

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

## SSM6N15FE

High Speed Switching Applications

Analog Switching Applications

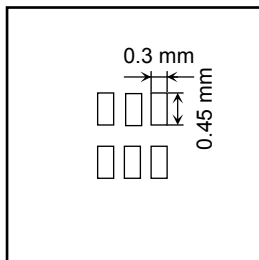
- Small package
- Low ON resistance :  $R_{on} = 4.0 \Omega$  (max) (@ $V_{GS} = 4$  V)  
:  $R_{on} = 7.0 \Omega$  (max) (@ $V_{GS} = 2.5$  V)

### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ ) (Q1, Q2 Common)

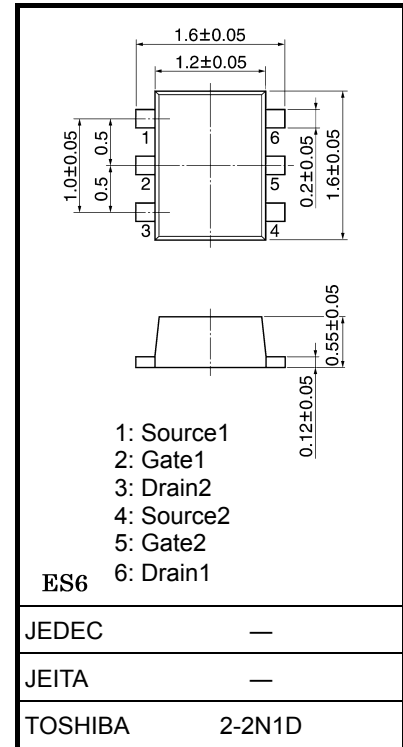
| Characteristics                                      |       | Symbol         | Rating         | Unit             |
|------------------------------------------------------|-------|----------------|----------------|------------------|
| Drain-Source voltage                                 |       | $V_{DS}$       | 30             | V                |
| Gate-Source voltage                                  |       | $V_{GSS}$      | $\pm 20$       | V                |
| Drain current                                        | DC    | $I_D$          | 100            | mA               |
|                                                      | Pulse | $I_{DP}$       | 200            |                  |
| Drain power dissipation ( $T_a = 25^\circ\text{C}$ ) |       | $P_D$ (Note 1) | 150            | mW               |
| Channel temperature                                  |       | $T_{ch}$       | 150            | $^\circ\text{C}$ |
| Storage temperature range                            |       | $T_{stg}$      | $-55 \sim 150$ | $^\circ\text{C}$ |

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: Total rating, mounted on FR4 board  
( $25.4 \text{ mm} \times 25.4 \text{ mm} \times 1.6 \text{ t}$ , Cu Pad:  $0.135 \text{ mm}^2 \times 6$ )

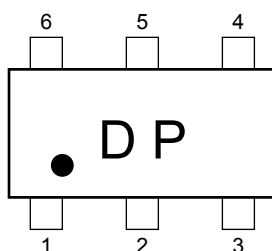


Unit: mm

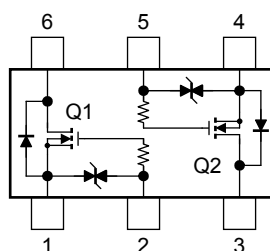


Weight: 3mg (typ.)

### Marking



### Equivalent Circuit (top view)



### Handling Precaution

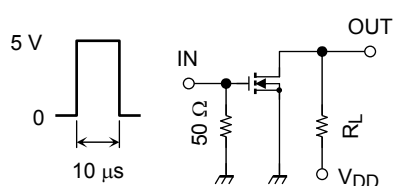
When handling individual devices (which are not yet mounting on a circuit board), be sure that the environment is protected against electrostatic electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static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

## Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)

| Characteristics                | Symbol        | Test Condition                                        | Min                                                                           | Typ. | Max     | Unit          |
|--------------------------------|---------------|-------------------------------------------------------|-------------------------------------------------------------------------------|------|---------|---------------|
| Gate leakage current           | $I_{GSS}$     | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0$               | —                                                                             | —    | $\pm 1$ | $\mu\text{A}$ |
| Drain-Source breakdown voltage | $V_{(BR)DSS}$ | $I_D = 0.1 \text{ mA}, V_{GS} = 0$                    | 30                                                                            | —    | —       | V             |
| Drain cut-off current          | $I_{DSS}$     | $V_{DS} = 30 \text{ V}, V_{GS} = 0$                   | —                                                                             | —    | 1       | $\mu\text{A}$ |
| Gate threshold voltage         | $V_{th}$      | $V_{DS} = 3 \text{ V}, I_D = 0.1 \text{ mA}$          | 0.8                                                                           | —    | 1.5     | V             |
| Forward transfer admittance    | $ Y_{fs} $    | $V_{DS} = 3 \text{ V}, I_D = 10 \text{ mA}$           | 25                                                                            | —    | —       | mS            |
| Drain-Source ON resistance     | $R_{DS(ON)}$  | $I_D = 10 \text{ mA}, V_{GS} = 4 \text{ V}$           | —                                                                             | 2.2  | 4.0     | $\Omega$      |
|                                |               | $I_D = 10 \text{ mA}, V_{GS} = 2.5 \text{ V}$         | —                                                                             | 4.0  | 7.0     |               |
| Input capacitance              | $C_{iss}$     | $V_{DS} = 3 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$ | —                                                                             | 7.8  | —       | pF            |
| Reverse transfer capacitance   | $C_{rss}$     |                                                       | —                                                                             | 3.6  | —       | pF            |
| Output capacitance             | $C_{oss}$     |                                                       | —                                                                             | 8.8  | —       | pF            |
| Switching time                 | Turn-on time  | $t_{on}$                                              | $V_{DD} = 5 \text{ V}, I_D = 10 \text{ mA},$<br>$V_{GS} = 0 \sim 5 \text{ V}$ | 50   | —       | ns            |
|                                | Turn-off time | $t_{off}$                                             |                                                                               | 180  | —       |               |

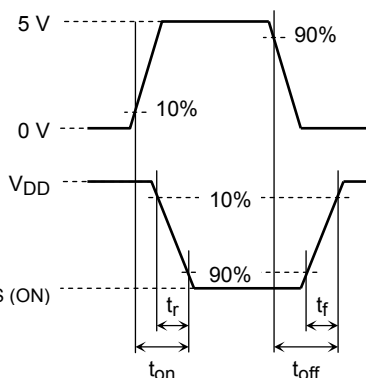
## Switching Time Test Circuit

### (a) Test circuit

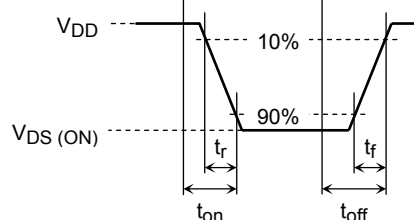


$V_{DD} = 5 \text{ V}$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5 \text{ ns}$   
 $(Z_{out} = 50 \Omega)$   
 Common Source  
 $T_a = 25^\circ\text{C}$

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



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

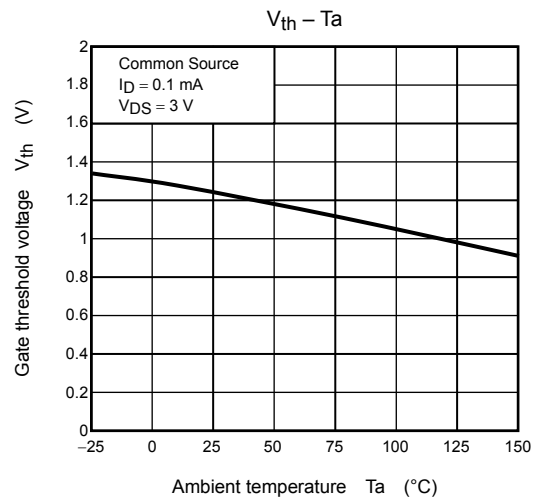
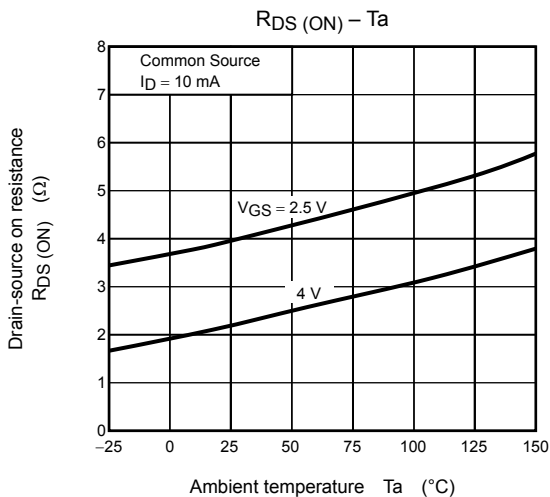
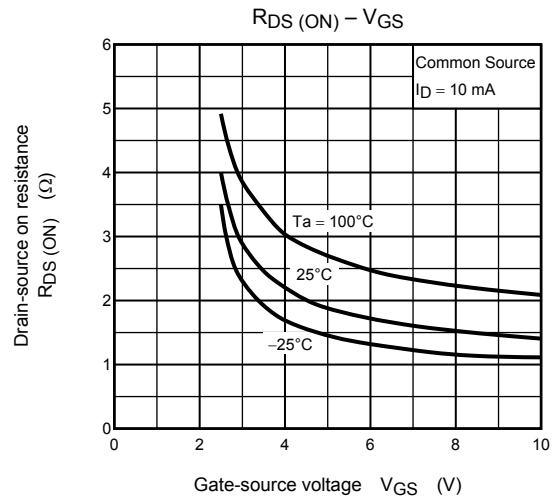
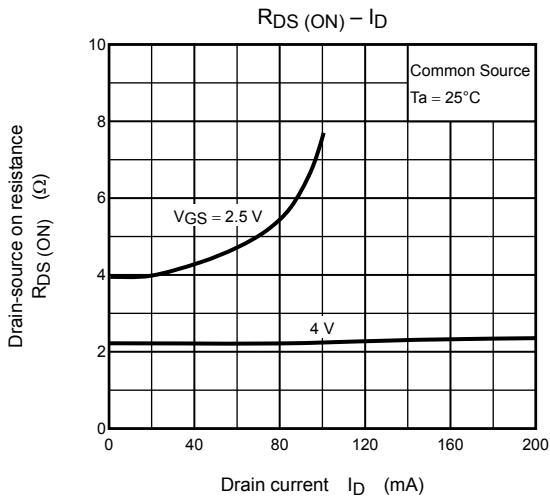
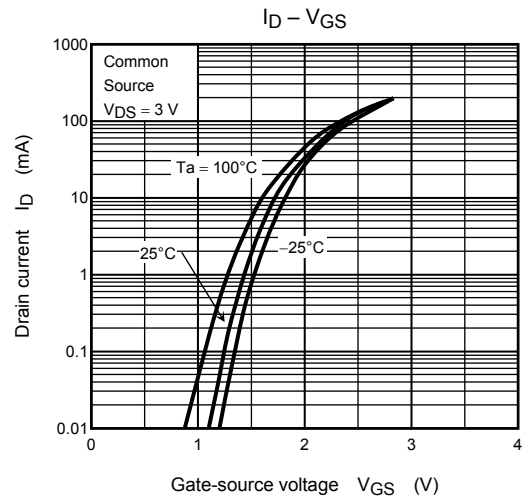
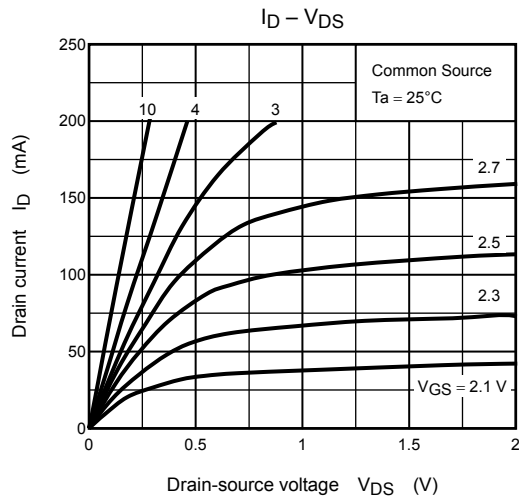


## Precaution

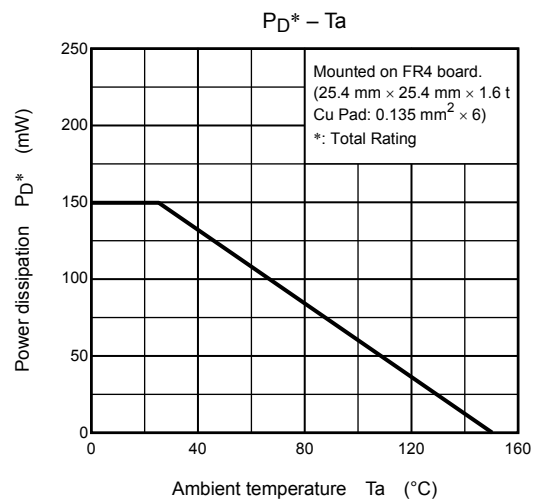
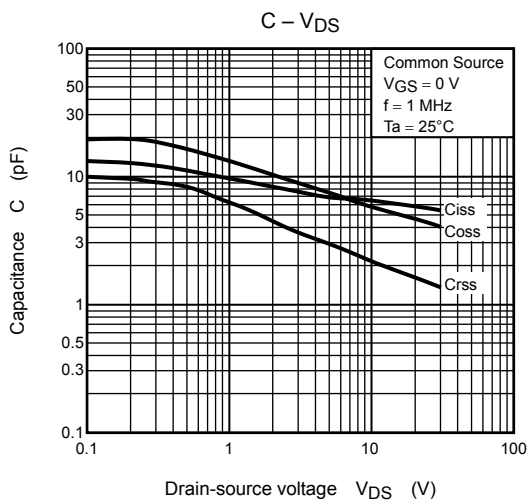
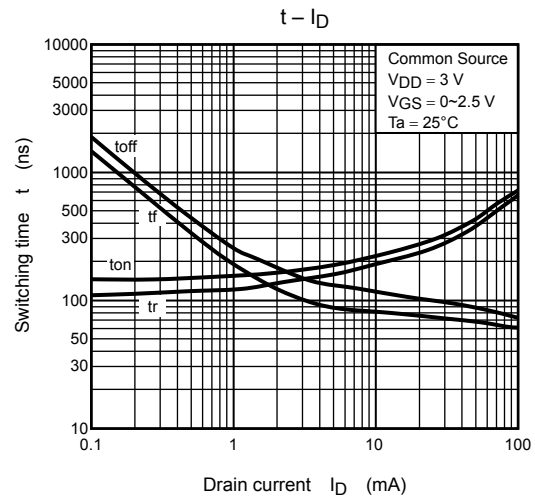
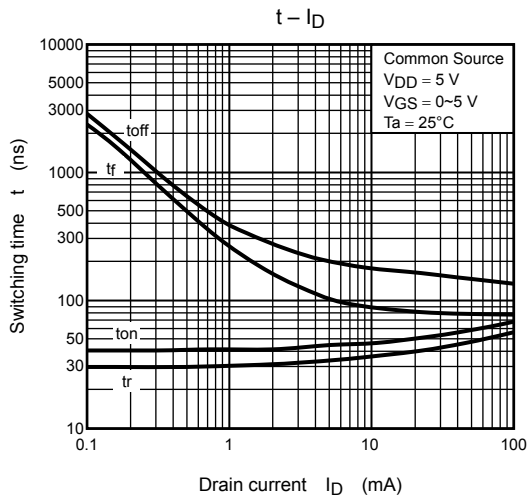
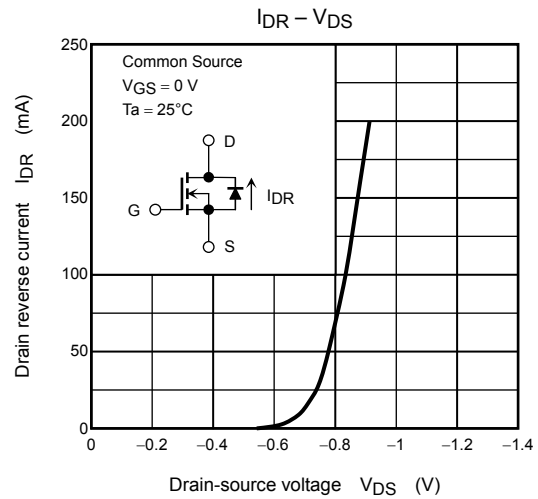
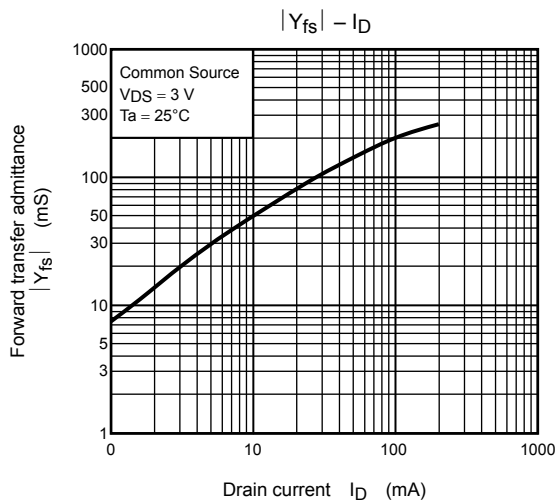
$V_{th}$  can be expressed as voltage between gate and source when low operating current value is  $I_D = 100 \mu\text{A}$  for this product. For normal switching operation,  $V_{GS(on)}$  requires higher voltage than  $V_{th}$  and  $V_{GS(off)}$  requires lower voltage than  $V_{th}$ . (Relationship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

Please take this into consideration for using the device.

(Q1, Q2 Common)



(Q1, Q2 Common)



\*: Total rating

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