# RJE0620JPD

## –60V, –10A, P Channel Thermal FET Power Switching

R07DS1235EJ0100
Rev.1.00
Nov 06, 2014

## Description

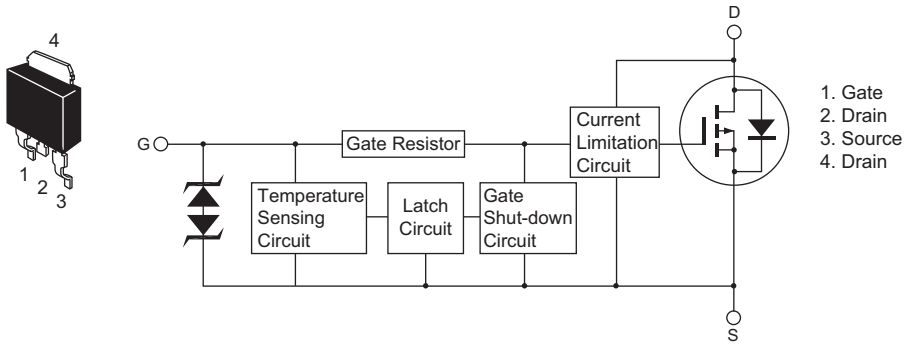
This FET has the over temperature shut-down capability sensing to the junction temperature. This FET has the built-in over temperature shut-down circuit in the gate area. And this circuit operation to shut-down the gate voltage in case of high junction temperature like applying over power consumption,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

## Features

- 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: PRSS0004ZD-C
(Package name: DPAK (S) )




## 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 |
| | $V_{GSS}$ | 2.5 | V |
| Drain current | $I_D$ Note3 | –10 | A |
| Body-drain diode reverse drain current | $I_{DR}$ | –10 | A |
| Avalanche current | $I_{AP}$ Note 2 | –7 | A |
| Avalanche energy | $E_{AR}$ Note 2 | 210 | mJ |
| Channel dissipation | Pch Note 1 | 40 | W |
| Channel temperature | Tch | 150 | °C |
| Storage temperature | Tstg | –55 to +150 | °C |

Notes: 1. Tch = 25°C
2. Tch = 25°C, Rg ≥ 50 Ω
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 (Gate non shut down) | $I_{IH1}$ | — | — | –100 | μA | Vi = –8 V, $V_{DS}$ = 0 |
| | $I_{IH2}$ | — | — | –50 | μA | Vi = –3.5 V, $V_{DS}$ = 0 |
| | $I_{IL}$ | — | — | –1 | μA | Vi = –1.2 V, $V_{DS}$ = 0 |
| Input current (Gate shut down) | $I_{IH(sd)1}$ | — | –0.8 | — | mA | Vi = –8 V, $V_{DS}$ = 0 |
| | $I_{IH(sd)2}$ | — | –0.35 | — | mA | Vi = –3.5 V, $V_{DS}$ = 0 |
| Shut down temperature | Tsd | — | 175 | — | °C | Channel temperature |
| Gate operation voltage | Vop | –3.5 | — | –12 | V | |
| Drain current (Current limitation value) | $I_{D\ limt}$ | –10 | — | — | A | $V_{GS}$ = –12 V, $V_{DS}$ = –10 V Note 4 |

Notes; 4. Pulse test

## Electrical Characteristics

(Ta = 25°C)

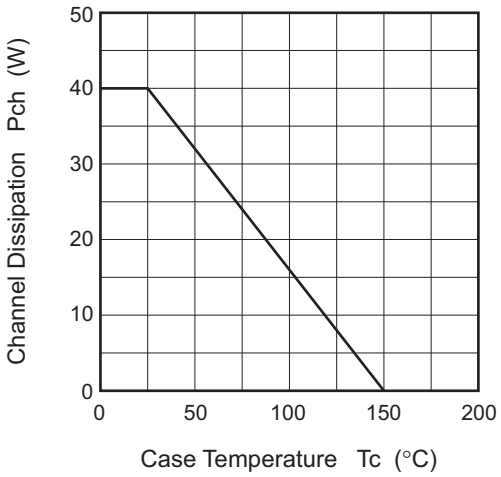
| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Drain current | $I_{D1}$ | — | — | –16 | A | $V_{GS}$ = –3.5 V, $V_{DS}$ = –10 V Note 5 |
| | $I_{D2}$ | — | — | –10 | mA | $V_{GS}$ = –1.2 V, $V_{DS}$ = –10 V |
| | $I_{D3}$ | –10 | — | — | A | $V_{GS}$ = –12 V, $V_{DS}$ = –10 V Note 5 |
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | –60 | — | — | V | $I_D$ = –10 mA, $V_{GS}$ = 0 |
| Gate to source breakdown voltage | $V_{(BR)GSS}$ | –16 | — | — | V | $I_G$ = –800 μA, $V_{DS}$ = 0 |
| | $V_{(BR)GSS}$ | 2.5 | — | — | V | $I_G$ = 100 μA, $V_{DS}$ = 0 |
| Gate to source leak current | $I_{GSS1}$ | — | — | –100 | μA | $V_{GS}$ = –8 V, $V_{DS}$ = 0 |
| | $I_{GSS2}$ | — | — | –50 | μA | $V_{GS}$ = –3.5 V, $V_{DS}$ = 0 |
| | $I_{GSS3}$ | — | — | –1 | μA | $V_{GS}$ = –1.2 V, $V_{DS}$ = 0 |
| | $I_{GSS4}$ | — | — | 100 | μA | $V_{GS}$ = 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 | $I_{DSS1}$ | — | — | –10 | μA | $V_{DS}$ = –60 V, $V_{GS}$ = 0 |
| Gate to source cutoff voltage | $V_{GS(off)}$ | –1.0 | — | –2.1 | V | $V_{DS}$ = –10 V, $I_D$ = –1 mA |
| Forward transfer admittance | $\|y_{fs}\|$ | 5 | 9 | — | S | $I_D$ = –5 A, $V_{DS}$ = –10 V Note 5 |
| Static drain to source on state resistance | $R_{DS(on)}$ | — | 131 | 180 | mΩ | $I_D$ = –5 A, $V_{GS}$ = –4 V Note 5 |
| | $R_{DS(on)}$ | — | 100 | 120 | mΩ | $I_D$ = –5 A, $V_{GS}$ = –10 V Note 5 |
| Output capacitance | Coss | — | 444 | — | pF | $V_{DS}$ = –10 V, $V_{GS}$ = 0, f = 1MHz |
| Turn-on delay time | $t_{d(on)}$ | — | 2.6 | — | μs | $V_{GS}$ = –10 V, $I_D$= –5 A, $R_L$ = 6 Ω |
| Rise time | $t_r$ | — | 10.6 | — | μs | |
| Turn-off delay time | $t_{d(off)}$ | — | 3.1 | — | μs | |
| Fall time | $t_f$ | — | 6.0 | — | μs | |
| Body-drain diode forward voltage | $V_{DF}$ | — | –0.93 | — | V | $I_F$ = –10 A, $V_{GS}$ = 0 Note 5 |
| Body-drain diode reverse recovery time | $t_{rr}$ | — | 100 | — | ns | $I_F$ = –10 A, $V_{GS}$ = 0<br>$di_F/dt$ = 50 A/μs |
| Over load shut down operation time Note 6 | $t_{os1}$ | — | 2.2 | — | ms | $V_{GS}$ = –5 V, $V_{DD}$ = –16 V |
| | $t_{os2}$ | — | 1.1 | — | ms | $V_{GS}$ = –5 V, $V_{DD}$ = –24 V |

Notes: 5. Pulse test

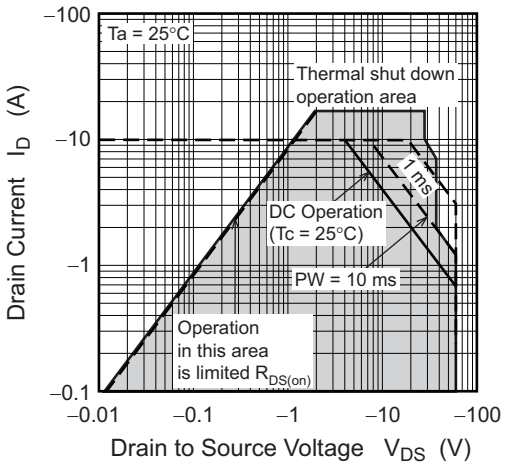
6. Including the junction temperature rise of the over loaded condition.

## Main Characteristics

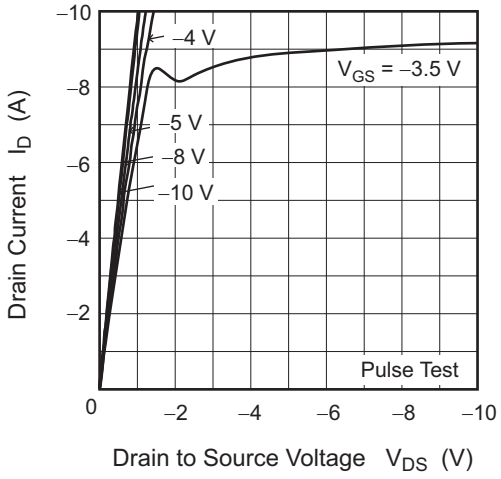
Power vs. Temperature Derating



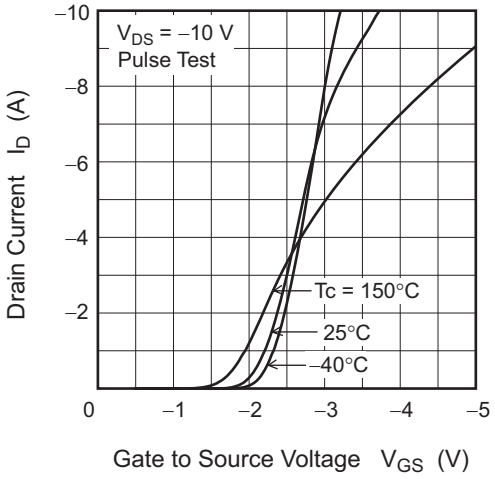

Maximum Safe Operation Area



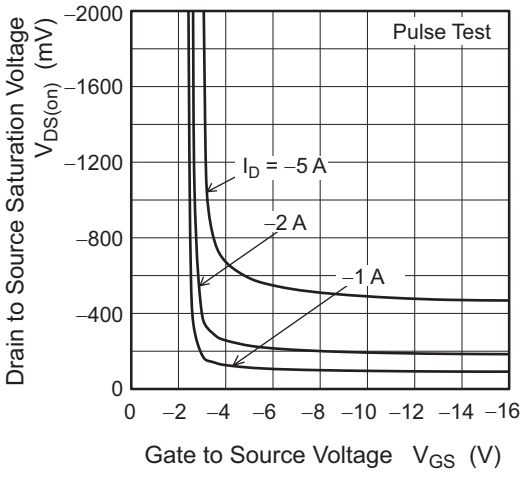

Typical Output Characteristics



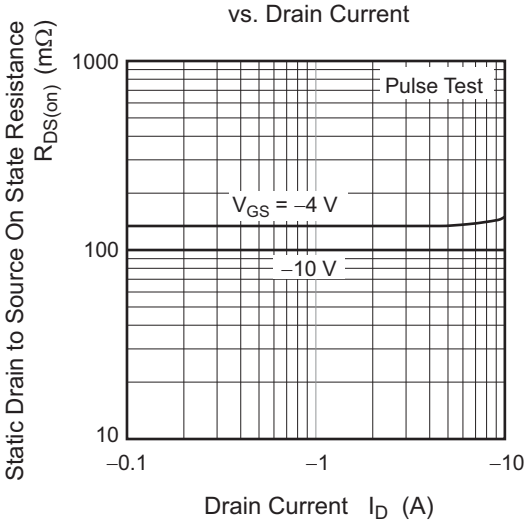

Typical Transfer Characteristics



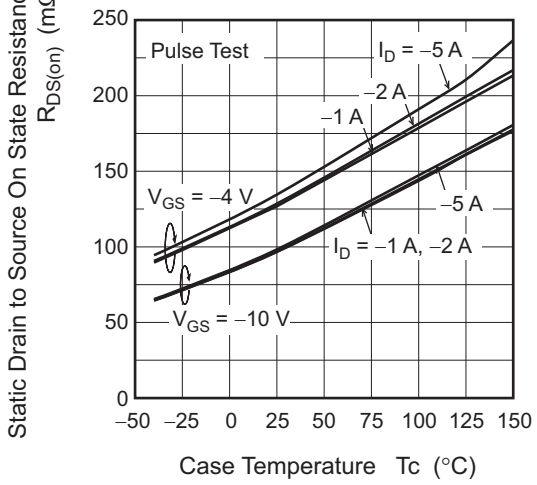

Drain to Source Saturation Voltage vs. Gate to Source Voltage



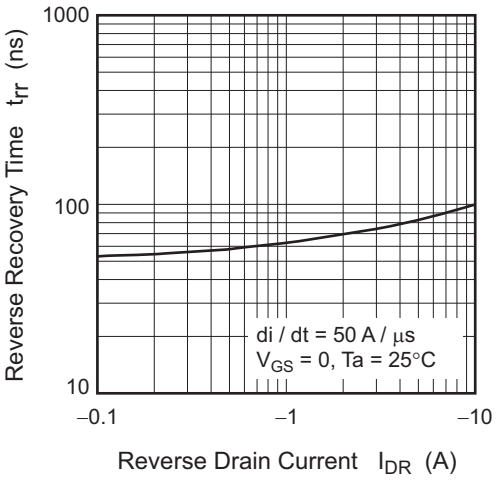

Static Drain to Source On State Resistance vs. Drain Current



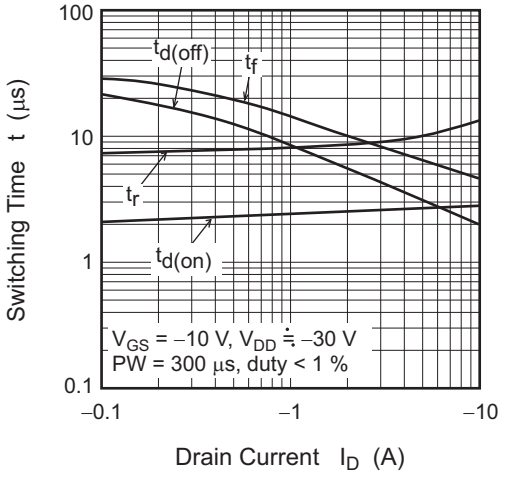
Static Drain to Source On State Resistance vs. Temperature



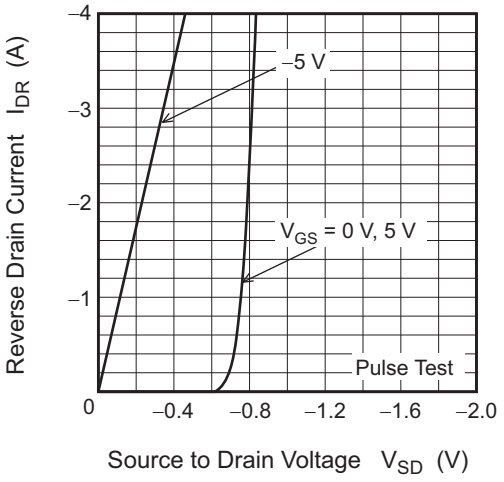

Body-Drain Diode Reverse Recovery Time



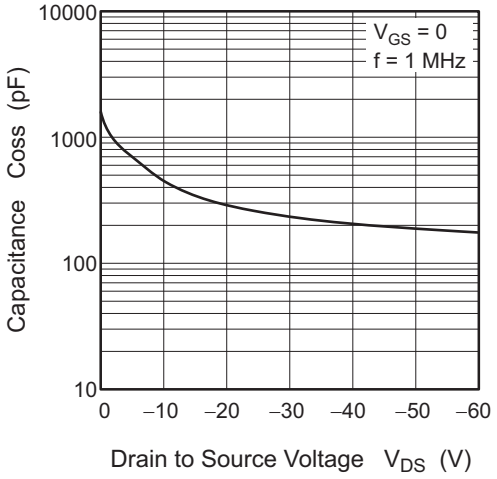

Switching Characteristics



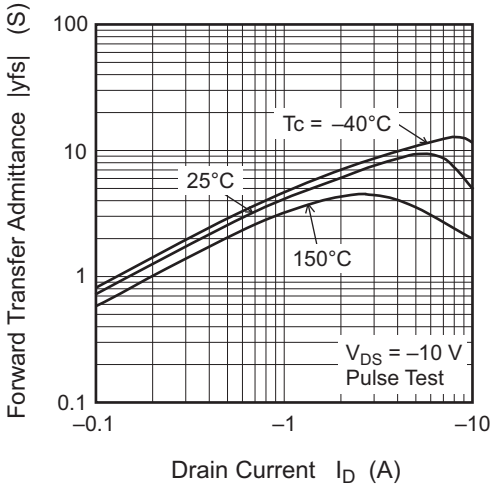

Reverse Drain Current vs. Source to Drain Voltage



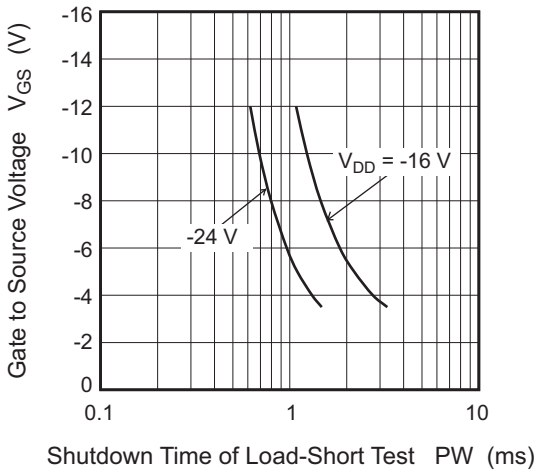

Typical Capacitance vs. Drain to Source Voltage



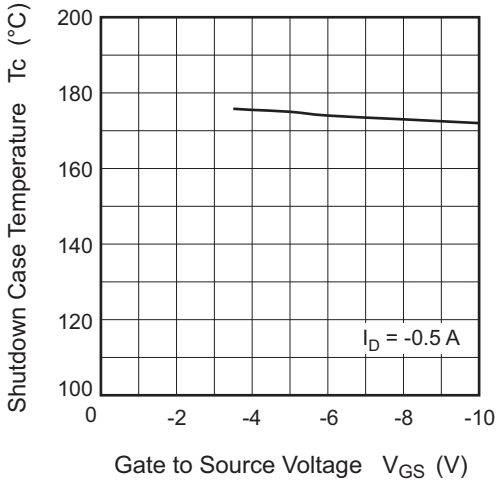

Forward Transfer Admittance vs. Drain Current



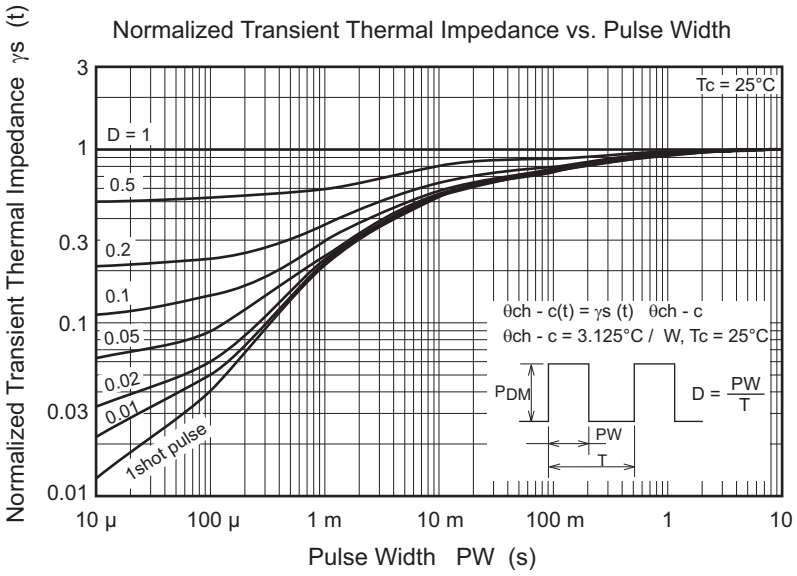
Gate to Source Voltage vs.
Shutdown Time of Load-Short Test



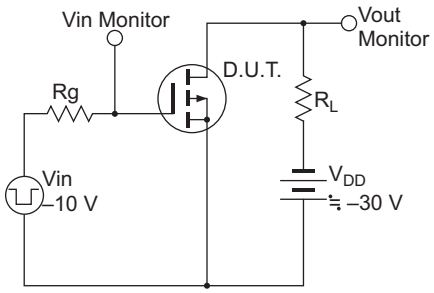

Shutdown Case Temperature vs.
Gate to Source Voltage



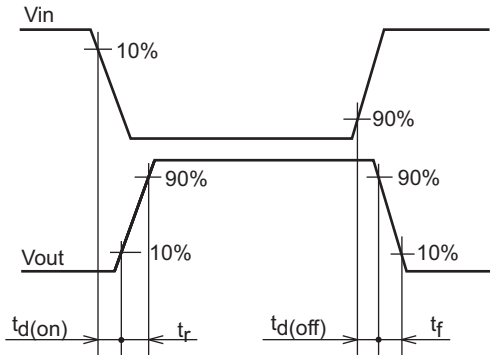

Normalized Transient Thermal Impedance vs. Pulse Width



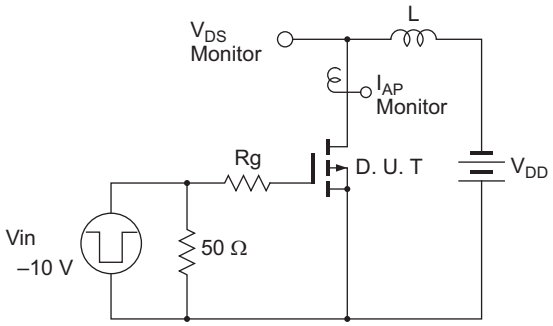
Switching Time Test Circuit




Waveform

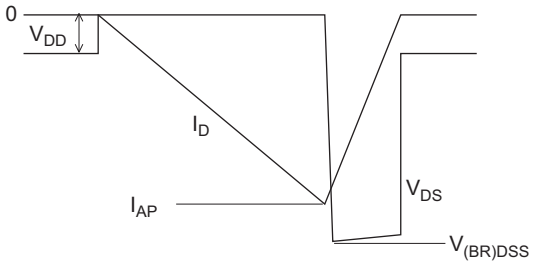



Avalanche Test Circuit




Avalanche Waveform

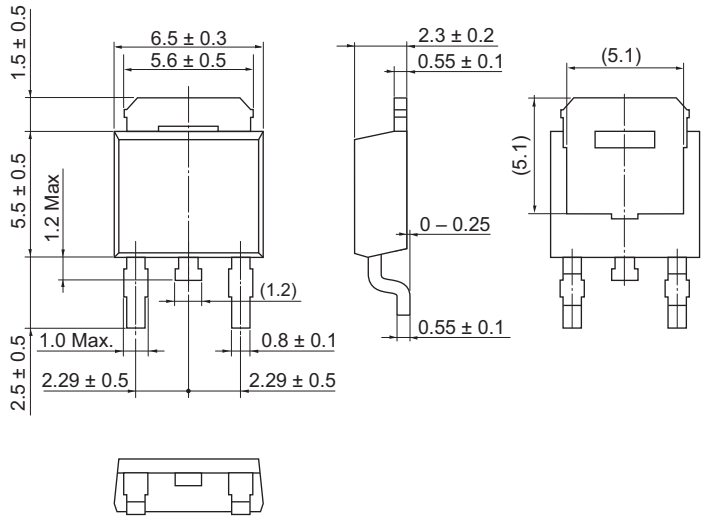
$$E_{AR} = \frac{1}{2} L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



## Package Dimensions

| Package Name | JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|---|
| DPAK(S) | SC-63 | PRSS0004ZD-C | DPAK(S) / DPAK(S)V | 0.28g |

Unit: mm




## Ordering Information

| Orderable Part Number | Quantity | Shipping Container |
|---|---|---|
| RJE0620JPD-00-J3 | 3000 pcs | Taping |

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