

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type( $\pi$ -MOSVI)

# SSM5P16FE

High Speed Switching Applications

Analog Switch Applications

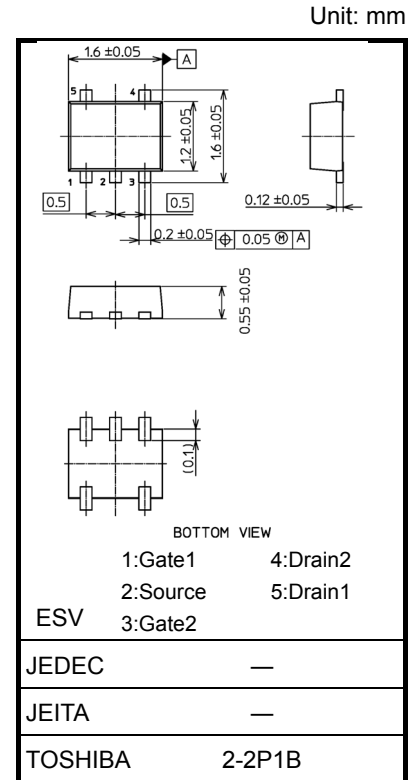
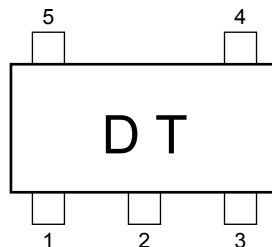
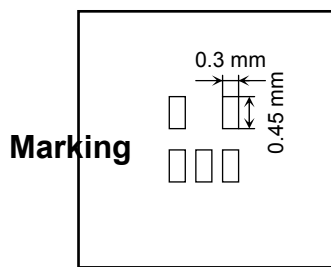
- Small package
- Low on-resistance :  $R_{DS(ON)} = 8 \Omega$  (max) (@ $V_{GS} = -4 V$ )  
 :  $R_{DS(ON)} = 12 \Omega$  (max) (@ $V_{GS} = -2.5 V$ )  
 :  $R_{DS(ON)} = 45 \Omega$  (max) (@ $V_{GS} = -1.5 V$ )

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

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		$V_{DSS}$	-20	V
Gate-Source voltage		$V_{GSS}$	$\pm 10$	V
Drain current	DC	$I_D$	-100	mA
	Pulse	$I_{DP}$	-200	
Power dissipation		$P_D$ (Note 1)	150	mW
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°C

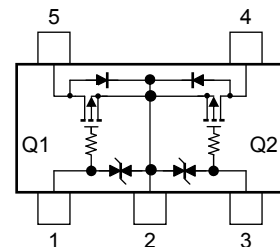
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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 FR4 board  
 (25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm, Cu Pad: 0.135 mm<sup>2</sup>  $\times$  5)



Weight: 3 mg (typ.)

## 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  
 2002-01

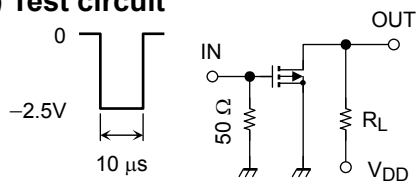
**Electrical Characteristics (Ta = 25°C) (Q1, Q2 common)**

Characteristic	Symbol	Test Condition	MIN.	TYP.	MAX.	UNIT	
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 10\text{ V}, V_{DS} = 0$	—	—	$\pm 1$	$\mu\text{A}$	
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = -0.1\text{ mA}, V_{GS} = 0$	-20	—	—	V	
Drain cut-off current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0$	—	—	-1	$\mu\text{A}$	
Gate threshold voltage	$V_{th}$	$V_{DS} = -3\text{ V}, I_D = -0.1\text{ mA}$	-0.6	—	-1.1	V	
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -3\text{ V}, I_D = -10\text{ mA}$ (Note2)	25	—	—	mS	
Drain-Source on-resistance	$R_{DS(ON)}$	$I_D = -10\text{ mA}, V_{GS} = -4\text{ V}$ (Note2)	—	6	8	$\Omega$	
		$I_D = -10\text{ mA}, V_{GS} = -2.5\text{ V}$ (Note2)	—	8	12		
		$I_D = -1\text{ mA}, V_{GS} = -1.5\text{ V}$ (Note2)	—	18	45		
Input capacitance	$C_{iss}$	$V_{DS} = -3\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$	—	11	—	pF	
Reverse transfer capacitance	$C_{rss}$		—	3.7	—	pF	
Output capacitance	$C_{oss}$		—	10	—	pF	
Switching time	Turn-on time	$t_{on}$	$V_{DD} = -3\text{ V}, I_D = -10\text{ mA},$ $V_{GS} = 0\text{ to }-2.5\text{ V}$	—	130	—	ns
	Turn-off time	$t_{off}$		—	190	—	

Note2: Pulse test

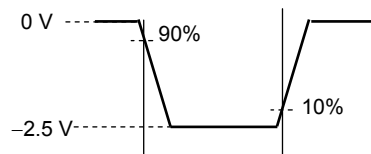
**Switching Time Test Circuit**

(a) Test circuit

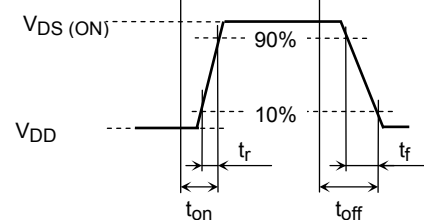


$V_{DD} = -3\text{ V}$   
 Duty  $\leq 1\%$   
 $V_{IN}$ :  $t_r, t_f < 5\text{ ns}$   
 ( $Z_{out} = 50\ \Omega$ )  
 Common Source  
 $T_a = 25^\circ\text{C}$

(b)  $V_{IN}$



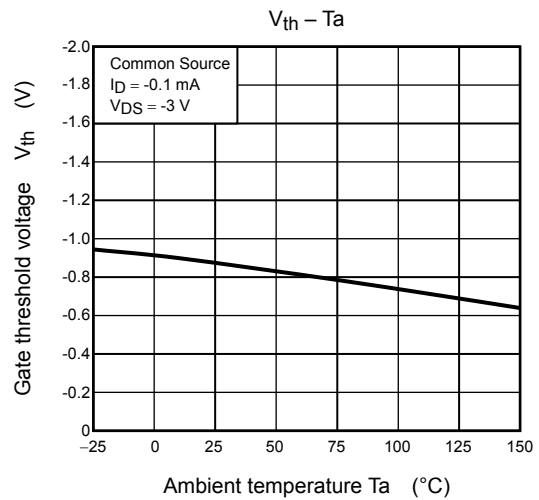
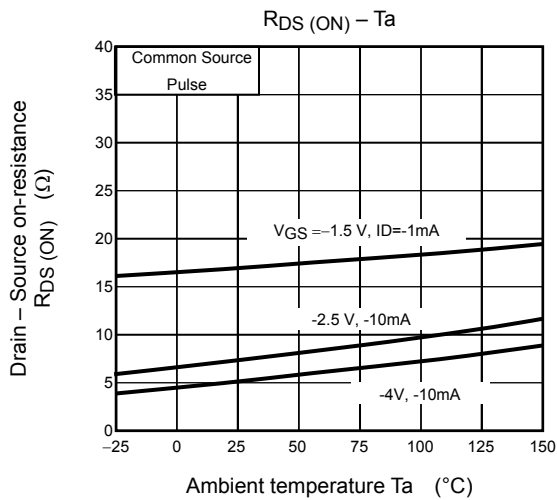
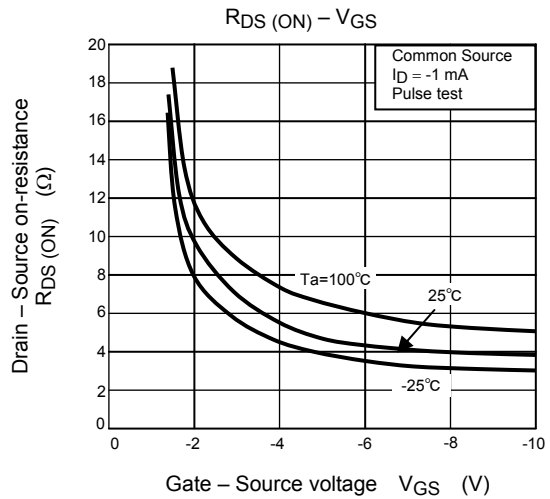
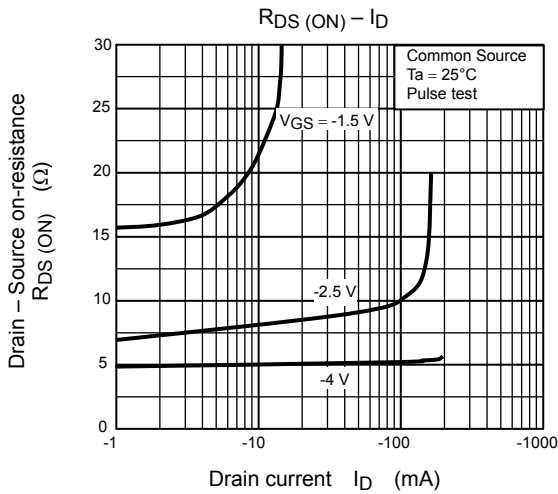
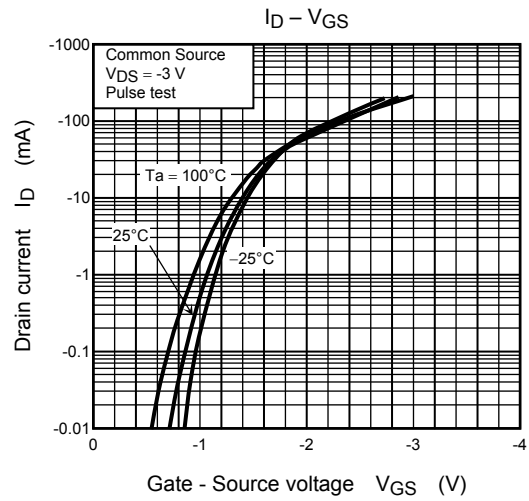
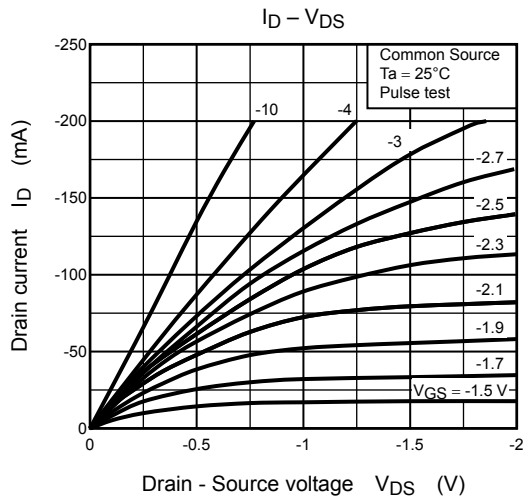
(c)  $V_{OUT}$

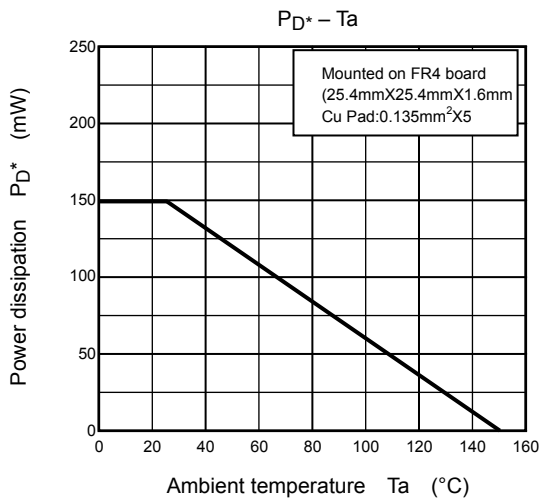
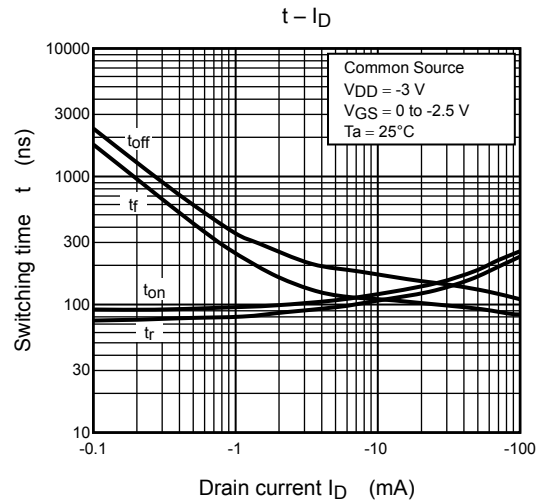
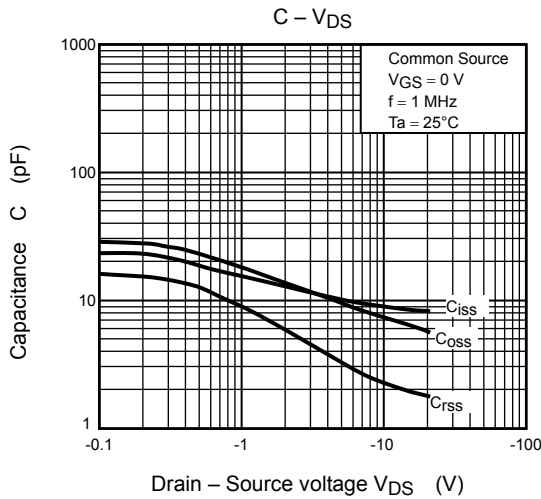
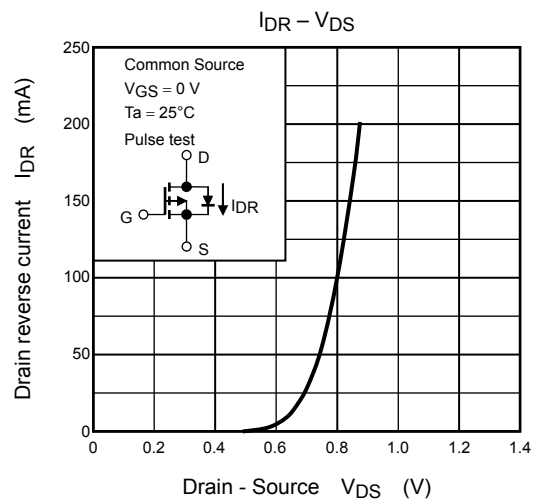
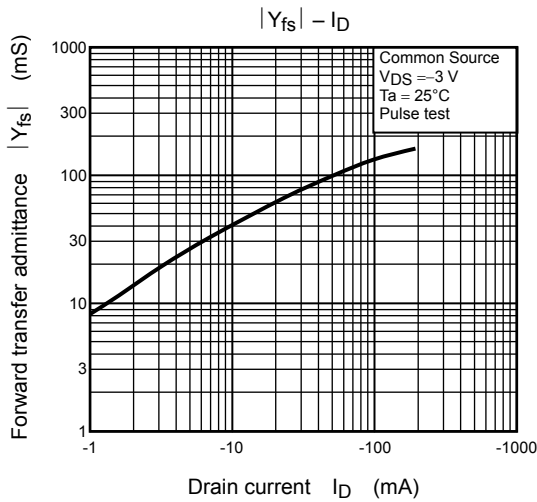


**Precaution**

$V_{th}$  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.





\*:Total rating

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