

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

## 2SK3176

HIGH SPEED, HIGH VOLTAGE SWITCHING APPLICATIONS

SWITCHING REGULATOR, DC-DC CONVERTER AND MOTOR DRIVE APPLICATIONS

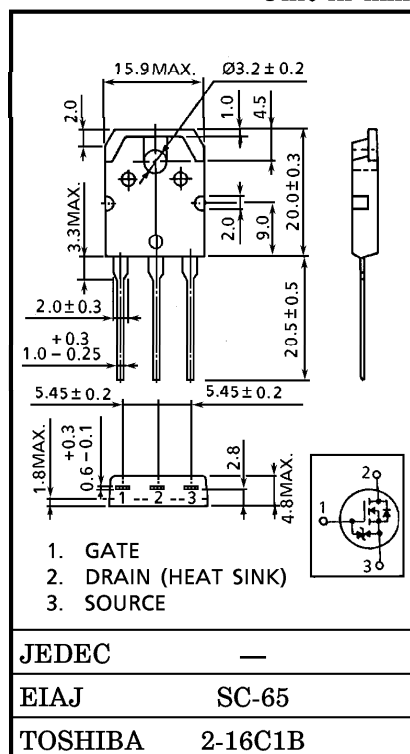
INDUSTRIAL APPLICATIONS

Unit in mm

- Low Drain-Source ON Resistance :  $R_{DS(ON)} = 38 \text{ m}\Omega$  (Typ.)
- High Forward Transfer Admittance :  $|Y_{fs}| = 30 \text{ S}$  (Typ.)
- Low Leakage Current :  $I_{DSS} = 100 \mu\text{A}$  (Max.) ( $V_{DS} = 200 \text{ V}$ )
- Enhancement-Model :  $V_{th} = 1.5 \sim 3.5 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

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

| CHARACTERISTIC                                  |       | SYMBOL           | RATING  | UNIT |
|-------------------------------------------------|-------|------------------|---------|------|
| Drain-Source Voltage                            |       | V <sub>DSS</sub> | 200     | V    |
| Drain-Gate Voltage (R <sub>GS</sub> = 20 kΩ)    |       | V <sub>DGR</sub> | 200     | V    |
| Gate-Source Voltage                             |       | V <sub>GSS</sub> | ±20     | V    |
| Drain Current                                   | DC    | I <sub>D</sub>   | 30      | A    |
|                                                 | Pulse | I <sub>DP</sub>  | 120     | A    |
| Drain Power Dissipation (T <sub>c</sub> = 25°C) |       | P <sub>D</sub>   | 150     | W    |
| Single Pulse Avalanche Energy*                  |       | E <sub>AS</sub>  | 925     | mJ   |
| Avalanche Current                               |       | I <sub>AR</sub>  | 30      | A    |
| Repetitive Avalanche Energy**                   |       | E <sub>AR</sub>  | 15      | mJ   |
| Channel Temperature                             |       | T <sub>ch</sub>  | 150     | °C   |
| Storage Temperature Range                       |       | T <sub>stg</sub> | −55~150 | °C   |



## THERMAL CHARACTERISTICS

| CHARACTERISTIC                         | SYMBOL         | MAX.  | UNIT               |
|----------------------------------------|----------------|-------|--------------------|
| Thermal Resistance, Channel to Case    | $R_{th(ch-c)}$ | 0.833 | $^\circ\text{C/W}$ |
| Thermal Resistance, Channel to Ambient | $R_{th(ch-a)}$ | 50.0  | $^\circ\text{C/W}$ |

Note ;

\*  $V_{DD} = 50 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.66 \text{ mH}$ ,  $I_{AR} = 30 \text{ A}$ ,  $R_G = 25 \Omega$ 

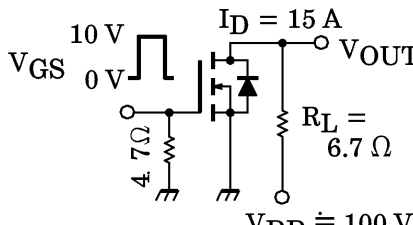
\*\* Repetitive rating ; Pulse Width Limited by Max. junction temperature.

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

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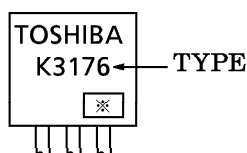
## ELECTRICAL CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                                  |               | SYMBOL        | TEST CONDITION                                                                                                                                                                                                                                                 | MIN. | TYP. | MAX.     | UNIT             |
|-------------------------------------------------|---------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|----------|------------------|
| Gate Leakage Current                            |               | $I_{GSS}$     | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$                                                                                                                                                                                                              | —    | —    | $\pm 10$ | $\mu\text{A}$    |
| Drain Cut-off Current                           |               | $I_{DSS}$     | $V_{DS} = 200 \text{ V}, V_{GS} = 0 \text{ V}$                                                                                                                                                                                                                 | —    | —    | 100      | $\mu\text{A}$    |
| Drain-Source Breakdown Voltage                  |               | $V_{(BR)DSS}$ | $I_D = 10 \text{ mA}, V_{GS} = 0 \text{ V}$                                                                                                                                                                                                                    | 200  | —    | —        | V                |
| Gate Threshold Voltage                          |               | $V_{th}$      | $V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$                                                                                                                                                                                                                    | 1.5  | —    | 3.5      | V                |
| Drain-Source ON Resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 10 \text{ V}, I_D = 15 \text{ A}$                                                                                                                                                                                                                    | —    | 38   | 52       | $\text{m}\Omega$ |
| Forward Transfer Admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10 \text{ V}, I_D = 15 \text{ A}$                                                                                                                                                                                                                    | 15   | 30   | —        | S                |
| Input Capacitance                               |               | $C_{iss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}$<br>$f = 1 \text{ MHz}$                                                                                                                                                                                           | —    | 5400 | —        | pF               |
| Reverse Transfer Capacitance                    |               | $C_{rss}$     |                                                                                                                                                                                                                                                                | —    | 580  | —        |                  |
| Output Capacitance                              |               | $C_{oss}$     |                                                                                                                                                                                                                                                                | —    | 1900 | —        |                  |
| Switching Time                                  | Rise Time     | $t_r$         |  <p><math>V_{GS} = 10 \text{ V}, 0 \text{ V}</math><br/><math>I_D = 15 \text{ A}</math><br/><math>R_L = 6.7 \Omega</math><br/><math>V_{DD} \approx 100 \text{ V}</math></p> | —    | 15   | —        | ns               |
|                                                 | Turn-on Time  | $t_{on}$      |                                                                                                                                                                                                                                                                | —    | 55   | —        |                  |
|                                                 | Fall Time     | $t_f$         |                                                                                                                                                                                                                                                                | —    | 25   | —        |                  |
|                                                 | Turn-off Time | $t_{off}$     |                                                                                                                                                                                                                                                                | —    | 190  | —        |                  |
| Total Gate Charge (Gate-Source Plus Gate-Drain) |               | $Q_g$         | $V_{DD} \approx 160 \text{ V}, V_{GS} = 10 \text{ V}$<br>$I_D = 30 \text{ A}$                                                                                                                                                                                  | —    | 125  | —        | nC               |
| Gate-Source Charge                              |               | $Q_{gs}$      |                                                                                                                                                                                                                                                                | —    | 80   | —        |                  |
| Gate-Drain ("Miller") Charge                    |               | $Q_{gd}$      |                                                                                                                                                                                                                                                                | —    | 45   | —        |                  |

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

| CHARACTERISTIC                   | SYMBOL    | TEST CONDITION                                | MIN. | TYP. | MAX. | UNIT          |
|----------------------------------|-----------|-----------------------------------------------|------|------|------|---------------|
| Continuous Drain Reverse Current | $I_{DR}$  | —                                             | —    | —    | 30   | A             |
| Pulse Drain Reverse Current      | $I_{DRP}$ | —                                             | —    | —    | 90   | A             |
| Diode Forward Voltage            | $V_{DSF}$ | $I_{DR} = 30 \text{ A}, V_{GS} = 0 \text{ V}$ | —    | —    | -2.0 | V             |
| Reverse Recovery Time            | $t_{rr}$  | $I_{DR} = 30 \text{ A}, V_{GS} = 0 \text{ V}$ | —    | 270  | —    | ns            |
| Reverse Recovery Charge          | $Q_{rr}$  | $dI_{DR}/dt = 100 \text{ A}/\mu\text{s}$      | —    | 3.0  | —    | $\mu\text{C}$ |

## MARKING

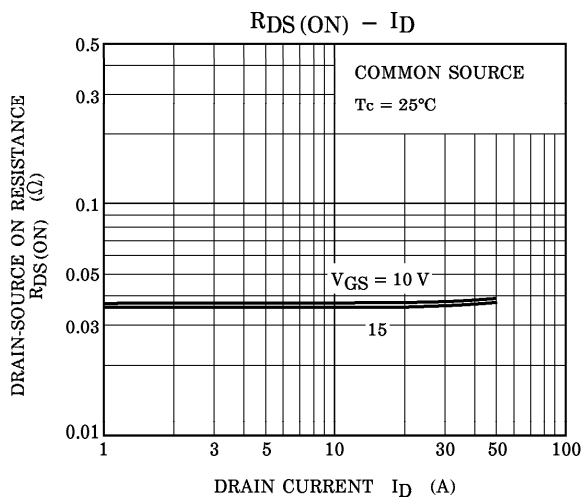
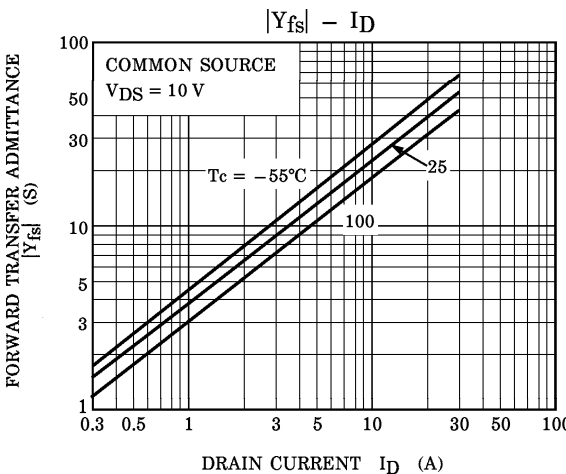
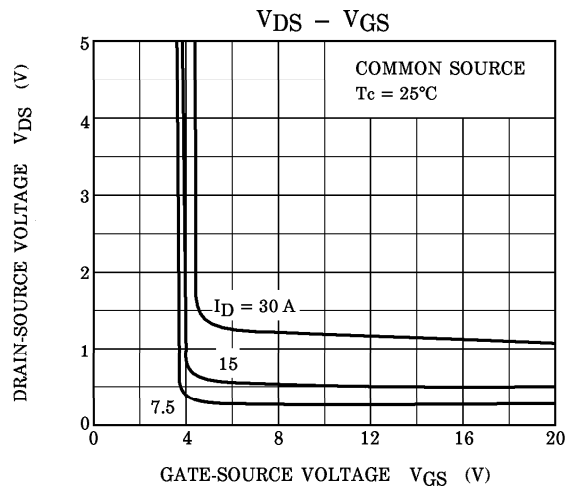
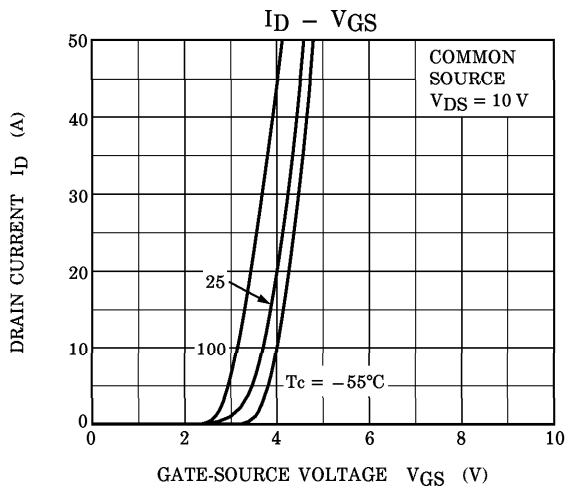
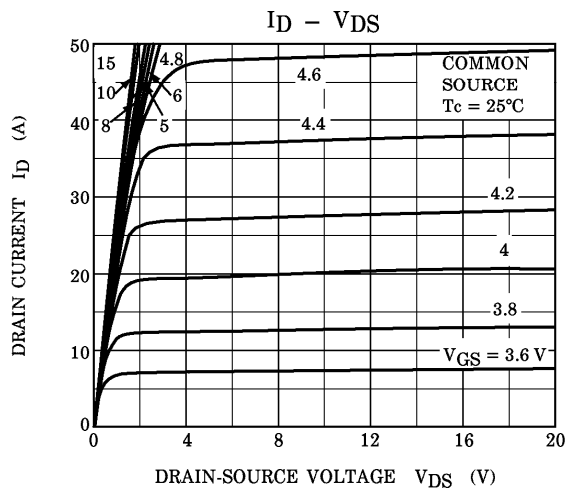
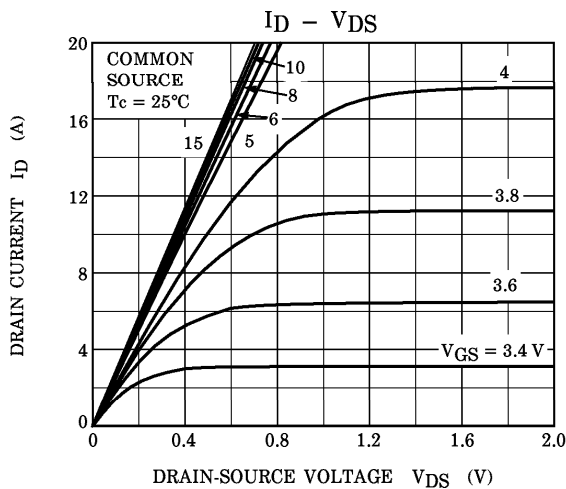


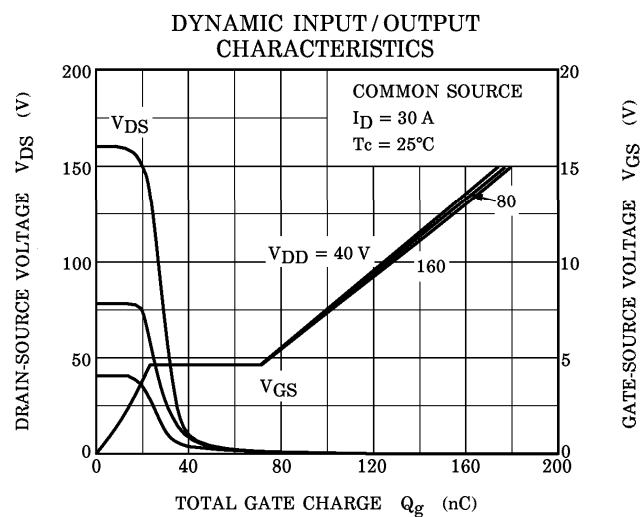
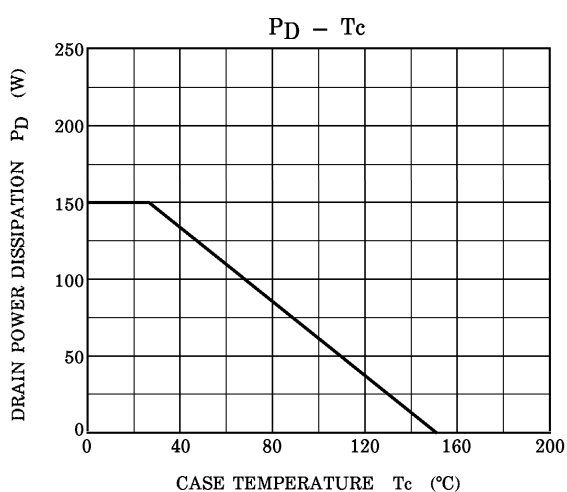
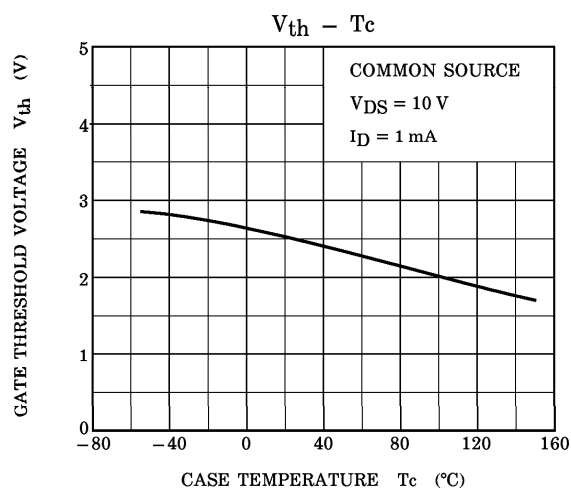
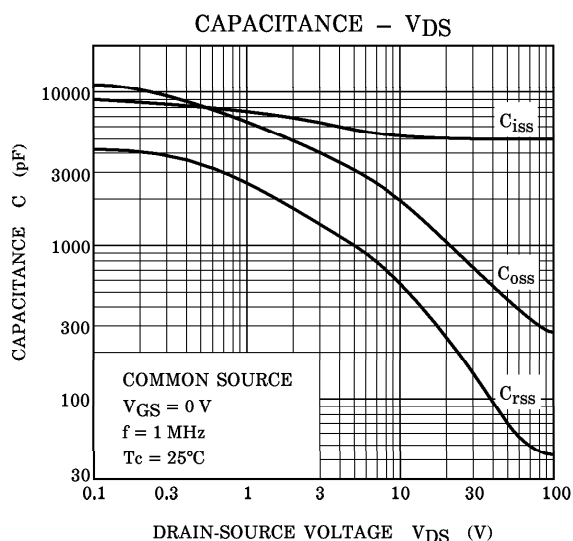
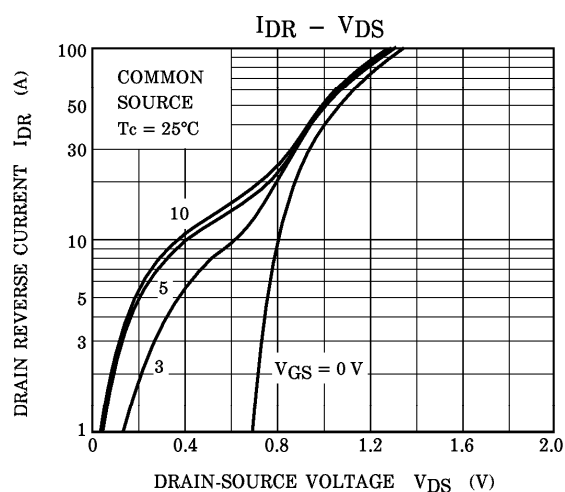
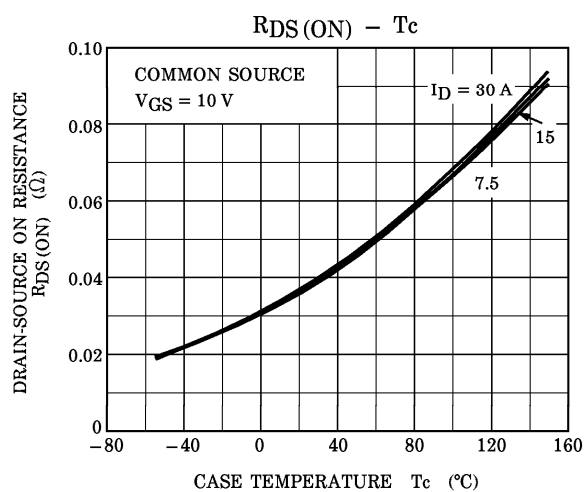
※ Lot Number

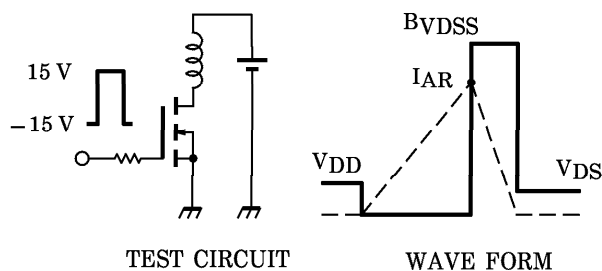
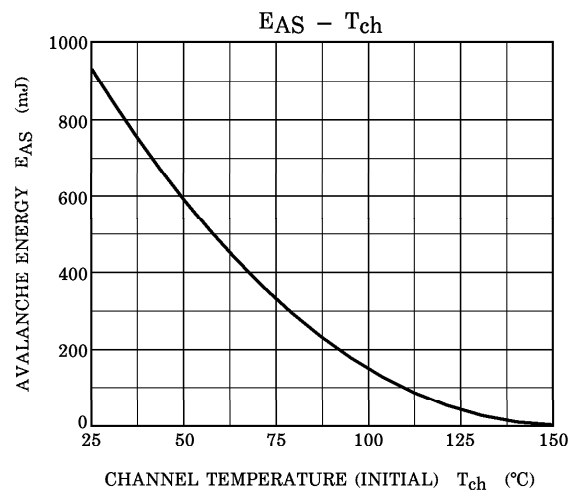
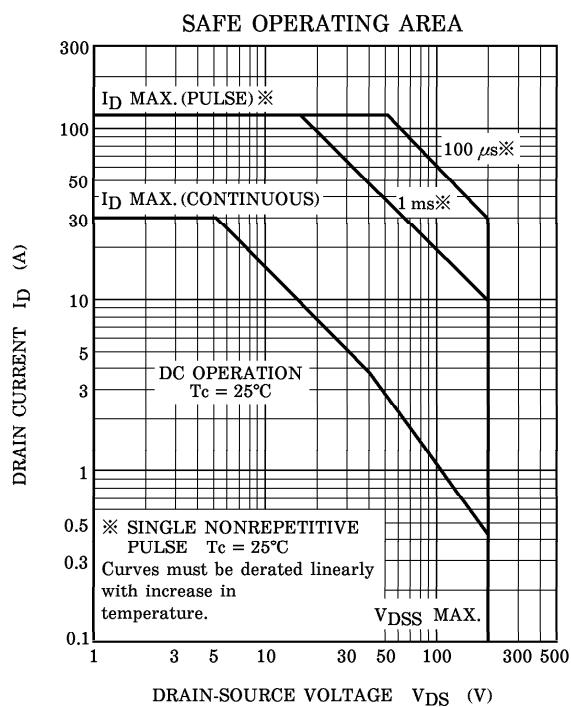
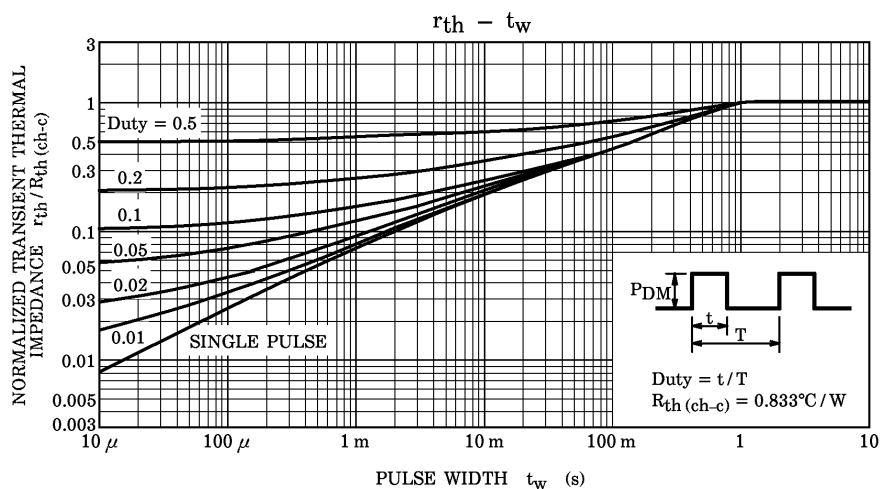


Month (Starting from Alphabet A)

Year (Last Number of the Christian Era)







Peak  $I_{AR} = 30\text{ A}$ ,  $R_G = 25\ \Omega$   
 $V_{DD} = 50\text{ V}$ ,  $L = 1.66\text{ mH}$

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