

Silicon P-Channel MOS Type / Silicon Epitaxial Schottky Barrier Diode

SSM5G06FE

DC-DC Converter Applications

- Combined a P-channel MOSFET and a Schottky barrier diode in one package.
- Optimum for high-density mounting in small packages

Absolute Maximum Ratings (Ta = 25°C) MOSFET

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DSS}	-20	V
Gate-Source voltage		V_{GSS}	± 10	V
Drain current	DC	I_D	-100	mA
	Pulse	I_{DP} (Note 2)	-200	
Power dissipation		P_D (Note 1)	150	mW
Channel temperature		T_{ch}	150	°C

Absolute Maximum Ratings (Ta = 25°C) SBD

Characteristics		Symbol	Rating	Unit
Maximum (peak) reverse voltage		V_{RM}	15	V
Reverse voltage		V_R	12	V
Average forward current		I_O	100	mA
Peak one cycle surge forward current (10ms)		I_{FSM}	1 (50 Hz)	A
Junction temperature		T_j	125	°C

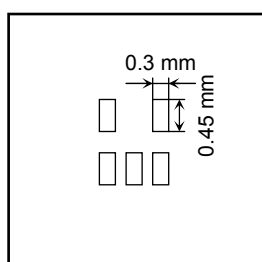
Absolute Maximum Ratings (Ta = 25°C) MOSFET, SBD COMMON

Characteristics		Symbol	Rating	Unit
Storage temperature range		T_{stg}	-55 to 125	°C
Operating temperature range		T_{opr} (Note3)	-40 to 100	°C

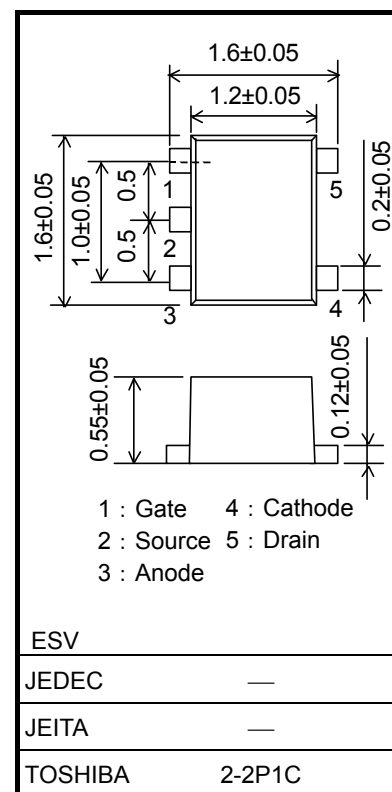
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

Note1: Total rating. Mounted on an FR4 board. (25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.135 mm² × 5)



Unit: mm



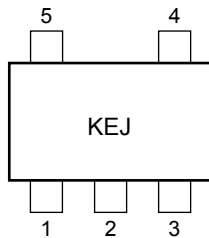
Weight: 3 mg (Typ.)

Start of commercial production
2002-08

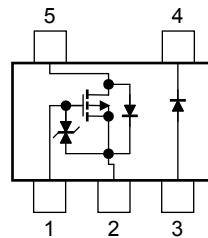
Note 2: The pulse width limited by max channel temperature.

Note 3: Operating temperature limited by max channel temperature and max junction temperature.

Marking



Equivalent Circuit



Handling Precaution

When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against static discharge. Operators should wear anti-static clothing and use containers and other objects that are made of anti-static materials.

MOSFET

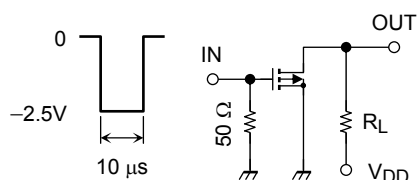
Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current	I_{GSS}	$V_{GS} = \pm 10 \text{ V}, V_{DS} = 0 \text{ V}$	—	—	± 1	μA
Drain-Source breakdown voltage	$V_{(BR)DSS}$	$I_D = -0.1 \text{ mA}, V_{GS} = 0 \text{ V}$	-20	—	—	V
Drain Cut-off current	I_{DSS}	$V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}$	—	—	-1	μA
Gate threshold voltage	V_{th}	$V_{DS} = -3 \text{ V}, I_D = -0.1 \text{ mA}$	-0.6	—	-1.1	V
Forward transfer admittance	$ Y_{fs} $	$V_{DS} = -3 \text{ V}, I_D = -10 \text{ mA}$ (Note 4)	25	—	—	mS
Drain-Source on-resistance	$R_{DS(ON)}$	$I_D = -10 \text{ mA}, V_{GS} = -4 \text{ V}$ (Note 4)	—	6	8	Ω
		$I_D = -10 \text{ mA}, V_{GS} = -2.5 \text{ V}$ (Note 4)	—	8	12	
		$I_D = -1 \text{ mA}, V_{GS} = -1.5 \text{ V}$ (Note 4)	—	18	45	
Input capacitance	C_{iss}	$V_{DS} = -3 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	11	—	pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = -3 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	3.7	—	pF
Output capacitance	C_{oss}	$V_{DS} = -3 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	—	10	—	pF
Switching time	Turn-on time	t_{on}	—	130	—	ns
	Turn-off time	t_{off}				

Note 4: Pulse test

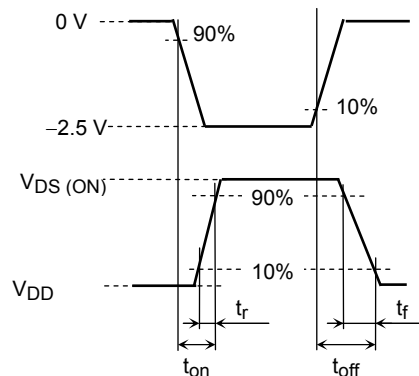
Switching Time Test Circuit

(a) Test circuit



$V_{DD} = -3 \text{ V}$
Duty $\leq 1\%$
 V_{IN} : $t_r, t_f < 5 \text{ ns}$
($Z_{out} = 50 \Omega$)
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 low operating current value is $I_D = -100 \mu\text{A}$ for this product. For normal switching operation, $V_{GS(on)}$ requires higher voltage than V_{th} and $V_{GS(off)}$ requires lower voltage than V_{th} .

(Relationship can be established as follows: $V_{GS(off)} < V_{th} < V_{GS(on)}$)

Please take this into consideration for using the device.

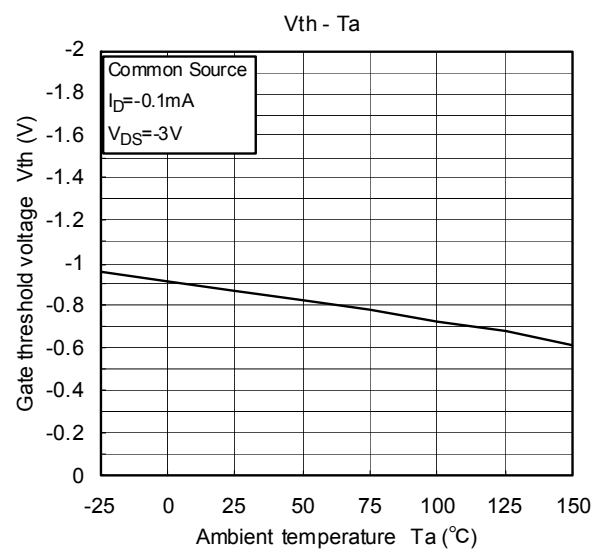
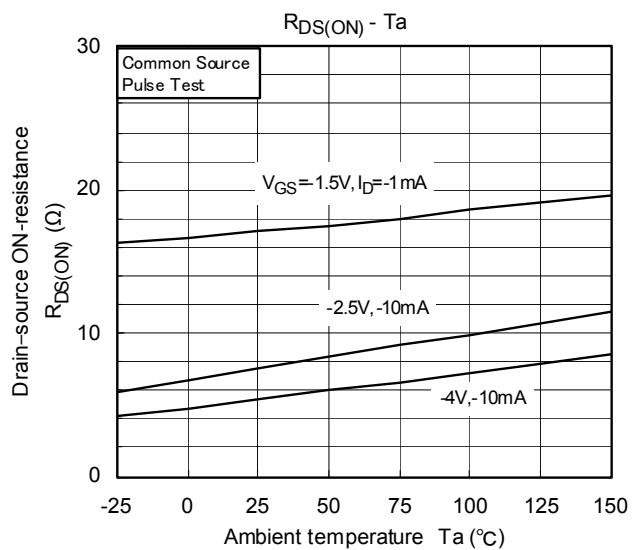
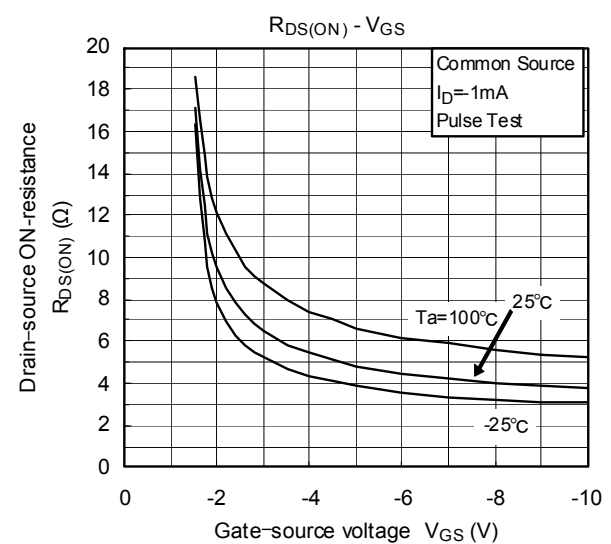
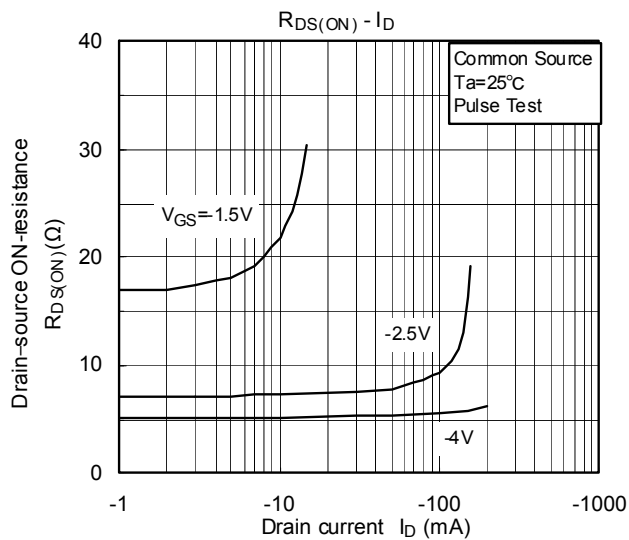
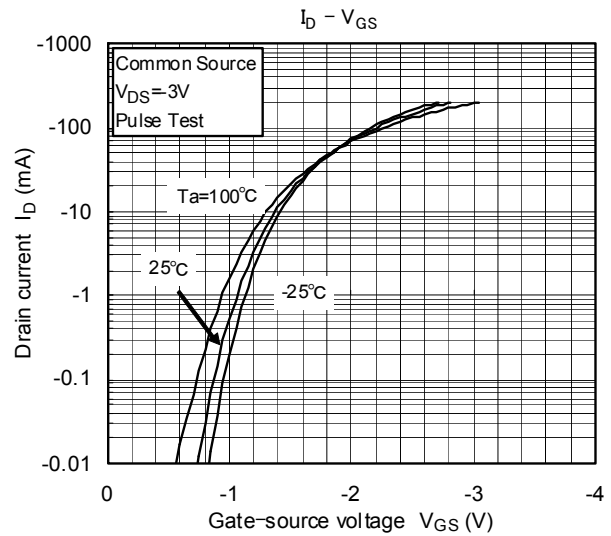
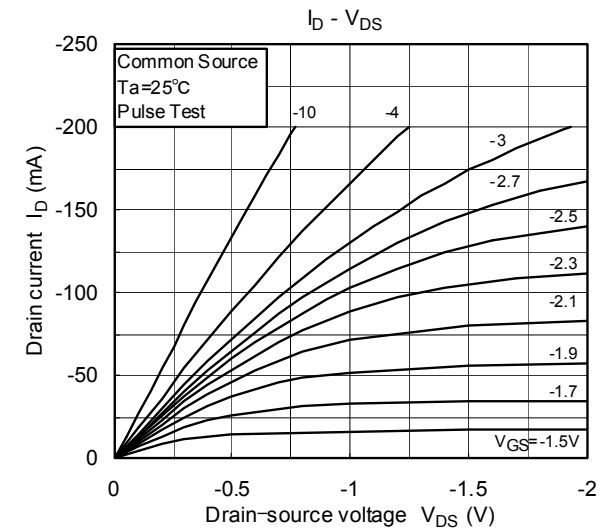
SBD**Electrical Characteristics (Ta = 25°C)**

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward voltage	$V_F (1)$	$I_F = 1 \text{ mA}$	—	0.18	—	V
	$V_F (2)$	$I_F = 5 \text{ mA}$	—	0.23	0.30	V
	$V_F (3)$	$I_F = 100 \text{ mA}$	—	0.35	0.50	V
Reverse current	I_R	$V_R = 12 \text{ V}$	—	—	22	μA
Total capacitance	C_T	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$	—	20	40	pF

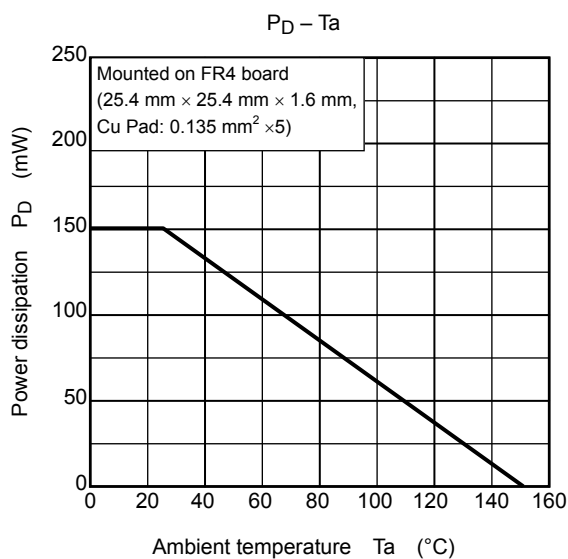
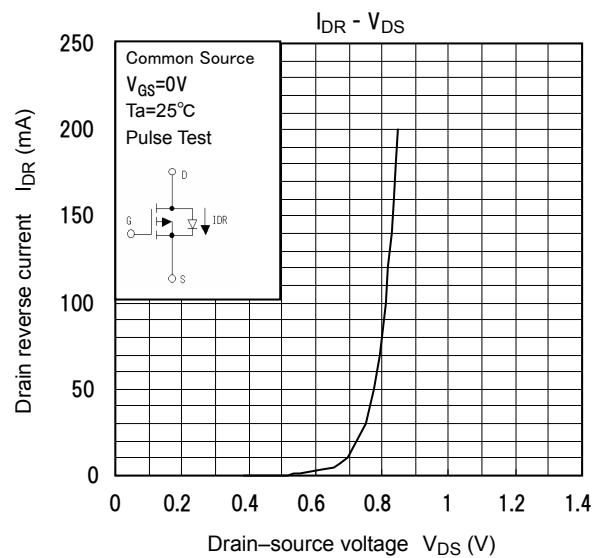
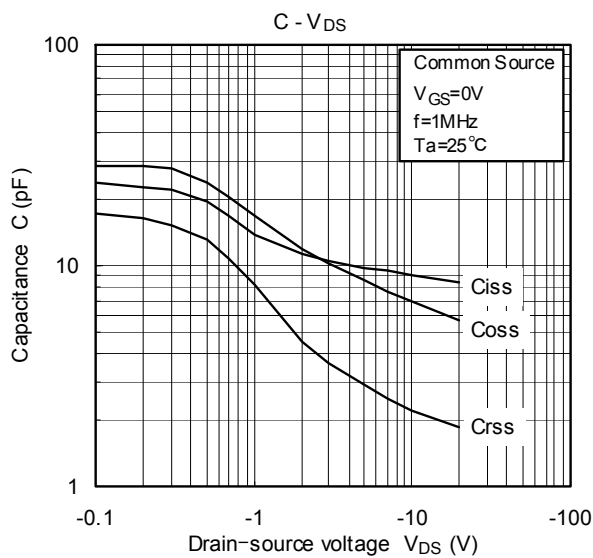
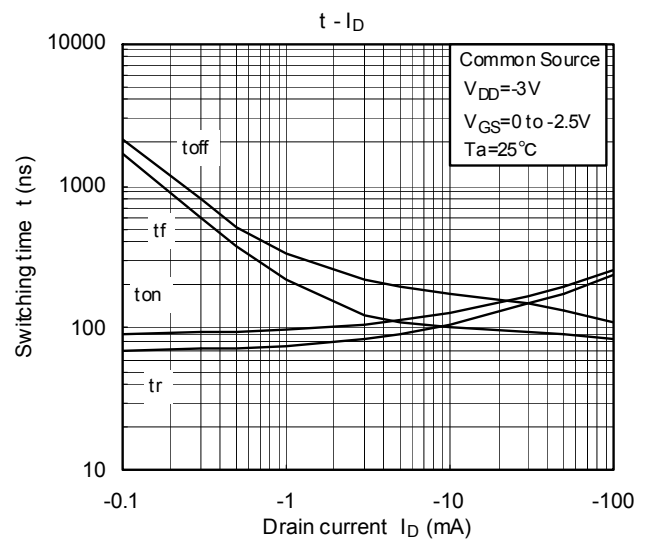
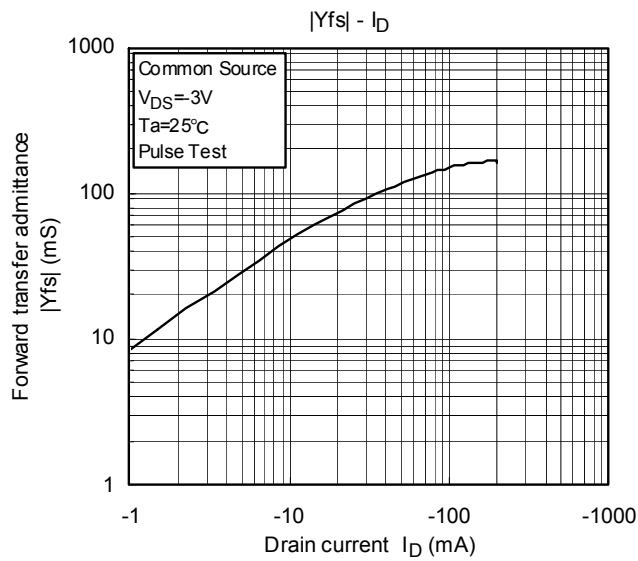
Precaution

The Schottky barrier diode in this device has large reverse current leakage compared to typical switching diodes. Thus, excessive operating temperature or voltage may cause thermal runaway. To avoid this problem, be sure to take both forward and reverse loss into consideration.

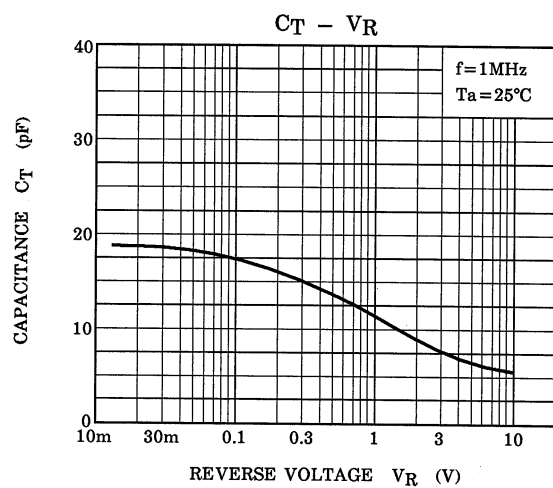
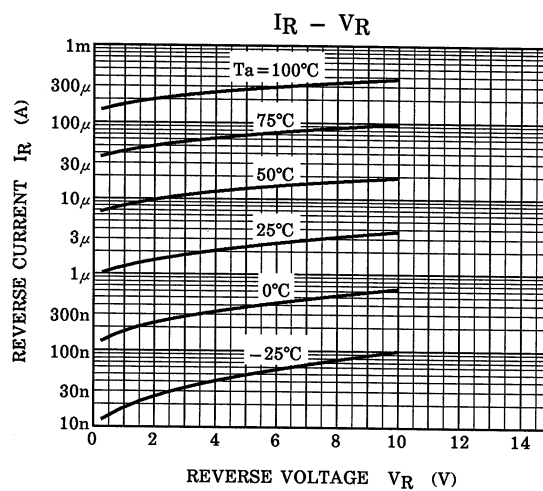
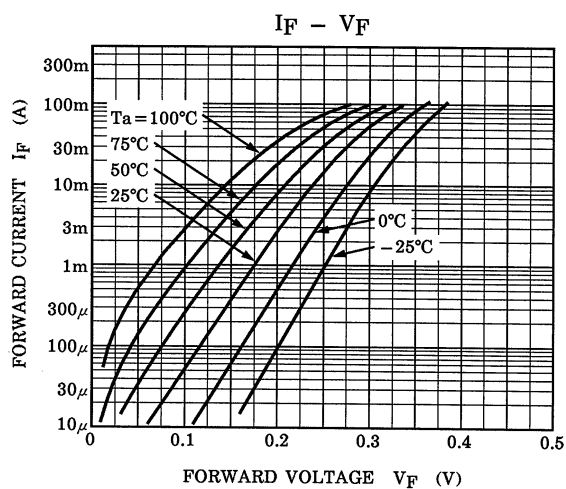
MOSFET



MOSFET



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