

RJF0610JSP

60V , 1.5A Silicon N channel Thermal FET
Power Switching

R07DS0568EJ0301
Rev.3.01
Sep 06, 2016

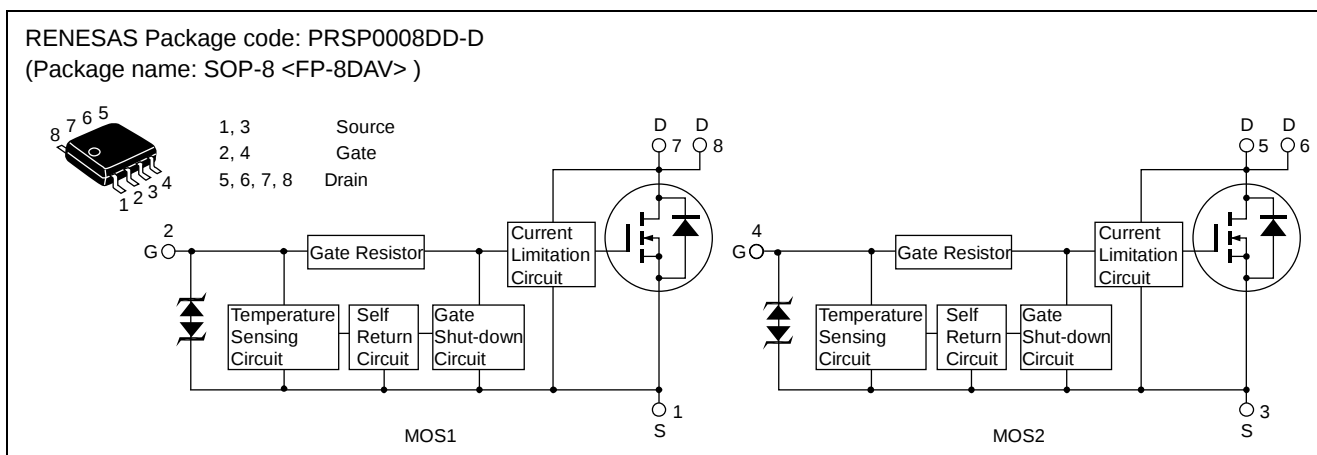
Description

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 (5 to 6 V Gate drive).
- Built-in the over temperature shut-down circuit.
- High endurance capability against to the short circuit.
- Temperature hysteresis type.
- 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_{DS}	60	V
Gate to source voltage	V_{GS}	16	V
Gate to source voltage	V_{GS}	-2.5	V
Drain current	I_D ^{Note 4}	1.5	A
Body-drain diode reverse drain current	I_{DR}	1.5	A
Avalanche current	I_{AP} ^{Note 3}	0.95	A
Avalanche energy	E_{AR} ^{Note 3}	77.4	mJ
Channel dissipation	P_{ch} ^{Note 1}	2	W
Channel dissipation	P_{ch} ^{Note 2}	3	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), $PW \leq 10$ s
2. 2 Drive operation: When using the glass epoxy board (FR4 40 × 40 × 1.6 mm), $PW \leq 10$ s
3. $T_{ch} = 25^\circ\text{C}$, $R_g \geq 50 \Omega$, $L = 100$ mH
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 _{IH}	3.5	—	—	V	
	V _{IL}	—	—	1.2	V	
Input current (Gate non shut down)	I _{IH1}	—	—	100	μA	V _i = 5 V, V _{DS} = 0
	I _{IH2}	—	—	50	μA	V _i = 3.5 V, V _{DS} = 0
	I _{IL}	—	—	1	μA	V _i = 1.2 V, V _{DS} = 0
Input current (Gate shut down)	I _{IH(sD)1}	—	0.4	—	mA	V _i = 8 V, V _{DS} = 0
	I _{IH(sD)2}	—	0.24	—	mA	V _i = 5 V, V _{DS} = 0
	I _{IH(sD)3}	—	0.16	—	mA	V _i = 3.5 V, V _{DS} = 0
Shut down temperature	T _{sd}	—	175	—	°C	Channel temperature
Return temperature	T _{hr}	—	120	—	°C	Channel temperature
Gate operation voltage	V _{op}	3.5	—	12	V	
Drain current (Current limitation value)	I _{D limit}	1.5	—	—	A	V _{GS} = 5 V, V _{DS} = 10 V ^{Note 5}

Notes; 5. Pulse test

Electrical Characteristics

(Ta = 25°C)

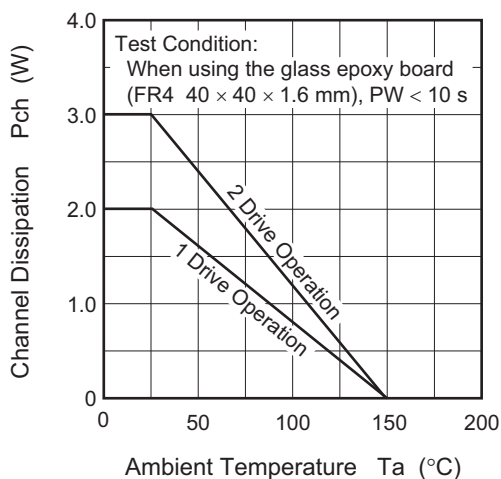
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I _{D1}	—	—	2.4	A	V _{GS} = 3.5 V, V _{DS} = 2 V
	I _{D2}	—	—	10	mA	V _{GS} = 1.2 V, V _{DS} = 2 V
	I _{D3}	1.5	—	—	A	V _{GS} = 5 V, V _{DS} = 10 V ^{Note 6}
Drain to source breakdown voltage	V _{(BR)DSS}	60	—	—	V	I _D = 10 mA, V _{GS} = 0
Gate to source breakdown voltage	V _{(BR)GSS}	16	—	—	V	I _G = 500 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} = 5 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}	—	0.4	—	mA	V _{GS} = 8 V, V _{DS} = 0
	I _{GS(OP)2}	—	0.24	—	mA	V _{GS} = 5 V, V _{DS} = 0
	I _{GS(OP)3}	—	0.16	—	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
	I _{DSS2}	—	—	10	μA	V _{DS} = 48 V, V _{GS} = 0, Ta = 125°C
Gate to source cutoff voltage	V _{GS(off)}	1.4	—	2.5	V	I _D = 1 mA, V _{DS} = 10 V
Static drain to source on state resistance	R _{DS(on)}	—	207	285	mΩ	I _D = 0.7 A, V _{GS} = 5 V ^{Note 6}
	R _{DS(on)}	—	153	214	mΩ	I _D = 0.7 A, V _{GS} = 10 V ^{Note 6}
Output capacitance	C _{oss}	—	267	—	pF	V _{DS} = 10 V, V _{GS} = 0, f = 1MHz
Turn-on delay time	t _{d(on)}	—	4.3	—	μs	I _D = 0.7 A, V _{GS} = 5 V, R _L = 43 Ω
Rise time	t _r	—	18.3	—	μs	
Turn-off delay time	t _{d(off)}	—	0.62	—	μs	
Fall time	t _f	—	0.61	—	μs	
Body-drain diode forward voltage	V _{DF}	—	0.8	—	V	I _F = 1.5 A, V _{GS} = 0
Body-drain diode reverse recovery time	t _{rr}	—	55	—	ns	I _F = 1.5 A, V _{GS} = 0 di _F /dt = 50 A/μs
Over load shut down operation time ^{Note 7}	t _{os1}	—	18	—	ms	V _{GS} = 5 V, V _{DD} = 16 V
	t _{os2}	—	5.7	—	ms	V _{GS} = 5 V, V _{DD} = 24 V

Notes: 6. Pulse test

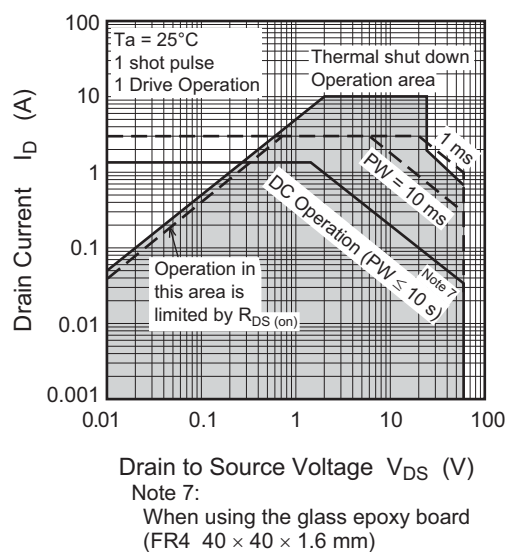
7. Including the junction temperature rise of the over loaded condition.

Main Characteristics

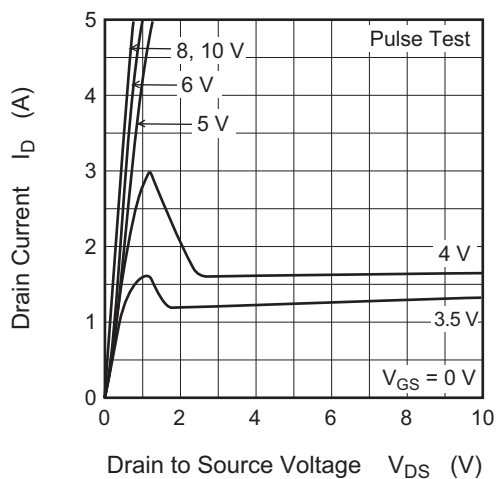
Power vs. Temperature Derating



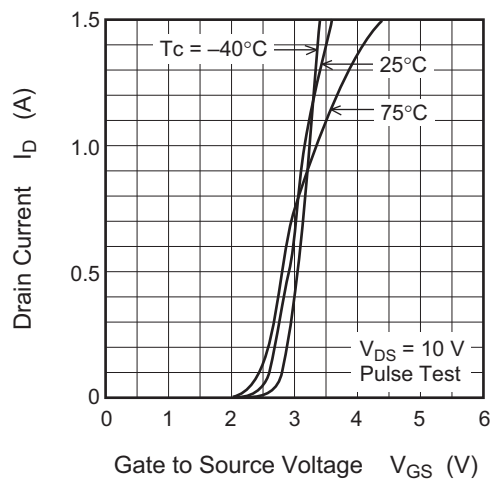
Maximum Safe Operation Area



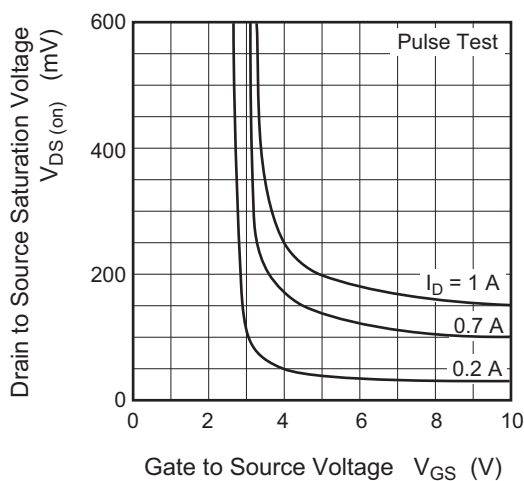
Typical Output Characteristics



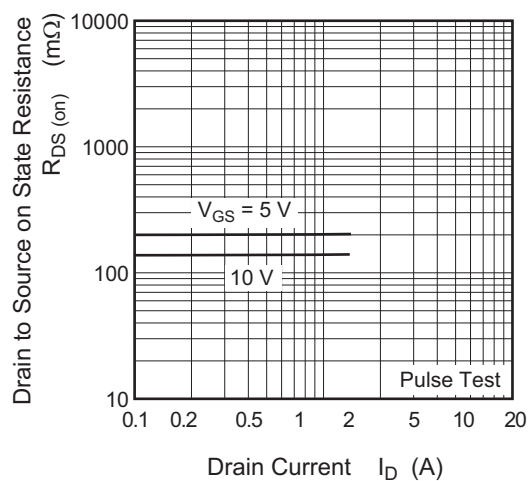
Typical Transfer Characteristics

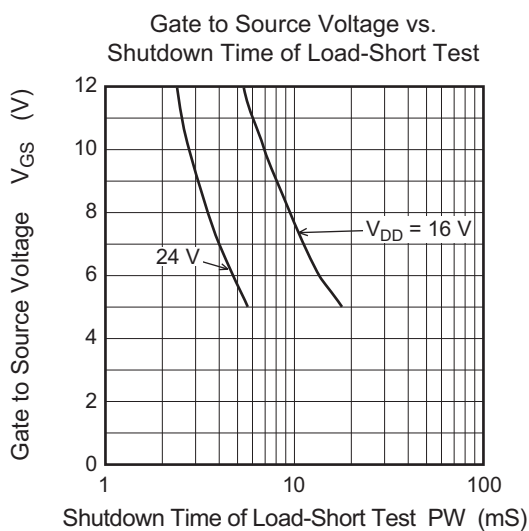
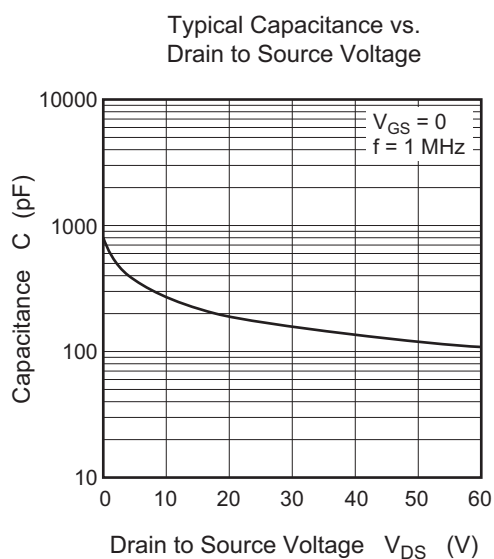
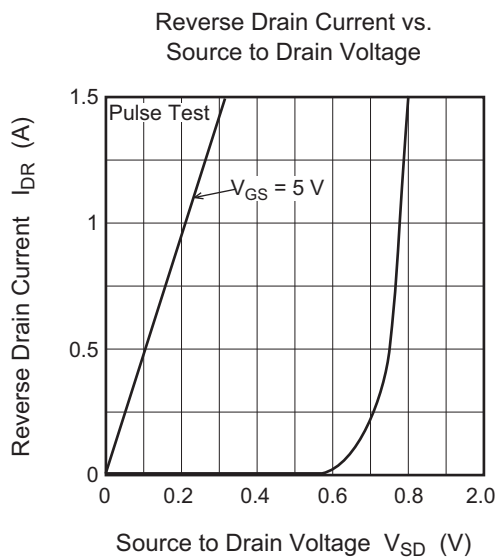
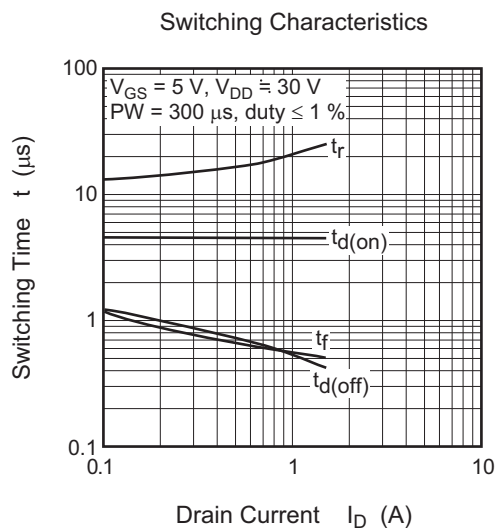
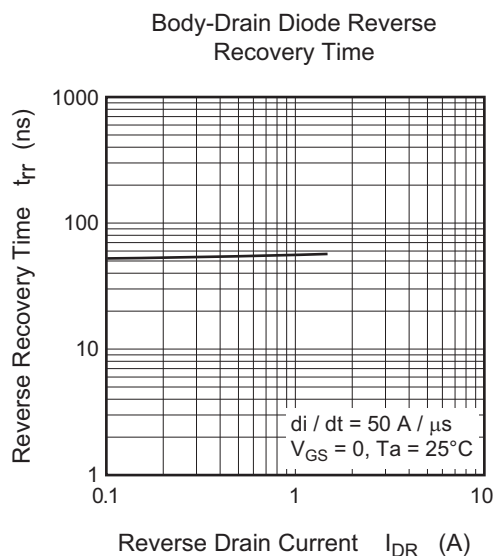
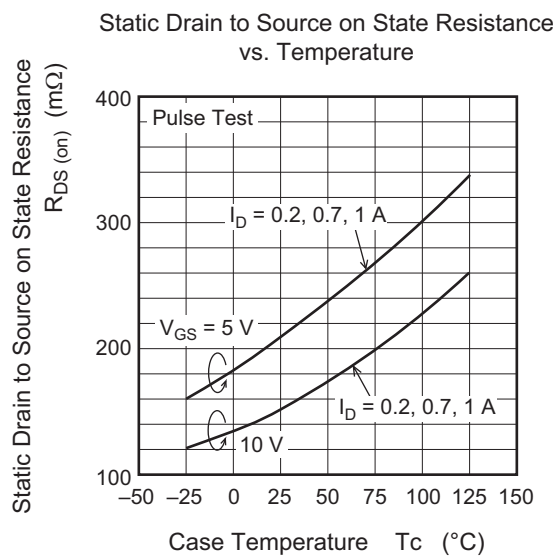


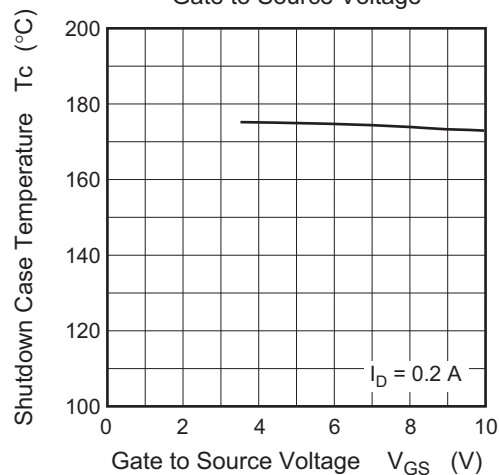
Drain to Source Saturation Voltage vs. Gate to Source Voltage



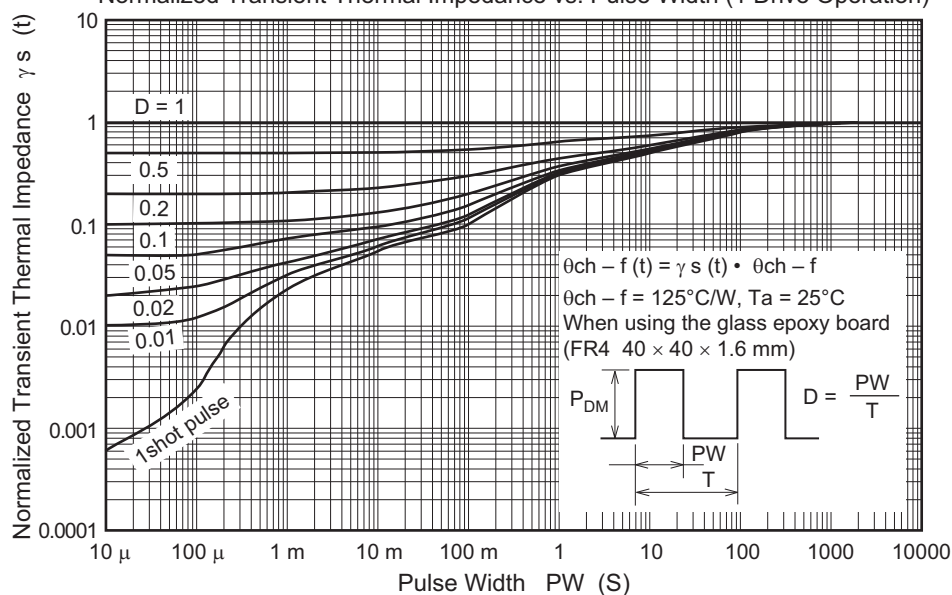
Static Drain to Source on State Resistance vs. Drain Current



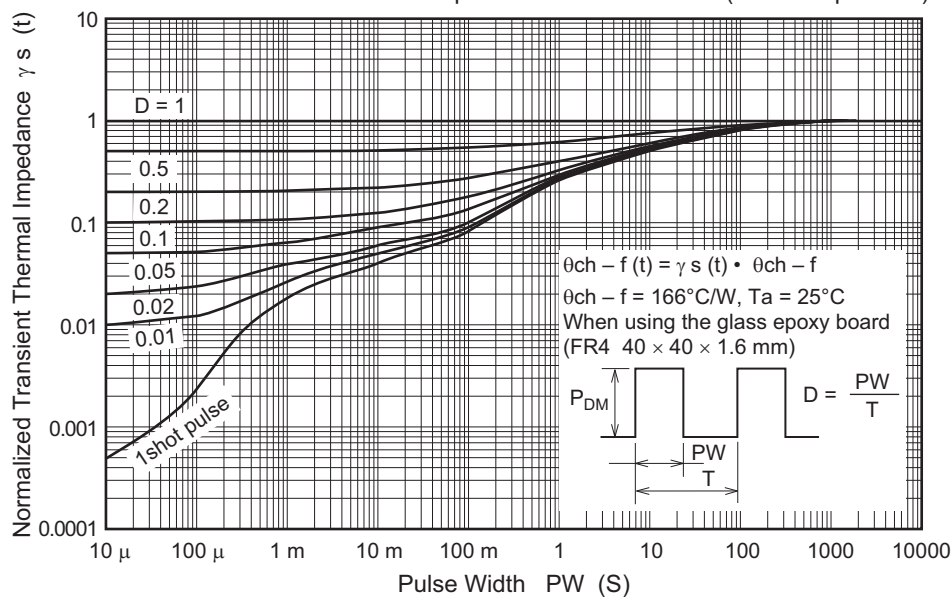


Shutdown Case Temperature vs.
Gate to Source Voltage

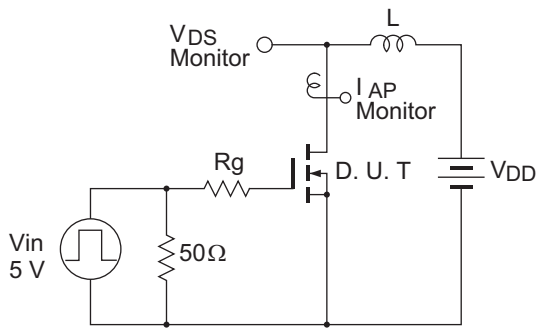
Normalized Transient Thermal Impedance vs. Pulse Width (1 Drive Operation)



Normalized Transient Thermal Impedance vs. Pulse Width (2 Drive Operation)

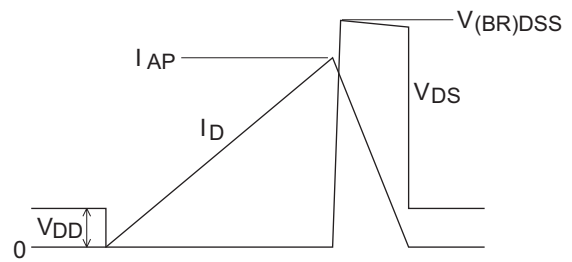


Avalanche Test Circuit

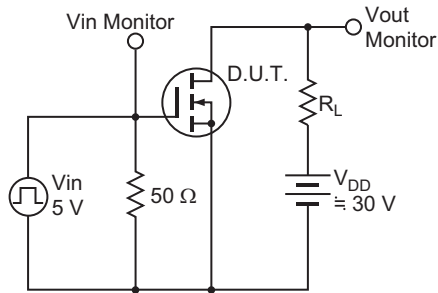


Avalanche Waveform

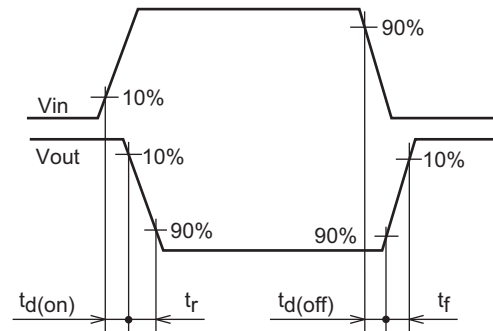
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



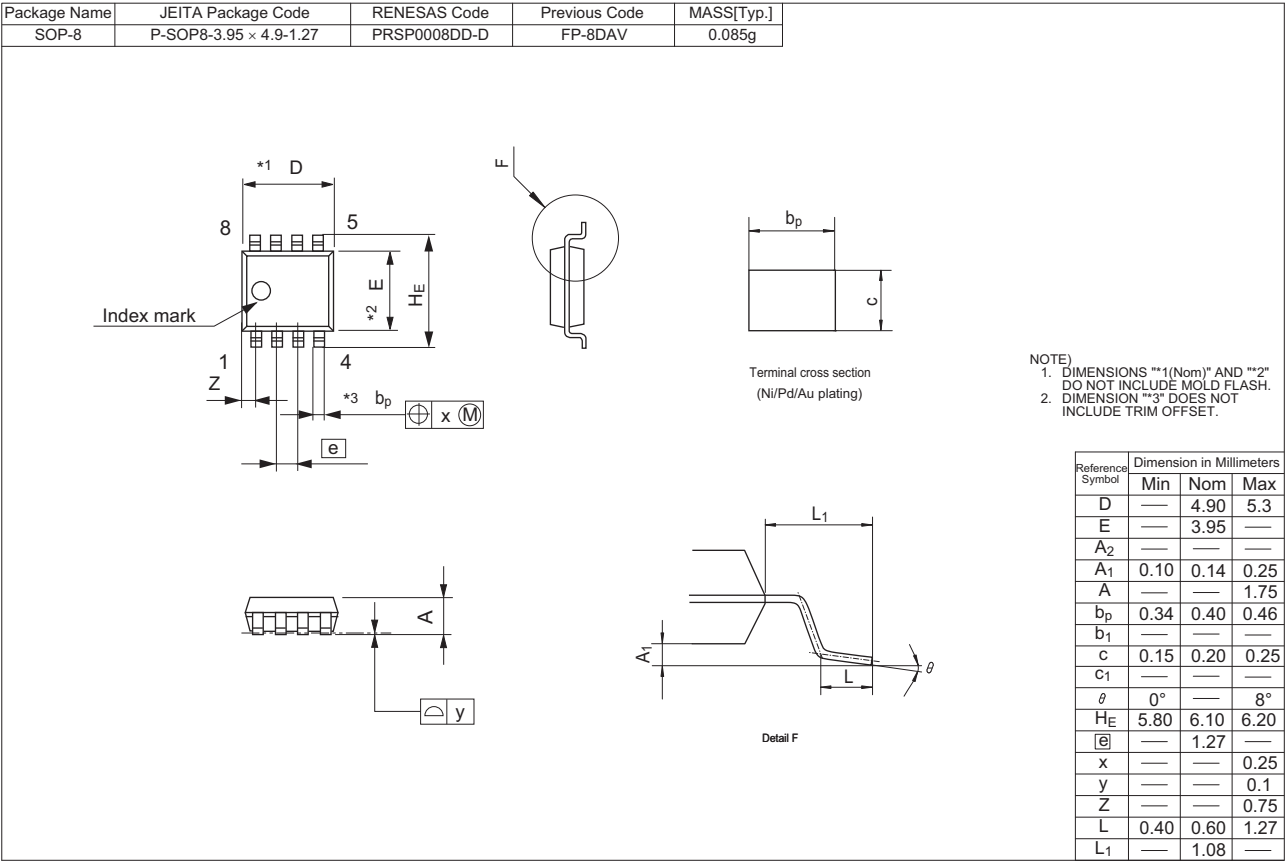
Switching Time Test Circuit



Waveform



Package Dimensions



Ordering Information

Orderable Part Number	Quantity	Shipping Container
RJF0610JSP-00#J0	2500 pcs	Taping (Reel)

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Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

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80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

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Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL II Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
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