

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (L²-π-MOSV)

2SK2381

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- Low drain-source ON resistance : $R_{DS(ON)} = 0.56 \Omega$ (typ.)
- High forward transfer admittance : $|Y_{fs}| = 4.5 S$ (typ.)
- Low leakage current : $I_{DSS} = 100 \mu A$ (max) ($V_{DS} = 200 V$)
- Enhancement mode : $V_{th} = 1.5 \sim 3.5 V$ ($V_{DS} = 10 V, I_D = 1 mA$)

Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|--|----------------|----------|------|
| Drain-source voltage | V_{DSS} | 200 | V |
| Drain-gate voltage ($R_{GS} = 20 k\Omega$) | V_{DGR} | 200 | V |
| Gate-source voltage | V_{GSS} | ± 20 | V |
| Drain current | DC (Note 1) | I_D | 5 A |
| | Pulse (Note 1) | I_{DP} | 20 A |
| Drain power dissipation ($T_c = 25^\circ C$) | P_D | 25 | W |
| Single pulse avalanche energy (Note 2) | E_{AS} | 65 | mJ |
| Avalanche current | I_{AR} | 5 | A |
| Repetitive avalanche energy (Note 3) | E_{AR} | 2.5 | mJ |
| Channel temperature | T_{ch} | 150 | °C |
| Storage temperature range | T_{stg} | -55~150 | °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

| Characteristics | Symbol | Max | Unit |
|--|----------------|------|--------|
| Thermal resistance, channel to case | $R_{th(ch-c)}$ | 5.0 | °C / W |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 62.5 | °C / W |

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

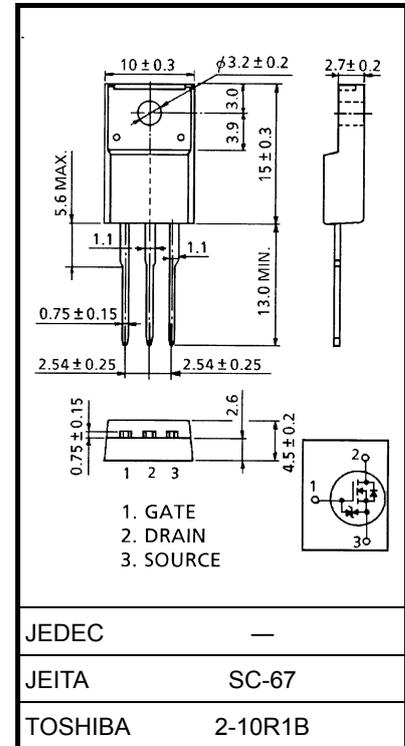
Note 2: $V_{DD} = 50 V, T_{ch} = 25^\circ C$ (initial), $L = 4.2 mH, R_G = 25 \Omega, I_{AR} = 5 A$

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

This transistor is an electrostatic-sensitive device.

Please handle with caution.

Unit: mm



Weight: 1.9 g (typ.)

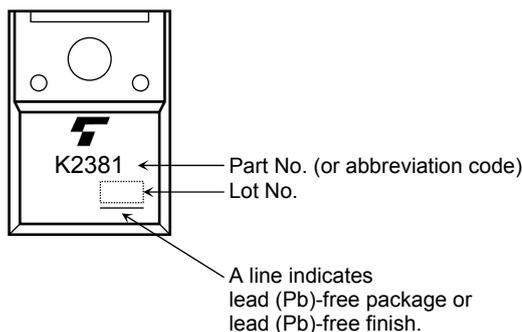
Electrical Characteristics (Ta = 25°C)

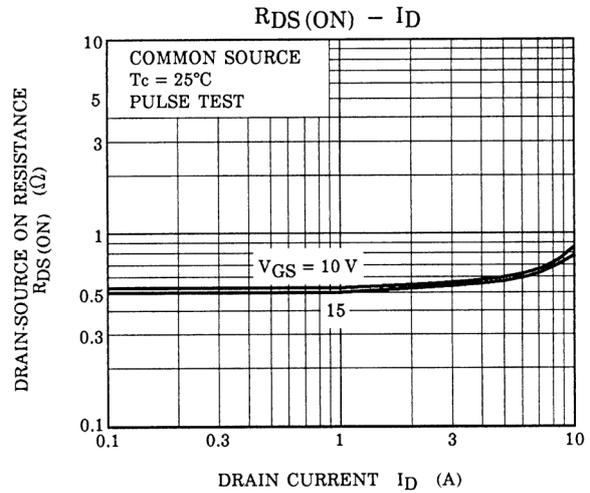
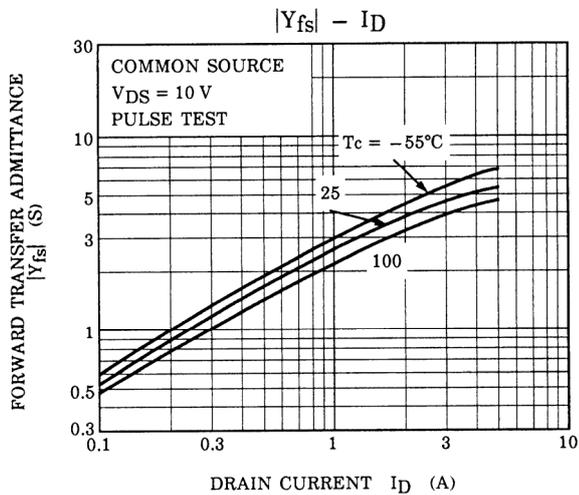
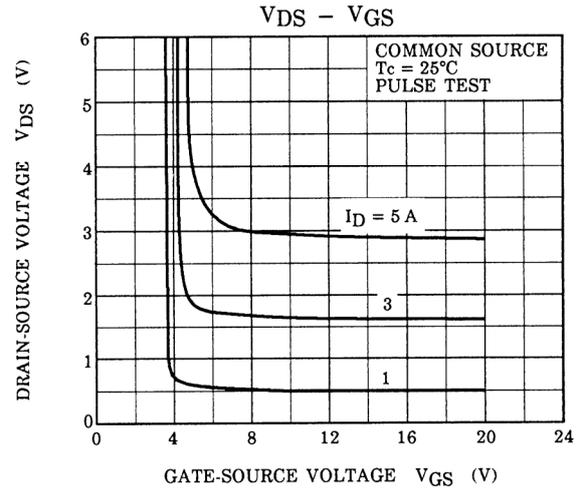
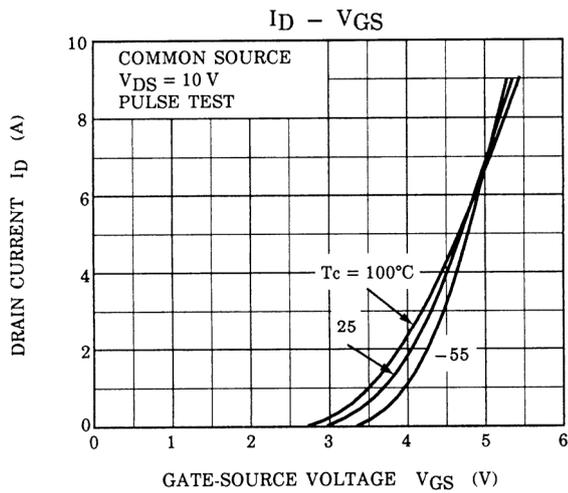
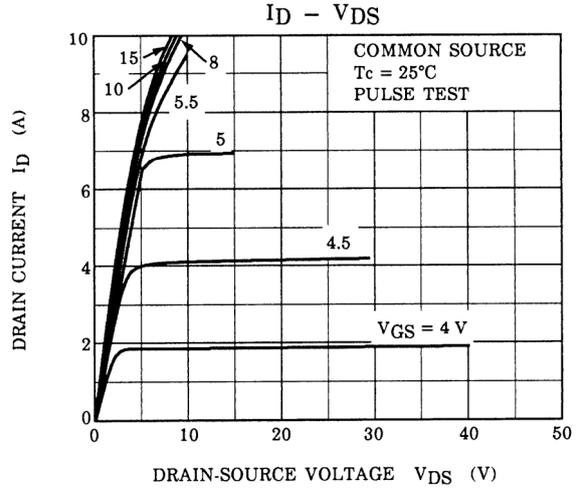
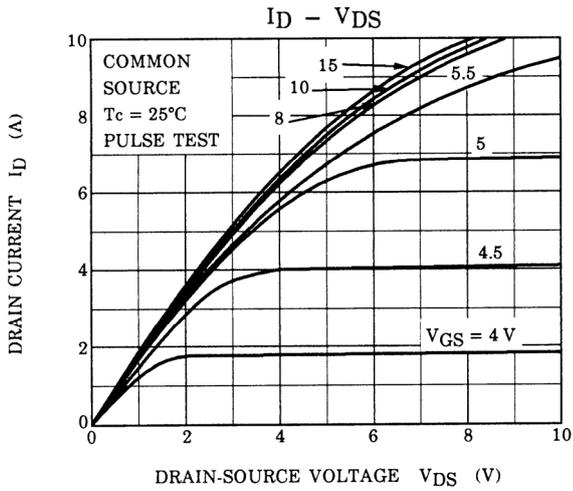
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|--|-----|------|----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 10 | μA |
| Drain cut-off current | | I_{DSS} | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 100 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 200 | — | — | V |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 1.5 | — | 3.5 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$ | — | 0.56 | 0.8 | Ω |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 2.5\text{ A}$ | 2.0 | 4.5 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 440 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 35 | — | |
| Output capacitance | | C_{oss} | | — | 120 | — | |
| Switching time | Rise time | t_r | <p>$I_D = 2.5\text{ A}$ $V_{GS} = 10\text{ V}$ 0 V 50Ω $R_L = 40\Omega$ $V_{DD} \approx 100\text{ V}$ $\text{Duty} \leq 1\%, t_w = 10\mu\text{s}$</p> | — | 15 | — | ns |
| | Turn-on time | t_{on} | | — | 20 | — | |
| | Fall time | t_f | | — | 15 | — | |
| | Turn-off time | t_{off} | | — | 60 | — | |
| Total gate charge (Gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 100\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$ | — | 10 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 6 | — | |
| Gate-drain ("miller") charge | | Q_{gd} | | — | 4 | — | |

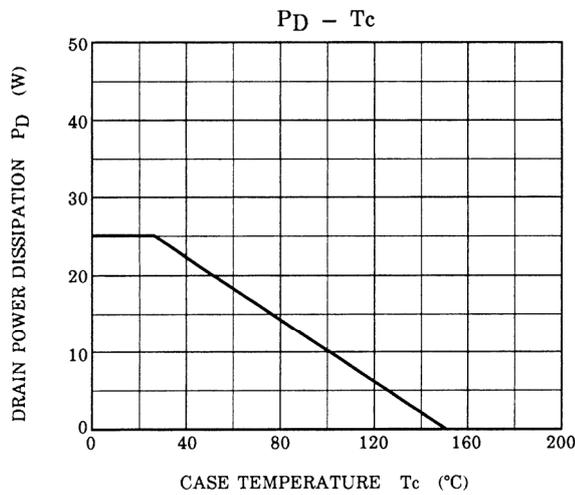
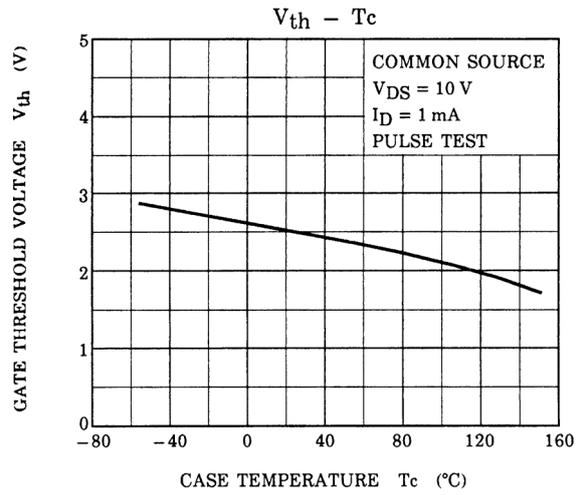
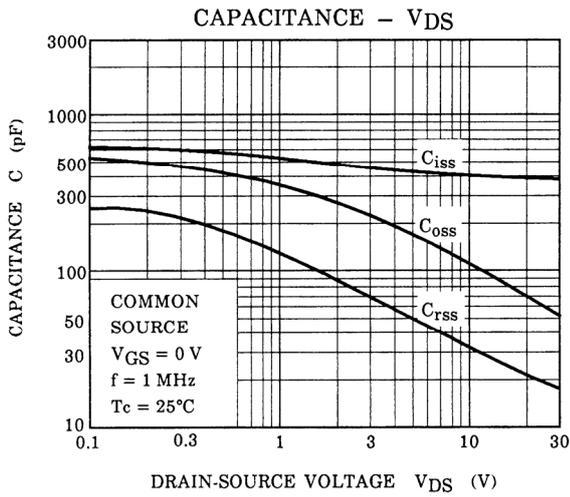
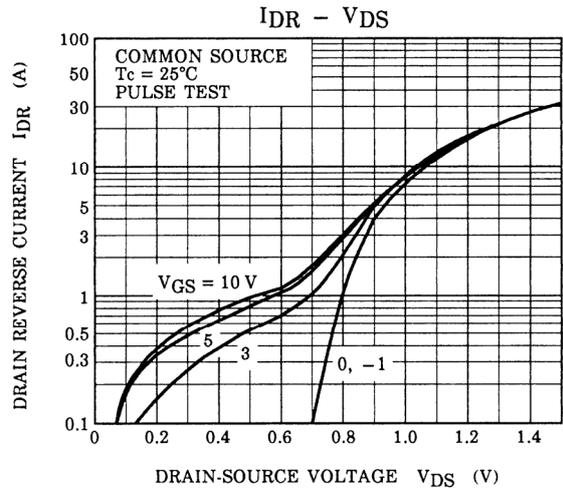
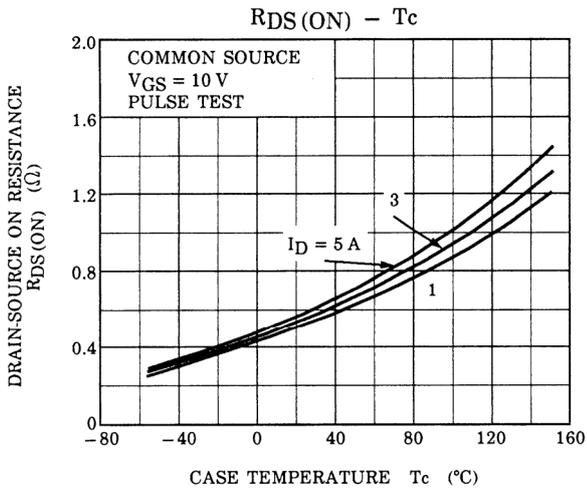
Source-Drain Ratings and Characteristics (Ta = 25°C)

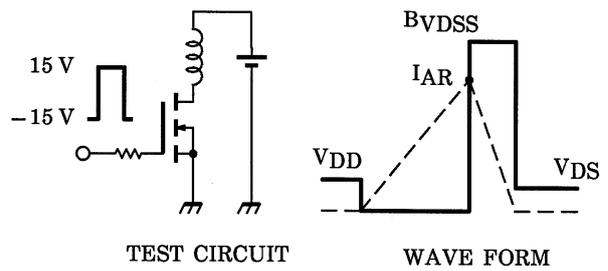
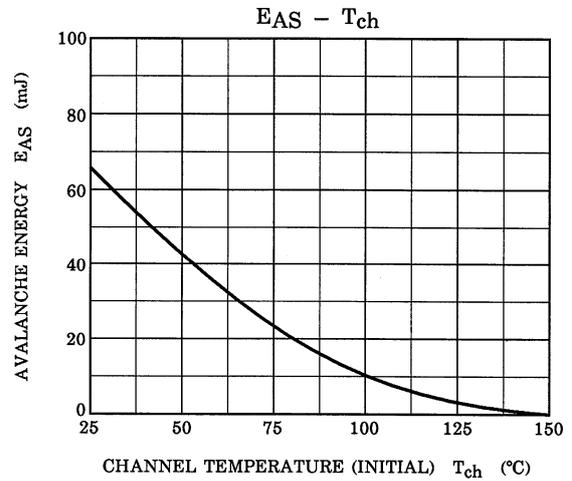
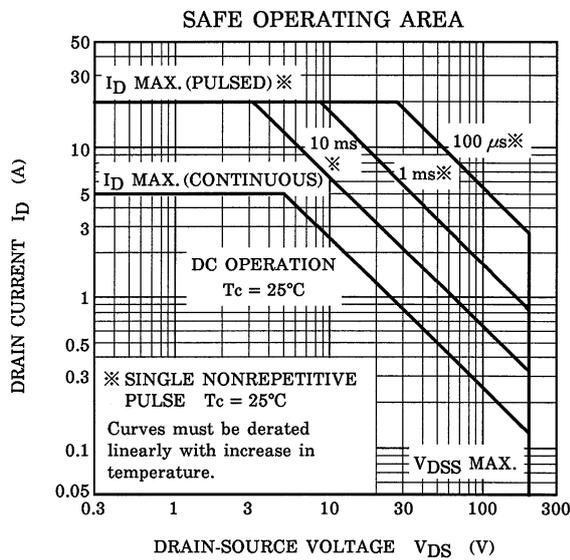
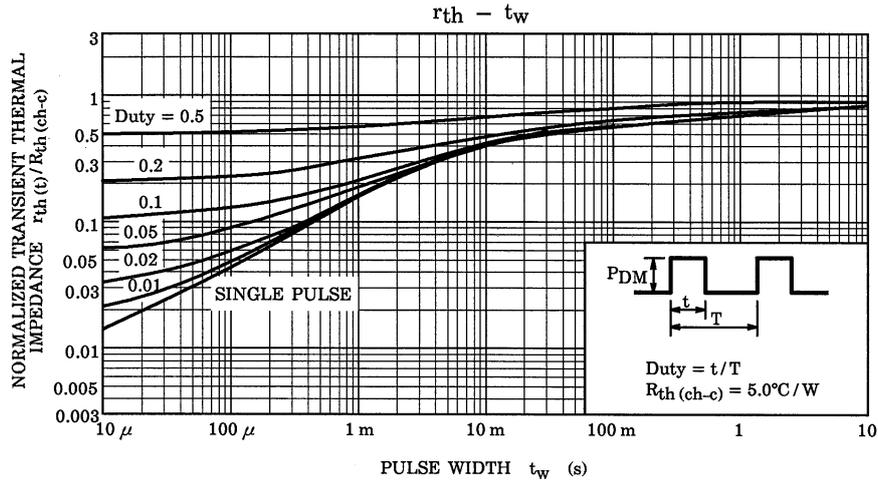
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 5 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 20 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -2.0 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}$ $dI_{DR} / dt = 100\text{ A} / \mu\text{s}$ | — | 150 | — | ns |
| Reverse recovered charge | Q_{rr} | | — | 0.45 | — | μC |

Marking









$R_G = 25 \Omega$
 $V_{DD} = 50 \text{ V}, L = 4.2 \text{ mH}$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{BVDSS}{BVDSS - V_{DD}} \right)$$

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