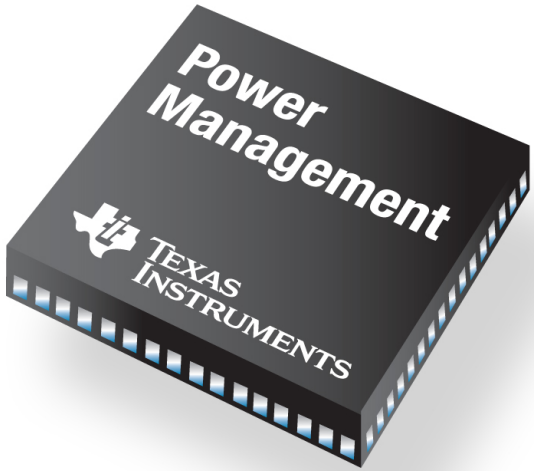
New Power-Supply Products from Texas Instruments



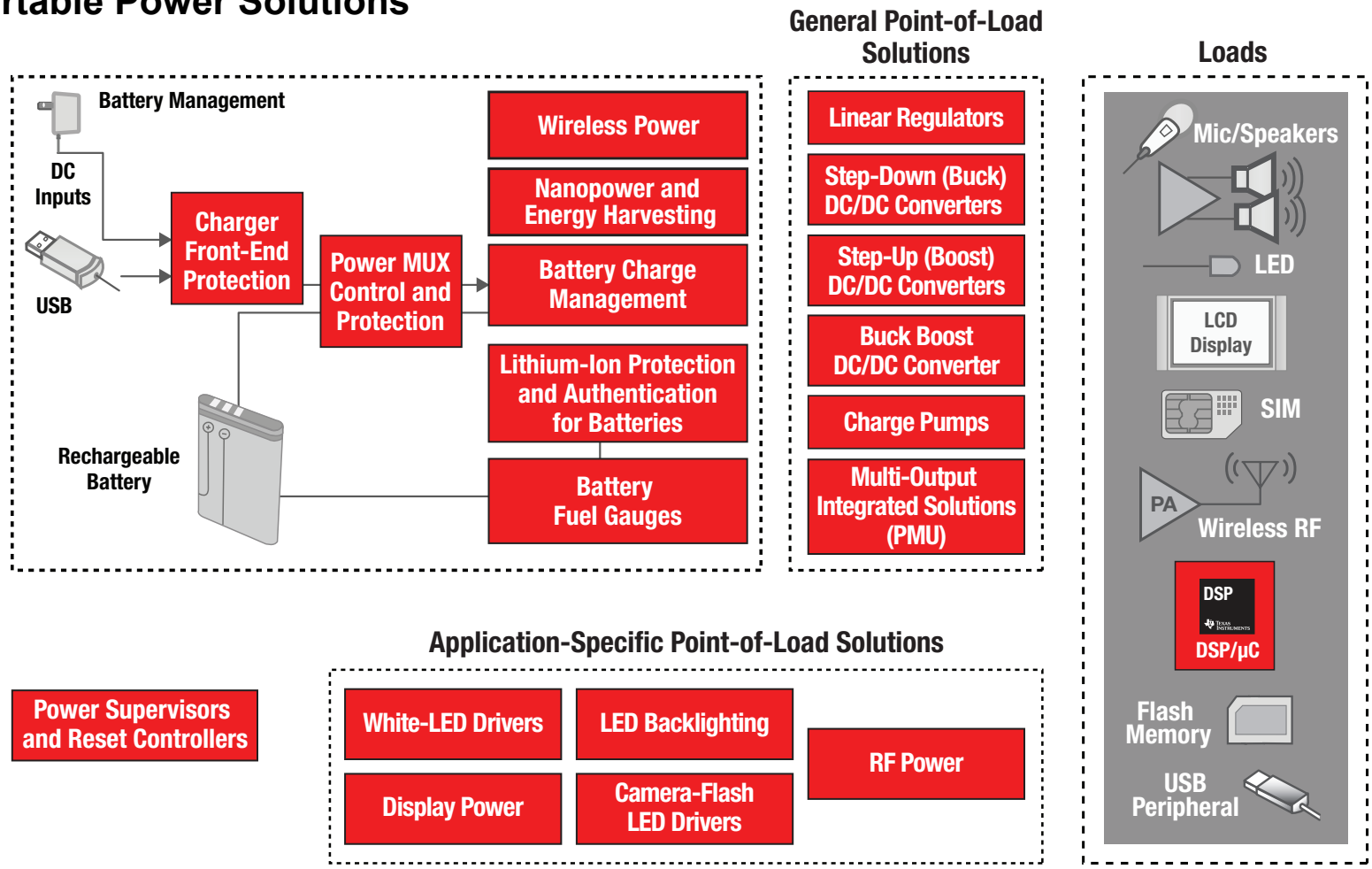
TI Power-Management Strategy

- To be your first choice for power-management solutions by helping you drive innovation and success in your products

- Our strategy is to provide:
  - Advanced products to meet your power design requirements
  - Application knowledge to make your design process easier
  - Technical support provided locally where you need it

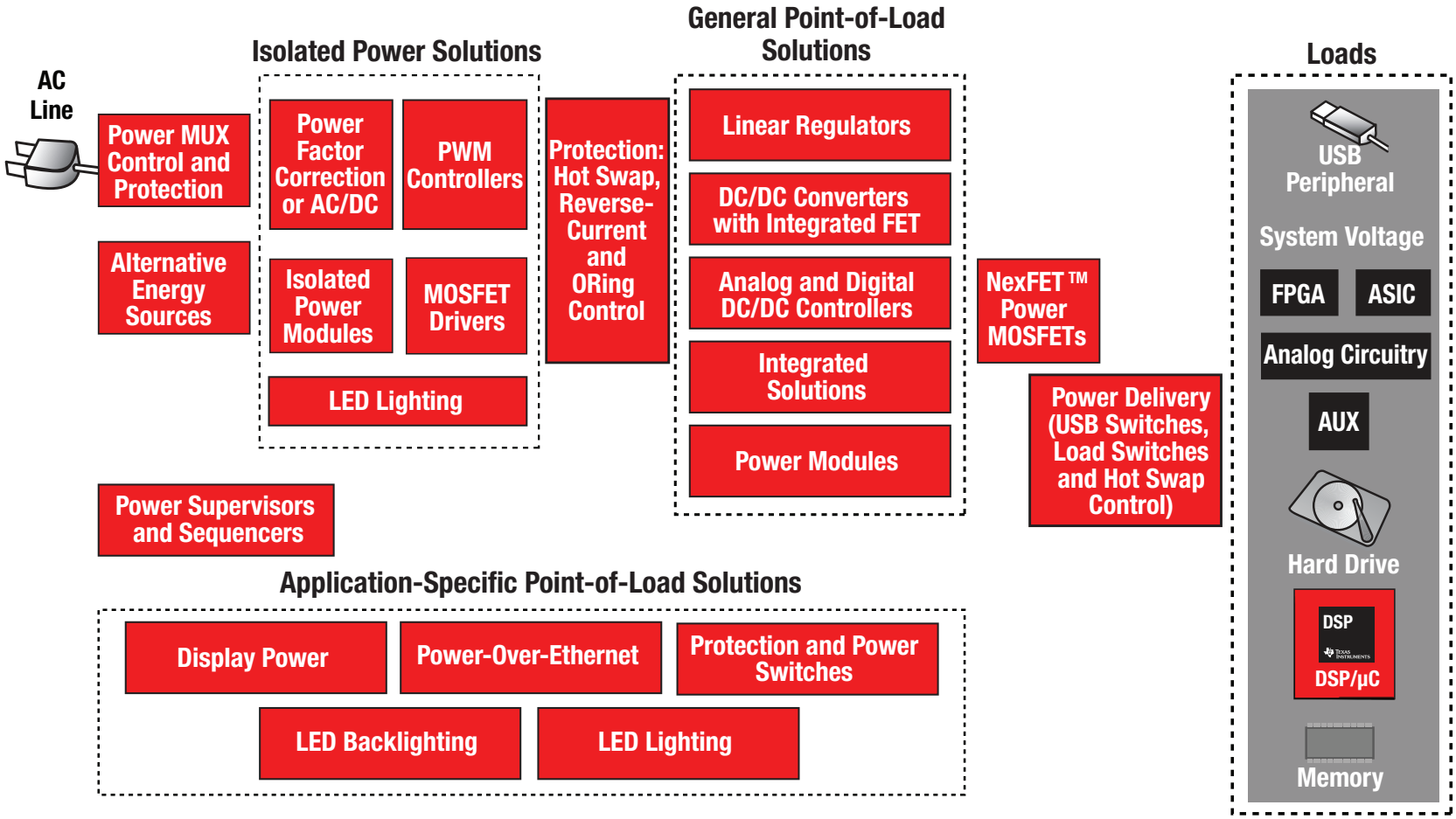
Total Power Management for Battery-Driven Electronics …

Portable Power Solutions



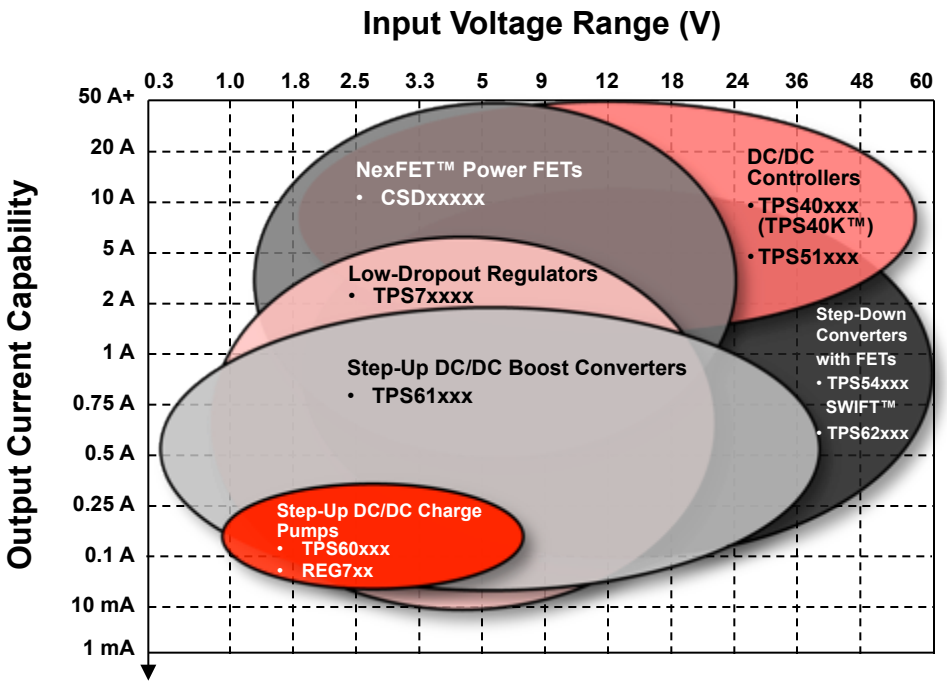
… and Full System Solutions

Line Power Solutions



Broadest Product Portfolio

DC/DC Product Overview



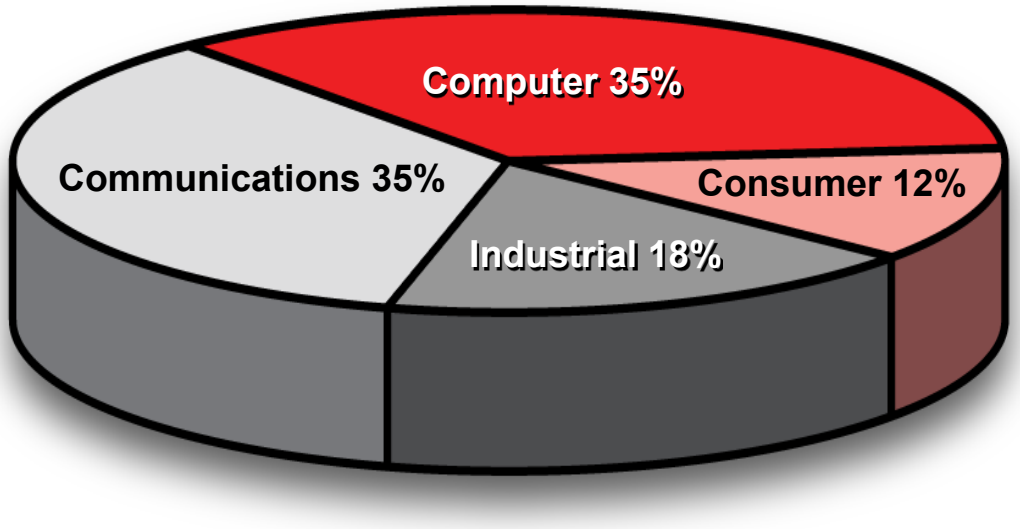
Multidimensional broad portfolio

- Portfolio: 3,500 base chips
- Annual introduction: >200 base chips
- Portfolio supports any power design requirement
- From LDOs to MOSFETs to power modules

Supporting Diverse Markets and Applications

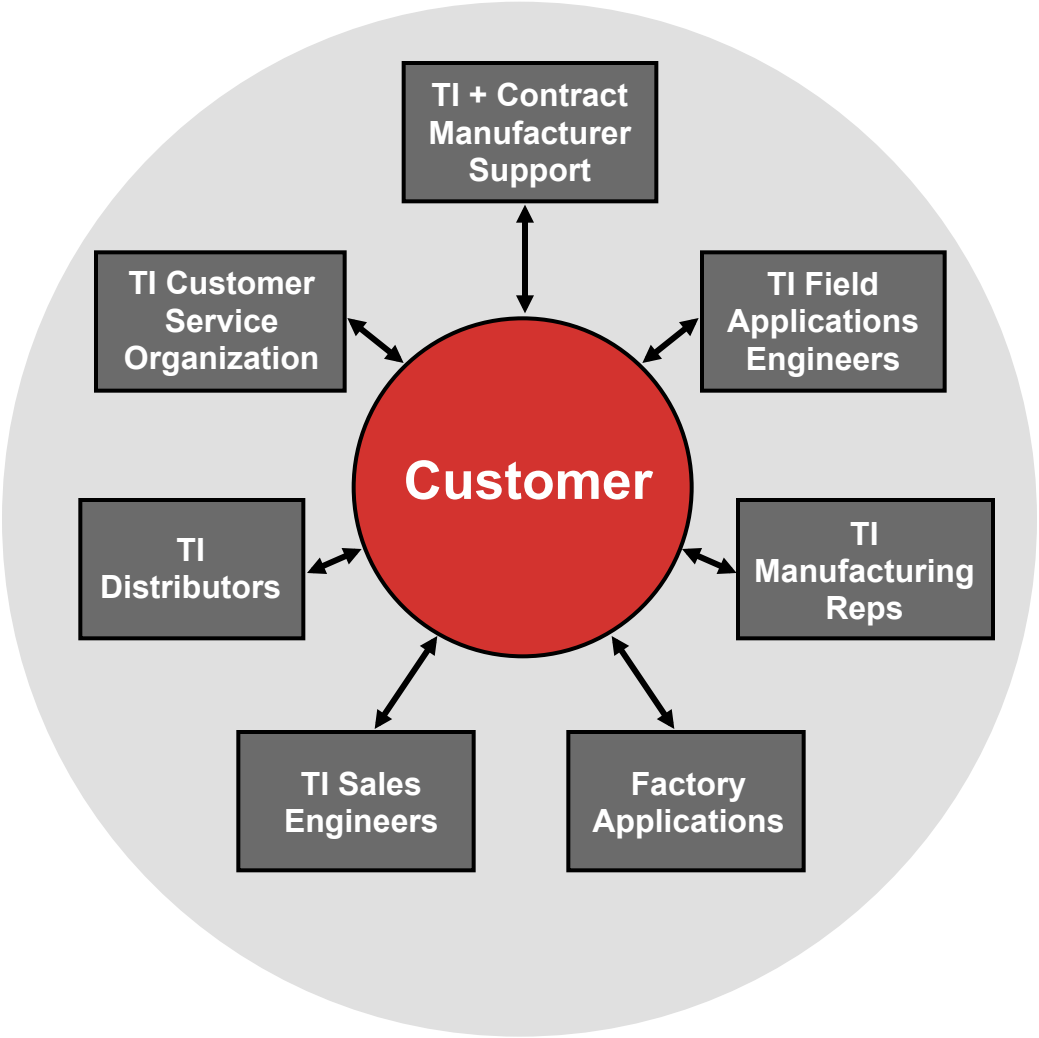
- More than 40,500 customers
- Detailed system and power-building block diagrams designed for more than 150 end applications
- App notes, tools, software to help engineers produce robust designs in dozens of applications

TI Management Revenue



TI has the portfolio, tools and support structures to service your design requirements

Technical Sales



- Global team of sales engineers
- > 290 analog field engineers (AFAs)
- 50 factory-based application engineers for next-level support
- ESP provides factory, reps and distributors the latest info on TI products
- Continuous training to ensure our customers are being supported with the latest technology

Over a Decade of Acquisitions Make TI Number 1 in Power Management

Year	Company	Contribution
2000	Unitrode	Offline Power Supply Control
2000	Benchmark	Battery Charger/Gas Gauge
2000	Power Trends	Power Supply Modules
2001	Burr Brown	Linear Regulator/Precision Analog
2009	Ciclon	Efficient MOSFET's
2012	National	Simple Switcher/Power Supply Control/Precision Analog/Webench

New Product Focus

- Higher voltage/current integrated switchers
- Packaging
- PMBus
- Digital loops
- Light load efficiency
- Transient load reponse
- Lower voltage outputs
- Higher voltage MOSFET’s

6th Gen 60 V – LM46000/01/2

0.5A/1A/2A SIMPLE SWITCHER® Synchronous Buck Regulators

Features

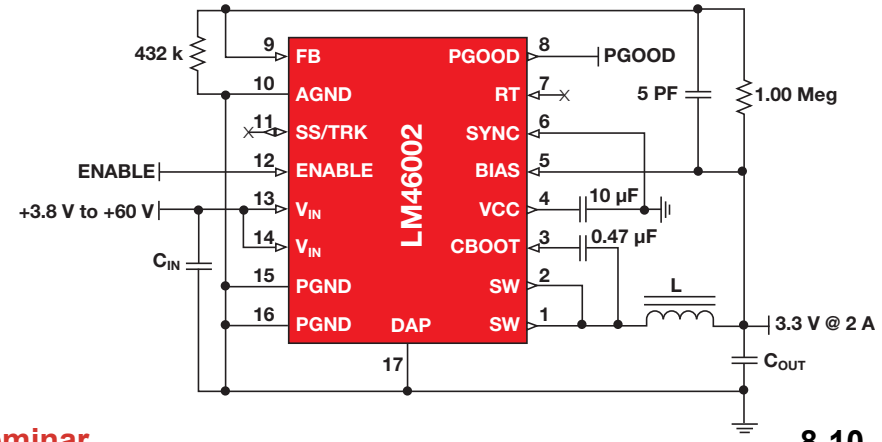
- V_{in} range 3.5 V to 60 V
- V_{out} range 1.0 V to 28 V_{out}, ± 1%
- Synchronous peak current mode architecture
- Output current options: 0.5 A/1 A/2 A
- **Low 30 µA operating quiescent current**
- Precision enable
- Default frequency of 500 kHz, adjustable or synchronizable from **200 kHz – 2.2 MHz**
- Internal or adjustable soft-start/tracking
- Power good output
- **Internal compensation**
- Operating junction temperature: -40 to 125C
- eTSSOP16 package options

Applications

- Industrial
- Sub AM-band 12 V and 24 V automotive
- Networking
- Computing

Benefits

- Transient protection for 12 V, 24 V, 36 V, 48 V input systems
- Improved efficiency compared to non-synchronous solutions
- **80% efficiency at 1 mA output current (12 V → 3.3 V)**
- Higher switching frequency allows smaller external filtering components
- Minimized BOM count and solution size
- Scalable footprint simplifies design reuse
- P_{in} compatible with 36 V 0.5 A/1 A/2 A/3 A family



LMZ31530

4.5 V to 14.5 V Input, 30 A Step-Down DC/DC Integrated Power Solution

Features

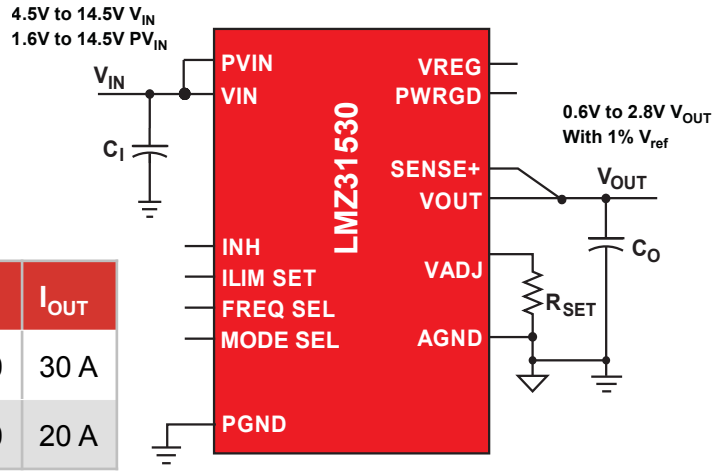
- Integrated inductor and passives encapsulated on leadframe
- Easy to mount 15x16x5.8 mm QFN package delivers 940 W/in^3 solution
- 95% peak efficiency
- Flexible—selectable frequency, soft start, current limit mode, adjustable UVLO
- PG pin, V_{reg}

Applications

- Broadband & communication infrastructure
- Automated test and medical equipment
- Compact PCI / PCI Express / PXI Express
- DSP & FPGA point of load applications

Benefits

- Simple design procedure – only 3 external components required
- Small integrated inductor solution
- Low temperature rise with 9°C/W Θ_{JA}
- Provides the design flexibility of a discrete solution



Part #	I_{OUT}
LMZ31530	30 A
LMZ31520	20 A

LM5160

1.5 A Synchronous Buck Converter or Isolated FlyBuck™

Features

- **Wide 4.5 V to 65 V input range (70 V Abs Max)**
- Integrated 0.3 Ω buck and 0.15 Ω sync FETs
  - No Schottky diode required
  - 1.5 A maximum output current
- **Constant on-time control**
  - **Output error correction**
  - **Nearly constant switching frequency**
- **CCM or diode emulation DCM options**
- Line UVLO with adjustable hysteresis
- Programmable soft-start
- Near constant frequency adjustable to 1MHz
- 2.5 V±1.5% FB reference
- Peak current limit protection
- Package: SON-12 (4x4 mm), HTSSOP-14

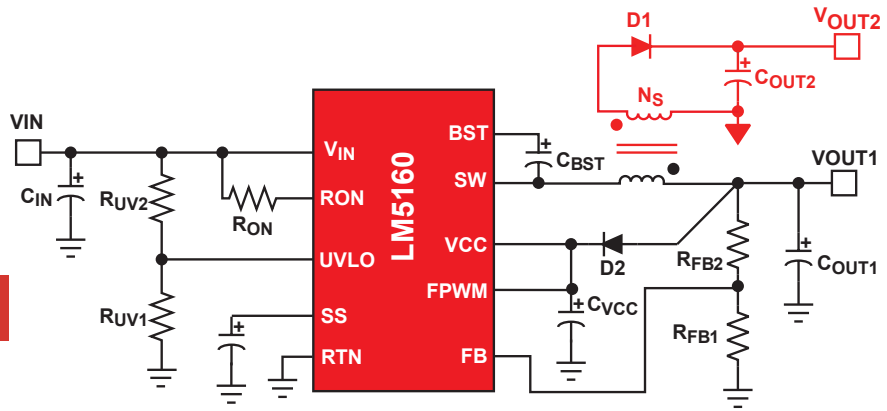
Applications

- Telecom equipment
- Industrial
- E-meters
- Automotive

Benefits

- Integrated buck and sync FETs save space and provide ease of use
- COT control easy to use, low component count and fast transient response
- No compensation needed
- Can be used as an isolated bias supply
- Low current limit options for optimizing inductor size

Multi-Output Flybuck Option



TPS56428 & TPS56528

4.5 V-18 V_{IN}, 4 A & 5 A SWIFT™ Converters w/ Advanced Eco-Mode™

Features

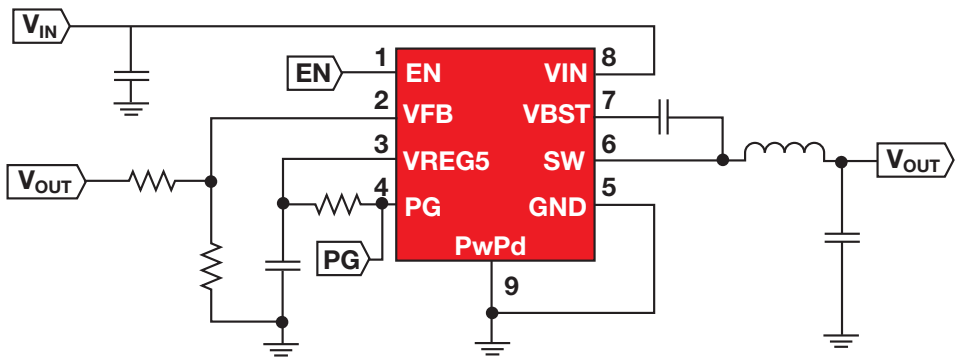
- Fast adaptive on-time (D-CAP2) control
- Very low ON resistance MOSFETs
- Fixed 650 kHz switching frequency
- Advanced Eco-Mode™ with 170 µA Iq
- 1% output voltage accuracy
- Fixed soft start / power good
- Hiccup current limit
- 8 pin HSOIC package

Benefits

- High performance with 2x22 µF ceramic C_{OUT}
- 90% efficiency; optimized for low V_{OUT}
- 50% smaller inductor value than 350 kHz
- >60% efficiency at 5 mA load
- Meets latest processor V_{CORE} requirements
- Reduces inrush / power sequencing support
- Avoid huge power loss in failure events
- Low pin count & easy to use

Applications

- Digital TV
- HD, Blu-ray™ player
- Networking home terminal
- Digital set top box



CSD19536KCS

100 V, N-ch NexFET™ Power MOSFET

Features

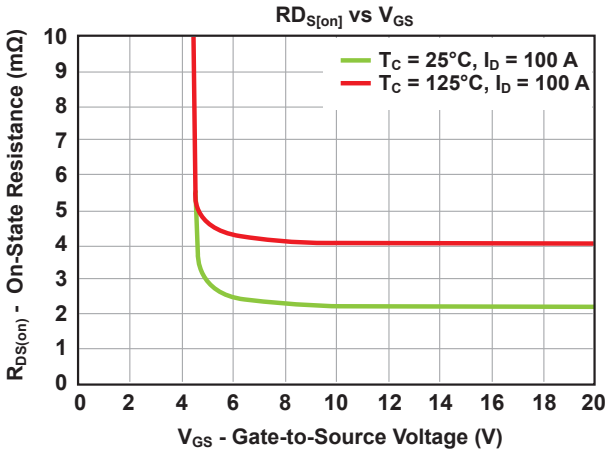
- 100 V V_{DS} rating
- Ultra low 2.3 mΩ $R_{DS(ON)}$ @ 10 V
- 118 nC gate charge @ 10 V
- Excellent avalanche capability
- Excellent dv/dt immunity
- Industry std TO-220 package

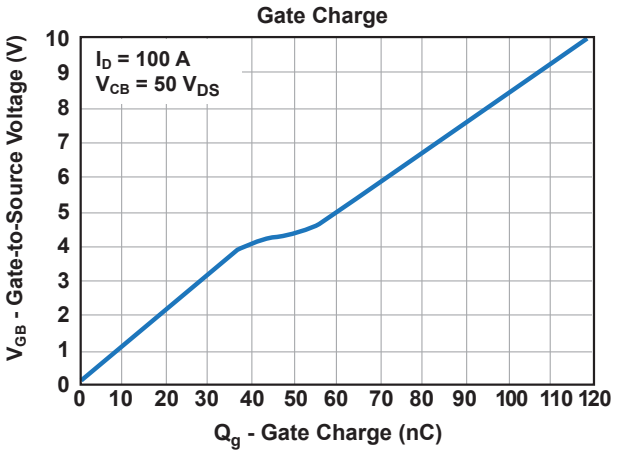
Applications

- Secondary side synchronous rectifiers
- Motor control

Benefits

- Higher efficiency systems at high current
- Reduced operating temperatures for improved reliability
- Higher switching frequency
- Ensures design ruggedness for high stress applications
- Ease of adoption & sourcing alternate solutions





TPS544B20/C20 – Top Apollo

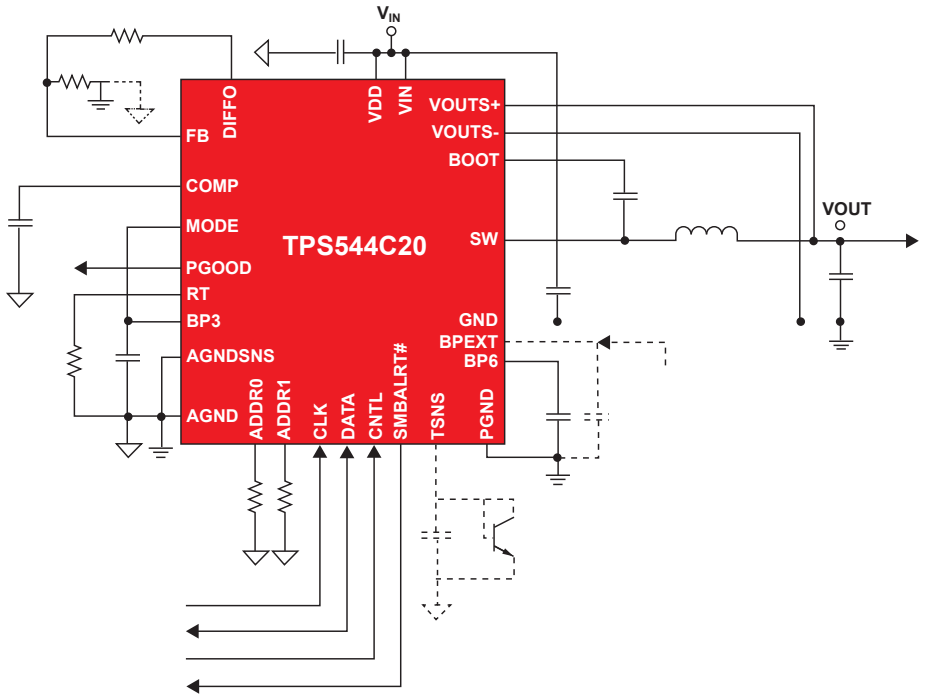
4.5-20 V Input, 20 A/30 A SWIFT™ Converters with PMBus™ and Telemetry

Features

- 4.5 V to 18 V_{IN}, V_O 0.6 to 5.5 volts
- **D-CAP and D-CAP2 mode operation for fast transient response**
- **Output currents up to 30 A**
- Integrated NexFETs with **senseFET** technology
- **PMBUS interface**
  - **Accurate I_O, V_O, temperature sensing**
  - Programmable UVLO, soft-start, PGood, margining
  - Programmable thermally compensated OCP levels
- 0.6 V reference voltage with 0.5% accuracy
- Supports pre-biased output
- Remote sensing
- D-CAP or DCAP2 selection pin
- On-chip NVM
- **40-pin 5x7mm QFN package**

Applications

- Cloud computing/server/storage
- Switchers/routers/wireless infrastructure



UCD3138064 – Digital PWM Controller w/ 64 kB Memory

Features

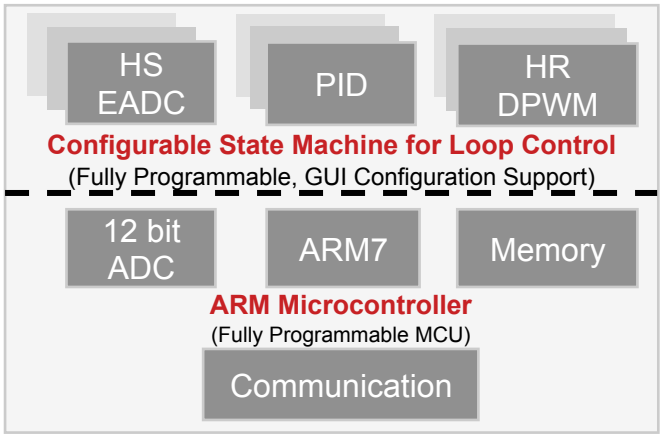
- 3 independent feedback loops
- 16 MHz error analog to digital converter (EADC)
- 14-bit (effective) DAC for control loop reference
- Dedicated PID hardware (2p/2z configurable)
- 8 high resolution DPWM outputs (250 ps pulse width resolution)
- 2 MHz max switching frequency
- High performance 31.25 MHz, 32-bit ARM7 processor
- 15 channel, 12-bit, 265 ksps general purpose ADC
- 2 UARTs + PMBus interface
- 7-50 ns analog comparators, cycle-by-cycle I_{LIMIT}
- -40C to 125C extended temp range
- **UCD3138128 is an extension to the UCD3138 family that adds:**
  - **64 kB program flash memory**
  - **80-pin, 64-pin, 48-pin and 40-pin package options**
  - **Support for Dual Program Flash Images**
  - **SPI communication (for external EEPROM, power metering IC)**
  - **2nd I2C port (for external EEPROM, additional peripherals)**

Applications

- Offline AC/DC and isolated DC/DC power supplies
- 48 V_{in} isolated DC/DC converters
- PFC, phase shifted full bridge, two switch forward, hard switching full bridge, and resonant LLC

Benefits

- Fully programmable and customizable solution with control architecture optimized for power supply applications
- Independent, high speed power supply loop control, separated from housekeeping microcontroller
- Programmable hardware for high speed functions (mode switching, voltage feedforward, constant current, etc.)



UCC2752X (& UCC27524A**): 5 A Dual-Channel Low-Side Driver

Features

- ± 5 A peak current drive capability (@V_{DD}=12 V)
- V_{DD} operating range 4.5 V to 18 V
- 12 ns (typ) propagation delay
- 1 ns (typ) delay matching
- Ability to handle negative voltages at inputs (-2 V for 200 ns)
- Ability to handle -5 V at outputs *(UCC27524A Only)*
- TTL input threshold logic (UCC27524A, UCC27523/5/6)
- CMOS input threshold logic (UCC27528)
- LDMOS output stage allowing rail-to-rail output drive
- Individual ENABLE function (pin can be floated)
- Industry standard pin-outs

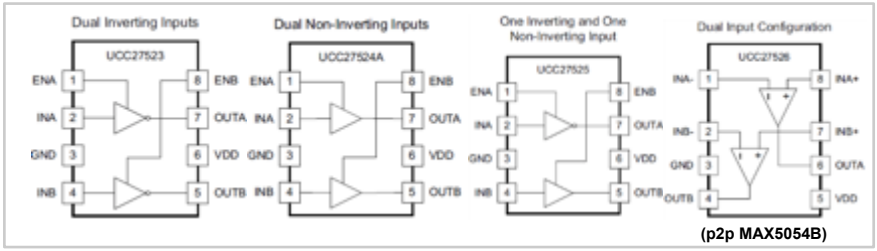
Benefits

- High peak current for fast MOSFET on/off switching
- 18 V operation allows headroom for 12 V output V_{DD} biasing
- Low pulse transmission distortion & better loop stability
- Ability to parallel driver outputs to double drive current
- Negative voltage capability offers compatibility with gate drive transformers, reduces external clamp circuitry, increases overall robustness
- Direct drop-in improvement to competitors (3x3 mm, SO-8)

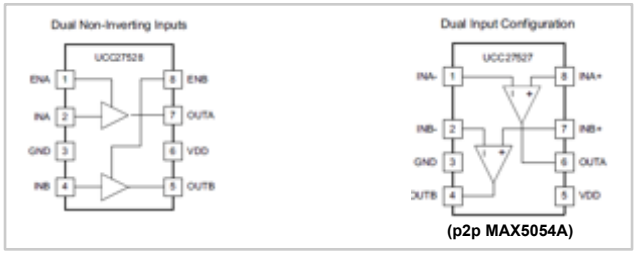
Applications

- Synchronous rectifier and PFC MOSFET drive circuits
- Gate drive transformer drive circuits
- General purpose MOSFFET driving (push-pull etc)

TTL Input



CMOS Input



Driver Configuration	Input Threshold	SOIC-8	MSOP-8	3x3 DFN-8
Dual Non-Inverting	TTL	UCC27524AD	UCC27524ADGN	UCC27524DSD
	CMOS	UCC27528D		UCC27528DSD
Dual Inverting	TTL	UCC27523D	UCC27523DGN	UCC27523DSD
One Non-Inverting, One-Inverting	TTL	UCC27525D	UCC27525DGN	UCC27525DSD
Dual Input Configuration	TTL			UCC27526DSD
	CMOS			UCC27527DSD

*** UCC27524A is a derivative of the UCC2752X family, adding negative voltage capability at output pins. UCC27524A is recommended for new designs.*

Dual Channel driver roadmap

UCC28180 – Programmable Frequency CCM PFC IC

Features

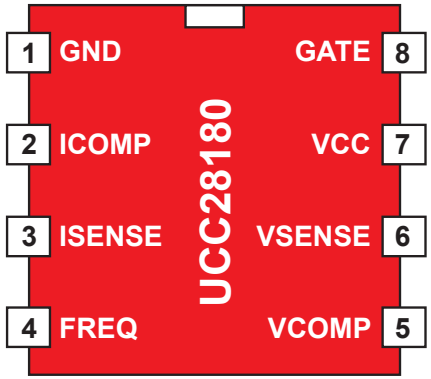
- **Wide range programmable switching frequency (18 KHz to 250 KHz)**
- Integrated 1.5 ASRC/2 A SNK integrated gate driver, with 15.2 V clamped output for IGBT drive
- Average current mode control
- **Audible noise minimization circuitry**
- **Reduced current sense thresholds**
- **Enhanced dynamic response during load transient**
- **Trimmed current loop circuit for low THD**
- Rich protection functions
- SOIC 8-pin (D) package

Applications

- Universal AC input, boost PFC converters
- Server & desktop power supplies
- White good appliances (A/C, refrigerators)
- Industrial power supplies (DIN rail)
- Flat panel (PDP/LCD/LED) TVs

Benefits

- Flexible CCM PFC controller optimized for variety of applications
  - **300 W to few-kW**
  - **18 kHz (IGBTs) to 250 kHz (GaN/SiC/Si switches)**
- Reduced power dissipation in I_{SNS} resistor
- Low THD (<5%, medium-to-full load)
- No audible noise
  - **Pin-to-pin compatible with Infineon ICE2PCSO1/5**



Complete Design/Product Cycle Support

- Seminars, webcasts, collateral and design notes
- Selection guides, web search tools, industry brochures, application notes, data sheets, Analog Customer Applications Team (ACAT)
- Rapid delivery samples, EVMs
- WEBENCH design tools, PowerLab reference designs, cookbooks, design services
- TINA-TI™ SPICE-based simulation
- Analog field applications engineers (AFAs), ACAT and FAQs
- Distributor partners, manufacturing capacity
- Distributor FAEs and internal support teams

Education

Analysis

Research

Product Ramp

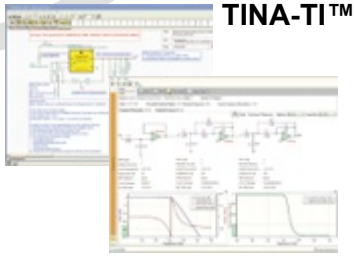
Sample Hardware

Breadboard Test

Schematic Design

Simulation

WEBENCH® Design Center



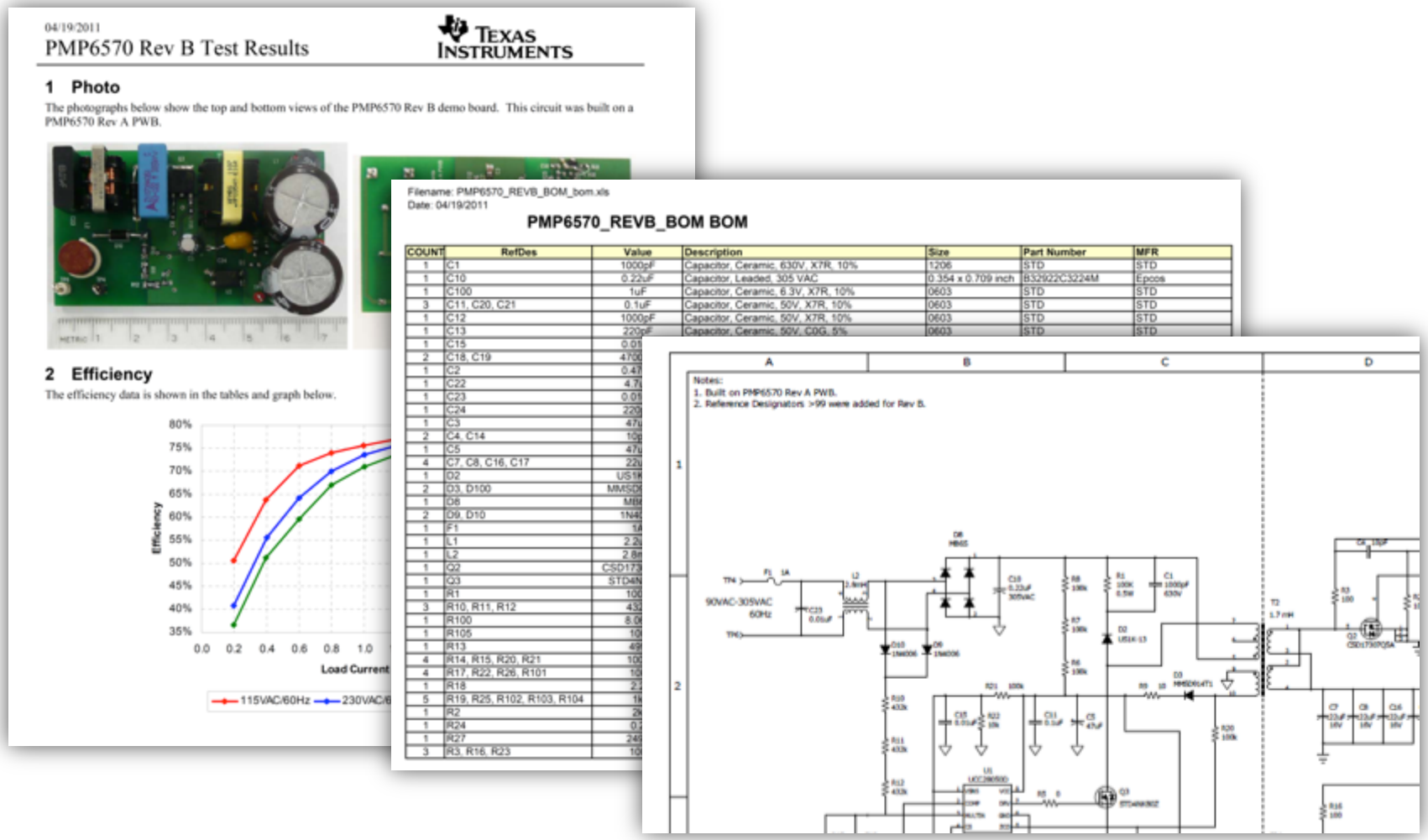
TINA-TI™

FilterPro™

PowerLab™ at a Glance

- A library of 1200 TI power reference designs that have been built and tested
- Includes an interactive search tool that allows customers to sort through hundreds of designs
  - V_{IN}, V_{OUT}, I_{OUT}, topology, application, part number, etc.
- Each design contains a schematic, bill of material and test report
- The designs leverage many years of power supply design expertise
- PowerLab is open to the public on TI's Power Website

Test Results, BOM and Schematic in .PDF Form



Summary

We want to be your first choice for power-management solutions by providing …

- Advanced products to meet your power design requirements
- Application knowledge to make your design process easier
- Technical support provided locally where you need it

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In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
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Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
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Logic	logic.ti.com	Security	www.ti.com/security
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