

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

SSM3K15AFU

Load Switching Applications

- 2.5 V drive
- Low ON-resistance:  $R_{DS(ON)} = 3.6 \Omega$  (max) (@ $V_{GS} = 4 \text{ V}$ )  
 $R_{DS(ON)} = 6.0 \Omega$  (max) (@ $V_{GS} = 2.5 \text{ V}$ )

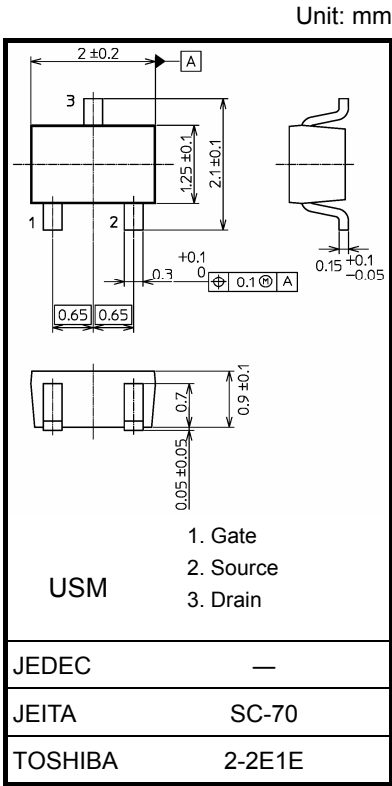
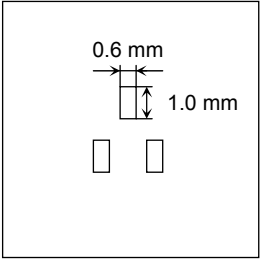
Absolute Maximum Ratings (Ta = 25°C)

| Characteristics           |       | Symbol         | Rating     | Unit |
|---------------------------|-------|----------------|------------|------|
| Drain-Source voltage      |       | $V_{DSS}$      | 30         | V    |
| Gate-Source voltage       |       | $V_{GSS}$      | $\pm 20$   | V    |
| Drain current             | DC    | $I_D$          | 100        | mA   |
|                           | Pulse | $I_{DP}$       | 400        |      |
| Power dissipation         |       | $P_D$ (Note 1) | 150        | mW   |
| Channel temperature       |       | $T_{ch}$       | 150        | °C   |
| Storage temperature range |       | $T_{stg}$      | -55 to 150 | °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.

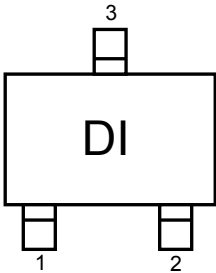
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Mounted on FR4 board (25.4 mm × 25.4 mm × 1.6mm , Cu Pad : 0.6mm<sup>2</sup> × 3)

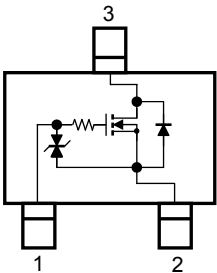


Weight: 6.0 mg (typ.)

Marking



Equivalent Circuit (top view)



Start of commercial production  
2012-08

## Electrical characteristics (Ta = 25°C)

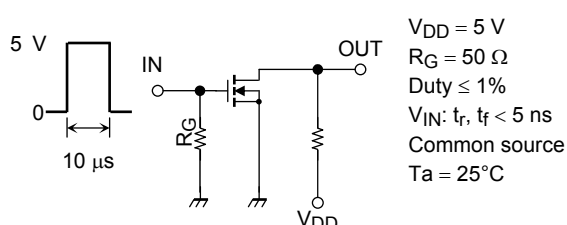
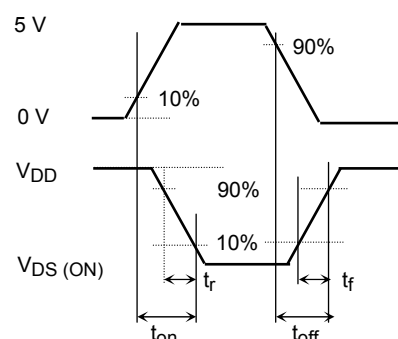
| Characteristics                | Symbol        | Test Condition                                                                                             | Min | Typ.  | Max     | Unit          |
|--------------------------------|---------------|------------------------------------------------------------------------------------------------------------|-----|-------|---------|---------------|
| Drain-Source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 0.1 \text{ mA}$ , $V_{GS} = 0 \text{ V}$                                                            | 30  | —     | —       | V             |
|                                | $V_{(BR)DSX}$ | $I_D = 0.1 \text{ mA}$ , $V_{GS} = -10 \text{ V}$ (Note 3)                                                 | 16  | —     | —       |               |
| Drain cut-off current          | $I_{DSS}$     | $V_{DS} = 30 \text{ V}$ , $V_{GS} = 0 \text{ V}$                                                           | —   | —     | 1       | $\mu\text{A}$ |
| Gate leakage current           | $I_{GSS}$     | $V_{GS} = \pm 16 \text{ V}$ , $V_{DS} = 0 \text{ V}$                                                       | —   | —     | $\pm 1$ | $\mu\text{A}$ |
| Gate threshold voltage         | $V_{th}$      | $V_{DS} = 3 \text{ V}$ , $I_D = 0.1 \text{ mA}$                                                            | 0.8 | —     | 1.5     | V             |
| Forward transfer admittance    | $ Y_{fs} $    | $V_{DS} = 3 \text{ V}$ , $I_D = 10 \text{ mA}$ (Note 2)                                                    | 35  | —     | —       | mS            |
| Drain-Source ON-resistance     | $R_{DS(ON)}$  | $I_D = 10 \text{ mA}$ , $V_{GS} = 4 \text{ V}$ (Note 2)                                                    | —   | 2.3   | 3.6     | $\Omega$      |
|                                |               | $I_D = 10 \text{ mA}$ , $V_{GS} = 2.5 \text{ V}$ (Note 2)                                                  | —   | 3.5   | 6.0     |               |
| Input capacitance              | $C_{iss}$     | $V_{DS} = 3 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$                                      | —   | 13.5  | —       | pF            |
| Output capacitance             | $C_{oss}$     |                                                                                                            | —   | 8.0   | —       |               |
| Reverse transfer capacitance   | $C_{rss}$     |                                                                                                            | —   | 6.5   | —       |               |
| Switching time                 | Turn-on time  | $V_{DD} = 5 \text{ V}$ , $I_D = 10 \text{ mA}$<br>$V_{GS} = 0 \text{ to } 5 \text{ V}$ , $R_G = 50 \Omega$ | —   | 5.5   | —       | ns            |
|                                | Turn-off time |                                                                                                            | —   | 35    | —       |               |
| Drain-source forward voltage   | $V_{DSF}$     | $I_D = -100 \text{ mA}$ , $V_{GS} = 0 \text{ V}$ (Note 2)                                                  | —   | -0.85 | -1.2    | V             |

Note 2: Pulse test

Note 3: If a reverse bias is applied between gate and source, this device enters  $V_{(BR)DSX}$  mode. Note that the drain-source breakdown voltage is lowered in this mode

## Switching Time Test Circuit

## (a) Test circuit

(b)  $V_{IN}$ (c)  $V_{OUT}$ 

## Precaution

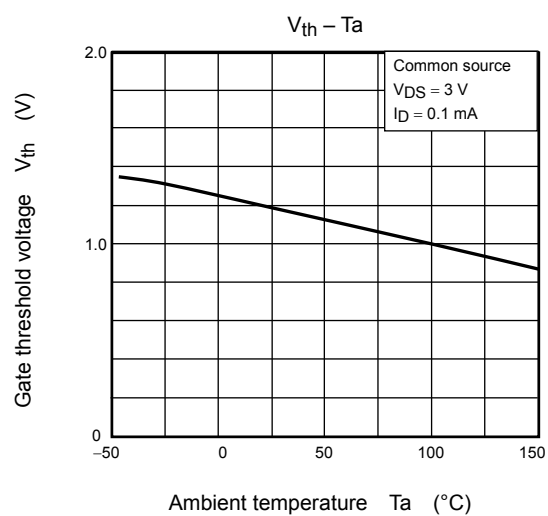
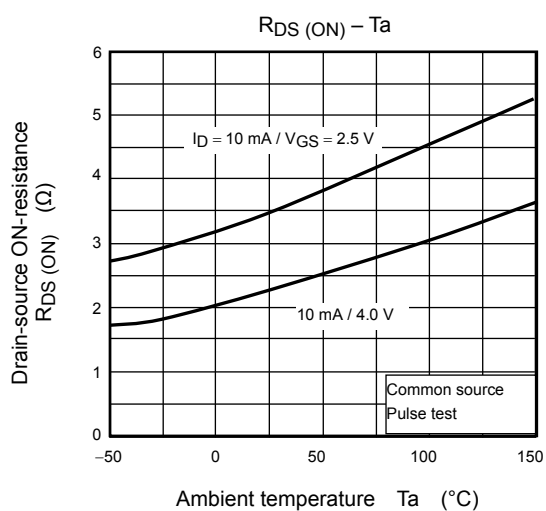
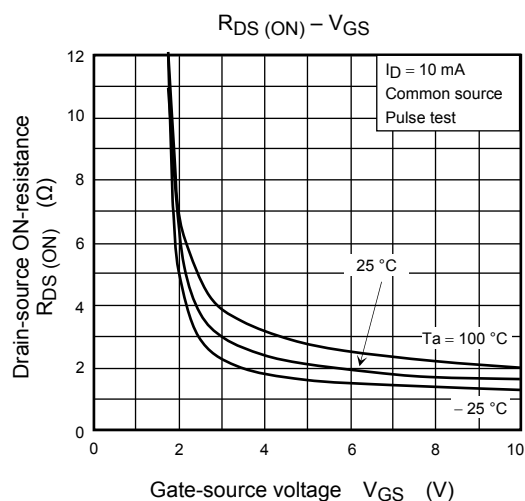
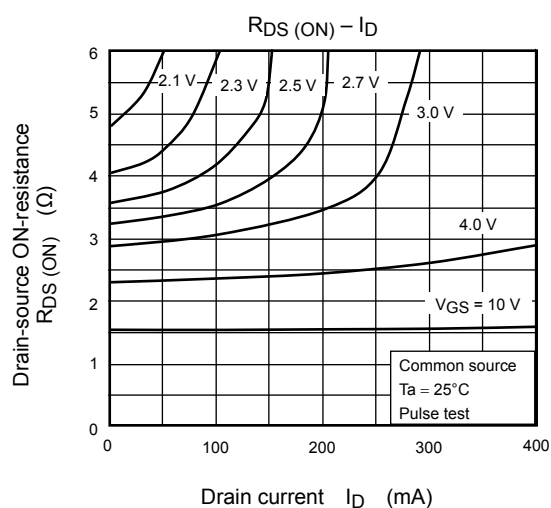
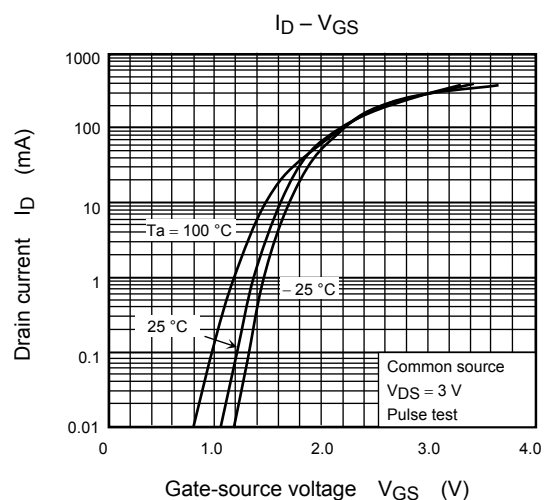
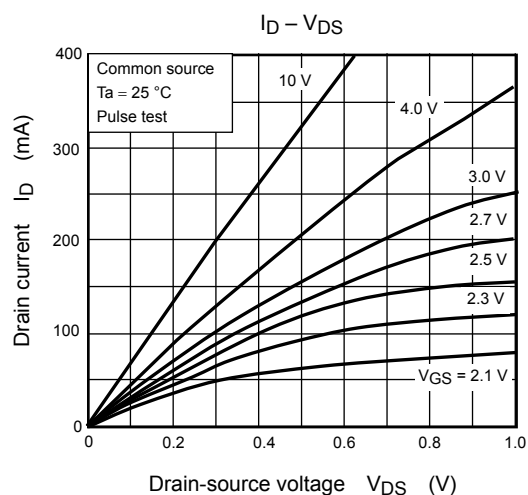
$V_{th}$  can be expressed as voltage between gate and source when low operating current value is  $I_D = 0.1 \text{ mA}$  for this product. For normal switching operation,  $V_{GS(on)}$  requires higher voltage than  $V_{th}$  and  $V_{GS(off)}$  requires lower voltage than  $V_{th}$ . (Relationship can be established as follows:  $V_{GS(off)} < V_{th} < V_{GS(on)}$ ) Please take this into consideration for using the device.

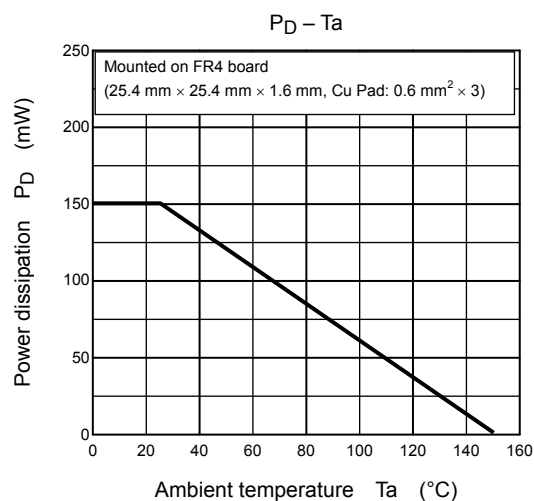
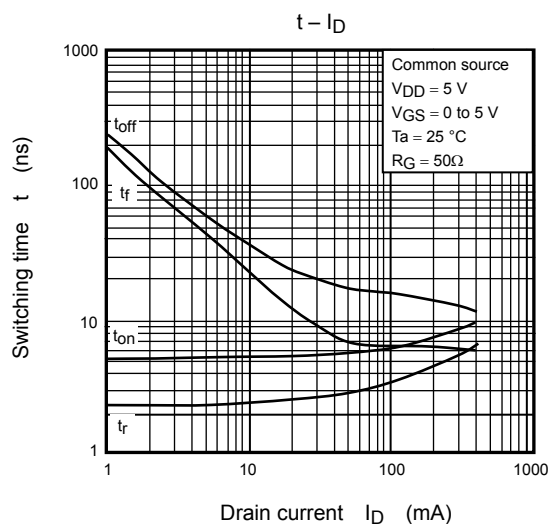
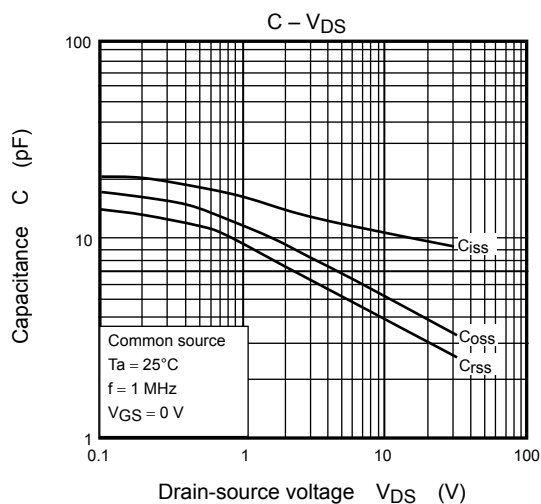
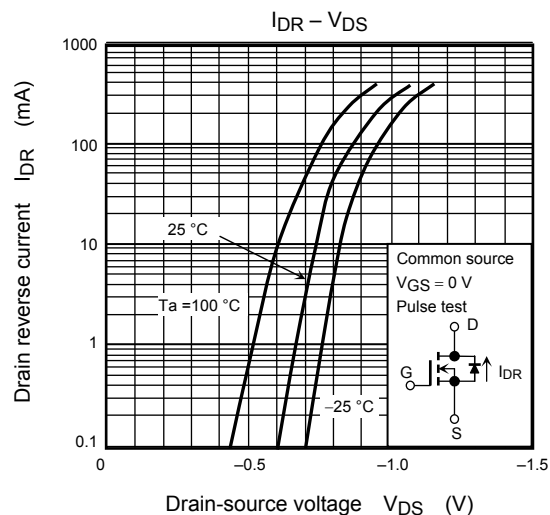
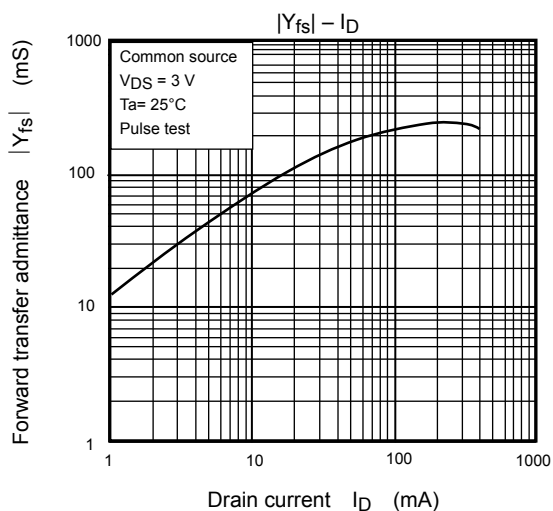
Do not use this device under avalanche mode. It may cause the device to break down.

## Handling Precaution

When handling individual devices (which are not yet mounting 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.

Thermal resistance  $R_{th(ch-a)}$  and power dissipation  $P_D$  vary depending on board material, board area, board thickness and pad area. When using this device, please take heat dissipation into consideration





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