

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

SSM6L09FU

Power Management Switch

High Speed Switching Applications

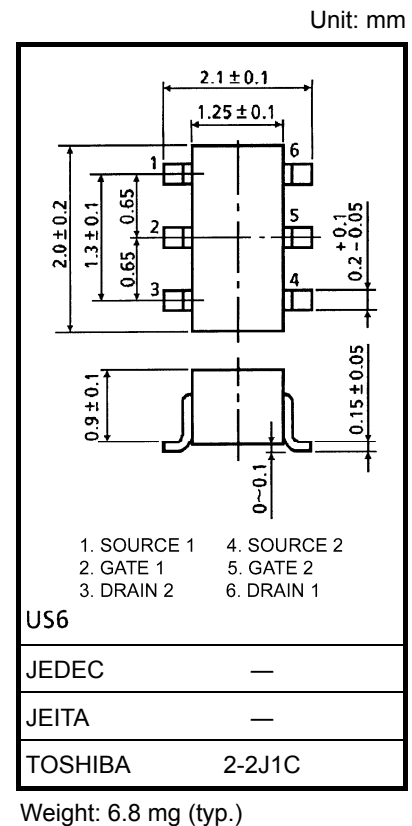
- Small package
 - Low on-resistance
- Q1: $R_{DS(ON)} = 0.7 \Omega$ (max) (@ $V_{GS} = 10 V$)
 Q2: $R_{DS(ON)} = 2.7 \Omega$ (max) (@ $V_{GS} = -10 V$)

Q1 Absolute Maximum Ratings ($T_a = 25^\circ C$)

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

Q2 Absolute Maximum Ratings ($T_a = 25^\circ C$)

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



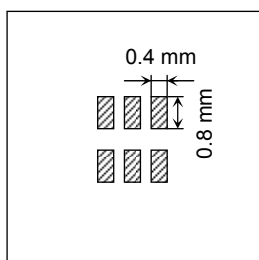
Absolute Maximum Ratings (Q1, Q2 common) ($T_a = 25^\circ C$)

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

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.

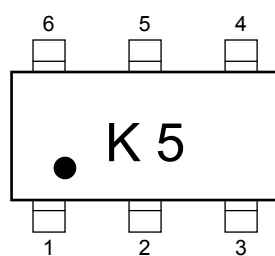
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

Note 1: Total rating, mounted on FR4 board
 (25.4 mm $\times$ 25.4 mm $\times$ 1.6 mm, Cu Pad: 0.32 mm² $\times$ 6)

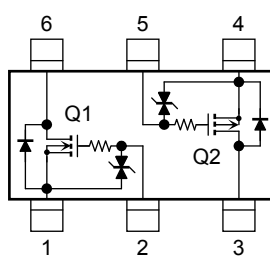


Start of commercial production
 2001-02

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.

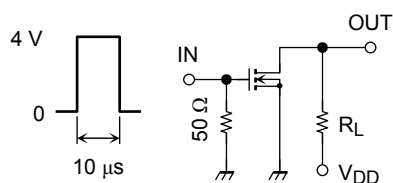
Q1 Electrical Characteristics (Ta = 25°C)

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}	$V_{DS} = 5 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$	—	20	—	pF
Reverse transfer capacitance		C_{rss}		—	7	—	pF
Output capacitance		C_{oss}		—	16	—	pF
Switching time	Turn-on time	t_{on}	$V_{DD} = 5 \text{ V}, I_D = 200 \text{ mA},$ $V_{GS} = 0 \text{ to } 4 \text{ V}$	—	72	—	ns
	Turn-off time	t_{off}		—	68	—	

Note2: Pulse test

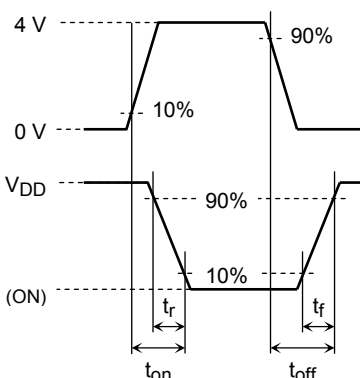
Switching Time Test Circuit

(a) Test circuit

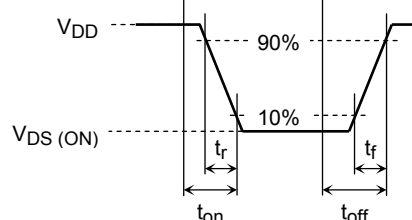


$V_{DD} = 5 \text{ V}$
Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5 \text{ ns}$
($Z_{out} = 50 \Omega$)
Common Source
 $T_a = 25^\circ\text{C}$

(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.

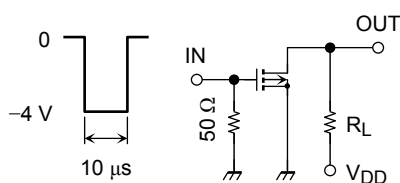
Q2 Electrical Characteristics (Ta = 25°C)

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}	$V_{DD} = -5 \text{ V}, I_D = -100 \text{ mA},$	—	85	ns
	Turn-off time	t_{off}	$V_{GS} = 0 \text{ to } -4 \text{ V}$	—	85	

Note3: Pulse test

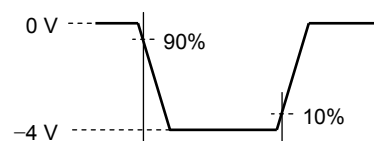
Switching Time Test Circuit

(a) Test circuit

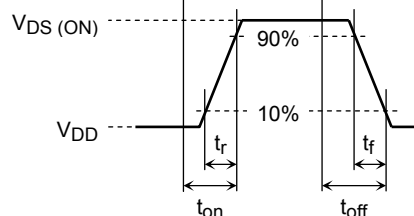


$V_{DD} = -5 \text{ V}$
 Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5 \text{ ns}$
 $(Z_{out} = 50 \Omega)$
 Common Source
 $T_a = 25^\circ\text{C}$

(b) V_{IN}



(c) V_{OUT}

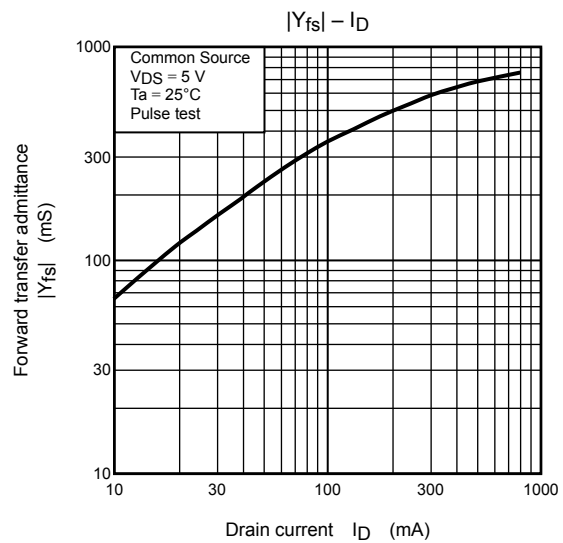
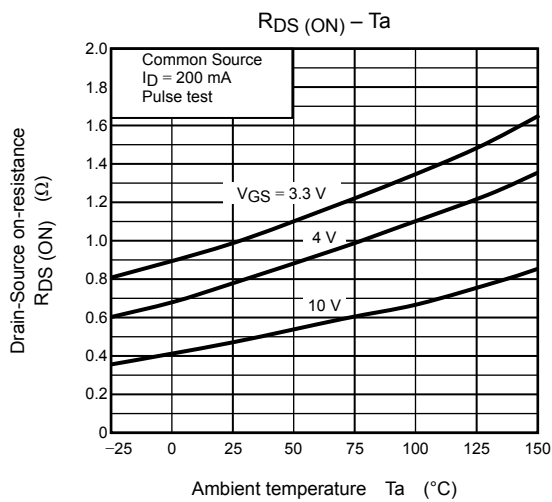
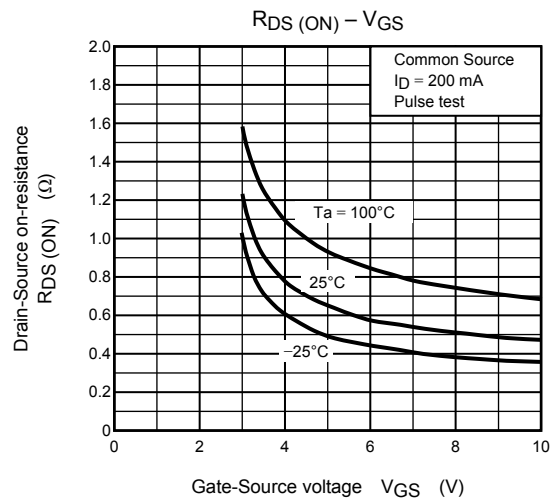
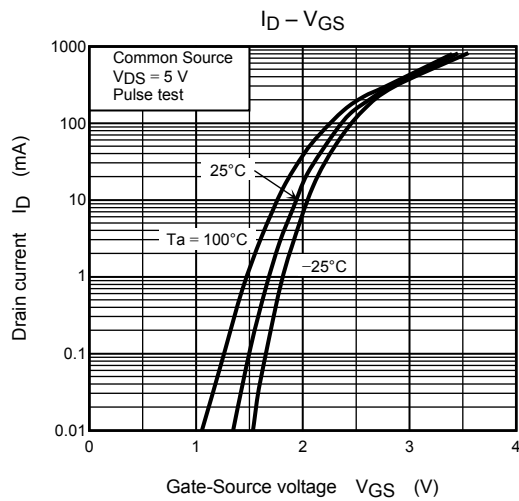
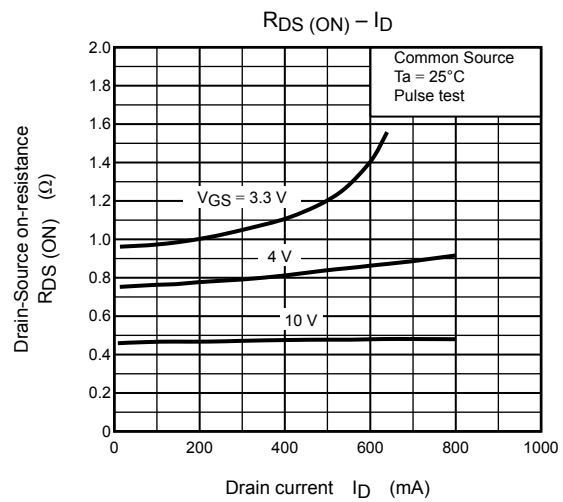
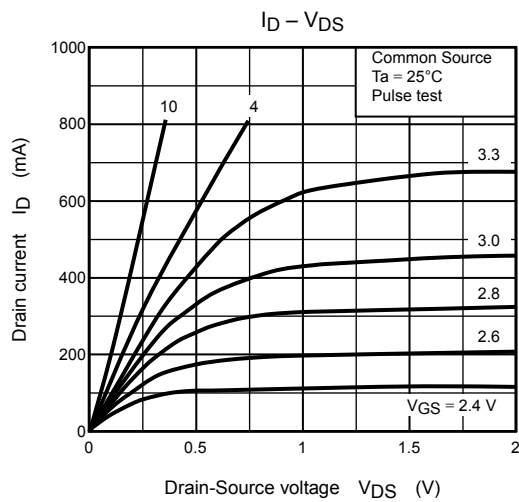


Precaution

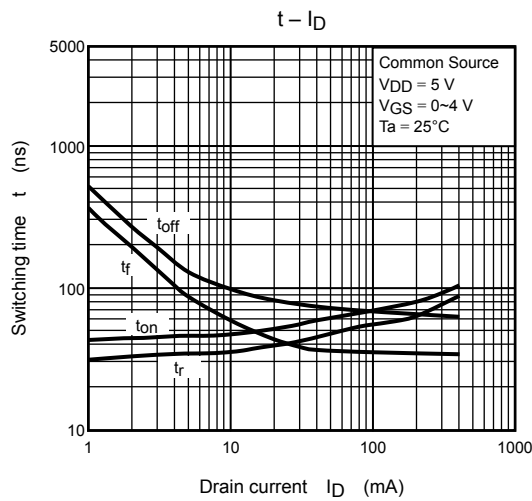
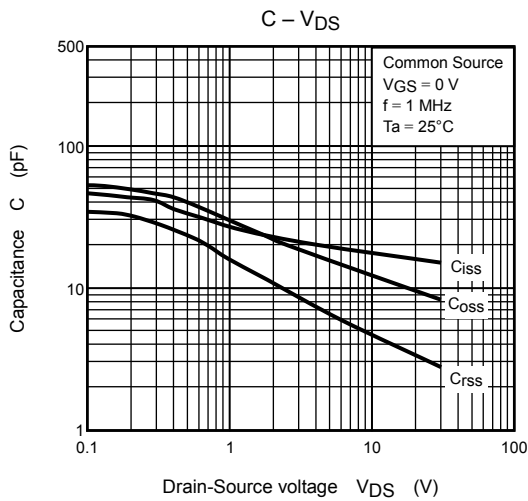
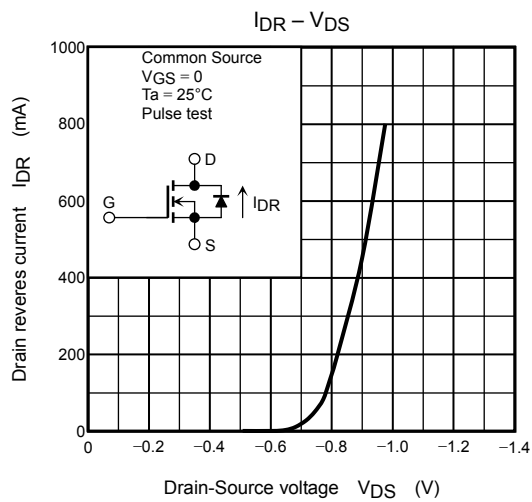
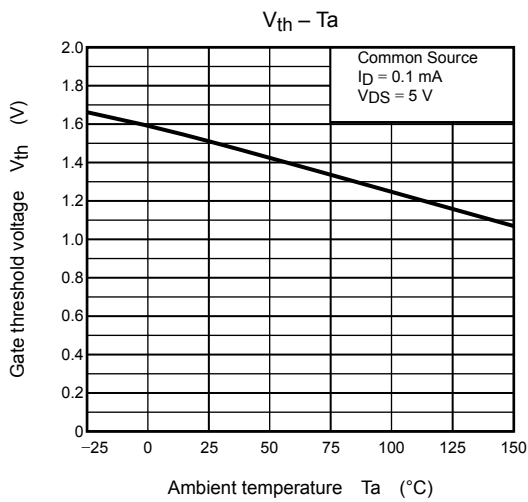
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Please take this into consideration for using the device.

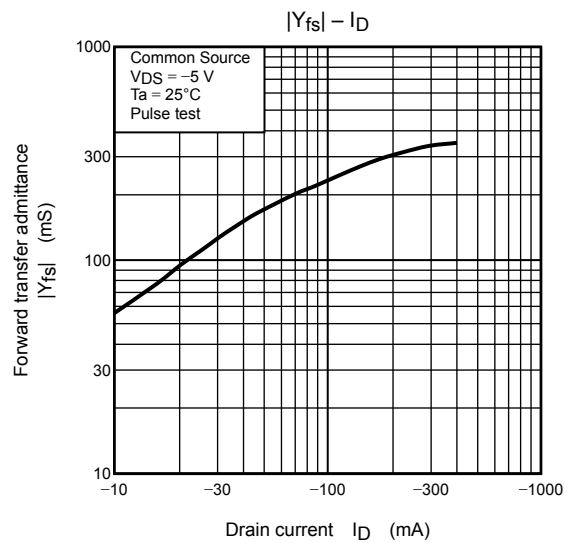
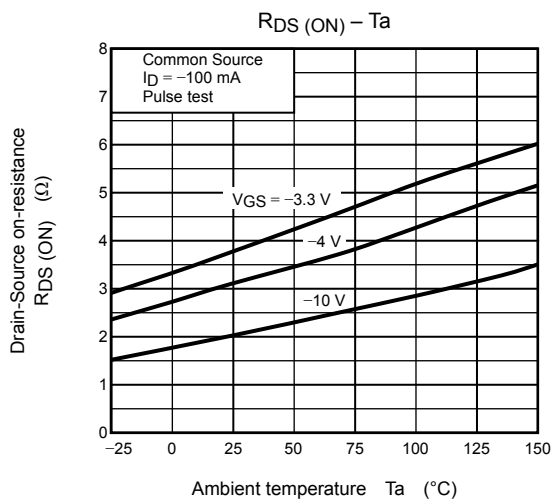
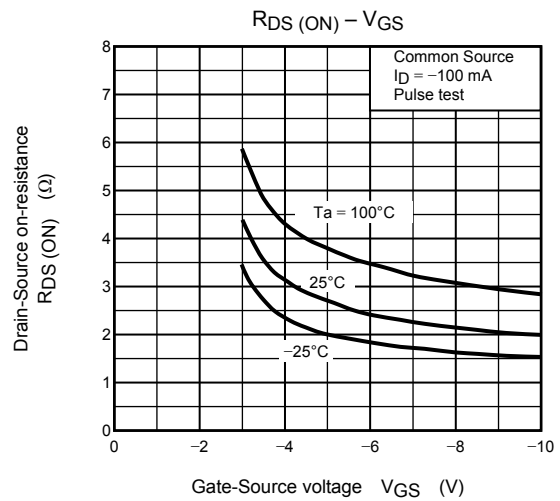
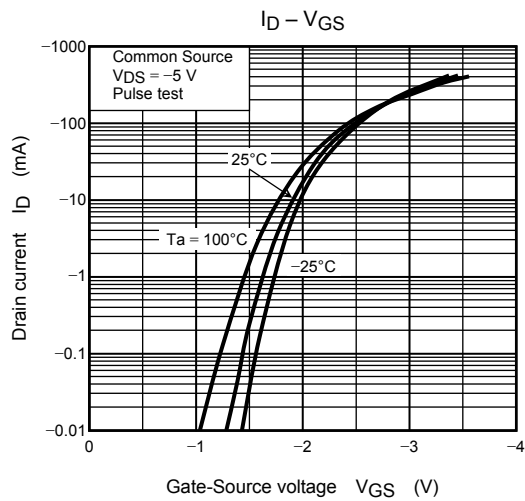
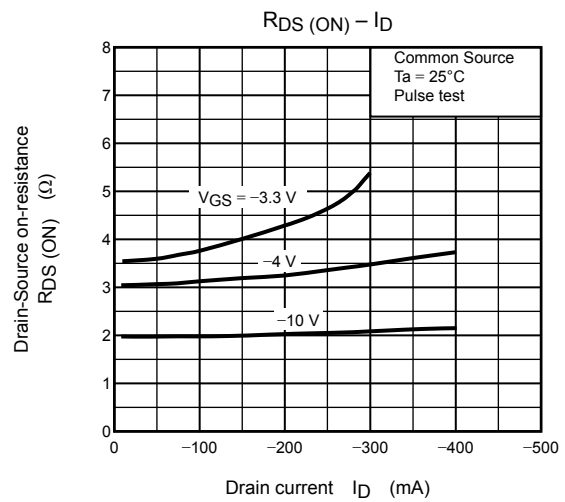
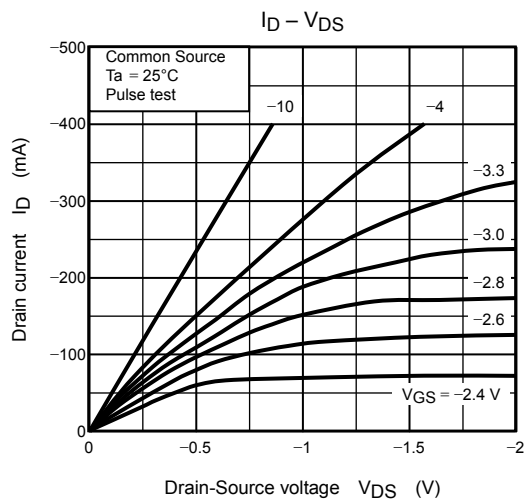
Q1 (Nch MOS FET)



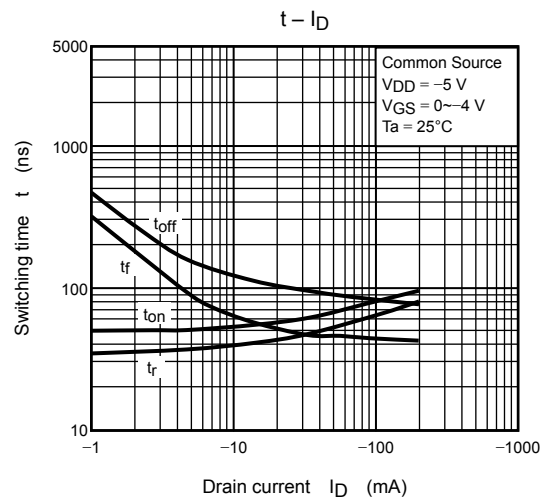
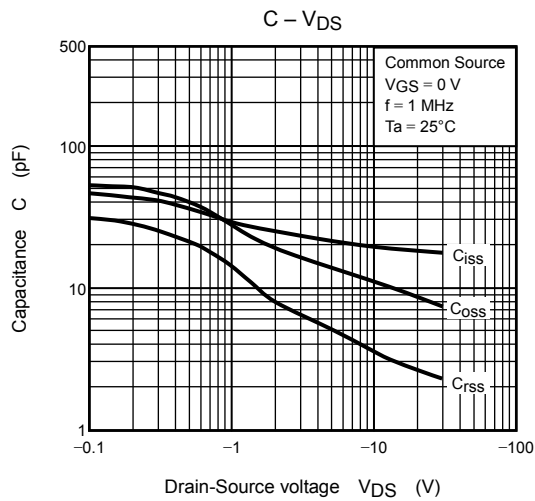
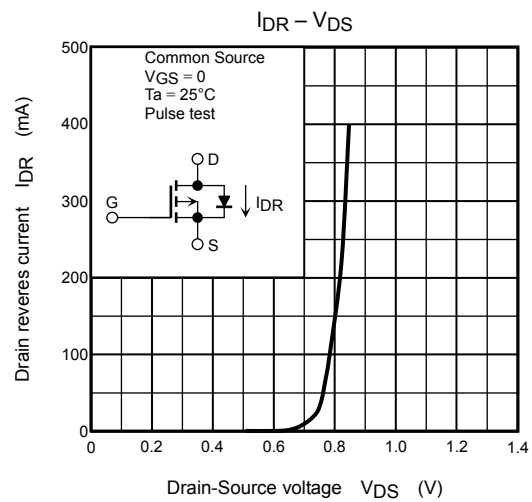
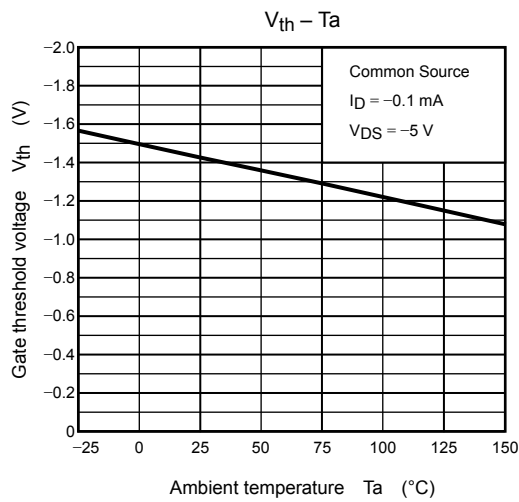
Q1 (Nch MOS FET)



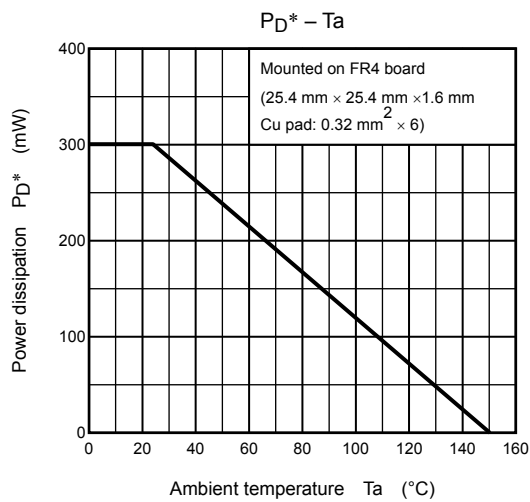
Q2 (Pch MOS FET)



Q2 (Pch MOS FET)



Common Characteristics



*: Total rating

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