

# SSM6J23FE

High Current Switching Applications  
DC-DC Converter

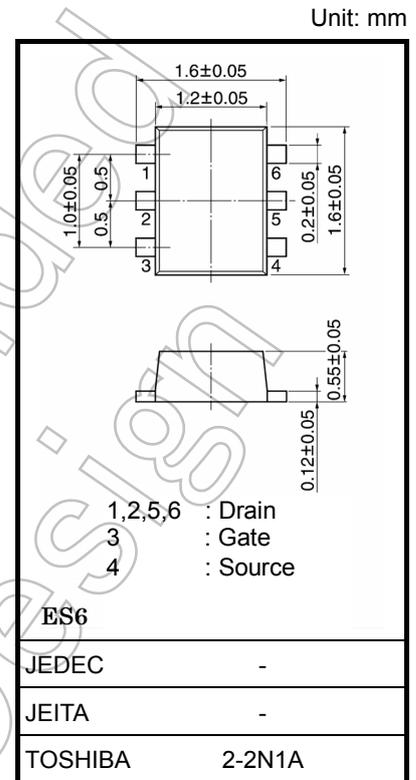
- Suitable for high-density mounting due to compact package
- Low on-resistance:  $R_{on} = 160 \text{ m}\Omega$  (max) (@ $V_{GS} = -4.0 \text{ V}$ )  
 $R_{on} = 210 \text{ m}\Omega$  (max) (@ $V_{GS} = -2.5 \text{ V}$ )

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

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	-12	V
Gate-Source voltage		$V_{GS}$	$\pm 8$	V
Drain current	DC	$I_D$	-1.2	A
	Pulse	$I_{DP}$	-4.8	
Drain power dissipation		$P_D$ (Note 1)	500	mW
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°C

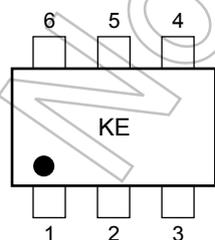
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

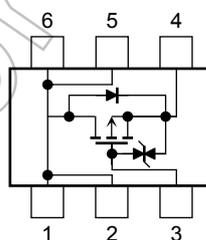


Weight: 3 mg (typ.)

### Marking



### Equivalent Circuit



### 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 use containers and other objects that are made of anti-static materials.

Start of commercial production  
2004-02

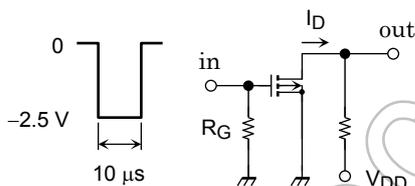
## Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit	
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 8 \text{ V}, V_{DS} = 0$	-	-	$\pm 1$	$\mu\text{A}$	
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = -1 \text{ mA}, V_{GS} = 0$	-12	-	-	V	
	$V_{(BR)DSX}$	$I_D = -1 \text{ mA}, V_{GS} = +8 \text{ V}$	-4	-	-		
Drain cut-off current	$I_{DSS}$	$V_{DS} = -12 \text{ V}, V_{GS} = 0$	-	-	-1	$\mu\text{A}$	
Gate threshold voltage	$V_{th}$	$V_{DS} = -3 \text{ V}, I_D = -0.1 \text{ mA}$	-0.5	-	-1.1	V	
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -3 \text{ V}, I_D = -0.6 \text{ A}$ (Note2)	1.75	3.5	-	S	
Drain-Source on-resistance	$R_{DS(ON)}$	$I_D = -0.6 \text{ A}, V_{GS} = -4 \text{ V}$ (Note2)	-	110	160	m $\Omega$	
		$I_D = -0.6 \text{ A}, V_{GS} = -2.5 \text{ V}$ (Note2)	-	145	210		
Input capacitance	$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$	-	420	-	pF	
Reverse transfer capacitance	$C_{rss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$	-	75	-	pF	
Output capacitance	$C_{oss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$	-	93	-	pF	
Switching time	Turn-on time	$t_{on}$	$V_{DD} = -10 \text{ V}, I_D = -0.6 \text{ A}$		-	23	ns
	Turn-off time	$t_{off}$	$V_{GS} = 0 \text{ to } -2.5 \text{ V}, R_G = 4.7 \Omega$		-	30	

Note2: Pulse test

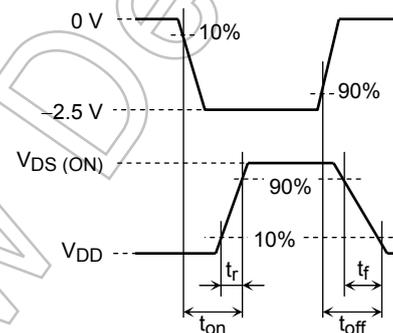
## Switching Time Test Circuit

### (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) $V_{IN}$

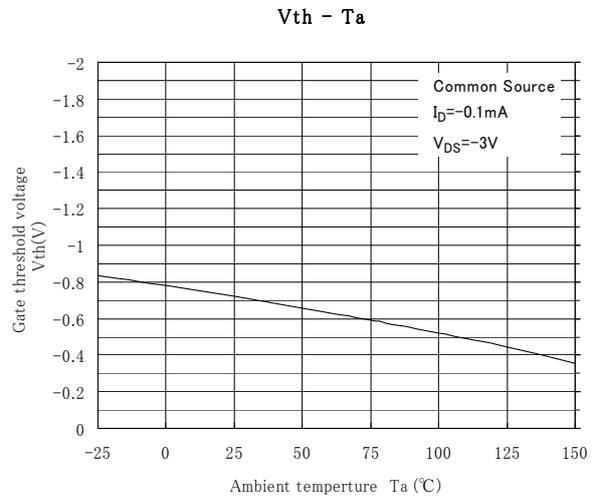
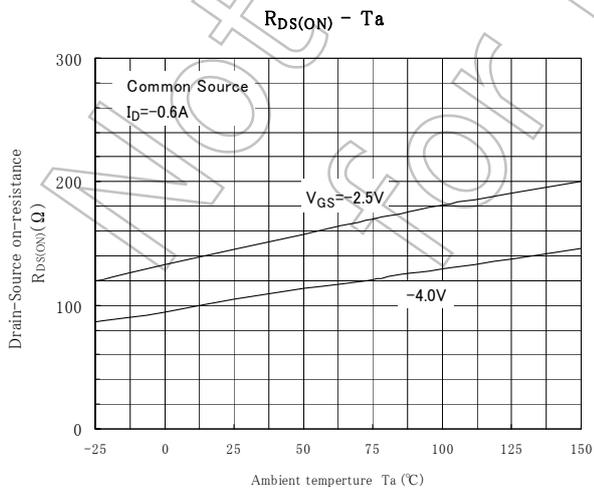
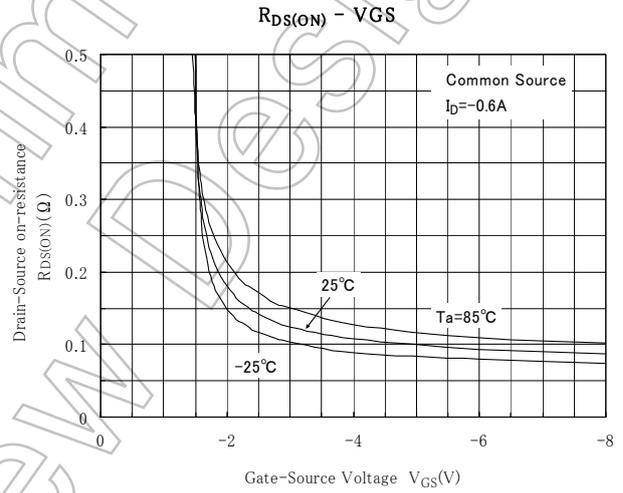
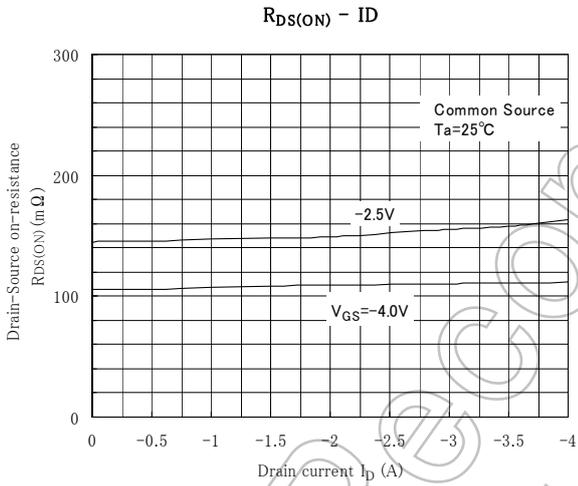
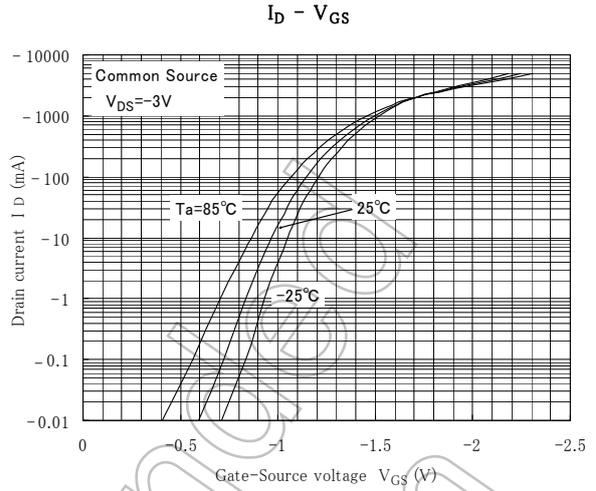
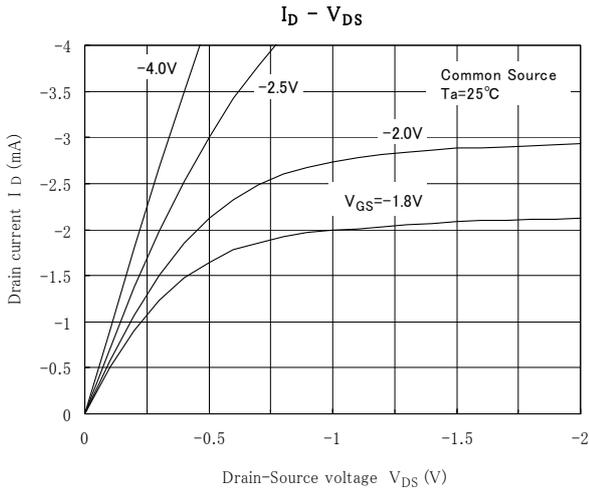


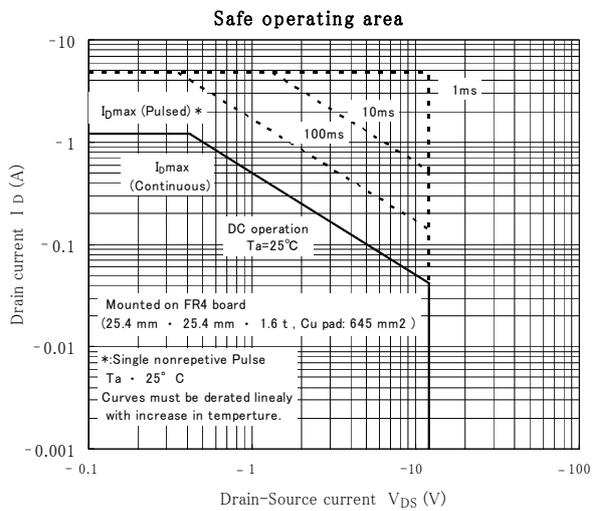
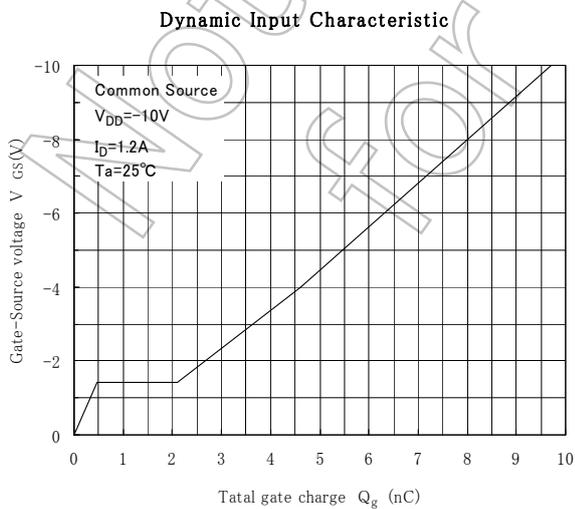
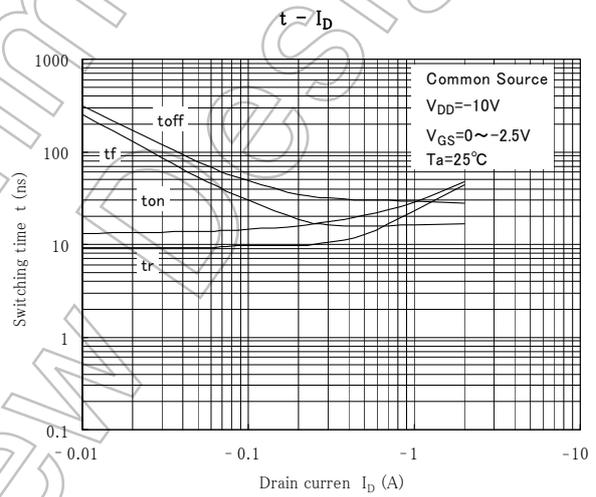
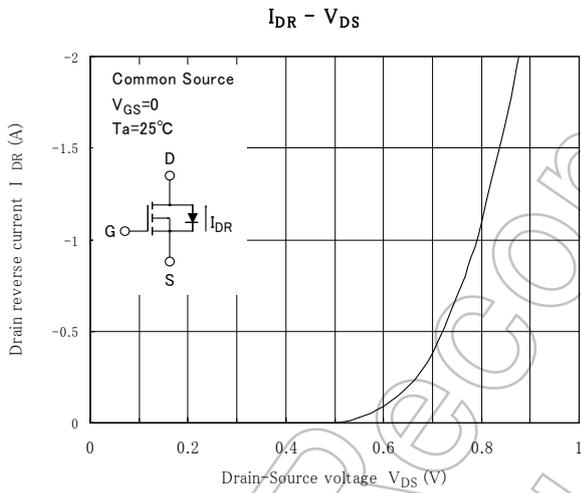
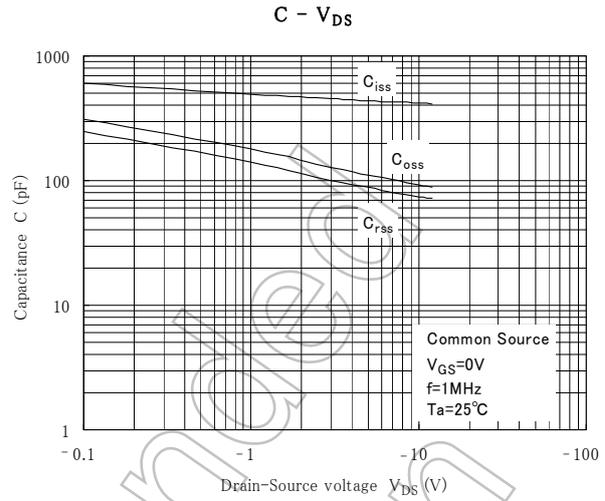
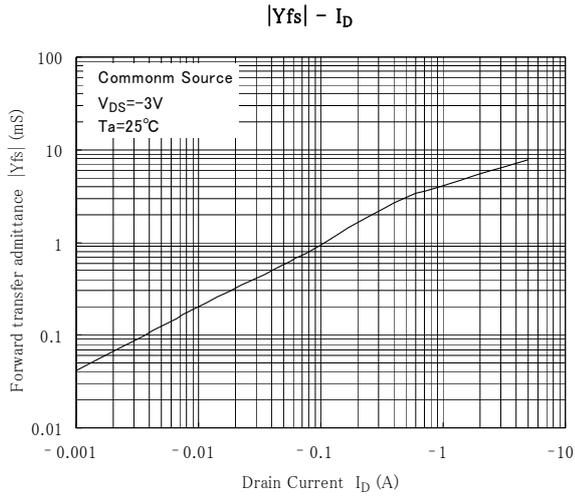
### (c) $V_{OUT}$

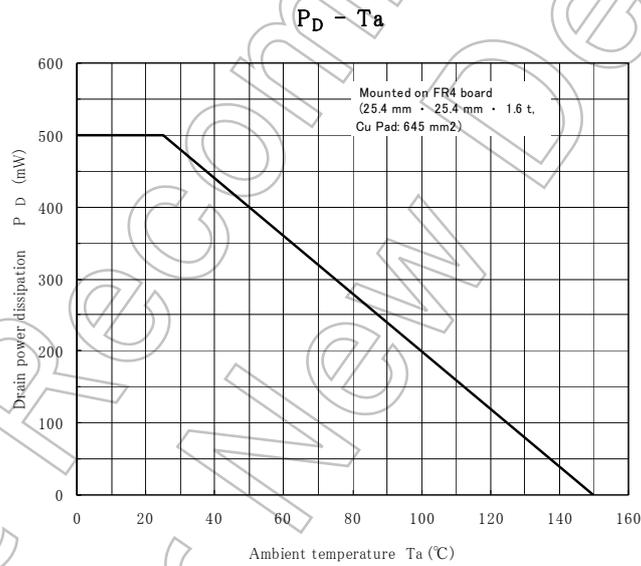
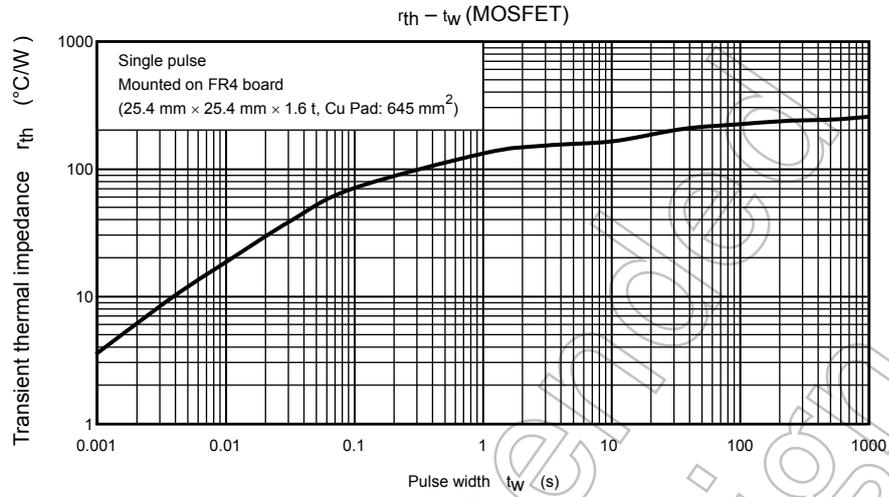
## Precaution

$V_{th}$  can be expressed as the voltage between gate and source when the low operating current value is  $I_D = 100 \mu\text{A}$  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:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ )

Please take this into consideration when using the device.







Not for New Design

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