

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

**SSM3K101TU**

## High Speed Switching Applications

- 1.8V drive
- Low on-resistance:  $R_{on} = 230\text{m}\Omega$  (max) (@ $V_{GS} = 1.8\text{ V}$ )  
 $R_{on} = 138\text{m}\Omega$  (max) (@ $V_{GS} = 2.5\text{ V}$ )  
 $R_{on} = 103\text{m}\Omega$  (max) (@ $V_{GS} = 4.0\text{ V}$ )

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

Characteristic	Symbol	Rating	Unit
Drain-Source voltage	$V_{DS}$	20	V
Gate-Source voltage	$V_{GSS}$	$\pm 12$	V
Drain current	DC $I_D$	2.2	A
	Pulse $I_{DP}$	4.4	
Drain power dissipation	$P_D$ (Note 1)	800	mW
	$P_D$ (Note 2)	500	
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.

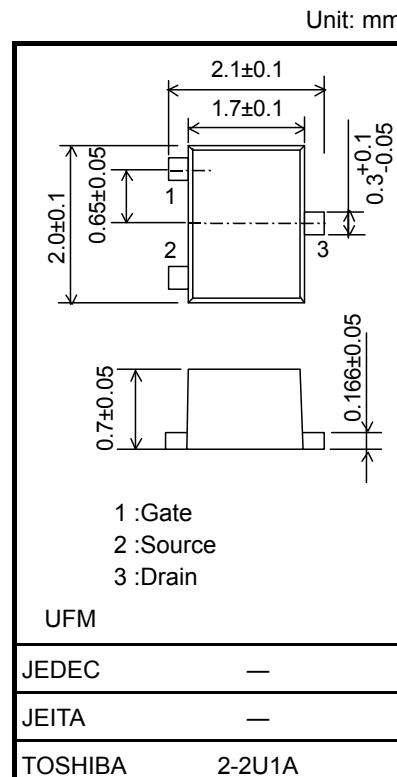
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

Note 1: Mounted on ceramic board.

(25.4 mm × 25.4 mm × 0.8 mm, Cu Pad: 645 mm<sup>2</sup>)

Note 2: Mounted on FR4 board.

(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm<sup>2</sup>)



Weight: 6.6 mg (typ.)

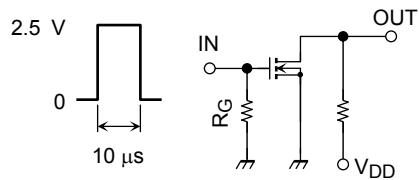
**Electrical Characteristics (Ta = 25°C)**

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	$V_{(BR) DSS}$	$I_D = 1\text{ mA}, V_{GS} = 0$	20	—	—	V
	$V_{(BR) DSX}$	$I_D = 1\text{ mA}, V_{GS} = -12\text{ V}$	12	—	—	
Drain cut-off current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0$	—	—	1	μA
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 12\text{ V}, V_{DS} = 0$	—	—	±1	μA
Gate threshold voltage	$V_{th}$	$V_{DS} = 3\text{ V}, I_D = 1\text{ mA}$	0.4	—	1.0	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 3\text{ V}, I_D = 1.0\text{ A}$ (Note3)	2.7	4.5	—	S
Drain-Source on-resistance	$R_{DS (\text{ON})}$	$I_D = 1.0\text{ A}, V_{GS} = 4.0\text{ V}$ (Note3)	—	85	103	mΩ
		$I_D = 0.5\text{ A}, V_{GS} = 2.5\text{ V}$ (Note3)	—	105	138	
		$I_D = 0.2\text{ A}, V_{GS} = 1.8\text{ V}$ (Note3)	—	140	230	
Input capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	125	—	pF
Output capacitance	$C_{oss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	42	—	pF
Reverse transfer capacitance	$C_{rss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	17	—	pF
Switching time	Turn-on time	$V_{DD} = 10\text{ V}, I_D = 0.75\text{ A}, V_{GS} = 0\sim 2.5\text{ V}, R_G = 4.7\text{ Ω}$	—	14	—	ns
	Turn-off time		—	20	—	
Drain-Source forward voltage	$V_{DSF}$	$I_D = -2.2\text{ A}, V_{GS} = 0\text{ V}$ (Note3)	—	-0.85	-1.2	V

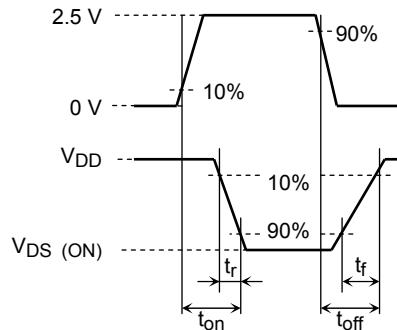
Note3: Pulse test

## Switching Time Test Circuit

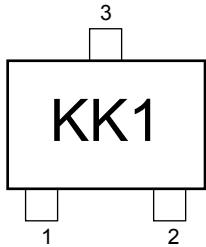
(a) Test Circuit



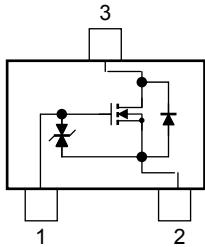
$V_{DD} = 10 \text{ V}$   
 $R_G = 4.7 \Omega$   
D.U.  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5 \text{ ns}$   
Common Source  
 $T_a = 25^\circ\text{C}$

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

## Marking



## Equivalent Circuit (top view)



## Precaution

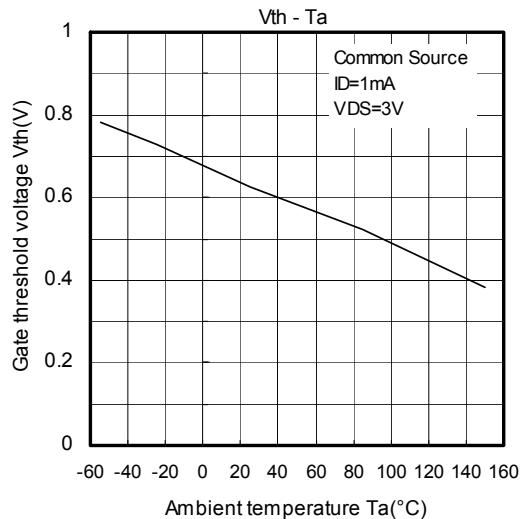
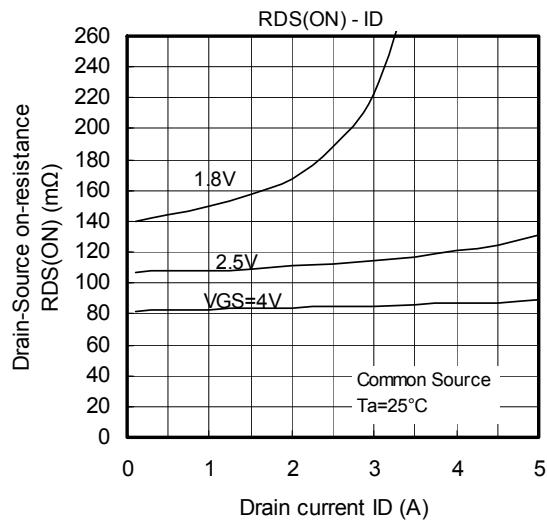
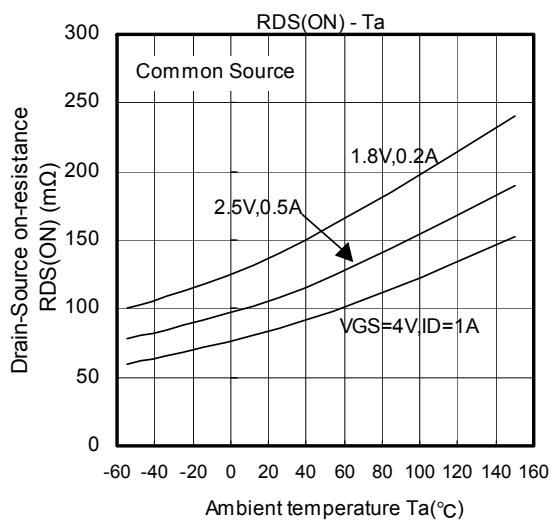
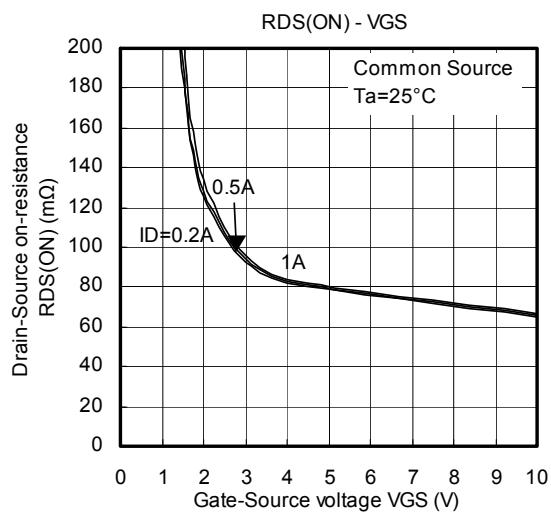
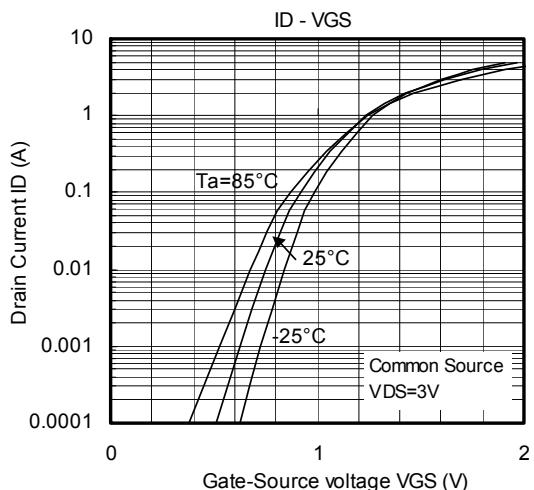
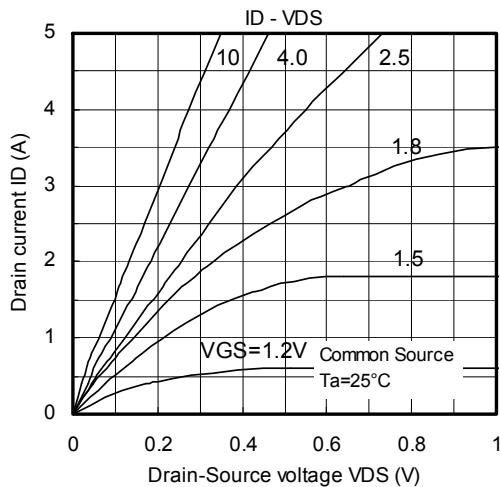
$V_{th}$  can be expressed as the voltage between gate and source when the low operating current value is  $I_D=1\text{mA}$  for this product. For normal switching operation,  $V_{GS}$  (on) requires a higher voltage than  $V_{th}$ , and  $V_{GS}$  (off) requires a lower voltage than  $V_{th}$ .

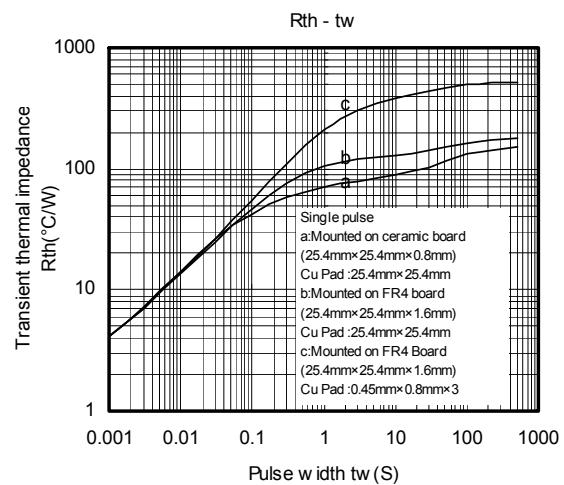
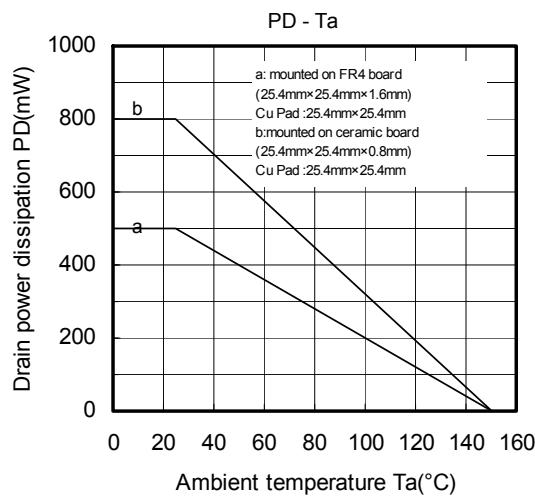
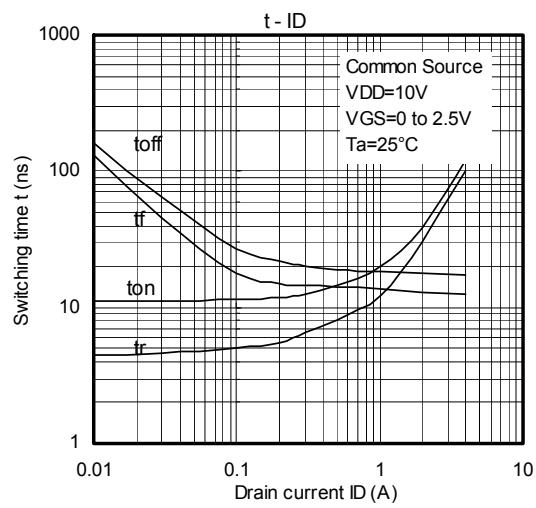
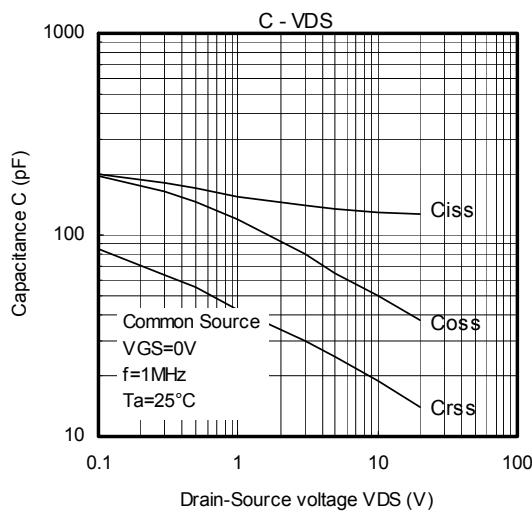
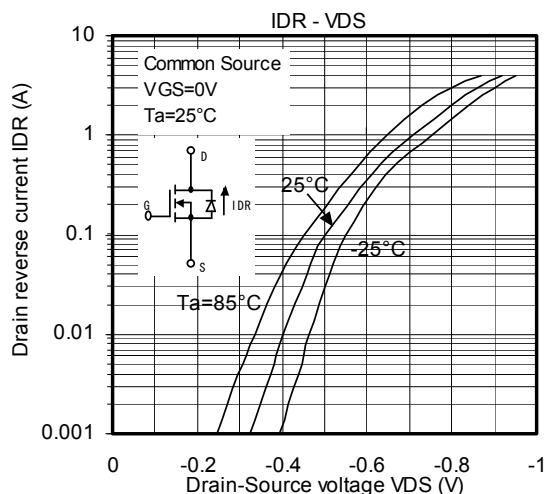
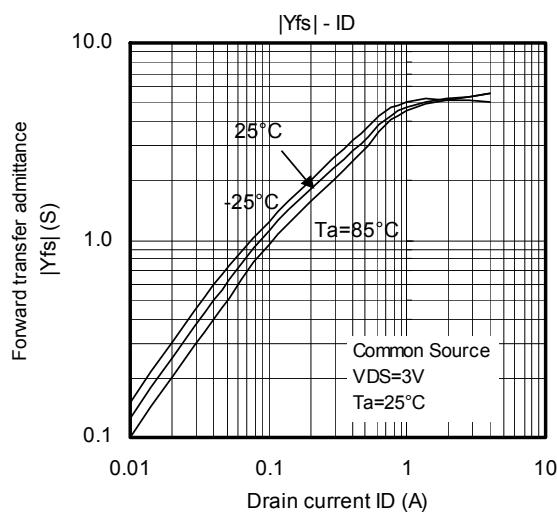
(The relationship can be established as follows:  $V_{GS}$  (off)  $< V_{th} < V_{GS}$  (on))

Take this into consideration when using the device.

## Handling Precaution

When handling individual devices which are not yet mounted on a circuit board, be sure that the environment is protected against electrostatic discharge. 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.





## RESTRICTIONS ON PRODUCT USE

20070701-EN GENERAL

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