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

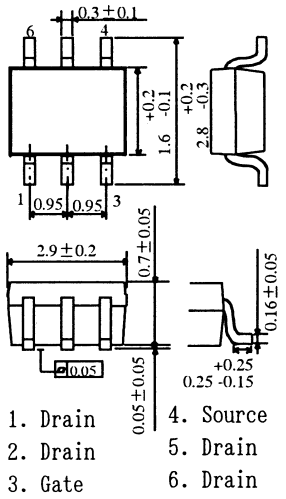
# TPC6104

Notebook PC Applications

Portable Equipment Applications

- Low drain-source ON resistance: $R_{DS\ (ON)}$ = 33 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 12 S (typ.)
- Low leakage current: $I_{DSS}$ = −10 μA (max) ($V_{DS}$ = −20 V)
- Enhancement mode: $V_{th}$ = −0.5 to −1.2 V ($V_{DS}$ = −10 V, $I_D$ = −200 μA)

Unit: mm



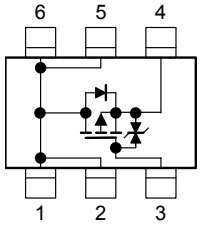

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-3T1A |

Weight: 0.011 g (typ.)

## Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain-source voltage | | $V_{DSS}$ | −20 | V |
| Drain-gate voltage ($R_{GS}$ = 20 kΩ) | | $V_{DGR}$ | −20 | V |
| Gate-source voltage | | $V_{GSS}$ | ±8 | V |
| Drain current | DC (Note 1) | $I_D$ | −5.5 | A |
| | Pulse (Note 1) | $I_{DP}$ | −22 | |
| Drain power dissipation (t = 5 s) (Note 2a) | | $P_D$ | 2.2 | W |
| Drain power dissipation (t = 5 s) (Note 2b) | | $P_D$ | 0.7 | W |
| Single pulse avalanche energy (Note 3) | | $E_{AS}$ | 4.9 | mJ |
| Avalanche current | | $I_{AR}$ | −2.75 | A |
| Repetitive avalanche energy (Note 4) | | $E_{AR}$ | 0.22 | mJ |
| Channel temperature | | $T_{ch}$ | 150 | °C |
| Storage temperature range | | $T_{stg}$ | −55~150 | °C |

## Circuit Configuration



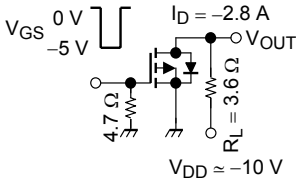

## Thermal Characteristics

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

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

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

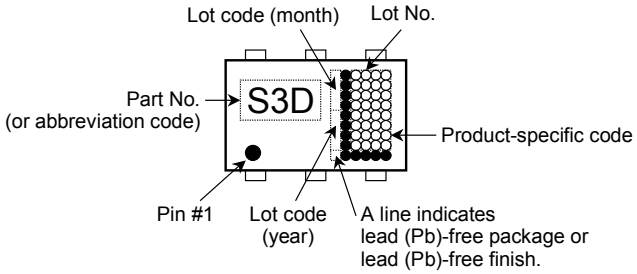
## Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±8 V, $V_{DS}$ = 0 V | — | — | ±10 | μA |
| Drain cut-off current | | $I_{DSS}$ | $V_{DS}$ = −20 V, $V_{GS}$ = 0 V | — | — | −10 | μA |
| Drain-source breakdown voltage | | $V_{(BR)\ DSS}$ | $I_D$ = −10 mA, $V_{GS}$ = 0 V | −20 | — | — | V |
| | | $V_{(BR)\ DSX}$ | $I_D$ = −10 mA, $V_{GS}$ = 8 V | −12 | — | — | |
| Gate threshold voltage | | $V_{th}$ | $V_{DS}$ = −10 V, $I_D$ = −200 μA | −0.5 | — | −1.2 | V |
| Drain-source ON resistance | | $R_{DS\ (ON)}$ | $V_{GS}$ = −1.8 V, $I_D$ = −1.4 A | — | 78 | 120 | mΩ |
| | | $R_{DS\ (ON)}$ | $V_{GS}$ = −2.5 V, $I_D$ = −2.8 A | — | 49 | 60 | |
| | | $R_{DS\ (ON)}$ | $V_{GS}$ = −4.5 V, $I_D$ = −2.8 A | — | 33 | 40 | |
| Forward transfer admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = −10 V, $I_D$ = −2.8 A | 6 | 12 | — | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = −10 V, $V_{GS}$ = 0 V, f = 1 MHz | — | 1430 | — | pF |
| Reverse transfer capacitance | | $C_{rss}$ | | — | 200 | — | |
| Output capacitance | | $C_{oss}$ | | — | 240 | — | |
| Switching time | Rise time | $t_r$ |   Duty ≦ 1%, $t_w$ = 10 μs | — | 8.5 | — | ns |
| | Turn-on time | $t_{on}$ | | — | 15 | — | |
| | Fall time | $t_f$ | | — | 20 | — | |
| | Turn-off time | $t_{off}$ | | — | 66 | — | |
| Total gate charge (gate-source plus gate-drain) | | $Q_g$ | $V_{DD}$ ≃ −16 V, $V_{GS}$ = −5 V, $I_D$ = −5.5 A | — | 19 | — | nC |
| Gate-source charge | | $Q_{gs}$ | | — | 14 | — | |
| Gate-drain (“miller”) charge | | $Q_{gd}$ | | — | 5 | — | |

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

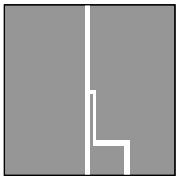
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Drain reverse current | Pulse (Note 1) | $I_{DRP}$ | — | — | — | −22 | A |
| Forward voltage (diode) | | $V_{DSF}$ | $I_{DR}$ = −5.5 A, $V_{GS}$ = 0 V | — | — | 1.2 | V |

## Marking (Note 5)



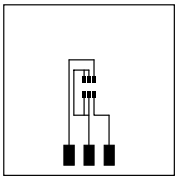

Note 1: Ensure that the channel temperature does not exceed 150°C.

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



FR-4
25.4 × 25.4 × 0.8
Unit: (mm)

(a)



FR-4
25.4 × 25.4 × 0.8
Unit: (mm)

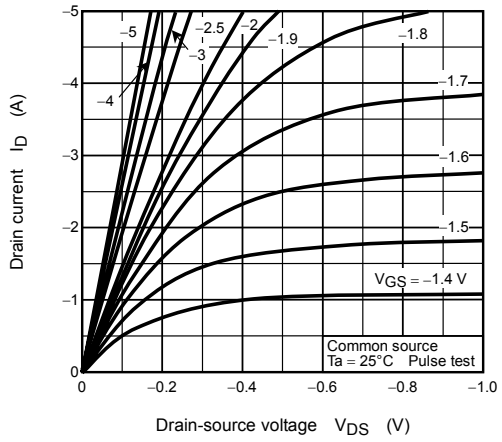
(b)

Note 3: $V_{DD}$ = −16 V, $T_{ch}$ = 25°C (initial), L = 0.5 mH, $R_G$ = 25 Ω, $I_{AR}$ = −2.75 A

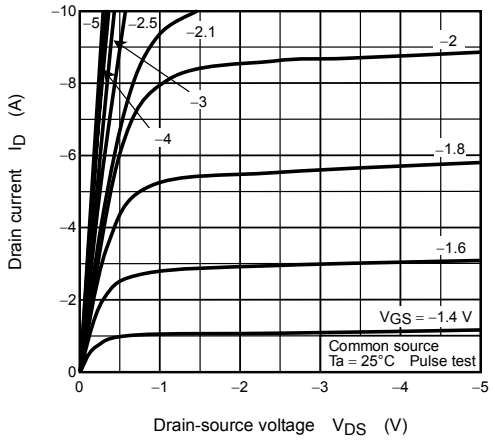
Note 4: Repetitive rating;:pulse width limited by maximum channel temperature

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

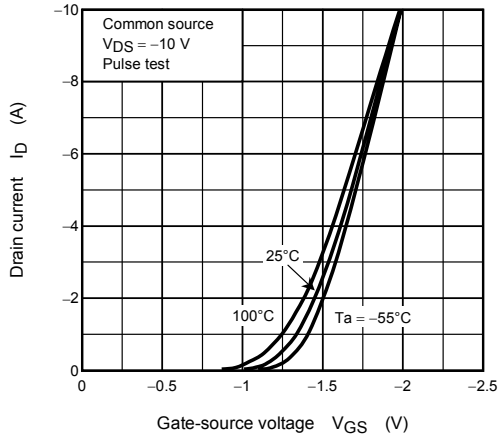
$I_D - V_{DS}$



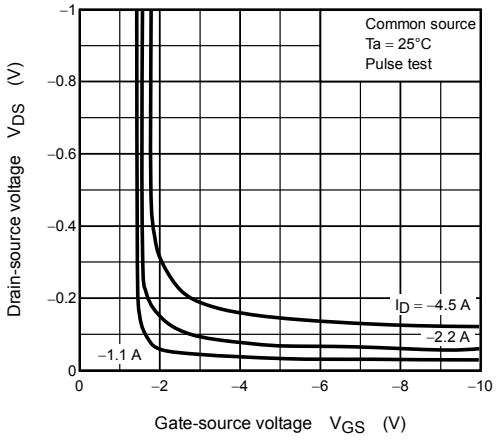

$I_D - V_{DS}$



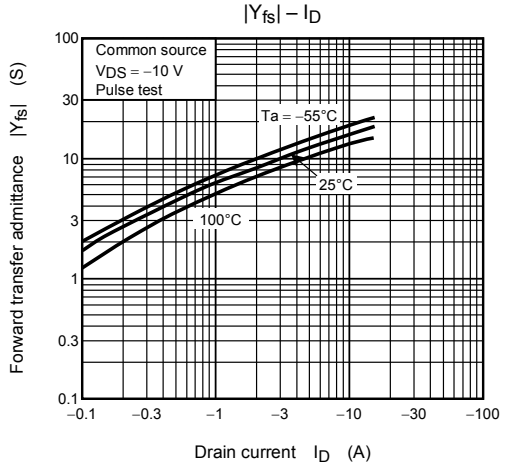

$I_D - V_{GS}$



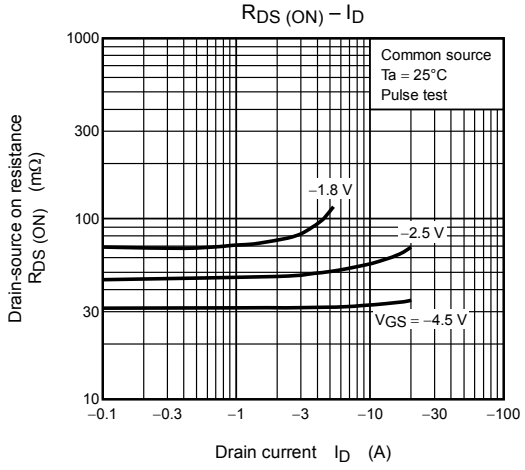

$V_{DS} - V_{GS}$



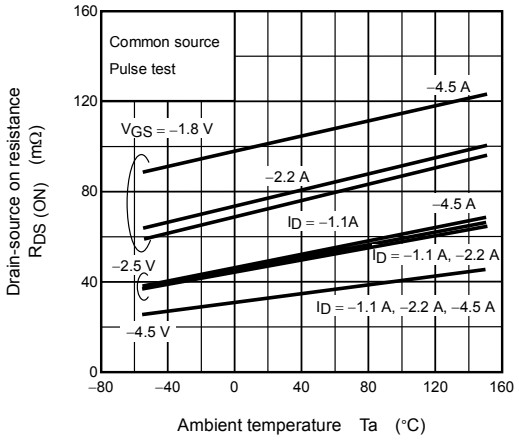

$|Y_{fs}| - I_D$



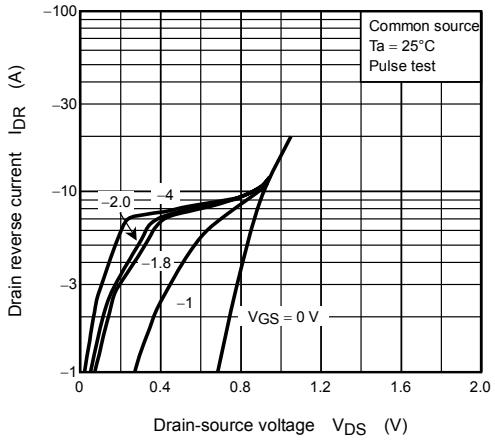

$R_{DS\ (ON)} - I_D$



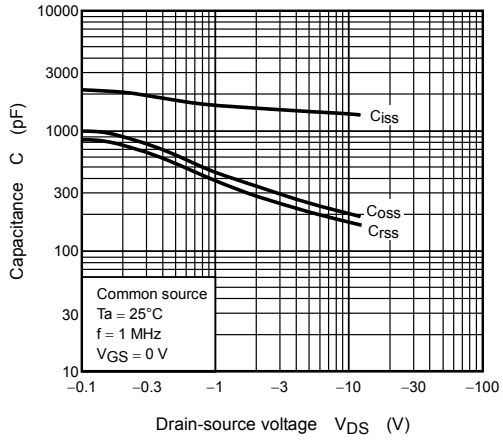
$R_{DS\ (ON)}$ – Ta



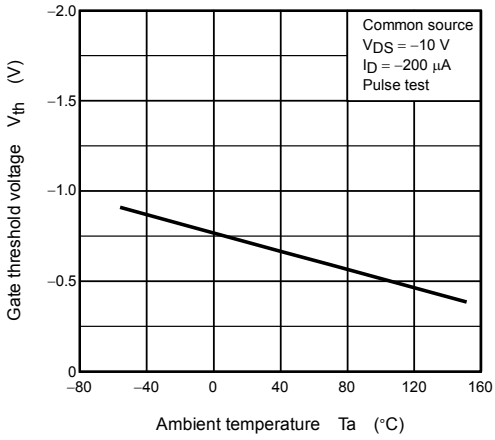

$I_{DR}$ – $V_{DS}$



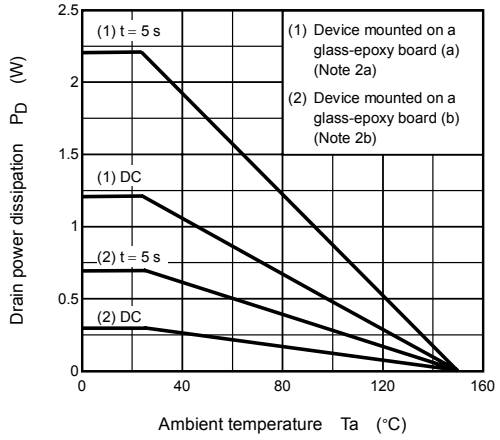

Capacitance – $V_{DS}$



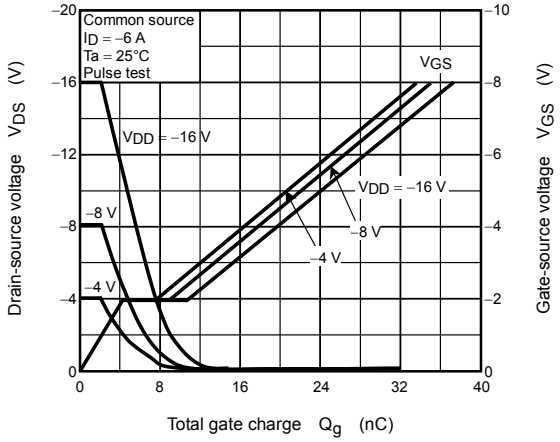

$V_{th}$ – Ta



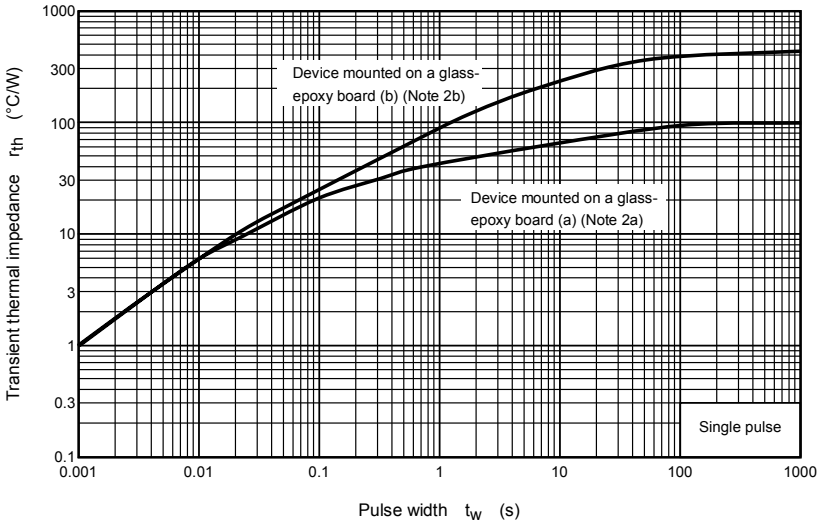

$P_D$ – Ta



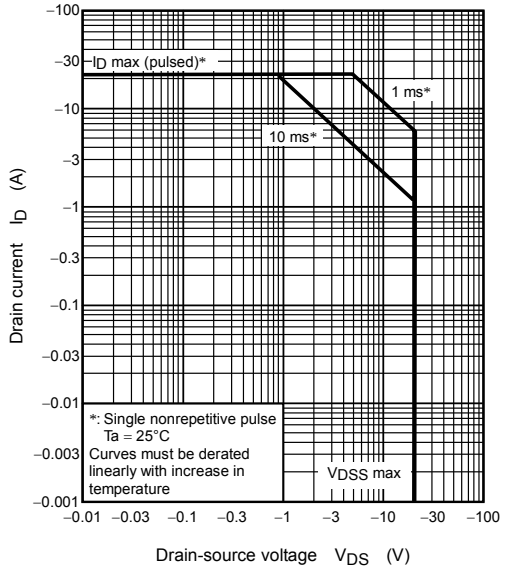

Dynamic input/output characteristics



$r_{th} - t_w$




Safe operating area



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