

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

# SSM5N05FU

High Speed Switching Applications

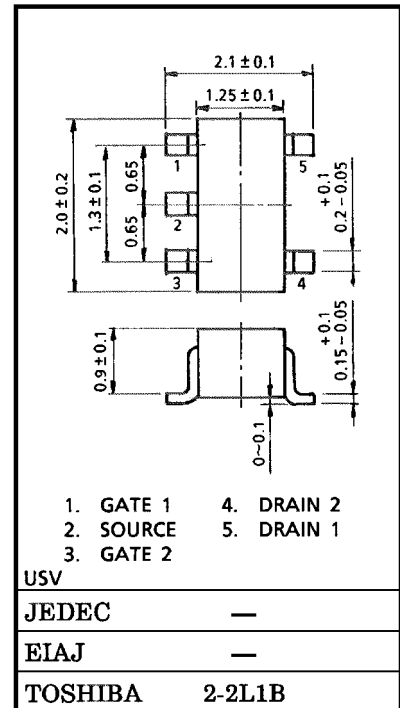
- Small package
- Low on resistance :  $R_{on} = 0.8 \Omega$  (max) (@ $V_{GS} = 4$  V)  
:  $R_{on} = 1.2 \Omega$  (max) (@ $V_{GS} = 2.5$  V)
- Low gate threshold voltage

## Maximum Ratings ( $T_a = 25^\circ\text{C}$ ) (Q1, Q2 Common)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DS}$	20	V
Gate-Source voltage		$V_{GSS}$	$\pm 12$	V
Drain current	DC	$I_D$	400	mA
	Pulse	$I_{DP}$	800	
Drain power dissipation ( $T_a = 25^\circ\text{C}$ )		$P_D$ (Note1)	300	mW
Channel temperature		$T_{ch}$	150	$^\circ\text{C}$
Storage temperature range		$T_{stg}$	$-55 \sim 150$	$^\circ\text{C}$

Note1: Total rating, mounted on FR4 board  
( $25.4 \text{ mm} \times 25.4 \text{ mm} \times 1.6 \text{ t}$ , Cu Pad:  $0.32 \text{ mm}^2 \times 5$ )

Unit in mm



## Handling Precaution

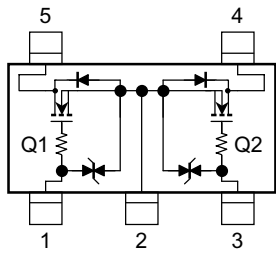
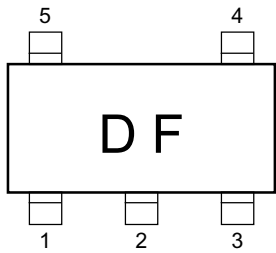
When handling individual devices (which are not yet mounting on a circuit board), be sure that the environment is protected against electrostatic electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static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

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**Marking**

**Equivalent Circuit (top view)**



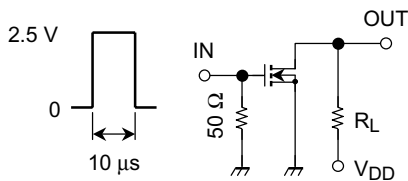
**Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)**

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		$I_{GSS}$	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$
Drain-Source breakdown voltage		$V_{(BR)DSS}$	$I_D = 1 \text{ mA}, V_{GS} = 0$	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} $	$V_{DS} = 3 \text{ V}, I_D = 200 \text{ mA}$ (Note2)	350	—	—	mS
Drain-Source ON resistance		$R_{DS(ON)}$	$I_D = 200 \text{ mA}, V_{GS} = 4 \text{ V}$ (Note2)	—	0.6	0.8	$\Omega$
			$I_D = 200 \text{ mA}, V_{GS} = 2.5 \text{ V}$ (Note2)	—	0.85	1.2	
Input capacitance		$C_{iss}$	$V_{DS} = 3 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$	—	22	—	pF
Reverse transfer capacitance		$C_{rss}$		—	9	—	pF
Output capacitance		$C_{oss}$		—	21	—	pF
Switching time	Turn-on time	$t_{on}$	$V_{DD} = 3 \text{ V}, I_D = 100 \text{ mA},$ $V_{GS} = 0 \sim 2.5 \text{ V}$	—	60	—	ns
	Turn-off time	$t_{off}$		—	70	—	

Note2: Pulse test

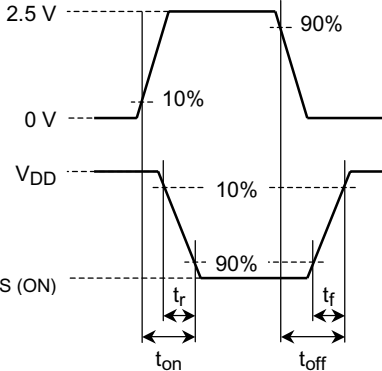
**Switching Time Test Circuit**

**(a) Test circuit**

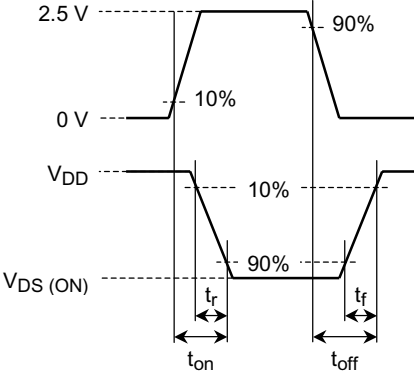


$V_{DD} = 3 \text{ V}$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5 \text{ ns}$   
 ( $Z_{out} = 50 \Omega$ )  
 Common Source  
 $T_a = 25^\circ\text{C}$

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



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

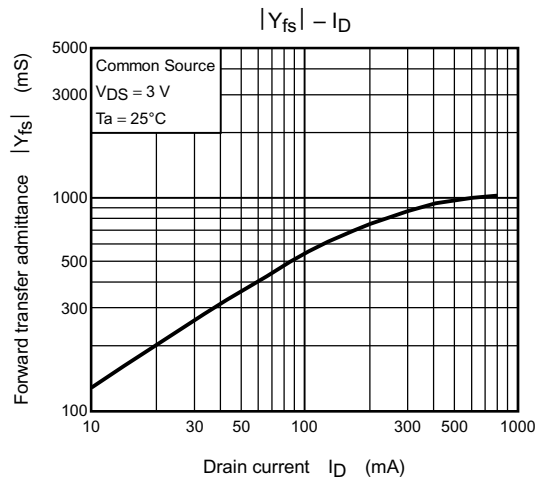
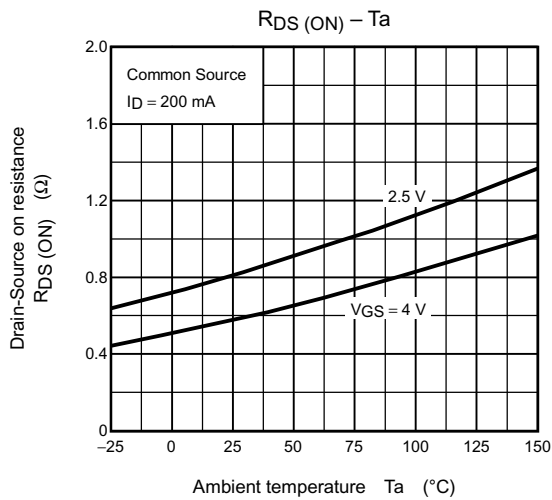
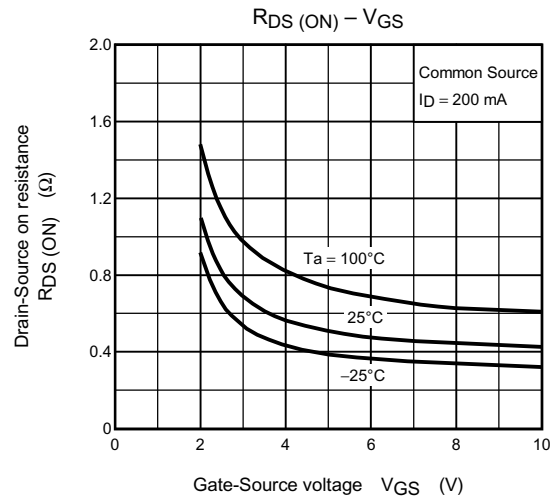
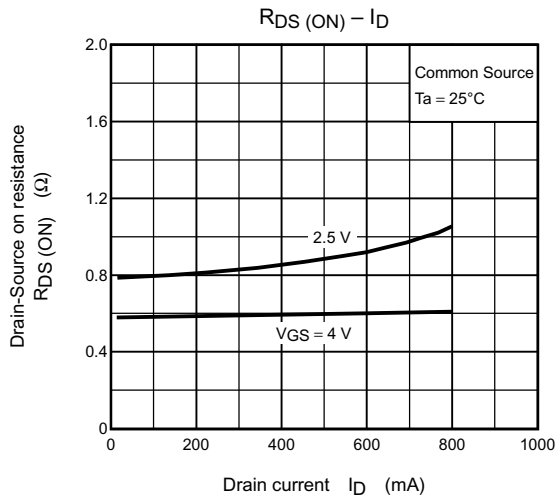
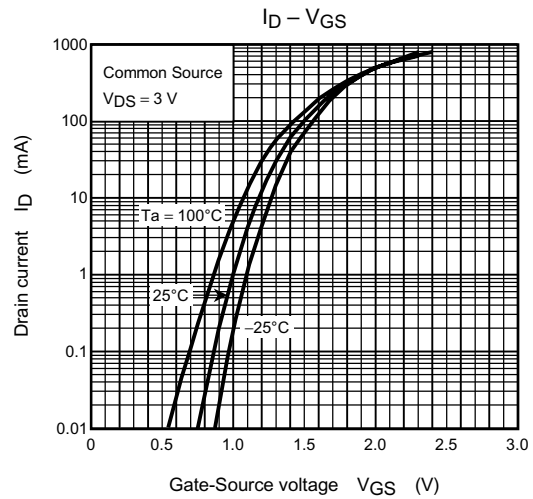
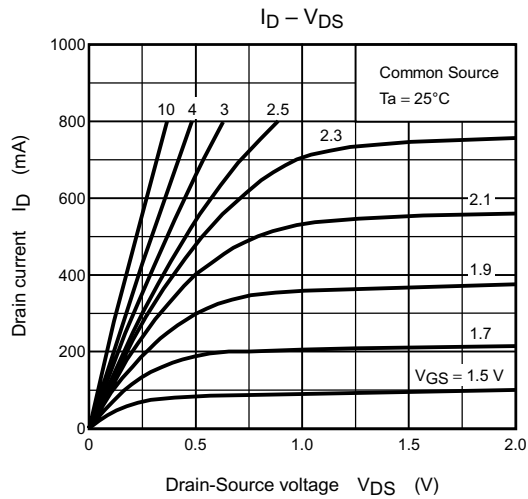


**Precaution**

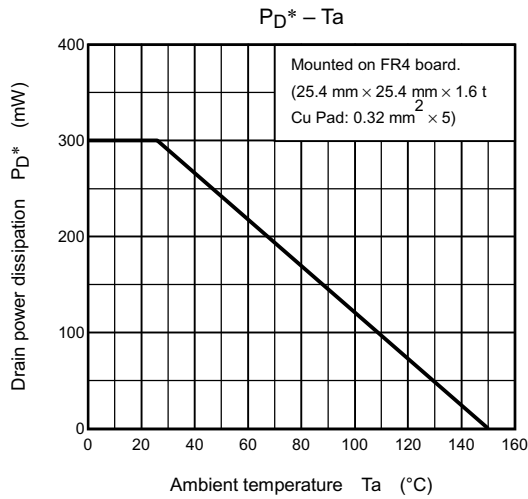
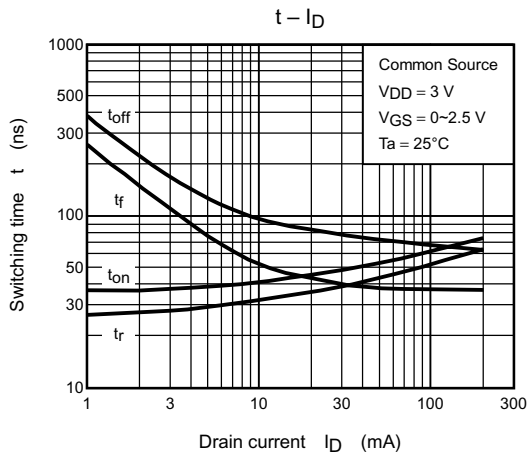
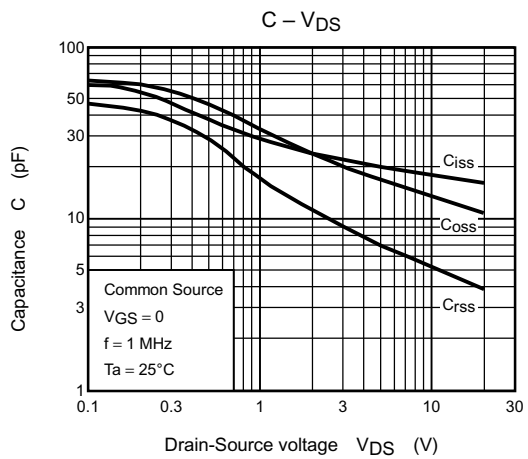
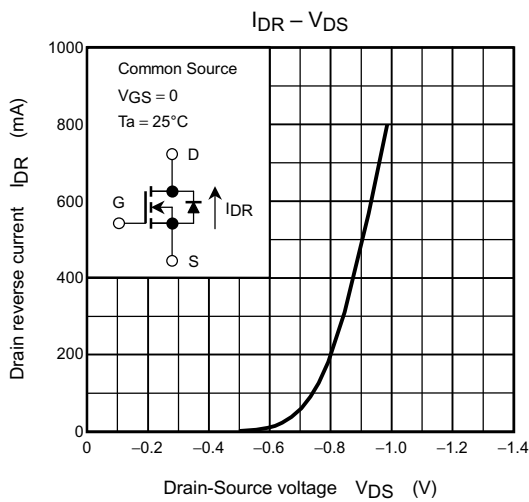
$V_{th}$  can be expressed as voltage between gate and source when low operating current value is  $I_D = 100 \mu\text{A}$  for this product. For normal switching operation,  $V_{GS(on)}$  requires higher voltage than  $V_{th}$  and  $V_{GS(off)}$  requires lower voltage than  $V_{th}$ . (Relationship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

Please take this into consideration for using the device.  $V_{GS}$  recommended voltage of 2.5 V or higher to turn on this product.

(Q1, Q2 common)



(Q1, Q2 common)



\*: Total rating