

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (MACH II π -MOS VI)

2SK3906

Switching Regulator Applications

- Small gate charge: $Q_g = 60 \text{ nC}$ (typ.)
- Fast reverse recovery time: $t_{rr} = 400 \text{ ns}$ (typ.)
- Low drain-source ON-resistance: $R_{DS(ON)} = 0.27 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 15\text{S}$ (typ.)
- Low leakage current: $I_{DSS} = 500 \mu\text{A}$ ($V_{DS} = 600 \text{ V}$)
- Enhancement mode: $V_{th} = 2.0\sim 4.0 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

| Characteristic | Symbol | Rating | Unit |
|--|----------------|----------|------------------|
| Drain-source voltage | V_{DSS} | 600 | V |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | V_{DGR} | 600 | V |
| Gate-source voltage | V_{GSS} | ± 30 | V |
| Drain current | DC (Note 1) | I_D | 20 |
| | Pulse (Note 1) | I_{DP} | 80 |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | P_D | 150 | W |
| Single-pulse avalanche energy (Note 2) | E_{AS} | 792 | mJ |
| Avalanche current | I_{AR} | 20 | A |
| Repetitive avalanche energy (Note 3) | E_{AR} | 15 | mJ |
| Channel temperature | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | T_{stg} | -55~150 | $^\circ\text{C}$ |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings. Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Thermal Characteristics

| Characteristic | Symbol | Max | Unit |
|--|----------------|-------|--------------------|
| Thermal resistance, channel to case | $R_{th(ch-c)}$ | 0.833 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 50 | $^\circ\text{C/W}$ |

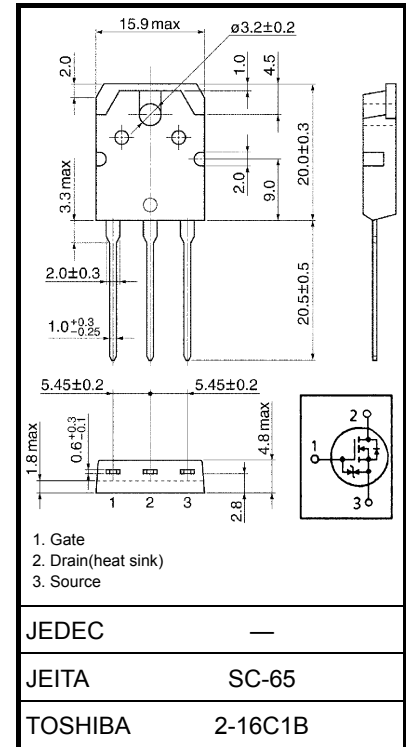
Note 1: Ensure that the channel temperature does not exceed 150°C .

Note 2: $V_{DD} = 90 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 3.46 \text{ mH}$, $I_{AR} = 20 \text{ A}$, $R_G = 25 \Omega$

Note 3: Repetitive rating: pulse width limited by maximum channel temperature

This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 4.6 g (typ.)

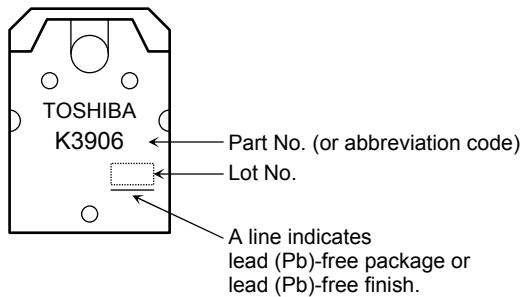
Electrical Characteristics (Ta = 25°C)

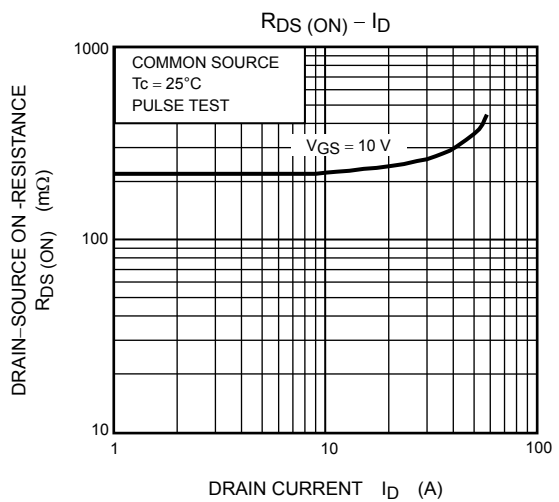
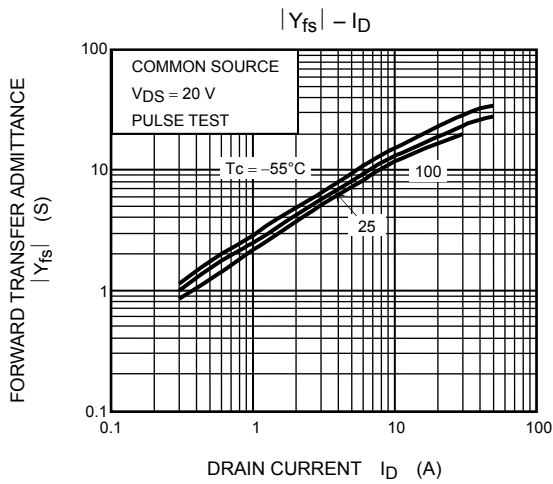
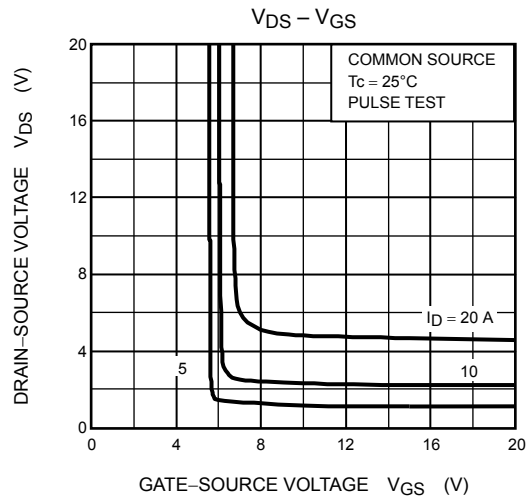
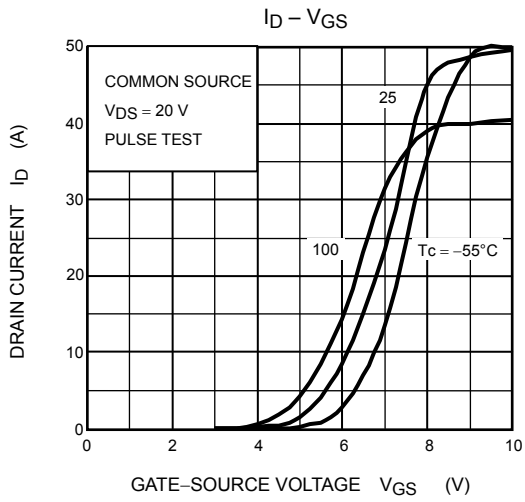
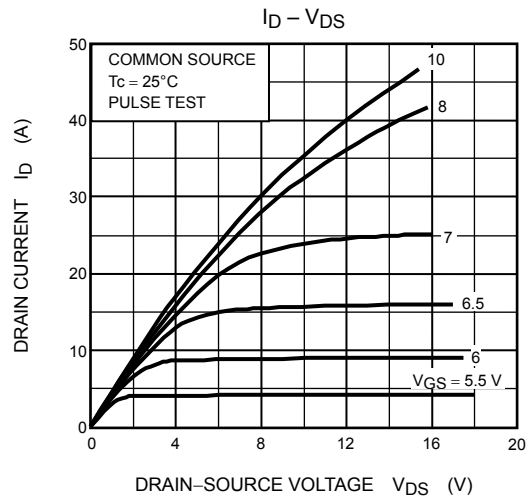
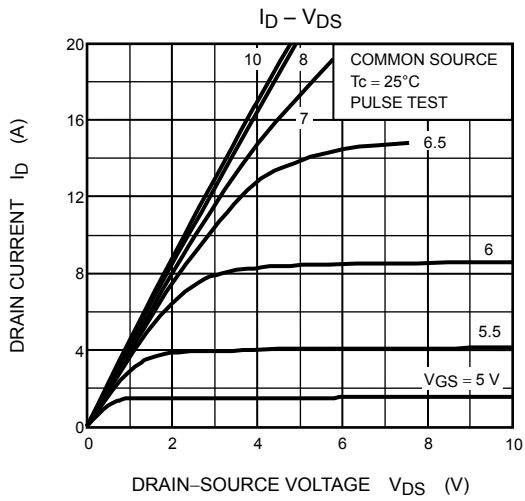
| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------|---------------|---------------|---|----------|------|----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 10 | μA |
| Gate-source breakdown voltage | | $V_{(BR)GSS}$ | $I_D = \pm 10\ \mu\text{A}, V_{GS} = 0\text{ V}$ | ± 30 | — | — | V |
| Drain cutoff current | | I_{DSS} | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 500 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 600 | — | — | V |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 2.0 | — | 4.0 | V |
| Drain-source ON-resistance | | $R_{DS(ON)}$ | $V_{GS} = 10\text{ V}, I_D = 10\text{ A}$ | — | 0.27 | 0.33 | Ω |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 10\text{ A}$ | 7 | 15 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 4250 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 10 | — | |
| Output capacitance | | C_{oss} | | — | 420 | — | |
| Switching time | Rise time | t_r | <p>$V_{GS} = 10\text{ V}, 0\text{ V}$ $I_D = 10\text{ A}$ $R_L = 20\ \Omega$ $V_{DD} \approx 200\text{ V}$ Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p> | — | 12 | — | ns |
| | Turn-on time | t_{on} | | — | 45 | — | |
| | Fall time | t_f | | — | 10 | — | |
| | Turn-off time | t_{off} | | — | 80 | — | |
| Total gate charge | | Q_g | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$ | — | 60 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 50 | — | |
| Gate-drain charge | | Q_{gd} | | — | 10 | — | |

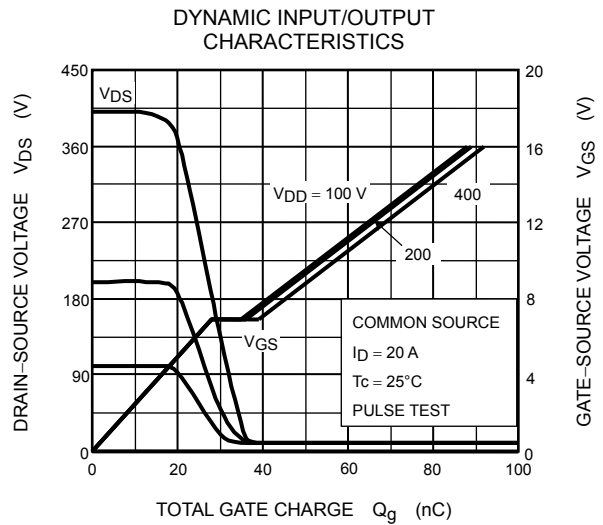
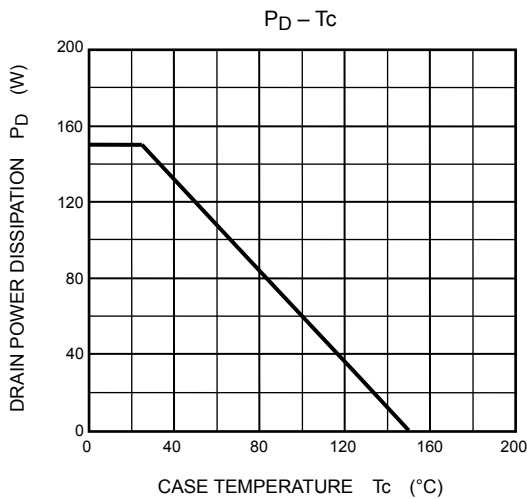
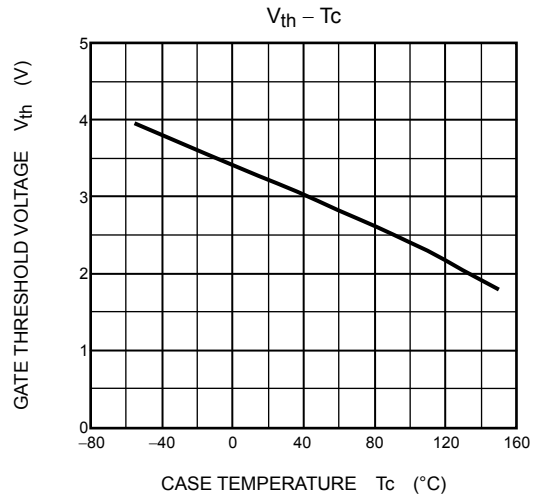
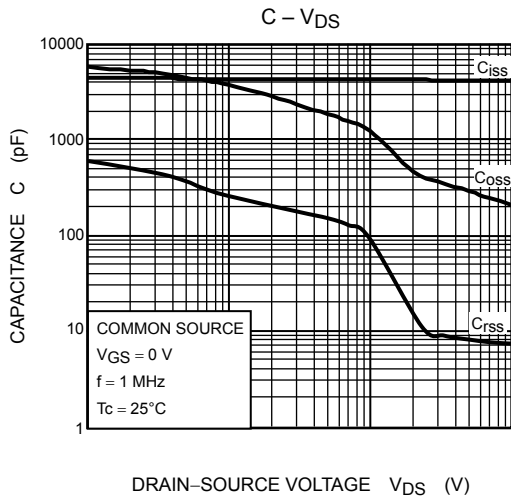
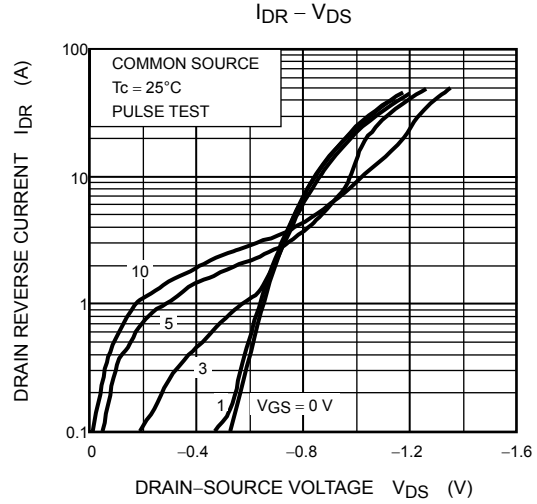
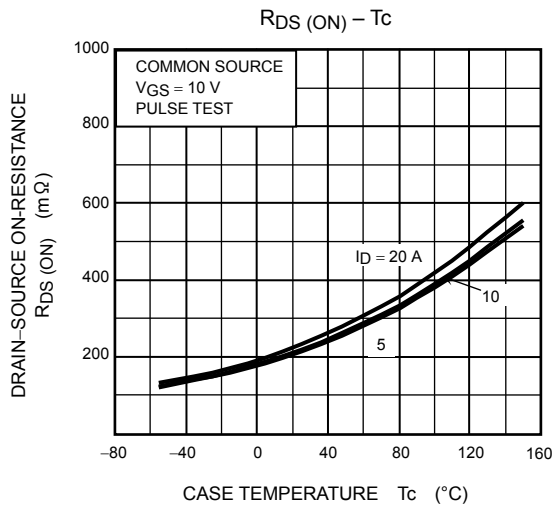
Source-Drain Ratings and Characteristics (Ta = 25°C)

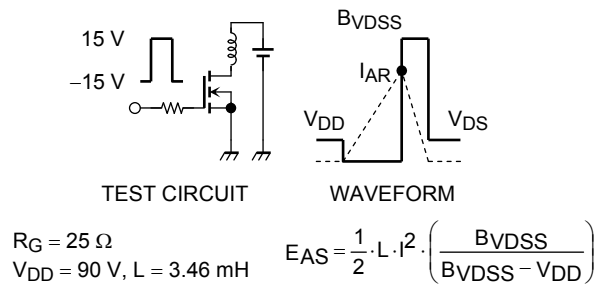
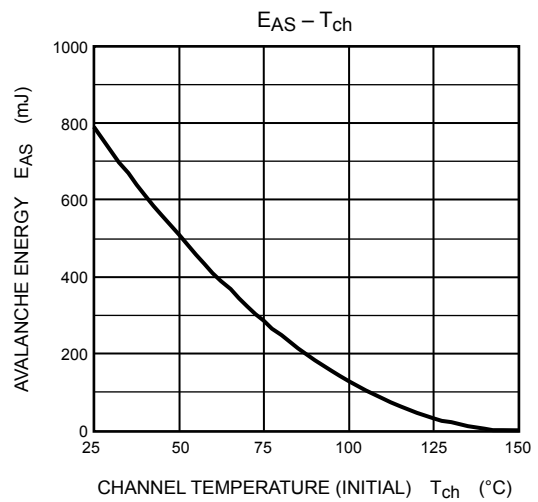
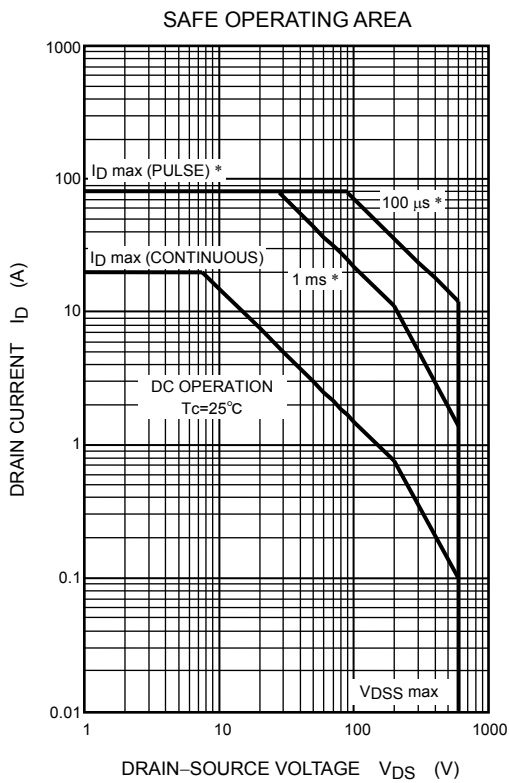
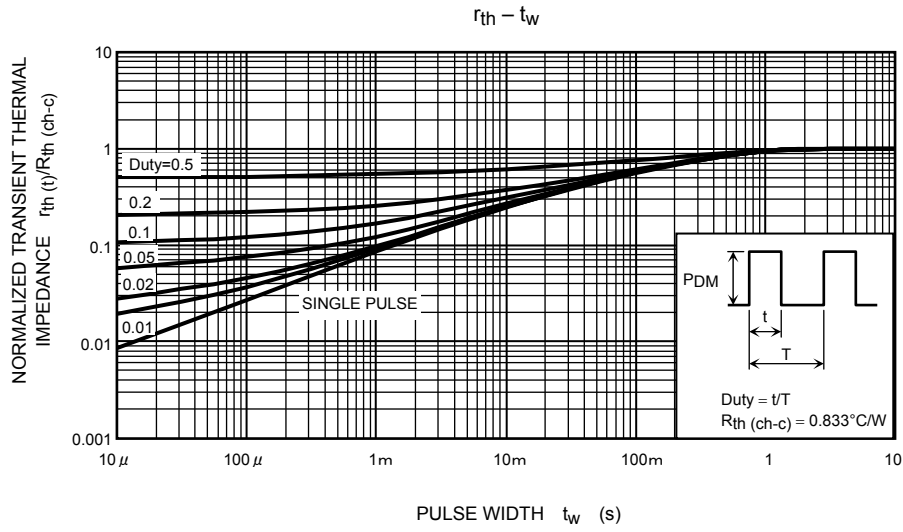
| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--|-----------|--|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 20 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 80 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V},$ | — | 400 | — | ns |
| Reverse recovery charge | Q_{rr} | $dI_{DR}/dt = 100\text{ A}/\mu\text{s}$ | — | 2.9 | — | μC |

Marking









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