

TOSHIBA Field Effect Transistor Silicon P-Channel MOS Type

# SSM3J113TU

## High Speed Switching Applications

- 2.0V drive
- Low on-resistance:  $R_{on} = 449\text{m}\Omega$  (max) (@ $V_{GS} = -2.0\text{ V}$ )  
 $R_{on} = 249\text{m}\Omega$  (max) (@ $V_{GS} = -2.5\text{ V}$ )  
 $R_{on} = 169\text{m}\Omega$  (max) (@ $V_{GS} = -4.0\text{ V}$ )

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

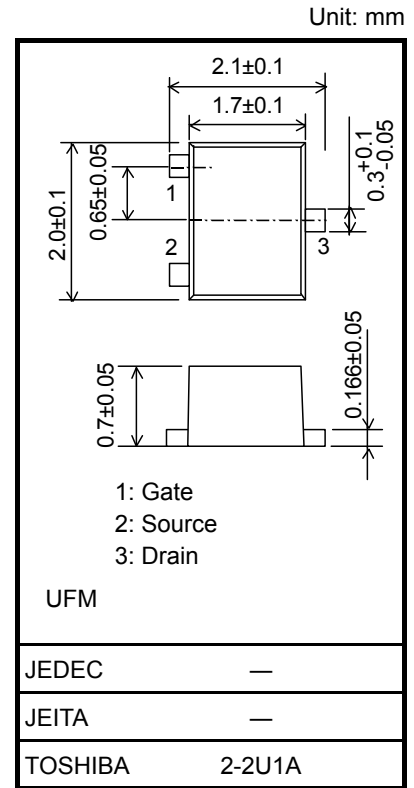
Characteristic	Symbol	Rating	Unit
Drain-Source voltage	$V_{DS}$	-20	V
Gate-Source voltage	$V_{GSS}$	$\pm 12$	V
Drain current	DC	$I_D$	-1.7
	Pulse	$I_{DP}$	-3.4
Drain power dissipation	$P_D$ (Note 1)	800	mW
	$P_D$ (Note 2)	500	
Channel temperature	$T_{ch}$	150	°C
Storage temperature range	$T_{stg}$	-55~150	°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 ceramic board.  
(25.4 mm × 25.4 mm × 0.8 mm, Cu Pad: 645 mm<sup>2</sup>)

Note 2: Mounted on FR4 board.  
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm<sup>2</sup>)



Weight: 6.6 mg (typ.)

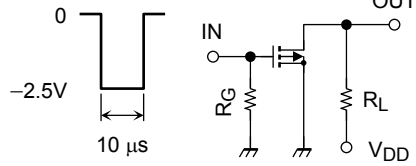
## Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	$V_{(BR) DSS}$	$I_D = -1\text{ mA}, V_{GS} = 0$	-20	—	—	V
	$V_{(BR) DSX}$	$I_D = -1\text{ mA}, V_{GS} = +12\text{ V}$	-8	—	—	
Drain cut-off current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0$	—	—	-1	μA
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 12\text{ V}, V_{DS} = 0$	—	—	$\pm 1$	μA
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} $	$V_{DS} = -3\text{ V}, I_D = -0.65\text{ A}$ (Note3)	1.3	2.7	—	S
Drain-Source on-resistance	$R_{DS(ON)}$	$I_D = -0.65\text{ A}, V_{GS} = -4.0\text{ V}$ (Note3)	—	129	169	mΩ
		$I_D = -0.65\text{ A}, V_{GS} = -2.5\text{ V}$ (Note3)	—	189	249	
		$I_D = -0.65\text{ A}, V_{GS} = -2.0\text{ V}$ (Note3)	—	249	449	
Input capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	370	—	pF
Output capacitance	$C_{oss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	116	—	pF
Reverse transfer capacitance	$C_{rss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	73	—	pF
Switching time	Turn-on time	$t_{on}$	—	33	—	ns
	Turn-off time	$t_{off}$		47		
Drain-Source forward voltage	$V_{DSF}$	$I_D = 1.7\text{ A}, V_{GS} = 0\text{ V}$ (Note3)	—	0.77	1.2	V

Note3: Pulse test

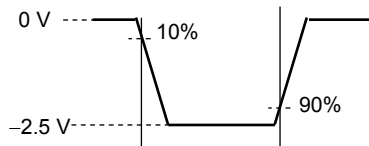
**Switching Time Test Circuit**

**(a) Test circuit**

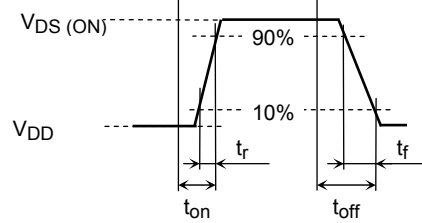


$V_{DD} = -10\text{ V}$   
 $R_G = 4.7\ \Omega$   
 $D.U. \leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5\text{ ns}$   
 Common Source  
 $T_a = 25^\circ\text{C}$

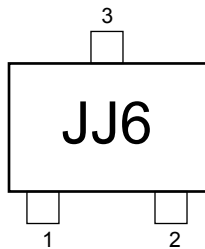
**(b)  $V_{IN}$**



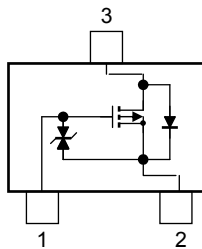
**(c)  $V_{OUT}$**



**Marking**



**Equivalent Circuit (top view)**



**Precaution**

$V_{th}$  can be expressed as the voltage between 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  $V_{th}$ .

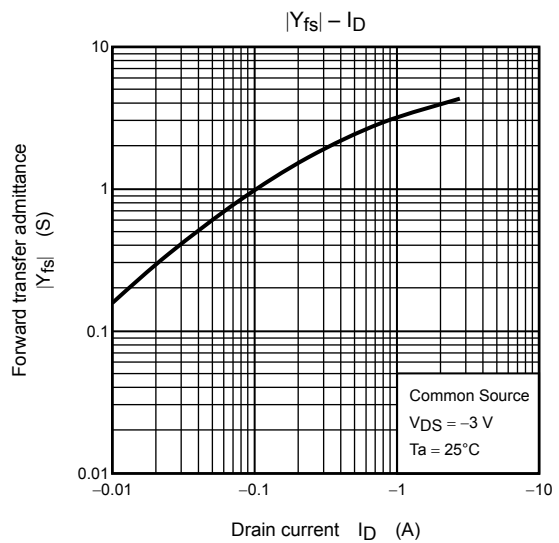
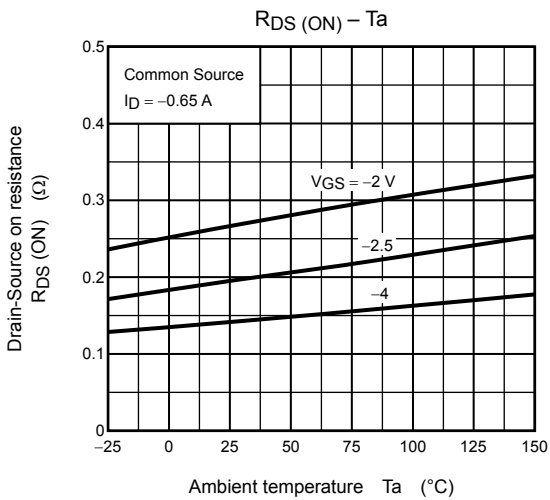
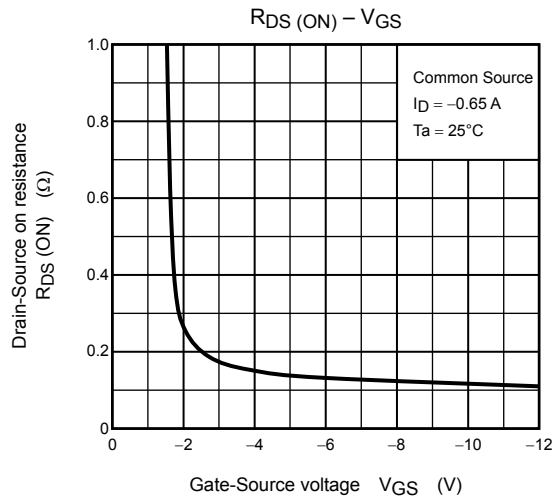
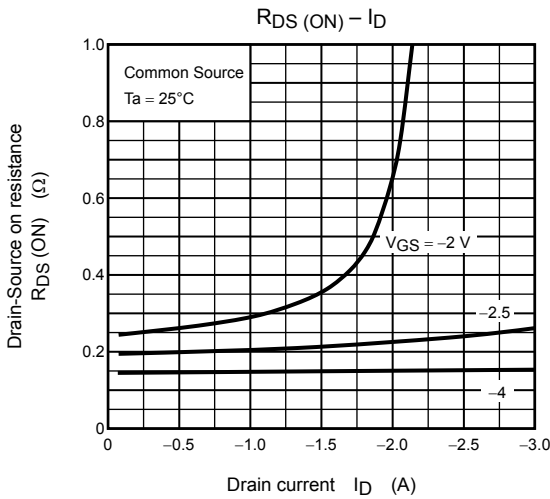
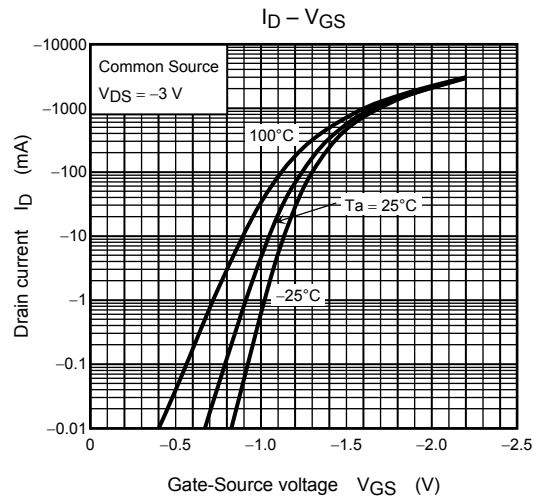
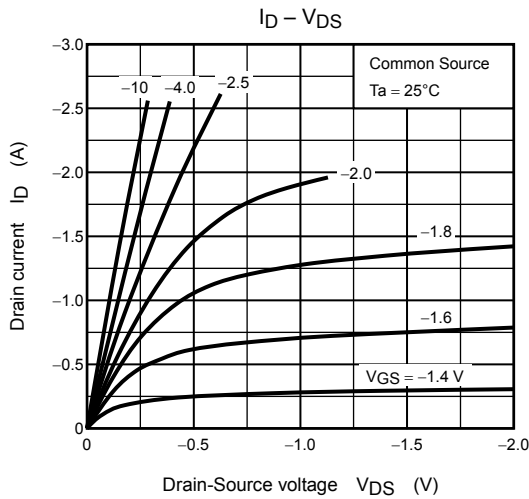
(The relationship can be established as follows:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ )

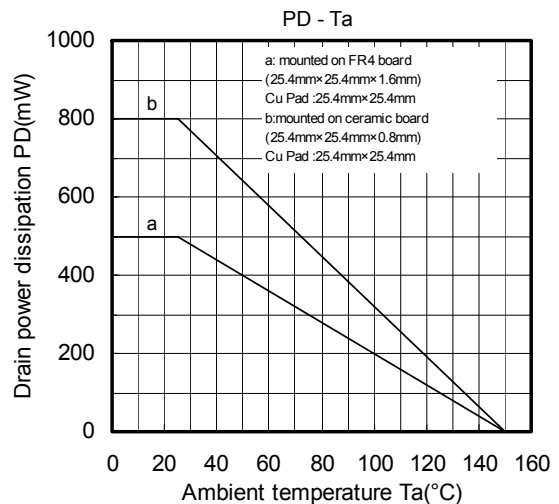
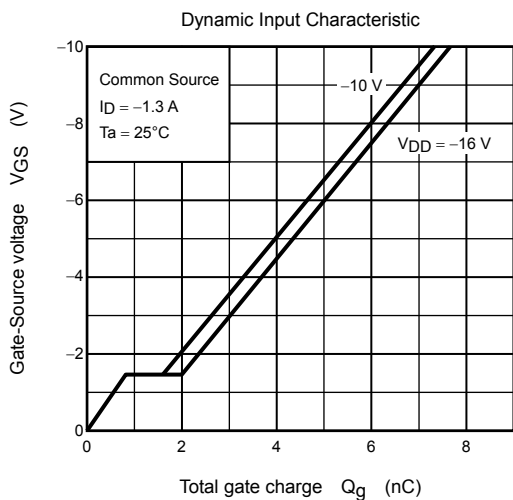
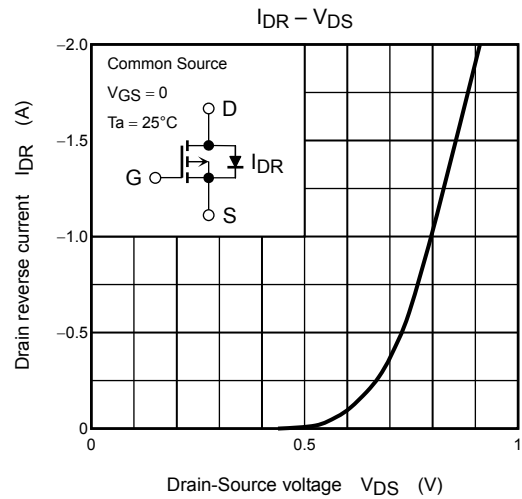
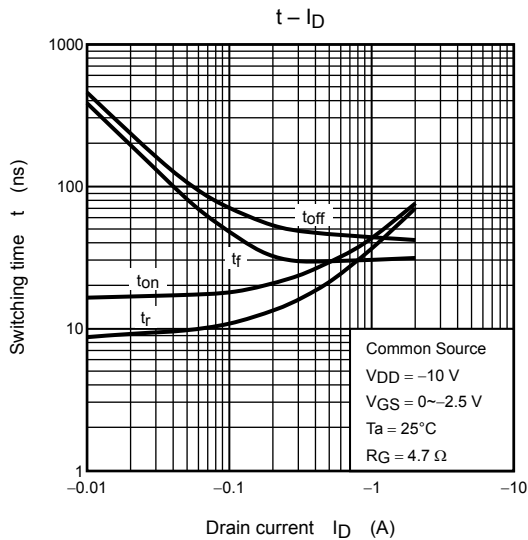
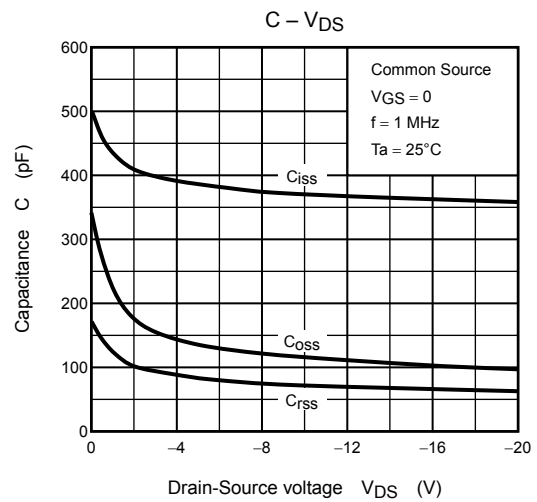
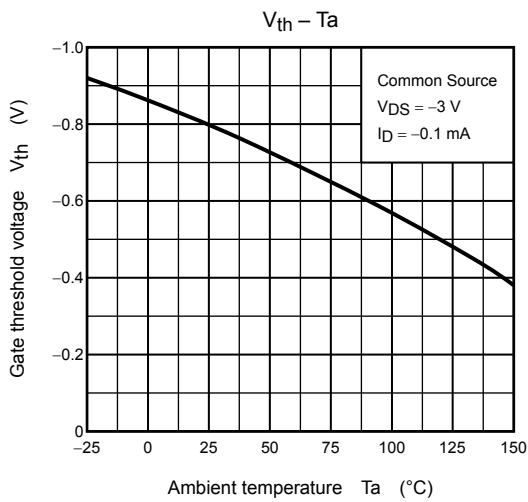
Take this into consideration when using the device.

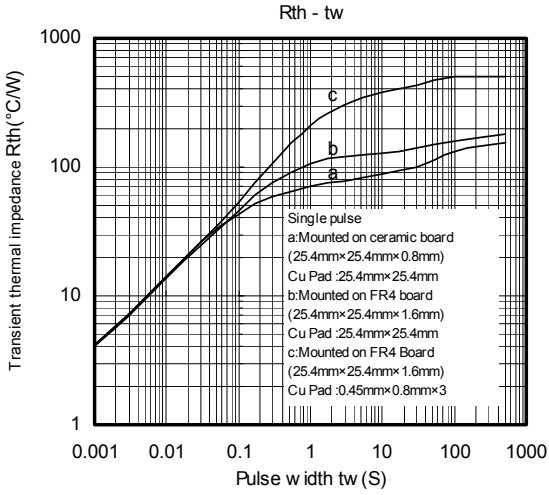
**Handling Precaution**

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 containers and other objects that come into direct contact with devices should be made of anti-static materials.

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20070701-EN GENERAL

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