

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

TPCA8128

Lithium Ion Battery Applications
Power Management Switch Applications

- Small footprint due to compact and slim package
- Low drain-source ON resistance : $R_{DS(ON)} = 3.7 \text{ m}\Omega$ (typ.)
- Low leakage current : $I_{DSS} = -10 \text{ }\mu\text{A}$ (max) ($V_{DS} = -30 \text{ V}$)
- Enhancement mode
: $V_{th} = -0.8 \text{ to } -2.0 \text{ V}$ ($V_{DS} = -10 \text{ V}$, $I_D = -0.5 \text{ mA}$)

Absolute Maximum Ratings (Ta = 25°C)

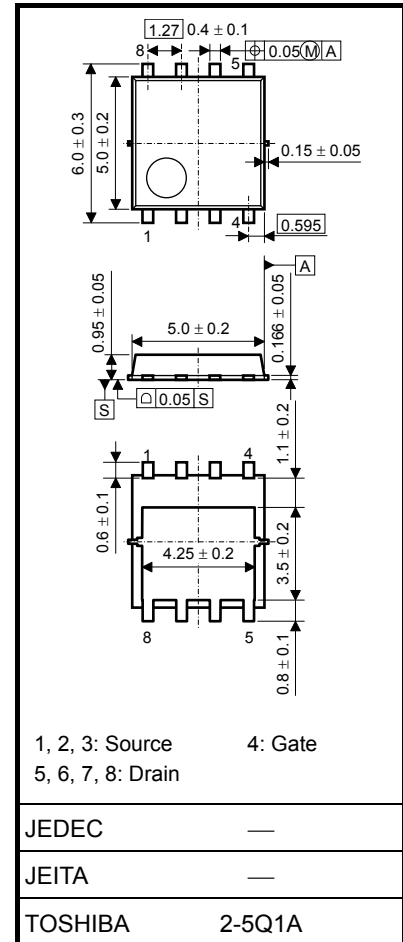
| Characteristics | | Symbol | Rating | Unit |
|--|----------------|-----------|------------|------|
| Drain-source voltage | | V_{DSS} | -30 | V |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | | V_{DGR} | -30 | V |
| Gate-source voltage | | V_{GSS} | -25/+20 | V |
| Drain current | DC (Note 1) | I_D | -34 | A |
| | Pulse (Note 1) | I_{DP} | -102 | |
| 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 | |
| Drain power dissipation ($t = 10 \text{ s}$) (Note 2b) | | P_D | 1.6 | |
| Single pulse avalanche energy (Note 3) | | E_{AS} | 150 | mJ |
| Avalanche current | | I_{AR} | -34 | A |
| Channel temperature | | T_{ch} | 150 | °C |
| Storage temperature range | | T_{stg} | -55 to 150 | °C |

Note: For (Note 1), (Note 2), (Note 3), 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).

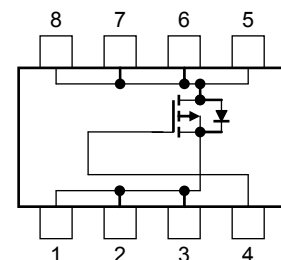
This transistor is an electrostatic-sensitive device. Handle with caution.

Unit: mm



Weight: 0.076 g (typ.)

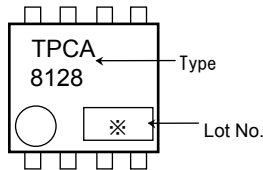
Circuit Configuration



Thermal Characteristics

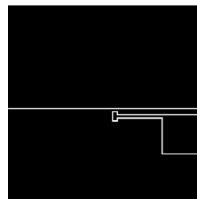
| Characteristics | Symbol | Max | Unit |
|---|----------------|------|--------------------|
| Thermal resistance, channel to case ($T_c = 25\text{ }^\circ\text{C}$) | $R_{th(ch-c)}$ | 2.78 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient ($t = 10\text{ s}$) (Note 2a) | $R_{th(ch-a)}$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

Marking (Note 4)



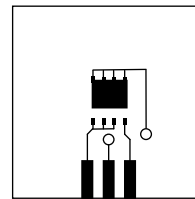
Note 1: The channel temperature should not exceed 150°C during use.

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



(a)

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

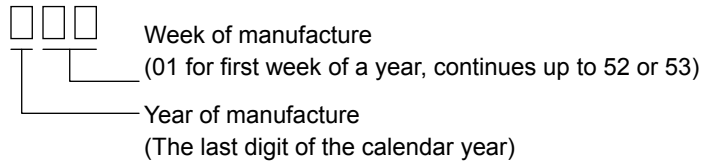


(b)

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

Note 3: $V_{DD} = -24\text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 100\text{ }\mu\text{H}$, $R_G = 25\text{ }\Omega$, $I_{AR} = -34\text{ A}$

Note 4: ※ Weekly code: (Three digits)



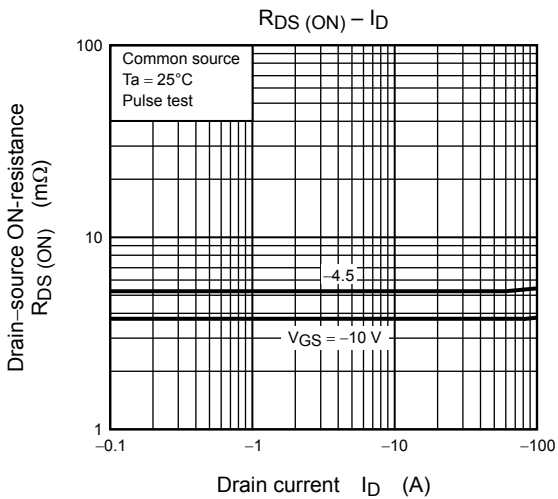
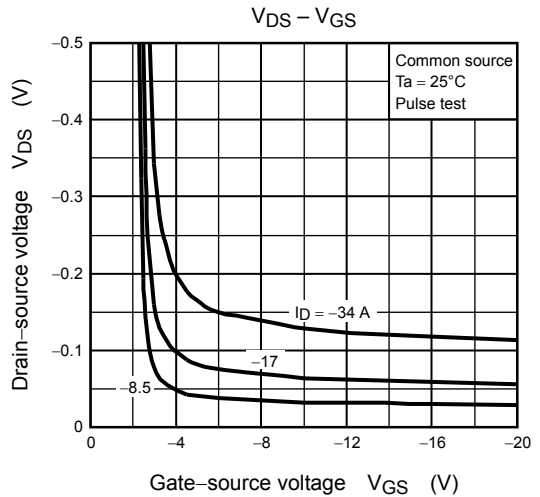
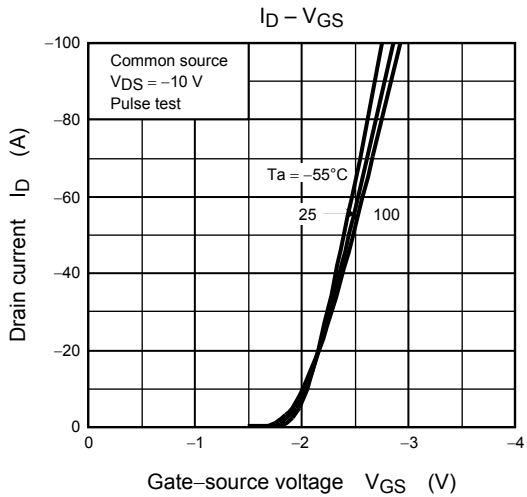
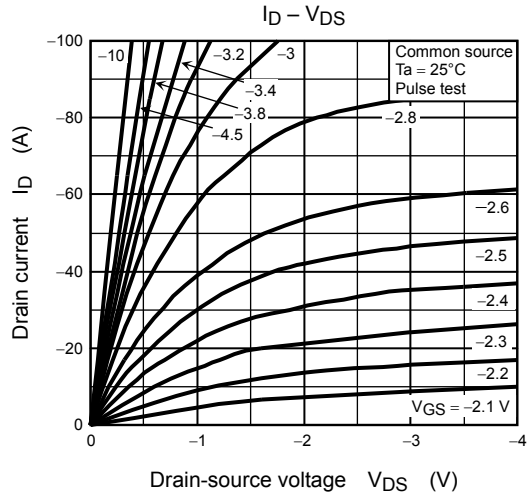
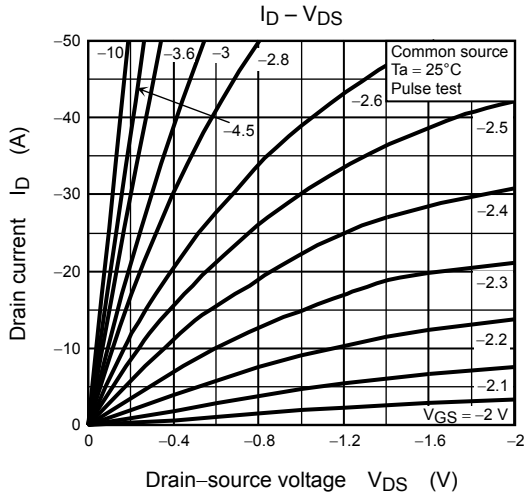
Electrical Characteristics (Ta = 25°C)

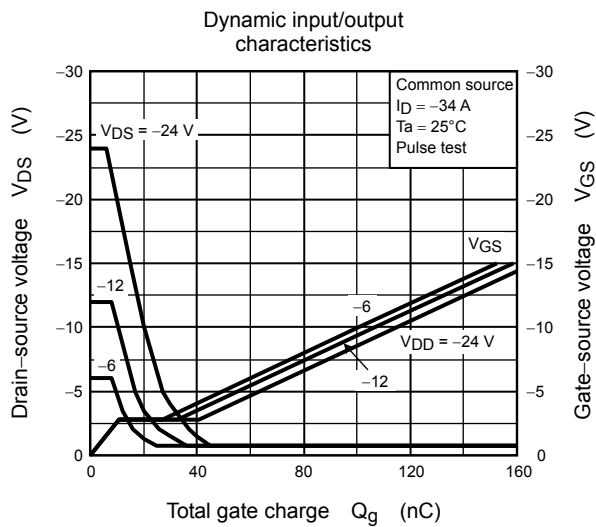
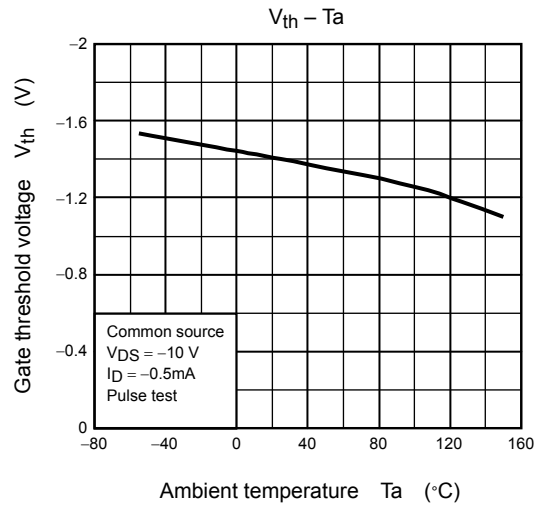
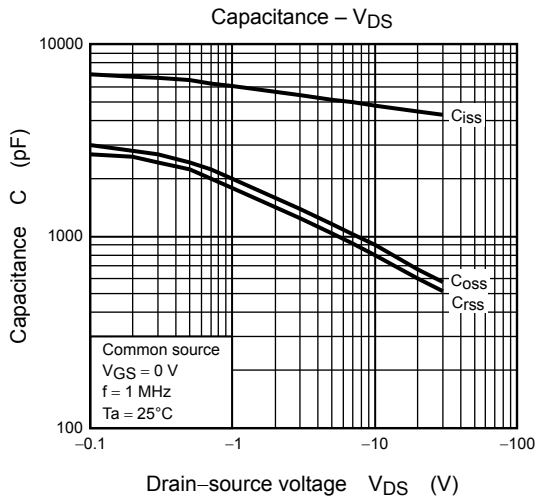
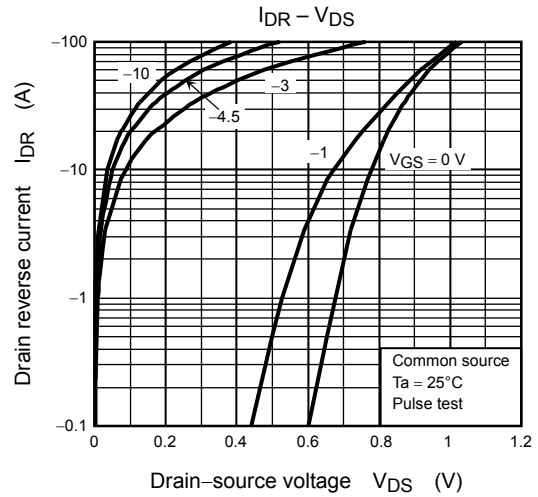
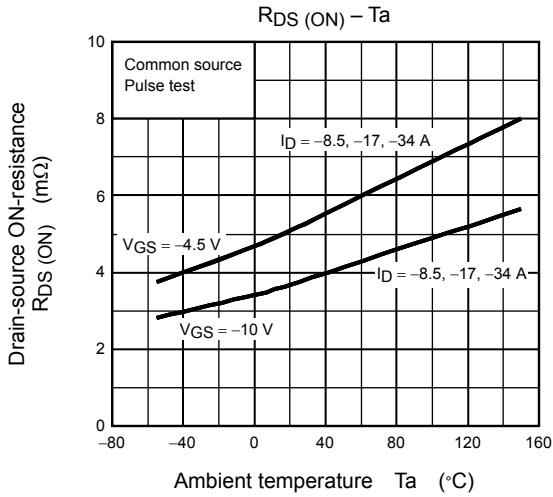
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|--|---|------|-----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 100 | nA |
| Drain cut-off current | | I_{DSS} | $V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$ | — | — | -10 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$ | -30 | — | — | V |
| | | $V_{(BR)DSX}$ | $I_D = -10\text{ mA}, V_{GS} = 10\text{ V}$ (Note 5) | -21 | — | — | |
| Gate threshold voltage | | V_{th} | $V_{DS} = -10\text{ V}, I_D = -0.5\text{ mA}$ | -0.8 | — | -2.0 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = -4.5\text{ V}, I_D = -17\text{ A}$ | — | 5.1 | 6.7 | m Ω |
| | | | $V_{GS} = -10\text{ V}, I_D = -17\text{ A}$ | — | 3.7 | 4.8 | |
| Input capacitance | | C_{iss} | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 4800 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 800 | — | |
| Output capacitance | | C_{oss} | | — | 900 | — | |
| Switching time | Rise time | t_r | | — | 11 | — | ns |
| | Turn-on time | t_{on} | | — | 21 | — | |
| | Fall time | t_f | | — | 135 | — | |
| | Turn-off time | t_{off} | | Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$ | — | 390 | |
| Total gate charge (gate-source plus gate-drain) | | Q_g | $V_{DD} \approx -24\text{ V}, V_{GS} = -10\text{ V}$ $I_D = -34\text{ A}$ | — | 115 | — | nC |
| Gate-source charge 1 | | Q_{gs1} | | — | 11 | — | |
| Gate-drain ("Miller") charge | | Q_{gd} | | — | 30 | — | |

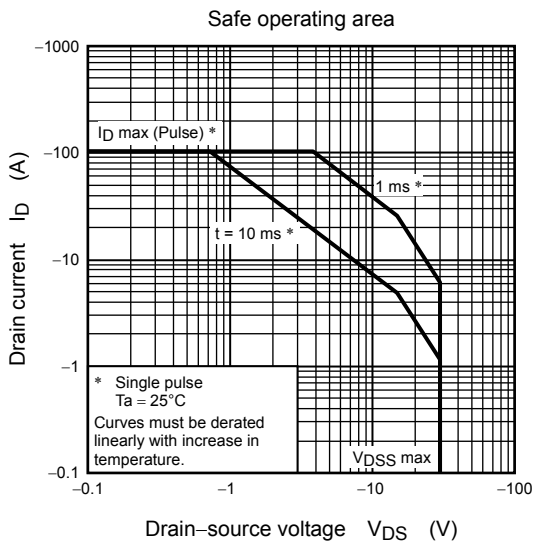
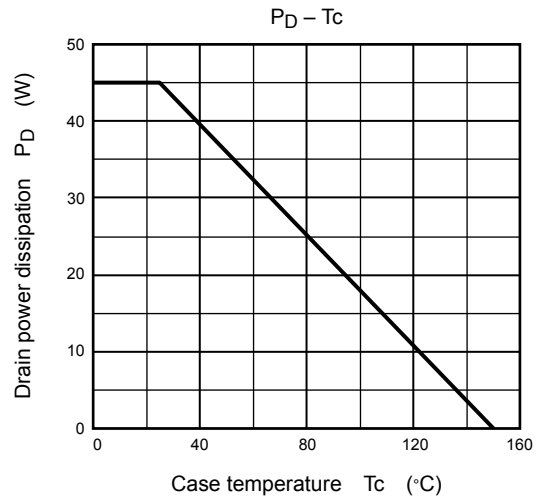
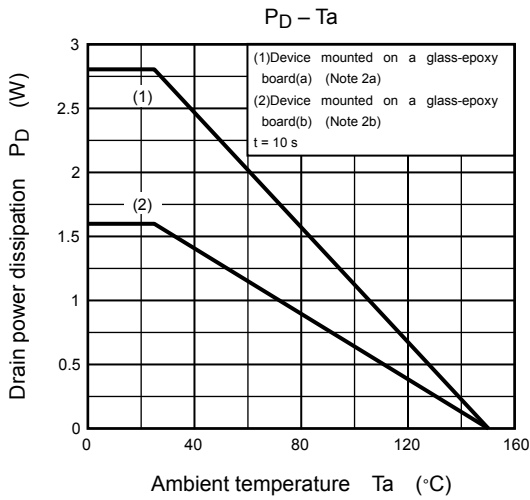
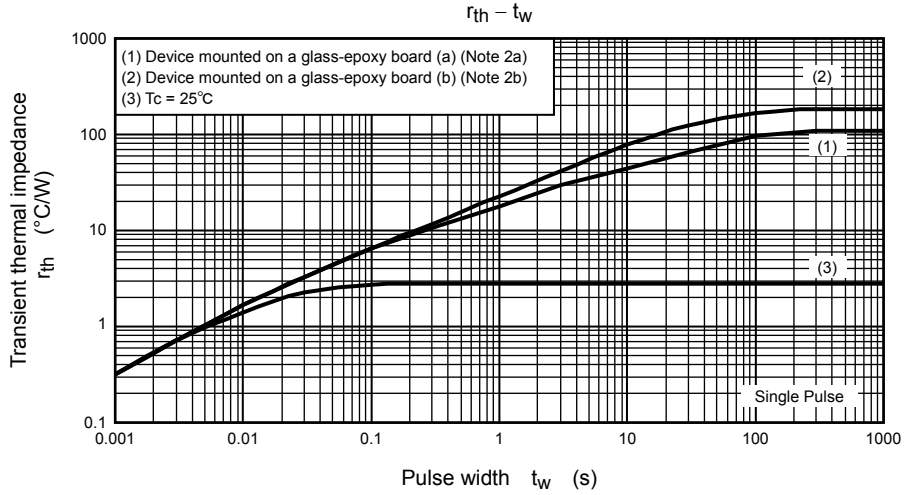
Source-Drain Ratings and Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------------|----------------|-----------|--|-----|------|------|------|
| Drain reverse current | Pulse (Note 1) | I_{DRP} | — | — | — | -102 | A |
| Forward voltage (diode) | | V_{DSF} | $I_{DR} = -34\text{ A}, V_{GS} = 0\text{ V}$ | — | — | 1.2 | V |

Note 5: V_{DSX} mode (the application of a plus voltage between gate and source) may cause decrease in maximum rating of drain-source voltage.







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