

ZXCT1032EV1 USER GUIDE

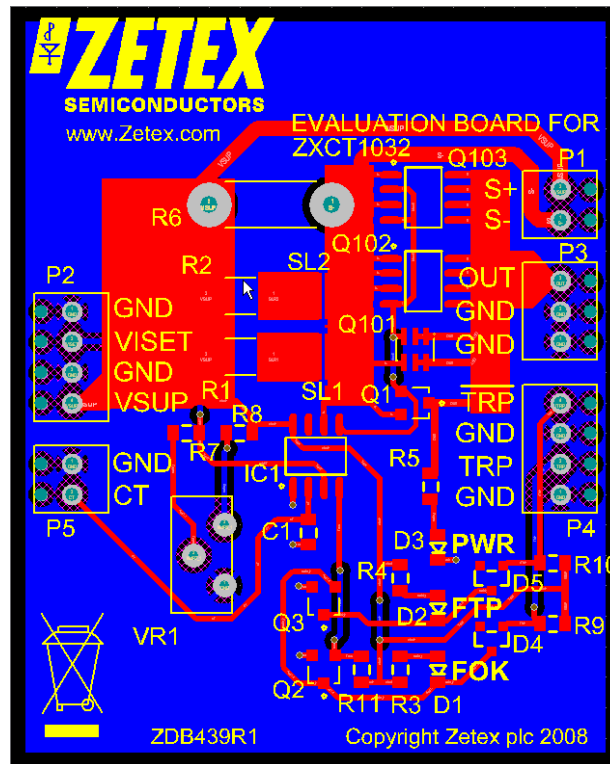


Figure 1 Evaluation board components' layout

The ZXCT1032EV1 provides a very convenient means for evaluating the capabilities of the ZXCT1032 current monitor.

The ZXCT1032 is a high-side current monitor that drives a PMOS or PNP transistor to provide in-rush current limit and over-current protection. The ZXCT1032 includes a high accuracy high-side current monitor, a start-up timer and a re-try inhibit timer. The ZXCT1032 takes the voltage developed across a current shunt resistor and compares this with an externally set trip point. It works in three modes:

- Linear soft-start
- Over-current detector
- Over-current disconnect/fuse

For details on these and other features of the ZXCT1032, refer to the datasheet which is available on the Zetex Semiconductors' web site.

The evaluation board is more complex than the typical application of the device. This is because it contains some features to aid with experimentation and visualisation of the operational status of the device. Some of these will be briefly explained with reference to Figure 1.

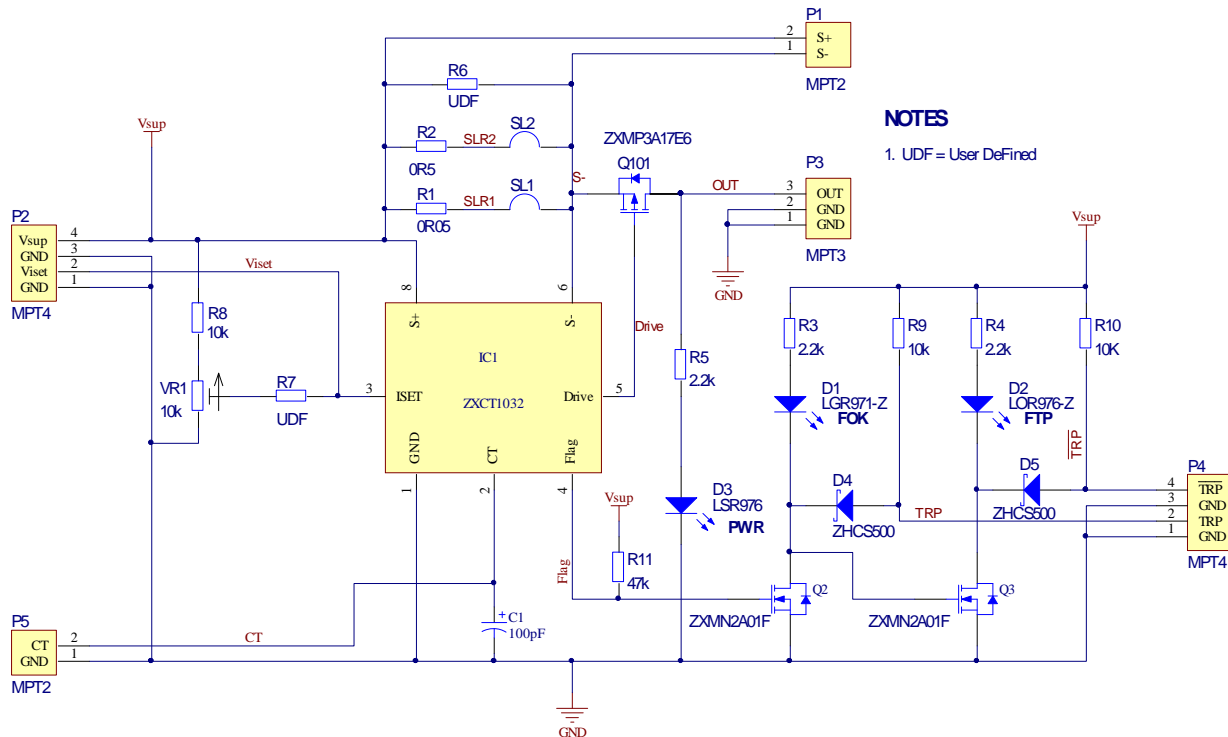


Figure 2 Circuit diagram for evaluation board ZXCT1032EV1

Supply Range 9.5V to 20V

Current sensing

The sense resistor, R_S , consists of two resistors (R1 and R2) which are configured in parallel such that either one or both resistors could be connected by completing the solder-bridge link next to each one. R2 (0.5R) is connected by default.

A third resistor, R6, is in parallel with R1 and R2 consists of two pads with a hole in each pad. R6 provides means for connecting an external R_S either alone or in parallel with R1 and R2.

Trip current

When the load current reaches or exceeds a certain value, transistor Q101 is switched off. The current at which this happens is given by,

$$I_{TRIP} = \frac{V_{ISET} - 0.15}{10 \cdot R_{SENSE}}$$

With the default values supplied on the evaluation board, this becomes

$$I_{TRIP} = \frac{2.1 - 0.15}{10 \cdot 0.5} = 390mA$$

The board is supplied without R7 which means that V_{ISET} defaults to the internal 2.1V reference. An external V_{ISET} can be imposed on terminal P2-2. A lower V_{ISET} will lower the trip current and vice versa. A V_{ISET} of less than 100mV will permanently turn the series transistor off.

On-board adjustment of V_{ISET}

As an alternative to using the on-board voltage reference for V_{ISET} , a multi-turn potentiometer, VR1, is provided on the evaluation board. This can be connected to the V_{ISET} input by adding R7. R7 can be

any value from 0 to 2.2k. It might however be best not to make R7 zero if external V_{ISET} will also be used so that the external source of V_{ISET} is not inadvertently shorted out when VR1 is set to 0Ω.

When VR1 is supplying V_{ISET} , the range will be adjustable from a minimum value up to a maximum value that is largely dependent on the supply voltage. The minimum and maximum values can be determined from the following expressions.

$$V_{ISET(\min)} = \frac{V_{REF} \cdot R7}{R7 + R_{VREF}} = \frac{2.1 \cdot R7}{R7 + 50k}$$

where R7 is in kΩ and both V_{ISET} and V_{REF} are in Volts. R_{VREF} is the source resistance of the on-chip voltage reference.

$$V_{ISET(\max)} = \frac{V_T \cdot R_{VREF} + V_{REF} \cdot R_T}{R_{VREF} + R_T}$$

$$\text{where } V_T = \frac{V_{SUP}}{2} \text{ and } R_T = 5k + R7.$$

For $R7 = 2.2k\Omega$, the above formulae simplify to

$$V_{ISET(\min)} = \frac{2.1 \cdot 2.2}{2.2 + 50} = 92.7mV \text{ (VR1 at minimum)}$$

$$V_{ISET(\max)} = 0.437 \cdot V_{SUP} + 0.264 \text{ V (VR1 at maximum)}$$

Flags and indicators

The ZXCT1032 has an active low flag which goes low when the device has tripped. This flag is used to provide a number of indications regarding the status of the evaluation board.

LEDs

There are two LEDs labelled FOK (Flag OK - green) and FTP(Flag TriPped - yellow). These light to indicate their respective functions.

There is a third LED labelled PWR (PoWeR – red) which will be on as long as there is power on at the output, i.e. Q101 is on.

Flags

The device flag is buffered by a two stage transistor (Q2,3) to provide an active high (\overline{TRP}) and active low (TRP) tripped flag which are available on terminals P4-2 and P4-4 respectively. Terminals P4-1 and P4-3 are ground pins.

Both the TRP and \overline{TRP} pins can sink currents up to 500mA from a voltage not greater than ($V_{SUP} + 5V$) or 30V whichever is the lower.

Interfaces

The interfaces are as shown in Figure 1.

P1 – V_{SENSE} - Provides a convenient point to monitor V_{SENSE} . Do not use this terminal for shunt resistors especially when handling high currents. Use R6 instead.

P1		
1	S-	
2	S+	

P2 – Input

P2		
1	Ground	
2	V_{ISET}	$0V - V_{SUPPLY}$
3	Ground	
4	Supply voltage	$9.5V - 20V$

P3 – Output

P3		
1	Ground	
2	Ground	
3	Output	To load

P4 – Flags

P4		
1	Ground	
2	Tripped	Active high
3	Ground	
4	<i>Tripped</i>	Active Low

P5 – Timing capacitor C_T . There is an on-board $0.1\mu F$ capacitor. Any addition across P5 will appear in parallel with this $0.1\mu F$ capacitor.

P5		
1	Ground	
2	C_T	No limit

ORDERING INFORMATION

ORDER NUMBER
ZXCT1032EV1

Please note evaluation boards are subject to availability and qualified leads.

ZXCT1032EV1 Summary

Sense resistor

The board has been designed with two selectable values of sense resistor. The value of the sense resistor can be chosen by using the solder links SL1 and SL2.

The board is also tracked for a user-defined through-hole resistor (R6).

The 50mΩ resistor (R1) is selected by shorting SL1 and opening SL2.

The 500mΩ resistor (R2) is selected by shorting SL2 and opening SL1.

If both links are shorted the effective resistance is 45.45 mΩ.

If both links are open, the optional leaded resistor R6 can be exclusively used as the sense resistor. The maximum power dissipation rating of the resistor must be appropriate to the load current level.

For further information on choosing a value of sense resistor please refer to the ZXCT1032 datasheet.

Trip current sensitivity and its adjustment

The current at which the ZXCT1032EV1 trips (DRIVE goes high and FLAG goes low) for a given R_S is changed by setting V_{ISET} .

This trip current is given by,

$$I_{TRIP} = \frac{V_{ISET} - 0.15}{10 \cdot R_S}$$

Configuration table for ZXCT1032EV1

R_S (mΩ)	Trip Current	SOLDER LINK CONFIGURATION	NOTES
50	3.9	Short SL2	
500	0.39	Short SL1	
45.45	4.3	Short SL1 & SL2	

Configuration for different trip currents.

The board can be configured for different trip currents by changing the SMD resistors or fitting a suitable wire ended resistor and opening both solder links. It is important to ensure an appropriate value of R_S is selected to obtain the desired accuracy for a given output current.

Choosing a larger value for R_S gives a higher output voltage for a given current resulting in better resolution but at the expense of increased voltage drop and higher dissipation in R_S .

The ZXCT1032 is optimized for values of V_{SENSE} around 200mV.

Accuracy

The accuracy of the trip current will be influenced by the tolerance of the external sense resistors used. The ZXCT1032EV1 utilizes 1% sense resistors.

COMPONENTS LIST

Ref	Qty	Value	Pkg	Part Number	Manufacturer	Notes
C1	1	0.1 μ F/25v	0805			
D1	1	LED Grn	0805	LGR971-Z	Osram	FEC 122-6373
D2	1	LED Yel	0805	LYR971-Z	Osram	FEC 122-6420
D3	1	LED Red	0805	LSR976	Osram	FEC 122-6392
D4,5	2	Schottky	SOT-23	ZHCS500	Zetex	
IC1	1	Current Monitor	SO8	ZXCT1032N8	Zetex	
P1,5	2	2-W STB	MPT2	1725656	Phoenix	FEC 304-1359
P3	1	3-W STB	MPT3	1725669	Phoenix	FEC 304-1360
P2,4	2	4-W STB	MPT4	1725672	Phoenix	FEC 304-1414
Q101	1	FET	SOT-23-6	ZXMP3A17E6	Zetex	
Q2,3	2	FET	SOT-23	ZXMN3B01F	Zetex	
R1	1	50m Ω	2512	LR2512-R050FW	Welwyn	SMD Sense Resistor 1%
R2	1	500m Ω	2512	LR2512-R500FW	Welwyn	SMD Sense Resistor 1%
R3,4,5	3	2.2k	0805	Standard 0805 1%		
R8,9,10	3	10k	0805	Standard 0805 1%		
R11	1	47k	0805	Standard 0805 1%		
RV1	1	10k	Trim-pot	T93YB 10k 10% TU	Vishay	FEC 114-1419
Total	25					

SET-UP AND TEST

The board is preset to trip at a load current of 390mA (SL2 is shorted to connect in R2, 500m Ω , sense resistor and internal V_{REF} is used).

Required Equipment

1. 1 x 30R 15W resistor (load – it may be necessary to mount resistor on heat sink).
2. 1 x adjustable bench PSU. (A second PSU can optionally be used to vary V_{SET} to change the trip current - see **Error! Reference source not found.** – or the on-board variable resistor may be used instead.)
3. 2 x DVM's (one for voltage measurement and one for current measurement)
4. 1.5/1.8mm flat jeweller's screw driver (for terminal blocks).

420mA load test. (Refer to **Error! Reference source not found.** for test diagram.)

1. Ensure SL2 is shorted.
2. Set PSU1 to 0V and limit its current to 500mA.
3. Connect PSU1 to VSUP.
4. Connect the resistor in series with the ammeter set to a suitable range for measuring up to 500 mA DC.
5. Switch on PSU1 and adjust until the ammeter reads 350 mA \pm 1 mA. LED's **PWR** and **FOK** should be lit.
6. On terminal P4, measure pin \overline{TRP} with a DVM. It should be high.
7. On terminal P4, measure pin TRP with a DVM. It should be low.
8. Increase PSU1 until ammeter current drops to less than 40mA. Make sure that this happens around 390mA \pm 30mA (the yellow LED will light whilst the red and green LED's will glow at a reduced brightness - some flickering may be observed).
9. On terminal P4, measure pin $\overline{TRP}^{(1)}$ with a DVM. It should be low. Low means less than 0.15V_{SUP}.
10. On terminal P4, measure pin TRP^(**Error! Bookmark not defined.**) with a DVM. It should be high. High means greater than 0.85V_{SUP}.

End of Test

¹ The voltage on pins \overline{TRP} and TRP are square waves with complementary low and high duty cycles respectively. The duty cycle is governed by capacitor C_T. Therefore, the coefficient of V_{SUP} given for these tests will change if a different value of C_T is used. The same thing applies to the 40mA limit in Test 8.

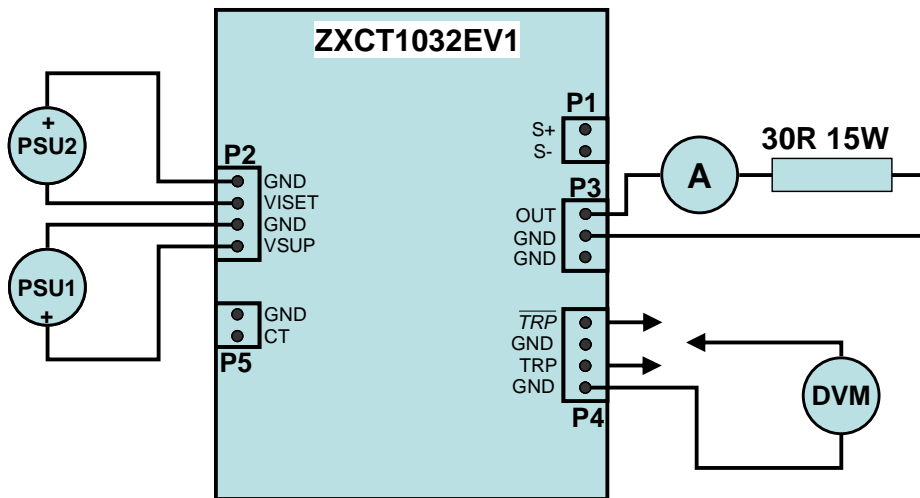
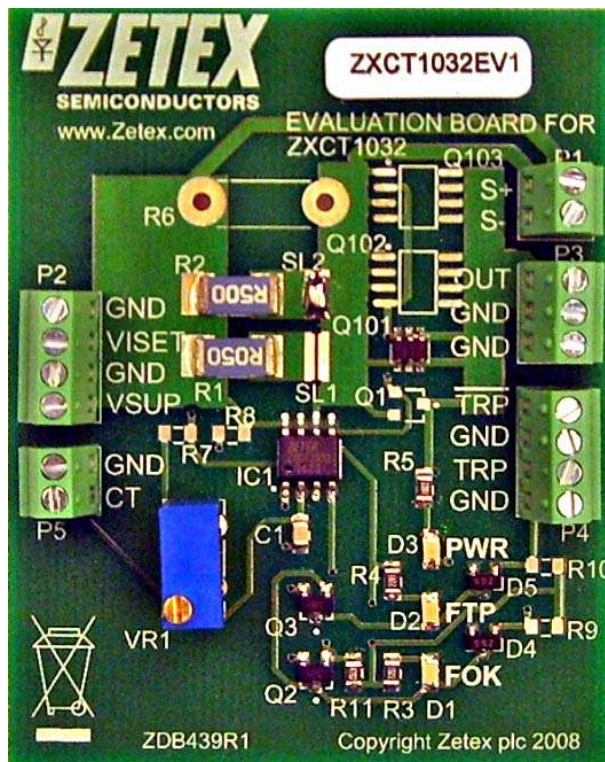


Figure 3 Test diagram for ZXCT1032EV1

EVALUATION BOARD



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