

# RJF0609JSP

60V - 1.5V Silicon N Channel Thermal FET  
Power Switching

R07DS1066EJ0100  
Rev.1.00  
May 10, 2013

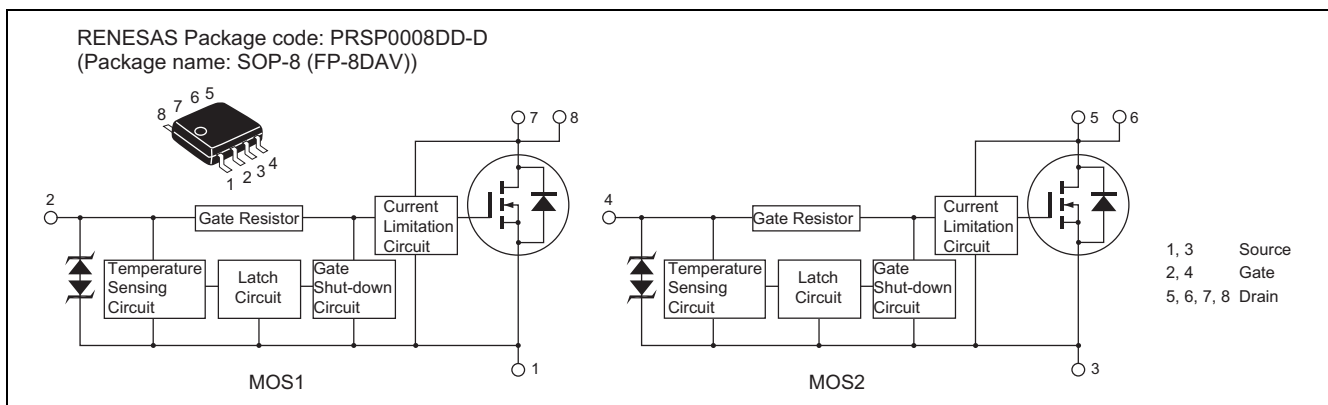
## Description

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



## 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	$I_D$ <small>Note 4</small>	1.5	A
Body-drain diode reverse drain current	$I_{DR}$	1.5	A
Avalanche current	$I_{AP}$ <small>Note 3</small>	1.5	A
Avalanche energy	$E_{AR}$ <small>Note 3</small>	9.6	mJ
Channel dissipation	$P_{ch}$ <small>Note 1</small>	1	W
Channel dissipation	$P_{ch}$ <small>Note 2</small>	1.5	W
Channel temperature	$T_{ch}$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

- Notes: 1. 1 Drive operation : When using the glass epoxy board (FR4 40 × 40 × 1.6 mm), PW ≤ 10 s  
 2. 2 Drive operation : When using the glass epoxy board (FR4 40 × 40 × 1.6 mm), PW ≤ 10 s  
 3.  $T_{ch}$  = 25°C,  $R_g$  ≥ 50 Ω  
 4. 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 (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 (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 (Current limitation value)	I <sub>D limit</sub>	1.5	—	—	A	V <sub>GS</sub> = 5 V, V <sub>DS</sub> = 10 V <sup>Note 5</sup>

Notes: 5. Pulse test

## Electrical Characteristics

(Ta = 25°C)

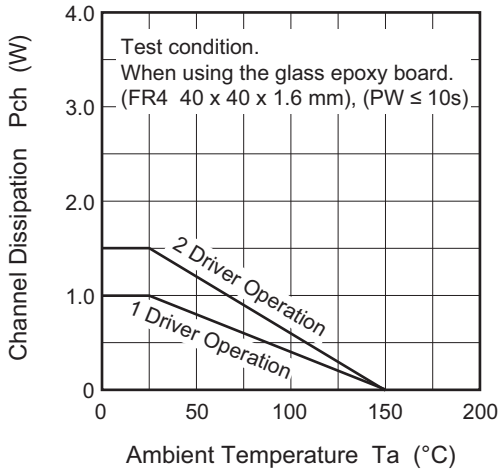
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I <sub>D1</sub>	—	—	5.4	A	V <sub>GS</sub> = 3.5 V, V <sub>DS</sub> = 10 V <sup>Note 6</sup>
	I <sub>D2</sub>	—	—	10	mA	V <sub>GS</sub> = 1.2 V, V <sub>DS</sub> = 10 V
	I <sub>D3</sub>	1.5	—	—	A	V <sub>GS</sub> = 12 V, V <sub>DS</sub> = 10 V <sup>Note 6</sup>
Drain to source breakdown voltage	V <sub>(BR)DSS</sub>	60	—	—	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 Ta = 125°C
Gate to source cutoff voltage	V <sub>GS(off)</sub>	1.1	—	2.1	V	I <sub>D</sub> = 1 mA, V <sub>DS</sub> = -0 V
Forward transfer admittance	y <sub>fs</sub>	1.0	2.2	—	S	I <sub>D</sub> = 0.7 A, V <sub>DS</sub> = 10 V <sup>Note 6</sup>
Static drain to source on state resistance	R <sub>DS(on)</sub>	—	208	350	mΩ	I <sub>D</sub> = 0.7 A, V <sub>GS</sub> = 4 V <sup>Note 6</sup>
	R <sub>DS(on)</sub>	—	142	263	mΩ	I <sub>D</sub> = 0.7 A, V <sub>GS</sub> = 10 V <sup>Note 6</sup>
Output capacitance	C <sub>oss</sub>	—	265	—	pF	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0, f = 1MHz
Turn-on delay time	t <sub>d(on)</sub>	—	0.55	—	μs	I <sub>D</sub> = 0.7 A, V <sub>GS</sub> = 10 V R <sub>L</sub> = 43 Ω
Rise time	t <sub>r</sub>	—	1.88	—	μs	
Turn-off delay time	t <sub>d(off)</sub>	—	3.9	—	μs	
Fall time	t <sub>f</sub>	—	3.7	—	μs	
Body-drain diode forward voltage	V <sub>DF</sub>	—	0.82	—	V	I <sub>F</sub> = 1.5 A, V <sub>GS</sub> = 0
Body-drain diode reverse recovery time	t <sub>rr</sub>	—	71	—	ns	I <sub>F</sub> = 1.5 A, V <sub>GS</sub> = 0 di <sub>F</sub> /dt = 50 A/μs
Over load shut down operation time <sup>Note 7</sup>	t <sub>os1</sub>	—	1.02	—	ms	V <sub>GS</sub> = 5 V, V <sub>DD</sub> = 16 V
	t <sub>os2</sub>	—	0.59	—	ms	V <sub>GS</sub> = 5 V, V <sub>DD</sub> = 24 V

Notes: 6. Pulse test

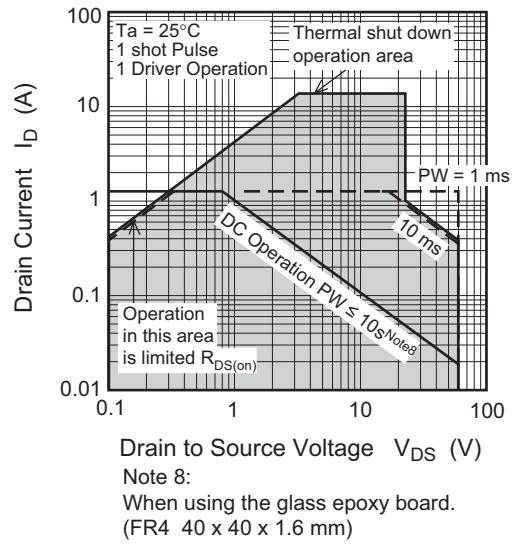
7. Including the junction temperature rise of the over loaded condition.

Main Characteristics

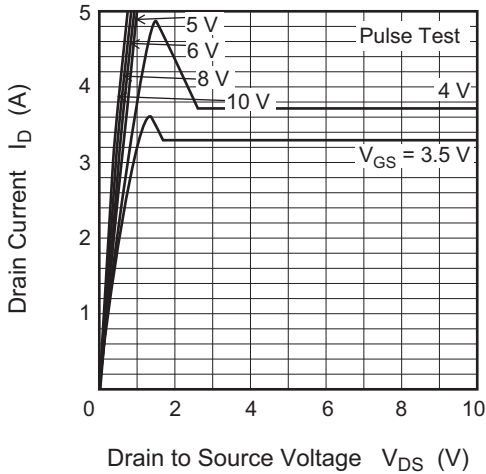
Power vs. Temperature Derating



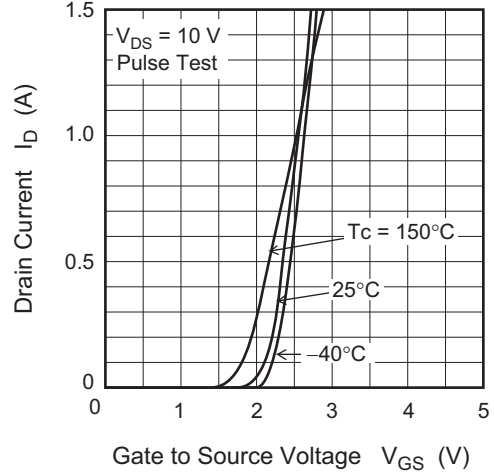
Maximum Safe Operation Area



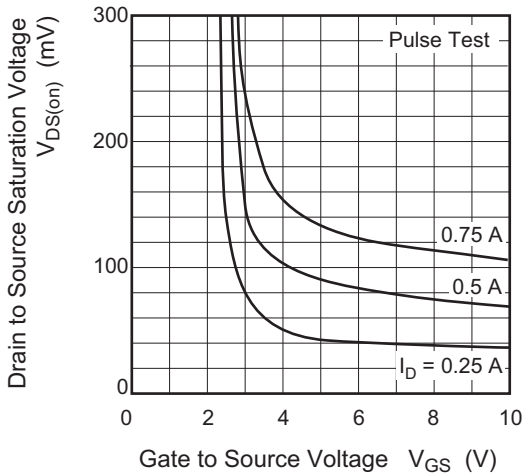
Typical Output Characteristics



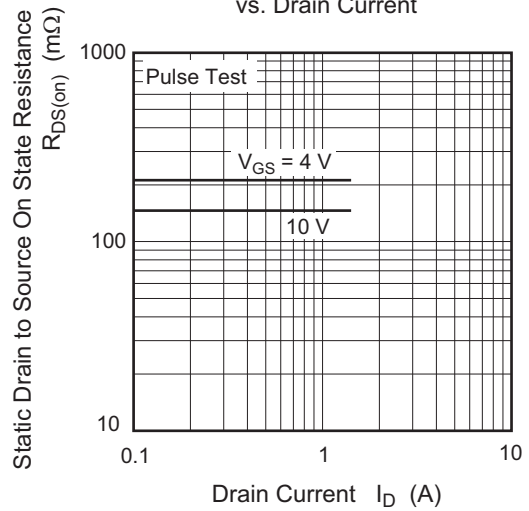
Typical Transfer Characteristics

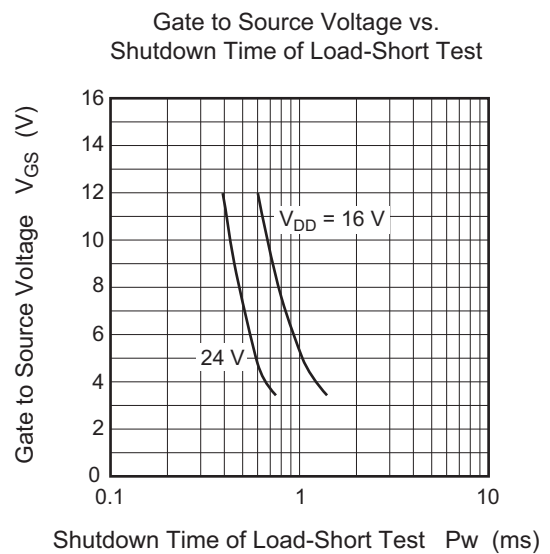
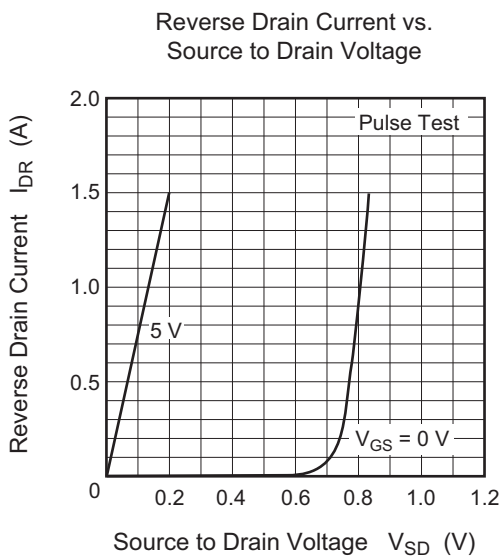
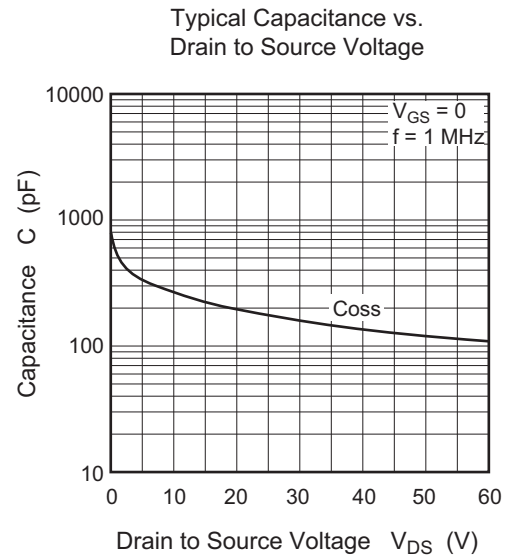
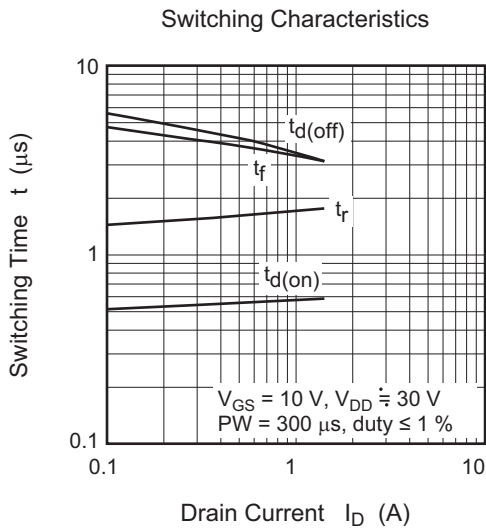
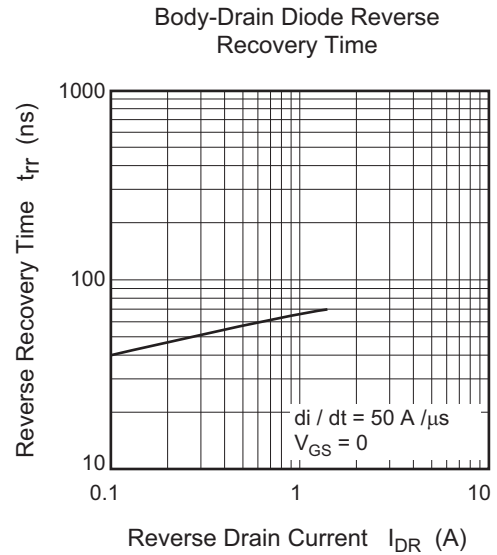
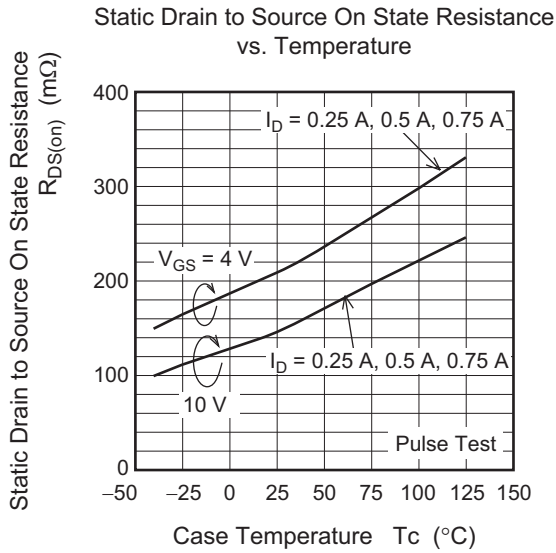


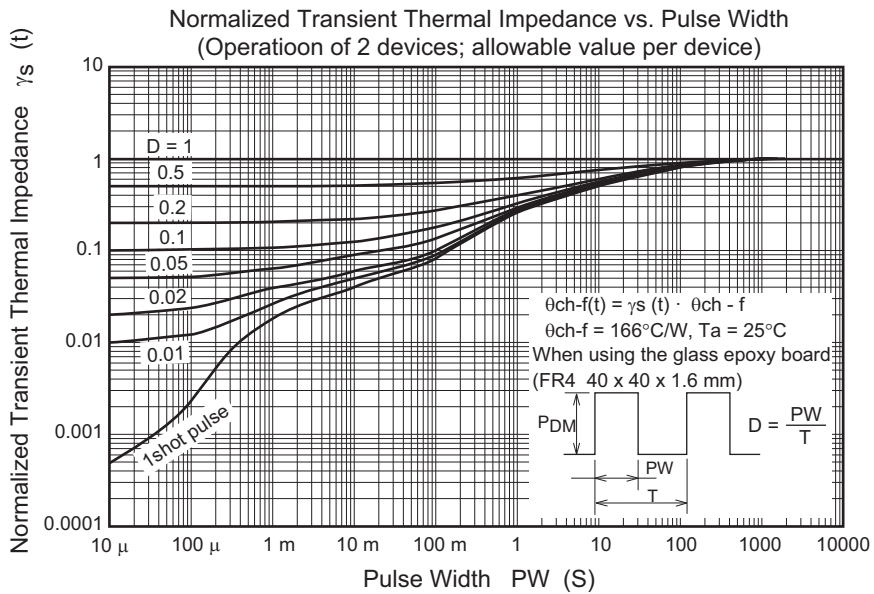
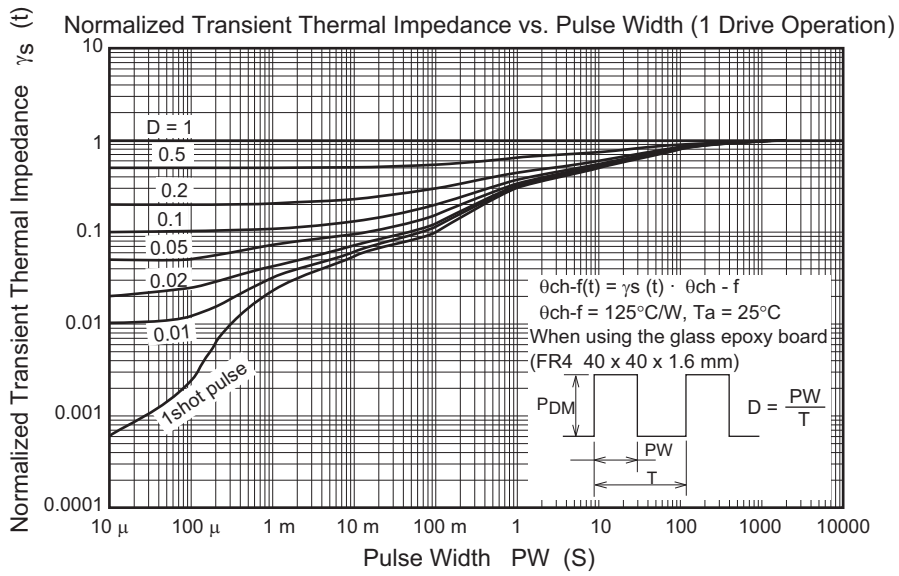
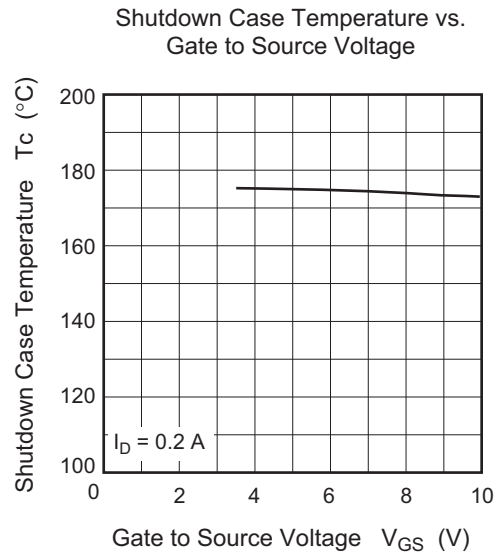
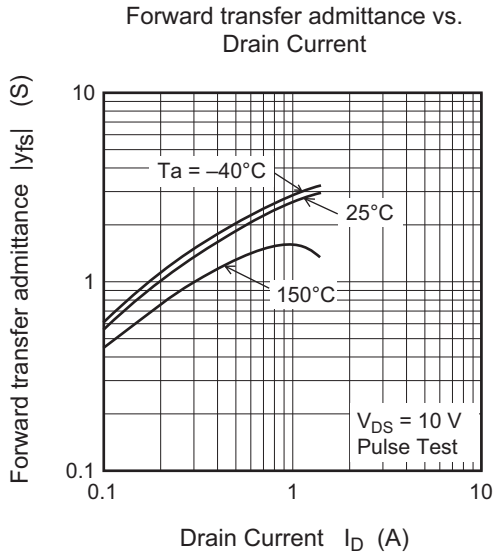
Drain Source Saturation Voltage vs. Gate to Source Voltage



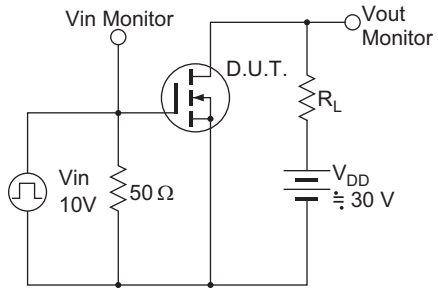
Static Drain to Source On State Resistance vs. Drain Current



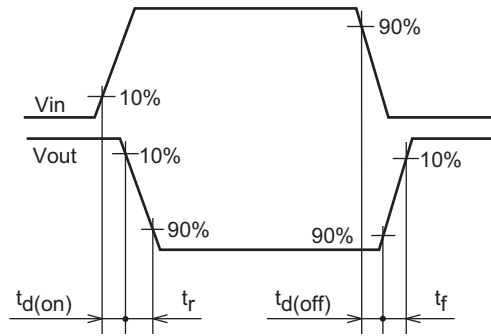




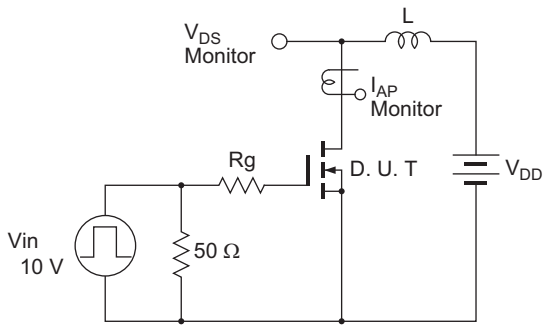
Switching Time Test Circuit



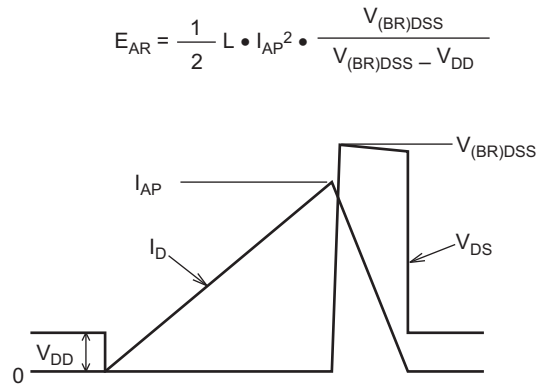
Waveform



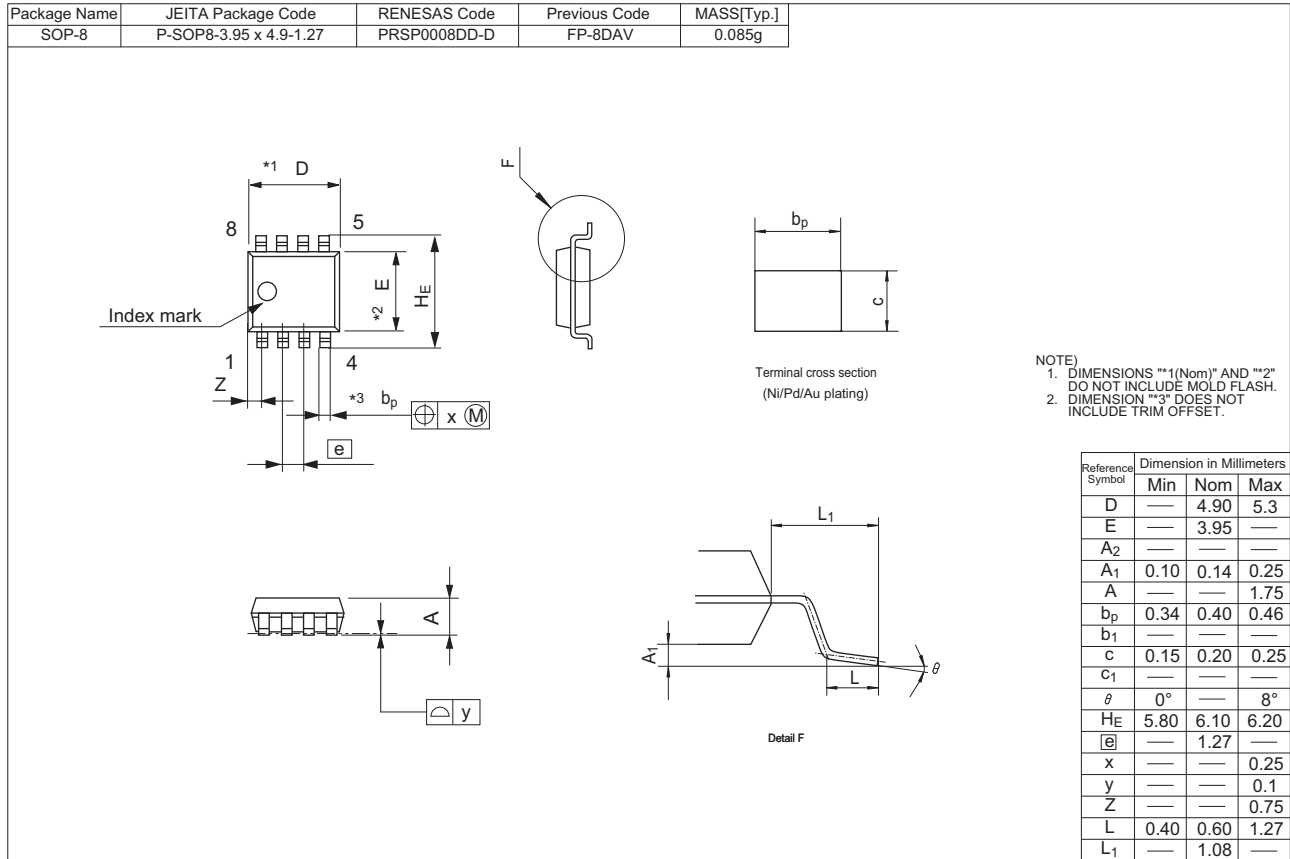
Avalanche Test Circuit



Avalanche Waveform



### Package Dimensions



### Ordering Information

Orderable Part Number	Quantity	Shipping Container
RJF0609JSP-00-J0	2500 pcs/reel	Taping

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

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