

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type (L²-π-MOSV)

2SK2311

Chopper Regulator, DC-DC Converter and Switching Regulator Applications

- 4-V gate drive
- Low drain-source ON resistance : $R_{DS(ON)} = 36 \text{ m}\Omega$ (typ.)
- High forward transfer admittance : $|Y_{fs}| = 16 \text{ S}$ (typ.)
- Low leakage current : $I_{DSS} = 100 \text{ }\mu\text{A}$ (max) ($V_{DS} = 60 \text{ V}$)
- Enhancement mode : $V_{th} = 0.8 \text{ to } 2.0 \text{ V}$ ($V_{DS} = 10 \text{ V}$, $I_D = 1 \text{ mA}$)

Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit | |
|--|----------------|------------|------|---|
| Drain-source voltage | V_{DSS} | 60 | V | |
| Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | V_{DGR} | 60 | V | |
| Gate-source voltage | V_{GSS} | ± 20 | V | |
| Drain current | DC (Note 1) | I_D | 25 | A |
| | Pulse (Note 1) | I_{DP} | 100 | A |
| Drain power dissipation ($T_c = 25^\circ\text{C}$) | P_D | 40 | W | |
| Single pulse avalanche energy (Note 2) | E_{AS} | 156 | mJ | |
| Avalanche current | I_{AR} | 25 | A | |
| Repetitive avalanche energy (Note 3) | E_{AR} | 3.5 | mJ | |
| Channel temperature | T_{ch} | 150 | °C | |
| Storage temperature range | T_{stg} | -55 to 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 | $R_{th(ch-c)}$ | 3.125 | °C / W |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 83.3 | °C / W |

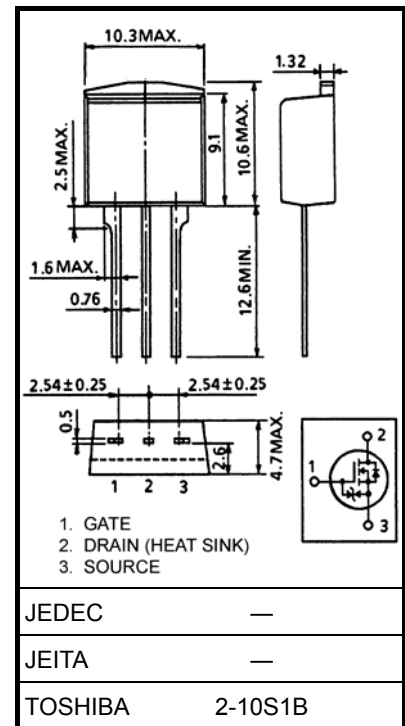
Note 1: Ensure that the channel temperature does not exceed 150°C.

Note 2: $V_{DD} = 25 \text{ V}$, $T_{ch} = 25^\circ\text{C}$ (initial), $L = 339 \text{ }\mu\text{H}$, $R_G = 25 \text{ }\Omega$, $I_{AR} = 25 \text{ A}$

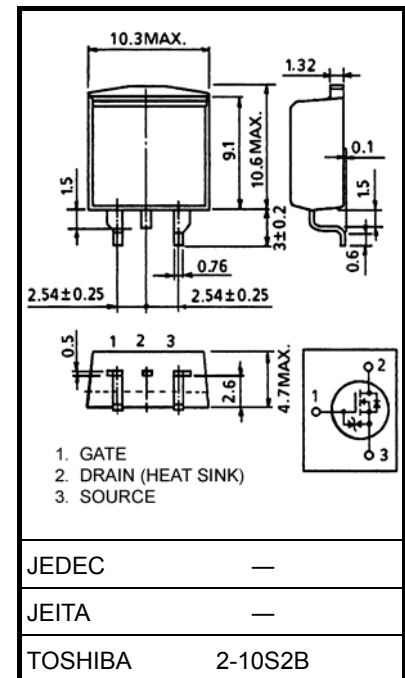
Note 3: Repetitive rating: pulse width limited by maximum channel temperature

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

Unit: mm



Weight: 1.5 g (typ.)



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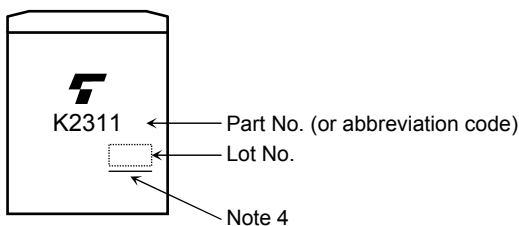
Electrical Characteristics (Ta = 25°C)

| Characteristics | | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---------------|----------------|--|-----|------|----------|---------------|
| Gate leakage current | | I_{GSS} | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$ | — | — | ± 10 | μA |
| Drain cut-off current | | I_{DSS} | $V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$ | — | — | 100 | μA |
| 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 | | $R_{DS(ON)}$ | $V_{GS} = 4 \text{ V}, I_D = 12 \text{ A}$ | — | 57 | 80 | m Ω |
| | | | $V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}$ | — | 36 | 46 | |
| Forward transfer admittance | | $ Y_{fs} $ | $V_{DS} = 10 \text{ V}, I_D = 12 \text{ A}$ | 10 | 16 | — | S |
| Input capacitance | | C_{iss} | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | — | 1000 | — | pF |
| Reverse transfer capacitance | | C_{rss} | | — | 200 | — | |
| Output capacitance | | C_{oss} | | — | 550 | — | |
| Switching time | Rise time | t_r | <p>$I_D = 12 \text{ A}$ $V_{GS} = 10 \text{ V}$ 0 V 50Ω $R_L = 2.5 \Omega$ $V_{DD} = 30 \text{ V}$ V_{OUT} $Duty \leq 1\%, t_w = 10 \mu\text{s}$</p> | — | 20 | — | ns |
| | Turn-on time | t_{on} | | — | 30 | — | |
| | Fall time | t_f | | — | 55 | — | |
| | Turn-off time | t_{off} | | — | 130 | — | |
| Total gate charge (Gate-source plus gate-drain) | | Q_g | $V_{DD} \approx 48 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 25 \text{ A}$ | — | 38 | — | nC |
| Gate-source charge | | Q_{gs} | | — | 25 | — | |
| Gate-drain ("miller") charge | | Q_{gd} | | — | 13 | — | |

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

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | I_{DR} | — | — | — | 25 | A |
| Pulse drain reverse current (Note 1) | I_{DRP} | — | — | — | 100 | A |
| Forward voltage (diode) | V_{DSF} | $I_{DR} = 25 \text{ A}, V_{GS} = 0 \text{ V}$ | — | — | -1.8 | V |
| Reverse recovery time | t_{rr} | $I_{DR} = 25 \text{ A}, V_{GS} = 0 \text{ V}$ | — | 50 | — | ns |
| Reverse recovery charge | Q_{rr} | $dI_{DR} / dt = 50 \text{ A} / \mu\text{s}$ | — | 35 | — | μC |

Marking

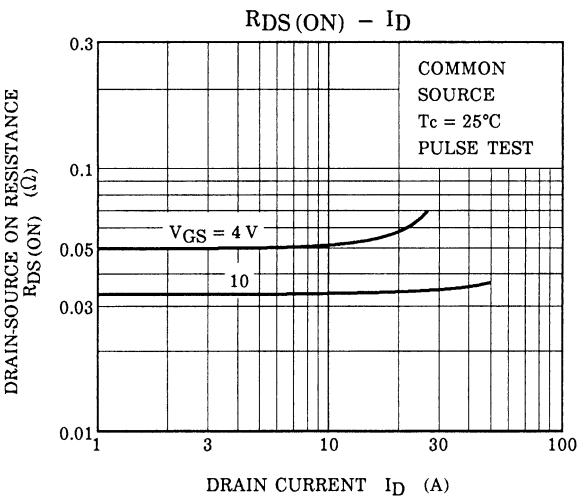
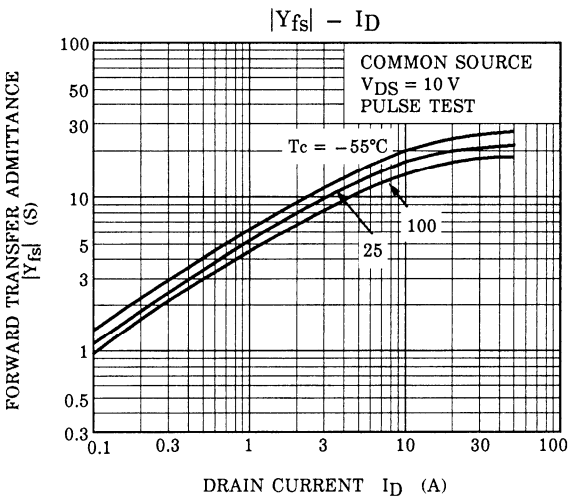
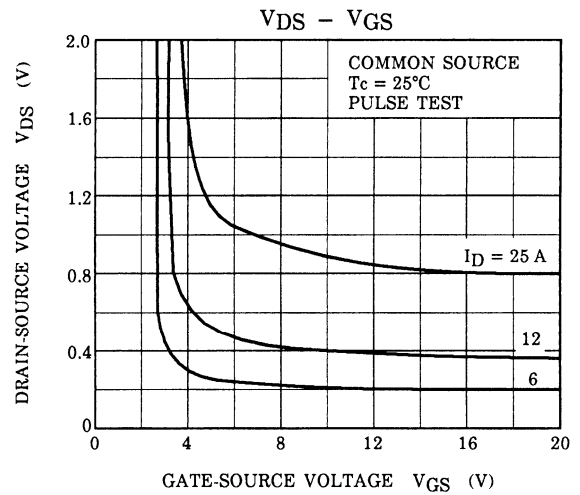
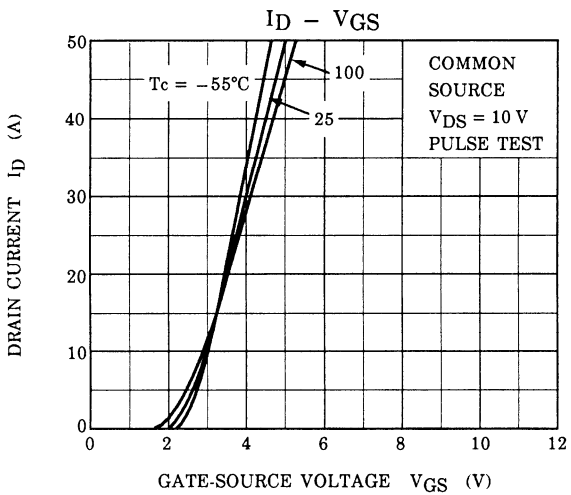
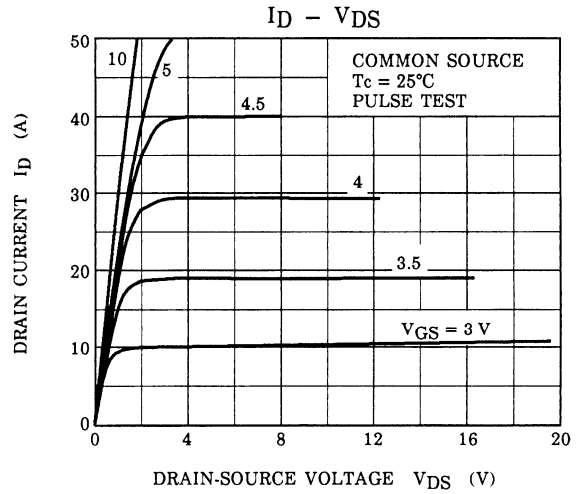
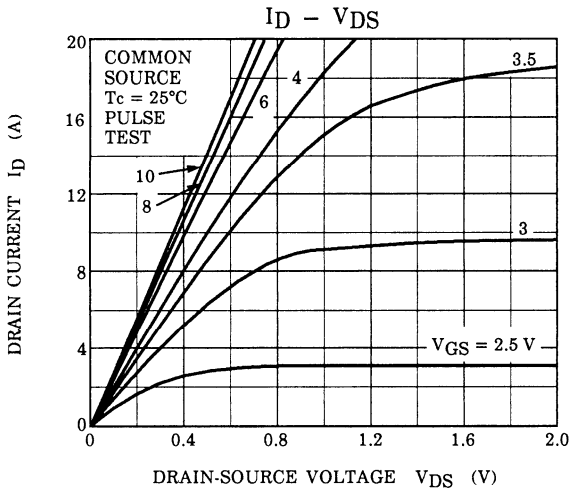


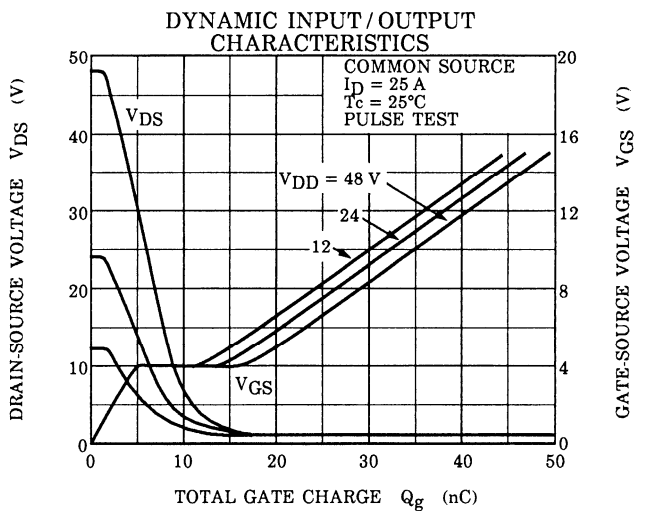
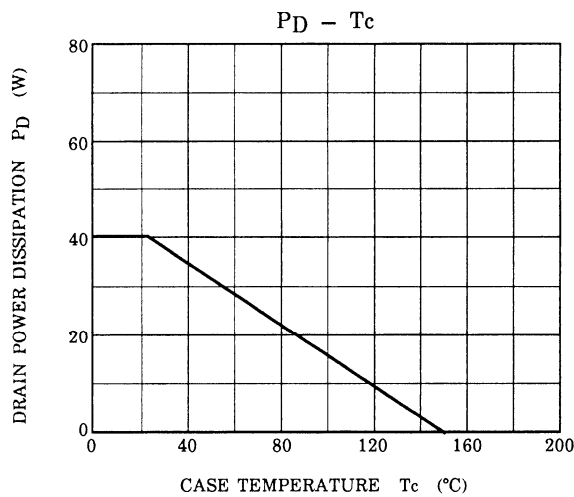
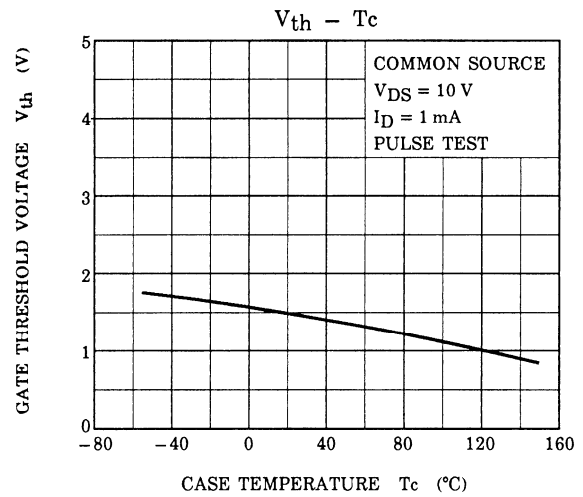
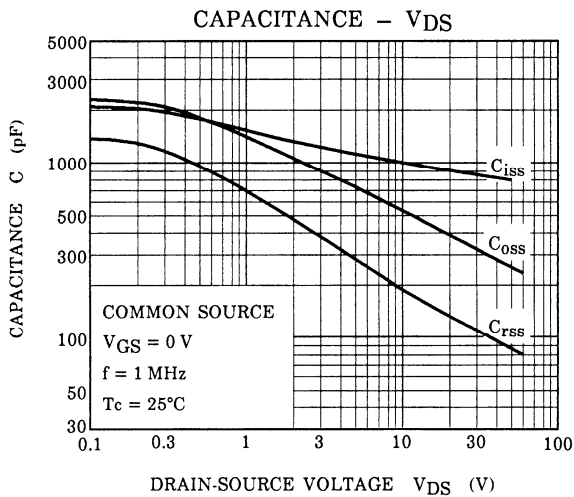
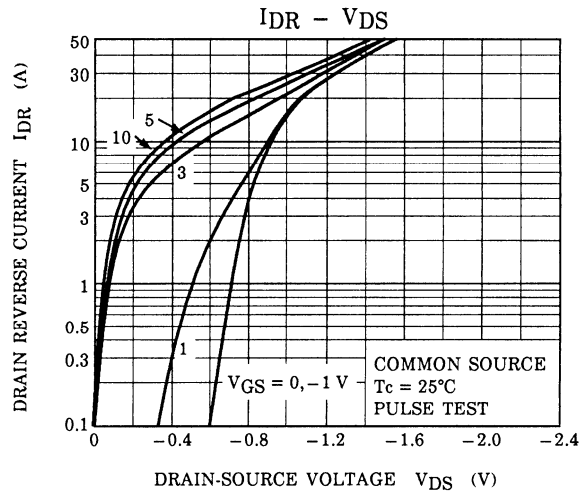
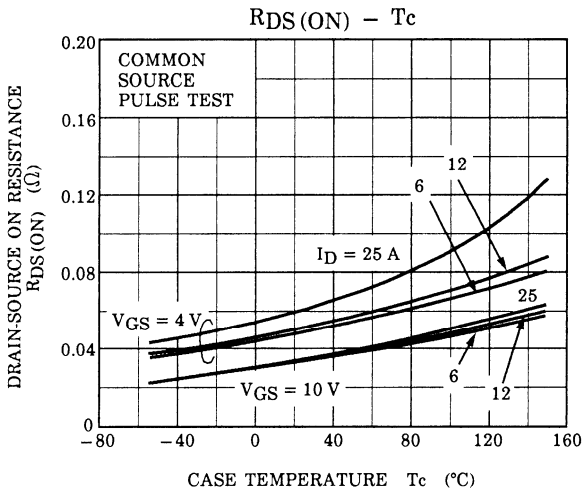
Note 4: A line under a Lot No. identifies the indication of product Labels.

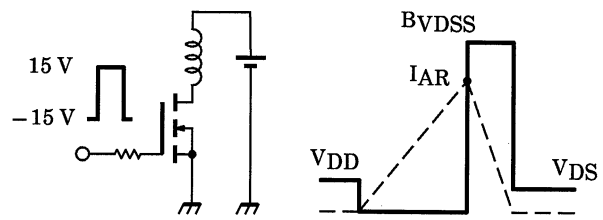
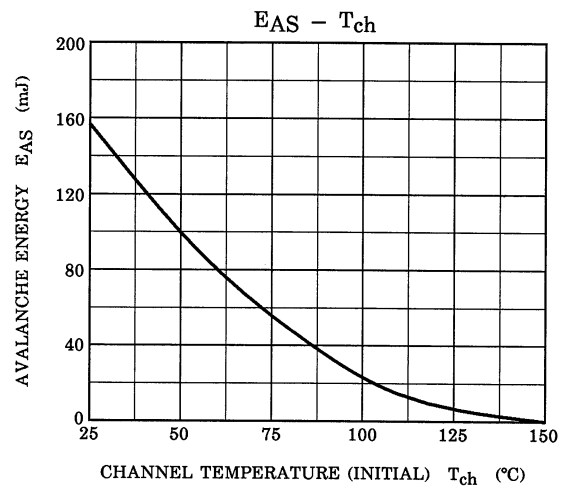
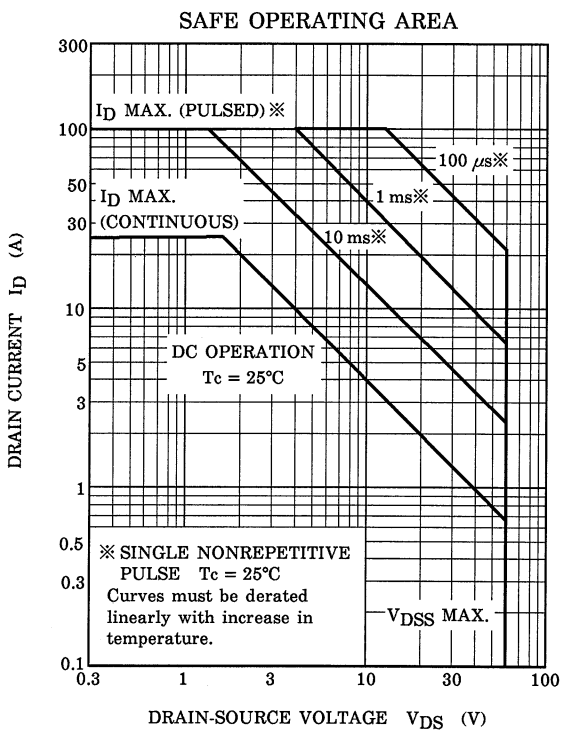
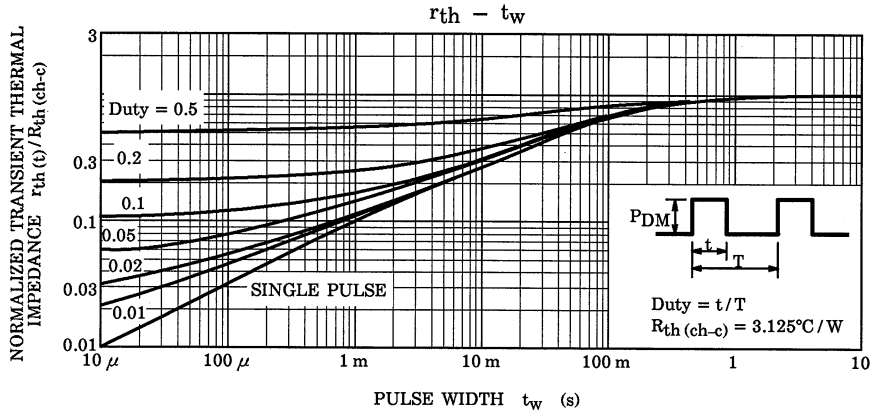
Not underlined: $[[Pb]]/INCLUDES > MCV$

Underlined: $[[G]]/RoHS COMPATIBLE$ or $[[G]]/RoHS [[Pb]]$

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TEST CIRCUIT

$R_G = 25 \Omega$
 $V_{DD} = 25 \text{ V}, L = 339 \mu\text{H}$

WAVE FORM

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

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