SALES OFFICES

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Established : August 16,1949
Capital : ¥17,823,148,008 (As of March 31, 2018)
Main Business : Manufacture and sale of semiconductor products, power supply products and car electronics products
Net Sales : ￥92,177,000,000（FY2017）

Sales Promotion Section, Sales Control Dept.

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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 2018

CAT.NO.F80-5e

11th International Automotive Electronics Technology Exhibition

ShinDengen
New power. Your power.

I N D E X

Power Device Products

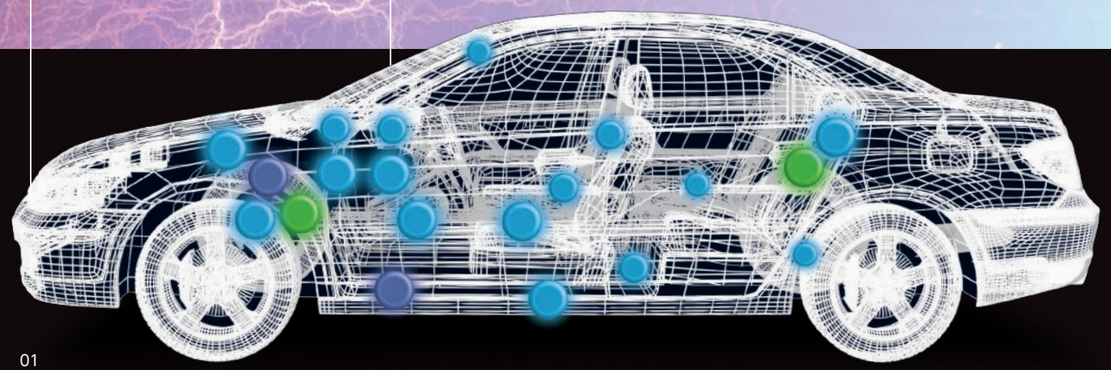
Car Electronics Products

- On-Board Chargers
- DC/DC Converters
- DC/AC Inverters

Energy System Products

- High Power Quick Chargers
- Quick Chargers
- AC Chargers
- Wall Mounted AC Chargers
- Wireless Charging Systems

- FY and FR Packages
- Thyristors
- Low Voltage MOSFETs
- High Voltage MOSFETs
- Power Modules
- Stack Structure Packages
- Reverse-Connection/ Reverse-Current Prevention Low-Loss Devices

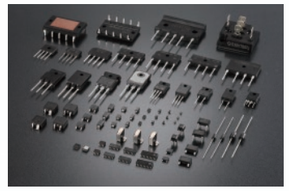


M I S S I O N

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

- Chargers for EV/PHEV (Quick and standard chargers)
- Power conditioners for photovoltaic generation
- Power generation and accumulation systems
- Rectifiers for communication stations
- Rectifiers for mobile communication base stations
- Inverters for communication stations
- Monitoring devices

Downsizing and weight saving

High efficiency of the energy

Realization of the low-carbon society

For environmentally-friendly vehicles (EV/PHEV)

Under development

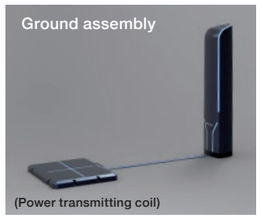
Wireless Charging Systems

Wireless Charging System(WCS) Ground assembly and vehicle assembly

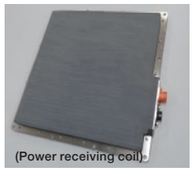
Overview

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.

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.



Vehicle assembly



Features

Super!

- **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】

● 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

Multi-EV simultaneous charging compatible

New Product

High-output Quick Chargers for EVs

Overview

- **New CHAdeMO version**
  CHAdeMO protocol Rev 1.2 compatible
- **High power**
  High-power quick charger can deliver 90 kW which is about twice the power of conventional chargers. This is compatible with vehicles that have a large capacity battery
- **Multiple outputs**
  In addition to being able to charge two vehicles at the same time, charging time is reduced by a charging method that optimally allocates the power output.
- **High efficiency**
  94% or more
- **Outstanding environmental resistance**
  IP54 dustproof and waterproof performance with Heavy-Duty Salt-Resistant paint
- **Lightning protection function**
  Design with strong lighting protection in compliance with IEC61000-4-5 Level-4
- **Noise**
  Use of communication-device power supply technology reduces the effects of noise on equipment installed nearby
- **Convenient functions**
  Charging condition setting function: Charging time, charging rate and usage time can be set
  Language selection function: Japanese, English and Chinese can be selected

Super!

Specifications

● Model	:	SDQC2F series
● Charging standard	:	CHAdeMO protocol Rev 1.2
● Rated input	:	3-phase 4-wire, AC415V, 50/60Hz
● Power receiving capacity	:	97kVA *1
● Power factor	:	0.99 or more *2
● Output voltage	:	DC150V～450V
● Output current	:	0～200A(maximum per system)
● Output power	:	0～90kW(maximum power of charger)
● Dimensions (W×H×D)	:	990㎜×1,840㎜×900㎜(excluding protruding parts)
● Weight	:	Approx. 750kg

*1 At AC352V input, DC430V output and maximum output current
*2 At AC415V input, DC430V output and maximum output current

Communication network-compatible Quick Chargers for EVs

Features

●Built-in communication module
Built-in a communication module to enable provision to EV users of benefits such as authentication and payment services and charger information through smart oasis®.
∗smart oasis® is a registered trademark of Nihon Unisys, Ltd.

●Lightning protection function
Design with strong lightning protection in compliance with IEC61000-4-5 level-4

●Noise
Use of communication-device power supply technology reduces the effects of noise on equipment installed nearby

●Convenient functions
Charging condition setting function:
Charging time and rate can be set
Language selection function:
Japanese, English and Chinese can be selected

●Selectable output capacity ∗only for 3-phase system
Selectable output capacity from 3 types within a range of 20 – 50kW to match the installation environment makes it possible to keep output capacity down and realize low-cost installation.

Specifications

	【 3-phase 】	【 Single-phase 】
●Model:	①SDQC-50-U ②SDQC-30-U ③SDQC-20-U	SDQC-301-U
●Charging standard:	CHAdeMO Protocol rev.0.9 Certified	
●Rated input:	3-phase 3-wire AC200V 50/60Hz	Single phase AC200V 50/60Hz
●Power receiving capacity:	①59kVA or lower ②36kVA ③24kVA	36kVA or lower∗1
●Power factor:	95% or more	
●Output voltage:	DC50V～500V	DC50V～450V
●Output current:	①0～125A ②0～75A ③0～50A	0～75A
●Output power:	①0～50kW ②0～30kW ③0～20kW	0～30kW
●Conversion efficiency:	90% or more	
●Dimensions (W x H x D):	550mm×1,700mm×800mmNot including protuberances	
●Weight:	①Approx.285kg ②Approx.245kg ③Approx.225kg	Approx.245kg
●Place of usage:	Outdoor (waterproof performance IP33)	
●Ambient temperature:	–10°C～40°C∗2	
●Humidity:	30～90%RH	
●Others:	With IC card authentication function/Communication network-compatible (U), stand-alone (not communication-compatible) SDQC-(50/30/20)-S and SDQC-301-S are also available	

∗1: At AC200V input, DC400V output and maximum output current
∗2: Mounting a heater for cold regions enables use even at temperatures of 10°C or lower. (Option available)

Model eligible for Next Generation Vehicle Promotion Center subsidy

Communication network-compatible EV/PHEV AC Chargers

Features

●High quality, high-function power supply
IEC61851/1-compliant charging method JARI A0001 2014 (New JARI standard certified product)

●Communication function
Connectable to smart oasis®
∗smart oasis ® is a registered trademark of Nihon Unisys, Ltd.

●Outstanding environmental resistance
With IP55-compliant dustproof and waterproof performance suitable for outdoor installation (The charging connector is IP44-compliant)
Stainless steel with outstanding anti-corrosive properties is used for the casing.

●High maintainability
The front panel can be opened for ease of maintenance work.

●Security lock
The charging connector is controlled automatically through interlock with user authentication.
IC card authentication, password authentication or non-authentication may be selected for the authentication function.

●Lightning protection function
Design with strong lightning protection in compliance with IEC61000-4-5 level-4

JARI EVSE 認証 http://www.jari-ts.jp/ JAAR 0002

Specifications

●Model:	PM-CS04-U-H1
●Rated voltage:	Single-phase AC200V 50/60Hz
●Rated continuous current:	20A
●Rated current during continuous use:	18A (Charging current to the vehicle)
●Protection function:	Mounted with an electric leakage circuit breaker ∗Stops supply to the vehicle when a leakage current of 15mA or more is detected. Overcurrent detection ∗Mounted with a function that automatically stops supply to the vehicle when the current supplied to the vehicle is 20A or more. Built-in charge coupler auto lock function ∗The lock is disengaged when the user is authenticated.
●Charging method:	Compliant with IEC61851-1, IEC61851-22, SAE J172
●Environmental conditions:	-10°C - 45°C
●Water and dust proofing:	Compliant with JIS C 0920 IP55 (However, the charging connecter is compliant with IP44)
●Dimensions (W x H x D):	230mm×1,520mm×300mm (not including protuberances)
●Weight:	41kg or less
●Charging connector:	Safety standard UL2251-compliant product, compliant with SAE J1772
●Others:	With IC card authentication function/Communication network-compatible (U), stand-alone (not communication-compatible)PM-CS04-S-H1 is also available.

Model eligible for Next Generation Vehicle Promotion Center subsidy

Compact lightweight wall-mounted type EV/PHEV AC Chargers

Features

●High quality advanced power supply
IEC61851/1-compliant charging method JARI A0001 2014 (New JARI standard certified product)

●Communication function
Communication function capable of all types of monitoring and controls via a PC.
Capable of recording up to 2,000 items including the charging date, usage time and charged capacity and downloading log files to a PC.

●Outstanding environmental resistance
IP55-compliant dustproof and waterproof performance suitable for outdoor installation (The charging connector is IP44-compliant)
Stainless steel with outstanding anti-corrosive properties is used for the casing.

●High maintainability
The front panel can be opened for ease of maintenance work.

●Security lock
The charging connector is controlled automatically through interlock with user authentication.

●Lightning protection function
Design with strong lightning protection in compliance with IEC61000-4-5 level-4

JARI EVSE 認証 http://www.jari-ntu.jp/ JAAR 0002

Specifications

●Model:	PM-CS05-S
●Rated voltage:	Single-phase AC200V 50/60Hz
●Rated continuous current:	20A
●Rated current during continuous use:	18A (Charging current to the vehicle)
●Protection function:	Mounted with an electric leakage circuit breaker ＊Stops supply to the vehicle when a leakage current of 15mA or more is detected. Overcurrent detection ＊Mounted with a function that automatically stops supply to the vehicle when the current supplied to the vehicle is 20A or more. Built-in charge coupler auto lock function ＊The lock is disengaged when the user is authenticated.
●Charging method:	IEC61851-1
●Environmental conditions:	-10°C - 45°C
●Water and dust proofing:	Compliant with JIS C 0920 IP55 (However, the charging connecter is compliant with IP44)
●Dimensions (W x H x D):	300mm× 655mm× 225mm (not including protuberances)
●Weight:	22kg or less
●Charging connector:	Electrical Materials and Appliances Safety Act (PSE) compliant product, compliant with SAE J1772
●Lightning protection function:	IEC61000-4-5 level-4 compliant
●Others:	With IC card authentication function

Model eligible for Next Generation Vehicle Promotion Center subsidy

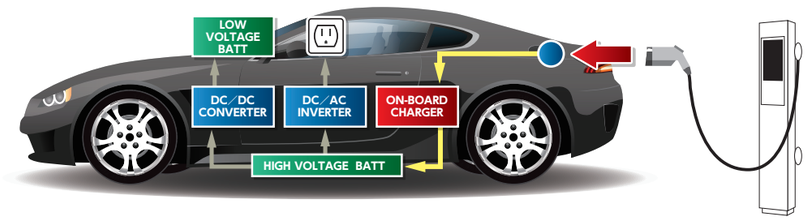
On-Board Chargers for environmentally-friendly vehicles (PHEV/EV)

Under development

Overview

On-board charger for environmentally-friendly vehicles (EV/PHEV) is an isolated AC/DC converter that converts commercial power supply (AC100/200V) with high efficiency to charge a high voltage battery.

Environmental concerns such as global warming, air pollution and resource depletion are driving development of vehicles which have excellent environmental performance.
This product is an on-board normal charger for PHEV and EV environmentally-friendly vehicles. It converts electricity from household electrical power to charge a lithium ion or other type of high voltage battery.



On-board charger system configuration image diagram

Features

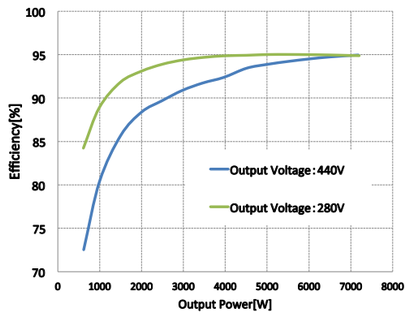
Super!

●Compact size and high efficiency are realized by use of an interleaved bridgeless PFC circuit and LLC soft-switching circuit

●Full digital control allows optimum power control and safe design and communication with a top class ECU

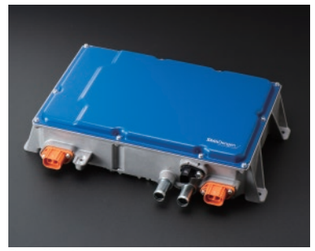
●By using semiconductors and windings which are manufactured in-house, optimum design becomes possible so that improved performance and cost reduction are realized

●Efficiency characterics (Representaive)



Specifications

●Maximum output power	: 7.2kW
●Input voltage	: 85～264VAC (single-phase)
●Output voltage:	: DC290～410V
●Dimensions (WxDxH)	: 330mm×220mm×82mm
●Power density	: 1210W/ℓ
●Weight	: 7.0kg
●Conversion efficiency	: 95.0%
●Input current limit	: 32A(max) variable by communication
●Cooling method	: Water cooling (water temperature -40 to 65°C)
●Operation-guaranteed temperature	: -40～80°C
●Mounting location	: Inside and outside the vehicle



Specifications and external design are under development and subject to change without notice.

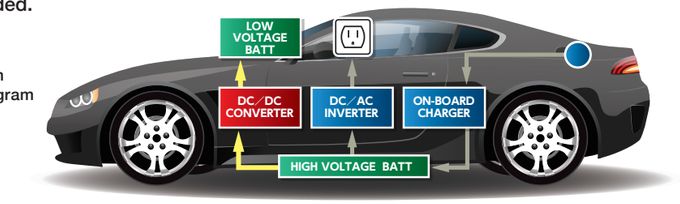
DC/DC Converters for environmentally-friendly vehicles (EV/PHEV/HEV/FCV)

Overview

The DC/DC converter for environmentally-friendly vehicles (HEVs, PHEV, EVs, FCVs) is an insulated type that performs highly-efficient conversion of power from high-voltage batteries (e.g. Rated voltage of 144V, 288V) to power for low-voltage batteries (12V).

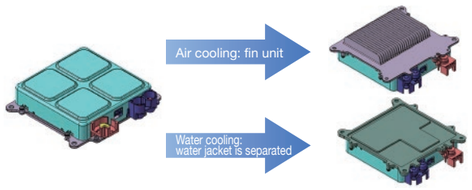
Together with advances in automotive electronics, the electrical power needed by the electrical parts is increasing. The essential parts, such as high voltage battery, inverter and motor, are also increasing so that each new generation of vehicles has higher density. As the power output capacity of the DC/DC converter increase, miniaturization and weight reduction are also demanded.

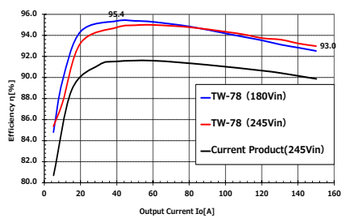
DC/DC converter system configuration image diagram



Features

- Main circuit phase control, auxiliary power supply control, and communication control receive full-digital power supply control by one DSP in order to reduce size and cost.
- Through optimization by semiconductors and windings which are manufactured in-house, the same power output of current products can be obtained with just half the floor area.
- Industry leading maximum efficiency of 95% achieved through using a synchronous rectifier circuit
- **Water cooling or air cooling can be selected by changing the case.** Super!





Efficiency representative characteristics comparison
Vin=180,245V Vo=14.5V Ta=25℃

Specifications

Maximum output power	:	1.9～2.7kW
Input voltage (standard)	:	DC180～310V
Input voltage (derivative specification)	:	Lineup setting within a range of DC90～410V (range of our lineup)
Output voltage	:	DC10.0～15.5V *Variable in 0.1V steps
Maximum output current	:	150A, 175A (Water cooling),
Dimensions (WxHxD)	:	160mmx160mmx40mm
Power density	:	2124W/ℓ
Weight	:	1.4kg
Conversion efficiency	:	94.6% (at Iout=60A)
Control method	:	Full-bridge phase shift secondary synchronous rectification
Communication system	:	CAN2.0 500kbps
Cooling method	:	Air cooling, water cooling (non-waterproof)
Operation-guaranteed temperature	:	-40 - 80°C
Mounting location	:	On-board

DC/AC Inverters for environmentally-friendly vehicles (EV/PHEV/HEV/FCV)

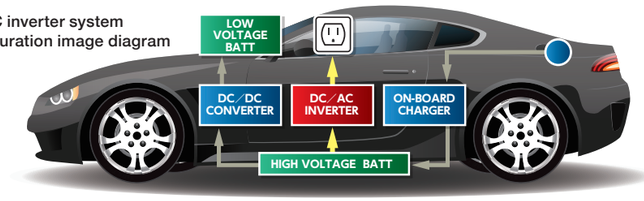
Under development

Overview

This DC/AC inverter generates AC power from the high voltage battery in an environmentally-friendly vehicle (EV/PHEV/HEV/FCV).

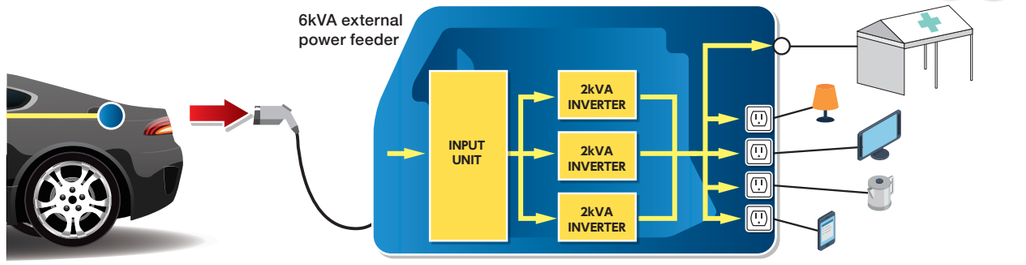
As the number of vehicles with high voltage batteries increases due to market expansion of environmentally-friendly vehicles, the demand for AC power from the high voltage batteries is also increasing, for example in disaster and outdoor use.
By using circuit technology from the inverter for the engine generator, an AC power supply (sine wave) with high quality and excellent overload response capability is generated from the high voltage battery. Super!

DC/AC inverter system configuration image diagram



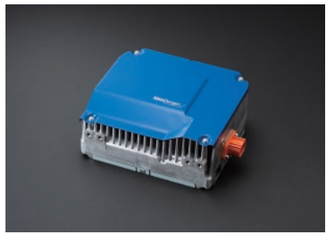
Features

- With a rating of 2kVA, this can be used for loads that require excessive power at startup
- Forced air cooling from a fan is employed so the inverter can be installed in the passenger compartment or trunk.
- **Parallel operation of up to 3units (6kVA) is possible, allowing expansion to external power feeders.** Super!



Specifications

Rated output	:	2kVA
Rated input (standard)	:	DC230～370V
Output voltage	:	AC100/120/225V, 50/60Hz
Output waveform distortion	:	2% max (cos θ=1)
Dimensions (WxDxH)	:	190mmx213mmx86 mm
Weight	:	Approx. 4.0kg
Conversion efficiency	:	90% typ. (2kVA output, cos θ=1)
Cooling method	:	Forced air cooling (internal fan)
Operation-guaranteed temperature	:	-30～65 °C
Mounting location	:	On-board



Specifications and external design are under development and subject to change without notice.

Low voltage 40～150V MOSFET **Under development** **New Product**

EETMOS series

Based on AEC-Q101

Overview

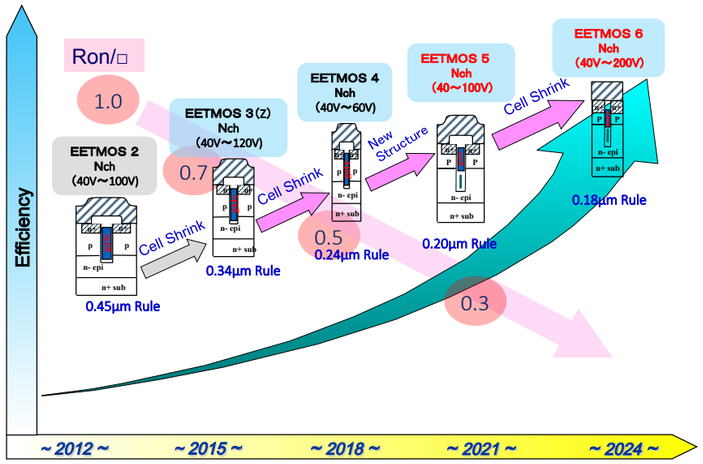
The trench gate structure and layout have been optimized and low Qg has been realized.
Our lineup includes the medium voltage types which are required for the 48V applications.We can also supply bare die from custom specifications.

【Main Applications】
Various motor drives, DC/DC converters, LED related, various ECUs

Features

- Wide range of breakdown voltage variations
- Ultra low Ron (Cu clip products)
- Low Ron and Low Qg (industry top class) from optimum structure

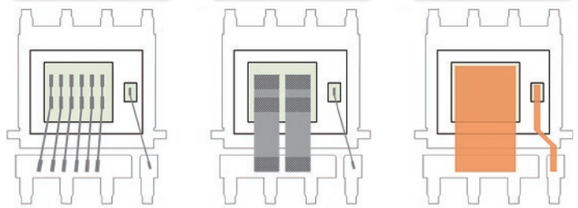
Super!



Specifications

- LF package

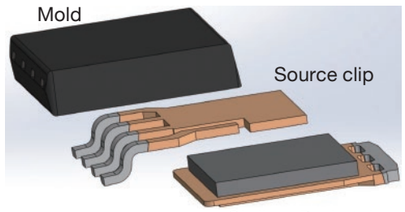
Current mainstream | Also available | Future mainstream



Al wire connection
· Source: Al wire
· Gate: Al wire

Ribbon wire connection
· Source: Ribbon wire
· Gate: Al wire

Cu clip connection
· Source: Cu clip
· Gate: Cu clip



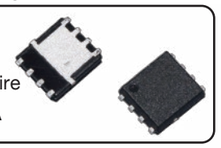
【LF Package products】

Features

- 5x6mm outline (SOP8, HSON package and foot compatibility)
- Gull wing shape terminals relieve stress on the substrate
- Terminals are also plated
- Based on AEC-Q101 (Tch(max)=175°C)
- Increased current capacity (up to 140A) from copper clip connection

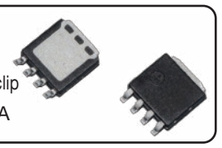
Previos (LD package)

- 5×6 mm size
- Connection: Al wire
- ID(DC): up to 80A



New (LF package)

- 5×6 mm size
- Connection: copper clip
- ID(DC): up to 140A



【Specification Example】

Item	V_{DS}(min)	I_D(max)	Vth(typ)	Ron (typ)	Ron (max)	Ciss(typ)	Status
P105LF4QNK	40V	105A	3.0V	1.8mΩ	2.3mΩ	3540pF	New product
P140LF4QNK	40V	140A	3.0V	1.2mΩ	1.4mΩ	5740pF	
P64LF6QNK	60V	64A	3.0V	4.0mΩ	5.0mΩ	3570pF	
P98LF6QNK	60V	98A	3.0V	2.5mΩ	3.1mΩ	5780pF	
P32LF10SNK	100V	32A	3.0V	14.4mΩ	18.1mΩ	2420pF	
P50LF10SNK	100V	50A	3.0V	8.5mΩ	10.6mΩ	4100pF	
P25LF12SNK	120V	25A	3.0V	21.0mΩ	27.0mΩ	2450pF	
P40LF12SNK	120V	40A	3.0V	12.5mΩ	15.7mΩ	4150pF	

【FZ-7p package products】

Features

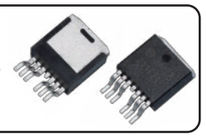
- Improved current capacity (200A or more) by replacing source terminal connection aluminum wire with copper clip
- Based on AEC-Q101 planned(Tch(max)=175°C)

Current products (FP package)

- TO-263Adv
- Connection: Al wire
- ID(DC): up to 180A

New (FZ package)

- TO-263SC
- Connection: Cu clip
- ID(DC): up to 260A



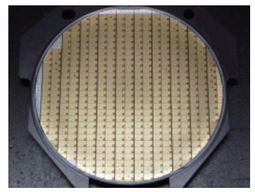
【Specification Example】

Item	V_{DS}(min)	I_D(max)	Vth(typ)	Ron (typ)	Ron (max)	Ciss(typ)	Status
P240FZ4QNKA	40V	240A	3.0V	1.01mΩ	1.27mΩ	8410pF	New product
P260FZ4QNKA	40V	260A	3.0V	0.77mΩ	0.97mΩ	12390pF	
P170FZ6QNKA	60V	170A	3.0V	1.94mΩ	2.50mΩ	8470pF	
P200FZ6QNKA	60V	200A	3.0V	1.40mΩ	1.75mΩ	12490pF	

【Bare Dies】

Features

- Double-side prober enables accurate measurement of Ron (large current 80A(max))
- Inductive load guarantee (80A(max)) and external appearance guarantee
- Breakdown voltage ,chip aspect ratio, gate pad position and other individual design is possible
- Wafers and chips (trays or taping) can be supplied



650V superjunction MOSFET — Under development

EEVAMOS series

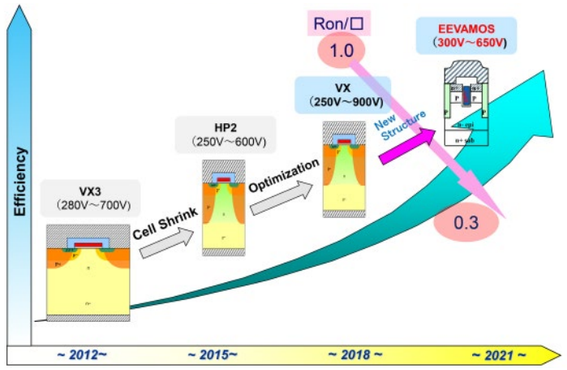
Overview

In order to achieve high efficiency, the on-resistance has been reduced to 1/4 that of our previous products (planar) and high avalanche resistance and high speed have been realized.

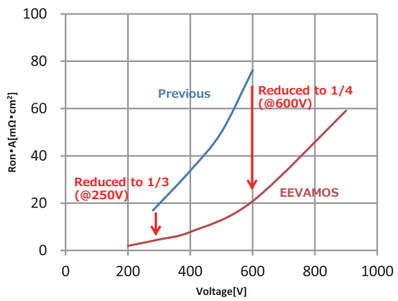
【Main Applications】
Quick chargers, DC/DC converters for EV/HEV, PFC (power factor correction) circuits

Features

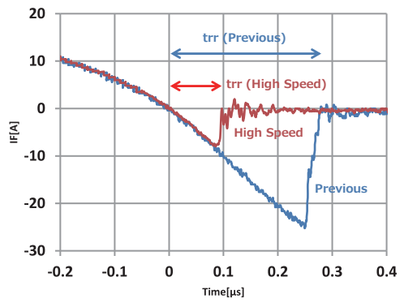
- **Improved ease of use in power supply circuits thanks to a unique noise reduction method and speed up of the body diode** Super!
- **Industry top level Ron and Qg**



【Tradeoff Curve】



【Body diode optimization】



【Specification Example】

Item	V_{DS}(min)	I_D(max)	Ron		Qg(typ)	trr(typ)	Package	Status
			(typ)	(max)				
P20F65EVFK	650V	20A	0.15Ω	0.18Ω	40nC	110ns	FTO-220	Under developments
P30W65EVFK	650V	30A	0.09Ω	0.11Ω	51nC	130ns	MTO-3PV	
P60W65EVFK	650V	60A	0.05Ω	0.06Ω	91nC	150ns	MTO-3PV	

High voltage 250～900V MOSFET — Under development — New Product

VX series

Overview

In order to achieve high efficiency, the on-resistance has been reduced 20% below that of our previous product (VX3 series). High avalanche resistance, high di/dt breakdown, and high ESD resistance have been realized.

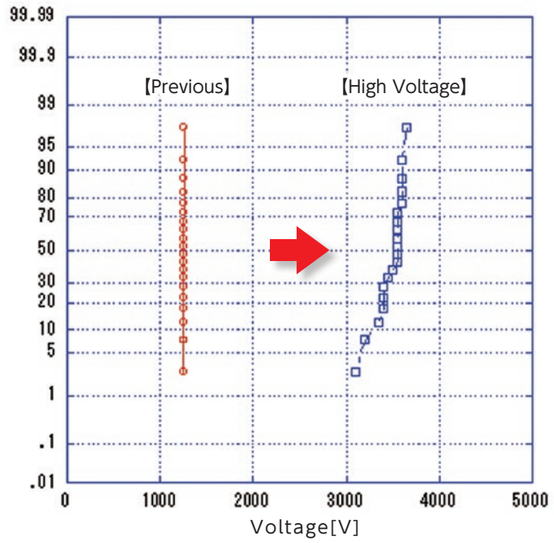
【Main Applications】
Auxiliary power supplies, DC/DC converters, charging and discharging circuits

Features

- Industry top level Ron and Qg (planar products)
- **High ESD immunity (HBM: 2kV or more)** Super!
- Total avalanche guarantee
- **100% di/dt inspection (Shindengen original warranty)**
- Customization such as acceleration of the body diode is acceptable

【ESD resistance (Human Body Model)】

Revising the chip structure greatly improved the ESD resistance (example: P1FE90VX6K).



【Specification Example】

Item	V_{DS}(min)	I_D(max)	Ron		Ciss(typ)	Package	Status
			(typ)	(max)			
P3FE60VX6K	600V	3A	1.85Ω	2.31Ω	388pF	TO-252	Under development
P16FH60VX6K	600V	16A	8Ω	10Ω	2410pF	TO-263	
P16F60VX6K	600V	16A	0.37Ω	0.46Ω	1845pF	FTO-220AG	
P1FE90VX6K	900V	1A	10.5Ω	14Ω	193pF	TO-252	New product
P5FH90VX6K	900V	5A	1.4Ω	2Ω	1400pF	TO-263	Under development
P5F90VX6K	900V	5A	1.4Ω	2Ω	1400pF	FTO-220AG	

Under development | New Product

TO-277A (FY) Package

Overview

For automotive applications, there were strong demands for miniaturization of diodes with IF(AV) = 5A or more.
We have developed a device that matches the large current area, where the TO-252 or TO-263 package only could cover previously, in a compact and thin TO-277A package (in-house name: FY).

Features

- Thin (t=1.1mm)
- High heat dissipation (terminal thickness=0.3mm)
- Connection: Cu clip + solder
- Based on AEC-Q101

Specifications

● Diodes

Category	Item	VRRM	IF (AV)	VF (max)	IR (max)	Status
Ultra low IR SLSBD®	D5FY4R5ST	45V	5A	0.74V	15μA	New product
	D10FY4R5ST	45V	10A	0.74V	30μA	
	D15FY4R5ST	45V	15A	0.74V	40μA	
	D5FY6ST	60V	5A	0.78V	15μA	
	D10FY6ST	60V	10A	0.78V	30μA	
	D15FY6ST	60V	15A	0.78V	40μA	
	D5FY10ST	100V	5A	0.86V	15μA	
	D10FY10ST	100V	10A	0.86V	30μA	
	D15FY10ST	100V	15A	0.86V	40μA	
	D5FY15ST	150V	5A	0.88V	15μA	
	D10FY15ST	150V	10A	0.88V	30μA	
	D15FY15ST	150V	15A	0.88V	40μA	
Low IR SLSBD®	D5FY4R5SY	45V	5A	0.59V	200μA	
	D10FY4R5SY	45V	10A	0.59V	400μA	
	D15FY4R5SY	45V	15A	0.59V	500μA	
	D5FY6SY	60V	5A	0.67V	200μA	
	D10FY6SY	60V	10A	0.67V	400μA	
	D15FY6SY	60V	15A	0.67V	500μA	
	D5FY10SY	100V	5A	0.8V	200μA	
	D10FY10SY	100V	10A	0.8V	400μA	
	D15FY10SY	100V	15A	0.8V	500μA	
General rectifying diode	D10FY60VE	600V	10A	1.00V	10μA	
FRD	D5FY60K	600V	5A	1.50V	10μA	

●TVS (Power Zener) Features: High withstand capacity 2000W (10/1000μs)

Category	Item	VR	VBR	PRSM	IR (max)	Status
TVS	ST20-27FY	23V	25～29V	2000W	5μA	Under development
	ST20-30FY	24V	28～32V	2000W	5μA	
	ST20-33FY	25V	31～35V	2000W	5μA	
	ST20-36FY	25V	34～38V	2000W	5μA	

Under development | New Product

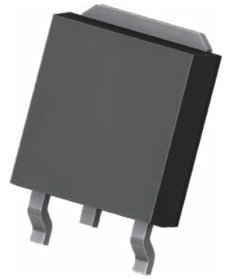
FR Package

Overview

In a size equivalent to TO-252, this package realizes a large current area that was impossible under the previous various constraints.

Features

- Thin (t=2.3mm) (TO-252 is around 2.6mm)
- Can be mounted on TO-252 standard soldering pads
- Connection: Cu clip + solder



Specifications

● Diodes

Category	Item	VRRM	IF (AV)	VF (max)	IR (max)	Status
General rectifying diode	D10FR60V	600V	10A	1.05V	10μA	New product
	D15FR60V	600V	15A	1.05V	10μA	
Ultra low IR SLSBD®	D15FR4ST	40V	15A	0.74V	40μA	
	D20FR4ST	40V	20A	0.74V	60μA	
LowVFSBD	D20FR4R5S	45V	20A	0.55V	2800μA	Under development
Ultra high speed FRD	D10FR60LA	600V	10A	2.1V	10μA	
	D15FR60LA	600V	15A	2.1V	10μA	

Under development | New Product

Thyristors

Overview

〈FR Package〉
Includes a 12A rated chip in a size which is equivalent to the previous TO-252 which was about 5A.

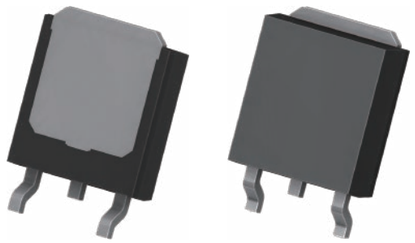
〈JA Package〉
A thyristor and a bridge diode are modularized in our bridge diode package (JA) which realizes space saving and high efficiency.

Features

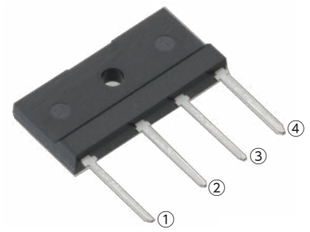
- Miniaturization, thin form, large current
- High heat dissipation

Specifications

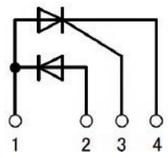
Item	Tj	V_{DRM}	V_{RRM}	$I_{T(AV)}$	I_{GT}	Externals	Status
KC8FR40H	125℃	400V	400V	8A	0.2mA	FR	Under development
KC12FR40	125℃	400V	400V	12A	10mA		
KR12JA40A	125℃	400V	400V	12A	10mA	JA	New product



FR package
(similar to TO-252)



JA package



JA package circuit diagram

Under development | New Product

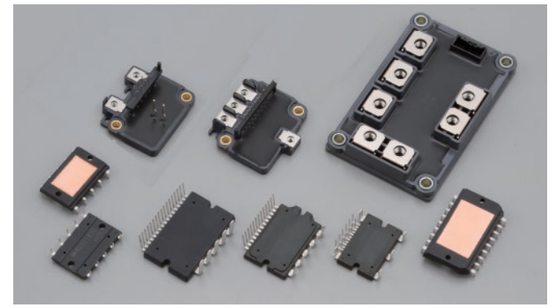
Power Modules (Standard package)

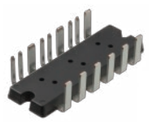
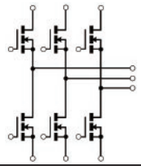
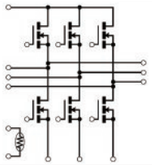
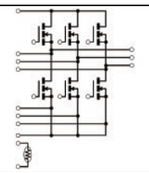
Overview

Starting with an industrial motor-oriented power module in 2014, we have mass-produced modules for automotive use, DC/DC converters, EPS, and EOP. In order to respond to the needs of compact and lightweight in-vehicle devices, we will launch a series of “standard packages” that incorporate high heat dissipation packaging technology.

Features

- Wide range of standard packages
- Semi-custom or full-custom can be accommodated at your request



	MG031	MG035	MG032
Outline			
Circuit diagram (example)			
Insulated/ non-insulated	Non-insulated	Insulated	Insulated
Characteristics (example)	V_{DSS}=40V $R_{DS(ON)}$typ=1.75mΩ I_D=148A	V_{DSS}=40V $R_{DS(ON)}$typ=1.9mΩ I_D=160A	V_{DSS}=100V $R_{DS(ON)}$typ=0.99mΩ I_D=420A
Status	New product	Under development	New product

Under development | Reference

Power Modules(Next generation devices)

Overview

In recent years, next generation devices (SiC and GaN) that do not use silicon are attracting attention due to their value in power supply miniaturization and high efficiency.
Although next-generation devices can realize high efficiency by reducing switching loss, there was a problem in mastering their usage because of the high slew rate.
To solve this, we modularized the basic circuit to make it easy to handle and easy to realize miniaturization and high efficiency in the final equipment.

Features

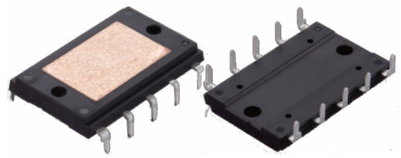
SiC Power Modules

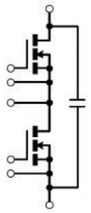
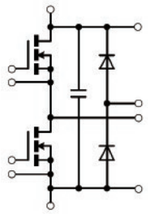
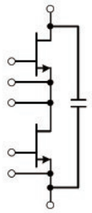
- Realization of miniaturization and large capacity by use of an insulating package with high heat dissipation
- The totem-pole bridgeless PFC incorporates our proprietary low VF diodes

GaN Power Modules

Super!

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



Type	SiC		GaN
	Half-bridge	Totem-pole bridgeless PFC	Half-bridge
Circuit diagram (example)			
Characteristics (example)	V_{DSS}=650V $R_{DS(ON)}$typ =20mΩ,52mΩ	【SiC MOSFET】 V_{DSS}=650V $R_{DS(ON)}$typ=52mΩ 【Diode】 V_{RM}=600V $V_F$typ=0.87V	V_{DSS}=650V $R_{DS(ON)}$typ=50mΩ Vthtyp=1.7V

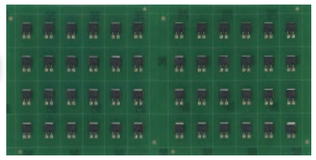
Reference

i-Stack Modules

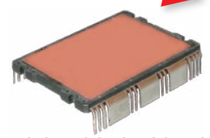
Overview

Many modern devices are multifunctional so miniaturization and high heat dissipation are also required for the power module.
Shindengen is planning the following single-side and double-side heat dissipation structure modules for compact size and high heat dissipation in a trade-off relationship.

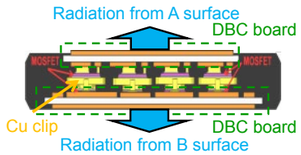
Conventional construction module



Previous discrete device



i-Stack module with double-side heat dissipation Heat dissipation from A side DBC board Connector Heat dissipation from B side

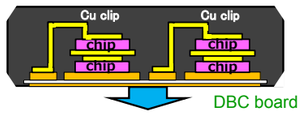


- Stack structure reduces mounting area
- Double-sided heat dissipation structure gives high heat dissipation
- Lower internal resistance and inductance

- Area reduction of about 50%
- About 1/3 the weight and volume

Super!

i-Stack module with single-side heat dissipation Cu clip DBC board Heat dissipating side

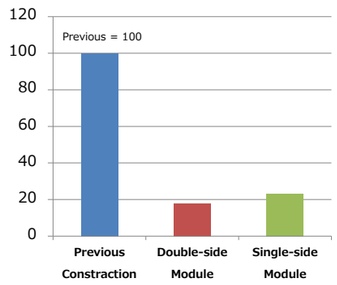


- Stack structure reduces mounting area
- High heat dissipation by a special laminated structure
- Lower internal resistance and inductance

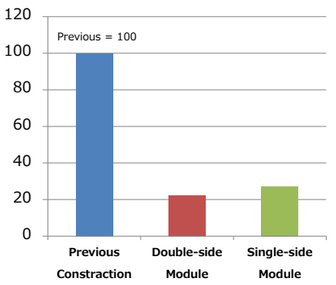
- Area reduction of about 40%
- About 1/3 the weight and volume

Super!

Effect: Wiring Resistance Ratio



Effect: Parasitic Inductance Ratio



Reverse-connection/
Reverse-current prevention low-loss devices

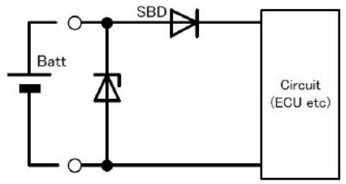
Under development

V-Diode (Pch-MOSFET with reverse-current prevention)
High-side Nch-MOSFET gate driver IC

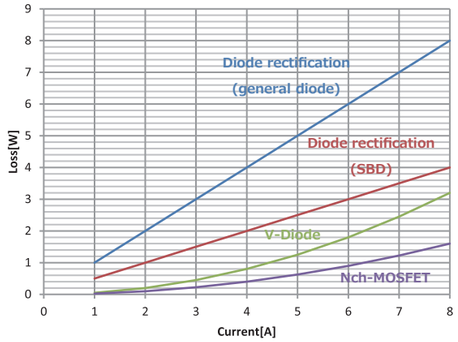
Overview

Advances in automotive electronics in recent years, combined with redundancy functions and increased protection functions, has led to increasing power consumption in ECUs. Because of this, the voltage drop and heat generation in the diode to prevent reverse-connection and reverse-current can no longer be ignored. Shindengen proposes a device that reduces the loss at the terminals for reverse-connection and reverse-current prevention in the unit input, and that reduces heat generation and voltage drop.

Features

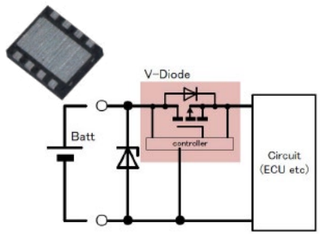


Diode Rectification(Previous)



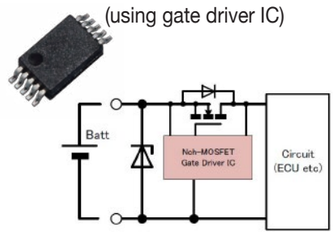
(General Diode：VF=1V、SBD：VF=0.5V、V-Diode：Ron=50mΩ、Nch-MOSFET：Ron=25mΩ)

V-Diode rectification



Absolute maximum rating: 42V
Operating voltage: 2.5–40V
Dark current: ≤ 3μA
Internal reverse-connection/reverse-current prevention
Internal MOSFET Ron: 50mΩ
Package: DFN8

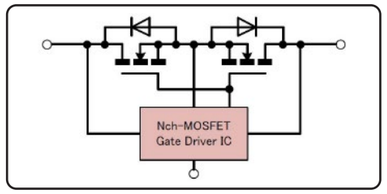
Nch-MOSFET rectification (using gate driver IC)



Absolute maximum rating: 100V
Operating voltage: 3.5 - 70V
Dark current: 3μA (typ.) (with external signal)
Output current: 100μA (min.)
Reverse-connection/Reverse-current prevention
Charge pump: Built-in capacitor (external capacitor available)
Package: VSOP10

【Mechanical Relay Replacement】

This can be used as a driver IC when changing from a mechanical relay to a semiconductor relay.



※V-Diode:Virtual Diode

Shindengen Global Network

Overseas Network

Offices

- Seoul Office

Affiliated Companies

- SHINDENGEN UK LTD.
- SHINDENGEN AMERICA, INC.
- LUMPHUN SHINDENGEN CO., LTD.
- SHINDENGEN PHILIPPINES CORP.
- SHINDENGEN INDIA PVT LTD.
- PT. SHINDENGEN INDONESIA
- SHINDENGEN VIETNAM CO., LTD.
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- SHINDENGEN (THAILAND) CO., LTD.
- SHINDENGEN (H.K) CO.,.
- SHINDENGEN SINGAPORE PTE LTD.
- SHINDENGEN (SHANGHAI) ELECTRIC COMPANY LTD.
- SHINDENGEN LAO CO., LTD.
- NAPINO AUTO & ELECTRONICS LTD.

Domestic Network

Offices

- HEAD OFFICE (Chiyoda-ku, Tokyo)
- OSAKA BRANCH OFFICE
- NAGOYA BRANCH OFFICE
- HAMAMATSU SALES OFFICE
- UTSUNOMIYA SALES OFFICE
- HANNO FACTORY

Affiliated Companies

- AKITA SHINDENGEN CO., LTD.
- HIGASHINE SHINDENGEN CO., LTD.
- OKABE SHINDENGEN CO., LTD.
- SHINDENGEN THREE E CO., LTD.
- SHINDENGEN KUMAMOTO TECHNORESEARCH CO., LTD.
- SHINDENGEN ENTERPRISES CO., LTD.
- SHINDENGEN MECHATRONICS CO., LTD.