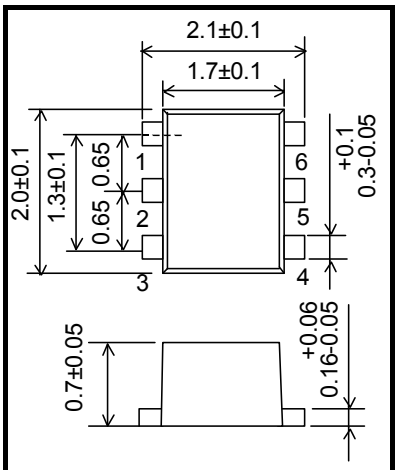
TOSHIBA Field Effect Transistor Silicon P/N Channel MOS Type

SSM6L10TU

High Speed Switching Applications

- Optimum for high-density mounting in small packages
- Low on-resistance Q1: R_{on} = 395mΩ (max) (@V_{GS} = 1.8 V)
  Q2: R_{on} = 980mΩ (max) (@V_{GS} = -1.8 V)

Unit: mm



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

UF6	
JEDEC	—
JEITA	—
TOSHIBA	2-2T1B

Weight: 7.0 mg (typ.)

Q1 Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	20	V
Gate-Source voltage		V_{GSS}	± 12	V
Drain current	DC	I_D	0.5	A
	Pulse	I_{DP}	1.5	

Q2 Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	-20	V
Gate-Source voltage		V_{GSS}	± 8	V
Drain current	DC	I_D	-0.5	A
	Pulse	I_{DP}	-1.5	

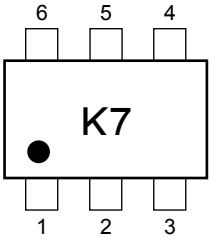
Absolute Maximum Ratings(Q1,Q2 Common)(Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Drain power dissipation	P_D (Note 1)	500	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	−55~150	°C

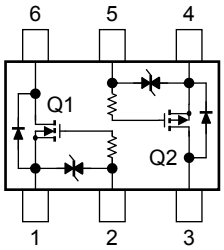
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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 FR4 board. (total dissipation)
(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 645 mm^2)

Marking



Equivalent Circuit (top view)



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.

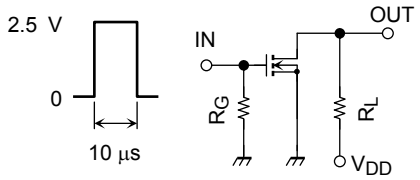
Q1 Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±12V, V_{DS} = 0	—	—	±1	μA
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	10	—	—	
Drain cut-off current		I_{DSS}	V_{DS} = 20 V, V_{GS} = 0	—	—	1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 0.1 mA	0.5	—	1.1	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 0.25 A (Note2)	1.2	2.4	—	S
Drain-Source on-resistance		$R_{DS\ (ON)}$	I_D = 0.25 A, V_{GS} = 4.0 V (Note2)	—	125	145	mΩ
			I_D = 0.25 A, V_{GS} = 2.5 V (Note2)	—	150	190	
			I_D = 0.25 A, V_{GS} = 1.8 V (Note2)	—	200	395	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	268	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	34	—	pF
Output capacitance		C_{oss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	44	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 0.25 A,	—	11	—	ns
	Turn-off time	t_{off}	V_{GS} = 0~2.5 V, R_G = 4.7 Ω	—	15	—	

Note2: Pulse test

Switching Time Test Circuit

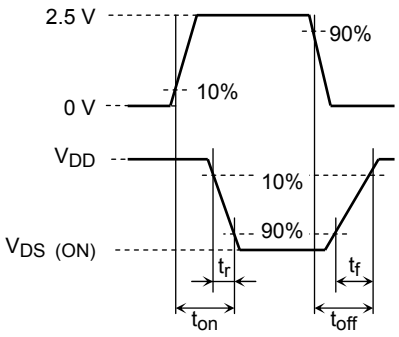
(a) Test Circuit



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}



Precaution

V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D=100 μA 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} < $V_{GS\ (on)}$)

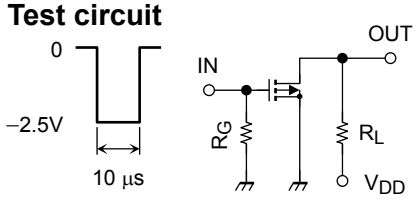
Q2 Electrical Characteristics (Ta = 25°C)

Characteristics		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	-20	—	—	V
		$V_{(BR)\ DSX}$	I_D = -1 mA, V_{GS} = +8 V	-12	—	—	
Drain cut-off current		I_{DSS}	V_{DS} = -20 V, V_{GS} = 0	—	—	-1	μA
Gate threshold voltage		V_{th}	V_{DS} = -3 V, I_D = -0.1 mA	-0.5	—	-1.1	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = -3 V, I_D = -0.25 A (Note3)	0.8	1.7	—	S
Drain-Source on-resistance		$R_{DS\ (ON)}$	I_D = -0.25 A, V_{GS} = -4 V (Note3)	—	200	230	mΩ
			I_D = -0.25 A, V_{GS} = -2.5 V (Note3)	—	260	330	
			I_D = -0.25 A, V_{GS} = -1.8 V (Note3)	—	400	980	
Input capacitance		C_{iss}	V_{DS} = -10 V, V_{GS} = 0, f = 1 MHz	—	250	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = -10 V, V_{GS} = 0, f = 1 MHz	—	35	—	pF
Output capacitance		C_{oss}	V_{DS} = -10 V, V_{GS} = 0, f = 1 MHz	—	45	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = -10 V, I_D = -0.25 A,	—	14	—	ns
	Turn-off time	t_{off}	V_{GS} = 0~-2.5 V, R_G = 4.7 Ω	—	15	—	

Note3: Pulse test

Switching Time Test Circuit

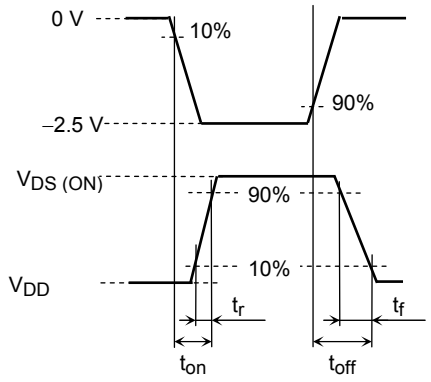
(a) Test circuit



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 the voltage between gate and source when the low operating current value is I_D=-100 μA 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: $V_{GS\ (off)} < V_{th} < V_{GS\ (on)}$)

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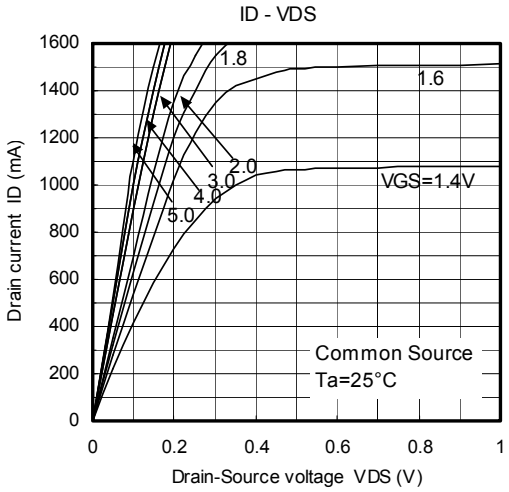
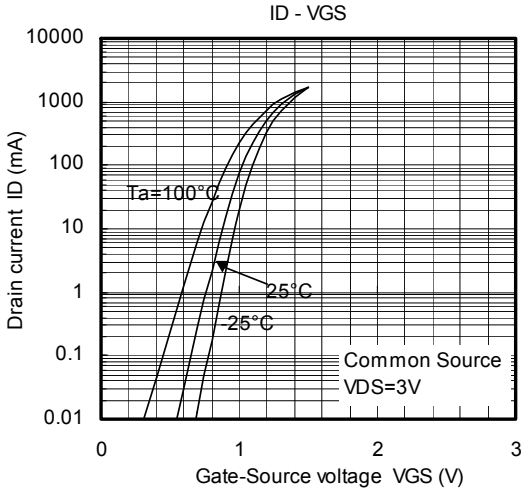
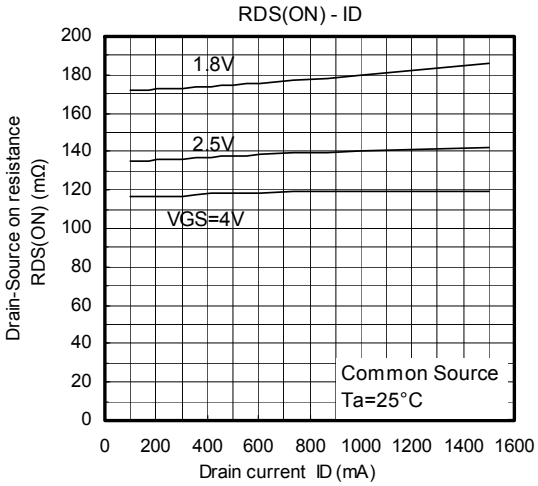
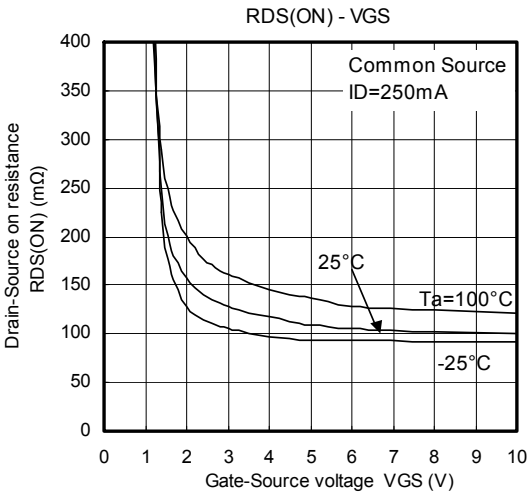
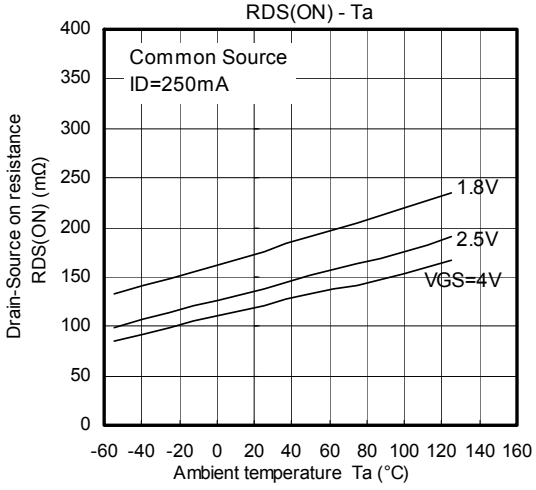
Q1(Nch MOS FET)

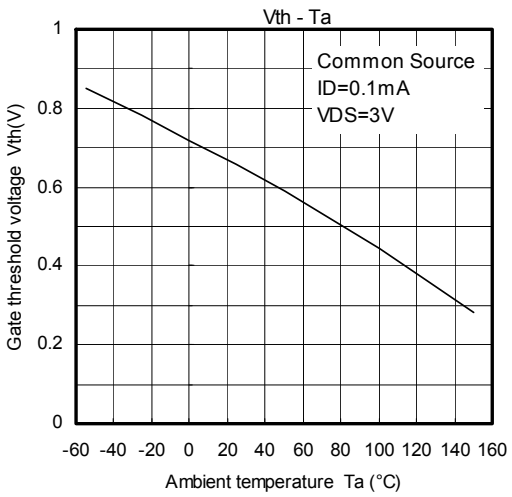




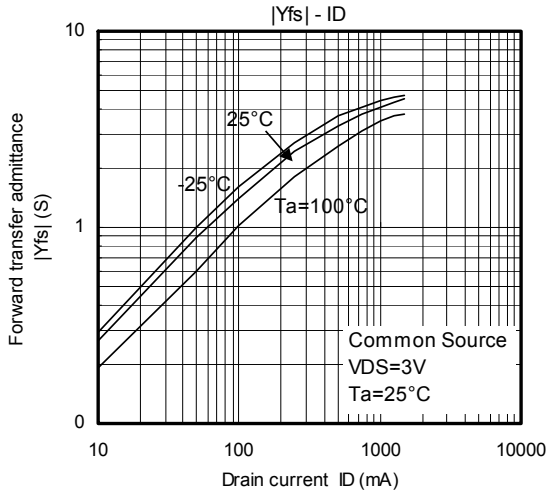


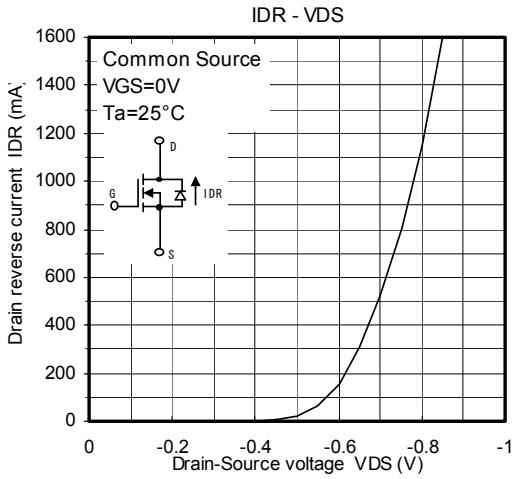


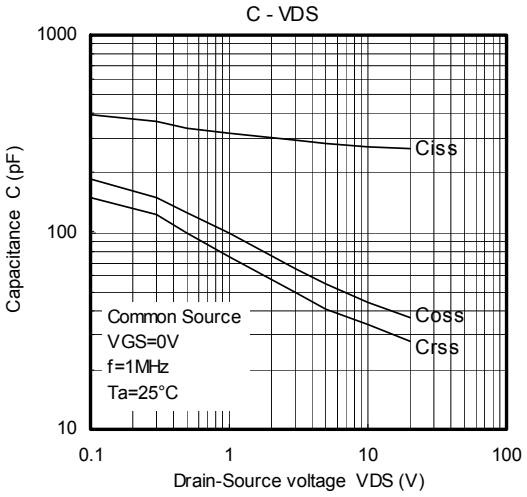


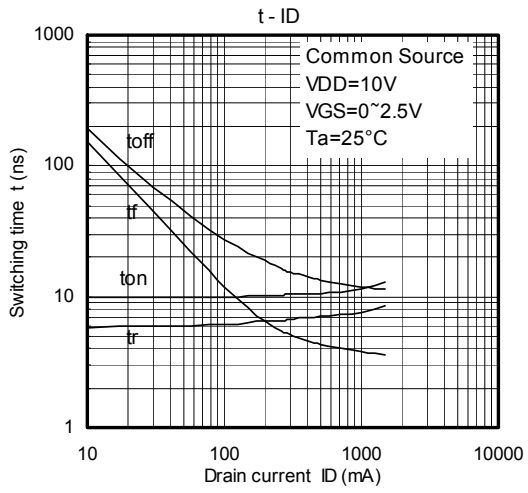


Q1(Nch MOS FET)

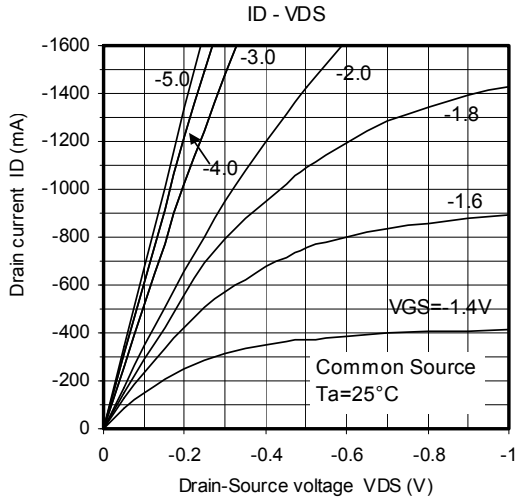


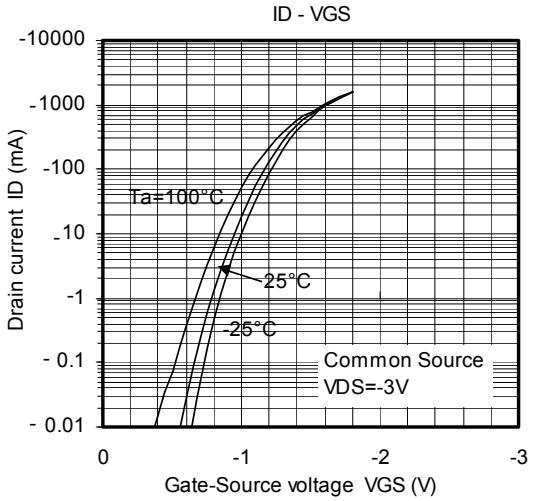


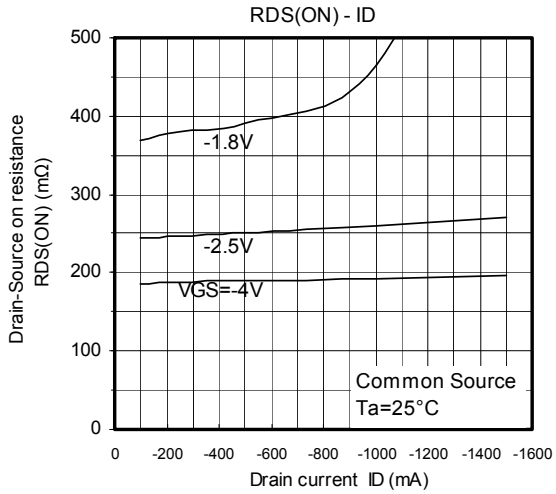


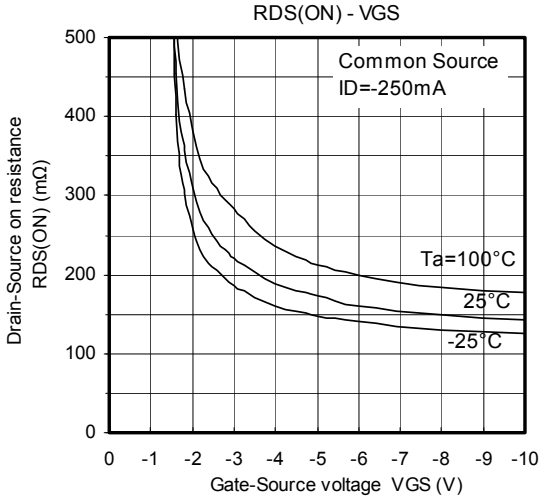


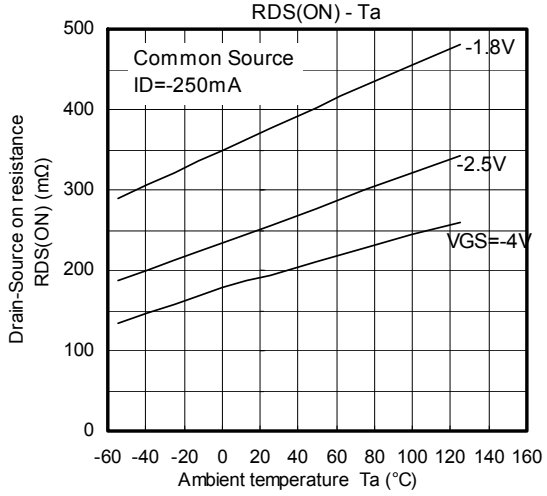
Q2(Pch MOS FET)

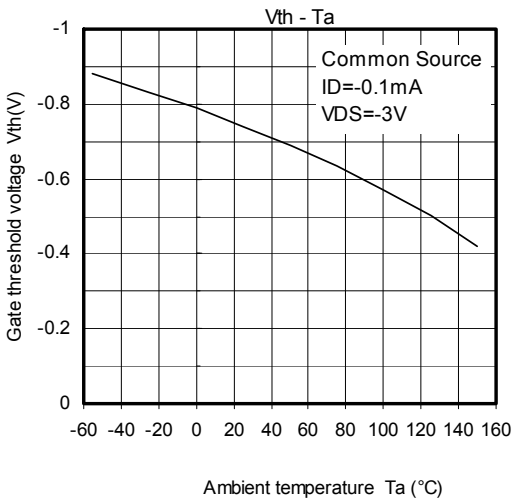




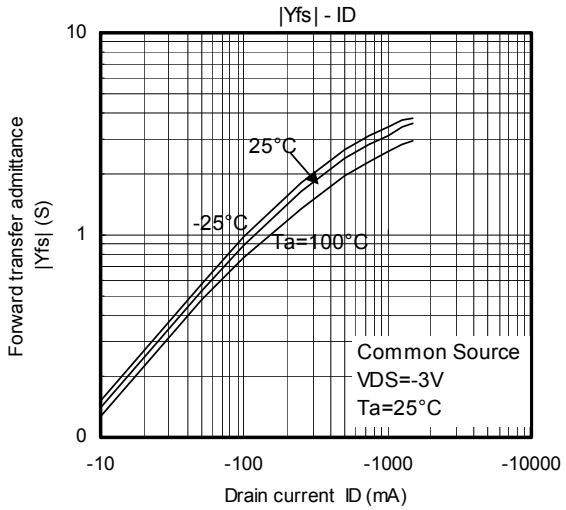


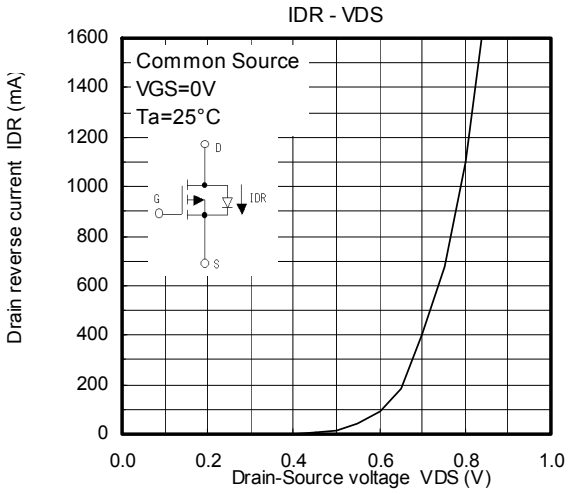


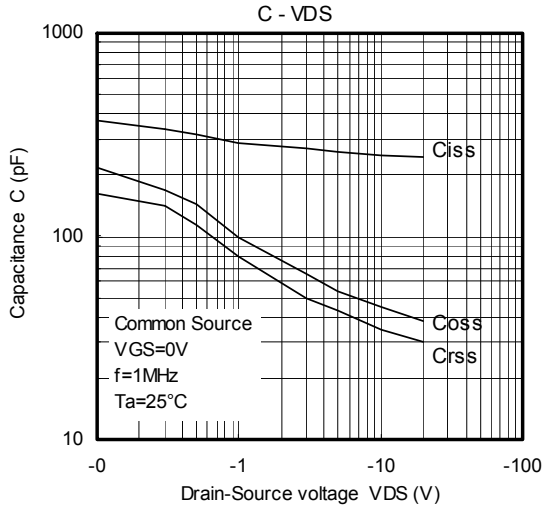


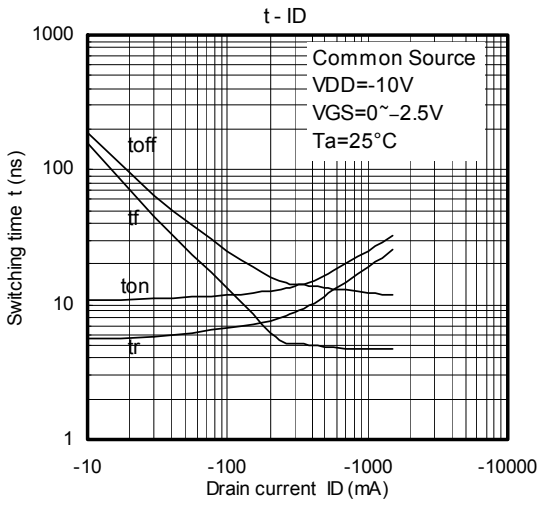


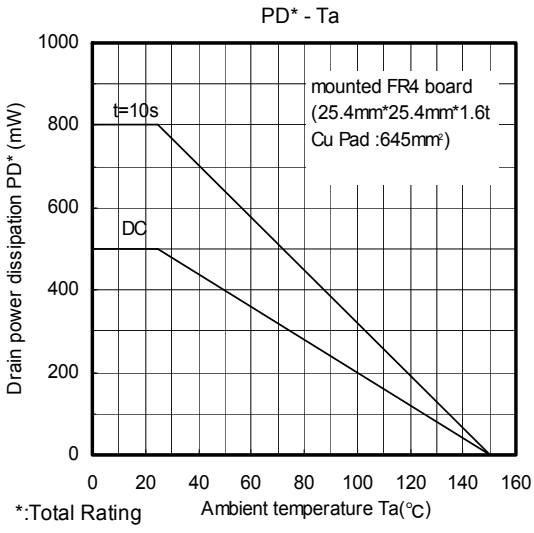
Q2(Pch MOS FET)



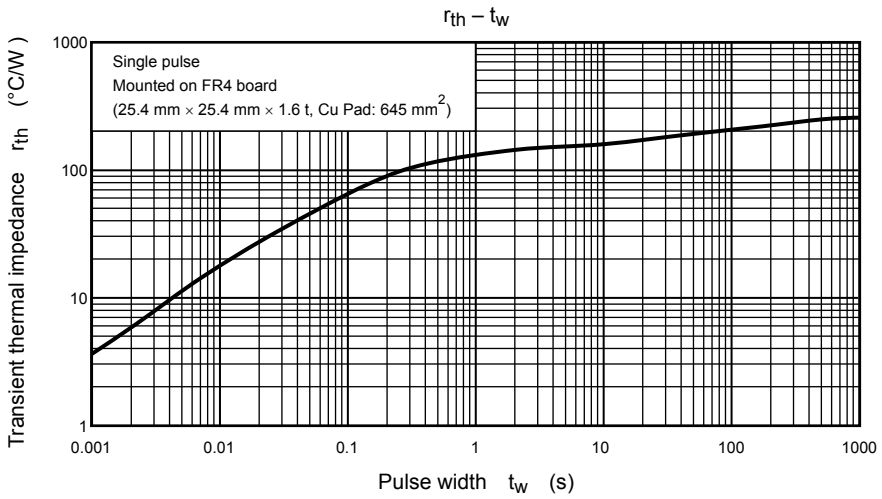








*:Total Rating


$r_{th} - t_w$
Single pulse
Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 645 mm^2)
Transient thermal impedance r_{th} (°C/W)
1000
100
10
1
0.001
0.01
0.1
1
10
100
1000
Pulse width t_w (s)

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20070701-EN GENERAL

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