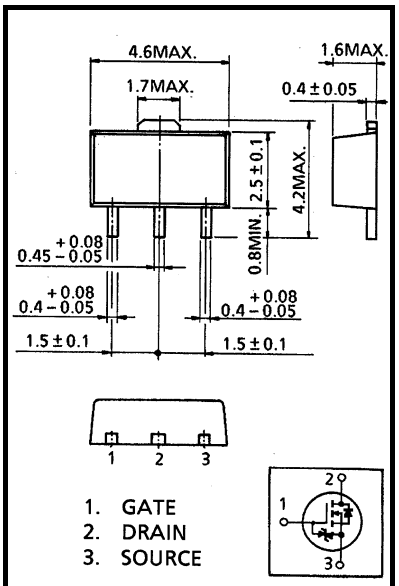
TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (π−MOSV)

# 2SK2992

Chopper Regulator, DC−DC Converter and Motor Drive Applications

- Low drain−source ON resistance : $R_{DS\ (ON)}$ = 2.2 Ω (typ.)
- High forward transfer admittance : $|Y_{fs}|$ = 0.9 S (typ.)
- Low leakage current : $I_{DSS}$ = 100 μA (max) ($V_{DS}$ = 200 V)
- Enhancement mode : $V_{th}$ = 2.0 to 3.5 V ($V_{DS}$ = 10 V, $I_D$ = 1 mA)

Unit: mm




| | |
|---|---|
| JEDEC | — |
| JEITA | SC-62 |
| TOSHIBA | 2-5K1B |

Weight: 0.05 g (typ.)

## Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain−source voltage | | $V_{DSS}$ | 200 | V |
| Drain−gate voltage ($R_{GS}$ = 20 kΩ) | | $V_{DGR}$ | 200 | V |
| Gate−source voltage | | $V_{GSS}$ | ±20 | V |
| Drain current | DC (Note 1) | $I_D$ | 1 | A |
| | Pulse (Note 1) | $I_{DP}$ | 3 | A |
| Drain power dissipation | | $P_D$ | 0.5 | W |
| Drain power dissipation (Note 2) | | $P_D$ | 1.5 | W |
| Single pulse avalanche energy (Note 3) | | $E_{AS}$ | 36 | mJ |
| Avalanche current | | $I_{AR}$ | 1 | A |
| Repetitive avalanche energy (Note 4) | | $E_{AR}$ | 0.05 | 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 ambient | $R_{th\ (ch-a)}$ | 250 | °C / W |

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

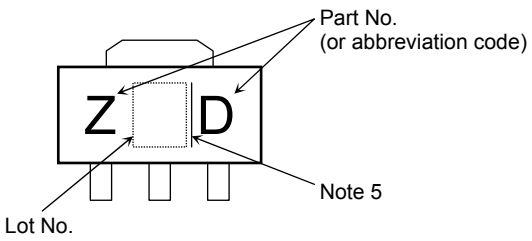
Note 2: Mounted on a ceramic substrate (25.4 mm × 25.4 mm × 0.8 mm)

Note 3: $V_{DD}$ = 50 V, $T_{ch}$ = 25°C (initial), L = 56.7 mH, $R_G$ = 25 Ω, $I_{AR}$ = 1 A

Note 4: Repetitive rating: pulse width limited by maximum channel temperature

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

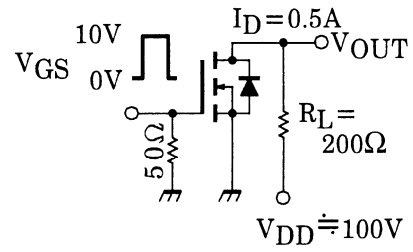
## Marking




Note 5: A line to the right of a Lot No. identifies the indication of product Labels.
Without a line: [[Pb]]/INCLUDES > MCV
With a line: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. 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.

## Electrical Characteristics (Ta = 25°C)

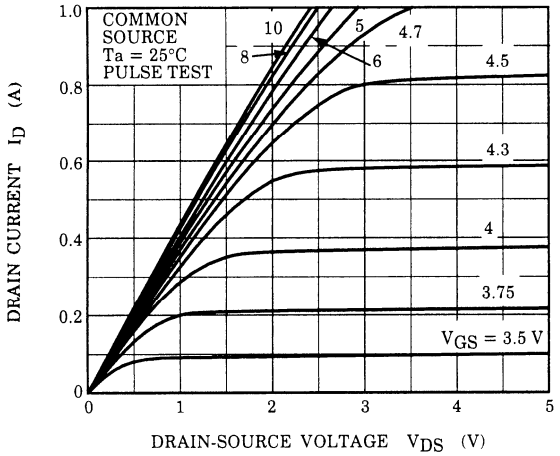
| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Gate leakage current | | $I_{GSS}$ | $V_{GS}$ = ±16 V, $V_{DS}$ = 0 V | — | — | ±10 | μA |
| Drain cut−off current | | $I_{DSS}$ | $V_{DS}$ = 200 V, $V_{GS}$ = 0 V | — | — | 100 | μA |
| Drain−source breakdown voltage | | $V_{(BR)\ DSS}$ | $I_D$ = 10 mA, $V_{GS}$ = 0 V | 200 | — | — | V |
| Gate threshold voltage | | $V_{th}$ | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 2.0 | — | 3.5 | V |
| Drain−source ON resistance | | $R_{DS\ (ON)}$ | $V_{GS}$ = 10 V, $I_D$ = 0.5 A | — | 2.2 | 3.5 | Ω |
| Forward transfer admittance | | $\|Y_{fs}\|$ | $V_{DS}$ = 10 V, $I_D$ = 0.5 A | 0.5 | 0.9 | — | S |
| Input capacitance | | $C_{iss}$ | $V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1 MHz | — | 90 | — | pF |
| Reverse transfer capacitance | | $C_{rss}$ | | — | 10 | — | |
| Output capacitance | | $C_{oss}$ | | — | 30 | — | |
| Switching time | Rise time | $t_r$ |  | — | 9 | — | ns |
| | Turn−on time | $t_{on}$ | | — | 17 | — | |
| | Fall time | $t_f$ | | — | 16 | — | |
| | Turn−off time | $t_{off}$ | | — | 45 | — | |
| Total gate charge (gate−source plus gate−drain) | | $Q_g$ | $V_{DD}$ ≈ 160 V, $V_{GS}$ = 10 V, $I_D$ = 1 A | — | 3.0 | — | nC |
| Gate−source charge | | $Q_{gs}$ | | — | 1.8 | — | |
| Gate−drain (“miller”) charge | | $Q_{gd}$ | | — | 1.2 | — | |



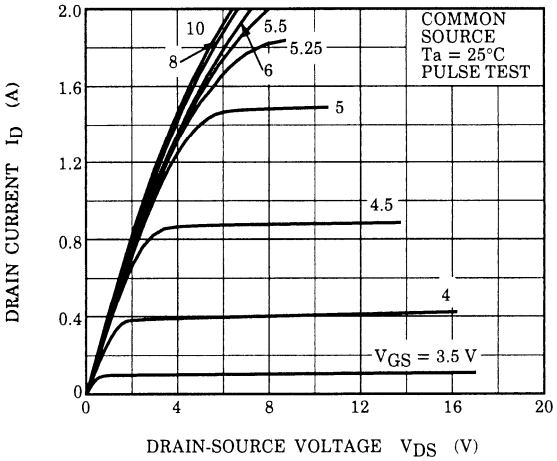
## Source−Drain Ratings and Characteristics (Ta = 25°C)

| 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 A, $V_{GS}$ = 0 V | — | — | −1.5 | V |
| Reverse recovery time | $t_{rr}$ | $I_{DR}$ = 1 A, $V_{GS}$ = 0 V, $dI_{DR}$ / dt = 100 A / μs | — | 85 | — | ns |
| Reverse recovery charge | $Q_{rr}$ | | — | 190 | — | nC |

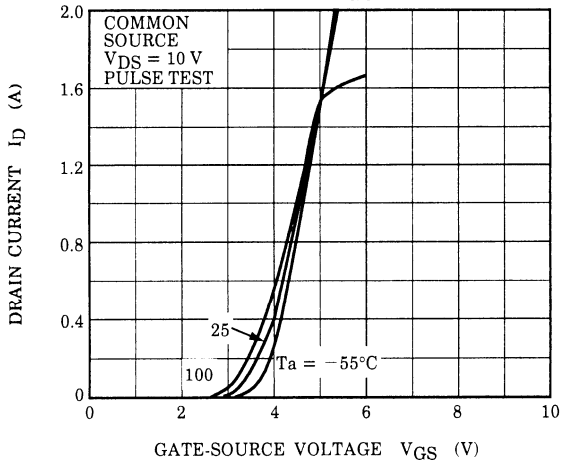
$I_D - V_{DS}$



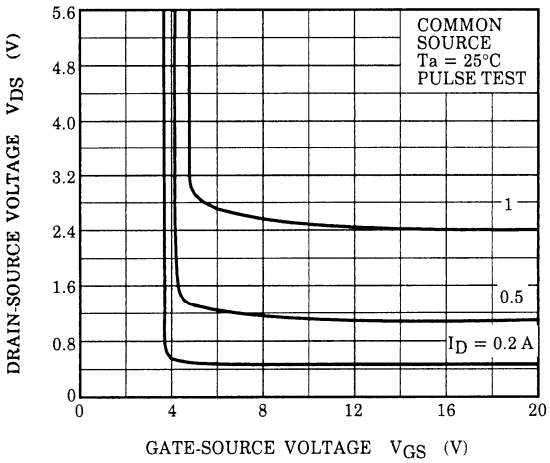

$I_D - V_{DS}$



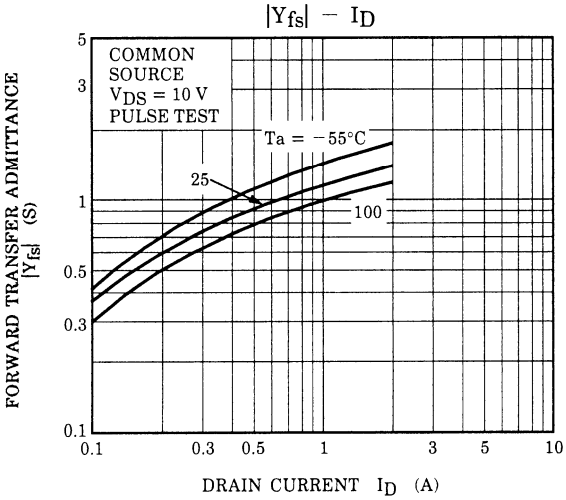

$I_D - V_{GS}$



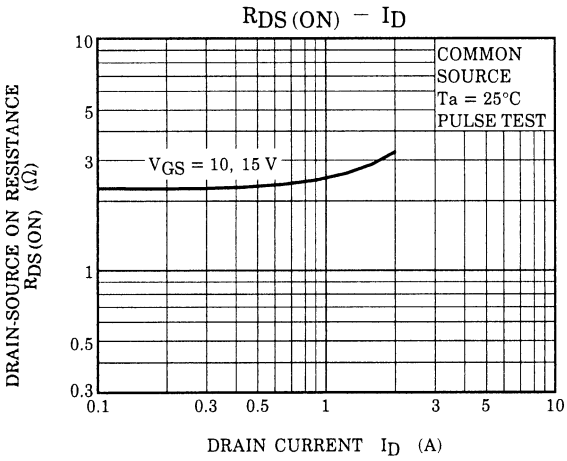

$V_{DS} - V_{GS}$



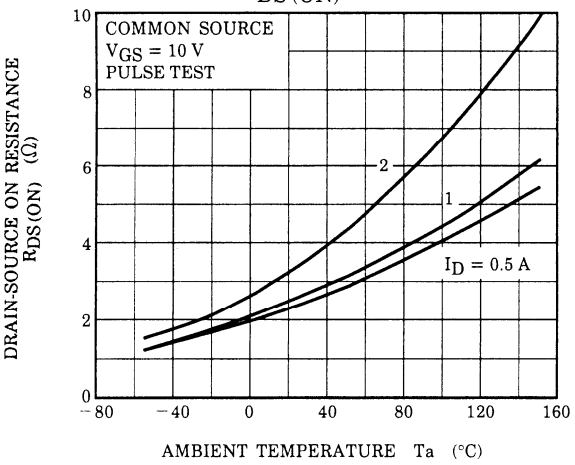

$|Y_{fs}| - I_D$



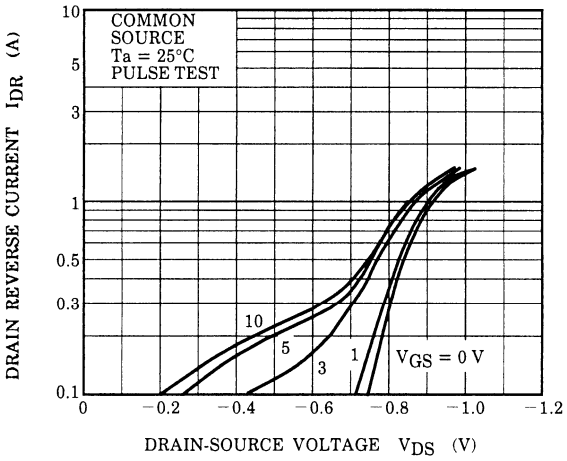

$R_{DS\,(ON)} - I_D$



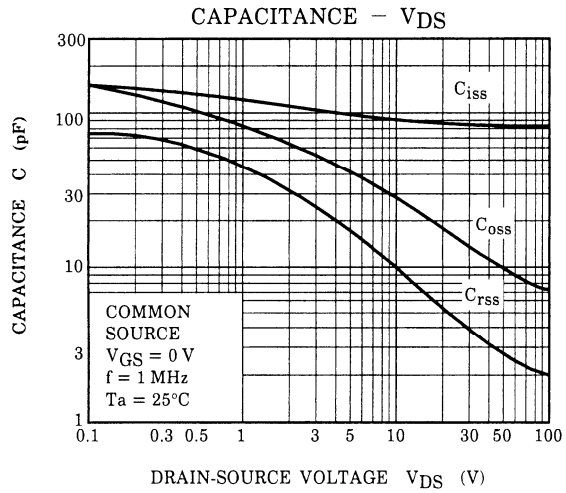
$R_{DS\,(ON)}$ – Ta



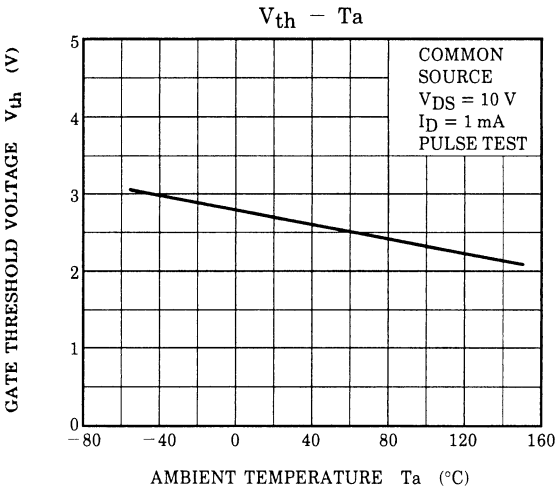

$I_{DR}$ – $V_{DS}$



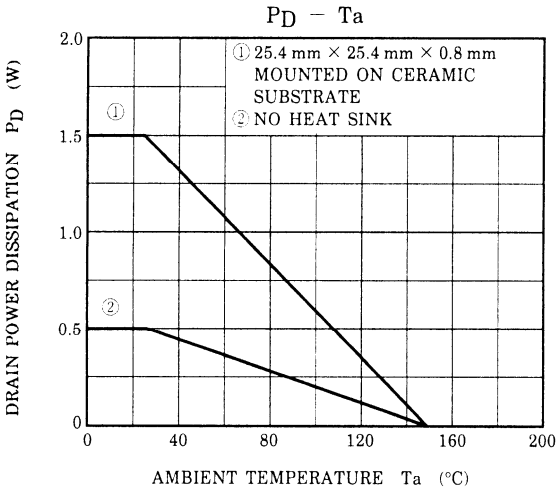

CAPACITANCE – $V_{DS}$



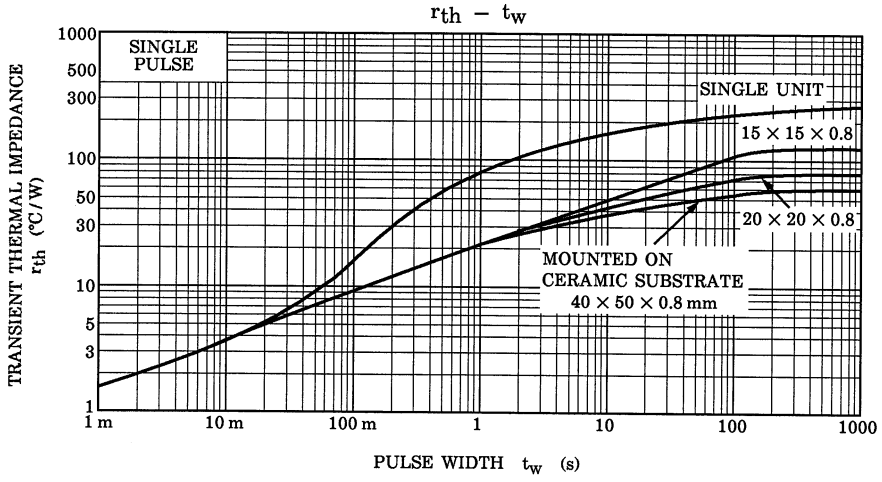

$V_{th}$ – Ta



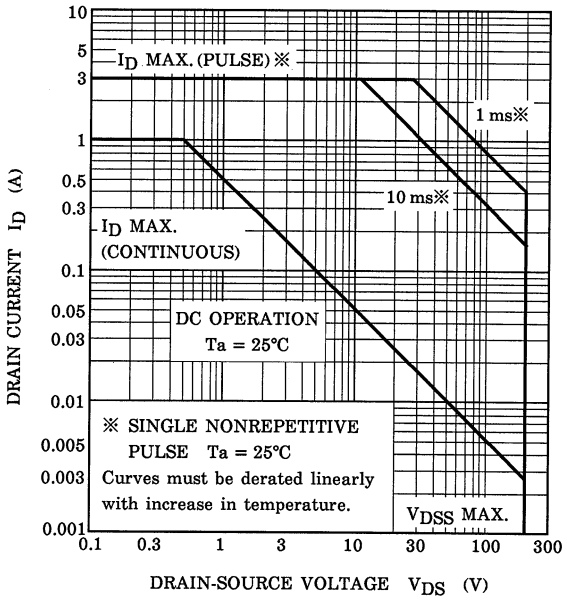

$P_D$ – Ta



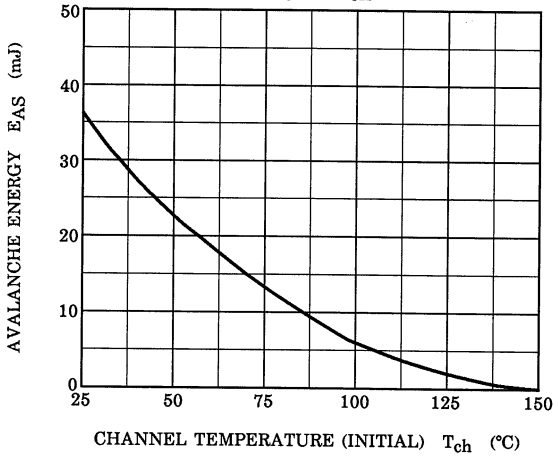
$r_{th} - t_w$

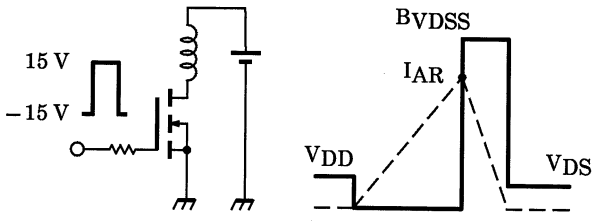



SAFE OPERATING AREA




$E_{AS} - T_{ch}$




TEST CIRCUIT WAVE FORM

$R_G = 25\ \Omega$
$V_{DD} = 50$ V, L = 56.7 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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