

Charge Pump Products

March 2003

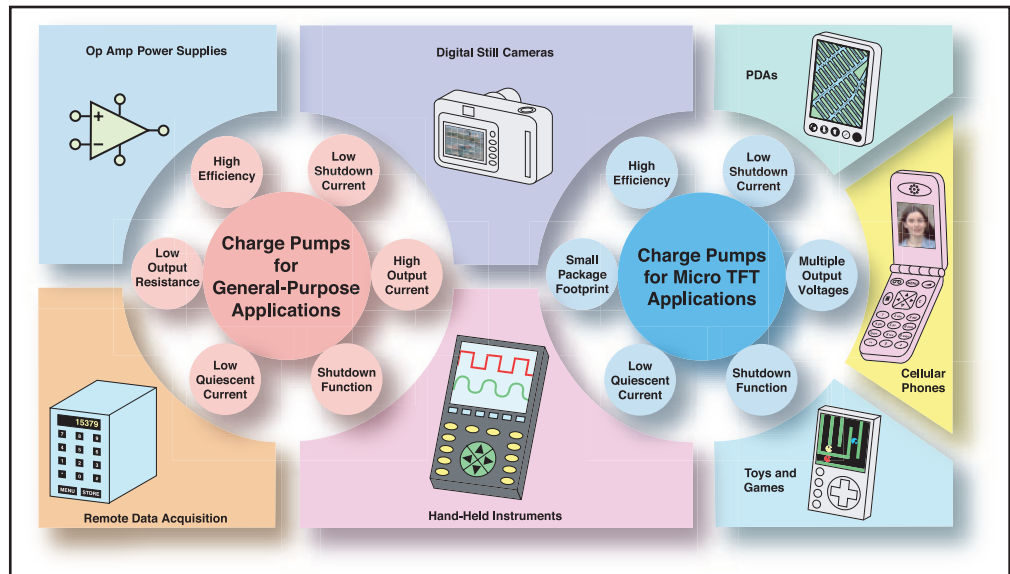
Analog Devices Applications Bulletin

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Compact, High Efficiency Charge Pumps

Analog Devices' portfolio of charge pumps offers designers many benefits for mobile and other applications. Their key features include low power dissipation, very small packages, and power efficiency ratings up to 99%. They require a minimum number of external components, resulting in reduced board space and cost. Package dimensions are as small as 2.9 mm × 2.75 mm.



Charge Pump Selection Guide

Part Number	Input Voltage (V)	Output Voltage(s) (V)	Output Current(s)	Efficiency (%)	Package Type	Page
ADM660	1.5 to 7	$-V_{IN}$ or $2 \times V_{IN}$	100 mA	80	DIP/SOIC/TSSOP	5
ADM8660	1.5 to 7	$-V_{IN}$	100 mA	80	DIP/SOIC/TSSOP	5
ADM8828	1.5 to 5.5	$-V_{IN}$	25 mA	99	6-Lead SOT-23	6
ADM8829	1.5 to 5.5	$-V_{IN}$	25 mA	99	6-Lead SOT-23	6
ADM8830	2.6 to 3.6	+5.1/+15.3/-10.2	8 mA/100 μ A/-100 μ A	80	20-Lead LFCSP	4
ADM8839	2.7 to 4.2	+5/+15/-15	8 mA/150 μ A/-150 μ A	82	20-Lead LFCSP	2
ADM8840	2.7 to 3.6	+5/+15/-15	8 mA/150 μ A/-150 μ A	70	32-Lead LFCSP	3
ADP3605	3 to 6	-3	120 mA	—	SOIC/TSSOP	See Website
ADP3607	3 to 5	+5	50 mA	—	SOIC/TSSOP	See Website
ADP3610	3 to 3.6	$2 \times V_{IN}$	320 mA	—	16-Lead TSSOP	See Website



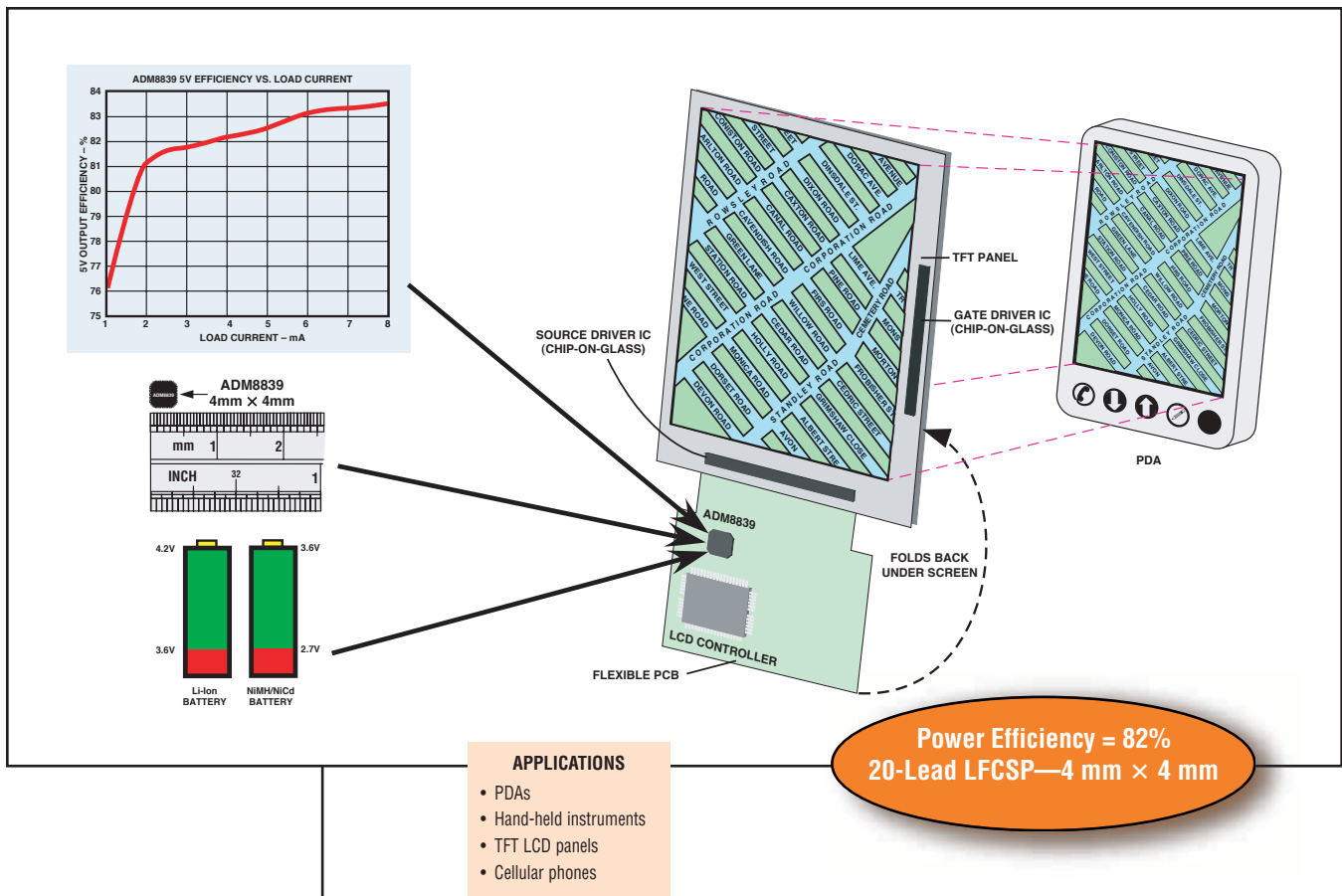
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ADM8839 Charge Pump Regulator for Color TFT Panel (+5 V \pm 2%, +15 V, -15 V)

The ADM8839 is ideal for TFT (thin film transistor) LCDs (liquid crystal displays). The device generates three voltages (+5 V \pm 2%, +15 V, and -15 V) from a single 2.7 V to 4.2 V supply—for use with li-ion or NiMH/NiCd batteries. These voltages provide supplies to the LCD controller (+5 V \pm 2%) and the gate drives for the transistors in the panel (+15 V and -15 V). Few external capacitors are required, minimizing board space and cost. An efficient, low dropout voltage regulator ensures that the power efficiency is high and provides low noise output.

The ADM8839 consumes less than 5 μ A in shutdown. Power efficiency is maximized on the 5 V output with an oscillator enabling scheme (Green Idle™). Power sequencing ensures that the -15 V supply powers up before the +15 V. The ADM8839 is fabricated using CMOS technology for minimal power consumption and is packaged in a 20-lead LFCSP (lead frame chip scale package) with a tiny 4 mm \times 4 mm footprint.



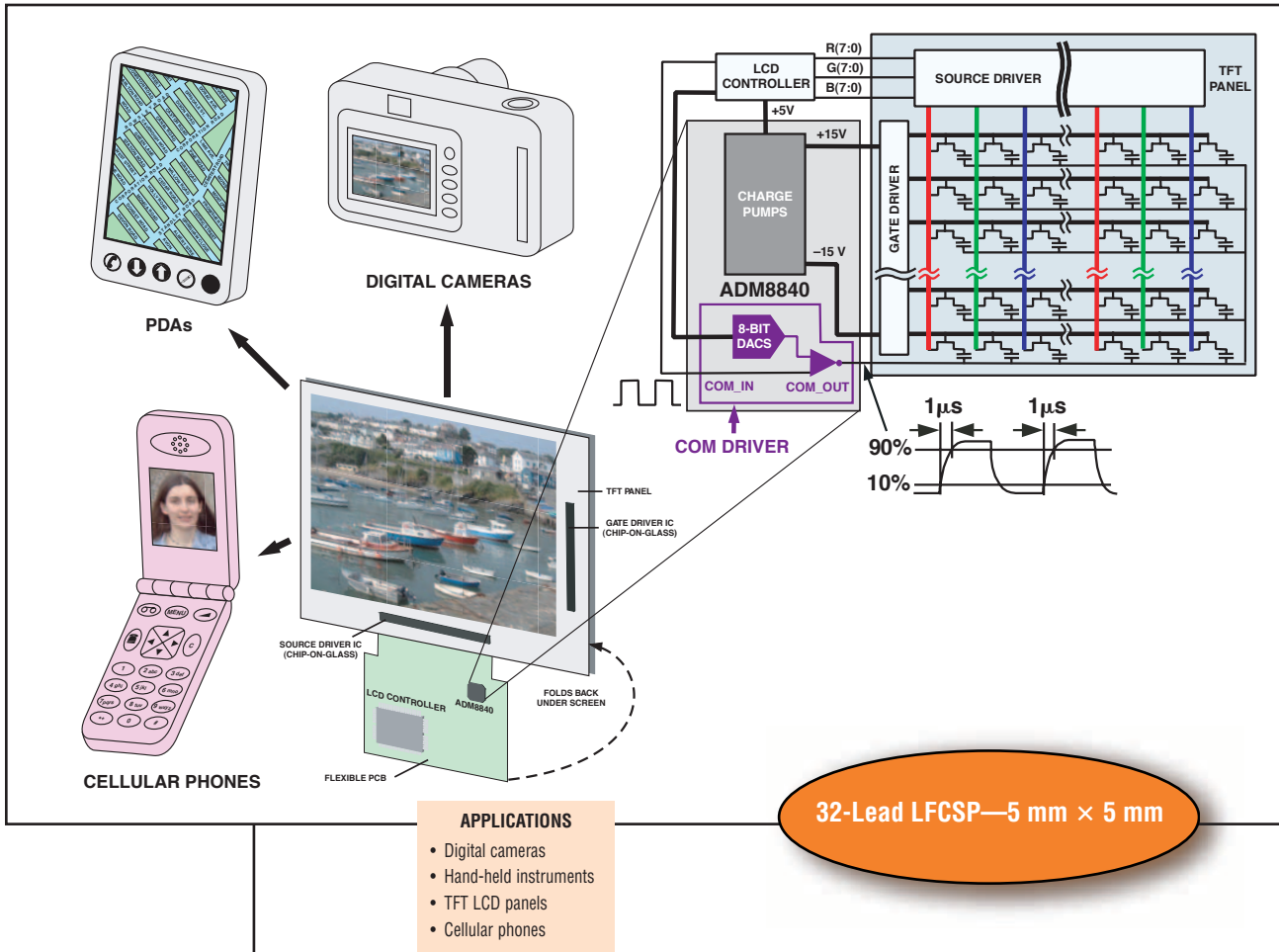
Key Features

- 3 output voltages (+5 V \pm 2%, +15 V, -15 V) from one 2.7 V to 4.2 V input supply
- Power efficiency optimized for use with TFT in mobile applications ($P_{EFF} = 82\%$)
- Low quiescent current
- Low shutdown current: <5 μ A
- Small package footprint: 4 mm \times 4 mm
- Minimal external components

ADM8840 Charge Pump Regulator and COM Driver for Color TFT Panel (+5 V \pm 2%, +15 V, -15 V)

The ADM8840 features a common line (COM) driver in a single-chip solution for TFT LCDs. The device provides an LCD controller and grayscale DAC supply voltage of 5.0 V \pm 2% and two gate drive voltages of \pm 15 V. The COM driver voltage alternates the polarity of the common line voltage every line or every frame on the display to prevent screen burn occurring over time. The ADM8840 is powered by a single 2.7 V to 3.6 V supply.

The ADM8840 receives the COM clock from the controller with a frequency as high as 10 kHz and allows programmable conditioning of its amplitude and center voltage through the use of on-board DACs. The ADM8840 is fabricated using CMOS technology for minimal power consumption. The part comes in a 32-pin LFCSP package with a 5 mm \times 5 mm footprint.



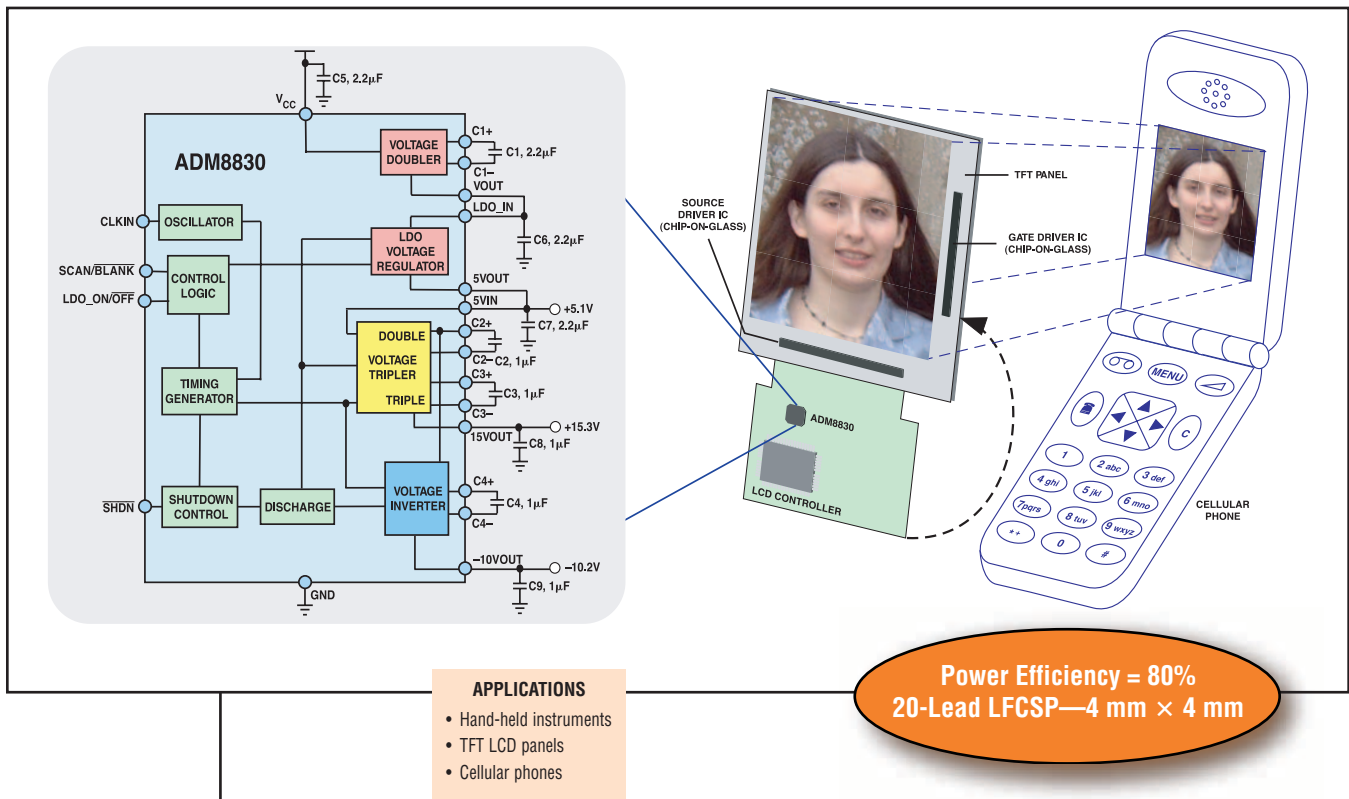
Key Features

- One-chip, integrated COM driver and charge pump
- Programmable COM driver to prevent screen burn
- 3 output voltages (5.0 V \pm 2%, 15.0 V, -15.0 V) from one 2.7 V to 3.6 V input supply
- Power efficiency optimized for use with TFT in mobile applications ($P_{EFF} = 70\%$)
- Low quiescent current
- Low shutdown current: $< 5 \mu\text{A}$
- Small package footprint: 5 mm \times 5 mm
- Minimal number of external components

ADM8830 Charge Pump Regulator for Color TFT Panel (+5.1 V \pm 2%, +15.3 V \pm 4%, -10.2 V \pm 4%)

The ADM8830 is ideal for TFT (thin film transistor) LCDs (liquid crystal displays). The device generates three voltages (+5.1 V \pm 2%, +15.3 V \pm 4%, and -10.2 V \pm 4%) from a single 2.6 V to 3.6 V supply. These voltages provide supplies to the LCD controller (+5.1 V \pm 2%) and the gate drives for the transistors in the panel (+15.3 V and -10.2 V). Few external capacitors are required, minimizing board space and cost. An efficient low dropout voltage regulator ensures the power efficiency is high and provides a low noise output. A 100 kHz internal oscillator is used to clock the charge pumps during scanning mode, when the current is highest. During blanking periods, the ADM8830 switches to use an external, lower frequency clock. This allows the user to vary the frequency and maximize power efficiency during blanking periods.

The ADM8830 consumes less than 1 μ A in shutdown. Power efficiency is maximized on the 5.1 V output with an oscillator enabling (Green Idle) scheme. Power sequencing ensures that the -10.2 V supply powers up before the +15.3 V supply. The ADM8830 is fabricated using CMOS technology for minimal power consumption. The part is packaged in a 20-lead LFCSP (lead frame chip scale package) with a tiny 4 mm \times 4 mm footprint.



Key Features

- 3 voltages (5.1 V \pm 2%, 15.3 V \pm 4%, -10.2 V \pm 4%) from one 2.6 V to 3.6 V supply
- Power efficiency optimized for use with TFT in mobile applications ($P_{EFF} = 80\%$)
- Low quiescent current
- Low shutdown current (<1 μ A)
- Fast transient response
- Shutdown function
- Power saving during blanking period
- Small package footprint: 4 mm \times 4 mm
- Minimal number of external components

Visit our website for samples, data sheets, and additional product information.

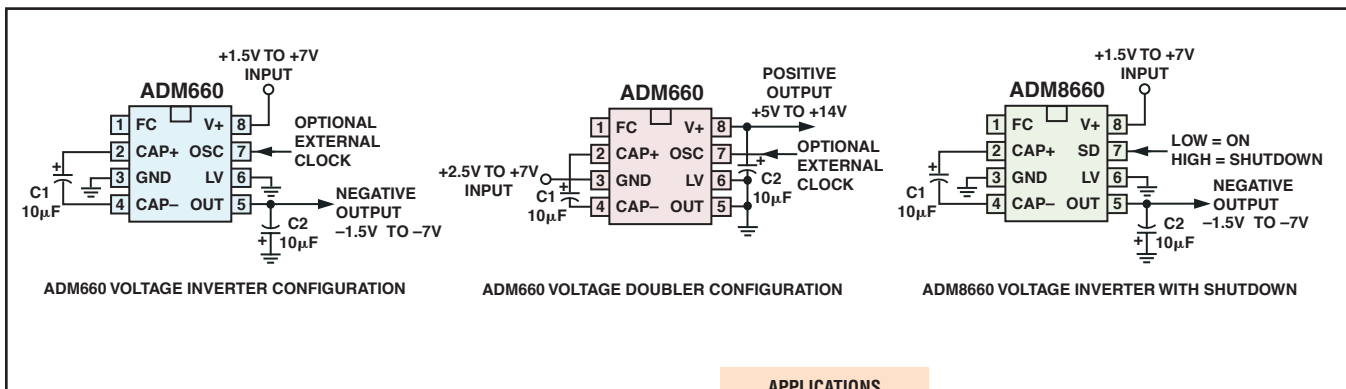
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ADM660/ADM8660 High Current CMOS Switched Capacitor Voltage Converters

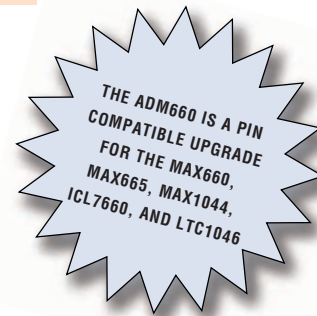
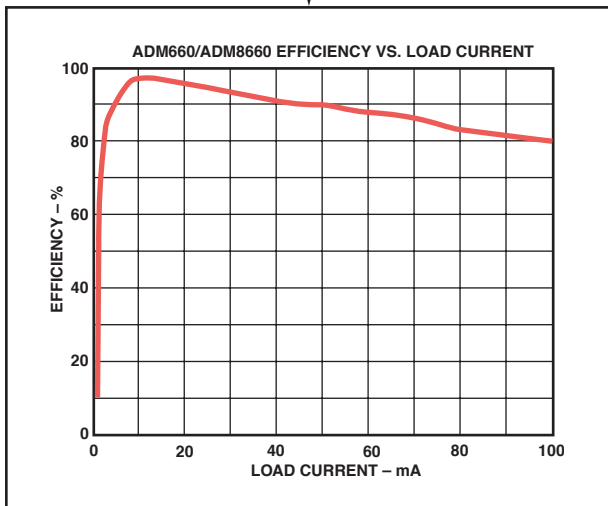
The ADM660/ADM8660 invert the input voltage, producing $V_{OUT} = -V_{IN}$. The inverting scheme is ideal for generating a negative rail in a single-supply system. Only two small external capacitors are needed for the charge pump. Output currents up to 50 mA with greater than 90% efficiency are achievable. A frequency control (FC) input pin is used to select either 25 kHz or 120 kHz charge pump operation, optimizing the capacitor sizes.

For applications that demand a higher voltage, the ADM660 can be used to double the input voltage, $V_{OUT} = 2 \times V_{IN}$. Output voltages of 14 V maximum are attainable. In shutdown mode, the ADM660/ADM8660 consume 300 nA of current. The ADM660 is a pin compatible upgrade for the MAX660, MAX665, MAX1044, ICL7660, and LTC1046. The ADM660/ADM8660 are available in 8-lead DIP and narrow body SOIC packages. The ADM660 is also available in a 16-lead TSSOP package.



APPLICATIONS

- Hand-held instruments
- Portable computers
- Remote data acquisition
- Op amp power supplies



Key Features

- ADM660 is a pin compatible upgrade for the MAX660, MAX665, MAX1044, ICL7660, and LTC1046
- ADM660 inverts or doubles input supply voltage
- ADM8660 inverts input supply voltage
- 100 mA output current
- Shutdown function (ADM8660)
- 2.2 μ F or 10 μ F capacitors
- Only 0.3 V drop at 30 mA load
- 1.5 V to 7 V supply
- Low power CMOS: 600 μ A quiescent current
- Selectable charge pump frequency (25 kHz/120 kHz)
- Available in 16-lead TSSOP package

ADM8828/ADM8829 Switched Capacitor Voltage Inverters with Shutdown

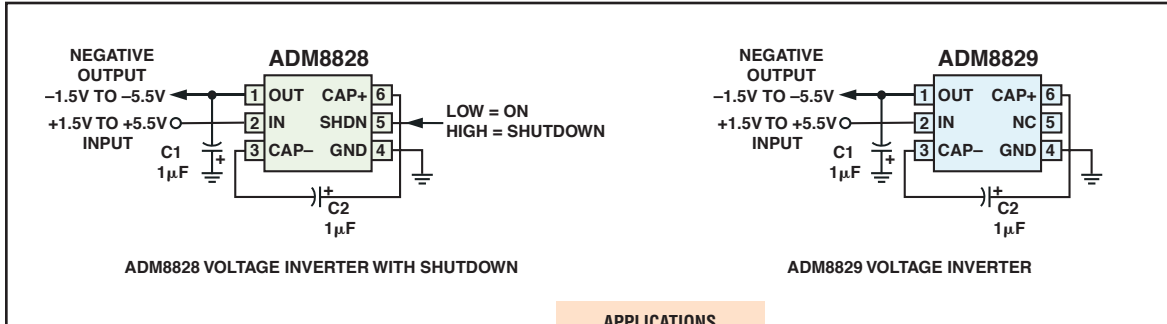
The ADM8828/ADM8829 is a charge pump voltage inverter that generates a negative supply from a positive input. Input voltages ranging from +1.5 V to +5.5 V can be inverted into a -1.5 V to -5.5 V output supply. This inverting scheme is ideal for generating a negative rail in single-power supply systems. Only two small external capacitors are needed. Output currents up to 25 mA with greater than 99% efficiency are achievable. The ADM8828 also features a low power shutdown (SHDN) pin that can be used to disable the device and reduce the quiescent current to 20 nA. The ADM8828 and ADM8829 are available in a 6-lead SOT-23 package and are pin compatible with the MAX828 and MAX829.

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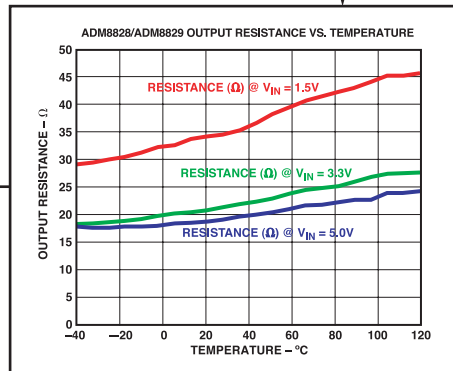
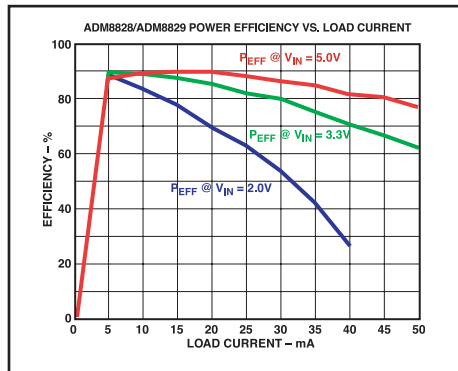
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- APPLICATIONS**
- Hand-held instruments
 - LCD panels
 - Cellular phones
 - PDAs
 - Remote data acquisition
 - Op amp power supplies



- Key Features**
- Pin compatible with the MAX828 and MAX829
 - Invert input supply voltage
 - 99% voltage conversion efficiency
 - 18 Ω output resistance in SOT-23 package
 - High output current
 - Shutdown function
 - Require only 2 capacitors
 - 1 µF capacitors
 - 1.5 V to 5.5 V input range
 - 600 mA quiescent current
 - 20 nA shutdown current (ADM8828)