

TOSHIBA Field Effect Transistor Silicon N/P Channel MOS Type(π-MOSVI)

SSM6L09FU

Power Management Switch
High Speed Switching Applications

- Small package
 - Low on-resistance
- Q1: $R_{DS(ON)} = 0.7 \Omega$ (max) (@ $V_{GS} = 10 V$)
Q2: $R_{DS(ON)} = 2.7 \Omega$ (max) (@ $V_{GS} = -10 V$)

Q1 Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DSS}	30	V
Gate-Source voltage		V_{GSS}	±20	V
Drain current	DC	I_D	400	mA
	Pulse	I_{DP}	800	

Q2 Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DSS}	-30	V
Gate-Source voltage		V_{GSS}	±20	V
Drain current	DC	I_D	-200	mA
	Pulse	I_{DP}	-400	

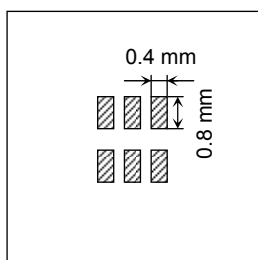
Absolute Maximum Ratings (Q1, Q2 common) (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power dissipation	P_D (Note 1)	300	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	-55 to 150	°C

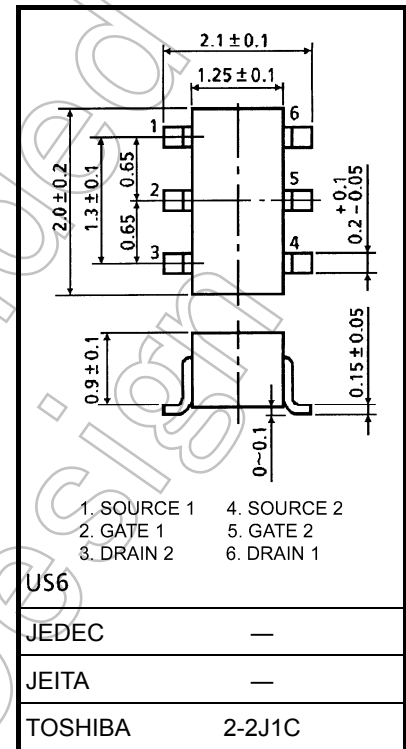
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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: 0.32 mm² × 6)



Unit: mm



- 1. SOURCE 1
- 2. GATE 1
- 3. DRAIN 2
- 4. SOURCE 2
- 5. GATE 2
- 6. DRAIN 1

US6

JEDEC

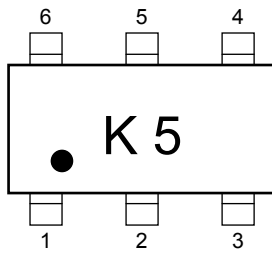
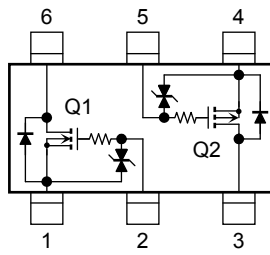
JEITA

TOSHIBA

2-2J1C

Weight: 6.8 mg (typ.)

Start of commercial production
2001-02

Marking (top view)**Equivalent Circuit****Handling Precaution**

When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against static 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.

Not Recommended for New Design

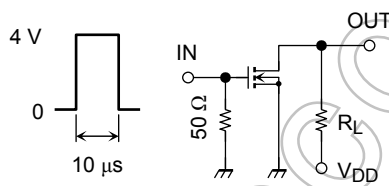
Q1 Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Gate leakage current	I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0$	—	—	± 1	μA
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 1\text{ mA}, V_{GS} = 0$	30	—	—	V
Drain cut-off current	I_{DSS}	$V_{DS} = 30\text{ V}, V_{GS} = 0$	—	—	1	μA
Gate threshold voltage	V_{th}	$V_{DS} = 5\text{ V}, I_D = 0.1\text{ mA}$	1.1	—	1.8	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 5\text{ V}, I_D = 200\text{ mA}$ (Note2)	270	—	—	mS
Drain-Source on-resistance	$R_{DS(ON)}$	$I_D = 200\text{ mA}, V_{GS} = 10\text{ V}$ (Note2)	—	0.5	0.7	Ω
		$I_D = 200\text{ mA}, V_{GS} = 4\text{ V}$ (Note2)	—	0.8	1.2	
		$I_D = 200\text{ mA}, V_{GS} = 3.3\text{ V}$ (Note2)	—	1.0	1.7	
Input capacitance	C_{iss}		—	20	—	pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 5\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	7	—	pF
Output capacitance	C_{oss}		—	16	—	pF
Switching time	Turn-on time	t_{on}	$V_{DD} = 5\text{ V}, I_D = 200\text{ mA},$		—	ns
	Turn-off time	t_{off}	$V_{GS} = 0\text{ to }4\text{ V}$		—	

Note2: Pulse test

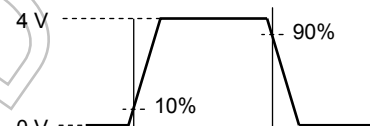
Switching Time Test Circuit

(a) Test circuit

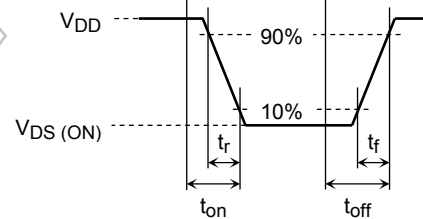


$V_{DD} = 5\text{ V}$
 Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5\text{ ns}$
 ($Z_{out} = 50\ \Omega$)
 Common Source
 $T_a = 25^\circ\text{C}$

(b) V_{IN}



(c) V_{OUT}



Precaution

V_{th} can be expressed as the voltage between the gate and source when the low operating current value is $I_D = 0.1\text{ mA}$ 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: $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$.)

Be sure to take this into consideration when using the device.

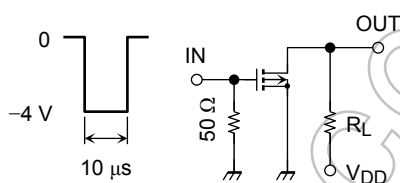
Q2 Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Gate leakage current	I_{GSS}	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0$	—	—	± 1	μA
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = -1\text{ mA}, V_{GS} = 0$	-30	—	—	V
Drain cut-off current	I_{DSS}	$V_{DS} = -30\text{ V}, V_{GS} = 0$	—	—	-1	μA
Gate threshold voltage	V_{th}	$V_{DS} = -5\text{ V}, I_D = -0.1\text{ mA}$	-1.1	—	-1.8	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -5\text{ V}, I_D = -100\text{ mA}$ (Note3)	115	—	—	mS
Drain-Source on-resistance	$R_{DS(ON)}$	$I_D = -100\text{ mA}, V_{GS} = -10\text{ V}$ (Note3)	—	2.1	2.7	Ω
		$I_D = -100\text{ mA}, V_{GS} = -4\text{ V}$ (Note3)	—	3.3	4.2	
		$I_D = -100\text{ mA}, V_{GS} = -3.3\text{ V}$ (Note3)	—	4.0	6.0	
Input capacitance	C_{iss}	$V_{DS} = -5\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	22	—	pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = -5\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	5	—	pF
Output capacitance	C_{oss}	$V_{DS} = -5\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	14	—	pF
Switching time	Turn-on time	t_{on}	$V_{DD} = -5\text{ V}, I_D = -100\text{ mA},$		—	ns
	Turn-off time	t_{off}	$V_{GS} = 0\text{ to }-4\text{ V}$		—	

Note3: Pulse test

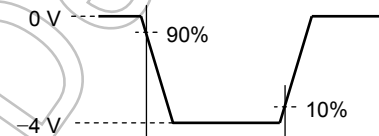
Switching Time Test Circuit

(a) Test circuit

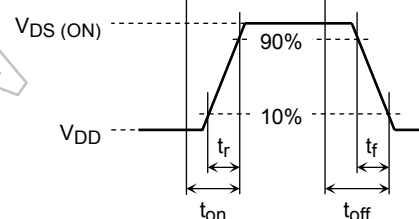


$V_{DD} = -5\text{ V}$
 Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5\text{ ns}$
 ($Z_{out} = 50\ \Omega$)
 Common Source
 $T_a = 25^\circ\text{C}$

(b) V_{IN}



(c) V_{OUT}

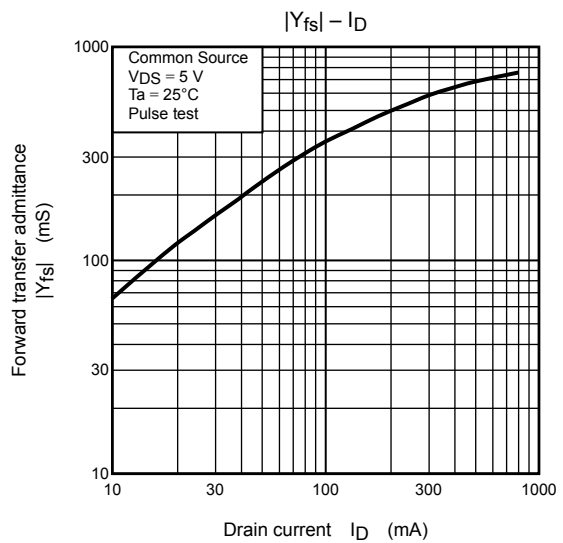
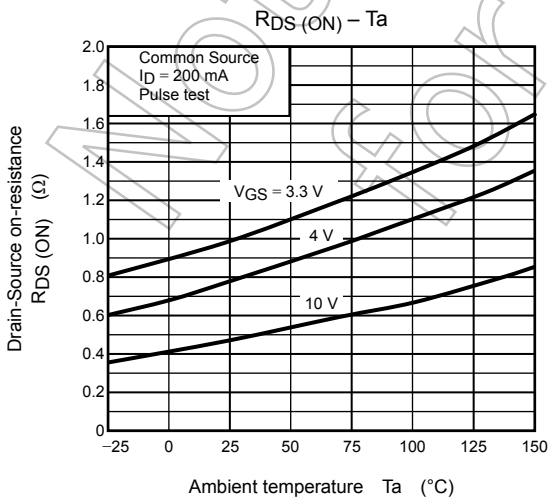
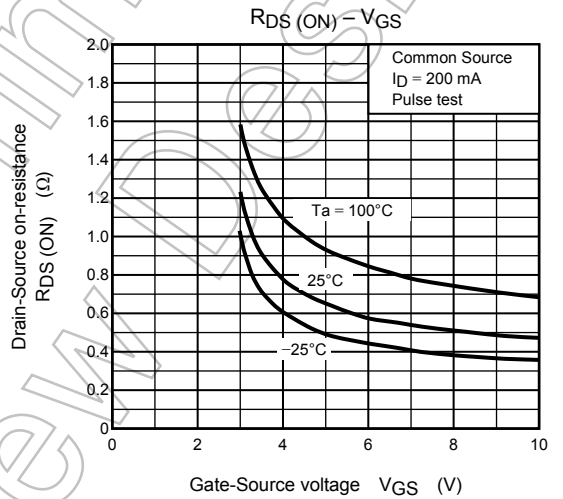
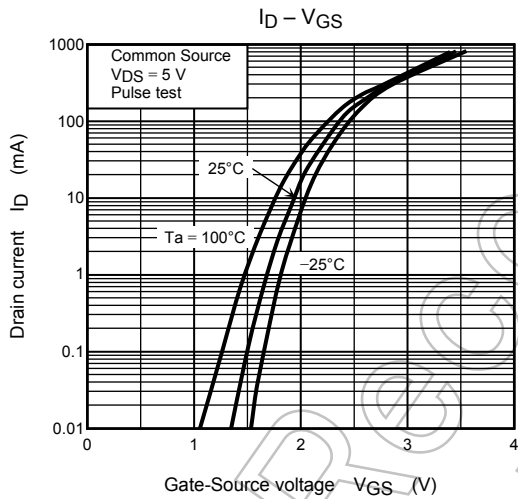
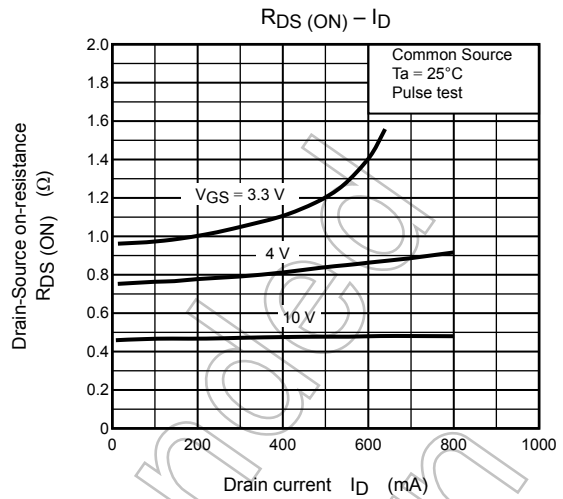
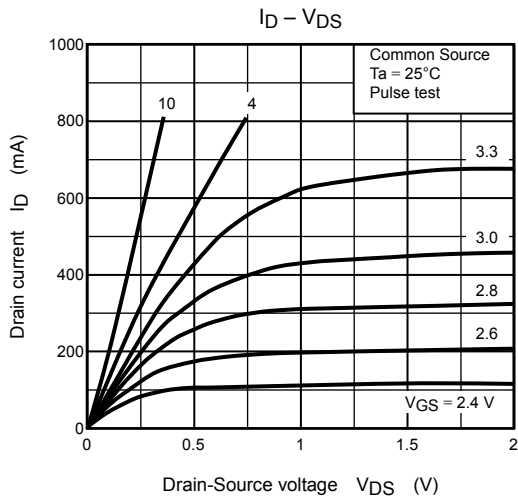


Precaution

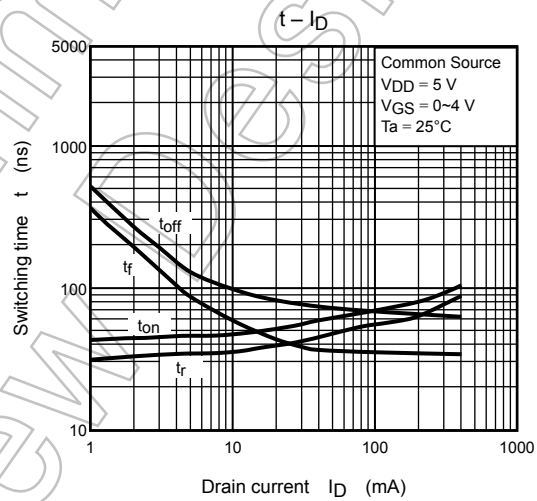
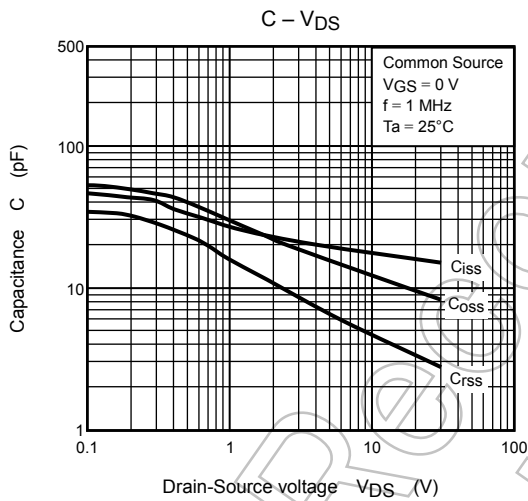
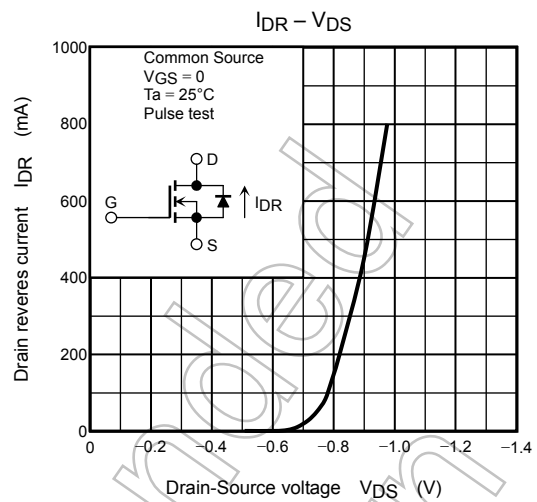
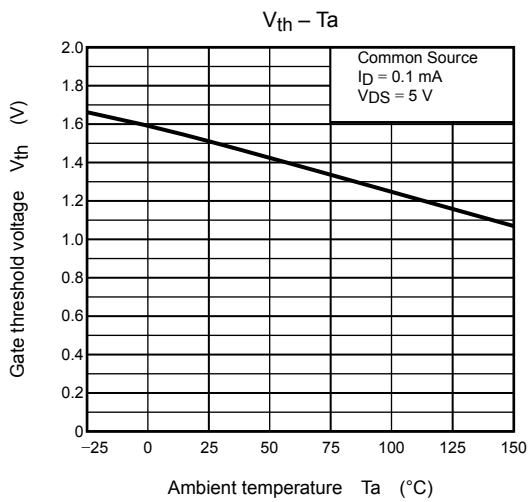
V_{th} can be expressed as voltage between gate and source when low operating current value is $I_D = -0.1\text{ mA}$ for this product. For normal switching operation, $V_{GS(ON)}$ requires higher voltage than V_{th} and $V_{GS(OFF)}$ requires lower voltage than V_{th} . (Relationship can be established as follows: $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$)

Please take this into consideration for using the device.

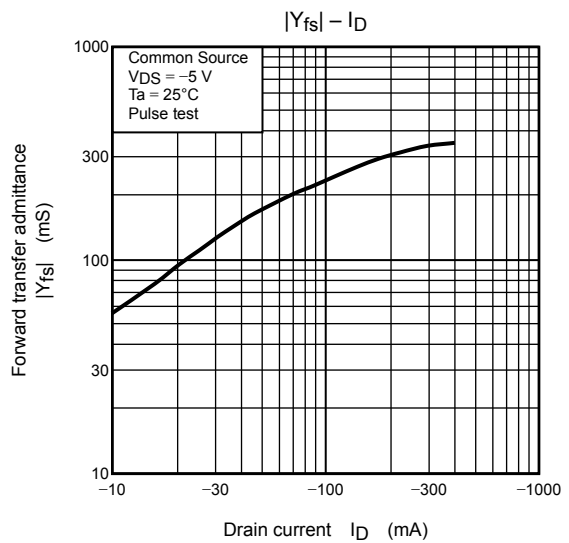
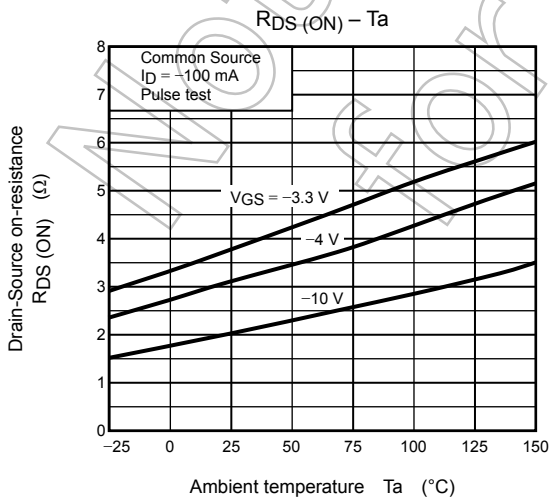
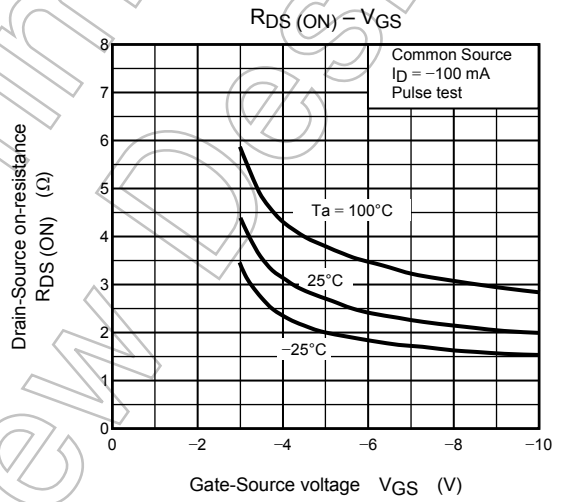
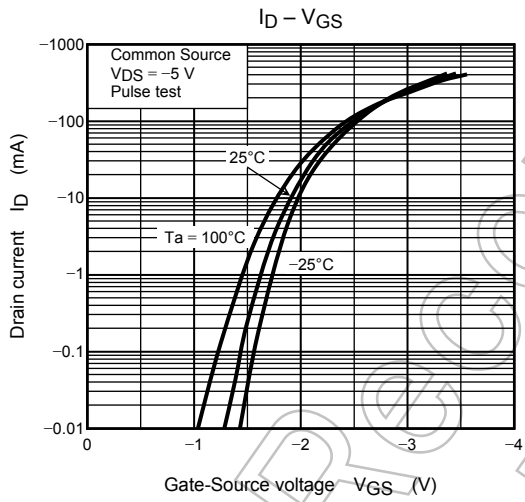
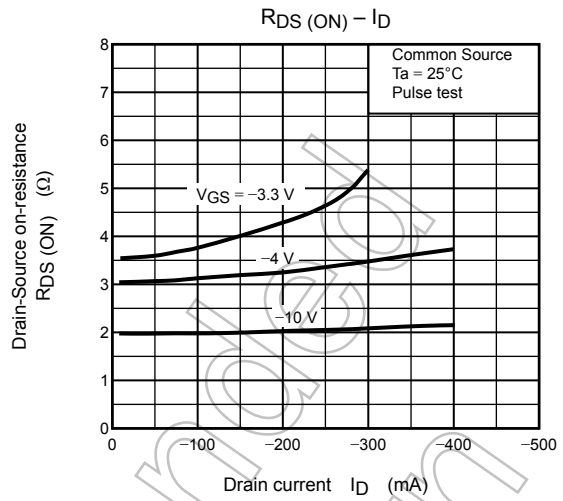
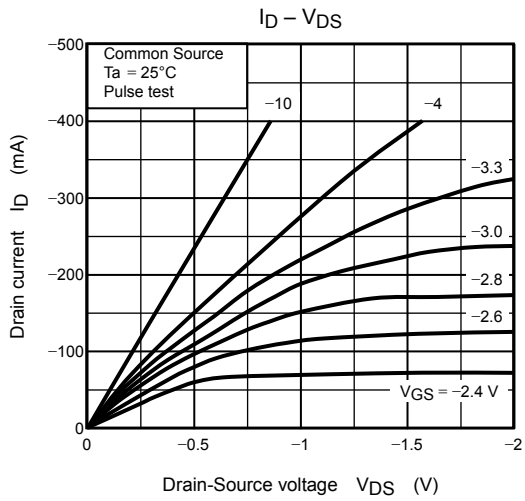
Q1 (Nch MOS FET)



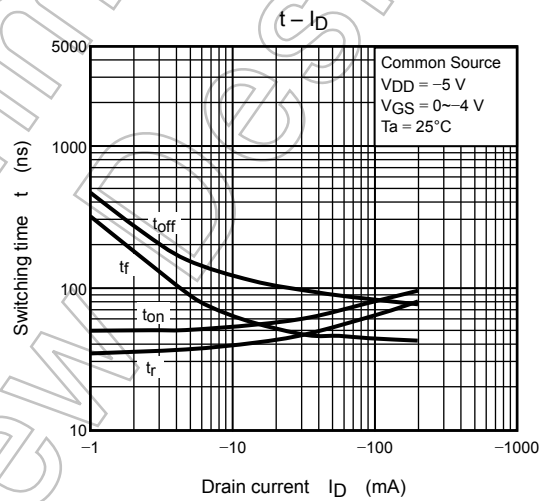
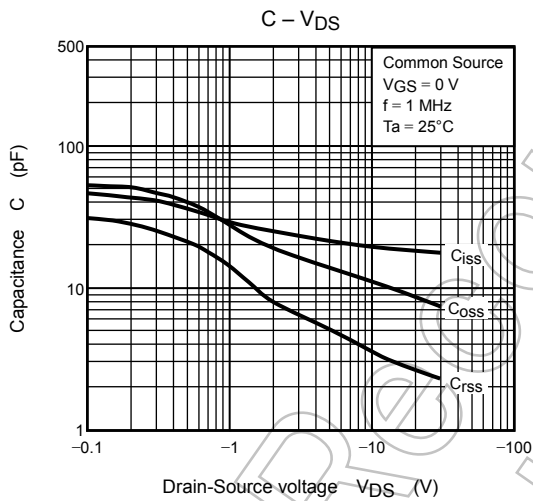
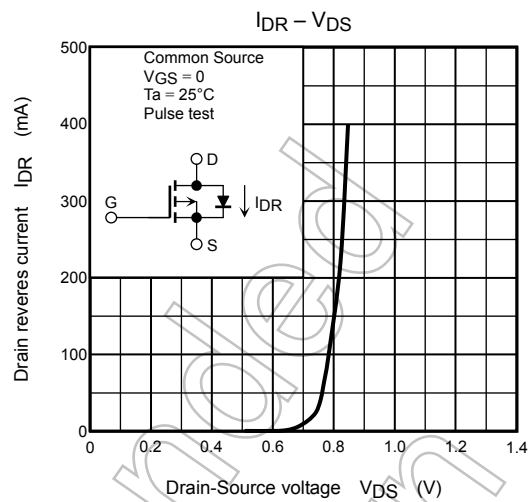
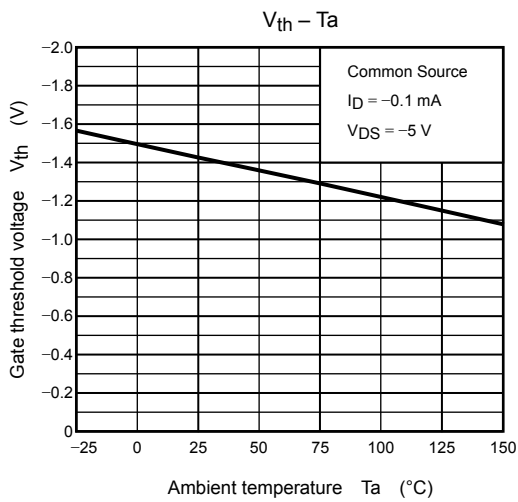
Q1 (Nch MOS FET)



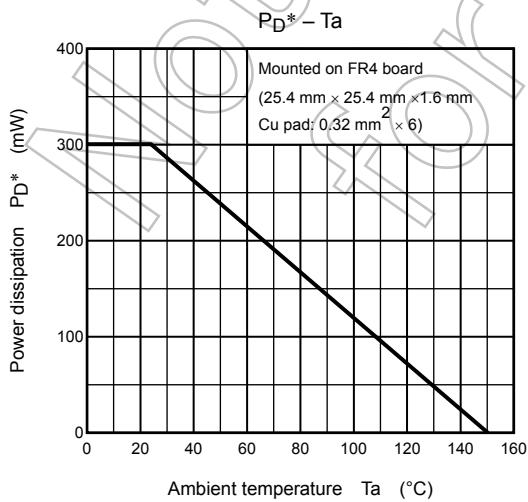
Q2 (Pch MOS FET)



Q2 (Pch MOS FET)



Common Characteristics



*: Total rating

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