TOSHIBA Field-Effect Transistor Silicon N-Channel MOS Type

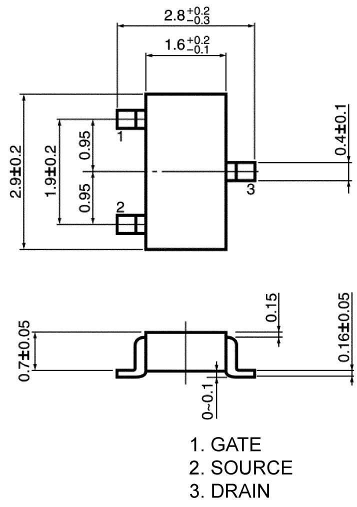
SSM3K309T

○ Power Management Switch Applications

○ High-Current Switching Applications

- 1.8V drive
- Low on-resistance : R_{on} = 47mΩ (max.) (@V_{GS} = 1.8V)
  : R_{on} = 35mΩ (max.) (@V_{GS} = 2.5V)
  : R_{on} = 31mΩ (max.) (@V_{GS} = 4.0V)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-3S1A

Weight: 10mg (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	4.7	A
	Pulse	I_{DP}	9.4	
Drain power dissipation		P_D (Note 1)	700	mW
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°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)

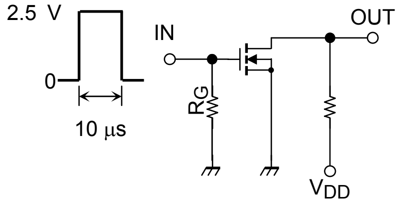
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain–source breakdown voltage		$V_{(BR)DSS}$	I_D = 1 mA, V_{GS} = 0	20	—	—	V
		$V_{(BR)DSX}$	I_D = 1 mA, V_{GS} = -12 V	12	—	—	
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	0.35	—	1.0	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 4.0A (Note2)	13	25	—	S
Drain–source ON-resistance		$R_{DS (ON)}$	I_D = 4.0 A, V_{GS} = 4.0 V (Note2)	—	22	31	mΩ
			I_D = 3.0 A, V_{GS} = 2.5 V (Note2)	—	25	35	
			I_D = 1.0 A, V_{GS} = 1.8 V (Note2)	—	30	47	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	1020	—	pF
Output capacitance		C_{oss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	175	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	160	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 2A	—	23	—	ns
	Turn-off time	t_{off}	V_{GS} = 0~2.5 V, R_G = 4.7 Ω	—	34	—	
Drain–source forward voltage		V_{DSF}	I_D = -4.7 A, V_{GS} = 0 (Note2)	—	-0.85	-1.2	V

Note2: Pulse test

Switching Time Test Circuit

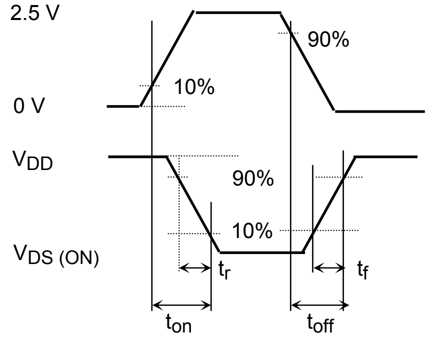
(a) Test Circuit



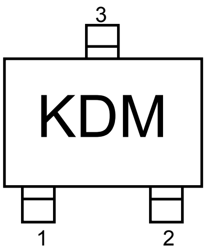
V_{DD} = 10 V
R_G = 4.7 Ω
D.U. ≦ 1%
V_{IN}: t_r, t_f < 5 ns
Common source
Ta = 25°C

(b) V_{IN}

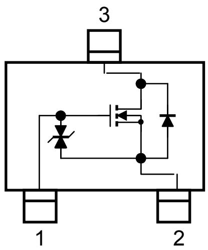
(c) V_{OUT}



Marking



Equivalent Circuit (top view)

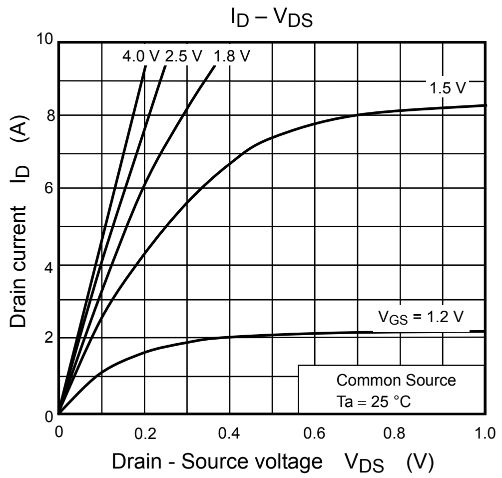


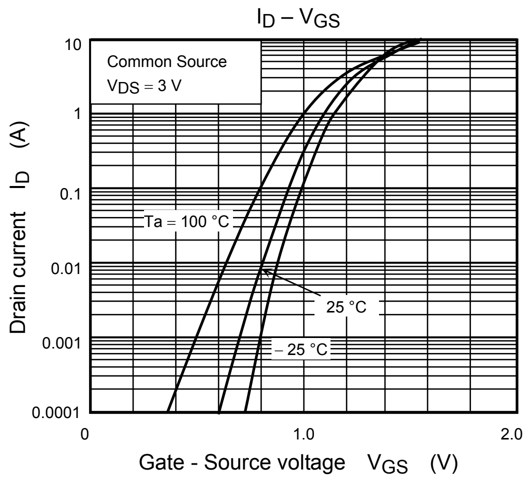
Precaution

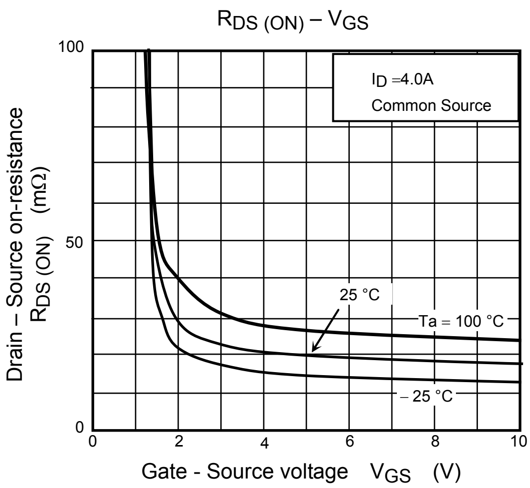
V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D = 1 mA for this product. For normal switching operation, $V_{GS\ (on)}$ requires a higher voltage than V_{th} and $V_{GS\ (off)}$ requires a lower voltage than V_{th}.
(The relationship can be established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

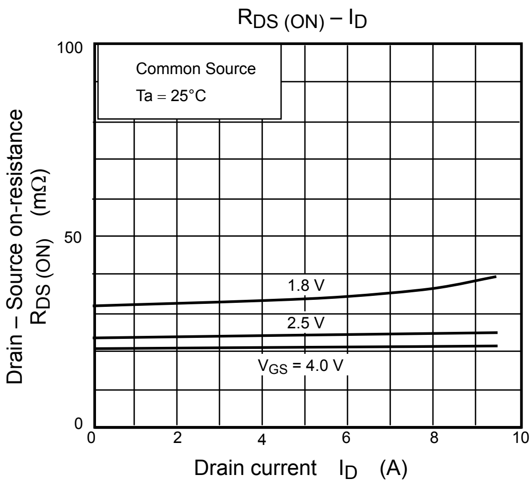
Handling Precaution

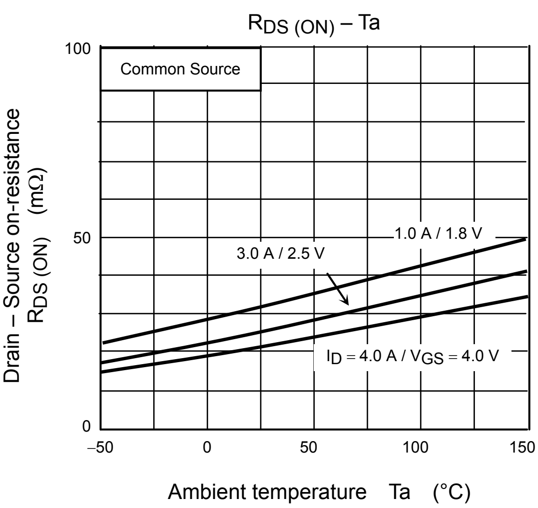
When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic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

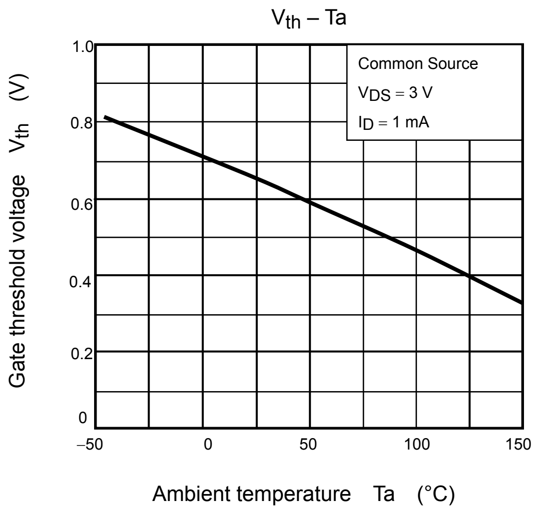

I_D – V_{DS}
Drain current I_D (A)
Drain - Source voltage V_{DS} (V)
4.0 V 2.5 V 1.8 V
1.5 V
V_{GS} = 1.2 V
Common Source
Ta = 25 °C


I_D – V_{GS}
Common Source
V_{DS} = 3 V
Ta = 100 °C
25 °C
− 25 °C
Drain current I_D (A)
Gate - Source voltage V_{GS} (V)

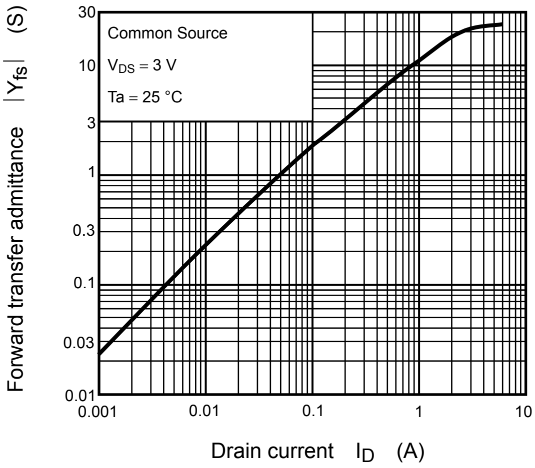

$R_{DS (ON)}$ – V_{GS}
I_D =4.0A
Common Source
25 °C
Ta = 100 °C
− 25 °C
Drain – Source on-resistance $R_{DS (ON)}$ (mΩ)
Gate - Source voltage V_{GS} (V)


$R_{DS (ON)}$ – I_D
Common Source
Ta = 25°C
1.8 V
2.5 V
V_{GS} = 4.0 V
Drain – Source on-resistance $R_{DS (ON)}$ (mΩ)
Drain current I_D (A)

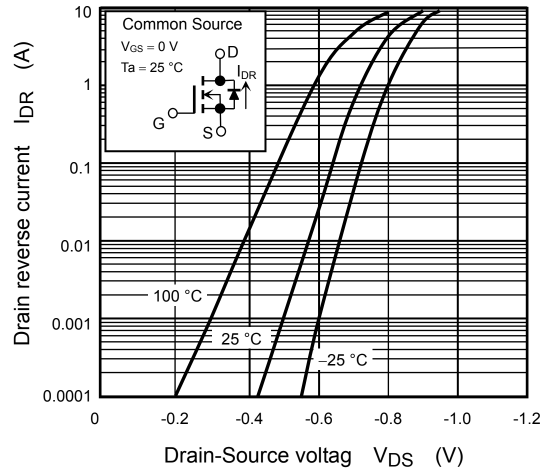

$R_{DS (ON)}$ – Ta
Common Source
1.0 A / 1.8 V
3.0 A / 2.5 V
I_D = 4.0 A / V_{GS} = 4.0 V
Drain – Source on-resistance $R_{DS (ON)}$ (mΩ)
Ambient temperature Ta (°C)


V_{th} – Ta
Common Source
V_{DS} = 3 V
I_D = 1 mA
Gate threshold voltage V_{th} (V)
Ambient temperature Ta (°C)

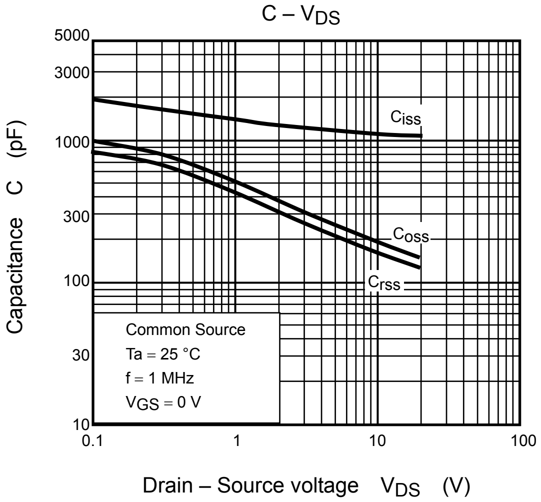
$|Y_{fs}| – I_D$



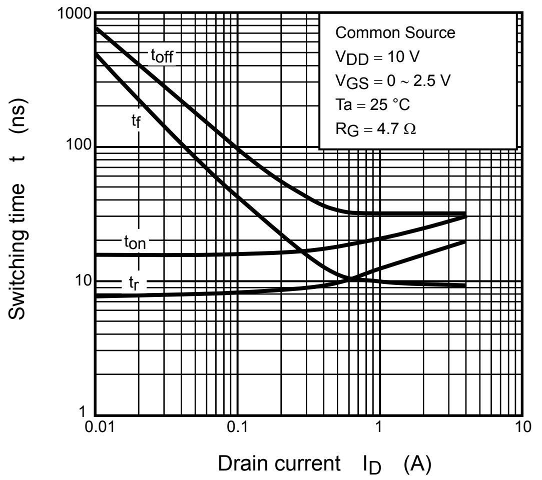
$I_{DR} – V_{DS}$



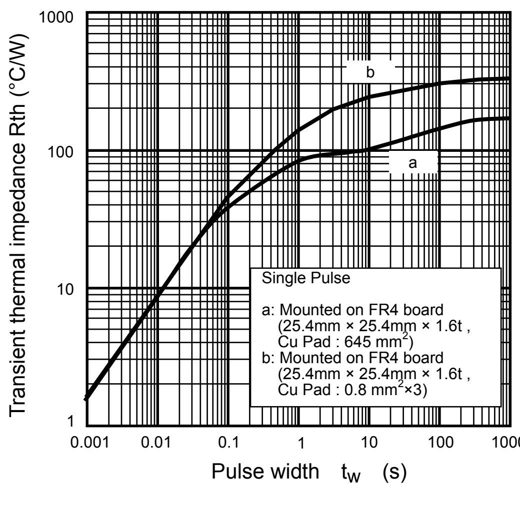
$C – V_{DS}$



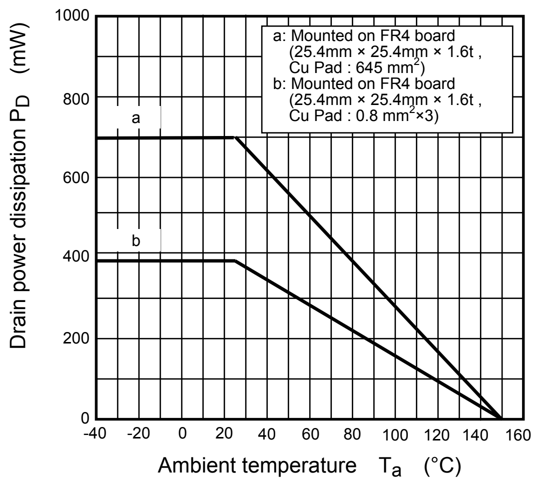
$t – I_D$



$r_{th} – t_w$



$P_D – T_a$



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20070701-EN GENERAL

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