

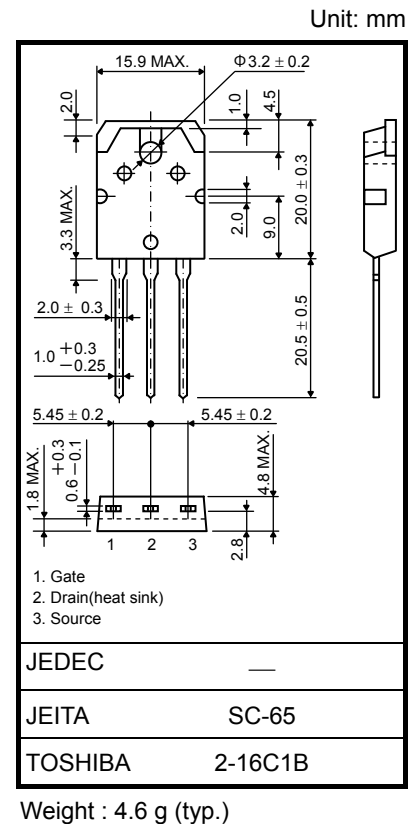
# TK12J60U

## Switching Regulator Applications

- Low drain-source ON-resistance:  $R_{DS(ON)} = 0.36 \Omega$  (typ.)
- High forward transfer admittance:  $|Y_{fs}| = 7.0 S$  (typ.)
- Low leakage current:  $I_{DSS} = 100 \mu A$  (max) ( $V_{DS} = 600 V$ )
- Enhancement mode:  $V_{th} = 3.0$  to  $5.0 V$  ( $V_{DS} = 10 V, I_D = 1 mA$ )

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

| Characteristics                                |                | Symbol    | Rating     | Unit       |
|--|----------------|-----------|------------|------------|
| Drain-source voltage                           |                | $V_{DSS}$ | 600        | V          |
| Gate-source voltage                            |                | $V_{GSS}$ | $\pm 30$   | V          |
| Drain current                                  | DC (Note 1)    | $I_D$     | 12         | A          |
|  | Pulse (Note 1) | $I_{DP}$  | 24         |            |
| Drain power dissipation ( $T_c = 25^\circ C$ ) |                | $P_D$     | 144        | W          |
| Single pulse avalanche energy (Note 2)         |                | $E_{AS}$  | 69         | mJ         |
| Avalanche current                              |                | $I_{AR}$  | 8          | A          |
| Repetitive avalanche energy (Note 3)           |                | $E_{AR}$  | 14         | mJ         |
| Channel temperature                            |                | $T_{ch}$  | 150        | $^\circ C$ |
| Storage temperature range                      |                | $T_{stg}$ | -55 to 150 | $^\circ C$ |



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

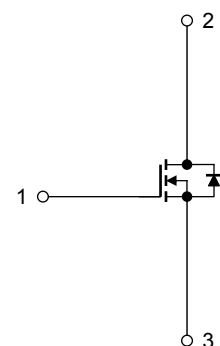
| Characteristics                        | Symbol         | Max   | Unit         |
|--|----------------|-------|--------------|
| Thermal resistance, channel to case    | $R_{th(ch-c)}$ | 0.868 | $^\circ C/W$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 50    | $^\circ C/W$ |

Note 1: Ensure that the channel temperature does not exceed  $150^\circ C$ .

Note 2:  $V_{DD} = 90 V, T_{ch} = 25^\circ C$  (initial),  $L = 1.89 mH, R_G = 25 \Omega, I_{AR} = 8 A$

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

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



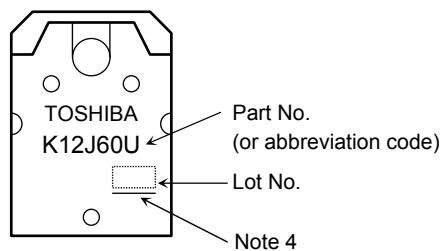
## Electrical Characteristics (Ta = 25°C)

| 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          |               | $I_{DSS}$     | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$                           | —   | —    | 100     | $\mu\text{A}$ |
| Drain-source breakdown voltage |               | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$                              | 600 | —    | —       | V             |
| Gate threshold voltage         |               | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$                              | 3.0 | —    | 5.0     | V             |
| Drain-source ON-resistance     |               | $R_{DS(ON)}$  | $V_{GS} = 10\text{ V}, I_D = 6\text{ A}$                               | —   | 0.36 | 0.4     | $\Omega$      |
| Forward transfer admittance    |               | $ Y_{fs} $    | $V_{DS} = 10\text{ V}, I_D = 6\text{ A}$                               | 2.0 | 7.0  | —       | S             |
| Input capacitance              |               | $C_{iss}$     | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$          | —   | 720  | —       | pF            |
| Reverse transfer capacitance   |               | $C_{rss}$     |  | —   | 55   | —       |               |
| Output capacitance             |               | $C_{oss}$     |  | —   | 1700 | —       |               |
| Switching time                 | Rise time     | $t_r$         |  | —   | 30   | —       | ns            |
|                                | Turn-on time  | $t_{on}$      |  | —   | 60   | —       |               |
|                                | Fall time     | $t_f$         |  | —   | 8    | —       |               |
|                                | Turn-off time | $t_{off}$     |  | —   | 75   | —       |               |
| Total gate charge              |               | $Q_g$         | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 12\text{ A}$ | —   | 14   | —       | nC            |
| Gate-source charge             |               | $Q_{gs}$      |  | —   | 8.5  | —       |               |
| Gate-drain charge              |               | $Q_{gd}$      |  | —   | 5.5  | —       |               |

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

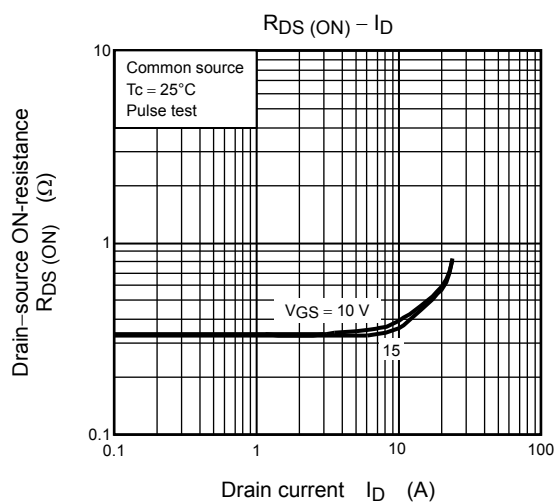
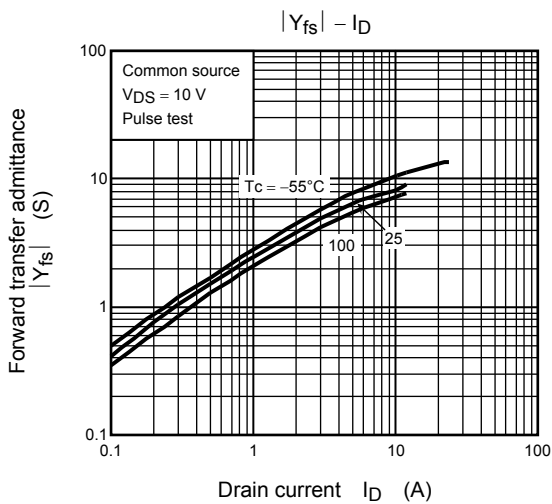
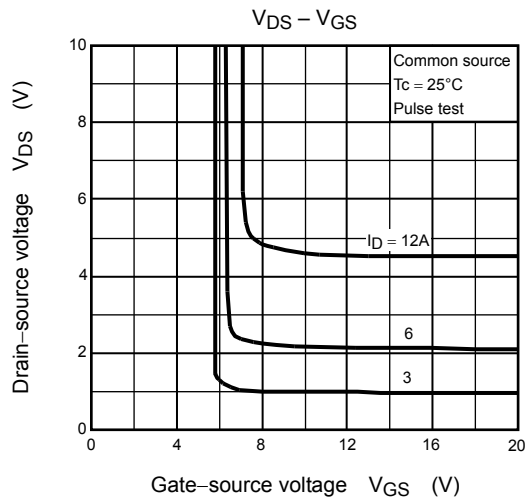
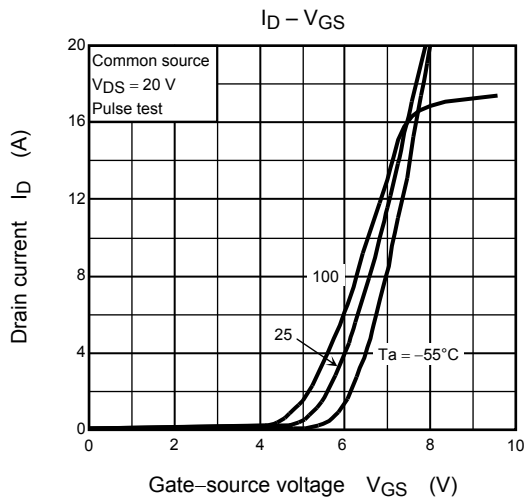
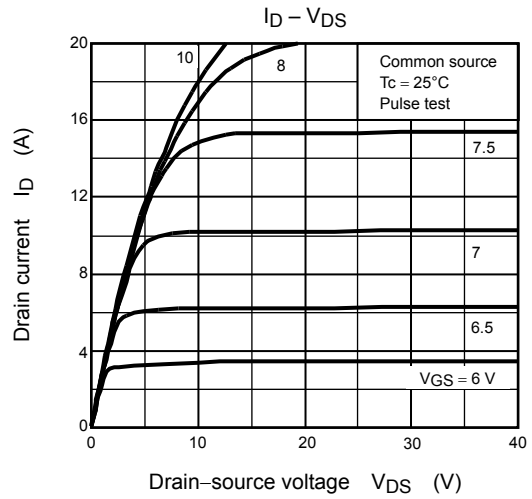
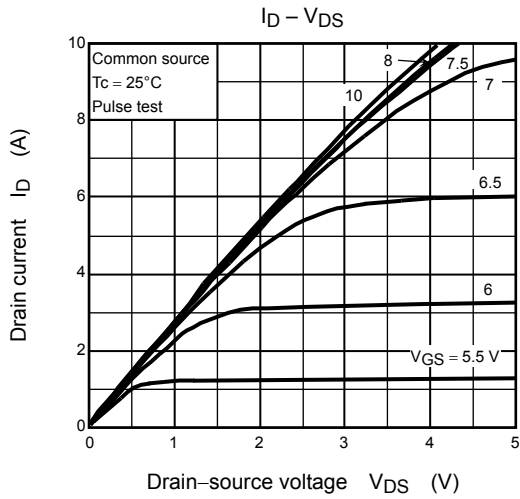
| Characteristics                              |  | Symbol    | Test Condition                               | Min | Typ. | Max  | Unit          |
|--|--|-----------|--|-----|------|------|---------------|
| Continuous drain reverse current<br>(Note 1) |  | $I_{DR}$  | —  | —   | —    | 12   | A             |
| Pulse drain reverse current<br>(Note 1)      |  | $I_{DRP}$ | —  | —   | —    | 24   | A             |
| Forward voltage (diode)                      |  | $V_{DSF}$ | $I_{DR} = 12\text{ A}, V_{GS} = 0\text{ V}$  | —   | —    | -1.7 | V             |
| Reverse recovery time                        |  | $t_{rr}$  | $I_{DR} = 12\text{ A}, V_{GS} = 0\text{ V},$ | —   | 380  | —    | ns            |
| Reverse recovery charge                      |  | $Q_{rr}$  | $dI_{DR}/dt = 100\text{ A}/\mu\text{s}$      | —   | 5.3  | —    | $\mu\text{C}$ |

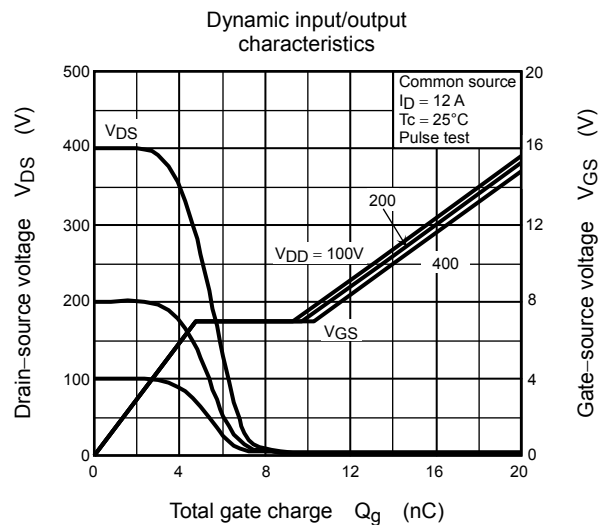
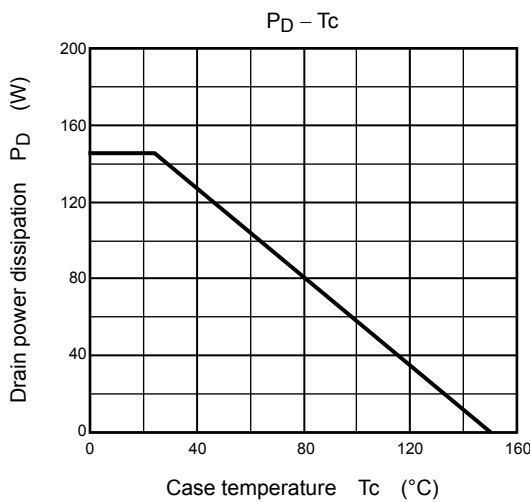
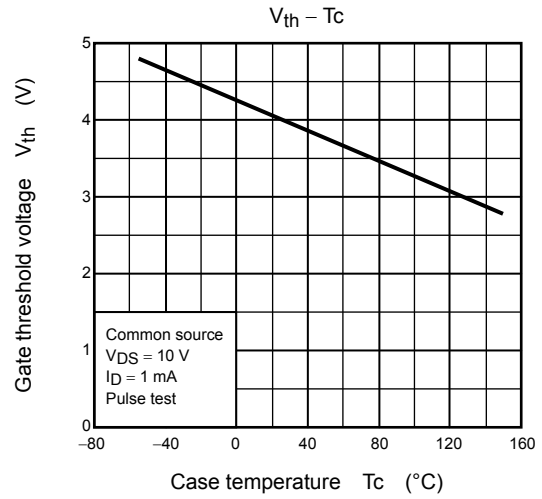
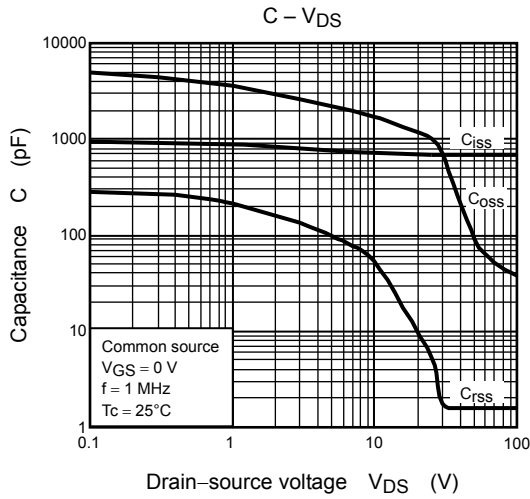
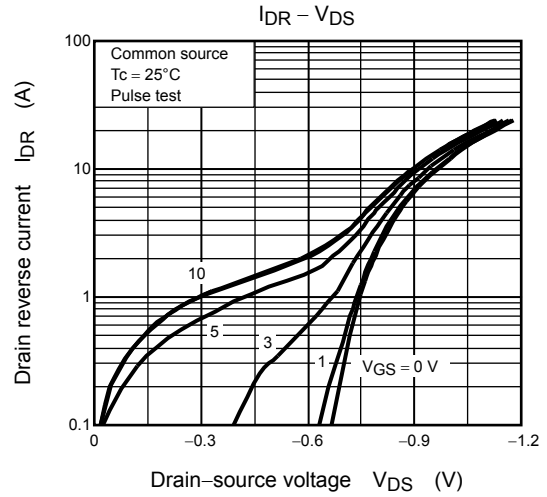
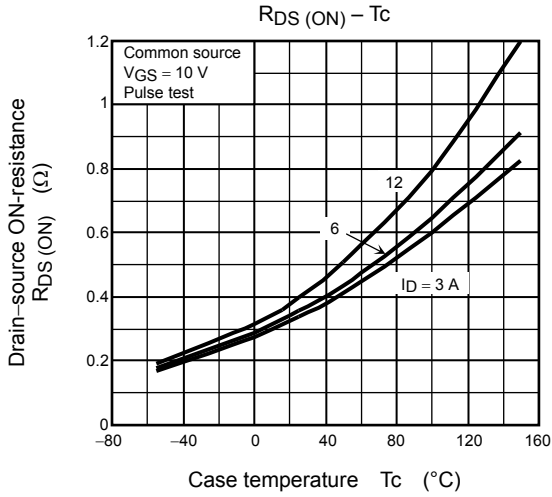
## Marking

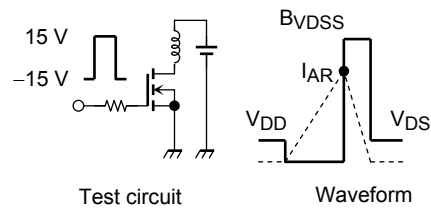
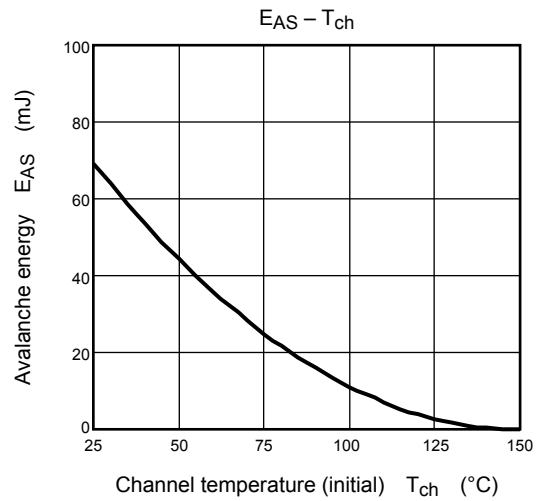
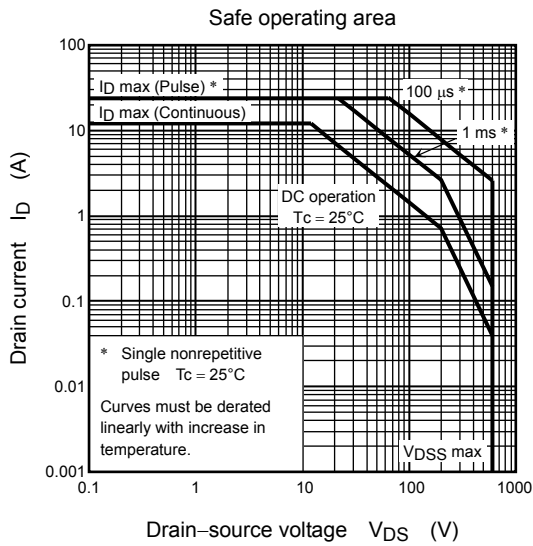
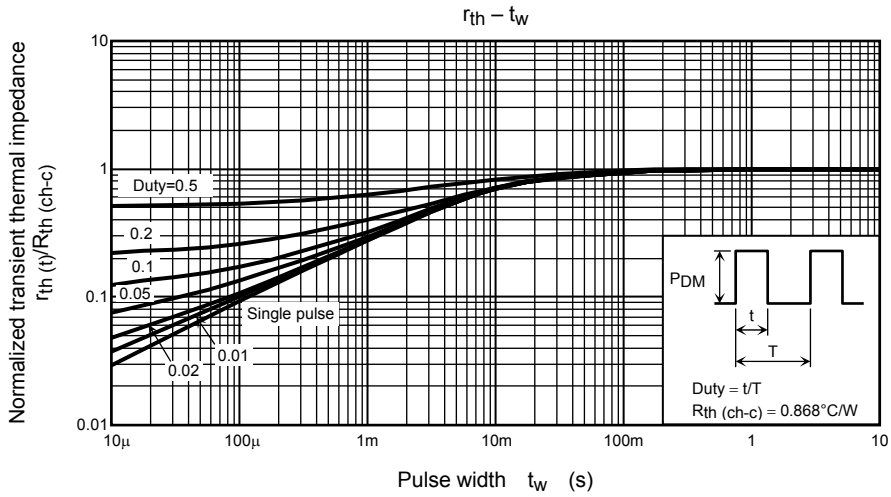


Note 4 : A line under a Lot No. identifies the indication of product Labels  
[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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$R_G = 25 \Omega$   
 $V_{DD} = 90 V, L = 1.89 mH$

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

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