

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (L^2 - π -MOS V)

2SK2963

DC-DC Converter, Relay Drive and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON-resistance: $R_{DS(ON)} = 0.5 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 1.2 S$ (typ.)
- Low leakage current: $I_{DSS} = 100 \mu A$ (max) ($V_{DS} = 100 V$)
- Enhancement mode: $V_{th} = 0.8$ to $2.0 V$ ($V_{DS} = 10 V$, $I_D = 1 mA$)

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

| Characteristics | | Symbol | Rating | Unit |
|--|----------------|-----------|------------|------------|
| Drain-source voltage | | V_{DSS} | 100 | V |
| Drain-gate voltage ($R_{GS} = 20 k\Omega$) | | V_{DGR} | 100 | V |
| Gate-source voltage | | V_{GSS} | ± 20 | V |
| Drain current | DC (Note 1) | I_D | 1 | A |
| | Pulse (Note 1) | I_{DP} | 3 | |
| Drain power dissipation | | P_D | 0.5 | W |
| Drain power dissipation (Note 2) | | P_D | 1.5 | W |
| Single pulse avalanche energy (Note 3) | | E_{AS} | 137 | mJ |
| Avalanche current | | I_{AR} | 1 | A |
| Repetitive avalanche energy (Note 4) | | E_{AR} | 0.05 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ C$ |
| Storage temperature range | | T_{stg} | -55 to 150 | $^\circ C$ |

Note 1: Ensure that the channel temperature does not exceed $150^\circ C$.Note 2: Mounted on a ceramic board ($25.4 mm \times 25.4 mm \times 0.8 mm$)Note 3: $V_{DD} = 25 V$, $T_{ch} = 25^\circ C$ (initial), $L = 221 mH$, $R_G = 25 \Omega$, $I_{AR} = 1 A$

Note 4: Repetitive rating: pulse width limited by maximum junction temperature.

Note 5: 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.).

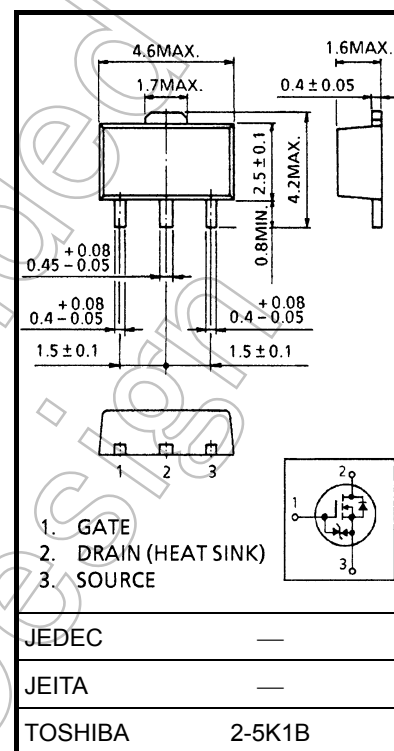
This transistor is an electrostatic-sensitive device.

Handle with care.

Thermal Characteristics

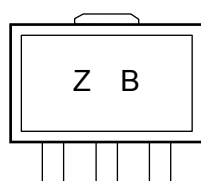
| Characteristics | Symbol | Max | Unit |
|--|----------------|-----|--------------|
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 250 | $^\circ C/W$ |

Unit: mm



Weight: 0.05 g (typ.)

Marking



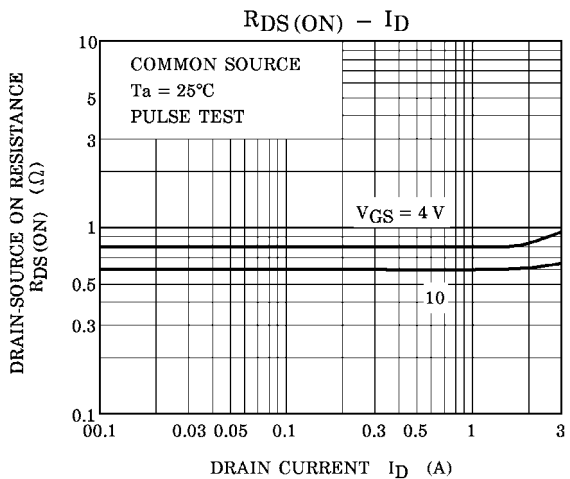
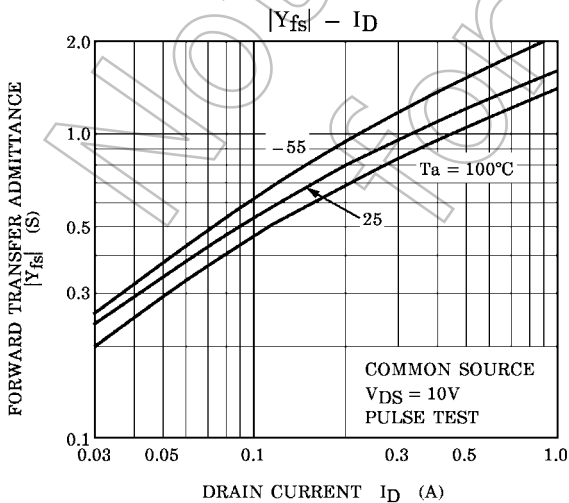
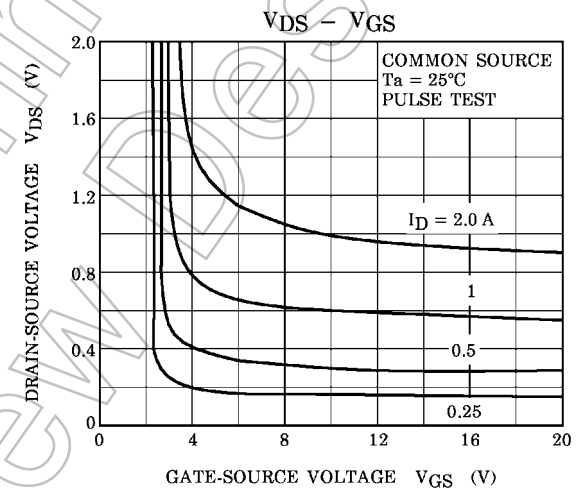
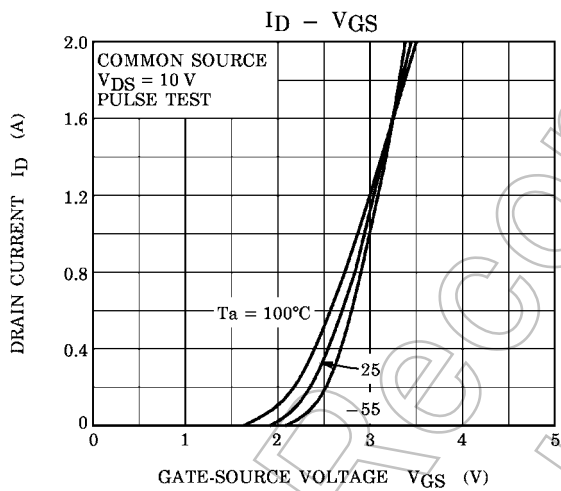
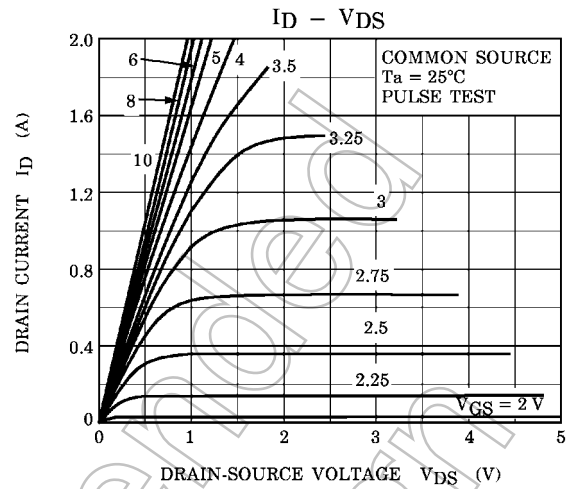
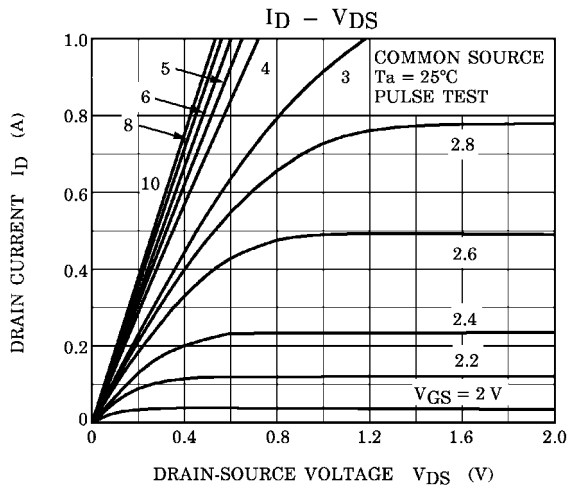
(The two digits represent the part number.)

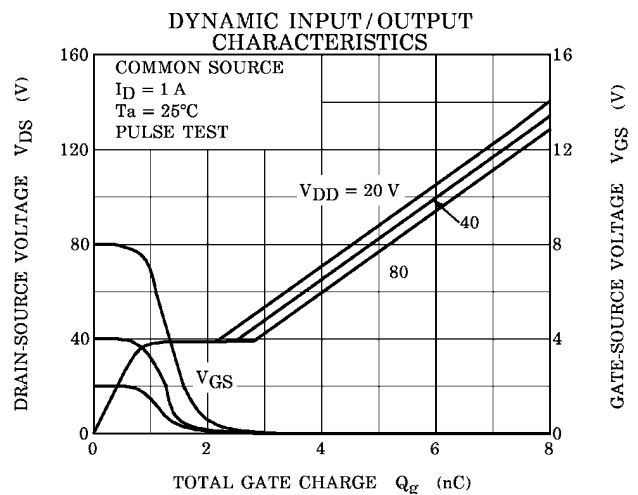
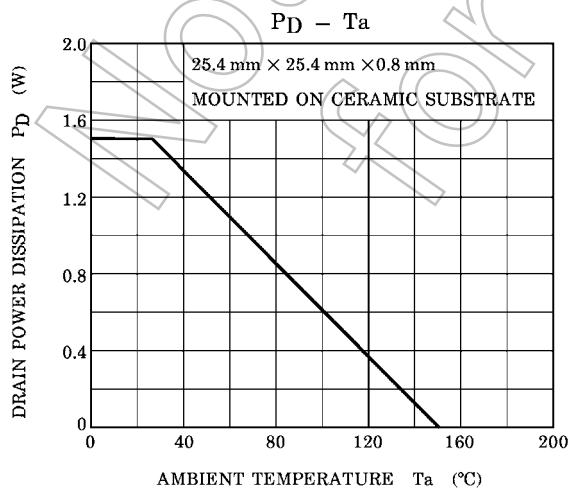
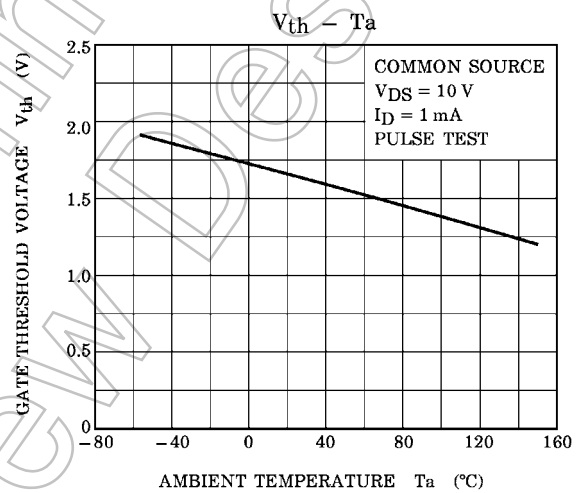
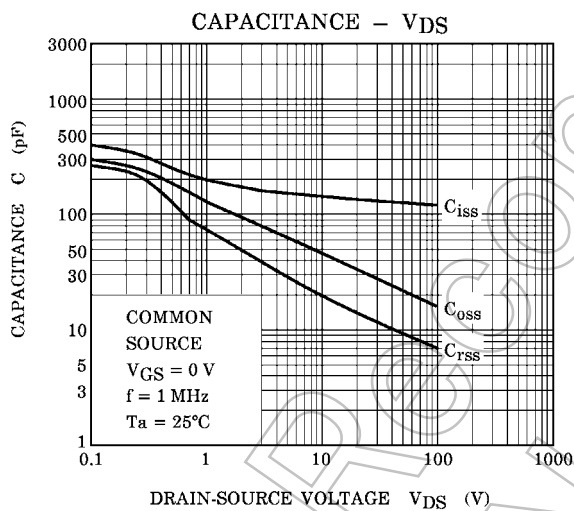
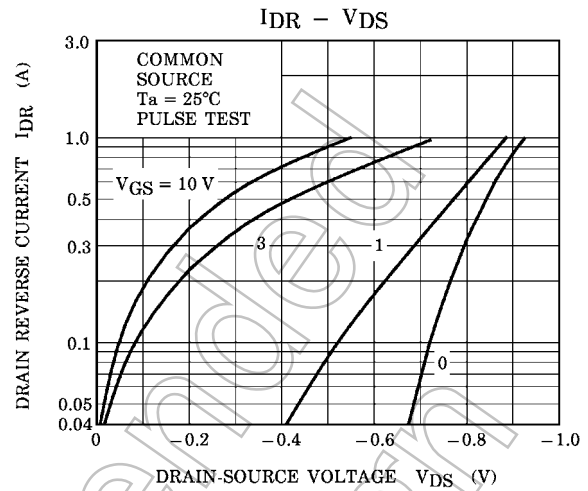
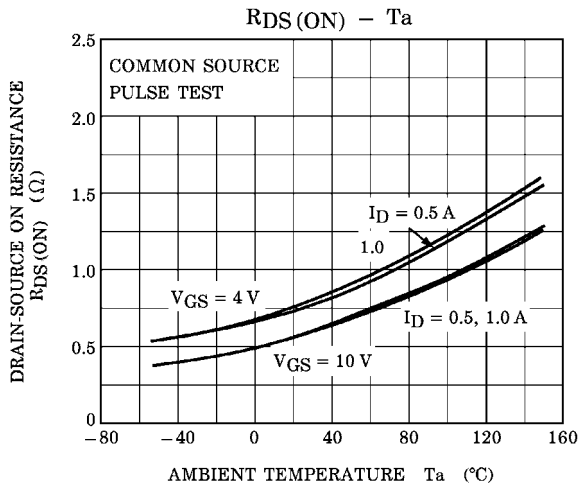
Electrical Characteristics (Ta = 25°C)

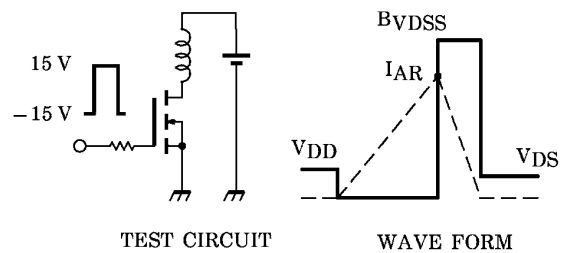
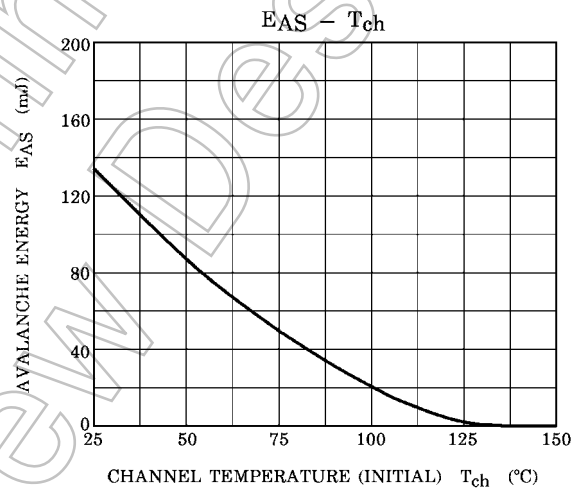
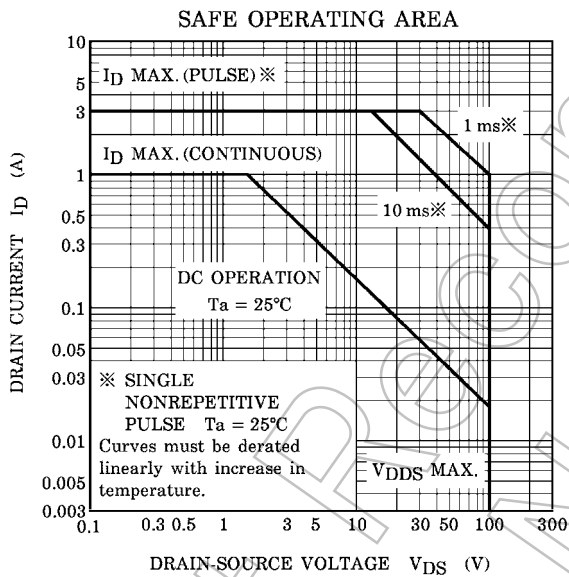
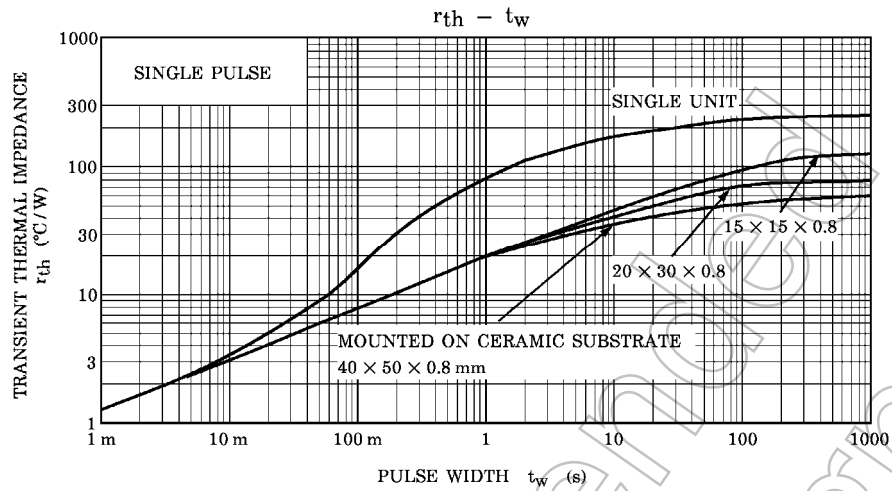
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|---|-----|------|----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$ | — | — | ± 10 | μA |
| Drain cut-off current | | I_{DSS} | $V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V}$ | — | — | 100 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$ | 100 | — | — | 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 | | $R_{DS(ON)}$ | $V_{GS} = 4 \text{ V}, I_D = 0.5 \text{ A}$ | — | 0.65 | 0.95 | Ω |
| | | | $V_{GS} = 10 \text{ V}, I_D = 0.5 \text{ A}$ | — | 0.5 | 0.7 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10 \text{ V}, I_D = 0.5 \text{ A}$ | 0.6 | 1.2 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | — | 140 | — | pF |
| Reverse transfer capacitance | | C_{rss} | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | — | 20 | — | pF |
| Output capacitance | | C_{oss} | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | — | 45 | — | pF |
| Switching time | Rise time | t_r | | — | 8 | — | ns |
| | Turn-on time | t_{on} | | — | 13 | — | |
| | Fall time | t_f | | — | 45 | — | |
| | Turn-off time | t_{off} | | — | 175 | — | |
| Total gate charge (gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 80 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 1 \text{ A}$ | — | 6.3 | — | nC |
| Gate-source charge | | Q_{gs} | $V_{DD} \approx 80 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 1 \text{ A}$ | — | 4.3 | — | nC |
| Gate-drain ("miller") charge | | Q_{gd} | $V_{DD} \approx 80 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 1 \text{ A}$ | — | 2 | — | nC |

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 1 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 3 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 1 \text{ A}, V_{GS} = 0 \text{ V}$ | — | — | -1.5 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 1 \text{ A}, V_{GS} = 0 \text{ V}, dI_{DR}/dt = 50 \text{ A}/\mu\text{s}$ | — | 80 | — | ns |
| Reverse recovery charge | Q_{rr} | $I_{DR} = 1 \text{ A}, V_{GS} = 0 \text{ V}, dI_{DR}/dt = 50 \text{ A}/\mu\text{s}$ | — | 140 | — | μC |







$$R_G = 25 \, \Omega$$

$$V_{DD} = 25 \, \text{V}, L = 221 \, \text{mH} \quad E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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