ZXCT1023

MICROPOWER FIXED GAIN OF 50 CURRENT MONITOR

Description

The ZXCT1023 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.

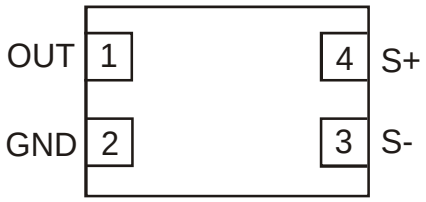
The ZXCT1023 has a fixed internal gain of 50 and the only external component required is the external current sense resistor; this combined with its 1.2mm x 1.8mm TDFN package more than quarters the solution size of the ZXCT1010.

The wide input voltage range of 20V down to as low as 2.5V makes it suitable for a range of applications.

The combination of operation down to 2.5V and just 3.5µA quiescent current makes it ideal for single cell Li-Ion/polymer battery charge/discharge measurement applications.

Pin Assignments

TDFN1218-4L



Top View

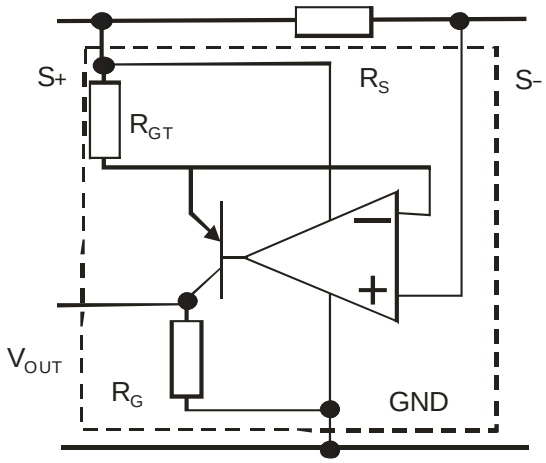
Features

- Accurate high-side current sensing
- Fixed gain of 50 output scaling
- 2.5V – 20V operating range
- 3.5µA quiescent current
- TDFN1218 package

Applications

- Battery capacity measurement
- Battery chargers
- Over-current monitor

Typical Application Circuit



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Pin Descriptions

Pin Name	Pin Number	Description
1	OUT	Voltage output. The output voltage is referenced to GND. The overall voltage gain is 50, i.e., V_{OUT} = 50 x V_{SENSE} where V_{SENSE} = V_{S+} - V_{S-}
2	GND	Ground and substrate connection of device
3	S-	High impedence negative sense voltage input
4	S+	Positive sense input. Also acts as power supply pin to ZXCT1023
	Central Paddle	Substrate. Connect to GND

Absolute Maximum Ratings

Description	Rating	Unit
Voltage on S+ (Note 1)	-0.5 to 20	V
Voltage on S- (Note 1, 2), OUT(Note 1)	-0.5 V_{S+}+0.5	V
V_{SENSE} (Note 3)	-0.5 to +2.5	V
Junction Temperature	-40 to 125	°C
Storage Temperature	-55 to 150	°C
Package Power Dissipation (T_A = 25°C) TDFN1218		mW
ESD Ratings		
Human Body Model	2000	V
Machine Model	150	V

These are stress ratings only. Operation outside the absolute maximum ratings may cause device failure. Operation at the absolute maximum rating for extended periods may reduce device reliability.
Semiconductor devices are ESD sensitive and may be damaged by exposure to ESD events. Suitable ESD precautions should be taken when handling and transporting these devices.

Notes:
1. Measured with respect to GND pin
2. Subject to absolute maximum V_{SENSE} not being exceeded.
3. V_{SENSE} is defined as the voltage difference across the sense resistor, R_S.
4. The usable V_{SENSE} range is limited by the output voltage range; and as such will be reduced at lower V_{S+} values.

Recommended Operating Conditions (T_A = 25°C)

Symbol	Parameter	Min	Max	Unit
V_{S+} (Note 1)	Common-Mode Sense Input Range	2.5	20	V
V_{SENSE}	Differential Sense Input Voltage Range	0	380 (Note 4)	mV
V_{OUT}	Output Voltage Range	0	V_{S-} - 1	V
T_A	Ambient Temperature Range	-40	85	°C

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Electrical Characteristics (T_A = 25°C, V_{S+} = 3.6V, V_{SENSE} = 50mV, unless otherwise stated)

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{OUT}	Output voltage	V_{SENSE} = 0mV		0.3	50	mV
		V_{SENSE} = 10mV	425	500	575	
		V_{SENSE} = 30mV	1.41	1.5	1.59	V
		V_{SENSE} = 50mV	2.425	2.5	2.575	
		V_{SENSE} = 100mV, V_{S+} = 20V	4.85	5	5.15	
TC (Note 5)	Output voltage temperature coefficient			50	300	ppm/°C
I_Q	Ground pin current	V_{SENSE} = 0V		3.5	8	µA
I_{S-}	SENSE- input current	V_{SENSE} = 0V			100	nA
Acc	Accuracy	V_{SENSE} = 50mV	-3		3	%
Gain	V_{OUT}/V_{SENSE}	V_{SENSE} = 50mV		50		V/V
R_{OUT}	Output resistance			15		kΩ
BW	Bandwidth	V_{SENSE} (DC) = 10mV		300		kHz
		V_{SENSE} (DC) = 50mV		1		MHz
PSRR (Note 6)	Power supply rejection ratio	V_{SENSE} = 30mV, V_{S+} = 2.5 to 20V	50	60		dB

Notes 5. TC limits are determined by characterization.
6. PSRR is defined as change in output voltage per change in S+ voltage, V_{S+}.

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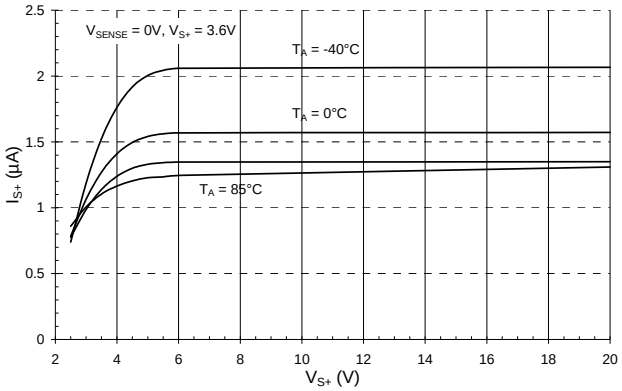
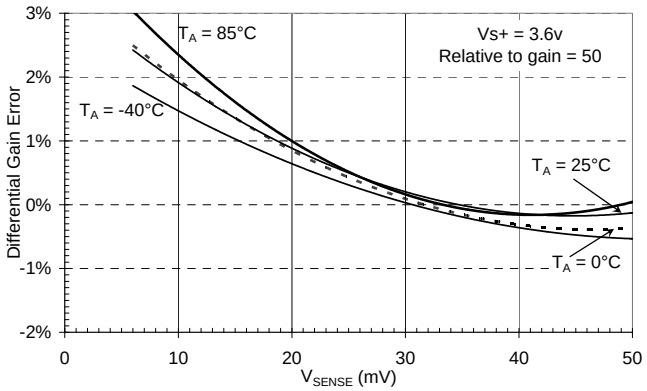
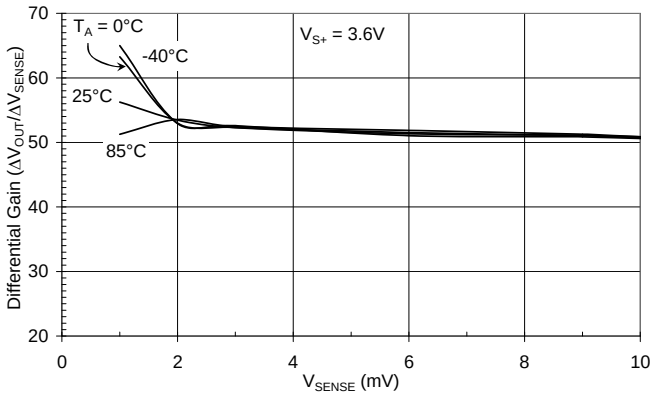
Typical DC Characteristics



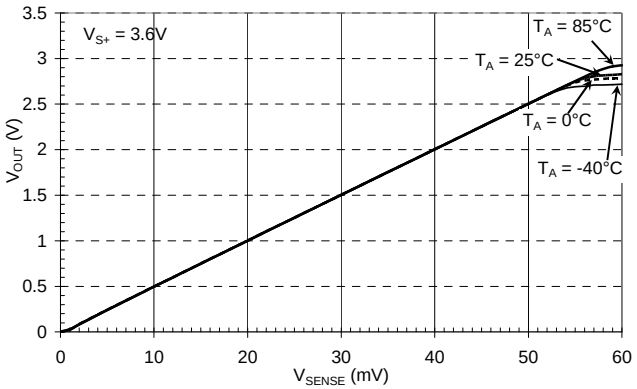
S+ Input Current vs. Supply voltage



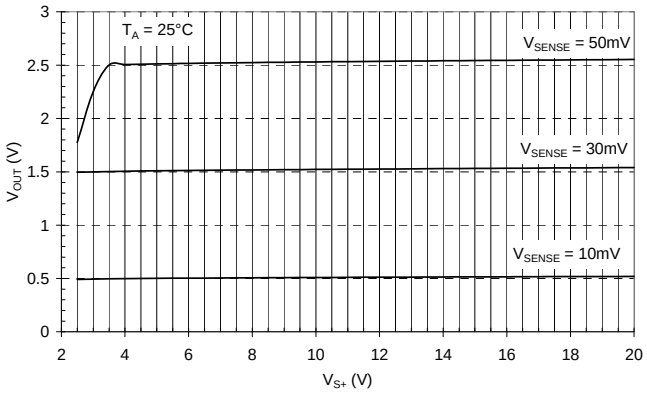
Normalised Gain Error vs. Sense Voltage



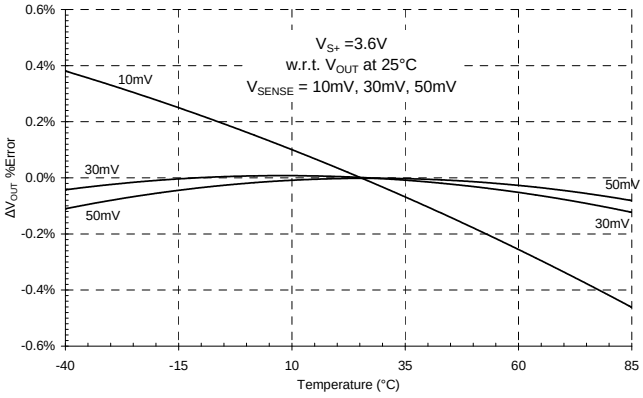
Differential Gain vs. Sense Voltage



Output Voltage vs. Sense Voltage



Output Voltage vs. Input voltage



Relative Output Voltage Change vs. Temperature

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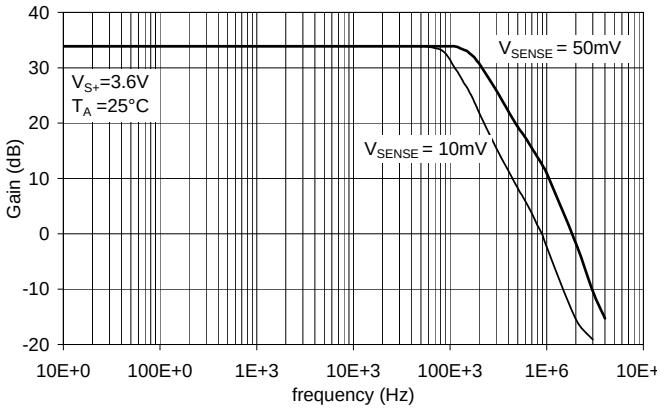
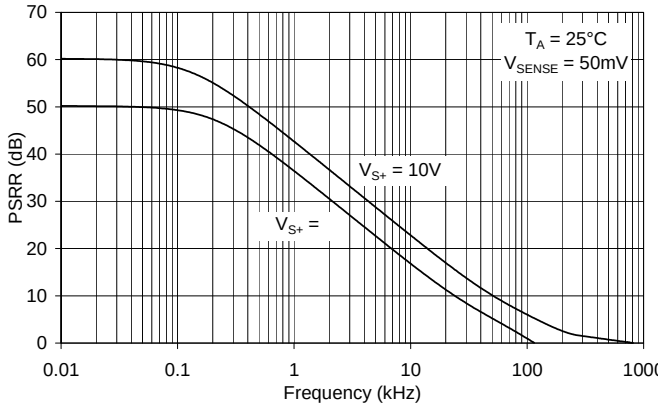
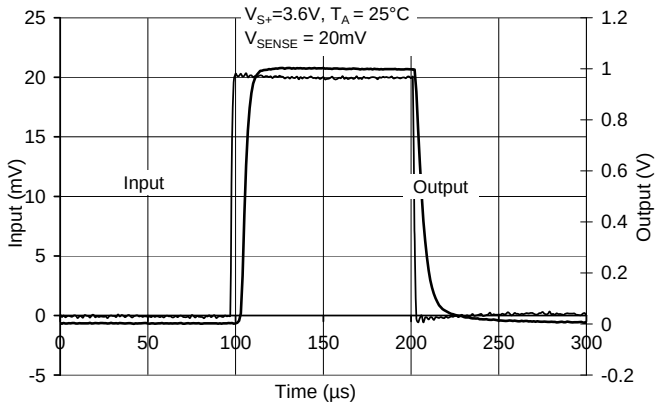
Typical AC Characteristics



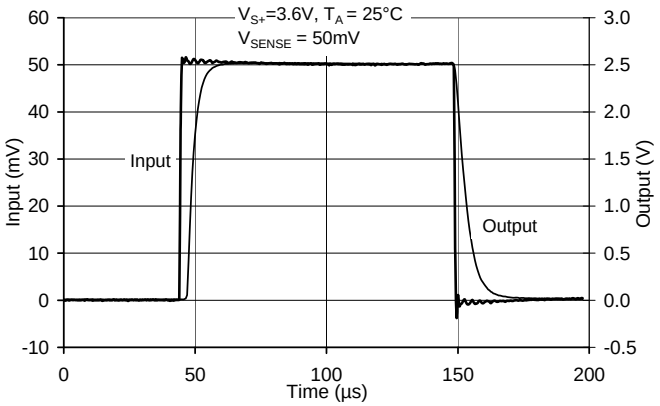
Small Signal Frequency Response



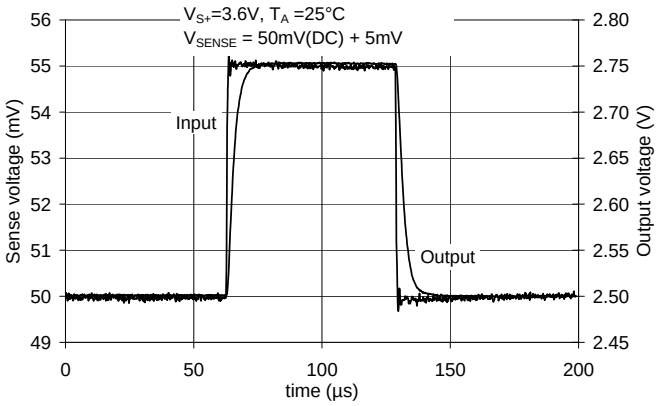
Power Supply Rejection Ratio



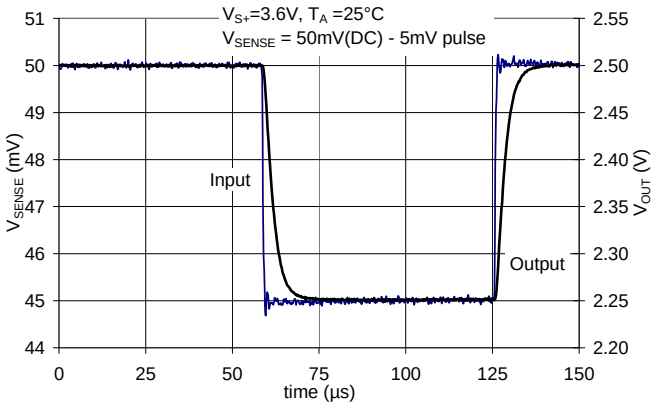
Large Signal Pulse Response 20mV



Large Signal Pulse Response 50mV



Small Signal Positive Pulse Response



Small Signal Negative Pulse Response

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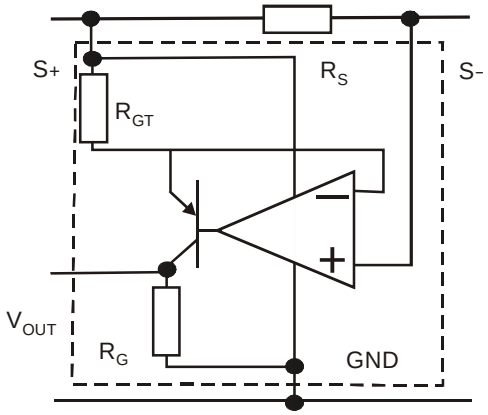
Application Information

The ZXCT1023 is line powered (derives its power from the rail being sensed) this reduces the number of pins used and PCB trace routing. The fixed gain of 50 reduces the PCB area by reducing the number of external components. The only external component required is the sense resistor. This coupled with the 1.2mm x 1.8mm TDFN package makes the solution size very small.

The fixed gain of 50 has been chosen to meet the normal requirements of most applications.



The ZXCT1023 has its gain setting resistor, R_G, set at 15kΩ which further reduces power consumption at larger V_{SENSE}.

Application Examples

Please refer to Zetex AN39 for sample applications.

Ordering Information

Order Reference	Package	Device Marking	Status	Reel Size (inches)	Quantity Per Reel	Tape Width (mm)
ZXCT1023DFGTA	TDFN1218	23	Active	7	3000	8

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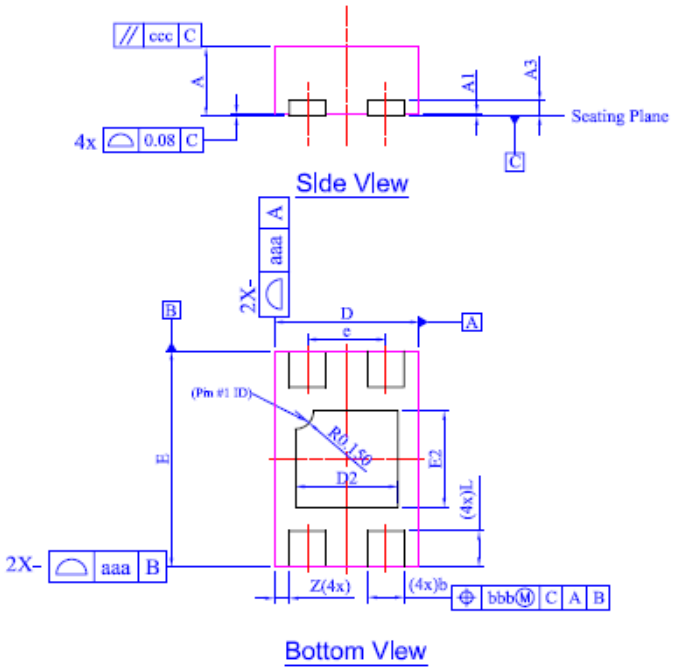
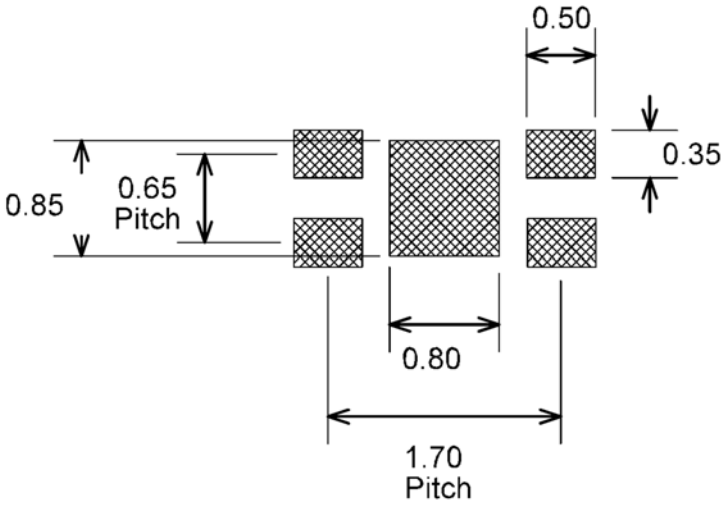
Package Outline Dimensions (All Dimensions in mm)

TDFN1218-4



Dim	Min	Max	Typ
D	1.15	1.25	1.20
E	1.75	1.85	1.80
D2	0.75	0.95	0.85
E2	0.70	0.90	0.80
A	0.545	0.605	0.575
A1	0	0.05	0.02
A3	—	—	0.13
b	0.25	0.35	0.30
L	0.25	0.35	0.30
e	—	—	0.65
Z	—	—	0.125
aaa	0.25		
bbb	0.10		
ccc	0.10		

Recommended PCB Land Pattern



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