

ZXCT1022

Low offset high-side current monitor

Description

The ZXCT1022 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.

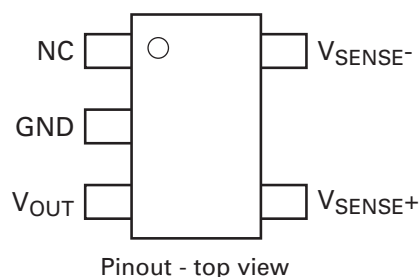
The ZXCT1022 provides a fixed gain of 100 for applications where minimal sense voltage is required.

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

Features

- Accurate high-side current sensing
- Ground referred output
- 2.5V – 20V supply range
- 25 μ A quiescent current
- SOT23-5 package

Pinout information



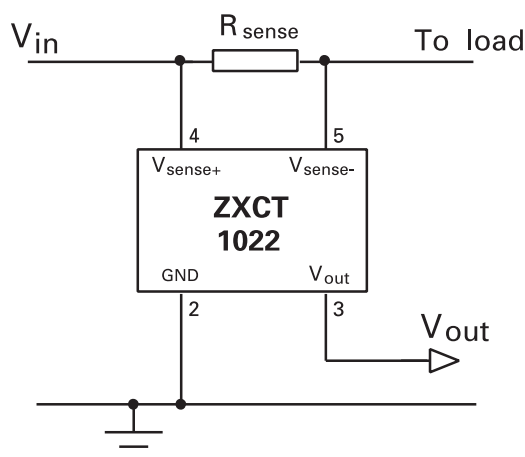
giving better tolerances for small sense resistors necessary at higher currents.

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 μ 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 protection
- Power supply current measurement
- Level translating

Typical application circuit



Ordering information

Order reference	Package	Device marking	Status	Reel size (inches)	Quantity per reel	Tape width (mm)
ZXCT1022E5TA	SOT23-5	1022	Active	7	3000	8

Absolute maximum ratings

Voltage on $V_{S+}^{(*)}$ pin	-0.6V to 20V
Voltage on $V_{S-}^{(*)}(\dagger)V_{OUT}^{(*)}(\dagger)$ pin	-0.6V to $V_{S+} + 0.5V$
$V_{SENSE}^{(\ddagger)}$	-0.6V to +0.5V
Operating temperature	-40 to 85°C
Storage temperature	-55 to 150°C
Package power dissipation	($T_A = 25^\circ C$)
- SOT23-5	- 450mW

NOTES:

(*) with respect to GND pin

(†) voltage not to exceed 20V

(‡) $V_{SENSE} = V_{S+} - V_{S-}$

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_{S-}	High impedance negative sense voltage input
V_{S+}	Supply and positive sense voltage input

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	$V_{SENSE} = 0\text{V}$	0	30	100	mV
		$V_{SENSE} = 10\text{mV}$	0.97	1.0	1.03	V
		$V_{SENSE} = 30\text{mV}$	2.91	3.0	3.09	V
		$V_{SENSE} = 100\text{mV}$	9.7	10.0	10.3	V
R_{OUT}	Output resistance		10	15	20	$\text{k}\Omega$
$T_C^{(*)}$	Output temperature coefficient			50	300	ppm
I_Q	Ground pin current	$V_{SENSE} = 0\text{V}$		25	35	μA
$V_{SENSE}^{(\dagger)}$	Sense voltage	$V_{IN} = 20\text{V}$	0		180 ^(‡)	mV
I_{SENSE}	Load pin current	$V_{SENSE} = 0\text{V}$			100	nA
Acc	Accuracy	$V_{SENSE} = 10\text{mV}$	-3		3	%
Gain	V_{OUT} / V_{SENSE}	$V_{SENSE} = 10\text{mV}$	97	100	103	V/V
BW	Bandwidth	$V_{SENSE} = 10\text{mV}$		300		kHz
		$V_{SENSE} = 100\text{mV}$		2		MHz

NOTES:

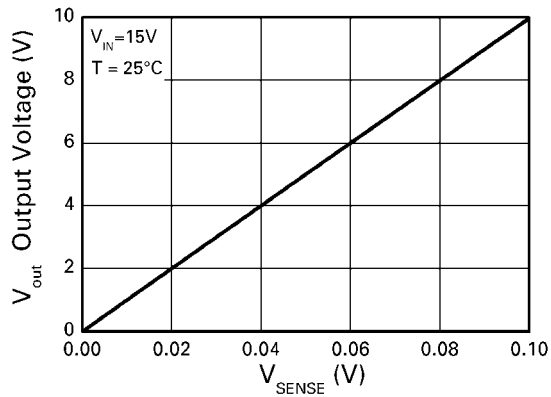
(*) T_C limits are determined by characterization

(†) $V_{SENSE} = V_{IN} - V_{LOAD}$

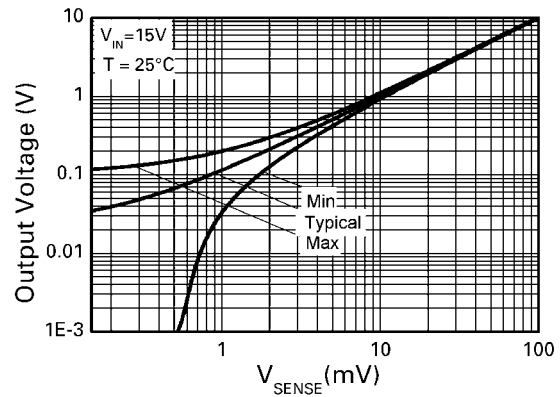
(‡) For linear operation maximum V_{SENSE} is limited by operating voltage and is approximately:

$$V_{SENSE} = \frac{(V_{IN} - 2)}{100}$$

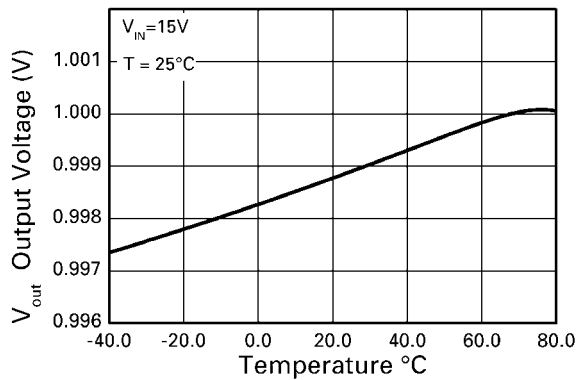
Typical characteristics



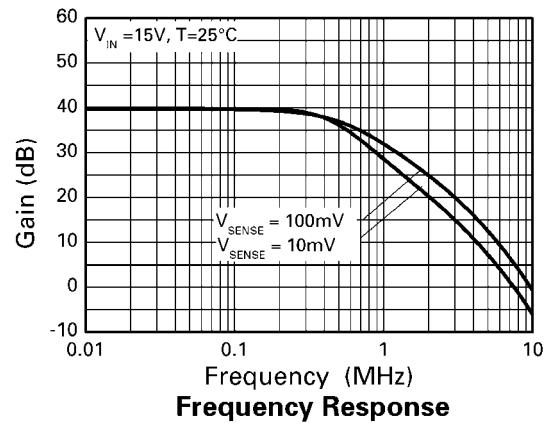
Typical Output v Sense Voltage



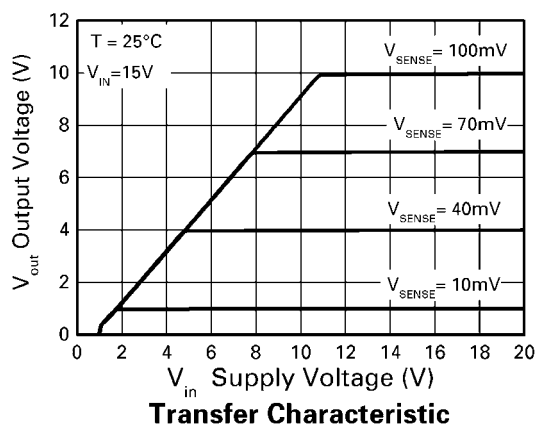
Error v Sense Voltage



Output Voltage v Temperature

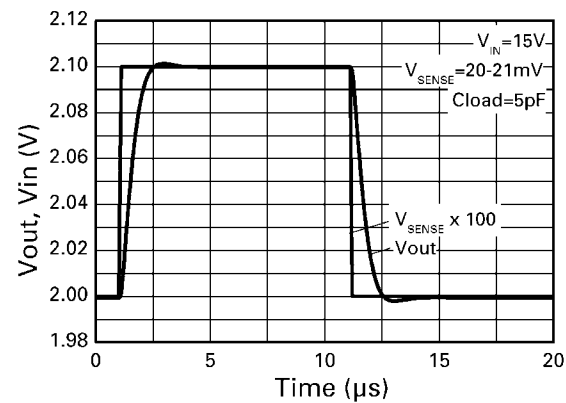


Frequency Response

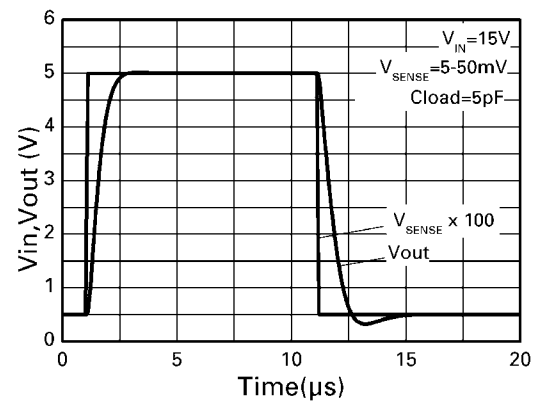


Transfer Characteristic

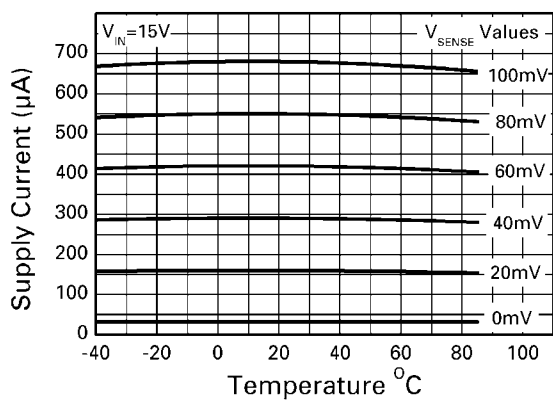
Typical characteristics



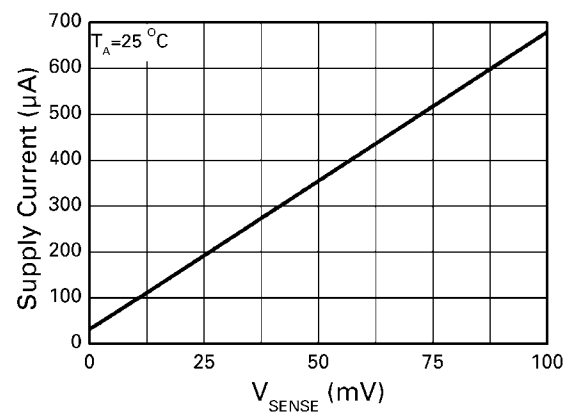
Small Signal Step Response



Large Signal Step Response



Isupply v Temperature



Isupply v Vsense

Application information

The ZXCT1022 has a fixed dc voltage gain of 100. No external scaling resistors are required for the output. Output voltage is simply defined as:

$$V_{OUT} = 100 \times V_{SENSE} (V)$$

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 150mΩ using 1 oz copper. Smaller resistances can be used if required.

Total circuit solution: 1 component. Shows area of 150mΩ sense resistor compared to SOT23 package.

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

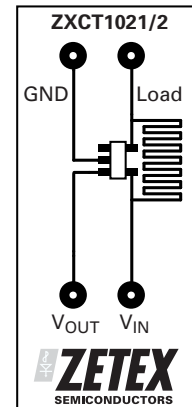
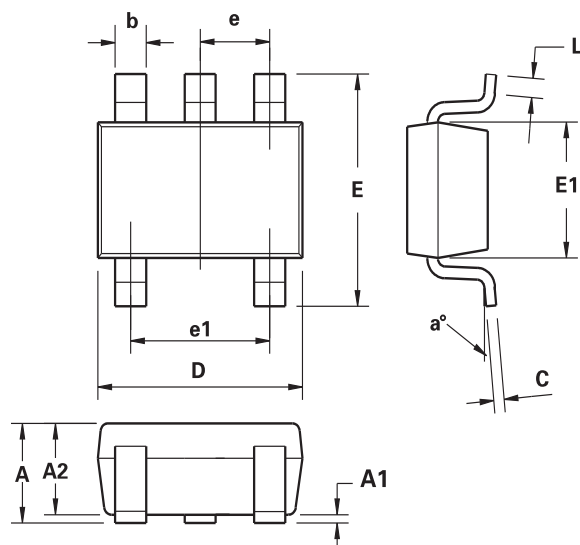


Figure 1 PCB layout suggestion

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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