



# Lyontek Inc.

## LY8210

Preliminary. 1.2

**2.5 W/CH Stereo Class D Audio power Amplifier (WCSP/ TSSOP)**

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### **REVISION HISTORY**

<b><u>Revision</u></b>	<b><u>Description</u></b>	<b><u>Issue Date</u></b>
Rev. 0.1	Initial Issue	Oct. 28. 2007
Rev. 0.2	Add Application Circuit	Jan. 12. 2008
Rev. 1.0	Release datasheet and add TSSOP20 package	Mar. 27. 2008
Rev. 1.1	Modify TSSOP Package Type M to R	Aug. 27. 2008
Rev. 1.2	Modify TSSOP Package Type R to A (I)	Oct. 29. 2008



#### FEATURES

- 2.5 W/CH Into 4Ω from 5V power supply at THD = 10% (Typ.).
- 2.5V~5.5V Power supply.
- Low shutdown Current.
- Low Quiescent Current.
- Minimum external components.
- No output filter required for inductive loads.
- Output Pin Short-Circuit Protection (Short to Output Pin, Short to GND, Short to VCC)
- Low noise during turn-on and turn-off transitions.
- Lead free and green package available. (RoHS Compliant)
- Wafer Chip Scale (WCSP) and TSSOP 20 pin packaging available.

#### GENERAL DESCRIPTION

The LY8210 is a high efficiency, 2.5 W stereo class D audio power amplifier. It is a low noise, filterless PWM architecture eliminates the output filter, reducing external component count, system cost, and simplify design.

The LY8210 is designed to meet of Multimedia application includes mobile phones and other portable electronic devices. The LY8210 is a single 5V supply, it is capable of driving 4Ω speaker load at a continuous average output of 2.5 W/CH with 10% THD+N.

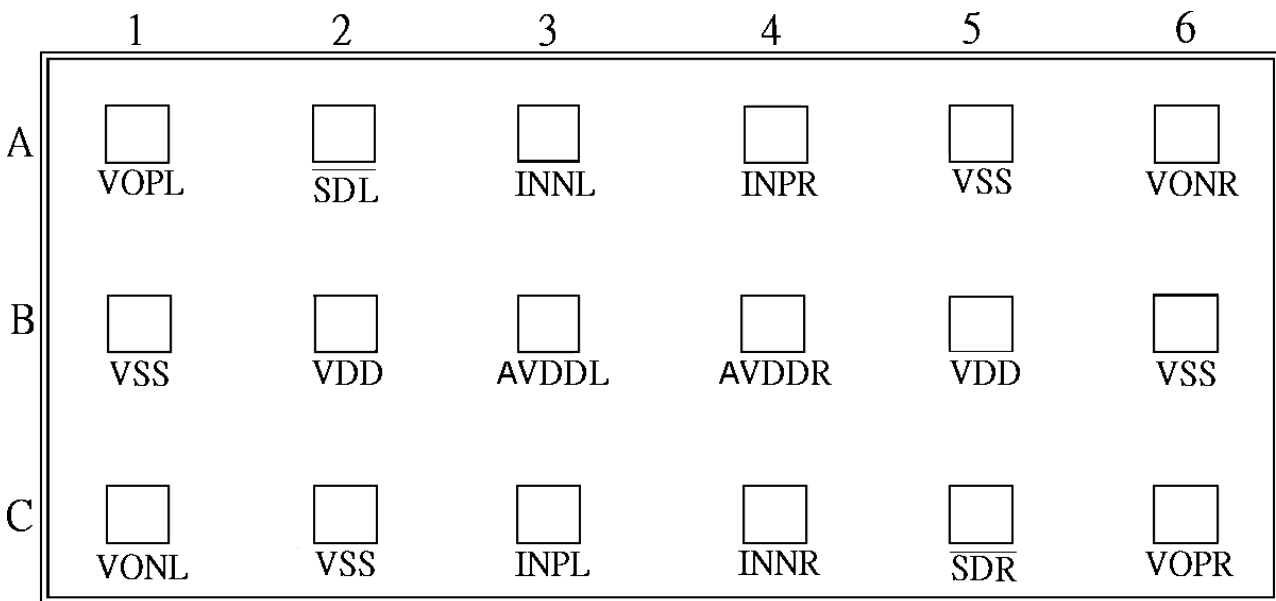
In cellular handsets, the earpiece, speaker phone, and melody ringer can each be driven by the LY8210. Output pin short circuit ( short to output pin, short to ground and short to VDD ) protection prevent the device from damage during fault conditions.

#### APPLICATION

- Portable electronic devices
- Mobile Phones, PDAs
- DVD/CD Players, TFT LCD TVs/Monitors
- USB Audio, 2.1 / 5.1 CH Audio System

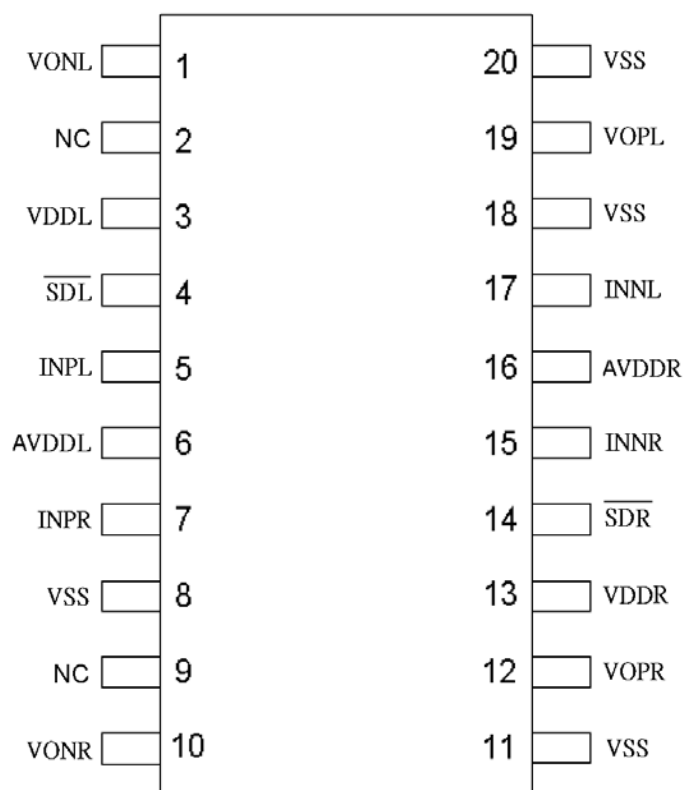
#### PIN CONFIGURATION

**LY8210 WCSP 18 Ball Pin Configuration (Top View)**





#### LY8210 TSSOP20 Pin Configuration (Top View)

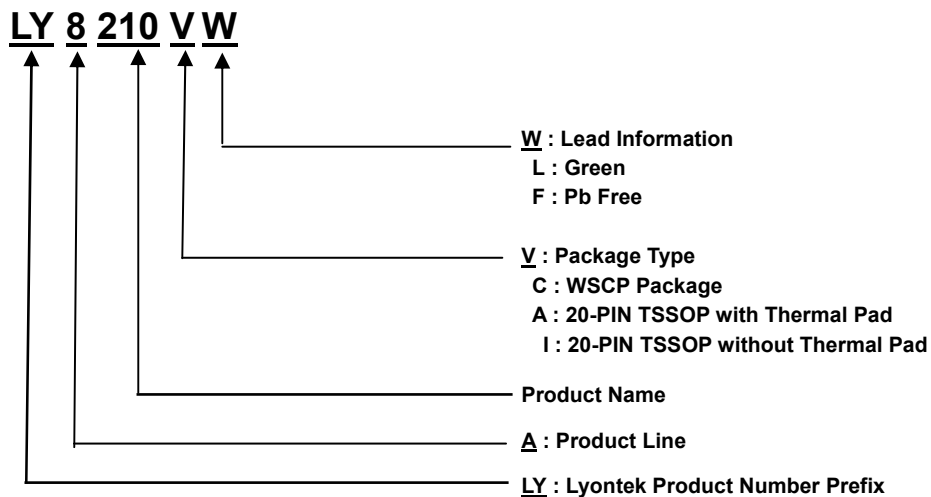


#### PIN DESCRIPTION

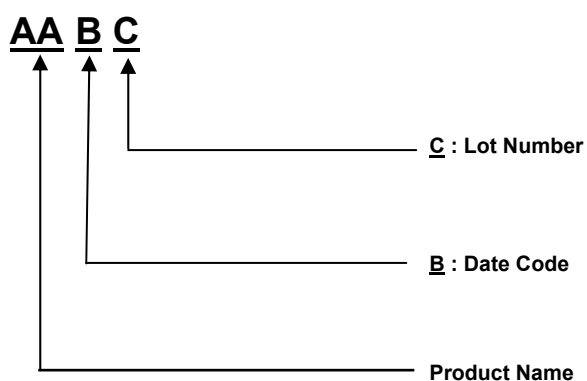
SYMBOL	Pin No.		DESCRIPTION
	WCSP	TSSOP	
SDL	A2	4	Shutdown pin of left channel. (when low level is active the pin).
INPL	C3	5	Positive input of left channel.
INN	A3	17	Negative input of left channel.
VOPL	A1	19	Positive BTL output of left channel.
VONL	C1	1	Negative BTL output of left channel.
AVDD	B3/B4	6/16	Analog Power supply of left and right channel.
VDD	B2/B5	3/13	Power supply of left and right channel.
VSS	C2/A5 B1/B6	8/11/18/20	Ground
SDR	C5	14	Shutdown pin of right channel. (when low level is active the pin).
INPR	A4	7	Positive input of right channel.
INNR	C4	15	Negative input of right channel.
VOPR	C6	12	Positive BTL output of right channel.
VONR	A6	10	Negative BTL output of right channel.
NC	--	2/9	No Connection.



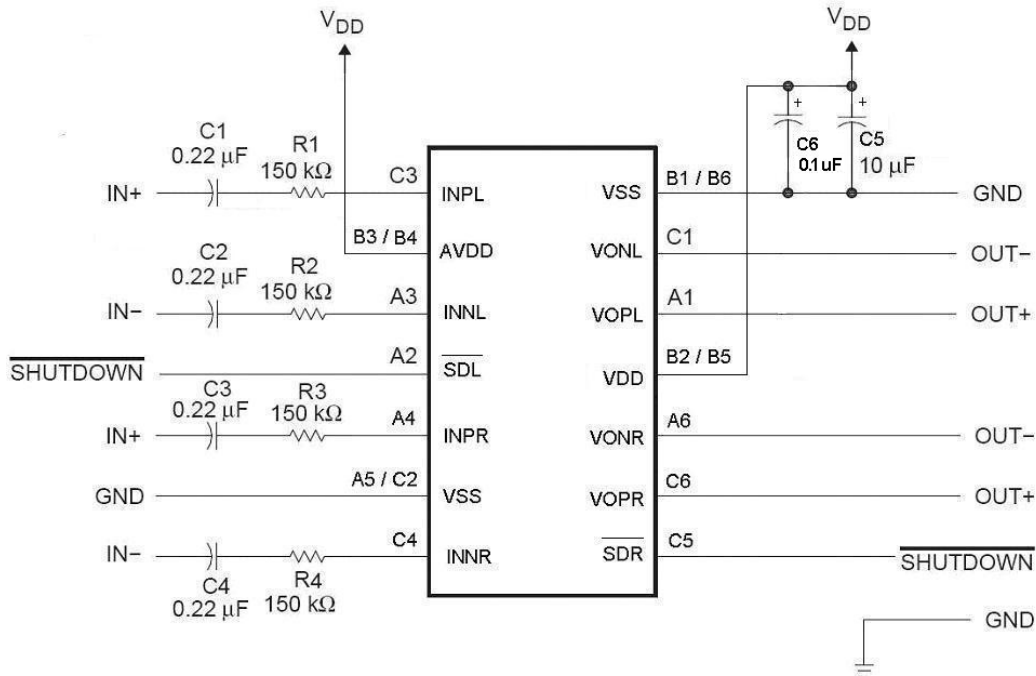
### ORDERING INFORMATION



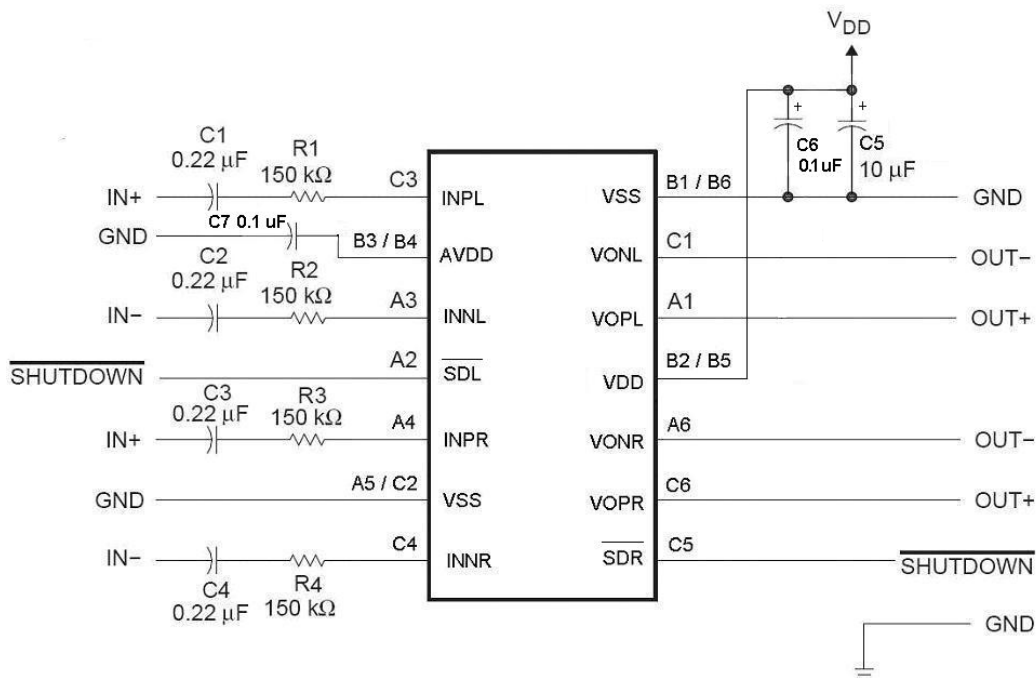
### PACKAGE MARKING FORMAT (For WCSP Package only)



#### Typical Application Circuit



**Figure 1. Typical Application Schematic With Differential Input and AVDD Connect to VDD Configuration**



**Figure 2. Typical Application Schematic With Differential Input and AVDD Increase Capacitors Configuration.**

Note: In case of AVDD and VDD, the use of AVDD Increase Capacitors will optimize the THD+N.



#### **ABSOLUTE MAXIMUM RATINGS\***

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V_{DD}$	6.0	V
Operating Temperature	$T_A$	0 to 70 (C grade)	
		-20 to 80 (E grade)	
		-40 to 85 (I grade)	
Input Voltage	$V_I$	-0.3V to $V_{DD} + 0.3V$	V
Storage Temperature	$T_{STG}$	-65 to 150	
Power Dissipation	$P_D$	Internally Limited	W
ESD Susceptibility	$V_{ESD}$	2000	V
Junction Temperature	$T_{JMAX}$	150	
Soldering Temperature (under 10 sec)	$T_{SOLDER}$	260	

\*Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to the absolute maximum rating conditions for extended period may affect device reliability.

#### **ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , Unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output offset voltage (measured differentially)	$ V_{OS} $	$V_I = 0\text{ V}$ , $A_v = 2\text{ V/V}$ , $V_{DD} = 2.5\text{ V to } 5.5\text{ V}$	-	-	50	mV
High-level input current	$ I_{IH} $	$V_{DD} = 5.5\text{ V}$ , $V_I = 5.8\text{ V}$	-	-	200	$\mu\text{A}$
Low-level input current	$ I_{IL} $	$V_{DD} = 5.5\text{ V}$ , $V_I = 0.3\text{ V}$	-	-	10	$\mu\text{A}$
Power supply rejection ratio	PSRR	$V_{DD} = 2.5\text{ V to } 5.5\text{ V}$		-75	-55	dB
Common mode rejection ratio	CMRR	$V_{DD} = 2.5\text{ V to } 5.5\text{ V}$ , $V_{IC} = V_{DD}/2\text{ to } 0.5\text{ V}$ , $V_{IC} = V_{DD}/2\text{ to } V_{DD} - 0.8\text{ V}$ ,		-60	-48	dB
Quiescent Current / Ch	$I_Q$	$V_{DD} = 5.5\text{ V}$ , No Load	-	6.8	9.0	mA
		$V_{DD} = 3.6\text{ V}$ , No Load	-	5.6	-	
		$V_{DD} = 2.5\text{ V}$ , No Load	-	4.4	6.4	
Shutdown Current / Ch	$I_{SD}$	$V_{SHUTDOWN} = 0.8\text{ V}$ , $V_{DD} = 2.5\text{ V to } 5.5\text{ V}$	-	0.6	4	$\mu\text{A}$



#### ■ OPERATING CHARACTERISTICS (T<sub>A</sub> = 25 °C, Gain = 2V/V, R<sub>L</sub> = 8Ω, Unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Out Power / Ch	P <sub>O</sub>	THD+N= 10%, f = 1 kHz, R <sub>L</sub> = 4Ω	V <sub>DD</sub> =5V	-	2.5	-
			V <sub>DD</sub> =3.6V	-	1.3	-
			V <sub>DD</sub> =2.5V	-	0.5	-
		THD+N= 1%, f = 1 kHz, R <sub>L</sub> = 4Ω	V <sub>DD</sub> =5V	-	2.0	-
			V <sub>DD</sub> =3.6V	-	1.0	-
			V <sub>DD</sub> =2.5V	-	0.4	-
		THD+N= 10%, f = 1 kHz, R <sub>L</sub> = 8Ω	V <sub>DD</sub> =5V	-	1.4	-
			V <sub>DD</sub> =3.6V	-	0.7	-
			V <sub>DD</sub> =2.5V	-	0.35	-
		THD+N= 1%, f = 1 kHz, R <sub>L</sub> = 8Ω	V <sub>DD</sub> =5V	-	1.2	-
			V <sub>DD</sub> =3.6V	-	0.6	-
			V <sub>DD</sub> =2.5V	-	0.3	-
Total harmonic distortion + noise	THD+N	P <sub>O</sub> = 1 W, f = 1 kHz, R <sub>L</sub> = 8Ω	V <sub>DD</sub> =5V	-	0.15	-
		P <sub>O</sub> = 0.5 W, f = 1 kHz, R <sub>L</sub> = 8Ω	V <sub>DD</sub> =3.6V	-	0.18	-
		P <sub>O</sub> = 0.2 W, f = 1 kHz, R <sub>L</sub> = 8Ω	V <sub>DD</sub> =2.5V	-	0.2	-
Supply ripple rejection ratio	K <sub>SVR</sub>	f = 217 Hz, V <sub>(RIPPLE)</sub> = 200mVpp, inputs ac-grounded with C <sub>i</sub> = 2μF	V <sub>DD</sub> =3.6V	-	-71	-
Signal-to-noise ratio	SNR	P <sub>O</sub> = 1 W, R <sub>L</sub> = 8Ω	V <sub>DD</sub> =5V	-	97	-
Output voltage noise	V <sub>n</sub>	V <sub>DD</sub> = 3.6 V, f = 20 Hz to 20 kHz, Inputs ac-grounded with C <sub>i</sub> = 2 μF	No weighting	-	48	-
			A weighting	-	36	-
Common mode rejection ratio	CMRR	V <sub>IC</sub> = 1 Vpp, f = 217 Hz	V <sub>DD</sub> =3.6V	-	-63	-
Start-up time from shutdown	Z <sub>I</sub>	V <sub>DD</sub> = 3.6 V	-	-	1	-

## Application Information Circuit

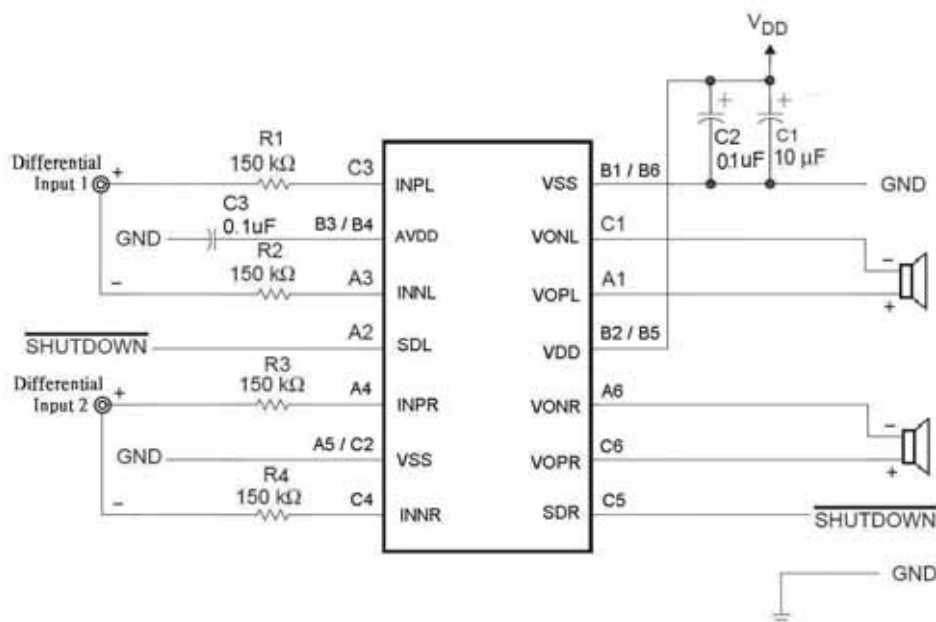


Figure 3. Application Schematic With Differential Input Configuration

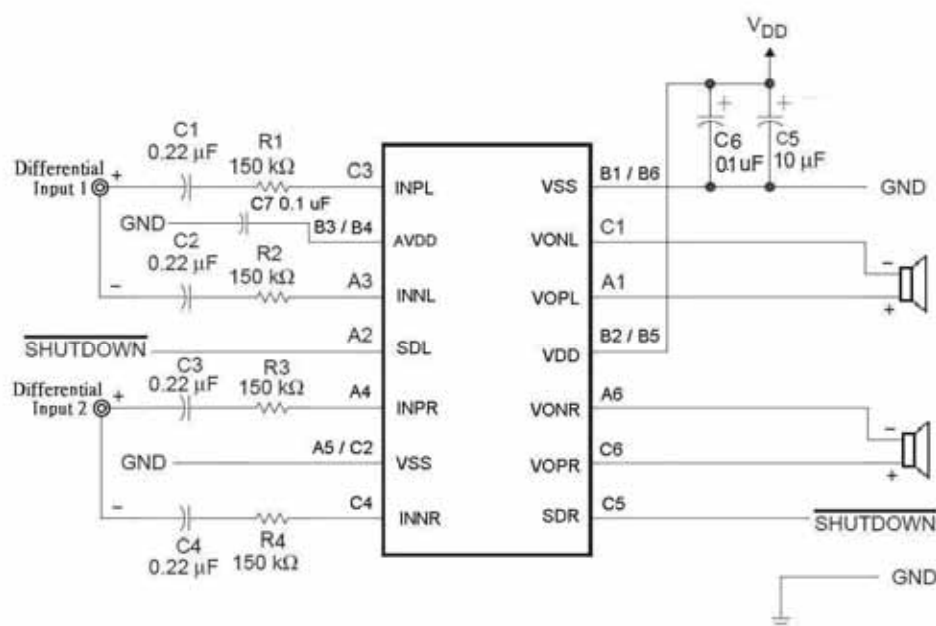


Figure 4. Application Schematic With Differential and Capacitors Input Configuration



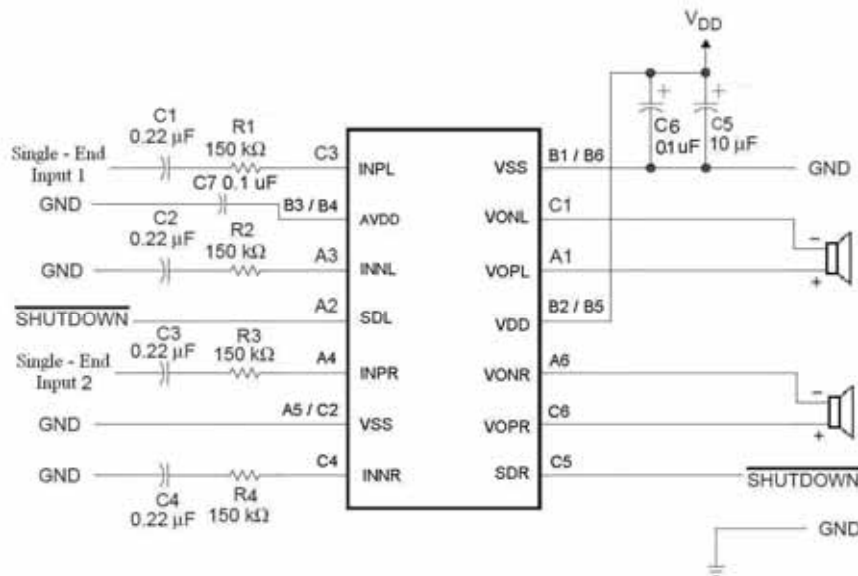


Figure 5. Application Schematic With Single-Ended Input

## APPLICATION INFORMATION

### Fully Differential Amplifier

The LY8210 is a fully differential amplifier with differential inputs and outputs. The fully differential amplifier consists of a differential amplifier and a common-mode amplifier. The differential amplifier ensures that the amplifier outputs a differential voltage on the output that is equal to the differential input times the gain. The common-mode feedback ensures that the common-mode voltage at the output is biased around  $V_{DD}/2$  regardless of the common-mode voltage at the input. The fully differential LY8210 can still be used with a single-ended input; however, the LY8210 should be used with differential inputs when in a noisy environment, like a wireless handset, to ensure maximum noise rejection.

### Advantages of Fully Differential Amplifiers

Input-coupling capacitors not required:

The fully differential amplifier allows the inputs to be biased at voltage other than mid-supply. For example, if a codec has a midsupply lower than the midsupply of the LY8210, the common-mode feedback circuit will adjust, and the LY8210 outputs will still be biased at midsupply of the LY8210. The inputs of the LY8210 can be biased from 0.5 V to  $V_{DD} - 0.8$  V. If the inputs are biased outside of that range, input - coupling capacitors are required.

Midsupply bypass capacitor,  $C_{(BYPASS)}$ , not required:

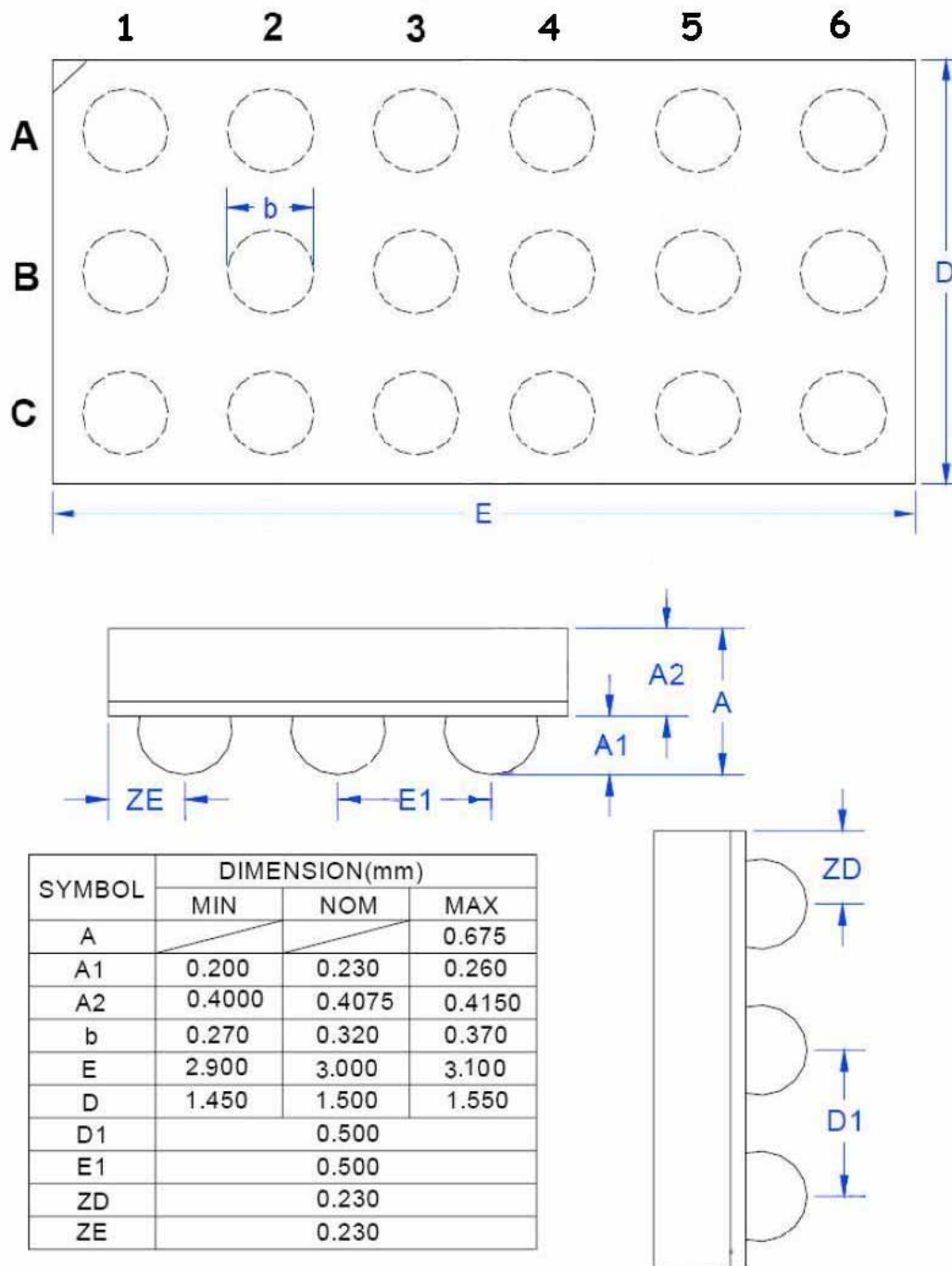
The fully differential amplifier does not require a bypass capacitor. This is because any shift in the midsupply affects both positive and negative channels equally and cancels at the differential output.

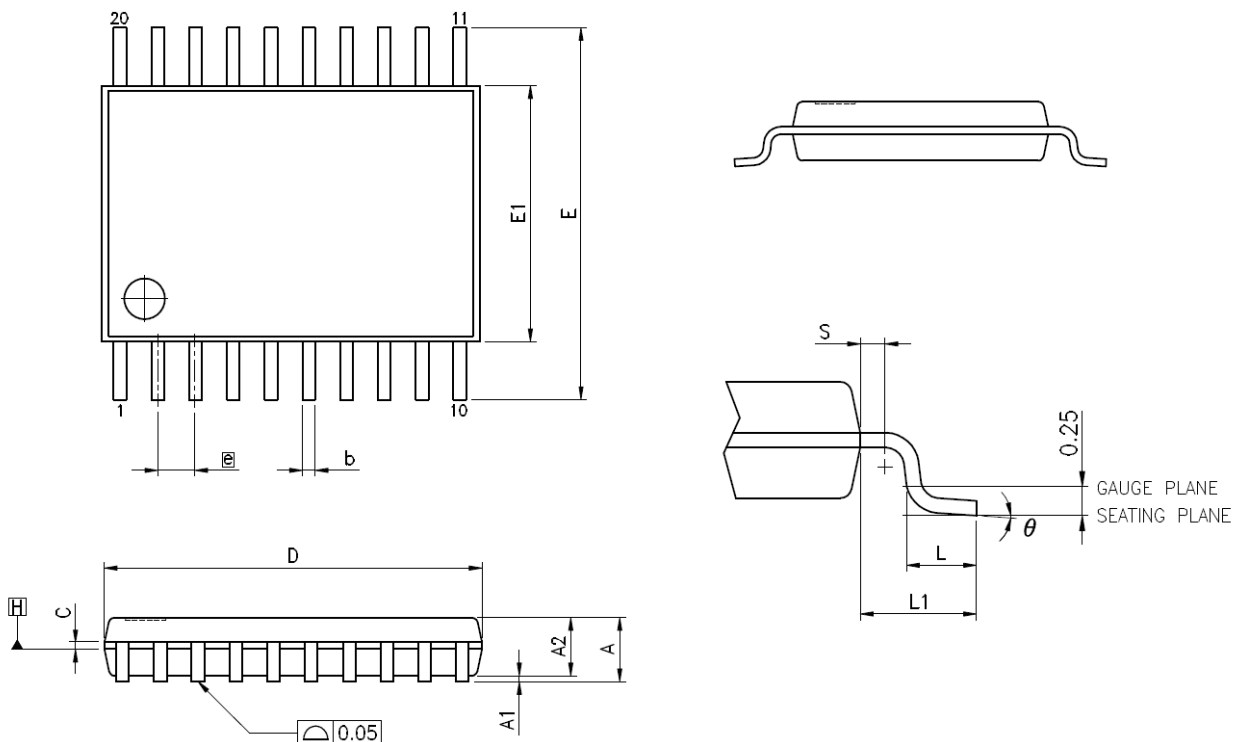
Better RF-immunity:

GSM handsets save power by turning on and shutting off the RF transmitter at a rate of 217 Hz. The transmitted signal is picked-up on input and output traces. The fully differential amplifier cancels the signal much better than the typical audio amplifier.

#### PACKAGE OUTLINE DIMENSION

##### 18 Ball WCSP Package Outline Dimension



**TSSOP 20 Pin Package Outline Dimension**

**VARIATIONS (ALL DIMENSIONS SHOWN IN MM)**

SYMBOLS	MIN.	NOM.	MAX.
A	—	—	1.20
A1	0.05	—	0.15
A2	0.80	0.90	1.05
b	0.19	—	0.30
C	0.09	—	0.20
D	6.40	6.50	6.60
E1	4.30	4.40	4.50
E	6.40 BSC		
e	0.65 BSC		
L1	1.00 REF		
L	0.50	0.60	0.75
S	0.20	—	—
θ	0°	—	8°