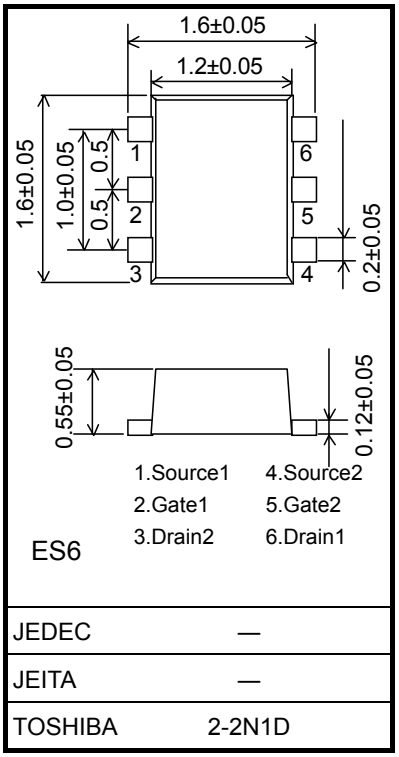
TOSHIBA Field Effect Transistor Silicon P Channel MOS Type(U-MOS-V)

SSM6P41FE

○ Power Management Switches

- 1.5-V drive
- Low on-resistance : $R_{DS(ON)}$ = 1.04 Ω (max) (@V_{GS} = -1.5 V)
  : $R_{DS(ON)}$ = 0.67 Ω (max) (@V_{GS} = -1.8 V)
  : $R_{DS(ON)}$ = 0.44 Ω (max) (@V_{GS} = -2.5 V)
  : $R_{DS(ON)}$ = 0.30 Ω (max) (@V_{GS} = -4.5 V)

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	2-2N1D

Weight: 3.0 mg (typ.)

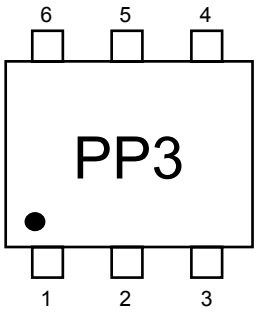
Absolute Maximum Ratings (Ta = 25 °C) (Q1, Q2 Common)

Characteristic		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	-20	V
Gate-source voltage		V_{GSS}	±8	V
Drain current	DC	I_D	-720	mA
	Pulse	I_{DP}	-1440	
Power dissipation		P_D (Note1)	150	mW
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

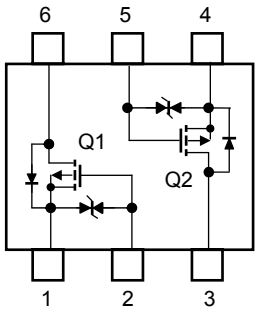
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Marking



Equivalent Circuit (top view)



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.

Start of commercial production
2009-04

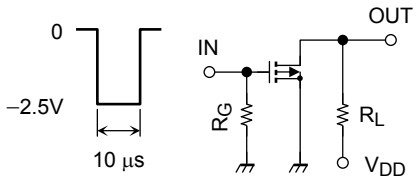
Electrical Characteristics (Ta = 25°C) (Q1, Q2 Common)

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} = -20 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 = -400 mA (Note2)	850	—	—	mS
Drain-source on-resistance		$R_{DS\ (ON)}$	I_D = -400 mA, V_{GS} = -4.5 V (Note2)	—	0.25	0.30	Ω
			I_D = -200 mA, V_{GS} = -2.5 V (Note2)	—	0.34	0.44	
			I_D = -100 mA, V_{GS} = -1.8 V (Note2)	—	0.44	0.67	
			I_D = -50 mA, V_{GS} = -1.5 V (Note2)	—	0.55	1.04	
Input capacitance		C_{iss}	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz	—	110	—	pF
Output capacitance		C_{oss}		—	28	—	
Reverse transfer capacitance		C_{rss}		—	20	—	
Total Gate Charge		Q_g	V_{DD} = -10 V, I_D= -720 mA V_{GS} = -4.5 V	—	1.76	—	nC
Gate−Source Charge		Q_{gs}		—	1.22	—	
Gate−Drain Charge		Q_{gd}		—	0.54	—	
Switching time	Turn-on time	t_{on}	V_{DD} = -10 V, I_D = -100 mA V_{GS} = 0 to -2.5 V, R_G = 50 Ω	—	11	—	ns
	Turn-off time	t_{off}		—	38	—	
Drain-source forward voltage		V_{DSF}	I_D = 720 mA, V_{GS} = 0 V (Note2)	—	0.85	1.2	V

Note2: Pulse test

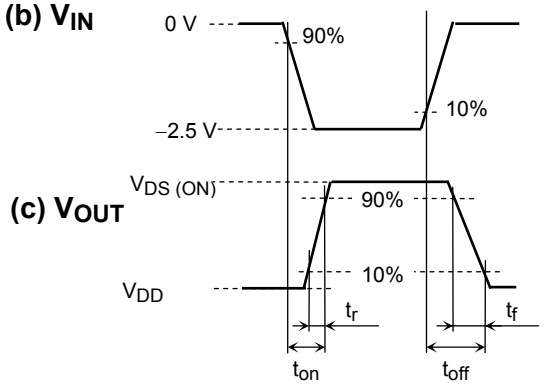
Switching Time Test Circuit

(a) Test circuit



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

(b) V_{IN} / (c) V_{OUT}

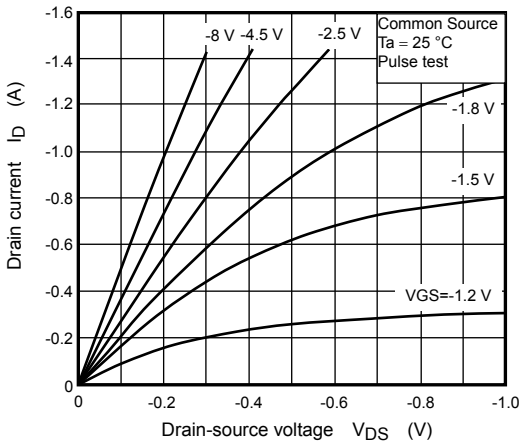


Precaution

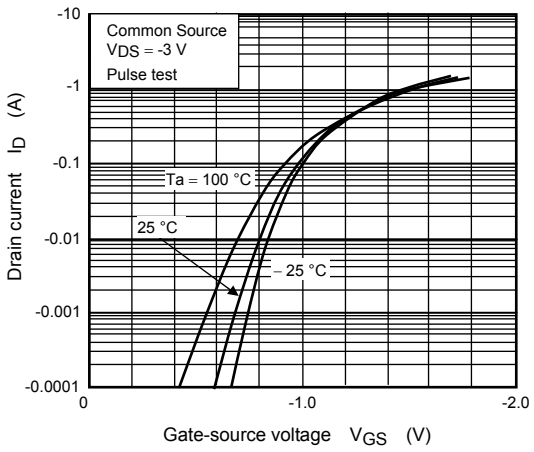
Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to be low (-1mA for the SSM6P41FE). Then, for normal switching operation, $V_{GS(on)}$ must be higher than V_{th}, and $V_{GS(off)}$ must be lower than V_{th}. This relationship can be expressed as: $V_{GS(off)} < V_{th} < V_{GS(on)}$.

Take this into consideration when using the device.

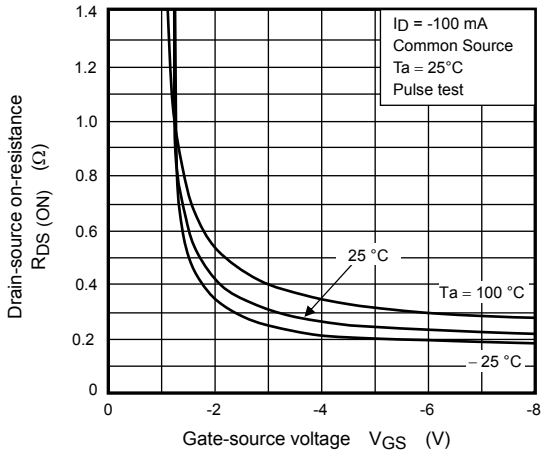
$I_D - V_{DS}$



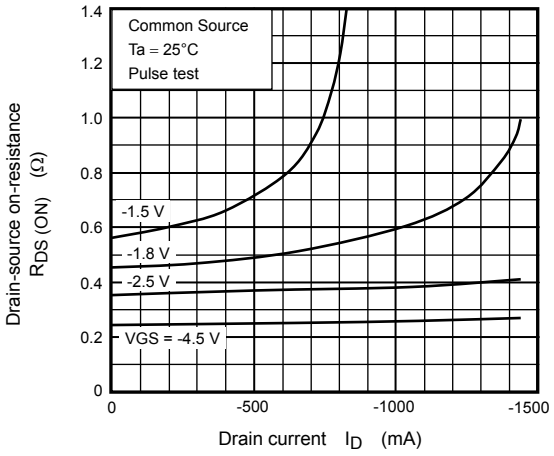
$I_D - V_{GS}$



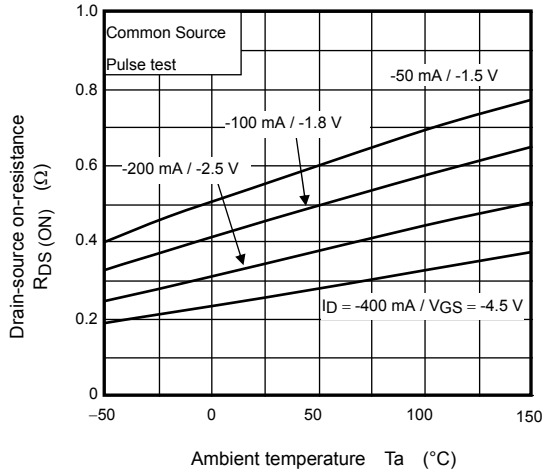
$R_{DS\ (ON)} - V_{GS}$



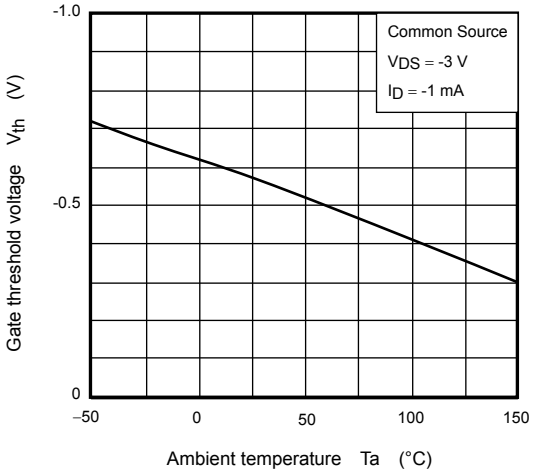
$R_{DS\ (ON)} - I_D$



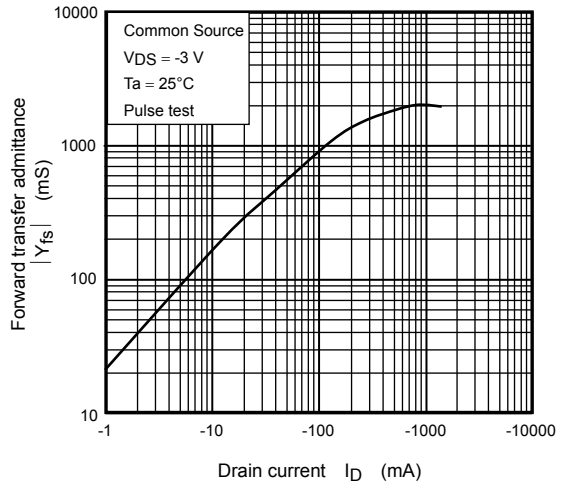
$R_{DS\ (ON)} - Ta$



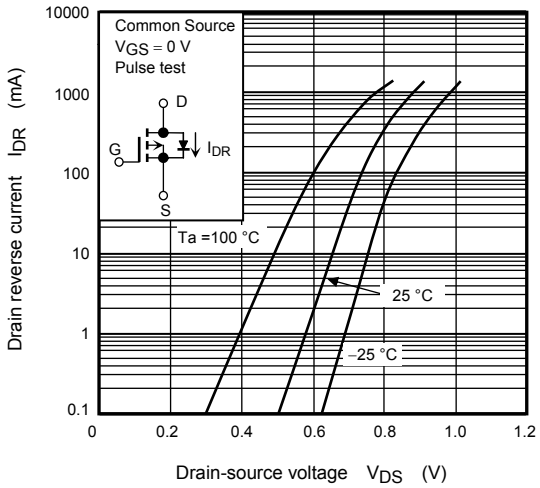
$V_{th} - Ta$



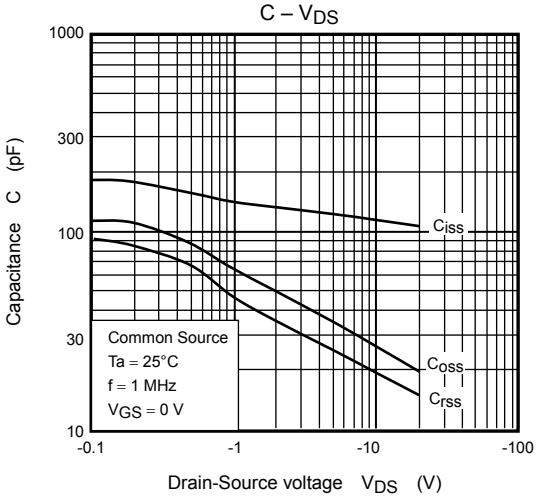
$|Y_{fs}| - I_D$



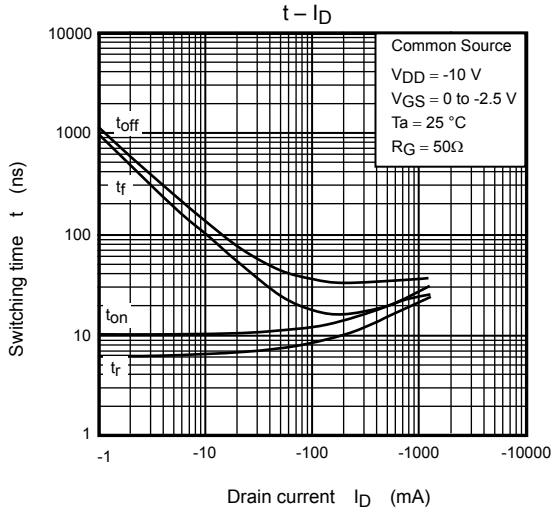
$I_{DR} - V_{DS}$



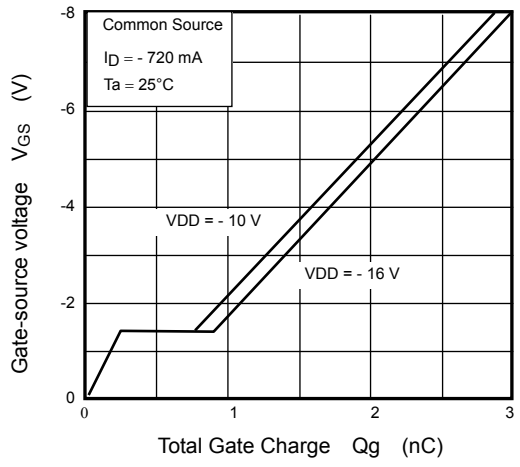
$C - V_{DS}$



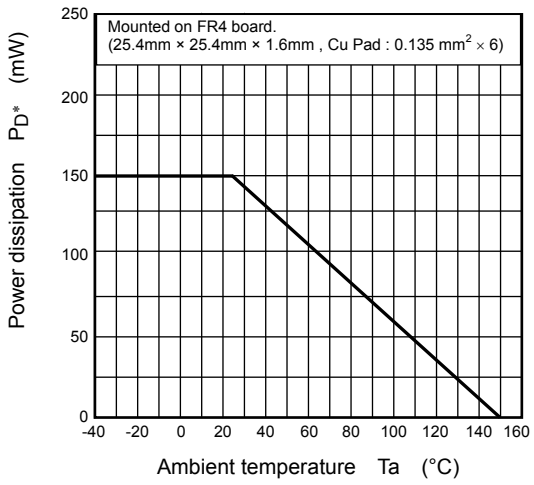
$t - I_D$



Dynamic Input Characteristic



$P_D^* - T_a$



*:Total Rating

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