TOSHIBA Field-Effect Transistor Silicon N-Channel MOS Type

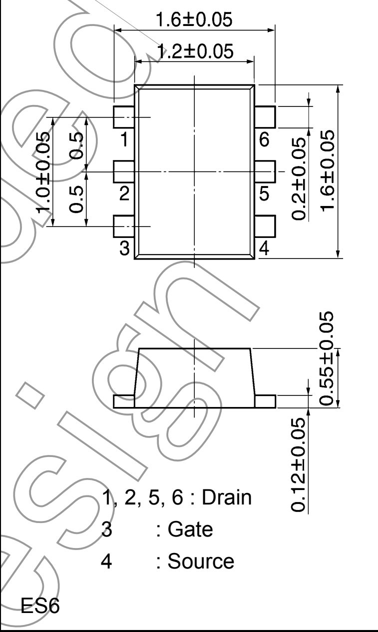
SSM6K203FE

○ High-Speed Switching Applications

○ Power Management Switch Applications

- 1.5 V drive
- Low ON-resistance: R_{on} = 153 mΩ (max) (@V_{GS} = 1.5V)
  R_{on} = 106 mΩ (max) (@V_{GS} = 1.8V)
  R_{on} = 76 mΩ (max) (@V_{GS} = 2.5V)
  R_{on} = 61 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_{DSS}	20	V
Gate–source voltage		V_{GSS}	± 10	V
Drain current	DC	I_D	2.8	A
	Pulse	I_{DP}	5.6	
Drain power dissipation		P_D (Note 1)	500	mW
Channel temperature		T_{ch}	150	°C
Storage temperature		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: Mounted on an FR4 board
(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 645 mm^2)

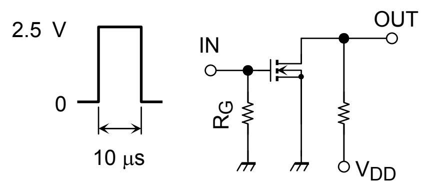
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition		Min	Typ.	Max	Unit
Drain–source breakdown voltage		$V_{(BR)DSS}$	I_D = 1 mA, V_{GS} = 0 V		20	―	―	V
		$V_{(BR)DSX}$	I_D = 1 mA, V_{GS} = −10 V		12	―	―	V
Drain cutoff current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V		―	―	1	μA
Gate leakage current		I_{GSS}	V_{GS} = ± 10 V, V_{DS} = 0 V		―	―	±1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 1 mA		0.35	―	1.0	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 2.0 A	(Note2)	5.3	10.5	―	S
Drain–source ON-resistance		$R_{DS(ON)}$	I_D = 2.0 A, V_{GS} = 4.0 V	(Note2)	―	49	61	mΩ
			I_D = 2.0 A, V_{GS} = 2.5 V	(Note2)	―	59	76	
			I_D = 1.0 A, V_{GS} = 1.8 V	(Note2)	―	73	106	
			I_D = 0.5 A, V_{GS} = 1.5 V	(Note2)	―	88	153	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz		―	400	―	pF
Output capacitance		C_{oss}			―	68	―	
Reverse transfer capacitance		C_{rss}			―	60	―	
Total Gate Charge		Q_g	V_{DS} = 10 V, I_D = 2.8 A V_{GS} = 4 V		―	5.9	―	nC
Gate–Source Charge		Q_{gs}			―	4.1	―	
Gate–Drain Charge		Q_{gd}			―	1.8	―	
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 2 A, V_{GS} = 0 to 2.5 V, R_G = 4.7 Ω		―	14	―	ns
	Turn-off time	t_{off}			―	15	―	
Drain–source forward voltage		V_{DSF}	I_D = − 2.8 A, V_{GS} = 0 V	(Note2)	―	− 0.85	− 1.2	V

Note 2: Pulse test

Switching Time Test Circuit

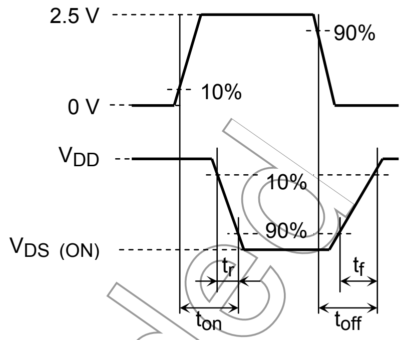
(a) Test Circuit



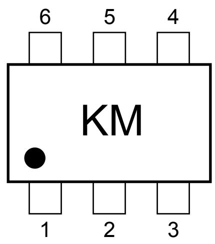
V_{DD} = 10 V
R_G = 4.7 Ω
D.U. ≦ 1%
V_{IN}: t_r, t_f < 5 ns
Common Source
Ta = 25°C

(b) V_{IN}

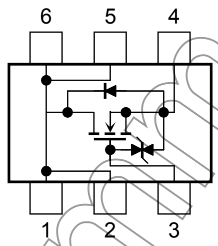
(c) V_{OUT}



Marking



Equivalent Circuit (top view)



Notice on Usage

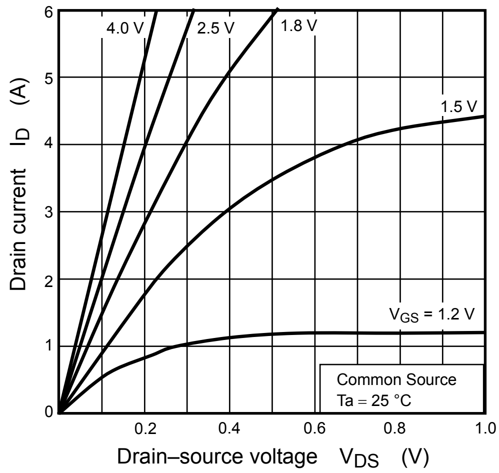
V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D = 1 mA for this product. For normal switching operation, $V_{GS\ (on)}$ requires a higher voltage than V_{th} and $V_{GS\ (off)}$ requires a lower voltage than $V_{th.}$ (The relationship can be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

Take this into consideration when using the device.

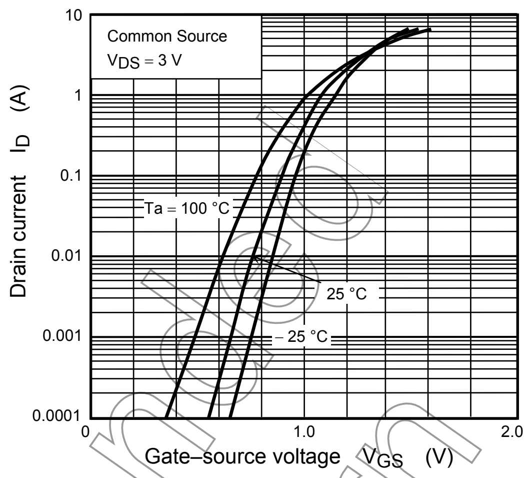
Handling Precaution

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.

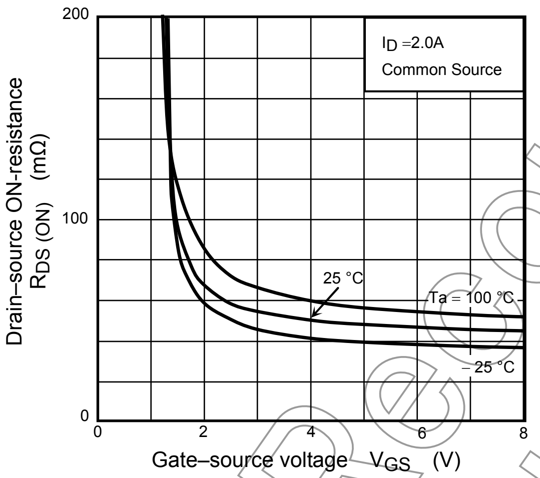
I_D – V_{DS}



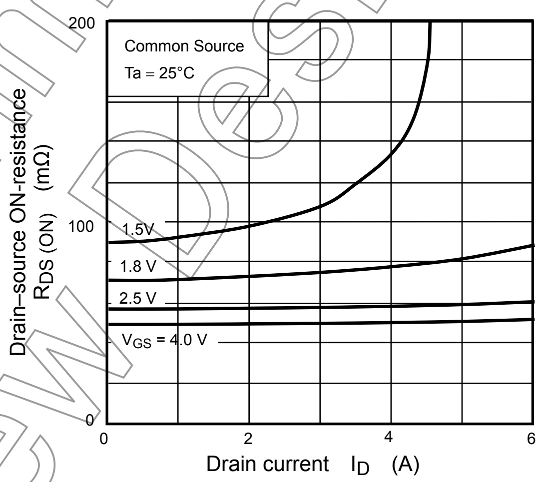
I_D – V_{GS}



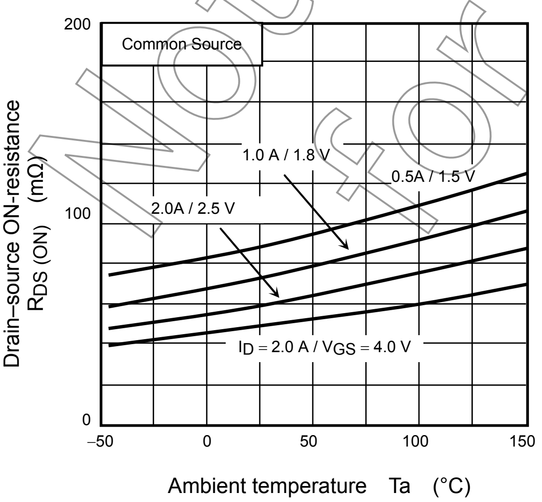
$R_{DS\ (ON)}$ – V_{GS}



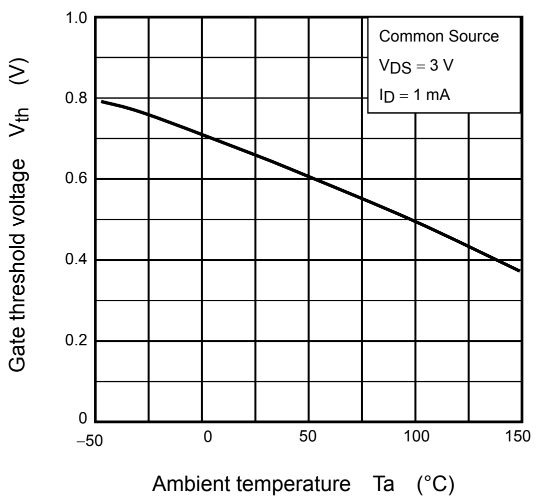
$R_{DS\ (ON)}$ – I_D



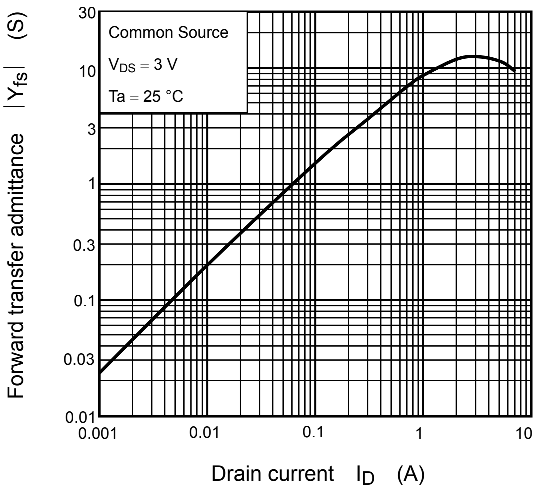
$R_{DS\ (ON)}$ – Ta



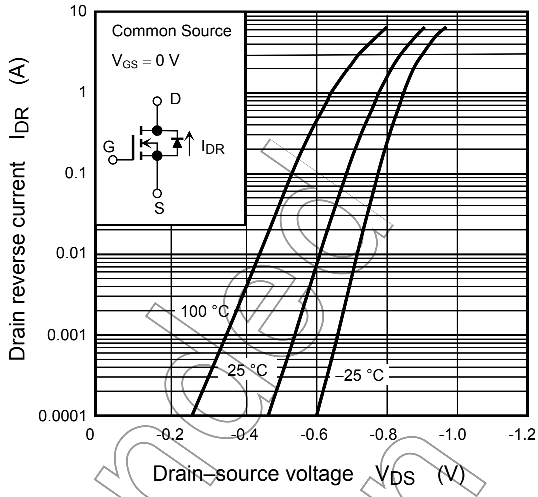
V_{th} – Ta



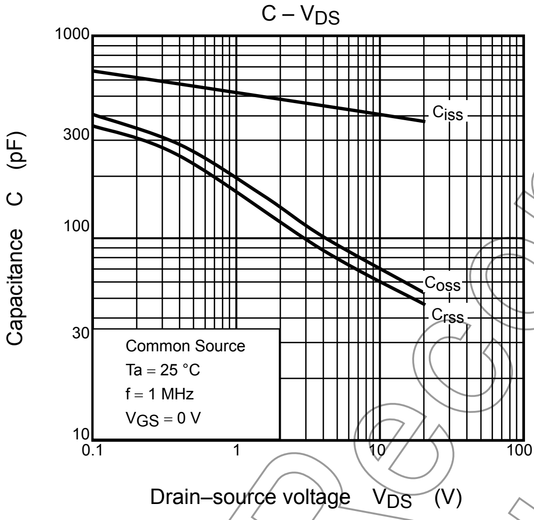
|Yfs| – ID



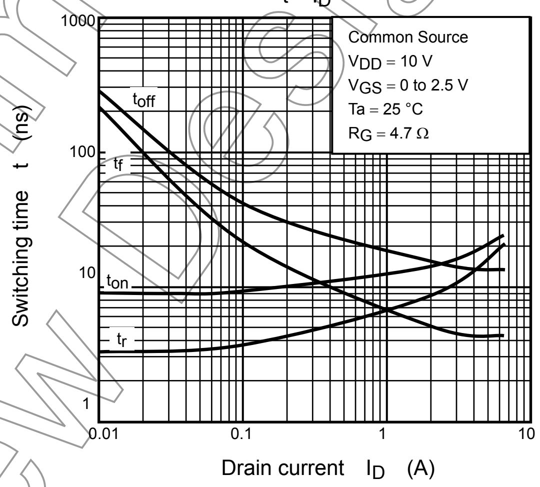
IDR – VDS



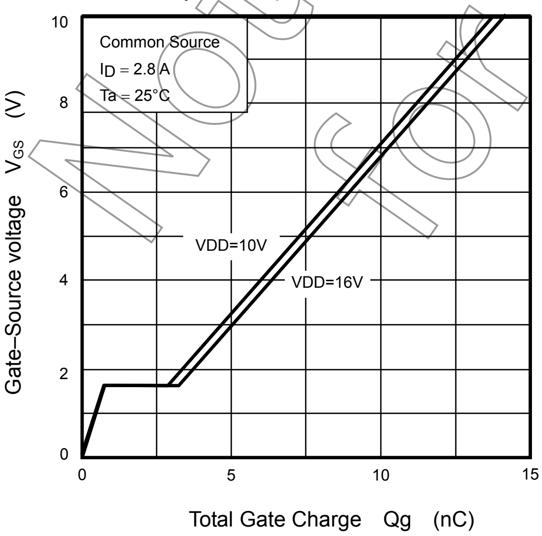
C – VDS



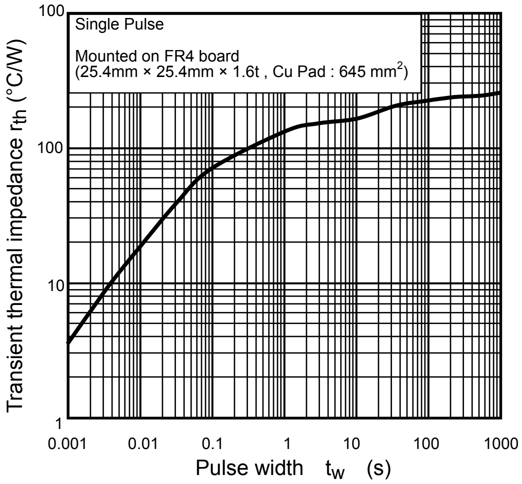
t – ID



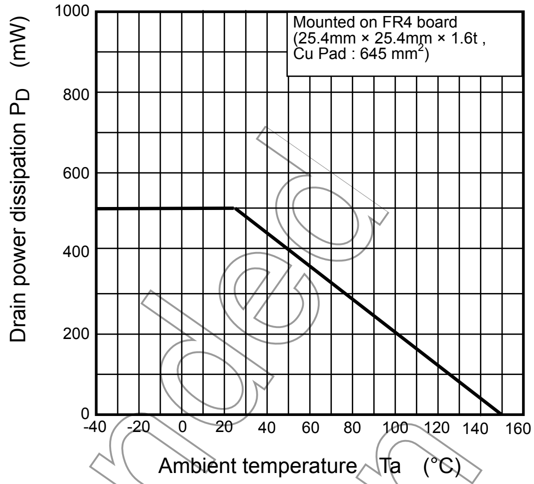
Dynamic Input Characteristic



$r_{th} – t_w$


Single Pulse
Mounted on FR4 board
(25.4mm × 25.4mm × 1.6t , Cu Pad : 645 mm²)
Transient thermal impedance rth (°C/W)
1
10
100
100
0.001
0.01
0.1
1
10
100
1000
Pulse width tw (s)

$P_D – T_a$


Mounted on FR4 board
(25.4mm × 25.4mm × 1.6t ,
Cu Pad : 645 mm²)
Drain power dissipation PD (mW)
0
200
400
600
800
1000
-40
-20
0
20
40
60
80
100
120
140
160
Ambient temperature Ta (°C)

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