

# DC/DC Converters

**A** DC/DC converter steps down the high-voltage direct current from the main battery in an electric, hybrid, or fuel-cell vehicle to charge the lower-voltage auxiliary battery. Needs for DC/DC conversion are mounting as automakers adopt fuel-saving powertrain technologies. DENSO is an industry leader in pertinent technologies and is leading efforts to make DC/DC converters smaller, lighter, and more cost-competitive.



DC/DC converter



■ Prius

## In the marketplace

Demand for DC/DC converters has surged with the introduction of hybrid vehicles. Those vehicles typically have an “idle stop” function. They shut off their engine automatically during brief stops—as at stoplights—to save gasoline. They rely on electric power from the DC/DC converter to power their electrical systems during stops.

We began supplying DC/DC converters for electric vehicles in 1996 and for hybrid vehicles in 1997. By the end of 2000, we had supplied about 50,000 units.

## In comparison with competitors

Power density is an important competitive criterion in DC/DC converters. Our units compare favorably in that criterion with the handful of competing products that we have examined.

## Issues and outlook

Cost is an overriding issue in hybrid vehicles. Their cost needs to come down further to make their fuel savings a genuine economic incentive for customers.

We expect hybrid vehicles to account for about 10% of global production of automobiles by 2010. That would be about five million hybrid vehicles a year, which would be a big market for DC/DC converters. Demand for the converters also will benefit from the gradual introduction of fuel-cell vehicles.

## Technical highlights

Our DC/DC converters use a full-bridge circuit, which is common practice in heavy electrical equipment. Switching transistors invert the high-voltage direct current from the main battery to high-frequency, high-voltage alternating current. A transformer then transforms the alternating current to low voltage. Diodes rectify the low-voltage alternating current, and a smoothing filter converts it to direct current.

The full-bridge circuit accommodates a wide range of input voltages and provides high output. We have minimized size and weight by using high-frequency switching and low-profile magnetic parts.