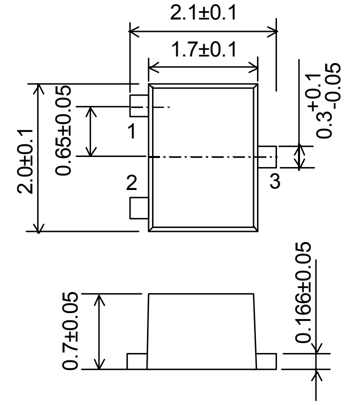
TOSHIBA Field Effect Transistor Silicon P-Channel MOS Type

SSM3J108TU

High Speed Switching Applications

- 1.8V drive
- Low on-resistance: R_{on} = 363mΩ (max) (@V_{GS} = −1.8 V)
  R_{on} = 230mΩ (max) (@V_{GS} = −2.5 V)
  R_{on} = 158mΩ (max) (@V_{GS} = −4.0 V)
- Lead(Pb)-free

Unit: mm



1 :Gate
2 :Source
3 :Drain

UFM

JEDEC	―
JEITA	―
TOSHIBA	2-2U1A

Weight: 6.6 mg (typ.)

Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	−20	V
Gate-Source voltage		V_{GSS}	± 8	V
Drain current	DC	I_D	−1.8	A
	Pulse	I_{DP}	−3.6	
Drain power dissipation		P_D (Note1)	800	mW
		P_D (Note2)	500	
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

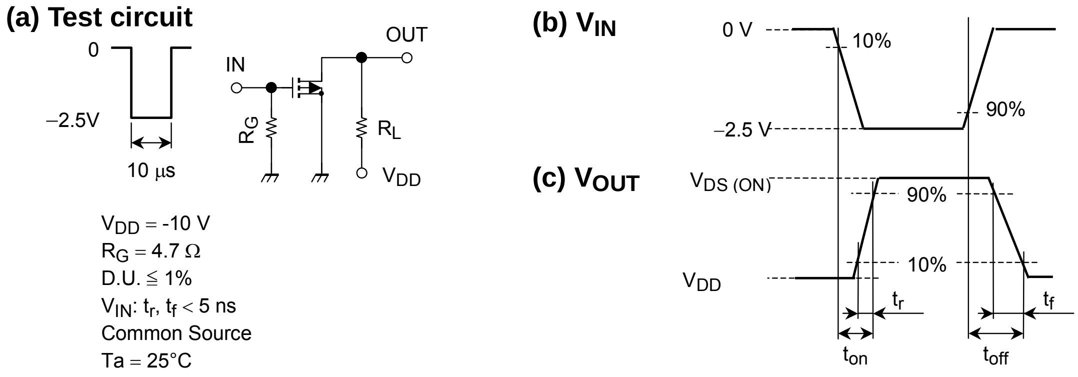
Note1: Mounted on ceramic board.
(25.4 mm × 25.4 mm × 0.8 mm, Cu Pad: 645 mm^2)
Note2: Mounted on FR4 board.
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm^2)

Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Conditions	Min	Typ.	Max	Unit
Drain-Source breakdown voltage		$V_{(BR)DSS}$	I_D = −1 mA, V_{GS} = 0	−20	―	―	V
		$V_{(BR)DSX}$	I_D = −1 mA, V_{GS} = +8 V	−12	―	―	
Drain cut-off current		I_{DSS}	V_{DS} = −20 V, V_{GS} = 0	―	―	−10	μA
Gate leakage current		I_{GSS}	V_{GS} = ±8V, V_{DS} = 0	―	―	±1	μA
Gate threshold voltage		V_{th}	V_{DS} = −3 V, I_D = −1 mA	−0.3	―	−1.0	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = −3 V, I_D =− 0.8 A (Note3)	1.9	3.2	―	S
Drain-Source on-resistance		$R_{DS(ON)}$	I_D = −0.8 A, V_{GS} = −4.0 V (Note3)	―	125	158	mΩ
			I_D = −0.4 A, V_{GS} = −2.5 V (Note3)	―	170	230	
			I_D = −0.1 A, V_{GS} = −1.8 V (Note3)	―	230	363	
Input capacitance		C_{iss}	V_{DS} = −10 V, V_{GS} = 0, f = 1 MHz	―	250	―	pF
Output capacitance		C_{oss}	V_{DS} = −10 V, V_{GS} = 0, f = 1 MHz	―	45	―	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = −10 V, V_{GS} = 0, f = 1 MHz	―	35	―	pF
Switching time	Turn-on time	t_{on}	V_{DD} = −10 V, I_D = −0.25 A, V_{GS} = 0~−2.5 V, R_G = 4.7 Ω	―	12	―	ns
	Turn-off time	t_{off}		―	18	―	
Drain-Source forward voltage		V_{DSF}	I_D = 1.8A, V_{GS} = 0 V (Note3)	―	0.85	1.2	V

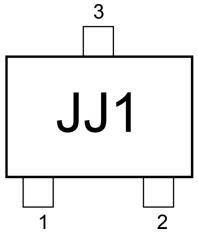
Note3: Pulse test

Switching Time Test Circuit

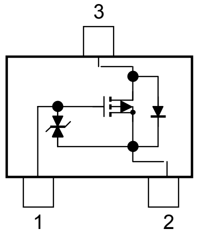


V_{DD} = -10 V
R_G = 4.7 Ω
D.U. ≦ 1%
V_{IN}: t_r, t_f < 5 ns
Common Source
Ta = 25°C

Marking



Equivalent Circuit (top view)



Precaution

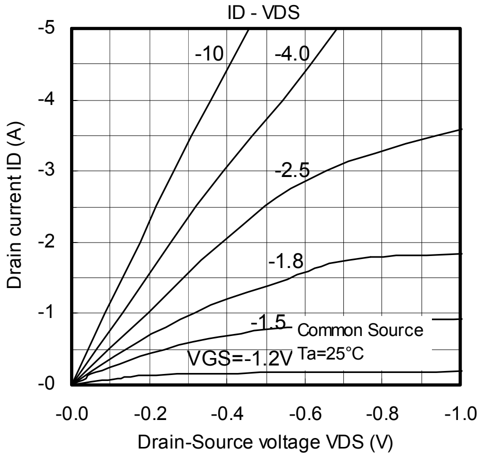
V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D=−1mA for this product. For normal switching operation, $V_{GS\ (on)}$ requires a higher voltage than V_{th}, and $V_{GS\ (off)}$ requires a lower voltage than V_{th}.
(The relationship can be established as follows: $V_{GS\ (off)} < V_{th} < V_{GS\ (on)}$)

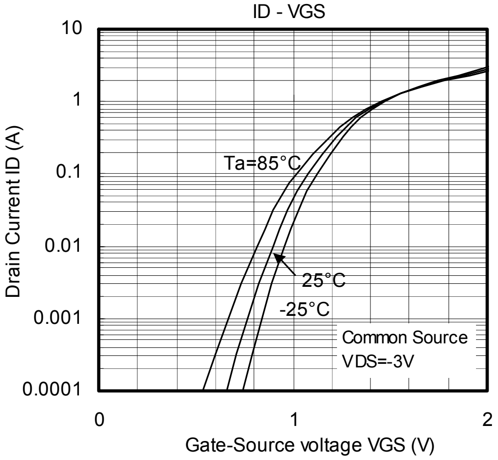
Take this into consideration when using the device.

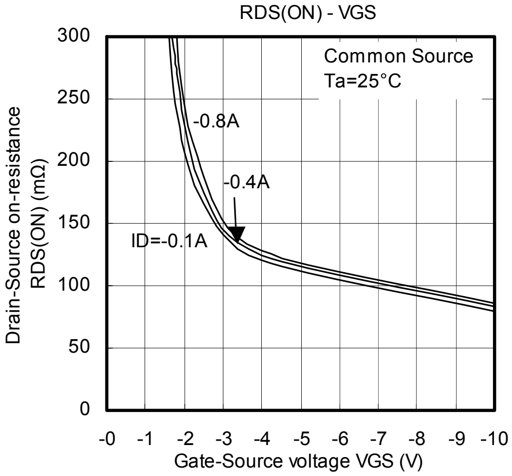
The recommended V_{GS} voltage for turning on this product is −1.8 V or higher.

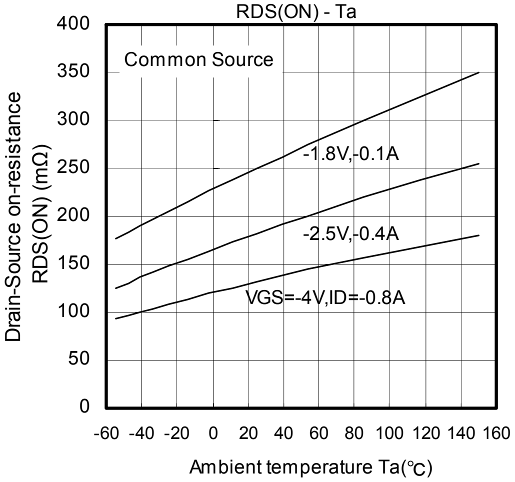
Handling Precaution

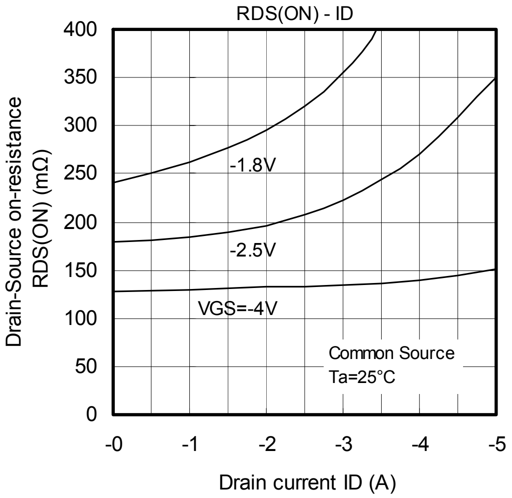
When handling individual devices which are not yet mounted on a circuit board, be sure that the environment is protected against electrostatic discharge. Operators should wear anti-static clothing, and containers and other objects that come into direct contact with devices should be made of anti-static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

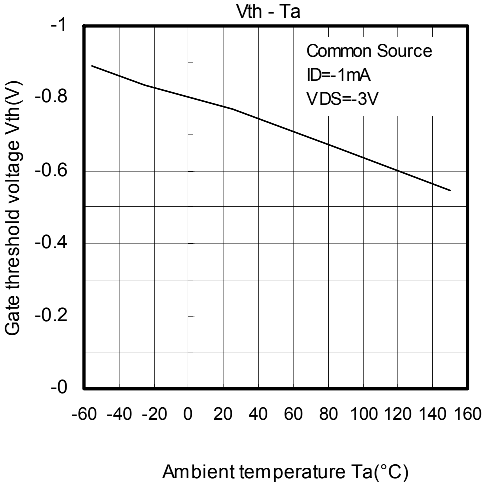

ID - VDS
-10
-4.0
-2.5
-1.8
-1.5
VGS=-1.2V
Common Source
Ta=25°C
Drain current ID (A)
-5
-4
-3
-2
-1
-0
-0.0
-0.2
-0.4
-0.6
-0.8
-1.0
Drain-Source voltage VDS (V)

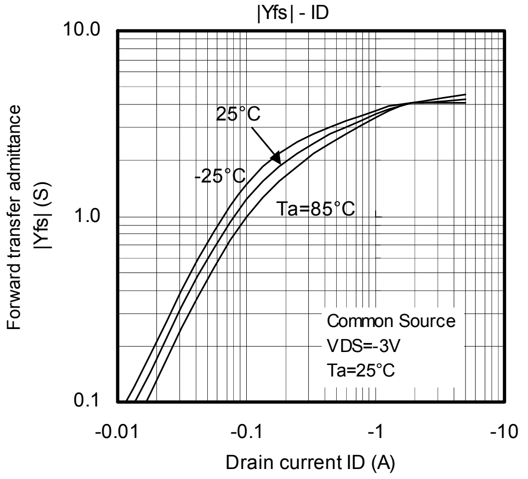

ID - VGS
Ta=85°C
25°C
-25°C
Common Source
VDS=-3V
Drain Current ID (A)
10
1
0.1
0.01
0.001
0.0001
0
1
2
Gate-Source voltage VGS (V)

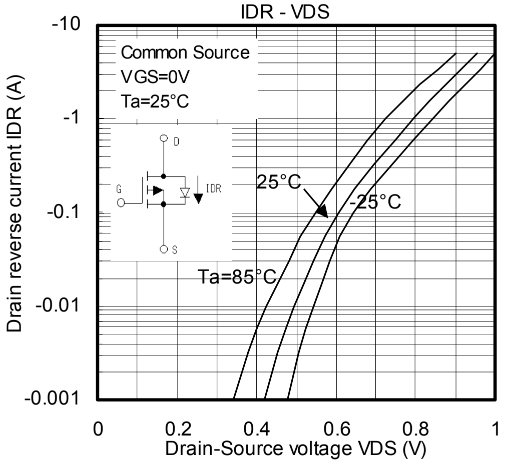

RDS(ON) - VGS
Common Source
Ta=25°C
-0.8A
-0.4A
ID=-0.1A
Drain-Source on-resistance
RDS(ON) (mΩ)
300
250
200
150
100
50
0
-0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
Gate-Source voltage VGS (V)

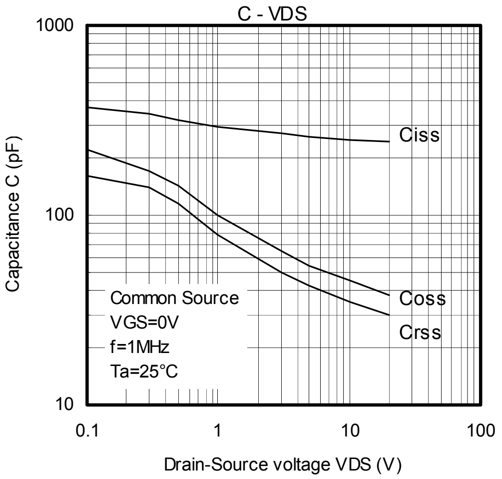

RDS(ON) - Ta
Common Source
-1.8V,-0.1A
-2.5V,-0.4A
VGS=-4V,ID=-0.8A
Drain-Source on-resistance
RDS(ON) (mΩ)
400
350
300
250
200
150
100
50
0
-60
-40
-20
0
20
40
60
80
100
120
140
160
Ambient temperature Ta(℃)

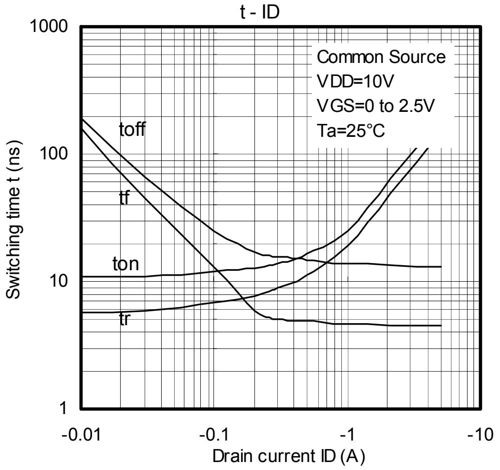

RDS(ON) - ID
-1.8V
-2.5V
VGS=-4V
Common Source
Ta=25°C
Drain-Source on-resistance
RDS(ON) (mΩ)
400
350
300
250
200
150
100
50
0
-0
-1
-2
-3
-4
-5
Drain current ID (A)

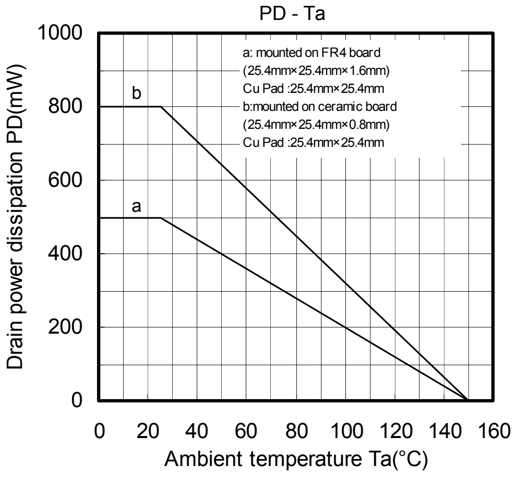

Vth - Ta
Common Source
ID=-1mA
VDS=-3V
Gate threshold voltage Vth(V)
-1
-0.8
-0.6
-0.4
-0.2
-0
-60
-40
-20
0
20
40
60
80
100
120
140
160
Ambient temperature Ta(°C)

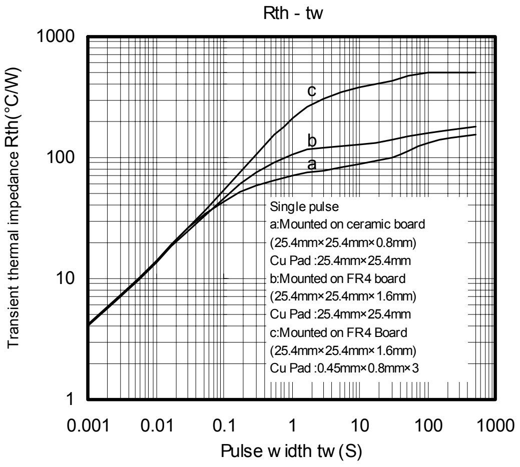

|Yfs| - ID
10.0
1.0
0.1
Forward transfer admittance
|Yfs| (S)
25°C
-25°C
Ta=85°C
Common Source
VDS=-3V
Ta=25°C
-0.01
-0.1
-1
-10
Drain current ID (A)


IDR - VDS
-10
-1
-0.1
-0.01
-0.001
Drain reverse current IDR (A)
Common Source
VGS=0V
Ta=25°C
D
G
S
IDR
25°C
-25°C
Ta=85°C
0
0.2
0.4
0.6
0.8
1
Drain-Source voltage VDS (V)


C - VDS
1000
100
10
Capacitance C (pF)
Ciss
Coss
Crss
Common Source
VGS=0V
f=1MHz
Ta=25°C
0.1
1
10
100
Drain-Source voltage VDS (V)


t - ID
1000
100
10
1
Switching time t (ns)
Common Source
VDD=10V
VGS=0 to 2.5V
Ta=25°C
toff
tf
ton
tr
-0.01
-0.1
-1
-10
Drain current ID (A)


PD - Ta
1000
800
600
400
200
0
Drain power dissipation PD(mW)
a: mounted on FR4 board
(25.4mm×25.4mm×1.6mm)
Cu Pad :25.4mm×25.4mm
b:mounted on ceramic board
(25.4mm×25.4mm×0.8mm)
Cu Pad :25.4mm×25.4mm
b
a
0
20
40
60
80
100
120
140
160
Ambient temperature Ta(°C)


Rth - tw
1000
100
10
1
Transient thermal impedance Rth(°C/W)
c
b
a
Single pulse
a:Mounted on ceramic board
(25.4mm×25.4mm×0.8mm)
Cu Pad :25.4mm×25.4mm
b:Mounted on FR4 board
(25.4mm×25.4mm×1.6mm)
Cu Pad :25.4mm×25.4mm
c:Mounted on FR4 Board
(25.4mm×25.4mm×1.6mm)
Cu Pad :0.45mm×0.8mm×3
0.001
0.01
0.1
1
10
100
1000
Pulse width tw (S)

RESTRICTIONS ON PRODUCT USE

030619EAA

- The information contained herein is subject to change without notice.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (“Unintended Usage”). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer’s own risk.
- TOSHIBA products should not be embedded to the downstream products which are prohibited to be produced and sold, under any law and regulations.