

## TOSHIBA DTMOS II FAMILY OF 600V POWER MOSFETS USE SUPERJUNCTION STRUCTURE TO INCREASE POWER EFFICIENCY

**12A, 15A, or 20A 600V MOSFETs in Second DTMOS Generation Utilize "Superjunction" Technology to Reduce On-state Resistance x Gate Charge by 68 Percent Compared to Conventional Toshiba MOSFET Technology**

IRVINE, Calif., Sept. 3, 2008 — Toshiba America Electronic Components, Inc. (TAEC)\* today announced a family of 600V DTMOS II superjunction MOSFETs that contribute to higher efficiency of switched-mode power supplies, such as AC adapters in notebook and desktop computers, servers, flat panel displays, and ballasts used in lighting, due to lower on-state resistance ( $R_{DS(ON)}$ ) and faster switching characteristics. Developed by Toshiba Corp., the DTMOS II MOSFETs employ a superjunction structure that enables a reduction in both on-state resistance ( $R_{DS(ON)}$ ) and gate charge ( $Q_g$ ), which usually are tradeoffs. Typically, when either of these characteristics is reduced, the other increases, but with its superjunction DTMOS II design, Toshiba has been able to reduce both simultaneously, enabling higher power efficiency and switching performance than conventional MOSFETs.

In these devices, Toshiba refined the superjunction structure with the company's second generation DTMOS technology. By applying this design and optimizing the entire device, Toshiba has achieved figure of merit values for  $R_{DS(ON)} * Q_g$  (see note 1) that are approximately 68 percent less than that of conventional Toshiba MOSFETs. This figure of merit is one important performance index for MOSFETs in which smaller is better, and is indicative of higher switching performance and power efficiency.

The first twelve products in the DTMOS II family include 12A, 15A, and 20A 600V MOSFETs, each offered in a choice of four packages, including TO-3P(N), TO-220SIS, TO-220(W) and TFP, a compact surface mount package. The 12A devices feature low on-resistance of 0.4 ohms ( $\Omega$ , max.), the 15A devices feature on-resistance of 0.3  $\Omega$  (max.) and 20A devices have on-resistance rated at 0.19  $\Omega$  (max.).

"With a combination of low on-resistance, fast switching and ruggedness, our new DTMOS II devices are ideally suited for the switched-mode power supply and ballast lighting markets and are expected to enable a significant increase in power efficiency," said Jeff Lo, business development manager, Discrete Power Devices, for TAEC.



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### Features

Due to the superjunction structure,  $R_{DS(ON)}$  can be as low as 0.19  $\Omega$  (max.) for the 20A devices, at  $V_{DS} = 600V$ .

Based on  $R_{DS(ON)} * Q_g$ , the Toshiba DTMOS II MOSFETs feature competitive performance among superjunction MOSFETs available in the market today.

Available in four packages to provide designers a choice best suited to their needs: TO-3P(N), TO-220(W), TO-220SIS, or TFP, a compact Toshiba package.

### Technical Specifications: Family/Line/Product Name

Part Number	Gate-Source Voltage $V_{DS}$ (max.)	Drain Current $I_D$ (max.)	Drain-source ON resistance $R_{DS(ON)}$ (max.) <sup>2</sup>	Gate Charge, $Q_g$ (typ.) <sup>3</sup>	Avalanche Energy (mJ)		Package		Planned Mass Production
					Single Pulse <sup>4</sup>	Repetitive <sup>5</sup>	Toshiba Package/Dimensions (mm)	Industry Standard Equivalent	
TK20J60U					144	19	TO-3P(N) 15.9 x 23.3 x 4.8	TO-247AD	Sept. '08
TK20A60U	+ 30V	20A	0.19 $\Omega$	27nC	144	4	TO-220SIS 10 x 17.8 x 4.5	TO-220F (Isolated)	Sept. '08
TK20D60U					144	19	TO-220(W) 10 x 17.8 x 4.5	TO-220 (Non-isolated)	Sept. '08

TK20X60U					144	15	TFP 9.2 x 10.7 x 3.0	N/A	Oct. '08
TK15J60U					81	17	TO-3P(N) 15.9 x 23.3 x 4.8	TO-247AD	Now
TK15A60U					81	4	TO-220SIS 10 x 17.8 x 4.5	TO-220F (Isolated)	Now
	+ 30V	15A	0.3 $\Omega$	17nC					
TK15D60U					81	17	TO-220(W) 10 x 17.8 x 4.5	TO-220 (Non-isolated)	Now
TK15X60U					81	12.5	TFP 9.2 x 10.7 x 3.0	N/A	Oct. '08
TK12J60U					69	14	TO-3P(N) 15.9 x 23.3 x 4.8	TO-247AD	Sept. '08
TK12A60U					69	3.5	TO-220SIS 10 x 17.8 x 4.5	TO-220F (Isolated)	Sept. '08
	+ 30V	12A	0.4 $\Omega$	14nC					
TK12D60U					69	14	TO-220(W) 10 x 17.8 x 4.5	TO-220 (Non-isolated)	Sept. '08
TK12X60U					69	10	TFP 9.2 x 10.7 x 3.0	N/A	Oct. '08

### Pricing and Availability

Samples of the twelve Toshiba second-generation DTMOS II devices are available now, with prices beginning at \$1.30. The 12A TK12A60U, 15A TK15A60U, and 20A TK20A60U are in mass production now, and the remaining devices are scheduled to be in mass production by October 2008.

### Toshiba's Discrete Products

Since 1986, Toshiba Corp. has ranked as the top discrete supplier on a worldwide basis, based on annual revenue from international shipments of total discrete products. According to the most recent annual report from market research firm Gartner Dataquest (San Jose, CA), Toshiba remained the top discrete semiconductor supplier. (Source: "2007 Worldwide Semiconductor Market Share Report," Gartner, released April 2008). More specifically, Toshiba is a leading supplier in a number of discrete product categories, including power transistors, rectifiers and thyristors, LMOS logic, CMOS logic, photocouplers, TOSLINKs, LEDs, small signal diodes and transistors. The company's discrete devices are designed to meet the growing demand for high-performance and lower voltages in today's wireless telecommunications and consumer electronics applications, while emphasizing its strength in the automotive and industrial markets.

#### \*About TAEC and Toshiba Corp.

Through proven commitment, lasting relationships and advanced, reliable electronic components, Toshiba enables its customers to create market-leading designs. Toshiba is the heartbeat within product breakthroughs from OEMs, ODMs, CMs, distributions and fabless chip companies worldwide. A committed electronic components leader, Toshiba designs and manufactures high-quality flash memory-based storage solutions, discrete devices, displays, advanced materials, medical tubes, custom SoCs/ASICs, digital multimedia and imaging products, microcontrollers and wireless components that make possible today's leading cell phones, MP3 players, cameras, medical devices, automotive electronics and more.

Toshiba America Electronic Components, Inc. is an independent operating company owned by Toshiba America, Inc., a subsidiary of Toshiba Corporation, Japan's largest semiconductor manufacturer and the world's third largest semiconductor manufacturer (Gartner, 2007 WW Semiconductor Revenue, April 2008). For additional company and product information, please visit <http://www.toshiba.com/taec/>.

<sup>1</sup>The product of on-state resistance and gate charge. The smaller this value is, the better the performance of the MOSFET.

<sup>2</sup>  $V_{GS}=10V$ ,  $I_D=10A$  (20A devices), 7.5A (15A devices), 6A (12A devices).

<sup>3</sup>  $V_{DD}=400V$ ,  $V_{GS}=10V$ ,  $I_D=20A$  (20A devices), 15A (15A devices), 12A (12A devices)

<sup>4</sup>  $V_{DD}=90V$ ,  $T_{ch}=25^\circ C$  (initial),  $R_G=25\text{ ohm}$ ,  
 $L=0.63\text{ mH}$ ,  $I_{AR}=20A$  (20A devices).  
 $L=0.63\text{ mH}$ ,  $I_{AR}=15A$  (15A devices).  
 $L=0.84\text{ mH}$ ,  $I_{AR}=12A$  (12A devices).

<sup>5</sup>Repetitive rating: pulse width limited by maximum channel temperature.

Information in this press release, including product pricing and specifications, content of services and contact information, is current and believed to be accurate on the date of the announcement, but is subject to change without prior notice. Technical and application information contained here is subject to the most recent applicable Toshiba product specifications. In developing designs, please ensure that Toshiba products are used within specified operating ranges as set forth in the most recent Toshiba product specifications and the information set forth in Toshiba's "Handling Guide for Semiconductor Devices," or "Toshiba Semiconductor Reliability Handbook." This information is available at [chips.toshiba.com](http://chips.toshiba.com) or from your TAEC representative.

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