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

# TPCS8101

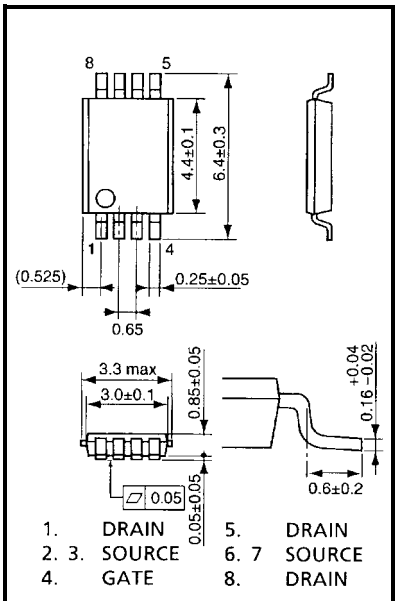
Lithium Ion Battery Applications

Portable Equipment Applications

Notebook PCs

- Small footprint due to small and thin package
- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 15 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 12 S (typ.)
- Low leakage current: $I_{DSS}$ = −10 μA (max) ($V_{DS}$ = −30 V)
- Enhancement-mode: $V_{th}$ = −0.8~−2.0 V ($V_{DS}$ = −10 V, $I_D$ = −1 mA)

Unit: mm




| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-3R1B |

Weight: 0.035 g (typ.)

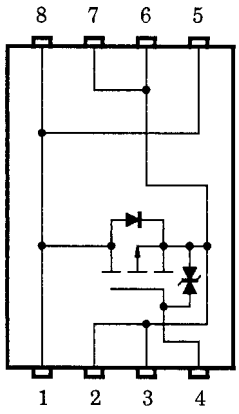
## Maximum Ratings (Ta = 25°C)

| 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) | $I_D$ | −6 | A |
| | Pulse (Note 1) | $I_{DP}$ | −24 | |
| Drain power dissipation | (t = 10 s) (Note 2a) | $P_D$ | 1.5 | W |
| Drain power dissipation | (t = 10 s) (Note 2b) | $P_D$ | 0.6 | W |
| Single pulse avalanche energy | (Note 3) | $E_{AS}$ | 46.8 | mJ |
| Avalanche current | | $I_{AR}$ | −6 | A |
| Repetitive avalanche energy | (Note 2a, Note 4) | $E_{AR}$ | 0.15 | mJ |
| Channel temperature | | $T_{ch}$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55 to 150 | °C |

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

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

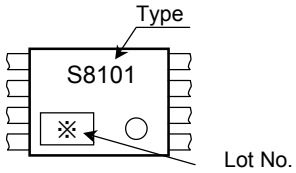
## Circuit Configuration



## Thermal Characteristics

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, channel to ambient (t = 10 s) (Note 2a) | $R_{th\ (ch\text{-}a)}$ | 83.3 | °C/W |
| Thermal resistance, channel to ambient (t = 10 s) (Note 2b) | $R_{th\ (ch\text{-}a)}$ | 208 | °C/W |

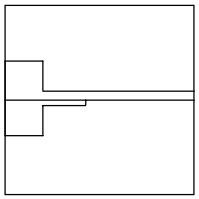
## Marking (Note 5)




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

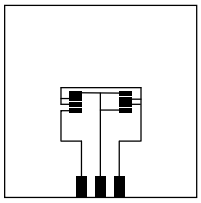
Note 2:

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



FR-4
25.4 × 25.4 × 0.8
(unit: mm)

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



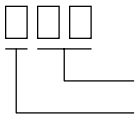
FR-4
25.4 × 25.4 × 0.8
(unit: mm)

Note 3: $V_{DD}$ = −24 V, $T_{ch}$ = 25°C (initial), L = 1.0 mH, $R_G$ = 25 Ω, $I_{AR}$ = −6.0 A

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

Note 5: ○ on lower right of the marking indicates Pin 1.

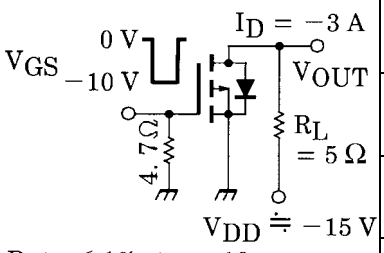
※ Weekly code: (Three digits)



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

Year of manufacture
(One low-order digits of calendar year)

## Electrical Characteristics (Ta = 25°C)

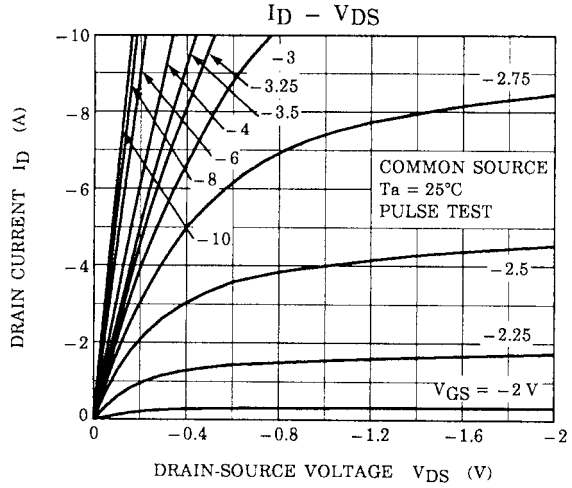
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±16 V, $V_{DS}$ = 0 V | — | — | ±10 | μA |
| Drain cut-OFF current | | $I_{DSS}$ | $V_{DS}$ = −30 V, $V_{GS}$ = 0 V | — | — | −10 | μA |
| Drain-source 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 | −15 | — | — | |
| 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, $I_D$ = −3 A | — | 32 | 40 | mΩ |
| | | $R_{DS\ (ON)}$ | $V_{GS}$ = −10 V, $I_D$ = −3 A | — | 15 | 25 | |
| Forward transfer admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = −10 V, $I_D$ = −3 A | 6 | 12 | — | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = −10 V, $V_{GS}$ = 0 V, f = 1 MHz | — | 1810 | — | pF |
| Reverse transfer capacitance | | $C_{rss}$ | | — | 350 | — | pF |
| Output capacitance | | $C_{oss}$ | | — | 610 | — | pF |
| Switching time | Rise time | $t_r$ |  | — | 9 | — | ns |
| | Turn-ON time | $t_{on}$ | | — | 15 | — | |
| | Fall time | $t_f$ | | — | 49 | — | |
| | Turn-OFF time | $t_{off}$ | | — | 135 | — | |
| Total gate charge (gate-source plus gate-drain) | | $Q_g$ | $V_{DD}$ ≈ −24 V, $V_{GS}$ = −10 V, $I_D$ = −6 A | — | 37 | — | nC |
| Gate-source charge | | $Q_{gs}$ | | — | 30 | — | nC |
| Gate-drain (“miller”) charge | | $Q_{gd}$ | | — | 7 | — | nC |



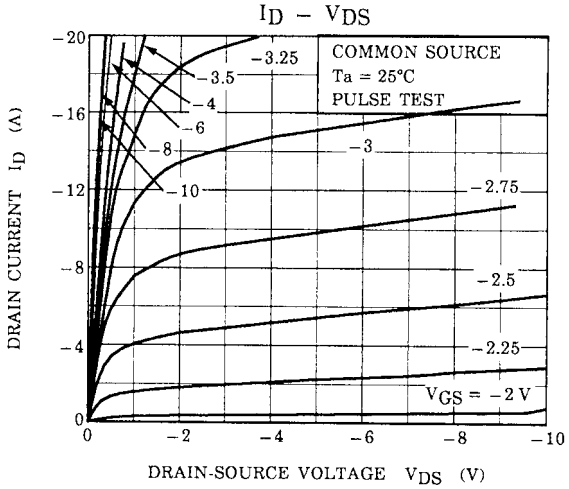
## Source-Drain Ratings and Characteristics (Ta = 25°C)

| 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 A, $V_{GS}$ = 0 V | — | — | 1.2 | V |

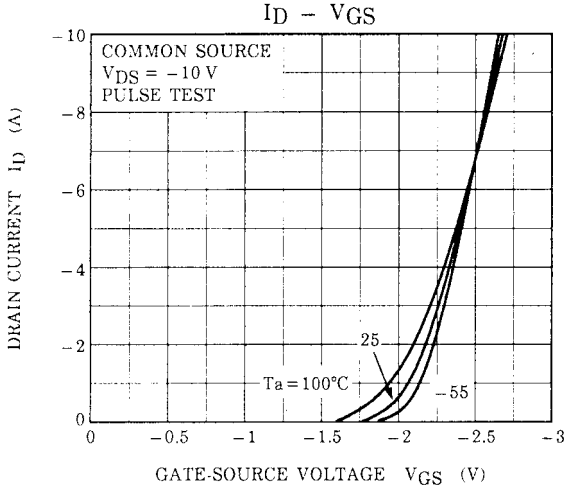
$I_D - V_{DS}$



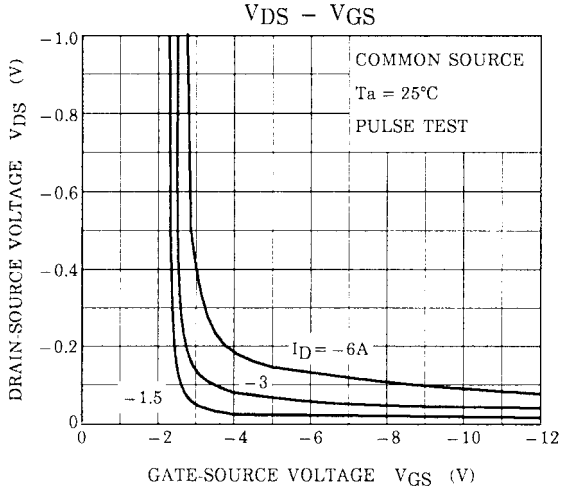

$I_D - V_{DS}$



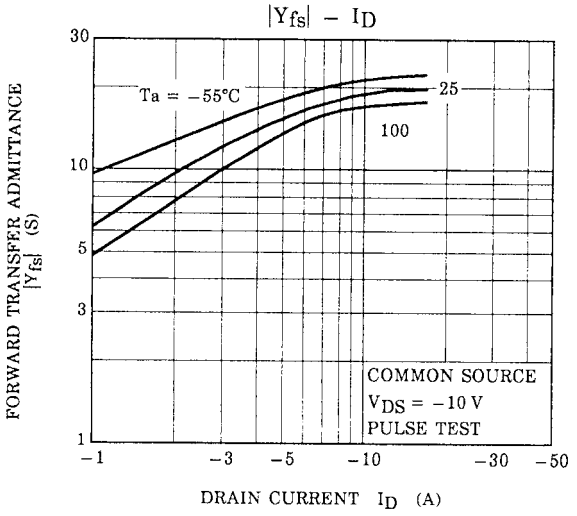

$I_D - V_{GS}$



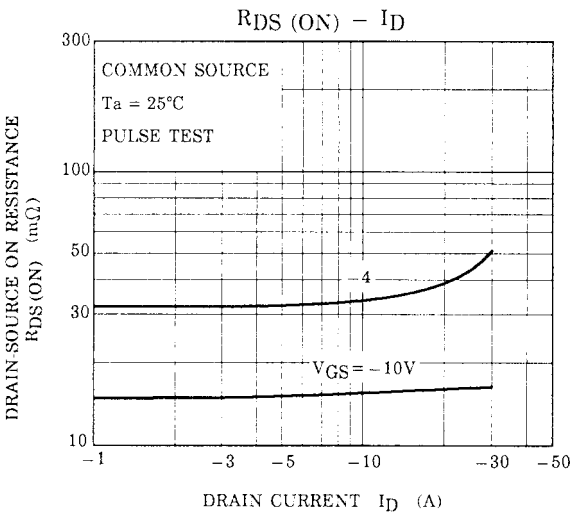

$V_{DS} - V_{GS}$



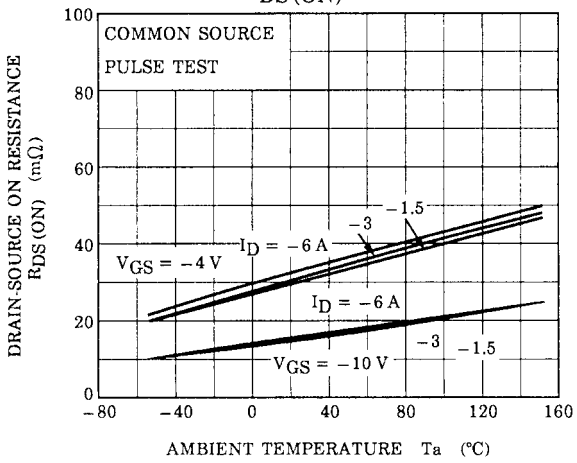

$|Y_{fs}| - I_D$



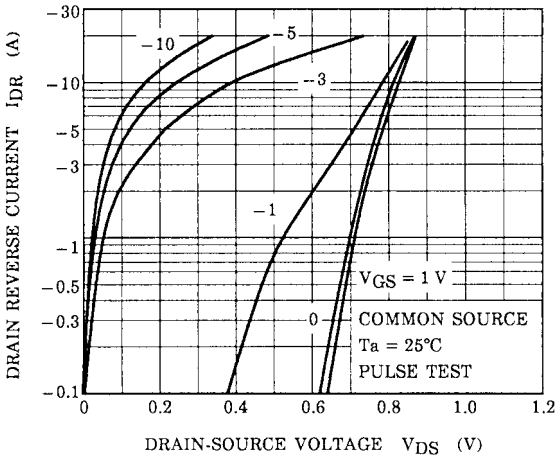

$R_{DS\ (ON)} - I_D$



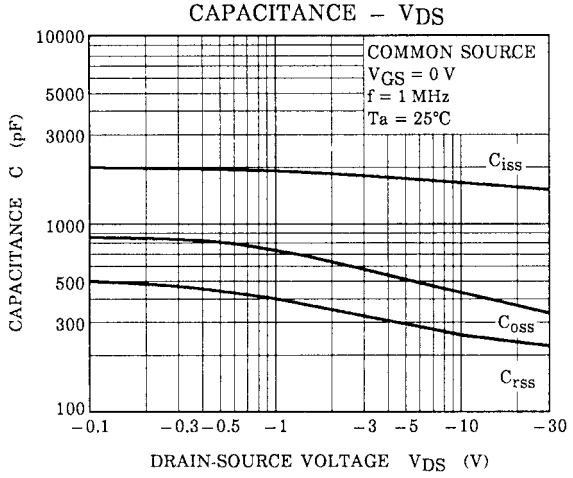
$R_{DS\,(ON)}$ – Ta



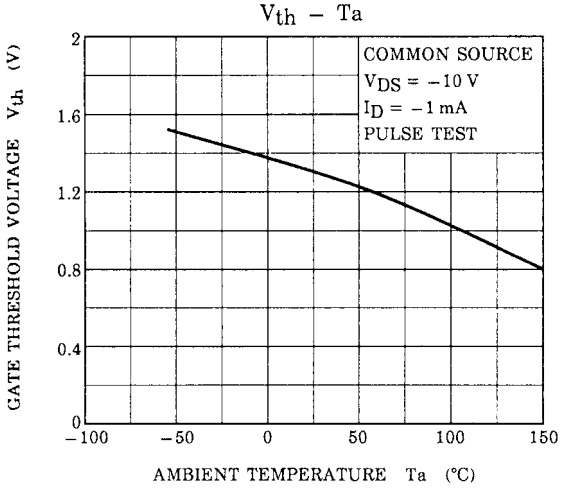

$I_{DR}$ – $V_{DS}$



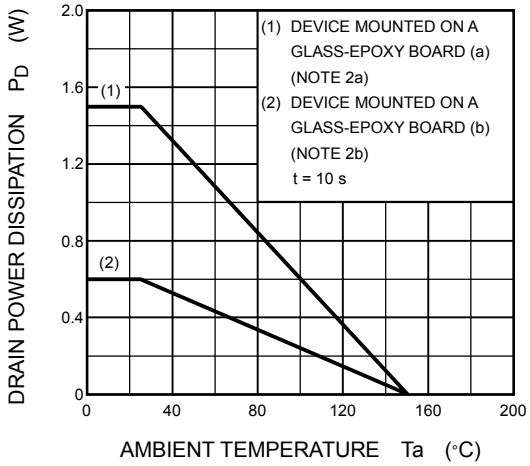

CAPACITANCE – $V_{DS}$



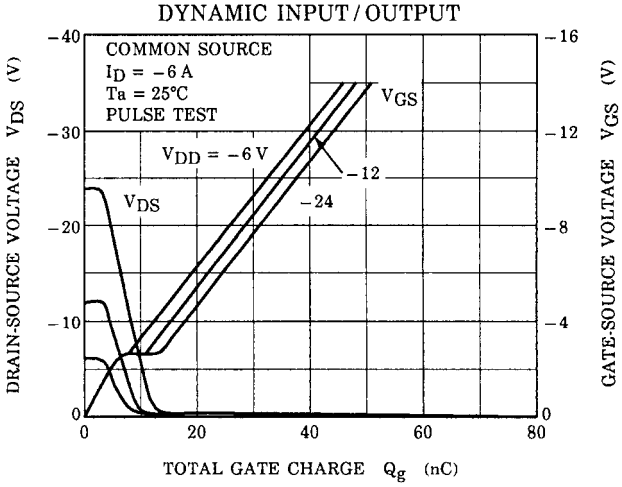

$V_{th}$ – Ta



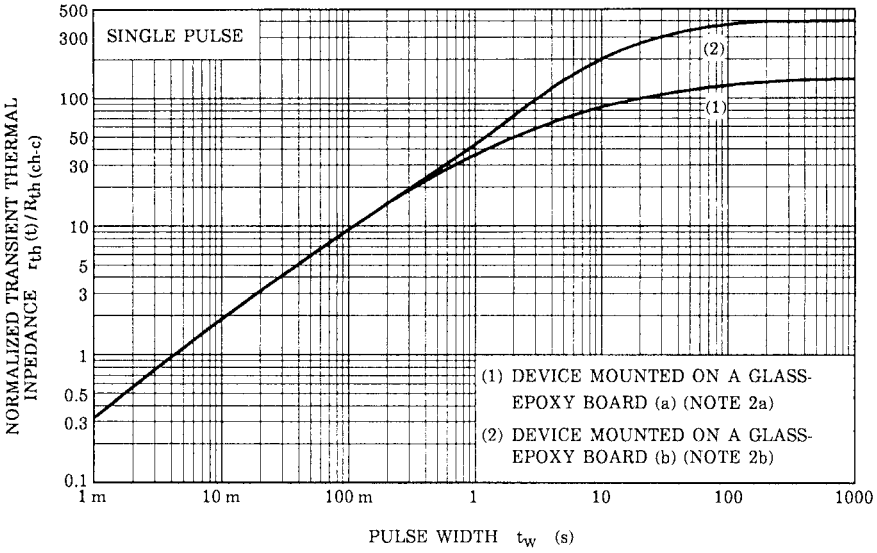

$P_D$ – Ta



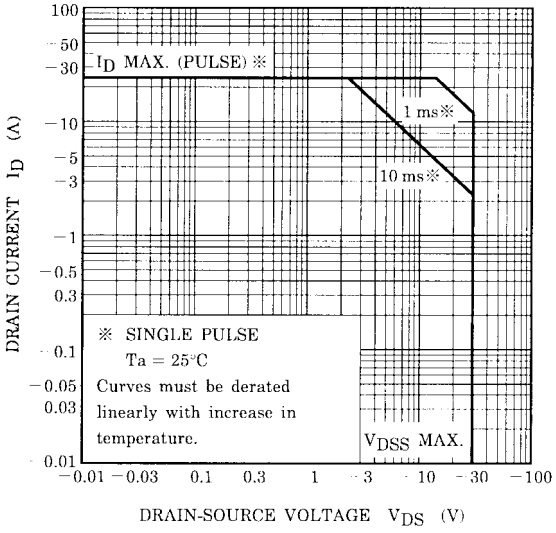

DYNAMIC INPUT / OUTPUT



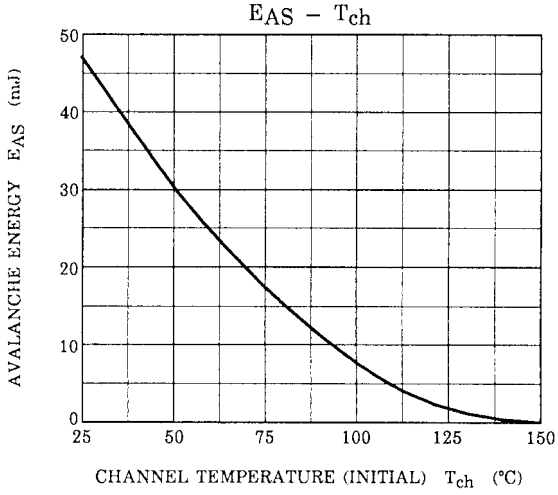
$r_{th}$ – $t_w$

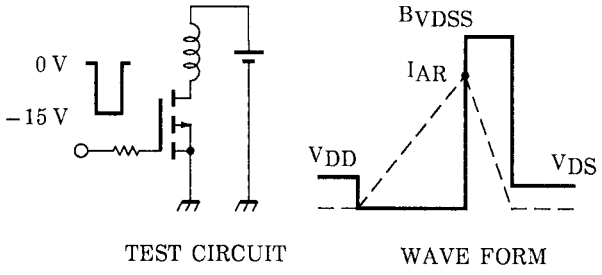



SAFE OPERATING AREA




$E_{AS}$ – $T_{ch}$




$T_{ch}$ = 25°C (Initial)
Peak $I_{AR}$ = −6 A, $R_G$ = 25 Ω $E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}}\right)$
$V_{DD}$ = −16 V, L = 1.0 mH

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