Silicon N Channel MOS Type (U-MOSIII)/Silicon Epitaxial Schottky Barrier Diode

SSM5H08TU

DC-DC Converter

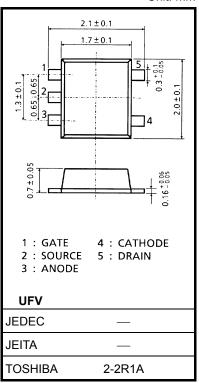
- Nch MOSFET and schottky diode combined in one package
- Low RDS (ON) and low VF

Absolute Maximum Ratings (Ta = 25°C) MOSFET

| Characteristics | | Symbol | Rating | Unit | |
|-------------------------|-------|--------------------------|--------|------|--|
| Drain-Source voltage | | V _{DS} | 20 | V | |
| Gate-Source voltag | e | V _{GSS} | ±12 | V | |
| Drain current | DC | I _D | 1.5 | А | |
| | Pulse | I _{DP} (Note 2) | 6.0 | ~ | |
| Drain power dissipation | | P _D (Note 1) | 0.5 | W | |
| | | t = 10s | 0.8 | vv | |
| Channel temperature | | T _{ch} | 150 | °C | |

Absolute Maximum Ratings (Ta = 25°C) SCHOTTKY DIODE

| Characteristics | Symbol | Rating | Unit |
|-------------------------------------------------------|-----------------|-----------|------|
| Maximum (peak) reverse voltage | V _{RM} | 25 | V |
| Reverse voltage | V _R | 20 | V |
| Average forward current | Ι _Ο | 0.5 | А |
| Peak one cycle surge forward current (non-repetitive) | IFSM | 2 (50 Hz) | А |
| Junction temperature | Тj | 125 | °C |



Weight: 7 mg (typ.)

Absolute Maximum Ratings (Ta = 25°C) MOSFET, DIODE COMMON

| Characteristics | Symbol | Rating | Unit |
|-----------------------|------------------------------|------------|------|
| Storage temperature | T _{stg} | -55 to 125 | °C |
| Operating temperature | T _{opr} (Note 3) | –40 to 100 | °C |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

- Note 1: Mounted on FR4 board (25.4 mm \times 25.4 mm \times 1.6 t, Cu pad: 645 mm²)
- Note 2: Pulse width limited by max channel temperature
- Note 3: Operating temperature limited by max channel temperature and max junction temperature

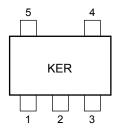
Start of commercial production 2004-01

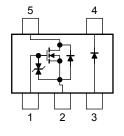
Unit: mm



Marking

Equivalent Circuit





Handling Precaution

When handling individual devices (which are not yet mounted on a circuit board), be sure that the environment is protected against electrostatic discharge. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static materials.

The Channel-to-Ambient thermal resistance $R_{th (ch-a)}$ and the drain power dissipation P_D vary according to the board material, board area, board thickness and pad area. When using this device, be sure to take heat dissipation fully into account.

MOSFET

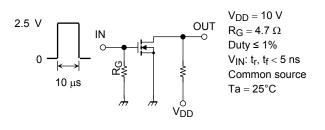
Electrical Characteristics (Ta = 25°C)

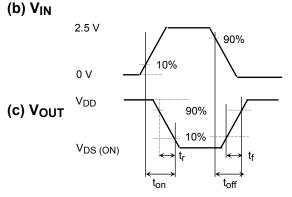
| Characteristic | | Symbol | Test Condition | Min | Тур. | Max | Unit |
|--------------------------------|---------------|----------------------|-----------------------------------------------------------------|-----|------|-----|------|
| Gate leakage current | | I _{GSS} | $V_{GS}=\pm 12~V,~V_{DS}=0~V$ | _ | | ±1 | μA |
| Drain-Source breakdown voltage | | V (BR) DSS | $I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$ | 20 | _ | _ | v |
| | | V (BR) DSX | $I_D = 1 \text{ mA}, V_{GS} = -12 \text{ V}$ | 12 | _ | _ | |
| Drain Cut-off current | | I _{DSS} | $V_{DS}=20~V,~V_{GS}=0~V$ | _ | — | 1 | μA |
| Gate threshold voltage | | V _{th} | $V_{DS} = 3 \text{ V}, \text{ I}_{D} = 0.1 \text{ mA}$ | 0.4 | _ | 1.1 | V |
| Forward transfer admittance | | Y _{fs} | $V_{DS} = 3 \text{ V}, \text{ I}_{D} = 0.75 \text{ A}$ (Note 4) | 1.4 | 2.8 | _ | S |
| Drain-Source on-resistance | | R _{DS} (ON) | $I_D = 0.75 \text{ A}, V_{GS} = 4 \text{ V}$ (Note 4) | _ | 140 | 160 | mΩ |
| | | | $I_D = 0.75 \text{ A}, V_{GS} = 2.5 \text{ V}$ (Note 4) | _ | 180 | 220 | |
| Input capacitance | | C _{iss} | V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz | _ | 125 | _ | pF |
| Reverse transfer capacitance | | C _{rss} | V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz | _ | 17 | _ | pF |
| Output capacitance | | C _{oss} | V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz | _ | 42 | _ | pF |
| Switching time | Turn-on time | t _{on} | $V_{DD} = 10 \text{ V}, \text{ I}_{D} = 0.75 \text{ A}$ | _ | 15.5 | | 200 |
| | Turn-off time | t _{off} | V_{GS} = 0 to 2.5 V, R_G = 4.7 Ω | | 8.5 | | ns |

Note 4: Pulse measurement

Switching Time Test Circuit

(a) Test circuit





Precaution

 V_{th} can be expressed as voltage between gate and source when the low operating current value is $I_D = 100 \ \mu A$ for this product. For normal switching operation, V_{GS} (on) requires a higher voltage than V_{th} and V_{GS} (off) requires a lower voltage than V_{th} .

(The relationship can be established as follows: $V_{GS (off)} < V_{th} < V_{GS (on)}$) Be sure to take this into consideration when using the device.

Schottky Diode

Electrical Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min | Тур. | Max | Unit |
|-------------------|--------------------|---------------------------------|-----|------|------|------|
| Forward voltage | V _{F (1)} | I _F = 0.3 A | | 0.38 | 0.45 | V |
| | V _{F (2)} | I _F = 0.5 A | _ | 0.43 | — | V |
| Reverse current | Ι _R | V _R = 20 V | _ | _ | 50 | μA |
| Total capacitance | CT | V _R = 0 V, f = 1 MHz | _ | 46 | _ | pF |

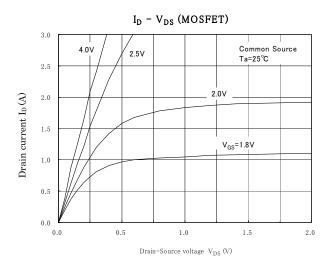
Precaution

The schottky barrier diodes of this product have large-reverse-current-leakage characteristics compared to other switching diodes. This current leakage and improper operating temperature or voltage may cause thermal runaway resulting in breakdown. Take forward and reverse loss into consideration in radiation design and safety design.

MOS Electrical Characteristics Graph

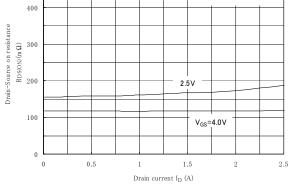
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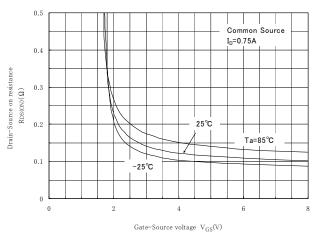


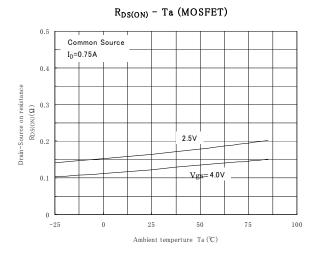
 $I_D - V_{GS}$ (MOSFET) 10000 Common Source V_{DS}=3V 1000 100 Drain current I D (mA) Ta=85℃ 25°C 10 1 -25°C 0.1 0.01 0 2 3 4 1 Gate-Source voltage $\,V_{\rm GS}\,(V)$

R_{DS(ON)} - ID (MOSFET)

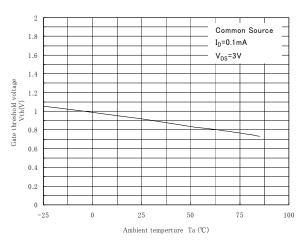


R_{DS(ON)} - VGS (MOSFET)

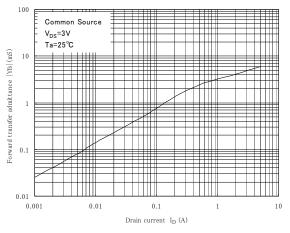


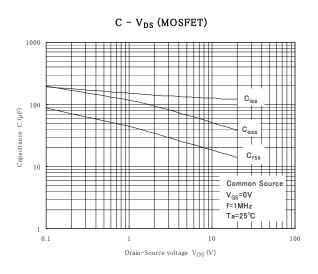


Vth - Ta (MOSFET)



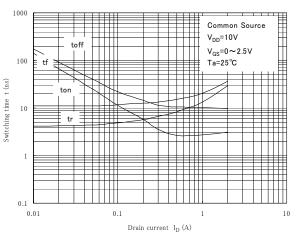
|Yfs| – I_D (MOSFET)



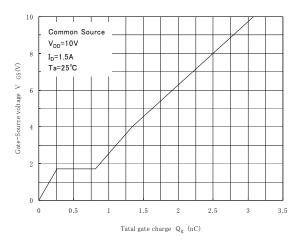


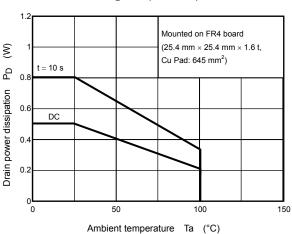
I_{DR} - V_{DS} (MOSFET) 4 3.5 Common Source V_{GS}=0 V Ta=25℃ Drain reverse current I DR (mA) 3 2.5 2 1.5 1 0.5 0 0 -0.2 -0.4 -0.6 -0.8 -1 Drain-Source voltage $\,V_{\rm DS}$ (V)

t - I_D (MOSFET)



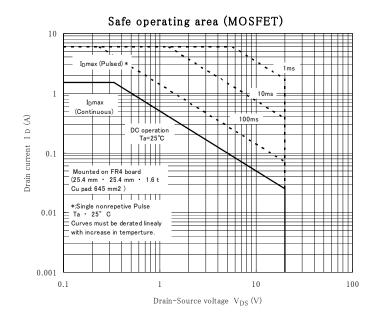
Dynamic Input Characteristic (MOSFET)





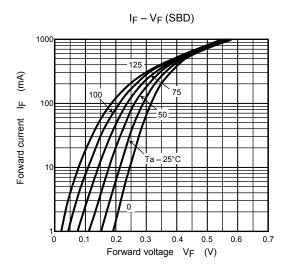
P_D – Ta (MOSFET)

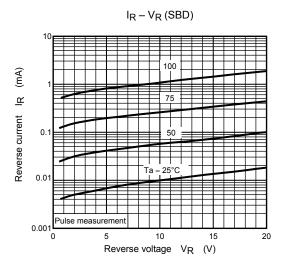
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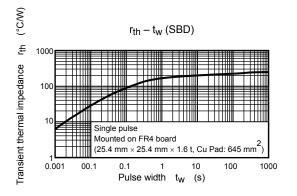


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SBD Electrical Characteristics Graph

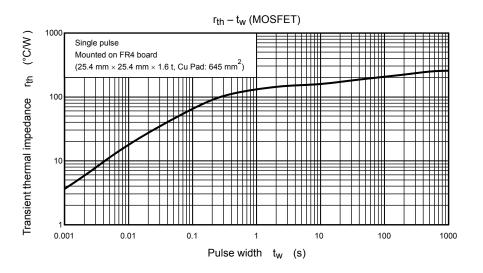


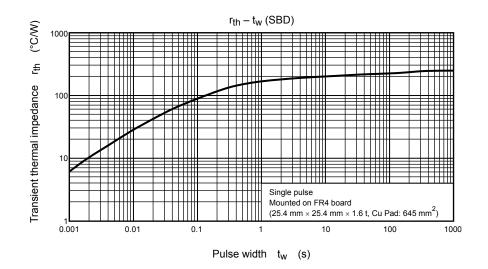




 $C_T - V_R \, (SBD)$ 3000 f = 1 MHz Ta = 25°C 1000 **I** (PF) Ч С 111 100 Total capacitance 10 1 0.01 0.1 100 10 1 Reverse voltage V_R (V)

Transient Thermal Impedance Graph





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