High Voltage DTMOS Power MOSFET Using A Super Junction Structure To Reduce Power Consumption

March 29 2005

Continuing its leadership role in developing innovative power semiconductors, Toshiba America Electronic Components, Inc. (TAEC) and its parent Toshiba Corp. announced a new power MOSFET called DTMOS, that employs a new super junction structure that enables a reduction in power consumption caused by on-state resistance (RDS_{ON}) to approximately 40 percent of the value typically achieved with conventional MOSFETs. Developed by Toshiba, the first device in the DTMOS family, TK15A60S, is targeted for use in power supplies in television sets, home appliances, AC adapters and ballast lighting. Toshiba began shipping samples of the new MOSFET today, and will begin production in April 2005.

The super junction structure, which has vertical paths to allow electrical current to flow through easily on a silicon substrate, realizes lower RDS_{ON} than the theoretical limit of silicon. By applying this super junction structure and optimizing the total device, the RDS_{ON} for the same area in Toshiba's DTMOS device achieves a 60 percent reduction and its gate charge (Q_g) achieves a 40 percent reduction compared with Toshiba's conventional MOSFETs. Consequently, $RDS_{ON} * Q_g$, a characteristic that is one important performance index for MOSFETs (in which smaller is better), is one-fourth the value of the company's conventional MOSFETs.

With this announcement, Toshiba is combining a super junction

structure with the company's original Deep Trench MOSFET (DTMOS) technology. This is the first in the market using super junction structure combined with deep trench technology.

The first device in the family, designated TK15A60S , features maximum ratings of 15 Amp (A) and 600 volt (V) with on resistance of 0.3 Ohm and will begin sampling in March 2005.

"We're very pleased to introduce the first member of our DTMOS product line, targeted at achieving significant reductions in power consumption in the mainstream switch mode power supply and ballast lighting markets with a 600V, 15A device," said Brach Cox, business development manager, power devices, in Toshiba's Discrete Business Unit.

Background of the Development

Recently, reduction of power consumption and miniaturization of consumer electronics have been in strong demand, and consequently, lower RDSON in power MOSFETs has been a target to improve their power efficiency. In order to respond to the demand for lower power consumption, Toshiba is commercializing a new product utilizing DTMOS technology which can improve efficiency of power supplies. Toshiba succeeded in the development of DTMOS because of its broad repertoire of power MOSFET devices and development expertise and device technology.

Features

-- Due to the super junction structure, RDS ON reaches 0.3 Ohm (maximum).
-- At this time, Toshiba is the first to utilize a super junction structure

with deep trench technology on a silicon substrate.
-- The device uses a TO-220SIS package, which is widely used in the market, and enables conventional products to be replaced easily.