

# 2.5V Drive Nch+Nch MOS FET

AEC-Q101 Qualified

## QS6K1FRA

**●Structure**

Silicon N-channel  
MOS FET

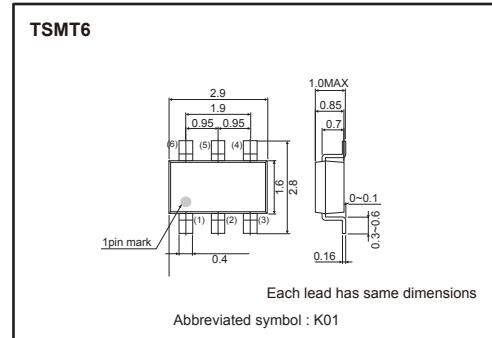
**●Features**

- 1) Low on-resistance.
- 2) Built-in G-S Protection Diode.
- 3) Small and Surface Mount Package (TSMT6).

**●Application**

Power switching, DC / DC converter.

**●External dimensions (Unit : mm)**



**●Packaging specifications**

|          |                              |        |
|----------|------------------------------|--------|
| Type     | Package                      | Taping |
|          | Code                         | TR     |
|          | Basic ordering unit (pieces) | 3000   |
| QS6K1FRA |                              | ○      |

**●Absolute maximum ratings (Ta=25°C)**

<It is the same ratings for the Tr1 and Tr2>

| Parameter                         | Symbol     | Limits      | Unit        |
|-----------------------------------|------------|-------------|-------------|
| Drain-source voltage              | $V_{DSS}$  | 30          | V           |
| Gate-source voltage               | $V_{GSS}$  | 12          | V           |
| Drain current                     | Continuous | $I_D$       | $\pm 1.0$ A |
|                                   | Pulsed     | $I_{DP}$ *1 | $\pm 4.0$ A |
| Source current (Body diode)       | Continuous | $I_S$       | 0.8 A       |
|                                   | Pulsed     | $I_{SP}$ *1 | 4.0 A       |
| Total power dissipation (Tc=25°C) | $P_D$ *2   | 1.25        | W / TOTAL   |
|                                   |            | 0.9         | W / ELEMENT |
| Channel temperature               | $T_{ch}$   | 150         | °C          |
| Storage temperature               | $T_{stg}$  | -55 to +150 | °C          |

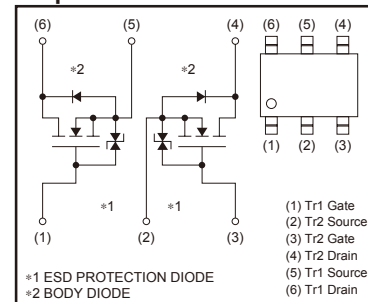
\*1  $P_w \leq 10\mu s$ , Duty cycle  $\leq 1\%$   
\*2 Mounted on a ceramic board

**●Thermal resistance**

| Parameter          | Symbol           | Limits | Unit             |
|--------------------|------------------|--------|------------------|
| Channel to ambient | $R_{th}(ch-a)$ * | 100    | °C / W / TOTAL   |
|                    |                  | 139    | °C / W / ELEMENT |

\* Mounted on a ceramic board

**●Equivalent circuit**



\*A protection diode is included between the gate and the source terminals to protect the diode against static electricity when the product is in use. Use the protection circuit when the fixed voltages are exceeded.

Transistors

●Electrical characteristics (Ta=25°C)

<It is the same characteristics for the Tr1 and Tr2>

| Parameter                               | Symbol                | Min. | Typ. | Max. | Unit | Conditions                                   |
|---|-----------------------|------|------|------|------|--|
| Gate-source leakage                     | I <sub>GSS</sub>      | –    | –    | 10   | μA   | V <sub>GS</sub> =12V, V <sub>DS</sub> =0V    |
| Drain-source breakdown voltage          | V <sub>(BR) DSS</sub> | 30   | –    | –    | V    | I <sub>D</sub> =1mA, V <sub>GS</sub> =0V     |
| Zero gate voltage drain current         | I <sub>DSS</sub>      | –    | –    | 1    | μA   | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V    |
| Gate threshold voltage                  | V <sub>GS(th)</sub>   | 0.5  | –    | 1.5  | V    | V <sub>DS</sub> =10V, I <sub>D</sub> =1mA    |
| Static drain-source on-state resistance | R <sub>DS(on)</sub> * | –    | 170  | 238  | mΩ   | I <sub>D</sub> =1.0A, V <sub>GS</sub> =4.5V  |
|   |                       | –    | 180  | 252  |      | I <sub>D</sub> =1.0A, V <sub>GS</sub> =4.0V  |
|   |                       | –    | 260  | 364  |      | I <sub>D</sub> =1.0A, V <sub>GS</sub> =2.5V  |
| Forward transfer admittance             | Y <sub>fs</sub>   *   | 1.0  | –    | –    | S    | I <sub>D</sub> =1.0A, V <sub>DS</sub> =10V   |
| Input capacitance                       | C <sub>iss</sub>      | –    | 77   | –    | pF   | V <sub>DS</sub> =10V                         |
| Output capacitance                      | C <sub>oss</sub>      | –    | 25   | –    | pF   | V <sub>GS</sub> =0V                          |
| Reverse transfer capacitance            | C <sub>rss</sub>      | –    | 15   | –    | pF   | f=1MHz                                       |
| Turn-on delay time                      | t <sub>d(on)</sub> *  | –    | 7    | –    | ns   | I <sub>D</sub> =500mA, V <sub>DD</sub> ≐ 15V |
| Rise time                               | t <sub>r</sub> *      | –    | 7    | –    | ns   | V <sub>GS</sub> =4.5V                        |
| Turn-off delay time                     | t <sub>d(off)</sub> * | –    | 15   | –    | ns   | R <sub>L</sub> =30.0Ω                        |
| Fall time                               | t <sub>f</sub> *      | –    | 6    | –    | ns   | R <sub>G</sub> =10Ω                          |
| Total gate charge                       | Q <sub>g</sub> *      | –    | 1.7  | 2.4  | nC   | V <sub>DD</sub> ≐ 15V                        |
| Gate-source charge                      | Q <sub>gs</sub> *     | –    | 0.4  | –    | nC   | V <sub>GS</sub> =4.5V                        |
| Gate-drain charge                       | Q <sub>gd</sub> *     | –    | 0.4  | –    | nC   | I <sub>D</sub> =1.0A                         |

\*Pulsed

●Body diode characteristics (Source-Drain) (Ta=25°C)

<It is the same characteristics for the Tr1 and Tr2>

| Parameter       | Symbol            | Min. | Typ. | Max. | Unit | Conditions                                |
|-----------------|-------------------|------|------|------|------|---|
| Forward voltage | V <sub>SD</sub> * | –    | –    | 1.2  | V    | I <sub>S</sub> =3.2A, V <sub>GS</sub> =0V |

\*Pulsed

Transistors

●Electrical characteristic curves

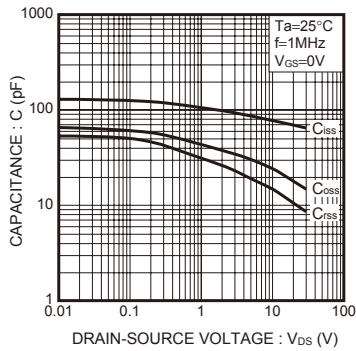


Fig.1 Typical Capacitance vs. Drain-Source Voltage

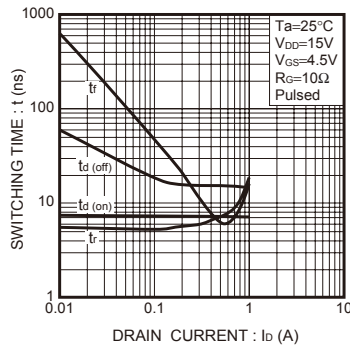


Fig.2 Switching Characteristics

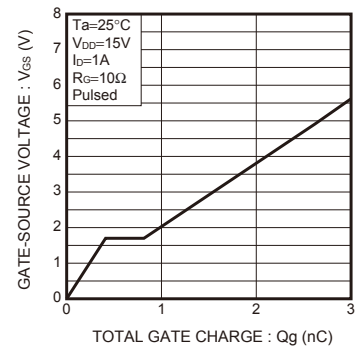


Fig.3 Dynamic Input Characteristics

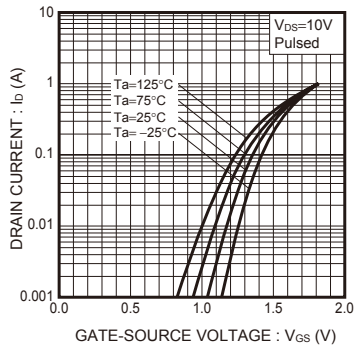


Fig.4 Typical Transfer Characteristics

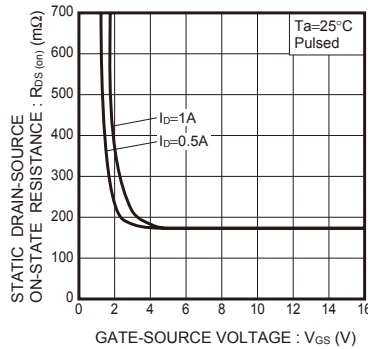


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

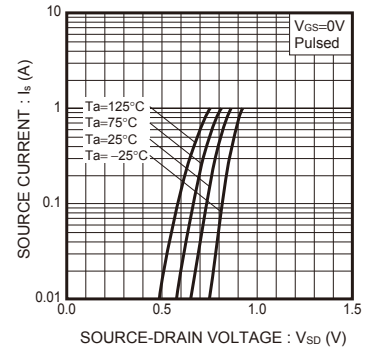


Fig.6 Source Current vs. Source-Drain Voltage

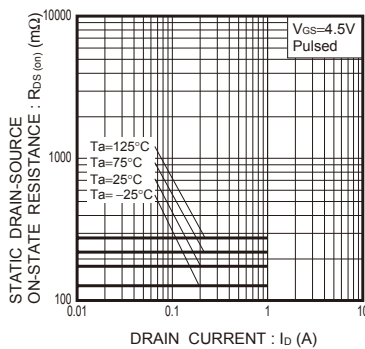


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

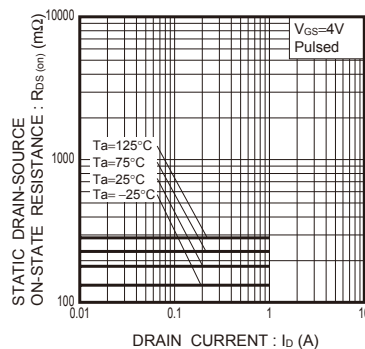


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

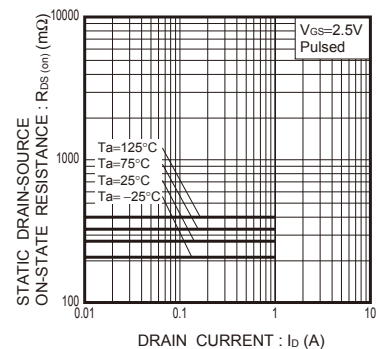


Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

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| JAPAN     | USA       | EU         | CHINA     |
|-----------|-----------|------------|-----------|
| CLASS III | CLASS III | CLASS II b | CLASS III |
| CLASS IV  |           | CLASS III  |           |

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  - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
  - [f] Sealing or coating our Products with resin or other coating materials
  - [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
  - [h] Use of the Products in places subject to dew condensation
4. The Products are not subject to radiation-proof design.
5. Please verify and confirm characteristics of the final or mounted products in using the Products.
6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
8. Confirm that operation temperature is within the specified range described in the product specification.
9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

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2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

**Precautions Regarding Application Examples and External Circuits**

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of ionizer, friction prevention and temperature / humidity control).

**Precaution for Storage / Transportation**

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
  - [a] the Products are exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [b] the temperature or humidity exceeds those recommended by ROHM
  - [c] the Products are exposed to direct sunshine or condensation
  - [d] the Products are exposed to high Electrostatic
2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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