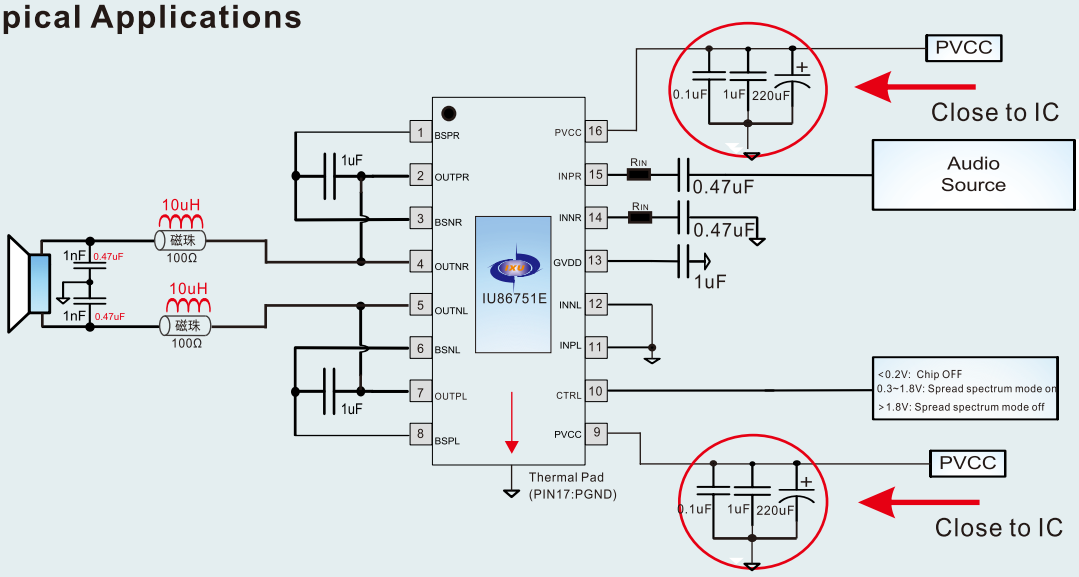
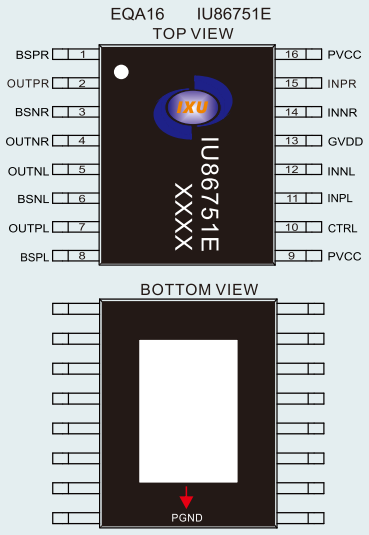


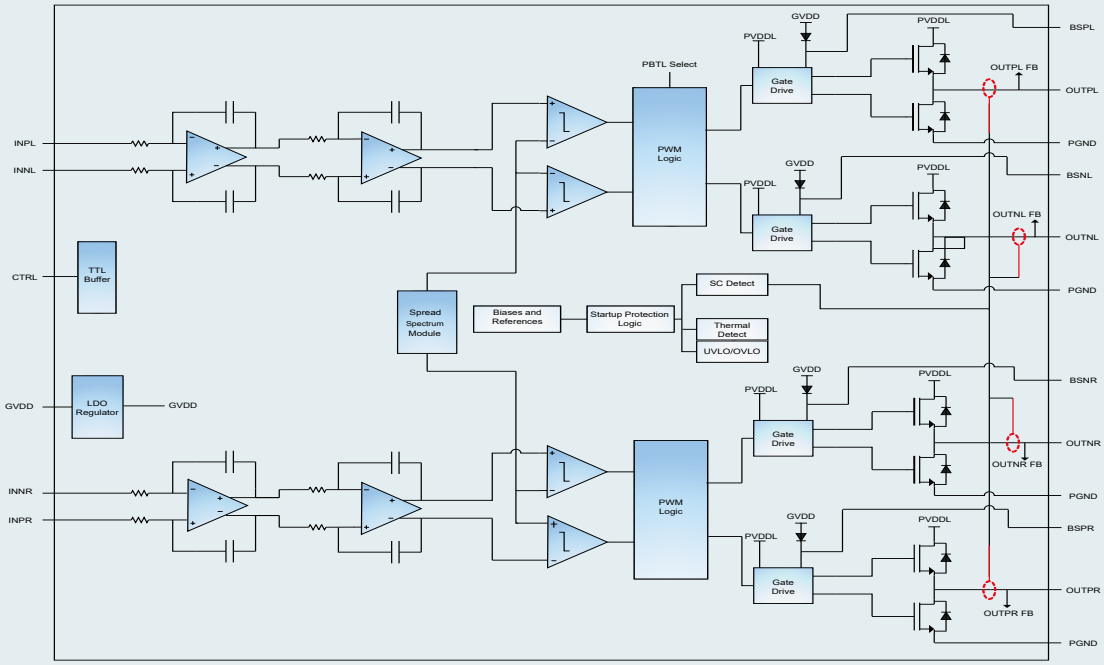
FIG. 2 Typical application of single-ended input and PBTL output mono

PIN Configuration and Functions



NO.	NAME	I/O	DESCRIPTION
1	BSPR	I	Right channel positive output upper tube bootstrap
2	OUTPR	O	Right channel audio output positive end
3	BSNR	I	Right channel negative output upper tube bootstrap
4	OUTNR	O	Right channel audio output negative end
5	OUTNL	O	Left channel audio output negative end
6	BSNL	I	Left channel negative output upper tube bootstrap
7	OUTPL	O	Left channel audio output positive end
8	BSPL	I	Left channel positive output upper tube bootstrap
9	PVCC	P	Power supply terminal
10	CTRL	I	Turn off / Spread spectrum mode control
11	INPL	I	Left channel audio input negative end
12	INNL	I	Left channel audio input positive end
13	GVDD	P	Upper gate drive voltage
14	INNR	I	Right channel audio input negative end
15	INPR	I	Right channel audio input positive end
16	PVCC	P	Power supply terminal
17	PGND	P	Power ground(Heat sink)

Functional Block Diagram



Absolute Maximum Ratings [1]

SYMBOL	PARAMETER	VALUE	UNIT
V_{IN}	Power supply without signal input	21	V
V_I	Input voltage	-0.3 to VIN+0.3	V
T_J	Junction operating temperature range	-40℃to170℃	℃
T_{SDR}	Lead temperature (Soldering, 10 sec.)	260	℃
T_{STG}	Storage temperature range	-65℃ to150℃	℃

Recommended Operating Conditions

SYMBOL	PARAMETER	VALUE	UNIT
V_{IN}	Input voltage	5.0~20	V
T_A	Ambient temperature range	-40~85	℃
T_j	Junction operating temperature range	-40~125	℃

Thermal Information [2]

SYMBOL	PARAMETER	VALUE	UNIT
θ_{JA}(EQA16)	Package thermal resistance - chip to environment thermal resistance	45	℃/W
θ_{JC}(EQA16)	Package thermal resistance - chip to package surface thermal resistance	10	℃/W

Ordering Information

Product Name	Package Type	Device Marking	Reel Size	Tape width	Quantity
IU86751E	EQA16L		13''	12mm	4000

ESD Range

HBM (Human Body Model) ---------- ±2kV
MM (Machine model) ---------- ±200V

Recommended Operating Conditions

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
V_{CC}	Power supply	PVCC	5	20	V
V_{IH}	Input high level	CTRL	2		V
V_{IL}	Input low level	CTRL		0.8	V
V_{OL}	Output high level	$R_{PULL-UP}$=100k,V_{CC}=15V		0.8	V
I_{IH}	High level input current	CTRL,V_I =2V,V_{CC}=15V		50	uA
I_{IL}	Low level input current	CTRL,V_I=0.8V,V_{CC}=15V		5	uA
OVP	Over voltage protection			19	V

DC Parameters

T_A=25°C,Vcc =12 V, RL = 8 Ω (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$\|V_{OS}\|$	Output offset voltage	V_I =0V			1.5	15	mV
I_{CC}	Quiescent current	CTRL=1V,No load ,PV_{CC}=12V			6.5	9	mA
$I_{CC(SD)}$	Standby current	CTRL=0.2V,No load ,PV_{CC}=12V			20	50	uA
$r_{DS(on)}$	Source drain on resistance	V_{CC} =12V,I_O=500mA, T_J =25℃	Upper tube		80		mΩ
			Lower tube		80		
t_{on}	Turn on time	CTRL=2V			200		ms
t_{OFF}	Turn off time	CTRL=0V			2		us
GVDD	Gate drive voltage	I_{GVDD} =100 mA		4.0	4.5	5.0	V

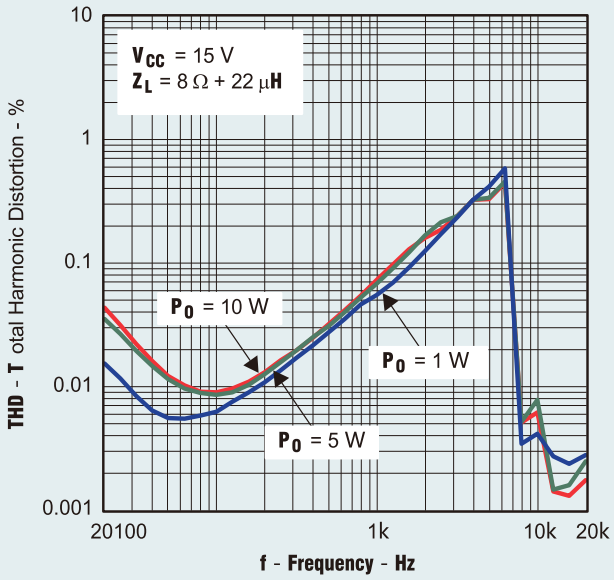
AC Parameters

T_A=25°C,Vcc = 14 V, RL = 4 Ω (unless otherwise noted)

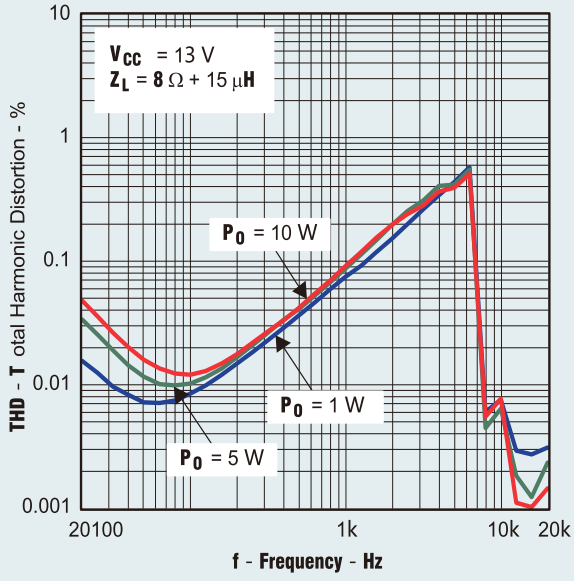
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
K_{SVR}	Power supply ripple rejection ratio	1kHz，200mVpp Ripple Gain=20dB，Input AC coupled to ground		70		dB
THD+N	Total harmonic distortion + noise	VCC=12V， f=1kHz Po=8W		0.1		%
V_n	Output noise	20~22kHz， Add filter		90		uV
		Gain=20dB		-80		dBV
	Crosstalk	Vo=1Vrms,Gain=20dB,f=1kHz		-90		dB
SNR	Signal to noise ratio	Gain=20dB Maximum output THD+N < 1%， f=1kHz		102		dB
f_{OSC}	modulation frequency			300		KHz
Thermal protection temperature				170		℃
Hysteresis temperature				15		℃
Po	output power:stereo	PO at 10% THD+N, VDD = 12V@RL =4 Ω		2X20		W
		PO at 1% THD+N, VDD = 12V@RL = 4 Ω		2X16		
		PO at 10% THD+N, VDD = 15V@RL = 4 Ω		2X30		
		PO at 1% THD+N, VDD =18V@RL = 4 Ω		2X30		
	output power:mono	PO at 10% THD+N, VDD = 12V@RL =4 Ω		20		W
		PO at 1% THD+N, VDD = 12V@RL = 4 Ω		16		
		PO at 10% THD+N, VDD = 20V@RL = 4 Ω		54		
		PO at 1% THD+N, VDD =16V@RL = 4 Ω		27		

Typical Characteristics All tests are based on 1kHz signal (unless otherwise specified)

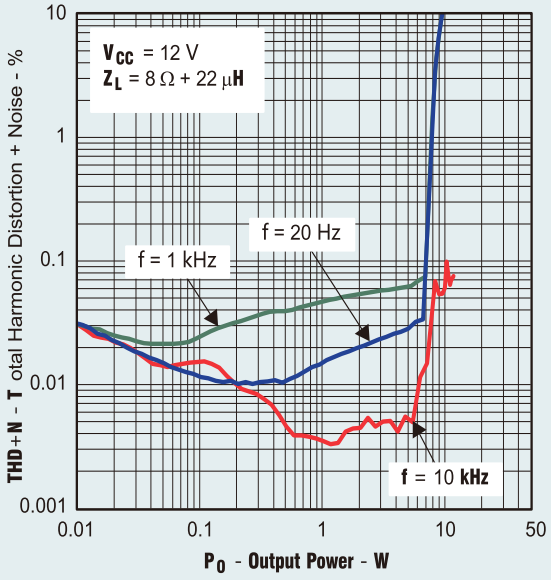
TOTALHARMONICDISTORTION vs FREQUENCY(BTL)



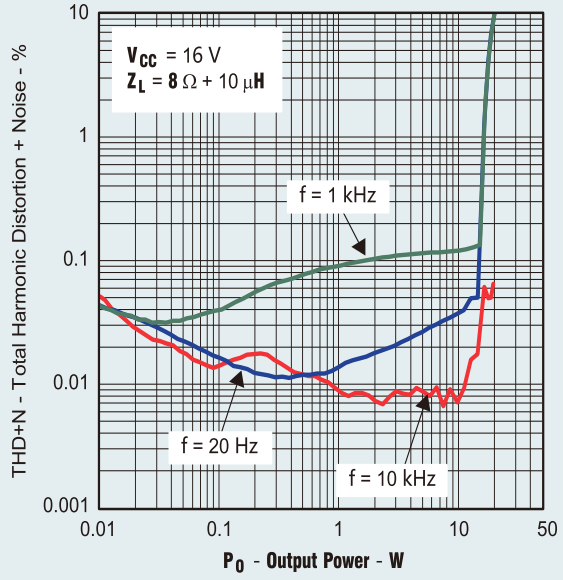
TOTALHARMONICDISTORTION vs FREQUENCY(BTL)



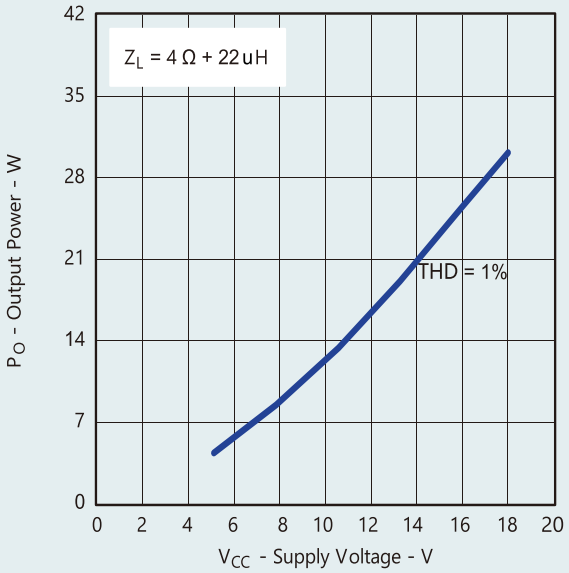
TOTALHARMONICDISTORTION+NOISE vs OUTPUTPOWER(BTL)



TOTALHARMONICDISTORTION+NOISE vs OUTPUTPOWER(BTL)

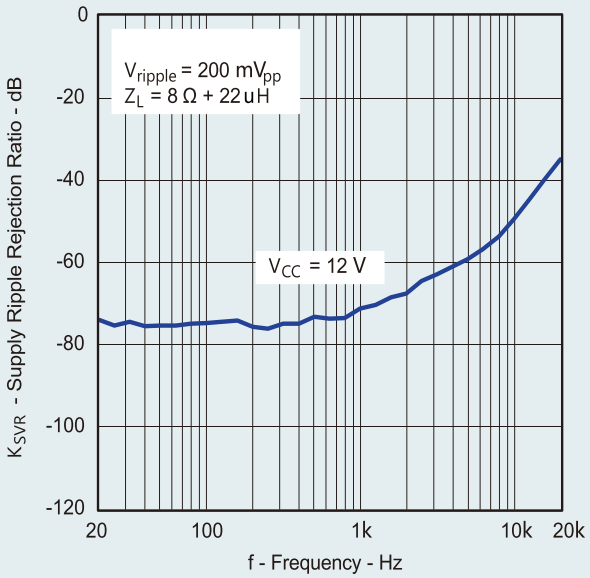


OUTPUTPOWER
vs
SUPPLYVOLTAGE(STERO)

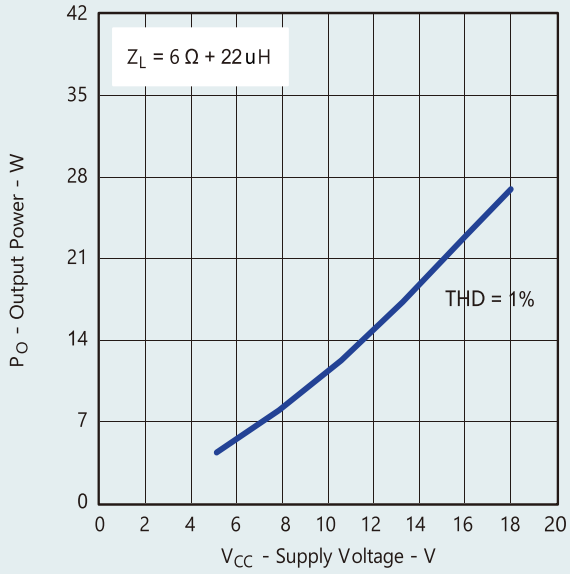


Note:DashedLinesrepresentthermallylimitedregions.

SUPPLYRIPPLEREJECTIONRATIO
vs
FREQUENCY(PBTL)

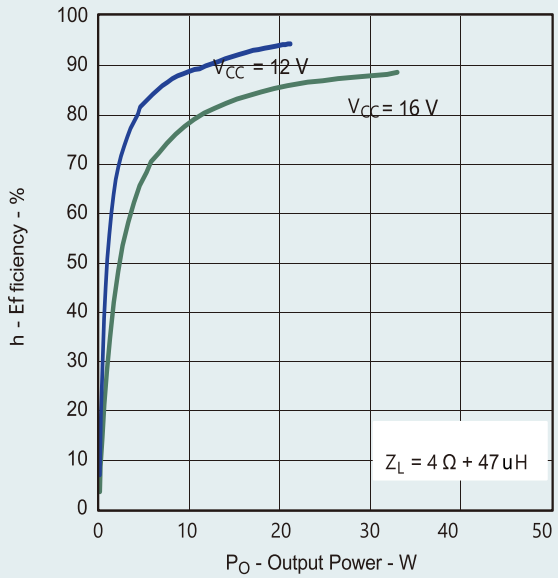


OUTPUTPOWER
vs
SUPPLYVOLTAGE(STERO)



Note:DashedLinesrepresentthermallylimitedregions.

EFFICIENCY
vs
OUTPUTPOWER(BTL)



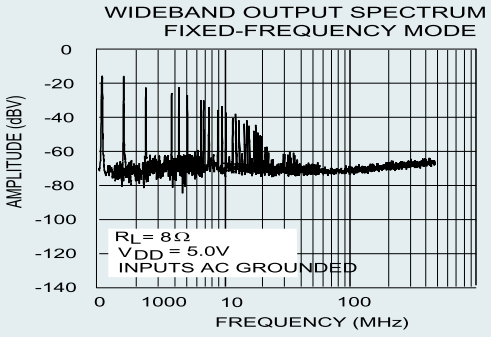
Note:DashedLinesrepresentthermallylimitedregions.

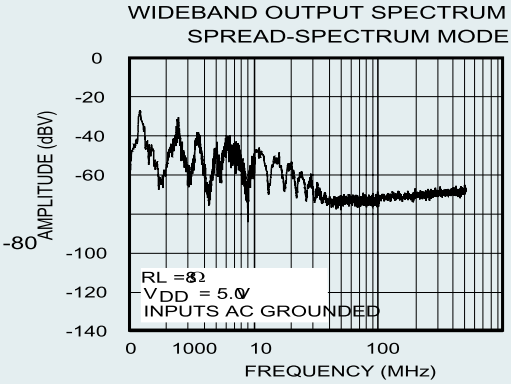
Application Information

Standby Mode and Spread Spectrum Mode Settings

When the voltage of the CTRL pin is less than 0.2V, the IU86751E will enter the standby mode. When it works normally, you can't let the CTRL hang and not connect, because this will make the OP AMP unpredictable. In order to achieve the best turn off performance, put the OP AMP in standby mode before turning off the power supply. When the voltage of the CTRL pin is between 0.3 and 1.8V, IU86751E works normally and enters the spread spectrum mode. When the voltage of the CTRL pin is above 1.8V, IU86751E works normally and switches off the spread spectrum mode.

IU86751E has a unique spread spectrum modulation mode. In this mode, the spectrum components are spread over a wide frequency band, which can effectively reduce EMI (see fixed frequency spectrum energy map and spread spectrum technology spectrum energy map). Proprietary technology ensures that the switching frequency changes with the period and does not reduce the audio reconstruction performance or efficiency. The switching frequency varies randomly in the range of ±30KHz near the center frequency of 300KHz. In this way, the energy is distributed over the whole frequency band, instead of concentrating a large amount of spectrum energy at the frequency doubling of the switching frequency. In the frequency band up to several MHz, EMI is equivalent to white noise of broadband frequency (see EMI spectrum diagram).





Short Circuit Protection and Automatic Recovery

IU86751E protects the over-current state caused by short-circuit at the output end. When the short-circuit occurs, IU86751E will immediately shut down the output. When the output short-circuit fault is eliminated, IU86751E can automatically recover after waiting for 110ms.

Temperature protection

The temperature protection of IU86751E is to prevent the device from damage when the temperature exceeds 150°C. There is an upper and lower allowable range of ± 15°C between devices at this temperature point. Once the temperature exceeds the set temperature point, the device will enter the off state without output. When the temperature drops by 20°C, the temperature protection will be eliminated and the device will start to work normally.

Single Ended Input Mode of IU86751E

The analog input of IU86751E is a standard differential input interface. In the system design, differential input mode is recommended to connect the audio output of the main chip. The use of differential input mode can make POP sound control relatively simple and signal anti-interference ability is strong. The comparison between differential input mode and single ended input mode is shown in the following table:

Comparison table of differential and single input modes

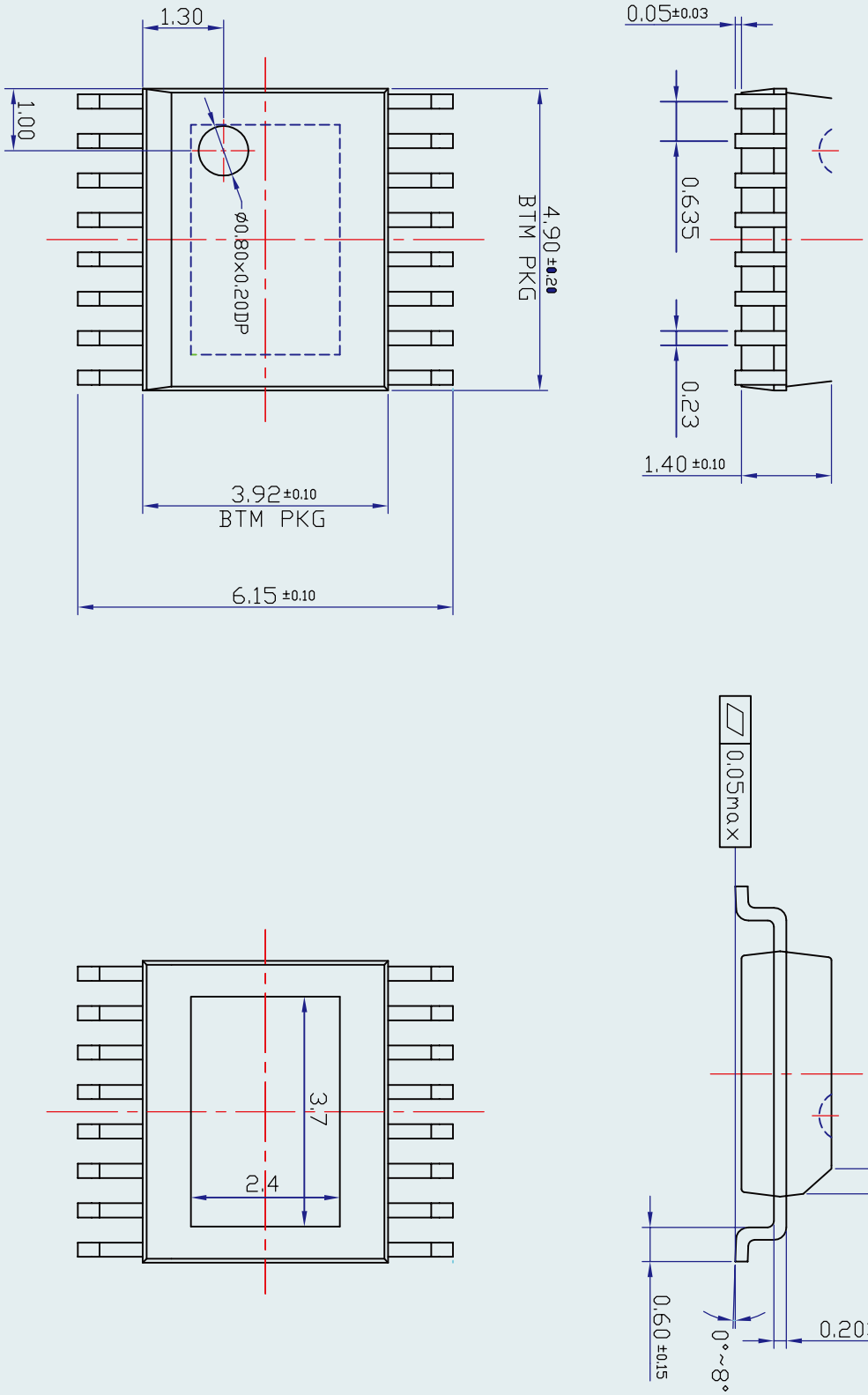
	Differential input	Single ended input
Anti noise interference capability	There is a strong common mode Noise suppression performance	There is no suppression function, need to pay more attention to the PCB layout
On startup / shutdown POP sound performance	The differential input symmetry ensures the optimal on-off POP sound performance	The input network and control circuit should be carefully designed to avoid POP sound caused by input imbalance

When using single ended input mode, you should pay attention to the following points:

- In the application of single ended input mode, more attention should be paid to the routing and ground plane distribution of audio signal, because single ended input mode has no ability to suppress the common mode interference signal in the system.
- Compared with the differential signal input mode, single ended input requires twice the input signal level to achieve the same output power.
- In single ended input mode, we must pay attention to the impedance matching of P/N pin circuit network, and try not to use complex filter network in input stage. Improper impedance network will cause pop sound of power on and off.

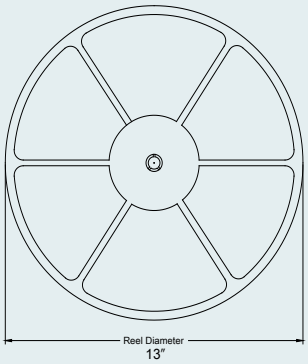
Package information

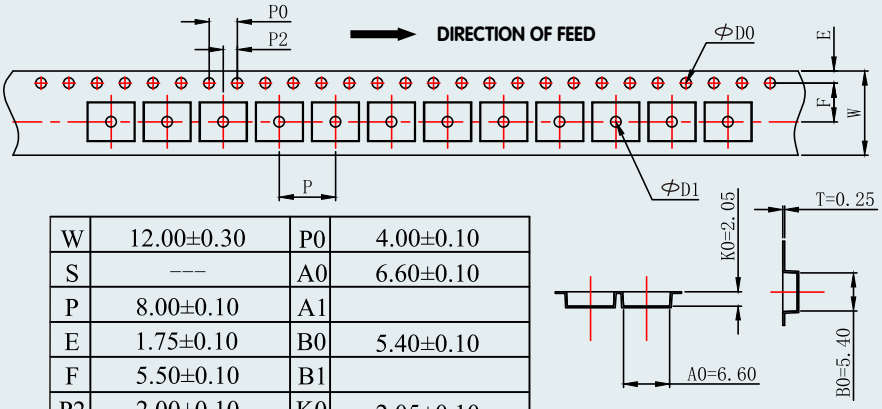
IU86751E EQA16(95*145) PACKAGE OUTLINE DIMENSIONS UNITS:MM



TAPE AND REEL INFORMATION

REEL DIMENSIONS





W	12.00±0.30	P0	4.00±0.10
S	---	A0	6.60±0.10
P	8.00±0.10	A1	
E	1.75±0.10	B0	5.40±0.10
F	5.50±0.10	B1	
P2	2.00±0.10	K0	2.05±0.10
D0	1.50+0.10/-0.00	K1	
D1	1.50+0.10/-0.00	t	0.25±0.05



Precautions for MOS Circuit Operation:

Static electricity can be generated in many places. The following precautions can effectively prevent MOS circuit from being damaged due to the sound of electrostatic discharge:

- Operators shall be grounded through anti-static wrist strap.
- The equipment enclosure must be grounded.
- Tools used during assembly must be grounded.
- Conductor packaging or anti-static materials must be used for packaging or transportation.

Declaration:

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