# onsemi

### NOCAP<sup>™</sup> Ad anced S e eb Head hbne Am lifie

### NCP2811

NCP2811 is a dual audio power amplifier designed for portable communication device applications such as mobile phones. This part is capable of delivering 27 mW of continuous average power into a 16  $\Omega$  load from a 2.7 V power supply with a THD+N of 1%.

Based on the power supply delivered to the device, an internal power management block generates a symmetrical positive and negative voltage. Thus, the internal amplifiers provide outputs referenced to Ground. In this True Ground configuration, the two external heavy coupling capacitors can be removed. It offers significant space and cost savings compared to a typical stereo application.

NCP2811 is available with an external adjustable gain (version A), or with an internal gain of 1.5 V/V (version B). It reaches a superior

100 dB PSRR and noise floor. Thus, it offers high fidelity audio sound, as well as a direct connection to the battery. It contains circuitry to prevent from "Pop & Click" noise that would otherwise occur during turn on and turn off transitions. The device is available in 12 bump CSP package (2 x 1.5 mm) which help to save space on the board. It is also available in WQFN12 and TSSOP 14 packages.

#### Features

• True Ground Configuration Output Eliminates DC Blocking Capacitors:

Save Board Area Save Component Cost No Low Frequency Response Attenuation

- High PSRR ( 100 dB): Direct Connection to the Battery
- "Pop and Click" Noise Protection Circuitry
- Internal Gain ( 1.5 V/V) or External Adjustable Gain
- Ultra Low Current Shutdown Mode
- 2.7 V 5.0 V Operation
- Thermal Overload Protection Circuitry
- CSP 2 x 1.5 mm
- WQFN123x3mm
- TSSOP 14
- These Devices are Pb Free, Halogen Free/BFR Free and are RoHS Compliant

#### **Typical Applications**

- Headset Audio Amplifier for
  - Cellular Phones
  - MP3 Player
  - Personal Digital Assistant and Portable Media Player Portable Devices



#### 12 PIN CSP FC SUFFIX CASE 499AZ

2811xz AYWW

MARKING DIAGRAMS

- x = A for NCP2811A
- = B for NCP2811B
- z = C for backside laminate
- A = Assembly Location
- Y = Year
- WW = Work Week
- = Pb–Free Package



WQFN12 MT SUFFIX CASE 510AH



(Note: Microdot may be in either location)



TSSOP-14 DTB SUFFIX CASE 948G

#### **ORDERING INFORMATION**

See detailed ordering and shipping information on page 12 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 12.

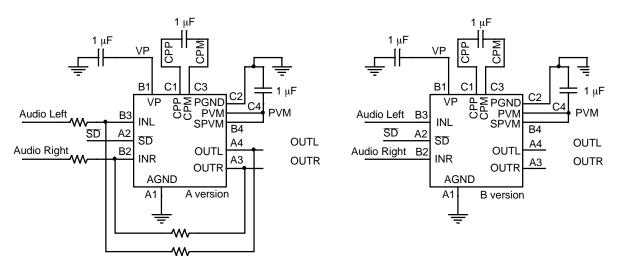
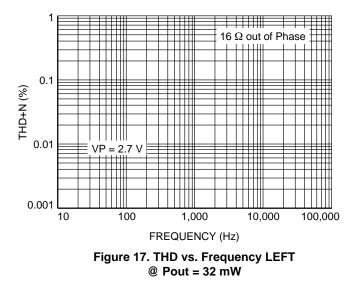


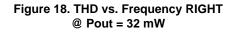
Figure 1. Application Schematics

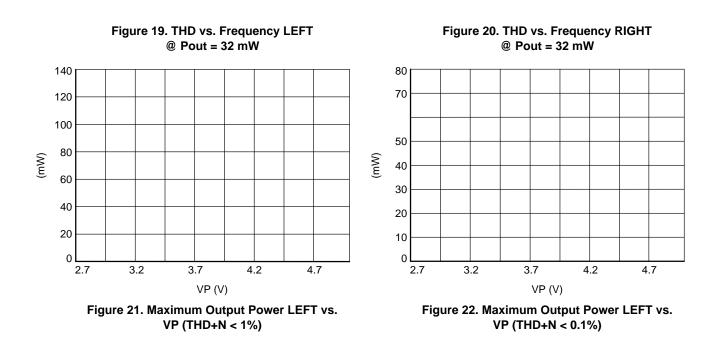
Table 3. ELECTRICAL CHARACTERISTICS Min & Max Limits apply for T <sub>A</sub> between -40°C to +85°C and T <sub>J</sub> up to + 125°C for V <sub>IN</sub>	١
between 2.7 V to 5.0 V (Unless otherwise noted). Typical values are referenced to $T_A = +25^{\circ}C$ and $V_{IN} = 3.6$ V.	

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
VP	Operational Power Supply		2.7		5.0	V

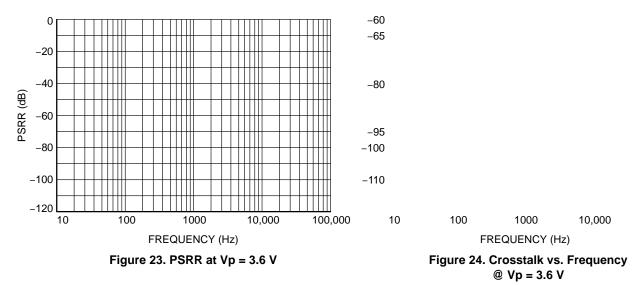








www.onsemi.com



#### **TYPICAL OPERATING CHARACTERISTICS**

#### DETAIL OPERATING DESCRIPTION

#### **Detailed Descriptions**

The NCP2811 is a stereo headphone amplifier with a true ground architecture. This architecture eliminates the need to use 2 external big capacitors required by conventional headphone amplifier.

The structure of the NCP2811 is basically composed of 2 true ground amplifiers, an UVLO, a short circuit protection and also a thermal shutdown. A special circuitry is embedded to eliminate any pop and click noise that occurs during turn on and turn off time. The A version has an external gain selectable by two resistor, B version has a gain of 1.5 V/V.

#### NOCAP™

NOCAP<sup>™</sup> is a patented architecture which requires only 2 small ceramic capacitors. It generates a symmetrical positive and negative voltage and it allows the output of the amplifiers to be biased around the ground.

#### **Current Limit Protection Circuit**

The NCP2811 embed a protection circuitry against short to ground. When an output is shorted to GND and when a signal appears at the input, the current is limited to 300 mA.

#### **Thermal Overload Protection**

Internal amplifiers are switched off when the temperature exceed 160°C, and will be switch on again when the temperature decrease below 140°C.

#### **Under Voltage Lockout**

When the battery voltage decreases below 2.3 V, the amplifiers are turned off. The hysteresis to turn on it again is 100 mV.

#### Pop and Click Suppression Circuitry

The NCP2811 includes a special circuitry to eliminate any pop and click noise during turn on and turn off time. Basic amplifier creates an offset during these transitions at the output which give a parasitic noise called "pop and click noise". The NCP2811 eliminates this problem.

### Gain Setting Resistor Selection (Rin & Rf, A version only)

 $R_{in}$  and  $R_f$  set the closed loop gain of the amplifier. A low gain configuration (close to 1) minimizes the THD + noise values and maximizes the signal to noise ratio.

A closed loop gain in the range of 1 to 10 is recommended to optimize overall system performance.

The formula to calculate the gain is:

$$Av = -\frac{R_{f}}{R_{in}}$$

#### Input Capacitor Selection

The input coupling capacitor blocks the DC voltage at the amplifier input terminal. This capacitor creates a high pass

filter with  $R_{in}$  (externally selectable for A version, 20  $k\Omega$  for B version).

The size of the capacitor must be large enough to couple in low frequencies without severe attenuation in the audio bandwith (20 Hz - 20 kHz).

The cut off frequency for the input high pass filter is:

$$F_{c} = \frac{1}{2\pi R_{in}C_{in}}$$

A  $F_c < 20$  Hz is recommended.

#### **Charge Pump Capacitor Selection**

Use ceramic capacitor with low ESR for better performances. X5R / X7R capacitor is recommended.

The flying capacitor (C2) serves to transfer charge during the generation of the negative voltage.

The CPVM capacitor (C3) must be equal at least to the CFIy capacitor to allow maximum transfer charge. The CPVM value must not exceed 1  $\mu$ F. Higher capacitor value can damage the part.

Table 4 suggests typical value and manufacturer:

#### Table 4.

Value	Reference	Package	Manufacturer
1 μF	C1005X5R0J105K	0402	TDK
1 μF	GRM155R60J105K19	0402	Murata

Lower value of capacitors can be used but the maximum output power is reduced and the device may not operate to specifications.

#### Power Supply Decoupling Capacitor (C1)

The NCP2811 is a True Ground amplifier which requires the adequate decoupling capacitor to reduce noise and THD+N. Use X5R / X7R ceramic capacitor and place it closed to the CPVDD pin. A value of  $1 \,\mu$ F is recommended.

#### **Shutdown Function**

The device enters in shutdown mode when shutdown signal is low. During the shutdown mode, the DC quiescent current of the circuit does not exceed 500 nA. In this configuration, the output impedance is  $10 \text{ k}\Omega$  on each output.

#### **Output Resistor for Capacitive Drive Capability**

Under normal operation, NCP2811 maximum direct capacitive load is in the 80 pF range. If, for any reason, high value capacitive loads should be connected to NCP2811 outputs, an additional 10  $\Omega$  resistor should be placed between the NCP2811 output and the capacitive load to ensure amplifier stability.

#### Layout Recommendation

Connect C1 as close as possible of the Vp pin.

Connect C2 and C3 as close as possible of the NCP2811.

Route audio signal and AGND far from Vp, CPP, CPM, PVM and PGND to avoid any perturbation due to the switching.

#### **Table 5. ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NCP2811ADTBR2G	TSSOP-14 (Pb-Free)	2500/Tape & Reel

#### **DISCONTINUED** (Note 9)

NCP2811BDTBR2G	TSSOP-14 2500/Tape & Reel (Pb-Free)		
NCP2811AFCT1G	Flip–Chip 12 (Pb–Free)	3000/Tape & Reel	
NCP2811BFCT1G	Flip-Chip 12 (Pb-Free)	3000/Tape & Reel	
NCP2811BFCCT1G	Flip-Chip 12 (Backside Laminate Coating) (Pb-Free)	3000/Tape & Reel	
NCP2811AMTTXG	WQFN12 (Pb-Fre)	3000/Tape & Reel	
NCP2811BMTTXG	WQFN12 (Pb-Free)	3000/Tape & Reel	

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
9. DISCONTINUED: These devices are not recommended for new design. Please contact your onsemi representative for information. The most current information on these devices may be available on <a href="https://www.onsemi.com">www.onsemi.com</a>.

## |-|-

DE VIEW

OP VIEW

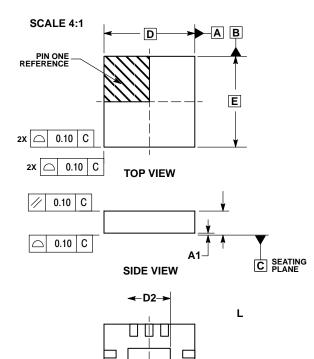
**→ ► e** 

\_|0.

WLCSP12 2.00x1.50x0.596

#### WQFN12 3x3, 0.5P CASE 510AH ISSUE O

DATE 20 JAN 2009





- DIME LO ON VEC
   DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
   CONTROLLING DIMENSION: MILLIMETERS.
   DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
   COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

**BOTTOM VIEW** 

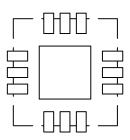
ШГ

-=

E2

.

¥ 



	MILLIN	<b>IETERS</b>	INC	HES	
DIM	MIN	MAX	MIN	MAX	
А	4.90	5.10	0.193	0.200	
В	4.30	4.50	0.169	0.177	
С		1.20		0.047	
D	0.05	0.15	0.002	0.006	
F	0.50	0.75	0.020	0.030	
G	0				
		53.7 TE	M4567	1.2 TD(0	GTw )TjTT4jTT2 w(e4jTT2 w(e4jT

BIL

onsemi, , and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi's product/patent coverage may be accessed at <a href="http://www.onsemi.com/site/pdf/Patent-Marking.pdf">www.onsemi.com/site/pdf/Patent-Marking.pdf</a>. Onsemi reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or incruit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi