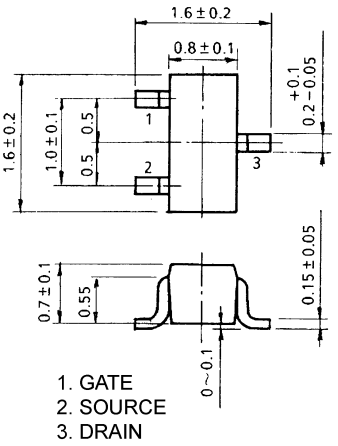
TOSHIBA Field-Effect Transistor Silicon N Channel MOS Type

SSM3K36FS

○ High-Speed Switching Applications

- 1.5-V drive
- Low ON-resistance : R_{on} = 1.52 Ω (max) (@V_{GS} = 1.5 V)
  : R_{on} = 1.14 Ω (max) (@V_{GS} = 1.8 V)
  : R_{on} = 0.85 Ω (max) (@V_{GS} = 2.5 V)
  : R_{on} = 0.66 Ω (max) (@V_{GS} = 4.5 V)
  : R_{on} = 0.63 Ω (max) (@V_{GS} = 5.0 V)

Unit: mm



SSM	
JEDEC	—
JEITA	—
TOSHIBA	2-2H1B

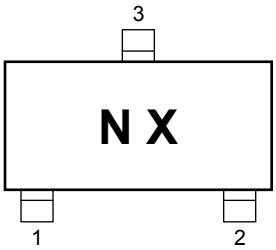
Weight: 2.4 mg (typ.)

Absolute Maximum Ratings (Ta = 25 °C)

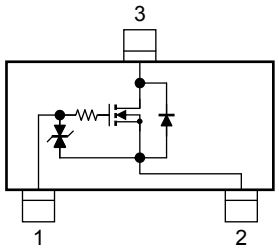
Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DS}	20	V
Gate-source voltage		V_{GSS}	± 10	V
Drain current	DC	I_D	500	mA
	Pulse	I_{DP}	1000	
Drain power dissipation		P_D (Note1)	150	mW
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

Note1: Mounted on an FR4 board
(25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 0.36 mm^2 × 3)

Marking



Equivalent Circuit (top view)



Start of commercial production
2008-02

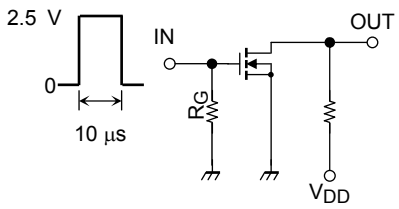
Electrical Characteristics (Ta = 25°C)

Characteristics		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} = - 10 V	12	—	—	
Drain cutoff current		I_{DSS}	V_{DS} =20 V, V_{GS} = 0	—	—	1	μA
Gate leakage current		I_{GSS}	V_{GS} = ±10 V, V_{DS} = 0	—	—	±1	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 1 mA	0.35	—	1.0	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 200 mA (Note2)	420	840	—	mS
Drain-source ON-resistance		$R_{DS\ (ON)}$	I_D = 200 mA, V_{GS} = 5.0 V (Note2)	—	0.46	0.63	Ω
			I_D = 200 mA, V_{GS} = 4.5 V (Note2)	—	0.51	0.66	
			I_D = 200 mA, V_{GS} = 2.5 V (Note2)	—	0.66	0.85	
			I_D = 100 mA, V_{GS} = 1.8 V (Note2)	—	0.81	1.14	
			I_D = 50 mA, V_{GS} = 1.5 V (Note2)	—	0.95	1.52	
Input capacitance		C_{iss}	V_{DS} = 10 V, V_{GS} = 0, f = 1 MHz	—	46	—	pF
Output capacitance		C_{oss}		—	10.8	—	
Reverse transfer capacitance		C_{rss}		—	7.3	—	
Total Gate Charge		Q_g	V_{DS} = 10V, I_D = 0.5 A, V_{GS} = 4.0 V	—	1.23	—	nC
Gate−Source Charge		Q_{gs}		—	0.60	—	
Gate−Drain Charge		Q_{gd}		—	0.63	—	
Switching time	Turn-on time	t_{on}	V_{DD} = 10 V, I_D = 200 mA V_{GS} = 0 to 2.5 V, R_G = 50 Ω	—	30	—	ns
	Turn-off time	t_{off}		—	75	—	
Drain-source forward voltage		V_{DSF}	I_D = -0.5 A, V_{GS} = 0 V (Note2)	—	-0.88	-1.2	V

Note2: Pulse test

Switching Time Test Circuit

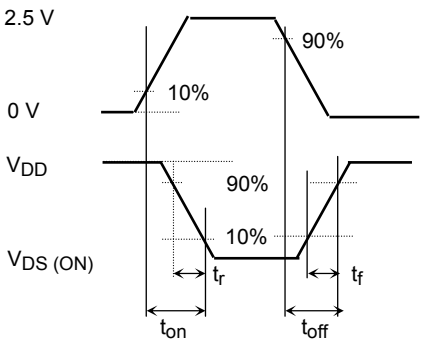
(a) Test Circuit



V_{DD} = 10 V
R_G = 50 Ω
Duty ≤ 1%
V_{IN}: t_r, t_f < 5 ns
Common Source
Ta = 25°C

(b) V_{IN}

(c) V_{OUT}



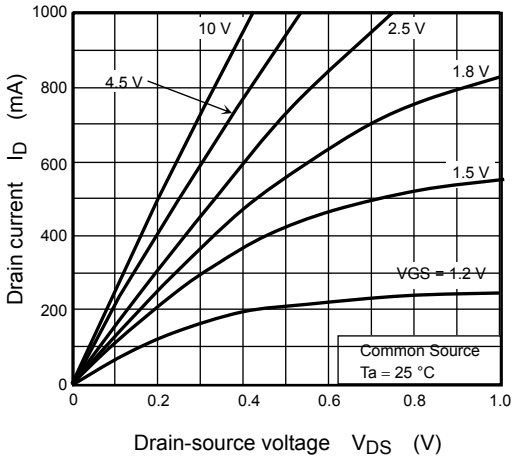
Usage Considerations

Let V_{th} be the voltage applied between gate and source that causes the drain current (I_D) to below (1 mA for the SSM3K36FS). Then, for normal switching operation, $V_{GS(on)}$ must be higher than V_{th}, and $V_{GS(off)}$ must be lower than V_{th}. This relationship can be expressed as: $V_{GS(off)} < V_{th} < V_{GS(on)}$.
Take this into consideration when using the device.

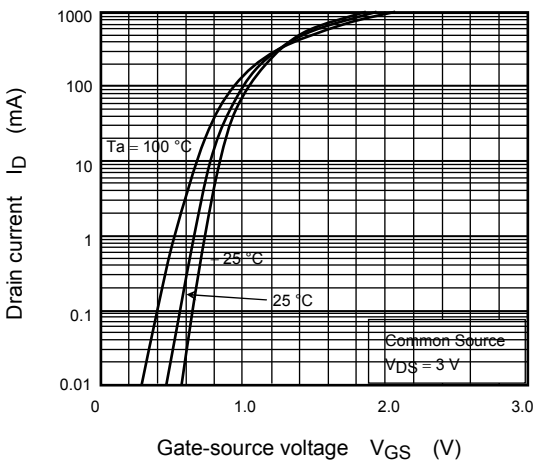
Handling Precaution

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

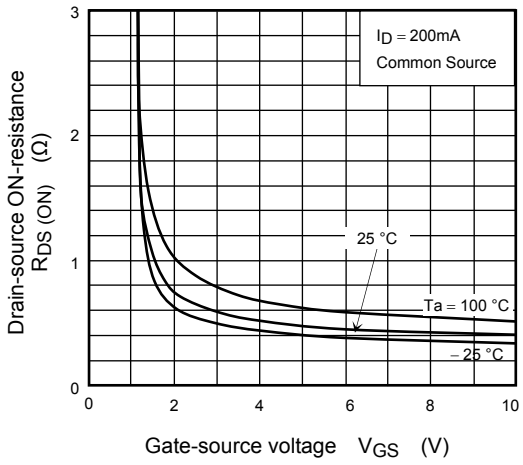
$I_D - V_{DS}$



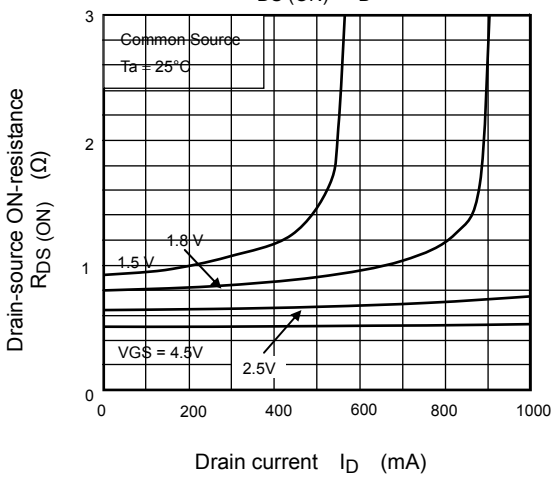
$I_D - V_{GS}$



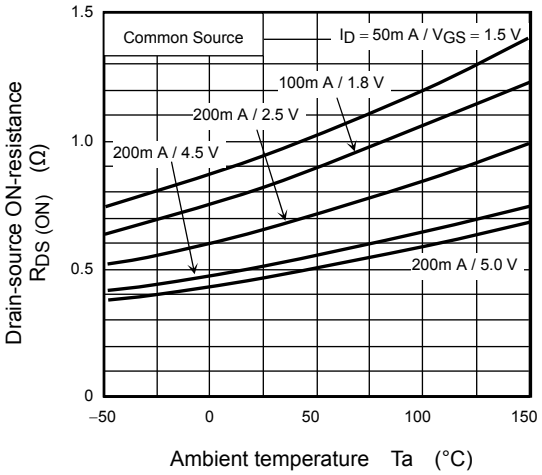
$R_{DS\ (ON)} - V_{GS}$



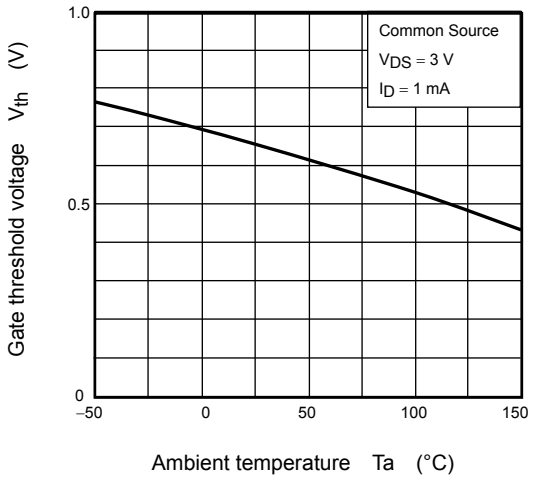
$R_{DS\ (ON)} - I_D$

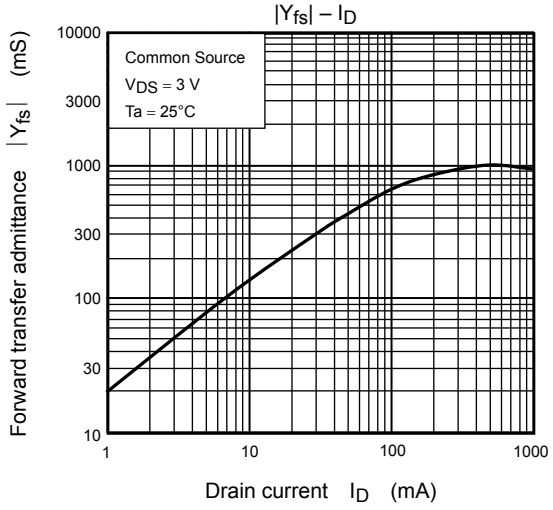


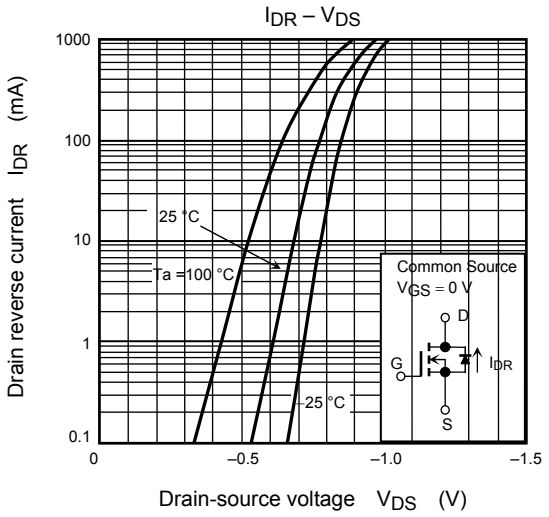
$R_{DS\ (ON)} - Ta$

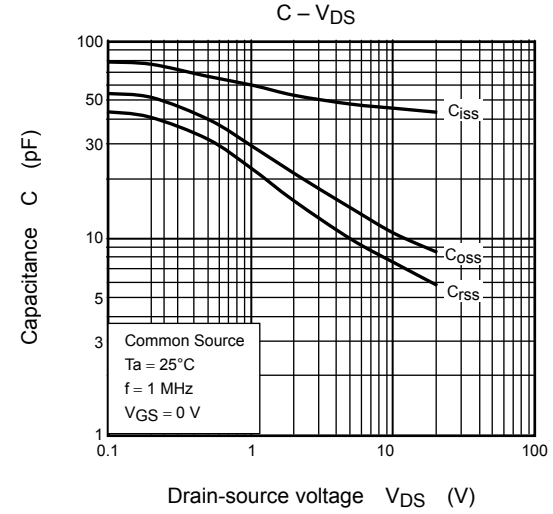


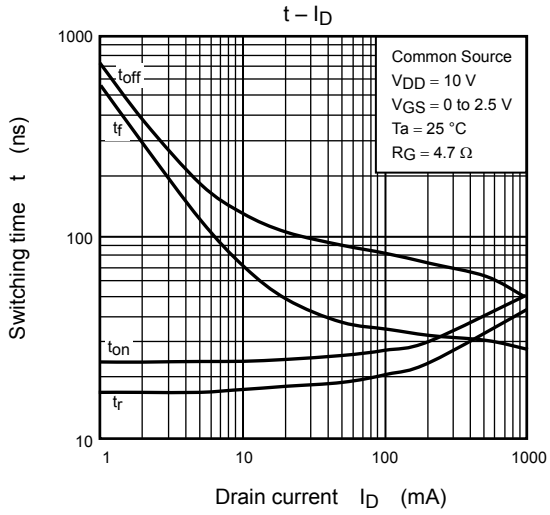
$V_{th} - Ta$

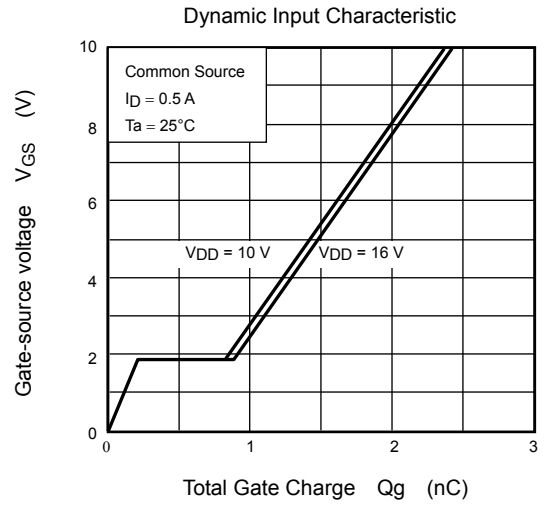


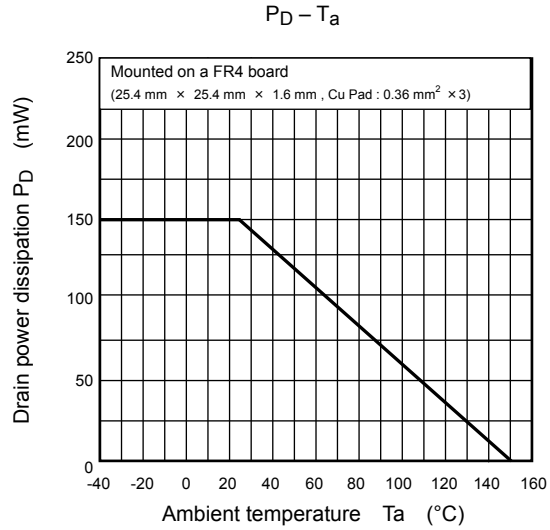

|Yfs| – ID
Common Source
VDS = 3 V
Ta = 25°C
Forward transfer admittance |Yfs| (mS)
Drain current ID (mA)


IDR – VDS
25 °C
Ta = 100 °C
25 °C
Common Source
VGS = 0 V
D
G
S
IDR
Drain reverse current IDR (mA)
Drain-source voltage VDS (V)


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


t – ID
Common Source
VDD = 10 V
VGS = 0 to 2.5 V
Ta = 25 °C
RG = 4.7 Ω
toff
tf
ton
tr
Switching time t (ns)
Drain current ID (mA)


Dynamic Input Characteristic
Common Source
ID = 0.5 A
Ta = 25°C
VDD = 10 V
VDD = 16 V
Gate-source voltage VGS (V)
Total Gate Charge Qg (nC)


PD – Ta
Mounted on a FR4 board
(25.4 mm × 25.4 mm × 1.6 mm , Cu Pad : 0.36 mm2 ×3)
Drain power dissipation PD (mW)
Ambient temperature Ta (°C)

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