

# 2SK3670

## Chopper Regulator and DC-DC Converter Applications

- 2.5V-Gate Drive
- Low drain-source ON-resistance:  $R_{DS(ON)} = 1.0 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 2.1 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \mu\text{A}$  (max) ( $V_{DS} = 150 \text{ V}$ )
- Enhancement mode:  $V_{th} = 0.5$  to  $1.3 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 200 \mu\text{A}$ )

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

| Characteristics                                      | Symbol                                | Rating     | Unit             |
|--|---------------------------------------|------------|------------------|
| Drain-source voltage                                 | $V_{DSS}$                             | 150        | V                |
| Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ ) | $V_{DGR}$                             | 150        | V                |
| Gate-source voltage                                  | $V_{GSS}$                             | $\pm 12$   | V                |
| Drain current  | DC (Note 1)                           | $I_D$      | 0.67             |
|  | Pulse ( $t \leq 5\text{s}$ ) (Note 1) | $I_{DP}$   | 1                |
|  | Pulse (Note 1)                        | $I_{DP}$   | 3                |
| Drain power dissipation                              | $P_D$                                 | 0.9        | W                |
| Single pulse avalanche energy (Note 2)               | $E_{AS}$                              | 41         | mJ               |
| Avalanche current                                    | $I_{AR}$                              | 0.67       | A                |
| Repetitive avalanche energy (Note 3)                 | $E_{AR}$                              | 0.09       | 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 ambient | $R_{th(ch-a)}$ | 138 | $^\circ\text{C} / \text{W}$ |

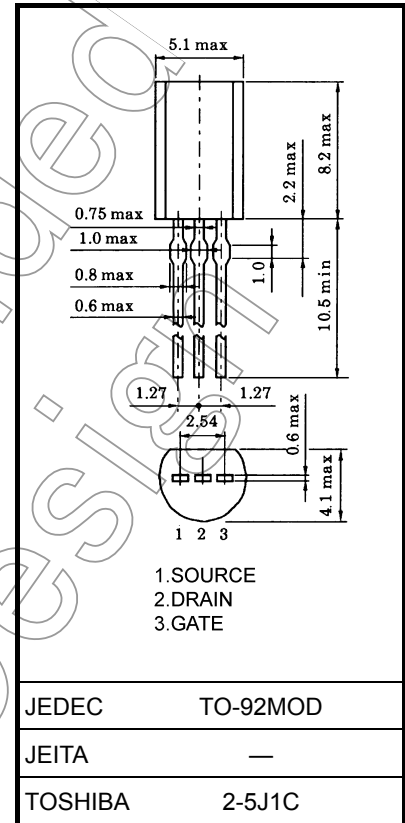
Note 1: Ensure that the channel temperature does not exceed  $150^\circ\text{C}$ .

Note 2:  $V_{DS} = 50\text{V}$ ,  $T_{ch} = 25^\circ\text{C}$ (initial),  $L = 135\text{mH}$ ,  $I_{AR} = 0.67\text{A}$ ,  $R_G = 25\Omega$

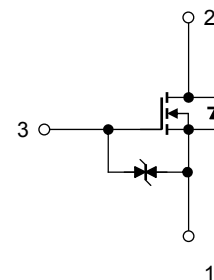
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

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

Unit: mm



Weight: 0.36 g (typ.)



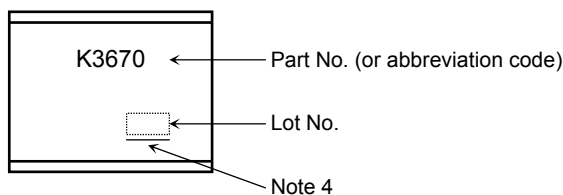
## Electrical Characteristics (Ta = 25°C)

| Characteristics                                 |               | Symbol        | Test Condition  | Min                                      | Typ. | Max      | Unit          |
|---|---------------|---------------|---|--|------|----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 9.6 \text{ V}, V_{DS} = 0 \text{ V}$                      | —  | —    | $\pm 10$ | $\mu\text{A}$ |
| Drain cut-off current                           |               | $I_{DSS}$     | $V_{DS} = 150 \text{ V}, V_{GS} = 0 \text{ V}$                          | —  | —    | 100      | $\mu\text{A}$ |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$                             | 150                                      | —    | —        | V             |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = 10 \text{ V}, I_D = 200 \mu\text{A}$                          | 0.5                                      | —    | 1.3      | V             |
| Drain-source ON-resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 2.5 \text{ V}, I_D = 0.5 \text{ A}$                           | —  | 1.1  | 2        | $\Omega$      |
|   |               |               | $V_{GS} = 4 \text{ V}, I_D = 0.5 \text{ A}$                             | —  | 1.0  | 1.7      |               |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10 \text{ V}, I_D = 0.5 \text{ A}$                            | 1.0                                      | 2.1  | —        | S             |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$        | —  | 230  | —        | pF            |
| Reverse transfer capacitance                    |               | $C_{rss}$     |   | —  | 14   | —        |               |
| Output capacitance                              |               | $C_{oss}$     |   | —  | 50   | —        |               |
| Switching time                                  | Rise time     | $t_r$         |   | —  | 16   | —        | ns            |
|   | Turn-on time  | $t_{on}$      |   | —  | 40   | —        |               |
|   | Fall time     | $t_f$         |   | —  | 23   | —        |               |
|   | Turn-off time | $t_{off}$     |   | Duty $\leq 1\%$ , $t_w = 10 \mu\text{s}$ | —    | 95       |               |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx 120 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 1 \text{ A}$ | —  | 4.6  | —        | nC            |
| Gate-source charge                              |               | $Q_{gs}$      |   | —  | 2.9  | —        |               |
| Gate-drain ("miller") Charge                    |               | $Q_{gd}$      |   | —  | 1.7  | —        |               |

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

| Characteristics                             | Symbol    | Test Condition                                 | Min | Typ. | Max  | Unit |
|---|-----------|--|-----|------|------|------|
| Continuous drain reverse current (Note 1)   | $I_{DR}$  | —  | —   | —    | 0.67 | A    |
| Pulse drain reverse current (t=5s) (Note 1) | $I_{DRP}$ | —  | —   | —    | 1    | A    |
| Pulse drain reverse current (Note 1)        | $I_{DRP}$ | —  | —   | —    | 3    | A    |
| Forward voltage (diode)                     | $V_{DSF}$ | $I_{DR} = 0.5 \text{ A}, V_{GS} = 0 \text{ V}$ | —   | —    | -1.5 | V    |
| Reverse recovery time                       | $t_{rr}$  | $I_{DR} = 1 \text{ A}, V_{GS} = 0 \text{ V}$   | —   | 95   | —    | ns   |
| Reverse recovery charge                     | $Q_{rr}$  | $dI_{DR} / dt = 50 \text{ A} / \mu\text{s}$    | —   | 110  | —    | nC   |

## Marking



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

[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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