

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

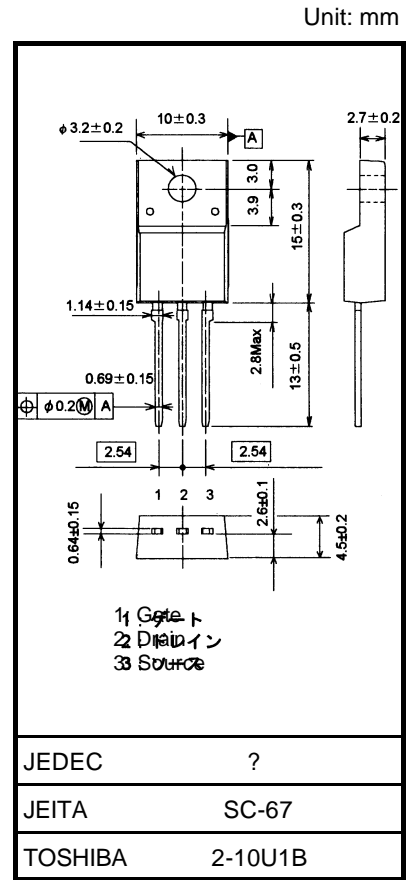
# 2SK3934

## Switching Regulator Applications

- Low drain-source ON resistance:  $R_{DS(ON)} = 0.23$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 8.2$  S (typ.)
- Low leakage current:  $I_{DSS} = 100 \mu A$  ( $V_{DS} = 500$  V)
- Enhancement-mode:  $V_{th} = 2.0 \sim 4.0$  V ( $V_{DS} = 10$  V,  $I_D = 1$  mA)

## Maximum Ratings (Ta = 25°C)

| Characteristics                                 |                           | Symbol    | Rating   | Unit |
|---|---------------------------|-----------|----------|------|
| Drain-source voltage                            |                           | $V_{DSS}$ | 500      | V    |
| Drain-gate voltage ( $R_{GS} = 20$ k $\Omega$ ) |                           | $V_{DGR}$ | 500      | V    |
| Gate-source voltage                             |                           | $V_{GSS}$ | $\pm 30$ | V    |
| Drain current                                   | DC (Note 1)               | $I_D$     | 15       | A    |
|   | Pulse (t = 1 ms) (Note 1) | $I_{DP}$  | 60       |      |
| Drain power dissipation ( $T_c = 25^\circ C$ )  |                           | $P_D$     | 50       | W    |
| Single pulse avalanche energy (Note 2)          |                           | $E_{AS}$  | 1.08     | J    |
| Avalanche current                               |                           | $I_{AR}$  | 15       | A    |
| Repetitive avalanche energy (Note 3)            |                           | $E_{AR}$  | 5.0      | mJ   |
| Channel temperature                             |                           | $T_{ch}$  | 150      | °C   |
| Storage temperature range                       |                           | $T_{stg}$ | -55~150  | °C   |



Weight : 1.7 g (typ.)

## Thermal Characteristics

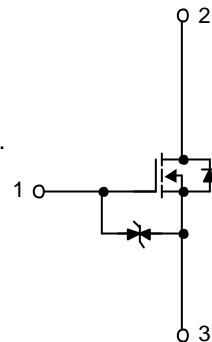
| Characteristics                        | Symbol         | Max  | Unit |
|--|----------------|------|------|
| Thermal resistance, channel to case    | $R_{th(ch-c)}$ | 2.5  | °C/W |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 62.5 | °C/W |

Note 1: Please use devices on conditions that the channel temperature is below 150°C.

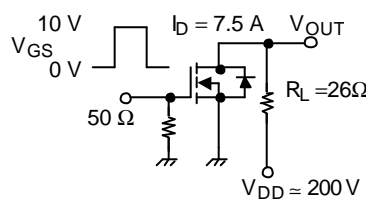
Note 2:  $V_{DD} = 90$  V,  $T_{ch} = 25^\circ C$ (initial),  $L = 8.16$ mH,  $I_{AR} = 15$  A,  $R_G = 25 \Omega$

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

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

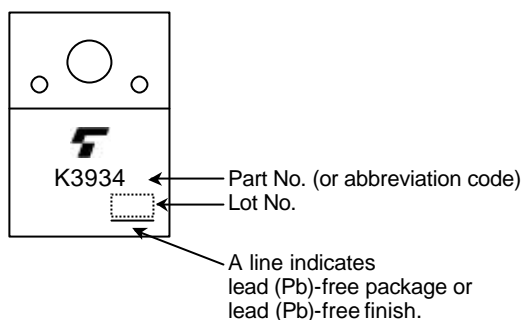


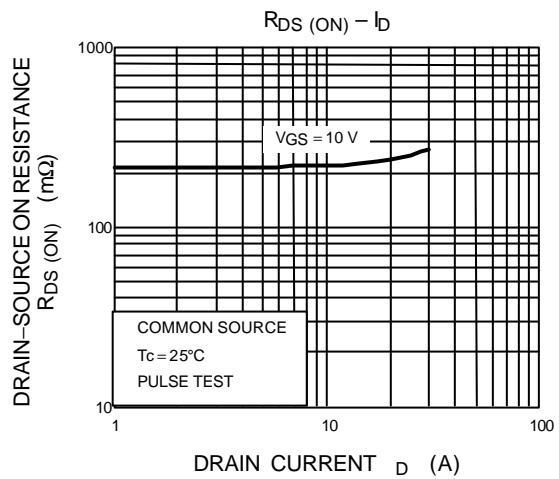
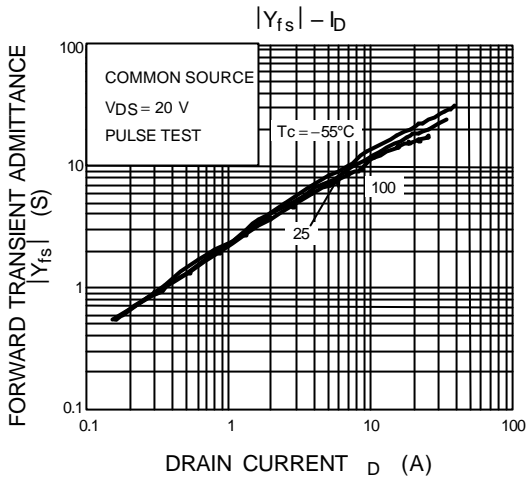
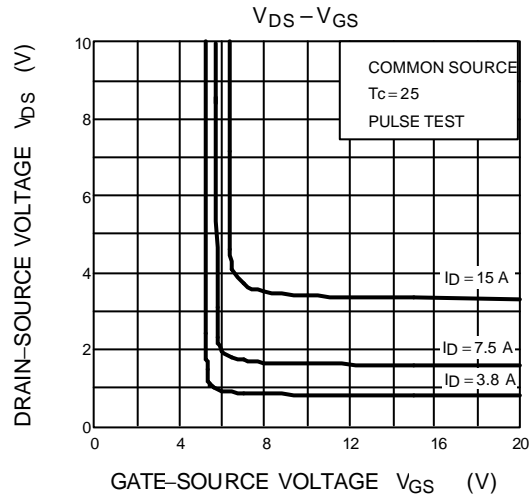
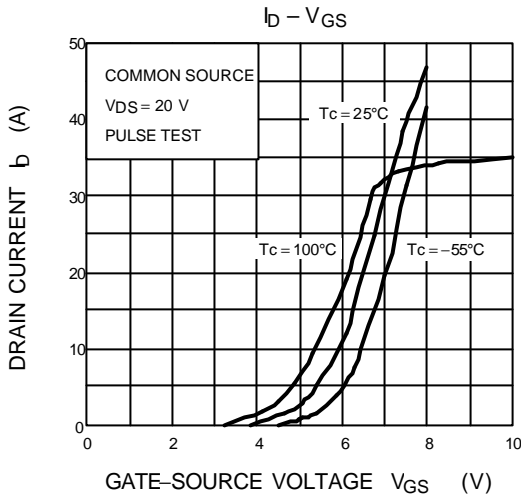
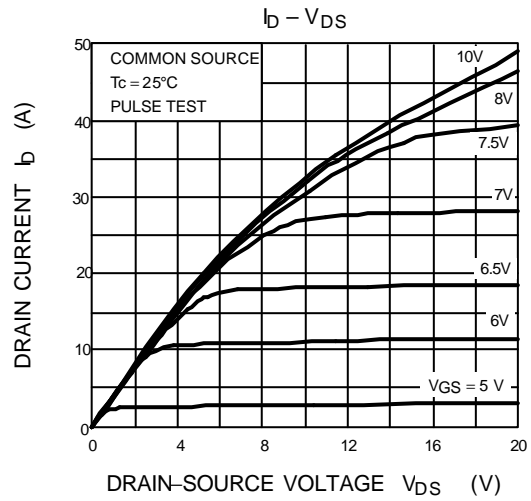
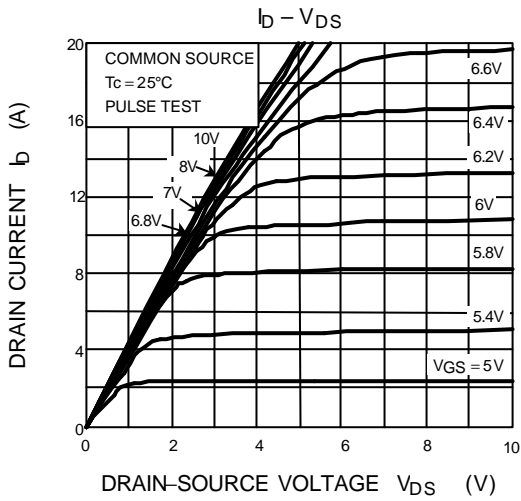
**Electrical Characteristics (Ta = 25°C)**

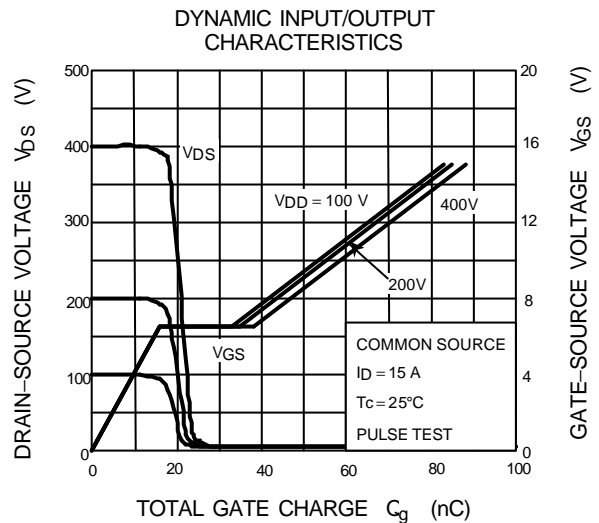
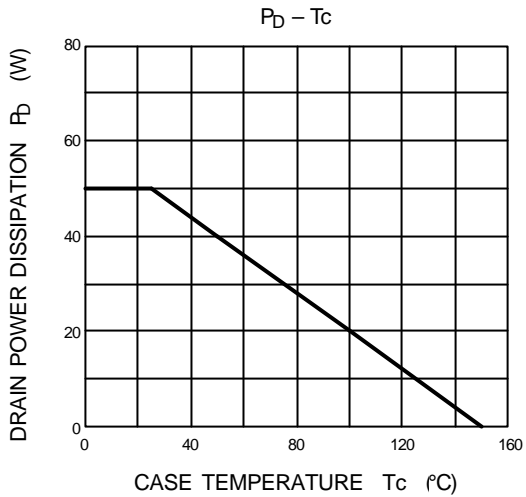
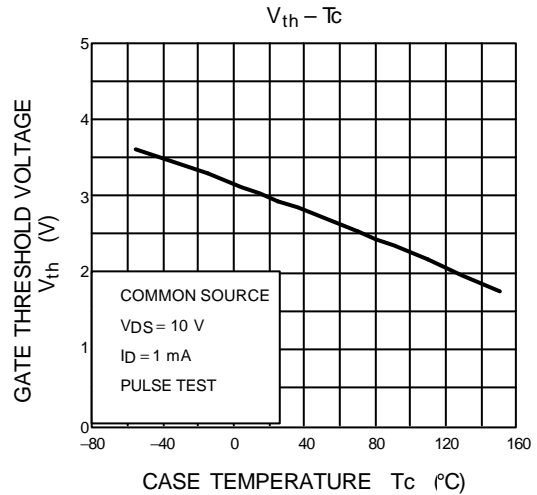
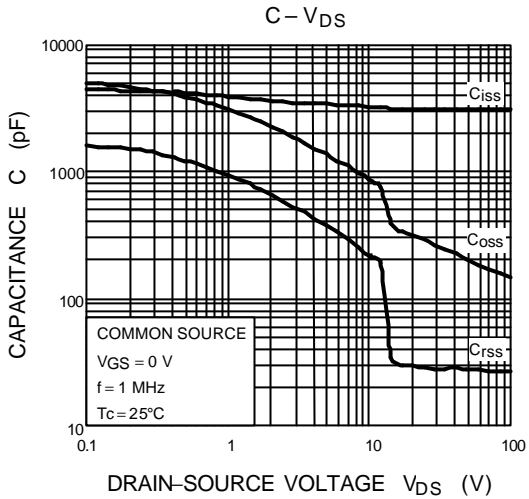
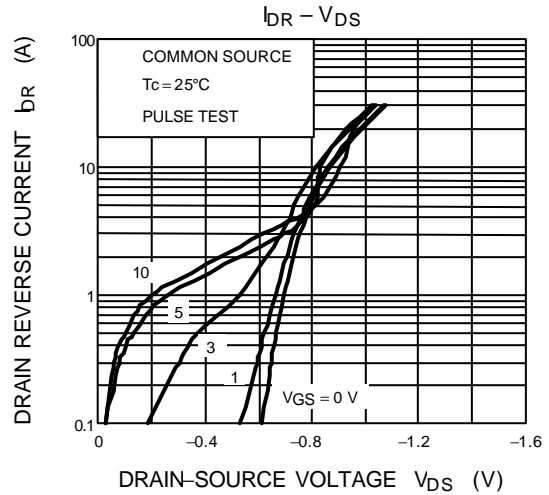
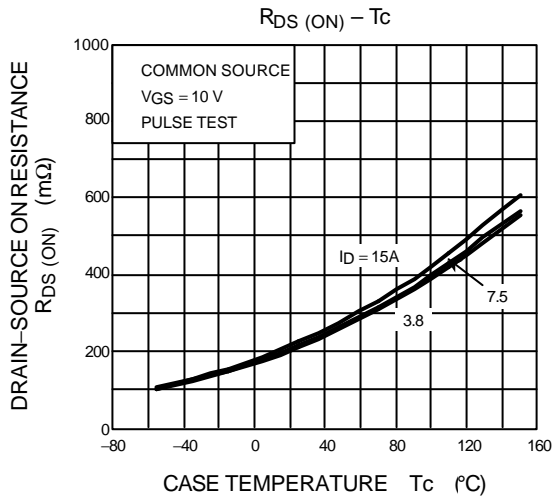
| Characteristics                |               | Symbol        | Test Condition   | Min                                       | Typ. | Max      | Unit          |
|--------------------------------|---------------|---------------|--|---|------|----------|---------------|
| Gate leakage current           |               | $I_{GSS}$     | $V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$                                    | —   | —    | $\pm 10$ | $\mu\text{A}$ |
| Gate-source breakdown voltage  |               | $V_{(BR)GSS}$ | $I_G = \pm 10\ \mu\text{A}, V_{DS} = 0\text{ V}$                                   | $\pm 30$                                  | —    | —        | V             |
| Drain cut-off current          |               | $I_{DSS}$     | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$                                       | —   | —    | 100      | $\mu\text{A}$ |
| Drain-source breakdown voltage |               | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$  | 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     |               | $R_{DS(ON)}$  | $V_{GS} = 10\text{ V}, I_D = 7.5\text{ A}$   | —   | 0.23 | 0.3      | $\Omega$      |
| Forward transfer admittance    |               | $ Y_{fs} $    | $V_{DS} = 10\text{ V}, I_D = 7.5\text{ A}$   | 2.3                                       | 8.2  | —        | S             |
| Input capacitance              |               | $C_{iss}$     | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$                      | —   | 3100 | —        | pF            |
| Reverse transfer capacitance   |               | $C_{rss}$     |  | —   | 20   | —        |               |
| Output capacitance             |               | $C_{oss}$     |  | —   | 270  | —        |               |
| Switching time                 | Rise time     | $t_r$         |  | —   | 70   | —        | ns            |
|                                | Turn-on time  | $t_{on}$      |  | —   | 130  | —        |               |
|                                | Fall time     | $t_f$         |  | —   | 70   | —        |               |
|                                | Turn-off time | $t_{off}$     |  | Duty $\leq 1\%$ , $t_w = 10\ \mu\text{s}$ | —    | 280      |               |
| Total gate charge              |               | $Q_g$         | $V_{DD} = 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 15\text{ A}$                   | —   | 62   | —        | nC            |
| Gate-source charge             |               | $Q_{gs}$      |  | —   | 40   | —        |               |
| Gate-drain charge              |               | $Q_{gd}$      |  | —   | 22   | —        |               |

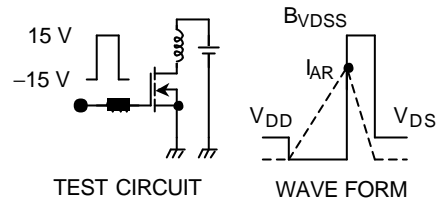
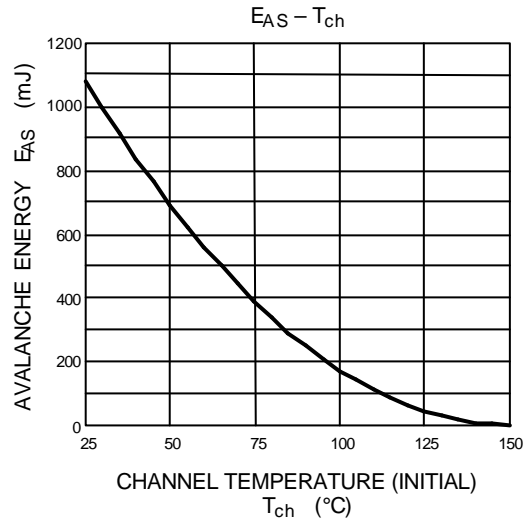
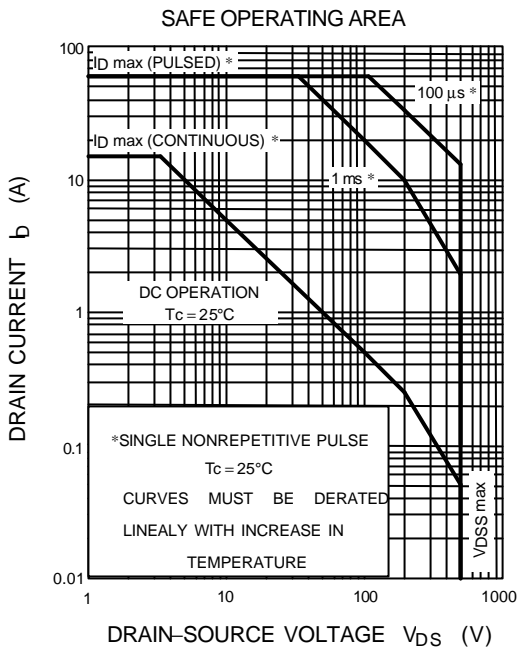
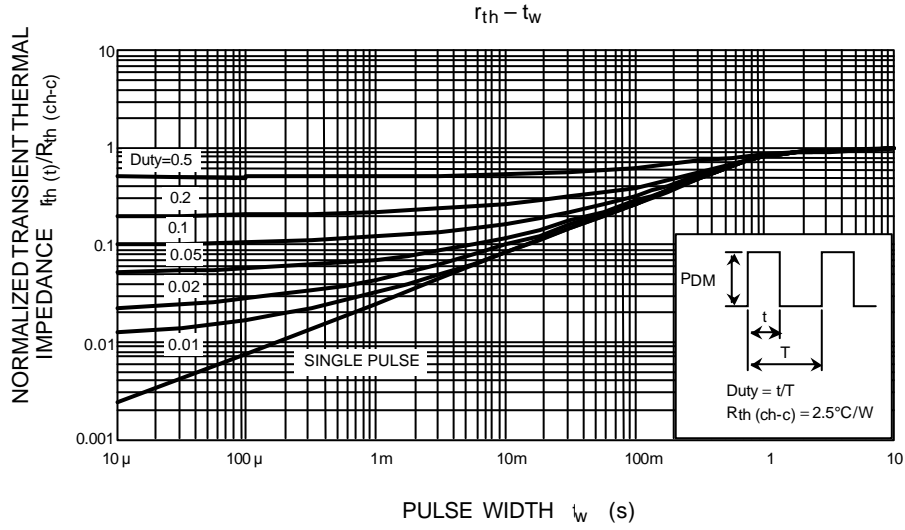
**Source-Drain Ratings and Characteristics (Ta = 25°C)**

| Characteristics                           |  | Symbol    | Test Condition                               | Min | Typ. | Max  | Unit          |
|---|--|-----------|--|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) |  | $I_{DR}$  | —  | —   | —    | 15   | A             |
| Pulse drain reverse current (Note 1)      |  | $I_{DRP}$ | —  | —   | —    | 60   | A             |
| Forward voltage (diode)                   |  | $V_{DSF}$ | $I_{DR} = 15\text{ A}, V_{GS} = 0\text{ V}$  | —   | —    | -1.7 | V             |
| Reverse recovery time                     |  | $t_{rr}$  | $I_{DR} = 15\text{ A}, V_{GS} = 0\text{ V},$ | —   | 1.3  | —    | $\mu\text{s}$ |
| Reverse recovery charge                   |  | $Q_{rr}$  | $dI_{DR}/dt = 100\text{ A}/\mu\text{s}$      | —   | 18   | —    | $\mu\text{C}$ |

**Marking**







$R_G = 25 \Omega$   
 $V_{DD} = 90 \text{ V}, L = 8.13 \text{ mH}$

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

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