NXA2101

1.4W fixed gain mono fully differential audio power amplifier

General Description

The NXA2101 is a 1.4W high efficiency audio power amplifier. It operates in extremely efficient class D operation, using the high switching speed of power MOS transistors. The NXA2101 is designed to meet the demands of mobile phones and other portable communication devices. The device operates from 2.5V to 5.5V, drawing only 2.5mA at 5V of quiescent supply current. The NXA2101 is available in space-saving 3mm*3mm DFN package. The NXA2101 features a low-power consumption shutdown mode, and thermal shutdown protection. It also utilizes circuitry to reduce "Pop noise" during device turn-on.

Features

. Supply Voltage : 2.5V~5.5V
. Mono BTL amplifier mode
. 1.4W into 8Ω From a 5V Supply at THD = 10% (Typ)
. Low Supply Current : 2.0mA typ at 3.6V
. Shutdown Current : 1.0uA (Max)
. Fixed Gain : 12.0dB / Under 12.0dB gain with external resister
. Short-circuit and Thermal Protection
. Self enable when remove protection condition
. Extremely low pop noise with sub-feedback technic
. Package : DFN-8 3mm*3mm

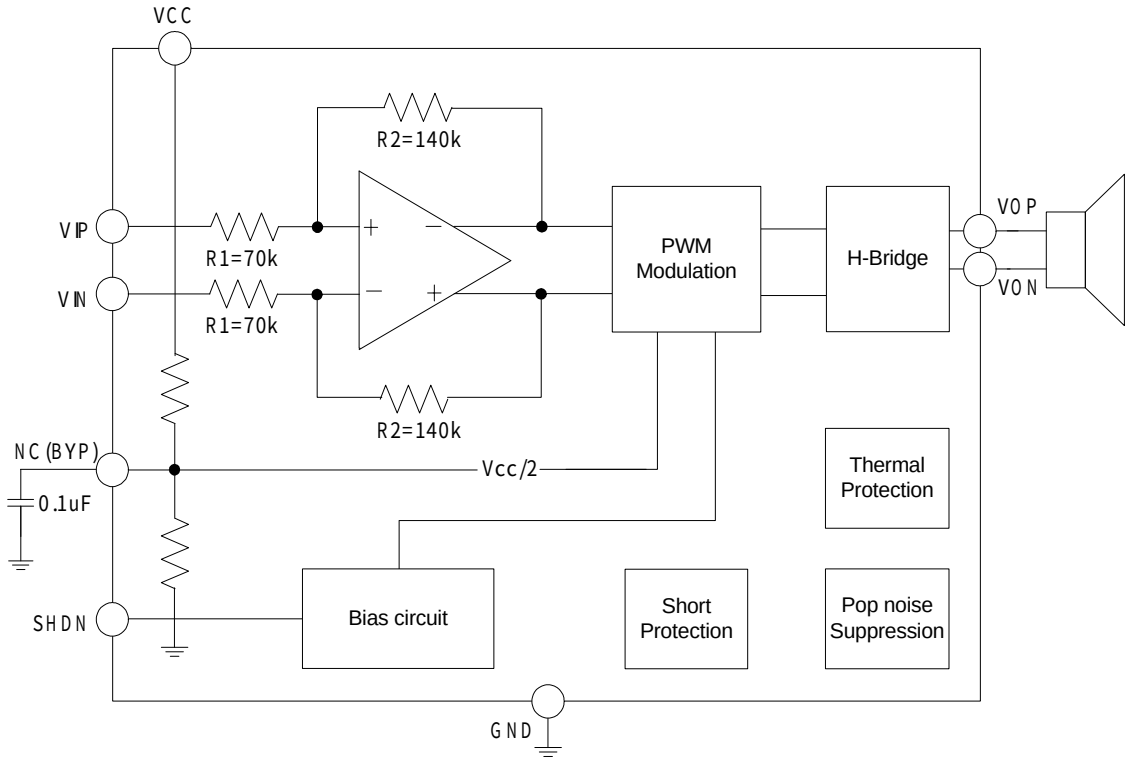
Applications

. Mobile phones
. PDAs
. Portable electronic devices

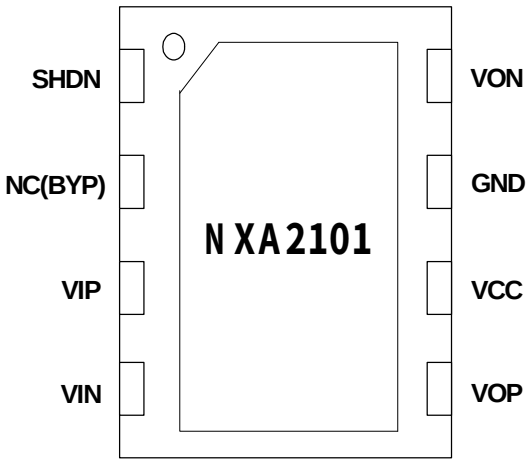
Ordering Information

Part Number	Marking	Junction Temp. range	Package
NXA2101		-40℃~125℃	3mm*3mm DFN

Block Diagram



Terminal Assignment



DFN

3mm × 3mm

Pin Description

Pin Name	Pin No.	I/O	Description
SHDN	1	I	Shutdown pin (active low)
NC(BYP)	2	I	No connection
VIP	3	I	Positive differential input
VIN	4	I	Negative differential input
VOP	5	O	Positive BTL output
VCC	6	S	Power supply
GND	7	S	Ground
VON	8	O	Negative BTL output

Maximum Absolute Ratings

Parameter	Symbol	Value	Unit
Supply voltage	Vcc	-0.3 ~6.0	V
Operating supply voltage	Vcc	2.5 ~5.5	V
Operating free-air temperature	T_A	-40 ~125	°C
Storage temperature	Tstg	-50 ~200	°C
Power dissipation	Pdmax	Note1	mW

Note1.) It depends on T_A, Pdmax=(Tj-Ta)/θJa, θJa of 3mm*3mm DFN is about 75°C/W,
If Tj rise about 140°C, then thermal protection is ON

Electrical Characteristics

(Vcc=3.3V, GND=0V, SHDN=Vcc, speaker impedance = 8Ω)

Characteristics	Symbol	Conditions	Value			Unit
			min	typ	max	
Supply Voltage Range	Vcc		2.5		5.5	V
Quiescent current	Icc	Vcc=2.5V, VOP=VON		1.8		mA
		Vcc=5V, VOP=VON		2.5	5.0	
Shutdown current	I_{SHDN}	SHDN=0			1.0	uA
Gain			2*140kΩ/(70kΩ+Ri)			V/V
Static drain-source on state resistance	R_{DS}	Vcc=5V		0.5	0.8	Ω
Output voltage noise	Vn	Vcc=3.6V, f=20 ~20KHz, Av=12dB		35		uV_{RMS}

Characteristics	Symbol	Conditions		Value			Unit
				min	typ	max	
Switching frequency	$f_{(sw)}$	Vcc=5V, VIP=VIN		-	350	-	kHz
Low-output swing		R_L=8Ω, Vcc=5V, VIP=Vcc, VIN=0V or VIP=0V, VIN=Vcc			0.3		V
High-output swing		R_L=8Ω, Vcc=5V, VIP=Vcc, VIN=0V or VIP=0V, VIN=Vcc			4.7		V
SHDN threshold voltage	V_{SHDN}	Vcc=5V, Power on			2.8		V
		Vcc=5V, Power off			1.9		V
Thermal shutdown		Threshold			150		°C
		Hysteresis			30		°C
Power Supply Rejection Ratio	PSRR	V_{CC}=3.6V, f_{ripple}=217Hz, V_{ripple}=200mV_{pp} sine, Inputs to AC GND CI=0.1uF, Input Referred			-75		dB
Common Mode Rejection Ratio	CMRR	V_{CC}=3.6V, V_{ripple}=1V_{pp} sine, f_{ripple}=217Hz, Input Referred			-65		dB
Output power	Po	THD+N=1%, f=1kHz, R_L=8Ω	Vcc=5V		1.2		W
			Vcc=3.6V		0.63		
			Vcc=2.5V		0.28		
		THD+N=10%, f=1kHz, R_L=8Ω	Vcc=5V		1.4		W
			Vcc=3.6V		0.75		
			Vcc=2.5V		0.35		
Total harmonic distortion + Noise	THD+N	Po=0.7W, f=1kHz, Vcc=5V			0.08		%
		Po=0.4W, f=1kHz, Vcc=3.6V			0.09		
		Po=0.2W, f=1kHz, Vcc=2.5V			0.1		
Signal-to-Noise-Ratio	SNR	Vcc=5V, Po=1W, R_L=8Ω			98		dB

Application Note

Fully Differential Amplifier

The NXA2101 is a fully differential amplifier with differential inputs and outputs. The fully differential amplifier consists of a differential amplifier and a common mode amplifier.

Shutdown Mode

The NXA2101 feature a low-power shutdown mode that reduces quiescent current consumption to 1.0uA(Max). The SHDN input should be held high during normal operation when the amplifier is in use.

Pop-Noise Suppression

The NXA2101 feature Pop-noise suppression circuitry that reduces audible Pop noise during startup and shutdown. When entering shutdown, the amplifier outputs are pulled to GND through an internal 150kΩ resistor.

Short-circuit Protection

The NXA2101 has short circuit protection circuitry on the outputs that prevents damage to the device during output-to-output shorts, output-to-GND shorts, and output-to-Vcc shorts. When a short-circuit is detected on the outputs, the part immediately disable the output drive. And after about 200u seconds, It will clear the internal short-circuit flag and allow for normal operation. If the short was not removed yet, the protection circuitry will activate and output will disable again. When short-circuit flag is clear itself, if the short was removed, then this chip is do normal operation

Bypass capacitor and start-up Time

The internal voltage divider at the BYP pin of this device sets a mid-supply voltage for internal references and the output voltage to Vcc/2. Bypass capacitor also determines the rise time of VOP and VON when the device is taken out of shutdown.
The larger the capacitor, the slower the rise time.

Thermal Protection

Thermal protection on the NXA2101 prevents damage to the device when internal die temperature exceeds 150°C. Once the die temperature exceeds the thermal set point, outputs are disabled. This is not a latched fault. The thermal fault is cleared once the temperature of the die is reduced by 30°C.The device begins normal operation at this point.

Gain Selection

The gain of the NXA2101 is set by the external resistors, Rin in Figure1.
The Gain is given by Equation : $Av = 2 \times 140k\Omega / (70k\Omega + Rin)$
The Rin resistors should be placed close to the input pins of the NXA2101

Application Circuit

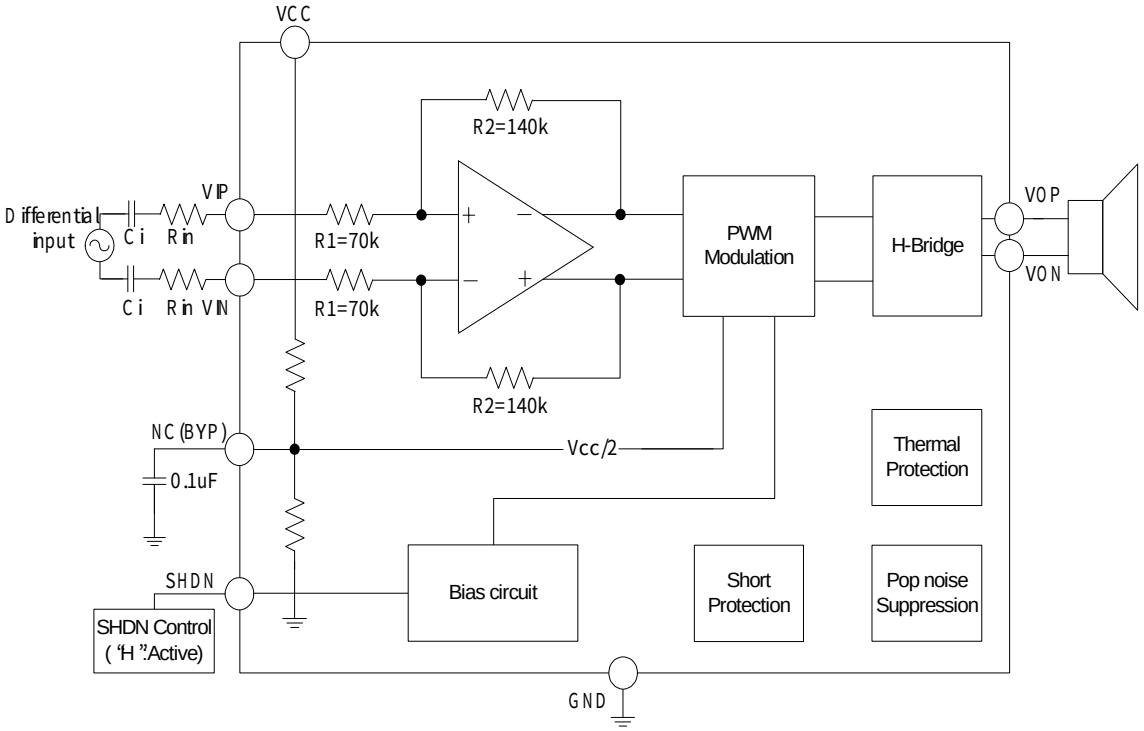


Figure1. Differential Input Application Schematic (Gain selection by Rin)

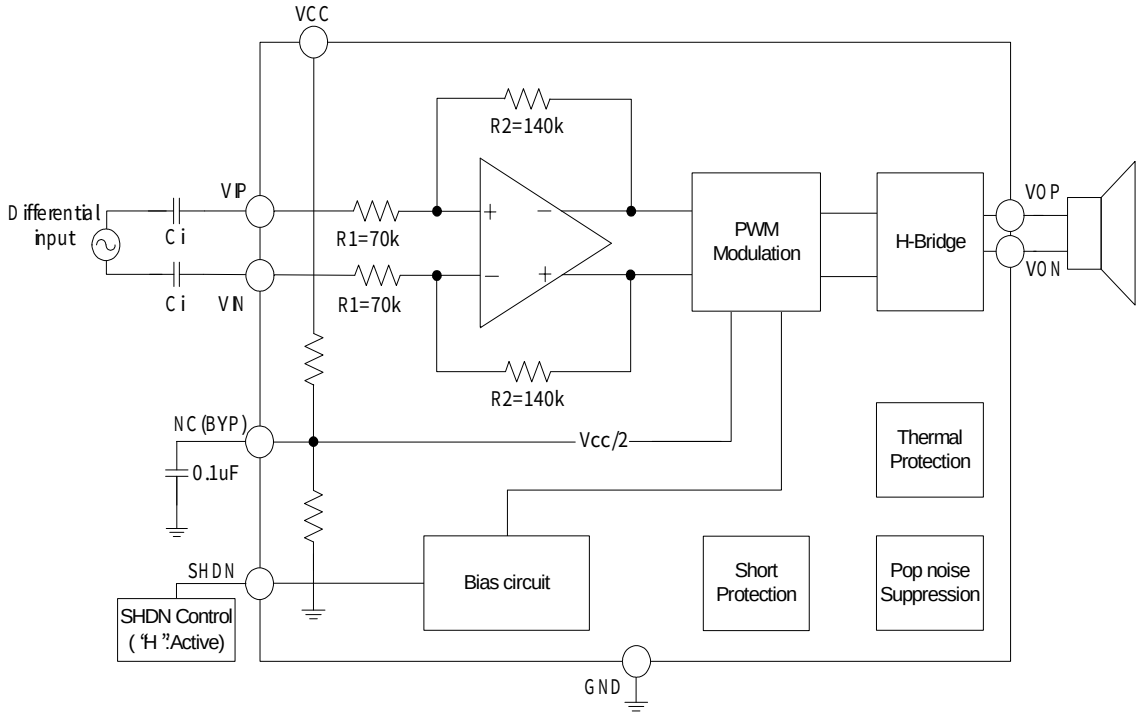


Figure2. Differential Input Application Schematic with Input capacitors (Fixed gain)

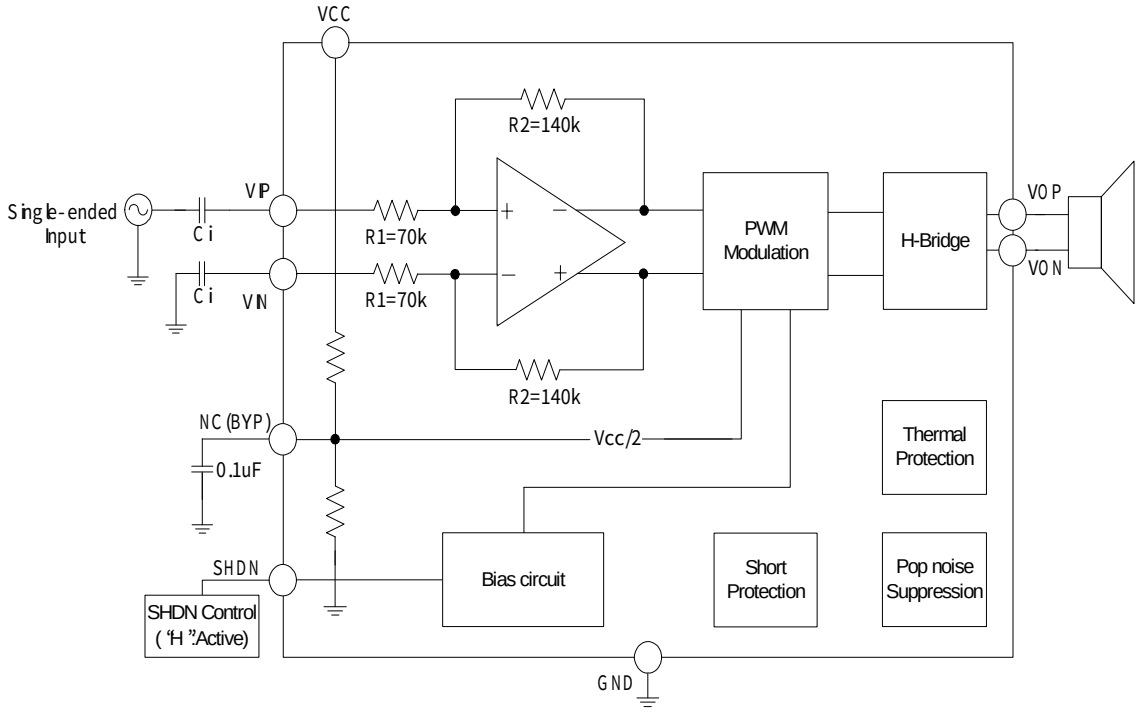


Figure3. Single-Ended Application Schematic