

MOSFETs Silicon N-Channel MOS

SSM3K7002KFU

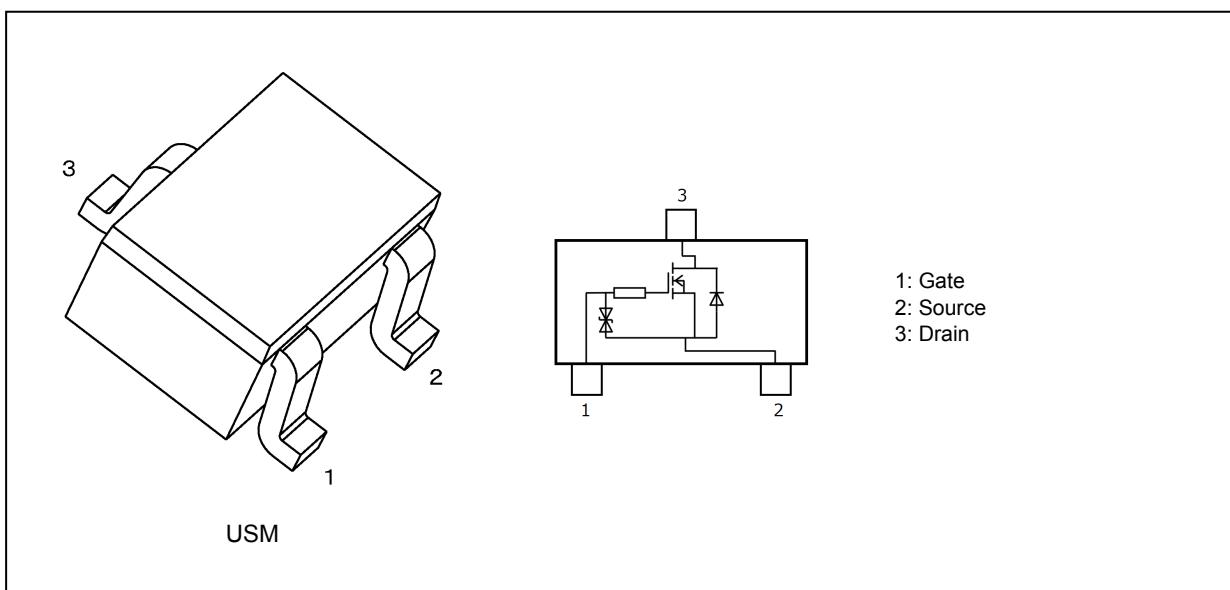
1. Applications

- High-Speed Switching

2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) Low drain-source on-resistance
 - : $R_{DS(ON)} = 1.05 \Omega$ (typ.) (@ $V_{GS} = 10$ V)
 - $R_{DS(ON)} = 1.15 \Omega$ (typ.) (@ $V_{GS} = 5.0$ V)
 - $R_{DS(ON)} = 1.2 \Omega$ (typ.) (@ $V_{GS} = 4.5$ V)

3. Packaging and Internal Circuit



4. Orderable part number

| Orderable part number | AEC-Q101 | Note |
|-----------------------|--------------|-------------------------|
| SSM3K7002KFU,LF | — | General Use |
| SSM3K7002KFU,LXG | YES (Note 1) | Unintended Use (Note 1) |
| SSM3K7002KFU,LXH | YES | Automotive Use |

Note 1: For more information, please contact our sales or use the inquiry form on our website.

Start of commercial production
2016-01

5. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|------------------------|-----------|------------|------------------|
| Drain-source voltage | V_{DSS} | 60 | V |
| Gate-source voltage | V_{GSS} | ± 20 | |
| Drain current (DC) | I_D | 400 | mA |
| Drain current (pulsed) | I_{DP} | 1200 | |
| Power dissipation | P_D | 150 | mW |
| Power dissipation | | 700 | |
| Channel temperature | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -55 to 150 | |

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: Ensure that the channel temperature does not exceed 150°C .

Note 2: pulse width $\leq 10\ \mu\text{s}$, Duty $\leq 1\%$

Note 3: Device mounted on a $25.4\ \text{mm} \times 25.4\ \text{mm} \times 1.6\ \text{mm}$ FR4 glass epoxy board (Cu pad: $0.6\ \text{mm}^2 \times 3$)

Note 4: Device mounted on a $25.4\ \text{mm} \times 25.4\ \text{mm} \times 1.6\ \text{mm}$ FR4 glass epoxy board (Cu pad: $645\ \text{mm}^2$)

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

Note: The MOSFETs in this device are sensitive to electrostatic discharge. When handling this device, the worktables, operators, soldering irons and other objects should be protected against anti-static discharge.

Note: 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.

6. Electrical Characteristics

6.1. Static Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------------|---|-----|------|----------|---------------|
| Gate leakage current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 16\text{ V}$ | — | — | ± 10 | μA |
| Drain cut-off current | I_{DSS} | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 1 | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$ | 60 | — | — | |
| Gate threshold voltage | V_{th} | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 1.1 | — | 2.1 | V |
| Drain-source on-resistance (Note 1) | $R_{DS(\text{ON})}$ | $I_D = 100\text{ mA}, V_{GS} = 4.5\text{ V}$ | — | 1.2 | 1.75 | |
| | | $I_D = 100\text{ mA}, V_{GS} = 5.0\text{ V}$ | — | 1.15 | 1.65 | |
| | | $I_D = 100\text{ mA}, V_{GS} = 10\text{ V}$ | — | 1.05 | 1.5 | |
| Forward transfer admittance (Note 1) | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$ | — | 1 | — | S |

Note 1: Pulse measurement.

6.2. Dynamic Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------------|---------------------|---|-----|------|-----|-------------|
| Input capacitance | C_{iss} | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 26 | 40 | pF |
| Reverse transfer capacitance | C_{rss} | | — | 1.3 | — | |
| Output capacitance | C_{oss} | | — | 5.5 | — | |
| Switching time (rise time) | t_r | $V_{DD} = 30\text{ V}, I_D = 200\text{ mA}, V_{GS} = 0\text{ to }10\text{ V}, R_{GS} = 50\text{ }\Omega$ Duty $\leq 1\%$, $V_{IN} \cdot t_r, t_f < 5\text{ ns}$, Common source, See Chapter 6.3. | — | 3.6 | — | ns |
| Switching time (turn-on delay time) | $t_{d(\text{on})}$ | | — | 5.5 | 11 | |
| Switching time (fall time) | t_f | | — | 17 | — | |
| Switching time (turn-off delay time) | $t_{d(\text{off})}$ | | — | 38 | 90 | |

6.3. Switching Time Test Circuit

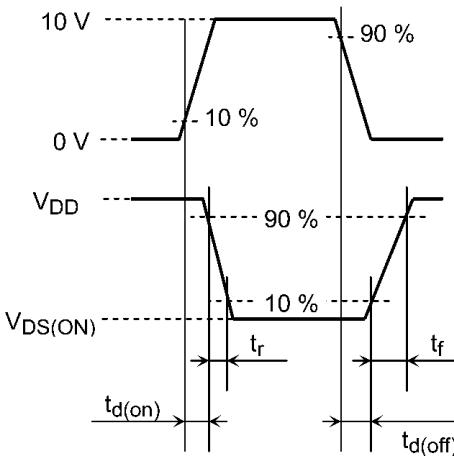
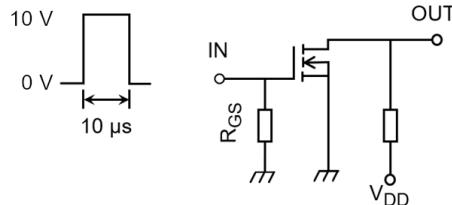


Fig. 6.3.1 Switching Time Test Circuit

Fig. 6.3.2 Input Waveform/Output Waveform

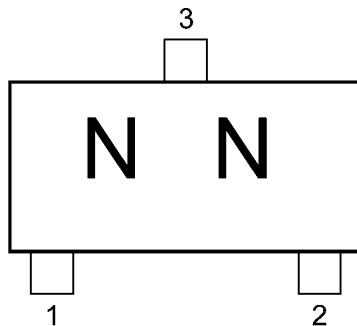
6.4. Gate Charge Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|----------|--|-----|------|-----|-------------|
| Total gate charge (gate-source plus gate-drain) | Q_g | $V_{DD} = 30\text{ V}, I_D = 200\text{ mA}, V_{GS} = 4.5\text{ V}$ | — | 0.39 | 0.6 | nC |
| Gate-source charge | Q_{gs} | | — | 0.2 | — | |
| Gate-drain charge | Q_{gd} | | — | 0.11 | — | |

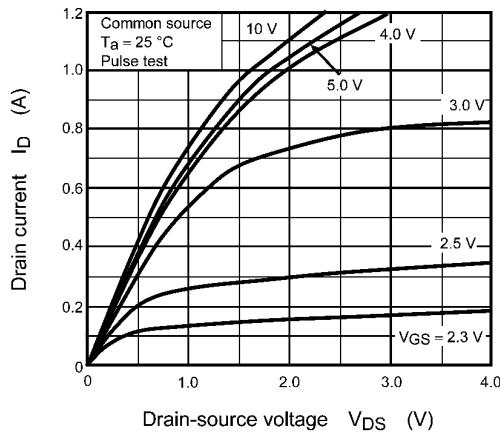
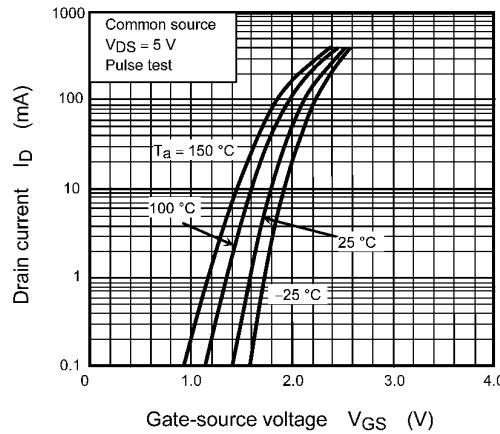
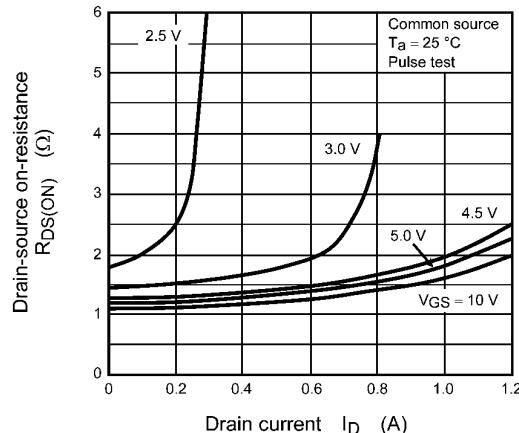
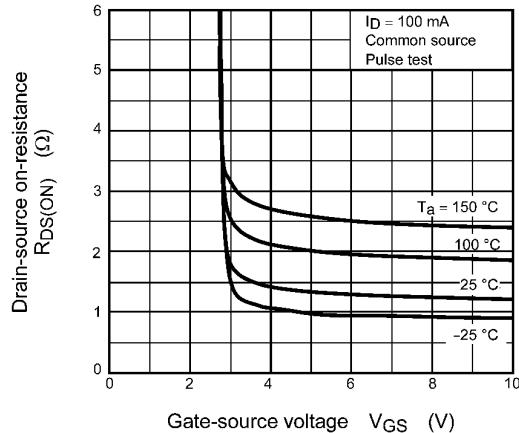
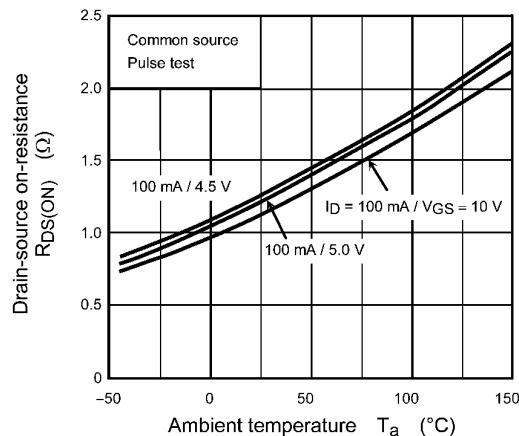
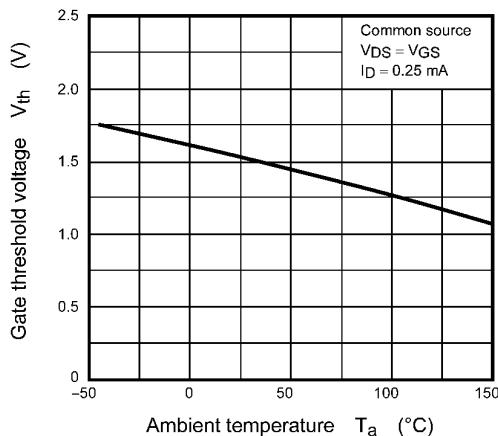
6.5. Source-Drain Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-----------------------------------|-----------|--|-----|------|-----|------|
| Diode forward voltage (Note 1) | V_{DSF} | $I_{DR} = 115 \text{ mA}$, $V_{GS} = 0 \text{ V}$ | — | 0.79 | 1.1 | V |

Note 1: Pulse measurement.

7. Marking

8. Characteristics Curves (Note)

Fig. 8.1 I_D - V_{DS} Fig. 8.2 I_D - V_{GS} Fig. 8.3 $R_{DS(ON)}$ - I_D Fig. 8.4 $R_{DS(ON)}$ - V_{GS} Fig. 8.5 $R_{DS(ON)}$ - T_a Fig. 8.6 V_{th} - T_a

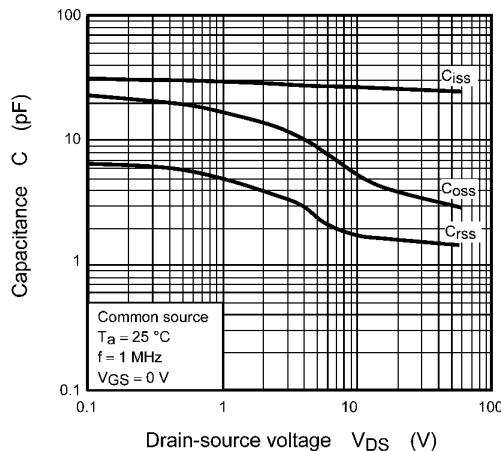


Fig. 8.7 C - V_{DS}

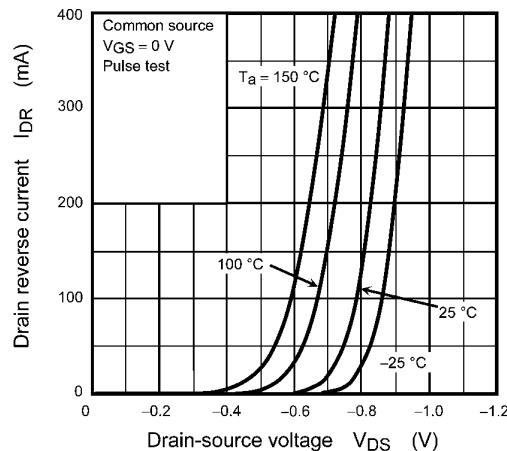


Fig. 8.8 I_{DR} - V_{DS}

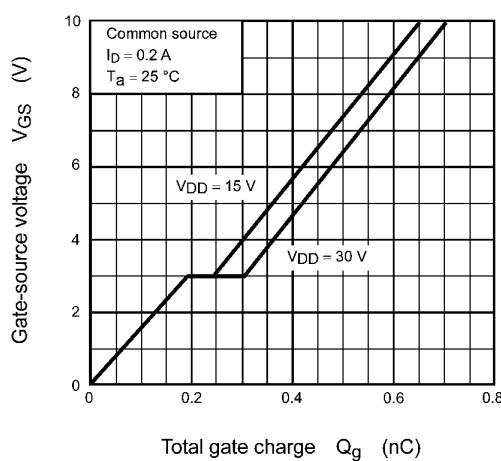


Fig. 8.9 Dynamic Input Characteristics

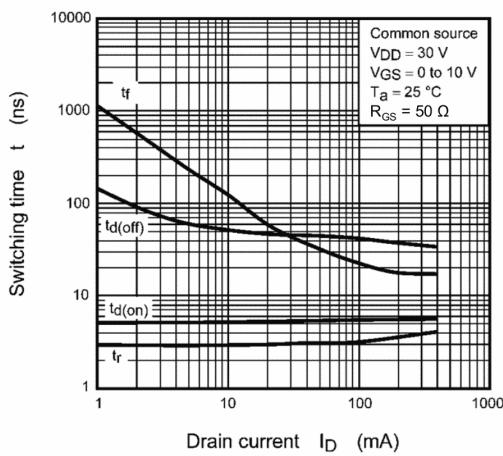


Fig. 8.10 t - I_D

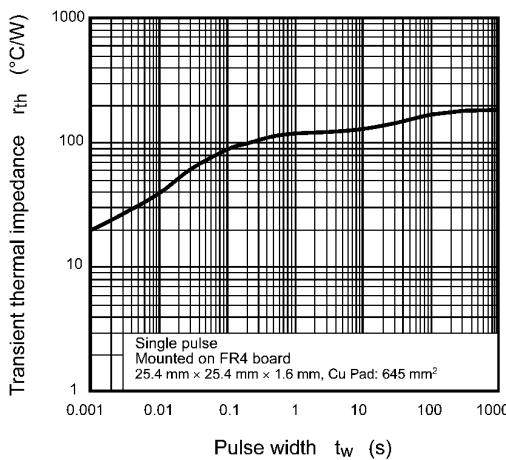


Fig. 8.11 r_{th} - t_w

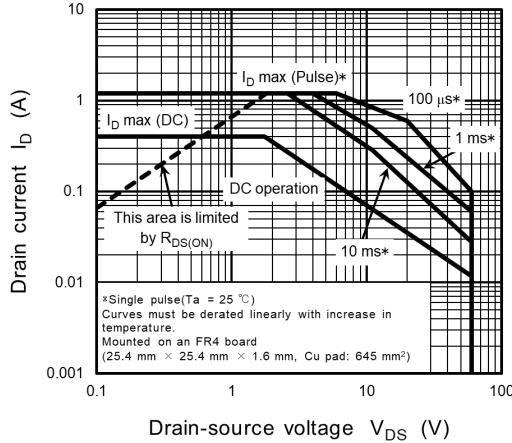
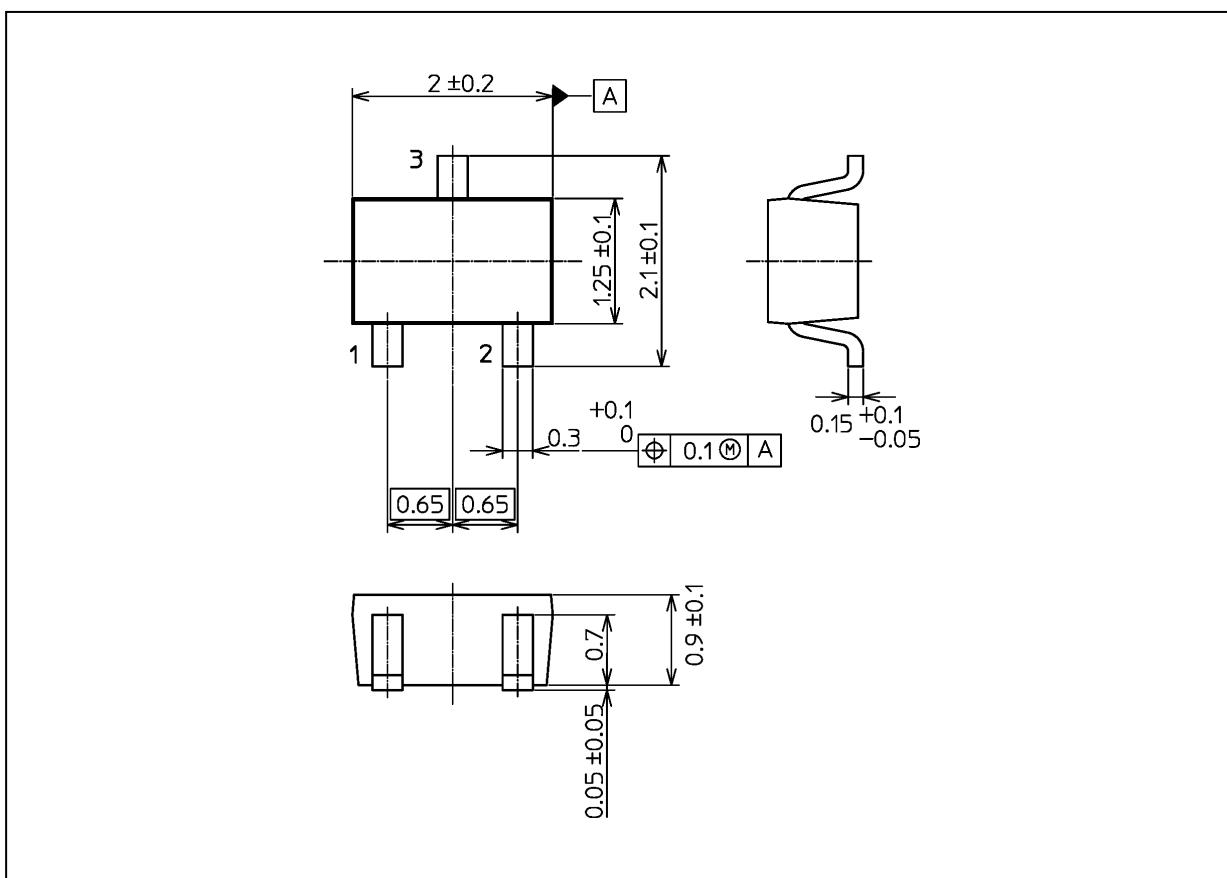


Fig. 8.12 Safe Operating Area

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 6.0 mg (typ.)

| Package Name(s) |
|-----------------|
| JEDEC: SOT-323 |
| Nickname: USM |

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