Target Applications

Application example: ADAS (Advanced Driver Assistance System)

Range of ROHM’s Analog ICs for Power Management

Application example: Inverter
POWER MANAGEMENT ICs

Based on long term experience with Discrete Power Devices, ROHM Semiconductor offers a broad lineup of integrated Power Management ICs for various applications. This includes a broad lineup of DC/DC Converters & LDOs as well as fully integrated PMICs. All new products are especially focusing on low Iq for Green Energy and high reliability applications for the Industrial Market.

PMICs for dedicated MCU platform

Developed in close cooperation with partners like Intel, Renesas and NXP – ROHM’s Power Management ICs offer complete solutions for embedded MCU platforms.

Providing Solutions for SoC

<table>
<thead>
<tr>
<th>Highlight: Ultra Low Iq Current LDO Regulators – BD7xxLx-C Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ultra-low quiescent current: 6μA (Typ.)</td>
</tr>
<tr>
<td>• Output transistor: Low saturation Pch DMOS (3Ω Typ.)</td>
</tr>
<tr>
<td>• VCC maximum voltage: 50V</td>
</tr>
<tr>
<td>• Output current: 200mA (Max.) / 500mA (Max.)</td>
</tr>
<tr>
<td>• Output voltage: 3.3V±2% / 5.0V±2%</td>
</tr>
<tr>
<td>• Enables low ESR ceramic capacitors</td>
</tr>
<tr>
<td>• Integrated output current control circuit</td>
</tr>
<tr>
<td>• Built-in thermal shutdown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Features: Ultra small 1x1mm LDOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Offering several series of CMOS LDOs in ultra small 1x1mm package</td>
</tr>
<tr>
<td>• High Ripple Rejection</td>
</tr>
<tr>
<td>• Low Current Consumption</td>
</tr>
</tbody>
</table>

| Lineup: |
| BUXXTH5WNVX Series: 500mA; Vin: 1.7V to 6.0V; Output: 1.05V to 3.5V (4types) |
| BUxxTD2WNVX Series: 200mA; Vin: 1.7V to 6.0V; Output: 1.00V to 3.4V (27types) |
| BUxxUA3WNVX Series: 300mA; Vin: 1.7V to 5.5V; Output: 1.00V to 3.7V (31types) |
ROHM Semiconductor offers a large selection of specialized DC/DC-Converters and LDOs for Automotive.

**Automotive Grade Buck Converters**

- **Direct conversion from 48V to 3.3V or 5V (at 2MHz)**
- **State-of-the-art 9ns minimum ON-time control**
- **Enables 1-stage buck configuration even with large step-down ratios**

**Specifications:**
- **Input voltage:** 16V to 60V (Absolute Maximum Ratings 70V)
- **Output switch current:** 1A (Max.)

**Features:**
- Direct conversion from 48V to 3.3V or 5V (at 2MHz)
- State-of-the-art 9ns minimum ON-time control
- Enables 1-stage buck configuration even with large step-down ratios

**Current Mode Control Provides Easy Phase Compensation**

- Current mode control ensures easy phase compensation with fewer external components

**Direct Conversion from 48V to 3.3V MCU Power Supply**

**Mounting Area Reduction by 2MHz Operation**

- 70% reduction

**Inductorsize (Reference) 6mm² → 2.4mm²**

**Highlight:** 2MHz Nano Pulse Control Synchronous Buck Converter BD9V100MUF-C

**State-of-the-art 9ns Minimum ON-time Control**

- 1/10th the ON time of our conventional products – the smallest in the world

**Features:**
- Direct conversion from 48V to 3.3V or 5V (at 2MHz)
- State-of-the-art 9ns minimum ON-time control
- Enables 1-stage buck configuration even with large step-down ratios

**Specifications:**
- Input voltage: 16V to 60V (Absolute Maximum Ratings 70V)
- Output switch current: 1A (Max.)
Industrial Linear Regulators for Industrial

### Output

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>0.1-0.15</th>
<th>0.2</th>
<th>0.3</th>
<th>0.5-0.55</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>3.0</th>
<th>4.0</th>
<th>EXTERNAL MOSFET</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>3.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>24</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>60</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Input

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>3.3</th>
<th>5.0</th>
<th>12</th>
<th>24</th>
<th>48</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input*</td>
<td>45-50</td>
<td>30-36</td>
<td>18</td>
<td>15</td>
<td>10</td>
<td>6.0-7.0</td>
</tr>
</tbody>
</table>

**High Voltage for automotive and industrial**

### Highlight: High Voltage 100mA LDO Regulators

- High output voltage accuracy: ±1%
- Supports compact 1µF ceramic capacitors
- Overcurrent protection, thermal shutdown circuits
- High withstand voltage: 30V
- Soft Start
- Output current: 100mA
- Pin compatible with 78L series from other suppliers

### Line-up

<table>
<thead>
<tr>
<th>Part No.</th>
<th>BD90</th>
<th>BD93</th>
<th>BD96</th>
<th>BD54</th>
<th>BD50</th>
<th>BD99</th>
<th>BD98</th>
<th>BD96</th>
<th>BD95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage (V)</td>
<td>3.3</td>
<td>3.3</td>
<td>5</td>
<td>5.4</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

### Standard and Industrial Grade Buck Converters

**BD9x Series: Pin Compatible Standard Buck Converter Series**

ROHM's single output buck DC/DC converters provide a power supply solution that satisfies your specification requirements based on a matrix of input voltage and output current. In the product name of BD9x Family, the numeric value “9” following “BD” represents the “buck” topology, the subsequent alphabet represents the maximum rated input voltage and the subsequent numeric value represents the output current.

#### Part No. Description

<table>
<thead>
<tr>
<th>Topology</th>
<th>Serial No.</th>
<th>Output Current</th>
<th>Maximum Rated Input Voltage and Control Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Buck</td>
<td>B: Boost, Buck, Boost-Boosting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>±0.1%</td>
<td>±0.3%</td>
<td>±0.6%</td>
<td>±1.0%</td>
</tr>
</tbody>
</table>

#### Highlight: Ultra Small Low Ringing Switching Regulator

The BD9A302QWZ, BD9B304QWZ, BD9D322QWZ, and BD9D323QWZ adopt ultra small packages, reducing the surface mount as well as the parasitic inductance existing inside the circuit. In addition, the ringing in the switching waveform and unwanted radiation are reduced by decreasing the trace area of a loop that has a large variation in the switching current on the PCB.

#### Product example: BD9D322QWZ

- **Input voltage range:** 4.5 to 18 V
- **Output voltage range:** 0.765 to 7.0 V
- **Reference-voltage:** 0.765V±1.6%
- **Output current:** 3A
- **Switching frequency:** 700kHz
- **Integrated switch FET:** 80mΩ, 50mΩ
- **Current consumption:** 0.7mA

#### Ultra Small Package UMMP008Z2020

- Output 3A
- Large current per area
- 2.0×2.0mm² = 4.0mm²

---

**Highlight:** High Voltage 100mA LDO Regulators

Small surface mount package

Pd=1.67W with built-in heat sink (ROHM standard mounting board)

SOT89-3K (4.5×4.095×1.6mm)

---

**Highlights:**

- High output voltage accuracy: ±1%
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- Soft Start
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<th>Output Current</th>
<th>Maximum Rated Input Voltage and Control Mode</th>
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<tr>
<td>A: Buck</td>
<td>B: Boost, Buck, Boost-Boosting</td>
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<td>±0.1%</td>
<td>±0.3%</td>
<td>±0.6%</td>
<td>±1.0%</td>
</tr>
</tbody>
</table>

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**Highlight:** High Voltage 100mA LDO Regulators

Small surface mount package

Pd=1.67W with built-in heat sink (ROHM standard mounting board)

SOT89-3K (4.5×4.095×1.6mm)
**ISOLATED REGULATORS**

ROHM Semiconductor offers a wide line-up of DC/DC controllers for high voltage and high current applications, featuring various protection features and isolated topologies.

**Highlight:** BD7Fx00EFJ-LB feedback less, isolated flyback DC/DC controller

**Key Features:**
- High-speed load response via adaptive on-time control
- Automatic “light load mode” ensures high efficiency across all load conditions
- Eliminates the need for parts that cross the isolation boundary, improving functional safety
- Output voltage adjustable with external resistor and transformer winding ratio
- Evaluation Boards available
- Small and compact solution

<table>
<thead>
<tr>
<th>Type</th>
<th>BD7F100EFJ-LB</th>
<th>BD7F200EFJ-LB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Max. Rating</td>
<td>45V</td>
<td>45V</td>
</tr>
<tr>
<td>Operating Supply Range</td>
<td>3-40V</td>
<td>3-40V</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>400kHztyp</td>
<td>400kHztyp</td>
</tr>
<tr>
<td>Current-Limit (MOSFET)</td>
<td>1.25Atyp</td>
<td>2.75Atyp</td>
</tr>
</tbody>
</table>

**AC/DC CONVERTER & CONTROLLER**

ROHM Semiconductor offers a wide line-up of AC/DC Converters for external MOSFET as well as fully integrated converters with internal MOSFETs.

**AC/DC Converter IC Series BM2POxx Series**

Built-in 650V Super Junction MOSFET

ROHM’s proprietary super junction MOSFETs feature class-leading efficiency and miniaturization. ROHM’s broad lineup enables customers to select the ideal solution based on application requirements (i.e. current, protection circuits).

**AC/DC Converter Control ICs for SiC Drive BD7682 Series**

Maximizing the performance of SiC contributes to dramatically improved power savings and miniaturization

ROHM fuses analog design and SiC device technologies to maximize SiC performance and significantly reduce power consumption.

**Features:**
- Internal driver circuit maximizes SiC MOSFET performance
- Low-noise, high efficiency quasi-resonant system supports up to 150W power supplies
- Multiple protection circuits enable high voltage operation

**Achieves greater miniaturization**

Conventional Product vs BM25CO21NT

**MOSFET drive voltage comparison**

Achieves greater miniaturization

Compact package achieved through low heat generation

High-Power Insertion Type

Compact Surface Mount Type

DIP7 6.2x6.2x4.3 mm Ideal for embedded power supplies and adapters

SOP8 6.2x4.5 mm Optimized for compact devices

**New development BD7Jxxx (Samples Q4-18)**

Operating Supply Voltage Range up to 80V
ROHM Semiconductor offers a wide range of high integrated LED and Motor Drivers for Automotive, Industrial, and consumer market.

**Automotive LED Driver**

**Target Applications**
- **Exterior**
  - Dashboard lights, Ambient lighting, Dome and Map lighting, Center stack lighting, and others make up the Automotive interior lighting.
- **Interior**
  - Heads-up display also uses LEDs lights, as shown in the block diagram in Page 13.
  - In interior lighting, the number of channels, control interface, and to some extent the output type (open-drain, constant-current, etc.) is the key.

**Product Map**

- **Automotive LED Driver**
  - **Function**
    - RGB LED Drivers for cluster panels
    - Boost / Buck / Buck-Boost DC/DC
  - **Part No.**
    - BD8378FV-M (8ch)
    - BD8379FV-M (12ch)
    - BD8388FV-M (8ch)
    - BD8389FV-M (12ch)
    - BD2808MUV-M (24ch)

- **Head Lamps / Parking**
  - **Function**
    - Boost / Buck / Buck-Boost DC/DC
  - **Part No.**
    - BD1835EFV-M
    - BD18391EFV-M
    - BD18395EFV-M

- **Cluster Panel / Car Navigation and AV Backlights**
  - **Function**
    - Boost / Buck / Buck-Boost DC/DC
  - **Part No.**
    - BD5465UV-M
    - BD18A44EFV-M
    - BD18A24EFV-M
    - BD18A74EFV-M

- **Matrix LED Controller**
  - **Function**
    - Matrix LED Controller
  - **Part No.**
    - BD18362EFV-M
    - BD183xxEFV-M

- **Rear / Turn Lamps**
  - **Function**
    - Constant Current Driver
  - **Part No.**
    - BD18372HFP-M
    - BD1834HFP-M

**Automotive Motor Driver**

**Target Applications**
- **Exterior**
  - Brushless DC Motor
  - **Function**
    - Three-phase Driver (AEC-Q100 Qualified)
  - **Part No.**
    - BD16805FV-M
    - BD63030EKFV-C

- **Interior**
  - **Function**
    - Constant-current output type
  - **Part No.**
    - BD16905FV-M
    - BD63035EKFV-M

- **Line-up for Brushless DC Motor**
  - **Function**
    - Hall Sensor Drive Three-phase Driver (AEC-Q100 Qualified)
  - **Part No.**
    - BD16805FV-M
    - BD63030EKFV-C

**Rear View Mirror**

**Function**
- **Part No.**
- BD8372HFP-M
- BD1834HFP-M

**Under development**
- BD18346HFN-M

**Note:** The provided content is a summary and may not include all details. For more specific information, please refer to the original document.
**Motor Drivers**

ROHM Semiconductor offers a broad lineup of H-Bridge and stepper motor drivers in a wide range of supply voltages, output currents and channels. Features like VREF-PWM conversion for H-bridge drivers and integrated protection functions grant high reliability operation, making them ideal for a wide range of applications.

### MOSFET Integrated H-Bridge Driver Lineup

Compatible – Easy to Use – High Reliability

**Highlight:** EVK based on Arduino Platform

- Supports 1 stepper motor (or 2 DC motors)
- Designed to be stackable (max. 2 shields are supported)
- Package: HTSSOP-B28
- Driver IC: Re-use board for multiple pin-compatible ICs:
  - BD63710AEFV
  - BD63715AEFV
  - BD63720AEFV
  - BD63725AEFV
  - BD63524AEFV
  - BD63843EFV
  - BD63847EFV
  - BD63873EFV
- Motor Voltage: 8 to 28V / 19 to 42V
- Max. Motor Current: 1A / 1.5A / 2A / 2.5A

### Standard H-Bridge Drivers for Brushed DC Motors

<table>
<thead>
<tr>
<th>Type</th>
<th>High Voltage</th>
<th>Mid Voltage</th>
<th>Low Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ch</td>
<td>&gt;36V</td>
<td>-20V (Motor)</td>
<td>-10V (Motor)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-7V</td>
</tr>
<tr>
<td></td>
<td>BD6230F(0.5A)</td>
<td>BD65491FV(1.2A)</td>
<td>BD6736FV(1A)</td>
</tr>
<tr>
<td></td>
<td>BD6211F(1A)</td>
<td>BD65494FV(1.2A)</td>
<td>BD6736M(1A)</td>
</tr>
<tr>
<td></td>
<td>BD6312F(1.7A)</td>
<td>BD65423FV(1A)</td>
<td>BD6735FV(1A)</td>
</tr>
<tr>
<td></td>
<td>BD65496MUV(1A)</td>
<td>BD6736FV(1A)</td>
<td>BD6735FV(1A)</td>
</tr>
<tr>
<td></td>
<td>BD6231FP(1A)</td>
<td>BD65496MUV(1A)</td>
<td>BD6736FV(1A)</td>
</tr>
<tr>
<td></td>
<td>BD6312F(1.7A)</td>
<td>BD65423FV(1A)</td>
<td>BD6735FV(1A)</td>
</tr>
</tbody>
</table>

New devices marked in red

**36V Brush Motor Driver ICs BD62110AEFJ**

**HTSSOP-J8**

(4.9×6.0×1.0mm)
### MOTOR DRIVERS

#### MOSFET integrated Stepper Driver Line-up

Wide Line-up – Easy to Use

![Stepper Driver ICs for Bipolar Stepper Motors](image)

<table>
<thead>
<tr>
<th>Type</th>
<th>High Voltage</th>
<th>Standard Type</th>
<th>Standard Type</th>
<th>Low Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARA-IN</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>BDD6422EFSV(1A)</td>
<td>BDD6906EFSV(0.8A)</td>
<td>BDD6906EFSV(1.2A)</td>
<td>BDD6306EFSV(1.0A)</td>
</tr>
<tr>
<td>CLK-IN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BDD63510EFSV(1.0A)</td>
<td>BDD6310EFSV(0.8A)</td>
<td>BDD6310EFSV(0.8A)</td>
<td>BDD6306EFSV(1.0A)</td>
</tr>
<tr>
<td></td>
<td>BDD63520EFSV(2.0A)</td>
<td>BDD6370EFSV(2.0A)</td>
<td>BDD6370EFSV(0.8A)</td>
<td>BDD6306EFSV(1.0A)</td>
</tr>
<tr>
<td>CLK/ PARA-IN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BDD63730EFSV(2.0A)</td>
<td>BDD6380EFSV(2.0A)</td>
<td>BDD6380EFSV(2.0A)</td>
<td>BDD6306EFSV(1.0A)</td>
</tr>
<tr>
<td></td>
<td>BDD6390EFSV(1.0A)</td>
<td>BDD6380EFSV(2.0A)</td>
<td>BDD6380EFSV(2.0A)</td>
<td>BDD6306EFSV(1.0A)</td>
</tr>
<tr>
<td></td>
<td>BDD6390EFSV(1.0A)</td>
<td>BDD6380EFSV(2.0A)</td>
<td>BDD6380EFSV(2.0A)</td>
<td>BDD6306EFSV(1.0A)</td>
</tr>
</tbody>
</table>

**New devices marked in red**

#### BLDC Driver – MOSFET integrated ICs

- **Low Vibration / Silent Drive**
- Sine Wave Drive, Tunable Parameters
- **Low Power Consumption / High efficiency**
- Low stand-by and operating current
- **High Reliability**
- Integrated protection circuits, large voltage/current margins

#### BLDC Driver – MOSFET integrated IPM Modules

ROHM offers a product family of pin compatible High Voltage BLDC Motor Drivers

- This allows the selection of the required Energization, Voltage and Current Rating tailored for the customer’s application
- This can be realized by pairing a Controller IC with a Driver IC or by selecting the Combined Controller + Driver Type

#### BLDC Driver – IGBT integrated IPM Modules

**Key Features:**
- 3-phase DC/AC Inverter
- 600V / 10, 20 and 30A (Max. Current Rating)
- Int. Built-in Bootstrap Diode
- Int. High Side IGBT Gate Driver (HVIC) - SOI Process
- Int. Low Side IGBT Gate Driver (LVIC):
  - Thermal Shutdown (TSD)
  - Fault Signal (LVIC): SCP (Low Side IGBT), TSD, UVLO Fault
The ROHM Semiconductor voltage detector IC series include a wide selection of Reset ICs with high accurate detection of ±1%, low current consumption, small thin packages and wide range of detection voltages. Default SSOP packages are pin- and function-compatible, so they can be used as replacement for existing IC.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Output type</th>
<th>Delay type</th>
<th>Current consumption</th>
<th>Temperature range</th>
<th>Detection voltage accuracy</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD48xxG</td>
<td>Nch Open drain output</td>
<td>–</td>
<td>0.85μA(Typ.)</td>
<td>–40°C to +105°C</td>
<td>±1% (Ta=+25°C)</td>
<td>xx=23 to 60 (2.3V to 6.0V 0.1VStep)</td>
</tr>
<tr>
<td>BD49xxG</td>
<td>CMOS output</td>
<td>Delay</td>
<td>2.70μA(Max.)</td>
<td>–40°C to +105°C</td>
<td>±4% (Ta=+25°C)</td>
<td>xx=23 to 48 (2.3V to 4.8V 0.1VStep)</td>
</tr>
<tr>
<td>BD45xxG</td>
<td>Nch Open drain output</td>
<td>Built-in</td>
<td>0.85μA(Typ.)</td>
<td>–40°C to +105°C</td>
<td>±3% (Ta=+25°C)</td>
<td>xx=23 to 60 (2.3V to 6.0V 0.1VStep)</td>
</tr>
<tr>
<td>BD52xxG</td>
<td>Nch Open drain output</td>
<td>Adjustable</td>
<td>0.27μA(Typ.)</td>
<td>–40°C to +125°C</td>
<td>±3% (Ta=+25°C)</td>
<td>xx=69 to 50 (0.9V to 5.0V 0.1VStep)</td>
</tr>
</tbody>
</table>

Highlight: AEC-Q100 Qualified – SSOP5 (SOT23-5) package

Automotive Voltage Detectors

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Output type</th>
<th>Delay type</th>
<th>Current consumption</th>
<th>Temperature range</th>
<th>Detection voltage accuracy</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML5203</td>
<td>4 - 7</td>
<td>±15mV</td>
<td>NMOS FET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ML5235</td>
<td>4 - 10</td>
<td>±15mV</td>
<td>NMOS FET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ML5235</td>
<td>5 - 13</td>
<td>±15mV</td>
<td>NMOS FET</td>
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<tr>
<td>ML5245</td>
<td>5 - 13</td>
<td>±25mV</td>
<td>NMOS FET</td>
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<tr>
<td>ML5232</td>
<td>14</td>
<td>±20mV</td>
<td>NMOS FET</td>
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</tr>
</tbody>
</table>

Typical Applications

- Stand-alone Type
  - Battery monitoring LSI protects battery pack without microcontroller control. With additional microcontroller, cell voltage measurement and other functions are available.

- Analog Front End Type
  - Battery monitoring LSI protects battery pack and supports functions such as cell voltage measurement, cell balancing and other functions, with controlled by microcontroller.