

To our customers,

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## Old Company Name in Catalogs and Other Documents

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

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# HAF2012(L), HAF2012(S)

Silicon N Channel MOS FET Series  
Power Switching

REJ03G1139-0400

Rev.4.00

Jul 13, 2007

## Description

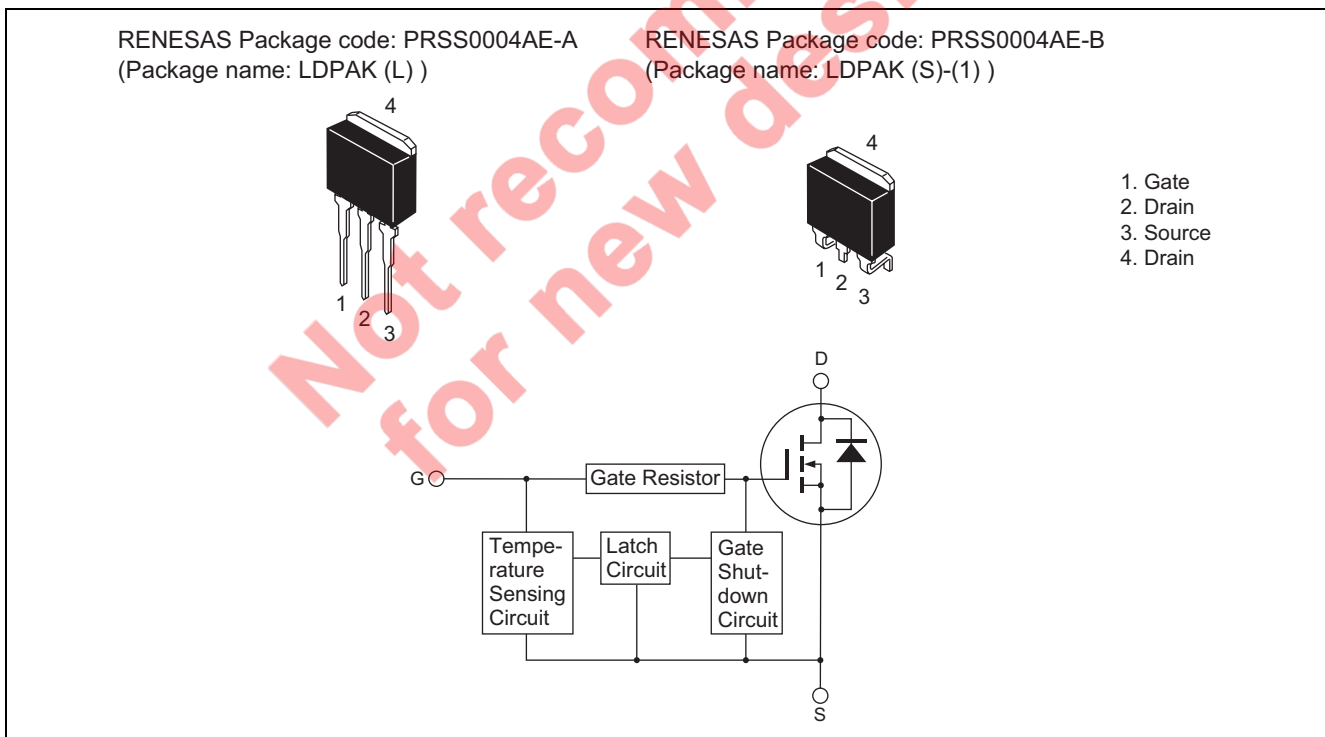
This FET has the over temperature shut-down capability sensing to the junction temperature.

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

## Outline



## Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Value	Unit
Drain to source voltage	V <sub>DSS</sub>	60	V
Gate to source voltage	V <sub>GSS</sub>	16	V
	V <sub>GSS</sub>	-2.8	V
Drain current	I <sub>D</sub>	20	A
Drain peak current	I <sub>D (pulse)</sub> <sup>Note 1</sup>	40	A
Body-drain diode reverse drain current	I <sub>DR</sub>	20	A
Channel dissipation	P <sub>ch</sub> <sup>Note 2</sup>	50	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. Value at Ta = 25°C

## 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	—	13	V	

Not recommended  
for new designs

## Electrical Characteristics

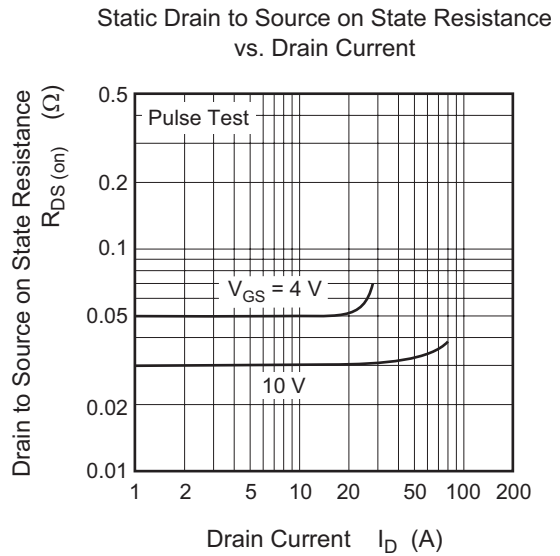
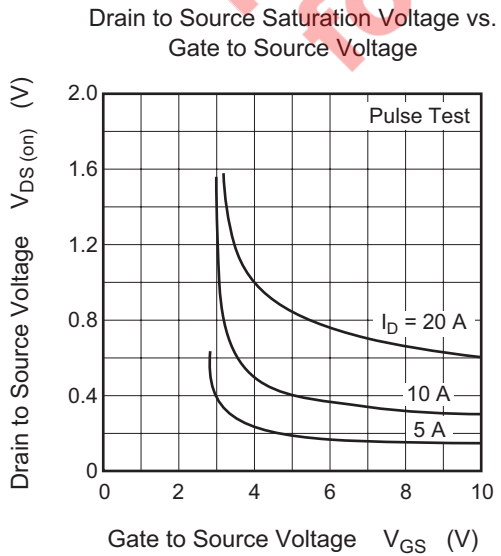
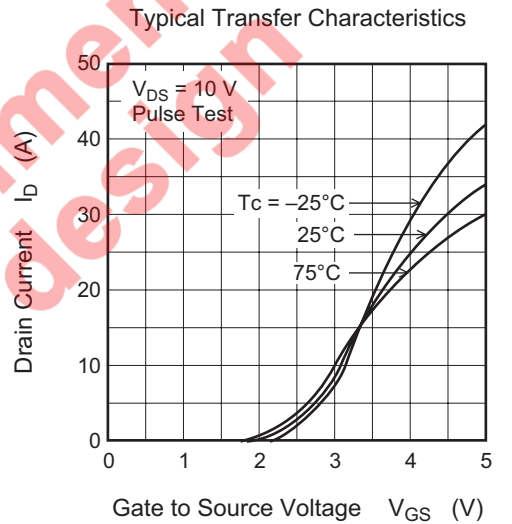
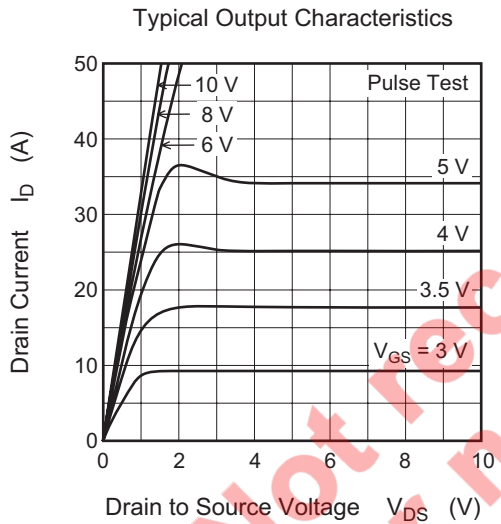
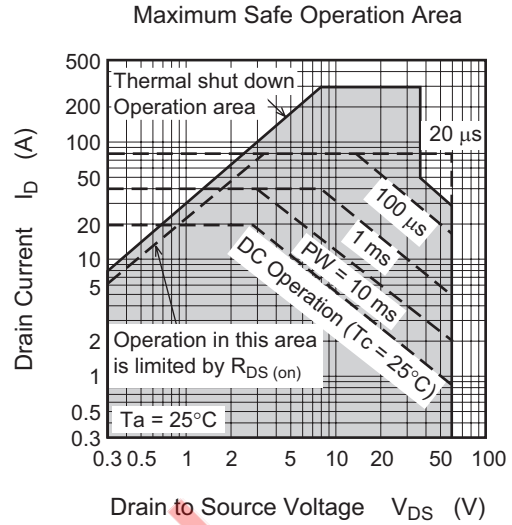
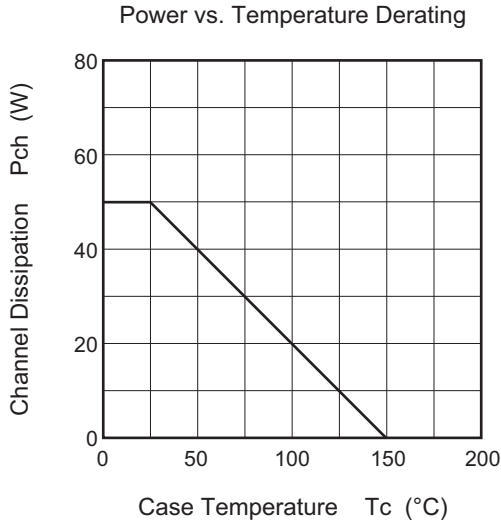
(Ta = 25°C)

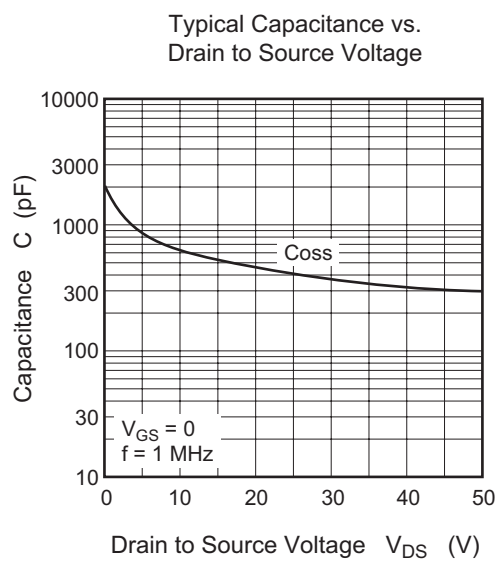
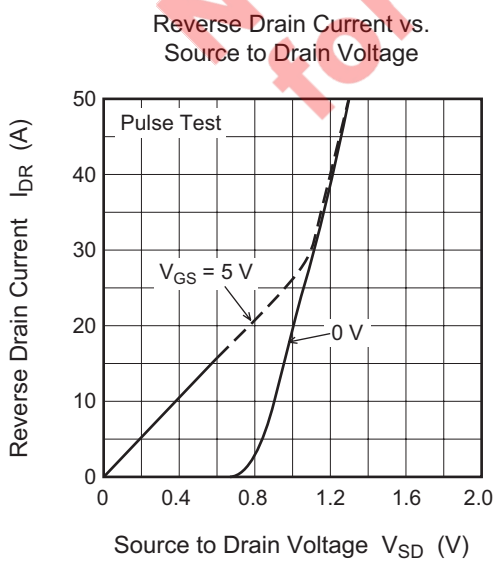
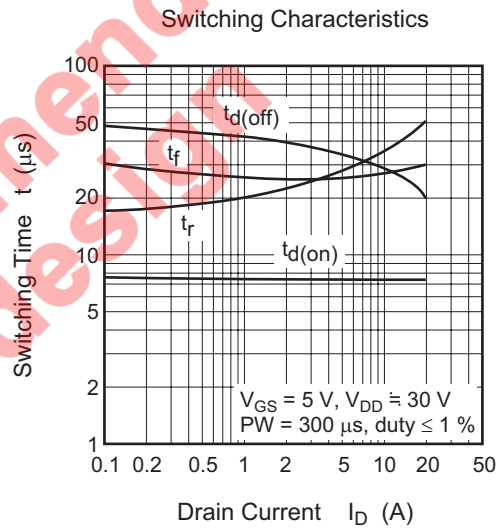
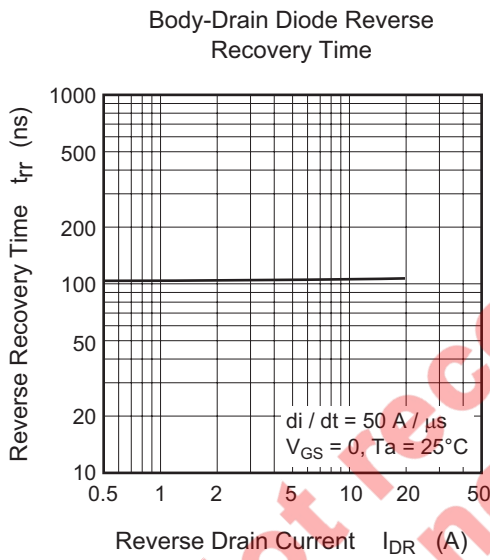
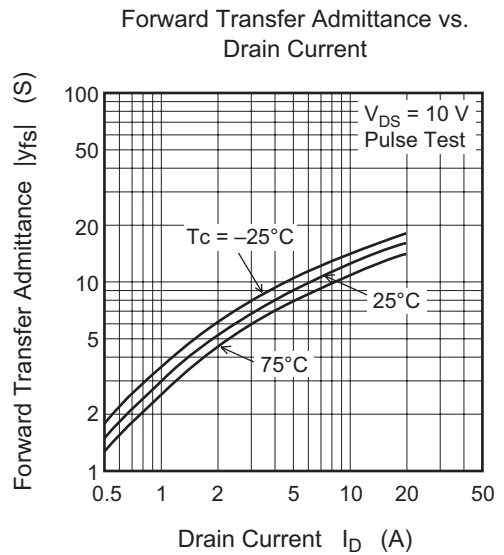
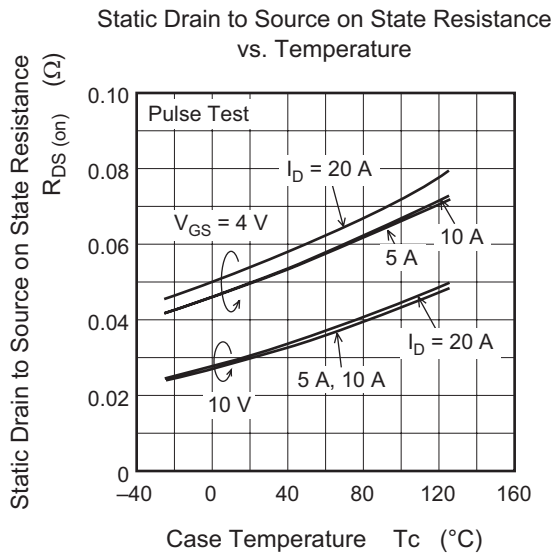
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	10	—	—	A	$V_{GS} = 3.5 \text{ V}, V_{DS} = 2 \text{ V}$
	$I_{D2}$	—	—	10	mA	$V_{GS} = 1.2 \text{ V}, V_{DS} = 2 \text{ V}$
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	$I_D = 10 \text{ mA}, V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	16	—	—	V	$I_G = 100 \mu\text{A}, V_{DS} = 0$
	$V_{(BR)GSS}$	-2.8	—	—	V	$I_G = -100 \mu\text{A}, V_{DS} = 0$
Gate to source leak current	$I_{GSS1}$	—	—	100	$\mu\text{A}$	$V_{GS} = 8 \text{ V}, V_{DS} = 0$
	$I_{GSS2}$	—	—	50	$\mu\text{A}$	$V_{GS} = 3.5 \text{ V}, V_{DS} = 0$
	$I_{GSS3}$	—	—	1	$\mu\text{A}$	$V_{GS} = 1.2 \text{ V}, V_{DS} = 0$
	$I_{GSS4}$	—	—	-100	$\mu\text{A}$	$V_{GS} = -2.4 \text{ V}, V_{DS} = 0$
Input current (shut down)	$I_{GS(op)1}$	—	0.8	—	mA	$V_{GS} = 8 \text{ V}, V_{DS} = 0$
	$I_{GS(op)2}$	—	0.35	—	mA	$V_{GS} = 3.5 \text{ V}, V_{DS} = 0$
Zero gate voltage drain current	$I_{DSS}$	—	—	250	$\mu\text{A}$	$V_{DS} = 50 \text{ V}, V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.25	V	$I_D = 1 \text{ mA}, V_{DS} = 10 \text{ V}$
Static drain to source on state resistance	$R_{DS(on)}$	—	50	65	$\text{m}\Omega$	$I_D = 10 \text{ A}, V_{GS} = 4 \text{ V}$ <sup>Note 3</sup>
	$R_{DS(on)}$	—	30	43	$\text{m}\Omega$	$I_D = 10 \text{ A}, V_{GS} = 10 \text{ V}$ <sup>Note 3</sup>
Forward transfer admittance	$ y_{fs} $	6	12	—	S	$I_D = 10 \text{ A}, V_{DS} = 10 \text{ V}$ <sup>Note 3</sup>
Output capacitance	$C_{oss}$	—	630	—	pF	$V_{DS} = 10 \text{ V}, V_{GS} = 0$ $f = 1 \text{ MHz}$
Turn-on delay time	$t_{d(on)}$	—	7.5	—	$\mu\text{s}$	$I_D = 5 \text{ A}$ $V_{GS} = 5 \text{ V}$ $R_L = 6 \Omega$
Rise time	$t_r$	—	29	—	$\mu\text{s}$	
Turn-off delay time	$t_{d(off)}$	—	34	—	$\mu\text{s}$	
Fall time	$t_f$	—	26	—	$\mu\text{s}$	
Body-drain diode forward voltage	$V_{DF}$	—	1.0	—	V	$I_F = 20 \text{ A}, V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	110	—	ns	$I_F = 20 \text{ A}, V_{GS} = 0$ $di_F/dt = 50 \text{ A}/\mu\text{s}$
Over load shut down operation time <sup>Note4</sup>	$t_{os1}$	—	1.8	—	ms	$V_{GS} = 5 \text{ V}, V_{DD} = 12 \text{ V}$
	$t_{os2}$	—	0.7	—	ms	$V_{GS} = 5 \text{ V}, V_{DD} = 24 \text{ V}$

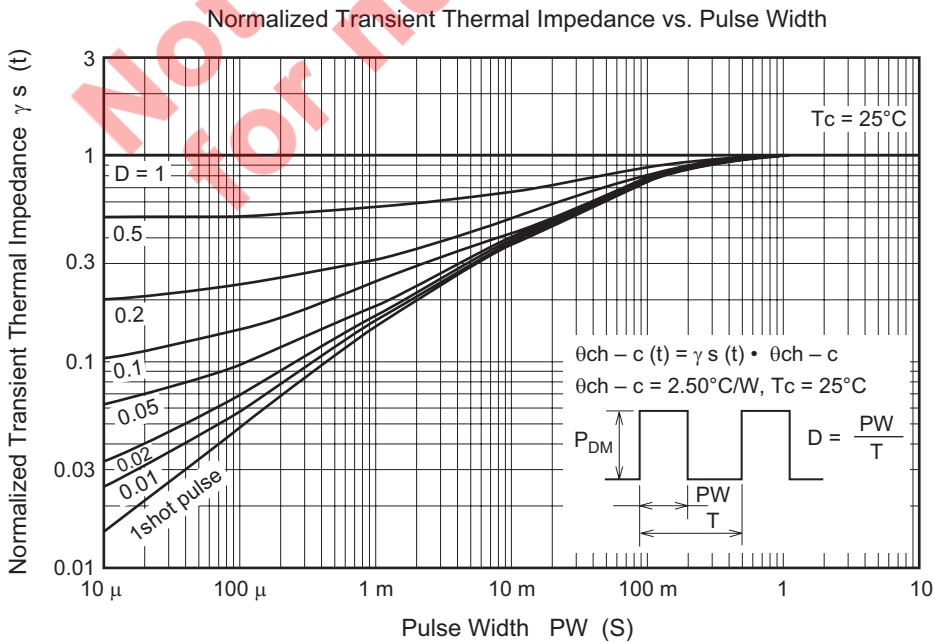
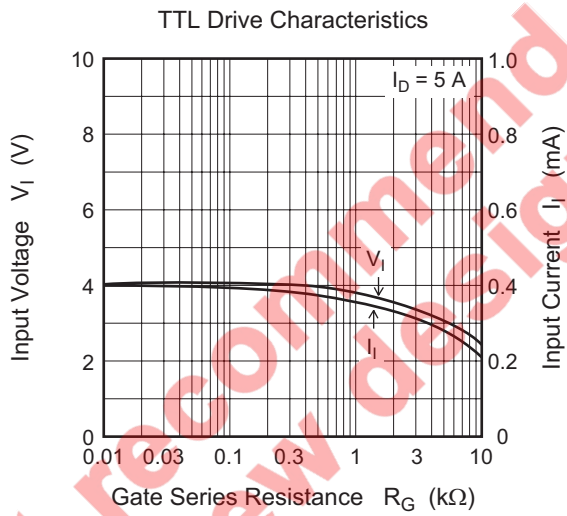
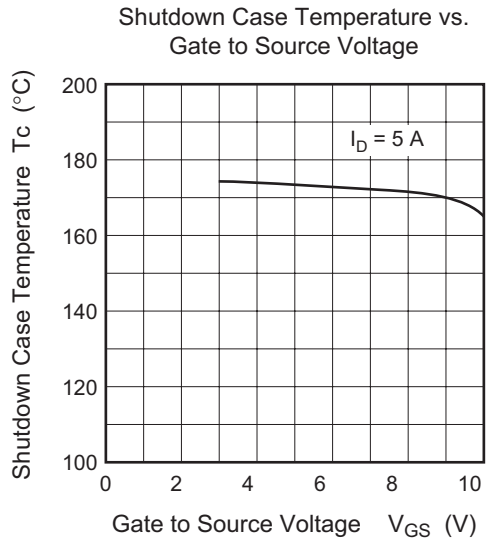
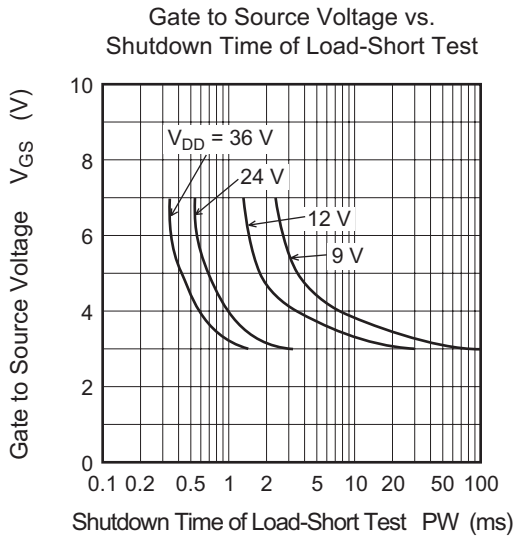
Notes: 3. Pulse test

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

Main Characteristics

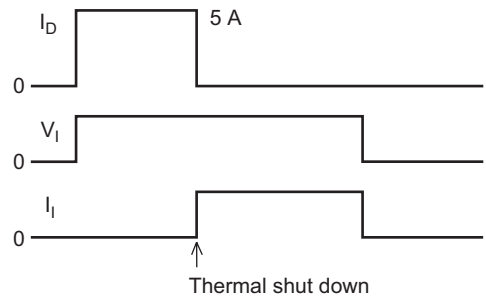
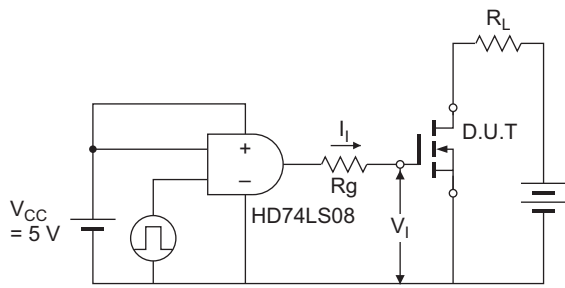




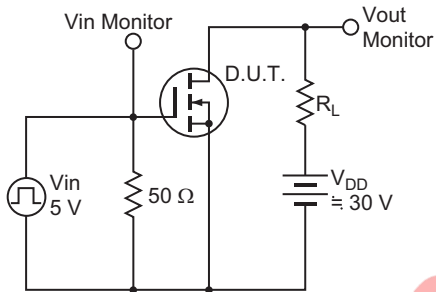




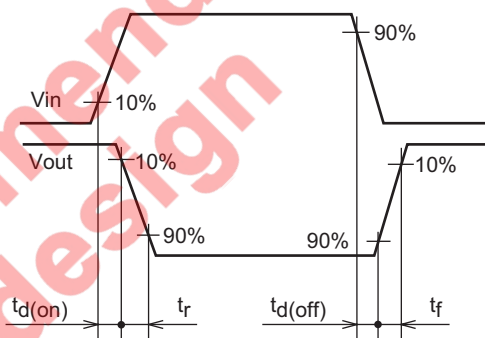
Test Circuit



Switching Time Test Circuit



Waveform

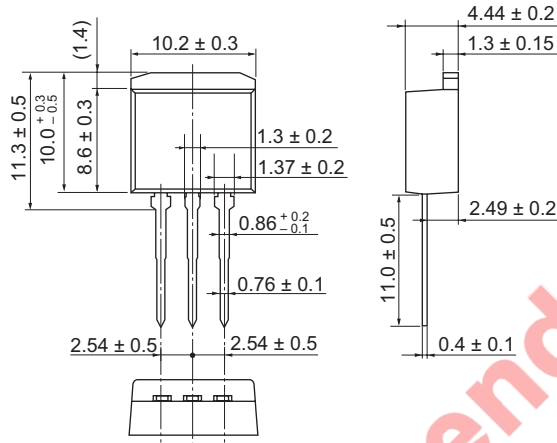


Not recommended for new design

Package Dimensions

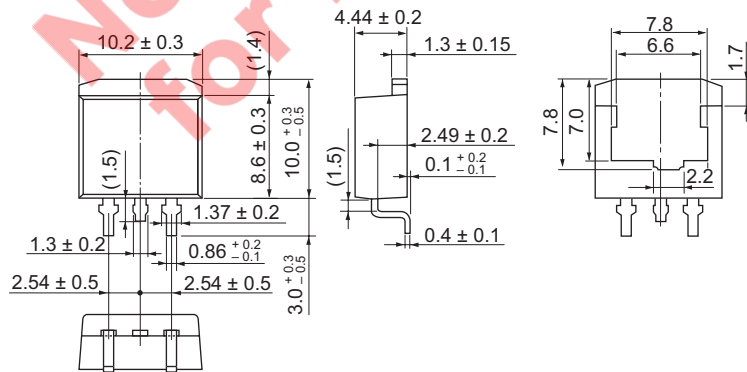
Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
LDBPAK(L)	—	PRSS0004AE-A	LDBPAK(L) / LDBPAK(L)V	1.40g

Unit: mm



Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
LDBPAK(S)-(1)	SC-83	PRSS0004AE-B	LDBPAK(S)-(1) / LDBPAK(S)-(1)V	1.30g

Unit: mm



### Ordering Information

Part Name	Quantity	Shipping Container
HAF2012-90L	Max: 50 pcs/sack	Sack
HAF2012-90S	Max: 50 pcs/sack	Sack
HAF2012-90STL	1000 pcs/Reel	Embossed tape
HAF2012-90STR	1000 pcs/Reel	Embossed tape

**Not recommend  
for new design**

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