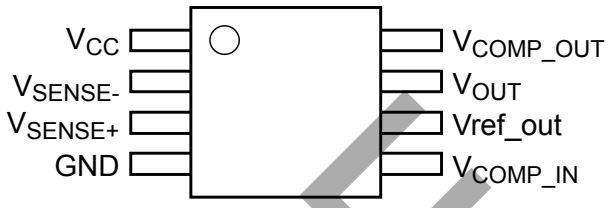
## Description

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.

## Pin Assignments



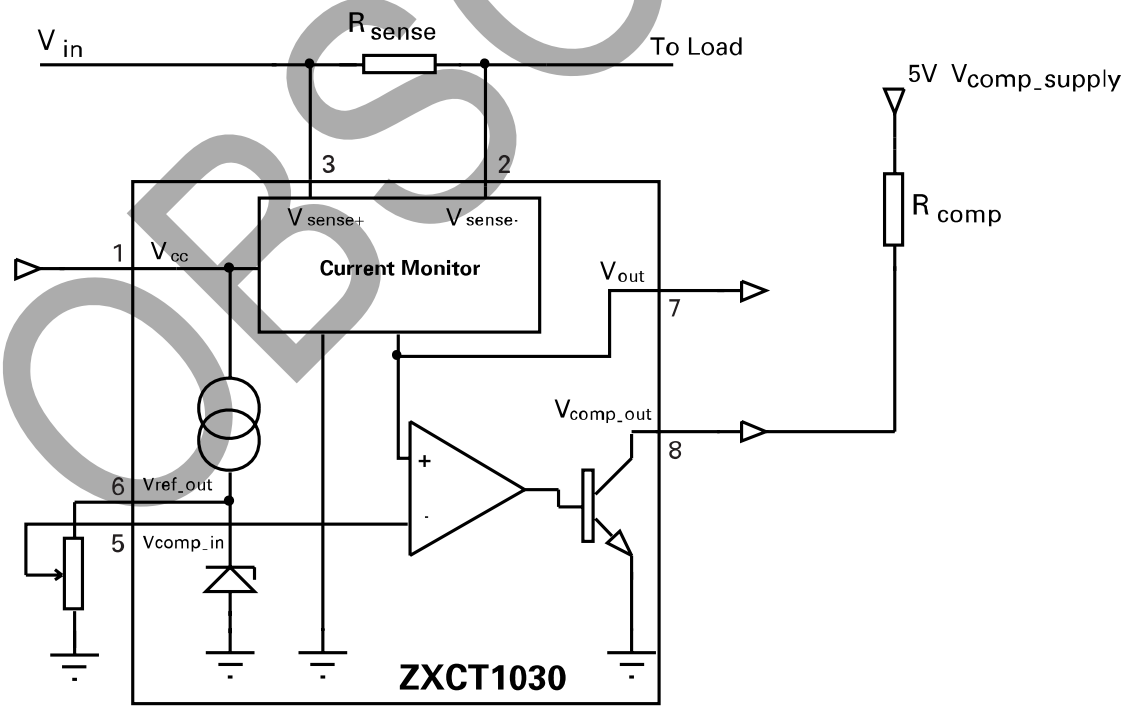

## Features

- 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



## Pin Description

| 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 |
| $V_{REF\_OUT}$ | Reference output |
| $V_{OUT}$ | Current monitor output voltage |
| $V_{COMP\_OUT}$ | Open collector comparator output |

## Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|---|---|
| Voltage on any pin | -0.6 and $V_{CC}$ +0.6 | V |
| Operating Temperature | -40 to 85 | °C |
| Storage Temperature | -55 to 125 | °C |
| Package Power Dissipation | ($T_{AMB}$ = 25) | °C |
| SO8 | 700 | mW |

## Recommended Operating Conditions

| Parameter | Min | Max | Units |
|---|---|---|---|
| $V_{CC}$ | 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 |

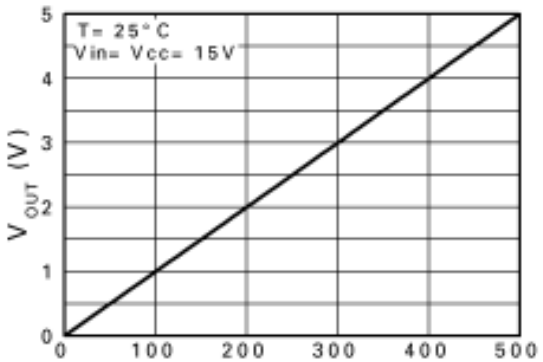
## Electrical Characteristics (ZXCT1030N8) – Test conditions $T_{AMB}$ = 25°C, $V_{IN}$ = $V_{CC}$ = 15V, $R_{COMP}$ = 10kΩ, $V_{COMP\_SUPPLY}$ = 5V unless otherwise stated.

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | $V_{CC}$ Range | | 2.2 | | 20 | V |
| $V_{SENSE}$+ | Sense+ Range | | 2.2 | | $V_{CC}$ | |
| $V_{OUT}$ | Output Voltage | $V_{SENSE}$ = 0<br>$V_{SENSE}$ = 10<br>$V_{SENSE}$ = 30<br>$V_{SENSE}$ = 50<br>$V_{SENSE}$ = 100<br>$V_{SENSE}$ = 500 | 0<br>88<br>284<br>480<br>970<br>4500 | 2<br>100<br>300<br>500<br>1000<br>5000 | 10<br>112<br>316<br>520<br>1030<br>5500 | mV |
| $R_{OUT}$ | Output Resistance | $V_{SENSE\ -}$ = 15V,<br>$V_{OUT}$ = 1V | 1.2 | 1.5 | 1.8 | kΩ |
| $V_{OUT}$<br>$T_C$ | $V_{OUT}$<br>Temperature Coefficient | | | 30 | | ppm/°C |
| $I_{CC}$ | Supply Current | $V_{SENSE\ -}$ = 15V | 170 | 270 | 350 | µA |
| $I_{SENSE}$+ | $V_{SENSE}$+ Input Current | | | 48 | 90 | µA |
| $I_{SENSE}$- | $V_{SENSE}$- Input Current | $V_{SENSE-}$ = 14.9V | | 70 | 220 | nA |
| $V_{CM(MIN)}$ [B] | Minimum Active Common Mode Voltage | $V_{CC}$ = 15V<br>$V_{COMP\_SUPPLY}$ = 5V<br>$V_{COMP\_IN}$ = $V_{REF}$<br>$V_{SENSE}$ = 10mV | 2.8 | | | V |
| $A_{CC}$ | Accuracy | $V_{SENSE}$ = 100mV | -3 | | 3 | % |
| GAIN | $V_{OUT}/V_{SENSE}$ | $V_{SENSE}$ = 100mV | 9.7 | 10.0 | 10.3 | |
| BW | Bandwidth | $V_{SENSE}$ = 10mVp-p<br>$V_{SENSE}$ = 100mVp-p | | 3<br>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 | | | | $V_{COMP\_SUPPLY}$ | |
| $I_{OL}$ | Output Sink Current | Vol = 0.4V | 2 | | | mA |
| $I_{OH}$ | Output High Leakage Current | | | | 1.0 | µA |
| **Voltage Reference** | | | | | | |
| $V_{REF}$ | | Reference Current = +300µA to -5µA | 1.200 | 1.240 | 1.280 | V |
| Delta $V_{REF}$ | Change in $V_{REF}$ | $I_{SOURCE}$ 5µA to $I_{SINK}$ 300µA | | 10 | | mV |
| $T_C$ | | | | 30 | | ppm/°C |
| PSR | Supply Rejection | | | 0.01 | | %/V |

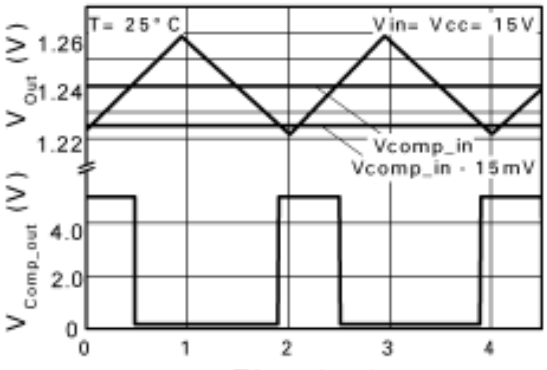
Notes: (a) ($V_{SENSE+}$) – ($V_{SENSE-}$)
(b) Level of $V_{SENSE}$+ where comparator output defaults to 'off'.

OBSOLETE – PART DISCONTINUED

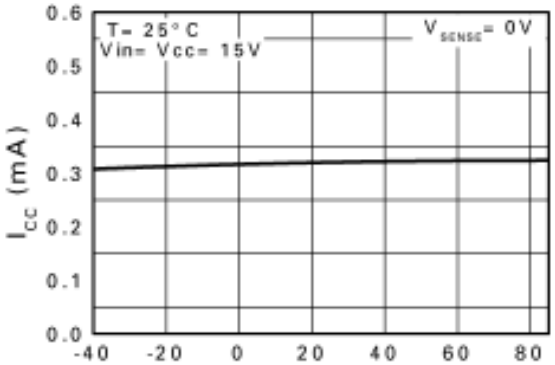
## Typical Application Circuits



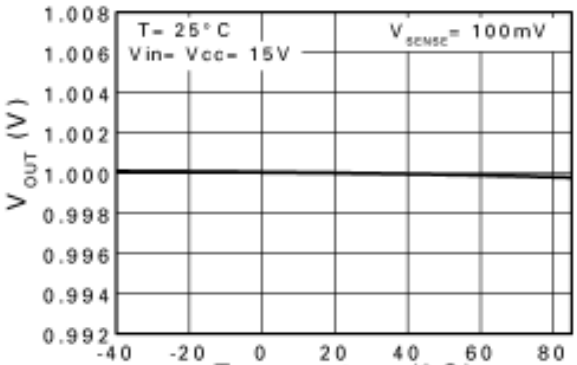

**$V_{OUT}$ v $V_{SENSE}$**



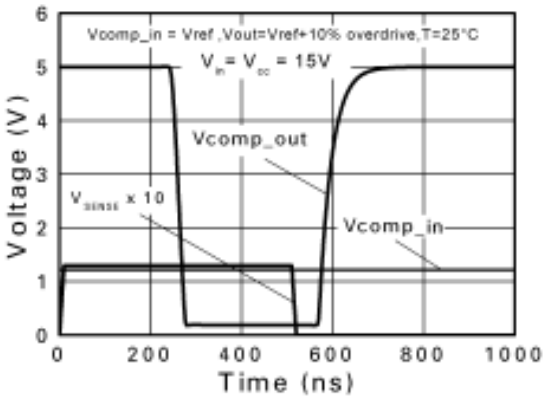

**Input Hysteresis**



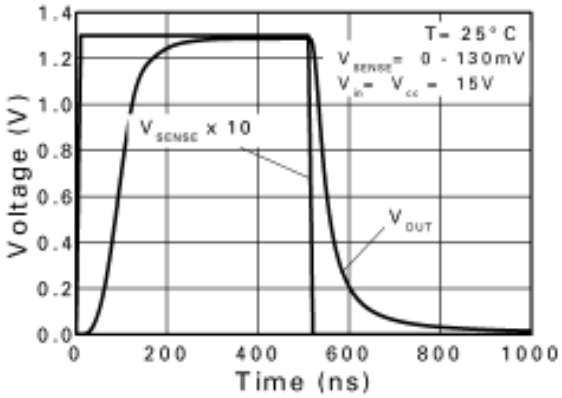

**$I_{SUPPLY}$ v Temperature**




**$V_{OUT}$ v Temperature**




**Monitor and Comparator Step Response**




**Current Monitor Step Response**

## 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 5µA, making potentiometers ≥250kΩ 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).

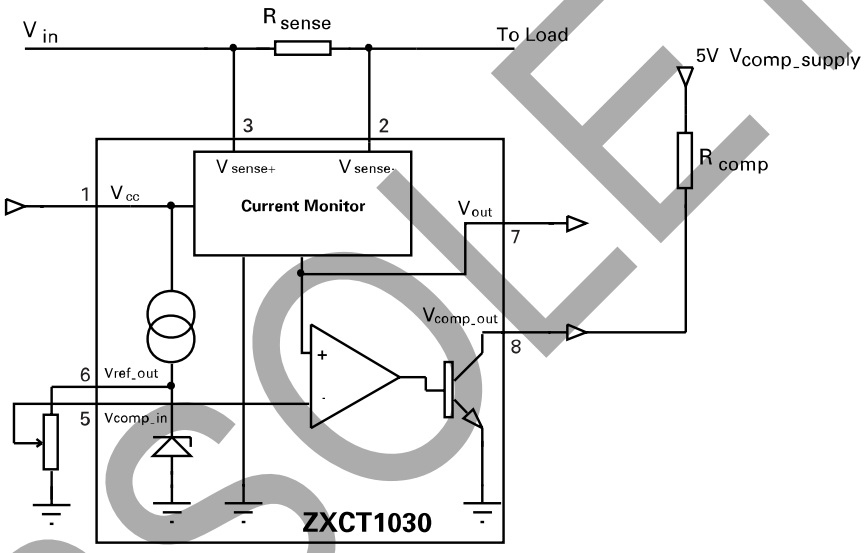



**Figure 1: External Resistor for Reference Level**

The voltage reference has a maximum current sink capability. This magnitude of current will be influenced by the value of R1 which is inserted between $V_{REF}$ and $V_{CC}$. The value of current flowing through R1 can be expressed as:

$I = (V_{CC} - V_{REF}) / R1$

### Comparator

The open collector output is active low and is asserted when $V_{SENSE}$ x 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 10-100kΩ.

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 10µF will be adequate.

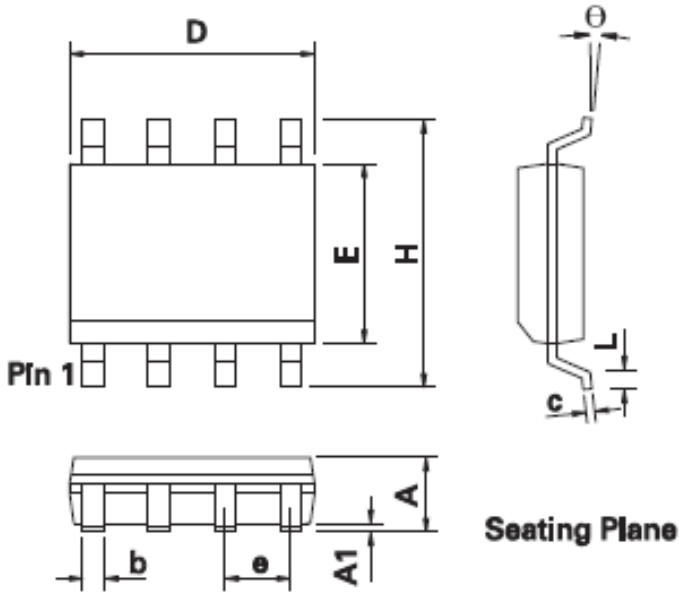
OBSOLETE – PART DISCONTINUED

## Ordering Information*

| Device | Status(*) | Package | Device Marking | Reel Size (inches) | Tape Width (mm) | Quantity Per reel |
|---|---|---|---|---|---|---|
| ZXCT1030X8TA | Obsolete | MSOP8 | ZXCT1030 | 7 | 12 | 1000 |
| ZXCT1030N8TA | Active | SO8 | ZXCT1030 | 7 | 12 | 500 |

Notes: *ZXCT1030X8TA is obsolete for more device information please check our obsolete products search on diodes website

## 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

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