

To our customers,

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# HAF1010RJ

## Silicon P Channel MOS FET Series Power Switching

REJ03G0573-0100

Rev.1.00

Mar.03.2005

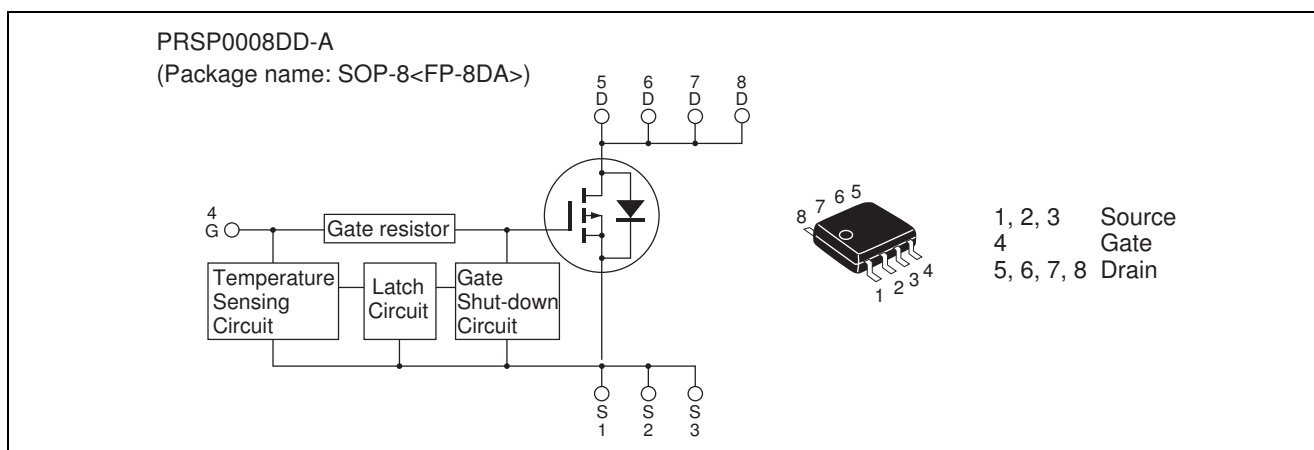
### Description

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 to (-4 to -6 V Gate drive)
- Built-in the over temperature shut-down circuit
- High endurance capability against to the shut-down circuit
- Latch type shut down operation (need 0 voltage recovery)
- High density mounting

### Outline



### Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V <sub>DSS</sub>	-60	V
Gate to source voltage	V <sub>GSS</sub>	-16	V
Gate to source voltage	V <sub>GSS</sub>	2.5	V
Drain current	I <sub>D</sub>	-5	A
Drain peak current	I <sub>D (pulse)</sub> <sup>Note1</sup>	-10	A
Body-drain diode reverse drain current	I <sub>DR</sub>	-5	A
Channel dissipation	P <sub>ch</sub> <sup>Note2</sup>	2.5	W
Channel temperature	T <sub>ch</sub>	150	°C
Storage temperature	T <sub>stg</sub>	-55 to +150	°C

Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%

2. When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), PW ≤ 10s

## 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> = -8V, V <sub>DS</sub> = 0
	I <sub>IH2</sub>	—	—	-50	μA	V <sub>i</sub> = -3.5V, V <sub>DS</sub> = 0
	I <sub>IL</sub>	—	—	-1	μA	V <sub>i</sub> = -1.2V, V <sub>DS</sub> = 0
Input current (Gate shut down)	I <sub>IH(sd)1</sub>	—	-0.8	—	mA	V <sub>i</sub> = -8V, V <sub>DS</sub> = 0
	I <sub>IH(sd)2</sub>	—	-0.35	—	mA	V <sub>i</sub> = -3.5V, 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	

## Electrical Characteristics

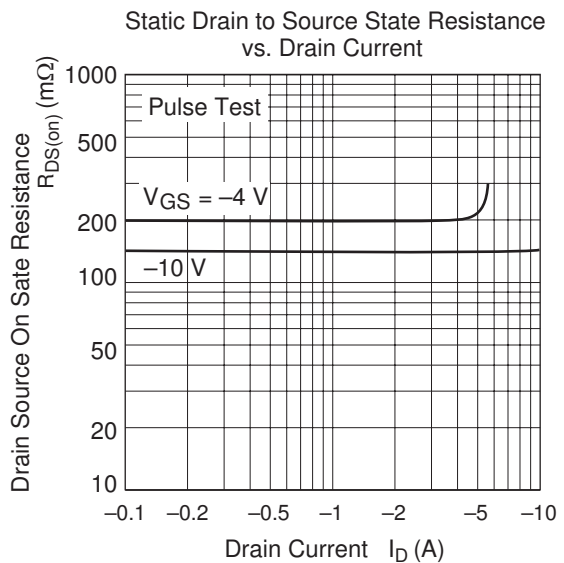
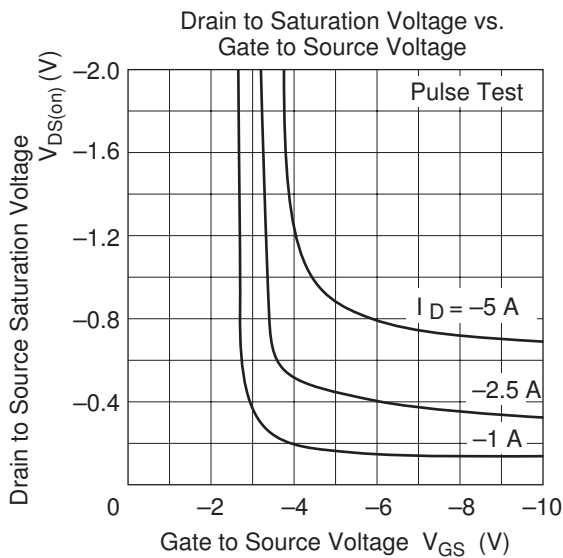
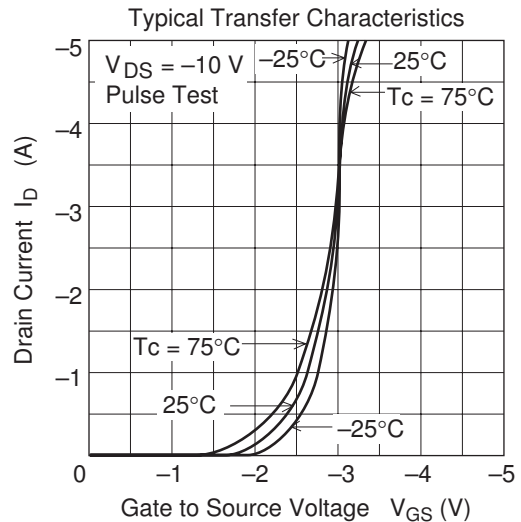
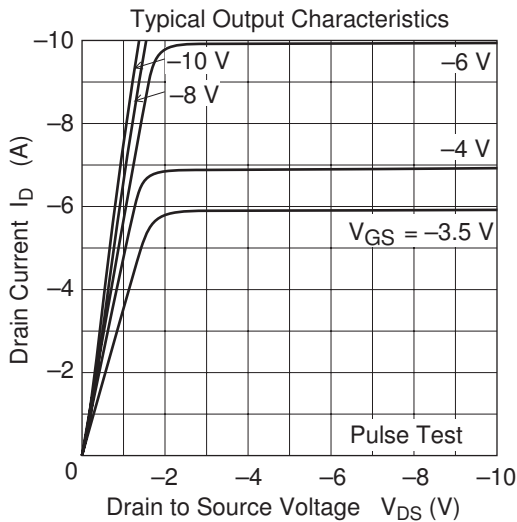
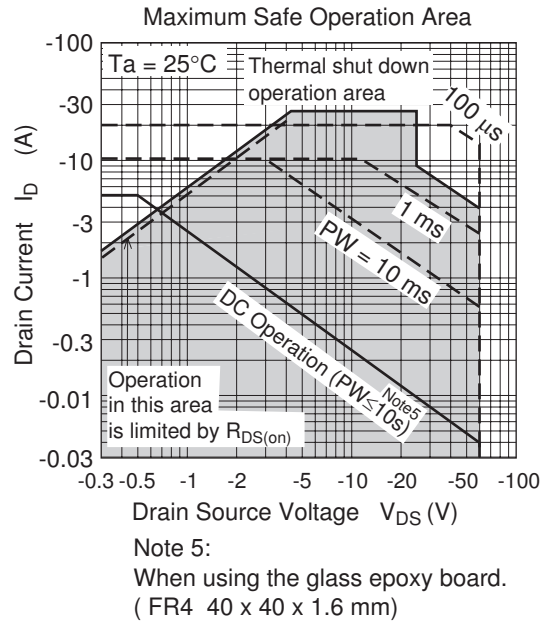
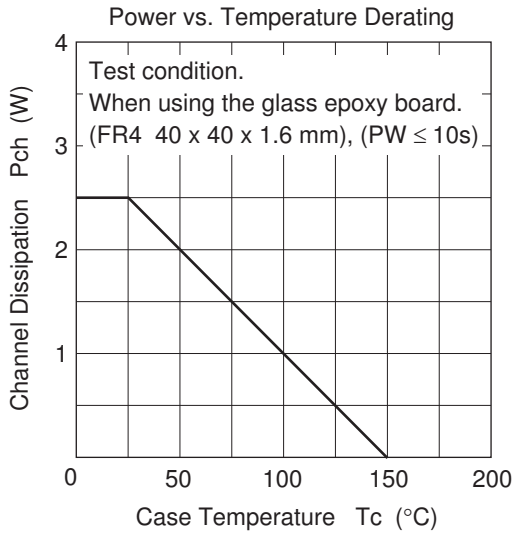
(Ta = 25°C)

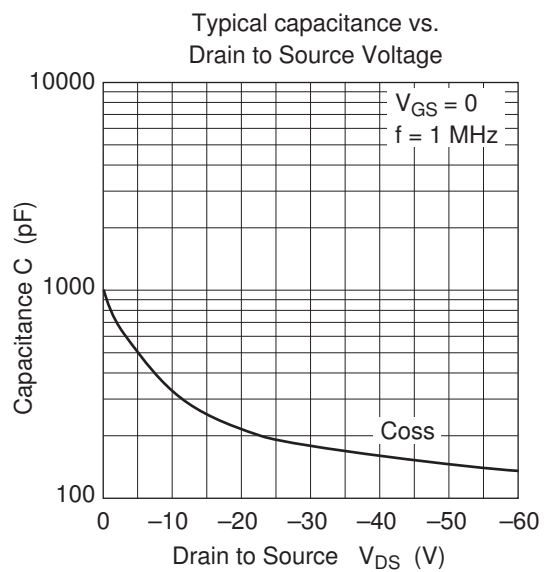
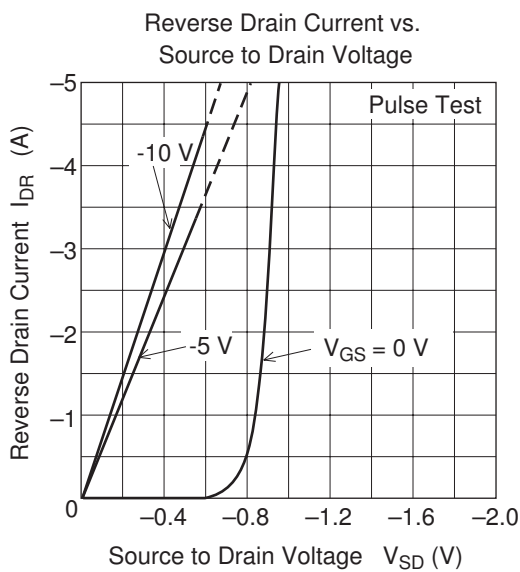
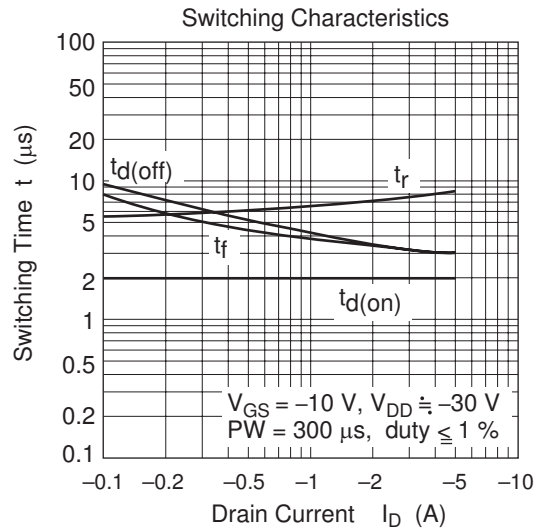
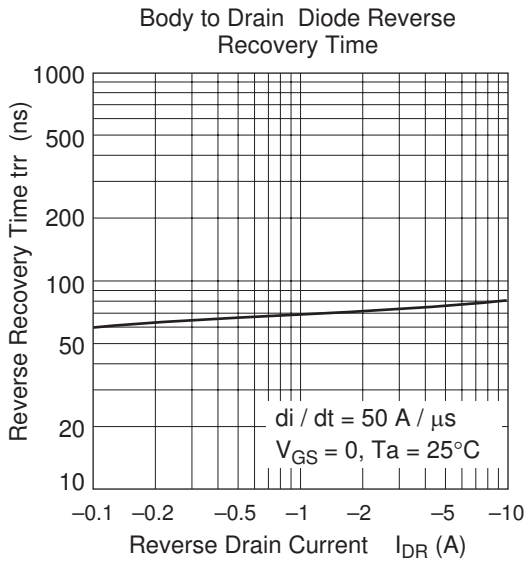
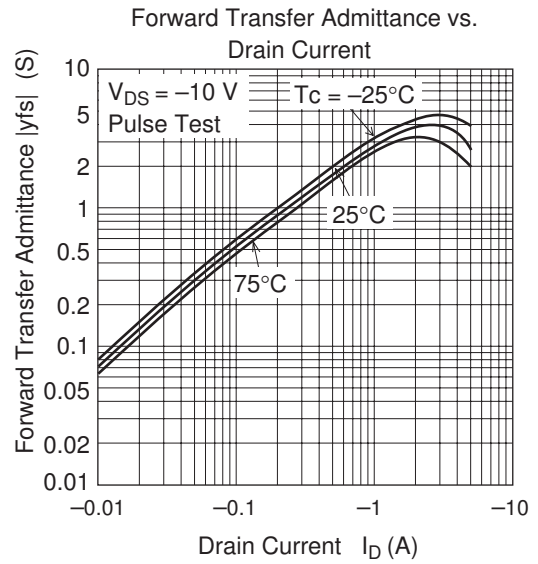
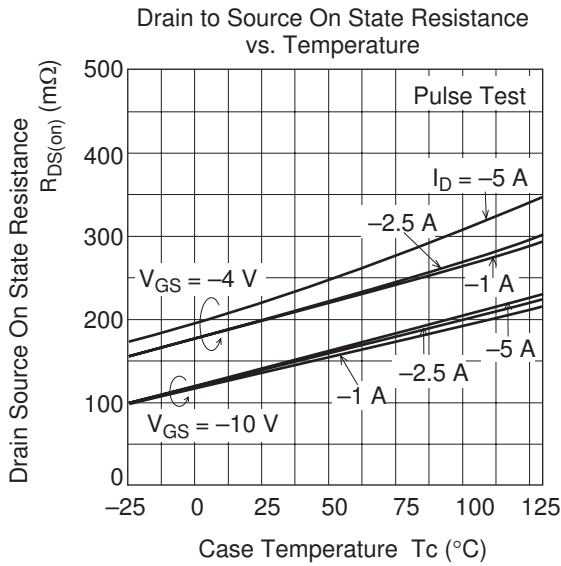
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I <sub>D1</sub>	-1.5	—	—	A	V <sub>GS</sub> = -3.5 V, V <sub>DS</sub> = -2 V
Drain current	I <sub>D2</sub>	—	—	-10	mA	V <sub>GS</sub> = -1.2 V, V <sub>DS</sub> = -2 V
Drain to source breakdown voltage	V <sub>(BR)DSS</sub>	-60	—	—	V	I <sub>D</sub> = -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
Gate to source breakdown voltage	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> = -60 V, V <sub>GS</sub> = 0
Gate to source cut off voltage	V <sub>GS(off)</sub>	-1.1	—	-2.25	V	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1 mA
Forward transfer admittance	y <sub>fs</sub>	2	4	—	S	I <sub>D</sub> = -2.5 A, V <sub>DS</sub> = -10 V <sup>note3</sup>
Static drain to source on state resistance	R <sub>DS(on)</sub>	—	200	340	mΩ	I <sub>D</sub> = -2.5 A, V <sub>GS</sub> = -4 V <sup>note3</sup>
	R <sub>DS(on)</sub>	—	140	200	mΩ	I <sub>D</sub> = -2.5 A, V <sub>GS</sub> = -10 V <sup>note3</sup>
Output capacitance	C <sub>oss</sub>	—	326	—	pF	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0, f = 1 MHz
Turn-on delay time	t <sub>d(on)</sub>	—	2	—	μs	V <sub>GS</sub> = -5 V, I <sub>D</sub> = -2.5 A, R <sub>L</sub> = 12 Ω
Rise time	t <sub>r</sub>	—	7.6	—	μs	
Turn off delay time	t <sub>d(off)</sub>	—	3.2	—	μs	
Fall time	t <sub>f</sub>	—	3.2	—	μs	
Body-drain diode forward voltage	V <sub>DF</sub>	—	-0.9	—	V	I <sub>F</sub> = -5 A, V <sub>GS</sub> = 0
Body-drain diode reverse recovery time	t <sub>rr</sub>	—	77	—	ns	I <sub>F</sub> = -5 A, V <sub>GS</sub> = 0 diF/dt = 50 A/μs
Over load shut down operation time <sup>note4</sup>	t <sub>os1</sub>	—	4.4	—	ms	V <sub>GS</sub> = -5 V, V <sub>DD</sub> = -16 V
	t <sub>os2</sub>	—	2	—	ms	V <sub>GS</sub> = -5 V, V <sub>DD</sub> = -24 V

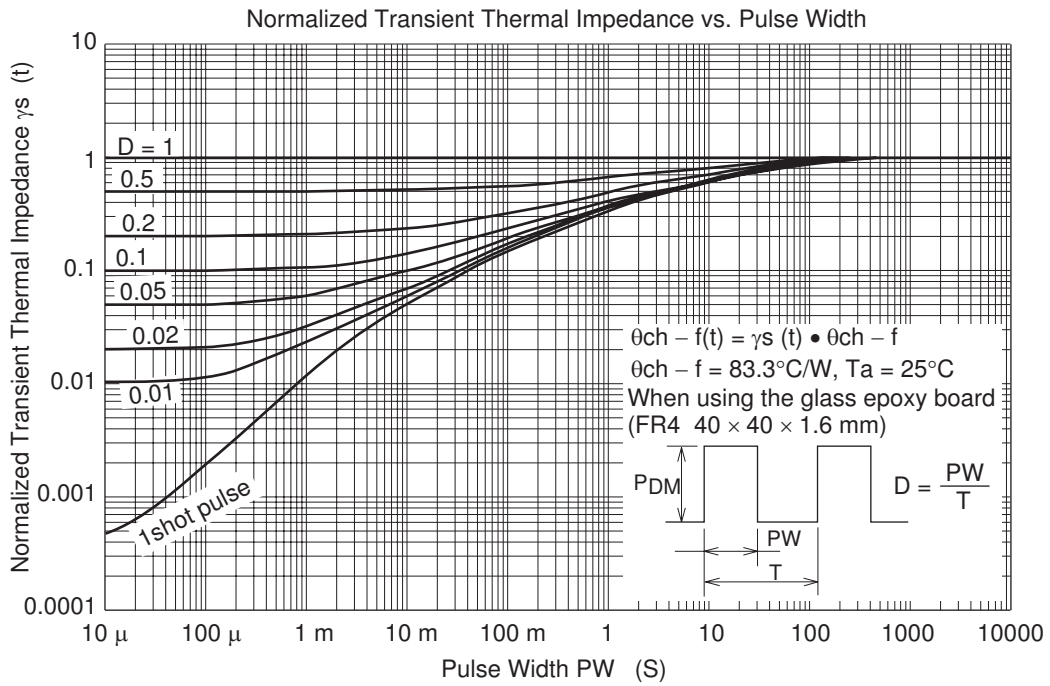
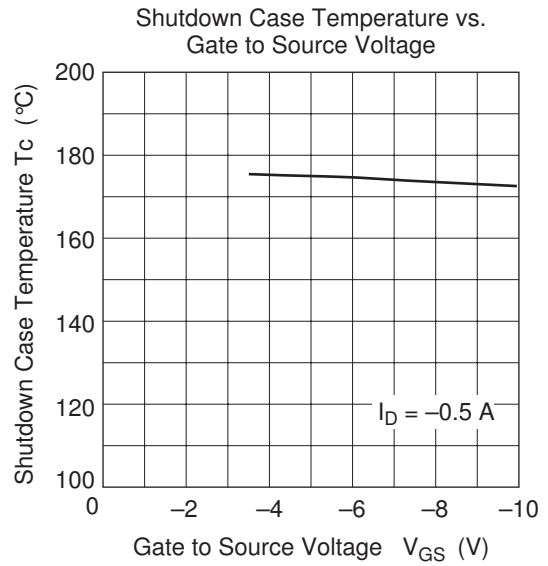
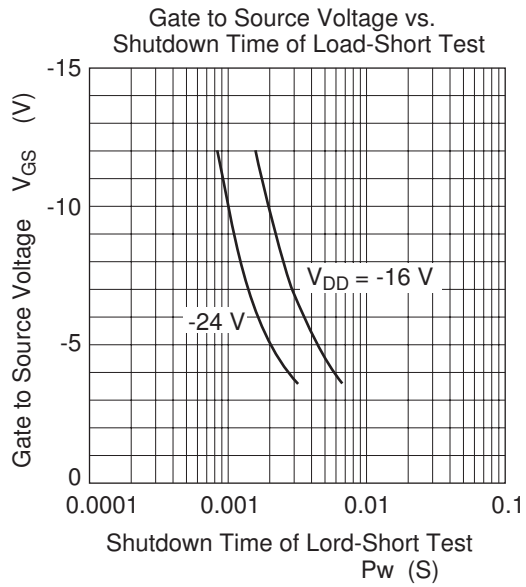
Notes: 3. Pulse test

4. Including the junction temperature rise of the lorted condition

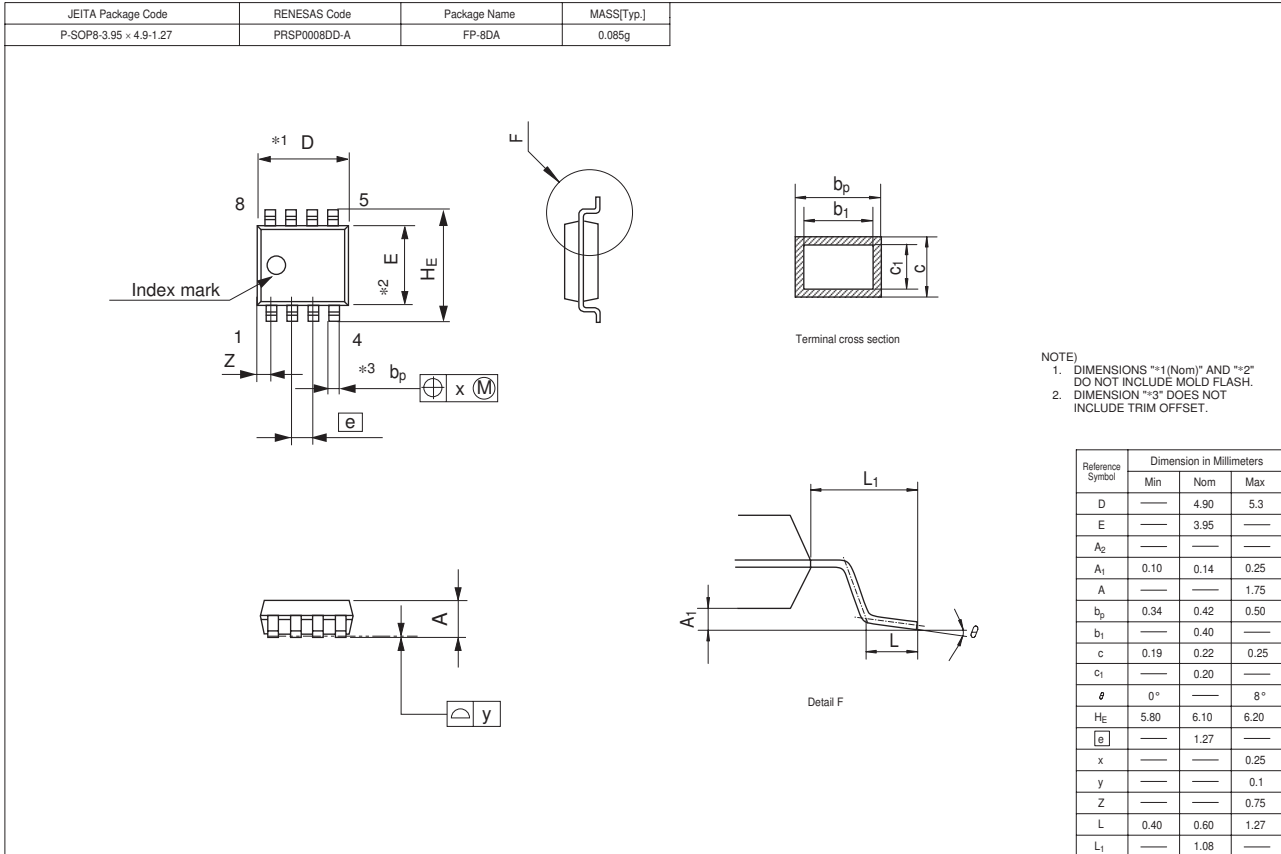
## Main Characteristics







### Package Dimensions



### Ordering Information

Part Name	Quantity	Shipping Container
HAF1010RJ	2500 pcs/ Reel	Embossed tape (Reel)

Note: For some grades, production may be terminated.  
 Please contact the Renesas sales office to check the state of production before ordering the product.



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