

# CELLULAR/PCS PHONES



Data Sheets

Applications Notes

Free Samples

3rd EDITION



## Miniature 2GHz LNA/Mixers for W-CDMA Draw Less than 8mA Average Current

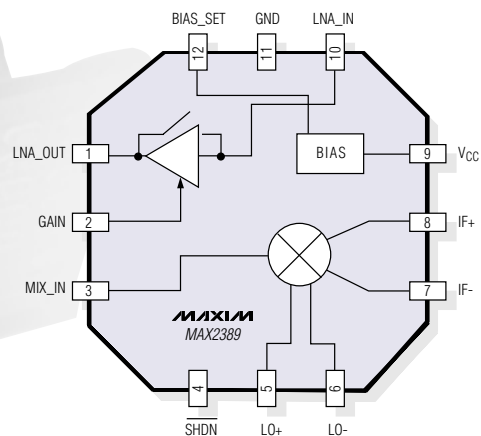
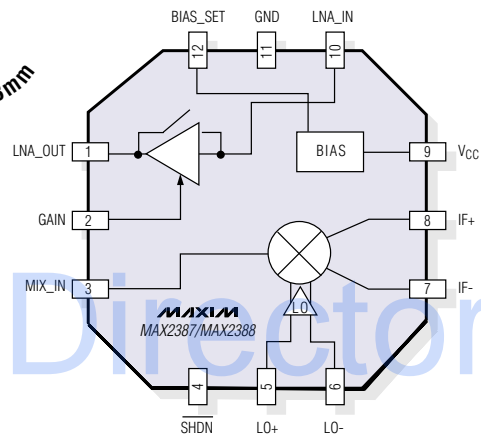
**Better Performance than Discretés  
at Less than Half the Size**

The MAX2387\*/MAX2388\*/MAX2389\* are designed for the emerging ARIB (Japan) and ETSI-UMTS (Europe) wideband CDMA (W-CDMA) markets. These SiGe devices consist of a dual-gain LNA and a low-current, ultra-low-noise mixer, both optimized for 2110MHz to 2170MHz operation. The devices draw very little power from a 2.7V to 3.3V source. Their high gain and input third-order intercept point (IP3) simplify meeting system noise and interference specifications, and the adjustable-gain LNA increases dynamic range while saving current. The MAX2387/MAX2388/MAX2389 support all common IF frequencies (190MHz to 380MHz). The new 12-pin leadless QFN package measures only 3mm x 3mm, saving valuable board space.

\*Future products—contact factory for availability.



12-QFN  
3mm x 3mm



The MAX2387/MAX2388/MAX2389 come in an ultra-small 12-pin QFN package and draw an average current of less than 8mA.

Part	LO Input Power	LNA Gain (dB)	Mixer Gain (dB)	Cascade Noise (2.5dB Filter Loss)(dB)	Supply Current (High Gain/Low Gain)(mA)
MAX2387	-10dBm ±3dB	15/-17	10.5	2.3	11/7.5
MAX2388	-10dBm ±3dB	15/-3	10.5	2.3	10/6.7
MAX2389	-4dBm ±3dB	15/-3	10.5	2.3	8/5

IP3s range from +3dBm to +6dBm for both the LNA and the mixer.





# Dramatically Reduce Cost and Component Count in Your Dual-Band Cell Phone

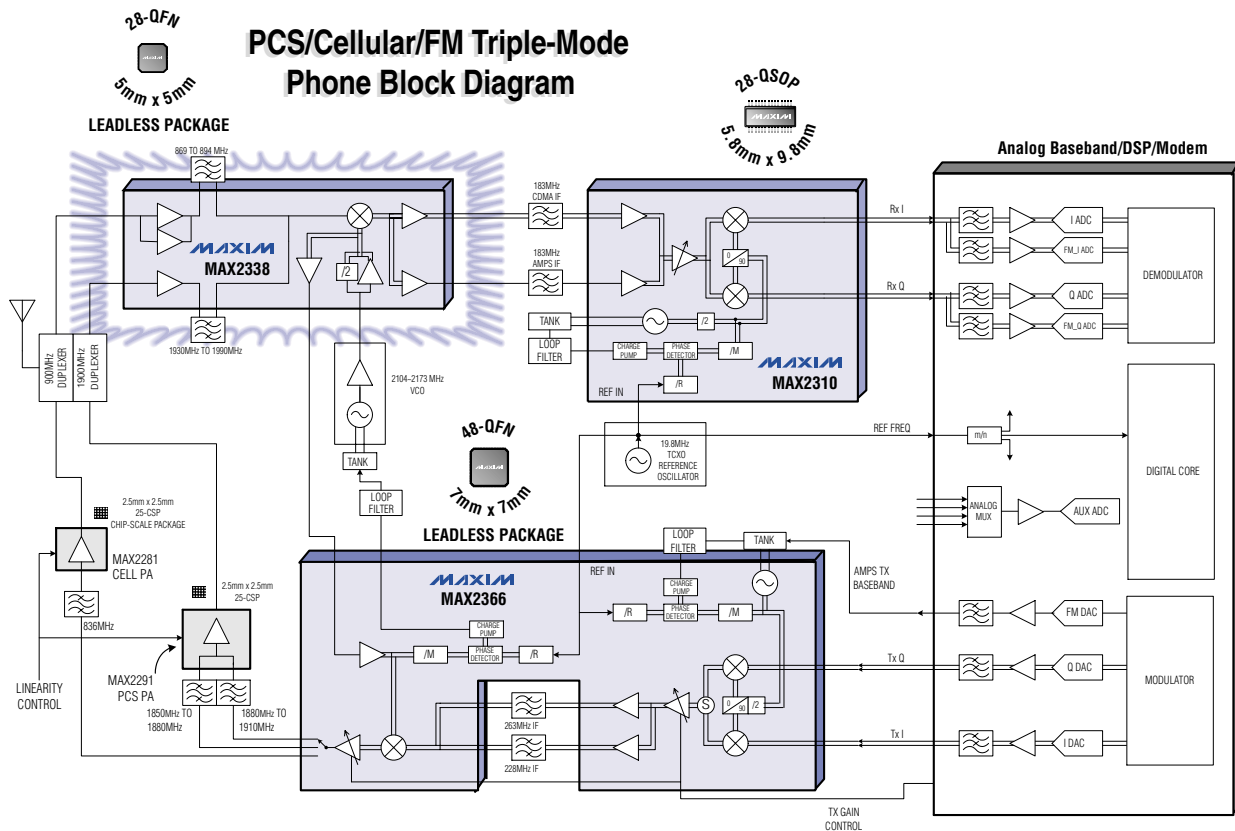
**SiGe IC replaces high component count discrete designs and eliminates one VCO module!**

The MAX2338\* receive RF front-end IC is designed for dual-band CDMA cellular phones, but it can also be used in dual-band TDMA, GSM, or EDGE cellular phones. Dual-band phones can now use one receive IF frequency around 183MHz. Thanks to the MAX2338's on-chip low-power LO divider, the cellular VCO module can be eliminated.

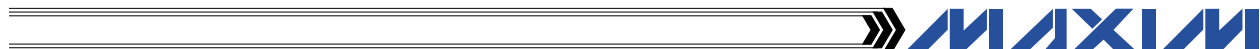
The MAX2338 represents the next generation in Maxim's comprehensive product line of cellular receive front-end ICs.

\*Future product—contact factory for availability.

- **1.4dB LNA Noise Figure**
- **15dB LNA Gain**
- **13.5dB Mixer Gain**
- **LO Divider**
- **Mixer Noise Figure 7.5dB Differential 9dB Single Ended**
- **LO Buffer Amplifiers for TX**
- **+11dBm Cellular LNA IIP3**
- **Ultra-Small 28-Pin QFN Package**



The MAX2338 simplifies the architecture of dual-band cellular radio designs, resulting in substantial size and cost reduction.





# World's Most Integrated Transmit IC for Dual-Band Cellular Phones

## Includes Dual-Band I/Q Modulator, Upconverters, PA Drivers, IF VCOs, and Dual-Band IF/RF PLLs in a Single 48-Pin QFN

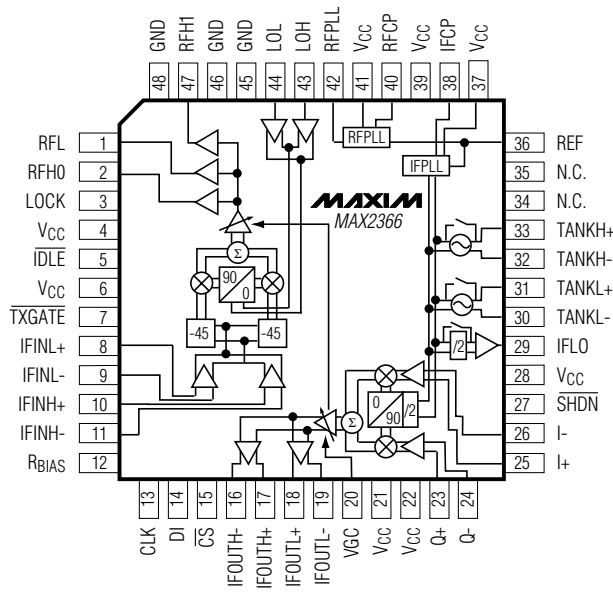
The new MAX2366 is designed for cdmaOne™, cdma2000™, TDMA, EDGE, and W-CDMA dual-band cellular phones. It features the industry's highest integration level, which translates to the smallest transmitter size and implementation cost.

The MAX2366 accepts baseband inputs to its wideband I/Q modulator with dual IF outputs. Dual VCOs allow different IF frequencies for the PCS band and cellular band, which enables the use of a single receive IF filter. The dual-band upconverter is implemented using an image-reject architecture and is followed by three power amplifier (PA) drivers. To reduce receive-band noise power in the PCS band, two PCS driver outputs are provided to support split-band noise filters at negligible additional cost. The PA drivers' high output power allows the use of just one TX SAW filter per band, further reducing system size and implementation cost.

The MAX2366 features over 90dB output power adjustment range through simultaneous IF and RF AGC control. The integer-N-type IF and RF PLL circuits and most device operational modes are fully programmable using the 3-wire serial interface.

For single-band applications, use either the MAX2367 (PCS only) or the MAX2368 (cellular only). They come in the same package and have pinouts compatible with the MAX2366.

- **World's Highest Integration Level**
- **Includes +7dBm (-54dBc ACPR) PA Drivers**
- **Saves up to Three SAW RF Filters and PA Drivers**
- **48-Pin QFN Package**
- **Supports Dual IFs**
- **Integrated RF and IF PLLs**
- **Serial-Interface Control**
- **Other Versions Available**  
**PCS Only (MAX2367)**  
**Cellular Only (MAX2368)**
- **Saves Space and Cost**
- **Compatible with W-CDMA (3% cascade EVM)**



The MAX2366's high integration level saves cost and size in dual-band cellular phones.

cdmaOne and cdma2000 are trademarks of the CDMA Development Group.



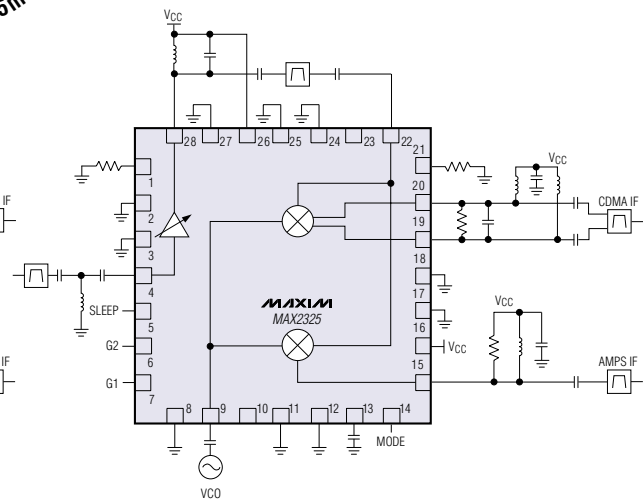
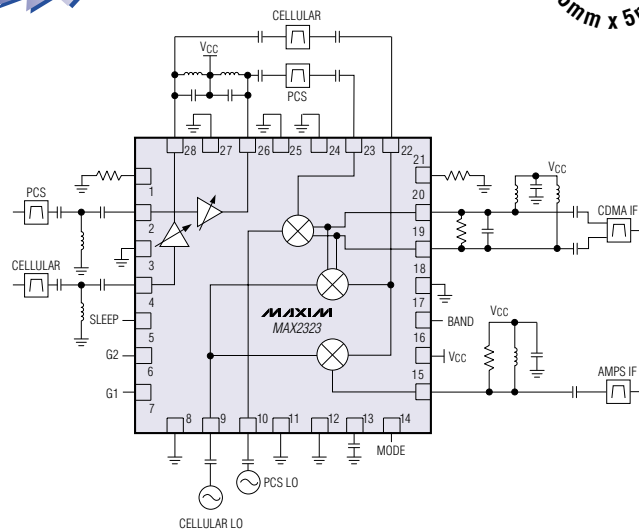
# Dual-Band SiGe LNA+Mixer IC Has Highest IP3

## SiGe IC in 25mm<sup>2</sup> QFN Package Sets New Industry Standard

The MAX2323 low-noise amplifier (LNA) plus mixer is designed for dual-band CDMA cellular phones and can also be used in dual-band TDMA, GSM, or EDGE cellular phones. Improvements over its predecessor, the MAX2320, include the addition of a third gain stage to improve switchover hysteresis margin, a smaller package, and a further increased IP3. The LNAs now have +10dBm input IP3 (adjustable to over +13dBm), which is high enough to overcome even the most persistent transmitter leakage problems common in today's tiny phones. The addition of a third gain state on the cellular LNA facilitates meeting all IS-98C two-tone specs with high margin. Other improvements over the MAX2320 include slightly higher gain for all blocks and significantly reduced mixer noise figure, yielding overall better sensitivity.

The MAX2325 is intended for applications in the cellular frequency band. It is pin compatible with the MAX2323, providing a simple cost-reduction path.

- **Over +10dBm LNA Input IP3 Adjustable to over +13dBm**
- **Multiple Power-Saving Modes, Including a 17mA Paging Mode**
- **Switchable LNA Gain**
- **Over 26dB Overall Gain**
- **<2.6dB Cascade PCS Noise Figure (Includes 3dB Interstage Filter Loss)**
- **Ultra-Small 28-Pin QFN Package**



Very high input IP3 and the industry's smallest package make the MAX2323 unique.

The cellular-only MAX2325 is pin compatible with the MAX2323.

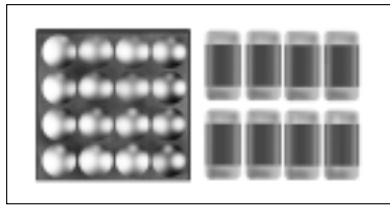


# 4mm<sup>2</sup> TDMA PA Sells for \$1\*

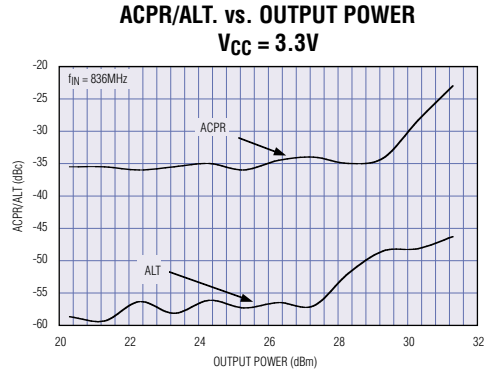
## First TDMA Cellular Band PA in Chip-Scale Package

The MAX2251 is designed for use at 824MHz to 849MHz in single-band or dual-band TDMA phone applications. The die-level chip-scale package allows for both very compact implementation size and inherently lower cost than devices in conventional packages.

- >30dBm TDMA Output Power
- >32dBm AMPS Output Power
- On-Chip Power Detector with 29dB Dynamic Range
- 41% TDMA Efficiency
- 51% AMPS Efficiency



Measuring only 2mm x 2mm, the MAX2251 occupies less space than eight 0402 components.

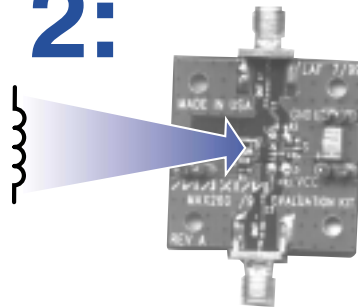


\*1M units per month/FOB USA.

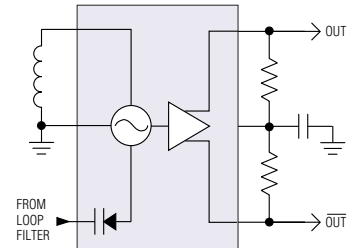
# Build Your 45MHz to 650MHz Oscillator in 5 Minutes

**STEP 1:** Choose the appropriate Maxim part from table below and calculate the inductance using the formula in the data sheet.

**STEP 2:** Insert inductor into EVKIT.



**STEP 3:** Test oscillation frequency. Done.



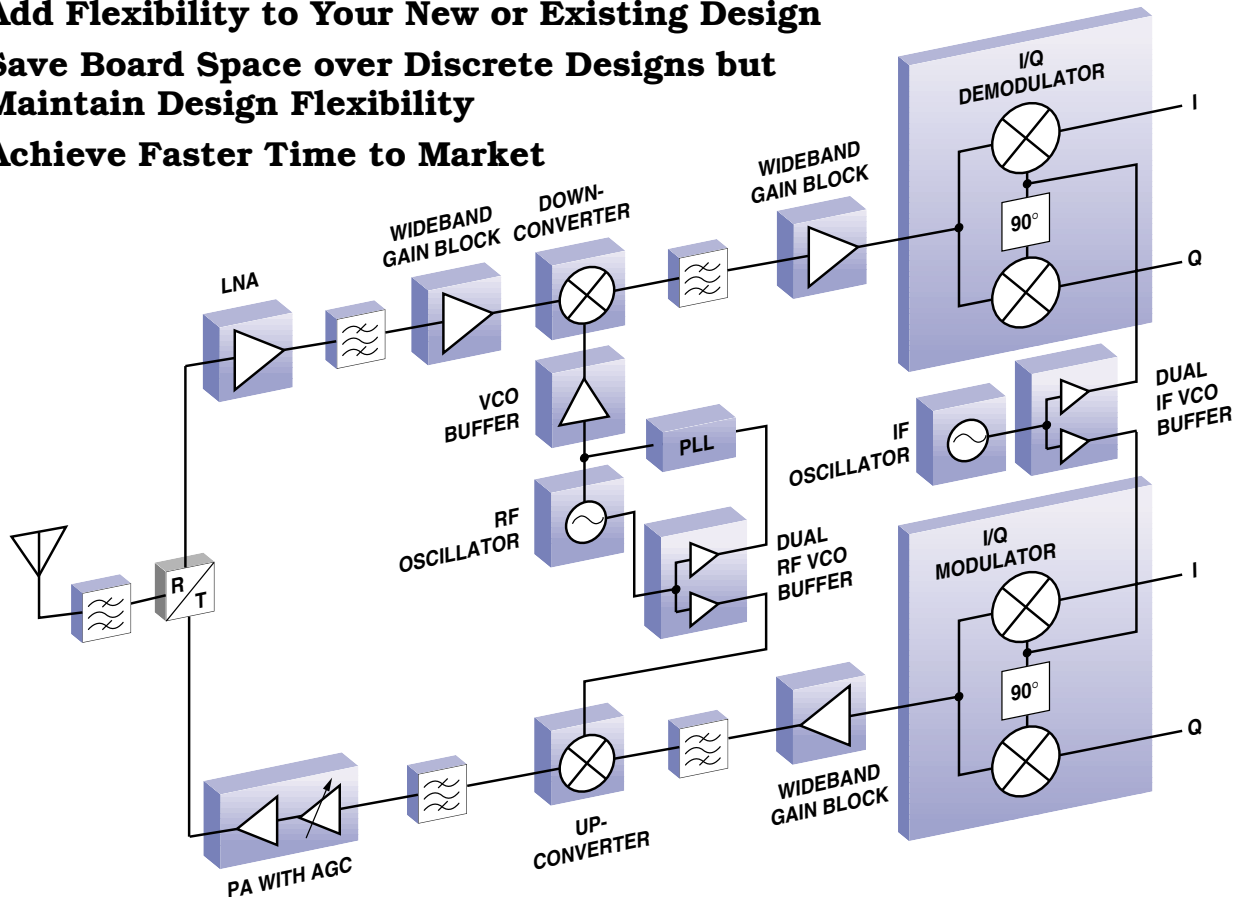
The MAX2605–MAX2609 oscillators contain varactors, core transistors, bias circuitry, coupling capacitors, and a differential output buffer in a miniature SOT23-6 package. The internal varactor's tuning range is factory tested so that startup and proper operation over temperature are guaranteed.

Part	Frequency Range (MHz)	Supply Current (mA)	Phase Noise at 100kHz Offset (dBc/Hz)
MAX2605	45 to 70	1.9	-117
MAX2606	70 to 150	2.1	-112
MAX2607	150 to 300	2.1	-107
MAX2608	300 to 500	2.7	-100
MAX2609	500 to 650	3.6	-93



# Build Your Radio with Maxim's Wide Array of Low-Cost RF Building Blocks (continued on next page)

- Add Flexibility to Your New or Existing Design
- Save Board Space over Discrete Designs but Maintain Design Flexibility
- Achieve Faster Time to Market



## SiGe Low-Noise Amplifiers

Part	Supply Voltage (V)	Current (mA)	Frequency Range (MHz)	Gain (dB)	Noise Figure (dB)	Input IP3 (dBm)	Pin-Package	Features
MAX2640	2.7 to 5.5	3.5	400 to 1500	15.1 (at 900MHz)	0.9	-10	6-Pin SOT23	Ultra-low noise, SiGe
MAX2641	2.7 to 5.5	3.5	1400 to 2500	14.4 (at 1900MHz)	1.3	-4	6-Pin SOT23	Ultra-low noise, SiGe
MAX2642/43	2.7 to 5.5	5.3	800 to 1000	16.7 (at 900MHz)	1.3	0	6-Pin SC70	Adjustable IP3/bias, 13dB gain step, shutdown
MAX2644	2.7 to 5.5	7	2000 to 2700	16 (at 2450MHz)	1.8	+1.8	6-Pin SC70	Adjustable IP3/bias, integrated output 50Ω match
MAX2645	2.7 to 5.5	9.2	3400 to 3800	15 (at 3550MHz)	2.3	Up to +12	10-Pin μMAX-EP	Adjustable IP3/bias, 24dB gain step, shutdown
MAX2651	2.7 to 3.3	5.7/5.9	925 to 960/ 1805 to 1880	18	1.2/1.8	-8.5	10-Pin μMAX	Dual LNA, GSM/DCS/PCS, 20dB gain step
MAX2652	2.7 to 3.3	7.0/7.2	925 to 960/ 1805 to 1880	18	1.3/1.8	-7	10-Pin μMAX	Dual LNA, GSM/DCS/PCS, 20dB gain step, shutdown
MAX2653	2.7 to 3.3	5.4	1805 to 1880	18	1.7	-8.5	8-Pin μMAX	Single LNA, DCS/PCS, 20dB gain step, shutdown
MAX2654	2.7 to 5.5	5.1	1500 to 1800	15 (at 1575MHz)	1.5	-8	6-Pin SC70	Integrated output 50Ω match
MAX2655	2.7 to 5.5	7.8	1500 to 1800	14.2 (at 1575MHz)	1.7	+3.7	6-Pin SC70	Adjustable IP3/bias, gain step
MAX2656	2.7 to 5.5	11.3	1800 to 2000	14.1 (at 1960MHz)	2.0	+4.2	6-Pin SC70	Adjustable IP3/bias, gain step

## VCO Buffers

Part	Supply Current (mA)	Frequency Range (MHz)	Gain (dB)	Reverse Isolation (dB)	Pin-Package	Features
MAX2470	3.0 to 5.1 (adj)	10 to 500	14.9	64 (at 200MHz)	6-Pin SOT23	Dual diff outputs, single-ended input, adj bias
MAX2471	5.1	10 to 500	16.9	69 (at 200MHz)	6-Pin SOT23	Dual diff outputs, diff inputs
MAX2472	5.1	500 to 2500	10.2	49 (at 900MHz)	6-Pin SOT23	Dual open-collector outputs, single-ended input
MAX2473	2.5 to 4.3 (adj)	500 to 2500	11.8	48 (at 900MHz)	6-Pin SOT23	Single open-collector output, adj bias/output power

# Build Your Radio with Maxim's Wide Array of Low-Cost RF Building Blocks (continued from previous page)

## Wideband Gain Blocks

Part	Supply Voltage (V)	Current (mA)	Frequency Range (MHz)	Gain* (dB)	P1dB* (dBm)	Noise Figure* (dB)	Pin-Package	Features
MAX2611	4.5 to 5.5	16	DC to 1100	18.3	2.6	3.5	4-SOT143	High output power
MAX2630	2.7 to 5.5	7	DC to 1200	14	-9	3.5	4-SOT143	Internal bias
MAX2631	2.7 to 5.5	7	DC to 1200	14	-9	3.5	5-SOT23	Shutdown control
MAX2632	2.7 to 5.5	7	DC to 1200	14	-9	3.5	5-SOT23	Bias control
MAX2633	2.7 to 5.5	7	DC to 1200	14	-9	3.5	6-SOT23	Shutdown and bias control
MAX2650	4.5 to 5.5	18	DC to 1100	18	1.5	3.2	4-SOT143	High output power

## RF Downconverters

Part	Supply Voltage (V)	Current (mA)	RF Frequency (MHz)	IF Frequency (MHz)	Conversion Gain (dB)	Noise Figure (dB)	Input IP3 (dBm)	Pin-Package	Features
MAX2680	2.7 to 5.5	5	400 to 2500	10 to 500	11.6	6.3	-13	6-SOT23	Low noise, SiGe
MAX2681	2.7 to 5.5	8.7	400 to 2500	10 to 500	14.2	7	-6	6-SOT23	Low noise, SiGe
MAX2682	2.7 to 5.5	15	400 to 2500	10 to 500	14.7	6.5	-2	6-SOT23	Low noise, SiGe
MAX2683	2.7 to 5.5	55	3400 to 3800	100 to 400	6.7	12	Up to +11	10- $\mu$ MAX-EP	High IIP3, selectable LO doubler
MAX2684	2.7 to 5.5	55	3400 to 3800	800 to 1000	1.0	13.6	Up to +12	10- $\mu$ MAX-EP	High IIP3, selectable LO doubler
MAX2690	2.7 to 5.5	16	40 to 2500	10 to 500	7.9	10	7.6	10- $\mu$ MAX-EP	High IIP3, shutdown

## RF Upconverters

Part	Supply Voltage (V)	Current (mA)	RF Frequency (MHz)	IF Frequency (MHz)	Conversion Gain (dB)	Noise Figure (dB)	Output IP3 (dBm)	Pin-Package	Features
MAX2660	2.7 to 5.5	5	40 to 2500	10 to 500	8	8	10	6-SOT23	Low current
MAX2661	2.7 to 5.5	9	40 to 2500	10 to 500	11	8	11	6-SOT23	High OIP3
MAX2663	2.7 to 5.5	3	40 to 2500	10 to 500	4	8	3	6-SOT23	Low current
MAX2671	2.7 to 5.5	14	40 to 2500	10 to 500	11	8	11	6-SOT23	High IIP3, LO buffer
MAX2673	2.7 to 5.5	20	40 to 2500	10 to 500	12	8	12	8- $\mu$ MAX	Differential output, LO buffer

## Power Amplifiers

Part	Supply Voltage (V)	Current (mA)	Frequency Range (MHz)	Output Power (dBm)	Class	Pin-Package	Features
MAX2232	2.7 to 5.5	160	800 to 1000	24	C	16-PQSOP	Analog gain control, auto power ramp, shutdown
MAX2233	2.7 to 5.5	160	800 to 1000	24	C	16-PQSOP	Digital gain control, shutdown
MAX2235	2.7 to 5.5	610	800 to 1000	30.3	C	20-TSSOP-EP	Analog gain control, auto power ramp, shutdown
MAX2240	2.7 to 5.0	105	2400 to 2500	20	C	9-UCSP	Digital power control, shutdown
MAX2430	3 to 5.5	52	800 to 1000	21	AB	16-SO/QSOP	Power control, shutdown
MAX2601	2.7 to 5.5	450	DC to 1000	30	AB/C	8-PSOPII	Power transistor
MAX2602	2.7 to 5.5	450	DC to 1000	30	AB/C	8-PSOPII	Power transistor with on-chip bias diode power ramp, shutdown

## Oscillator

Part	Supply Voltage (V)	Current (mA)	Frequency Range (MHz)	Phase Noise** (dBc/Hz)	Output Power (dBm)	Pin-Package	Features
MAX2620	2.7 to 5.25	9	10 to 1050	-110	-3	8- $\mu$ MAX	Dual buffered outputs, shutdown control

## I/Q Modulators and Demodulators

Part	Supply Voltage (V)	Current (mA)	IF Frequency (MHz)	Baseband Bandwidth (MHz)	I/Q Amplitude Balance (dB)	I/Q Phase Balance (degrees)	Pin-Package	Features
MAX2450	2.7 to 3.3	5.9	70	9	0.45	$\pm 3$	20-QSOP/SO	Modulator/demodulator in one chip
MAX2451	2.7 to 3.3	5.5	70	9	0.45	$\pm 3$	16-SO	Demodulator with on-chip VCO and phase shifter
MAX2452	2.7 to 3.3	4.1	70	15	0.45	$\pm 3$	16-SO	Modulator with on-chip VCO and phase shifter

\*Typical performance at 500MHz.

\*\*At 25kHz offset from 915MHz carrier.





# World's Smallest Integrated Power ICs for CDMA Handsets Get Even Smaller!

The MAX1798/MAX1799 system power supplies are designed specifically for W-CDMA cellular/PCS handsets using a variety of available CDMA chipsets. Each IC contains five low-noise, low-dropout linear regulators (LDOs); a 140ms (min) reset timer; a watchdog timer input; two undedicated high-current, open-drain drivers; optional push-on/push-off power control; and a serial interface. The two devices differ only in their serial interface: the MAX1798 features a 3-wire SPI-compatible interface, and the MAX1799 features an I<sup>2</sup>C-compatible interface.

Each linear regulator offers extremely low dropout voltage of 100mV. LDO1 is rated for 300mA, and LDO2-LDO5 are each rated for 150mA. All LDOs are optimized for high accuracy, low noise, high 70dB PSRR, and high 60dB channel-to-channel isolation. For added flexibility, each LDO's output voltage is independently programmable to any of 32 voltages in the 1.8V to 3.3V range through the serial interface. For added system protection, each LDO has independent current limiting and thermal-overload protection.

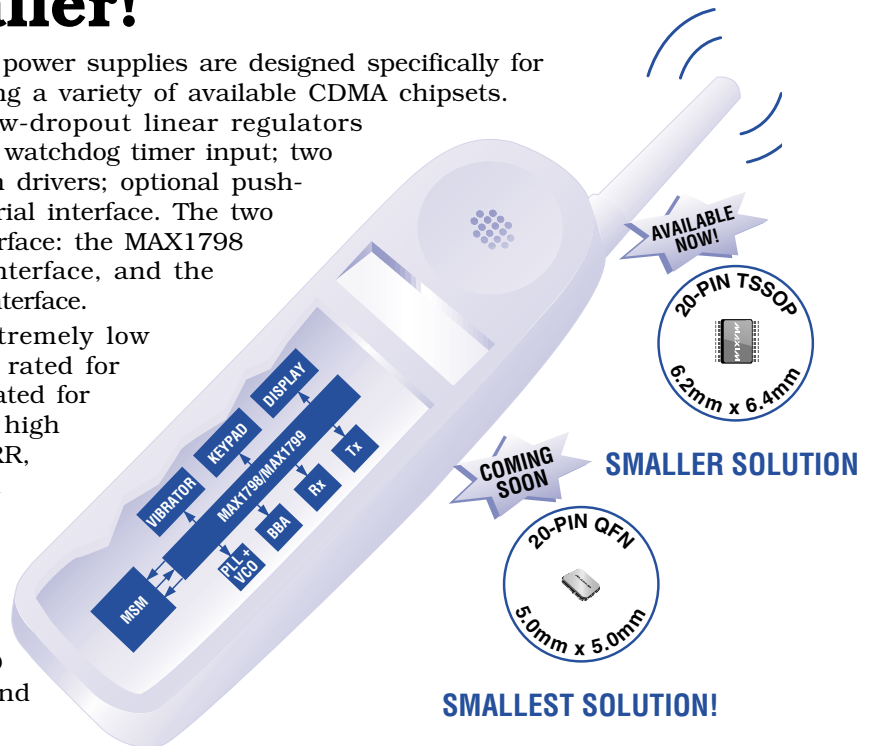
In addition to the small 20-pin TSSOP package, these devices are also available in the tiny 20-pin QFN package, which is just 5mm × 5mm, making them the most compact solutions available for CDMA handset system power.

## • Low-Noise, Low-Dropout Linear Regulators

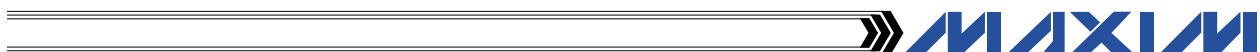
- One 300mA LDO
- Four 150mA LDOs
- Low 100mV (max) Dropout
- Excellent AC Specs
  - <45µVRMS Output Voltage Noise
  - >60dB Channel-to-Channel Isolation
  - 70dB PSRR
- Independent Current and Thermal-Overload Protection (each LDO)
- 140ms (min) Reset Timer
- Watchdog Input
- Two Independent, High-Current, Open-Drain Driver Outputs

## • Optional Push-On/ Push-Off Power Control

- Serial Interface
  - Independently Programs LDO Output Voltage from 1.8V to 3.3V
  - Independently Enables/Disables LDOs
  - Independently Enables/Disables High-Current Drivers
  - 3-Wire SPI™-Compatible Serial Interface (MAX1798)
  - 2-Wire I<sup>2</sup>C-Compatible Serial Interface (MAX1799)
- +2.5V to +5.5V Input Voltage Range
- Tiny 5mm × 5mm 20-Pin QFN Package



SPI is a trademark of Motorola, Inc.





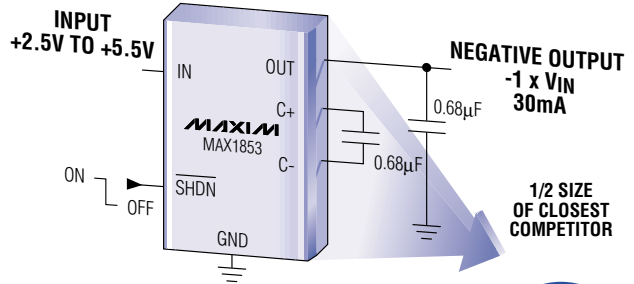


# World's First Charge-Pump Voltage Inverters in SC70

The MAX1852/MAX1853 are the world's first charge-pump voltage inverters packaged in the ultra-small SC70 package. These devices are just half the size of their closest competition and maintain the full +2.5V to +5V input voltage range, yet they outperform their SOT23 rivals by achieving just 15Ω output resistance and a high 30mA output current capability.

These devices differ in their operating frequency: The MAX1852 operates at 50kHz to reduce quiescent supply current (60μA), while the MAX1853 operates at 200kHz to allow tiny external components (0.68μF). Both devices feature slew-rate limiting to reduce output voltage noise, and both devices feature a logic-controlled micro-power shutdown mode.

## WORLD'S SMALLEST CHARGE-PUMP INVERTER FOR GaAsFET AND LCD BIASES



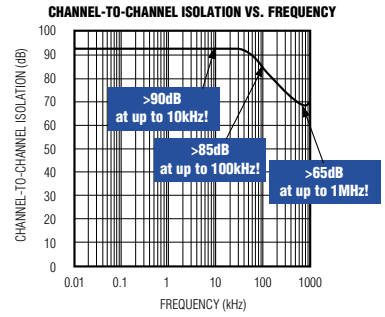
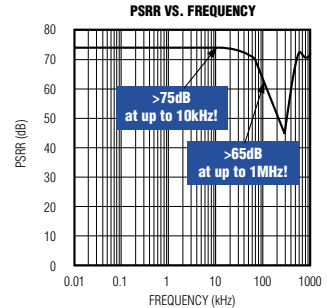
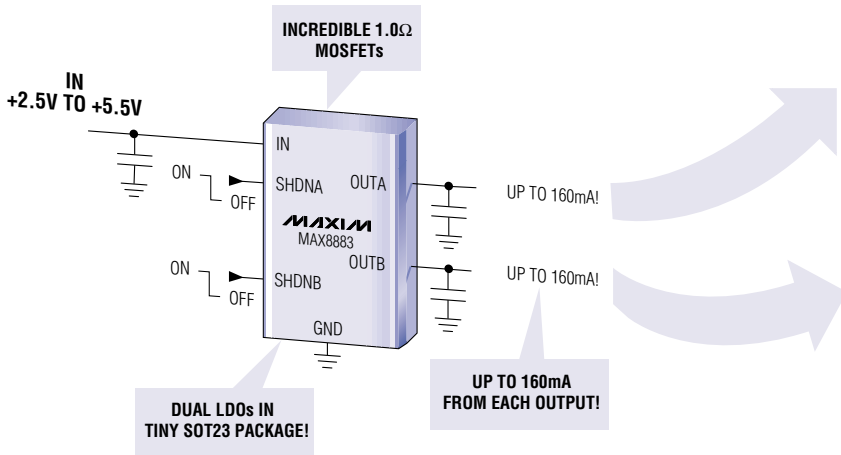
1/2 SIZE OF CLOSEST COMPETITOR



# Dual Low-Dropout Linear Regulators in SOT23 Have Lower Noise and Dropout than Single LDOs

The MAX8882\*/MAX8883\* are dual low-noise, low-dropout linear regulators that operate from a +2.5V to +5.5V input and deliver up to 160mA of continuous output current from each output. These devices are less than 1/2 the size of their closest competition, yet their incredible 1.0Ω on-resistance is lower than most single-LDO competition in the same package.

These devices were designed to achieve excellent AC performance and feature 75dB PSRR (>65dB at 100kHz) and >90dB (>85dB at 100kHz) of channel-to-channel isolation. The MAX8882 has a single SHDN control input and achieves just 40μV<sub>RMS</sub> output noise, while the MAX8883 features independent shutdown control for each regulator. Both devices are available in fixed output voltages of 2.85V/2.85V, 3.3V/2.5V, 3.3V/1.8V, and 2.5V/1.8V. Contact the factory for custom output voltage combinations.



\* Future products—contact factory for availability.

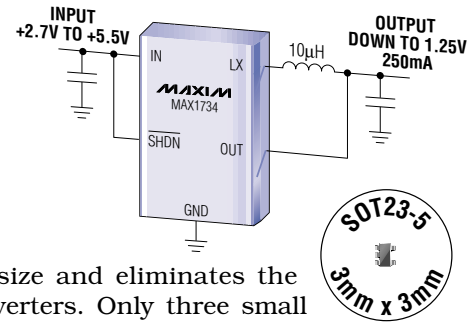




# Smallest 250mA Step-Down DC-DC Solutions Achieve 95% Efficiency for Sub-2V Logic

The MAX1733/MAX1734 step-down DC-DC converters deliver over 250mA to outputs as low as 1.25V. Their 2.7V to 5.5V input voltage range makes them ideal for portable applications powered from a single Li+ cell, from three alkaline or NiCd/NiMH cells, or from a regulated 5V or 3.3V supply.

These converters use a unique, proprietary current-limited control scheme that maintains a low 40µA quiescent supply current while their high 1.2MHz max switching frequency and internal synchronous rectification significantly improve efficiency and minimize solution size. This reduces external component size and eliminates the external Schottky diode required of conventional step-down converters. Only three small external components are needed for a complete DC-DC solution.



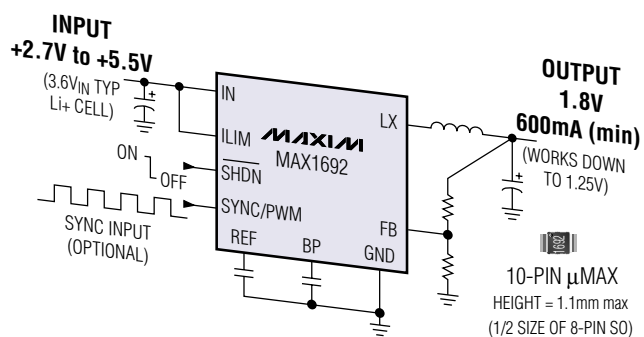
The MAX1733 provides a resistor-adjustable output voltage, while the MAX1734 is available in a variety of preset output voltages. Both devices are available in space-saving 5-pin SOT23 packages.

- **95% Efficiency**
- **40µA Quiescent Supply Current**
- **Fixed 1.8V and 1.5V Output Voltages (MAX1734)**
- **1.5% Output Voltage Accuracy**
- **Soft-Start Limits Start-Up Current**

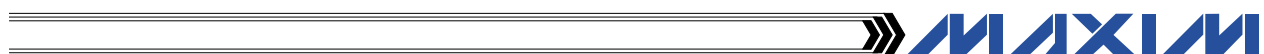
# Tiny Switcher is 10x Better than LDOs for 1.8V Logic Supply

**600mA min Output Current, up to 95% Efficiency, 10x Power Savings**

The MAX1692 step-down DC-DC converter allows PDAs and cell phones to take full advantage of the power savings associated with low-voltage (<1.8V) core logic supplies. Many systems now use linear regulators, which typically dissipate 900mW. The MAX1692 dissipates only 90mW, reducing heat and saving battery life, and delivers a minimum of 600mA at outputs down to 1.25V. Its synchronous rectifier provides up to 95% efficiency. This device requires no external FETs and comes in a tiny 10-pin µMAX package.



- **No External FETs or Schottky Diode Required**
- **Synchronous Rectification Provides up to 95% Efficiency**
- **Low-Dropout Voltage: 150mV at 500mA (vs. 500mV for Linear Regulator)**
- **Adjustable Output: 1.25V to  $V_{IN}$**
- **Guaranteed 600mA Output Current**
- **Low-Noise, Fixed-Frequency PWM Operation at 750kHz (or Sync at 450kHz to 900kHz)**
- **85µA Quiescent Supply Current**
- **EV Kit Available (MAX1692EVKIT)**



**NEW**

# Regulated Charge Pumps

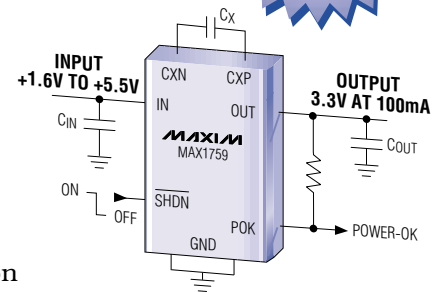
## Replace Switchers and Linears in Compact Designs

White-LED bias applications!

The MAX1730 and MAX1759 are new additions to Maxim's extensive line of regulated charge pumps. Both devices are available in tiny  $\mu$ MAX packages and require only a few small external capacitors to implement complete DC-DC solutions.

The MAX1730 is a regulated step-down charge pump that generates up to 50mA at fixed voltages of either 1.8V or 1.9V. Specifically designed as a high-efficiency linear-regulator replacement for logic supplies, this converter employs fractional-conversion techniques to greatly exceed the efficiency of a linear regulator. A high 2MHz max operating frequency permits the use of 0.22 $\mu$ F flying capacitors, ensuring the smallest solution possible. Proprietary soft-start prevents excessive current draw from the supply at startup, making the MAX1730 compatible with higher impedance sources such as alkaline and Li+ cells.

The MAX1759 is a buck/boost regulating charge pump that generates a regulated 3.3V (or 2.5V to 5.5V adjustable) output voltage from a single Li+ cell, or from two or three NiMH or alkaline cells for small hand-held portable equipment. Designed to be an extremely compact buck/boost converter, this device requires only three small ceramic capacitors to build a complete DC-DC converter capable of generating a guaranteed 100mA min output current. Despite its high 1.5MHz operating frequency, the MAX1759 maintains low 50 $\mu$ A quiescent supply current. For added flexibility, the MAX1759 also includes an open-drain power-OK (POK) output that signals when the output voltage is in regulation.



### MAX1730:

- > 85% Peak Efficiency
- 50mA Guaranteed Output Current
- Fixed 1.8V/1.9V Output Voltages
- Up to 2MHz Operating Frequency
- Small 0.22 $\mu$ F Capacitors
- No Inductor Required
- Low 75 $\mu$ A Quiescent Supply Current
- 1 $\mu$ A Shutdown Mode
- +2.7V to +5.5V Input Voltage Range
- Output Disconnects from Input in Shutdown
- Small 10-Pin  $\mu$ MAX Package

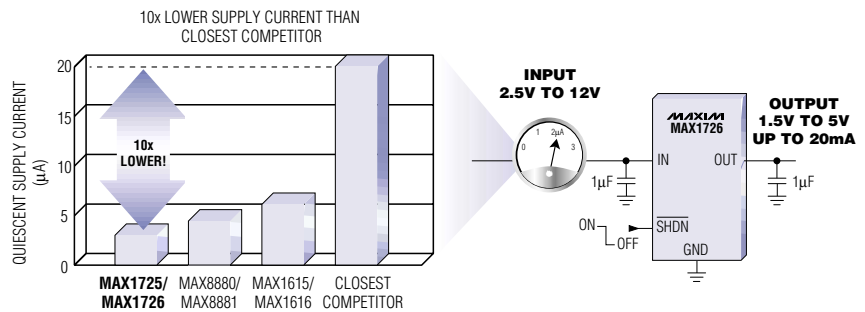
### MAX1759:

- Regulated Output Voltage (Fixed 3.3V or Adj 2.5V to 5.5V)
- 100mA Guaranteed Output Current
- +1.6V to +5.5V Input Voltage Range
- Low 50 $\mu$ A Quiescent Supply Current
- 1 $\mu$ A Shutdown Mode
- Load Disconnects from Input in Shutdown
- High 1.5MHz Operating Frequency
- Uses Small Ceramic Capacitors
- Short-Circuit Protection and Thermal Shutdown
- Small 10-Pin  $\mu$ MAX Package

# World's Lowest Power LDOs Give Battery-Powered Applications Longest Standby

## MAX1725/MAX1726

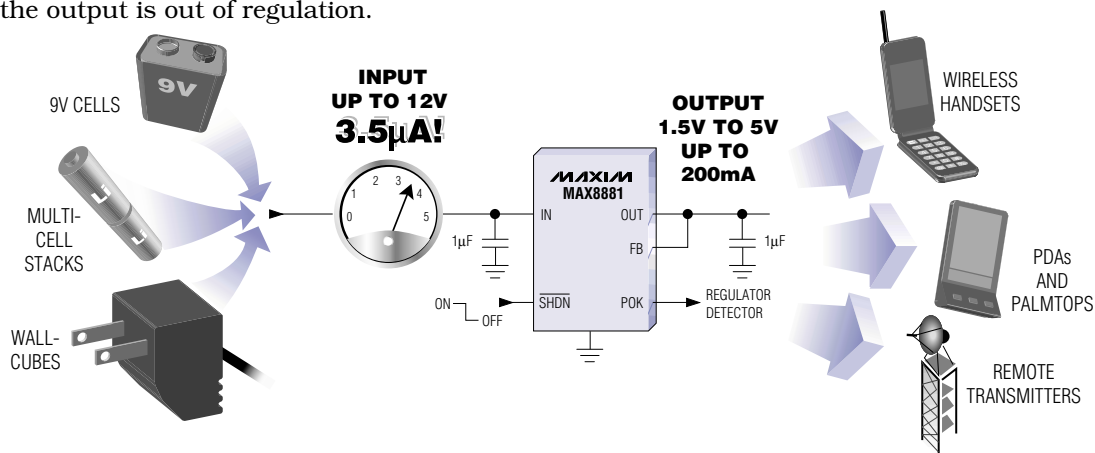
The MAX1725/MAX1726 are the industry's lowest power low-dropout linear regulators, intended for low-power applications that require the longest possible battery life, such as smoke detectors and real-time clock (RTC) or CMOS backup power. These SOT23 devices feature an ultra-low 2 $\mu$ A supply current and reverse battery protection.



- **Ultra-Low 2 $\mu$ A Quiescent Supply Current**
- **1%-Accurate Output Voltages**
- **2.5V<sub>IN</sub> to 12V<sub>IN</sub> Operation**
- **Small 1 $\mu$ F Output Capacitors**
- **Automatic Reverse-Battery Protection—Eliminates External Blocking Diodes**
- **Fixed Output (1.8V, 2.5V, 3.3V, or 5V, MAX1726) or Adjustable Output (1.5V to 5.5V, MAX1725)**

## MAX8880/MAX8881 with Power-OK Output

The MAX8880/MAX8881 are SOT23 200mA low-dropout linear regulators that feature extremely low 3.5 $\mu$ A quiescent supply current for portable applications that require the longest possible standby times. These devices feature a 12V input voltage range and a power-OK (POK) output that indicates when the output is out of regulation.



- **Ultra-Low 3.5 $\mu$ A Quiescent Supply Current**
- **200mA Output Current Capability**
- **1%-Accurate Output Voltages**
- **2.5V to 12V Input Range**
- **Small 1 $\mu$ F Output Capacitors**
- **Reverse-Battery Protection**
- **Fixed Output (1.8V, 2.5V, 3.3V, or 5V, MAX8881) or Adjustable Output (1.5V to 5.5V, MAX8880)**
- **Power-OK Output for Out-of-Regulation Indicator**



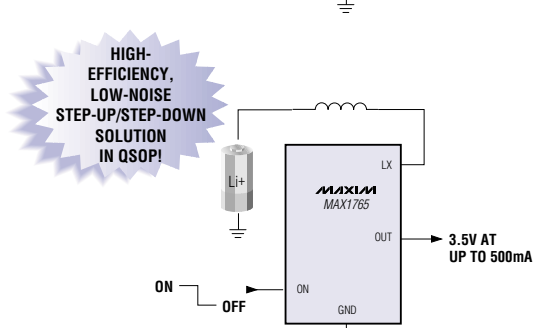
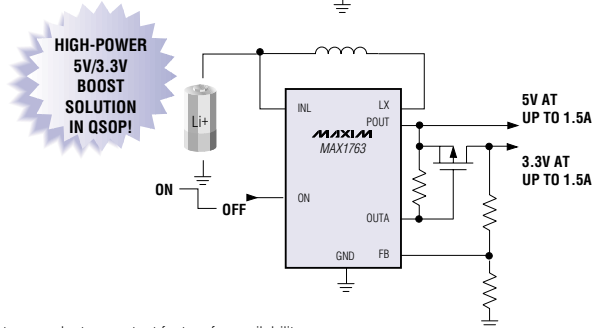
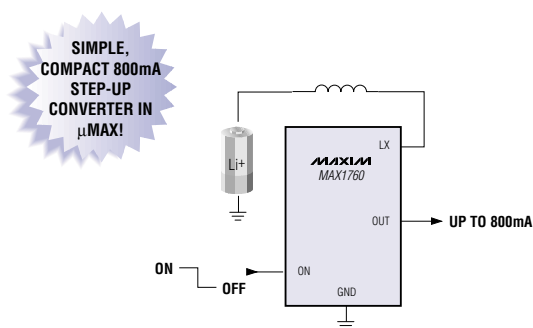
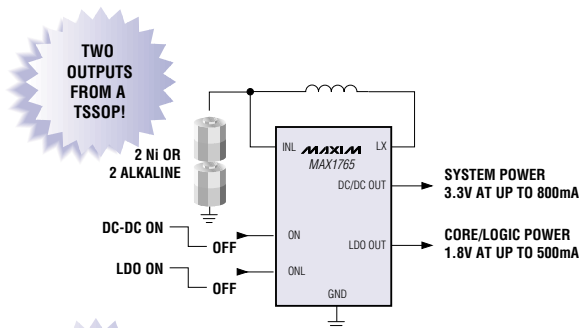
# High-Performance Upgrades to Industry-Leading DC-DC Boost Family!

## New Devices Combine High Efficiency with Smaller Size and More Functionality

The MAX1760/MAX1763\*/MAX1765\* are high-performance upgrades to Maxim's industry-leading MAX1700/MAX1703/MAX1705 family of DC-DC boost-converters. In addition to the high-efficiency, low-noise operation of their predecessors, these devices come in smaller packages, use smaller external components, and offer additional features such as adjustable current limit and soft-start.

The MAX1760 is the simplest device, has 800mA of output current capability, and is packaged in a small 10-pin  $\mu$ MAX package. The MAX1763 can supply up to 1.5A and includes a gain-block that is useful for building an external high-power LDO. The MAX1765 is an 800mA device that integrates a 500mA LDO, which can be operated independently of the DC-DC converter or in Maxim's proprietary Track-Mode™ for a low-noise, high-efficiency output. All devices have evaluation kits available to simplify their evaluation.

- **0.7V to 5.5V Input Range**
- **Up to 1.5A Output Current (MAX1763)**
- **Fixed 3.3V or Adj (2.5V to 5.5V) Outputs**
- **Constant-Frequency (1MHz) or Synchronizable (500kHz to 1.2MHz) PWM Operation**
- **Adjustable Current Limit and Soft-Start**
- **On-Board 500mA Low-Dropout Linear Regulator (MAX1765)**
- **Gain-Block for High-Power Linear Regulator (MAX1763)**
- **Small 10-Pin  $\mu$ MAX Package (MAX1760)**



\* Future products—contact factory for availability.

Track-Mode is a trademark of Maxim Integrated Products.





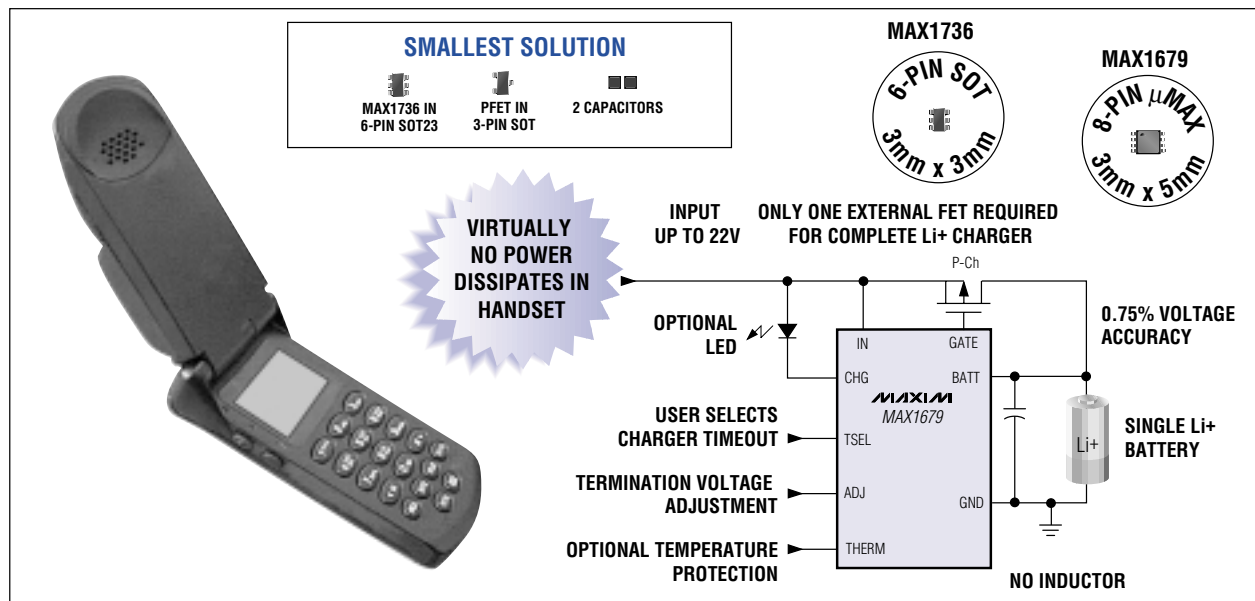
# Chargers Dissipate Virtually No Power in the Handset

The MAX1679 and MAX1736 are single-cell Li+ battery chargers suitable for cellular/PCS phones and low-power hand-held equipment such as PDAs and portable digital audio players. Unlike heat-dissipating linear-mode chargers, their low-dissipation control scheme works in conjunction with a low-cost, current-limited wall cube to dissipate virtually no heat—even over extended periods of fast charging. Both devices feature overall system accuracy of 0.75%, ensuring that the cell capacity is fully utilized without degrading the life of the cell.

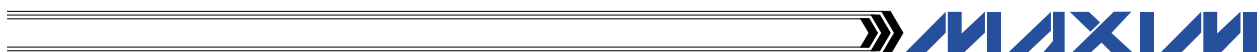
The MAX1679, packaged in an 8-pin  $\mu$ MAX, is a flexible device that provides all of the intelligence required of a complete charging solution for Li+ cells. It includes three safety timer settings to automatically terminate the charge cycle under fault conditions, an LED driver to communicate the current charge state, continuous thermal and under/overvoltage protection, and an output voltage that can be adjusted using a single low-cost resistor.

The MAX1736 comes in a 6-pin SOT23 package and provides the high-accuracy voltage regulation required to charge Li+ cells. Its single control pin permits an optional microcontroller to easily implement a wide range of algorithms to control charge, allowing this device to be easily integrated into new and existing designs.

Both the MAX1679 and MAX1736 detect the presence of their power source and automatically power down when the source is removed to minimize battery drain. Both devices automatically initiate a charge cycle when the power source is applied or when the battery is inserted, and the charging cycle automatically terminates when the average charging current falls below a preset threshold.



- **Simple Stand-Alone Application Circuits**
- **Lowest Power-Dissipation Control Scheme**
- **Tiny Packages Minimize Space Requirements**
- **0.75% Overall System Accuracy**
- **No Inductor Required**
- **Safely Conditions Near-Dead Cells**
- **Continuous Thermal Protection (MAX1679)**
- **Programmable Safety Timeout (MAX1679)**
- **Automatic Power-Down when the Power Source Is Removed**

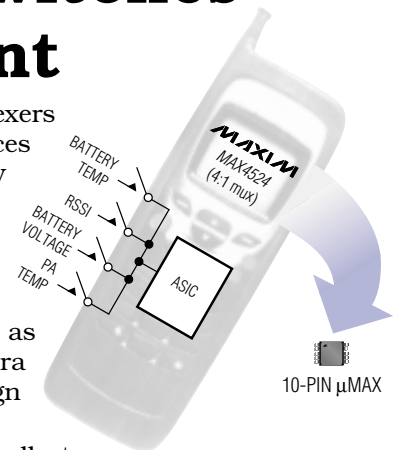


# Tiny Low-Voltage Muxes/Switches Ideal for Wireless Equipment

Maxim's broad line of low-voltage CMOS analog switches and multiplexers are designed with hand-held portable applications in mind. These devices feature single-supply operation from voltages as low as 1.8V, and supply current is generally 1µA at +25°C. Tiny packages are also available: SC70, SOT23, µMAX, and TSSOP.

Switches and muxes solve a number of portable equipment design problems:

- 1) **ASIC functionality limitations.** ASIC manufacturers must integrate as many features as possible, and will often reduce the number of extra analog input or GPIO pins. In cases where this inflexibility hinders design modification, Maxim can "mux-in" additional functionality.
- 2) **Board space limitations.** Maxim switches and muxes come in the smallest packages available and are offered in a wide variety of configurations.
- 3) **Cost.** Maxim offers low-cost solutions for every application.
- 4) **Reliability.** Designed on CMOS and BiCMOS processes, Maxim's analog switches offer a monolithic solution with guaranteed device performance. They are often preferred over a risky ASIC integration approach, where digital process geometries do not lend themselves to optimum switch performance.



Low-Voltage Analog Switches

Part	Function	RON (Ω) at +25°C, +5V	Operating Voltage (V)	Supply Current (µA) at +25°C	Switching Times (ns)		Pin-Package
					tON	tOFF	
MAX4626/7	SPST NC/NO	0.5	2 to 5.5	1	50	30	5-SOT23
MAX4628	SPST NC+NO	0.5	2 to 5.5	1	50	30	5-SOT23
MAX4645/6	SPST NC/NO	2.5	1.8 to 5.5	1	15	10	5-SOT23/6-SOT23
MAX4514/15	SPST NC/NO	20	2 to 12	1	150	100	5-SOT23
MAX4594/5	SPST NC/NO	10	2 to 5.5	1	35	40	5-SC70
MAX4596/7	SPST NC/NO	10	2 to 5.5	1	35	40	5-SC70
MAX4501/2	SPST NC/NO	250	2 to 12	1	75	50	5-SC70/SOT23
MAX4641/2	2 SPST NC/NO	4	1.8 to 5.5	1	15	8	8-µMAX
MAX4643	2 SPST NC, NO	4	1.8 to 5.5	1	15	8	8-µMAX
MAX4541/2	2 SPST NC/NO	60	2 to 12	1	100	75	8-SOT23/µMAX
MAX4543	2 SPST NC, NO	60	2 to 12	1	100	75	8-SOT23/µMAX
MAX4624/5	2:1	1	1.8 to 5.5	1	50	50	6-SOT23
MAX4644	2:1	4	1.8 to 5.5	1	15	8	6-SOT23
MAX4544	2:1	60	2 to 12	1	100	75	6-SOT23
MAX4599	2:1	60	2 to 5.5	1	30	25	6-SC70/SOT23

Low-Voltage Analog Multiplexers

Part	Function	RON (Ω) at +25°C, +5V	Operating Voltage (V)	Supply Current (µA) at +25°C	Switching Times (ns)		Pin-Package
					tON	tOFF	
MAX4624/5	2:1	1	2 to 5.5	1	50	50	6-SOT23
MAX4644	2:1	4	1.8 to 5.5	1	15	8	6-SOT23
MAX4544	2:1	60	2 to 12	1	100	75	6-SOT23
MAX4599	2:1	60	2 to 5.5	1	30	25	6-SC70/SOT23
MAX4636	Dual 2:1	4	1.8 to 5.5	1	12	5	10-µMAX
MAX4525	Dual 2:1	150	2 to 12	1	150	120	10-µMAX
MAX4619	Triple 2:1	10	2 to 5.5	1	15	10	16-TSSOP
MAX4583	Triple 2:1	80	2 to 12	1	200	100	16-TSSOP
MAX4634	4:1	4	1.8 to 5.5	1	18	11	10-µMAX
MAX4524	4:1	150	2 to 12	1	150	120	10-µMAX
MAX4639	Dual 4:1	4	1.8 to 5.5	1	14	5	16-TSSOP
MAX4618	Dual 4:1	10	2 to 5.5	1	15	10	16-TSSOP
MAX4582	Dual 4:1	80	2 to 12	1	100	100	16-TSSOP
MAX4638	8:1	4	1.8 to 5.5	1	14	5	16-TSSOP
MAX4617	8:1	10	2 to 5.5	1	15	10	16-TSSOP
MAX4581	8:1	80	2 to 12	1	200	100	16-TSSOP



# World's Smallest SIM/Smart-Card Level Translators

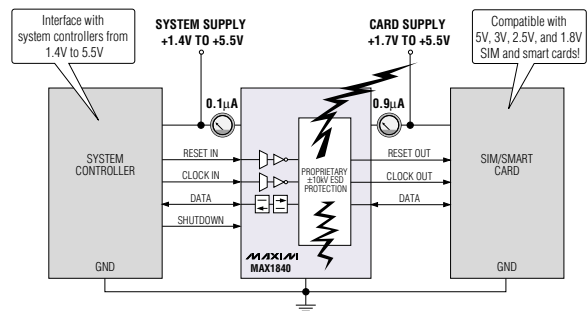
## ±10kV ESD Protection, 1.8V Operation, 20MHz Speed

The MAX1840/MAX1841 SIM/smart-card level translators provide level shifting and ESD protection for subscriber identification module (SIM) and smart-card ports. These devices integrate two unidirectional level shifters for the reset and clock signals, a bidirectional level shifter for the serial data stream, and ±10kV ESD protection on all card contacts. These devices are pin compatible with the popular MAX1740/MAX1741 SIM interface ICs, and allow operation at lower voltages and higher operating speeds (up to 20MHz).

The MAX1840 includes a  $\overline{\text{SHDN}}$  control input to aid card insertion and removal, while the MAX1841 includes a system-side data driver to support system controllers without open-drain drivers. Both devices simplify power management by automatically shutting down when either supply is removed, and either device may be combined with the MAX1686H to provide a complete level-translation and card-power solution for SIMs and smart cards.

The MAX1840/MAX1841 are available in ultra-small 10-pin  $\mu\text{MAX}$  packages, which occupy half the area of an 8-pin SO and are only 1.09mm high.

- **No External Components Required**
- **±10kV ESD Protection on All Card Contacts**
- **1 $\mu\text{A}$  Quiescent Supply Current**
- **0.01 $\mu\text{A}$  Shutdown Supply Current**



# +3V, 1 $\mu\text{A}$ , ±15kV ESD-Protected RS-232 ICs Simplify Smart Phones

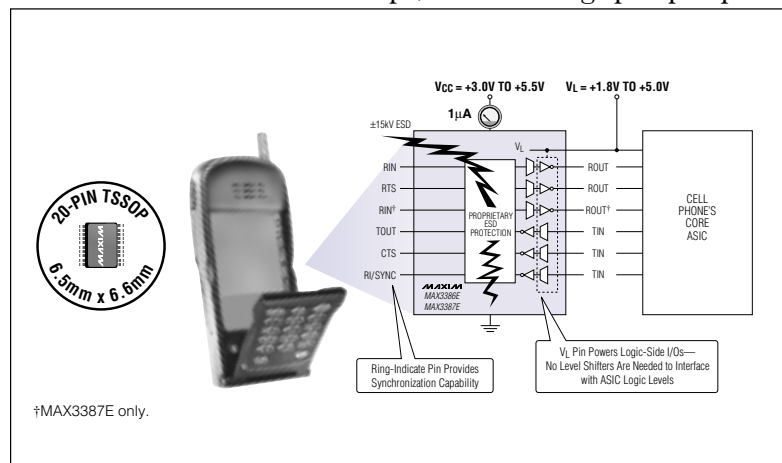
## Separate Logic Supplies Ensure Compatibility with Mixed Logic Levels

The MAX3386E/MAX3387E feature a unique  $V_L$  pin allowing the devices to operate with various logic levels. Input and output logic levels are pin programmable down to 1.8V through the  $V_L$  pin, eliminating the need for level shifters in mixed-voltage logic systems.

A proprietary low-dropout transmitter output stage enables RS-232-compliant performance over a full +3.0V to +5.5V supply range through a dual charge pump and consumes only 1 $\mu\text{A}$  of supply current in shutdown mode. Each device is guaranteed to run at data rates of 250kbps, and the charge pump requires only four small 0.1 $\mu\text{F}$  capacitors.

All RS-232 inputs and outputs are protected to ±15kV per the IEC 1000-4-2 Air-Gap Discharge method, ±8kV per the IEC 1000-4-2 Contact Discharge method, ±15kV per the Human Body Model, and ±4kV per the IEC 1000-4-4 Electrical Fast Transient\* method. The MAX3386E has two receivers and three transmitters, while the MAX3387E has three receivers and three transmitters. Both devices are available in space-saving TSSOP packages.

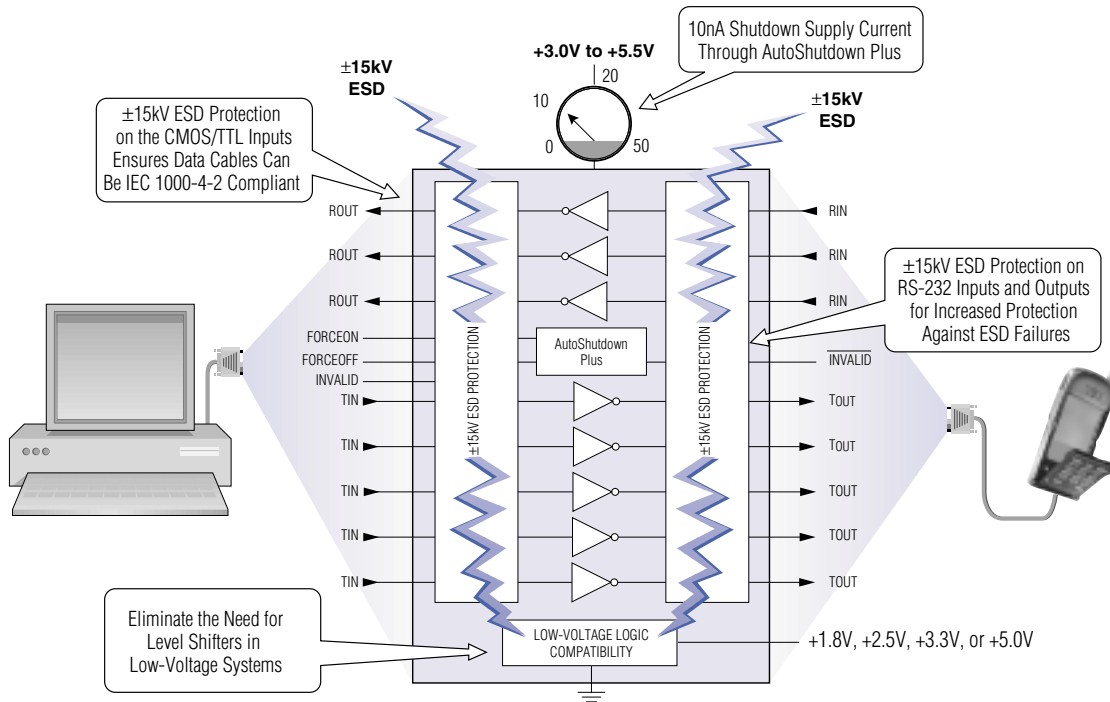
\*Pending completion of testing.







# ±15kV ESD Protection on All Logic and RS-232 I/O Pins Produces the Most Rugged Interface ICs Ever!



The MAX3237E/MAX3238E/MAX3248E are the first RS-232 ICs to feature integrated ±15kV electrostatic discharge (ESD) protection on all TTL/CMOS pins and all RS-232 inputs and outputs. Adding ESD protection to the logic pins safeguards the devices in data cable applications, since either connector of the cable can be exposed to harsh environments.

The MAX3248E can also interoperate with +1.8V, +2.5V, +3.3V, and +5.0V logic levels, providing compatibility with low-voltage logic systems and eliminating the need for level shifters in these applications.

The MAX3238E/MAX3248E achieve 10nA of supply current through Maxim's proprietary AutoShutdown Plus™ feature. This architecture reduces supply current to 10nA by sensing when the RS-232 port is disconnected or idle for more than 30 seconds. A proprietary voltage doubler and low-dropout stage allow the MAX3237E/MAX3238E/MAX3248E to deliver true RS-232 performance over a full +3.0V to +5.5V supply range.

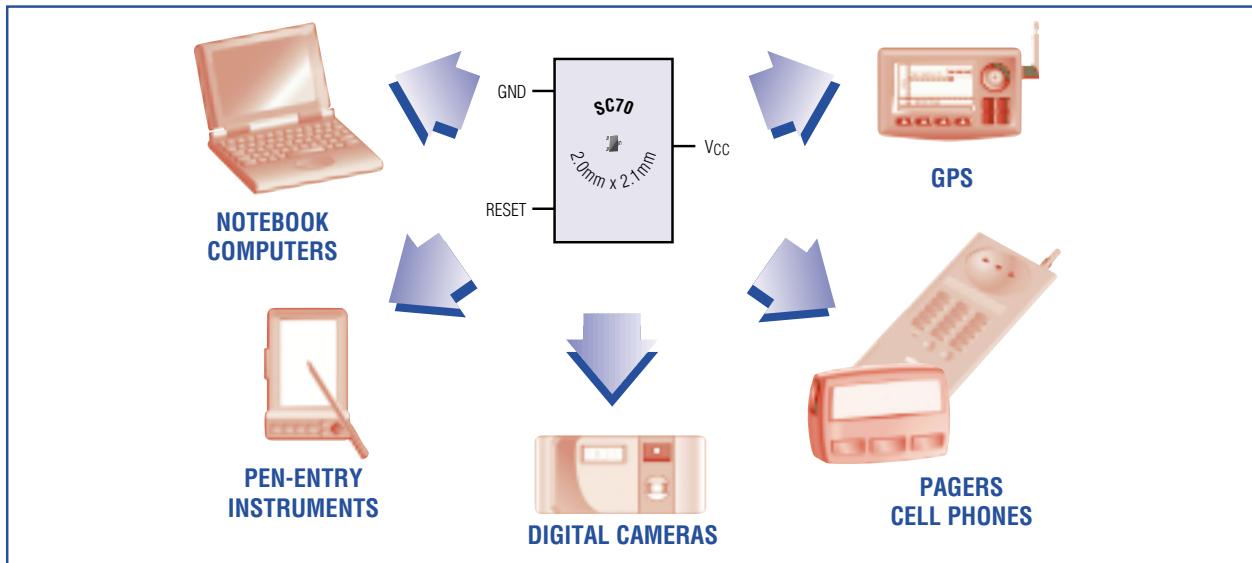
**Get Price, Delivery, and Place Orders Online at**  
[www.maxim-ic.com](http://www.maxim-ic.com)

AutoShutdown Plus is a trademark of Maxim Integrated Products.



# Maxim Offers Lowest Power Reset ICs in Miniature SC70 Package

Ideal for Portable Equipment Applications



**CUT BOARD SPACE AND POWER CONSUMPTION WITH THESE TINY DEVICES!**

SMALL...



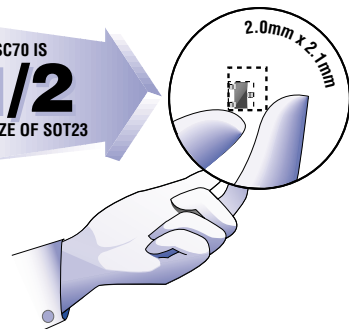
SOT23

SC70 IS  
**1/2**  
THE SIZE OF SOT23

JUST GOT  
SMALLER...



SC70

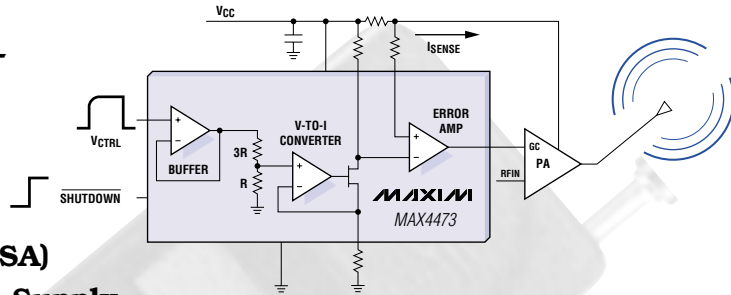


- **Super-Small SC70 Package**
- **Precision Monitoring (2.5% Over Temperature) of +2.5V/+3.0V/+3.3V/+5V Power Supplies**
- **No External Components Required**
- **Debounced Manual Input (MAX6711/MAX6712/MAX6713)**
- **Three Reset Output Options**
- **Fully Specified to +125°C (MAX803/MAX809/MAX810/MAX6711/MAX6712/MAX6713)**

Part	Push-Pull RESET	Push-Pull RESET	Open-Drain RESET	Manual Reset Input	Reset Threshold Range	Typical Supply Current (µA)
MAX6326	✓				2.20V to 3.08V in	
MAX6327		✓			approximately	0.5
MAX6328			✓		100mV increments	
MAX6346	✓				3.30V to 4.63V in	
MAX6347		✓			approximately	1.0
MAX6348			✓		100mV increments	
MAX803			✓			
MAX809	✓				Nominal thresholds of	
MAX810		✓			2.32V, 2.63V, 2.93V,	12
MAX6711	✓			✓	3.08V, 4.38V, and 4.63V	
MAX6712		✓		✓		
MAX6713			✓	✓		

# World's Best Single-Chip Solution for GSM Power-Amp Control

**Optimized for GSM Cell Phone Requirements— Save Months of Layout and Design Time!**



- **Low Cost: 75¢ (50k pc, FOB USA)**
- **Flexible +2.7V to +6.5V Single Supply**
- **Low 1.2mA Supply Current, 1µA Shutdown Current**
- **External Gain-Setting Resistors Maximize Flexibility**
- **Rail-to-Rail® Input Buffer**
- **Offered in Space-Saving 8-Pin µMAX**



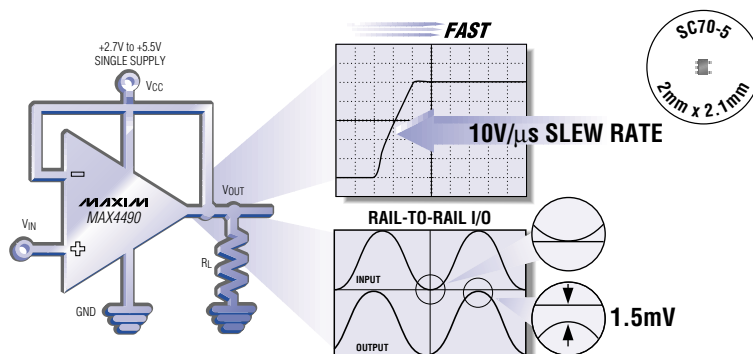
The MAX4473 PA control IC greatly simplifies power ramp-up and ramp-down control circuitry required by Global Satellite Mobile communication (GSM) and other TDMA cell phone PAs. Housed in a tiny 8-pin µMAX package (3mm x 5mm), this IC saves layout and design time by replacing three discrete op amps and a handful of passive components, virtually eliminating various RF noise and stability design issues. Optimized to meet strict GSM bandwidth and slew-rate requirements, the MAX4473 offers the unique benefit of guaranteed 1.5µs enable/disable times and low 1.2mA supply current. This reduces power consumption without compromising dynamic response. Three external gain resistors offer maximum versatility.

The MAX4473 has a robust rail-to-rail output capable of driving 500Ω and/or 300pF of capacitance, enabling it to drive low-impedance PA gain-control inputs. The internal error amplifier's rail-to-rail inputs allow accurate power control over a wide common-mode range and prevent phase reversal of the outputs. Other features include a rail-to-rail control input buffer and a wide +2.7V to +6.5V supply voltage range. In shutdown mode, the device draws less than 1µA of supply current, and the output is actively pulled down.

Rail-to-Rail is a registered trademark of Nippon Motorola, Ltd.

## **NEW** World's Only 10V/µs Rail-to-Rail I/O Op Amp in Tiny SC70 Package

**Mini Size, Mini Price, Max Performance: Ideal for PA Control**



- **800µA Supply Current**
- **10MHz Gain Bandwidth**
- **Drives 2kΩ Loads**
- **50pA Input Bias Current**
- **Drives 200pF with No Isolation Resistor**
- **SC70 Package**

