

TOSHIBA

BLDC: Brushless Motor

Proposal for Electric Motor Applications

~ Power Devices ~

Toshiba Electronic Devices & Storage Corporation

2021.April

Low withstanding voltage MOSFET (LVMOS)

Value provided

Wide lineup and easy-to-use design, contributing to energy saving and high efficiency

1 High Efficiency (Energy saving)

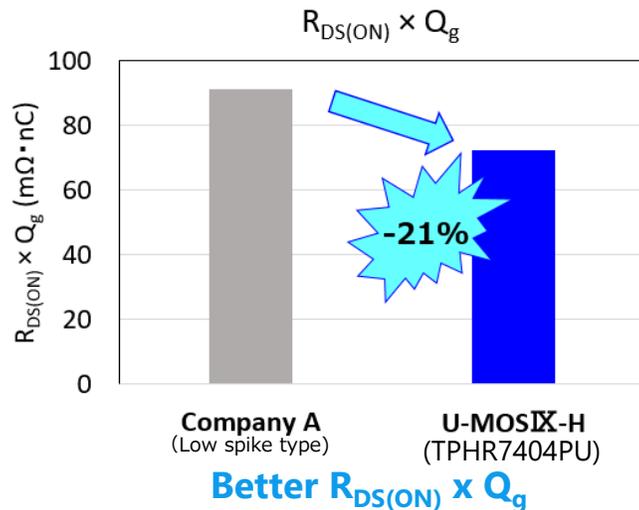
- Low On-Resistance Characteristics by Advanced Refinement Process
- Improves $R_{DS(ON)}$ and Q_g trade-off by optimization of cell structure

2 Wide Line up

- Wide range of withstanding voltage lineups (20 to 250V)
- Support various packages from SMD to TO-220 type

3 Ease of Use

- Low Spike and Low Ringing Characteristics with Parasitic Snubbers
- $T_{ch}=175^{\circ}C$ guaranteed (U-MOSIX-H, X-H)
- High avalanche tolerance



Various package lineup

Customer value / Social subject contribution

- High-efficiency performance in line with increasing energy-saving requirements (low on-resistance, low charge)
- Optimized for secondary-side synchronous rectification of power supply circuits and inverter drive of Motors in conjunction with higher efficiency
- Achieved industry-leading FOM (performance indicator)*
*As of 10th May 2021(as surveyed by Toshiba)

Product lineup

- U-MOSX-H : 80V
- U-MOSIX-H : 30V, 40V, 45V, 60V, 100V
40V(low spike type), 60V(low spike type)
- U-MOSVIII-H : 30V, 40V, 60V, 75V, 80V, 100V, 120V, 150V, 200V, 250V

Value provided

Extensive product lineup allows you to select MOSFETs that best meet application requirements.

1 For power factor correction (PFC):
DTMOS series

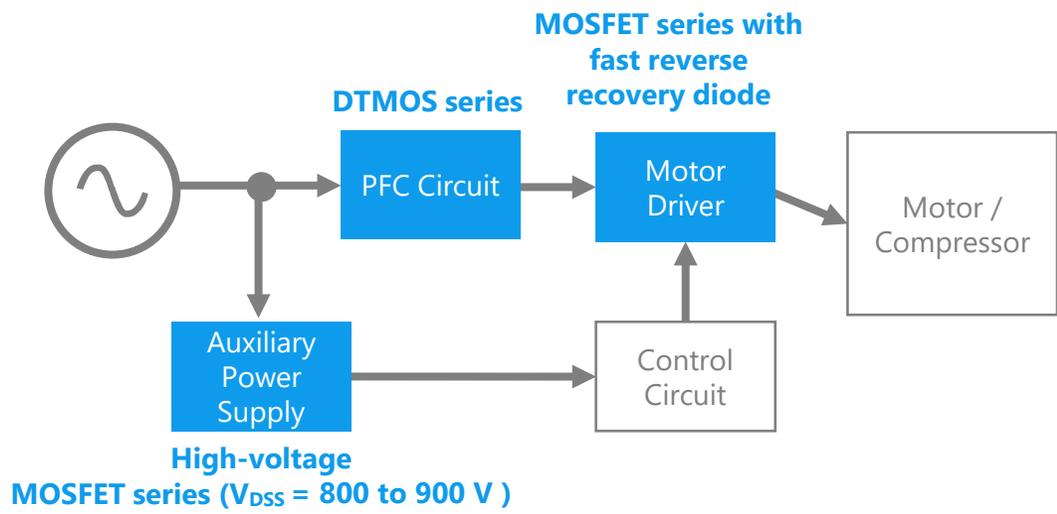
Reduces power loss and improves efficiency because of low gate capacitance, fast switching, and low on-resistance.

2 For Motor drive and inverter circuits:
MOSFET series with fast reverse recovery diode

Reduces power loss and improves efficiency because of optimum reverse recovery characteristics of parasitic diode

3 For switching devices on primary side of auxiliary power supplies
High-voltage MOSFET series (V_{DSS} = 800 to 900 V)

MOSFETs with V_{DSS} of 800 to 900 V are ideal as switching devices on primary side of small-capacity auxiliary power supplies for which flyback configuration is commonly used.



Customer value / Social subject contribution

- Efficiency improvement and reduction in power consumption
- Environmental protection

Product lineup

Product lineup

- PFC circuits: DTMOSVI series (650 V): Available
DTMOSIV-H series (600 V, 650 V): Available
- Motor drivers: DTMOSIV (HSD) series (600 V, 650 V): Available
- Auxiliary power supplies: DTMOSIV series (800 V): Available
High-voltage π-MOSVIII series (800 V, 900 V): Available

Value provided

Low-loss device by fine integration & field-stop structure

1 Low power consumption

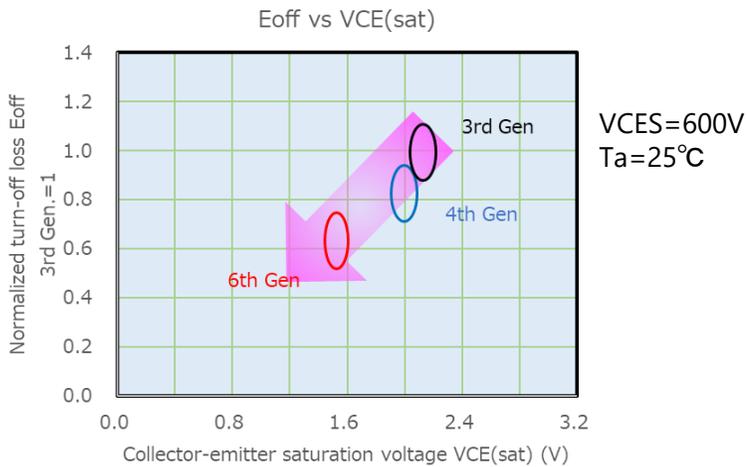
- Low VCE(sat) & high speed by field-stop structure
- Low capacitance with new gate structure
→ Low Switching & drive loss

2 Reduction of short-circuit current

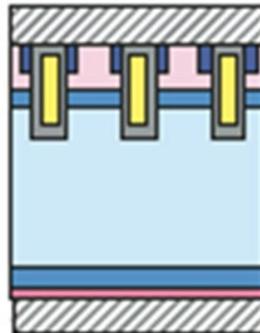
- Reduction of short-circuit current by reducing collector-emitter saturation current

3 Low emission noise

- Optimized chip design
- High-speed performance by reducing emission noise



Field-stop structure



Customer value / Social subject contribution

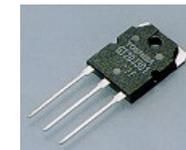
- Low-loss device by field-stop structure
- Improved durability by reducing short-circuit current

Product lineup

- GT15J341 (TO-220SIS)
- GT20J341 (TO-220SIS)
- GT30J341 (TO-3PN)



TO-220SIS



TO-3PN

Value provided

Designer-friendly product "Toshiba SiC MOSFET"

1 Wide V_{GSS} specification

- V_{GSS} specification is wider than that of competitors.
- SiC MOSFET V_{GSS} : -10V to 25V
→ designer-friendly product

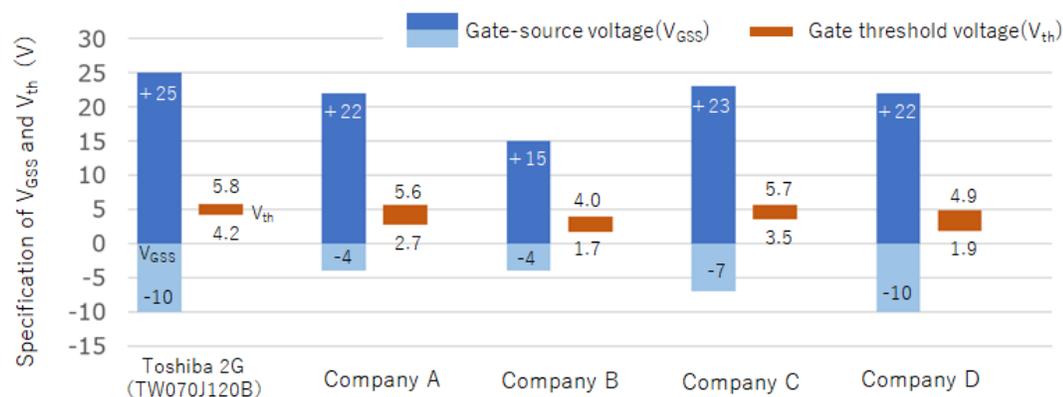
2 High V_{th}

- High V_{th} with low On resistance
- SiC MOSFET V_{th} : 5.0V(typ.)
Spec: 4.2 to 5.8V
→ prevention from malfunction

3 SBD embedded in die

- Small diode VF
 $V_{DSF} = -1.35V$ (typ.)

Comparison in V_{GSS} & V_{th} specifications



As of Dec 2020, from a survey by Toshiba

Customer value / Social subject contribution

- Ease of design
- Prevention from malfunction
- Energy saving by high-efficiency performance
- 2nd generation 1200V SiC MOSFET (TW070J12B)
- 3rd generation 650/1200V SiC MOSFET (Under development)

Value provided

Wide lineup of current & package, contributing to energy saving and high efficiency

1 Low IR

- Low IR by improved JBS structure
IR : 50 μ A max @650V, 25 $^{\circ}$ C

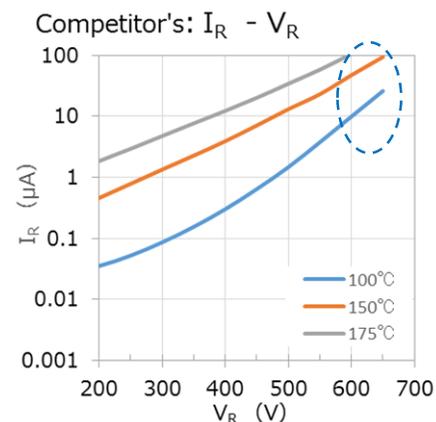
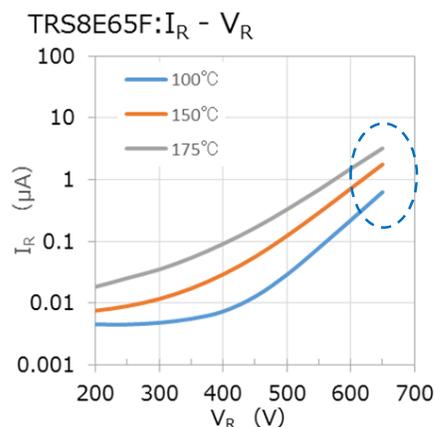
2 Low VF

- Low VF by thinner-wafer technology
VF spec, : 1.45V (typ.)
- * 3rd generation
(under development)=1.2V

3 High IFSM

- High IFSM by improved JBS structure
(83A @ TRS10E65F)

I_R comparison at high temperature (highly better than competitor's)



Customer value / Social subject contribution

- Energy saving by low-power-loss performance
- High durability

Product lineup

- 2nd generation 650V SiC SBD
- 3rd generation 650V/1200V SiC SBD (under development)

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