

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

2SJ681

Relay Drive, DC-DC Converter and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON-resistance: $R_{DS(ON)} = 0.12 \Omega$ (typ.)
($V_{GS} = -10 V$)
- High forward transfer admittance: $|Y_{fs}| = 5.0 S$ (typ.)
- Low leakage current: $I_{DSS} = -100 \mu A$ (max) ($V_{DS} = -60 V$)
- Enhancement mode: $V_{th} = -0.8$ to $-2.0 V$ ($V_{DS} = -10 V, I_D = -1 mA$)

Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|--|----------------|-----------|------------|------|
| Drain-source voltage | | V_{DSS} | -60 | V |
| Drain-gate voltage ($R_{GS} = 20 k\Omega$) | | V_{DGR} | -60 | V |
| Gate-source voltage | | V_{GSS} | ± 20 | V |
| Drain current | DC (Note 1) | I_D | -5 | A |
| | Pulse (Note 1) | I_{DP} | -20 | A |
| Drain power dissipation | | P_D | 20 | W |
| Single pulse avalanche energy (Note 2) | | E_{AS} | 40.5 | mJ |
| Avalanche current | | I_{AR} | -5 | A |
| Repetitive avalanche energy (Note 3) | | E_{AR} | 2 | mJ |
| Channel temperature | | T_{ch} | 150 | °C |
| Storage temperature range | | T_{stg} | -55 to 150 | °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

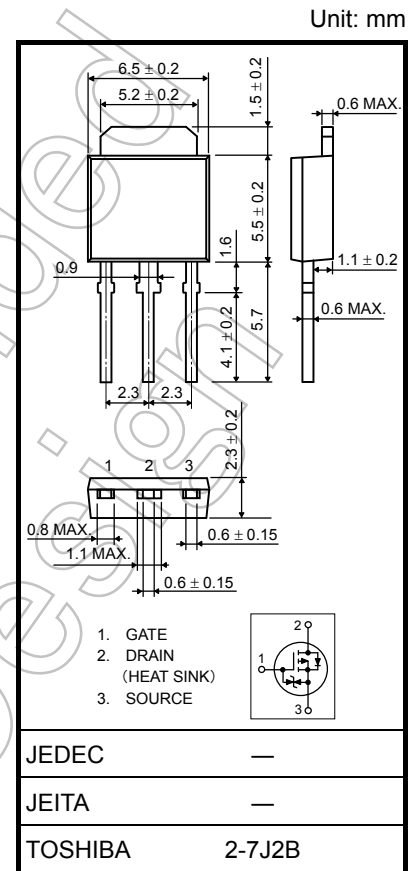
| Characteristics | Symbol | Max | Unit |
|--|----------------|------|--------|
| Thermal resistance, channel to case | $R_{th(ch-c)}$ | 6.25 | °C / W |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 125 | °C / W |

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

Note 2: $V_{DD} = -25 V, T_{ch} = 25^\circ C$ (initial), $L = 2.2 mH, R_G = 25 \Omega, I_{AR} = -5 A$

Note 3: Repetitive rating: pulse width limited by maximum channel temperature

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



Weight: 0.36 g (typ.)

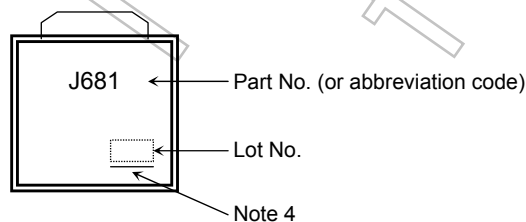
Electrical Characteristics (Ta = 25°C)

| 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} | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$ | — | — | -100 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$ | -60 | — | — | V |
| | | $V_{(BR)DSX}$ | $I_D = -10\text{ mA}, V_{GS} = 20\text{ V}$ | -35 | — | — | V |
| Gate threshold voltage | | V_{th} | $V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$ | -0.8 | — | -2.0 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = -4\text{ V}, I_D = -2.5\text{ A}$ | — | 0.16 | 0.25 | Ω |
| | | | $V_{GS} = -10\text{ V}, I_D = -2.5\text{ A}$ | — | 0.12 | 0.17 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = -10\text{ V}, I_D = -2.5\text{ A}$ | 2.5 | 5.0 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 700 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 60 | — | |
| Output capacitance | | C_{oss} | | — | 90 | — | |
| Switching time | Rise time | t_r | | — | 14 | — | ns |
| | Turn-on time | t_{on} | | — | 24 | — | |
| | Fall time | t_f | | — | 14 | — | |
| | Turn-off time | t_{off} | | — | 95 | — | |
| Total gate charge (Gate-source plus gate-drain) | | Q_g | $V_{DD} \approx -48\text{ V}, V_{GS} = -10\text{ V}, I_D = -5\text{ A}$ | — | 15 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 11 | — | |
| Gate-drain ("miller") charge | | Q_{gd} | | — | 4 | — | |

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|-----|------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | -5 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | -20 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = -5\text{ A}, V_{GS} = 0\text{ V}$ | — | — | 1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = -5\text{ A}, V_{GS} = 0\text{ V}$ | — | 40 | — | ns |
| Reverse recovery charge | Q_{rr} | $dI_{DR} / dt = 50\text{ A} / \mu\text{s}$ | — | 32 | — | nC |

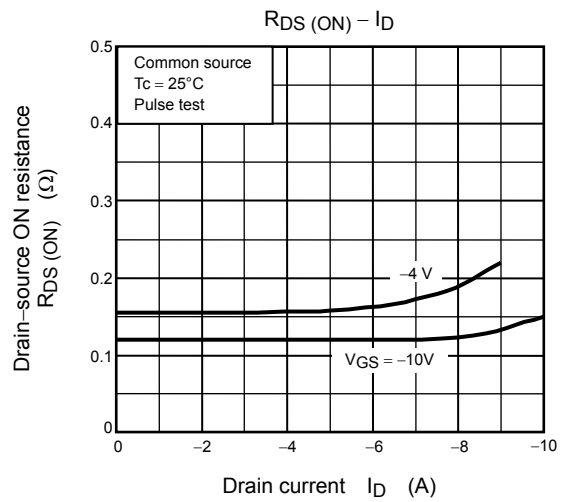
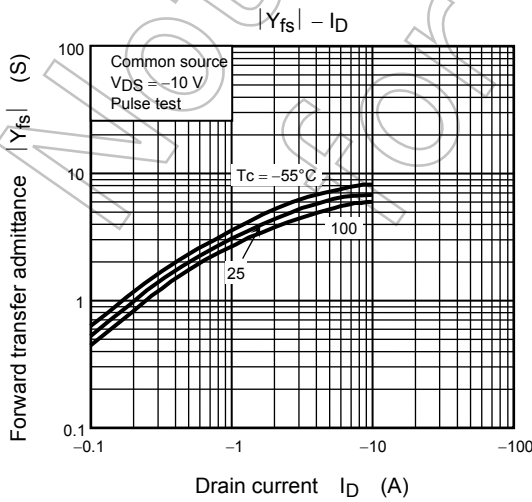
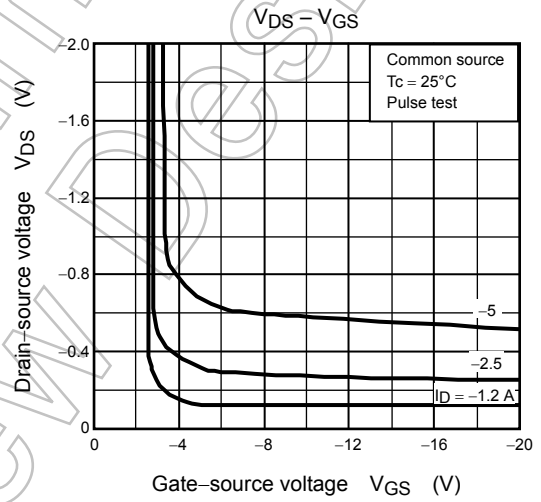
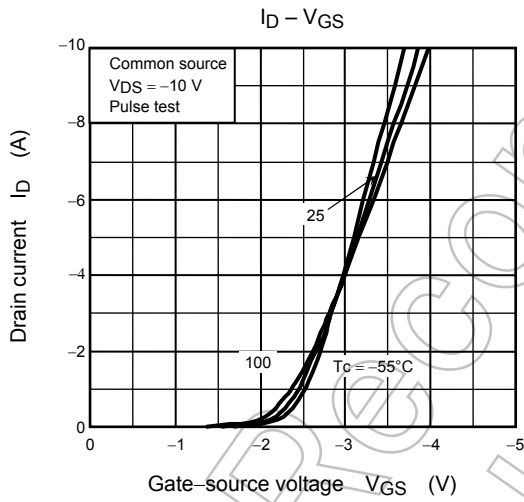
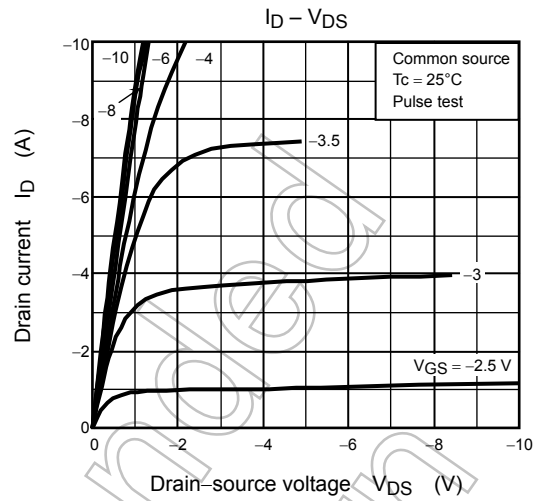
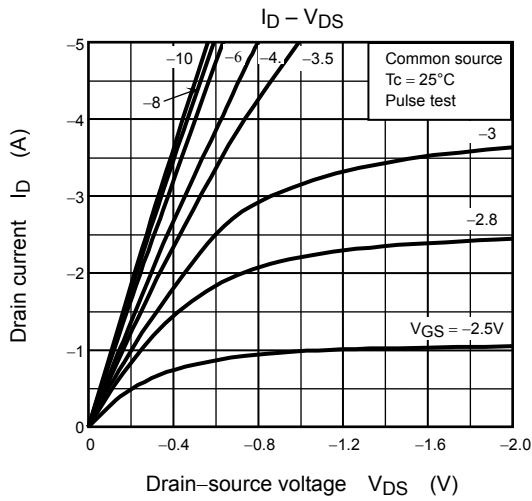
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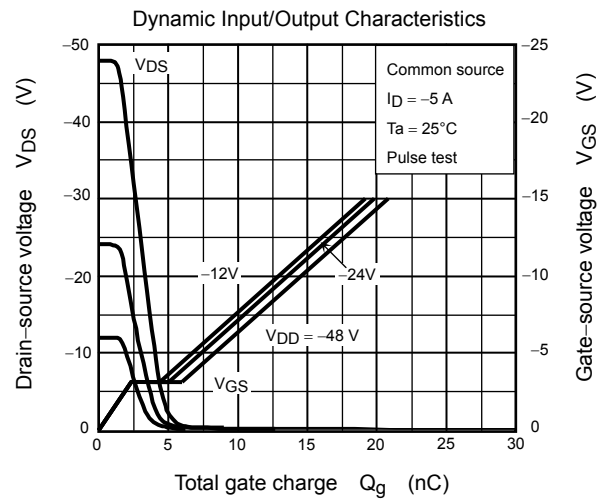
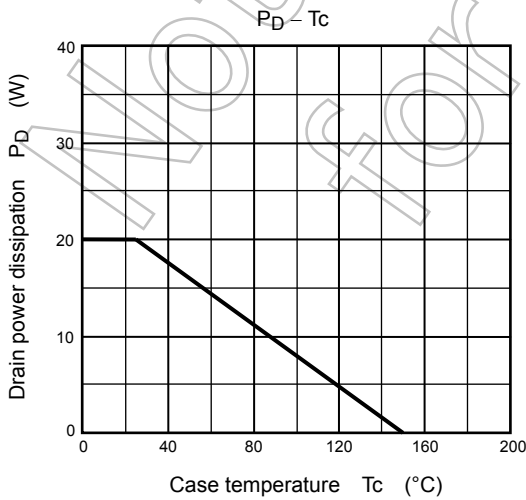
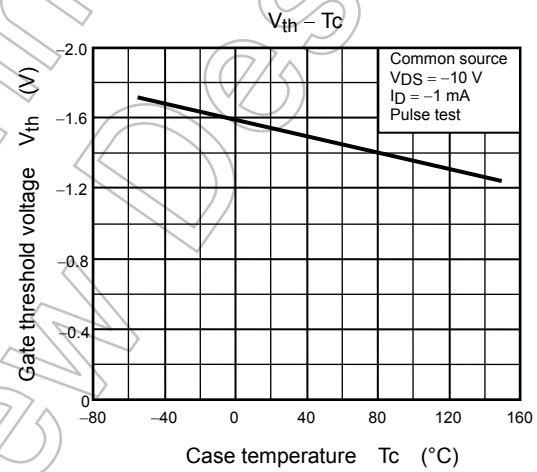
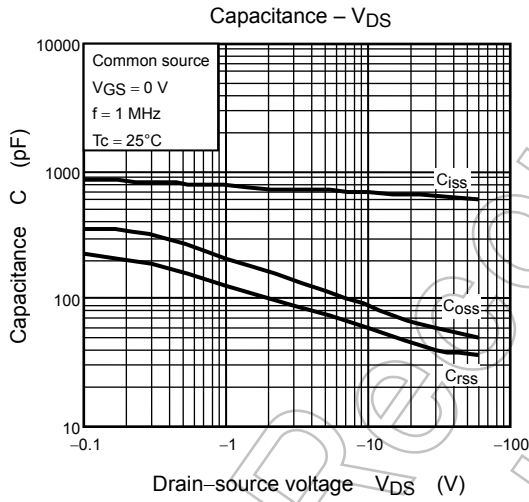
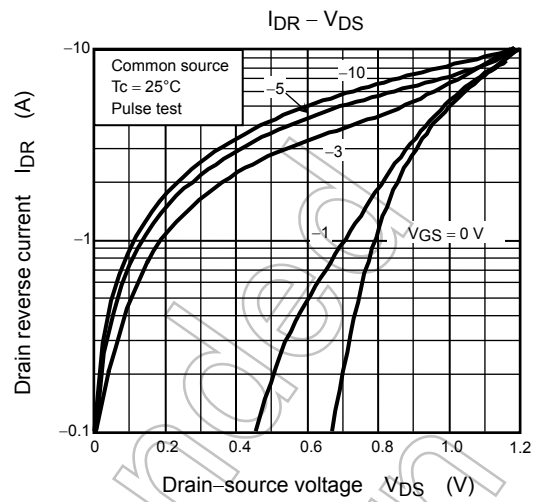
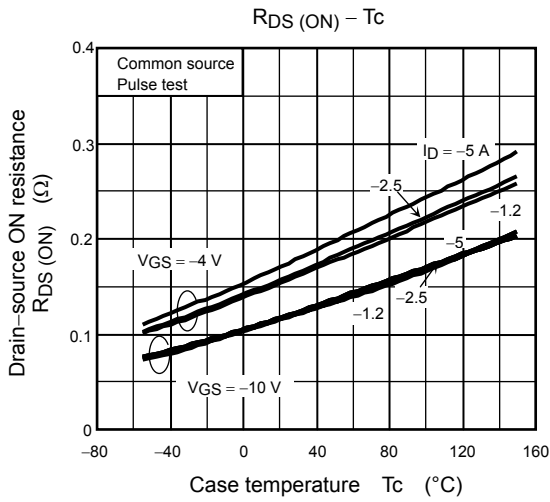


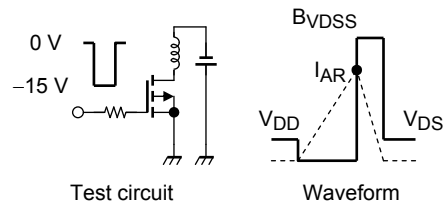
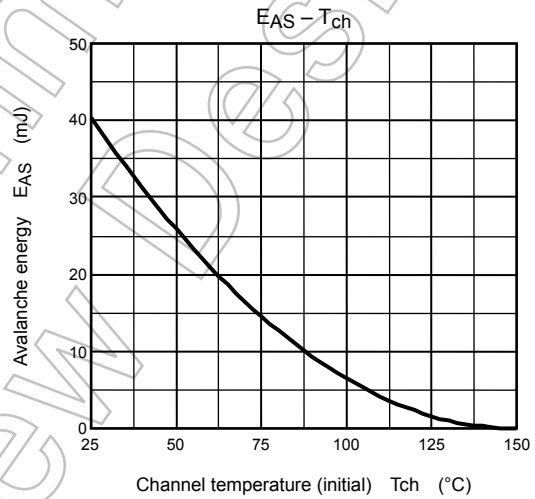
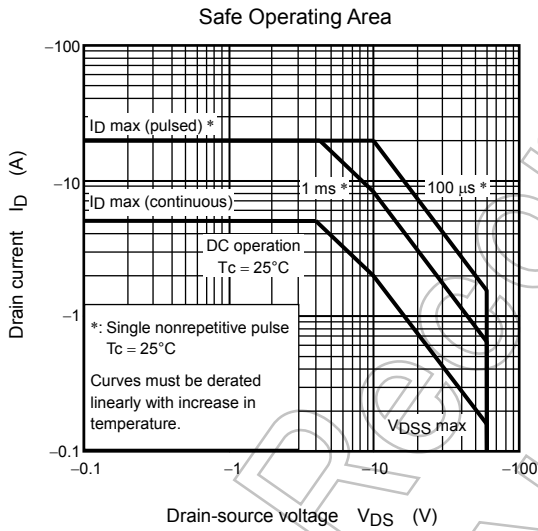
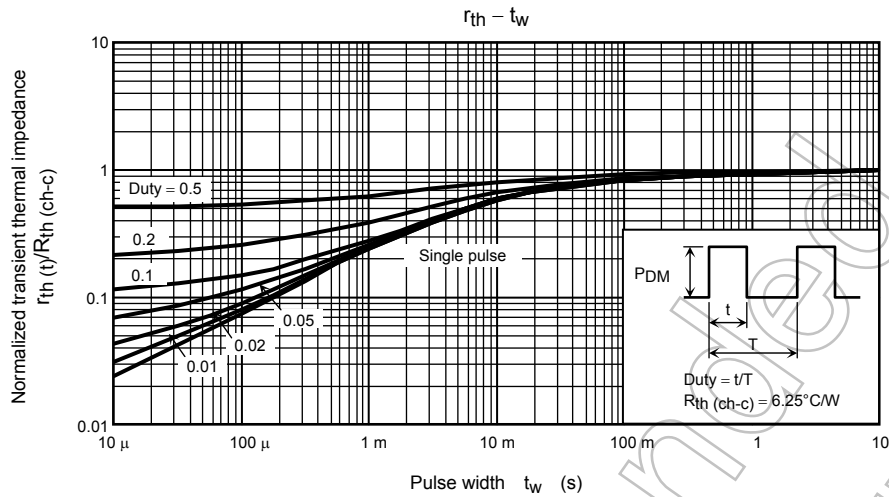
Note 4: A line under a Lot No. identifies the indication of product Labels.

[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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$R_G = 25 \Omega$
 $V_{DD} = -25 \text{ V}, L = 2.2 \text{ mH}$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AR}^2 \cdot \left(\frac{BVDSS}{BVDSS - V_{DD}} \right)$$

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