

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (II-MOS VII)

## SSM6K30FE

- High-speed switching
- DC-DC Converter

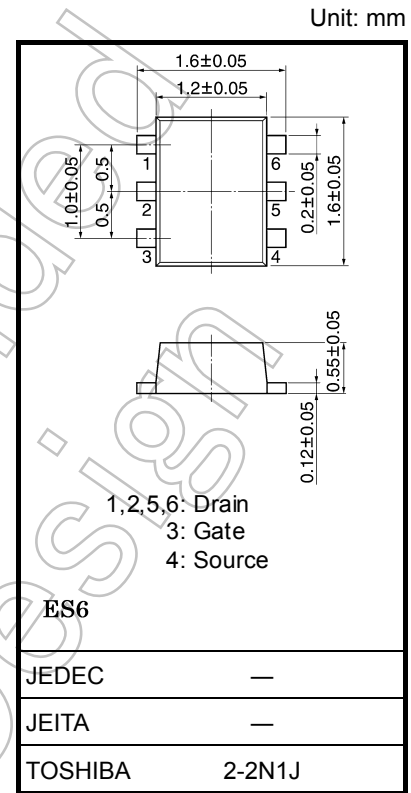
- Small package
- Low  $R_{DS(ON)}$ :  $R_{DS(ON)} = 210 \text{ m}\Omega$  (max) (@ $V_{GS} = 10 \text{ V}$ )  
:  $R_{DS(ON)} = 420 \text{ m}\Omega$  (max) (@ $V_{GS} = 4 \text{ V}$ )
- High-speed switching:  $t_{on} = 19 \text{ ns}$  (typ.)  
:  $t_{off} = 10 \text{ ns}$  (typ.)

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

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	20	V
Gate-Source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC	$I_D$	1.2	A
	Pulse	$I_{DP}$	2.4	
Drain power dissipation		$P_D$ (Note 1)	500	mW
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature		$T_{stg}$	-55 to 150	$^\circ\text{C}$

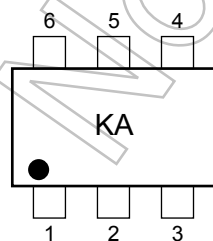
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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 FR4 board  
(25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm (t), Cu pad: 645 mm<sup>2</sup>)

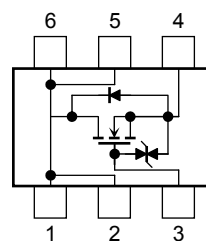


Weight: 3 mg (typ.)

### Marking



### Equivalent Circuit (top view)



### Handling Precaution

When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against static 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  
2003-04

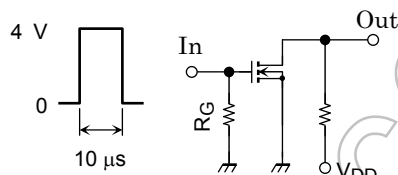
## Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 1$	$\mu\text{A}$
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$	20	—	—	V
Drain cut-off current	$I_{DSS}$	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	1	$\mu\text{A}$
Gate threshold voltage	$V_{th}$	$V_{DS} = 5 \text{ V}, I_D = 0.1 \text{ mA}$	1.1	—	2.3	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 5 \text{ V}, I_D = 0.6 \text{ A}$ (Note 2)	0.68	—	—	S
Drain-Source on-resistance	$R_{DS(ON)}$	$I_D = 0.6 \text{ A}, V_{GS} = 10 \text{ V}$ (Note 2)	—	145	210	$\text{m}\Omega$
		$I_D = 0.6 \text{ A}, V_{GS} = 4 \text{ V}$ (Note 2)	—	260	420	
Input capacitance	$C_{iss}$	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	60	—	pF
Reverse transfer capacitance	$C_{rss}$	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	17	—	pF
Output capacitance	$C_{oss}$	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	47	—	pF
Switching time	Turn-on time	$t_{on}$	—	19	—	ns
	Turn-off time	$t_{off}$		10		

Note 2: Pulse measurement

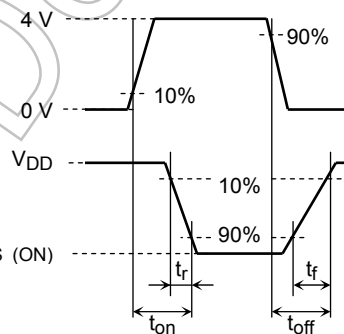
## Switching Time Test Circuit

### (a) Test circuit

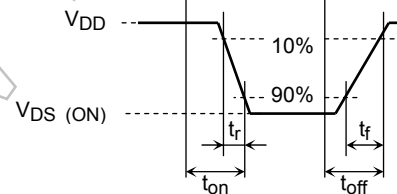


$V_{DD} = 10 \text{ V}$   
 $R_G = 10 \Omega$   
Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5 \text{ ns}$   
Common source  
 $T_a = 25^\circ\text{C}$

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



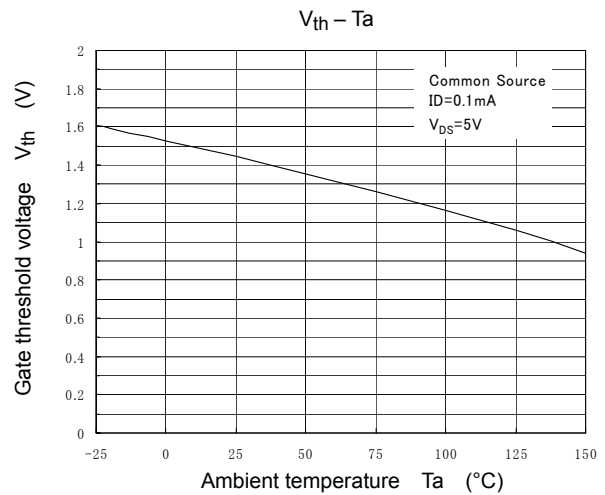
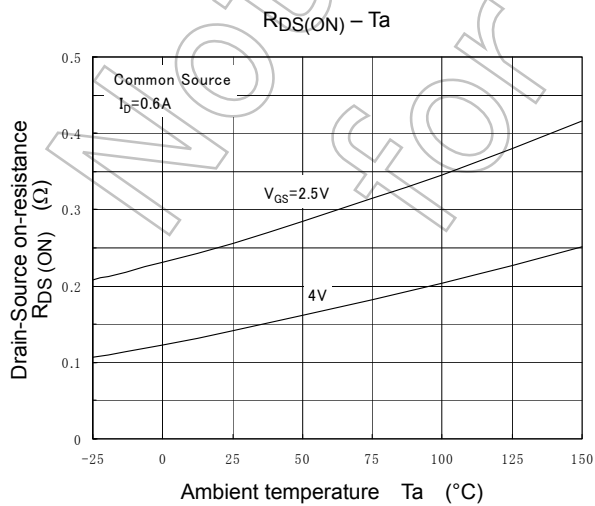
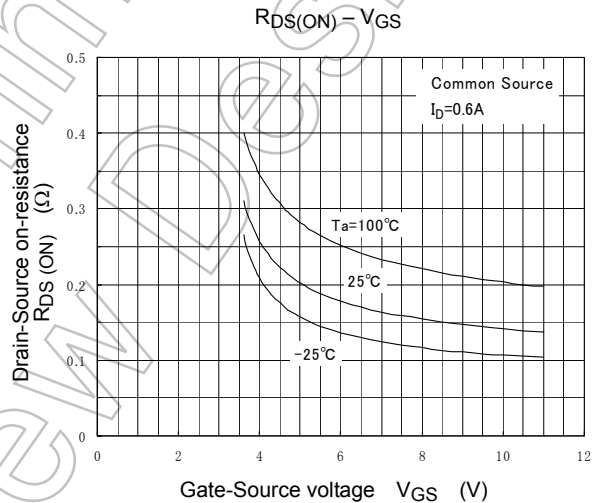
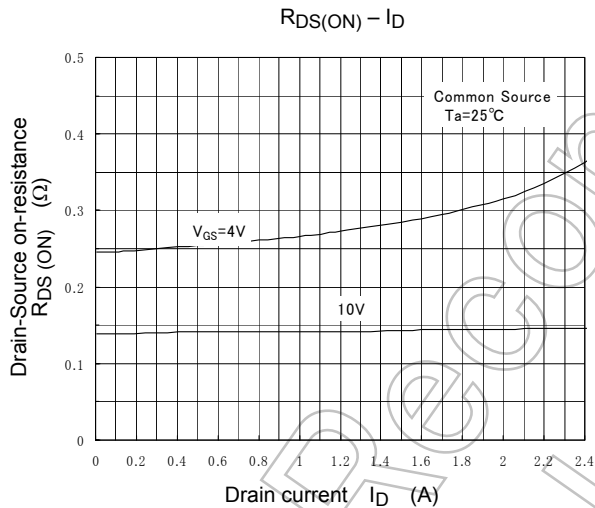
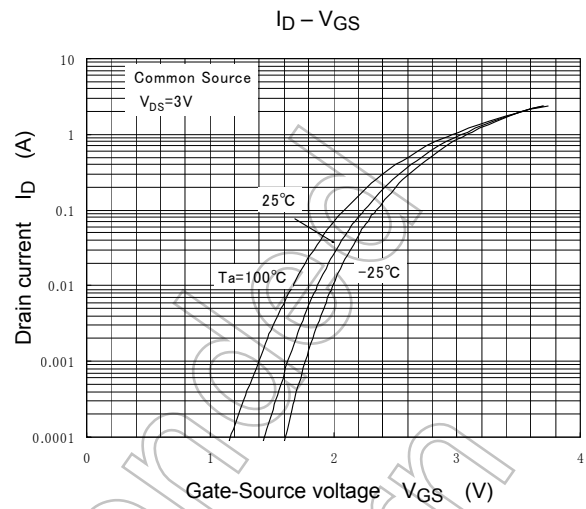
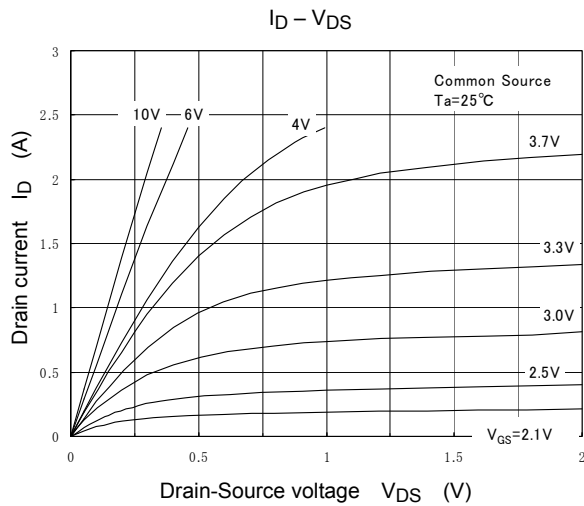
### (c) $V_{OUT}$

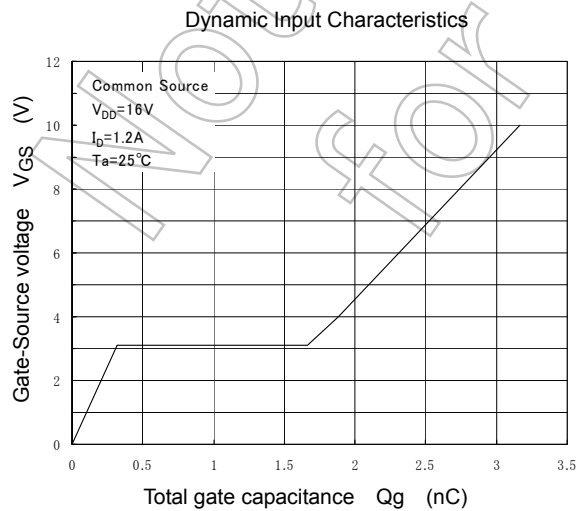
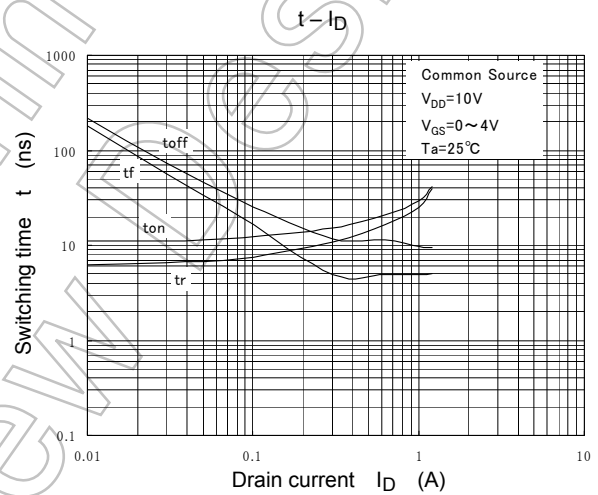
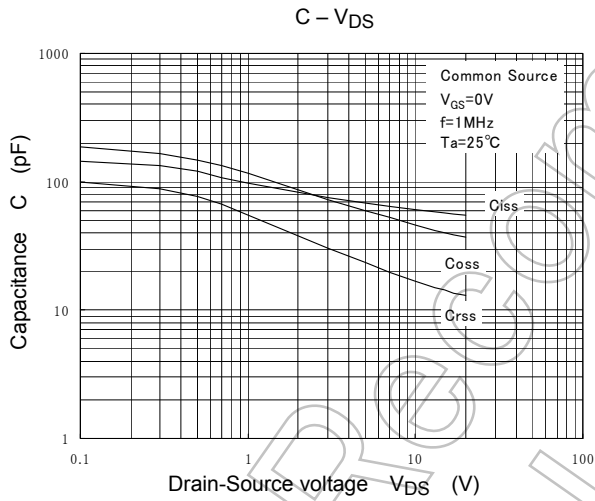
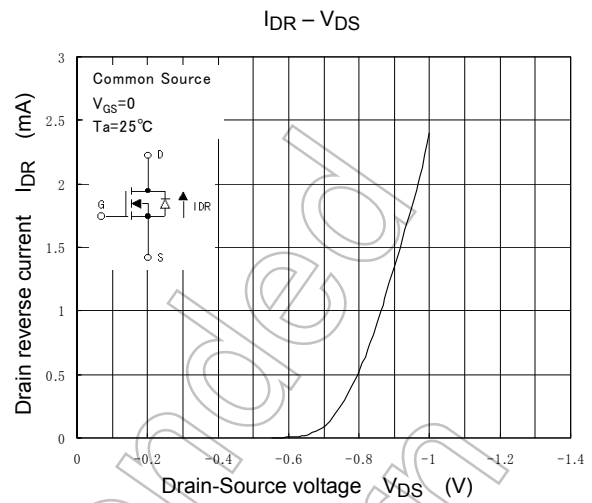
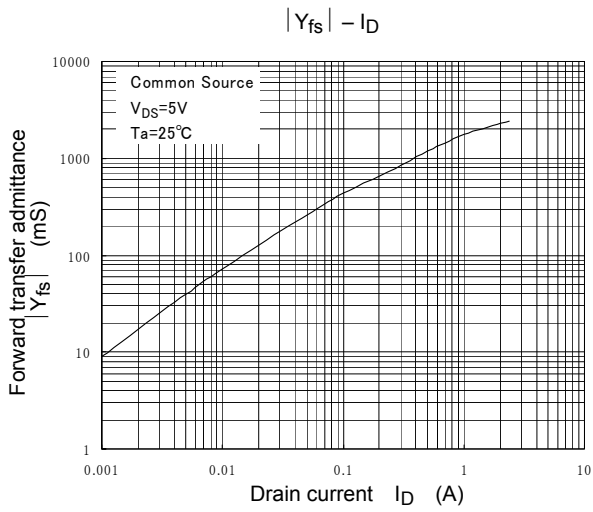


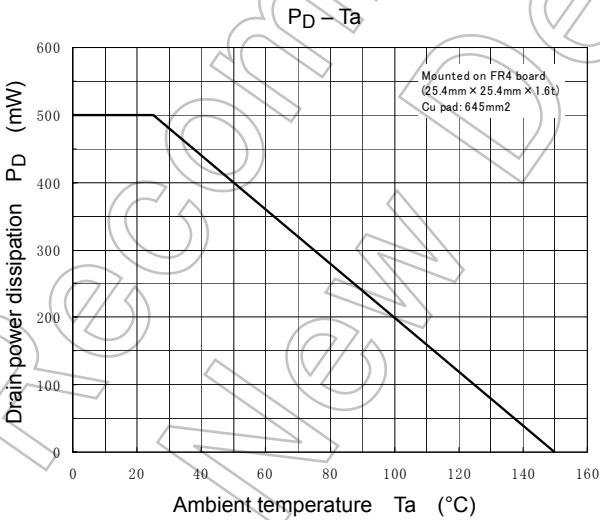
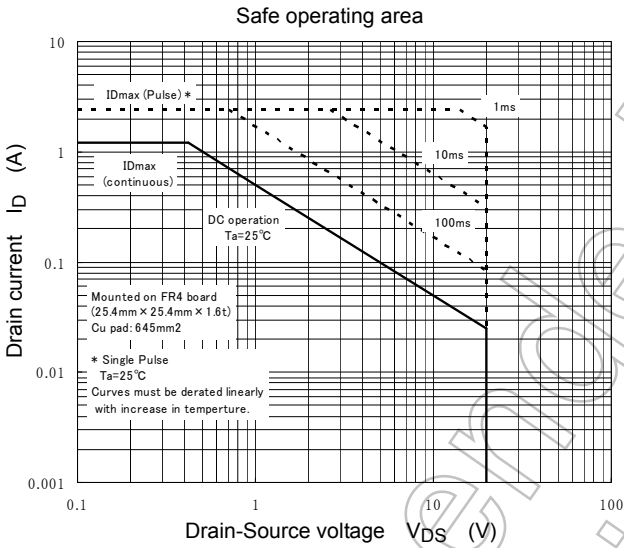
## Precaution

$V_{th}$  can be expressed as the voltage between the 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:  $V_{GS(OFF)} < V_{th} \leq V_{GS(ON)}$ .)

Be sure to take this into consideration when using the device.







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