

2SK3399

Switching Regulator Applications

- Low drain-source ON resistance: $R_{DS(ON)} = 0.54 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 5.2 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 100 \mu\text{A}$ (max) ($V_{DS} = 600 \text{ V}$)
- Enhancement mode: $V_{th} = 3.0$ to 5.0 V ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

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

| Characteristics | | 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 | 10 | A |
| | Pulse (Note 1) | I_{DP} | 40 | |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | | P_D | 100 | W |
| Single pulse avalanche energy (Note 2) | | E_{AS} | 363 | mJ |
| Avalanche current | | I_{AR} | 10 | A |
| Repetitive avalanche energy (Note 3) | | E_{AR} | 10 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | | T_{stg} | -55 to 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

| Characteristics | Symbol | Max | Unit |
|--|----------------|------|--------------------|
| Thermal resistance, channel to case | $R_{th(ch-c)}$ | 1.25 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 83.3 | $^\circ\text{C/W}$ |

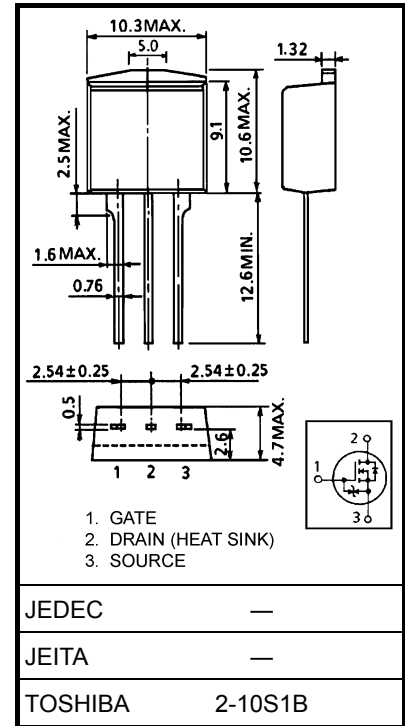
Note 1: Ensure that the channel temperature does not exceed 150°C .

Note 2: $V_{DD} = 90 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 6.36 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = 10 \text{ A}$

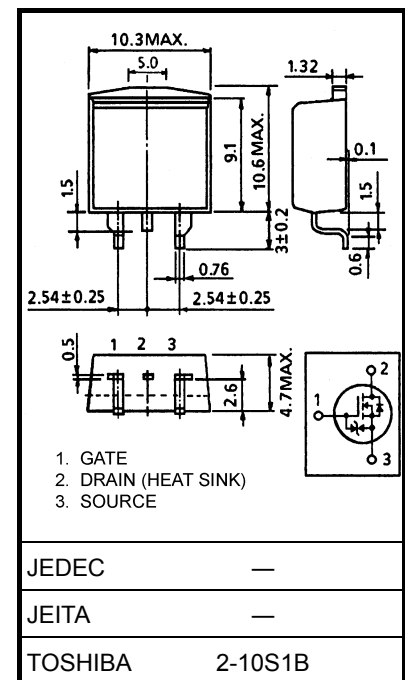
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

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

Unit: mm



Weight: 1.5 g (typ.)



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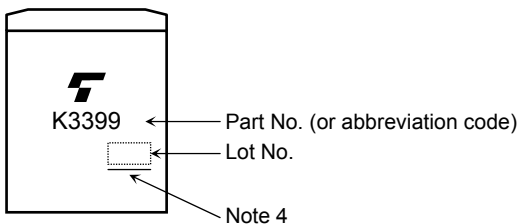
Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|--|----------|------|----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 10 | μA |
| Gate-source breakdown voltage | | $V_{(BR)GSS}$ | $I_G = \pm 10\ \mu\text{A}, V_{DS} = 0\text{ V}$ | ± 30 | — | — | V |
| Drain cut-off current | | I_{DSS} | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 100 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 600 | — | — | V |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 3.0 | — | 5.0 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = 10\text{ V}, I_D = 5\text{ A}$ | — | 0.54 | 0.75 | Ω |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 5\text{ A}$ | 2.0 | 5.2 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 1750 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 11 | — | |
| Output capacitance | | C_{oss} | | — | 170 | — | |
| Switching time | Rise time | t_r | <p>$V_{IN}: t_r, t_f < 5\text{ ns}$ Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p> | — | 15 | — | ns |
| | Turn-on time | t_{on} | | — | 40 | — | |
| | Fall time | t_f | | — | 8 | — | |
| | Turn-off time | t_{off} | | — | 35 | — | |
| Total gate charge (Gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 10\text{ A}$ | — | 35 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 15 | — | |
| Gate-drain ("Miller") charge | | Q_{gd} | | — | 20 | — | |

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|--|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 10 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 40 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 10\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 10\text{ A}, V_{GS} = 0\text{ V},$ | — | 1300 | — | ns |
| Reverse recovery charge | Q_{rr} | $dI_{DR}/dt = 100\text{ A}/\mu\text{s}$ | — | 16 | — | μC |

Marking



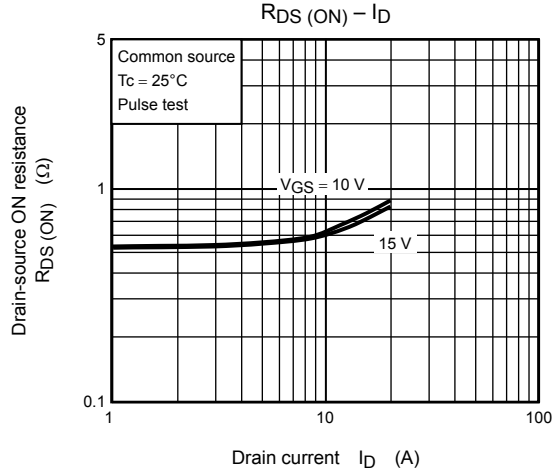
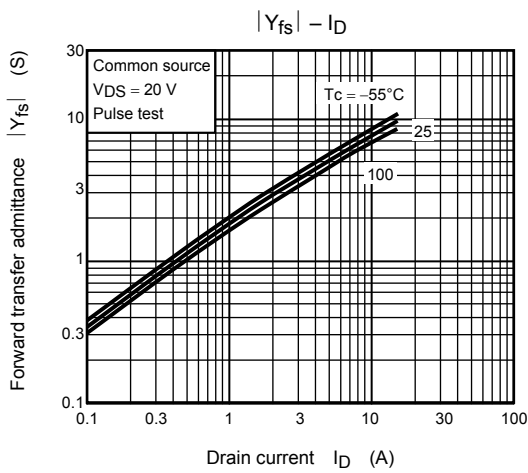
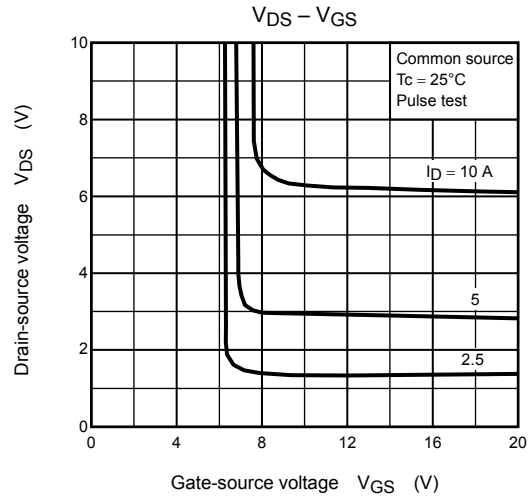
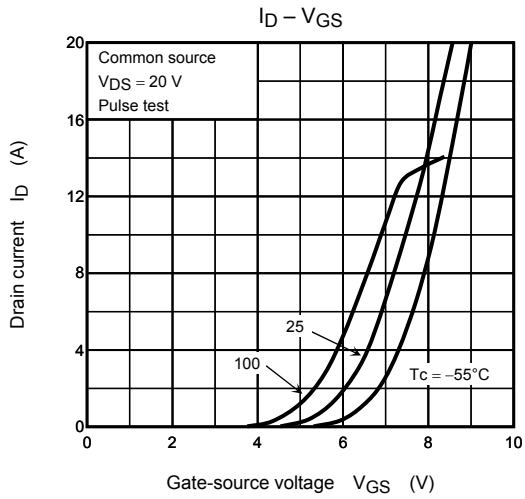
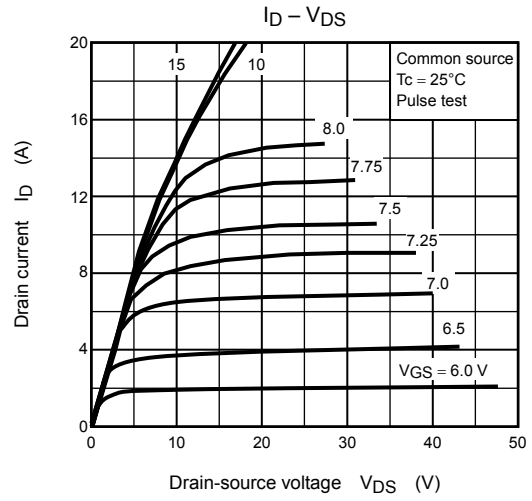
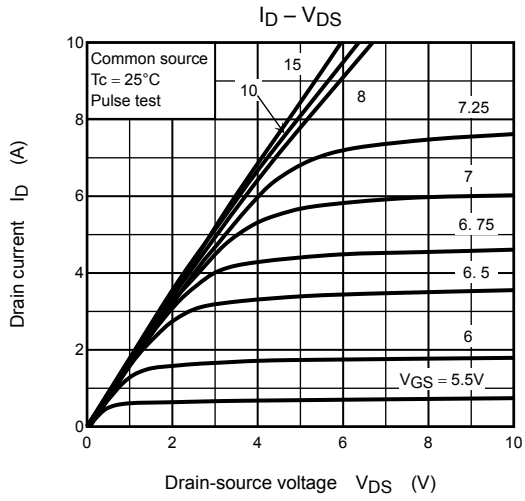
Note 4: A line under a Lot No. identifies the indication of product Labels.

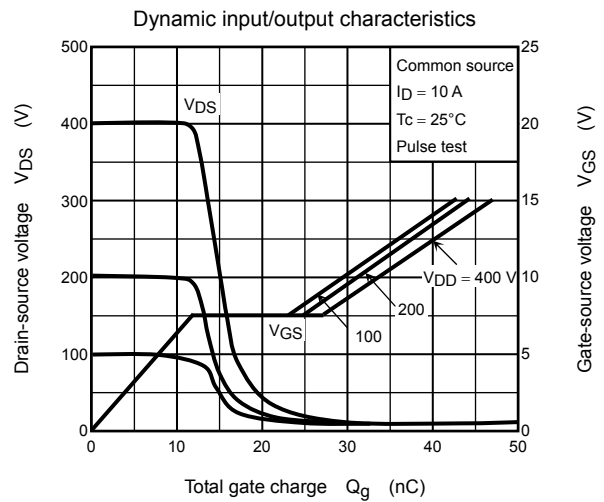
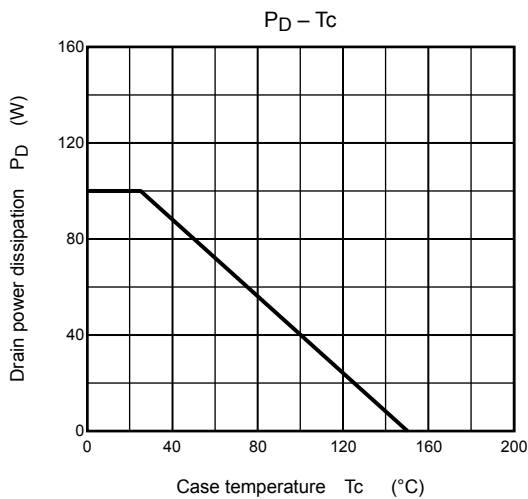
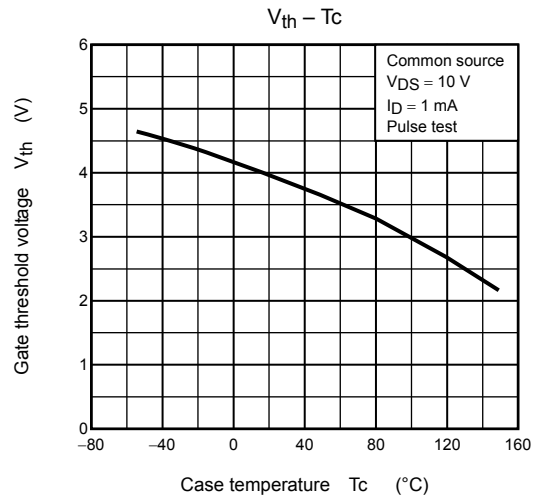
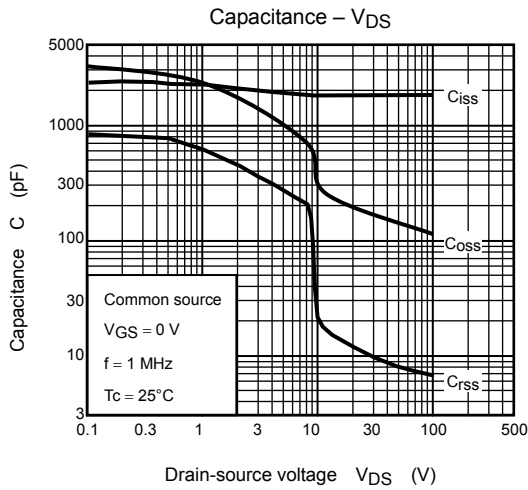
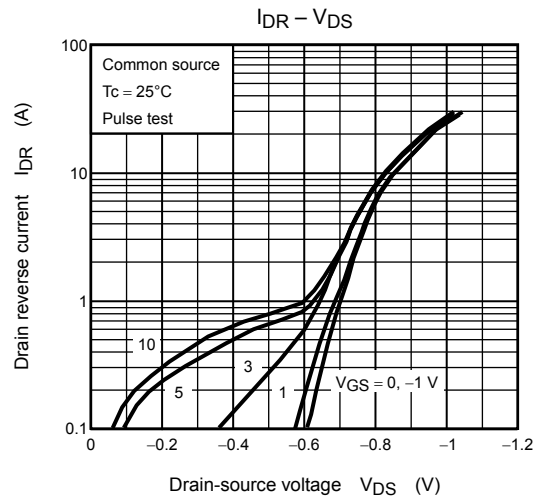
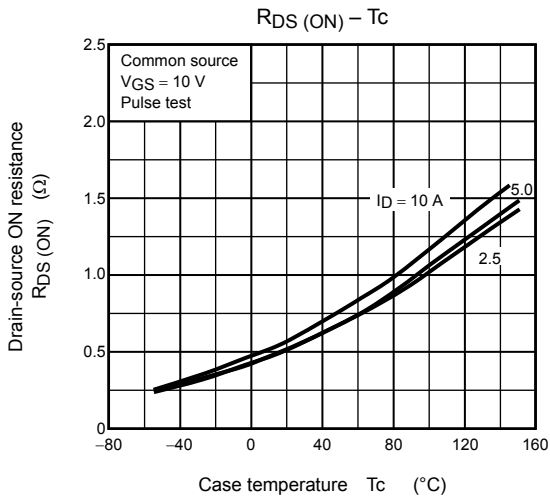
Not underlined: $[[Pb]]/INCLUDES > MCV$

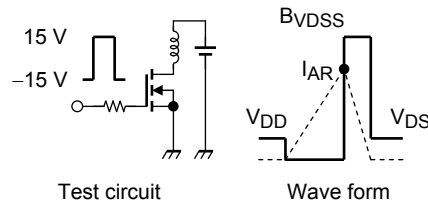
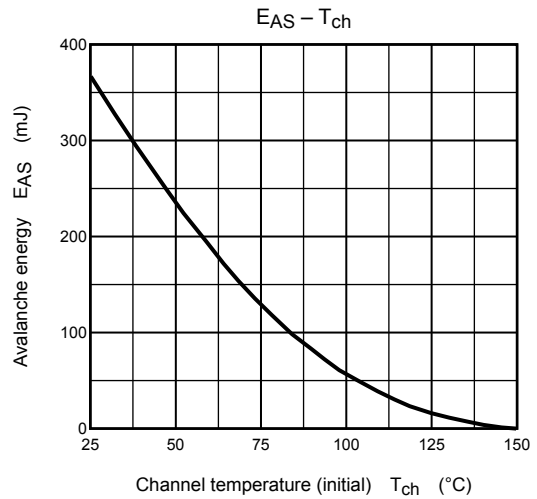
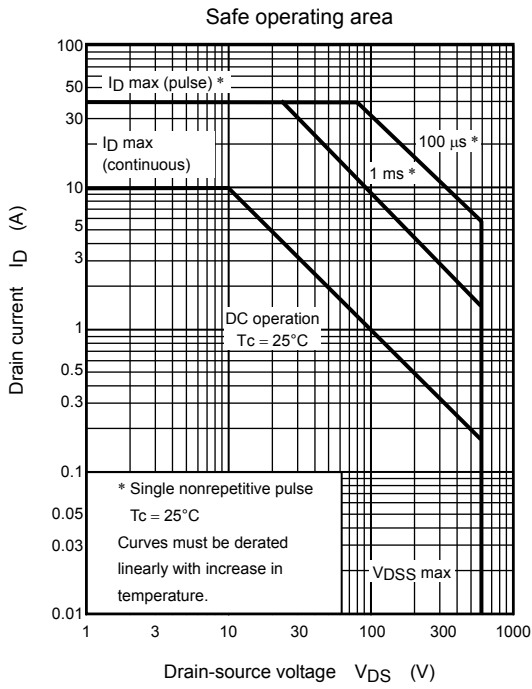
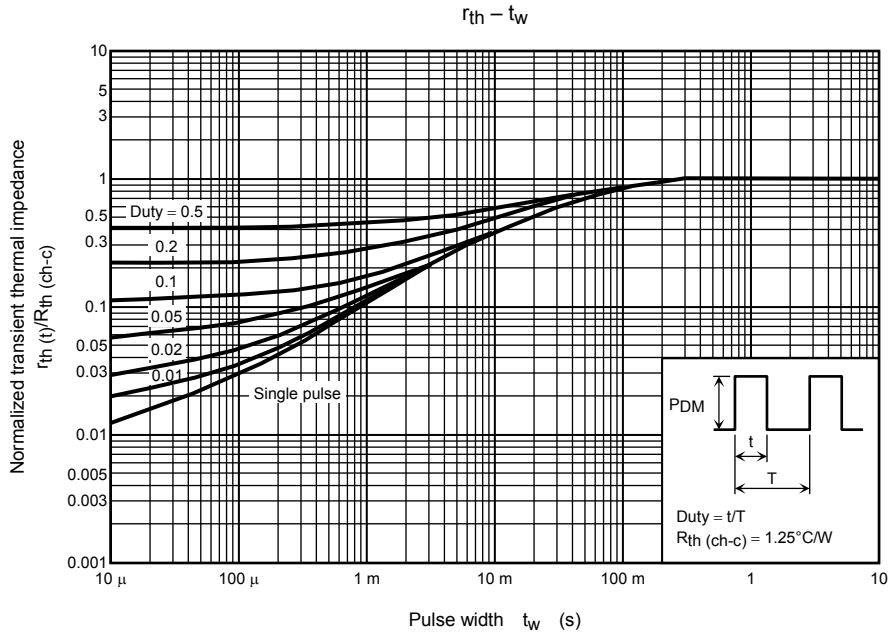
Underlined: $[[G]]/RoHS COMPATIBLE$ or $[[G]]/RoHS [[Pb]]$

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.







$R_G = 25 \Omega$
 $V_{DD} = 90 \text{ V}, L = 6.36 \text{ mH}$

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

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