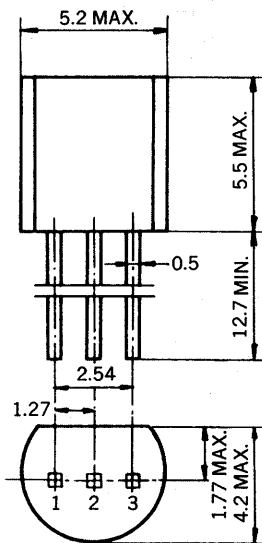


# MOS FIELD-EFFECT TRANSISTOR

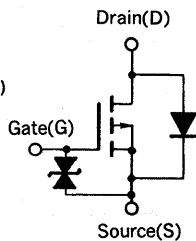
## 2SJ178

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

#### OUTLINE DIMENSIONS (Unit : mm)



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



(Diode in the above figure is a parasitic diode.)

The 2SJ178 is a p-channel vertical type MOS FET switching device which can be directly driven from an IC operating with a 5 V single power supply. The device featuring low ON-state resistance is of the voltage drive type and thus is ideal for driving actuators such as motors, solenoids, and relays.

#### FEATURES

- Low ON-state resistance
  - $R_{DS(on)} = 1.5 \Omega$  MAX. at  $V_{GS} = -4$  V,  $I_D = -0.5$  A
  - $R_{DS(on)} = 1.0 \Omega$  MAX. at  $V_{GS} = -10$  V,  $I_D = -0.5$  A
- Voltage drive at logic level ( $V_{GS} = -4$  V) is possible.
- Bidirectional zener diode for protection is incorporated in between the gate and the source.
- Inductive loads can be driven without protective circuit thanks to the improved breakdown voltage between the drain and source.

#### QUALITY GRADE

Standard

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

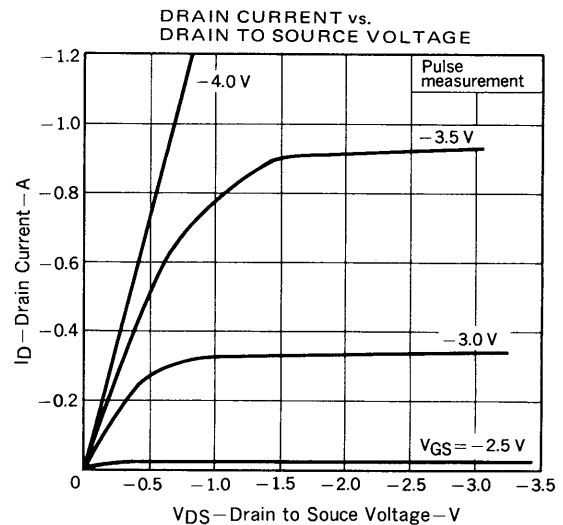
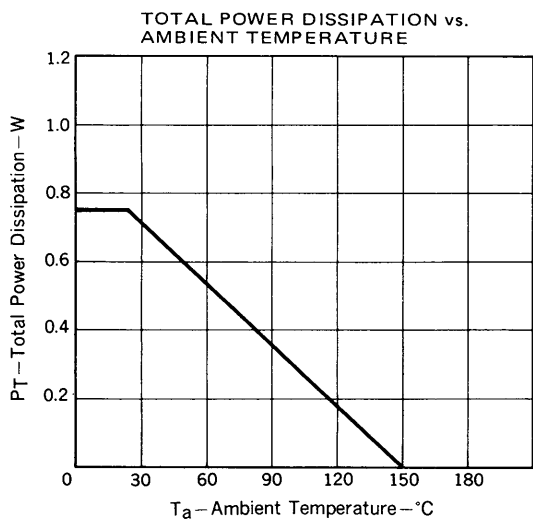
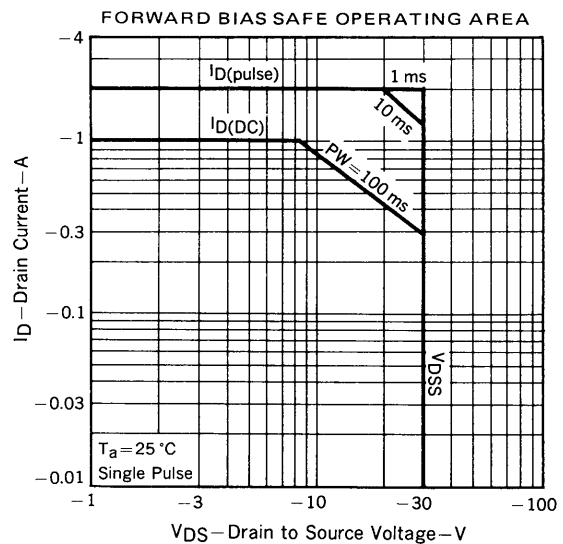
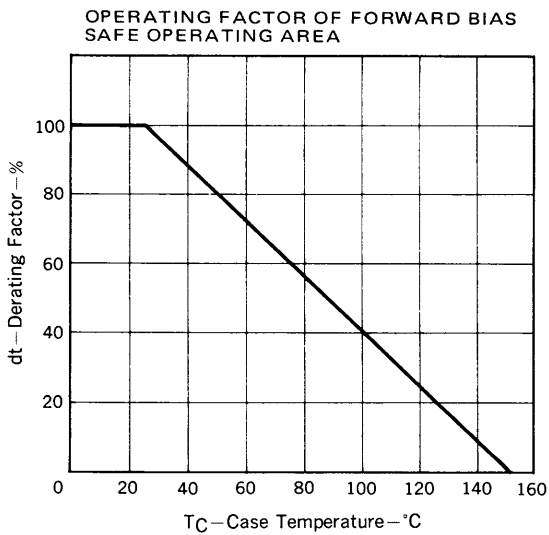
#### ABSOLUTE MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

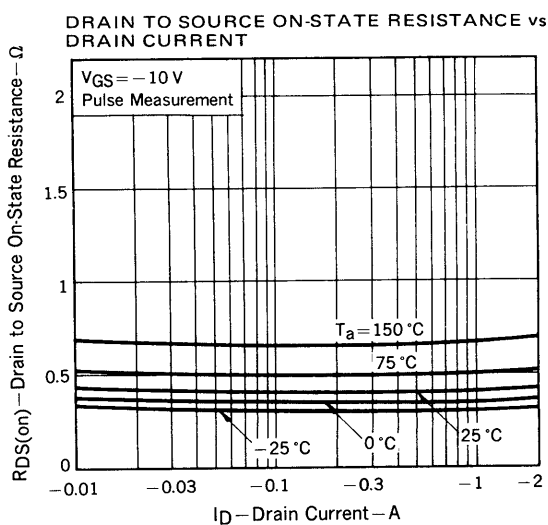
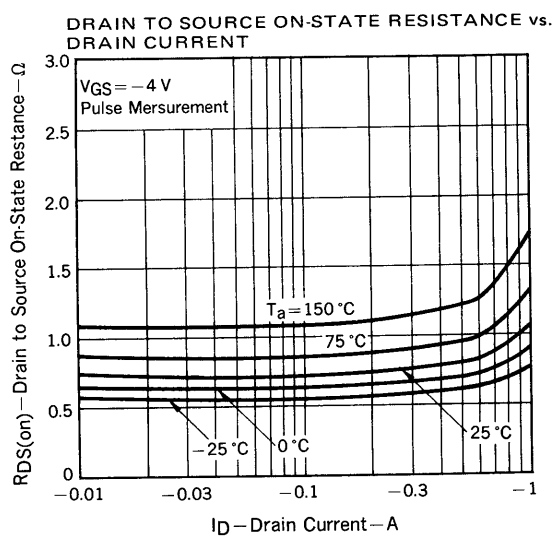
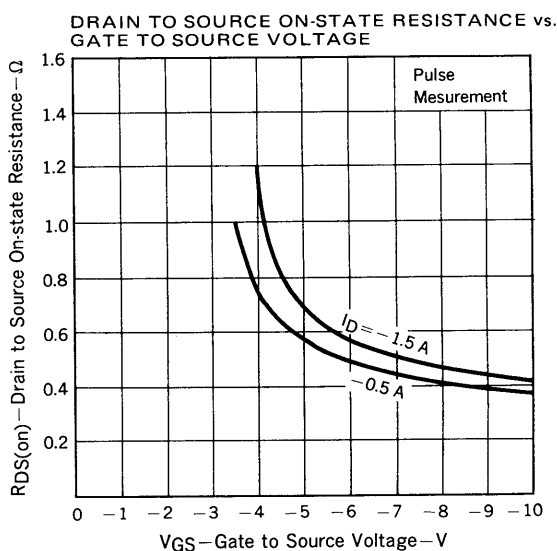
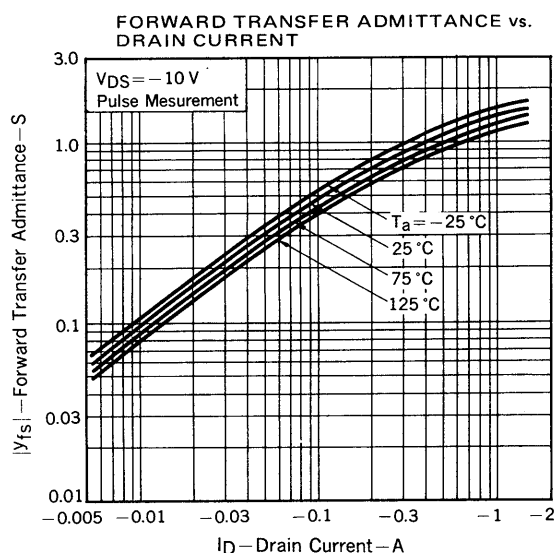
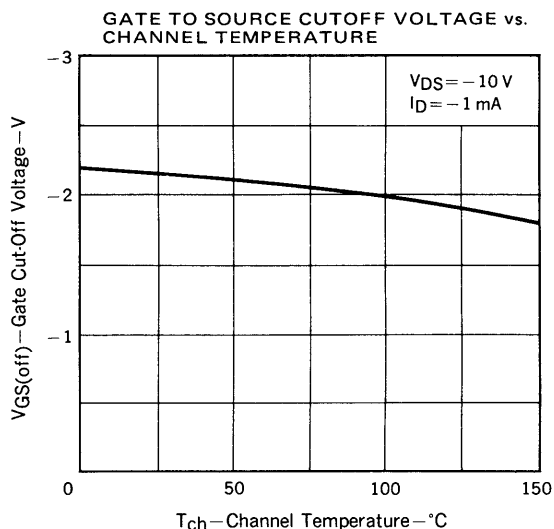
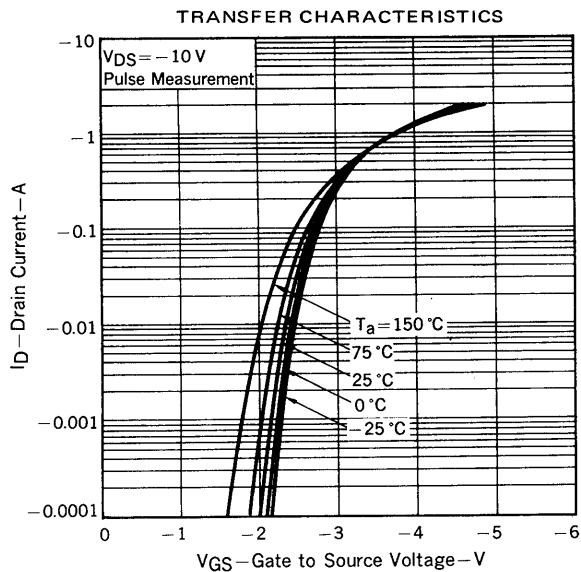
| ITEM                    | SYMBOL              | RATING      | UNIT             | TEST CONDITIONS                         |
|-------------------------|---------------------|-------------|------------------|---|
| Drain to Source Voltage | $V_{DSS}$           | -30         | V                | $V_{GS} = 0$                            |
| Gate to Source Voltage  | $V_{GSS}$           | $\pm 20$    | V                | $V_{DS} = 0$                            |
| Drain Current (DC)      | $I_D(\text{DC})$    | $\pm 1.0$   | A                |   |
| Drain Current (pulse)   | $I_D(\text{pulse})$ | $\pm 2.0$   | A                | $PW \leq 10$ ms, Duty Cycle $\leq 50$ % |
| Total Power Dissipation | $P_T$               | 750         | mW               | $T_a = 25^\circ\text{C}$                |
| Channel Temperature     | $T_{ch}$            | 150         | $^\circ\text{C}$ |   |
| Storage Temperature     | $T_{stg}$           | -55 to +150 | $^\circ\text{C}$ |   |

**ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )**

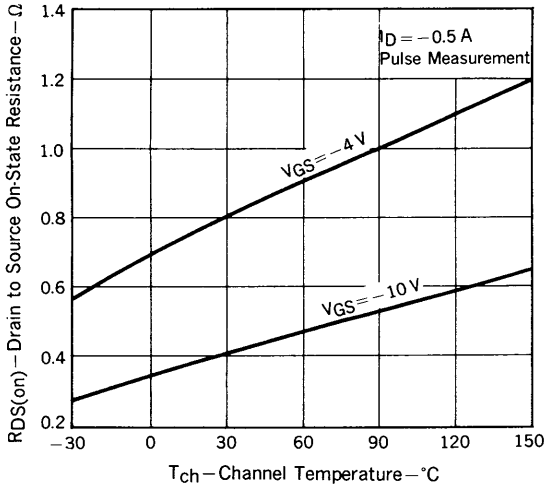
| ITEM                                  | SYMBOL        | MIN. | TYP. | MAX.     | UNIT          | TEST CONDITIONS   |
|---------------------------------------|---------------|------|------|----------|---------------|---|
| Drain Breaking Current                | $I_{DSS}$     |      |      | -10      | $\mu\text{A}$ | $V_{DS} = -30\text{ V}, V_{GS} = 0$   |
| Gate Leakage Current                  | $I_{GSS}$     |      |      | $\mp 10$ | $\mu\text{A}$ | $V_{GS} = \mp 20\text{ V}, V_{DS} = 0$  |
| Gate Cutoff Voltage                   | $V_{GS(off)}$ | -1.0 | -2.2 | -3.0     | V             | $V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$   |
| Forward Transfer Admittance           | $ y_{fs} $    | 0.4  |      |          | S             | $V_{DS} = -10\text{ V}, I_D = -0.5\text{ A}$  |
| Drain to Source ON-State Resistance 1 | $R_{DS(on)1}$ |      | 0.8  | 1.5      | $\Omega$      | $V_{GS} = -4\text{ V}, I_D = -0.5\text{ A}$   |
| Drain to Source ON-State Resistance 2 | $R_{DS(on)2}$ |      | 0.4  | 1.0      | $\Omega$      | $V_{GS} = -10\text{ V}, I_D = -0.5\text{ A}$  |
| Input Capacitance                     | $C_{iss}$     |      | 210  |          | pF            | $V_{DS} = -10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$   |
| Output Capacitance                    | $C_{oss}$     |      | 130  |          | pF            |   |
| Feedback Capacitance                  | $C_{rss}$     |      | 3    |          | pF            |   |
| ON-State Delay Time                   | $t_{d(on)}$   |      | 35   |          | ns            | $I_D = -0.5\text{ A}, R_L = 50\ \Omega$<br>$V_{GS(on)} = -10\text{ V}$<br>$R_G = 10\ \Omega, V_{DD} = -25\text{ V}$ |
| Rise Time                             | $t_r$         |      | 70   |          | ns            |   |
| OFF-State Delay Time                  | $t_{d(off)}$  |      | 380  |          | ns            |   |
| Fall Time                             | $t_f$         |      | 200  |          | ns            |   |

**CHARACTERISTIC CURVES ( $T_a = 25^\circ\text{C}$ )**

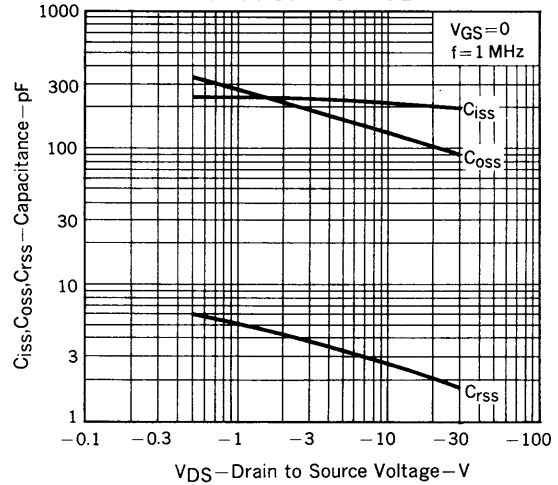




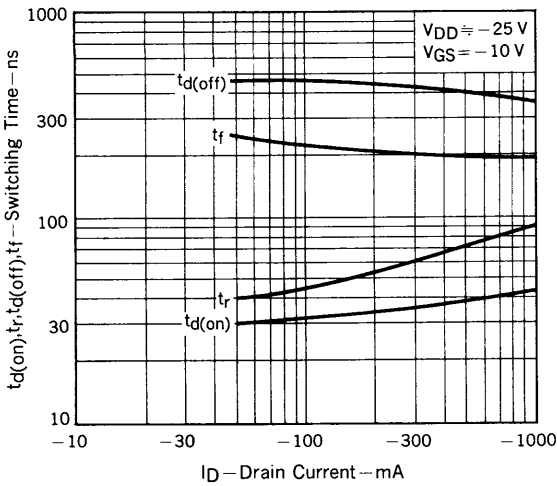
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



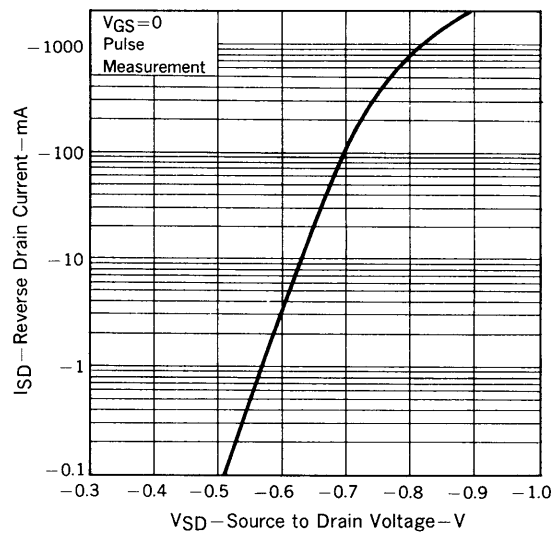
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



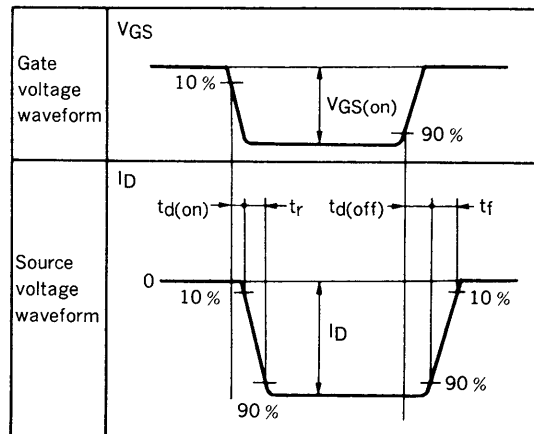
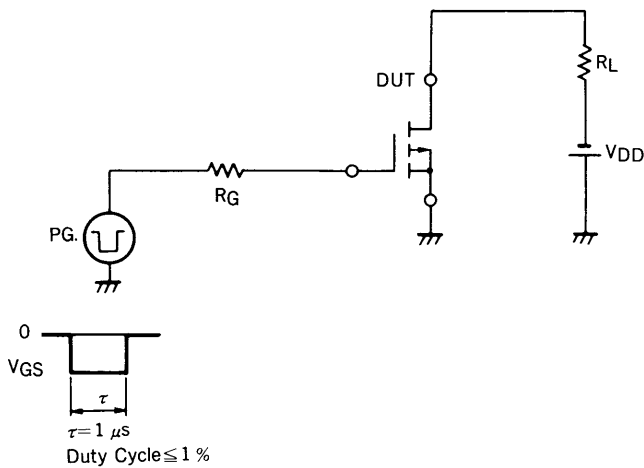
SWITCHING CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE



SWITCHING TIME MEASUREMENT CIRCUIT & MEASUREMENT CONDITIONS



**RECOMMENDED SOLDERING CONDITIONS**

Solder this product under the following recommended conditions.

For soldering methods or soldering conditions other than those recommended in the table, please consult our NEC salespeople.

**Insert type**

| Soldering method | Soldering conditions  | Recommended condition code |
|------------------|---|----------------------------|
| Wave soldering   | Solder bath temperature: 260 °C max.<br>Soldering time: 10 sec max. |                            |

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Application examples recommended by NEC Corporation

Standard: Data processing and office equipment, Communication equipment (terminal, mobile). Test and Measurement equipment, Audio and Video equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Communication equipment (trunk line), Train and Traffic control devices, industrial robots, Burning control systems, antidisaster systems, anticrime systems etc.



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