TOSHIBA Field-Effect Transistor Silicon N-Channel MOS Type

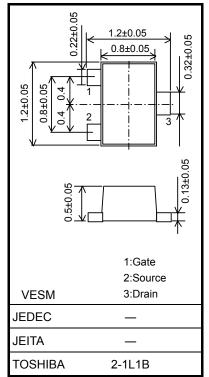
# SSM3K36MFV

#### ○ High-Speed Switching Applications

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

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

Characteristics		Symbol	Rating	Unit	
Drain-source voltage		V <sub>DSS</sub>	20	V	
Gate-source voltage		V <sub>GSS</sub>	± 10	V	
Drain current	DC	۱ <sub>D</sub>	500	mA	
	Pulse	I <sub>DP</sub>	1000		
Drain power dissipation		P <sub>D</sub> (Note 1)	150	mW	
Channel temperature		T <sub>ch</sub>	150	°C	
Storage temperature		T <sub>stg</sub>	–55 to 150	°C	



Weight: 1.5 mg (typ.)

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

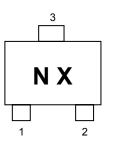
temperature/current/voltage, etc.) are within the absolute maximum ratings.

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).

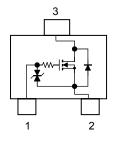
#### Note1:Mounted on an FR4 board

(25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm, Cu Pad: 0.585 mm<sup>2</sup>)

#### Marking



## Equivalent Circuit (top view)



Start of commercial production 2008-02

Unit: mm

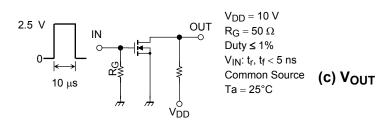
Electrical Characteristics (Ta = 25°C)

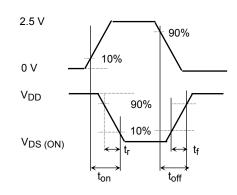
Char	acteristics	Symbol	Test Conditions	Min	Тур.	Max	Unit
Drain-source breakdown voltage	V (BR) DSS	$I_D = 1 \text{ mA}, V_{GS} = 0$	20	_	_	V	
	V (BR) DSX	$I_D = 1 \text{ mA}, V_{GS} = -10 \text{ V}$	12	—	_	v	
Drain cutoff currer	nt	I <sub>DSS</sub>	$V_{DS} = 20 V, V_{GS} = 0$	_	_	1	μA
Gate leakage curr	ent	I <sub>GSS</sub>	$V_{GS}=\pm 10~V,~V_{DS}=0$	_	—	±1	μA
Gate threshold vo	Itage	V <sub>th</sub>	$V_{DS} = 3 V, I_{D} = 1 mA$	0.35	_	1.0	V
Forward transfer a	admittance	Y <sub>fs</sub>	$V_{DS} = 3 V, I_D = 200 mA$ (Note2)	420	840	_	mS
Drain-source ON-resistance		$I_D = 200 \text{ mA}, V_{GS} = 5.0 \text{ V}$ (Note2)	_	0.46	0.63	Ω	
		$I_D = 200 \text{ mA}, V_{GS} = 4.5 \text{ V}$ (Note2)	_	0.51	0.66		
	R <sub>DS (ON)</sub>	$I_D = 200 \text{ mA}, V_{GS} = 2.5 \text{ V}$ (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 Output capacitance		C <sub>iss</sub>		_	46		pF
		C <sub>OSS</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0, f = 1 MHz	_	10.8		
Reverse transfer capacitance		C <sub>rss</sub>		_	7.3		
Total Gate Charge		Qg		_	1.23		nC
Gate-Source Charge		Q <sub>gs</sub>	$V_{DS}$ = 10V, I <sub>D</sub> = 0.5 A, V <sub>GS</sub> = 4.0 V	_	0.60		
Gate-Drain Charge		Q <sub>gd</sub>		—	0.63	—	
Switching time	Turn-on time	t <sub>on</sub>	V <sub>DD</sub> = 10 V, I <sub>D</sub> = 200 mA	_	30		- ns
	Turn-off time	t <sub>off</sub>	$V_{GS}$ = 0 to 2.5 V, $R_{G}$ = 50 $\Omega$	_	75	_	
Drain-source forward voltage		V <sub>DSF</sub>	$I_D = -0.5 \text{ A}, V_{GS} = 0 \text{ V}$ (Note2)	_	-0.88	-1.2	V

Note2: Pulse test

# Switching Time Test Circuit

#### (a) Test Circuit





#### **Usage Considerations**

Let V<sub>th</sub> be the voltage applied between gate and source that causes the drain current (I<sub>D</sub>) to below (1 mA for the SSM3K36MFV). Then, for normal switching operation, V<sub>GS(on)</sub> must be higher than V<sub>th</sub>, and V<sub>GS(off)</sub> must be lower than V<sub>th</sub>. This relationship can be expressed as: V<sub>GS(off)</sub> < V<sub>th</sub> < V<sub>GS(on)</sub>.

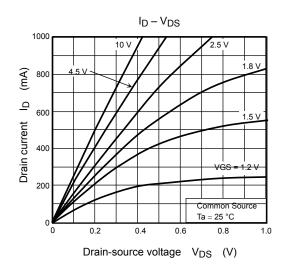
(b) V<sub>IN</sub>

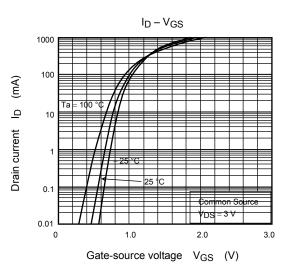
Take this into consideration when using the device.

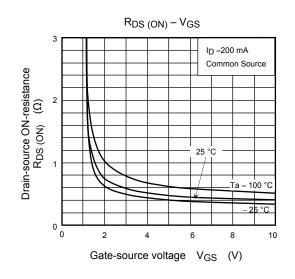
## **Handling Precaution**

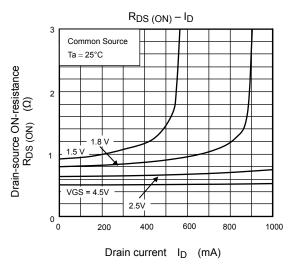
When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic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

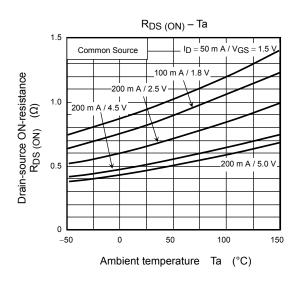
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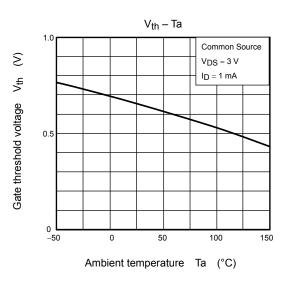




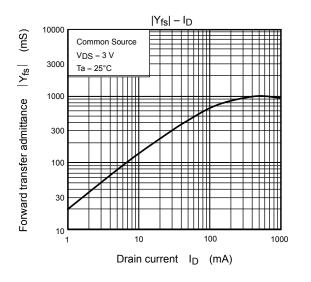


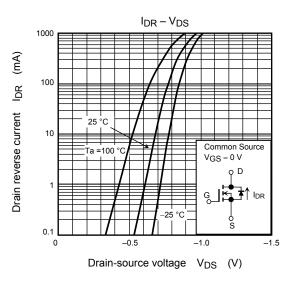


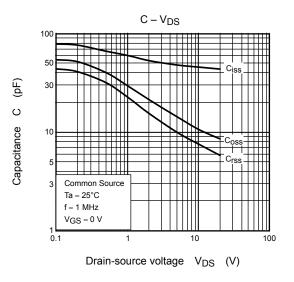


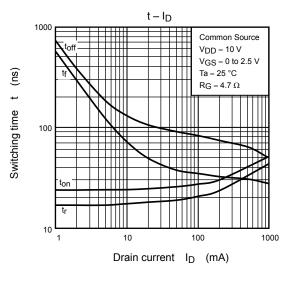


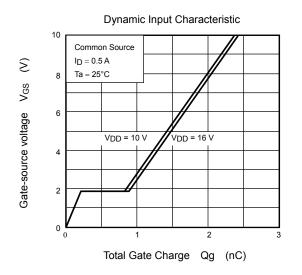
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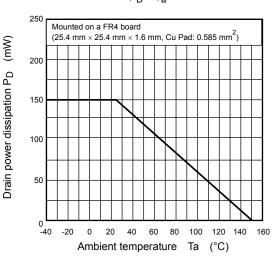








P<sub>D</sub> – T<sub>a</sub>



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