

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

2SK3313

Chopper Regulator and DC-DC Converter Applications
Motor Drive Applications

- Fast reverse recovery time : $t_{rr} = 90 \text{ ns (typ.)}$
- Built-in high-speed free-wheeling diode
- Low drain-source ON resistance : $R_{DS(ON)} = 0.5 \Omega \text{ (typ.)}$
- High forward transfer admittance : $|Y_{fs}| = 8.5 \text{ S (typ.)}$
- Low leakage current : $I_{DSS} = 100 \mu\text{A (max)}$ ($V_{DS} = 500 \text{ V}$)
- Enhancement mode : $V_{th} = 2.0 \sim 4.0 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

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

| Characteristics | | Symbol | Rating | Unit |
|--|----------------|-----------|----------|------------------|
| Drain-source voltage | | V_{DSS} | 500 | V |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | | V_{DGR} | 500 | V |
| Gate-source voltage | | V_{GSS} | ± 30 | V |
| Drain current | DC (Note 1) | I_D | 12 | A |
| | Pulse (Note 1) | I_{DP} | 48 | A |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | | P_D | 40 | W |
| Single pulse avalanche energy (Note 2) | | E_{AS} | 324 | mJ |
| Avalanche current | | I_{AR} | 12 | A |
| Repetitive avalanche energy (Note 3) | | E_{AR} | 4.0 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | | T_{stg} | -55~150 | $^\circ\text{C}$ |

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 | $R_{th(ch-c)}$ | 3.125 | $^\circ\text{C} / \text{W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 62.5 | $^\circ\text{C} / \text{W}$ |

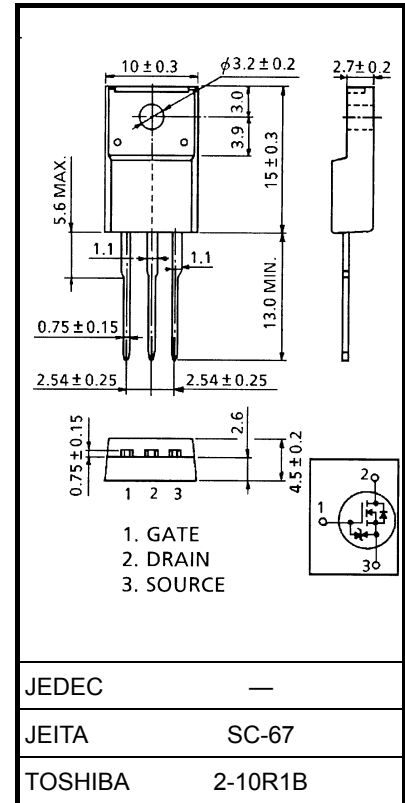
Note 1: Ensure that the channel temperature does not exceed 150°C .

Note 2: $V_{DD} = 90 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 3.83 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = 12 \text{ A}$

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

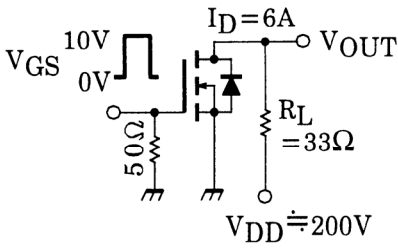
This transistor is an electrostatic-sensitive device.
Please handle with caution.

Unit: mm



Weight: 1.9 g (typ.)

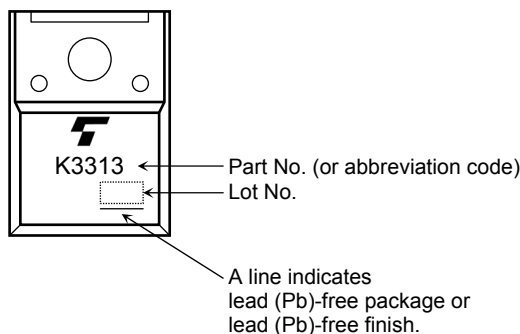
Electrical Characteristics (Ta = 25°C)

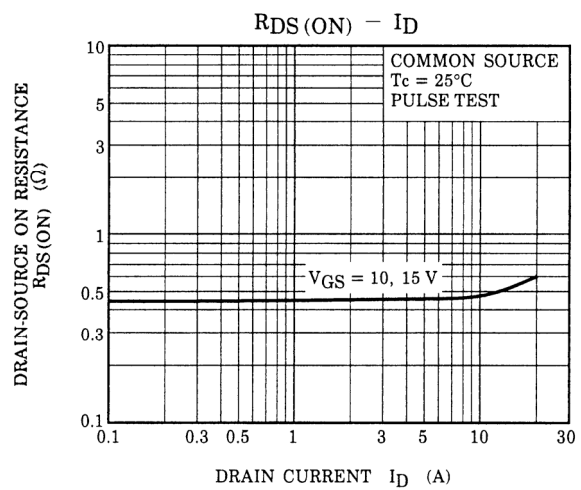
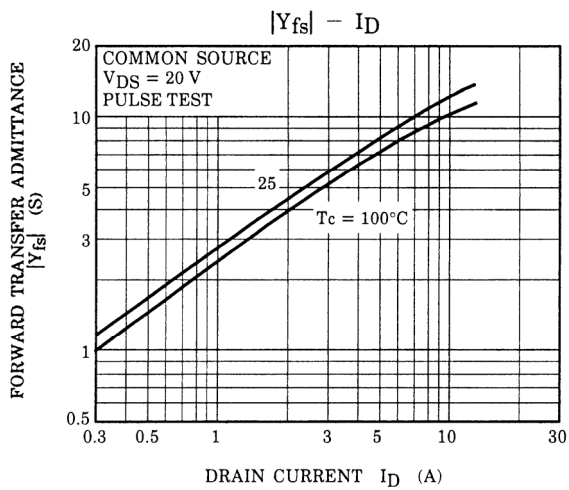
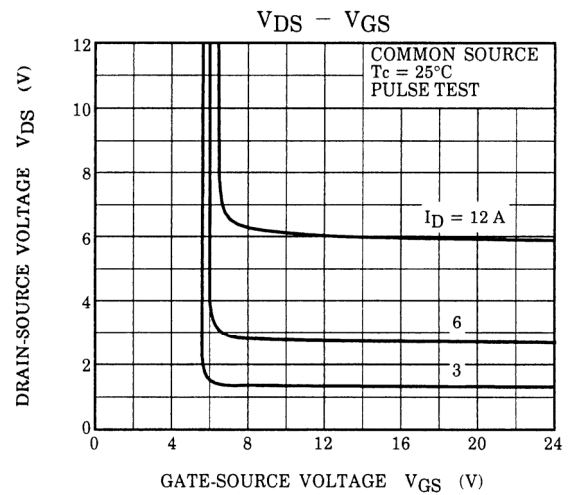
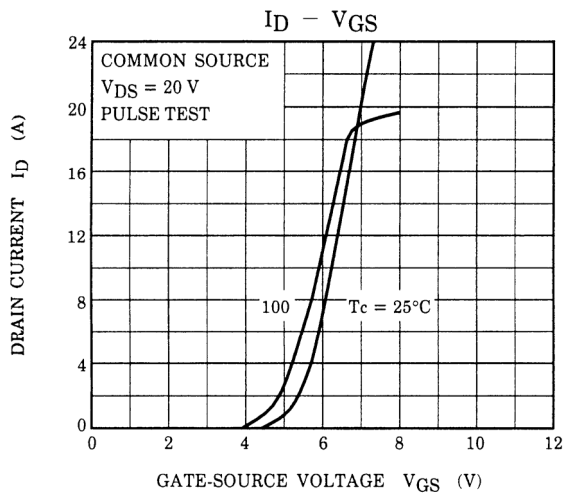
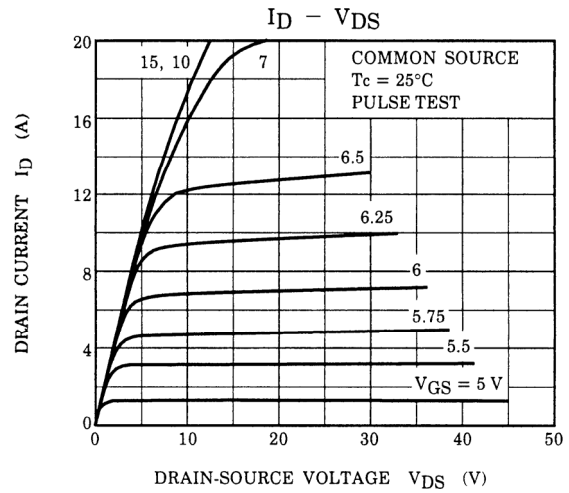
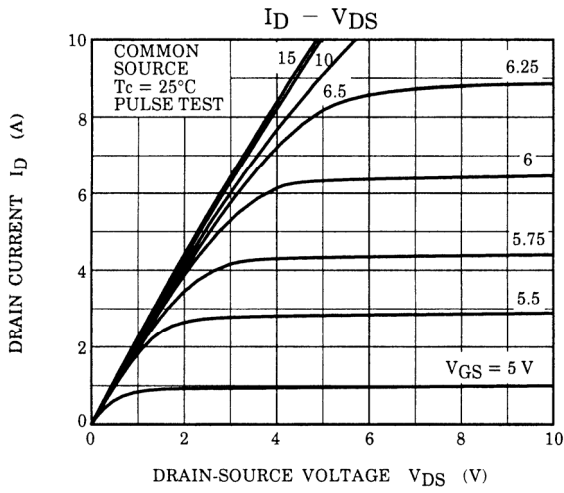
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|---------------|--|----------|------|----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 10 | μA |
| Gate-source breakdown voltage | | $V_{(BR)GSS}$ | $I_G = \pm 100\ \mu\text{A}, V_{DS} = 0\text{ V}$ | ± 30 | — | — | V |
| Drain cut-off current | | I_{DSS} | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 100 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 500 | — | — | V |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 2.0 | — | 4.0 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = 10\text{ V}, I_D = 6\text{ A}$ | — | 0.5 | 0.62 | Ω |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{GS} = 10\text{ V}, I_D = 6\text{ A}$ | 3.0 | 8.5 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 2040 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 210 | — | |
| Output capacitance | | C_{oss} | | — | 630 | — | |
| Switching time | Rise time | t_r |  <p>$V_{GS} = 10\text{ V}$ $V_{GS} = 0\text{ V}$ $I_D = 6\text{ A}$ V_{OUT} $R_L = 33\ \Omega$ $V_{DD} = 200\text{ V}$ $50\ \Omega$</p> <p>Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p> | — | 22 | — | ns |
| | Turn-on time | t_{on} | | — | 58 | — | |
| | Fall time | t_f | | — | 36 | — | |
| | Turn-off time | t_{off} | | — | 180 | — | |
| Total gate charge (Gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 12\text{ A}$ | — | 45 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 25 | — | |
| Gate-drain ("miller") charge | | Q_{gd} | | — | 20 | — | |

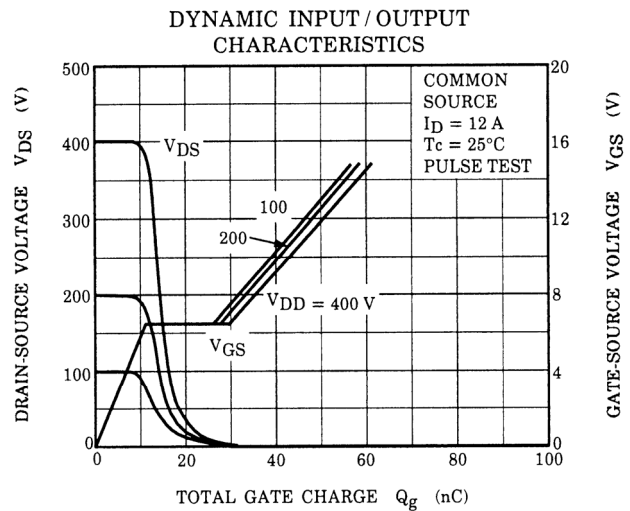
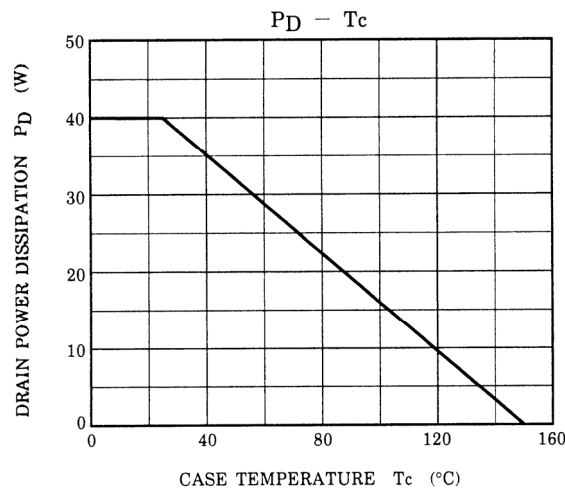
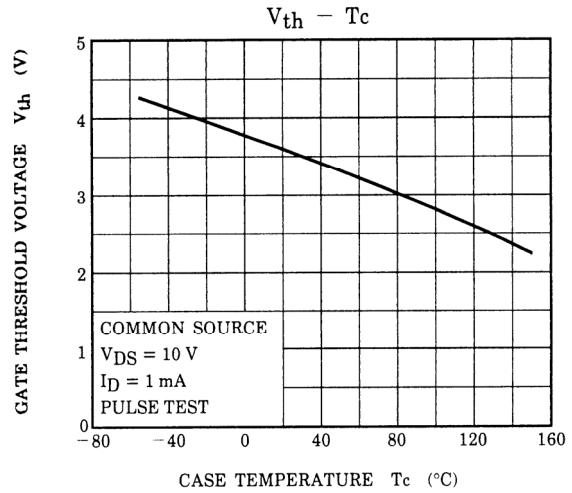
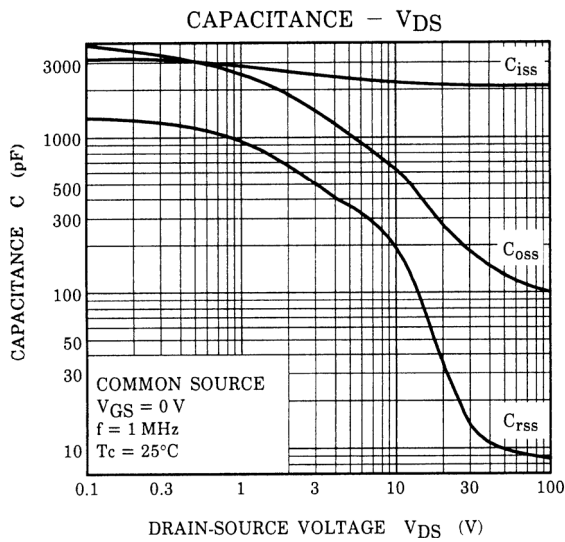
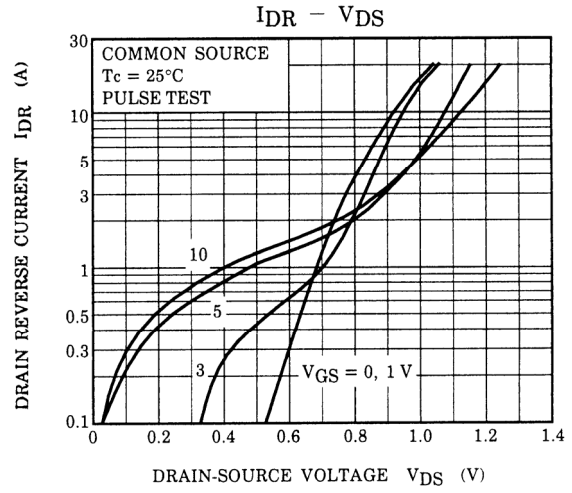
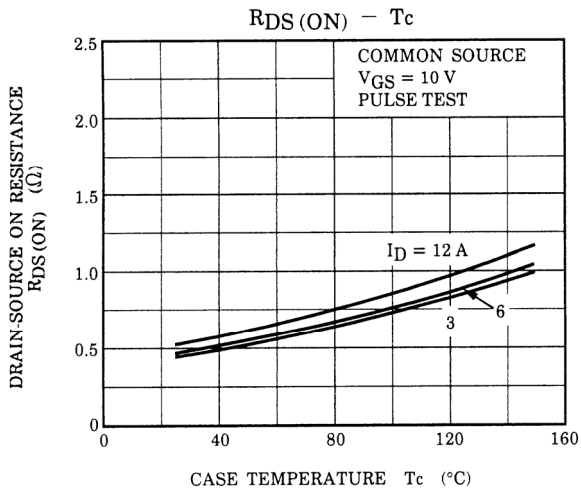
Source-Drain Ratings and Characteristics (Ta = 25°C)

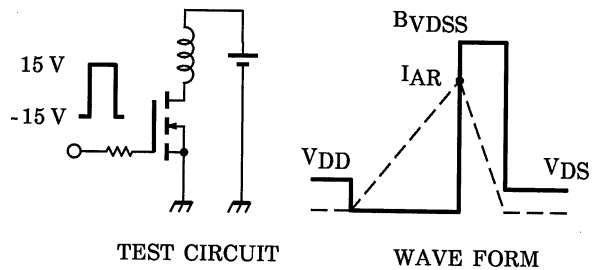
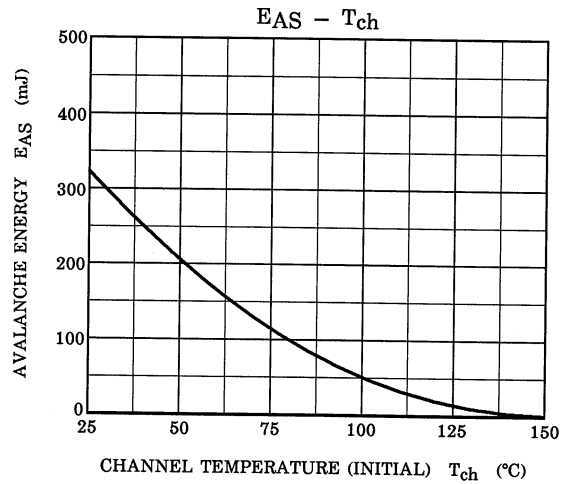
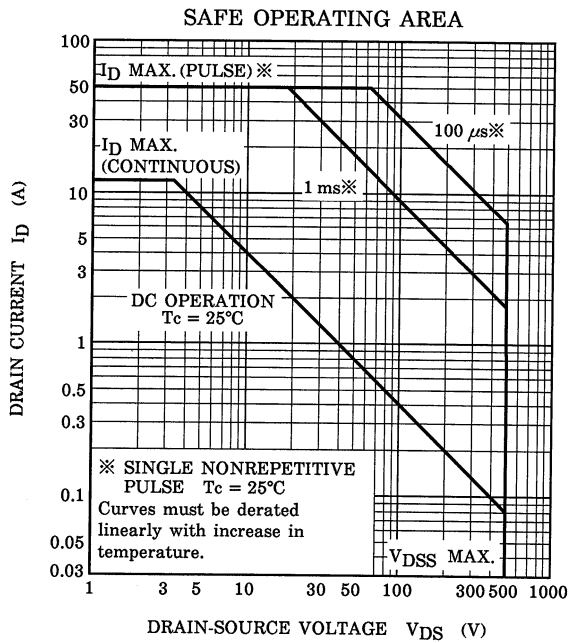
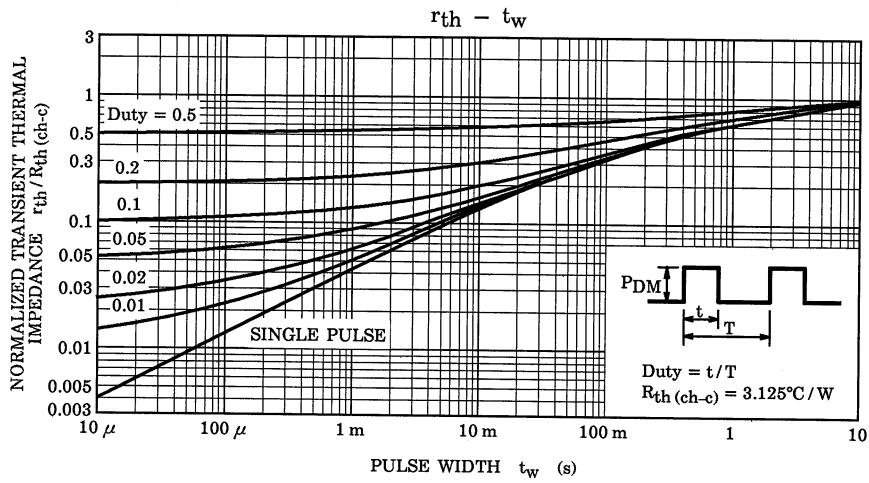
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 12 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 48 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 12\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 12\text{ A}, V_{GS} = 0\text{ V}$ | — | 90 | 160 | ns |
| Reverse recovery charge | Q_{rr} | $dI_{DR} / dt = 100\text{ A} / \mu\text{s}$ | — | 0.25 | — | μC |

Marking









$$R_G = 25 \Omega$$

$$V_{DD} = 90 \text{ V}, L = 3.83 \text{ mH}$$

$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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20070701-EN

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