To our customers,

## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

# MOS FIELD EFFECT TRANSISTOR

# 2SK2159

## N-CHANNEL MOS FET
## FOR HIGH-SPEED SWITCHING

The 2SK2159 is an N-channel vertical type MOS FET featuring an operating voltage as low as 1.5 V. Because it can be driven on a low voltage and it is not necessary to consider driving current, the 2SK2159 is suitable for driving actuators of low-voltage portable systems such as headphone stereo sets and camcorders.

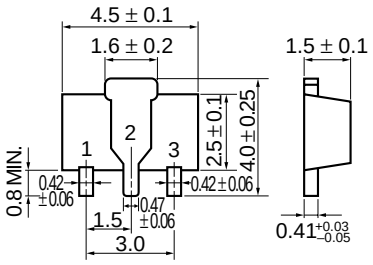
### FEATURES

- Capable of drive gate with 1.5 V
- Small $R_{DS(on)}$

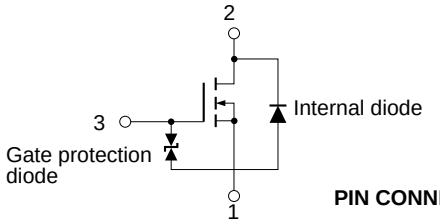
  $R_{DS(on)}$ = 0.7 Ω MAX. @$V_{GS}$ = 1.5 V, $I_D$ = 0.1 A

  $R_{DS(on)}$ = 0.3 Ω MAX. @$V_{GS}$ = 4.0 V, $I_D$ = 1.0 A

### PACKAGE DIMENSIONS
### (in millimeters)




### EQUIVALENT CIRCUIT




**PIN CONNECTION**

1. Source (S)
2. Drain (D)
3. Gate (G)

Marking: NW

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C)

| PARAMETER | SYMBOL | TEST CONDITIONS | RATINGS | UNIT |
|---|---|---|---|---|
| Drain to Source Voltage | $V_{DSS}$ | $V_{GS}$ = 0 | 60 | V |
| Gate to Source Voltage | $V_{GSS}$ | $V_{DS}$ = 0 | ±14 | V |
| Drain Current (DC) | $I_{D(DC)}$ | | ±2.0 | A |
| Drain Current (pulse) | $I_{D(pulse)}$ | PW ≤ 10 ms,<br>Duty Cycle ≤ 50 % | ±4.0 | A |
| Total Power Dissipation | $P_T$ | Mounted on 16 $cm^2$ × 0.7 mm ceramic substrate. | 2.0 | W |
| Channel Temperature | $T_{ch}$ | | 150 | °C |
| Storage Temperature | $T_{stg}$ | | –55 to +150 | °C |

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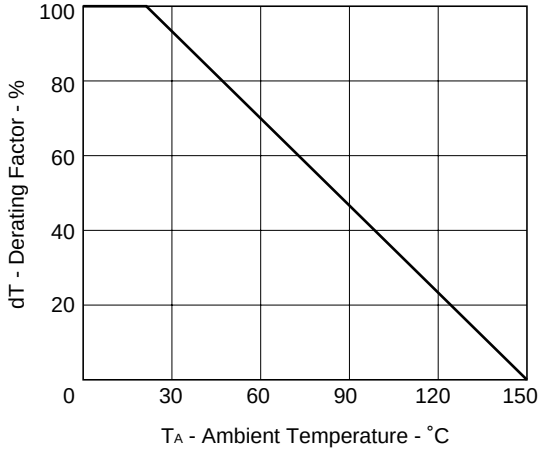
Printed in Japan

## ELECTRICAL CHARACTERISTICS ($T_A$ = 25 °C)

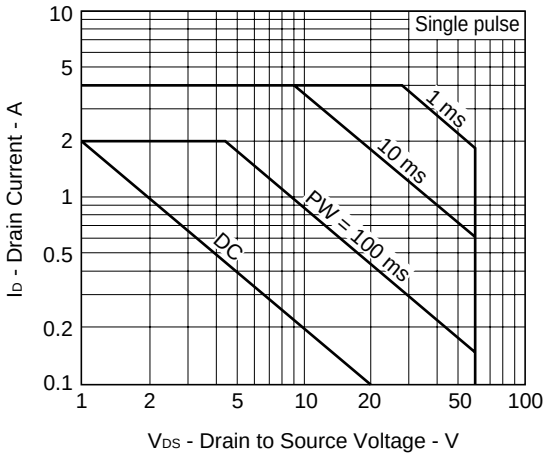
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Drain Cut-off Current | $I_{DSS}$ | $V_{DS}$ = 60 V, $V_{GS}$ = 0 | | | 1.0 | μA |
| Gate Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±14 V, $V_{DS}$ = 0 | | | ±10 | μA |
| Gate Cut-off Voltage | $V_{GS(off)}$ | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 0.5 | 0.9 | 1.1 | V |
| Forward Transfer Admittance | $\|y_{fs}\|$ | $V_{DS}$ = 10 V, $I_D$ = 1.0 A | 0.4 | | | S |
| Drain to Source On-state Resistance | $R_{DS(on)1}$ | $V_{GS}$ = 1.5 V, $I_D$ = 0.1 A | | 0.55 | 0.7 | Ω |
| Drain to Source On-state Resistance | $R_{DS(on)2}$ | $V_{GS}$ = 2.5 V, $I_D$ = 1.0 A | | 0.27 | 0.5 | Ω |
| Drain to Source On-state Resistance | $R_{DS(on)3}$ | $V_{GS}$ = 4.0 V, $I_D$ = 1.0 A | | 0.22 | 0.3 | Ω |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 10 V, $V_{GS}$ = 0, f = 1.0 MHz | | 319 | | pF |
| Output Capacitance | $C_{oss}$ | | | 109 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 22 | | pF |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 25 V, $I_D$ = 1.0 A, $V_{GS(on)}$ = 3 V, $R_G$ = 10 Ω, $R_L$ = 25 Ω | | 38 | | ns |
| Rise Time | $t_r$ | | | 128 | | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 237 | | ns |
| Fall Time | $t_f$ | | | 130 | | ns |

## TYPICAL CHARACTERISTICS ($T_A$ = 25 ˚C)

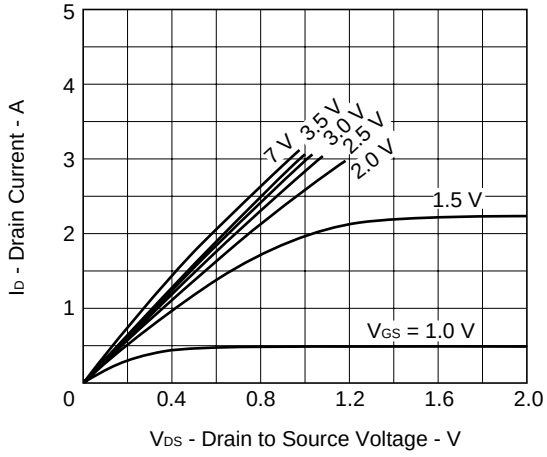
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



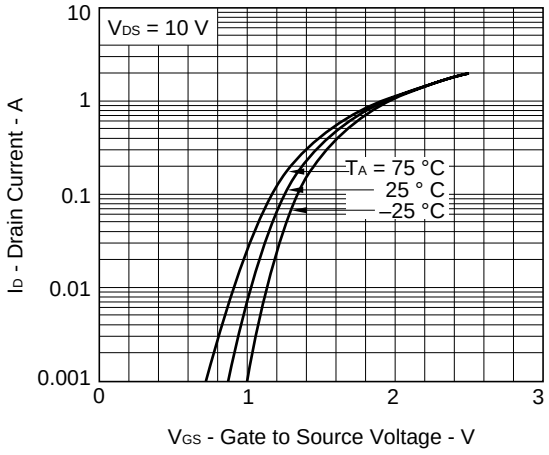

FORWARD BIAS SAFE OPERATING AREA



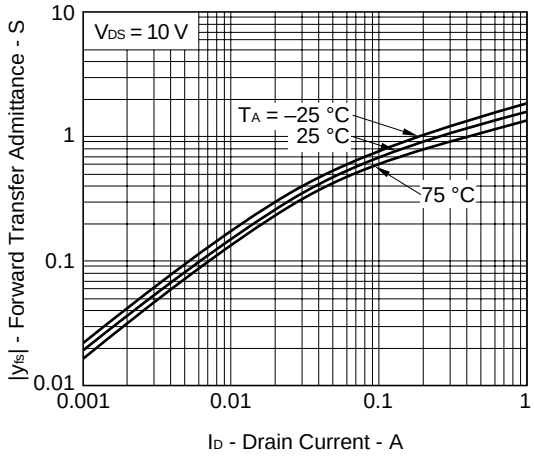

DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



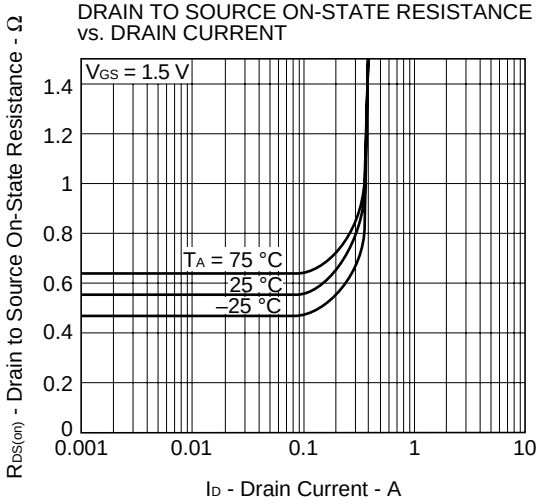

TRANSFER CHARACTERISTICS



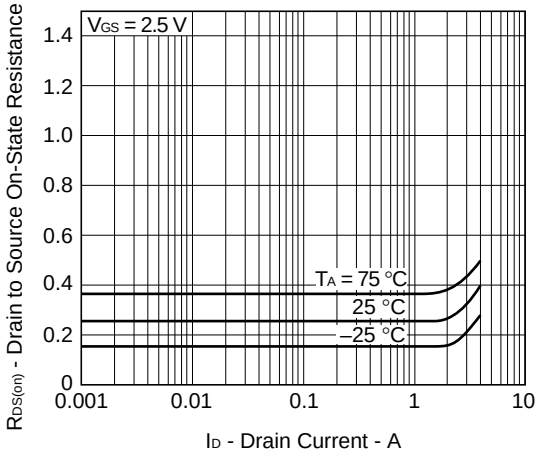

FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



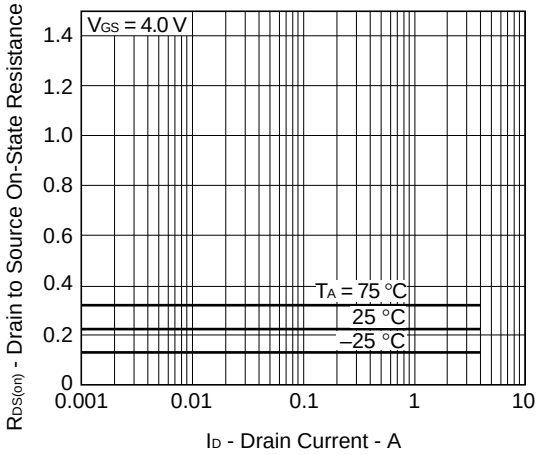

DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



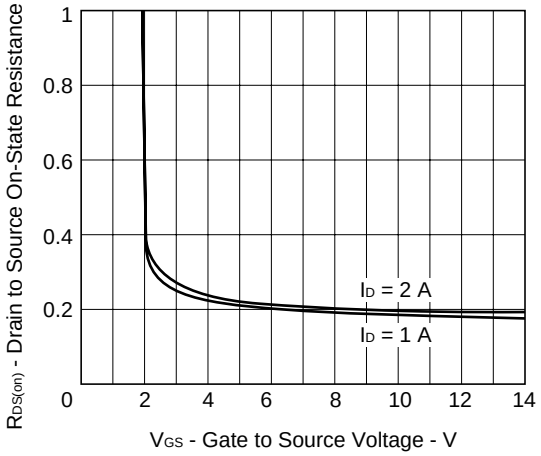
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



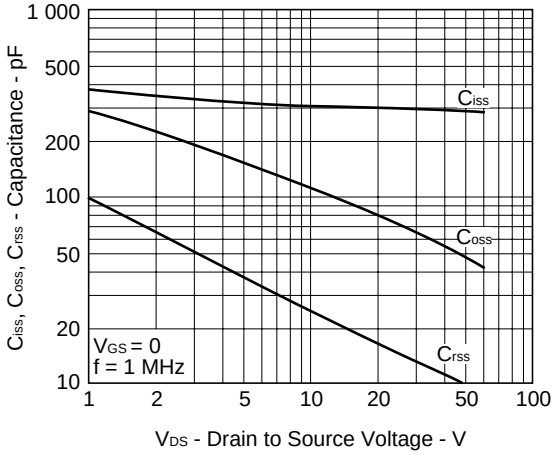

DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



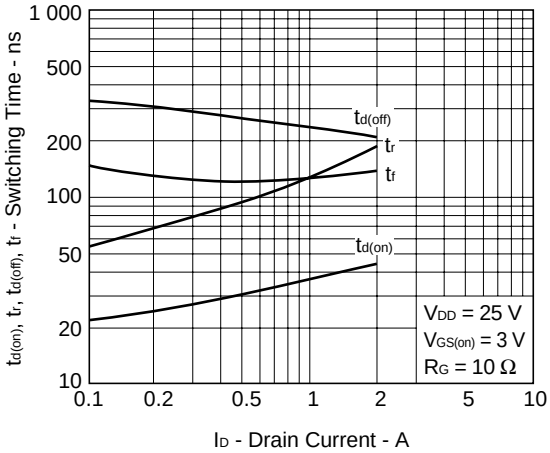

DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



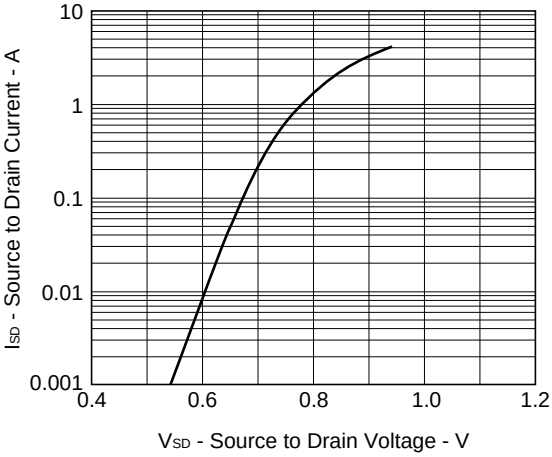

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE




SWITCHING CHARACTERISTICS




SOURCE TO DRAIN DIODE FORWARD VOLTAGE



## REFERENCE

| Document Name | Document No. |
|---|---|
| NEC semiconductor device reliability/quality control system | TEI-1202 |
| Quality grade on NEC semiconductor devices | IEI-1209 |
| Semiconductor device mounting technology manual | C10535E |
| Guide to quality assurance for semiconductor devices | MEI-1202 |
| Semiconductor selection guide | X10679E |