

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type

## SSM3J16FU

High Speed Switching Applications

Analog Switch Applications

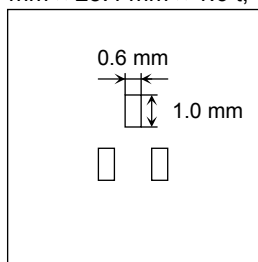
- Small package
- Low on-resistance :  $R_{on} = 8 \Omega$  (max) (@ $V_{GS} = -4 V$ )  
 :  $R_{on} = 12 \Omega$  (max) (@ $V_{GS} = -2.5 V$ )  
 :  $R_{on} = 45 \Omega$  (max) (@ $V_{GS} = -1.5 V$ )

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

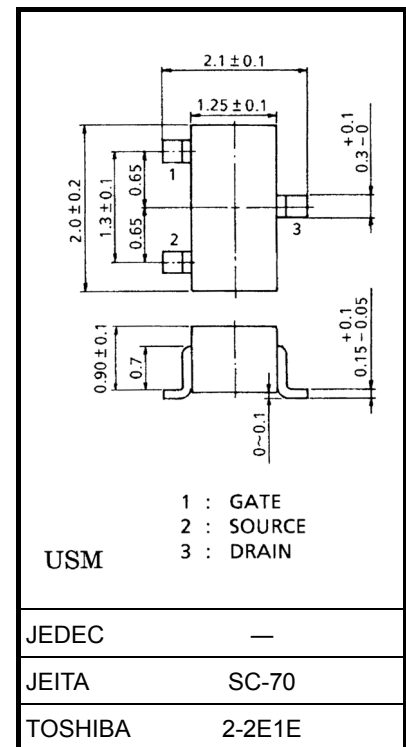
Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	-20	V
Gate-Source voltage		$V_{GSS}$	$\pm 10$	V
Drain current	DC	$I_D$	-100	mA
	Pulse	$I_{DP}$	-200	
Drain power dissipation ( $T_a = 25^\circ C$ )		$P_D$ (Note 1)	150	mW
Channel temperature		$T_{ch}$	150	$^\circ C$
Storage temperature range		$T_{stg}$	-55~150	$^\circ C$

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).

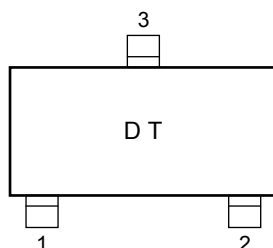
Note 1: Total rating, mounted on FR4 board  
 (25.4 mm  $\times$  25.4 mm  $\times$  1.6 t, Cu Pad: 0.6 mm<sup>2</sup>  $\times$  3)



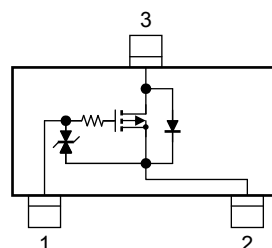
Unit: mm



### Marking



### Equivalent Circuit (top view)



### Handling Precaution

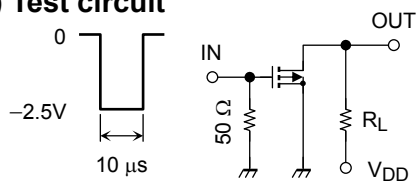
When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against static electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static materials.

## Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	MIN.	TYP.	MAX.	UNIT	
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 10\text{ V}, V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$	
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = -0.1\text{ mA}, V_{GS} = 0$	-20	—	—	V	
Drain cut-off current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0$	—	—	-1	$\mu\text{A}$	
Gate threshold voltage	$V_{th}$	$V_{DS} = -3\text{ V}, I_D = -0.1\text{ mA}$	-0.6	—	-1.1	V	
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -3\text{ V}, I_D = -10\text{ mA}$	25	—	—	mS	
Drain-Source ON resistance	$R_{DS(ON)}$	$I_D = -10\text{ mA}, V_{GS} = -4\text{ V}$	—	6	8	$\Omega$	
		$I_D = -10\text{ mA}, V_{GS} = -2.5\text{ V}$	—	8	12		
		$I_D = -1\text{ mA}, V_{GS} = -1.5\text{ V}$	—	18	45		
Input capacitance	$C_{iss}$	$V_{DS} = -3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	11	—	pF	
Reverse transfer capacitance	$C_{rss}$		—	3.7	—	pF	
Output capacitance	$C_{oss}$		—	10	—	pF	
Switching time	Turn-on time	$t_{on}$	$V_{DD} = -3\text{ V}, I_D = -10\text{ mA}, V_{GS} = 0 \sim -2.5\text{ V}$	—	130	—	ns
	Turn-off time	$t_{off}$		—	190	—	

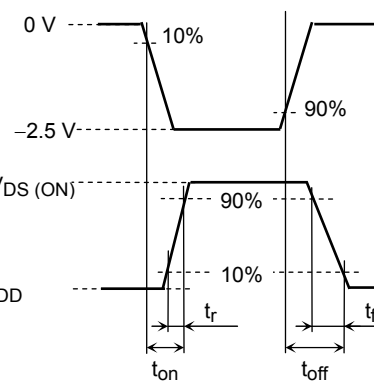
## Switching Time Test Circuit

(a) Test circuit

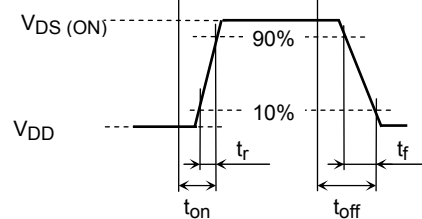


$V_{DD} = -3\text{ V}$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5\text{ ns}$   
 $(Z_{out} = 50\ \Omega)$   
 Common Source  
 $T_a = 25^\circ\text{C}$

(b)  $V_{IN}$



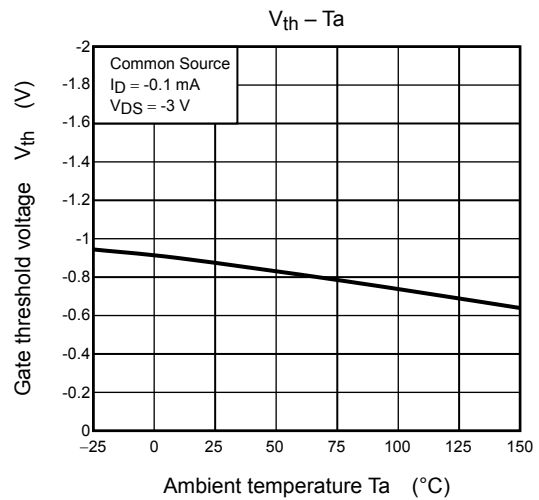
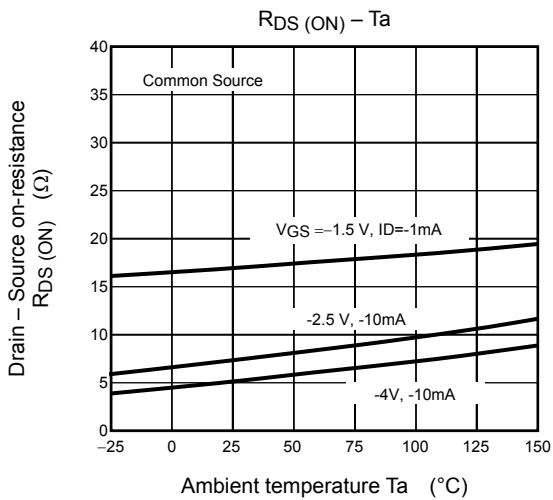
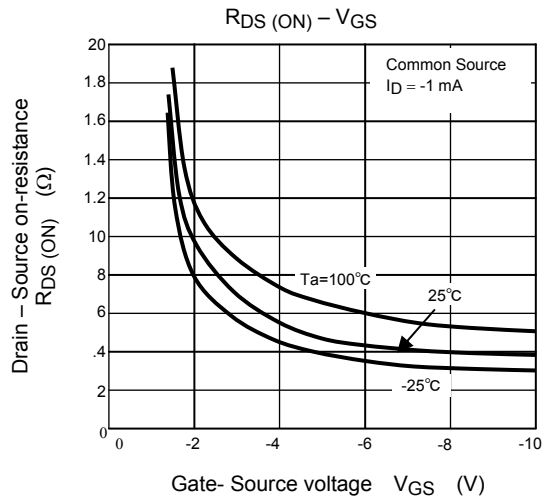
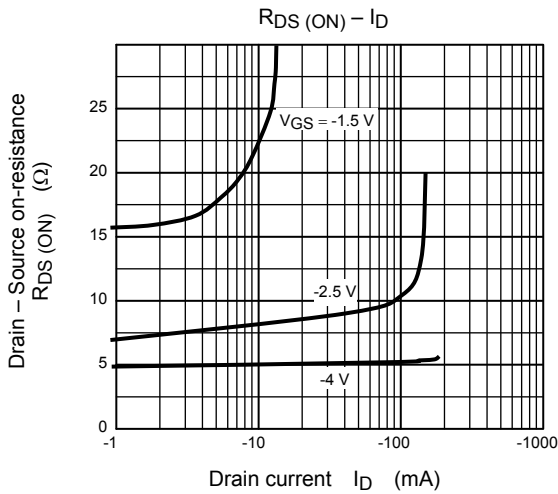
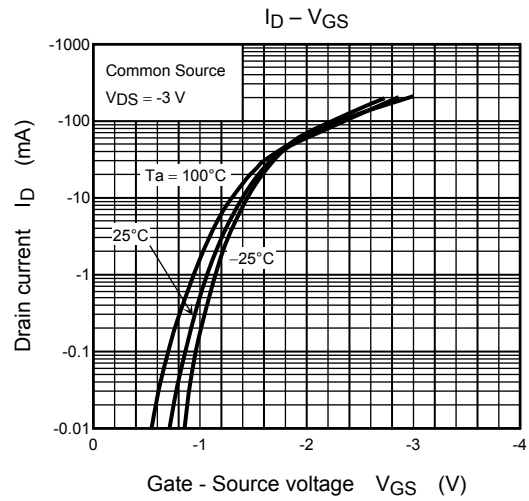
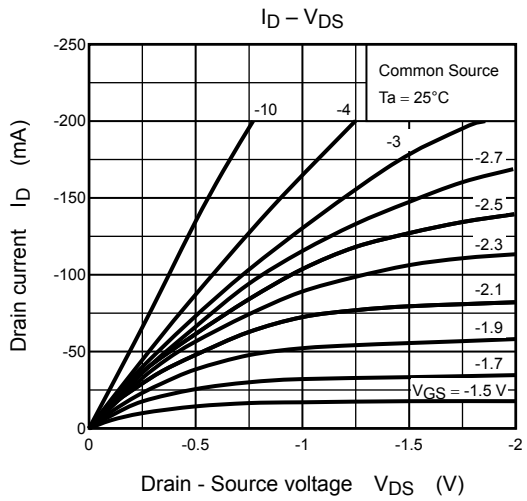
(c)  $V_{OUT}$

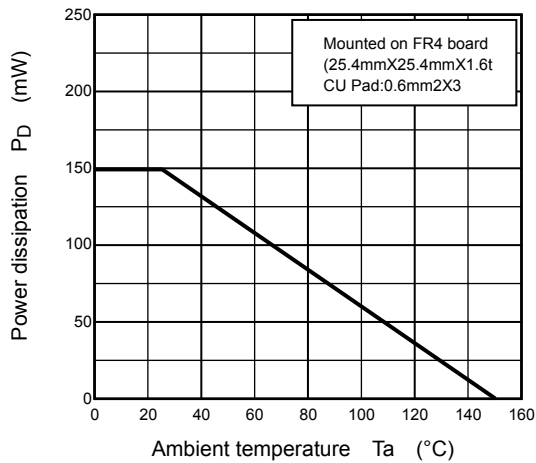
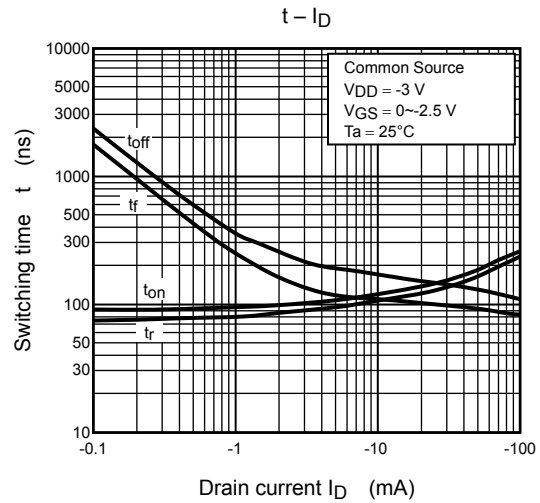
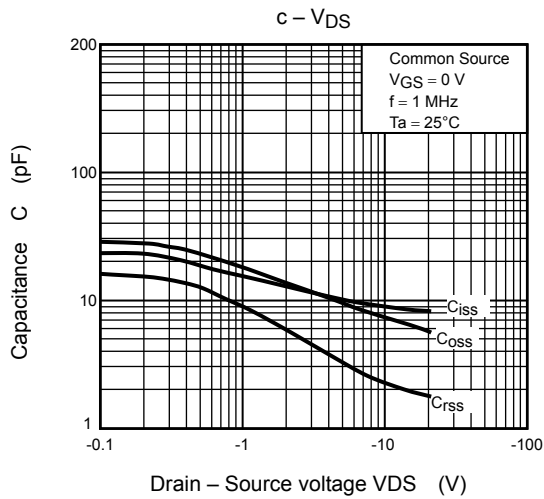
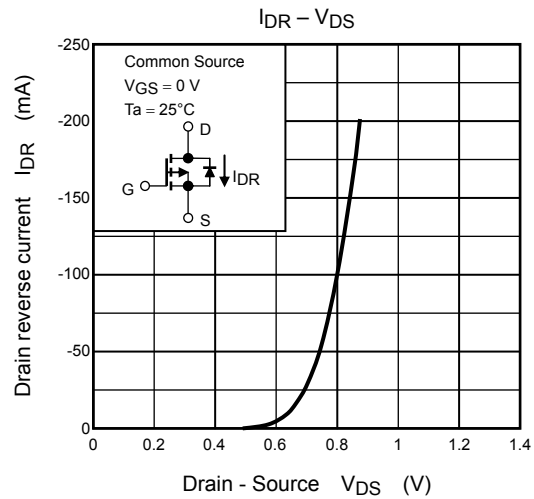
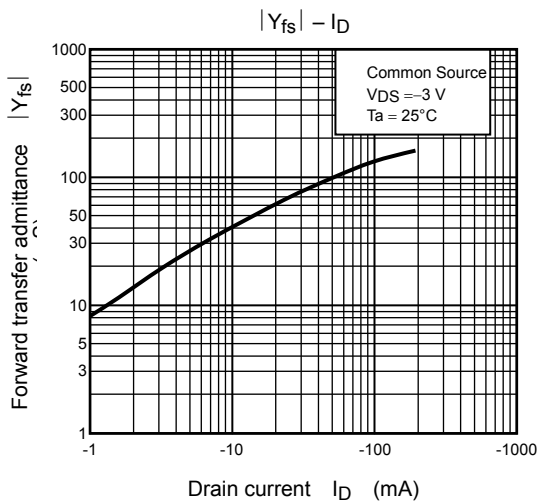


## Precaution

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

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





**RESTRICTIONS ON PRODUCT USE**

20070701-EN GENERAL

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- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.  
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