

MOSFETs Silicon P-Channel MOS (U-MOSVII)

SSM3J78FS

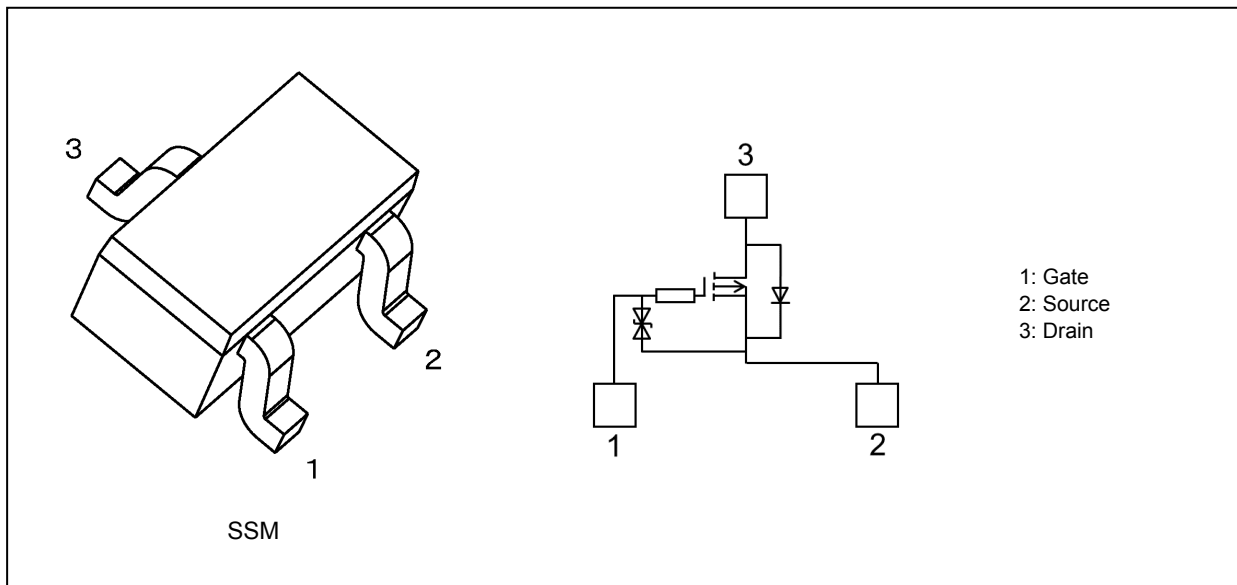
1. Applications

- Analog Switches

2. Features

- (1) 1.2 V drive
- (2) Low drain-source on-resistance
 - : $R_{DS(ON)} = 3.2 \Omega$ (typ.) (@ $V_{GS} = -1.2$ V)
 - $R_{DS(ON)} = 2.3 \Omega$ (typ.) (@ $V_{GS} = -1.5$ V)
 - $R_{DS(ON)} = 2.0 \Omega$ (typ.) (@ $V_{GS} = -1.8$ V)
 - $R_{DS(ON)} = 1.5 \Omega$ (typ.) (@ $V_{GS} = -2.5$ V)
 - $R_{DS(ON)} = 1.1 \Omega$ (typ.) (@ $V_{GS} = -4.5$ V)
- (3) Low leakage current

3. Packaging and Internal Circuit



Start of commercial production
2024-04

4. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DSS}	-20	V
Gate-source voltage	V_{GSS}	± 10	
Drain current (DC) (Note 1)	I_D	-250	mA
Drain current (pulsed) (Note 1)	I_{DP}	-600	
Power dissipation (Note 2)	P_D	150	mW
Power dissipation (Note 3)		500	
Channel temperature	T_{ch}	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to 150	

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: Ensure that the channel temperature does not exceed $150\text{ }^\circ\text{C}$.

Note 2: Mounted on an FR4 board ($25.4\text{ mm} \times 25.4\text{ mm} \times 1.6\text{ mm}$, Cu pad: $0.36\text{ mm}^2 \times 3$)

Note 3: Mounted on an FR4 board ($25.4\text{ mm} \times 25.4\text{ mm} \times 1.6\text{ mm}$, Cu pad: 645 mm^2)

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.

Note: The MOSFETs in this device are sensitive to electrostatic discharge. When handling this device, the worktables, operators, soldering irons and other objects should be protected against anti-static discharge.

Note: The channel-to-ambient thermal resistance, $R_{th(ch-a)}$, and the drain power dissipation, P_D , vary according to the board material, board area, board thickness and pad area. When using this device, be sure to take heat dissipation fully into account.

5. Electrostatic Discharge Test ($T_a=25\text{ }^\circ\text{C}$)

Apply voltage	Failure	Test conditions
$\pm 2000\text{ V}$	0/10 pcs	$C = 100\text{ pF}$, $R = 1.5\text{ k}\Omega$ (JEITA ED-4701)

Note: Conducted Electrostatic Discharge Test based on JEITA ED-4701 standard, and confirmed above result.

6. Electrical Characteristics

6.1. Static Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 5\text{ V}$	—	—	± 0.08	μA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$	—	—	± 1	
Drain cut-off current	I_{DSS}	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$	—	—	-0.08	V
Drain-source breakdown voltage	$V_{(BR)DSS}$	$I_D = -1\text{ mA}, V_{GS} = 0\text{ V}$	-20	—	—	
Drain-source breakdown voltage (Note 1)	$V_{(BR)DSX}$	$I_D = -1\text{ mA}, V_{GS} = 10\text{ V}$	-10	—	—	
Gate threshold voltage (Note 2)	V_{th}	$V_{DS} = -10\text{ V}, I_D = -100\text{ }\mu\text{A}$	-0.3	—	-1	
Drain-source on-resistance (Note 3)	$R_{DS(ON)}$	$I_D = -10\text{ mA}, V_{GS} = -1.2\text{ V}$	—	3.2	20	Ω
		$I_D = -20\text{ mA}, V_{GS} = -1.5\text{ V}$	—	2.3	4.0	
		$I_D = -50\text{ mA}, V_{GS} = -1.8\text{ V}$	—	2.0	2.9	
		$I_D = -150\text{ mA}, V_{GS} = -2.5\text{ V}$	—	1.5	2.1	
		$I_D = -150\text{ mA}, V_{GS} = -4.5\text{ V}$	—	1.1	1.4	
Forward transfer admittance (Note 3)	$ Y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -100\text{ mA}$	—	430	—	mS

Note 1: If a reverse bias is applied between gate and source, this device enters $V_{(BR)DSX}$ mode. Note that the drain-source breakdown voltage is lowered in this mode.

Note 2: Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to be below (-100 μA for this device). 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.

Note 3: Pulse measurement.

6.2. Dynamic Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input capacitance	C_{iss}	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$	—	21	42	μF
Reverse transfer capacitance	C_{rss}		—	2	—	
Output capacitance	C_{oss}		—	6	—	
Switching time (rise time)	t_r	$V_{DD} = -10\text{ V}, I_D = -50\text{ mA},$ $V_{GS} = 0\text{ to }-4.5\text{ V}, R_{GS} = 10\text{ }\Omega$ Duty $\leq 1\%$, V_{IN} : $t_r, t_f < 5\text{ ns}$, Common source, See Chapter 6.3.	—	42	—	ns
Switching time (turn-on delay time)	$t_{d(on)}$		—	17	—	
Switching time (fall time)	t_f		—	145	—	
Switching time (turn-off delay time)	$t_{d(off)}$		—	420	—	

6.3. Switching Time Test Circuit

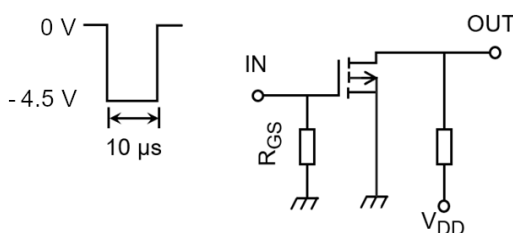


Fig. 6.3.1 Switching Time Test Circuit

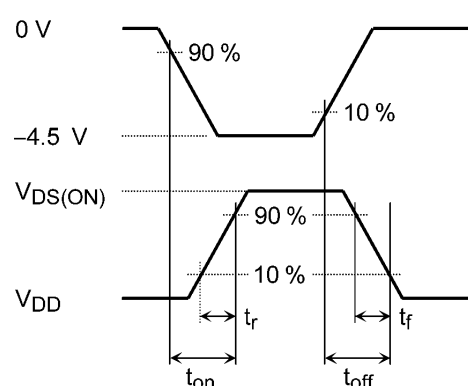


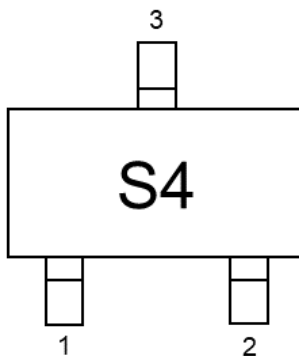
Fig. 6.3.2 Input Waveform/Output Waveform

6.4. Source-Drain Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Diode forward voltage (Note 1)	V_{DSF}	$I_D = 100\text{ mA}$, $V_{GS} = 0\text{ V}$	—	0.83	1.2	V

Note 1: Pulse measurement.

7. Marking



8. Characteristics Curves (Note)

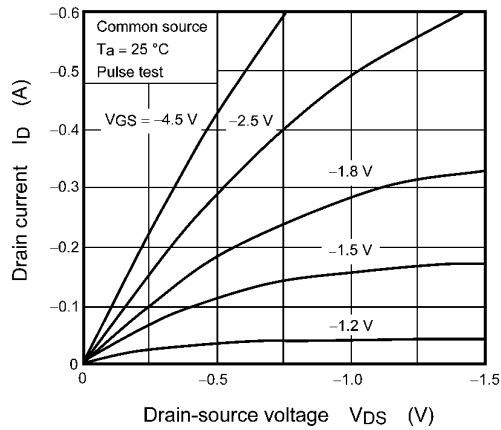


Fig. 8.1 $I_D - V_{DS}$

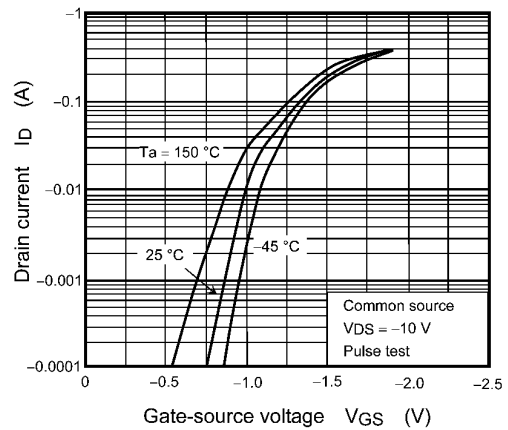


Fig. 8.2 $I_D - V_{GS}$

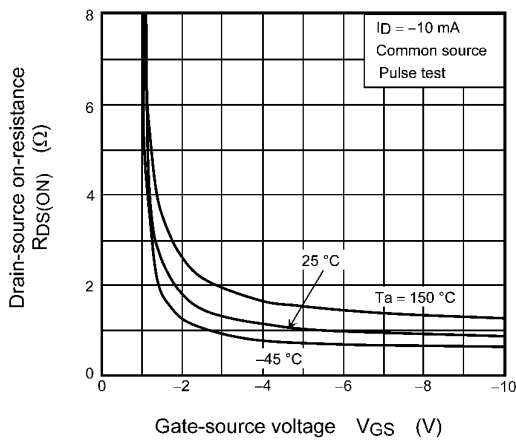


Fig. 8.3 $R_{DS(ON)} - V_{GS}$

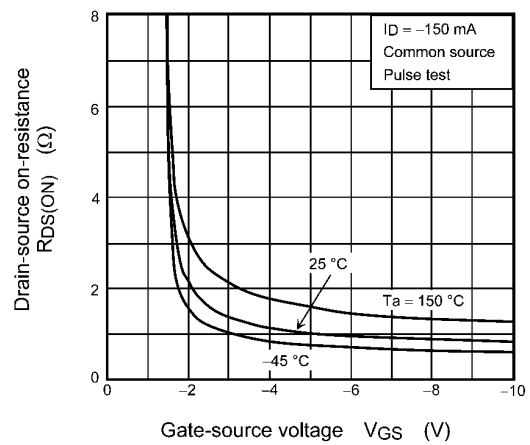


Fig. 8.4 $R_{DS(ON)} - V_{GS}$

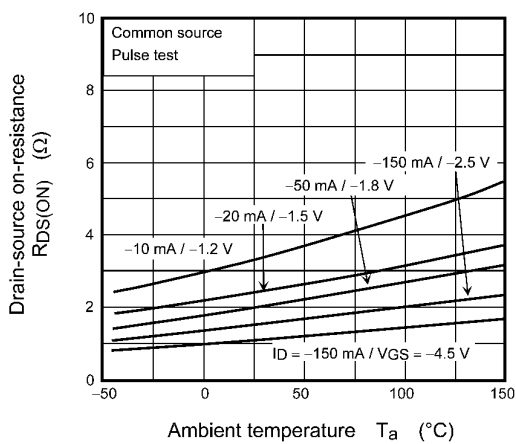


Fig. 8.5 $R_{DS(ON)} - T_a$

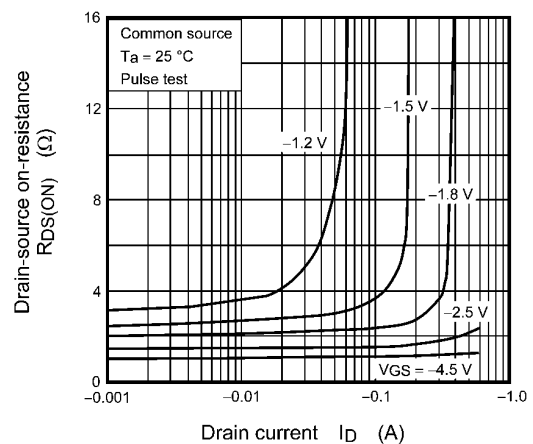


Fig. 8.6 $R_{DS(ON)} - I_D$

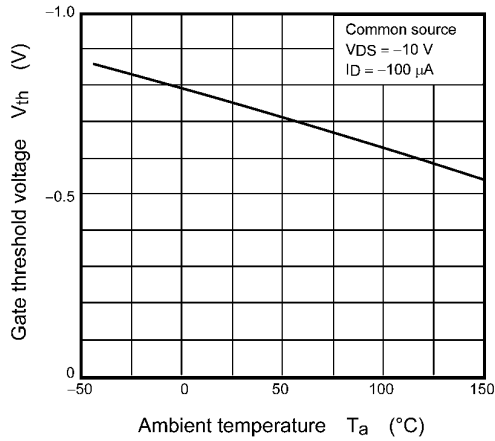


Fig. 8.7 $V_{th} - T_a$

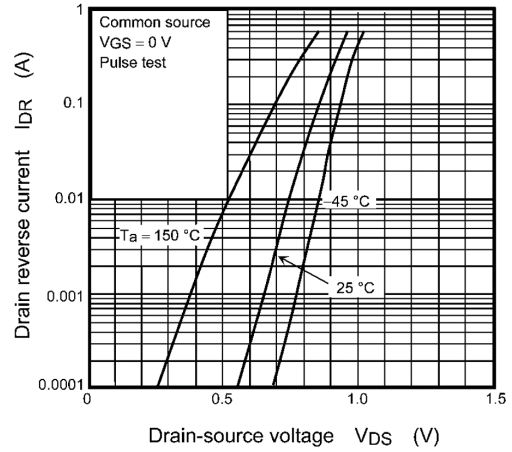


Fig. 8.8 $I_{DR} - V_{DS}$

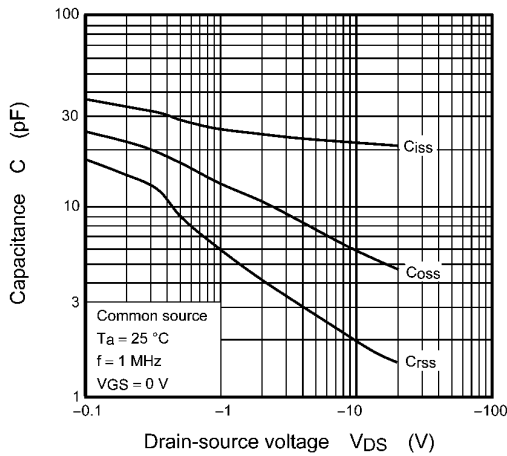


Fig. 8.9 $C - V_{DS}$

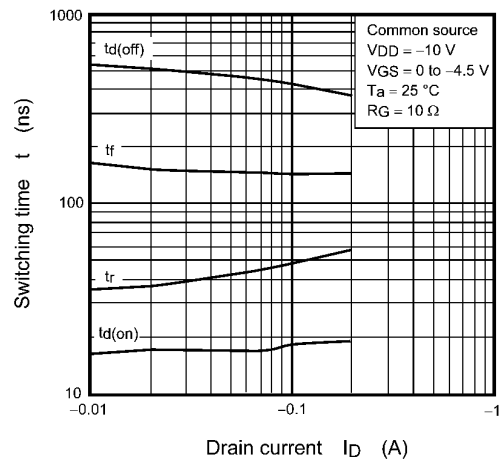


Fig. 8.10 $t - I_D$

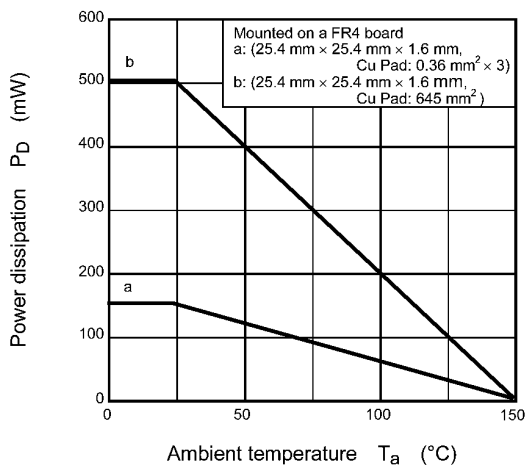
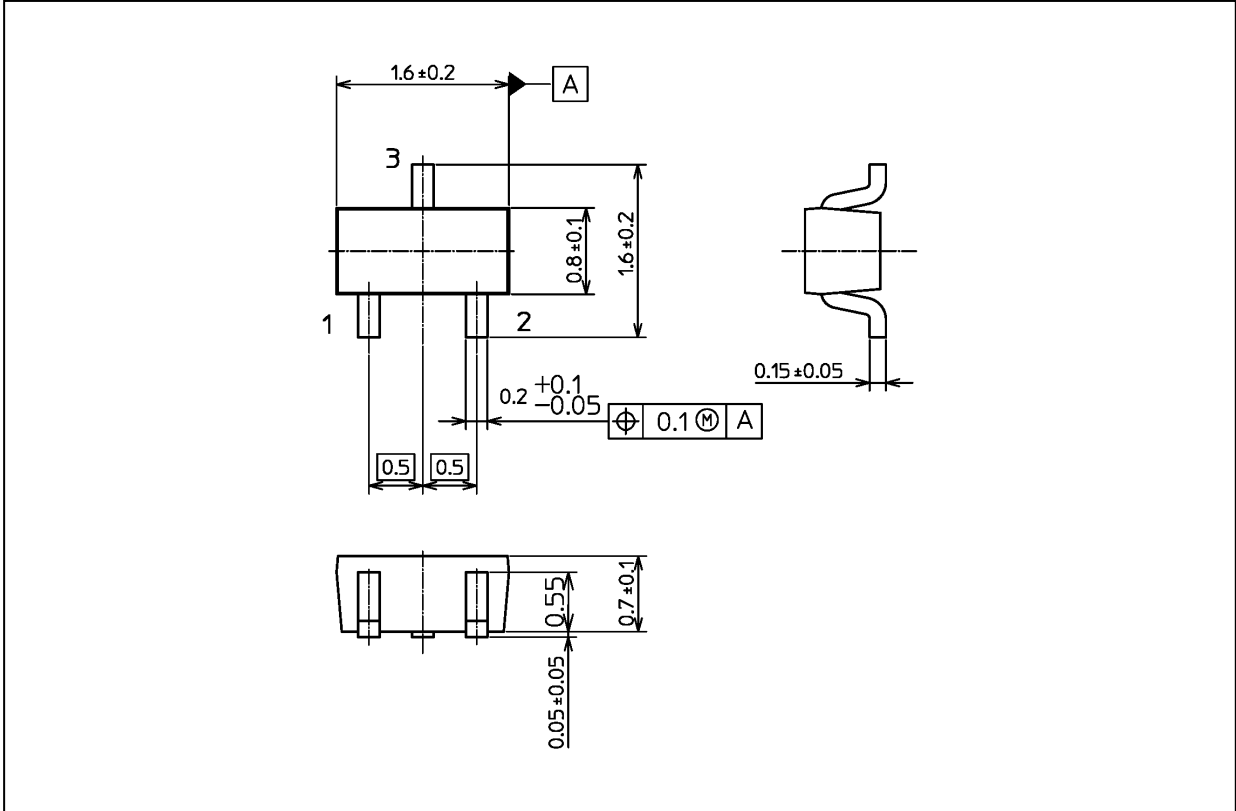


Fig. 8.11 $P_D - T_a$

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 2.4 mg (typ.)

Package Name(s)
JEDEC: SOT-416
Nickname: SSM

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