

MOSFETs Silicon N-channel MOS (U-MOSVII-H)

# SSM6K809R

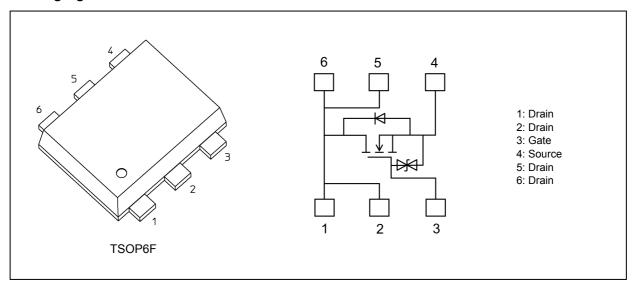
#### 1. Applications

- · Power Management Switches
- · DC-DC Converters

#### 2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) 175 °C MOSFET
- (3) 4.0-V drive
- (4) Low drain-source on-resistance
  - $$\label{eq:RDS(ON)} \begin{split} : R_{DS(ON)} = 28 \ \text{m}\Omega \ (typ.) \ (@V_{GS} = 10 \ \text{V}) \\ R_{DS(ON)} = 36 \ \text{m}\Omega \ (typ.) \ (@V_{GS} = 4.5 \ \text{V}) \end{split}$$
  - $R_{\mathrm{DS(ON)}} = 43 \ \mathrm{m}\Omega \ (\mathrm{typ.}) \ (@V_{\mathrm{GS}} = 4 \ \mathrm{V})$

### 3. Packaging and Internal Circuit



#### 4. Orderable part number

Orderable part number	AEC-Q101		Note		
SSM6K809R,LF			General Use		
SSM6K809R,LXGF	YES	(Note 1)	Unintended Use	(Note 1)	
SSM6K809R,LXHF	YES		Automotive Use		

Note 1: For more information, please contact our sales or use the inquiry form on our website.

Start of commercial production



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

Characteristics	Symbol	Rating	Unit		
Drain-source voltage			$V_{DSS}$	60	V
Gate-source voltage			$V_{GSS}$	±20	
Drain current (DC)		(Note 1)	Ι <sub>D</sub>	6	Α
Drain current (pulsed)	(t ≤ 10 ms)	(Note 1), (Note 2)	I <sub>DP</sub>	24	
Power dissipation		(Note 3)	$P_D$	1.8	W
Power dissipation	(t ≤ 10 s)	(Note 3)	$P_{D}$	3	
Single-pulse avalanche energy		(Note 4)	E <sub>AS</sub>	19.5	mJ
Channel temperature		(Note 5)	T <sub>ch</sub>	175	°C
Storage temperature		(Note 5)	T <sub>stg</sub>	-55 to 175	

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 175 °C.
- Note 2: Pulse width  $\leq$  10 ms, duty  $\leq$  1 %
- Note 3: Device mounted on a 25.4 mm × 25.4 mm × 1.6 mm FR4 glass epoxy board (Cu pad: 645 mm<sup>2</sup>)
- Note 4:  $V_{DD}$  = 25 V,  $T_{ch}$  = 25 °C (Initial state), L = 1 mH,  $R_G$  = 25  $\Omega$
- Note 5: The definitions of the absolute maximum channel and storage temperatures are qualified per AEC-Q101.

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<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.

#### 6. Thermal Characteristics

Characteristics		Symbol	Max	Unit
Channel-to-ambient thermal resistance	(Note 1)	R <sub>th(ch-a)</sub>	83	°C/W

Note 1: Device mounted on an 25.4 mm × 25.4 mm × 1.6 mm FR4 glass epoxy board (Cu pad: 645 mm<sup>2</sup>)



#### 7. Electrical Characteristics

## 7.1. Static Characteristics (Unless otherwise specified, Ta = 25 °C)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Gate leakage current		I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 16 \text{ V}$	_	_	±10	μА
Drain cut-off current		I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	_	_	1	
Drain-source breakdown voltage		V <sub>(BR)DSS</sub>	I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V	60	_		V
Drain-source breakdown voltage	(Note 1)	V <sub>(BR)DSX</sub>	$I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$	40	_	_	
Gate threshold voltage	(Note 2)	$V_{th}$	$V_{DS}$ = 10 V, $I_{D}$ = 0.1 mA	1.5	_	2.5	
Drain-source on-resistance	(Note 3)	R <sub>DS(ON)</sub>	I <sub>D</sub> = 2 A, V <sub>GS</sub> = 4 V	_	43	69	mΩ
			I <sub>D</sub> = 3 A, V <sub>GS</sub> = 4.5 V	_	36	51	
			I <sub>D</sub> = 5 A, V <sub>GS</sub> = 10 V	_	28	36	

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 (0.1 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:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ .

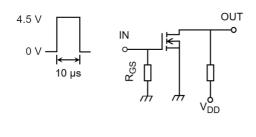
Take this into consideration when using the device.

Note 3: Pulse measurement.

# 7.2. Dynamic Characteristics (Unless otherwise specified, Ta = 25 °C)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Input capacitance	C <sub>iss</sub>	$V_{DS} = 10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ ,	_	550	_	pF
Reverse transfer capacitance	C <sub>rss</sub>	f = 1 MHz	_	35	_	
Output capacitance	C <sub>oss</sub>		_	300	_	
Switching time (rise time)	t <sub>r</sub>	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 3 A,	_	48	_	ns
Switching time (turn-on time)	t <sub>on</sub>	$V_{GS}$ = 0 to 4.5 V, $R_{GS}$ = 50 Ω Duty ≤ 1 %, Input: $t_r$ , $t_f$ < 5 ns,	_	63	_	
Switching time (fall time)	t <sub>f</sub>	Common source, See 7.3	_	6	_	
Switching time (turn-off time)	t <sub>off</sub>		_	18	_	

#### 7.3. Switching Time Test Circuit



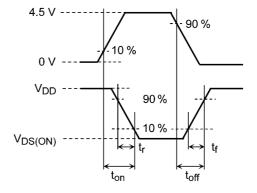


Fig. 7.3.1 Switching Time Test Circuit

Fig. 7.3.2 Input Waveform/Output Waveform



## 7.4. Gate Charge Characteristics (Unless otherwise specified, Ta = 25 °C)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Total gate charge (gate-source plus gate-drain)	Qg	$V_{DD} = 48 \text{ V}, I_D = 2 \text{ A},$	_	9.3	_	nC
Gate-source charge 1	Q <sub>gs1</sub>	V <sub>GS</sub> = 10 V	_	1.8	_	
Gate-drain charge	Q <sub>gd</sub>		_	2.0	_	

# 7.5. Source-Drain Characteristics (Unless otherwise specified, Ta = 25 °C)

Characteristics		Symbol	Test Condition	Min	Тур.	Max	Unit
Diode forward voltage	(Note 1)	$V_{DSF}$	I <sub>DR</sub> = 6 A, V <sub>GS</sub> = 0 V	_	0.9	1.5	V

Note 1: Pulse measurement.

### 8. Marking

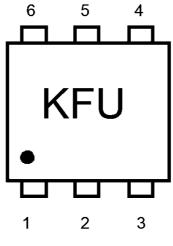


Fig. 8.1 Marking



#### 9. Characteristics Curves (Note)

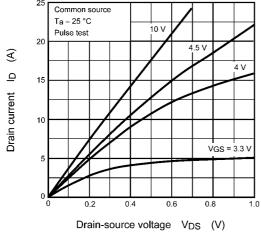


Fig. 9.1 I<sub>D</sub> - V<sub>DS</sub>

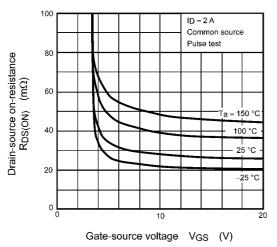


Fig. 9.3 R<sub>DS(ON)</sub> - V<sub>GS</sub>

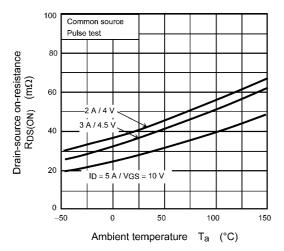


Fig. 9.5 R<sub>DS(ON)</sub> - T<sub>a</sub>

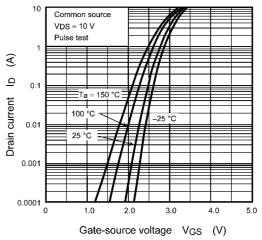


Fig. 9.2 I<sub>D</sub> - V<sub>GS</sub>

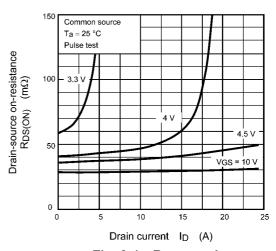


Fig. 9.4 R<sub>DS(ON)</sub> - I<sub>D</sub>

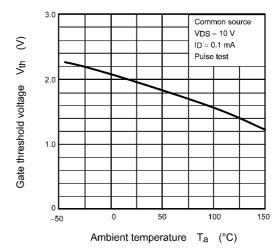


Fig. 9.6 V<sub>th</sub> - T<sub>a</sub>



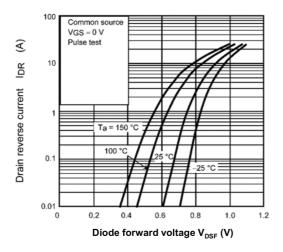


Fig. 9.7 IDR - VDSF

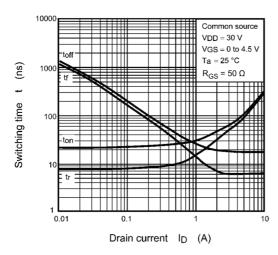


Fig. 9.9 t - I<sub>D</sub>

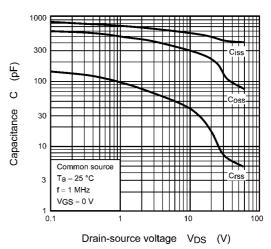


Fig. 9.8 C - V<sub>DS</sub>

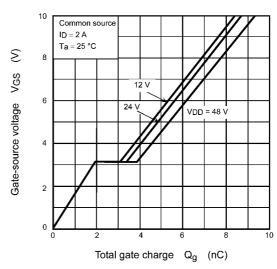


Fig. 9.10 Dynamic Input Characteristics



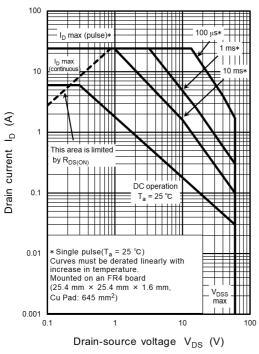


Fig. 9.11 Safe Operating Area

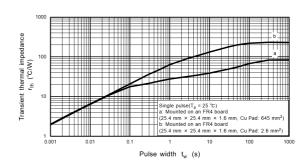


Fig. 9.12 rth - tw

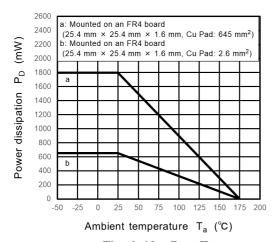


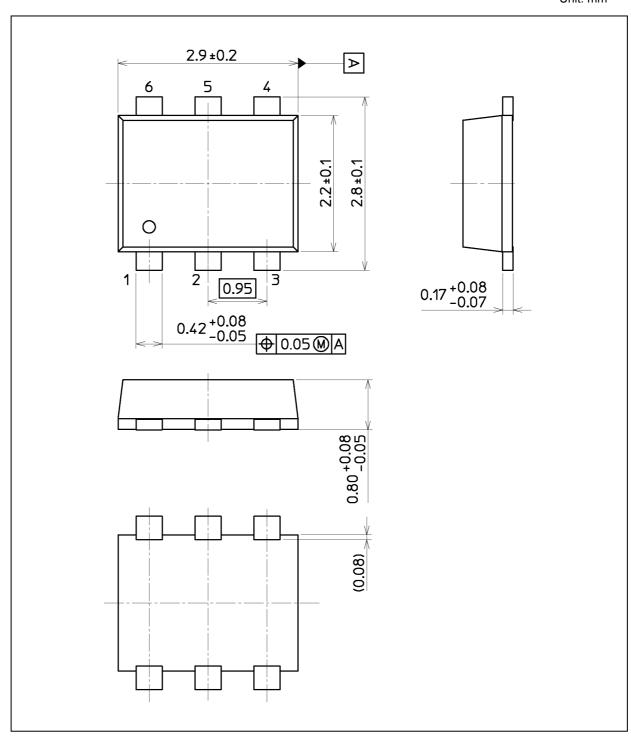
Fig. 9.13 P<sub>D</sub> - T<sub>a</sub>

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



## **Package Dimensions**

Unit: mm



Weight: 0.016 g (typ.)

	Package Name(s)
Nickname: TSOP6F	



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