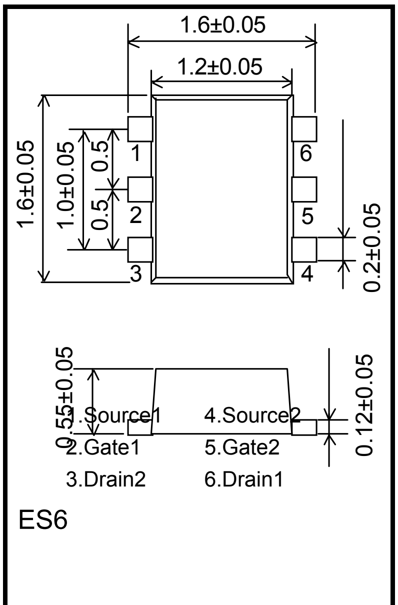
TOSHIBA Field-Effect Transistor Silicon N / P Channel MOS Type

SSM6L36FE

○ High-Speed Switching Applications

Unit: mm



JEDEC	-
JEITA	-
TOSHIBA	2-2N1D

Weight: 3.0 mg (typ.)

- 1.5-V drive
- Low ON-resistance Q1 Nch: R_{on} = 1.52Ω (max) (@V_{GS} = 1.5 V)
  R_{on} = 1.14Ω (max) (@V_{GS} = 1.8 V)
  R_{on} = 0.85Ω (max) (@V_{GS} = 2.5 V)
  R_{on} = 0.66Ω (max) (@V_{GS} = 4.5 V)
  R_{on} = 0.63Ω (max) (@V_{GS} = 5.0 V)
- Q2 Pch: R_{on} = 3.60Ω (max) (@V_{GS} = -1.5 V)
  R_{on} = 2.70Ω (max) (@V_{GS} = -1.8 V)
  R_{on} = 1.60Ω (max) (@V_{GS} = -2.8 V)
  R_{on} = 1.31Ω (max) (@V_{GS} = -4.5 V)

Q1 Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain–source voltage		V_{DSS}	20	V
Gate–source voltage		V_{GSS}	±10	V
Drain current	DC	I_D	500	mA
	Pulse	I_{DP}	1000	

Q2 Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain–source voltage		V_{DSS}	-20	V
Gate–source voltage		V_{GSS}	±8	V
Drain current	DC	I_D	-330	mA
	Pulse	I_{DP}	-660	

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

Characteristics	Symbol	Rating	Unit
Drain 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 an FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.135 mm^2 × 6)

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} = 0V	20	—	—	V
		$V_{(BR)\ DSX}$	I_D = 1 mA, V_{GS} = - 10 V	12	—	—	
Drain cutoff current		I_{DSS}	V_{DS} =20 V, V_{GS} = 0V	—	—	1	μA
Gate leakage current		I_{GSS}	V_{GS} = ±10 V, V_{DS} = 0V	—	—	±1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 1 mA	0.35	—	1.0	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 200 mA (Note2)	420	840	—	mS
Drain-source ON-resistance		$R_{DS\ (ON)}$	I_D = 200 mA, V_{GS} = 5.0 V (Note2)	—	0.46	0.63	Ω
			I_D = 200 mA, V_{GS} = 4.5 V (Note2)	—	0.51	0.66	
			I_D = 200 mA, V_{GS} = 2.5 V (Note2)	—	0.66	0.85	
			I_D = 100 mA, V_{GS} = 1.8 V (Note2)	—	0.81	1.14	
			I_D = 50 mA, V_{GS} = 1.5 V (Note2)	—	0.95	1.52	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0V, f = 1 MHz	—	46	—	pF
Output capacitance		C_{oss}		—	10.8	—	
Reverse transfer capacitance		C_{rss}		—	7.3	—	
Total Gate Charge		Q_g	V_{DS} = 10V, I_D = 0.5 A V_{GS} = 4.0 V	—	1.23	—	nC
Gate–Source Charge		Q_{gs}		—	0.60	—	
Gate–Drain Charge		Q_{gd}		—	0.63	—	
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 200 mA V_{GS} = 0 to 2.5 V, R_G = 50 Ω	—	30	—	ns
	Turn-off time	t_{off}		—	75	—	
Drain-source forward voltage		V_{DSF}	I_D = -0.5 A, V_{GS} = 0 V (Note2)	—	-0.88	-1.2	V

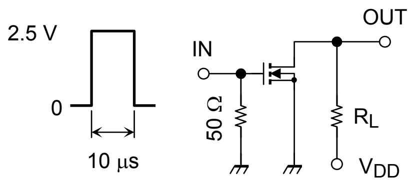
Q2 Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Conditions	Min	Typ.	Max	Unit
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = -1 mA, V_{GS} = 0 V	-20	—	—	V
		$V_{(BR)\ DSX}$	I_D = -1 mA, V_{GS} = 8 V	-12	—	—	
Drain cutoff current		I_{DSS}	V_{DS} = -16 V, V_{GS} = 0 V	—	—	-10	μA
Gate leakage current		I_{GSS}	V_{GS} = ±8 V, V_{DS} = 0 V	—	—	±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 = -100mA (Note2)	190	—	—	mS
Drain-source ON-resistance		$R_{DS\ (ON)}$	I_D = -100mA, V_{GS} = -4.5 V (Note2)	—	0.95	1.31	Ω
			I_D = -80mA, V_{GS} = -2.8 V (Note2)	—	1.22	1.60	
			I_D = -40mA, V_{GS} = -1.8 V (Note2)	—	1.80	2.70	
			I_D = -30mA, V_{GS} = -1.5 V (Note2)	—	2.23	3.60	
Input capacitance		C_{iss}	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz	—	43	—	pF
Output capacitance		C_{oss}		—	10.3	—	
Reverse transfer capacitance		C_{rss}		—	6.1	—	
Total Gate Charge		Q_g	V_{DS} = -10 V, I_{DS}= -330mA V_{GS} = -4 V	—	1.2	—	nC
Gate–Source Charge		Q_{gs}		—	0.85	—	
Gate–Drain Charge		Q_{gd}		—	0.35	—	
Switching time	Turn-on time	t_{on}	V_{DD} = -10 V, I_D = -100mA V_{GS} = 0 to -2.5 V, R_G = 50Ω	—	90	—	ns
	Turn-off time	t_{off}		—	200	—	
Drain-source forward voltage		V_{DSF}	I_D =330mA, V_{GS} = 0 V (Note2)	—	0.88	1.2	V

Note 2: Pulse test

Q1 Switching Time Test Circuit

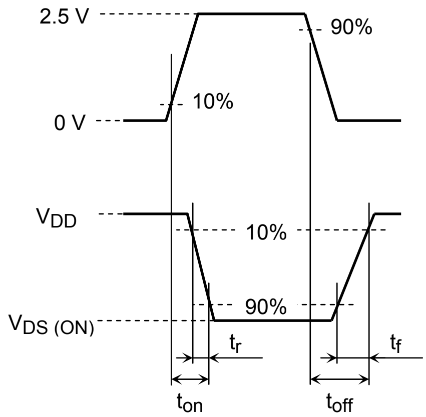
(a) Test Circuit



V_{DD} = 10 V
D.U. ≤ 1%
V_{IN}: t_r, t_f < 5 ns
(Z_{out} = 50 Ω)
Common Source
Ta = 25°C

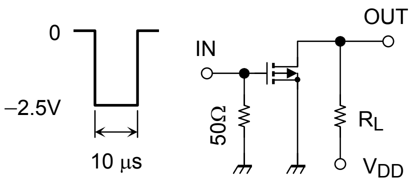
(b) V_{IN}

(c) V_{OUT}



Q2 Switching Time Test Circuit

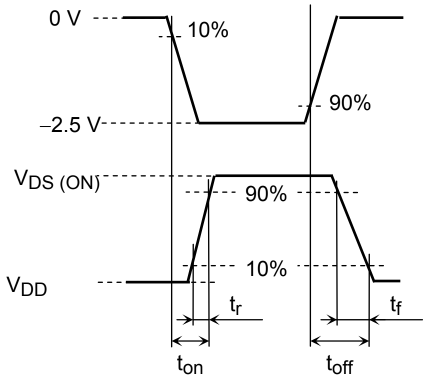
(a) Test Circuit



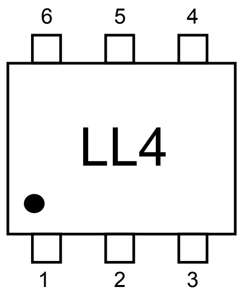
V_{DD} = -10 V
D.U. ≤ 1%
V_{IN}: t_r, t_f < 5 ns
(Z_{out} = 50 Ω)
Common Source
Ta = 25°C

(b) V_{IN}

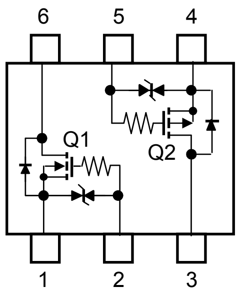
(c) V_{OUT}



Marking



Equivalent Circuit (top view)



Q1 Usage Considerations

Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to below (1 mA for the Q1 of the SSM6L36FE). Then, for normal switching operation, $V_{GS(on)}$ must be higher than $V_{th,}$ and $V_{GS(off)}$ must be lower than $V_{th.}$ This relationship can be expressed as: $V_{GS(off)} < V_{th} < V_{GS(on).}$

Take this into consideration when using the device.

Q2 Usage Considerations

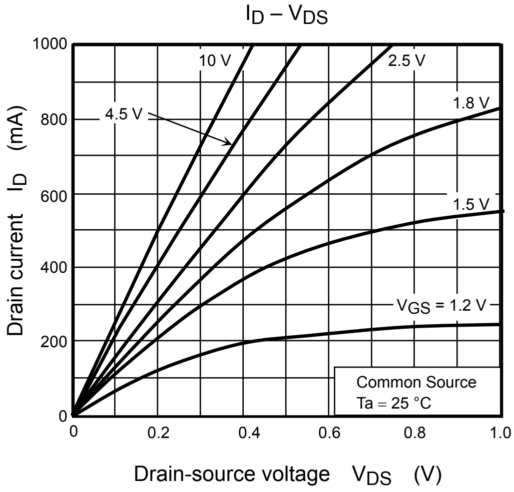
Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to below (−1 mA for the Q2 of the SSM6L36FE). Then, for normal switching operation, $V_{GS(on)}$ must be higher than $V_{th,}$ and $V_{GS(off)}$ must be lower than $V_{th.}$ This relationship can be expressed as: $V_{GS(off)} < V_{th} < V_{GS(on).}$

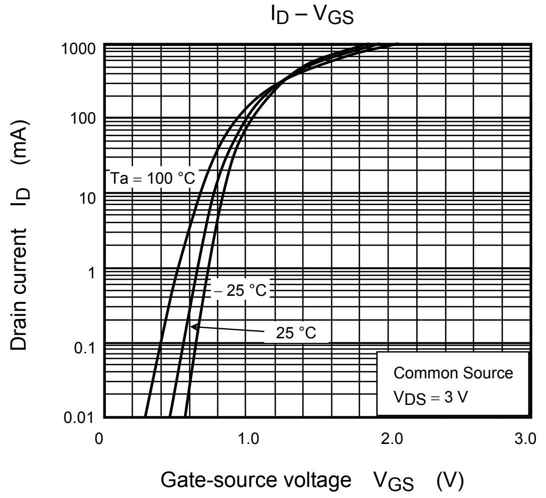
Take this into consideration when using the device.

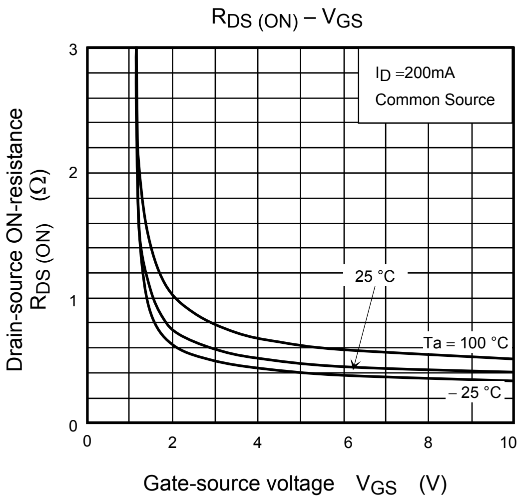
Handling Precaution

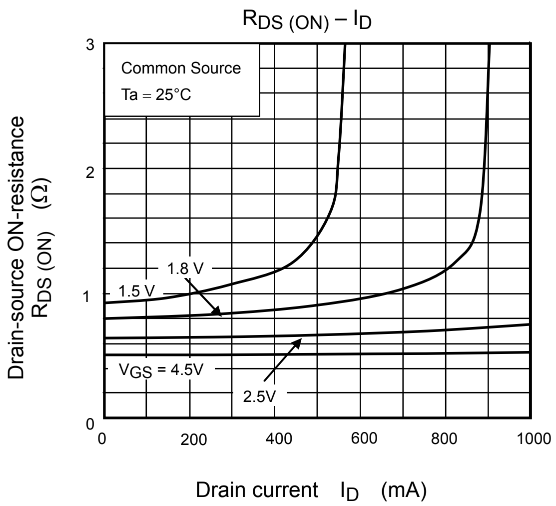
When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

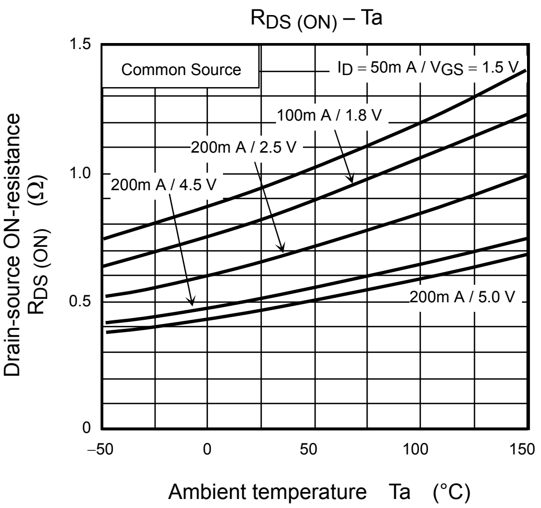
Q1 (N-ch MOSFET)

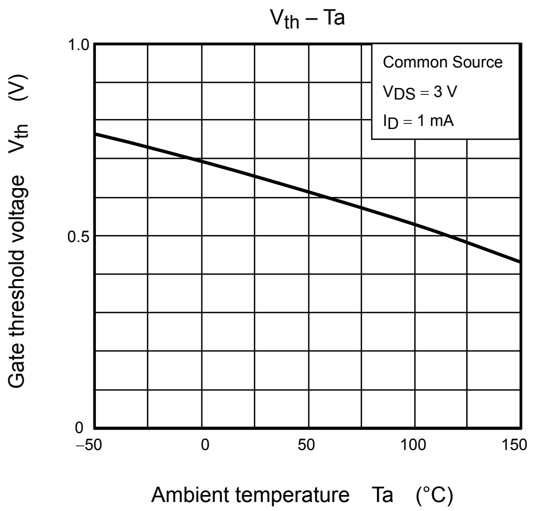




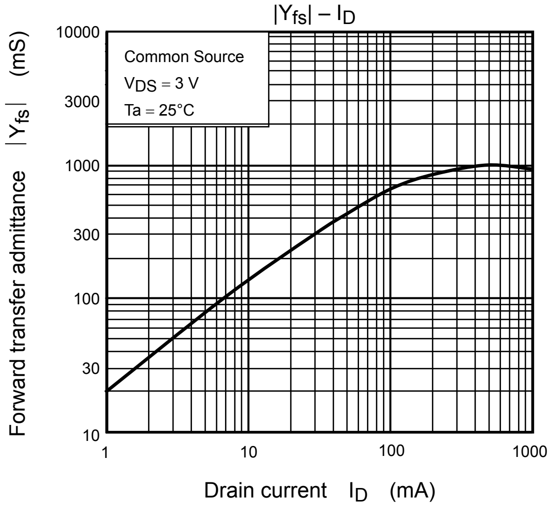


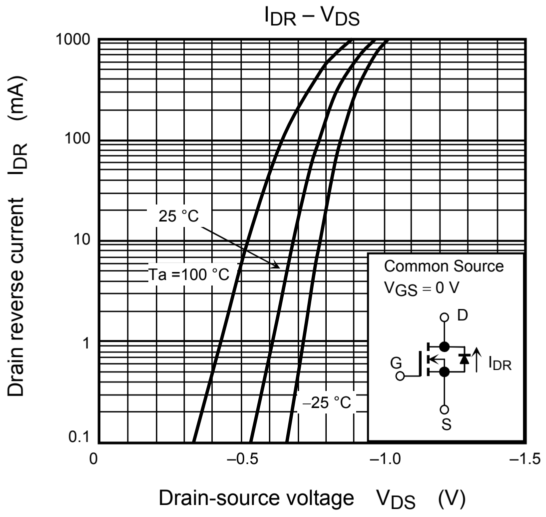


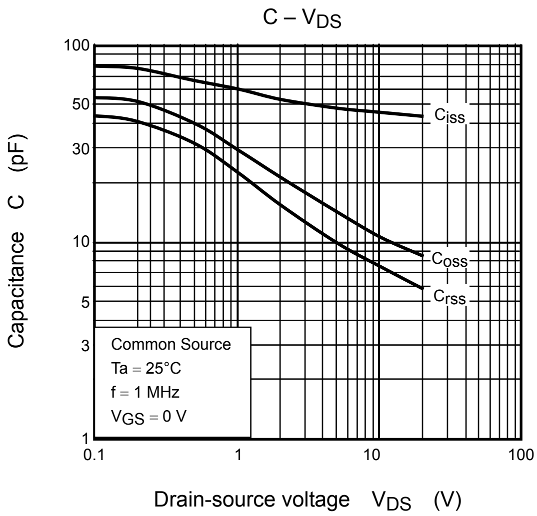


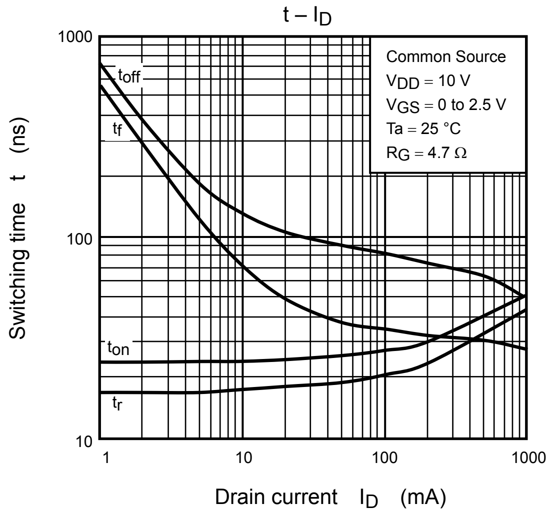


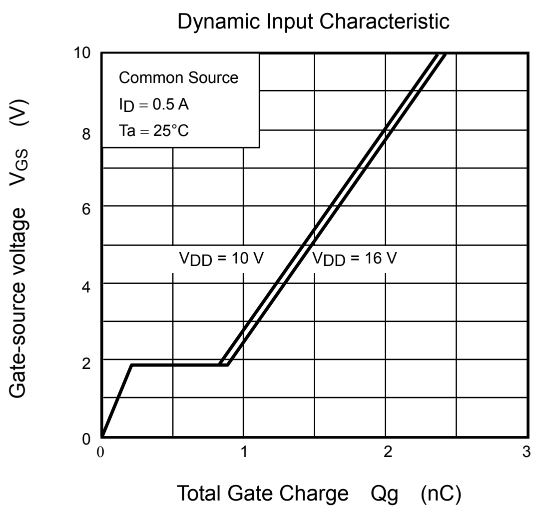
Q1 (N-ch MOSFET)



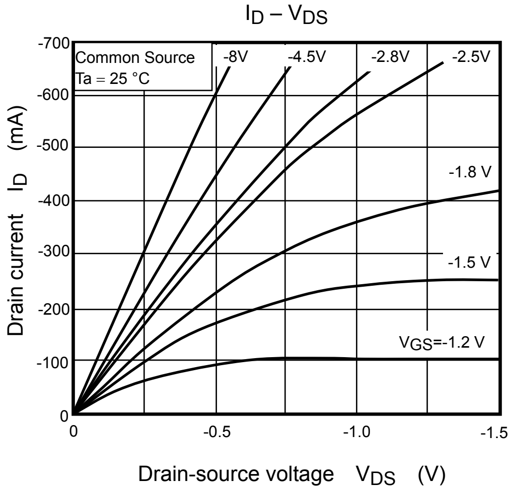


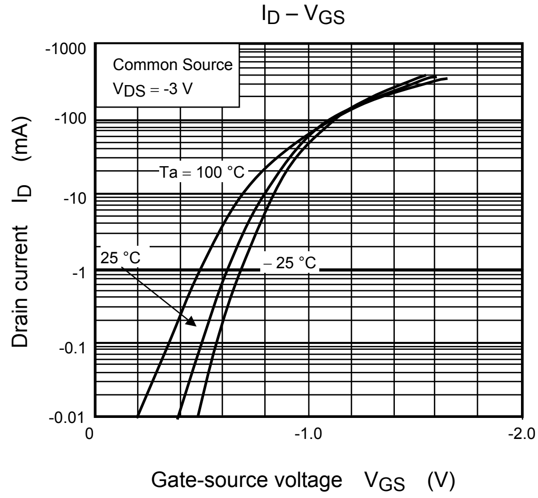


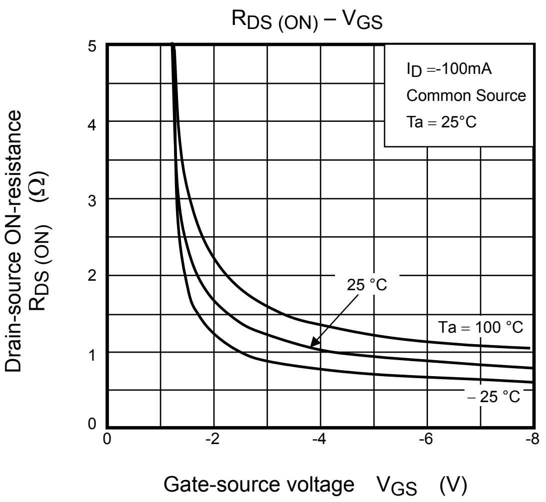


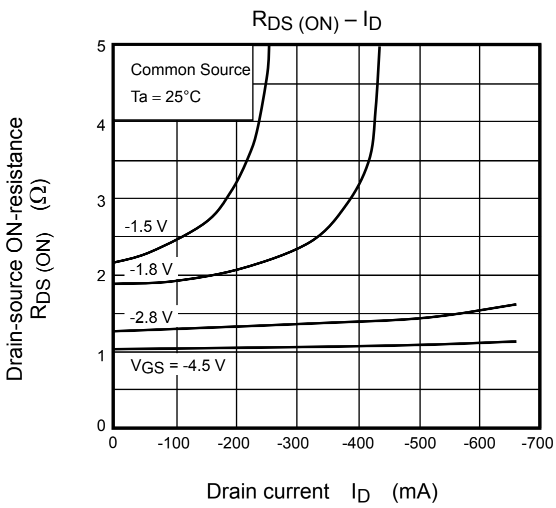


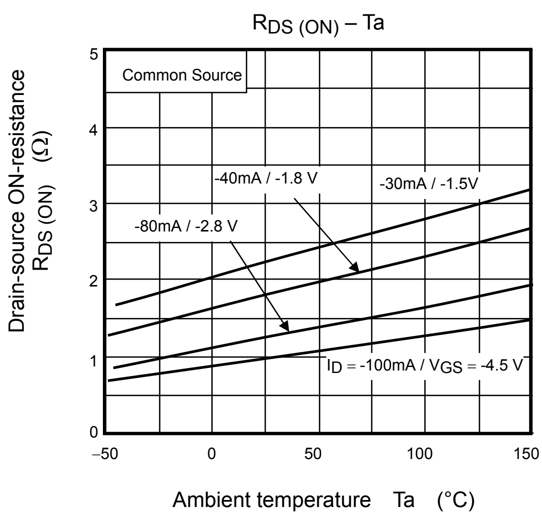
Q2 (P-ch MOSFET)

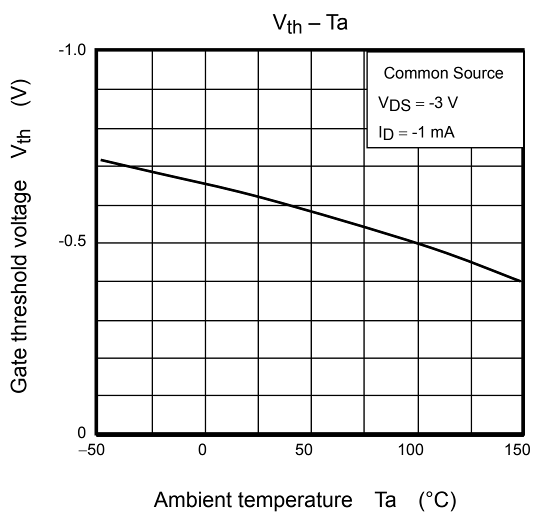




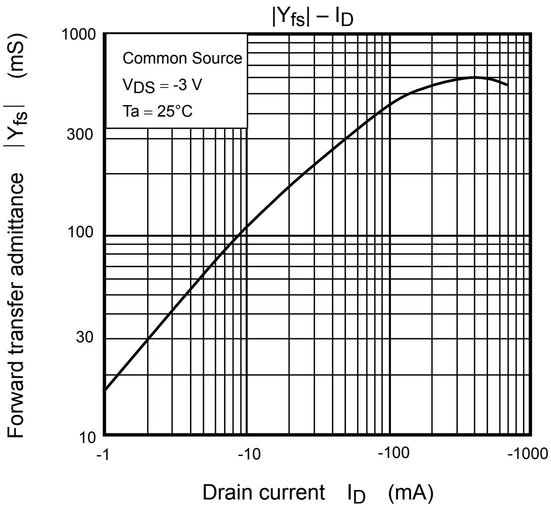


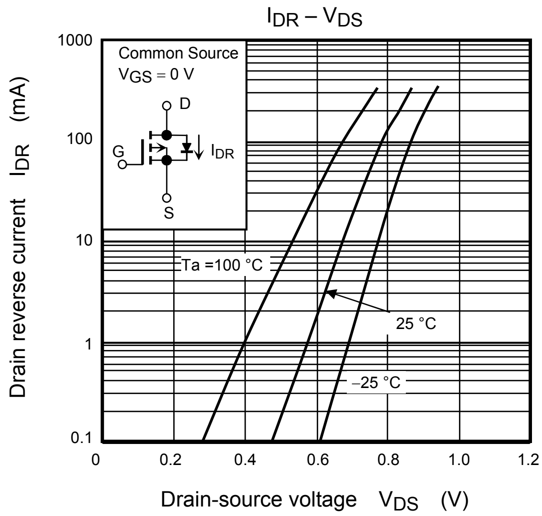


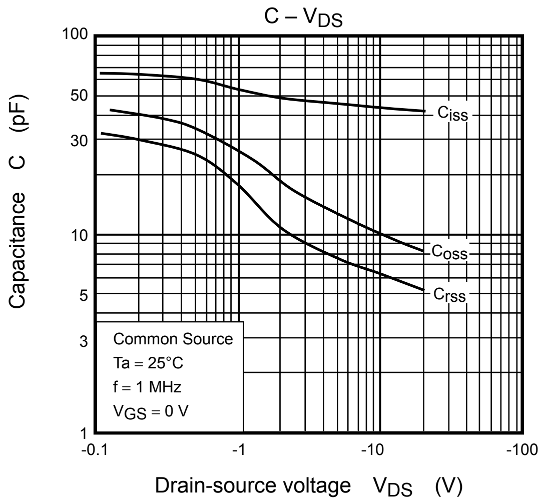


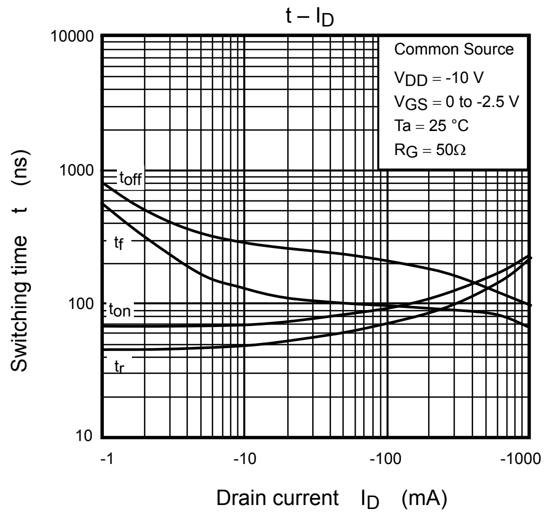


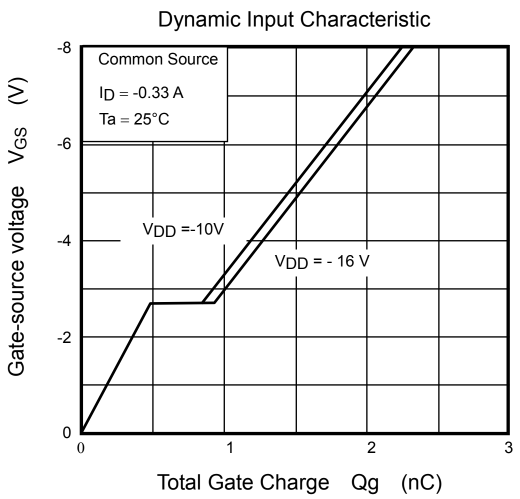
Q2 (P-ch MOSFET)



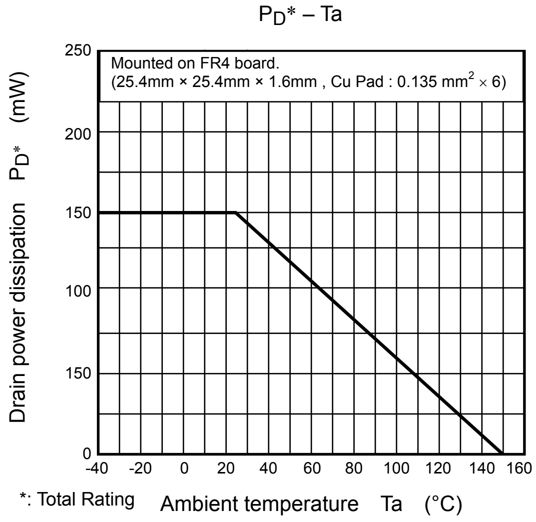








Q1, Q2 Common


PD* – Ta
Mounted on FR4 board.
(25.4mm × 25.4mm × 1.6mm , Cu Pad : 0.135 mm2 × 6)
Drain power dissipation PD* (mW)
250
200
150
100
150
0
-40
-20
0
20
40
60
80
100
120
140
160
Ambient temperature Ta (°C)
*: Total Rating

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