

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

# TPC6011

Notebook PC Applications  
 Portable Equipment Applications

- Low drain-source ON-resistance:  $R_{DS(ON)} = 16 \text{ m}\Omega$  (typ.)  
 (  $V_{GS} = 10\text{V}$  )
- Low leakage current:  $I_{DSS} = 10 \text{ }\mu\text{A}$  (max) ( $V_{DS} = 30 \text{ V}$ )
- Enhancement mode:  $V_{th} = 1.3 \text{ to } 2.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

## Absolute Maximum Ratings (Ta = 25°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<br>(Note 1)         | $I_D$     | 6          | A    |
|  | Pulse<br>(Note 1)      | $I_{DP}$  | 24         |      |
| Drain power dissipation                              | (t = 5 s)<br>(Note 2a) | $P_D$     | 2.2        | W    |
| Drain power dissipation                              | (t = 5 s)<br>(Note 2b) | $P_D$     | 0.7        | W    |
| Single pulse avalanche energy (Note 3)               |                        | $E_{AS}$  | 2.3        | mJ   |
| Avalanche current                                    |                        | $I_{AR}$  | 3          | A    |
| Channel temperature                                  |                        | $T_{ch}$  | 150        | °C   |
| Storage temperature range                            |                        | $T_{stg}$ | -55 to 150 | °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).

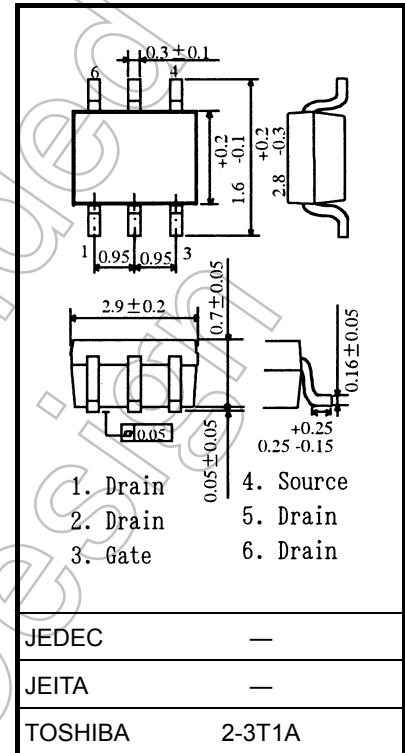
## Thermal Characteristics

| Characteristics  | Symbol         | Max   | Unit |
|--|----------------|-------|------|
| Thermal resistance, channel to ambient<br>(t = 5 s)<br>(Note 2a) | $R_{th(ch-a)}$ | 56.8  | °C/W |
| Thermal resistance, channel to ambient<br>(t = 5 s)<br>(Note 2b) | $R_{th(ch-a)}$ | 178.5 | °C/W |

Note: (Note 1), (Note 2), (Note 3): See other pages.

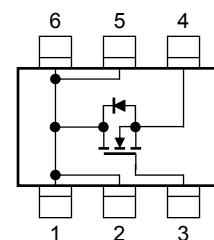
This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



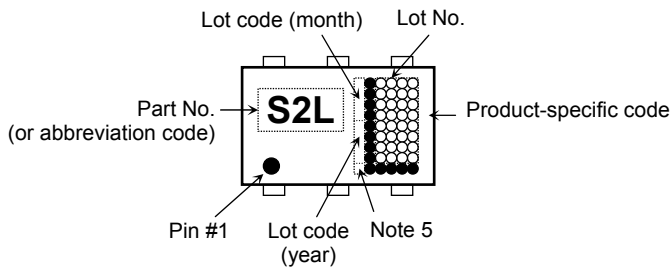
Weight: 0.011 g (typ.)

## Circuit Configuration



Start of commercial production  
 2009-07

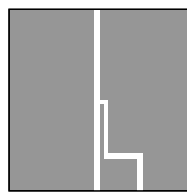
## Marking (Note 4)



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

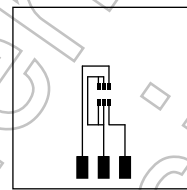
Note 2: (a) Device mounted on a glass-epoxy board (a) (t = 5 s)

(b) Device mounted on a glass-epoxy board (b) (t = 5 s)



(a)

FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)



(b)

FR-4  
25.4 × 25.4 × 0.8  
(Unit: mm)

Note 3:  $V_{DD} = 24\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 200\ \mu\text{H}$ ,  $R_G = 25\ \Omega$ ,  $I_{AR} = 3\text{ A}$

Note 4: • on lower left of the marking indicates Pin 1.

Note 5: A dot marking identifies the indication of product Labels.

Without a dot: [[Pb]]/INCLUDES > MCV

With a dot: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

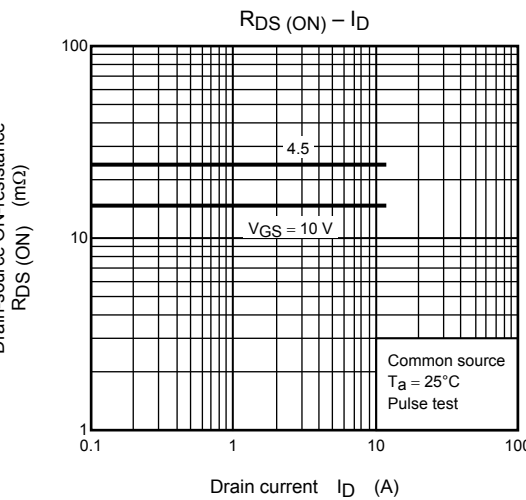
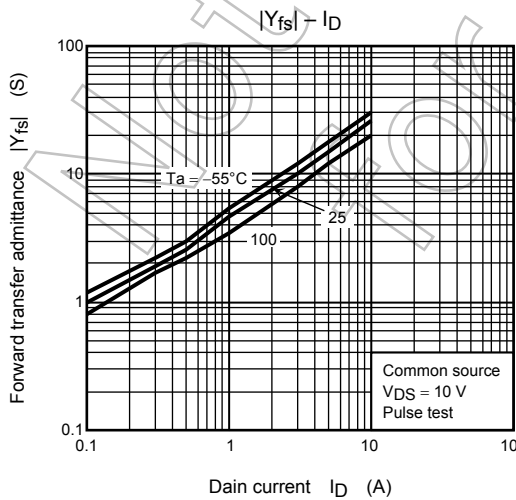
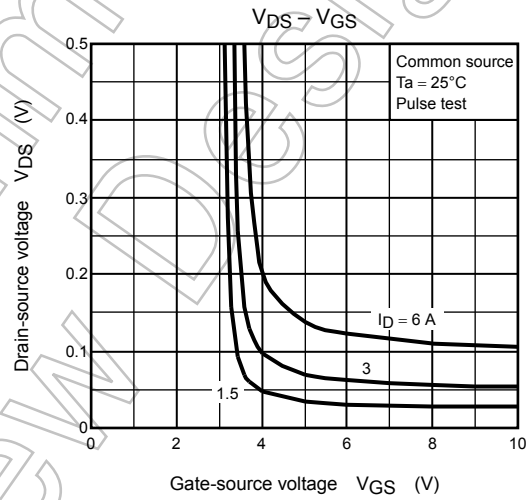
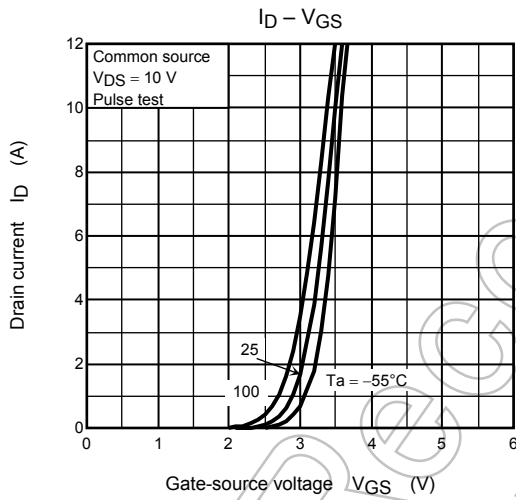
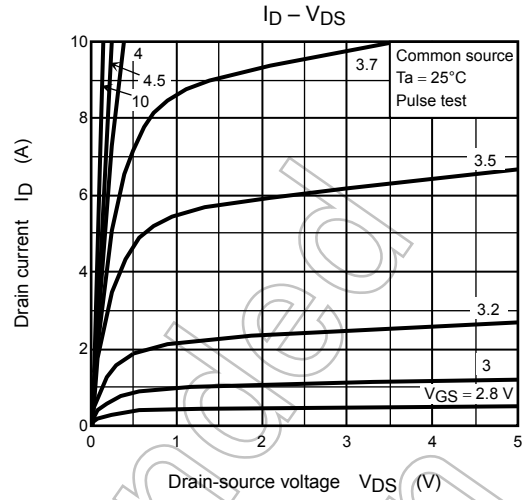
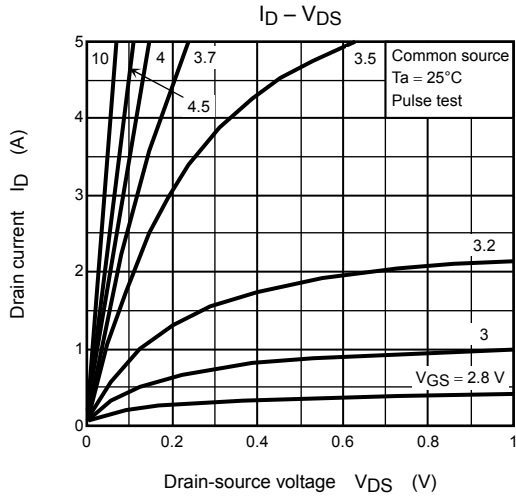
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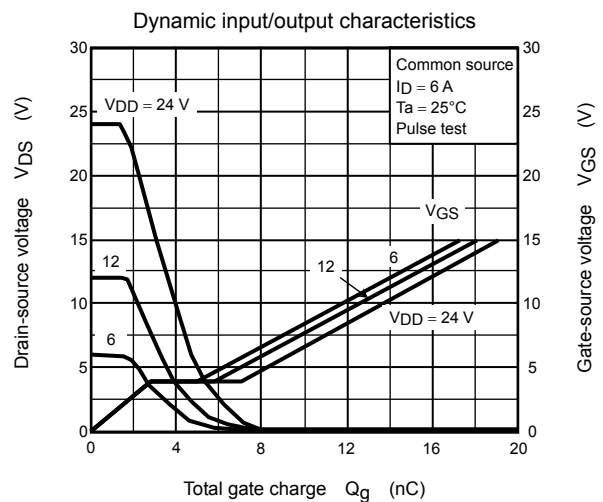
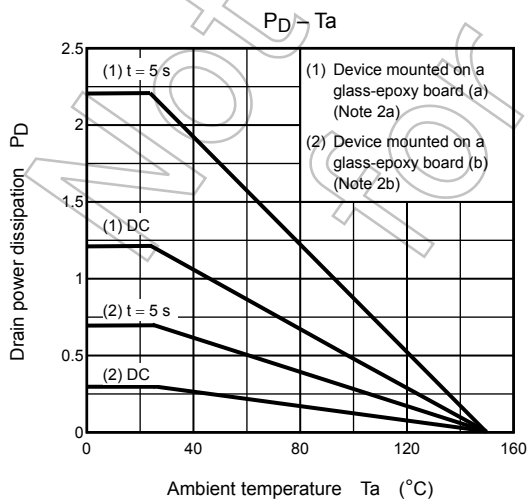
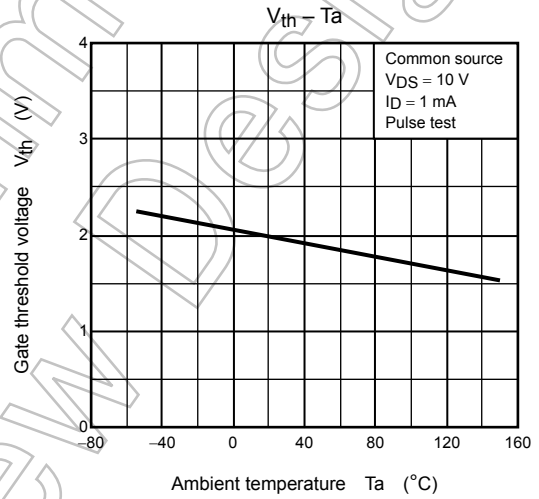
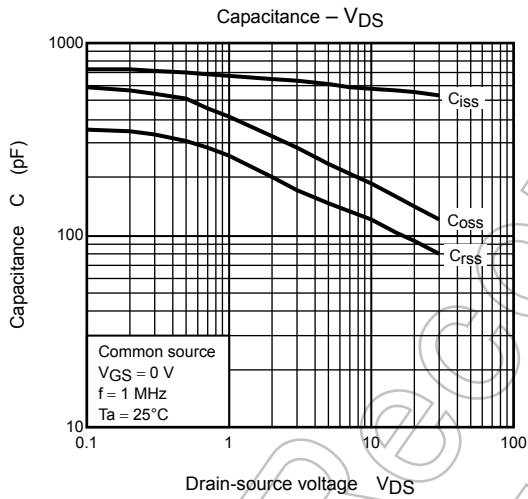
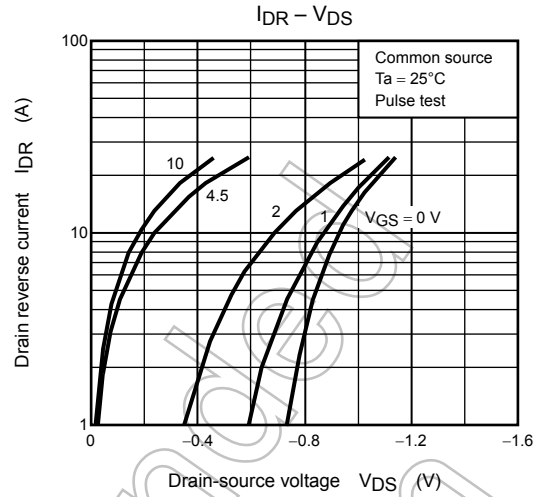
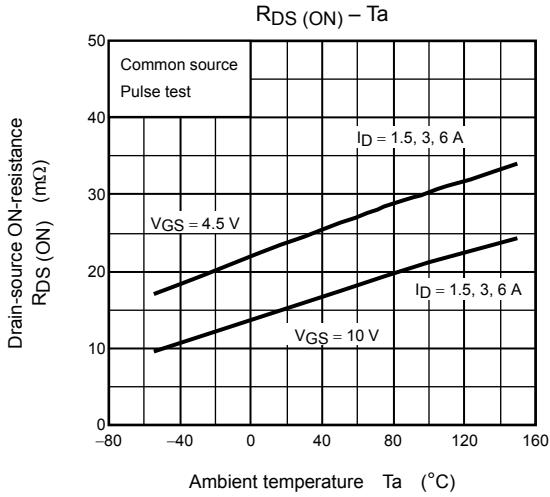
**Electrical Characteristics (Ta = 25°C)**

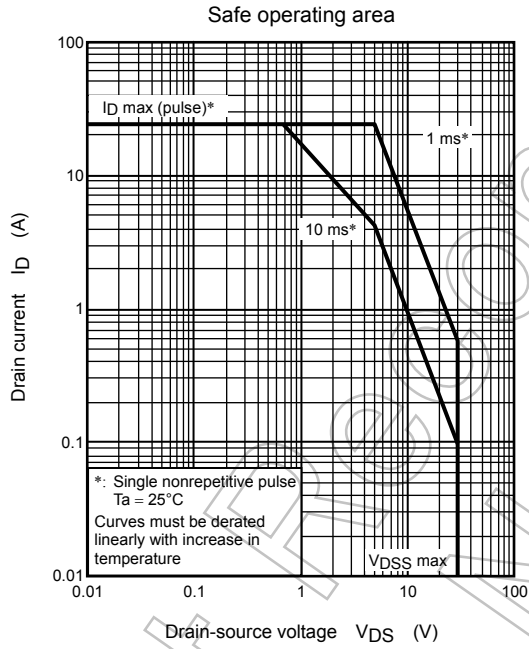
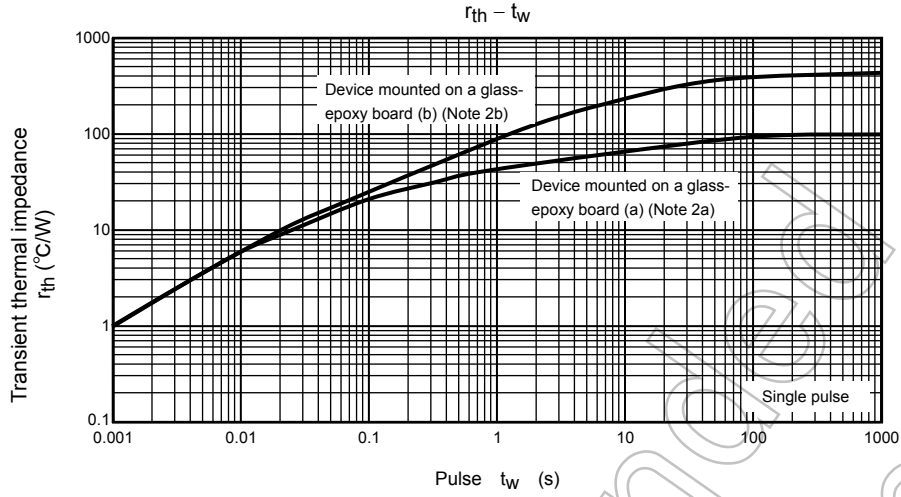
| Characteristics                                 |               | Symbol        | Test Condition   | Min                                       | Typ. | Max       | Unit          |
|---|---------------|---------------|--|---|------|-----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$                      | —   | —    | $\pm 100$ | nA            |
| Drain cut-off current                           |               | $I_{DSS}$     | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$                          | —   | —    | 10        | $\mu\text{A}$ |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$                            | 30  | —    | —         | V             |
|   |               | $V_{(BR)DSX}$ | $I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$                          | 10  | —    | —         |               |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$                            | 1.3                                       | —    | 2.5       | V             |
| Drain-source ON-resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 4.5\text{ V}, I_D = 3\text{ A}$                            | —   | 24   | 32        | m $\Omega$    |
|   |               | $R_{DS(ON)}$  | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}$                             | —   | 16   | 20        |               |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10\text{ V}, I_D = 3\text{ A}$                             | 5   | 10   | —         | S             |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$        | —   | 640  | —         | pF            |
| Reverse transfer capacitance                    |               | $C_{rss}$     |  | —   | 125  | —         |               |
| Output capacitance                              |               | $C_{oss}$     |  | —   | 185  | —         |               |
| Switching time                                  | Rise time     | $t_r$         |  | —   | 5.8  | —         | ns            |
|   | Turn-on time  | $t_{on}$      |  | —   | 12   | —         |               |
|   | Fall time     | $t_f$         |  | —   | 8    | —         |               |
|   | Turn-off time | $t_{off}$     |  | Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$ | —    | 24.5      |               |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx 24\text{ V}, V_{GS} = 10\text{ V}, I_D = 6\text{ A}$ | —   | 14   | —         | nC            |
| Gate-source charge 1                            |               | $Q_{gs1}$     |  | —   | 2.7  | —         |               |
| Gate-drain ("miller") charge                    |               | $Q_{gd}$      |  | —   | 4.2  | —         |               |

**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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