

ZXCT1030

High-side current monitor with comparator

Description

The ZXCT1030 is a high side current sense monitor containing an internal reference and comparator with a non-latching output. Using this device eliminates the need to disrupt the ground plane when sensing a load current.

The wide input voltage range of 20V down to as low as 2.2V make it suitable for a range of applications. Dynamics and supply current are optimized for the processing of fast pulses, associated with switch mode applications.

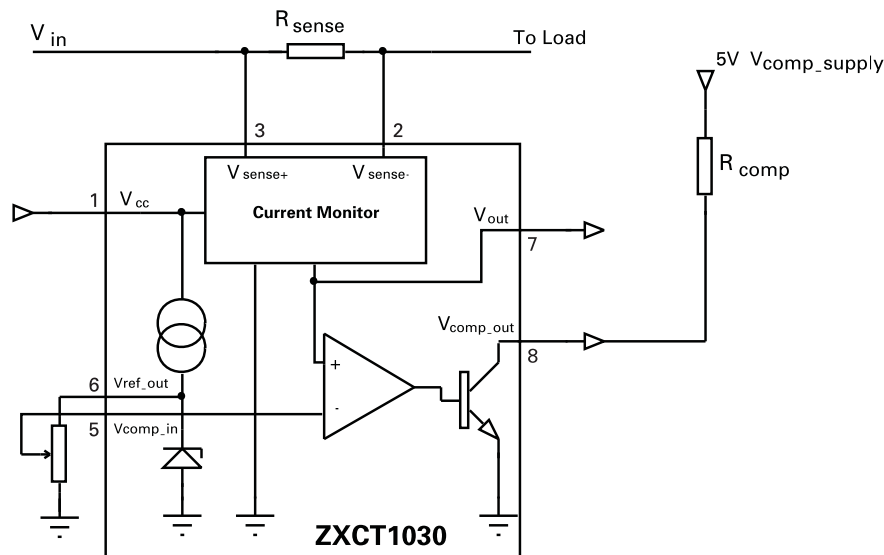
Features

- Low cost, accurate high-side current sensing
- Output voltage scaling
- Up to 18V output
- 2.2V - 20V supply range
- Voltage reference on chip
- Comparator on chip
- SO8 package

Applications

- Battery chargers
- Electronic fuse
- DC motor control
- Over current monitor
- Power management
- Inrush current limiting

Typical application circuit



Ordering information

Device	Status	Package	Device marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXCT1030X8TA	Last time buy	MSOP8	ZXCT1030	7	12	1000
ZXCT1030N8TA	Active	SO8	ZXCT1030	7	12	500

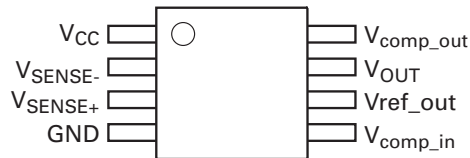
Absolute maximum ratings

Voltage on any pin	-0.6V and $V_{CC} + 0.6V$
Operating temperature	-40 to 85°C
Storage temperature	-55 to 125°C
Package power dissipation	($T_{amb} = 25°C$)
MSOP8	500mW

Recommended operating conditions

Parameter	Min.	Max.	Unit
V_{CC}	2.2	20	V
V_{SENSE+}	2.2	V_{CC}	V
$V_{SENSE}^{(a)}$	10	500	mV
V_{OUT}	0	$V_{SENSE} - 1V$	V
$V_{comp-in}$	0.005	10	V
T_{amb}	-40	85	°C

Pin-out connections



Pin name	Function
V_{CC}	Supply voltage
V_{SENSE-}	Negative sense input
V_{SENSE+}	Positive sense input
GND	Ground
V_{comp_in}	Comparator input, usually a ratio of the reference or other control signal
Vref_out	Reference output
V_{OUT}	Current monitor output voltage
V_{comp_out}	Open collector comparator output

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Electrical characteristics (ZXCT1030X8) - Test conditions $T_{amb} = 25^{\circ}\text{C}$, $V_{IN} = V_{CC} = 15\text{V}$, $R_{comp} = 10\text{k}\Omega$, $V_{comp_supply} = 5\text{V}$ unless otherwise stated.

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	V_{CC} range		2.2		20	V
V_{SENSE+}	Sense+ range		2.2		V_{CC}	
V_{OUT}	Output voltage	$V_{SENSE} = 0\text{V}$	0	2	10	mV
		$V_{SENSE} = 10\text{mV}$	88	100	112	mV
		$V_{SENSE} = 30\text{mV}$	284	300	316	mV
		$V_{SENSE} = 50\text{mV}$	480	500	520	mV
		$V_{SENSE} = 100\text{mV}$	970	1000	1030	mV
		$V_{SENSE} = 500\text{mV}$	4500	5000	5500	mV
R_{OUT}	Output resistance	$V_{SENSE-} = 15\text{V}$, $V_{OUT} = 1\text{V}$	1.2	1.5	1.8	$\text{k}\Omega$
V_{OUT} T_C	V_{OUT} temperature coefficient			30		$\text{ppm}/^{\circ}\text{C}$
I_{CC}	Supply current	$V_{SENSE-} = 15\text{V}$	170	270	350	μA
I_{SENSE+}	V_{SENSE+} input current		25	48	90	μA
I_{SENSE-}	V_{SENSE-} input current	$V_{SENSE-} = 14.9\text{V}$	25	70	220	nA
$V_{CM(\text{min})}^{(b)}$	Minimum active common mode voltage	$V_{CC} = 15\text{V}$ $V_{comp_supply} = 5\text{V}$ $V_{comp_in} = V_{REF}$ $V_{SENSE} = 10\text{mV}$	2.8			V
A_{CC}	Accuracy	$V_{SENSE} = 100\text{mV}$	-3		3	%
Gain	V_{OUT} / V_{SENSE}	$V_{SENSE} = 100\text{mV}$	9.7	10.0	10.3	
BW	Bandwidth	$V_{SENSE} = 10\text{mVp-p}$		3		MHz
		$V_{SENSE} = 100\text{mVp-p}$		6		MHz
Comparator						
V_{comp_in}	Input voltage		0.005		10	V
V_H	Hysteresis			15		mV
I_B	Input bias		5	80	150	nA
T_D	Propagation delay			100		ns
V_{OL}	Output voltage low		30	150	200	mV
V_{OH}	Output voltage high				V_{comp_supply}	V
I_{OL}	Output sink current	$V_{OL} = 0.4\text{V}$	2			mA
I_{OH}	Output high leakage current				1.0	μA
Voltage reference						
V_{ref}		Reference current = +300 μA to -5 μA	1.200	1.240	1.280	V
ΔV_{ref}	Change in V_{ref}	$I_{source} 5\mu\text{A}$ to $I_{sink} 300\mu\text{A}$		10		mV
T_C				30		$\text{ppm}/^{\circ}\text{C}$
PSR	Supply rejection			0.01		$\%/V$

NOTES:

(a) $V_{SENSE} = (V_{SENSE+}) - (V_{SENSE-})$

(b) Level of V_{SENSE+} where comparator output defaults to 'off'.

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Electrical characteristics (ZXCT1030N8) - Test conditions $T_{amb} = 25^{\circ}\text{C}$, $V_{IN} = V_{CC} = 15\text{V}$, $R_{comp} = 10\text{k}\Omega$, $V_{comp_supply} = 5\text{V}$ unless otherwise stated.

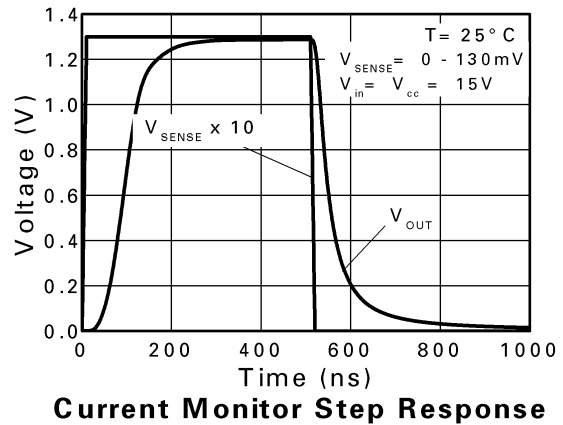
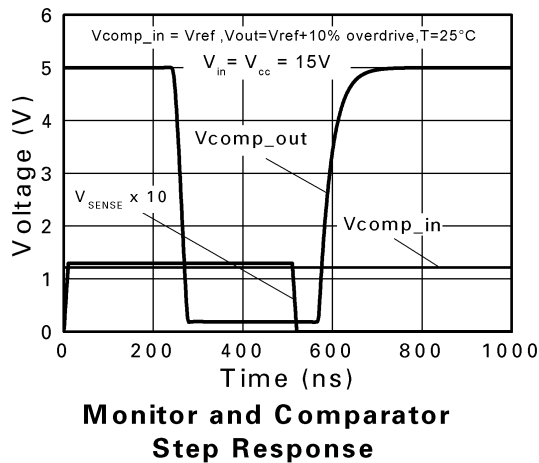
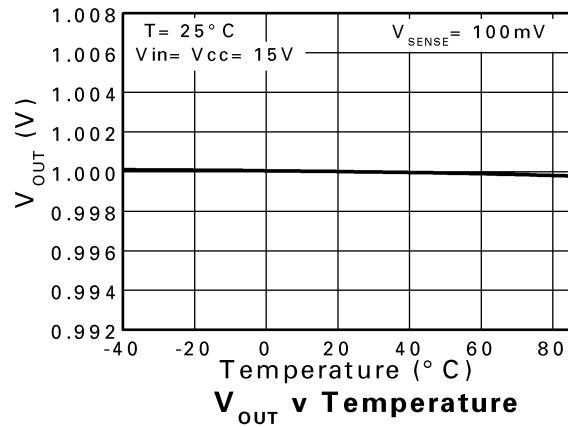
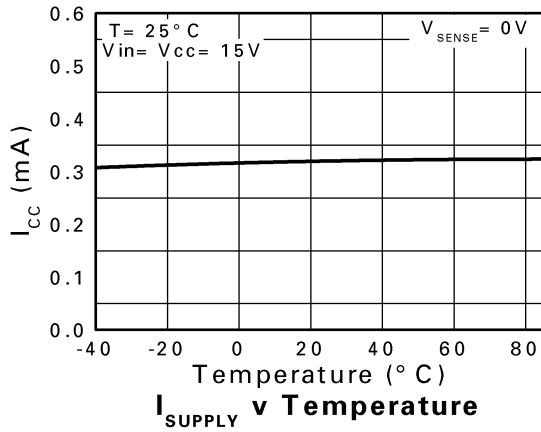
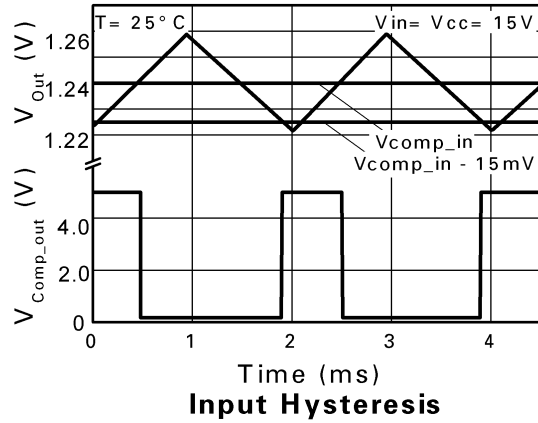
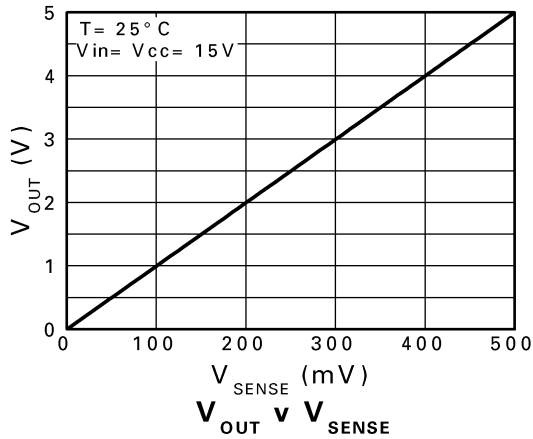
Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
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A_{CC}	Accuracy	$V_{SENSE} = 100\text{mV}$	-3		3	%
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Comparator						
V_{comp_in}	Input voltage		0.005		10	V
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I_B	Input bias		5	80	150	nA
T_D	Propagation delay			100		ns
V_{OL}	Output voltage low		30	150	200	mV
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ΔV_{ref}	Change in V_{ref}	$I_{source} 5\mu\text{A}$ to $I_{sink} 300\mu\text{A}$		10		mV
T_C				30		$\text{ppm}/^{\circ}\text{C}$
PSR	Supply rejection			0.01		$\%/V$

NOTES:

(c) $V_{SENSE} = (V_{SENSE+}) - (V_{SENSE-})$

(d) Level of V_{SENSE+} where comparator output defaults to 'off'.

Typical characteristics



Voltage output current monitor

Referring to the block diagram, the current monitor takes the small voltage developed across the sense resistor (V_{SENSE}) and transfers it from the large common mode supply voltage to a ground-referenced signal with a gain of 10. The sense input common mode range is 2.2V to 20V. In this range, a linear output voltage is delivered.

Reference

The bandgap reference allows the comparator to compare the translated V_{sense} with threshold value chosen by the user which can be any voltage from 0 to 1.24V, configured by two external resistors which forms V_{comp_in} .

The output current which can be drawn from the comparator reference (I_{ref} source) is limited to $5\mu A$, making potentiometers $\geq 250k\Omega$ suitable for setting a threshold level. Where a lower potentiometer resistor value is used, an additional resistor value should be inserted between V_{ref} and V_{CC} to maintain sufficient current for the reference. (as shown in Figure 1).

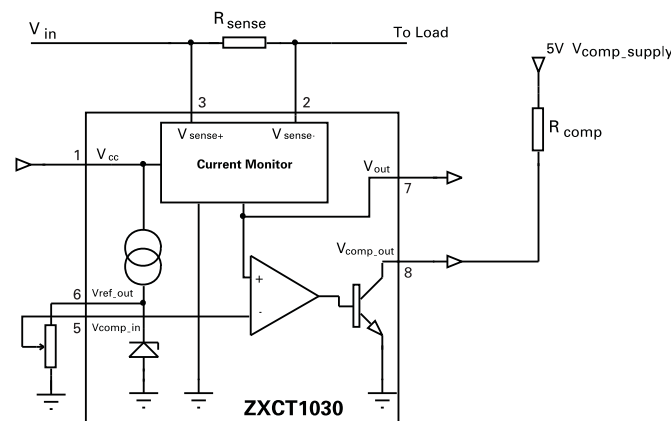


Figure 1: External resistor for reference level

The voltage reference has a maximum current sink capability. This magnitude of current will be influenced by the value of R_1 which is inserted between V_{ref} and V_{CC} . The value of current flowing through R_1 can be expressed as:

$$I = (V_{CC} - V_{ref}) / R_1$$

Comparator

The open collector output is active low and is asserted when $V_{SENSE} \times 10 (V_{OUT}) > V_{comp_in}$.

It can be connected to any voltage rail up to V_{in} via a pull-up resistor. Suggest values for the resistor are in the range of 10-100k Ω .

In the case where high load currents or a short circuit occurs, thus reducing the common mode signals (V_+ , V_-) typically below 2.2V, the comparator will default to the asserted state. This can eliminate a closed loop system 'latch-up' condition, allowing the controller to remove the applied power.

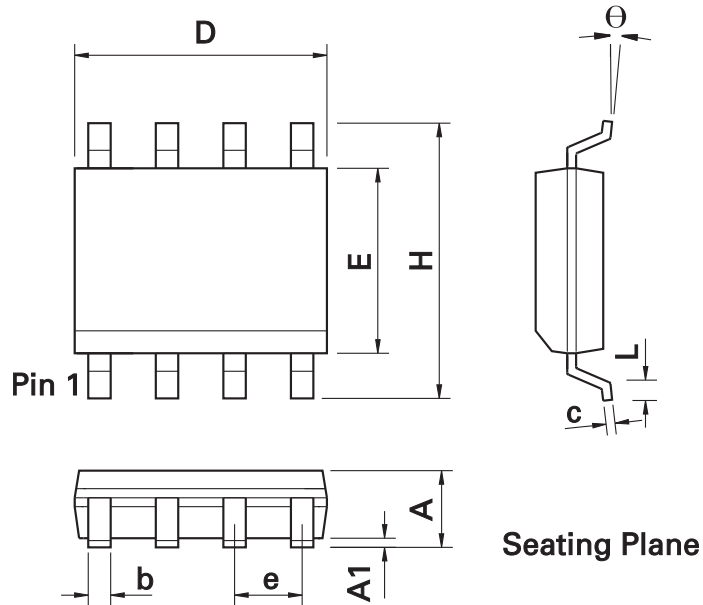
Stability

To ensure stable operation of the ZXCT1030, it is recommended a decoupling capacitor is placed across the V_{CC} and ground connections. A ceramic 10 μF will be adequate.

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ZXCT1030

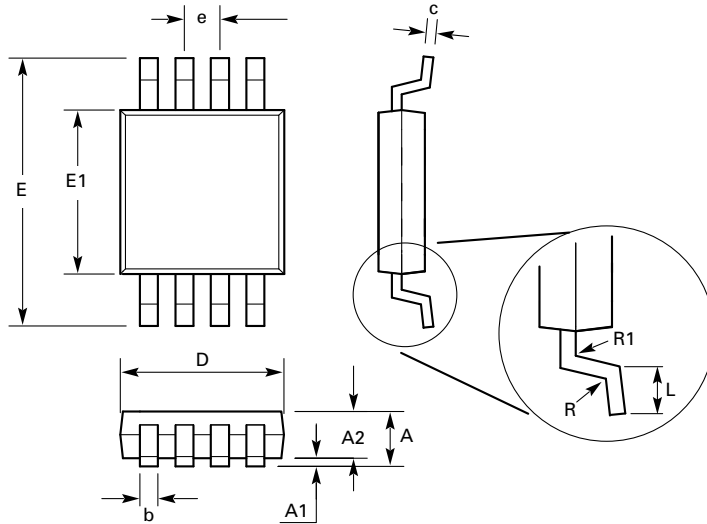
Package outline - SO8



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.053	0.069	1.35	1.75	e	0.050 BSC		1.27 BSC	
A1	0.004	0.010	0.10	0.25	b	0.013	0.020	0.33	0.51
D	0.189	0.197	4.80	5.00	c	0.008	0.010	0.19	0.25
H	0.228	0.244	5.80	6.20	Θ	0°	8°	0°	8°
E	0.150	0.157	3.80	4.00	h	0.010	0.020	0.25	0.50
L	0.016	0.050	0.40	1.27	-	-	-	-	-

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

Package outline - MSOP8



DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	-	1.10	-	0.0433
A1	0.05	0.15	0.002	0.006
A2	0.75	0.95	0.0295	0.0374
b	0.25	0.40	0.010	0.0157
c	0.13	0.23	0.005	0.009
D	2.90	3.10	0.114	0.122
E	4.90 BSC		0.193 BSC	
E1	2.90	3.10	0.114	0.122
e	0.65 BSC		0.025 BSC	
L	0.40	0.70	0.0157	0.0192
R	0.07	-	0.0027	-
R1	0.07	-	0.0027	-

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

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