

New Products

Supplement

national.com

2011 Vol. 1

Data Conversion
Interface
Audio
Power Management
Automotive Grade
Mobile
Solar



Energy-Efficient Analog Makes the Difference

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For more than 50 years, National Semiconductor has created analog-intensive solutions to differentiate our customers' products by providing greater energy efficiency, precision, portability, better audio, and sharper images in electronic systems.

This New Product Supplement is an addendum to the *2011 Analog Product Guide* and includes products released since its publication. Products are categorized by type or qualification for easy reference. For additional information on each product, please visit national.com and enter the product ID into the search field.







New Products

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 PowerWise® product

^E Evaluation board

^W WEBENCH® enabled

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 PowerWise® product

^E Evaluation board

^W WEBENCH® enabled

Data Conversion Solutions

ADC08DL500 – Low-Power, Dual 8-Bit 500 MSPS A/D Converter

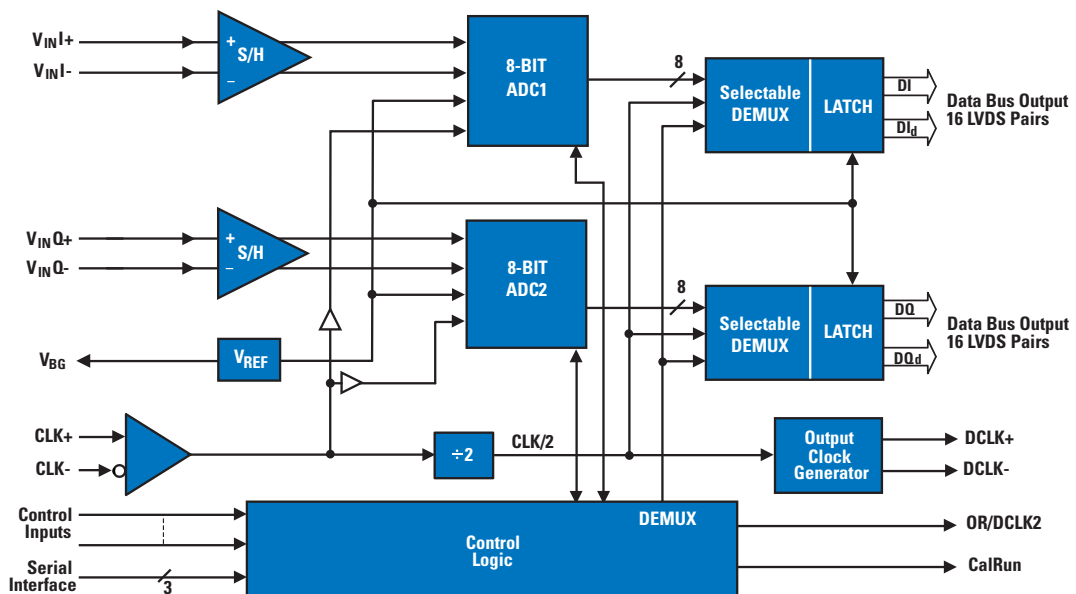
Features

- Single +1.9V \pm 0.1V precision operation
- Duty cycle-corrected sample clock
- Excellent dynamic performance
 - 7.2 ENOB, 46 dB SNR, 55 dB SFDR at 248 MHz input
 - IMD3: 71.4 dBFS at $f_1 = 111.47$ MHz/ $f_2 = 121.47$ MHz input, NPR: 38.4 dB
 - -135.4 dBm/Hz, -133.3 dBFS/Hz noise floor
- 625 mW/ch low power consumption

Applications

Ideal for use in satellite modems, digital oscilloscopes, direct RF down conversion, communications systems, and test instrumentation

Block Diagram



LMP90100 – Multi-Channel, 24-Bit Sensor Analog Front End

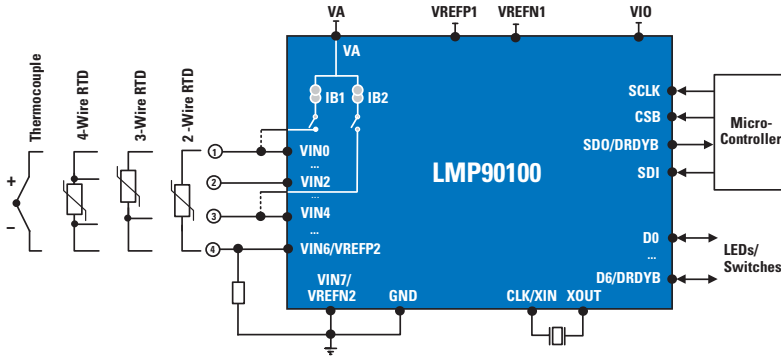
Features

- 24-bit low-power Sigma Delta ADC
- True Continuous Background Calibration at all gains
- Low-noise programmable gain (1x to 128x)
- Continuous background open/short and out-of-range sensor diagnostics
- 8 selectable output data rates (ODR) with single-cycle settling
- 2 matched excitation current sources from 100 μ A to 1000 μ A

Applications

Ideal for use in temperature and pressure transmitters, strain gauge interfaces, and industrial process control applications

Block Diagram



LMP91000 – Micro-Power Chemical Sensor Analog Front End

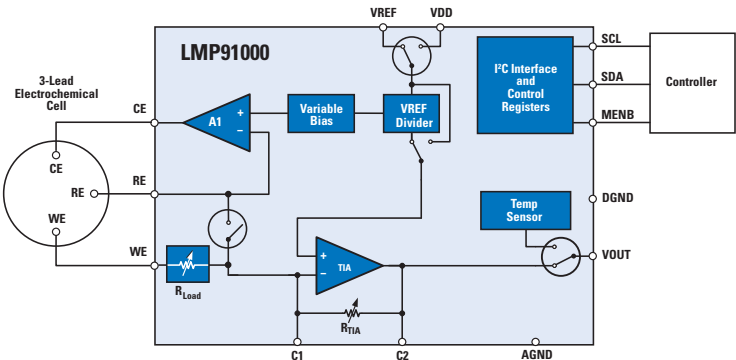
Features

- 2.7V to 5.25V supply voltage
- <10 μ A supply current
- Cell conditioning current up to 10 mA
- Reference electrode bias current (85°C), 900 pA (max)
- 750 μ A output drive current
- Complete potentiostat circuit to interface to most chemical cells

Applications

Ideal for use in chemical species identification, amperometric applications, and electrochemical blood glucose meters

Block Diagram



Amplifier Solutions

LMP8350 – Ultra-Low-Distortion, Fully Differential Operational Amplifier

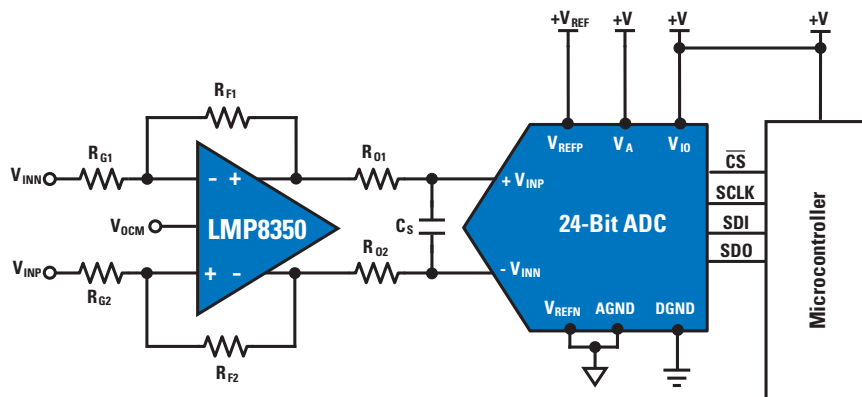
Features

- Differential input and output
- Tri-level power settings with shutdown
- Ultra-low HD2/HD3 and THD+N distortion
- Adjustable output common mode level
- Fully balanced differential architecture
- Single or dual supply operation

Applications

Ideal for use in high-resolution differential ADC drivers, portable instrumentation, and precision line drivers

Block Diagram



LMP92001 – Analog System Monitor and Controller

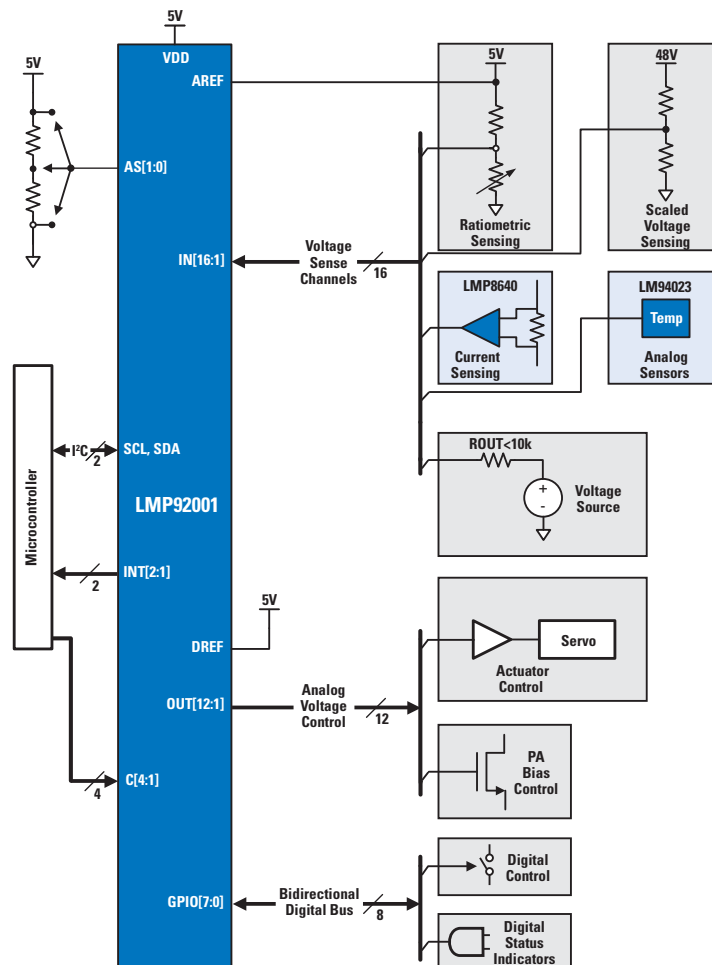
Features

- Fully integrated system monitor and controller
 - Includes 16-channel ADC, 12 DACs, local temperature and reference
- DAC output switches with asynchronous control
- Programmable window comparator function
- Two independent (Int/Ext) voltage reference options
- I²C-compliant bus
- Mirrored pinout in a small LLP-54 package

Applications

Ideal for use in RF PA bias, system, and industrial monitoring and control and test equipment and instrumentation

Block Diagram



Clock and Timing Solutions

LMK04800 – Family of High-Performance Clock Jitter Cleaners with Cascaded PLLs

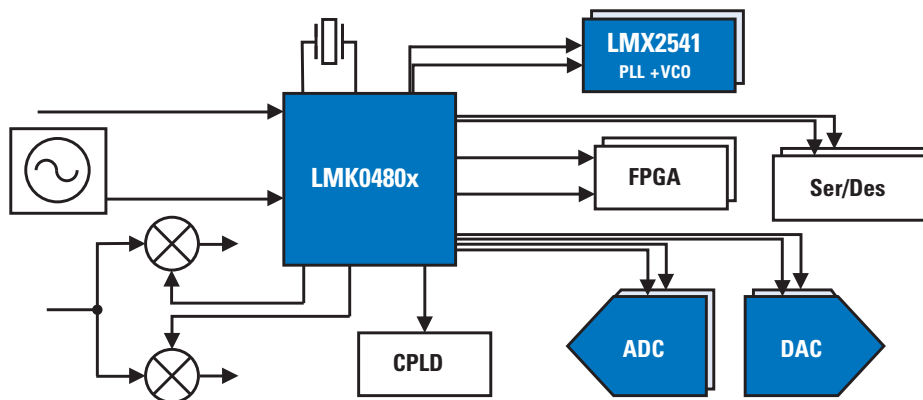
Features

- Dual-loop PLLatinum® architecture provides low-noise jitter cleaner and clock generation
- Integrated low-noise crystal oscillator circuit
- Ultra-low RMS jitter performance
 - 115 fs RMS jitter (12 kHz to 20 MHz)
 - 125 fs RMS jitter (100 Hz to 20 MHz)
- LVPECL, LVDS, or LVCMOS programmable outputs
- Clock rates of up to 1536 MHz
- Hold-over, zero delay, analog, and programmable digital delay modes

Applications

Ideal for data converter clocking, wireless infrastructure, networking, SONET/SDH, and DSLAM

Typical Application Circuit



DP83620 – Industrial Temperature Single-Port 10/100 Mbps Ethernet Transceiver

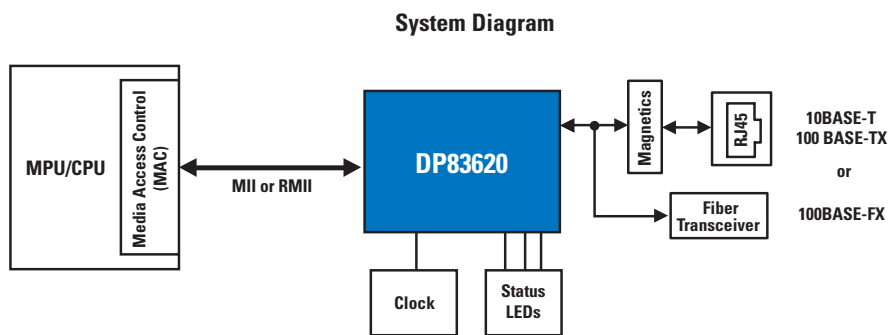
Features

- Selectable frequency-synchronized clock output
- Dynamic link quality monitoring
- TDR-based cable health and system diagnostics
- 25 MHz MDC and MDIO serial management interface

- 10/100 Mbps packet Built-In Self Test (BIST)
- Error-free operation up to 150 meters CAT-5 cable

Applications

Ideal for use in factory automation and general embedded applications



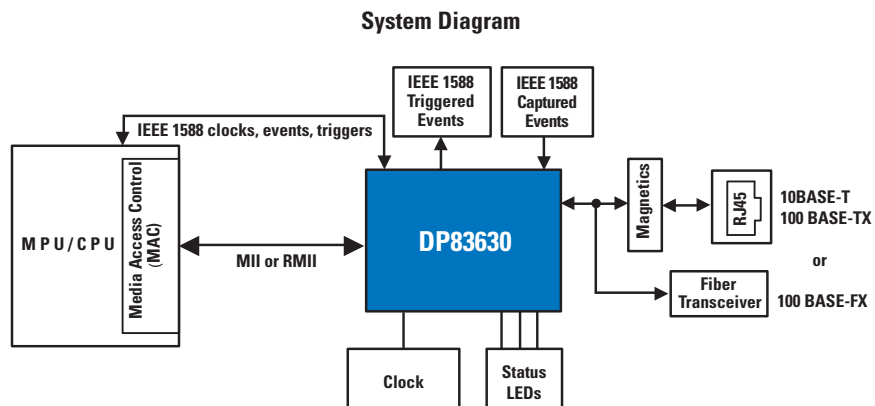
DP83630 – Precision PHYTER® IEEE 1588 Precision Time Protocol Transceiver

Features

- Supports IEEE 1588 v1 and v2, including UDP/IPv4, UDP/IPv6, and Layer 2 packets
- IEEE 1588 clock synchronization
- Selectable frequency-synchronized low jitter clock output
- Timestamp resolution of 8 ns
- Allows sub 10 ns synchronization to master reference over a single link
- Synchronized, phase-aligned clock-out and synchronized GPIOs

Applications

Ideal for use in telecom, factory automation, test and measurement, video synchronization, and real-time networking



Interface Solutions

DS64/100MB201 – Dual-Port Mux/Buffers with Equalization and De-Emphasis

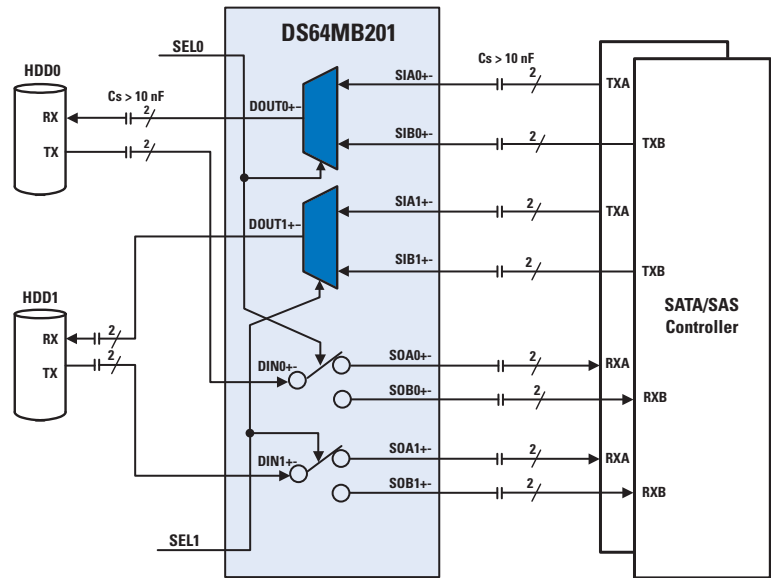
Features

- Up to 6.4 /10 Gbps dual lane 2:1 mux, 1:2 switch or fan-out
- Adjustable receive equalization up to +33 dB gain
- Adjustable transmit de-emphasis up to -12 dB
- Adjustable transmit V_{OD}
- <0.25 UI of residual DJ at 6.4 Gbps with 40" FR-4 trace

Applications

Ideal for use in SATA/SAS, XAUI, Infiniband, CPRI, and other high-speed datacom/telecom applications

Typical Application Diagram



DS100BR410/210/111 – 10 Gbps Repeaters with Equalizer and De-Emphasis Driver

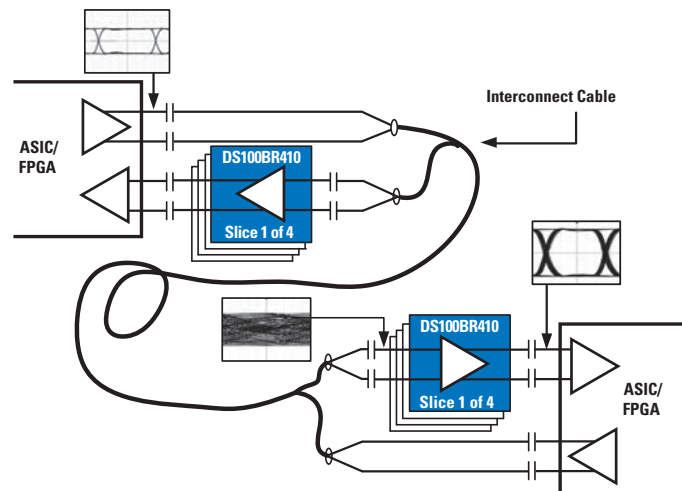
Features

- DS100BR410 (quad, uni-directional), DS100BR210 (dual, uni-directional), DS100BR111 (dual, bi-directional)
- Low power consumption with option to power down unused channel
- Adjustable receive equalization +36 dB
- Adjustable transmit de-emphasis
- <0.3 UI of residual DJ at 10 Gbps with 50' FR-4
- Signal conditioning programmable via pin selection or SMBus interface

Applications

Designed for use in active copper cable assemblies and backplane interconnects

Typical Application



DS80PCI800/402 – Multi-Lane PCI Express Gen-1-2-3 Repeaters with Equalization and De-Emphasis

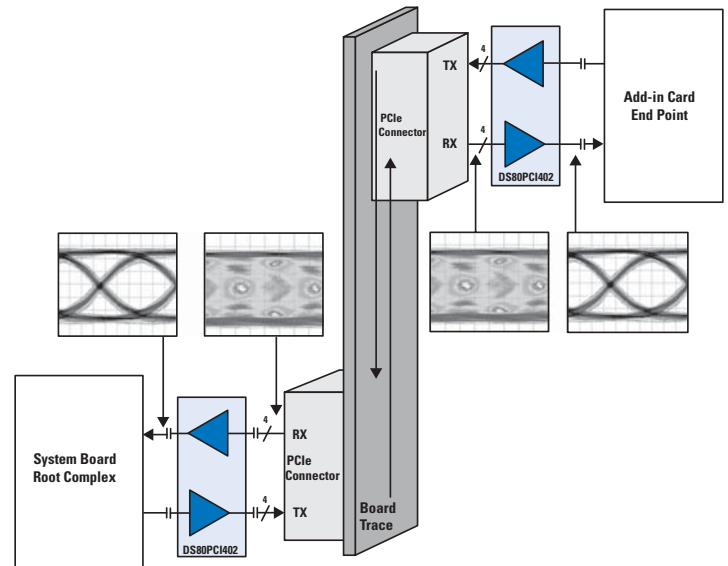
Features

- Supports x4/x8/x16 PCI Express configuration
 - DS80PCI800 8-channel, unidirectional for x8/x16
 - DS80PCI402 4-lane, bidirectional for x4
- Rate adaptive signal conditioning up to 36 dB receive EQ, 12 dB transmit de-emphasis
- Seamless handling of new Gen-3 transmit FIR coefficient handshake
- Industry's lowest power consumption at 65 mW per channel
- Automatic receiver detection on each channel supports hot plug
- No external reference clock requirement

Applications

Extends the reach of high-speed PCIe signals across lossy backplane and cable ICs in communications systems

Typical Backplane Application



DS80PCI102 – Single-Lane PCI Express Gen-1-2-3 Repeater with Input Equalization and Output De-Emphasis

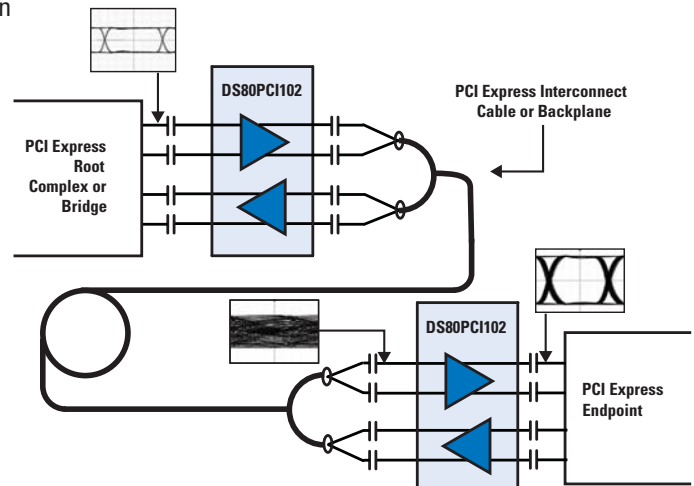
Features

- Single, bidirectional lane supports x1 PCI Express configuration
- Rate adaptive signal conditioning, up to 36 dB receive EQ, 12 dB transmit de-emphasis
- Seamless handling of new Gen-3 transmit FIR coefficient handshake
- Industry's lowest power consumption, 65 mW per channel
- Automatic receiver detection on each channel supports hot plug
- No external reference clock requirement

Applications

Extends the reach of high-speed PCIe signals across lossy backplane and cable ICs in communications systems

Typical Application



Audio Solutions

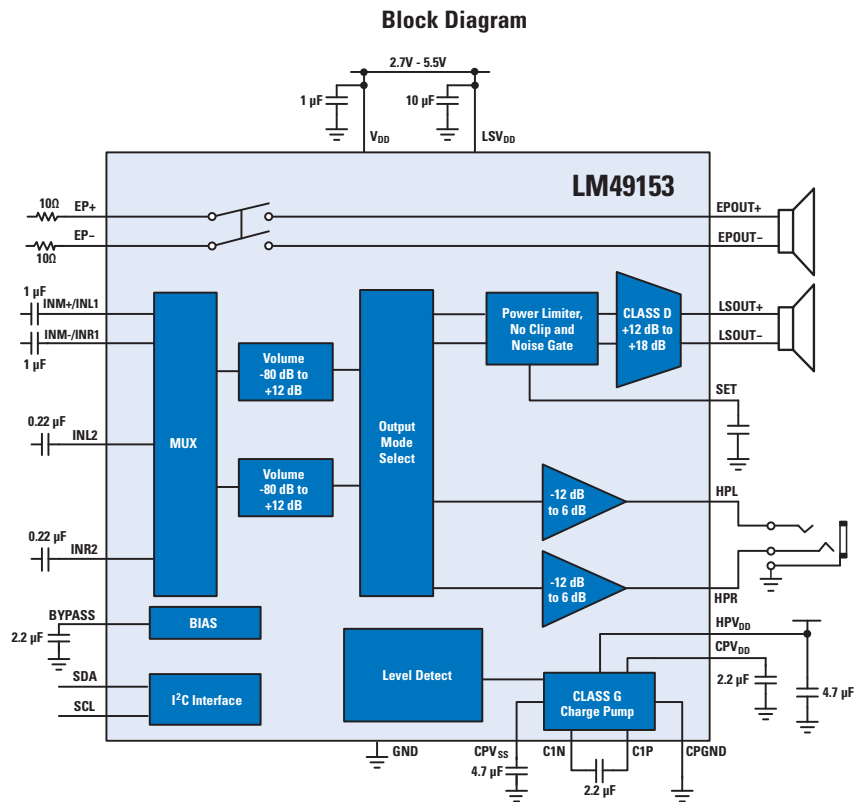
LM49153 – Mono Audio Subsystem with Class G Headphone Amplifier, Class D Speaker Amplifier, Noise Gate, and Speaker Protection

Features

- Class G ground-referenced headphone outputs
- High-efficiency Class D amplifier with spread spectrum
- No clip
- Speaker protection
- Noise gate
- I²C-compliant volume and mode control
- Advanced click-and-pop suppression

Applications

Ideal for use in feature phones and smartphones



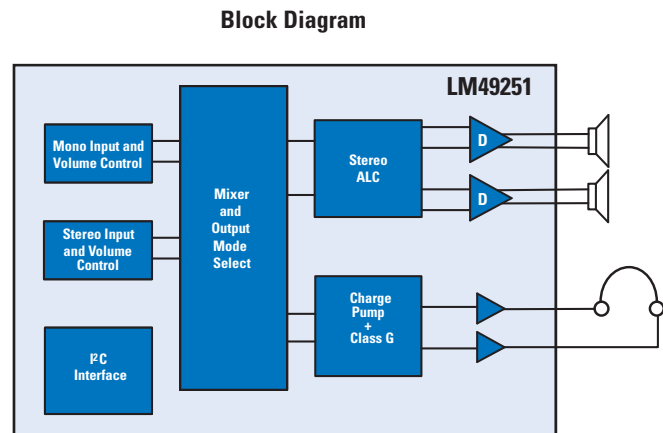
LM49251 – Stereo Audio Subsystem with Class G Headphone Amplifier and Class D Speaker Amplifier with Speaker Protection

Features

- Class G ground-referenced headphone outputs
- E²S Class D amplifier
- No clip function
- Power limiter speaker protection
- I²C-compliant volume and mode control
- Advanced click-and-pop suppression

Applications

Ideal for use in feature phones and smartphones



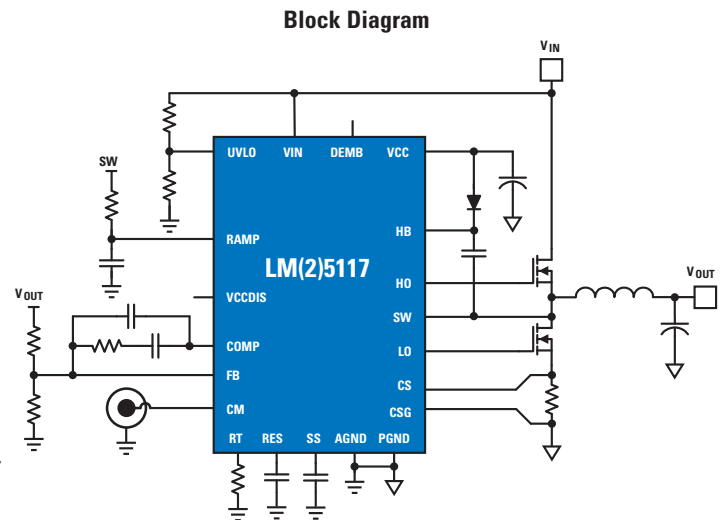
LM(2)5117 – High-Voltage Synchronous Buck Controllers with Analog Current Monitor

Features

- Emulated Current Mode (ECM)
- Wide operating range
 - 5.5V to 65V (LM5117)
 - 4.5V to 42V (LM25117)
- Analog current monitor
- Robust 3.3A peak gate drives
- Optional diode emulation mode
- Programmable output from 0.8V

Applications

Ideal for use in applications requiring a widely changing input voltage and large step-down conversions, such as basestations, servers, and routers



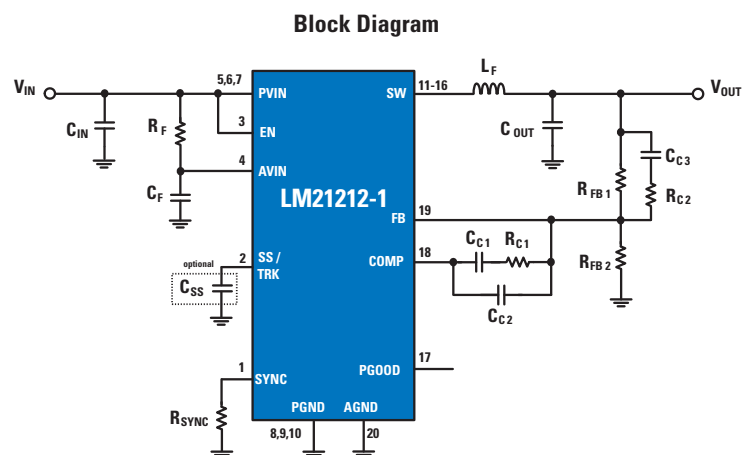
LM2121x – Family of High-Current (12A to 15A) High-Efficiency Synchronous Buck Regulators

Features

- Greater than 97% peak efficiency
- Capable of delivering up to 15A of continuous output current
- Sub 7 mΩ integrated FET switches
- Adjustable output voltage down to $0.6V \pm 1\%$
- Output voltage tracking capability
- Precision enable pin with hysteresis
- Integrated OVP, OTP, UVLO, and Power GOOD

Applications

Ideal for use in basestations, servers, and 5V POL conversions to drive high-performance ASICs and FPGAs



Power Solutions

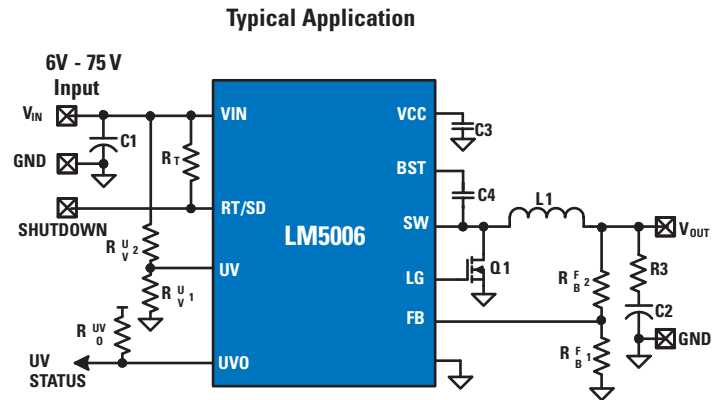
LM5006 – 80V, 650 mA Constant On-Time Synchronous Buck Switching Regulator

Features

- Operating input voltage range 6V to 75V
- Gate output driver for synchronous rectification
- Programmable input UV detector with status flag output
- Integrated 80V, N-channel buck switch
- No loop compensation required
- Ultra-fast transient response

Applications

Ideal for use as a non-isolated telecommunications buck regulator capable of operating in synchronous or non-synchronous rectification mode



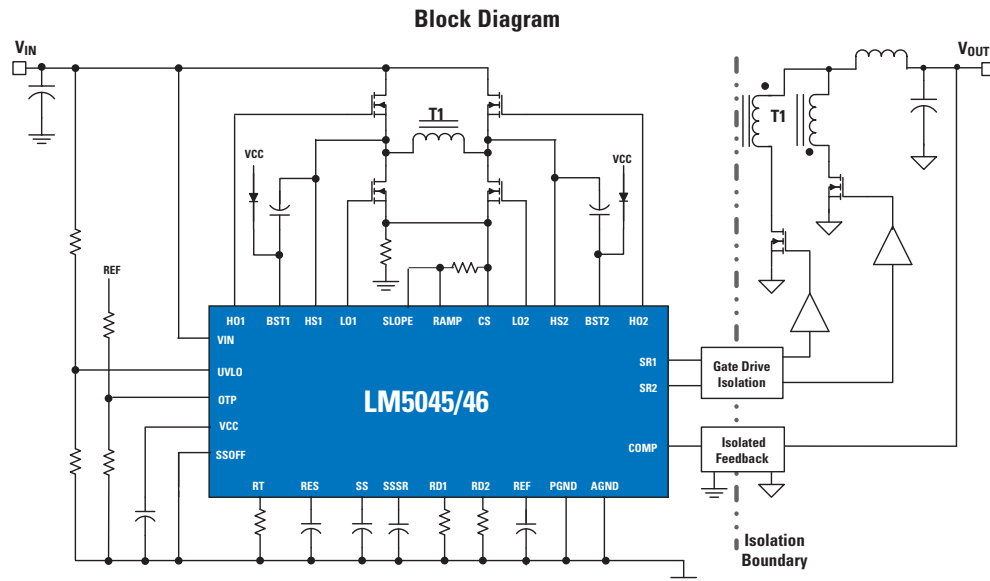
LM5045/46 – Most Integrated Family of Full-Bridge PWM Controllers

Features

- High-current 2A full-bridge gate drivers
- Intelligent sync rectifier startup for linear turn-on into pre-biased loads
- 5V sync rectifier drive for digital isolators or transformer
- 105V high-current startup regulator
- Independently programmable synchronous rectifier delays (LM5045)
- Programmable resonant times for ZVS operation (LM5046)

Applications

Ideal for use in high-power-density module manufacturing



LM5050 – High-Side OR-ing FET Controllers

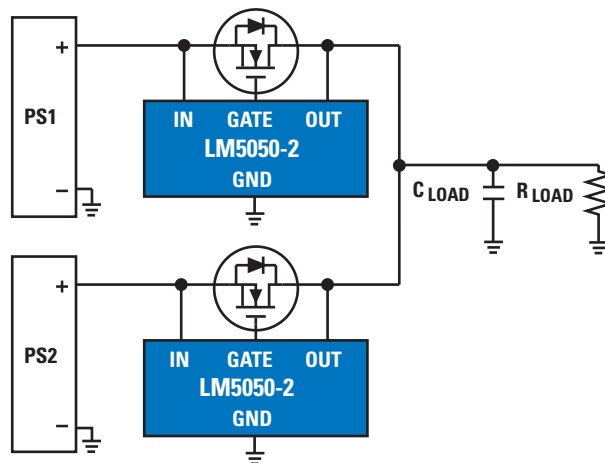
Features

- Charge pump gate driver for external N-channel MOSFET
- Input operating range from 5V to 75V
 - LM5050-1 5V input minimum
 - LM5050-2 6V input minimum
- +100V transient capability
- Precision reverse-current comparator for near-ideal diode emulation
- FET diagnostic test mode allows system controller to test for shorted MOSFETs (LM5050-2)
- Fast 150 ns response to current reversal

Applications

Ideal for use in communications infrastructure equipment and industrial and merchant power applications

Block Diagram



Power Solutions

SIMPLE SWITCHER® Power Modules

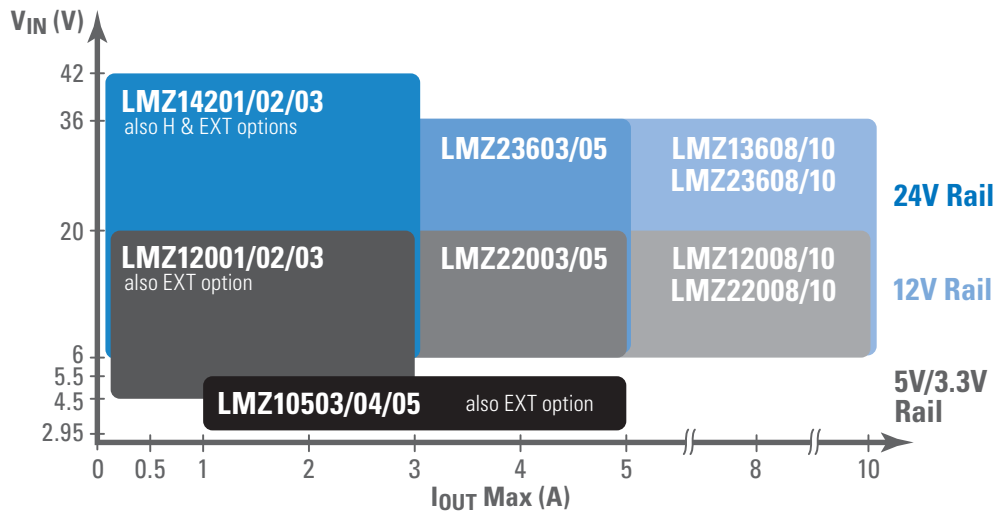
Whether an application requires superior EMI and thermal performance, high output current, high output voltage, or testing to meet extreme conditions, SIMPLE SWITCHER® power modules provide an all-in-one power solution in a small, easy-to-use package for your power designs.

LMZ1-Series Features

- Enable
- Soft-start

LMZ2-Series Features

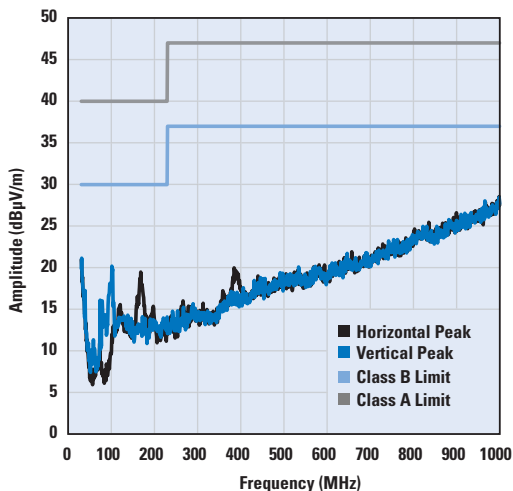
- Enable
- Soft-start
- Frequency sync
- Current sharing (8/10A version)



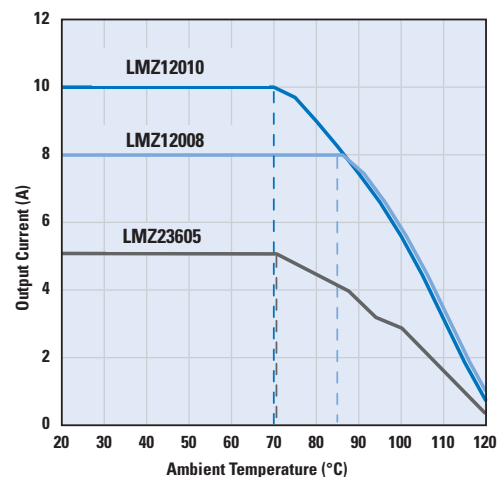
All Power Modules include:

- Integrated shielded inductor
- Precision enable, external soft-start, and tracking for sequencing
- Best-in-class thermal performance
- Low output voltage ripple
- Standard junction temperature grade from -40° to +125°C
- Pin-to-pin compatible for different load currents
- Easy-to-use package with single exposed copper bottom
- Passes EN55022 (CISPR22) Class B Radiated and Conducted EMI Standard

LMZ22010 Radiated EMI Performance



Thermal Performance



LMZ1-Series Power Modules

The LMZ1-series of power modules are ideal for applications requiring a standard feature set. All power modules in the LMZ1-series have a precision enable pin and soft-start pin.

New modules include:

LMZ14201/EXT/H – High-output voltage 1A power module

LMZ14202/EXT/H – High-output voltage 2A power module

LMZ14203/EXT/H – High-output voltage 3A power module

LMZ12008 – 8A power module with 20V maximum input voltage

LMZ12010 – 10A power module with 20V maximum input voltage

LMZ13608 – 8A power module with 36V maximum input voltage

LMZ13610 – 10A power module with 36V maximum input voltage

LMZ2-Series Power Modules

The newest power modules are available in output currents up to 10A with additional features for powering high-current intermediate rails, FPGAs, and noise-sensitive applications. They also feature a frequency synchronization pin that controls the switching frequency of the internal circuitry, and a current-sharing pin for paralleling multiple power modules together for achieving up to 60A of output current.

New modules include:

LMZ22003 – 3A power module with 20V maximum input voltage

LMZ22005 – 5A power module with 20V maximum input voltage

LMZ23603 – 3A power module with 36V maximum input voltage

LMZ23605 – 5A power module with 36V maximum input voltage

LMZ22008 – 8A power module with 20V maximum input voltage and current sharing

LMZ22010 – 10A power module with 20V maximum input voltage and current sharing

LMZ23608 – 8A power module with 36V maximum input voltage and current sharing

LMZ23610 – 10A power module with 36V maximum input voltage and current sharing

Automotive Solutions

ADC128S052Q – 8-Channel, 12-Bit A/D Converter

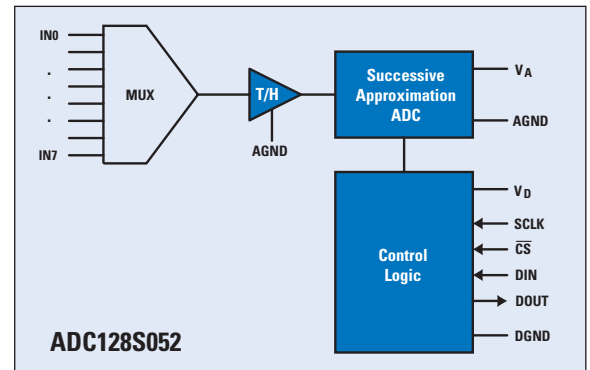
Features

- AEC-Q100 Grade 1 qualified
- Eight input channels
- Variable power management
- Independent analog and digital supplies
- SPI/QSPI/MICROWIRE®/DSP-compatible

Applications

Ideal for use in automotive navigation, portable systems, medical instruments, mobile communications, and instrumentation and control systems

Block Diagram



LM25011AQ – Low-Dropout Constant On-Time Switching Regulator

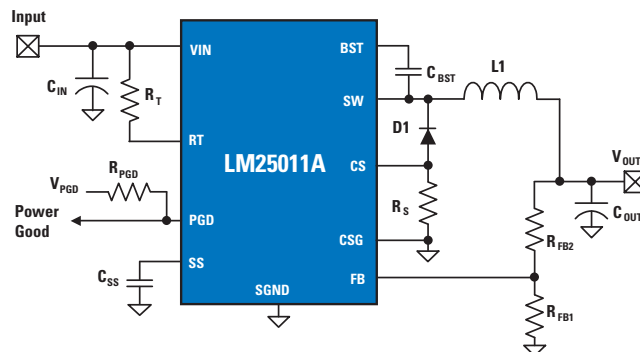
Features

- AEC-Q100 Grade 1 qualified
- Low dropout operation at high switching frequency
- 6V to 42V input operating voltage range
- No loop compensation required
- Current limit adjustable to 2A
- Switching frequency adjustable to 2 MHz

Applications

Ideal for use in automotive infotainment and telematics, particularly as a USB power supply

Block Diagram



LM(2)5088Q – Wide-Input Range Non-Synchronous Buck Controllers

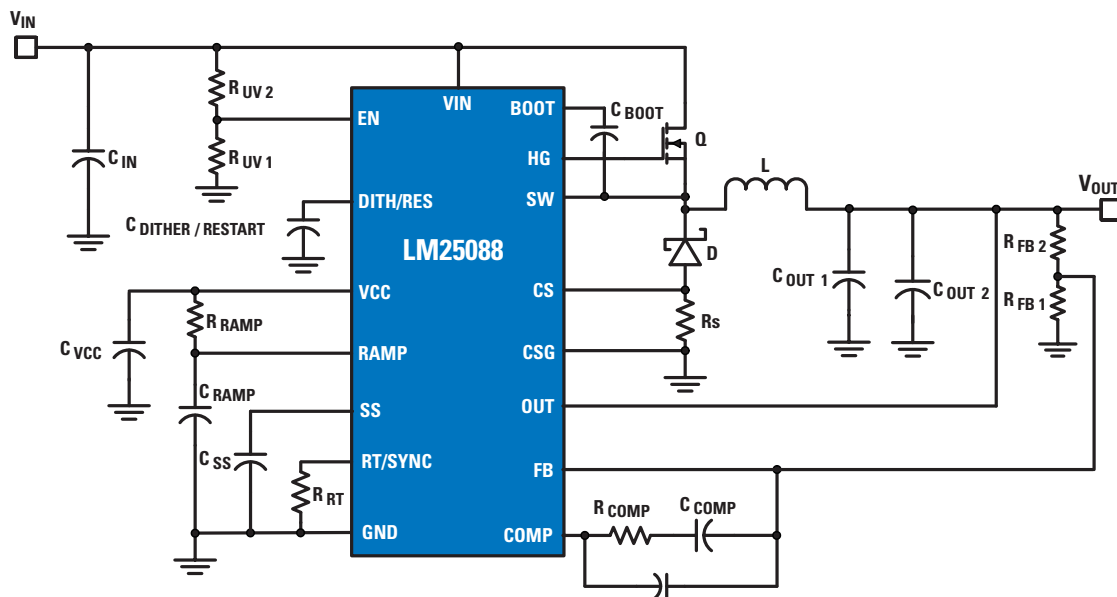
Features

- AEC-Q100 Grade 1 qualified
- Ultra-wide operating input range from 4.5V to 42V/75V
- Low Iq and standby modes
- LM(2)5088-1: Spread Spectrum EMI reduction
- LM(2)5088-2: Hiccup timer for overload protection
- Oscillator synchronization capability

Applications

Ideal for use in automotive infotainment, portable systems, medical instrumentation, mobile communications, and instrumentation and control systems

Block Diagram



Automotive Solutions

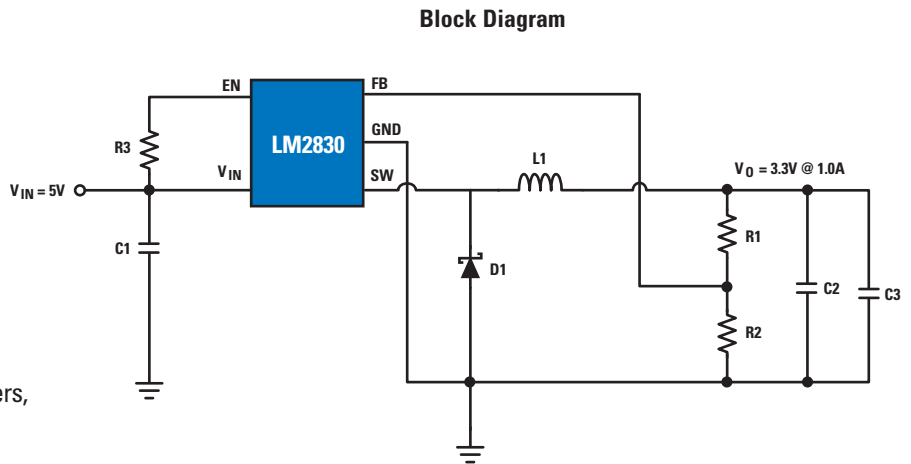
LM2830ZQ – High-Frequency 1.0A Load Step-Down DC-DC Regulator

Features

- AEC-Q100 Grade 1 qualified
- 3.0V to 5.5V input voltage range
- 0.6V to 4.5V output voltage range
- 1.0A output current
- High switching frequencies
 - 1.6 MHz (LM2830X), 3.0 MHz (LM2830Z)
- 130 mΩ PMOS switch

Applications

Ideal for use in local 5V to V_{CORE} step-down converters, core power in HDDs, USB-powered devices, and automotive applications



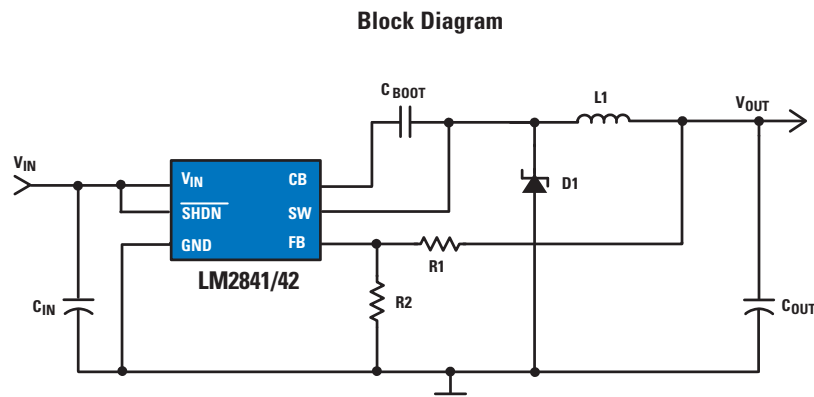
LM2841/42Q – 300/600 mA up to 42V Input Step-Down DC-DC Regulator

Features

- AEC-Q100 Grade 1 qualified
- 4.5V to 42V input voltage range
- 300 mA and 600 mA output current options
- 0.765V feedback pin voltage
- 550 kHz (X) or 1.25 MHz (Y) switching frequency
- Low shutdown I_q , 16 μ A typical

Applications

Ideal for use in automotive infotainment, camera modules, and instrument clusters



LM3481Q – High-Efficiency Low-Side N-Channel Controller for Switching Regulators

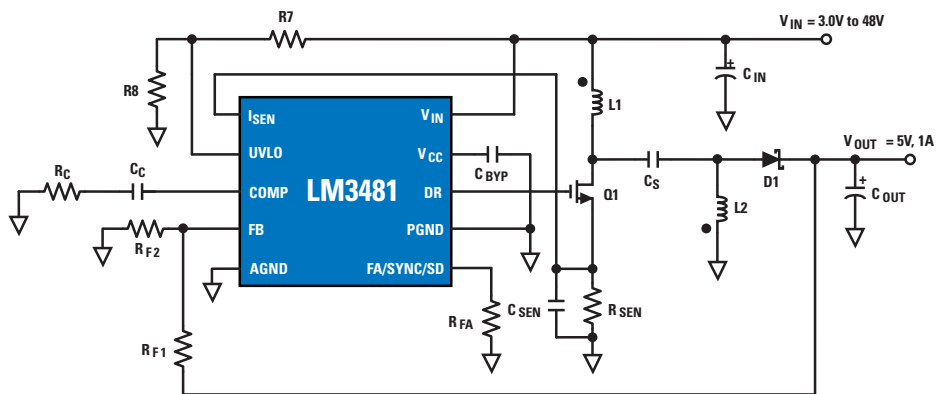
Features

- AEC-Q100 Grade 1 qualified
- Internal push-pull driver with 1A peak current capability
- Current limit and thermal shutdown
- Frequency compensation optimized with a capacitor and a resistor
- Internal soft-start

Applications

Ideal for use in automotive infotainment, wireless chargers, injection systems, instrument clusters, and hybrid engine management

Block Diagram



LMV762Q – Dual, Low-Voltage Comparator

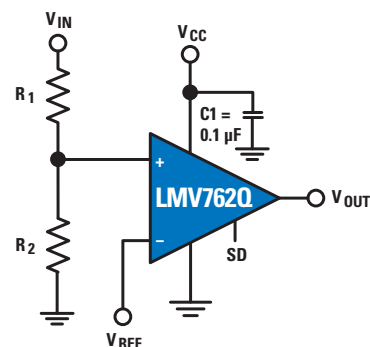
Features

- AEC-Q100 Grade 1 qualified
- 0.2 mV input offset voltage
- 1 mV input offset voltage (max over temp.)
- 0.2 pA input bias current
- 120n propagation delay (OD=50 mV)
- Low supply current 300 μ A

Applications

Ideal for use in automotive, portable and battery-powered systems, zero-crossing detectors, and high-speed sampling circuits

Block Diagram



Automotive Solutions

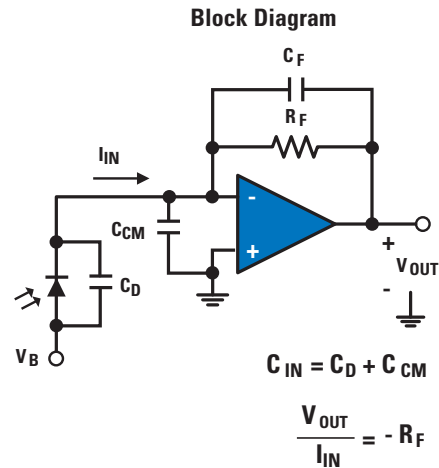
LMV796Q – Low-Noise Operational Amplifier

Features

- AEC-Q100 Grade 1 qualified
- Guaranteed 2.5V and 5V performance
- 5.8 nV/√Hz input referred voltage noise
- 100 fA input bias current
- 1.15A supply current per channel

Applications

Ideal for use in automotive, photodiode, instrumentation, and sensor interface applications



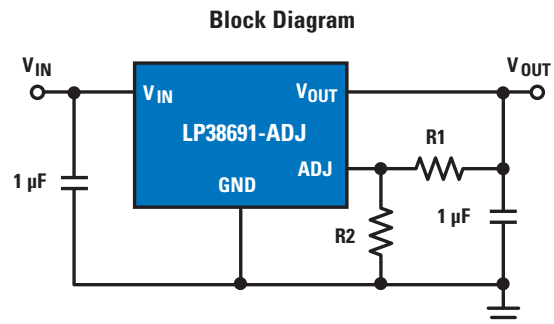
LP38691QSD-ADJ – Low Dropout CMOS Linear Regulator

Features

- AEC-Q100 Grade 1 qualified
- Output voltage range of 1.25V to 9V
- 2.0% adjust pin voltage accuracy at 25°C
- Low dropout voltage 250 mV at 500 mA (typ, 5V out)
- Wide input voltage range 2.7V to 10V
- Precision (trimmed) bandgap reference

Applications

Ideal for use in automotive infotainment and safety systems, particularly surround-view cameras and blind spot detection



LM8850 – High-Performance, Step-Up DC-DC Converter

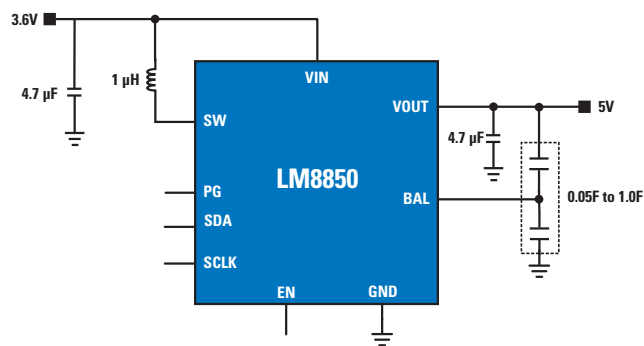
Features

- 6 μA typ. quiescent current
- V_{OUT} range 3.6V to 5.7V
- Operates from a single lithium ion cell (2.3V to 5.5V)
- 8 user-selectable output voltages via I²C-compliant bus
- High-speed 3.4 MHz I²C-compliant interface
- Up to 1.0A maximum load current capability

Applications

Ideal for use in flash LEDs, mobile phones, WiMAX, USB, and audio amplifiers

Block Diagram



Solar Solutions

SM72442 – Programmable MPPT Controller for Photovoltaic Solar Panels

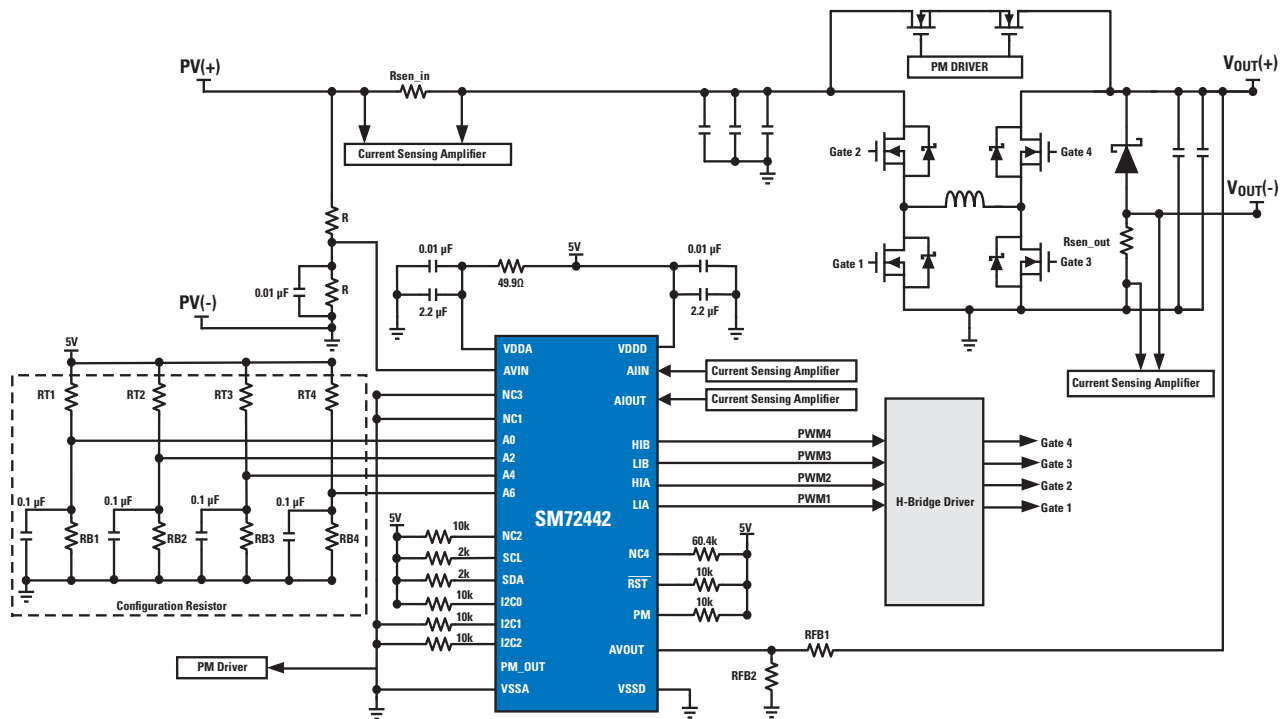
Features

- Programmable maximum power point tracking
- Photovoltaic solar panel voltage and current diagnostic
- Single inductor, four switch buck-boost converter control
- I²C-compliant interface for communication
- V_{OUT} overvoltage and over-current protection
- Renewable energy grade

Applications

Designed for solar panel power optimizers and charge controllers

Typical Application Circuit



SM72295 – Photovoltaic Full-Bridge Driver

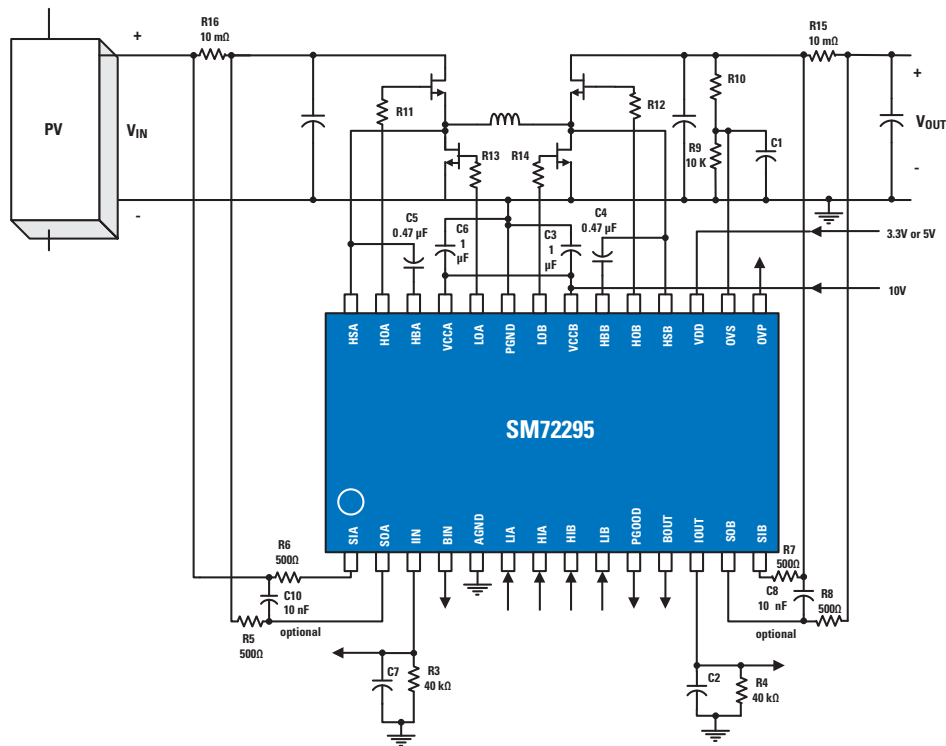
Features

- Dual half-bridge MOSFET drivers
- Integrated 100V bootstrap diodes
- Independent high and low driver logic inputs
- Bootstrap supply voltage range up to 115V DC
- Two current sense amplifiers with externally programmable gain and buffered outputs
- Renewable energy grade

Applications

Designed for solar panel power optimizers, microinverters, and charge controllers

Typical Application Circuit



WEBENCH® Designer Tools

Faster Custom Results with Easy-to-Use Tools

Use the popular WEBENCH® designer tools to simultaneously compare the performance of multiple devices in multiple circuit requirements. Get instant access to the latest simulation models, parametric data, and package information for power, lighting, and sensing applications.

In 1999, National introduced the WEBENCH online environment and the ability to produce a reliable power supply circuit online in minutes. Designers specified the circuit performance and the WEBENCH toolset delivered results.

Today, WEBENCH designer tools create and display all of the possible power, lighting, or sensing circuits to meet a design requirement even faster. This enables value-based comparisons at a system and supply chain level before a design is committed.

WEBENCH designer tools feature both fundamental tools for creating single-circuit designs and advanced tools for creating system-level designs.

| Single-Circuit Design Tools | Advanced Hierarchical Design Tools |
|-----------------------------|------------------------------------|
| WEBENCH® Power Designer | WEBENCH® Power Architect |
| WEBENCH® LED Designer | WEBENCH® LED Architect |
| WEBENCH® Sensor Designer | WEBENCH® FPGA Power Designer |

Use these tools to compare design alternatives side-by-side. Tune results across footprint, efficiency, or system cost in a single step. Find solutions from more than 110 component manufacturers and electronic distributors and more than 21,000 components with price and availability updated hourly.

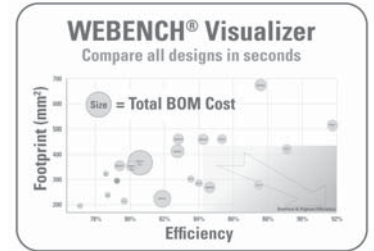


Select from 110,000 Alternate Components

Unique Design Features

WEBENCH Visualizer

A powerful comparison and selection tool, WEBENCH Visualizer creates a graphical snapshot of options across multiple criteria, such as power efficiency, footprint, and system bill of materials (BOM) cost. It draws from 25 different switching power supply architectures and 21,000 components. Use the optimizer dial to “dial-in” a preference for footprint, system BOM cost, and power efficiency and get instant access to 50-70 designs from 48 billion possible design options.



Use the visualizer control panel to adjust design options for voltage, current, and temperature. In seconds, get an updated set of solutions highlighting each design’s topology, schematic, footprint, efficiency, operating values, and BOM cost/count.

WEBENCH Optimizer Dial

This feature is unique to National and makes it easy to tune the WEBENCH designer circuit creation algorithms with the turn of a dial. Review the output, tune again, and instantly compare the alternatives.



WEBENCH designer tools are tried and true with more than 1.5 million designs and counting.

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Design, build, and test analog circuits in this online design and prototyping environment.

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- Design Centers
- Manufacturing Facilities

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Longmont, Colorado
Norcross, Georgia
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Delft, Netherlands
Fürstfeldbruck, Germany
Eindhoven, Netherlands
Greenock, Scotland
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Oulu, Finland
Tallinn, Estonia

ASIA:

Bangalore, India
Hong Kong, China

Manufacturing Facilities

Wafer (Die) Fabrication:

Greenock, Scotland
South Portland, Maine

Chip Test and Assembly:

Melaka, Malaysia

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