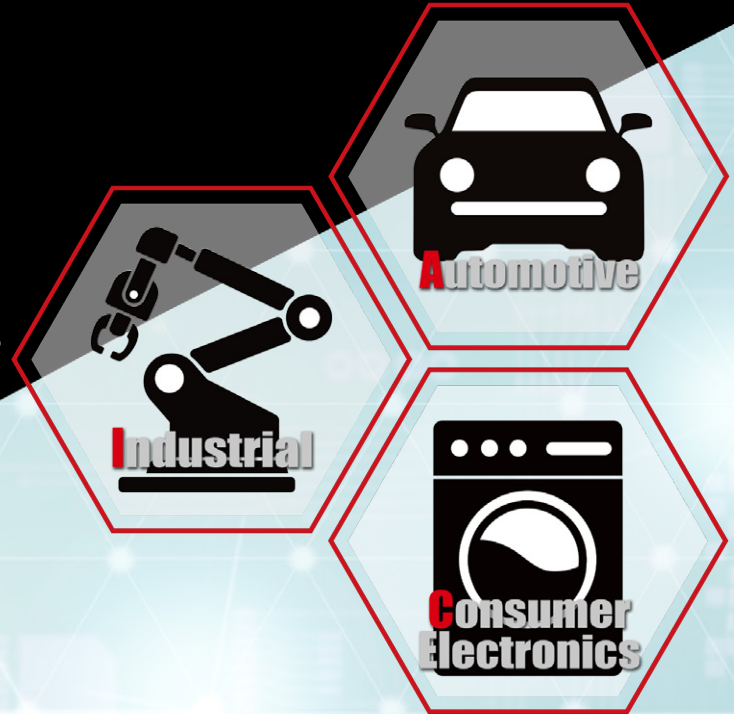


Class-leading adoption track record

# ROHM Si Power Diodes: A Comprehensive Lineup of Performance and Package Options

- Schottky Barrier Diodes
- Fast Recovery Diodes
- Standard Rectifier Diodes
- TVS Diodes
- Zener Diodes



ROHM's Si power diodes have gained widespread adoption for their consistent quality and extensive lineup that allows for optimal product selection tailored to specific application and package needs. Backed by a strong commitment to technology and quality, ROHM's manufacturing system delivers reliable performance across a broad spectrum of applications, including automotive, industrial, and consumer devices.

## Features

- **Broad lineup enables selection of the most suitable products for a wide range of applications**

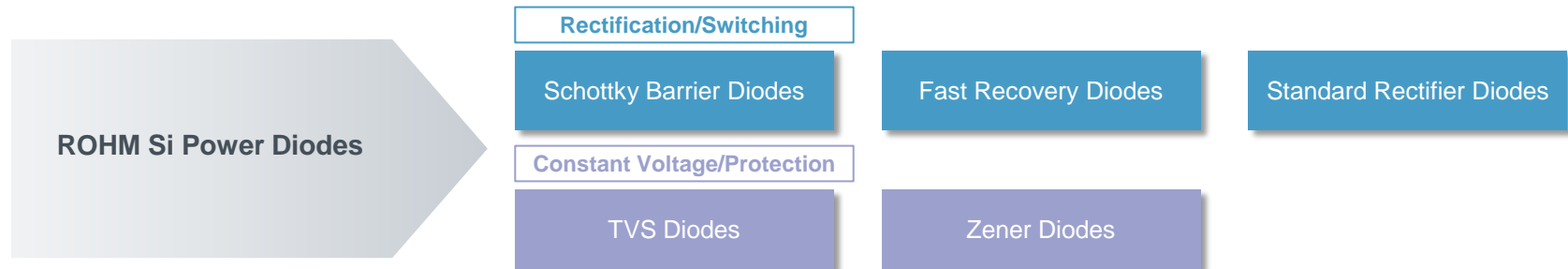
The diverse portfolio includes low  $V_F$  types, low  $I_R$  types, and high-speed  $t_{rr}$  types, along with a wide selection of package options to suit various requirements

- **Ensures worry-free operation with industry-leading market share and ongoing series expansion**

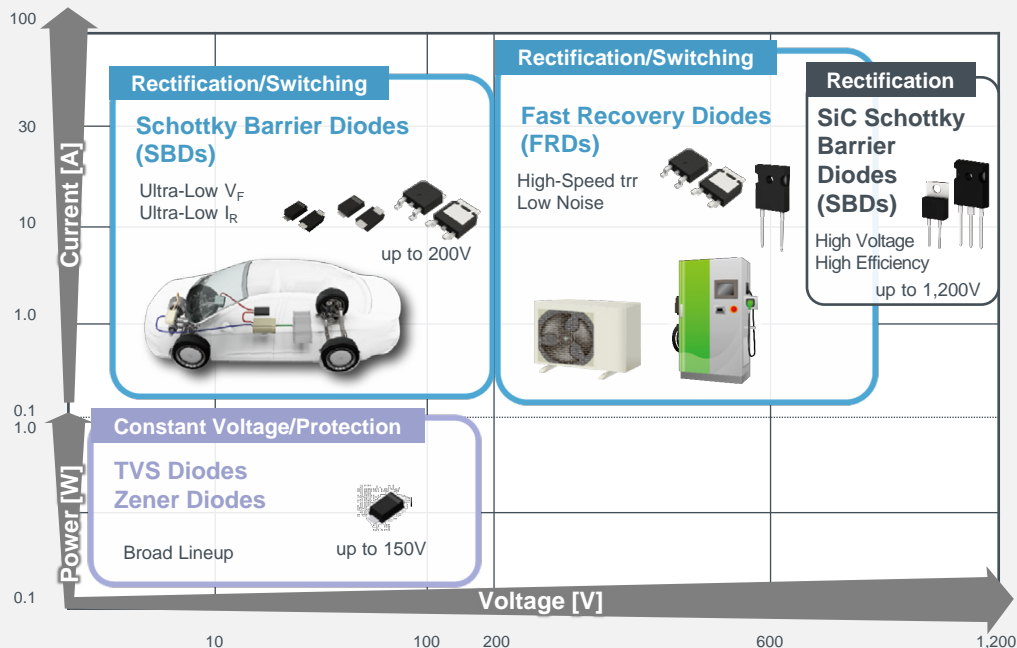
ROHM maintains a market-leading share by leveraging a development system that integrates advanced technologies and a production system focused on quality

- **Stable production is secured through a BCM system designed for flexible response to unforeseen events**

Utilizing also external manufacturing sources effectively hedges against various risks



## Power Diode Product Family (Including SiC Devices)



## ROHM Si Power Diode Features

### Rectification/Switching

#### Schottky Barrier Diodes (SBDs)

- Broad product range, from ultra-low  $V_F$  to ultra-low  $I_R$  types, supports high efficiency, high temperature operation in automotive and industrial equipment
- Expanded package lineup of 100V to 200V models meets the growing demands for higher voltage tolerances and space-saving designs

### Rectification/Switching

#### Fast Recovery Diodes (FRDs)

- A comprehensive lineup that combines high-speed  $t_{rr}$  and low loss with ultra-low noise is ideal for industrial and consumer equipment requiring high power
- The expanding range of high-current automotive-grade products in various package options supports high current applications

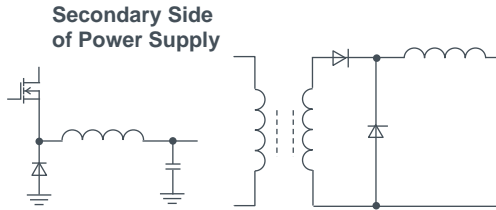
### Constant Voltage/Protection

#### TVS Diodes, Zener Diodes (ZD)

- A wide selection of voltage ratings, including automotive-grade products, ensures suitability for a variety of applications
- The expanded lineup of high power, high voltage products addresses the increasing demand for higher power applications

## Rectification/Switching

- ✓ Utilized in a variety of blocks, especially power supply circuits

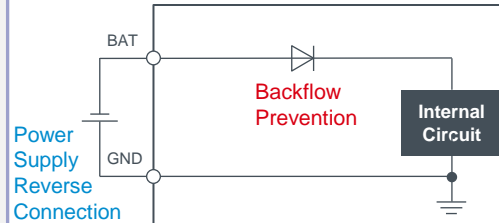


### Key Characteristics

- Low  $V_F$
- Fast  $t_{rr}$

## Reverse Connection Protection

- ✓ Used for reverse connection protection in external power supply lines

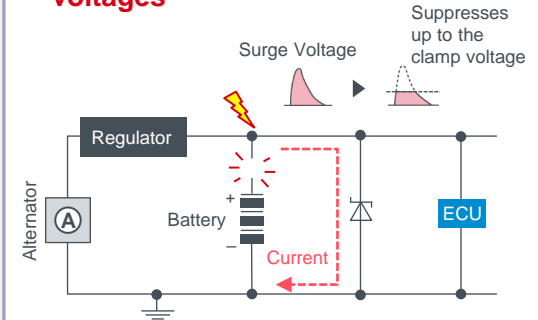


### Key Characteristics

- Low  $V_F$
- Greater miniaturization (low cost)

## Surge Protection







- ✓ Adopted in circuits to protect devices from external surge voltages



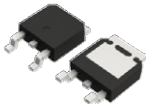
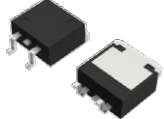






### Key Characteristics

- High rated power
- Excellent robustness (long life)

## Medium Power Packages

			Newly Recommended		Newly Recommended
<p>(PMDE)</p>  <p>2.5mm×1.3mm t=0.95mm</p>	<p>SOD-123FL (PMDU(M))</p>  <p>3.5mm×1.6mm t=0.8mm</p>	<p>SOD-128 (PMDTM) &lt;SMAF&gt;</p>  <p>4.7mm×2.5mm t=0.95mm</p>	<p>DO-214AC (PMDS) &lt;SMA&gt;</p>  <p>5.0mm×2.6mm t=2.0mm</p>	<p>DO-214AA (SMBP) &lt;SMB&gt;</p>  <p>5.34mm×3.62mm t=2.29mm</p>	<p>TO-277A</p>  <p>6.5mm×4.6mm t=1.1mm</p>

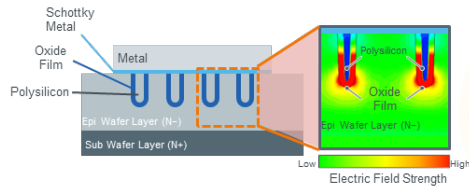
## Power Packages

Surface Mount Type			Through Hole Type				
<p>TO-252AA &lt;DPAK&gt;</p>  <p>10.0mm×6.6mm t=2.2mm</p>	<p>TO-263AB (TO-263S) &lt;D2PAK&gt;</p>  <p>13.1mm×10.1mm t=4.5mm</p>	<p>TO-263AB (TO-263L) &lt;D2PAK&gt;</p>  <p>15.1mm×10.1mm t=4.5mm</p>	<p>TO-220AB (TO-220FN)</p> 	<p>TO-220ACFP</p>  <p>29mm×10mm</p>	<p>TO-220AC</p> 	<p>TO-247-2L</p> 	<p>TO-247-3L</p>  <p>41mm×16mm</p>

**A comprehensive package lineup ranging from thin, compact sizes to high power types supports a wide variety of applications**

# ROHM's Si Power Diode W/W Share and Efforts to Expand Production Scale

## Strengths of ROHM's Si Power Diodes and Global Market Share



Development framework incorporating advanced technologies

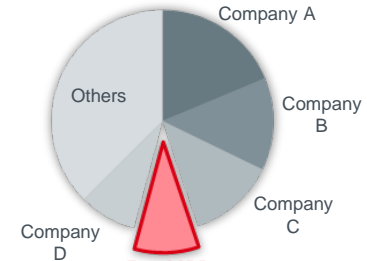
+

Quality-first production system



Quality Division Analysis Center

Global Market Share of Si Power Schottky Barrier Diodes

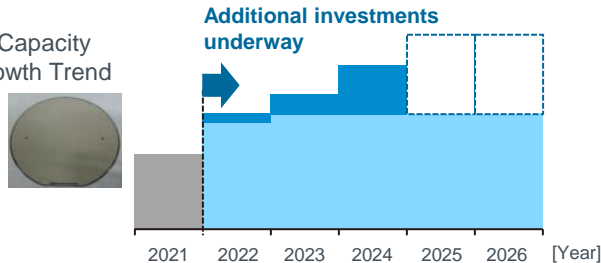


\*ROHM study (as of 2022)

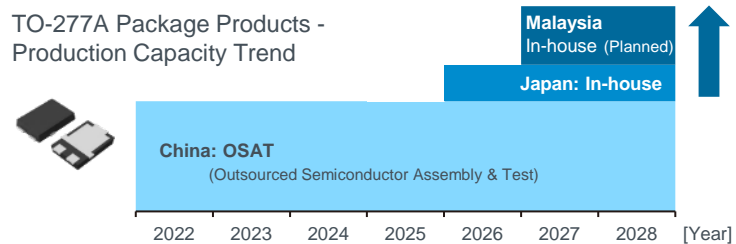
**Leveraging ROHM's manufacturing strengths to secure a top 4 position in the industry**

## Initiatives to Expand Production Capacity

Wafer Production Capacity (Shiga Plant) - Growth Trend

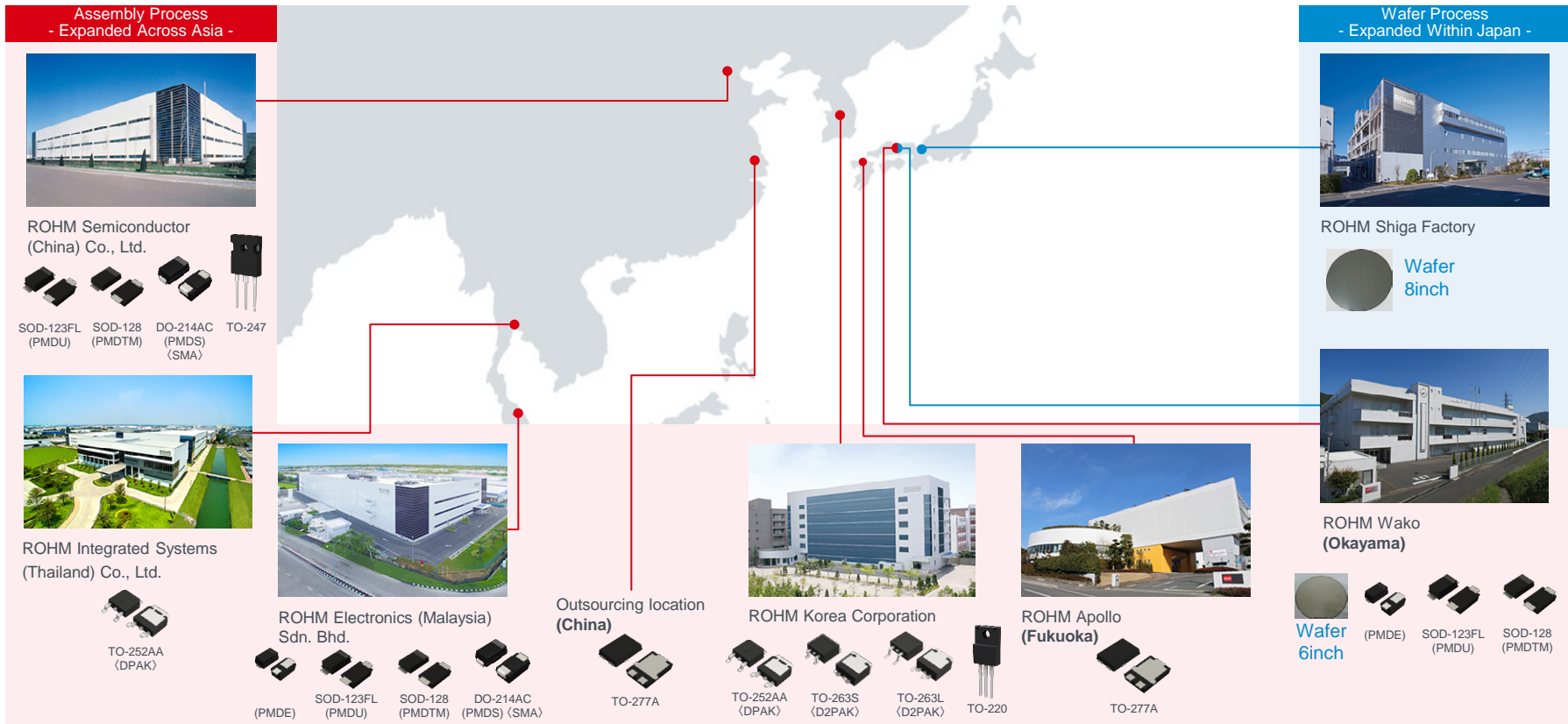


TO-277A Package Products - Production Capacity Trend



**Continuously expanding production scale and supply through strategic capital investment**

# Robust BCM System Ensures Stable Production



**ROHM has established a robust BCM system that incorporates multiple production sites (including external) based on a vertical integration strategy to hedge against various risks**

## Rectification/Switching

### Schottky Barrier Diodes

- ✓ Broad product lineup
- ✓ Product development using cutting-edge technology

**New**

YQ series

▶ P.9

### Fast Recovery Diodes

- ✓ Extensive product lineup
- ✓ Expanding number of high-performance variants

**Under Development**

RFL/RFS series

▶ P.12

### Standard Rectifier Diodes

- ✓ Comprehensive withstand voltage lineup
- ✓ Proven track record in automotive applications

▶ P.15

## Constant Voltage/Protection

### TVS Diodes

- ✓ Wide selection of packages
- ✓ High power, high voltage

▶ P.16

### Zener Diodes

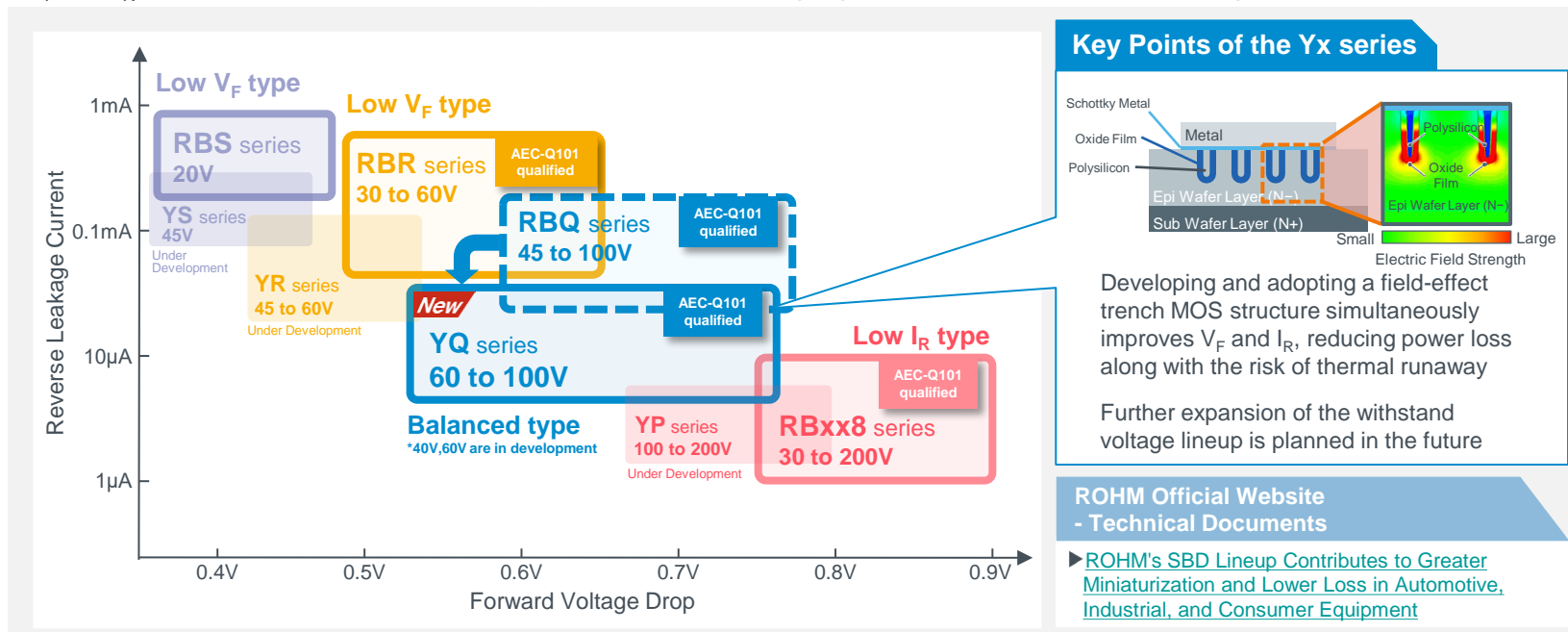
- ✓ Extensive  $V_z$  range

▶ P.17



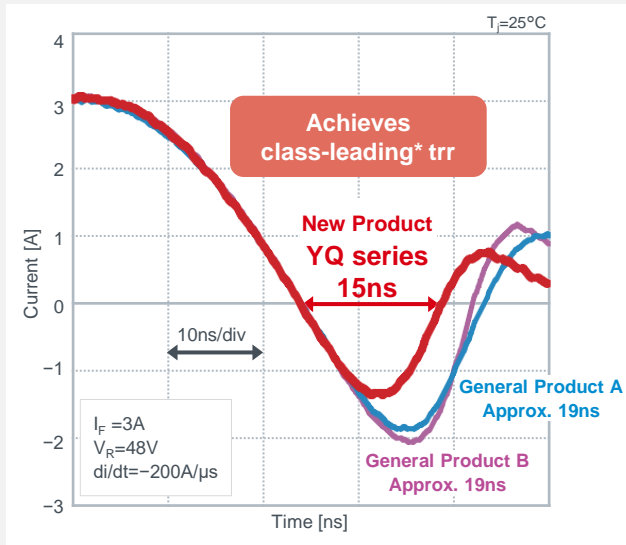
## Features

- **The comprehensive lineup enables optimal product selection across a broad spectrum of applications**  
Five series are available, ranging from low  $V_F$  to low  $I_R$ , with package options ranging from compact to high power, including high-voltage variants
- **ROHM is expanding its lineup of products featuring a proprietary MOS structure (Yx series)**  
 $V_F$  and  $I_R$  characteristics are simultaneously improved, supporting high-efficiency operation even in high-temperature environments

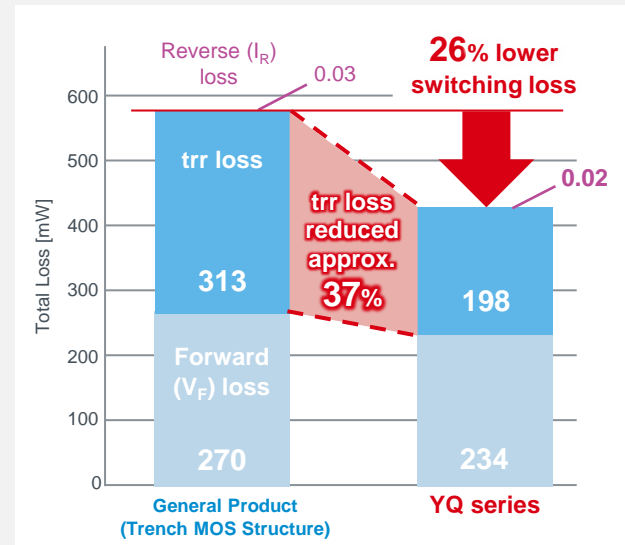


## High-Speed trr Characteristics Minimize Loss

trr Waveforms Under Inductive (L) Load



Switching Loss Comparison  
(Measured on an LED Headlamp Evaluation Board)



**Class-leading\* trr characteristics minimize switching losses, contributing to lower application power consumption**

\*Comparison of trench MOS products: ROHM December 2023 study

# Schottky Barrier Diodes

Rectification/Switching

e.g. **YQ10RSM10SD** **TF** **TL1**  
 Part No. Product Performance Code Packaging Symbol



Low  $V_F$  type

**RBS series**



20V



SOD-123FL  
(3516)



SOD-128  
(4725)

Achieves significantly lower losses in forward-biased circuits. Ideal for rectification applications in mobile devices.

Low  $V_F$  type

**RBR series**



AEC-Q101 qualified

30V/40V/60V



PMDE  
(2513)



SOD-123FL  
(3516)



SOD-128  
(4725)



SMA  
(5026)



SMB  
(5336)



TO-277A



TO-252AA



TO-263S



TO-220FN

Optimized for devices requiring high efficiency with minimal forward loss.

Balanced type

**YQ series**



**RBQ series**



AEC-Q101 qualified

40V/45V/60V/65V/100V



PMDE  
(2513)



SOD-123FL  
(3516)



SOD-128  
(4725)



SMA  
(5026)



TO-277A



TO-252AA



TO-263S



TO-263L



TO-220FN

Delivers a well-balanced combination of  $V_F$  and  $I_R$  characteristics. Suitable for rectification and protection applications in high-temperature environments and high-current systems.

Low  $I_R$  type

**RBxx8 series**



AEC-Q101 qualified

35V/40V/45V/60V/100V/110V/150V/200V



PMDE  
(2513)



SOD-123FL  
(3516)



SOD-128  
(4725)



SMA  
(5026)



SMB  
(5336)



TO-277A



TO-252AA



TO-263S



TO-220FN

Reduces the risk of thermal runaway, making it ideal for rectification applications in high-temperature environments.

\*The SMB and TO-220FN packages are not suitable for automotive applications.



Clicking on the icon links to ROHM's website.

### Features

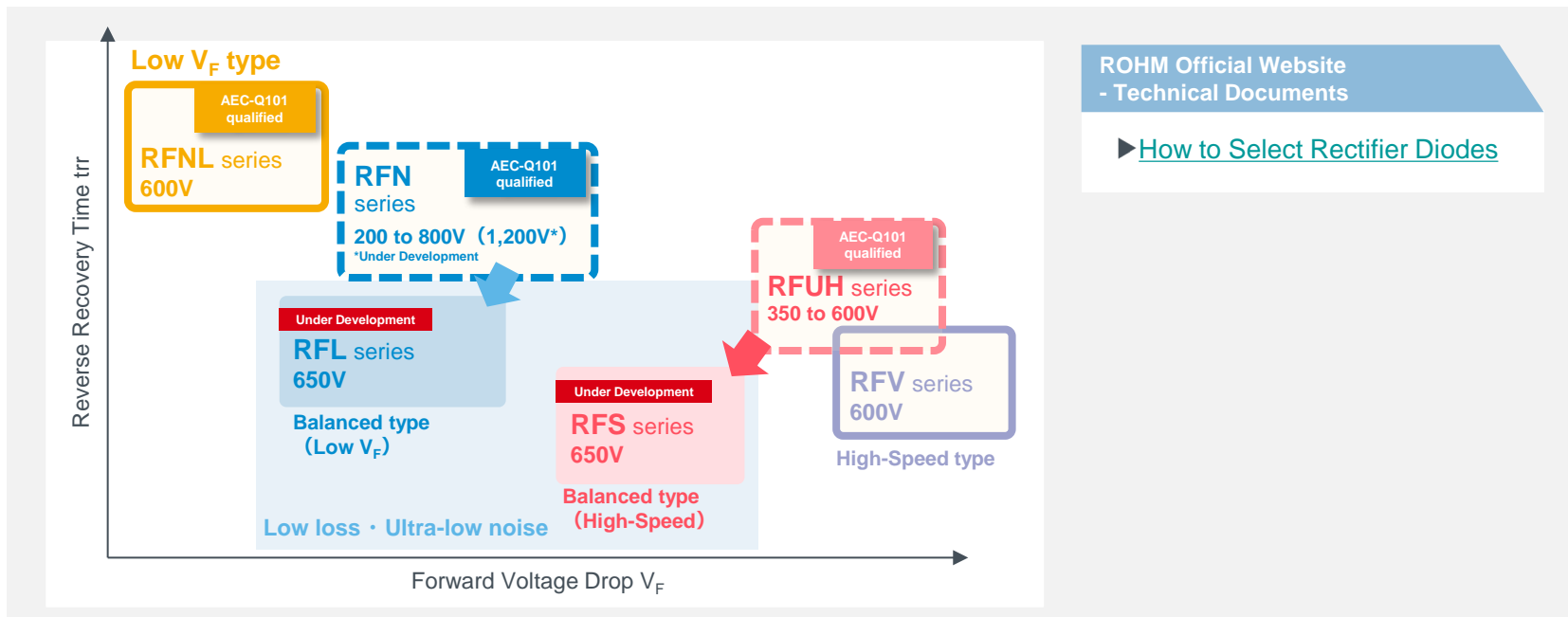
- **A comprehensive lineup enables optimal product selection for a wide range of applications**

Four series are offered, from low  $V_F$  to high-speed trr types, with package options ranging from compact to high power, including high-voltage variants

- **Combines ultra-low noise switching characteristics with high-speed trr performance, reducing the burden of noise design**

(RFL/RFS series Under Development)

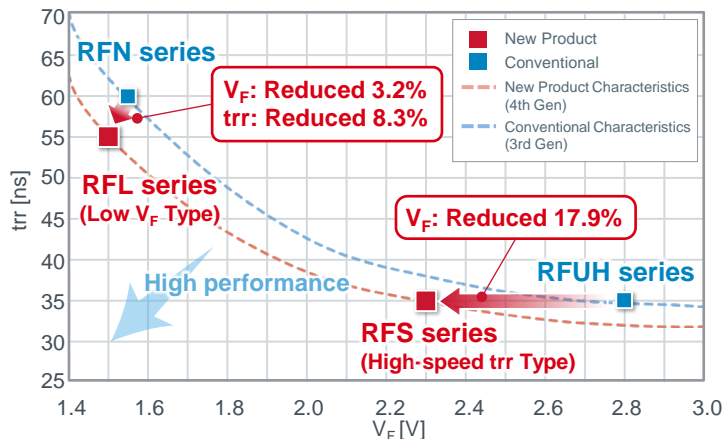
Improving both  $V_F$  and trr characteristics over the conventional series contributes to greater efficiency in end products



ROHM Official Website  
- Technical Documents

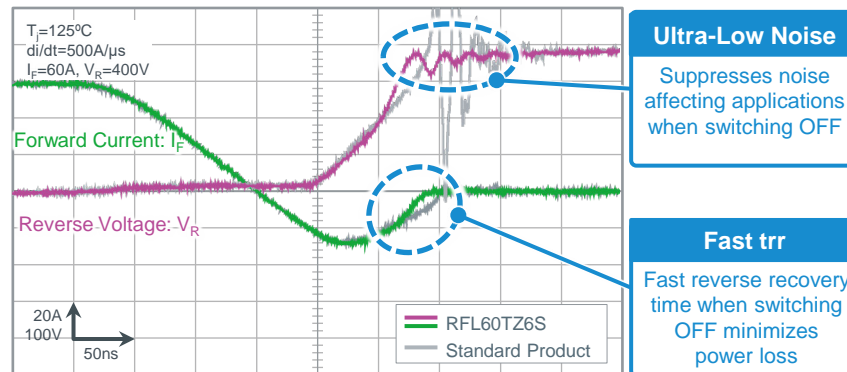
► [How to Select Rectifier Diodes](#)

## $V_F \cdot t_{rr}$ Characteristics Comparison



Improving the  $V_F/t_{rr}$  characteristics of both series based on the power supply configuration contributes to higher overall device efficiency

## Noise Characteristics Comparison



Reduces the burden of noise design by combining ultra-low noise and high-speed  $t_{rr}$  characteristics

# Fast Recovery Diodes

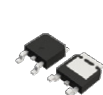
Rectification/Switching



**High-Speed type**  
**RFV series**

Hard recovery ultra-high speed trr type  
 ideal for continuous conduction mode PFC  
 circuits.

600V



TO-252AA



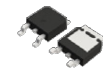
TO-220AC/NFM

**Low  $V_F$  type**  
**RFNL series**

AEC-Q101 qualified

Ultra-low  $V_F$  type enables increased energy  
 savings in equipment, making it suitable for  
 critical conduction mode PFC circuits.

600V



TO-252AA



TO-220AC/NFM

**Balanced type (Low  $V_F$ )**  
**RFL series** Under Development  
**RFN series** AEC-Q101 qualified

Low  $V_F$  type offers low-loss performance  
 paired with ultra-low noise characteristics,  
 enhancing overall power supply efficiency.

200V/350V/400V/600V/650V/700V/800V



PMDE  
(2513)



SOD-123FL  
(3516)



SOD-128  
(4725)



SMA  
(5026)



TO-277A



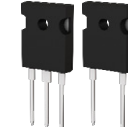
TO-252AA



TO-263S



TO-220NFM

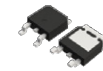


TO-247

**Balanced type (High-Speed)**  
**RFS series** Under Development  
**RFUH series** AEC-Q101 qualified

Fast trr type combines low-loss performance  
 with ultra-low noise characteristics, contributing  
 to improved power supply efficiency.

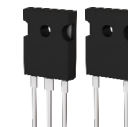
350V/400V/600V/650V



TO-252AA



TO-220NFM



TO-247

Clicking on the icon links to ROHM's website.

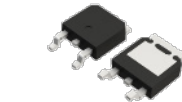
## Features

- **The comprehensive lineup supports optimal product selection across a wide variety of applications**  
A full selection of package is offered, from compact to high power, in an extensive range of withstand voltage options
- **A proven track record in automotive applications ensure reliable, worry-free adoption**  
Our unwavering commitment to a 'Quality First' philosophy allows us to deliver products with stable, dependable performance

### RRxx series

Broad lineup ranging from compact to high-current compatible products

400V/500V/600V/750V/1000V



TO-252GE/TO-252M



TO-220ACFP

ROHM Official Website - Technical Documents

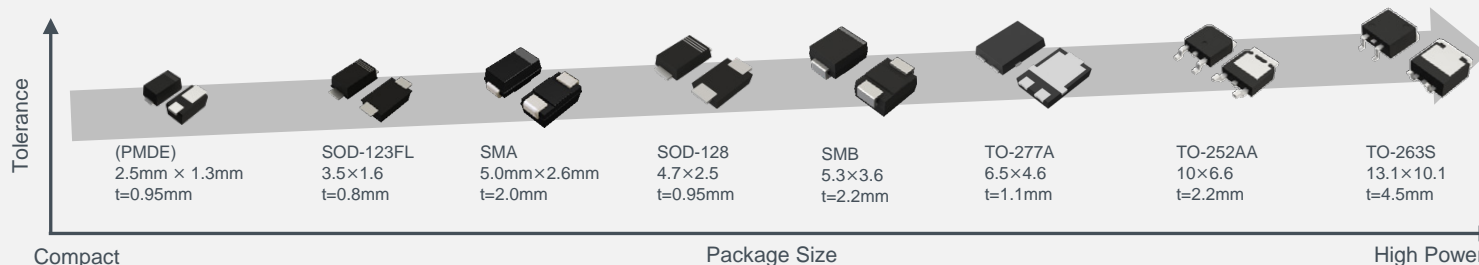
▶ [How to Select Rectifier Diodes](#)

 Clicking on the icon links to ROHM's website.

## Features

- **The extensive lineup enables optimal product selection to meet diverse application needs**  
A wide variety of package are available, from compact to high power, in a broad range of withstand voltages
- **A long track record in automotive applications ensures dependable, worry-free integration**  
Our unwavering commitment to a 'Quality First' philosophy allows us to deliver products with reliable performance

Series	VSxxVUA1VWM VSxxVLNVWM	SMFxx	Under Development	VSxxVUA1LAM	RSDTxxRSM	RSDTxxBM	RSDTxxNS
P <sub>pp</sub> t <sub>p</sub> =10/1000μs	200W	200W	400W	600W	1,500W	2,500W	3,600W
V <sub>RWM</sub>	5 to 130V	5 to 33V	5 to 100V	5 to 30V	22 to 24V	22 to 24V	22 to 24V
Automotive Grade (AEC-Q101)	YES	YES	YES	YES	—	YES	YES



ROHM Official Website - Technical Documents

▶ [Selection Method and Usage of TVS Diodes](#)

▶ [PCB Layout for TVS Diodes](#)

Clicking on the icon links to ROHM's website.





## Automotive Applications

LED Front Lights  
(LED Headlamps) ..... [P.19](#)  
Cluster ..... [P.20](#)

Automotive DC-DC Converters ..... [P.21](#)  
Body Control Modules (BCMs) ..... [P.22](#)  
Battery Management System  
(BMS) ..... [P.23](#)



## Industrial Equipment Applications

Server Boards ..... [P.24](#)  
Photovoltaic (PV) Inverters ..... [P.25](#)  
Base Station Remote Radio Heads  
(RRHs) ..... [P.26](#)

Industrial Inverters  
(Motor) ..... [P.27](#)  
Electric Smart Meters ..... [P.28](#)  
Gas Leak Detectors ..... [P.29](#)



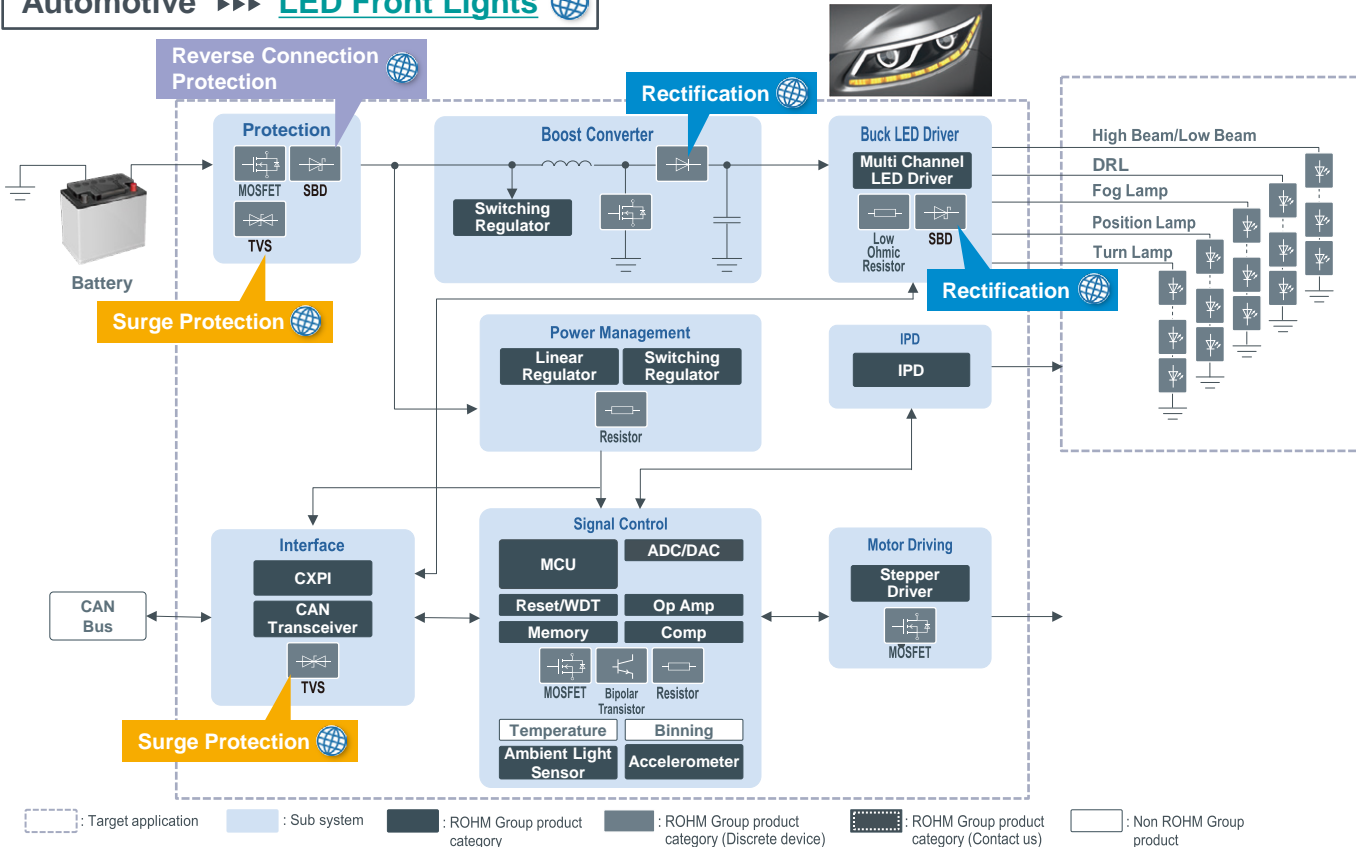
## Consumer Electronics Applications

Air Conditioners ..... [P.30](#)  
Refrigerators ..... [P.31](#)



# Application Block Diagrams (Power Diode Circuits and Recommended Products)

## Automotive >>> LED Front Lights



### Key Points for Narrowing Down Product Selection

#### Rectification

##### Schottky Barrier Diodes

$V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Reverse Connection Protection

##### Schottky Barrier Diodes

$V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

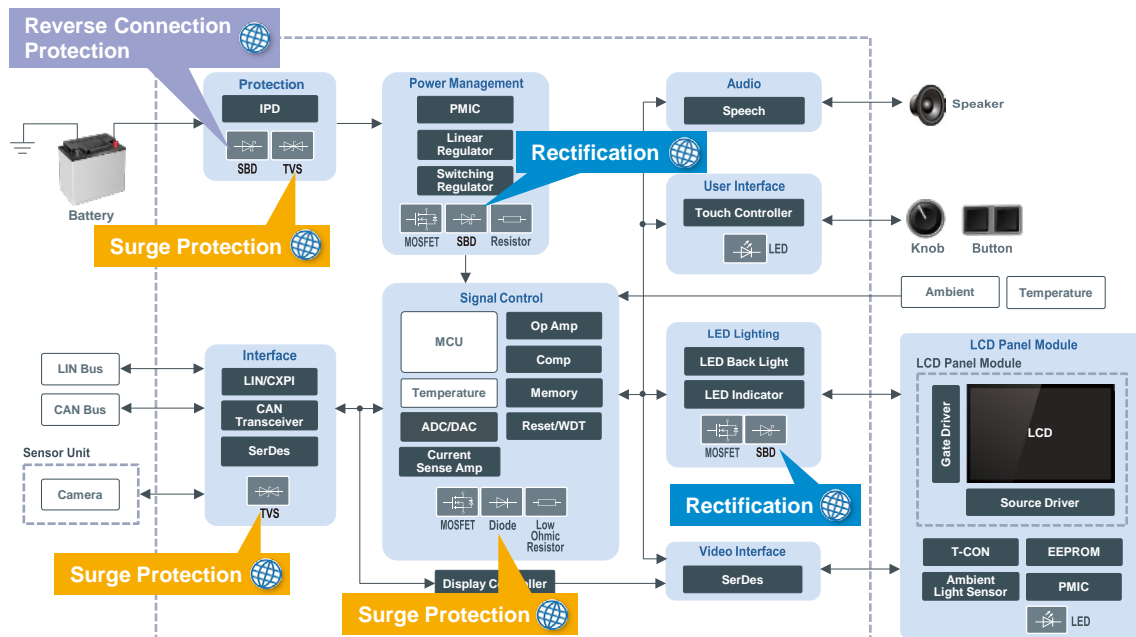
#### Surge Protection

- Protection TVS Diodes High power package

- Interface TVS Diodes Small signal package

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## Automotive >>> Cluster/Center Information Displays (CIDs)



   : Target application  
    : Sub system  
    : ROHM Group product category  
    : ROHM Group product category (Discrete device)  
    : ROHM Group product category (Contact us)  
    : Non ROHM Group product

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### Key Points for Narrowing Down Product Selection

#### Rectification

##### Schottky Barrier Diodes

$V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Reverse Connection Protection

##### Schottky Barrier Diodes

$V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Surge Protection

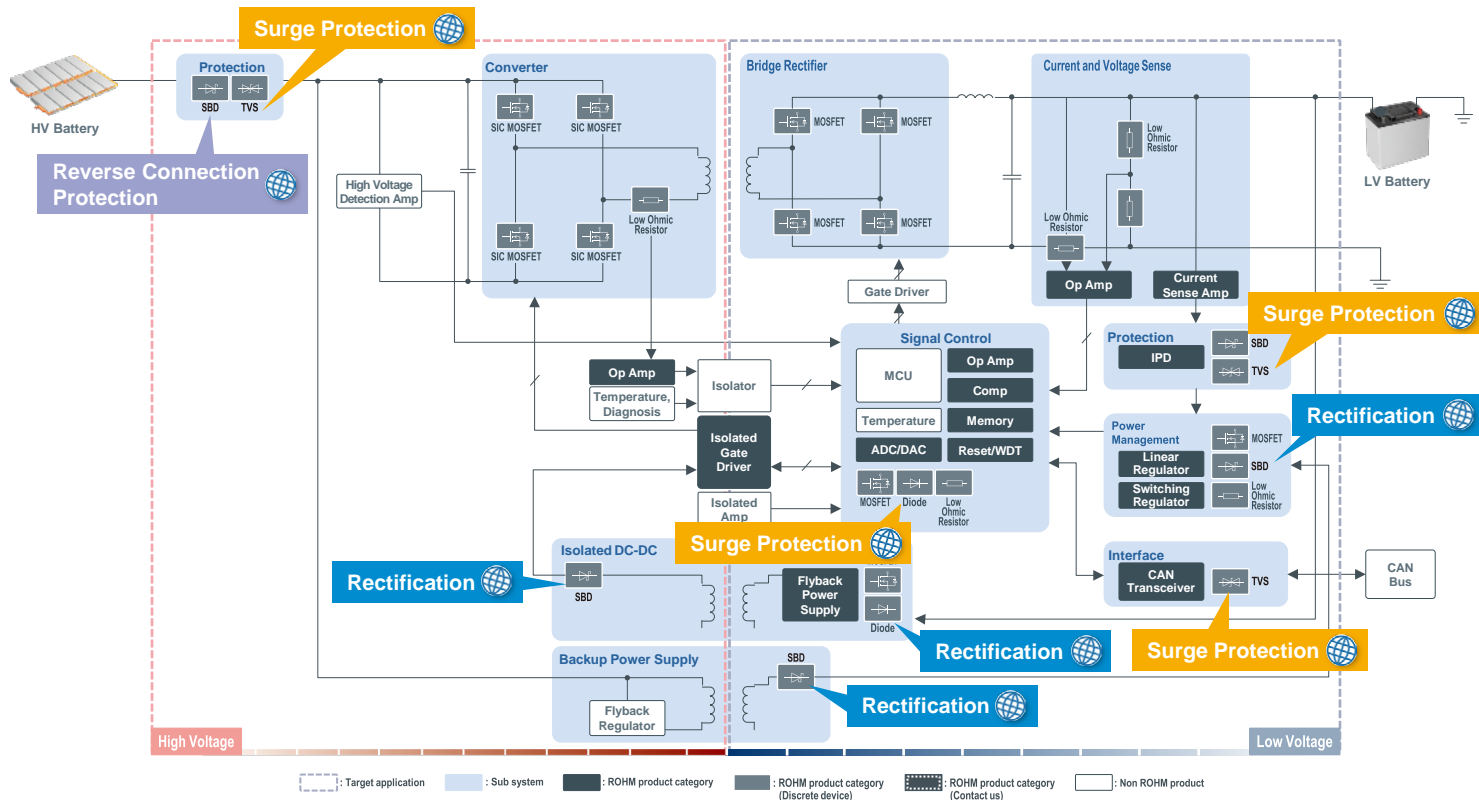
- Protection TVS Diodes  
High power package

- Interface TVS Diodes  
Small signal package

- Signal Control Schottky Barrier Diodes  
30V, 40V  
Ultra-Low  $V_F$

# Application Block Diagrams (Power Diode Circuits and Recommended Products)

## Automotive >>> Automotive DC-DC Converters



### Key Points for Narrowing Down Product Selection

#### Rectification

**Schottky Barrier Diodes**  
 $V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Reverse Connection Protection

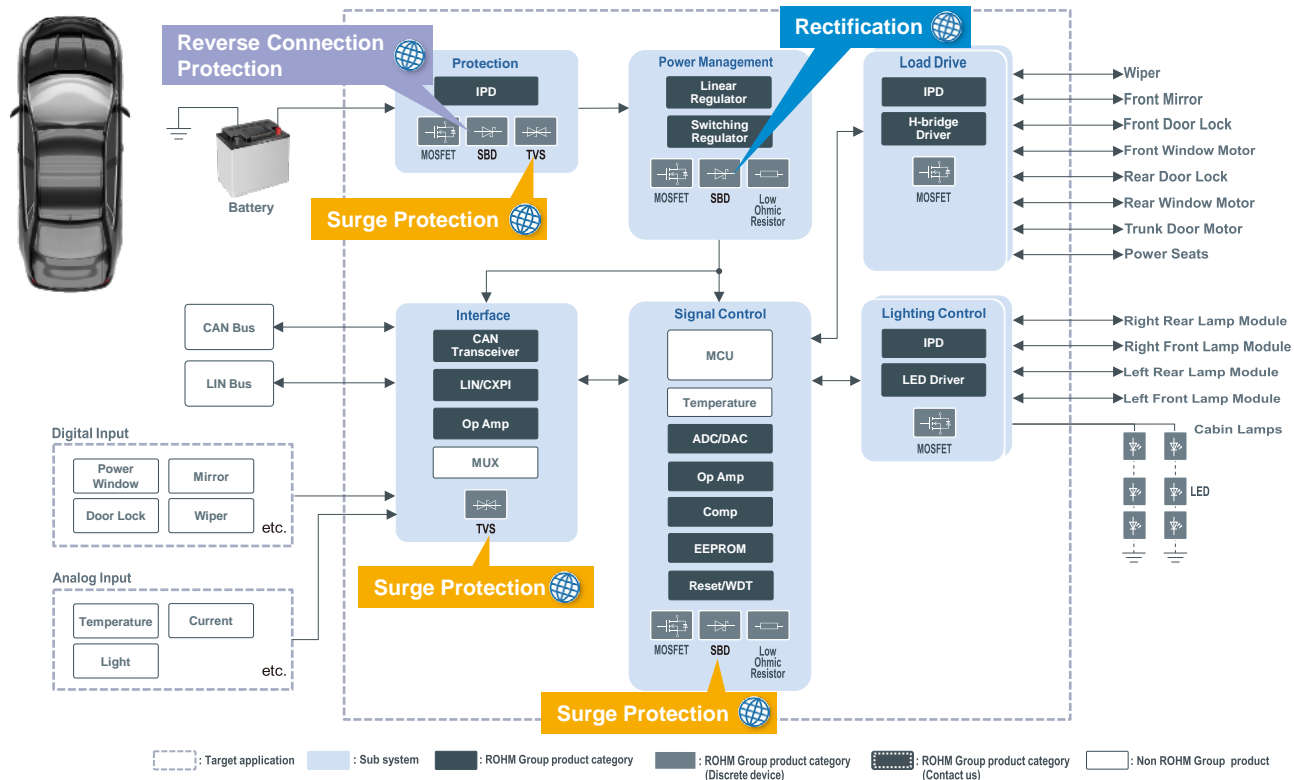
**Schottky Barrier Diodes**  
 $V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Surge Protection

- **Protection**  
TVS Diodes  
High power package
- **Interface**  
TVS Diodes  
Small signal package
- **Signal Control**  
Schottky Barrier Diodes  
30V, 40V  
Ultra-Low  $V_F$

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## Automotive >>> **Body Control Modules (BCMs)**



### Key Points for Narrowing Down Product Selection

#### Rectification

##### Schottky Barrier Diodes

$V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Reverse Connection Protection

##### Schottky Barrier Diodes

$V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Surge Protection

- **Protection**  
 TVS Diodes  
 High power package
- **Interface**  
 TVS Diodes  
 Small signal package
- **Signal Control**  
 Schottky Barrier Diodes  
 30V, 40V  
 Ultra-Low  $V_F$

Clicking on the icon links to ROHM's website.

## Automotive >>> **Battery Management System (BMS)**

### Key Points for Narrowing Down Product Selection

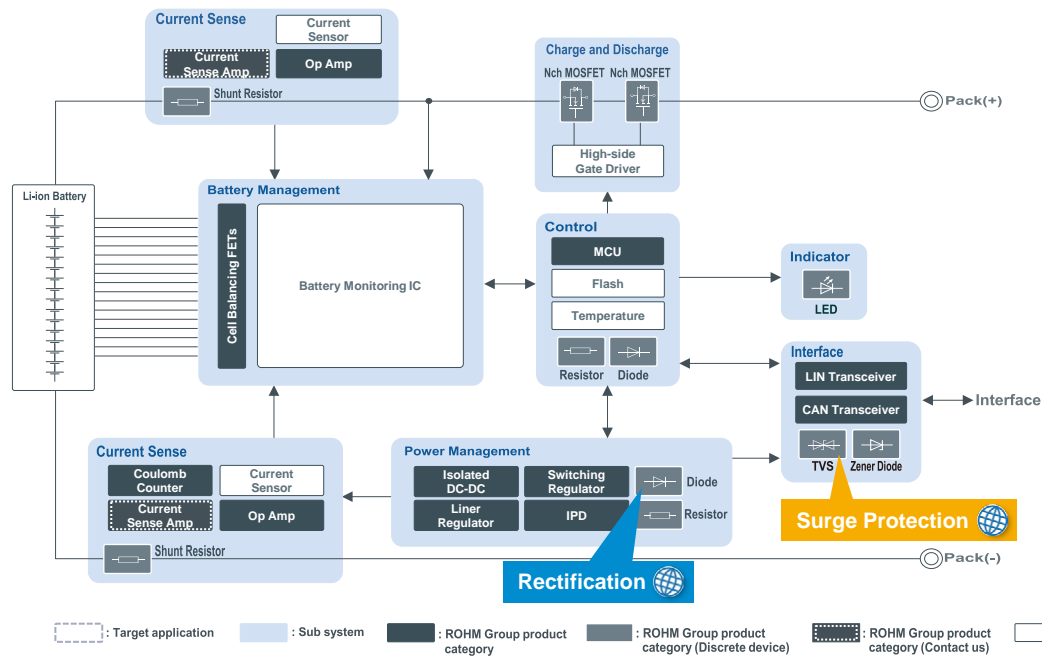
#### Rectification

#### Schottky Barrier Diodes

$V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

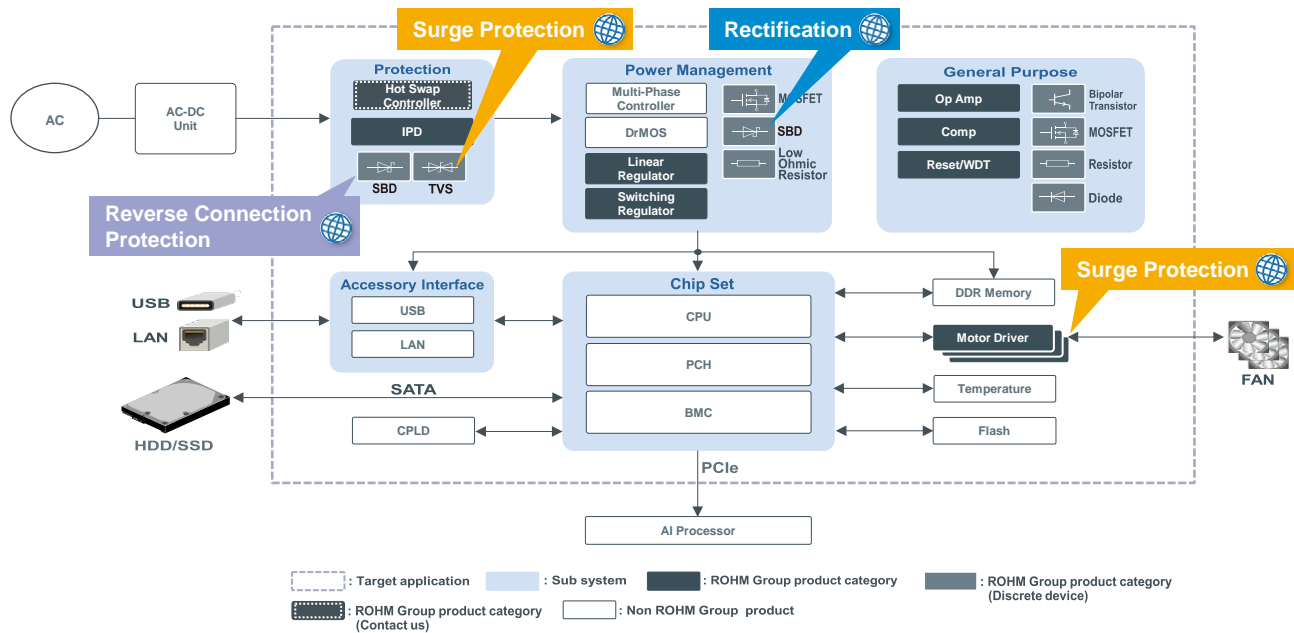
#### Surge Protection

TVS Diodes  
 Small signal package



Clicking on the icon links to ROHM's website.

## Industrial Equipment >>> Server Boards



### Key Points for Narrowing Down Product Selection

#### Rectification

**Schottky Barrier Diodes**  
 $V_R$  : 60V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Reverse Connection Protection

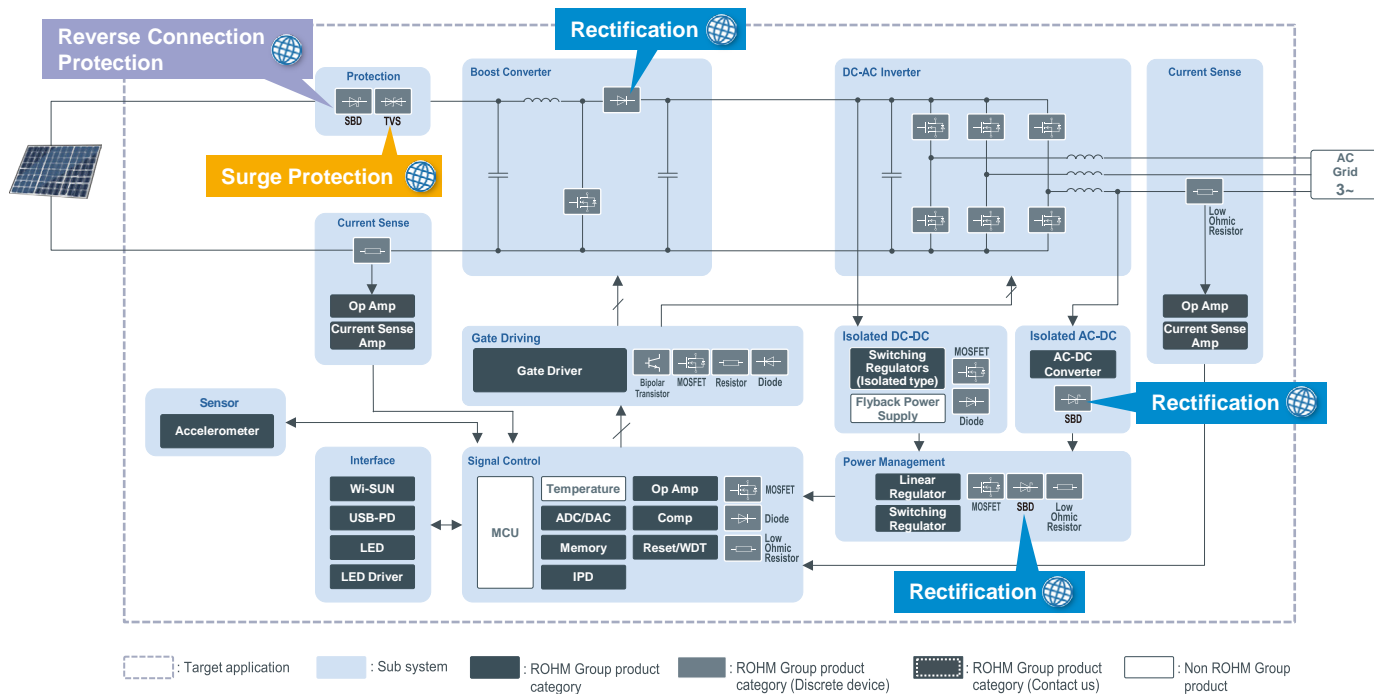
**Schottky Barrier Diodes**  
 $V_R$  : 40V or more  
 $I_O$  : 1A or more  
 Middle power package

#### Surge Protection

- **Protection TVS Diodes**  
High power package
- **Motor Driver Schottky Barrier Diodes**  
30V, 40V  
Ultra-Low  $V_F$



## Industrial Equipment >>> Photovoltaic (PV) Inverters



### Key Points for Narrowing Down Product Selection

#### Rectification

- **Boost Converter**  
Fast Recovery Diodes  
 $V_R$  : 400V or more
- **Isolated AC-DC**  
Schottky Barrier Diodes  
 $V_R$  : 30V to 60V
- **Power Management**  
Schottky Barrier Diodes  
 $V_R$  : 30V to 60V

#### Reverse Connection Protection

- **Schottky Barrier Diodes**  
 $V_R$  : 40V or more  
 $I_O$  : 1A or more  
Middle power package

#### Surge Protection

- **Protection**  
TVS Diodes  
High power package

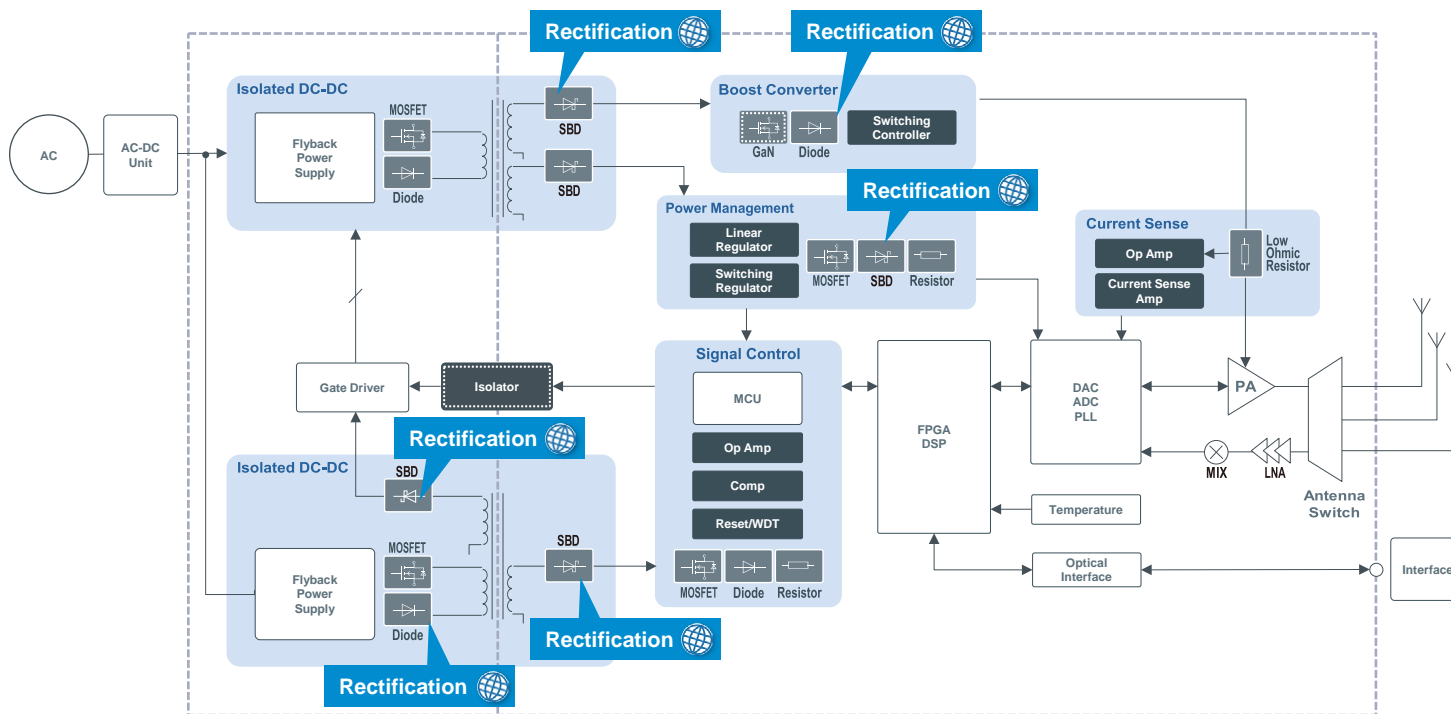
## Industrial Equipment >>> **Base Station Remote Radio Heads (RRHs)**

Key Points for Narrowing Down Product Selection

### Rectification

#### Schottky Barrier Diodes

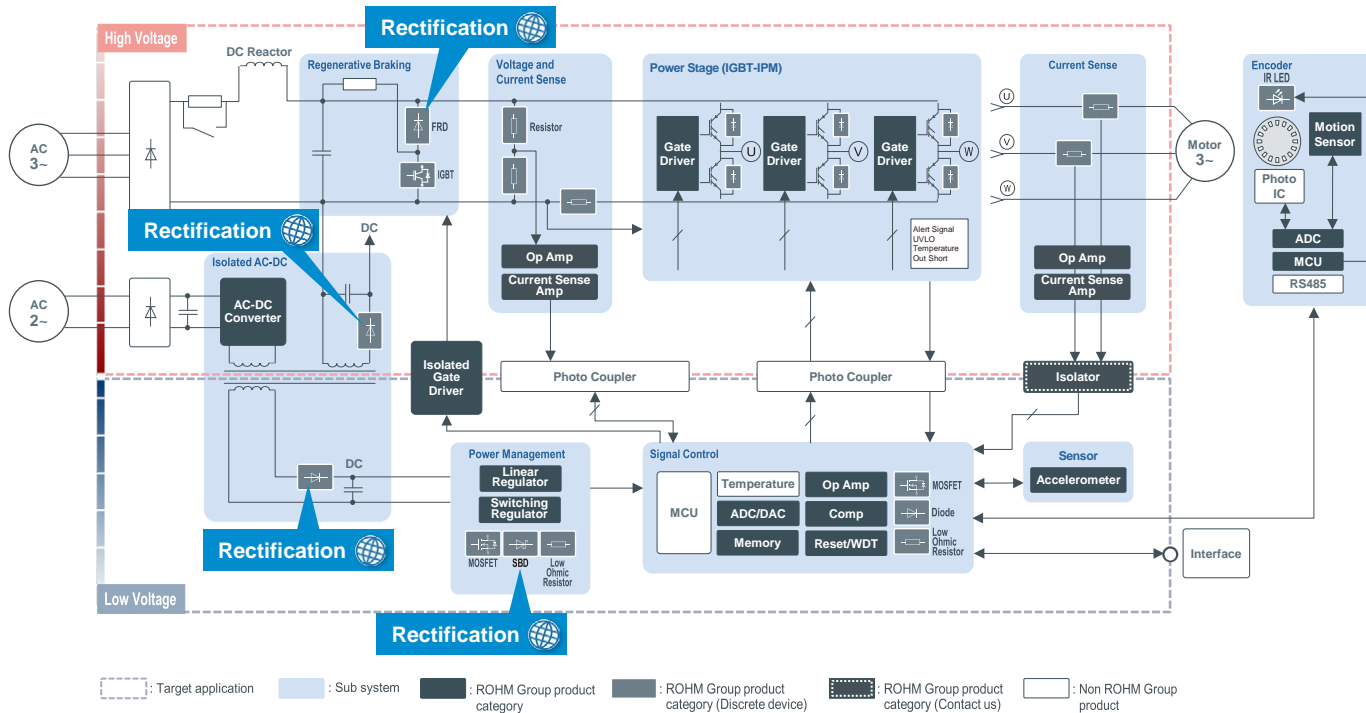
$V_R$  : 60V or more  
 $I_O$  : 1A or more



: Target application   
 : Sub system   
 : ROHM product category   
 : ROHM product category (Discrete device)   
 : ROHM product category (Contact us)   
 : Non ROHM product

Clicking on the icon links to ROHM's website.

## Industrial Equipment >>> Industrial Inverters (Motor)



### Key Points for Narrowing Down Product Selection

#### Rectification

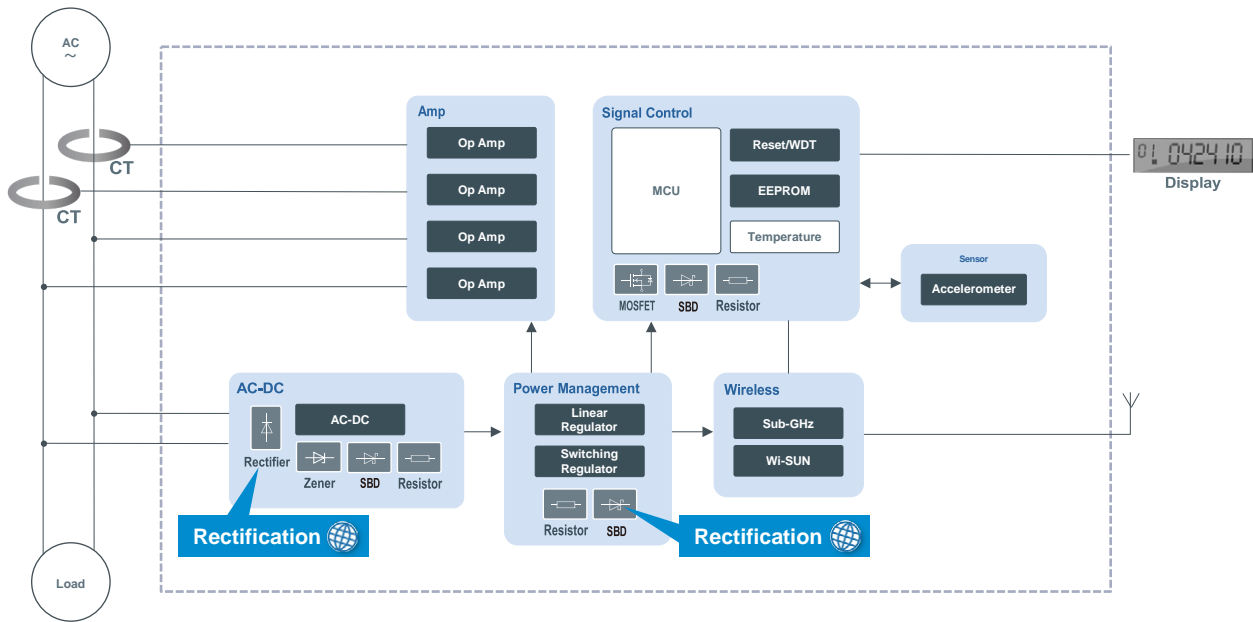
- **High Voltage**  
Fast Recovery Diodes  
 $V_R$  : 400V or more
- **Low Voltage**  
Schottky Barrier Diodes  
 $V_R$  : 60V or more  
 $I_O$  : 1A or more

## Industrial Equipment >>> [Electric Smart Meters - CT Method](#)

### Key Points for Narrowing Down Product Selection

#### Rectification

- **AC-DC**  
Fast Recovery Diodes  
 $V_R$  : 400V or more
- **Power Management**  
Schottky Barrier Diodes  
 $V_R$  : 30V to 60V



: Target application   
 : Sub system   
 : ROHM Group product category   
 : ROHM Group product category (Discrete device)   
 : ROHM Group product category (Contact us)   
 : Non ROHM Group product

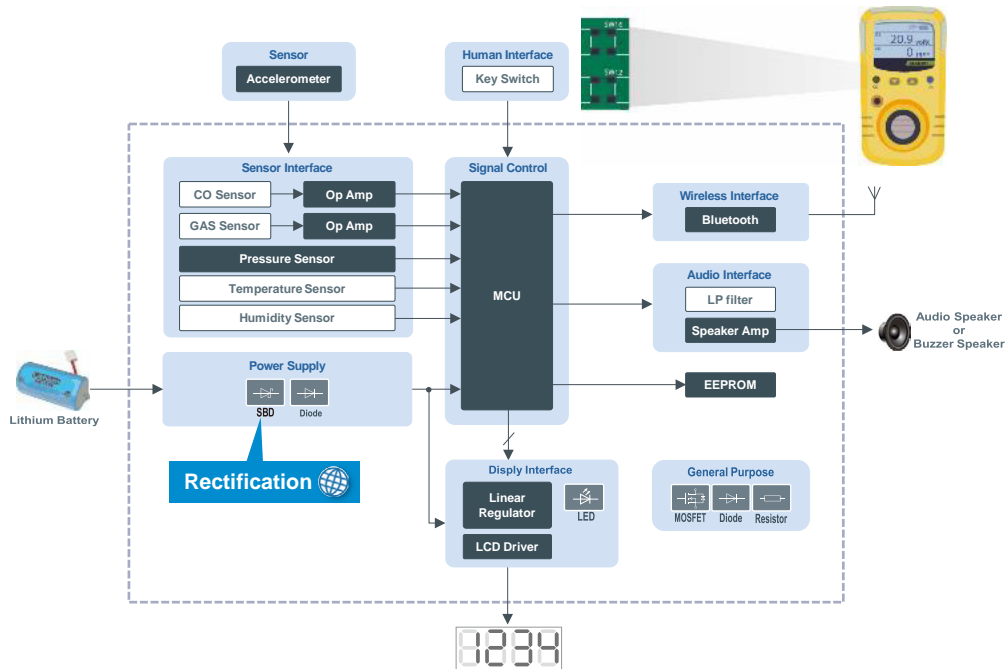
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## Industrial Equipment >>> Gas Leak Detectors (Industrial Use, Handy Type)

Key Points for Narrowing Down Product Selection

### Rectification

Schottky Barrier Diodes  
 $V_R$  : 30V to 60V



: Target application   
 : Sub system   
 : ROHM Group product category   
 : ROHM Group product category (Discrete device)   
 : ROHM Group product category (Contact us)   
 : Non ROHM Group product

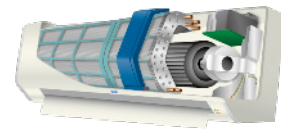
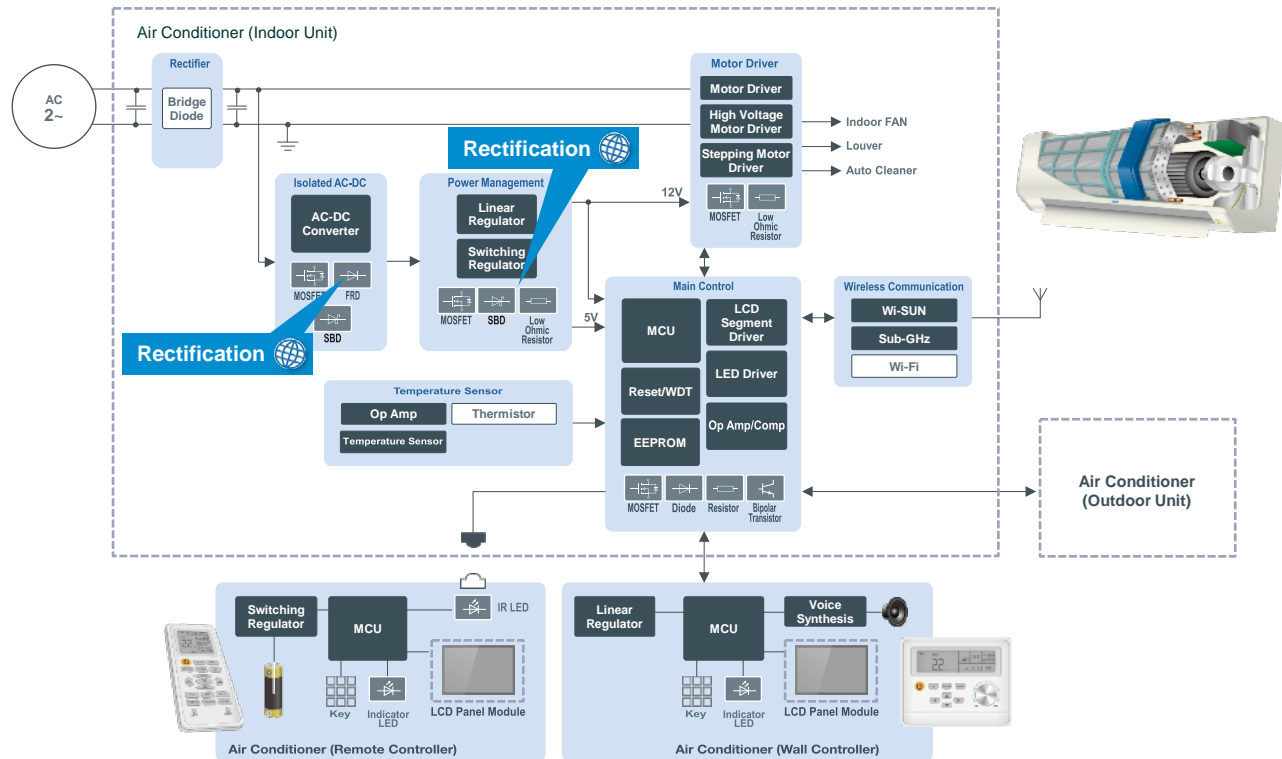
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## Consumer Electronics >>> Air Conditioners

Key Points for Narrowing Down Product Selection

### Rectification

- Isolated AC-DC  
Fast Recovery Diodes  
 $V_R$  : 400V or more
- Power Management  
Schottky Barrier Diodes  
 $V_R$  : 60V or more  
 $I_O$  : 1A or more



: Target application  
 : Sub-system  
 : ROHM Group product category  
 : ROHM Group product category (Discrete device)  
 : ROHM Group product category (Contact us)  
 : Non ROHM Group product

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