

2SK2401

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- Low drain-source ON resistance : $R_{DS(ON)} = 0.13 \Omega$ (typ.)
- High forward transfer admittance : $|Y_{fs}| = 17 S$ (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 ($T_a = 25^\circ C$)

| 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 | 15 | A |
| | Pulse (Note 1) | I_{DP} | 45 | A |
| Drain power dissipation ($T_c = 25^\circ C$) | | P_D | 75 | W |
| Single pulse avalanche energy (Note 2) | | E_{AS} | 166 | mJ |
| Avalanche current | | I_{AR} | 15 | A |
| Repetitive avalanche energy (Note 3) | | E_{AR} | 7.5 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ C$ |
| Storage temperature range | | T_{stg} | -55~150 | $^\circ C$ |

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 | $R_{th(ch-c)}$ | 1.67 | $^\circ C / W$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 83.3 | $^\circ C / W$ |

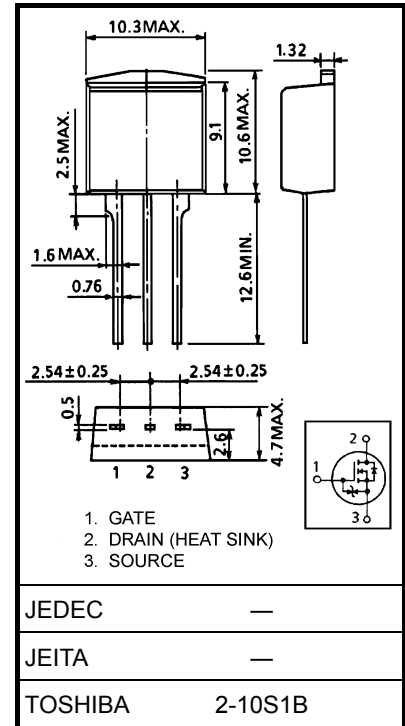
Note 1: Ensure that the channel temperature does not exceed $150^\circ C$.

Note 2: $V_{DD} = 50 V, T_{ch} = 25^\circ C$ (initial), $L = 1.2 mH, R_G = 25 \Omega, I_{AR} = 15 A$

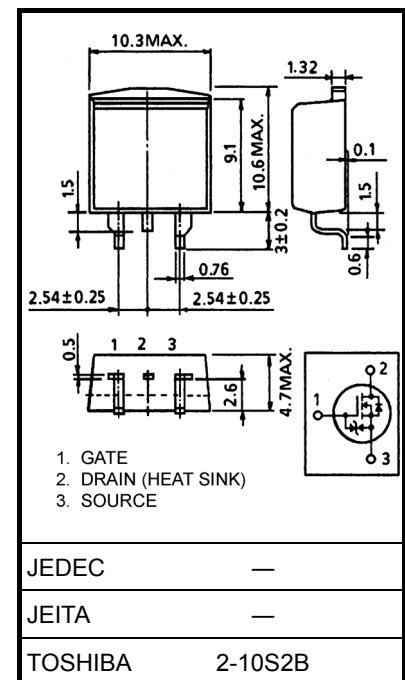
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

This transistor is an electrostatic-sensitive device.
Please handle with caution.

Unit: mm



Weight: 1.5 g (typ.)



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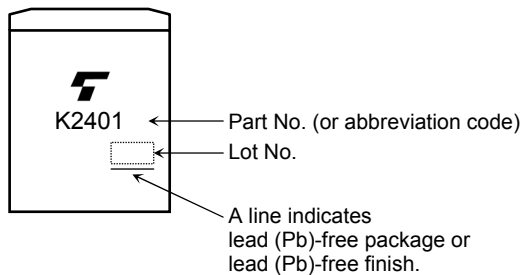
Electrical Characteristics (Ta = 25°C)

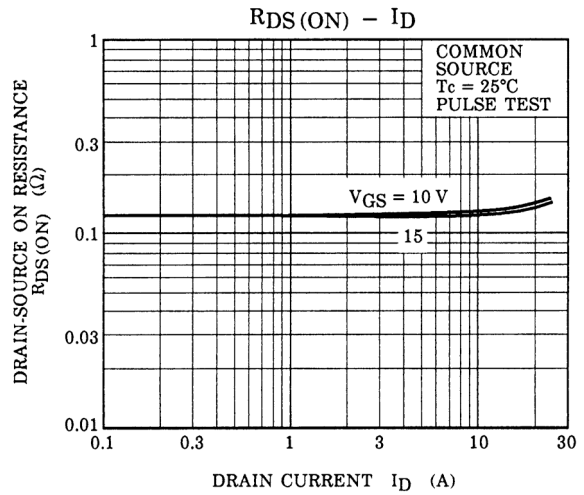
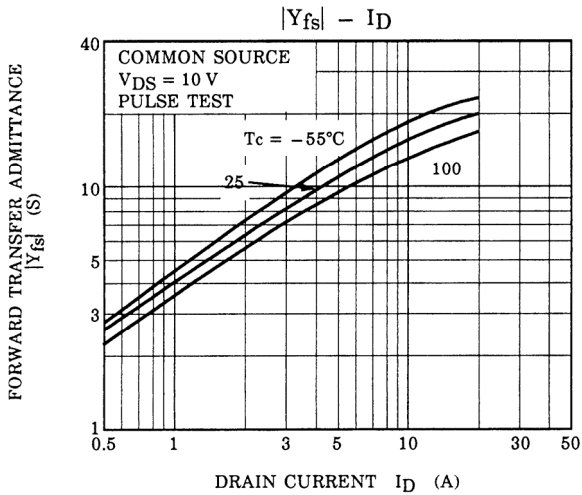
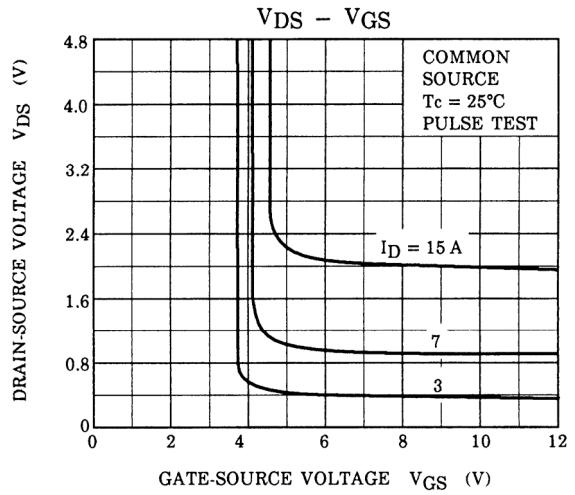
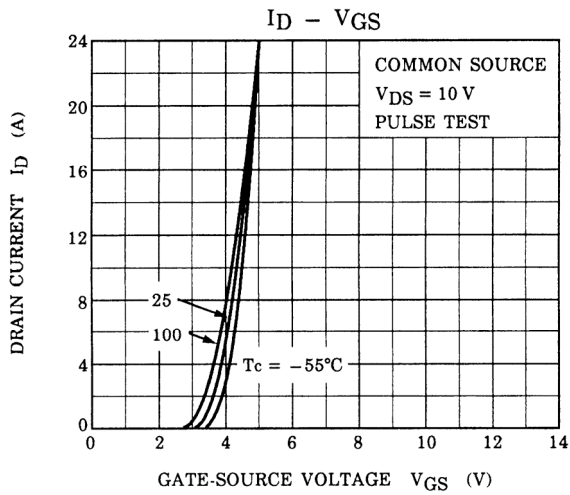
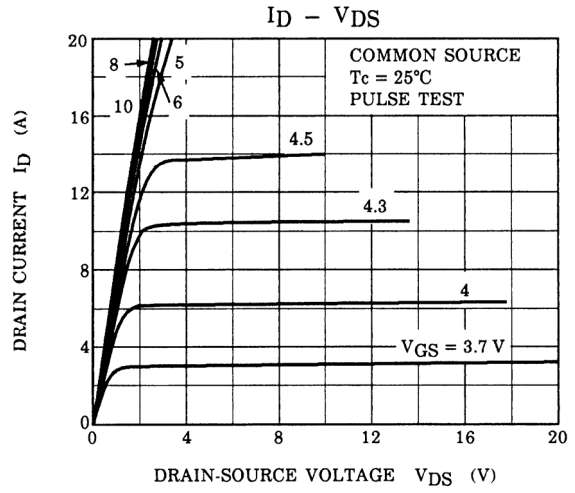
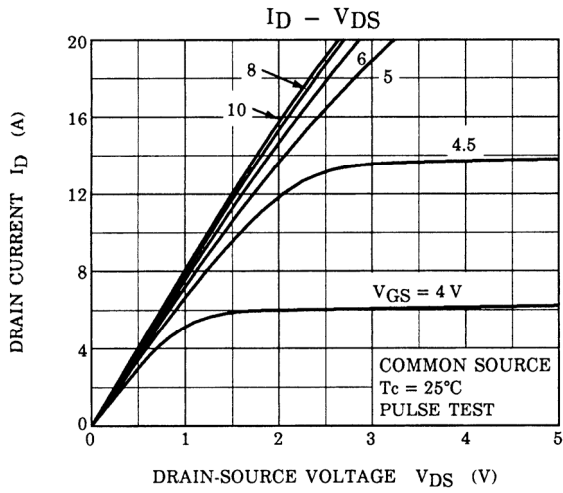
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|---|-----|------|----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$ | — | — | ± 10 | μA |
| Drain cut-off current | | I_{DSS} | $V_{DS} = 200 \text{ V}, V_{GS} = 0 \text{ V}$ | — | — | 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 | | $R_{DS(ON)}$ | $V_{GS} = 10 \text{ V}, I_D = 10 \text{ A}$ | — | 0.13 | 0.18 | Ω |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10 \text{ V}, I_D = 10 \text{ A}$ | 10 | 17 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | — | 2000 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 200 | — | |
| Output capacitance | | C_{oss} | | — | 600 | — | |
| Switching time | Rise time | t_r | <p>$I_D = 10 \text{ A}$ $V_{GS} = 10 \text{ V}$ $V_{GS} = 0 \text{ V}$ 4.7Ω $R_L = 10 \Omega$ $V_{DD} = 100 \text{ V}$ V_{out} $Duty \leq 1\%, t_w = 10 \mu\text{s}$</p> | — | 35 | — | ns |
| | Turn-on time | t_{on} | | — | 50 | — | |
| | Fall time | t_f | | — | 10 | — | |
| | Turn-off time | t_{off} | | — | 66 | — | |
| Total gate charge (Gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 100 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 15 \text{ A}$ | — | 40 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 25 | — | |
| Gate-drain ("miller") charge | | Q_{gd} | | — | 15 | — | |

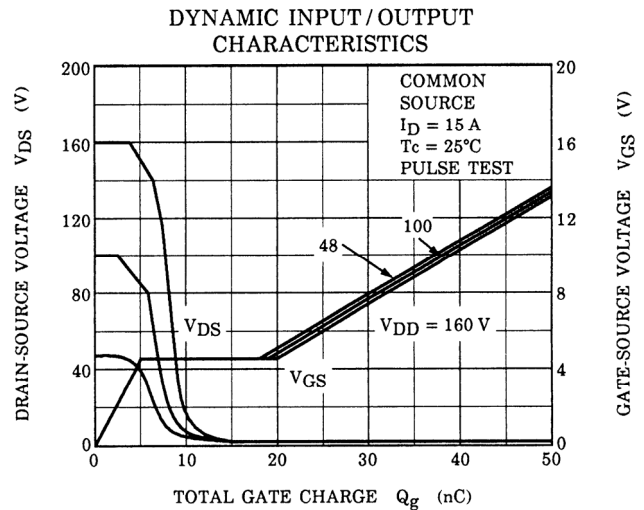
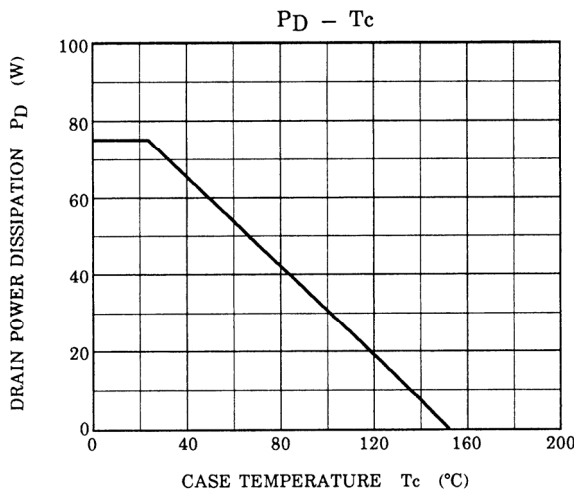
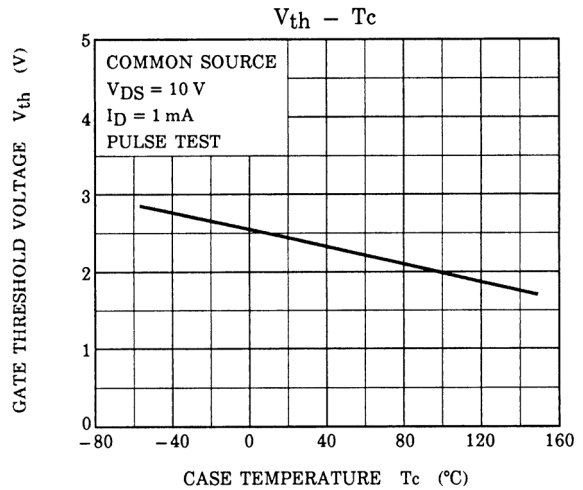
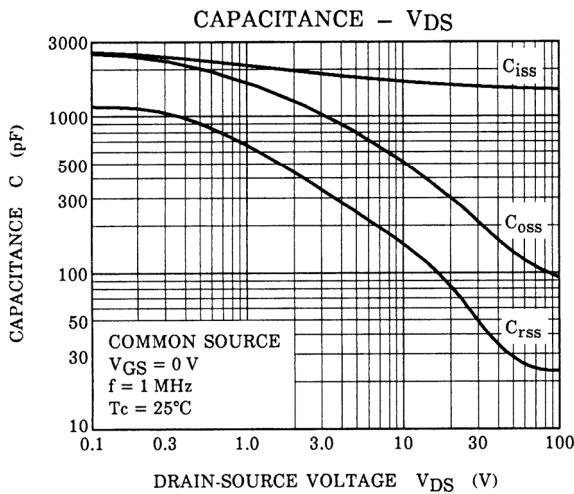
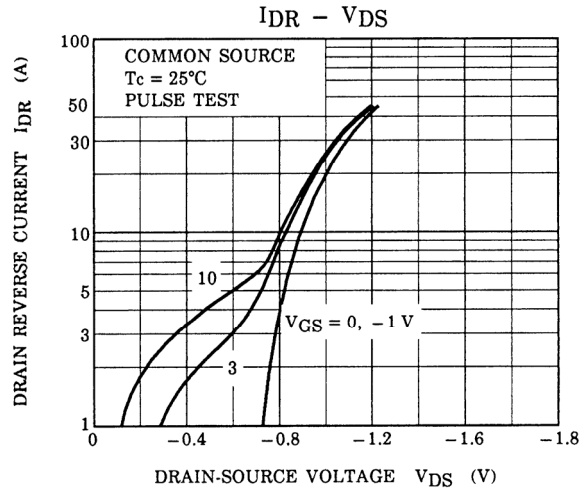
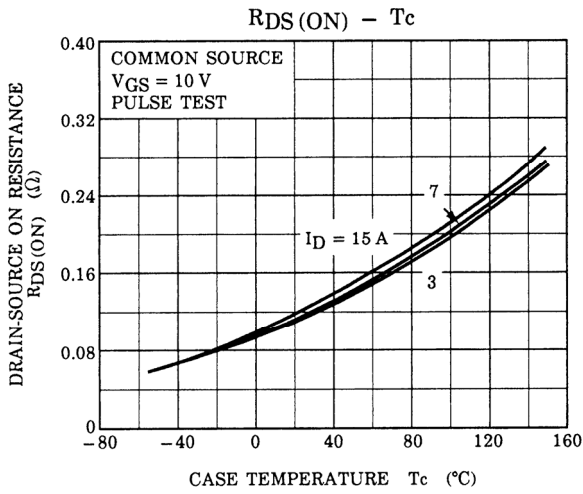
Source-Drain Ratings and Characteristics (Ta = 25°C)

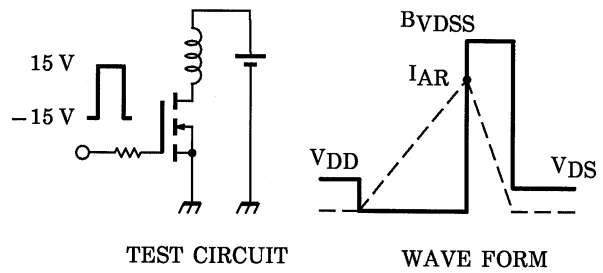
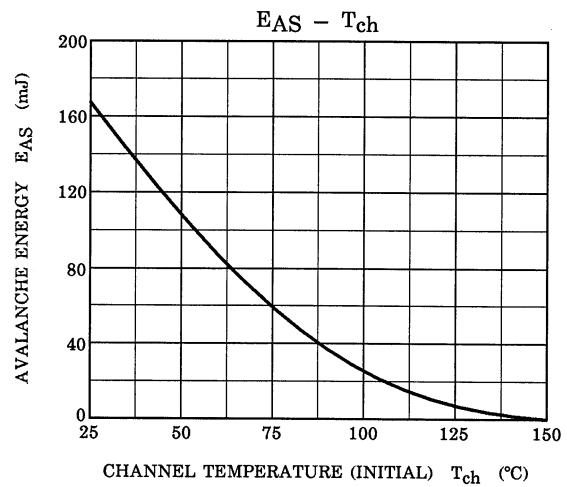
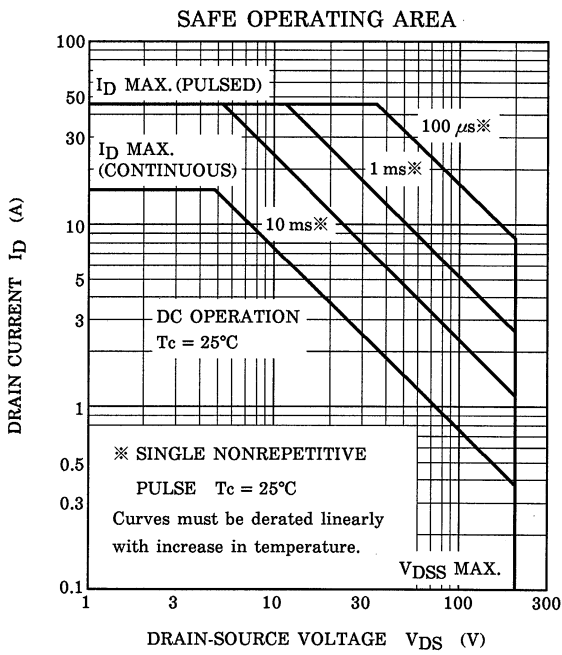
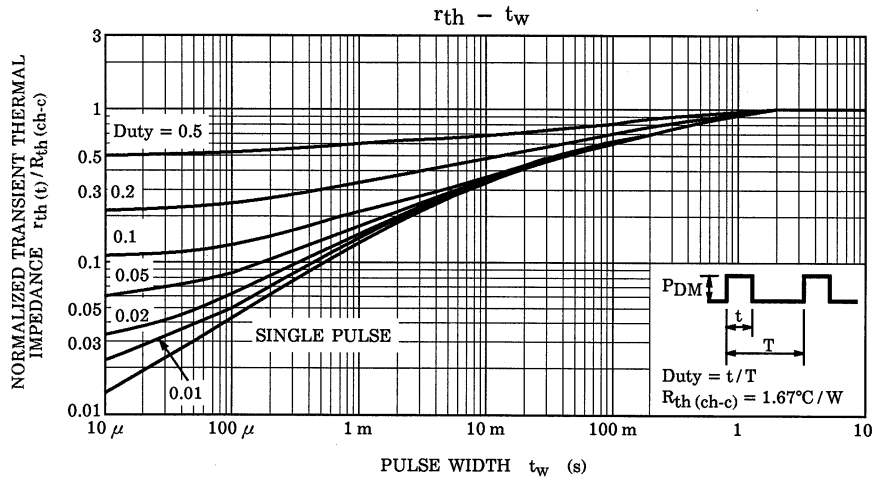
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 15 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 45 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 15 \text{ A}, V_{GS} = 0 \text{ V}$ | — | — | -2.0 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 15 \text{ A}, V_{GS} = 0 \text{ V}$ | — | 180 | — | ns |
| Reverse recovery charge | Q_{rr} | $di_{DR} / dt = 100 \text{ A} / \mu\text{s}$ | — | 1.13 | — | μC |

Marking









$R_G = 25 \Omega$
 $V_{DD} = 50 \text{ V}, L = 1.2 \text{ mH}$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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20070701-EN

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