# N-CHANNEL MOS FIELD EFFECT POWER TRANSISTOR

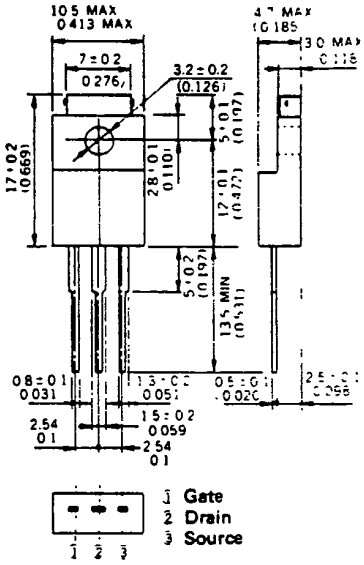
# 2SK659

**DESCRIPTION** The 2SK659 is N-Channel MOS Field Effect Power Transistor designed for solenoid, motor and lamp driver.

**FEATURES**

- 4 V Gate Drive – Logic level –
- Low $R_{DS(on)}$
- No Secondary Breakdown

**PACKAGE DIMENSIONS**
in millimeters (inches)




## ABSOLUTE MAXIMUM RATINGS

Maximum Temperatures

- Storage Temperature . . . . . −55 to +150 °C
- Channel Temperature . . . . . 150 °C Maximum

Maximum Power Dissipations

- Total Power Dissipation ($T_a$ = 25 °C) . . . 2.0 W
- Total Power Dissipation ($T_c$ = 25 °C) . . . 35 W

Maximum Voltages and Currents ($T_a$ = 25 °C)

- $V_{DSS}$ Drain to Source Voltage . . . . . 60 V
- $V_{GSS}$ Gate to Source Voltage . . . . . ±20 V
- $I_{D(DC)}$ Drain Current (DC) . . . . . ±12 A
- $I_{D(pulse)}$ Drain Current (pulse)* . . . . . ±60 A

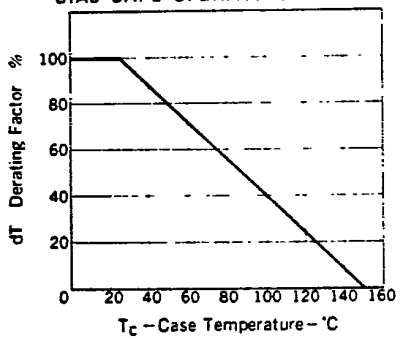
*PW ≦ 300 μs, Duty Cycle ≦ 10 %

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

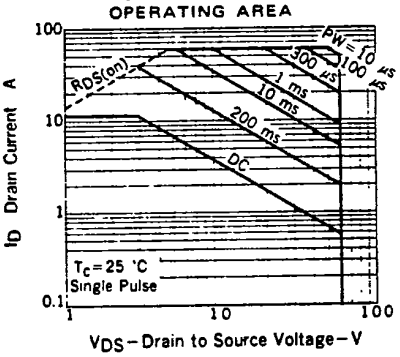
| SYMBOL | CHARACTERISTIC | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| $R_{DS(on)}$ | Drain to Source On-State Resistance | | | 0.075 | Ω | $V_{GS}$ = 10 V, $I_D$ = 6 A |
| $R_{DS(on)}$ | Drain to Source On-State Resistance | | | 0.095 | Ω | $V_{GS}$ = 4 V, $I_D$ = 6 A |
| $V_{GS(off)}$ | Gate to Source Cutoff Voltage | 1 | | 2.5 | V | $V_{DS}$ = 10 V, $I_D$ = 1 mA |
| $\|y_{fs}\|$ | Forward Transfer Admittance | 5 | | | S | $V_{DS}$ = 10 V, $I_D$ = 6 A |
| $I_{DSS}$ | Drain Leakage Current | | | 10 | μA | $V_{DS}$ = 60 V, $V_{GS}$ = 0 |
| $I_{GSS}$ | Gate to Source Leakage Current | | | ±100 | nA | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 |
| $C_{iss}$ | Input Capacitance | | 1300 | | pF | $V_{DS}$ = 10 V<br>$V_{GS}$ = 0<br>f = 1 MHz |
| $C_{oss}$ | Output Capacitance | | 600 | | pF | |
| $C_{rss}$ | Reverse Transfer Capacitance | | 260 | | pF | |
| $t_{d(on)}$ | Turn-On Delay Time | | 15 | | ns | $I_D$ = 6 A, $V_{CC}$ ≒ 30 V<br>$R_L$ = 5 Ω, $V_{GS(on)}$ = 10 V<br>$R_{in}$ = 10 Ω |
| $t_r$ | Rise Time | | 75 | | ns | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 80 | | ns | |
| $t_f$ | Fall Time | | 80 | | ns | |

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

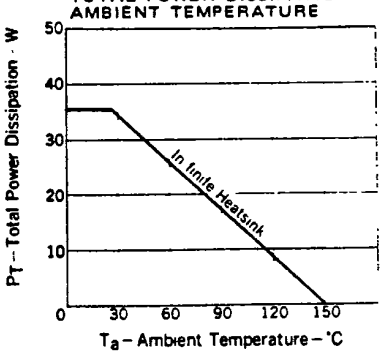
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



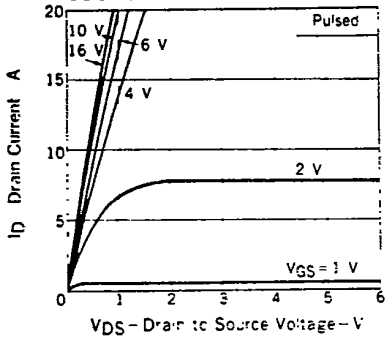

FORWARD BIAS SAFE OPERATING AREA



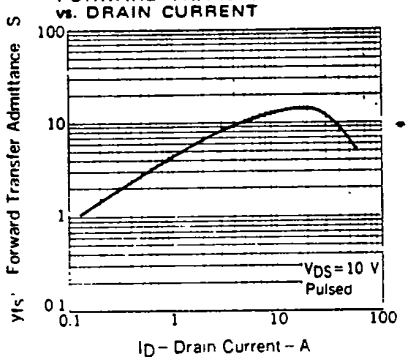

TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



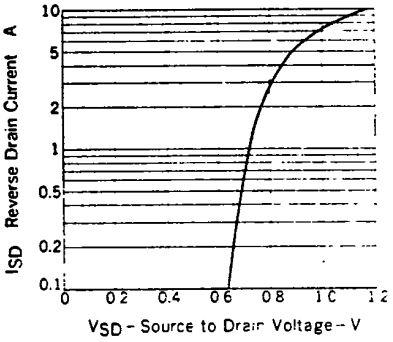

DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



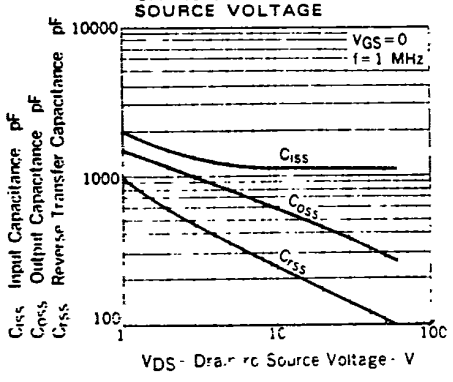

FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



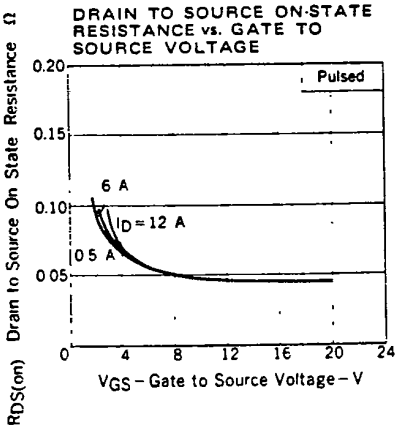

SOURCE TO DRAIN DIODE FORWARD VOLTAGE



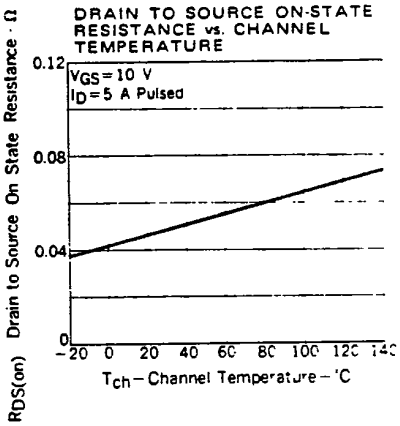

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

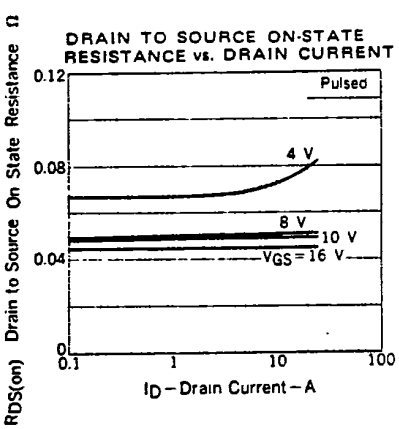


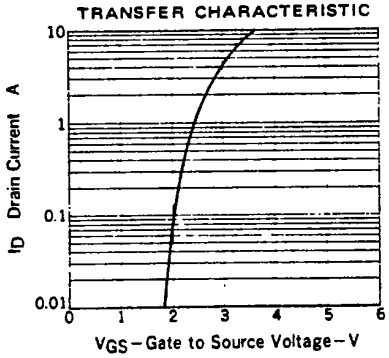

DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

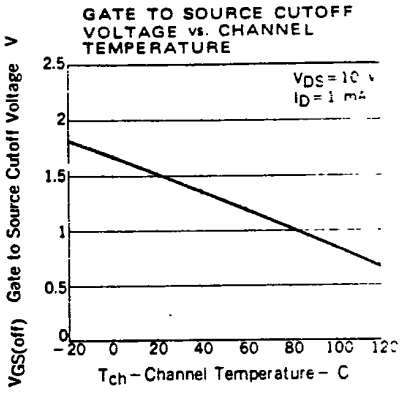



DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE






## SWITCHING TIME TEST CIRCUIT