

TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (U-MOSVI-H)

TPCA8052-H

Switching Regulator Applications

Motor Drive Applications

DC-DC Converter Applications

- Small footprint due to a small and thin package
- High-speed switching
- Small gate charge: $Q_{SW} = 6.8 \text{ nC}$ (typ.)
- Low drain-source ON-resistance: $R_{DS(ON)} = 7.2 \text{ m}\Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 58 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 10 \text{ }\mu\text{A}$ (max) ($V_{DS} = 40 \text{ V}$)
- Enhancement mode: $V_{th} = 1.3 \text{ to } 2.3 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 0.2 \text{ mA}$)

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

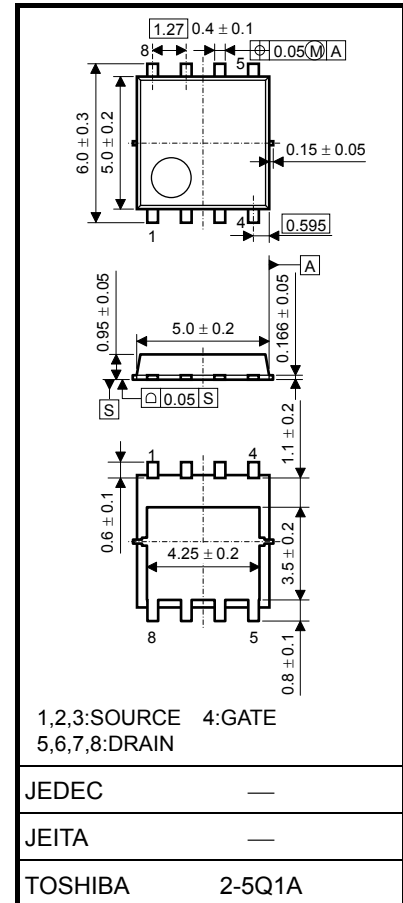
| Characteristic | | Symbol | Rating | Unit |
|---|-----------------|-----------|------------|------------------|
| Drain-source voltage | | V_{DSS} | 40 | V |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | | V_{DGR} | 40 | V |
| Gate-source voltage | | V_{GSS} | ± 20 | V |
| Drain current | DC (Note 1) | I_D | 20 | A |
| | Pulsed (Note 1) | I_{DP} | 60 | |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | | P_D | 30 | 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} | 37 | mJ |
| Avalanche current | | I_{AR} | 20 | A |
| Repetitive avalanche energy ($T_c = 25^\circ\text{C}$) (Note 4) | | E_{AR} | 2.24 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | | T_{stg} | -55 to 150 | $^\circ\text{C}$ |

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).

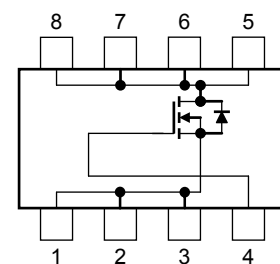
This transistor is an electrostatic-sensitive device. Handle with care.

Unit: mm



Weight: 0.069 g (typ.)

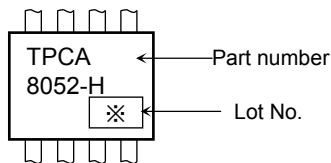
Circuit Configuration



Thermal Characteristics

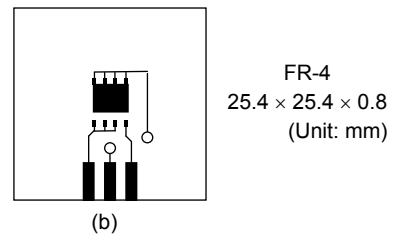
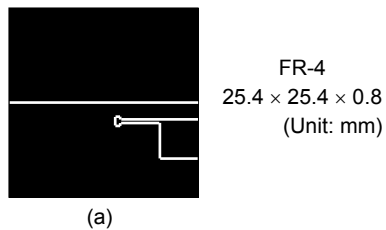
| Characteristic | Symbol | Max | Unit |
|---|-----------------|------|--------------------|
| Thermal resistance, channel to case ($T_c = 25^\circ\text{C}$) | $R_{th} (ch-c)$ | 4.17 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient ($t = 10\text{ s}$) (Note 2a) | $R_{th} (ch-a)$ | 44.6 | $^\circ\text{C/W}$ |
| 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: Ensure that the channel temperature does not exceed 150°C .

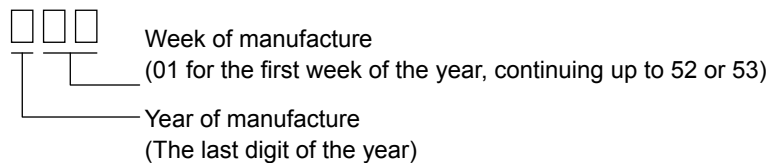
Note 2: (a) Device mounted on a glass-epoxy board (a) (b) Device mounted on a glass-epoxy board (b)



Note 3: $V_{DD} = 24\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 100\ \mu\text{H}$, $R_G = 25\ \Omega$, $I_{AR} = 20\text{ A}$

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

Note 5: * Weekly code: (Three digits)

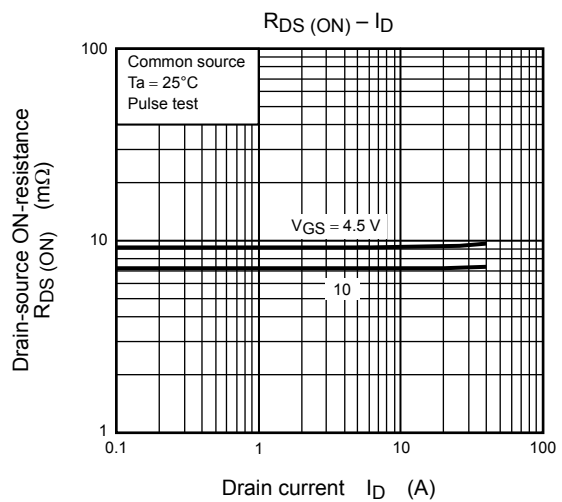
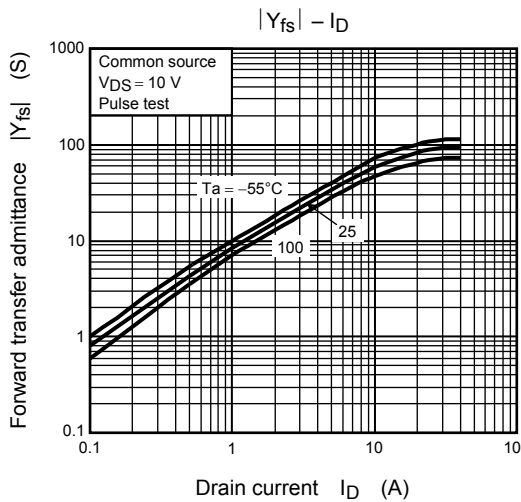
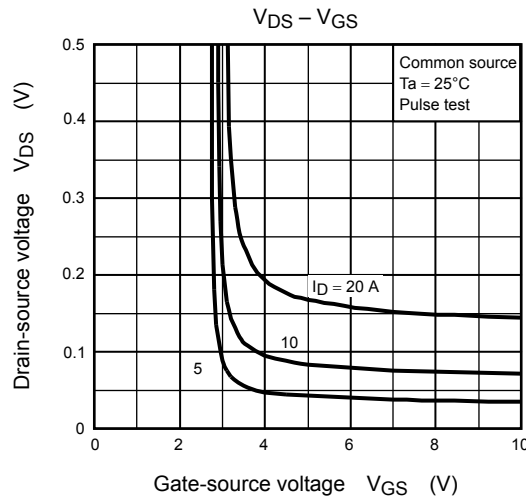
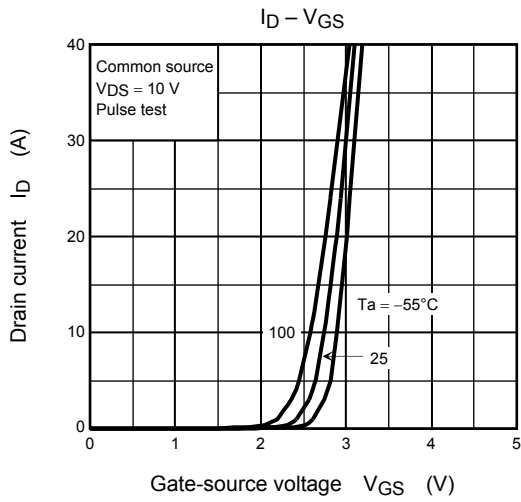
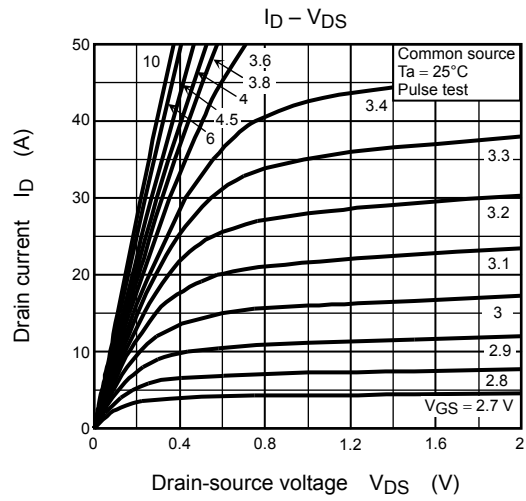
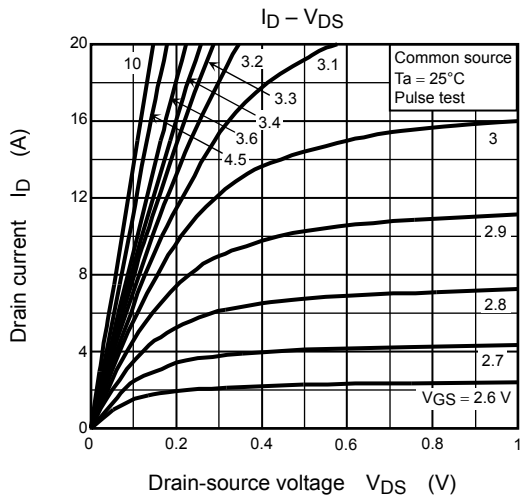


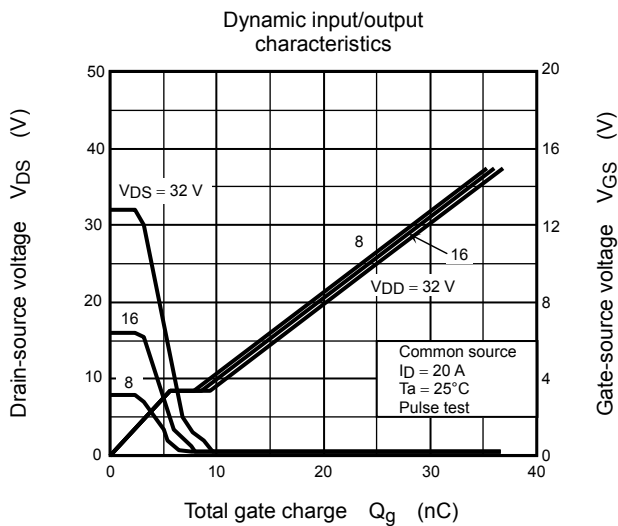
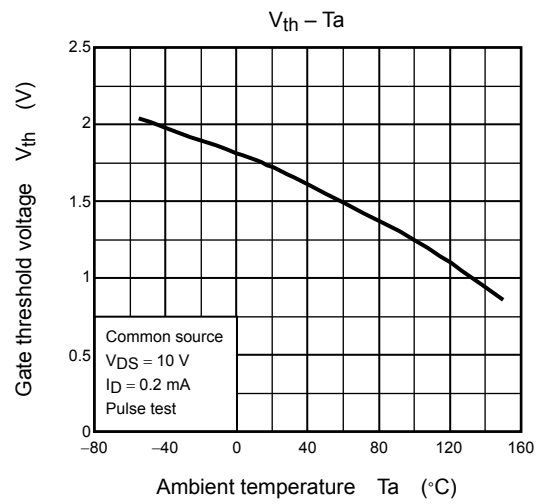
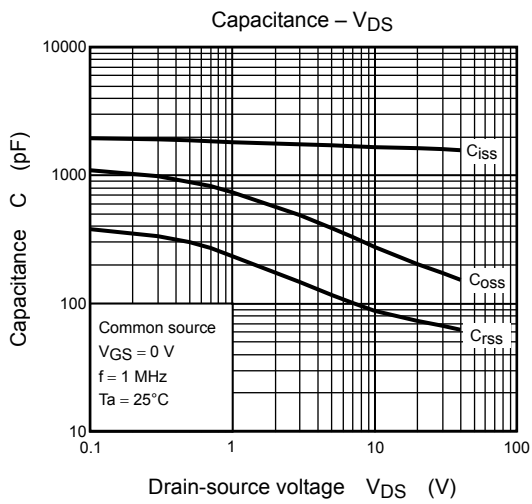
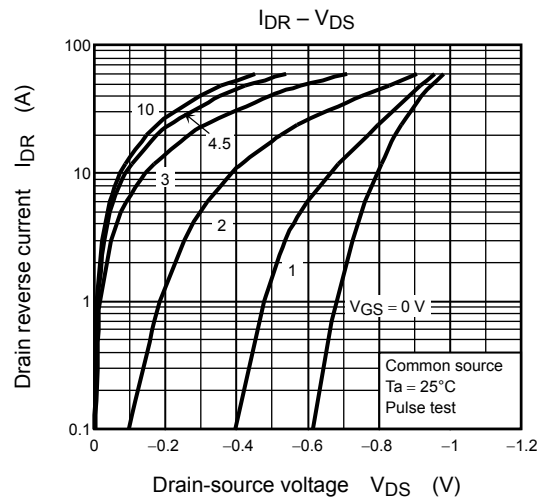
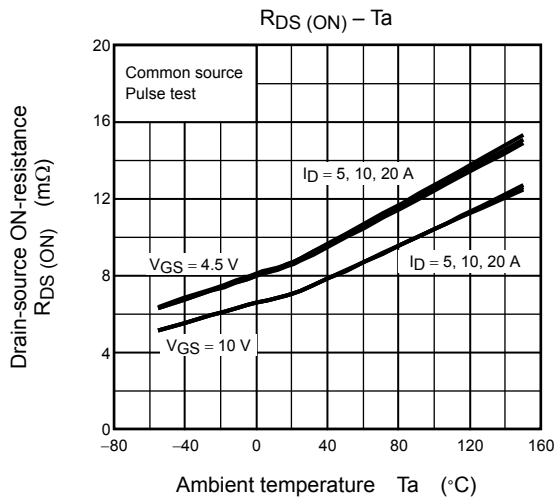
Electrical Characteristics (Ta = 25°C)

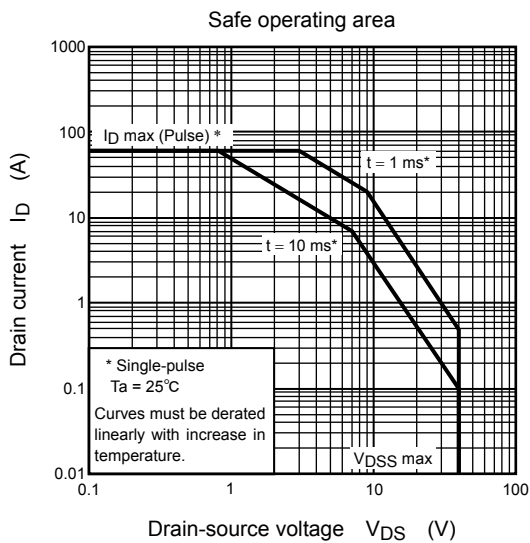
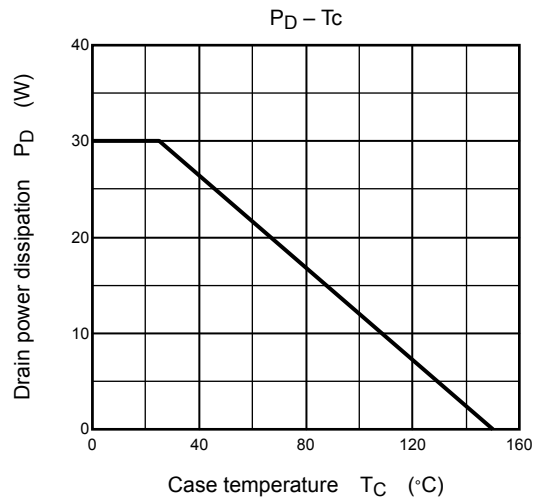
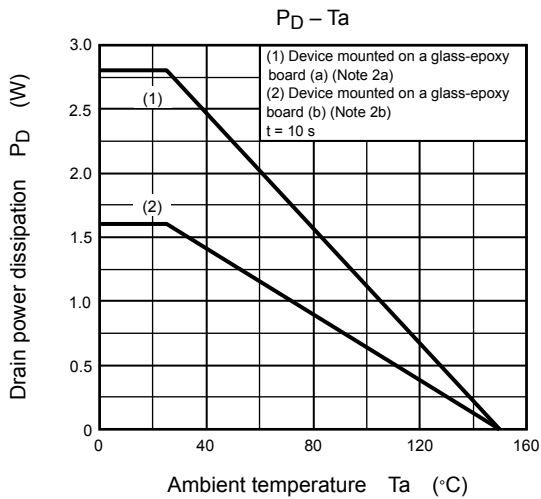
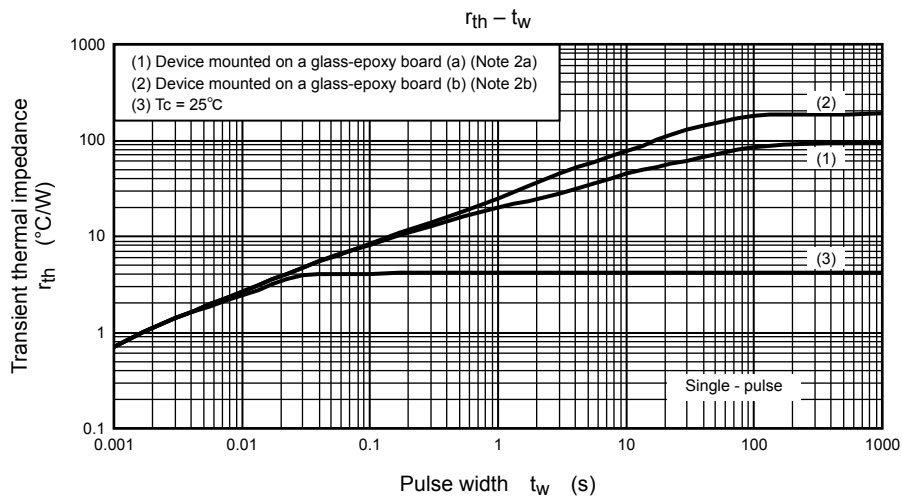
| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|---|-----|------|-----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 100 | nA |
| Drain cutoff current | | I_{DSS} | $V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 10 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 40 | — | — | V |
| | | $V_{(BR)DSX}$ | $I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$ | 23 | — | — | |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 0.2\text{ mA}$ | 1.3 | — | 2.3 | V |
| Drain-source ON-resistance | | $R_{DS(ON)}$ | $V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$ | — | 9.1 | 13.1 | m Ω |
| | | | $V_{GS} = 10\text{ V}, I_D = 10\text{ A}$ | — | 7.2 | 11.3 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 10\text{ A}$ | 29 | 58 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 1620 | 2110 | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 85 | 130 | |
| Output capacitance | | C_{oss} | | — | 280 | — | |
| Gate resistance | | r_g | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 5\text{ MHz}$ | — | 2.3 | 3.5 | Ω |
| Switching time | Rise time | t_r | <p>$V_{GS} = 10\text{ V}$ 0 V</p> <p>$I_D = 10\text{ A}$</p> <p>V_{OUT}</p> <p>$4.7\ \Omega$</p> <p>$R_L = 2.0\ \Omega$</p> <p>$V_{DD} \approx 20\text{ V}$</p> <p>Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p> | — | 2.4 | — | ns |
| | Turn-on time | t_{on} | | — | 8.4 | — | |
| | Fall time | t_f | | — | 8.0 | — | |
| | Turn-off time | t_{off} | | — | 35 | — | |
| Total gate charge (gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 32\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$ | — | 25 | — | nC |
| | | | $V_{DD} \approx 32\text{ V}, V_{GS} = 5\text{ V}, I_D = 20\text{ A}$ | — | 13 | — | |
| Gate-source charge 1 | | Q_{gs1} | $V_{DD} \approx 32\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$ | — | 5.6 | — | |
| Gate-drain ("Miller") charge | | Q_{gd} | | — | 3.8 | — | |
| Gate switch charge | | Q_{sw} | | — | 6.8 | — | |

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

| Characteristic | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------------|----------------|-----------|---|-----|------|------|------|
| Drain reverse current | Pulse (Note 1) | I_{DRP} | — | — | — | 60 | A |
| Forward voltage (diode) | | V_{DSF} | $I_{DR} = 20\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.2 | V |







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