

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ( $\pi$ -MOSV)

# 2SK2417

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- Low drain-source ON resistance :  $R_{DS(ON)} = 0.42 \Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 7.5 S$  (typ.)
- Low leakage current :  $I_{DSS} = 100 \mu A$  (max) ( $V_{DS} = 250 V$ )
- Enhancement mode :  $V_{th} = 1.5$  to  $3.5 V$  ( $V_{DS} = 10 V, I_D = 1 mA$ )

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

| Characteristics                                |                | Symbol    | Rating   | Unit       |
|--|----------------|-----------|----------|------------|
| Drain-source voltage                           |                | $V_{DSS}$ | 250      | V          |
| Drain-gate voltage ( $R_{GS} = 20 k\Omega$ )   |                | $V_{DGR}$ | 250      | V          |
| Gate-source voltage                            |                | $V_{GSS}$ | $\pm 20$ | V          |
| Drain current                                  | DC (Note 1)    | $I_D$     | 7.5      | A          |
|  | Pulse (Note 1) | $I_{DP}$  | 30       | A          |
| Drain power dissipation ( $T_c = 25^\circ C$ ) |                | $P_D$     | 30       | W          |
| Single pulse avalanche energy (Note 2)         |                | $E_{AS}$  | 110      | mJ         |
| Avalanche current                              |                | $I_{AR}$  | 7.5      | A          |
| Repetitive avalanche energy (Note 3)           |                | $E_{AR}$  | 3        | mJ         |
| Channel temperature                            |                | $T_{ch}$  | 150      | $^\circ C$ |
| Storage temperature range                      |                | $T_{stg}$ | -55~150  | $^\circ C$ |

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    | $R_{th(ch-c)}$ | 4.16 | $^\circ C / W$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 62.5 | $^\circ C / W$ |

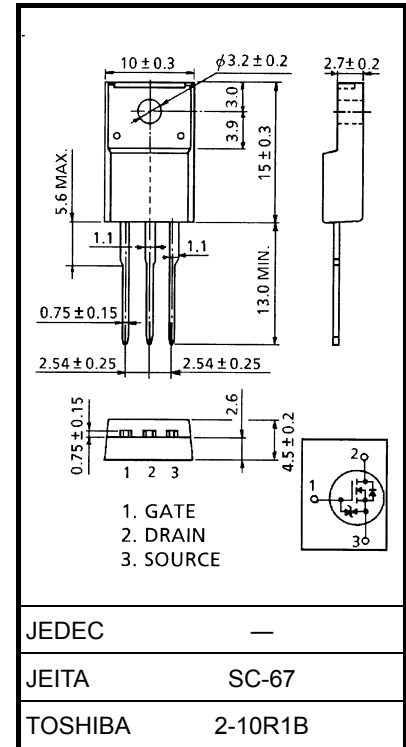
Note 1: Ensure that the channel temperature does not exceed  $150^\circ C$ .

Note 2:  $V_{DD} = 50 V, T_{ch} = 25^\circ C$  (initial),  $L = 3.3 mH, R_G = 25 \Omega, I_{AR} = 7.5 A$

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.)

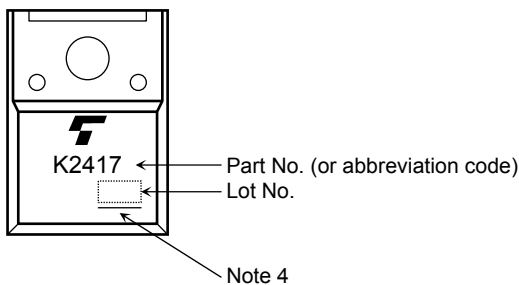
## Electrical Characteristics (Ta = 25°C)

| Characteristics                                 |               | Symbol        | Test Condition   | Min | Typ. | Max      | Unit          |
|---|---------------|---------------|--|-----|------|----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$  | —   | —    | $\pm 10$ | $\mu\text{A}$ |
| Drain cut-off current                           |               | $I_{DSS}$     | $V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$   | —   | —    | 100      | $\mu\text{A}$ |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$  | 250 | —    | —        | V             |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$  | 1.5 | —    | 3.5      | V             |
| Drain-source ON resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$   | —   | 0.42 | 0.5      | $\Omega$      |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10\text{ V}, I_D = 3.5\text{ A}$   | 4   | 7.5  | —        | S             |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$  | —   | 700  | —        | pF            |
| Reverse transfer capacitance                    |               | $C_{rss}$     |  | —   | 80   | —        |               |
| Output capacitance                              |               | $C_{oss}$     |  | —   | 270  | —        |               |
| Switching time                                  | Rise time     | $t_r$         | <p><math>I_D = 3.5\text{ A}</math><br/><math>V_{GS} = 10\text{ V}, 0\text{ V}</math><br/><math>V_{OUT}</math><br/><math>R_L = 28.6\ \Omega</math><br/><math>V_{DD} = 100\text{ V}</math><br/><math>1.5\ \Omega</math><br/>Duty <math>\leq 1\%</math>, <math>t_w = 10\ \mu\text{s}</math></p> | —   | 10   | —        | ns            |
|   | Turn-on time  | $t_{on}$      |  | —   | 20   | —        |               |
|   | Fall time     | $t_f$         |  | —   | 10   | —        |               |
|   | Turn-off time | $t_{off}$     |  | —   | 70   | —        |               |
| Total gate charge (Gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx 200\text{ V}, V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$  | —   | 20   | —        | nC            |
| Gate-source charge                              |               | $Q_{gs}$      |  | —   | 13   | —        |               |
| Gate-drain ("miller") charge                    |               | $Q_{gd}$      |  | —   | 7    | —        |               |

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

| Characteristics                           | Symbol    | Test Condition                               | Min | Typ. | Max  | Unit          |
|---|-----------|--|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | $I_{DR}$  | —  | —   | —    | 7.5  | A             |
| Pulse drain reverse current (Note 1)      | $I_{DRP}$ | —  | —   | —    | 30   | A             |
| Forward voltage (diode)                   | $V_{DSF}$ | $I_{DR} = 7.5\text{ A}, V_{GS} = 0\text{ V}$ | —   | —    | -2.0 | V             |
| Reverse recovery time                     | $t_{rr}$  | $I_{DR} = 7.5\text{ A}, V_{GS} = 0\text{ V}$ | —   | 180  | —    | ns            |
| Reverse recovery charge                   | $Q_{rr}$  | $dI_{DR} / dt = 100\text{ A} / \mu\text{s}$  | —   | 1.1  | —    | $\mu\text{C}$ |

## Marking

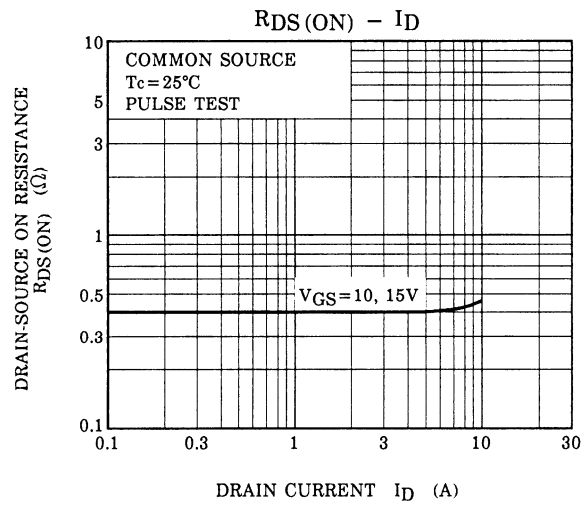
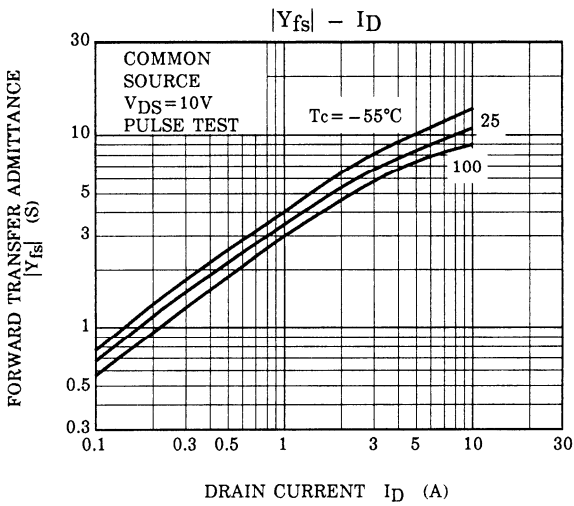
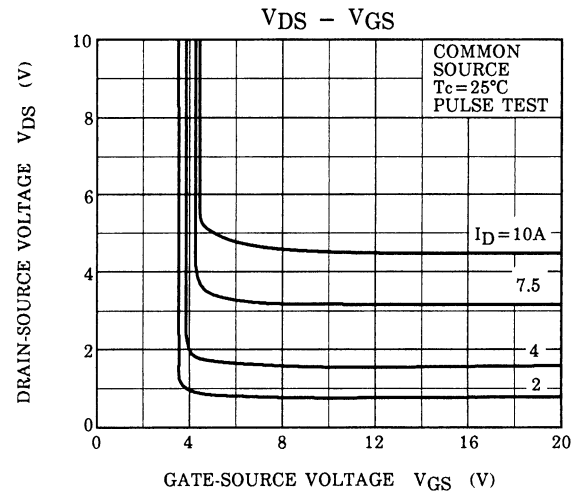
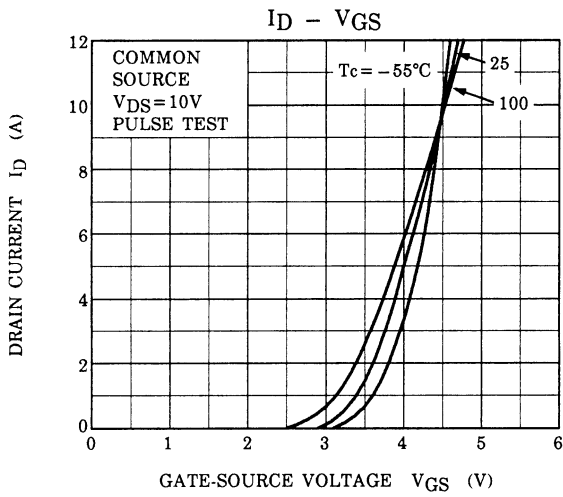
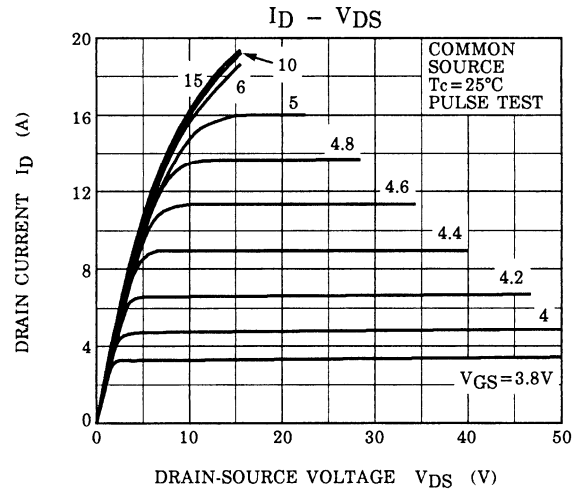
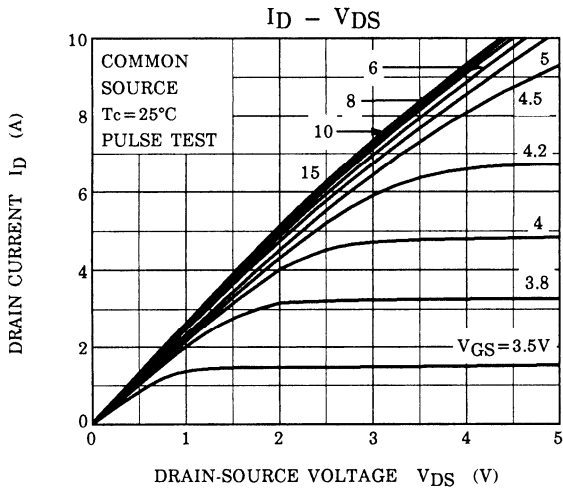


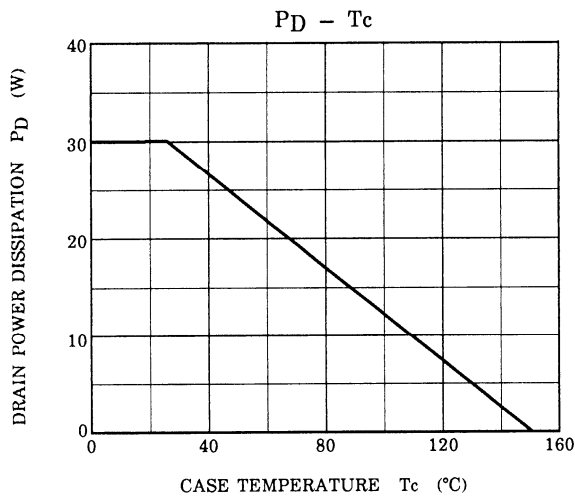
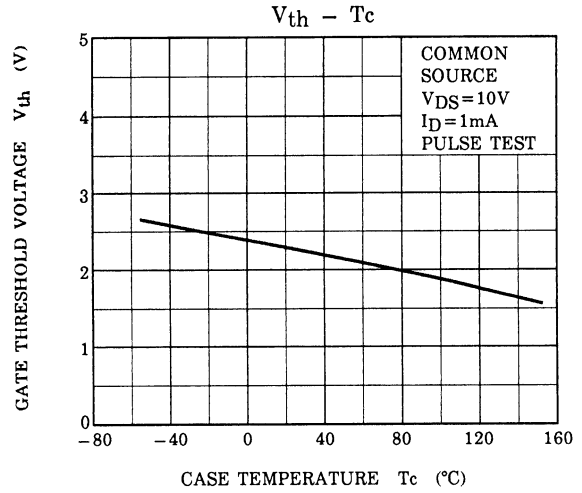
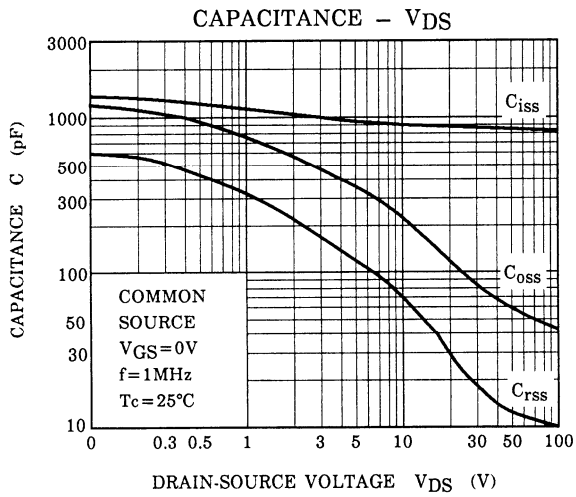
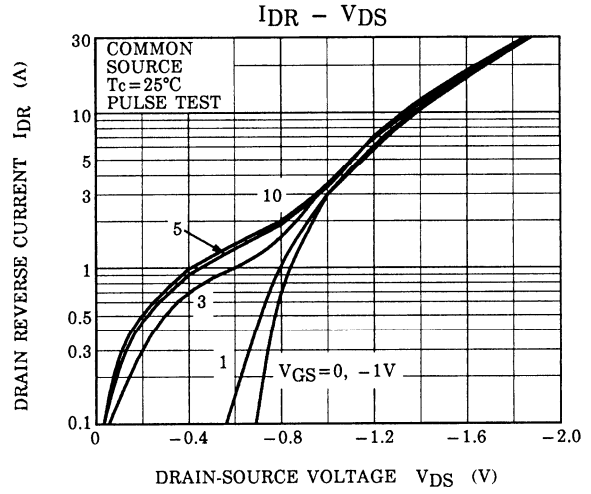
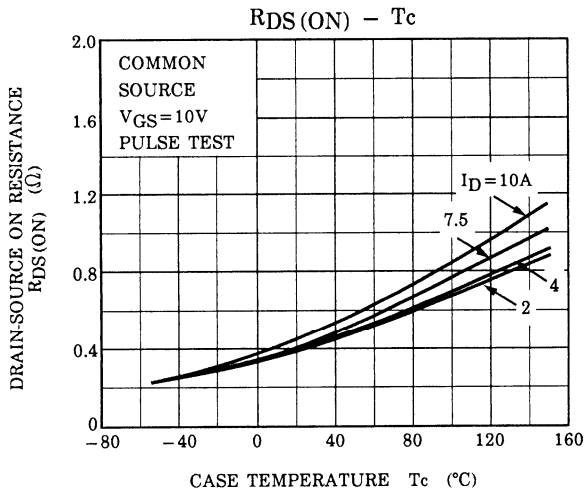
Note 4: A line under a Lot No. identifies the indication of product Labels.

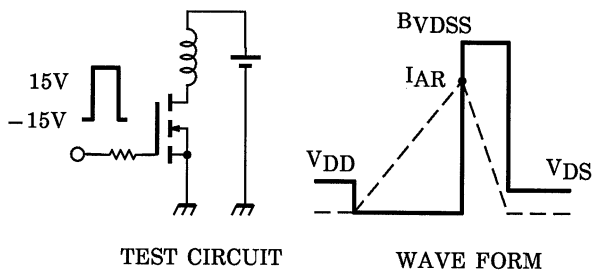
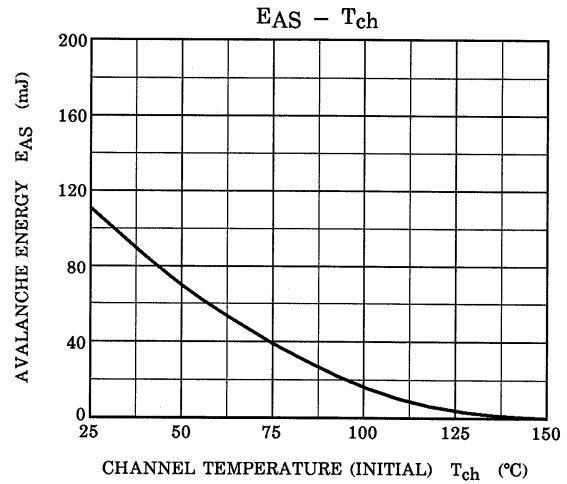
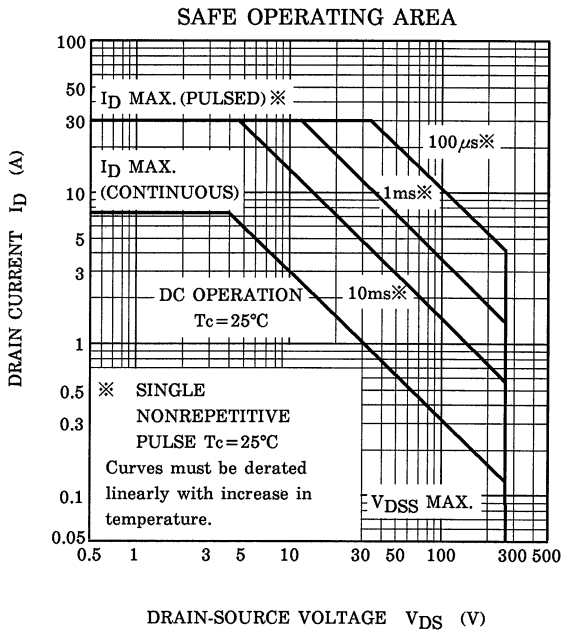
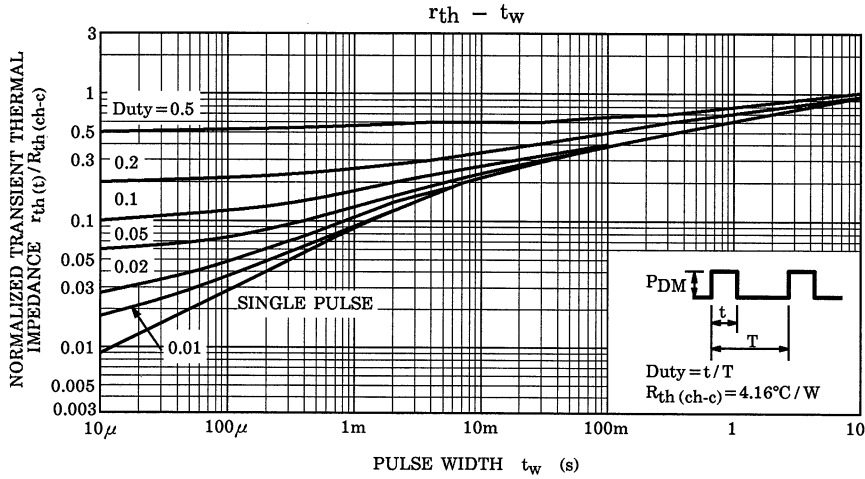
Not underlined: [[Pb]]/INCLUDES > MCV

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

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$R_G = 25 \Omega$   
 $V_{DD} = 50 V, L = 3.3 mH$

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

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