

# SSM3K09FU

## High Speed Switching Applications

- Small package
- Low on resistance
  - :  $R_{on} = 0.7 \Omega$  (max) (@ $V_{GS} = 10 V$ )
  - :  $R_{on} = 1.2 \Omega$  (max) (@ $V_{GS} = 4 V$ )

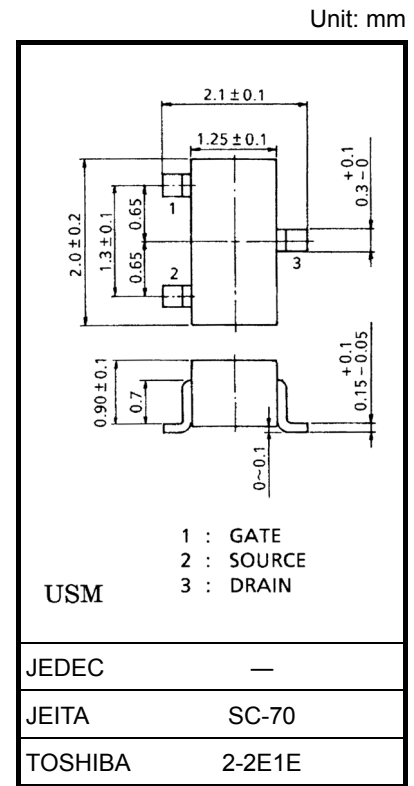
## Absolute Maximum Ratings ( $T_a = 25^\circ C$ )

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	30	V
Gate-Source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC	$I_D$	400	mA
	Pulse	$I_{DP}$	800	
Drain power dissipation ( $T_a = 25^\circ C$ )		$P_D$ (Note 1)	150	mW
Channel temperature		$T_{ch}$	150	$^\circ C$
Storage temperature		$T_{stg}$	-55 to 150	$^\circ C$

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.

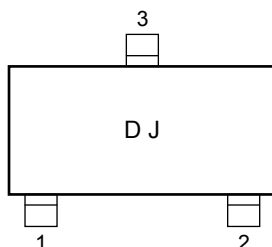
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Mounted on FR4 board  
(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 0.6 mm<sup>2</sup> × 3) Figure 1.



Weight: 0.006 g (typ.)

## Marking



## Equivalent Circuit (top view)

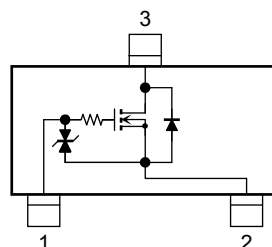
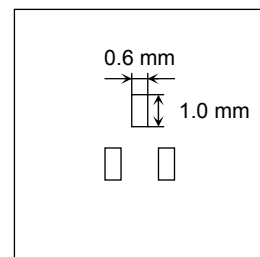


Figure 1: 25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 0.6 mm<sup>2</sup> × 3



## 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.

Start of commercial production  
2000-01

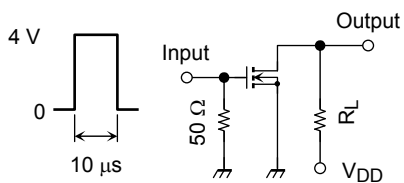
## Electrical Characteristics (Ta = 25°C)

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	$V_{(BR)DSS}$	$I_D = 1\text{ mA}, V_{GS} = 0$	30	—	—	V
Drain cut-off current	$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0$	—	—	1	$\mu\text{A}$
Gate threshold voltage	$V_{th}$	$V_{DS} = 5\text{ V}, I_D = 0.1\text{ mA}$	1.1	—	1.8	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 5\text{ V}, I_D = 200\text{ mA}$ (Note2)	270	—	—	mS
Drain-Source ON resistance	$R_{DS(ON)}$	$I_D = 200\text{ mA}, V_{GS} = 10\text{ V}$ (Note2)	—	0.5	0.7	$\Omega$
		$I_D = 200\text{ mA}, V_{GS} = 4\text{ V}$ (Note2)	—	0.8	1.2	
		$I_D = 200\text{ mA}, V_{GS} = 3.3\text{ V}$ (Note2)	—	1.0	1.7	
Input capacitance	$C_{iss}$	$V_{DS} = 5\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	20	—	pF
Reverse transfer capacitance	$C_{rss}$	$V_{DS} = 5\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	7	—	pF
Output capacitance	$C_{oss}$	$V_{DS} = 5\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	16	—	pF
Switching time	Turn-on time	$t_{on}$	—	72	—	ns
	Turn-off time	$t_{off}$		68		ns

Note2: Pulse test

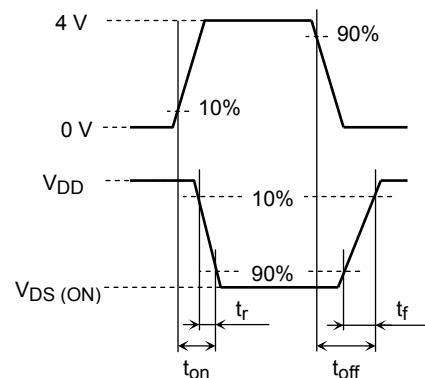
## Switching Time Test Circuit

### (a) Test circuit



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

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



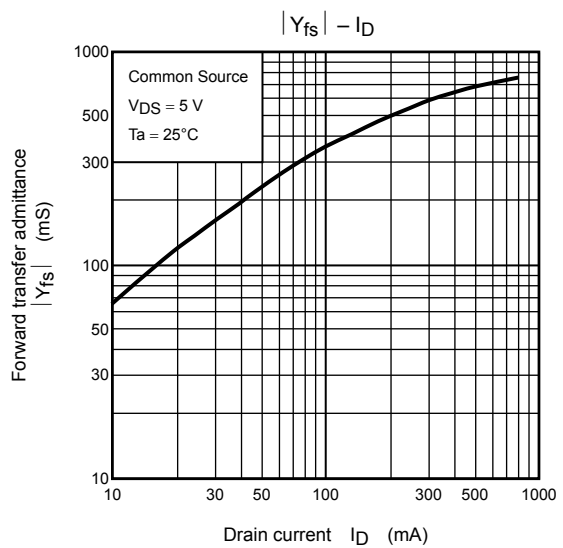
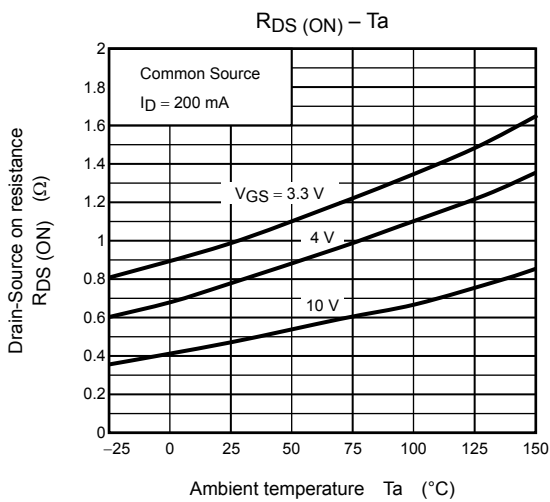
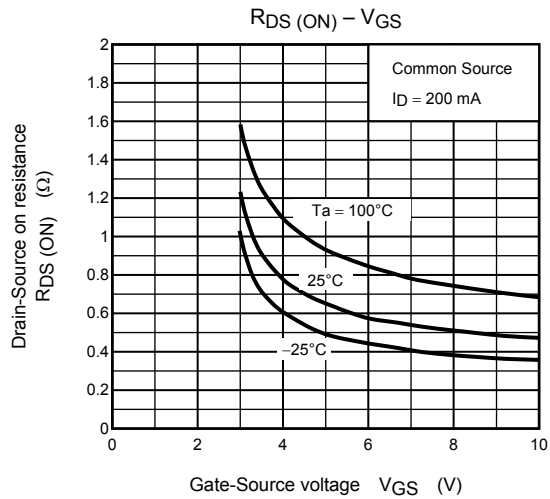
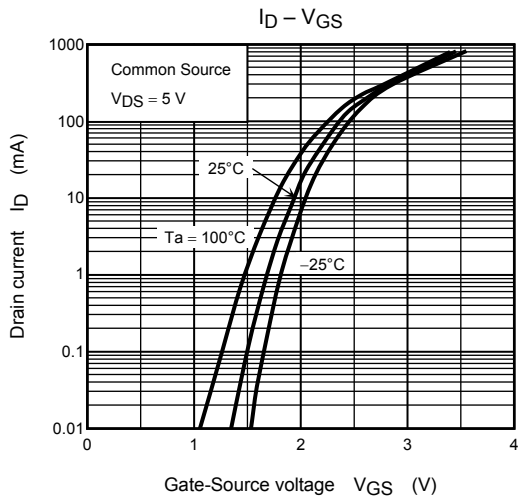
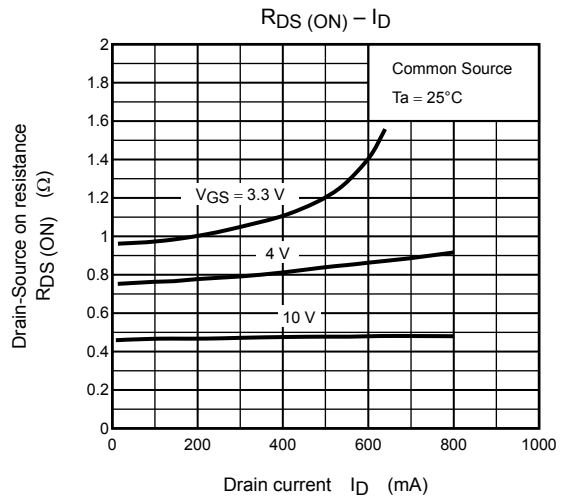
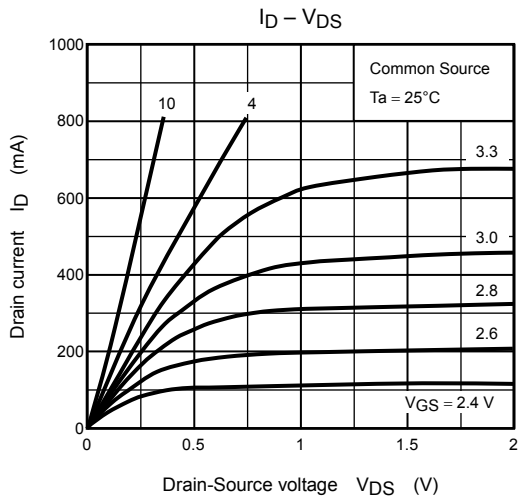
### (c) $V_{OUT}$

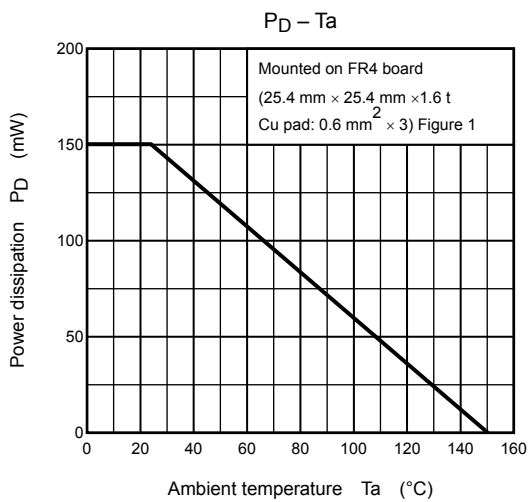
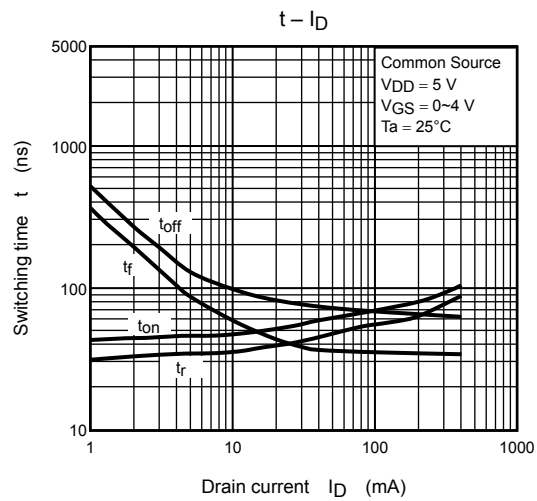
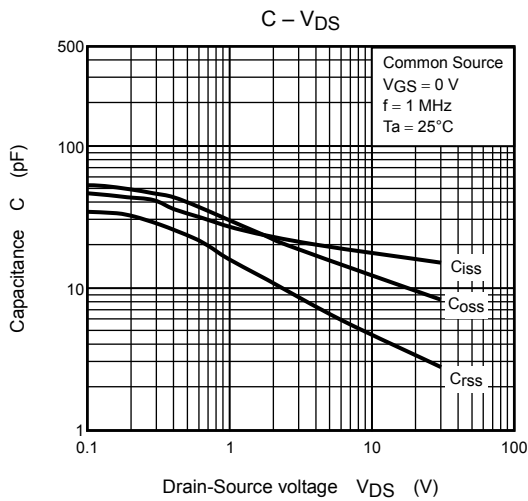
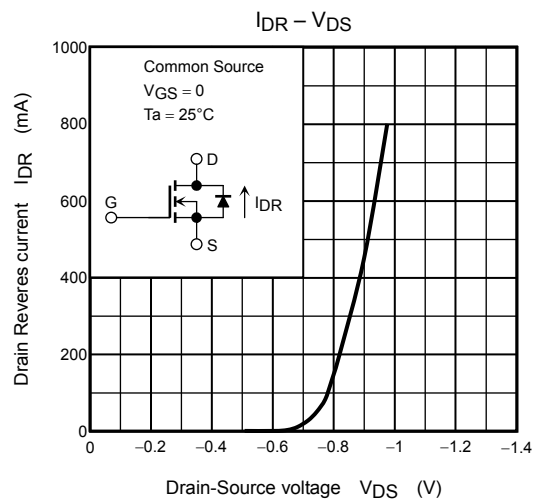
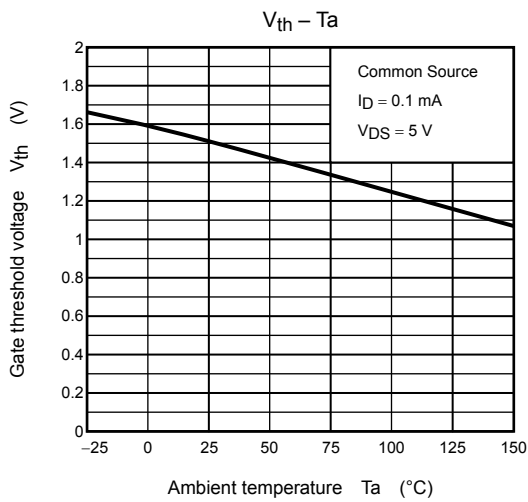
## Precaution

$V_{th}$  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.





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