Preliminary

TOSHIBA Field Effect Transistor
Silicon P Channel MOS Type (U-MOSII)

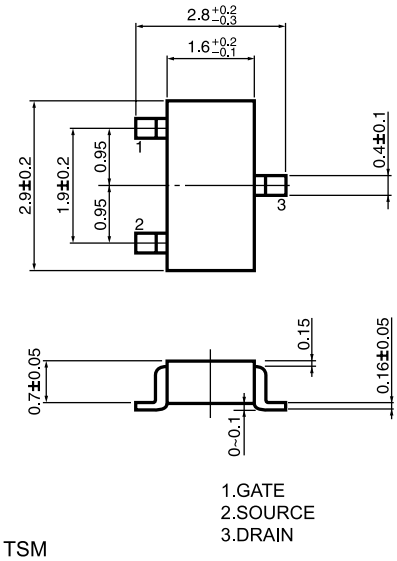
S S M 3 J 1 3 T

Power Management Switch

High Speed Switching Applications

- Small Package
- Low on Resistance: R_{on} = 70 mΩ (max) (@V_{GS} = −4 V)
  : R_{on} = 95 mΩ (max) (@V_{GS} = −2.5 V)
- Low Gate Threshold Voltage

UNIT : mm



1.GATE
2.SOURCE
3.DRAIN

TSM	
JEDEC	—
EIAJ	—
TOSHIBA	2-3S1A

Weight: 10 mg

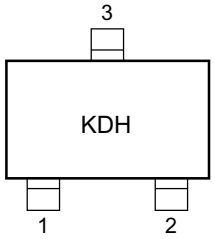
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	−12	V
Gate-Source voltage		V_{GSS}	±8	V
Drain current	DC	I_D	−3.0	A
	Pulse	I_{DP} (Note 2)	−6.0	
Drain power dissipation		P_D (Note 1)	1.25	W
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

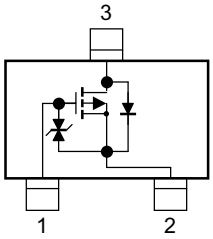
Note 1: Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 t, Cu pad: 645 mm^2, t = 10 s)

Note 2: The pulse width limited by max channel temperature.

Marking



Equivalent Circuit



Handling Precaution

When handling individual devices (which are not yet mounted 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.

The Channel-to-Ambient thermal resistance $R_{th\ (ch\text{-}a)}$ and the drain power dissipation P_D vary according to the board material, board area, board thickness and pad area, and are also affected by the environment in which the product is used. When using this device, please take heat dissipation fully into account

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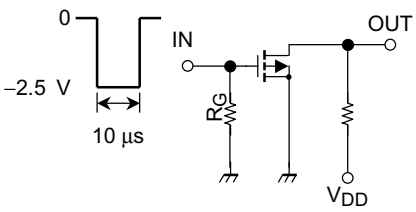
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±8 V, V_{DS} = 0	—	—	±1	μA
Drain-Source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −1 mA, V_{GS} = 0	−12	—	—	V
		$V_{(BR)\ DSX}$	I_D = −1 mA, V_{GS} = 8 V	−4	—	—	V
Drain Cut-off current		I_{DSS}	V_{DS} = −12 V, V_{GS} = 0	—	—	−1	μA
Gate threshold voltage		V_{th}	V_{DS} = −3 V, I_D = −0.1 mA	−0.45	—	−1.1	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −3 V, I_D = −1.5 A (Note 3)	3.8	—	—	S
Drain-Source ON resistance		$R_{DS\ (ON)}$	I_D = −1.5 A, V_{GS} = −4 V (Note 3)	—	50	70	mΩ
			I_D = −1.5 A, V_{GS} = −2.5 V (Note 3)	—	70	95	
			I_D = −1.5 A, V_{GS} = −2.0 V (Note 3)	—	90	180	
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0, f = 1 MHz	—	890	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = −10 V, V_{GS} = 0, f = 1 MHz	—	203	—	pF
Output capacitance		C_{oss}	V_{DS} = −10 V, V_{GS} = 0, f = 1 MHz	—	288	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = −10 V, I_D = −1 A	—	48	—	ns
	Turn-off time	t_{off}	V_{GS} = 0~−2.5 V, R_G = 4.7 Ω	—	120	—	

Note 3: Pulse test

Switching Time Test Circuit

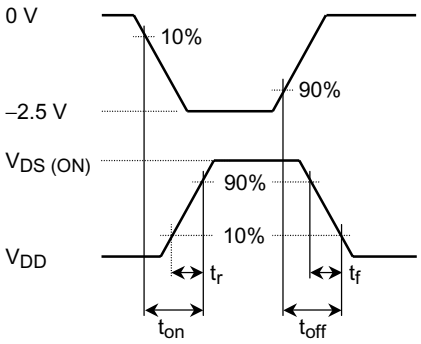
(a) Test circuit



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}



Precaution

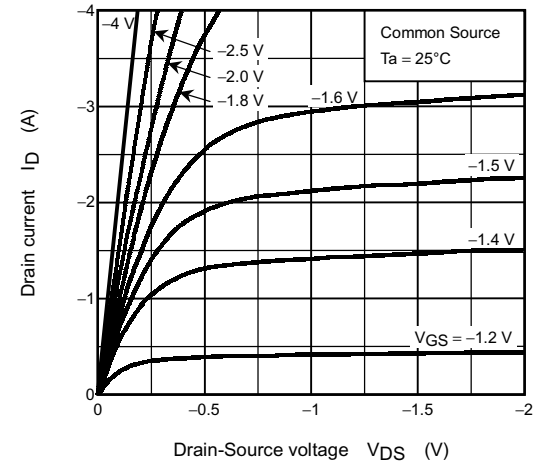
V_{th} can be expressed as voltage between gate and source when low operating current value is I_D = −100 μA for this product. For normal switching operation, $V_{GS\ (on)}$ requires higher voltage than V_{th} and $V_{GS\ (off)}$ requires lower voltage than V_{th}.

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

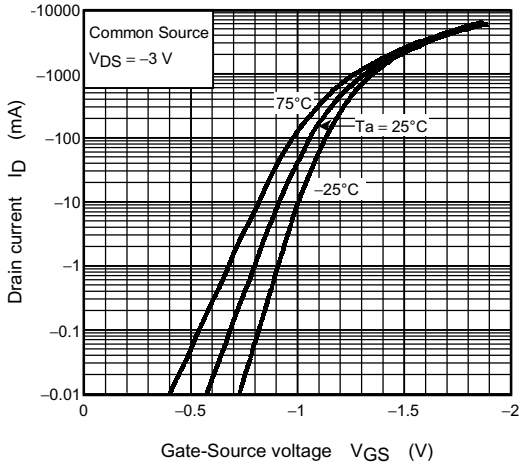
Please take this into consideration for using the device.

V_{GS} recommended voltage of −2.5 V or higher to turn on this product.

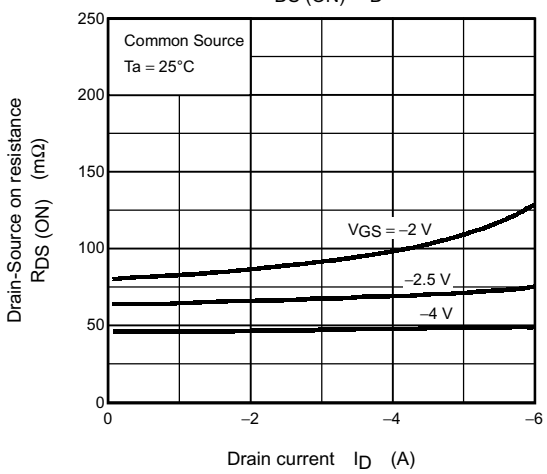
$I_D - V_{DS}$



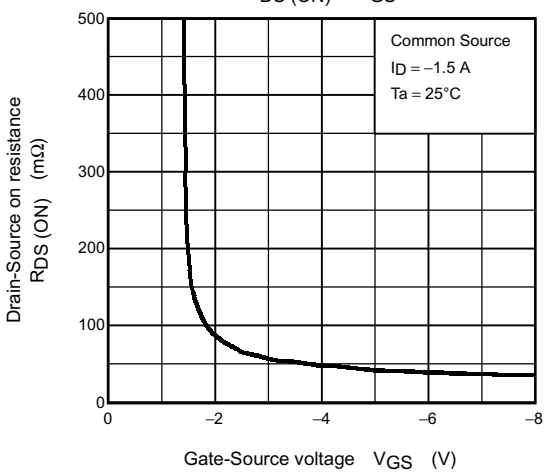
$I_D - V_{GS}$



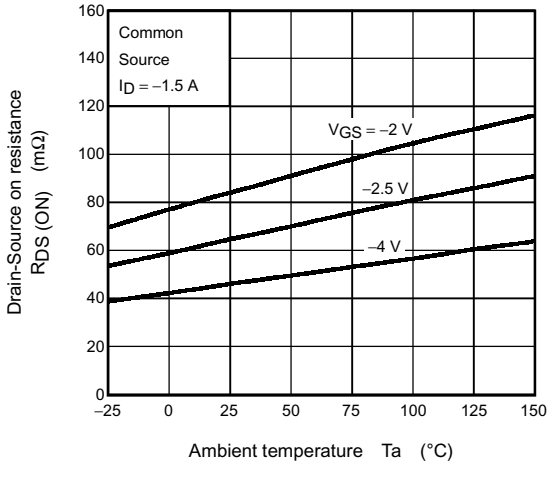
$R_{DS\ (ON)} - I_D$



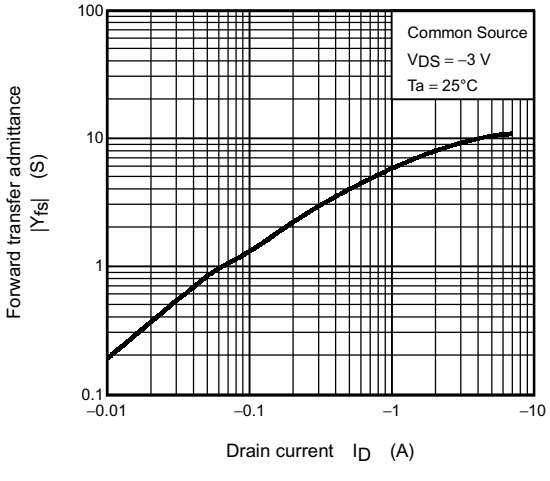
$R_{DS\ (ON)} - V_{GS}$



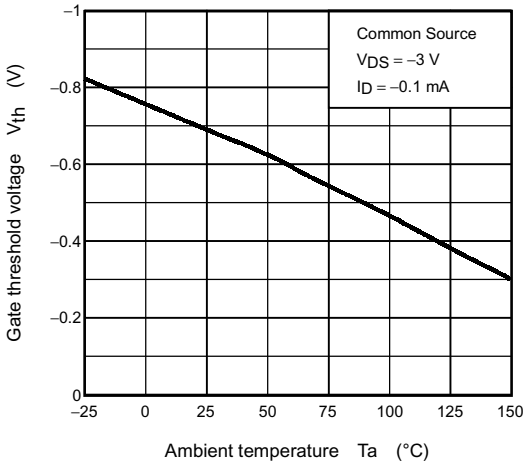
$R_{DS\ (ON)} - Ta$



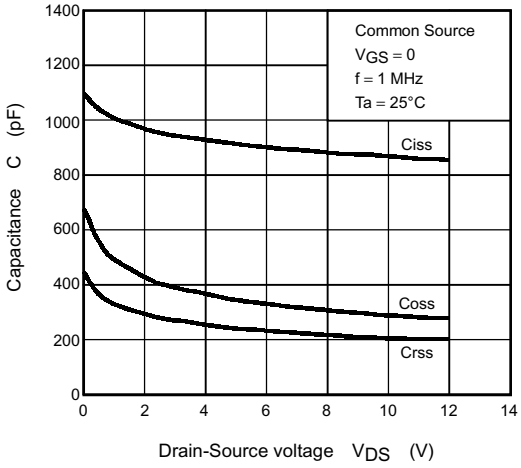
$|Y_{fs}| - I_D$



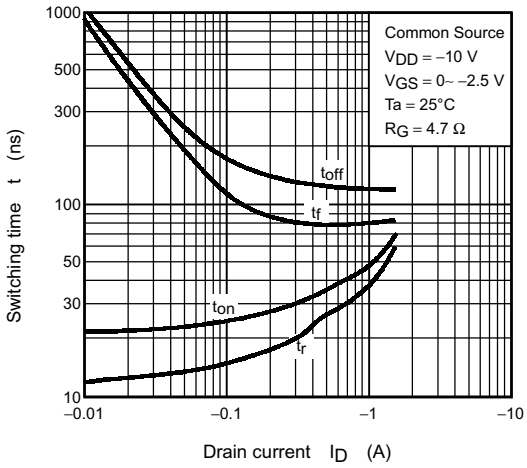
V_{th} – Ta



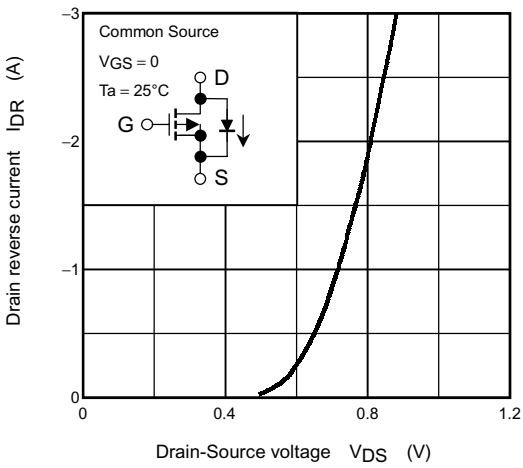
C – V_{DS}



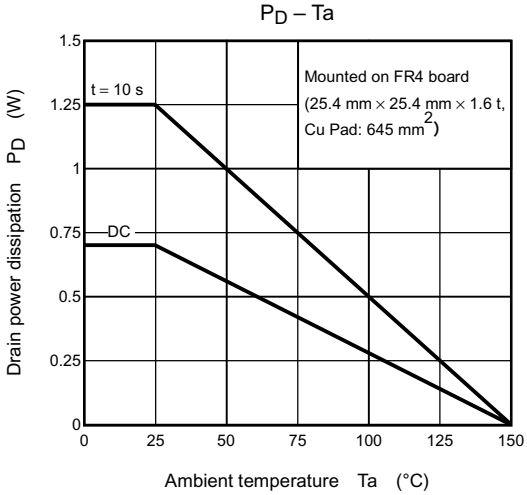
t – I_D



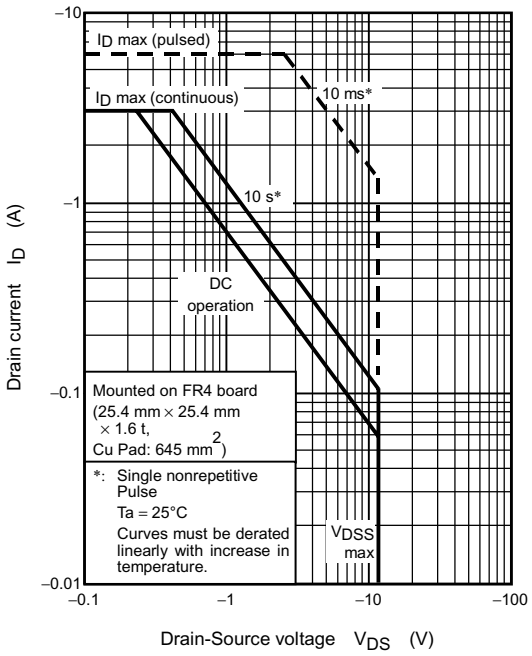
I_{DR} – V_{DS}



P_D – Ta



Safe operating area



r_{th} – tw