

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (L²-π-MOSV)

2SJ401

DC-DC Converter, Relay Drive and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON resistance : $R_{DS(ON)} = 33 \text{ m}\Omega$ (typ.)
- High forward transfer admittance : $|Y_{fs}| = 20 \text{ S}$ (typ.)
- Low leakage current : $I_{DSS} = -100 \mu\text{A}$ (max) ($V_{DS} = -60 \text{ V}$)
- Enhancement mode : $V_{th} = -0.8 \text{ to } -2.0 \text{ V}$ ($V_{DS} = -10 \text{ V}$, $I_D = -1 \text{ mA}$)

Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|--|----------------|-----------|----------|------|
| Drain-source voltage | | V_{DSS} | -60 | V |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | | V_{DGR} | -60 | V |
| Gate-source voltage | | V_{GSS} | ± 20 | V |
| Drain current | DC (Note 1) | I_D | -20 | A |
| | Pulse (Note 1) | I_{DP} | -80 | A |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | | P_D | 100 | W |
| Single pulse avalanche energy (Note 2) | | E_{AS} | 800 | mJ |
| Avalanche current | | I_{AR} | -20 | A |
| Repetitive avalanche energy (Note 3) | | E_{AR} | 10 | mJ |
| Channel temperature | | T_{ch} | 150 | °C |
| Storage temperature range | | T_{stg} | -55~150 | °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 | $R_{th(ch-c)}$ | 1.25 | °C / W |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 83.3 | °C / W |

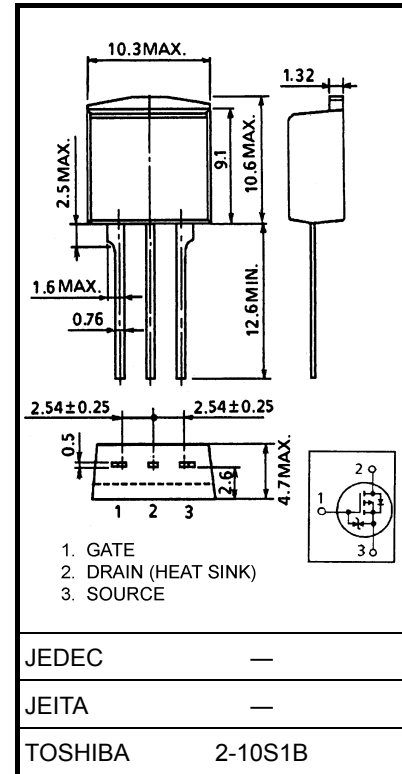
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: $V_{DD} = -50 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 1.44 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = -20 \text{ A}$

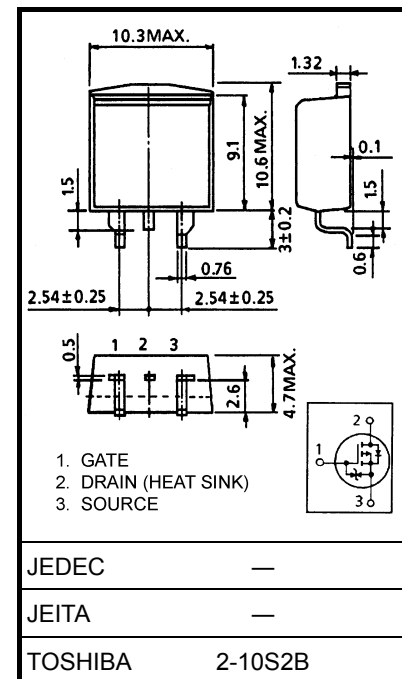
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

This transistor is an electrostatic-sensitive device. Please handle with caution.

Unit: mm



Weight: 1.5 g (typ.)



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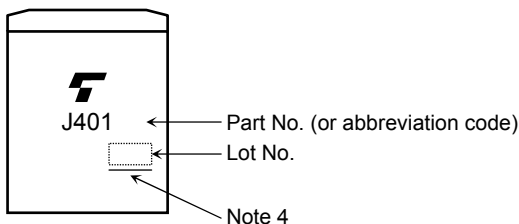
Electrical Characteristics (Ta = 25°C)

| 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 |
| Gate threshold voltage | | V_{th} | $V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$ | -0.8 | — | -2.0 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = -4\text{ V}, I_D = -10\text{ A}$ | — | 50 | 90 | m Ω |
| | | | $V_{GS} = -10\text{ V}, I_D = -10\text{ A}$ | — | 33 | 45 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = -10\text{ V}, I_D = -10\text{ A}$ | 10 | 20 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 2800 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 450 | — | |
| Output capacitance | | C_{oss} | | — | 1300 | — | |
| Switching time | Rise time | t_r | | — | 15 | — | ns |
| | Turn-on time | t_{on} | | — | 35 | — | |
| | Fall time | t_f | | — | 25 | — | |
| | Turn-off time | t_{off} | | — | 120 | — | |
| Total gate charge (Gate-source plus gate-drain) | | Q_g | $V_{DD} \approx -48\text{ V}, V_{GS} = -10\text{ V}, I_D = -20\text{ A}$ | — | 90 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 65 | — | |
| Gate-drain ("miller") charge | | Q_{gd} | | — | 25 | — | |

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|--|-----|------|-----|------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | -20 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | -80 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = -20\text{ A}, V_{GS} = 0\text{ V}$ | — | — | 1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = -20\text{ A}, V_{GS} = 0\text{ V}$ | — | 75 | — | ns |
| Reverse recovery charge | Q_{rr} | $dI_{DR} / dt = 50\text{ A} / \mu\text{s}$ | — | 83 | — | nC |

Marking



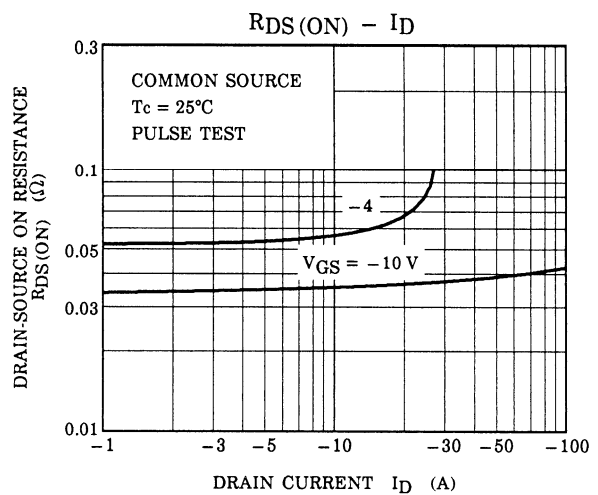
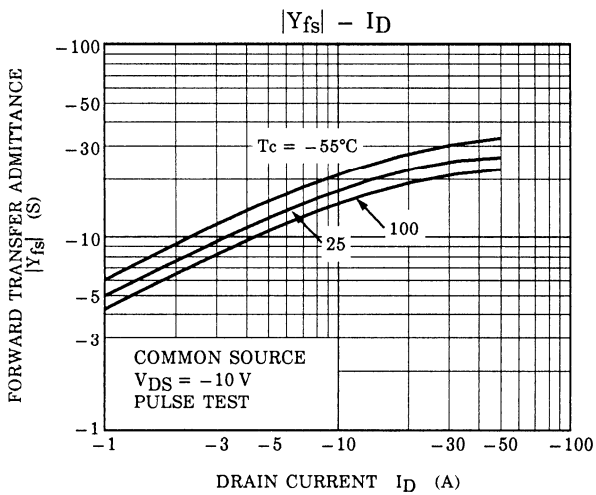
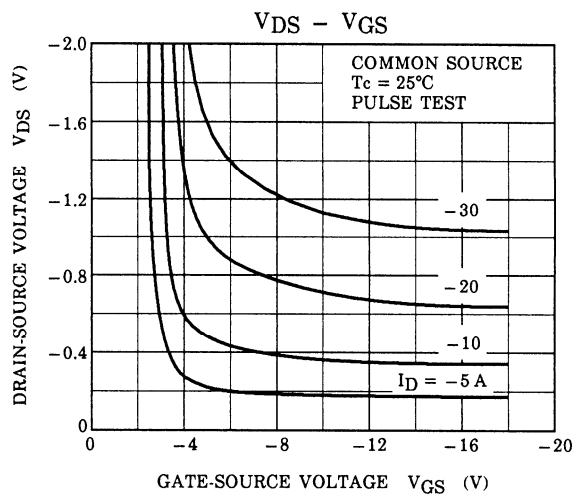
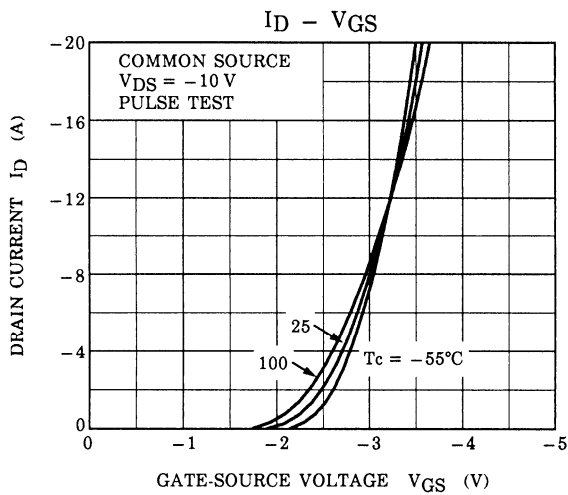
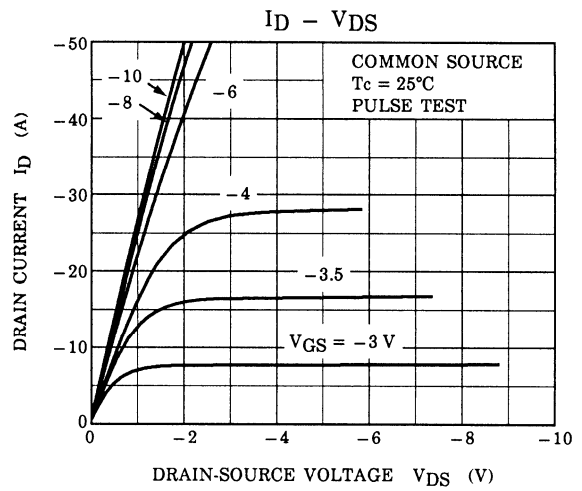
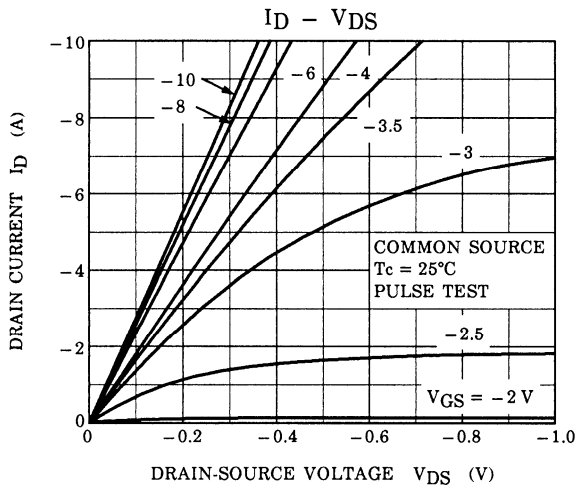
Note 4: A line under a Lot No. identifies the indication of product Labels.

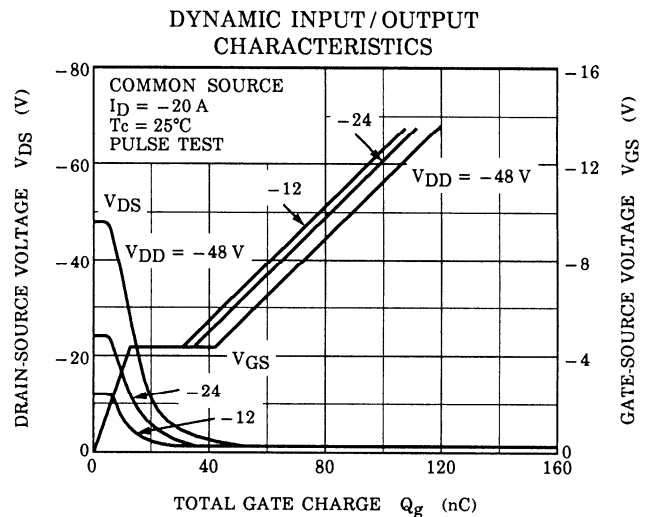
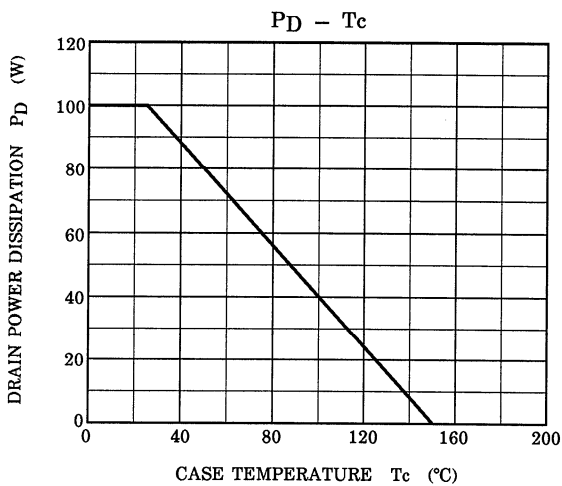
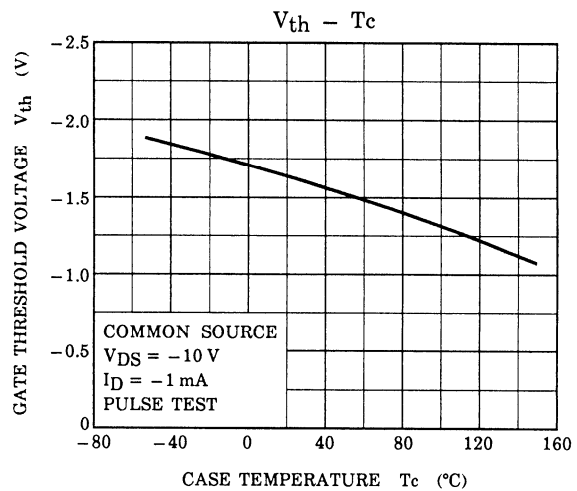
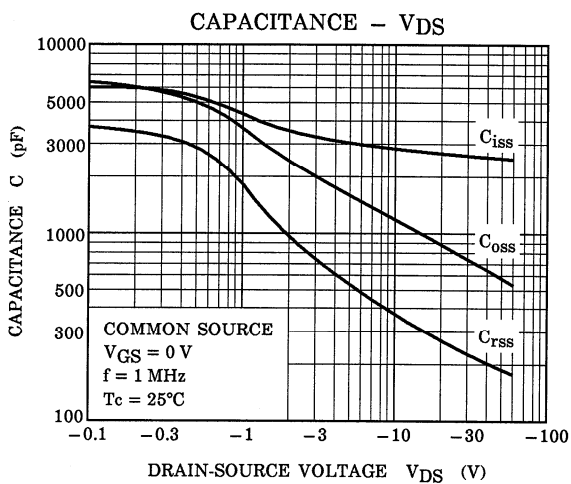
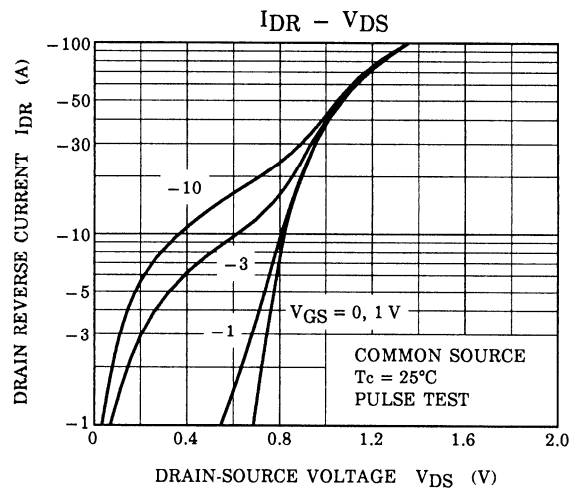
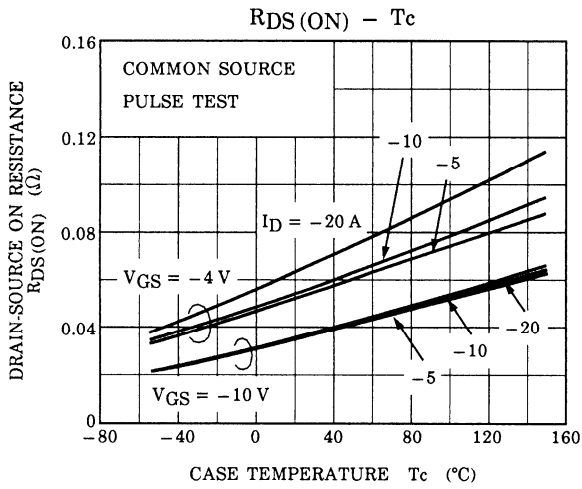
Not underlined: [[Pb]]/INCLUDES > MCV

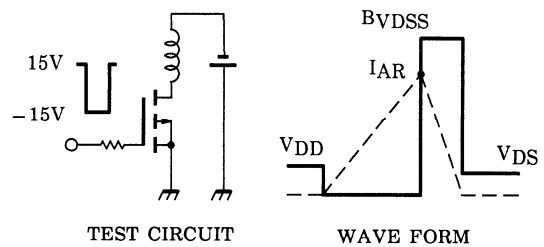
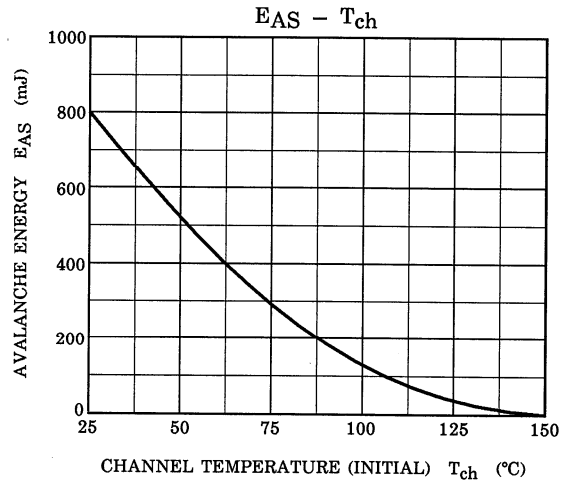
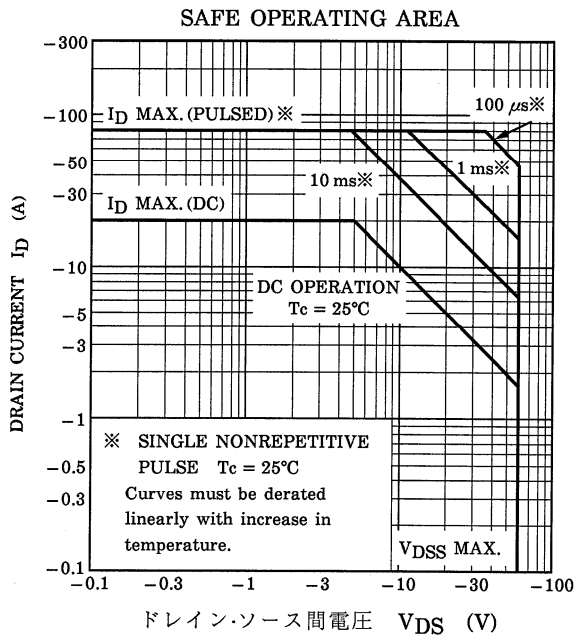
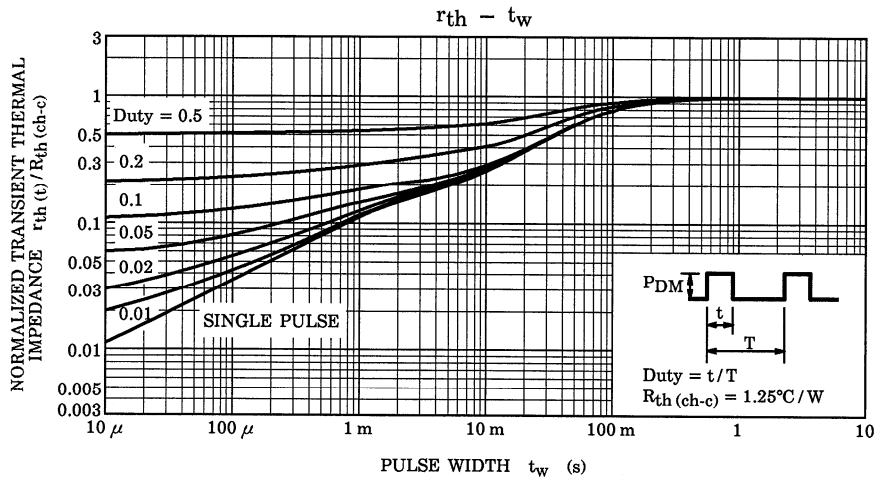
Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.







$R_G = 25\Omega$
 $V_{DD} = -50V, L = 1.44mH$

$$EAS = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{BVDSS}{BVDSS - V_{DD}} \right)$$

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