

Front-End System Protection & Power Management Solutions

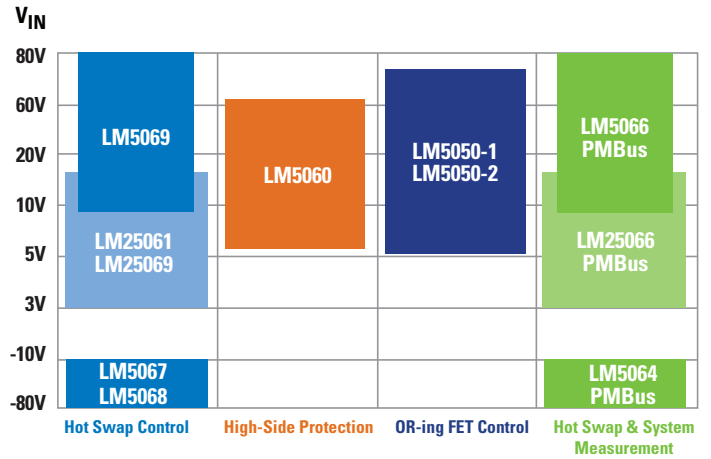
Increased System Reliability and Efficiency

national.com/hotswap

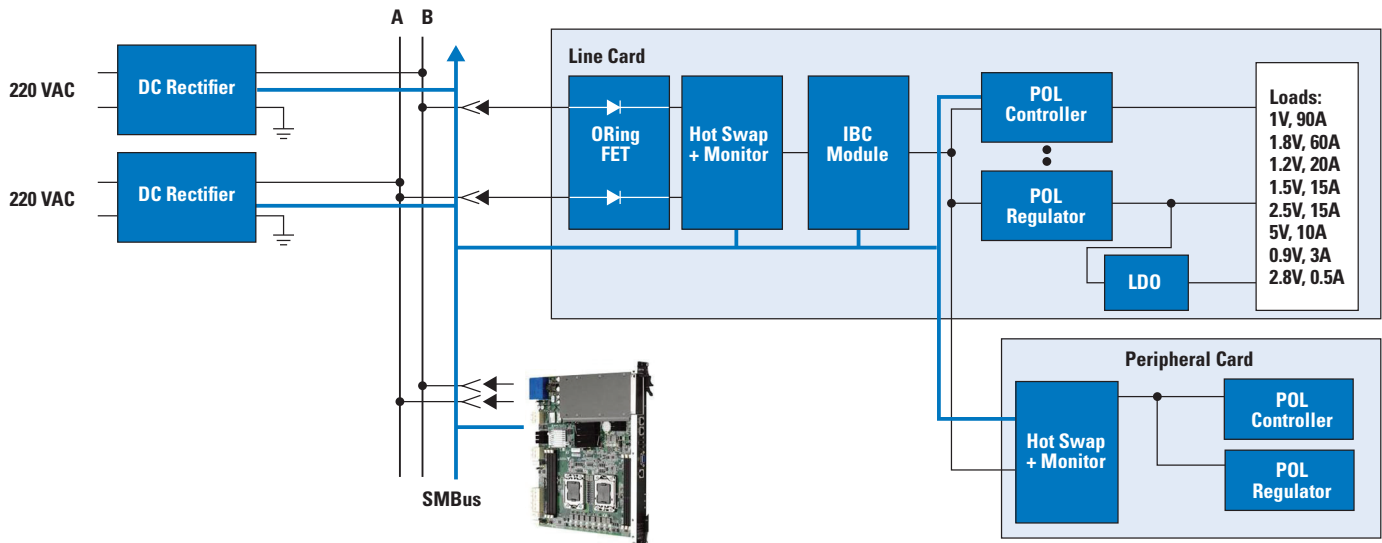
Communications Infrastructure, Merchant Power, Industrial, Automotive Applications

Complete system protection and management solutions from National Semiconductor deliver high system reliability. Analog and digital hot swap controllers provide both current and power limiting to dynamically adjust the current limit at large V_{DS} to ensure the MOSFET stays in the Safe Operating Area (SOA) — maximizing long-term system reliability and robustness. The LM(2)506x family of intelligent hot swap devices feature system diagnostic and telemetry reporting which enables the system to take immediate action to control or optimize power delivery. The LM505x family of ORing FET controllers allows MOSFETs to replace diode rectifiers in power distribution networks and reduce both power loss and voltage drops while providing best-in-class reverse current protection.

System Protection and Management Portfolio



Typical System Application



Hot Swap Control and High-Side Protection

Hot swap controllers are the power gate keepers that control the flow of power into the board, monitor for fault conditions, and protect against undesirable events. National's hot swap controller and high-side protection solutions provide robust front end protection for a range of communication infrastructure, merchant power, industrial, and automotive applications.






Features


- Hot swap/In-rush control
- Adjustable input current *and* input power limiting enable use of smallest MOSFETs
- Circuit breaker for over-current events
- Programmable under-voltage and over-voltage thresholds
- Fast response to fault current conditions

Power Limiting Protection

To ensure system reliability, MOSFET drivers must operate within the SOA in order to avoid FET failure. Most hot swap controllers control only the current, but when the FET is turning on, the voltage across it can still be large and the power through the FET can cause it to exceed its SOA curve unless the design accounts to over-size the FET, which adds both cost and size. National's hot swap controllers provide both current and power limiting to dynamically adjust the current limit at large V_{DS} and ensure the MOSFET stays in the SOA at all conditions. This technique enables the use of smaller and lower cost MOSFETs.

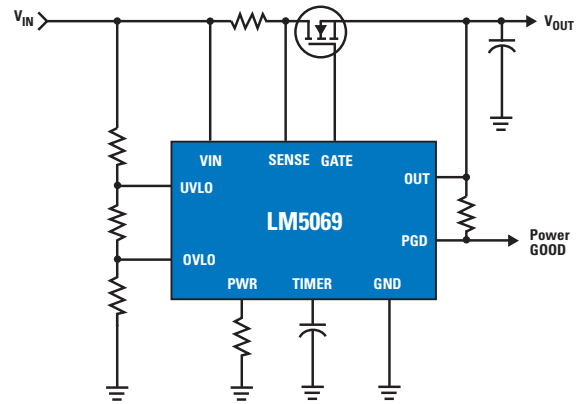
Hot Swap/In-Rush Current Controllers

Product ID	V_{IN} Range (V)	V_{IN} Abs Max (V)	Power Good	Adjustable UVLO/OVLO	Active Current/Power Limiting	Fault Latch-Off /Auto Retry	Monitoring	Digital Interface	Packaging
LM25061 ^E	2.9 to 17	20	✓	UVLO	✓	✓	—	—	MSOP-10
LM25069 ^E	2.9 to 17	20	✓	✓	✓	✓	—	—	MSOP-10
LM5069 ^E	9 to 80	100	✓	✓	✓	✓	—	—	MSOP-10
LM5067 ^E	-9 to -80	-100	✓	✓	✓	✓	—	—	MSOP-10, LLP-10
LM5068 ^E	-10 to -90	-100	✓	✓	Active Current	✓	—	—	MSOP-8
LM5060 ^E	5.5 to 65	75	✓	✓	✓	Latch-off	—	—	MSOP-10
LM25066 ^E 	2.9 to 17	24	✓	✓	✓	✓	Current, Voltage, Power, Temp	I ² C/SMBus with PMBus-compliant	LLP-24
 LM5066 ^E 	10 to 80	100	✓	✓	✓	✓	Current, Voltage, Power, Temp	I ² C/SMBus with PMBus-compliant	eTSSOP-28
 LM5064 ^E 	-10 to -80	-100	✓	✓	✓	✓	Current, Voltage, Power, Temp	I ² C/SMBus with PMBus-compliant	eTSSOP-28

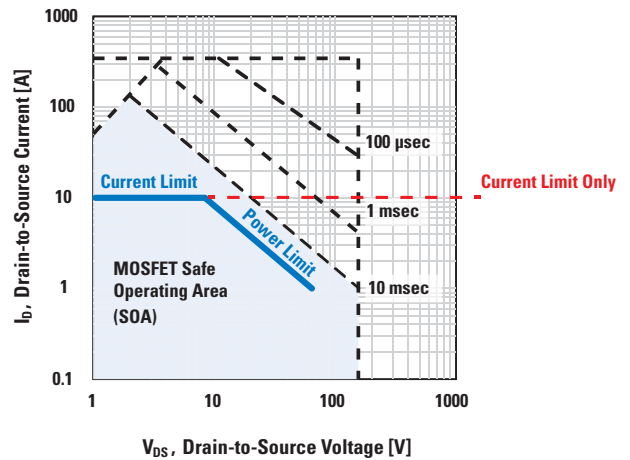
 PowerWise® product

^E Evaluation board

Typical Application Circuit



Current and Power Limiting Protection from National



 PowerWise® product

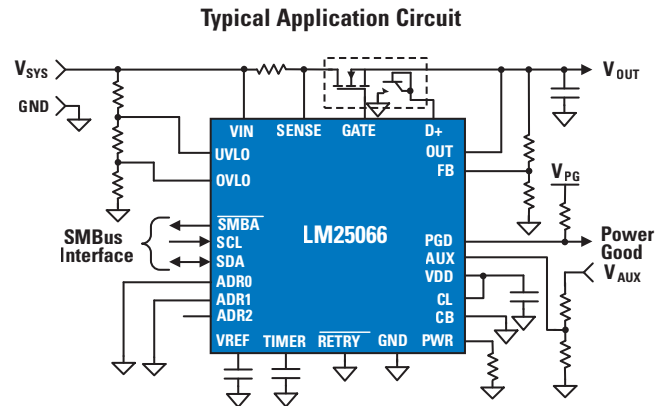
^E Evaluation board

Hot Swap and System Measurement

National's PMBus-enabled system protection and management products combine hot swap control with embedded telemetry measurement, intelligence, and digital communications which enable them to deliver accurate power usage data back to the system to optimize power consumption, reduce operating expenses, and increase reliability.

Features

- Hot swap with current *and* power limiting
- Adjustable current limit, circuit breaker thresholds
- Measure voltage, current, power, and temperature
- Simultaneous sampling of current and voltage for true power measurement
- Peak and programmable average power capture
- Dynamic configuration of fault and warning levels
- I²C/SMBus interface with PMBus compliance

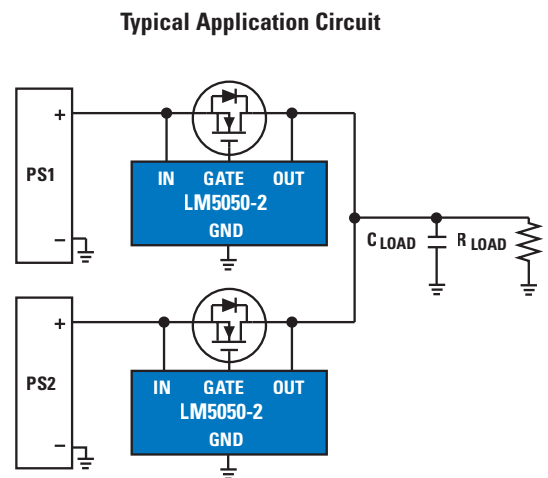


ORing MOSFET Controllers

High-side ORing MOSFET controllers improve redundant power supply reliability by delivering ideal diode response to reverse current. Using LM5050 to control MOSFETs as a replacement for a Schottky ORing diode also improves the efficiency of the redundant power supplies. An ultra-fast 50 ns shut off significantly limits the flow of reverse current.

Features

- +100V transient capability
- Precision reverse current near ideal diode, minimize power losses and increase system reliability
- Fast 50 ns response to current reversal



ORing FET Controllers

Product ID	V _{in} Range (V)	V _{in} Abs Max (V)	Additional Features	Packaging
NEW LM5050-1 ^E	5 to 75	100	Separate bias supply input	TSOT23-6
LM5050-2 ^E	6 to 75	100	MOSFET diagnostic test mode	TSOT23-6

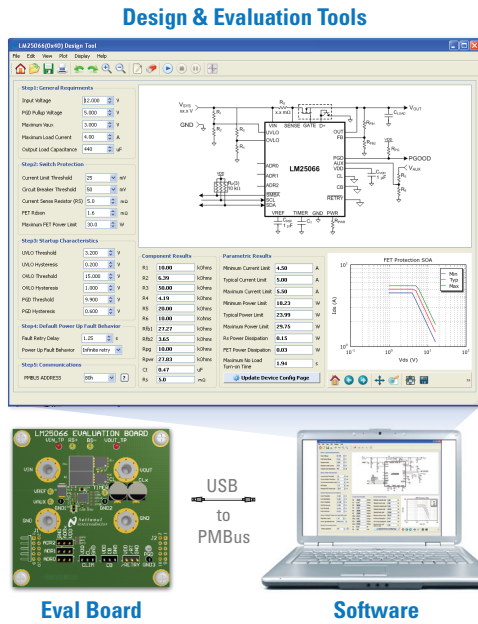
PowerWise® product

^E Evaluation board

Design Tools

National offers a full suite of design resources and evaluation tools, such as application notes, reference designs, demo videos, a hot swap component calculator, WEBENCH® Power Architect, and other design tools.

Component Calculator Design and Evaluation GUI tool



Evaluate solutions for your system with an easy-to-use design calculator and PMBus configuration software that includes real-time data logging.

Application Notes

- AN-2187** – Using LM25066 with Intel® Node Manager 2.0
- AN-2186** – Using LM25066 with Intel® Node Manager 1.5
- AN-2160** – LM5066 Board for positive high-voltage systems
- AN-2100** – LM25066 Board for positive voltage systems
- AN-2087** – LM5050-1 Positive high-voltage board
- AN-2051** – LM5050-2 Positive high-voltage board
- AN-2040** – Output voltage clamping using LM5069
- AN-2000** – LM5060 Evaluation board
- AN-1947** – LM25069 Board for positive voltage systems
- AN-1946** – LM25061 Board for positive voltage systems
- AN-1723** – LM5067 Board for negative high-voltage systems
- AN-1522** – LM5069 Board for positive high-voltage systems
- AN-1326** – LM5068 Board for negative high-voltage systems
- AN-1304** – LM5068 -48V hot swap controller

Design and Evaluation Tools

Product ID	Quick Start Calculator	Evaluation Board	USB GUI Tool	WEBENCH® Power Architect
LM25061, LM25069, LM5069, LM5067	✓	✓	—	Coming Soon
LM25066, LM5066, LM5064	✓	✓	✓	Coming Soon
LM5060	—	✓	—	—
LM5050	Spice Model	✓	—	—

National Semiconductor
2900 Semiconductor Drive
Santa Clara, CA 95051
1 800 272 9959

Mailing address:
PO Box 58090
Santa Clara, CA 95052

Visit our website at:
national.com/hotswap

**For more information,
send email to:**
support@nsc.com

