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, 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 25µA, combined with its SOT23-5 package make it suitable for portable battery equipment too.

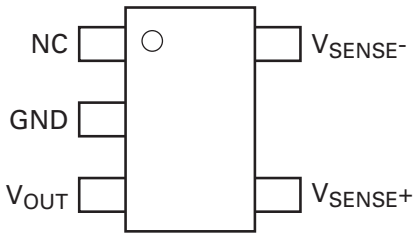
Features

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

Applications

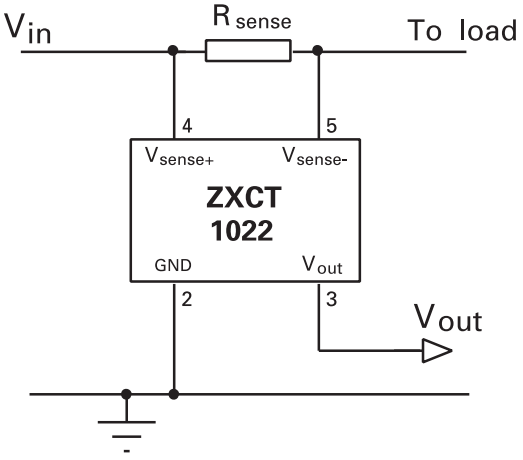
- Battery chargers
- Smart battery packs
- DC motor control
- Over-current protection
- Power supply current measurement
- Level translating

Pinout information



Pinout - top view

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-} (*) (†) V_{OUT} (*)(†) pin	-0.6V to V_{S+} +0.5V
V_{SENSE} (‡)	-0.6V to +0.5V
Operating temperature	-40 to 85°C
Storage temperature	-55 to 150°C
Package power dissipation	(T_A = 25°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

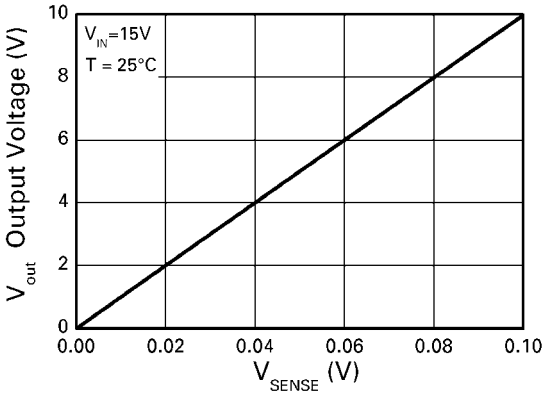
Electrical characteristics test conditions T_{amb} = 25°C, V_{IN} = 15V

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{IN}	V_{CC} range		2.5		20	V
V_{OUT}	Output voltage	V_{SENSE} = 0V	0	30	100	mV
		V_{SENSE} = 10mV	0.97	1.0	1.03	V
		V_{SENSE} = 30mV	2.91	3.0	3.09	V
		V_{SENSE} = 100mV	9.7	10.0	10.3	V
R_{OUT}	Output resistance		10	15	20	kΩ
T_C (*)	Output temperature coefficient			50	300	ppm
I_Q	Ground pin current	V_{SENSE} = 0V		25	35	μA
V_{SENSE} (†)	Sense voltage	V_{IN} = 20V	0		180 (‡)	mV
I_{SENSE}	Load pin current	V_{SENSE} = 0V			100	nA
Acc	Accuracy	V_{SENSE} = 10mV	-3		3	%
Gain	V_{OUT} / V_{SENSE}	V_{SENSE} = 10mV	97	100	103	V/V
BW	Bandwidth	V_{SENSE} = 10mV		300		kHz
		V_{SENSE} = 100mV		2		MHz

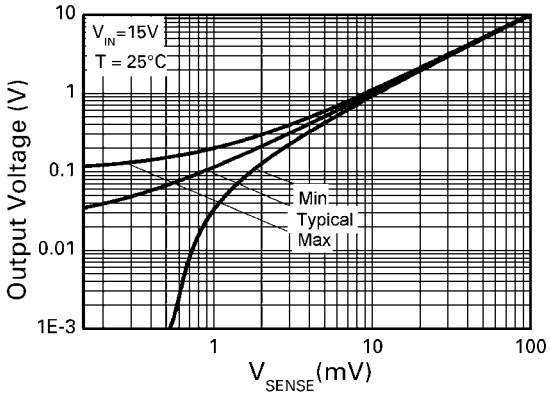
NOTES:
(*) T_C limits are determined by characterization
(†) $V_{SENSE} = V_{IN} - V_{LOAD}$
(‡) For linear operation maximum V_{SENSE} is limited by operating voltage and is approximately:

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

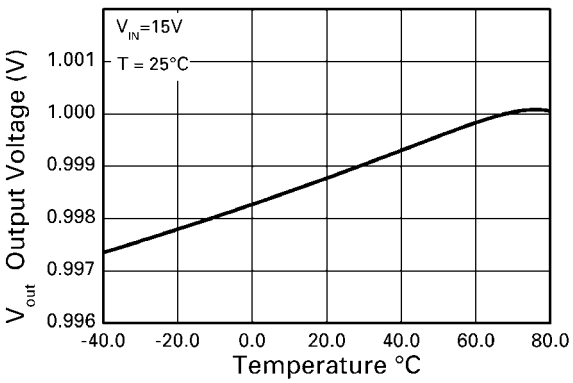
Typical characteristics



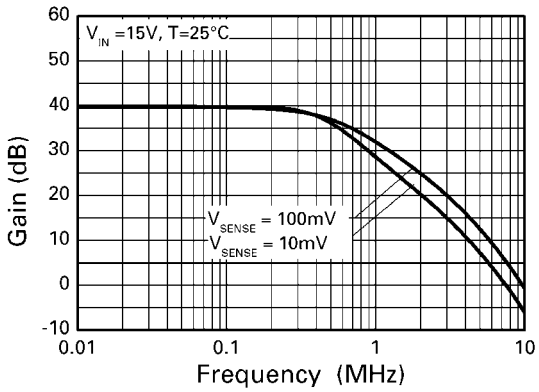
Typical Output v Sense Voltage



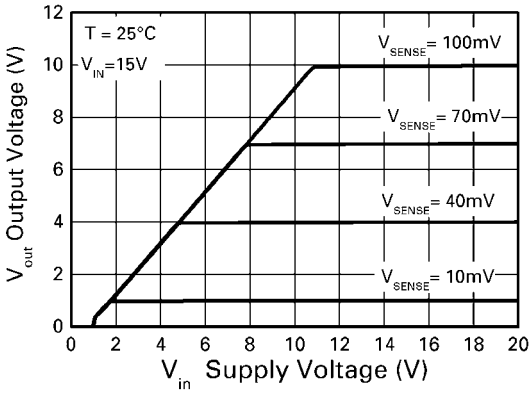
Error v Sense Voltage



Output Voltage v Temperature

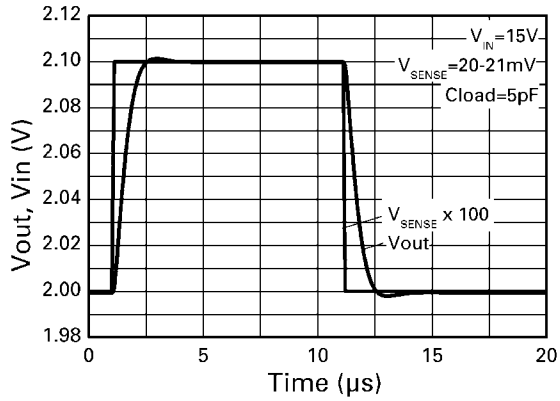


Frequency Response

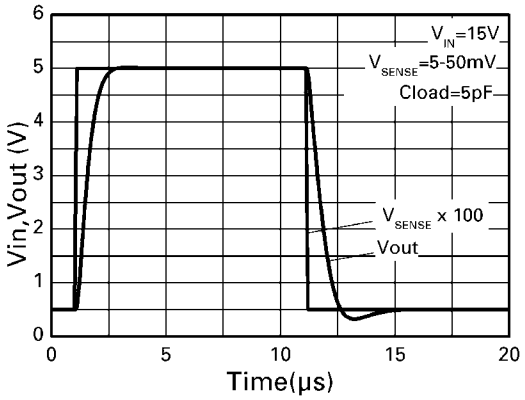


Transfer Characteristic

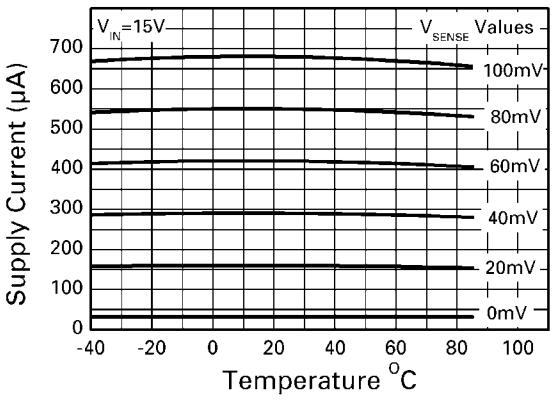
Typical characteristics



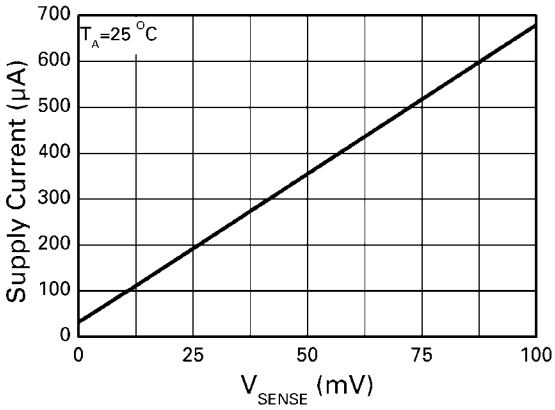
Small Signal Step Response



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:

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

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.

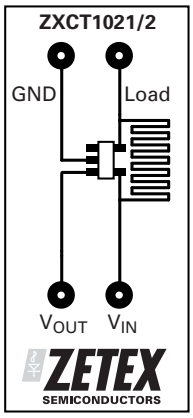
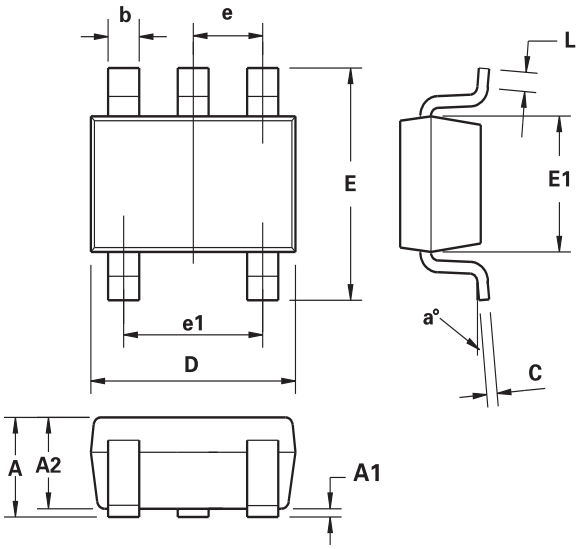


Figure 1 PCB layout suggestion

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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