

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ( $\pi$ -MOS $\text{VII}$ )

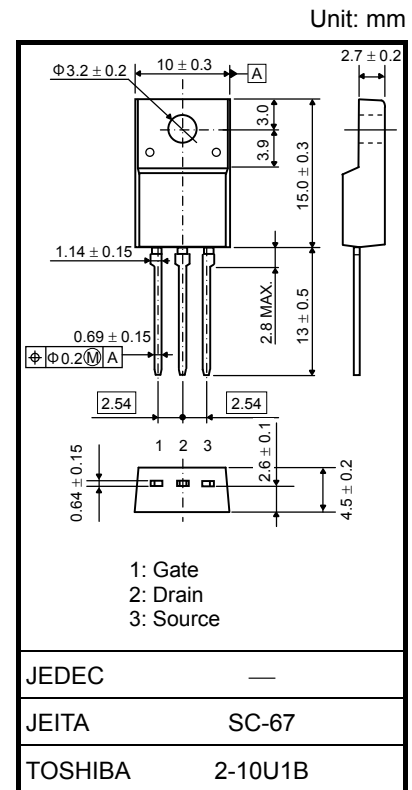
## TK9A55DA

### Switching Regulator Applications

- Low drain-source ON resistance:  $R_{DS(ON)} = 0.68 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 4.7 \text{ S}$  (typ.)
- Low leakage current:  $I_{DSS} = 10 \mu\text{A}$  (max) ( $V_{DS} = 550 \text{ V}$ )
- Enhancement-mode:  $V_{th} = 2$  to  $4 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

| Characteristics                                      |                | Symbol    | Rating     | Unit             |
|--|----------------|-----------|------------|------------------|
| Drain-source voltage                                 |                | $V_{DSS}$ | 550        | V                |
| Gate-source voltage                                  |                | $V_{GSS}$ | $\pm 30$   | V                |
| Drain current  | DC (Note 1)    | $I_D$     | 8.5        | A                |
|  | Pulse (Note 1) | $I_{DP}$  | 34         |                  |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ ) |                | $P_D$     | 40         | W                |
| Single pulse avalanche energy (Note 2)               |                | $E_{AS}$  | 252        | mJ               |
| Avalanche current                                    |                | $I_{AR}$  | 8.5        | A                |
| Repetitive avalanche energy (Note 3)                 |                | $E_{AR}$  | 4          | mJ               |
| Channel temperature                                  |                | $T_{ch}$  | 150        | $^\circ\text{C}$ |
| Storage temperature range                            |                | $T_{stg}$ | -55 to 150 | $^\circ\text{C}$ |



Weight : 1.7 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

| Characteristics                        | Symbol         | Max   | Unit               |
|--|----------------|-------|--------------------|
| Thermal resistance, channel to case    | $R_{th(ch-c)}$ | 3.125 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 62.5  | $^\circ\text{C/W}$ |

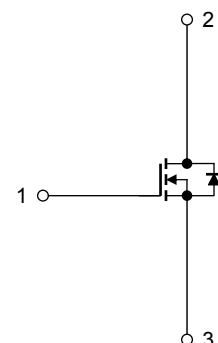
Note 1: Please use devices on conditions that the channel temperature is below  $150^\circ\text{C}$ .

Note 2:  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 6.04 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 8.5 \text{ A}$

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

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

Internal Connection



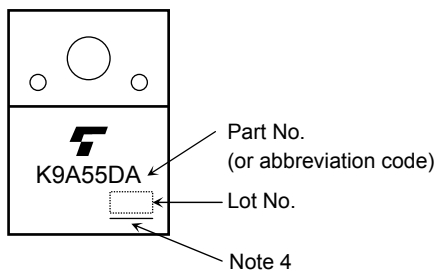
## Electrical Characteristics (Ta = 25°C)

| Characteristics                |               | Symbol        | Test Condition  | Min                                       | Typ. | Max     | Unit          |
|--------------------------------|---------------|---------------|---|---|------|---------|---------------|
| Gate leakage current           |               | $I_{GSS}$     | $V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$                         | —   | —    | $\pm 1$ | $\mu\text{A}$ |
| Drain cut-off current          |               | $I_{DSS}$     | $V_{DS} = 550\text{ V}, V_{GS} = 0\text{ V}$                            | —   | —    | 10      | $\mu\text{A}$ |
| Drain-source breakdown voltage |               | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$                               | 550                                       | —    | —       | 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     |               | $R_{DS(ON)}$  | $V_{GS} = 10\text{ V}, I_D = 4.3\text{ A}$                              | —   | 0.68 | 0.86    | $\Omega$      |
| Forward transfer admittance    |               | $ Y_{fs} $    | $V_{DS} = 10\text{ V}, I_D = 4.3\text{ A}$                              | 1.2                                       | 4.7  | —       | S             |
| Input capacitance              |               | $C_{iss}$     | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$           | —   | 1050 | —       | pF            |
| Reverse transfer capacitance   |               | $C_{rss}$     |   | —   | 5    | —       |               |
| Output capacitance             |               | $C_{oss}$     |   | —   | 100  | —       |               |
| Switching time                 | Rise time     | $t_r$         |   | —   | 25   | —       | ns            |
|                                | Turn-on time  | $t_{on}$      |   | —   | 60   | —       |               |
|                                | Fall time     | $t_f$         |   | —   | 10   | —       |               |
|                                | Turn-off time | $t_{off}$     |   | Duty $\leq 1\%$ , $t_W = 10\ \mu\text{s}$ | —    | 75      |               |
| Total gate charge              |               | $Q_g$         | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 8.5\text{ A}$ | —   | 20   | —       | nC            |
| Gate-source charge             |               | $Q_{gs}$      |   | —   | 13   | —       |               |
| Gate-drain charge              |               | $Q_{gd}$      |   | —   | 7    | —       |               |

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

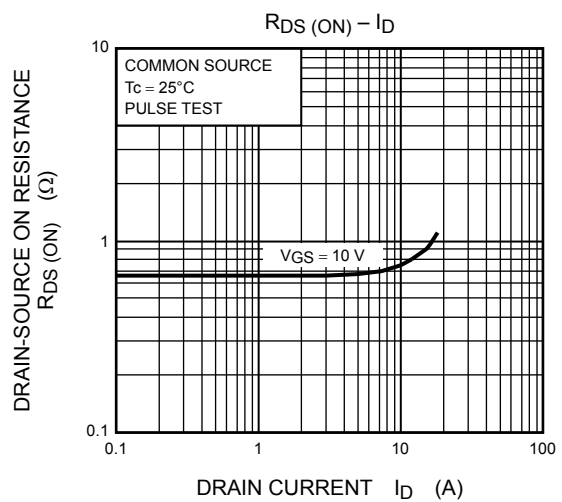
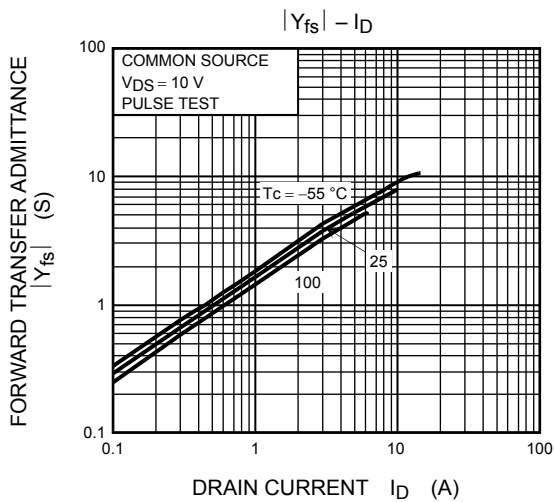
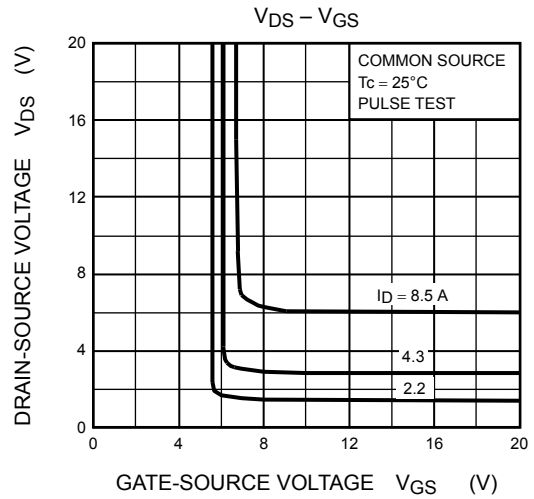
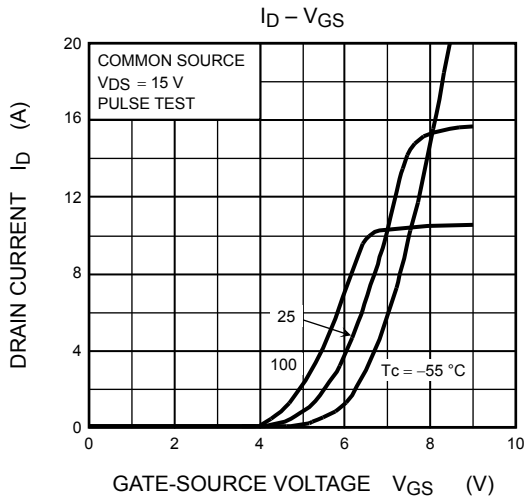
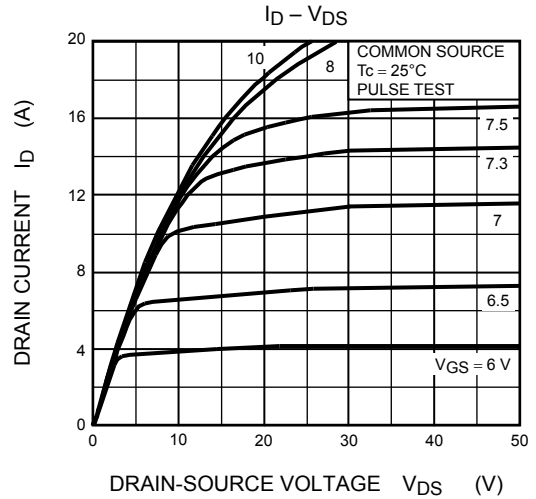
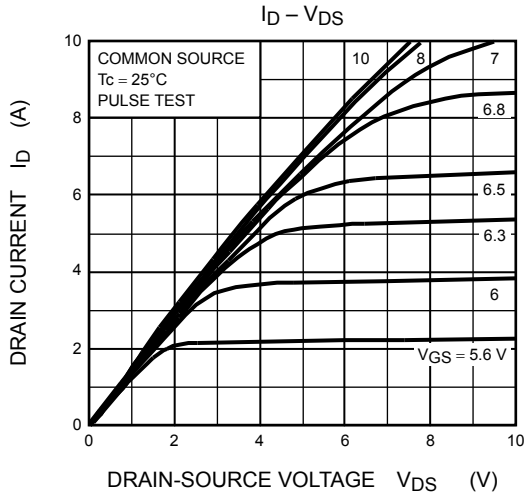
| Characteristics                           | Symbol    | Test Condition                                | Min | Typ. | Max  | Unit          |
|---|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | $I_{DR}$  | —   | —   | —    | 8.5  | A             |
| Pulse drain reverse current (Note 1)      | $I_{DRP}$ | —   | —   | —    | 34   | A             |
| Forward voltage (diode)                   | $V_{DSF}$ | $I_{DR} = 8.5\text{ A}, V_{GS} = 0\text{ V}$  | —   | —    | -1.7 | V             |
| Reverse recovery time                     | $t_{rr}$  | $I_{DR} = 8.5\text{ A}, V_{GS} = 0\text{ V},$ | —   | 1200 | —    | ns            |
| Reverse recovery charge                   | $Q_{rr}$  | $dI_{DR}/dt = 100\text{ A}/\mu\text{s}$       | —   | 11   | —    | $\mu\text{C}$ |

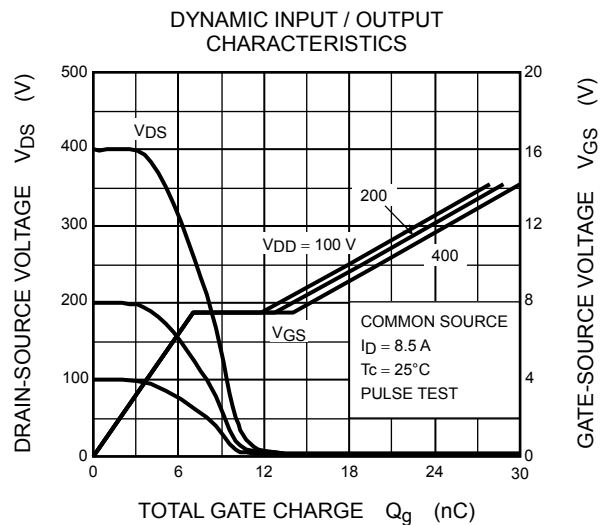
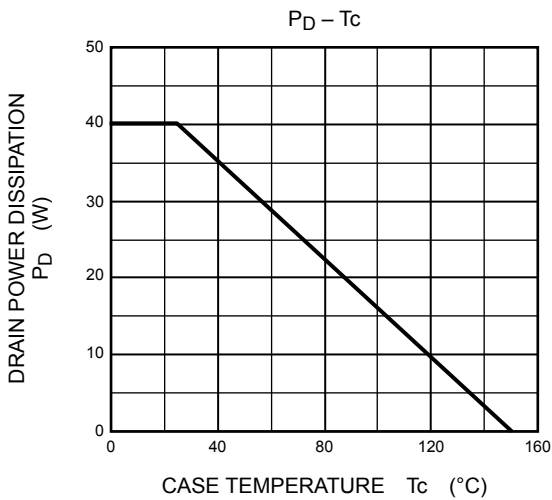
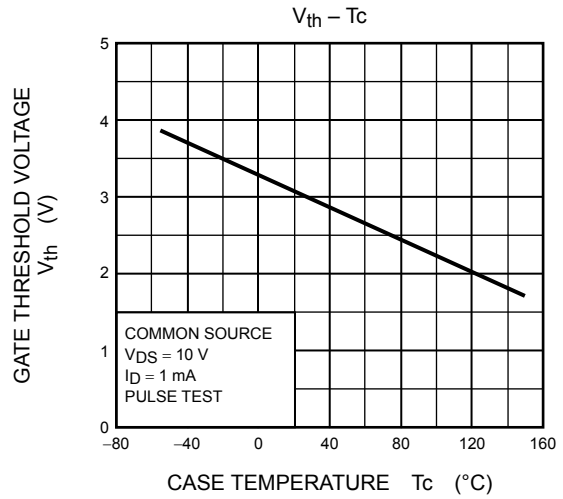
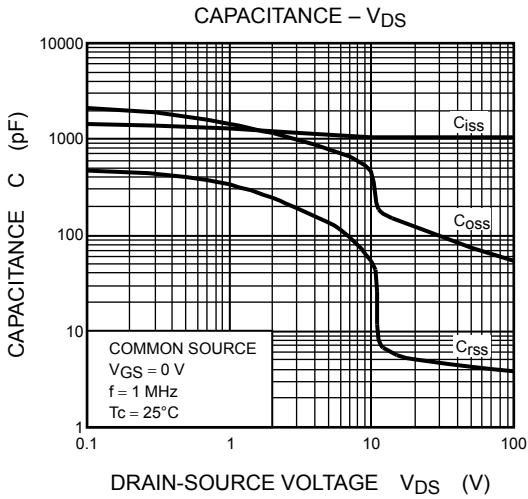
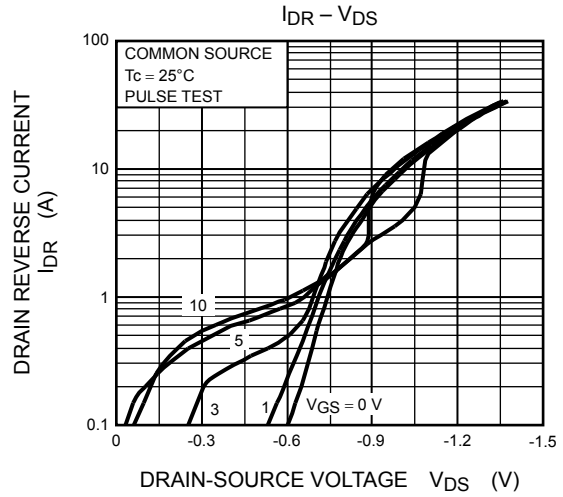
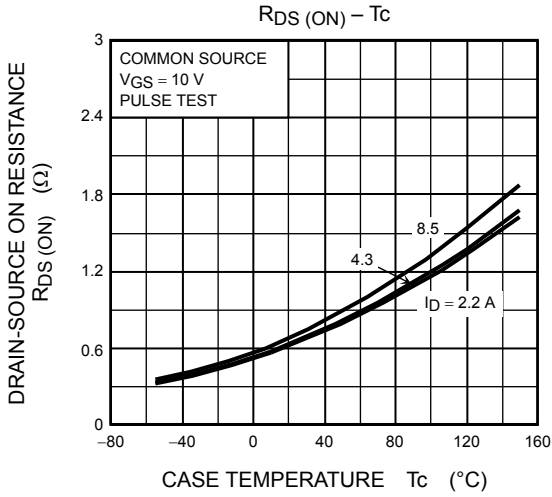
## Marking

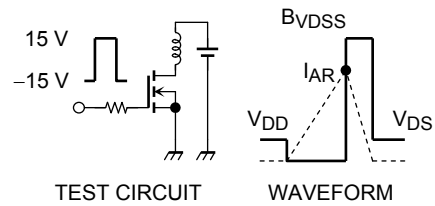
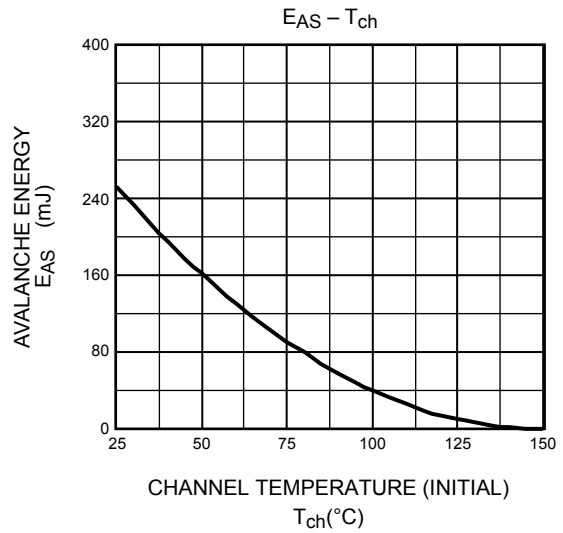
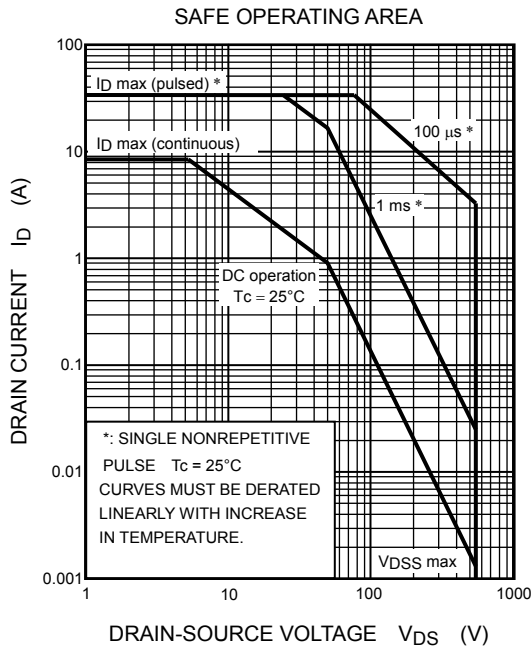
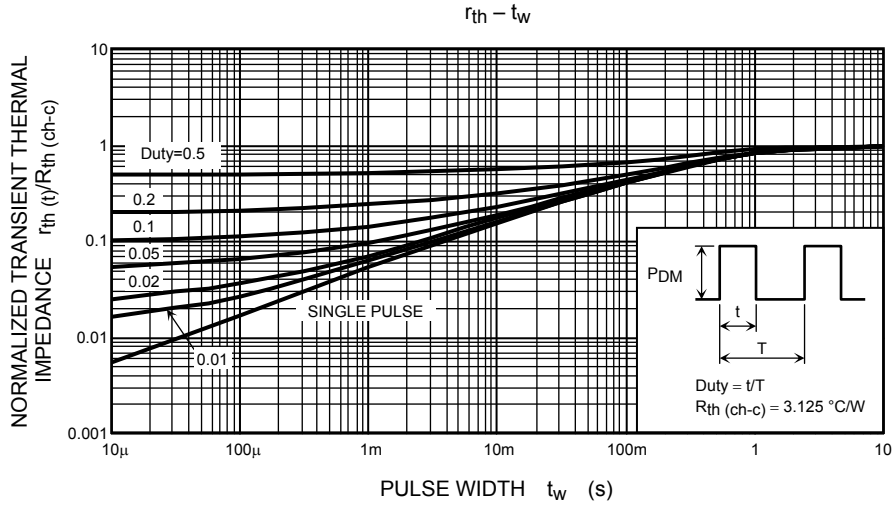


Note 4 : A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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$R_G = 25 \Omega$   
 $V_{DD} = 90 V, L = 6.04 mH$

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

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