

TOSHIBA Field-Effect Transistor Silicon N Channel MOS Type (U-MOSIV)

# SSM3K7002BFS

High-Speed Switching Applications

Analog Switch Applications

- Small package
- Low ON-resistance :  $R_{DS(ON)} = 3.3 \Omega$  (max) (@ $V_{GS} = 4.5 V$ )  
 :  $R_{DS(ON)} = 2.6 \Omega$  (max) (@ $V_{GS} = 5 V$ )  
 :  $R_{DS(ON)} = 2.1 \Omega$  (max) (@ $V_{GS} = 10 V$ )

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

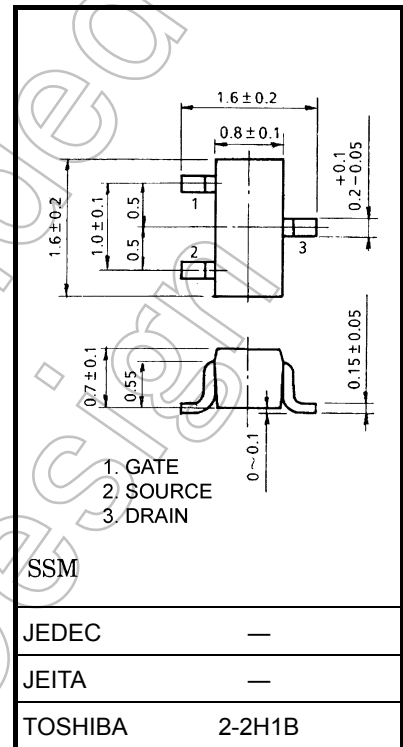
Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DSS}$	60	V
Gate-source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC	$I_D$	200	mA
	Pulse	$I_{DP}$	800	
Power dissipation		$P_D$ (Note 1)	150	mW
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°C

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).

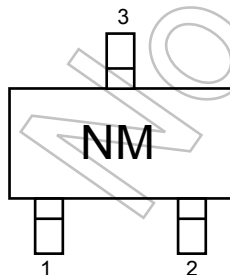
Note 1: mounted on FR4 board  
 (25.4 mm × 25.4 mm × 1.6mm, Cu Pad: 0.36 mm<sup>2</sup> × 3)

Unit: mm

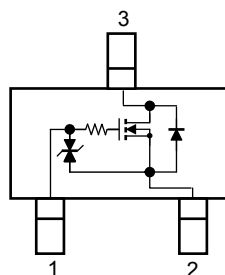


Weight: 2.4 mg (typ.)

## Marking



## Equivalent Circuit (top view)



Start of commercial production  
2009-11

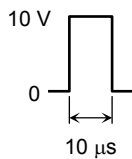
## Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit	
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$	60	—	—	V	
	$V_{(BR)DSX}$	$I_D = 10\text{ mA}, V_{GS} = -10\text{ V}$	45	—	—	V	
Drain cutoff current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	—	—	1	$\mu\text{A}$	
Gate threshold voltage	$V_{th}$	$V_{DS} = 10\text{ V}, I_D = 0.25\text{ mA}$	1.5	—	3.1	V	
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$ (Note 2)	225	—	—	mS	
Drain-source ON-resistance	$R_{DS(ON)}$	$I_D = 500\text{ mA}, V_{GS} = 10\text{ V}$ (Note 2)	—	1.62	2.1	$\Omega$	
		$I_D = 100\text{ mA}, V_{GS} = 5\text{ V}$ (Note 2)	—	1.90	2.6		
		$I_D = 100\text{ mA}, V_{GS} = 4.5\text{ V}$ (Note 2)	—	2.10	3.3		
Input capacitance	$C_{iss}$	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	—	17.0	—	$\text{pF}$	
Reverse transfer capacitance	$C_{rss}$		—	1.9	—		
Output capacitance	$C_{oss}$		—	3.6	—		
Switching time	Turn-on delay time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, I_D = 200\text{ mA}, V_{GS} = 0\text{ to }10\text{ V}$	—	3.3	6.6	ns
	Turn-off delay time	$t_{d(off)}$		—	14.5	40	
Drain-Source forward voltage	$V_{DSF}$	$I_D = -200\text{ mA}, V_{GS} = 0\text{ V}$ (Note 2)	—	-0.84	-1.2	V	

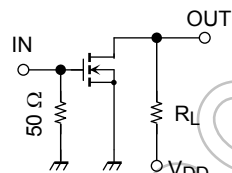
Note2: Pulse test

## Switching Time Test Circuit

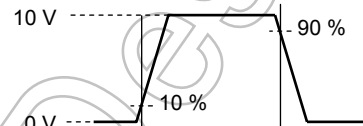
### (a) Test circuit



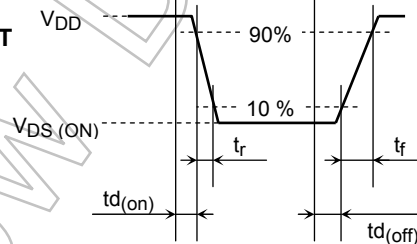
$V_{DD} = 30\text{ V}$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 2\text{ ns}$   
 $(Z_{out} = 50\ \Omega)$   
 Common Source  
 $T_a = 25\text{ }^\circ\text{C}$



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



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



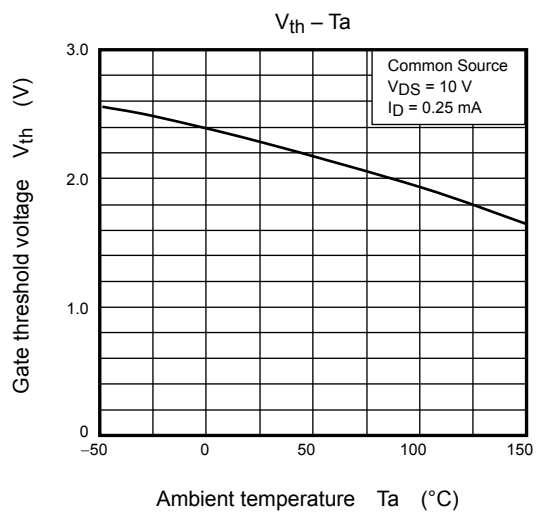
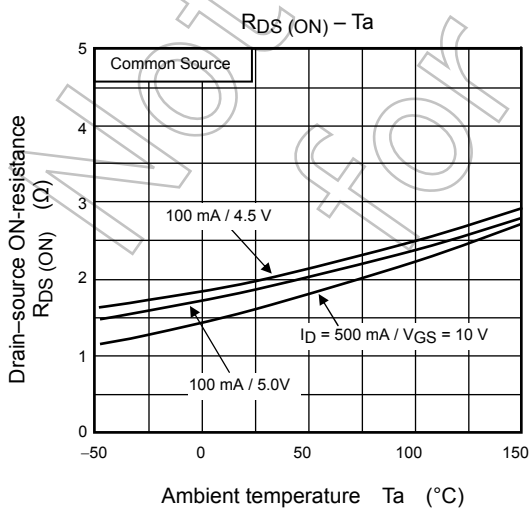
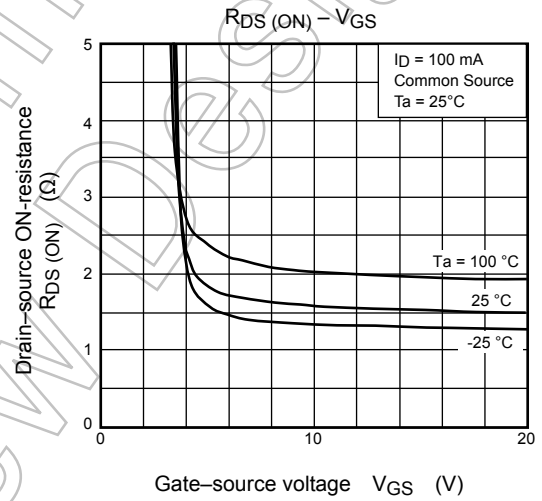
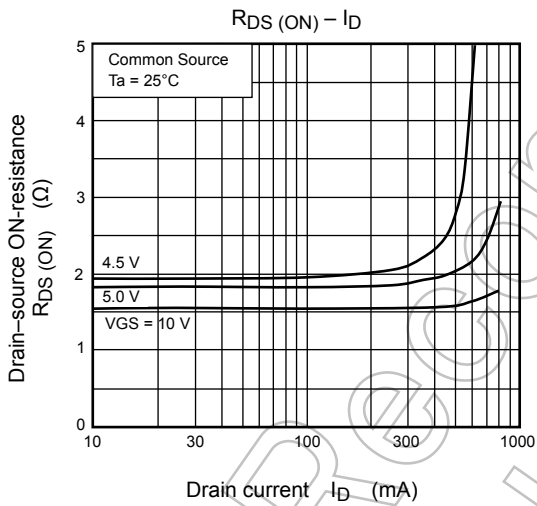
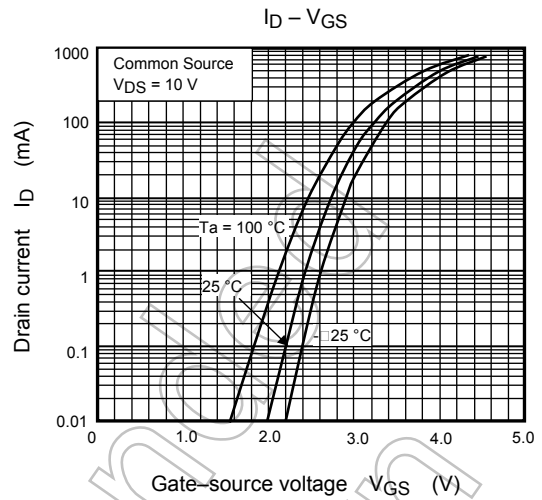
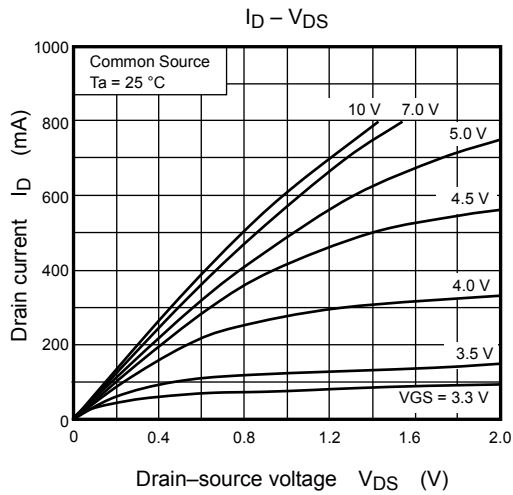
## Precaution

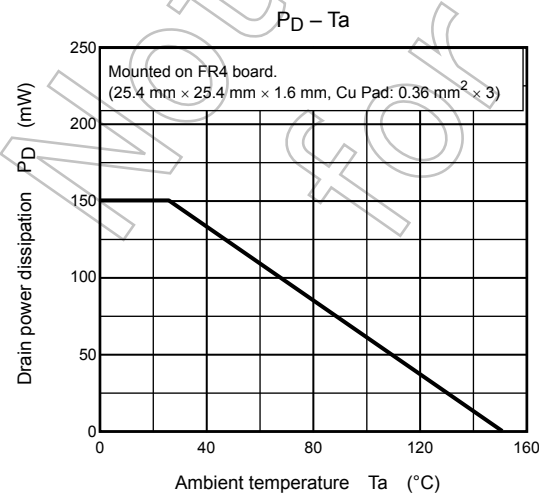
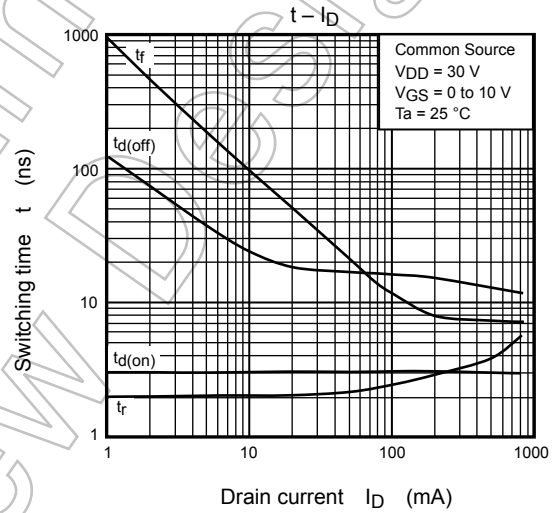
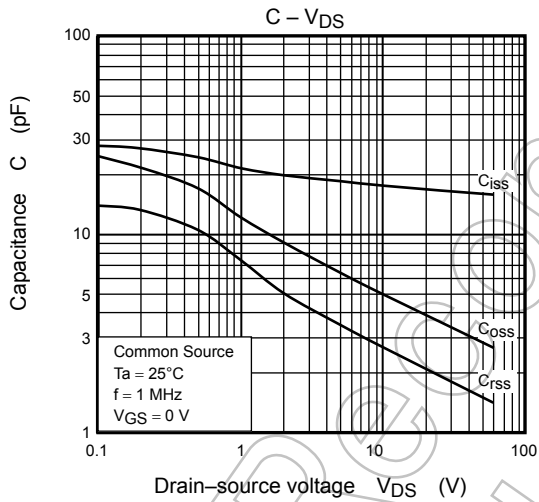
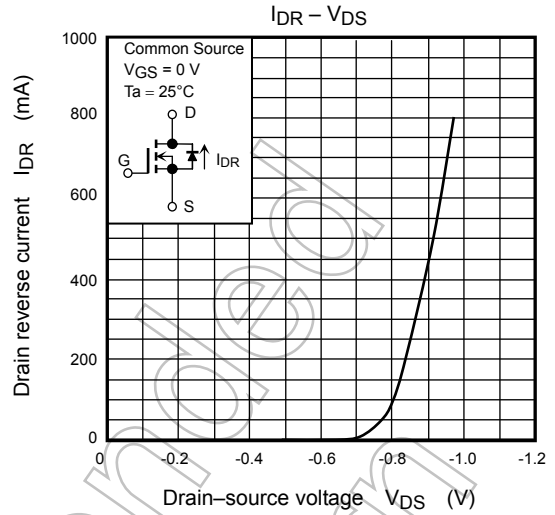
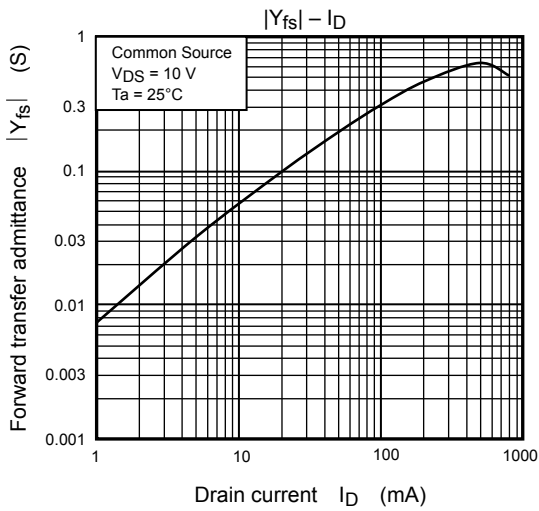
Let  $V_{th}$  be the voltage applied between gate and source that causes the drain current ( $I_D$ ) to be low (0.25 mA for the SSM3K7002BFS). Then, for normal switching operation,  $V_{GS(on)}$  must be higher than  $V_{th}$ , and  $V_{GS(off)}$  must be lower than  $V_{th}$ . This relationship can be expressed as:  $V_{GS(off)} < V_{th} < V_{GS(on)}$ . Take this into consideration when using the device.

## Handling Precaution

When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

Thermal resistance  $R_{th(ch-a)}$  and Power dissipation  $P_D$  vary depending on board material, board area, board thickness and pad area. When using this device, please take heat dissipation into consideration.





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