NEC

# MOS FIELD EFFECT POWER TRANSISTOR
# 2SK1122

## SWITCHING
## N-CHANNEL POWER MOS FET
## INDUSTRIAL USE

### DESCRIPTION

The 2SK1122 is N-channel MOS Field Effect Transistor designed for solenoid, motor and lamp driver.

### FEATURES

- Low On-state Resistance
  $R_{DS(on)} \leqq 50$ mΩ ($V_{GS}$ = 10 V, $I_D$ = 20 A)
  $R_{DS(on)} \leqq 70$ mΩ ($V_{GS}$ = 4 V, $I_D$ = 20 A)
- Low $C_{iss}$ $C_{iss}$ = 3 300 pF TYP.
- Built-in G-S Gate Protection Diodes

### QUALITY GRADE

Standard

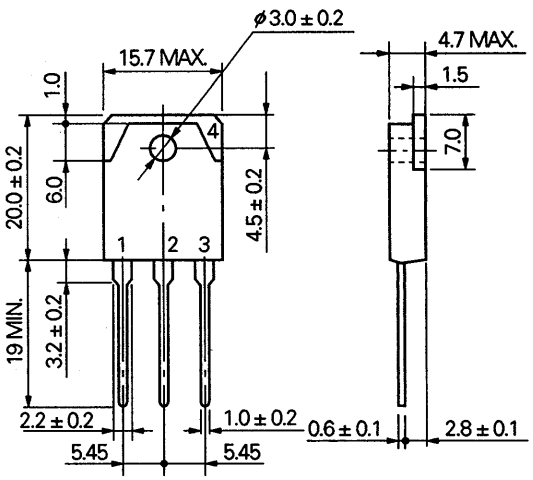
Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

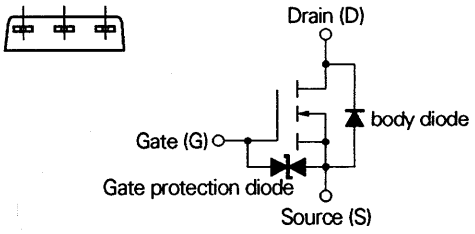
### ABSOLUTE MAXIMUM RATINGS ($T_a$ = 25 °C)

| | | | |
|---|---|---|---|
| Drain to Source Voltage | $V_{DSS}$ | 100 | V |
| Gate to Source Voltage | $V_{GSS(AC)}$ | ±20 | V |
| Drain Current (DC) | $I_{D(DC)}$ | ±40 | A |
| Drain Current (pulse) | $I_{D(pulse)}$* | ±160 | A |
| Total Power Dissipation ($T_c$ = 25 °C) | $P_{T1}$ | 100 | W |
| Total Power Dissipation ($T_a$ = 25 °C) | $P_{T2}$ | 3.0 | W |
| Channel Temperature | $T_{ch}$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | −55 to +150 | °C |

* PW ≦ 10 μs, Duty Cycle ≦ 1 %

### PACKAGE DIMENSIONS
(in millimeters)




1. Gate
2. Drain
3. Source
4. Fin (Drain)

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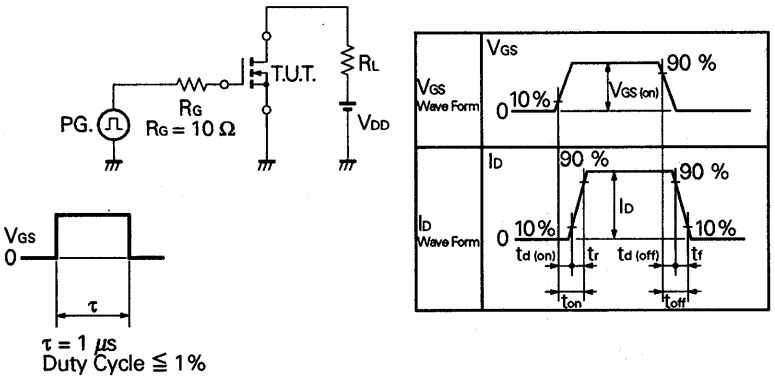
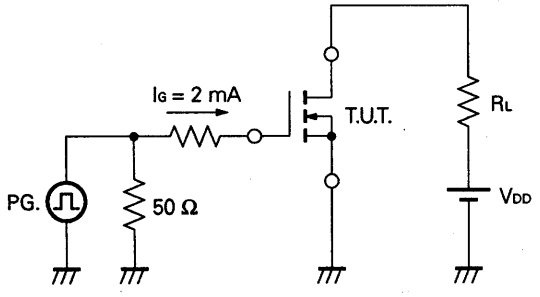
## ELECTRICAL CHARACTERISTICS ($T_a$ = 25 °C)

| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Drain to Source On-state Resistance | $R_{DS(on)}$ | | 42 | 50 | mΩ | $V_{GS}$ = 10 V, $I_D$ = 20 A |
| Drain to Source On-state Resistance | $R_{DS(on)}$ | | 50 | 70 | mΩ | $V_{GS}$ = 4.0 V, $I_D$ = 20 A |
| Gate to Source Cutoff Voltage | $V_{GS(off)}$ | 1.0 | | 2.5 | V | $V_{DS}$ = 10 V, $I_D$ = 1 mA |
| Forward Transfer Admittance | $\|y_{fs}\|$ | 12 | | | S | $V_{DS}$ = 10 V, $I_D$ = 20 A |
| Drain Leakage Current | $I_{DSS}$ | | | 10 | μA | $V_{DS}$ = 100 V, $V_{GS}$ = 0 |
| Gate to Source Leakage Current | $I_{GSS}$ | | | ±10 | μA | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 |
| Input Capacitance | $C_{iss}$ | | 3300 | | pF | $V_{DS}$ = 10 V<br>$V_{GS}$ = 0<br>f = 1 MHz |
| Output Capacitance | $C_{oss}$ | | 800 | | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | | 200 | | pF | |
| Turn-On Delay Time | $t_{d(on)}$ | | 40 | | ns | $V_{GS(on)}$ = 10 V<br>$V_{DD}$ = 50 V<br>$I_D$ = 20 A, $R_G$ = 10 Ω<br>$R_L$ = 2.5 Ω |
| Rise Time | $t_r$ | | 210 | | ns | |
| Turn-Off Delay Time | $t_{d(off)}$ | | 210 | | ns | |
| Fall Time | $t_f$ | | 155 | | ns | |
| Total Gate Charge | $Q_G$ | | 80 | | nC | $V_{GS}$ = 10 V<br>$I_D$ = 40 A<br>$V_{DD}$ = 80 V |
| Gate to Source Charge | $Q_{GS}$ | | 10 | | nC | |
| Gate to Drain Charge | $Q_{GD}$ | | 30 | | nC | |
| Diode Forward Voltage | $V_{SD}$ | | 1.2 | | V | $I_{SD}$ = 40 A, $V_{GS}$ = 0 |
| Reverse Recovery Time | $t_{rr}$ | | 210 | | ns | $I_F$ = 40 A, $V_{GS}$ = 0<br>di/dt = 50 A/μs |
| Reverse Recovery Charge | $Q_{rr}$ | | 600 | | nC | |

### Test Circuit 1: Switching Time

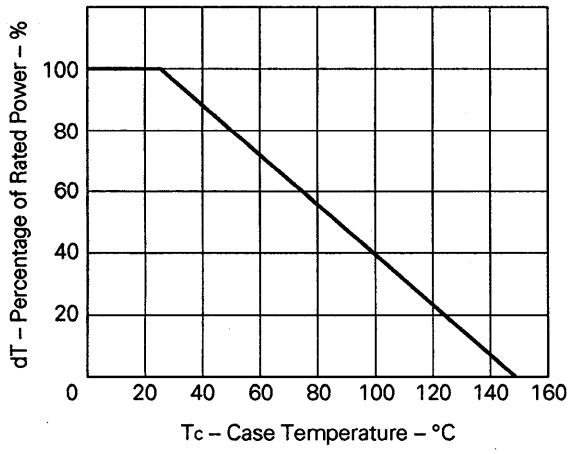



### Test Circuit 2: Gate Charge

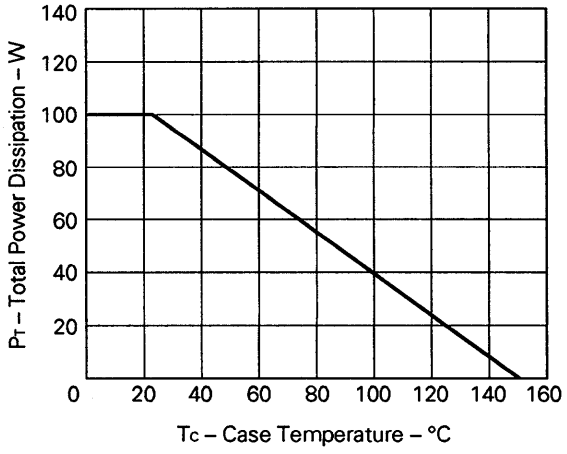


## TYPICAL CHARACTERISTICS ($T_a$ = 25 °C)

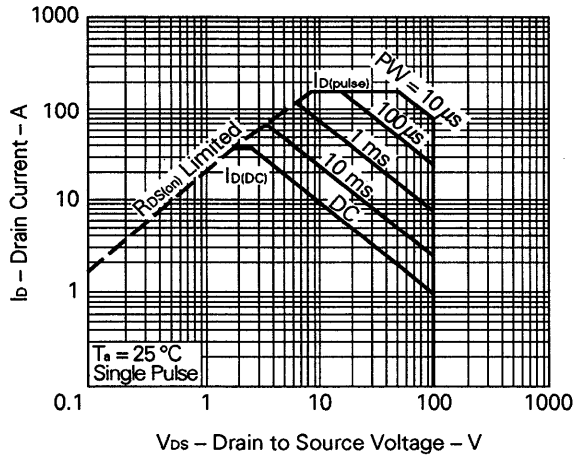
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



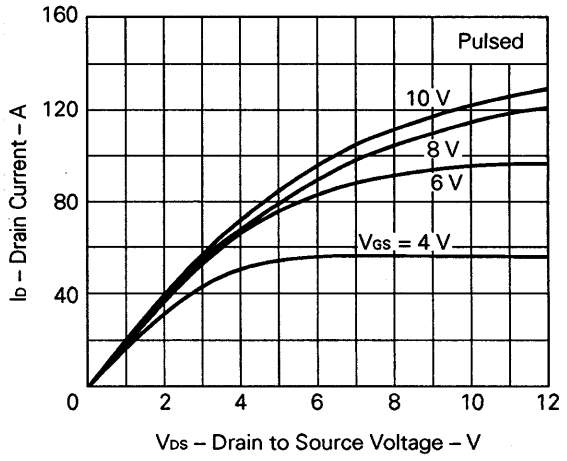

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



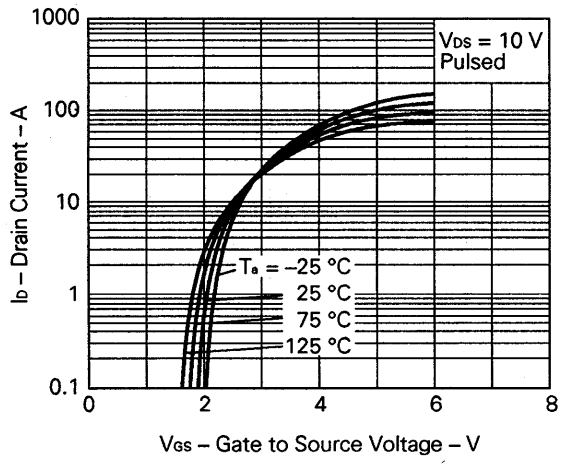

FORWARD BIAS SAFE OPERATING AREA



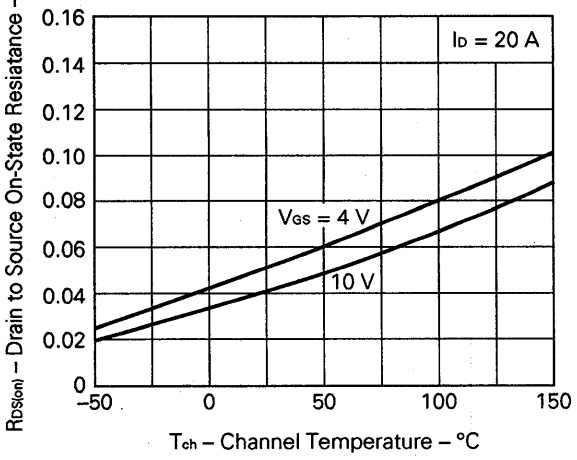

DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



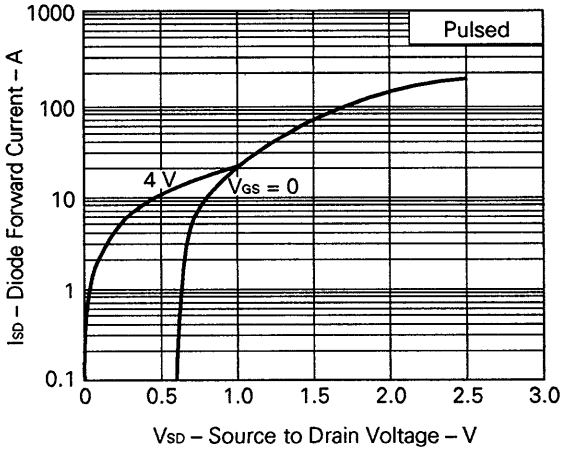

TRANSFER CHARACTERISTICS



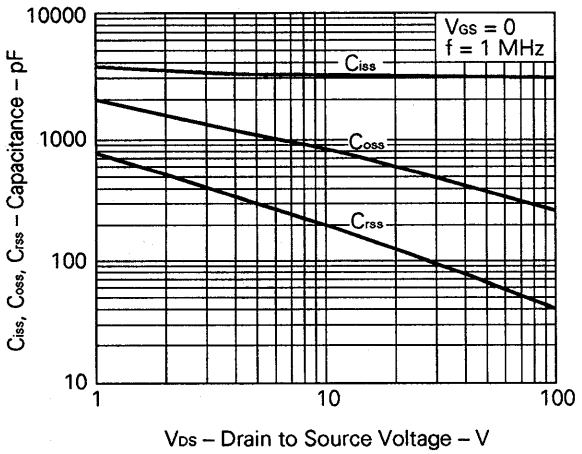
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



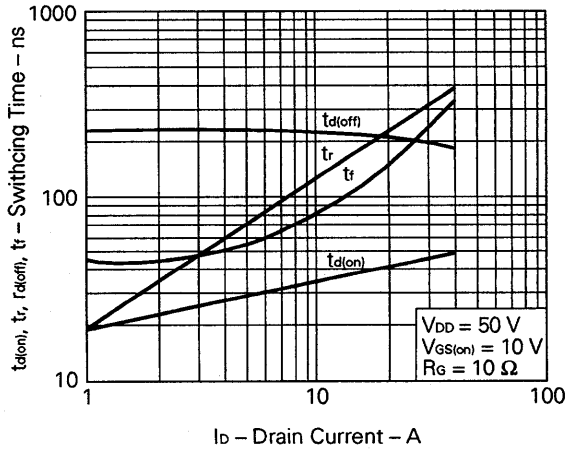

SOURCE TO DRAIN DIODE FORWARD VOLTAGE



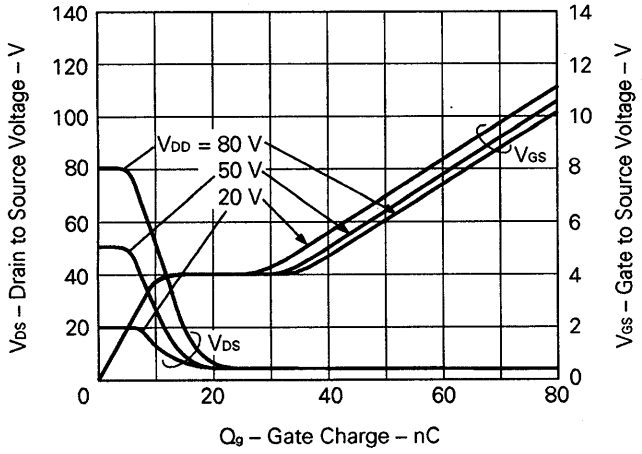

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



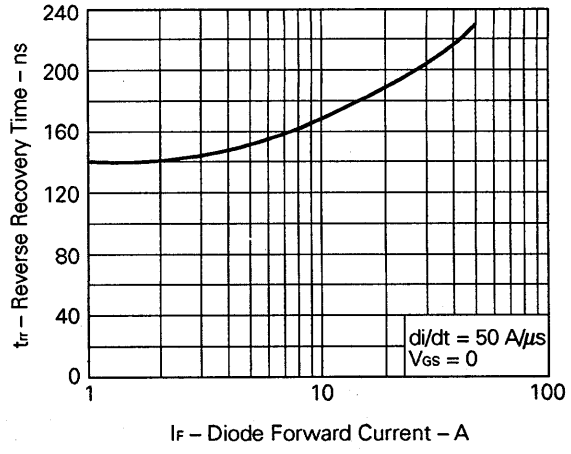

SWITCHING CHARACTERISTICS



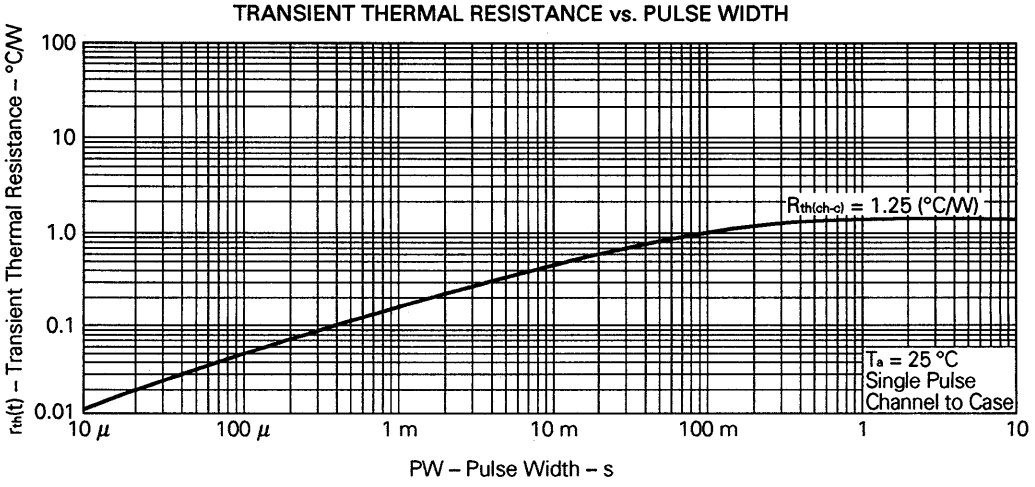

DYNAMIC INPUT CHARACTERISTICS



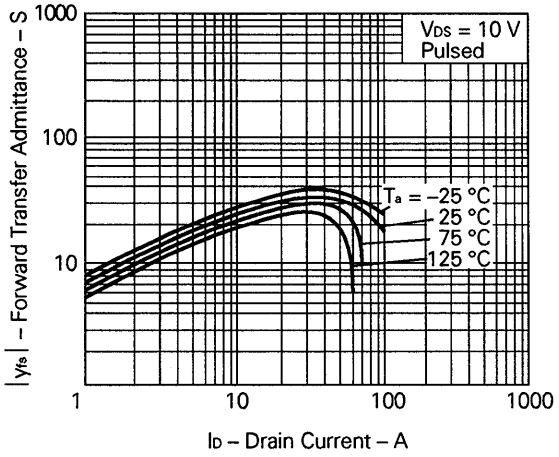

REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



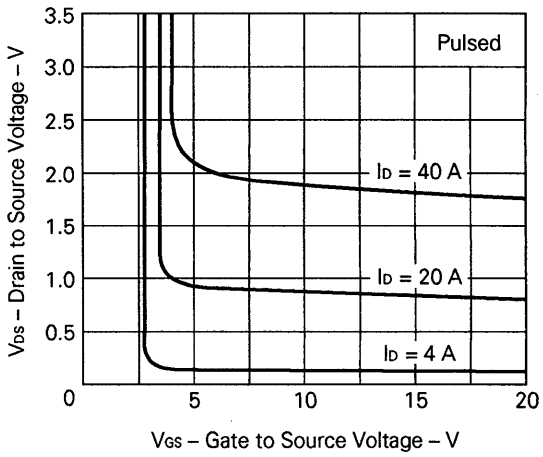
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



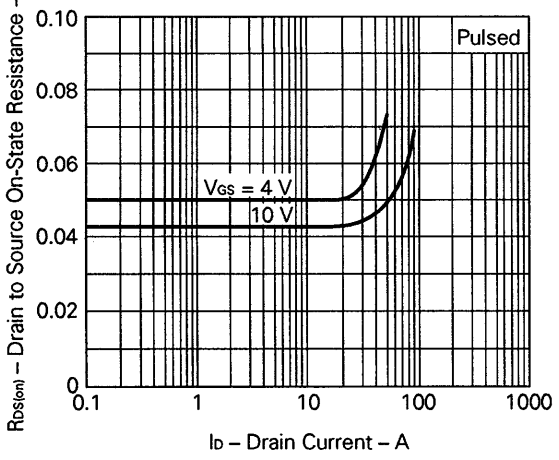

FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



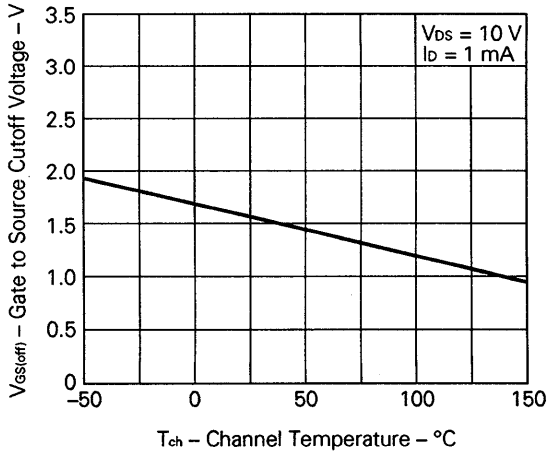

DRAIN TO SOURCE VOLTAGE vs. GATE TO SOURCE VOLTAGE




DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT




GATE TO SOURCE CUTOFF VOLTAGE vs. CHANNEL TEMPERATURE



## REFERENCE

| Application note name | No. |
|---|---|
| Safe operating area of Power MOS FET. | TEA-1034 |
| Application circuit using Power MOS FET. | TEA-1035 |
| Quality control of NEC semiconductors devices. | TEI-1202 |
| Quality control guide of semiconductors devices. | MEI-1202 |
| Assembly manual of semiconductors devices. | IEI-1207 |

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