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TOSHIBA Field Effect Transistor Silicon P Channel MOS Type

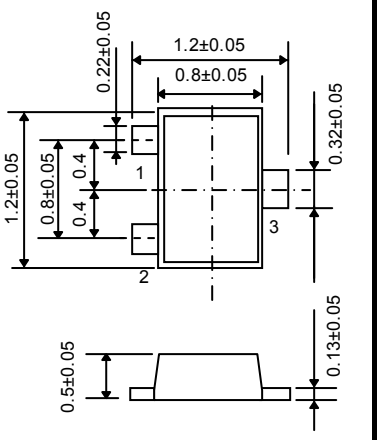
SSM3J15FV

High-Speed Switching Applications

Analog Switch Applications

- Optimum for high-density mounting in small packages
- Low on-resistance : $R_{DS(ON)}$ = 12 Ω (max) (@V_{GS} = −4 V)
  : $R_{DS(ON)}$ = 32 Ω (max) (@V_{GS} = −2.5 V)

Unit: mm



VESM	1.GATE 2.SOURCE 3.DRAIN
JEDEC	—
JEITA	—
TOSHIBA	2-1L1B

Weight: 1.5 mg (typ.)

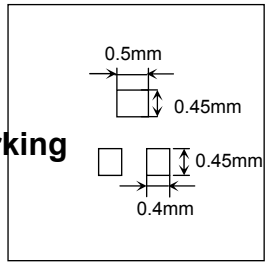
Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DSS}	−30	V
Gate-Source voltage		V_{GSS}	±20	V
Drain current	DC	I_D	−100	mA
	Pulse	I_{DP}	−200	
Power dissipation (Ta = 25°C)		P_D (Note 1)	150	mW
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

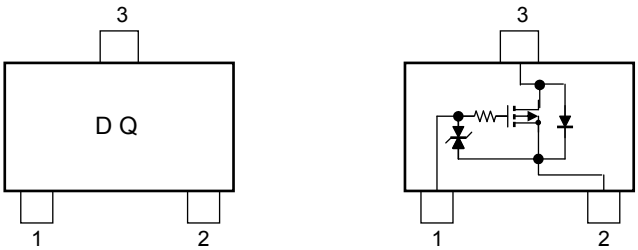
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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: 0.585 mm^2)

Marking



Equivalent Circuit (top view)



Handling Precaution

When handling individual devices (which are not yet mounted 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.

Start of commercial production
2003-04

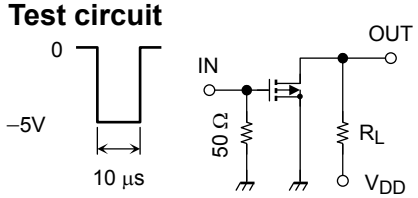
Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	MIN	TYP.	MAX	UNIT
Gate leakage current		I_{GSS}	V_{GS} = ±16 V, V_{DS} = 0 V	—	—	±1	μA
Drain-Source breakdown voltage		$V_{(BR)\ DSS}$	I_D = – 0.1 mA, V_{GS} = 0 V	–30	—	—	V
Drain cut-off current		I_{DSS}	V_{DS} = – 30 V, V_{GS} = 0 V	—	—	–1	μA
Gate threshold voltage		V_{th}	V_{DS} = – 3 V, I_D = – 0.1 mA	–1.1	—	–1.7	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = – 3 V, I_D = – 10 mA (Note 2)	20	—	—	mS
Drain-Source on-resistance		$R_{DS\ (ON)}$	I_D = – 10 mA, V_{GS} = – 4 V (Note 2)	—	8	12	Ω
			I_D = – 1 mA, V_{GS} = – 2.5 V (Note 2)	—	14	32	
Input capacitance		C_{iss}	V_{DS} = – 3 V, V_{GS} = 0 V, f = 1 MHz	—	9.1	—	pF
Reverse transfer capacitance		C_{rss}		—	3.5	—	pF
Output capacitance		C_{oss}		—	8.6	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = – 5 V, I_D = – 10 mA, V_{GS} = 0 to –5 V	—	65	—	ns
	Turn-off time	t_{off}		—	175	—	

Note 2: Pulse Test

Switching Time Test Circuit

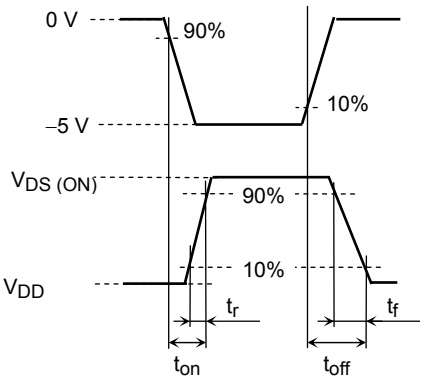
(a) Test circuit



V_{DD} = –5 V
Duty ≤ 1%
V_{IN}: t_r, t_f < 5 ns
(Z_{out} = 50 Ω)
Common Source
Ta = 25°C

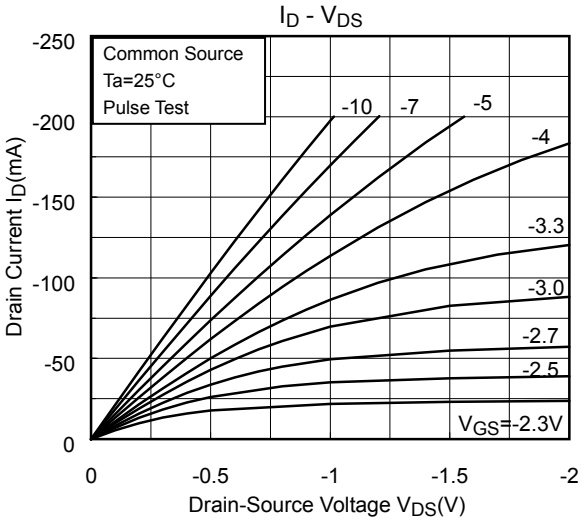
(b) V_{IN}

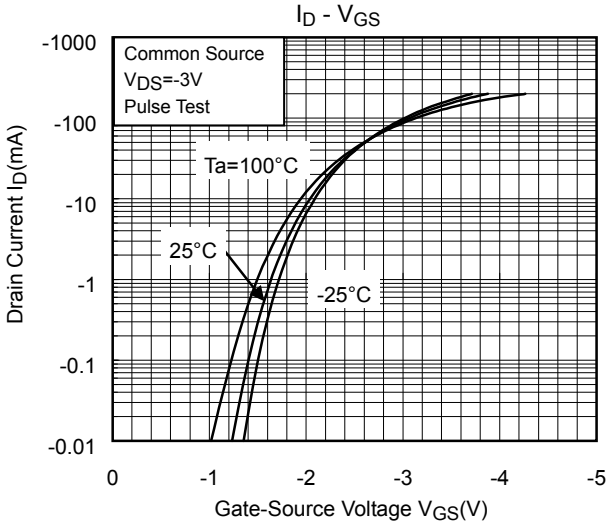
(c) V_{OUT}

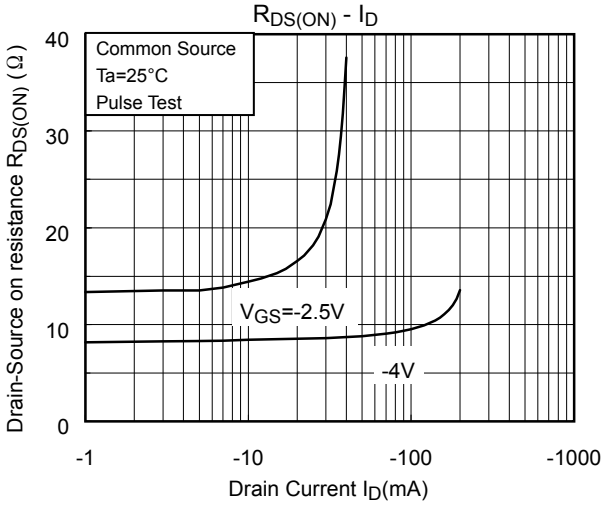


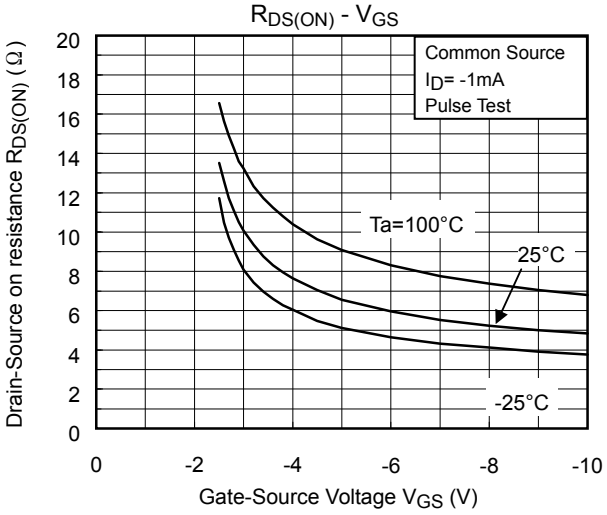
Precaution

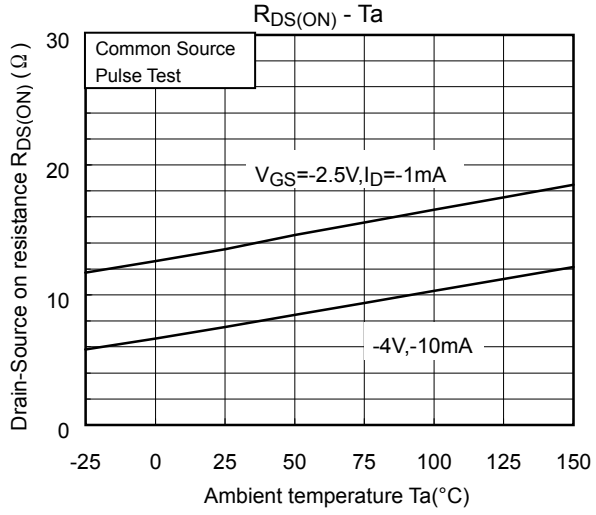
V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D = -100 μA for this product. For normal switching operation, $V_{GS\ (on)}$ requires a higher voltage than V_{th} and $V_{GS\ (off)}$ requires a lower voltage than V_{th}.
(The relationship can be established as follows: $V_{GS\ (off)} < V_{th} < V_{GS\ (on)}$)
Please take this into consideration when using the device.

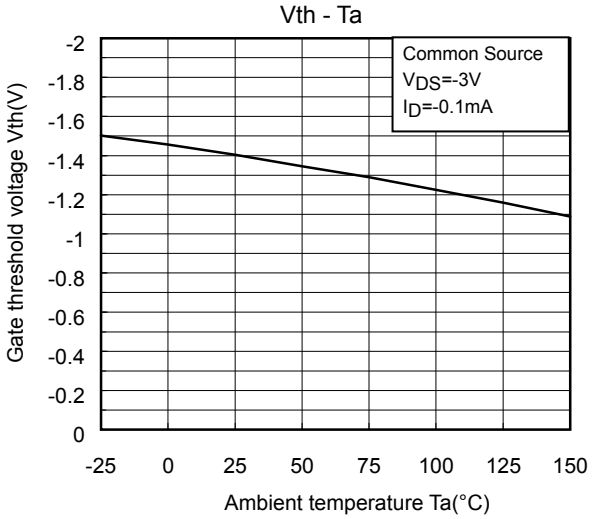

I_D - V_{DS}
Common Source
Ta=25°C
Pulse Test
-10
-7
-5
-4
-3.3
-3.0
-2.7
-2.5
V_{GS}=-2.3V
Drain Current I_D(mA)
Drain-Source Voltage V_{DS}(V)

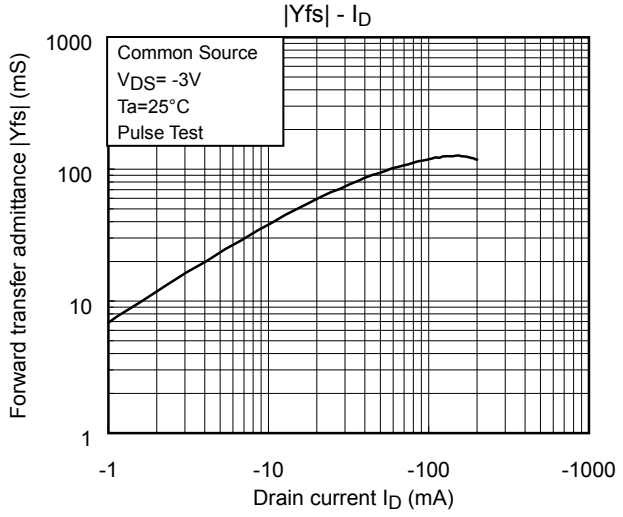

I_D - V_{GS}
Common Source
V_{DS}=-3V
Pulse Test
Ta=100°C
25°C
-25°C
Drain Current I_D(mA)
Gate-Source Voltage V_{GS}(V)

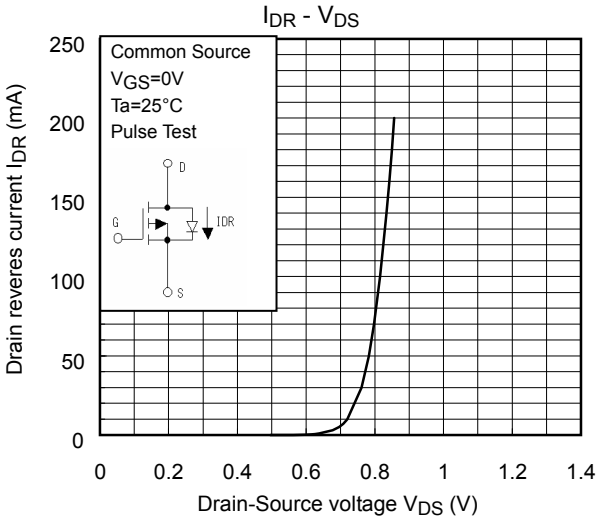

$R_{DS(ON)}$ - I_D
Common Source
Ta=25°C
Pulse Test
V_{GS}=-2.5V
-4V
Drain-Source on resistance $R_{DS(ON)}$ (Ω)
Drain Current I_D(mA)

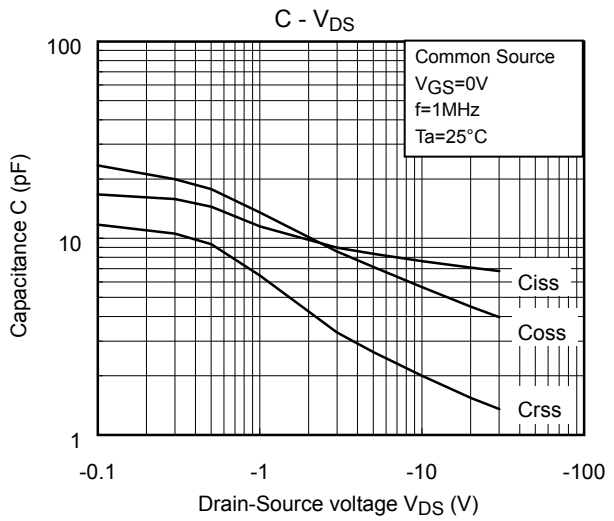

$R_{DS(ON)}$ - V_{GS}
Common Source
I_D= -1mA
Pulse Test
Ta=100°C
25°C
-25°C
Drain-Source on resistance $R_{DS(ON)}$ (Ω)
Gate-Source Voltage V_{GS} (V)

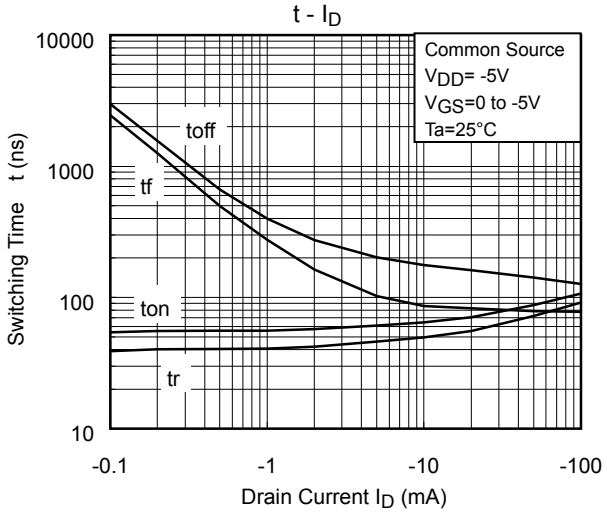

$R_{DS(ON)}$ - Ta
Common Source
Pulse Test
V_{GS}=-2.5V,I_D=-1mA
-4V,-10mA
Drain-Source on resistance $R_{DS(ON)}$ (Ω)
Ambient temperature Ta(°C)

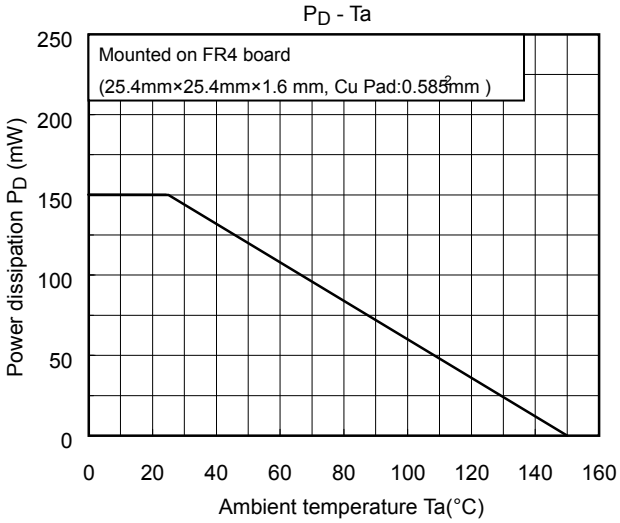

Vth - Ta
Common Source
V_{DS}=-3V
I_D=-0.1mA
Gate threshold voltage Vth(V)
Ambient temperature Ta(°C)


|Yfs| - ID
Common Source
VDS= -3V
Ta=25°C
Pulse Test
Forward transfer admittance |Yfs| (mS)
1000
100
10
1
-1
-10
-100
-1000
Drain current ID (mA)


IDR - VDS
Common Source
VGS=0V
Ta=25°C
Pulse Test
D
G
S
IDR
Drain reveres current IDR (mA)
250
200
150
100
50
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Drain-Source voltage VDS (V)


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


t - ID
Common Source
VDD= -5V
VGS=0 to -5V
Ta=25°C
Switching Time t (ns)
10000
1000
100
10
toff
tf
ton
tr
-0.1
-1
-10
-100
Drain Current ID (mA)


PD - Ta
Mounted on FR4 board
(25.4mm×25.4mm×1.6 mm, Cu Pad:0.585mm2)
Power dissipation PD (mW)
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
Ambient temperature Ta(°C)

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