

TOSHIBA Multi-Chip Device
Silicon P-Channel MOS Type + N-Channel MOS Type

SSM6E02TU

○Power Management Switch Applications

- 1.5 V drive
- P-channel MOSFET and N-channel MOSFET incorporated into one package.
- Low power dissipation due to P-channel MOSFET that features low $R_{DS(ON)}$ and low-voltage operation

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

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	-20	V
Gate-Source voltage		V_{GSS}	± 8	V
Drain current	DC	I_D	-1.8	A
	Pulse	I_{DP} (Note 1)	-3.6	

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

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	20	V
Gate-Source voltage		V_{GSS}	± 10	V
Drain current	DC	I_D	0.1	A
	Pulse	I_{DP} (Note 1)	0.2	

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

Characteristics	Symbol	Rating	Unit
Drain power dissipation	P_D (Note 2)	0.5	W
Channel temperature	T_{ch}	150	$^\circ\text{C}$
Storage temperature range	T_{stg}	-55 to 150	$^\circ\text{C}$

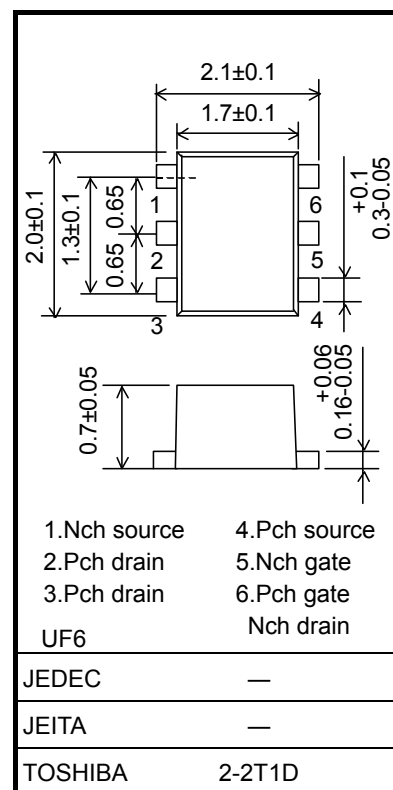
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Note 2: Mounted on an FR4 board (25.4 mm × 25.4 mm × 1.6 t, Cu pad: 645 mm²)

Unit: mm



Weight: 7.0 mg (typ.)

Q1 Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
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	—	—	-10	μA
Gate leakage current		I _{GSS}	V _{GS} = ± 8 V, V _{DS} = 0	—	—	±1	μA
Gate threshold voltage		V _{th}	V _{DS} = -3 V, I _D = -1 mA	-0.3	—	-1.0	V
Forward transfer admittance		Y _{fs}	V _{DS} = -3 V, I _D = -0.9 A (Note 3)	2.7	5.4	—	S
Drain-Source on-resistance	R _{DS (ON)}		I _D = -1.0 A, V _{GS} = -2.5 V (Note 3)	—	95	136	mΩ
			I _D = -1.0 A, V _{GS} = -1.8 V (Note 3)	—	122	204	
			I _D = -0.1 A, V _{GS} = -1.5 V (Note 3)	—	137	364	
Input capacitance		C _{iss}	V _{DS} = -10 V, V _{GS} = 0 f = 1 MHz	—	568	—	pF
Output capacitance		C _{oss}		—	75	—	
Reverse transfer capacitance		C _{rss}		—	67	—	
Switching time	Turn-on time	t _{on}	V _{DD} = -10 V, I _D = -0.9 A	—	29	—	ns
	Turn-off time	t _{off}	V _{GS} = 0 to -2.5 V, R _G = 4.7 Ω	—	39	—	
Total gate charge		Q _g	V _{DS} = -16 V, I _{DS} = -1.8 A, V _{GS} = -4 V	—	10.6	—	nC
Gate-Source charge		Q _{gs}		—	7.4	—	
Gate-Drain charge		Q _{gd}		—	3.3	—	
Drain-Source forward voltage		V _{DSF}	I _D = 1.8 A, V _{GS} = 0 (Note 3)	—	0.8	1.2	V

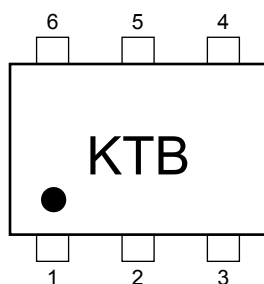
Note 3: Pulse test

Q2 Electrical Characteristics (Ta = 25°C)

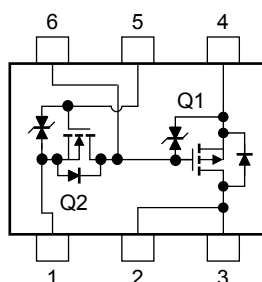
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain-Source breakdown voltage		V (BR) DSS	I _D = 0.1 mA, V _{GS} = 0	20	—	—	V
Drain cut-off current		I _{DSS}	V _{DS} = 20 V, V _{GS} = 0	—	—	1	μA
Gate leakage current		I _{GSS}	V _{GS} = ±10 V, V _{DS} = 0	—	—	±1	μA
Gate threshold voltage		V _{th}	V _{DS} = 3 V, I _D = 0.1 mA	0.6	—	1.1	V
Forward transfer admittance		Y _{fs}	V _{DS} = 3 V, I _D = 10 mA (Note 3)	40	—	—	mS
Drain-Source on-resistance	R _{DS (ON)}		I _D = 10 mA, V _{GS} = 4 V (Note 3)	—	1.5	3.0	Ω
			I _D = 10 mA, V _{GS} = 2.5 V (Note 3)	—	2.2	4.0	
			I _D = 1 mA, V _{GS} = 1.5 V (Note 3)	—	5.2	15	
Input capacitance		C _{iss}	V _{DS} = 3 V, V _{GS} = 0 f = 1 MHz	—	9.3	—	pF
Output capacitance		C _{oss}		—	9.8	—	
Reverse transfer capacitance		C _{rss}		—	4.5	—	
Switching time	Turn-on time	t _{on}	V _{DD} = 3 V, I _D = 10 mA	—	70	—	ns
	Turn-off time	t _{off}	V _{GS} = 0 to 2.5 V, R _G = 50 Ω	—	125	—	

Note 3: Pulse test

Marking



Equivalent Circuit (top view)



Precaution

V_{th} can be expressed as the voltage between the gate and source when the low operating current value is $I_D = -1\text{mA}$ 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: $V_{GS(off)} < V_{th} < V_{GS(on)}$.)

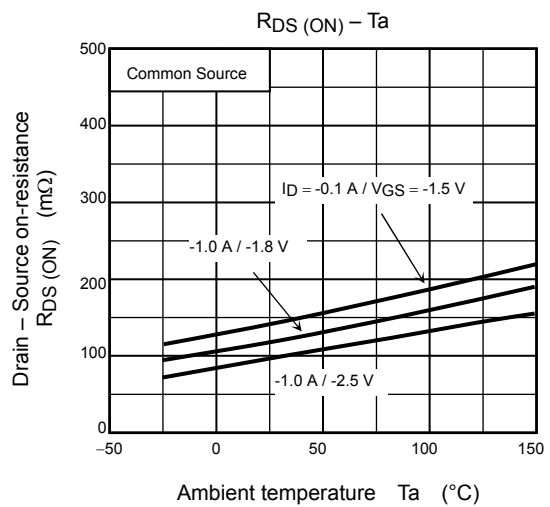
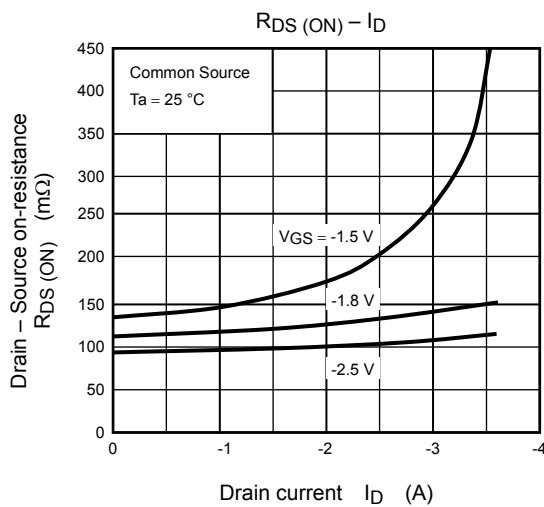
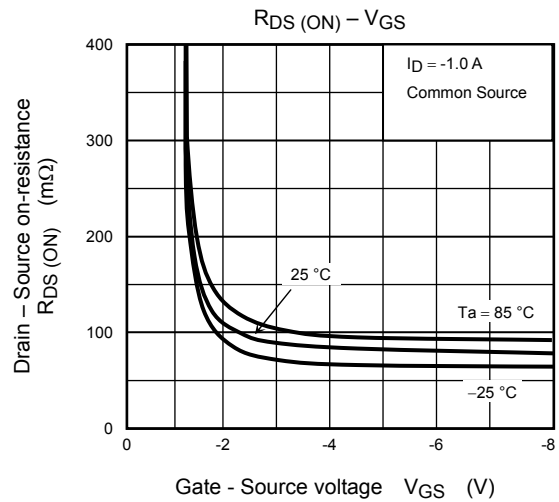
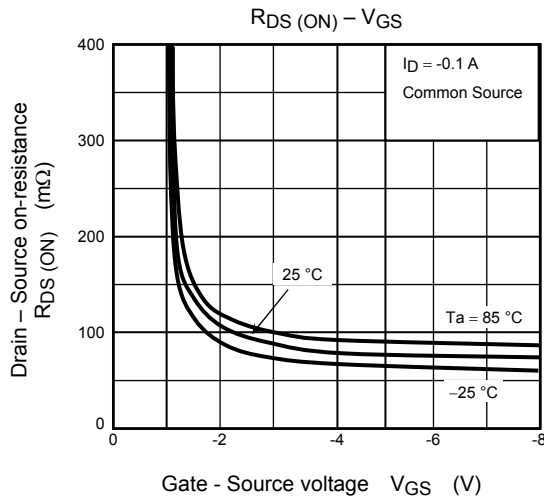
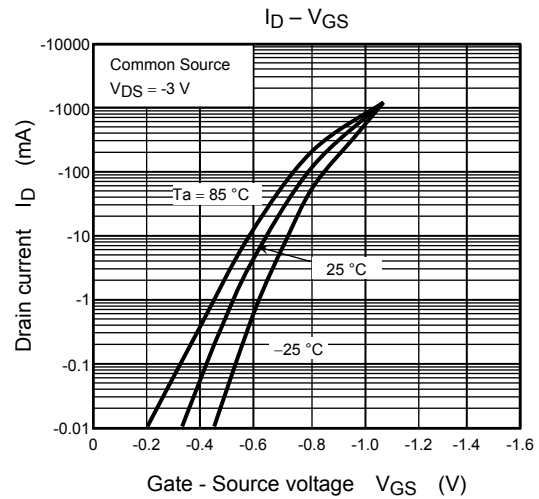
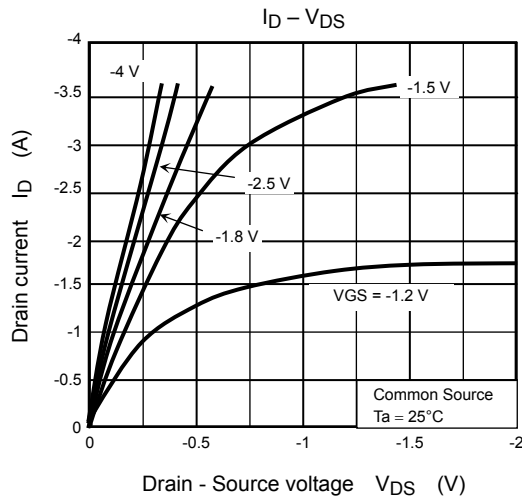
Be sure to take this into consideration when using the device.

Handling Precaution

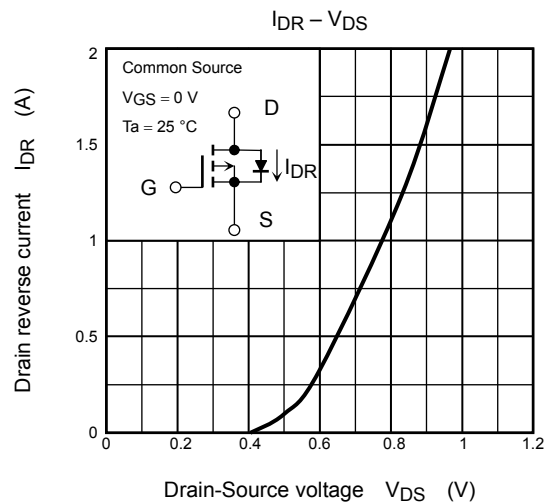
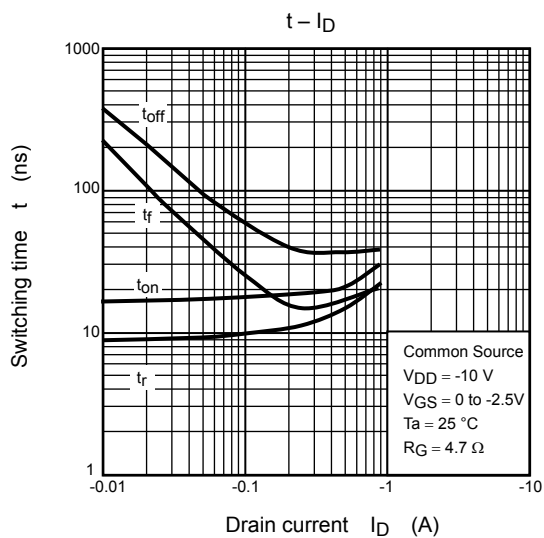
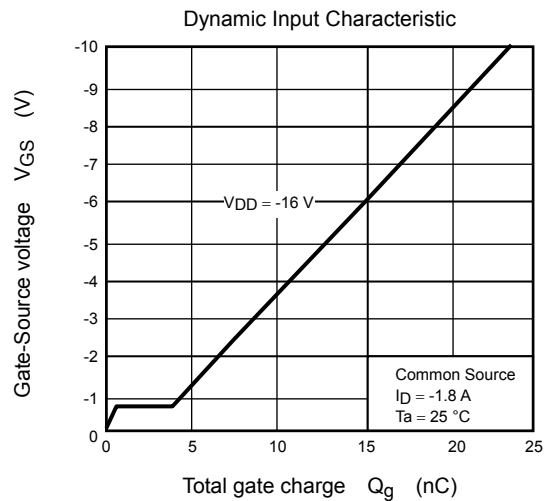
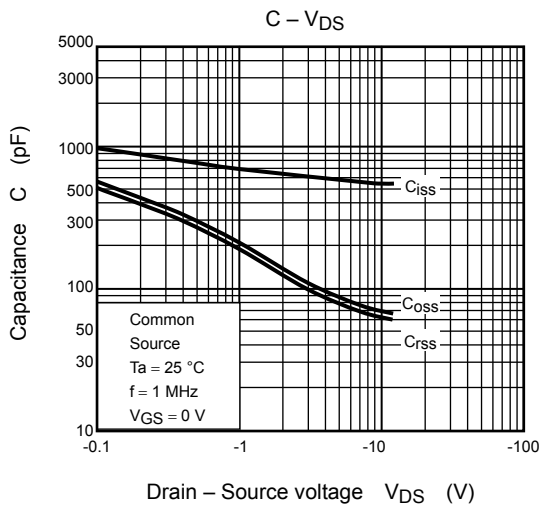
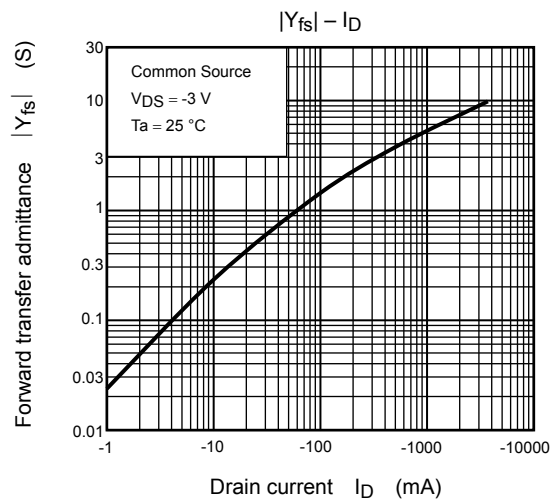
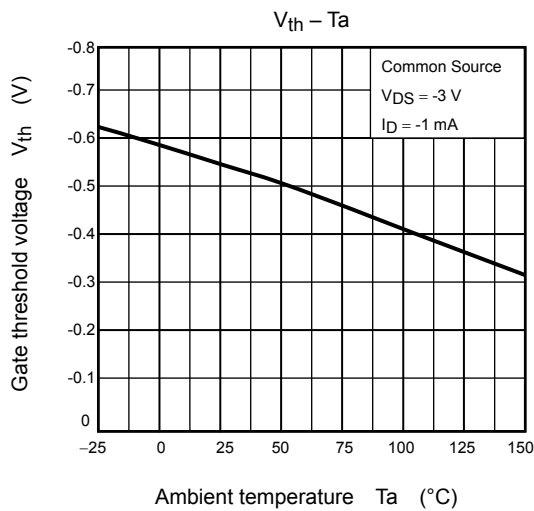
When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against static electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static materials.

Thermal resistance $R_{th(j-a)}$ and drain 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.

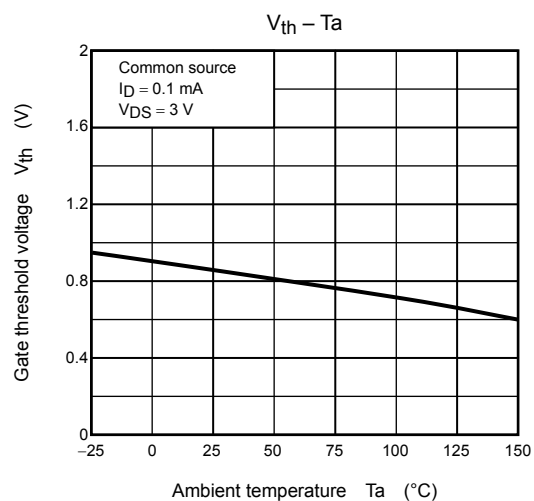
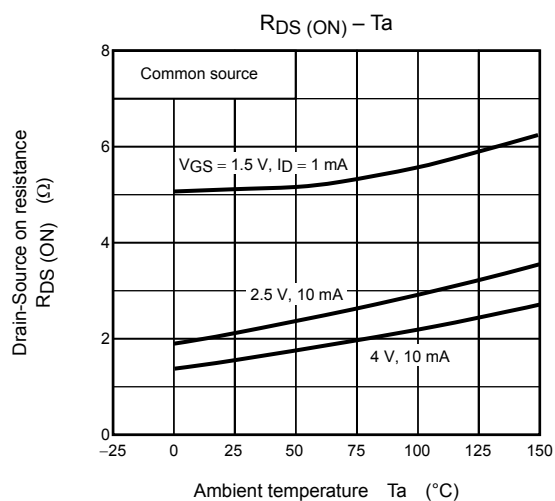
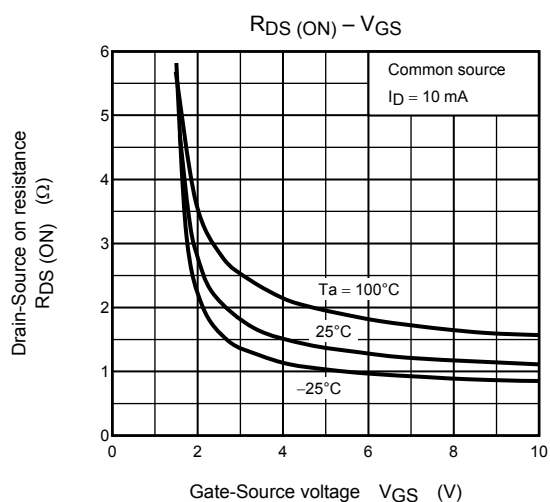
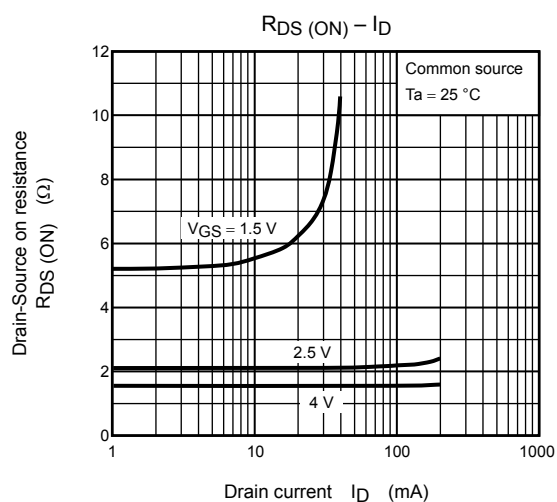
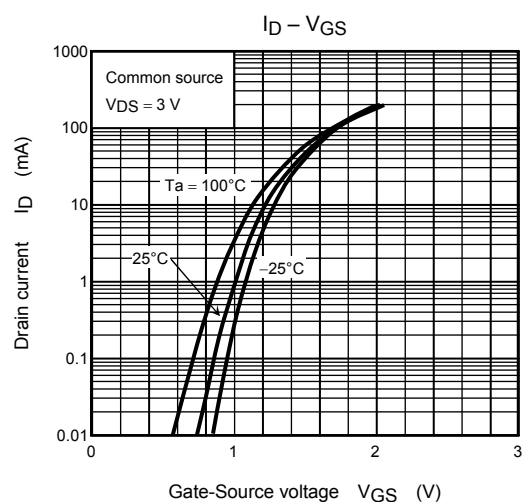
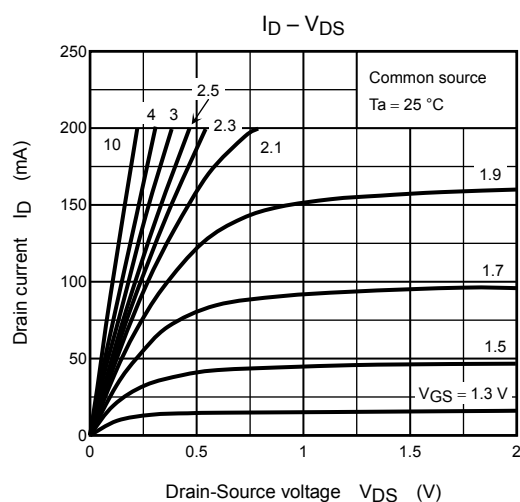
Q1 (Pch MOSFET)



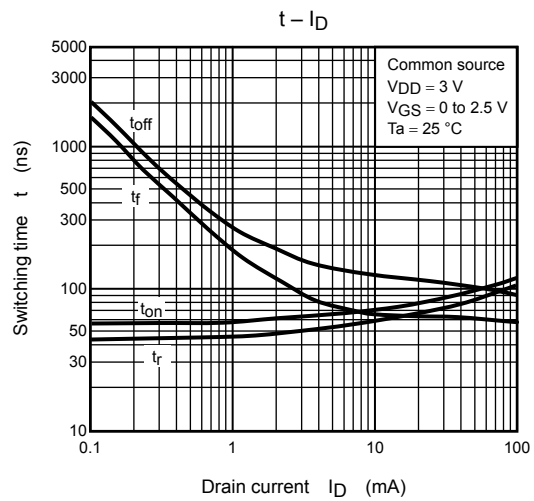
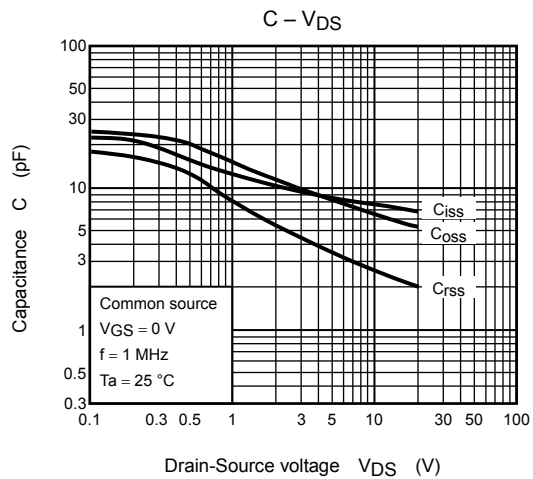
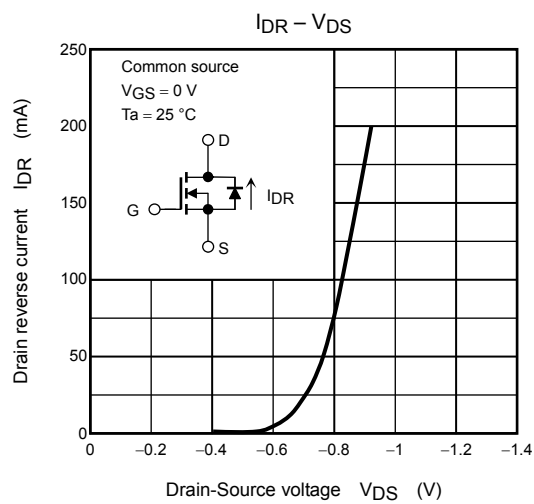
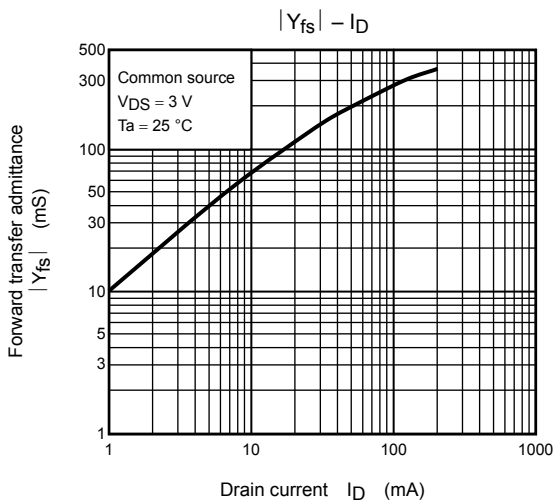
Q1 (Pch MOSFET)



Q2 (Nch MOSFET)



Q2 (Nch MOSFET)



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