

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

TPC6006-H

Notebook PC Applications

Portable Equipment Applications

- Small footprint due to small and thin package
- High-speed switching
- Small gate charge: $Q_{sw} = 2.4 \text{ nC (typ.)}$
- Low drain-source ON-resistance: $R_{DS(ON)} = 59 \text{ m}\Omega \text{ (typ.)}$
- High forward transfer admittance: $|Y_{fs}| = 7 \text{ S (typ.)}$
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A (max) (}V_{DS} = 40 \text{ V)}$
- Enhancement mode: $V_{th} = 1.1 \text{ to } 2.3 \text{ V (}V_{DS} = 10 \text{ V, } I_D = 1 \text{ mA)}$

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

| Characteristics | | Symbol | Rating | Unit |
|--|------------------------------------|-----------|------------|------------------|
| Drain-source voltage | | V_{DSS} | 40 | V |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | | V_{DGR} | 40 | V |
| Gate-source voltage | | V_{GSS} | ± 20 | V |
| Drain current | DC (Note 1) | I_D | 3.9 | A |
| | Pulse (Note 1) | I_{DP} | 15.6 | |
| Drain power dissipation | ($t = 5 \text{ s}$) (Note 2a) | P_D | 2.2 | W |
| Drain power dissipation | ($t = 5 \text{ s}$) (Note 2b) | P_D | 0.7 | W |
| Single pulse avalanche energy | (Note 3) | E_{AS} | 7 | mJ |
| Avalanche current | | I_{AR} | 3.9 | A |
| Repetitive avalanche energy | (Note 4) | E_{AR} | 0.22 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | | T_{stg} | -55 to 150 | $^\circ\text{C}$ |

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.).

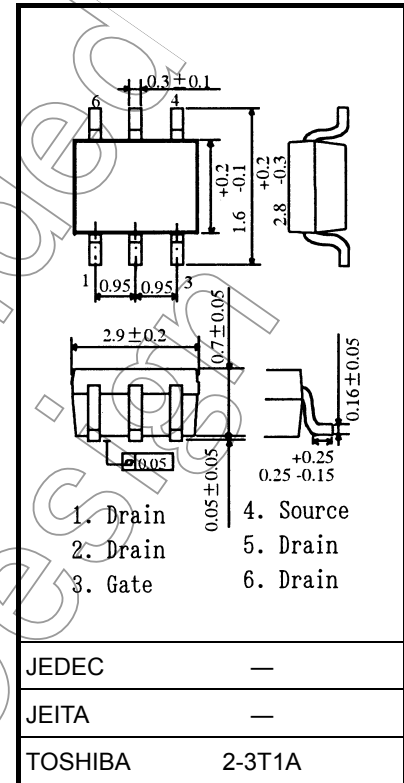
Thermal Characteristics

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

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

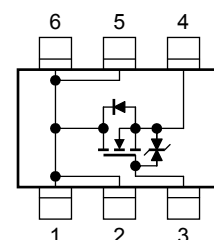
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm

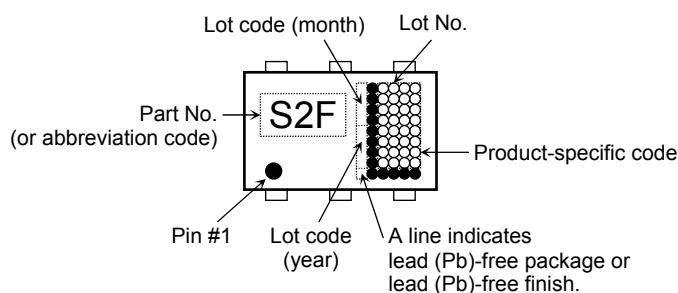


Weight: 0.011 g (typ.)

Circuit Configuration



Marking (Note 5)



Electrical Characteristics (Ta = 25°C)

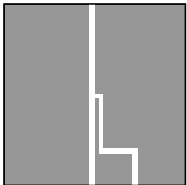
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|----------------|---|-----|------|----------|------------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$ | — | — | ± 10 | μA |
| Drain cut-OFF current | | I_{DSS} | $V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}$ | — | — | 10 | μA |
| Drain-source breakdown voltage | | $V_{(BR) DSS}$ | $I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$ | 40 | — | — | V |
| | | $V_{(BR) DSX}$ | $I_D = 10 \text{ mA}, V_{GS} = -20 \text{ V}$ | 25 | — | — | |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$ | 1.1 | — | 2.3 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = 4.5 \text{ V}, I_D = 1.9 \text{ A}$ | — | 78 | 100 | $\text{m}\Omega$ |
| | | | $V_{GS} = 10 \text{ V}, I_D = 1.9 \text{ A}$ | — | 59 | 75 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10 \text{ V}, I_D = 1.9 \text{ A}$ | 3.5 | 7 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | — | 251 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 18 | — | |
| Output capacitance | | C_{oss} | | — | 73 | — | |
| Switching time | Rise time | t_r | <p>$V_{GS} = 10 \text{ V}, 0 \text{ V}$</p> <p>$I_D = 1.9 \text{ A}$</p> <p>$V_{DD} \approx 20 \text{ V}$</p> <p>Duty $\leq 1\%$, $t_w = 10 \mu\text{s}$</p> | — | 4 | — | ns |
| | Turn-ON time | t_{on} | | — | 9 | — | |
| | Fall time | t_f | | — | 3 | — | |
| | Turn-OFF time | t_{off} | | — | 18 | — | |
| Total gate charge (gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 32 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 3.9 \text{ A}$ | — | 4.4 | — | nC |
| | | | $V_{DD} \approx 32 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 3.9 \text{ A}$ | — | 2.4 | — | |
| Gate-source charge 1 | | Q_{gs1} | $V_{DD} \approx 32 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 3.9 \text{ A}$ | — | 1.0 | — | |
| Gate-drain ("Miller") charge | | Q_{gd} | | — | 0.8 | — | |
| Gate switch charge | | Q_{SW} | | — | 1.3 | — | |

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------------|-----------|---|-----|------|------|------|
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 15.6 | A |
| Forward voltage (Diode) | V_{DSF} | $I_{DR} = 3.9\text{ A}$, $V_{GS} = 0\text{ V}$ | — | — | -1.2 | V |

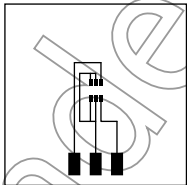
Note 1: Ensure that the channel temperature does not exceed 150°C.

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



(a)

FR-4
25.4 × 25.4 × 0.8
Unit: (mm)



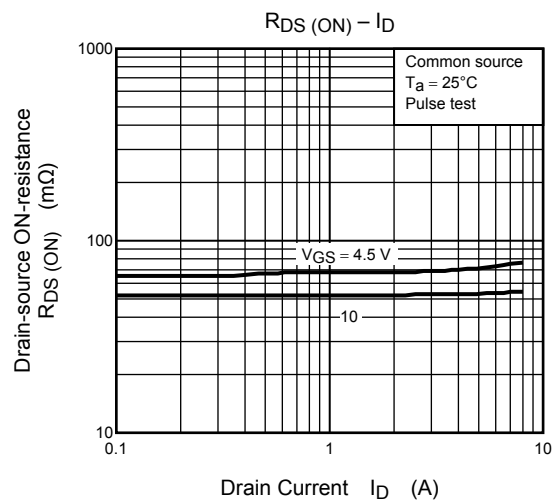
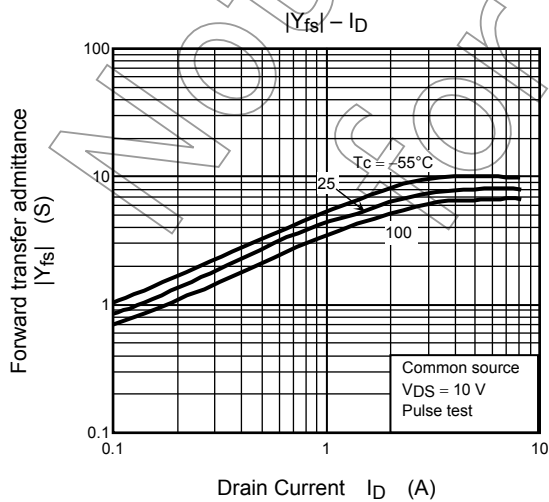
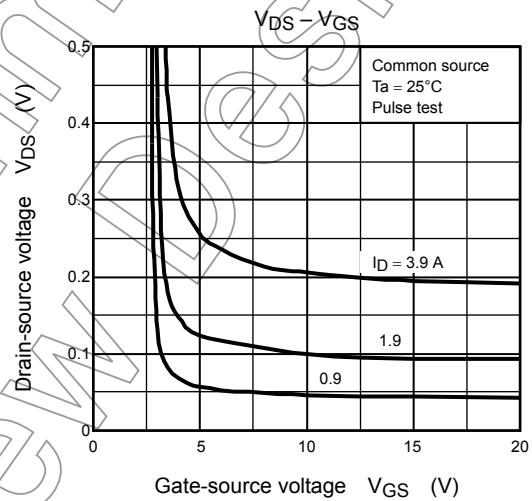
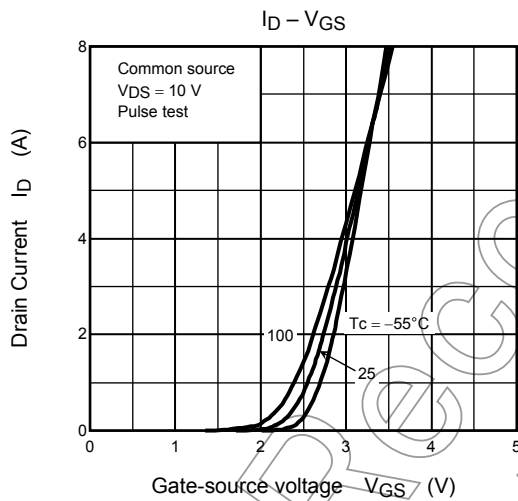
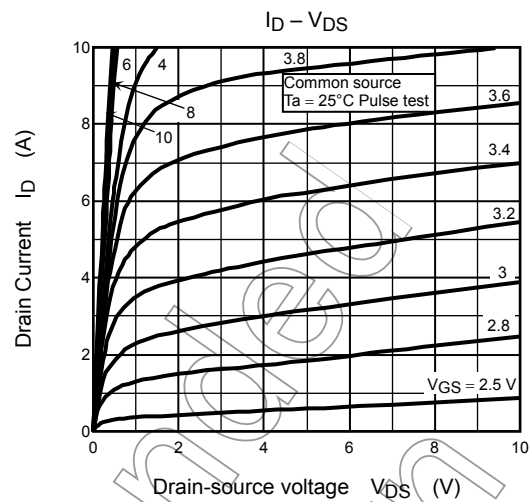
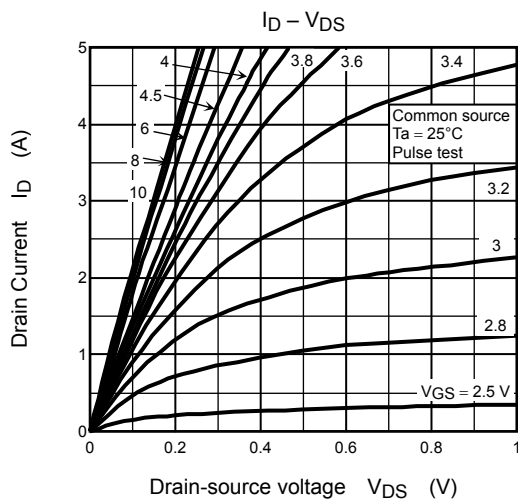
(b)

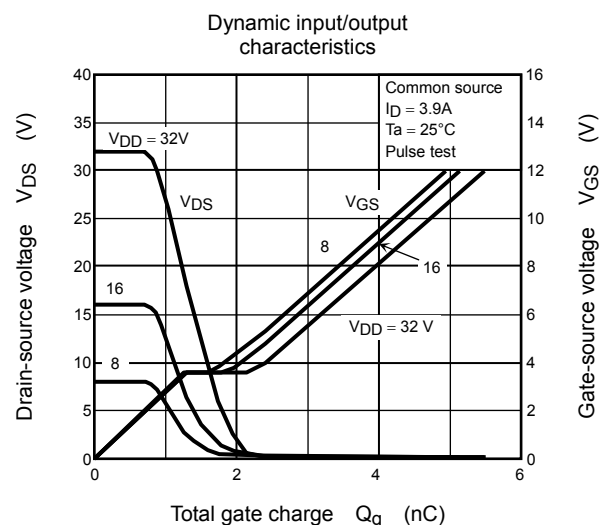
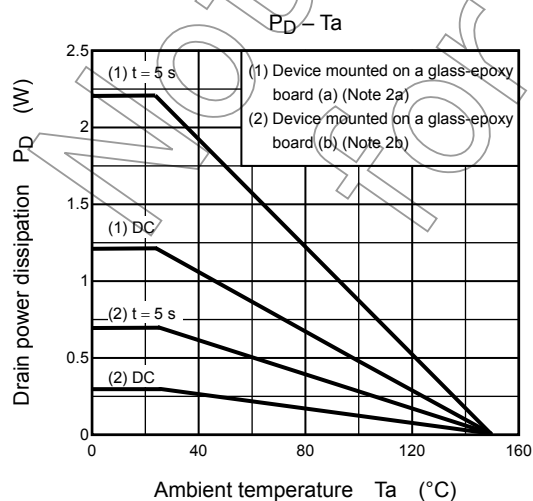
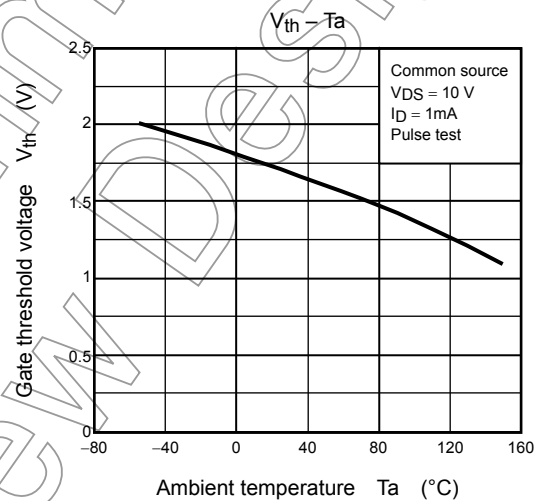
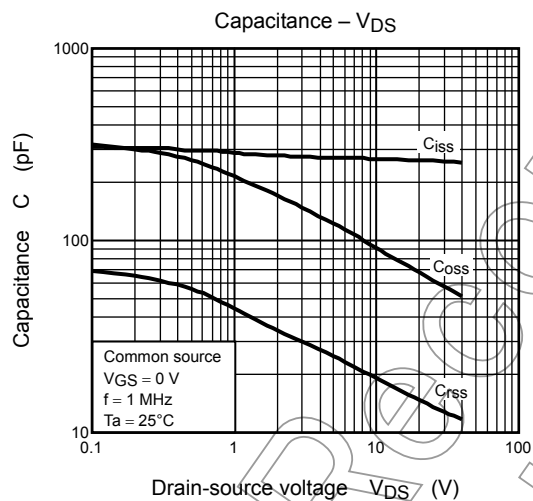
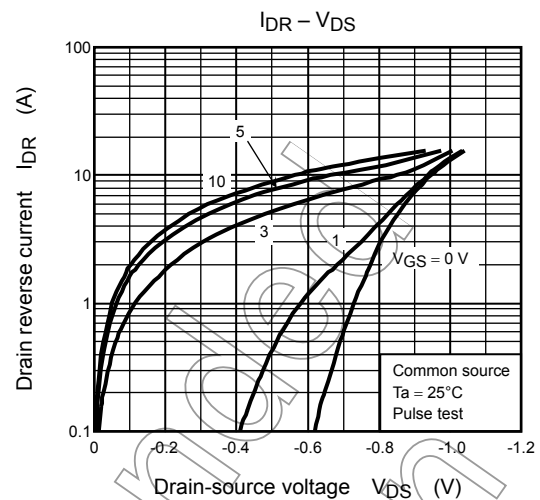
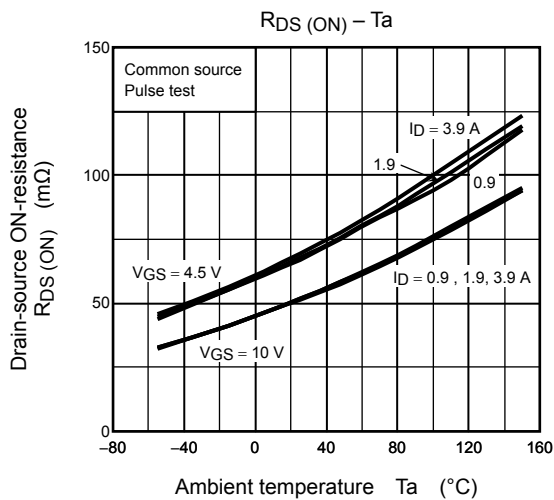
FR-4
25.4 × 25.4 × 0.8
Unit: (mm)

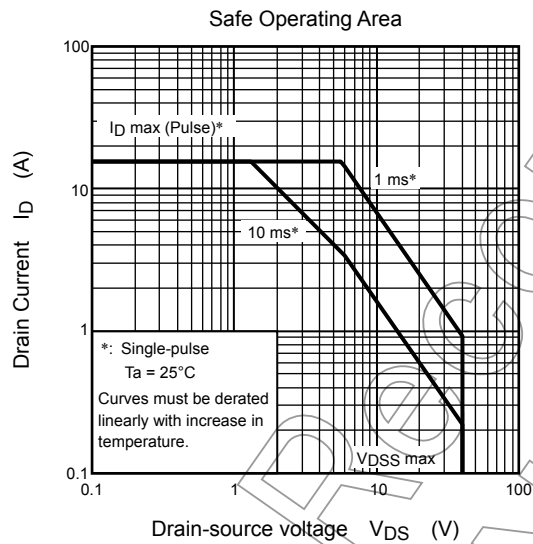
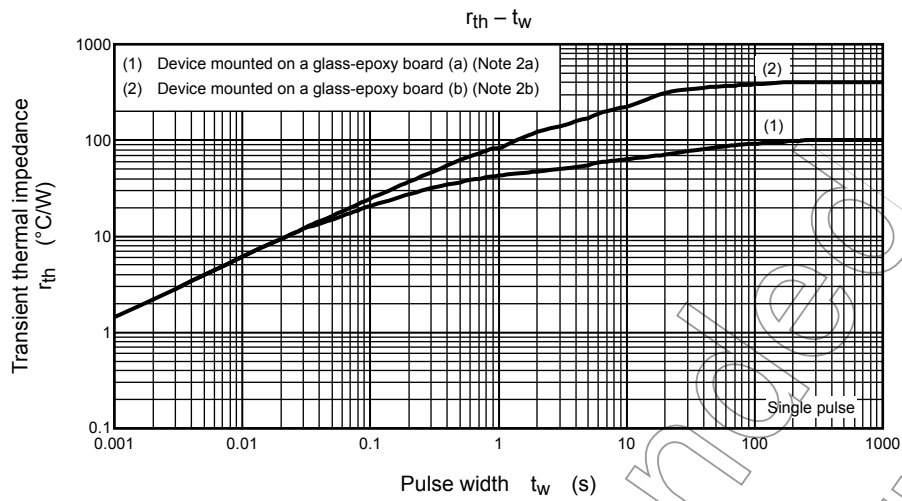
Note 3: $V_{DD} = 24\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 0.5\text{ mH}$, $R_G = 25\ \Omega$, $I_{AR} = 3.9\text{ A}$

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

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







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20070701-EN

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