

# 2SK3132

Chopper Regulator DC-DC Converter and Motor Drive Applications

- Low drain-source ON resistance :  $R_{DS(ON)} = 0.07 \Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 33 \text{ S}$  (typ.)
- Low leakage current :  $I_{DSS} = 100 \mu\text{A}$  (max) ( $V_{DS} = 500 \text{ V}$ )
- Enhancement mode :  $V_{th} = 2.4 \text{ to } 3.4 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

| Characteristics                                      |                | Symbol    | Rating     | Unit             |
|--|----------------|-----------|------------|------------------|
| Drain-source voltage                                 |                | $V_{DSS}$ | 500        | V                |
| Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ ) |                | $V_{DGR}$ | 500        | V                |
| Gate-source voltage                                  |                | $V_{GSS}$ | $\pm 30$   | V                |
| DC drain current                                     | DC (Note 1)    | $I_D$     | 50         | A                |
|  | Pulse (Note 1) | $I_{DP}$  | 200        | A                |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ ) |                | $P_D$     | 250        | W                |
| Single pulse avalanche energy (Note 2)               |                | $E_{AS}$  | 525        | mJ               |
| Avalanche current                                    |                | $I_{AR}$  | 50         | A                |
| Repetitive avalanche energy (Note 3)                 |                | $E_{AR}$  | 25         | 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

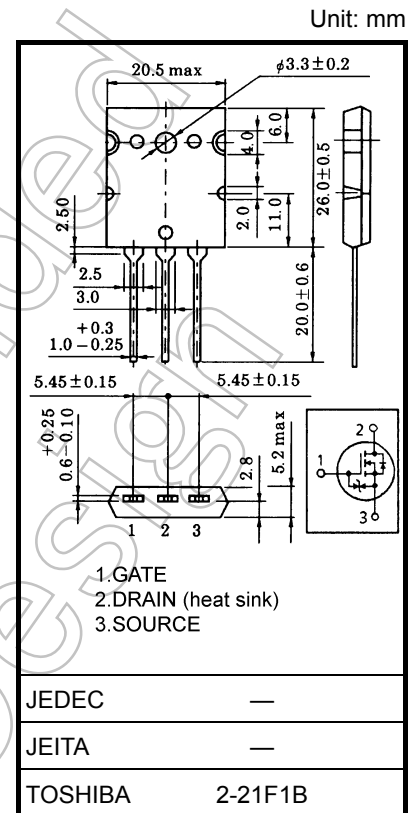
| Characteristics                        | Symbol         | Max  | Unit                        |
|--|----------------|------|-----------------------------|
| Thermal resistance, channel to case    | $R_{th(ch-c)}$ | 0.5  | $^\circ\text{C} / \text{W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 35.7 | $^\circ\text{C} / \text{W}$ |

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

Note 2:  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 357 \mu\text{H}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 50 \text{ A}$

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

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



Weight: 9.75 g (typ.)

Start of commercial production  
1998-09

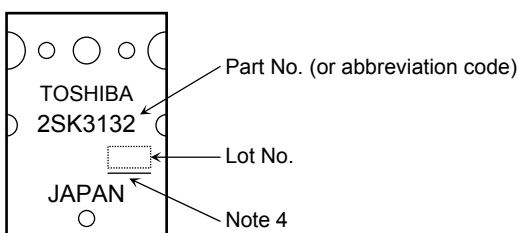
## Electrical Characteristics (Ta = 25°C)

| Characteristics                                 |               | Symbol        | Test Condition   | Min      | Typ.  | Max      | Unit          |
|---|---------------|---------------|--|----------|-------|----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 25\text{ V}, V_{DS} = 0\text{ V}$                        | —        | —     | $\pm 10$ | $\mu\text{A}$ |
| Gate-source breakdown voltage                   |               | $V_{(BR)GSS}$ | $I_G = \pm 10\ \mu\text{A}, V_{DS} = 0\text{ V}$                       | $\pm 30$ | —     | —        | V             |
| Drain cut-off current                           |               | $I_{DSS}$     | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$                           | —        | —     | 100      | $\mu\text{A}$ |
| Drain-source breakdown voltage                  |               | $V_{(BR)DSS}$ | $I_D = 10\text{ mA}, V_{GS} = 0\text{ V}$                              | 500      | —     | —        | V             |
| Gate threshold voltage                          |               | $V_{th}$      | $V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$                              | 2.4      | —     | 3.4      | V             |
| Drain-source ON resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 10\text{ V}, I_D = 25\text{ A}$                              | —        | 0.07  | 0.095    | $\Omega$      |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10\text{ V}, I_D = 25\text{ A}$                              | 15       | 33    | —        | S             |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$          | —        | 11000 | —        | pF            |
| Reverse transfer capacitance                    |               | $C_{rss}$     |  | —        | 2100  | —        |               |
| Output capacitance                              |               | $C_{oss}$     |  | —        | 4200  | —        |               |
| Switching time                                  | Rise time     | $t_r$         |  | —        | 105   | —        | ns            |
|   | Turn-on time  | $t_{on}$      |  | —        | 160   | —        |               |
|   | Fall time     | $t_f$         |  | —        | 65    | —        |               |
|   | Turn-off time | $t_{off}$     |  | —        | 245   | —        |               |
| Total gate charge (Gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 50\text{ A}$ | —        | 280   | —        | nC            |
| Gate-source charge                              |               | $Q_{gs}$      |  | —        | 150   | —        |               |
| Gate-drain ("miller") charge                    |               | $Q_{gd}$      |  | —        | 130   | —        |               |

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

| Characteristics                           | Symbol    | Test Condition                              | Min | Typ. | Max  | Unit          |
|---|-----------|---|-----|------|------|---------------|
| Continuous drain reverse current (Note 1) | $I_{DR}$  | —   | —   | —    | 50   | A             |
| Pulse drain reverse current (Note 1)      | $I_{DRP}$ | —   | —   | —    | 200  | A             |
| Forward voltage (diode)                   | $V_{DSF}$ | $I_{DR} = 25\text{ A}, V_{GS} = 0\text{ V}$ | —   | —    | -1.7 | V             |
| Reverse recovery time                     | $t_{rr}$  | $I_{DR} = 50\text{ A}, V_{GS} = 0\text{ V}$ | —   | 600  | —    | ns            |
| Reverse recovery charge                   | $Q_{rr}$  | $dI_{DR} / dt = 100\text{ A} / \mu\text{s}$ | —   | 12   | —    | $\mu\text{C}$ |

## Marking

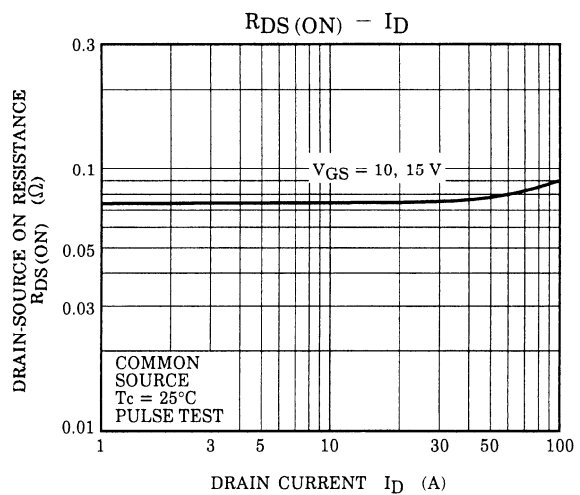
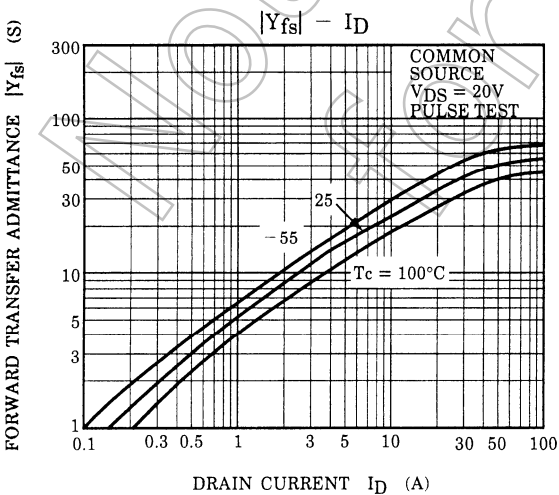
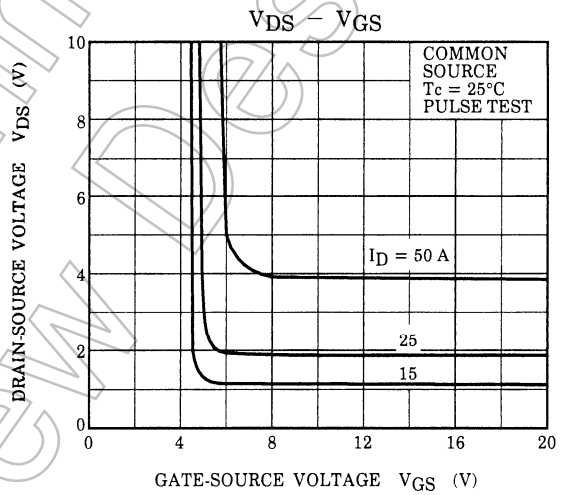
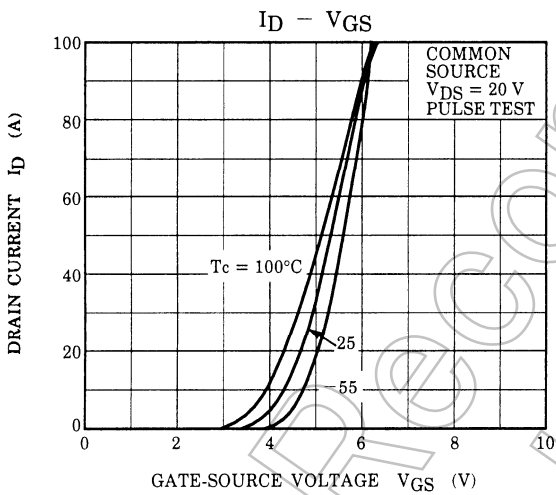
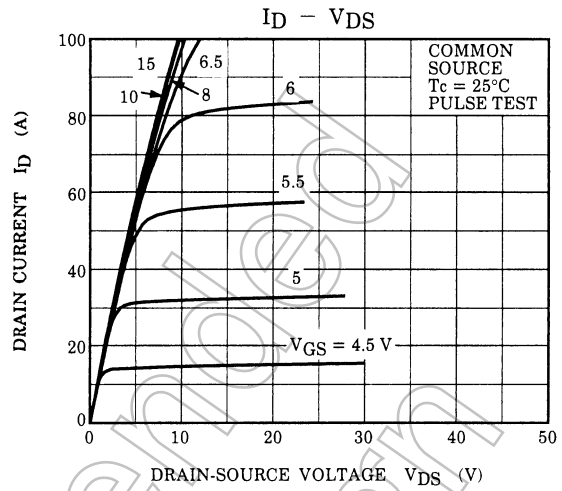
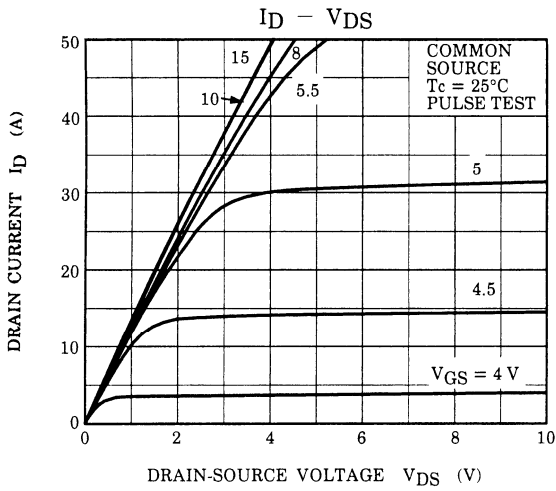


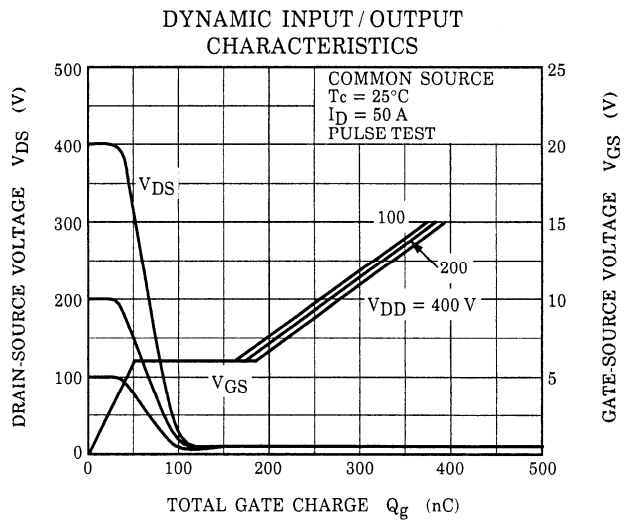
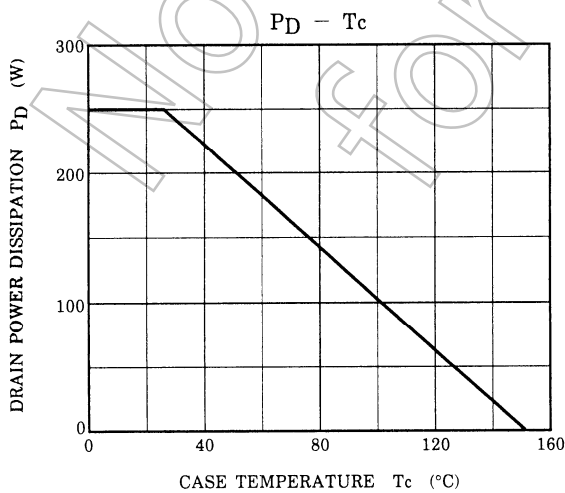
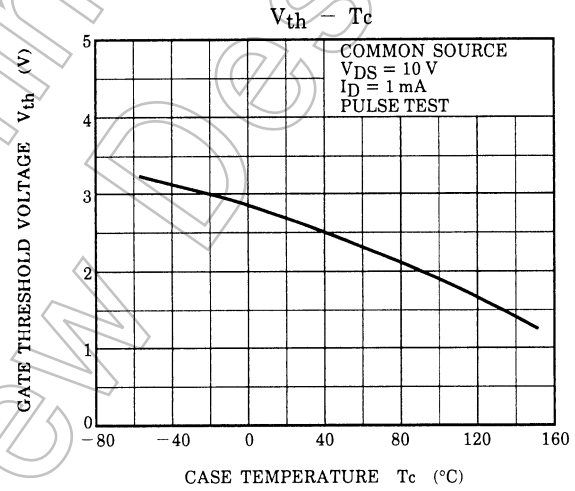
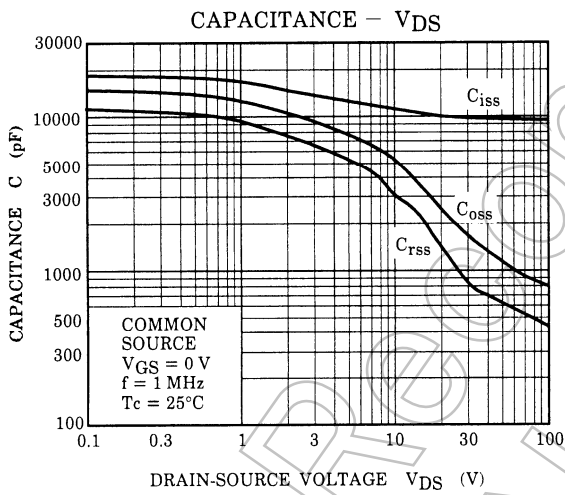
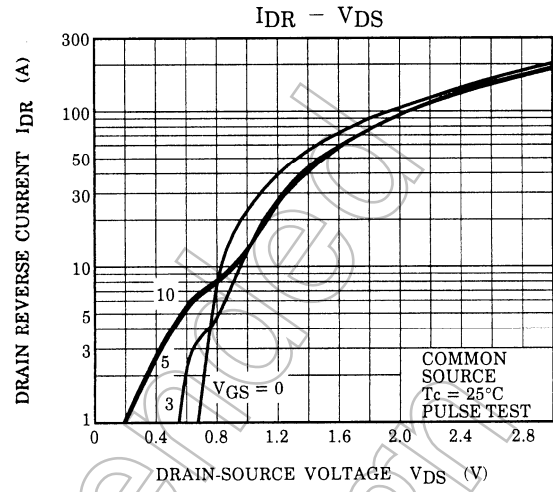
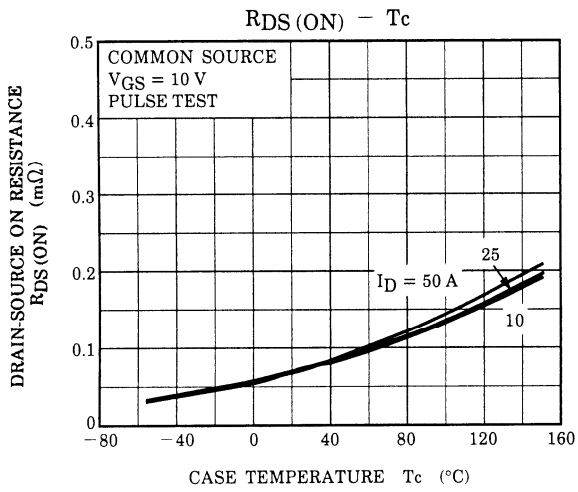
Note 4: A line under a Lot No. identifies the indication of product Labels.

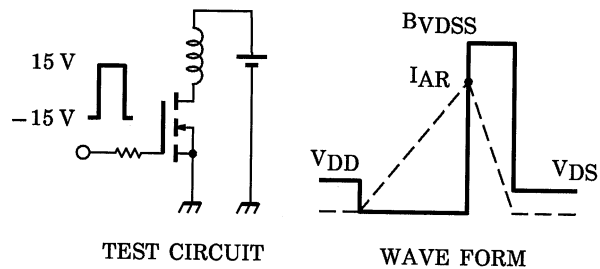
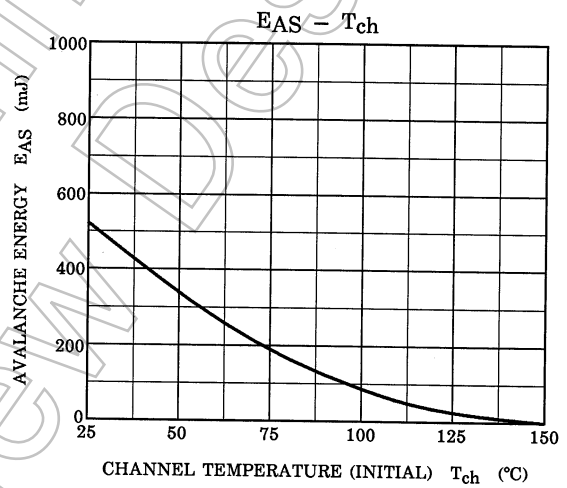
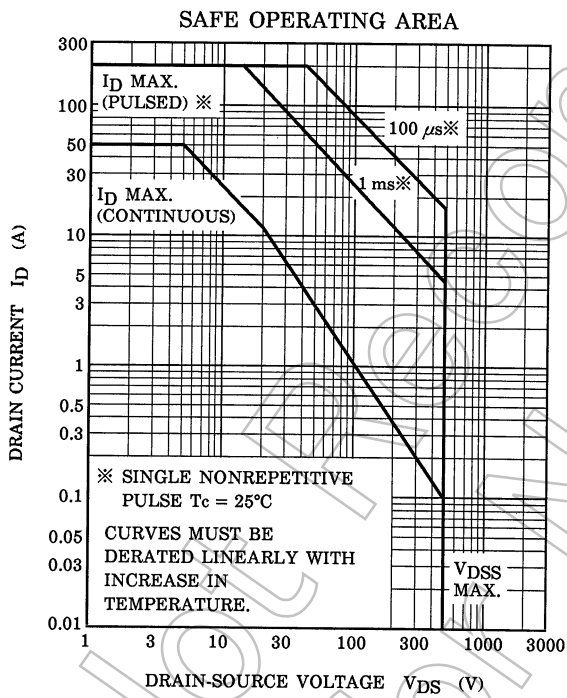
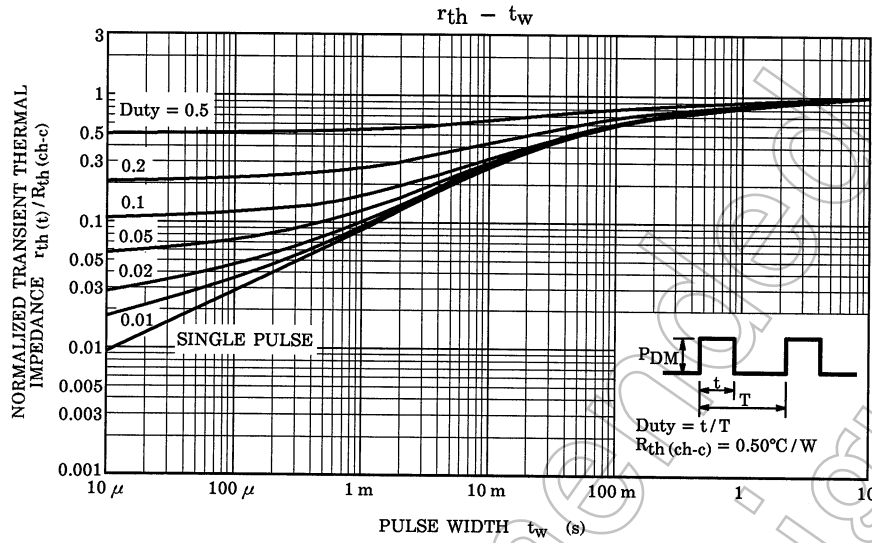
Not underlined:  $[[\text{Pb}]]/\text{INCLUDES} > \text{MCV}$

Underlined:  $[[\text{G}]]/\text{RoHS COMPATIBLE}$  or  $[[\text{G}]]/\text{RoHS} [[\text{Pb}]]$

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.







$R_G = 25 \Omega$   
 $V_{DD} = 90 \text{ V}, L = 357 \mu\text{H}$

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

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