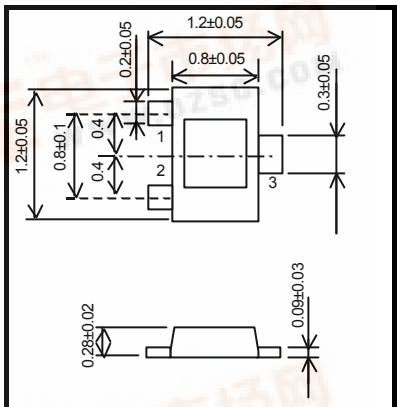
TOSHIBA Field Effect Transistor Silicon N Channel Junction Type

# 2SK4059TV

For ECM

- Application for Ultra-compact ECM

Unit: mm




1.Drain
2.Source
3.Gate

VESM2

| | |
|---|---|
| JEDEC | - |
| JEITA | - |
| TOSHIBA | 2-1H1A |

Weight: 0.8mg (typ.)

## Absolute Maximum Ratings (Ta=25°C)

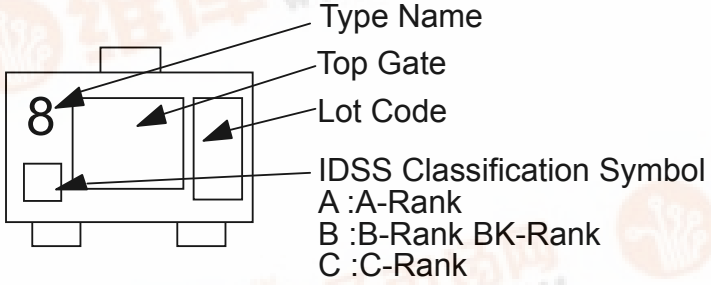
| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Gate-Drain voltage | $V_{GDO}$ | -20 | V |
| Gate Current | $I_G$ | 10 | mA |
| Drain power dissipation (Ta = 25°C) | $P_D$ | 100 | mW |
| Junction Temperature | $T_j$ | 125 | °C |
| Storage temperature range | $T_{stg}$ | −55~125 | °C |

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).

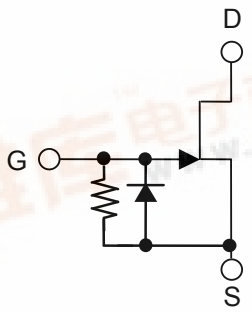
IDSS CLASSIFICATION

| | |
|---|---|
| A-Rank | 140~240μA |
| B-Rank | 210~350μA |
| BK-Rank | 210~400μA |
| C-Rank | 320~500μA |

## Marking




## Equivalent Circuit




## Precaution

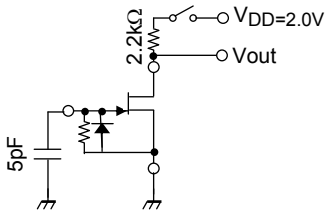
There is a metal plate on the top of package, which has the same electrical potential as the Gate terminal. Don’t use it as a terminal.

## Electrical Characteristics (Ta=25°C)

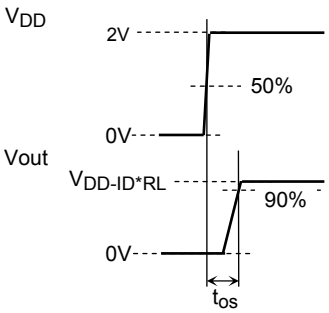
| Characteristic | Symbol | Test Condition | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Drain Current | $I_{DSS}$ | $V_{DS}$ = 2 V, $V_{GS}$ = 0 | A | 140 | — | 240 | μA |
| | | | B | 210 | — | 350 | |
| | | | BK | 210 | — | 400 | |
| | | | C | 320 | — | 500 | |
| Drain Current | $I_D$ | $V_{DD}$ = 2 V, RL= 2.2kΩ,Cg = 5pF | A | 125 | — | 260 | μA |
| | | | B | 190 | — | 370 | |
| | | | BK | 190 | — | 420 | |
| | | | C | 290 | — | 500 | |
| Gate-Source Cut-off Voltage | $V_{GS(OFF)}$ | $V_{DS}$ = 2 V, $I_D$ = 1μA | | -0.1 | — | -1.0 | V |
| Forward transfer admittance | $\|Y_{fs}\|$ | $V_{DS}$ = 2 V,$V_{GS}$ = 0V | | 1.35 | 1.85 | — | mS |
| Gate-Drain Voltage | $V_{(BR)GDO}$ | IG=-10μA | | -20 | — | — | V |
| Input capacitance | $C_{iss}$ | $V_{DS}$ = 2 V, $V_{GS}$ = 0, f = 1 MHz | | — | 4.0 | — | pF |
| Voltage Gain | Gv | $V_{DD}$ = 2V, RL= 2.2kΩ,Cg = 5pF, f = 1kHz,vin=100mV | A | -1.2 | +0.9 | — | dB |
| | | | B | -0.2 | +1.4 | — | |
| | | | BK | -0.2 | +1.7 | — | |
| | | | C | +0.5 | +1.8 | — | |
| Delta Voltage Gain | DGv(f) | $V_{DD}$ = 2V, RL= 2.2kΩ,Cg = 5pF,f = 1kHz~100Hz,vin=100mV | | — | 0 | -1 | dB |
| Delta Voltage Gain | DGv(V) | $V_{DD}$ = 2V~1.5V, RL= 2.2kΩ,Cg = 5pF,f = 1kHz, vin=100mV | A | — | -0.6 | -1.1 | dB |
| | | | B | — | -0.8 | -1.7 | |
| | | | BK | — | -1.1 | -2.0 | |
| | | | C | — | -1.4 | -3.2 | |
| Noise Voltage | VN | $V_{DD}$ = 2V, RL= 1kΩ,Cg = 10pF,Gv=80dB, A-Curve Filter | A | — | 33 | 75 | mV |
| | | | B | — | 38 | 80 | |
| | | | BK | — | 40 | 85 | |
| | | | C | — | 42 | 90 | |
| Total Harmonic Distortion | THD | $V_{DD}$ = 2V, RL= 2.2kΩ,Cg = 5pF, f = 1kHz, vin=50mV | A | — | 1.3 | — | % |
| | | | B | — | 0.6 | — | |
| | | | BK | — | 0.5 | — | |
| | | | C | — | 0.1 | — | |
| Time Output Stability | tos | $V_{DD}$ = 2V, RL= 2.2kΩ,Cg = 5pF | | — | 100 | 200 | ms |

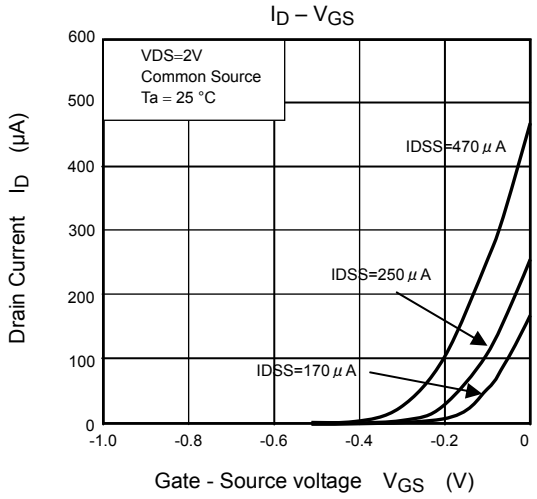
## Time Output Stability Test Method

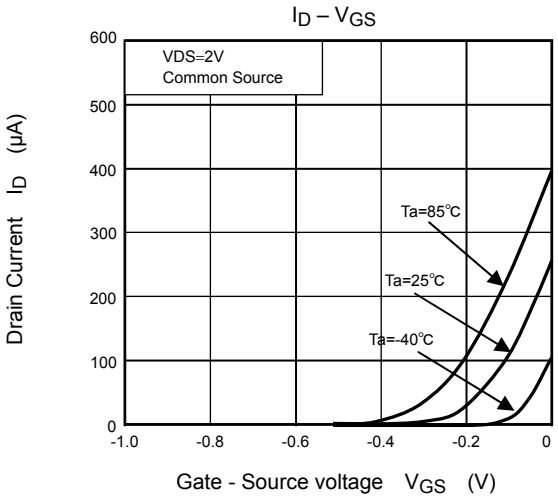
a) TEST CIRCUIT

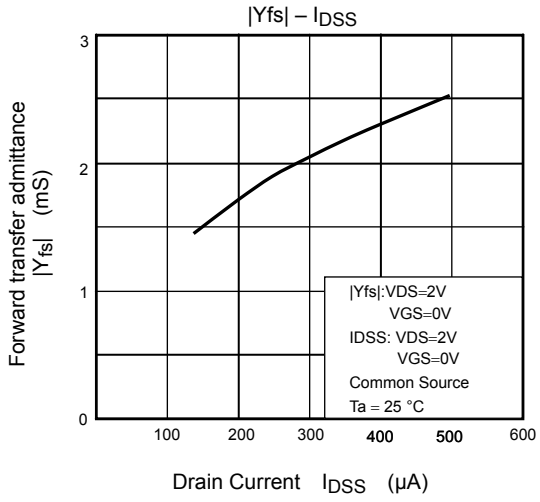


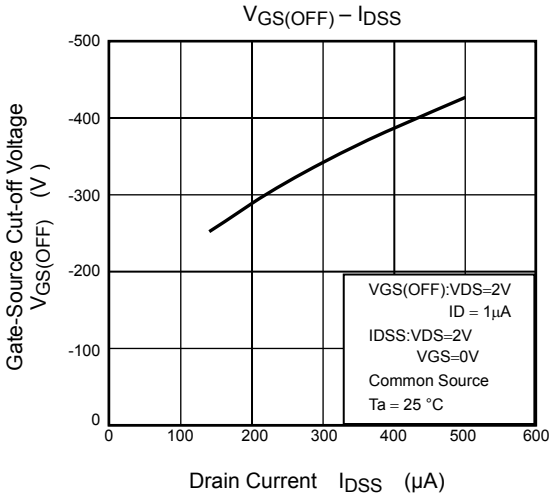

b) TEST SIGNAL

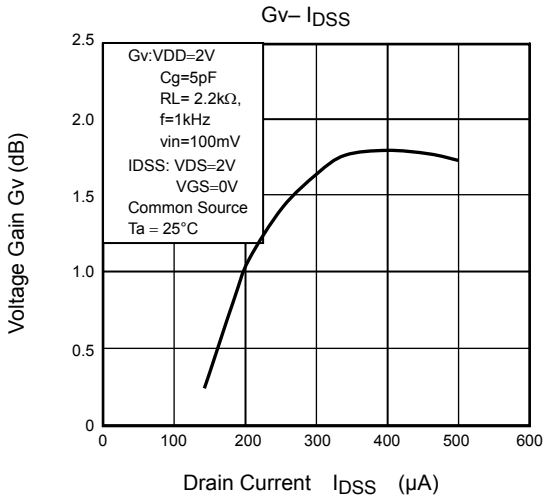


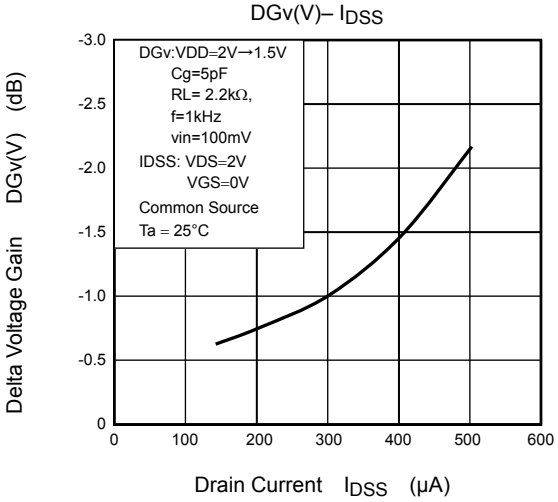

$I_D$ – $V_{GS}$
VDS=2V
Common Source
Ta = 25 °C
IDSS=470 μ A
IDSS=250 μ A
IDSS=170 μ A
Drain Current $I_D$ (μA)
Gate - Source voltage $V_{GS}$ (V)


$I_D$ – $V_{GS}$
VDS=2V
Common Source
Ta=85℃
Ta=25℃
Ta=-40℃
Drain Current $I_D$ (μA)
Gate - Source voltage $V_{GS}$ (V)

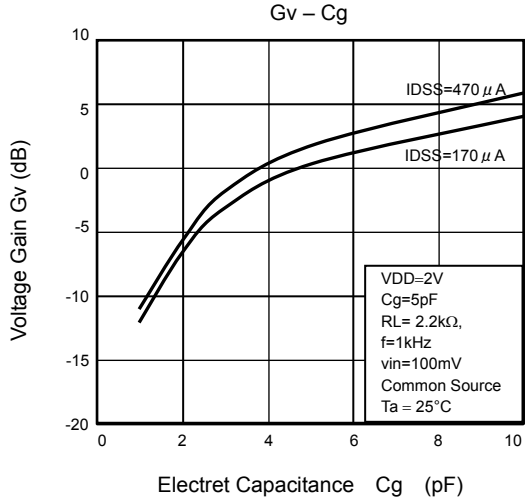

|Yfs| – $I_{DSS}$
|Yfs|:VDS=2V
VGS=0V
IDSS: VDS=2V
VGS=0V
Common Source
Ta = 25 °C
Forward transfer admittance
$|Y_{fs}|$ (mS)
Drain Current $I_{DSS}$ (μA)


$V_{GS(OFF)}$ – $I_{DSS}$
VGS(OFF):VDS=2V
ID = 1μA
IDSS:VDS=2V
VGS=0V
Common Source
Ta = 25 °C
Gate-Source Cut-off Voltage
$V_{GS(OFF)}$ (V)
Drain Current $I_{DSS}$ (μA)

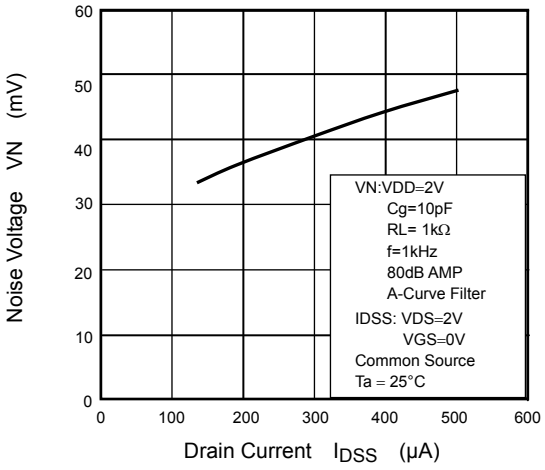

Gv– $I_{DSS}$
Gv:VDD=2V
Cg=5pF
RL= 2.2kΩ,
f=1kHz
vin=100mV
IDSS: VDS=2V
VGS=0V
Common Source
Ta = 25°C
Voltage Gain Gv (dB)
Drain Current $I_{DSS}$ (μA)


DGv(V)– $I_{DSS}$
DGv:VDD=2V→1.5V
Cg=5pF
RL= 2.2kΩ,
f=1kHz
vin=100mV
IDSS: VDS=2V
VGS=0V
Common Source
Ta = 25°C
Delta Voltage Gain DGv(V) (dB)
Drain Current $I_{DSS}$ (μA)

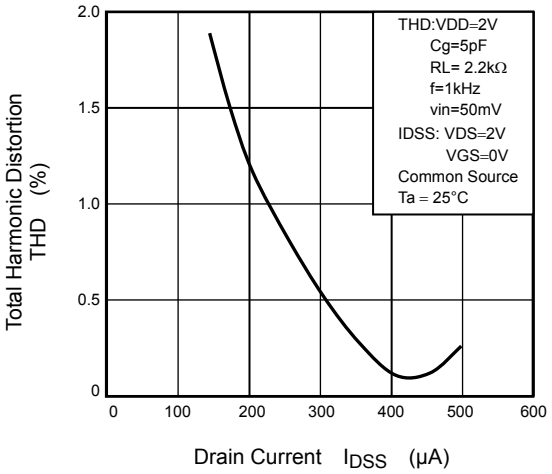
Gv – Cg



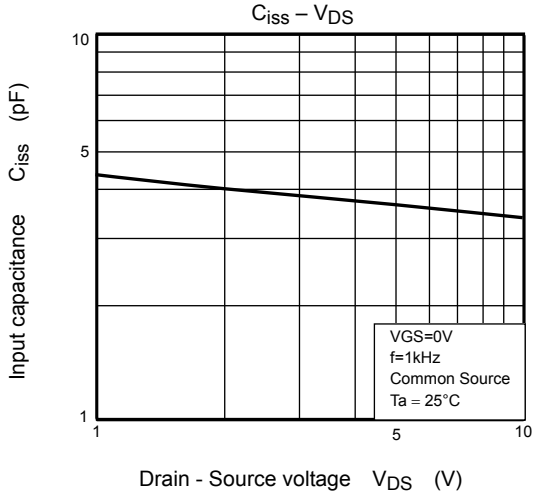

VN – $I_{DSS}$




THD– $I_{DSS}$




$C_{iss}$ – $V_{DS}$



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20070701-EN GENERAL

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