

# RJF0408JPD

40V, 30A Silicon N Channel Thermal FET  
Power Switching

R07DS1133EJ0200  
Rev.2.00  
Jul 28, 2015

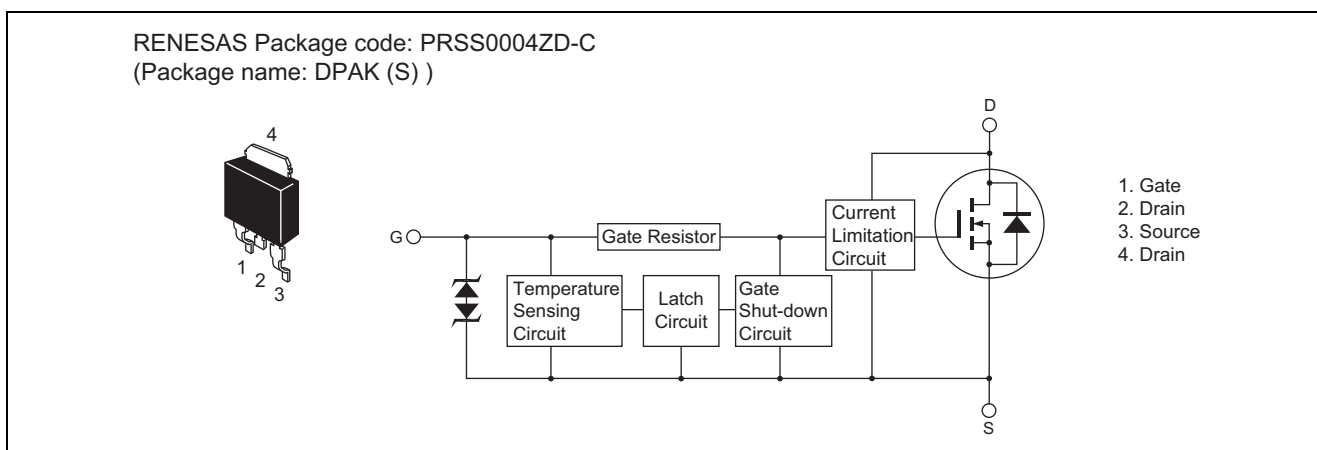
## Description

This FET has the over temperature shut-down capability sensing to the junction temperature. This FET has the built-in over temperature shut-down circuit in the gate area. And this circuit operation to shut-down the gate voltage in case of high junction temperature like applying over power consumption, over current etc..

## Features

- Logic level operation (4 V Gate drive).
- Built-in the over temperature shut-down circuit.
- High endurance capability against to the short circuit.
- Latch type shut down operation (need 0 voltage recovery).
- Built-in the current limitation circuit.
- Power supply voltage applies 12 V.
- AEC-Q101 Compliant.
- Endurance capability against to ESD.

## Outline



## Absolute Maximum Ratings

(Ta = 25°C)

| Item                                   | Symbol          | Ratings     | Unit |
|----------------------------------------|-----------------|-------------|------|
| Drain to source voltage                | $V_{DSS}$       | 40          | V    |
| Gate to source voltage                 | $V_{GSS}$       | 16          | V    |
| Gate to source voltage                 | $V_{GSS}$       | -2.5        | V    |
| Drain current                          | $I_D$ Note3     | 30          | A    |
| Body-drain diode reverse drain current | $I_{DR}$        | 30          | A    |
| Avalanche current                      | $I_{AP}$ Note 2 | 6           | A    |
| Avalanche energy                       | $E_{AR}$ Note 2 | 240         | mJ   |
| Channel dissipation                    | $P_{ch}$ Note 1 | 40          | W    |
| Channel temperature                    | $T_{ch}$        | 150         | °C   |
| Storage temperature                    | $T_{stg}$       | -55 to +150 | °C   |

Notes: 1. Value at  $T_c = 25^\circ\text{C}$   
2.  $T_{ch} = 25^\circ\text{C}$ ,  $R_g \geq 50 \Omega$   
3. It provides by the current limitation lower bound value.

## Typical Operation Characteristics

(Ta = 25°C)

| Item                                        | Symbol               | Min | Typ  | Max | Unit | Test Conditions                                                 |
|---------------------------------------------|----------------------|-----|------|-----|------|-----------------------------------------------------------------|
| Input voltage                               | V <sub>IH</sub>      | 3.5 | —    | —   | V    |                                                                 |
|                                             | V <sub>IL</sub>      | —   | —    | 1.2 | V    |                                                                 |
| Input current<br>(Gate non shut down)       | I <sub>IH1</sub>     | —   | —    | 100 | μA   | V <sub>i</sub> = 8 V, V <sub>DS</sub> = 0                       |
|                                             | I <sub>IH2</sub>     | —   | —    | 50  | μA   | V <sub>i</sub> = 3.5 V, V <sub>DS</sub> = 0                     |
|                                             | I <sub>IL</sub>      | —   | —    | 1   | μA   | V <sub>i</sub> = 1.2 V, V <sub>DS</sub> = 0                     |
| Input current<br>(Gate shut down)           | I <sub>IH(sD)1</sub> | —   | 0.8  | —   | mA   | V <sub>i</sub> = 8 V, V <sub>DS</sub> = 0                       |
|                                             | I <sub>IH(sD)2</sub> | —   | 0.35 | —   | mA   | V <sub>i</sub> = 3.5 V, V <sub>DS</sub> = 0                     |
| Shut down temperature                       | T <sub>sd</sub>      | —   | 175  | —   | °C   | Channel temperature                                             |
| Gate operation voltage                      | V <sub>op</sub>      | 3.5 | —    | 12  | V    |                                                                 |
| Drain current<br>(Current limitation value) | I <sub>D limit</sub> | 28  | —    | —   | A    | V <sub>GS</sub> = 5 V, V <sub>DS</sub> = 10 V <sup>Note 4</sup> |

Note: 4. Pulse test

## Electrical Characteristics

(Ta = 25°C)

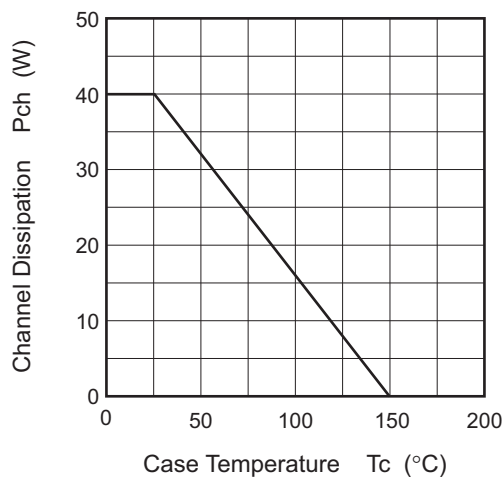
| Item                                                 | Symbol               | Min  | Typ  | Max  | Unit | Test Conditions                                                     |
|------------------------------------------------------|----------------------|------|------|------|------|---------------------------------------------------------------------|
| Drain current                                        | I <sub>D1</sub>      | —    | —    | 38   | A    | V <sub>GS</sub> = 3.5 V, V <sub>DS</sub> = 10 V <sup>Note 5</sup>   |
|                                                      | I <sub>D2</sub>      | —    | —    | 10   | mA   | V <sub>GS</sub> = 1.2 V, V <sub>DS</sub> = 10 V                     |
|                                                      | I <sub>D3</sub>      | 28   | —    | —    | A    | V <sub>GS</sub> = 5 V, V <sub>DS</sub> = 10 V <sup>Note 5</sup>     |
| Drain to source breakdown voltage                    | V <sub>(BR)DSS</sub> | 40   | —    | —    | V    | I <sub>D</sub> = 10 mA, V <sub>GS</sub> = 0                         |
| Gate to source breakdown voltage                     | V <sub>(BR)GSS</sub> | 16   | —    | —    | V    | I <sub>G</sub> = 800 μA, V <sub>DS</sub> = 0                        |
|                                                      | V <sub>(BR)GSS</sub> | -2.5 | —    | —    | V    | I <sub>G</sub> = -100 μA, V <sub>DS</sub> = 0                       |
| Gate to source leak current                          | I <sub>GSS1</sub>    | —    | —    | 100  | μA   | V <sub>GS</sub> = 8 V, V <sub>DS</sub> = 0                          |
|                                                      | I <sub>GSS2</sub>    | —    | —    | 50   | μA   | V <sub>GS</sub> = 3.5 V, V <sub>DS</sub> = 0                        |
|                                                      | I <sub>GSS3</sub>    | —    | —    | 1    | μA   | V <sub>GS</sub> = 1.2 V, V <sub>DS</sub> = 0                        |
|                                                      | I <sub>GSS4</sub>    | —    | —    | -100 | μA   | V <sub>GS</sub> = -2.4 V, V <sub>DS</sub> = 0                       |
| Input current (shut down)                            | I <sub>GS(OP)1</sub> | —    | 0.8  | —    | mA   | V <sub>GS</sub> = 8 V, V <sub>DS</sub> = 0                          |
|                                                      | I <sub>GS(OP)2</sub> | —    | 0.35 | —    | mA   | V <sub>GS</sub> = 3.5 V, V <sub>DS</sub> = 0                        |
| Zero gate voltage drain current                      | I <sub>DSS</sub>     | —    | —    | 10   | μA   | V <sub>DS</sub> = 32 V, V <sub>GS</sub> = 0, T <sub>c</sub> = 110°C |
| Gate to source cutoff voltage                        | V <sub>GS(off)</sub> | 1.1  | —    | 2.1  | V    | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA                       |
| Forward transfer admittance                          | y <sub>fs</sub>      | 16   | 26   | —    | S    | I <sub>D</sub> = 15 A, V <sub>DS</sub> = 10 V <sup>Note 5</sup>     |
| Static drain to source on state resistance           | R <sub>DS(on)</sub>  | —    | 24   | 40   | mΩ   | I <sub>D</sub> = 15 A, V <sub>GS</sub> = 5 V <sup>Note 5</sup>      |
|                                                      | R <sub>DS(on)</sub>  | —    | 19   | 30   | mΩ   | I <sub>D</sub> = 15 A, V <sub>GS</sub> = 10 V <sup>Note 5</sup>     |
| Output capacitance                                   | C <sub>oss</sub>     | —    | 537  | —    | pF   | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0, f = 1MHz               |
| Turn-on delay time                                   | t <sub>d(on)</sub>   | —    | 3.7  | —    | μs   | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A, R <sub>L</sub> = 2 Ω |
| Rise time                                            | t <sub>r</sub>       | —    | 14.9 | —    | μs   |                                                                     |
| Turn-off delay time                                  | t <sub>d(off)</sub>  | —    | 10.4 | —    | μs   |                                                                     |
| Fall time                                            | t <sub>f</sub>       | —    | 15.6 | —    | μs   |                                                                     |
| Body-drain diode forward voltage                     | V <sub>DF</sub>      | —    | 0.9  | —    | V    | I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0                          |
| Body-drain diode reverse recovery time               | t <sub>rr</sub>      | —    | 101  | —    | ns   | I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0<br>di/dt = 50 A/μs       |
| Over load shut down operation time <sup>Note 6</sup> | t <sub>os1</sub>     | —    | 0.46 | —    | ms   | V <sub>GS</sub> = 5 V, V <sub>DD</sub> = 16 V                       |

Notes: 5. Pulse test

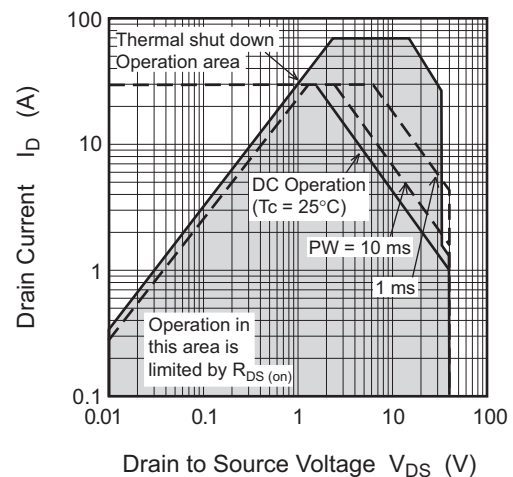
6. Including the junction temperature rise of the over loaded condition.

## Main Characteristics

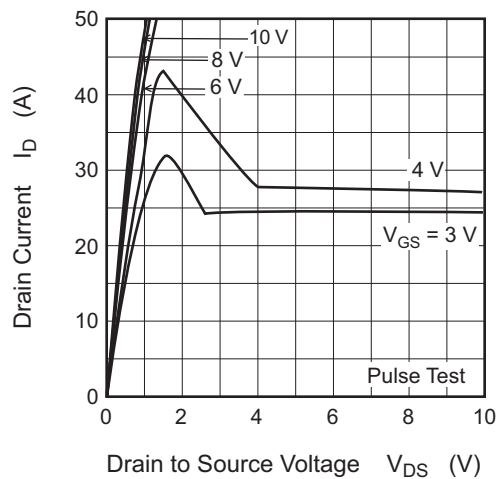
Power vs. Temperature Derating



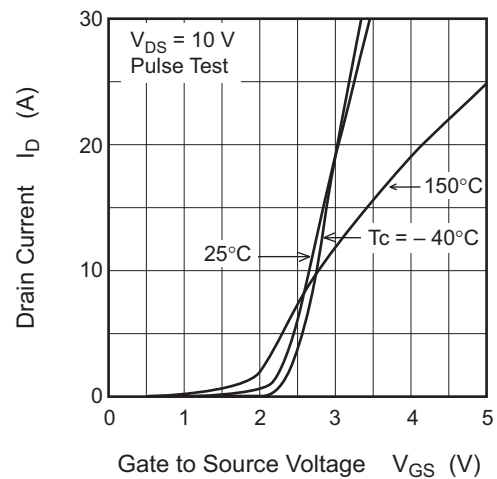
Maximum Safe Operation Area



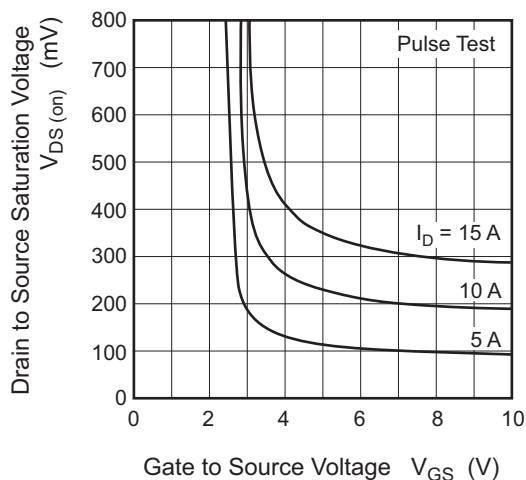
Typical Output Characteristics



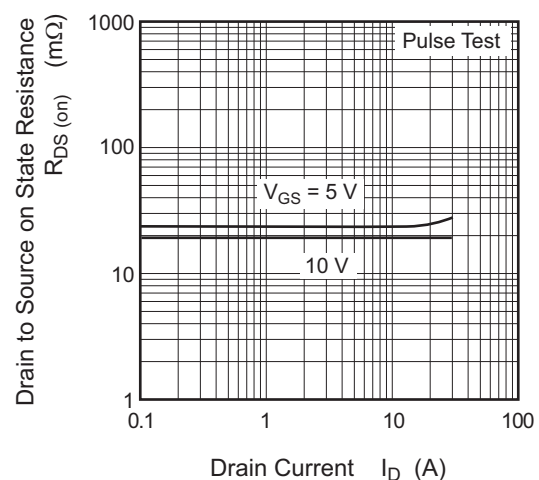
Typical Transfer Characteristics

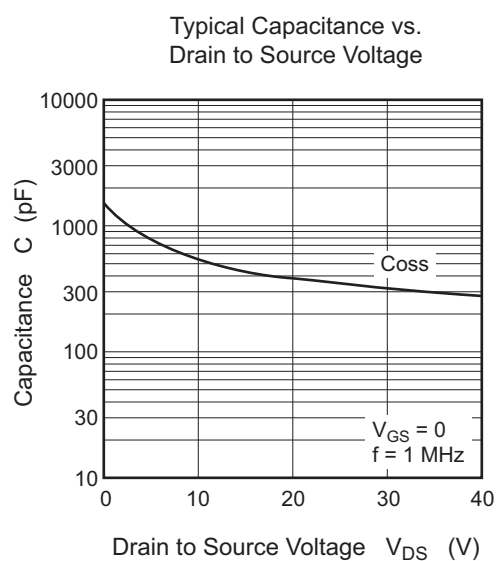
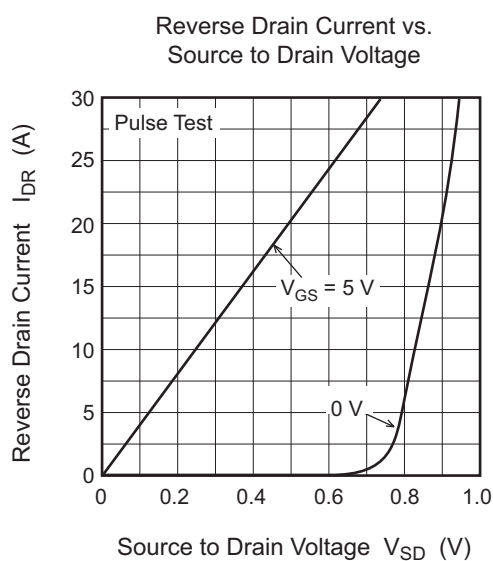
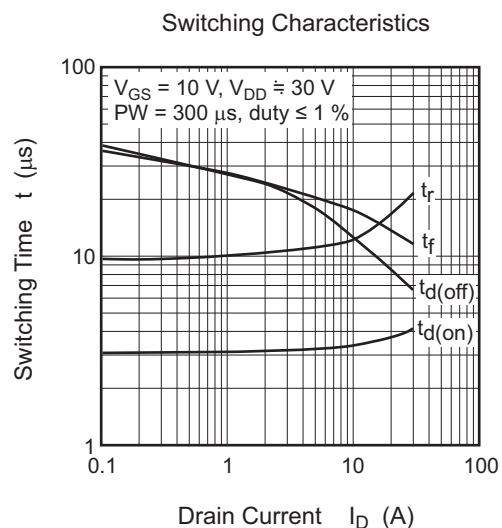
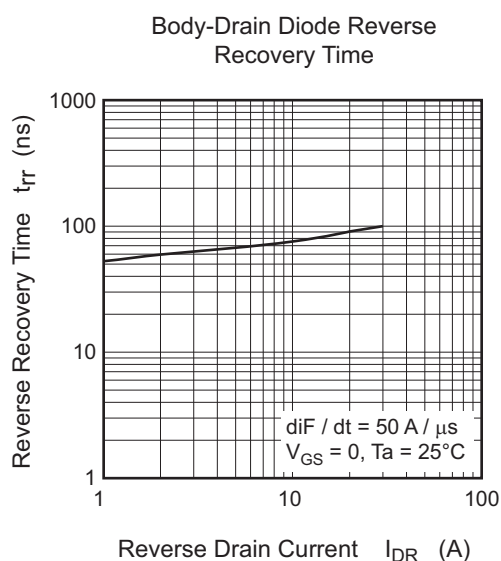
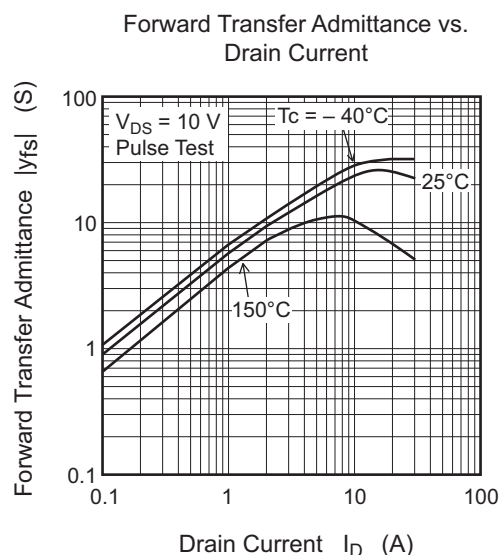
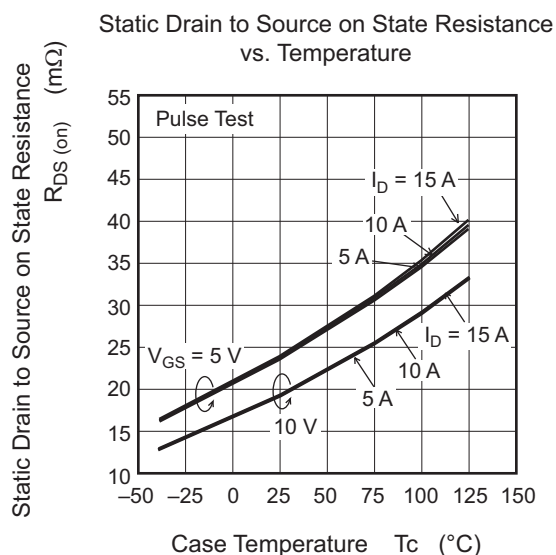


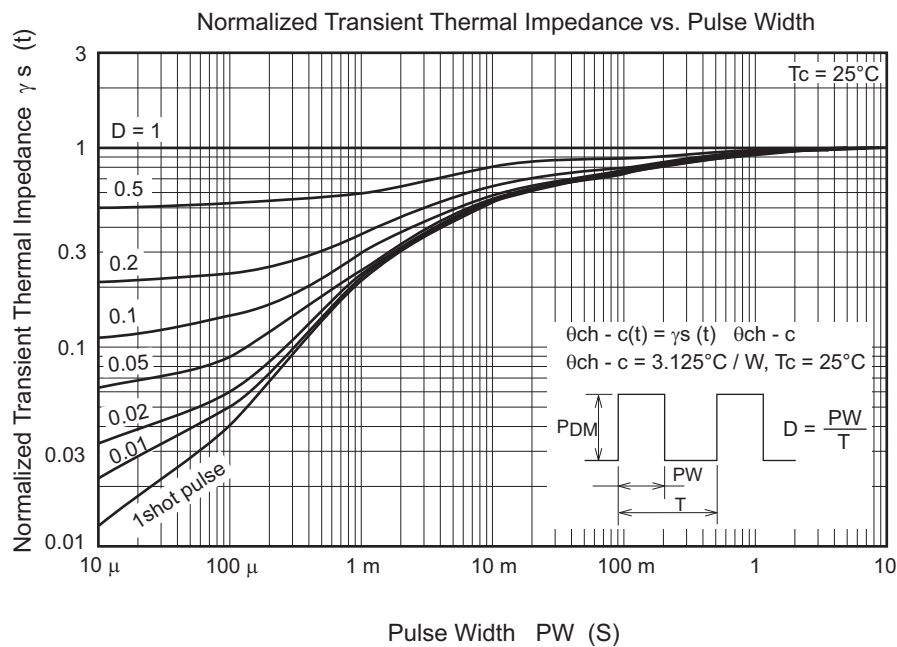
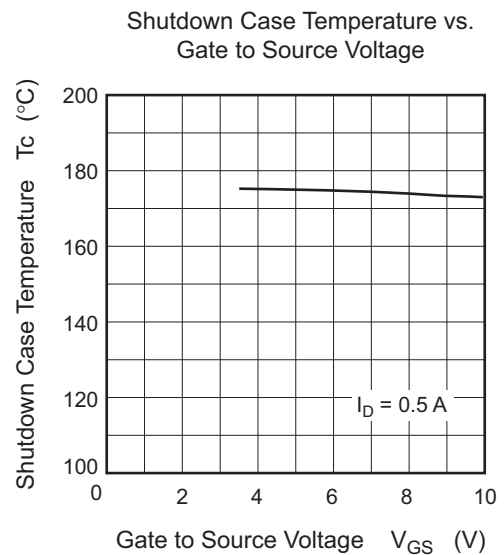
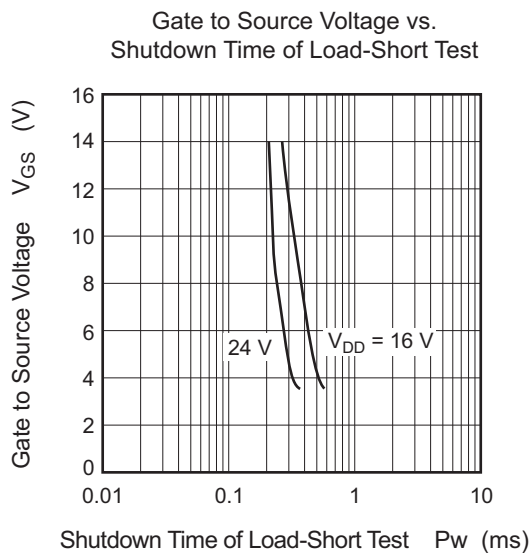
Drain to Source Saturation Voltage vs. Gate to Source Voltage



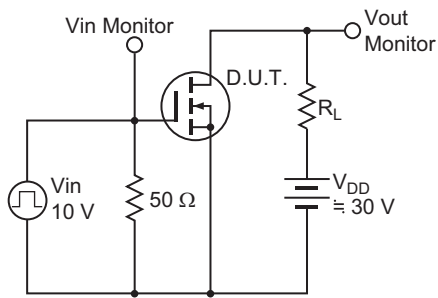
Static Drain to Source on State Resistance vs. Drain Current



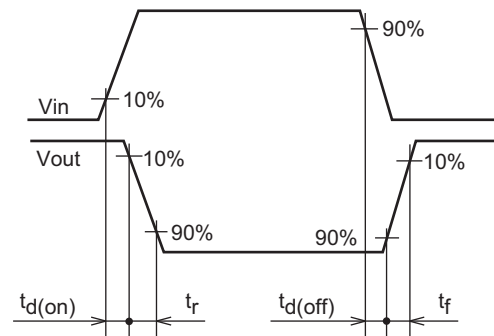




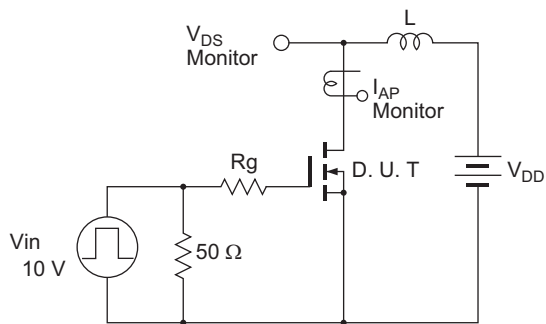
Switching Time Test Circuit



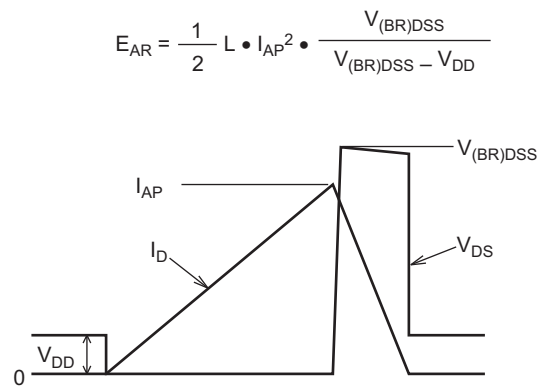
Waveform



Avalanche Test Circuit



Avalanche Waveform





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