

# HAF2011(L), HAF2011(S)

## Silicon N Channel MOS FET Series Power Switching

REJ03G1138-0300  
(Previous: ADE-208-738A)  
Rev.3.00  
Sep 07, 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 (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

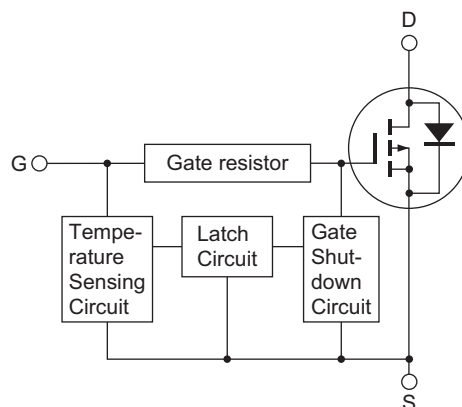
RENESAS Package code: PRSS0004AE-A  
(Package name: LDKPAK (L) )



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 Ta = 25°C

## Typical Operation Characteristics

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	

## Electrical Characteristics

(Ta = 25°C)

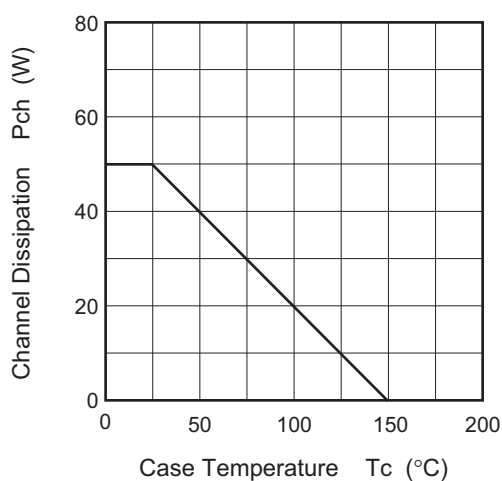
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	15	—	—	A	$V_{GS} = 3.5 \text{ V}$ , $V_{DS} = 2 \text{ V}$
	$I_{D2}$	—	—	10	mA	$V_{GS} = 1.2 \text{ V}$ , $V_{DS} = 2 \text{ V}$
Drain to source breakdown voltage	$V_{(BR) DSS}$	60	—	—	V	$I_D = 10 \text{ mA}$ , $V_{GS} = 0$
Gate to source 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

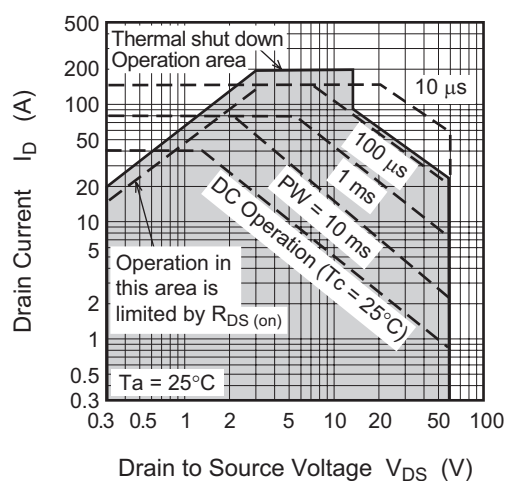
4. Including the junction temperature rise of the over loaded condition.

## Main Characteristics

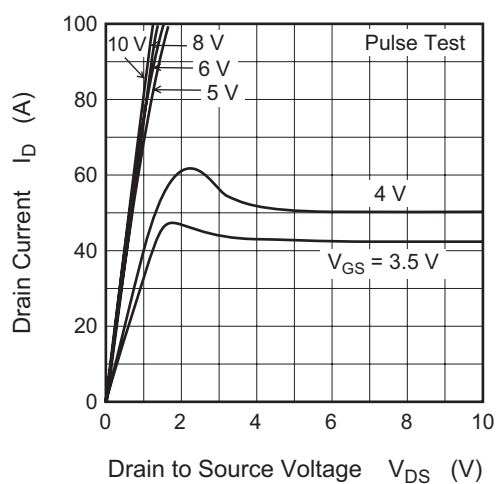
Power vs. Temperature Derating



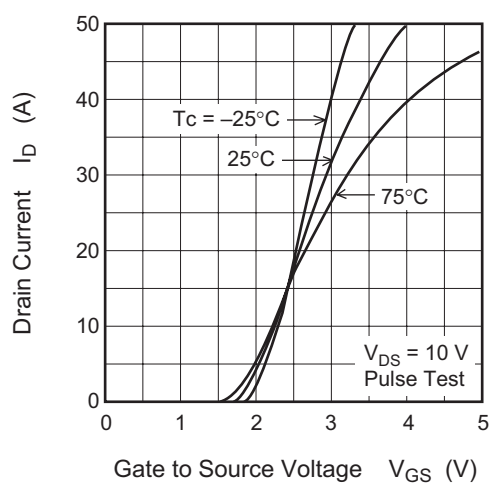
Maximum Safe Operation Area



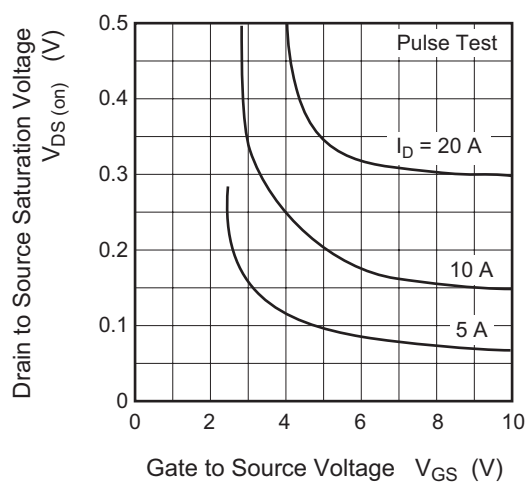
Typical Output Characteristics



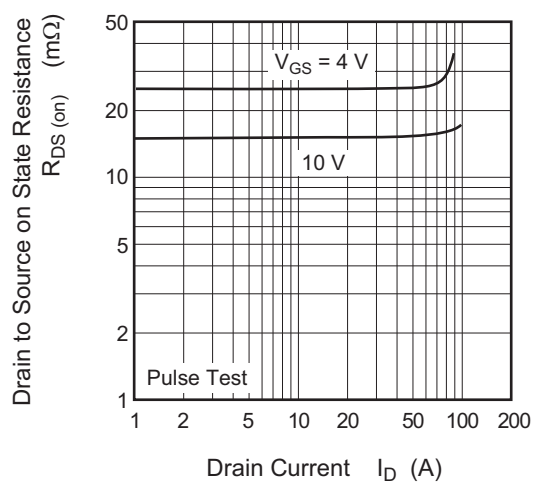
Typical Transfer Characteristics

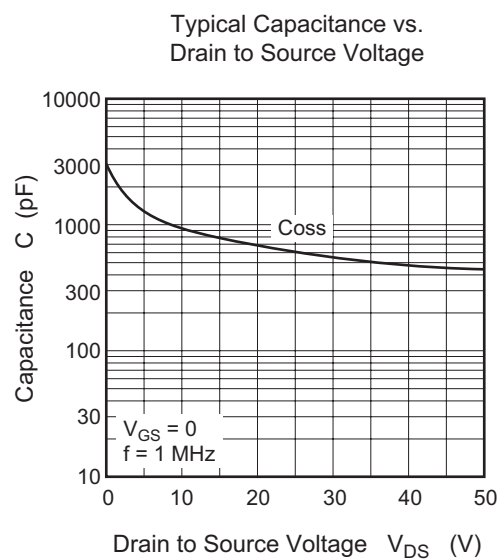
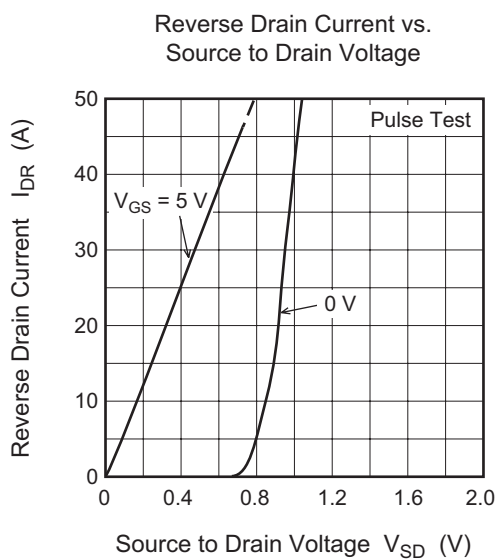
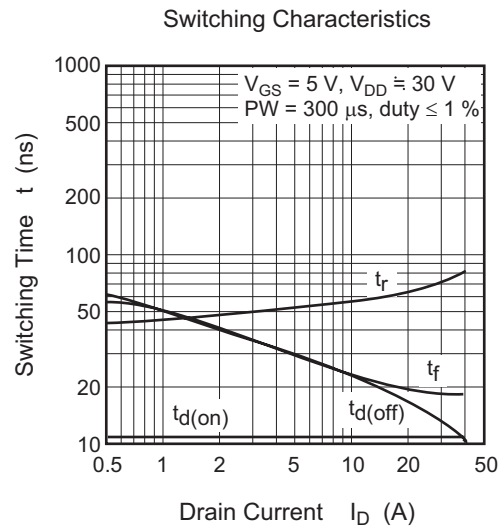
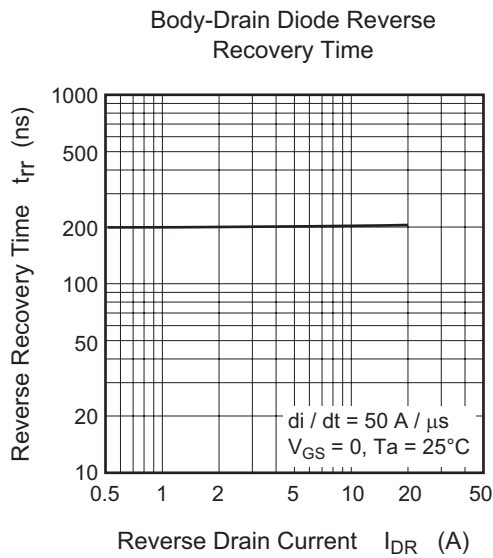
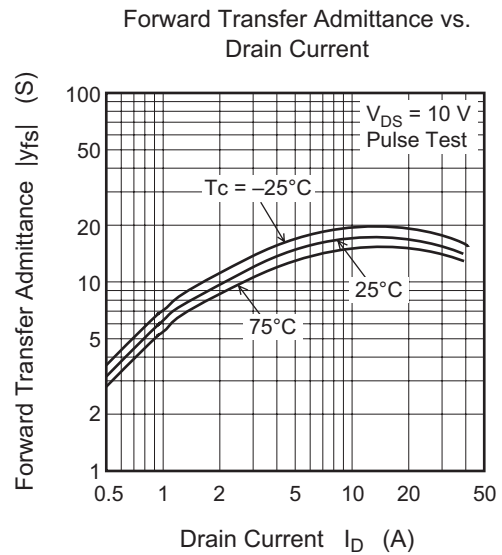
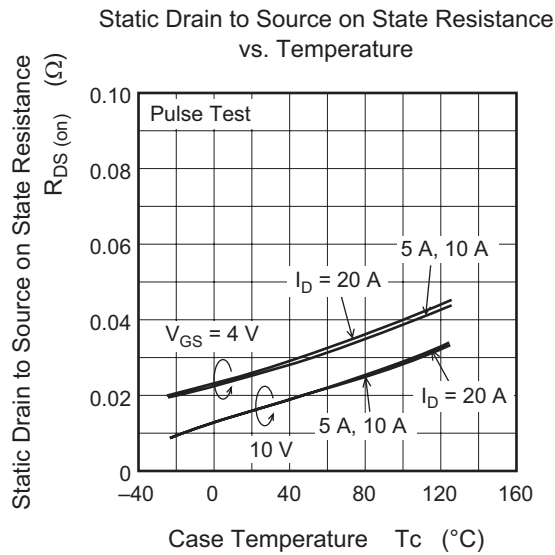


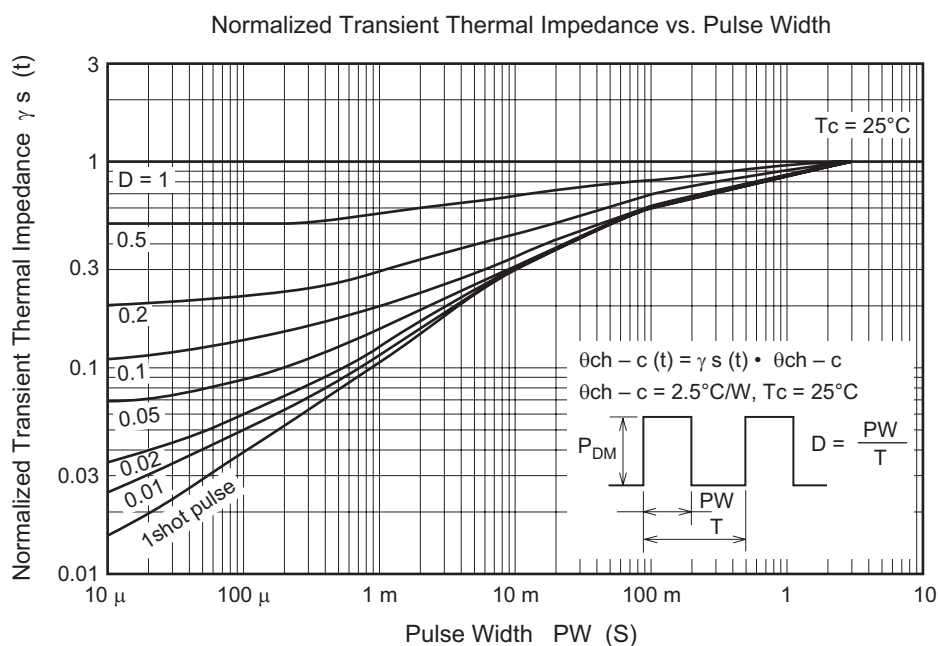
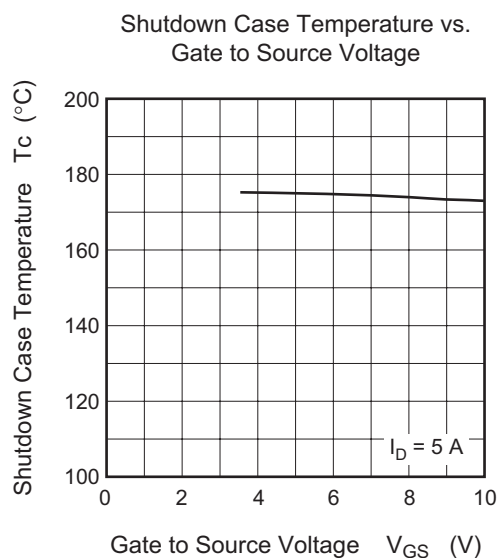
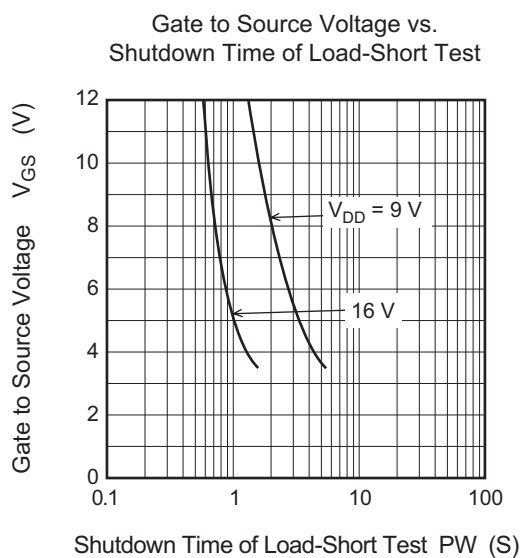
Drain to Source Saturation Voltage vs. Gate to Source Voltage



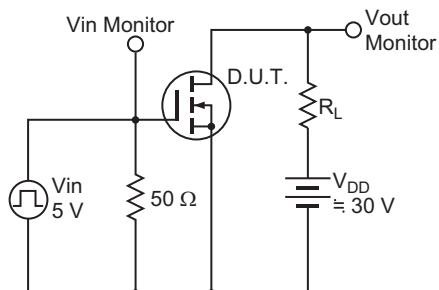
Static Drain to Source on State Resistance vs. Drain Current



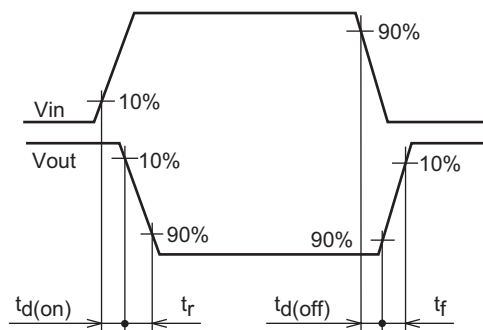




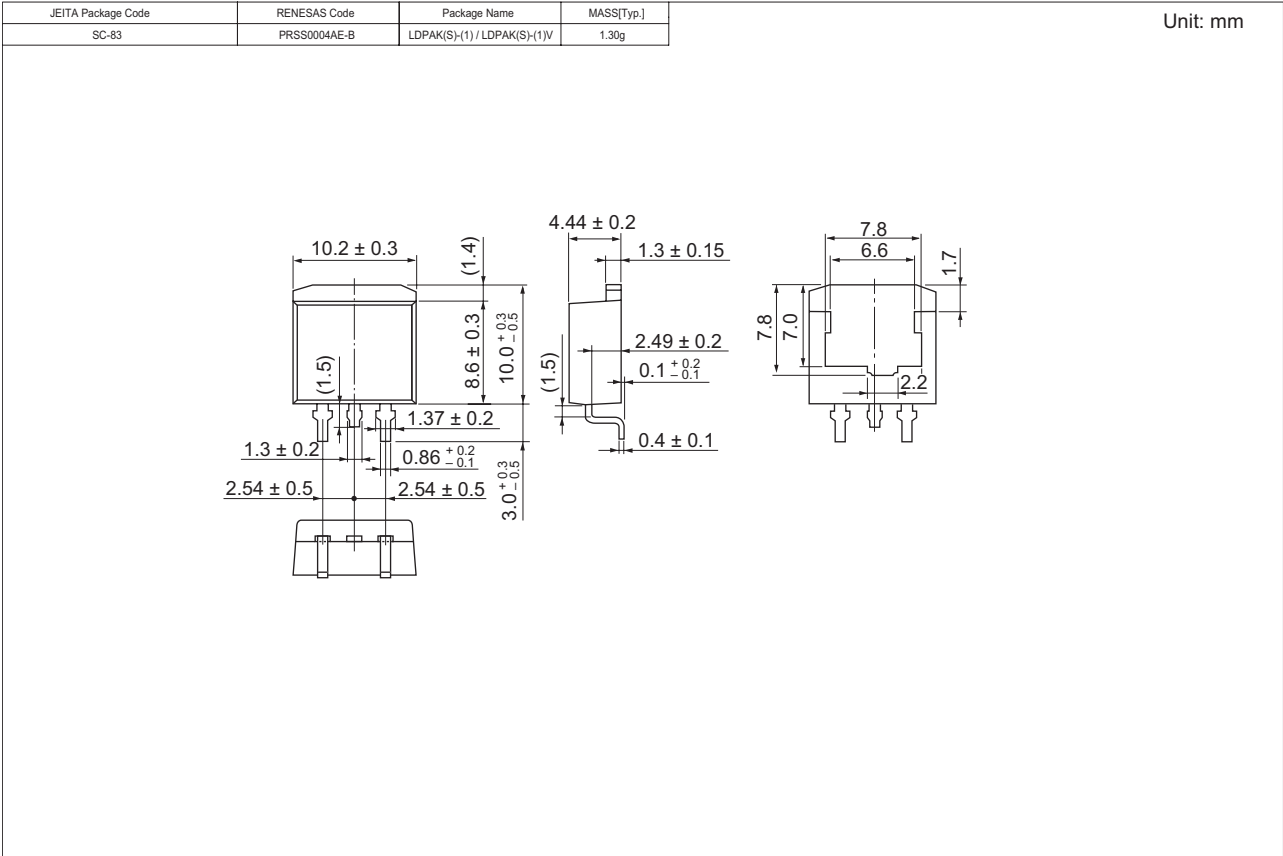
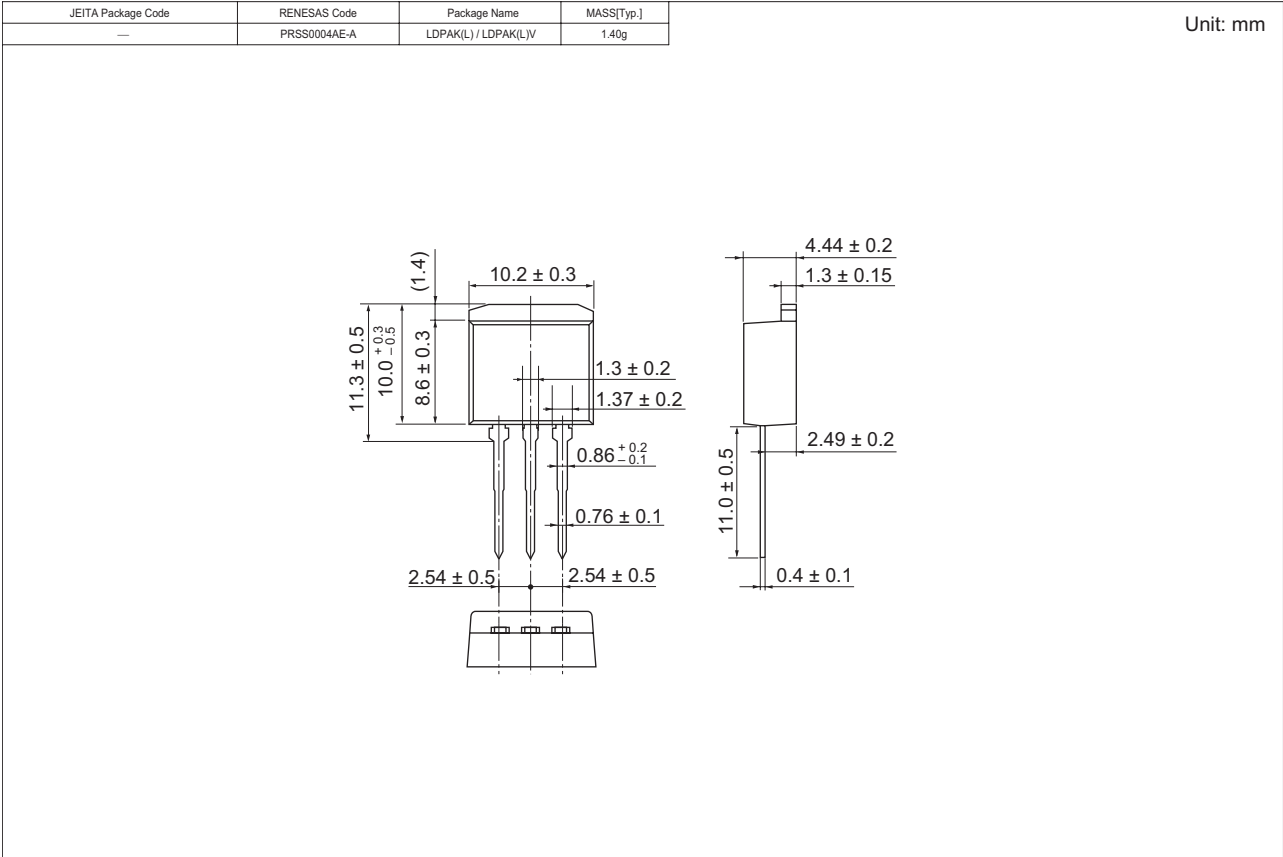
Switching Time Test Circuit



Waveform



Package Dimensions



**Ordering Information**

<b>Part Name</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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