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

DATA SHEET

NY9A001A/NY9A002A

2.5W Audio Power Amplifier

Version 1.0

Apr. 16, 2014

Revision History

Version	*Date*	*Description*	*Modified Page*
1.0	2014/04/16	New release.	-

1. 概述

NY9A001A和NY9A002A爲CMOS的單聲道音頻功率放大器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。NY9A001A是一款橋式(Bridge-Tied Load)音頻功率放大器，NY9A002A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3.0W 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). NY9A001A: 橋式(BTL, Bridge-Tied Load)。

(3). NY9A002A: 橋式(BTL, Bridge-Tied Load) 或 單端/接地(SE, Single-Ended) 模式操作。

(4). 高輸出功率：P_{OUT} 爲2.5W，條件爲 V_{DD} = 5V, Load = 4Ω, f = 1kHz 和 THD+N = 10%。

(5). 低關斷(待機)電流。 (Typ.=0.1uA)

(6). 支援PWM差動訊號輸入(Differential signal input)。(NY9A001A)

(7). 不需額外的輸出耦合電容、緩衝電容或啓動電容。

(8). BTL 橋式輸出能夠直接推動電容式負載(蜂鳴片)。

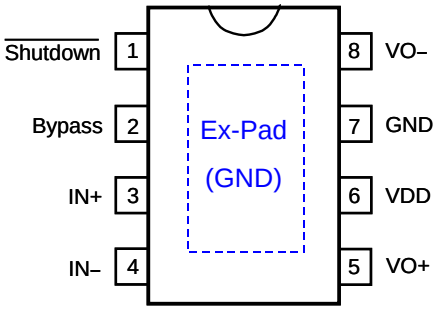
(9). 內建自動 Ramp-up/Ramp-down 線路，能有效抑制開關時的雜音(Pop noise)，可以使用C_b Bypass電容來調整Ramp-up/Ramp-down 的時間。

(10). 內建過溫保護功能 (TSD, Thermal Shutdown)。

(11). 高達 5KV 的人體靜電模式 (HBM) 的 ESD 保護。

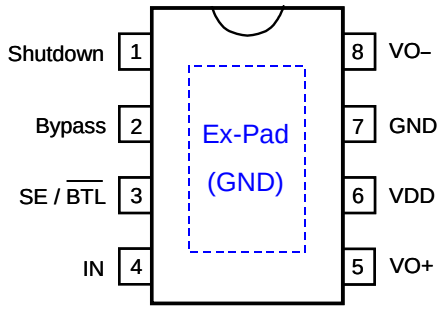
(12). 提供 SOP-8 和 ESOP-8 封裝。

NY9A001A



SOP-8 / ESOP-8

NY9A002A



SOP-8 / ESOP-8

: ESOP-8 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 NY9A001A & NY9A002A are mono audio power amplifier CMOS ICs. They are designed by LSI high technology with a low-power and low-cost process. Less peripheral components are required in application. NY9A001A is a Bridge-Tied Load (BTL) power amplifier, and NY9A002A 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 3.0W 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 ~ 6.8V.

(2). NY9A001A: Bridge-Tied Load (BTL).

(3). NY9A002A: Bridge-Tied Load (BTL) or Single-Ended (SE) modes operation.

(4). High output power: P_{OUT} is 2.5W for V_{DD} = 5V, Load =4Ω, f = 1kHz and THD+N = 10%.

(5). Low standby (shutdown) current. (Typ.=0.1uA)

(6). Support PWM differential signal input. (NY9A001A)

(7). No output coupling capacitors, snubber networks or bootstrap capacitors required.

(8). BTL output can directly drive capacitive loads such like piezo-buzzer.

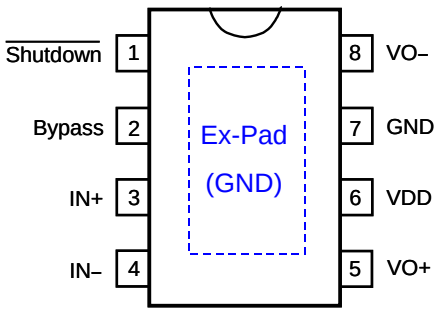
(9). Built-in auto Ramp-up/ Ramp-down circuit to minimize the turn-on and turn-off pop noise. The time of Ramp-up/ Ramp-down can be adjusted by C_b bypass capacitor.

(10). Built-in Thermal Shutdown (TSD).

(11). High 5KV Human Body Mode (HBM) ESD protection.

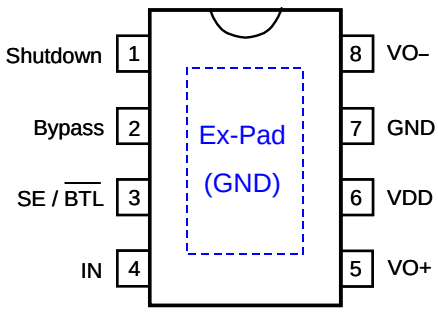
(12). SOP-8 and ESOP-8 package type are available.

NY9A001A



SOP-8 / ESOP-8

NY9A002A

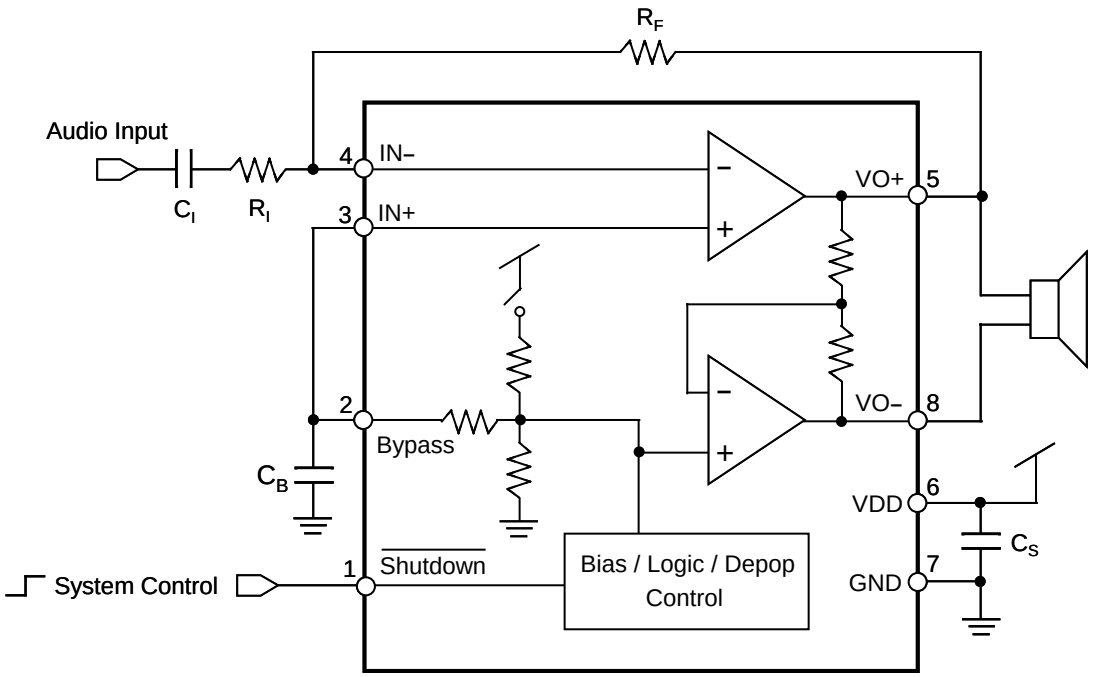


SOP-8 / ESOP-8

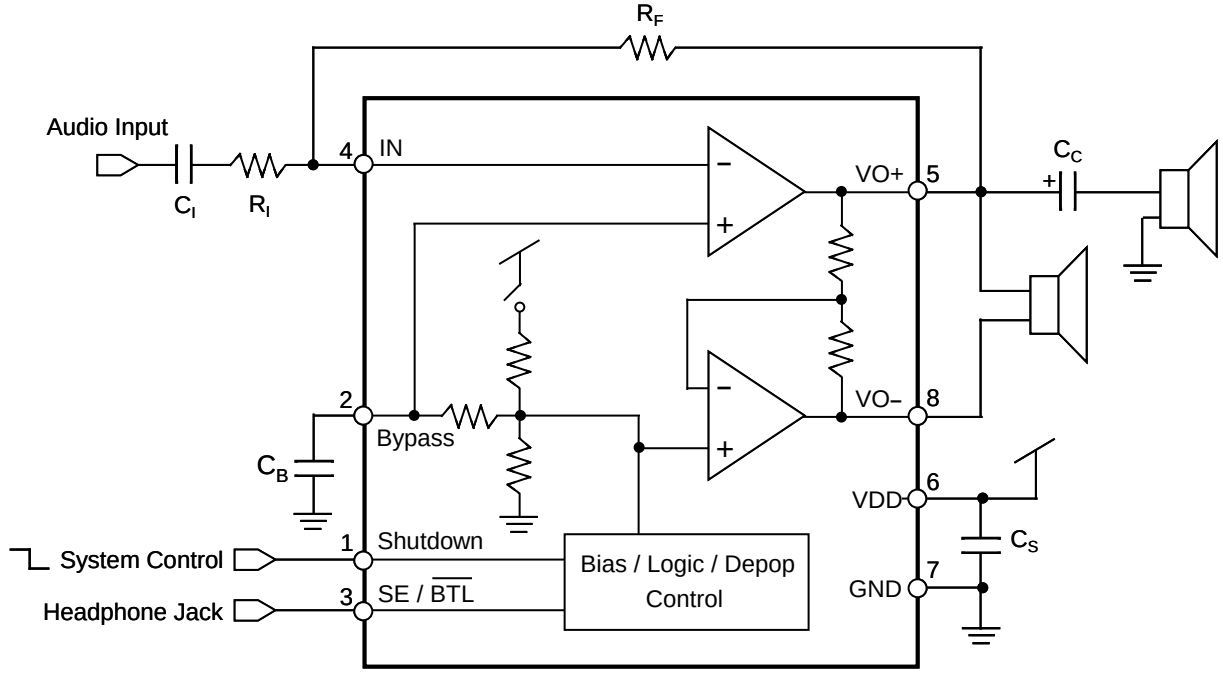
: Exposed pad for ESOP-8 only. Must be connected to PCB ground plane for heat dissipation.

3. BLOCK DIAGRAM

3.1 NY9A001A



3.2 NY9A002A



4. PIN DESCRIPTION

4.1 NY9A001A

Pin #	Pin Name	ATTR.	Description
1	$\overline{\text{Shutdown}}$	I	Active low input to disable NY9A operation.
2	Bypass	I	Mid-supply bias at VDD/2 with an external 0.1uF ~ 1.0uF capacitor.
3	IN+	I	Non-inverting input.
4	IN-	I	Inverting input.
5	VO+	O	Positive BTL output.
6	VDD	Power	Power input.
7	GND	Power	Ground reference.
8	VO-	O	Negative BTL output.
9	Ex-Pad	Power	Exposed pad for thermal tab, must be connected to GND. *(ESOP-8 only)*

4.2 NY9A002A

Pin #	Pin Name	ATTR.	Description
1	Shutdown	I	Active high input to disable NY9A002A operation.
2	Bypass	I	Mid-supply bias at VDD/2 with an external 0.1uF ~ 1.0uF capacitor.
3	SE / $\overline{\text{BTL}}$	I	When this input is high, NY9A002A is in SE mode. When this input is low, NY9A002A is in BTL mode.
4	IN	I	Inverting input.
5	VO+	O	Positive BTL output.
6	VDD	Power	Power input.
7	GND	Power	Ground reference.
8	VO-	O	Negative BTL output.
9	Ex-Pad	Power	Exposed pad for thermal tab, must be connected to GND. *(ESOP-8 only)*

5. ELECTRICAL CHARACTERISTICS

5.1 Absolute Maximum Rating

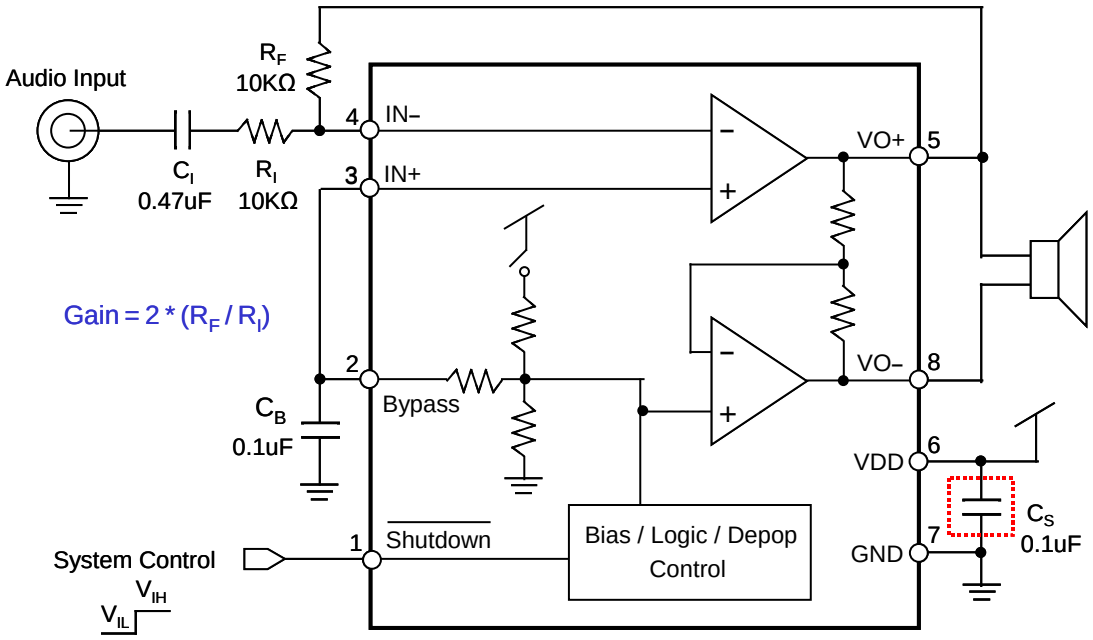
Symbol	Parameter		Rating	Unit
V_{DD} - V_{SS}	Supply voltage		-0.5 ~ +7.0	V
V_{IN}	Input voltage		V_{SS}-0.3V ~ V_{DD}+0.3	V
θ_{JA}	Thermal resistance (Junction to Ambient)	SOP-8	150	°C/W
		ESOP-8	60	
P_D	Power dissipation	SOP-8	1.0	W
		ESOP-8	2.5	
T_A	Operating ambient temperature		-40 ~ +85	°C
T_J	Operating junction temperature		+170	°C
T_{ST}	Storage temperature		-55 ~ +170	°C

5.2 DC Characteristics *(V_{DD}=5.0V, T_A=25ºC, unless otherwise specified)*

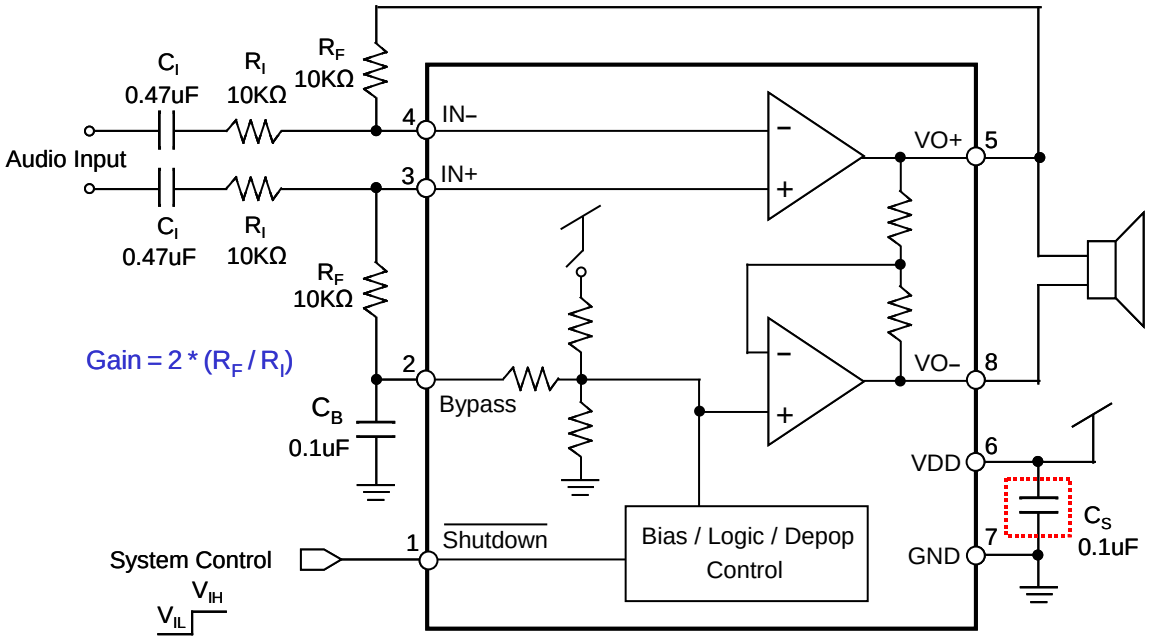
Symbol	Parameter		Min.	Typ.	Max.	Unit	Condition
V_{DD}	Operating voltage		1.8		6.8	V	
I_{SB}	Standby (Shutdown) current			0.1	1	uA	Shutdown is enabled.
I_{OP}	Operating current (BTL mode)	V_{DD} = 3.0V		1.6		mA	No load
		V_{DD} = 5.0V		2.0		mA	
	Operating current (SE mode)	V_{DD} = 3.0V		0.9		mA	
		V_{DD} = 5.0V		1.2		mA	
THD+N	Total harmonic distortion + noise			0.1		%	R_L = 4Ω, P_{OUT} = 1.0W
				0.1		%	R_L = 8Ω, P_{OUT} = 1.0W
SNR	Signal-to-Noise ratio			100		dB	R_L = 4Ω, P_{OUT} = 1.6W
				102		dB	R_L = 8Ω, P_{OUT} = 1.0W
P_{OUT}	Output power (f = 1kHz)	R_L = 4Ω		2.0		W	THD+N = 1%
				2.5		W	THD+N = 10%
		R_L = 8Ω		1.3		W	THD+N = 1%
				1.6		W	THD+N = 10%
V_{OS}	Output offset voltage			6	30	mV	V_{IN} = 0V
PSRR	Power supply rejection ratio			70		dB	f = 1kHz
T_{ON}	Wakeup time (BTL mode)			63		ms	C_B = 0.1uF
				100		ms	C_B = 0.47uF
	Wakeup time (SE mode)			70		ms	C_B = 0.1uF
				145		ms	C_B = 0.47uF
T_{OFF}	Shutdown time (BTL mode)			5		ms	C_B = 0.1uF
				37		ms	C_B = 0.47uF
	Shutdown time (SE mode)			25		ms	C_B = 0.1uF
				160		ms	C_B = 0.47uF

7. APPLICATION CIRCUIT

7.1 NY9A001A Typical Application

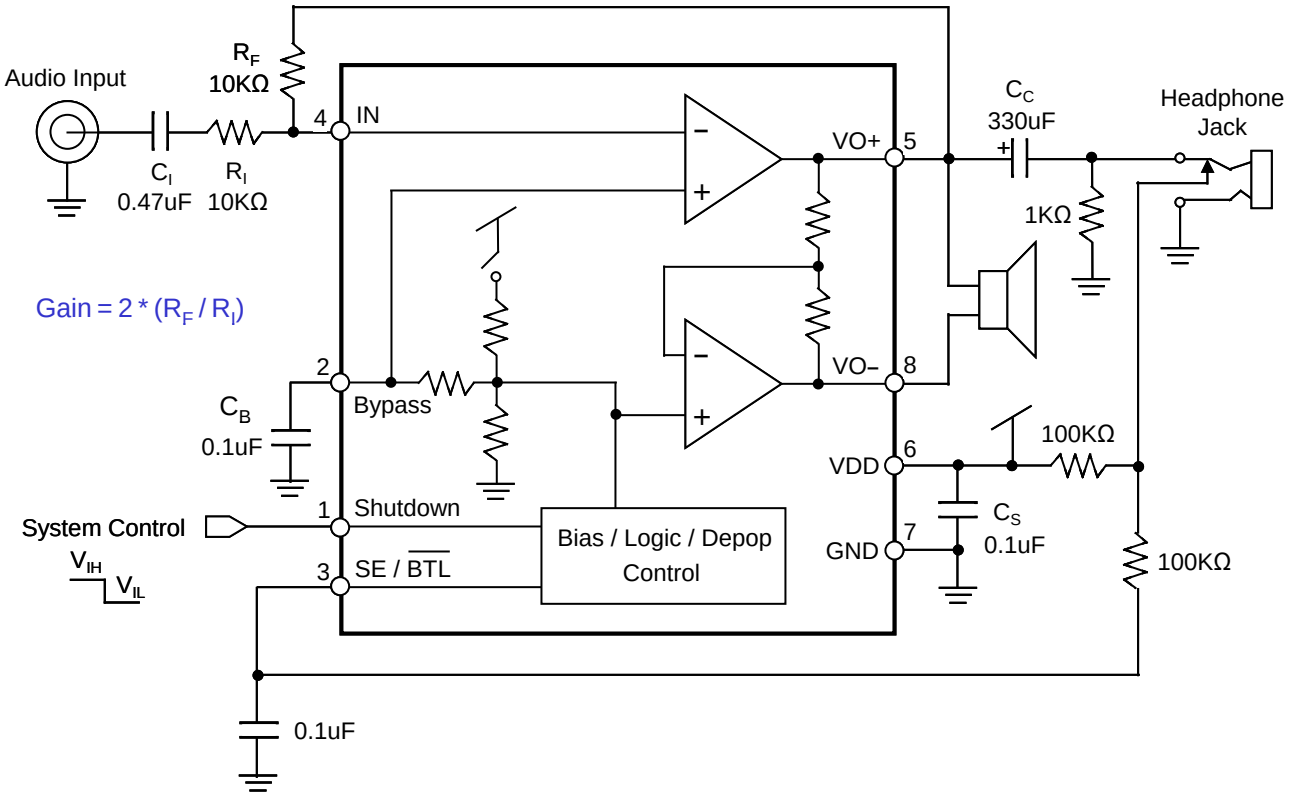


7.2 NY9A001A Differential Input Application



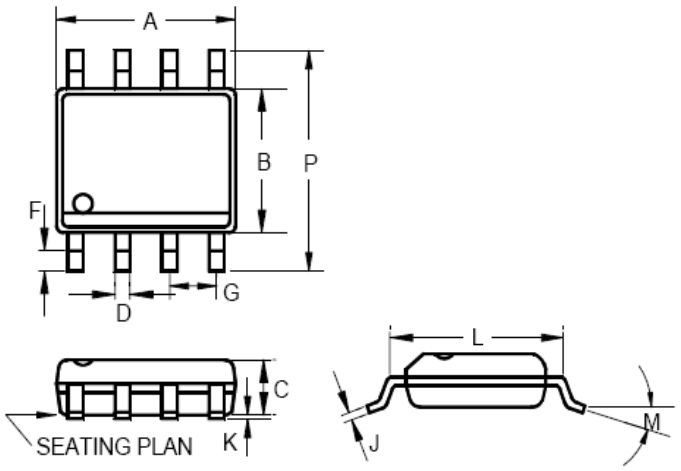
** In toy application, C_S (0.1uF) can be saved, but please reserve C_S space at PCB layout.*

7.3 NY9A002A Typical Application



8. PACKAGE DIMENSION

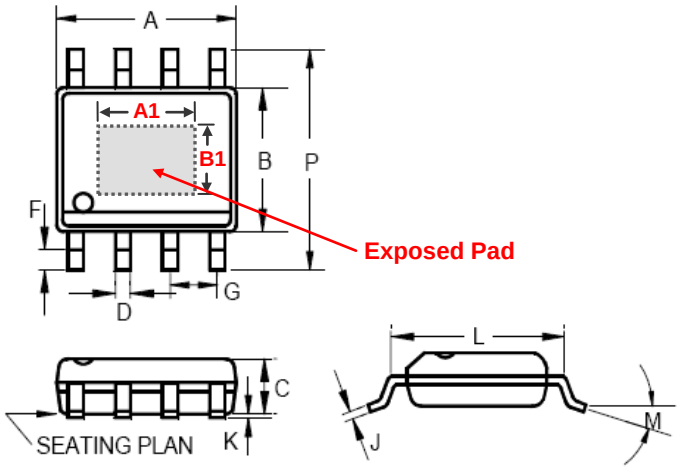
8.1 8-Pin Plastic SOP (150 mil)



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.183	-	0.202	4.65	-	5.13
B	0.144	0.150	0.163	3.66	3.81	4.14
C	0.068	-	0.074	1.35	-	1.88
D	0.010	-	0.020	0.25	-	0.51
F	0.015	-	0.035	0.38	-	0.89
G	0.050 BSC			1.27 BSC		
J	0.007	-	0.010	0.19	-	0.25
K	0.005	-	0.010	0.13	-	0.25
L	0.189	-	0.205	4.80	-	5.21
M	-	-	8°	-	-	8°
P	0.228	-	0.244	5.79	-	6.20

Note: For 8-pin SOP IC, 100 units per tube.

8.2 8-Pin Plastic ESOP with Exposed Pad (150 mil)



	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.183	-	0.202	4.65	-	5.13
B	0.144	0.150	0.163	3.66	3.81	4.14
C	0.068	-	0.074	1.35	-	1.88
D	0.010	-	0.020	0.25	-	0.51
F	0.015	-	0.035	0.38	-	0.89
G	0.050 BSC			1.27 BSC		
J	0.007	-	0.010	0.19	-	0.25
K	0.005	-	0.010	0.13	-	0.25
L	0.189	-	0.205	4.80	-	5.21
M	-	-	8°	-	-	8°
P	0.228	-	0.244	5.79	-	6.20
A1	0.077		0.090	1.95	-	2.28
B1	0.077		0.090	1.95	-	2.28

Note: For 8-pin SOP IC, 100 units per tube.

9. ORDERING INFORMATION

P/N	*Shipping Type*	*Remarks*
NY9A001AS8	SOP-8	Width 150 mil.
NY9A001AE8	ESOP-8	Width 150 mil.
NY9A002AS8	SOP-8	Width 150 mil.
NY9A002AE8	ESOP-8	Width 150 mil.