HOT SWAP AND POWER MONITORING

2007/2008 ANALOG DEVICES APPLICATIONS BULLETIN

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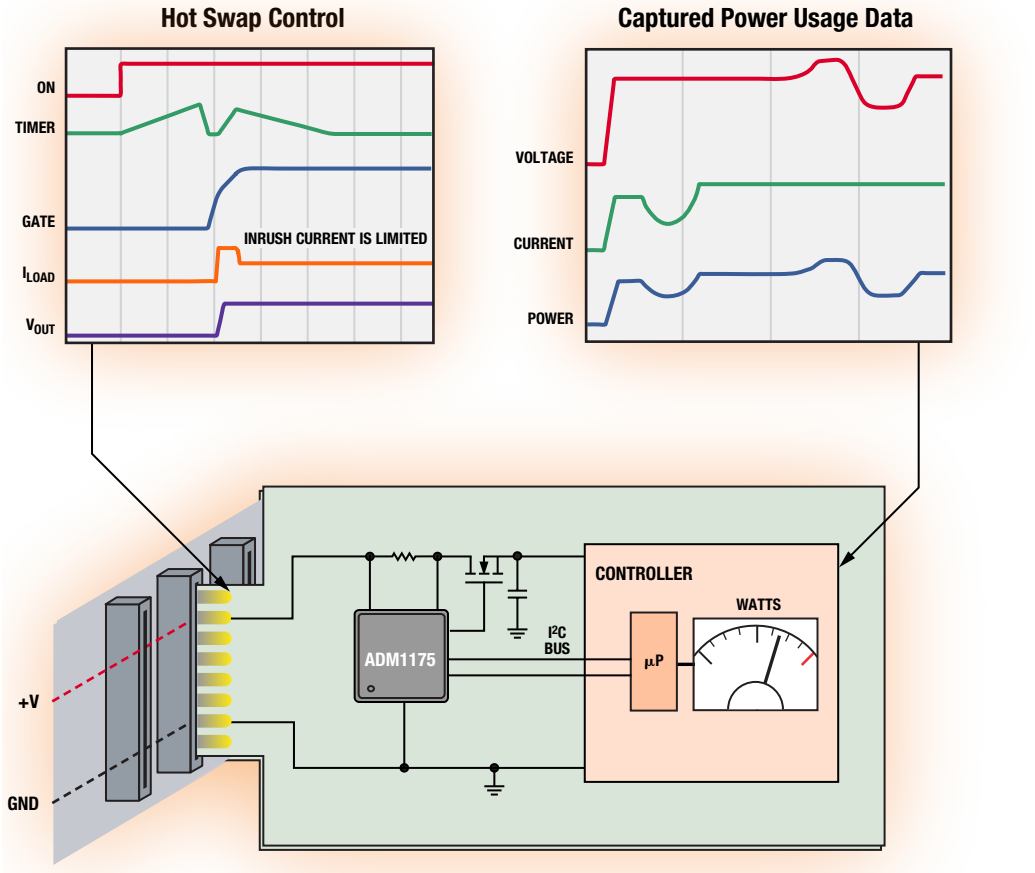
ADI Introduces the World's Most Accurate Digital Power Monitors



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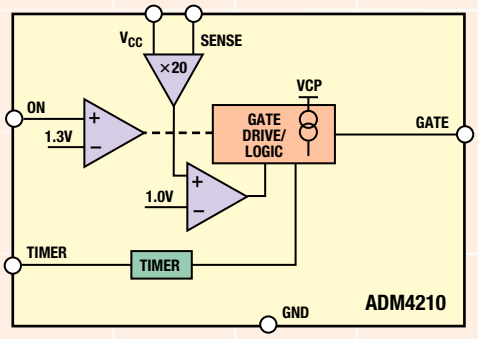
ANALOG DEVICES

ADM4210: Positive Hot Swap Controller

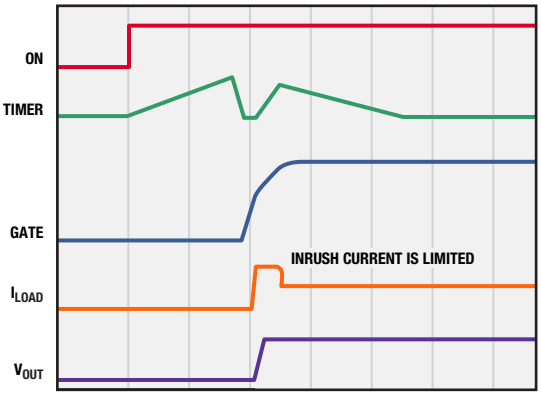
The ADM4210 is a positive, high-side hot swap controller that safely enables a printed circuit board to be removed and inserted to a live backplane. An external N-channel power MOSFET and a sense resistor is required. An internal charge pump is used to enhance the gate of the N-channel FET.

Features

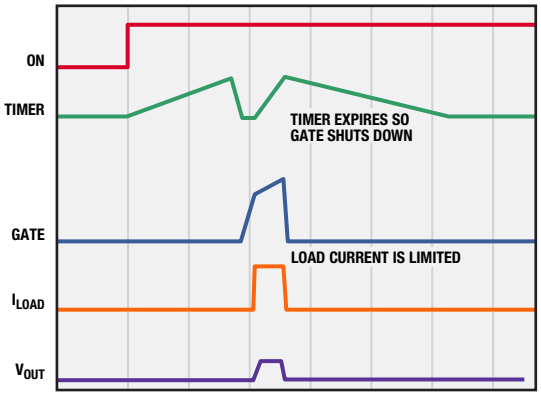
- Controls supply rails from 2.7 V to 16.5 V
- 50 mV sense voltage limit providing minimal voltage drop losses
- Charge pumped gate drive for N-channel FET
- Automatic retry or latch-off
- 6-lead TSOT package

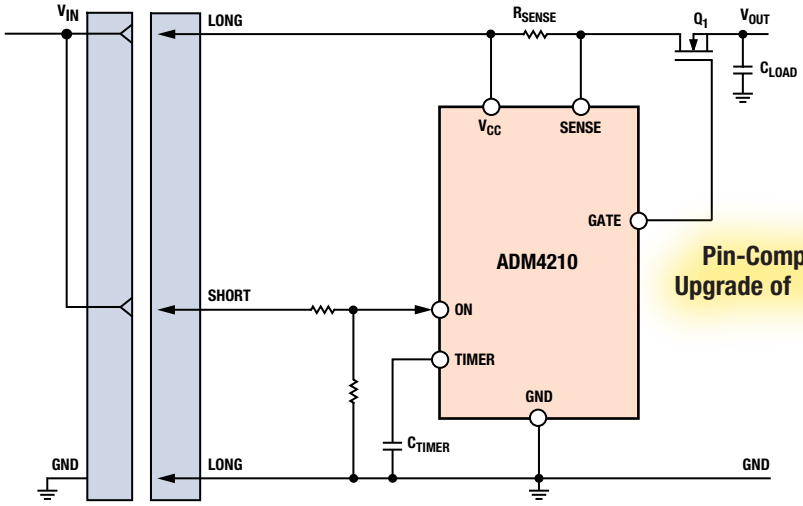


Hot Swap Under Normal Conditions



Hot Swap Under Shorted Load





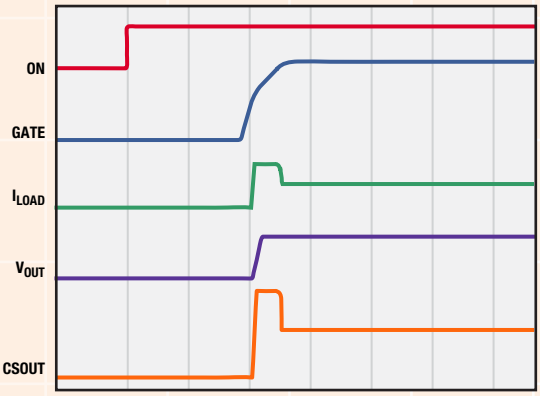
Pin-Compatible Upgrade of LTC4210

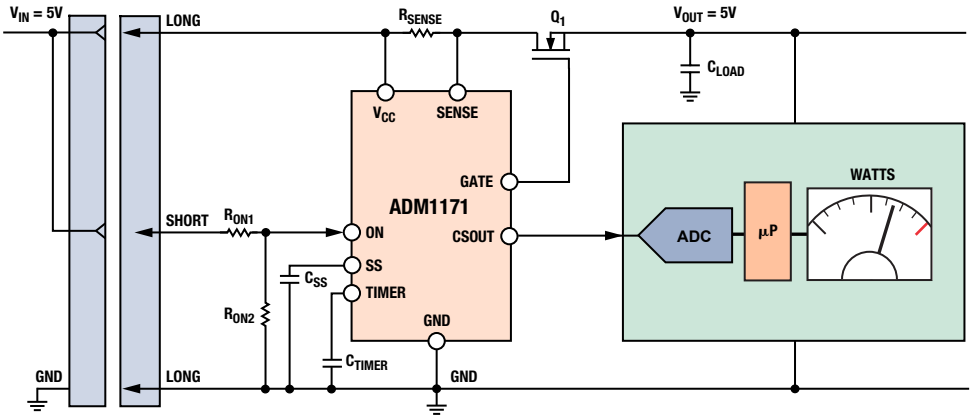
ADM1170/ADM1171/ADM1172: Positive Hot Swap Controllers

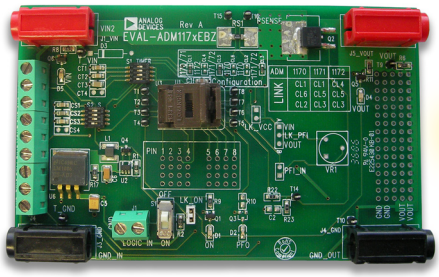
The ADM1170/ADM1171/ADM1172 are a series of low voltage, positive, high-side, hot swap controllers that safely enable a printed circuit board to be removed and inserted to a live backplane. This is achieved using an external N-channel power MOSFET with a current control loop that monitors the load current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

Features

- Current-sense output—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 or latch-off
- 8-lead TSOT package







Evaluation Kits Available

Part Number	Hot Swap Voltage Range (V)	Soft Start	Additional Features	Auto Retry	Latch-Off	Price ($US)[1]
ADM1170-1	1.6 to 16.5	Yes	Separate V_{CC} pin	Yes	—	2.10
ADM1170-2	1.6 to 16.5	Yes	Separate V_{CC} pin	—	Yes	2.10
ADM1171-1	2.7 to 16.5	Yes	Current-sense output	Yes	—	2.20
ADM1171-2	2.7 to 16.5	Yes	Current-sense output	—	Yes	2.20
ADM1172-1	2.7 to 16.5	No	Power fail comparator	Yes	—	2.00
ADM1172-2	2.7 to 16.5	No	Power fail comparator	—	Yes	2.00

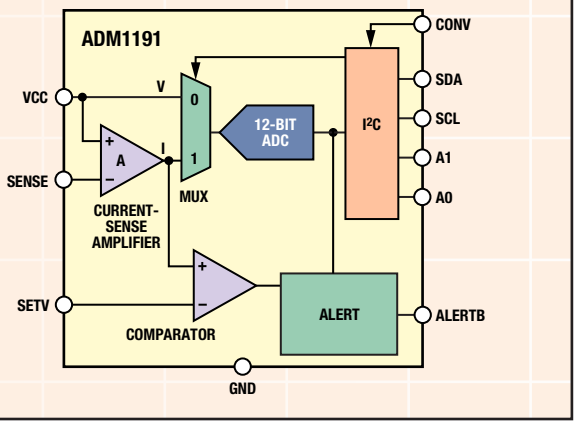
[1]All prices are in USD in quantities greater than 1000.

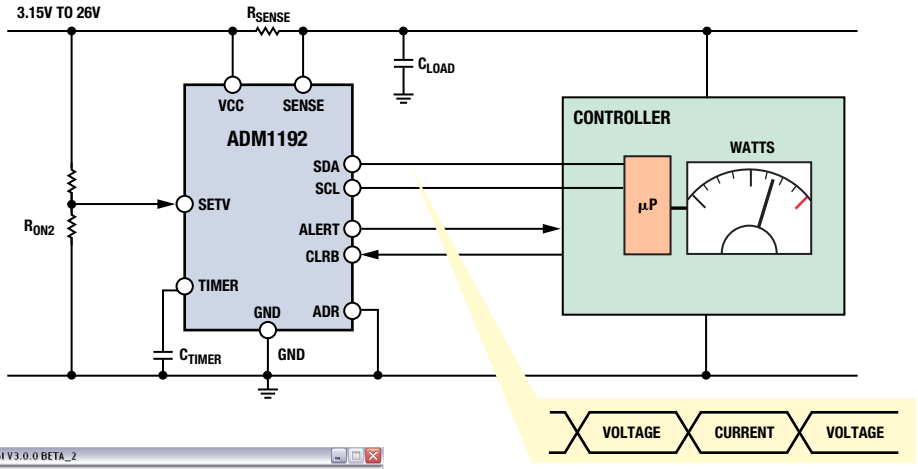
ADM1191/ADM1192: Digital Power Monitors with I²C

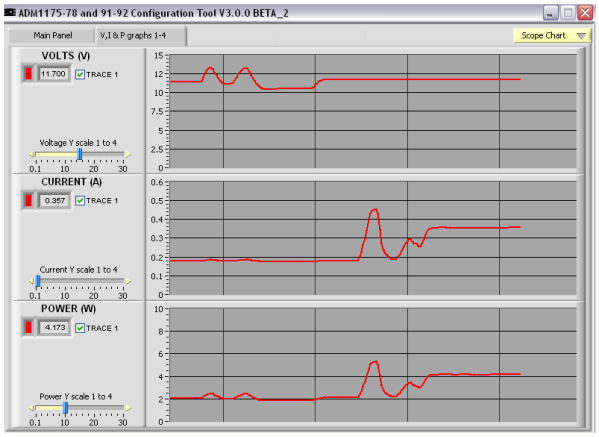
The ADM1191 and ADM1192 are integrated current-sense amplifiers that offer digital current and voltage monitoring via an on-chip, 12-bit analog-to-digital converter (ADC), communicated through an I²C® interface.

Features

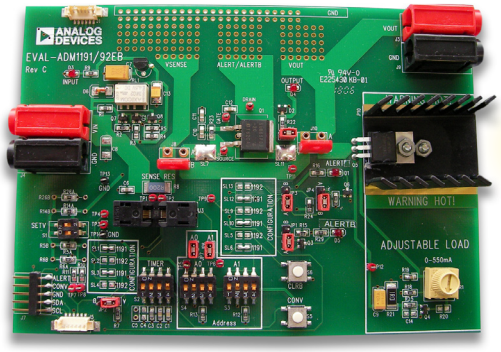
- Sensing from 3.15 V to 26 V
- ±1.5% accuracy
- 12-bit ADC for current and voltage readback
- ALERT output for overcurrent interrupts
- I²C fast mode-compliant interface
- Up to 16 devices on the same bus
- 10-lead MSOP







ADM119x evaluation software.



Evaluation Kits Available

Part Number	ALERT Polarity	Number of I²C Addresses	Additional Features	Price ($US)[1]
ADM1191	ALERTB	16	Convert pin	1.90
ADM1192	ALERT	4	Overcurrent timer	1.90

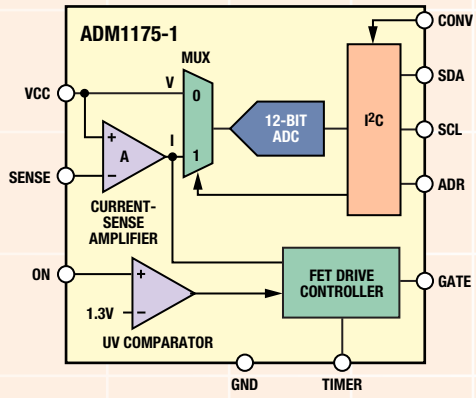
[1]All prices are in USD in quantities greater than 1000.

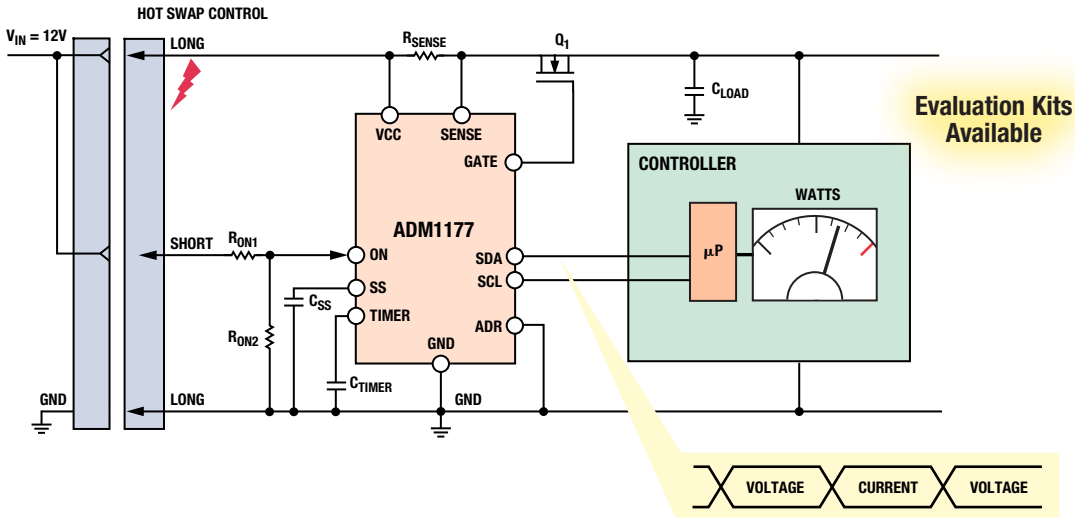
ADM1175/ADM1176/ADM1177/ADM1178: Hot Swap with I²C Digital Power Monitoring

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
- ±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 or latch-off on current fault
- I²C fast mode-compliant interface
- 10-lead MSOP





Part Number	Additional Features	Auto Retry	Latch-Off	Price ($US)[1]
ADM1175-1	Manual convert pin	Yes	—	2.50
ADM1175-2	Manual convert pin	—	Yes	2.50
ADM1176-1	Additional address pin providing 16 I²C addresses in total	Yes	—	2.50
ADM1176-2	Additional address pin providing 16 I²C addresses in total	—	Yes	2.50
ADM1177-1	Soft start			2.50
ADM1177-2	Soft start			2.50
ADM1178-1	Overcurrent alert pin	Yes	—	2.70
ADM1178-2	Overcurrent alert pin	—	Yes	2.70

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

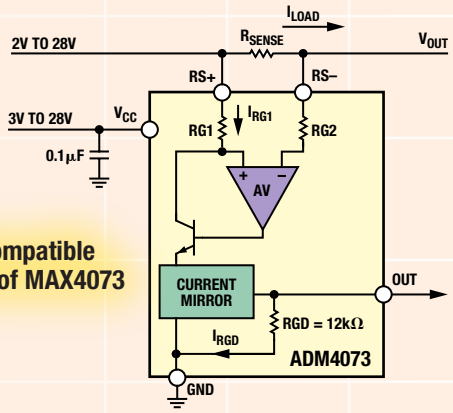
ADM4073: High-Side, Voltage Output, Current-Sense Amplifier

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

Pin-Compatible Upgrade of MAX4073

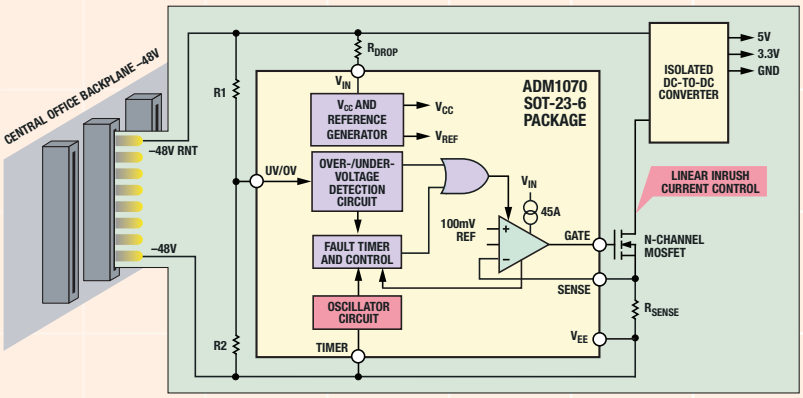


ADM1070: –48 V Hot Swap Controller

The ADM1070 is a negative voltage hot swap controller that allows a board to be safely inserted and removed from a live –48 V backplane. The part achieves this by providing robust current limiting, protection against transient and nontransient short circuits, and overvoltage and undervoltage conditions. Inrush current is limited to a programmable value by controlling the gate drive of an external N-channel FET. The current limit can be programmed by the choice of the external sense resistor.

Features

- Typically operates from –36 V to –80 V
- Tolerates transients up to –200 V
- Inrush current control
- Short-circuit protection
- Programmable timeout in current limit
- Limited consecutive retry
- Single pin undervoltage/overvoltage detection
- Small, 6-lead SOT-23 package

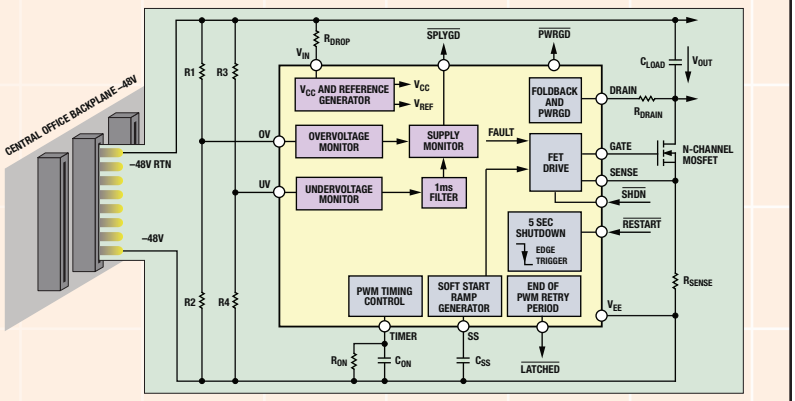


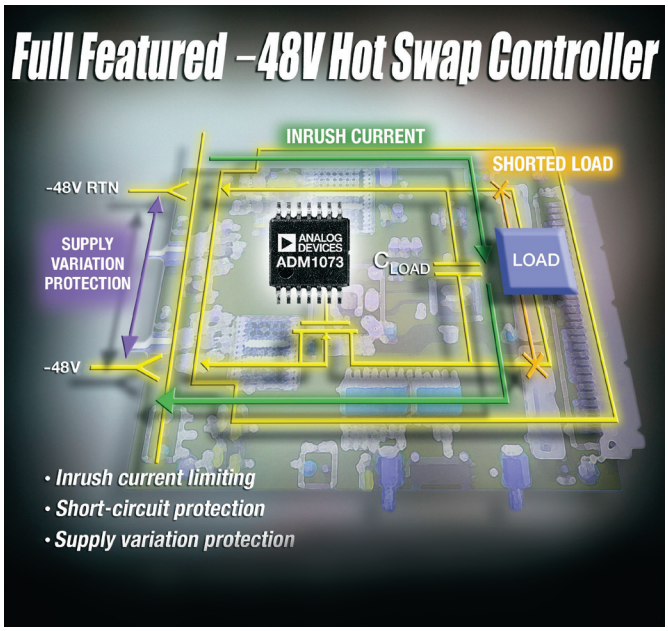
ADM1073: Full Feature –48 V Hot Swap Controller

The ADM1073 is a negative voltage hot swap controller that allows a board to be safely inserted and removed from a live –48 V backplane. This device performs the same basic function as the ADM1070 but with the addition of new features providing a more robust and powerful solution. A built-in soft start function allows control of the inrush current profile by an external capacitor on the soft start pin. The drain of the FET is also monitored to better ensure the FETs SOA is not exceeded during linear regulation of the FET. Separate UV and OV pins are included to provide further programmability. There are also a number of additional I/O pins, which can be used to determine and control the status of the system. The ADM1073 features a high accuracy current control loop, which is key to a robust hot swap control solution.

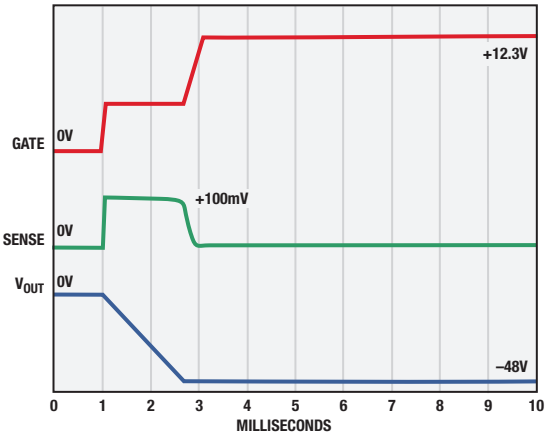
Features

- Precision current control
- Soft start inrush current-limit profiling
- Additional SOA protection via FET drain monitor
- Precision maximum on-time in-current limit
- PWM current control scheme
- Limited number of PWM cycles
- Continuous autoretry with a 5-second cooling period
- High transient voltage tolerance
- Separate UV and OV pins
- Power-good flag

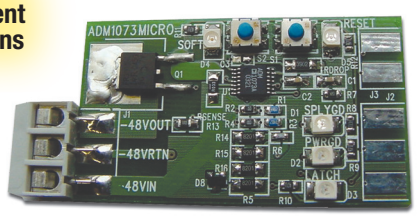




Typical Startup Profiles



Suitable for High Current Applications



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	–18 to –80	UV/OV pin	—	—	6-lead SOT-23	1.55
ADM1073	–18 to –80	UV pin, OV pin	—	Soft start, drain pin monitoring, additional I/Os	14-lead TSSOP	2.10
ADM1170	1.6 to 16.5	ON pin (UV)	—	Soft start, separate V_{CC} pin	8-lead TSOT	2.10
ADM1171	2.7 to 16.5	ON pin (UV)	—	Soft start, current-sense output	8-lead TSOT	2.20
ADM1172	2.7 to 16.5	ON pin (UV)	—	Power fail detector	8-lead TSOT	2.00
ADM1175	3.15 to 16.5	ON pin (UV); ONB pin (OV)	I²C interface with four addresses	Convert pin	10-lead MSOP	2.50
ADM1176	3.15 to 16.5	ON pin (UV)	I²C interface with 16 addresses	—	10-lead MSOP	2.50
ADM1177	3.15 to 16.5	ON pin (UV)	I²C interface with four addresses	Soft start	10-lead MSOP	2.50
ADM1178	3.15 to 16.5	ON pin (UV)	I²C interface with four addresses	ALERTB pin	10-lead MSOP	2.70
ADM4210	2.7 to 16.5	ON pin (UV)	—	—	6-lead TSOT	2.98

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

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	1.90
ADM1192	3.15 to 26	Capacitor Programmable	I²C Interface with four addresses	Programmable alert output, timer CLR pin	10-lead MSOP	1.90

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

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	0.6
ADM4073F	2 to 28	50	150	3 to 28	1%	6-lead SOT-23	0.6
ADM4073H	2 to 28	100	150	3 to 28	1%	6-lead SOT-23	0.6

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

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