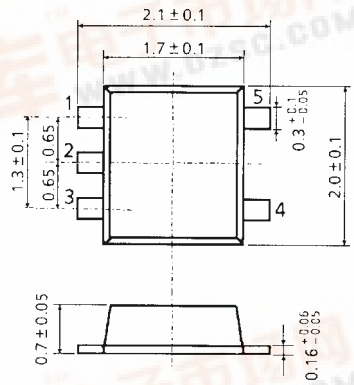
Silicon P Channel MOS Type (U-MOSII)/Silicon Epitaxial Schottky Planar Diode

SSM5G01TU

DC-DC Converter for DSCs and Camcorders

- Co-packaged Pch MOSFET and Schottky Diode.
- Low $R_{DS\ (ON)}$ and Low V_F

Unit: mm



1 : GATE 4 : CATHODE
2 : SOURCE 5 : DRAIN
3 : ANODE

UFV

JEDEC	—
JEITA	—
TOSHIBA	2-2R1A

Weight: 7 mg (typ.)

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	−30	V
Gate-Source voltage		V_{GSS}	±20	V
Drain current	DC	I_D	−1.0	A
	Pulse	I_{DP} (Note 2)	−2.0	
Channel temperature		P_D (Note 1)	0.5	W
		t = 10s	0.8	
Channel temperature		T_{ch}	150	°C

Maximum Ratings (Ta = 25°C) SCHOTTKY DIODE

Characteristics	Symbol	Rating	Unit
Maximum (peak) reverse voltage	V_{RM}	25	V
Reverse voltage	V_R	20	V
Average forward current	I_O	0.5	A
Peak one cycle surge forward current (non-repetitive)	I_{FSM}	2 (50 Hz)	A
Junction temperature	T_j	125	°C

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

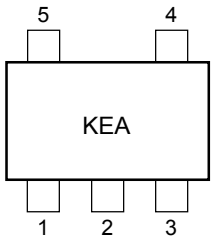
Characteristics	Symbol	Rating	Unit
Storage temperature	T_{stg}	−55~125	°C
Operating temperature	T_{opr} (Note 3)	−40~100	°C

Note 1: Mounted on FR4 board
(25.4 mm × 25.4 mm × 1.6 t, Cu pad: 645 mm^2)

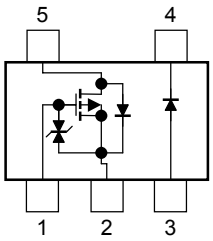
Note 2: The pulse width limited by max channel temperature.

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 mounting on a circuit board), be sure that the environment is protected against electrostatic electricity. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static materials.

The Channel-to-Ambient thermal resistance $R_{th\ (ch\text{-}a)}$ and the drain power dissipation P_D vary according to the board material, board area, board thickness and pad area are also affected by the environment in which the product is used. When using this device, please take heat dissipation fully into account.

MOSFET

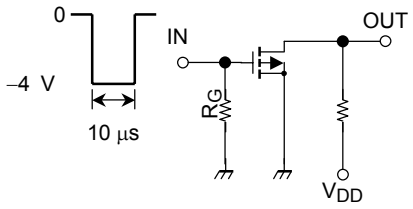
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0	—	—	±1	μA
Drain-Source breakdown voltage		$V_{(BR)\ DSS}$	I_D = −1 mA, V_{GS} = 0	−30	—	—	V
		$V_{(BR)\ DSX}$	I_D = −1 mA, V_{GS} = 20 V	−15	—	—	
Drain Cut-off current		I_{DSS}	V_{DS} = −30 V, V_{GS} = 0	—	—	−1	μA
Gate threshold voltage		V_{th}	V_{DS} = −5 V, I_D = −0.1 mA	−0.8	—	−1.8	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −5 V, I_D = −0.5 A (Note 4)	0.5	1.0	—	S
Drain-Source ON resistance		$R_{DS\ (ON)}$	I_D = −0.5 A, V_{GS} = −10 V (Note 4)	—	0.3	0.4	Ω
			I_D = −0.5 A, V_{GS} = −4 V (Note 4)	—	0.6	0.8	
Input capacitance		C_{iss}	V_{DS} = −15 V, V_{GS} = 0, f = 1 MHz	—	86	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = −15 V, V_{GS} = 0, f = 1 MHz	—	14	—	pF
Output capacitance		C_{oss}	V_{DS} = −15 V, V_{GS} = 0, f = 1 MHz	—	25	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = −15 V, I_D = −0.5 A	—	14	—	ns
	Turn-off time	t_{off}	V_{GS} = 0~−4 V, R_G = 10 Ω	—	8.5	—	

Note 4: Pulse measurement

Switching Time Test Circuit

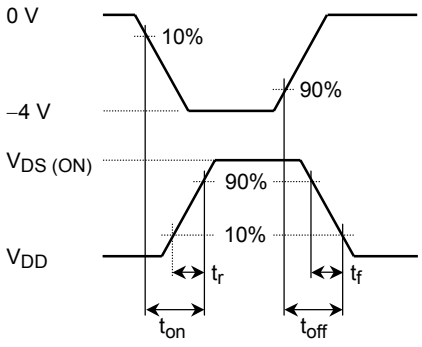
(a) Test circuit



V_{DD} = −15 V
R_G = 10 Ω
Duty ≦ 1%
V_{IN}: t_r, t_f < 5 ns
Common source
Ta = 25°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 μA 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.

V_{GS} recommended voltage of −2.5 V or higher to turn on this product.

Schottky Diode

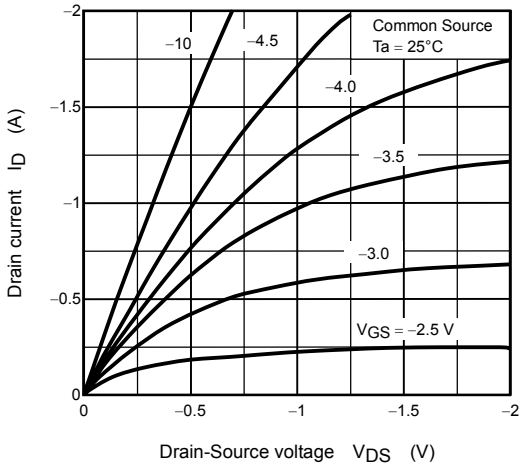
Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward voltage	$V_{F\ (1)}$	I_F = 0.3 A	—	0.38	0.45	V
	$V_{F\ (2)}$	I_F = 0.5 A	—	0.43	—	V
Reverse current	I_R	V_R = 20 V	—	—	50	μA
Total capacitance	C_T	V_R = 0 V, f = 1 MHz	—	46	—	pF

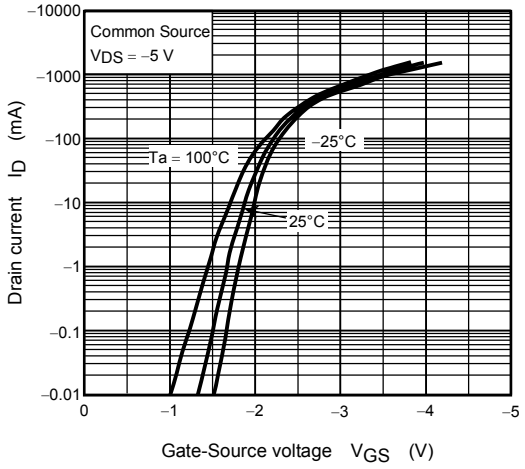
Precaution

The schottky barrier diode of this product are having large-reverse-current-leakage characteristic compare to the other switching diodes. This current leakage and not proper operating temperature or voltage may cause thermal runaway. Please take forward and reverse loss into consideration when you design.

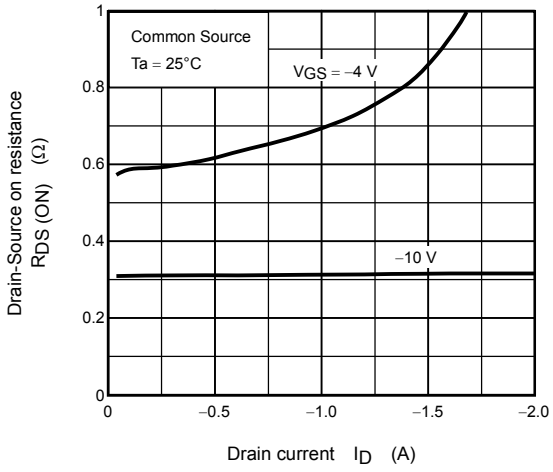
$I_D - V_{DS}$ (MOSFET)



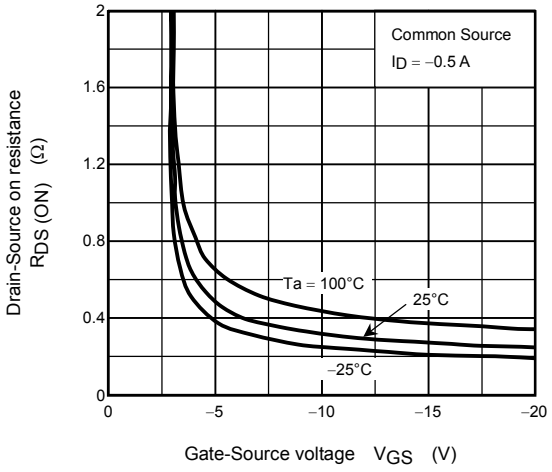
$I_D - V_{GS}$ (MOSFET)



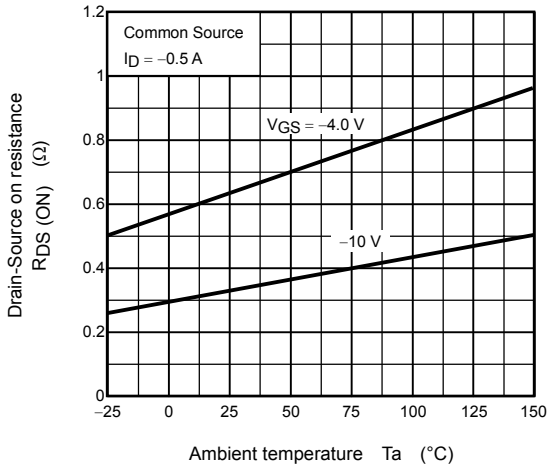
$R_{DS\ (ON)} - I_D$ (MOSFET)



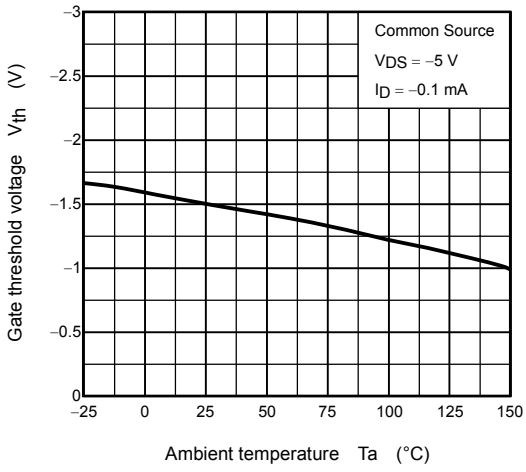
$R_{DS\ (ON)} - V_{GS}$ (MOSFET)



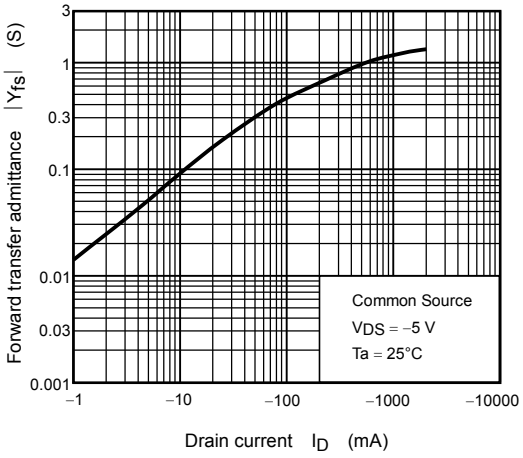
$R_{DS\ (ON)} - Ta$ (MOSFET)



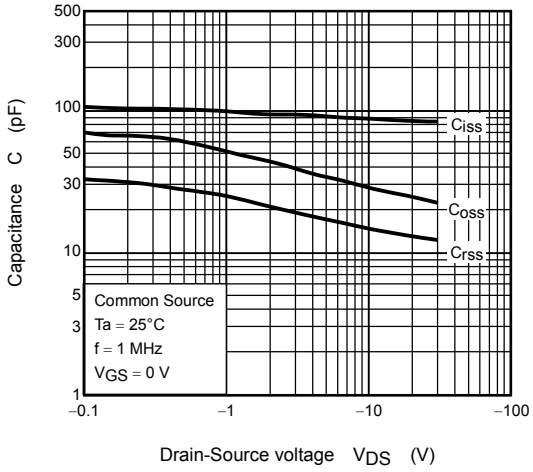
$V_{th} - Ta$ (MOSFET)



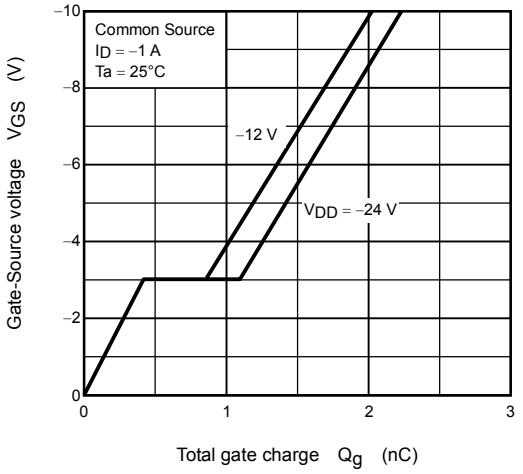
$|Y_{fs}| - I_D$ (MOSFET)



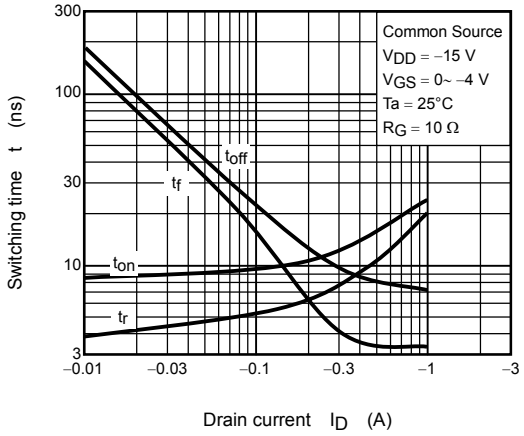
$C - V_{DS}$ (MOSFET)



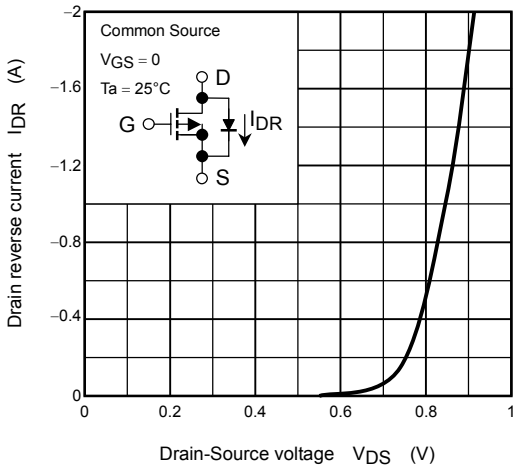
Dynamic input characteristic (MOSFET)



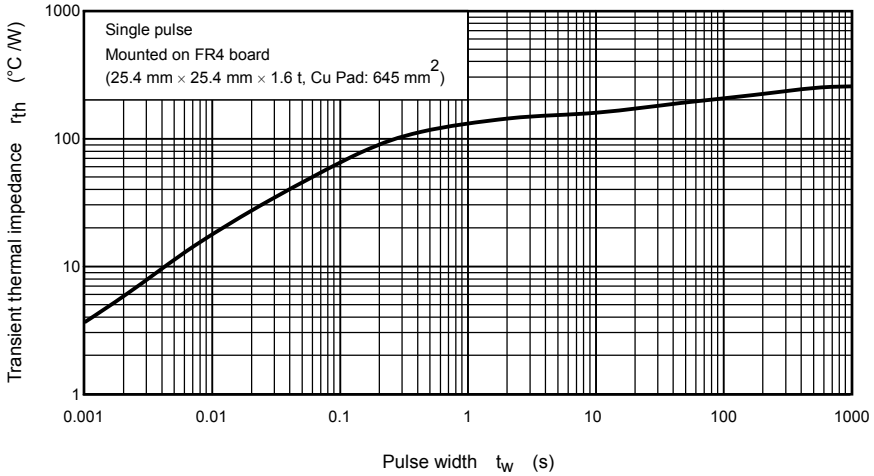
$t - I_D$ (MOSFET)



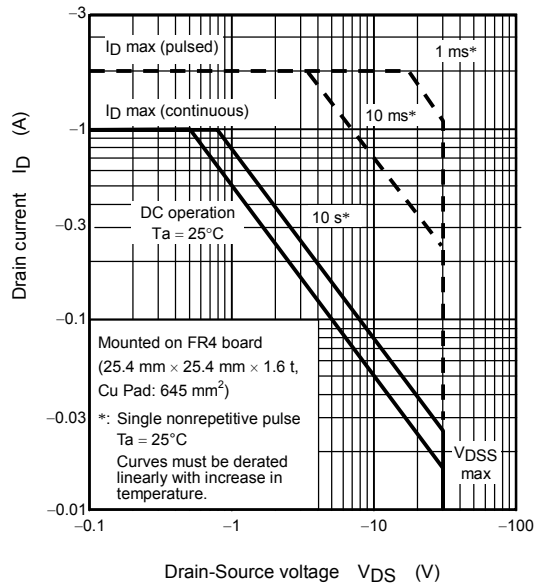
$I_{DR} - V_{DS}$ (MOSFET)



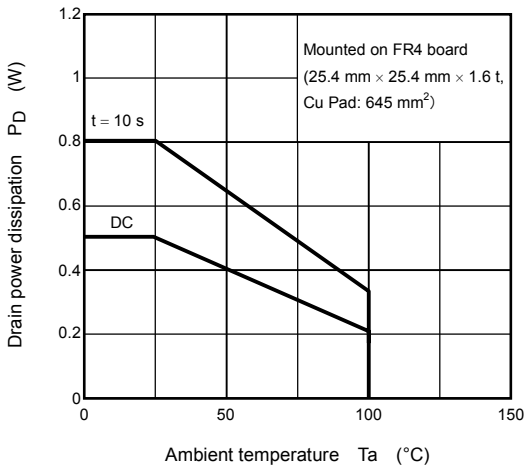
$r_{th} - t_w$ (MOSFET)



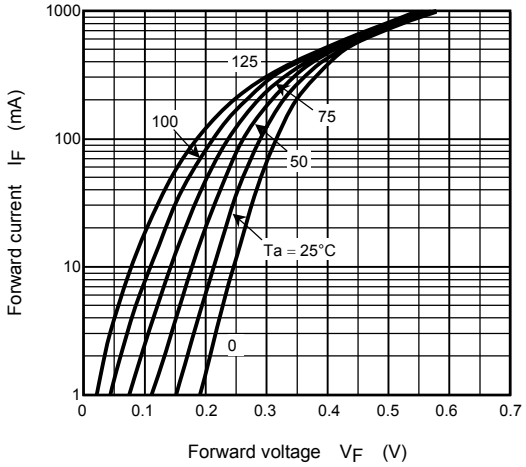
Safe operating area (MOSFET)



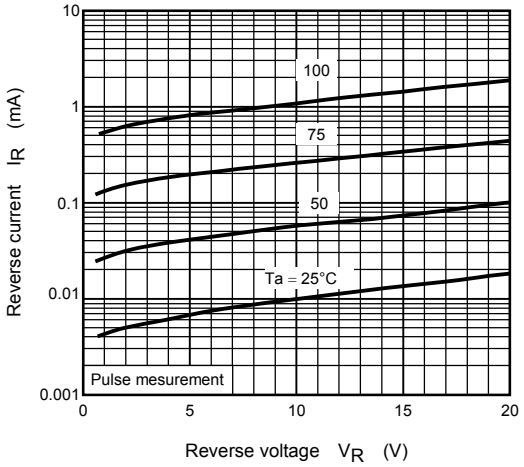
P_D – Ta (MOSFET)



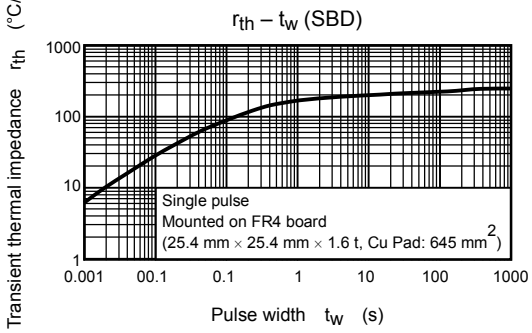
$I_F – V_F$ (SBD)



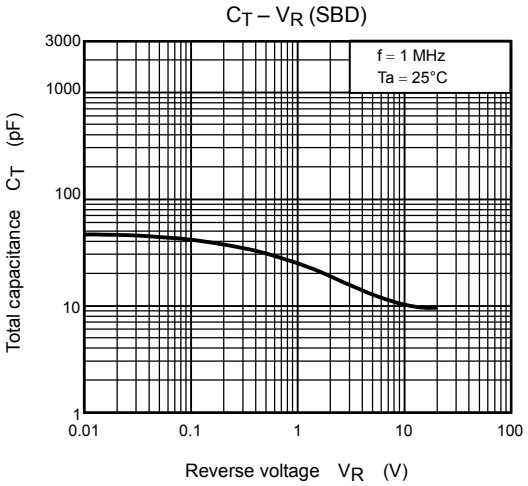
$I_R – V_R$ (SBD)



$r_{th} – t_w$ (SBD)



$C_T – V_R$ (SBD)



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