

**TOSHIBA**

TPCT4201

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (U-MOSIII)

# TPCT4201

## Lithium Ion Battery Applications

- Lead(Pb)-Free
- Small footprint due to small and thin package
- Low drain-source ON resistance:  $R_{SS(ON)} = 25.5m\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 15 S$  (typ.)
- Low leakage current:  $I_{SSS} = 10 \mu A$  (max) ( $V_{DS} = 20 V$ )
- Enhancement-mode:  $V_{th} = 0.5 \sim 1.2 V$  ( $V_{SS} = 10 V, I_S = 200 \mu A$ )
- Common drain

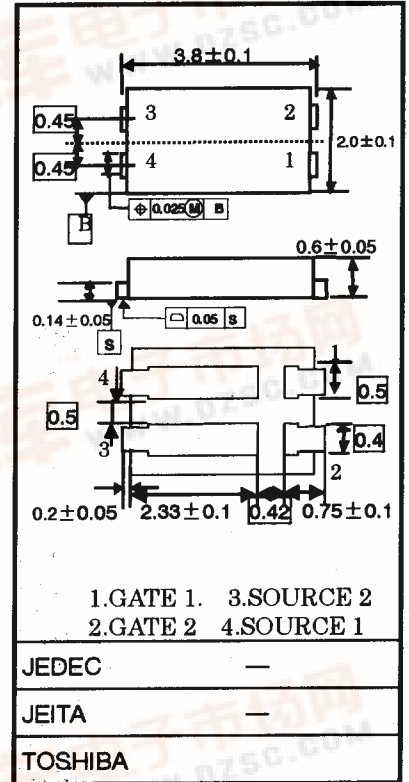
## Maximum Ratings (Ta = 25°C)

| Characteristics   |  | Symbol    | Rating   | Unit |
|---|--|-----------|----------|------|
| Source-source voltage   |  | $V_{SSS}$ | 20       | V    |
| Gate-source voltage   |  | $V_{GSS}$ | $\pm 12$ | V    |
| Drain current   | DC (Note 1)                                    | $I_S$     | 6        | A    |
|   | Pulse (Note 1)                                 | $I_{SP}$  | 24       |      |
| Drain power dissipation (t = 10 s) (Note 2a)                                      | Single-device value at dual operation (Note 3) | $P_D$     | 1.7      | W    |
| Drain power dissipation (t = 10 s) (Note 2b)                                      | Single-device value at dual operation (Note 3) | $P_D$     | 0.51     | W    |
| Single pulse avalanche energy (Note 4)  |  | $E_{AS}$  | 46.8     | mJ   |
| Avalanche current   |  | $I_{AR}$  | 6        | A    |
| Repetitive avalanche energy Single-device value at dual operation (Note 2a, 3, 5) |  | $E_{AR}$  | 0.17     | mJ   |
| Channel temperature   |  | $T_{ch}$  | 150      | °C   |
| Storage temperature range   |  | $T_{stg}$ | -55~150  | °C   |

Note: (Note 1), (Note 2), (Note 3), (Note 4), (Note 5) please refer to the next page.

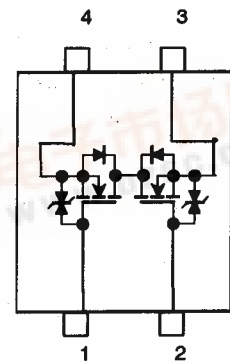
This transistor is an electrostatic sensitive device. Please handle with caution.

Unit: mm



Weight: 0.010 g (typ.)

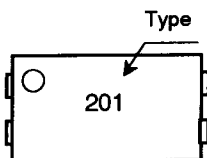
## Circuit Configuration



## Thermal Characteristics

| Characteristics   |  | Symbol         | Max | Unit |
|---|--|----------------|-----|------|
| Thermal resistance, channel to ambient<br>(t = 10 s)<br>(Note 2a) | Single-device value at<br>dual operation<br>(Note 3) | $R_{th(ch-a)}$ | 76  | °C/W |
| Thermal resistance, channel to ambient<br>(t = 10 s)<br>(Note 2b) | Single-device value at<br>dual operation<br>(Note 3) | $R_{th(ch-a)}$ | 244 | °C/W |

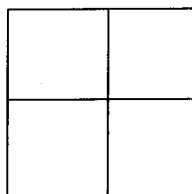
## Marking (Note 5)



Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2:

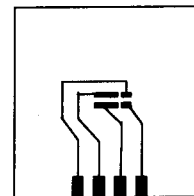
(a) Device mounted on a glass-epoxy board



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)

(a)

(b) Device mounted on a glass-epoxy board



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)

(b)

Note 3: The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both devices.)

Note 4:  $V_{DD} = 16\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.0\text{ mH}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 6\text{ A}$

Note 5: Repetitive rating: pulse width limited by max channel temperature

Note 6:  $\circ$  on lower right of the marking indicates Pin 1.

## Electrical Characteristics (Ta = 25°C)

| Characteristics                                 |               | Symbol              | Test Condition  | Min | Typ. | Max      | Unit          |
|---|---------------|---------------------|---|-----|------|----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$           | $V_{GS} = \pm 10\text{ V}, V_{SS} = 0\text{ V}$   | —   | —    | $\pm 10$ | $\mu\text{A}$ |
| Source cut-OFF current                          |               | $I_{SSS}$           | $V_{SS} = 20\text{ V}, V_{GS} = 0\text{ V}$   | —   | —    | 10       | $\mu\text{A}$ |
| Source -source breakdown voltage                |               | $V_{(BR) SSS}$      | $I_S = 10\text{ mA}, V_{GS} = 0\text{ V}$   | 20  | —    | —        | V             |
|   |               | $V_{(BR) SSX}$      | $I_S = 10\text{ mA}, V_{GS} = -12\text{ V}$   | 8   | —    | —        |               |
| Gate threshold voltage                          |               | $V_{th}$            | $V_{SS} = 10\text{ V}, I_S = 200\ \mu\text{A}$  | 0.5 | —    | 1.2      | V             |
| Source -source ON resistance                    |               | $R_{SS}(\text{ON})$ | $V_{GS} = 2.5\text{ V}, I_S = 3\text{ A}$   | 28  | 37   | 49       | m $\Omega$    |
|   |               |                     | $V_{GS} = 4.0\text{ V}, I_S = 3\text{ A}$   | 21  | 27   | 32       |               |
|   |               |                     | $V_{GS} = 4.5\text{ V}, I_S = 3\text{ A}$   | 19  | 25.5 | 31       |               |
| Forward transfer admittance                     |               | $ Y_{fs} $          | $V_{SS} = 10\text{ V}, I_S = 3\text{ A}$  | 7.5 | 15   | —        | S             |
| Input capacitance                               |               | $C_{iss}$           | $V_{SS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$   | —   | 1740 | —        | pF            |
| Reverse transfer capacitance                    |               | $C_{rSS}$           |   | —   | 180  | —        |               |
| Output capacitance                              |               | $C_{oss}$           |   | —   | 260  | —        |               |
| Switching time                                  | Rise time     | $t_r$               | <p><math>V_{GS} = 5\text{ V}</math><br/><math>0\text{ V}</math><br/><math>I_S = 3\text{ A}</math><br/><math>V_{SS} = 10\text{ V}</math><br/><math>R_L = 3.3\ \Omega</math><br/>Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p> | —   | 9    | —        | ns            |
|   | Turn-ON time  | $t_{on}$            |   | —   | 13   | —        |               |
|   | Fall time     | $t_f$               |   | —   | 57   | —        |               |
|   | Turn-OFF time | $t_{off}$           |   | —   | 145  | —        |               |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$               | $V_{SS} = 16\text{ V}, V_{GS} = 5\text{ V}, I_D = 6\text{ A}$   | —   | 21   | —        | nC            |
| Gate-source charge 1                            |               | $Q_{gs1}$           |   | —   | 4    | —        |               |
| Gate- source ("miller") charge                  |               | $Q_{gs}$            |   | —   | 4    | —        |               |

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

| Characteristics         |                | Symbol    | Test Condition                             | Min | Typ. | Max  | Unit |
|-------------------------|----------------|-----------|--|-----|------|------|------|
| Source reverse current  | Pulse (Note 1) | $I_{SRP}$ | —  | —   | —    | 24   | A    |
| Forward voltage (diode) |                | $V_{SSF}$ | $I_{SR} = 6\text{ A}, V_{GS} = 0\text{ V}$ | —   | —    | -1.2 | V    |

**RESTRICTIONS ON PRODUCT USE**

030619EAA

- The information contained herein is subject to change without notice.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.  
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- TOSHIBA products should not be embedded to the downstream products which are prohibited to be produced and sold, under any law and regulations.