AUTOMOTIVE

Product Guide
# 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

<table>
<thead>
<tr>
<th>Part</th>
<th>$V_{IN}$ (max) (V)</th>
<th>$I_{OUT}$ (A)</th>
<th>$f_{SW}$</th>
<th>Spread Spectrum</th>
<th>$I_{Q}$ (μA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX16907</td>
<td>36</td>
<td>3</td>
<td>1MHz to 2.2MHz</td>
<td>Yes</td>
<td>30</td>
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<tr>
<td>MAX16909</td>
<td>36</td>
<td>3</td>
<td>220kHz to 1MHz</td>
<td>No</td>
<td>30</td>
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<tr>
<td>MAX16974</td>
<td>28</td>
<td>2</td>
<td>220kHz to 2MHz</td>
<td>No</td>
<td>35</td>
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<tr>
<td>MAX16975</td>
<td>28</td>
<td>1.2</td>
<td>220kHz to 1MHz</td>
<td>No</td>
<td>45</td>
</tr>
<tr>
<td>MAX16976</td>
<td>28</td>
<td>0.6</td>
<td>220kHz to 1MHz</td>
<td>No</td>
<td>45</td>
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<tr>
<td>MAX16977</td>
<td>36</td>
<td>2</td>
<td>1MHz to 2.2MHz</td>
<td>Yes</td>
<td>30</td>
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</table>

## 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 $V_{IN}$ 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

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-IQ Automotive LDO Conserves Battery Life in Always-On Applications

45V, 200mA LDO Consumes Only 20μA Iq

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 IQ Automotive LDOs

<table>
<thead>
<tr>
<th>Part</th>
<th>No-Load</th>
<th>Iq (μA)</th>
<th>Vin Range (V)</th>
<th>Adjustable</th>
<th>Reset Threshold (%)</th>
<th>Package (mm x mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX15006</td>
<td>10</td>
<td>50</td>
<td>4 to 40 (45, max)</td>
<td>1.8 to 10</td>
<td>—</td>
<td>6-TDFN-EP (3 x 3)</td>
</tr>
<tr>
<td>MAX15007</td>
<td>10</td>
<td>50</td>
<td>4 to 40 (45, max)</td>
<td>1.8 to 10</td>
<td>—</td>
<td>6-TDFN-EP (3 x 3)</td>
</tr>
<tr>
<td>MAX16910</td>
<td>20</td>
<td>200</td>
<td>3.5 to 30 (45, max)</td>
<td>1.5 to 11</td>
<td>87.5, 92.5</td>
<td>8-TDFN-EP (3 x 3), 8-SSO-EP (5 x 4)</td>
</tr>
</tbody>
</table>

High-Efficiency, Low-IQ, 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

<table>
<thead>
<tr>
<th>Part</th>
<th>Vin Range (V)</th>
<th>Iq (A)</th>
<th>fSW (MHz)</th>
<th>Spread-Spectrum</th>
<th>Iq (μA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX16961</td>
<td>2.7 to 5.5</td>
<td>3</td>
<td>2.2</td>
<td>Yes</td>
<td>27</td>
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<tr>
<td>MAX16962</td>
<td>2.7 to 5.5</td>
<td>4</td>
<td>2.2</td>
<td>Yes</td>
<td>27</td>
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<tr>
<td>MAX16963</td>
<td>2.7 to 5.5</td>
<td>1.5/1.5</td>
<td>2.2</td>
<td>Yes</td>
<td>36</td>
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<tr>
<td>MAX1556</td>
<td>2.6 to 5.5</td>
<td>1.2</td>
<td>1</td>
<td>No</td>
<td>16</td>
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<tr>
<td>MAX1557</td>
<td>2.6 to 5.5</td>
<td>0.6</td>
<td>1</td>
<td>No</td>
<td>16</td>
</tr>
</tbody>
</table>

*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 25mm² 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®

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

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®

Overvoltage Protectors Prevent Damage to Downstream Circuitry

Maxim’s extended thermal capabilities and input voltage

Maxim’s extended thermal capabilities and input voltage
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 \( I^C \) 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

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 

Advantage |
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>THD+N</td>
<td>0.30%</td>
<td>0.01%*</td>
<td>30 times better THD+N</td>
</tr>
<tr>
<td>SNR</td>
<td>65dB</td>
<td>100dB</td>
<td>35dB SNR improvement</td>
</tr>
<tr>
<td>Frequency response</td>
<td>25Hz to 18kHz</td>
<td>10Hz to 22kHz</td>
<td>Full audio-frequency response</td>
</tr>
<tr>
<td>Channel separation</td>
<td>60dB</td>
<td>75dB</td>
<td>Enhanced channel separation</td>
</tr>
</tbody>
</table>

*0.01% THD+N at 5% 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 \( I^C \) interface
- Short-to-battery tolerant inputs
- Quasi-differential inputs to eliminate common-mode noise
- 80dB CMRR (typ)
- Jack sense, audio presence detection
- \( V_{BAT}/GND/short/open \) diagnostics for remote AUX jack
- Up to 7VRMS input-voltage range
- AEC-Q100 qualified

Part Gain (dB) Temp Range (°C) Package
<table>
<thead>
<tr>
<th>Part</th>
<th>Gain (dB)</th>
<th>Temp Range (°C)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX13335E</td>
<td>-14 to +16</td>
<td>-40 to +105</td>
<td>16-QSOP</td>
</tr>
<tr>
<td>MAX13336E</td>
<td>-22 to +8</td>
<td>-40 to +105</td>
<td>16-QSOP</td>
</tr>
</tbody>
</table>
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.

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)

Minimizes System Cost

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

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

<table>
<thead>
<tr>
<th>Part</th>
<th>Function</th>
<th>Interface</th>
<th>Content Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX9249</td>
<td>✓</td>
<td>LVDS</td>
<td></td>
</tr>
<tr>
<td>MAX9259</td>
<td>✓</td>
<td>Parallel</td>
<td></td>
</tr>
<tr>
<td>MAX9260</td>
<td>✓</td>
<td>Parallel</td>
<td>✓</td>
</tr>
<tr>
<td>MAX9263</td>
<td>✓</td>
<td>Parallel</td>
<td>✓</td>
</tr>
<tr>
<td>MAX9264</td>
<td>✓</td>
<td>Parallel</td>
<td>✓</td>
</tr>
<tr>
<td>MAX9265</td>
<td>✓</td>
<td>LVDS</td>
<td>✓</td>
</tr>
<tr>
<td>MAX9266</td>
<td>✓</td>
<td>LVDS</td>
<td>✓</td>
</tr>
<tr>
<td>MAX9268</td>
<td>✓</td>
<td>LVDS</td>
<td>✓</td>
</tr>
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</table>

*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

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.

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 scalers for each video channel

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

<table>
<thead>
<tr>
<th>Part</th>
<th>Package Size (mm²)</th>
<th>Operating Power (mW)</th>
<th>Digital I/O (V)</th>
<th>Temperature Range (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX9526</td>
<td>30</td>
<td>200</td>
<td>1.7 to 3.3</td>
<td>-40 to +125</td>
</tr>
<tr>
<td>Competitor A</td>
<td>144</td>
<td>335</td>
<td>3.0 to 3.5</td>
<td>0 to +70</td>
</tr>
<tr>
<td>Competitor B</td>
<td>36</td>
<td>250</td>
<td>3.0 to 3.5</td>
<td>-40 to +85</td>
</tr>
</tbody>
</table>

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

**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

**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**

**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)

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

Reducer 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

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

<table>
<thead>
<tr>
<th>Part</th>
<th>Type</th>
<th>Temp Range (°C)</th>
<th>Power Consumption (mA)</th>
<th>RF Performance at 315MHz Modulation</th>
<th>Modulation</th>
<th>Price* ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX1471 Rx</td>
<td>-40</td>
<td>7.0 (typ)</td>
<td>-114dBm (ASK)/-108dBm (FSK) with 45dB image rejection</td>
<td>ASK/FSK</td>
<td>2.39</td>
<td></td>
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<tr>
<td>MAX1472 Tx</td>
<td>-40</td>
<td>5.3 (typ, ASK at 50% duty cycle)</td>
<td>+10dBm output ASK</td>
<td>ASK</td>
<td>0.96</td>
<td></td>
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<tr>
<td>MAX7034 Rx</td>
<td>-40</td>
<td>6.7 (typ)</td>
<td>-114dBm with 50dB image rejection</td>
<td>ASK</td>
<td>1.72</td>
<td></td>
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<tr>
<td>MAX7036 Rx</td>
<td>-40</td>
<td>5.5 (typ)</td>
<td>-100dBm with integrated IF filter ASK</td>
<td>ASK</td>
<td>1.12</td>
<td></td>
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<tr>
<td>MAX7044 Tx</td>
<td>-40</td>
<td>7.7 (typ, ASK at 50% duty cycle)</td>
<td>+13dBm output ASK</td>
<td>ASK</td>
<td>1.05</td>
<td></td>
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<tr>
<td>MAX7057 Tx</td>
<td>-40</td>
<td>8.5 (typ)</td>
<td>+10dBm output, 50 MHz tunable from 300MHz to 450MHz ASK/FSK</td>
<td>ASK/FSK</td>
<td>1.26</td>
<td></td>
</tr>
<tr>
<td>MAX7058 Tx</td>
<td>-40</td>
<td>8.0 (typ)</td>
<td>+10dBm output, dual frequency (315MHz and 390MHz) ASK</td>
<td>ASK</td>
<td>1.32</td>
<td></td>
</tr>
</tbody>
</table>

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)
- 6.3mA Rx current
- -40°C to +125°C automotive temperature range

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

<table>
<thead>
<tr>
<th>Part</th>
<th>Frequency Range (MHz)</th>
<th>fOUT (dmin, min)</th>
<th>fOUT (dmax, max)</th>
<th>VCC (V)</th>
<th>ISUPPLY (mA)</th>
<th>Package (mm x mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX2470</td>
<td>10 to 500</td>
<td>-16</td>
<td>-1</td>
<td>2.7 to 5.5</td>
<td>3.6 to 5.5</td>
<td>6-SOT23 (2.7 x 2.9)</td>
</tr>
<tr>
<td>MAX2620</td>
<td>10 to 1050</td>
<td>-16</td>
<td>-2</td>
<td>2.5 to 5.25</td>
<td>9</td>
<td>8-μMAX® (3.0 x 4.9)</td>
</tr>
<tr>
<td>MAX2750</td>
<td>2400 to 2500</td>
<td>-3</td>
<td>-3</td>
<td>2.7 to 5.5</td>
<td>11.3</td>
<td>8-μMAX® (3.0 x 4.9)</td>
</tr>
</tbody>
</table>
Maxim ASIC Design Services

Custom-Tailored Solutions for Your Specific Needs

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

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

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

Available in TQFN and TSSOP Packages

Maxim ASIC Design Services

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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

www.maximintegrated.com
Industry’s First Integrated, Dual 2-Wire Hall-Effect Sensor Interface Solution

Improves Reliability and Performance While Saving Cost

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

Improves Performance and Reliability

• High-side, current-sense architecture eliminates the need for a ground return wire without introducing ground shift

Saves Space and Cost

• High-side, current-sense architecture eliminates 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

### Operational Amplifiers

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

### Current-Sense Amplifiers

<table>
<thead>
<tr>
<th>Part</th>
<th>CMVR (V)</th>
<th>Supply-Voltage Range (V)</th>
<th>Supply Current (μA)</th>
<th>Bidirectional Current Sense</th>
<th>GBWP (MHz)</th>
<th>Auto Temp Range*</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX4069–72</td>
<td>1.35 to 15</td>
<td>2.7 to 24</td>
<td>100</td>
<td></td>
<td>40</td>
<td>100</td>
<td>1.5% total output error</td>
</tr>
<tr>
<td>MAX4073F/73H/73T</td>
<td>2 to 28</td>
<td>3 to 28</td>
<td>500</td>
<td>1600, 1700, 1800, 1800</td>
<td></td>
<td></td>
<td>±1% accuracy, SC70</td>
</tr>
<tr>
<td>MAX4376/77/78</td>
<td>0 to 28</td>
<td>3 to 28</td>
<td>1000</td>
<td>1200, 1700, 2000, 2000</td>
<td></td>
<td></td>
<td>±0.5% accuracy</td>
</tr>
<tr>
<td>MAX9918–20</td>
<td>-20 to +75</td>
<td>4.5 to 5.5</td>
<td>1000</td>
<td>75 to 230</td>
<td></td>
<td></td>
<td>±0.6% accuracy</td>
</tr>
</tbody>
</table>

### Comparators

<table>
<thead>
<tr>
<th>Part</th>
<th>No. of Comparators</th>
<th>Supply-Voltage Range (V)</th>
<th>Supply Current (μA)</th>
<th>Propagation Delay (ns)</th>
<th>Logic Output</th>
<th>Auto Temp Range*</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX9022/21/24</td>
<td>1/2/4</td>
<td>2.5 to 5.5</td>
<td>5</td>
<td>3000</td>
<td>CMOS/TTL</td>
<td></td>
<td>Hysteresis for low-power, rail-to-rail output</td>
</tr>
<tr>
<td>MAX940/41/42/44</td>
<td>1/2/4</td>
<td>2.7 to 5.5</td>
<td>320</td>
<td>40</td>
<td>CMOS/TTL</td>
<td></td>
<td>50% offset voltage</td>
</tr>
<tr>
<td>MAX9919/20</td>
<td>1</td>
<td>1.8 to 5.5</td>
<td>0.8</td>
<td>22000</td>
<td>CMOS/TTL</td>
<td></td>
<td>Nanopower (750μA), 1.245V ±1.5% REF</td>
</tr>
</tbody>
</table>

*Human Body Model

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

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

- Electronic power steering
- Seat-control modules
- Window lifters/power-door modules
- Transmission control/gearbox
- Tire-pressure monitoring
- ABS and stability
- Power mirrors

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

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

*MAX11105, 3000-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—6.8kHz 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
Maxim’s Products Satisfy the Quality Needs of the Automotive Market

Automotive “V” Flow Drives Products to Zero Defects

<table>
<thead>
<tr>
<th>/V Features</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO/TS 16949</td>
<td>✓</td>
</tr>
<tr>
<td>FAB—2 sites</td>
<td>✓</td>
</tr>
<tr>
<td>Parametric (PT)</td>
<td>✓</td>
</tr>
<tr>
<td>Wafer sort (probe)</td>
<td>✓</td>
</tr>
<tr>
<td>SYA/SBL</td>
<td>✓</td>
</tr>
<tr>
<td>Assembly—2 sites</td>
<td>✓</td>
</tr>
<tr>
<td>Burn-in</td>
<td>✓</td>
</tr>
<tr>
<td>Tri-temp tested</td>
<td>✓</td>
</tr>
<tr>
<td>AEC-Q100 qualified</td>
<td>✓</td>
</tr>
<tr>
<td>SPC, Cpk ≥ 1.67</td>
<td>✓</td>
</tr>
<tr>
<td>PPAP</td>
<td>✓</td>
</tr>
<tr>
<td>PCN horizons</td>
<td>✓</td>
</tr>
</tbody>
</table>

Distinctive Attributes of Maxim’s Vehicle (“V”) Flow

- Full ISO 14001:2004-certified environmental management system
- AEC-Q100-qualified parts for specified temperature grades
- Statistical process controls to Cpk ≥ 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