

TOSHIBA Field Effect Transistor Silicon P Channel MOS Type ( $L^2$ - $\pi$ -MOSV)

## 2SJ401

DC-DC Converter, Relay Drive and Motor Drive Applications

Unit: mm

- 4-V gate drive
- Low drain-source ON resistance :  $R_{DS(ON)} = 33 \text{ m}\Omega$  (typ.)
- High forward transfer admittance :  $|Y_{fs}| = 20 \text{ S}$  (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 ( $T_a = 25^\circ\text{C}$ )

| 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                                  |                | $V_{GSS}$ | $\pm 20$ | V                |
| Drain current                                        | DC (Note 1)    | $I_D$     | -20      | A                |
|                                                      | Pulse (Note 1) | $I_{DP}$  | -80      | A                |
| Drain power dissipation ( $T_c = 25^\circ\text{C}$ ) |                | $P_D$     | 100      | W                |
| Single pulse avalanche energy (Note 2)               |                | $E_{AS}$  | 800      | mJ               |
| Avalanche current                                    |                | $I_{AR}$  | -20      | A                |
| Repetitive avalanche energy (Note 3)                 |                | $E_{AR}$  | 10       | mJ               |
| Channel temperature                                  |                | $T_{ch}$  | 150      | $^\circ\text{C}$ |
| Storage temperature range                            |                | $T_{stg}$ | -55~150  | $^\circ\text{C}$ |

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

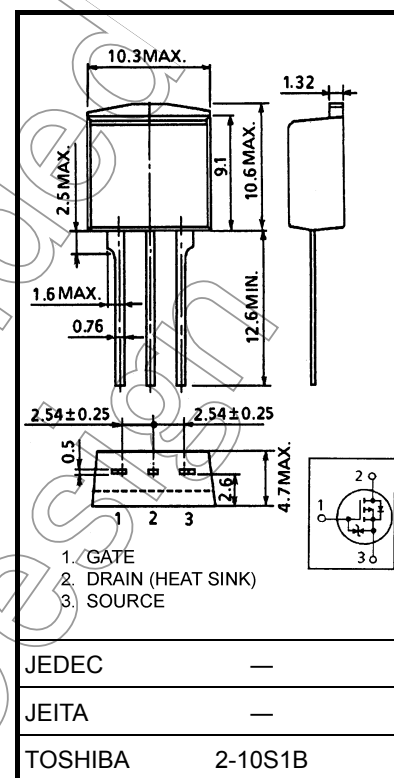
| Characteristics                        | Symbol         | Max  | Unit                        |
|----------------------------------------|----------------|------|-----------------------------|
| Thermal resistance, channel to case    | $R_{th(ch-c)}$ | 1.25 | $^\circ\text{C} / \text{W}$ |
| Thermal 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  $150^\circ\text{C}$ .

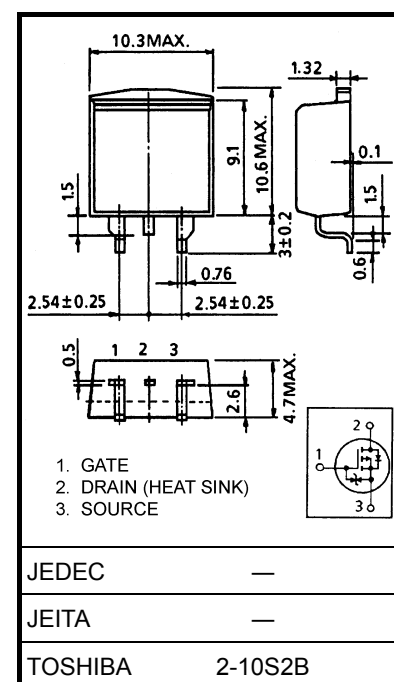
Note 2:  $V_{DD} = -50 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 1.44 \text{ mH}$ ,  $R_G = 25 \text{ }\Omega$ ,  $I_{AR} = -20 \text{ A}$

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

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

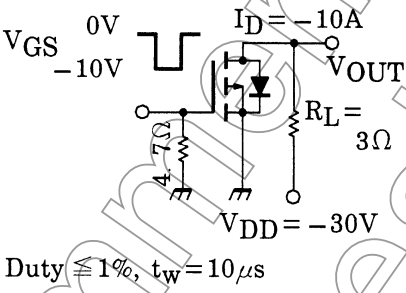


Weight: 1.5 g (typ.)



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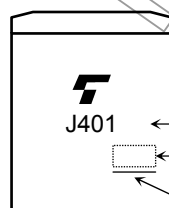
## Electrical Characteristics (Ta = 25°C)

| Characteristics                                 |               | Symbol         | Test Condition                                                                     | Min  | Typ. | Max      | Unit          |
|-------------------------------------------------|---------------|----------------|------------------------------------------------------------------------------------|------|------|----------|---------------|
| Gate leakage current                            |               | $I_{GSS}$      | $V_{GS} = \pm 16 \text{ V}, V_{DS} = 0 \text{ V}$                                  | —    | —    | $\pm 10$ | $\mu\text{A}$ |
| Drain cut-off current                           |               | $I_{DSS}$      | $V_{DS} = -60 \text{ V}, V_{GS} = 0 \text{ V}$                                     | —    | —    | -100     | $\mu\text{A}$ |
| Drain-source breakdown voltage                  |               | $V_{(BR) DSS}$ | $I_D = -10 \text{ mA}, V_{GS} = 0 \text{ V}$                                       | -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                      |               | $R_{DS(ON)}$   | $V_{GS} = -4 \text{ V}, I_D = -10 \text{ A}$                                       | —    | 50   | 90       | m $\Omega$    |
|                                                 |               |                | $V_{GS} = -10 \text{ V}, I_D = -10 \text{ A}$                                      | —    | 33   | 45       |               |
| Forward transfer admittance                     |               | $ Y_{fs} $     | $V_{DS} = -10 \text{ V}, I_D = -10 \text{ A}$                                      | 10   | 20   | —        | S             |
| Input capacitance                               |               | $C_{iss}$      | $V_{DS} = -10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$                  | —    | 2800 | —        | pF            |
| Reverse transfer capacitance                    |               | $C_{rss}$      |                                                                                    | —    | 450  | —        |               |
| Output capacitance                              |               | $C_{oss}$      |                                                                                    | —    | 1300 | —        |               |
| Switching time                                  | Rise time     | $t_r$          |  | —    | 15   | —        | ns            |
|                                                 | Turn-on time  | $t_{on}$       |                                                                                    | —    | 35   | —        |               |
|                                                 | Fall time     | $t_f$          |                                                                                    | —    | 25   | —        |               |
|                                                 | Turn-off time | $t_{off}$      |                                                                                    | —    | 120  | —        |               |
| Total gate charge (Gate-source plus gate-drain) |               | $Q_g$          | $V_{DD} \approx -48 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -20 \text{ A}$        | —    | 90   | —        | nC            |
| Gate-source charge                              |               | $Q_{gs}$       |                                                                                    | —    | 65   | —        |               |
| Gate-drain ("miller") charge                    |               | $Q_{gd}$       |                                                                                    | —    | 25   | —        |               |

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

| Characteristics                           | Symbol    | Test Condition                                 | Min | Typ. | Max | Unit |
|-------------------------------------------|-----------|------------------------------------------------|-----|------|-----|------|
| Continuous drain reverse current (Note 1) | $I_{DR}$  | —                                              | —   | —    | -20 | A    |
| Pulse drain reverse current (Note 1)      | $I_{DRP}$ | —                                              | —   | —    | -80 | A    |
| Forward voltage (diode)                   | $V_{DSF}$ | $I_{DR} = -20 \text{ A}, V_{GS} = 0 \text{ V}$ | —   | —    | 1.7 | V    |
| Reverse recovery time                     | $t_{rr}$  | $I_{DR} = -20 \text{ A}, V_{GS} = 0 \text{ V}$ | —   | 75   | —   | ns   |
| Reverse recovery charge                   | $Q_{rr}$  | $dI_{DR} / dt = 50 \text{ A} / \mu\text{s}$    | —   | 83   | —   | nC   |

## Marking



Part No. (or abbreviation code)

Lot No.

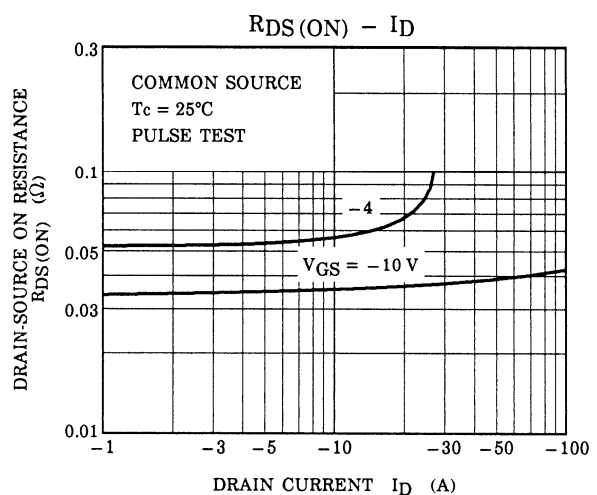
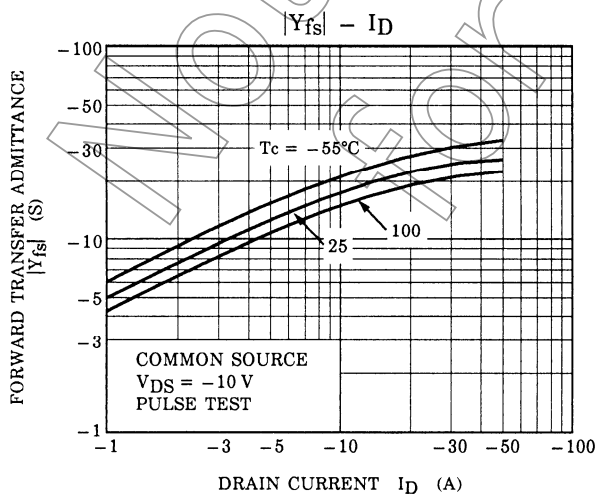
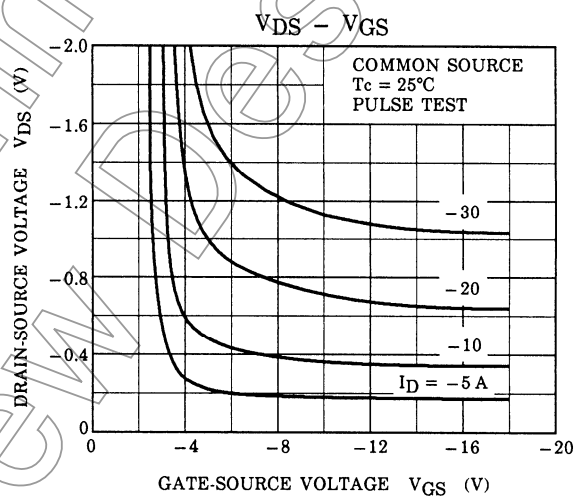
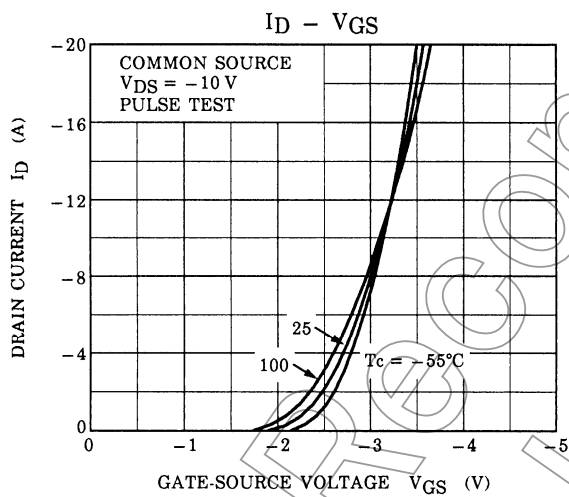
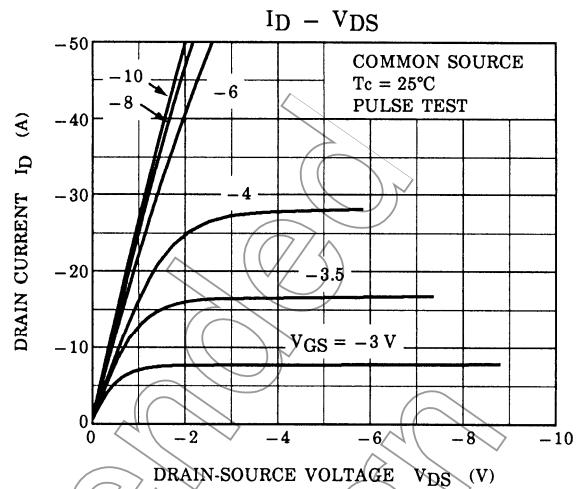
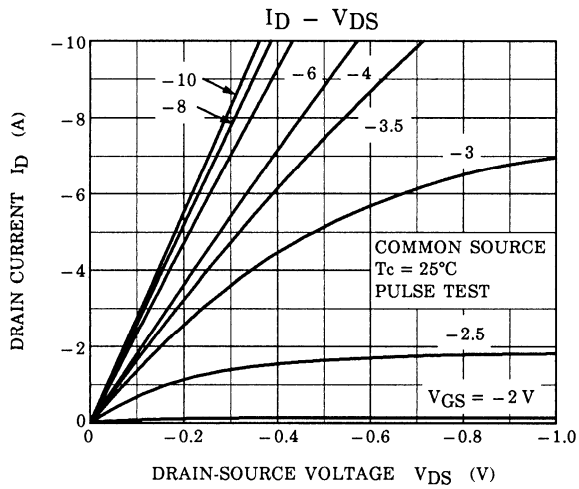
Note 4

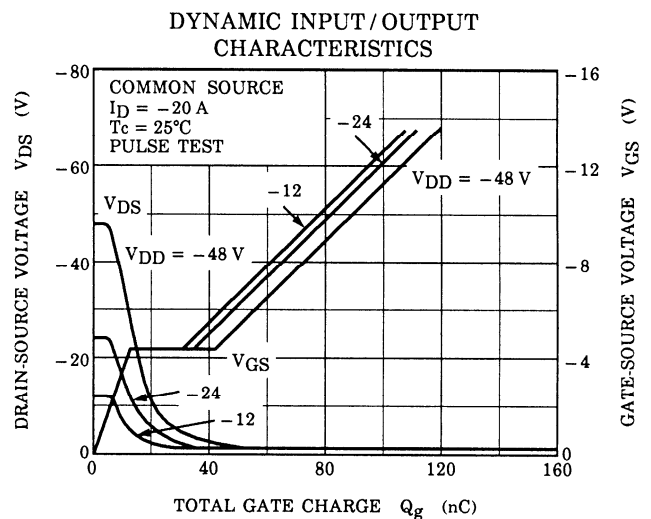
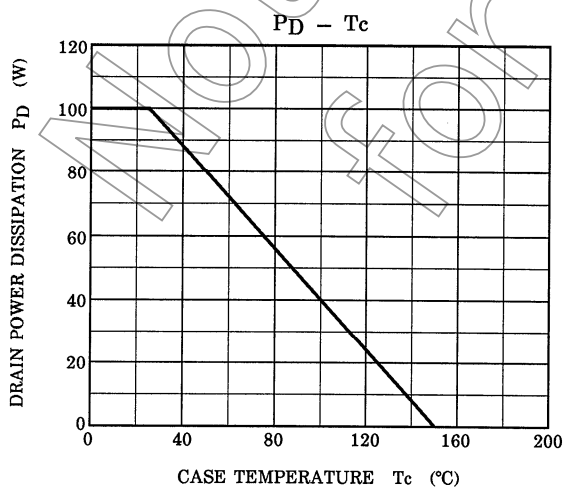
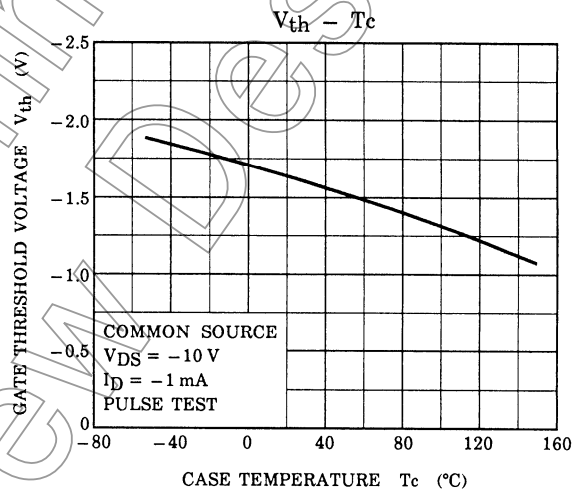
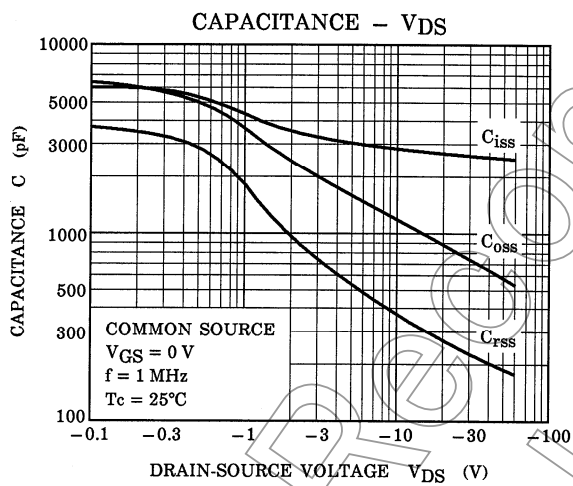
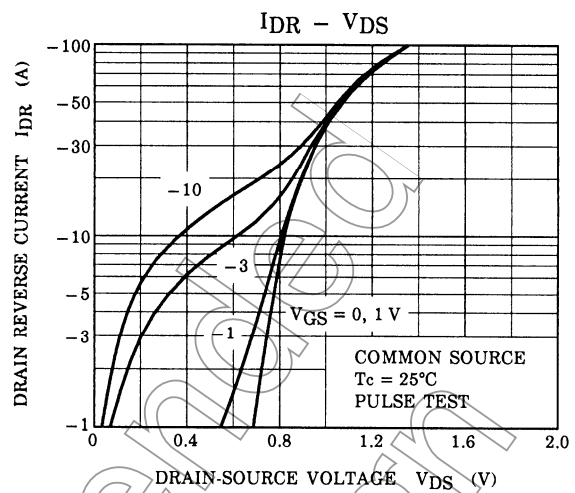
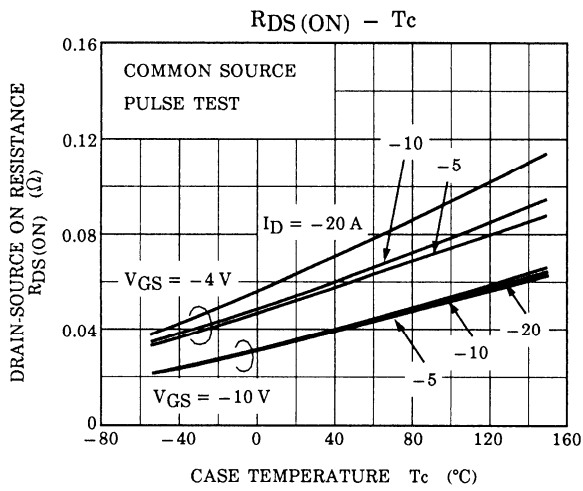
Note 4: A line under a Lot No. identifies the indication of product Labels.

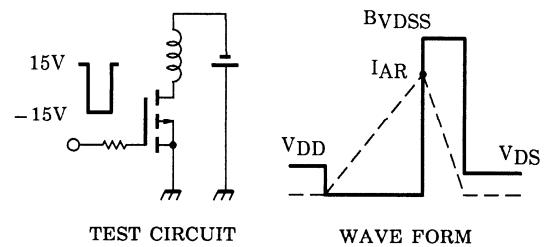
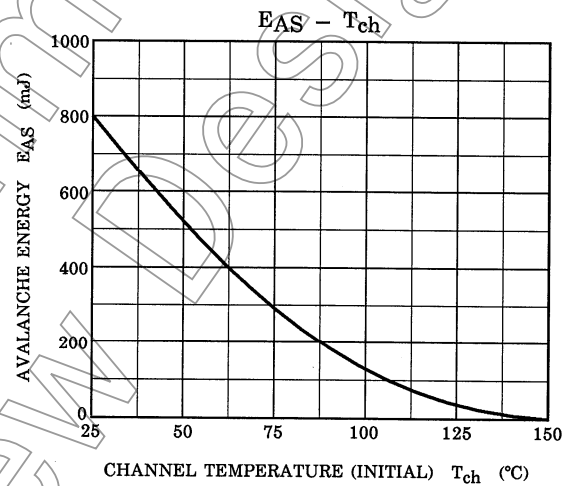
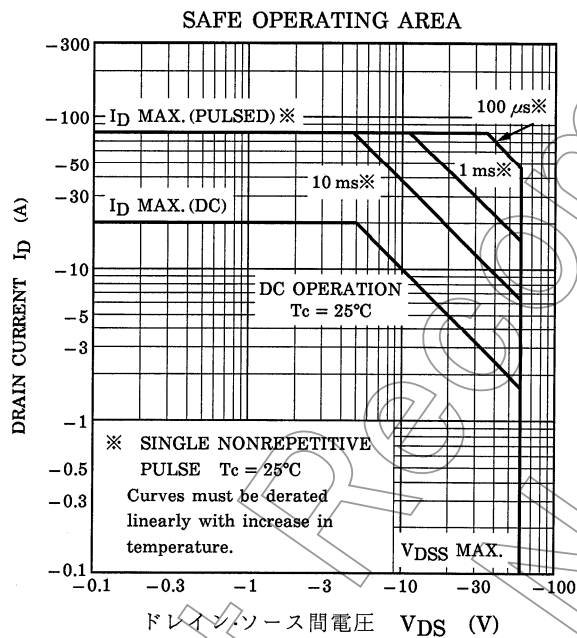
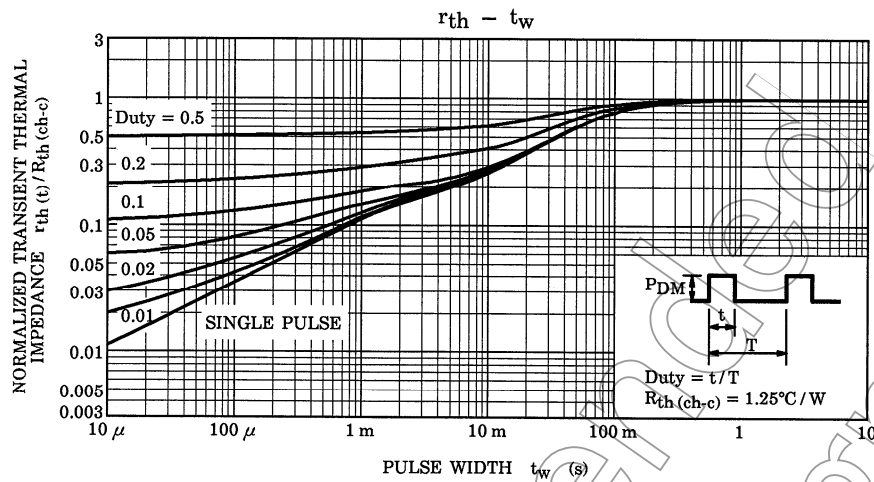
Not underlined: [[Pb]]/INCLUDES > MCV

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

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$$R_G = 25\Omega$$

$$V_{DD} = -50V, L = 1.44mH$$

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

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