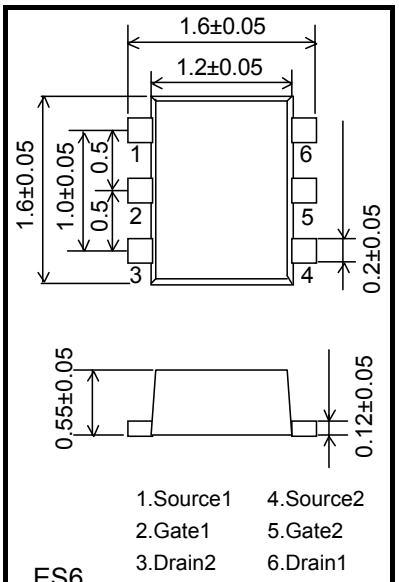
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOS III)

SSM6N15AFE

Load Switching Applications

- 2.5 V drive
- N-ch 2-in-1
- Low ON-resistance: $R_{DS(ON)}$ = 3.6 Ω (max) (@V_{GS} = 4.0 V)
  $R_{DS(ON)}$ = 6.0 Ω (max) (@V_{GS} = 2.5 V)

Unit: mm



1.Source1 4.Source2
2.Gate1 5.Gate2
3.Drain2 6.Drain1

ES6

JEDEC	—
JEITA	—
TOSHIBA	2-2N1D

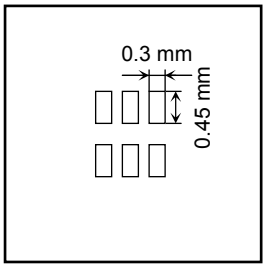
Weight: 3.0 mg (typ.)

Absolute Maximum Ratings (Ta = 25°C) (Q1, Q2 Common)

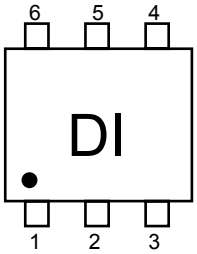
Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DSS}	30	V
Gate-Source voltage		V_{GSS}	±20	V
Drain current	DC	I_D	100	mA
	Pulse	I_{DP}	400	
Power dissipation		P_D (Note 1)	150	mW
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

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).

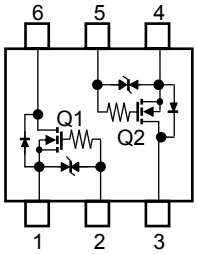
Note 1: Total rating
Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.135 mm^2 × 6)



Marking



Equivalent Circuit (top view)



Start of commercial production
2010-11

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

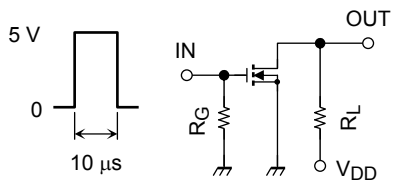
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-Source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 0.1 mA, V_{GS} = 0 V	30	—	—	V
		$V_{(BR)\ DSX}$	I_D = 0.1 mA, V_{GS} = -10 V (Note 3)	16	—	—	
Drain cut-off current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V	—	—	1	μA
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 0.1 mA	0.8	—	1.5	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 10 mA (Note 2)	35	—	—	mS
Drain-Source ON resistance		$R_{DS\ (ON)}$	I_D = 10 mA, V_{GS} = 4 V (Note 2)	—	2.3	3.6	Ω
			I_D = 10 mA, V_{GS} = 2.5 V (Note 2)	—	3.5	6.0	
Input capacitance		C_{iss}	V_{DS} = 3 V, V_{GS} = 0 V, f = 1 MHz	—	13.5	—	pF
Output capacitance		C_{oss}		—	8.0	—	
Reverse transfer capacitance		C_{rss}		—	6.5	—	
Switching time	Turn-on time	t_{on}	V_{DD} = 5 V, I_D = 10 mA, V_{GS} = 0 to 5 V, R_G = 50 Ω	—	5.5	—	ns
	Turn-off time	t_{off}		—	35	—	
Drain-source forward voltage		V_{DSF}	I_D = -100 mA, V_{GS} = 0 V (Note 2)	—	-0.85	-1.2	V

Note 2: Pulse test

Note 3: If a reverse bias is applied between gate and source, this device enters V(BR)DSX mode. Note that the drain-source breakdown voltage is lowered in this mode.

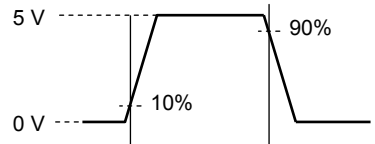
Switching Time Test Circuit

(a) Test circuit

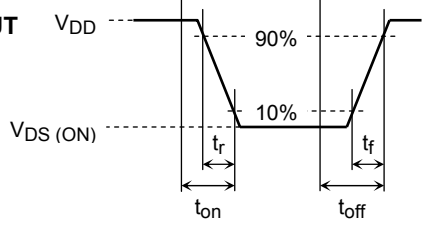


V_{DD} = 5 V
R_G = 50 Ω
Duty ≤ 1%
V_{IN}: t_r, t_f < 5 ns
Common Source
Ta = 25°C

(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 = 0.1 mA 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.

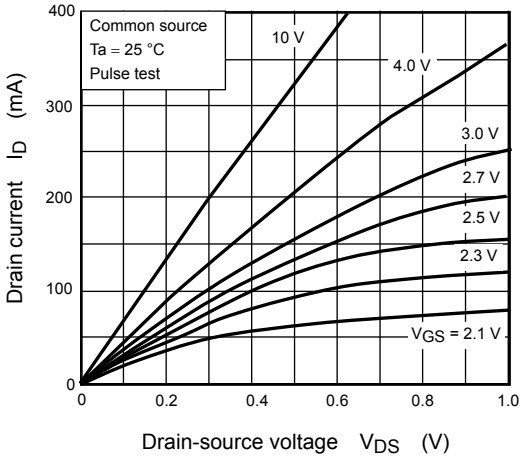
Do not use this device under avalanche mode. It may cause the device to break down.

Handling Precaution

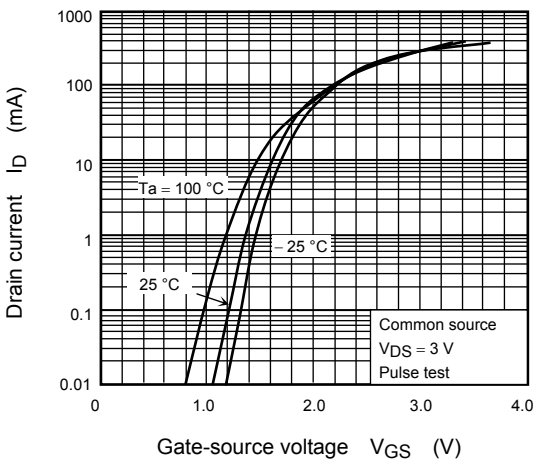
When handling individual devices (which are not yet mounting on a circuit board), be sure that the environment is protected against electrostatic electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static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

Thermal resistance $R_{th\ (ch\text{-}a)}$ and power dissipation P_D vary depending on board material, board area, board thickness and pad area. When using this device, please take heat dissipation into consideration

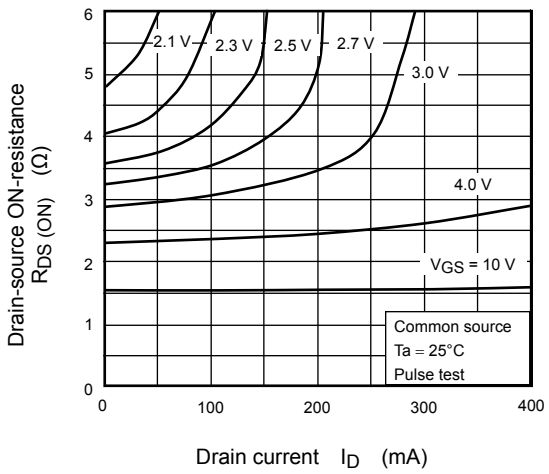
$I_D - V_{DS}$



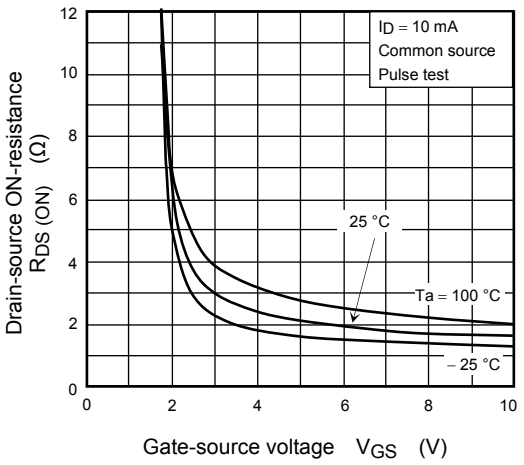
$I_D - V_{GS}$



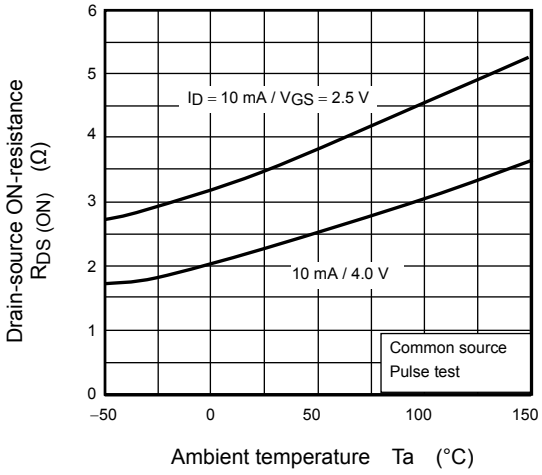
$R_{DS\ (ON)} - I_D$



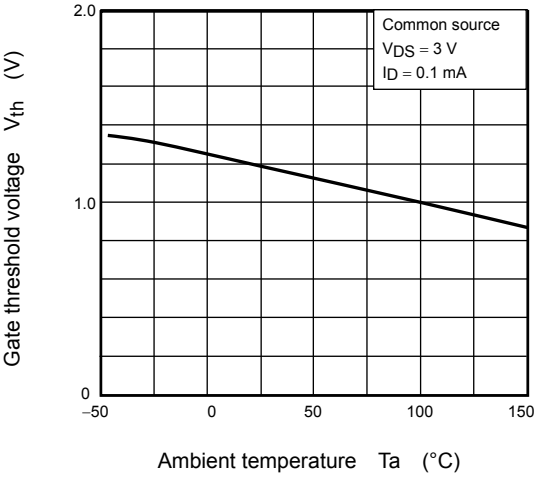
$R_{DS\ (ON)} - V_{GS}$



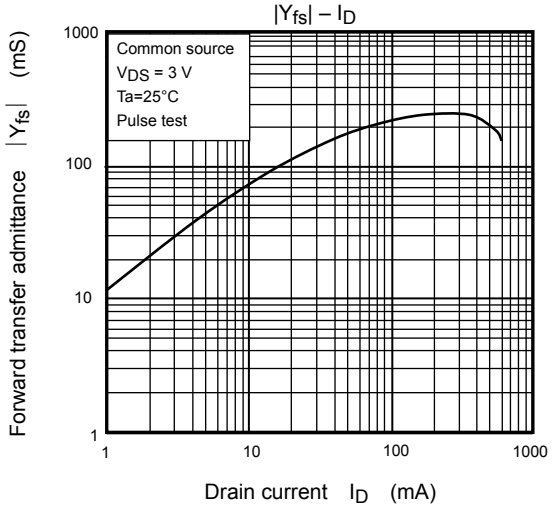
$R_{DS\ (ON)} - Ta$



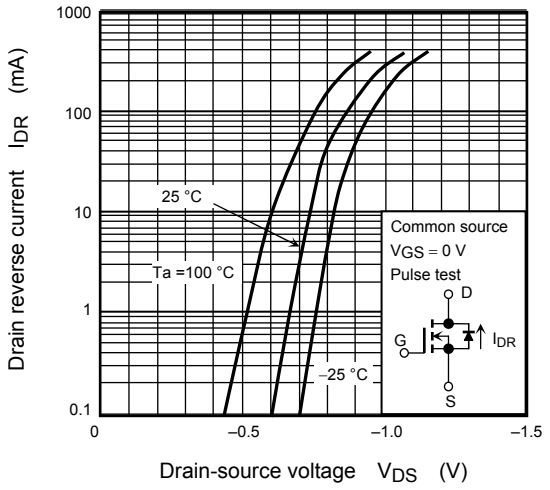
$V_{th} - Ta$



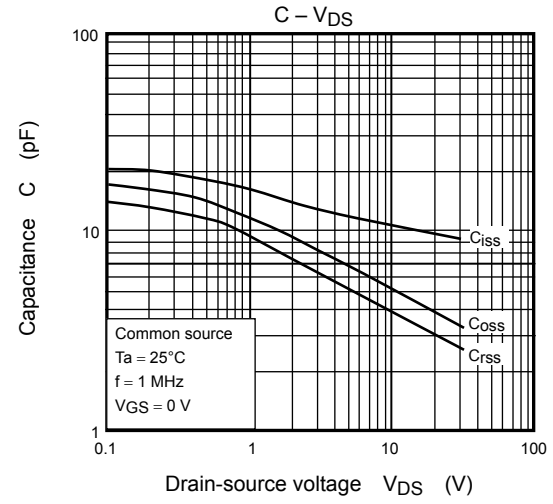
$|Y_{fs}| - I_D$



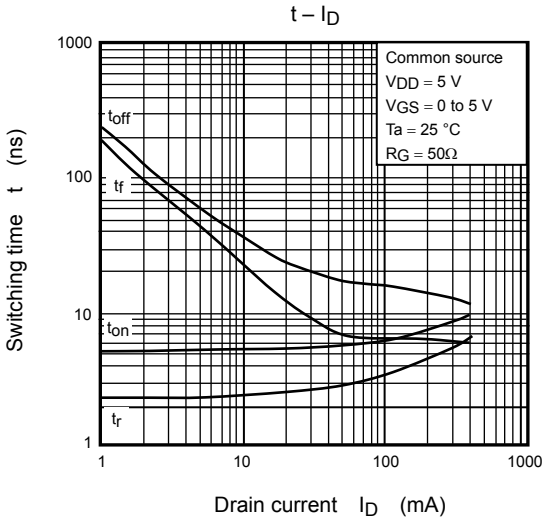
$I_{DR} - V_{DS}$



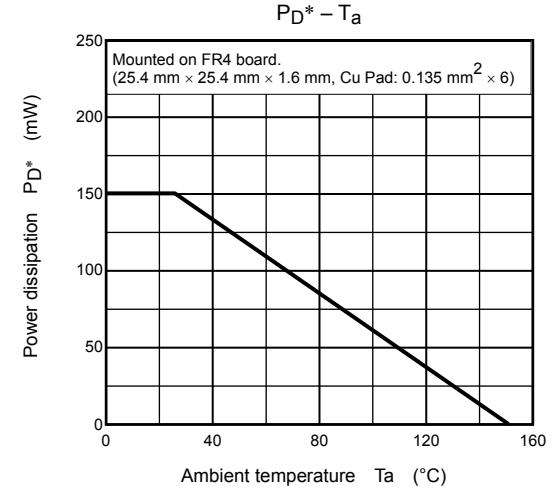
$C - V_{DS}$



$t - I_D$



$P_D^* - T_a$



*:Total Rating

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