

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOSII)

SSM3K14T

DC-DC Converter
High Speed Switching Applications

- Small Package
- Low ON-resistance: $R_{on} = 39 \text{ m}\Omega$ (max) (@ $V_{GS} = 10 \text{ V}$)
: $R_{on} = 57 \text{ m}\Omega$ (max) (@ $V_{GS} = 4.5 \text{ V}$)
- High speed: $t_{on} = 24 \text{ ns}$ (typ.)
: $t_{off} = 19 \text{ ns}$ (typ.)

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

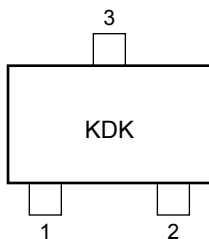
| Characteristic | Symbol | Rating | Unit |
|--|----------------|--------------------|------------------|
| Drain-Source voltage | V_{DS} | 30 | V |
| Gate-Source voltage | V_{GS} | ± 20 | V |
| Drain current | DC | I_D | 4.0 |
| | Pulse | I_{DP} (Note 2) | 8.0 |
| Drain power dissipation ($T_a = 25^\circ\text{C}$) | P_D (Note 1) | | 0.7 |
| | | $t = 10 \text{ s}$ | 1.25 |
| Channel temperature | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | T_{stg} | -55~150 | $^\circ\text{C}$ |

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).

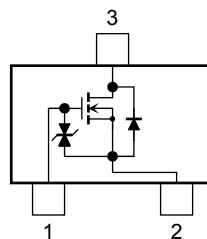
Note 1: Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 t, Cu pad: 645 mm²)

Note 2: The pulse width limited by max channel temperature.

Marking



Equivalent Circuit

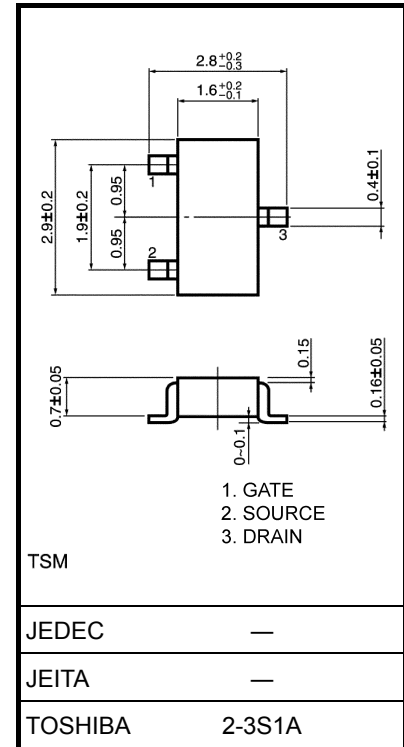


Handling Precaution

When handling individual devices (which are not yet mounted on a circuit board), be sure that the environment is protected against electrostatic electricity. 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, and are also affected by the environment in which the product is used. When using this device, please take heat dissipation fully into account.

Unit: mm



Weight: 10 mg (typ.)

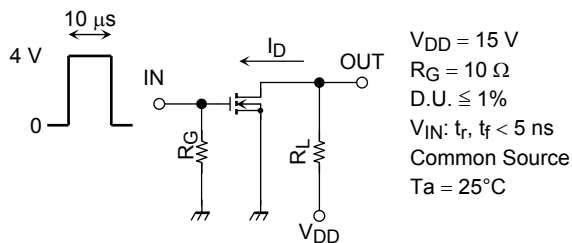
Electrical Characteristics (Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit | |
|--------------------------------|---------------|---|--|------|---------|---------------|----|
| Gate leakage current | I_{GSS} | $V_{GS} = \pm 16\text{ V}, V_{DS} = 0$ | — | — | ± 1 | μA | |
| Drain-Source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 1\text{ mA}, V_{GS} = 0$ | 30 | — | — | V | |
| | $V_{(BR)DSX}$ | $I_D = 1\text{ mA}, V_{GS} = -20\text{ V}$ | 15 | — | — | | |
| Drain Cut-off current | I_{DSS} | $V_{DS} = 30\text{ V}, V_{GS} = 0$ | — | — | 1 | μA | |
| Gate threshold voltage | V_{th} | $V_{DS} = 5\text{ V}, I_D = 0.1\text{ mA}$ | 1.0 | — | 2.5 | V | |
| Forward transfer admittance | $ Y_{fs} $ | $V_{DS} = 5\text{ V}, I_D = 2\text{ A}$ (Note 3) | 3.2 | 6.4 | — | S | |
| Drain-Source ON resistance | $R_{DS(ON)}$ | $I_D = 2\text{ A}, V_{GS} = 10\text{ V}$ (Note 3) | — | 31 | 39 | m Ω | |
| | | $I_D = 2\text{ A}, V_{GS} = 4.5\text{ V}$ (Note 3) | — | 45 | 57 | | |
| | | $I_D = 2\text{ A}, V_{GS} = 4.0\text{ V}$ (Note 3) | — | 50 | 67 | | |
| Total gate charge | Q_g | $V_{DD} \approx 24\text{ V}, I_D = 4\text{ A}, V_{GS} = 4\text{ V}$ | — | 5.0 | — | nC | |
| Input capacitance | C_{iss} | $V_{DS} = 15\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$ | — | 460 | — | pF | |
| Reverse transfer capacitance | C_{rss} | $V_{DS} = 15\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$ | — | 62 | — | pF | |
| Output capacitance | C_{oss} | $V_{DS} = 15\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$ | — | 106 | — | pF | |
| Switching time | Rise time | t_r | $V_{DD} = 15\text{ V}, I_D = 2\text{ A}$ $V_{GS} = 0 \sim 4\text{ V}, R_G = 10\ \Omega$ | — | 15 | — | ns |
| | Turn-on time | t_{on} | | — | 24 | — | |
| | Fall time | t_f | | — | 6 | — | |
| | Turn-off time | t_{off} | | — | 19 | — | |

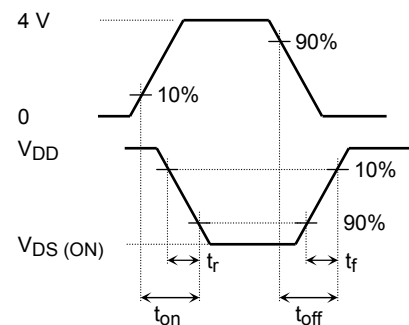
Note 3: Pulse test

Switching Time Test Circuit

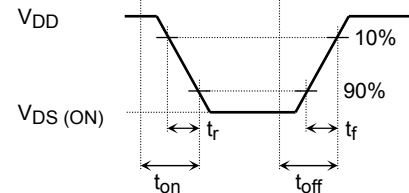
(a) Test circuit



(b) V_{IN}



(c) V_{OUT}

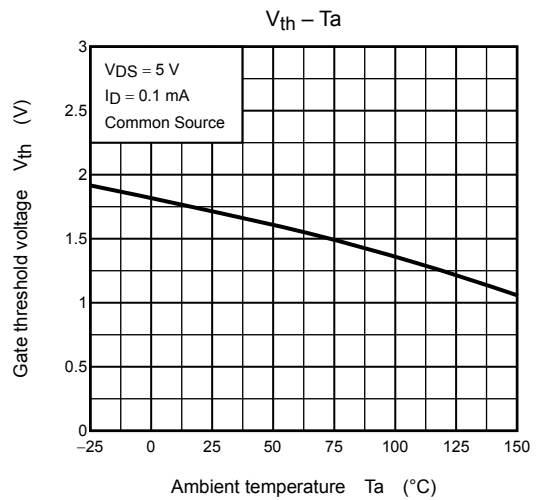
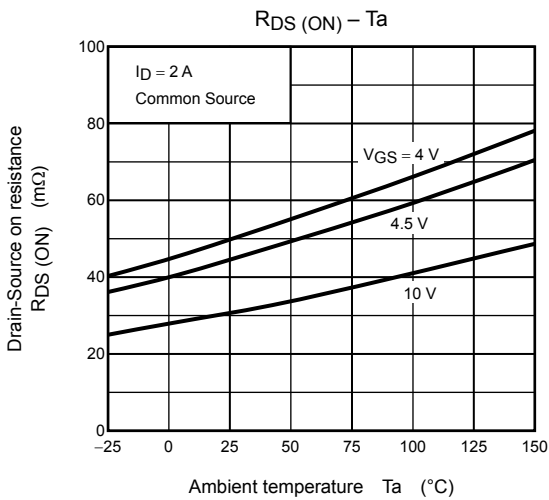
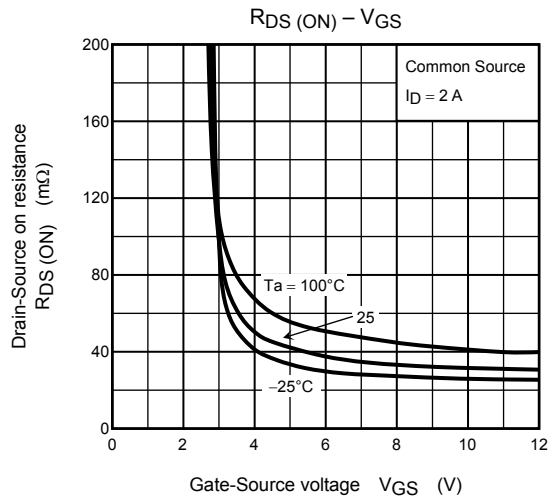
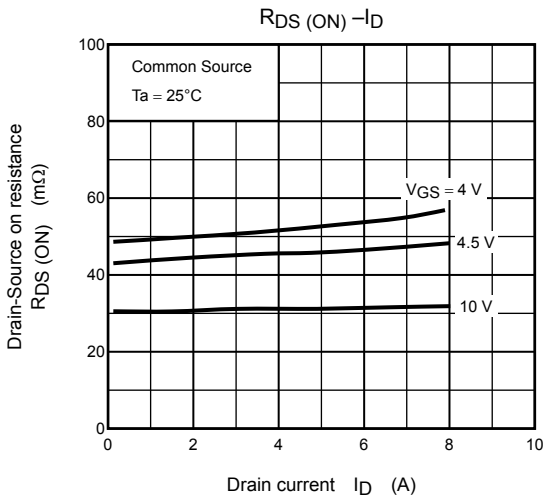
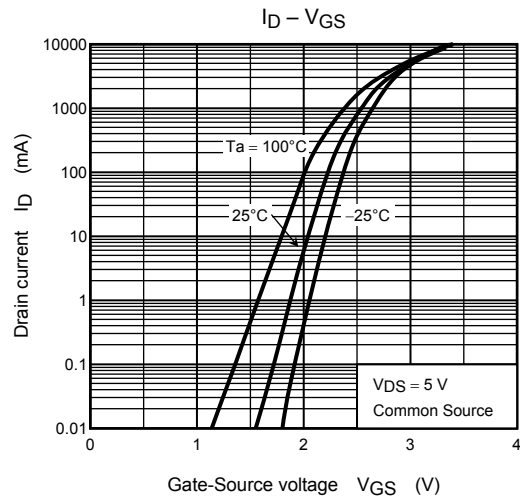
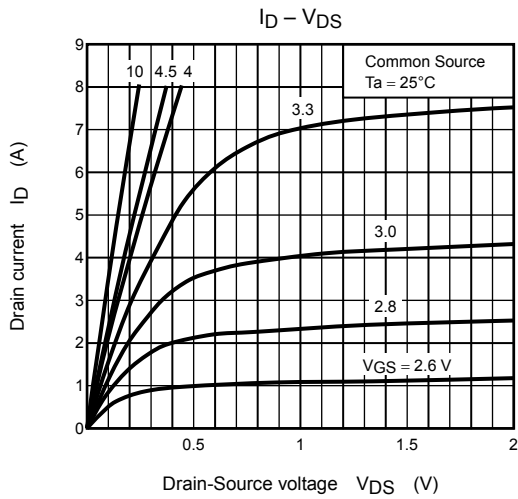


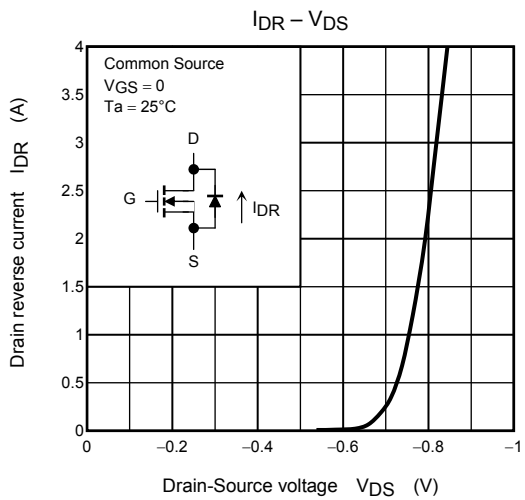
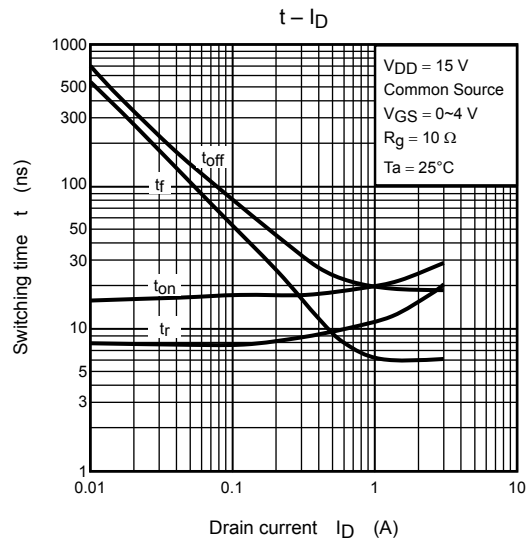
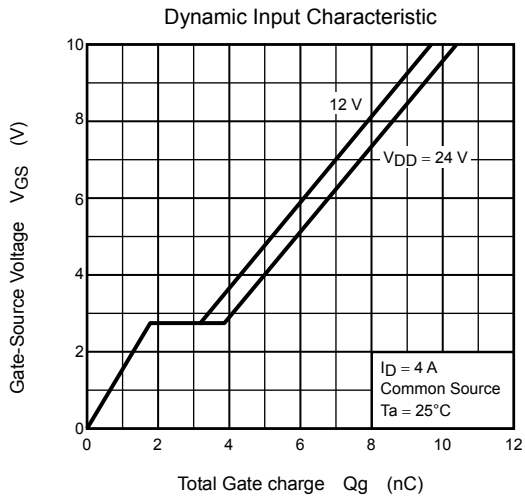
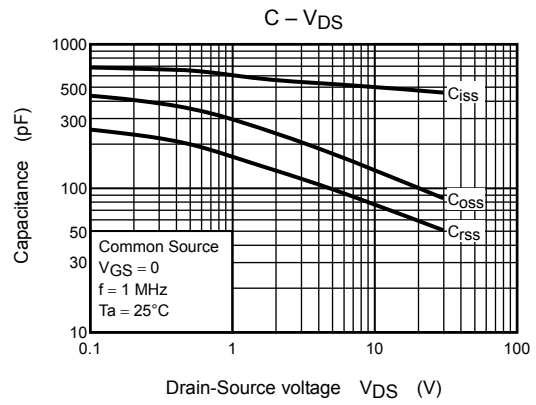
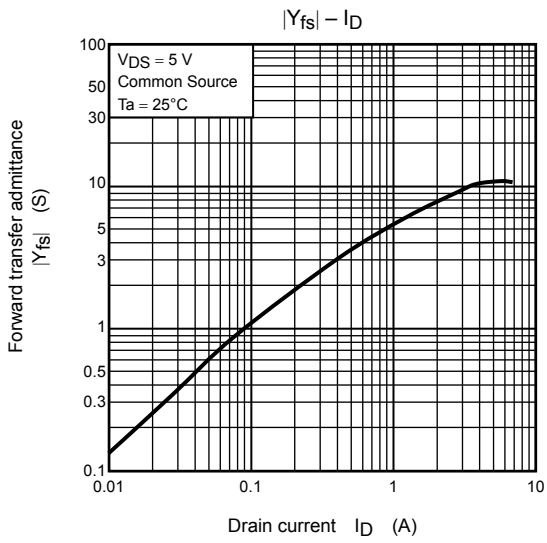
Precaution

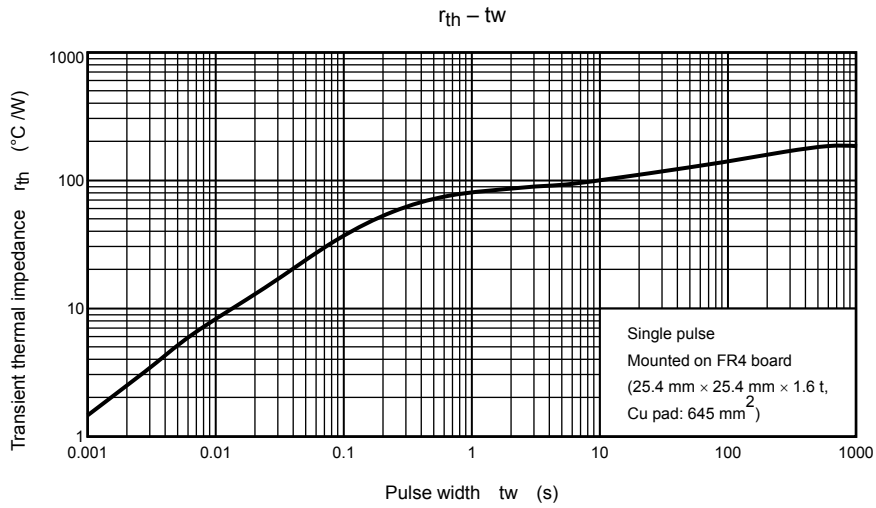
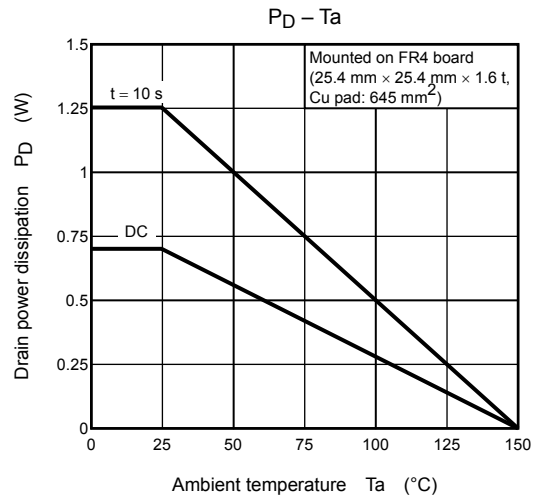
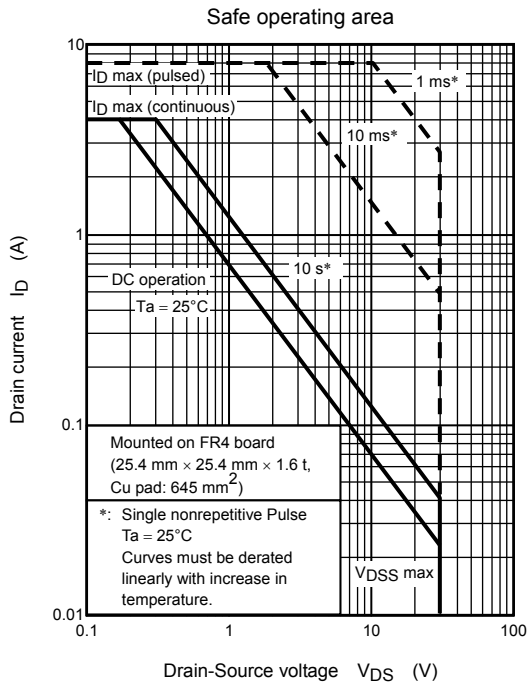
V_{th} can be expressed as voltage between gate and source when low operating current value is $I_D = 100\ \mu\text{A}$ for this product. For normal switching operation, $V_{GS(ON)}$ requires higher voltage than V_{th} and $V_{GS(OFF)}$ requires lower voltage than V_{th} .

(relationship can be established as follows: $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$)

Please take this into consideration for using the device.







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20070701-EN GENERAL

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