

Silicon N Channel MOS Type (U-MOS<sup>III</sup>)/Silicon Epitaxial Schottky Barrier Diode

## SSM5H14F

○ Fuse cut applications of the battery pack

- 1.8-V drive
- An N-ch MOSFET and a Schottky Barrier Diode in one package.
- Low  $R_{DS(ON)}$  and Low  $V_F$

### Absolute Maximum Ratings

#### MOSFET (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Drain-source voltage	$V_{DSS}$	30	V
Gate-source voltage	$V_{GSS}$	±12	V
Drain current	DC	$I_D$	3.0
	Pulse	$I_{DP}$	6.0
Drain power dissipation	$P_D$ (Note 1)	0.75	W
Channel temperature	$T_{ch}$	150	°C

#### Schottky Diode (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Maximum (peak) reverse Voltage	$V_{RM}$	45	V
Reverse voltage	$V_R$	40	V
Average forward current	$I_O$	100	mA
Maximum (peak) forward current	$I_{FM}$	300	mA
Surge current (10ms)	$I_{FSM}$	1	A
Junction temperature	$T_j$	125	°C

#### MOSFET and Diode (Ta = 25°C)

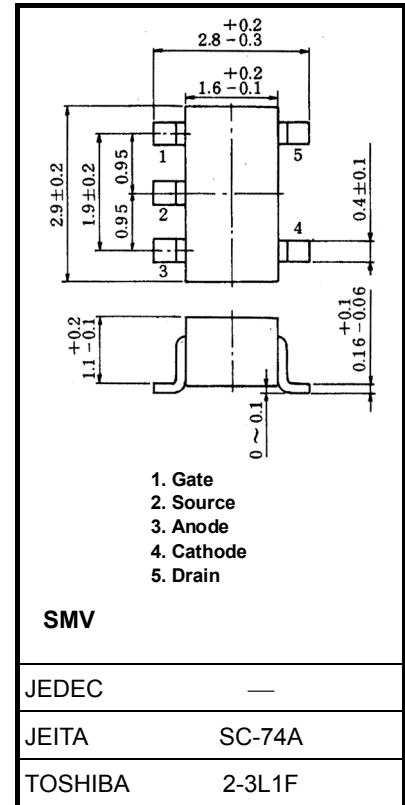
Characteristics	Symbol	Rating	Unit
Storage temperature range	$T_{stg}$	-55 to 125	°C
Operating temperature range	$T_{opr}$	-40 to 100	°C

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).

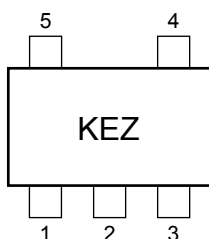
Note 1: Mounted on FR4 board (25.4 mm × 25.4 mm × 1.6 mm, Cu pad: 645 mm<sup>2</sup>)

Unit: mm

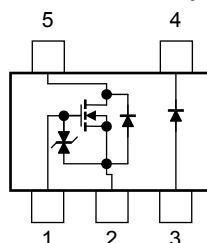


Weight : 14 mg (typ.)

### Marking



### Equivalent Circuit (top view)



## MOSFET

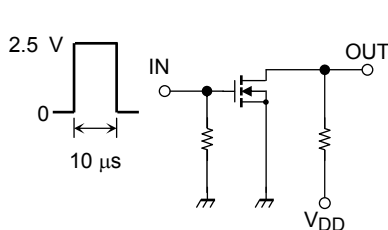
### Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$	30	—	—	V
	$V_{(BR)DSX}$	$I_D = 1 \text{ mA}, V_{GS} = -12 \text{ V}$	18	—	—	
Drain cut-off current	$I_{DSS}$	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	1	$\mu\text{A}$
Gate leakage current	$I_{GSS}$	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	$\pm 1$	$\mu\text{A}$
Gate threshold voltage	$V_{th}$	$V_{DS} = 3 \text{ V}, I_D = 1 \text{ mA}$	0.4	—	1.0	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = 3 \text{ V}, I_D = 2.0 \text{ A}$ (Note2)	3.8	7.7	—	S
Drain-source ON-resistance	$R_{DS(ON)}$	$I_D = 2.0 \text{ A}, V_{GS} = 4.0 \text{ V}$ (Note2)	—	59	78	m $\Omega$
		$I_D = 1.0 \text{ A}, V_{GS} = 2.5 \text{ V}$ (Note2)	—	71	94	
		$I_D = 0.5 \text{ A}, V_{GS} = 1.8 \text{ V}$ (Note2)	—	88	138	
Input capacitance	$C_{iss}$	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	270	—	pF
Output capacitance	$C_{oss}$		—	56	—	
Reverse transfer capacitance	$C_{rss}$		—	47	—	
Total Gate Charge	$Q_g$	$V_{DD} = 15 \text{ V}, I_D = 3.0 \text{ A}$ $V_{GS} = 4 \text{ V}$	—	4.3	—	nC
Gate-Source Charge	$Q_{gs}$		—	2.8	—	
Gate-Drain Charge	$Q_{gd}$		—	1.5	—	
Switching time	Turn-on time	$t_{on}$	$V_{DD} = 10 \text{ V}, I_D = 2 \text{ A}$ $V_{GS} = 0 \text{ to } 2.5 \text{ V}, R_G = 4.7 \Omega$	—	20	ns
	Turn-off time	$t_{off}$		—	31	
Drain-Source forward voltage	$V_{DSF}$	$I_D = -3.0 \text{ A}, V_{GS} = 0 \text{ V}$ (Note2)	—	-0.85	-1.2	V

Note 2: Pulse test

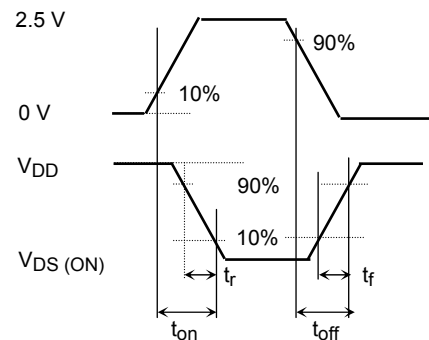
### Switching Time Test Circuit

#### (a) Test Circuit



$V_{DD} = 10 \text{ V}$   
 $R_G = 4.7 \Omega$   
 $D.U. \leq 1\%$   
 $V_{IN}: t_r, t_f < 5 \text{ ns}$   
 Common Source  
 $T_a = 25^\circ\text{C}$

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



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

### Precaution

$V_{th}$  can be expressed as voltage between gate and source when the low operating current value is  $I_D = 1 \text{ mA}$  for this product. For normal switching operation,  $V_{GS(ON)}$  requires a higher voltage than  $V_{th}$  and  $V_{GS(OFF)}$  requires a lower voltage than  $V_{th}$ .

(The relationship can be established as follows:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ )

Be sure to take this into consideration when using the device.

## Schottky Barrier Diode

### Electrical Characteristics (Ta = 25°C)

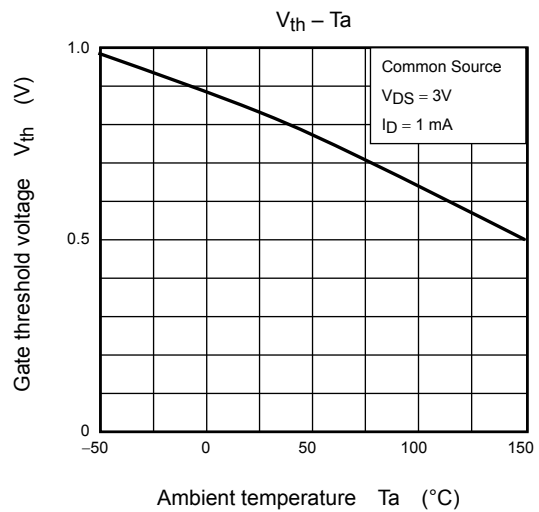
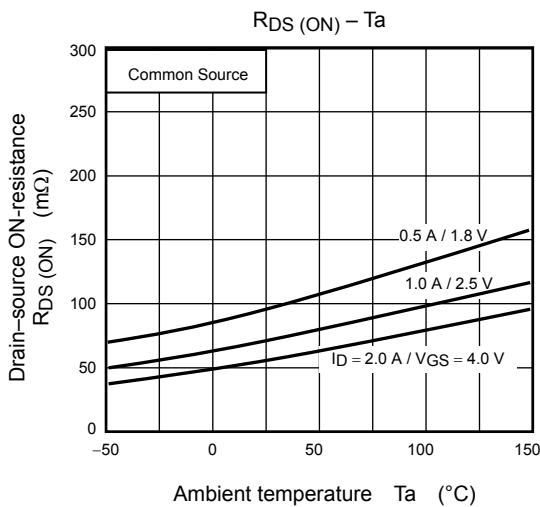
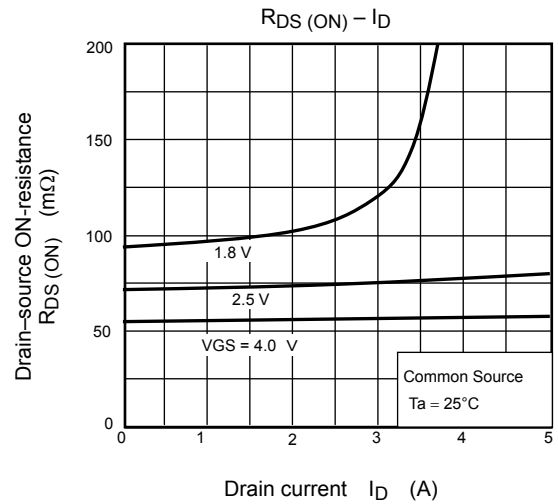
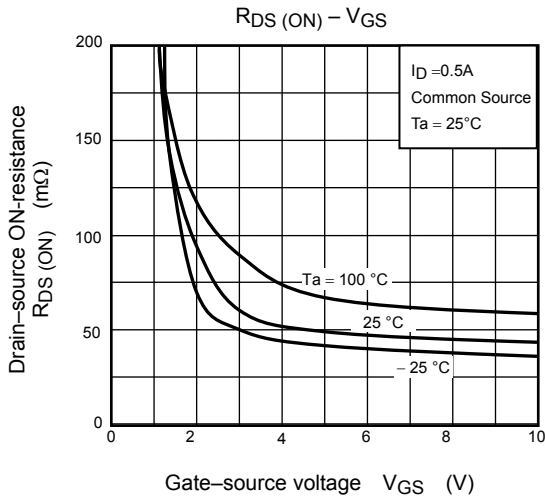
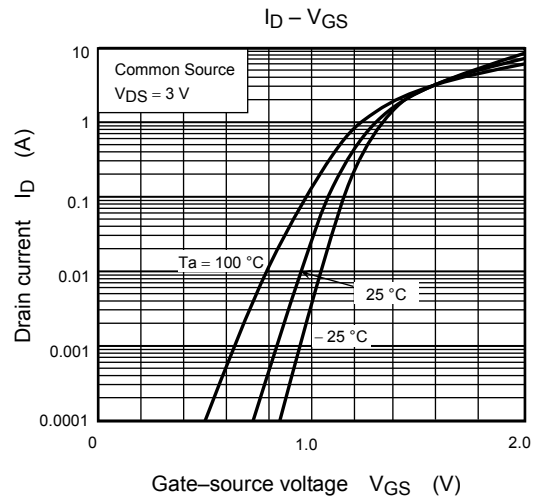
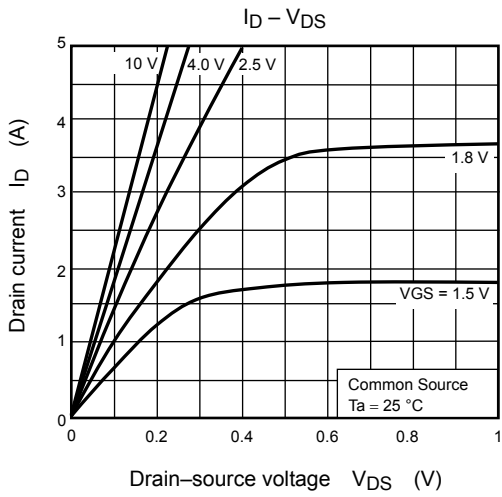
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward voltage	$V_F (1)$	$I_F = 1 \text{ mA}$	—	0.28	—	V
	$V_F (2)$	$I_F = 10 \text{ mA}$	—	0.36	—	
	$V_F (3)$	$I_F = 100 \text{ mA}$	—	0.54	0.60	
Reverse current	$I_R$	$V_R = 40 \text{ V}$	—	—	5	$\mu\text{A}$
Total capacitance	$C_T$	$V_R = 0 \text{ V}, f = 1\text{MHz}$	—	18	25	pF

### Handling Precaution

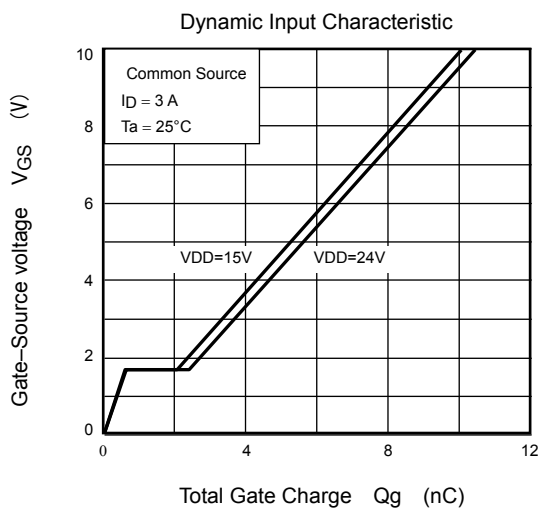
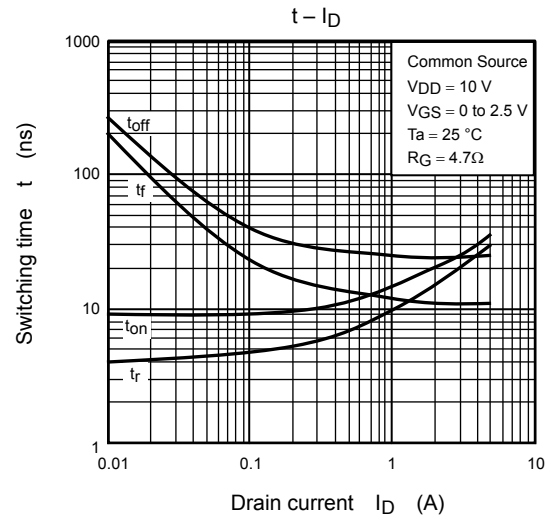
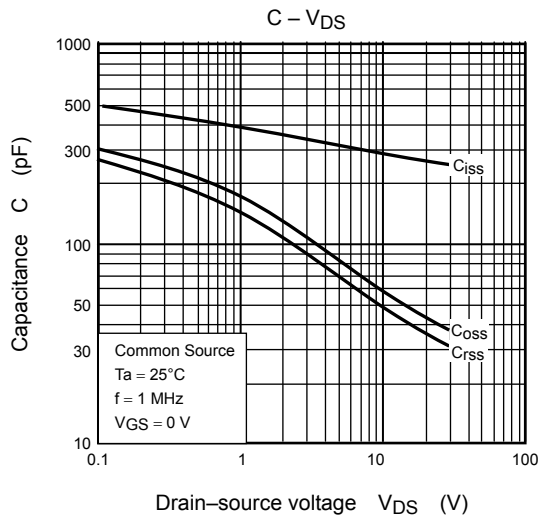
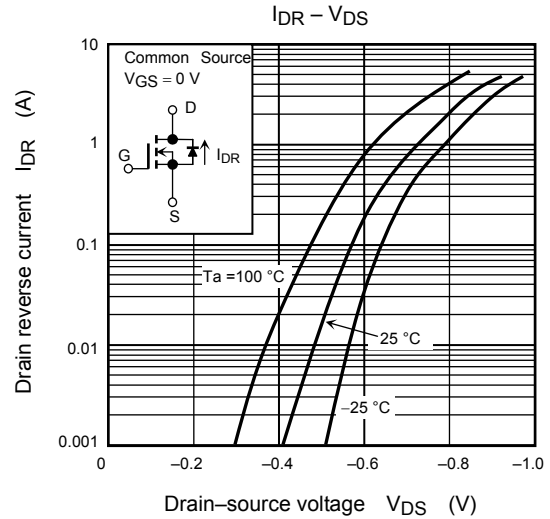
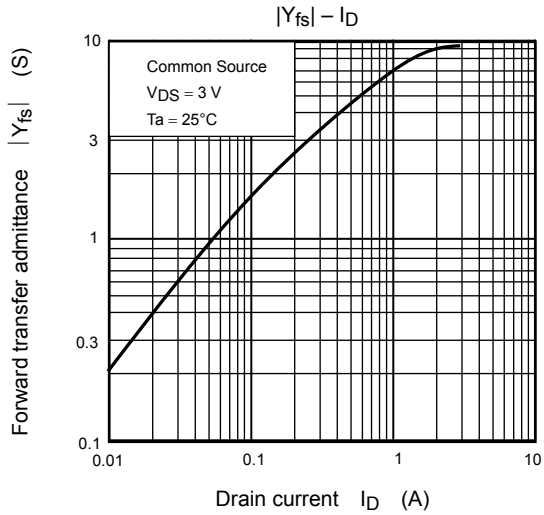
When handling individual devices that are not yet mounted on a circuit board, make sure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic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

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.

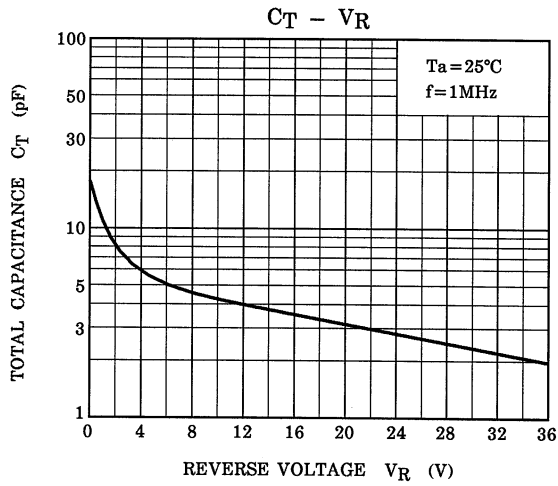
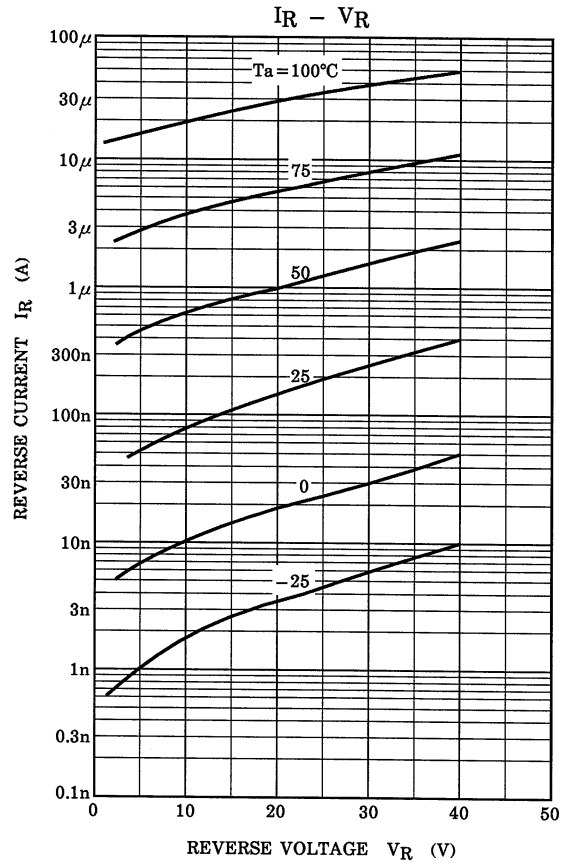
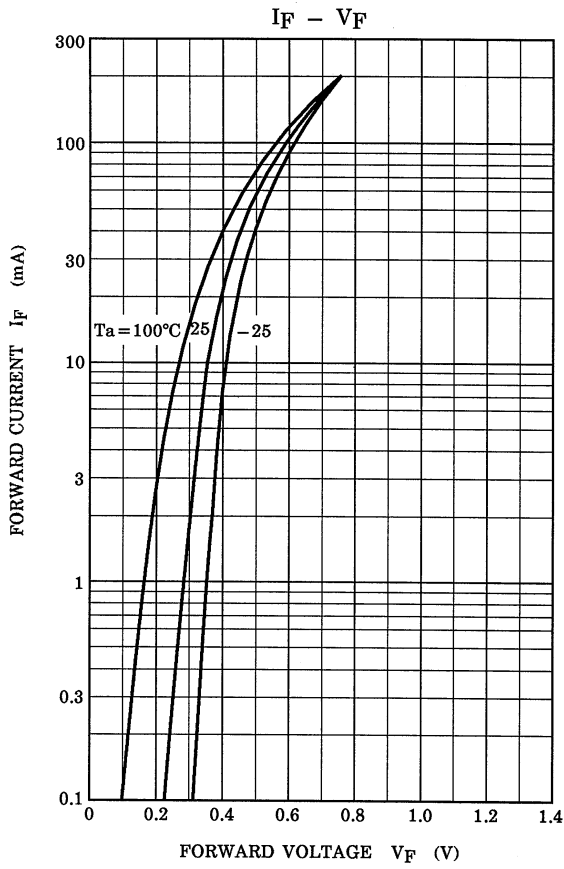
## MOS FET



## MOS FET



Schottky Barrier Diode



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