

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

# TPCS8212

## Lithium Ion Battery Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance:  $R_{DS(ON)} = 16 \text{ m}\Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 11 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 20 \text{ V}$ )
- Enhancement mode:  $V_{th} = 0.5 \sim 1.2 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 200 \text{ }\mu\text{A}$ )
- Common drain

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

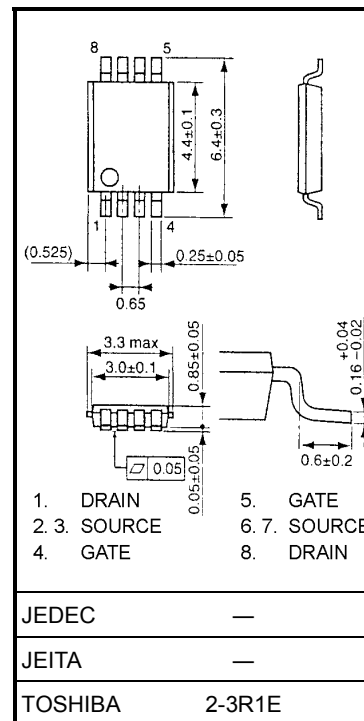
| Characteristics                                                                       |                                                 | Symbol    | Rating         | Unit             |
|---------------------------------------------------------------------------------------|-------------------------------------------------|-----------|----------------|------------------|
| Drain-source voltage                                                                  |                                                 | $V_{DSS}$ | 20             | V                |
| Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )                                  |                                                 | $V_{DGR}$ | 20             | V                |
| Gate-source voltage                                                                   |                                                 | $V_{GSS}$ | $\pm 12$       | V                |
| Drain current                                                                         | DC (Note 1)                                     | $I_D$     | 6              | A                |
|                                                                                       | Pulse (Note 1)                                  | $I_{DP}$  | 24             |                  |
| Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2a)                              | Single-device operation (Note 3a)               | $P_D(1)$  | 1.1            | W                |
|                                                                                       | Single-device value at dual operation (Note 3b) | $P_D(2)$  | 0.75           |                  |
| Drain power dissipation ( $t = 10 \text{ s}$ ) (Note 2b)                              | Single-device operation (Note 3a)               | $P_D(1)$  | 0.6            |                  |
|                                                                                       | Single-device value at dual operation (Note 3b) | $P_D(2)$  | 0.35           |                  |
| Single pulse avalanche energy (Note 4)                                                |                                                 | $E_{AS}$  | 46.8           | mJ               |
| Avalanche current                                                                     |                                                 | $I_{AR}$  | 6              | A                |
| Repetitive avalanche energy<br>Single-device value at dual operation (Note 2a, 3b, 5) |                                                 | $E_{AR}$  | 0.075          | mJ               |
| Channel temperature                                                                   |                                                 | $T_{ch}$  | 150            | $^\circ\text{C}$ |
| Storage temperature range                                                             |                                                 | $T_{stg}$ | $-55 \sim 150$ | $^\circ\text{C}$ |

Note: (Note 1), (Note 2), (Note 3), (Note 4) and (Note 5): See the next page.

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).

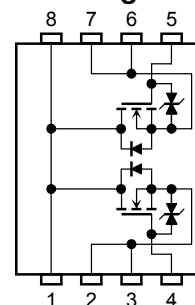
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 0.035 g (typ.)

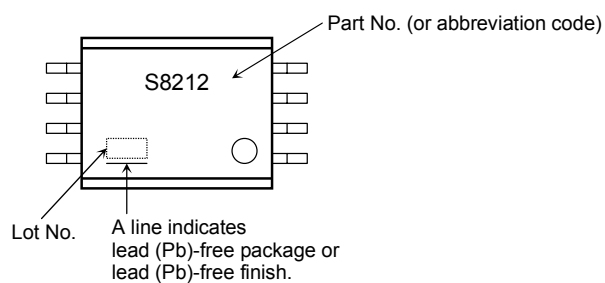
## Circuit Configuration



## Thermal Characteristics

| Characteristics                                                      |                                                    | Symbol            | Max | Unit |
|----------------------------------------------------------------------|----------------------------------------------------|-------------------|-----|------|
| Thermal resistance, channel to ambient<br>( $t = 10$ s)<br>(Note 2a) | Single-device operation<br>(Note 3a)               | $R_{th(ch-a)}(1)$ | 114 | °C/W |
|                                                                      | Single-device value at dual operation<br>(Note 3b) | $R_{th(ch-a)}(2)$ | 167 |      |
| Thermal resistance, channel to ambient<br>( $t = 10$ s)<br>(Note 2b) | Single-device operation<br>(Note 3a)               | $R_{th(ch-a)}(1)$ | 208 | °C/W |
|                                                                      | Single-device value at dual operation<br>(Note 3b) | $R_{th(ch-a)}(2)$ | 357 |      |

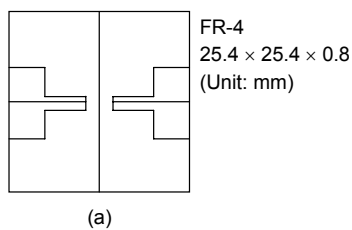
## Marking (Note 6)



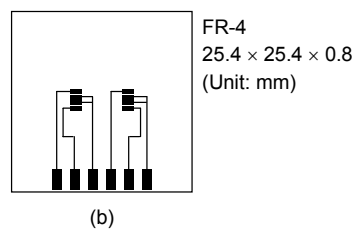
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2:

a) Device mounted on a glass-epoxy board (a)



b) Device mounted on a glass-epoxy board (b)



Note 3:

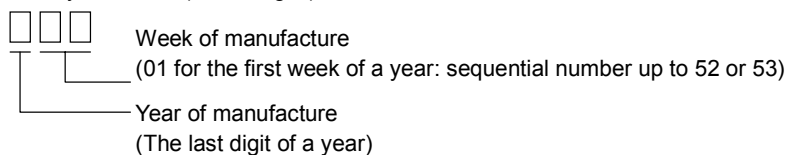
- a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.).
- b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both devices.).

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

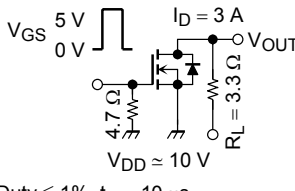
Note 5: Repetitive rating; pulse width limited by maximum channel temperature

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

※ Weekly code: (Three digits)

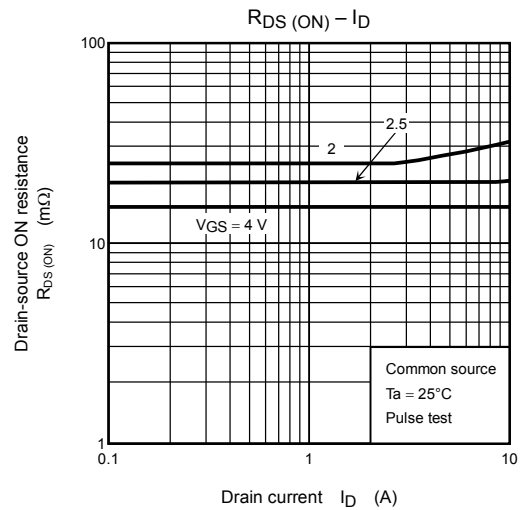
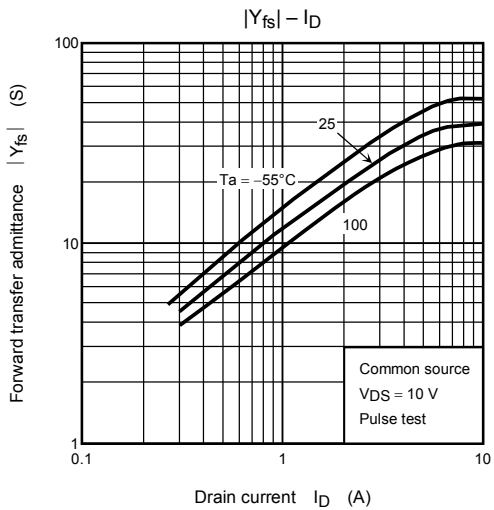
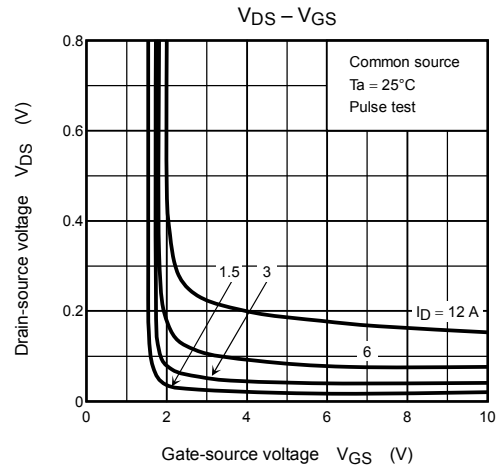
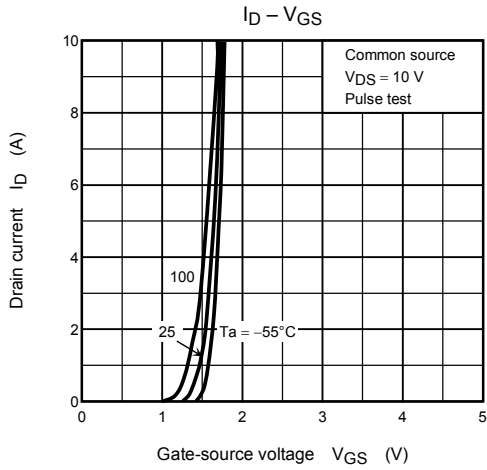
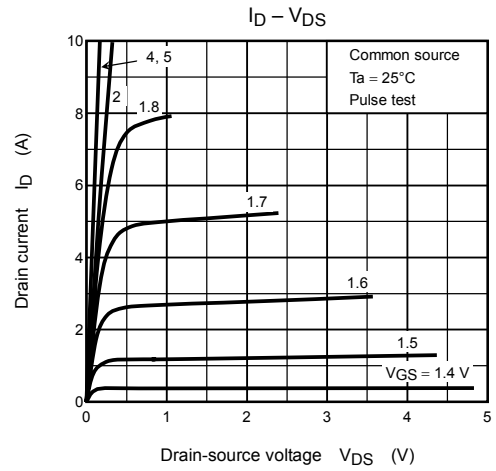
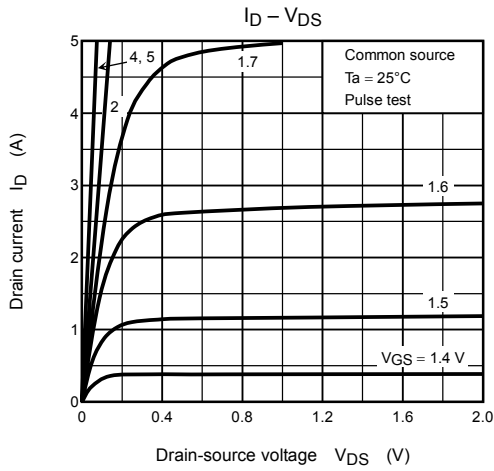


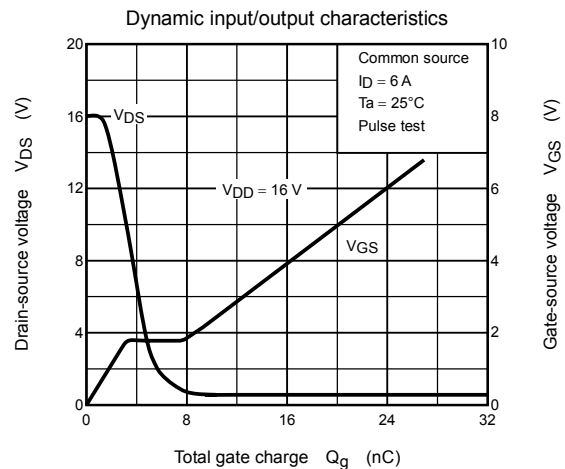
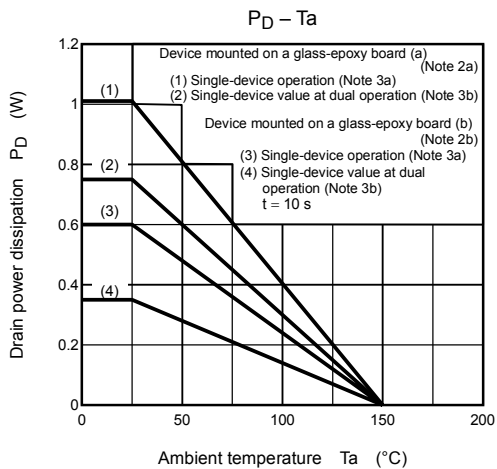
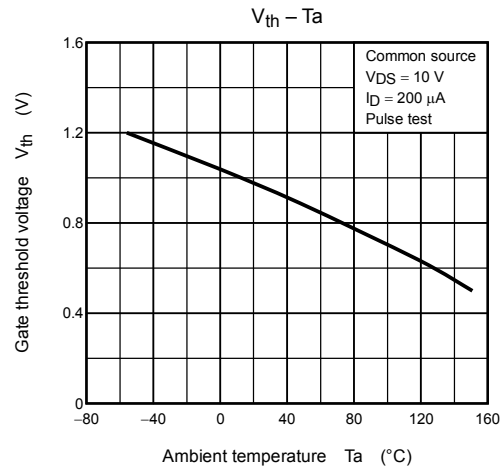
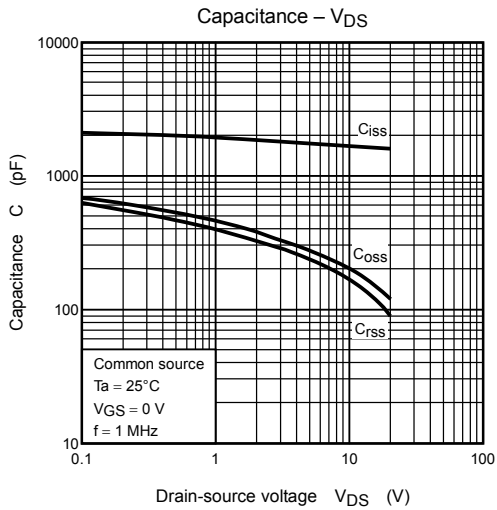
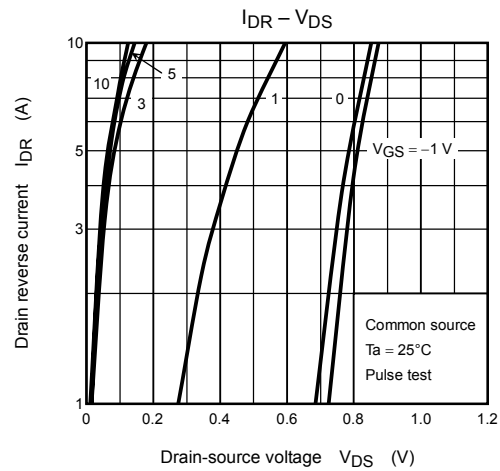
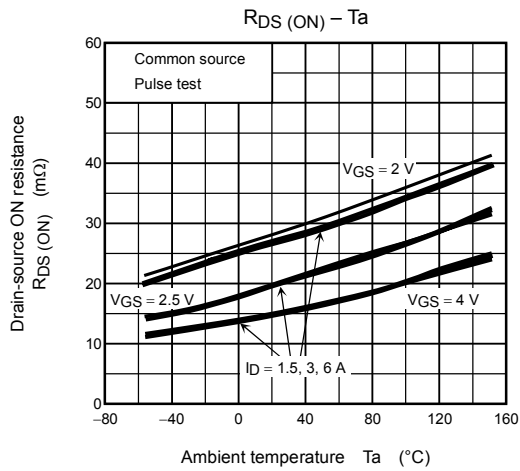
## Electrical Characteristics (Ta = 25°C)

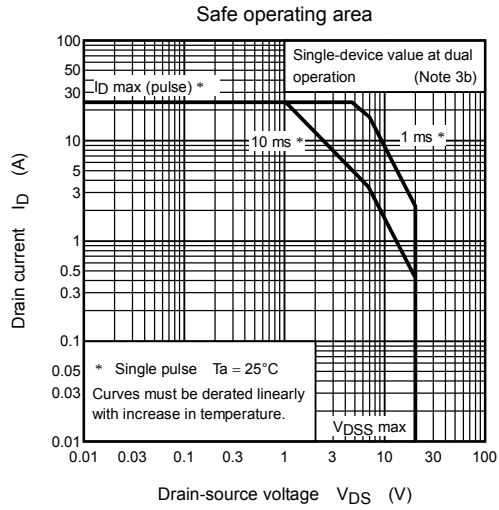
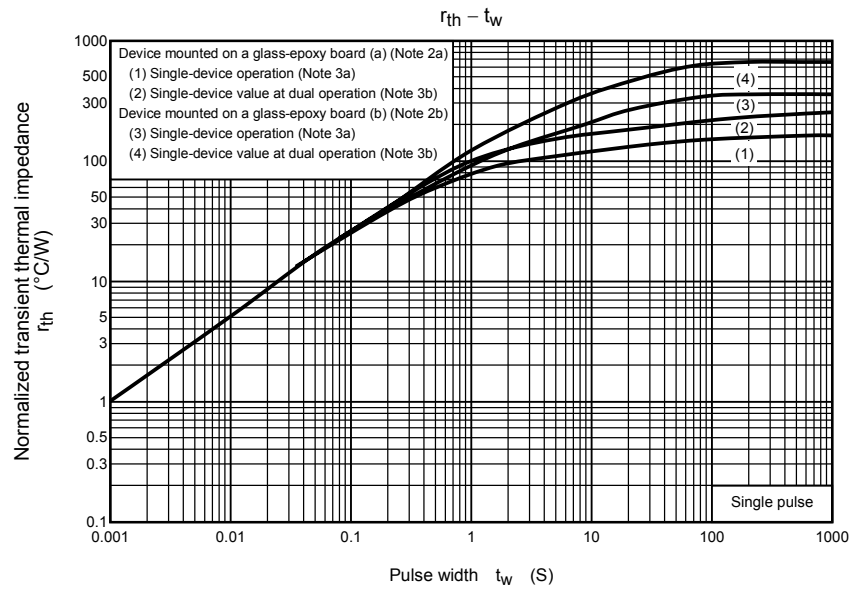
| Characteristics                                 |               | Symbol         | Test Condition                                                                     | Min | Typ. | Max      | Unit             |
|-------------------------------------------------|---------------|----------------|------------------------------------------------------------------------------------|-----|------|----------|------------------|
| Gate leakage current                            |               | $I_{GSS}$      | $V_{GS} = \pm 10 \text{ V}, V_{DS} = 0 \text{ V}$                                  | —   | —    | $\pm 10$ | $\mu\text{A}$    |
| Drain cut-OFF current                           |               | $I_{DSS}$      | $V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}$                                      | —   | —    | 10       | $\mu\text{A}$    |
| Drain-source breakdown voltage                  |               | $V_{(BR) DSS}$ | $I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$                                        | 20  | —    | —        | V                |
|                                                 |               | $V_{(BR) DSX}$ | $I_D = 10 \text{ mA}, V_{GS} = -12 \text{ V}$                                      | 8   | —    | —        |                  |
| Gate threshold voltage                          |               | $V_{th}$       | $V_{DS} = 10 \text{ V}, I_D = 200 \mu\text{A}$                                     | 0.5 | —    | 1.2      | V                |
| Drain-source ON resistance                      |               | $R_{DS (ON)}$  | $V_{GS} = 2.0 \text{ V}, I_D = 4.2 \text{ A}$                                      | —   | 26   | 45       | $\text{m}\Omega$ |
|                                                 |               |                | $V_{GS} = 2.5 \text{ V}, I_D = 4.2 \text{ A}$                                      | —   | 21   | 29       |                  |
|                                                 |               |                | $V_{GS} = 4.0 \text{ V}, I_D = 4.8 \text{ A}$                                      | —   | 16   | 24       |                  |
| Forward transfer admittance                     |               | $ Y_{fs} $     | $V_{DS} = 10 \text{ V}, I_D = 3.0 \text{ A}$                                       | 5.5 | 11   | —        | S                |
| Input capacitance                               |               | $C_{iss}$      | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                   | —   | 1590 | —        | pF               |
| Reverse transfer capacitance                    |               | $C_{rss}$      |                                                                                    | —   | 180  | —        |                  |
| Output capacitance                              |               | $C_{oss}$      |                                                                                    | —   | 200  | —        |                  |
| Switching time                                  | Rise time     | $t_r$          |  | —   | 6.4  | —        | ns               |
|                                                 | Turn-ON time  | $t_{on}$       |                                                                                    | —   | 22   | —        |                  |
|                                                 | Fall time     | $t_f$          |                                                                                    | —   | 10   | —        |                  |
|                                                 | Turn-OFF time | $t_{off}$      |                                                                                    | —   | 42   | —        |                  |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$          | $V_{DD} \approx 16 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 6 \text{ A}$             | —   | 20   | —        | nC               |
| Gate-source charge 1                            |               | $Q_{gs1}$      |                                                                                    | —   | 3.5  | —        |                  |
| Gate-drain ("miller") charge                    |               | $Q_{gd}$       |                                                                                    | —   | 4.5  | —        |                  |

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

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







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