

ZXCT1011EV1 USER GUIDE

DESCRIPTION

The ZXCT1011EV1 is a current monitor evaluation board which measures 0.5A, 2.0A or a 2.5A load current. This current is then translated to a proportional output current which is scaled by an external resistor to give a 2.5V full scale output voltage.

A current reference resistor, external to the IC, results in a low temperature coefficient.

The board also incorporates additional solder pads for a user defined sense resistor to cater for additional load currents which may require measuring.

FEATURES

- Supply Range 2.5 to 20V
- Selectable current measurement range
- 2.5V Output Voltage
- SOT23-5 package
- Low Temperature Coefficient

APPLICATIONS

- Battery Charging
- Power Supplies
- DC motor and solenoid control

ORDERING INFORMATION

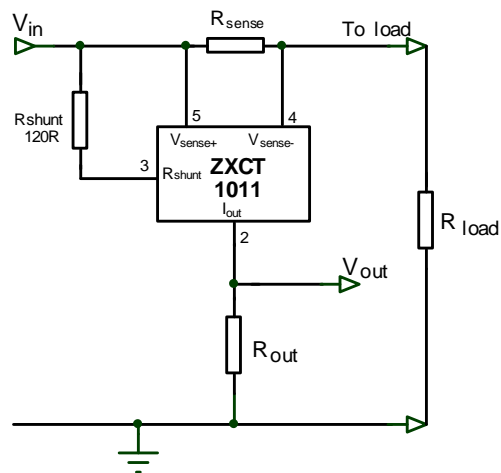
ORDER NUMBER
ZXCT1011EV1

Please note evaluation boards are subject to availability and qualified leads

PAD NAMES AND DEFINITIONS

NAME	DESCRIPTION
VIN	Supply Voltage
VLOAD	Connection to load/Battery
VOUT	Output Voltage
GND	0V – Ground
SL6,SL7	Solder Links

TYPICAL APPLICATION CIRCUIT



REFERENCE DESIGN

The ZXCT1011EV1 is configured to the schematic diagram in figure 1.0. The target applications are battery chargers, power supply units and automotive current monitoring.

The input voltage range for the ZXCT1011EV1 is 20V down to a minimum of 2.5V, making in suitable for a wide range of applications.

The ZXCT1011 IC utilises an external reference resistor which gives the ZXCT1011 a low temperature coefficient.

R_{sense}

The board has been designed with three set selectable values of R_{sense}, to measure either a 0.5A, 2.0A or 2.5A range. The value of sense resistor can be chosen by using the solder links SL6 and SL7.

To measure a 0.5A load current, the 200mΩ resistor (R3) should be selected by shorting SL7. To measure a 2.0A current, the 50mΩ resistor (R2) should be selected by shorting SL6. To measure a 2.5A current, short both SL6 and SL7. The 50mΩ in parallel with the 200mΩ will give a 40mΩ resistance. RST is also available if a user defined current load level is required to be measured. This allows the user to scale in a more appropriate value of sense resistor. If the value of sense resistor is changed, the maximum power dissipation of the resistor must be appropriate to the load current level.

NB The board is set by default to measure 0.5A i.e. SL7 is shorted, utilizing the 200mΩ resistor.

For further information on choosing a value of sense resistor please refer to the ZXCT1011 datasheet.

V_{out}

If the preset selectable values of sense resistor are chosen, the device will output 2.5V at both the 0.5A and 2.0A current levels. The board has been designed for each of the sense resistors to develop 100mV across them at the three levels of current.

Configuration table for ZXCT1011EV1

LOAD CURRENT (A)	R _{sense} (mΩ)	V _{OUT} (V)	SOLDER LINK CONFIGURATION
0.5	200	2.5	Short SL7
2.0	50	2.5	Short SL6
2.5	40	2.5	Short SL7 and SL6

Configuration for different LOAD currents.

The board can be configured to accommodate different load currents if necessary. If surface mount sense resistors are to be used, remove R2 and R3 and replace with a required value. RST can be used if a through hole sense resistor is used. It is important to ensure an appropriate value of R_{sense} is selected to obtain the desired accuracy for a given output current.

NB Changing the sense resistor value will change the output current. It may therefore be necessary to change R5 to obtain the required output voltage.

The following lines describe how to scale a load current to an output voltage.

$$\begin{aligned} V_{\text{sense}} &= (V_{\text{sense}+}) - (V_{\text{sense}-}) = I_{\text{load}} \times R_{\text{sense}} \\ \text{Defining then} \quad I_{\text{out}} &= I_q + V_{\text{sense}} \times g_m \\ \text{since} \quad g_m &= 1.2 / R_{\text{shunt}} \\ I_{\text{out}} &= I_q + [(V_{\text{sense}} \times 1.2) / R_{\text{shunt}}] \\ &= I_q + [(1.2 \times I_{\text{load}} \times R_{\text{sense}} / R_{\text{shunt}})] \end{aligned}$$

Note: I_q is embedded into the specification of the ZXCT1011 and therefore appears an offset error.

$$\therefore V_{\text{out}} = (R_{\text{out}} \times I_{\text{offset}}) + [(1.2 \times R_{\text{out}} \times I_{\text{load}} \times R_{\text{sense}}) / R_{\text{shunt}}]$$

The output current of the ZXCT1011 is directly related to the size of the trimming resistor used. It is important to ensure the tolerance of R_{shunt} is considered. A 1% change in R_{shunt} will cause a 1% change in output.

Example: Scaling for 1.5A load current and a 500mV output.

Choose a value of R_{shunt} to give a required transconductance; using a 120 Ω resistor will give 10mA/V.

Choose a value of sense resistor to accommodate the required accuracy on the output.

A 150mV drop across the sense resistor will require a 100m Ω sense resistor.

$$V_{\text{out}} = g_m \times V_{\text{sense}} \times R_{\text{out}}$$

$$\text{Where } g_m = 1.2 / R_{\text{shunt}} \quad g_m = \text{transconductance (S)}$$

Therefore, the required output resistor for a 500mV output for $R_{\text{shunt}} = 120\Omega$ will be:

$$R_{\text{out}} = 500 \times 10^{-3} / (150 \times 10^{-3} \times 0.01) = 333.33\Omega$$

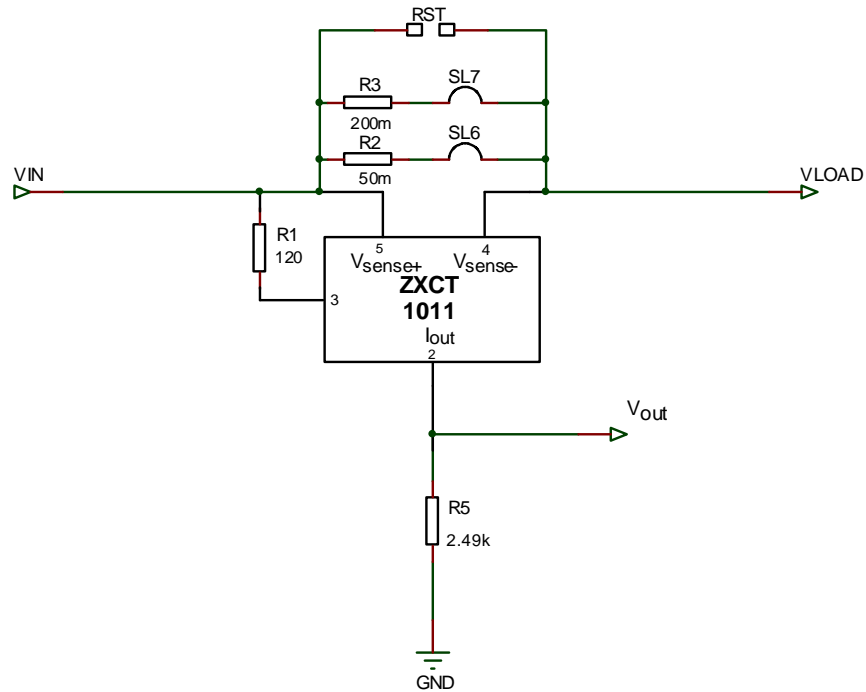
Nearest preferred value: 332 Ω

Accuracy

The ZXCT1011 current monitor IC is a 2.5%¹ accurate device. The accuracy of the output voltage will be influenced by the tolerance of the external resistors used. The ZXCT1011EV1 uses a 1% accurate sense resistor and a 0.1% accurate output resistors.

¹ Maximum error at 200mV

Figure 1.0 Schematic Diagram
(default configuration with SL7 shorted and SL6 open)



Materials List

Ref	Value	Package	Part Number	Manufacturer	Notes
R1	120Ω	0805		Panasonic	SMD ±25ppm 1%
R2	50mΩ	1206	LR1206	Welwyn	SMD Sense Resistor 1%
R3	200mΩ	1206	LR1206	Welwyn	SMD Sense Resistor 1%
R4	0Ω	0805			Zero ohm link
R5	2.49k	0805			SMD ±25ppm 0.1%
ZXCT		SOT23	ZXCT1011E5	ZETEX	

ZXCT1011EV1

Set-up and Test

The board is preset to measure 0.5A. SL7 is shorted to connect in the 200mΩ sense resistor. To change the board to measure 2.0A, de-solder SL7 and short SL6.

0.5 Ampere load test

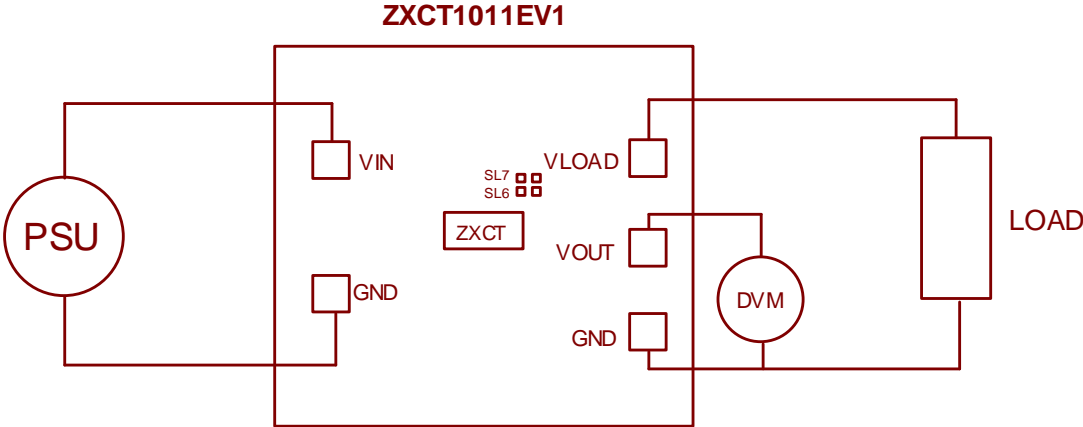
1. Ensure SL7 is shorted.
2. Connect a linear power supply of +10V between the VIN and GND terminals.
3. Set a load current of 0.5A.
4. Turn on the power supply
5. Check with a DVM the supply voltage is +10V between the VIN and GND terminals.
6. Measure VOUT with a DVM. The nominal output voltage should read 2.5V.

ZXCT1011EV1

ISSUE 2 – September 2005

The output current can be set by using either an external power resistor or an electronic load. The accuracy of the current set will have an influence on the output voltage.

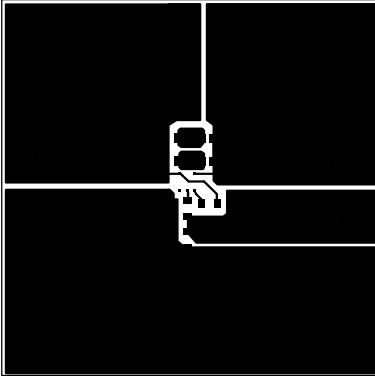
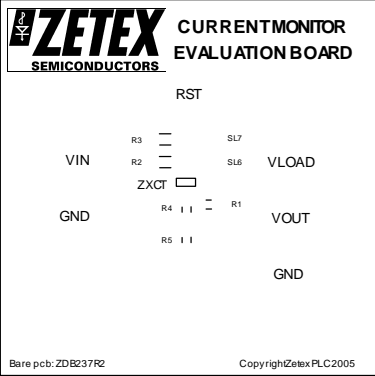
Connection Diagram



The ZXCT1009EV1 board can also be used to evaluate the following Zetex current monitors IC's:

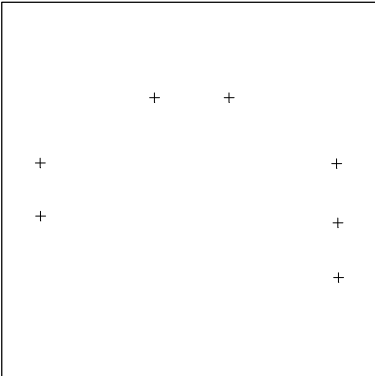
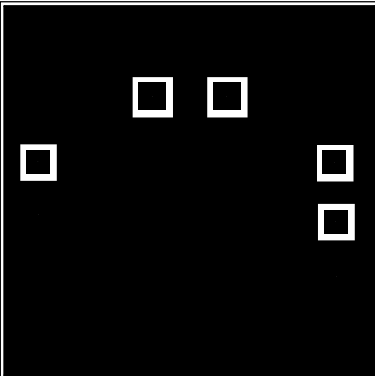
- ZXCT1008
- ZXCT1009

Layout



Top Silk

Top Copper



Bottom Copper

Drill File



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