

## Product of the Month

### Versatile, High Efficiency Switching Regulator in SO-8 Operates Over 3.5V to 36V Range

The LTC<sup>®</sup>1624 is a current mode switching regulator controller that drives an external N-channel MOSFET. Operation is over an input voltage range of 3.5V to 36V which allows it to be powered from a variety of batteries and bus voltages. The LTC1624

operates in all standard switching configurations including boost, step-down, inverting and SEPIC (Figure 1). Its 200kHz fixed frequency PWM operation provides lower switching noise for RF-sensitive applications and allows use of small inductors to mini-

mize PC board space. The LTC1624 is targeted towards applications requiring up to 36V input and output currents from 1A to 8A. It is ideal for use in automotive and marine GPS systems, industrial single board computers and DC power distribution systems.

In step-down operation, such as shown in Figure 2, the LTC1624's output voltage can range from 1.19V to 30V. The operating current level is user-programmable via an external current sense resistor which allows higher output voltages (especially in boost mode). A 95% maximum duty cycle provides low dropout for longer operating time in portable systems. Peak efficiency in a 3.3V step-down converter approaches 90% and Burst Mode<sup>™</sup> operation maintains high efficiency even at low load currents.

The LTC1624 is screened to the commercial and industrial temperature ranges and is available from stock in an SO-8 package. For a data sheet and evaluation samples, contact your local Linear Technology sales office or for more information visit our web site at [www.linear-tech.com](http://www.linear-tech.com).

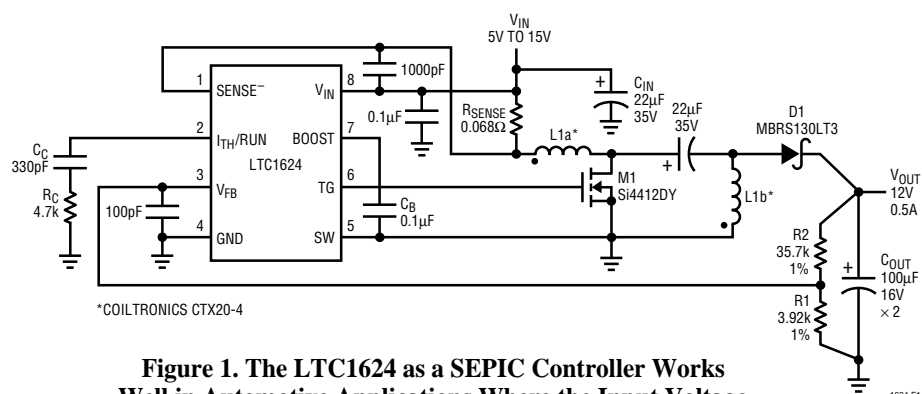


Figure 1. The LTC1624 as a SEPIC Controller Works Well in Automotive Applications Where the Input Voltage Can Vary Above and Below the Output Voltage

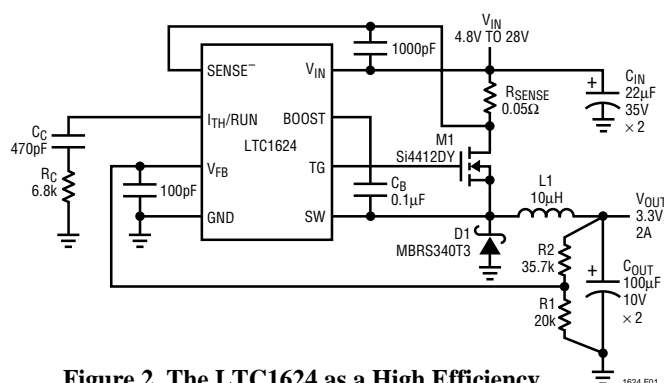


Figure 2. The LTC1624 as a High Efficiency Step-Down Converter

### Varactor Diode Driver for Cellular Phones Extends Frequency Tuning Range

The LTC1340 is a varactor diode driver specifically targeted for Phase Locked Loop (PLL) frequency synthesizers in GSM cellular phone applications. From a 3V supply, it generates a 5V supply rail to the internal varactor drive amplifier by means of a charge pump. The low noise amplifier has a gain of 2.3, allowing the smaller output voltage range of the synthesizer phase detector to drive the varactor diode with a wider voltage range. The amplifier input stage includes a built-in offset voltage that allows

Continued on page 2

#### Inside This Issue:

500ksps Micropower 10-Bit ADCs Fit in 8-Lead MSOP .....	2
Driving Multiple Video Cables with the LT <sup>®</sup> 1206 .....	3
1.2V, 10μA Shunt Reference in SO-8 Guarantees 25ppm/°C and 0.05% Initial Accuracy .....	3
5V Versions of the LT1460 Precision Reference Now Available .....	4
Triple RS232 Transceiver Now Has ±15kV ESD Protection .....	4

## 500ksps Micropower 10-Bit ADCs Fit in 8-Lead MSOP

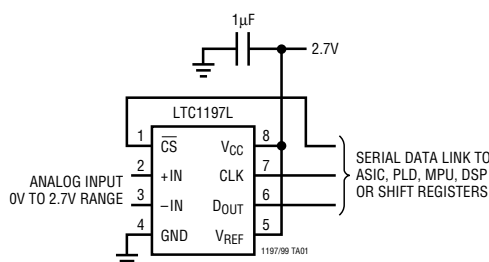
The LTC1197/LTC1197L and LTC1199/LTC1199L are single and dual channel 10-bit analog-to-digital (A/D) converters in an 8-lead MSOP package for 5V and 3V supply applications where small size, low power and low cost are critical design factors. The single channel LTC1197 and dual channel LTC1199 operate on a single 5V source while achieving sample rates up to 500kHz and 450kHz, respectively.

The LTC1197L and LTC1199L operate on a single 3V source and dissipates only 2.2mW of power. Auto shutdown between conversions reduces supply current to just 1nA, guaranteeing the lowest operating power for such power sensitive applications as bar code readers, touch screen interfaces and handheld instrumentation. Their speed and resolution are also well-suited to baseband signal processing and demodulation for narrowband wireless data systems.


All of these devices have a 3-wire serial interface and include an on-chip 200ns

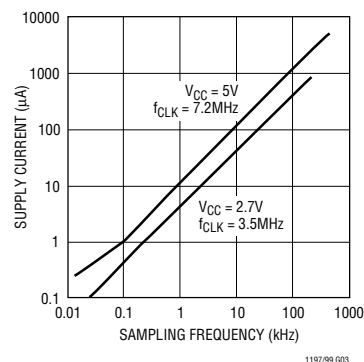
sample-and-hold. The LTC1197/LTC1197L have a differential analog input with an external reference input. The LTC1199/LTC1199L have a software selectable 2-channel MUX. All have excellent DC performance with  $\pm 1$ LSB INL and 10-bit no missing codes resolution. The offset error is  $\pm 2$ LSB (maximum) and the gain error is  $\pm 4$ LSB (maximum).

The LTC1197/LTC1197L and LTC1199/LTC1199L are offered in 8-lead



**Figure 1. A Single 5V Supply, 500ksps, 10-Bit Sampling A/D Converter**

MSOP and SO packages. Parts are screened to the commercial and industrial temperature ranges and are available from stock. For more details, see our web site at [www.linear-tech.com](http://www.linear-tech.com). To obtain a data sheet and evaluation samples, contact your local Linear Technology sales office. 



**Figure 2. Effective Number of Bits Frequency Response Curve for LTC1197**

LTC1340 from page 1


the output voltage to swing to ground without requiring 0V on the input. This feature controls the phase detector within its linear range of operation.

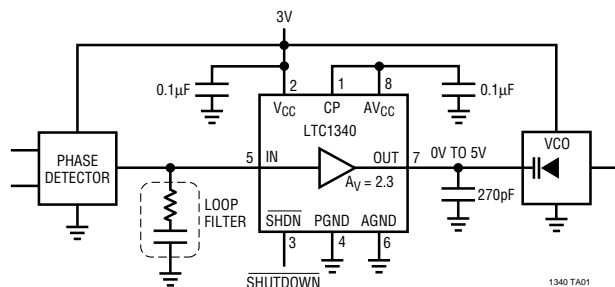
The LTC1340 requires only three external surface mount capacitors to implement a complete varactor driver module, as shown in Figure 1. It is ideal in enhancing cellular phone operation on 3V supplies and in wireless modems for Internet and PC-to-base-station wireless networking applications. Although the output current is only about

20µA, it is sufficient to be used in low supply voltage instrumentation applications.

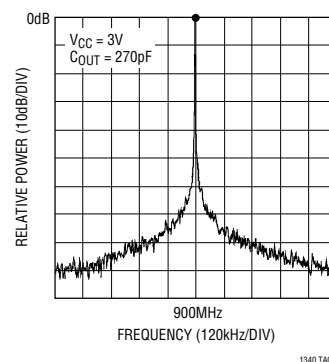
The LTC1340 features output referred noise of 15µV<sub>RMS</sub>, minimizing frequency deviation in PLL frequency synthesizer systems. Figure 2 shows the spectral plot of the VCO output driven by the LTC1340. The op amp bandwidth is adjustable from 10kHz to 500kHz by adjusting the output capacitance. The output typically sinks or sources 20µA, allowing fast output signal changes with a typical varactor load. When shut down, the

charge pump disconnects the power to the op amp, reducing supply current to less than 1µA typically.

The LTC1340 is available in the SO-8 as well as the 8-lead MSOP for size critical applications. For a data sheet and evaluation samples, contact your local Linear Technology sales office or visit our web site at [www.linear-tech.com](http://www.linear-tech.com) for more information. 



**Figure 1. The LTC1340 Amplifies the Phase Detector Output to the VCO in PLL Frequency Synthesizer Systems. The Op Amp Bandwidth is 125kHz with a 1nF Output Capacitance**



**Figure 2. Spectral Plot of VCO Output with 300Hz Resolution Bandwidth**

# Application of the Month

## Driving Multiple Video Cables with the LT1206

The combination of a 60MHz bandwidth, 250mA output current capability and low output impedance makes the LT1206 ideal for driving multiple video cables. One concern when driving multiple transmission lines is the effect of an unterminated (open) line on the other outputs. Since the unterminated line creates a reflected wave that is incident on the output of the driver, a nonzero amplifier output impedance will result in crosstalk to the other lines. Figure 1 shows the LT1206 connected as a distribution amplifier. Each line is separately terminated to minimize the effect of reflections. For systems using composite video, the differential gain and phase performance are also important and have been considered in the internal design of the device. The differential phase and differential gain performance versus supply is shown in Figures 2 and 3 for 1, 3, 5 and 10 cables. Figure 4 shows the output impedance versus frequency. Note that at 5MHz the output impedance is only 0.6Ω.

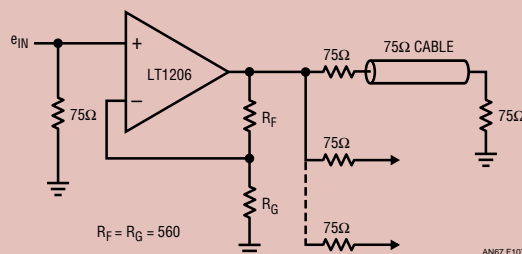
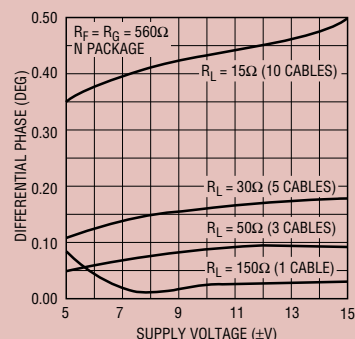
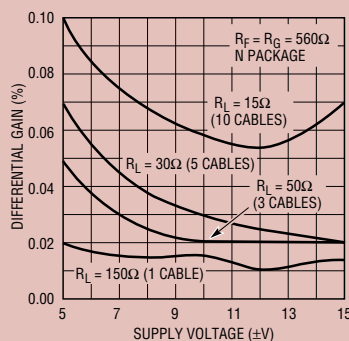


Figure 1. LT1206 Distribution Amplifier



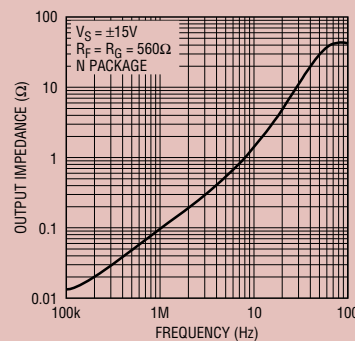
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Figure 2. Differential Phase vs Supply Voltage



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Figure 3. Differential Gain vs Supply Voltage

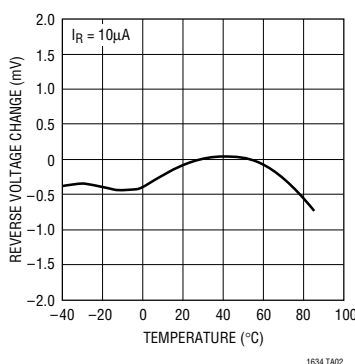


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Figure 4. Output Impedance vs Frequency

## 1.2V Shunt Reference in SO-8 Guarantees 25ppm/°C and 0.05% Initial Accuracy, Operates on 10μA

The LT1634 is the first device in a series of precision shunt references—the initial release in this family being a 1.2V output device with an initial accuracy of 0.05% and a maximum guaranteed drift of 25ppm/°C. It is stable with any value of output capacitor, including none, saving components and board space. These features make it an excellent reference for use in portable meters, precision regulators and in data conversion applications. Advances in design, processing and packaging techniques guaran-



1634 TA02

Figure 1. LT1634 Reference Has Low Drift Over a Wide Temperature Range

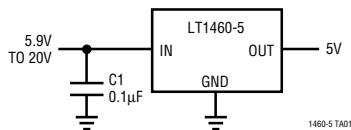
tee a minimum operating current of only 10μA and low temperature cycling hysteresis. The compactness of the product makes it ideal for space limited applications.

The LT1634-1.2 is immediately available in volume from stock in 8-lead SO or MSOP surface mount packages (TO-92 packages will also be released soon). Contact your local Linear Technology sales office for a data sheet and evaluation samples or visit our web site at [www.linear-tech.com](http://www.linear-tech.com) for more information.



## 5V Versions of the LT1460 Precision Reference Now Available

The **LT1460-5** is a micropower precision 5V series, bandgap voltage reference that combines high accuracy and low drift with low power dissipation and small packaging. The various options available in electrical grade (shown boldfaced), packaging and temperature grade are described in Table 1.



**Figure 1. LT1460-5 Series Reference Draws Only 130µA of Supply Current**

Actual Size of MS8 Versions

**Table 1. Commercial and Industrial Grade 5V Versions of the LT1460 Reference**

Part Number	Package	Electrical Grade	Temperature Range	Accuracy	Drift
LT1460ACN8-5	8-Lead PDIP	A	0°C to 70°C	0.075%	10ppm/°C
LT1460ACS8-5	SO-8	A	0°C to 70°C	0.075%	10ppm/°C
LT1460BIN8-5	8-Lead PDIP	B	-40°C to 85°C	0.100%	10ppm/°C
LT1460BIS8-5	SO-8	B	-40°C to 85°C	0.100%	10ppm/°C
LT1460CCMS8-5	8-Lead MSOP	C	0°C to 70°C	0.100%	15ppm/°C
LT1460DCN8-5	8-Lead PDIP	D	0°C to 70°C	0.100%	20ppm/°C
LT1460DCS8-5	SO-8	D	0°C to 70°C	0.100%	20ppm/°C
LT1460EIN8-5	8-Lead PDIP	E	-40°C to 85°C	0.125%	20ppm/°C
LT1460EIS8-5	SO-8	E	-40°C to 85°C	0.125%	20ppm/°C
LT1460FCMS8-5	8-Lead MSOP	F	0°C to 70°C	0.150%	25ppm/°C
LT1460GCZ-5	TO-92	G	0°C to 70°C	0.250%	25ppm/°C
LT1460GIZ-5	TO-92	G	-40°C to 85°C	0.250%	25ppm/°C

The LT1460 uses temperature compensation and trimmed, precision thin-film resistors to achieve its high accuracy and is stable with any value of output capacitor, including none, saving components and board space. Drawing a maximum of only 130µA of supply current, the LT1460-5 will source up to 20mA of output current, making it ideal for precision regulator applications. Figure 1 shows the LT1460 in the MS8 package.

The LT1460-5 precision reference is available in 8-lead PDIP, SO and MSOP surface mount packages and in a 3-lead TO-92. Parts are screened to the commercial and industrial temperature ranges and are available from stock. Contact your local Linear Technology sales office for a data sheet and evaluation samples or visit our web site at [www.linear-tech.com](http://www.linear-tech.com) for more information.

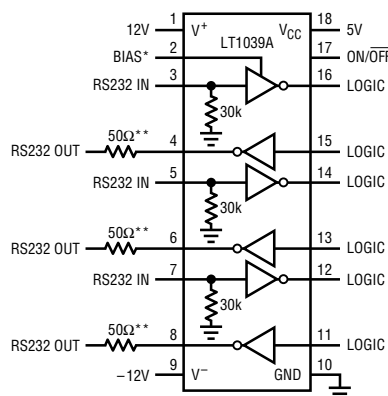


## Triple RS232 Transceiver Now Has ±15kV ESD Protection

The **LT1039A** triple RS232 transceiver has much improved ESD protection for those applications that must be compliant to the IEC 1000-4-2, ±15kV Electro-Static Discharge standard. The IEC standard is mandatory for products to achieve the "CE" mark for sale into Europe. Each receiver of the LT1039A will accept up to ±30V input and can drive either TTL or CMOS logic. The RS232 drivers accept TTL logic inputs, and output RS232 voltage levels. The outputs are fully protected against overload and can be shorted to ground or up to ±30V without damage to the drivers. Additionally, when the system is shut down or power is off, the outputs are in a high impedance state allowing data line sharing. On-chip ESD protection eliminates the need for external protection devices.

The LT1039A operates off ±5V to ±12V supplies. The LT1039A is available in an 18-lead SO surface mount package with a shutdown pin to reduce power consumption. A 16-lead SO package (LT1039ACS16) is

**The LT1039A Triple RS232 Transceiver's Bus Pins Will Withstand ±15kV per the IEC Model**



\* BIAS PIN USED TO KEEP THE RECEIVER ON WHILE IN SHUTDOWN

\*\* 50 Ω RESISTORS MAY BE REQUIRED FOR IEC-1000-4-2 ESD PROTECTION DEPENDING UPON PC BOARD AND CONNECTOR LEAD LENGTH

1039A TA01

also available without the shutdown or bias pin functions. (The BIAS pin keeps the receiver on while in shutdown.) Contact your local Linear Technology sales office for a data sheet and evaluation samples. Visit our web site at [www.linear-tech.com](http://www.linear-tech.com) for more information.



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