

# HAF2011(L), HAF2011(S)

Silicon N Channel MOS FET Series  
Power Switching

REJ03G1138-0500

Rev.5.00

Aug 21, 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

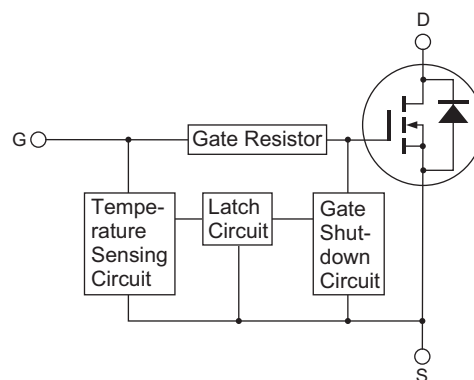
RENESAS Package code: PRSS0004AE-A  
(Package name: LDKPAK (L) )



RENESAS Package code: PRSS0004AE-B  
(Package name: LDKPAK (S)-(1) )



1. Gate
2. Drain
3. Source
4. Drain



## 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>	-2.5	V
Drain current	I <sub>D</sub>	40	A
Drain peak current	I <sub>D (pulse)</sub> <sup>Note 1</sup>	80	A
Body-drain diode reverse drain current	I <sub>DR</sub>	40	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 Tc = 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	Vi = 8 V, V <sub>DS</sub> = 0
	I <sub>IH2</sub>	—	—	50	μA	Vi = 3.5 V, V <sub>DS</sub> = 0
	I <sub>IL</sub>	—	—	1	μA	Vi = 1.2 V, V <sub>DS</sub> = 0
Input current (Gate shut down)	I <sub>IH (sd) 1</sub>	—	0.8	—	mA	Vi = 8 V, V <sub>DS</sub> = 0
	I <sub>IH (sd) 2</sub>	—	0.35	—	mA	Vi = 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	

## Electrical Characteristics

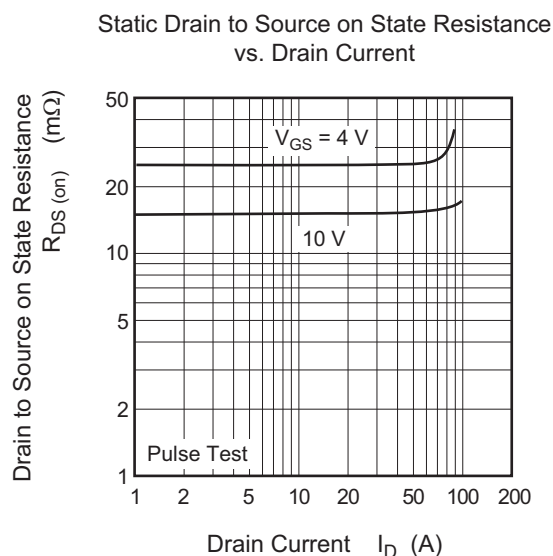
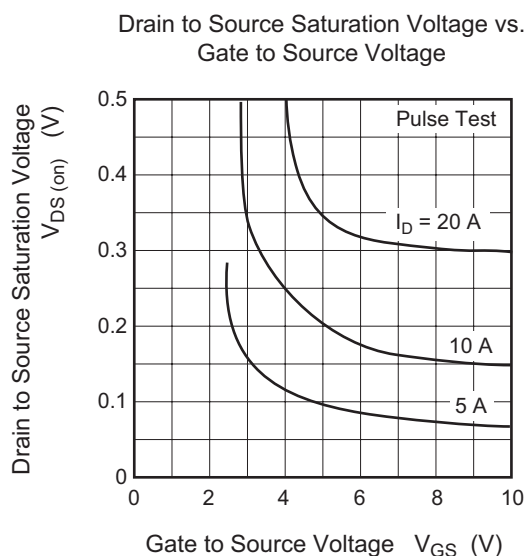
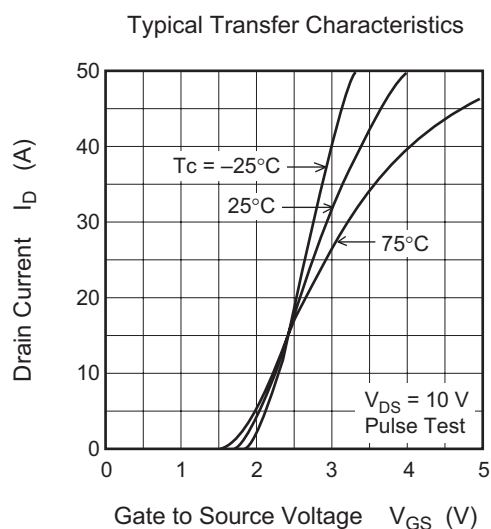
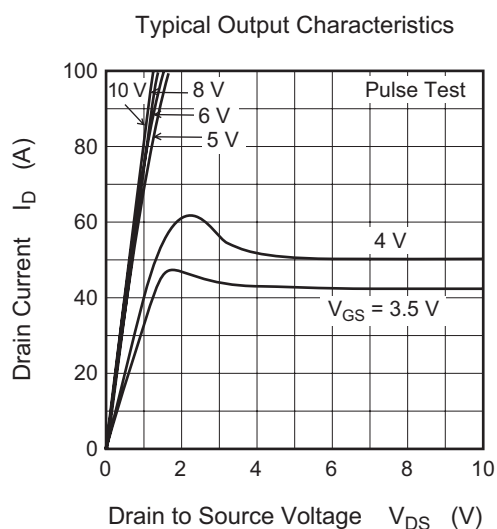
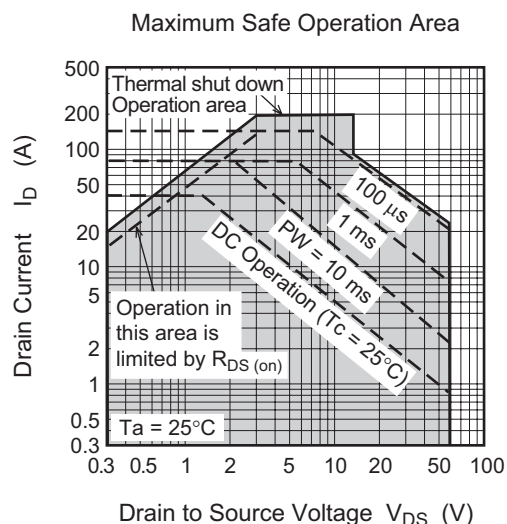
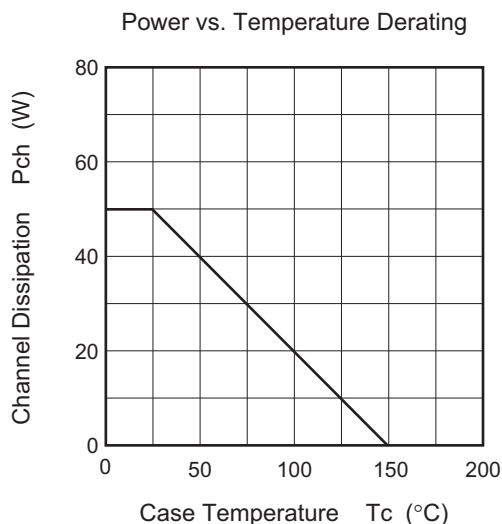
(Ta = 25°C)

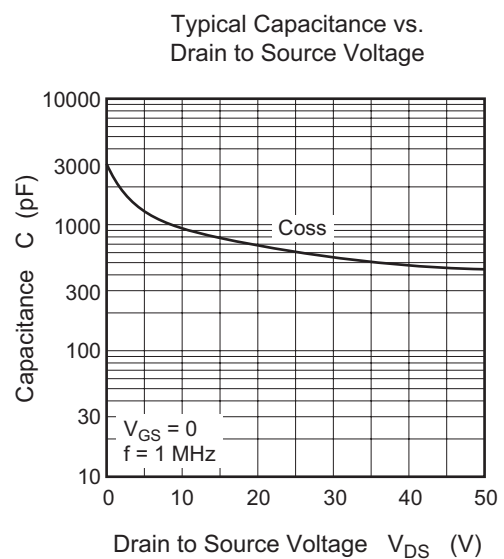
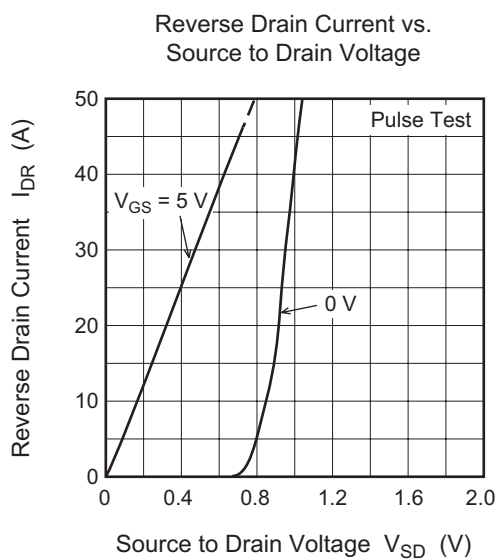
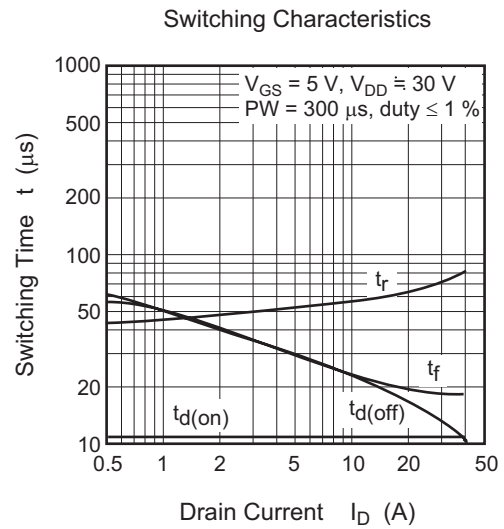
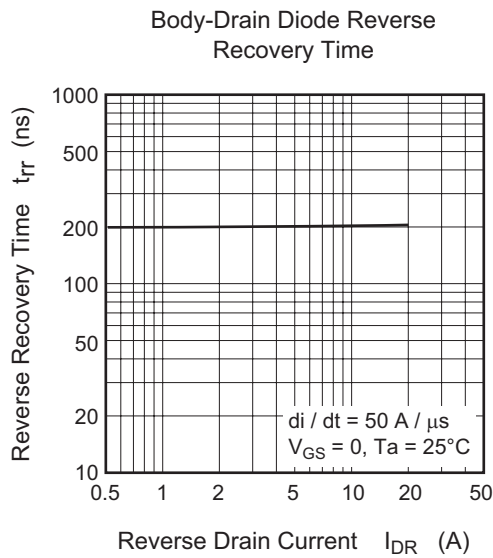
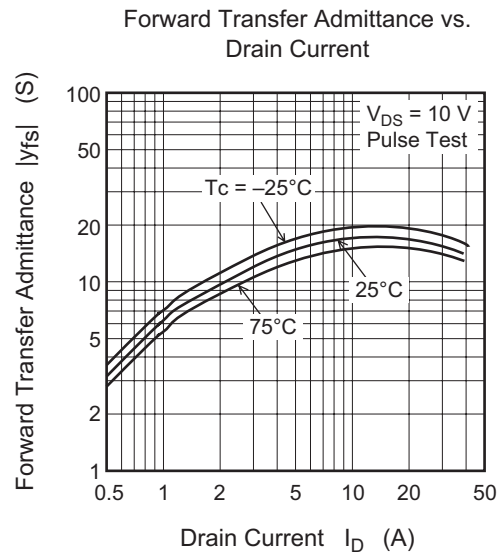
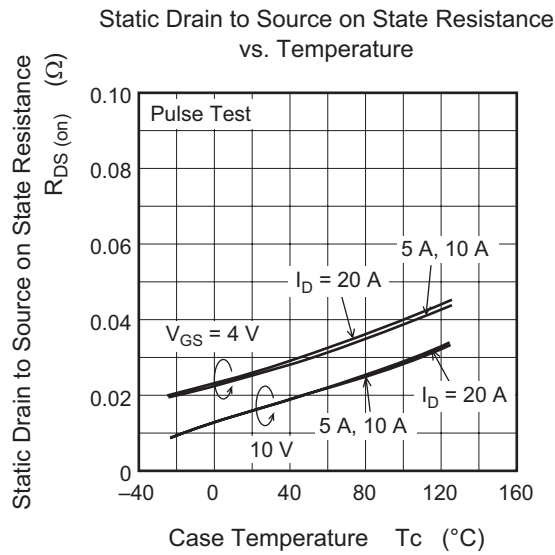
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	15	—	—	A	$V_{GS} = 3.5 \text{ V}$ , $V_{DS} = 2 \text{ V}$
	$I_{D2}$	—	—	10	mA	$V_{GS} = 1.2 \text{ V}$ , $V_{DS} = 2 \text{ V}$
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	$I_D = 10 \text{ mA}$ , $V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	16	—	—	V	$I_G = 300 \mu\text{A}$ , $V_{DS} = 0$
	$V_{(BR)GSS}$	-2.5	—	—	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	$I_{DSS}$	—	—	10	$\mu\text{A}$	$V_{DS} = 60 \text{ V}$ , $V_{GS} = 0$
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	$R_{DS (on)}$	—	25	33	$\text{m}\Omega$	$I_D = 20 \text{ A}$ , $V_{GS} = 4 \text{ V}$ <sup>Note 3</sup>
	$R_{DS (on)}$	—	15	20	$\text{m}\Omega$	$I_D = 20 \text{ A}$ , $V_{GS} = 10 \text{ V}$ <sup>Note 3</sup>
Forward transfer admittance	$ y_{fs} $	8	16	—	S	$I_D = 20 \text{ A}$ , $V_{DS} = 10 \text{ V}$ <sup>Note 3</sup>
Output capacitance	$C_{oss}$	—	940	—	pF	$V_{DS} = 10 \text{ V}$ , $V_{GS} = 0$ $f = 1 \text{ MHz}$
Turn-on delay time	$t_{d (on)}$	—	10.7	—	$\mu\text{s}$	$I_D = 20 \text{ A}$ $V_{GS} = 5 \text{ V}$ $R_L = 1.5 \Omega$
Rise time	$t_r$	—	66	—	$\mu\text{s}$	
Turn-off delay time	$t_{d (off)}$	—	15.5	—	$\mu\text{s}$	
Fall time	$t_f$	—	19	—	$\mu\text{s}$	
Body-drain diode forward voltage	$V_{DF}$	—	1	—	V	$I_F = 40 \text{ A}$ , $V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	200	—	ns	$I_F = 40 \text{ A}$ , $V_{GS} = 0$ $di_F/dt = 50 \text{ A}/\mu\text{s}$
Over load shut down operation time <sup>Note4</sup>	$t_{os1}$	—	1	—	ms	$V_{GS} = 5 \text{ V}$ , $V_{DD} = 16 \text{ V}$

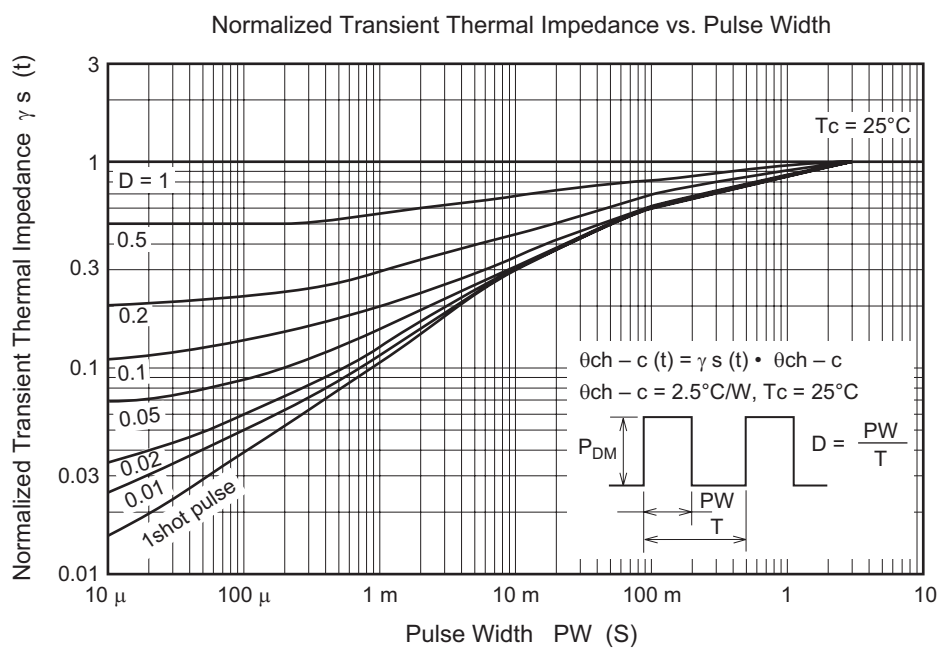
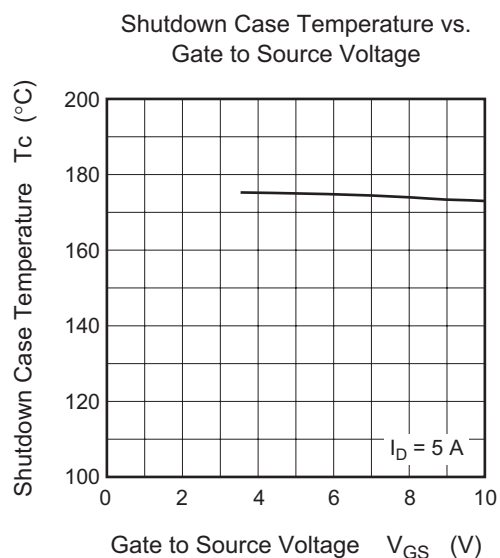
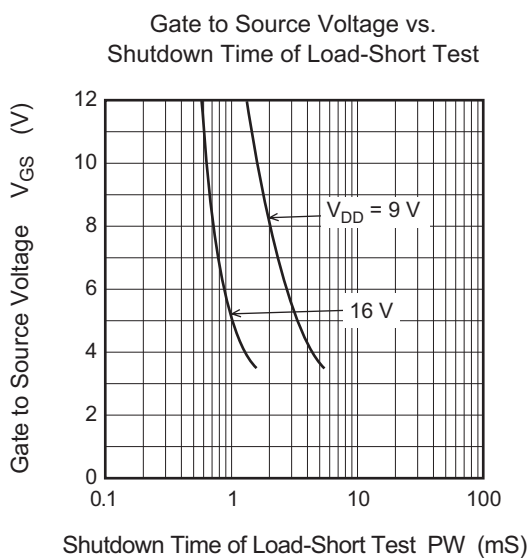
Notes: 3. Pulse test

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

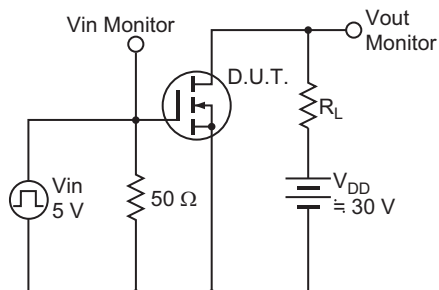
## Main Characteristics



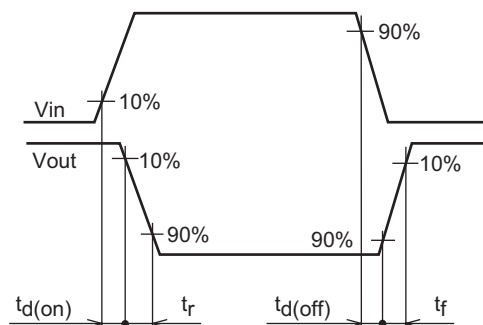




Switching Time Test Circuit



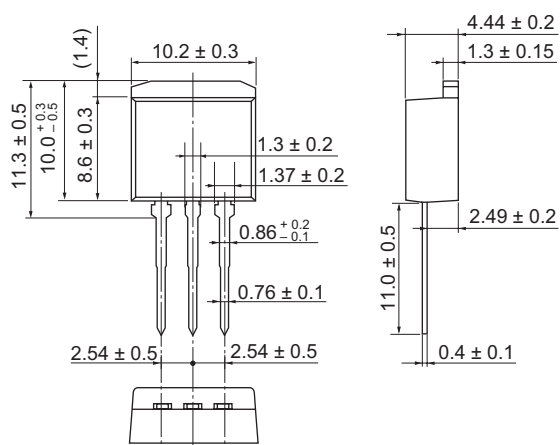
Waveform



## Package Dimensions

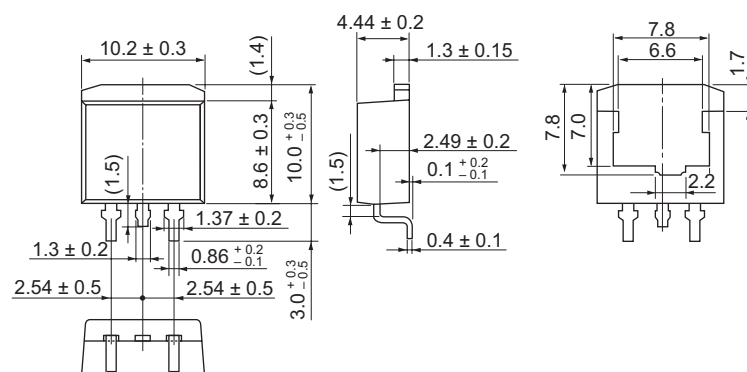
Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
LDBAK(L)	—	PRSS0004AE-A	LDBAK(L) / LDBAK(L)V	1.40g

Unit: mm



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

Unit: mm



**Ordering Information**

<b>Part No.</b>	<b>Quantity</b>	<b>Shipping Container</b>
HAF2011-90L	Max: 50 pcs/sack	Sack
HAF2011-90S	Max: 50 pcs/sack	Sack
HAF2011-90STL	1000 pcs/Reel	Embossed tape
HAF2011-90STR	1000 pcs/Reel	Embossed tape



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