Document Title

1W Per Channel Stereo Class-D Audio Power Amplifier

Revision History

Rev. No.	History	Issue Date	Remark
0.0	Initial issue	October 8, 2001	Preliminary
0.1	Add Application Circuits and Important Notice Change document title from “2 Channel 1W Stereo Class-D Audio Power Amplifier” to “1W Per Channel Stereo Class-D Audio Power Amplifier”	November 7, 2001	

Preliminary — 1W Per Channel Stereo Class-D Audio Power Amplifier

Features

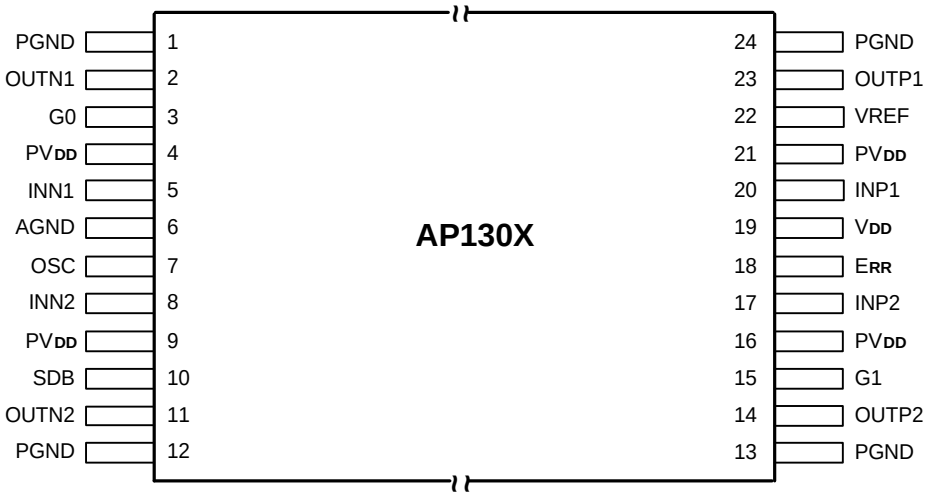
- 1 watt per channel with 8-ohm load
- Max. efficiency ≈ 80% with 8-ohm load at 5 volts
- Filterless
- Digital gain control
- Build-in depop circuitry
- Error protection for short circuit and over-temperature
- Mute (shutdown) current < 1μA typical
- Low operating current (4mA at 5 volts without load)
- TSSOP 24L package available

General Description

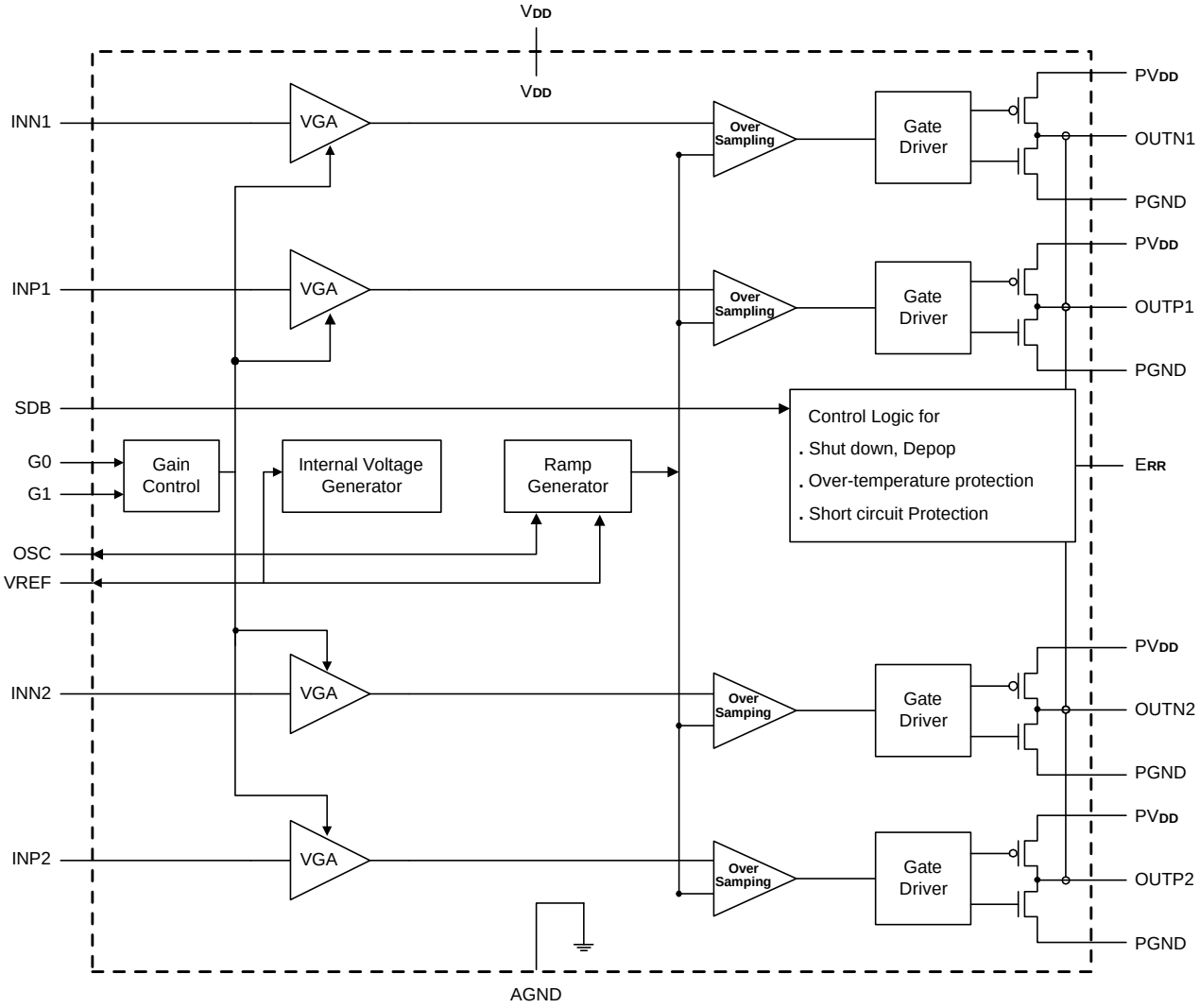
The AP130 is an oversampling class-D power amplifier for stereo audio applications. It provides high power-efficiency for filterless 8-ohm load. Build-in depop, mute and gain control features simplify the applications.
BTL (Bridge-Tied-Load) configuration delivers up to 1 watt into 8-ohm load per channel at 5-V supply voltage. It allows direct coupling of the power signal. Reliability is improved through over-temperature and short circuit protections.
The class-D power amplifier enables high efficiency applications for portable devices.

Pin Configurations

■ **TSSOP**



Block Diagram



Pin Function

Pin No.	Signal Name	I/O	Function Description
6	AGND	PWR	Ground for Analog circuitry
22	VREF	I/O	Internal voltage reference
7	OSC	I/O	A 220pF capacitor connected to this pin sets the ramp frequency to ≈ 3µs
3	G0	I	Bit 0 of gain control
15	G1	I	Bit 1 of gain control
5	INN1	I	Channel 1 negative differential input
20	INP1	I	Channel 1 positive differential input
2	OUTN1	O	Channel 1 negative output
23	OUTP1	O	Channel 1 positive output
1, 12 13, 24	PGND	PWR	Ground for noisy signals
4, 9 16, 21	PV_{DD}	PWR	Power supply for noisy signals
8	INN2	I	Channel 2 negative differential input
17	INP2	I	Channel 2 positive differential input
18	E_{RR}	O	A high output at E_{RR} indicates over-temperature, short circuit or depop in effect
11	OUTN2	O	Channel 2 negative output
14	OUTP2	O	Channel 2 positive output
10	SDB	I	Logic low to shutdown the amplifiers; Logic high to enable normal operation of the amplifiers
19	V_{DD}	PWR	Power supply for analog circuitry

Absolute Maximum Ratings Over Operating Free-air Temperature

Supply Voltage, V_{DD}, PV_{DD} ..... -0.3V to 6V
Input Voltage ..... -0.3V to VDD + 0.3V
Operating Free-air Temperature Range ..... -40°C to 85°C
Operating Junction Temperature Range ..... -40°C to 150°C
Storage Temperature Range ..... -65°C to 150°C

Recommended Operating Conditions

		Min.	Max.	Unit
Supply voltage, V_{DD}, PV_{DD}		2.7	5.5	V
High-level input voltage, V_{IH}	G0, G1, SDB	2		V
Low-level input voltage, V_{IL}	G0, G1, SDB		0.8	V
Operating free-air temperature, T_A		-40	85	°C
Ramp		200	400	kHz

Electrical Characteristics, TA=25°C, VDD=PVDD=5V (unless otherwise noted)

Parameter		Test Conditions	Min.	Typ.	Max.	Unit
$\lvert V_{OO} \rvert$	Output offset voltage	V_I = 0V			10	mV
PSRR	Power supply rejection ratio	V_{DD} = PV_{DD} = 2.7V to 5.5V		-77		dB
I_{IH}	High-level input current	V_{DD} = PV_{DD} = 5.5V, V_I = V_{DD} =PV_{DD}			1	μA
I_{IL}	Low-level input current	V_{DD} = PV_{DD} = 5.5V, V_I = 0V	-1			μA
I_{DD}	Supply current	V_{DD} = PV_{DD} = 5.5V		4	6	mA
$I_{DD(SD)}$	Supply current (shutdown)				1	μA

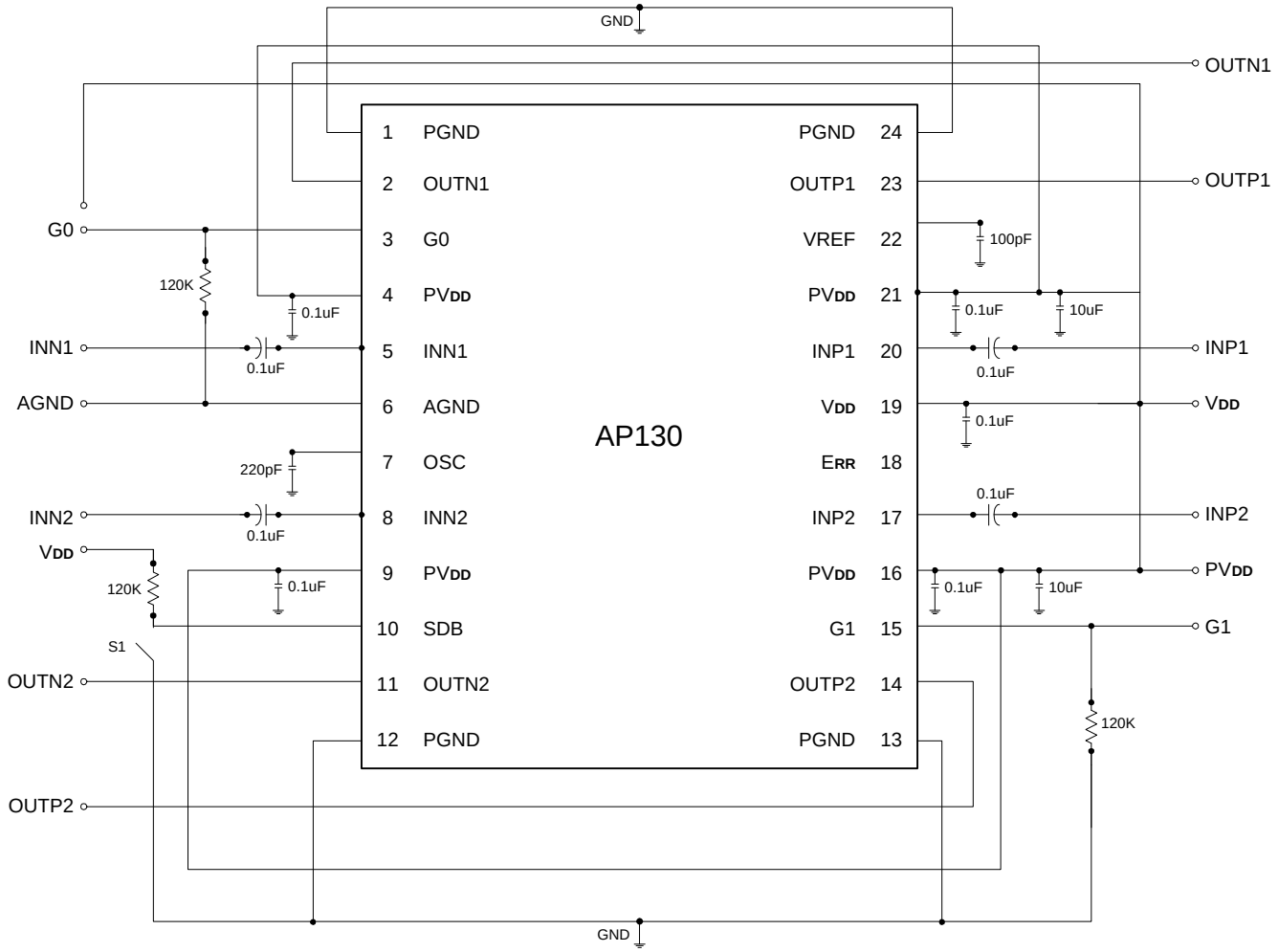
Operating Characteristics, TA=25°C, VDD=PVDD=5V, RL=8W, Gain=8dB

Parameter		Test Conditions	Min.	Typ.	Max.	Unit
P_O	Output power	THD = 0.4%, f = 1kHz, R_L = 8Ω		1		W
THD+N	Total harmonic distortion plus noise	P_O = 0.5W, f = 20Hz to 20kHz		<0.2%		
B_{OM}	Maximum output power bandwidth	THD = 5%		20		kHz
K_{SVR}	Supply ripple rejection ratio	f = 1kHz $C_{(VREF)}$ = 0.4μF		-60		dB
SNR	Signal-to-noise ratio	20Hz to 20kHz		87		dBV
Z_I	Input impedance			20		kΩ

Gain Settings

GAIN0	GAIN1	AMPLIFIER GAIN (dB)	INPUT IMPEDANCE (kW)
		Typ.	Typ.
0	0	8	20
0	1	12	20
1	0	17.5	20
1	1	23.5	20

Application Circuits



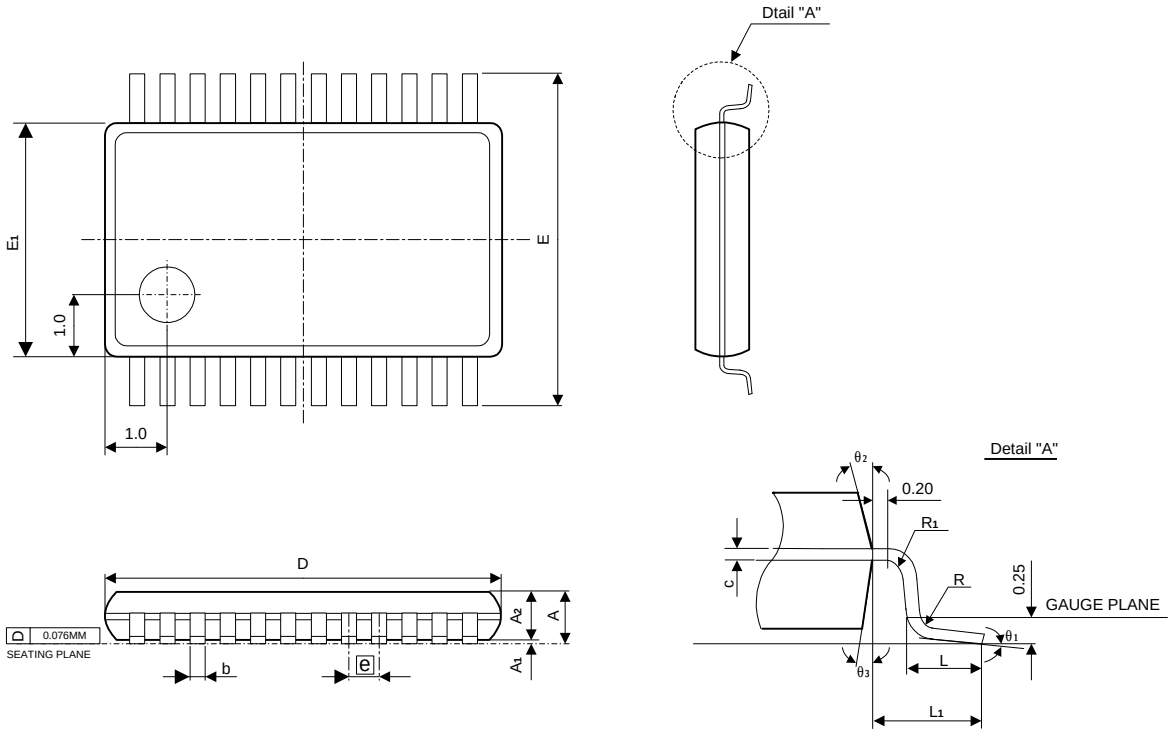
Ordering Information

Part No.	Package
AP130X	24L TSSOP

Package Information

TSSOP 24L (4.40mm BODY) Outline Dimensions

unit: inches/mm



Symbol	Dimensions in inches			Dimensions in mm		
	Min	Nom	Max	Min	Nom	Max
A	-	-	0.043	-	-	1.20
A_1	0.002	-	0.006	0.05	-	0.15
A_2	0.031	0.035	0.041	0.80	0.90	1.05
L	0.020	0.024	0.030	0.50	0.60	0.75
L_1	0.039 REF			1.0 REF		
D	0.303	0.307	0.311	7.70	7.80	7.90
E	0.252 BSC			6.40 BSC		
E_1	0.169	0.173	0.177	4.30	4.40	4.50
R	0.004	-	-	0.09	-	-
R_1	0.004	-	-	0.09	-	-
b	0.007	-	0.012	0.19	-	0.30
c	0.004	-	0.008	0.09	-	0.20
e	0.026 BSC			0.65 BSC		
θ_1	0°	-	8°	0°	-	8°
θ_2	12 REF			12 REF		
θ_3	12 REF			12 REF		

Notes:
1. The maximum value of dimension D includes end flash.
2. Dimension E does not include resin fins.