

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

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	$^\circ\text{C}$
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: Mounted on ceramic board.  
 (25.4 mm  $\times$  25.4 mm  $\times$  0.8 mm, Cu Pad: 645 mm<sup>2</sup>)

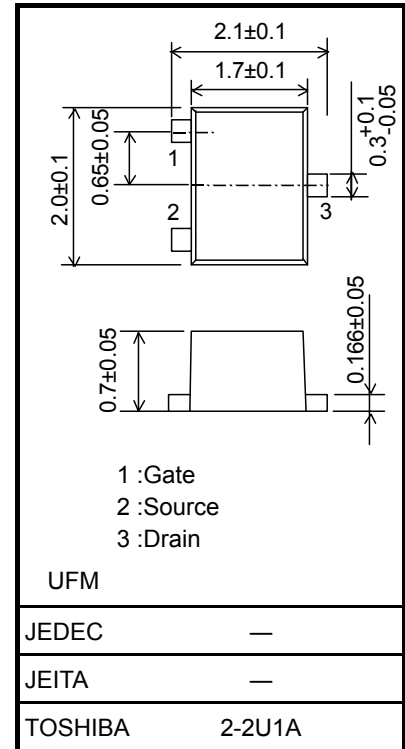
Note 2: Mounted on FR4 board.  
 (25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm, Cu Pad: 645 mm<sup>2</sup>)

Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

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	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 12\text{ V}$ , $V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$
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	$R_{DS(ON)}$	$I_D = 1.0\text{ A}$ , $V_{GS} = 4.0\text{ V}$ (Note3)	—	85	103	m $\Omega$
		$I_D = 0.5\text{ A}$ , $V_{GS} = 2.5\text{ V}$ (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	$V_{DD} = 10\text{ V}$ , $I_D = 0.75\text{ A}$ , $V_{GS} = 0\sim 2.5\text{ V}$ , $R_G = 4.7\text{ }\Omega$	—	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

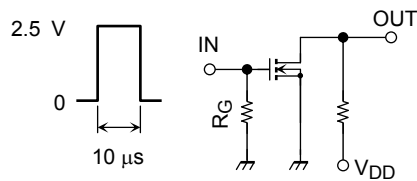
Unit: mm



Weight: 6.6 mg (typ.)

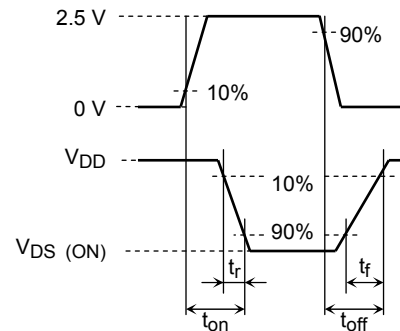
## Switching Time Test Circuit

(a) Test Circuit



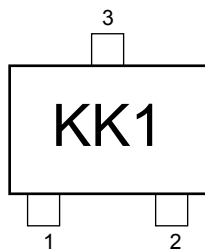
$V_{DD} = 10\text{ V}$   
 $R_G = 4.7\ \Omega$   
 $D.U. \leq 1\%$   
 $V_{IN}: t_r, t_f < 5\text{ ns}$   
 Common Source  
 $T_a = 25^\circ\text{C}$

(b)  $V_{IN}$

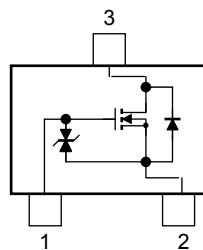


(c)  $V_{OUT}$

## Marking



## Equivalent Circuit (top view)



## Precaution

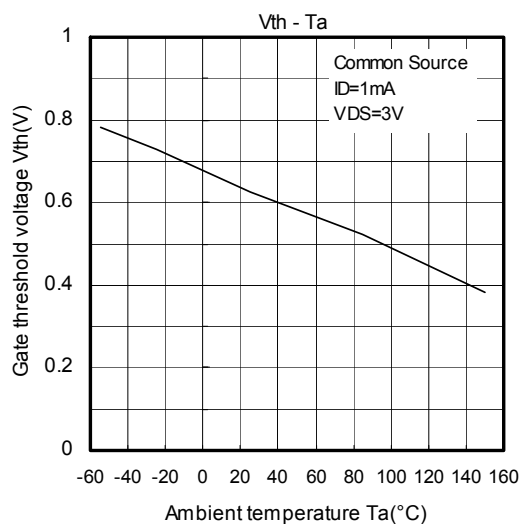
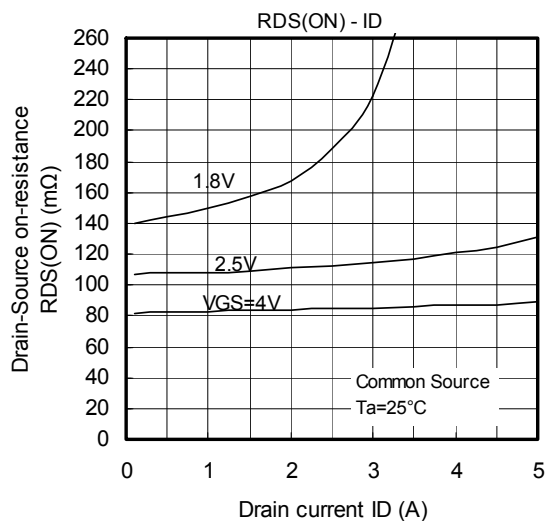
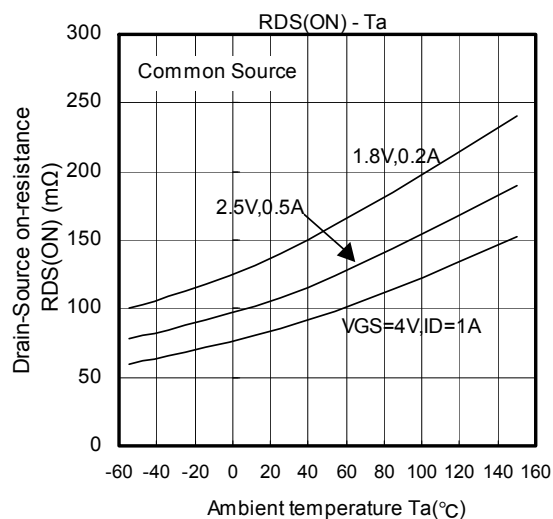
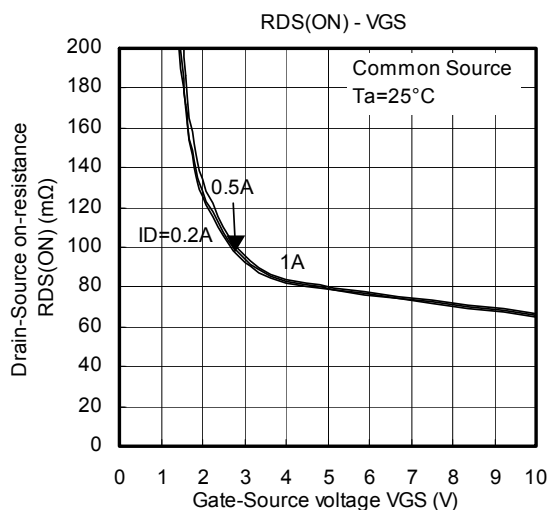
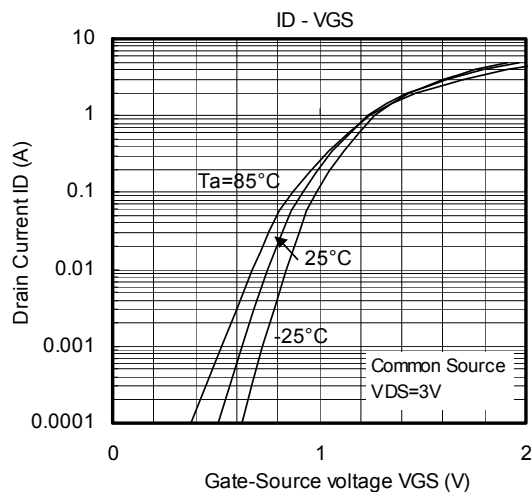
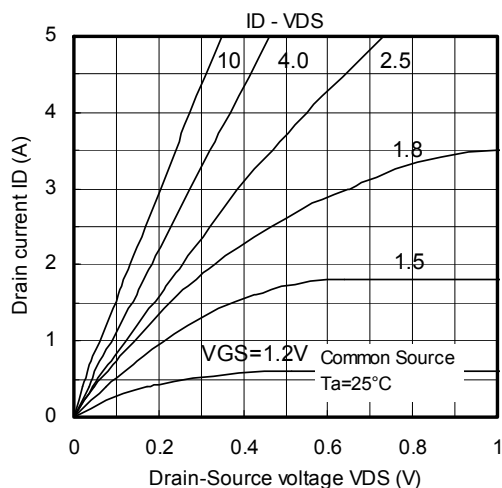
$V_{th}$  can be expressed as the voltage between gate and source when the low operating current value is  $I_D=1\text{mA}$  for this product. For normal switching operation,  $V_{GS (on)}$  requires a higher voltage than  $V_{th}$ , and  $V_{GS (off)}$  requires a lower voltage than  $V_{th}$ .

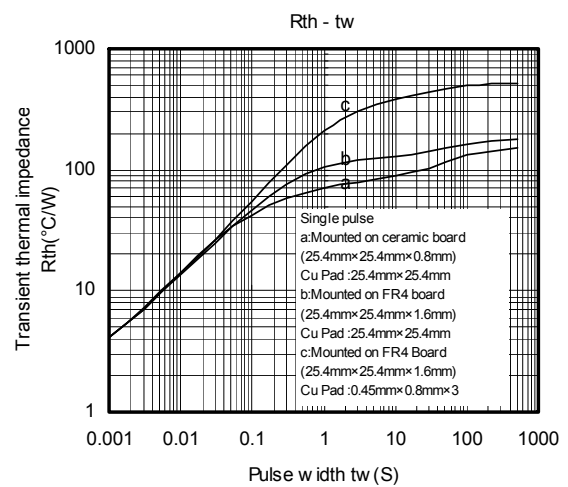
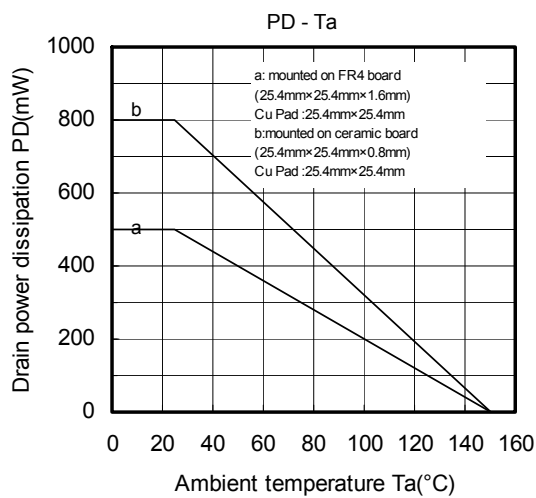
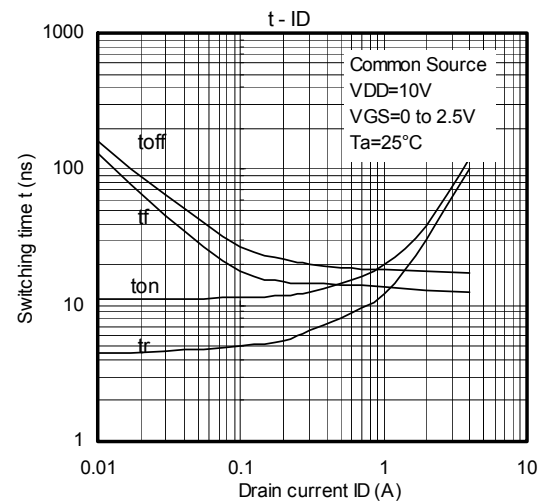
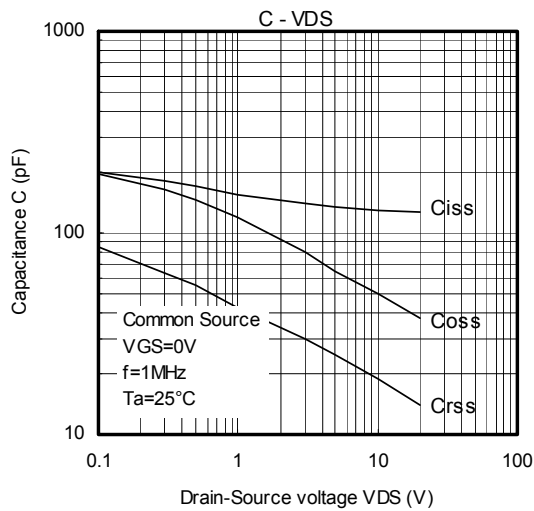
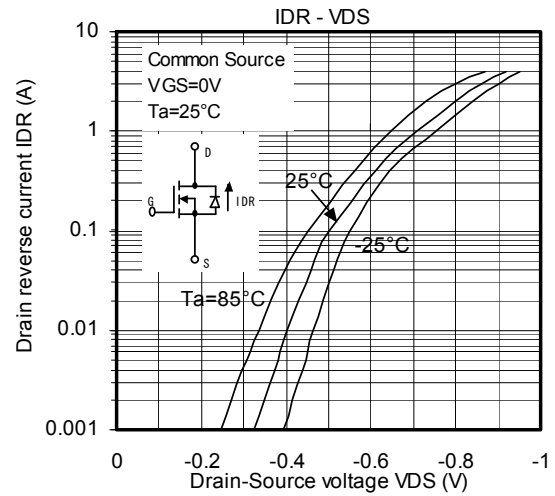
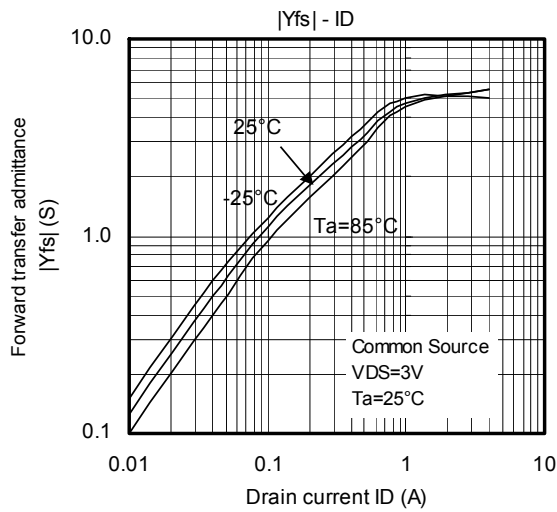
(The relationship can be established as follows:  $V_{GS (off)} < V_{th} < V_{GS (on)}$ )

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.





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20070701-EN GENERAL

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