

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)

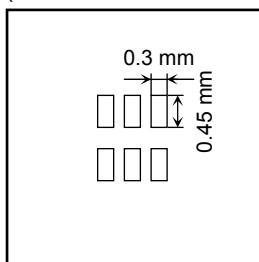
Characteristics	Symbol	Rating	Unit
Drain-Source voltage	V_{DSS}	30	V
Gate-Source voltage	V_{GSS}	±20	V
Drain current	DC	I_D	100
	Pulse	I_{DP}	400
Power dissipation	P_D (Note 1)	150	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	-55 to 150	°C

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.

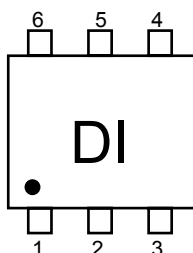
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

Note 1: Total rating

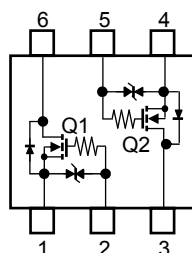
Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.135 mm² × 6)



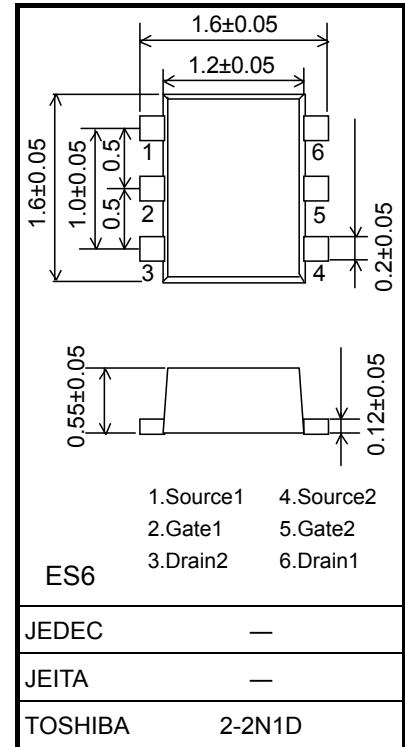
Marking



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)

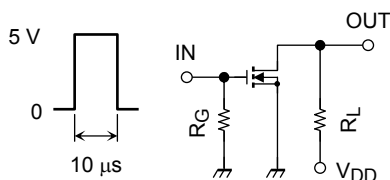
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 0.1 \text{ mA}, V_{GS} = 0 \text{ V}$	30	—	—	V
	$V_{(BR)DSX}$	$I_D = 0.1 \text{ mA}, V_{GS} = -10 \text{ V}$ (Note 3)	16	—	—	
Drain cut-off current	I_{DSS}	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{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

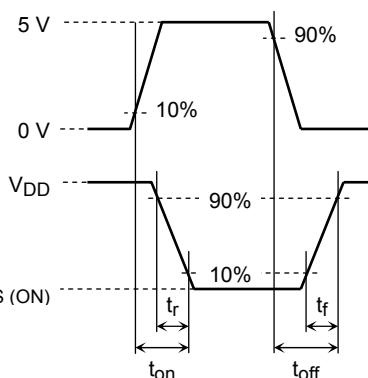
Switching Time Test Circuit

(a) Test circuit



$V_{DD} = 5 \text{ V}$
 $R_G = 50 \Omega$
 Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5 \text{ ns}$
 Common Source
 $T_a = 25^\circ\text{C}$

(b) V_{IN}



(c) V_{OUT}

Precaution

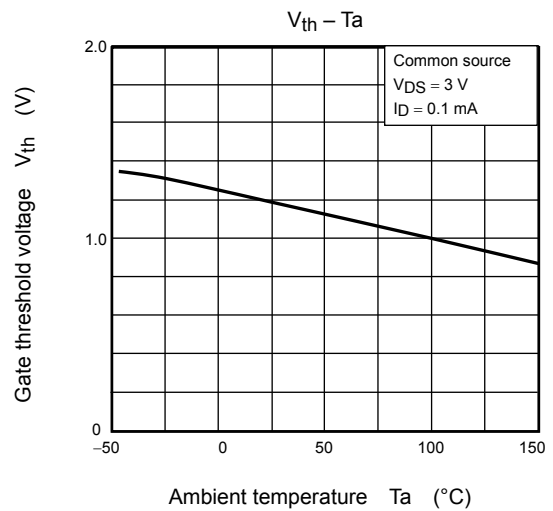
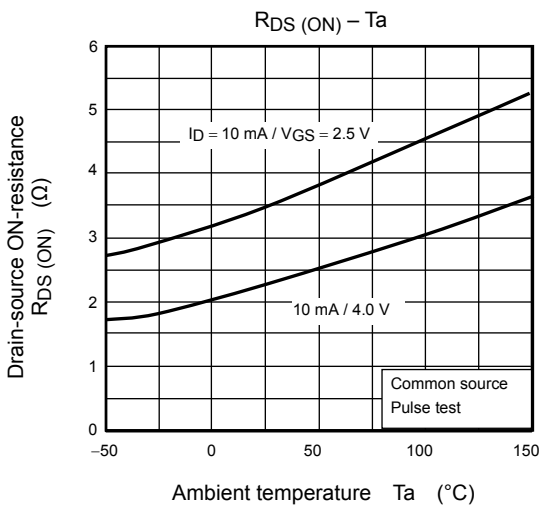
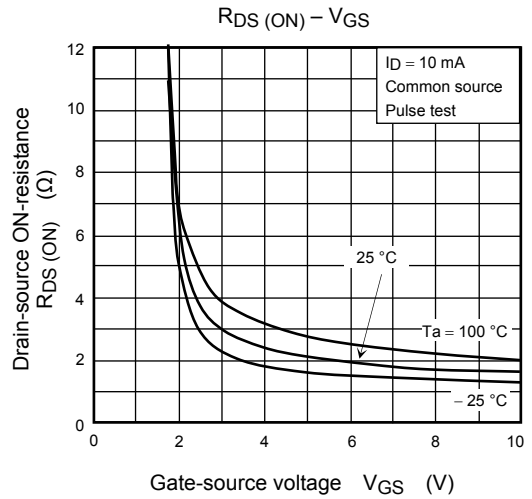
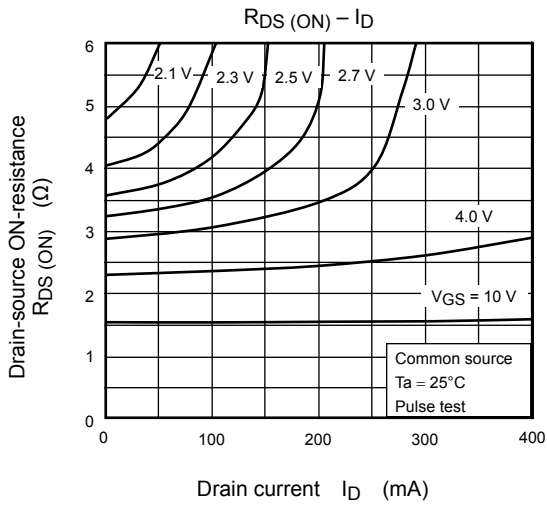
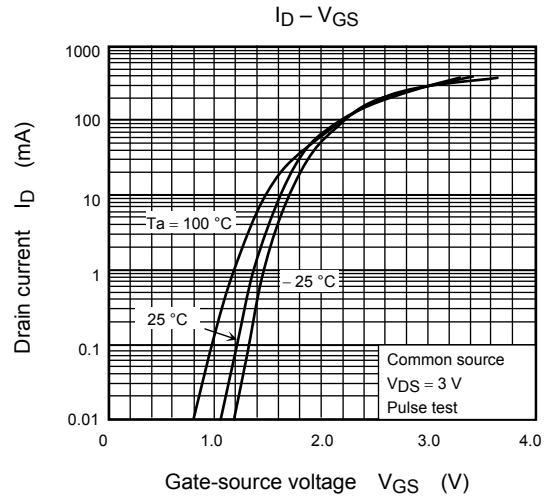
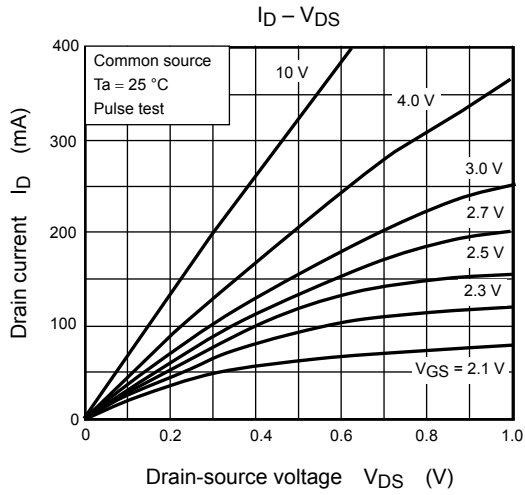
V_{th} can be expressed as voltage between gate and source when low operating current value is $I_D = 0.1 \text{ mA}$ for this product. For normal switching operation, $V_{GS(on)}$ requires higher voltage than V_{th} and $V_{GS(off)}$ requires lower voltage than V_{th} . (Relationship can be established as follows: $V_{GS(off)} < V_{th} < V_{GS(on)}$) Please take this into consideration for using the device.

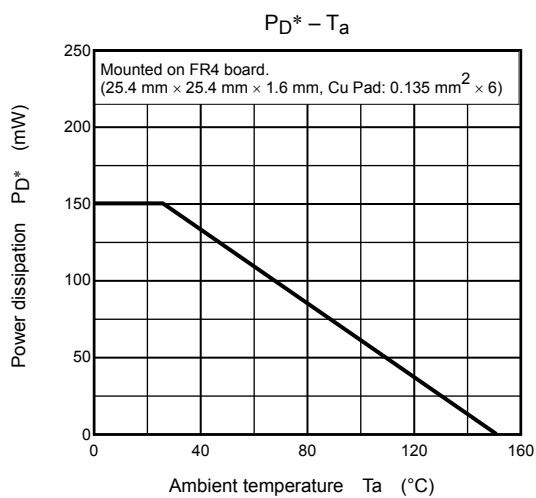
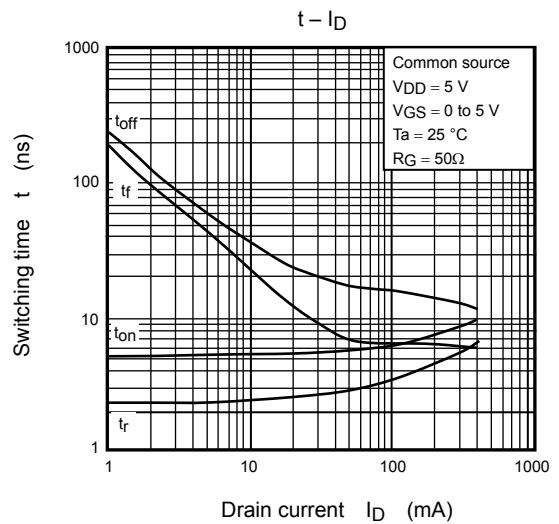
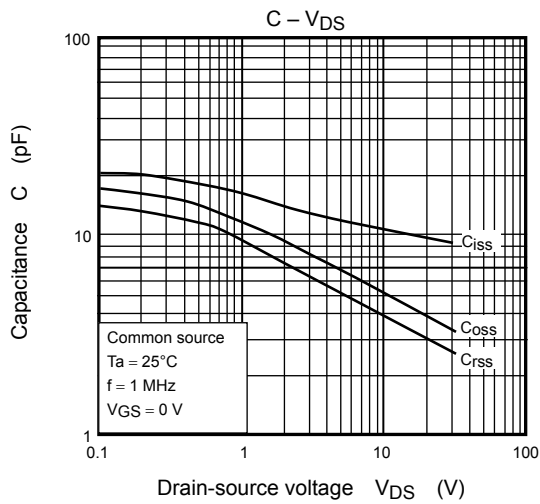
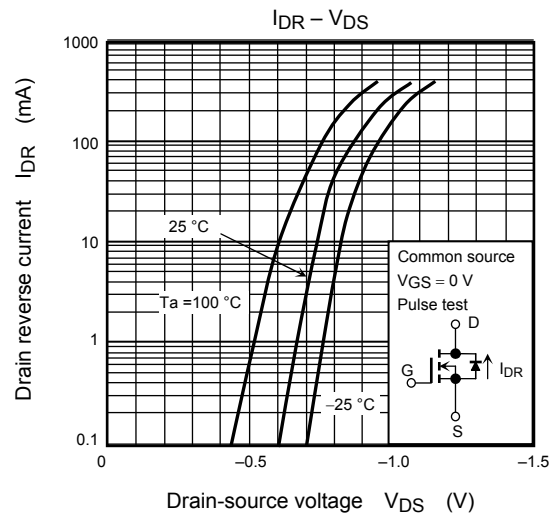
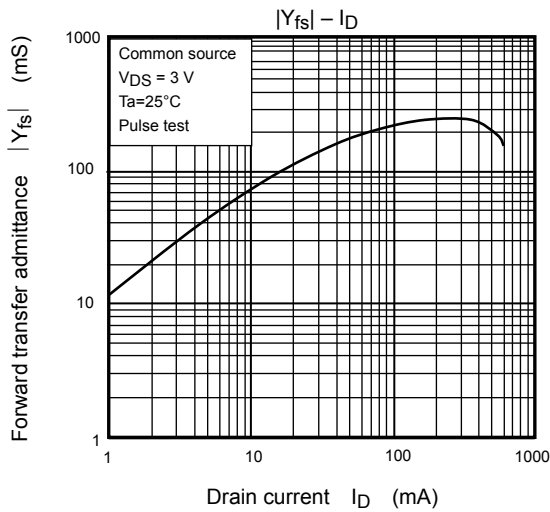
Do not use this device under avalanche mode. It may cause the device to break down.

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 $R_{th(ch-a)}$ 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





*: Total Rating

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