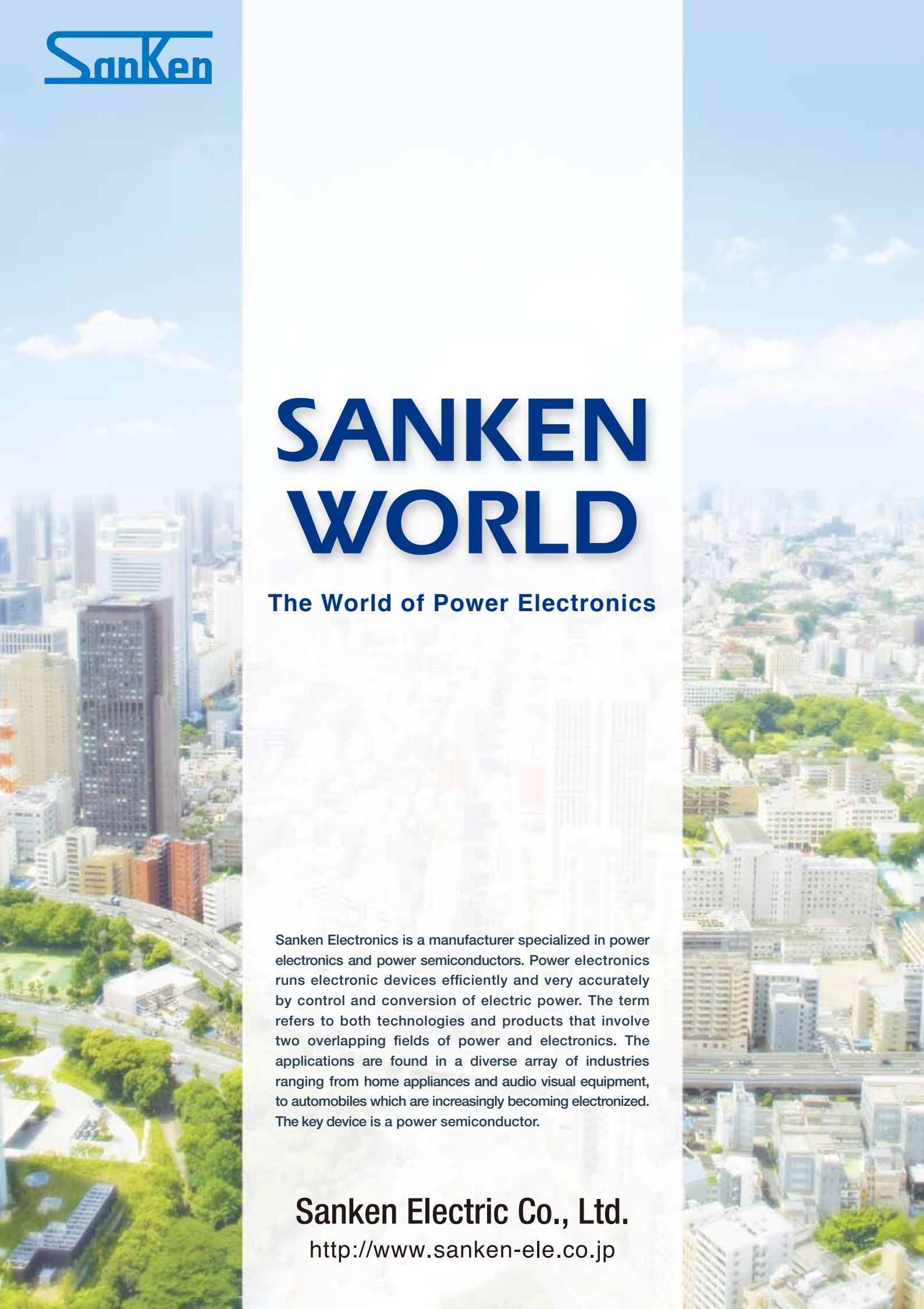


SANKEN WORLD

The World of Power Electronics

Sanken Electronics is a manufacturer specialized in power electronics and power semiconductors. Power electronics runs electronic devices efficiently and very accurately by control and conversion of electric power. The term refers to both technologies and products that involve two overlapping fields of power and electronics. The applications are found in a diverse array of industries ranging from home appliances and audio visual equipment, to automobiles which are increasingly becoming electronized. The key device is a power semiconductor.

Sanken Electric Co., Ltd.
http://www.sanken-ele.co.jp

Electricity generated at a power station cannot be used as is

Hundreds of thousands of volts of electricity generated at power stations are converted into 100V and/or 200V alternating currents (AC) by substations and supplied to households, offices, facilities, and other destinations. These currents are, however, unable to run home appliances and office automation equipment as is. For instance, PCs consist of microcomputers and various other electronic components which run at 3V or 5V direct current (DC). This requires conversion of voltage.
Sanken's power semiconductors and other power electronics products are used to control electric power for a variety of devices and systems including automobiles which are increasingly becoming electronized, air conditioning systems within buildings, and mobile communication base stations.

Main Products from Sanken Electric	
Semiconductors	■Diodes ■Transistors ■Integrated circuits (ICs) ■Current sensors ■Intelligent power modules (IPM) ■Light-emitting diode (LED), etc.
Power supply units and related products	■Switching power units ■AC adapters (chargers) ■Power supplies for flat panel displays (FPD) ■Inverter powers (for use in air-conditioning systems, etc.)
Power supply systems application-specific	■Motor drive inverters ■DC current power supply systems ■Uninterrupted power systems (UPS) ■High-intensity obstruction lights ■LED lighting fixtures and others

Radio towers & Bridges

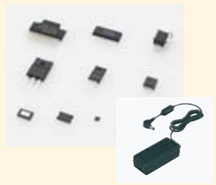
High-intensity obstruction lights

These lights are installed on tall structures required by law to have obstruction lights, such as elevated bridges, chimneys, and other high-rise buildings. These lights are flashing strobe-like and non-stop to ensure safe air navigation.

Offices (office automation equipment)

Devices and power supply units

Motor driver ICs, sensors, and many other devices and power supply units are incorporated into office automation equipment such as printers and scanners, which are becoming more high-functioning, and mobile phones indispensable to daily business operations.

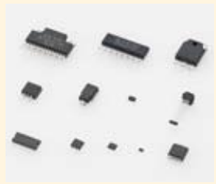


See pages 7 and 8 for more information

Automobiles

Devices

More than 100 semiconductor devices are incorporated into a single automobile, as automobiles are increasingly becoming electronized for maximum fuel efficiency. These include a powertrain control module, which is the brain of the engine control system, and transmission control systems, as well as an antilock brake system (ABS) and high-intensity discharge (HID) lights for driving-safety.

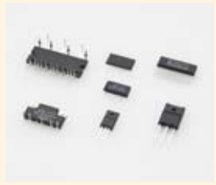


See pages 5 and 6 for more information

Households (home appliances and audio visual equipment)

Devices and power supply units

Various types of devices are incorporated into home appliances such as air-conditioners, wash machines, refrigerators, etc. and solar power generators. At the same time, various types of power supply units are incorporated into a broad range of home appliances and audio visual equipment, including televisions, which are increasingly becoming larger and thinner, and seeking less power consumption power supplies for operations.



See pages 9 and 10 for more information

Factories and warehouses

Motor drive inverters

These inverters are capable of freely controlling the rotation speed of power motors (three-phase induction motors), which run fans, pumps, and transport devices, by controlling voltage and frequency without using mechanical elements such as gears.

Communication base stations

DC power supply systems

These systems supply electric power to mobile phone base stations, various types of mobile communication equipment, and digital broadcast consoles. They consistently deliver a high-quality and high-accuracy stream of DC currents.

Data centers

Uninterrupted power systems (UPS)

These systems constantly deliver a consistent stream of AC current to computers and various types of production facilities. They assist in keeping computers and network systems running reliably when blackouts, voltage fluctuations, and other power source problems occur.

See pages 7 and 8 for more information

Road lights, Streetlights & Room lights

Light-emitting diodes (LED), power supply units, and lighting fixtures

These products deliver a total solution which encompasses a full range of lighting systems from LEDs which are the core of LED lighting systems, of the next generation lighting solutions, as well as LED driver ICs and power sources to lighting fixtures.

See pages 9 and 10 for more information

Power semiconductors control motors and lighting systems and convert electric power. Their characteristic lies in that they handle high voltages and large currents.

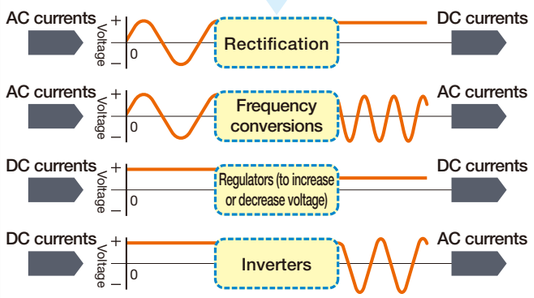
LSIs such as microcomputers and memories are well known semiconductors. These are designed to perform computations and memorization tasks, while power semiconductors control power supplies (electric power) and supply power to run motors, charge batteries, or run microcomputers and LSIs by performing AC to DC conversions, reducing voltage to appropriate operating level such as 5V or 3V.

Power semiconductors
Control and supply electric power.

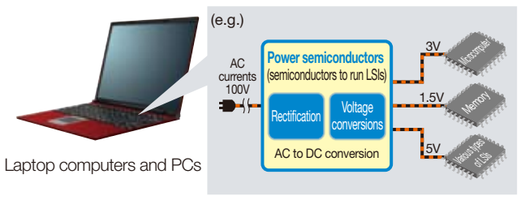
Microcomputers and memories
Perform computations and memorization tasks.

■ Task performed by power semiconductors

Transform electric currents to get electricity more noise-free, accurate and economical.



You can find power semiconductors being used in various products around us.



Laptop computers and PCs

Automobile

Television

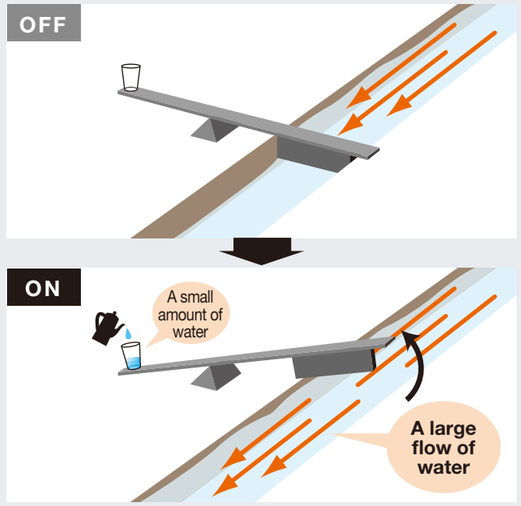
Air conditioner

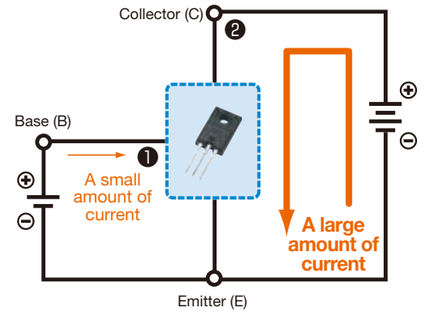
Transistor

Transistors

Able to carry heavy loads with three legs (amplification & switches)

Transistors are elements which are the basis of electronic circuits. They perform amplification and switching operations
Amplification is to convert a small amount of electricity to a large amount of electricity. For instance, the act of turning up the volume of small sounds in earphones to those coming through loud speakers is amplification. Switching means turning ON and OFF large current and high voltage electricity with only a small amount of electric power, such as to drive display screens, and to run motors, etc.





<e.g.>
When 3mA (0.003A) of current is fed through ❶ (the switch turned ON), 3A of current flows through ❷, resulting in amplification by 1,000 times.
Likewise, when the current stops flowing through ❶ (the switch turned OFF), the device stops running, and no current flows through ❷.

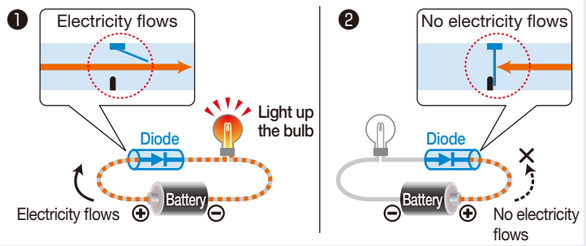
Diode

Diodes

One-way flow of electrons (rectification), yet with a vast range of applications

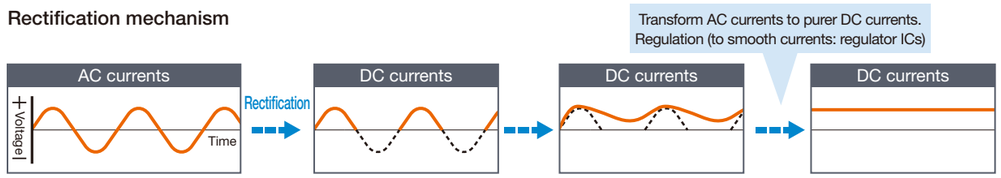
Electricity flows from high voltage (+) down to low voltage (-), just like water.
For instance, prepare two electric wires, place a diode and electric bulb half way up each wire, and connect these wires to batteries, as shown in the illustration to the right. In the case of ❶, electricity flows through the wire and lights up the bulb. In the case of ❷, however, no electricity flows through the wire.
This is because **the diode is a semiconductor which serves as a tap valve to allow electricity to flow in only one direction.**

Serve as a tap valve



Its real task is a rectifier for AC to DC conversions.
Diodes designed for this purpose are called rectifier diodes (rectifier elements). It is AC currents that are supplied to households. However, DC currents are required to run electronic equipment circuits. Rectifier diodes perform AC to DC conversions.

Rectification mechanism

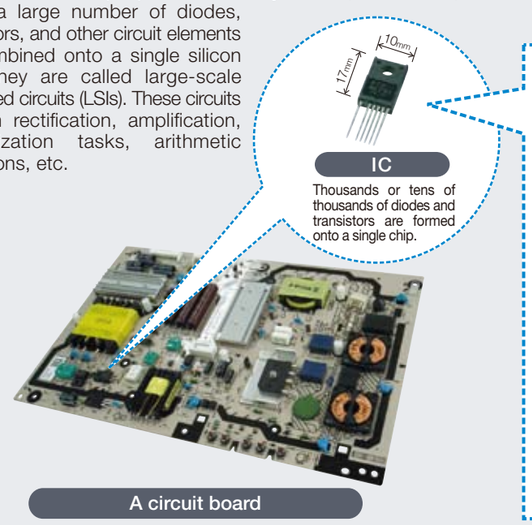


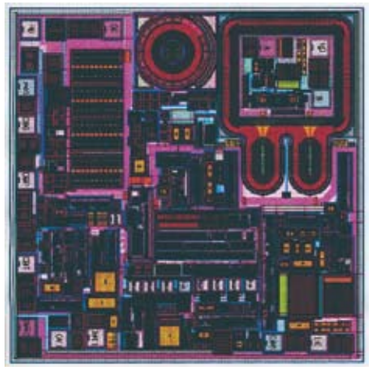
Integrated Circuit

Integrated circuits (ICs)

A single chip to perform multiple tasks

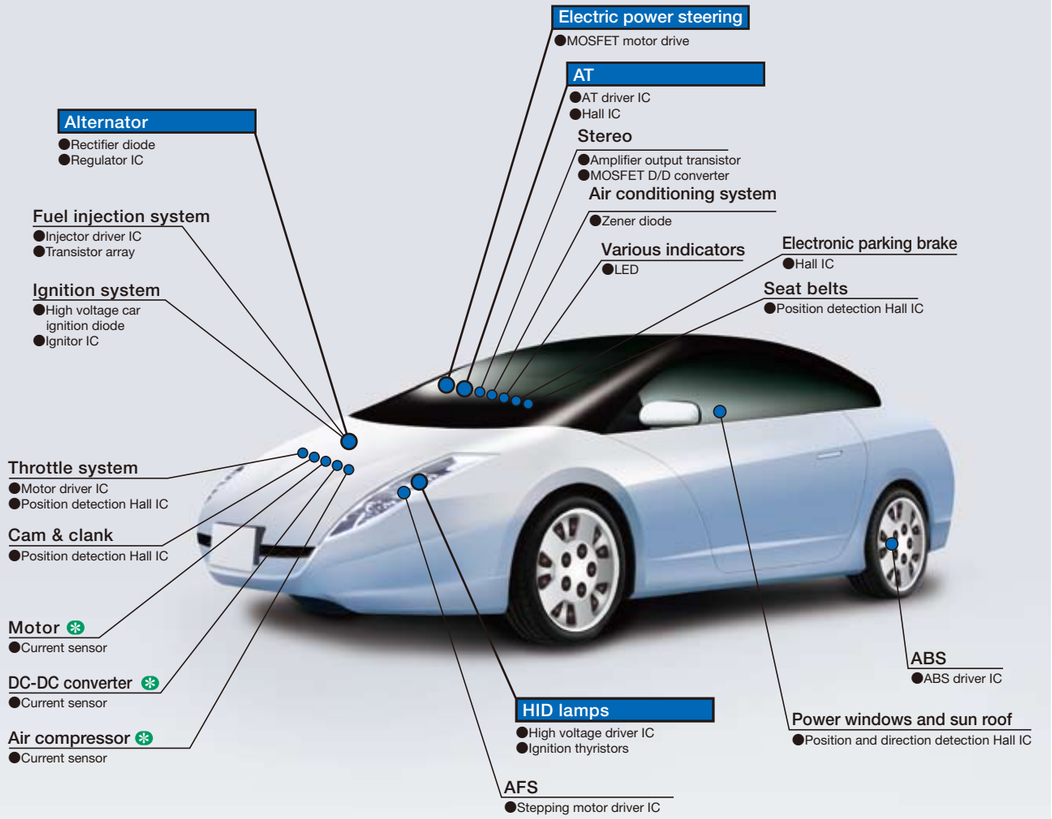
Integrated circuits (ICs) combine many diodes, transistors, and other circuit elements onto a single silicon chip.
When a large number of diodes, transistors, and other circuit elements are combined onto a single silicon chip, they are called large-scale integrated circuits (LSIs). These circuits perform rectification, amplification, memorization tasks, arithmetic operations, etc.





Numerous devices are combined to form a highly integrated single chip.

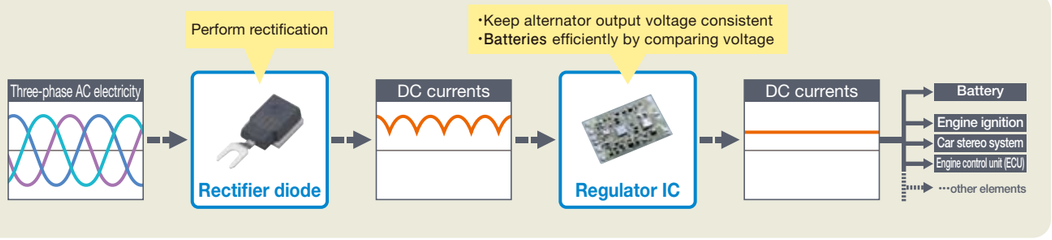
Automobile



●…Demand is expected to rise with more electric vehicles (EVs) in use going forward.

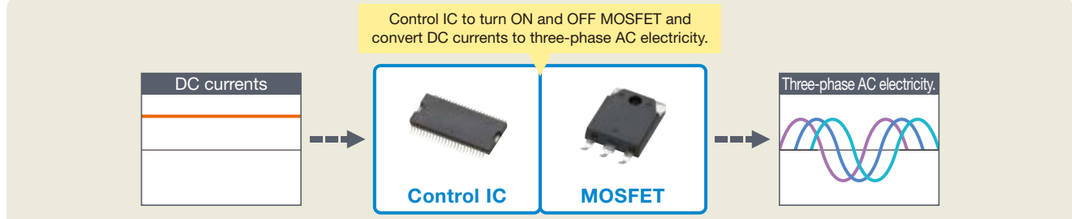
Alternator

Alternators are generators that supply electricity to batteries and various types of automobile electric components. They generate electricity by rotational power supplied by the engine. Since the generated electric power is three-phase AC electricity, however, it cannot be directly fed to various loads. A rectifier diode needs to convert the power to DC currents, while a regulator adjusts voltage.



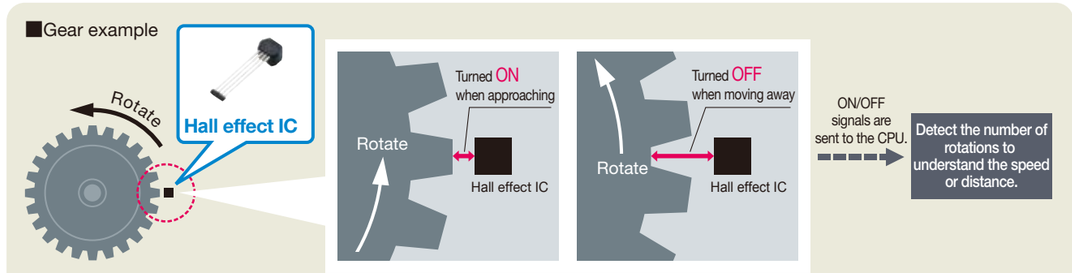
Electric power steering (EPS)

Electric power steering assists the driver in steering a car by using motors. Three-phase brushless motors are commonly used. A control IC and a metal-oxide silicom Field-effect transistor (MOSFET) are combined to run these motors by converting DC currents from for battery to three-phase AC electricity.



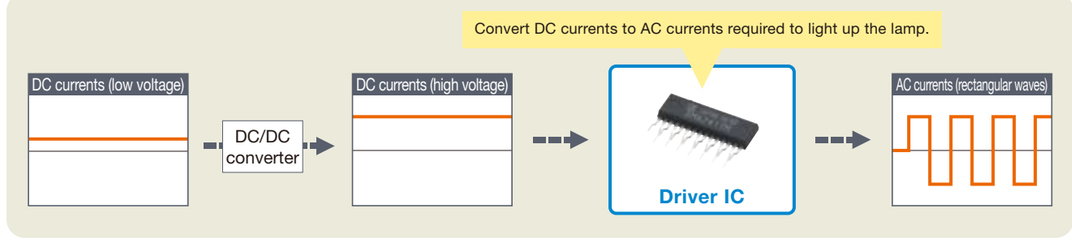
Automatic Transmission (AT)

A Hall effect IC is one of the switches that are magnetically turned ON and OFF. This characteristic is used in a diverse range of applications, such as detection of the number of rotating gear teeth and the AT selector position.



High Intensity Discharge (HID) lamps

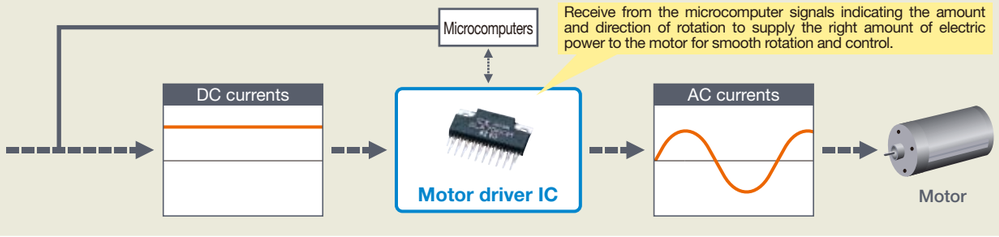
HID lamps emit light by an electric discharge. Thus it is necessary to apply high voltage. AC currents (rectangular waves) light up theses lights. The DC/DC converter increases battery voltage, and then the HID driver IC converts DC currents to AC currents (rectangular waves).



Offices

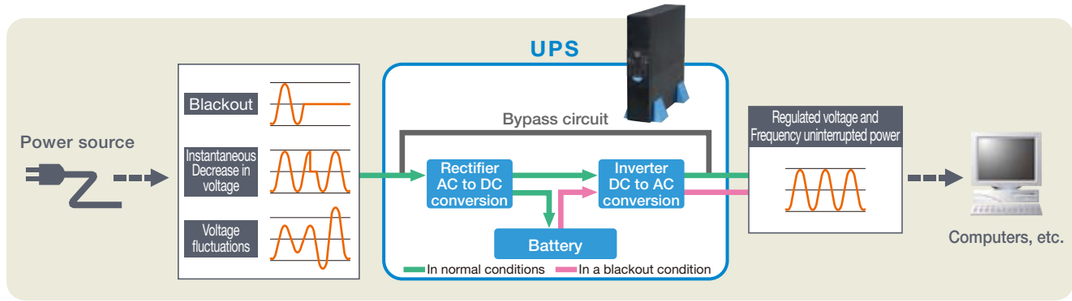
Plain Paper Copier (PPC) Printers and Scanners

PPC uses motors (mainly stepping motors) to feed paper and the scanner to scan original documents. Motor driver ICs control these motors to ensure accurate and smooth rotation and supply power to these motors.



Uninterruptible power supply (UPS)

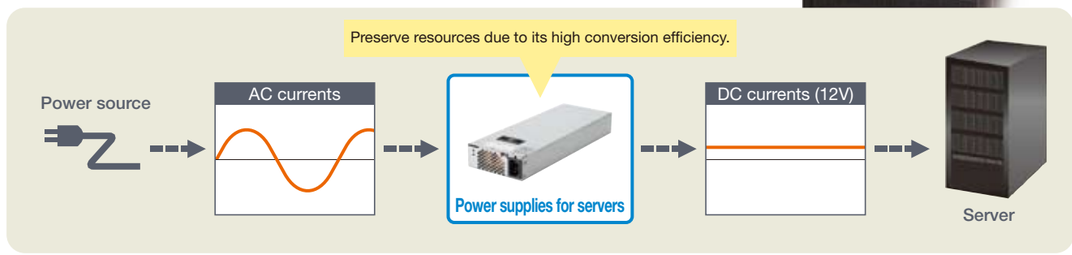
Uninterruptible power supply constantly delivers to computers, a reliable, consistent stream of electricity stored in the internal battery when blackouts, voltage fluctuations, and other power source problems occur.



Servers (data centers)

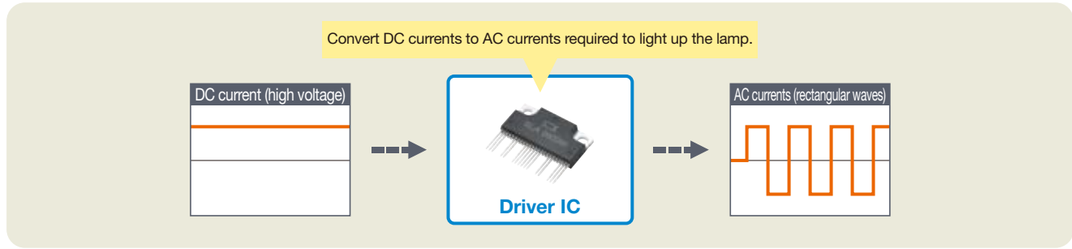
Servers used in data centers are increasingly becoming highly integrated and more multi-functioning, requiring more compact and higher efficiency power sources for energy savings and conservation.

*Sanken Electric has achieved a conversion efficiency of 94% for 600W power supplies by means of its proprietary control circuits to improve the efficiency.

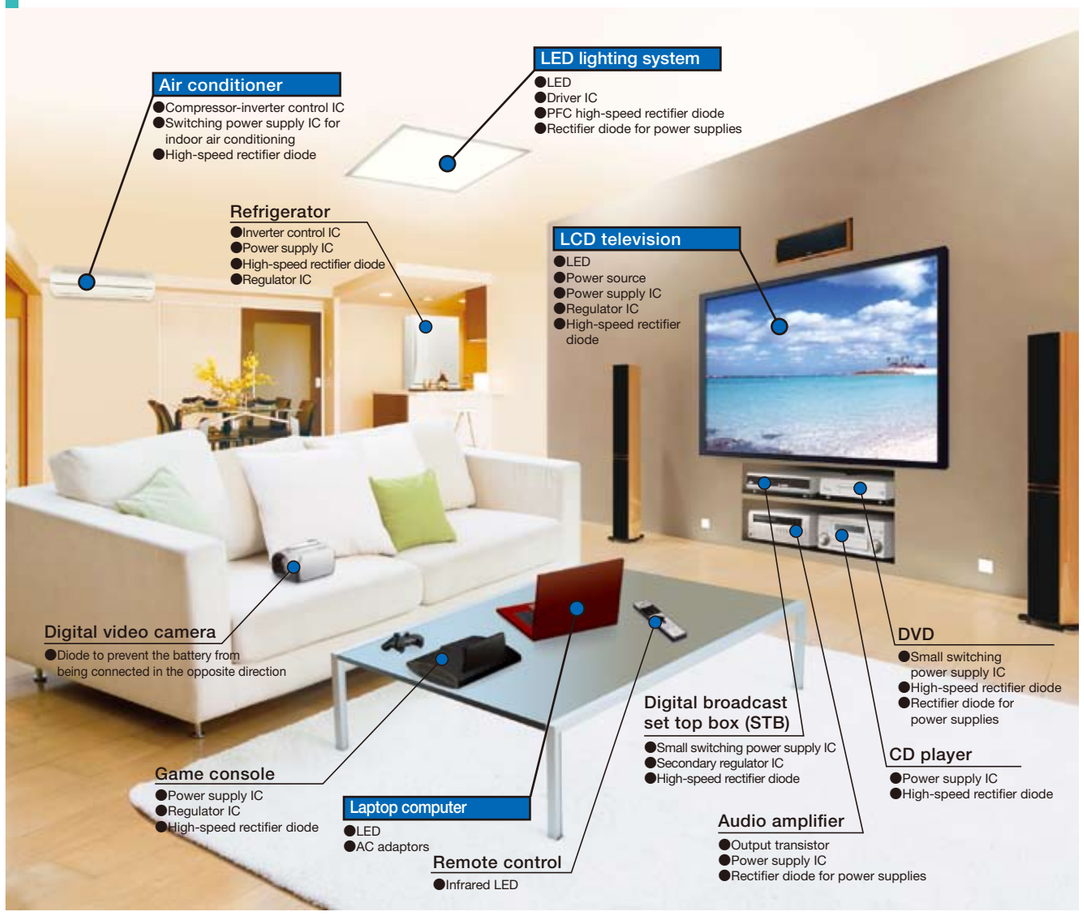


Projectors

High intensity Discharge(HID) lamps (electric discharge tubes) are used for projectors for their brightness and color reproduction capabilities. High voltage needs to be applied to these lamps to start discharging and AC currents (rectangular waves) needs to be supplied to the lamps to light up the lamps. AC currents are generated by HID lamp driver ICs.

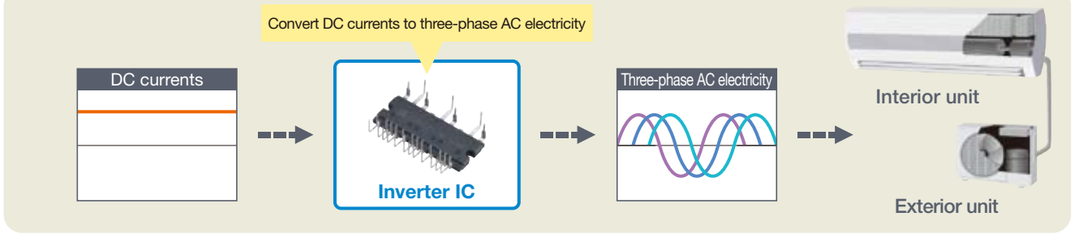


Living Rooms



Air conditioners

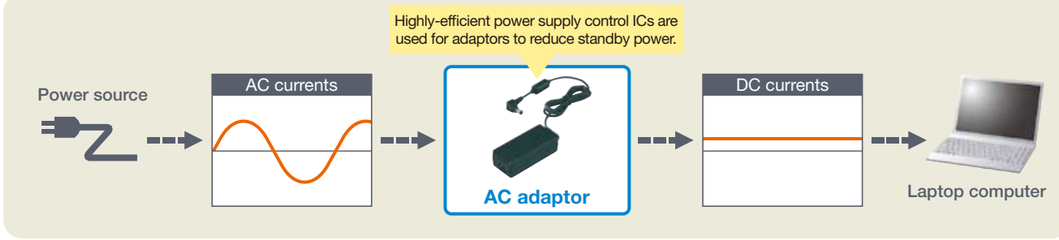
Air conditioners optimize its operation of compressor and fan motors by constantly changing rotations according to the difference between the specified temperature and actual room temperature. Since inverter control is performed using three-phase AC electricity, the inverter IC converts plug's single-phase AC 100V to three-phase AC electricity to control rotations.



Laptop computers (AC adaptors)

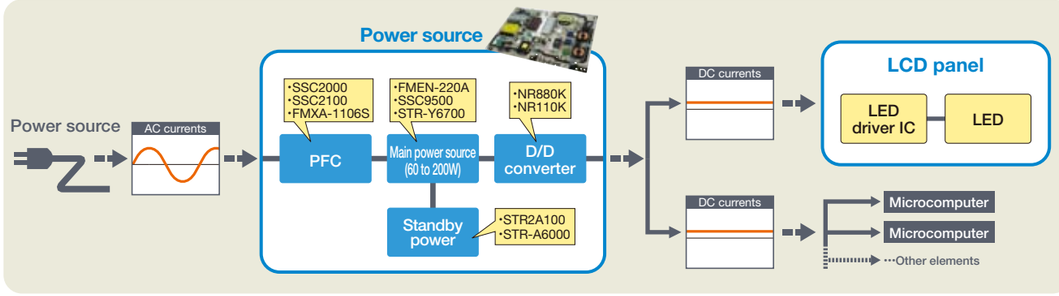
AC adaptors use AC electricity* received from commercial electrical sources to convert the AC electricity to DC currents to run PCs and to charge batteries.

*AC 100 to 240V supported for worldwide use.



Liquid crystal display (LCD) televisions

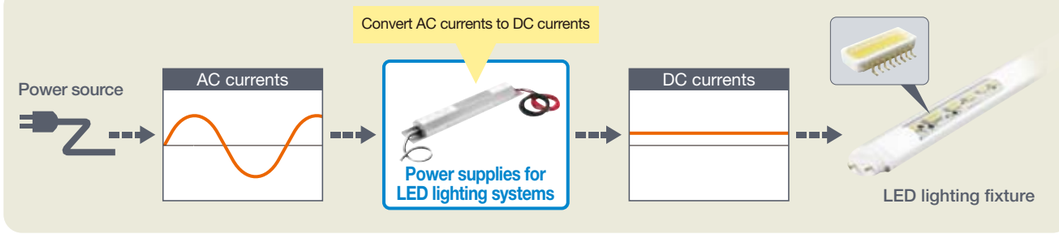
Sanken Electric's total solution, which encompasses a full range of power supplies from main power sources to LCD panel driving devices, which is base on the company's own internally-manufactured, highly reliable devices, responds to the needs of LCD televisions, which are increasingly becoming thinner, larger, and more multi-functioning.



LED lighting systems

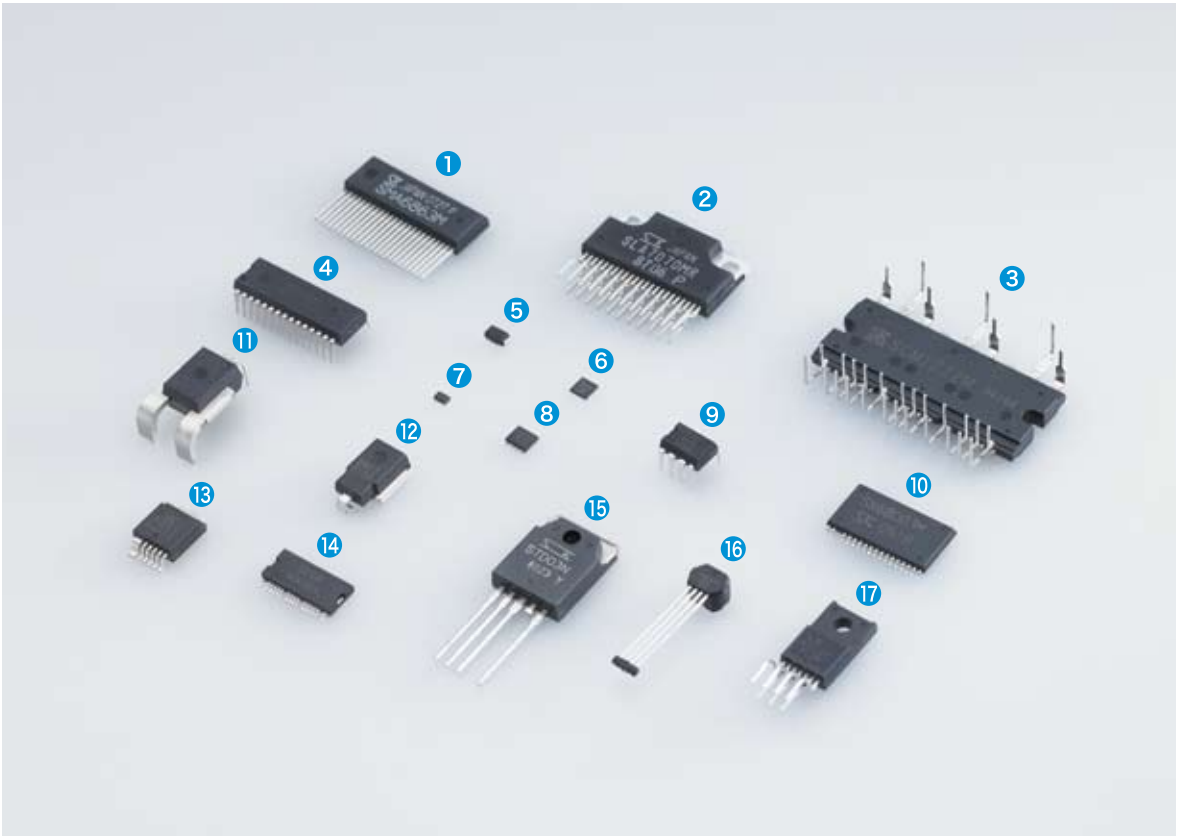
These systems deliver a total solution which course all aspects of lighting systems, from LEDs themselves which are the core of LED lighting systems, the next generation lighting solutions, as well as LED driver ICs, and power sources.

* SankenNEOVIEW is the trademark of the LED lighting fixtures manufactured by Sanken Electric Co., Ltd. (registration pending)



Major types of semiconductor packages and Sanken's semiconductor products

Semiconductors are resin encapsulated in various types of packages for the purpose of protecting devices such as chips, maintaining their electrical characteristics, addressing the issue of heat dissipation, etc. Packages are expected not only to be more compact, thinner, and lower-cost but also to be more multi-pinned and highly complex, densely integrated, in response to the demand for application-specific semiconductors.



1. SMA6863M (high-voltage three-phase brushless motor driver ICs for air conditioners and water heaters)
2. SLA7070MPR (two-phase stepping motor driver ICs for LBP and PPC)
3. SCM1222M (high-voltage three-phase brushless motor driver ICs for air conditioners and refrigerator compressors)
4. SI-7510 (general-purpose five-phase stepping motor driver ICs)
5. SJPZ-N33 (power Zener diodes)
6. A4984SES (two-phase stepping motor driver ICs, manufactured by Massachusetts-based Allegro MicroSystems, Inc.)
7. A1221ELH (seat positioning, AT, Hall ICs for power windows, etc., manufactured by Massachusetts-based Allegro MicroSystems, Inc.)
8. LC5205S (LED driver ICs)
9. STR2A153 (AC/DC converter ICs for standby power)
10. SX68003M (high-voltage three-phase brushless motor driver ICs for fans)
11. ACS758LCB-100B-PFF (current sensors for automobiles, financial affairs (FA) information, home appliances, etc., manufactured by Massachusetts-based Allegro MicroSystems, Inc.)
12. SZ-10N27 (power Zener diodes)
13. SI-5201(semiconductor relays)
14. SPF5104 (HID lamp diver ICs)
15. STD03N (temperature compensated audio transistors)
16. ATS648LSG (ABS/AT Hall ICs, manufactured by Massachusetts-based Allegro MicroSystems, Inc.)
17. SI-8010Y (DC/DC converter ICs)

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http://www.sanken-ele.co.jp

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