

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type

# SSM6P41FE

## ○ Power Management Switches

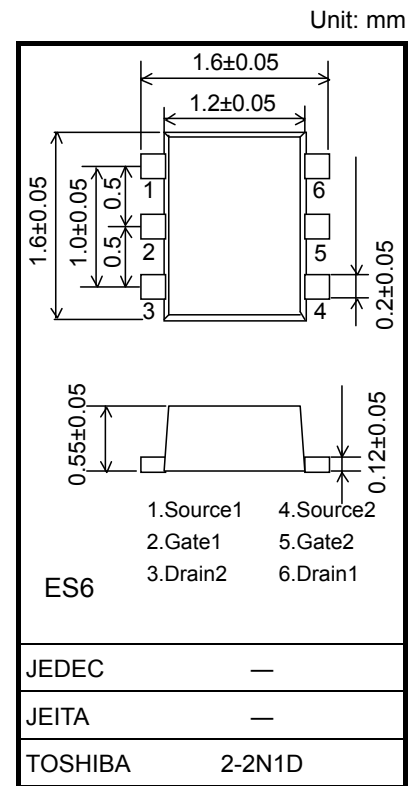
- 1.5-V drive
- Low ON-resistance :  $R_{on} = 1.04 \Omega$  (max) (@ $V_{GS} = -1.5 V$ )  
 :  $R_{on} = 0.67 \Omega$  (max) (@ $V_{GS} = -1.8 V$ )  
 :  $R_{on} = 0.44 \Omega$  (max) (@ $V_{GS} = -2.5 V$ )  
 :  $R_{on} = 0.30 \Omega$  (max) (@ $V_{GS} = -4.5 V$ )

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

Characteristic	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	-20	V
Gate-source voltage	$V_{GSS}$	$\pm 8$	V
Drain current	DC	$I_D$	-720
	Pulse	$I_{DP}$	-1440
Drain power dissipation	$P_D$ (Note1)	150	mW
Channel temperature	$T_{ch}$	150	$^\circ C$
Storage temperature range	$T_{stg}$	-55 to 150	$^\circ C$

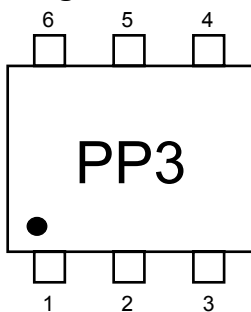
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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 an FR4 board  
 (25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm, Cu Pad: 0.135 mm<sup>2</sup>  $\times$  6)

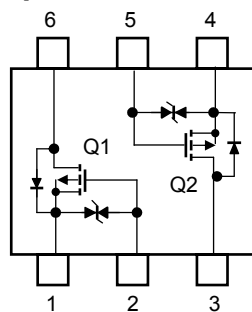


Weight: 3.0 mg (typ.)

## 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.

## 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:  $V_{GS(off)} < V_{th} < V_{GS(on)}$ .

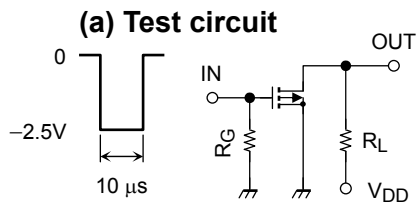
Take this into consideration when using the device.

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

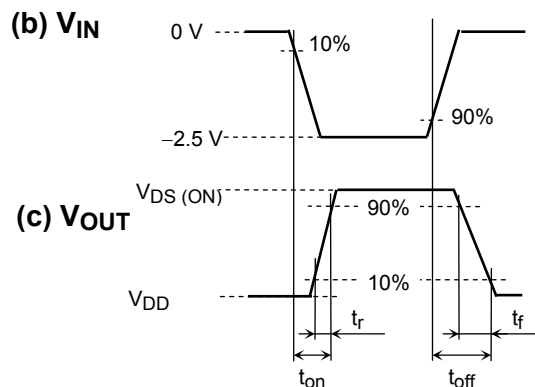
Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit	
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = -1 \text{ mA}, V_{GS} = 0 \text{ V}$	-20	—	—	V	
	$V_{(BR)DSX}$	$I_D = -1 \text{ mA}, V_{GS} = 8 \text{ V}$	-12	—	—		
Drain cutoff current	$I_{DSS}$	$V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	-10	$\mu\text{A}$	
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 8 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 1$	$\mu\text{A}$	
Gate threshold voltage	$V_{th}$	$V_{DS} = -3 \text{ V}, I_D = -1 \text{ mA}$	-0.3	—	-1.0	V	
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -3 \text{ V}, I_D = -400 \text{ mA}$ (Note2)	850	—	—	mS	
Drain-source ON-resistance	$R_{DS(ON)}$	$I_D = -400 \text{ mA}, V_{GS} = -4.5 \text{ V}$ (Note2)	—	0.25	0.30	$\Omega$	
		$I_D = -200 \text{ mA}, V_{GS} = -2.5 \text{ V}$ (Note2)	—	0.34	0.44		
		$I_D = -100 \text{ mA}, V_{GS} = -1.8 \text{ V}$ (Note2)	—	0.44	0.67		
		$I_D = -50 \text{ mA}, V_{GS} = -1.5 \text{ V}$ (Note2)	—	0.55	1.04		
Input capacitance	$C_{iss}$	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	110	—	pF	
Output capacitance	$C_{oss}$		—	28	—		
Reverse transfer capacitance	$C_{rss}$		—	20	—		
Total Gate Charge	$Q_g$	$V_{DS} = -10 \text{ V}, I_{DS} = -720 \text{ mA}$ $V_{GS} = -4.5 \text{ V}$	—	1.76	—	nC	
Gate-Source Charge	$Q_{gs}$		—	1.22	—		
Gate-Drain Charge	$Q_{gd}$		—	0.54	—		
Switching time	Turn-on time	$t_{on}$	$V_{DD} = -10 \text{ V}, I_D = -100 \text{ mA}$ $V_{GS} = 0 \text{ to } -2.5 \text{ V}, R_G = 50 \Omega$	—	11	—	ns
	Turn-off time	$t_{off}$		—	38	—	
Drain-source forward voltage	$V_{DSF}$	$I_D = 720 \text{ mA}, V_{GS} = 0 \text{ V}$ (Note2)	—	0.85	1.2	V	

Note2: Pulse test

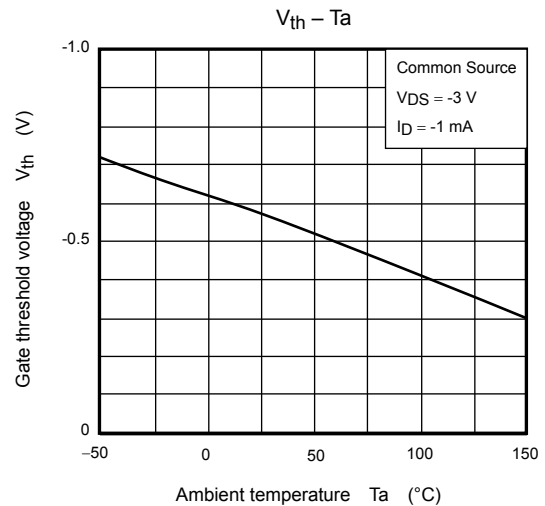
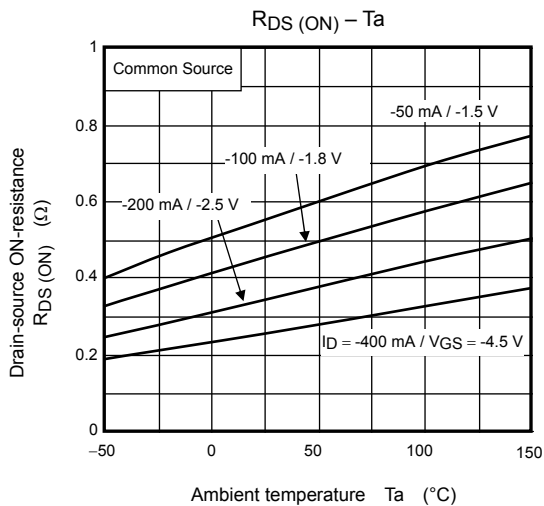
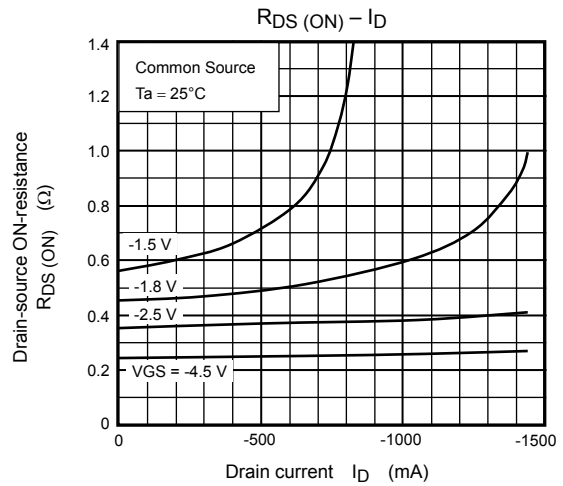
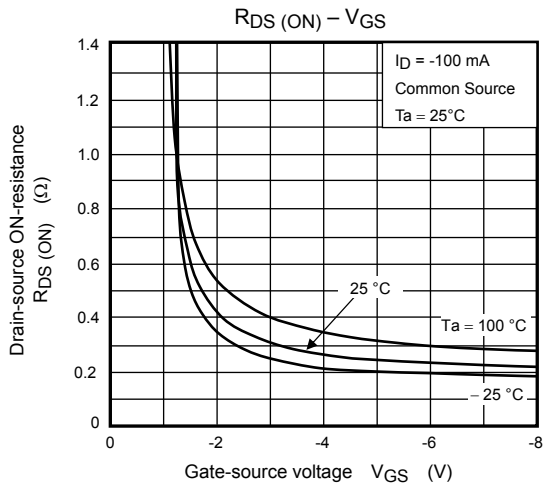
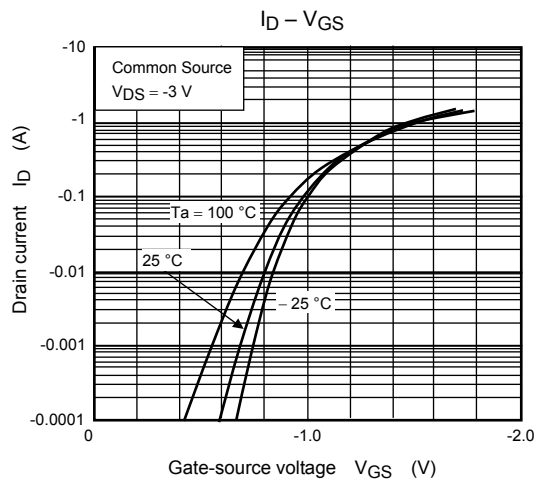
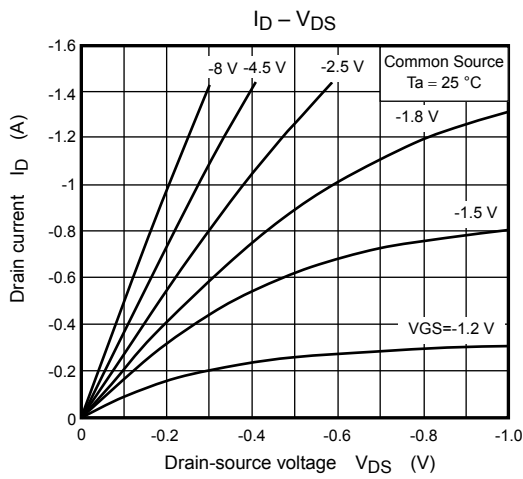
## Switching Time Test Circuit



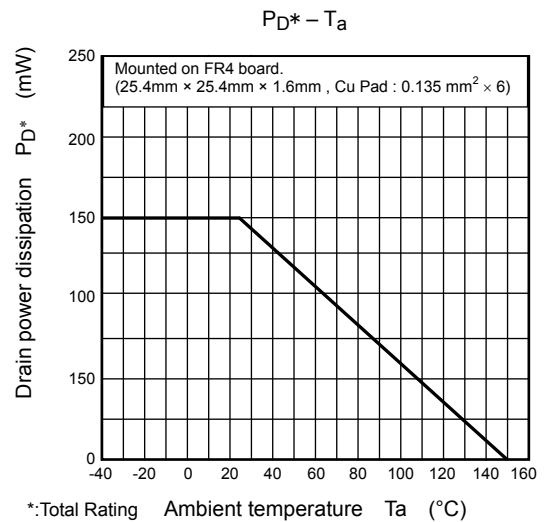
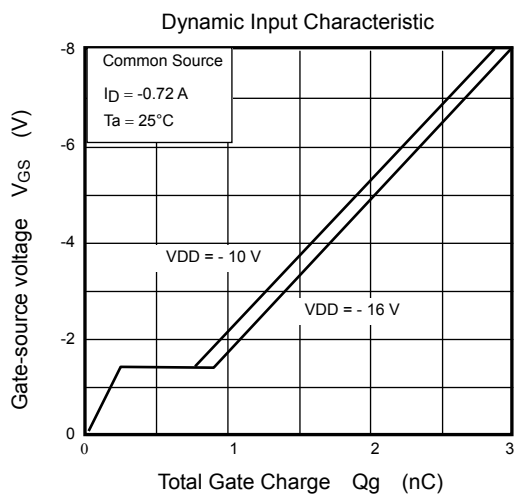
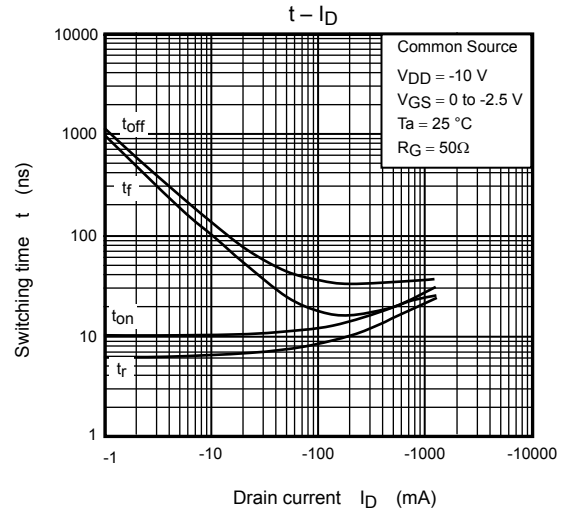
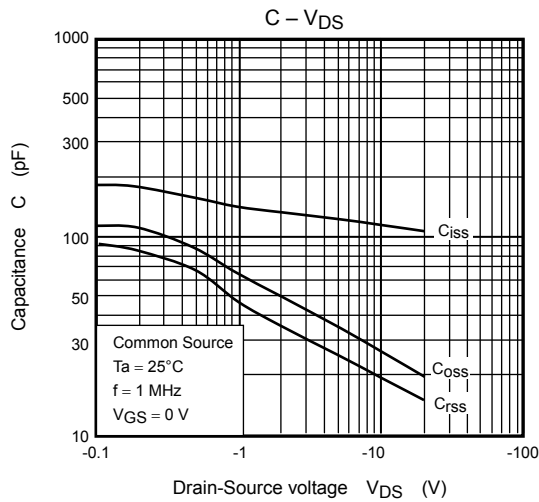
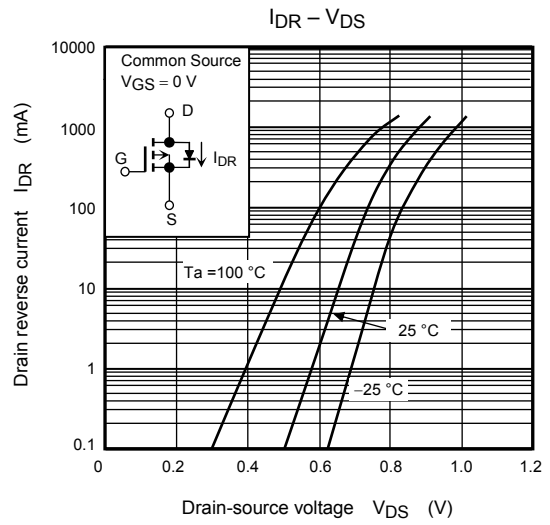
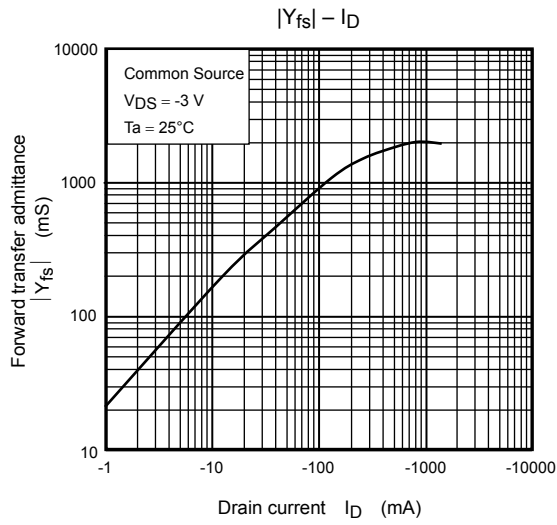
$V_{DD} = -10 \text{ V}$   
 $R_G = 50 \Omega$   
 Duty  $\leq 1\%$   
 $V_{IN}: t_r, t_f < 5 \text{ ns}$   
 $(Z_{out} = 50 \Omega)$   
 Common Source  
 $T_a = 25^\circ\text{C}$



(Q1, Q2 Common)



(Q1, Q2 Common)



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