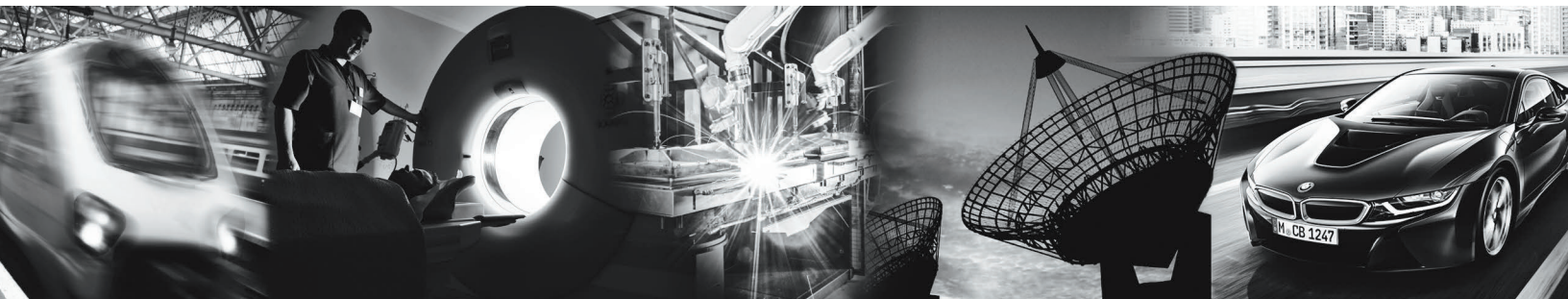


August 2015

# New Products Catalog

High Performance Analog ICs



LTC4040 2.5A Battery Backup Power Manager

LTC2348-18 Octal, 18-Bit, 200ksps Differential  $\pm 10.24\text{V}$  Input  
SoftSpan ADC with Wide Input Common Mode Range

LTM4622 Dual Ultrathin 2.5A Step-Down DC/DC  $\mu$ Module Regulator

LT8330 Low  $I_Q$  Boost/SEPIC/Inverting Converter with 1A, 60V Switch

LT8616 Dual 42V Synchronous Monolithic Step-Down Regulator with  
6.5 $\mu\text{A}$  Quiescent Current

LTC2984 Multi-Sensor High Accuracy Digital Temperature  
Measurement System with EEPROM

**Battery Management**

LTC®4015 Multichemistry Buck Battery Charger Controller with Digital Telemetry System.....	1
LTC4040 2.5A Battery Backup Power Manager.....	2

**Data Converters**

LTC2000A 16-/14-/11-Bit 2.7Gsps DACs .....	3
LTC2348-18 Octal, 18-Bit, 200ksps Differential $\pm 10.24V$ Input SoftSpan™ ADC with Wide Input Common Mode Range .....	6
LTC2372-16 16-Bit, 500ksps, 8-Channel SAR ADC with 96dB SNR .....	7
LTC2373-16 16-Bit, 1Msps, 8-Channel SAR ADC with 96dB SNR .....	8

**Interface**

LTC4316 Single I²C/SMBus Address Translator.....	9
LTC4317 Dual I²C/SMBus Address Translator .....	12
LTC4318 Dual I²C/SMBus Address Translator .....	13

**PoE**

LT®4276 LTPoE++™/PoE+/PoE PD Forward/Flyback Controller .....	14
---	----

**µModule® Regulators**

LTM®4622 Dual Ultrathin 2.5A Step-Down DC/DC µModule Regulator .....	15
LTM4630-1 Dual 18A or Single 36A µModule Regulator with 0.8% DC and 3% Transient Accuracy.....	16
LTM4675 Dual 9A or Single 18A µModule Regulator with Digital Power System Management.....	17
LTM4676A Dual 13A or Single 26A µModule Regulator with Digital Power System Management .....	18

**Supercap Charger**

LTC3110 2A Bidirectional Buck-Boost DC/DC Regulator and Charger/Balancer.....	19
---	----

**Switching Regulators—Monolithic**

LTC3335 Nanopower Buck-Boost DC/DC with Integrated Coulomb Counter .....	20
LTC3815 6A Monolithic Synchronous DC/DC Step-Down Converter with Digital Power System Management .....	21
LT8330 Low $I_Q$ Boost/SEPIC/Inverting Converter with 1A, 60V Switch .....	22
LT8494 SEPIC/Boost DC/DC Converter with 2A, 70V Switch, and 7 $\mu$ A Quiescent Current.....	23
LT8602 42V Quad Monolithic Synchronous Step-Down Regulator.....	24
LT8616 Dual 42V Synchronous Monolithic Step-Down Regulator with 6.5 $\mu$ A Quiescent Current .....	26
LT8631 100V, 1A Synchronous Micropower Step-Down Regulator .....	27

**Temperature Sensors**

LTC2984 Multi-Sensor High Accuracy Digital Temperature Measurement System with EEPROM .....	28
---	----

**Design Note**

DN541 Micropower Op Amp Drives 8-Channel 18-Bit Simultaneous Sampling ADC without Compromising Accuracy or Breaking the Power Budget .....	
--	--

## LTC4015

### Multichemistry Buck Battery Charger Controller with Digital Telemetry System

#### FEATURES

- Multichemistry Li-Ion/Polymer, LiFePO<sub>4</sub>, or Lead-Acid Battery Charger with Termination
- High Efficiency Synchronous Buck Battery Charger
- Digital Telemetry System Monitors  $V_{BAT}$ ,  $I_{BAT}$ ,  $R_{BAT}$ , NTC Ratio (Battery Temperature),  $V_{IN}$ ,  $I_{IN}$ ,  $V_{SYSTEM}$ , Die Temperature
- Coulomb Counter and Integrated 14-Bit ADC
- Wide Charging Input Voltage Range: 4.5V to 35V
- Wide Battery Voltage Range: Up to 35V
- Input Undervoltage Charge Current Limit Loop
- Maximum Power Point Tracking
- Optional I<sup>2</sup>C Serial Port Control
- Input Current Limit Prioritizes System Load Output
- Input and Output Ideal Diodes Provide Low Loss PowerPath™ Operation
- Instant-On Operation with Discharged Battery

#### APPLICATIONS

- Portable Medical Instruments/Military Equipment
- Industrial Handhelds/Lighting
- Ruggedized Notebook/Tablet Computers

#### DESCRIPTION

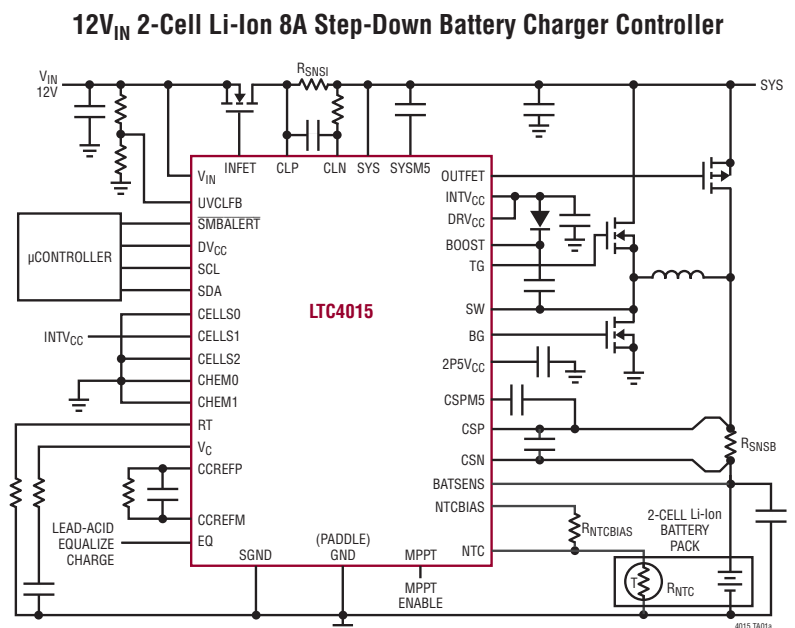
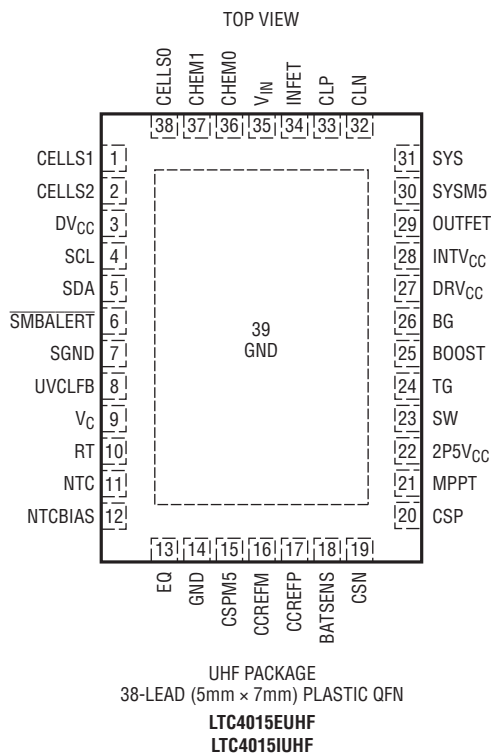
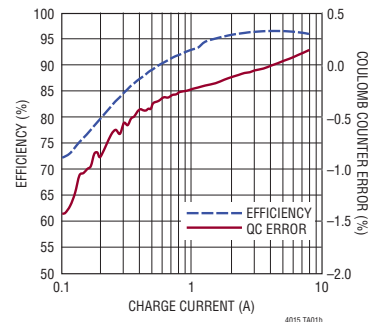
The LTC4015 is a complete synchronous buck controller/charger with pin selectable, chemistry specific charging and termination algorithms.

The LTC4015 can charge Li-Ion/Polymer, LiFePO<sub>4</sub>, or lead-acid batteries. Battery charge voltage is pin selectable and I<sup>2</sup>C adjustable. Input current limit and charge current can be accurately programmed with sense resistors and can be individually adjusted via the I<sup>2</sup>C serial port. A digital telemetry system monitors all system power parameters.

Safety timer and current termination algorithms are supported for lithium chemistry batteries. The LTC4015 also includes automatic recharge, precharge (Li-Ion) and NTC thermistor protection. The LTC4015's I<sup>2</sup>C port allows user customization of charger algorithms, reading of charger status information, configuration of the maskable and programmable alerts, plus use and configuration of the Coulomb counter.

Available in a 38-lead 5mm × 7mm QFN package.

#### Step-Down Charger Efficiency and Coulomb Counter Error vs Battery Charge Current



# LTC4040

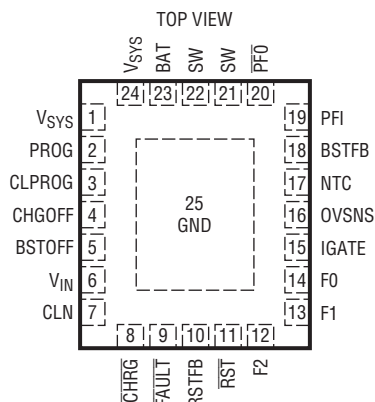
## 2.5A Battery Backup Power Manager

## FEATURES

- **Step-Up Backup Supply and Step-Down Battery Charger**
- **6.5A Switches for 2.5A Backup from 3.2V Battery**
- **Input Current Limit Prioritizes Load Over Charge Current**
- **Input Disconnect Switch Isolates Input During Backup**
- **Automatic Seamless Switch-Over to Backup Mode**
- Input Power Loss Indicator
- System Power Loss Indicator
- Pin Selectable Battery: Li-Ion (3.95V/4.0V/4.05V/4.1V) or LiFePO<sub>4</sub> (3.45V/3.5V/3.55V/3.6V)
- Optional OVP Circuitry Protects Device to >60V
- Constant Frequency Operation
- Low Profile (0.75mm) 24-Lead 4mm × 5mm QFN Package

## APPLICATIONS

- Fleet and Asset Tracking
- Automotive GPS Data Loggers
- Automotive Telematics Systems
- Toll Collection Systems
- Security Systems
- USB Powered Devices



UFD PACKAGE  
24-LEAD (4mm x 5mm) PLASTIC QFN  
**LTC4040EUF**  
**LTC4040IUF**

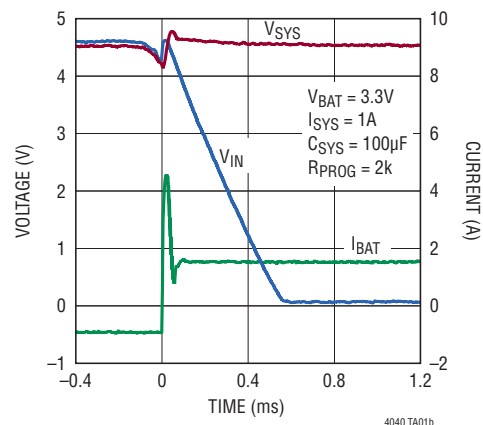
## DESCRIPTION

The LTC4040 is a complete 3.5V to 5.5V supply rail battery backup system. It contains a high current step-up DC/DC regulator to back up the supply from a single-cell Li-Ion or LiFePO<sub>4</sub> battery. When external power is available, the step-up regulator operates in reverse as a step-down battery charger.

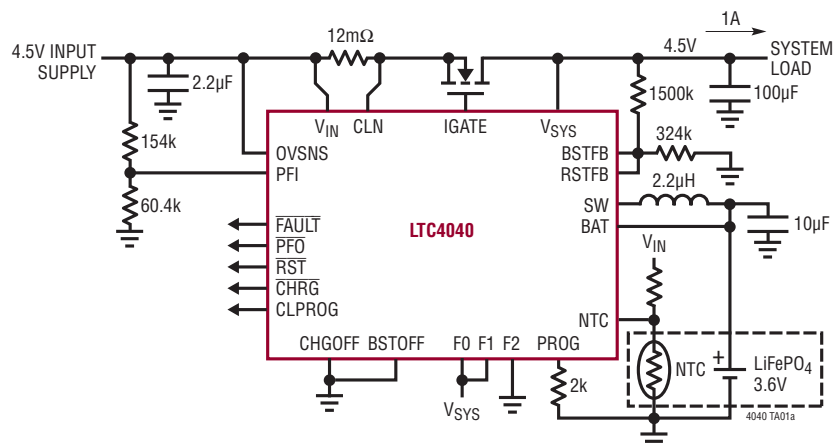
The LTC4040's adjustable input current limit function reduces charge current to protect the main supply from overload while an external disconnect switch isolates the external supply during backup. When the input supply drops below the adjustable PFI threshold, the 2.5A boost regulator delivers power from the battery to the system output.

An optional input overvoltage protection (OVP) circuit protects the LTC4040 from high voltage damage at the  $V_{IN}$  pin. One logic input selects either the Li-Ion or the  $LiFePO_4$  battery option, and two other logic inputs program the battery charge voltage to one of four levels suitable for backup applications. The LTC4040 is available in a low profile (0.75mm) 24-lead 4mm  $\times$  5mm QFN package.

### Normal to Backup Mode Transition Waveform



### 4.5V Backup Application with 4.22V PFI Threshold (Charge Current Setting: 1A, Input Current Limit Setting: 2A)



## LTC2000A

### 16-/14-/11-Bit 2.7Gsp/s DACs

#### FEATURES

- 80dBc SFDR at 50MHz  $f_{OUT}$
- >68dBc SFDR from DC to 1080MHz  $f_{OUT}$
- 40mA Nominal Full-Scale,  $\pm 1V$  Output Compliant
- 10mA to 60mA Adjustable Full-Scale Current Range
- Single or Dual Port DDR LVDS and DHSTL Interface
- Low Latency (7.5 Cycles for Single Port, 11 Cycles for Dual Port)
- >78dBc 2-Tone IMD from DC to 1000MHz  $f_{OUT}$
- 156dBc/Hz Additive Phase Noise at 1MHz Offset for 65MHz  $f_{OUT}$
- 170-Lead (9mm  $\times$  15mm) BGA Package

#### APPLICATIONS

- Broadband Communication Systems
- DOCSIS CMTS
- Direct RF Synthesis
- Radar
- Instrumentation
- Automatic Test Equipment

#### DESCRIPTION

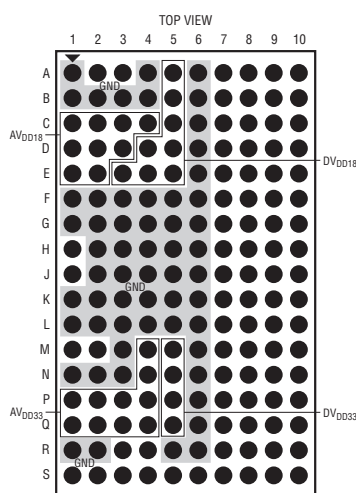
The LTC2000A is a family of 16-/14-/11-bit 2.7Gsp/s current steering DACs with exceptional spectral purity.

The single (1.35Gsp/s mode) or dual (2.7Gsp/s mode) port source synchronous LVDS interface supports data rates of up to 1.35Gbps using a 675MHz DDR data clock, which can be either in quadrature or in phase with the data. An internal synchronizer automatically aligns the data with the DAC sample clock.

Additional features such as pattern generation, LVDS loopout and junction temperature sensing simplify system development and testing.

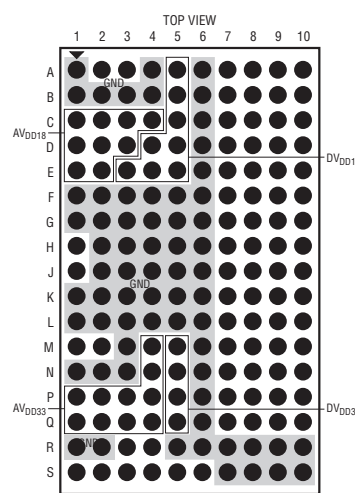
A serial peripheral interface (SPI) port allows configuration and read back of internal registers. Operating from 1.86V and 3.3V supplies, the LTC2000A consumes 2.41W at 2.7Gsp/s and 1.43W at 1.35Gsp/s.

**LTC2000A-16**



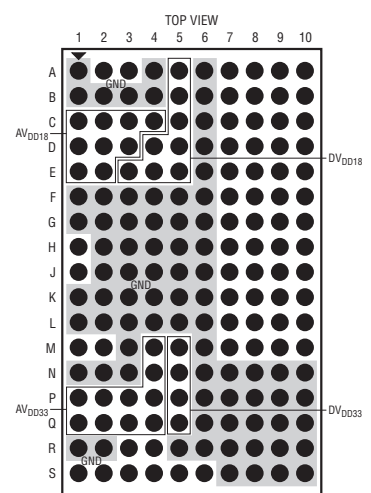
BGA PACKAGE  
170-LEAD (9mm  $\times$  15mm  $\times$  1.54mm)  
**LTC2000ACY-16**  
**LTC2000AIY-16**

**LTC2000A-14**



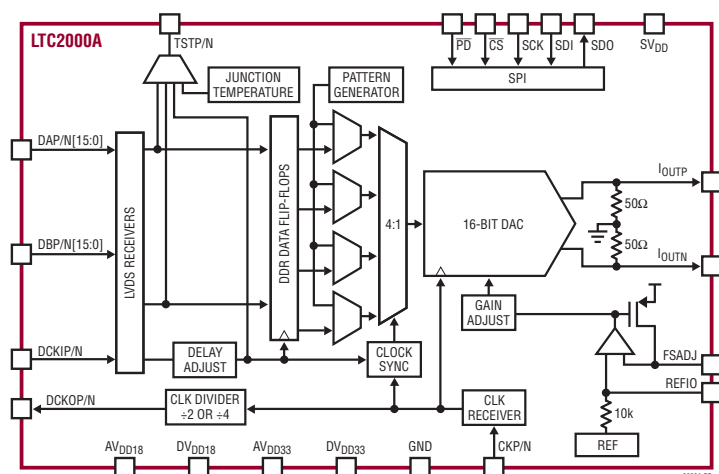
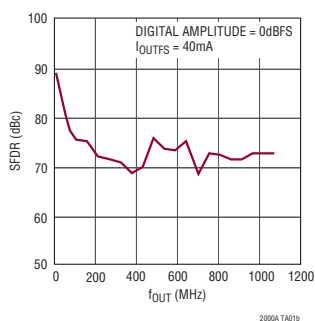
BGA PACKAGE  
170-LEAD (9mm  $\times$  15mm  $\times$  1.54mm)  
**LTC2000ACY-14**  
**LTC2000AIY-14**

**LTC2000A-11**

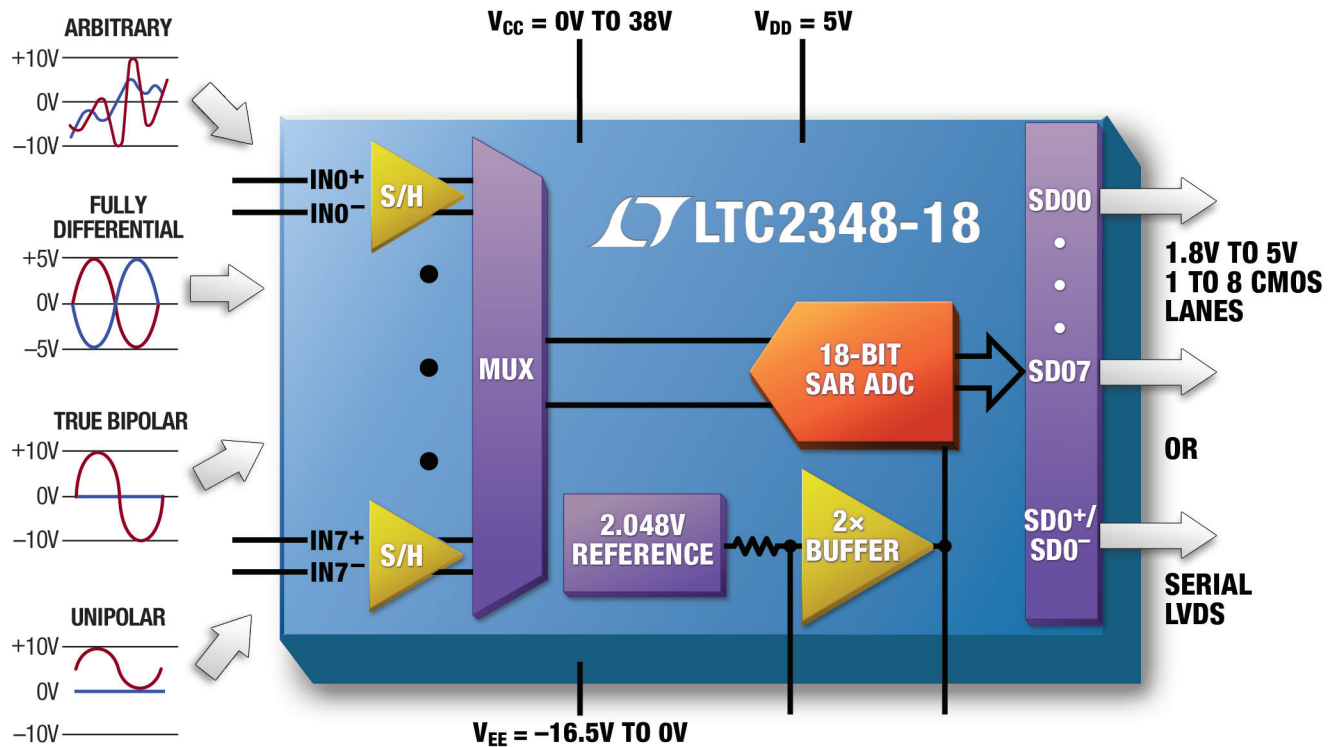


BGA PACKAGE  
170-LEAD (9mm  $\times$  15mm  $\times$  1.54mm)  
**LTC2000ACY-11**  
**LTC2000AIY-11**

**SFDR vs  $f_{OUT}$ ,  $f_{DAC} = 2.7Gsp/s$**







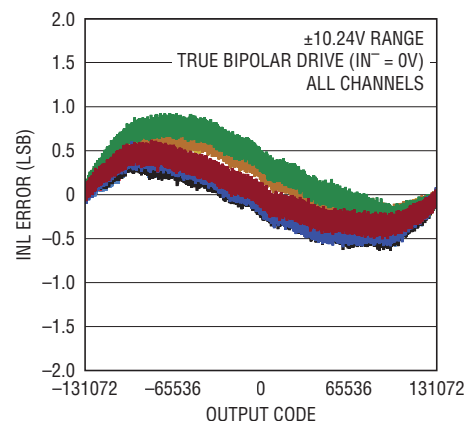
## Octal ADC Offers Unprecedented Performance and Flexibility

The LTC®2348-18 offers the ultimate blend of high performance and flexibility. Eight differential SoftSpan™ input channels are independently configurable on a conversion-by-conversion basis to accept different voltage ranges and input types, over a wide input common range from -16.5V to 34V. Furthermore, the high voltage supplies can be individually biased anywhere within the specified operating range to enable application-specific common mode input ranges for maximum design flexibility.

## Features

- 200ksp/s per Channel Throughput
- Eight Simultaneous Sampling Channels
- $\pm 3\text{LSB}$  INL Maximum
- Guaranteed 18-Bit, No Missing Codes
- Differential, Wide Common Mode Range Inputs
- Per-Channel SoftSpan Input Ranges:
  - $\pm 10.24\text{V}$ ,  $0\text{V}$  to  $10.24\text{V}$ ,  $\pm 5.12\text{V}$ ,  $0\text{V}$  to  $5.12\text{V}$
- 96.7dB Single-Conversion SNR
- $-109\text{dB}$  THD and Crosstalk,  $118\text{dB}$  CMRR
- Integrated Reference and Buffer
- SPI CMOS ( $1.8\text{V}$  to  $5\text{V}$ ) and LVDS Serial I/O
- $140\text{mW}$  Power Dissipation (Typical)
- 48-Lead ( $7\text{mm} \times 7\text{mm}$ ) LQFP Package

## Integral Nonlinearity vs Output Code and Channel



**LT**, *LT*, *LTC*, *LTM*, Linear Technology and the Linear logo are registered trademarks and SoftSpan is a trademark of Linear Technology Corporation. All other trademarks are the property of their respective owners.

# High Precision SAR ADCs

16-Bit to 20-Bit Resolution, 100ksps Up to 5Msps

		100ksps to 200ksps	250ksps to 400ksps	500ksps to 600ksps	1Msps	1.6Msps	2Msps to 5Msps
20-Bit	1-Ch		2376-20	2377-20	2378-20		
	1-Ch		2364-18 2376-18 2326-18 2336-18	2367-18 2377-18 2327-18 2337-18	2368-18 2378-18 2328-18 2338-18	2369-18 2379-18	2389-18
18-Bit	2-Ch			* 2343-18			
	4-Ch		* 2347-18				
	8-Ch	2348-18		2372-18	2373-18		
16-Bit	1-Ch	1864L 1609 1605-1 1605 1605-2	2364-16 2376-16 1864 2326-16 1606 2391-16 1603 1604	2367-16 2377-16 2327-16 2392-16 1608	2368-16 2378-16 2328-16 2393-16		2370-16 2380-16 2389-16
	2-Ch	1865L	1865	* 2343-16			2321-16 2323-16
	4-Ch		* 2347-16				
	8-Ch	2348-16 1856 1859 1867L 1867		2372-16	2373-16		

## Serial

- Pseudo- or Fully Differential Pin-Compatible ADCs
- ±10V True Bipolar Inputs
- 8-Channel MUX'd Input ADCs
- 3V/5V Supply µPower ADCs
- 3.3V/5V Supply Simultaneous Sampling ADCs
- ±10V SoftSpan Simultaneous Sampling ADCs

## Serial/Parallel

- Pseudo- or Fully Differential Pin-Compatible ADCs
- Fully Differential Pin-Compatible ADCs

## Parallel

- ±10V True Bipolar Inputs
- ±2.5V True Bipolar Inputs
- 0V to 4V, ±4V Unipolar/True Bipolar Inputs

\* Future Product



## LTC2348-18

Octal, 18-Bit, 200ksps Differential  $\pm 10.24\text{V}$  Input  
SoftSpan ADC with Wide Input Common Mode Range

### FEATURES

- 200ksps per Channel Throughput
- Eight Simultaneous Sampling Channels
- $\pm 3\text{LSB}$  INL (Maximum,  $\pm 10.24\text{V}$  Range)
- Guaranteed 18-Bit, No Missing Codes
- Differential, Wide Common Mode Range Inputs
- Per-Channel SoftSpan Input Ranges:  
 $\pm 10.24\text{V}$ ,  $0\text{V}$  to  $10.24\text{V}$ ,  $\pm 5.12\text{V}$ ,  $0\text{V}$  to  $5.12\text{V}$
- 96.7dB Single-Conversion SNR (Typical)
- 109dB THD (Typical) at  $f_{\text{IN}} = 2\text{kHz}$
- 118dB CMRR (Typical) at  $f_{\text{IN}} = 200\text{Hz}$
- Rail-to-Rail Input Overdrive Tolerance
- Guaranteed Operation to  $125^\circ\text{C}$
- Integrated Reference and Buffer (4.096V)
- 2.5V to 5V External Reference Input Range
- SPI CMOS (1.8V to 5V) and LVDS Serial I/O
- Internal Conversion Clock, No Cycle Latency
- 140mW Power Dissipation (Typical)
- 48-Lead (7mm  $\times$  7mm) LQFP Package

### APPLICATIONS

- Programmable Logic Controllers
- Industrial Process Control
- Power Line Monitoring
- Test and Measurement

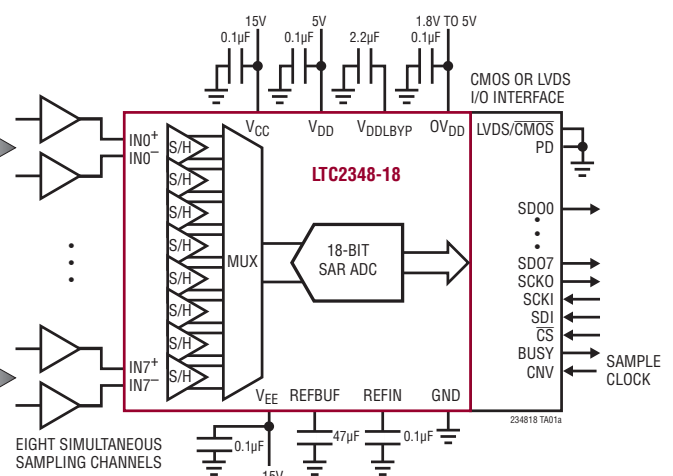
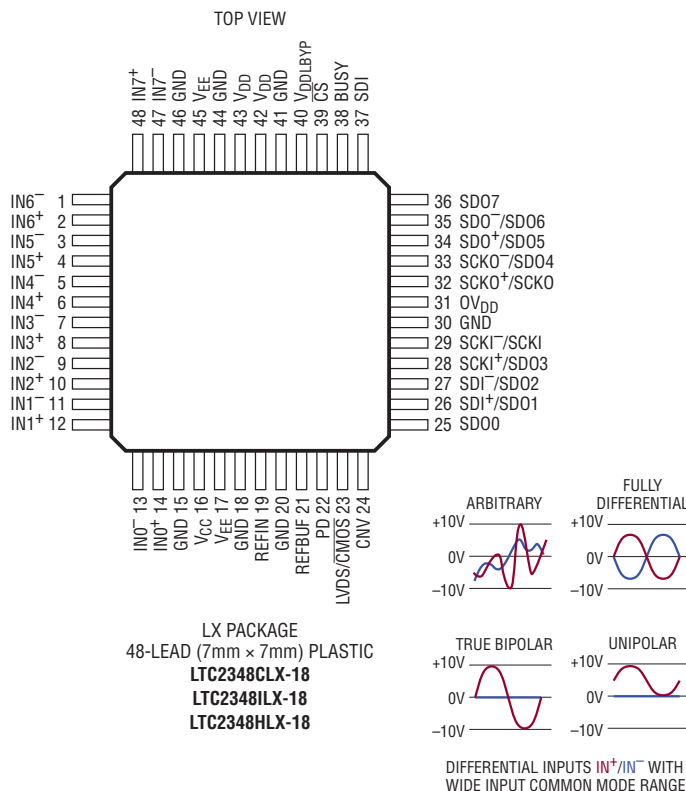
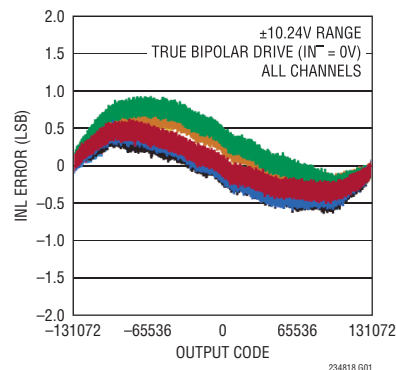
### DESCRIPTION

The LTC2348-18 is an 18-bit, low noise 8-channel simultaneous sampling successive approximation register (SAR) ADC with differential, wide common mode range inputs. Operating from a 5V low voltage supply, flexible high voltage supplies, and using the internal reference and buffer, each channel of this SoftSpan ADC can be independently configured on a conversion-by-conversion basis to accept  $\pm 10.24\text{V}$ ,  $0\text{V}$  to  $10.24\text{V}$ ,  $\pm 5.12\text{V}$ , or  $0\text{V}$  to  $5.12\text{V}$  signals. Individual channels may also be disabled to increase throughput on the remaining channels.

The wide input common mode range and 118dB CMRR of the LTC2348-18 analog inputs allow the ADC to directly digitize a variety of signals, simplifying signal chain design. This input signal flexibility, combined with  $\pm 3\text{LSB}$  INL, no missing codes at 18 bits, and 96.7dB SNR, makes the LTC2348-18 an ideal choice for many high voltage applications requiring wide dynamic range.

The LTC2348-18 supports pin-selectable SPI CMOS (1.8V to 5V) and LVDS serial interfaces. Between one and eight lanes of data output may be employed in CMOS mode, allowing the user to optimize bus width and throughput.

Integral Nonlinearity vs  
Output Code and Channel



## LTC2372-16

16-Bit, 500ksps, 8-Channel SAR  
ADC with 96dB SNR

### FEATURES

- 500ksps Throughput Rate
- 16-Bit Resolution with No Missing Codes
- 8-Channel Multiplexer with Selectable Input Range
  - Fully Differential ( $\pm 4.096V$ )
  - Pseudo-Differential Unipolar (0V to 4.096V)
  - Pseudo-Differential Bipolar ( $\pm 2.048V$ )
- INL:  $\pm 1LSB$  (Maximum)
- SNR: 96dB (Fully Differential)/93.5dB (Pseudo-Differential) (Typical) at  $f_{IN} = 1kHz$
- THD:  $-110dB$  (Typical) at  $f_{IN} = 1kHz$
- Programmable Sequencer
- Selectable Digital Gain Compression
- Single 5V Supply with 1.8V to 5V I/O Voltages
- SPI-Compatible Serial I/O
- Onboard 2.048V Reference and Reference Buffer
- No Pipeline Delay, No Cycle Latency
- Power Dissipation 27mW (Typical)
- Guaranteed Operation to 125°C
- 32-Lead 5mm  $\times$  5mm QFN Package

### APPLICATIONS

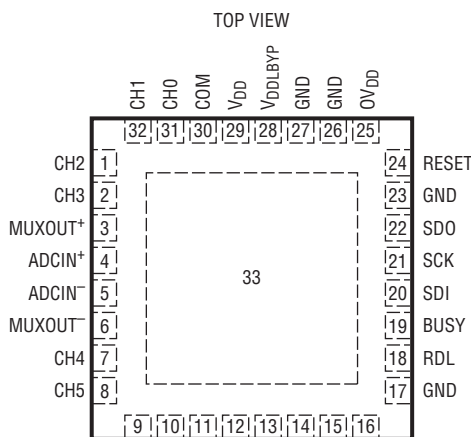
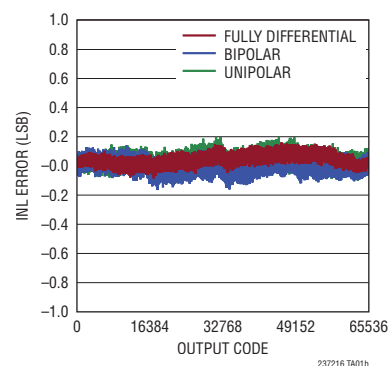
- Programmable Logic Controllers
- Industrial Process Control
- High Speed Data Acquisition
- Portable or Compact Instrumentation
- ATE

### DESCRIPTION

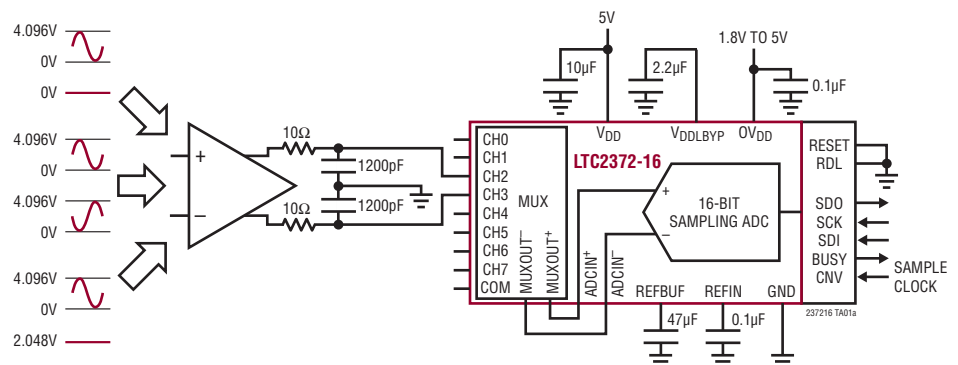
The LTC2372-16 is a low noise, high speed, 8-channel 16-bit successive approximation register (SAR) ADC. Operating from a single 5V supply, the LTC2372-16 has a highly configurable, low crosstalk 8-channel input multiplexer, supporting fully differential, pseudo-differential unipolar and pseudo-differential bipolar analog input ranges. The LTC2372-16 achieves  $\pm 1LSB$  INL (maximum) in all input ranges, no missing codes at 16-bits and 96dB (fully differential)/93.5dB (pseudo-differential) SNR (typical).

The LTC2372-16 has an onboard low drift (20ppm/°C max) 2.048V temperature-compensated reference and a single-shot capable reference buffer. The LTC2372-16 also has a high speed SPI-compatible serial interface that supports 1.8V, 2.5V, 3.3V and 5V logic through which a sequencer with a depth of 16 may be programmed. An internal oscillator sets the conversion time, easing external timing considerations. The LTC2372-16 dissipates only 27mW and automatically naps between conversions, leading to reduced power dissipation that scales with the sampling rate. A sleep mode is also provided to reduce the power consumption of the LTC2372-16 to 300 $\mu$ W for further power savings during inactive periods.

Integral Nonlinearity  
vs Output Code



UH PACKAGE  
32-LEAD (5mm  $\times$  5mm) PLASTIC QFN  
LTC2372CUH-16  
LTC2372IUH-16  
LTC2372HUH-16



## LTC2373-16

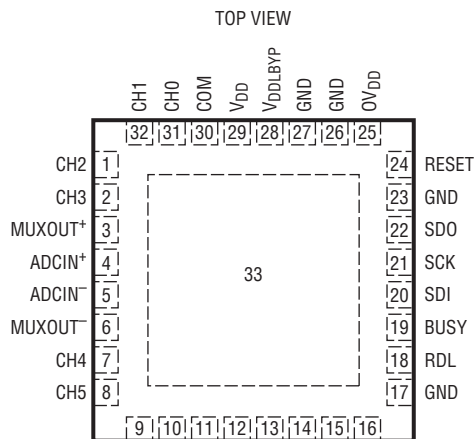
16-Bit, 1Msps, 8-Channel SAR ADC with 96dB SNR

### FEATURES

- 1Msps Throughput Rate
- 16-Bit Resolution with No Missing Codes
- 8-Channel Multiplexer with Selectable Input Range
  - Fully Differential ( $\pm 4.096V$ )
  - Pseudo-Differential Unipolar (0V to 4.096V)
  - Pseudo-Differential Bipolar ( $\pm 2.048V$ )
- INL:  $\pm 1LSB$  (Maximum)
- SNR: 96dB (Fully Differential)/93.4dB (Pseudo-Differential) (Typical) at  $f_{IN} = 1kHz$
- THD:  $-110dB$  (Typical) at  $f_{IN} = 1kHz$
- Programmable Sequencer
- Selectable Digital Gain Compression
- Single 5V Supply with 1.8V to 5V I/O Voltages
- SPI-Compatible Serial I/O
- Onboard 2.048V Reference and Reference Buffer
- No Pipeline Delay, No Cycle Latency
- Power Dissipation 40mW (Typical)
- Guaranteed Operation to 125°C
- 32-Lead 5mm  $\times$  5mm QFN Package

### APPLICATIONS

- Programmable Logic Controllers
- Industrial Process Control
- High Speed Data Acquisition
- Portable or Compact Instrumentation
- ATE



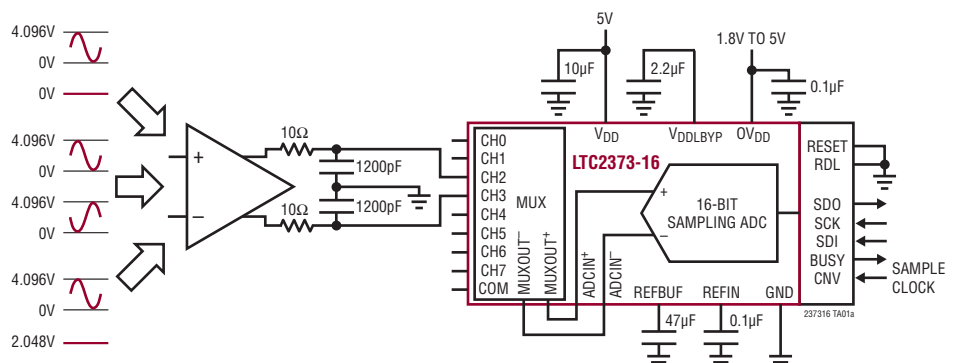
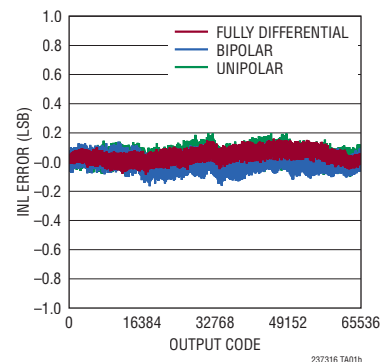
UH PACKAGE  
32-LEAD (5mm  $\times$  5mm) PLASTIC QFN  
LTC2373CUH-16  
LTC2373IUH-16  
LTC2373HUH-16

### DESCRIPTION

The LTC2373-16 is a low noise, high speed, 8-channel 16-bit successive approximation register (SAR) ADC. Operating from a single 5V supply, the LTC2373-16 has a highly configurable, low crosstalk 8-channel input multiplexer, supporting fully differential, pseudo-differential unipolar and pseudo-differential bipolar analog input ranges. The LTC2373-16 achieves  $\pm 1LSB$  INL (maximum) in all input ranges, no missing codes at 16-bits and 96dB (fully differential)/ 93.4dB (pseudo-differential) SNR (typical).

The LTC2373-16 has an onboard low drift (20ppm/°C max) 2.048V temperature-compensated reference and a single-shot capable reference buffer. The LTC2373-16 also has a high speed SPI-compatible serial interface that supports 1.8V, 2.5V, 3.3V and 5V logic through which a sequencer with a depth of 16 may be programmed. An internal oscillator sets the conversion time, easing external timing considerations. The LTC2373-16 dissipates only 40mW and automatically naps between conversions, leading to reduced power dissipation that scales with the sampling rate. A sleep mode is also provided to reduce the power consumption of the LTC2373-16 to 300 $\mu$ W for further power savings during inactive periods.

Integral Nonlinearity  
vs Output Code



## LTC4316

### Single I<sup>2</sup>C/SMBus Address Translator

#### FEATURES

- Allows Multiple Slaves with the Same Address to Coexist on the Same Bus
- Resistor Configurable Address Translation
- No Software Programming Required
- Compatible with SMBus, I<sup>2</sup>C and I<sup>2</sup>C Fast Mode
- Pass-Through Mode Allows General Call Addressing
- $\pm 4$ kV HBM ESD Ruggedness
- Level Translation for 2.5V, 3.3V and 5V Buses
- Stuck Bus Timeout
- Prevents SDA and SCL Corruption During Live Board Insertion and Removal
- Support Bus Hot Swap™
- 10-Lead MSOP and DFN 3mm × 3mm Packages

#### APPLICATIONS

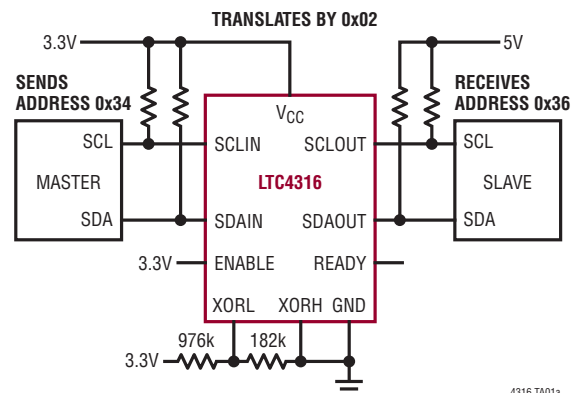
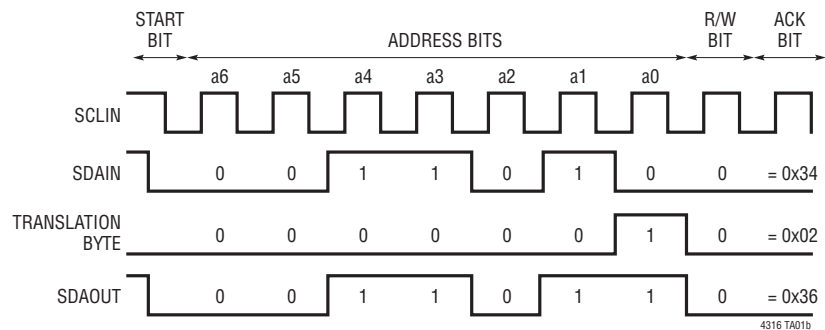
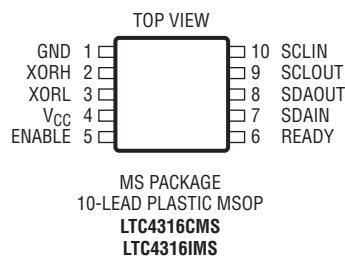
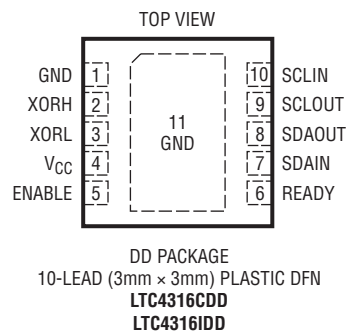
- I<sup>2</sup>C, SMBus Address Expansion
- Address Translation
- Servers
- Telecom

#### DESCRIPTION

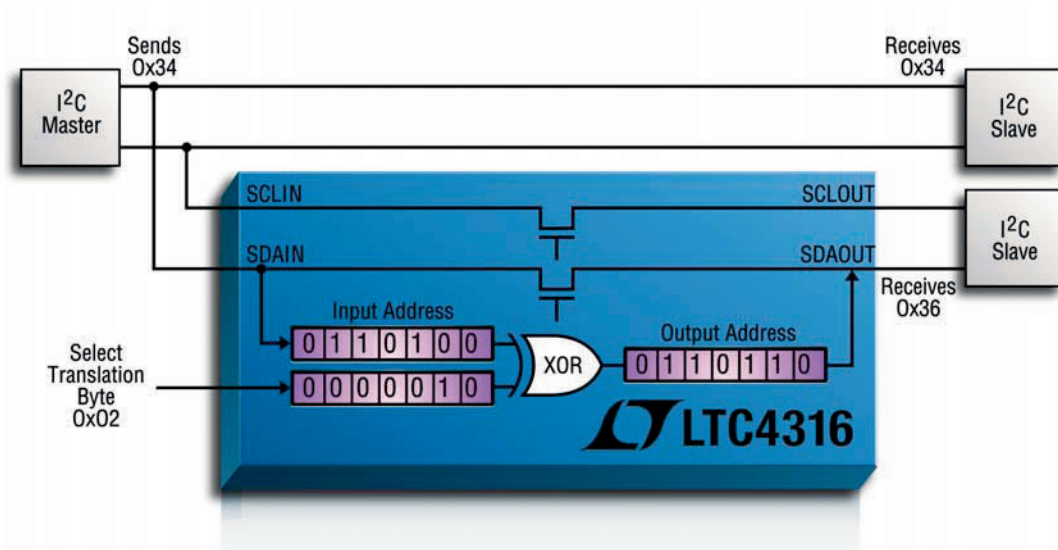
The LTC4316 enables the hardwired address of one or more I<sup>2</sup>C or SMBus slave devices to be translated to a different address. This allows slaves with the same hardwired address to coexist on the same bus. Only discrete resistors are needed to select the new address and no software programming is required. Up to 127 different address translations are available.

The LTC4316 incorporates a pass-through mode which disables the address translation and allows general call addressing by the master. The LTC4316 is designed to automatically recover from abnormal bus conditions like bus stuck low or premature STOP bits.

PART NUMBER	NUMBER OF INPUT CHANNELS	NUMBER OF OUTPUT CHANNELS
LTC4316	1	1
LTC4317	1	2
LTC4318	2	2



# I<sup>2</sup>C/SMBus Address Translators



The LTC4316/LTC4317/LTC4318 are I<sup>2</sup>C/SMBus address translators that bridge two or more segments of an I<sup>2</sup>C bus, reading incoming addresses on the master side and transmitting a different 7-bit I<sup>2</sup>C address to the slave side to avoid address conflicts. Only discrete resistors are needed to select the new address and no software programming is required. Up to 127 different address translations are available.

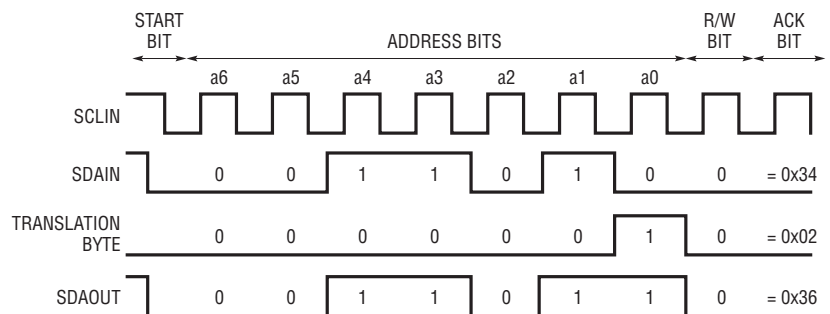
## Features

- Allows Multiple Slaves with the Same Address to Coexist on the Same Bus
- Resistor Configurable Address Translation
- No Software Programming Required
- SMBus, I<sup>2</sup>C and I<sup>2</sup>C Fast Mode Compatible
- Pass-Through Mode Allows General Call Addressing
- ±4kV HBM ESD
- Level Translation for 2.5V, 3.3V and 5V Buses
- Stuck Bus Timeout
- Prevents SDA and SCL Corruption During Live Board Insertion and Removal

## Part Selection

Part Number	Number of Input Channels	Number of Output Channels	Packages
LTC4316	1	1	3mm × 3mm DFN-10, MSOP-10
LTC4317	1	2	5mm × 3mm DFN-16
LTC4318	2	2	4mm × 4mm QFN-20

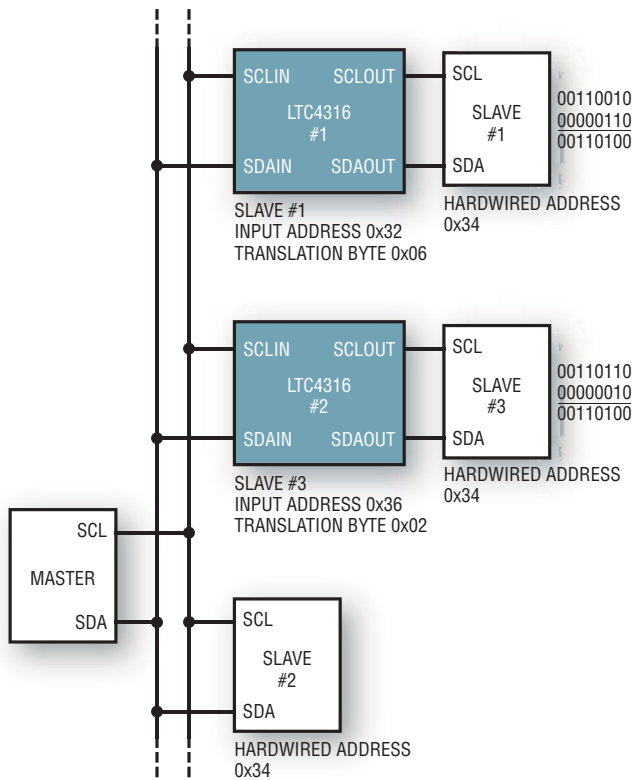
## Timing Diagram Example



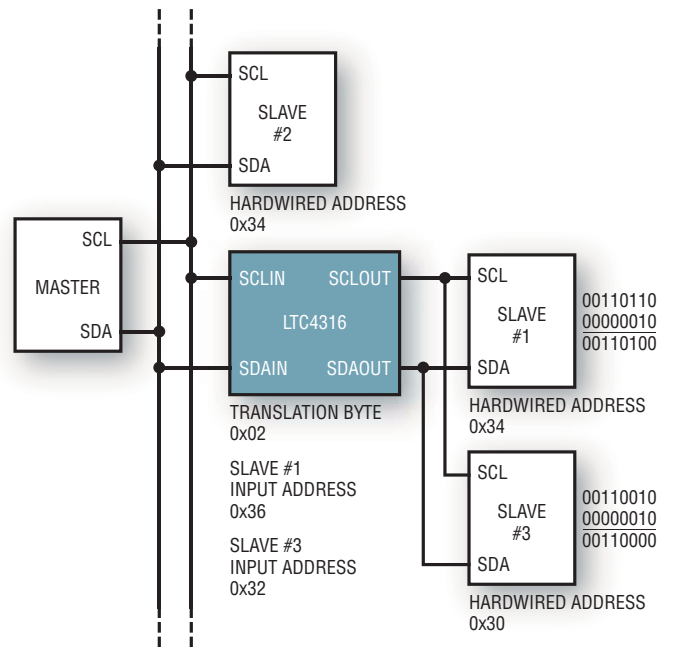
LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

## Configurations

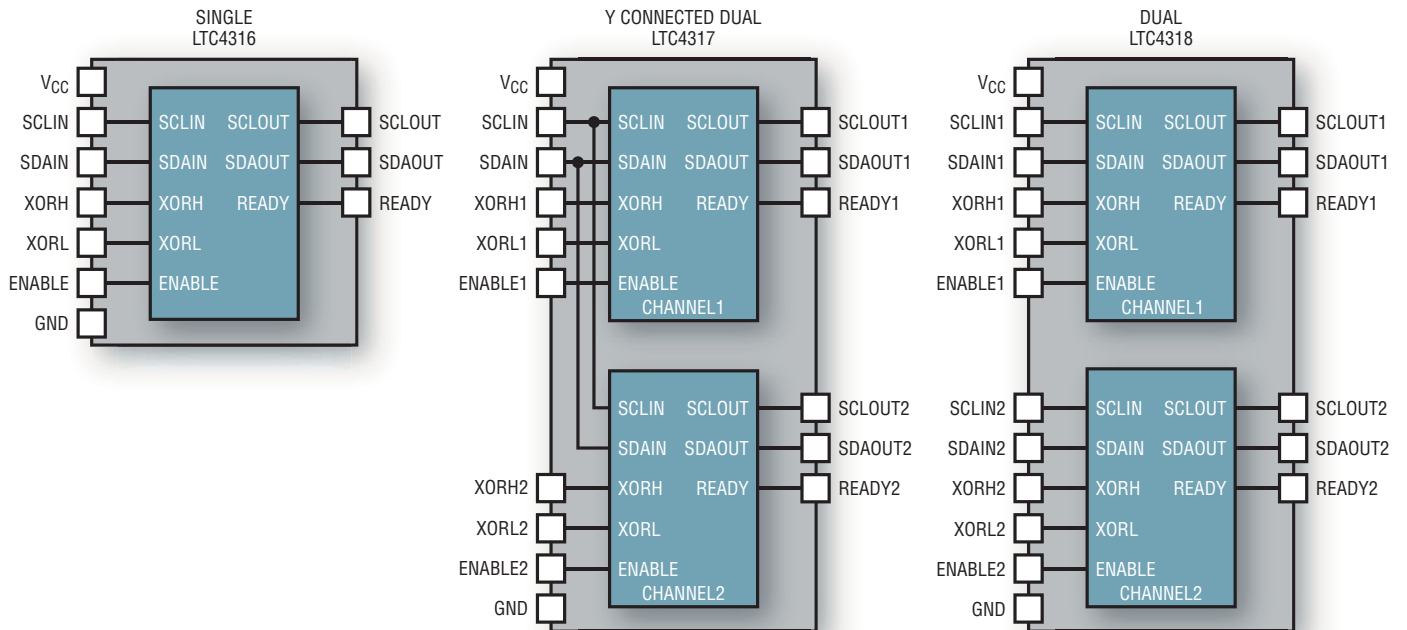
### Two Independent Address Translations



### Two Slaves Sharing One LTC4316



## Part Comparison





## LTC4317

### Dual I<sup>2</sup>C/SMBus Address Translator

#### FEATURES

- Allows Multiple Slaves with the Same Address to Coexist on the Same Bus
- Resistor Configurable Address Translation
- No Software Programming Required
- Compatible with SMBus, I<sup>2</sup>C and I<sup>2</sup>C Fast Mode
- Pass-Through Mode Allows General Call Addressing
- ±4kV HBM ESD Ruggedness
- Level Translation for 2.5V, 3.3V and 5V Buses
- Stuck Bus Timeout
- Prevents SDA and SCL Corruption During Live Board Insertion and Removal
- Support Bus Hot Swap
- 16-Lead DFN 5mm × 3mm Package

#### APPLICATIONS

- I<sup>2</sup>C, SMBus Address Expansion
- Address Translation
- Servers
- Telecom

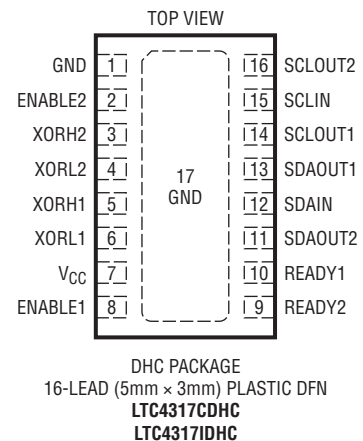
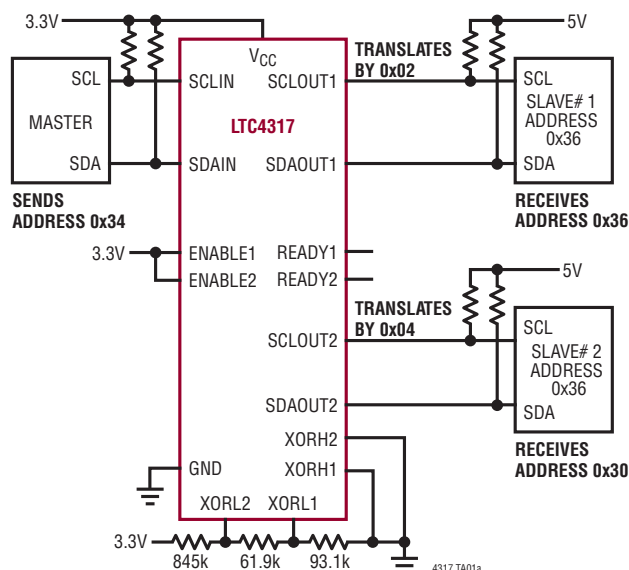
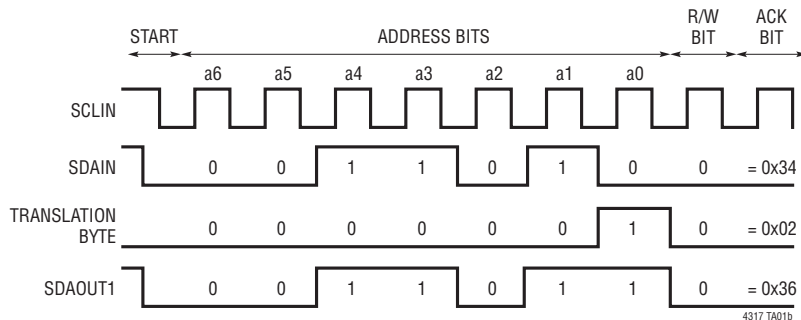
#### DESCRIPTION

The LTC4317 enables the hardwired address of one or more I<sup>2</sup>C or SMBus slave device to be translated to a different address. This allows slaves with the same hardwired address to coexist on the same bus. Only discrete resistors are needed to select the new address and no software programming is required. Up to 127 different address translations are available.

The LTC4317 incorporates a pass-through mode which disables the address translation and allows general call addressing by the master. The LTC4317 is designed to automatically recover from abnormal bus conditions like bus stuck low or premature STOP bits.

The LTC4317 has two output channels for two different sets of slaves. The input channels are tied together to a common set of pins to reduce the pin count and package size.

PART NUMBER	NUMBER OF INPUT CHANNELS	NUMBER OF OUTPUT CHANNELS
LTC4316	1	1
LTC4317	1	2
LTC4318	2	2



## LTC4318

### Dual I<sup>2</sup>C/SMBus Address Translator

#### FEATURES

- Allows Multiple Slaves with the Same Address to Coexist on the Same Bus
- Resistor Configurable Address Translation
- No Software Programming Required
- Compatible with SMBus, I<sup>2</sup>C and I<sup>2</sup>C Fast Mode
- Pass-Through Mode Allows General Call Addressing
- ±4kV HBM ESD Ruggedness
- Level Translation for 2.5V, 3.3V and 5V Buses
- Stuck Bus Timeout
- Prevents SDA and SCL Corruption During Live Board Insertion and Removal
- Support Bus Hot Swap
- 20-Lead QFN 4mm × 4mm Package

#### APPLICATIONS

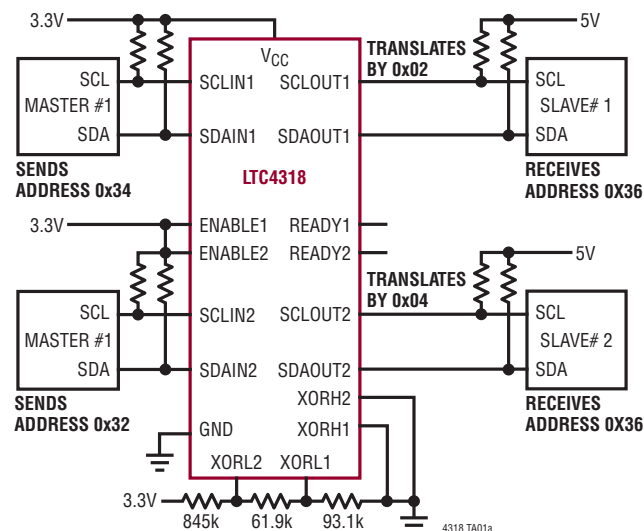
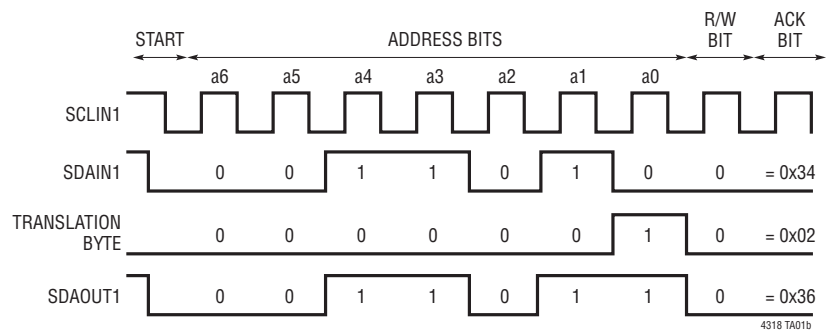
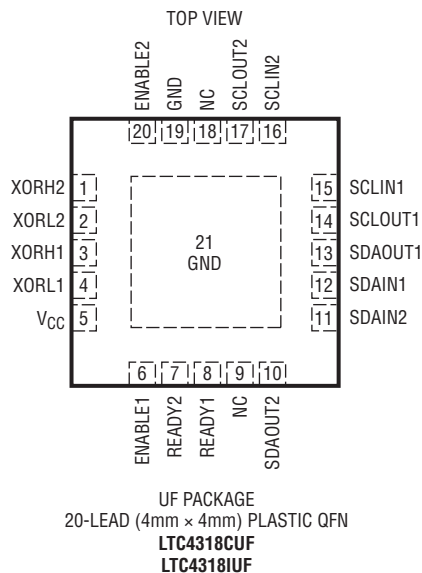
- I<sup>2</sup>C, SMBus Address Expansion
- Address Translation
- Servers
- Telecom

#### DESCRIPTION

The LTC4318 enables the hardwired address of one or more I<sup>2</sup>C or SMBus slave devices to be translated to a different address. This allows slaves with the same hardwired address to coexist on the same bus. Only discrete resistors are needed to select the new address and no software programming is required. Up to 127 different address translations are available.

The LTC4318 incorporates a pass-through mode which disables the address translations and allows general call addressing by the master. The LTC4318 is designed to automatically recover from abnormal bus conditions like bus stuck low or premature STOP bits.

PART NUMBER	NUMBER OF INPUT CHANNELS	NUMBER OF OUTPUT CHANNELS
LTC4316	1	1
LTC4317	1	2
LTC4318	2	2



## LT4276

### LTPoE++/PoE+/PoE PD Forward/Flyback Controller

#### FEATURES

- IEEE802.3af/at and LTPoE++ 90W Powered Device (PD) with Forward/Flyback Controller
- LT4276A Supports All of the Following Standards:
  - LTPoE++ 38.7W, 52.7W, 70W and 90W
  - IEEE 802.3at 25.5W Compliant
  - IEEE 802.3af up to 13W Compliant
- LT4276B is IEEE 802.3at/af Compliant
- LT4276C is IEEE 802.3af Compliant
- Superior Surge Protection (100V Absolute Maximum)
- Wide Junction Temperature Range ( $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ )
- Auxiliary Power Support as Low as 9V
- No Opto-Isolator Required for Flyback Operation
- External Hot Swap N-Channel MOSFET for Lowest Power Dissipation and Highest System Efficiency
- >94% End-to-End Efficiency with LT4321 Ideal Bridge
- Available in a 28-Lead 4mm  $\times$  5mm QFN Package

#### APPLICATIONS

- High Power Wireless Data Systems
- Outdoor Security Camera Equipment
- Commercial and Public Information Displays
- High Temperature Applications

#### DESCRIPTION

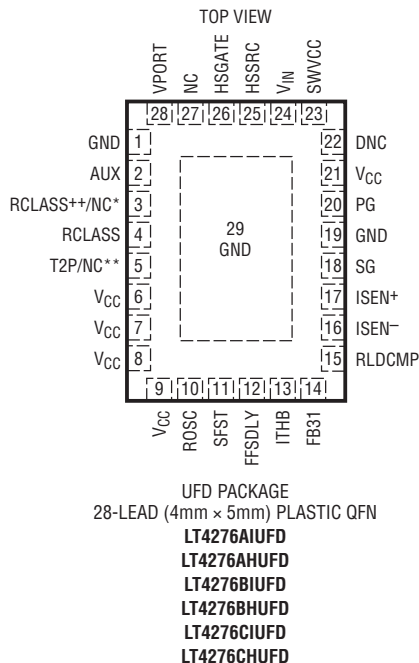
The LT4276 is a pin-for-pin compatible family of IEEE 802.3 and LTPoE++ Powered Device (PD) controllers. It includes an isolated switching regulator controller capable of synchronous operation in both forward and flyback topologies with auxiliary power support. The LT4276A employs the LTPoE++ classification scheme, receiving 38.7W, 52.7W, 70W or 90W of power at the PD RJ45 connector, and is backwards compatible with IEEE 802.3. The LT4276B is a fully 802.3at compliant, 25.5W Type 2 (PoE+) PD. The LT4276C is a fully 802.3af compliant, 13W Type 1 (PoE) PD.

The LT4276 supports both forward and flyback power supply topologies, configurable for a wide range of PoE applications. The flyback topology supports No-Opto feedback. Auxiliary input voltage can be accurately sensed with just a resistor divider connected to the AUX pin.

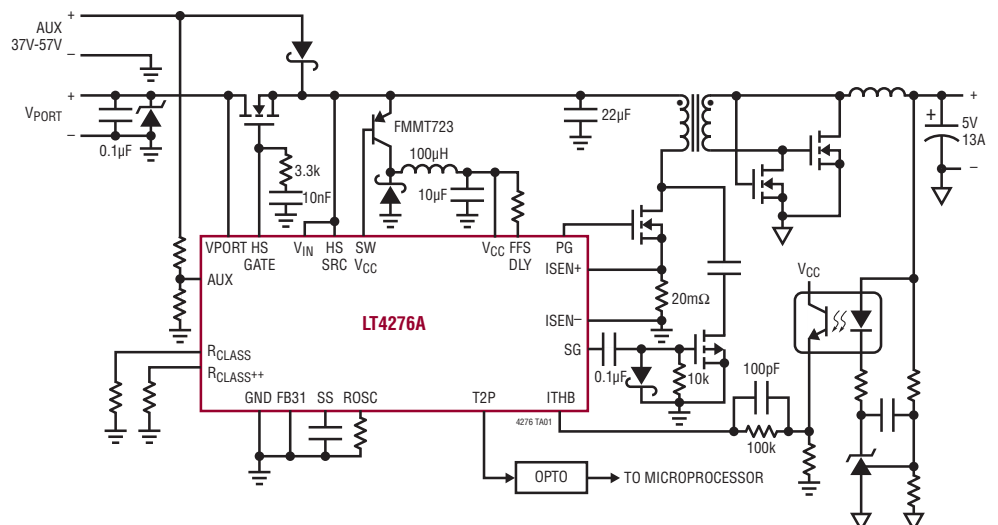
The LT4276 utilizes an external, low  $R_{DS(ON)}$  N-channel MOSFET for the Hot Swap function, maximizing power delivery and efficiency, reducing heat dissipation, and easing the thermal design.

LT4276 Family

MAX DELIVERED POWER	LT4276 GRADE		
	A	B	C
LTPoE++ 90W	●		
LTPoE++ 70W	●		
LTPoE++ 52.7W	●		
LTPoE++ 38.7W	●		
25.5W	●	●	
13W	●	●	●



LTPoE++ 70W Power Supply in a Forward Mode



## LTM4622

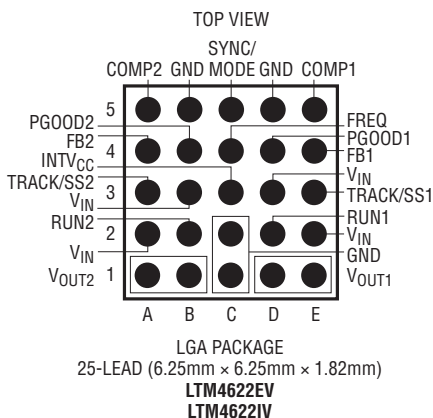
### Dual Ultrathin 2.5A Step-Down DC/DC μModule Regulator

#### FEATURES

- Complete Solution in  $<1\text{cm}^2$
- Wide Input Voltage Range: 3.6V to 20V
- 3.3V Input Compatible with  $V_{\text{IN}}$  Tied to  $\text{INTV}_{\text{CC}}$
- 0.6V to 5.5V Output Voltage
- Dual 2.5A DC, 3A Peak Output Current
- $\pm 1.5\%$  Maximum Total Output Voltage Regulation Error Over Load, Line and Temperature
- Current Mode Control, Fast Transient Response
- External Frequency Synchronization
- Multiphase Parallelable with Current Sharing
- Output Voltage Tracking and Soft-Start Capability
- Selectable Burst Mode® Operation
- Overvoltage Input and Overtemperature Protection
- Power Good Indicators
- 6.25mm × 6.25mm × 1.82mm LGA Package

#### APPLICATIONS

- General Purpose Point of Load Conversion
- Telecom, Networking and Industrial Equipment
- Medical Diagnostic Equipment
- Test and Debug Systems



#### DESCRIPTION

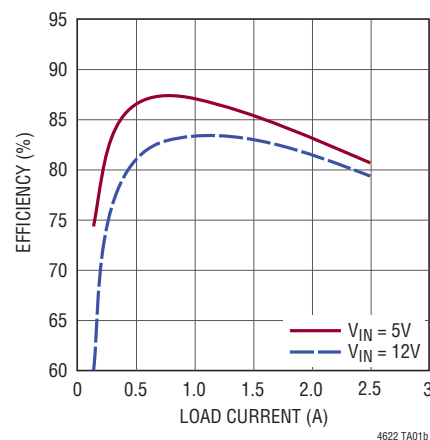
The LTM4622 is a complete dual 2.5A step-down switching mode μModule (micromodule) regulator in a tiny ultrathin 6.25mm × 6.25mm × 1.82mm LGA package. Included in the package are the switching controller, power FETs, inductor and support components. Operating over an input voltage range of 3.6V to 20V, the LTM4622 supports an output voltage range of 0.6V to 5.5V, set by a single external resistor. Its high efficiency design delivers dual 2.5A continuous, 3A peak, output current. Only a few ceramic input and output capacitors are needed.

The LTM4622 supports selectable Burst Mode operation and output voltage tracking for supply rail sequencing. Its high switching frequency and current mode control enable a very fast transient response to line and load changes without sacrificing stability.

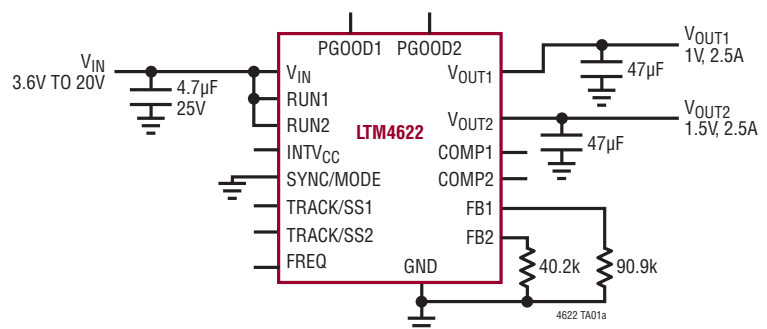
Fault protection features include input overvoltage, output overcurrent and overtemperature protection.

The LTM4622 is RoHS compliant with Pb-free finish.

#### 1.5V Output Efficiency vs Load Current



#### 1.5V and 1V Dual Output DC/DC Step-Down μModule Regulator



## LTM4630-1

Dual 18A or Single 36A μModule Regulator  
with 0.8% DC and 3% Transient Accuracy

### FEATURES

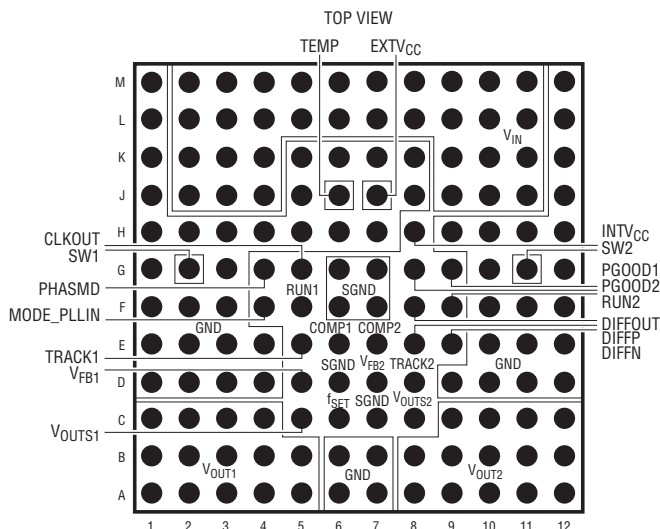
- ±0.8% Maximum Total DC Output Error Over Line, Load and Temperature (LTM4630-1A)
- ±3% Transient Output Error with Minimum Output Capacitance
- Dual 18A or Single 36A Output
- 4.5V to 15V Input, 0.6V to 1.8V Output Voltage Range
- Differential Remote Sense Amplifier
- Current Mode Control/Fast Transient Response
- Current Sharing Up to 144A
- 16mm × 16mm × 5.01mm BGA Package

### APPLICATIONS

- FPGA, ASIC, μProcessor Core Voltage Regulation
- Information, Communication Systems

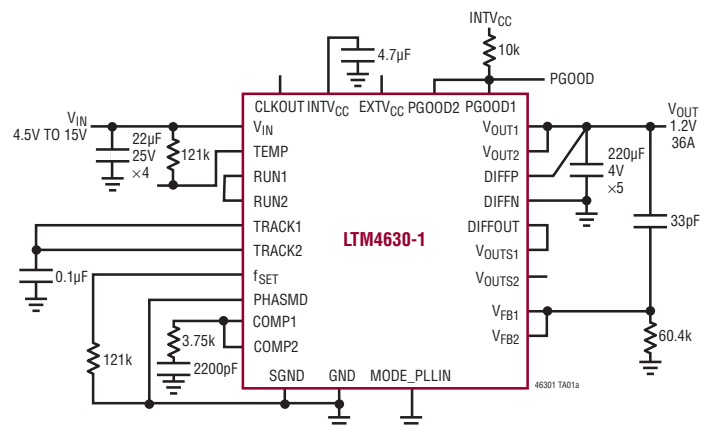
### DESCRIPTION

The LTM4630-1A/LTM4630-1B are dual 18A or single 36A output step-down μModule (micromodule) regulators with ±0.8% (LTM4630-1A) and ±1.5% (LTM4630-1B) total DC output error, respectively, with ±3% transient output error. Included in the package are the switching controller, power FETs, inductors, and all supporting components. External compensation allows for fast transient response to minimize output capacitance when powering FPGAs, ASICs and processors. With synchronized multiphase parallel current sharing, four LTM4630-1 devices can deliver up to 144A. The LTM4630-1 is offered in a 16mm × 16mm × 5.01mm BGA package.

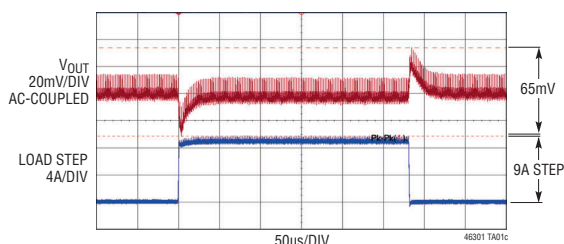


BGA PACKAGE  
144-LEAD (16mm × 16mm × 5.01mm)  
LTM4630EY-1A  
LTM4630IY-1A  
LTM4630EY-1B  
LTM4630IY-1B

### 36A, 1.2V Output DC/DC μModule Regulator

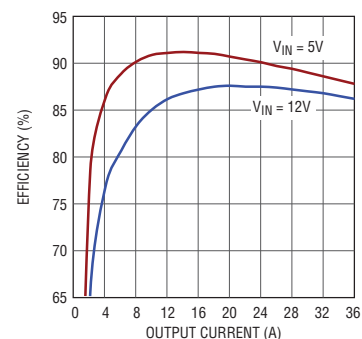


### 25% Load Step Transient Response, ±3% Output Regulation Window. 12V<sub>IN</sub>, 1.2V<sub>OUT</sub>, 36A with 5x 220μF Ceramic Cap



\*SEE DEMO CIRCUIT  
DC2081A-B

### 1.2V Output Efficiency, f<sub>sw</sub> = 500kHz



## LTM4675

Dual 9A or Single 18A μModule Regulator with Digital Power System Management

### FEATURES

- Dual, Fast, Analog Loops with Digital Interface for Control and Monitoring
- Wide Input Voltage Range: 4.5V to 17V
- Output Voltage Range: 0.5V to 5.5V
- $\pm 0.5\%$  Maximum DC Output Error Over Temperature
- $\pm 2.5\%$  Current Readback Accuracy at 9A Load
- 400kHz PMBus-Compliant I<sup>2</sup>C Serial Interface
- Integrated 16-Bit  $\Delta\Sigma$  ADC
- Supports Telemetry Polling Rates Up to 125Hz
- Constant Frequency Current Mode Control
- Parallel and Current Share Multiple Modules
- All 7-Bit Slave Addresses Supported
- Drop-In Pin-Compatible to Dual 13A LTM4676A
- 16mm × 11.9mm × 3.51mm BGA Package

### Readable Data:

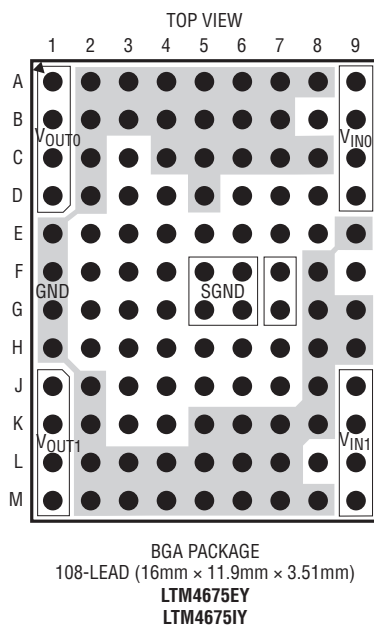
- Input and Output Voltages, Currents and Temperatures
- Running Peak Values, Uptime, Faults and Warnings
- Onboard EEPROM Fault Log Record

### Writable Data and Configurable Parameters:

- Output Voltage, Voltage Sequencing and Margining
- Digital Soft-Start/Stop Ramp
- OV/UV/OT, UVLO, Frequency and Phasing

### APPLICATIONS

- System Optimization, Characterization and Data Mining in Prototype, Production and Field Environments



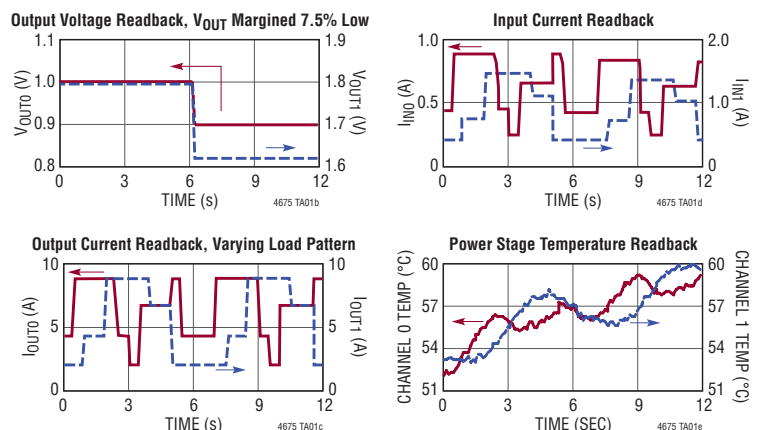
### DESCRIPTION

The LTM4675 is a dual 9A or single 18A step-down μModule (micromodule) DC/DC regulator with 70ms turn-on time. It features remote configurability and telemetry-monitoring of power management parameters over PMBus— an open standard I<sup>2</sup>C-based digital interface protocol. The LTM4675 is comprised of fast analog control loops, precision mixed-signal circuitry, EEPROM, power MOSFETs, inductors and supporting components.

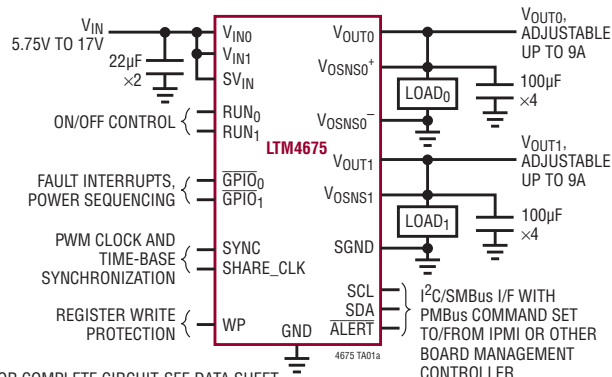
The LTM4675's 2-wire serial interface allows outputs to be margined, tuned and ramped up and down at programmable slew rates with sequencing delay times. Input and output currents and voltages, output power, temperatures, uptime and peak values are readable. Custom configuration of the EEPROM contents is not required. At start-up, output voltages, switching frequency, and channel phase angle assignments can be set by pin-strapping resistors. The LTpowerPlay GUI and DC1613 USB-to-PMBus converter and demo kits are available.

The LTM4675 is offered in a 16mm × 11.9mm × 3.51mm BGA package available with SnPb or RoHS compliant terminal finish.

### Using PMBus and LTpowerPlay™ to Monitor Telemetry and Margin V<sub>OUT0</sub>/V<sub>OUT1</sub> During Load Pattern Tests. 10Hz Polling Rate. 12V<sub>IN</sub>



### Dual 9A μModule Regulator with Digital Interface for Control and Monitoring\*



\*FOR COMPLETE CIRCUIT, SEE DATA SHEET



## LTM4676A

Dual 13A or Single 26A μModule Regulator with Digital Power System Management

### FEATURES

- Dual, Fast, Analog Loops with Digital Interface for Control and Monitoring
- Wide Input Voltage Range: 4.5V to 17V
- Output Voltage Range: 0.5V to 5.5V
- $\pm 0.5\%$  Maximum DC Output Error Over Temperature
- $\pm 2.5\%$  Current Readback Accuracy at 10A Load
- 400kHz PMBus-Compliant I<sup>2</sup>C Serial Interface
- Integrated 16-Bit  $\Delta\Sigma$  ADC
- Supports Telemetry Polling Rates Up to 125Hz
- Constant Frequency Current Mode Control
- Parallel and Current Share Multiple Modules
- All 7-Bit Slave Addresses Supported
- Rail and Global Addressing Supported
- 16mm × 16mm × 5.01mm BGA Package

### Readable Data:

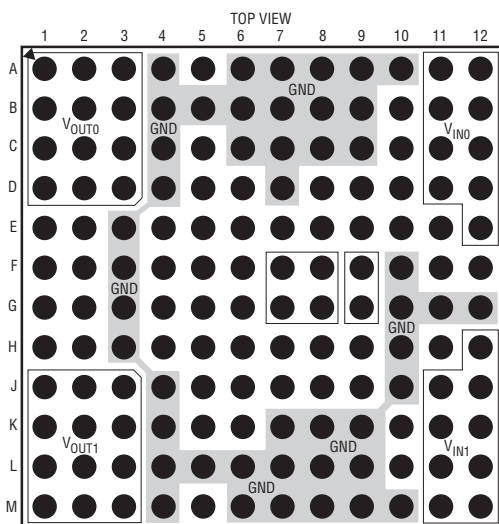
- Input and Output Voltages, Currents, and Temperatures
- Running Peak Values, Uptime, Faults and Warnings
- Onboard EEPROM Fault Log Record

### Writable Data and Configurable Parameters:

- Output Voltage, Voltage Sequencing and Margining
- Digital Soft-Start/Stop Ramp
- OV/UV/OT, UVLO, Frequency and Phasing

### APPLICATIONS

- System Optimization, Characterization and Data Mining in Prototype, Production and Field Environments



BGA PACKAGE  
144-LEAD (16mm × 16mm × 5.01mm)  
**LTM4676AEY**  
**LTM4676AIY**

### DESCRIPTION

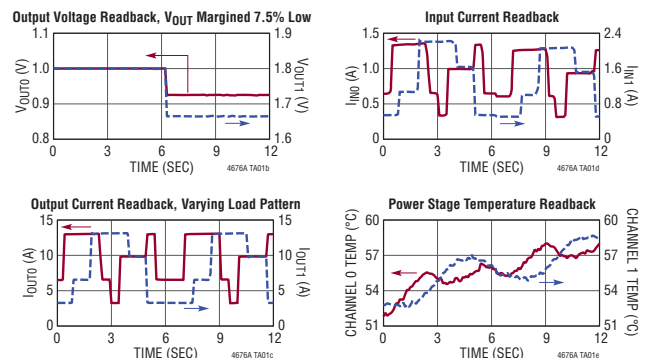
The LTM4676A is a dual 13A or single 26A step-down μModule (micromodule) DC/DC regulator with 70ms turn-on time. It features remote configurability and telemetry-monitoring of power management parameters over PMBus— an open standard I<sup>2</sup>C-based digital interface protocol. The LTM4676A is comprised of fast analog control loops, precision mixed-signal circuitry, EEPROM, power MOSFETs, inductors and supporting components.

The LTM4676A's 2-wire serial interface allows outputs to be margined, tuned and ramped up and down at programmable slew rates with sequencing delay times. Input and output currents and voltages, output power, temperatures, uptime and peak values are readable. At start-up, output voltages, switching frequency, and channel phase angle assignments can be set by pin-strapping resistors. The LTpowerPlay GUI and DC1613 USB-to-PMBus converter and demo kits are available.

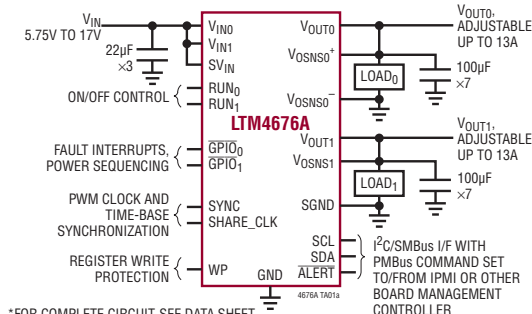
PART NUMBER	TURN-ON START-UP TIME (MAX) (ms)	V <sub>IN</sub> RANGE (V)	V <sub>OUT</sub> RANGE (V)	PIN-COMPATIBLE
LTM4676	170	4.5 to 26.5	0.5V to 4 (CH0) 0.5 to 5.4 (CH1)	Yes
LTM4676A	70	4.5 to 17	0.5 to 5.5 (Both CH)	

See Table 1 and page 18 on data sheet for more on LTM4676A's enhancements over LTM4676's feature set.

### Using PMBus and LTpowerPlay to Monitor Telemetry and Margin V<sub>OUT0</sub>/V<sub>OUT1</sub> During Load Pattern Tests. 10Hz Polling Rate. 12V<sub>IN</sub>



### Dual 13A μModule Regulator with Digital Interface for Control and Monitoring\*



\*FOR COMPLETE CIRCUIT, SEE DATA SHEET

## LTC3110

### 2A Bidirectional Buck-Boost DC/DC Regulator and Charger/Balancer

#### FEATURES

- **V<sub>CAP</sub> Operating Range: 0.1V to 5.5V**
- **V<sub>SYN</sub> Operating Range: 1.71V to 5.25V**
- **Automatic Switchover from Charge to Backup Mode**
- **Programmable  $\pm 2\%$  Accurate Charge Input Current Limit from 125mA to 2A**
- **$\pm 1\%$  Backup Voltage Accuracy**
- **Automatic Backup Capacitor Balancing**
- Fixed 1.2MHz Switching Frequency
- Burst Mode Operation: 40 $\mu$ A Quiescent Current
- Built-In Programmable Multipurpose Comparator with Open-Collector Output
- Open-Collector Outputs to Indicate Direction of Operation and End of Charge
- Thermally Enhanced TSSOP-24 and 4mm  $\times$  4mm QFN-24 Packages

#### APPLICATIONS

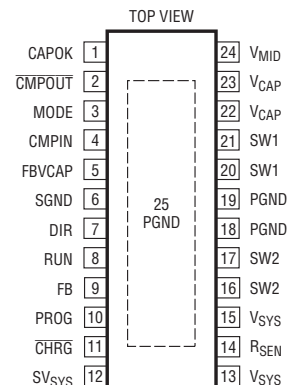
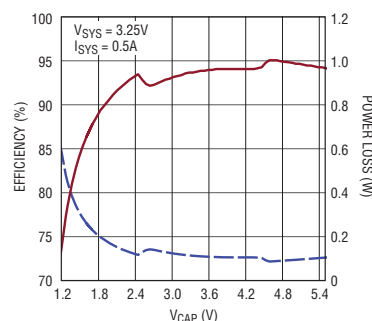
- Supercapacitor Backup Converter and Charger
- Battery Backup Converter and Charger
- Servers, RAID Systems
- RF Systems with Battery/Capacitor Backup

#### DESCRIPTION

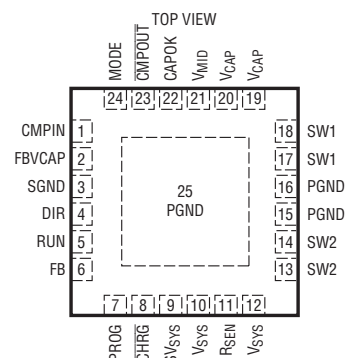
The LTC3110 is a 2A bidirectional buck-boost DC/DC regulator with capacitor charger and balancer. Its wide 0.1V to 5.5V capacitor/battery voltage and 1.8V to 5.25V system backup voltage ranges make it well suited to a wide variety of backup applications using supercapacitors or batteries. A proprietary low noise switching algorithm optimizes efficiency with capacitor/battery voltages that are above, below or equal to the system output voltage.

The LTC3110 can autonomously transition from charge to backup mode or switch modes based on an external command. Pin-selectable Burst Mode operation reduces standby current and improves light-load efficiency, which combined with a 1 $\mu$ A shutdown current make the LTC3110 ideally suited for backup applications. Additional features include voltage supervisors for direction control and end of charge, and a general purpose comparator with open-collector output for interfacing with a  $\mu$ C. The LTC3110 is available in thermally enhanced, low profile 24-lead TSSOP and 4mm  $\times$  4mm QFN packages.

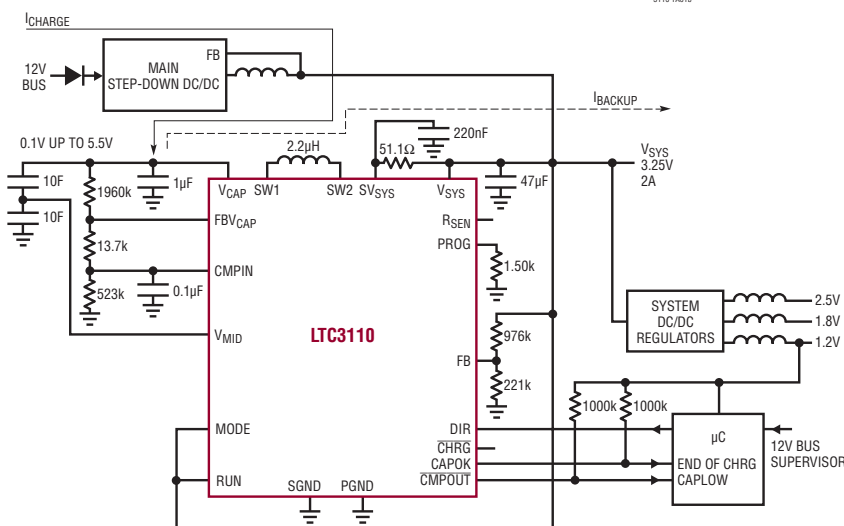
#### Backup Mode Efficiency



FE PACKAGE  
24-LEAD PLASTIC TSSOP  
**LTC3110EFE**  
**LTC3110IFE**



UF PACKAGE  
24-LEAD (4mm  $\times$  4mm) PLASTIC QFN  
**LTC3110EUF**  
**LTC3110IUF**



## LTC3335

### Nanopower Buck-Boost DC/DC with Integrated Coulomb Counter

#### FEATURES

- 680nA Input Quiescent Current (Output in Regulation at No Load)
- 1.8V to 5.5V Input Operating Range
- Selectable Output Voltages of 1.8V, 2.5V, 2.8V, 3V, 3.3V, 3.6V, 4.5V, 5V
- Integrated Coulomb Counter Measures Accumulated Battery Discharge
- ±5% Battery Discharge Measurement Accuracy
- Programmable Peak Input Current of 5mA, 10mA, 15mA, 25mA, 50mA, 100mA, 150mA, 250mA
- Up to 50mA of Output Current
- Up to 90% Efficiency
- Programmable Coulomb Counter Prescaler for Wide Range of Battery Sizes
- Programmable Discharge Alarm Threshold
- I<sup>2</sup>C Interface
- Low Profile (0.75mm) 20-Lead (3mm × 4mm) QFN Package

#### APPLICATIONS

- Long Lifetime Primary Cell Battery Applications
- Wireless Sensors
- Remote Monitors
- Dust Networks® SmartMesh® Applications

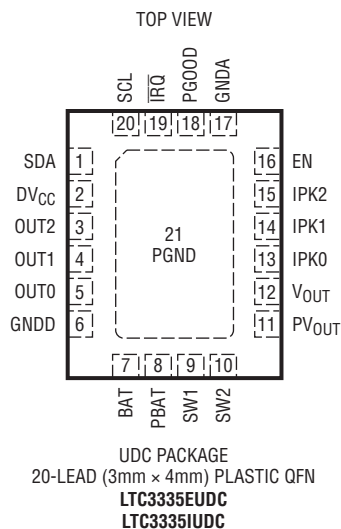
#### DESCRIPTION

The LTC3335 is a high efficiency, low quiescent current (680nA) buck-boost DC/DC converter with an integrated precision coulomb counter which monitors accumulated battery discharge in long life battery powered applications. The buck-boost can operate down to 1.8V on its input and provides eight pin-selectable output voltages with up to 50mA of output current.

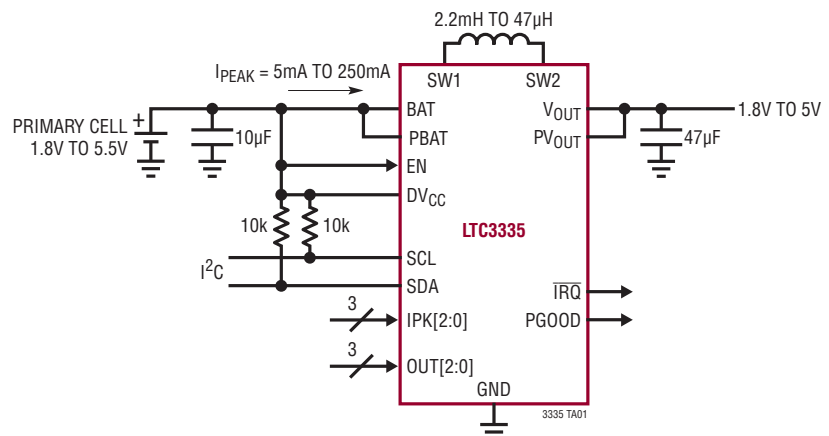
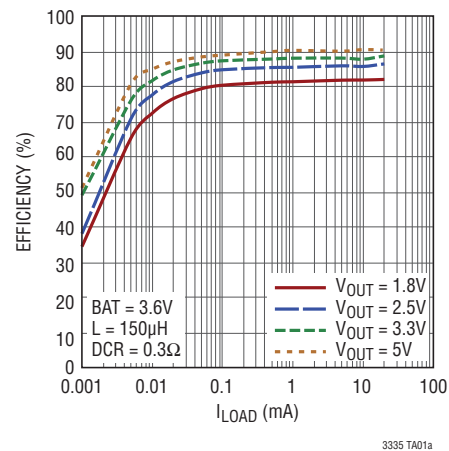
The coulomb counter stores the accumulated battery discharge in an internal register accessible via an I<sup>2</sup>C interface. The LTC3335 features a programmable discharge alarm threshold. When the threshold is reached, an interrupt is generated at the  $\overline{\text{IRQ}}$  pin.

To accommodate a wide range of battery types and sizes, the peak input current can be selected from as low as 5mA to as high as 250mA and the full-scale coulomb counter has a programmable range of 32,768:1.

The LTC3335 is available in a 3mm × 4mm QFN-20 package.



Efficiency vs Load for 100mA  
I<sub>PEAK</sub> Setting



## LTC3815

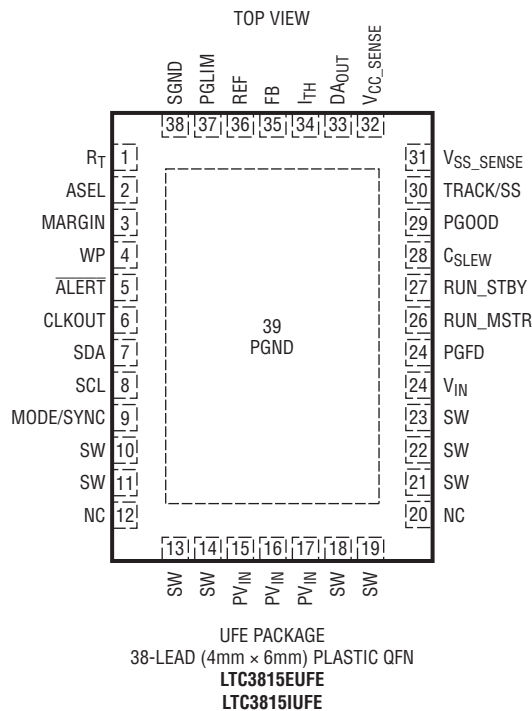
### 6A Monolithic Synchronous DC/DC Step-Down Converter with Digital Power System Management

#### FEATURES

- 2.25V to 5.5V Input Voltage Range
- ±1% Total Output Voltage Accuracy Over Temperature at  $V_{IN} = 3.3V$  or 5V
- Single Resistor-Programmable Output Voltage
- PMBus Compliant Serial Interface:
  - Programmable Output Voltage Margining: Up to ±25%  $V_{OUT}$  Range with 0.1% Resolution
  - Read back of Average and Peak Temperature, Current, and Voltage (25Hz Refresh Rate)
  - Fault Status
- Phase-Lockable Fixed Frequency Up to 3MHz
- Less Than 1ms Power-Up Time
- Integrated 13-Bit ADC
- Optional External Reference Input
- Pin Selectable Fast-Margining of the Output Voltage
- Power Good Flag with Pin Programmable Thresholds and Filter Delay
- Differential Remote Output Voltage Sensing
- Master Shutdown Mode: <1μA Supply Current
- Clock Out for 2-Phase Operation (12A Output Current)
- Available in a Thermally Enhanced 38-Lead 4mm × 6mm QFN Package

#### APPLICATIONS

- Intelligent Energy Efficient Power Conversion
- ASIC/FPGA/Processor Power
- Distributed Power Systems
- Point of Load Power Conversion

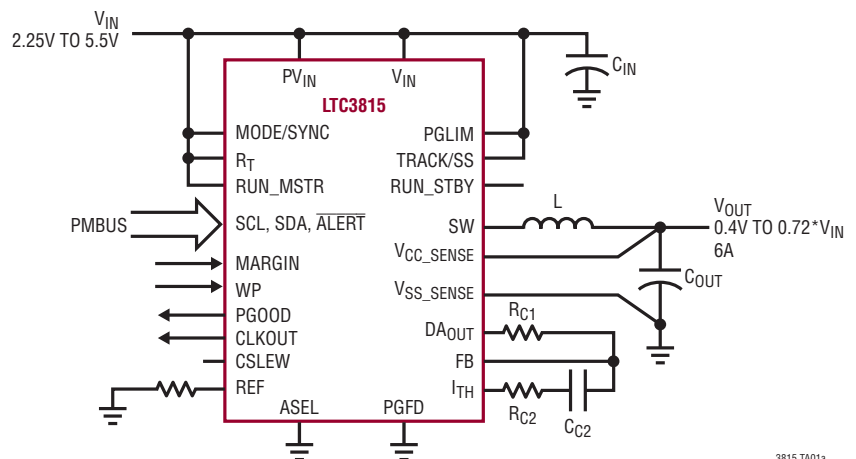
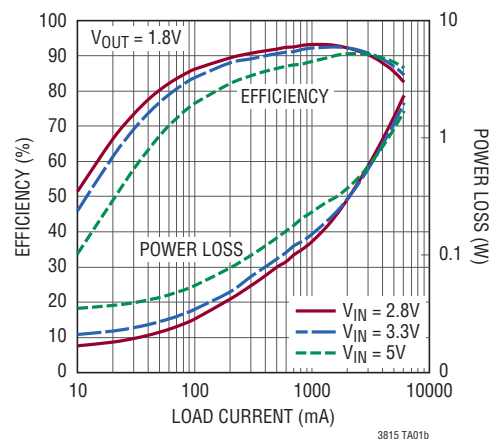


#### DESCRIPTION

The LTC3815 is a high efficiency, 6A monolithic synchronous buck regulator using a phase lockable controlled on-time, current mode architecture. The output voltage is programmable from 0.4V to 72% of  $V_{IN}$  with a single external resistor or an external voltage reference through the reference input (REF) pin. The output voltage can be margined up or down up to 25% with 0.1% resolution via a PMBus-compliant serial interface. The serial interface can also be used to read back fault status and both time-averaged (~4ms) and peak input/output current, input/output voltage, and temperature. System configuration and monitoring is supported by the LTpowerPlay development system.

The architecture provides extremely fast transient response and allows operation at the very low on-times required to regulate low output voltages at high switching frequencies. The operating frequency is programmable from 400kHz to 3MHz with an external resistor or for noise sensitive applications, it can be synchronized to an external clock over the same range. The operating supply voltage range is from 2.25V to 5.5V making it suitable for operation from 2.5V, 3.3V or 5V rails or lithium-ion batteries.

Efficiency and Power Loss vs Load Current



## LT8330

Low  $I_Q$  Boost/SEPIC/Inverting Converter with 1A, 60V Switch

### FEATURES

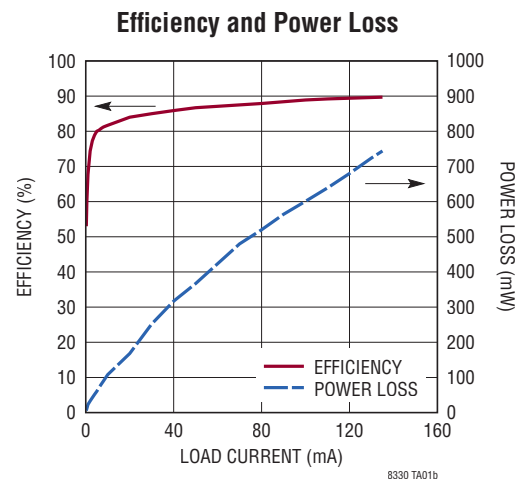
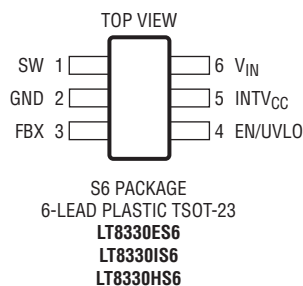
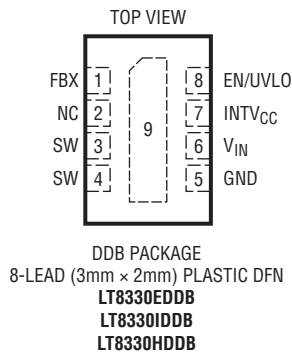
- 3V to 40V Input Voltage Range
- Ultralow Quiescent Current and Low Ripple Burst Mode Operation:  $I_Q = 6\mu A$
- 1A, 60V Power Switch
- Positive or Negative Output Voltage Programming with a Single Feedback Pin
- Fixed 2MHz Switching Frequency
- Accurate 1.6V EN/UVLO Pin Threshold
- Internal Compensation and Soft-Start
- Low Profile (1mm) ThinSOT™ Package
- Low Profile (0.75mm) 8-Lead (3mm × 2mm) DFN Package

### APPLICATIONS

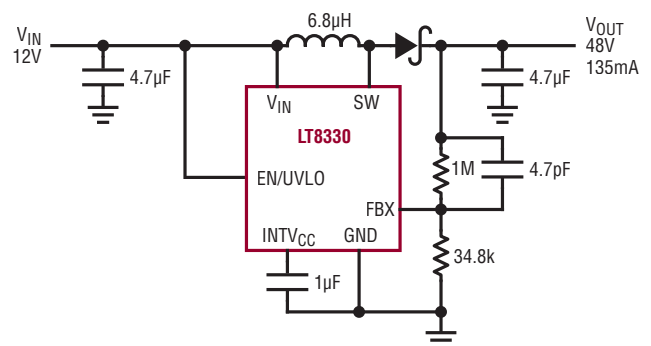
- Industrial and Automotive
- Telecom
- Medical Diagnostic Equipment
- Portable Electronics

### DESCRIPTION

The LT8330 is a current mode DC/DC converter capable of generating either positive or negative output voltages using a single feedback pin. It can be configured as a boost, SEPIC or inverting converter consuming as low as  $6\mu A$  of quiescent current. Low ripple Burst Mode operation maintains high efficiency down to very low output currents while keeping the output ripple below 15mV in a typical application. The internally compensated current mode architecture results in stable operation over a wide range of input and output voltages. Integrated soft-start and frequency foldback functions are included to control inductor current during start-up. The 2MHz operation combined with small package options, enables low cost, area efficient solutions.



### 48V Boost Converter



## LT8494

SEPIC/Boost DC/DC Converter with 2A, 70V Switch, and 7 $\mu$ A Quiescent Current

### FEATURES

- Low Ripple Burst Mode Operation:
  - 7 $\mu$ A  $I_Q$  at 12V<sub>IN</sub> to 5V<sub>OUT</sub>
  - Output Ripple (<10mV Typ.)
- Dual Supply Pins:
  - Improves Efficiency
  - Reduces Minimum Supply Voltage to ~1V after Start-Up to Extend Battery Life
- Wide Input Voltage Range of ~1V to 60V (2.5V to 32V for Start-Up)
- PG Functional for Input Supply Down to 1.3V
- FMEA Fault Tolerant in TSSOP Package
- Fixed Frequency PWM, SEPIC/BOOST/FLYBACK Topologies
- NPN Power Switch: 2A/70V
- Programmable Switching Frequency: 250kHz to 1.5MHz
- UVLO Programmable on SWEN Pin
- Soft-Start Programmable with One Capacitor
- Small 20-Lead QFN or 20-Lead TSSOP Packages

### APPLICATIONS

- Automotive ECU Power
- Power for Portable Products
- Industrial Supplies

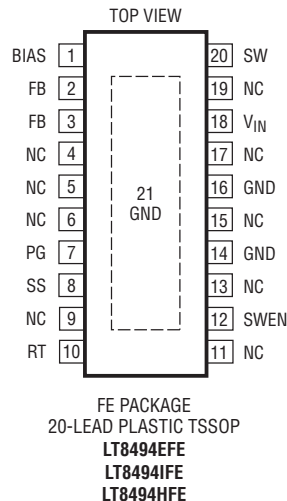
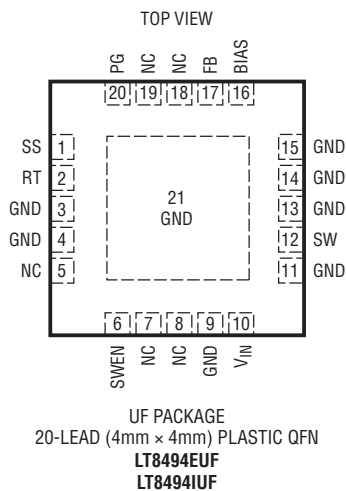
### DESCRIPTION

The LT8494 is an adjustable frequency (250kHz to 1.5MHz) monolithic switching regulator. Quiescent current can be less than 7 $\mu$ A when operating and is ~0.3 $\mu$ A when SWEN is low. The LT8494 can be configured as either a SEPIC, boost or flyback converter.

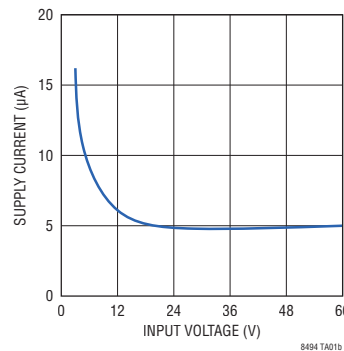
The low ripple Burst Mode operation maintains high efficiency at low output current while keeping output ripple below 10mV. Dual supply pins (V<sub>IN</sub> and BIAS) allow the part to automatically operate from the most efficient supply. Input supply voltage can be up to 60V for SEPIC topologies and up to 32V (with ride-through up to 60V) for boost and flyback topologies. After start-up, battery life is extended since the part can draw current from its output (BIAS) even when V<sub>IN</sub> voltage drops below 2.5V.

Using a resistor divider on the SWEN pin provides a programmable undervoltage lockout (UVLO) for the converter. A power good flag signals when V<sub>OUT</sub> reaches 92% of the programmed output voltage.

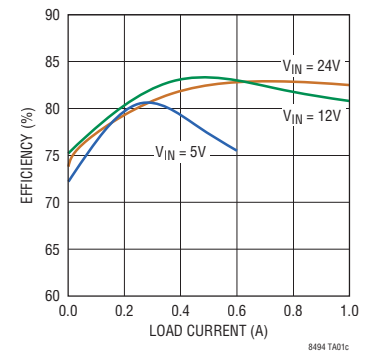
Additional features such as frequency foldback and soft-start are integrated. The LT8494 is available in 20-lead QFN and 20-lead TSSOP packages with exposed pads for low thermal resistance. Fault tolerance in the TSSOP allows for adjacent pin shorts or an open without raising the output voltage above its programmed value.



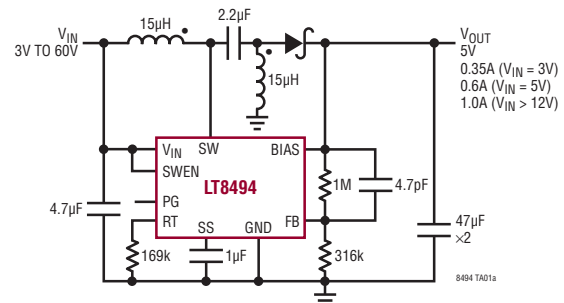
### No-Load Supply Current



### Efficiency



### 450kHz, 5V Output SEPIC Converter





## LT8602

### 42V Quad Monolithic Synchronous Step-Down Regulator

#### FEATURES

- Flexible Power Supply System Providing Four Outputs with a Wide Input Range
- Two High Voltage Synchronous Buck Regulators:
  - 3V to 42V Input Voltage Range
  - Output Currents Up to 2.5A and 1.5A
  - High Efficiency Up to 93%
- Two Low Voltage Synchronous Buck Regulators:
  - 2.6V to 5.5V Input Voltage Range
  - Output Currents Up to 1.8A and 94% Efficiency
- Resistor Programmable and Synchronizable 250kHz to 2.2MHz Switching Frequency
- Low Ripple Burst Mode Operation:
  - 30μA  $I_Q$  at 12V<sub>IN</sub>
  - Output Ripple < 15mV
- Programmable Power-On Reset
- Power Good Indicators
- 2-Phase Clock Reduces Input Current Ripple
- Available in Thermally Enhanced 40-Lead QFN (6mm × 6mm) Package

#### APPLICATIONS

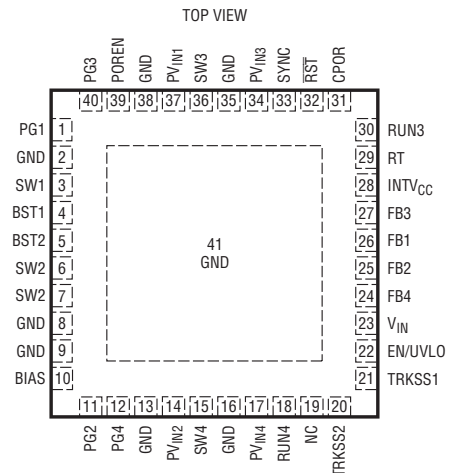
- Automotive Systems
- Distributed Supply Regulation
- Industrial Controls and Power Supplies

#### DESCRIPTION

The LT8602 is a quad channel, current mode, monolithic buck switching regulator with a programmable power-on reset. All regulators are synchronized to a single oscillator with an adjustable frequency from 250kHz to 2.2MHz. The LT8602 can be configured for micropower Burst Mode operation or pulse-skipping operation at light load. Micropower operation results in quiescent current of 30μA with all four regulators operating in the application below.

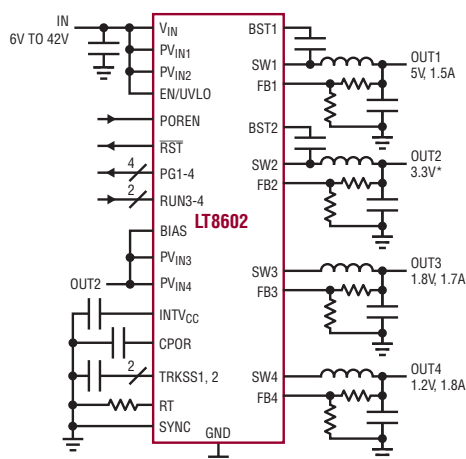
The high voltage channels are synchronous buck regulators that operate from an input of 3V to 42V. The output currents are up to 1.5A (OUT1) and 2.5A (OUT2). The low voltage channels operate from an input of 2.6V to 5.5V. Internal synchronous power switches provide high efficiency with output currents up to 1.8A. The LT8602 uses a 2-phase clock with channels 1 and 3 operating 180° from channels 2 and 4 to reduce input ripple current on both HV and LV inputs. All channels have cycle-by-cycle current limit, providing protection against shorted outputs. Thermal shutdown provides additional protection.

The LT8602 is available in a 40-lead 6mm × 6mm QFN package.



UJ PACKAGE  
40-LEAD (6mm × 6mm) PLASTIC QFN  
LT8602EUJ  
LT8602IUJ

### 5V, 3.3V, 1.8V and 1.2V Step-Down Regulators



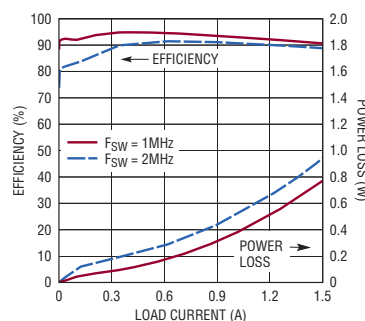
$$*I_{OUT2} = 2.5A - I_{PVIN3} - I_{PVIN4}$$

8602 TA01a

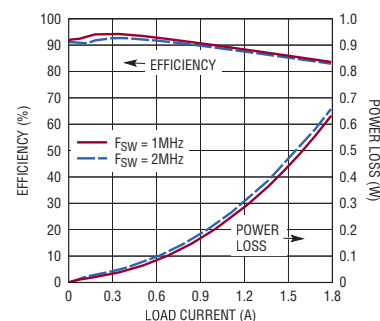
8602 TA01b

8602 TA01c

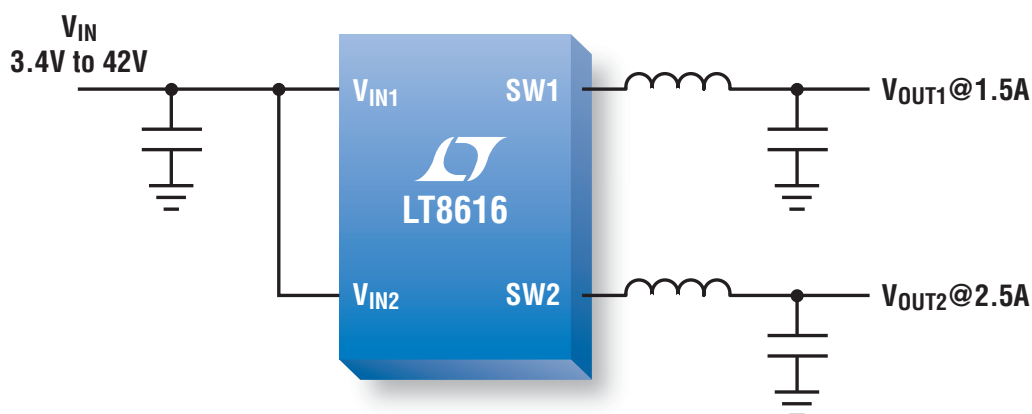
#### HV Channel Efficiency, $V_{IN} = 12V$ , $V_{OUT1} = 5V$



#### LV Channel Efficiency, $V_{OUT3} = 1.8V$



# *DUAL* 42V, 2MHz Sync Buck



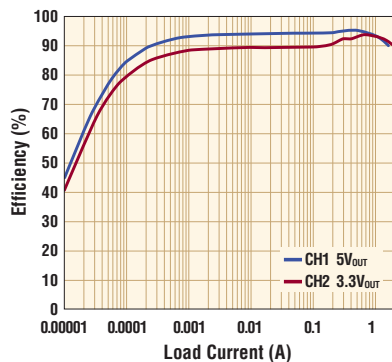
## 96% Efficient, 2.5A and 1.5A Outputs, 6.5 $\mu$ A $I_Q$

The LT<sup>®</sup>8616 brings a new level of performance for 42V input monolithic synchronous buck converters by incorporating dual outputs in a FMEA compliant 28-pin package. Channel 1 is capable of delivering 1.5A of continuous output current, while channel 2 can deliver 2.5A, both with outputs as low as 0.8V. Each channel operates 180° out of phase to further reduce input ripple. Burst Mode<sup>®</sup> operation requires only 6.5 $\mu$ A of quiescent current (both channels on), thereby extending battery life in battery-powered systems. For high step-down ratio applications, the LT8616 bucks from 16V down to 1.5V at a switching frequency of 2MHz, enabling a compact solution footprint.

### ▼ Features

- Input Voltage Range: 3.4V to 42V
- Dual Outputs: 2.5A and 1.5A
- Ultralow Quiescent Current: 6.5 $\mu$ A (Both Channels On)
- Low Output Ripple: < 10mV<sub>P-P</sub>
- Adjustable/Synchronizable Frequency: 200kHz to 3MHz
- High Step-Down Ratios: 16V to 1.5V@2MHz
- 28-Lead 3mm x 6mm QFN and FMEA Compliant TSSOP-28E Packages

Efficiency with  
12V<sub>IN</sub> to 5V<sub>OUT</sub> and 3.3V<sub>OUT</sub>



### ▼ Info & Free Samples

[www.linear.com/product/LT8616](http://www.linear.com/product/LT8616)

[www.linear.com/LT86XX](http://www.linear.com/LT86XX)

1-800-4-LINEAR

LT, LT, LTC, LTM, Linear Technology, the Linear logo and Burst Mode are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

## LT8616

### Dual 42V Synchronous Monolithic Step-Down Regulator with 6.5μA Quiescent Current

#### FEATURES

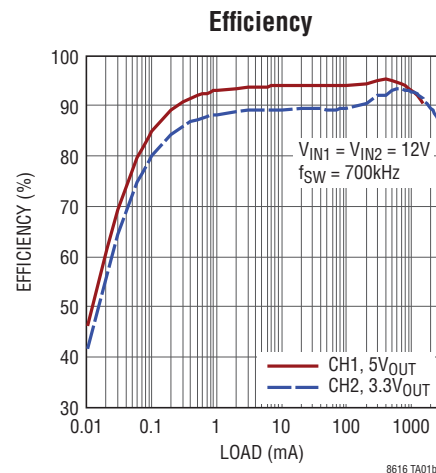
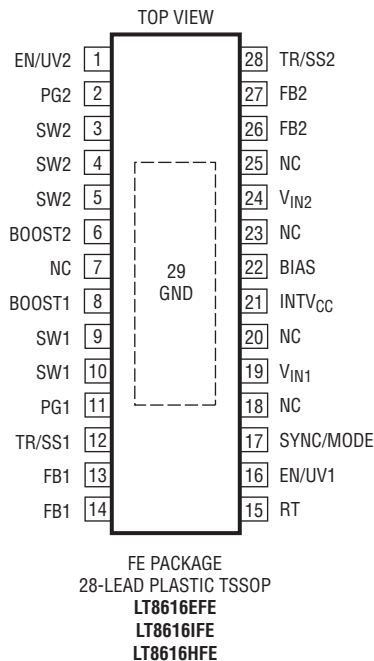
- Wide Input Voltage Range: 3.4V to 42V
- 2.5A and 1.5A Buck Regulators with Separate Inputs
- Fast Minimum Switch On-Time: 35ns
- Ultralow Quiescent Current Burst Mode Operation:
  - 6.5μA  $I_Q$  Regulating 12V<sub>IN</sub> to 5V<sub>OUT</sub> and 3.3V<sub>OUT</sub>
  - Output Ripple < 15mV
- 180° Out-of-Phase Switching
- Adjustable and Synchronizable: 200kHz to 3MHz
- Accurate 1V Enable Pin Thresholds
- Internal Compensation
- Output Soft-Start and Tracking
- TSSOP Package: Output Stays at or Below Regulation Voltage During Adjacent Pin Short or When a Pin Is Left Floating
- Thermally Enhanced 28-Lead TSSOP Package

#### APPLICATIONS

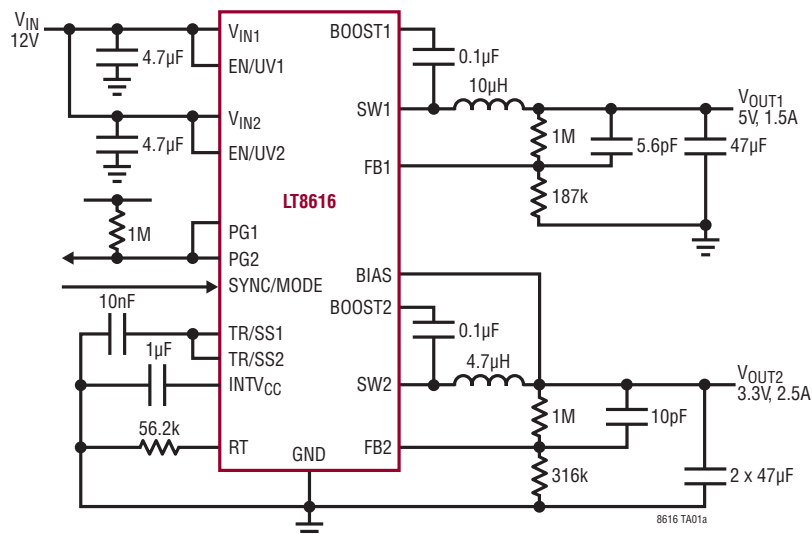
- Automotive and Industrial Supplies
- General Purpose Step-Down

#### DESCRIPTION

The LT8616 is a high efficiency, high speed, dual synchronous monolithic step-down switching regulator that consumes only 6.5μA of quiescent current with both channels enabled. Both channels contain all switches and necessary circuitry to minimize the need for external components. Low ripple Burst Mode operation enables high efficiency down to very low output currents while minimizing output ripple. A SYNC pin allows synchronization to an external clock. Internal compensation with peak current mode topology allows the use of small inductors and results in fast transient response and good loop stability. The enable pins have accurate 1V thresholds and can be used to program undervoltage lockout. Capacitors on the TR/SS pins programs the output voltage ramp rate during start-up while the PG pins signal when each output is within 10% of the programmed output voltage. The LT8616 is available in a TSSOP package for high reliability.



#### 5V, 3.3V, 700kHz Step-Down Converter



## LT8631 100V, 1A Synchronous Micropower Step-Down Regulator

### FEATURES

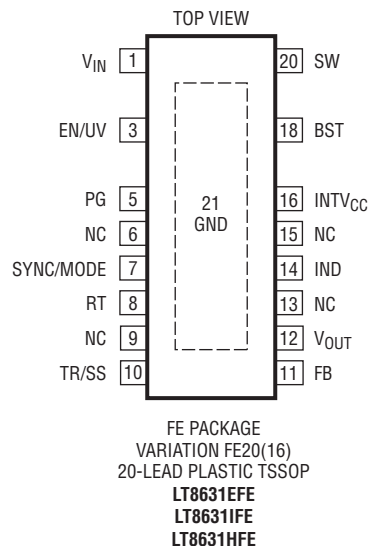
- **Ultrawide Input Voltage Range: 3V to 100V**
- **Output Voltage Range: 0.8V to 60V**
- **Internal Synchronous Switches**
- **Low Ripple Burst Mode Operation:**  
16 $\mu$ A  $I_Q$  at 12V<sub>IN</sub> to 5V<sub>OUT</sub> Output Ripple <10mV<sub>p,p</sub>  
7 $\mu$ A  $I_Q$  at 48V<sub>IN</sub> to 5V<sub>OUT</sub> Output Ripple <10mV<sub>p,p</sub>
- **Low Dropout: 99% Maximum Duty Cycle**
- **Peak Current Mode Control**
- **Fixed Frequency Operation: 100kHz to 1MHz**
- **Synchronization Input**
- **Programmable Undervoltage Lockout**
- **Power Good Flag**
- Flexible Output Voltage Tracking
- Short-Circuit Protection
- Low Shutdown Current: 5 $\mu$ A
- Tolerates Pin Open/Short Faults
- Thermally Enhanced 20-Lead TSSOP with High Voltage Lead Spacing

### APPLICATIONS

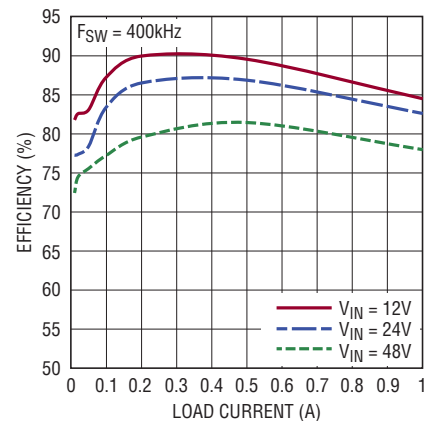
- Automotive Supplies
- Telecom Supplies
- Distributed Supply Regulation

### DESCRIPTION

The LT8631 is a current mode PWM step-down DC/DC converter with internal synchronous switches that provide current for output loads up to 1A. The wide input range of 3V to 100V makes the LT8631 suitable for regulating power from a wide variety of sources, including automotive and industrial systems and 36V to 72V telecom supplies. Low ripple Burst Mode operation enables high efficiency operation down to very low output currents while keeping the output ripple below 10mV<sub>p,p</sub>. Resistor programmable 100kHz to 1MHz frequency range and synchronization capability enable optimization between efficiency and external component size. The soft-start feature controls the ramp rate of the output voltage, eliminating input current surge during start-up, while also providing output tracking. A power good flag signals when the output voltage is within  $\pm 7.5\%$  of the regulated output. Undervoltage lockout can be programmed using the EN/UV pin. Shutdown mode reduces the total quiescent current to < 5 $\mu$ A. The LT8631 is available in a 20-lead TSSOP package with exposed pad for low thermal resistance and high voltage lead spacing.

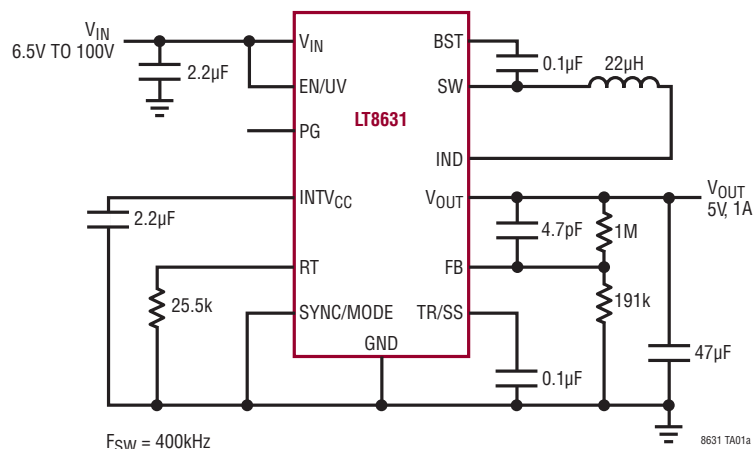


Efficiency vs Load Current



8631 TA01b

### 5V, 1A Step-Down Converter



8631 TA01a

## LTC2984

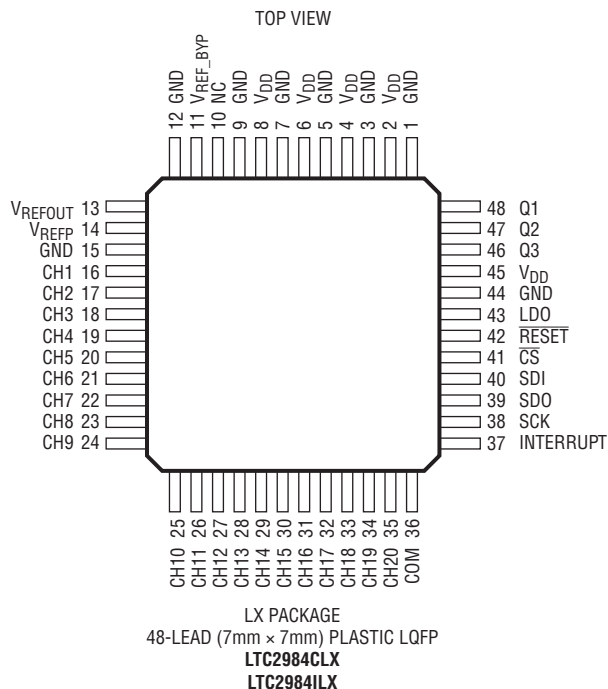
### Multi-Sensor High Accuracy Digital Temperature Measurement System with EEPROM

#### FEATURES

- Directly Digitizes 2-, 3-, or 4-Wire RTDs, Thermocouples, Thermistors, and Diodes
- On-Chip EEPROM Stores Channel Configuration Data and Custom Coefficients
- Single 2.85V to 5.25V Supply
- 20 Flexible Inputs Allow Interchanging Sensors
- Automatic Thermocouple Cold Junction Compensation
- Built-In Standard and User-Programmable Coefficients for Thermocouples, RTDs and Thermistors
- Measures Negative Thermocouple Voltages
- Automatic Burn Out, Short-Circuit and Fault Detection
- Buffered Inputs Allow External Protection
- Simultaneous 50Hz/60Hz Rejection
- Includes 15ppm/°C (Max) Reference (I-Grade)

#### APPLICATIONS

- Direct Thermocouple Measurements
- Direct RTD Measurements
- Direct Thermistor Measurements
- Custom Sensor Applications

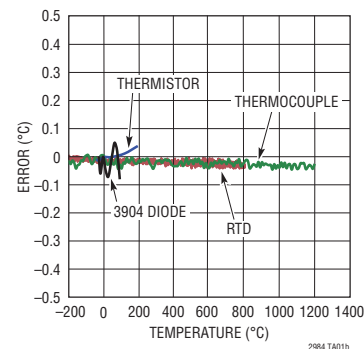


#### DESCRIPTION

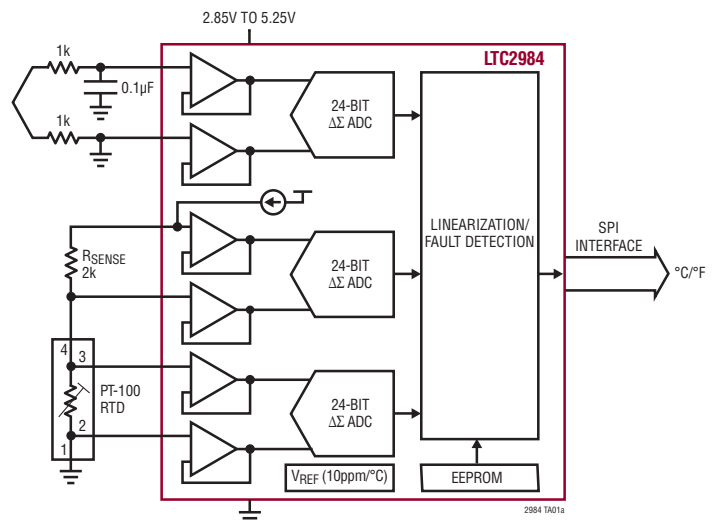
The LTC2984 measures a wide variety of temperature sensors and digitally outputs the result, in °C or °F, with 0.1°C accuracy and 0.001°C resolution. The LTC2984 can measure the temperature of virtually all standard (type B, E, J, K, N, S, R, T) or custom thermocouples, automatically compensate for cold junction temperatures and linearize the results. The device can also measure temperature with standard 2-, 3-, or 4-wire RTDs, thermistors, and diodes. It has 20 reconfigurable analog inputs enabling many sensor connections and configuration options. The LTC2984 includes excitation current sources and fault detection circuitry appropriate for each type of temperature sensor as well as an EEPROM for storing custom coefficients and channel configuration data.

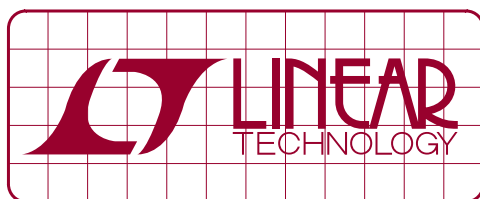
The LTC2984 allows direct interfacing to ground referenced sensors without the need for level shifters, negative supply voltages or external amplifiers. All signals are buffered and simultaneously digitized with three high accuracy, 24-bit  $\Delta\Sigma$  ADCs, driven by an internal 10ppm/°C (maximum) reference.

Typical Temperature Error Contribution



#### Thermocouple Measurement with Automatic Cold Junction Compensation





# DESIGN NOTES

## Micropower Op Amp Drives 8-Channel 18-Bit Simultaneous Sampling ADC without Compromising Accuracy or Breaking the Power Budget

Design Note 541

Guy Hoover

### Introduction

The op amps used to drive 18-bit analog-to-digital converters (ADCs) typically draw as much supply current as the ADC itself, often with a maximum offset spec that is well above that of the ADC. If multiple ADC channels are required, the power dissipation from these drivers quickly rises to unacceptable levels.

If 18-bit precision is required (SNR, THD,  $V_{OS}$ ), but not high sampling rates, and the input signals are low frequency or DC, the simple buffer presented is capable of driving the LTC<sup>®</sup>2348-18 8-channel simultaneous sampling ADC. It also achieves performance equivalent to typical specs for SNR, THD and offset performance with very low power dissipation.

### Circuit Description

The LTC2348-18 is a low noise, 8-channel simultaneous sampling 18-bit successive approximation register (SAR) ADC with wide input common mode range. With a  $\pm 10.24V$  input range, the LTC2348-18 achieves  $-109dB$  THD (typical),  $96.7dB$  SNR (typical) with an offset of  $\pm 550\mu V$  (maximum) while dissipating only  $140mW$  (typical) at  $200ksps$ . When operated at the  $10ksps$  rate of this application, the ADC's power consumption drops to  $45mW$  (typical) by using the device's NAP mode.

The LT6020 is a dual micropower,  $5V/\mu s$  precision rail-to-rail output op amp with input offset voltage of less than  $30\mu V$  (maximum) that draws only  $100\mu A$  per amplifier (maximum).

The circuit of Figure 1 shows the LT6020 op amp configured as a noninverting buffer driving the analog inputs of the LTC2348-18. Maximum power dissipation of each op amp is only  $3mW$ . For all eight channels this adds up to only  $24mW$ , approximately half the ADC power consumption at  $10ksps$ .

The RC filter at the buffer output minimizes the noise contribution of the LT6020 and reduces the effect of the sampling transient caused by the MUX and the input sampling capacitor. For a chosen RC time constant, the R value should be kept as small as possible to reduce the voltage drop across the resistor. This results in a gain error if the filter output is not allowed to settle completely. The R value must be large enough to prevent excessive ringing at the op amp output, which adds to settling time and increases distortion.

LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

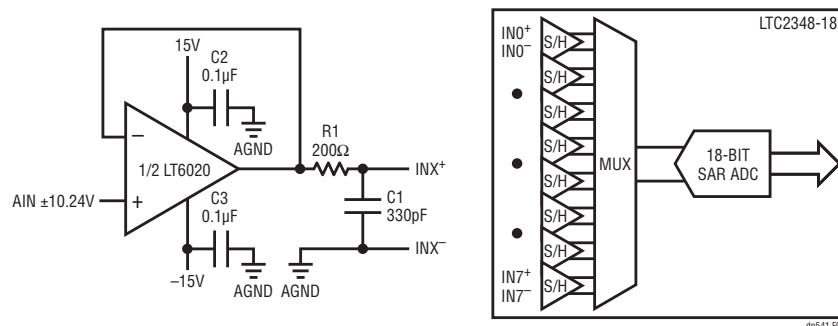


Figure 1. LT6020 Buffer Driving the LTC2348-18 8-Channel Simultaneous Sampling SAR ADC



The LTC2348-18 accepts arbitrary differential input signals swinging over a wide common mode range. Differential signals may be buffered into the positive and negative analog inputs using two unity-gain amplifiers. Pseudo-differential input signals referenced to a low impedance node such as ground require only one buffer amplifier. This second case is used by the circuit in Figure 1.

### Circuit Performance

All data and curves shown were taken with the DC2094A-A. Improved performance may be possible by holding  $t_{ACQ}$  constant at 12 $\mu$ s while varying the sample rate. Figure 2 shows an 8192-point FFT of the LTC2348-18 driven pseudo-differentially by the buffer of Figure 1. THD is -108dB and SNR is 95.8dBFS at 10ksps, which compares well with the typical specs of the LTC2348-18.

Figure 3 shows SNR and THD vs sampling rate. SNR stays fairly flat near 96dBFS up to 10ksps. THD starts to rise above -108dB at 10ksps.

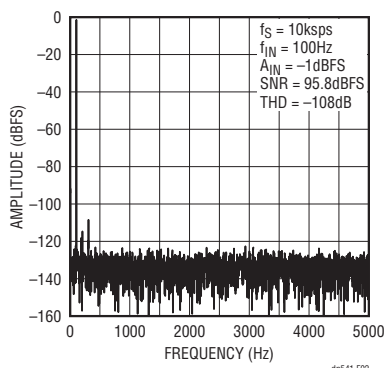


Figure 2. 8192-Point FFT for the Circuit of Figure 1

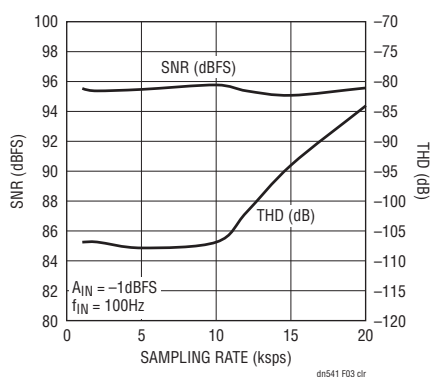


Figure 3. SNR and THD vs Sampling Rate for the Circuit of Figure 1

Figure 4 shows SNR and THD vs input frequency. Both SNR and THD slowly degrade from the typical specs of the LTC2348-18 above 100Hz until at 1kHz SNR is 94dBFS and THD is -85dB.

Figure 5 shows the combined offset error of the LT6020 driver and ADC vs sampling rate. Offset is initially less than 1LSB and starts to degrade as the sampling rate exceeds 10ksps.

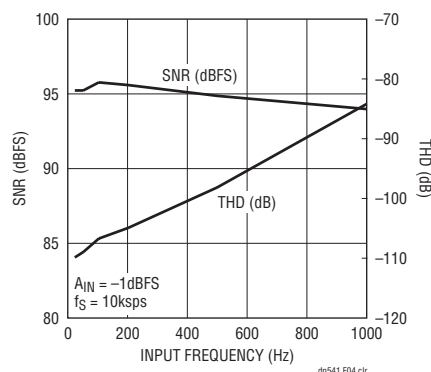


Figure 4. SNR and THD vs Input Frequency for the Circuit of Figure 1

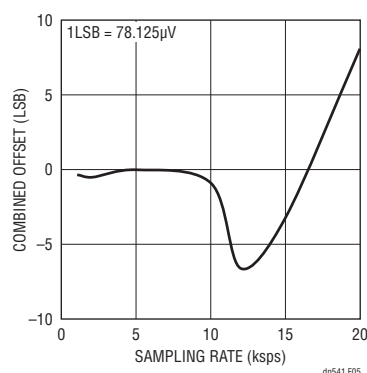


Figure 5. Combined ADC and Driver Offset vs Sampling Rate for the Circuit of Figure 1

### Conclusion

A simple driver for the LTC2348-18 18-bit, 200ksps, 8-channel simultaneous sampling SAR ADC—consisting of the LT6020 low power precision dual op amp configured as noninverting buffers—dissipates only 3mW per op amp (maximum), and at 10ksps the LTC2348-18 dissipates only 45mW. At a sampling rate of 10ksps, SNR is measured at 95.8dB, THD -109dB and offset is measured at less than 1LSB.

### Data Sheet Download

[www.linear.com/LTC2348-18](http://www.linear.com/LTC2348-18)

For applications help,  
call (408) 432-1900, Ext. 3227

Linear Technology Corporation  
1630 McCarthy Blvd., Milpitas, CA 95035-7417  
(408) 432-1900 • FAX: (408) 434-0507 • [www.linear.com](http://www.linear.com)

dn541f LT/AP 0815 111K REV A • PRINTED IN THE USA

**LINEAR**  
TECHNOLOGY  
© LINEAR TECHNOLOGY CORPORATION 2015

# Sales Offices

## NORTH AMERICA

### WESTERN U.S.

2085 E. Technology Cir., Ste. 101  
**Tempe, AZ** 85284  
Tel: (480) 777-1600  
Fax: (480) 838-1104

7595 Irvine Center Dr., Ste. 120  
**Irvine, CA** 92618  
Tel: (949) 453-4650  
Fax: (949) 453-4765

11300 W. Olympic Blvd., Ste. 700  
**Los Angeles, CA** 90064  
Tel: (818) 703-0835  
Fax: (818) 703-0517

720 Sycamore Dr.  
**Milpitas, CA** 95035  
Tel: (408) 428-2050  
Fax: (408) 432-6331

3009 Douglas Blvd., Ste. 140  
**Roseville, CA** 95661  
Tel: (916) 787-5210  
Fax: (916) 787-0110

5090 Shoreham Place, Ste. 110  
**San Diego, CA** 92122  
Tel: (858) 638-7131  
Fax: (858) 638-7231

7102 La Vista Place, Ste. 201  
**Niwot, CO** 80503  
Tel: (303) 926-0002  
Fax: (303) 530-1477

**Salt Lake City, NV**  
Tel: (801) 731-8008

5285 SW Meadows Rd., Ste. 240  
**Lake Oswego, OR** 97035  
Tel: (503) 431-6960  
Fax: (503) 431-6961

2018 156th Ave. NE, Ste. 100  
**Bellevue, WA** 98007  
Tel: (425) 748-5010  
Fax: (425) 748-5009

### MIDWEST U.S.

2040 E. Algonquin Rd., Ste. 512  
**Schaumburg, IL** 60173  
Tel: (847) 925-0860  
Fax: (847) 925-0878

**Indiana**  
Tel: (847) 925-0860

**Iowa**  
Tel: (847) 925-0860

**Kansas**  
Tel: (913) 634-7966

**Michigan**  
Tel: (440) 239-0817

7805 Telegraph Rd., Ste. 225  
**Bloomington, MN** 55438  
Tel: (952) 903-0605

**Missouri**  
Tel: (913) 634-7966

**Columbus, OH**  
Tel: (614) 488-4466

7550 Lucerne Dr., Ste. 106  
**Middleburg Heights, OH** 44130  
Tel: (440) 239-0817  
Fax: (440) 239-1466

**Wisconsin**  
Tel: (262) 331-4040

### NORTHEAST U.S.

**Connecticut**  
Tel: (860) 228-4104

15 Research Place  
**North Chelmsford, MA** 01863  
Tel: (978) 656-4750  
Fax: (978) 656-4760

**New York**  
Tel: (978) 656-4750

3220 Tillman Dr., Ste. 120  
**Bensalem, PA** 19020  
Tel: (215) 638-9667  
Fax: (215) 638-9764

### SOUTHEAST U.S.

**Huntsville, AL**  
Tel: (256) 881-9850

**Fort Lauderdale, FL**  
Tel: (407) 688-7616

**Orlando, FL**  
Tel: (407) 688-7616

**Tampa, FL**  
Tel: (813) 634-9434

**Atlanta, GA**  
Tel: (770) 888-8137

170 Weston Oaks Ct.  
**Cary, NC** 27513  
Tel: (919) 677-0066  
Fax: (919) 678-0041

8500 N. Mopac, Ste. 603  
**Austin, TX** 78759  
Tel: (512) 795-8000  
Fax: (512) 795-0491

22515 Sail Harbour Ct.  
**Katy, TX** 77450  
Tel: (713) 463-5002

2301 W. Plano Pkwy., Ste. 109  
**Plano, TX** 75075  
Tel: (972) 733-3071  
Fax: (972) 380-5138

## CANADA

**Calgary, AB**  
Tel: (403) 455-3577

**Vancouver, BC**  
Tel: (604) 783-3084

**Ottawa, ON**  
Tel: (613) 680-3473

**Toronto, ON**  
Tel: (440) 239-0817

**Montreal, QC**  
Tel: (514) 236-6261

## ASIA/PACIFIC

### AUSTRALIA/NEW ZEALAND

133 Alexander Street  
Crows Nest, **NSW** 2065, **Australia**  
Tel: +61 (0)2 9432 7803  
Fax: +61 (0)2 9439 2738

Suite 121A, 89 High Street  
Kew, **Victoria** 3101, **Australia**  
Tel: +61 3 9854 6120

### CHINA

Room 1763, Office Building  
New Century Hotel  
No. 6 Southern Road of Capital Gym  
Haidian District  
**Beijing, China** 100044  
Tel: +86 (10) 6801-1080  
Fax: +86 (10) 6805-4030

Unit 09, 14/F, Complex Building  
No. 88 Shenghe Yi Rd., Hi-Tech Zone  
Sichuan Province, **Chengdu City**  
China 610041  
Tel: +86 28-8555 9725  
Fax: +86 28-8542 6859

Unit 1503-04, Metroplaza Tower 2  
223 Hing Fong Road  
Kwai Fong, N.T., **Hong Kong**  
Tel: +852 2428-0303  
Fax: +852 2348-0885

Room 2701, City Gateway  
No. 398 Cao Xi North Road  
**Shanghai, China** 200030  
Tel: +86 (21) 6375-9478  
Fax: +86 (21) 5465-5918

Room 2109-2111, 21/F, Block D  
Southern International Plaza  
3013 Yitian Road, Futian District  
**Shenzhen, China** 518048  
Tel: +86 755-2360-4866  
Fax: +86 755-2360-4966

Room 1805, Tower A  
Optics Valley International Plaza  
No. 889 Luoyu Rd., Wuchang District  
**Wuhan, China** 430074  
Tel: +86 027-8665 9231  
Fax: +86 027-8665 9241

Rm. 2410, Tower A, Greenland SOHO  
No. 5 ZhangBa 1 Road  
High-Tech Development Zone  
Shaanxi Province  
**Xian, China** 710065  
Tel: +86 029-6851 8978/6851 8979  
Fax: +86 029-6851 8976

## INDIA

602, 6th Floor, Prestige Meridian-1  
No. 29, MG Road, **Bangalore**  
560001, India  
Tel: +91 80 4012-4610  
Fax: +91 80 4012-4612

## JAPAN

7F, Sakuradori Ohtsu KT Bldg.  
3-20-22 Marunouchi, Naka-ku  
**Nagoya-shi**, 460-0002, Japan  
Tel: +81 (52) 955-0056  
Fax: +81 (52) 955-0058

6F Kearny Place Honmachi Bldg.  
1-6-13 Awaza, Nishi-ku  
**Osaka-shi**, 550-0011, Japan  
Tel: +81 (6) 6533-5880  
Fax: +81 (6) 6543-2588

8F Shuwa Kioicho Park Bldg.  
3-6 Kioicho Chiyoda-ku  
**Tokyo**, 102-0094, Japan  
Tel: +81 (3) 5226-7291  
Fax: +81 (3) 5226-0268

## KOREA

Yundang Building, #1002  
Samsung-Dong 144-23  
Kangnam-Ku  
**Seoul** 135-090, Korea  
Tel: +82 (2) 792-1617  
Fax: +82 (2) 792-1619

## SINGAPORE

507 Yishun Industrial Park A  
**Singapore** 768734  
Tel: +65 6753-2692  
Fax: +65 6752-0108

## TAIWAN

8F-1, 77, Nanking E. Rd., Sec. 3  
**Taipei, Taiwan**  
Tel: +886 (2) 2505-2622  
Fax: +886 (2) 2516-0702

## EUROPE

### FINLAND

Kirkkokatu 31  
90100 **Oulu**, Finland  
Tel: +358 (0)46 712 2171  
Fax: +358 (0)46 712 2175

Teknobulevardi 3-5, P.O. Box 35  
FIN-01531 **Vantaa**, Finland  
Tel: +358 (0)46 712 2171  
Fax: +358 (0)46 712 2175

### FRANCE

Parc Tertiaire Silic  
2 Rue de la Couture, BP10217  
94518 **Rungis** CEDEX, France  
Tel: +33 (1) 56 70 19 90  
Fax: +33 (1) 56 70 19 94

### GERMANY

Haselburger Damm 4  
D-59387 **Ascheberg**, Germany  
Tel: +49 (2593) 9516-0  
Fax: +49 (2593) 951679

Osterfeldstrasse 84, Haus C  
D-85737 **Ismaning**, Germany  
Tel: +49 (89) 962455-0  
Fax: +49 (89) 963147

Jesinger Strasse 65  
D-73230 **Kirchheim/Teck**, Germany  
Tel: +49 (0)7021 80770  
Fax: +49 (0)7021 807720

### ITALY

Via Torri Bianche 3, Palazzo Larice  
20871 **Vimercate** (MB), Italy  
Tel: +39 039 596 5080  
Fax: +39 039 596 5090

### SWEDEN

Electrum 204, Isafjordsgatan 22  
SE-164 40 **Kista**, Sweden  
Tel: +46 (8) 623 16 00  
Fax: +46 (8) 623 16 50

### UNITED KINGDOM

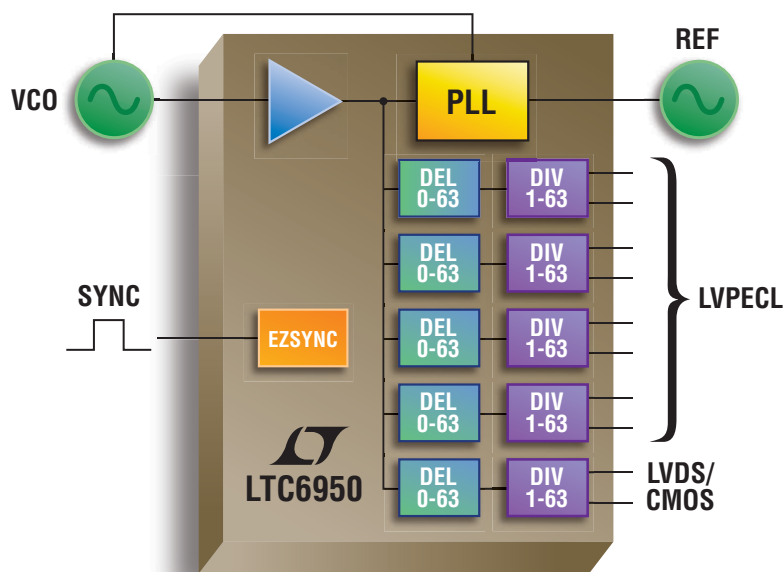
3 The Listons, Liston Road  
**Marlow**, Buckinghamshire SL7 1FD  
United Kingdom  
Tel: +44 (1628) 477066  
Fax: +44 (1628) 478153



**Linear Technology Corporation**

1630 McCarthy Blvd., Milpitas, CA 95035-7417

# 1.4GHz Clean Clocking Solution <20fs<sub>RMS</sub> Jitter



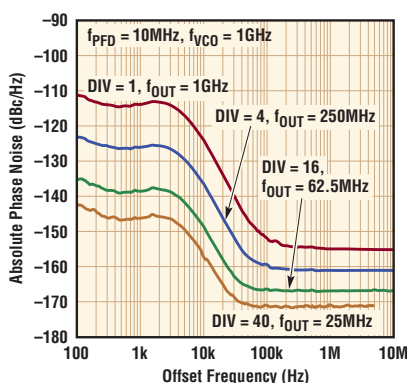
## High Performance, Low Phase Noise Clock Generator

Our new low jitter clock generation and distribution device is ideal for clocking high speed and high resolution ADCs and DACs without compromising performance. The LTC<sup>®</sup>6950 offers best-in-class additive noise performance. The LTC6950 PLL core delivers outstanding 1/f phase noise and in-band phase noise performance. In addition, our proprietary EZSync<sup>™</sup> multichip synchronization feature assures consistent edge alignment across all outputs.

### ▼ LTC6950 Features

- Additive Jitter <20fs<sub>RMS</sub> (12kHz to 20MHz)
- Additive Jitter <90fs<sub>RMS</sub> (10Hz to Nyquist Frequency)
- 1.4GHz Maximum Frequency
- Programmable 1 to 63 Output Dividers
- Programmable 0 to 63 Clock Cycle Delay
- EZSync Multichip Clock Edge Synchronization
- -226dBc/Hz Normalized In-Band Phase Noise Floor
- -274dBc/Hz Normalized 1/f Phase Noise

### LTC6950 Closed-Loop Phase Noise



### ▼ Info & Free Samples

[www.linear.com/ClockingSolutions](http://www.linear.com/ClockingSolutions)

1-800-4-LINEAR



LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks and EZSync and ClockWizard are trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.