



Preliminary

1W Per Channel Stereo Class-D Audio Power Amplifier

Document Title

1W Per Channel Stereo Class-D Audio Power Amplifier

Revision History

<u>Rev. No.</u>	<u>History</u>	<u>Issue Date</u>	<u>Remark</u>
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	

Important Notice:

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Features

- 1 watt per channel with 8-ohm load
- Max. efficiency \approx 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 $< 1\mu\text{A}$ 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.

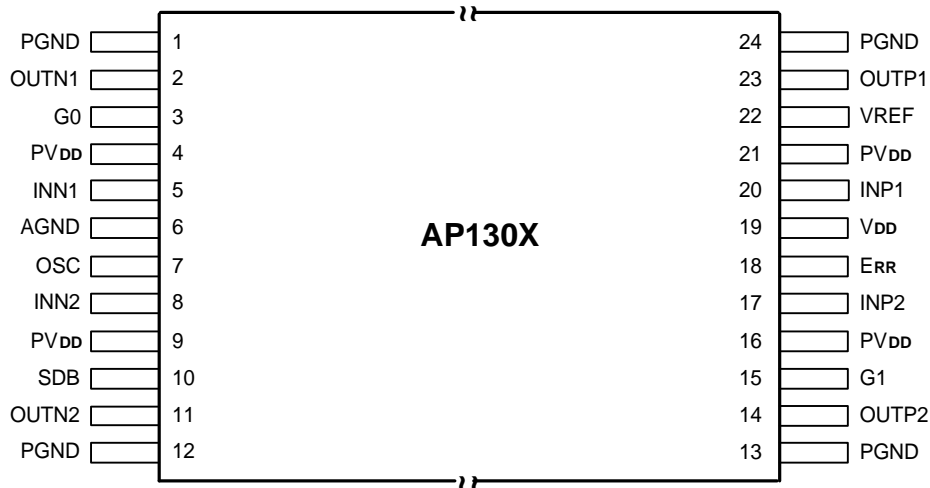
BTL (Bridge-Tied-Load) configuration delivers up to 1 watt into 8-ohm load per channel at 5-V supply voltage. It

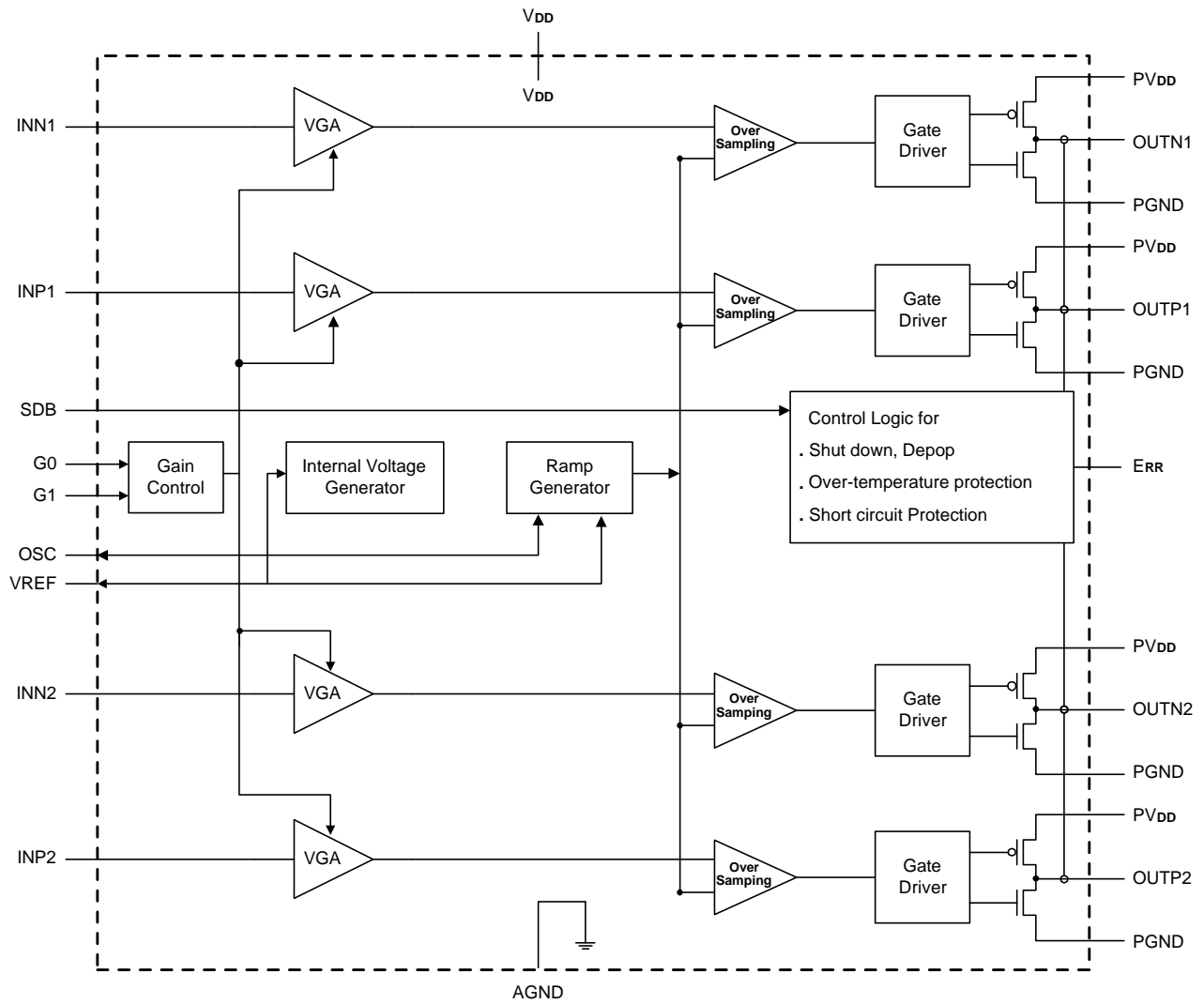
allows direct coupling of the power signal. Reliability is improved through over-temperature and short circuit protections.

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 $\approx 3\mu\text{s}$
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	PVDD	PWR	Power supply for noisy signals
8	INN2	I	Channel 2 negative differential input
17	INP2	I	Channel 2 positive differential input
18	ERR	O	A high output at ERR 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	VDD	PWR	Power supply for analog circuitry

Absolute Maximum Ratings Over Operating Free-air Temperature

Supply Voltage, VDD, PVDD	-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, $T_A=25^\circ\text{C}$, $V_{DD}=PV_{DD}=5\text{V}$ (unless otherwise noted)

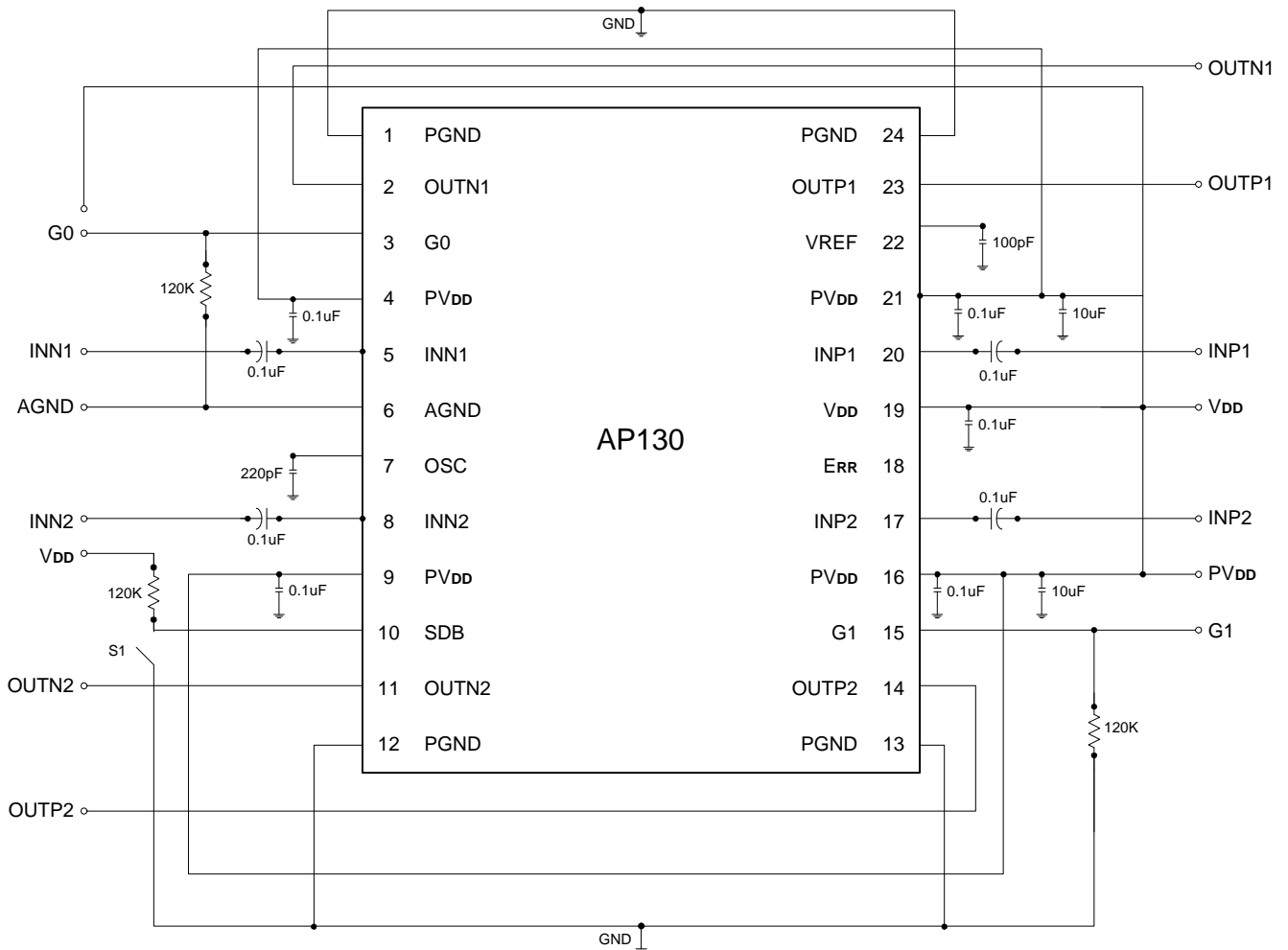
Parameter		Test Conditions	Min.	Typ.	Max.	Unit
$ V_{OO} $	Output offset voltage	$V_I = 0\text{V}$			10	mV
PSRR	Power supply rejection ratio	$V_{DD} = PV_{DD} = 2.7\text{V to } 5.5\text{V}$		-77		dB
I_{IH}	High-level input current	$V_{DD} = PV_{DD} = 5.5\text{V}$, $V_I = V_{DD} = PV_{DD}$			1	μA
I_{IL}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

Operating Characteristics, $T_A=25^\circ\text{C}$, $V_{DD}=PV_{DD}=5\text{V}$, $R_L=8\Omega$, Gain=8dB

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

Gain Settings

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

Application Circuits


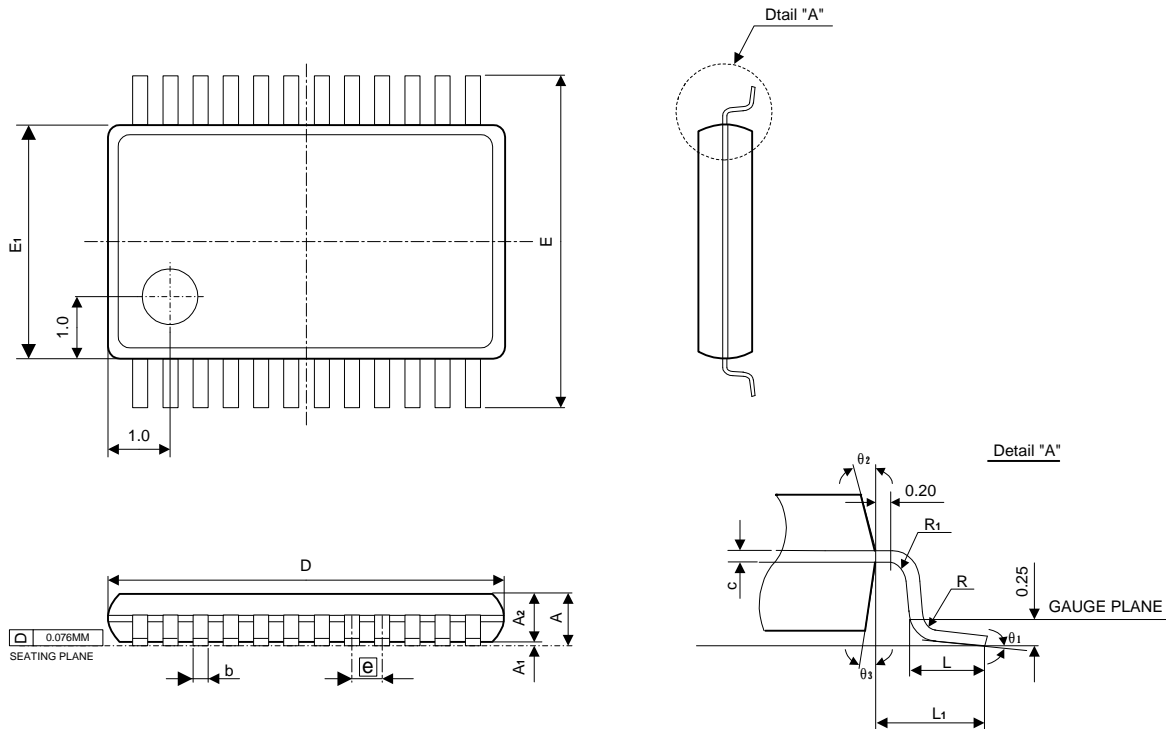


Ordering Information

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
A1	0.002	-	0.006	0.05	-	0.15
A2	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
L1	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		
E1	0.169	0.173	0.177	4.30	4.40	4.50
R	0.004	-	-	0.09	-	-
R1	0.004	-	-	0.09	-	-
b	0.007	-	0.012	0.19	-	0.30
c	0.004	-	0.008	0.09	-	0.20
\square 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.