Welcome!
Texas Instruments New Product Update

- This webinar will be recorded and available at www.ti.com/npu
- Phone lines will be muted
- Please post questions in the chat or contact your sales person or field applications engineer

New Product Update:
High-precision, multi-channel current sense amplifiers

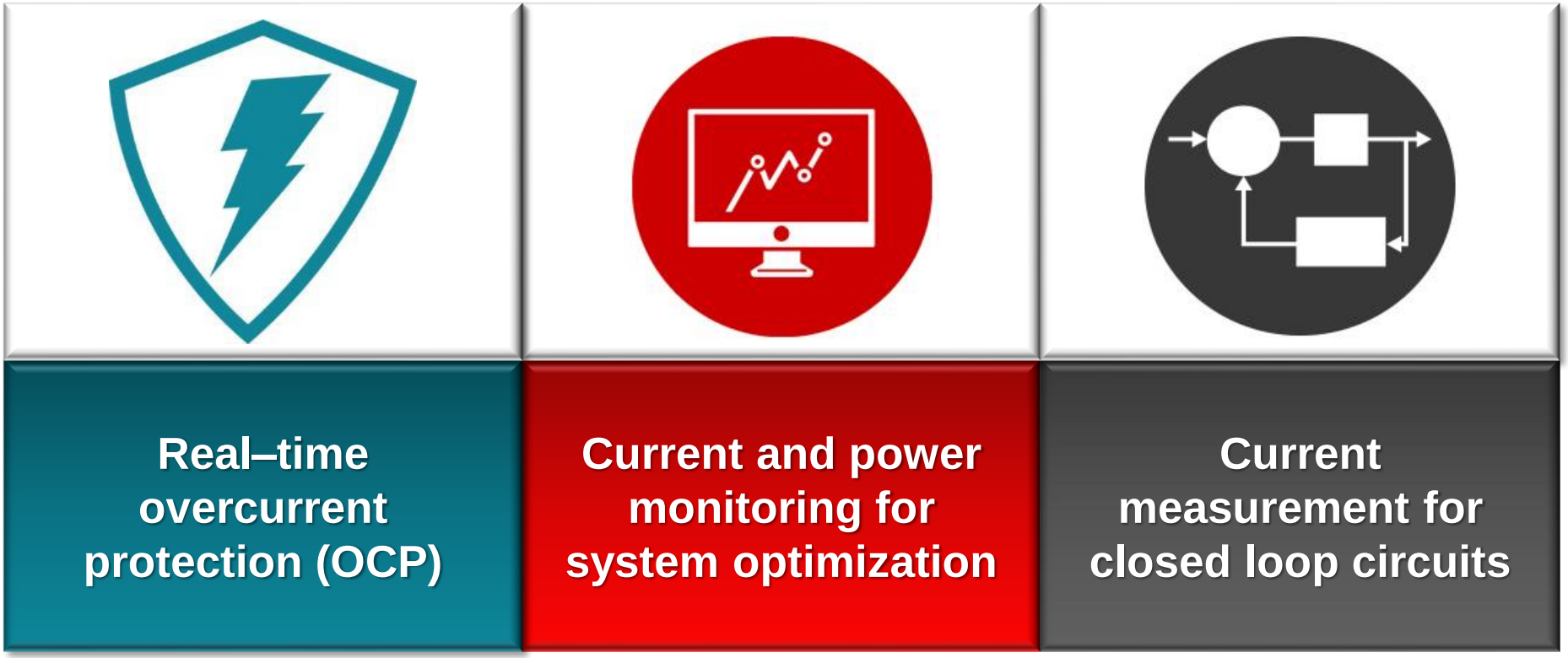
Kyle R. Stone

July 8, 2021

Agenda

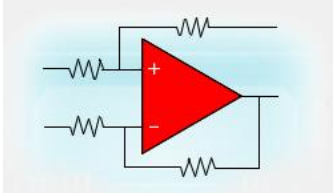
- Current Sensing Use-Case
- Types of Current Sensing Amplifiers(CSA)
- Difference between Discrete and CSA solutions
- Area Usage
- Typical multi-channel use-case
- Available high-precision multi-channel CSA’s

Current & power measurement use cases



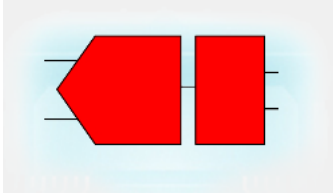
Current Sensing Portfolio

Analog Sense Amplifiers



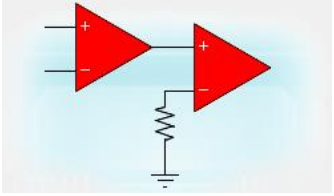
Integrate the full analog signal processing and provide a voltage or current output

Digital Power Monitors



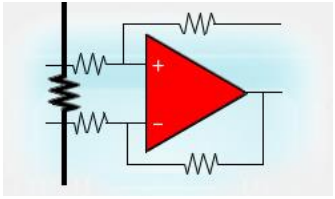
Integrate the full signal conditioning path and utilize a standard digital interface

Analog Output with Integrated Comparators



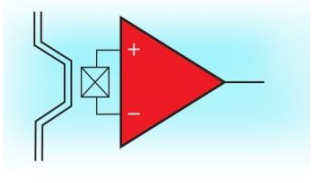
Provides an ALERT signal(s) when the load current exceeds a threshold along with the analog voltage output

In-package Shunt Solutions



Offers a low-drift, precision shunt resistor element in-package with either analog or digital out

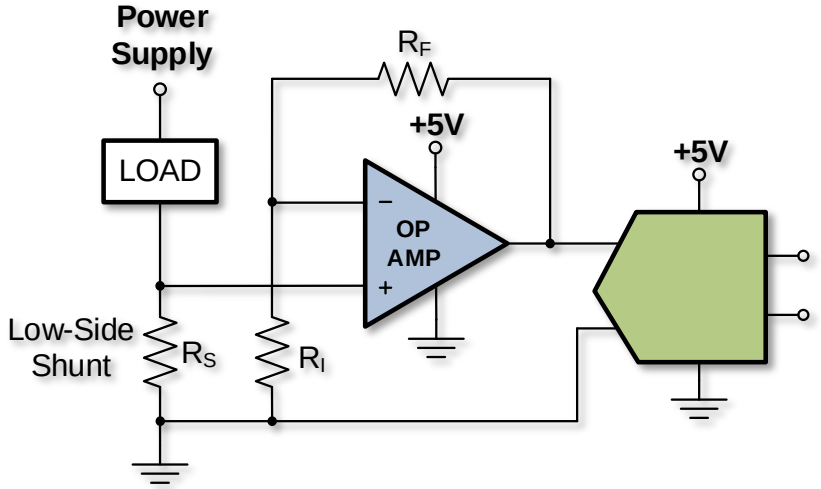
In-Package Hall-effect Current Sensors



Offers precision isolated Hall through-package current measurement

Benefits of designing with current sense amplifiers

Discrete current sense circuit

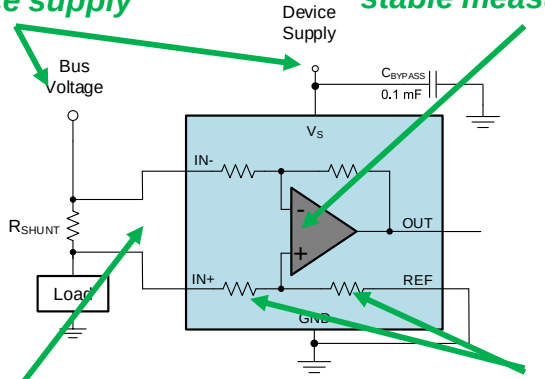


- External gain resistors are primary error and temperature drift contributor
- Input range limited by supply voltage

Dedicated current sense amplifier

Wide input range independent of device supply

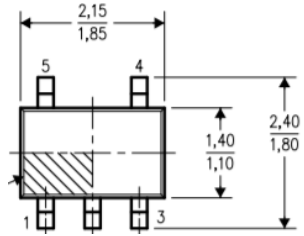
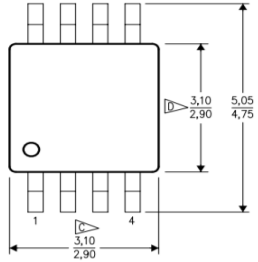
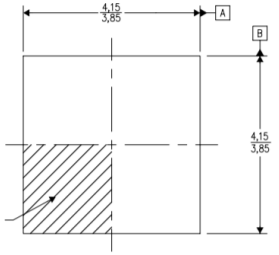
Zero-drift enables high precision, temperature stable measurements



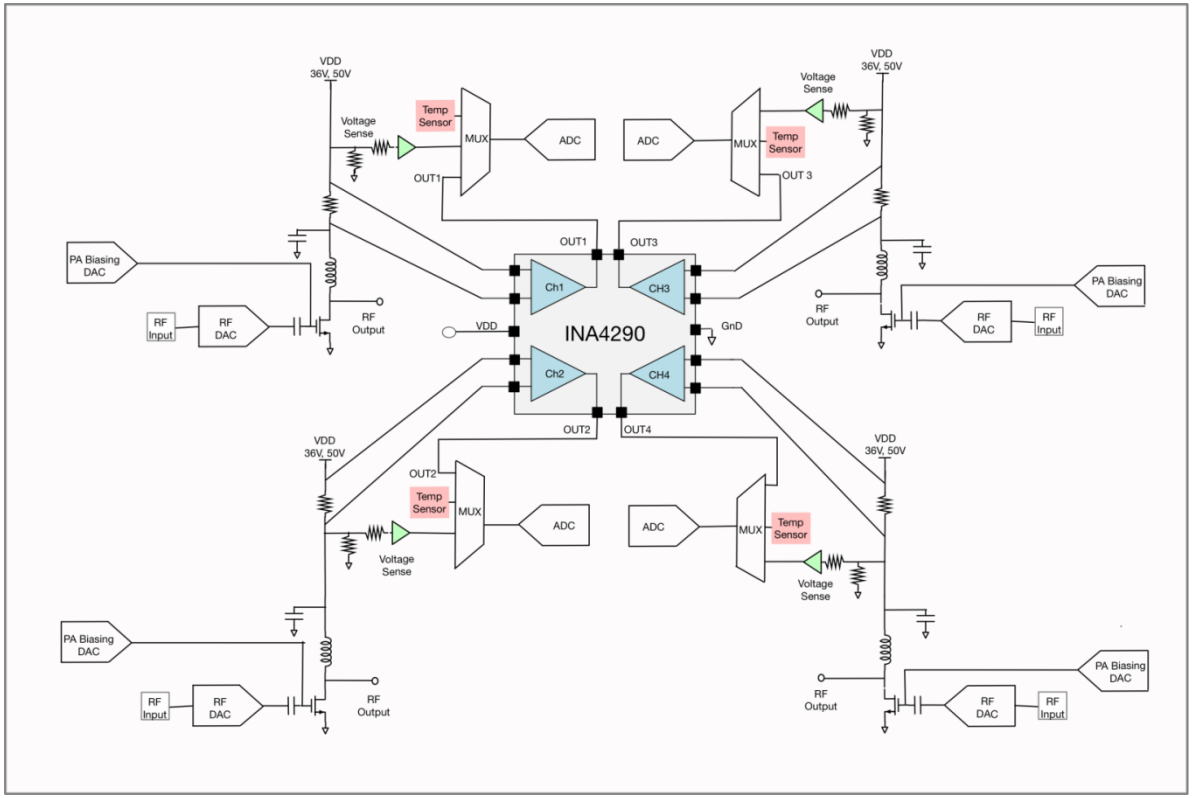
Very low amplifier offset voltage allows for lower ohmic shunt

Precision matched gain network increases accuracy & reduces drift

Benefits of designing with multi-channel CSA – INAx290 family

Single-Channel (INA290)	Dual-Channel (INA2290)	Quad-Channel (INA4290)
		
SC-70 Total IC area(max): ~5.2mm^2	VSSOP-8 Total IC area(max): ~15.6mm^2	QFN-16 Total IC area(max): ~17.2mm^2

4-Channel Analog Current Sense for AAS/RRU



Benefits

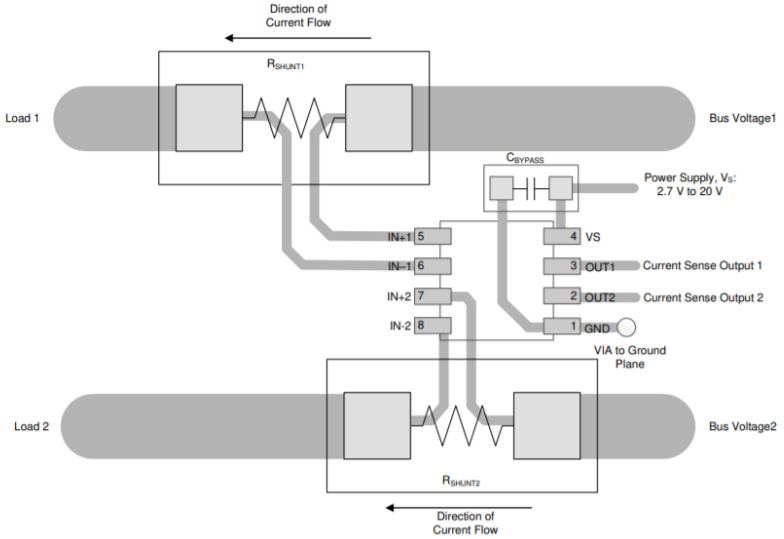
- Quad Ch. Current Sense Amplifier
- Simultaneous Quad Analog Output
- QFN Package (4mm x 4mm)
- Reduced cost per channel

Drawbacks

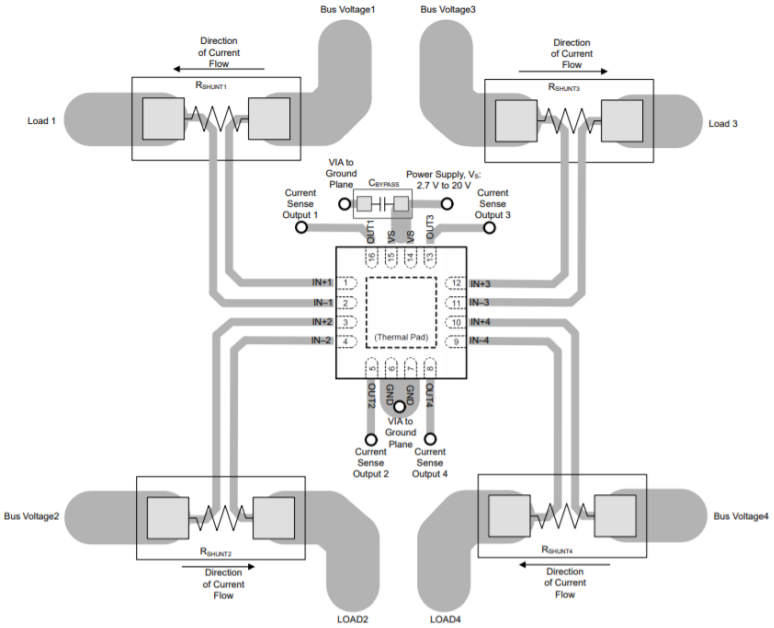
- Needs additional Quad ADC, Mux, Switches
- PCB level routing challenges

Recommended PCB Layout

INA2290



INA4290



INA2290

Available on TI.com

2.7 to 120V, Dual Channel, 1.1MHz, Ultra-Precise Current Sense Amplifier

Features

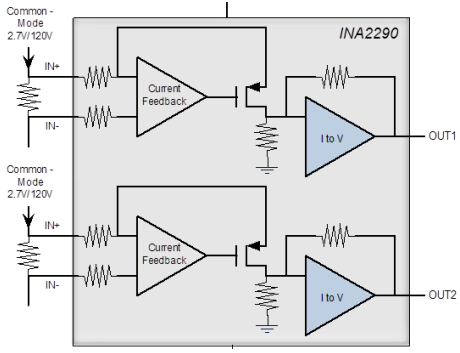
- 2.7V to 120V Common-Mode Range
  - -20V to 122V Survivability
- DC Accuracy:
  - Offset: 12µV (MAX) with 0.2µV/°C drift
  - Gain Error: 0.1% (MAX) with 5 ppm/°C drift
- High Speed: 1.1MHz 3dB bandwidth and 2V/µs slew rate
- Gain options: 20V/V, 50V/V, 100V/V, 200 V/V, 500V/V
- DC Supply: 2.7V to 20V
- Available in MSOP-8 Package

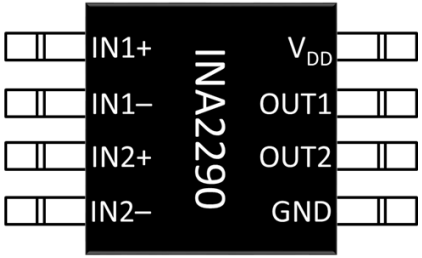
Benefits

- Wide common mode range supports 12V,24V,48V,60V,72V rails
  - Support negative transients survivability in harsh Inductive loads
- Low offset and Low gain error enables
  - improves system accuracy over temperature (-40°C to 125°C)
  - accurate lower current measurements
  - smaller shunt values (< 1mΩ)
- High Bandwidth and slew rate supports faster signal throughput
  - Ripple current measurement
  - Faster current throughput for protection
- Multiple Gain options increase design flexibility
- Wide supply range to support high voltage analog PID feedback systems.

Applications

- 48V Automotive Battery Systems
- Solenoid Control
- 48V Server
- 54V Telecom
- 60V Industrial Auto Transport
- 54V PA Biasing & Monitoring





MSOP-8

Texas Instruments

INA4290

Available on TI.com

2.7 to 120V, Quad Channel, 1.1MHz, Ultra-Precise Current Sense Amplifier in 4x4 QFN Package

Features

- 2.7V to 120V Common-Mode Range
  - -20V to 122V Survivability
- DC Accuracy:
  - Offset: 12µV (MAX) with 0.2µV/°C drift
  - Gain Error: 0.1% (MAX) with 5 ppm/°C drift
- High Speed: 1.1MHz 3dB bandwidth and 2V/µs slew rate
- Gain options: 20V/V, 50V/V, 100V/V, 200 V/V, 500V/V
- DC Supply: 2.7V to 20V
- Available in 4mm x 4mm QFN Package

Applications

- 48V Automotive Battery Systems
- Solenoid Control
- 48V Server
- 54V Telecom
- 60V Industrial Auto Transport
- 54V PA Biasing & Monitoring

Benefits

- Wide common mode range supports 12V,24V,48V,60V,72V rails
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- Low offset and Low gain error enables
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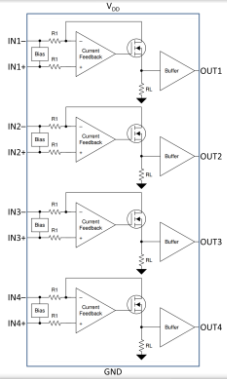
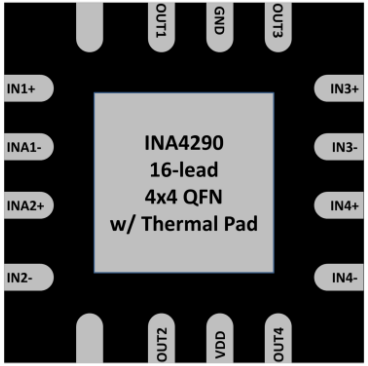




Texas Instruments

INA2191

Status – Early Preview on TI.com
Full Release – 3Q21

40V, Dual Channel, Bi-directional, Ultra-Precise Current Sense Amplifier with picoamp IB & ENABLE pin in 1.2 x 1.5 WCSP

Features

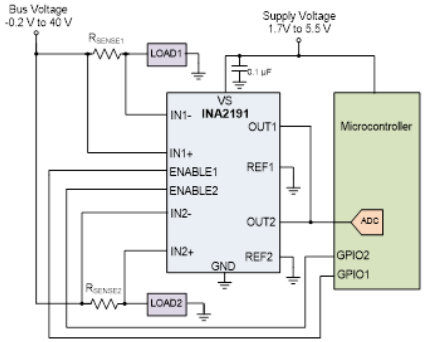
- Common Mode Voltage Range:
  - -0.1V to 40V
- High Accuracy
  - Voltage offset: +/-10uV (0.13uV/C)
  - 0.3% gain error (max over temp)
- Low power
  - Low quiescent current (135uA max)
  - Low disable current (0.1uA typ)
  - Low bias current (500pA typ)
- Independent Supply Voltage of +1.7V to +5.5V
- ENABLE pin shuts down device and sets VOUTx to High-Z

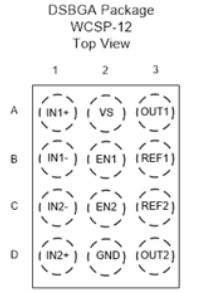
Applications

- Notebook Computers
- Battery-powered devices
- eCall Battery Status
- Cell Phones
- Telematics Equipment
- Battery Chargers

Benefits

- Common mode range supports low- and high-side up to 40V applications
- Reduces design error margins
- Ideal for low power and space sensitive applications
- Small bias current allows for measurement of small µA currents
- Independent supply voltage enables device to interface with 1.8V ADC
- Enable pin reduces power consumption and allows OUT multiplexing





1.17mm x 1.53mm x 0.35mm

Visit us http://www.ti.com/currentsense

For more information on the latest current sensors and resources to help you build your system

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