

## 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 optimised for the processing of fast pulses, associated with switch mode applications.

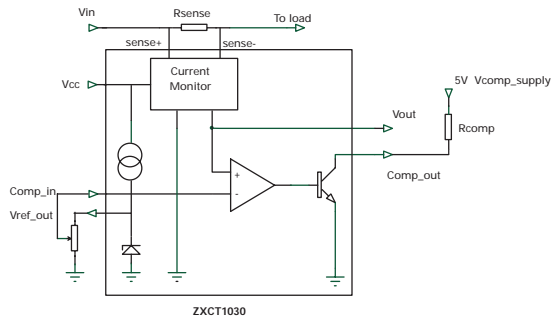
### APPLICATIONS

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

### FEATURES

- Low cost, accurate high-side current sensing.
- Output voltage scaling.
- Up to 18V output.
- 2.2V – 20V supply range.
- 270 $\mu$ A quiescent current.
- 1.5% typical accuracy.
- MSOP8 Package.
- Voltage reference on chip
- Comparator on chip

### FUNCTIONAL BLOCK DIAGRAM



### ORDERING INFORMATION

Device	Reel size	Tape width	Quantity per reel
ZXCT1030X8TA	7"	12mm	500 units
ZXCT1030X8TC	13"	12mm	2500 units

### DEVICE MARKING

- ZXCT  
1030

# ZXCT1030

## 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	( $T_A = 25^\circ C$ )
MSOP8	500mW

## ELECTRICAL CHARACTERISTICS Test Conditions $T_A = 25^\circ C$ , $V_{in} = V_{CC} = 15V$

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	$V_{sense} = 0V$ $V_{sense} = 10mV$ $V_{sense} = 30mV$ $V_{sense} = 50mV$ $V_{sense} = 100mV$ $V_{sense} = 500mV$	0 88 284 480 970 4500	2 100 300 500 1000 5000	10 112 316 520 1030 5500	mV mV mV mV mV mV
$R_{out}$	Output resistance	$V_{sense-} = 15V$ , $V_{out} = 1V$	1.2	1.5	1.8	$K\Omega$
$V_{out}$ TC	$V_{out}$ temperature coefficient			30		ppm/ $^\circ C$
$I_{CC}$	Supply current	$V_{sense-} = 15V$	170	270	350	$\mu A$
$I_{sense+}$	Sense+ input current		25	48	90	$\mu A$
$I_{sense-}$	Sense- input current	$V_{sense-} = 14.9V$	25	70	220	nA
$V_{sense}^2$	Sense Voltage		0		500	mV
$V_{cm}^3$	Common Mode Range	$V_{CC} = 15V$ $V_{comp\_supply} = 5V$ $V_{comp\_in} = V_{ref}$ $V_{sense} = 10mV$	2.8			V
Acc	Accuracy	$V_{sense} = 100mV$	-3		3	%
Gain	$V_{out} / V_{sense}$	$V_{sense} = 100mV$	9.7	10.0	10.3	
BW	Bandwidth	$V_{sense} = 10mVp-p$ $V_{sense} = 100mVp-p$		3 6		MHz MHz

<sup>2</sup>  $V_{sense} = (V_{sense+}) - (V_{sense-})$

<sup>3</sup> Level of  $V_{in}$  where comparator output defaults to 'off'.

# ZXCT1030

## Absolute Maximum Ratings

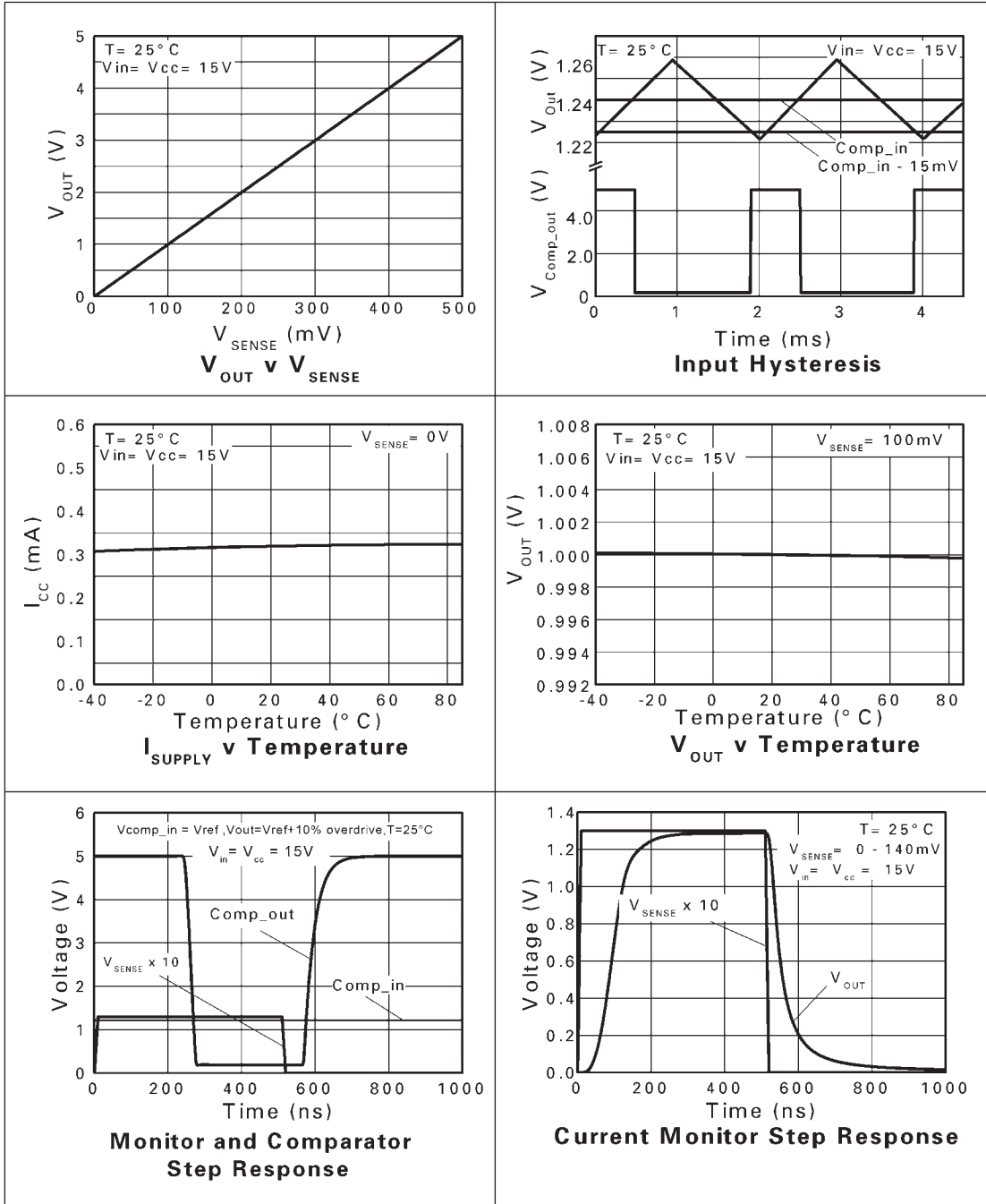
Voltage on any pin	-0.6V and $V_{CC} + 0.6V$
Operating Temperature	-40 to 85°C
Storage Temperature	-55 to 125°C
Package Power Dissipation MSOP8	( $T_A = 25^\circ\text{C}$ ) 500mW

## ELECTRICAL CHARACTERISTICS (Cont.) Test Conditions $T_A = 25^\circ\text{C}$ , $V_{in} = V_{CC} = 15V$

SYMBOL	PARAMETER	CONDITIONS	LIMITS			UNIT
			Min	Typ	Max	
<b>Comparator</b>						
V <sub>comp</sub>	Input Voltage		0.005		10	V
V <sub>H</sub>	Hysteresis	$V_{comp\_supply} = 5V$ $R_{comp} = 10k$		15		mV
I <sub>B</sub>	Input Bias	$V_{comp\_supply} = 5V$ $V_{comp\_in} = 1V$ $R_{comp} = 10k$	5	50	100	nA
T <sub>D</sub>	Propagation Delay	$V_{comp\_supply} = 5V$ $R_{comp} = 10k$		100		ns
V <sub>OL</sub>	Output Voltage Low	$V_{comp\_supply} = 5V$ $R_{comp} = 10k$	30	150	200	mV
V <sub>OH</sub>	Output Voltage High	$V_{comp\_supply} = 5V$ $R_{comp} = 10k$			$V_{comp\_supply}$	V
I <sub>OL</sub>	Output Sink Current	$V_{OL} = 0.4V$	2			mA
I <sub>OH</sub>	Output High Leakage Current	$V_{comp\_supply} = 5V$ $R_{comp} = 10k$			1.0	μA
<b>Voltage Reference</b>						
V <sub>ref</sub>		Reference Current = 0μA	1.200	1.240	1.280	V
		Reference Current = -300μA	1.200	1.240	1.280	V
		Reference Current = +5μA	1.200	1.240	1.280	V
delta V <sub>ref</sub>	Change in Vref	I <sub>source</sub> 5μA to I <sub>sink</sub> 300μA		10		mV
TC				30		ppm/°C
PSR	Supply rejection			0.01		%/V

# ZXCT1030

## TYPICAL CHARACTERISTICS



# ZXCT1030

## Voltage output Current Monitor

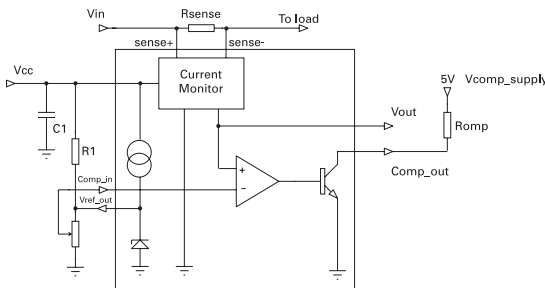
Referring to the block diagram, the current monitor takes the small voltage developed across the sense resistor ( $V_{sense}$ ) and transfers it from the large common mode supply voltage to a ground-referenced signal with a gain of 10. The sense input common mode range is 2.2V to 20V. In this range, 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 1.0).

**FIGURE 1.0**  
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 $\Omega$ .

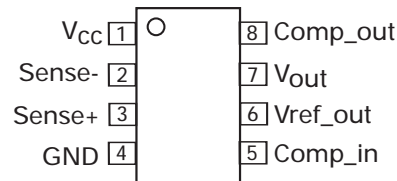
In the case where high load currents or a short circuit occurs, thus reducing the common mode signals ( $V_+$ ,  $V_-$ ) typically below 2.2V, the comparator will default to the asserted state. This can eliminate a closed loop system 'latch-up' condition, allowing the controller to remove the applied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

## PIN CONNECTIONS

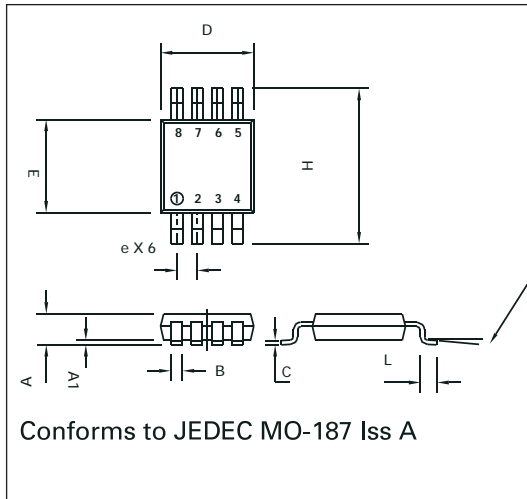
MSOP8



Pin Name	Pin Function
Vcc	Supply voltage
Sense-	Negative sense input
Sense+	Positive sense input
GND	Ground
Comp_in	Comparator input, usually a ratio of the reference or other control signal.
Vref_out	Reference output
Vout	Current Monitor output voltage
Comp_out	Open collector comparator output

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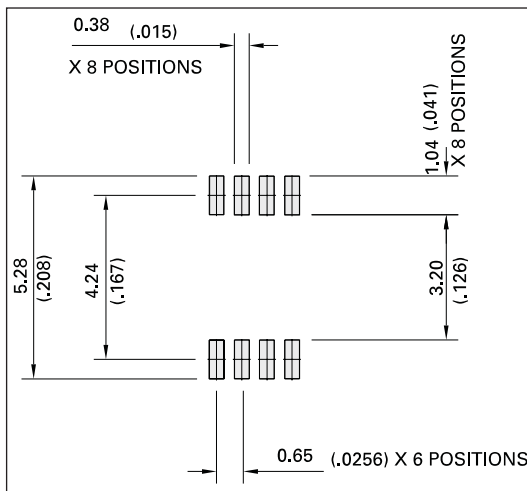
## PACKAGE DIMENSIONS



## PACKAGE DIMENSIONS

DIM	Millimetres		Inches	
	MIN	MAX	MIN	MAX
A	-	1.10	-	0.043
A1	0.05	0.15	0.002	0.006
B	0.25	0.40	0.010	0.016
C	0.13	0.23	0.005	0.009
D	2.90	3.10	0.114	0.122
e	0.65 BSC		0.0256 BSC	
E	2.90	3.10	0.114	0.122
H	4.90 BSC		0.193 BSC	
L	0.40	0.70	0.016	0.028
°	0°	6°	0°	6°

## PAD LAYOUT DETAILS



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