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# ZXCT1021

## Low offset high-side current monitor

### Description

The ZXCT1021 is a precision high-side current sense monitor. Using this type of device eliminates the need to disrupt the ground plane when sensing a load current.

The ZXCT1021 provides a fixed gain of 10 for applications where minimal sense voltage is required.

The very low offset voltage enables a typical accuracy of 3% for sense voltages of only 10mV,

### Features

- Accurate high-side current sensing
- Output voltage scaling
- 2.5V – 20V supply range
- 25 $\mu$ A quiescent current
- 1% typical accuracy
- SOT23-5 package

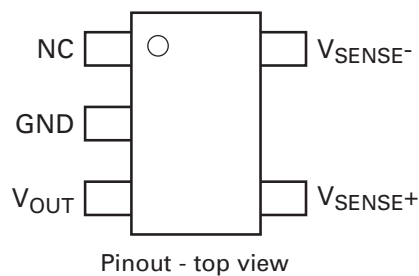
giving better tolerances for small sense resistors necessary at higher currents.

The wide input voltage range of 20V down to as low as 2.5V make it suitable for a range of applications. With a minimum operating current of just 25 $\mu$ A, combined with its SOT23-5 package make it suitable for portable battery equipment too.

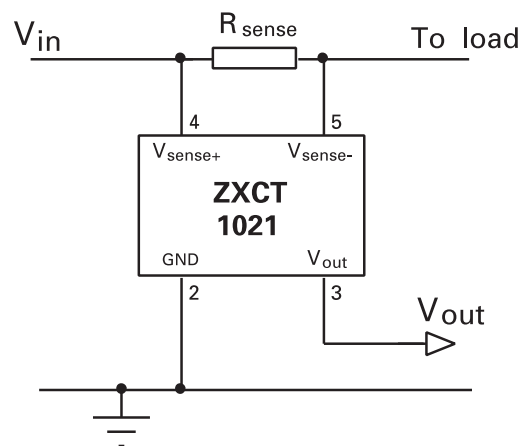
### Applications

- Battery chargers
- Smart battery packs
- DC motor control
- Over current monitor
- Power management
- Level translating
- Programmable current source

### Pinout information



### Typical application circuit



### Ordering information

Order reference	Package	Device marking	Status	Reel size (inches)	Quantity per reel	Tape width (mm)
ZXCT1021E5TA	SOT23-5	1021	Released	7	3000	8

## Absolute maximum ratings

Voltage on any pin with respect to END pin	-0.6V to 20V
$V_{SENSE}$	-0.6V to $V_{IN} + 0.5V$
Operating temperature	-40 to 85°C
Storage temperature	-55 to 150°C
Package power dissipation	( $T_{amb} = 25^{\circ}C$ )
SOT23-5	300mW

## Pinout information

Pin name	Pin function
N/C	Not internally connected
GND	Ground
$V_{OUT}$	Voltage output referenced to GND. Intended to drive high impedance loads
$V_{SENSE-}$	High impedance negative sense voltage input
$V_{SENSE+}$	Supply and positive sense voltage input

# ZXCT1021

Electrical characteristics test conditions  $T_{amb} = 25^{\circ}\text{C}$ ,  $V_{IN} = 15\text{V}$

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
$V_{IN}$	$V_{CC}$ range		2.5		20	V
$V_{OUT}$	Output voltage	$V_{SENSE} = 30\text{mV}$	291	300	309	mV
		$V_{SENSE} = 100\text{mV}$	0.98	1.00	1.02	V
		$V_{SENSE} = 150\text{mV}$	1.47	1.50	1.53	V
$R_{OUT}$	Output resistance		10	15	20	$\text{k}\Omega$
$T_C^{(*)}$	Output voltage temperature coefficient			50	300	ppm
$I_Q$	Ground pin current	$V_{SENSE} = 0\text{V}$		25	35	$\mu\text{A}$
$V_{SENSE}^{(\dagger)}$	Sense voltage	$V_{IN} = 20\text{V}$	0		1.5 <sup>(‡)</sup>	V
$I_{LOAD}$	$V_{SENSE}$ - load pin input current	$V_{SENSE} = 0\text{V}$			100	nA
Acc	Accuracy	$V_{SENSE} = 100\text{mV}$	-2		2	%
Gain	$V_{OUT} / V_{SENSE}$	$V_{SENSE} = 100\text{mV}$	9.8	10	10.2	V/V
BW	Bandwidth	$V_{SENSE} = 10\text{mV}$		300		kHz
		$V_{SENSE} = 100\text{mV}$		2		MHz

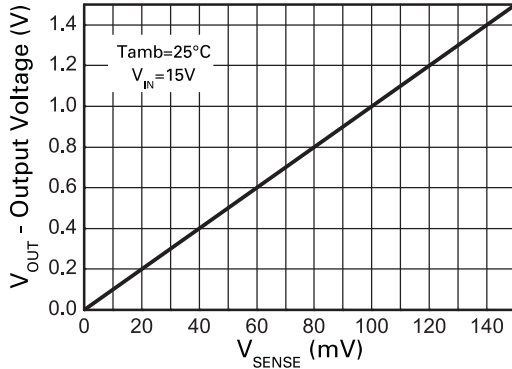
**NOTES:**

(\*)  $T_C$  limits are determined by characterization

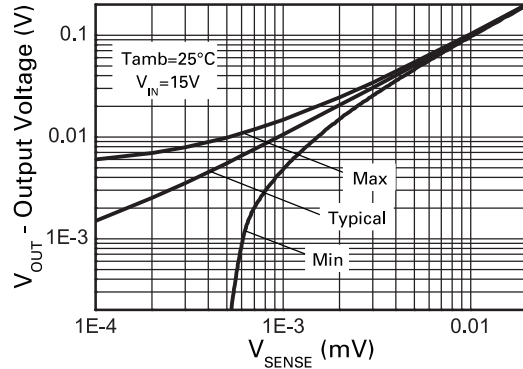
(†)  $V_{SENSE} = V_{IN} - V_{LOAD}$

(‡) This will be reduced at lower  $V_{IN}$  voltages due to clipping of output voltage.

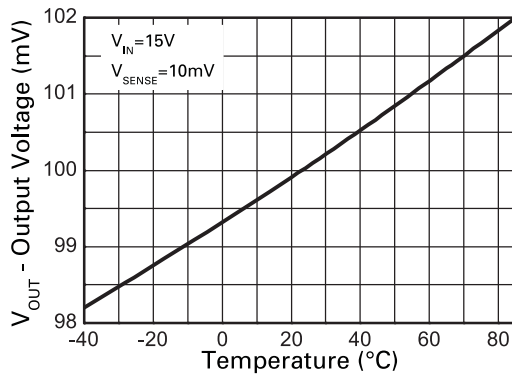
## Typical characteristics



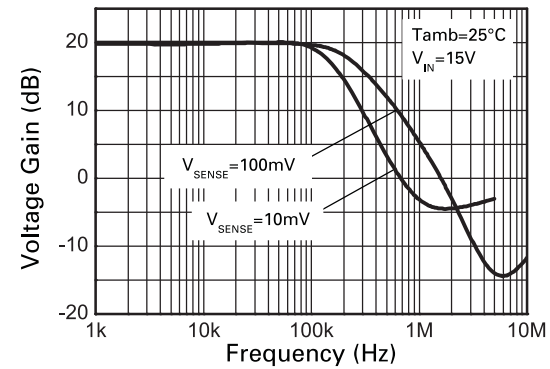
**Typical Output v Sense Voltage**



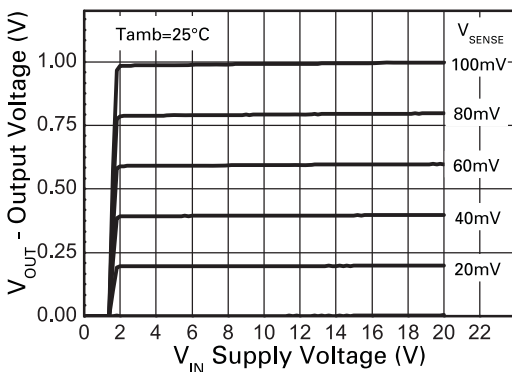
**V<sub>OUT</sub> v Sense Voltage**



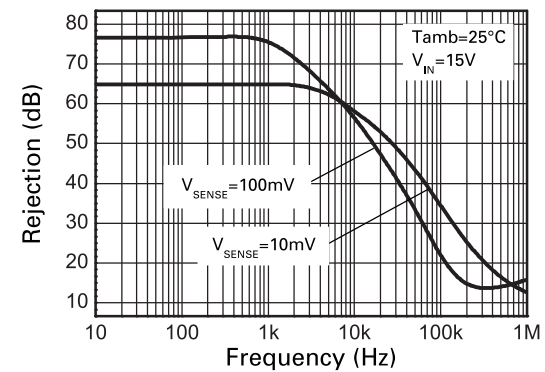
**Output Voltage v Temperature**



**Frequency Response**

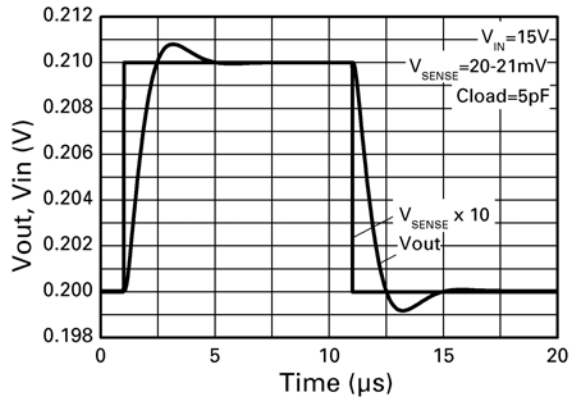


**Transfer Characteristic**

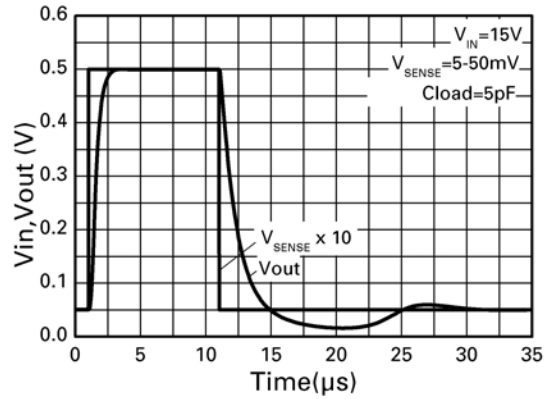


**Common Mode Rejection**

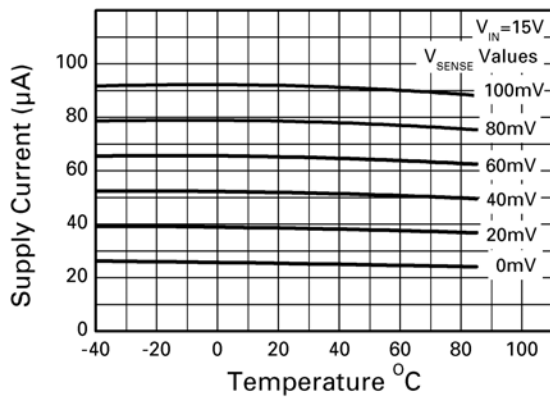
## Typical characteristics



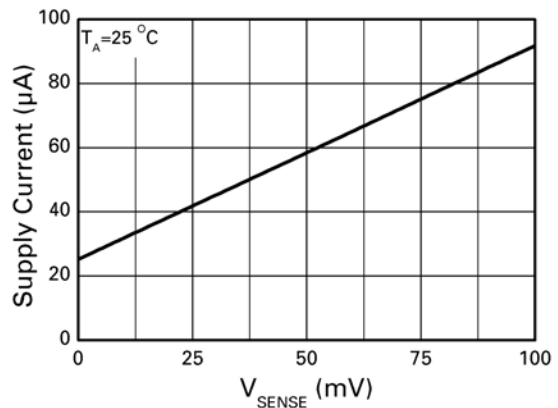
**Small Signal Step Response**



**Large Signal Step Response**



**Isupply v Temperature**



**Isupply v Vtemp**

## Application information

The ZXCT1021 has a fixed dc voltage gain of 100. No external scaling resistors are required for the output. Output voltage is simply defined as:

$$V_{OUT} = 10 \times V_{SENSE} (V)$$

Where  $V_{SENSE} = V_{IN} - V_{LOAD}$

## PCB trace shunt resistor for low cost solution

Figure 1 shows a PCB layout suggestion for a low cost solution where a PCB resistive trace in replacement for a conventional shunt resistor, can be used. The resistor section is 25mm x 0.25mm giving approximately 150m $\Omega$  using 1 oz copper. Smaller resistances can be used if required.

Total circuit solution: 1 component. Shows area of 150m $\Omega$  sense resistor compared to SOT23 package.

Practical tolerance of the PCB resistor will be around 5% depending on manufacturing methods.

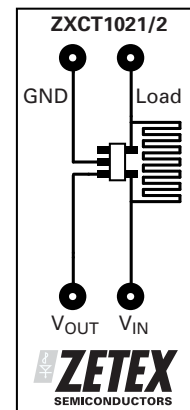
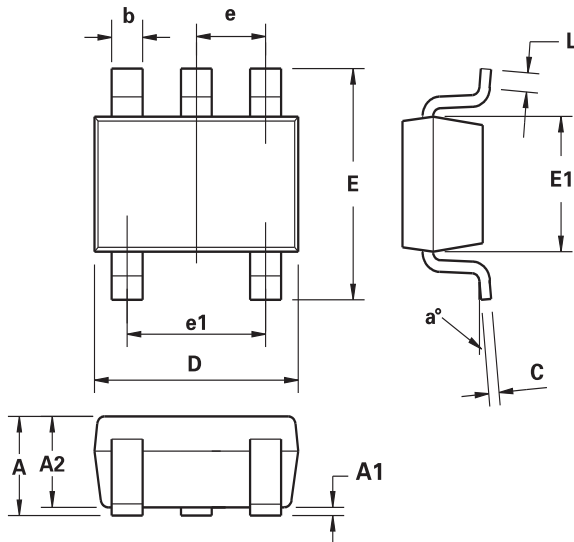


Figure 1 PCB layout suggestion

# ZXCT1021

## Package outline - SOT23-5



DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.45	0.0354	0.0570
A1	0.00	0.15	0.00	0.0059
A2	0.90	1.30	0.0354	0.0511
b	0.20	0.50	0.0078	0.0196
C	0.09	0.26	0.0035	0.0102
D	2.70	3.10	0.1062	0.1220
E	2.20	3.20	0.0866	0.1181
E1	1.30	1.80	0.0511	0.0708
e	0.95 REF		0.0374 REF	
e1	1.90 REF		0.0748 REF	
L	0.10	0.60	0.0039	0.0236
a°	0°	30°	0°	30°

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches



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