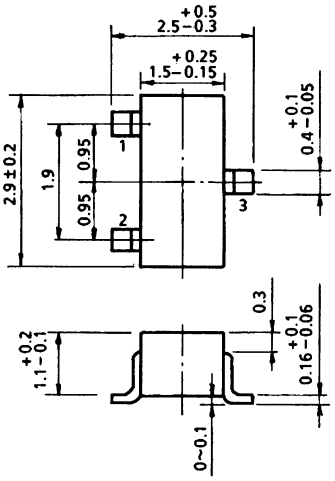
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type

# 2SK2033

High Speed Switching Applications
Analog Switch Applications

- High input impedance.
- Low gate threshold voltage: $V_{th}$ = 0.5~1.5 V
- Excellent switching times: $t_{on}$ = 0.16 μs (typ.)
  $t_{off}$ = 0.15 μs (typ.)
- Small package.
- Enhancement-mode

Unit: mm



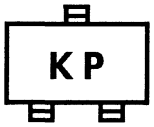

1. GATE
2. SOURCE
3. DRAIN

S-MINI

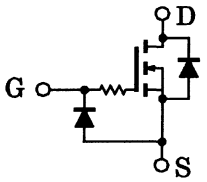
| | |
|---|---|
| JEDEC | TO-236MOD |
| JEITA | SC-59 |
| TOSHIBA | 2-3F1F |

Weight: 0.012 g (typ.)

**Marking**




**Equivalent Circuit**




## Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | 20 | V |
| Gate-source voltage | $V_{GSS}$ | 10 | V |
| DC drain current | $I_D$ | 100 | mA |
| Drain power dissipation | $P_D$ | 200 | mW |
| Channel temperature | $T_{ch}$ | 150 | °C |
| Storage temperature range | $T_{stg}$ | −55~150 | °C |

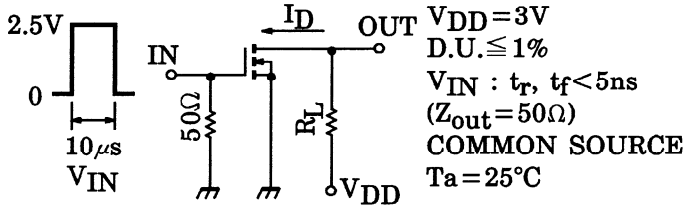
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

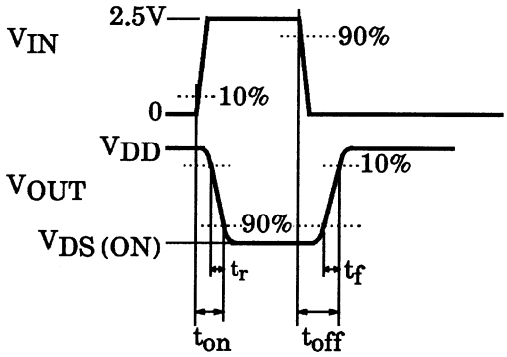
Note: This transistor is electrostatic sensitive device. Please handle with caution.

## Electrical Characteristics (Ta = 25°C)

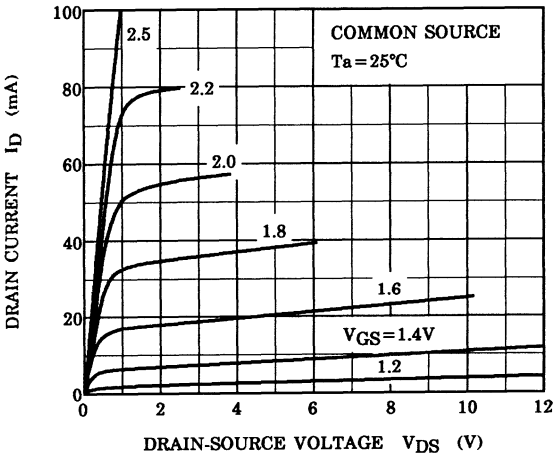
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 0 | — | — | 1 | μA |
| Drain-source breakdown voltage | | $V_{(BR)\ DSS}$ | $I_D$ = 100 μA, $V_{GS}$ = 0 | 20 | — | — | V |
| Drain cut-off current | | $I_{DSS}$ | $V_{DS}$ = 20 V, $V_{GS}$ = 0 | — | — | 1 | 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, $I_D$ = 10 mA | 25 | 50 | — | mS |
| Drain-source ON resistance | | $R_{DS\ (ON)}$ | $I_D$ = 10 mA, $V_{GS}$ = 2.5 V | — | 8 | 12 | Ω |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = 3 V, $V_{GS}$ = 0, f = 1 MHz | — | 8.5 | — | pF |
| Reverse transfer capacitance | | $C_{rss}$ | $V_{DS}$ = 3 V, $V_{GS}$ = 0, f = 1 MHz | — | 3.3 | — | pF |
| Output capacitance | | $C_{oss}$ | $V_{DS}$ = 3 V, $V_{GS}$ = 0, f = 1 MHz | — | 9.3 | — | pF |
| Switching time | Turn-on time | $t_{on}$ | $V_{DD}$ = 3 V, $I_D$ = 10 mA, $V_{GS}$ = 0~2.5 V | — | 0.16 | — | μs |
| | Turn-off time | $t_{off}$ | $V_{DD}$ = 3 V, $I_D$ = 10 mA, $V_{GS}$ = 0~2.5 V | — | 0.15 | — | |

## Switching Time Test Circuit

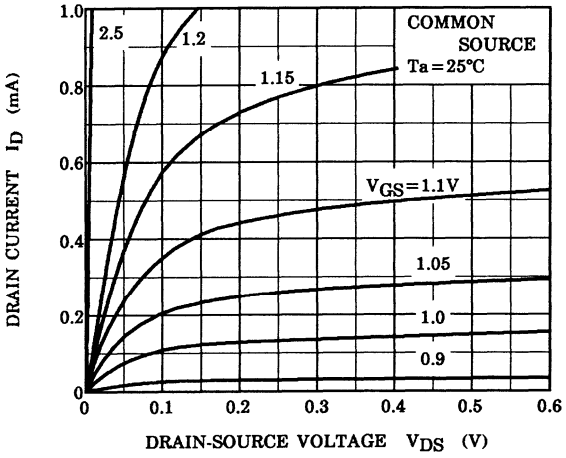


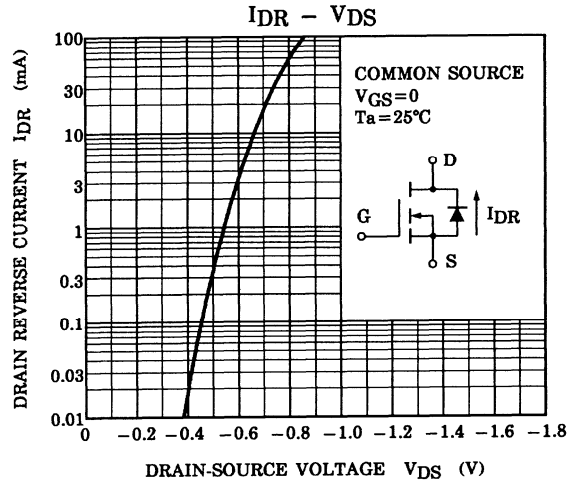
$I_D$ – $V_{DS}$



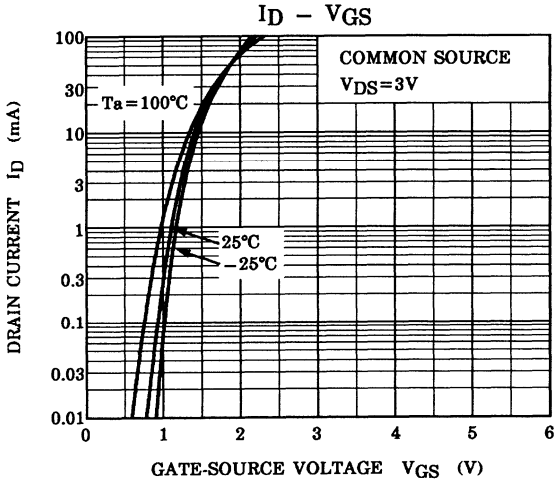

$I_D$ – $V_{DS}$ (LOW VOLTAGE REGION)



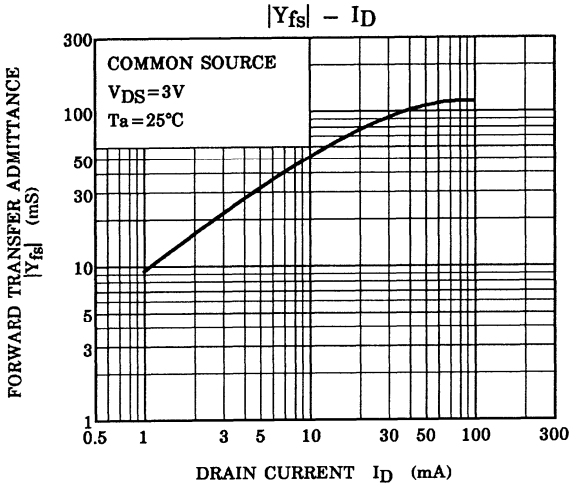

$I_{DR}$ – $V_{DS}$



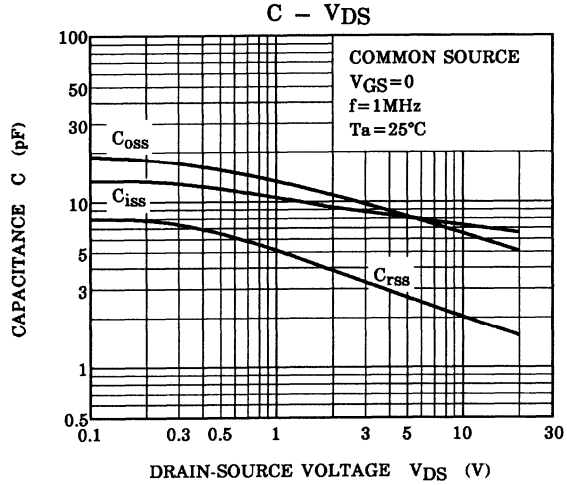

$I_D$ – $V_{GS}$



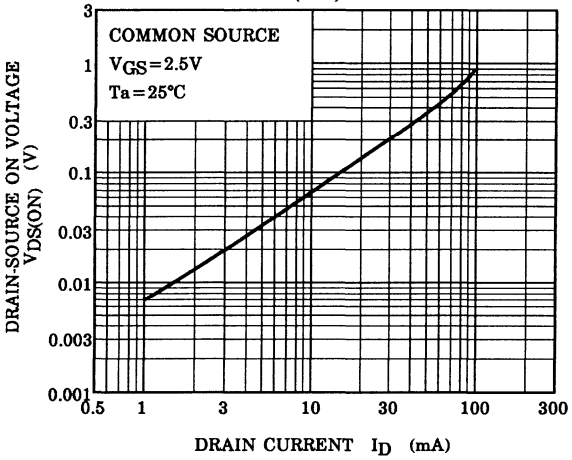

$|Y_{fs}|$ – $I_D$



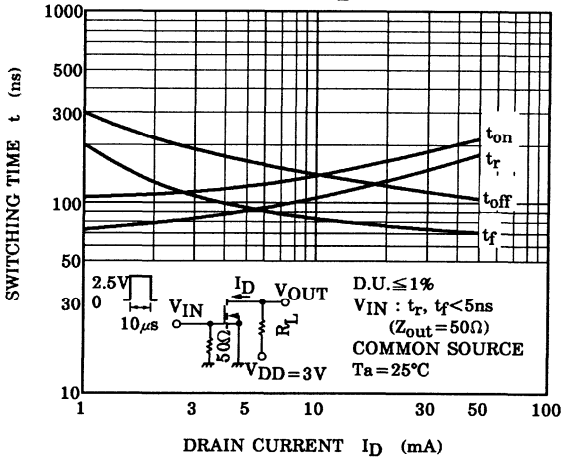

C – $V_{DS}$



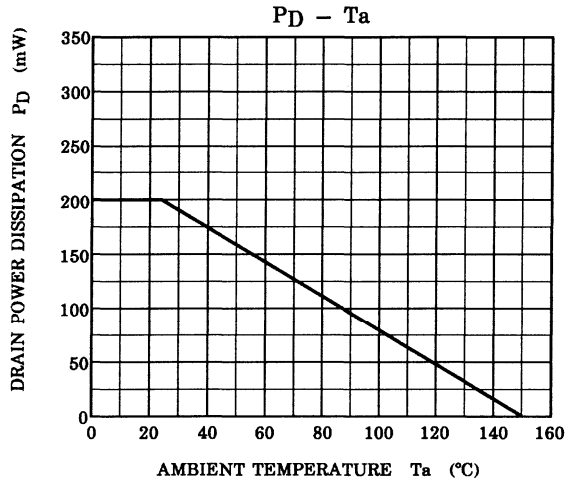
$V_{DS\,(ON)}$ – $I_D$




t – $I_D$




$P_D$ – Ta



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