Tentative

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

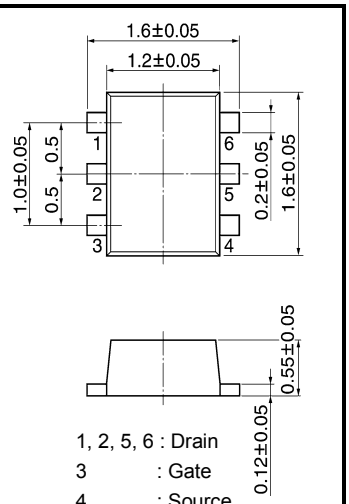
SSM6K201FE

Power Management Switch Applications

High Speed Switching Applications

- 1.8 V drive
- Low ON-resistance: R_{on} = 186 mΩ (max) (@V_{GS} = 1.8V)
  R_{on} = 119 mΩ (max) (@V_{GS} = 2.5V)
  R_{on} = 91 mΩ (max) (@V_{GS} = 4.0V)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-2N1A

Weight: 3 mg (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Drain–source voltage		V_{DS}	20	V
Gate–source voltage		V_{GSS}	± 12	V
Drain current	DC	I_D	2.3	A
	Pulse	I_{DP}	4.6	
Drain power dissipation		P_D (Note 1)	500	W
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

Note 1: Mounted on an FR4 board.
(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 645 mm^2)

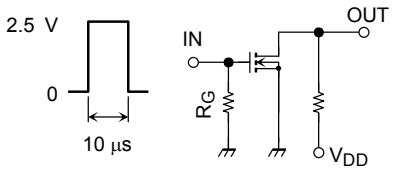
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain–source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 1 mA, V_{GS} = 0	20	—	—	V
		$V_{(BR)\ DSX}$	I_D = 1 mA, V_{GS} = –12 V	10	—	—	V
Drain cutoff current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0	—	—	1	μA
Gate leakage current		I_{GSS}	V_{GS} = ± 12 V, V_{DS} = 0	—	—	±1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 1 mA	0.4	—	1.0	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 1.0 A (Note2)	2.8	5.5	—	S
Drain–source ON-resistance		$R_{DS\ (ON)}$	I_D = 1.0 A, V_{GS} = 4.0 V (Note2)	—	71	91	mΩ
			I_D = 0.5 A, V_{GS} = 2.5 V (Note2)	—	91	119	
			I_D = 0.2 A, V_{GS} = 1.8 V (Note2)	—	121	186	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	220	—	pF
Output capacitance		C_{oss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	51	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	42	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 2.0 A,	—	12	—	ns
	Turn-off time	t_{off}	V_{GS} = 0 to 2.5 V, R_G = 4.7 Ω	—	10	—	
Drain–source forward voltage		V_{DSF}	I_D = – 2.3 A, V_{GS} = 0 V (Note2)	—	– 0.85	– 1.20	V

Note2: Pulse test

Switching Time Test Circuit

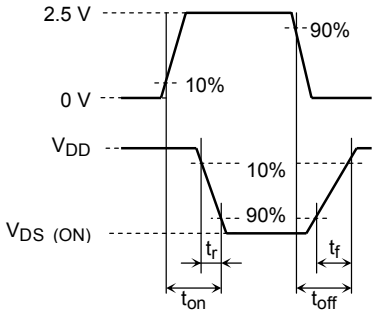
(a) Test Circuit



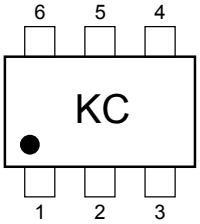
V_{DD} = 10 V
R_G = 4.7 Ω
D.U. ≦ 1%
V_{IN}: t_r, t_f < 5 ns
Common Source
Ta = 25°C

(b) V_{IN}

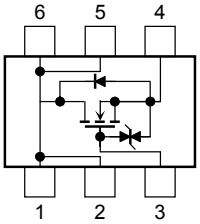
(c) V_{OUT}



Marking



Equivalent Circuit (top view)



Notice on Usage

V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D = 1 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}.

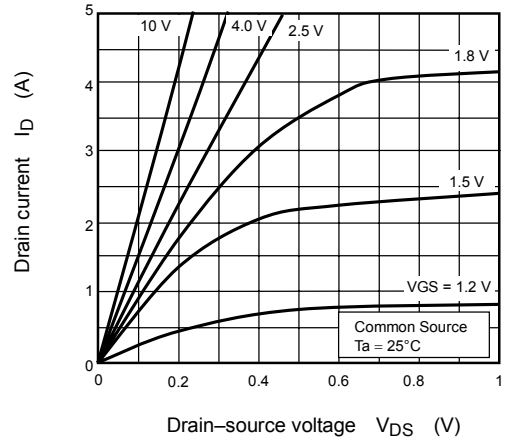
(The relationship can be established as follows: $V_{GS\ (off)} < V_{th} < V_{GS\ (on)}$.)

Take this into consideration when using the device. The V_{GS} recommended voltage for turning on this product is 1.8 V or higher.

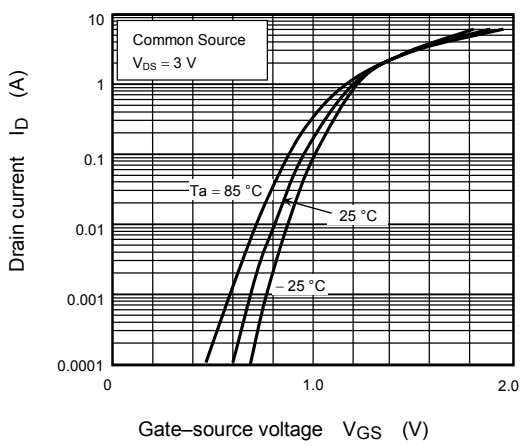
Handling Precaution

When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

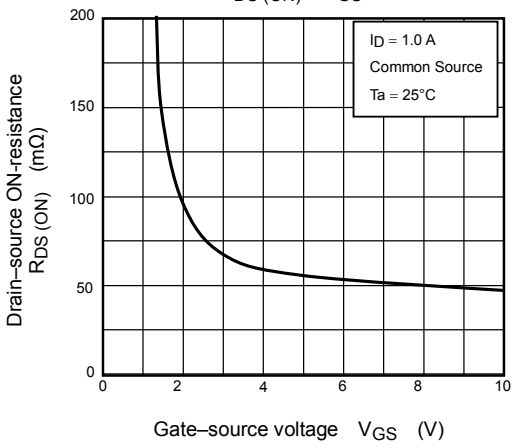
$I_D - V_{DS}$



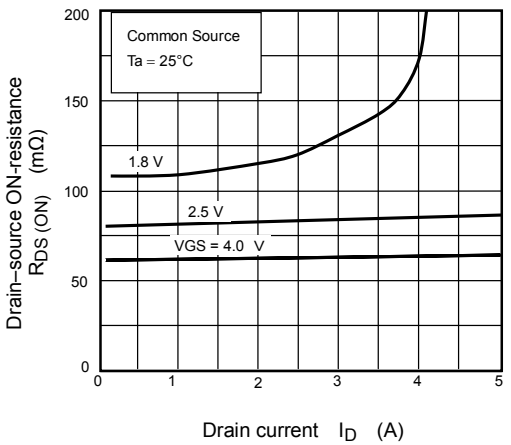
$I_D - V_{GS}$



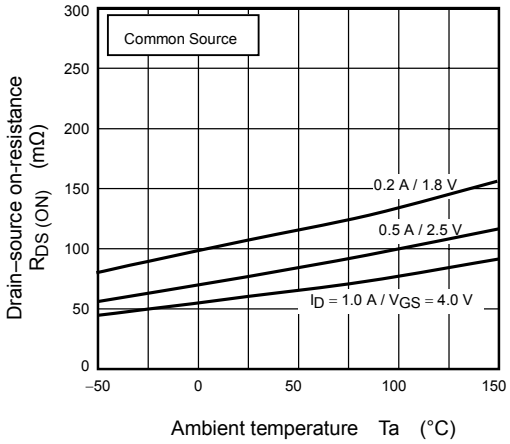
$R_{DS\ (ON)} - V_{GS}$



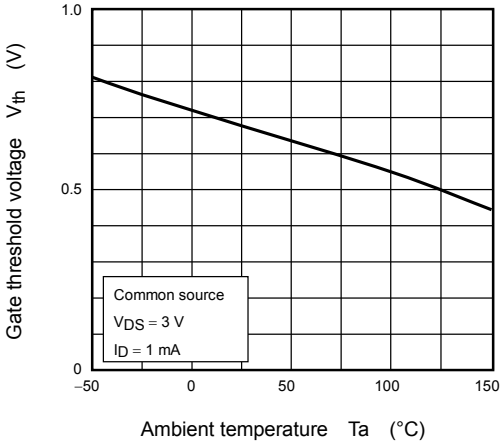
$R_{DS\ (ON)} - I_D$

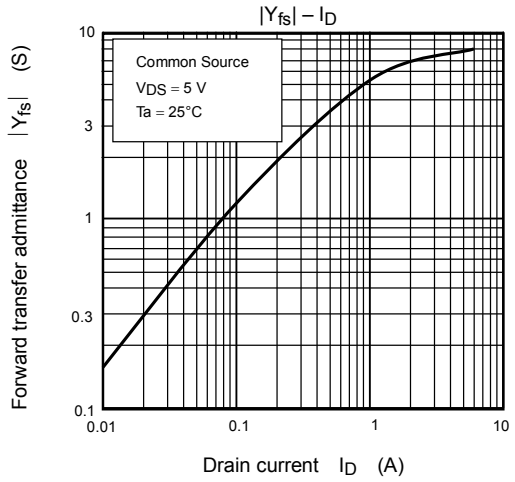


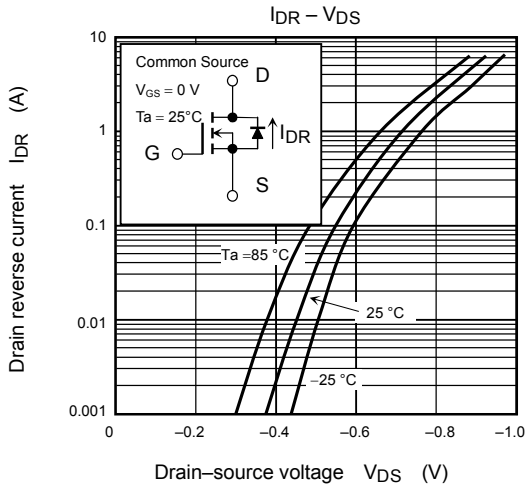
$R_{DS\ (ON)} - Ta$

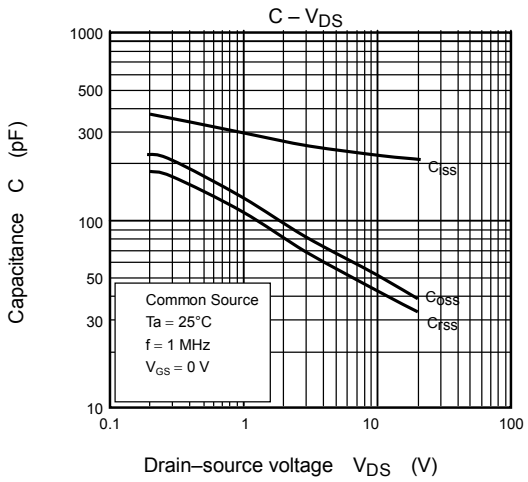


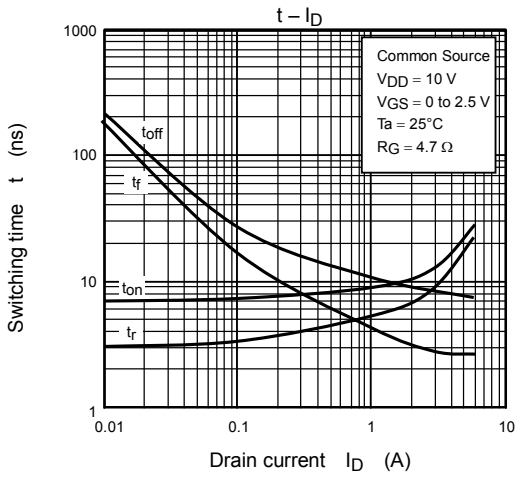
$V_{th} - Ta$

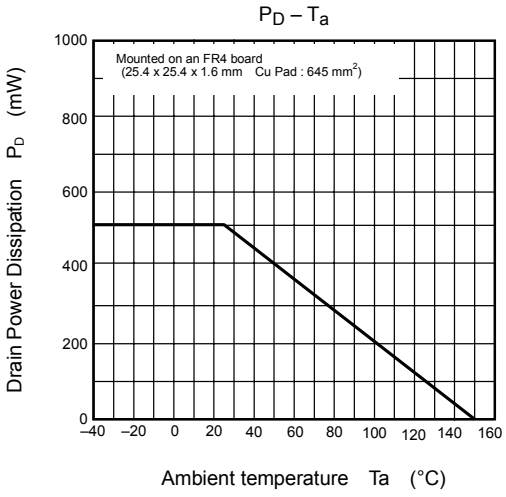



|Yfs| – ID
Common Source
VDS = 5 V
Ta = 25°C
Forward transfer admittance |Yfs| (S)
Drain current ID (A)
10
3
1
0.3
0.1
0.01
0.1
1
10


IDR – VDS
Common Source
VGS = 0 V
Ta = 25°C
D
G
S
IDR
Ta =85 °C
25 °C
−25 °C
Drain reverse current IDR (A)
Drain–source voltage VDS (V)
10
1
0.1
0.01
0.001
0
−0.2
−0.4
−0.6
−0.8
−1.0


C – VDS
Common Source
Ta = 25°C
f = 1 MHz
VGS = 0 V
Css
Coss
Crss
Capacitance C (pF)
Drain–source voltage VDS (V)
1000
500
300
100
50
30
10
0.1
1
10
100


t – ID
Common Source
VDD = 10 V
VGS = 0 to 2.5 V
Ta = 25°C
RG = 4.7 Ω
toff
tf
ton
tr
Switching time t (ns)
Drain current ID (A)
1000
100
10
1
0.01
0.1
1
10


PD – Ta
Mounted on an FR4 board
(25.4 x 25.4 x 1.6 mm Cu Pad : 645 mm2)
Drain Power Dissipation PD (mW)
Ambient temperature Ta (°C)
1000
800
600
400
200
0
−40
−20
0
20
40
60
80
100
120
140
160

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