



九齊科技股份有限公司  
Nyquest Technology Co., Ltd.

DATA SHEET

# NY9A004A

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## 2.5W Stereo Audio Power Amplifier with Headphone Driver

**Version 1.1**

**Nov. 25, 2015**

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## Revision History

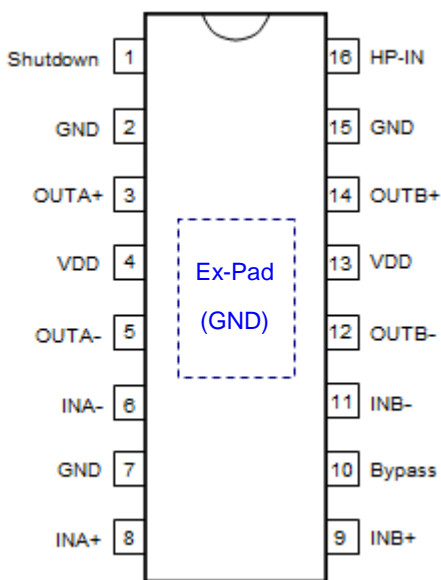
<i>Version</i>	<i>Date</i>	<i>Description</i>	<i>Modified Page</i>
1.0	2015/04/09	New release.	-
1.1	2015/11/25	1. Modify the attribute for pin 10. 2. Modify DC characteristics.	5 6

## 1. 概述

NY9A004A為CMOS的立體聲音頻功率放大器IC，利用大型積體電路(LSI)製造技術，具有低電源及低成本的特性，在使用時只需要很少的週邊元件。NY9A004A則是一款橋式(Bridge-Tied Load)或單端/接地(Single-Ended)可支援耳機輸出的音頻功率放大器。在5V電源電壓下，它能向4Ω負載提供2.5W的輸出功率，或向3Ω負載提供2.7W的輸出功率，THD+N 小於10%。

## 2. 功能

- (1). 寬廣的工作電壓：1.8V ~ 6.8V。
- (2). NY9A004A: 橋式(BTL, Bridge-Tied Load) 或 單端/接地(SE, Single-Ended) 模式操作。
- (3). 高輸出功率： $P_{OUT}$  為2.5W，條件為  $V_{DD} = 5V$ ,  $Load = 4\Omega$ ,  $f = 1KHz$  和  $THD+N = 10\%$ 。
- (4). 低關斷(待機)電流。(Typ.=0.1uA)
- (5). 不需額外的輸出耦合電容、緩衝電容或啟動電容。
- (6). BTL 橋式輸出能夠直接推動電容式負載(蜂鳴片)。
- (7). 內建自動 Ramp-up/Ramp-down 線路，能有效抑制開關時的雜音(Pop noise)，可以使用 $C_b$  Bypass電容來調整Ramp-up/Ramp-down 的時間。
- (8). 內建過溫保護功能(TSD, Thermal Shutdown) 以及過流保護功能(OCP, Over Current Protection)。
- (9). 高達 5KV 的人體靜電模式 (HBM) 的 ESD 保護。
- (10). 提供 SOP-16 和 ESOP-16 封裝。



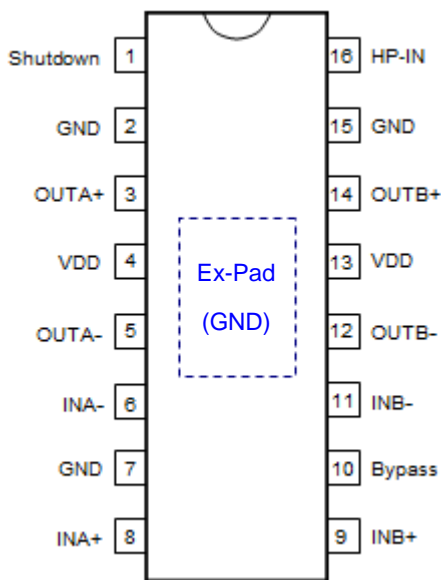
: ESOP-16 才有的外部焊墊，必須連接到PCB的接地散熱片以利散熱。

**1. GENERAL DESCRIPTION**

The NY9A004A is stereo audio power amplifier CMOS ICs. It is designed by LSI high technology with a low-power and low-cost process. Less peripheral components are required in application. NY9A004A is a Bridge-Tied Load (BTL) or a Single-Ended (SE) power amplifier with headphone support. It is capable of delivering 2.5W of average power to a 4Ω load or 2.7W of average power to a 3Ω load with less than 10% distortion (THD+N) from a 5V power supply.

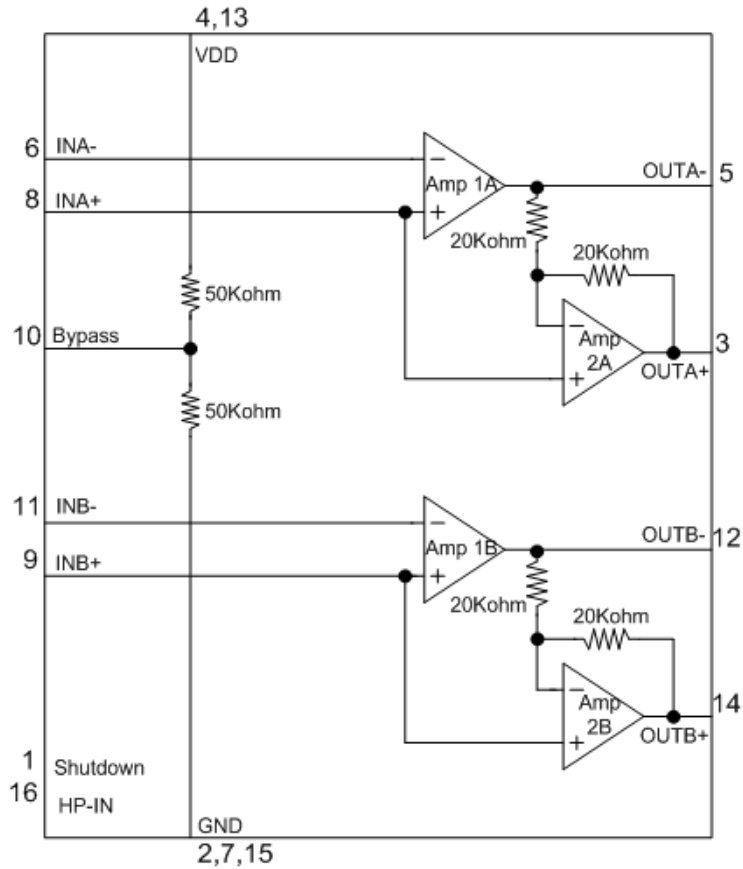
**2. FEATURES**

- (1). Wide operating voltage range:  $V_{DD} = 1.8V \sim 6.8V$ .
- (2). NY9A004A: Bridge-Tied Load (BTL) or Single-Ended (SE) modes operation.
- (3). High output power:  $P_{OUT}$  is 2.5W for  $V_{DD} = 5V$ , Load =4Ω,  $f = 1KHz$  and THD+N = 10%.
- (4). Low standby (shutdown) current. (Typ.=0.1uA)
- (5). No output coupling capacitors, snubber networks or bootstrap capacitors required.
- (6). BTL output can directly drive capacitive loads such like piezo-buzzer.
- (7). Built-in auto Ramp-up/ Ramp-down circuit to minimize the turn-on and turn-off pop noise. The time of Ramp-up/ Ramp-down can be adjusted by  $C_b$  bypass capacitor.
- (8). Built-in Thermal Shutdown (TSD) and Over Current Protection (OCP).
- (9). High 5KV Human Body Mode (HBM) ESD protection.
- (10). SOP-16 and ESOP-16 package type are available.



: Exposed pad for ESOP-16 only. Must be connected to PCB ground plane for heat dissipation.

### 3. BLOCK DIAGRAM



### 4. PIN DESCRIPTION

Pin #	Pin Name	ATTR.	Description
1	Shutdown	I	Active High input to disable NY9A004A operation.
2, 7, 15	GND	Power	Ground reference.
3	OUTA+	O	OUTA+ is channel A positive BTL output.
4, 13	VDD	Power	Power input
5	OUTA-	O	OUTA- is channel A negative output for BTL and SE mode.
6	INA-	I	Channel A Audio input.
8	INA+	I	INA+ is the channel A internal mid-supply bias, this pin should be connected to Bypass pin.
9	INB+	I	INB+ is the channel B internal mid-supply bias, this pin should be connected to Bypass pin.
10	Bypass	I	Mid-supply bias at VDD/2 with an external 0.1uF ~ 1.0uF capacitor.
11	INB-	I	Channel B Audio input.
12	OUTB-	O	OUTB- is channel B negative output for BTL and SE mode.
14	OUTB+	O	OUTB+ is channel B positive BTL output.
16	HP-IN	I	When HP-IN is low, NY9A004A is in BTL mode. When HP-IN is high, NY9A004A is in SE mode.

## 5. ELECTRICAL CHARACTERISTICS

### 5.1 Absolute Maximum Rating

Symbol	Parameter	Rating	Unit	
$V_{DD} - V_{SS}$	Supply voltage	-0.5 ~ +7.0	V	
$V_{IN}$	Input voltage	$V_{SS}-0.3V \sim V_{DD}+0.3$	V	
$\theta_{JA}$	Thermal resistance (Junction to Ambient)	SOP-16	123	°C/W
		ESOP-16	45	
$P_D$	Power dissipation	SOP-16	1.1	W
		ESOP-16	3.0	
$T_A$	Operating ambient temperature	-40 ~ +85	°C	
$T_J$	Operating junction temperature	+170	°C	
$T_{ST}$	Storage temperature	-55 ~ +170	°C	

### 5.2 DC Characteristics

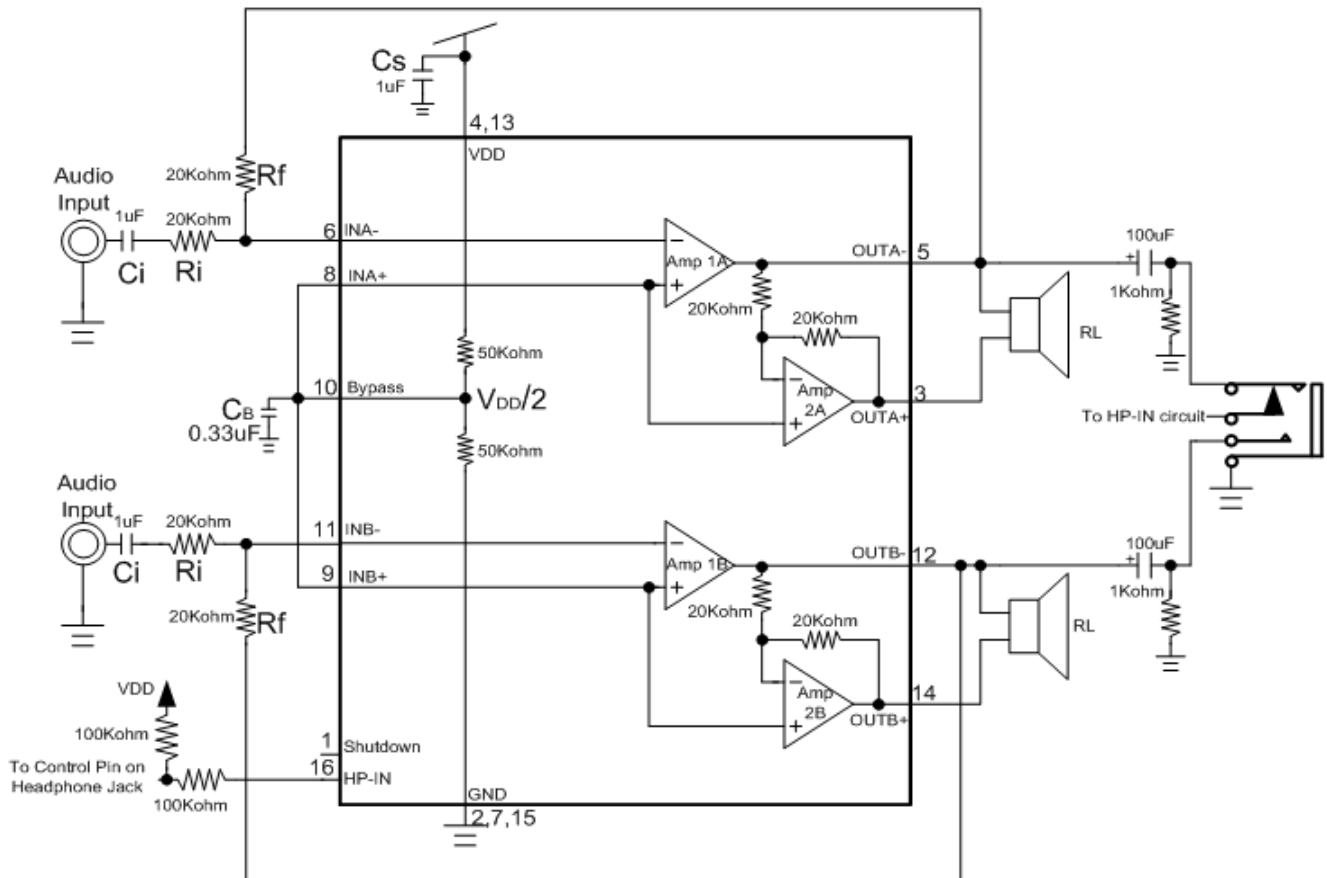
(BTL Mode,  $V_{DD}=5.0V$ ,  $T_A=25^\circ C$ , unless otherwise specified)

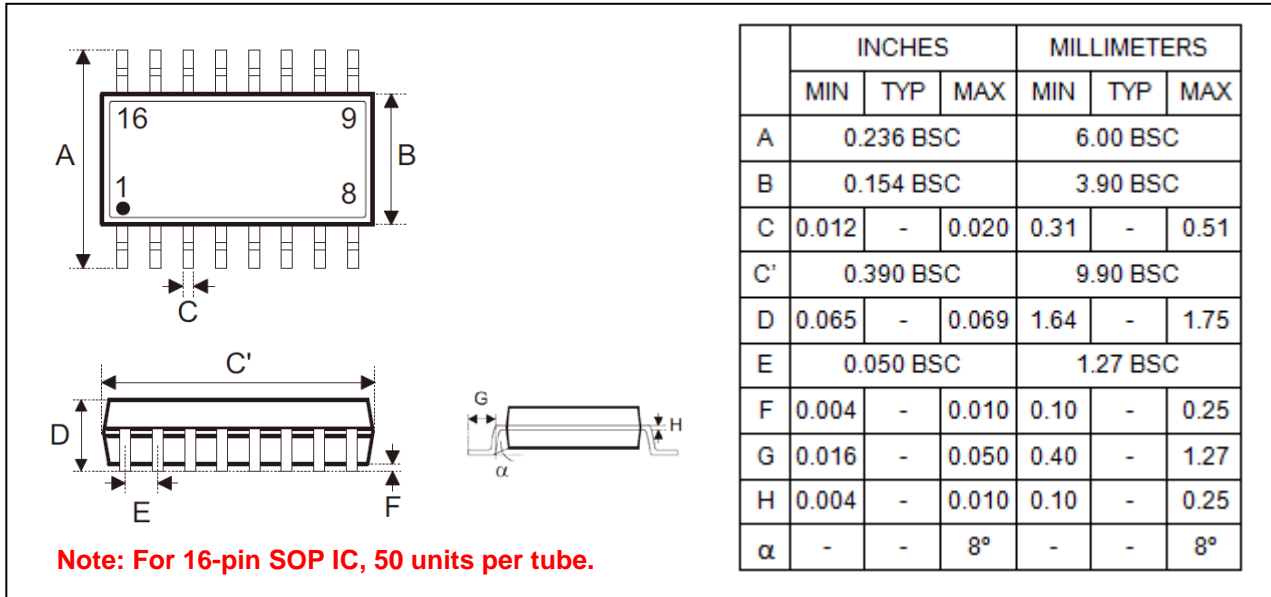
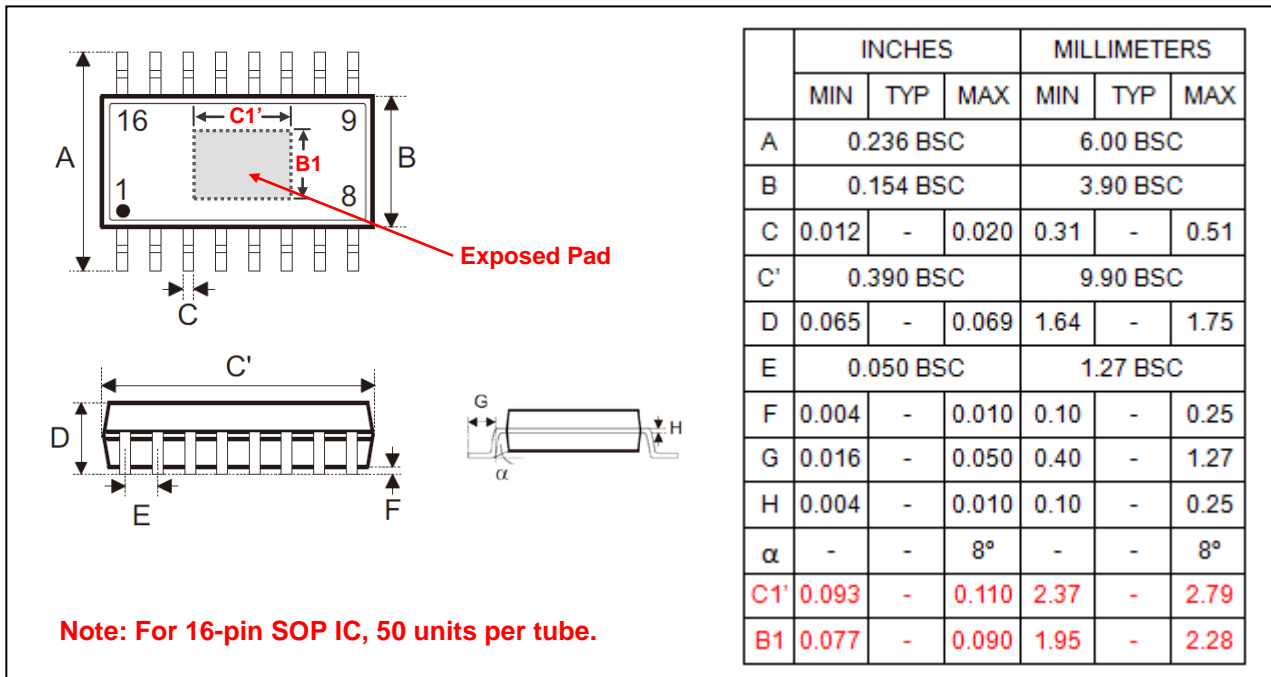
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition	
$V_{DD}$	Operating voltage	1.8		6.8	V		
$I_{SB}$	Standby (Shutdown) current		0.1	1	uA	Shutdown is enabled.	
$I_{OP}$	Operating current (BTL mode)	$V_{DD} = 3.0V$		6.2	mA	No load	
		$V_{DD} = 5.0V$		8.4	mA		
	Operating current (SE mode)	$V_{DD} = 3.0V$		3.2	mA		
		$V_{DD} = 5.0V$		4.3	mA		
THD+N	Total harmonic distortion + noise		0.2		%	$R_L = 4\Omega$ , $P_{OUT} = 1.75W$	
			0.15		%	$R_L = 8\Omega$ , $P_{OUT} = 1.0W$	
SNR	Signal-to-Noise ratio		107		dB	$R_L = 8\Omega$ , $P_{OUT} = 1.1W$	
$P_{OUT}$	Output power (f = 1kHz)	$R_L = 3\Omega$		2.2	W	THD+N = 1%	
				2.75	W	THD+N = 10%	
		$R_L = 4\Omega$		2	W	THD+N = 1%	
				2.47	W	THD+N = 10%	
		$R_L = 8\Omega$		1.27			THD+N = 1%
				1.6			THD+N = 10%
$V_{OS}$	Output offset voltage		6	30	mV	$V_{IN} = 0V$	
PSRR	Power supply rejection ratio		62		dB	f = 1kHz	
$X_{TALK}$	Channel separation		74		dB	f = 1kHz, $C_B = 1\mu F$	
$T_{TSD}$	Thermal shutdown (TSD)		170		°C	Junction temperature	
$T_{ON}$	Wakeup time		140		ms	$C_B = 0.1\mu F$	
			240		ms	$C_B = 0.33\mu F$	
$T_{OFF}$	Shutdown time		180		ms	$C_B = 0.1\mu F$	
			380		ms	$C_B = 0.33\mu F$	

(SE Mode,  $V_{DD}=5.0V$ ,  $T_A=25^\circ C$ , unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
$V_{OS}$	Output offset voltage		5	30	mV	$V_{IN} = 0V$
THD+N	Total harmonic distortion + noise		0.03		%	$AV = -1V/V$ , $R_L = 32\Omega$ , $P_{OUT} = 50mW$
$P_{OUT}$	Output power ( $f = 1kHz$ )	$R_L = 32\Omega$		75	mW	THD+N = 0.5%
		$R_L = 8\Omega$		290	mW	THD+N = 1%
				370	mW	THD+N = 10%
SNR	Signal-to-Noise ratio		107		dB	$R_L = 8\Omega$ , $P_{OUT} = 340mW$
PSRR	Power supply rejection ratio		65		dB	$f = 1kHz$
$X_{TALK}$	Channel separation		60		dB	$f = 1kHz$ , $C_B = 1\mu F$
$T_{ON}$	Wakeup time		140		ms	$C_B = 0.1\mu F$
			240		ms	$C_B = 0.33\mu F$
$T_{OFF}$	Shutdown time		180		ms	$C_B = 0.1\mu F$
			380		ms	$C_B = 0.33\mu F$

## 6. APPLICATION CIRCUIT



**7. PACKAGE DIMENSION**
**16-Pin Plastic SOP (150 mil)**

**16-Pin Plastic ESOP with Exposed Pad (150 mil)**

**8. ORDERING INFORMATION**

P/N	Package Type	Package Width	Shipping
NY9A004AS16	SOP-16	150 mil.	Tape & Reel: 2.5K pcs per Reel Tube: 50 pcs per Tube
NY9A004AE16	ESOP-16	150 mil.	