Integrating Current Sensor Module:
MOI-ICS I-A1-XXX
Endurance Analog Family

micro-oscillator.com

High Voltage High-Side Isolated DC Integrating Current Sensor Module

ICS I-A1-XXX

General Description

Micro Oscillator Inc. isolated high-side DC current sensor provides a uni-directional current sensing system module with frequency output while eliminating the need for electronic sampling and A/D converter circuitry**.** The current measurement is performed by a current frequency converter which utilizes an integrator. The integrator performs virtually continuous measurement of the current. This results in all the spikes and dips, over a frequency range of DC-130 KHz, being averaged together. The voltage drop across the sensor resistor (RS) controls the current flow through the gain resistor (RSxGain). The ratio of gain resistor to sensor resistor resistance values determines the ratio of sense current to integrator input current level. By matching the temperature coefficients of these resistors the effects of temperature are reduced allowing low cost resistors to be used.

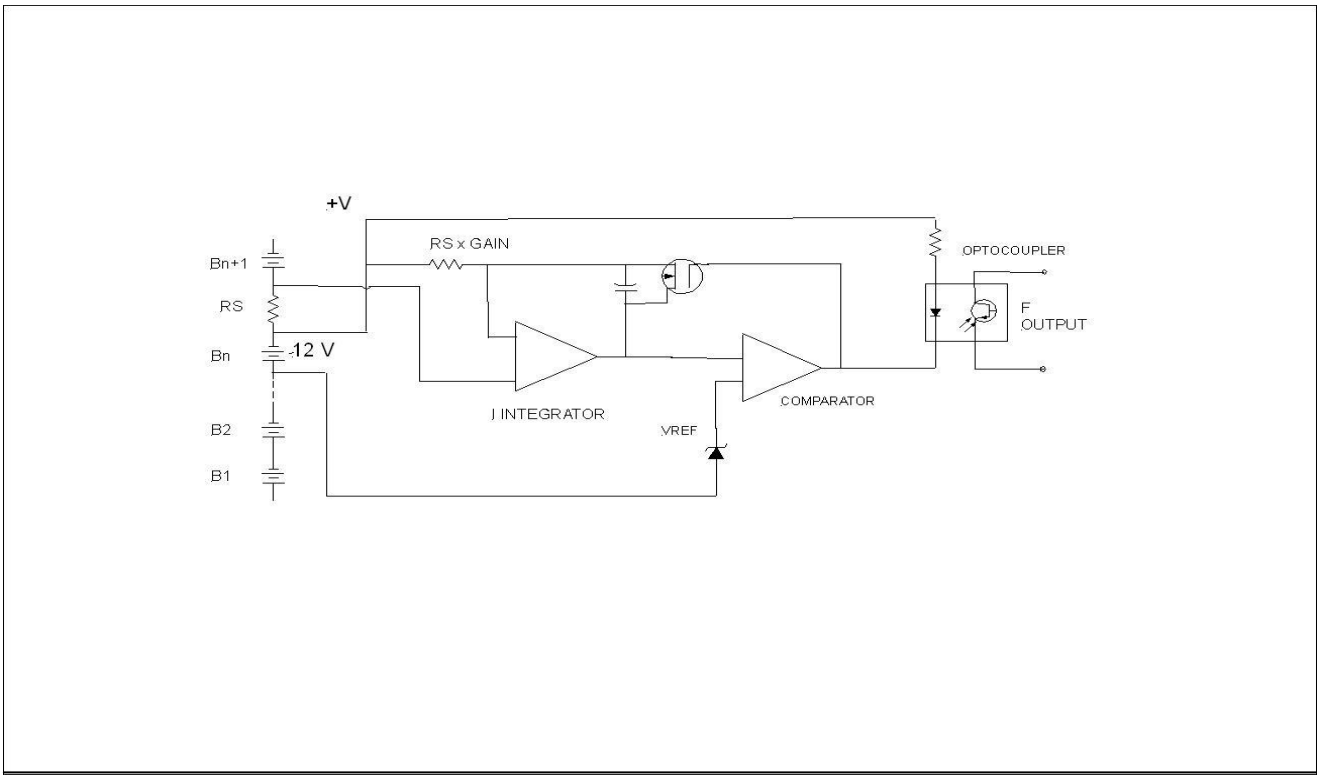
Features and Benefits

- Reduced sensor resistor's tol. and temp. coefficient error
- Single floating +12 V supply operation (other voltages 6v, 24v available)
- 2 KVRMS isolation voltage between I sensor and output
- Wide 130 KHz bandwidth
- Internal Integration of Current captures pulses
- -40°C to 85°C Automotive temperature range
- Frequency output
- Low loss: 20 mV sense resistor drop
- User selectable External or Internal sense resistor
- Patented

Applications

- Precision high and low voltage current and voltage monitoring
- Battery monitors
- Motor control and servo systems
- Transmission, steering, and throttle control

Functional Block Diagram



Absolute Maximum Ratings

- Operating Temperature; -40°C to 85°C
- Supply Voltage; (Vss) 18 Vmax
- Internal Sensor Resistor Current; 10 A
- Sensor input; V_{S2} -.8V to +.8V
- Optocoupler Output ;
  Current 80 mA
  VCE = 80 Vmax
- Storage Temperature; -40°C to 125°C

Electrical Characteristics

RS= 0.1 Ohms, TA = 25°C, Supply Voltage = 13V, unless otherwise noted.

		Min	Typ	Max	Units	Conditions
Internal Sensor Resistor	Rs	.099	.1	.101	Ohms	
Full-scale sense voltage			Vs-0.02		V	
Supply Voltage	Vs	10		16	V	
Supply Current	Is		7		mA	
Integrator						
Gain Bandwidth Product			1.3		MHz	
Input bias current			60		pA	TA = +85°C
Input Offset Current			50		pA	TA = +85°C
Input Offset Voltage		-2		2	uV	
GAIN	Freq/I		10KHz/10mA			I sensor RS=200mA Vs=13V Internal RS
GAIN Tolerance I sensor RS =300mA						
Accuracy			2.5%			
Accuracy over Temperature			0.5%			-40°C to 85°C
Accuracy over Voltage			0.5%			VS=10V to 16V
GAIN Tolerance I sensor RS=200mA						
Accuracy		-2%		2%		
Accuracy over Temperature		-1%		1%		-40°C to 85°C
Accuracy over Voltage		-1%		1%		VS=10V to 16V
GAIN Tolerance I sensor RS=150mA						

Accuracy			2.5%			
Accuracy over Temperature			0.5%			-40°C to 85°C
Accuracy over Voltage			0.5%			VS=10V to 16V
GAIN Tolerance I sensor RS=100mA						
Accuracy			2.5%			
Accuracy over Temperature			0.5%			-40°C to 85°C
Accuracy over Voltage			0.5%			VS=10V to 16V
GAIN Tolerance I sensor RS=50mA						
Accuracy			2.5%			
Accuracy over Temperature			0.5%			-40°C to 85°C
Accuracy over Voltage			1%			VS=10V to 16V
GAIN Tolerance I sensor RS=20mA						
Accuracy			2.5%			
Accuracy over Temperature			0.5%			-40°C to 85°C
Accuracy over Voltage			2%			VS=10V to 16V
Output						
FODM124 Optocoupler						Note; 1
LED drive		2		3.2	mA	
Transistor output	RL		3.32k		ohms	VL=5V
	RL		2.2k		ohms	VL=3.3V

1; Refer to FODM124 datasheet for details.

Detailed Description

Micro Oscillator Inc. isolated high-side DC current sensor module provides uni-directional current sensing with a frequency output. The current measurement utilizes an integrator to convert the current level to frequency. The integrator performs virtually continuous measurement of the current. This results in all the spikes and dips, over a frequency range of DC-130 KHz, being averaged together. This reduces computational processing required of the sensor output signal since the output already represents the average value of the sensed current level.

Using integration provides the major advantage, as the name implies, the output represents the integral or average of an input current. Any changes in the current signal have a cumulative effect on the frequency output. Other ADC strategies merely "capture" the current signal level at a single point in time every cycle. If the current signal contains significant levels of current spikes/dips, one of the other ADC converter technologies may occasionally miss a spike or dip because it captures the signal repeatedly at a single point in time. Integration, on the other hand, averages together all the spikes and dips thus providing a more accurate output.

Another major advantage of using Micro Oscillator Inc. isolated high-side DC current sensor module is that the sensor resistor's tolerance and temperature coefficient error can be cancelled out. This is because the ratio of gain resistor to sensor resistor resistance values determines the ratio of sense current to integrator input current level.

The measured full-scale current is determined by the value of the sense resistor (RS). The voltage drop across sensor resistor controls the current flow through gain resistor (RSxGain) which controls the integrator input current. The integrator input current charges a capacitor which varies the capacitor voltage level. When the capacitor voltage level equals that of the internal voltage reference, the capacitor is discharged producing an output pulse signal. The process of charging the capacitor is again repeated. Since the capacitance value and internal voltage reference values are constant, the value of charge in the fully charged capacitor is constant. By counting the number of output pulse per unit of time (frequency), the average current level is determined. For example a 100mA dc current through the sense resistor, (RS) produces a 10KHz output signal. Even if the instantaneous current level varies causing the instantaneous frequency to vary, the average current level is still obtained by counting the number of output pulse per unit of time.

Application Information

Diagram using internal sense resistor

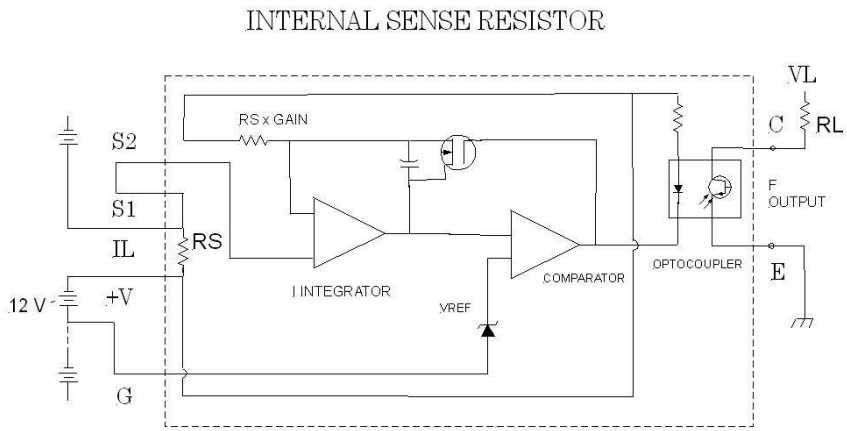
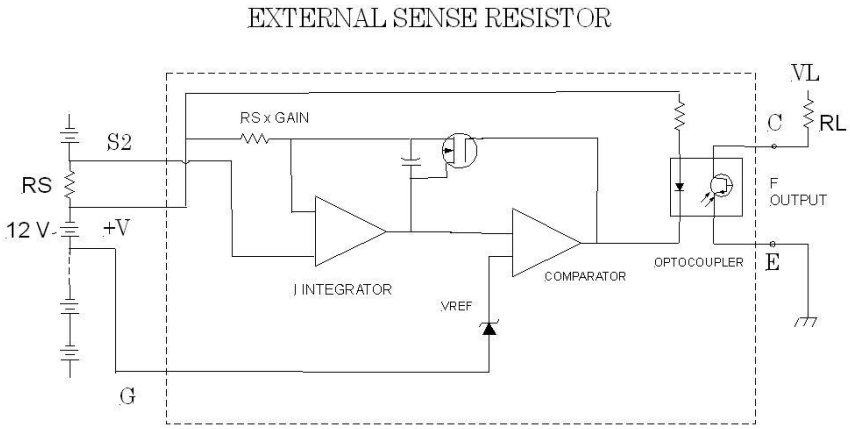


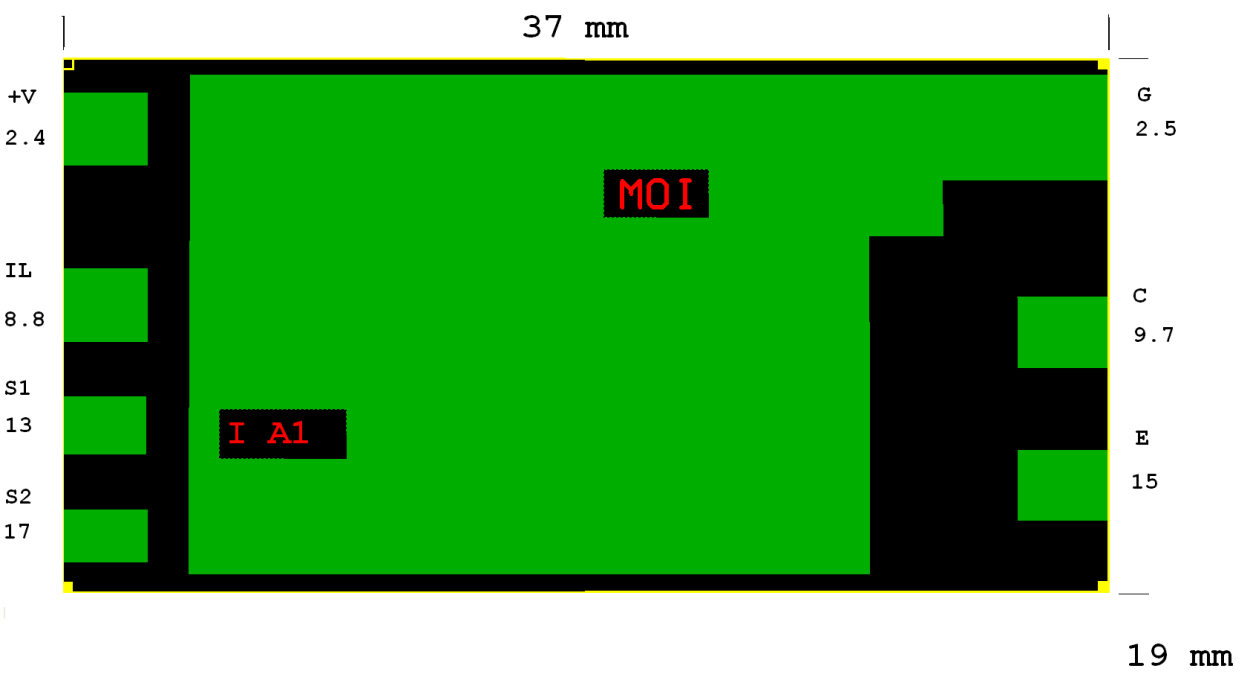
Diagram using external sense resistor



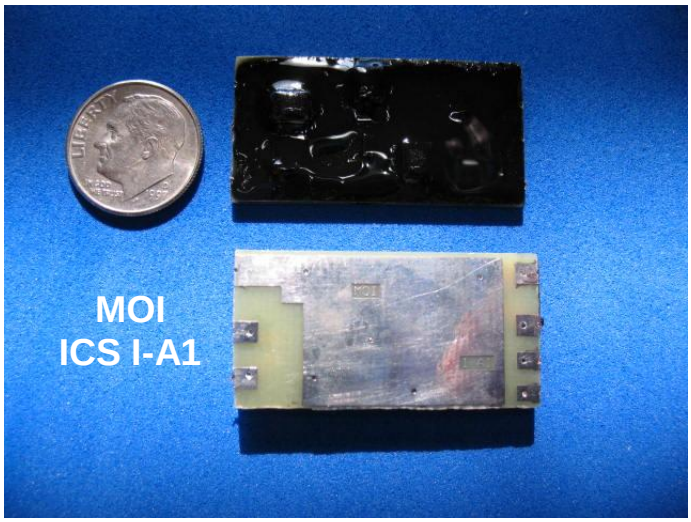
Device Branding Key

MOI_ICS I-A1-XXX	-40°C to 85°C	Integrating Current Sensor (Isolated)
MOI_ICS I-BA1-XXX	-55°C to 125°C	Integrating Current Sensor-Bidirectional
MOI_ICS IV-A1-XXX	-40°C to 85°C	Integrating Current & Voltage Sensor (Isolated)
MOI_ICS IV-BA1-XXX	-55°C to 125°C	Integrating Current & Voltage Sensor-Bidirectional

Package Details



Micro Oscillator, Inc. ICS I-A1



Handling Precautions

All device pins have limited ESD protection. Normal precautions should be taken to guard against ESD damage.

Warranty

Micro Oscillator, Inc. does not assume any liability arising out of the application or use of any product or circuit described herein. Our products are not authorized for use as components in devices used for life support or other critical application where failure can cause death or bodily injury. In the case of this product being defective in manufacturing, labeling, packaging or shipping, it will be replaced with a satisfactory part or the purchase price refunded.

Patented

U.S.A., patent # 7,719,259