

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

# SSM5N15FU

High Speed Switching Applications

Analog Switch Applications

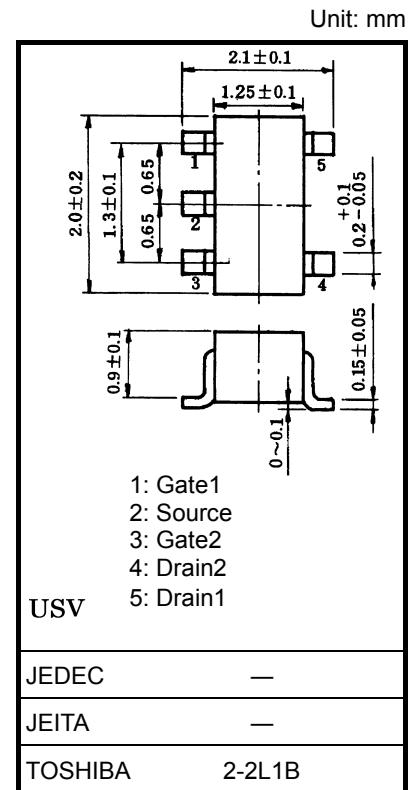
- Small package
- Low ON resistance :  $R_{DS(ON)} = 4.0 \Omega$  (max) (@ $V_{GS} = 4 V$ )  
:  $R_{DS(ON)} = 7.0 \Omega$  (max) (@ $V_{GS} = 2.5 V$ )

## Absolute Maximum Ratings (Ta = 25°C) (Q1, Q2 Common)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	30	V
Gate-Source voltage		$V_{GSS}$	$\pm 20$	V
Drain current	DC	$I_D$	100	mA
	Pulse	$I_{DP}$	200	
Drain power dissipation (Ta = 25°C)		$P_D$ (Note 1)	200	mW
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°C

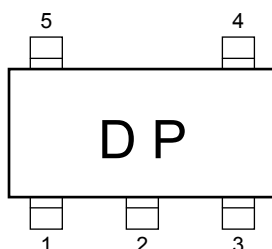
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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: Total rating,

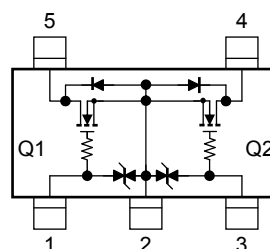


Weight: 6 mg (typ.)

## Marking



## Equivalent Circuit (top view)



## Handling Precaution

When handling individual devices (which are not yet mounting on a circuit board), be sure that the environment is protected against electrostatic 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.

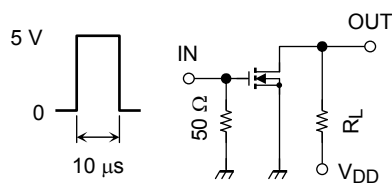
Start of commercial production  
2001-02

## Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 0.1\text{ mA}, V_{GS} = 0$	30	—	—	V
Drain cut-off current	$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0$	—	—	1	$\mu\text{A}$
Gate threshold voltage	$V_{th}$	$V_{DS} = 3\text{ V}, I_D = 0.1\text{ mA}$	0.8	—	1.5	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 3\text{ V}, I_D = 10\text{ mA}$	25	—	—	mS
Drain-Source ON resistance	$R_{DS(ON)}$	$I_D = 10\text{ mA}, V_{GS} = 4\text{ V}$	—	2.2	4.0	$\Omega$
		$I_D = 10\text{ mA}, V_{GS} = 2.5\text{ V}$	—	4.0	7.0	
Input capacitance	$C_{iss}$	$V_{DS} = 3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	7.8	—	pF
Reverse transfer capacitance	$C_{rss}$		—	3.6	—	pF
Output capacitance	$C_{oss}$		—	8.8	—	pF
Switching time	Turn-on time	$t_{on}$	$V_{DD} = 5\text{ V}, I_D = 10\text{ mA},$		—	ns
	Turn-off time	$t_{off}$	$V_{GS} = 0\text{ to }5\text{ V}$		—	

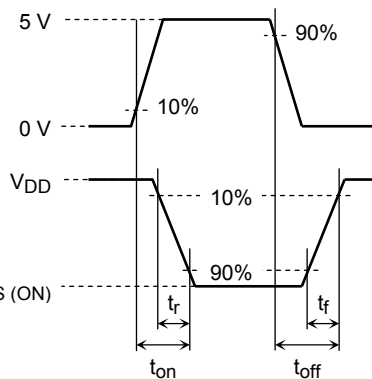
## Switching Time Test Circuit

(a) Test circuit



$V_{DD} = 5\text{ V}$   
 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)  $V_{IN}$



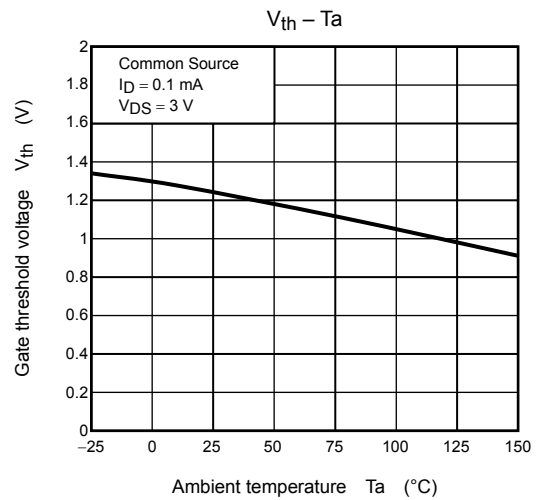
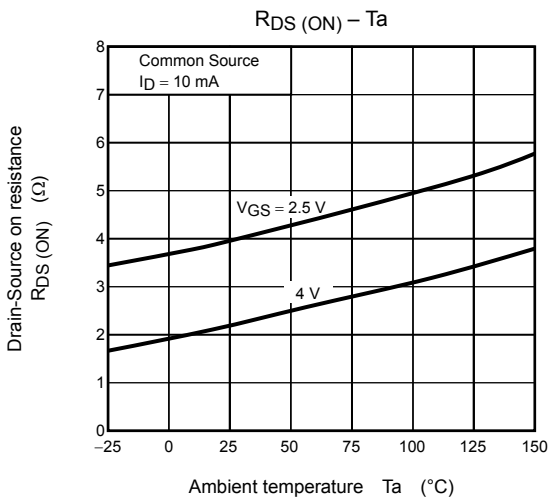
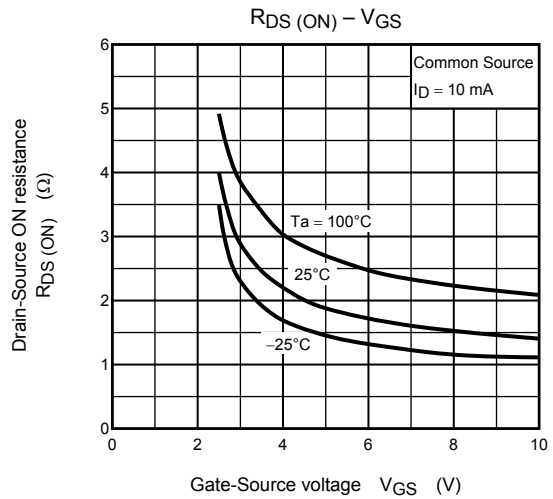
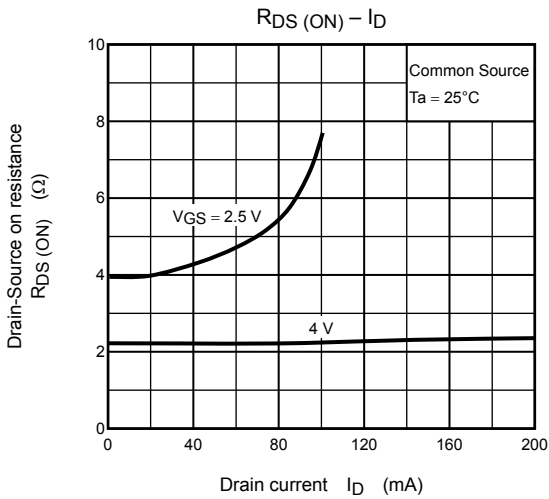
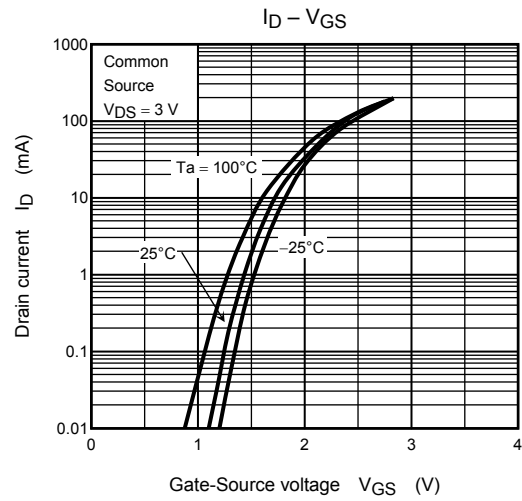
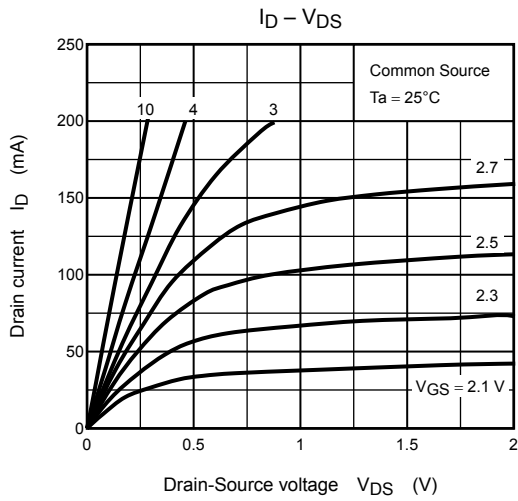
(c)  $V_{OUT}$

## Precaution

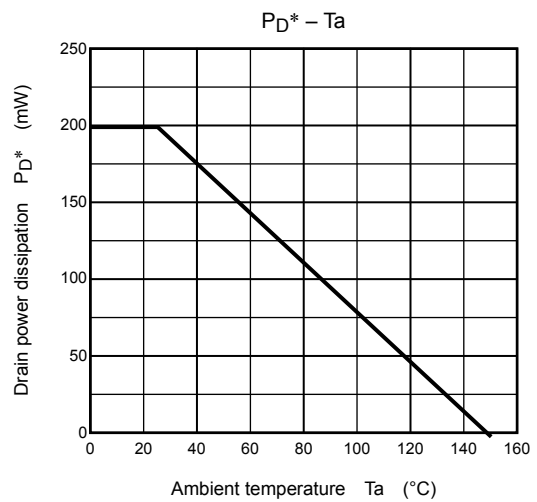
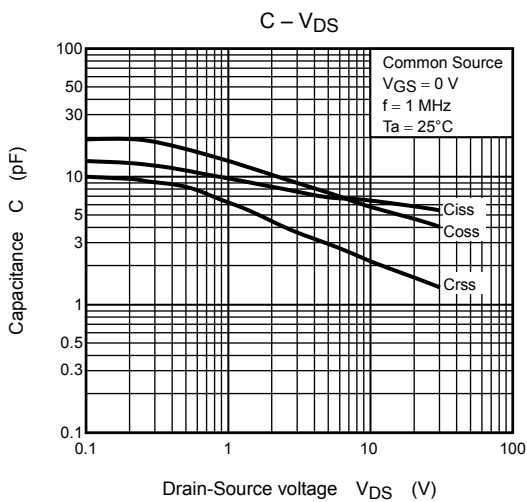
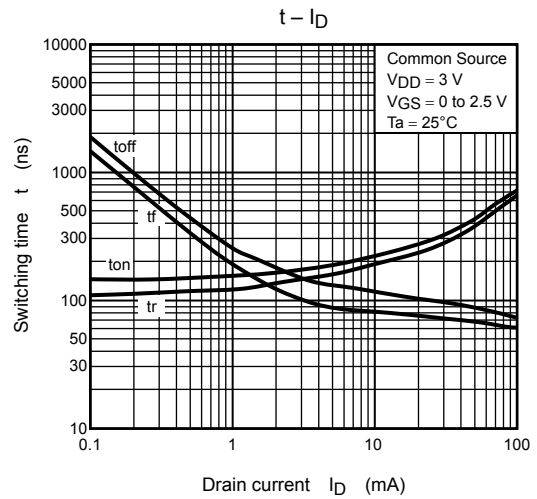
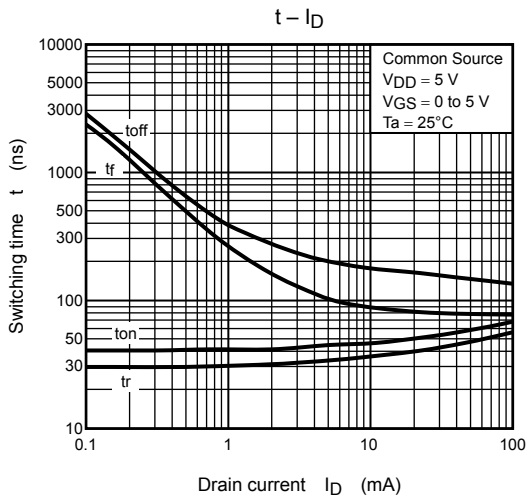
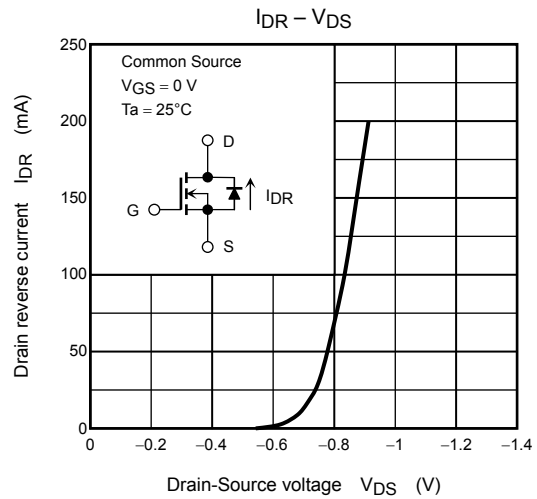
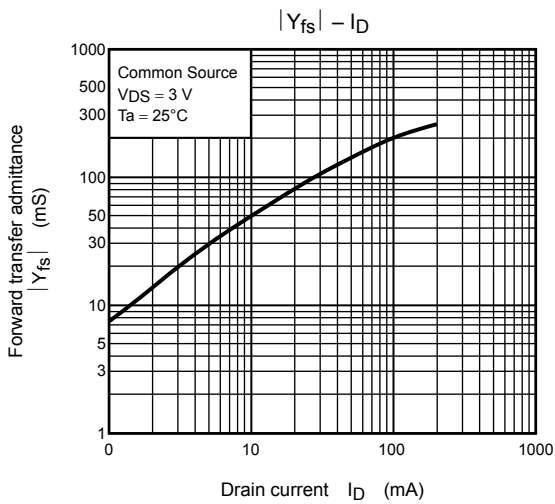
$V_{th}$  can be expressed as voltage between gate and source when low operating current value is  $I_D = 100\ \mu\text{A}$  for this product. For normal switching operation,  $V_{GS(ON)}$  requires higher voltage than  $V_{th}$  and  $V_{GS(OFF)}$  requires lower voltage than  $V_{th}$ . (Relationship can be established as follows:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ )

Please take this into consideration for using the device.

(Q1, Q2 common)



(Q1, Q2 common)



\*: Total rating

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