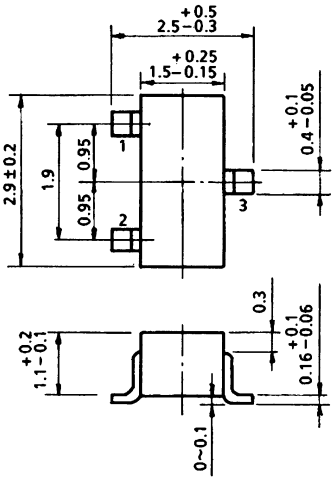
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

2SK2009

High Speed Switching Applications
Analog Switch Applications

- High input impedance.
- Low gate threshold voltage: V_{th} = 0.5 to 1.5 V
- Excellent switching times: t_{on} = 0.06 μs (typ.)
  t_{off} = 0.12 μs (typ.)
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 1.2 Ω (typ.)
- Small package
- Enhancement-mode

Unit: mm



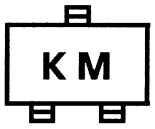
1. GATE
2. SOURCE
3. DRAIN

S-MINI

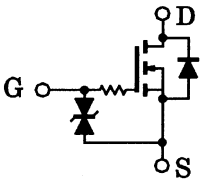
JEDEC	TO-236MOD
JEITA	SC-59
TOSHIBA	2-3F1F

Weight: 0.012 g (typ.)

Marking



Equivalent Circuit



Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V_{DS}	30	V
Gate-source voltage	V_{GSS}	±20	V
DC drain current	I_D	200	mA
Drain power dissipation	P_D	200	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).

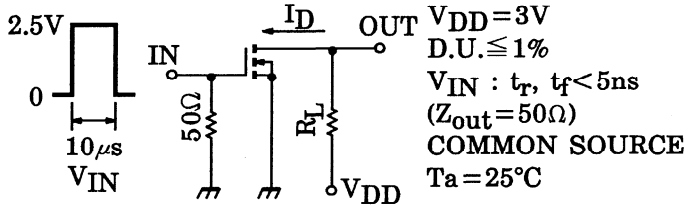
Note: This transistor is electrostatic sensitive device. Please handle with caution.

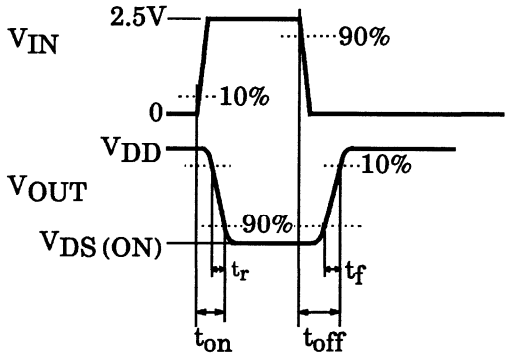
Start of commercial production
1992-04

Electrical Characteristics (Ta = 25°C)

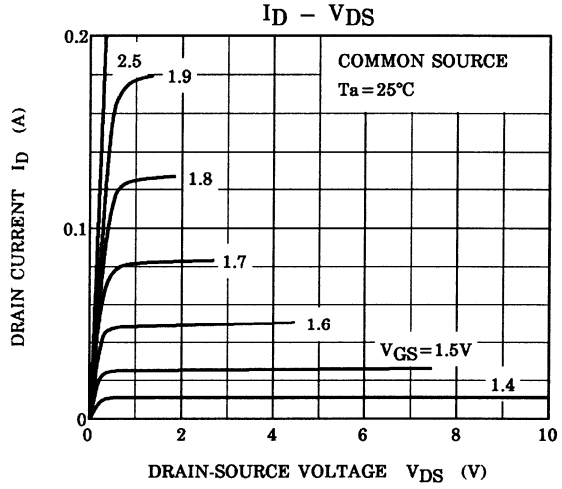
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	V_{GS} = ±10 V, V_{DS} = 0	—	—	±0.1	μA
Drain-source breakdown voltage		$V_{(BR)\ DSS}$	I_D = 1 mA, V_{GS} = 0	30	—	—	V
Drain cut-off current		I_{DSS}	V_{DS} = 30 V, V_{GS} = 0	—	—	10	μA
Gate threshold voltage		V_{th}	V_{DS} = 3 V, I_D = 0.1 mA	0.5	—	1.5	V
Forward transfer admittance		$\|Y_{fs}\|$	V_{DS} = 3 V, I_D = 50 mA	100	—	—	mS
Drain-source ON resistance		$R_{DS\ (ON)}$	I_D = 50 mA, V_{GS} = 2.5 V	—	1.2	2	Ω
Input capacitance		C_{iss}	V_{DS} = 3 V, V_{GS} = 0, f = 1 MHz	—	70	—	pF
Reverse transfer capacitance		C_{rss}	V_{DS} = 3 V, V_{GS} = 0, f = 1 MHz	—	23	—	pF
Output capacitance		C_{oss}	V_{DS} = 3 V, V_{GS} = 0, f = 1 MHz	—	58	—	pF
Switching time	Turn-on time	t_{on}	V_{DD} = 3 V, I_D = 10 mA, V_{GS} = 0 to 2.5 V	—	0.06	—	μs
	Turn-off time	t_{off}	V_{DD} = 3 V, I_D = 10 mA, V_{GS} = 0 to 2.5 V	—	0.12	—	

Switching Time Test Circuit

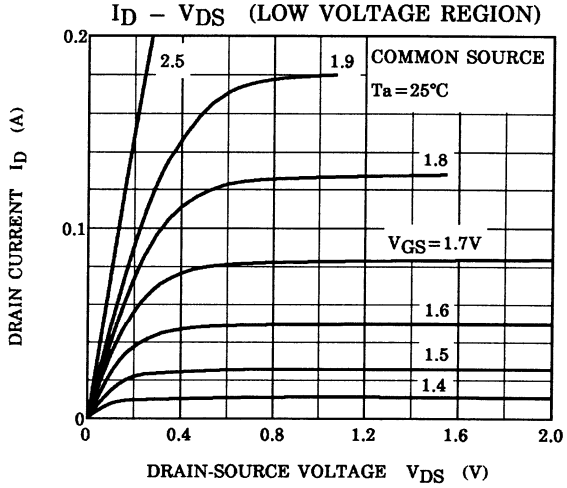




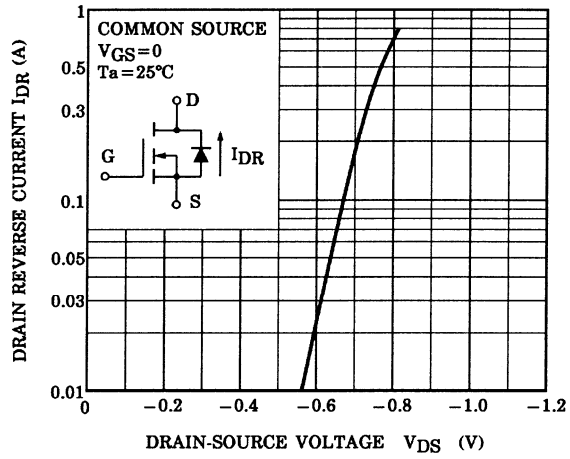
I_D – V_{DS}



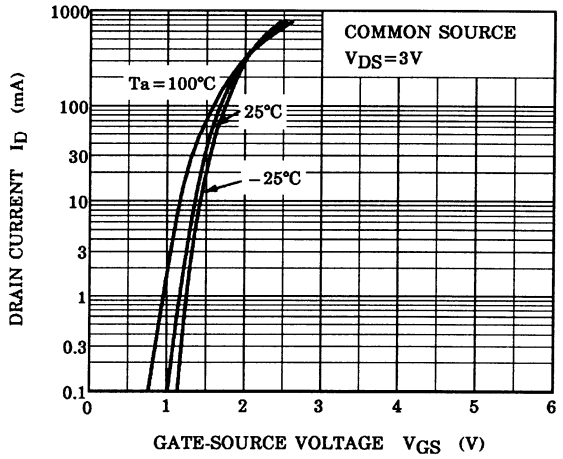
I_D – V_{DS} (LOW VOLTAGE REGION)



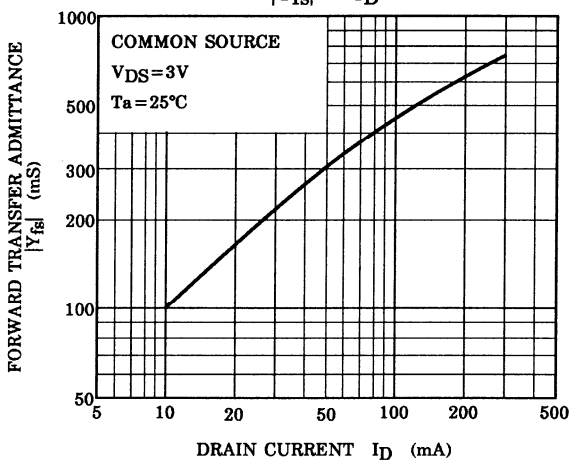
I_{DR} – V_{DS}



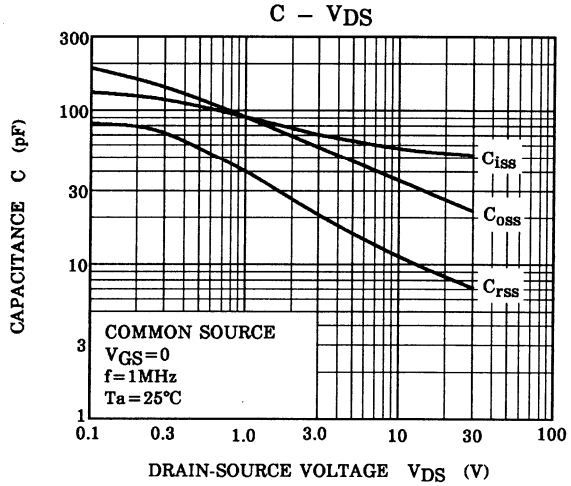
I_D – V_{GS}

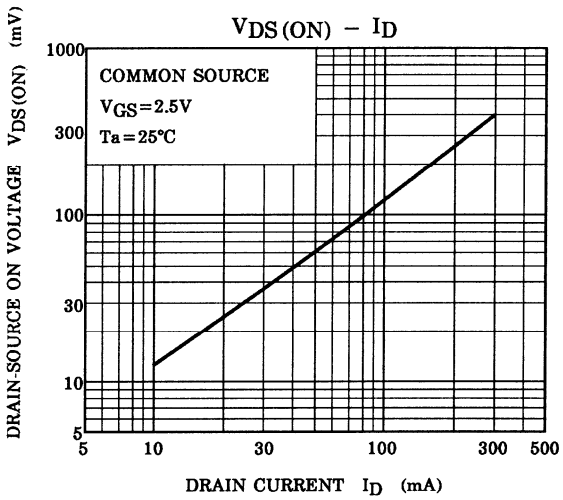


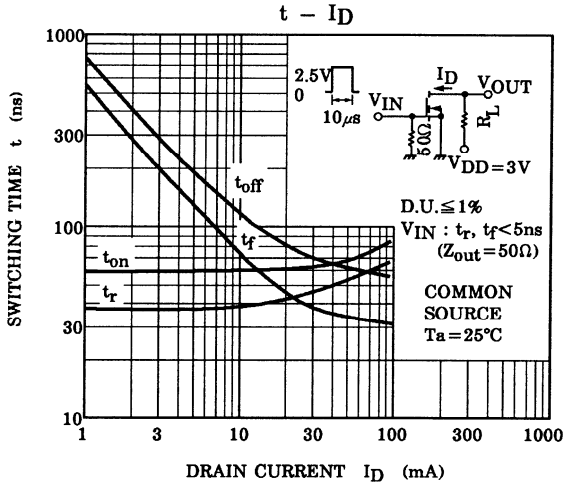
$|Y_{fs}|$ – I_D

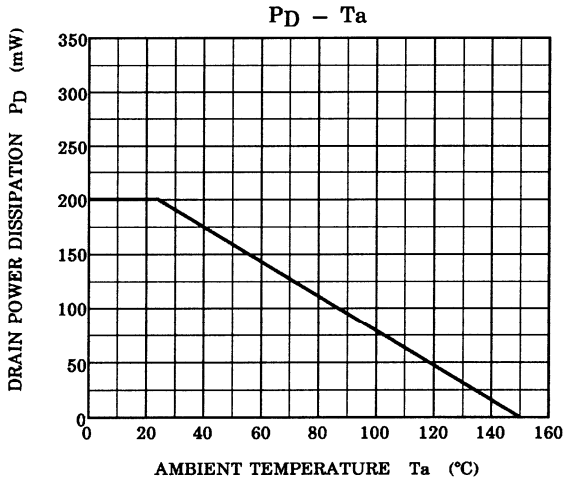


C – V_{DS}




$V_{DS(ON)}$ – I_D
COMMON SOURCE
V_{GS}=2.5V
Ta=25°C
DRAIN-SOURCE ON VOLTAGE $V_{DS(ON)}$ (mV)
DRAIN CURRENT I_D (mA)
1000
300
100
30
10
5
5
10
30
100
300
500


t – I_D
SWITCHING TIME t (ns)
DRAIN CURRENT I_D (mA)
t_{off}
t_f
t_{on}
t_r
2.5V
0
10μs
V_{IN}
I_D
V_{OUT}
R_L
50Ω
V_{DD}=3V
D.U.≦1%
V_{IN} : t_r, t_f<5ns
(Z_{out}=50Ω)
COMMON SOURCE
Ta=25°C
1000
300
100
30
10
1
3
10
30
100
300
1000


P_D – Ta
DRAIN POWER DISSIPATION P_D (mW)
AMBIENT TEMPERATURE Ta (°C)
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160

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