

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

# SSM3K16FS

High Speed Switching Applications  
 Analog Switch Applications

- Suitable for high-density mounting due to compact package
- Low on resistance:  $R_{on} = 3.0 \Omega$  (max) (@ $V_{GS} = 4 V$ )  
 :  $R_{on} = 4.0 \Omega$  (max) (@ $V_{GS} = 2.5 V$ )  
 :  $R_{on} = 15 \Omega$  (max) (@ $V_{GS} = 1.5 V$ )

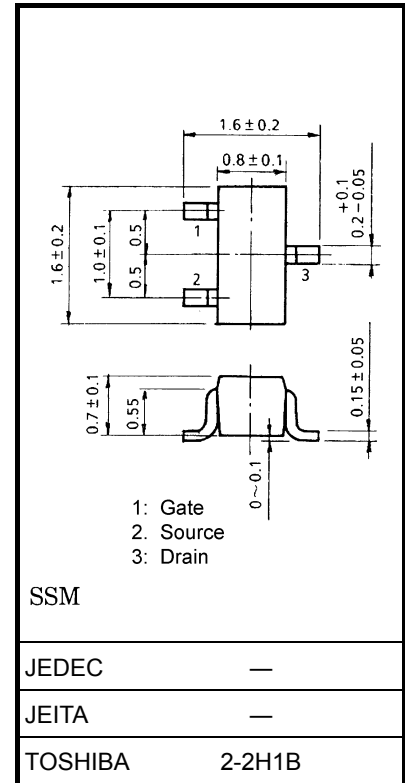
### Absolute Maximum Ratings (Ta = 25°C)

| Characteristics                     | Symbol    | Rating   | Unit |
|-------------------------------------|-----------|----------|------|
| Drain-Source voltage                | $V_{DS}$  | 20       | V    |
| Gate-Source voltage                 | $V_{GSS}$ | $\pm 10$ | V    |
| Drain current                       | DC        | $I_D$    | mA   |
|                                     | Pulse     | $I_{DP}$ |      |
| Drain power dissipation (Ta = 25°C) | $P_D$     | 100      | mW   |
| Channel temperature                 | $T_{ch}$  | 150      | °C   |
| Storage temperature range           | $T_{stg}$ | -55~150  | °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.

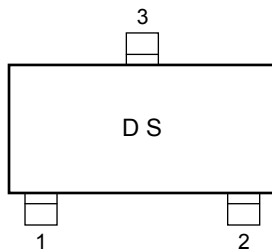
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Unit: mm

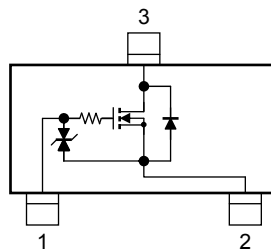


Weight: 2.4 mg (typ.)

### Marking



### Internal connections



### Handling Precaution

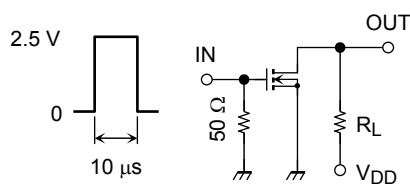
When handling individual devices (which are not yet mounting on a circuit board), be sure that the environment is protected against electrostatic electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static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

## Electrical Characteristics (Ta = 25°C)

| Characteristics                | Symbol        | Test Condition                                      | Min                                                                          | Typ. | Max     | Unit          |    |
|--------------------------------|---------------|-----------------------------------------------------|------------------------------------------------------------------------------|------|---------|---------------|----|
| Gate leakage current           | $I_{GSS}$     | $V_{GS} = \pm 10\text{ V}, V_{DS} = 0$              | —                                                                            | —    | $\pm 1$ | $\mu\text{A}$ |    |
| Drain-Source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 0.1\text{ mA}, V_{GS} = 0$                   | 20                                                                           | —    | —       | V             |    |
| Drain cut-off current          | $I_{DSS}$     | $V_{DS} = 20\text{ V}, V_{GS} = 0$                  | —                                                                            | —    | 1       | $\mu\text{A}$ |    |
| Gate threshold voltage         | $V_{th}$      | $V_{DS} = 3\text{ V}, I_D = 0.1\text{ mA}$          | 0.6                                                                          | —    | 1.1     | V             |    |
| Forward transfer admittance    | $ Y_{fs} $    | $V_{DS} = 3\text{ V}, I_D = 10\text{ mA}$           | 40                                                                           | —    | —       | mS            |    |
| Drain-Source ON resistance     | $R_{DS(ON)}$  | $I_D = 10\text{ mA}, V_{GS} = 4\text{ V}$           | —                                                                            | 1.5  | 3.0     | $\Omega$      |    |
|                                |               | $I_D = 10\text{ mA}, V_{GS} = 2.5\text{ V}$         | —                                                                            | 2.2  | 4.0     |               |    |
|                                |               | $I_D = 1\text{ mA}, V_{GS} = 1.5\text{ V}$          | —                                                                            | 5.2  | 15      |               |    |
| Input capacitance              | $C_{iss}$     | $V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$ | —                                                                            | 9.3  | —       | pF            |    |
| Reverse transfer capacitance   | $C_{rss}$     | $V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$ | —                                                                            | 4.5  | —       | pF            |    |
| Output capacitance             | $C_{oss}$     | $V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$ | —                                                                            | 9.8  | —       | pF            |    |
| Switching time                 | Turn-on time  | $t_{on}$                                            | $V_{DD} = 3\text{ V}, I_D = 10\text{ mA},$<br>$V_{GS} = 0 \sim 2.5\text{ V}$ | —    | 70      | —             | ns |
|                                | Turn-off time | $t_{off}$                                           |                                                                              | —    | 125     | —             |    |

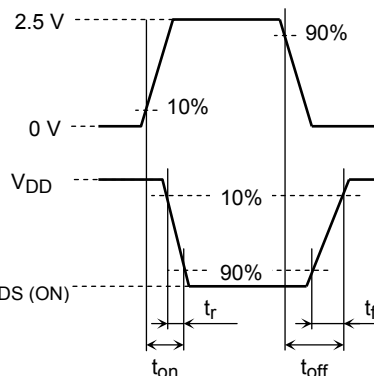
## Switching Time Test Circuit

### (a) Test circuit

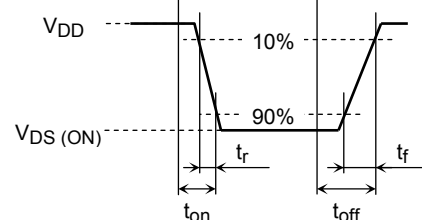


$V_{DD} = 3\text{ V}$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5\text{ ns}$   
 $(Z_{out} = 50\ \Omega)$   
 Common Source  
 $T_a = 25^\circ\text{C}$

### (b) $V_{IN}$



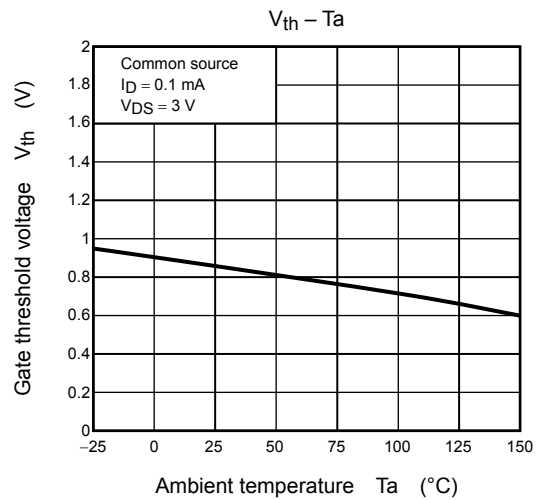
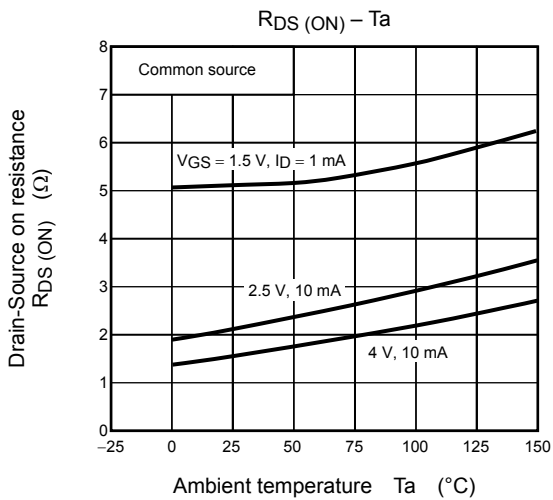
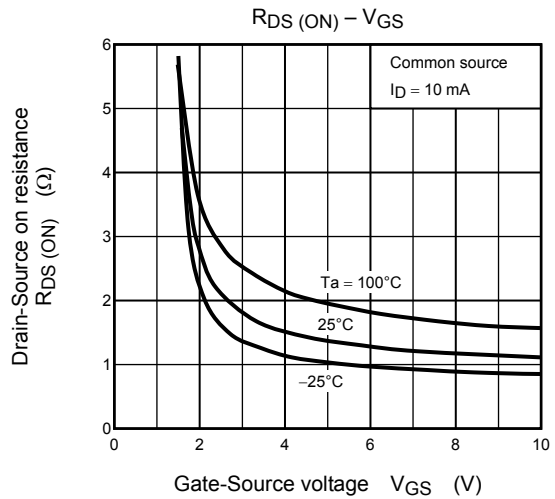
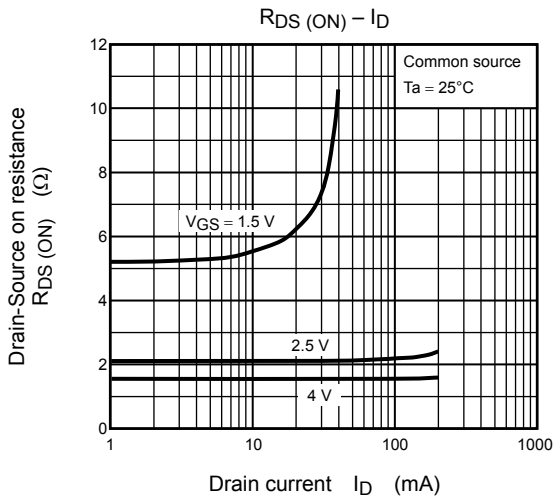
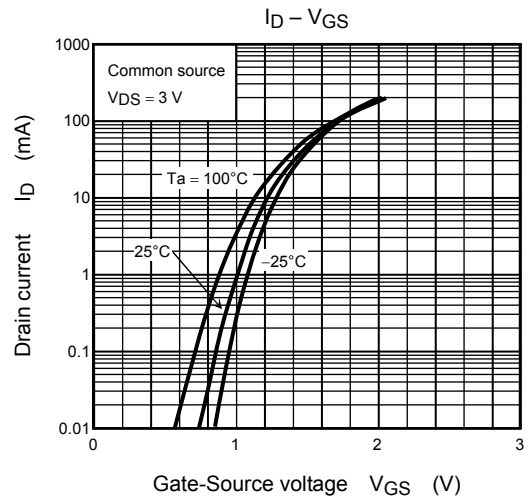
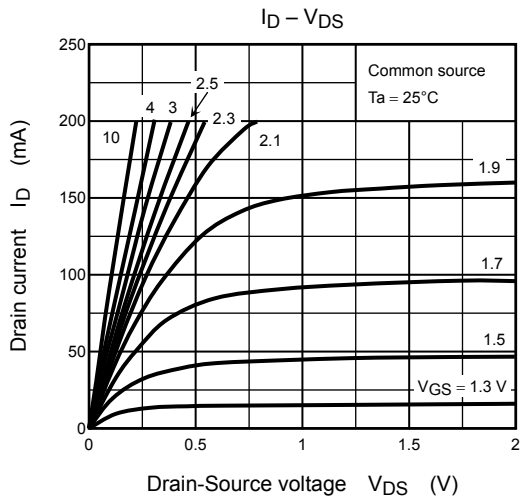
### (c) $V_{OUT}$

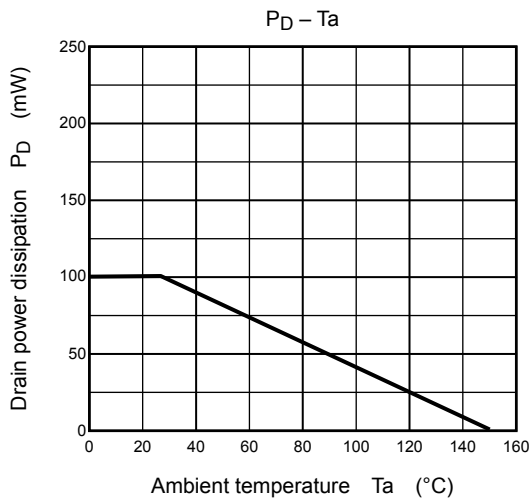
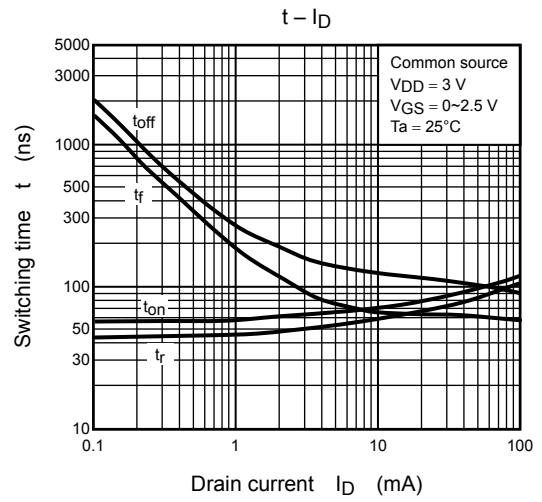
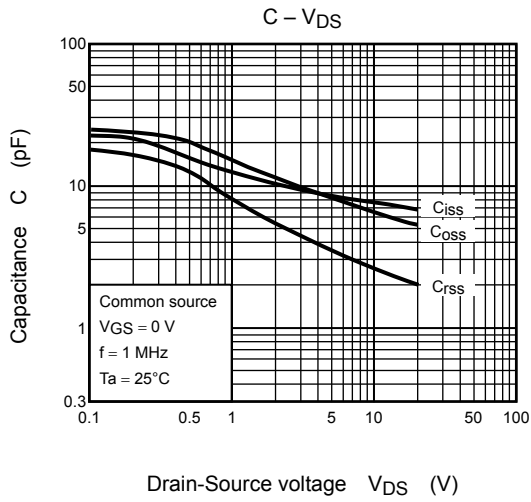
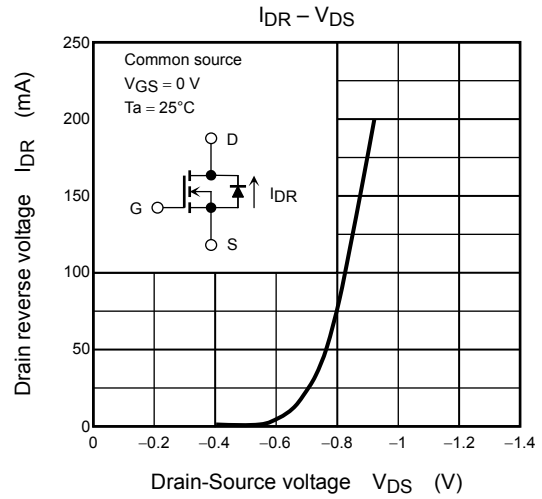
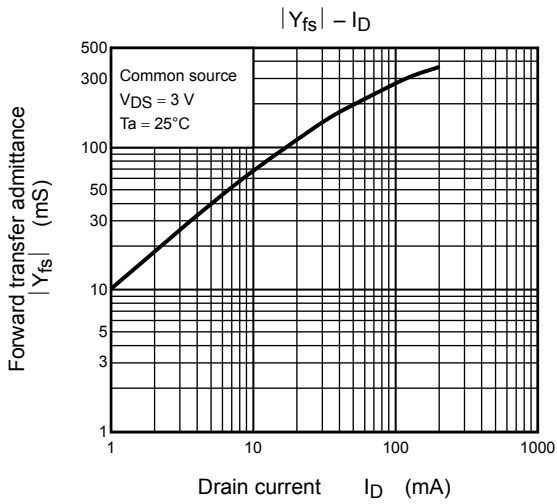


## Precaution

$V_{th}$  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.





**RESTRICTIONS ON PRODUCT USE**

20070701-EN GENERAL

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- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.  
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