

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

# SSM3K116TU

## High Speed Switching Applications

- 2.5V drive
- Low on-resistance:  $R_{on} = 135m\Omega$  (max) (@ $V_{GS} = 2.5 V$ )  
 $R_{on} = 100m\Omega$  (max) (@ $V_{GS} = 4.5 V$ )

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

Characteristic		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	30	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 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).

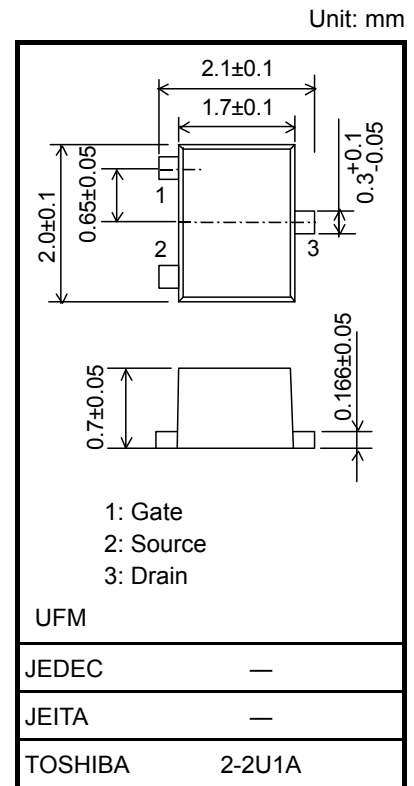
Note 1: Mounted on ceramic board.  
 (25.4 mm × 25.4 mm × 0.8 mm, Cu Pad: 645 mm<sup>2</sup>)

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

## Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Conditions	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	$V_{(BR) DSS}$		$I_D = 1 mA, V_{GS} = 0$	30	—	—	V
	$V_{(BR) DSX}$		$I_D = 1 mA, V_{GS} = -12 V$	18	—	—	
Drain cut-off current		$I_{DSS}$	$V_{DS} = 30 V, V_{GS} = 0$	—	—	1	μA
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 12V, V_{DS} = 0$	—	—	$\pm 1$	μA
Gate threshold voltage		$V_{th}$	$V_{DS} = 3 V, I_D = 0.1 mA$	0.5	—	1.1	V
Forward transfer admittance		$ Y_{fs} $	$V_{DS} = 3 V, I_D = 0.25 A$ (Note3)	1	2	—	S
Drain-Source on-resistance	$R_{DS(ON)}$		$I_D = 0.5 A, V_{GS} = 4.5 V$ (Note3)	—	75	100	mΩ
			$I_D = 0.25 A, V_{GS} = 2.5 V$ (Note3)	—	95	135	
Input capacitance		$C_{iss}$	$V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz$	—	245	—	pF
Output capacitance		$C_{oss}$	$V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz$	—	41	—	pF
Reverse transfer capacitance		$C_{rss}$	$V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz$	—	33	—	pF
Switching time	Turn-on time	$t_{on}$	$V_{DD} = 10 V, I_D = 0.25 A,$ $V_{GS} = 0 \text{ to } 2.5 V, R_G = 4.7 \Omega$	—	9	—	ns
	Turn-off time	$t_{off}$		—	15	—	
Drain-Source forward voltage		$V_{DSF}$	$I_D = -2.2A, V_{GS} = 0 V$ (Note3)	—	-0.83	-1.2	V

Note3: Pulse test

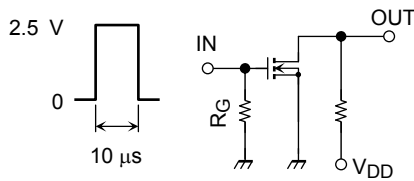


Weight: 6.6 mg (typ.)

Start of commercial production  
 2005-06

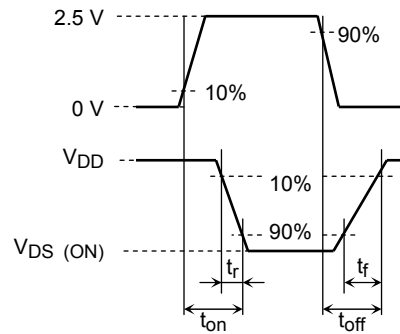
## Switching Time Test Circuit

(a) Test Circuit



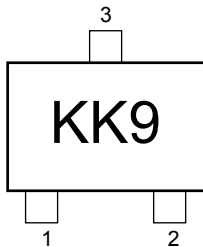
$V_{DD} = 10\text{ V}$   
 $R_G = 4.7\ \Omega$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5\text{ ns}$   
 Common Source  
 $T_a = 25^\circ\text{C}$

(b)  $V_{IN}$

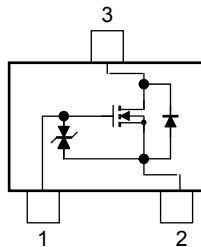


(c)  $V_{OUT}$

## Marking



## Equivalent Circuit (top view)



## Precaution

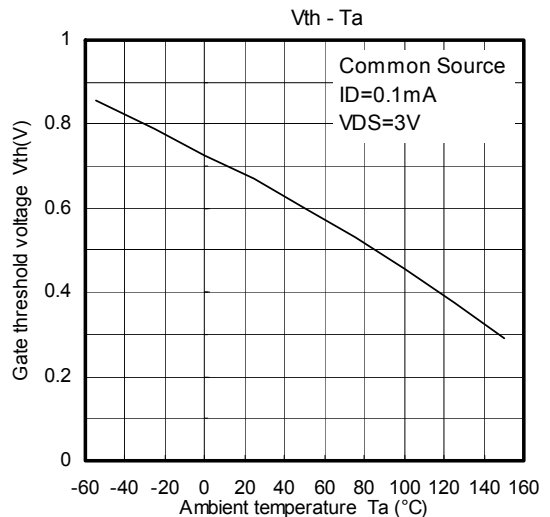
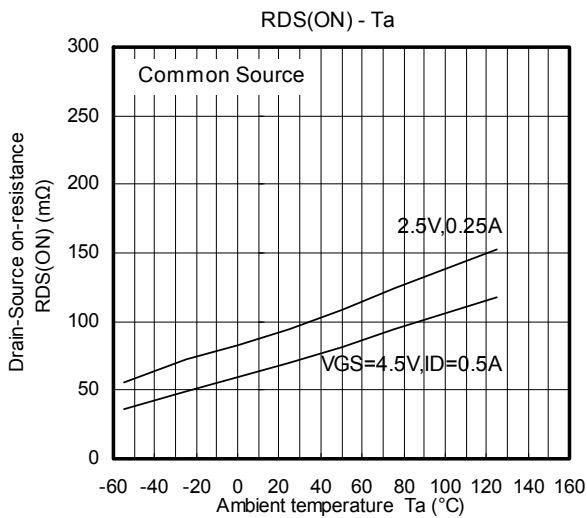
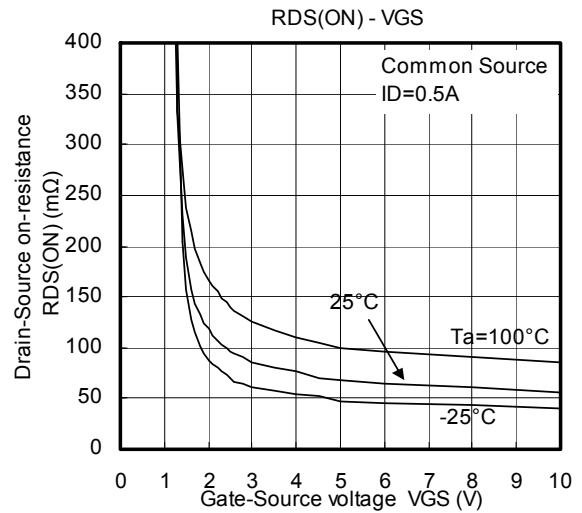
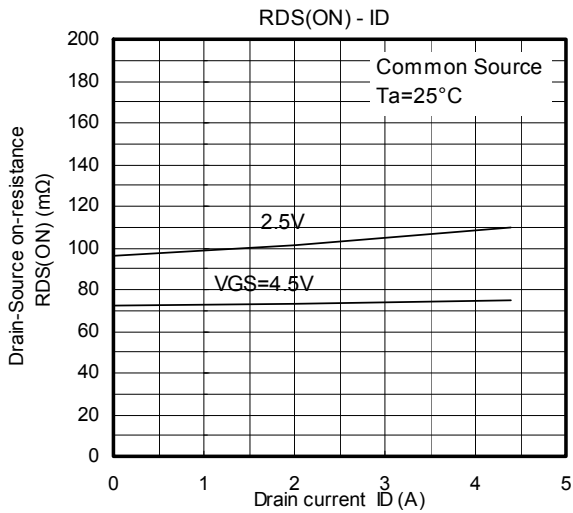
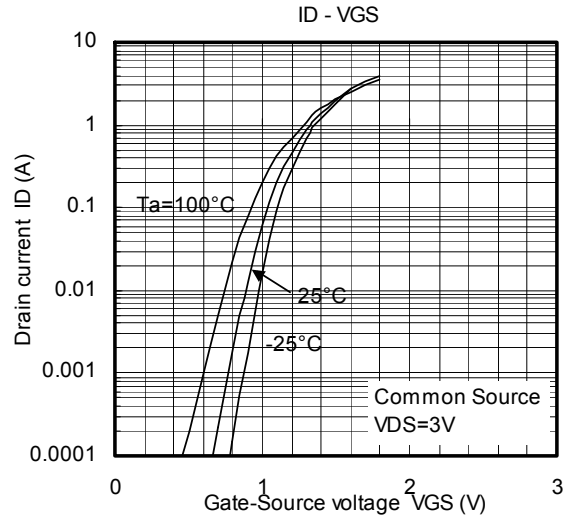
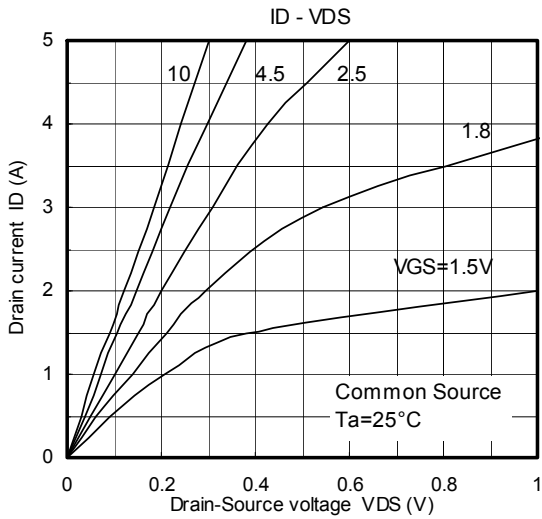
$V_{th}$  can be expressed as the voltage between gate and source when the low operating current value is  $I_D=0.1\text{mA}$  for this product. For normal switching operation,  $V_{GS(on)}$  requires a higher voltage than  $V_{th}$ , and  $V_{GS(off)}$  requires a lower voltage than  $V_{th}$ .

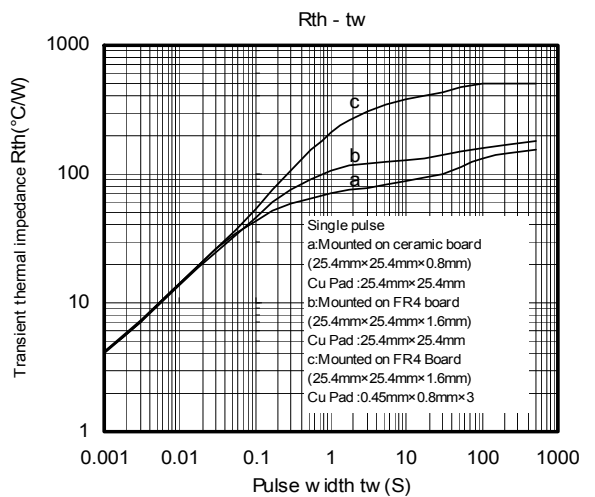
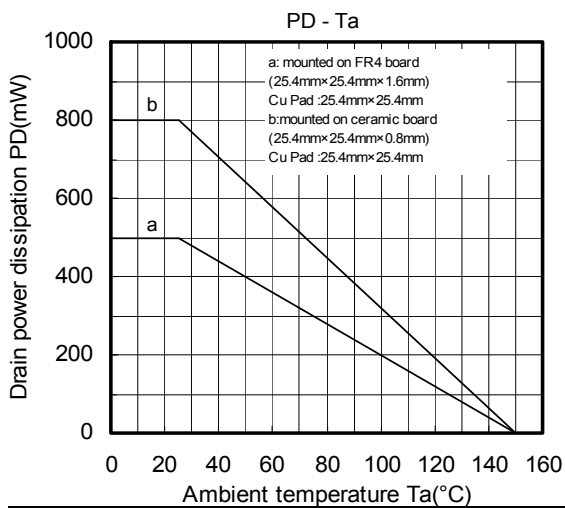
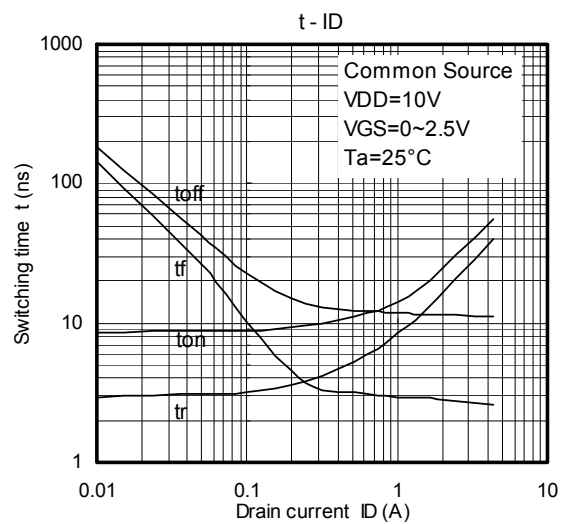
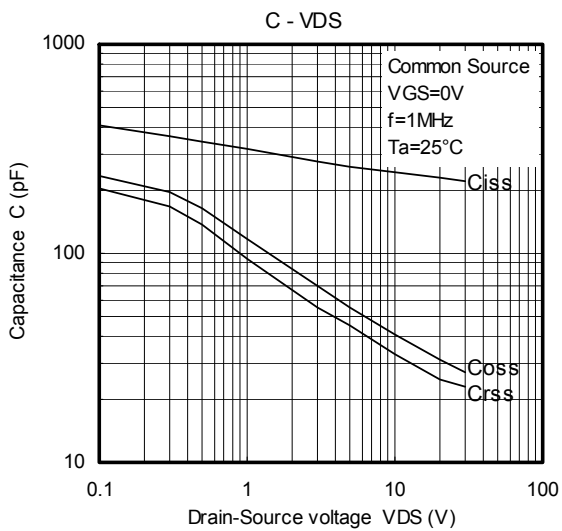
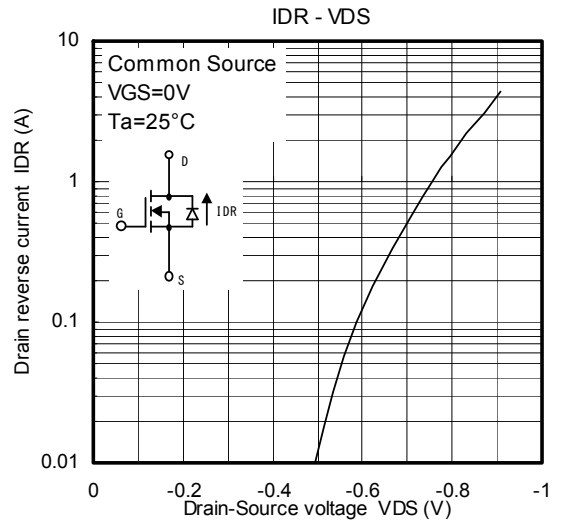
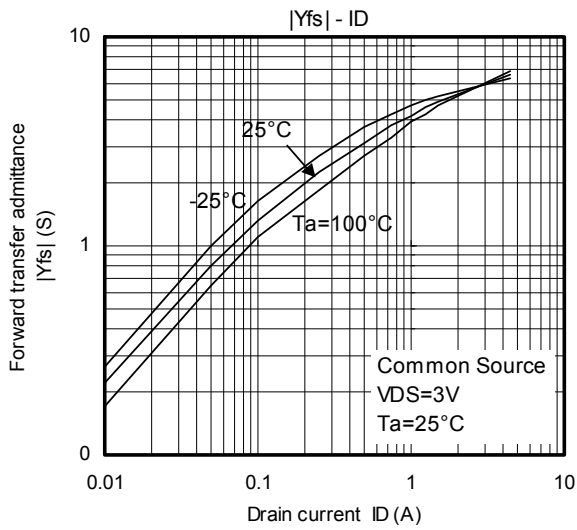
(The relationship can be established as follows:  $V_{GS(off)} < V_{th} < V_{GS(on)}$ )

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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