IXYS | IXI848

High-Side Current Monitor

Features:

- High-Side Current Sense Amplifier
- 2.7V to 40V Input Range
- 0.7% Typical Full Scale Accuracy
- Scalable Output Voltage
- SOIC Package Type

Applications:

- Power Management Systems
- Smart Battery Packs
- Battery Chargers
- Battery Powered Portable Equipment
- DC Motor Control

General Description

The IXI848 is a precision high side current sense monitor. High side power-line monitoring offers the advantage of allowing the ground plane to remain undisturbed when sensing load currents.

An external sense resistor sets the range of the amplified ground-referenced output monitoring voltage. The output voltage is amplified by a selectable fixed gain of either 10 or 50. With an input voltage range exceeding 37V, and output gain of up to 50, the IXI848 is designed to address a wide variety of current sense applications.

The IXI848 operates over a temperature range of -40°C to +85°C. The IXI848 is available in an 8-Lead SOIC package.

Figure 1. IXI848 Functional Block Diagram and General Application Circuit

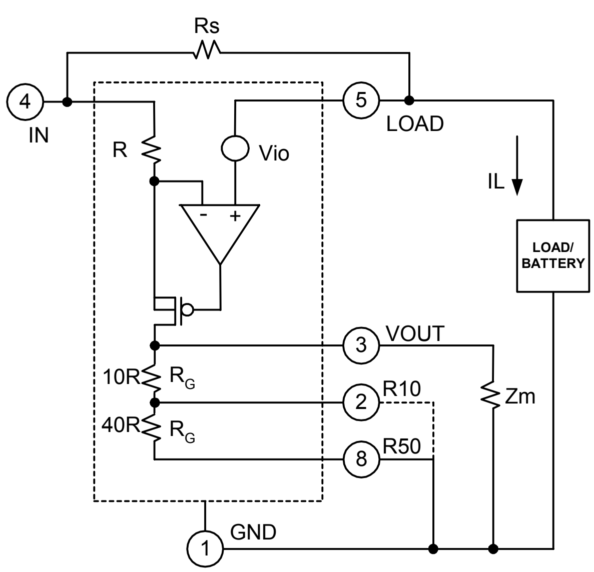
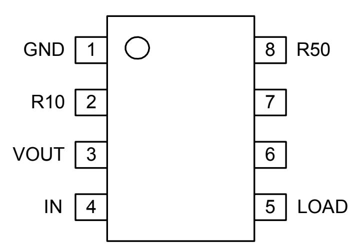


Figure 2. IXI848 SOIC PIN Configuration



8 - Lead SOIC

IN = Positive supply terminal
R_S = Sense Resistor
LOAD = Load side terminal
Zm = External voltage monitor impedance
R_G = Output gain setting resistors
R10, R50 = Selectable output gain terminals
VOUT = Amplified output monitoring voltage

Absolute Maximum Ratings

Parameter	Rating
Voltage to any pin	-0.3V to +40V
Differential Input Voltage (V_{SENSE})	±0.4V
Input Current to any pin	TBD
Operating Ambient Temp Range	-40°C to +85°C
Operating Junction Temp Range	-40°C to +125°C
θJA	150°C/W
θJC	40°C/W
Storage Temp Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	+300°C

Absolute Maximum Ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this data sheet is not implied. Exposure of the device to the absolute maximum ratings for an extended period may degrade the device and affect its reliability.

ESD Warning

ESD (electrostatic discharge) sensitive device. Electrostatic charges can readily accumulate on test equipment and the human body in excess of 4000 Volts. This energy can discharge without detection. Although the IXI848 feature proprietary ESD protection circuitry, permanent damage may be sustained if subjected to high energy electrostatic discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

Electrical Characteristics

T_A = 25°C, V_{IN} = 2.7V to 40V, unless otherwise noted

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Operating Voltage Range	V_{IN}			2.7		40	V
Supply Current	I_{DD}	V_{IN} = 20V, V_{SENSE} = 0V, I_{LOAD} = 0A			.065		mA
Full Scale Sense Voltage	V_{SENSE}	Gain = 10V/V			150		mV
		Gain = 50V/V			150		
Input Offset Voltage	V_{OS}	V_{IN} = 12V			±0.5		mV
Full Scale Accuracy		V_{SENSE} = 100mV, V_{IN} = 12V T_A = +25°C			±0.7		%
Total OUT Voltage Error (Note 1, Note 2)		V_{SENSE} = 100mV V_{IN} = 12V	T_A = +25°C		±0.7		%
			Δ @ T_A = -40° to +85°C		±0.3		
		V_{SENSE} = 100mV V_{IN} = 40V	T_A = +25°C		±0.8		%
			Δ @ T_A = -40° to +85°C		±0.4		
Gain Accuracy (Note 2)		V_{SENSE} = 20mV to 100mV V_{IN} = 12V, 40V	T_A = +25°C		±0.5		%
			Δ @ T_A = -40° to +85°C		±0.1		
OUT output resistance	R_{OUT}	V_{IN} = 12V V_{SENSE} = 100mV	Gain = 10V/V		33		kΩ
			Gain = 50V/V		165		kΩ

Note 1: Total OUT voltage error is the sum of gain and offset voltage errors.

Note 2: Production Tested at T_A =25°C.

Typical Performance Characteristics

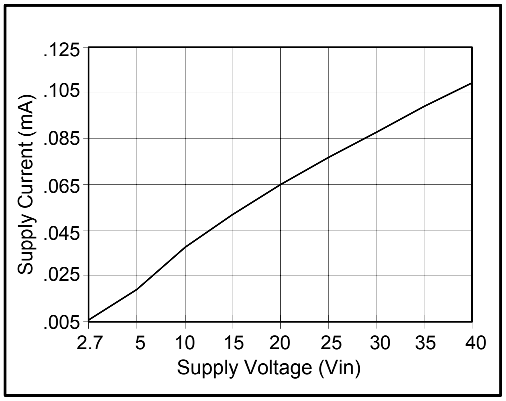


Fig 3. Supply Current vs. Voltage

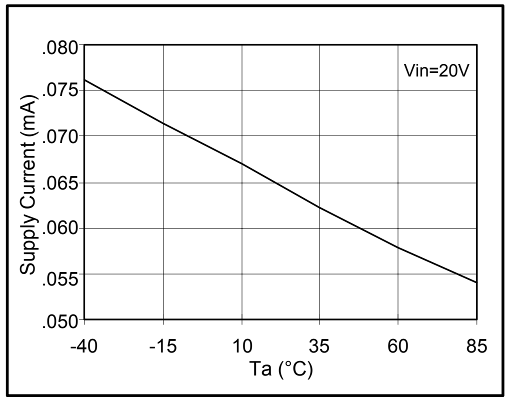


Fig 4. Supply Current vs. Temperature

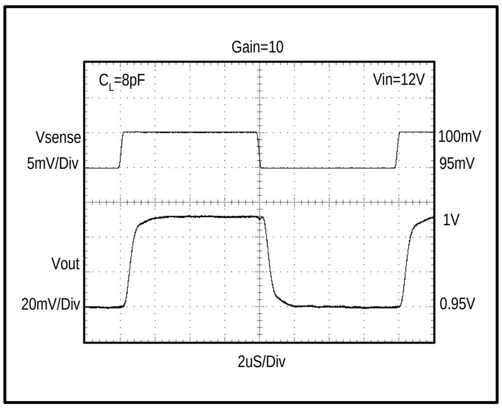


Fig 5. Small Signal Transient Response 10X

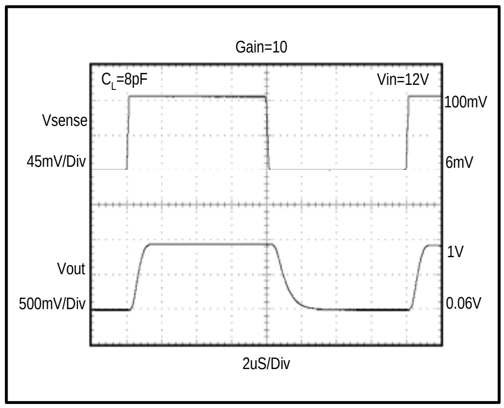


Fig 6. Large Signal Transient Response 10X

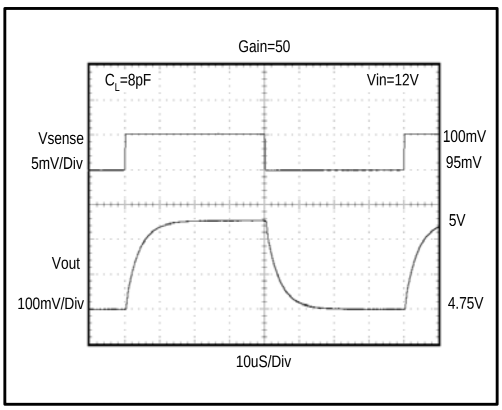


Fig 7. Small Signal Transient Response 50X

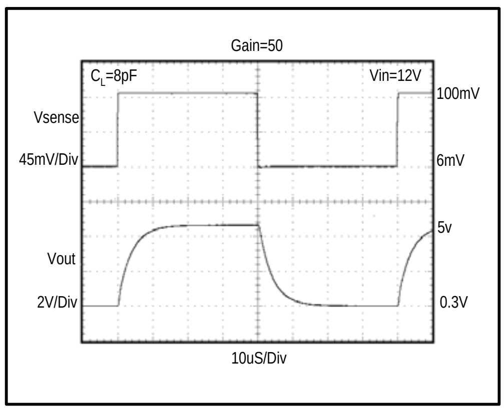


Fig 8. Large Signal Transient Response 50X

Ordering Information

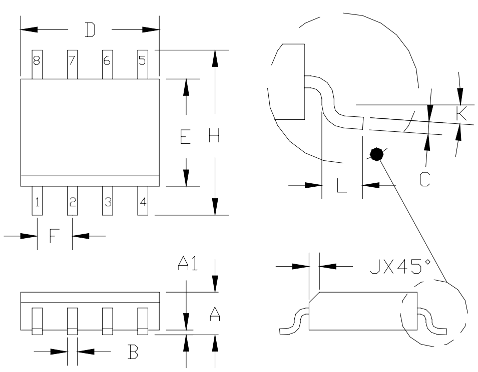
Part No.	Description	Package	Pack Quantity
IXI848S1	High Side Current Sense Monitor	8-Pin SOIC	98 (Tube)
IXI848S1T/R		8-Pin SOIC	2500 (Tape & Reel)

Pin Description and Configuration

SOIC	Name	Description
8	R50	Connecting R50 to GND, (R10=N/C) selects a VOUT voltage that is 50X the voltage across R_{SENSE}.
1	GND	Ground
5	LOAD	High impedance load-side connection to the external Sense Resistor.
4	IN	Positive supply terminal and power connection for the external Sense Resistor.
3	VOUT	Output voltage proportional to the voltage across R_{SENSE}.
2	R10	Connecting R10 to GND, (R50=N/C) selects a VOUT voltage that is 10X the voltage across R_{SENSE}.
6	N/C	No Connect
7	N/C	No Connect

Package Outline

8-LEAD SOIC



3. MOLDED PACKAGE SHALL CONFORM TO JEDEC STANDARD CONFIGURATION MS-012 VARIATION AA.

(2) DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.

(1) CONTROLLING DIMENSIONS: MILLIMETERS.

NOTES: (UNLESS OTHERWISE SPECIFIED)

DIM.	INCH MIN.	INCH MAX.	MM. MIN.	MM. MAX.	NOTE
A	.0532	.0688	1.35	1.75	----
A1	.0040	.0098	.10	.25	----
B	.013	.020	.33	.51	----
C	.0075	.0098	.19	.25	----
D	.1890	.1968	4.80	5.00	(2)
E	.1497	.1574	3.80	4.00	(2)
F	.050 BSC		1.27 BSC		----
H	.2284	.2440	5.80	6.20	----
J	.0099	.0196	.25	.50	----
K	0°	8°	0°	8°	----
L	.016	.050	.40	1.27	----

DIMENSIONS (1)

Detailed Circuit Description

The IXI848 is a precision high side current sense monitor featuring an input voltage range of 2.7V to 40V, and a selectable ground referenced fixed gain output of either 10 or 50.

A small voltage developed across an external sense resistor (R_S), is converted to an amplified ground referenced voltage output at VOUT, (Figure 1). The amplifier's non-inverting input is high impedance making the voltage at that terminal equal to V_{IN} – (I_L) (R_S). The amplifier forces the high impedance inverting terminal to equal the non-inverting input voltage by turning on the P-Channel MOS FET.

As the P-Channel MOS FET is biased on by the amplifier output, current is sourced through R_G (10R or 10R+40R), to produce a voltage equal to V_{IN} – (I_L) (R_S) at the inverting input of the amplifier. This develops a voltage across the inverting input resistor, R that matches the sense voltage across R_S, plus any associated input offset voltage, (V_{IO}). Consequently, the voltage at VOUT corresponds to R_G / R.

Output: $VOUT = G [(I_L) (R_S) + V_{IO}]$

Gain: $G = (R_G) (Z_M) / R (R_G (R_G + Z_M))$

R_G = 10R or 50R selectable

Input Offset: $V_{IO} = \pm 1.2$mV max

R = 3.3kΩ ±20%

Temperature coefficient:
(all on-chip resistors) R = 700ppm / °C typical

Gain error = ±0.5% typical

R_{SENSE} Component Selection

The R_{SENSE} value should be selected such that the voltage across R_{SENSE} is at full-scale for the load current to be monitored. Operating the IXI848 at or near the full-scale sense voltage will minimize the error component associated with the input offset voltage of the internal op amp, (0.7% typical at full-scale).

The IXI848 can be configured to measure a wide selection of currents by using different R_{SENSE} values. Some common values for typical operation of the IXI848 are listed in the following table.

Full-Scale I_L (A)	R_{SENSE} R_S (Ω)	Gain (V/V)	VOUT (V) V_{SENSE} = 150mV
0.15	1.0	10	1.5
1.5	0.1	10	1.5
5	0.01	50	2.5
100	0.001	50	5

Output Impedance

The VOUT output is a current source driving a 33kΩ resistance to ground for a gain of 10, or a 165kΩ resistance to ground for a gain of 50. Output gain is reduced by resistive loading of the VOUT terminal. The impedance of the external monitor load (Z_M) should be chosen high enough to maintain the desired accuracy. Buffering of the VOUT terminal with a high-impedance input stage may be required to minimize output errors.

The following formulas quantify the percent error introduced by output loading:

For a Gain of 10
$\%_{ERROR} = 100 [R_{LOAD} / (33k\Omega + R_{LOAD}) – 1]$

For a Gain of 50
$\%_{ERROR} = 100 [R_{LOAD} / (165k\Omega + R_{LOAD}) – 1]$

R_{LOAD} = the external load applied to VOUT