

MOSFETs Silicon P-Channel MOS (U-MOSVI)

# SSM3J144TU

### 1. Applications

· Power Management Switches

#### 2. Features

- (1) AEC-Q101 qualified (Note 1)
- 1.5-V gate drive voltage.
- (3) Low drain-source on-resistance

 $R_{\rm DS(ON)} = 240 \ {\rm m}\Omega \ ({\rm max}) \ (@V_{\rm GS} = -1.5 \ {\rm V})$ 

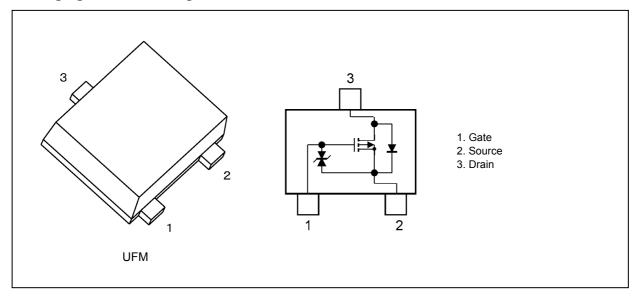
 $R_{DS(ON)} = 168 \text{ m}\Omega \text{ (max) (@V_{GS} = -1.8 V)}$ 

 $R_{DS(ON)} = 123 \text{ m}\Omega \text{ (max) } (@V_{GS} = -2.5 \text{ V})$ 

 $R_{DS(ON)} = 93 \text{ m}\Omega \text{ (max) (@V_{GS} = -4.5 V)}$ 

Note 1: For detail information, please contact to our sales.

### 3. Packaging and Pin Configuration





## 4. Absolute Maximum Ratings (Note) (Unless otherwise specified, Ta = 25°C)

С	haracteristics	Symbol	Rating	Unit	
Drain-source voltage			V <sub>DSS</sub>	-20	V
Gate-source voltage			V <sub>GSS</sub>	-8/+6	
Drain current (DC)		(Note 1)	I <sub>D</sub>	-3.2	Α
Drain current (pulsed)		(Note 1,2)	I <sub>DP</sub>	-6.4	
Power dissipation		(Note 3)	P <sub>D</sub>	500	mW
Power dissipation	(t < 1 s)	(Note 3)	P <sub>D</sub>	1000	mW
Channel temperature			T <sub>ch</sub>	150	°C
Storage temperature			T <sub>stg</sub>	-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°C.
- Note 2: Pulse width (PW)  $\leq$  10 ms, duty  $\leq$  1%
- Note 3: Device mounted on an FR4 board.(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm<sup>2</sup>)

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<sub>th(ch-a)</sub>, and the drain power dissipation, P<sub>D</sub>, 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. Electrical Characteristics

## 5.1. Static Characteristics (T<sub>a</sub> = 25°C unless otherwise specified)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	$V_{GS} = -8/+6 \text{ V}, V_{DS} = 0 \text{ V}$	_	_	±1	μА
Drain cut-off current		I <sub>DSS</sub>	$V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}$	_	_	-1	
Drain-source breakdown voltage		V <sub>(BR)DSS</sub>	$I_D$ = -1 mA, $V_{GS}$ = 0 V	-20	_	_	V
Drain-source breakdown voltage	(Note 1)	V <sub>(BR)DSX</sub>	$I_D = -1 \text{ mA}, V_{GS} = 5 \text{ V}$	-15	_		
Gate threshold voltage	(Note 2)	$V_{th}$	$V_{DS} = -3 \text{ V}, I_{D} = -1 \text{ mA}$	-0.3	_	-1.0	
Drain-source on-resistance	(Note 3)	R <sub>DS(ON)</sub>	$I_D = -1.5 \text{ A}, V_{GS} = -4.5 \text{ V}$	_	78.5	93	mΩ
			$I_D = -1.0 \text{ A}, V_{GS} = -2.5 \text{ V}$	_	97.5	123	
			$I_D = -0.5 \text{ A}, V_{GS} = -1.8 \text{ V}$	_	120	168	
			I <sub>D</sub> = -0.25 A, V <sub>GS</sub> = -1.5 V	_	141	240	
Forward transfer admittance	(Note 3)	Y <sub>fs</sub>	$V_{DS} = -3 \text{ V}, I_{D} = -1.0 \text{ A}$	2.9	5.8	_	S

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 below (-1 mA 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:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ .

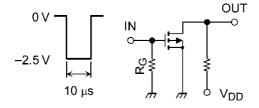
Take this into consideration when using the device.

Note 3: Pulse measurement.

## 5.2. Dynamic Characteristics (T<sub>a</sub> = 25°C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C <sub>iss</sub>	$V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V},$	_	290	_	pF
Reverse transfer capacitance	C <sub>rss</sub>	f = 1 MHz		32		
Output capacitance	C <sub>oss</sub>			44		
Switching time (turn-on time)	t <sub>on</sub>	$V_{DD}$ = -10 V, $I_{D}$ = -0.5 A $V_{GS}$ = 0 to -2.5 V, $R_{G}$ = 4.7 $\Omega$		12		ns
Switching time (turn-off time)	t <sub>off</sub>	Duty $\leq$ 1%, Input: $t_r$ , $t_f$ < 5 ns Common source, See Chapter 5.3		46.2	_	

#### 5.3. Switching Time Test Circuit



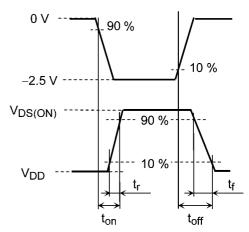


Fig. 5.3.1 Test Circuit of Switching Time

Fig. 5.3.2 Input Waveform/Output Waveform



## 5.4. Gate Charge Characteristics ( $T_a = 25^{\circ}$ C unless otherwise specified)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	$Q_g$	$V_{DD} = -10 \text{ V}, V_{GS} = -4.5 \text{ V},$	_	4.7	_	nC
Gate-source charge 1	Q <sub>gs1</sub>	$I_D = -2.0 \text{ A}$	_	0.4	_	
Gate-drain charge	Q <sub>gd</sub>		_	1.0	_	

## 5.5. Source-Drain Characteristics (T<sub>a</sub> = 25°C unless otherwise specified)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Diode forward voltage	(Note 1)	V <sub>DSF</sub>	I <sub>D</sub> =3.2 A, V <sub>GS</sub> = 0 V	_	0.9	1.2	V

Note 1: Pulse measurement.

## 6. Marking

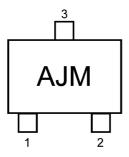


Fig. 6.1 Marking



## 7. Characteristics Curves (Note)

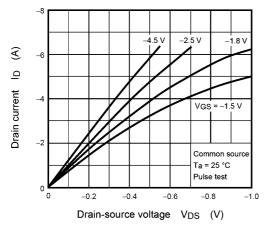


Fig. 7.1  $I_D - V_{DS}$ 

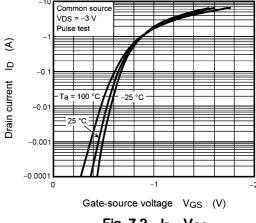


Fig. 7.2 I<sub>D</sub> - V<sub>GS</sub>

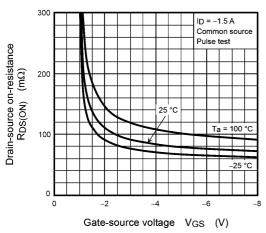


Fig. 7.3 R<sub>DS(ON)</sub> - V<sub>GS</sub>

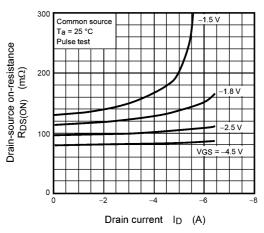


Fig. 7.4 R<sub>DS(ON)</sub> - I<sub>D</sub>

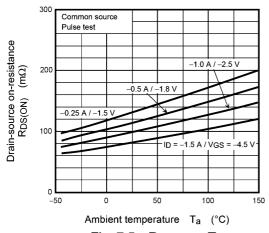


Fig. 7.5 R<sub>DS(ON)</sub> - T<sub>a</sub>

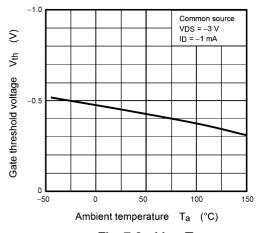


Fig. 7.6 V<sub>th</sub> - T<sub>a</sub>

5



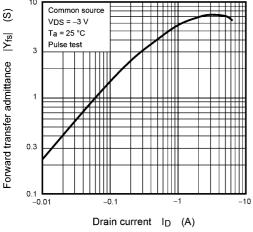


Fig. 7.7 |Yfs| - ID

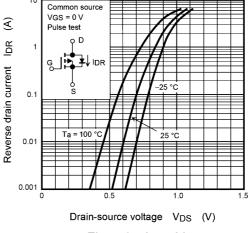


Fig. 7.8 IDR - VDS

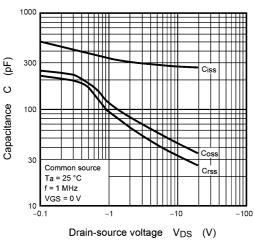


Fig. 7.9 C - V<sub>DS</sub>

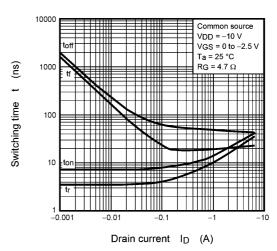


Fig. 7.10  $t - I_D$ 

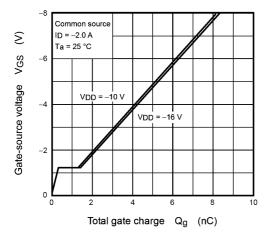


Fig. 7.11 Dynamic Input Characteristics

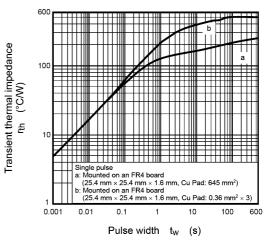
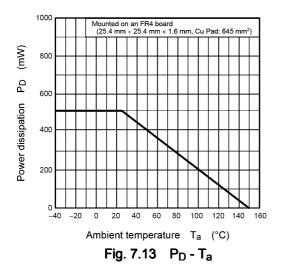


Fig. 7.12 r<sub>th</sub> - t<sub>w</sub>



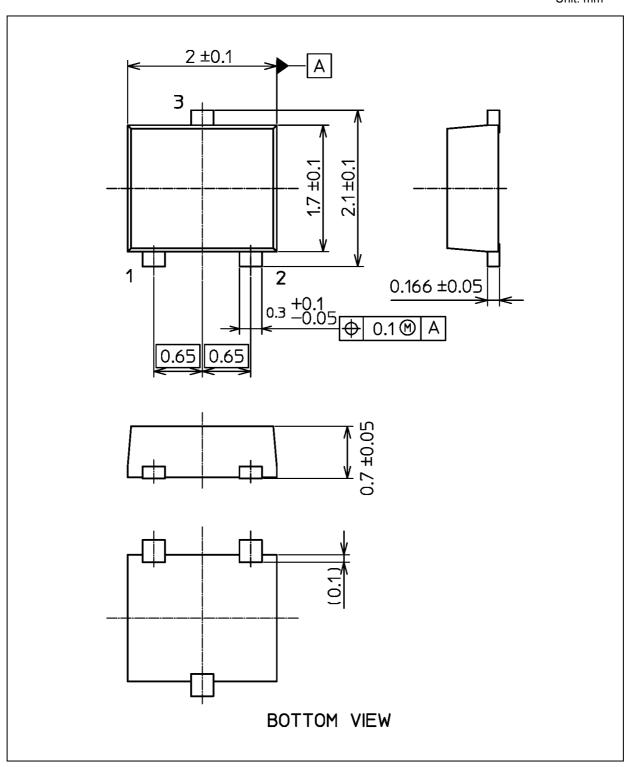


Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



## **Package Dimensions**

Unit: mm



Weight: 6.6 mg (typ.)

	Package Name(s)
TOSHIBA: 2-2U1S	
Nickname: UFM	



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105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

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