

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

TPCA8011-H

High Efficiency DC/DC Converter Applications

Notebook PC Applications

Portable-Equipment Applications

- Small footprint due to a small and thin package
- High speed switching
- Small gate charge: $Q_{SW} = 16 \text{ nC (typ.)}$
- Low drain-source ON-resistance: $R_{DS(ON)} = 2.7 \text{ m}\Omega \text{ (typ.)}$
- High forward transfer admittance: $|Y_{fs}| = 120 \text{ S (typ.)}$
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A (max) (}V_{DS} = 20 \text{ V)}$
- Enhancement mode: $V_{th} = 0.6 \text{ to } 1.3 \text{ V (}V_{DS} = 10 \text{ V, } I_D = 200 \text{ }\mu\text{A)}$

Absolute Maximum Ratings (Ta = 25°C)

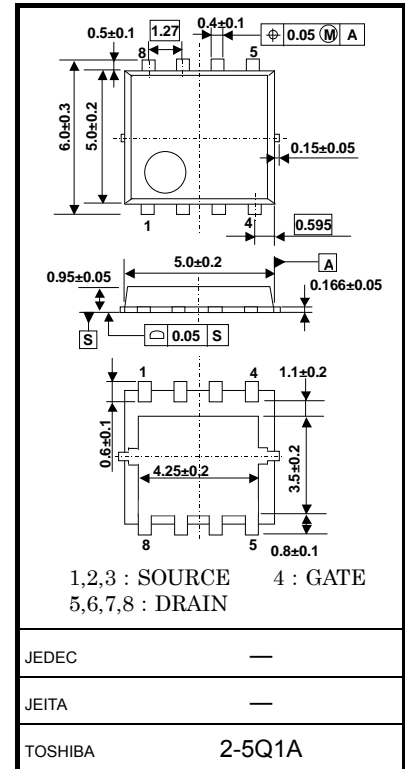
| Characteristic | | Symbol | Rating | Unit |
|---|-----------------|-----------|------------|------|
| Drain-source voltage | | V_{DSS} | 20 | V |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | | V_{DGR} | 20 | V |
| Gate-source voltage | | V_{GSS} | ± 12 | V |
| Drain current | DC (Note 1) | I_D | 40 | A |
| | Pulsed (Note 1) | I_{DP} | 120 | |
| Drain power dissipation ($T_c=25^\circ\text{C}$) | | P_D | 45 | W |
| Drain power dissipation ($t = 10 \text{ s}$) (Note 2a) | | P_D | 2.8 | W |
| Drain power dissipation ($t = 10 \text{ s}$) (Note 2b) | | P_D | 1.6 | W |
| Single-pulse avalanche energy (Note 3) | | E_{AS} | 208 | mJ |
| Avalanche current | | I_{AR} | 40 | A |
| Repetitive avalanche energy ($T_c=25^\circ\text{C}$) (Note 4) | | E_{AR} | 2.0 | mJ |
| Channel temperature | | T_{ch} | 150 | °C |
| Storage temperature range | | T_{stg} | -55 to 150 | °C |

Note: For Notes 1 to 4, refer to 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.).

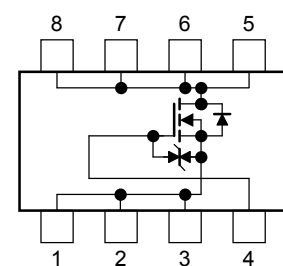
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

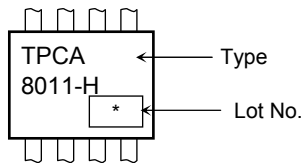
Circuit Configuration



Thermal Characteristics

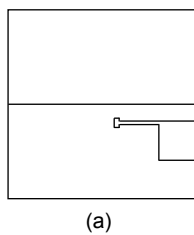
| Characteristic | Symbol | Max | Unit |
|---|----------------|------|--------------------|
| Thermal resistance, channel to case ($T_c=25^\circ\text{C}$) | $R_{th(ch-c)}$ | 2.78 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient ($t = 10\text{ s}$) (Note 2a) | $R_{th(ch-a)}$ | 44.6 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient ($t = 10\text{ s}$) (Note 2b) | $R_{th(ch-a)}$ | 78.1 | $^\circ\text{C/W}$ |

Marking (Note 5)

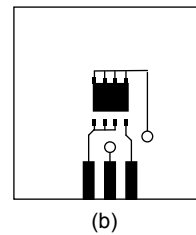


Note 1: The channel temperature should not exceed 150°C during use.

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



FR-4
 $25.4 \times 25.4 \times 0.8$
 (Unit: mm)

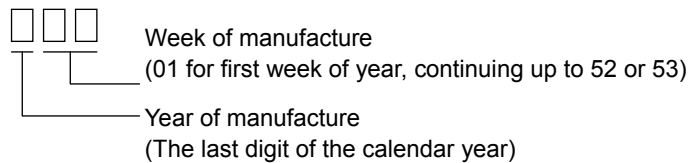


FR-4
 $25.4 \times 25.4 \times 0.8$
 (Unit: mm)

Note 3: $V_{DD} = 16\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$, $I_{AR} = 40\text{ A}$

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

Note 5: * Weekly code: (Three digits)

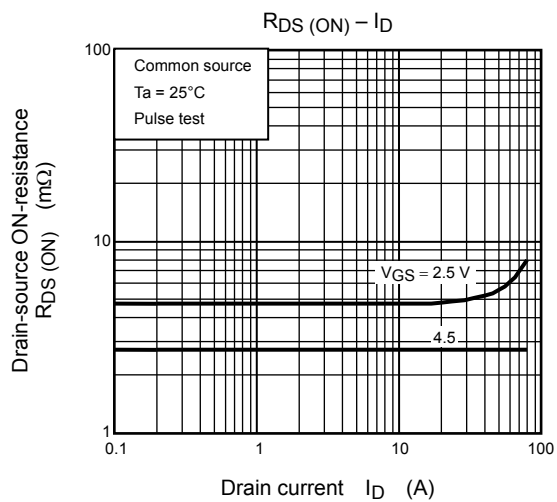
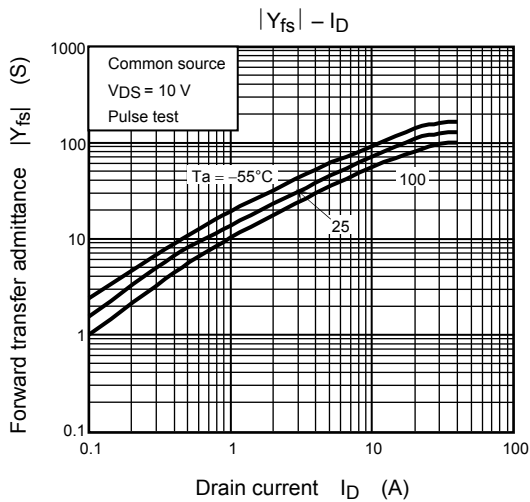
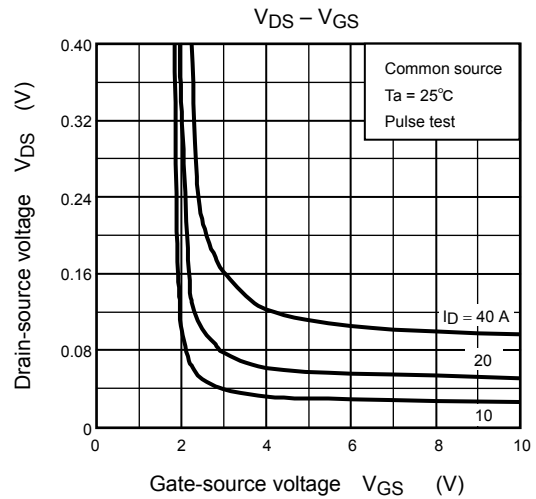
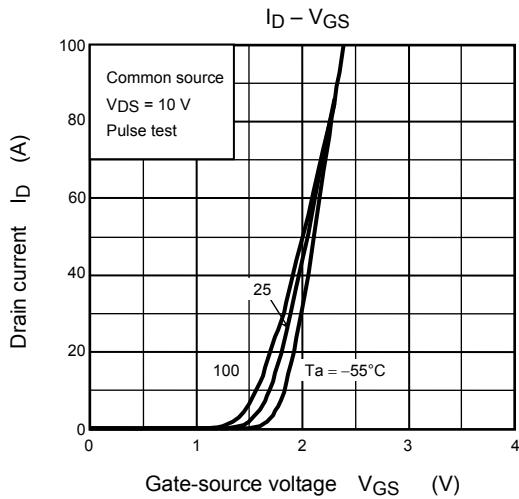
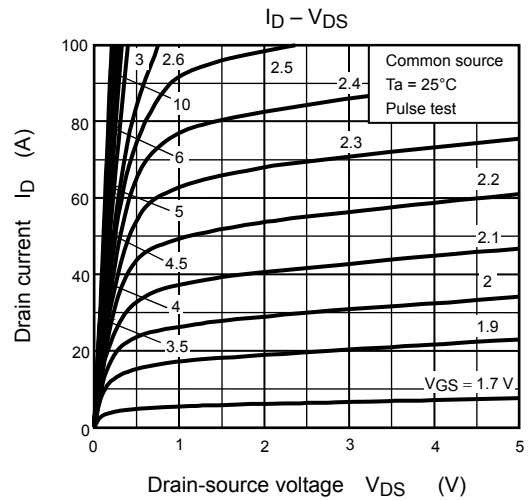
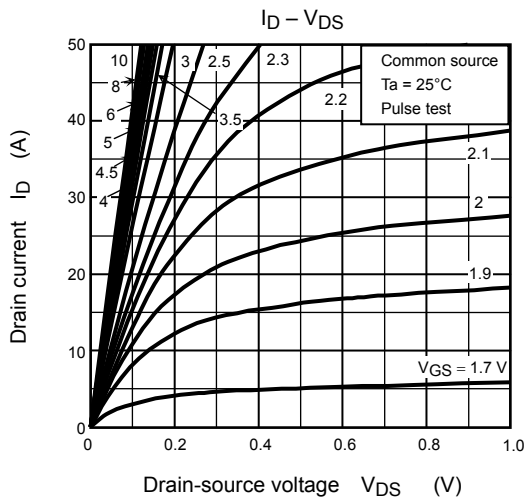


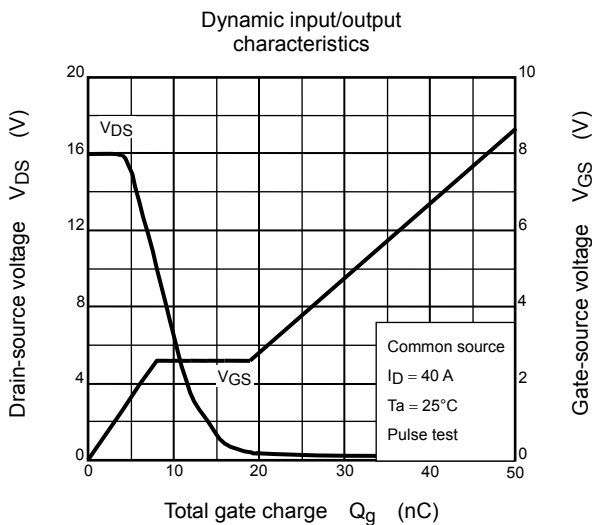
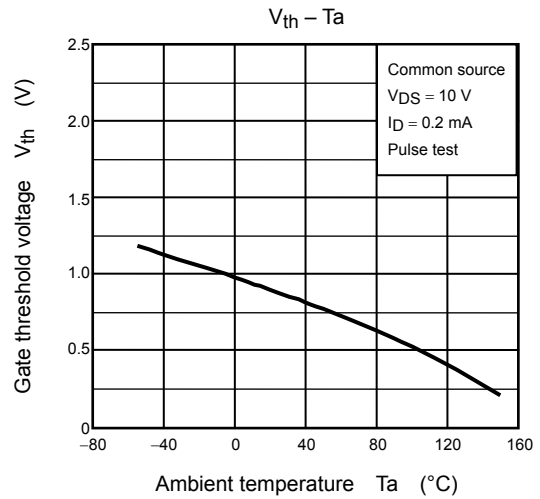
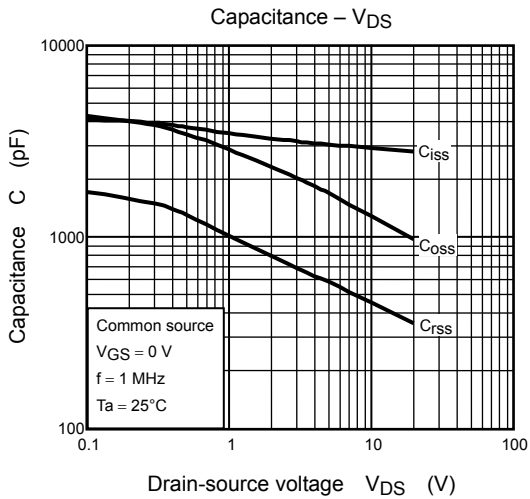
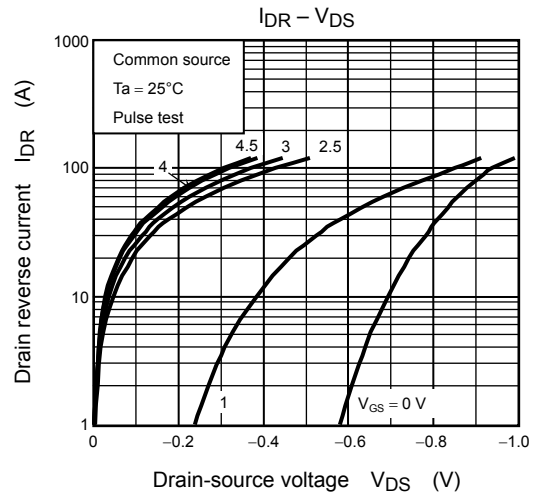
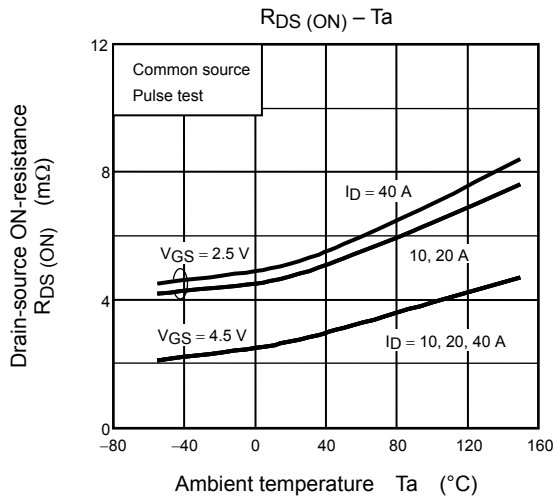
Electrical Characteristics (Ta = 25°C)

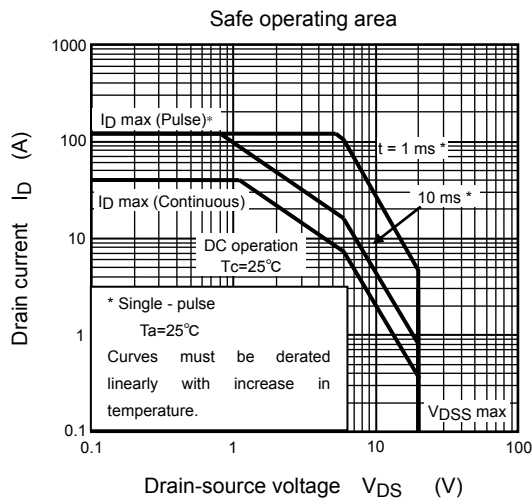
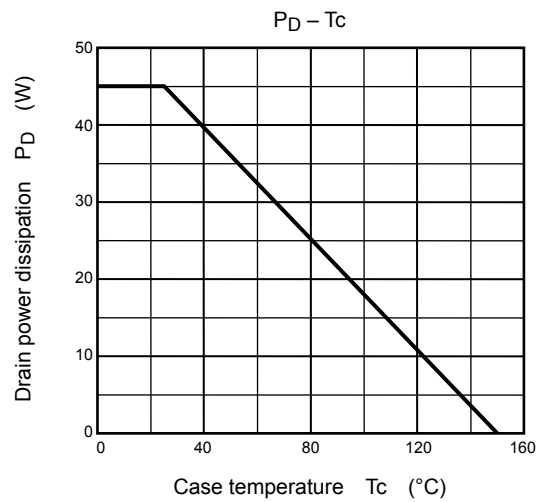
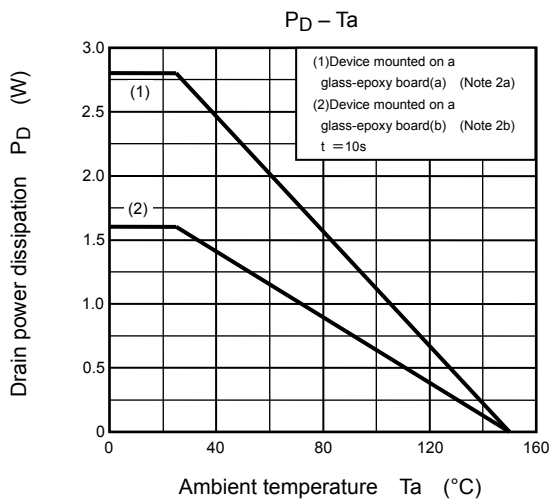
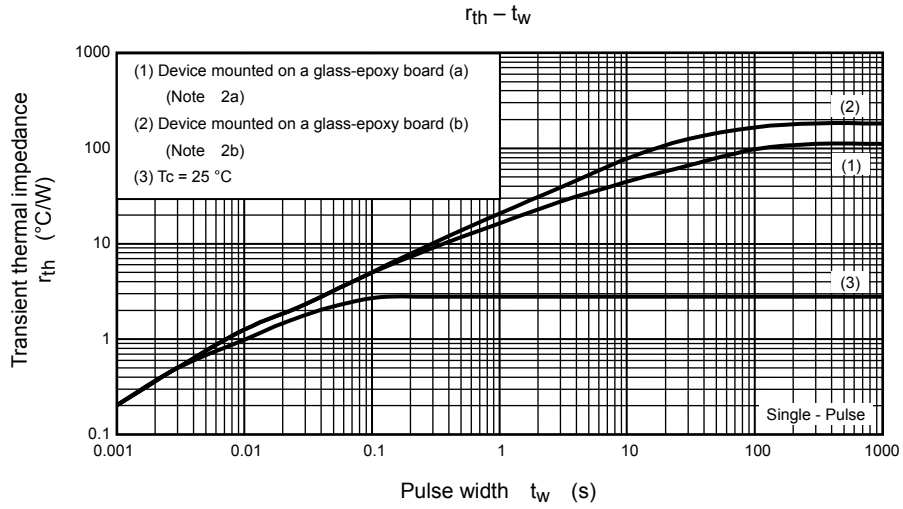
| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|--|-----|------|----------|------------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 10\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 10 | μA |
| Drain cutoff current | | I_{DSS} | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 10 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 20 | — | — | V |
| | | $V_{(BR)DSX}$ | $I_D = 10\text{ mA}, V_{GS} = -12\text{ V}$ | 8 | — | — | |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 200\ \mu\text{A}$ | 0.6 | — | 1.3 | V |
| Drain-source ON-resistance | | $R_{DS(ON)}$ | $V_{GS} = 2.5\text{ V}, I_D = 20\text{ A}$ | — | 4.7 | 7.5 | $\text{m}\Omega$ |
| | | | $V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$ | — | 2.7 | 3.5 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 20\text{ A}$ | 60 | 120 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 2900 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 430 | — | |
| Output capacitance | | C_{oss} | | — | 1300 | — | |
| Switching time | Rise time | t_r | <p>$V_{GS} = 5\text{ V}, 0\text{ V}$ $I_D = 20\text{ A}$ V_{OUT} $4.7\ \Omega$ $R_L = 0.5\ \Omega$ $V_{DD} \approx 10\text{ V}$ Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p> | — | 13 | — | ns |
| | Turn-on time | t_{on} | | — | 24 | — | |
| | Fall time | t_f | | — | 22 | — | |
| | Turn-off time | t_{off} | | — | 61 | — | |
| Total gate charge (gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 16\text{ V}, V_{GS} = 5\text{ V}, I_D = 40\text{ A}$ | — | 32 | — | nC |
| Gate-source charge 1 | | Q_{gs1} | $V_{DD} \approx 16\text{ V}, V_{GS} = 5\text{ V}, I_D = 40\text{ A}$ | — | 7.7 | — | |
| Gate-drain ("Miller") charge | | Q_{gd} | | — | 11 | — | |
| Gate switch charge | | Q_{sw} | | — | 16 | — | |

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

| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------------|----------------|-----------|---|-----|------|------|------|
| Drain reverse current | Pulse (Note 1) | I_{DRP} | — | — | — | 120 | A |
| Forward voltage (diode) | | V_{DSF} | $I_{DR} = 40\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.2 | V |







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