

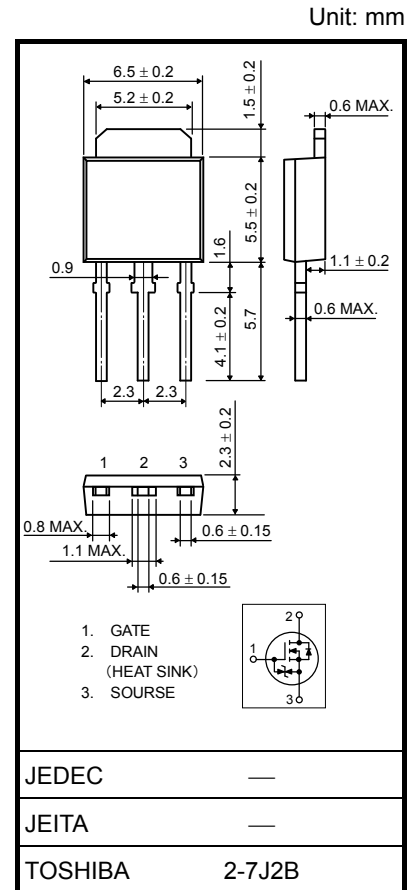
2SK4017

Chopper Regulator, DC-DC Converter and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON-resistance: $R_{DS(ON)} = 0.07 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 6.0 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 100 \mu\text{A}$ (max) ($V_{DS} = 60 \text{ V}$)
- Enhancement mode: $V_{th} = 1.3 \text{ to } 2.5 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

Absolute Maximum Ratings (Ta = 25°C)

| Characteristic | | 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 | 5 | A |
| | Pulse (Note 1) | I_{DP} | 20 | A |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | | P_D | 20 | W |
| Single-pulse avalanche energy (Note 2) | | E_{AS} | 40.5 | mJ |
| Avalanche current | | I_{AR} | 5 | A |
| Repetitive avalanche energy (Note 3) | | E_{AR} | 2 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | | T_{stg} | -55 to 150 | $^\circ\text{C}$ |



Weight: 0.36 g (typ.)

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

| Characteristic | Symbol | Max | Unit |
|----------------------------------------|----------------|------|-----------------------------|
| Thermal resistance, channel to case | $R_{th(ch-c)}$ | 6.25 | $^\circ\text{C} / \text{W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 125 | $^\circ\text{C} / \text{W}$ |

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

Note 2: $V_{DD} = 25 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 2.2 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = 5 \text{ A}$

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

This transistor is an electrostatic-sensitive device. Handle with care.

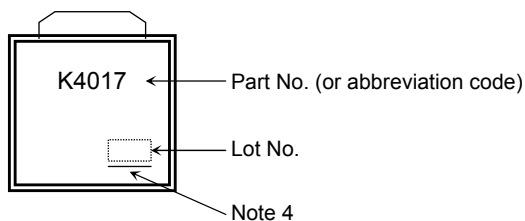
Electrical Characteristics (Ta = 25°C)

| Characteristic | | 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 cutoff 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 |
| | | $V_{(BR)DSX}$ | $I_D = 10\text{ mA}, V_{GS} = -20\text{ V}$ | 35 | — | — | V |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 1.3 | — | 2.5 | V |
| Drain-source ON-resistance | | $R_{DS(ON)}$ | $V_{GS} = 4\text{ V}, I_D = 2.5\text{ A}$ | — | 0.09 | 0.15 | Ω |
| | | | $V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$ | — | 0.07 | 0.10 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 2.5\text{ A}$ | 3.0 | 6.0 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 730 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 60 | — | |
| Output capacitance | | C_{oss} | | — | 95 | — | |
| Switching time | Rise time | t_r | <p>Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p> | — | 10 | — | ns |
| | Turn-on time | t_{on} | | — | 20 | — | |
| | Fall time | t_f | | — | 4 | — | |
| | Turn-off time | t_{off} | | — | 35 | — | |
| Total gate charge (gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$ | — | 15 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 11 | — | |
| Gate-drain ("Miller") charge | | Q_{gd} | | — | 4 | — | |

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

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------------------------------|-----------|----------------------------------------------------------------------------------|-----|------|------|------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 5 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 20 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 5\text{ A}, V_{GS} = 0\text{ V}, dI_{DR}/dt = 50\text{ A}/\mu\text{s}$ | — | 34 | — | ns |
| Reverse recovery charge | Q_{rr} | | — | 28 | — | nC |

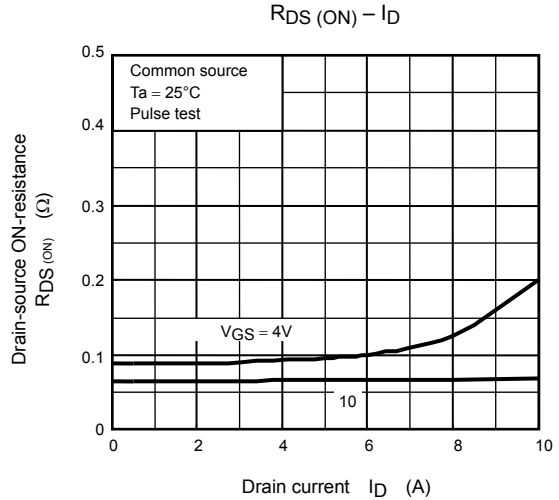
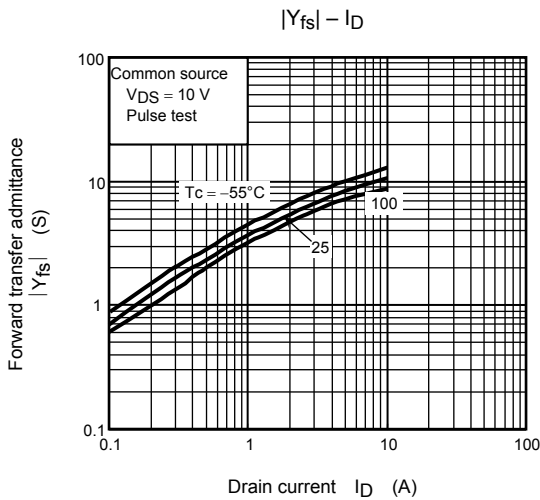
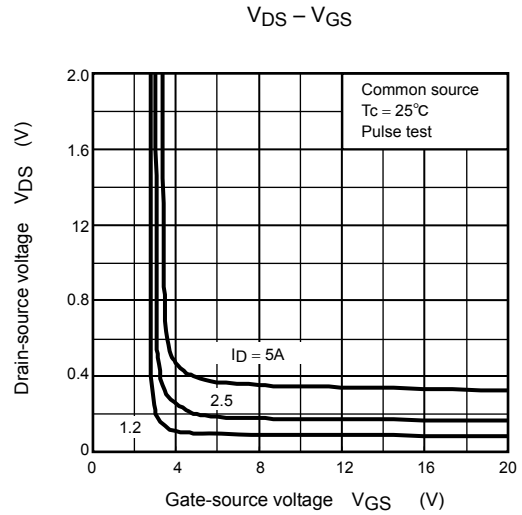
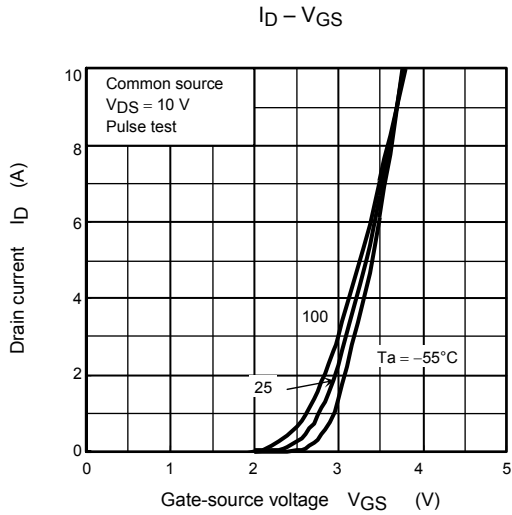
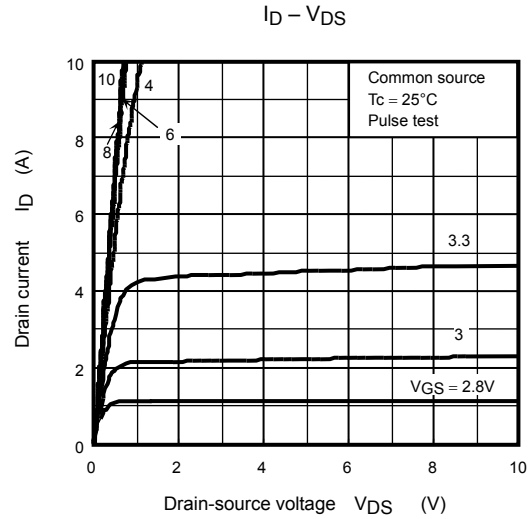
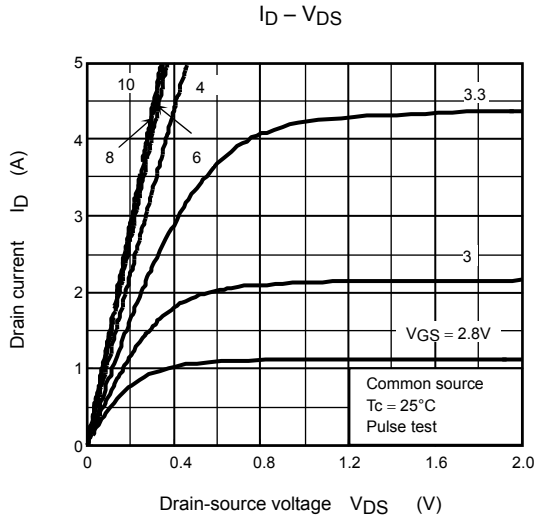
Marking



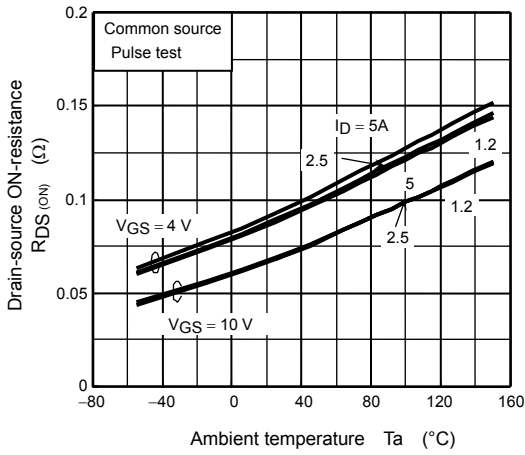
Note 4: A line under a Lot No. identifies the indication of product Labels.

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

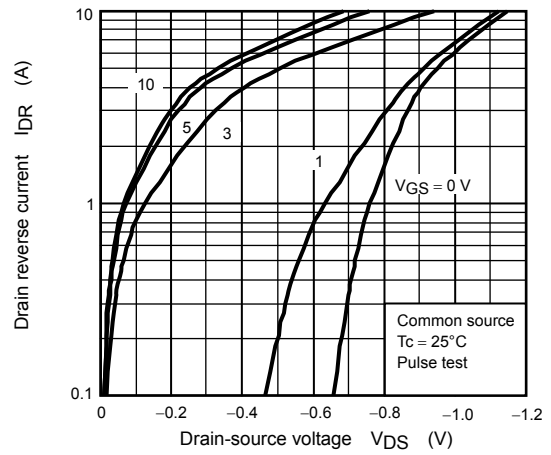
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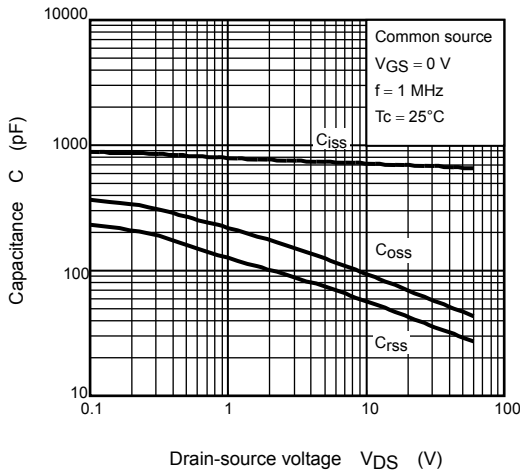
$R_{DS(ON)} - T_a$



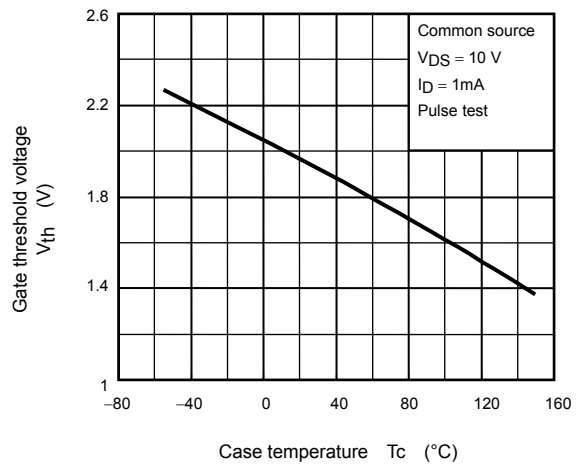
$I_{DR} - V_{DS}$



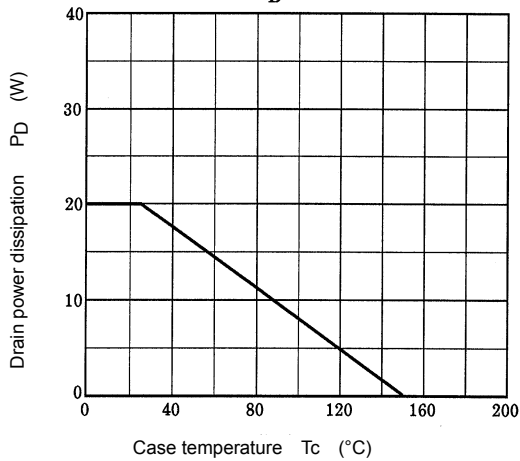
Capacitance - V_{DS}



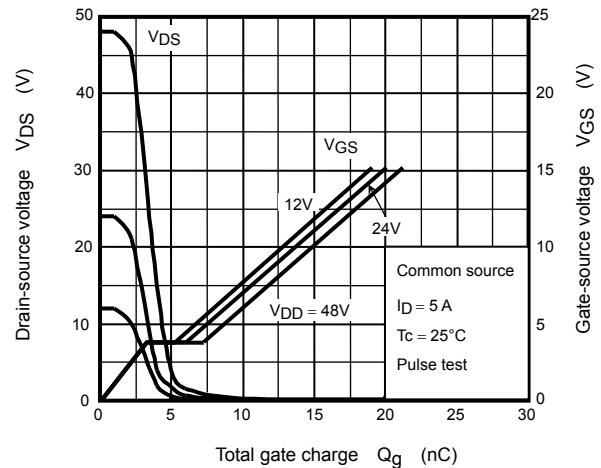
$V_{th} - T_c$

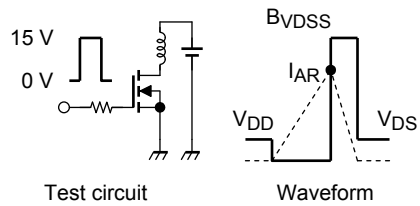
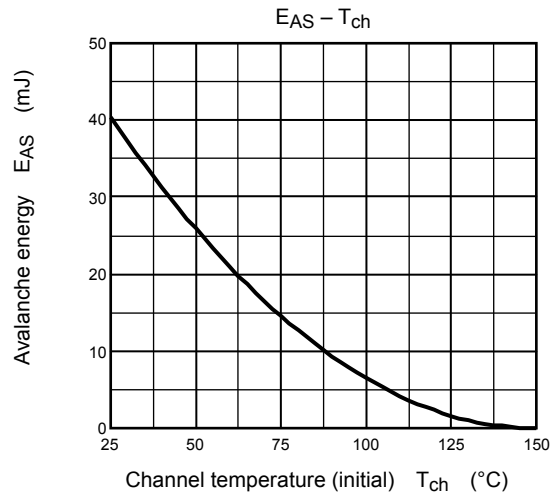
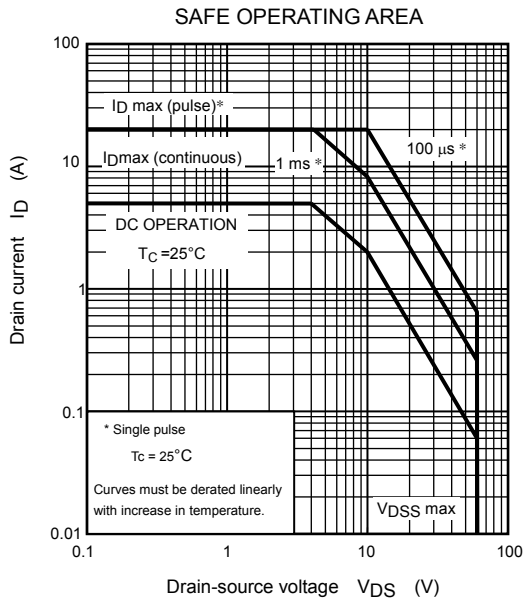
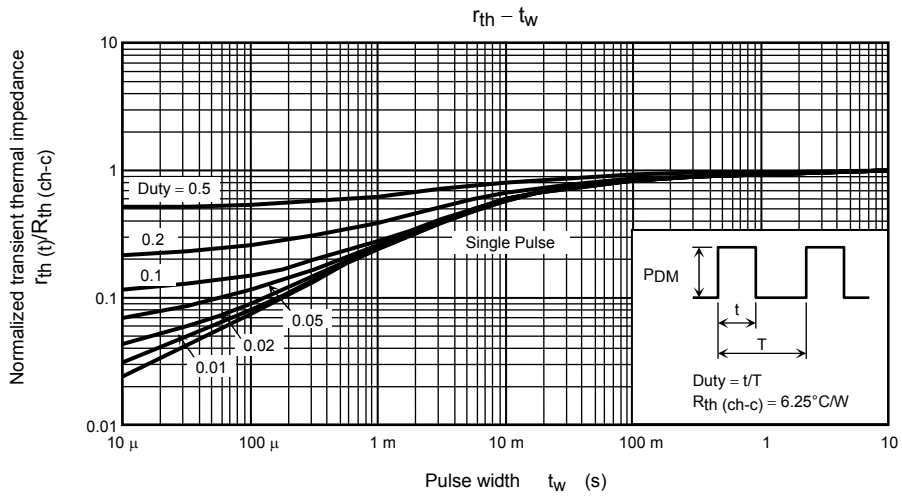


$P_D - T_c$



Dynamic input / output characteristics





$$R_G = 25 \Omega$$

$$V_{DD} = 25 V, L = 2.2 mH$$

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

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