

TOSHIBA Field Effect Transistor Silicon N Channel MOS Type ( $\pi$ -MOSV)

## 2SK2776

Chopper Regulator, DC-DC Converter and Motor Drive Applications

Unit: mm

- Low drain-source ON-resistance :  $R_{DS(ON)} = 0.75 \Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 7.0 \text{ S}$  (typ.)
- Low leakage current :  $I_{DSS} = 100 \mu\text{A}$  (max) ( $V_{DS} = 500 \text{ V}$ )
- Enhancement mode :  $V_{th} = 2.0 \text{ to } 4.0 \text{ V}$  ( $V_{DS} = 10 \text{ V}$ ,  $I_D = 1 \text{ mA}$ )

### 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                |
| Drain current                                        | DC (Note 1)    | $I_D$      | 8                |
|                                                      | Pulse (Note 1) | $I_{DP}$   | 32               |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ ) | $P_D$          | 65         | W                |
| Single pulse avalanche energy (Note 2)               | $E_{AS}$       | 312        | mJ               |
| Avalanche current                                    | $I_{AR}$       | 8          | A                |
| Repetitive avalanche energy (Note 3)                 | $E_{AR}$       | 6.5        | 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

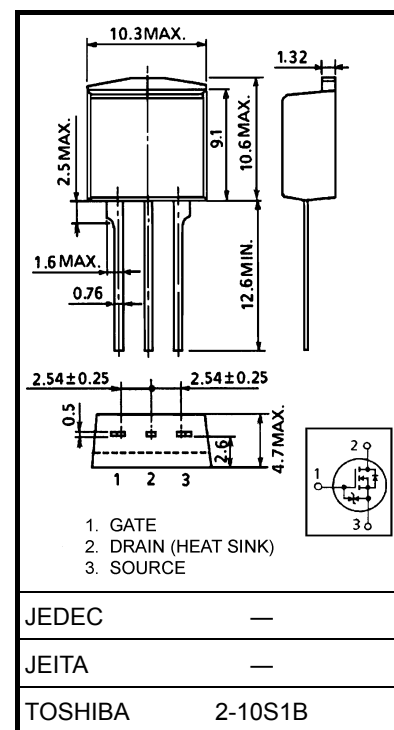
| Characteristics                        | Symbol         | Max  | Unit                        |
|----------------------------------------|----------------|------|-----------------------------|
| Thermal resistance, channel to case    | $R_{th(ch-c)}$ | 1.92 | $^\circ\text{C} / \text{W}$ |
| Thermal resistance, channel to ambient | $R_{th(ch-a)}$ | 83.3 | $^\circ\text{C} / \text{W}$ |

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

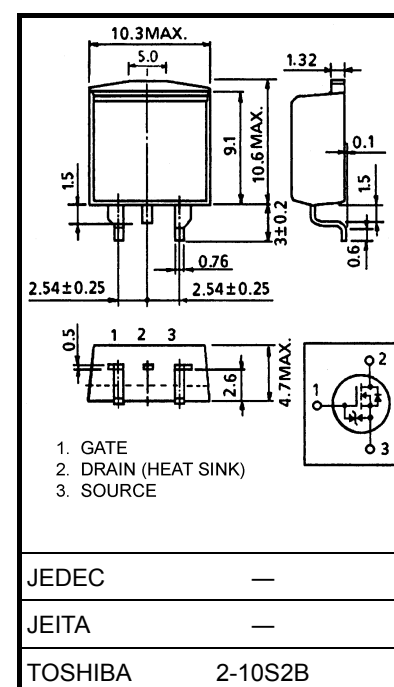
Note 2:  $V_{DD} = 90 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 8.3 \text{ mH}$ ,  $R_G = 25 \Omega$ ,  $I_{AR} = 8 \text{ A}$

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

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

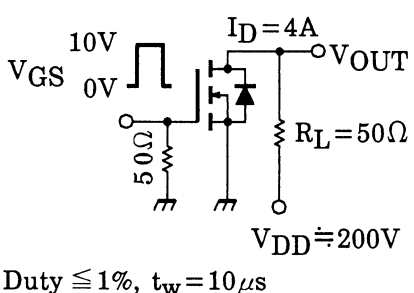


Weight: 1.5 g (typ.)



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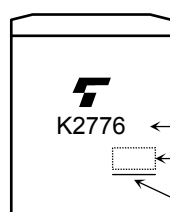
## Electrical Characteristics (Ta = 25°C)

| Characteristics                                 |               | Symbol        | Test Condition                                                                     | Min      | Typ. | Max      | Unit          |
|-------------------------------------------------|---------------|---------------|------------------------------------------------------------------------------------|----------|------|----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$     | $V_{GS} = \pm 25 \text{ V}, V_{DS} = 0 \text{ V}$                                  | —        | —    | $\pm 10$ | $\mu\text{A}$ |
| 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                          |               | $V_{th}$      | $V_{DS} = 10 \text{ V}, I_D = 1 \text{ mA}$                                        | 2.0      | —    | 4.0      | V             |
| Drain-source ON resistance                      |               | $R_{DS(ON)}$  | $V_{GS} = 10 \text{ V}, I_D = 4 \text{ A}$                                         | —        | 0.75 | 0.85     | $\Omega$      |
| Forward transfer admittance                     |               | $ Y_{fs} $    | $V_{DS} = 10 \text{ V}, I_D = 4 \text{ A}$                                         | 3.5      | 7.0  | —        | S             |
| Input capacitance                               |               | $C_{iss}$     | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                   | —        | 1300 | —        | pF            |
| Reverse transfer capacitance                    |               | $C_{rss}$     |                                                                                    | —        | 130  | —        |               |
| Output capacitance                              |               | $C_{oss}$     |                                                                                    | —        | 400  | —        |               |
| Switching time                                  | Rise time     | $t_r$         |  | —        | 26   | —        | ns            |
|                                                 | Turn-on time  | $t_{on}$      |                                                                                    | —        | 45   | —        |               |
|                                                 | Fall time     | $t_f$         |                                                                                    | —        | 40   | —        |               |
|                                                 | Turn-off time | $t_{off}$     |                                                                                    | —        | 140  | —        |               |
| Total gate charge (gate-source plus gate-drain) |               | $Q_g$         | $V_{DD} \approx 400 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 8 \text{ A}$           | —        | 30   | —        | nC            |
| Gate-source charge                              |               | $Q_{gs}$      |                                                                                    | —        | 17   | —        |               |
| 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) | $I_{DR}$  | —                                                                                        | —   | —    | 8    | A             |
| Pulse drain reverse current (Note 1)      | $I_{DRP}$ | —                                                                                        | —   | —    | 32   | A             |
| Forward voltage (diode)                   | $V_{DSF}$ | $I_{DR} = 8 \text{ A}, V_{GS} = 0 \text{ V}$                                             | —   | —    | -1.7 | V             |
| Reverse recovery time                     | $t_{rr}$  | $I_{DR} = 8 \text{ A}, V_{GS} = 0 \text{ V}, dI_{DR} / dt = 100 \text{ A} / \mu\text{s}$ | —   | 1200 | —    | ns            |
| Reverse recovery charge                   | $Q_{rr}$  |                                                                                          | —   | 10   | —    | $\mu\text{C}$ |

## Marking



K2776 ← Part No. (or brevity code)

← Lot No.

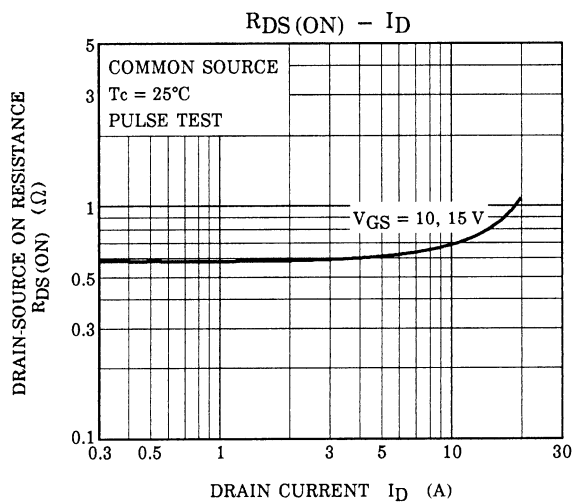
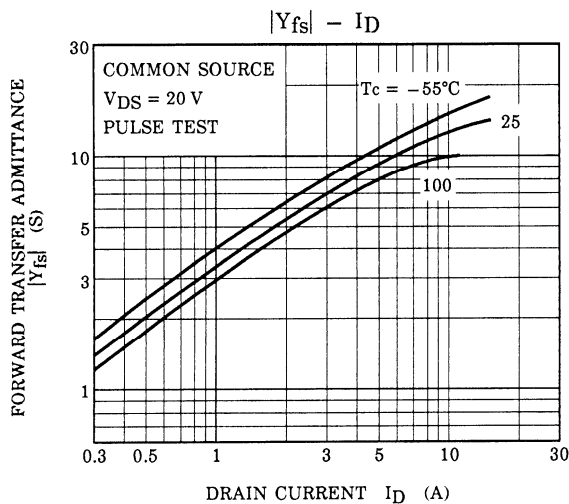
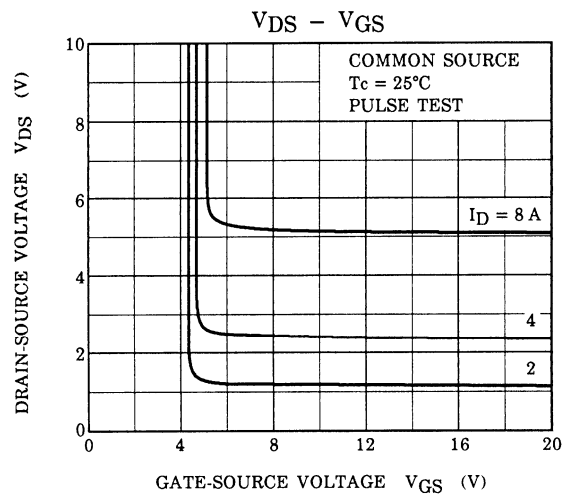
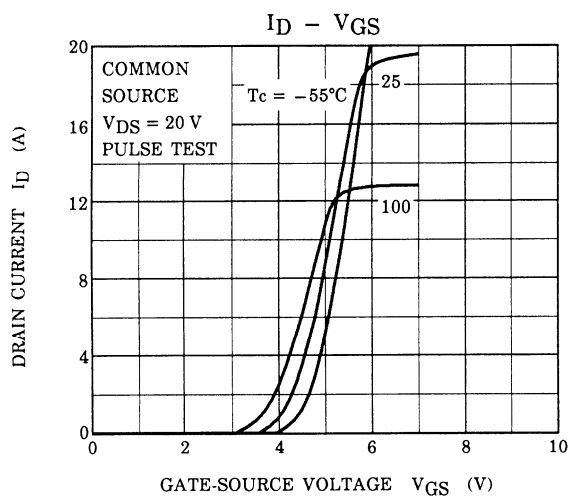
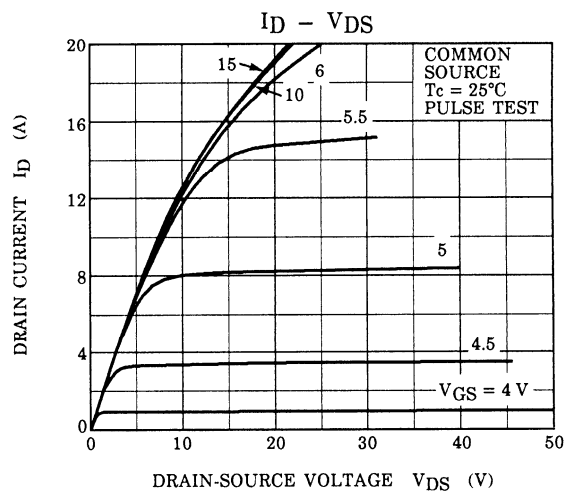
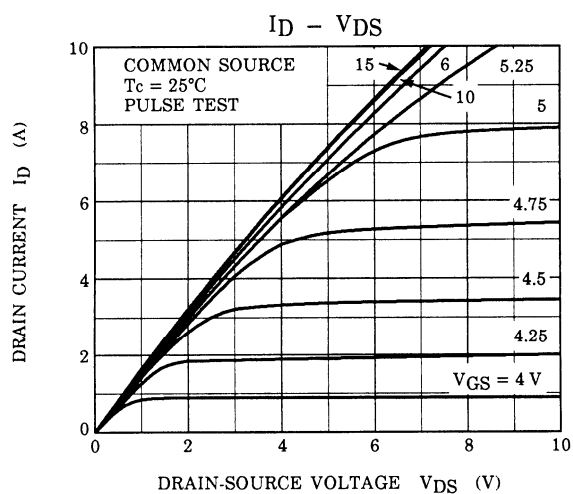
← Note 4

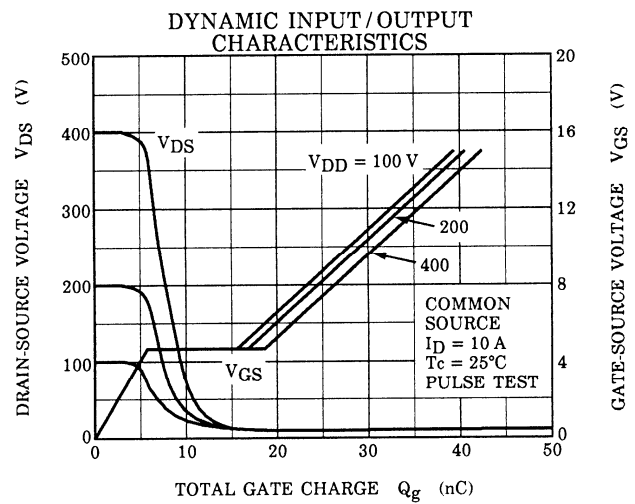
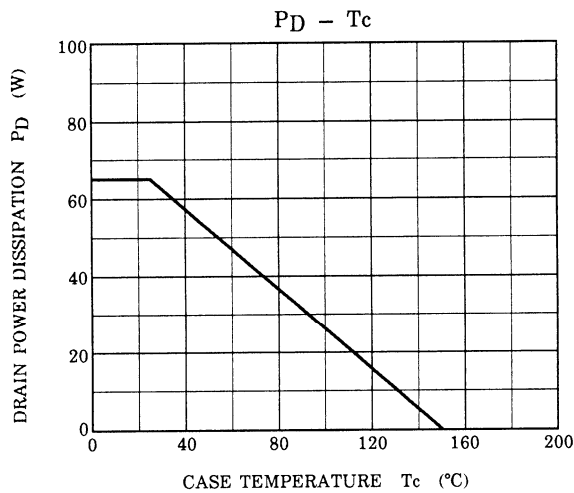
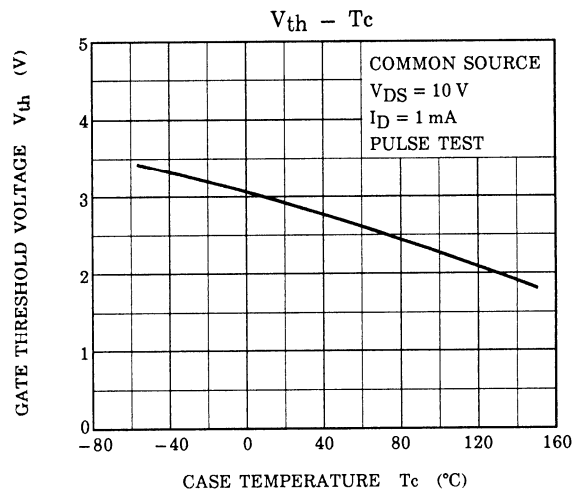
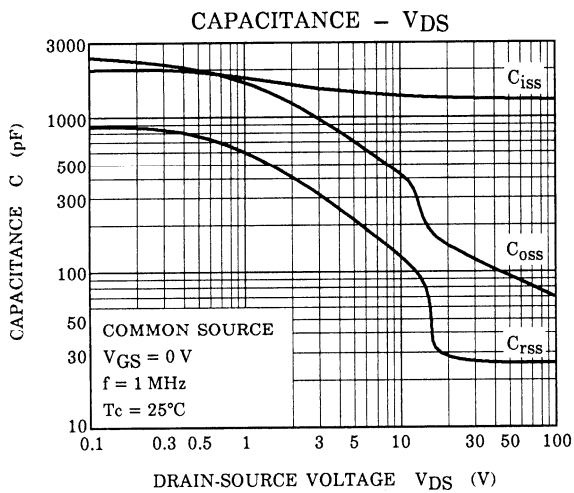
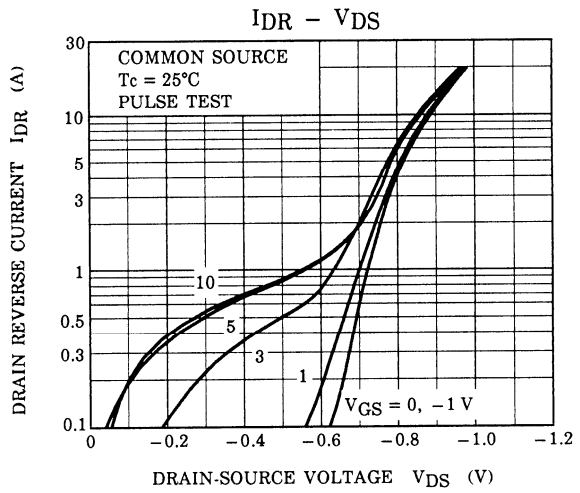
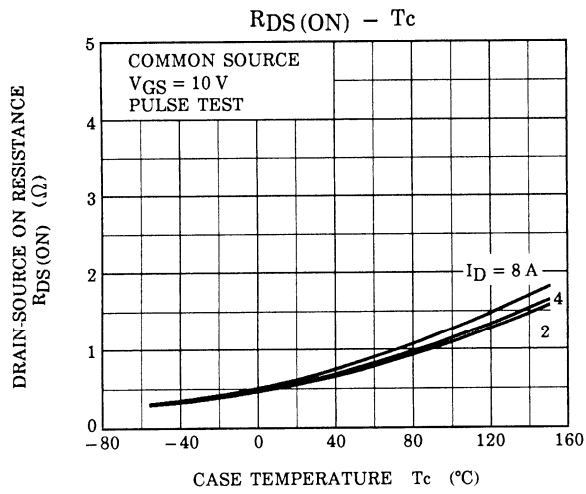
Note 4: A line under a Lot No. identifies the indication of product Labels.

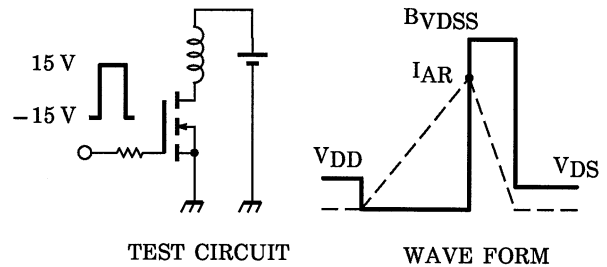
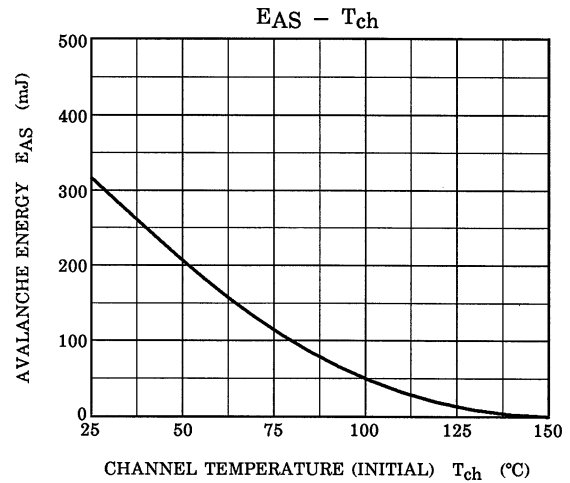
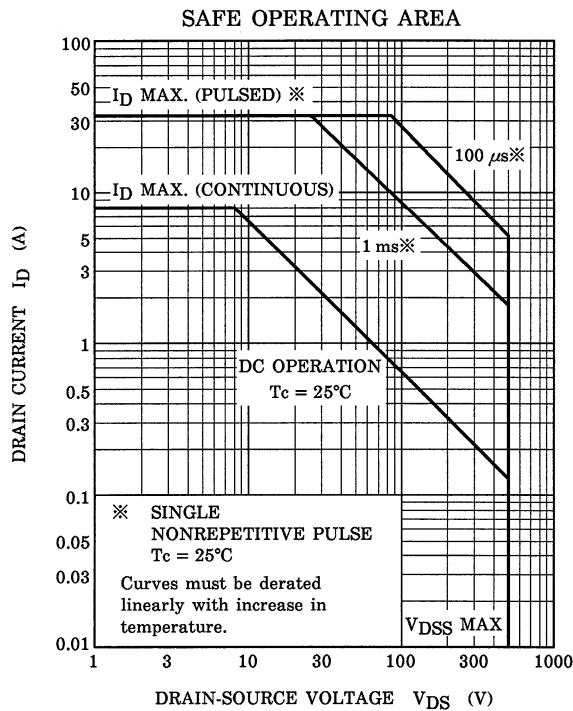
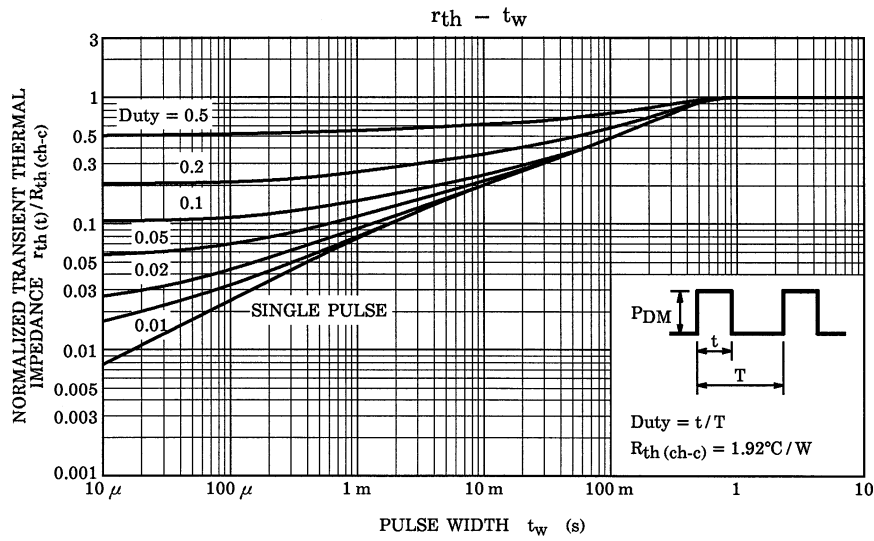
Not underlined:  $[[Pb]]/INCLUDES > MCV$

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

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$$R_G = 25 \, \Omega$$

$$V_{DD} = 90 \, V, L = 8.3 \, mH$$

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

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