# ZXCD1000EVMOL

## HIGH FIDELITY CLASS D AUDIO AMPLIFIER EVALUATION BOARD USING ZXCD1000 CLASS D CONTROL SYSTEM.

### DESCRIPTION

The ZXCD1000EVMOL evaluation board is based on the ZXCD1000 Class D audio amplifier solution from Zetex. This board allows the user to evaluate the high fidelity audio performance offered by the Zetex solution.

### FEATURES

- Class D architecture
- Single power supply
- Output power ( Vsupply = 25V)
  - 50 W into 4 Ohms
  - 25 W into 8 Ohms
- THD + N <0.2% @ 90% power
- >90% efficiency
- Flat frequency response 20Hz – 20 kHz
- Turn on / turn off pop suppression
- Noise floor –115dB

**Note:** The ZXCD1000EVMOL is intended as an evaluation platform for Zetex Class D solutions. Zetex accepts no liability for external equipment connected to the ZXCD1000EVMOL or any other form of consequential damage or loss.

### INTRODUCTION

The ZXCD1000EVMOL is a 50W RMS (4-Ohm Load) high performance class D amplifier. The circuitry contains MOSFET devices and should therefore be handled appropriately.

The board requires a single rail power supply of 13 volts minimum and 25 volts maximum. Voltages in excess of 25 volts may cause permanent damage to the board.

The heart of the solution is the ZXCD1000 class D controller IC and the user should refer to the ZXCD1000 data sheet for further technical information.

# ZXCD1000EVMOL

**CONNECTION AND OPERATION**

The following PCB shows the connections required for correct operation of the ZXCD1000EVMOL evaluation board.

**Power Connection**

The ZXCD1000EVMOL requires a single positive supply voltage as follows: -

16V @ approx 2A for 25 W RMS into 4 ohms

25V @ approx 3A for 50 W RMS into 4 ohms

Note: The connection points shown below

***The supply must not exceed 25V and must not be less than 13 V to ensure correct operation of the amplifier.***

**Audio Input**

The ZXCD1000EVMOL requires a single ended audio input as follows: -

Input impedance 18K Ohms

Input signal level required for full output power is approximately 2.5 Volts peak to peak

**Speaker connection**

A 4 or 8 Ohm speaker load may be connected across the solder terminals shown above. Ensure the correct polarity is maintained to avoid phasing errors in the audio when using more than one board.

NOTE: The output of the ZXCD1000EVMOL is a Bridge Tied Load configuration and the speaker terminals must not be shorted together or to ground as this may result in permanent damage to the amplifier.

Note: C35 is included on the board assuming a 4Ω load however it should be removed when driving an 8Ω load

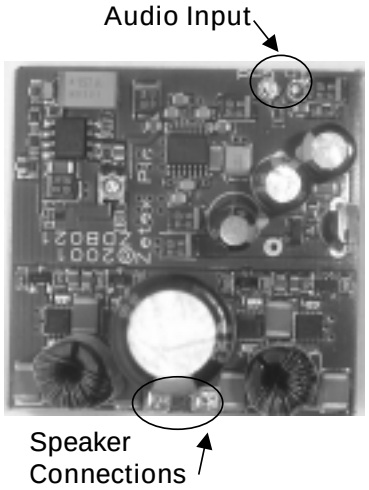
**EVALUATION BOARD DESCRIPTION AND OPERATION.**

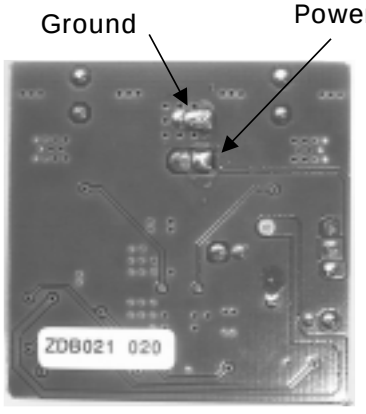
The top copper , bottom copper and silk screen ID overlay are shown in figure 1,2 and 3.

The ZXCD1000 is available in a 16-pin ESOP package. The exposed pad on the underside of the package is soldered down to an area of copper on the PCB, to function as a heatsink. To further assist heat dissipation, the PCB has plated through vias connecting to an area of copper on the underside of the board.

Connections to the board are made by soldering wires to the on board solder pads. Connect the power supply leads to solder pads on the underside of the board (ensure correct polarity!), connect the audio input source leads to the solder pads labelled In and (the adjacent) Gnd, and connect a resistive/speaker load of 4/8 ohms between the two Speaker output solder pads.

The speaker is connected as a Bridge Tied Load (BTL). This means that both sides of the speaker are driven from the Output Bridge and therefore neither side of the speaker connects to ground. This allows maximum power to be delivered to the load, from a given supply voltage.




**Warning**:
**Neither side of the speaker outputs must be shorted to ground, Vsupply or to each other as this could damage the output bridge Mosfet's. One of the outputs could inadvertently be shorted to ground for example, by connecting the ground of an oscilloscope probe to one of the speaker outputs, whilst trying to view the output signal.**

If it is wished to view or measure the signal across the load, a floating monitor must be used - for example a differential probe. Alternatively this may be achieved with a two channel oscilloscope monitoring the speaker A and speaker B outputs, and using the invert and add functions. For diagnostic purposes, the speaker outputs can be monitored single-ended with respect to ground with an oscilloscope (or other instrument) if desired. However any results obtained in this manner, are not valid for assessing performance. The true performance depends upon some differential cancellation across the speaker load.

The maximum supply voltage to the ZXCD1000EVMOL evaluation board is 25V nominal. A supply voltage of 25V will achieve 50W into a 4ohm load and a 16V supply will achieve 25W into a 4ohm load. The board is capable of driving an 8-ohm load with virtually identical performance, but the power will be 25W and 12.5W respectively.

The board is not rated at these powers continuously – more board area for heat sinking would be required.

The board requires an input signal of 2.5V pk-pk nominal to yield the full output power. This, as stated is supply voltage dependent. The input impedance of the board is nominally 18K ohm. This may attenuate the source voltage and may need to be allowed for, depending on the output impedance of the source.

The full power output voltage across the (bridge tied) load will be approximately 40V pk-pk with a supply voltage of 25V, or ~28V pk-pk with a supply voltage of 16V. Viewing outputs single-ended will yield half these voltages. Smaller input voltages will yield smaller output voltages.

Figure 1. Top Copper for PCB

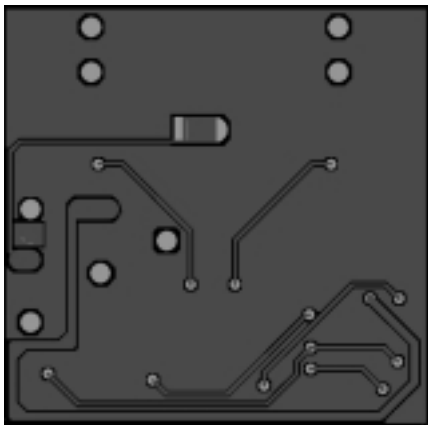


Figure 2. Bottom Copper

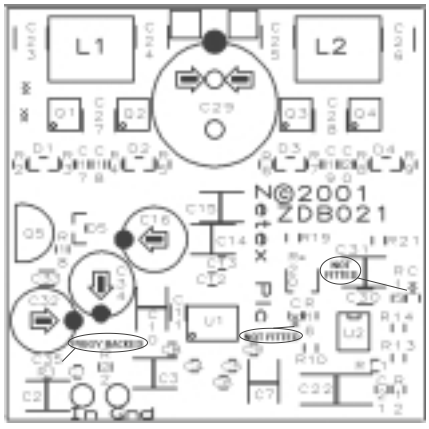



Figure 3. Component Overlay for PCB

# ZXCD1000EVMOL

**ZXCD1000EVMOL CIRCUIT DESCRIPTION.**

Propriety circuit design and high quality magnetics are necessary to yield the high THD performance specified. At the heart of the circuit is the Zetex ZXCD1000 class D audio IC.

The ZXCD1000EVMOL circuit diagram is illustrated in figure 4. The circuit consists of a voltage regulator, an input phase splitter, the ZXCD1000 and an output bridge to drive the load - via L-C filters. The voltage regulator (Q5, D5 etc.) is necessary to drop higher supply voltages to a level suitable for the ZXCD1000 (~12V on the board). The input phase splitter, built around the NE5532 dual op amp, is necessary to drive the Audio A and Audio B channels on the ZXCD1000. The Output Bridge is built around the Zetex ZXM64P03X and ZXM64N03X PMOS and NMOS transistors. The ZXCD1000 outputs drive Output Bridge Mosfet's, with the PWM signal, which subsequently drives the load via L-C filters. The purpose of the latter is to low pass filter the high frequency switching PWM signal from the bridge. Thus the lower frequency audio signal is recovered and is available at the speaker outputs.

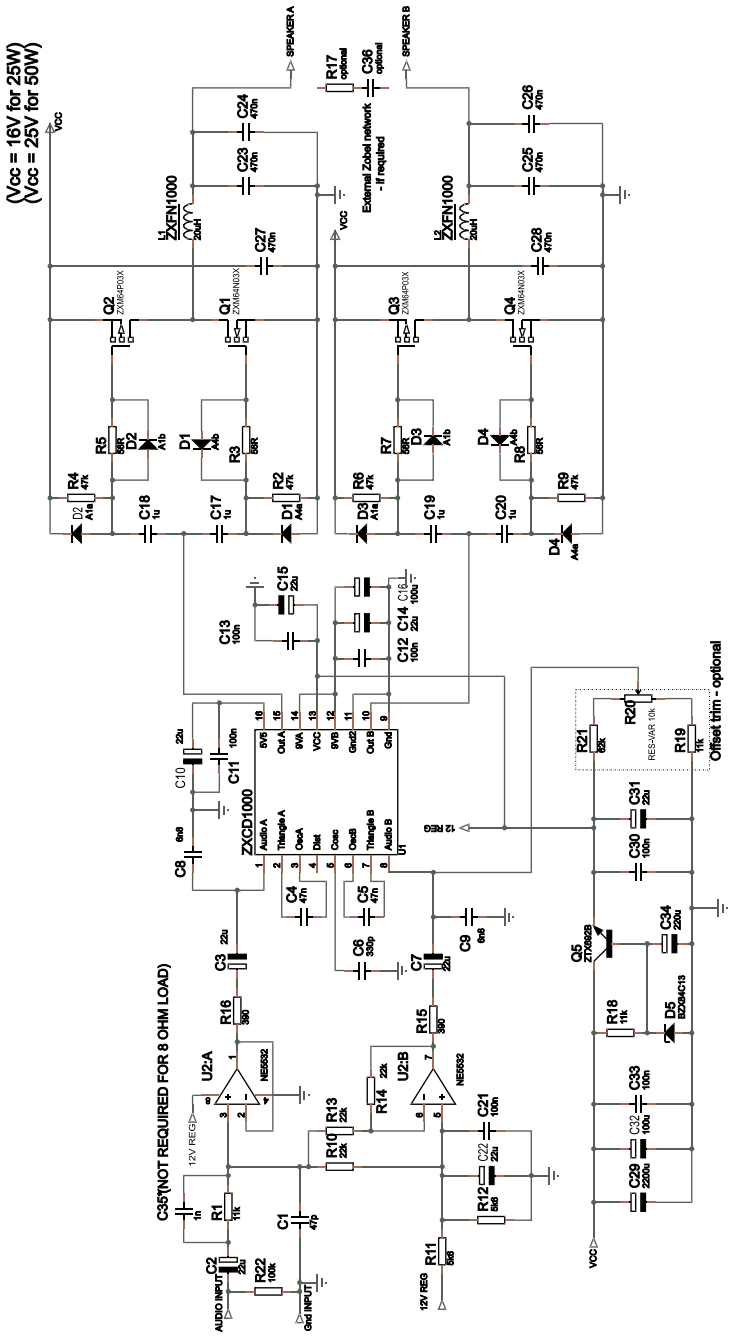
The more comprehensive description for the 25W open loop solution in the data sheet largely applies to the ZXCD1000EVMOL circuit and can be used for reference.

WARNING - Appropriate safety precautions should be taken by a competent person if the ZXCD1000EVMOL is to be connected to any potentially hazardous equipment.

| ZETEX CLASS D MONO BOARD (ZXCD1000EVMOL) | | | |
|---|---|---|---|
| **PCB ID** | **Value** | **Case** | **Notes** |
| R1 | 11K | SMD 0805 | |
| R2 | 47K | SMD 0805 | |
| R3 | 56R | SMD 0805 | |
| R4 | 47K | SMD 0805 | |
| R5 | 56R | SMD 0805 | |
| R6 | 47K | SMD 0805 | |
| R7 | 56R | SMD 0805 | |
| R8 | 56R | SMD 0805 | |
| R9 | 47K | SMD 0805 | |
| R10 | 22K | SMD 0805 | |
| R11 | 5K6 | SMD 0805 | |
| R12 | 5K6 | SMD 0805 | |
| R13 | 22K | SMPPD 0805 | |
| R14 | 22K | SMD 0805 | |
| R15 | 390R | SMD 0805 | |
| R16 | 390R | SMD 0805 | |
| R17 | OPTIONAL - Not included | | Zobel Network - user dependant |
| R18 | 11K | SMD 0805 | |
| R19 | 11K | SMD 0805 | Optional trim component |
| R20 | 10K | SMD 3mm sq Pot | Optional trim component |
| R21 | 62K | SMD 0805 | Optional trim component |
| R22 | 100K | SMD 0805 | |
| C1 | 47pF 16V | SMD 0805 | |
| C2 | 22uF 16V | SMD Tant B | |
| C3 | 22uF 16V | SMD Tant B | |
| C4 | 47n X7R 16V | SMD 0805 | |
| C5 | 47n X7R 16V | SMD 0805 | |
| C6 | 330pF COG 16V | SMD 0805 | |
| C7 | 22uF 16V | SMD Tant B | |
| C8 | 6n8 16V | SMD 0805 | |
| C9 | 6n8 16V | SMD 0805 | |
| C10 | 22uF 16V | SMD Tant B | |
| C11 | 100n X7R 25V | SMD 1206 | |
| C12 | 100n X7R 25V | SMD 0805 | |
| C13 | 100n X7R 25V | SMD 0805 | |
| C14 | 22uF 16V | SMD Tant B | |
| C15 | 22uF 16V | SMD Tant B | |
| C16 | 100uF 10V | std. Dia 5mm | Rubycon ZL series |
| C17 | 1uF 16V X7R | SMD 0805 | |
| C18 | 1uF 16V X7R | SMD 0805 | |

# ZXCD1000EVMOL

| ZETEX CLASS D MONO BOARD (ZXCD1000EVMOL) | | | |
|---|---|---|---|
| C19 | 1uF 16V X7R | SMD 0805 | |
| C20 | 1uF 16V X7R | SMD 0805 | |
| C21 | 100n 25V X7R | SMD 0805 | |
| C22 | 22uF 16V | SMD Tant C | |
| C23 | 470n 50V X7R | SMD 1812 | |
| C24 | 470n 50V X7R | SMD 1812 | |
| C25 | 470n 50V X7R | SMD 1812 | |
| C26 | 470n 50V X7R | SMD 1812 | |
| C27 | 470n 50V X7R | SMD 1812 | |
| C28 | 470n 50V X7R | SMD 1812 | |
| C29 | 2200uF 25V | std. Dia 12.5mm | Rubycon ZL series |
| C30 | 100n 50V X7R | SMD 1206 | |
| C31 | 22uF 16V | SMD Tant B | |
| C32 | 100uF 25V | std. Dia 6.3mm | Rubycon ZA series |
| C33 | 100n 50V X7R | SMD 1206 | |
| C34 | 220uF 16V | std. Dia 6.3mm | Rubycon YK series (or Euro Chemi-Con) |
| C35 | 1nF 16V X7R | SMD 0805 | (Remove for 8Ω load) |
| Note: C35 is piggy backed on top of R1 | | | |
| C36 | OPTIONAL - Not included | | Zobel Network - user dependant |
| U1 | ZXCD1000 | | |
| U2 | NE5532 | SMD SO 8 | |
| Q1 | ZXM64N03X | SMD MSOP 8 | |
| Q2 | ZXM64P03X | SMD MSOP 8 | |
| Q3 | ZXM64P03X | SMD MSOP 8 | |
| Q4 | ZXM64N03X | SMD MSOP 8 | |
| Q5 | ZTX692B E-line | TO92 compatible | |
| D1 | BAV70 | SMD SOT23 | A4 - Common Cathode |
| D2 | BAW56 | SMD SOT23 | A1 - Common Anode |
| D3 | BAW56 | SMD SOT23 | A1 - Common Anode |
| D4 | BAV70 | SMD SOT23 | A4 - Common Cathode |
| D5 | BZX84C13 | SMD SOT23 | 13V Zener diode |
| L1 | PG0036 / ZXFN1000 | 20uH | Pulse / Zetex |
| L2 | PG0036 / ZXFN1000 | 20uH | Pulse / Zetex |
| Note: Refer to zetex Web pages for availability and alternative sources | | | |


(Vcc = 16V for 25W)
(Vcc = 25V for 50W)
Vcc
SPEAKER A
SPEAKER B
R17 optional
C36 optional
External Zobel network - if required
L1 ZXFN1000 2.2uH
L2 ZXFN1000 2.2uH
C24 470n
C23 470n
C27 470n
C26 470n
C25 470n
C28 470n
Q2 ZXM64P03X
Q1 ZXM64N03X
Q3 ZXM64P03X
Q4 ZXM64N03X
R5 68R
R3 68R
R7 68R
R8 68R
R4 47k
R2 47k
R6 47k
R9 47k
D2 A1a
D1 A4a
D3 A1a
D4 A4a
C18 1u
C17 1u
C19 1u
C20 1u
C15 22u
C16 100u
C13 100n
C12 100n
C14 22u
C10 22u
C11 100n
C8 6n8
ZXCD1000
U1
C4 47n
C5 47n
C6 330p
C7 22u
C9 6n8
C3 22u
R16 390
R15 390
U2:A NE5532
U2:B NE5532
R14 22k
R13 22k
R10 22k
C21 100n
C22 22u
R12 680
R11 680
12V REG
C35 (NOT REQUIRED FOR 8 OHM LOAD)
R1 11k
C1 47p
C2 22u
R22 100k
AUDIO INPUT
Gnd INPUT
R20 RES-VAR 10k
R21 82k
R19 11k
Offset trim - optional
C31 22u
C30 100n
Q5 ZTX649
C34 220u
R18 11k
D5 BZX84C15
C33 100n
C32 100n
C29 2200u
VCC

# ZXCD1000EVMOL

This publication is issued to provide outline information only which (unless agreed by the Company in writing) may not be used, applied or reproduced for any purposes or form part of any order or contract or be regarded as representation relating to the products or services concerned. The company reserves the right to alter without notice the specification, design, price or conditions of supply of any product or service.

Some changes to earlier published data may have been made, data presented in this handbook supersedes all previous specifications. The information contained in this publication has been carefully checked and is considered to be accurate, but no responsibility is assumed for any inaccuracies.

**Zetex makes no warranty, representation or guarantee regarding the suitability of the products and circuits in this publication for any given purpose; nor does Zetex assume any liability arising from the use or application of any of these products or circuits and specifically disclaims any and all consequential and incidental damages.**

**Zetex products are specifically not authorised for use as critical components in life support devices or systems without the express written approval of the Managing Director of Zetex plc. As used herein -**

a. Life support devices or systems are devices or systems which

(1) are intended to implant into the body, or

(2) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labelling can be reasonably expected to result in significant injury to the user.

b. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

E. & O. E.



ZETEX Zetex plc.
Fields New Road, Chadderton, Oldham, OL9-8NP, United Kingdom.
Telephone: (44)161 622 4422 (Sales), (44)161 622 4444 (General Enquiries)
Fax: (44)161 622 4420

Zetex GmbH
Streitfeldstraße 19
D-81673 München
Germany
Telefon: (49) 89 45 49 49 0
Fax: (49) 89 45 49 49 49

Zetex Inc.
47 Mall Drive, Unit 4
Commack NY 11725
USA
Telephone: (631) 543-7100
Fax: (631) 864-7630

Zetex (Asia) Ltd.
3701-04 Metroplaza, Tower 1
Hing Fong Road,
Kwai Fong, Hong Kong
Telephone:(852) 26100 611
Fax: (852) 24250 494

These are supported by
agents and distributors in
major countries world-wide


**Internet**http://www.zetex.com