TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (U-MOSⅤ)

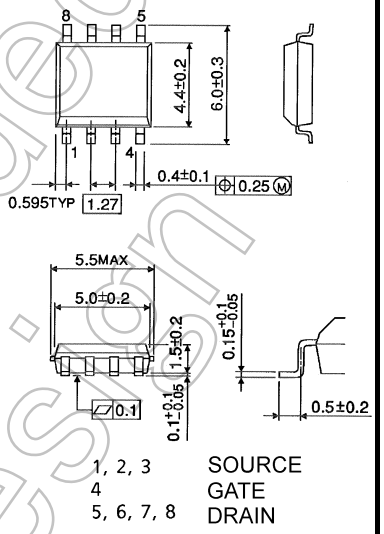
# TPC8122

Lithium Ion Battery Applications

Notebook PC Applications

- Small footprint due to small and thin package
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 6.3 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 30S (typ.)
- Low leakage current: $I_{DSS}$ = −10μA (max) ($V_{DS}$ = −30 V)
- Enhancement mode: $V_{th}$ = −0.8 to −2.0 V ($V_{DS}$ = −10 V, $I_D$ = −1 mA)

Unit: mm



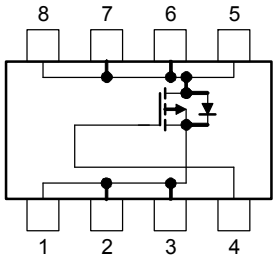

| | |
|---|---|
| JEDEC | ― |
| JEITA | ― |
| TOSHIBA | 2-6J1B |

Weight: 0.080 g (typ.)

## Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain-source voltage | | $V_{DSS}$ | −30 | V |
| Drain-gate voltage ($R_{GS}$ = 20 kΩ) | | $V_{DGR}$ | −30 | V |
| Gate-source voltage | | $V_{GSS}$ | ±20 | V |
| Drain current | DC (Note 1) | $I_D$ | −12 | A |
| | Pulse (Note 1) | $I_{DP}$ | −48 | |
| Drain power dissipation (t = 10 s) (Note 2a) | | $P_D$ | 1.9 | W |
| Drain power dissipation (t = 10 s) (Note 2b) | | $P_D$ | 1.0 | W |
| Single pulse avalanche energy (Note 3) | | $E_{AS}$ | 93 | mJ |
| Avalanche current | | $I_{AR}$ | −12 | A |
| Repetitive avalanche energy (Note 2a) (Note 4) | | $E_{AR}$ | 0.030 | mJ |
| Channel temperature | | $T_{ch}$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 150 | °C |

## Circuit Configuration




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

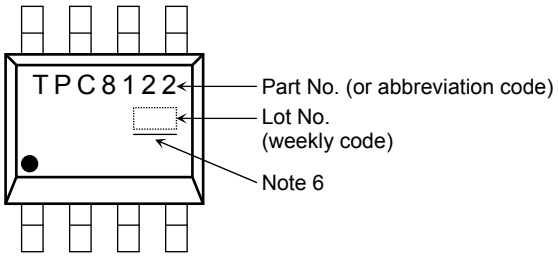
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within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

## Thermal Characteristics

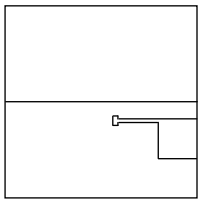
| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, channel to ambient (t = 10 s) (Note 2a) | $R_{th\ (ch\text{-}a)}$ | 65.8 | °C/W |
| Thermal resistance, channel to ambient (t = 10 s) (Note 2b) | $R_{th\ (ch\text{-}a)}$ | 125 | °C/W |

## Marking (Note 5)



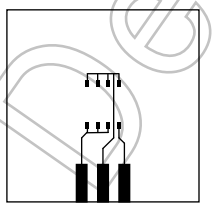

Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

(a)



FR-4
25.4 × 25.4 × 0.8
(Unit: mm)

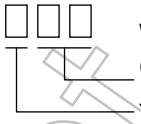
(b)

Note 3: $V_{DD}$ = −24 V, $T_{ch}$ = 25°C (initial), L = 500 μH, $R_G$ = 25 Ω, $I_{AR}$ = −12 A

Note 4: Repetitive rating; pulse width limited by maximum channel temperature

Note 5: • on the lower left of the marking indicates Pin 1.

* Weekly code: (Three digits)



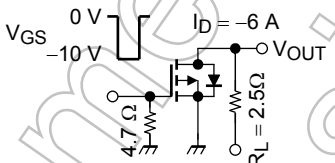
Week of manufacture
(01 for first week of year, continuing up to 52 or 53)

Year of manufacture
(The last digit of the calendar year)

Note 6: 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]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

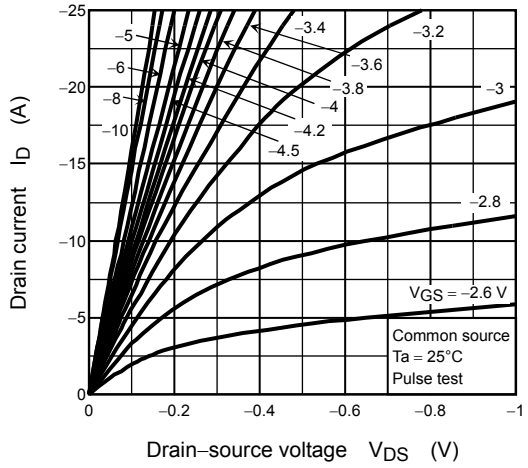
## Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | — | — | ±100 | nA |
| Drain cut-OFF current | | $I_{DSS}$ | $V_{DS}$ = −30 V, $V_{GS}$ = 0 V | — | — | −10 | μA |
| Drain-source breakdown voltage | | $V_{(BR)\ DSS}$ | $I_D$ = −10 mA, $V_{GS}$ = 0 V | −30 | — | — | V |
| | | $V_{(BR)\ DSX}$ | $I_D$ = −10 mA, $V_{GS}$ = 20 V | −13 | — | — | |
| Gate threshold voltage | | $V_{th}$ | $V_{DS}$ = −10 V, $I_D$ = −1 mA | −0.8 | — | −2.0 | V |
| Drain-source ON resistance | | $R_{DS\ (ON)}$ | $V_{GS}$ = −4 V, $I_D$ = −6 A | — | 11.5 | 16.5 | mΩ |
| | | | $V_{GS}$ = −10 V, $I_D$ = −6 A | — | 6.3 | 8 | |
| Forward transfer admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = −10 V, $I_D$ = −6 A | 15 | 30 | — | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = −10 V, $V_{GS}$ = 0 V, f = 1 MHz | — | 2450 | — | pF |
| Reverse transfer capacitance | | $C_{rss}$ | | — | 530 | — | |
| Output capacitance | | $C_{oss}$ | | — | 740 | — | |
| Switching time | Rise time | $t_r$ |   Duty ≤ 1%, $t_w$ = 10 μs | — | 12 | — | ns |
| | Turn-ON time | $t_{on}$ | | — | 22 | — | |
| | Fall time | $t_f$ | | — | 150 | — | |
| | Turn-OFF time | $t_{off}$ | | — | 360 | — | |
| Total gate charge (gate-source plus gate-drain) | | $Q_g$ | $V_{DD}$ ≈ −24 V, $V_{GS}$ = −10 V, $I_D$ = −12 A | — | 62 | — | nC |
| Gate-source charge 1 | | $Q_{gs1}$ | | — | 10 | — | |
| Gate-drain (“miller”) charge | | $Q_{gd}$ | | — | 19 | — | |

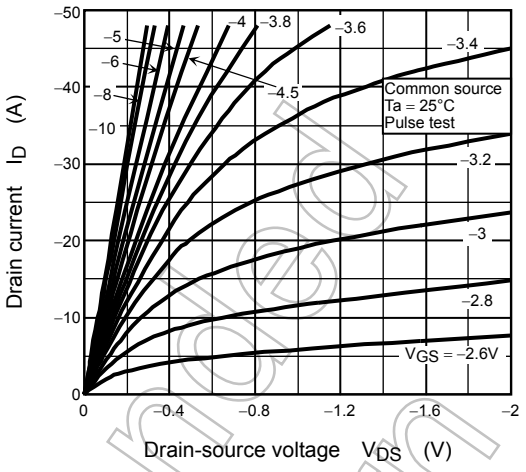
## Source-Drain Ratings and Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Drain reverse current | Pulse (Note 1) | $I_{DRP}$ | — | — | — | −48 | A |
| Forward voltage (diode) | | $V_{DSF}$ | $I_{DR}$ = −12 A, $V_{GS}$ = 0 V | — | — | 1.2 | V |

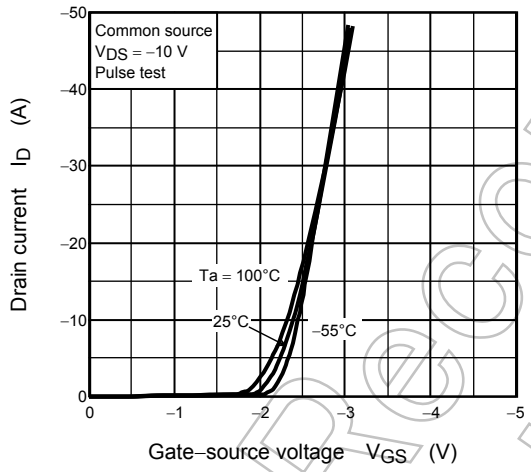
$I_D - V_{DS}$



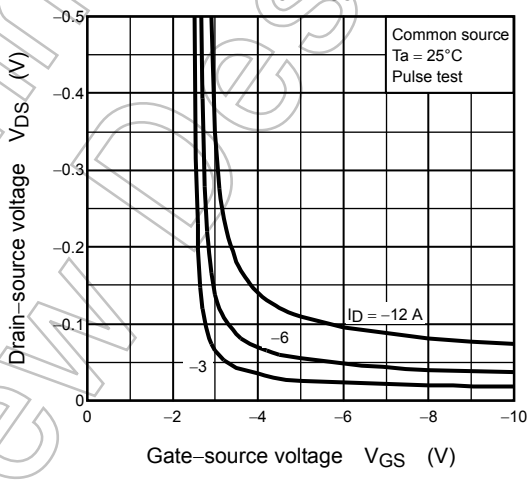

$I_D - V_{DS}$



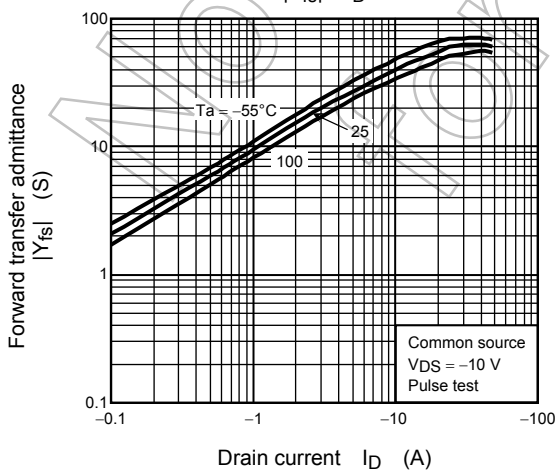

$I_D - V_{GS}$



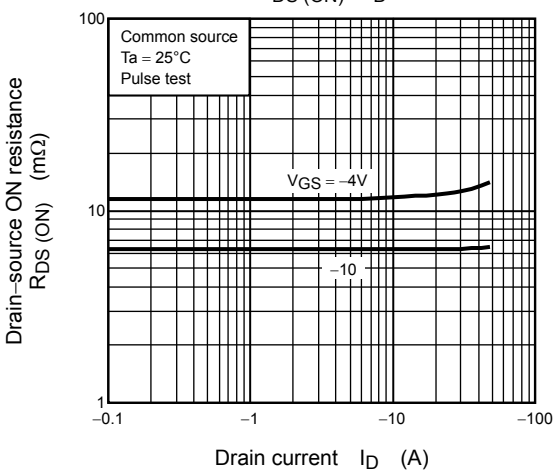

$V_{DS} - V_{GS}$



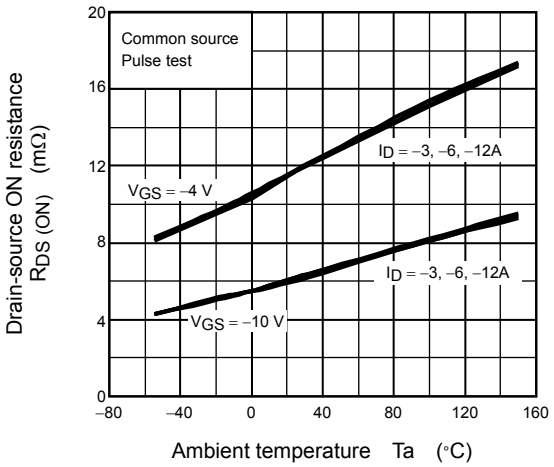

$|Y_{fs}| - I_D$



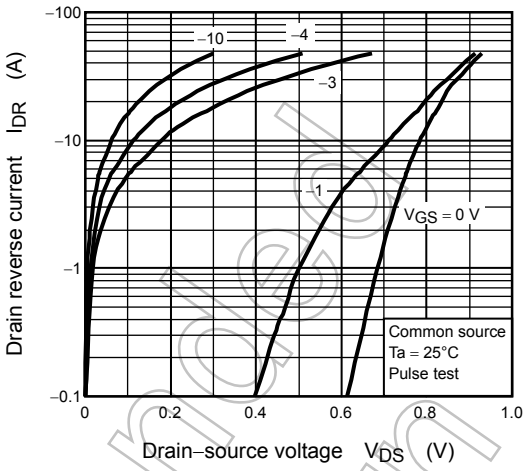

$R_{DS\ (ON)} - I_D$



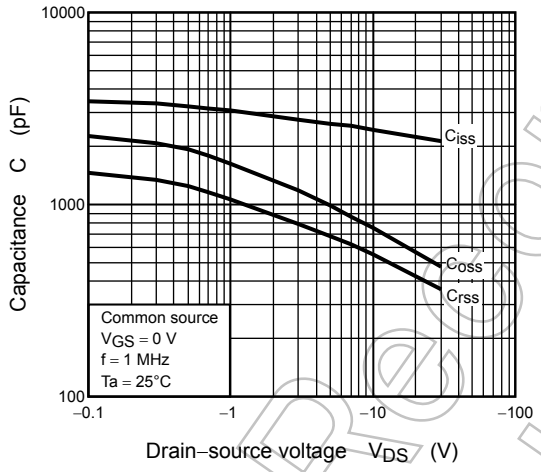
$R_{DS\ (ON)}$ – Ta



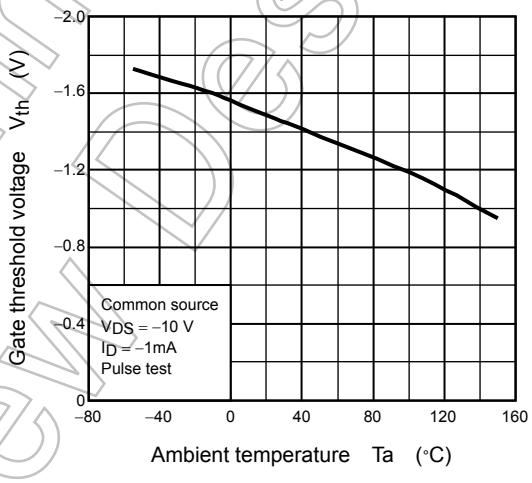

$I_{DR}$ – $V_{DS}$



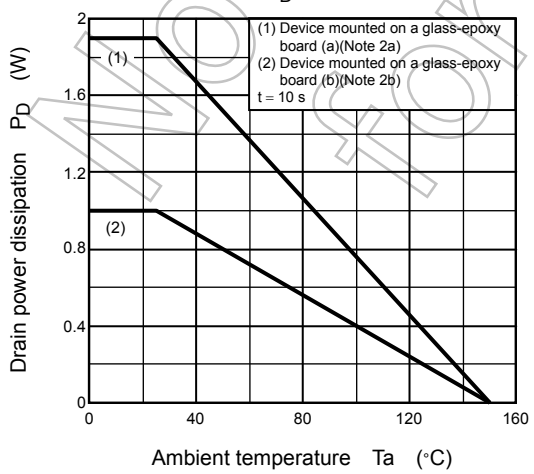

Capacitance – $V_{DS}$



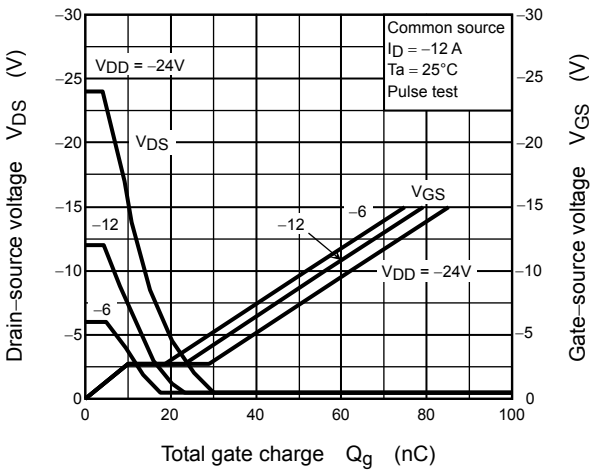

$V_{th}$ – Ta



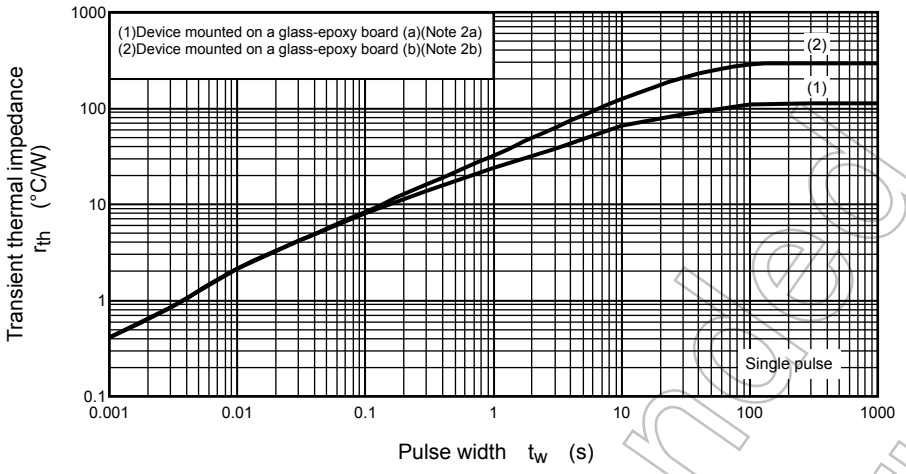

$P_D$ – Ta



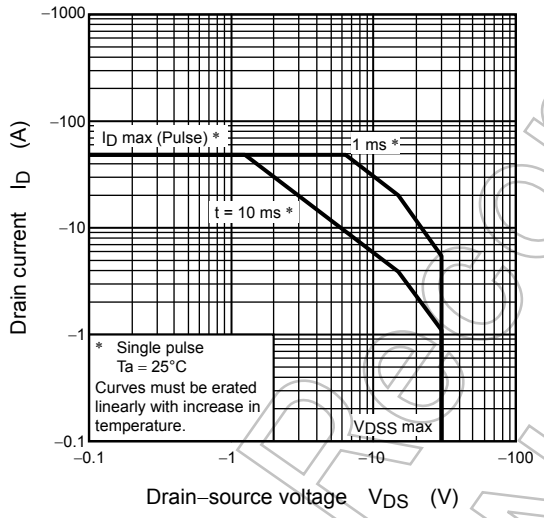

Dynamic input/output characteristics



$r_{th} - t_w$




Safe operating area



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