

TOSHIBA Field-Effect Transistor Silicon N Channel MOS Type

# SSM3K36FS

○ High-Speed Switching Applications

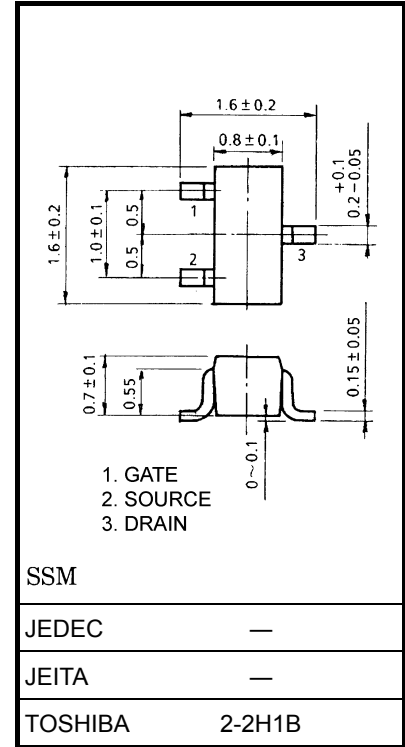
- 1.5-V drive
- Low ON-resistance :  $R_{on} = 1.52 \Omega$  (max) (@ $V_{GS} = 1.5 V$ )  
 :  $R_{on} = 1.14 \Omega$  (max) (@ $V_{GS} = 1.8 V$ )  
 :  $R_{on} = 0.85 \Omega$  (max) (@ $V_{GS} = 2.5 V$ )  
 :  $R_{on} = 0.66 \Omega$  (max) (@ $V_{GS} = 4.5 V$ )  
 :  $R_{on} = 0.63 \Omega$  (max) (@ $V_{GS} = 5.0 V$ )

**Absolute Maximum Ratings (Ta = 25 °C)**

Characteristics		Symbol	Rating	Unit
Drain-source voltage		$V_{DS}$	20	V
Gate-source voltage		$V_{GSS}$	$\pm 10$	V
Drain current	DC	$I_D$	500	mA
	Pulse	$I_{DP}$	1000	
Drain power dissipation		$P_D$ (Note1)	150	mW
Channel temperature		$T_{ch}$	150	°C
Storage temperature range		$T_{stg}$	-55 to 150	°C

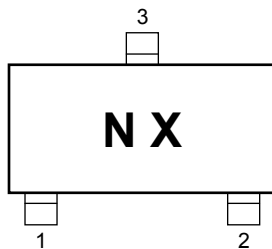
Note1: Mounted on an FR4 board  
 (25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.36 mm<sup>2</sup> × 3)

Unit: mm

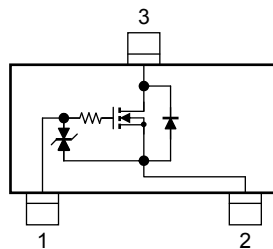


Weight: 2.4 mg (typ.)

**Marking**



**Equivalent Circuit (top view)**



Start of commercial production  
 2008-02

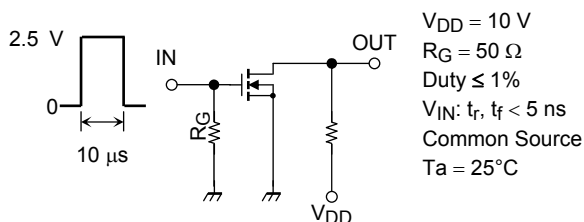
## Electrical Characteristics (Ta = 25°C)

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

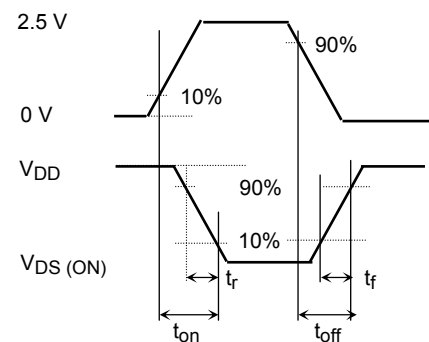
Note2: Pulse test

## Switching Time Test Circuit

### (a) Test Circuit



### (b) $V_{IN}$



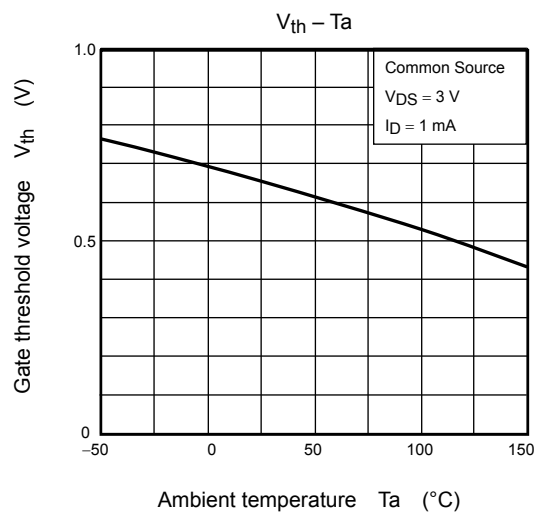
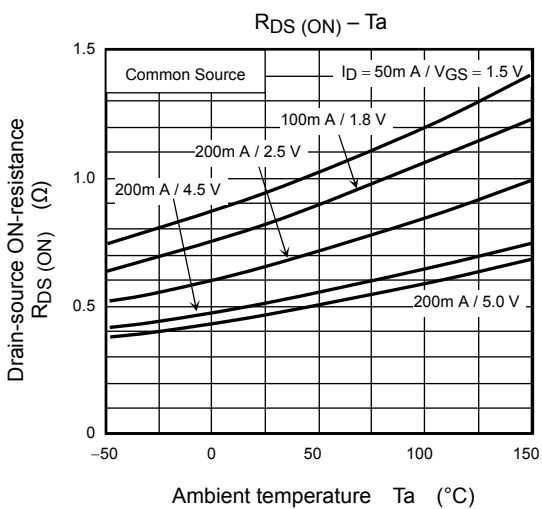
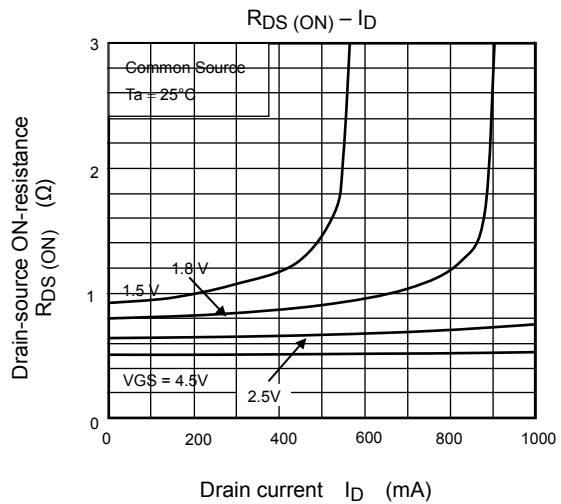
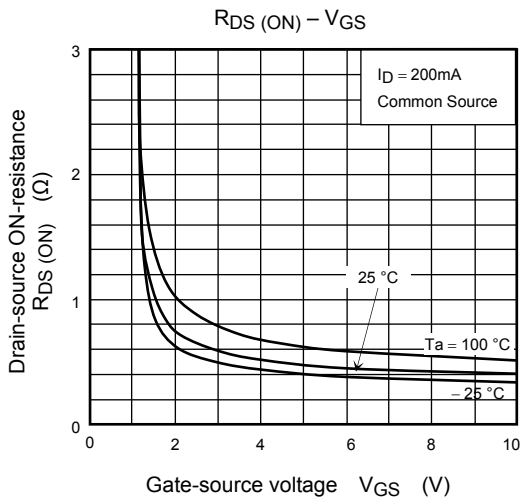
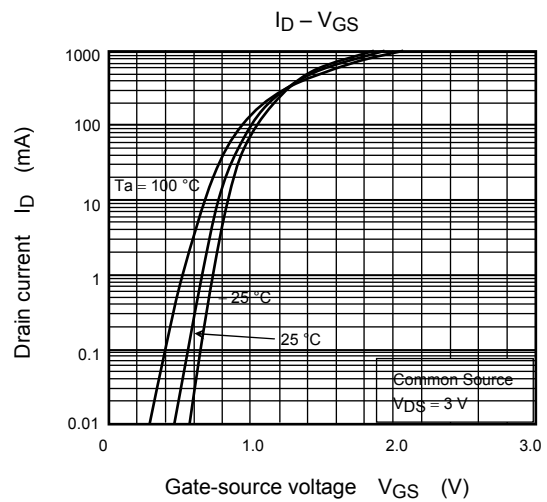
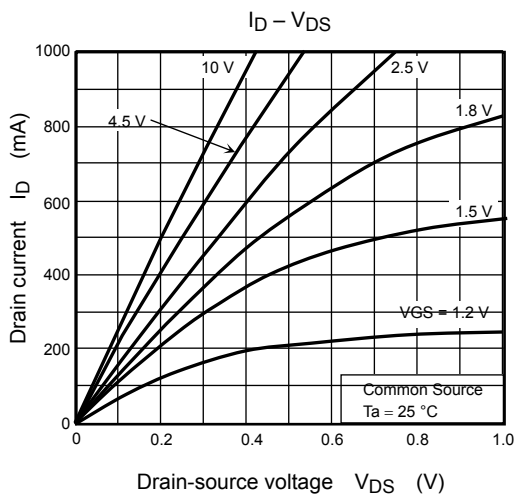
### (c) $V_{OUT}$

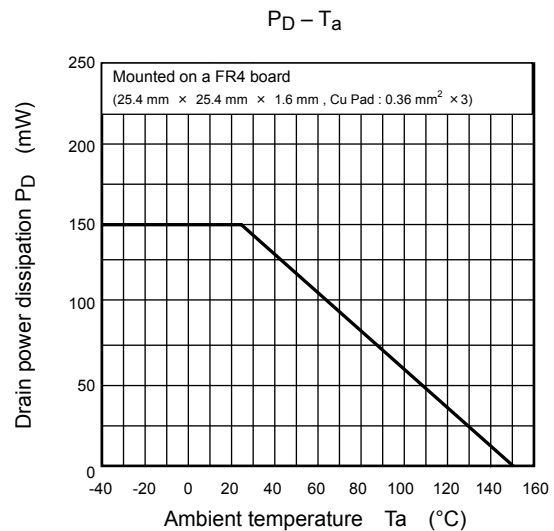
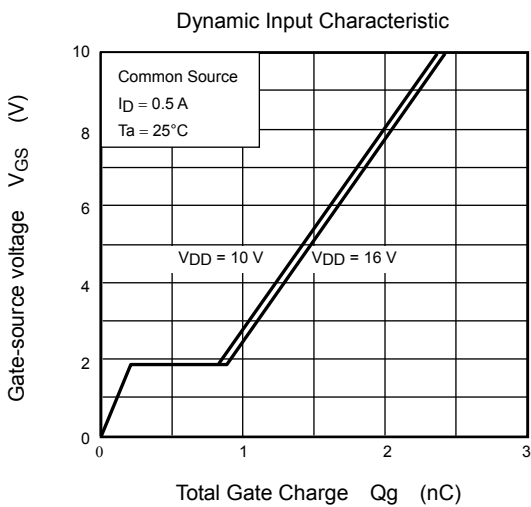
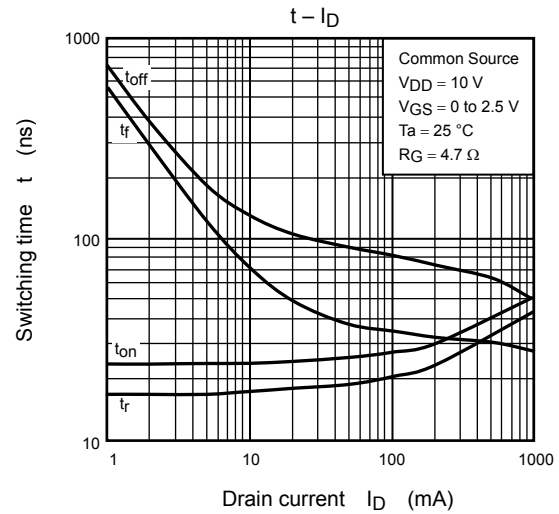
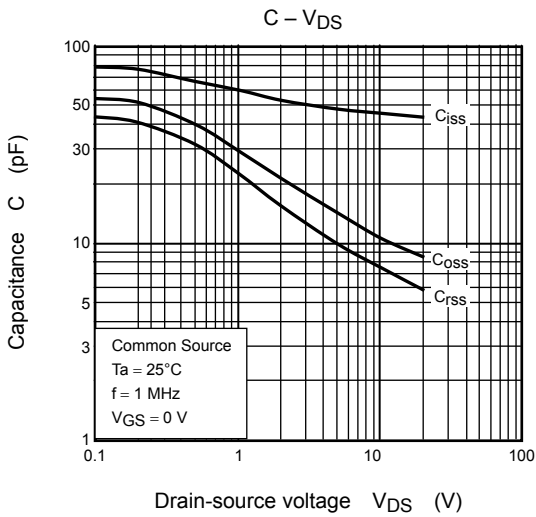
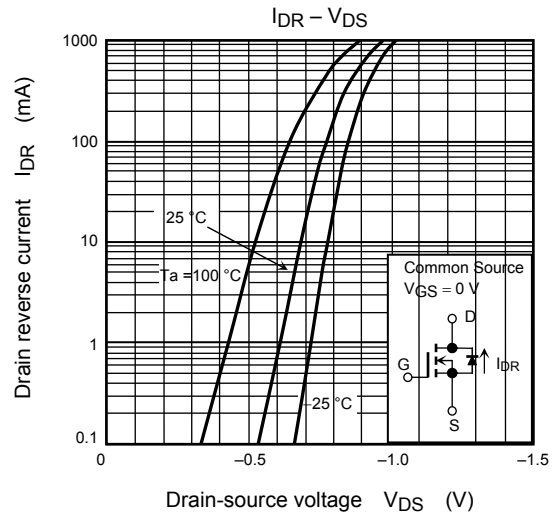
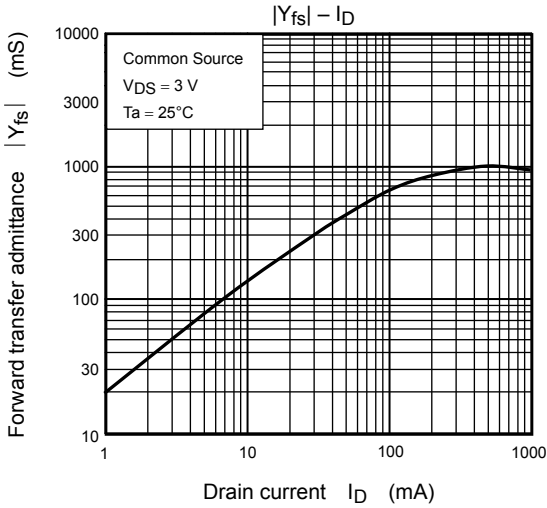
## Usage Considerations

Let  $V_{th}$  be the voltage applied between gate and source that causes the drain current ( $I_D$ ) to be below (1 mA for the SSM3K36FS). 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.





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