

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ( $\pi$ -MOS VI)

## 2SK3127

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- Low drain-source ON resistance:  $R_{DS(ON)} = 9.5 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 38 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- Enhancement-mode:  $V_{th} = 1.5 \text{ to } 3.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

| Characteristics                                      |                | Symbol    | Rating     | Unit             |
|--|----------------|-----------|------------|------------------|
| Drain-source voltage                                 |                | $V_{DSS}$ | 30         | V                |
| Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ ) |                | $V_{DGR}$ | 30         | V                |
| Gate-source voltage                                  |                | $V_{GSS}$ | $\pm 20$   | V                |
| Drain current  | DC (Note 1)    | $I_D$     | 45         | A                |
|  | Pulse (Note 1) | $I_{DP}$  | 135        |                  |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ ) |                | $P_D$     | 65         | W                |
| Single pulse avalanche energy (Note 2)               |                | $E_{AS}$  | 524        | mJ               |
| Avalanche current                                    |                | $I_{AR}$  | 45         | A                |
| Repetitive avalanche energy (Note 3)                 |                | $E_{AR}$  | 6          | mJ               |
| Channel temperature                                  |                | $T_{ch}$  | 150        | $^\circ\text{C}$ |
| Storage temperature range                            |                | $T_{stg}$ | -55 to 150 | $^\circ\text{C}$ |

Note 1: Please use devices on condition that the channel temperature is below  $150^\circ\text{C}$ .

Note 2:  $V_{DD} = 25 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 186 \text{ }\mu\text{H}$ ,  $R_G = 25 \text{ }\Omega$ ,  $I_{AR} = 45 \text{ A}$

Note 3: Repetitive rating: pulse width limited by maximum junction temperature.

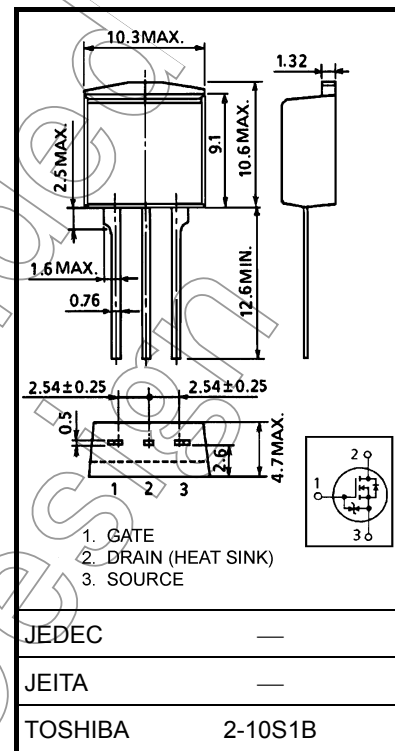
Note 4: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

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

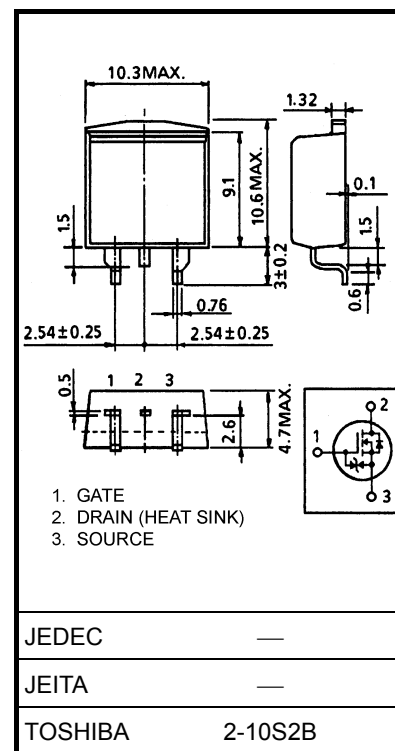
## Thermal Characteristics

| Characteristics                        | Symbol         | Max  | Unit               |
|--|----------------|------|--------------------|
| Thermal resistance, channel to case    | $R_{th(ch-c)}$ | 1.92 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 83.3 | $^\circ\text{C/W}$ |

Unit: mm

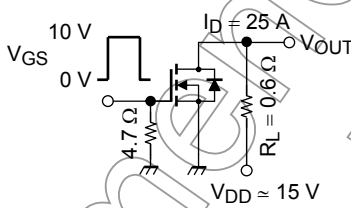


Weight: 1.5 g (typ.)



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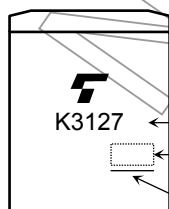
### Electrical Characteristics (Ta = 25°C)

| Characteristics                                 |               | Symbol        | Test Condition   | Min | Typ. | Max      | Unit             |
|---|---------------|---------------|--|-----|------|----------|------------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$                                  | —   | —    | $\pm 10$ | $\mu\text{A}$    |
| Drain cut-off current                           |               | $I_{DSS}$     | $V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$                                      | —   | —    | 100      | $\mu\text{A}$    |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$  | 30  | —    | —        | V                |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$  | 1.5 | —    | 3.0      | V                |
| Drain-source ON resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 10 \text{ V}, I_D = 25 \text{ A}$  | —   | 9.5  | 12       | $\text{m}\Omega$ |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10 \text{ V}, I_D = 25 \text{ A}$  | 19  | 40   | —        | S                |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                   | —   | 2300 | —        | pF               |
| Reverse transfer capacitance                    |               | $C_{rss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                   | —   | 380  | —        | pF               |
| Output capacitance                              |               | $C_{oss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                   | —   | 1100 | —        | pF               |
| Switching time                                  | Rise time     | $t_r$         |  | —   | 12   | —        | ns               |
|   | Turn-on time  | $t_{on}$      |  | —   | 25   | —        |                  |
|   | Fall time     | $t_f$         |  | —   | 75   | —        |                  |
|   | Turn-off time | $t_{off}$     |  | —   | 200  | —        |                  |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 45 \text{ A}$           | —   | 66   | —        | nC               |
| Gate-source charge                              |               | $Q_{gs}$      | $V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 45 \text{ A}$           | —   | 45   | —        | nC               |
| Gate-drain ("miller") charge                    |               | $Q_{gd}$      | $V_{DD} \approx 24 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 45 \text{ A}$           | —   | 21   | —        | nC               |

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

| Characteristics                              | Symbol    | Test Condition   | Min | Typ. | Max  | Unit |
|--|-----------|--|-----|------|------|------|
| Continuous drain reverse current<br>(Note 1) | $I_{DR}$  | —  | —   | —    | 45   | A    |
| Pulse drain reverse current (Note 1)         | $I_{DRP}$ | —  | —   | —    | 135  | A    |
| Forward voltage (diode)                      | $V_{DSF}$ | $I_{DR} = 45\text{ A}$ , $V_{GS} = 0\text{ V}$   | —   | —    | -1.7 | V    |
| Reverse recovery time                        | $t_{rr}$  | $I_{DR} = 45\text{ A}$ , $V_{GS} = 0\text{ V}$ ,<br>$dI_{DR}/dt = 50\text{ A}/\mu\text{s}$ | —   | 150  | —    | ns   |
| Reverse recovery charge                      | $Q_{rr}$  | $I_{DR} = 45\text{ A}$ , $V_{GS} = 0\text{ V}$ ,<br>$dI_{DR}/dt = 50\text{ A}/\mu\text{s}$ | —   | 270  | —    | nC   |

## Marking



Product No. (or abbreviation code)

Lot No.

Note 5

Note 5: 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]]

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