

TOSHIBA FIELD EFFECT TRANSISTOR SILICON N CHANNEL MOS TYPE ( $\pi$ -MOSV)

## 2SK3313

HIGH SPEED, HIGH VOLTAGE SWITCHING APPLICATIONS

SWITCHING REGULATOR, DC-DC CONVERTER APPLICATIONS

MOTOR DRIVE APPLICATIONS

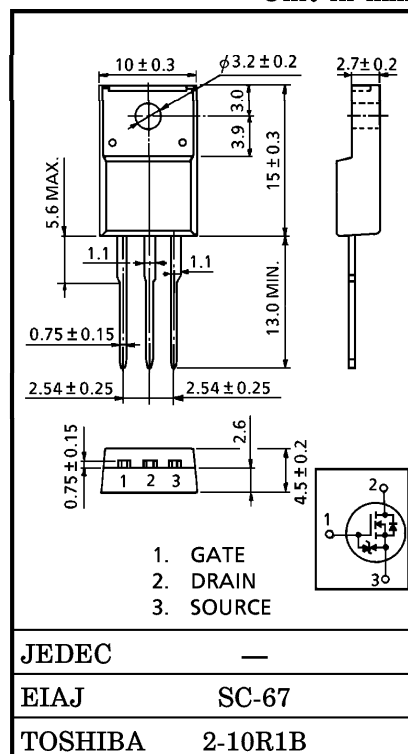
INDUSTRIAL APPLICATIONS

Unit in mm

- Fast Reverse Recovery Time :  $t_{rr} = 90 \text{ ns (Typ.)}$
- Built-in High-Speed Free-Wheeling Diode
- Low Drain-Source ON Resistance :  $R_{DS(ON)} = 0.5 \Omega \text{ (Typ.)}$
- High Forward Transfer Admittance :  $|Y_{fs}| = 8.5 \text{ S (Typ.)}$
- Low Leakage Current :  $I_{DSS} = 100 \mu\text{A (Max.) (} V_{DS} = 500 \text{ V)}$
- Enhancement-Mode :  $V_{th} = 2.0 \sim 4.0 \text{ V}$   
( $V_{DS} = 10 \text{ V, } I_D = 1 \text{ mA}$ )

MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

| CHARACTERISTIC                                       |       | 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                |
| Drain Current                                        | DC    | $I_D$     | 12             | A                |
|                                                      | Pulse | $I_{DP}$  | 48             | A                |
| Drain Power Dissipation ( $T_c = 25^\circ\text{C}$ ) |       | $P_D$     | 40             | W                |
| Single Pulse Avalanche Energy**                      |       | $E_{AS}$  | 324            | mJ               |
| Avalanche Current                                    |       | $I_{AR}$  | 12             | A                |
| Repetitive Avalanche Energy*                         |       | $E_{AR}$  | 4.0            | mJ               |
| Channel Temperature                                  |       | $T_{ch}$  | 150            | $^\circ\text{C}$ |
| Storage Temperature Range                            |       | $T_{stg}$ | $-55 \sim 150$ | $^\circ\text{C}$ |



## THERMAL CHARACTERISTICS

| CHARACTERISTIC                         | 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 ;

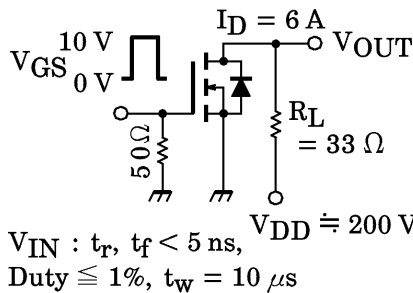
\* Repetitive rating ; Pulse Width Limited by Max. junction temperature.

\*\*  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 3.83 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 12 \text{ A}$ **This transistor is an electrostatic sensitive device.****Please handle with caution.**

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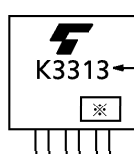
## ELECTRICAL CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                                  |               | 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                   |               | $V_{(BR)GSS}$ | $I_G = \pm 100 \mu\text{A}, V_{DS} = 0 \text{ V}$                                   | $\pm 30$ | —    | —        | 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                          |               | $V_{th}$      | $V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$                                         | 2.0      | —    | 4.0      | V             |
| Drain-Source ON Resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 10 \text{ V}, I_D = 6 \text{ A}$                                          | —        | 0.5  | 0.62     | $\Omega$      |
| Forward Transfer Admittance                     |               | $ Y_{fs} $    | $V_{GS} = 10 \text{ V}, I_D = 6 \text{ A}$                                          | 3.0      | 8.5  | —        | S             |
| Input Capacitance                               |               | $C_{iss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                    | —        | 2040 | —        | pF            |
| Reverse Transfer Capacitance                    |               | $C_{rss}$     |                                                                                     | —        | 210  | —        |               |
| Output Capacitance                              |               | $C_{oss}$     |                                                                                     | —        | 630  | —        |               |
| Switching Time                                  | Rise Time     | $t_r$         |  | —        | 22   | —        | ns            |
|                                                 | Turn-on Time  | $t_{on}$      |                                                                                     | —        | 58   | —        |               |
|                                                 | Fall Time     | $t_f$         |                                                                                     | —        | 36   | —        |               |
|                                                 | Turn-off Time | $t_{off}$     |                                                                                     | —        | 180  | —        |               |
| Total Gate Charge (Gate-Source Plus Gate-Drain) |               | $Q_g$         | $V_{DD} = 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}$                 | —        | 45   | —        | nC            |
| Gate-Source Charge                              |               | $Q_{gs}$      |                                                                                     | —        | 25   | —        |               |
| Gate-Drain ("Miller") Charge                    |               | $Q_{gd}$      |                                                                                     | —        | 20   | —        |               |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                   | SYMBOL    | TEST CONDITION                                                                            | MIN. | TYP. | MAX. | UNIT          |
|----------------------------------|-----------|-------------------------------------------------------------------------------------------|------|------|------|---------------|
| Continuous Drain Reverse Current | $I_{DR}$  | —                                                                                         | —    | —    | 12   | A             |
| Pulse Drain Reverse Current      | $I_{DRP}$ | —                                                                                         | —    | —    | 48   | A             |
| Diode Forward Voltage            | $V_{DSF}$ | $I_{DR} = 12 \text{ A}, V_{GS} = 0 \text{ V}$                                             | —    | —    | —1.7 | V             |
| Reverse Recovery Time            | $t_{rr}$  | $I_{DR} = 12 \text{ A}, V_{GS} = 0 \text{ V}$<br>$dI_{DR}/dt = 100 \text{ A}/\mu\text{s}$ | —    | 90   | 160  | ns            |
| Reverse Recovery Charge          | $Q_{rr}$  |                                                                                           | —    | 0.25 | —    | $\mu\text{C}$ |

## MARKING



TYPE

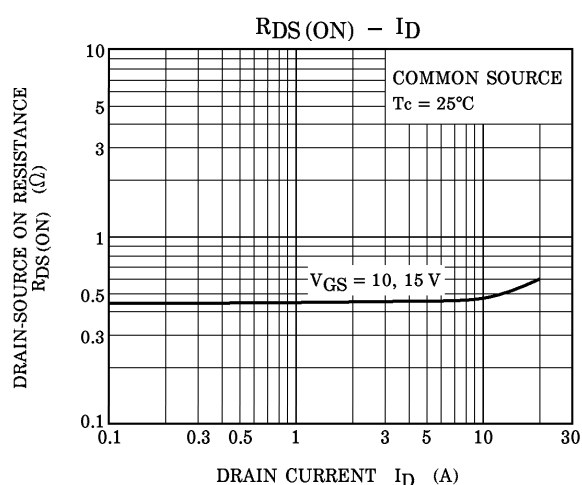
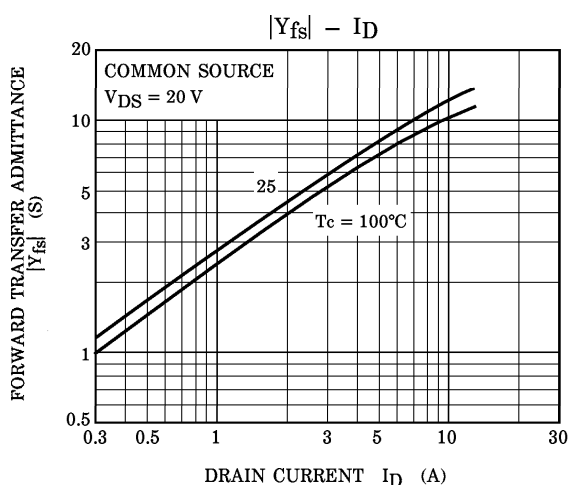
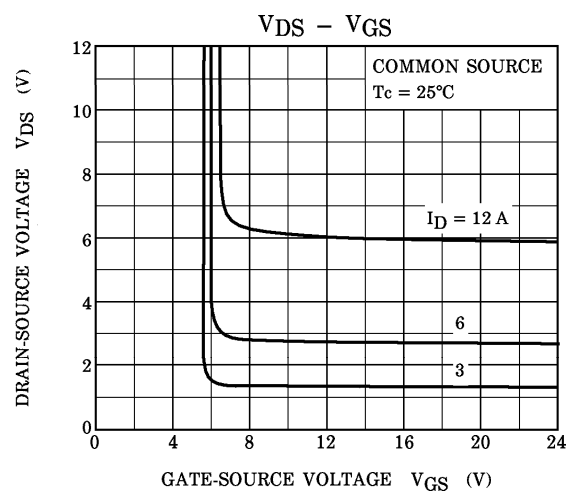
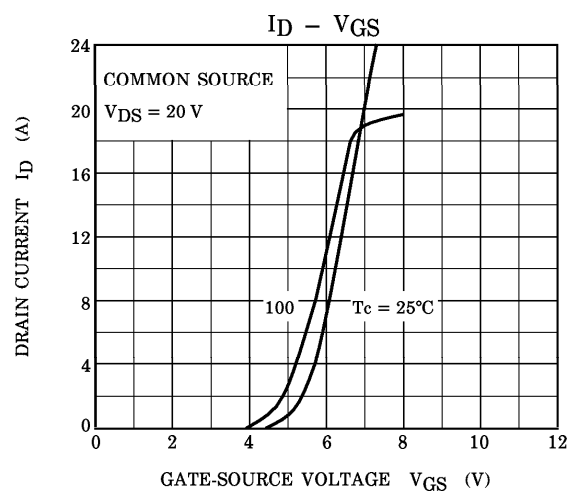
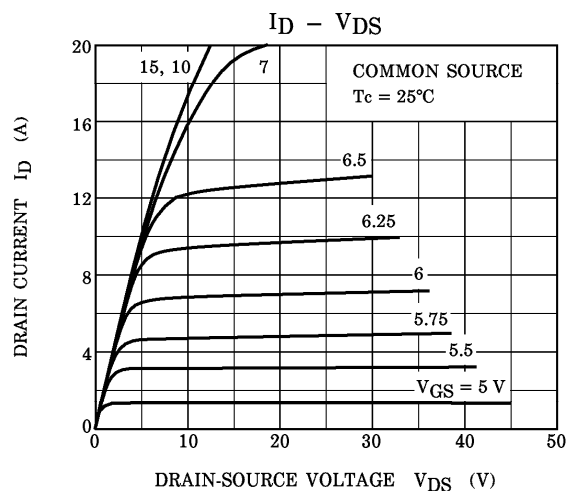
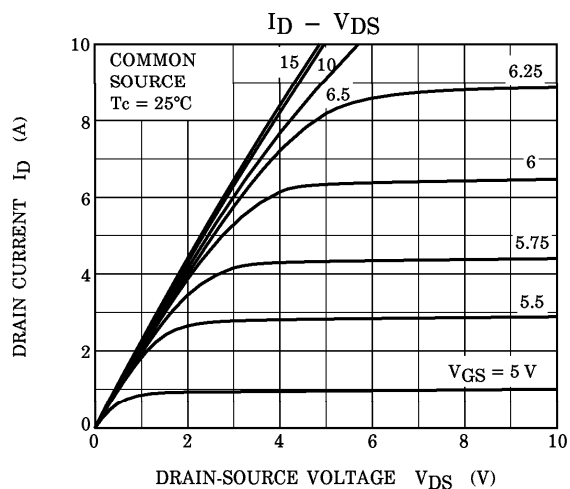
※ Lot Number

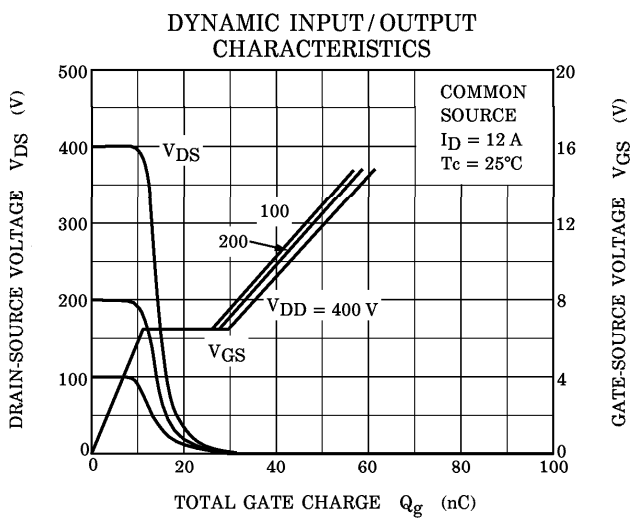
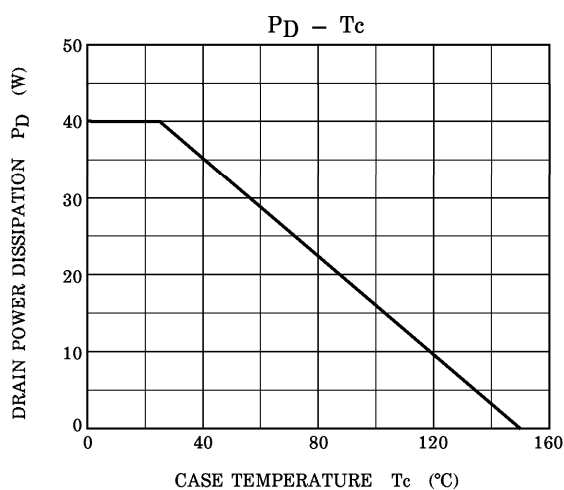
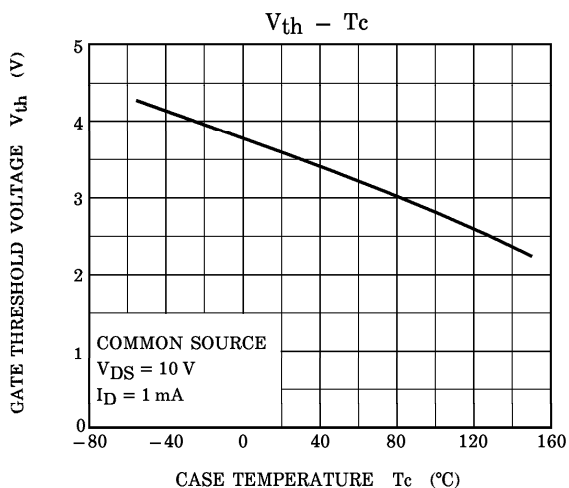
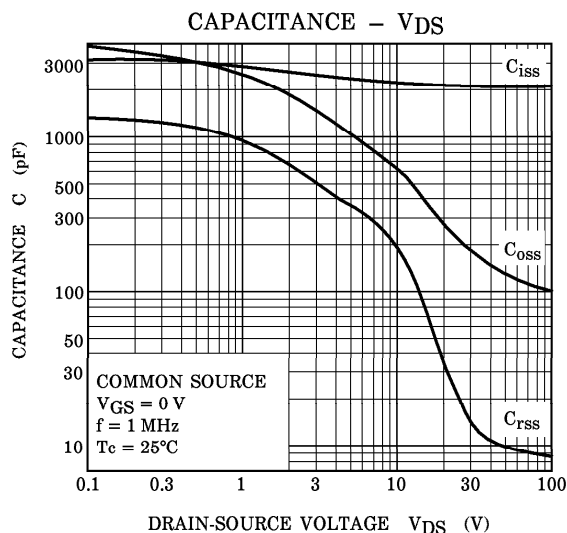
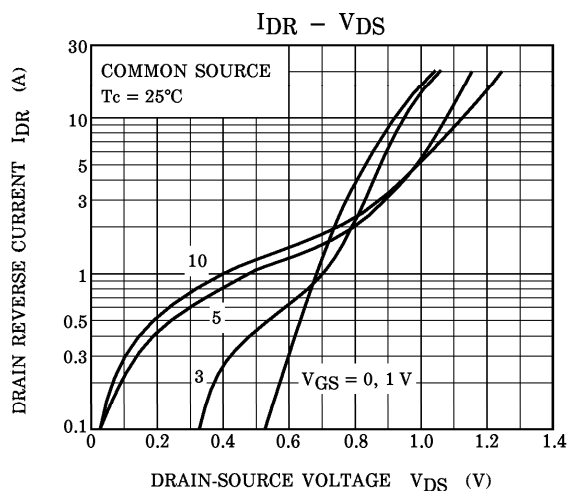
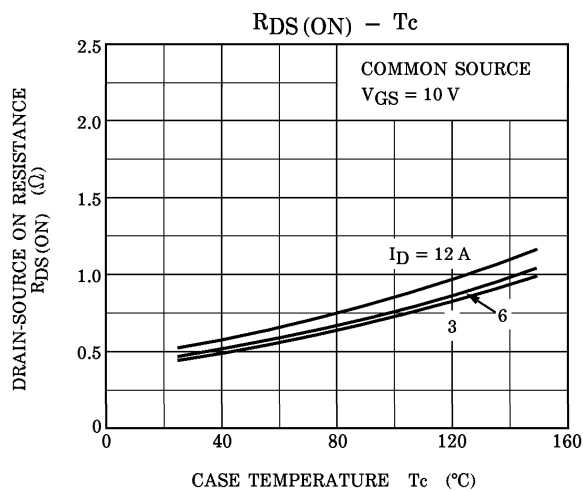


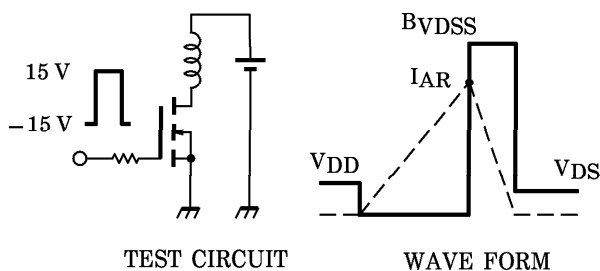
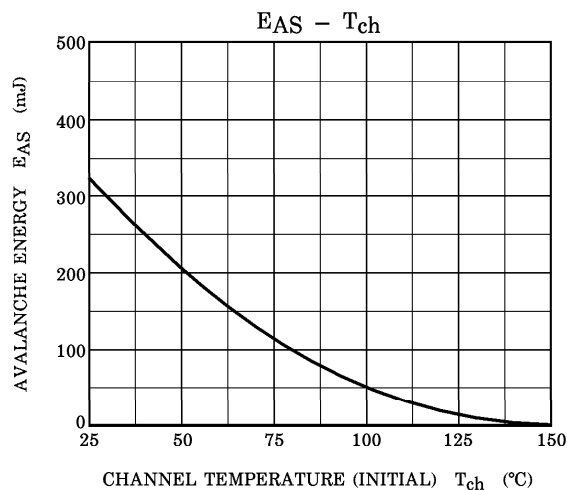
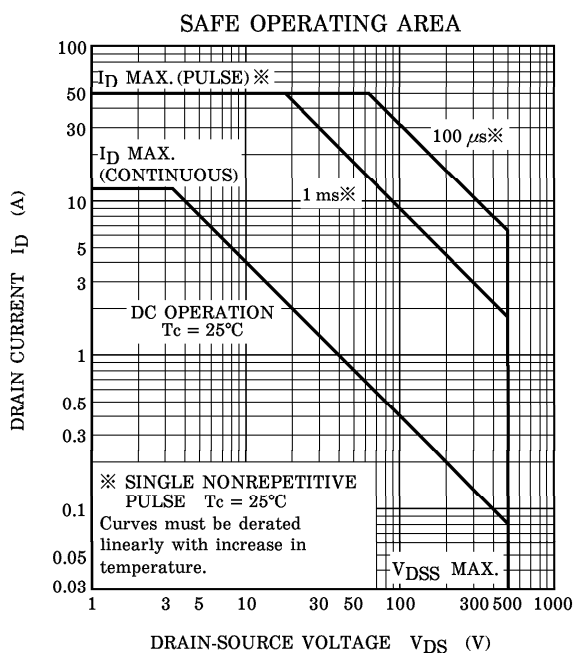
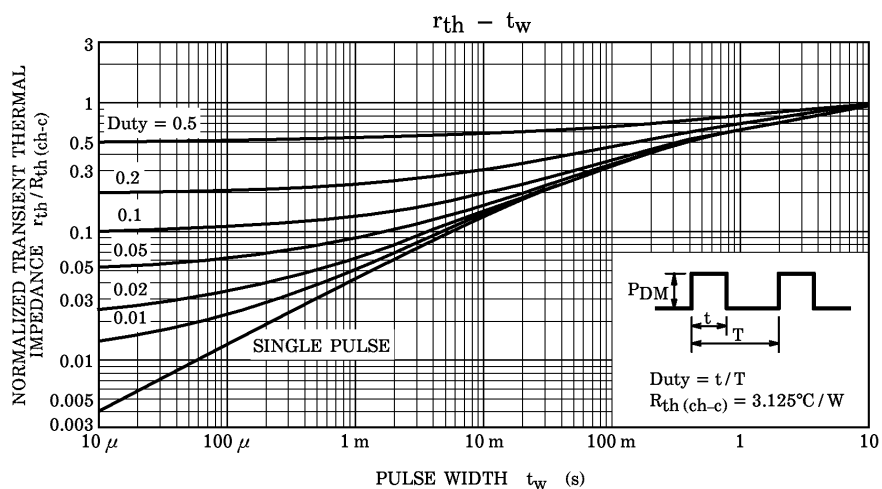
Month (Starting from Alphabet A)



Year (Last Number of the Christian Era)







Peak  $I_{AR} = 12\text{ A}$ ,  $R_G = 25\ \Omega$ ,  $V_{DD} = 90\text{ V}$ ,  $L = 3.83\text{ mH}$

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