

160mW免输出耦合电容的立体声耳机放大器

160mW CAP FREE STEREO HEADPHONE AMPLIFIER

■ FEATURES

- Direct Drive Outputs Eliminate DC-Blocking Capacitors, Save Space
- Excellent Bass Fidelity
- Shutdown and Startup without any Click-Pop Noise, $\pm 50\mu\text{V}$ (typical) Vos
- Exceptional Low THD+N: 0.002% Minimum
- Absolutely Low Noise Performance V_N : $8.5\mu\text{V}$
- Differential or Single-Ended Input
- Wide 2.5V to 6V Operating Range
- Output Power: 80mW ($V_{DD}=3.6\text{V}$, $f_{IN} = 1\text{kHz}$, $R_L=32\Omega$, THD+N=1%)
- 160mW ($PVDD = 5\text{V}$, $f_{IN} = 1\text{kHz}$, $R_L=32\Omega$, THD+N=0.1%)
- Pb Free Packages, QFN16L 3mm*3mm, Extremely Simple BOM Needed
- 输出无需隔直流电容
- 卓越的低音效果
- 无咔嗒/噼噗声, $\pm 50\mu\text{V}$ (typical) Vos
- 低THD+N: 最低0.002%
- 低噪声, V_N : $8.5\mu\text{V}$
- 支持单端输入和全差分输入
- 2.5V至6V较宽的电源工作范围
- 输出功率: 80mW ($f_{IN} = 1\text{kHz}$, $V_{DD}=3.6\text{V}$, $R_L=32\Omega$, THD+N=1%)
- 160mW ($PVDD = 5\text{V}$, $f_{IN} = 1\text{kHz}$, $R_L=32\Omega$, THD+N=0.1%)
- 无铅封装, QFN16L 3mm*3mm

■ APPLICATIONS

- Headphones · Simple Multimedia Interfaces
- Set-Top Boxes · Blue-ray and DVD Players
- LCD Televisions · Prosumer Audio Devices
- 耳机
- 机顶盒
- LCD电视
- 多媒体音频接口
- 蓝光/DVD播放器
- 音频消费电子产品

DESCRIPTION

The HT97226 is a differential input Direct Drive headphone amplifier, which can also drive single-ended input signal. It is capable of being driven with 160mW into 32Ω with a 5V supply. The IC is offered with an externally set gain through external resistors. The external gain setting nodes can also be used to configure filters for set-top box applications. The IC has exceptional THD+N over the full audio bandwidth.

An on-chip charge pump inverts the power-supply input, creating a negative rail. The output stage of the amplifier is powered between the positive input supply and the output of the charge pump. The bipolar supplies bias the output about ground, eliminating the need for large, distortion-introducing output coupling capacitors. The IC shutdowns and startups without click-pop noise.

The IC is available in a 3mm x 3mm, 16-pin QFN-PP and is specified over the extended -40°C to +85°C temperature range.

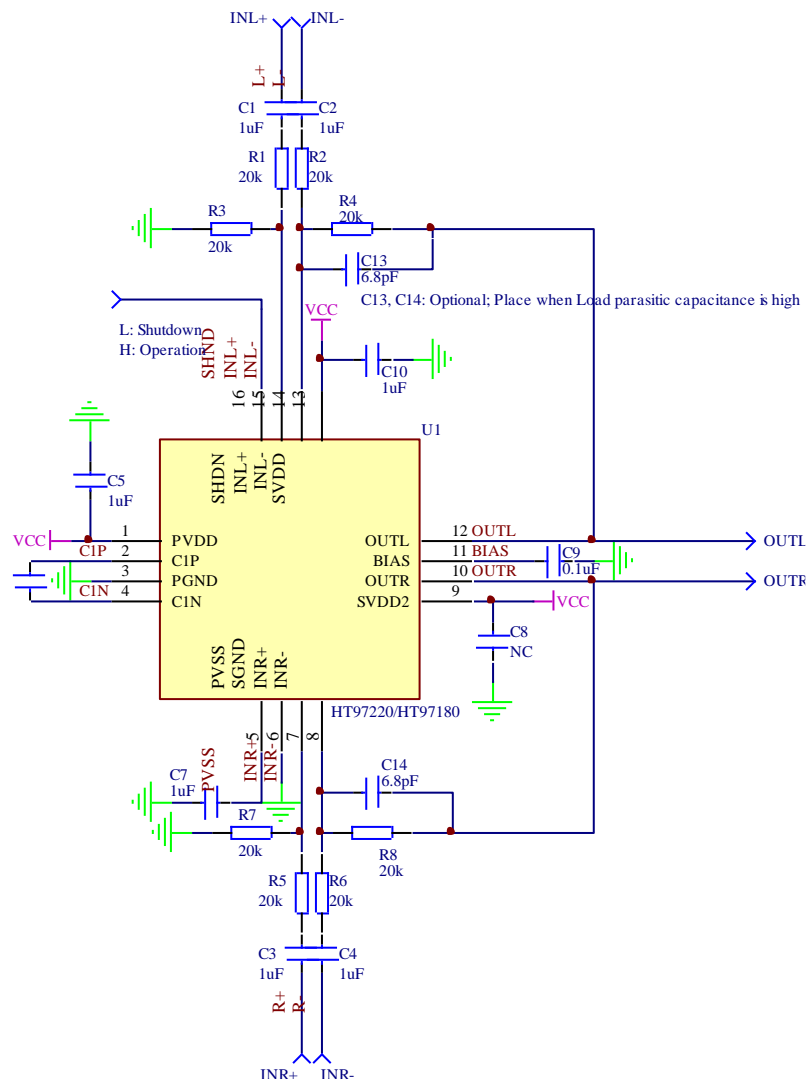
HT97226是一款差分输入/单端输入、可直接输出驱动的耳机放大器。5V供电时，器件可为32ohm耳机提供180mW的功率。器件可通过外部电阻调节增益。器件在音频范围内具有卓越的THD+N表现。

器件内部集成电荷泵产生负电压，器件输出级由输入正电压和该负电压驱动，使得输出偏置在零电位，省去了大尺寸、容易引入失真的输出耦合电容。

器件使能开关时，没有咔嗒/噼噗声。

器件封装为3mm x 3mm, 16-pin QFN-PP，能在-40°C 至 +85°C 温度范围内工作

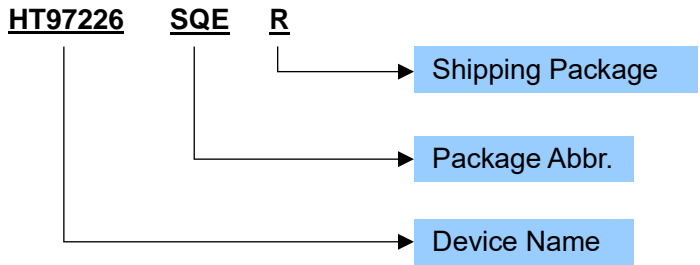
TYPICAL APPLICATION



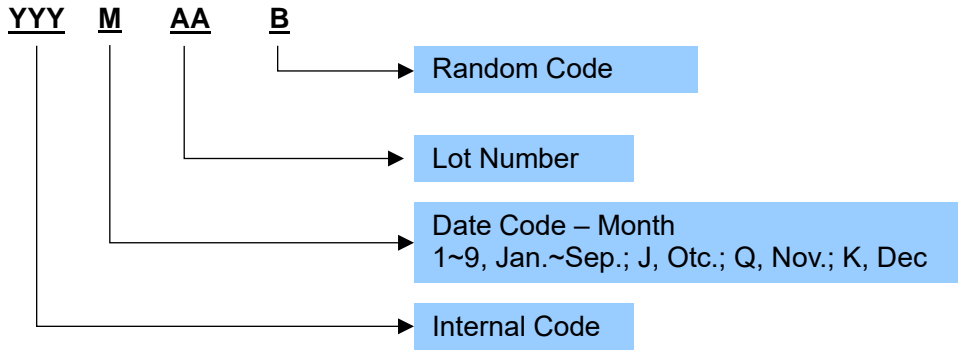
ORDERING INFORMATION

Part Number	Package Type	Package Abbr.	Marking	Shipping Package / MOQ
HT97226SQER	QFN3x3-16L	SQE	HT97226 YYYMAAB ¹	Tape and Reel (R) / 5000pcs

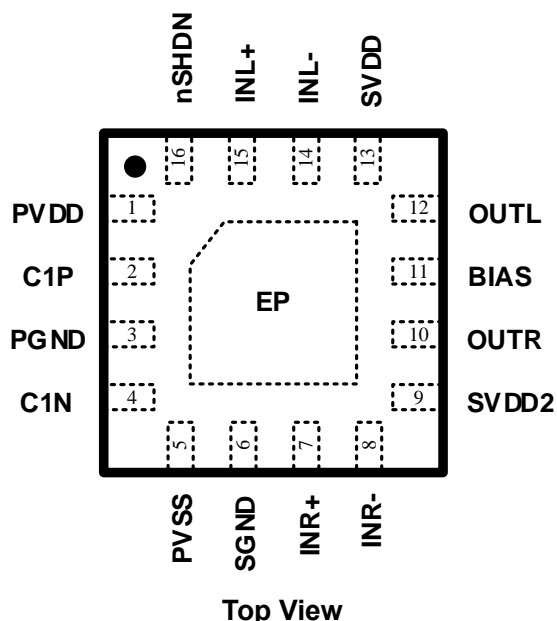
Part Number



Production Tracking Code



¹ YYYMAAB is production tracking code
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■ TERMINAL CONFIGURATION

■ TERMINAL FUNCTION

PIN	NAME	I/O ¹	Description
1	PVDD	P	Charge-Pump Power-Supply Input. Bypass to PGND with 1 μ F. 电荷泵电源输入端，接1 μ F滤波电容到PGND
2	C1P	P	Positive Flying Capacitor Connection. Connect a 1 μ F capacitor between C1P and C1N. 飞电容正端，在C1P和C1N间接1 μ F电容
3	PGND	G	Power Ground. Connect PGND and SGND together at the system ground plane.
4	C1N	P	Negative Flying Capacitor Connection. Connect a 1 μ F capacitor between C1P and C1N. 飞电容正端，在C1P和C1N间接1 μ F电容
5	PVSS	P	Negative Charge-Pump Output. Bypass to PGND with 1 μ F. 电荷泵负端电压输出，接1 μ F滤波电容到PGND
6	SGND	G	Signal Ground. Connect PGND and SGND together at the system ground plane.
7	INR+	I	Right Positive Polarity Input. 右声道正端输入
8	INR-	I	Right Negative Polarity Input. 右声道负端输入
9	SVDD2	P	Signal Path Power-Supply Input. Bypass to PGND with 1 μ F. Connect directly to PVDD. 信号路径电源输入端，与PVDD短接，接1 μ F滤波电容到PGND
10	OUTR	O	Right Direct Drive Output. 右声道输出
11	BIAS	O	Internal Supply Node. Bypass to PGND with 0.1 μ F. 内部供电端，接0.1 μ F电容到地
12	OUTL	O	Left Direct Drive Output. 左声道输出
13	SVDD	P	Signal Path Power-Supply Input. Bypass to PGND with 1 μ F. Connect directly to PVDD. 信号路径电源输入端，与PVDD短接，接1 μ F滤波电容到PGND
14	INL-	I	Left Negative Polarity Input. 左声道负端输入
15	INL+	I	Left Positive Polarity Input. 左声道正端输入
16	nSHDN	I	Active-Low Shutdown. Drive nSHDN high for normal operation. 拉低时关断；拉高时进行正常工作模式
—	EP	/	Exposed Pad. Electrically connect to PGND or leave unconnected.

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

■ SPECIFICATIONS¹
● Absolute Maximum Ratings²

PARAMETER ³	Symbol	MIN	MAX	UNIT
Supply Voltage (SVDD, SVDD2, PVDD) Range	V _{DD}	-0.3	+6.5	V
PVSS and BIAS Voltage Range		-6.5	+0.3	V
SGND Voltage Range	SGND	-0.3	+0.3	V
Input (INL+, INL-, INR+, INR-) Voltage Range	V _{IN}	-V _{SVDD} /2	+V _{SVDD} /2	V
Input (nSHDN) Voltage Range	nSHDN	-0.3	+6.5	V
Output (OUTL, OUTF) Voltage Range	V _{OUT}	-4.5	4.5	V
C1P Voltage Range	C1P	-0.3	V _{PVDD} +0.3	V
C1N Voltage Range	C1N	V _{PVSS}	+0.3	V
Operating temperature range	TA	-40	85	°C
Operating junction temperature range	TJ	-40	150	°C
Storage temperature range	TSTG	-65	150	°C

● Electrical Characteristics

Condition: Ta=25°C, V_{DD} (= V_{PVDD} = V_{SVDD} = V_{SVDD2}) = 5.0V, V_{PGND} = V_{SGND} = 0V, R_{IN} = R_F = 20kΩ, C_{FLY} = 1μF, C_{PVDD} = C_{PVSS} = 1μF, C_{BIAS} = 0.1μF, unless otherwise specified.

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply voltage range	V _{DD}		2.5		6.0	V
Quiescent Supply Current	I _{DD}	No Load		4.5		mA
Under-voltage Lockout	UVLO				2.2	V
Shutdown Supply Current	I _{SD}	nSHDN = 0		0.01		μA
Start-up time	t _{ON}	Power on, or pull nSHDN to high		4.2		ms
Amplifier						
Output Offset Voltage	V _{OS}			±50	±300	μV
Input Common-Mode Voltage Range	V _{CM}	Voltage at IN+ and IN-	-0.5 x V _{PVDD}		+0.5 x V _{PVDD}	V
Maximum Differential Input Signal	V _{DIFF}				V _{PVDD}	V _P
Output Power	P _{OUT}	V _{DD} = 3.3V, R _L = 32Ω, THD+N = 1%		70		mW
		V _{DD} = 3.6V, R _L = 32Ω, THD+N = 1%		80		
		V _{DD} = 5V, R _L = 32Ω, THD+N = 1%		180		
Total Harmonic Distortion Plus Noise	THD+N	V _{DD} = 3.3V, 1kHz, P _{OUT} = 10mW, R _L = 32Ω		0.002		%
		V _{DD} = 5V, 1kHz, P _{OUT} = 20mW, R _L = 32Ω		0.002		%
Signal-to-Noise Ratio	SNR	P _{OUT} = 50mW, 22Hz to 22kHz BW, A-weighted, R _L = 32Ω		102		dB
Output Noise Voltage	V _N	A-weighted, R _{IN} = R _F = 20kΩ		8.5		μV
CrossTalk	CT	1kHz, V _{OUT} = 1Vrms, R _L = 32Ω		-91		dB
Maximum Capacitive Load Drive	CL			200		pF
External Feedback Resistor Range	R _F		4.7	20	100	kΩ
Oscillator Frequency	f _{OSC}			500		kHz
Logic Input						

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

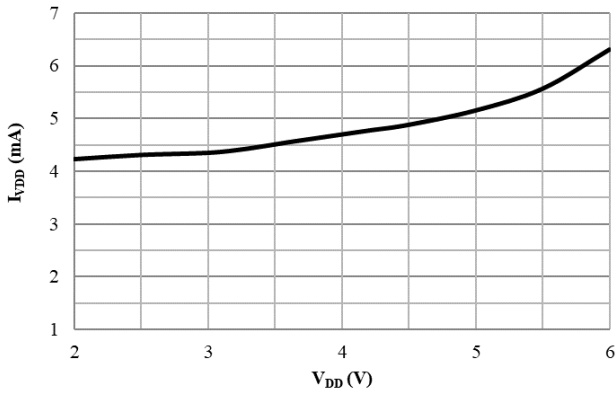
² Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

³ All Voltages is referenced to PGND.

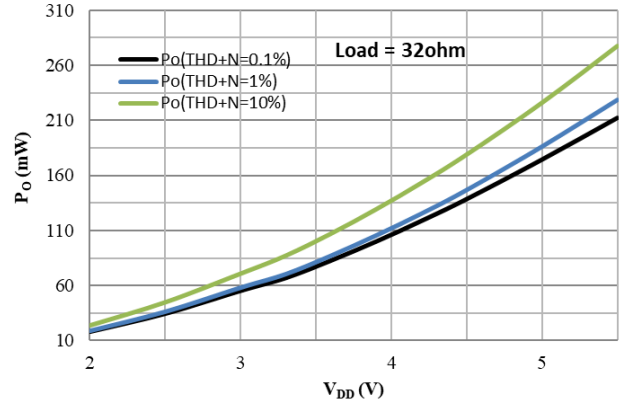
nSHDN Input Logic High	V_{IH}				1.3	V
nSHDN Input Logic Low	V_{IL}	Input Grounded, With or without load	0.6			V

TYPICAL OPERATING CHARACTERISTICS

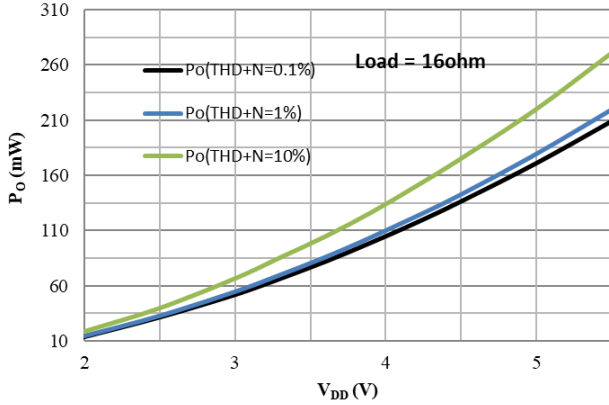
V_{DD} vs I_{DD}



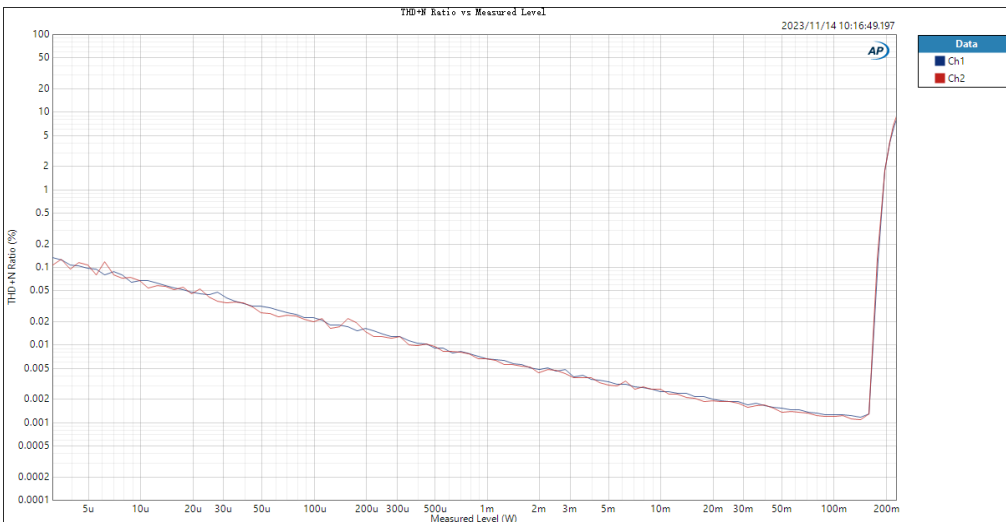
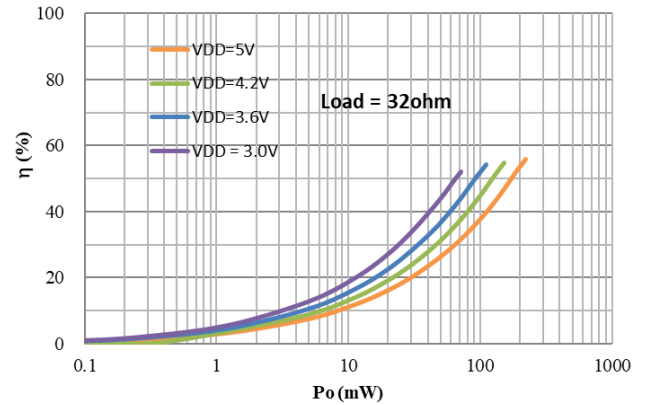
V_{DD} vs P_O



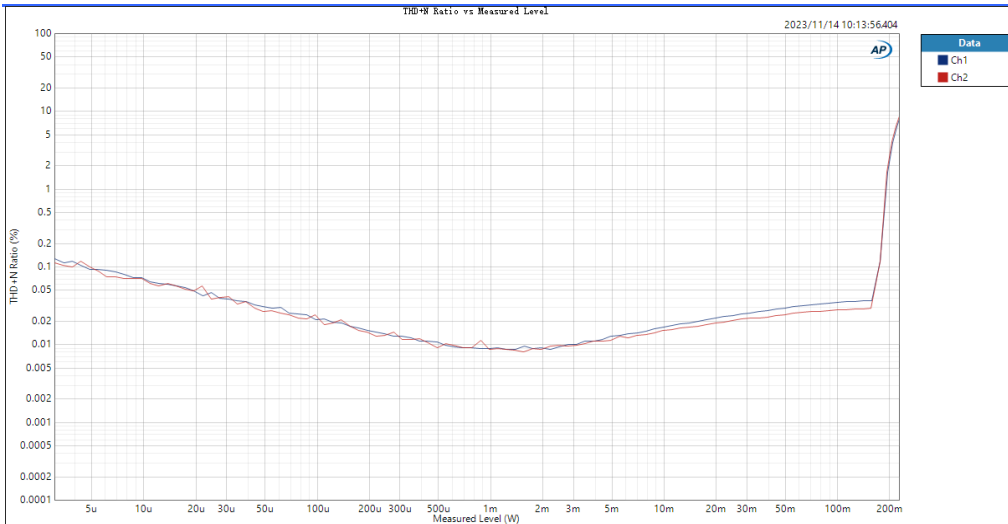
V_{DD} vs P_O



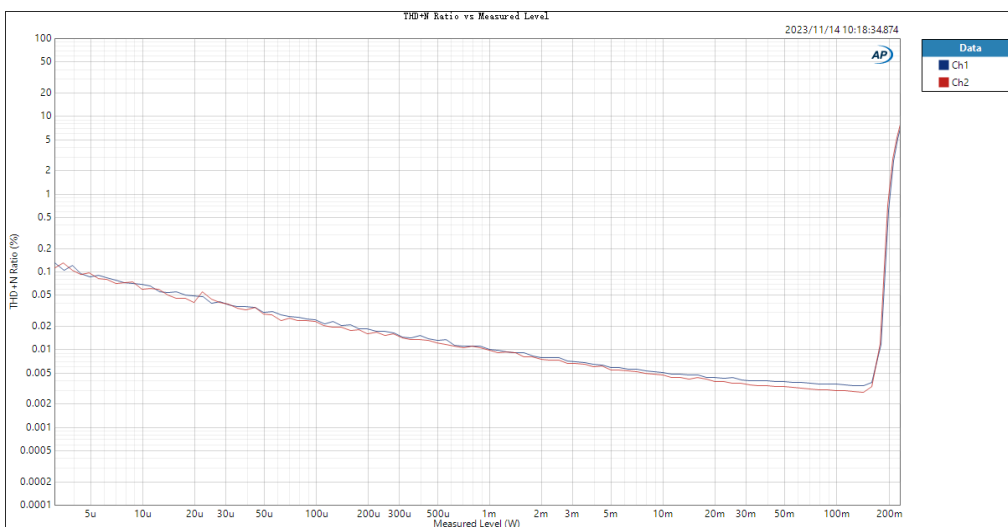
P_O (L/R) vs η



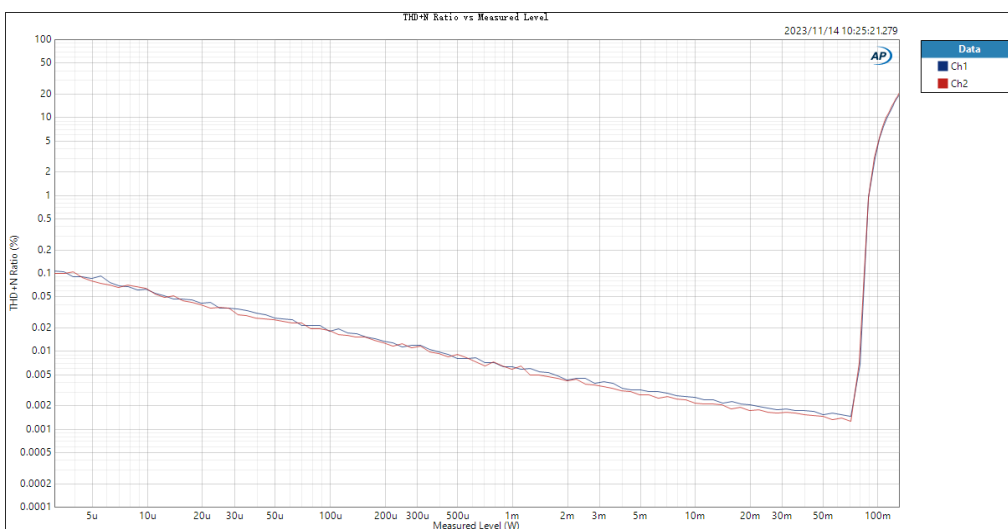
$V_{DD} = 5V$, $f_{IN} = 1kHz$, Load = 32R,
 P_O vs THD+N



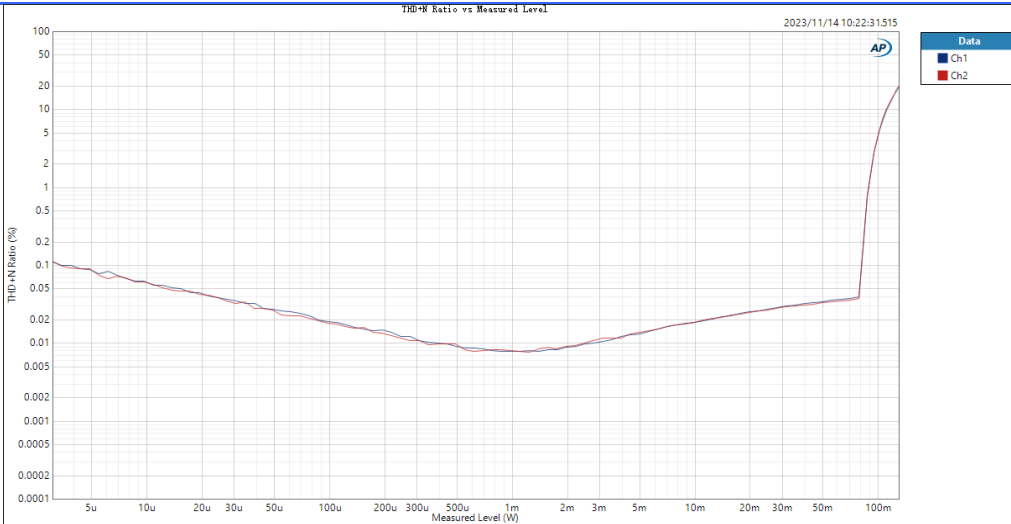
VDD = 5V, f_{IN} = 100Hz, Load = 32R, P_o vs THD+N



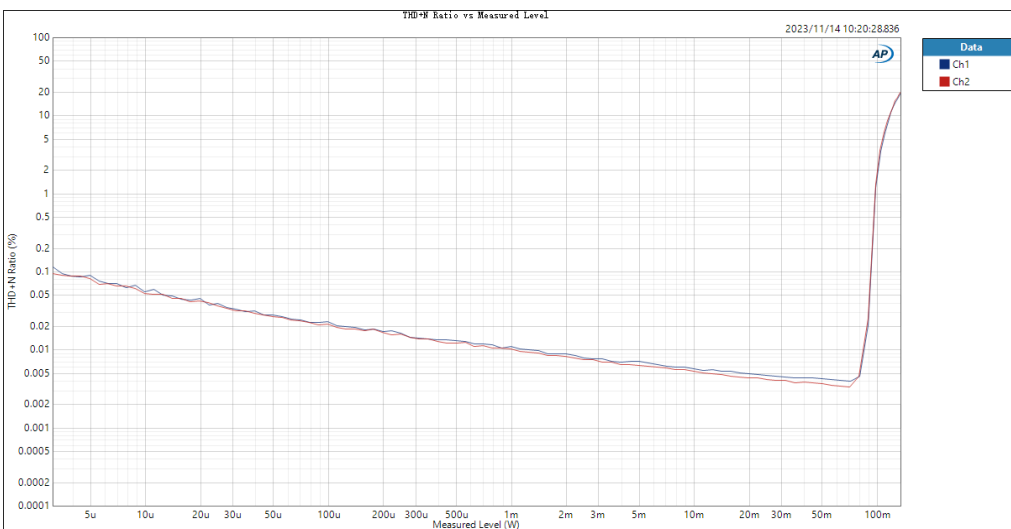
VDD = 5V, f_{IN} = 6kHz, Load = 32R, P_o vs THD+N



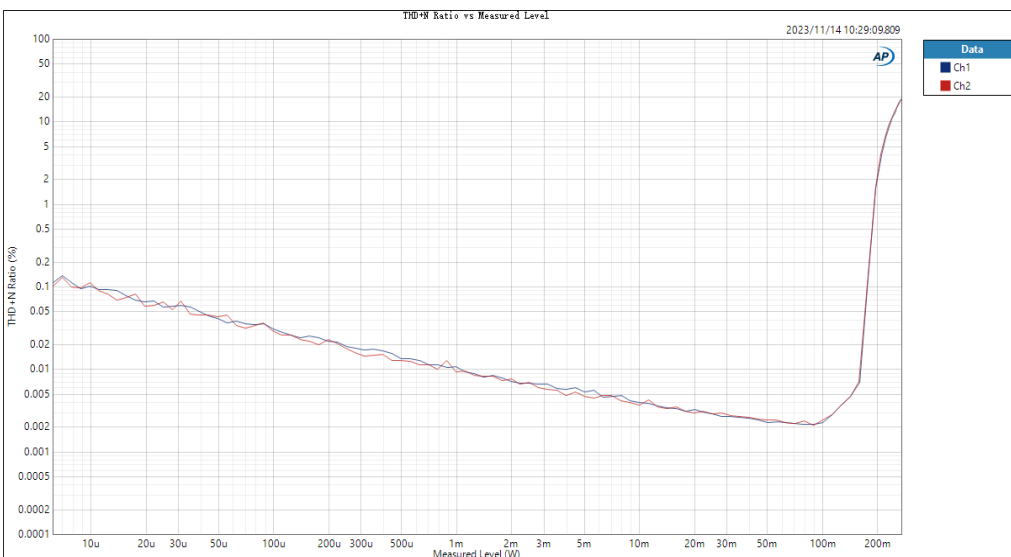
VDD = 3.6V, f_{IN} = 1kHz, Load = 32R, P_o vs THD+N



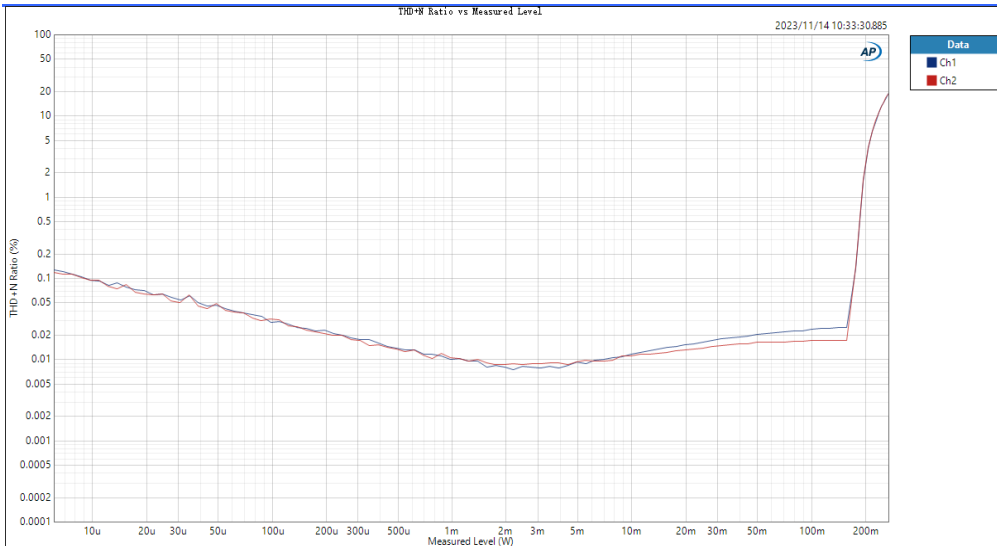
VDD = 3.6V, f_{IN} = 100Hz, Load = 32R, P_o vs THD+N



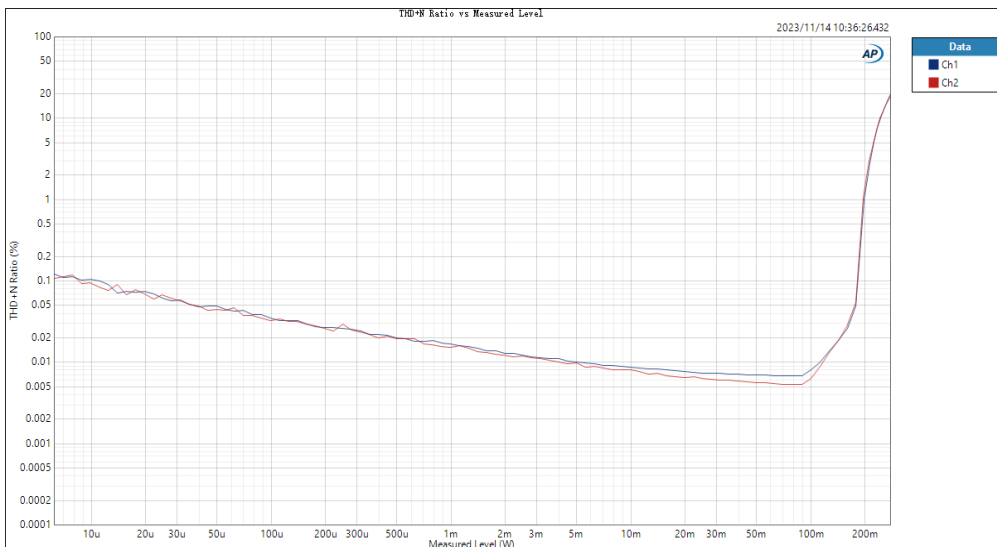
VDD = 3.6V, f_{IN} = 6kHz, Load = 32R, P_o vs THD+N



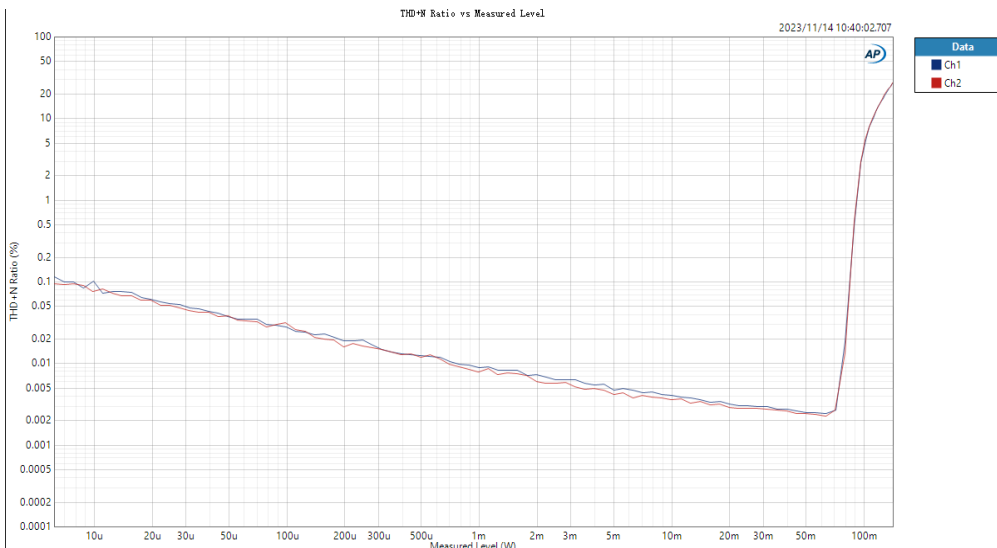
VDD = 5V, f_{IN} = 1kHz, Load = 16R, P_o vs THD+N



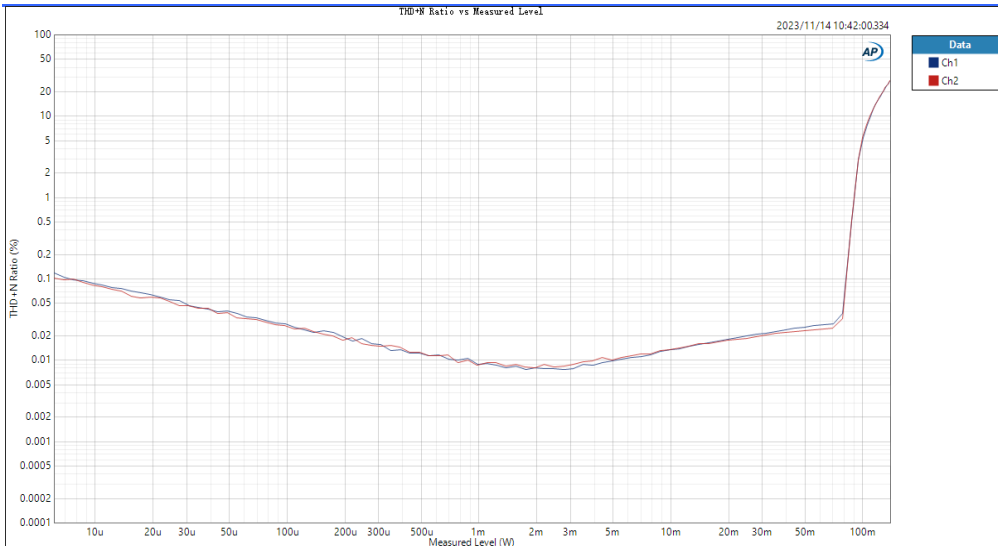
VDD = 5V, f_{IN} = 100Hz, Load = 16R, P_o vs THD+N



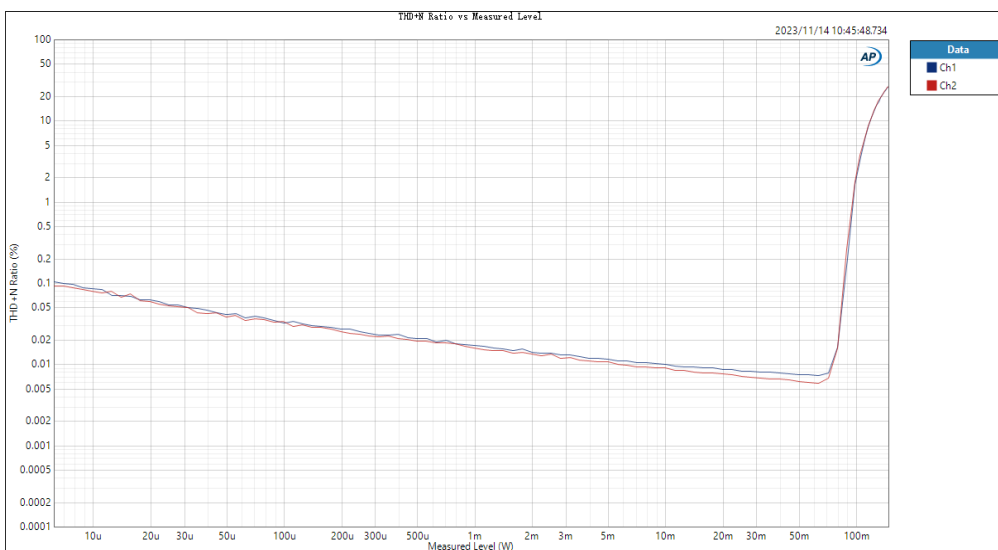
VDD = 5V, f_{IN} = 6kHz, Load = 16R, P_o vs THD+N



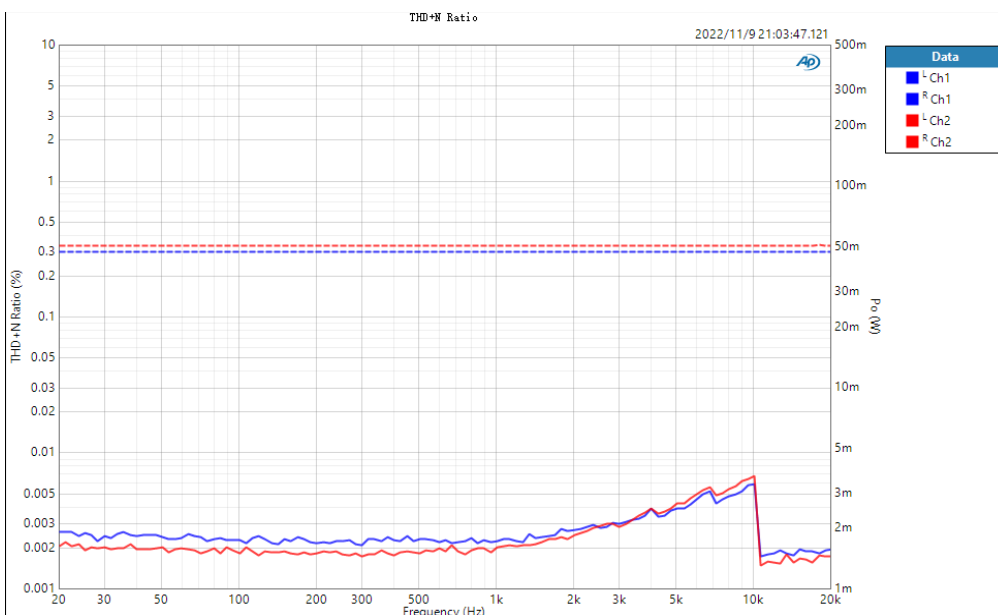
VDD = 3.6V, f_{IN} = 1kHz, Load = 16R, P_o vs THD+N



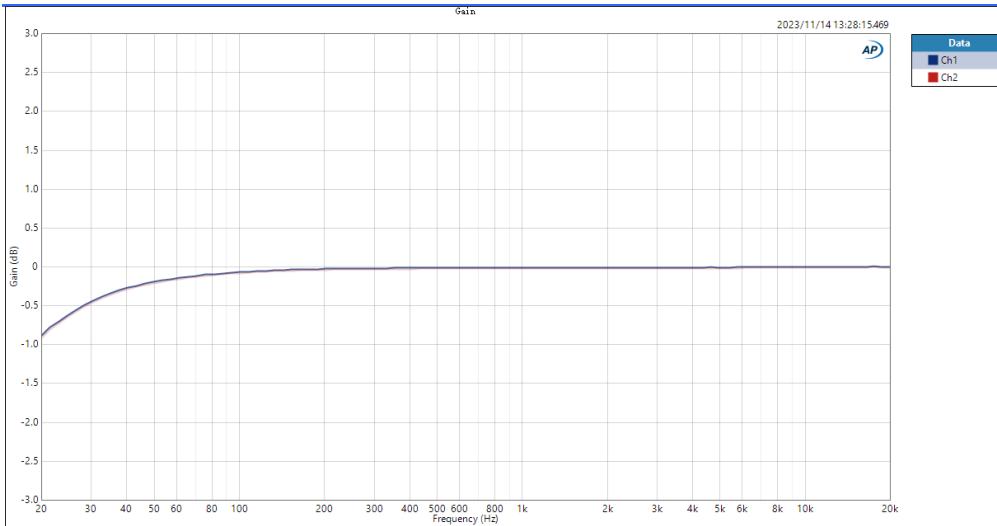
VDD = 3.6V, f_{IN} = 100Hz, Load = 16R, P_o vs THD+N



VDD = 3.6V, f_{IN} = 6kHz, Load = 16R, P_o vs THD+N



VDD = 4.2V, P_o = 50mW, Load = 32R, f_{IN} vs THD+N



CIN = 1uF, RIN =
RF = 20k, f_{IN} vs
Gain

APPLICATION INFORMATION

1 Detailed Description

HT97226 is a fully differential input headphone amplifier, which requires external input and feedback resistors to set the amplifier gain. The gain is:

$$AV = -R_F/R_{IN}$$

Choose feedback resistor values between the 4.7kΩ and 100kΩ range.

The IC can be configured as differential or single-ended input amplifiers (Figures 2 and 3).

HT97226 是差分输入耳放驱动器，需要外置输入电阻和反馈电阻来设置增益。增益为：

$$AV = -R_F/R_{IN}$$

反馈电阻应在 4.7k~100k 范围内。

芯片可以设置为差分输入或单端输入方式，入下图。

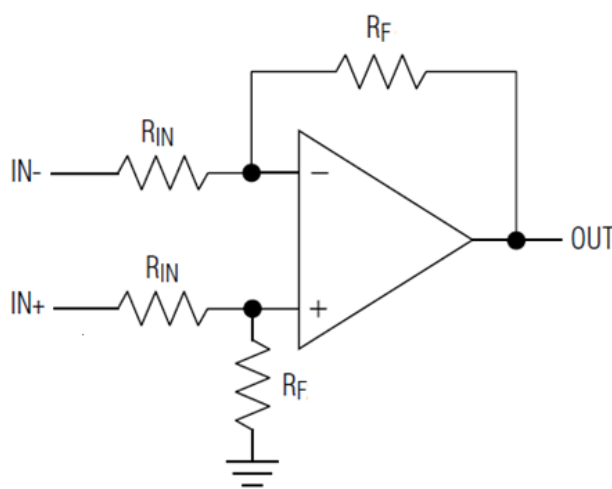


Figure 1 Differential Input Configuration

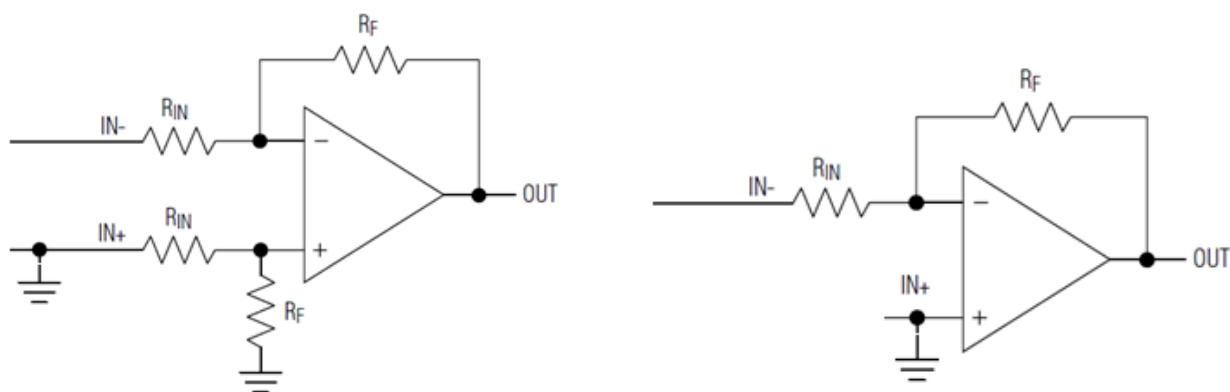


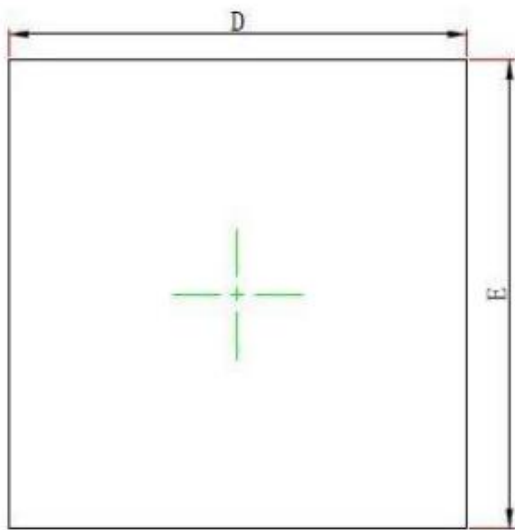
Figure 2 Single-Ended Input Configuration

HT97226 uses a charge pump to create an internal negative supply voltage, allowing the IC's outputs to be biased about PGND, so that it can directly drive the load without large DC-blocking capacitors.

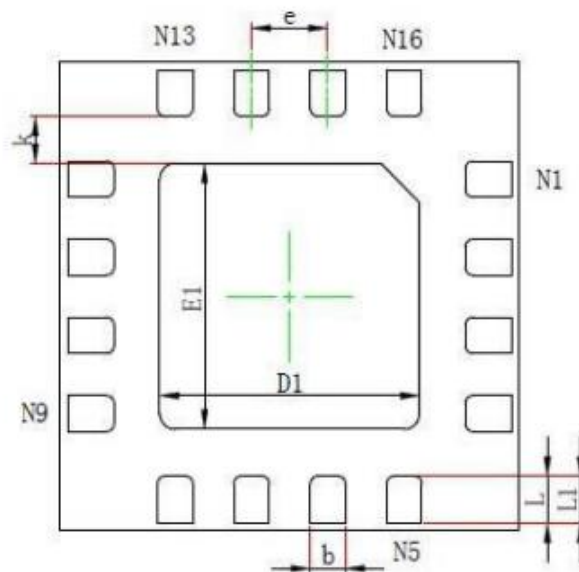
HT97226 内置电荷泵产生负压，从而使其输出偏置在 PGND，因此其不需要输出大隔直电容。

■ PACKAGE OUTLINE

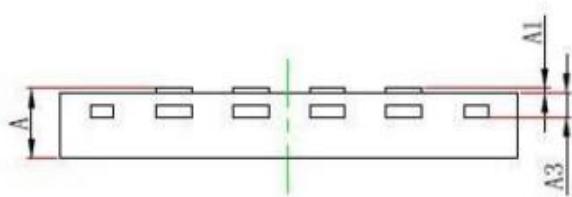
SQE (QFN3×3-16L)



TOP VIEW



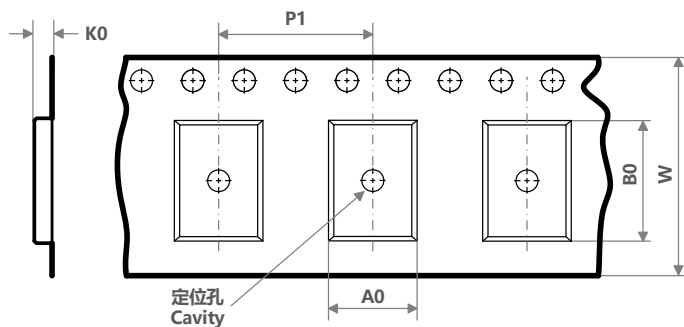
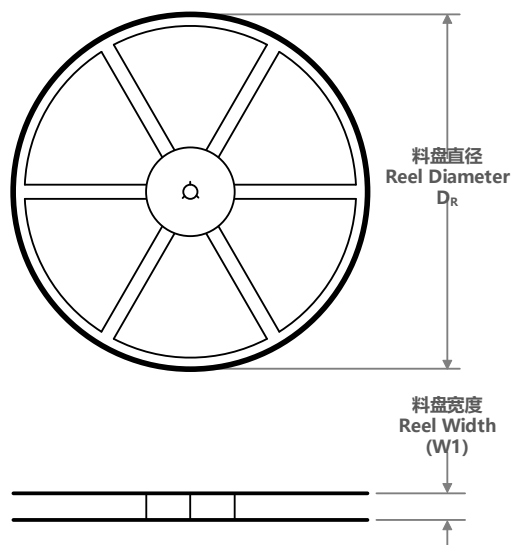
BOTTOM VIEW



SIDE VIEW

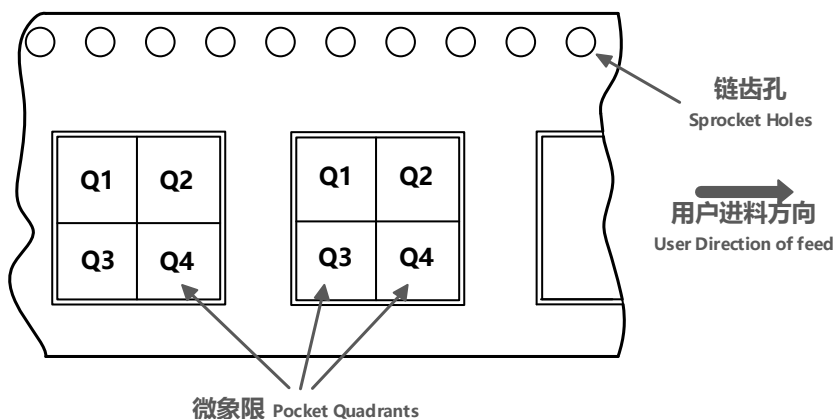
Symbol	Dimensions in Millimeters		
	Min.	NOM	Max.
A	0.700	0.750	0.800
A1	0.000	-	0.050
A2	0.195	0.203	0.211
D	2.950	3.000	3.050
E	2.950	3.000	3.050
D1	1.700	1.900	2.100
E1	1.700	1.900	2.100
k	0.200MIN.		
b	0.200	0.230	0.260
e	0.500TYP.		
L	0.250	0.300	0.350

TAPE AND REEL INFORMATION

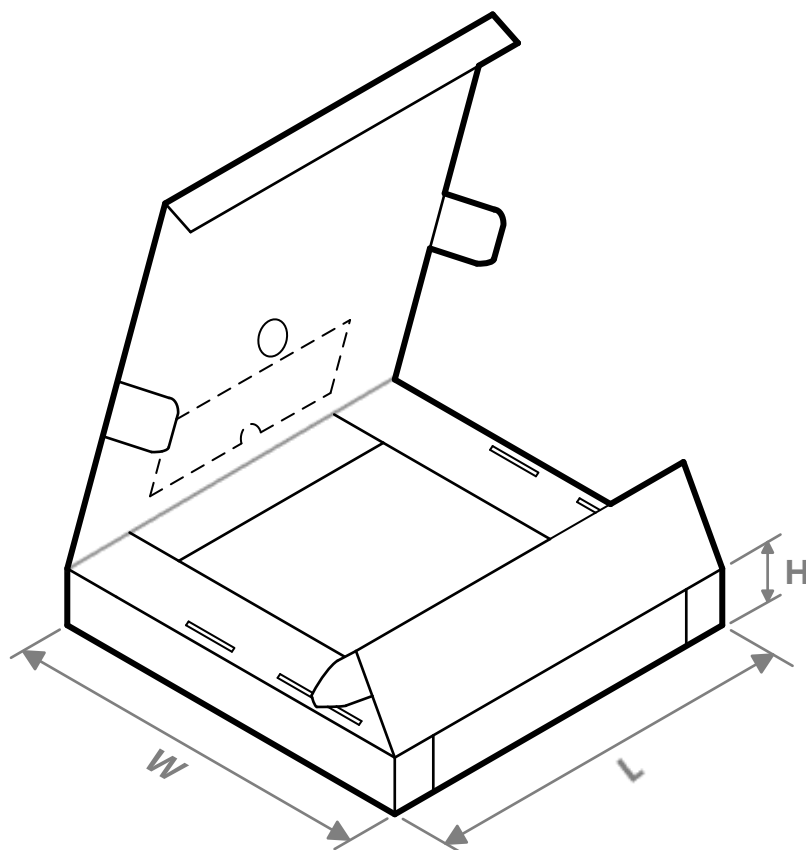


A0	Dimension designed to accommodate the component width; 料槽宽度
B0	Dimension designed to accommodate the component length; 料槽长度
K0	Dimension designed to accommodate the component thickness; 料槽厚度
W	Overall width of the carrier tape; 载带整体宽度
P1	Pitch between successive cavity centers; 相邻槽中心间距

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



器件料号 Part No.	封装类型 Package Type	封装标识 Package Code	引脚数 Pins	SPQ	料盘直径 D_R (mm)	料盘宽度 W_1 (mm)	A_0 (mm)	B_0 (mm)	K_0 (mm)	P_1 (mm)	W (mm)	Pin1 象限 Quadrant
HT97226SQER	QFN3×3	SQE	16	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

TAPE AND REEL BOX INFORMATION


器件料号 Part No.	封装类型 Package Type	封装标识 Package Code	引脚数 Pins	SPQ	长度 Length (mm)	宽度 Width (mm)	高度 Height (mm)
HT97226SQER	QFN3×3	SQE	16	TBD	TBD	TBD	TBD

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