

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

TK6A50D

Switching Regulator Applications

- Low drain-source ON-resistance: $R_{DS(ON)} = 1.2 \Omega$ (typ.)
- High forward transfer admittance: $|Y_{fs}| = 2.5 \text{ S}$ (typ.)
- Low leakage current: $I_{DSS} = 10 \mu\text{A}$ (max) ($V_{DS} = 500 \text{ V}$)
- Enhancement mode: $V_{th} = 2.4$ to 4.4 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} | 500 | V |
| Gate-source voltage | | V_{GSS} | ± 30 | V |
| Drain current | DC (Note 1) | I_D | 6 | A |
| | Pulse ($t = 1 \text{ ms}$) (Note 1) | I_{DP} | 24 | |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | | P_D | 35 | W |
| Single pulse avalanche energy (Note 2) | | E_{AS} | 144 | mJ |
| Avalanche current | | I_{AR} | 6 | A |
| Repetitive avalanche energy (Note 3) | | E_{AR} | 3.5 | mJ |
| Channel temperature | | T_{ch} | 150 | $^\circ\text{C}$ |
| Storage temperature range | | T_{stg} | -55 to 150 | $^\circ\text{C}$ |

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

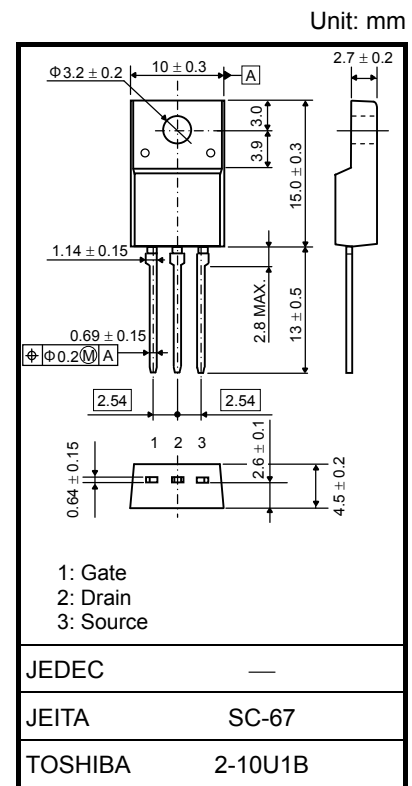
| Characteristics | Symbol | Max | Unit |
|----------------------------------------|----------------|------|--------------------|
| Thermal resistance, channel to case | $R_{th(ch-c)}$ | 3.57 | $^\circ\text{C/W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 62.5 | $^\circ\text{C/W}$ |

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

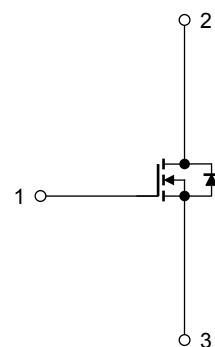
Note 2: $V_{DD} = 90 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 6.8 \text{ mH}$, $R_G = 25 \Omega$, $I_{AR} = 6 \text{ A}$

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

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



Weight: 1.7 g (typ.)



Start of commercial production
2009-04

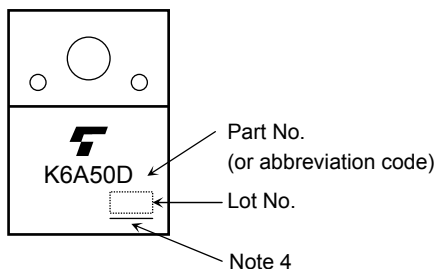
Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|--------------------------------|---------------|---------------|-----------------------------------------------------------------------|-----|------|---------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$ | — | — | ± 1 | μA |
| Drain cut-off current | | I_{DSS} | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | — | — | 10 | μA |
| Drain-source breakdown voltage | | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$ | 500 | — | — | V |
| Gate threshold voltage | | V_{th} | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$ | 2.4 | — | 4.4 | V |
| Drain-source ON resistance | | $R_{DS(ON)}$ | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}$ | — | 1.2 | 1.4 | Ω |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10\text{ V}, I_D = 3\text{ A}$ | 0.6 | 2.5 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | — | 540 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 3 | — | |
| Output capacitance | | C_{oss} | | — | 60 | — | |
| Switching time | Rise time | t_r | <p>Duty $\leq 1\%$, $t_w = 10\ \mu\text{s}$</p> | — | 18 | — | ns |
| | Turn-on time | t_{on} | | — | 40 | — | |
| | Fall time | t_f | | — | 8 | — | |
| | Turn-off time | t_{off} | | — | 55 | — | |
| Total gate charge | | Q_g | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 6\text{ A}$ | — | 11 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 6 | — | |
| Gate-drain charge | | Q_{gd} | | — | 5 | — | |

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

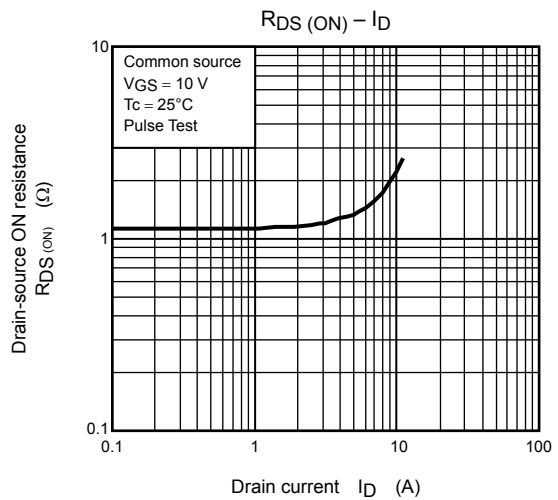
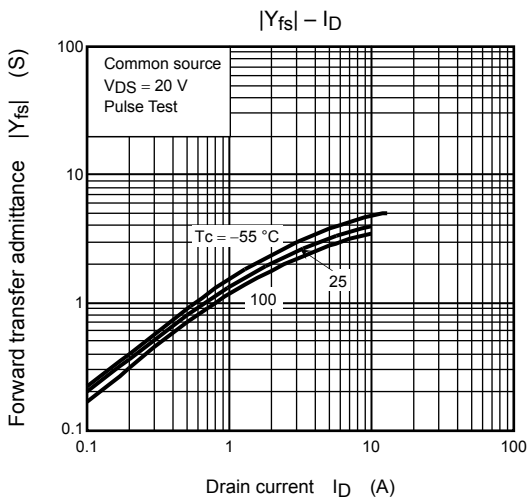
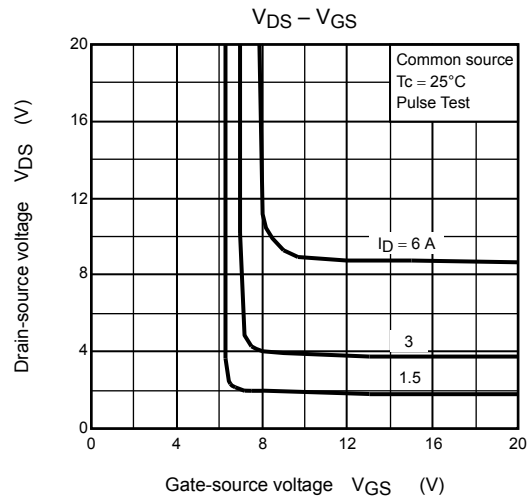
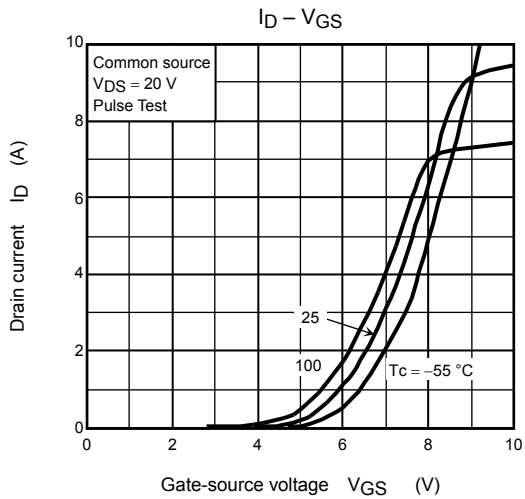
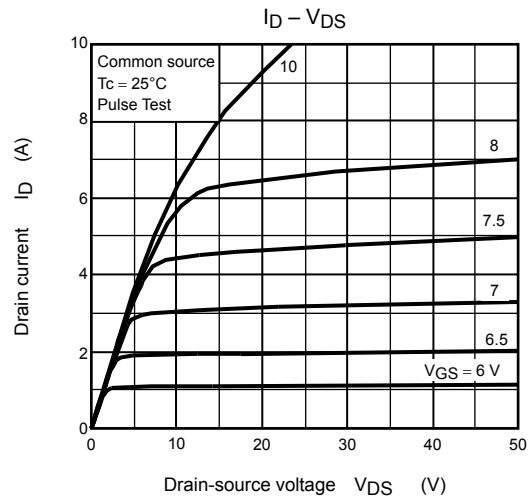
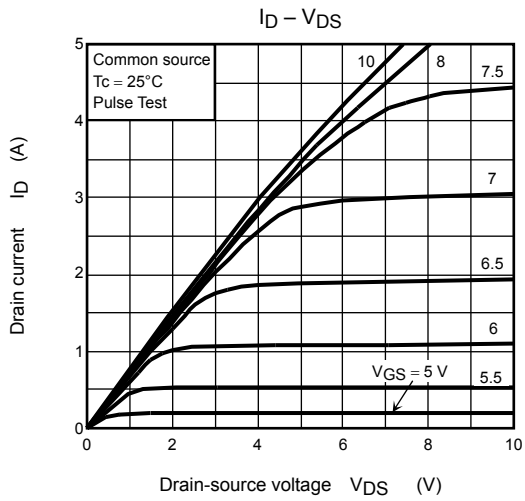
| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|-------------------------------------------|-----------|---------------------------------------------|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 6 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 24 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 6\text{ A}, V_{GS} = 0\text{ V}$ | — | — | -1.7 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 6\text{ A}, V_{GS} = 0\text{ V},$ | — | 1000 | — | ns |
| Reverse recovery charge | Q_{rr} | $dI_{DR}/dt = 100\text{ A}/\mu\text{s}$ | — | 6 | — | μC |

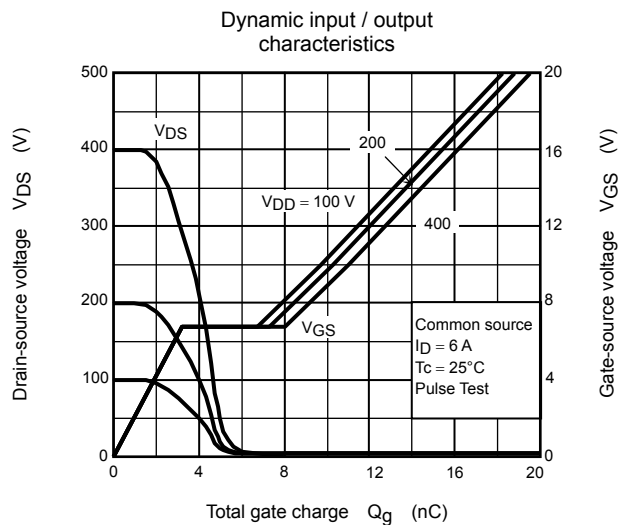
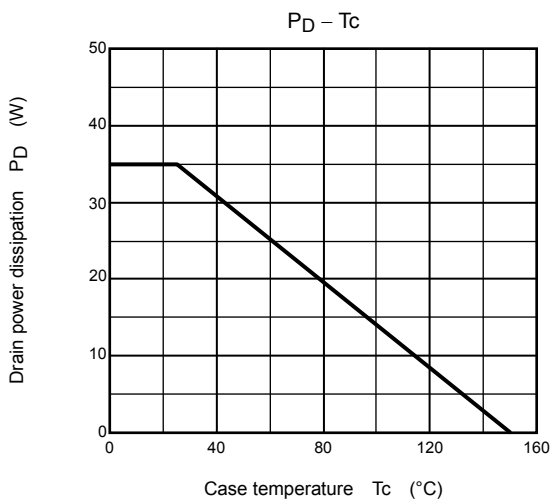
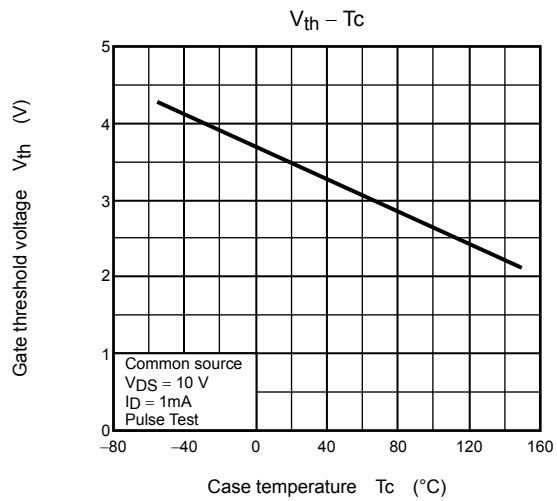
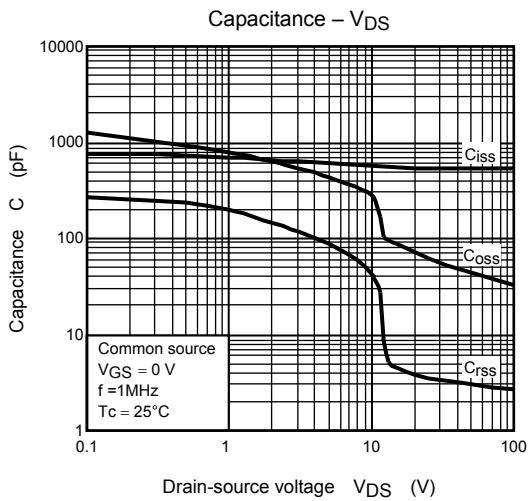
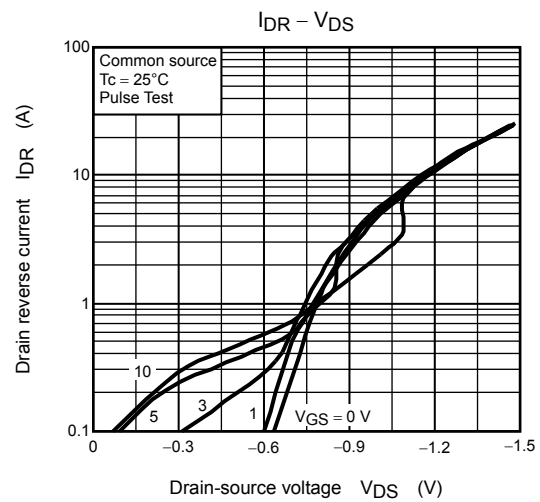
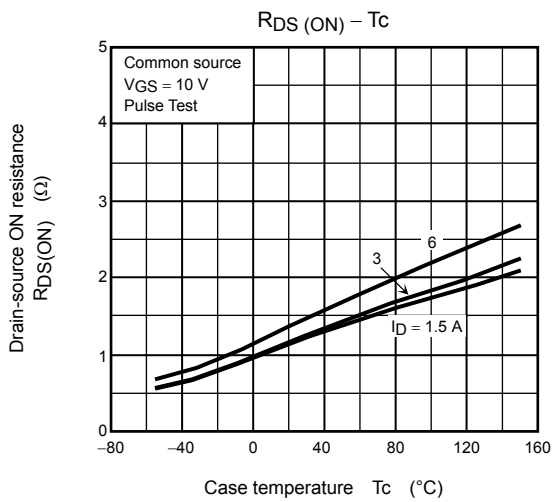
Marking

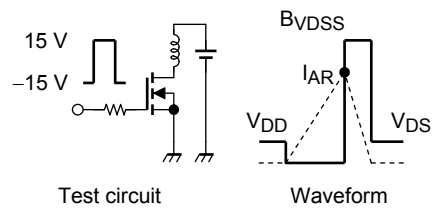
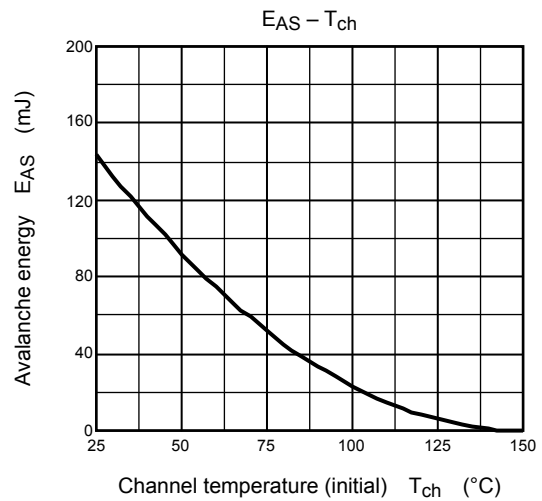
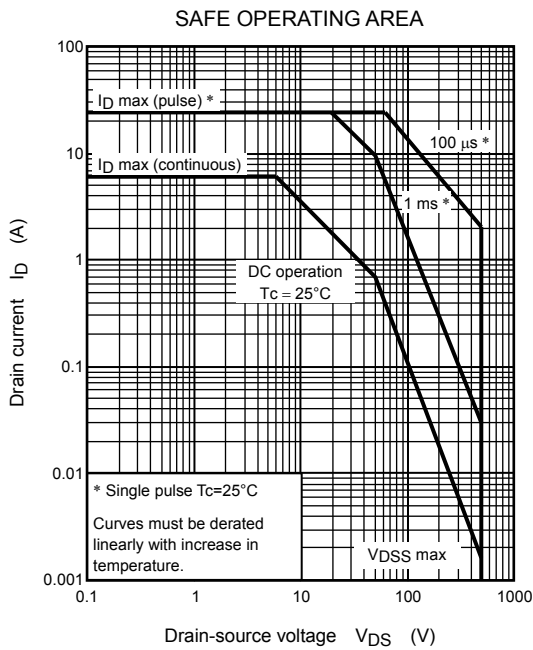
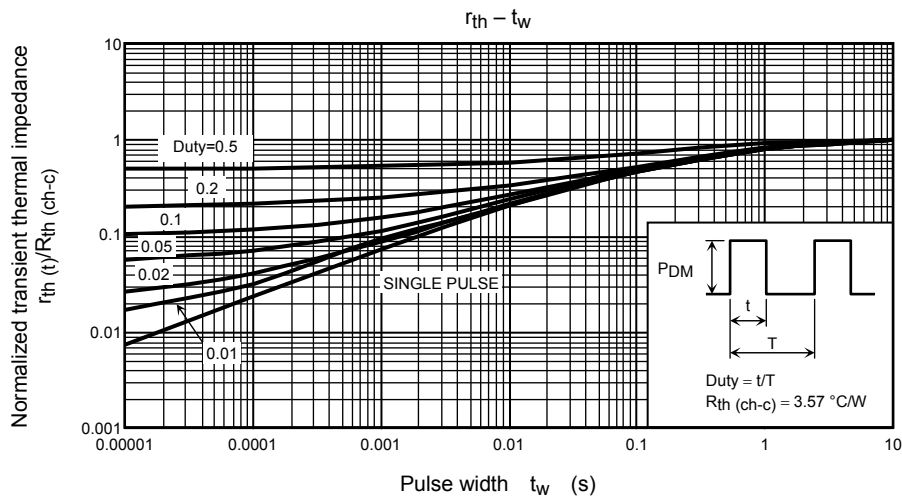


Note 4: A line under a Lot No. identifies the indication of product Labels [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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$R_G = 25 \Omega$
 $V_{DD} = 90 \text{ V}, L = 6.8 \text{ mH}$

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

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