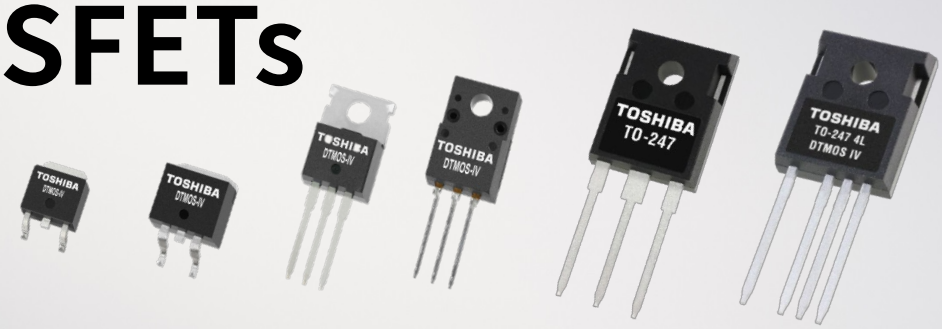
High Voltage MOSFETs



Latest Super-Junction Technology

Toshiba has developed generations of super-junction 500V, 600V, 650V, and 800V DTMOS MOSFET series. Fabricated using the state-of-the-art single epitaxial process, DTMOS IV provides a 30% reduction in Ron*A, a figure of merit (FOM) for MOSFETs, compared to its predecessor DTMOS III. A reduction in Ron*A leads to smaller $R_{DS(ON)}$ chips in the same packages. This helps users to improve efficiency and reduce the size of power systems. Fast switching X-type and fast body-diode W5-type versions are also available. DTMOS V series is providing even better EMI performance. New DTMOS VI series is designed for highest efficiency switching.

Applications

- Switched Mode Power Supply
- Lighting
- Power Factor Control
- Industrial applications (including UPS)

Features

- DTMOS IV: 30% reduction in $R_{DS(ON)}$·A compared to previous generation
- Reduction in C_{oss}
- Application of latest process technology: single epitaxial process
- Wide range of on-resistances and packaging options, see tables
- Lowest FOM ($R_{DS(ON)}$ x Q_{gd}) offered by DTMOS VI

Advantages

- Reduction of chip size at same performance or improved performance at same chip size
- DTMOS IV offers 12% reduced switching loss, E_{OSS}, compared to the predecessor
- Lower increase in on-resistance at temperature rise
- Freedom of choice and flexibility on package and on $R_{DS(ON)}$ lineup
- DTMOS VI for highest efficiency switching at power supply

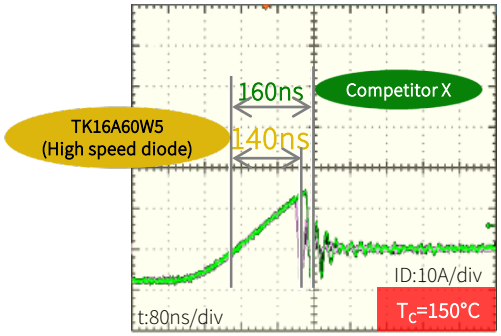
Benefits

- Reduced heat system costs
- Less costs of field failure
- Less passive component costs
- Reduced BOM costs due to most effective solutions
- Easy design-in for faster time to market and product launch
- Ready to support high volume markets with competitive prices
- Allows higher power density

DTMOS - series	Applications
DTMOS VI Z-Series: Lowest FOM ($R_{DS(ON)}$ x Q_{gd}) NEW	Data Center, PV-Inverter, UPS
DTMOS V Y-Series: Low EMI series	For lighting, battery charger and AC/DC adapter
DTMOS IV W-Series: Standard type	For general switching
DTMOS IV W5-Series: With high speed body diode	For bridge circuitry, like UPS or server SMPS
DTMOS IV X-Series: High speed type	For PFC circuit
DTMOS IV X5-Series: High speed MOSFET & body diode	For bridge circuitry, like UPS or server SMPS

DTMOS IV W5: Fast reverse recovery time

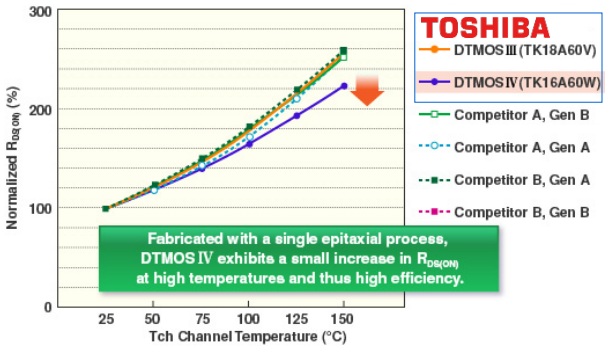
The DTMOS IV option with fast body diode (“W5”- suffix) offers a fast recovery time even at high temperature. This results in lower power losses, less heat generation and lower power costs for a better and more thermally efficient design.



Condition: V_{DD}=400V; I_{DR}=7.9A

DTMOS : 15% lower $R_{DS(ON)}$ at maximum operating temperature

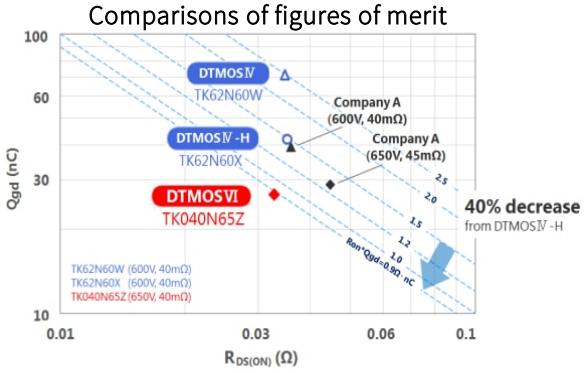
For the single-epitaxial process the dependency of $R_{DS(ON)}$ from temperature is much smaller compared to multi-epitaxial process. As DTMOS IV is manufactured with a single-epitaxial process, the $R_{DS(ON)}$ value will be 15% smaller at operating temperature, resulting in lower power consumption and higher system efficiency. At the same time, system cooling set-up can be relaxed and reliability is increased.

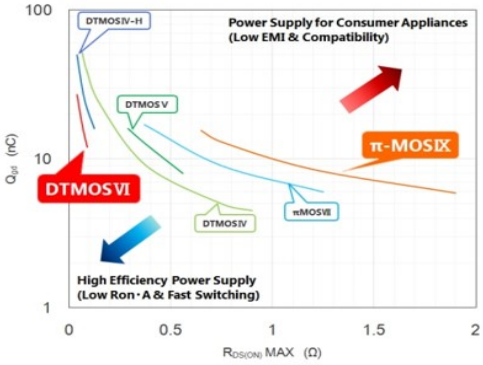


DTMOS VI: For highest efficiency switching

Offering the lowest figure of merit $R_{DS(ON)}$ x Q_{gd}, the DTMOS VI series has the high efficiency switching while additionally supporting DFN 8 x 8, TOLL and TO-247 4L packages with a Kelvin Source.

Comparisons of figures of merit





DTMOS VI 650V “Z” -series (lowest $R_{DS(ON)}$ x Q_{gd}) NEW

	DFN 8x8mm	TO-220	TO-220SIS	TO-247	TO-247-4L	TOLL
Outline						
0.190Ω	TK210V65Z		TK190A65Z			TK190U65Z
0.155Ω	TK170V65Z		TK155A65Z			TK155U65Z
0.110Ω	TK125V65Z		TK110A65Z	TK110N65Z	TK110Z65Z	TK110U65Z
0.09Ω	TK099V65Z	TK090E65Z*	TK090A65Z	TK090N65Z	TK090Z65Z	TK090U65Z
0.065Ω				TK065N65Z	TK065Z65Z	TK065U65Z
0.04Ω				TK040N65Z	TK040Z65Z	

0.21Ω
0.17Ω
0.125Ω
0.099Ω

* Under development

DTMOS IV & V 600V standard “W” & “Y“ series

	DPAK	IPAK	D2PAK	DFN 8x8mm	TO-220	TO-220SIS	TO-247
Outline							
0.75Ω	TK6P60W	TK6Q60W				TK6A60W	
0.60Ω	TK560P60Y* TK7P60W	TK7Q60W				TK560A60Y* TK7A60W	
0.50Ω	TK8P60W	TK8Q60W				TK8A60W	
0.38Ω	TK380P60Y* TK10P60W	TK10Q60W		TK10V60W	TK10E60W	TK380A60Y* TK10A60W	
0.30Ω	TK290P60Y* TK12P60W	TK12Q60W		TK12V60W	TK12E60W	TK290A60Y* TK12A60W	
0.19Ω			TK16G60W	TK16V60W	TK16E60W	TK16A60W	TK16N60W
0.155Ω			TK20G60W	TK20V60W	TK20E60W	TK20A60W	TK20N60W
88mΩ				TK31V60W	TK31E60W	TK31A60W	TK31N60W
65mΩ						TK39A60W	TK39N60W
40mΩ							TK62N60W

* DTMOS V

DTMOS IV 600V fast diode type “W5” series

	DPAK	D2PAK	DFN 8x8mm	TO-220	TO-220SIS	TO-247
0.65Ω	TK7P60W5 (0.67Ω)				TK7A60W5	
0.54Ω	TK8P60W5 (0.56Ω)				TK8A60W5	
0.45Ω					TK10A60W5	
0.23Ω		TK16G60W5	TK16V60W5 (0.24Ω)	TK16E60W5	TK16A60W5	TK16N60W5
0.175Ω			TK20V60W5 (0.19Ω)	TK20E60W5	TK20A60W5	TK20N60W5
99mΩ			TK31V60W5 (0.101Ω)			TK31N60W5
74mΩ						TK39N60W5
45mΩ						TK62N60W5

DTMOS IV 600V high speed type (low Q_{gd}), fast diode type “X” & “X5” series

	DFN 8x8mm	TO-220	TO-220SIS	TO-247 4 L	TO-247
0.145Ω	TK25V60X5**	TK25E60X5**	TK25A60X5**		TK25N60X5**
0.125Ω	TK25V60X (0.135Ω)	TK25E60X	TK25A60X	TK25Z60X	TK25N60X
88mΩ	TK31V60X (0.098Ω)	TK31E60X		TK31Z60X	TK31N60X
65mΩ				TK39Z60X	TK39N60X
40mΩ				TK62Z60X	TK62N60X

* Samples available ** fast Diode

DTMOS IV & V 650V standard “W” & “Y“ series

	DPAK	IPAK	D2PAK	DFN 8x8mm	TO-220	TO-220SIS	TO-247
Outline							
(1.0/1.05)Ω	TK6P65W 1.05Ω	TK6Q65W 1.05Ω				TK6A65W	
(0.78/0.8)Ω	TK7P65W 0.8Ω	TK7Q65W 0.8Ω				TK7A65W	
(0.65/0.67)Ω	TK8P65W 0.67Ω	TK8Q65W 0.67Ω				TK8A65W	
(0.5/0.56)Ω	TK560P65Y* TK9P65W 0.56Ω	TK9Q65W 0.56Ω				TK560A65Y* TK9A65W	
(0.39/0.44)Ω	TK380P65Y* TK11P65W 0.44Ω	TK11Q65W 0.44Ω				TK380A65Y* TK11A65W	
(0.25/0.29)Ω	TK290P65Y* 0.29Ω		TK14G65W	TK14V65W 0.28Ω	TK14E65W	TK290A65Y* TK14A65W	TK14N65W
(0.20/0.21)Ω				TK17V65W 0.21Ω	TK17E65W	TK17A65W	TK17N65W
(0.11/0.12)Ω				TK28V65W 0.12Ω	TK28E65W	TK28A65W	TK28N65W
80mΩ						TK35A65W	TK35N65W
55mΩ							TK49N65W

* DTMOS V

DTMOS IV 650V high speed type (low Q_{gd}), fast diode type “W5” & “X5” series

	D2 PAK	DFN 8x8mm	TO-220	TO-220SIS	TO-247
Outline					
0.3Ω	TK14G65W5		TK14E65W5	TK14A65W5	TK14N65W5
0.23Ω				TK17A65W5	
(0.16/0.17)Ω		TK22V65X5* 0.17Ω		TK22A65X5	
(0.13/0.14)Ω		TK28V65W5 0.14Ω			TK28N65W5
95mΩ				TK35A65W5	TK35N65W5
57mΩ					TK49N65W5

* Fast diode + High speed Type (low Qgd)

DTMOS IV 800V standard “W” series

	TO-220	TO-220SIS
Outline		
0.95Ω	TK7E80W	TK7A80W
0.55Ω	TK10E80W	TK10A80W
0.45Ω	TK12E80W	TK12A80W
0.29Ω	TK17E80W	TK17A80W

DTMOS IV 500V standard “W” series

	DPAK	TO-220SIS
Outline		
0.38Ω	TK10P50W 0.43Ω	TK10A50W
0.30Ω	TK12P50W 0.34Ω	TK12A50W
0.19Ω		TK19A50W