

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.)

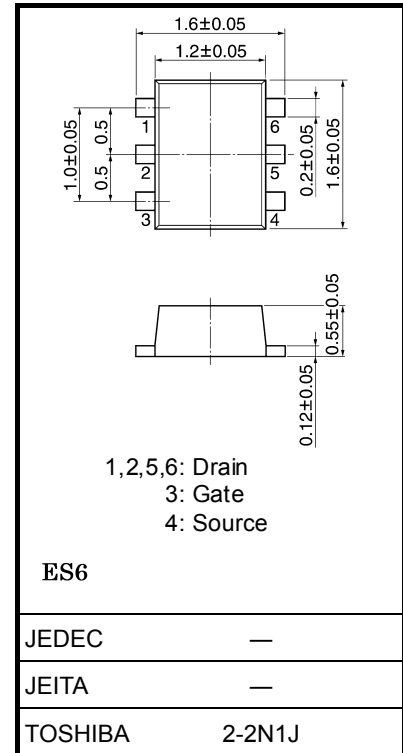
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	20	V
Gate-Source voltage		V_{GSS}	± 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).

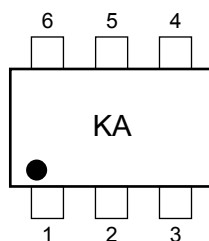
Note 1: Mounted on FR4 board
(25.4 mm $\times$ 25.4 mm $\times$ 1.6 mm (t), Cu pad: 645 mm²)

Unit: mm

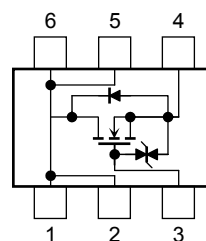


Weight: 3 mg (typ.)

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.

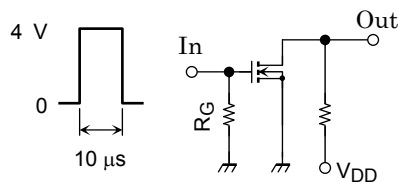
Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 1	μA
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	μA
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	$V_{DD} = 10 \text{ V}, I_D = 0.6 \text{ A},$ $V_{GS} = 0 \text{ to } 4 \text{ V}, R_G = 10 \Omega$	—	19	—	ns
	Turn-off time		—	10	—	

Note 2: Pulse measurement

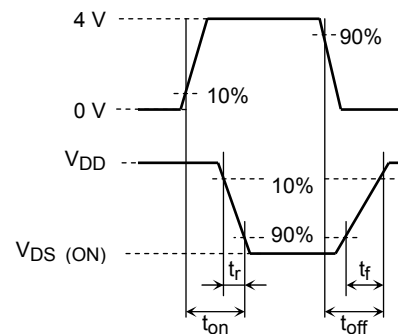
Switching Time Test Circuit

(a) Test circuit

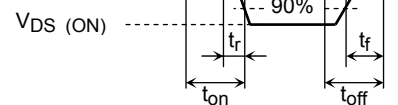


$V_{DD} = 10 \text{ V}$
 $R_G = 10 \Omega$
 Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5 \text{ ns}$
 Common source
 $T_a = 25^\circ\text{C}$

(b) V_{IN}



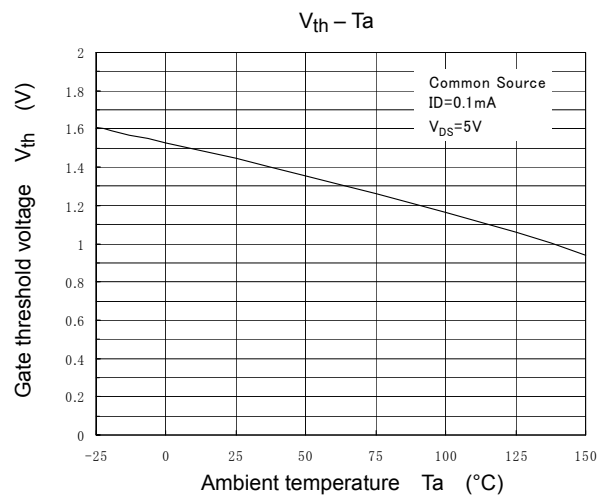
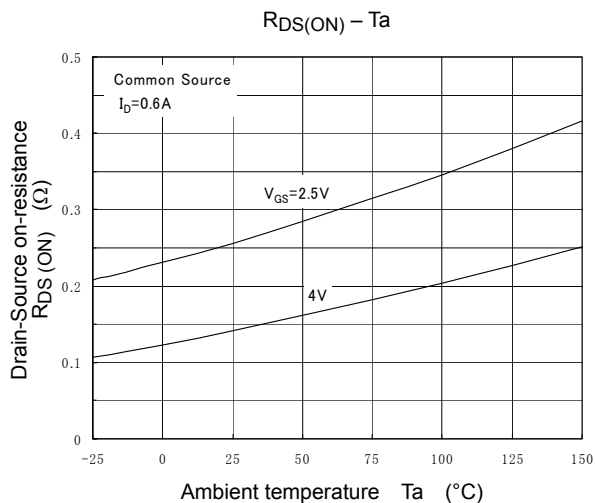
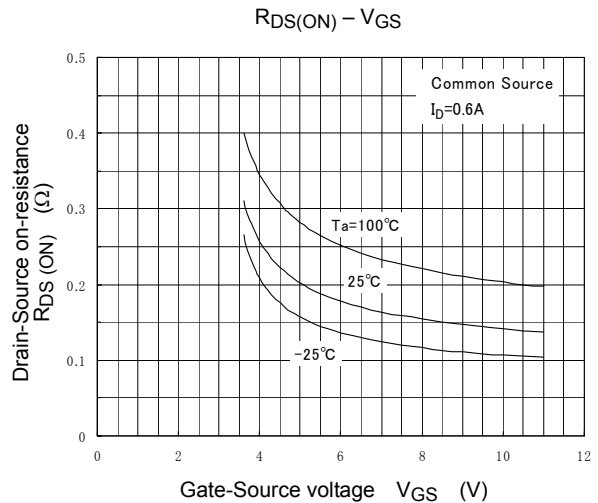
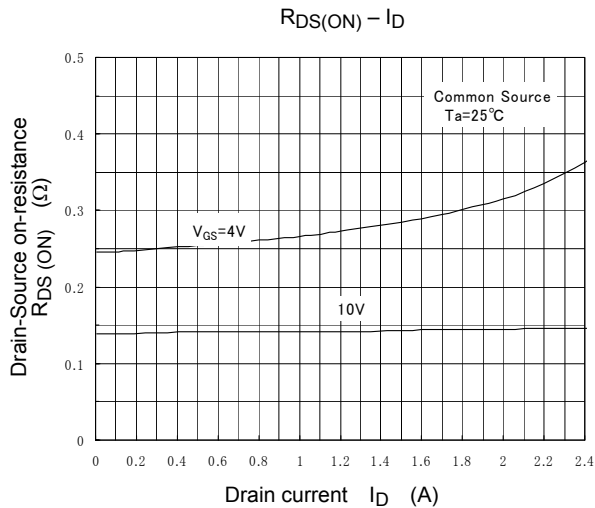
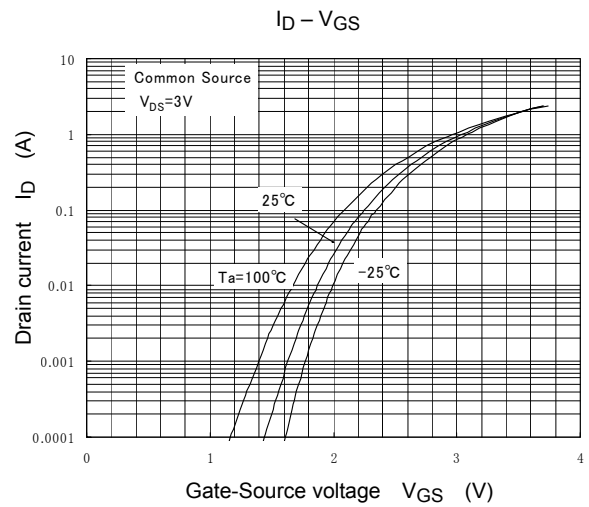
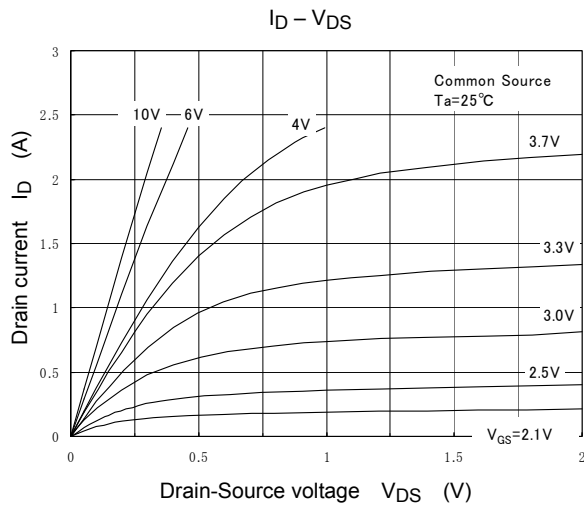
(c) V_{OUT}

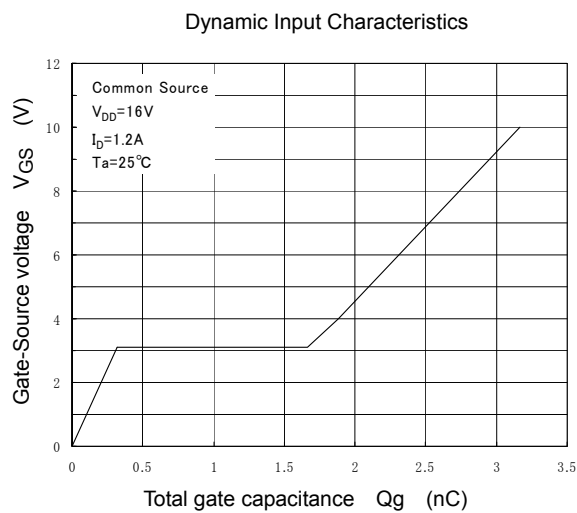
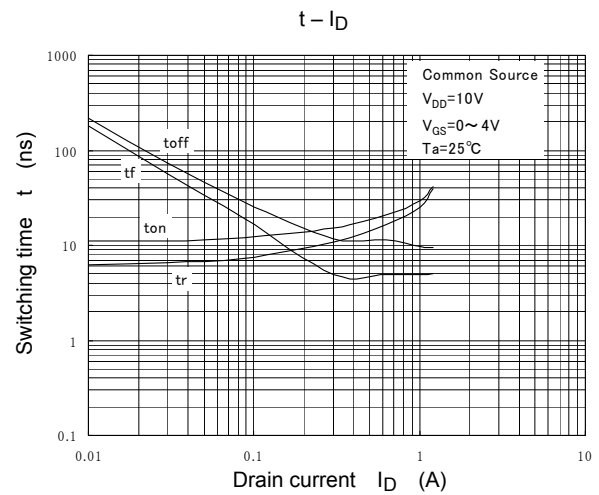
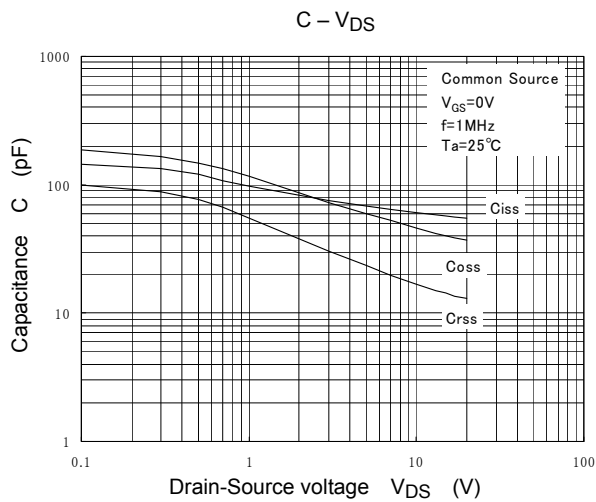
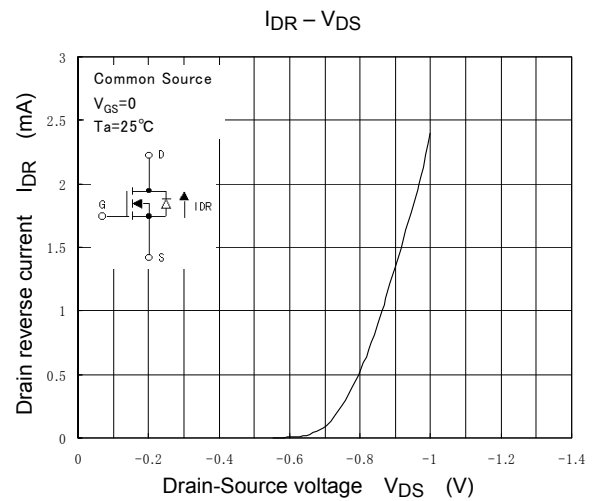
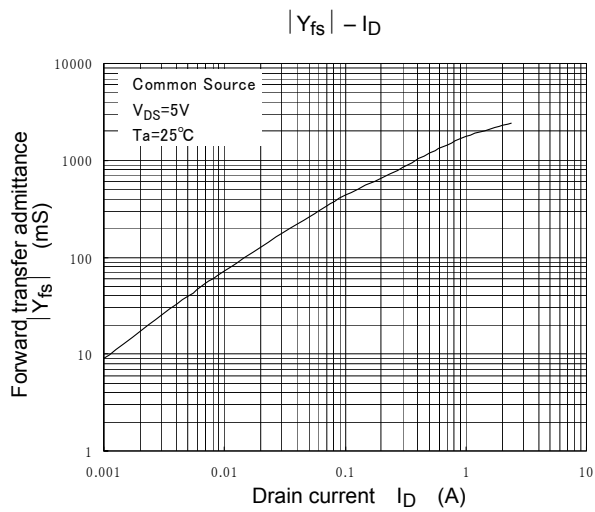


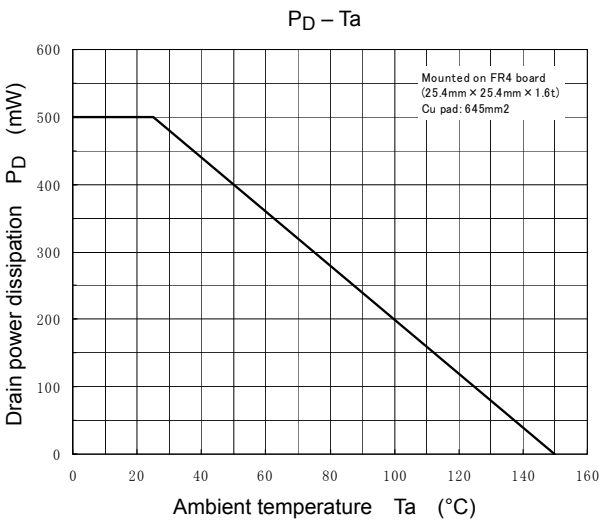
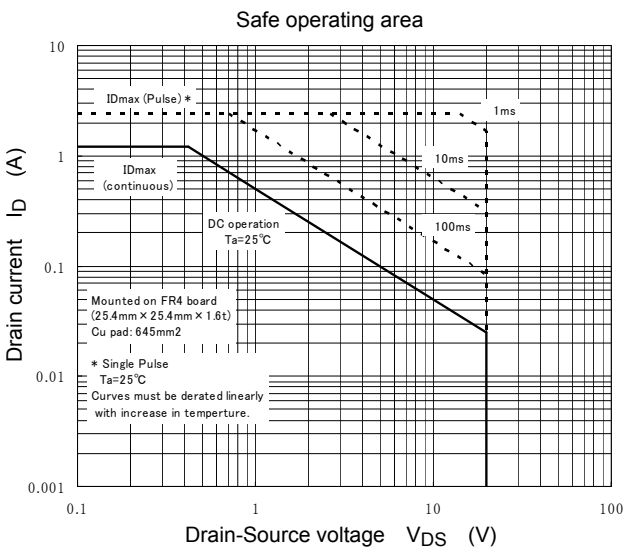
Precaution

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:
 $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$.)

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







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