

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:  $R_{DS(ON)} = 3.6\ \Omega$  (max) (@ $V_{GS} = 4.0\ V$ )  
 $R_{DS(ON)} = 6.0\ \Omega$  (max) (@ $V_{GS} = 2.5\ V$ )

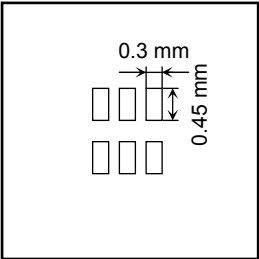
Absolute Maximum Ratings (Ta = 25°C)  
(Q1, Q2 Common)

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

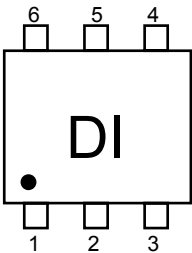
Note:    Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

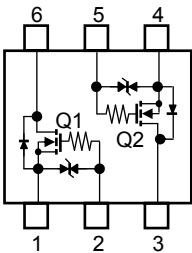
Note 1: Total rating  
Mounted on FR4 board  
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.135 mm<sup>2</sup> × 6)



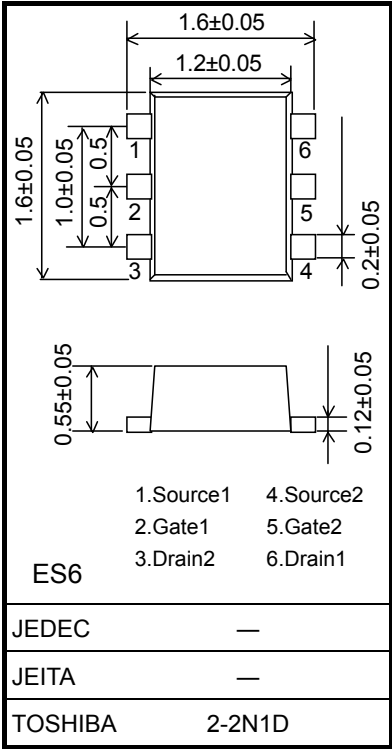
Marking



Equivalent Circuit (top view)



Unit: mm



Weight: 3.0 mg (typ.)

Start of commercial production  
2010-11

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

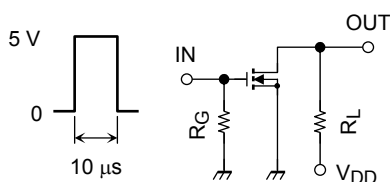
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	V (BR) DSS	I <sub>D</sub> = 0.1 mA, V <sub>GS</sub> = 0 V	30	—	—	V
	V (BR) DSX	I <sub>D</sub> = 0.1 mA, V <sub>GS</sub> = -10 V (Note 3)	16	—	—	
Drain cut-off current	I <sub>DSS</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V	—	—	1	μA
Gate leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±16 V, V <sub>DS</sub> = 0 V	—	—	±1	μA
Gate threshold voltage	V <sub>th</sub>	V <sub>DS</sub> = 3 V, I <sub>D</sub> = 0.1 mA	0.8	—	1.5	V
Forward transfer admittance	Y <sub>fs</sub>	V <sub>DS</sub> = 3 V, I <sub>D</sub> = 10 mA (Note 2)	35	—	—	mS
Drain-Source ON resistance	R <sub>DS (ON)</sub>	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 4 V (Note 2)	—	2.3	3.6	Ω
		I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 2.5 V (Note 2)	—	3.5	6.0	
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 3 V, V <sub>GS</sub> = 0 V, f = 1 MHz	—	13.5	—	pF
Output capacitance	C <sub>oss</sub>		—	8.0	—	
Reverse transfer capacitance	C <sub>rss</sub>		—	6.5	—	
Switching time	Turn-on time	V <sub>DD</sub> = 5 V, I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 to 5 V, R <sub>G</sub> = 50 Ω	—	5.5	—	ns
	Turn-off time		—	35	—	
Drain-source forward voltage	V <sub>DSF</sub>	I <sub>D</sub> = -100 mA, V <sub>GS</sub> = 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.

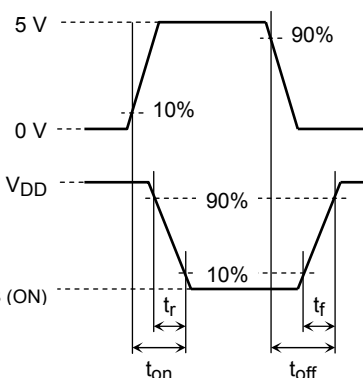
## Switching Time Test Circuit

(a) Test circuit

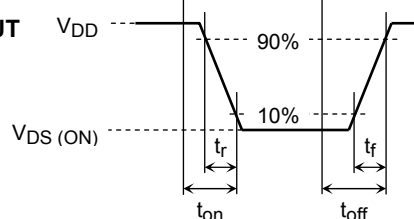


V<sub>DD</sub> = 5 V  
R<sub>G</sub> = 50 Ω  
Duty ≤ 1%  
V<sub>IN</sub>: t<sub>r</sub>, t<sub>f</sub> < 5 ns  
Common Source  
Ta = 25°C

(b) V<sub>IN</sub>



(c) V<sub>OUT</sub>



## Precaution

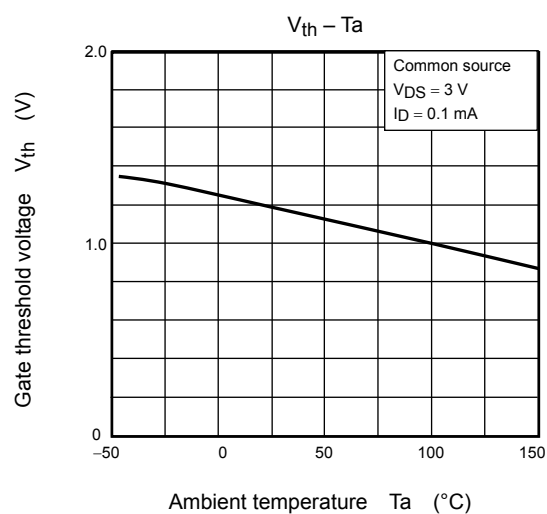
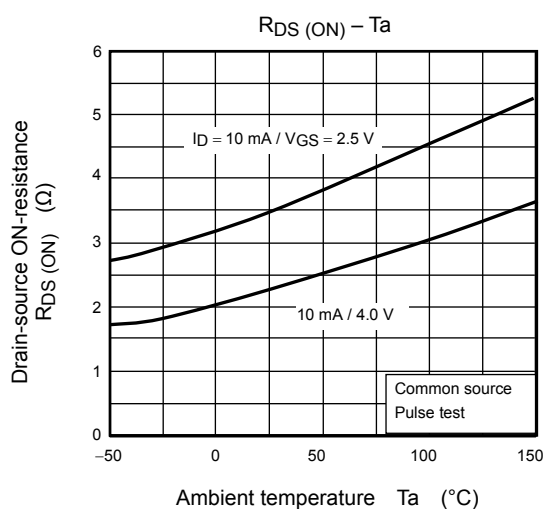
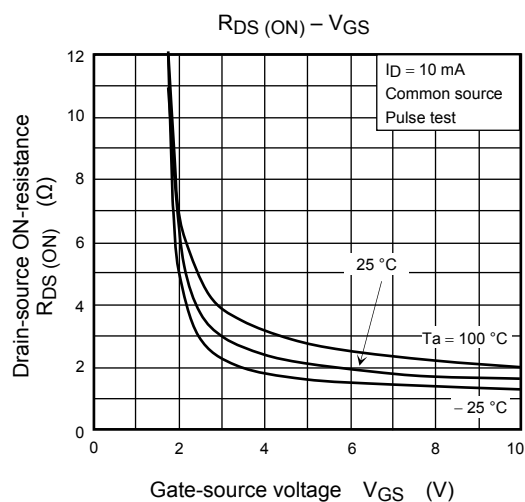
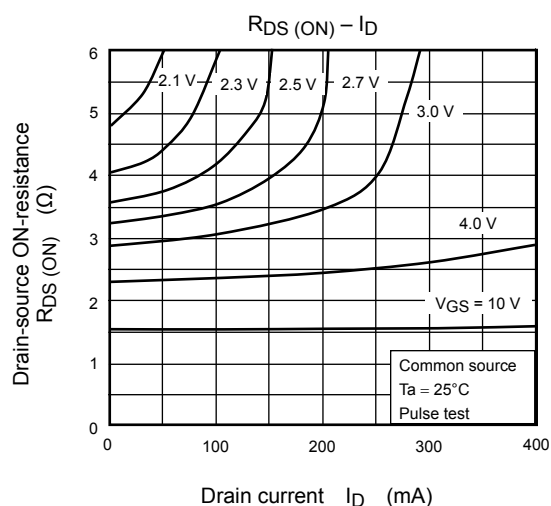
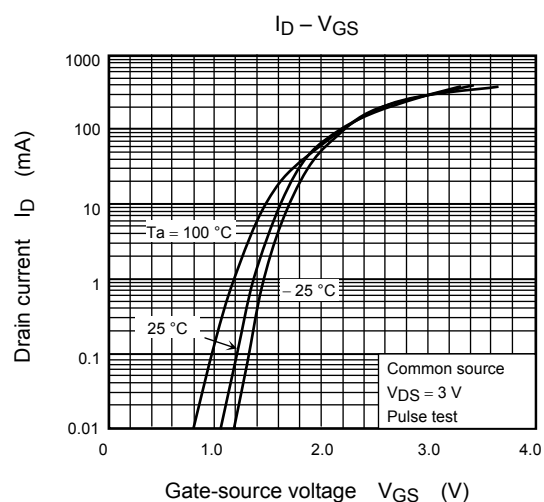
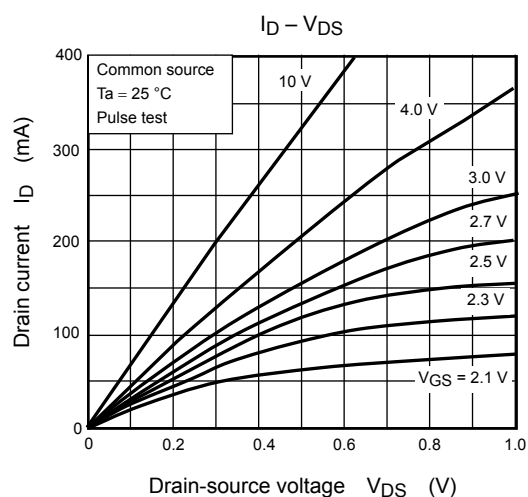
V<sub>th</sub> can be expressed as voltage between gate and source when low operating current value is I<sub>D</sub> = 0.1 mA for this product. For normal switching operation, V<sub>GS (on)</sub> requires higher voltage than V<sub>th</sub> and V<sub>GS (off)</sub> requires lower voltage than V<sub>th</sub>. (Relationship can be established as follows: V<sub>GS (off)</sub> < V<sub>th</sub> < V<sub>GS (on)</sub>) Please take this into consideration for using the device.

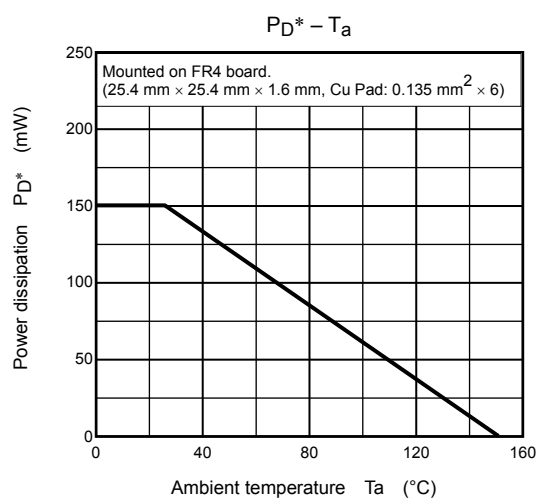
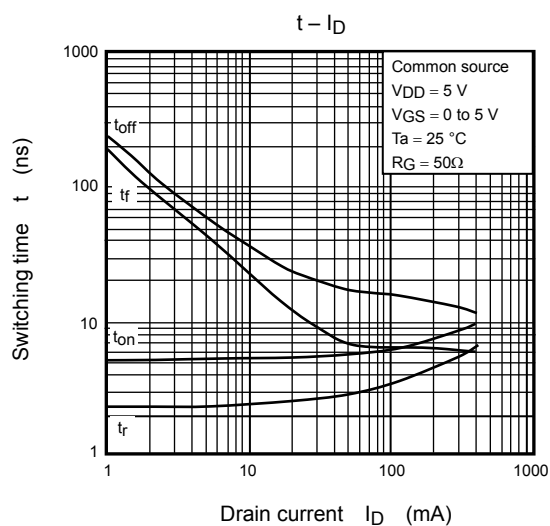
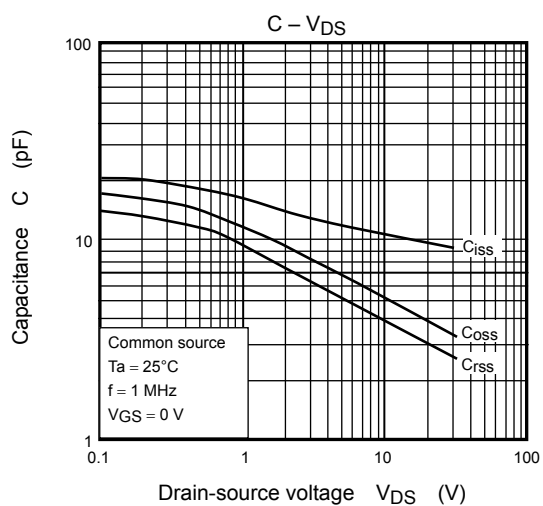
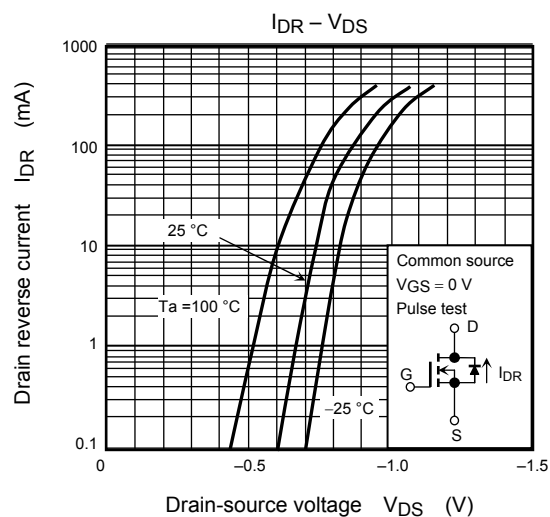
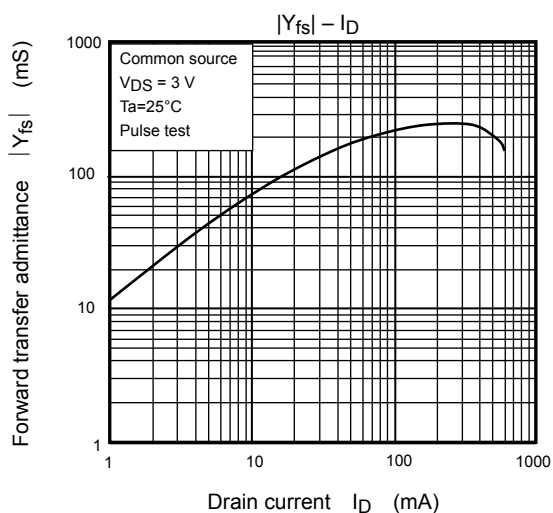
Do not use this device under avalanche mode. It may cause the device to break down.

## 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<sub>th (ch-a)</sub> and power dissipation P<sub>D</sub> vary depending on board material, board area, board thickness and pad area. When using this device, please take heat dissipation into consideration





\*:Total Rating

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