

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type (L<sup>2</sup>-π-MOSV)

# 2SJ334

DC-DC Converter, Relay Drive and Motor Drive Applications

- 4-V gate drive
- Low drain-source ON resistance : R<sub>DS (ON)</sub> = 29 mΩ (typ.)
- High forward transfer admittance : |Y<sub>fs</sub>| = 23 S (typ.)
- Low leakage current : I<sub>DSS</sub> = -100 μA (max) (V<sub>DS</sub> = -60 V)
- Enhancement mode : V<sub>th</sub> = -0.8~-2.0 V (V<sub>DS</sub> = -10 V, I<sub>D</sub> = -1 mA)

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

| Characteristics                                 | Symbol           | Rating          | Unit   |
|---|------------------|-----------------|--------|
| Drain-source voltage                            | V <sub>DSS</sub> | -60             | V      |
| Drain-gate voltage (R <sub>GS</sub> = 20 kΩ)    | V <sub>DGR</sub> | -60             | V      |
| Gate-source voltage                             | V <sub>GS</sub>  | ±20             | V      |
| Drain current                                   | DC (Note 1)      | I <sub>D</sub>  | -30 A  |
|   | Pulse (Note 1)   | I <sub>DP</sub> | -120 A |
| Drain power dissipation (T <sub>c</sub> = 25°C) | P <sub>D</sub>   | 45              | W      |
| Single pulse avalanche energy (Note 2)          | E <sub>AS</sub>  | 936             | mJ     |
| Avalanche current                               | I <sub>AR</sub>  | -30             | A      |
| Repetitive avalanche energy (Note 3)            | E <sub>AR</sub>  | 4.5             | mJ     |
| Channel temperature                             | T <sub>ch</sub>  | 150             | °C     |
| Storage temperature range                       | T <sub>stg</sub> | -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 case    | R <sub>th (ch-c)</sub> | 2.78 | °C / W |
| Thermal resistance, channel to ambient | R <sub>th (ch-a)</sub> | 62.5 | °C / W |

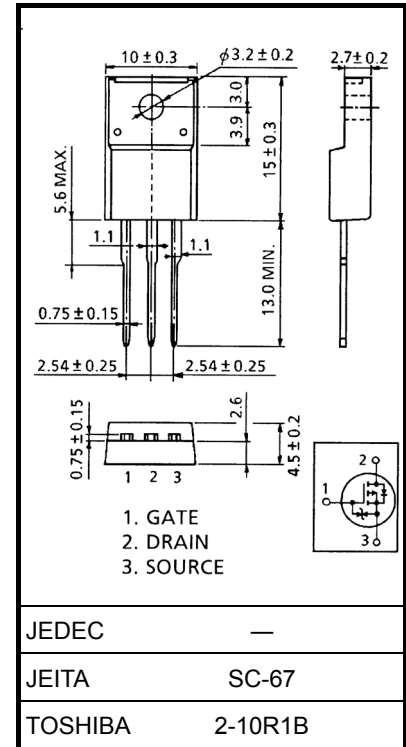
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: V<sub>DD</sub> = -50 V, T<sub>ch</sub> = 25°C (initial), L = 747 μH, R<sub>G</sub> = 25 Ω, I<sub>AR</sub> = -30 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.)

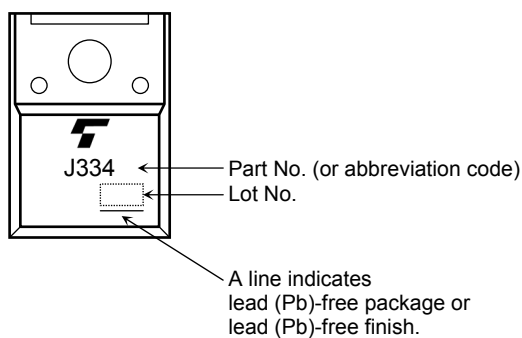
## Electrical Characteristics (Ta = 25°C)

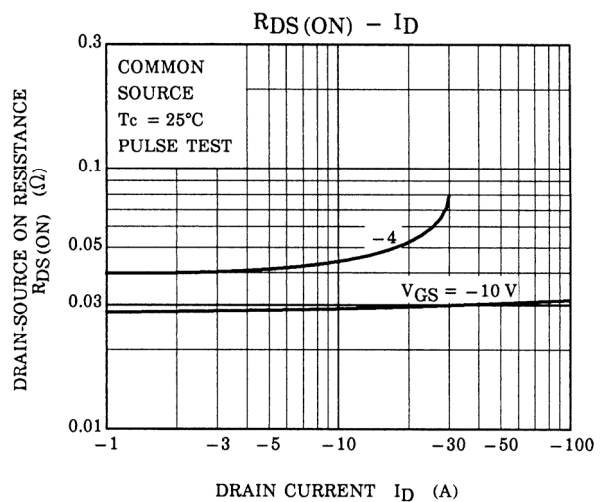
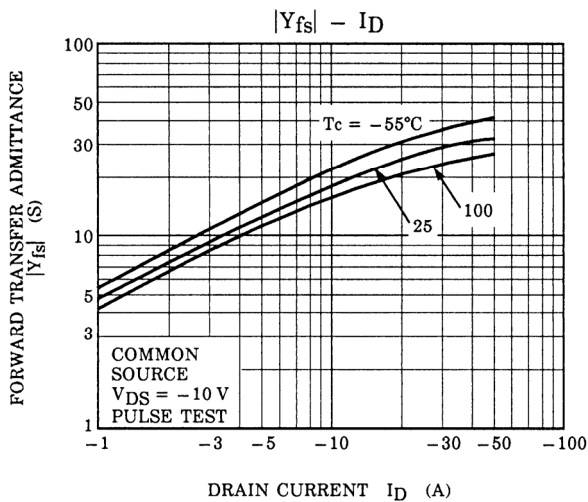
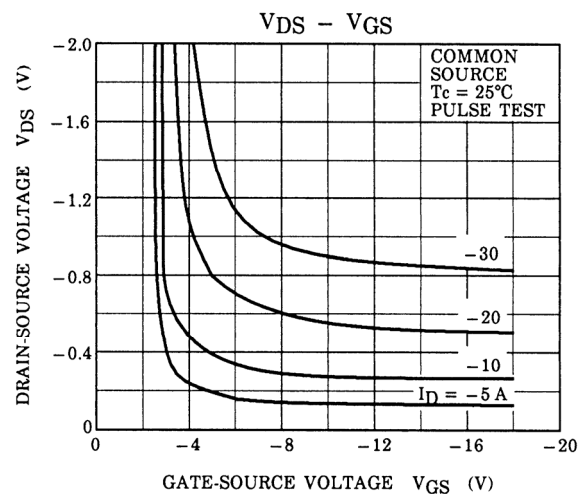
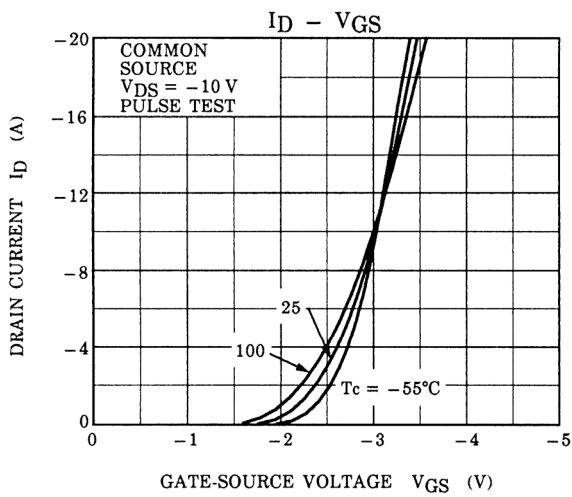
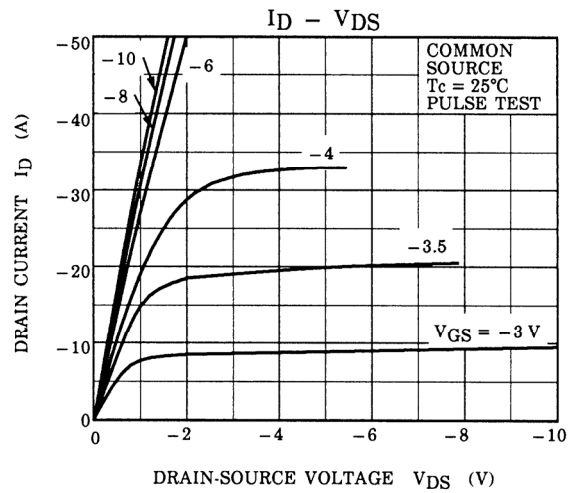
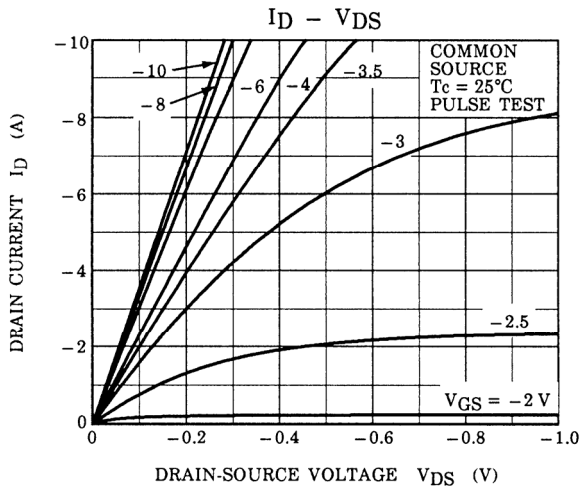
| Characteristics                                 |               | Symbol        | Test Condition   | Min  | Typ. | Max      | Unit          |
|---|---------------|---------------|--|------|------|----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$                          | —    | —    | $\pm 10$ | $\mu\text{A}$ |
| Drain cut-off current                           |               | $I_{DSS}$     | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$                             | —    | —    | -100     | $\mu\text{A}$ |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = -10\text{ mA}, V_{GS} = 0\text{ V}$                               | -60  | —    | —        | V             |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = -10\text{ V}, I_D = -1\text{ mA}$                              | -0.8 | —    | -2.0     | V             |
| Drain-source ON resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = -4\text{ V}, I_D = -15\text{ A}$                               | —    | 46   | 60       | m $\Omega$    |
|   |               |               | $V_{GS} = -10\text{ V}, I_D = -15\text{ A}$                              | —    | 29   | 38       |               |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = -10\text{ V}, I_D = -15\text{ A}$                              | 14   | 23   | —        | S             |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$           | —    | 3300 | —        | pF            |
| Reverse transfer capacitance                    |               | $C_{rss}$     |  | —    | 460  | —        |               |
| Output capacitance                              |               | $C_{oss}$     |  | —    | 1450 | —        |               |
| Switching time                                  | Rise time     | $t_r$         |  | —    | 20   | —        | ns            |
|   | Turn-on time  | $t_{on}$      |  | —    | 25   | —        |               |
|   | Fall time     | $t_f$         |  | —    | 35   | —        |               |
|   | Turn-off time | $t_{off}$     |  | —    | 130  | —        |               |
| Total gate charge (Gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx -48\text{ V}, V_{GS} = -10\text{ V}, I_D = -30\text{ A}$ | —    | 110  | —        | nC            |
| Gate-source charge                              |               | $Q_{gs}$      |  | —    | 75   | —        |               |
| Gate-drain ("miller") charge                    |               | $Q_{gd}$      |  | —    | 35   | —        |               |

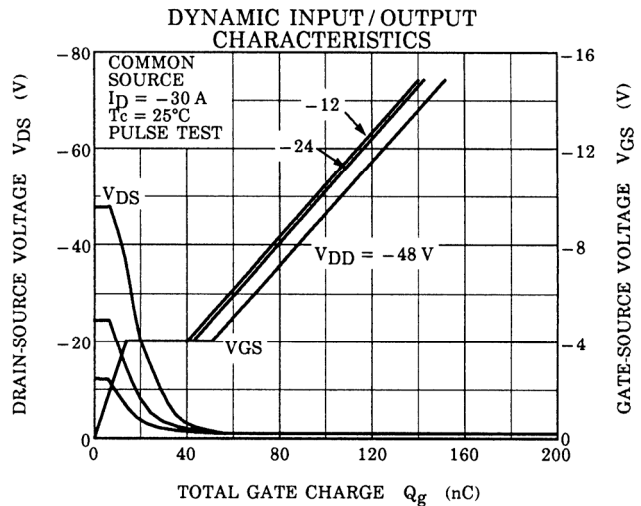
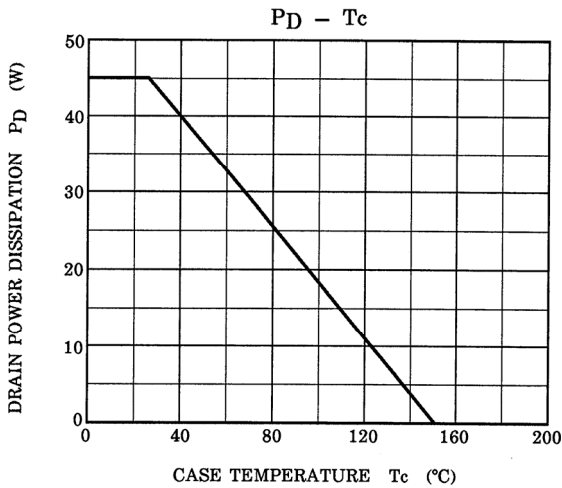
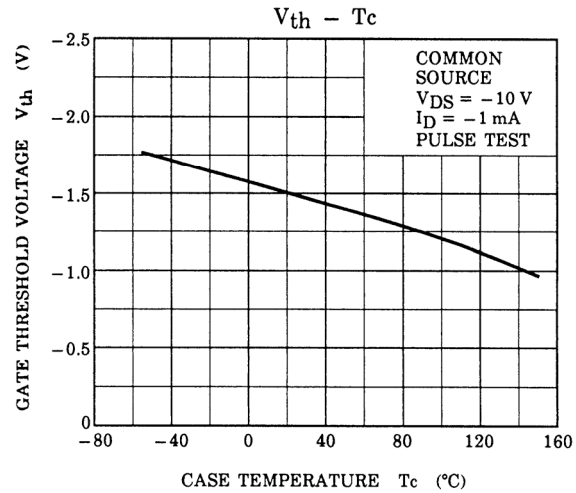
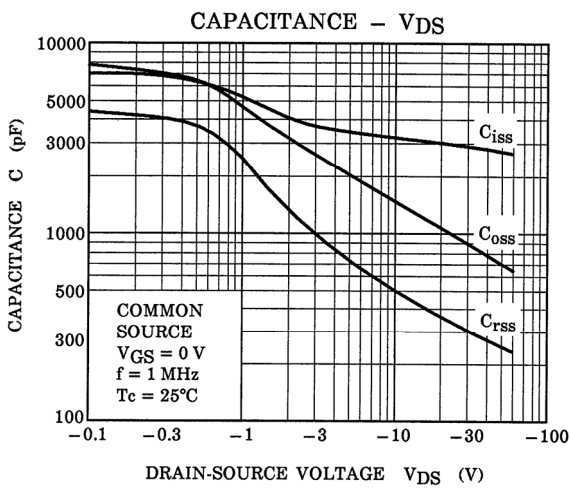
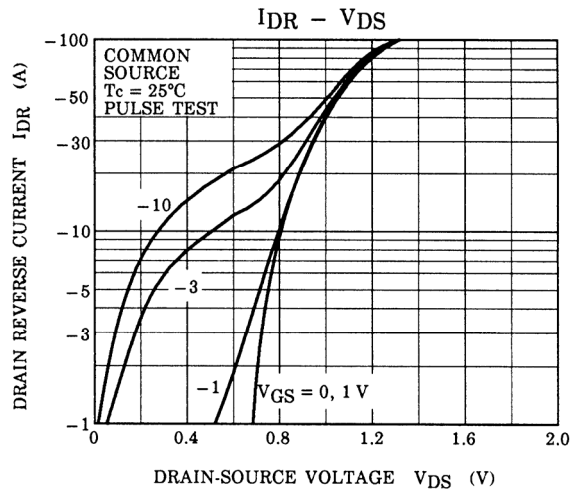
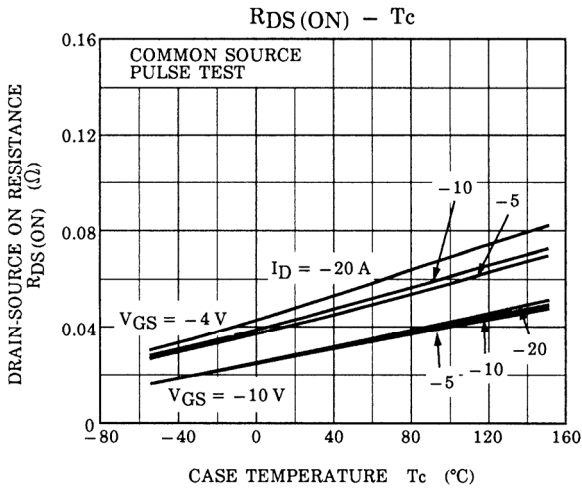
## Source-Drain Ratings and Characteristics (Ta = 25°C)

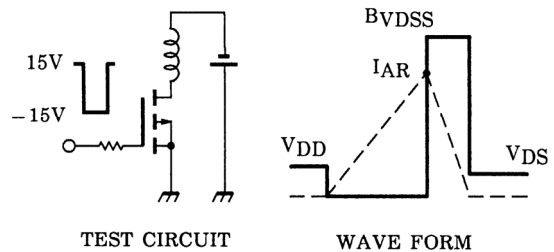
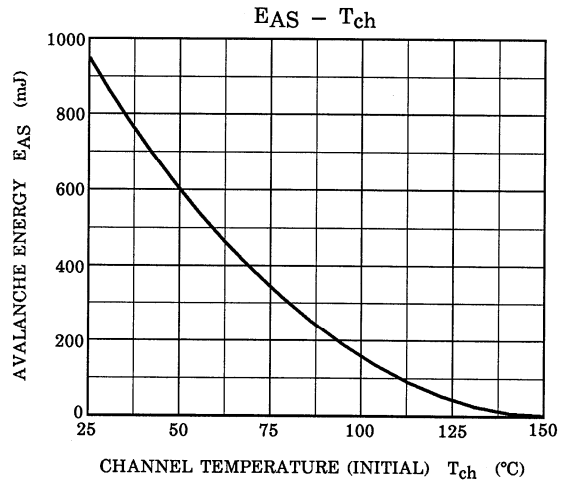
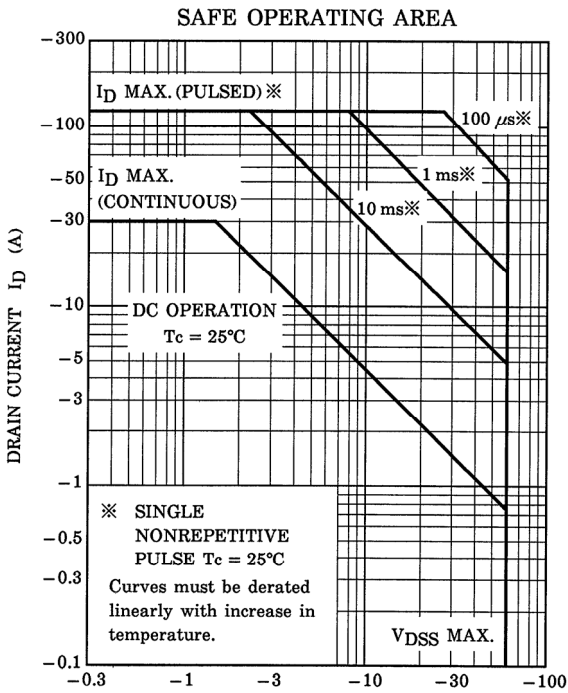
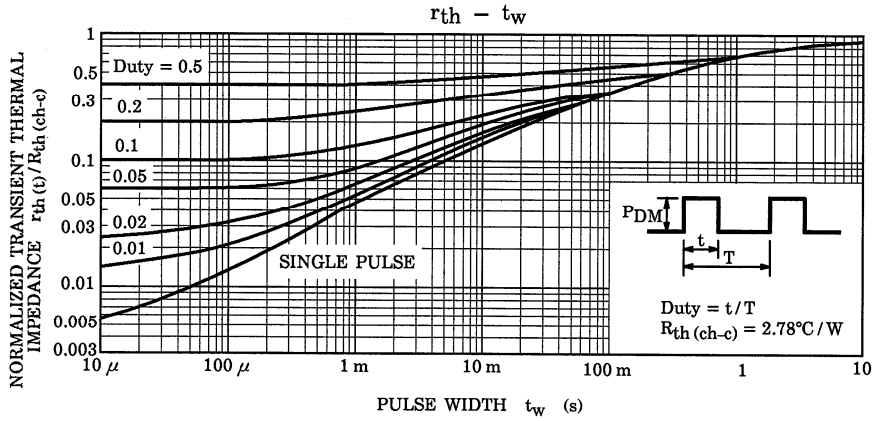
| Characteristics                           | Symbol    | Test Condition                               | Min | Typ. | Max | Unit          |
|---|-----------|--|-----|------|-----|---------------|
| Continuous drain reverse current (Note 1) | $I_{DR}$  | —  | —   | —    | 30  | A             |
| Pulse drain reverse current (Note 1)      | $I_{DRP}$ | —  | —   | —    | 120 | A             |
| Forward voltage (diode)                   | $V_{DSF}$ | $I_{DR} = -30\text{ A}, V_{GS} = 0\text{ V}$ | —   | —    | 1.7 | V             |
| Reverse recovery time                     | $t_{rr}$  | $I_{DR} = -30\text{ A}, V_{GS} = 0\text{ V}$ | —   | 100  | —   | ns            |
| Reverse recovery charge                   | $Q_{rr}$  | $dI_{DR} / dt = 50\text{ A} / \mu\text{s}$   | —   | 0.16 | —   | $\mu\text{C}$ |

## Marking









$R_G = 25\Omega$   
 $V_{DD} = -50V, L = 747\mu H$   
 $EAS = \frac{1}{2} \cdot L \cdot I^2 \cdot \left( \frac{BV_{DSS}}{BV_{DSS} - V_{DD}} \right)$

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