HITACHI

# 2SK970

**Silicon N-Channel MOS FET**

## Application

High speed power switching

## Features

- Low on-resistance
- High speed switching
- Low drive current
- 4 V gate drive device
  – Can be driven from 5 V source
- Suitable for motor drive, DC-DC converter, power switch and solenoid drive

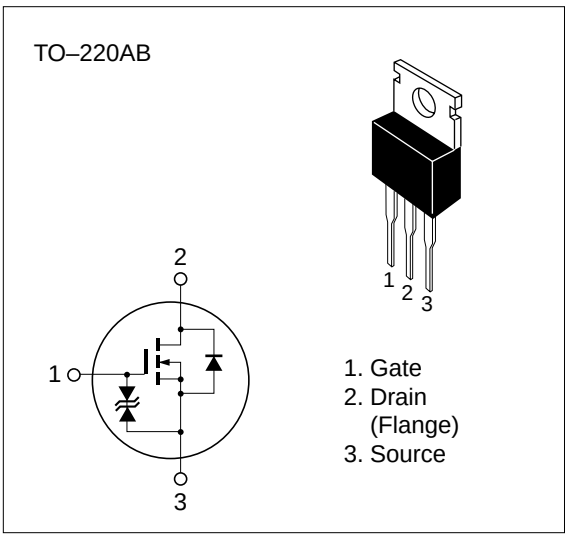



**Table 1 Absolute Maximum Ratings** (Ta = 25°C)

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Drain to source voltage | $V_{DSS}$ | 60 | V |
| Gate to source voltage | $V_{GSS}$ | ±20 | V |
| Drain current | $I_D$ | 10 | A |
| Drain peak current | $I_{D(pulse)}$* | 40 | A |
| Body to drain diode reverse drain current | $I_{DR}$ | 10 | A |
| Channel dissipation | Pch** | 30 | W |
| Channel temperature | Tch | 150 | °C |
| Storage temperature | Tstg | –55 to +150 | °C |

* PW ≤ 10 µs, duty cycle ≤ 1 %
** Value at $T_C$ = 25 °C

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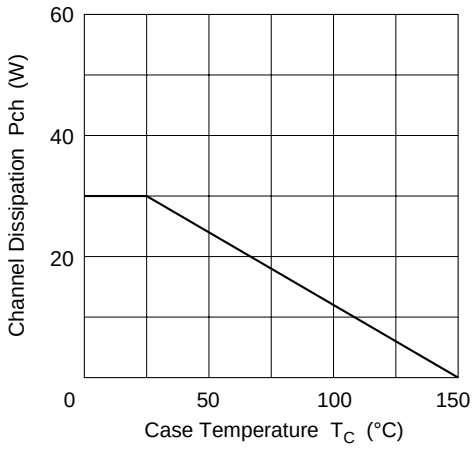
**Table 2 Electrical Characteristics** (Ta = 25°C)

| Item | Symbol | Min | Typ | Max | Unit | Test conditions |
|---|---|---|---|---|---|---|
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | 60 | — | — | V | $I_D$ = 10 mA, $V_{GS}$ = 0 |
| Gate to source breakdown voltage | $V_{(BR)GSS}$ | ±20 | — | — | V | $I_G$ = ±100 µA, $V_{DS}$ = 0 |
| Gate to source leak current | $I_{GSS}$ | — | — | ±10 | µA | $V_{GS}$ = ±16 V, $V_{DS}$ = 0 |
| Zero gate voltage drain current | $I_{DSS}$ | — | — | 250 | µA | $V_{DS}$ = 50 V, $V_{GS}$ = 0 |
| Gate to source cutoff voltage | $V_{GS(off)}$ | 1.0 | — | 2.0 | V | $I_D$ = 1 mA, $V_{DS}$ = 10 V |
| Static drain to source on state resistance | $R_{DS(on)}$ | — | 0.12 | 0.15 | Ω | $I_D$ = 5 A, $V_{GS}$ = 10 V * |
| | | | 0.17 | 0.22 | | $I_D$ = 5 A, $V_{GS}$ = 4 V * |
| Forward transfer admittance | $\|y_{fs}\|$ | 3.5 | 6.0 | — | S | $I_D$ = 5 A, $V_{DS}$ = 10 V * |
| Input capacitance | Ciss | — | 400 | — | pF | $V_{DS}$ = 10 V, $V_{GS}$ = 0, f = 1 MHz |
| Output capacitance | Coss | — | 220 | — | pF | |
| Reverse transfer capacitance | Crss | — | 60 | — | pF | |
| Turn-on delay time | $t_{d(on)}$ | — | 5 | — | ns | $I_D$ = 5 A, $V_{GS}$ = 10 V, $R_L$ = 6 Ω |
| Rise time | $t_r$ | — | 55 | — | ns | |
| Turn-off delay time | $t_{d(off)}$ | — | 140 | — | ns | |
| Fall time | $t_f$ | — | 90 | — | ns | |
| Body to drain diode forward voltage | $V_{DF}$ | — | 1.2 | — | V | $I_F$ = 10 A, $V_{GS}$ = 0 |
| Body to drain diode reverse recovery time | $t_{rr}$ | — | 125 | — | ns | $I_F$ = 10 A, $V_{GS}$ = 0, $di_F/dt$ = 50 A/µs |

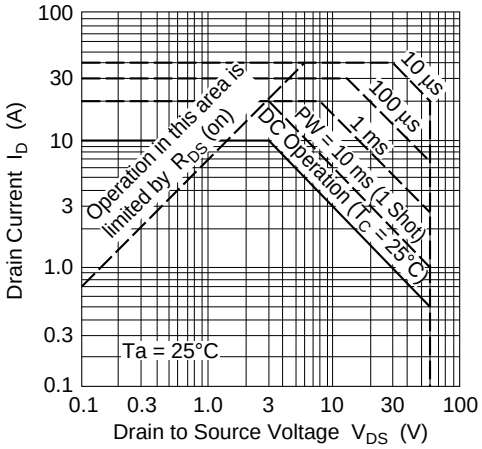
* Pulse Test

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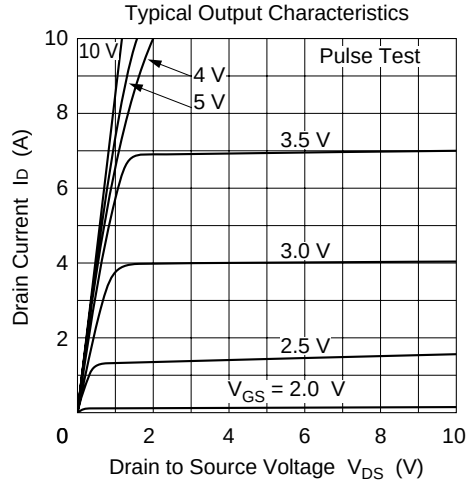
Power vs. Temperature Derating



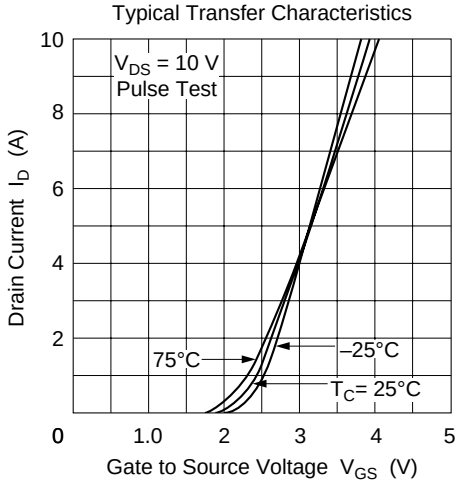

Maximum Safe Operation Area




Typical Output Characteristics

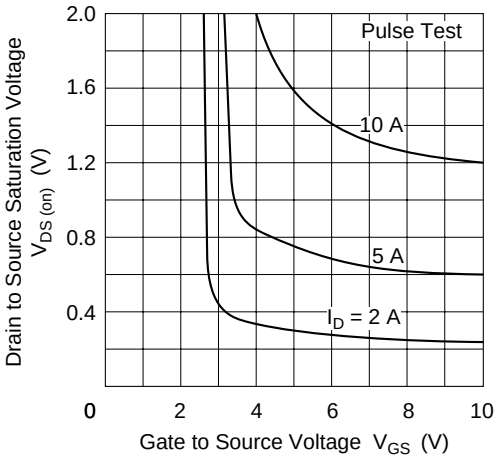



Typical Transfer Characteristics

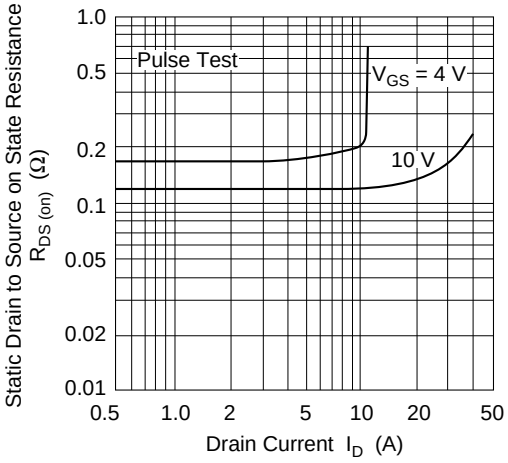



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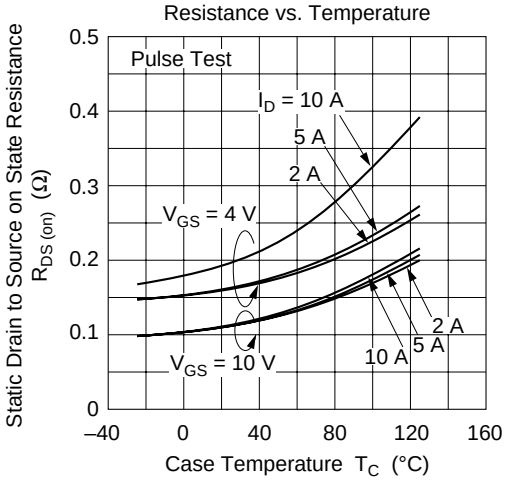
Drain to Source Saturation Voltage vs. Gate to Source Voltage



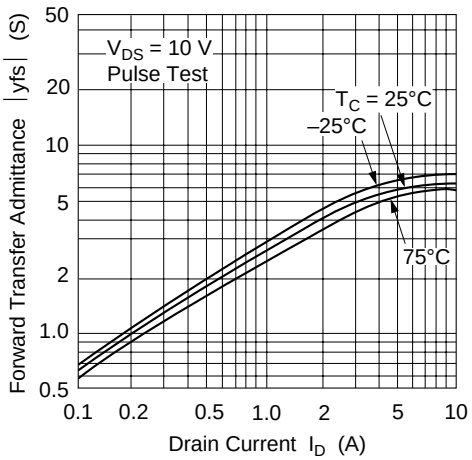

Static Drain to Source on State Resistance vs. Drain Current




Static Drain to Source on State Resistance vs. Temperature

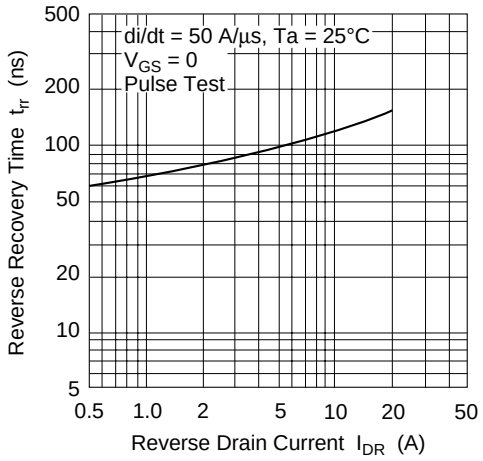



Forward Transfer Admittance vs. Drain Current

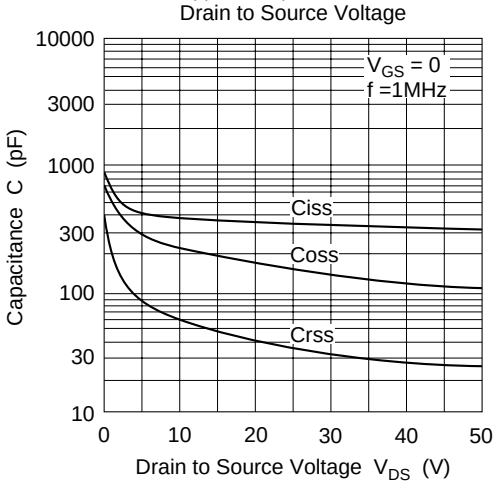



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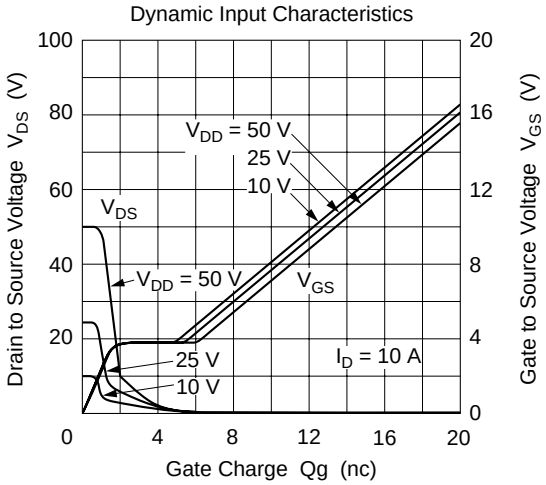
Body to Drain Diode Reverse Recovery Time



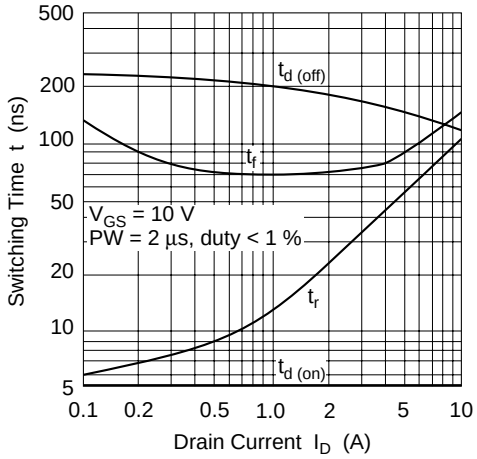

Typical Capacitance vs. Drain to Source Voltage




Dynamic Input Characteristics

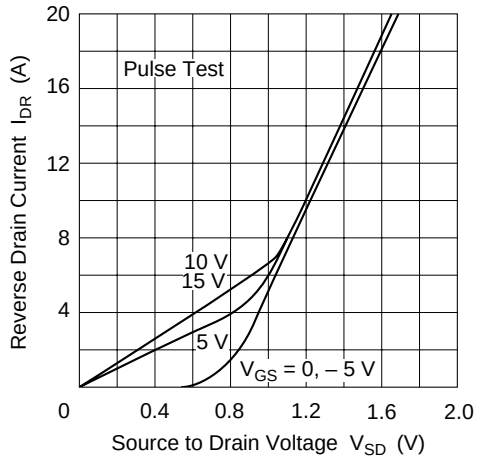



Switching Characteristics

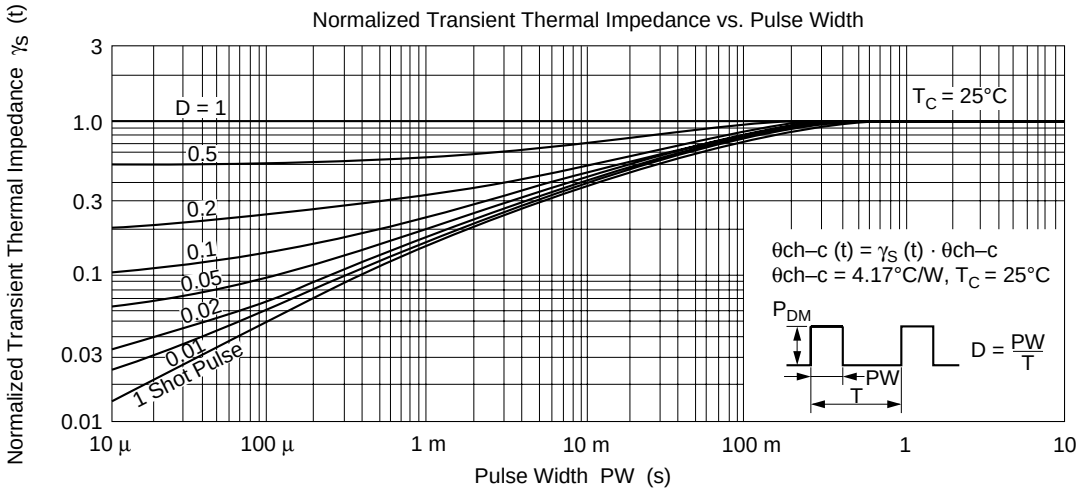



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Reverse Drain Current vs.
Source to Drain Voltage

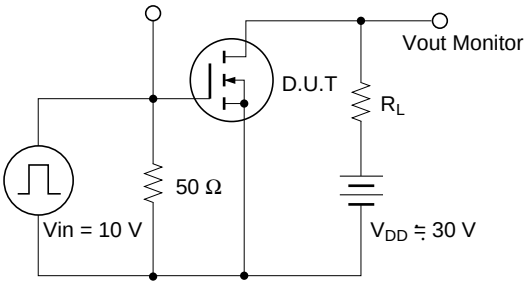



Normalized Transient Thermal Impedance vs. Pulse Width

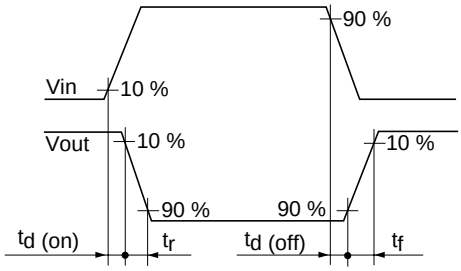



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Switching Time Test Circuit




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