SALES OFFICES

Shindengen Electric Manufacturing Co., Ltd.

www.shindengen.co.jp

Address : New-Ohtemachi Bldg., 2-2-1, Ohtemachi, Chiyoda-ku, Tokyo 100-0004, Japan
TEL : +81-3-3279-4431 (main)
FAX : +81-3-3279-6478
Established : August 16,1949
Capital : ￥17,823,148,008
Main Business : Manufacture and sale of semiconductor products, power supply products and car electronics products
Net Sales : ￥94,703,000,000（FY2018）

Sales Promotion Section, Sales Control Dept.

New-Ohtemachi Bldg., 2-2-1 Ohtemachi, Chiyoda-ku, Tokyo, Japan 100-0004
TEL: +81-3-3279-4537 FAX: +81-3-3279-4495

Regarding Export Restrictions

Please ask the relevant sales representative for information on export restrictions that may apply to products shown in this catalog before placing an order.

- In the interests of product improvements, details set out in this catalog may be changed without notice.
- Please make sure that the information set out in this catalog is up to date before placing an order.
- Please be sure to read the delivery specifications and instruction manual before using products.
- Printed January 2019

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12th International Automotive Electronics Technology Exhibition

ShinDengen
New power. Your power.

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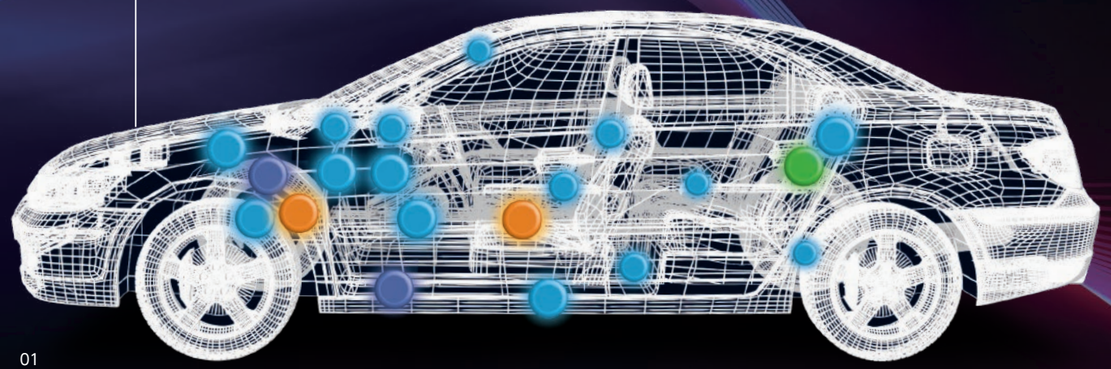
Energy System Products

- Communication Network Compatible 90kW (Dual Output) High Output Quick Chargers
- Wireless Charging Systems

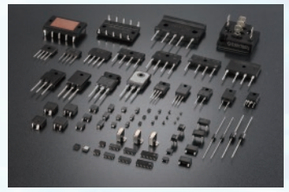


MISSION

Maximizing energy conversion efficiency for the benefit of humanity and society

Power Devices

- Bridge Diodes
- High-speed Rectifier Diodes
- Thyristors
- SIDACs
- Power MOSFETs
- Power ICs
- Power Modules



Car Electronics

- Products for 2-wheel vehicles
- Products for 4-wheel vehicles
- General-purpose products

Energy Systems

- EV/PHEV charger
- PV inverters for photovoltiac generation
- Power storage system
- Rectifier for communication station
- Rectifier for mobile communication base station
- Inverter for communication station
- Monitoring equipment

SUSTAINABLE DEVELOPMENT GOALS

7 AFFORDABLE AND CLEAN ENERGY

Power Devices
Car Electronics
Energy Systems
Wireless Charging Systems

EV/PHEV

Under development

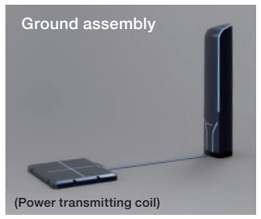
Wireless Charging Systems

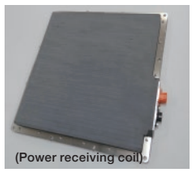
Wireless Charging System(WCS) Ground assembly and vehicle assembly

Current EV and PHEV charging systems require a cable which faces the annoying problem of connector deterioration. The future charging system can be reliable, safe, and very convenient wireless charging. We are developing this type of system.

Overview

If the wireless charging system is installed in an electric vehicle, the electromagnetic field from the power transmitting coil on the ground delivers power to the power receiving coil in the automobile to charge the battery in the vehicle.
Even if the distance between the power transmitting coil and the power receiving coil increases, the electrical power can be transmitted with high efficiency. This system is highly robust against position misalignment and it is suitable for electric vehicles. The battery can be charged just by parking the vehicle over a power transmission coil installed at home or in a parking lot. This system provides dramatically improved convenience.


Ground assembly
(Power transmitting coil)


Vehicle assembly
(Power receiving coil)

Features

- **In the maximum class 11kW power output for passenger vehicles, we are pursuing development in vehicle height space and the industry's largest Z3 class.**
- Various safety controls comforms the industry standard
- Use of semiconductors which are produced in-house allows optimum design and improved performance.

Specifications

【Ground Assembly】	SPEC
Rated input power	7.7kVA (WPT2)/11.1kVA (WPT3)
Linear system/input voltage range	Single-phase 2-wire system, AC180-264V
Z standard	Z1, Z2, Z3 compatible
【Vehicle Assembly】	
Rated output power	7.0kW／10kW
Output voltage	200V～450V
Z standard	Z2,Z3compatible
※ Connection compatibility	Scheduled to conform to IEC 61980 (SAE J2954)


Charging

EV/PHEV/HEV/FCV

Under development

Next Generation 1kW•2kW DC-DC Converters

These isolated DC-DC converter units convert the high DC voltage of an electric vehicle battery to a low DC voltage to supply power to 12V power lines for auxiliary equipment.

Overview

With the evolution of car electronics, the auxiliary power systems of environmentally-friendly vehicles are changing dramatically, including increased power supply for auxiliary devices as well as redundant power supplies in the case of autonomous vehicles.
using easy-to-integrate 1kW and 2kW DC-DC converters allows us to meet the power system needs of a wide range of next-generation environmentally friendly vehicles.

Features

- Compact general-purpose PSUs optimized for the redundant systems of autonomous vehicles
- 1kW Series and 2kW Series can be operated in parallel to achieve higher power levels
- Supports a wide range of input voltage (160–415V), also available in a compact mobility lineup (70–160V)
- 24V output series is also available, with air-cooled, water-cooled, and waterproof models (2kW) to choose from
- Achieves over 90% conversion efficiency (over 93% for the 2kW high efficiency model)
- Supports CAN-FD, Repro, and security systems"

Specifications

SPEC	1kW Series	2kw Series
Input Voltage Range	70～160V,160～415V	90～160V,160～415V
Output Voltage Range, 12V System	10～15.5V	
Output Voltage Range, 24V System	18～32V	
Maximum Output Current, 12V System	75A	150A/200A (instantaneous)
Maximum Output Current, 24V System	40A	100A
Dimensions (WxDxH)	166×100×30mm	160×160×40mm
Weight	830g	1400g/2200g (Waterproof)
Efficiency	90%	93%
Cooling Method	Air Cooled, Water Cooled,	Air Cooled, Water Cooled, Waterproof W/J

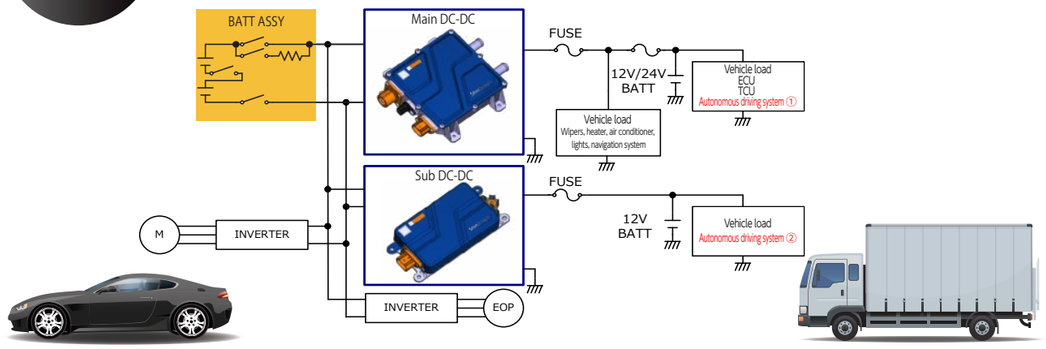
* Note that specifications, appearance etc. are subject to change without prior notice as the products are still under development.

EV/PHEV/HEV/FCV
Power Supply Systems for Vehicle's accessories

●Example Redundant System

Overview

When structuring an autonomous driving system with complete redundancy, it is also necessary to make the auxiliary power supply redundant. Using 1kW and 2kW DC-DC converters make it possible to meet the needs of a wide range of auxiliary power supply systems.



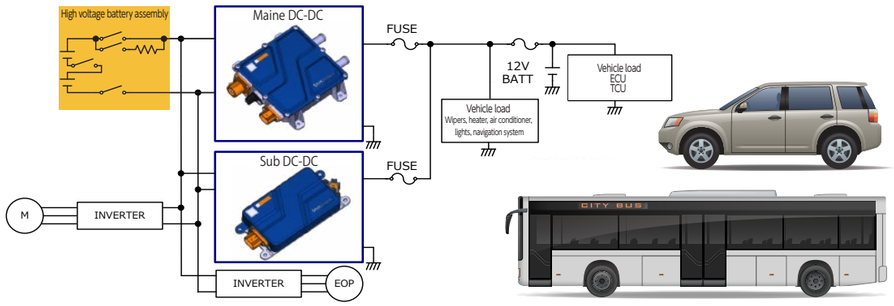
Features

- In this system example, the DC-DC converter and 12V battery are also made redundant to realize a fully redundant autonomous driving system.
- With the ability to be combined with a 24V output DC-DC converter, it can also be used for bus, truck etc. auxiliary power systems.
- Solutions for compact, lightweight, and low-cost redundancy systems are also available.

●Example Large Current System

Overview

With the increasing power load of auxiliary equipment due to the evolution of car electronics, DC-DC converters are also expected to provide high power output. The use of 1kW and 2kW DC-DC converters, which can be operated in parallel, can meet the growing power needs of auxiliary power supply systems.



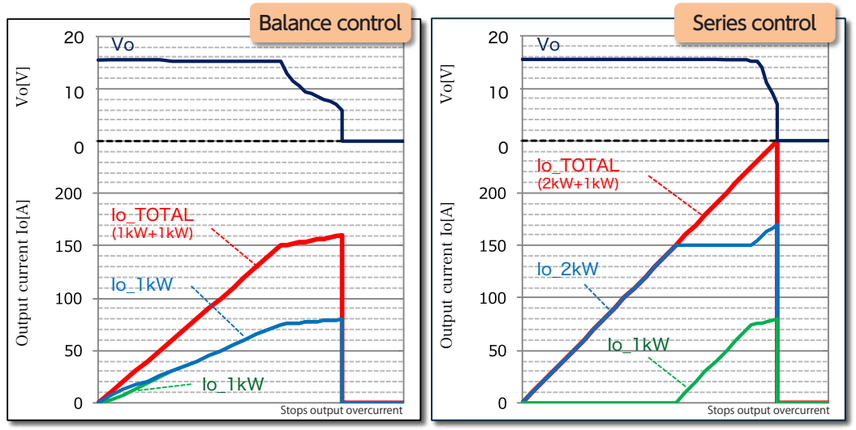
Features

- In this system example, a 1kW DC-DC converter is added via parallel connection as a booster when a heavy current converter is needed.
- By distributing the power for auxiliary equipment, this configuration helps reduce size of the main fuse and wire harnesses to accommodate increased current from the DC-DC converter.

●Output Characteristics in Parallel Operation

Overview

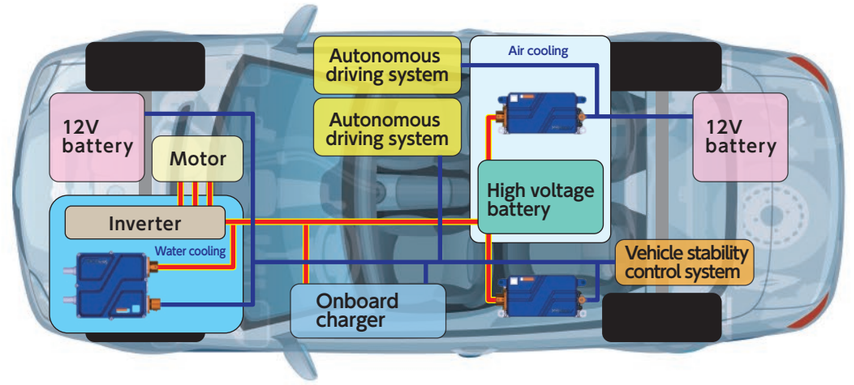
Below shows the characteristics of output voltage during parallel operation when combining 1kW and 2kW. Output current value of two converters can be adjusted to supply power in a well-balanced manner. If load demand exceeds rated power of the main DC-DC, power can then be supplied from the sub DC-DC as a booster.



Features

- Can be flexibly combined according to power requirements of the vehicles 12V power supply system.
- Helps reduce size of the converter by distributing the power system.
- Depending on how often output current is needed, the power supply system can be optimized in combination with an air- or water-cooling solution.

System image



Series development

Series	Input voltage range	Output voltage	Output current	Rating
1kW Series	160V～415V	10～15.5V	67A	1000W
	75V～160V	10～15.5V	50A	750W
	75V～160V	18～32V	40A	1000W
	150～300V	10～15.5V	75A	1100W
2kW Series	70～160V	10～15.5V	120A	1800W
	180～310V	10～15.5V	150A	2200W
	240～415V	10～15.5V	150A	2200W
	240～415V	18～32V	100A	2500W

* Note that specifications, appearance etc. are subject to change without prior notice as the products are still under development.

Communication Network Compatible 90kW (Dual Output) High Output Quick Charger

New Product

Overview

The SDQC2F90 Series is the only charger in Japan with a maximum output of 90kW, providing 1.8 times the output of conventional (50kW) quick charger. This can reduce the charging time of CHAdeMO1.2 certified EVs by about 40% compared to conventional (50kW) chargers, thereby helping eliminate lineups for charger at charging spots which is a growing concern due to the increase of EVs.

CHAdeMO

Features

- New charging standard compatibility: CHAdeMO protocol Rev 1.2 compatible
- Capable of 90kW output, about 1.8 times better than conventional (50kW) chargers
- Compatible with EVs equipped with a large capacity battery
- Multiple outputs: Able to optimally split the 90kW output power to two charging EVs
- IP54 dust and water resistance compliance to deliver outstanding environmental resistance
- Noise: Features low-noise design with power circuits whose technology has been refined in fields that requiring high reliability, such as power supplies for telecommunications carriers
- Convenient functions:

[Charging condition setting function] Charging time, charging rate, and usage time can be set;
[Multilingual Support] (Japanese, English, Chinese)

Specifications

Item	Specs
Model	SDQC2F90UT4415-M
Charging standard	CHAdeMO protocol Rev 1.2 (certified)
Rated input	3-phase 4-wire system, AC415V (±15%), 50/60Hz
Power receiving capacity	97kVA *1
Maximum input current	159kVA *1
Power factor	0.99 or more *2
Output voltage	DC150–450V
Output current	0–200A (maximum per system)
Output power	0–90kW (maximum power of charger)
Conversion efficiency	94% or more *2
Dimensions (WxHxD)	990mm×1,840mm×900mm (excluding protruding parts)
Weight	Approx. 650 kg
Communication network	Nihon Unisys, Ltd. "smartoasis®" *3 Charging infrastructure system service

* 1 Input AC352V, output DC450V/200A at output
* 2 Input AC415V, output DC450V/200A at output
* 3 "smartoasis®" is a registered trademark of Nihon Unisys, Ltd.

High Power/High Density Diodes

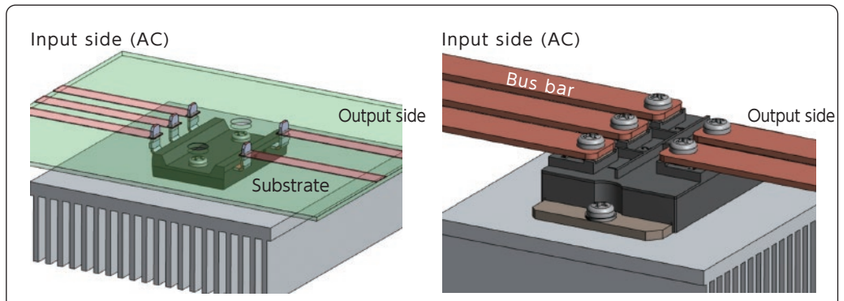
New Product

Overview

Shifting to higher power and density diodes is essential to facilitate to the downsizing of chargers.
We have commercialized compact, large-capacity bridge diodes that are also ideal for use in quick chargers.

Features

- Large current (Rated current: $I_F(AV)$=100–200A)
- High heat dissipation/Isolated type (UL1557 certified)
- Substrate-mountable thin DIP (JH Package)
- Same package height as a standard IGBT module (17 mm, MG038)
- Separated AC-DC type (makes pattern layout easy)



*Scan QR code for more info

Specifications

	Outline (mm)	Equivalent circuit	V_{RM}	$I_F(AV)$	V_F (※)
D100JHT80V	JH 30.0 45.7		800V	100A	1.10V
D100JHT160V			1600V	100A	1.15V
MG038A	MG038 50.0 89.0		800V	200A	1.05V
MG038B			800V	150A	1.05V
MG038C			1600V	200A	1.05V
MG038D			1600V	150A	1.05V

* Per element

Under development | Reference

Power Modules for Driving Large Current Motors

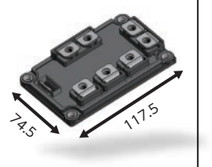
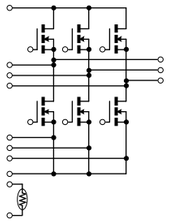
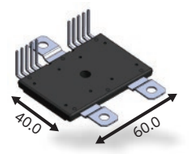
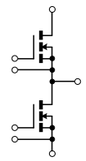
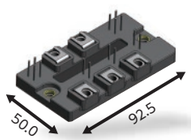
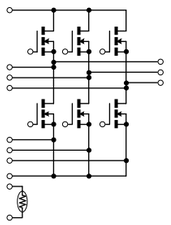
Overview

The shift towards vehicle electrification including mild hybrids, compact cars and motorcycles, is greatly expanding the need for high-current motors. At the same time, there is growing demand for higher current capacity in switching devices for driving motors. Our company is engaged in developing power modules for inverter circuits that drive heavy-duty motors.

Features

- Removes the need for the insulating measures required when using as a discrete component due to being separated from the heat radiating surface
- Eliminates device imbalances that occur when discrete components are connected in parallel
- Achieves a smaller size despite higher power capacity due to exclusively developed elements and a high heat dissipation package
- 1 leg structure improves flexibility for mounting (MG047)
- Can be provided in a semi- or full-custom solution that meets your specific needs

Specifications

	Outline (mm)	Equivalent circuit	Example Characteristics
MG032			●MG032A4207R5A V_{DSS}=75V I_D=420A Ron=0.98mΩmax. ●MG032B420010A V_{DSS}=100V I_D=420A Ron=1.37mΩmax.
MG047			V_{DSS} (or V_{CES}) 100, 200, 750V I_D (or I_C) 500A
MG055			●Specs1 V_{DSS}=100V I_D=400A Ron=1.52mΩtyp. ●Specs2 V_{DSS}=150V I_D=275A Ron=3.5mΩtyp. ●Specs3 V_{DSS}=200V I_D=190A Ron=7.3mΩtyp.

New Product | Under development | Reference

Devices for ECUs

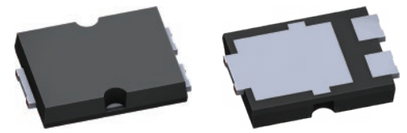
Overview

A wide variety of technologies that realize size and weight reduction are essential for devices that drive vehicle DC-DC converters, electric power steering, and electric oil pumps and other equipment. Our high heat dissipation packaging has earned an outstanding reputation in this field, and we are strongly committed to launching new products that leverage state-of-the-art technology.

Features

Diodes

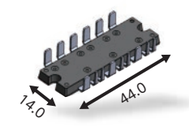
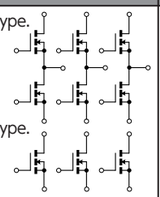
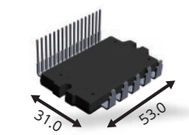
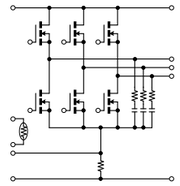
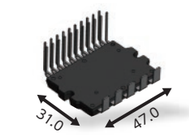
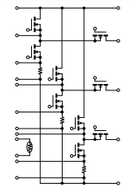
- TO-277A supports the wide current range of previous package types
  TO-252 or TO-263 (I_F (AV) =5–15A)
- Thin type (t=1.1 mm)
- Connection: copper clip + solder
- Based on AEC-Q101



Power Modules

- Extensive range of packages
- Specification lineup is geared towards vehicle-mounted compatibility (specifications vary by product)
  - Tj=175°C guaranteed (MG031)
  - Peripheral circuits (shunt resistor, thermistor, snubber, etc.) are built in to reduce drive circuit size (MG048, MG054)
- Can be provided in a semi- or full-custom solution that meets your specific needs

Specifications

	Outline (mm)	Equivalent circuit	Example Characteristics
MG031		6in1 type.  3in1 type.	●Specs1 VDSS=40V ID=148A Ron=2.2mΩtyp. ●Specs2 VDSS=120V ID=47A Ron=13mΩtyp.など
MG048			●Specs1 VDSS=40V ID=150A Ron=1.02mΩtyp. ●Specs2 VDSS=60V ID=100A Ron=1.55mΩtyp.
MG054			VDSS=40V ID=190A Ron=0.81mΩtyp.

Low Voltage Power MOSFETs
EETMOS Series

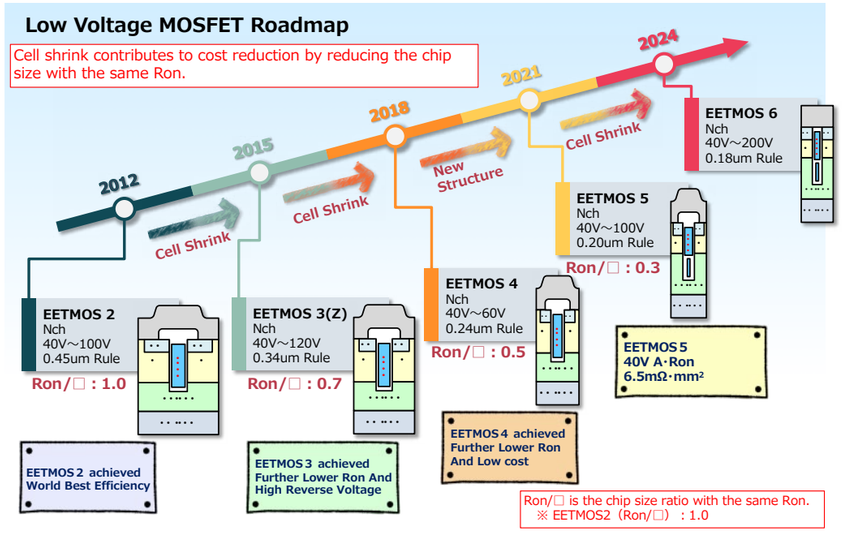
New Product　Under development

Overview

Many power MOSFETs used in electrical products—including various motors, DC-DC converters, and for preventing reversed connections—the demand for smaller sizes, larger currents, and lower noise has intensified.
Our power MOSFETs are ideal for a wide range of applications including motor drives, converters, ECUs and more.

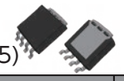
Features

- Achieves low Ron (On-resistance) and low Qg (Gate Charge) through a trench gate structure and optimized layout
- Lineup includes products with medium breakdown voltage (40–120V) necessary for moving to 48V
- New package (LF) structure improves mounting and reliability
- Based on AEC-Q101
- Semi-custom or bare die can also be supplied



Specifications

LF Packages (Similar to MO-235)



	V_{DS}	I_D	Ron(typ)	Qg	
P140LF4QNK	40V	140A	1.22mΩ	96nC	In production
P98LF6QNK	60V	98A	2.6mΩ	96nC	In production

FZ-7p Packages (TO-263SC)

	V_{DS}	I_D	Ron(typ)	Qg	
P240FZ4QNKA	40V	240A	1.07mΩ	133nC	In production
P170FZ6QNKA	60V	170A	1.93mΩ	139nC	under development

* Please see our semiconductor general catalog for the full lineup.

High Voltage Power MOSFETs
VX Series

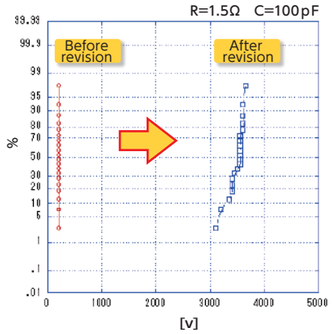
New Product　Under development

Overview

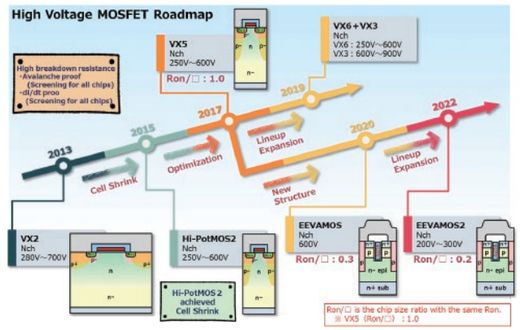
Low loss and high efficiency are required for power MOSFETs that function as switching elements used to convert power from a high voltage vehicle-mounted battery.
Our VX Series realizes high avalanche breakdown, high di/dt breakdown, and high ESD breakdown while lowering on-resistance (Ron) by 20% compared to the previous series.

Features

- High ESD immunity (min. 2kV with HBM)
- Features industry's highest Ron and Qg (planar structure)
- All guaranteed avalanche & di/dt
- Compliant with AEC-Q101
- Customization(faster integrated diode, etc.) is also available upon request



HBM immunity (ex. 900V1A)



Roadmap

Specifications

FE Packages (similar to TO-252AB)

	V_{DS}	I_D	Ron(typ)	Qg	
P6FE25VX5K	250V	6.0A	0.58Ω	10nC	In production
P2FE60VX5K	600V	2.0A	3.4Ω	12nC	In production
P1FE90VX3	900V	1.0A	9.5Ω	10.8nC	In production

FH Packages (TO-263AB-1)

	V_{DS}	I_D	Ron(typ)	Qg	
P3FH90VX3	900V	3.0A	2.8Ω	22nC	under development
P5FH90VX3	900V	5.0A	1.2Ω	41nC	under development

* Please see our semiconductor general catalog for the full lineup.

Reverse Input Protection

Under development

Pch MOSFET V-Diode

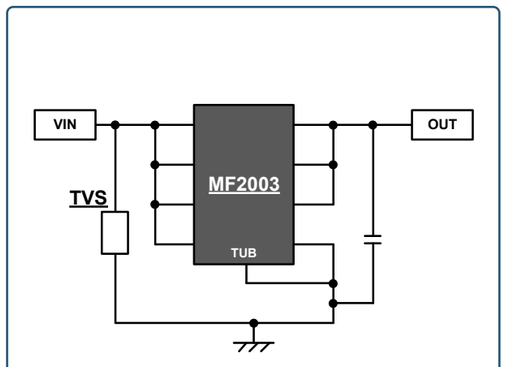
Overview

Due to the increasing capacity of various ECUs, loss due to voltage drop in the rectifier element used to prevent reverse connection/current has become a serious issue.
Our MF2003, equipped with measures to protect from a reversed connection or reverse current on a PchMOSFET, is not only effective in solving the above problems, but also contributes to reducing board size since it can be downsized.

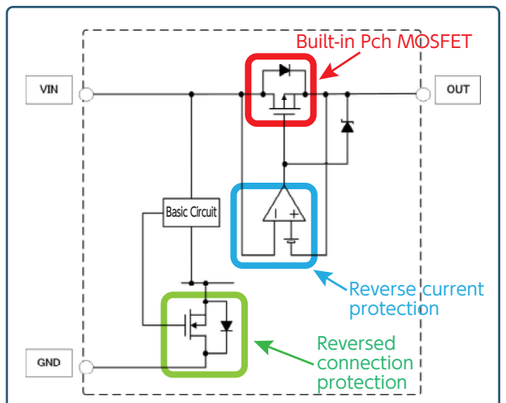
Features

- Product name: MF2003
- Built-in reverse input protection
- Built-in detection of reversed current
- PchMOSFET: Ron=57 mΩtyp.
- Dark current 3μA max.
- Broad input voltage range: 2.5–40V

Reverse Input Protection Application (Ideal Diode Operation)



Internal Block Diagram



Reverse Input Protection

Under development

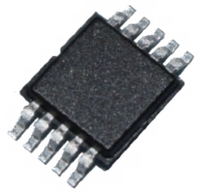
Nch MOSFET Gate Driver IC

Overview

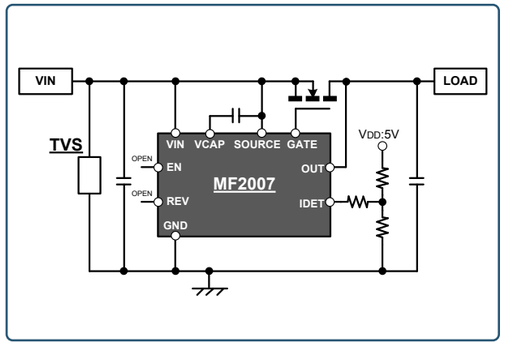
Protects from reversed connections and prevents reverse current when used in combination with any external Nch MOSFET.
The reverse current prevention function can be disabled at the switching terminal to allow use as an ON/OFF switch such as a semiconductor relay that conducts in both directions.
With an absolute maximum rating of 100V, these can also be used for high voltage input applications including 48V batteries.

Features

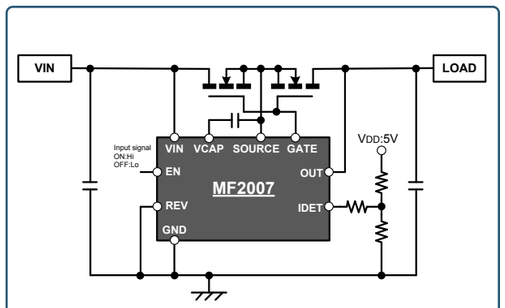
- Product name: MF2007
- Built-in reverse input protection
- Built-in detection of reversed current (can be disabled)
- "Back to Back" NchMOSFET connection is possible
- Broad input voltage range: 3.5–70V



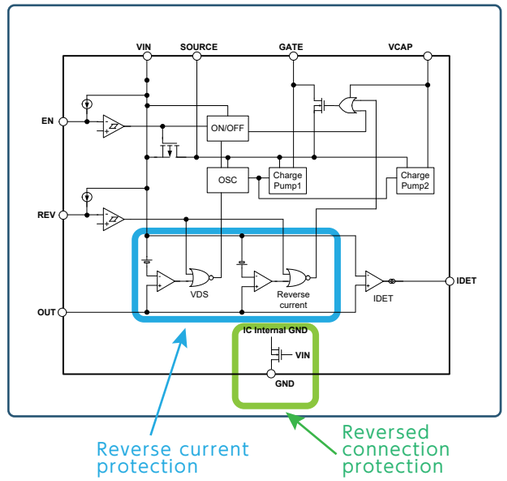
Reverse Input Protection Application (Ideal Diode Operation)



ON/OFF Application



Internal Block Diagram



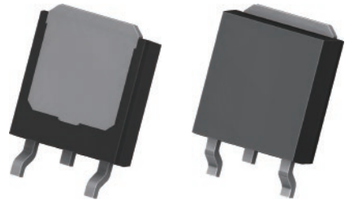
PIN No.	symbol	function
1	OUT	Output pin
2	GATE	External MOSFET Gate pin
3	SOURCE	External MOSFET Source pin
4	VCAP	Capacitor connection pin (For rapid discharge)
5	VIN	Power supply pin
6	EN	Stand-by signal input pin
7	REV	Reverse current protection changing pin
8	NC	Non connection
9	GND	GND pin
10	IDET	External MOSFET VDS output pin

For Surge Protection
TVS Series

New Product | Under development

Overview

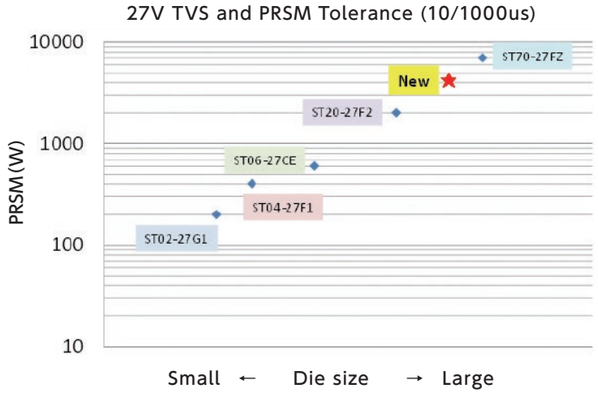
We are working on the productization of a new series for our ever-popular TVS series that will be capable of doubling overcurrent capacity while maintaining the same package size.



Features

- Achieves overcurrent resistance equivalent to TO-262 in a package similar to JEDEC TO-252
- Achieves a thinner 2.3 mm component height
- Can be mounted in a standard TO-252 soldering pattern (conforms to JEITA ED-7500B SC-63 (JEITA TO-252))
- Better durability with a 'copper clip + solder' connection
- Lineup planned to handle operating voltage (V_{BR}) of 27–75V for use with various batteries (12–48V)
- Planned to based on AEC-Q101

Comparison of Package PRSM Tolerances



Specifications

Planned lineup

	Absolute maximum rating				Electrical properties			Compliant with AEC-Q101
	P_{RSM}	T_{stg}	T_j	V_{RM}	V_{BR} min	V_{BR} max	I_R max	
	[W]	[℃]	[℃]	[V]	[V]	[V]	[uA]	
ST40-27FR	4000	-55~175	175	23	24.3	29.7	5	○
ST40-30FR	4000	-55~175	175	24	28.0	32.0	5	○
ST40-33FR	4000	-55~175	175	25	31.0	35.0	5	○
ST40-36FR	4000	-55~175	175	27	34.0	38.0	5	○
ST40-58FR	4000	-55~175	175	45	52.0	64.0	5	○
ST40-68FR	4000	-55~175	175	58	64.4	71.2	5	○
ST40-75FR	4000	-55~175	175	61	70.0	79.0	5	○

Reference

i-Stack/High Current Modules

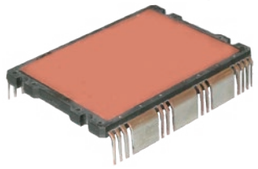
Overview

For our power modules developed for large motor driving inverter circuits, we have adopted a "stack structure" in the laminated structure. This has allowed us to achieved smaller size, better heat dissipation, lower inductance, and lower resistance than with previous module structures. Not only can further miniaturization be realized by mounting on next-generation devices (SiC, GaN, etc.), but these are also suited for high frequency operation due to their low inductance.

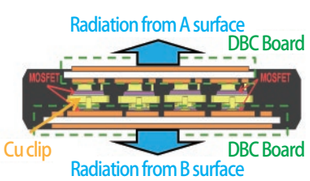
Features

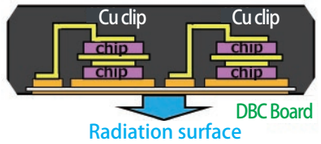
- Features compact size (40–50% smaller than previous product), high heat dissipation, low inductance, and low resistance
- Ideal for high-frequency operation due to its low inductance
- Screw-down terminal structure supports higher currents

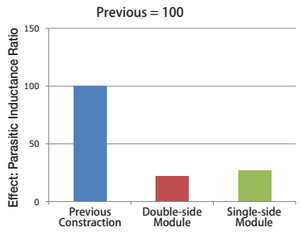
i-Stack module with double-side heat dissipation

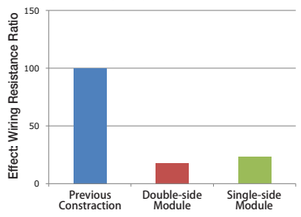


i-Stack module with single-side heat dissipation

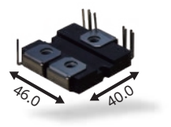
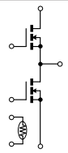
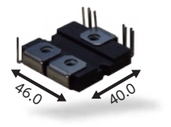
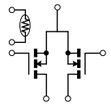
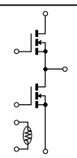








Specifications

	Outline (mm)	Circuit diagram	Example Characteristics
Inverter circuit RD002			V_{DSS}=100V Ron=0.45mΩtyp. I_D=400~500A
Relay circuit RD003			V_{DSS}=100V Ron=0.45mΩtyp. I_D=400~500A
Inverter circuit RD004			V_{DSS}=100V Ron=0.45mΩtyp. I_D=400~500A

Reference

Power Modules (Next generation devices)

Overview

In recent years, next generation devices (SiC and GaN) that do not use silicon have been attracting significant interest due to their benefits of smaller power supplies and better efficiency. While next-generation devices offer high efficiency by reducing switching loss, they are also difficult to use effectively due to their high slew rates.
To solve this, we modularized the basic circuit to not only make it easy to handle, but also make miniaturization and better efficiency of the final equipment much easier to achieve.

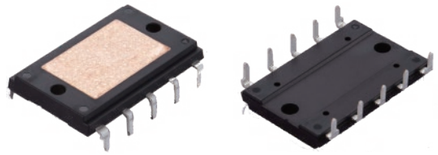
Features

SiC Power Modules (sample availability planned for 2020)

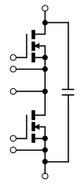
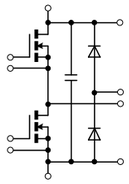
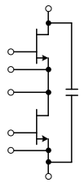
- Realizes miniaturization and large capacity by using an insulating package with a high heat dissipation rate
- Features a totem-pole type bridgeless PFC incorporating our proprietary low VF diodes

GaN Power Modules (sample availability planned for 2019)

- Easy handling is achieved by making the half-bridge a single module
- Realizes miniaturization and large capacity by using an insulating package with a high heat dissipation rate



Specifications

	Type	Circuit diagram	Example Characteristics
SiC	Half-bridge		VDSS=650V Ron=20,52mΩtyp.
	Totem-pole type bridgeless PFC		【SiCMOSFET】 VDSS=650V Ron=52mΩtyp. 【Diodes】 VRM=600V VF=0.87Vtyp.(※)
GaN	Half-bridge		VDSS=650V Ron=50mΩtyp. Vth=1.7Vtyp.

* Per element

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