

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type

## SSM3J120TU

## ○ Power Management Switch Applications

## ○ High-Current Switching Applications

- 1.5 V drive
- Low on-resistance

 $R_{on} = 140 \text{ m}\Omega$  (max) (@ $V_{GS} = -1.5 \text{ V}$ ) $R_{on} = 78 \text{ m}\Omega$  (max) (@ $V_{GS} = -1.8 \text{ V}$ ) $R_{on} = 49 \text{ m}\Omega$  (max) (@ $V_{GS} = -2.5 \text{ V}$ ) $R_{on} = 38 \text{ m}\Omega$  (max) (@ $V_{GS} = -4.0 \text{ V}$ )Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	-20	V
Gate-Source voltage		$V_{GSS}$	$\pm 8$	V
Drain current	DC	$I_D$	-4.0	A
	Pulse	$I_{DP}$	-8.0	
Drain power dissipation		$P_D$ (Note 1)	800	mW
		$P_D$ (Note 2)	500	
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature		$T_{stg}$	-55~150	$^\circ\text{C}$

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 ceramic board

(25.4 mm × 25.4 mm × 0.8 t, Cu Pad: 645 mm<sup>2</sup>)

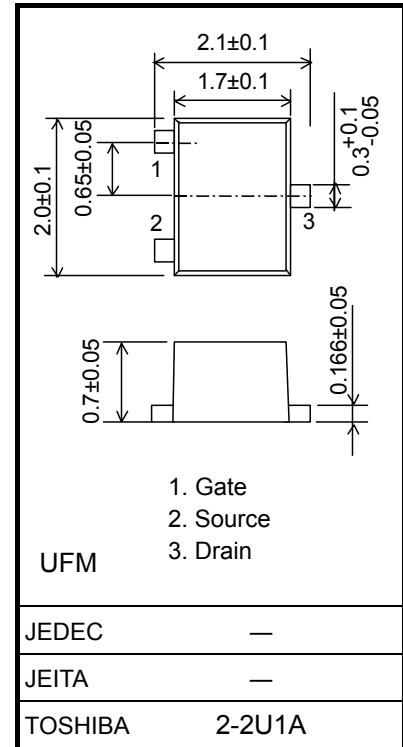
Note 2 : Mounted on FR4 board

(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 645 mm<sup>2</sup>)

Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = -1 \text{ mA}$ , $V_{GS} = 0$	-20	—	—	V
	$V_{(BR)DSX}$	$I_D = -1 \text{ mA}$ , $V_{GS} = +8 \text{ V}$	-12	—	—	
Drain cut-off current	$I_{DSS}$	$V_{DS} = -20 \text{ V}$ , $V_{GS} = 0$	—	—	-10	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 8 \text{ V}$ , $V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$
Gate threshold voltage	$V_{th}$	$V_{DS} = -3 \text{ V}$ , $I_D = -1 \text{ mA}$	-0.3	—	-1.0	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -3 \text{ V}$ , $I_D = -2.0 \text{ A}$ (Note 3)	6.1	12.1	—	S
Drain-Source ON-resistance	$R_{DS(ON)}$	$I_D = -3.0 \text{ A}$ , $V_{GS} = -4.0 \text{ V}$ (Note 3)	—	28	38	m $\Omega$
		$I_D = -2.0 \text{ A}$ , $V_{GS} = -2.5 \text{ V}$ (Note 3)	—	34	49	
		$I_D = -1.0 \text{ A}$ , $V_{GS} = -1.8 \text{ V}$ (Note 3)	—	47	78	
		$I_D = -0.3 \text{ A}$ , $V_{GS} = -1.5 \text{ V}$ (Note 3)	—	60	140	
Input capacitance	$C_{iss}$	$V_{DS} = -10 \text{ V}$ , $V_{GS} = 0$ $f = 1 \text{ MHz}$	—	1484	—	pF
Output capacitance	$C_{oss}$		—	185	—	pF
Reverse transfer capacitance	$C_{rss}$		—	169	—	pF
Switching time	Turn-on time	$V_{DD} = -10 \text{ V}$ , $I_D = -2.0 \text{ A}$	—	67	—	ns
	Turn-off time	$V_{GS} = 0 \sim -2.5 \text{ V}$ , $R_G = 4.7 \Omega$	—	92	—	

Unit: mm



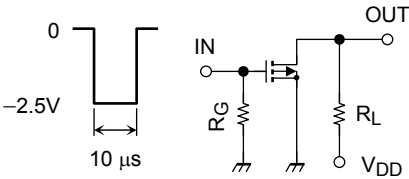
Weight: 6.6mg (typ.)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Total gate charge	$Q_g$	$V_{DS} = -16\text{ V}$ , $I_{DS} = -4.0\text{ A}$ , $V_{GS} = -4.0\text{ V}$ ,	—	22.3	—	nC
Gate-Source charge	$Q_{gs}$		—	14.9	—	
Gate-Drain charge	$Q_{gd}$		—	7.3	—	
Drain-Source forward voltage	$V_{DSF}$	$I_D = 4.0\text{ A}$ , $V_{GS} = 0$ (Note 3)	—	0.8	1.2	V

Note 3: Pulse test

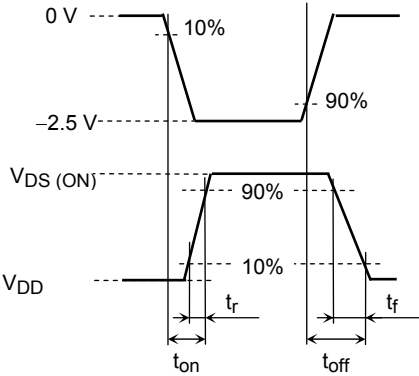
Switching Time Test Circuit

(a) Test Circuit



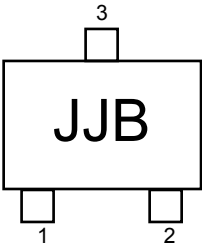
$V_{DD} = -10\text{ V}$   
 $R_G = 4.7\ \Omega$   
D.U.  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5\text{ ns}$   
Common Source  
 $T_a = 25\text{ }^\circ\text{C}$

(b)  $V_{IN}$

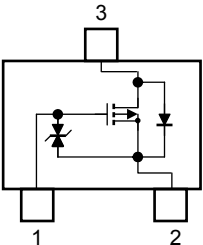


(c)  $V_{OUT}$

Marking



Equivalent Circuit (top view)



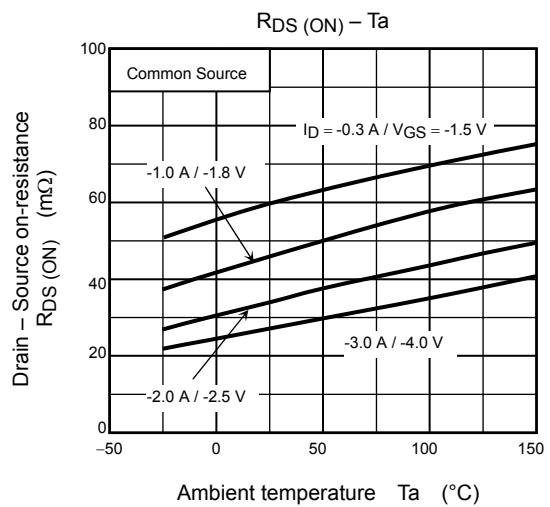
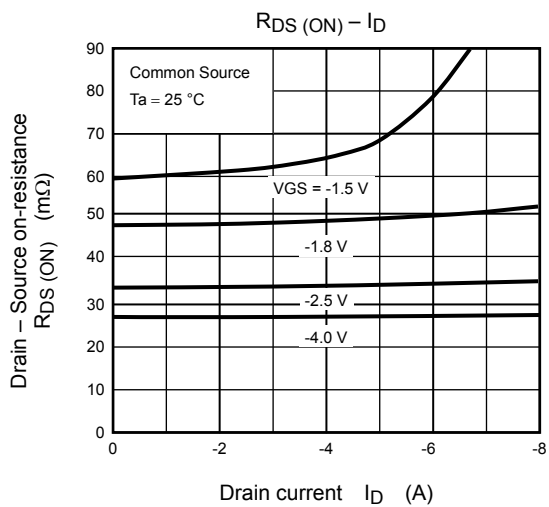
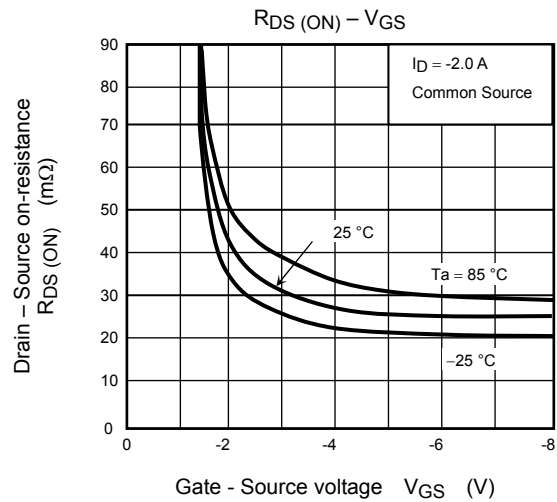
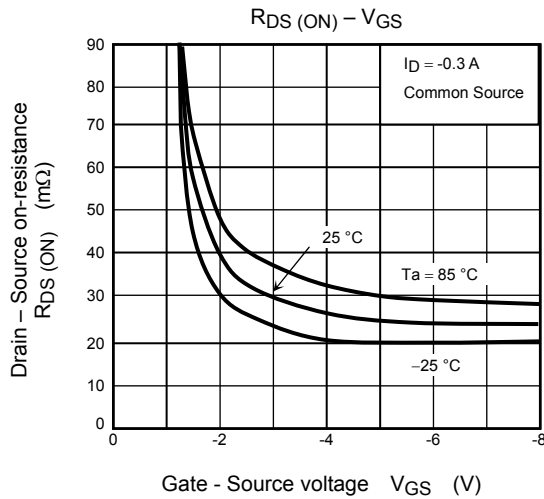
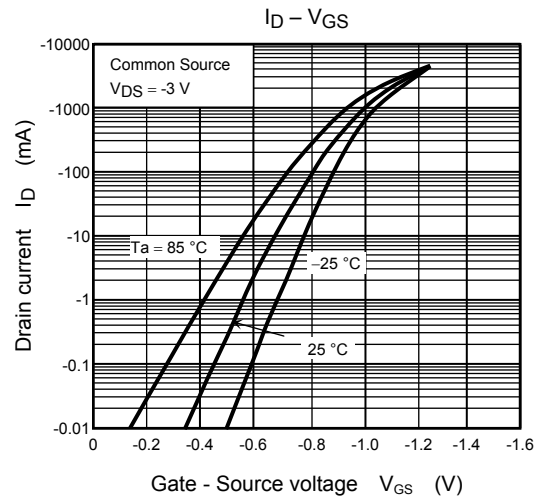
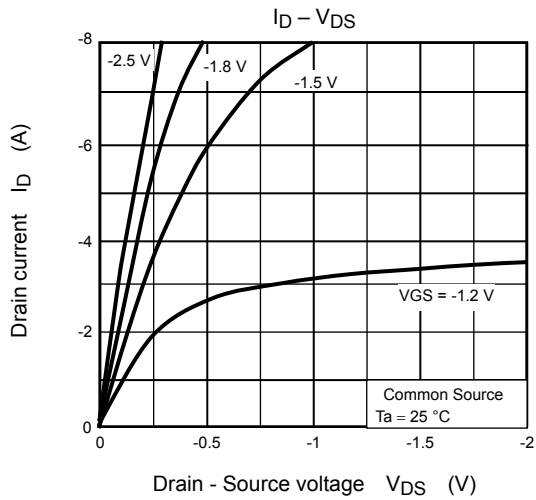
Precaution

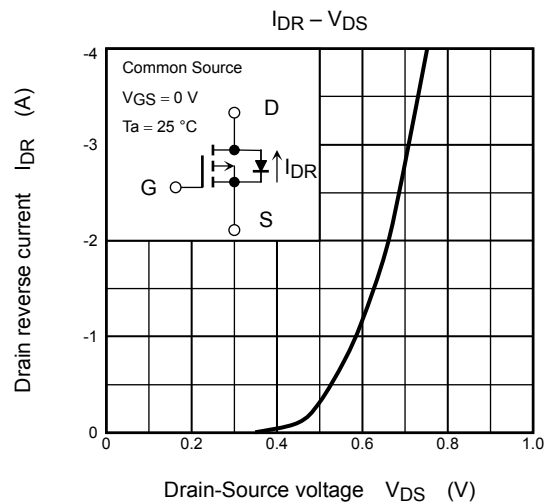
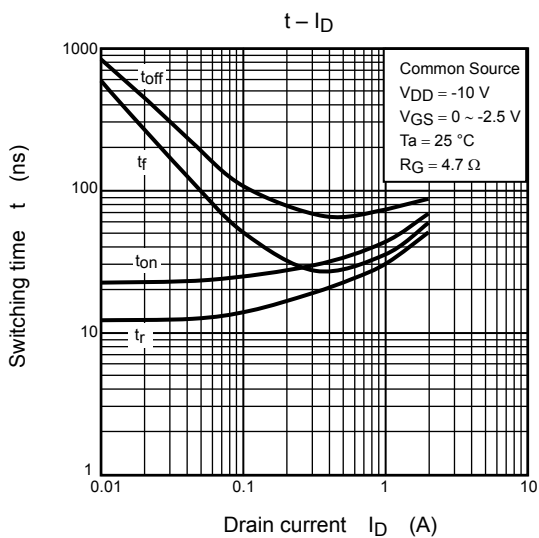
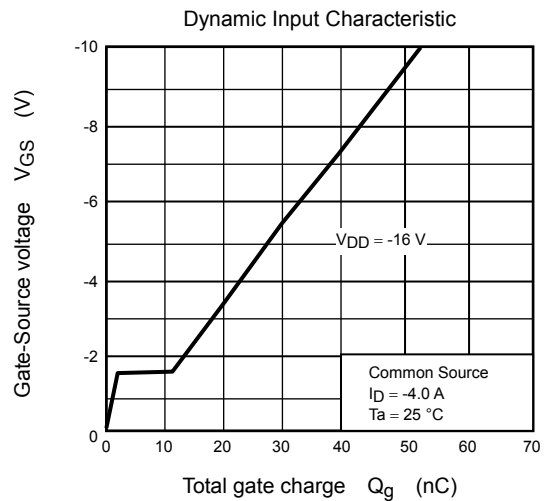
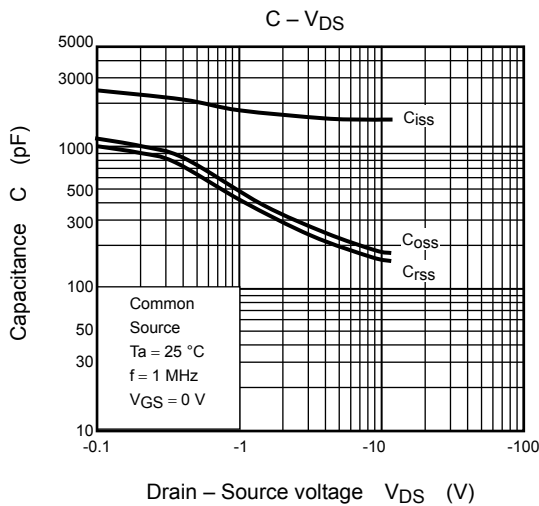
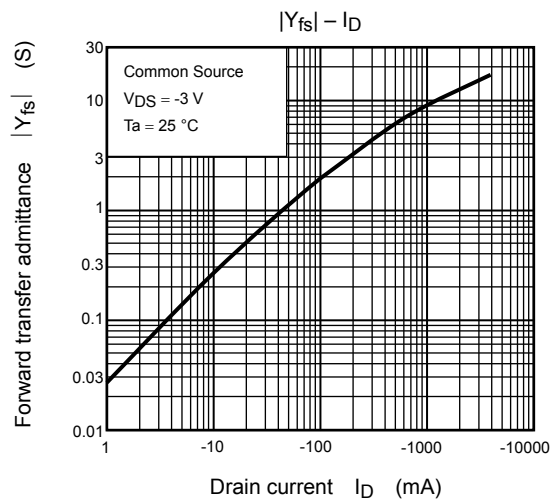
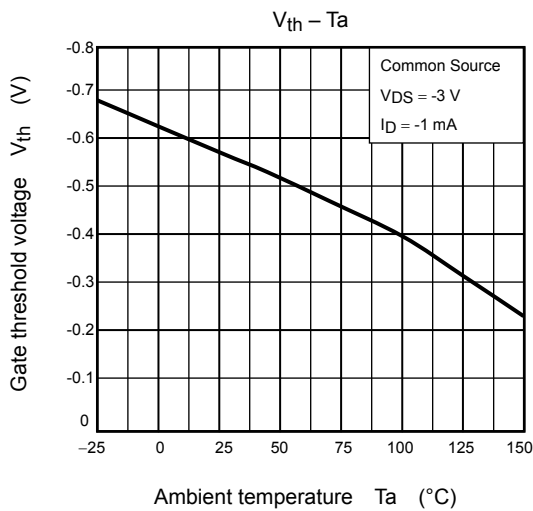
$V_{th}$  can be expressed as the voltage between the gate and source when the low operating current value is  $I_D = -1\text{ mA}$  for this product. For normal switching operation,  $V_{GS (on)}$  requires a higher voltage than  $V_{th}$  and  $V_{GS (off)}$  requires a lower voltage than  $V_{th}$ . (The relationship can be established as follows:  $V_{GS (off)} < V_{th} < V_{GS (on)}$ .)

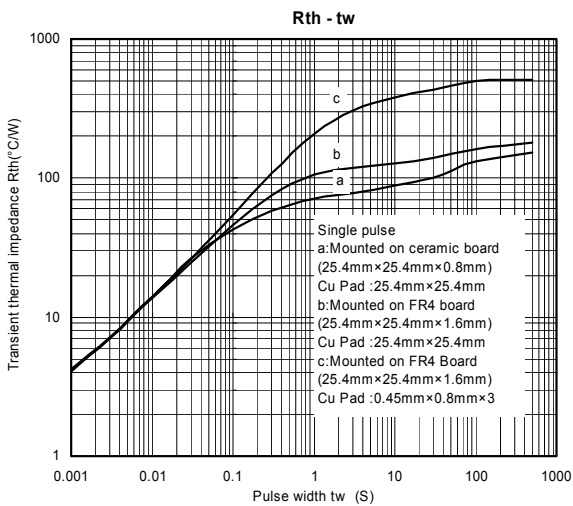
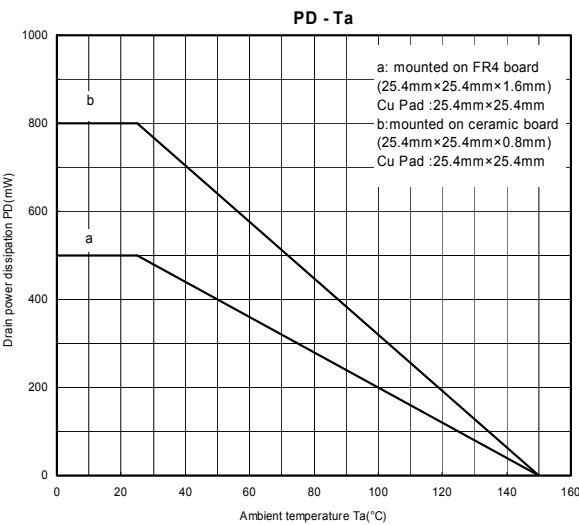
Be sure to take this into consideration when using the device.

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.







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20070701-EN GENERAL

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