

# RJF0613JSP

60 V - 10 A - N Channel MOS FET  
Power Switching

R07DS0874EJ0100  
Rev.1.00  
Aug 29, 2012

## Description

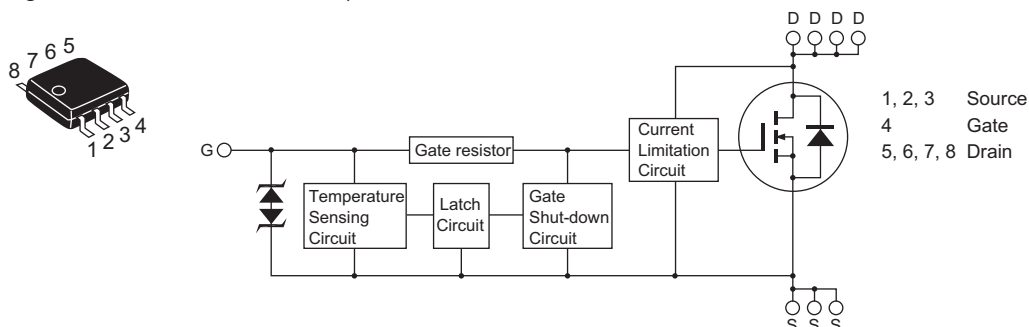
This FET has the over temperature shut-down capability sensing to the junction temperature. This FET has the built-in over temperature shut-down circuit in the gate area. And this circuit operation to shut-down the gate voltage in case of high junction temperature like applying over power consumption, 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.
- High density mounting
- Power supply voltage applies 12 V and 24 V.
- AEC-Q101 Compliant

## Outline

RENESAS Package code: PRSP0008DD-D  
(Package name: SOP-8 <FP-8DAV> )



## Absolute Maximum Ratings

(Ta = 25°C)

| Item                                   | Symbol                     | Ratings     | Unit |
|----------------------------------------|----------------------------|-------------|------|
| Drain to source voltage                | $V_{DSS}$                  | 60          | V    |
| Gate to source voltage                 | $V_{GSS}$                  | 16          | V    |
| Gate to source voltage                 | $V_{GSS}$                  | -2.5        | V    |
| Drain current                          | $I_D$ <sup>Note 3</sup>    | 10          | A    |
| Body-drain diode reverse drain current | $I_{DR}$                   | 10          | A    |
| Avalanche current                      | $I_{AP}$ <sup>Note 2</sup> | 4.7         | A    |
| Avalanche energy                       | $E_{AR}$ <sup>Note 2</sup> | 94.7        | mJ   |
| Channel dissipation                    | $P_{ch}$ <sup>Note 1</sup> | 2.5         | W    |
| Channel temperature                    | $T_{ch}$                   | 150         | °C   |
| Storage temperature                    | $T_{stg}$                  | -55 to +150 | °C   |

Notes: 1. When using the glass epoxy board (FR4 40 x 40 x 1.6 mm),  $PW \leq 10s$

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                               | $V_{IH}$              | 3.5 | —    | —   | V       |                                                 |
|                                             | $V_{IL}$              | —   | —    | 1.2 | V       |                                                 |
| Input current<br>(Gate non shut down)       | $I_{IH1}$             | —   | —    | 100 | $\mu A$ | $V_i = 8 V, V_{DS} = 0$                         |
|                                             | $I_{IH2}$             | —   | —    | 50  | $\mu A$ | $V_i = 3.5 V, V_{DS} = 0$                       |
|                                             | $I_{IL}$              | —   | —    | 1   | $\mu A$ | $V_i = 1.2 V, V_{DS} = 0$                       |
| Input current<br>(Gate shut down)           | $I_{IH(sd)1}$         | —   | 0.8  | —   | mA      | $V_i = 8 V, V_{DS} = 0$                         |
|                                             | $I_{IH(sd)2}$         | —   | 0.35 | —   | mA      | $V_i = 3.5 V, V_{DS} = 0$                       |
| Shut down temperature                       | Tsd                   | —   | 175  | —   | °C      | Channel temperature                             |
| Gate operation voltage                      | Vop                   | 3.5 | —    | 12  | V       |                                                 |
| Drain current<br>(Current limitation value) | $I_{D \text{ limit}}$ | 10  | —    | —   | A       | $V_{GS} = 5 V, V_{DS} = 10 V$ <sup>Note 4</sup> |

Note: 4. Pulse test

## Electrical Characteristics

(Ta = 25°C)

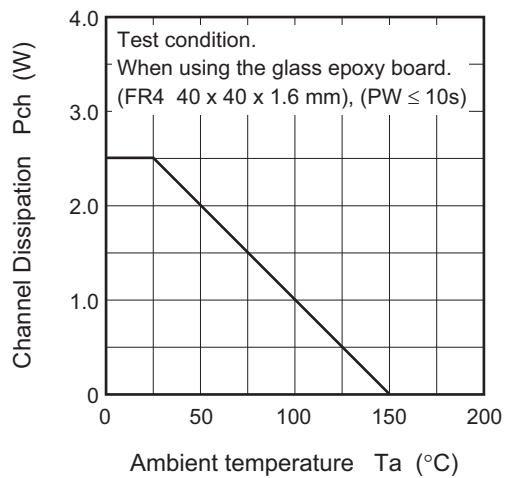
| Item                                                 | Symbol        | Min  | Typ  | Max  | Unit       | Test Conditions                                    |
|------------------------------------------------------|---------------|------|------|------|------------|----------------------------------------------------|
| Drain current                                        | $I_{D1}$      | —    | —    | 45   | A          | $V_{GS} = 3.5 V, V_{DS} = 10 V$ <sup>Note 5</sup>  |
|                                                      | $I_{D2}$      | —    | —    | 10   | mA         | $V_{GS} = 1.2 V, V_{DS} = 10 V$                    |
|                                                      | $I_{D3}$      | 10   | —    | —    | A          | $V_{GS} = 5 V, V_{DS} = 10 V$ <sup>Note 5</sup>    |
| Drain to source breakdown voltage                    | $V_{(BR)DSS}$ | 60   | —    | —    | V          | $I_D = 10 \text{ mA}, V_{GS} = 0$                  |
| Gate to source breakdown voltage                     | $V_{(BR)GSS}$ | 16   | —    | —    | V          | $I_G = 800 \mu A, V_{DS} = 0$                      |
|                                                      | $V_{(BR)GSS}$ | -2.5 | —    | —    | V          | $I_G = -100 \mu A, V_{DS} = 0$                     |
| Gate to source leak current                          | $I_{GSS1}$    | —    | —    | 100  | $\mu A$    | $V_{GS} = 8 V, V_{DS} = 0$                         |
|                                                      | $I_{GSS2}$    | —    | —    | 50   | $\mu A$    | $V_{GS} = 3.5 V, V_{DS} = 0$                       |
|                                                      | $I_{GSS3}$    | —    | —    | 1    | $\mu A$    | $V_{GS} = 1.2 V, V_{DS} = 0$                       |
|                                                      | $I_{GSS4}$    | —    | —    | -100 | $\mu A$    | $V_{GS} = -2.4 V, V_{DS} = 0$                      |
| Input current (shut down)                            | $I_{GS(OP)1}$ | —    | 0.8  | —    | mA         | $V_{GS} = 8 V, V_{DS} = 0$                         |
|                                                      | $I_{GS(OP)2}$ | —    | 0.35 | —    | mA         | $V_{GS} = 3.5 V, V_{DS} = 0$                       |
| Zero gate voltage drain current                      | $I_{DSS}$     | —    | —    | 10   | $\mu A$    | $V_{DS} = 32 V, V_{GS} = 0, T_a = 125^\circ C$     |
| Gate to source cutoff voltage                        | $V_{GS(off)}$ | 1.1  | —    | 2.1  | V          | $V_{DS} = 10 V, I_D = 1 \text{ mA}$                |
| Forward transfer admittance                          | $ y_{fs} $    | 12   | 17   | —    | S          | $I_D = 5 A, V_{DS} = 10 V$ <sup>Note 5</sup>       |
| Static drain to source on state resistance           | $R_{DS(on)}$  | —    | 30   | 40   | m $\Omega$ | $I_D = 5 A, V_{GS} = 4 V$ <sup>Note 5</sup>        |
|                                                      | $R_{DS(on)}$  | —    | 21   | 30   | m $\Omega$ | $I_D = 5 A, V_{GS} = 10 V$ <sup>Note 5</sup>       |
| Output capacitance                                   | Coss          | —    | 520  | —    | pF         | $V_{DS} = 10 V, V_{GS} = 0, f = 1 \text{ MHz}$     |
| Turn-on delay time                                   | $t_{d(on)}$   | —    | 3.5  | —    | $\mu s$    | $V_{GS} = 10 V, I_D = 5 A, R_L = 2 \Omega$         |
| Rise time                                            | $t_r$         | —    | 11   | —    | $\mu s$    |                                                    |
| Turn-off delay time                                  | $t_{d(off)}$  | —    | 7    | —    | $\mu s$    |                                                    |
| Fall time                                            | $t_f$         | —    | 12   | —    | $\mu s$    |                                                    |
| Body-drain diode forward voltage                     | $V_{DF}$      | —    | 0.9  | —    | V          | $I_F = 10 A, V_{GS} = 0$                           |
| Body-drain diode reverse recovery time               | $t_{rr}$      | —    | 63   | —    | ns         | $I_F = 10 A, V_{GS} = 0$<br>$di_F/dt = 50 A/\mu s$ |
| Over load shut down operation time <sup>Note 6</sup> | $t_{os1}$     | —    | 0.4  | —    | ms         | $V_{GS} = 5 V, V_{DD} = 16 V$                      |
|                                                      | $t_{os2}$     | —    | 0.25 | —    | ms         | $V_{GS} = 5 V, V_{DD} = 24 V$                      |

Notes: 5. Pulse test

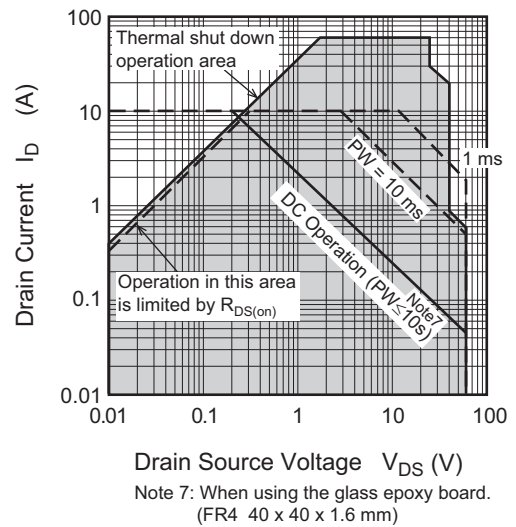
6. Including the junction temperature rise of the over loaded condition.

## Main Characteristics

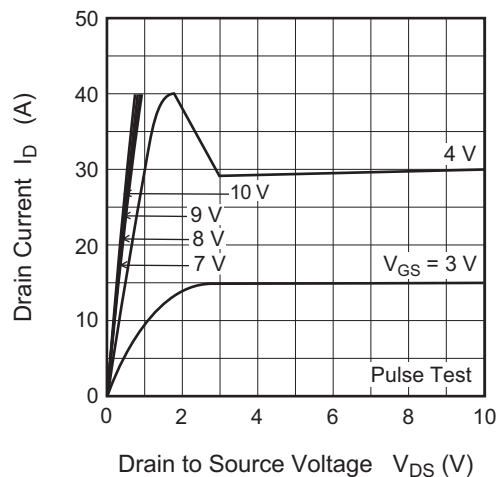
Power vs. Temperature Derating



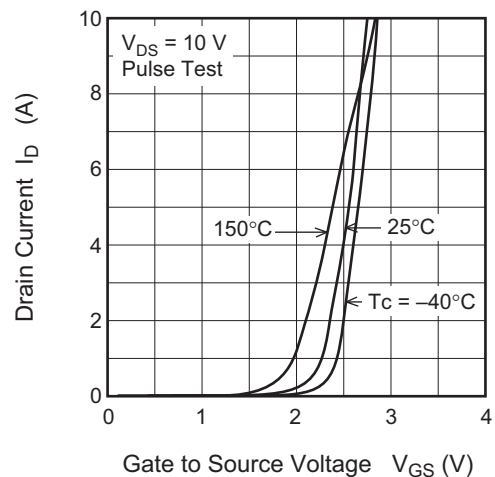
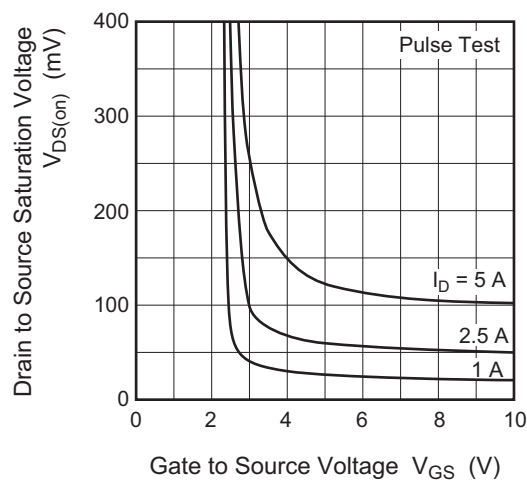
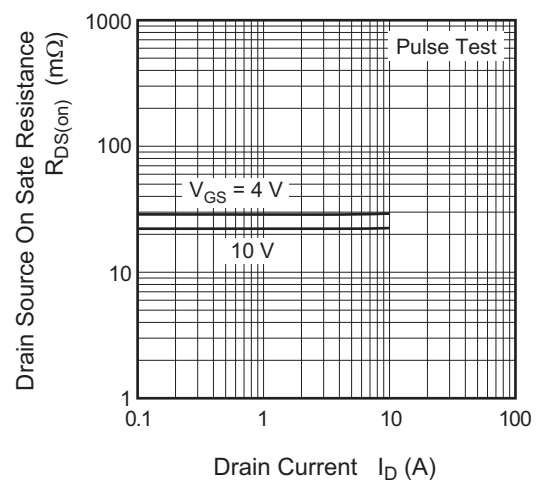
Maximum Safe Operation Area



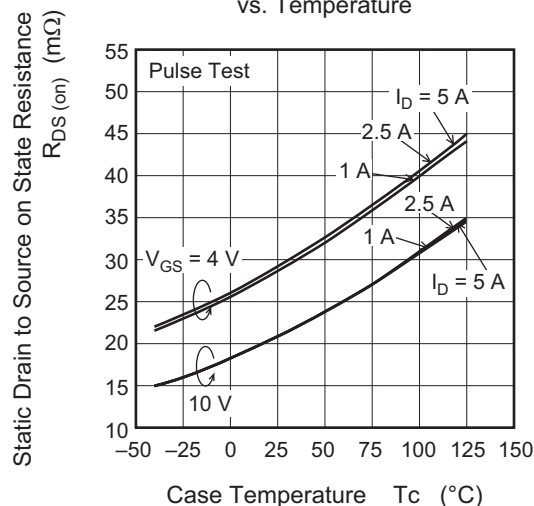
Typical Output Characteristics



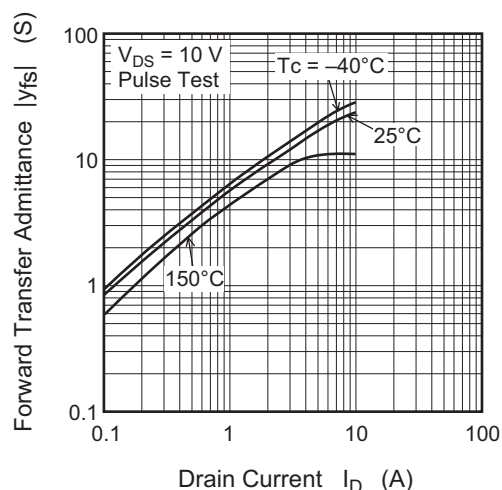
Typical Transfer Characteristics

Drain to Saturation Voltage vs.  
Gate to Source VoltageStatic Drain to Source State Resistance  
vs. Drain Current

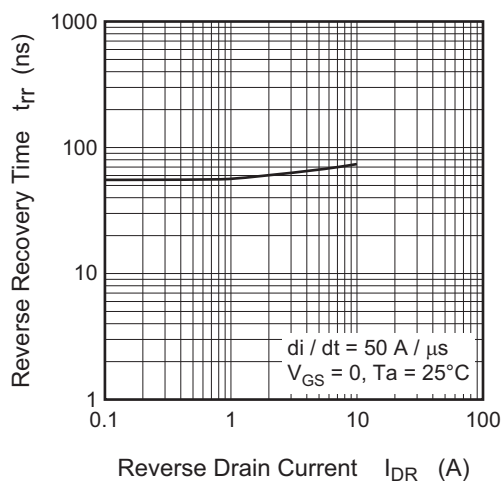
Static Drain to Source on State Resistance vs. Temperature



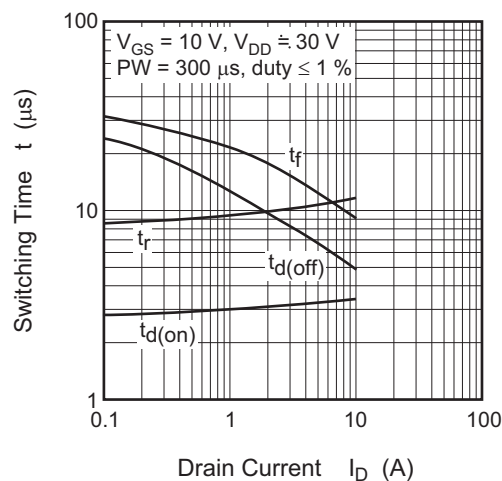
Forward Transfer Admittance vs. Drain Current



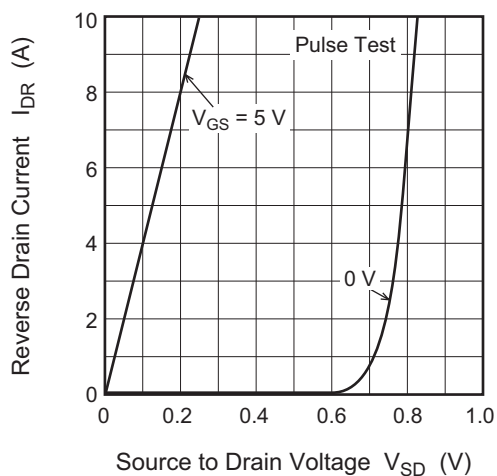
Body-Drain Diode Reverse Recovery Time



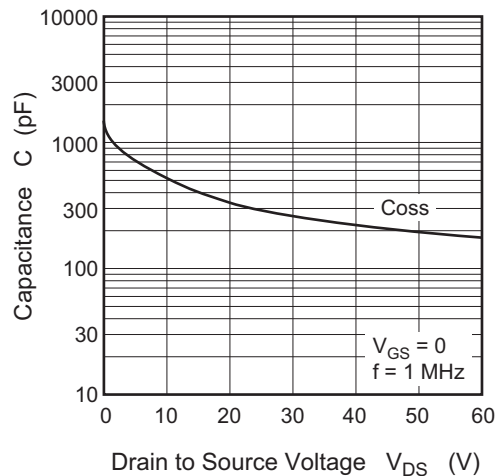
Switching Characteristics

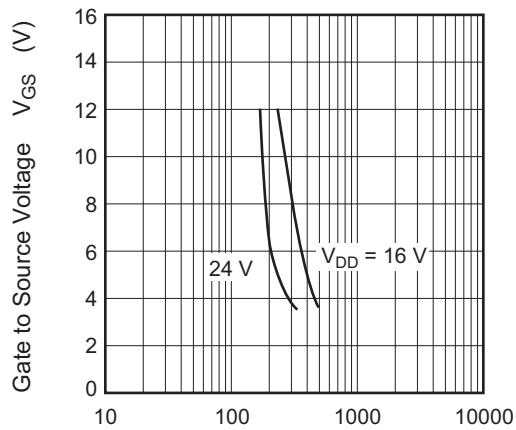


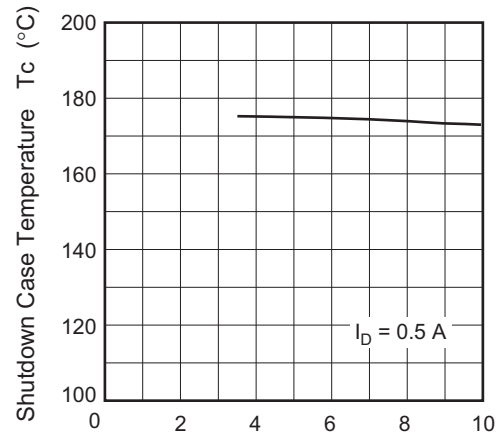
Reverse Drain Current vs. Source to Drain Voltage



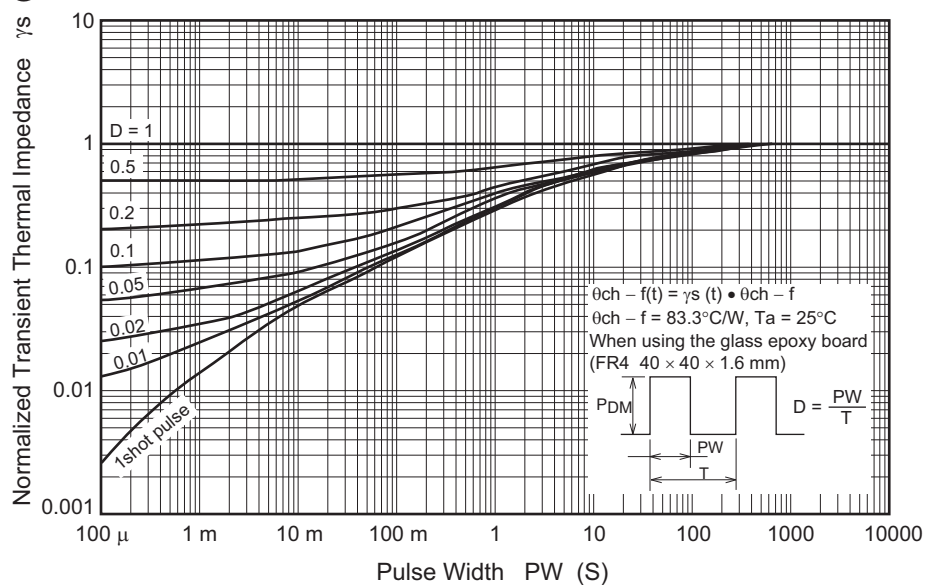
Typical Capacitance vs. Drain to Source Voltage



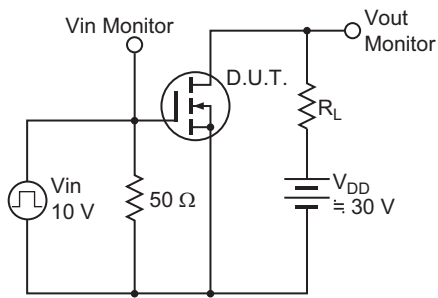
Gate to Source Voltage vs.  
Shutdown Time of Load-Short Test

Shutdown Time of Load-Short Test  $P_w$  ( $\mu$ s)

Shutdown Case Temperature vs.  
Gate to Source Voltage

Gate to Source Voltage  $V_{GS}$  (V)

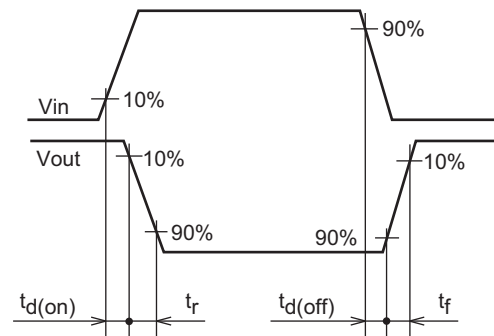
Normalized Transient Thermal Impedance vs. Pulse Width



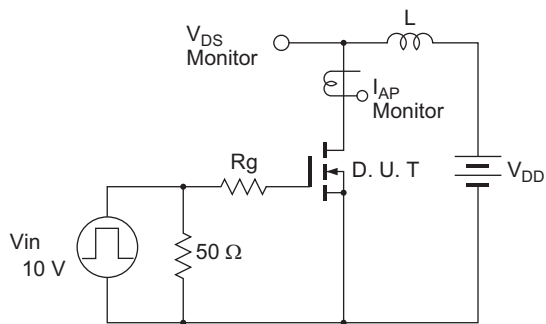
Switching Time Test Circuit



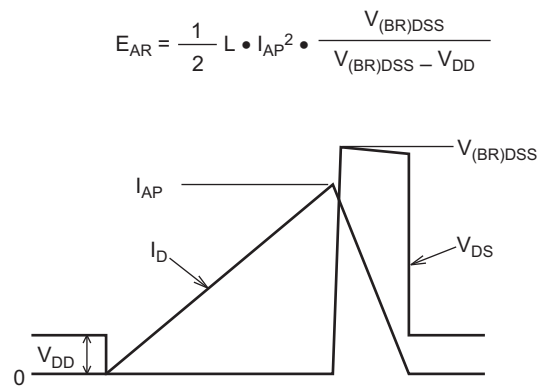
Waveform



Avalanche Test Circuit

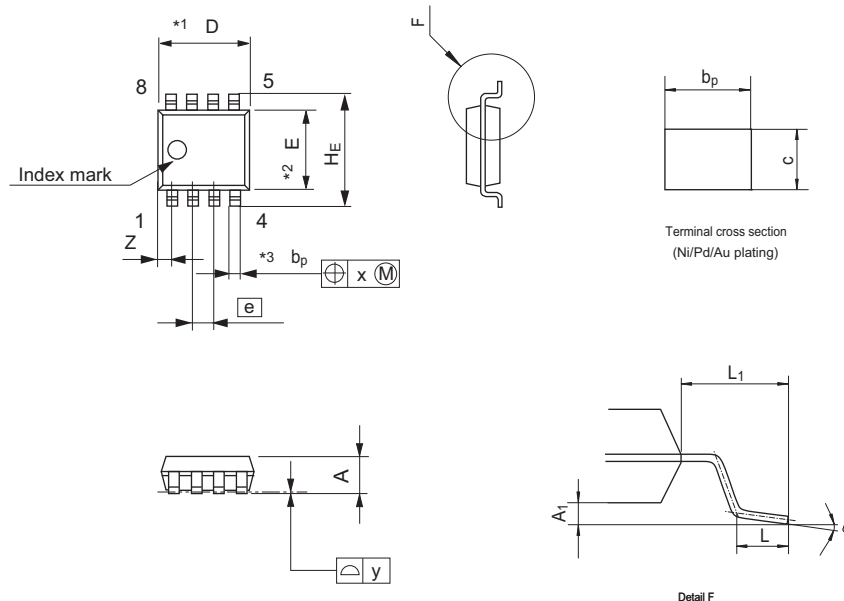


Avalanche Waveform



## Package Dimensions

| Package Name | JEITA Package Code     | RENESAS Code | Previous Code | MASS[Typ.] |
|--------------|------------------------|--------------|---------------|------------|
| SOP-8        | P-SOP8-3.95 × 4.9-1.27 | PRSP0008DD-D | FP-8DAV       | 0.085g     |



NOTE)  
 1. DIMENSIONS \*\*1(Nom)" AND \*\*2"  
 DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION \*\*3" DOES NOT  
 INCLUDE TRIM OFFSET.

| Reference<br>Symbol | Dimension in Millimeters |      |      |
|---------------------|--------------------------|------|------|
|                     | Min                      | Nom  | Max  |
| D                   | —                        | 4.90 | 5.3  |
| E                   | —                        | 3.95 | —    |
| A <sub>2</sub>      | —                        | —    | —    |
| A <sub>1</sub>      | 0.10                     | 0.14 | 0.25 |
| A                   | —                        | —    | 1.75 |
| b <sub>p</sub>      | 0.34                     | 0.40 | 0.46 |
| b <sub>1</sub>      | —                        | —    | —    |
| c                   | 0.15                     | 0.20 | 0.25 |
| c <sub>1</sub>      | —                        | —    | —    |
| $\theta$            | 0°                       | —    | 8°   |
| H <sub>E</sub>      | 5.80                     | 6.10 | 6.20 |
| $\triangle y$       | —                        | 1.27 | —    |
| x                   | —                        | —    | 0.25 |
| y                   | —                        | —    | 0.1  |
| Z                   | —                        | —    | 0.75 |
| L                   | 0.40                     | 0.60 | 1.27 |
| L <sub>1</sub>      | —                        | 1.08 | —    |

## Ordering Information

| Orderable Part Number | Quantity | Shipping Container |
|-----------------------|----------|--------------------|
| RJF0613JSP-00-J0      | 2500 pcs | Taping             |

Note: The symbol of 2nd "-" is occasionally presented as "#".

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