

7th Edition

# AUTOMOTIVE

*Product Guide*



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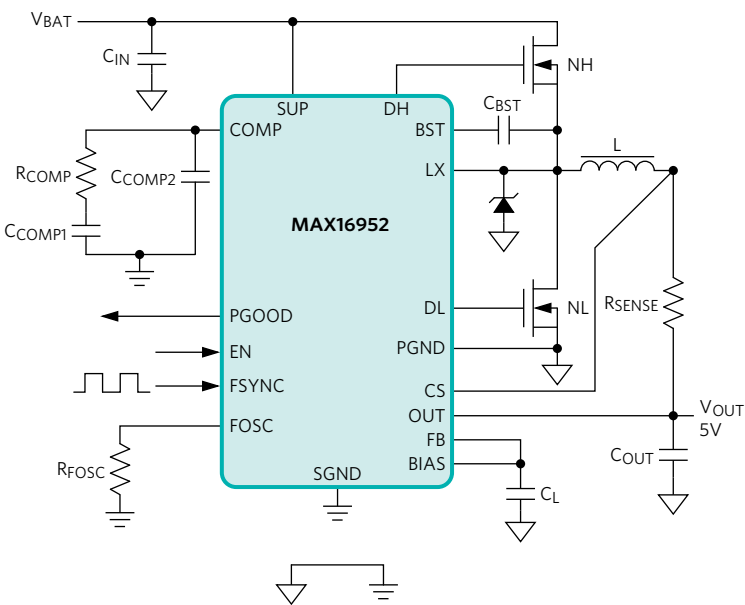
# Automotive-Qualified Step-Down Regulators for Infotainment and Body Applications

- 42V load-dump tolerance allows direct operation from the car battery
- Up to 2.2MHz adjustable switching frequency reduces external component size and optimizes solution cost
- Available spread-spectrum feature lowers EMI to minimize radio interference within the vehicle
- Ultra-low quiescent current in SKIP mode to meet stringent OEM module standby current requirements
- Wide operating voltage range ensures operation from cold crank up to truck battery inputs

Part	V <sub>IN</sub> (max) (V)	I <sub>OUT</sub> (A)	f <sub>SW</sub>	Spread Spectrum	I <sub>Q</sub> (μA)
MAX16907	36	3	1MHz to 2.2MHz	Yes	30
MAX16909	36	3	220kHz to 1MHz	No	30
MAX16974	28	2	220kHz to 2MHz	No	35
MAX16975	28	1.2	220kHz to 1MHz	No	45
MAX16976	28	0.6	220kHz to 1MHz	No	45
MAX16977	36	2	1MHz to 2.2MHz	Yes	30

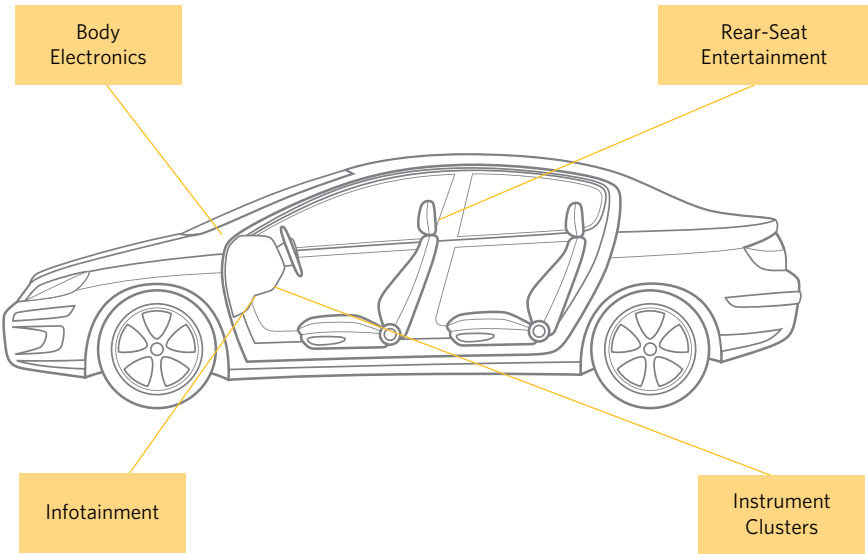
# High-Frequency Step-Down Controller Reduces Size, Cost, and AM Band Radio Interference

- 2.2MHz operating frequency minimizes AM band radio interference and reduces external component size
- 42V load-dump tolerance allows direct operation from the car battery
- Wide 3.5V to 36V V<sub>IN</sub> range ensures operation from cold crank up to battery inputs
- Ultra-low 50μA quiescent current meets stringent OEM module standby current requirements



# 28V, 1A, High-Frequency Synchronous Buck Gives You the Smallest Solution Footprint

The MAX16903 is the industry’s smallest automotive-grade synchronous buck converter capable of delivering 1A from a 3.5V to 28V input. Its 2.1MHz switching frequency allows you to use smaller external components while avoiding interference with the AM-radio band. This gives you an extremely compact solution with a very low BOM cost.



**Saves Space and Reduces BOM Cost**

- 2.1MHz operation allows tiny external components
- Integrated high- and low-side FETs with internal compensation eliminate the need for an external Schottky diode
- Requires only low-cost ceramic input/output capacitors
- Ultra-small 3mm x 3mm, 10-Pin TDFN-EP package

**Conserves Battery Life**

- 25µA quiescent current (no load) meets tight power budgets

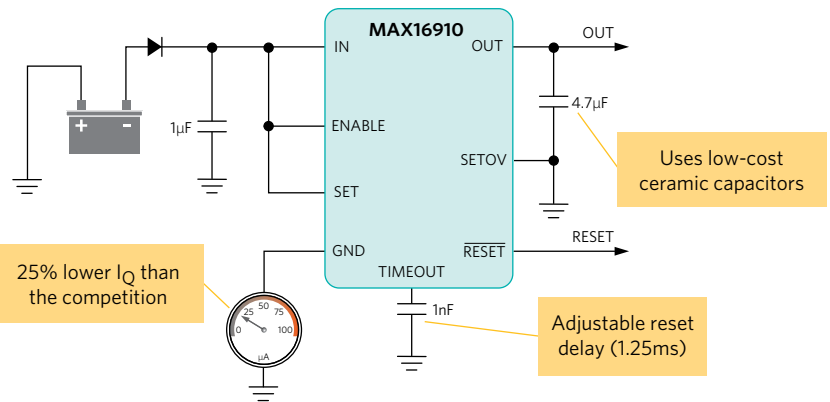
**Speeds Automotive Compliance**

- Fixed-frequency operation and optional spread-spectrum modulation reduce EMI
- Wide input range allows direct operation from battery
- Load-dump tolerant to 42V
- AEC-Q100 qualified
- -40°C to +125°C operation
- 10-pin TDFN-EP and 16-pin TSSOP-EP packages

# Ultra-Low-I<sub>Q</sub> Automotive LDO Conserves Battery Life in Always-On Applications

## 45V, 200mA LDO Consumes Only 20µA I<sub>Q</sub>

The MAX16910 operates over a wide input-voltage range (3.5V to 30V), survives load dumps up to 45V, and is guaranteed for operation over the -40°C to +125°C automotive temperature range. It includes three pin-selectable output-voltage configurations: 5.0V or 3.3V fixed, and adjustable from 1.5V to 11V. Additionally, the MAX16910 reduces component cost by operating with small ceramic capacitors.



**Industry's Lowest I<sub>Q</sub> Automotive LDOs**

Part	No-Load I <sub>Q</sub> (µA)	I <sub>OUT</sub> (mA)	V <sub>IN</sub> Range (V)	Adjustable Output Voltage (V)	Reset Threshold (%)	Package (mm x mm)
MAX15006	10	50	4 to 40 (45, max)	1.8 to 10	—	6-TDFN-EP (3 x 3)
MAX15007	10	50	4 to 40 (45, max)	1.8 to 10	—	6-TDFN-EP (3 x 3)
MAX16910	20	200	3.5 to 30 (45, max)	1.5 to 11	87.5, 92.5	8-TDFN-EP (3 x 3), 8-SO-EP (5 x 4)

# High-Efficiency, Low-I<sub>Q</sub>, Synchronous Step-Down Converters Provide Optimized Point-Of-Load Regulation

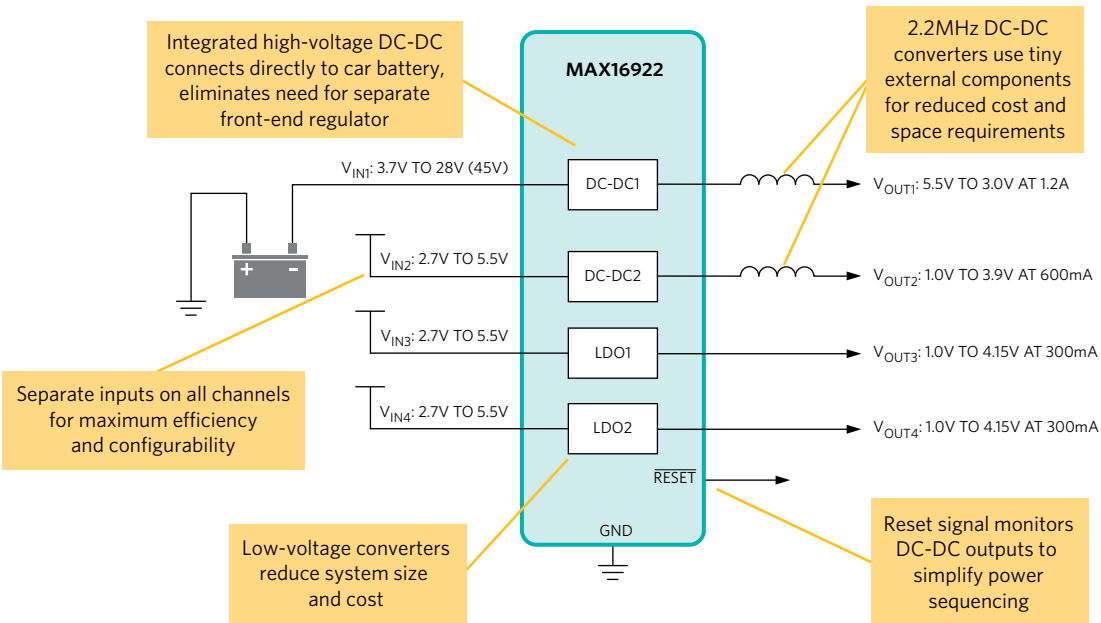
- Up to 2.2MHz switching frequency reduces external component size and minimizes solution cost
- Available spread-spectrum and forced PWM features lower EMI to minimize radio interference within the vehicle
- Current-controlled operation simplifies design effort and enables cycle-by-cycle current limit
- 3A (MAX16961\*) and 4A (MAX16962) output currents support high-current requirements of processor cores
- Dual-channel MAX16963 saves additional board space and offers most cost-effective solution

Part	V <sub>IN</sub> Range (V)	I <sub>OUT</sub> (A)	f <sub>SW</sub> (MHz)	Spread-Spectrum	I <sub>Q</sub> (µA)
MAX16961	2.7 to 5.5	3	2.2	Yes	27
MAX16962	2.7 to 5.5	4	2.2	Yes	27
MAX16963	2.7 to 5.5	1.5/1.5	2.2	Yes	36
MAX1556	2.6 to 5.5	1.2	1	No	16
MAX1557	2.6 to 5.5	0.6	1	No	16

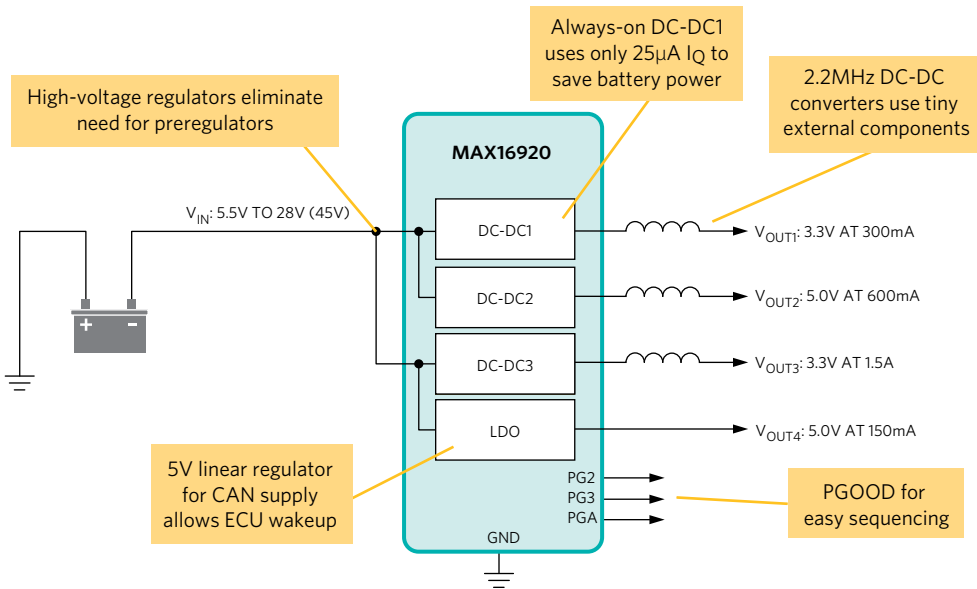
\*Future product—contact factory for availability.

# Industry’s Smallest 4-Channel Automotive PMIC that Connects Directly to the Car Battery

Two Step-Down DC-DCs and Two LDOs in a 25mm<sup>2</sup> Package



# 2MHz, High-Voltage PMIC Delivers Four Rails in Tiny Solution Size



# Space-Effective Solutions for Dashboard, Navigation, and Entertainment Systems

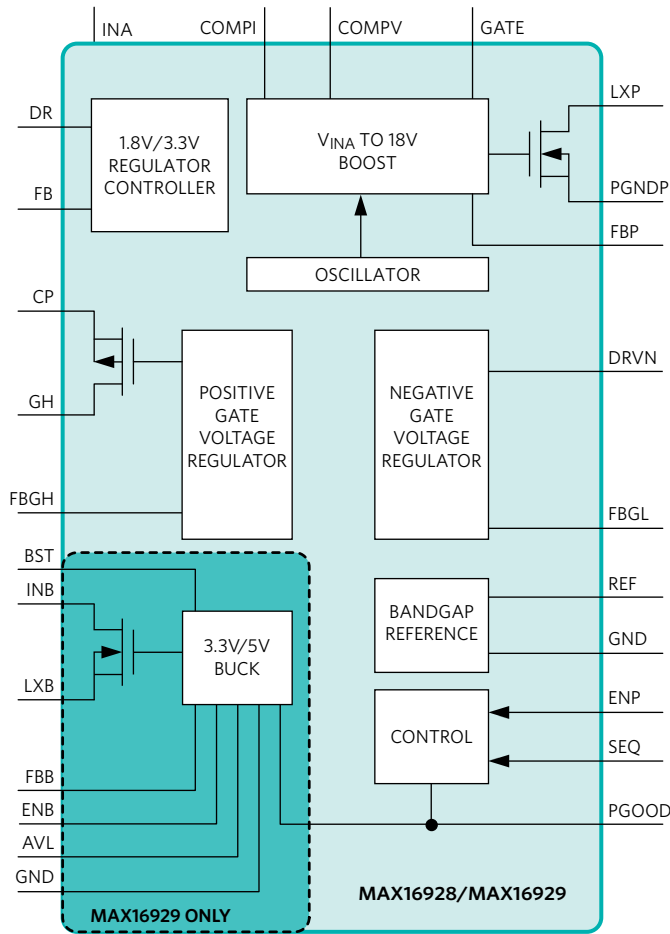
Automotive TFT-LCD PMICs Reduce EMI Through Spread-Spectrum Switching

## Cost-Effective, High-Performance Solution: MAX16928

- Highly integrated power supply
  - Boost converter, linear regulator, and power controllers
  - Flexible sequencing of positive gate voltage regulator and negative gate voltage regulator

## Power Your Display Directly from the Car Battery: MAX16929

- Integrated high-voltage front-end buck regulator
  - Allows direct voltage regulation from the car battery
  - Automotive load-dump tolerant up to 42V
- Highly integrated power supply
  - Boost converter, linear regulator, and power controllers
  - Flexible sequencing of both positive and negative gate voltage regulators

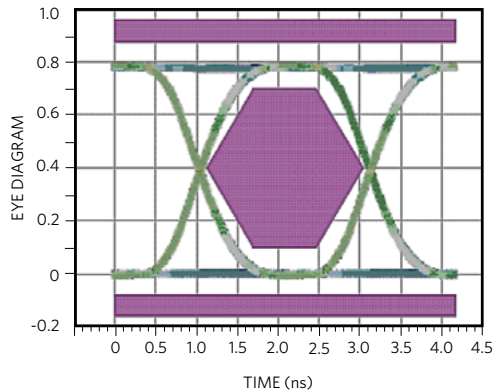


# Hi-Speed USB Protectors with Apple Fast Charge and USB Host Charge Detection

Offer Fully Integrated USB Power and Data Protection Switches with 480Mbps Operation While Providing High-ESD Protection

Applications for Automotive USB Architectures

- Radio head
- Navigation unit
- Clusters
- Module-to-module communication
- Phone cradle
- Connectivity hub
- Dedicated USB charging port
- Full-function USB charging
- iPod®/iPhone®/iPad®

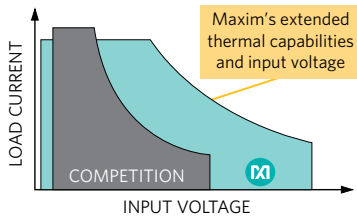


Feature	MAX16919	MAX16942E/3E/4E	MAX16969
USB Data Switches			
Short-to-battery, high-ESD protection, 480Mbps	✓	✓	✓
USB host charging BC1.1 BC1.2 CDP	✓		✓
Apple® rapid charging 1A			✓
USB Power Switch			
Internal power FET on-resistance (typical)	22mΩ	57mΩ	22mΩ
Current limit	Adjustable limit	Fixed threshold	Adjustable limit
Maximum current	3A	1.3A	3A
Short-to-battery, short-to-GND, high-ESD protection	✓	✓	✓
Short-to-battery protection FET	External	Internal	External

Protect your USB HVD+, HVD-, and HVBUS lines from the brutal automotive environment:  
[www.maximintegrated.com/auto-USB](http://www.maximintegrated.com/auto-USB)

# Automotive Regulators with Highest Reliability Over Wide Operating Range

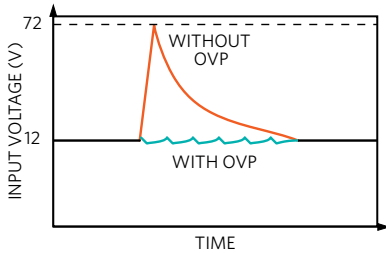
Maxim's family of automotive regulators operates over a very wide input-voltage range (up to 72V) and tolerates many voltage transients without any external circuitry. The ICs are fully specified up to +125°C and can dissipate more power than most competitive solutions. They also integrate various features such as a reset output, an extra undedicated comparator (PFI/PFO), a watchdog timer, enable and hold functionality, and a gate driver (GATEP) that protects against reverse-battery conditions by using a pFET.



Part	Output(s)	Watchdog	Enable Input(s)	Hold Input(s)	Additional Comparator	GATEP
MAX6765/MAX6766	100mA	—	1		—	
MAX6767/MAX6768	100mA	—	1	✓	—	
MAX6769/MAX6770	100mA	—	1		RESETIN	
MAX6771/MAX6772	100mA	—	2		—	
MAX6773/MAX6774	100mA	Fixed	1		—	
MAX6791/MAX6792	2 x 150mA	Adjustable, windowed	2	✓	PFI/PFO	✓
MAX6793/MAX6794	2 x 150mA	Adjustable	2	✓	PFI/PFO	✓
MAX6795/MAX6796	300mA	Adjustable	1	✓	PFI/PFO	✓

# Overvoltage Protectors Prevent Damage to Downstream Circuitry

Maxim's overvoltage protection circuits can protect your circuit from continuous voltage levels from below -30V to greater than 90V, and even higher transients. Some devices feature a limiter mode, which allows continuous system operation even during overvoltage fault conditions. The MAX16126/MAX16127 family is designed to protect for all ISO 7637 load-dump conditions.



Part	Function	MOSFET	Reverse Voltage	Undervoltage	Latch	POK	Built-In LDO
MAX16013	Switch/limiter	pFET	✓		—		
MAX16014	Switch	pFET	✓		Latch		
MAX16126/7	Switch/limiter	nFET	✓	✓	Autoretry/latch	✓	
MAX6397	Switch/limiter	nFET			—		✓
MAX6495	Switch/limiter	nFET			—		
MAX6496	Switch/limiter	nFET	✓		—		
MAX6497	Switch	nFET			Latch	✓	
MAX6498	Switch	nFET			Autoretry	✓	
MAX6499	Switch/limiter	nFET		✓	Latch with clear		



# 4 x 50W Class D Amplifier Provides High-Fidelity Automotive Audio

Ultra-Efficient Amp Operates Down to 6V with Full Automotive Diagnostics, Load-Dump Protection, and Excellent EMI Performance

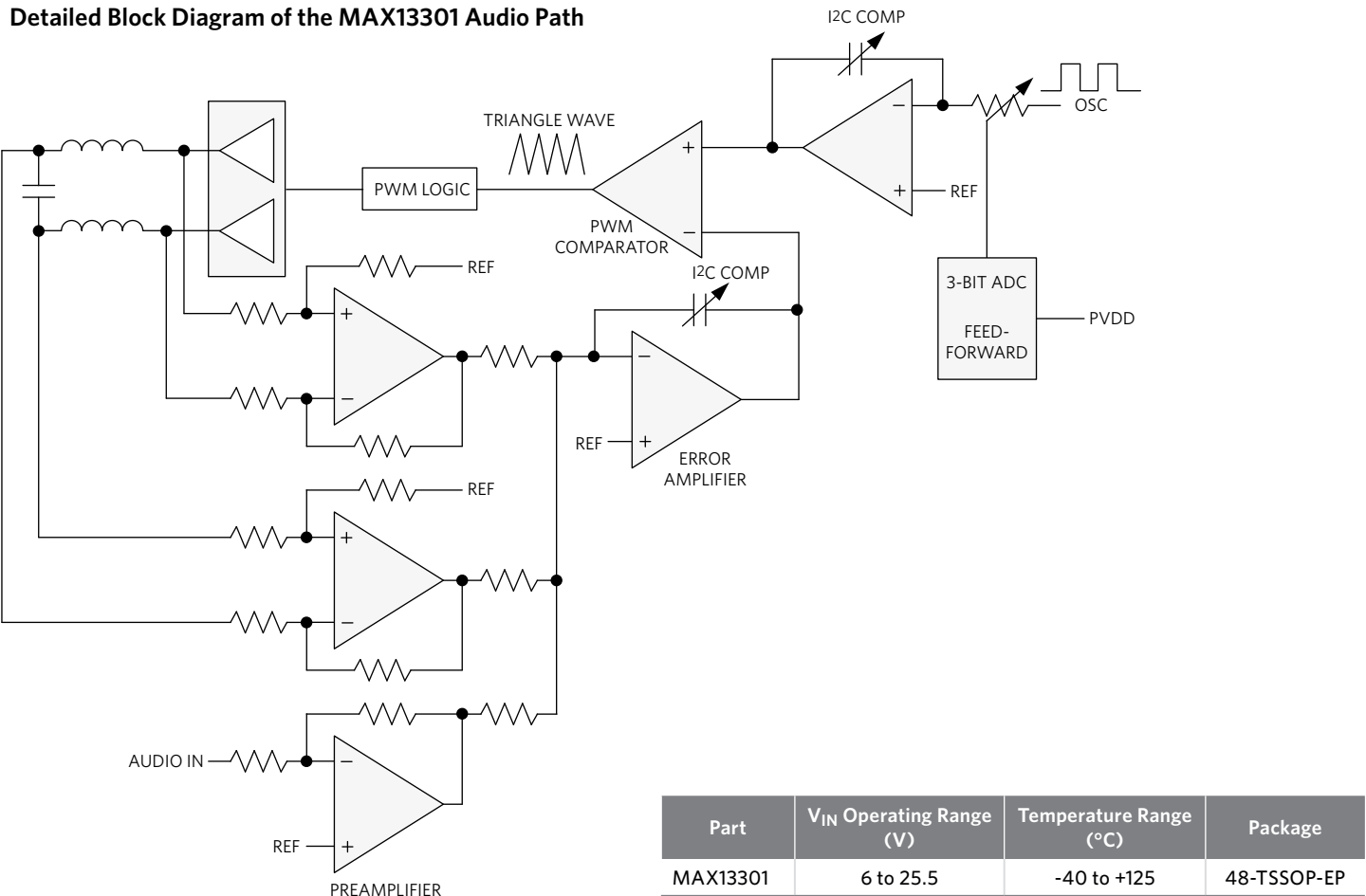
**Fulfill Automotive-Grade Requirements**

- 6V to 25.5V operating range
- Load-dump protection to 50V
- Short-circuit protection
- Open battery/GND tolerant
- Thermal-overload protection/warning
- On-board diagnostics through I<sup>2</sup>C interface
  - Short-to-battery/GND
  - Open/shorted load
  - Tweeter detect

**Provide High-Quality Audio**

- Programmable clip detection
- 0.04% THD+N performance due to feedback after the filter
- High output power (10% THD+N)
  - 2 x 160W into 2Ω at 24V
  - 4 x 80W into 4Ω at 24V
- Superior EMI performance meets OEM specifications

Detailed Block Diagram of the MAX13301 Audio Path



Part	V <sub>IN</sub> Operating Range (V)	Temperature Range (°C)	Package
MAX13301	6 to 25.5	-40 to +125	48-TSSOP-EP

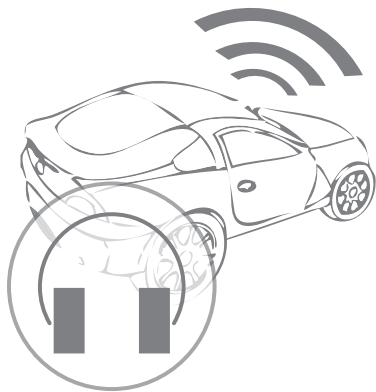
# Industry's First Headphone Amplifiers Designed for Automotive Applications

Integrate Output Protection and Deliver Superior Audio Quality

Get Superior Performance at a Lower Cost than Wireless Solutions

Parameter	Infrared Wireless Solutions	MAX13330/ MAX13331	The Maxim <sup>®</sup> Advantage
THD+N	0.30%	0.01%*	30 times better THD+N
SNR	65dB	100dB	35dB SNR improvement
Frequency response	25Hz to 18kHz	10Hz to 22kHz	Full audio-frequency response
Channel separation	60dB	75dB	Enhanced channel separation

\*0.01% THD+N at 1k output power into a 32Ω load.



# Protect Your Aux Input Device from Automotive Transients

Audio Input Amplifiers Provide Dual Channel, Low Noise, and Programmable Gains for Automotive Applications

**Features**

- 5V or 3.3V supply
- Automotive-grade diagnostics capability controlled through I<sup>2</sup>C interface
- Short-to-battery tolerant inputs
- Quasi-differential inputs to eliminate common-mode noise
- 80dB CMRR (typ)
- Jack sense, audio presence detection
- V<sub>BAT</sub>/GND/short/open diagnostics for remote AUX jack
- Up to 7V<sub>RMS</sub> input-voltage range
- AEC-Q100 qualified

Part	Gain (dB)	Temp Range (°C)	Package
MAX13335E	-14 to +16	-40 to +105	16-QSOP
MAX13336E	-22 to +8	-40 to +105	16-QSOP

# Smart, 18-Bit, Bidirectional LVDS SerDes Eliminates Need for CAN or LIN Interface

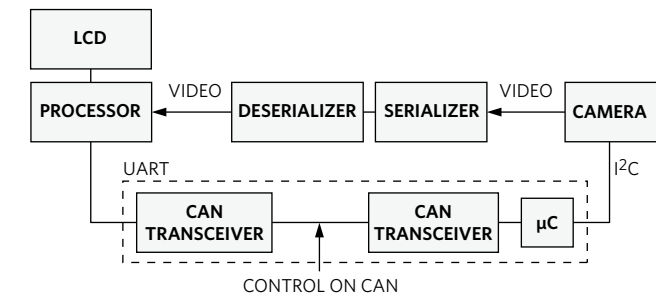
The MAX9257A/MAX9258A LVDS SerDes chipset provides a complete bidirectional digital video link between the automotive electronic control unit (ECU) and the camera. An integrated control channel eliminates the need for an external CAN or LIN interface, thus simplifying design and reducing system cost.

**Minimizes System Cost**

- Integrated control channel eliminates external CAN or LIN bus
- Advanced EMI suppression allows the use of lower cost cables and connectors

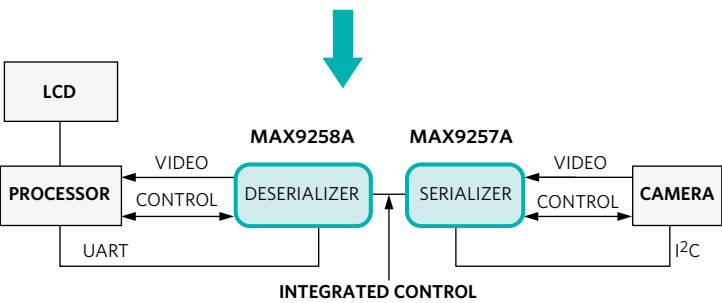
**Smart Features Improve Performance**

- Programmable serial data rate optimizes bandwidth utilization
- Patented spread-spectrum modulation\* reduces EMI in serial data and deserializer output
- High ESD protection: ±10kV Contact and ±30kV Air-Gap Discharge (ISO 10605)



Why Do This with the Typical Automotive Safety Application...

...When You Can Do This with Maxim's Simple Solution?



# Complete GMSL SerDes for Digital Video, Audio, and Control Data

## Supports Next-Generation Requirements for Infotainment Systems

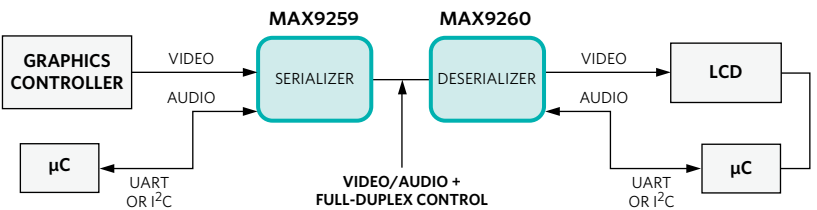
The MAX9259/MAX9260 SerDes chipset provides a fully integrated gigabit multimedia serial link (GMSL) solution for automotive infotainment, navigation, and rear-seat entertainment applications. This chipset integrates a bidirectional, full-duplex control channel, thus simplifying design while saving space and cost.

**Integrates Video and Control in a Single Channel**

- Differential, full-duplex control channel eliminates the need for a separate CAN or LIN interface
- Programmable spread spectrum minimizes EMI, speeding product qualification
- Driver preemphasis (MAX9259) and channel equalizer (MAX9260) extend link length and enhance link reliability

**Enhances the Multimedia Experience**

- Supports XGA (1280 x 768) or dual-view WVGA (two 854 x 480) panels
- Delivers 24-bit color and digital audio
- Supports multiple camera inputs



Part	Function		Interface	Content Protection
	Serializer	Deserializer		
MAX9249	✓		LVDS	
MAX9259	✓		Parallel	
MAX9260		✓	Parallel	
MAX9263	✓		Parallel	✓
MAX9264		✓	Parallel	✓
MAX9265	✓		LVDS	✓
MAX9266		✓	LVDS	✓
MAX9268		✓	LVDS	

\*U.S. Patent 6,847,257.

# 1.5Gbps GMSL SerDes with Coax Drive Cuts Cable and Connectivity Costs by 50%

## Supports Next-Generation Requirements for Megapixel Cameras

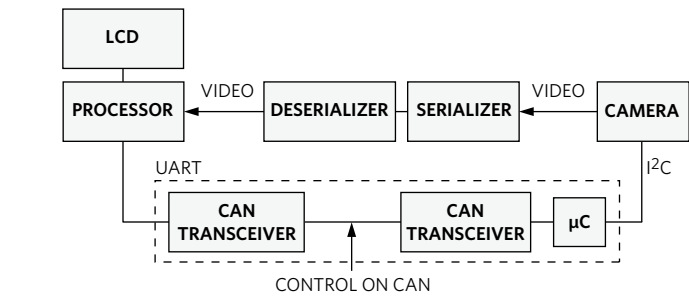
The MAX9271/MAX9272/MAX9273 SerDes chipset provides a fully integrated solution for automotive camera safety applications such as 360-view, forward collision warning (FCW), night vision, sign recognition, and more.

### Minimize System Cost

- Drive low cost 50Ω coax cable and FAKRA connectors or shielded twisted pair (STP)
- Programmable spread spectrum minimizes EMI, speeding product qualification
- Driver preemphasis (MAX9271/MAX9273) and channel equalizer (MAX9272) extend link length and enhance link reliability

### Smart Features Improve Performance

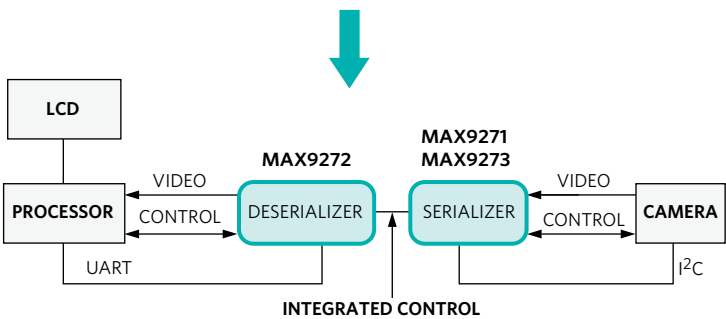
- Error detection and correction increases reliability
- 1.5Gbps serial data rate eliminates need for data compression and lag in image processing
- 100MHz clock supports megapixel image sensors



Why Do This with the Typical Automotive Safety Application...



...When You Can Do This with Maxim's Simple Solution?

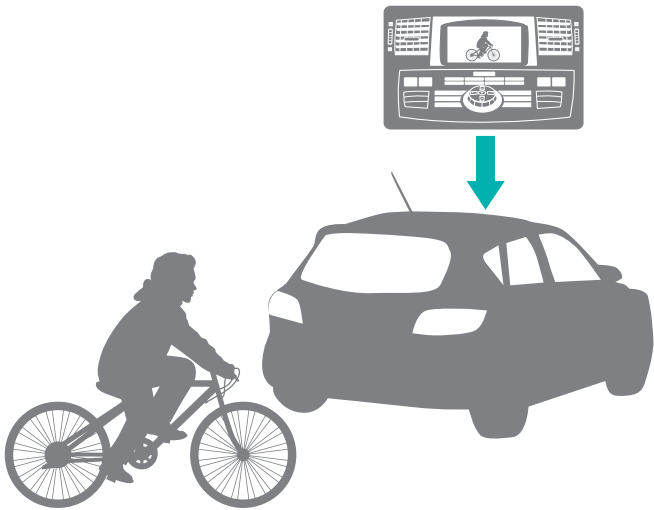


# 4-Channel Video Decoder Simplifies Automotive Vision Systems

## Converts Video Signals to Optimal Frame-Synchronized Digital Format Needed for Direct Connection to Maxim's H.264 Codec Family

### Simplifies Designs and Reduces Cost

- Excellent video quality from 4-channel NTSC/PAL video decoder with 54MHz, 10-bit ADC, and 5-line filter
- Flexible video output with byte- or frame-interleaving modes at 27MHz/54MHz/108MHz
- Multichip cascade configuration with direct connection
- Independent auto-equalizer processing for each video channel
- Individual video scalars for each video channel

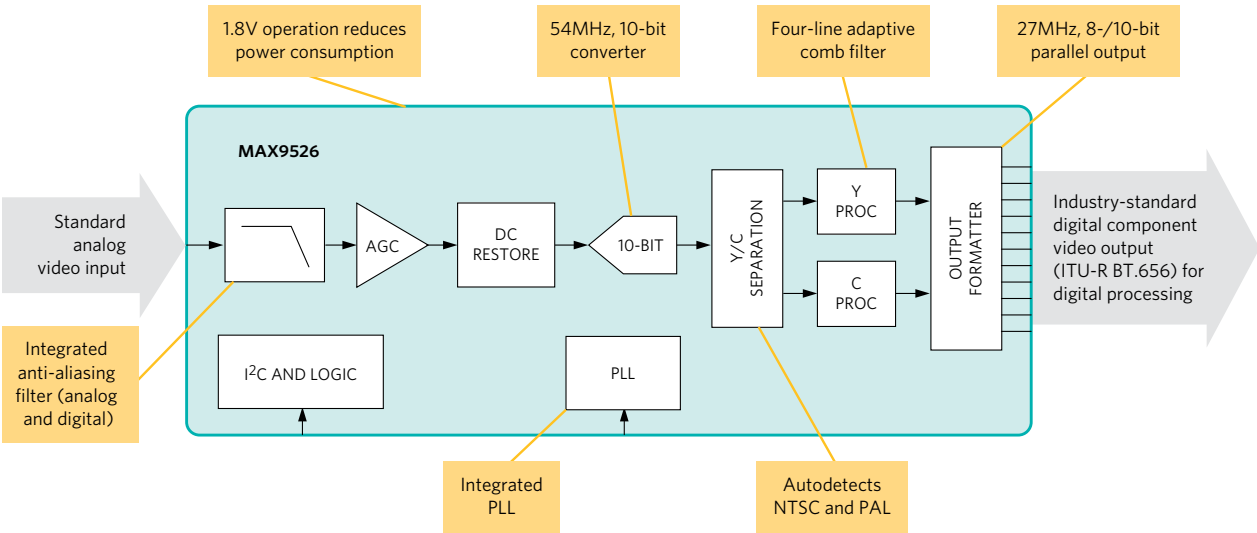


Key Features	Benefits
On-chip DDR2 memory controller for frame-interleaved, synchronous, multichannel output	Eliminates need for FPGA on video input Reduces system cost and design complexity with glueless, direct connection to Maxim's family of H.264 video processors
4-channel NTSC/PAL video decoder subsystem	Integrates video capture and digital conversion into one IC to greatly simplify PCB design and reduce component count and cost



# High-Performance Video Decoder Delivers Excellent Digital Video Quality

Meets Automotive Market’s Strict Requirements for Operating Temperature, Cost, and Ease of Use



**Provides Excellent Video Quality**

- 54MHz, 10-bit ADC
- 4x oversampling (54MHz)
- Multiline adaptive comb filter
- Internal anti-aliasing filter

**Satisfies Automotive Requirements**

- -40°C to +125°C operating temperature range
- Under 200mW typical power dissipation

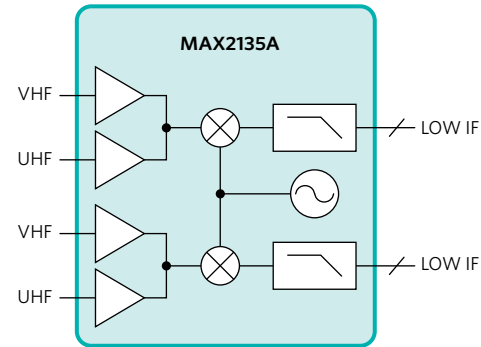
**NTSC/PAL Video Decoder Comparison**

Part	Package Size (mm <sup>2</sup> )	Operating Power (mW)	Digital I/O (V)	Temperature Range (°C)
MAX9526	30	200	1.7 to 3.5	-40 to +125
Competitor A	144	335	3.0 to 3.5	0 to +70
Competitor B	36	250	3.0 to 3.5	-40 to +85

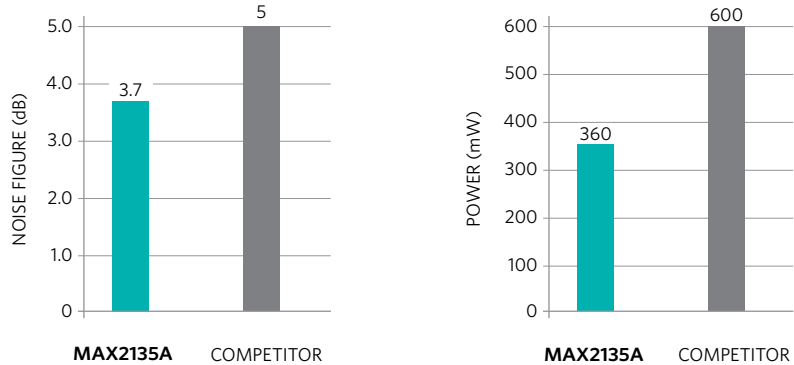
# Experience Uncompromised Infotainment and Performance with Space-Efficient Designs

**Industry's First Diversity Digital TV, ISDB-T/DVB-T Tuner: MAX2135A**

- High dynamic range provides superior reception (-99dBm to +10dBm)
- 50% smaller footprint (7mm x 7mm) than the competition allows for much smaller designs

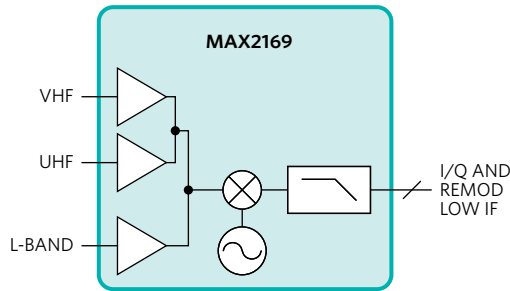


**Lower Noise Figure and Power at Half the Size of the Competition**



**Multimedia Multiband Tuner: MAX2169**

- Dual-output, zero-IF or low-IF (DAB/DMB-T) outputs support multiple interfaces
- Low-power design (100mW) enables portable aftermarket automotive applications

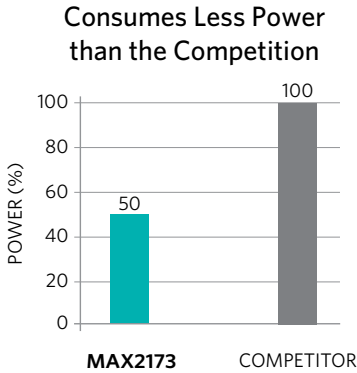
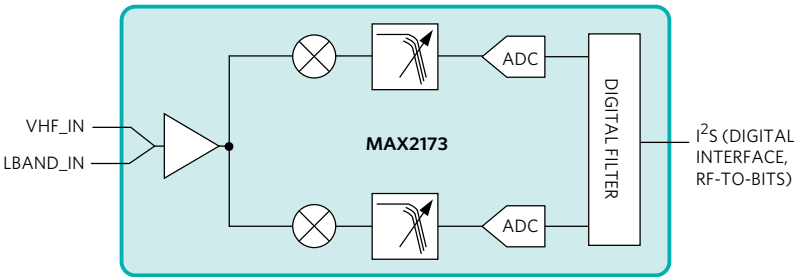


# Direct-Conversion, Low-IF DAB Tuner Allows Low-Power, Tuner-On-Board Designs

### RF to Bits® Digital Radio Tuner: MAX2173

- Simplified RF to Bits architecture
  - Modularized system and reduced design time
  - Allows the DSP to support other features

- Excellent blocking performance (50dB ACPR) offers static-free reception



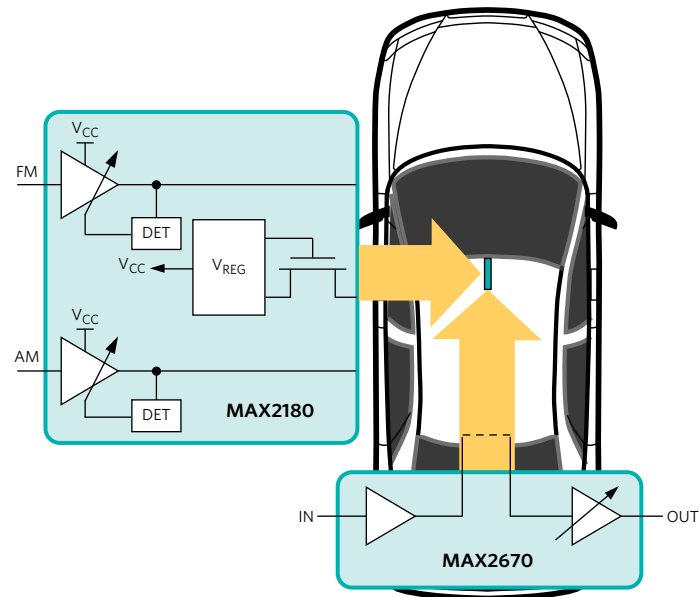
# Highly Integrated Active-Antenna Solutions Improve Functionality and Save Space and Cost

### AM/FM Car Antenna LNA: MAX2180

- Automatic gain control (AGC) and adjustable AGC attack points facilitate very versatile active AM/FM antenna solution for any automotive application
- Highly integrated architecture eliminates need for expensive, unpredictable pin diodes at LNA input
- Cutting-edge CMOS process provides a 6V to 24V operating voltage range

### Dual-Stage LNA for GPS/GNSS: MAX2670

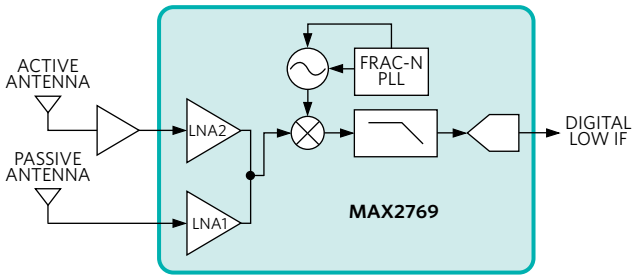
- High integration eliminates large, expensive, discrete transistor solutions
- Ultra-low noise figure (1dB, first stage) provides fast GPS lock
- Highly versatile design allows external filtering between first and second stage, providing flexibility for system optimization



# Complete GPS, GLONASS, Compass, and Galileo Front-End

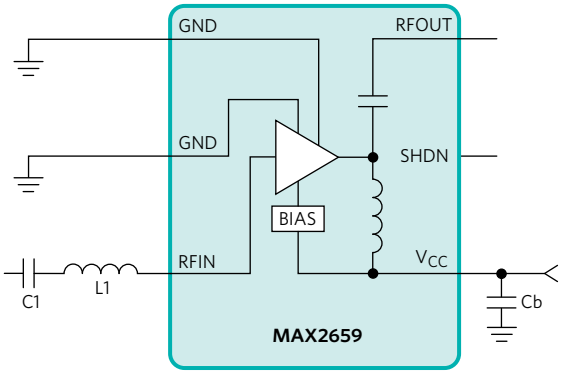
### Navigation RF to Bits Front-End: MAX2769

- Highly integrated RF to Bits receiver eliminates external ADC, thus increasing design flexibility to support any navigation application
- Achieves low 1.4dB noise figure without an external LNA for efficient satellite syncing
- Noise figure falls to 0.8dB when paired with MAX2659



# 0.8dB Noise Figure, 20dB Gain GPS LNA Improves Your Existing Solution

## Ultra-Small Leadless Package Saves Size and Cost



INPUT MATCH L1 = 6.5nH  
INPUT DC BLOCK C1 = 1800pF  
SUPPLY BYPASS Cb = 33nF

Improves your current GPS receiver's sensitivity

### Increases Performance of Existing Solution

- High 20.5dB gain
- Ultra-low 0.8dB noise figure
- 4.1mA supply current
- 1.6V to 3.3V supply voltage

### Maximizes Space and Minimizes Expense

- Integrated 50Ω output-matching circuit
- Ultra-small, RoHS-compliant, lead-free, 1.5mm x 1.0mm, 6-pin µDFN package

# High-Voltage LDOs and Switches Prevent System Damage to Remote RF LNAs

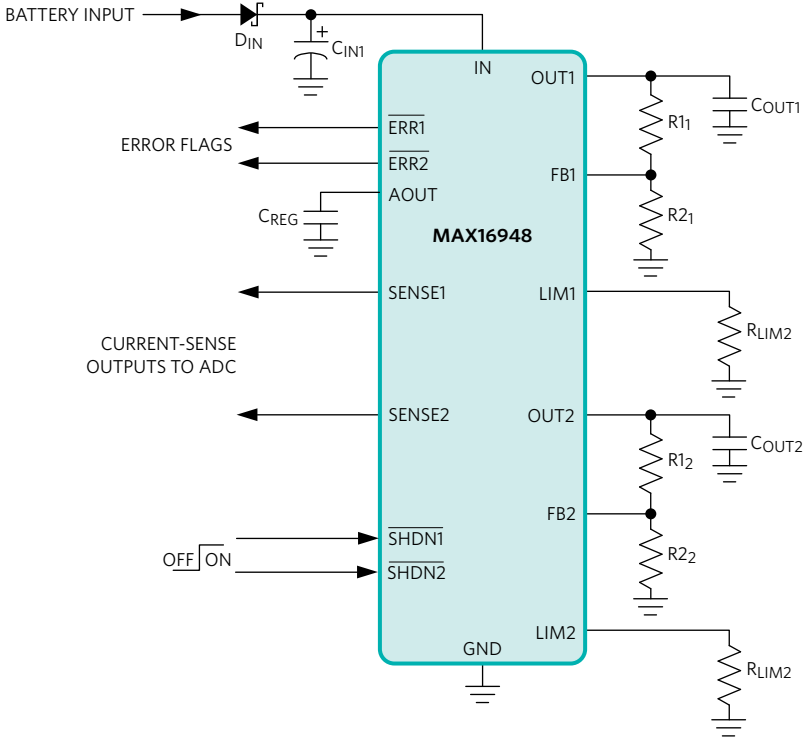
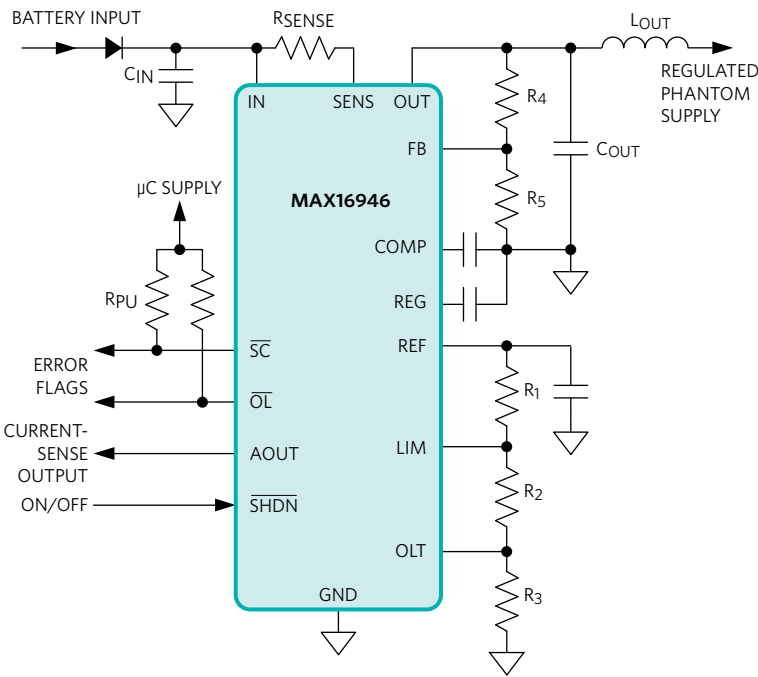
## Provide Fault-Proof Phantom Power to Remote Antennas

### Prevent System Damage While Providing Regulated Power

- Analog current measurement output
- Detect open-load and short-circuit conditions
- Thermal shutdown
- Overcurrent blanking enables hot-swapping
- -40°C to +105°C automotive temperature range
- AEC-Q100 qualified

### High-Side Current-Sense LDO: MAX16946

- Tolerate load-dump supply up to 45V
- Regulated 3.3V to 15V LDO output
- Adjustable current limit (500mA, max)



### Reduces Overall Antenna System Cost by Integrating Two Channels for Multiband Antenna Systems: MAX16948

- Protects system against output fault conditions and input-voltage transients
- Provides regulated power to remote LNA
  - Integrated LDO provides regulated power between 3.3V and 12V
  - High PSRR (73dB) enables clear signal transmission
- Fault flag diagnostics notify system of open-load and short-circuit conditions

# Keyless Go for Car Access and Mobilization with Improved Range, Reliability, and Cost

## 22kHz BPSK System Allows for Zero Blind Spots Using Fewer Coils

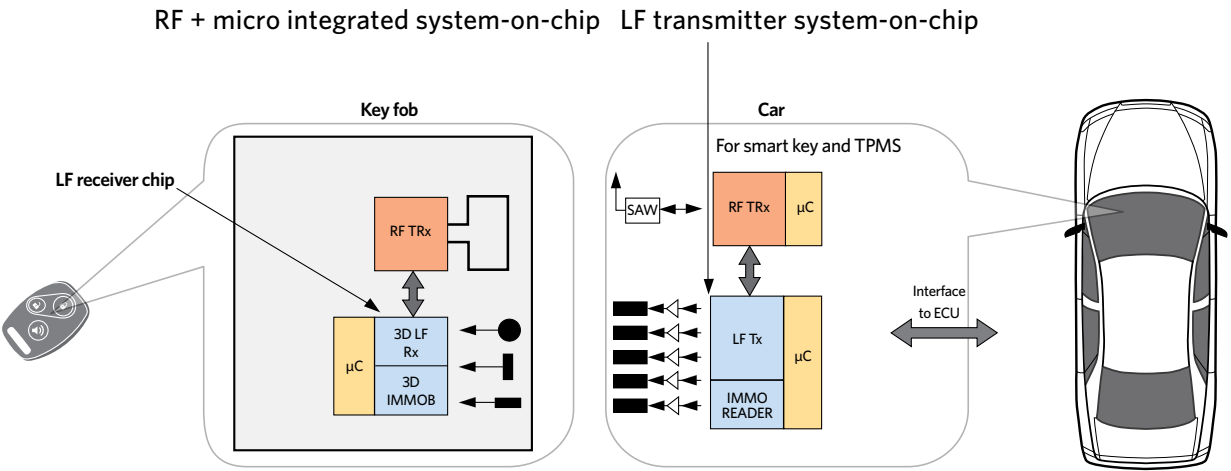
### Industry's Highest Performance

- Long LF range allows for improved comfort functions
- Autonomous system allows for minimal interaction of the with ECU and personalization of the key/car
- 3D active immobilizer allows for battery-less orientation independent communication with much longer range
- Industry's highest reliability through better coverage and immunity to interference (due to the 22kHz frequency)

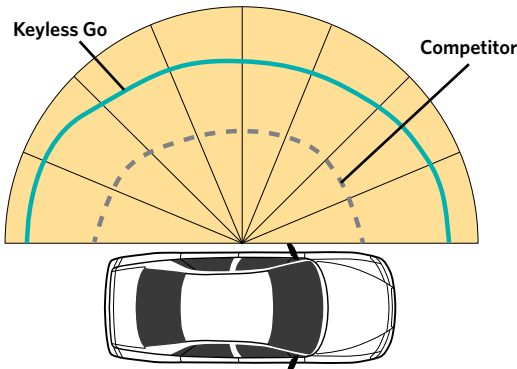
### Industry's Lowest Cost

- Industry's lowest system cost due to fewer coils and less expensive installation
- Significant cost reduction due to high integration in key/car
  - Car: microcontroller, immobilizer reader, LF-TX, door handle interface
  - Key: microcontroller, 3D LF-RX, 3D active immobilizer

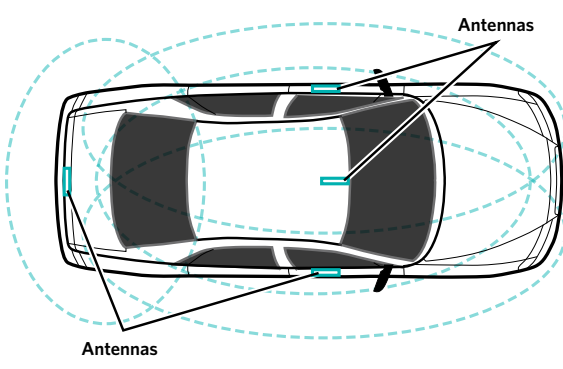
### Fully Integrated Keyless Go Solution



### 22kHz System Doubles the Detection Range



### Fewer Coils and 100% Coverage, No Blind Spots



# Low-Power 300MHz to 450MHz Transmitters and Receivers Increase Battery Life

- Ideal for**
- RKE and remote start
  - RF remote controls
  - Security systems
  - Tire pressure monitor systems (TPMS)
  - Garage door openers

**Up to -114dBm Receive Sensitivity**

Part	Type	Temp Range (°C)	Power Consumption (mA)	RF Performance at 315MHz	Modulation	Price* (\$)
MAX1471	Rx	-40 to +125	7.0 (typ)	-114dBm (ASK)/-108dBm (FSK) with 45dB image rejection	ASK/FSK	2.39
MAX1472	Tx	-40 to +125	5.3 (typ, ASK at 50% duty cycle)	+10dBm output	ASK	0.96
MAX7034	Rx	-40 to +125	6.7 (typ)	-114dBm with 50dB image rejection	ASK	1.72
MAX7036	Rx	-40 to +105	5.5 (typ)	-109dBm with integrated RF filter	ASK	1.12
MAX7044	Tx	-40 to +125	7.7 (typ, ASK at 50% duty cycle)	+13dBm output	ASK	1.05
MAX7057	Tx	-40 to +125	8.5 (typ)	+10dBm output, SPI tunable from 300MHz to 450MHz	ASK/FSK	1.26
MAX7058	Tx	-40 to +125	8.0 (typ)	+10dBm output, dual frequency (315MHz and 390MHz)	ASK	1.32

# Industry’s Highest Performance 300MHz to 450MHz Transceivers

Increase Range and Add Two-Way Capabilities to Car Alarms, RF Modules, and Remote Controls

Maxim’s MAX7030/MAX7031/MAX7032 crystal-referenced VHF/UHF transceivers are easy-to-use, high-performance devices that allow quick, two-way implementation of one-way systems.

- -114dBm (ASK)/-110dBm (FSK) Rx sensitivity
- +10dBm output power
- 12mA Tx current (FSK)
- 6.1mA Rx current
- -40°C to +125°C automotive temperature range

Part	RF (MHz)	Modulation	FSK Deviation (kHz)
MAX7030HATJ	433.92	ASK	—
MAX7030LATJ	315	ASK	—
MAX7031HATJ17	433.92	FSK	±17.2
MAX7031HATJ51	433.92	FSK	±51.7
MAX7031LATJ	308	FSK	±51.4
MAX7031MATJ50	315	FSK	±49.5

\*1000-up recommended resale. Prices provided are for design guidance and are FOB USA. International prices will differ due to local duties, taxes, and exchange rates. Not all packages are offered in 1k increments, and some may require minimum order quantities.

# Space-Saving 300MHz to 1500MHz LNA Extends Range of Automotive RKE Systems

**High Performance, Improves Range**

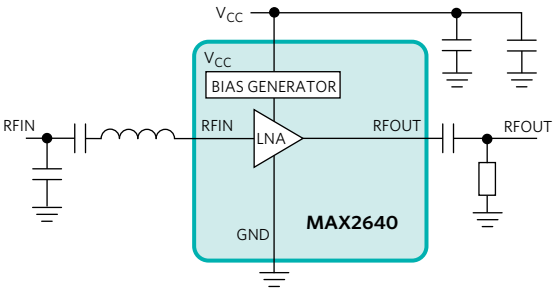
- 3.5mA supply current
- 2.7V to 5.5V single supply
- 0.9dB NF with matching components
- 15dB gain
- Tunable to 308MHz, 315MHz, 345MHz, 433.92MHz, 868MHz, and 902MHz to 928MHz

**AEC-Q100 Grade 1 Qualified**

- -40°C to +125°C automotive temperature range

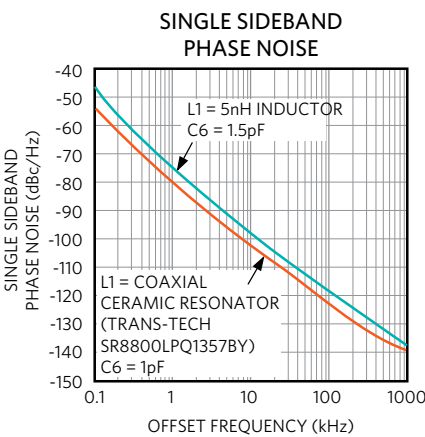
**Saves Space**

- Internally biased to eliminate the need for external bias resistors and chokes
- 2.8mm x 2.9mm, 6-pin SOT23



# Versatile, High-Performance VCO Enables Multiple Automotive Applications: MAX2620

- Wide frequency range provides versatility of deployment
- Smallest form factor conserves board space
- Exceptional out-of-band phase noise allows use in base-station platforms



Part	Frequency Range (MHz)	P <sub>OUT</sub> (dBm, min)	P <sub>OUT</sub> (dBm, max)	V <sub>CC</sub> (V)	I <sub>SUPPLY</sub> (mA)	Package (mm x mm)
MAX2470	10 to 500	-16	-1	2.7 to 5.5	3.6 to 5.5	6-SOT23 (2.7 x 2.9)
MAX2620	10 to 1050	-16	-2	2.5 to 5.25	9	8-μMAX® (3.0 x 4.9)
MAX2750	2400 to 2500	-3	-3	2.7 to 5.5	11.3	8-μMAX (3.0 x 4.9)

# Maxim ASIC Design Services

## Custom-Tailored Solutions for Your Specific Needs

### ASIC Design Services

Maxim’s ASIC design services are available to meet your specific application requirements. Maxim offers flexible engagement options, from foundry sales through turnkey design to joint-development projects.

ASIC Design Services	Customer Benefits
18 years of experience in the ASIC business	Expertise results in a high first-silicon success rate
Rich analog RF IP catalog	Fast time to market; vast application coverage
Optimized in-house process technologies	Controlled environment provides optimal performance-cost tradeoff

# Monitors for Thermocouple Opens and Shorts

## MAX31855 Replaces Four Precision Components and Features Open/Short Detection

With the temperature extremes involved, thermocouples are used in a variety of automotive applications, including exhaust gas temperature (EGT) and cylinder head temperature (CHT) monitoring. The new MAX31855 from Maxim converts thermocouple signals to a serial digital word with no external components. And unlike the discrete solution, it monitors the thermocouple for opens and shorts.

### Replaces Four Discrete Components

- Temperature sensor for cold-junction compensation
- Precision voltage reference
- Low-offset amplifier
- High-resolution ADC

### Flexible Architecture

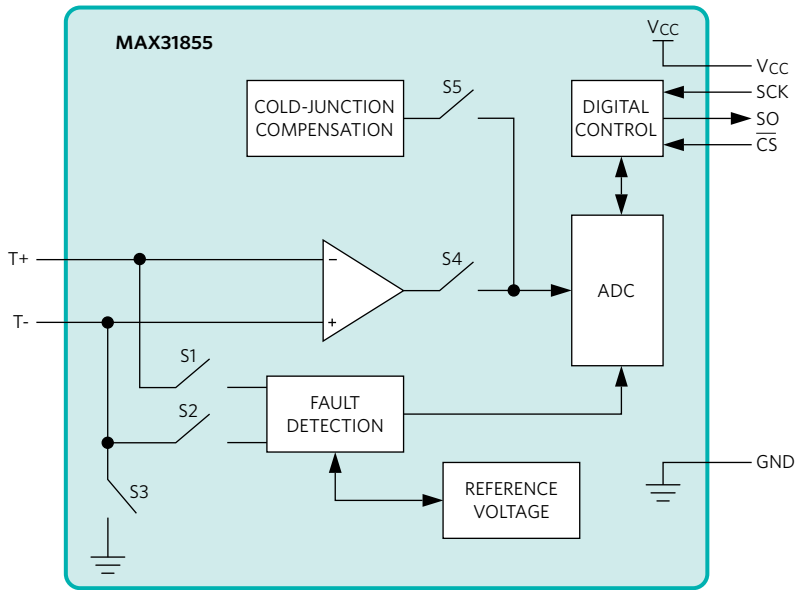
- Supports J, K, N, S, T, R, and E thermocouples
- Converts temperatures from -270°C to +1800°C

### Enhances Vehicle Safety and Reliability

- Monitors for thermocouple

### Reduces Time to Market

- SPI-compatible serial interface
- EV kit available



# Highly Integrated, High-Output-Current Multistring Drivers Provide a Reliable Solution

## Protect LEDs and Driver in Case of Fault, and Allow Dimming Over a 5000:1 Range

### Robust, Fault-Tolerant Solution

- 40V input capability
- Automatically disables LED strings if LEDs fail as open or short
- Fault-detection output

### Allow Dimming Over a Wide Range

- 5000:1 PWM dimming range at 200Hz dimming frequency

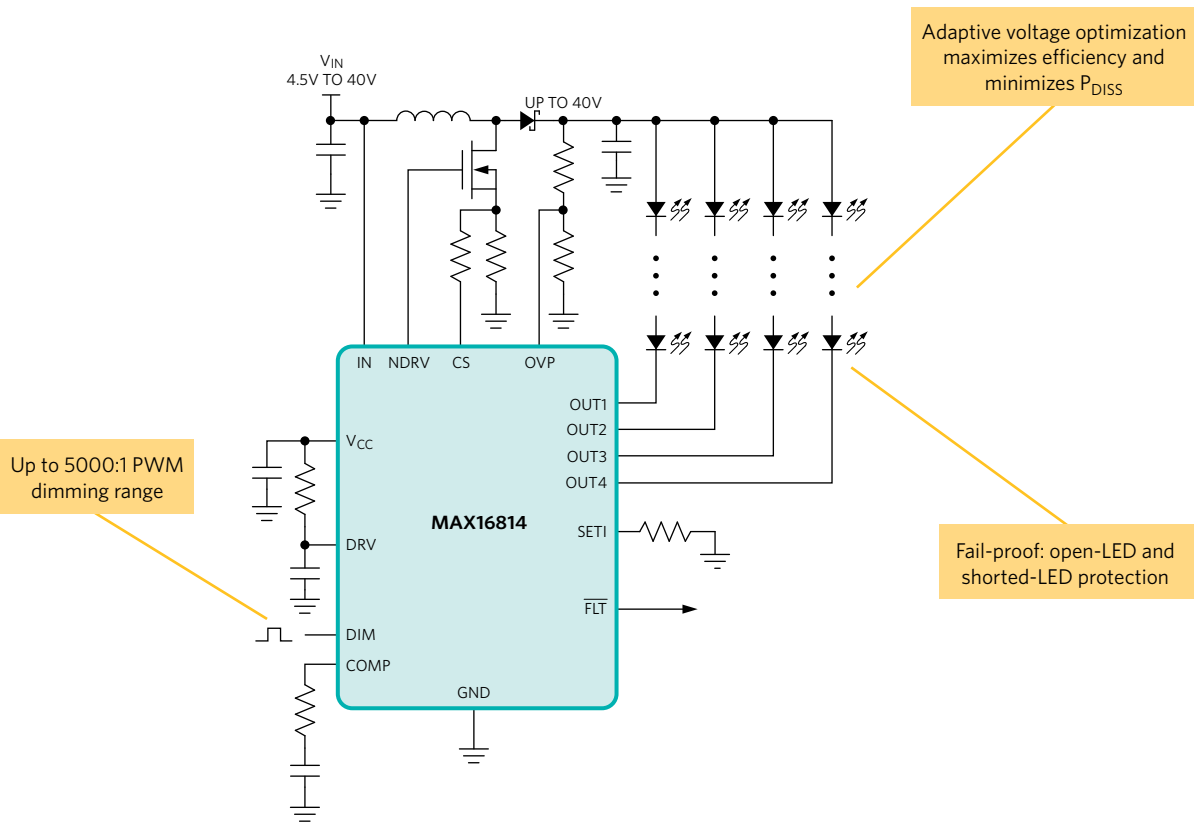
Available in TQFN and TSSOP Packages

### Ideal for a Wide Range of Backlighting Applications

- Four (MAX16814) or two (MAX16838) strings
- Up to 150mA/string

### Highly Integrated, Cost-Effective Solution

- Internal MOSFETs (except switching MOSFET for MAX16814)
- Output-voltage optimization for maximum efficiency
- LED fault protection





# Boost/Buck-Boost Controller Enables More Reliable, Low-EMI Fault-Tolerant LED Drivers

**Reliable, Fault-Tolerant Solution**

- High-side current sense and high-side pMOS drivers allow protection against any short between input, output, and ground
- Wide input-voltage capability up to 65V
- Overvoltage and thermal protection
- Fault indicator output
- -40°C to +125°C temperature range

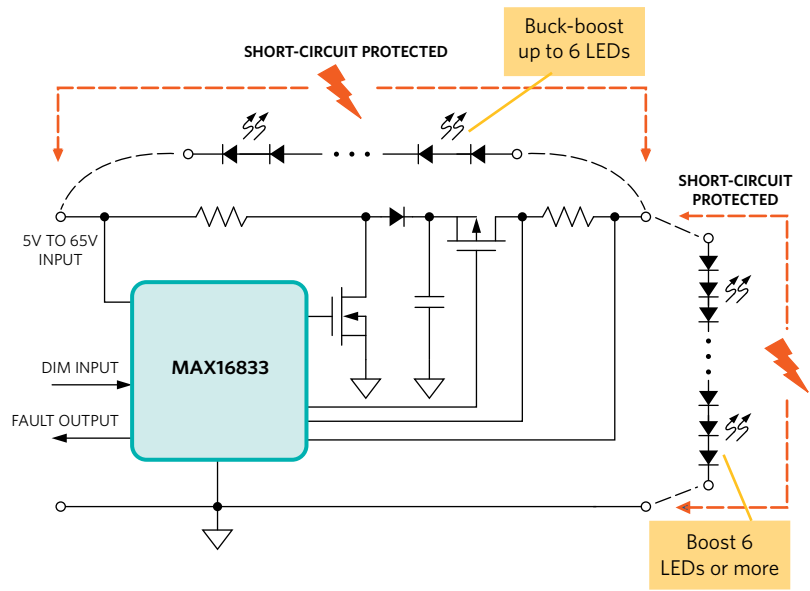
**Improved EMI**

- Internal frequency dithering improves EMI and reduces EMI filtering needs

**Very Flexible**

- Wide PWM-dimming range
- Allows single-wire connection to the LEDs
- Boost, buck-boost, buck, and SEPIC configurations
- ±2% accurate voltage reference output (MAX16833B)

Packaged in a 16-Pin TSSOP



# Linear Driver Uniquely Fulfills Automotive Fault-Detection Requirements

**Advanced Fault-Detection Features**

- Open-LED detection output
- In multistring applications, if one string fails, all are shut down

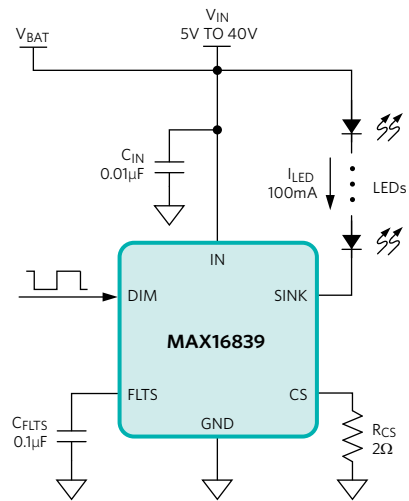
**Constant-Current LED Control**

- 15mA to 100mA LED current
- ±5% current accuracy

**Ideal for Automotive Voltage and Temperature Requirements**

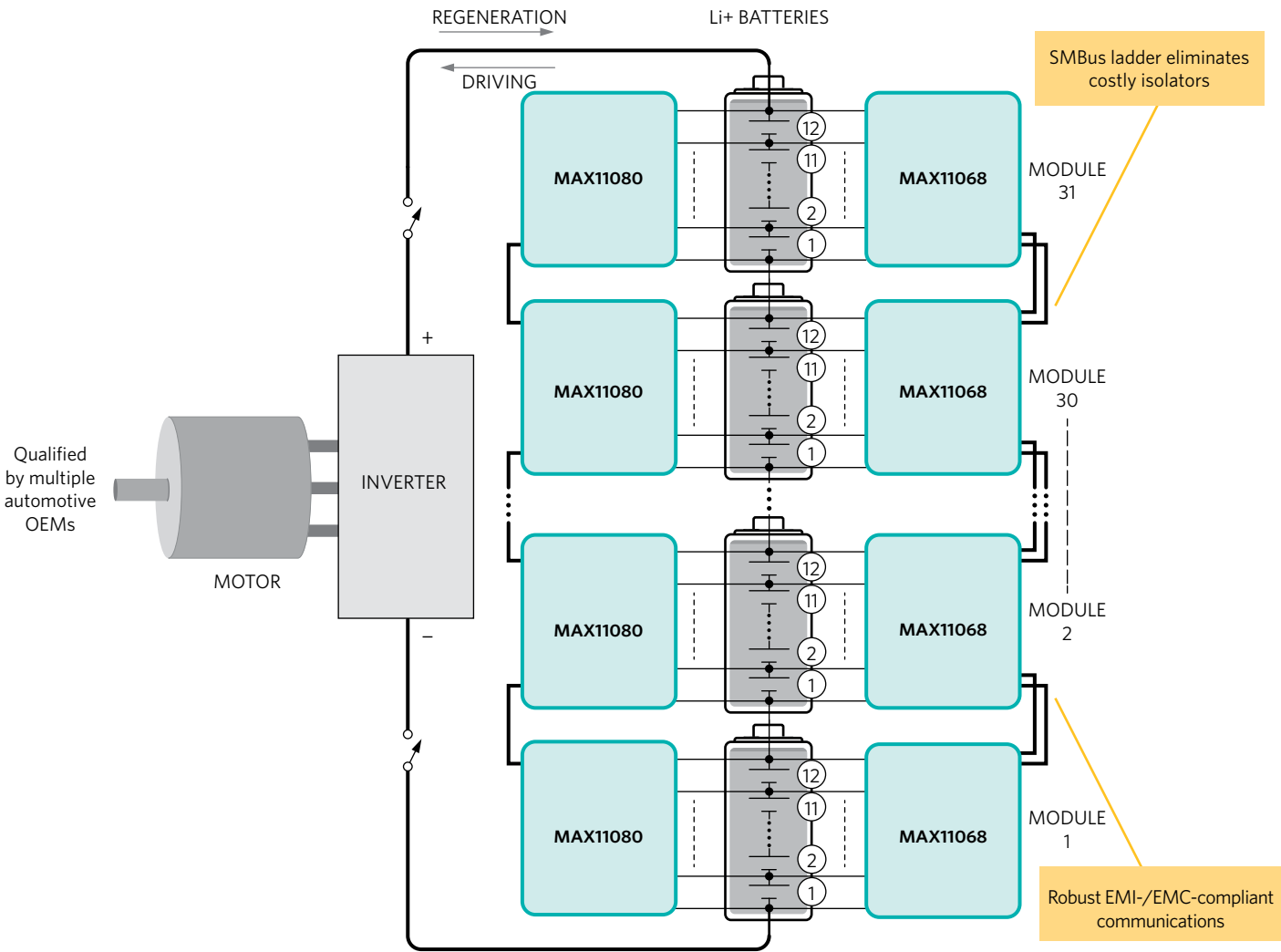
- 5V to 40V operating input-voltage range
- -40°C to +125°C temperature range

Available in 6-Pin TDFN and 8-Pin SO Packages



# Complete Solution for Automotive Battery with 80V-Tolerant Process

Robust, Daisy-Chained Communication Bus Reduces Total System Cost by Up to 80%



**Fault Protectors: MAX11080/MAX11081**

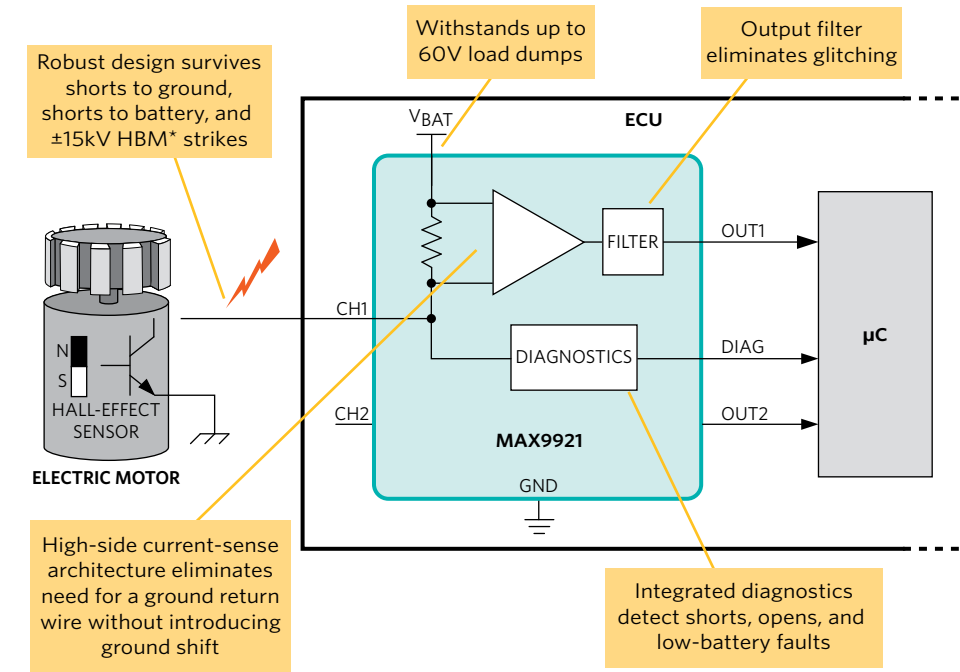
- Industry's best overvoltage accuracy
- Thorough pin open/short detection
- Compatible with ALL cell types
- Built-in self-diagnostics
- Ultra-low-power current drain: 80µA
- Shutdown-mode current: 2µA
- Daisy-chain up to 31 MAX11080/81 devices

**Smart Battery AFE: MAX11068**

- Highest voltage: 80V-tolerant process
- Highest cell count: 12-cell capable
- Fastest cell scanning: 107µs
- Ultra-low-power current drain: 75µA
- Shutdown-mode current: < 1µA
- Daisy-chain up to 31 MAX11068 devices

# Industry’s First Integrated, Dual 2-Wire Hall-Effect Sensor Interface Solution

Improves Reliability and Performance While Saving Cost



Ideal for window lifters (antipinch control), magnetic relays, automatic doors, seatbelt buckles, electric sunroofs, and powered liftgate controllers

### Improves Performance and Reliability

- Integrated diagnostics detect shorts, opens, and low-battery faults
- Withstands up to 60V load dumps
- Robust ±15kV HBM ESD protection
- Integrated deglitching output filters

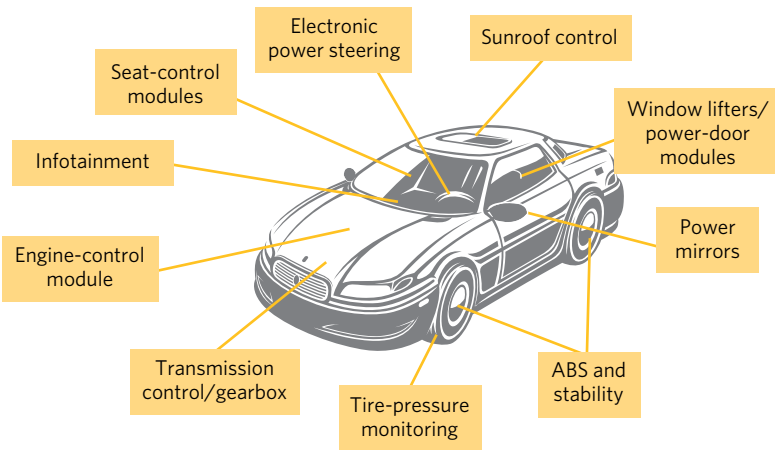
### Saves Space and Cost

- High-side, current-sense architecture eliminates the need for a ground return wire
- Eliminates up to 10 discrete components
- Integrates two complete sensor interface channels into a single 3mm x 5mm, 10-pin µMAX® package

\*Human Body Model

# Rugged Amplifiers and Comparators Are Ideal for Your Automotive Analog-Controlled Systems

Automotive-Grade High-Voltage Signal Conditioners and Sensor Signal Interface ICs



### Operational Amplifiers

Part	No. of Amps	Rail-to-Rail Input or Output	Supply-Voltage Range (V)	Supply Current per Amp (mA)	GBWP (MHz)	Auto Temp Range*	Features
MAX4036A/38A	1/2	Output	2.3 to 7	0.0008	0.004		Low supply current (800nA)
MAX4230-34	1/2/4	Input, output	2.7 to 5.5	1.1	10	✓**	Built-in RF immunity
MAX4245/46/47	1/2/2	Input, output	2.7 to 5.5	0.375	1	✓	Low-power shutdown (50nA)
MAX4400-03	1/2/4	Output	2.7 to 5.5	0.32	0.8	✓	Shutdown mode
MAX4475-78	1/2/4	Output	2.7 to 5.5	2.5	10	✓**	Low distortion (0.0002% THD+N)
MAX4480-83	1/2/4	Output	2.7 to 5.5	0.045	0.14	✓	Micropower current consumption (0.5µA)
MAX4484/86/87	1/2/4	Output	2.7 to 5.5	1.9	7	✓	Unity-gain stable, no phase reversal
MAX4490/91/92	1/2/4	Input, output	2.7 to 5.5	0.8	10	✓**	High slew rate (10V/µs)
MAX4493/94/95	1/2/4	Output	4.5 to 11	0.77	5	✓**	Small package (SC70)

### Current-Sense Amplifiers

Part	CMVR (V)	Supply-Voltage Range (V)	Supply Current (µA)	Bidirectional Current Sense	GBWP (kHz)	Auto Temp Range*	Features
MAX4069-72	1.35 to 24	2.7 to 24	100	✓	40, 100	✓	1.5% total output error
MAX4073F/73H/73T	2 to 28	3 to 28	500		1600, 1700, 1800, 1800	✓	±1% accuracy, SC70
MAX4376/77/78	0 to 28	3 to 28	1000		1200, 1700, 2000, 2000	✓**	±0.5% accuracy
MAX9918-20	-20 to +75	4.5 to 5.5	1000	✓	75 to 230	✓**	±0.6% accuracy

### Comparators

Part	No. of Comparators	Supply-Voltage Range (V)	Supply Current (µA)	Propagation Delay (ns)	Logic Output	Auto Temp Range*	Features
MAX9021/22/24	1/2/4	2.5 to 5.5	5	3000	CMOS/TTL	✓	Hysteresis for low-power, rail-to-rail output
MAX9140/41/42/44	1/1/2/4	2.7 to 5.5	320	40	CMOS/TTL	✓ (**, MAX9140A only)	500µV offset voltage
MAX919/20	1	1.8 to 5.5	0.8	22000	CMOS/TTL		Nanopower (750nA), 1.245V ±1.5% REF

\*Automotive temperature range: -40°C to +125°C  
\*\*AEC-Q100 Grade 1 qualified

# Heavy on Features, Light on Cost

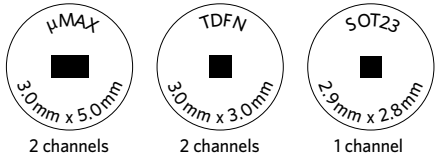
## Optimize Your Automotive Design with Maxim’s Family of Low-Cost, Low-Power ADCs

### Extend Battery Life

- 3.7mW active, 3.9μW power-down

### Save Space and Cost

- Footprints as small as 2.9mm x 2.8mm
- Priced as low as \$0.85\*



Part	Resolution (Bits)	Speed (Msps, max)	SNR (dB)	Power (mW)	Package
MAX11102	12	2	72	3.7	μMAX, TDFN
MAX11103	12	3	72	5.2	μMAX, TDFN
MAX11105	12	2	72	3.7	SOT23
MAX11106	10	3	61	5.2	TDFN
MAX11110	10	2	61	3.7	SOT23
MAX11111	8	3	49	5.2	TDFN
MAX11115	8	2	49	3.7	SOT23
MAX11116	8	3	49	5.2	SOT23
MAX11117	10	3	61	5.2	SOT23

\*MAX11115, 1000-up recommended resale. Prices provided are for design guidance and are FOB USA. International prices will differ due to local duties, taxes, and exchange rates. Not all packages are offered in 1k increments, and some may require minimum order quantities.

# Spread-Spectrum Solutions Reduce Peak EMI by Up to 20dB

### Silicon Oscillators with Spread-Spectrum Modulation

- Robust—no XTAL required
- Flexible—programmable or fixed
- Broad—4.8kHz to 133MHz

### Product Highlight: DS1091L

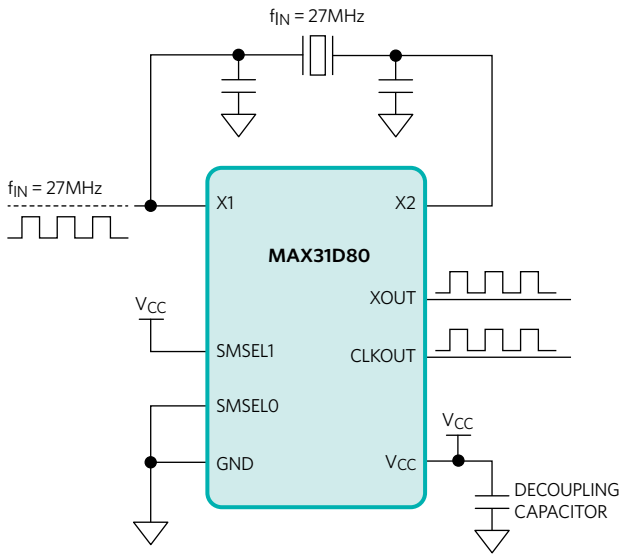
- No programming—pin-selectable dither settings
- 130kHz to 66.6MHz
- -40°C to +125°C

### Spread-Spectrum Clock Generators

- Simple—pin programmable
- Flexible—PLL clock multiplier
- Accurate—low jitter
- Low cost

### Product Highlight: MAX31C80/MAX31D80

- No programming—pin-selectable dither settings
- 75ps jitter
- 2MHz to 134MHz



For additional EMI-reduction solutions, visit [www.maximintegrated.com/auto-USB](http://www.maximintegrated.com/auto-USB)

# Maxim's Products Satisfy the Quality Needs of the Automotive Market

## Automotive "V" Flow Drives Products to Zero Defects

/V Features	Availability
ISO/TS 16949	✓
FAB—2 sites	✓
Parametric (PT)	✓
Wafer sort (probe)	✓
SYA/SBL	✓
Assembly—2 sites	✓
Burn-in	✓
Tri-temp tested	✓
AEC-Q100 qualified	✓
SPC, Cpk $\geq$ 1.67	✓
PPAP	✓
PCN horizons	

### Distinctive Attributes of Maxim's Vehicle ("V") Flow

- Full ISO/TS 16949:2002- and ISO 9001:2008-certified quality management system
- Full ISO 14001:2004-certified environmental management system
- AEC-Q100-qualified parts for specified temperature grades
- Statistical process controls to Cpk  $\geq$  1.67 on all key parameters
- Production Part Approval Process (PPAP) available
- Restriction to a maximum of two qualified production sites for wafer, assembly, and test
- Global failure-analysis support centers improve customer support
- Worldwide field quality support—Europe, Asia, Japan, and North America
- Limited product-change control system and extended PCN horizons

Select Maxim's "V" products, like the MAX2141ETH/V+, to receive AEC-Q100-qualified automotive parts.

[www.maximintegrated.com/V-flow](http://www.maximintegrated.com/V-flow)

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Rev. 0; October 2012



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