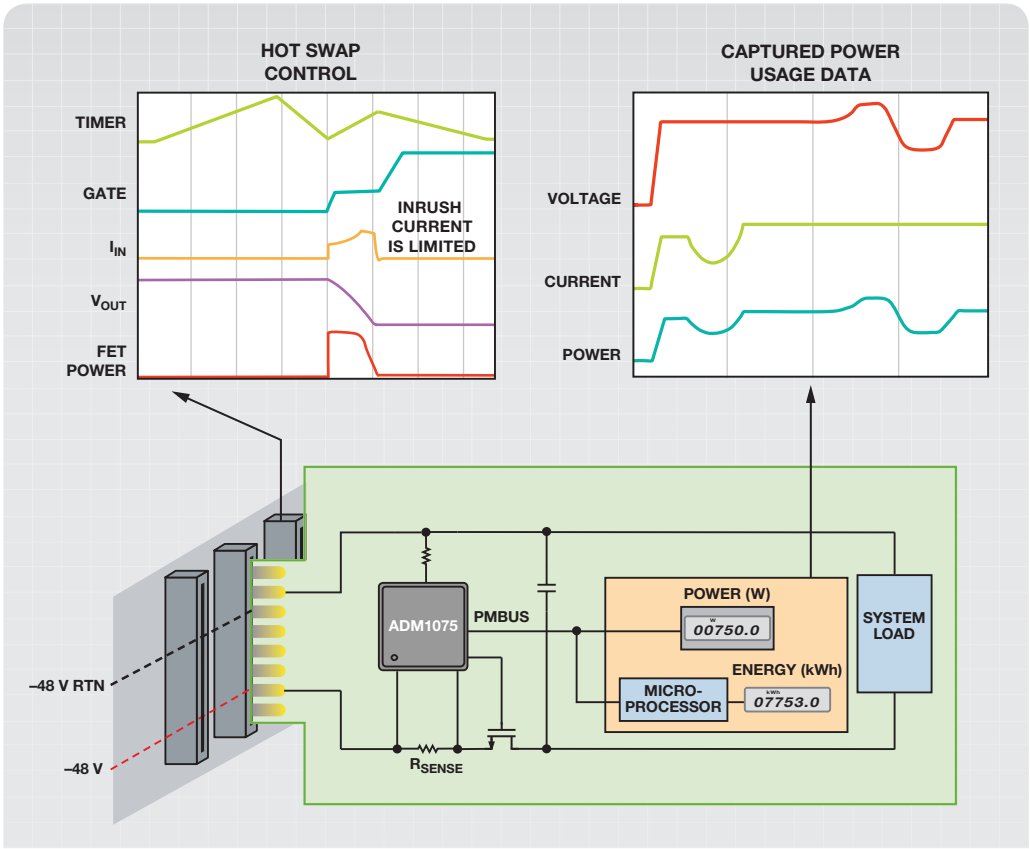
HOT SWAP AND POWER MONITORING

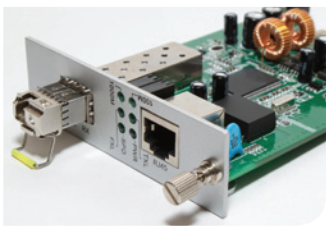
ADI Introduces the World's Most Accurate Hot Swap Controller with PMBus Digital Power Monitoring

The ADM1075 is a full feature, negative voltage, hot swap controller with constant power foldback that allows boards to be safely inserted and removed from a live –48 V backplane. It features current, voltage, and power readback, and energy metering via an integrated 12-bit analog-to-digital converter (ADC), accessed using a PMBus interface. The part provides precise and robust current limiting and protection against both transient and nontransient short circuits and overvoltage and undervoltage conditions.



Infrastructure for the evolving datacenter.

Switches and routers for carrier, access, enterprise networks.



Pluggable subsystems and modules.

Contents

ADM1075: Hot Swap Controller and Digital Power Monitor with PMBus Interface

The ADM1075 is a full feature, negative voltage, hot swap controller with constant power foldback that allows boards to be safely inserted and removed from a live –48 V backplane. It also features current, voltage, power readback, and energy metering via an integrated 12-bit analog-to-digital converter (ADC), accessed using a PMBus interface.

Shunt resistor: flexible operating range.

Supply good active low when input within programmed voltage window.

12-bit ADC ±1% accurate for current, voltage and power readback.

SHDN: level triggered shutdown of hot swap.
RESTART: falling edge triggered 10 sec restart.

PMBus (I²C) interface.
General-purpose output pins.

Separate UVH/UVL pins for accurate hysteresis settings.

Power-good output determined from drain and gate voltages.

High accuracy 1% UVH, UVL, OV thresholds.

PLIM: resistor divider sets constant power foldback.

Two separate ADC inputs for voltage monitoring.

GATE pin: responds to short circuits within 370 ns.
High gate drive (12 V) → lowest RDS_{ON} when FET fully enhanced.

ISET: resistor adjustable current limit.

R_{SENSE}: low insertion loss
15 mV to 25 mV ADM1075-1
30 mV to 50 mV ADM1075-2.

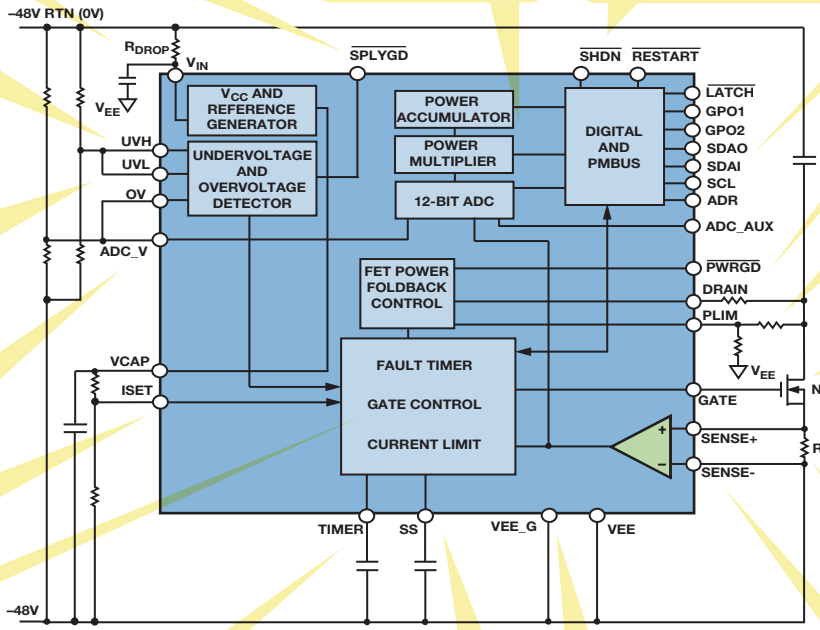
High accuracy current limit (2%) allows for tighter FET SOA protection.

TIMER cap: sets time, FET remains on while current in regulation.

SS cap: sets soft start current profile.

Separate ground pin for gate pull-down return.

Separate VEE and SENSE—ensures minimal voltage drop in sense trace.

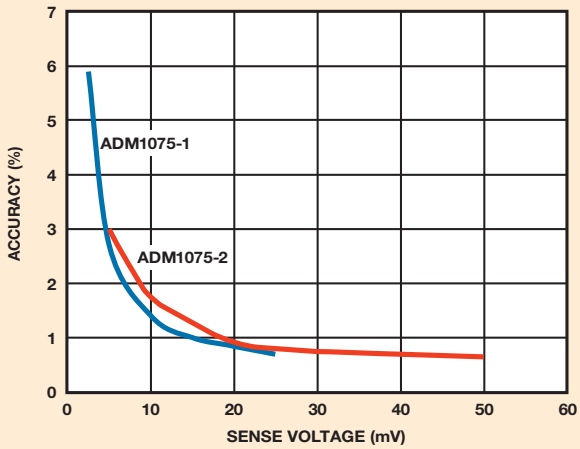


Hot Swap and E-Fuse Applications

- Telecommunications and data communication equipment
- Optical networks
- –48 V distributed power systems
- Central office switching
- High availability servers
- Negative power supply control

Features

- The ADM1075 features best-in-class current-sense accuracy (±0.7%)
- Constant power foldback for improved FET SOA protection
- Response time to short circuit <1 μs
- Resistor-programmable current limit
  - 5 mV to 25 mV for ADM1075-1
  - 10 mV to 50 mV for ADM1075-2
- ±1% accurate, 12-bit ADC for current, V_{IN}/V_{AUX} readback
- Suitable for wide input range due to internal shunt regulator
- High gate drive voltage to ensure lowest RDS_{ON}
- Fault recording with latched status register
- 28-lead LFCSP and 28-lead TSSOP

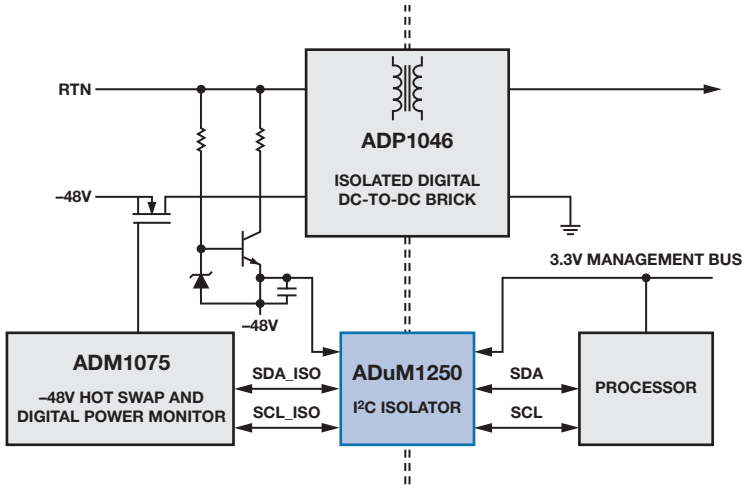


ADM1075: Applications Diagram and Isolation Information

Isolation is usually required between the –48 V backplane and any microcontroller communicating with the ADM1075 device.

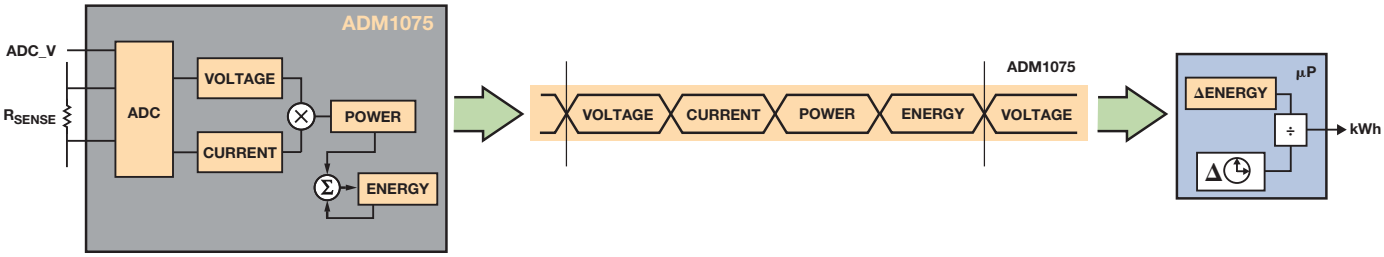
The ADuM1250 is an ideal companion device for I²C isolation. The ADuM1250 is an I²C isolator based on *i*Coupler® chip scale transformer technology from Analog Devices.

There are also other *i*Coupler devices available if isolation of other digital signals is required, for example, the ADuM5402, which also provides an integrated isolated dc-to-dc converter.



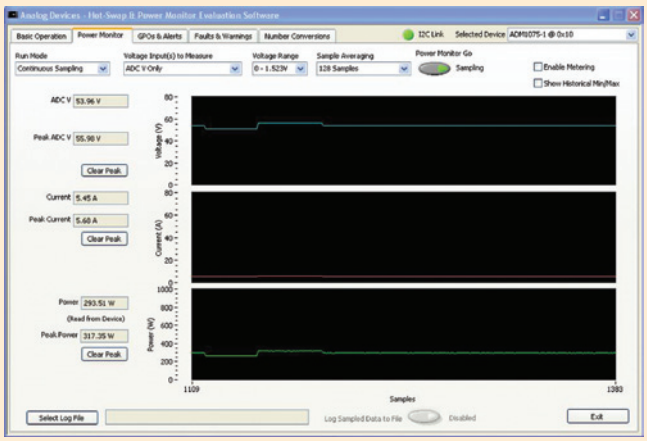
ADM1075: Energy Metering

A PMBus interface allows a controller to read current, voltage, and power from the ADC. The ADC_V input voltage and I_{OUT} current measurement values are multiplied by the ADM1075 to give the input power value. There is also an energy accumulator register—each time a power calculation is done, the power value is added to the energy accumulator register. This allows for the calculation of average power as well as instantaneous power measurements.

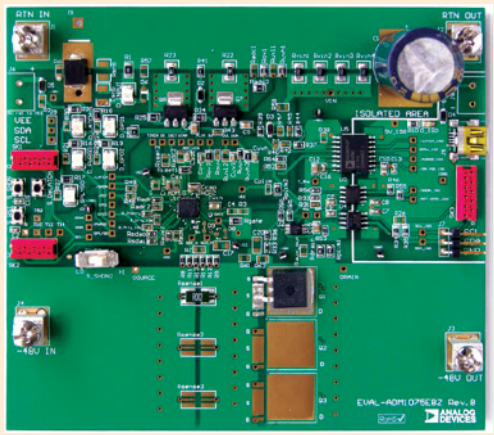


ADM1075: Evaluation Kits

The ADM1075 full feature evaluation board can be purchased on the ADM1075 Web page along with the serial I/O interface connector required to communicate with the evaluation board. The connector enables communication between the I²C port on the evaluation board and the evaluation software via the USB port on a PC. All relevant documentation and details can be found on the ADM1075 product page *www.analog.com/*ADM1075.



ADM1075 evaluation software.



Evaluation kits available.

ADM1275/ADM1276: Hot Swap Controller and Digital Power Monitor with PMBus Interface

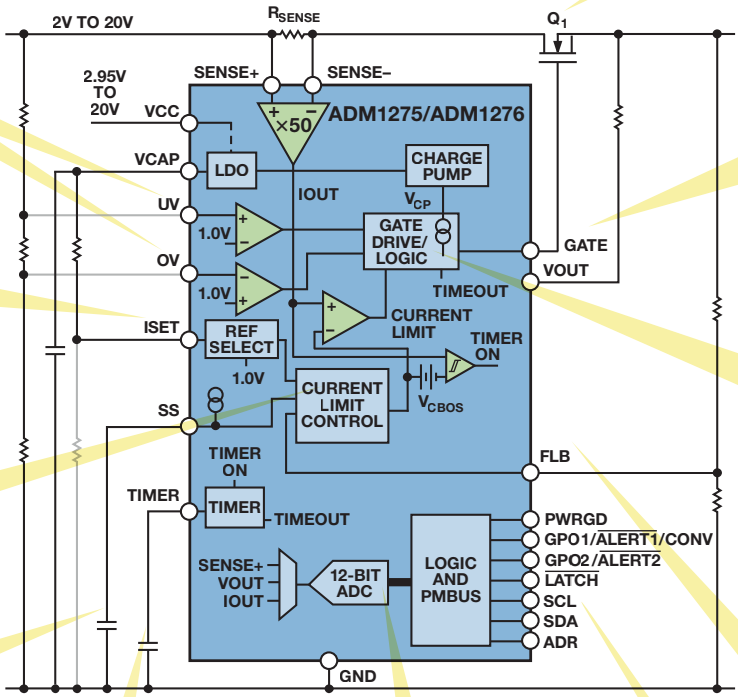
R_{SENSE}: measure system current. Hot swap control and fault protection.

Adjust current limit to allow for standard sense resistor value.

Low insertion loss (5 mV to 25 mV).

Q_1: current through sense resistor limited by controlling gate of FET.

UV/OV pins: FET gate pulled low if under/overvoltage detected.



ISET: resistor adjustable current limit.

GATE pin: responds to short circuit within 370 ns.

Gate drive/logic block: high gate drive → lowest RDS_{ON} when FET fully enhanced.

Current levels → ability to drive multiple FETs to share current.

Current limit control: high accuracy current limit (2%) → tighter FET SOA protection.

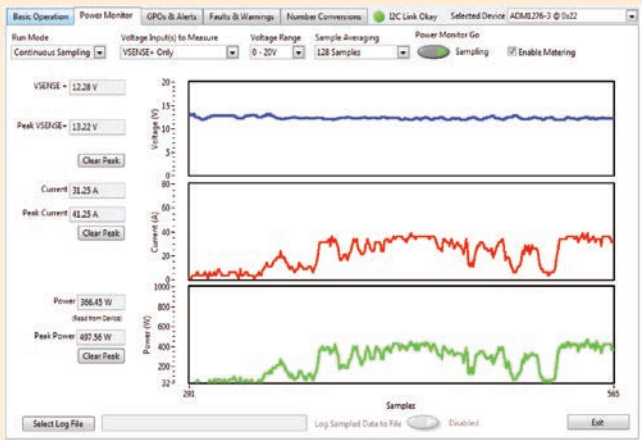
FLB pin: actively lowers the current limit as voltage across FET increases → tighter FET SOA protection.

SS cap: sets inrush current profile.

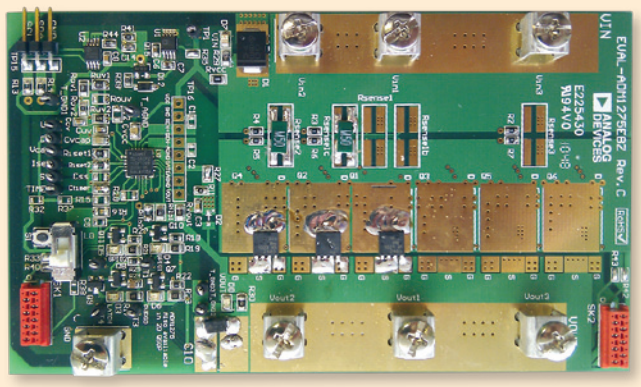
TIMER cap: sets time, FET remains on while current in regulation.

12-bit ADC: ±1% accurate ADC for current, voltage, and power readback.

ADM1276—energy metering.



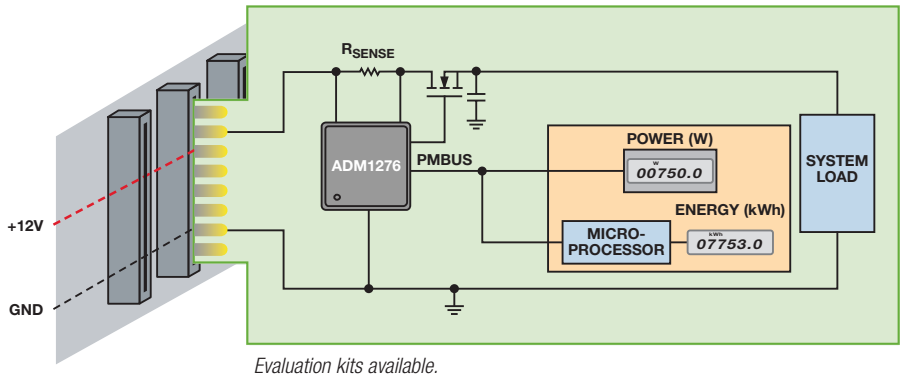
ADM1275/ADM1276 evaluation software.



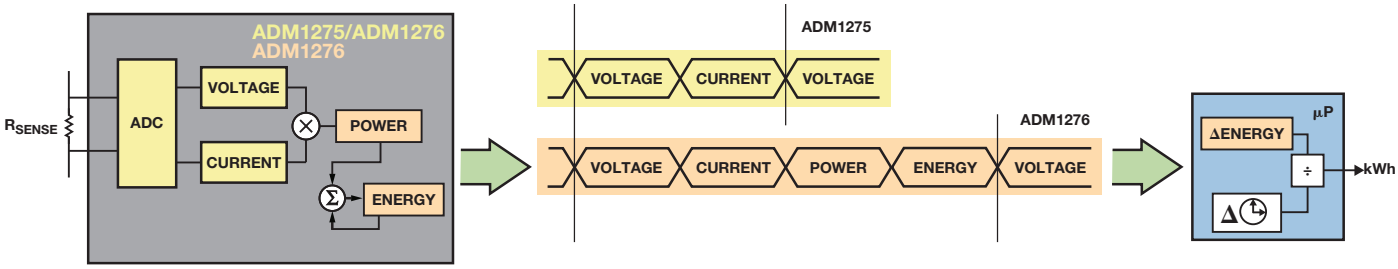
Evaluation kits available.

Power Monitoring and Energy Metering

A PMBus interface allows a controller to read current, voltage (ADM1275/ADM1276), and power (ADM1276 only) from the ADC. The V_{IN} input voltage and I_{OUT} current measurement values are multiplied by the ADM1276 to give the input power value. There is also an energy accumulator register—each time a power calculation is done, the power value is added to the energy accumulator register. This allows for the calculation of average power, as well as instantaneous power measurements.



Evaluation kits available.

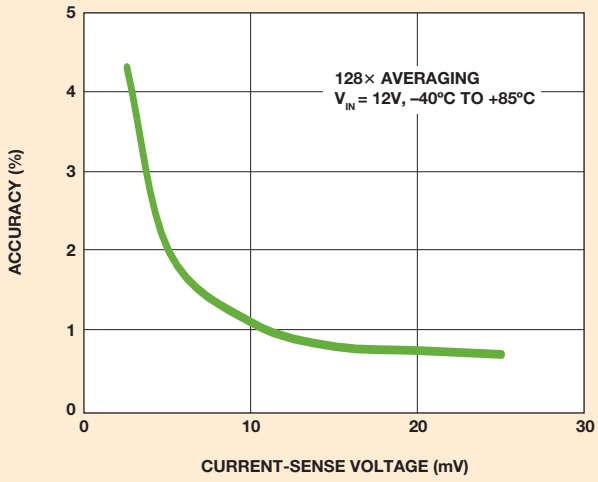


Hot Swap and E-Fuse Applications

- Servers
- Base stations
- Line cards
- Power monitoring and control/power budgeting
- Telecommunications and data communication equipment
- Central office equipment

Features

- The ADM1275/ADM1276 feature best-in-class current-sense accuracy (±0.7%)
- High accuracy over a wide sense voltage range ensures more accurate measurements at normal operating levels
- Controls supply voltages from 2 V to 20 V
- 370 ns response time to short circuit
- Resistor-programmable 5 mV to 25 mV current limit
- ±1% accurate, 12-bit ADC for current, V_{IN}/V_{OUT} readback
- Charge-pumped gate drive for multiple external N-channel FETs
- High gate drive voltage to ensure lowest RDS_{ON}
- Foldback for tighter FET SOA protection
- PMBus fast mode compliant interface
- 16-lead QSOP and 20-lead QSOP/LFCSP

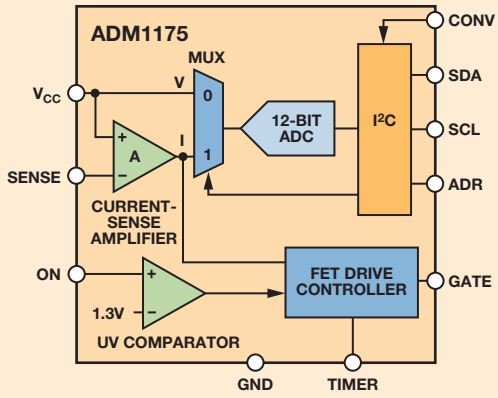


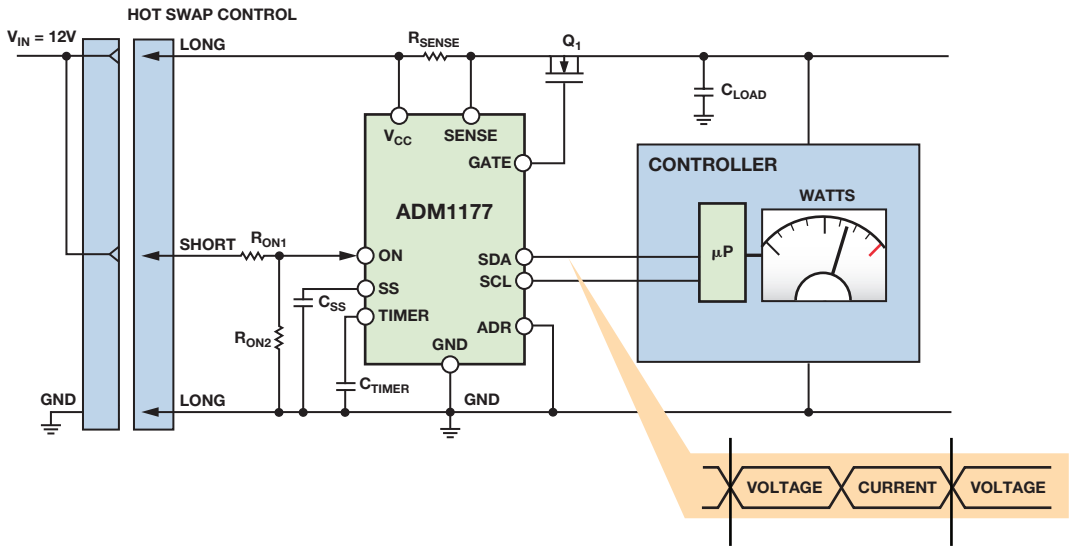
ADM1175/ADM1176/ADM1177/ADM1178: Hot Swap with I²C Digital Power Monitoring

The ADM1175/ADM1176/ADM1177/ADM1178 are a series of integrated hot swap controllers and current-sense amplifiers that offer digital current and voltage monitoring via an on-chip 12-bit analog-to-digital converter (ADC), communicated through an I²C interface.

Features

- Controls supply voltages from 3.15 V to 16.5 V
- Manual convert pin: ADM1175
- Additional address pin: ADM1176
- Soft start pin: ADM1177
- Overcurrent alert pin: ADM1178
- ±3% accurate hot swap current limit level
- 12-bit ADC for current and voltage readback
- Charge pumped gate drive for N-channel FET
- Adjustable current limit with circuit breaker
- Automatic retry (-1 model) or latch-off (-2 model) on current fault
- I²C fast mode-compliant interface
- 10-lead MSOP



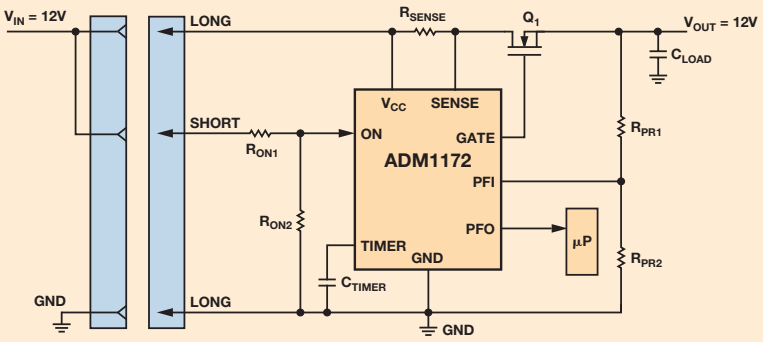


ADM1170/ADM1171/ADM1172/ADM4210: Positive Hot Swap Controllers

The ADM1170/ADM1171/ADM1172/ADM4210 are a series of low voltage, positive, high-side, hot swap controllers that safely enable a printed circuit board to be removed from and inserted into a live backplane. This is achieved using an external N-channel power MOSFET with a current control loop that monitors the load current through a sense resistor. An internal charge pump is used to enhance the gate of an N-channel FET.

Features

- Separate V_{CC} pin, soft start pin—ADM1170
- Current-sense output, soft start pin—ADM1171
- Power fail detector—ADM1172
- Controls supply rails from 1.6 V to 16.5 V
- 50 mV sense voltage limit providing minimal voltage drop losses
- Charge pumped gate drive for external N-channel FET
- Automatic retry (-1 model) or latch-off (-2 model)
- 8-lead TSOT (ADM117x)/6-lead TSOT (ADM4210)

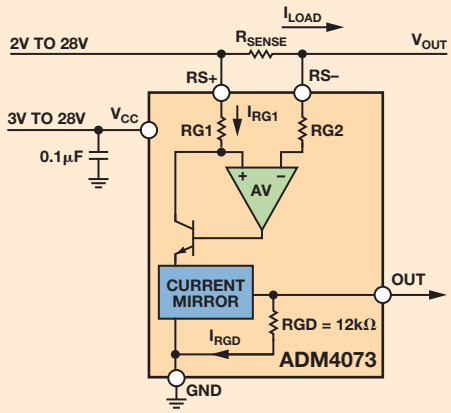


ADM4073: High-Side, Voltage Output, Current-Sense Amplifier

The ADM4073 is a low cost, high-side, current-sense amplifier ideal for small portable applications. The device is available in three different gain models. The voltage on the output pin is determined by the current flowing through the selectable external sense resistor and the gain of the version selected.

Features

- Low cost, compact current-sense solution
- Three available gain versions (20/50/100)
- Typical ±1.0% full-scale accuracy
- Wide 1.8 MHz bandwidth
- 3 V to 28 V operating supply
- Wide 2 V to 28 V common-mode range; operates from −40°C to +125°C
- Available in a 6-lead SOT-23 package

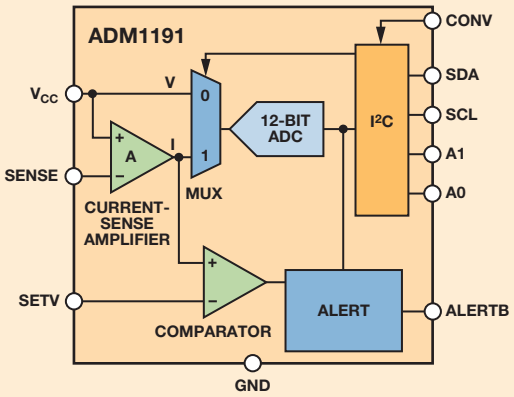


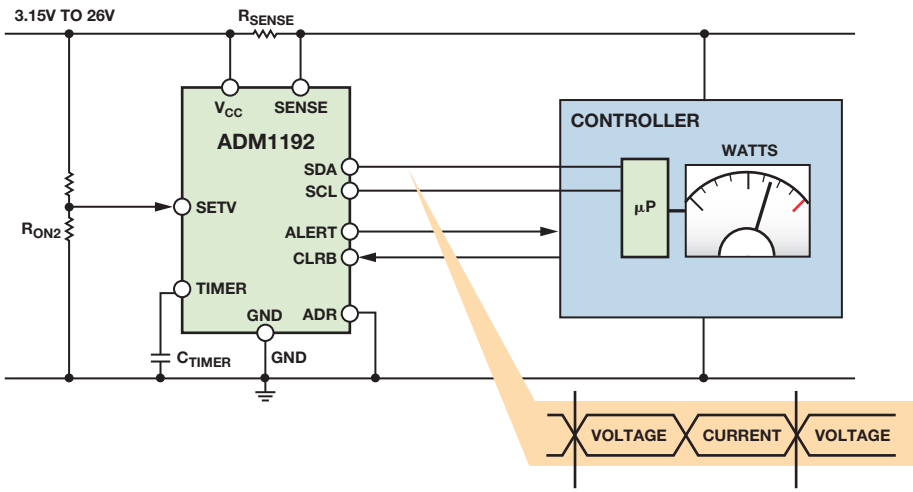
ADM1191/ADM1192: Digital Power Monitors with I²C Interface

The ADM1191 and ADM1192 are integrated current-sense amplifiers that offer digital current and voltage monitoring via an on-chip 12-bit analog-to-digital converter (ADC), communicated through an I²C interface.

Features

- Sensing from 3.15 V to 26 V
- ±1.5% current-sense accuracy
- 12-bit ADC for current and voltage readback
- ALERTB output for overcurrent interrupts
- I²C fast mode-compliant interface
- Up to 16 devices on the same bus
- 10-lead MSOP
- CONV, A1/A0, ALERTB—ADM1191
- TIMER, CLRB, ALERT—ADM1192





Low Voltage Positive Hot Swap Controllers with Digital Power Monitor

Part Number	Voltage Range (V)	Undervoltage Detection/Overvoltage Detection	Digital V and I Readback	Additional Features	Package	Price ($U.S.)[1]
ADM1175	3.15 to 16.5	$\overline{ON}$ pin (UV); $\overline{ON}$ pin (OV)	I²C interface with four addresses	Convert pin	10-lead MSOP	2.53
ADM1176	3.15 to 16.5	ON pin (UV)	I²C interface with 16 addresses	—	10-lead MSOP	2.53
ADM1177	3.15 to 16.5	ON pin (UV)	I²C interface with four addresses	Soft start	10-lead MSOP	2.53
ADM1178	3.15 to 16.5	ON pin (UV)	I²C interface with four addresses	ALERTB pin	10-lead MSOP	2.73
ADM1275 *New*	2 to 20	UV pin, OV pin	PMBus interface with four addresses	Soft start, foldback, fast gate shutdown, adjustable current-sense limit	16-lead QSOP, 20-lead QSOP, 20-lead LFCSP	4.49 4.99 4.99
ADM1276 *New*	2 to 20	UV pin, OV pin	PMBus interface with four addresses; also power readback	Soft start, foldback, fast gate shutdown, adjustable current-sense limit	20-lead LFCSP	5.29

Low Voltage Positive Hot Swap Controllers

Part Number	Voltage Range (V)	Undervoltage Detection/Overvoltage Detection	Additional Features	Package	Price ($U.S.)[1]
ADM1170	1.6 to 16.5	ON pin (UV)	Soft start, separate V_{CC} pin	8-lead TSOT	2.13
ADM1171	2.7 to 16.5	ON pin (UV)	Soft start, current-sense output	8-lead TSOT	2.23
ADM1172	2.7 to 16.5	ON pin (UV)	Power fail detector	8-lead TSOT	2.02
ADM4210	2.7 to 16.5	ON pin (UV)	—	6-lead TSOT	1.99

–48 V Hot Swap Controllers

Part Number	Voltage Range (V)	Undervoltage Detection/Overvoltage Detection	Digital V and I Readback	Additional Features	Package	Price ($U.S.)[1]
ADM1070	Shunt regulated	UV/OV pin	—	—	6-lead SOT-23	1.57
ADM1073	Shunt regulated	UV pin, OV pin	—	Soft start, drain pin monitoring, additional I/Os	14-lead TSSOP	2.13
ADM1075 *New*	Shunt regulated	UVH pin, UVL pin, OV pin	PMBus interface with four addresses; also power readback	Soft start, constant power foldback, fast gate shutdown, adjustable current-sense limit	28-lead LFCSP, 28-lead TSSOP	4.99

Digital Power Monitors

Part Number	Voltage Range (V)	Overcurrent Timer	Digital V and I Readback	Additional Features	Package	Price ($U.S.)[1]
ADM1191	3.15 to 26	—	I²C interface with 16 addresses	Programmable alert output, convert pin	10-lead MSOP	1.92
ADM1192	3.15 to 26	Capacitor programmable	I²C interface with four addresses	Programmable alert output, timer CLR pin	10-lead MSOP	1.92

Current-Sense Amplifiers—High Side

Part Number	CM Range (V)	Gain	Max Sense Voltage (mV)	Supply Range (V)	Accuracy (Typ)	Package	Price ($U.S.)[1]
ADM4073T	2 to 28	20	150	3 to 28	1%	6-lead SOT-23	0.99
ADM4073F	2 to 28	50	150	3 to 28	1%	6-lead SOT-23	0.99
ADM4073H	2 to 28	100	150	3 to 28	1%	6-lead SOT-23	0.99

[1]All prices are in USD in quantities greater than 1000.

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I²C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

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