PRECISION
ANALOG ICs

Precision Op Amps,
Precision Instrumentation Amplifiers,
Precision Voltage References,
Real Time Clocks,
Switches/MUXes,
Digital Potentiometers,
Interface

SIMPLY SMarter™
HIGH-PERFORMANCE ANALOG PRODUCTS: LOW-POWER, SPACE-EFFICIENT SOLUTIONS.

Intersil Precision Analog is creating a state of the art product portfolio built on the latest technology. We offer a wide portfolio of general purpose analog building blocks targeted at precision signal chain design. Intersil’s high-performance Precision Analog products include:

- Real Time Clocks (page 8)
- Switches/Muxes (page 10)
- Digital Potentiometers (page 12)
- Interface (page 14)
- Precision Op Amps (page 16)
- Precision Instrumentation Amplifiers (page 21)
- Precision Voltage References (page 22)

**Precision Op Amps**
(portal 16)
Portfolio of precision op-amps with all-around great performance:
- New ultra low noise, low distortion op amps at 5V and 40V
- New 5V and 40V low drift, precision op amps
- Excellent balance of power versus performance
- Single-supply operation, rail-to-rail input/output

**Switches / MUXes**
(page 10)
- Low \( R_{\text{ON}} \)
- Robustness (full dielectric isolation) to withstand electrical harshness
- Overvoltage protection

**Precision Instrumentation Amplifiers**
(page 21)
Large portfolio of low power, instrumentation amps:
- Micro-power 5V Instrumentation Amps down to 60\( \mu \)A
- Various options for low to high gain capability
- Excellent for low power, sensor modules
- Excellent for low power, current sensing or monitoring

**DCPs**
(page 12)
- Non-Volatile, Volatile
- EEPROM endurance = 1M cycles & retains data for 50 years
- Operate up to 125 °C
- 16 to 1024 taps
- I\(^2\)C/SPI/Up-Down/Push Button

**Analog to Digital**
Coming soon
- 24-bit \( \Delta \Sigma \)
- 12/14-bit SAR
Providing high-performance solutions for the signal chain.

**DCP**

**Voltage Reference**

**Digital Processing**

**DAC**

**Amp**

**Interface**

**(page 14)**
- RS-232
- RS-485/422
- Quad Tx/Rx
- Dual protocol

**Timing & Control (RTC)**

**Precision Voltage References**

**(page 22)**

- Lowest power voltage references:
  - Excellent balance of power versus performance
  - Among the industry’s best temperature drift and accuracy performances
  - Industry’s lowest power, low noise voltage reference offering

**RTCs**

**(page 8)**
- High accuracy (low drift) with low parts count
- Power supervisory and backup management functions
- 3 in 1 Module - Feature-Rich RTC with onboard crystal and temperature compensation
**Key Products**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Part Number</th>
<th>Where Used in Patient Monitors</th>
<th>Key Features / Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Precision Amplifiers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Noise (0.1 to 10Hz)</td>
<td>ISL28133, ISL28136, EL8176, ISL28217 (40V), ISL28207, ISL28210 (40V), ISL28248 (5V)</td>
<td>ECG, EEG imaging Body probe front-ends, RF rectification, secondary stage, gain/filtering, right leg drive. Required for accuracy of signal conditioning.</td>
<td>• High impedance inputs • Low noise (0.1 to 10Hz) • Low noise gain amplification • Low offset and low drift</td>
</tr>
<tr>
<td><strong>Instrumentation Amplifiers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Power In-Amps</td>
<td>EL8172/72, ISL28273, ISL28473</td>
<td>ECG, EEG imaging Portable, 5V body potential probe gain amp</td>
<td>• High CMRR • Low offset drift • Multiple channel In-Amps</td>
</tr>
<tr>
<td>Blood Pressure and Body Temperature</td>
<td>Sensor amp front end</td>
<td></td>
<td></td>
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<tr>
<td><strong>Digital Potentiometers</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Precision DCP</td>
<td>ISL22317</td>
<td>End-user adjustment Controlling display contrast or backlight, drip rate, dosage, etc</td>
<td>• 1st low voltage 1% accurate DCP to reduce additional calibration</td>
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<tr>
<td>Low voltage, volatile DCPs</td>
<td>ISL23315/ISL23415</td>
<td></td>
<td>• Industry’s lowest operating voltage DCP</td>
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<tr>
<td><strong>Interface</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>RS-232</td>
<td>ISL2212E, ISL3232E, ISL4243E, ISL4245E</td>
<td>System and Control Serial communication port</td>
<td>• High ESD protection • Small packages</td>
</tr>
<tr>
<td>RS-485</td>
<td>ISL317E, ISL315E</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Voltage Level Translators</strong></td>
<td>ISL303xE</td>
<td>SD Memory Card &amp; Other Applications Used to interface mixed voltage devices Vc as low as 1.5V up to 3.3V Vcc</td>
<td>• Highest ESD protection • Small leadless packages</td>
</tr>
<tr>
<td><strong>Switches/ MUXes</strong></td>
<td>HI-509A, HI546, DG408, DG409</td>
<td>Direct sensor interface In front of actuator buffer amps</td>
<td>• Over-voltage protected • Latch-up free • Low leakage</td>
</tr>
</tbody>
</table>
## Key Products

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Part Number</th>
<th>Where Used in Process Control</th>
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<tbody>
<tr>
<td><strong>Precison Amplifiers</strong></td>
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<tr>
<td>40V:</td>
<td>ISL282x7, ISL282x8, ISL28210</td>
<td>In analog input modules to signal condition incoming signals</td>
<td>Wide operating voltage range</td>
</tr>
<tr>
<td>Low Drift 5V:</td>
<td>ISL28133, ISL28146, EL8176</td>
<td>In analog output modules for driving signals to the outside world</td>
<td>Single or dual supply</td>
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<tr>
<td></td>
<td></td>
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<td>Low offset &amp; drift</td>
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<tr>
<td><strong>Digital Potentiometers</strong></td>
<td>ISL223x4, ISL224x4, ISL223x6</td>
<td>Sensor compensation</td>
<td>Non-volatile settings</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Digitally settable resistance or voltage</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1st DCP with memory to operate up to 125°C</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ideal for Industrial applications</td>
</tr>
<tr>
<td><strong>Instrumentation Amplifiers</strong></td>
<td>Low Power, Integrated Solution: EL8172/73, ISL28274</td>
<td>For sensor front ends</td>
<td>Low noise</td>
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<tr>
<td></td>
<td>Ultra Low Power 5V, Customize (Roll Your Own): ISL28154, ISL28195</td>
<td></td>
<td>Low power</td>
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<tr>
<td></td>
<td>Low Cost 5V Customize (Roll Your Own): ISL28230</td>
<td></td>
<td>High CMRR</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Low drift</td>
</tr>
<tr>
<td><strong>Voltage References</strong></td>
<td>ISL21090, ISL21400, ISL28130</td>
<td>Used as active sources for sensors</td>
<td>Low tempco</td>
</tr>
<tr>
<td></td>
<td>ISL21070, ISL21080, ISL60002</td>
<td>Accurate voltage sources for data conversion</td>
<td>Low drift</td>
</tr>
<tr>
<td><strong>Switches/ MUXes</strong></td>
<td>HI-509A, HI546, DG408, DG409</td>
<td>Direct sensor interface</td>
<td>Over-voltage protected</td>
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<td></td>
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<td>In front of actuator buffer amps</td>
<td>atch-up free</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low leakage</td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td>RS-232 ISL2221E, ISL232E, ISL4243E</td>
<td>System and Control Serial communication port</td>
<td>High ESD protection</td>
</tr>
<tr>
<td></td>
<td>RS-485 ISL317xE, ISL315xE</td>
<td></td>
<td>Small packages</td>
</tr>
<tr>
<td><strong>RTC</strong></td>
<td>ISL12024, ISL12025, ISL12026</td>
<td></td>
<td>System Power Supervision with Watchdog and Power-On Reset</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Onboard 512-bit EEPROM storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>64-bit Factory-programmed Unique ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IRQ, Frequency outputs</td>
</tr>
</tbody>
</table>
## Key Products

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Part Number</th>
<th>Where Used in Weigh Scale</th>
<th>Key Features / Benefits</th>
</tr>
</thead>
</table>
| **Precision Amplifier** | ISL28113, EL8176 | Strain gauge sense amps | • Low offset  
| | ISL28190, ISL28191 | Voltage reference buffer circuits | • Low drift  
| | ISL28133, EL8176 | Strain gauge sense amp | • High CMRR / PSRR  
| | ISL28113/213/413 | | • Low power  
| | ISL28114/214/414 | |  
| | ISL28130/230/430 | |  
| **Instrumentation Amplifiers** | EL8170, EL8172/72, ISL28274 | Bridge front ends | • Low power  
| **Voltage References** | ISL21009, ISL21090 | Used as active sources for sensors | • Low noise  
| | ISL21070, ISL21080, ISL60002 | Accurate voltage sources for data conversion | • Low power  
| **Interface** | RS-232 | Serial communication between the system slave and master | • ICC61000 ESD  
| | ISL4221E, ISL3232E | | • Small packages  
| | RS-485 | | • Enhanced VCC (ISL315XE)  
| | ISL317XE, ISL315XE | |  
| **Switches/MUXes** | ISL43741 | Sensor signal multiplexing between load cell and signal conditioning amplifier, allows very accurate ADC to be shared between load cells | • Low RON for low signal loss and higher accuracy  
| | ISL84052 | | • Usually differential connections to keep noise low  
| | ISL84582 | | • Small size  

---

**Diagram:**

```
Load Cell  Mux  Amp  ADC*  MCU  Interface  LCD Display/Printer  DC  LDO  Voltage Supervisors & System Mgt
```

**Diagram Description:**

- **Load Cell**: Input to the system
- **Mux**: Multiplexer for signal selection
- **Amp**: Amplifier for signal conditioning
- **ADC**: Analog-to-Digital Converter
- **MCU**: Microcontroller Unit
- **Interface**: Communication interface
- **LCD Display/Printer**: Output display and printing

**Key Components:**

- **VREF**: Reference voltage
- **VCC**: Power supply

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**Diagram Notes:**

- **RS232/485 Interface**: Serial communication between system slave and master
- **IEC61000 ESD**: ESD protection
- **Small packages**: Compact design
- **Enhanced VCC**: Improved voltage supply
- **Low RON**: Reduced resistance for better accuracy
- **Differential connections**: Reduced noise

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**Diagram References:**

- **Precision Amplifier**: ISL28190, ISL28191, EL8176
- **Low Drift, Precision, 5V**: ISL28133
- **Low Cost Op Amps**: ISL28113/213/413, ISL28114/214/414, ISL28130/230/430
- **Low Power In-Amps 5V**: EL8170, EL8172/72, ISL28274
- **Low Noise References**: ISL21009, ISL21090
- **Low Cost References**: ISL21070, ISL21080, ISL60002
- **Interface RS232/485**: ISL4221E, ISL3232E, ISL317XE, ISL315XE
- **Switches/ MUXes**: ISL43741, ISL84052, ISL84582
### Key Products

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Part Number</th>
<th>Target Applications</th>
<th>Differentiator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lowest Power, High Performance HS ADCs</strong></td>
<td></td>
<td>• High Speed Data Acquisition</td>
<td>• Much lower power enables compact design</td>
</tr>
<tr>
<td></td>
<td><strong>12 Bit 500MSPS HS ADC</strong></td>
<td>• Spectrum Analyzers</td>
<td>• Enables portable designs (battery operation)</td>
</tr>
<tr>
<td></td>
<td>ISLA112P50, KAD5512P-50</td>
<td>• Communication Analyzers</td>
<td>• Highest dynamic range improves measurement accuracy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Digital Oscilloscopes</td>
<td>• Excellent SFDR eases filtering requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High Speed Data Acquisition</td>
<td>• Low power eases thermal design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spectrum Analyzers</td>
<td>• Dual available for multi-channel applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Communication Analyzers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Digital Oscilloscopes</td>
<td></td>
</tr>
<tr>
<td><strong>High Linearity, Low Power DACs</strong></td>
<td></td>
<td>• Arbitrary Waveform Generator (AWG)</td>
<td>• Dub available for multi-channel applications</td>
</tr>
<tr>
<td></td>
<td><strong>14-Bit 270MSPS HS DAC</strong></td>
<td>• RF Signal Generators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISL5957</td>
<td>• Automatic Test Equipment (ATE)</td>
<td></td>
</tr>
<tr>
<td><strong>Fastest and Lowest Power HS Op Amps</strong></td>
<td></td>
<td>Same applications as those of HS ADCs and DACs</td>
<td>• Best-in-class speed, linearity, and power for driving/buffering HS ADCs/DACs in data acquisition systems</td>
</tr>
<tr>
<td></td>
<td><strong>1.4GHz Current Feedback Amplifier (AD-coupled)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EL5166</td>
<td>• 500MHz Rail-to-Rail Op Amp (DC-coupled)</td>
<td>• World’s largest offering of nonvolatile DCPs</td>
</tr>
<tr>
<td></td>
<td>EL8102</td>
<td>• 500MHz Rail-to-Rail Op Amp (DC-coupled)</td>
<td>• “Set and Forget” with EEPROM in DCPs</td>
</tr>
<tr>
<td><strong>DCPs</strong></td>
<td>ISL95811</td>
<td>Adjusts the offset of the high speed op amp in Data Acquisition products</td>
<td>• Low Noise, High Voltage, Rail-to-rail Output, high input impedance, robust inputs</td>
</tr>
<tr>
<td></td>
<td>ISL22316 (IC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISL22416 (SPI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Precision Op Amps</strong></td>
<td>ISL28210, ISL28227, ISL28218</td>
<td>Data Acquisition, DSO</td>
<td>• Low noise</td>
</tr>
<tr>
<td><strong>Voltage References</strong></td>
<td><strong>Low Noise References</strong></td>
<td>Used as active sources for sensors</td>
<td>• Low power</td>
</tr>
<tr>
<td></td>
<td>ISL21099, ISL21090</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Low Cost References</strong></td>
<td>Accurate voltage sources for data conversion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISL21070, ISL21080, ISL60002</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Data Acquisition System**

- Oscilloscope ½ Channel Input
- Spectrum Analyzer RF Input
- HS Op Amp
- Precision Op Amp
- DCP
- Down Conversion Stage in Spectrum Analyzers Only
- ADC
- FPGA
- LO Generation

**Vref**

- PWM
- LDO

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**PRECISION ANALOG ICs**

**INSTRUMENTATION**

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[www.intersil.com/precisionanalog](www.intersil.com/precisionanalog)
Intersil’s family of Real Time Clock products offer a wide variety of useful industry-standard functions and features including clocks and calendars, programmable alarms with event recording, non-volatile memory for system personality data and unique device IDs, and power supervision including backup battery and system shutdown management. The 3-in-1 Module products feature an integrated 32kHz crystal with onboard temperature sensor, to maintain high accuracy over the rated temperature range without user calibration.

TARGET APPLICATIONS

- Handheld / Portable Devices
- Industrial / Communications / Specialty
- High Volume Consumer
- Residential / Industrial Power Meter

Intersil’s Real Time Clocks Offer the Broadest Choice of Product Features
### HIGH-ACCURACY RTC MODULES
**WITH EMBEDDED CRYSTAL AND TEMPERATURE COMPENSATION**

<table>
<thead>
<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISL12020M</td>
<td>1000</td>
<td>1</td>
<td>15</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>128 Bytes</td>
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<tr>
<td>ISL12022M</td>
<td>1000</td>
<td>1</td>
<td>15</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>128 Bytes</td>
</tr>
<tr>
<td>ISL12022MA</td>
<td>1000</td>
<td>1</td>
<td>15</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>128 Bytes</td>
</tr>
<tr>
<td>ISL12022M-RE421</td>
<td>1000</td>
<td>1</td>
<td>15</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>128 Bytes</td>
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### FEATURE-RICH RTCS

<table>
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<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
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<tr>
<td>ISL12030</td>
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<td>2</td>
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<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>ISL12032</td>
<td>800</td>
<td>2</td>
<td>7</td>
<td>Y</td>
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<td>N</td>
<td>Y</td>
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</table>

**High Precision RTC with On-Chip Temperature Sensor**

<table>
<thead>
<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
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<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
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<td>ISL12022</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>128 Bytes</td>
</tr>
<tr>
<td>ISL12023</td>
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<td>15</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>128 Bytes</td>
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</table>

**With Embedded Unique ID**

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<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
<th>Package</th>
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<tbody>
<tr>
<td>ISL12024</td>
<td>850</td>
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<td>3</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>512x8-Bit EEPROM</td>
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<tr>
<td>ISL12024RTC2</td>
<td>850</td>
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<td>Shared Pin</td>
<td>512x8-Bit EEPROM</td>
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<td>ISL12025</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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</table>

**With Integrated EEPROM and CPU Supervisory Functions**

<table>
<thead>
<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
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<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
<th>Package</th>
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<tbody>
<tr>
<td>ISL12026</td>
<td>850</td>
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<td>3</td>
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<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>512x8-Bit EEPROM</td>
</tr>
<tr>
<td>ISL12026A</td>
<td>850</td>
<td>2</td>
<td>3</td>
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<td>Y</td>
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<td>512x8-Bit EEPROM</td>
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<td>ISL12027</td>
<td>850</td>
<td>2</td>
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<td>Y</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
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</table>

**LOW-COST, LOW-POWER**

<table>
<thead>
<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
<th>Package</th>
</tr>
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<tbody>
<tr>
<td>ISL12008</td>
<td>800</td>
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<td>1</td>
<td>N</td>
<td>N</td>
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<td>Y</td>
<td>Y</td>
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**With Battery Backup**

<table>
<thead>
<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
<th>Package</th>
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<tbody>
<tr>
<td>ISL1208</td>
<td>400</td>
<td>1</td>
<td>15</td>
<td>N</td>
<td>N</td>
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<td>2 Bytes</td>
</tr>
<tr>
<td>ISL1218</td>
<td>400</td>
<td>1</td>
<td>15</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Shared Pin</td>
<td>8 Bytes</td>
</tr>
<tr>
<td>ISL1220</td>
<td>400</td>
<td>1</td>
<td>15</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Dedicated Pin, Dedicated Pin</td>
<td>8 Bytes</td>
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</table>

**With Battery Backed RAM**

<table>
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<tr>
<th>Device</th>
<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
<th>Package</th>
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<tr>
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<td>ISL1219</td>
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<td>Dedicated Pin, Dedicated Pin</td>
<td>2 Bytes</td>
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</table>

**With Battery Backed RAM and Event Detection**

<table>
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<th>$I_{bat}$ (nA)</th>
<th>Alarms</th>
<th>Selectable Frequency Output</th>
<th>CPU Supervisory Function</th>
<th>Battery</th>
<th>IRQ</th>
<th>FOUT</th>
<th>SRAM</th>
<th>Other Functions</th>
<th>Package</th>
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<tr>
<td>ISL12057</td>
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<td>4</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Shared Pin</td>
<td>N</td>
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<tr>
<td>ISL12058</td>
<td>400</td>
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<td>4</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Shared Pin</td>
<td>N</td>
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<tr>
<td>ISL12059</td>
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<td>1</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Shared Pin</td>
<td>N</td>
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<td>ISL12082</td>
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<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Dedicated Pin, Dedicated Pin</td>
<td>N</td>
</tr>
</tbody>
</table>
Switch and Multiplexer Product Families

Excellent performance across the entire input voltage range

- Up to 70V_pp input signal
- Includes latchup free
- Comprehensive offering of high voltage single and dual supply switches
- Bandwidths to 500MHz for communications and video applications

Lowest distortion, highest ESD sub 0.5Ω switches

Supply Voltage (V)

Typical Switch Resistance (Ω)

HV (+/-15V) MUX
Quick Selection

- DG406
- HI-506 Latch-up free
- HI-506A OVP
- HI-546 OVP, \( R_{ON} \) matched

- DG408
- HI-508 Latch-up free
- HI-508A OVP
- HI-548 OVP, \( R_{ON} \) matched

- HI-516 Latch-up free

- HI-518 Latch-up free

- DG407
- HI-509 Latch-up free
- HI-509A OVP
- HI-549 OVP, \( R_{ON} \) matched
USB SWITCHES WITH CHARGE PUMP FOR HIGH SPEED DATA TRANSFER

With internal charge pump operation, the ISL54222A gives designers the choice of a wider USB eye opening at 480Mbps, or the ability to run the parts off LDO supply voltages as low as 1.8V, in high speed data transfer applications.

KEY FEATURES
- USB 2.0 High Speed Compliant
- Charge Pump Design
- Low ROH and Capacitance
- Low Leakage During Power Down
- Low Supply Current Power Down Mode
- Tiny μTQFN Packaging

APPLICATIONS
- Photo Mini-Printers
- MP3 and Other Personal Media Players
- Cellular/Mobile Phones
- PDAs
- Audio/USB Switching Applications

BLOCK DIAGRAM

Able to Meet USB Specs at Low 1.8V to 3.3V Supply Voltage
Can use the same LDO voltage as the core chipsets in handheld devices.

INTERNAL CHARGE PUMPS
Lower signal loss, wider eye opening with charge pump design.
DCPS ENABLE DIGITALLY CONTROLLED ANALOG SIGNAL PROCESSING

DCPs allow for digital flexibility in an analog circuit. DCPS provide a link between the digital and analog domains in the system, allowing repeatable control and configuration of analog circuitry. This approach is typically more power-efficient than computationally intensive digital signal processing. For more information, please see AN133.

DIGITALLY PROGRAMMABLE
- Voltage Amplifier
- Filter
- Voltage Reference
- Voltage Regulator

PROGRAMMABLE FILTER AND GAIN BLOCK
Controls Center Frequency
Controls Passband Gain

PROGRAMMABLE INVERTING AMPLIFIER
Adjust Offset, Gain, DC Signal Control

PROGRAMMABLE VOLTAGE REGULATOR
Controls Output Voltage

1ST LOW VOLTAGE PRECISION DCP
ISL22317 — Typically >99% Accurate at Each Tap

KEY FEATURES AND BENEFITS
- Eliminates additional calibration
- Temperature drift reduction – mirrors the temperature coefficient of the external reference resistor

APPLICATIONS
- Set specific current and resistor values

99% ACCURACY

TRUE DIGITAL RHEOSTAT
Known accuracy allows for precise settings.

SMALLEST NON VOLATILE PUSH-BUTTON DCP
ISL22511/12 — 2.15x1.65mm µTQFN Package

KEY FEATURES AND BENEFITS
- Simple push-button interface - No software required
- Auto/manual store – ease of use
- Zero-compensated wiper resistance - minimizes error of use

APPLICATIONS
- Adjust volume/contrast/backlight
- Additional user feature, i.e gain control

TINY µTQFN PACKAGE

BACKLIGHT CONTROL
Auto Store
Set & forget!

Low cost: ISL23511/ISL23512 volatile DCPS also available
### Non-Volatile (EEPROM Memory)

#### Single 16-Tap (4-Bits)
- X9116 - 10kΩ, Up-Down
- ISL22512 - 10kΩ, Push Button

#### Single 32-Tap (5-Bits)
- X9313 - 1kΩ / 10kΩ / 50kΩ, Up-Down
- X9314 - 10kΩ, Log Taper, Up-Down
- X9315 - 10kΩ / 50kΩ / 100kΩ, Up-Down
- X93154 - 50kΩ, Up-Down, 2-Terminal
- X93155 - 50kΩ, Up-Down, 2-Terminal
- X93156 - 12.5kΩ / 50kΩ, Up-Down
- X9511 - 1kΩ / 10kΩ, Push Button
- ISL22511 - 10kΩ / 50kΩ, Push Button

#### Single 64-Tap (6-Bits)
- X9429 - 2.5kΩ / 10kΩ, 2-Wire

#### Single 100-Tap (6.65-Bits)
- X9317 - 1kΩ / 10kΩ / 50kΩ / 100kΩ, Up-Down
- X9318 - 10kΩ, Up-Down
- X9319 - 10kΩ / 50kΩ / 100kΩ, Up-Down
- X9C102 - 1kΩ, Up-Down
- X9C103 - 10kΩ, Up-Down
- X9C104 - 100kΩ, Up-Down
- X9C503 - 50kΩ, Up-Down
- X9C303 - 32kΩ, Log Taper, Up-Down

#### Single 128-Tap (7-Bits)
- ISL22316 - 10kΩ / 50kΩ, PC
- ISL22317 - 10kΩ / 50kΩ / 100kΩ, 1% Tolerance, PC
- ISL22319 - 10kΩ / 50kΩ, PC, Wiper Only
- ISL95311 - 10kΩ / 50kΩ, PC
- ISL95711 - 10kΩ / 50kΩ, PC
- ISL96017 - 10kΩ / 50kΩ / 100kΩ, PC (16bits extra EEPROM)
- ISL22416 - 10kΩ / 50kΩ, SPI
- ISL22419 - 10kΩ / 50kΩ, SPI, Wiper Only
- ISL95310 - 10kΩ / 50kΩ, Up-Down
- ISL95710 - 10kΩ / 50kΩ, Up-Down

#### Single 256-Tap (8-Bits)
- ISL95810 - 10kΩ / 50kΩ, PC
- ISL95811 - 10kΩ / 50kΩ, PC
- ISL22313 - 10kΩ / 50kΩ / 100kΩ, PC
- ISL22414 - 10kΩ / 50kΩ / 100kΩ, SPI

#### Single 1024-Tap (10-Bits)
- X9110 - 100kΩ, SPI
- X9111 - 100kΩ, SPI
- X9118 - 100kΩ, 2-Wire
- X9119 - 100kΩ, 2-Wire

#### Dual 32-Tap (5-Bits)
- X93254 - 50kΩ, Up-Down, 2-Terminal
- X93255 - 50kΩ, Up-Down, 2-Terminal
- X93256 - 50kΩ, Up-Down

#### Dual 64-Tap (6-Bits)
- X9410 - 10kΩ, SPI
- X9221A - 2kΩ / 10kΩ / 50kΩ, 2-Wire
- X9418 - 2.5kΩ / 10kΩ, 2-Wire

#### Dual 128-Tap (7-Bits)
- ISL22326 - 10kΩ / 50kΩ, PC
- ISL22329 - 10kΩ / 50kΩ / 100kΩ, PC, Wiper Only
- ISL22426 - 10kΩ / 50kΩ, SPI
- ISL22429 - 10kΩ / 50kΩ, SPI, Wiper Only

#### Dual 256-Tap (8-Bits)
- X95820 - 10kΩ / 50kΩ, PC
- X9260 - 50kΩ / 100kΩ, SPI
- X9261 - 50kΩ / 100kΩ, SPI
- X9268 - 50kΩ / 100kΩ, 2-Wire
- ISL22323 - 10kΩ / 50kΩ / 100kΩ, PC
- ISL22424 - 10kΩ / 50kΩ / 100kΩ, SPI

#### Quad 64-Tap (6-Bits)
- ISL9400 - 2.5kΩ / 10kΩ, SPI
- X9401 - 10kΩ, SPI
- X9241A - 2kΩ / 10kΩ / 50kΩ, 2-Wire
- X9408 - 2.5kΩ / 10kΩ, 2-Wire
- X9409 - 2.5kΩ / 10kΩ, 2-Wire

#### Quad 128-Tap (7-Bits)
- ISL22346 - 10kΩ / 50kΩ, PC
- ISL22349 - 10kΩ / 50kΩ, PC, Wiper Only
- ISL22446 - 10kΩ / 50kΩ, SPI
- ISL22449 - 10kΩ / 50kΩ, SPI, Wiper Only

#### Quad 256-Tap (8-Bits)
- X95840 - 10kΩ / 50kΩ, PC
- ISL22343 - 10kΩ / 50kΩ / 100kΩ, PC
- ISL22444 - 10kΩ / 50kΩ / 100kΩ, SPI

### Special Function DCPs

- **Dual Audio DCP - Integrated Output Buffer Amps and Audio Detect**
  - ISL22102 - 32kΩ, Log Taper, Push Button, 0 to -72dB Dynamic Range

- **Low Voltage 1% Tolerant Precision DCP & Low Temperature Coefficient**
  - ISL22317 - 10kΩ / 50kΩ / 100kΩ, PC

- **Programmable Voltage Reference**
  - X60250 - Micro-power, 8-bit Adjustable, 0 to 1.25V

- **Sensor Conditioners with ADC, EEPROM Look-Up Tables, and DACs**
  - X96010 - Dual, 2-Wire

- **Single 128-Tap DCP with 16kbits General Purpose EEPROM**
  - ISL96017 - 10kΩ / 50kΩ, PC

- **TFT/LCD Programmable VCOM Calibrator (128 Step)**
  - ISL45041 - PC
  - ISL45042 - Up-Down

### Volatile (No EEPROM Memory)

#### Single 16-Tap (4-Bits)
- ISL23512 - 10kΩ, Push Button

#### Single 32-Tap (5-Bits)
- X9015 - 10kΩ / 50kΩ / 100kΩ, Up-Down
- ISL23511 - 10kΩ / 50kΩ, Push Button
- ISL90460 - 10kΩ / 50kΩ / 100kΩ, Up-Down, Rheostat
- ISL90461 - 10kΩ / 50kΩ / 100kΩ, Up-Down, 2-Terminal
- ISL90462 - 10kΩ / 50kΩ / 100kΩ, Up-Down, 2-Terminal

#### Single 128-Tap (7-Bits)
- ISL90726 - 10kΩ / 50kΩ, PC, 2-Terminal
- ISL90727 - 10kΩ / 50kΩ, PC, 2-Terminal
- ISL90728 - 10kΩ / 50kΩ, PC, 2-Terminal
- ISL23711 - 10kΩ / 50kΩ, PC
- ISL23710 - 10kΩ / 50kΩ, Up-Down

#### Single 256-Tap (8-Bits)
- ISL90810 - 10kΩ / 50kΩ, PC
- ISL23315 - 10kΩ / 50kΩ / 100kΩ, PC, Low Voltage
- ISL23415 - 10kΩ / 50kΩ / 100kΩ, SPI, Low Voltage

- **Dual 32-Tap (5-Bits)**
  - ISL22104 - 32kΩ, Log Taper, 2-Wire
  - ISL22105 - 32kΩ, Log Taper, Audio Detect, Push Button

- **Quad 64-Tap (6-Bits)**
  - ISL90841 - 10kΩ / 50kΩ, PC
  - ISL90842 - 10kΩ / 50kΩ, PC, 2-Terminal
  - ISL90843 - 10kΩ / 50kΩ, PC, Wiper Only

- **Extended positive terminal voltage**
- **Positive and negative terminal voltage**
RS-485/RS-422 transceivers

Get a 60% increase in output drive voltage (V_{OD}) that increases noise immunity and results in a more robust serial communication system and a space-saving MSOP package option.

**KEY FEATURES**
- 60% higher output voltage. 2.4V min vs. typical 1.5V min
- IEC61000 ESD protected I/O pins
- True 1/8 unit load

**APPLICATIONS**
- Electronic utility meter reading systems, E-meter
- Industrial air conditioning systems
- PROFIBUS and Factory automation

**ENHANCED NOISE IMMUNITY**
60% Higher Output Voltage (ISL315xE)

Provides enhanced noise immunity and can drive longer cable lengths or more cable terminations.

**SPACE-SAVING SMALL PACKAGE**

8 Ld SOIC 8 Ld MSOP

Full Fail-Safe Rx predictable performance when bus faults occur.

3.3V or 5V operation

IEC61000-4-2 ESD Protection ±15kV Airgap discharge, ±8kV contact discharge (half-duplex versions).

Hot Plug Capability prevents data corruption during power-up on an active bus.

**Typical Operating Circuit**

**ISL315xE, ISL317xE**

**Fractional Unit Load Rx** allows up to 256 devices on the bus without expensive repeaters.

**Selection Guide**

**RS-485/RS-422 transceivers**

<table>
<thead>
<tr>
<th>Device</th>
<th>Devices Allowed on Bus</th>
<th>Half/Full Duplex</th>
<th>Hot Plug</th>
<th>Data Rate (Mbps)</th>
<th>Slew Rate Limited</th>
<th>Tx/Rx Enable</th>
<th>I_{E} EN/DIS (µA)</th>
<th>SHDN ICC (µA)</th>
<th>V_{CC} Range (+V)</th>
<th>Package</th>
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<tbody>
<tr>
<td>ISL3150E</td>
<td>256</td>
<td>Full</td>
<td>Yes</td>
<td>0.115</td>
<td>Yes</td>
<td>Yes</td>
<td>800/700</td>
<td>0.07</td>
<td>4.5 to 5.5</td>
<td>10 Ld MSOP; 14 Ld SOIC</td>
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<td>ISL3152E</td>
<td>256</td>
<td>Half</td>
<td>Yes</td>
<td>0.115</td>
<td>Yes</td>
<td>Yes</td>
<td>800/700</td>
<td>0.07</td>
<td>4.5 to 5.5</td>
<td>8 Ld MSOP; 8 Ld PDIP; 8 Ld SOIC</td>
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<tr>
<td>ISL3153E</td>
<td>256</td>
<td>Full</td>
<td>Yes</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
<td>800/700</td>
<td>0.07</td>
<td>4.5 to 5.5</td>
<td>10 Ld MSOP; 14 Ld SOIC</td>
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<td>ISL3155E</td>
<td>256</td>
<td>Half</td>
<td>Yes</td>
<td>20</td>
<td>No</td>
<td>Yes</td>
<td>800/700</td>
<td>0.07</td>
<td>4.5 to 5.5</td>
<td>10 Ld MSOP; 14 Ld SOIC</td>
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<td>ISL3156E</td>
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<td>Full</td>
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<td>20</td>
<td>No</td>
<td>Yes</td>
<td>800/700</td>
<td>0.07</td>
<td>4.5 to 5.5</td>
<td>10 Ld MSOP; 14 Ld SOIC</td>
</tr>
</tbody>
</table>

**3.3V, Fractional UL, 15kV ESD, Full Fail-Safe**

<table>
<thead>
<tr>
<th>Device</th>
<th>Devices Allowed on Bus</th>
<th>Half/Full Duplex</th>
<th>Hot Plug</th>
<th>Data Rate (Mbps)</th>
<th>Slew Rate Limited</th>
<th>Tx/Rx Enable</th>
<th>I_{E} EN/DIS (µA)</th>
<th>SHDN ICC (µA)</th>
<th>V_{CC} Range (+V)</th>
<th>Package</th>
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<tbody>
<tr>
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<td>Yes</td>
<td>0.25</td>
<td>Yes</td>
<td>Yes</td>
<td>510/480</td>
<td>0.01</td>
<td>3.0 to 3.6</td>
<td>10 Ld MSOP; 14 Ld SOIC</td>
</tr>
<tr>
<td>ISL3172E</td>
<td>256</td>
<td>Half</td>
<td>Yes</td>
<td>0.25</td>
<td>Yes</td>
<td>Yes</td>
<td>510/480</td>
<td>0.01</td>
<td>3.0 to 3.6</td>
<td>8 Ld MSOP; 8 Ld SOIC</td>
</tr>
<tr>
<td>ISL3173E</td>
<td>256</td>
<td>Full</td>
<td>Yes</td>
<td>1</td>
<td>0.5</td>
<td>Yes</td>
<td>510/480</td>
<td>0.01</td>
<td>3.0 to 3.6</td>
<td>10 Ld MSOP; 14 Ld SOIC</td>
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<tr>
<td>ISL3175E</td>
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<td>Half</td>
<td>Yes</td>
<td>0.5</td>
<td>Yes</td>
<td>Yes</td>
<td>510/480</td>
<td>0.01</td>
<td>3.0 to 3.6</td>
<td>8 Ld MSOP; 8 Ld SOIC</td>
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<tr>
<td>ISL3176E</td>
<td>256</td>
<td>Full</td>
<td>Yes</td>
<td>20</td>
<td>No</td>
<td>Yes</td>
<td>510/480</td>
<td>0.01</td>
<td>3.0 to 3.6</td>
<td>10 Ld MSOP; 14 Ld SOIC</td>
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<tr>
<td>ISL3178E</td>
<td>256</td>
<td>Half</td>
<td>Yes</td>
<td>20</td>
<td>No</td>
<td>Yes</td>
<td>510/480</td>
<td>0.01</td>
<td>3.0 to 3.6</td>
<td>8 Ld MSOP; 8 Ld SOIC</td>
</tr>
</tbody>
</table>
**RS-485 / 422, RS-232**

**Single Tx and Rx RS-485/422**
- **ISL41334** RS-232, RS-422, ISL81334 RS-232, RS-422
- RS-232 Transceiver in a QFN Package

**Quad Tx and Rx RS-485/422**
- IEC61000 ESD Protection: 16.5kV Air Gap and 9kV Contact Discharge

**Dual Protocol Transceivers**
- 15kV HBM ESD Protection
- On all bus pins

**OVP RS-485**
- ±60V Fault Protected
- 125V Common Mode Range

**RS-232 Transceiver in a QFN Package**
- 5mm x 5mm QFN Package
- ±15kV HBM and IEC61000 ESD Protection

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**Go to www.intersil.com/precisionanalog for complete listing**

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**www.intersil.com/precisionanalog | 15**
Other Special Categories of Performance

### Precision Amps with Low Distortion
- **ISL28127**: 0.00005% THD+N, 10MHz, 40V
- **ISL28190**: 0.000017% THD+N, 170MHz, 5V
- **ISL28191**: 0.000017% THD+N, 5V

### Precision Amps with Low Current Noise (1kHz)
- **ISL28133**: 70fA/√Hz, 300µA IP2M, low Vos drift, 5V
- **ISL28207**: 20fA/√Hz, 300µA IP2M, 300µA IP2B, 40V
- **ISL28288**: 9fA/√Hz, 30pA IP2M, 78µA IP2B, 5V
- **ISL28210**: 9fA/√Hz, 2pA IP2M, 50V

### Precision Amps with Higher Bandwidth and Speed
- **ISL28127**: 10MHz, 3.6V/µs, 70µV Vos, low noise 40V
- **ISL28218**: 4MHz, 1.2V/µs, 230µV, 40V single supply
- **ISL28136**: 5MHz, 1.9V/µs, 150µV Vos, low noise 5V
- **ISL28138**: 4.5MHz, 4.8V/µs, 300µV Vos, 5V
- **ISL28210**: 40V JFET-input 2pA, 10MHz, 20µV/µs, low noise precision
- **ISL28290**: 170MHz, 50V/µs, 700µV Vos, low noise 5V
- **ISL28291**: 61MHz, 17V/µs, 700µV Vos, low noise 5V

### Precision Amps in Tiny Packages
- **EL8176**: WL CSP package
- **ISL28194, ISL28195, ISL28290, ISL28291, ISL28133**: μTDFN package

### Precision Amps with Shutdown Capability for Low Power
- **EL8176, ISL28194, ISL28195**: Nano-power
- **ISL28130, ISL28133, ISL28136, ISL28138, ISL28156, ISL28158, ISL28278**: Micro-power

### General Purpose/Cost Sensitive Amps
- **ISL28130/ISL28230/ISL28430**
- **ISL28113/ISL28213/ISL28413**
- **ISL28114/ISL28214/ISL28414**

---

**Precision Amps with Low Distortion**
- Precision Amps with Low Distortion
  - **ISL28127**: 0.00005% THD+N, 10MHz, 40V
  - **ISL28190**: 0.000017% THD+N, 170MHz, 5V
  - **ISL28191**: 0.000017% THD+N, 5V

**Precision Amps with Low Current Noise (1kHz)**
- Precision Amps with Low Current Noise (1kHz)
  - **ISL28133**: 70fA/√Hz, 300µA IP2M, low Vos drift, 5V
  - **ISL28207**: 20fA/√Hz, 300µA IP2M, 300µA IP2B, 40V
  - **ISL28288**: 9fA/√Hz, 30pA IP2M, 78µA IP2B, 5V
  - **ISL28210**: 9fA/√Hz, 2pA IP2M, 50V

**Precision Amps with Higher Bandwidth and Speed**
- Precision Amps with Higher Bandwidth and Speed
  - **ISL28127**: 10MHz, 3.6V/µs, 70µV Vos, low noise 40V
  - **ISL28218**: 4MHz, 1.2V/µs, 230µV, 40V single supply
  - **ISL28136**: 5MHz, 1.9V/µs, 150µV Vos, low noise 5V
  - **ISL28138**: 4.5MHz, 4.8V/µs, 300µV Vos, 5V
  - **ISL28210**: 40V JFET-input 2pA, 10MHz, 20µV/µs, low noise precision
  - **ISL28290**: 170MHz, 50V/µs, 700µV Vos, low noise 5V
  - **ISL28291**: 61MHz, 17V/µs, 700µV Vos, low noise 5V

**Precision Amps in Tiny Packages**
- Precision Amps in Tiny Packages
  - **EL8176**: WL CSP package
  - **ISL28194, ISL28195, ISL28290, ISL28291, ISL28133**: μTDFN package

**Precision Amps with Shutdown Capability for Low Power**
- Precision Amps with Shutdown Capability for Low Power
  - **EL8176, ISL28194, ISL28195**: Nano-power
  - **ISL28130, ISL28133, ISL28136, ISL28138, ISL28156, ISL28158, ISL28278**: Micro-power

**General Purpose/Cost Sensitive Amps**
- General Purpose/Cost Sensitive Amps
  - **ISL28130/ISL28230/ISL28430**
  - **ISL28113/ISL28213/ISL28413**
  - **ISL28114/ISL28214/ISL28414**
FEATURES AND BENEFITS

- Low drift / reduced offset voltage over temperature (typically < 5nV/°C) [Figure 1]
- Low drift / reduced offset voltage over time [Figure 2]
- Low offset voltage / reduced offset voltage (typically <1µV) [Figure 3]
- Low offset voltage over the common mode range and power supply (CMRR & PSRR typically > 125dB) [Figure 4, 5]
- Eliminates or no 1/f noise [Figure 6]
- Very High Open Loop Gain
- Precision Signal Amplifications

Ultra Low Offset Drift

LOW DRIFT OVER TEMPERATURE
Offset Drift = 0.02µV/°C

Figure 1. Vos vs Temperature

LOW DRIFT OVER TIME

Figure 2. Long Term Vos Drift

LOW OFFSET VOLTAGE

Figure 3. Vos vs Supply Voltage

Low Offset Voltage

HIGH CMRR

Figure 4. CMRR vs Temperature

HIGH PSRR

Figure 5. PSRR vs Temperature

NO 1/f NOISE

Figure 6. Input Noise Voltage Density

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Supply Voltage (V)</th>
<th>Rail-To-Rail</th>
<th>Vos Max @ 25°C</th>
<th>DCPSRR</th>
<th>CMRR min @ 25°C</th>
<th>PSRR min @ 25°C</th>
<th>Is Max @ 25°C</th>
<th>GBW</th>
<th>Slew Rate</th>
<th>Noise @ 1kHz</th>
<th>Voltage Noise @ 1kHz</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISL28133*</td>
<td>1.65 – 5.5</td>
<td>Yes</td>
<td>Yes</td>
<td>6</td>
<td>0.05</td>
<td>0.18</td>
<td>0.025</td>
<td>0.4</td>
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<td>1</td>
<td>65</td>
<td>SC70, SO233, TDFN</td>
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<td>Yes</td>
<td>6</td>
<td>0.05</td>
<td>0.18</td>
<td>0.025</td>
<td>0.4</td>
<td>0.2</td>
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<td>65</td>
<td>MSOP, SOIC</td>
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<td>Yes</td>
<td>6</td>
<td>0.05</td>
<td>0.18</td>
<td>0.025</td>
<td>0.4</td>
<td>0.2</td>
<td>1</td>
<td>65</td>
<td>TSSOP, TDFN</td>
</tr>
</tbody>
</table>

*Some specifications will differ, please check data sheet for actual parameters and/or conditions.
PR40 Process Overview

**PRECISION HIGH VOLTAGE OP AMPS WERE DEVELOPED ON INTERSIL'S NEW PR40 PROCESS**

Precision high voltage op amps were developed on Intersil’s new PR40 process. PR40 is a new precision process that enables Intersil to develop competitive precision high voltage amplifiers. Key features of the new process are full DI, complementary bipolar, low noise, well-matched Super-beta transistors, P-channel JFET, high breakdown voltage (>44V), high density capacitors, Thin Film resistors, fuse-link trim cells, and high ESD cells. (Figure 1)

**FEATURES AND BENEFITS**
- Full dielectric isolation (DI) and high ESD cells (>4kV ESD HBM) provide a highly robust inputs compared to older process amplifiers.
- Thin Film resistors and fuse-link trim cells offers very low offset voltages (Figure 2)

**NEW WAVE OF AMPLIFIERS FROM PR40-PRECISION-SOI ADVANCE BIPOLAR PROCESS**

Intersil’s ISL28127 is a high voltage precision op amp, delivering low frequency noise, low distortion, ultra low offset and low drift offset.

**FEATURES**
- Very Low Voltage Noise………………………2.5nV/√Hz
- Low Input Offset…………………………………….70μV, Max.
- Superb Offset Drift ………………………………0.5μV/°C, Max.
- Wide Supply Range……………………………….4.5V to 40V
- Gain-bandwidth Product…………………10MHz Unity Gain Stable
- Outstanding ESD Performance: Human Body Model: 4.0kV

**40V Low Noise, Precision Bipolar Op Amp**
**ISL28127**

**LOW OFFSET VOLTAGE**

**20% LOWER NOISE AT 30% LESS POWER THAN COMPETITION**

---

**Table**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Supply Voltage (V)</th>
<th>Rail-To-Rail</th>
<th>Vos Max @ 25°C</th>
<th>TCvos</th>
<th>Ib Max @ 25°C</th>
<th>CMRR min @ 25°C</th>
<th>PSRR min @ 25°C</th>
<th>Av min @ 25°C</th>
<th>Is @ Max @ 25°C</th>
<th>GBW</th>
<th>Slew Rate</th>
<th>Noise 0.1 to 1kHz</th>
<th>Voltage Noise @ 1kHz</th>
<th>Current Noise @ 1kHz</th>
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<tbody>
<tr>
<td>ISL28117B</td>
<td>ISL28217B</td>
<td>4.5</td>
<td>40</td>
<td>No</td>
<td>No</td>
<td>50</td>
<td>0.14</td>
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<td>120</td>
<td>120</td>
<td>0.3</td>
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<td>8</td>
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<td>10</td>
<td>0.085</td>
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<td>ISL28207</td>
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<td>40</td>
<td>No</td>
<td>No</td>
<td>75</td>
<td>0.1</td>
<td>0.3</td>
<td>115</td>
<td>115</td>
<td>120</td>
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<td>0.32</td>
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<td>ISL28217C</td>
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<td>40</td>
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<td>No</td>
<td>100</td>
<td>0.14</td>
<td>1</td>
<td>120</td>
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<td>120</td>
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<td>0.5</td>
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<td>ISL28118</td>
<td>ISL28218</td>
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<td>40</td>
<td>Single Supply</td>
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<td>230</td>
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<td>575</td>
<td>103</td>
<td>109</td>
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<td>3.2</td>
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<td>ISL28208</td>
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<td>40</td>
<td>Single Supply</td>
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<td>250</td>
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<td>43</td>
<td>105</td>
<td>110</td>
<td>117</td>
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<td>ISL28110</td>
<td>ISL28210</td>
<td>9</td>
<td>40</td>
<td>No</td>
<td>No</td>
<td>300</td>
<td>1</td>
<td>0.002</td>
<td>88</td>
<td>102</td>
<td>104</td>
<td>2.9</td>
<td>12.5</td>
<td>23</td>
</tr>
</tbody>
</table>
Low Noise Op Amps

Overview

LOW NOISE PRECISION OP AMPS

It is critical to have an amplifier having very low background noise when the desired signal is weak or absent. Intersil’s High voltage low noise op amps are developed on dielectrically isolated PR40 to offer low noise and improved THD.

KEY SPECIFICATIONS

- Low Frequency Noise (0.1 to 10Hz)
- Wideband Voltage Noise (@ 1kHz)
- Wideband Current Noise (@ 1kHz)
- THD+N (in dB or %)

Low Power Op Amps

Overview

LOW POWER PRECISION OP AMPS

Intersil offers wide range of low power amplifiers from lowest ‘nano-power’ to ‘high performance’ amplifiers depending on the application need.

KEY SPECIFICATIONS

- Quiescent or Supply Current (I_s)
- Enable / Disable (Turn off amplifier to save power)
- Low Operating Voltages

---

### TYPICAL APPLICATIONS

**NANO-POWER**

- Ultra-Low Single Supply Operation
- Supports a 2-cell alkaline input
- Low Offset Voltage V_{os} = 2mV (Max)

---

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Supply Voltage (V)</th>
<th>Rail-To-Rail</th>
<th>Vos Max @ 25°C</th>
<th>TCVos</th>
<th>I_b Max @ 25°C</th>
<th>CMRR min @ 25°C</th>
<th>PSRR min @ 25°C</th>
<th>Av min @ 25°C</th>
<th>Is Max @ 25°C</th>
<th>GBW</th>
<th>Slew Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISL28190</td>
<td>3.5 to 5.5 V</td>
<td>Single Supply</td>
<td>700 ± 100 mV</td>
<td>1.9</td>
<td>16,000 nA</td>
<td>78 ± 7 µV</td>
<td>74 ± 7 µV</td>
<td>94 ± 1 nA</td>
<td>11 ± 170 mA</td>
<td>50</td>
<td>2.1 kΩ</td>
</tr>
<tr>
<td>ISL28191</td>
<td>3.5 to 5.5 V</td>
<td>Single Supply</td>
<td>630 ± 100 mV</td>
<td>3.1</td>
<td>6,000 nA</td>
<td>78 ± 7 µV</td>
<td>74 ± 7 µV</td>
<td>99 ± 1 nA</td>
<td>10 ± 170 mA</td>
<td>50</td>
<td>2.1 kΩ</td>
</tr>
<tr>
<td>ISL28127</td>
<td>4.5 to 5.5 V</td>
<td>Single Supply</td>
<td>230 ± 100 mV</td>
<td>0.3</td>
<td>575 nA</td>
<td>103 ± 10 µV</td>
<td>109 ± 10 µV</td>
<td>120 ± 2.8 nA</td>
<td>10 ± 170 mA</td>
<td>50</td>
<td>2.1 kΩ</td>
</tr>
<tr>
<td>ISL28118</td>
<td>4.5 to 5.5 V</td>
<td>Single Supply</td>
<td>300 ± 100 mV</td>
<td>1.0</td>
<td>115 nA</td>
<td>115 ± 10 µV</td>
<td>115 ± 10 µV</td>
<td>120 ± 2.8 nA</td>
<td>10 ± 170 mA</td>
<td>50</td>
<td>2.1 kΩ</td>
</tr>
<tr>
<td>ISL28117</td>
<td>4.5 to 5.5 V</td>
<td>Single Supply</td>
<td>50 ± 100 mV</td>
<td>0.14</td>
<td>120 nA</td>
<td>120 ± 10 µV</td>
<td>120 ± 10 µV</td>
<td>120 ± 2.8 nA</td>
<td>10 ± 170 mA</td>
<td>50</td>
<td>2.1 kΩ</td>
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<tr>
<td>ISL28107</td>
<td>4.5 to 5.5 V</td>
<td>Single Supply</td>
<td>75 ± 100 mV</td>
<td>0.14</td>
<td>120 nA</td>
<td>120 ± 10 µV</td>
<td>120 ± 10 µV</td>
<td>120 ± 2.8 nA</td>
<td>10 ± 170 mA</td>
<td>50</td>
<td>2.1 kΩ</td>
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<tr>
<td>EL176</td>
<td>2.4 to 5.5 V</td>
<td>Low Power</td>
<td>1.02 ± 100 mV</td>
<td>0.12</td>
<td>1.2 nA</td>
<td>80 ± 10 µV</td>
<td>90 ± 10 µV</td>
<td>106 ± 4.7 nA</td>
<td>47 ± 106 mA</td>
<td>75</td>
<td>0.4 µs/µs</td>
</tr>
</tbody>
</table>

---

* Some specifications will differ, please check data sheet for actual parameters and/or conditions.
PRECISION LOW INPUT BIAS CURRENT OPERATIONAL AMPLIFIER

In ideal amplifier, there should be no current flow into the input terminals of an op amp. In general, there are always two input bias currents, $I_{B+}$ and $I_{B-}$.

- $I_{B}$ can vary from few fA to many μA, depending on the input device.
- Some input structures have well-matched $I_{B}$.
- FET op amp's $I_{B}$ doubles with every 10°C rise in temperature.
- Some structures have $I_{B}$ which may flow in either direction.
- Usually CMOS/JFET amplifiers.
- Intersil's new JFET amplifier (ISL28210) employs bias cancelling structure to offer low bias current over temperatures.
- Low $I_{B}$ amplifiers are ideal for photodiode, high impedance type applications.

LOW INPUT BIAS CURRENT AMPLIFIERS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Supply Voltage (V)</th>
<th>Rail-To-Rail</th>
<th>Vos Max @ 25°C</th>
<th>TC/Vos Typ</th>
<th>Ib Max @ 25°C</th>
<th>CMRR min @ 25°C</th>
<th>PSRR min @ 25°C</th>
<th>Is Max @ 25°C</th>
<th>GBW</th>
<th>Slew Rate</th>
<th>Noise 0.1 to 10Hz</th>
<th>Voltage Noise @ 1kHz</th>
<th>Itextarea</th>
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<tr>
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<td>50µA</td>
<td>2.4</td>
<td>0.3</td>
<td>0.3</td>
<td>2</td>
<td>75</td>
<td>80</td>
<td>1.1</td>
<td>4.5</td>
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<td>ISL28113*</td>
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<td>0.03</td>
<td>0.03</td>
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<td>1.1</td>
<td>4.5</td>
<td>2</td>
<td>4</td>
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<td>1.6</td>
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<td>50µA</td>
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<td>2</td>
<td>75</td>
<td>80</td>
<td>1.1</td>
<td>4.5</td>
<td>2</td>
<td>3</td>
<td>1</td>
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<td>0.03</td>
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<td>80</td>
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<td>4.5</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1.6</td>
<td></td>
</tr>
</tbody>
</table>

* Some specifications will differ, please check data sheet for actual parameters and/or conditions

KEY FEATURES

- 50µA Supply Current
- Supply Independent of Input
  - 2.7V to 28V Supply
  - 0V to 28V $V_{CM}$
- Max. 250µV Input $V_{OS}$
- Gain Accuracy Max:
  - 0.5% 25°C
  - 1% -40°C to +125°C
- Four Gain Options
  - 20V, 50V, 100V, & ADJ
  - -40°C to +125°C Operation

APPLICATIONS

- Low ohmic shunt sense
- Battery management
- mV/µV-meters
- High-precision voltage and current measurement
- Power management in communications, networking, industrial
- Test/DAQ (data acquisition) systems
- Computing and display power management
- Alternative energy (wind, power, solar)

28V MICRO-POWER, PRECISION HIGH SIDE AND LOW SIDE CURRENT SENSE AMPLIFIERS

Intersil's ISL28006 and ISL28005 families of integrated current shunt sense amplifiers with integrated gain options and adjustable gain for precision and low cost.

TYPICAL APPLICATION

ISL28210 is ideal for Flow Sensors and other high impedance applications.

CURRENT SENSE AMPLIFIERS

- ISL28005
- ISL28006

Only 50µA Current Consumption.

PRECISION CURRENT SENSE AMPLIFIER

1% Gain Accuracy Max -40°C to +125°C

Gain Resistor Option for Adjustable Gain (ISL28006 only)
Quad, Rail-Rail

ISL28470

WORLD’S FIRST QUAD INSTRUMENTATION AMPLIFIER

This one-of-a-kind quad device features the industry’s lowest offset voltage at 150µV (max), best CMRR (common mode rejection ratio) at 110dB, and rail-to-rail input and output capability. For applications that don’t benefit from quad functionality, this new family of rail-to-rail instrumentation amplifiers also includes single and dual versions that feature exceptional signal to dynamic range and voltage offset performance.

LOW POWER INSTRUMENTATION AMPLIFIERS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Ios (max) (µA/Amp)</th>
<th>Gain Error (%)</th>
<th>Vos @ 1kHz (nV/Hz)</th>
<th>Vos (max) (µV)</th>
<th>CMRR (dB)</th>
<th>Ios (max) (nA)</th>
<th>Min. Gain (V/V)</th>
<th>-3dB BW (kHz)</th>
<th>Package</th>
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<tbody>
<tr>
<td>EL8170</td>
<td>Single Rail-Rail 2.9V-5V In-Amp, G=100+</td>
<td>95</td>
<td>0.3</td>
<td>58</td>
<td>200</td>
<td>114</td>
<td>3</td>
<td>100</td>
<td>192</td>
<td>8 Ld SOIC</td>
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<tr>
<td>ISL28270</td>
<td>Dual Rail-Rail 2.4V-5V In-Amp, G=100+</td>
<td>78</td>
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<td>60</td>
<td>150</td>
<td>110</td>
<td>2</td>
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<td>150</td>
<td>110</td>
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<td>80</td>
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* Ios for all channels on
# Precision Voltage References

## Quick Selection

### Ultra Precision Voltage References
- **ISL21009**
  - 3ppm/°C
  - 4.5µVpp noise
  - 5V - 16V input
- **ISL21007**
- **ISL21060**
  - Low power
  - Low noise
- **ISL21090**

### Ultra Low Power Voltage References
- **ISL60002**
  - 700mA max
- **X60003**
- **ISL21032**
  - 0.6V output
- **ISL21060**
  - Stable for cap load drive

### Precision VREF with Kelvin Sense
- **ISL21060**
- **ISL21080**
- **ISL21070**

### Low Cost Voltage References
- **ISL21060**
- **ISL60002** D-grade
- **ISL21400**
  - Active temperature compensation
- **ISL60250**
  - Output voltages 0V to 1.25V

### Adjustable/Programmable Voltage References
- **ISL21060**
- **ISL21090**
- **ISL60002** D-grade
- **ISL21070**
  - **ISL21080**
- **ISL21090**

## Precision Voltage References

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**Check Data Sheet Conditions**
- ○ = available now
- ● = Sampling, call for more information

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Using an N-JFET and a Nano-power voltage reference, ISL60002, a precision, low cost, high impedance current source can be created. The precision of the current source is dependent on the tempco accuracy of the reference.

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