

Technology Trends in Primary Power Supplies

Until now, product manufacturers primarily focused on application circuits and secondary power supplies to improve set energy savings, but in recent years to meet the need for higher efficiencies and lower power consumption designers are beginning to look at primary power supplies as well. In addition, laws and regulations such as Energy Star, CoC, and DoE have spurred interest in power supply design.

ROHM proposes total solutions including power supply ICs and peripheral discrete components that leverage our latest proprietary power supply technologies. Ideal for advanced and next-generation primary power supply systems requiring greater stability and safety.

Our primary power supply ICs integrate a number of circuit design technologies to achieve high efficiency, low standby power and low noise.

Examples

- X capacitor discharge circuit
- Ringing noise improvement circuit at light loads
- Low current shunt regulator
- Burst operation at light loads
- V_{CC} recharge circuit
- Peak drive circuit

ROHM offers a broad portfolio of ICs, discretes, and modules to meet virtually any need. In addition, a variety of application support tools* are available that allow users to verify the details of our product lineup and the characteristics of the new power supply.

*Refer to P20

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Primary Power Supply Product Matrix

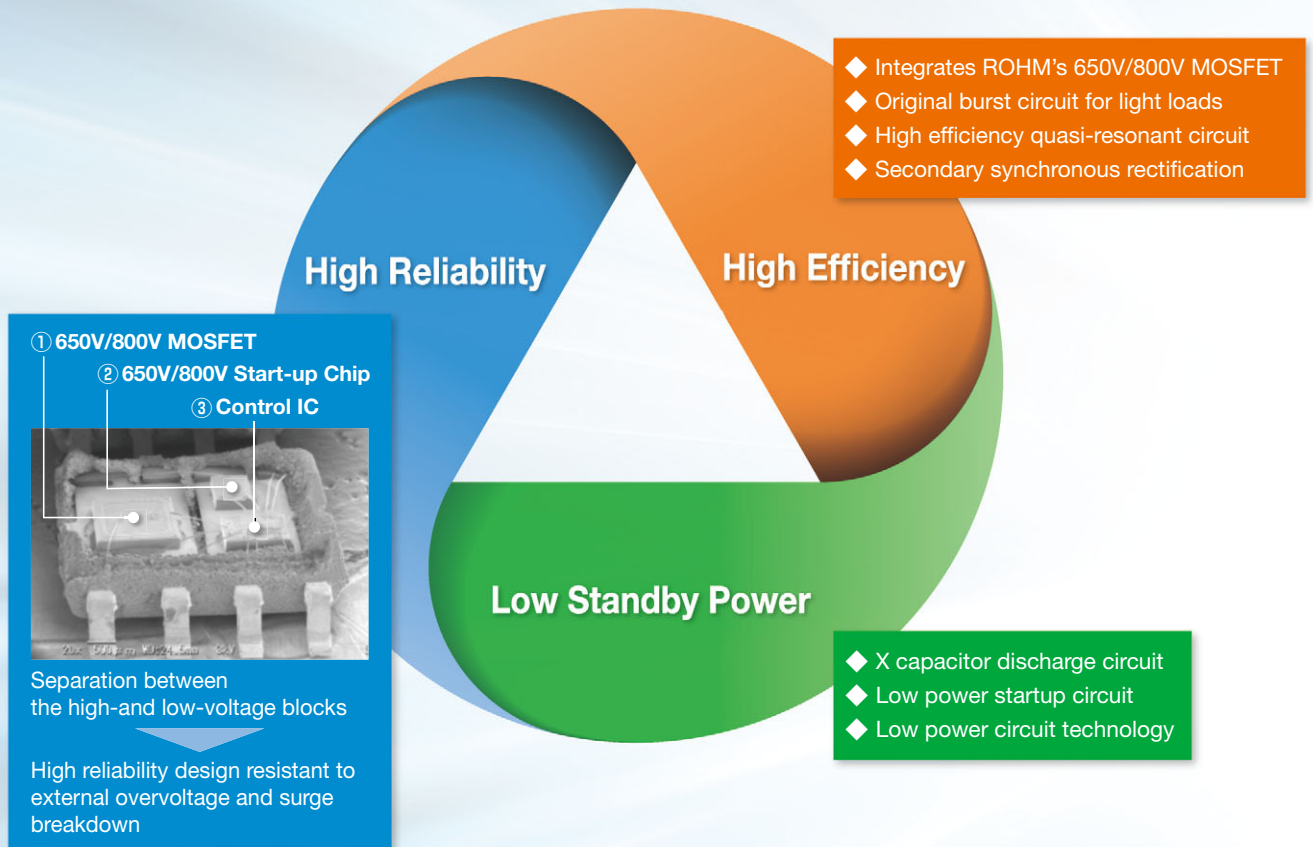
Lineup (By Power) Search for ROHM primary power supply ICs based on power, application, and/or topology

Input	Power	Applications	ITEM						
			AC/DC	PFC	Synchronous Rectification	MOSFET	Fast Recovery/ Zener Diodes	Resistor	
100V 200V	30W or less	Consumer Electronics Industrial Equipment	Built-in MOS BM2Pxxx series Built-in MOS (SiC) BM2SCQ12xT series	BD7690FJ BD7691FJ BD7692FJ					
	30 to 75W	Printers Industrial Equipment Others	External MOS BM1Q104 (Pseudo-Resonant) BM1P101 (PWM) Built-in MOS (SiC) BM2SCQ12xT series	—		1ch BM1R001xxF series			
	75 to 150W	TVs Audios Industrial Equipment	External MOS BM1Q104 (Pseudo-Resonant) BM1P101 (PWM) BM1C102 (PFC+QR)	BD7690FJ BD7691FJ BD7692FJ			▶ P.21 to 28	▶ P.29 to 32	▶ P.33 to 36
	150 to 300W	Laser Printers Others	—	Under development					
	300 to 500W	Gaming Systems Others	External MOS BM1Q104 (Pseudo-Resonant) BM1P101 (PWM) BM1C102 (PFC+QR)	BD7690FJ BD7691FJ BD7692FJ	2ch BD85506F				
	500 to 1,000W and over	Industrial Equipment Others	—	Under development					



AC/DC Converter Product Development Policy

3 Key Parameters (High Reliability • High Efficiency • Low Standby Power)



The features and development policy of primary power supplies are high reliability, high efficiency, and low standby power consumption. These 3 parameters are among the most in demand in recent years.

<p>High Reliability</p>	<p>This is perhaps the most important requirement for primary power supplies. Our AC/DC converter ICs feature a multi-chip configuration comprised of a high-voltage startup circuit, controller, and switching MOSFET.</p>
<p>High Efficiency</p>	<p>In addition to the built-in original SuperJunction MOSFET, ROHM leverages IC circuit current reduction, secondary synchronous rectification and other circuit technologies to meet market needs for greater efficiency.</p>
<p>Low Standby Power</p>	<p>ROHM's total solution combining proprietary circuit technologies such as an X capacitor discharge function and built-in low current shunt regulator with discrete components contribute to lower set standby power consumption.</p>

Built-in MOS series Buck Converter Topology

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

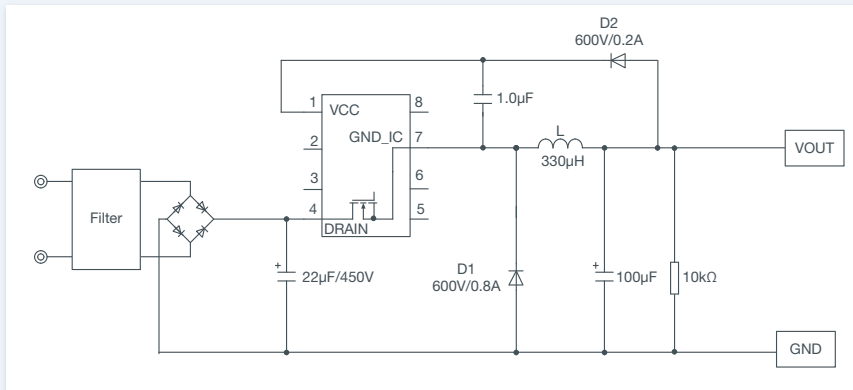
External MOS series

PFC series

Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

Buck Converter Features



Applicable Products

AC/DC **BM2Pxxx series**

Applications

Home
Appliances

TVs

Industrial
Equipment

Overview

A broad lineup is available.

- Packages: SOP8/DIP7/TO220
- Output Power: Up to 45W class
(depending on power supply specifications)
- Frequency: 65kHz to 130kHz
- Multiple protection circuits

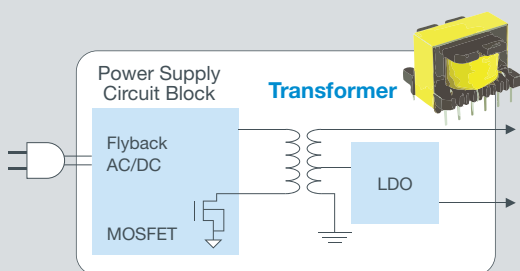
Technology Trend

Reducing standby power consumption has become a major theme.

To achieve high efficiency, various models are offered that minimize the internal circuit current.

Comparison vs Flyback Topology

Flyback Configuration



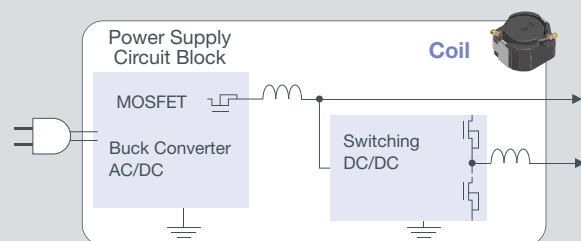
Inserted Components

Transformer		1pcs
Capacitor		5pcs
Resistors		6pcs

Surface Mount Components

Many inserted components

Buck Converter Configuration



Inserted Components

Transformer		0pcs ▼1pc eliminated
Capacitor		2pcs ▼3pcs eliminated
Resistors		2pcs ▼4pcs eliminated

Surface Mount Components

Few inserted components

Circuit Technology

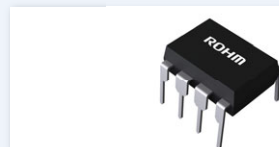
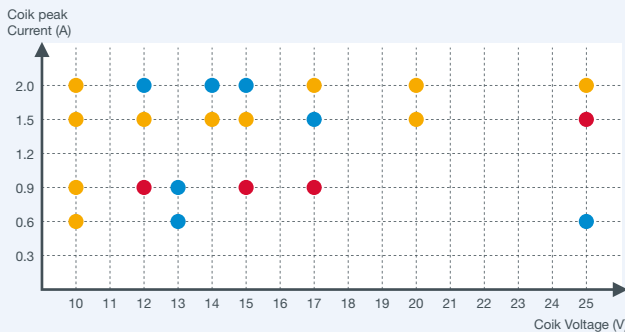
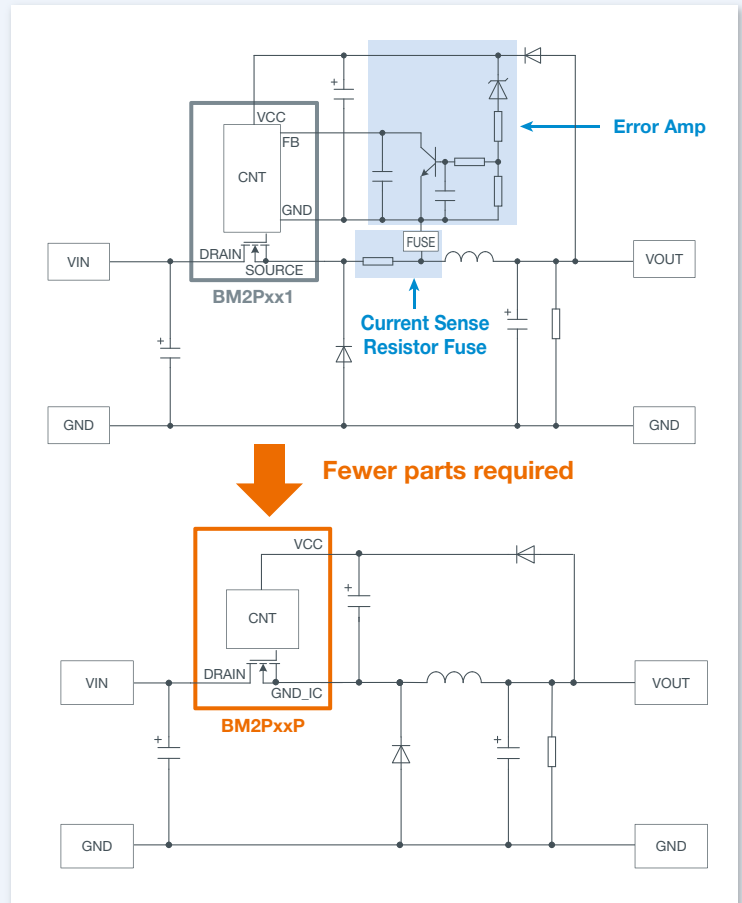
Significantly reduces board space Buck converter (achieves transformerless circuit)

Advantages

- Built-in current sense resistor improves reliability during open/short-circuits
- Significantly reduces the number of external parts, decreasing board area while simplifying design

Drawback Countermeasures

- Current flowing into the coil can only be monitored when the MOSFET is ON
→ **ROHM's original protection circuit prevents damage**
- The control voltage and coil current are fixed
→ **Broad lineup offered in a range of control voltages, coil currents, and packages**



DIP Package
(High power < 15W)



SOP Package
(Low power < 5W)

Built-in MOS series Buck Converter Topology

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

External MOS series

PFC series

Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

Built-in MOS series (Buck Converter Topology)

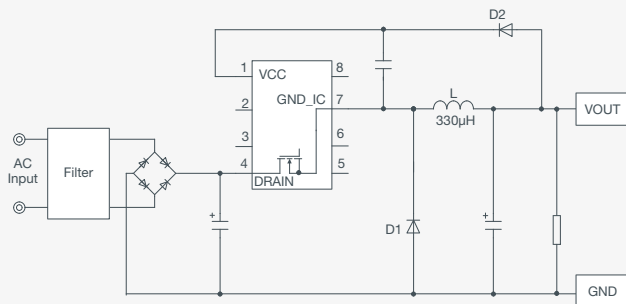
Features

- No photocoupler: AC/DC
- Switching frequency: 100kHz/65kHz
- PWM current mode
- Frequency hopping function
- Burst operation
- 650V/800V startup circuit
- Built-in 650V/800V SuperJunction MOSFET
- V_{CC} pin under/over voltage protection
- Pulse-by-pulse overcurrent limiter
- Soft start
- Integrated error amp reduces the number of external parts

Characteristics

- Rated drain voltage: 650V/800V
- Operating circuit current: 0.40mA (Typ)
- Burst circuit current: 0.25mA (Typ)
- Switching frequency: 100kHz (Typ)

Application Circuit Diagram



Package



SOP8

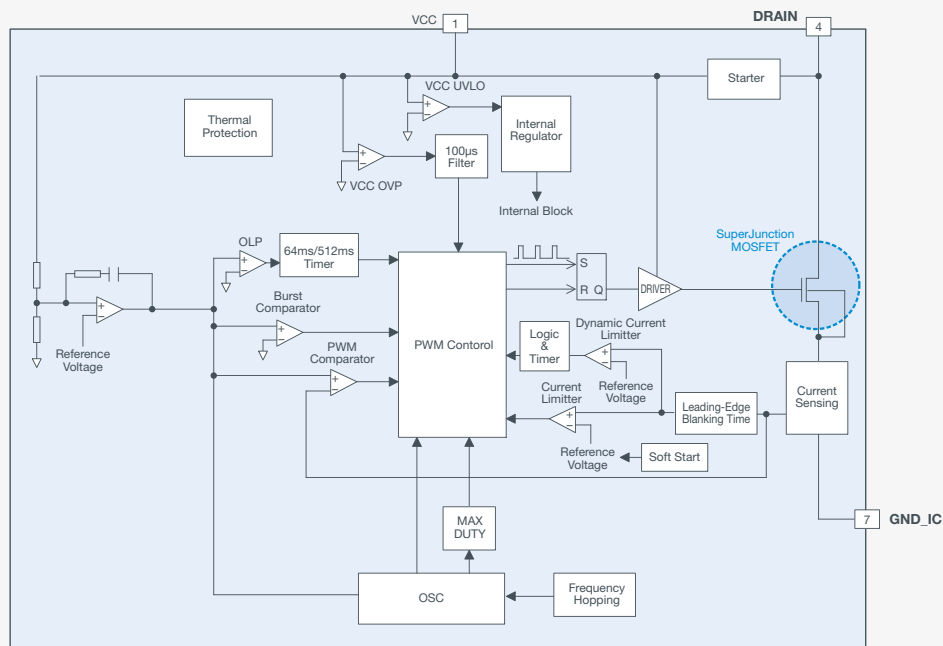
W (Typ) × D (Typ) × H (Typ)
5.00mm × 6.20mm × 1.71mm



DIP7K

W (Typ) × D (Typ) × H (Typ)
9.27mm × 6.35mm × 8.63mm
pitch: 2.54mm (Typ)

Block Diagram



Buck Converter Lineup

Part No.	Package	BreakDown Voltage (V)	On resistance (Typ) (Ω)	On resistance (Max) (Ω)	Frequency (kHz)	Frequency Reduction	V _{cc} OVP	Output Voltage (V)	Peak Current (A)	X-Cap. Discharge Function								
BM2P109TF	SSOP8S	650	9.50	12.50	100	—	Auto Restart	10.00	0.45	—								
BM2P129TF								12.00	0.45									
BM2P139TF			13.00	0.45														
BM2P135TF				0.45														
BM2P137TKF		800	7.50	10.50				0.45										
BM2P159PF		650	9.50	12.50				14.20	0.30									
BM2P159T1F								15.00	0.45									
BM2P189TF								18.00	0.45									
BM2P209TF								20.00	0.45									
BM2P249TF								24.80	0.45									
BM2P137QKF								800	7.50		10.50	13.00	0.80					
BM2P134QF		650	4.00	4.50				10.00	0.80									
BM2P107QKF		800	7.50	10.50					0.80									
BM2P104QF		650	4.00	4.50					0.80									
BM2P249Q	DIP7K	650	9.50	12.50	—	✓	24.80	0.80	—									
BM2P137QK	DIP7K	800	7.50	10.50	100	—	Auto Restart	13.00										
BM2P134Q		650	4.00	4.50				0.80										
BM2P107QK		800	7.50	10.50														
BM2P104Q		650	4.00	4.50														
BM2P101V	DIP7K	650	1.00	2.00	65	✓	Auto Restart	0.80	—									
BM2P101W								1.10										
BM2P101X								1.50										
BM2P121W								12.00		1.10								
BM2P121X										1.50								
BM2P131W								13.00		1.10								
BM2P131X										1.50								
BM2P141W								14.00		1.10								
BM2P141X										1.50								
BM2P151W								15.00		1.10								
BM2P151X										1.50								
BM2P181W								18.00		1.10								
BM2P061FK								DIP7AK		800	1.60	2.15	65	✓	Auto Restart	External Setting	External Setting	—
BM2P061GK													100					
BM2P101FK	130																	
BM2P101GK		3.30	4.80															
BM2P131FK	650	0.955	1.35	65														
BM2P131GK				100														
BM2P133EK				130														
BM2P061E				65														
BM2P101E					100													
BM2P131E					130													
BM2P064E					3.00	4.00	65											
BM2P104E				100														
BM2P134E	130																	
BM2P064EF	SOP8	650	3.00	4.00	65	✓	Auto Restart		External Setting	—	—							
BM2P104EF					100													
BM2P134EF					130													

Built-in MOS series PWM Flyback Topology

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

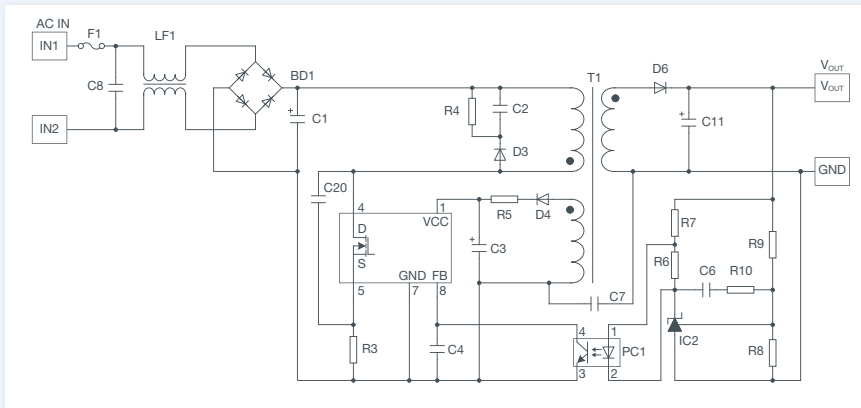
External MOS series

PFC series

Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

PWM Flyback Features



Applicable Products

AC/DC **BM2Pxxx series**

Applications

Home
Appliances

TVs

Industrial
Equipment

Overview

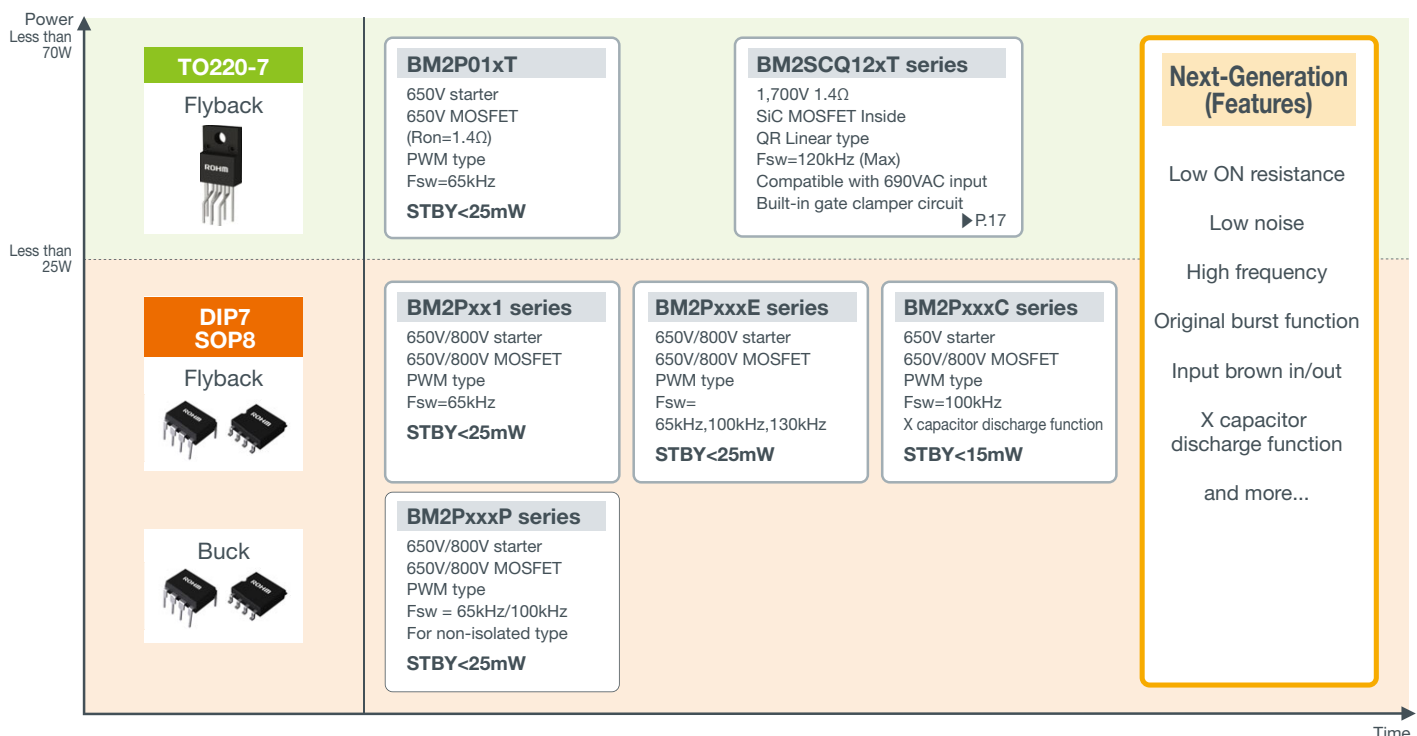
A broad lineup is available.

- Packages: SOP8/DIP7K/TO220
- Output Power: Up to 45W class
(depending on power supply specifications)
- Frequency: 65kHz to 130kHz
- Multiple protection circuits

Technology Trend

Reducing standby power has become a major theme. To achieve high efficiency, various models are offered featuring low circuit current.

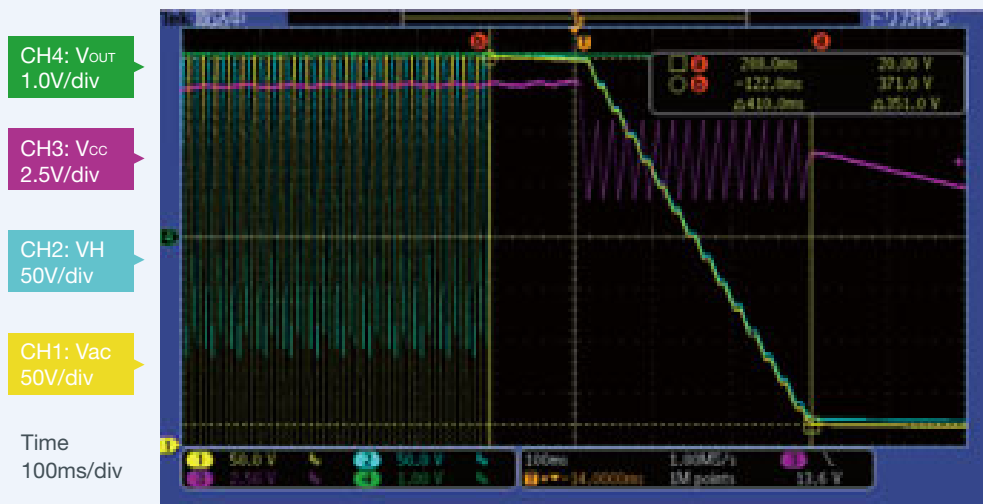
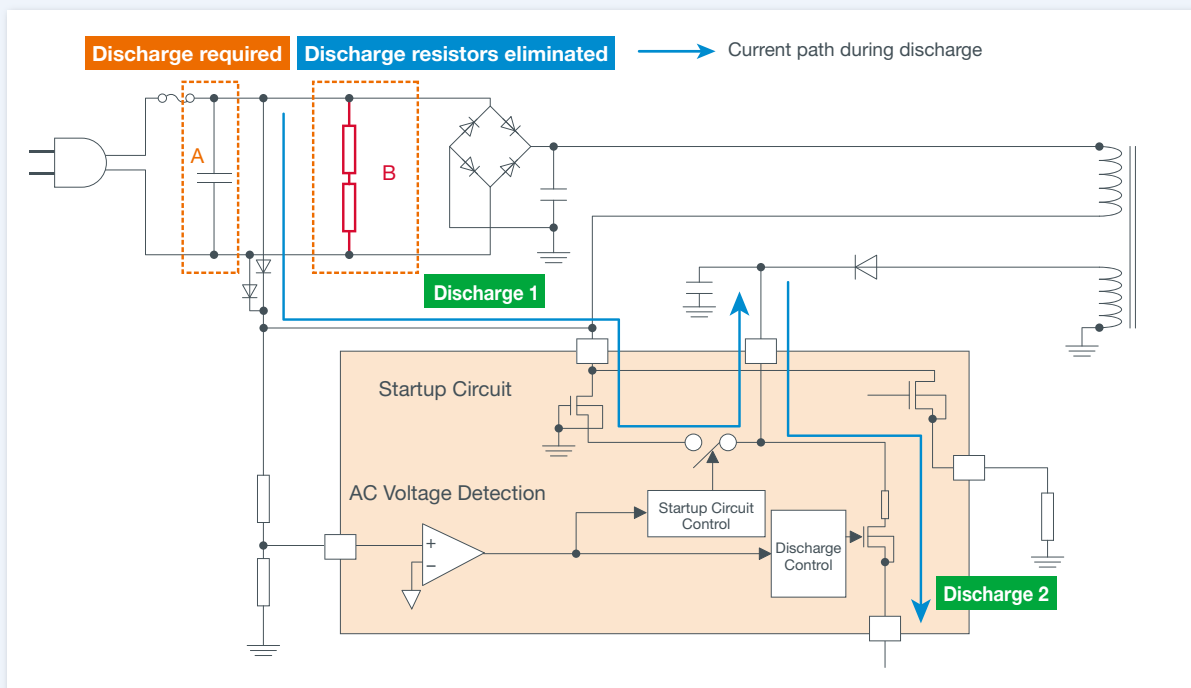
AC/DC Converter Road Map (PWM Flyback Topology with Built-in MOSFET)



Circuit Technology

AC/DC with X Capacitor Discharge Function

- ➔ Discharges the X capacitor without external discharge resistors
Supports capacitances up to 6.8 μ F (discharge)
- ➔ Ultra-low standby power consumption



Evaluation Result
(AC264V/IO=0A/Cx=4.0 μ F)

Built-in MOS series PWM Flyback Topology

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

External MOS series

PFC series

Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

PWM Flyback [X Capacitor Discharge (Low Standby Power Consumption)]

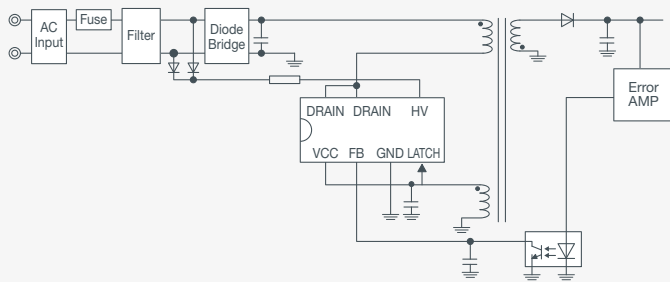
Features

- PWM peak current control
- Burst operation at light loads
- Built-in 650V startup circuit
- Integrated 800V SuperJunction MOSFET
- Equipped with high voltage sense circuit
- V_{CC} pin OVP/UVLO protection
- voltage compensation overcurrent protection
- External Latch function (Latch pin)
- X capacitor discharge function

Characteristics

- V_{CC} voltage range: 1.9V to 26.0V
- Switching frequency: 100kHz
- Operating circuit current: 700 μ A (Typ)
- Operating temperature range: -40°C to $+105^{\circ}\text{C}$
- Rated drain voltage: 800V
- Max drain current (pulse): 8.0A

Application Circuit Diagram



Pin Layout/Package

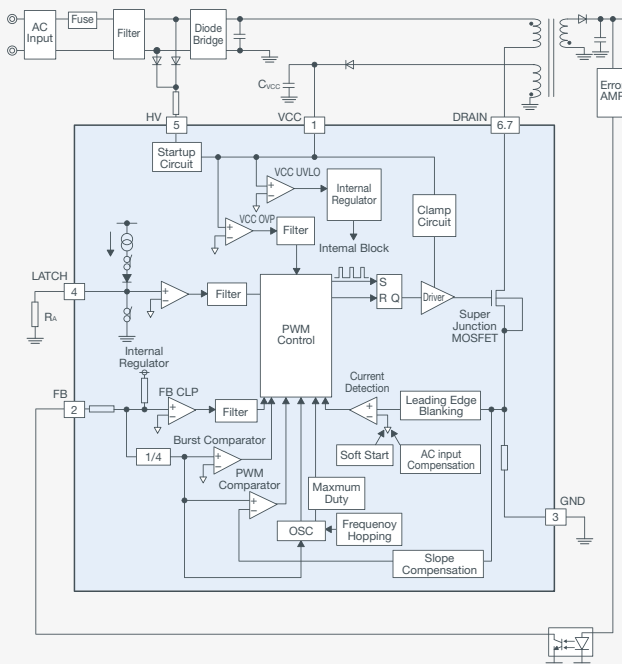
Pin No.	Pin Name	I/O	Function
1	VCC	I	Power supply input pin
2	FB	I	Feedback signal input pin
3	GND	I/O	GND pin
4	LATCH	I	External latch pin
5	VH	I	AC voltage startup pin
6	DRAIN	I/O	MOSFET DRAIN pin
7	DRAIN	I/O	MOSFET DRAIN pin



DIP7K

W (Typ) × D (Typ) × H (Typ)
9.27mm × 6.35mm × 8.63mm
pitch: 2.54mm (Typ)

Block Diagram



PWM Flyback Lineup

Part No.	Package	BreakDown Voltage (V)	On resistance (Typ) (Ω)	On resistance (Max) (Ω)	Frequency (kHz)	Frequency Reduction	V _{CC} OVP	BR UVLO	BR OVP	X-Cap. Discharge Function						
New BM2P26CK	DIP7K	800	6.00	8.40	100		Latch	Internal	—	✓						
BM2P011							Latch	External Setting	External Setting							
BM2P012		Auto Restart	—	—												
BM2P013		Latch				External Setting	External Setting									
BM2P014		Auto Restart	—	—												
BM2P031		650				2.40	4.00	65	✓	Latch	External Setting	External Setting				
BM2P032			Auto Restart	—	—											
BM2P033		Latch	External Setting			External Setting										
BM2P034		Auto Restart		—	—											
BM2P051		4.00	5.40			8.50	12.00			Latch	External Setting	External Setting				
BM2P052				Auto Restart	—			—								
BM2P053		Latch	External Setting	External Setting												
BM2P054		Auto Restart			—		—									
BM2P091		8.50	12.00						Latch	External Setting	External Setting					
BM2P092					Auto Restart		—	—								
BM2P093		Latch	External Setting	External Setting												
BM2P094		Auto Restart				—	—									
BM2P0141	DIP7K	650	1.40	2.00	65				✓	Auto Restart	—	—	—			
BM2P0322	DIP7K	650	4.00	5.40	65	✓	Auto Restart	External Setting	External Setting	—						
BM2P039	DIP7K	650	2.40	4.00	100	✓	Auto Restart	External Setting	External Setting	—						
BM2P0391							Auto Restart				External Setting	External Setting				
BM2P051F	SOP8	650	4.00	5.40	65	✓	Latch	External Setting	External Setting							
BM2P052F							Auto Restart				—	—				
BM2P053F							Latch							External Setting	External Setting	
BM2P054F							Auto Restart									
BM2P091F		8.50	12.00			Latch	External Setting	External Setting								
BM2P092F						Auto Restart				—	—					
BM2P093F						Latch							External Setting	External Setting		
BM2P094F						Auto Restart										—
BM2P0522F	SOP8	650	4.00	5.40	65	✓	Auto Restart	External Setting	External Setting							
BM2P0922F			8.50	12.00			Auto Restart			—	—					
BM2P074KF	SOP8	800	6.70	8.50	65	✓	Auto Restart	—	—				—			
BM2P012T	TO220	650	1.40	2.00	65	✓	Auto Restart	External Setting	External Setting	—						
BM2P014T							Auto Restart	—	—	—						

Part No.	Package	BreakDown Voltage (V)	On resistance (Typ) (Ω)	On resistance (Max) (Ω)	Frequency (kHz)	Frequency Reduction	V _{CC} OVP	BR UVLO	BR OVP	X-Cap. Discharge Function		
BM2P016	DIP7K	650	1.40	2.00	65	✓	Auto Restart	—	—	—		
BM2P0161			1.00	2.00							—	
BM2P0361			3.00	4.80								Latch
BM2P015			1.40	2.00								
BM2P0151			1.00	1.35								
BM2PA15			1.40	2.00								
BM2PA35			2.40	4.00								
BM2PA55			8.50	12.00								
BM2P0161K	DIP7K	800	1.60	2.15	65	✓	Auto Restart	—	—	—		
BM2P095F	SOP8	650	8.50	12.00	65	✓	Latch	—	—	—		
BM2PA96F						—	Auto Restart					
BM2P016T	TO220	650	1.40	2.00	65	✓	Auto Restart	—	—	—		

External MOS series

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

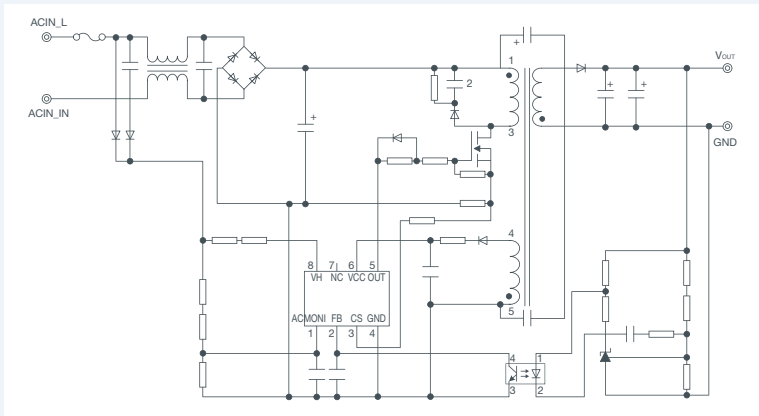
External MOS series

PFC series

Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

External MOS series Features



Applicable Products

AC/DC BM1Pxxx series (PWM)
BM1Qxxx series (QR)

MOSFET R65xxKNX (650V)
R80xxKNX (800V)

Applications

Home Appliances

TVs

Industrial Equipment

Overview

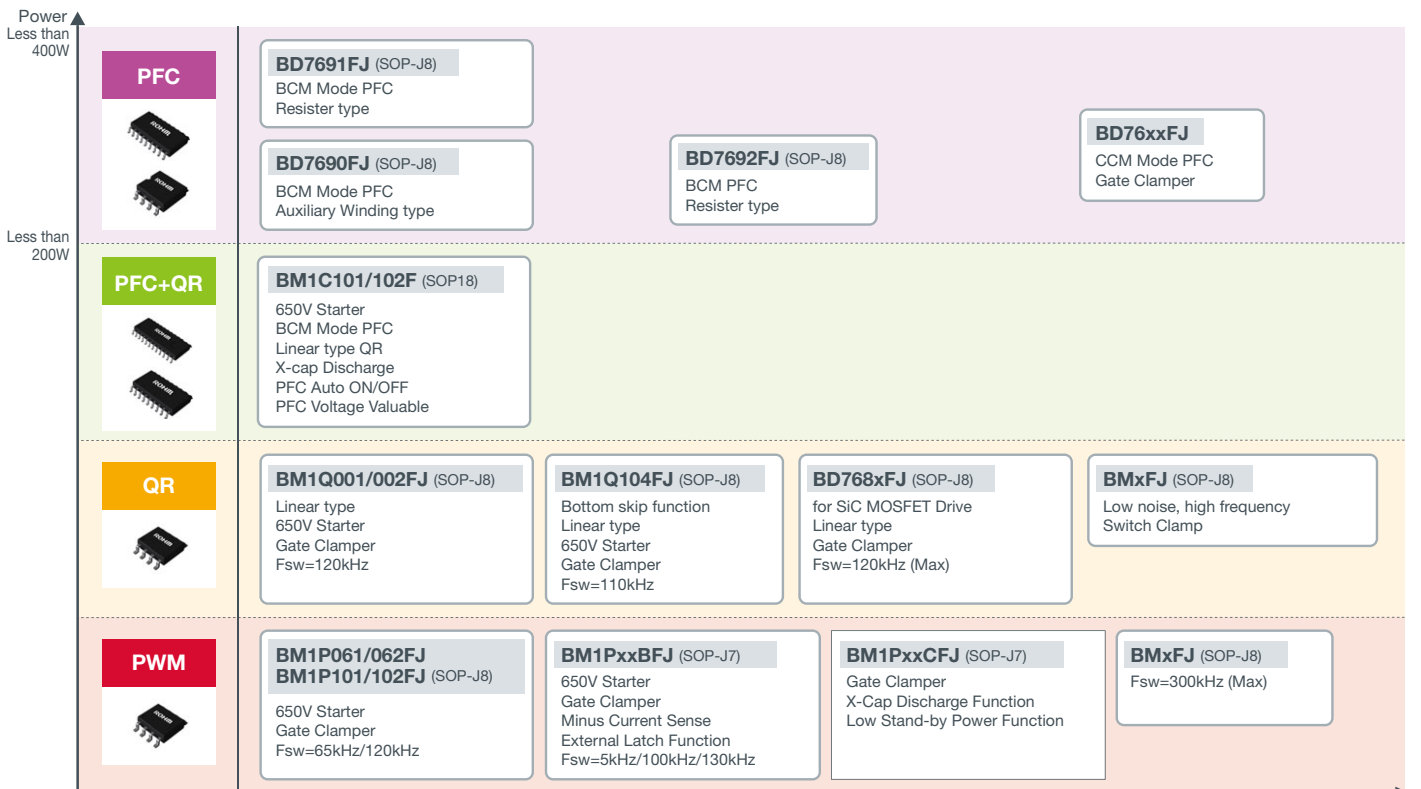
Flyback circuit (PWM/QR) with external MOSFET.
A broad lineup is offered.

- Packages: SOP-J8/SOP-J7
- Output power: Up to 150W class
(depending on power supply specifications)

Technology Trend

The technological trend is towards higher efficiency and lower standby power consumption. A wide range of ICs is available that incorporate a variety of functions, including those for reducing standby power consumption and transformer ringing noise.

Roadmap



*QR: Quasi-Resonant

Time

External MOS series Lineup

PWM

Part No.	Package	Frequency (kHz)	Frequency Reduction	Frequency Jitter	V _{cc} OVP	BR UVLO	FBOLP	ZTOVP	TSD	Burst Freq. Control	X-Cap. Discharge Function
BD7671FJ	SOP-J8	65	—	—	Latch	—	AR	AR	AR	—	—
BD7672BG	SSOP6	65	—	✓	Latch	—	AR	AR	AR	—	—
BD7673AG	SSOP6	65	—	✓	Latch	—	Latch	Latch	AR	—	—
BD7679G	SSOP6	65	—	✓	AR	—	AR	AR	AR	—	—
BD7678FJ	SOP-J8	65	✓	✓	Latch	✓	AR	AR	AR	—	—
BM1P061FJ	SOP-J8	65	✓	✓	AR	✓	AR	—	AR	—	✓
BM1P062FJ					Latch						
BM1P065FJ					AR						
BM1P066FJ					Latch						
BM1P067FJ					AR						
BM1P068FJ					Latch						
BM1P101FJ	SOP-J8	100	✓	✓	AR	—	AR	—	AR	—	✓
BM1P102FJ					Latch						
BM1P105FJ					AR						
BM1P107FJ					AR						
BM1P10CFJ	SOP-J7	100	✓	✓	—	AR	Latch	Latch	AR	✓	✓
BM1P06CFJ		65			—						

QR (Pseudo-Resonant)

Part No.	Package	Control method	Max Frequency (kHz)	Frequency Reduction	ZT Timeout	V _{cc} OVP	BR UVLO	FBOLP	ZTOVP	Burst Freq. Control	Burst Freq. Control	Gain change	2stage Timeout
BD7681FJ	SOP-J8	Max frequency	120	✓	15μs	Latch	✓	AR	Latch	—	—	—	—
BM1Q001FJ	SOP-J8	Max frequency	120	✓	15μs	AR	—	AR	—	—	✓	—	✓
BM1Q002FJ						Latch			Latch				
BM1Q011FJ						AR			—				
BM1Q021FJ	SOP-J8	Max frequency	120	✓	15μs	AR	—	AR	AR	—	—	—	✓
BM1Q103FJ	SOP-J8	Bottom Skip	116	✓	15μs	—	—	AR	Latch	✓	✓	✓	—
BM1Q104FJ						—							

AC/DC+PFC

Part No.	Package	QR Control method	Max Frequency (kHz)	QR Frequency Reduction	PFC Control method	PFC Max Frequency	PFC frequency jitter	V _{cc} OVP	QR FBOLP	PFC Voltage Switch	X-cap. Discharge
BD7690FJ	SOP-J8	—	—	—	BCM	220kHz	—	—	—	—	—
BD7691FJ	SOP-J8	—	—	—	BCM	220kHz	—	—	—	—	—
BD7692FJ	SOP-J8	—	—	—	BCM	400kHz	—	—	—	—	—
BM1050AF	SOP24	Max frequency	120	✓	Peak current	65kHz Fixed	✓	Latch/AR	AR	—	—
BM1051F							—				
BM1C101F	SOP18	Max frequency	120	✓	Voltage mode	500kHz	✓	Latch	AR	✓	✓
BM1C102F										—	

PFC series

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

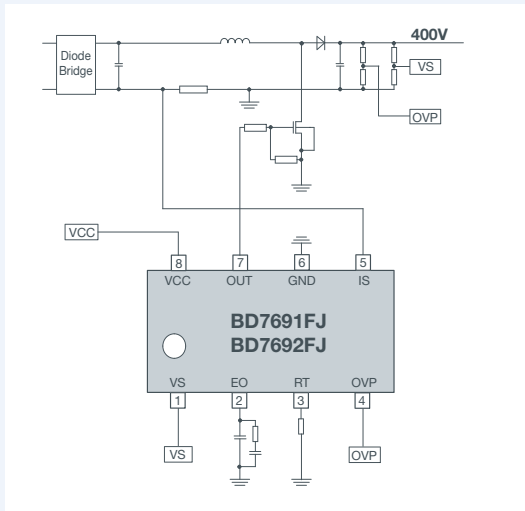
External MOS series

PFC series

Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

PFC Circuit Features



Applicable Products

AC/DC BD7690FJ (Winding Detection)
BD7691FJ (Resistance Detection)
BD7692FJ (Resistance Detection)

MOSFET R60xx series

Applications

TVs

OA equipment

LED lighting

Overview

These are transition-mode PFCs. Both winding and sense resistance detection types are offered. Especially for resistance detection types, a coil can be used instead of a transformer, eliminating the possibility of winding shorts for greater reliability. The maximum frequency can be set using the RT pin to reduce standby power consumption.

Technology Trend

The technological trend is towards higher efficiency and lower standby power consumption.

Overview

- Max frequency control (variable) improves efficiency at light loads
- Integrated high accuracy overcurrent detection
- VS pin dynamic and static OVP
- Multiple protection functions (overcurrent, error amp input short)
- Reduced IC circuit current minimizes power consumption
- Built-in clamper for the gate driver high side voltage
- Zero current detection via auxiliary winding (BD7690FJ)
- Zero current detection via resistance (BD7691FJ, BD7692FJ)
- IS-GND short protection (BD7692FJ)
- Startup overshoot reduction function (BD7692FJ)

Characteristics

- V_{CC} supply voltage range: 10.0V to 26.0V
- Operating current: 380 μ A (BD7690FJ)
540 μ A (BD7691FJ)
530 μ A (BD7692FJ)
- Max. frequency: 220kHz (BD7690FJ)
220kHz (BD7691FJ)
450kHz (BD7692FJ)
- Operating temperature range: -40°C to +105°C

Roadmap



SOP-J8

BD7690FJ
BCM
ZCD Auxiliary winding detection

▶ LED lighting and home appliances



SOP-J8

BD7692FJ
BCM
ZCD Resistance detection

▶ TVs and home appliances



SOP-J8

CCM PFC IC
(Under Development)

▶ Higher load sets

Secondary Synchronous Rectification IC series

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

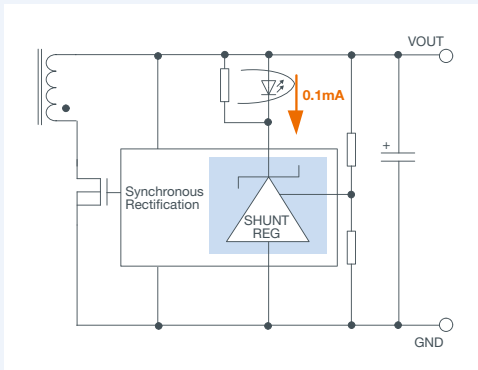
External MOS series

PFC series

Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

Secondary Synchronous Rectification Circuit Features



Applicable Products

Secondary
Synchronous
Rectification

BM1R001xxF series
BD85506F for LLCs

MOSFET

Rxxx series (Select according to
output voltage/output current)

Applications

TVs

OA equipment

Adapters

Overview

Built-in low power shunt regulators reduce standby power consumption while providing greater space savings. In addition, an auto shutdown function minimizes circuit current at light loads. Also, unlike conventional CCM circuits that require signal transmission from the primary to secondary side, ROHM products enable operation using a single resistor, contributing to low costs and improved space savings. A wide range of output voltages are supported, from 3.3V to 24.0V. The BD85506F for LLCs includes a MOSFET gate open protection function as a countermeasure to MOSFET heat generation.

Technology Trend

The technological trend is towards higher efficiency, lower standby power consumption, higher reliability, and greater space savings.

1

Low Power Consumption

An integrated low power shunt regulator reduces standby power. In addition, an auto shutdown function minimizes circuit current at light loads. This contributes to lower standby power consumption while saving space.

2

CCM (Current Continuous Mode) Compatible Circuit

Conventional CCM compatible circuits require signal transmission from the primary to the secondary side.

ROHM enables operation using a single resistor. The result is greater space savings and lower costs.

3

Supports a wide range of output voltages (BM1R001xxF series)

The AC/DC output voltage powers the secondary synchronous rectification IC.

ROHM products enables operation over a broad range, from 3.3V to 24.0V.

AC/DC Converters with Built-in 1700V SiC MOSFET

Built-in MOS series
(Buck Converter Topology)

Built-in MOS series
(PWM Flyback Topology)

External MOS series

PFC series

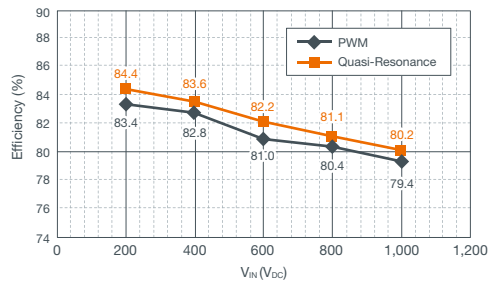
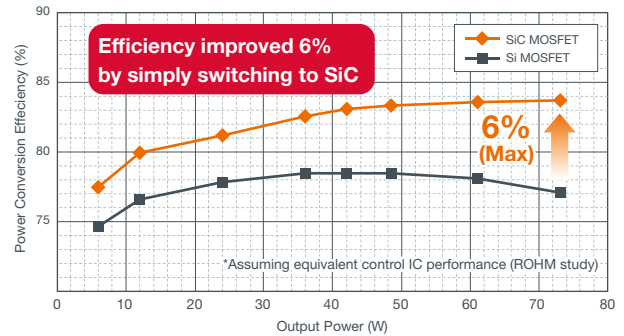
Secondary Synchronous
Rectification IC series

AC/DC series with
Built-in SiC MOSFET

SiC MOSFET-Equipped AC/DC series Features

	Si-Conventional Control IC	SiC+Specialized Control IC	SiC-Equipped Control IC
External Parts	20	5	1
Efficiency	Bad	Excellent	Excellent
Volume	Bad	Better	Excellent
Safety	Good	Excellent	Excellent

AC/DC Converter Efficiency Comparison: Si vs SiC



AC/DC with Built-in 1700V SiC MOSFET BM2SCQ12xT series

Features

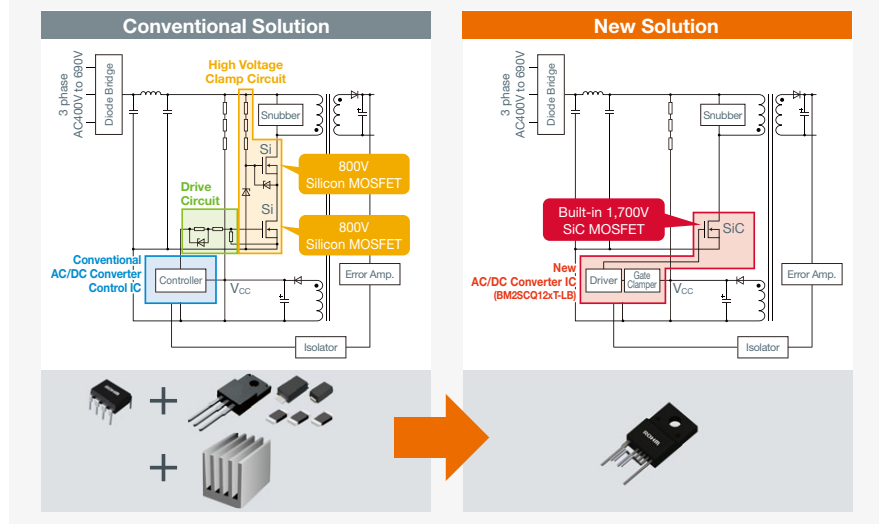
- The industry's first* AC/DC converters with built-in 1700V/4A SiC MOSFET deliver superior efficiency while reducing the number of external parts
- Low-noise, high efficiency quasi-resonant method
- Multiple protection circuits support up to 3-phase 690VAC

*ROHM May 2019 study

Applications

Inverter Servers Industrial power supplies

Reduces the number of parts along with mounting area



Lineup

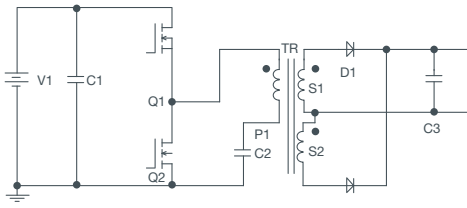
Part No.	Supply Voltage Range (V) (Max)	Normal Operating Current (μA) (Typ)	Burst Operating Current (μA) (Typ)	Max Operating Frequency (kHz) (Typ)	FB OLP	V _{CC} OVP	Operating Temperature (°C)
New BM2SCQ121T-LB	V _{CC} : 15.0 to 27.5 DRAIN: 1,700	2,000	500	120	Auto Restart	Latch	-40 to +105
BM2SCQ122T-LB					Latch	Latch	
BM2SCQ123T-LB					Auto Restart	Auto Restart	
BM2SCQ124T-LB					Latch	Auto Restart	

Circuit Diagrams (By Topology)

Topology

Target Devices/Applications

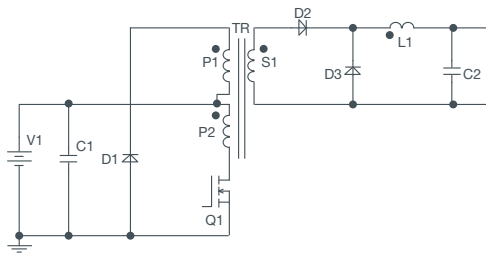
■ LLC



Secondary Synchronous Rectification IC: BD85506F
MOSFET: R60xx series (600V)

Applications: Home Appliances, TVs, Industrial Equipment

■ Forward



IGBT: • Low SW Loss &
• Low SW Noise
• Low Gate Charge
• Built-in Very Fast &
Soft Recovery FRD

IGBT: RGTV series

- Trench Gate & Thin Wafer Technology (3rd Gen)
- Short Circuit SOA 2μs Min
- Low $V_{CE(sat)}$ 1.5V Typ
- High Speed SW tf 40ns Typ

IGBT: RGTH series

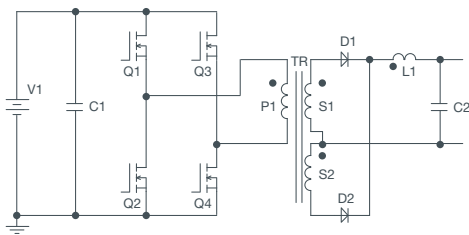
- Trench Gate & Thin Wafer Technology (2nd Gen)
- Low $V_{CE(sat)}$ 1.6V Typ
- High Speed SW tf 50ns Typ

IGBT: RGW series

- Trench Gate & Thin Wafer Technology (3rd Gen)
- Low $V_{CE(sat)}$ 1.5V Typ
- High Speed SW tf 30ns Typ

Applications: Home Appliances, TVs, Industrial Equipment

■ Full Bridge

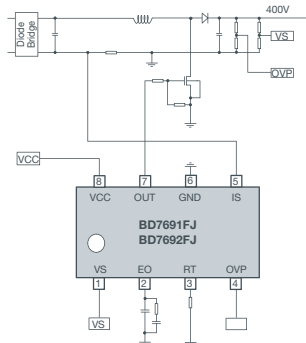


SuperJunction MOSFET-2nd Gen

R60xxKNX • Low $A \cdot Ron$
• Fast switching
• High efficiency

Applications: Home Appliances, TVs, Industrial Equipment

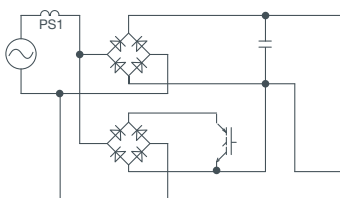
■ Single PFC



PFC: BD7690FJ (Winding Detection)
BD7691FJ (Resistance Detection)
BD7692FJ (Resistance Detection)

Applications: Lighting equipment, OA, TVs, Industrial Equipment

■ Partial SW PFC



IGBT: RGCL series

- Trench Gate & Thin Wafer
- Low $V_{CE(sat)}$ 1.4V Typ
- Low SW Noise

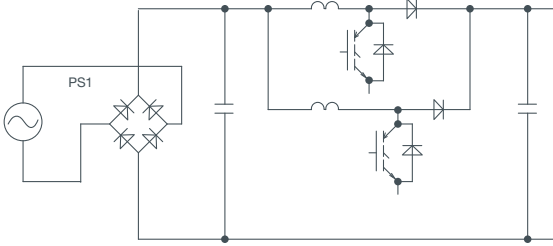
Applications: AC, Industrial Equipment

Circuit Diagrams (By Topology)

Topology

Target Devices/Applications

■ Interleaved PFC



- IGBT: • Low SW Loss & Low SW Noise
 • Low Gate Charge
 • Built-in Very Fast & Soft Recovery FRD
- IGBT: RGT series
 • Trench Gate & Thin Wafer Technology (2nd Gen)
 • Low $V_{CE(sat)}$ 1.6V Typ
 • High Speed SW tf 50ns Typ
- IGBT: RGTV series
 • Trench Gate & Thin Wafer Technology (3rd Gen)
 • Short Circuit SOA 2 μ s Min
 • Low $V_{CE(sat)}$ 1.5V Typ
 • High Speed SW tf 40ns Typ
- IGBT: RGW series
 • Trench Gate & Thin Wafer Technology (3rd Gen)
 • Low $V_{CE(sat)}$ 1.5V Typ
 • High Speed SW tf 30ns Typ

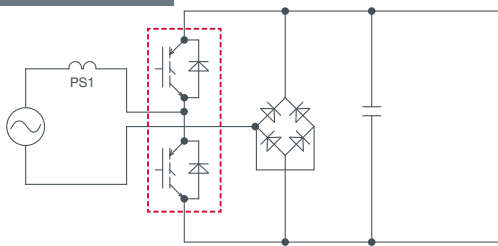
Applications

AC

Industrial
Equipment

■ Totem-Pole Di Bridgeless PFC

High Efficiency+Low Noise



- Switching Side
- IGBT: RGT series
 • Trench Gate & Thin Wafer Technology (2nd Gen)
 • Short Circuit SOA 5 μ s Min
 • Low $V_{CE(sat)}$ 1.65V Typ
 • High Speed SW
 • Low SW Loss & Low SW Noise
 • Low Gate Charge
 • Built-in Very Fast & Soft Recovery FRD

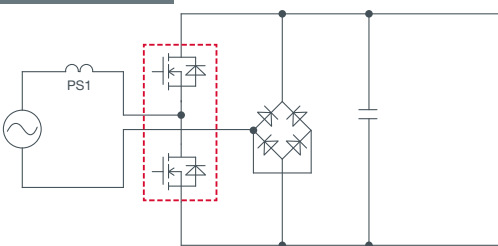
Applications

Home
Appliances

TVs

Industrial
Equipment

Light Load High Efficiency



- Switching Side
- Presto MOS: R60xxJNx series
 Fast- Recovery Body Diode SuperJunction MOSFET
 Presto MOS 2nd gen. R60xxMNx
 • Fast trr/Low Rds(on)
 • Improvement for Efficiency about Motors.
 • Able to remove parallel diode

Applications

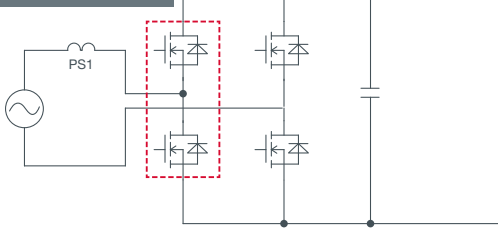
Home
Appliances

TVs

Industrial
Equipment

■ Totem-Pole Di Bridgeless PFC (Synchronous Rectification)

Light Load High Efficiency



- Rectification Side
- SJ-MOS: Low Noise SuperJunction MOSFET
 2nd Gen R60xxENx

Applications

Home
Appliances

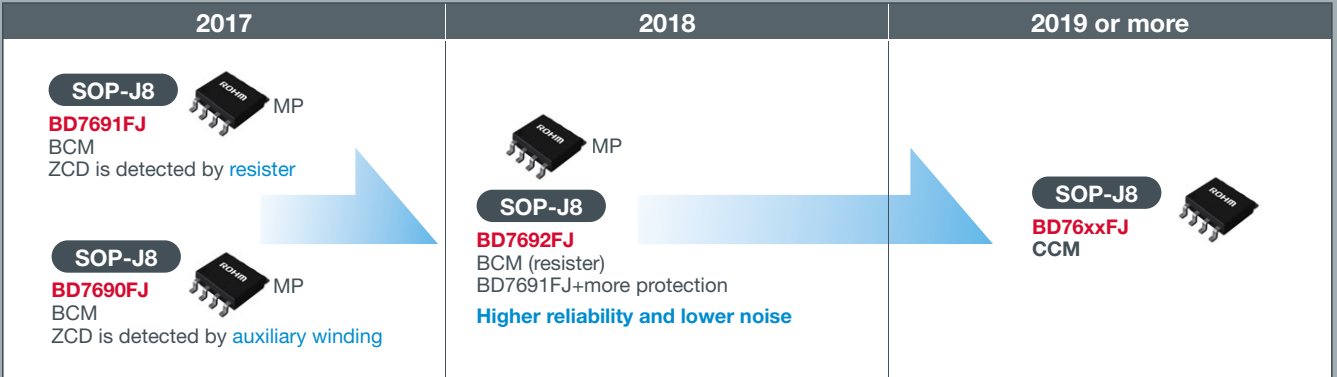
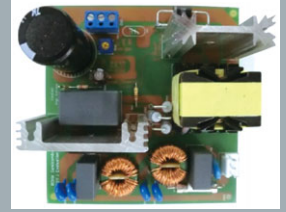
TVs

Industrial
Equipment

PFC (Power Factor Correction) ICs

ROHM proposes and develop products with the following features

Higher efficiency	<ul style="list-style-type: none"> ● Low loss: switching=20mW ● 12V FET drive voltage control (reduces FED drive switching loss)
High reliability	<ul style="list-style-type: none"> ● Multiple protection functions (OVP, VCC UVLO, OUT short, IS short) ● Integrated external FET protection (12V CLAMP)-eliminates the need for Zener diode for FET protection
Reduced development load	<ul style="list-style-type: none"> ● Industry-standard pin layout allows the board to be evaluated as-is



Application Support

ROHM provides various application support tools and welcomes customer requests regarding the power supply block circuit.

- Schematics
- Transformer Specifications
- Characteristics Evaluation (Comparison)
- Noise Characteristics Evaluation
- Heat Generation Evaluation
- Consultation of Board Layout

We also promote further development of the customer's power supply block through technical support utilizing actual equipment (including ICs and discretes) together with simulations.

Circuit

Evaluation-efficiency

AC100V_80Hz	Input(V)	Output(V)	Efficiency(%)	Power(W)	Temp(°C)
0.00	1.110	0.000	0.102	0.000	18.2
0.01	1.111	0.001	0.108	0.001	18.2
0.02	1.111	0.001	0.189	0.002	18.2
0.03	1.109	0.002	0.312	0.003	18.2
0.04	1.108	0.003	0.435	0.004	18.2
0.05	1.106	0.004	0.558	0.005	18.2
0.1	1.102	0.008	1.116	0.010	18.2
0.2	1.098	0.016	2.232	0.020	18.2
0.3	1.094	0.024	3.348	0.030	18.2
0.4	1.090	0.032	4.464	0.040	18.2
0.5	1.086	0.040	5.580	0.050	18.2
1.0	1.072	0.080	11.160	0.100	18.2
2.0	1.058	0.160	22.320	0.200	18.2
3.0	1.054	0.240	33.480	0.300	18.2
4.0	1.050	0.320	44.640	0.400	18.2

Noise Evaluation

Noise Terminal Voltage

Trans Design

Application Evaluation

Layout

Significantly lower switching loss makes it possible to achieve compact, high efficiency power supplies

3rd Gen Trench-type SiC MOSFETs

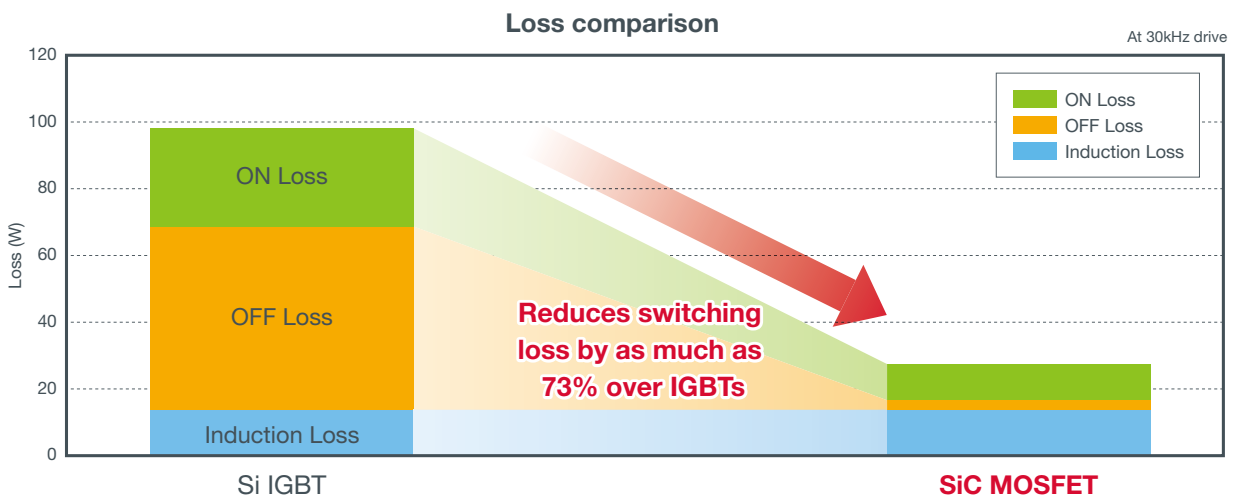
Applications

Solar Power Conditioners

Power supplies

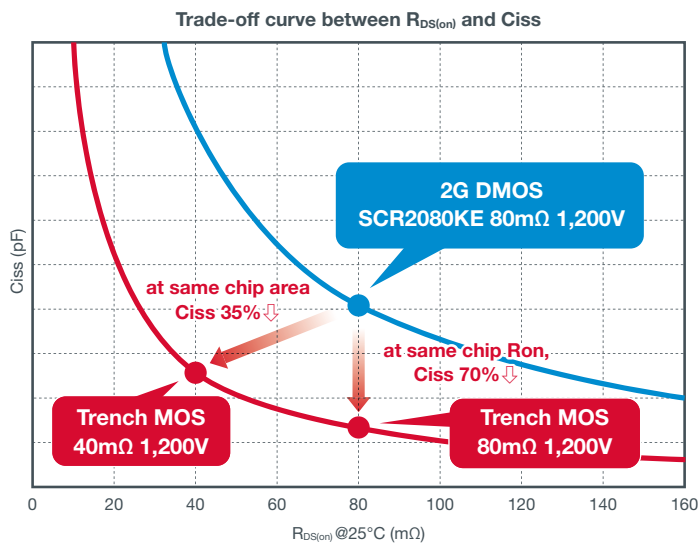
Dramatically Lower Switching Loss

SiC MOSFETs (right) significantly reduce switching loss compared with Si IGBTs (left)



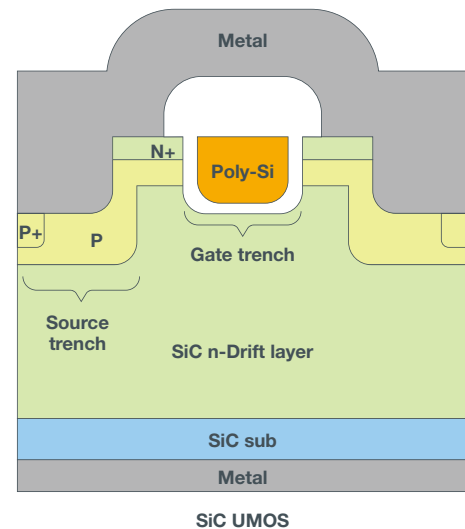
Achieves Even Lower ON Resistance

ROHM's 3rd Gen MOSFETs (red) features even lower ON resistance than 2nd Gen products (blue)



Structure

ROHM's original double trench structure



Product Lineup

2nd Gen (Planar type)									
Part No.	Polarity (ch)	V _{DSS} (V)	I _D (A)	P _D (W) (T _C =25°C)	R _{DS(on)} (Typ) (mΩ)	Q _g (Typ) (nC)		Package	Automotive Grade (AEC-Q101 Qualified)
						V _{DSS} =18V	Drive Voltage (V)		
SCT2120AF	N	650	29	165	120	61	18	TO-220AB	—
SCH2080KE	N	1,200	40	262	80	106	18	TO-247	—
SCT2080KE	N	1,200	40	262	80	106	18		YES
SCT2160KE	N	1,200	22	165	160	62	18		—
SCT2280KE	N	1,200	14	108	280	35	18		—
SCT2450KE	N	1,200	10	85	450	27	18		—
SCT2750NY	N	1,700	5.9	57	750	17	18		TO-268-2L
SCT2H12NY	N	1,700	4	44	1,150	14	18	—	
SCT2H12NZ	N	1,700	3.7	35	1,150	14	18	TO-3PFM	—
3rd Gen (Trench type)									
SCT3017AL	N	650	118	427	17	172	18	TO-247 (TO-247N)	YES
SCT3022AL	N	650	93	339	22	133	18		YES
SCT3030AL	N	650	70	262	30	104	18		YES
SCT3060AL	N	650	39	165	60	58	18		YES
SCT3080AL	N	650	30	134	80	48	18		YES
SCT3120AL	N	650	21	103	120	38	18		YES
SCT3022KL	N	1,200	95	427	22	178	18		YES
SCT3030KL	N	1,200	72	339	30	131	18		YES
SCT3040KL	N	1,200	55	262	40	107	18		YES
SCT3080KL	N	1,200	31	165	80	60	18		YES
New SCT3105KL	N	1,200	24	134	105	51	18		YES
SCT3160KL	N	1,200	17	103	160	42	18		YES

Note: Package indicates JEDEC code. () denotes ROHM package type.

Low V_F and fast recovery improves efficiency while reducing the size of power supplies

3rd Gen SiC Schottky Barrier Diodes

Applications

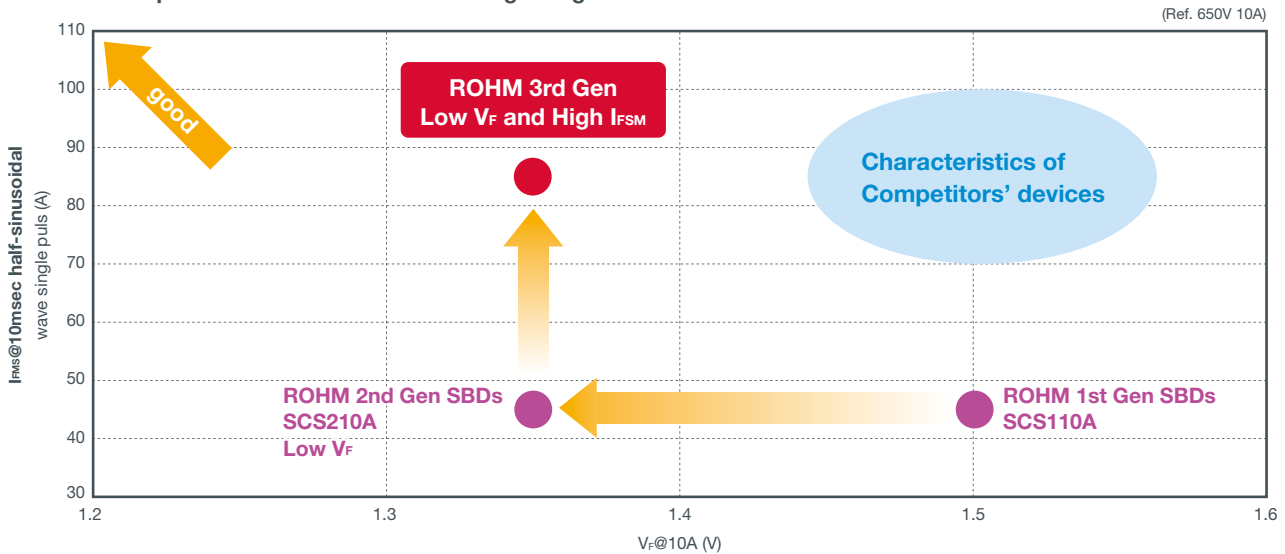
Solar Power Conditioners

Power Supply PFC

Charging Stations

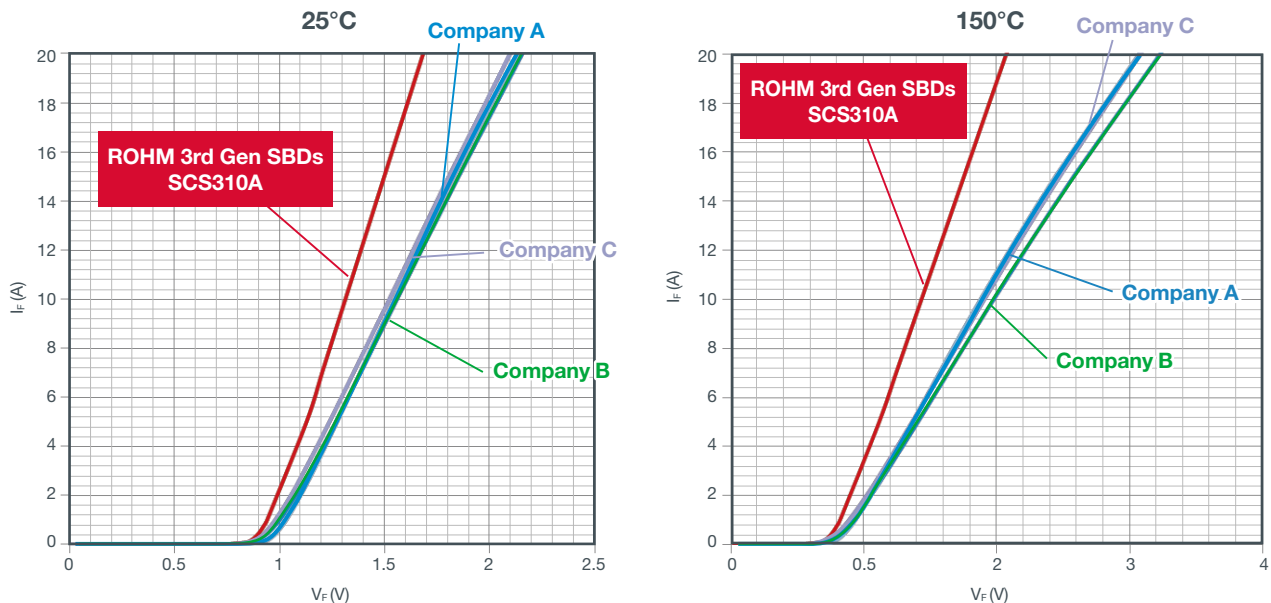
Low V_F and High Surge Resistance

ROHM's 2nd Gen (lower left) features low V_F while 3rd Gen products combine low V_F with high surge current resistance



Achieving Lower V_F Through Successive Generations

ROHM 3rd Gen SBDs ensure low V_F over a wide temperature range, from ambient to high temperatures



Product Lineup

Part No.	Absolute Maximum Ratings (Ta=25°C)				Electrical Characteristics (Ta=25°C)				Package	Equivalent Circuit Diagram	Automotive Grade (AEC-Q101 Qualified)
	V _{RM} (V)	V _R (V)	I _F (A)	I _{FSM} (A) 50Hz, 1 [∞]	V _F (Typ) (V)	I _R (μA)		V _R (A)			
						I _F (A)	(Max)				
SCS206AG	650	650	6	22	1.35	6	120	600	TO-220AC		—
SCS208AG	650	650	8	29	1.35	8	160	600			—
SCS210AG	650	650	10	38	1.35	10	200	600			—
SCS212AG	650	650	12	42	1.35	12	240	600			—
SCS215AG	650	650	15	52	1.35	15	300	600			—
SCS220AG	650	650	20	67	1.35	20	400	600			—
SCS206AGHR	650	650	6	22	1.35	6	120	600			YES
SCS208AGHR	650	650	8	29	1.35	8	160	600			YES
SCS210AGHR	650	650	10	38	1.35	10	200	600			YES
SCS212AGHR	650	650	12	42	1.35	12	240	600			YES
SCS215AGHR	650	650	15	52	1.35	15	300	600			YES
SCS220AGHR	650	650	20	67	1.35	20	400	600			YES
New SCS302AHG	650	650	2	19	1.35	2	10	650	TO-220AC (TO-220ACP)		—
New SCS304AHG	650	650	4	27	1.35	4	20	650			—
New SCS306AHG	650	650	6	47	1.35	6	30	650			—
New SCS308AHG	650	650	8	67	1.35	8	40	650			—
New SCS310AHG	650	650	10	82	1.35	10	50	650			—
New SCS312AHG	650	650	12	96	1.35	12	60	650			—
New SCS315AHG	650	650	15	112	1.35	15	75	650			—
New SCS320AHG	650	650	20	123	1.35	20	100	650			—
SCS206AM	650	650	6	22	1.35	6	120	600	TO-220FM		—
SCS208AM	650	650	8	29	1.35	8	160	600			—
SCS210AM	650	650	10	38	1.35	10	200	600			—
SCS212AM	650	650	12	42	1.35	12	240	600			—
SCS215AM	650	650	15	52	1.35	15	300	600			—
SCS220AM	650	650	20	67	1.35	20	400	600			—
New SCS304AM	650	650	4	27	1.35	4	20	650			—
New SCS306AM	650	650	6	47	1.35	6	30	650			—
New SCS308AM	650	650	8	67	1.35	8	40	650			—
New SCS310AM	650	650	10	82	1.35	10	50	650			—
New SCS312AM	650	650	12	96	1.35	12	60	650			—
New SCS315AM	650	650	15	112	1.35	15	75	650			—
New SCS320AM	650	650	20	123	1.35	20	100	650	—		
SCS215AE	650	650	15	52	1.35	15	300	600	TO-247		—
SCS220AE	650	650	20	67	1.35	20	400	600			—
SCS220AE2	650	650	10/20*	38/76*	1.35	10	200	600			—
SCS230AE2	650	650	15/30*	52/104*	1.35	15	300	600			—
SCS240AE2	650	650	20/40*	67/135*	1.35	20	400	600			—
SCS220AE2HR	650	650	10/20*	38/76*	1.35	10	200	600			YES
SCS230AE2HR	650	650	15/30*	52/104*	1.35	15	300	600			YES
SCS240AE2HR	650	650	20/40*	67/135*	1.35	20	400	600			YES
SCS205KG	1,200	1,200	5	22	1.4	5	100	1,200	TO-220AC		—
SCS210KG	1,200	1,200	10	42	1.4	10	200	1,200			—
SCS215KG	1,200	1,200	15	62	1.4	15	300	1,200			—
SCS220KG	1,200	1,200	20	78	1.4	20	400	1,200			—
SCS205KGHR	1,200	1,200	5	22	1.4	5	100	1,200			YES
SCS210KGHR	1,200	1,200	10	42	1.4	10	200	1,200			YES
SCS215KGHR	1,200	1,200	15	62	1.4	15	300	1,200			YES
SCS220KGHR	1,200	1,200	20	78	1.4	20	400	1,200			YES
SCS210KE2	1,200	1,200	5/10*	22/45*	1.4	5	100	1,200	TO-247		—
SCS220KE2	1,200	1,200	10/20*	42/84*	1.4	10	200	1,200			—
SCS230KE2	1,200	1,200	15/30*	62/124*	1.4	15	300	1,200			—
SCS240KE2	1,200	1,200	20/40*	78/157*	1.4	20	400	1,200			—
SCS210KE2HR	1,200	1,200	5/10*	22/45*	1.4	5	100	1,200			YES
SCS220KE2HR	1,200	1,200	10/20*	42/84*	1.4	10	200	1,200			YES

Note: Package indicates JEDEC code. () denotes ROHM package type. *1 pin/Package

Achieves high efficiency with low noise utilizing an optimized structure

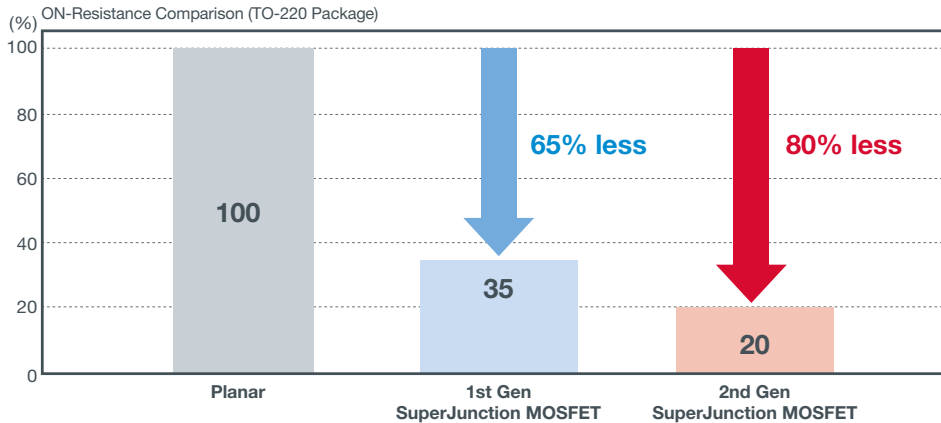
2nd Gen SuperJunction MOSFETs (600V, 650V)

Applications

Power Supply Circuits

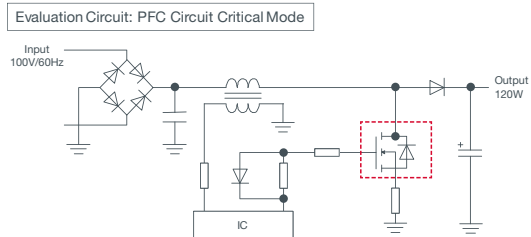
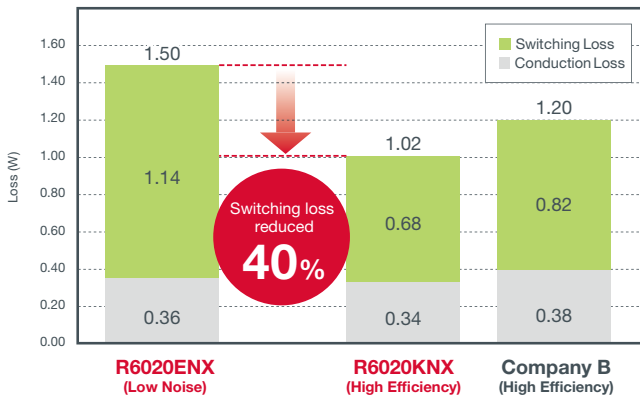
Low ON Resistance

1st Gen and 2nd Gen SuperJunction MOSFETs reduce ON resistance by 65% and 80%, respectively, compared with planar types



Efficiency Evaluation

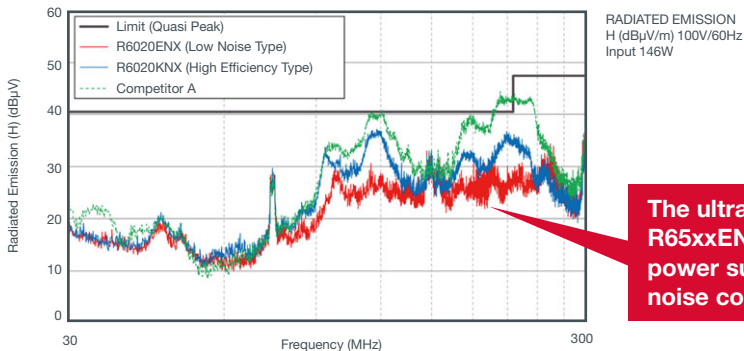
The KN series, specifically designed for high efficiency, features 40% less switching loss than the EN series



The R60xxKNx and R65xxKNx series, capable of high-speed switching, are ideal for power supply circuits demanding low loss and high efficiency

Noise Evaluation





The EN series featuring exceedingly low noise is recommended for circuits requiring noise countermeasures



The ultra-low-noise R60xxENx and R65xxENx series are optimized for power supply circuits requiring noise countermeasures.

Product Lineup







Low Noise type

Package	Applications	Part No.		Polarity (ch)	V _{DS} (V)	I _D (A)	P _D (W) (T _C =25°C)	R _{DS(on)} (Ω)		Q _g (nC) V _{GS} =10V	Drive Voltage (V)
		Part No.	Packaging Symbol					V _{GS} =10V			
								Typ	Max		
TO-252 (DPAK)		R6011END3	TL1	N	600	11	124	0.340	0.390	32	10
		R6009END3	TL1		600	9	94	0.500	0.535	23	10
		R6007END3	TL1		600	7	78	0.570	0.620	20	10
		R6004END3	TL1		600	4	59	0.900	0.980	15	10
		New R6002END3	TL1		600	1.7	26	2.800	3.400	6.5	10
		New R6511END3	TL1		650	11	124	0.360	0.400	32	10
		☆ R6509END3	TL1		650	9	94	0.530	0.585	24	10
		☆ R6507END3	TL1		650	7	78	0.605	0.665	20	10
		☆ R6504END3	TL1		650	4	59	0.955	1.050	15	10
		☆ R6502END3	TL1		650	1.7	24	3.000	3.300	6.5	10
TO-263S (LPTS) [SC-83] (D2PAK)		R6024ENJ	TL	N	600	24	245	0.150	0.165	70	10
		R6020ENJ	TL		600	20	231	0.170	0.196	60	10
		R6015ENJ	TL		600	15	184	0.260	0.290	40	10
		R6011ENJ	TL		600	11	124	0.340	0.390	32	10
		R6009ENJ	TL		600	9	94	0.500	0.535	23	10
		R6007ENJ	TL		600	7	78	0.570	0.620	20	10
		R6004ENJ	TL		600	4	58	0.900	0.980	15	10
		R6524ENJ	TL		650	24	245	0.160	0.185	70	10
		R6520ENJ	TL		650	20	231	0.185	0.205	61	10
		R6515ENJ	TL		650	15	184	0.280	0.315	40	10
		R6511ENJ	TL		650	11	124	0.360	0.400	32	10
		R6509ENJ	TL		650	9	94	0.530	0.585	24	10
		R6507ENJ	TL		650	7	78	0.605	0.665	20	10
		R6504ENJ	TL		650	4	58	0.955	1.050	15	10
		TO-220FM	Switching		R6030ENX	C7 G	N	600	30	86	0.115
R6024ENX	C7 G			600	24	74		0.150	0.165	70	10
R6020ENX	C7 G			600	20	68		0.170	0.196	60	10
R6015ENX	C7 G			600	15	60		0.260	0.290	40	10
R6011ENX	C7 G			600	11	53		0.340	0.390	32	10
R6009ENX	C7 G			600	9	48		0.500	0.535	23	10
R6007ENX	C7 G			600	7	46		0.570	0.620	20	10
R6004ENX	C7 G			600	4	35		0.900	0.980	15	10
R6530ENX	C7 G			650	30	86		0.125	0.140	90	10
R6524ENX	C7 G			650	24	74		0.160	0.185	70	10
R6520ENX	C7 G			650	20	68		0.185	0.205	61	10
R6515ENX	C7 G			650	15	60		0.280	0.315	40	10
R6511ENX	C7 G			650	11	53		0.360	0.400	32	10
R6509ENX	C7 G			650	9	48		0.530	0.585	24	10
R6507ENX	C7 G			650	7	46		0.605	0.665	20	10
R6504ENX	C7 G			650	4	35		0.955	1.050	15	10
TO-3PF				R6035ENZ	C8	N		600	35	102	0.095
		R6030ENZ	C8	600	30		86	0.115	0.130	85	10
		R6024ENZ	C8	600	24		74	0.150	0.165	70	10
		R6020ENZ	C8	600	20		68	0.170	0.196	60	10
		R6015ENZ	C8	600	15		60	0.260	0.290	40	10
		R6535ENZ	C8	650	35		102	0.098	0.115	113	10
		R6530ENZ	C8	650	30		86	0.125	0.140	90	10
		R6524ENZ	C8	650	24		74	0.160	0.185	70	10
		R6520ENZ	C8	650	20		68	0.185	0.205	61	10
		R6515ENZ	C8	650	15		60	0.280	0.315	40	10
TO-247		New R6076ENZ4	C13	N	600	76	735	0.038	0.042	260	10
		New R6047ENZ4	C13		600	47	481	0.066	0.072	145	10
		New R6035ENZ4	C13		600	35	379	0.095	0.102	110	10
		New R6030ENZ4	C13		600	30	305	0.115	0.130	85	10
		New R6024ENZ4	C13		600	24	245	0.150	0.165	70	10
		New R6020ENZ4	C13		600	20	231	0.170	0.196	60	10
		New R6576ENZ4	C13		650	76	735	0.040	0.046	260	10
		New R6547ENZ4	C13		650	47	481	0.070	0.080	145	10
		New R6535ENZ4	C13		650	35	379	0.098	0.115	110	10
		New R6530ENZ4	C13		650	30	305	0.125	0.140	85	10
		New R6524ENZ4	C13		650	24	245	0.160	0.185	70	10
		New R6520ENZ4	C13		650	20	231	0.185	0.205	60	10

Note: Package indicates JEDEC code. () ROHM Package, [] JEITA Code, () General Code.

☆: Under Development






High-Speed Switching type

Package	Applications	Part No.		Polarity (ch)	V _{DS} (V)	I _D (A)	P _D (W) (Tc=25°C)	R _{DS(on)} (Ω)		Q _g (nC) V _{GS} =10V	Drive Voltage (V)
		Part No.	Packaging Symbol					V _{GS} =10V			
								Typ	Max		
TO-252 (DPAK)		R6011KND3	TL1	N	600	11	124	0.340	0.390	22	10
		R6009KND3	TL1		600	9	94	0.500	0.535	16.5	10
		R6007KND3	TL1		600	7	78	0.570	0.620	15	10
		R6006KND3	TL1		600	6	70	0.720	0.830	12	10
		R6003KND3	TL1		600	3	44	1.300	1.500	8	10
		☆R6511KND3	TL1		650	11	124	0.360	0.400	22	10
		☆R6509KND3	TL1		650	9	94	0.530	0.585	16.5	10
		☆R6507KND3	TL1		650	7	78	0.605	0.665	15	10
		☆R6504KND3	TL1		650	4	58	0.955	1.050	10	10
TO-263S (LPTS) [SC-83] (D2PAK)		R6024KNJ	TL	N	600	24	245	0.150	0.165	46	10
		R6020KNJ	TL		600	20	231	0.170	0.196	40	10
		R6015KNJ	TL		600	15	184	0.260	0.290	30	10
		R6011KNJ	TL		600	11	124	0.340	0.390	22	10
		R6009KNJ	TL		600	9	94	0.500	0.535	16.5	10
		R6007KNJ	TL		600	7	78	0.570	0.620	15	10
		R6004KNJ	TL		600	4	58	0.900	0.980	10	10
		R6524KNJ	TL		650	24	245	0.160	0.185	46	10
		R6520KNJ	TL		650	20	231	0.185	0.205	40	10
		R6515KNJ	TL		650	15	184	0.280	0.315	30	10
		R6511KNJ	TL		650	11	124	0.360	0.400	22	10
		R6509KNJ	TL		650	9	94	0.530	0.585	16.5	10
		R6507KNJ	TL		650	7	78	0.605	0.665	15	10
		R6504KNJ	TL		650	4	58	0.955	1.050	10	10
		TO-220FM			R6030KNX	C7 G	N	600	30	86	0.115
R6024KNX	C7 G			600	24	74		0.150	0.165	46	10
R6020KNX	C7 G			600	20	68		0.170	0.196	40	10
R6015KNX	C7 G			600	15	60		0.260	0.290	30	10
R6011KNX	C7 G			600	11	53		0.340	0.390	22	10
R6009KNX	C7 G			600	9	48		0.500	0.535	16.5	10
R6007KNX	C7 G			600	7	46		0.570	0.620	15	10
R6006KNX	C7 G			600	6	40		0.720	0.830	12	10
R6004KNX	C7 G			600	4	35		0.900	0.980	10	10
R6530KNX	C7 G			650	30	86		0.125	0.140	56	10
R6524KNX	C7 G			650	24	74		0.160	0.185	46	10
R6520KNX	C7 G			650	20	68		0.185	0.205	40	10
R6515KNX	C7 G			650	15	60		0.280	0.315	30	10
R6511KNX	C7 G			650	11	53		0.360	0.400	22	10
R6509KNX	C7 G			650	9	48		0.530	0.585	16.5	10
R6507KNX	C7 G			650	7	46		0.605	0.665	15	10
R6504KNX	C7 G			650	4	35		0.955	1.050	10	10
TO-3PF		R6035KNZ	C8	N	600	35	102	0.095	0.102	72	10
		R6030KNZ	C8		600	30	86	0.115	0.130	56	10
		R6024KNZ	C8		600	24	74	0.150	0.165	46	10
		R6020KNZ	C8		600	20	68	0.170	0.196	40	10
		R6015KNZ	C8		600	15	60	0.260	0.290	30	10
		R6535KNZ	C8		650	35	102	0.098	0.115	72	10
		R6530KNZ	C8		650	30	86	0.125	0.140	56	10
		R6524KNZ	C8		650	24	74	0.160	0.185	46	10
		R6520KNZ	C8		650	20	68	0.185	0.205	40	10
		R6515KNZ	C8		650	15	60	0.280	0.315	30	10
		TO-247			New R6076KNZ4	C13	N	600	76	735	0.040
New R6047KNZ4	C13			600	47	481		0.070	0.072	100	10
New R6035KNZ4	C13			600	35	379		0.095	0.102	72	10
New R6030KNZ4	C13			600	30	305		0.115	0.130	56	10
New R6024KNZ4	C13			600	24	245		0.150	0.165	46	10
New R6020KNZ4	C13			600	20	231		0.170	0.196	40	10
New R6576KNZ4	C13			650	76	735		0.040	0.046	165	10
New R6547KNZ4	C13			650	47	481		0.070	0.080	100	10
New R6535KNZ4	C13			650	35	379		0.098	0.115	72	10
New R6530KNZ4	C13			650	30	305		0.125	0.140	56	10
New R6524KNZ4	C13			650	24	245		0.160	0.185	45	10
New R6520KNZ4	C13			650	20	231		0.185	0.205	40	10
TO-220AB		R6535KNX1	C10	N	650	35	102	0.098	0.115	72	10
		R6530KNX1	C10		650	30	86	0.125	0.140	56	10
		R6524KNX1	C10		650	24	74	0.160	0.185	45	10
		R6520KNX1	C10		650	20	68	0.185	0.205	40	10
		R6515KNX1	C10		650	15	60	0.280	0.315	27.5	10

Note: Package indicates JEDEC code. () ROHM Package, [] JEITA Code, () General Code.

☆: Under Development

High-Speed trr type (PrestoMOS™)

Package	Applications	Part No.		Polarity (ch)	V _{DS} (V)	I _D (A)	P _D (W) (T _C =25°C)	R _{DS(on)} (Ω)		Q _g (nC) V _{GS} =10V	trr (Typ) (ns)	Drive Voltage (V)
		Part No.	Packaging Symbol					V _{GS} =10V				
								Typ	Max			
TO-252 (DPAK)		New R6009JND3	TL1	N	600	9	125	0.450	0.585	22	65	15
		New R6007JND3	TL1		600	7	96	0.600	0.780	17.5	60	15
		New R6006JND3	TL1		600	6	86	0.720	0.936	15.5	58	15
		New R6004JND3	TL1		600	4	60	1.100	1.430	10.5	45	15
TO-263S (LPTS) [SC-83] (D2PAK)		New R6020JNJ	TL	N	600	20	252	0.200	0.260	50	85	15
		New R6018JNJ	TL		600	18	220	0.220	0.286	42	80	15
		New R6012JNJ	TL		600	12	160	0.300	0.390	28	70	15
		New R6009JNJ	TL		600	9	125	0.450	0.585	22	65	15
		New R6007JNJ	TL		600	7	96	0.600	0.780	17.5	60	15
		New R6006JNJ	TL		600	6	86	0.720	0.936	15.5	58	15
TO-220FM		New R6004JNJ	TL	N	600	4	60	1.100	1.430	10.5	45	15
		New R6025JNX	C7 G		600	25	85	0.140	0.182	57	90	15
		New R6020JNX	C7 G		600	20	76	0.200	0.260	45	85	15
		New R6018JNX	C7 G		600	18	72	0.220	0.286	42	80	15
		New R6012JNX	C7 G		600	12	60	0.300	0.390	28	70	15
		New R6009JNX	C7 G		600	9	53	0.450	0.585	22	65	15
		New R6007JNX	C7 G		600	7	46	0.600	0.780	17.5	60	15
		New R6006JNX	C7 G		600	6	43	0.720	0.936	15.5	58	15
TO-3PF		New R6004JNX	C7 G	N	600	4	35	1.100	1.430	10.5	45	15
		☆ R6050JNZ	C8		600	50	120	0.064	0.083	120	120	15
		New R6030JNZ	C8		600	30	93	0.110	0.143	75	100	15
		New R6025JNZ	C8		600	25	85	0.140	0.182	65	90	15
TO-247		New R6020JNZ	C8	N	600	20	76	0.180	0.234	50	85	15
		New R6070JNZ4	C13		600	70	770	0.045	0.058	160	135	15
		New R6050JNZ4	C13		600	50	615	0.064	0.083	120	120	15
		New R6042JNZ4	C13		600	42	495	0.080	0.104	100	110	15
		New R6030JNZ4	C13		600	30	370	0.110	0.143	74	100	15
		New R6025JNZ4	C13		600	25	306	0.150	0.195	65	90	15
		New R6020JNZ4	C13		600	20	252	0.180	0.234	45	85	15

Note: Package indicates JEDEC code. () ROHM Package, [] JEITA Code, () General Code.

☆: Under Development

Enables noiseless recovery

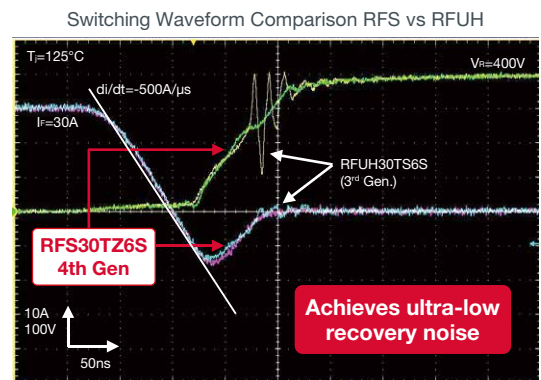
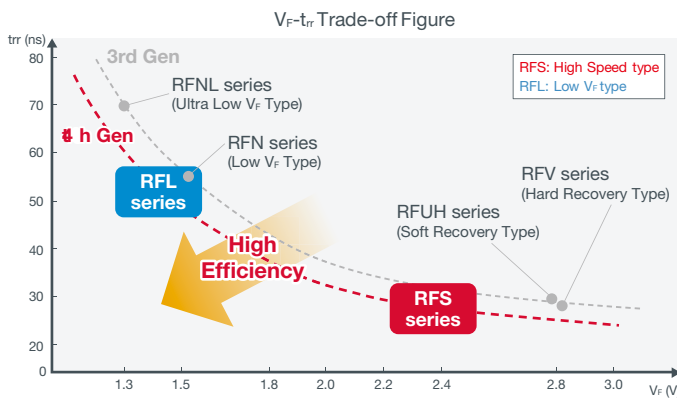
4th Gen Fast Recovery Diodes (RFS/RFL series)

Applications

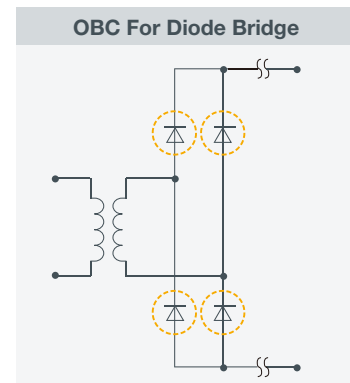
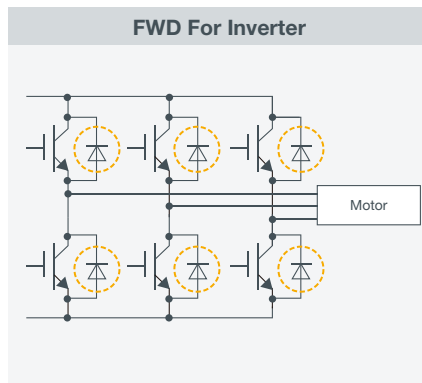
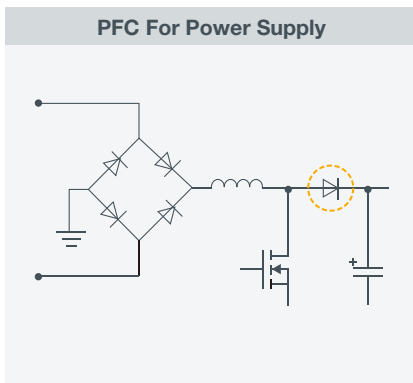
PFC circuits (i.e. AC, servers, UPS), inverter circuits (motors), secondary rectification circuits (e.g. OBC, charging stations)

Provides noiseless recovery operation along with lower V_F at the same recovery speed (t_{rr})

4th Gen products feature noiseless recovery operation. Both the RFS (high-speed t_{rr}) and RFL (low V_F) series are offered.



Application Circuit Examples



Product Lineup

4th Gen Fast Recovery Diodes

Part No.	Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)				Schedule	Package	Equivalent Circuit Diagram
	V_{RM} (V)	V_R (V)	I_o^{*1} (A)	$I_{FSM}(A)^{*2}$ 60Hz, 1 μ s			
RFS20TJ6S	650	650	20	120	Start mass production for consumer and industrial equipment in the second half of 2019	TO-220ACFP	
RFS60TZ6S	650	650	60	180	Start mass production for consumer and industrial equipment in the second half of 2019	TO-247-2L	
RFL60TZ6S	650	650	60	200	Start mass production for consumer and industrial equipment in the second half of 2019		
RFS30TZ6S	650	650	30	160	Start mass production for consumer and industrial equipment in the second half of 2019		
RFL30TZ6S	650	650	30	180	Start mass production for consumer and industrial equipment in the second half of 2019		
RFS30TS6D	650	650	15x2	80	Start mass production for consumer and industrial equipment in the first half of 2020		
RFL30TS6D	650	650	15x2	100	Start mass production for consumer and industrial equipment in the first half of 2020		
RFS60TS6D	650	650	30x2	160	Start mass production for consumer and industrial equipment in the first half of 2020		
RFL60TS6D	650	650	30x2	180	Start mass production for consumer and industrial equipment in the first half of 2020		

Note: Please note that specifications are subject to change without notice during development.
^{*1}The average output current per element is I_o (with one element) or $1/2 I_o$ (with 2 elements).
^{*2}Standard per element.

Expanded characteristics lineup for PFC circuits

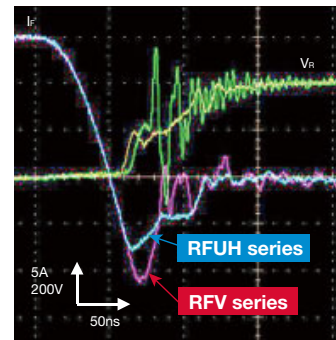
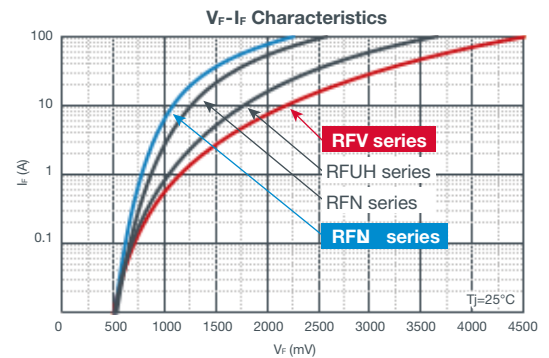
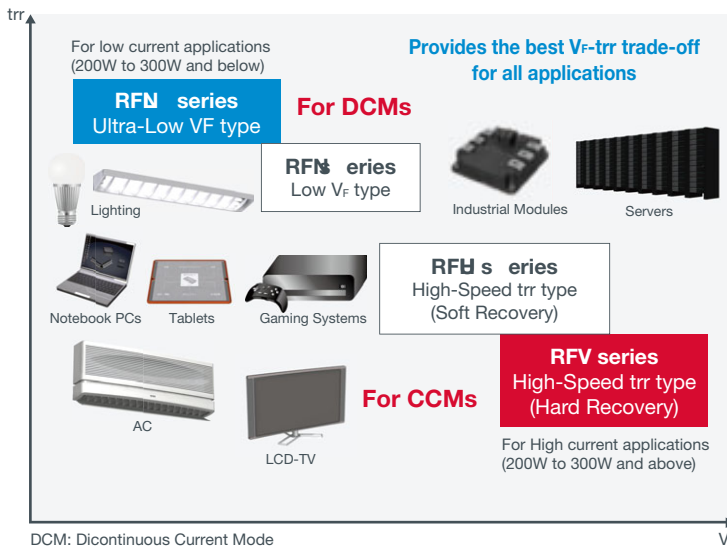
3rd Gen Fast Recovery Diodes (RFNL/RFV series)

Applications

Power supply PFC circuits (e.g. AC, servers, gaming, TVs)

Ultra-high-speed trr and ultra-low V_F types offered

3rd Gen RFV series (ultra-fast trr) and RFNL series (ultra-low V_F) now available



Product Lineup

Part No.				Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)				Electrical Characteristics ($T_J=25^\circ\text{C}$) ²						Package	Equivalent Circuit Diagram	Automotive Grade (AEC-Q101 Qualified)	
Part No.	Product Performance Code Standard Grade Automotive Grade	Packaging Symbol		V_{RM} (V)	V_R (V)	I_{O+1} (A)	I_{FSM} (A) ⁺² 60Hz, 1 τ_{rr}	V_F (V) (Max)	I_F (A)	I_R (μA) (Max)	V_R (V)	trr (ns) (Max)	I_F (A)				I_R (A)
RFNL5BGE6S	*	FH	TL	600	600	5	50	1.3	5	10	600	60	0.5	1	TO-252GE (DPAK)		—
RFNL5BM6	—	FH	TL	600	600	5	50	1.3	5	10	600	60	0.5	1	TO-252 (DPAK)		YES
RFV5BM6	*	FH	TL	600	600	5	60	2.8	5	10	600	20	0.5	1		YES	
RFV8BM6	*	FH	TL	600	600	8	100	2.8	8	10	600	25	0.5	1	YES		
RFNL5TJ6S	G	FHG	C9	600	600	5	50	1.3	5	10	600	60	0.5	1	TO-220ACFP		YES
RFVS8TJ6S	G	—	C9	600	600	8	60	3	8	10	600	20	0.5	1			—
RFV8TJ6S	G	—	C9	600	600	8	100	2.8	8	10	600	25	0.5	1			—
RFNL10TJ6S*3	G	FHG	C9	600	600	10	120	1.25	8	10	600	65	0.5	1			YES
RFV12TJ6S	G	—	C9	600	600	12	120	2.8	12	10	600	25	0.5	1			—
RFV15TJ6S	G	—	C9	600	600	15	150	2.8	15	10	600	30	0.5	1			—
RFNL15TJ6S	G	FHG	C9	600	600	15	160	1.3	15	10	600	65	0.5	1	TO-220AC		YES
RFNL20TJ6S	G	FHG	C9	600	600	20	200	1.3	20	10	600	70	0.5	1		YES	
RFVS8TG6S	G	—	C9	600	600	8	60	3	8	10	600	20	0.5	1	TO-220AC		—
RFV8TG6S	G	—	C9	600	600	8	100	2.8	8	10	600	25	0.5	1			—
RFV12TG6S	G	—	C9	600	600	12	120	2.8	12	10	600	25	0.5	1			—
RFV15TG6S	G	—	C9	600	600	15	150	2.8	15	10	600	30	0.5	1			—
RFV30TG6S	G	—	C9	600	600	30	200	2.8	30	10	600	40	0.5	1	—		

*The Product Performance Code is left blank for standard products. *1 The average output current per element is I_O (with one element) or $1/2 I_O$ (with 2 elements). *2 Standard per element. *3 V_F is guaranteed at the I_F 2 level
Note: Package indicates JEDEC code. () General code.

New series Product Lineup

UDZFV series

Part No. (Standard Grade)	Part No. (Automotive-Grade Product)	Pd (W)	Vz (V)			Iz (mA)	Schedule				MP
			Min	Typ	Max		DS		CS		
							Standard Grade	Automotive-Grade Product	Standard Grade	Automotive-Grade Product	
UDZFVTE-173.6B	UDZFVFHTE-173.6B	0.25	3.6	3.6	3.845	5	OK	—	OK	OK	Summer 2019
UDZFVTE-173.9B	UDZFVFHTE-173.9B		3.89	3.9	4.16	5	OK	—	OK	OK	
UDZFVTE-174.3B	UDZFVFHTE-174.3B		4.17	4.3	4.43	5	OK	—	OK	OK	
UDZFVTE-174.7B	UDZFVFHTE-174.7B		4.55	4.7	4.75	5	OK	OK	OK	OK	
UDZFVTE-175.1B	UDZFVFHTE-175.1B		4.98	5.1	5.2	5	OK	—	OK	OK	
UDZFVTE-175.6B	UDZFVFHTE-175.6B		5.49	5.6	5.73	5	OK	OK	OK	OK	
UDZFVTE-176.2B	UDZFVFHTE-176.2B		6.06	6.2	6.33	5	OK	OK	OK	OK	
UDZFVTE-176.8B	UDZFVFHTE-176.8B		6.65	6.8	6.93	5	OK	—	OK	OK	
UDZFVTE-177.5B	UDZFVFHTE-177.5B		7.28	7.5	7.6	5	OK	—	OK	OK	
UDZFVTE-178.2B	UDZFVFHTE-178.2B		8.02	8.2	8.36	5	OK	—	OK	OK	
UDZFVTE-179.1B	UDZFVFHTE-179.1B		8.85	9.1	9.23	5	OK	—	OK	OK	
UDZFVTE-1710B	UDZFVFHTE-1710B		9.77	10	10.21	5	OK	—	OK	OK	
UDZFVTE-1711B	UDZFVFHTE-1711B		10.76	11	11.22	5	OK	—	OK	OK	
UDZFVTE-1712B	UDZFVFHTE-1712B		11.74	12	12.24	5	OK	—	OK	OK	
UDZFVTE-1713B	UDZFVFHTE-1713B		12.91	13	13.49	5	OK	—	OK	OK	
UDZFVTE-1715B	UDZFVFHTE-1715B		14.34	15	14.98	5	—	OK	OK	OK	
UDZFVTE-1716B	UDZFVFHTE-1716B		15.85	16	16.51	5	OK	OK	OK	OK	
UDZFVTE-1718B	UDZFVFHTE-1718B		17.56	18	18.35	5	OK	OK	OK	OK	
UDZFVTE-1720B	UDZFVFHTE-1720B		19.52	20	20.39	5	OK	—	OK	OK	
UDZFVTE-1722B	UDZFVFHTE-1722B		21.54	22	22.47	5	OK	—	OK	OK	
UDZFVTE-1724B	UDZFVFHTE-1724B	23.72	24	24.78	5	OK	—	OK	OK		
UDZFVTE-1727B	UDZFVFHTE-1727B	26.19	27	27.53	5	—	OK	OK	OK		
UDZFVTE-1730B	UDZFVFHTE-1730B	29.19	30	30.69	5	OK	OK	OK	OK		
UDZFVTE-1733B	UDZFVFHTE-1733B	32.15	33	33.79	5	OK	—	OK	OK		
UDZFVTE-1736B	UDZFVFHTE-1736B	35.07	36	36.87	5	OK	—	OK	OK		

UDZGV series

Part No. (Standard Grade)	Part No. (Automotive-Grade Product)	Pd (W)	Vz (V)			Iz (mA)	Schedule
			Min	Typ	Max		
☆UDZGVTE-173.6B	☆UDZGVFHTE-173.6B	0.4	3.47	3.6	3.73	5	Under Development
☆UDZGVTE-173.9B	☆UDZGVFHTE-173.9B		3.76	3.9	4.04	5	
☆UDZGVTE-174.3B	☆UDZGVFHTE-174.3B		4.17	4.3	4.43	5	
☆UDZGVTE-174.7B	☆UDZGVFHTE-174.7B		4.61	4.7	4.79	5	
☆UDZGVTE-175.1B	☆UDZGVFHTE-175.1B		5	5.1	5.2	5	
☆UDZGVTE-175.6B	☆UDZGVFHTE-175.6B		5.49	5.6	5.71	5	
☆UDZGVTE-176.2B	☆UDZGVFHTE-176.2B		6.08	6.2	6.32	5	
☆UDZGVTE-176.8B	☆UDZGVFHTE-176.8B		6.66	6.8	6.94	5	
☆UDZGVTE-177.5B	☆UDZGVFHTE-177.5B		7.35	7.5	7.65	5	
☆UDZGVTE-178.2B	☆UDZGVFHTE-178.2B		8.04	8.2	8.36	5	
☆UDZGVTE-179.1B	☆UDZGVFHTE-179.1B		8.92	9.1	9.28	5	
☆UDZGVTE-1710B	☆UDZGVFHTE-1710B		9.8	10	10.2	5	
☆UDZGVTE-1711B	☆UDZGVFHTE-1711B		10.78	11	11.22	5	
☆UDZGVTE-1712B	☆UDZGVFHTE-1712B		11.76	12	12.24	5	
☆UDZGVTE-1713B	☆UDZGVFHTE-1713B		12.74	13	13.26	5	
☆UDZGVTE-1715B	☆UDZGVFHTE-1715B		14.7	15	15.3	5	
☆UDZGVTE-1716B	☆UDZGVFHTE-1716B		15.68	16	16.32	5	
☆UDZGVTE-1718B	☆UDZGVFHTE-1718B		17.64	18	18.36	5	
☆UDZGVTE-1720B	☆UDZGVFHTE-1720B		19.6	20	20.4	5	
☆UDZGVTE-1722B	☆UDZGVFHTE-1722B		21.56	22	22.44	5	
☆UDZGVTE-1724B	☆UDZGVFHTE-1724B	23.52	24	24.48	5		
☆UDZGVTE-1727B	☆UDZGVFHTE-1727B	26.33	27	27.68	2		
☆UDZGVTE-1730B	☆UDZGVFHTE-1730B	29.25	30	30.75	2		
☆UDZGVTE-1733B	☆UDZGVFHTE-1733B	32.18	33	33.83	2		
☆UDZGVTE-1736B	☆UDZGVFHTE-1736B	35.1	36	36.9	2		

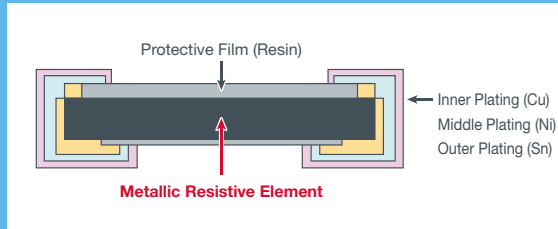
☆: Under Development

Utilizes a special alloy for the resistive element!
Original trimless design prevents heat concentration, reducing surface temperature rise

Ultra-Low Ohmic Metal Plate/General-Purpose type **PMR series**

For Current Detection Notebook PCs HDD Mobile phones Chargers DC/DC Converter Compact battery control Overcurrent detection

Special alloy used for resistive element



Original Trimless Design

Surface Temperature Rise Comparison

ROHM (88.7°C) vs **Other Co.** (98.8°C)

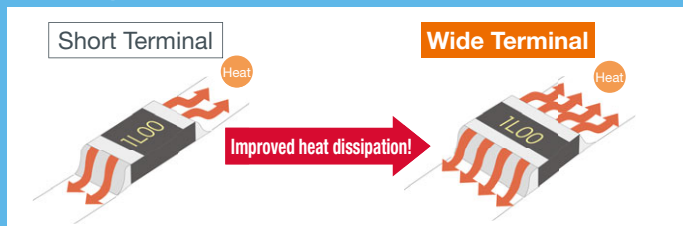
Trimless design prevents heat concentration, **reducing surface temperature rise!**

Size: 6432 Applied Power: 1W ROHM: PMR Other Co: Metal Plate type

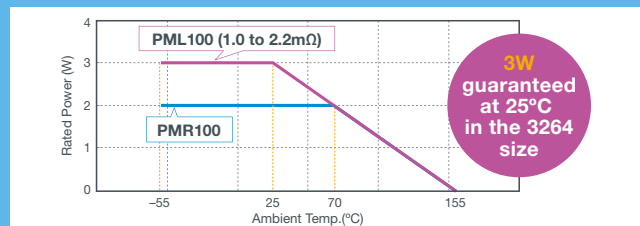
Ultra-Low Ohmic Metal Plate/Wide Terminal type **PML series**

For Current Detection Notebook PCs HDD Mobile phones Chargers DC/DC Converter Compact battery control Overcurrent detection

Wide terminal configuration improves electrode strength and heat dissipation characteristics



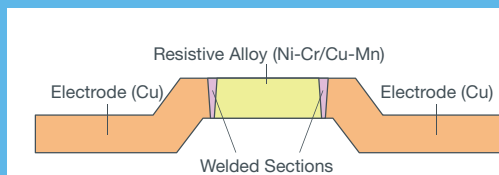
Rated Power Comparison



High heat dissipation structure featuring excellent thermal capacity achieved by joining a resistive metal alloy with thick copper electrodes utilizing original precision welding technology

Ultra-Low Ohmic Metal Plate/High Power type **PSR series**

For Current Detection Automotive (EPS, battery monitoring, etc.) Energy-related (power conditioners) Large appliances (AC, refrigerators)



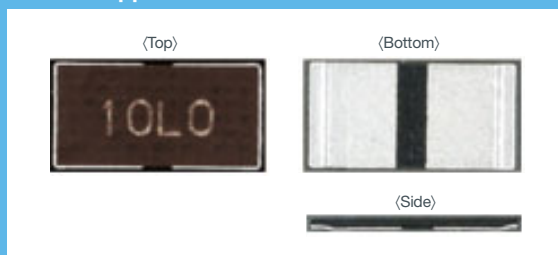
- **High power (3W to 5W class)**
High heat dissipation structure featuring excellent thermal capacity achieved utilizing original precision welding technology to join the resistive metal alloy with thick copper electrodes
- **Ultra-low resistances from 0.1mΩ**
Adopting a high-performance alloy material for the resistive element results in low TCR (Temperature Coefficient of Resistance)-even in the ultra-low resistance region
- **Adopts a convex shape**
Optimized design decreases the distance between the resistive metal and substrate, reducing thermal stress on the substrate

Combining a special alloy with ROHM's proprietary structure ensures low TCR with superior heat dissipation

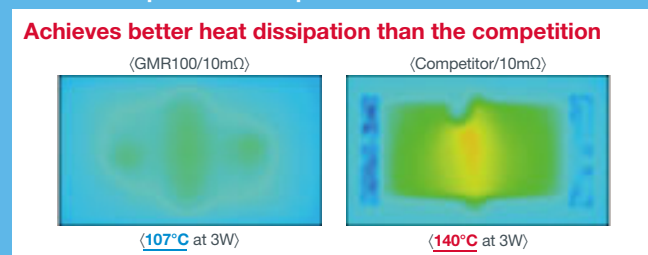
Ultra-Low Ohmic Metal Plate/High Power type **GMR series**

For Current Detection Automotive (ECUs, peripheral motor circuits, etc.) Industrial (general-purpose inverters) Energy storage (power conditioners) Large appliances (AC, refrigerators) Power supplies

External Appearance



Surface Temperature Comparison



Ultra-Low-Ohmic Chip Shunt Resistors (Metal Plate type)								
Part No.	External Appearance	Size mm (inch)	Rated Power (W)	Resistance Tolerance	Resistance Range (mΩ)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)	
PMR01		1005 (0402)	0.2	J (±5%)	10	0 to 200	-55 to +155	
PMR03		1608 (0603)	0.25	J (±5%) F (±1%)	10 (☆5)	0 to 150		
PMR10		2012 (0805)	0.5		2, 3, 4, 5, 6, 7, 8, 9, 10	±150		
PMR18		3216 (1206)	1		1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (☆: 1.2, 2.5)	±100		
PMR25		3225 (1210)	1		1, 2, 3, 4, 5	±100		
PMR50		5025 (2010)	1		1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (☆: 1.2, 1.5, 2.5)	±100		
PMR100		6432 (2512)	2		J (±5%) F (±1%)	1, 2, (☆: 1.5)		±150
						3, 4, 5, 6, 7, 8, 9, 10		±100
			☆3		1, 2	±150	-55 to +170	

Ultra-Low-Ohmic Wide Terminal Shunt Resistors (Metal Plate type)							
Part No.	External Appearance	Size mm (inch)	Rated Power (W)	Resistance Tolerance	Resistance Range (mΩ)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)
PML10		1220 (0508)	0.66	J (±5%) G (±2%)	1.0, 1.5, 2.0, 2.5	±200	-55 to +155
PML18		1632 (0612)	1	J (±5%) G (±2%)	0.5, 1.0, 1.5, 2.0, 2.5	±150	
PML50		2550 (1020)	2	J (±5%)	0.5, 2.2	±200	
PML100		3264 (1225)	2 (3W at 25°C)	J (±5%)	1.0, 1.5, 2.0, 2.2	±100	
			2		0.5	±150	

High Power Ultra-Low-Ohmic Chip Shunt Resistors (Metal Plate type)								
Part No.	External Appearance	Size mm (inch)	Rated Power Tk=70°C (W)	Rated Power Tk=110°C (W)	Resistance Tolerance	Resistance Range (mΩ)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)
PSR100		6432 (2512)	☆ 6	3	F (±1%)	0.3	±150	-55 to +170
						0.5	±115	
						1.0	±100	
						2.0, 3.0	±50	
PSR400		10×5.2 (3921)	☆ 12	4	F (±1%)	☆0.2	125±50	
						0.3, 0.5	±175	
						1.0, 2.0, 3.0	±75	
PSR500		15×7.75 (5931)	☆ 15	5	F (±1%)	☆0.1	200±50	
						0.2	±225	
						0.3, 0.4, 0.5	±150	
						1.0, 2.0	±75	

High Power Ultra-Low-Ohmic Chip Shunt Resistors (Metal Plate type)								
Part No.	External Appearance	Size mm (inch)	Rated Power Tk=70°C (W)	Rated Power Tk=110°C (W)	Resistance Tolerance	Resistance Range (mΩ)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)
GMR50		5025 (2010)	☆ 3	☆ 2	F (±1%)	5, 10 to 220 (E6)	±20 (at +20°C to +60°C)	-55 to +170
GMR100		6432 (2512)	☆ 5	3		5, 10 to 220 (E6) 10/15/20/22/ 33/39/40/47/ 50/56/100/ 220mΩ		
GMR320		7142 (2817)	☆ 7	☆ 5		5, 10 to 100 (E6)		

☆: Under Development

Bottom Electrode Chip Resistors (Thick Film type)			
Part No.	External Appearance	Size mm (inch)	Rated Power (W)
UCR006		0603 (0201)	0.1
UCR01		1005 (0402)	0.125
UCR03		1608 (0603)	0.25
UCR10		2012 (0805)	0.33
UCR18		3216 (1206)	0.5

High Power Wide Terminal Chip Resistors (Thick Film type)			
Part No.	External Appearance	Size mm (inch)	Rated Power (W)
LTR10		1220 (0508)	0.5
LTR18		1632 (0612)	1.0
New LTR50		2550 (1020)	2.0
LTR100		3264 (1225)	2.0
			☆3.0

☆: Under Development

Note: The resistance range of the Exx series will vary depending on the product. Please refer to the datasheet for additional information.

Anti-Surge Chip Resistors ESR series

- Supports higher power than the conventional series, contributing to set miniaturization
- Guaranteed electrostatic breakdown voltage: 2kV to 5kV

High Surge Resistance

■ Standard type

■ Anti-Surge Resistance type

Original resistance pattern significantly improves anti-surge characteristics vs standard products

Wide Terminal Chip Resistors LTR series

- Wide terminal configuration dramatically increases rated power over standard products
- Reducing the distance between electrodes results in superior junction reliability
- Guaranteed 3kV electrostatic breakdown voltage

High Rated Power

	WideTerminal LTR series	Conventional MCR series
Electrode Size	Large	Small
Heat Dissipation to Substrate	Superior	Standard
Rated Power	Excellent	Better

High Surge Resistance Chip Resistors SDR series

- Original resistance pattern and trimming technology significantly improves anti-surge characteristics

Electrostatic Breakdown Test Results

Improved surge resistance

Test Condition	
DC V (Applied Voltage)	3kV
No. of Cycles	±10
C (Capacitor)	100pF
R (Discharge Resistor)	1.5kΩ

Series	MCR series (Standard)	
	Size mm (inch)	
1005 (0402)	MCR01	0.063W
1608 (0603)	MCR03	0.10W
2012 (0805)	MCR10	0.125W
3216 (1206)	MCR18	0.25W
3225 (1210)	MCR25	0.25W
5025 (2010)	MCR50	0.50W
6432 (2512)	MCR100	1.0W

ESR series (High power)		SDR series (High power) (Anti-surge)		LTR series (High power) (Wide terminal)	
ESR01	0.20W	—	—	—	—
ESR03	0.25W	SDR03	0.3W	—	—
ESR10	0.40W	☆ SDR10	0.5W	LTR10	0.25W
ESR18	0.5W	—	—	LTR18	0.75W
ESR25	0.66W	—	—	—	—
—	—	—	—	LTR50	1.0W
—	—	—	—	LTR100	2.0W

☆: Under Development

2nd Gen Anti-Sulfuration Chip Resistors SFR series

Applications: Automotive | Industrial equipment | Communications infrastructure

- Optimized for applications exposed to sulfur-rich environments
- Dramatically improves sulfuration resistance compared to conventional anti-sulfuration products (by more than 3x in ROHM's standard tests)

Anti-Sulfuration Performance

Test Conditions

- Temperature: 110°C
- Sulfur powder: 10g
- Desiccator used
- Criteria: ΔR ≥ 100%

1st Gen Anti-Sulfuration Product Lifetime: 750hrs
SFR series: Over 3000hrs

Structure

Cross Sectional Diagram

① Side Electrode (Ni-Cr) ② Anti-Sulfuration Layer (Resin)

Surge Resistance Chip Resistors (High Reliability type)							
Part No.	External Appearance	Size mm (inch)	Rated Power (W)	Resistance Tolerance	Resistance Range (Ω)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)
ESR01		1005 (0402)	0.2	J (±5%)	1 to 9.1 10 to 10M	+500/-250 ±200	-55 to +155
ESR03		1608 (0603)	0.25	F (±1%)	10 to 2.2M	±100	
				J (±5%)	1 to 10M	±200	
				F (±1%)	1 to 9.76 10 to 10M	±200 ±100	
				D (±0.5%)	10 to 1M	±100	
ESR10		2012 (0805)	0.4	J (±5%)	1 to 30M	±200	
				F (±1%)	1 to 10M	±100	
				D (±0.5%)	10 to 1M	±100	
ESR18		3216 (1206)	0.5	J (±5%)	1 to 15M	±200	
				F (±1%)	1 to 10M	±100	
				D (±0.5%)	10 to 1M	±100	
ESR25		3225 (1210)	0.66	J (±5%) F (±1%) D (±0.5%)	J, F: 1 to 10M D: 10 to 1M	J: ±200 F, D: ±100	
SDR03		1608 (0603)	0.3	J (±5%)	1 to 10M (E24)	±200	-55 to +155
				F (±1%)	1 to 9.76 (E24/96) 10 to 10M (E24/96)	±200 ±100	
				D (±0.5%)	10 to 1M (E24/96)	±100	
☆ SDR10		2012 (0805)	0.5	J (±5%)	1 to 10M (E24)	±200	
				F (±1%)	1 to 9.76 (E24/96) 10 to 10M (E24/96)	±200 ±100	
				D (±0.5%)	10 to 1M (E24/96)	±100	

High Power Wide Terminal Chip Resistors (High Reliability type)							
Part No.	External Appearance	Size mm (inch)	Rated Power (W)	Resistance Tolerance	Resistance Range (Ω)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)
LTR10		1220 (0508)	0.25	J (±5%) F (±1%) D (±0.5%)	1 to 1M (D: 10 to 1M)	J: ±200 F, D: ±100	-55 to +155
LTR18		1632 (0612)	0.75				
LTR50		2550 (1020)	1.0				
LTR100		3264 (1225)	2.0				

High Voltage Resistance Chip Resistors (High Reliability type)								
Part No.	External Appearance	Size mm (inch)	Rated Power (W)	Max. Element Voltage (V)	Resistance Tolerance	Resistance Range (Ω)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)
KTR03		1608 (0603)	0.1	350	J (±5%) F (±1%)	1 to 10M	J: ±200 F: ±100	-55 to +155
KTR10		2012 (0805)	0.125	400		J: 1 to 30M F: 1 to 10M		
KTR18		3216 (1206)	0.25	500		J: 1 to 15M F: 1 to 10M		
KTR25		3225 (1210)	0.33	600		1 to 10M		

Anti-Sulfuration Chip Resistors (High Reliability type)							
Part No.	External Appearance	Size mm (inch)	Rated Power (W)	Resistance Tolerance	Resistance Range (Ω)	Temperature Coefficient of Resistance (ppm/°C)	Operating Temperature (°C)
SFR01		1005 (0402)	0.063	J (±5%)	1 to 9.1 (E24) 10 to 10M (E24)	+500/-250 ±200	-55 to +155
				F (±1%)	10 to 2.2M (E24/96)	±100	
SFR03		1608 (0603)	0.1	J (±5%)	1 to 9.1 (E24) 10 to 10M (E24)	±400 ±200	
				F (±1%)	10 to 10M (E24/96)	±100	
SFR10		2012 (0805)	0.125	J (±5%)	1 to 9.1 (E24) 10 to 10M (E24)	±400 ±200	
				F (±1%)	10 to 2.2M (E24/96)	±100	
New SFR18		3216 (1206)	0.25	J (±5%)	1 to 9.1 to (E24) 10 to 10M (E24)	±400 ±200	
				F (±1%)	10 to 2.2M (E24/96)	±100	
New SFR25		3225 (1210)	0.5	J (±5%)	1 to 1M (E24)	±200	
				F (±1%)	10 to 1M (E24/96)	±100	

Note: E24: Standard Products, E96: Custom Products

☆: Under Development

ROHM Group Locations (Japan)

Sales Offices

Kyoto Nagoya Nishi-Tokyo Utsunomiya
 Tokyo Matsumoto Sendai
 Yokohama Mito Takasaki

Manufacturing Facilities

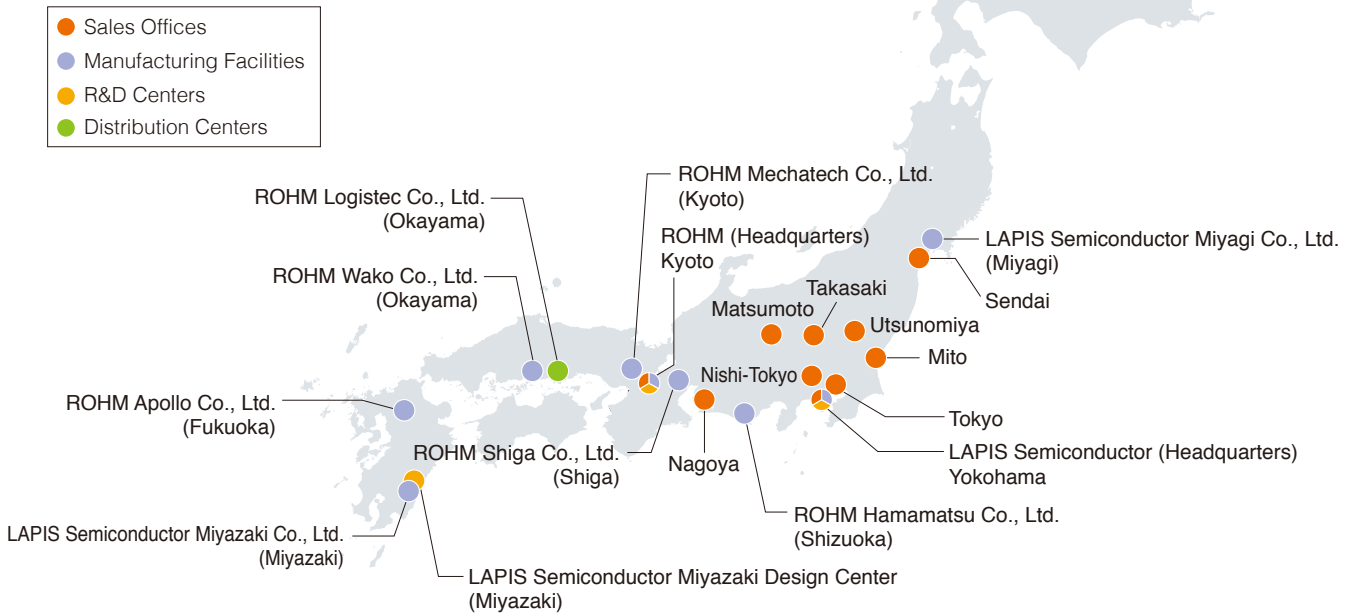
ROHM Co., Ltd.
 ROHM Shiga Co., Ltd.
 ROHM Hamamatsu Co., Ltd.
 ROHM Wako Co., Ltd.
 ROHM Apollo Co., Ltd.
 ROHM Mechatech Co., Ltd.
 LAPIS Semiconductor Co., Ltd.
 LAPIS Semiconductor Miyagi Co., Ltd.
 LAPIS Semiconductor Miyazaki Co., Ltd.

R&D Centers

Kyoto Technology Center (Head Office)
 Kyoto Technology Center (Kyoto Ekimae)
 Yokohama Technology Center
 LAPIS Semiconductor Co., Ltd. (Shin-Yokohama)
 LAPIS Semiconductor Miyazaki Design Center

Distribution Centers

ROHM Logistec Co., Ltd.



ROHM Group Locations (Global)

● Sales Offices

ASIA	ROHM Semiconductor Korea Corporation ROHM Semiconductor Trading (Dalian) Co., Ltd. ROHM Semiconductor Trading (Beijing) Co., Ltd. ROHM Semiconductor (Shanghai) Co., Ltd. ROHM Semiconductor (Shenzhen) Co., Ltd. ROHM Semiconductor Hong Kong Co., Ltd. ROHM Semiconductor Taiwan Co., Ltd. ROHM Semiconductor Singapore Pte. Ltd. ROHM Semiconductor Philippines Corporation ROHM Semiconductor (Thailand) Co., Ltd. ROHM Semiconductor Malaysia Sdn. Bhd. ROHM Semiconductor India Pvt. Ltd.
AMERICA	ROHM Semiconductor U.S.A., LLC
EUROPE	ROHM Semiconductor GmbH

● R&D Centers

ASIA	Korea Design Center Beijing Design Center Shanghai Design Center Shenzhen Design Center Taiwan Design Center India Design Center
AMERICA	America Design Center (Santa Clara)
EUROPE	Europe Design Center Finland Software Development Center ROHM POWERVATION Ltd.

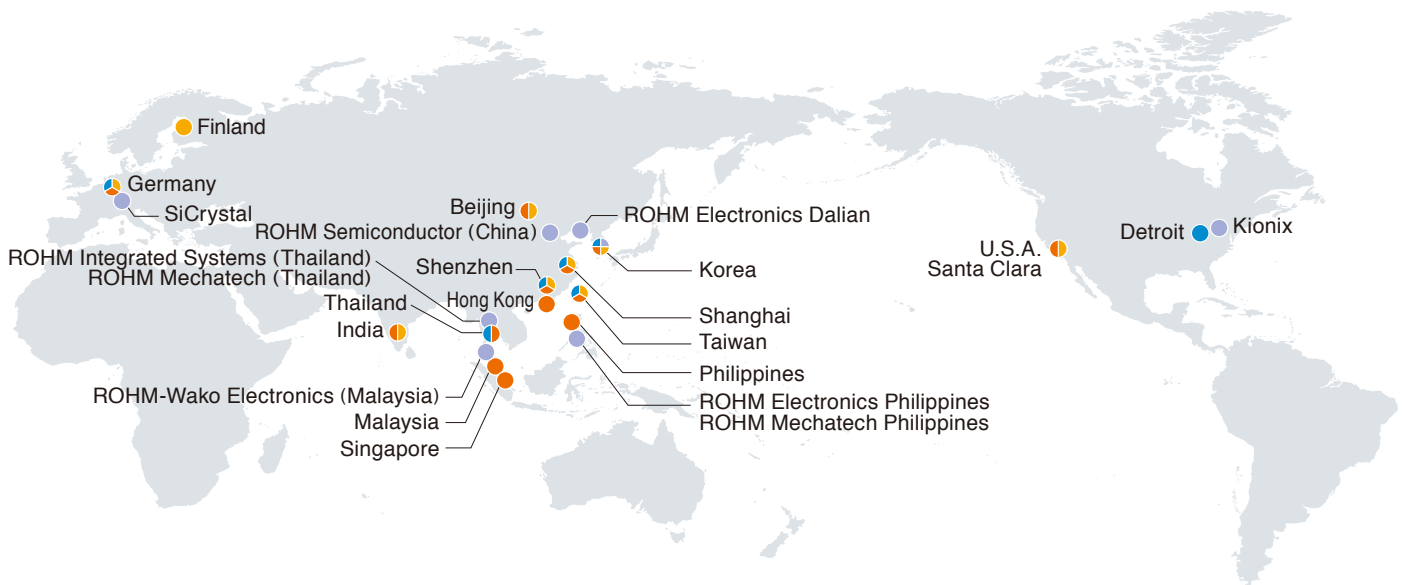
● Manufacturing Facilities

ASIA	ROHM Korea Corporation ROHM Electronics Philippines, Inc. ROHM Integrated Systems (Thailand) Co., Ltd. ROHM Semiconductor (China) Co., Ltd. ROHM Electronics Dalian Co., Ltd. ROHM-Wako Electronics (Malaysia) Sdn. Bhd. ROHM Mechatech Philippines, Inc. ROHM Mechatech (Thailand) Co., Ltd.
AMERICA	Kionix, Inc.
EUROPE	SiCrystal GmbH

● QA Centers

ASIA	Korea QA Center Shanghai QA Center Shenzhen QA Center Taiwan QA Center Thailand QA Center
AMERICA	Americas QA Center
EUROPE	Europe QA Center

● Sales Offices
● Manufacturing Facilities
● R&D Centers
● QA Centers



- 1) The information contained in this document is current as of August 1st, 2019.
- 2) The information contained herein is subject to change without notice. Before you use our Products, please contact our sales representative (as listed below) and verify the latest specifications.
- 3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors. Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. ROHM shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by ROHM.
- 4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.
- 5) The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM or any other parties. ROHM shall have no responsibility whatsoever for any dispute arising out of the use of such technical information.
- 6) The Products are intended for use in general electronic equipment (i.e. AV/OA devices, communication, consumer systems, gaming/entertainment sets) as well as the applications indicated in this document.
- 7) The Products specified in this document are not designed to be radiation tolerant.
- 8) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative: transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.
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