

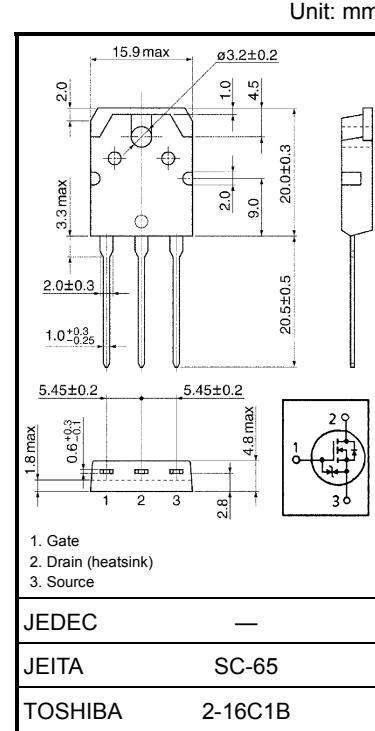
TOSHIBA Field Effect Transistor Silicon N-Channel MOS Type (MACHII  $\pi$ -MOSVI)**2SK3907**

## Switching Regulator Applications

- Small gate charge:  $Q_g = 60 \text{ nC}$  (typ.)
- Low drain-source ON resistance:  $R_{DS(\text{ON})} = 0.18 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 12 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 500 \mu\text{A}$  ( $V_{DS} = 500 \text{ V}$ )
- Enhancement model:  $V_{th} = 2.0 \sim 4.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

**Maximum Ratings (Ta = 25°C)**

| Characteristic                                       | 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                                  | $V_{GSS}$      | $\pm 30$ | V                |
| Drain current  | DC (Note 1)    | $I_D$    | 23               |
|  | Pulse (Note 1) | $I_{DP}$ | 92               |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ ) | $P_D$          | 150      | W                |
| Single pulse avalanche energy (Note 2)               | $E_{AS}$       | 552      | mJ               |
| Avalanche current                                    | $I_{AR}$       | 23       | A                |
| Repetitive avalanche energy (Note 3)                 | $E_{AR}$       | 15       | mJ               |
| Channel temperature                                  | $T_{ch}$       | 150      | $^\circ\text{C}$ |
| Storage temperature range                            | $T_{stg}$      | -55~150  | $^\circ\text{C}$ |



Weight: 4.6 g (typ.)

**Thermal Characteristics**

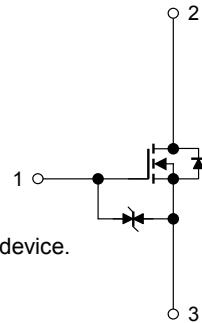
| Characteristic                         | Symbol                | Max   | Unit               |
|--|-----------------------|-------|--------------------|
| Thermal resistance, channel to case    | $R_{th}(\text{ch-c})$ | 0.833 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient | $R_{th}(\text{ch-a})$ | 50    | $^\circ\text{C/W}$ |

Note 1: Ensure that the channel temperature does not exceed 150°C during use of the device.

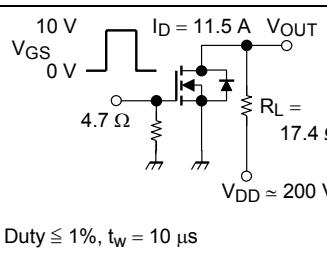
Note 2:  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.77 \text{ mH}$ ,  $I_{AR} = 23 \text{ A}$ ,  $R_G = 25 \Omega$ 

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

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



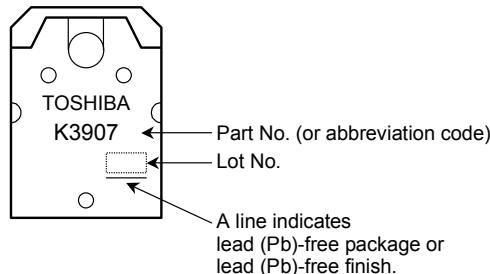
## Electrical Characteristics (Ta = 25°C)

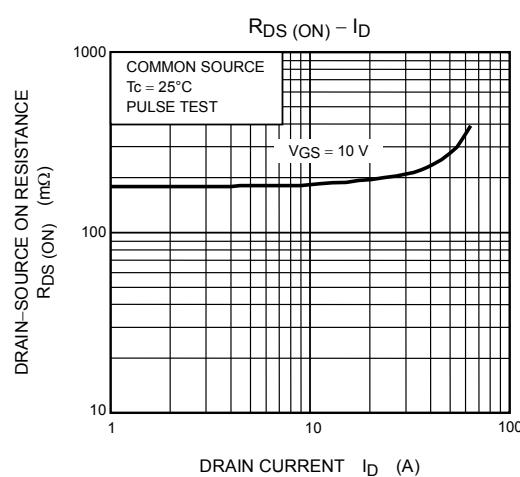
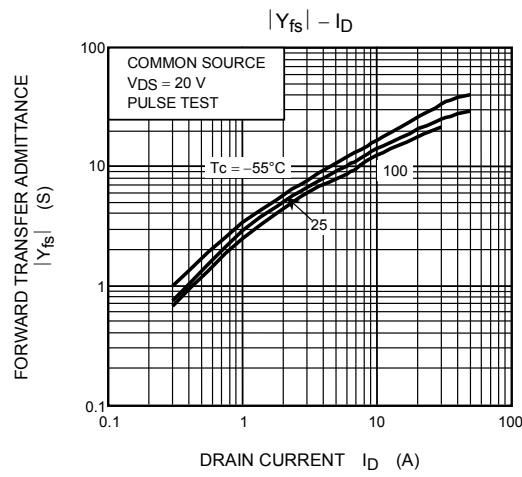
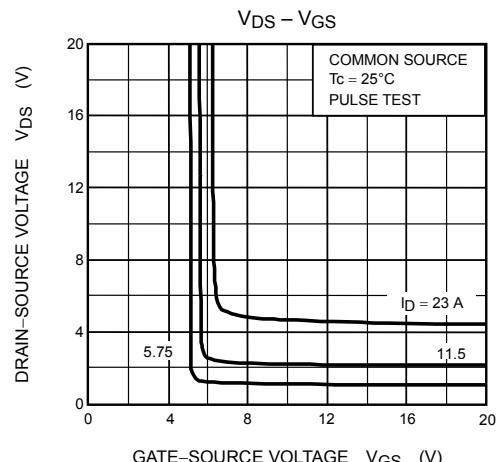
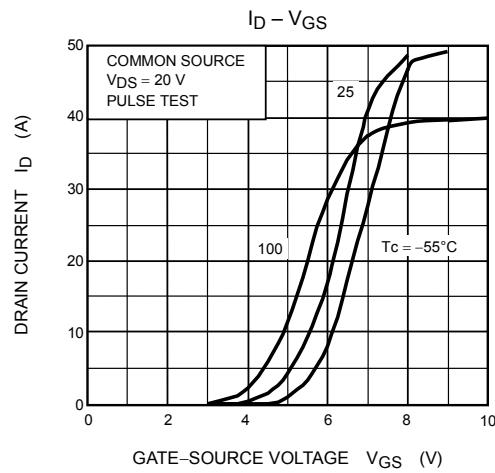
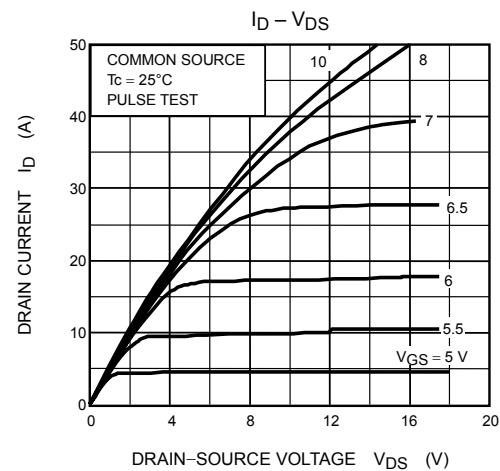
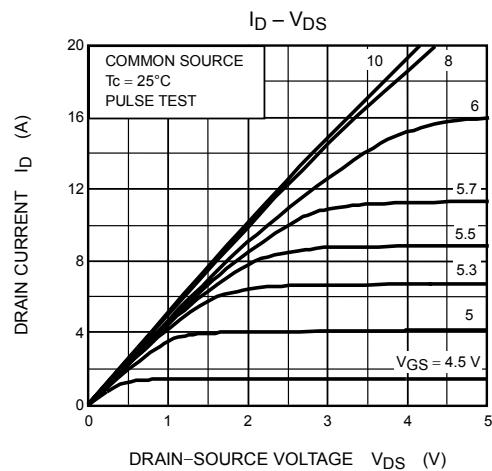
| Characteristic                 | Symbol                | Test Condition   | Min   | Typ. | Max  | Unit |
|--------------------------------|-----------------------|--|---|------|------|------|
| Gate leakage current           | I <sub>GSS</sub>      | V <sub>GS</sub> = ±25 V, V <sub>DS</sub> = 0 V                         | —   | —    | ±10  | μA   |
| Gate-source breakdown voltage  | V <sub>(BR) GSS</sub> | I <sub>D</sub> = 10 μA, V <sub>DS</sub> = 0 V                          | ±30   | —    | —    | V    |
| Drain cutoff current           | I <sub>DSS</sub>      | V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V                         | —   | —    | 500  | μA   |
| Drain-source breakdown voltage | V <sub>(BR) DSS</sub> | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0 V                          | 500   | —    | —    | V    |
| Gate threshold voltage         | V <sub>th</sub>       | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA                          | 2.0   | —    | 4.0  | V    |
| Drain-source ON resistance     | R <sub>DS (ON)</sub>  | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 11.5 A                        | —   | 0.18 | 0.23 | Ω    |
| Forward transfer admittance    | Y <sub>fs</sub>       | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 11.5 A                        | 3.4   | 12   | —    | S    |
| Input capacitance              | C <sub>iss</sub>      | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz               | —   | 4250 | —    | pF   |
| Reverse transfer capacitance   | C <sub>rss</sub>      |  | —   | 10   | —    |      |
| Output capacitance             | C <sub>oss</sub>      |  | —   | 420  | —    |      |
| Switching time                 | Rise time             | t <sub>r</sub>   | <br>10 V<br>V <sub>GS</sub><br>0 V<br>4.7 Ω<br>17.4 Ω<br>V <sub>OUT</sub><br>V <sub>DD</sub> ≈ 200 V<br>Duty ≤ 1%, t <sub>W</sub> = 10 μs | —    | 12   | —    |
|                                | Turn-on time          | t <sub>on</sub>  |   | —    | 45   | —    |
|                                | Fall time             | t <sub>f</sub>   |   | —    | 10   | —    |
|                                | Turn-off time         | t <sub>off</sub>   |   | —    | 80   | —    |
| Total gate charge              | Q <sub>g</sub>        | V <sub>DD</sub> ≈ 400 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A | —   | 60   | —    | nC   |
| Gate-source charge             | Q <sub>gs</sub>       |  | —   | 50   | —    |      |
| Gate-drain charge              | Q <sub>gd</sub>       |  | —   | 10   | —    |      |

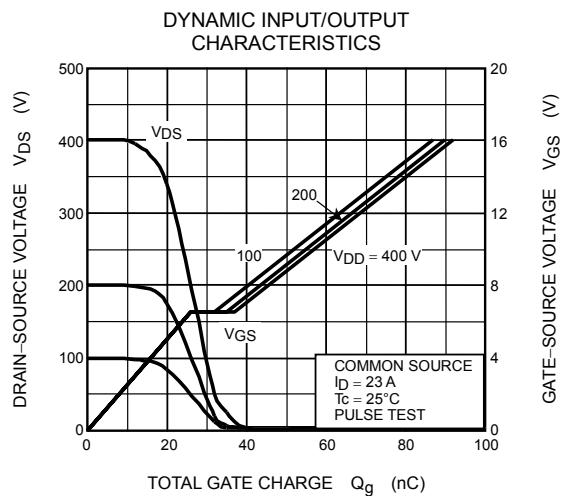
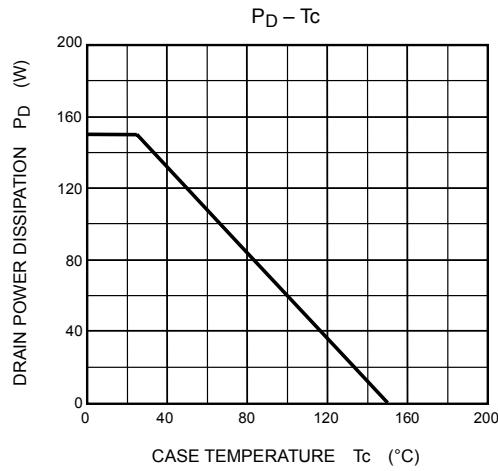
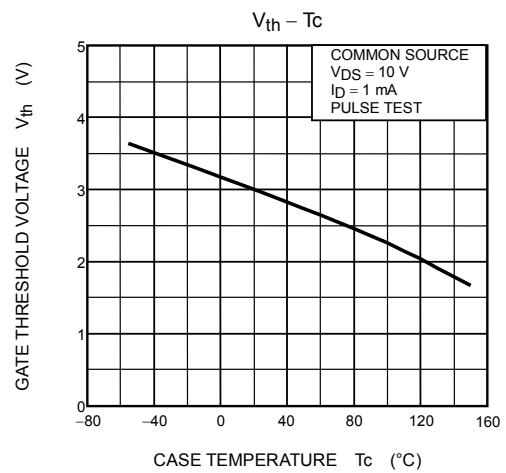
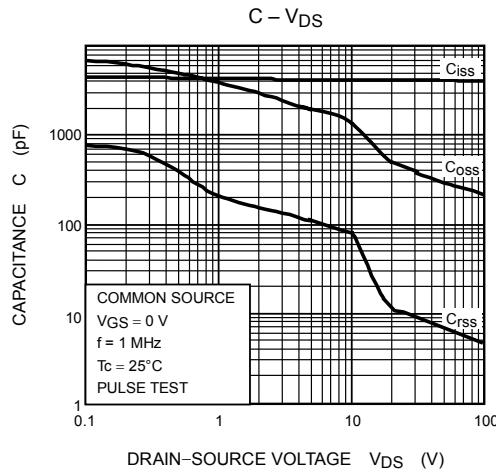
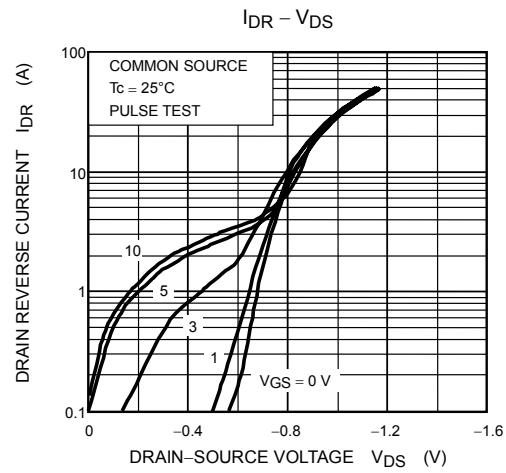
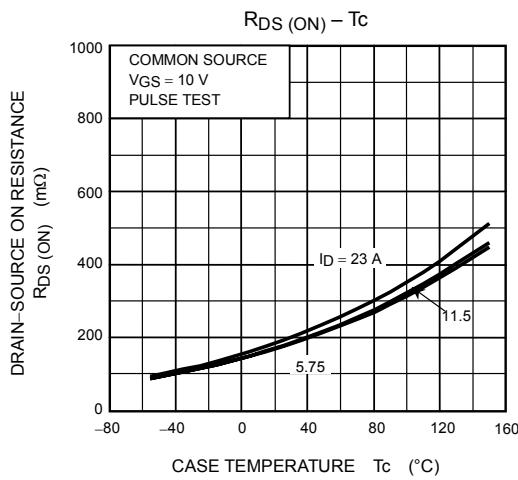
## Source-Drain Ratings and Characteristics (Ta = 25°C)

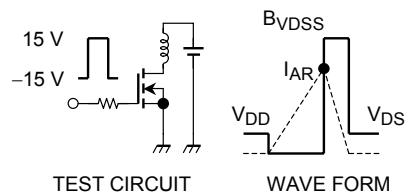
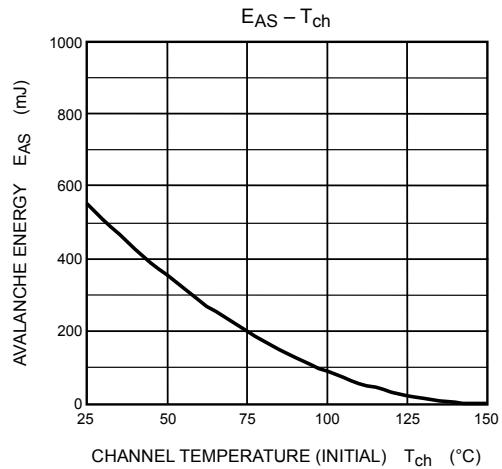
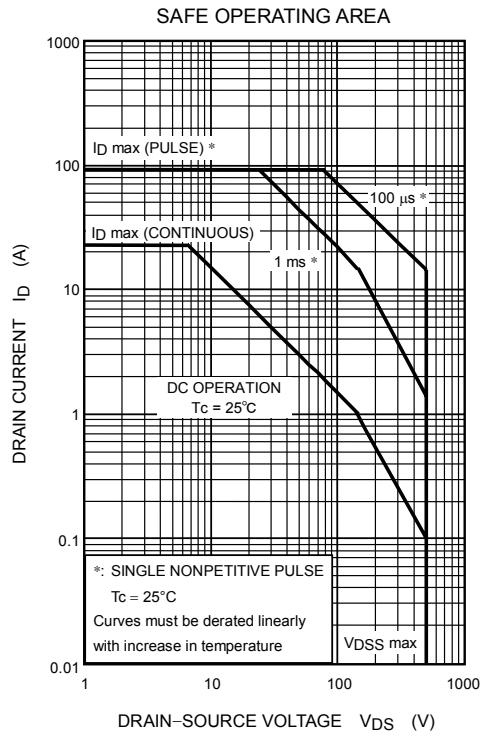
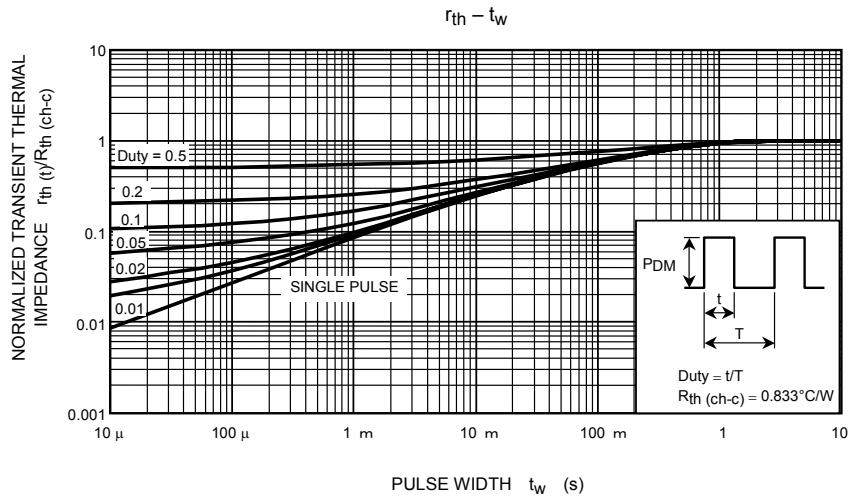
| Characteristic                            | Symbol           | Test Condition   | Min | Typ. | Max  | Unit |
|---|------------------|--|-----|------|------|------|
| Continuous drain reverse current (Note 1) | I <sub>DR</sub>  | —  | —   | —    | 23   | A    |
| Pulse drain reverse current (Note 1)      | I <sub>DRP</sub> | —  | —   | —    | 92   | A    |
| Forward voltage (diode)                   | V <sub>DSF</sub> | I <sub>DR</sub> = 23 A, V <sub>GS</sub> = 0 V                                  | —   | —    | -1.7 | V    |
| Reverse recovery time                     | t <sub>rr</sub>  | I <sub>DR</sub> = 23 A, V <sub>GS</sub> = 0 V, dI <sub>DR</sub> /dt = 100 A/μs | —   | 1350 | —    | ns   |
| Reverse recovery charge                   | Q <sub>rr</sub>  |  | —   | 24   | —    | μC   |

## Marking









$$R_G = 25 \Omega$$

$$V_{DD} = 90 \text{ V}, L = 1.77 \text{ mH}$$

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

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