TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOSIII)

SSM6K24FE

High Speed Switching Applications

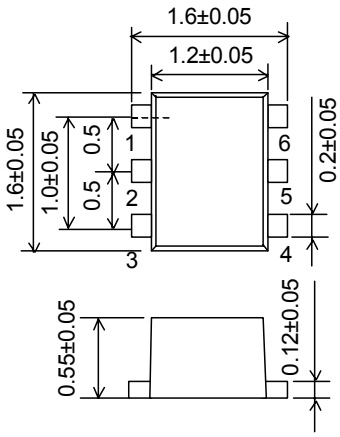
- Optimum for high-density mounting in small packages
- Low on-resistance: R_{on} = 145mΩ (max) (@V_{GS} = 4.5 V)
  R_{on} = 180mΩ (max) (@V_{GS} = 2.5 V)

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-Source voltage		V_{DS}	30	V
Gate-Source voltage		V_{GSS}	± 12	V
Drain current	DC	I_D	0.5	A
	Pulse	I_{DP}	1.5	
Drain power dissipation		P_D (Note1)	500	mW
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55~150	°C

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

Unit: mm

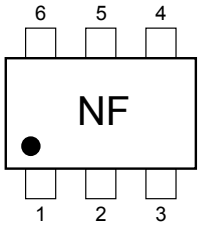


1,2,5,6 :Drain
3 :Gate
4 :Source

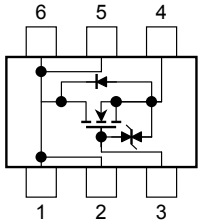
ES6	
JEDEC	—
JEITA	—
TOSHIBA	2-2N1A

Weight: 3.0 mg (typ.)

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.

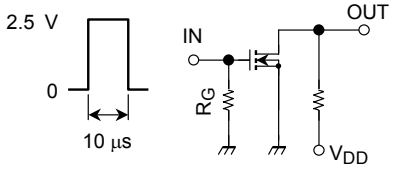
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±12 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} = −12 V	18	—	—	
Drain cut-off current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0	—	—	1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 0.1 mA	0.5	—	1.1	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 0.25 A (Note2)	1.0	2.0	—	S
Drain-Source on-resistance		$R_{DS\ (ON)}$	I_D = 0.50 A, V_{GS} = 4.5 V (Note2)	—	120	145	mΩ
			I_D = 0.25 A, V_{GS} = 2.5 V (Note2)	—	140	180	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	245	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	33	—	pF
Output capacitance		C_{oss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	41	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 0.25 A,	—	9	—	ns
	Turn-off time	t_{off}	V_{GS} = 0~2.5 V, R_G = 4.7 Ω	—	15	—	

Note2: Pulse test

Switching Time Test Circuit

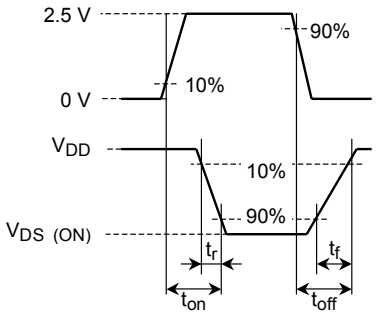
(a) Test Circuit



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

(b) V_{IN}

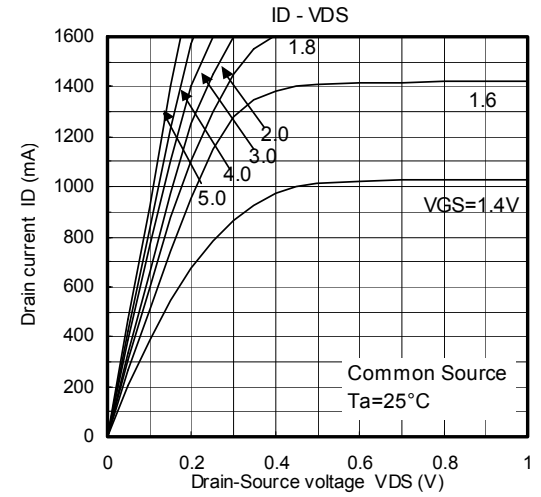
(c) V_{OUT}

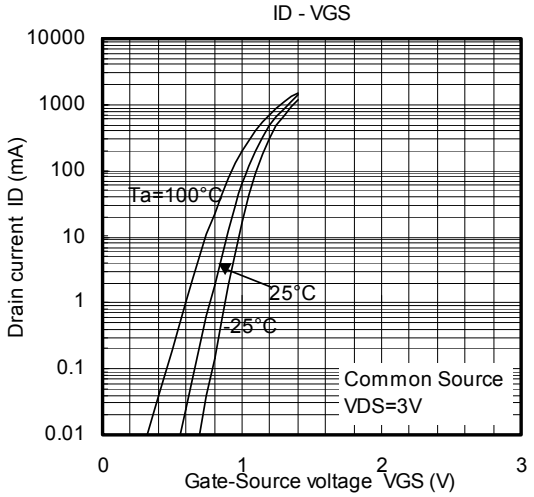


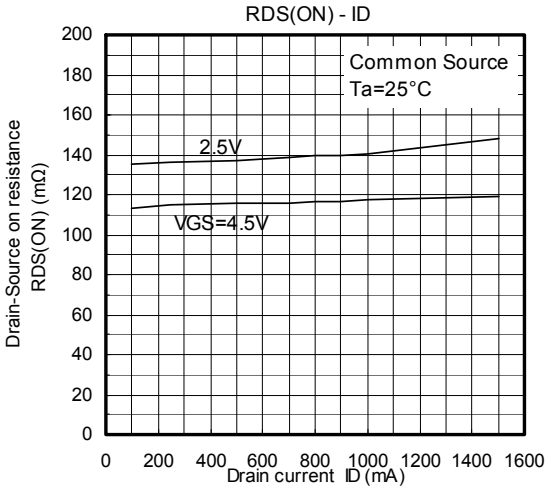
Precaution

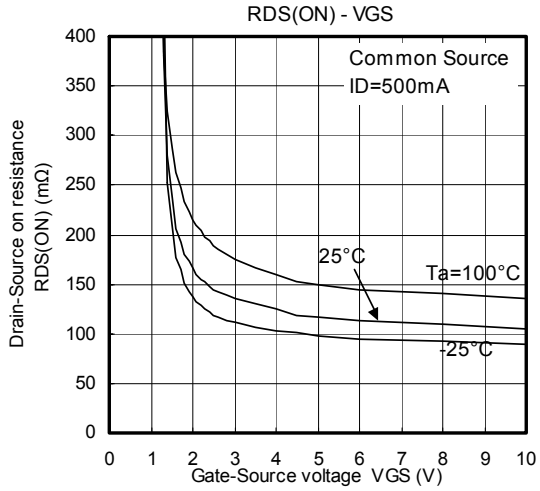
V_{th} can be expressed as the voltage between gate and source when the low operating current value is I_D = 100 μA for this product. For normal switching operation, $V_{GS\ (on)}$ requires a higher voltage than V_{th} and $V_{GS\ (off)}$ requires a lower voltage than V_{th}.
(The relationship can be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

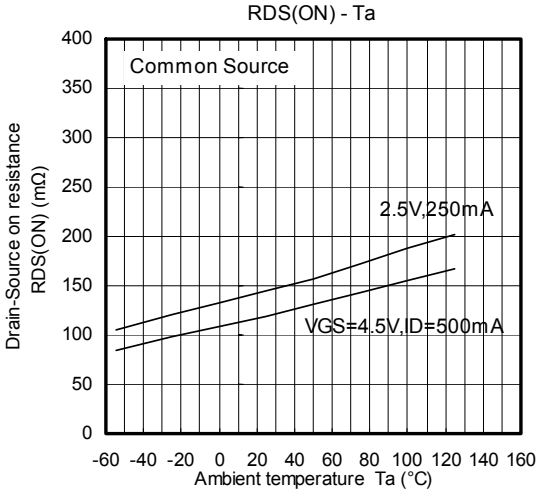
Please take this into consideration when using the device. The V_{GS} recommended voltage for turning on this product is 2.5 V or higher.

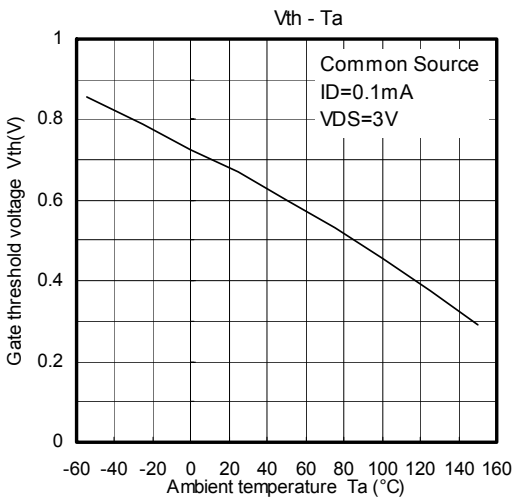

ID - VDS
Drain current ID (mA)
Drain-Source voltage VDS (V)
1.8
1.6
2.0
3.0
4.0
5.0
VGS=1.4V
Common Source
Ta=25°C

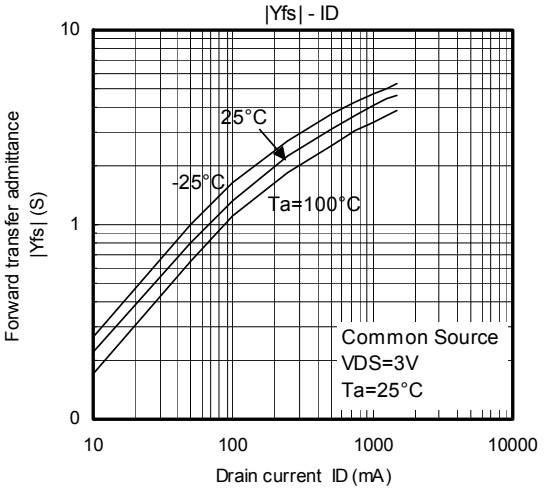

ID - VGS
Drain current ID (mA)
Gate-Source voltage VGS (V)
Ta=100°C
25°C
-25°C
Common Source
VDS=3V

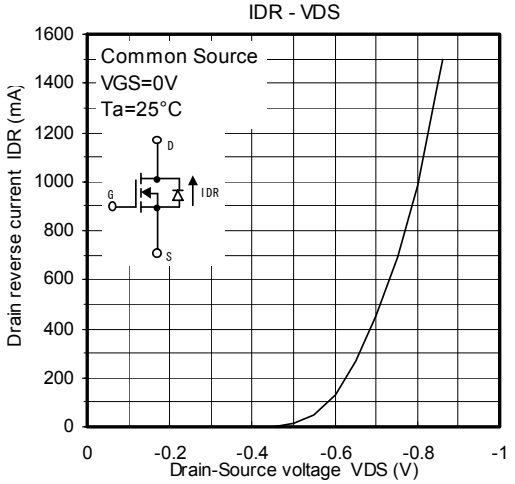

RDS(ON) - ID
Drain-Source on resistance RDS(ON) (mΩ)
Drain current ID (mA)
Common Source
Ta=25°C
2.5V
VGS=4.5V

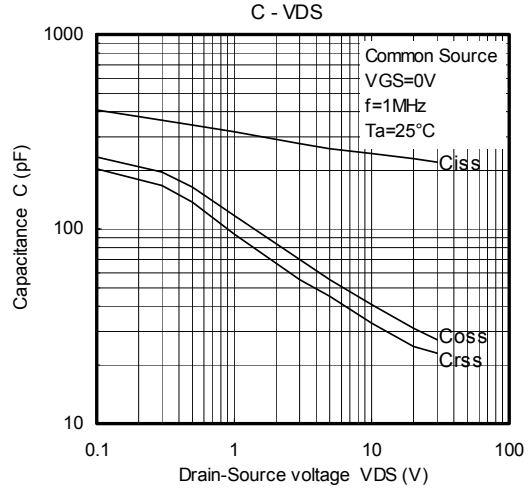

RDS(ON) - VGS
Drain-Source on resistance RDS(ON) (mΩ)
Gate-Source voltage VGS (V)
Common Source
ID=500mA
25°C
Ta=100°C
-25°C

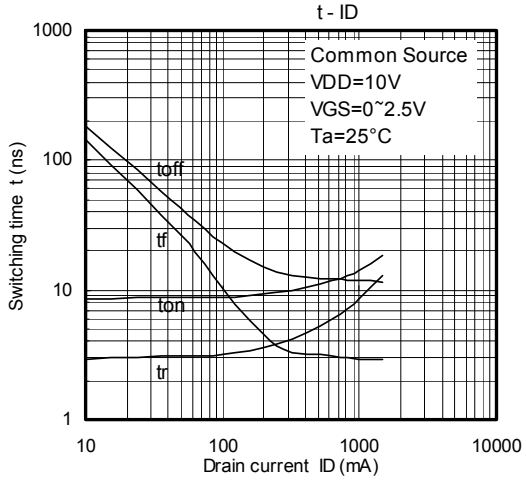

RDS(ON) - Ta
Drain-Source on resistance RDS(ON) (mΩ)
Ambient temperature Ta (°C)
Common Source
2.5V,250mA
VGS=4.5V,ID=500mA

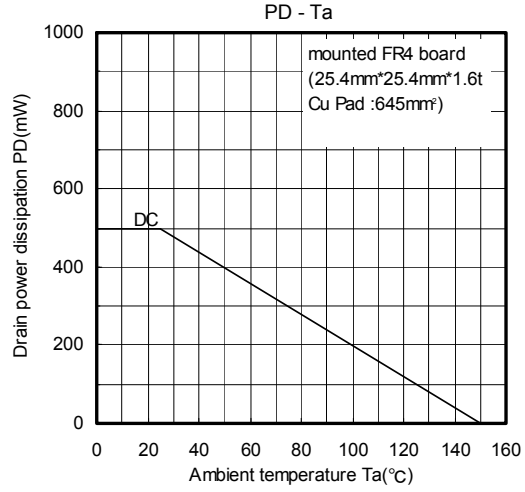

Vth - Ta
Gate threshold voltage Vth(V)
Ambient temperature Ta (°C)
Common Source
ID=0.1mA
VDS=3V


|Yfs| - ID
Forward transfer admittance |Yfs| (S)
Drain current ID (mA)
25°C
-25°C
Ta=100°C
Common Source
VDS=3V
Ta=25°C
10
1
0
10
100
1000
10000


IDR - VDS
Drain reverse current IDR (mA)
Drain-Source voltage VDS (V)
Common Source
VGS=0V
Ta=25°C
D
G
S
IDR
1600
1400
1200
1000
800
600
400
200
0
0
-0.2
-0.4
-0.6
-0.8
-1


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


t - ID
Switching time t (ns)
Drain current ID (mA)
Common Source
VDD=10V
VGS=0~2.5V
Ta=25°C
toff
tf
ton
tr
1000
100
10
1
10
100
1000
10000


PD - Ta
Drain power dissipation PD(mW)
Ambient temperature Ta(°C)
mounted FR4 board
(25.4mm*25.4mm*1.6t
Cu Pad :645mm²)
DC
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
160

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