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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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HAF1002(L), HAF1002(S)

Silicon P Channel MOS FET Series
Power Switching

REJ03G1133-0200
(Previous: ADE-208-586)
Rev.2.00
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)

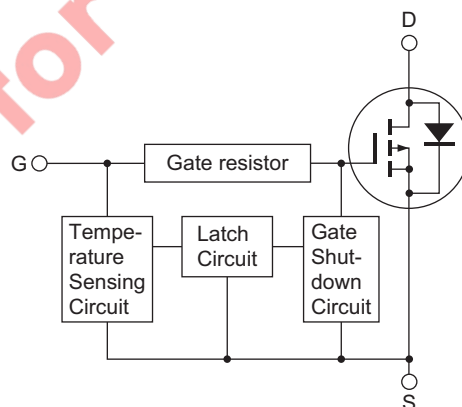
Outline

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 _{DSS}	-60	V
Gate to source voltage	V _{GSS}	-16	V
	V _{GSS}	3	V
Drain current	I _D	-15	A
Drain peak current	I _{D (pulse)} ^{Note 1}	-30	A
Body-drain diode reverse drain current	I _{DR}	-15	A
Channel dissipation	P _{ch} ^{Note 2}	50	W
Channel temperature	T _{ch}	150	°C
Storage temperature	T _{stg}	-55 to +150	°C

Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%

2. Value at Tc = 25°C

Typical Operation Characteristics

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 = -8 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}	—	-0.8	—	mA	V _i = -8 V, V _{DS} = 0
	I _{IH (sd) 2}	—	-0.35	—	mA	V _i = -3.5 V, V _{DS} = 0
Shut down temperature	T _{sd}	—	175	—	°C	Channel temperature
Gate operation voltage	V _{OP}	-3.5	—	-13	V	

Electrical Characteristics

(Ta = 25°C)

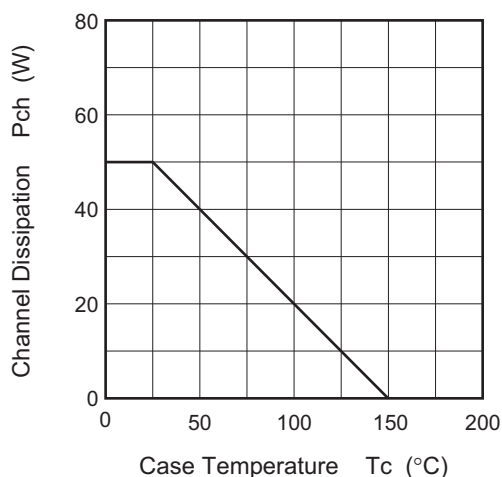
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	-7	—	—	A	$V_{GS} = -3.5 \text{ V}$, $V_{DS} = -2 \text{ V}$
	I_{D2}	—	—	-10	mA	$V_{GS} = -1.2 \text{ V}$, $V_{DS} = -2 \text{ V}$
Drain to source breakdown voltage	$V_{(BR) DSS}$	-60	—	—	V	$I_D = -10 \text{ mA}$, $V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR) GSS}$	-16	—	—	V	$I_G = -100 \mu\text{A}$, $V_{DS} = 0$
	$V_{(BR) GSS}$	3	—	—	V	$I_G = 100 \mu\text{A}$, $V_{DS} = 0$
Gate to source leak current	I_{GSS1}	—	—	-100	μA	$V_{GS} = -8 \text{ V}$, $V_{DS} = 0$
	I_{GSS2}	—	—	-50	μA	$V_{GS} = -3.5 \text{ V}$, $V_{DS} = 0$
	I_{GSS3}	—	—	-1	μA	$V_{GS} = -1.2 \text{ V}$, $V_{DS} = 0$
	I_{GSS4}	—	—	100	μA	$V_{GS} = 2.4 \text{ V}$, $V_{DS} = 0$
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	μA	$V_{DS} = -50 \text{ V}$, $V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS (off)}$	-1.1	—	-2.25	V	$I_D = -1 \text{ mA}$, $V_{DS} = -10 \text{ V}$
Static drain to source on state resistance	$R_{DS (on)}$	—	100	130	$\text{m}\Omega$	$I_D = -7.5 \text{ A}$, $V_{GS} = -4 \text{ V}$ ^{Note 3}
	$R_{DS (on)}$	—	70	90	$\text{m}\Omega$	$I_D = -7.5 \text{ A}$, $V_{GS} = -10 \text{ V}$ ^{Note 3}
Forward transfer admittance	$ y_{fs} $	5	10	—	S	$I_D = -7.5 \text{ A}$, $V_{DS} = -10 \text{ V}$ ^{Note 3}
Output capacitance	C_{oss}	—	610	—	pF	$V_{DS} = -10 \text{ V}$, $V_{GS} = 0$ $f = 1 \text{ MHz}$
Turn-on delay time	$t_{d (on)}$	—	7.5	—	μs	$I_D = -7.5 \text{ A}$ $V_{GS} = -5 \text{ V}$ $R_L = 4 \Omega$
Rise time	t_r	—	36	—	μs	
Turn-off delay time	$t_{d (off)}$	—	32	—	μs	
Fall time	t_f	—	29	—	μs	
Body-drain diode forward voltage	V_{DF}	—	-1.0	—	V	$I_F = -15 \text{ A}$, $V_{GS} = 0$
Body-drain diode reverse recovery time	t_{rr}	—	200	—	ns	$I_F = -15 \text{ A}$, $V_{GS} = 0$ $di_F/dt = 50 \text{ A}/\mu\text{s}$
Over load shut down operation time ^{Note4}	t_{os1}	—	3.7	—	ms	$V_{GS} = -5 \text{ V}$, $V_{DD} = -12 \text{ V}$
	t_{os2}	—	1	—	ms	$V_{GS} = -5 \text{ V}$, $V_{DD} = -24 \text{ V}$

Notes: 3. Pulse test

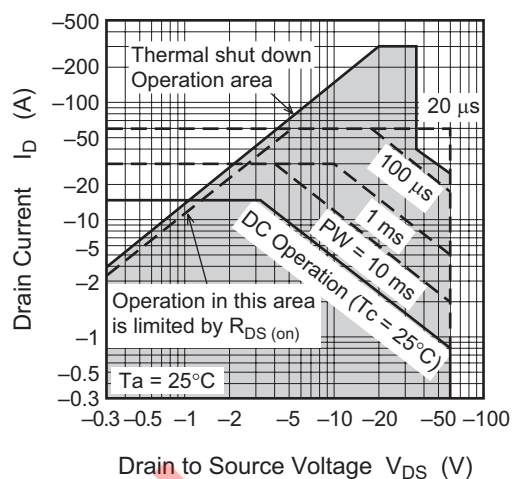
4. Include the time shift based on increasing of channel temperature when operate under over load condition.

Main Characteristics

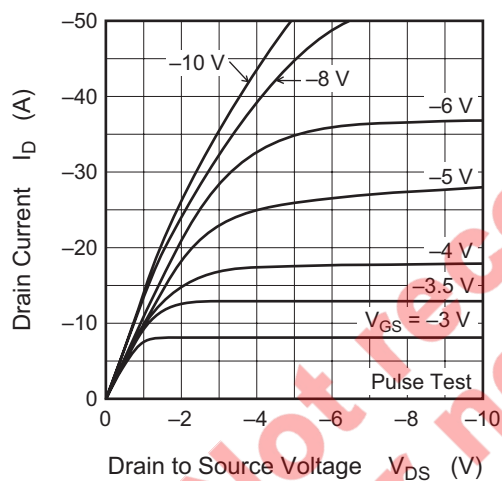
Power vs. Temperature Derating



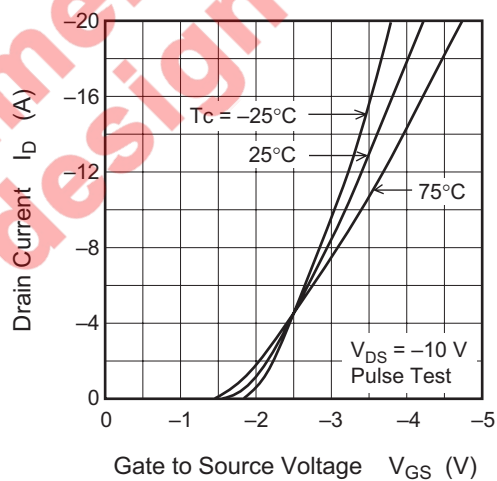
Maximum Safe Operation Area



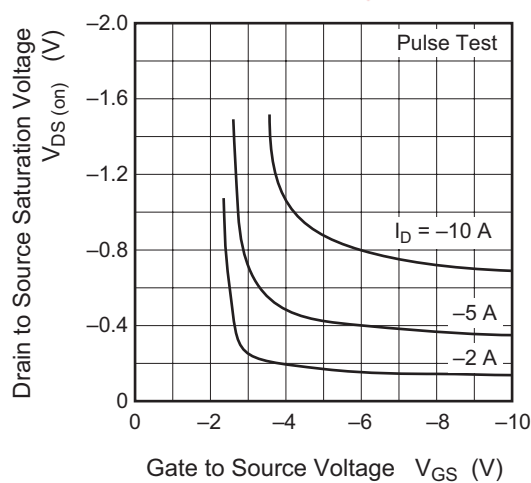
Typical Output Characteristics



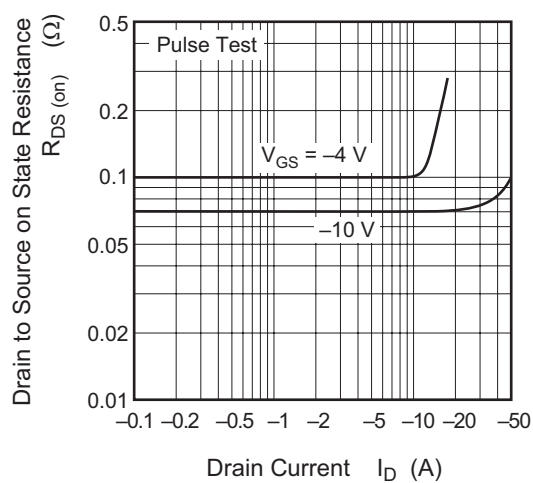
Typical Transfer Characteristics

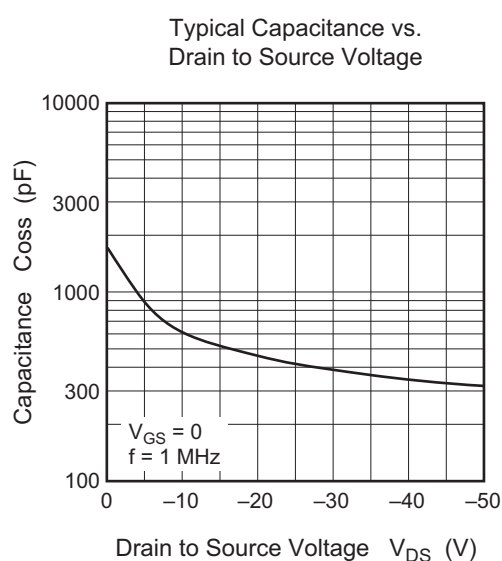
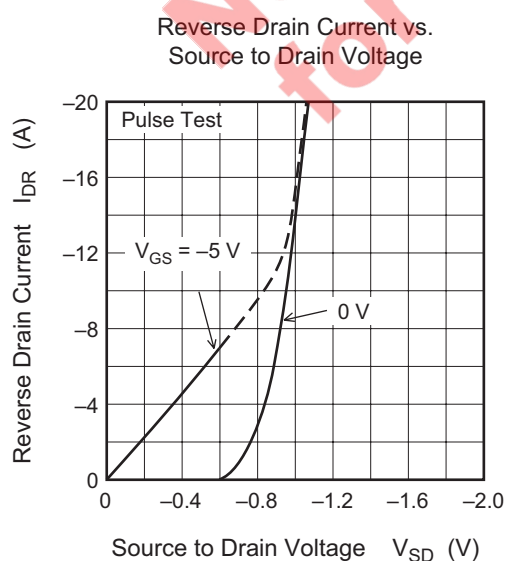
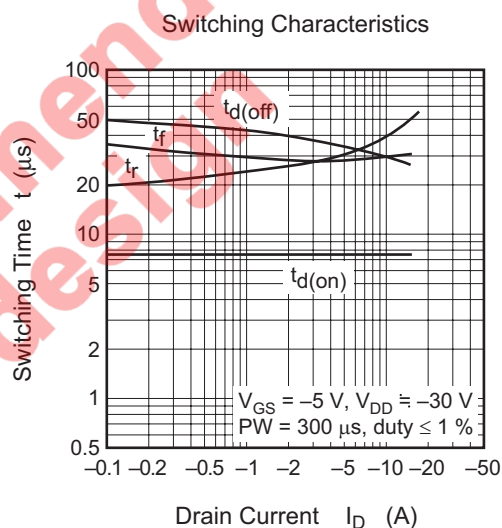
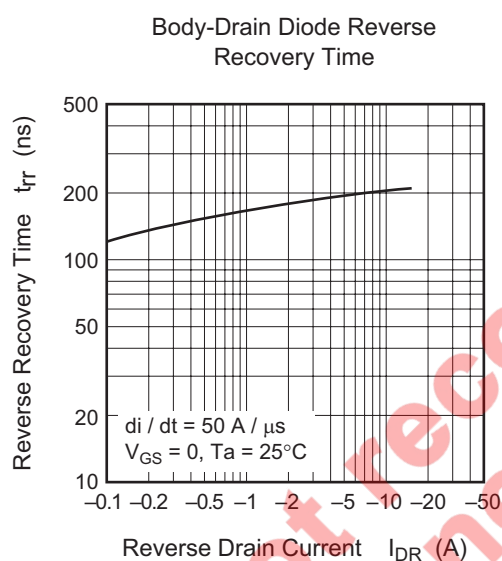
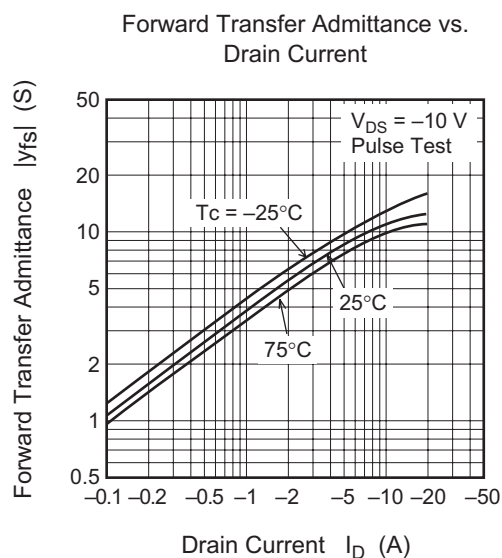
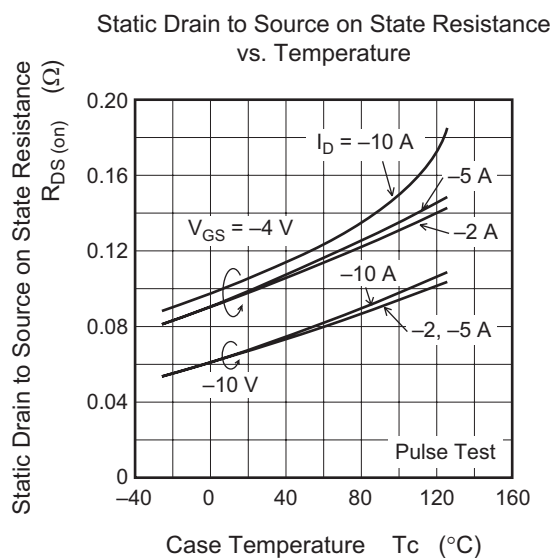


Drain to Source Saturation Voltage vs. Gate to Source Voltage

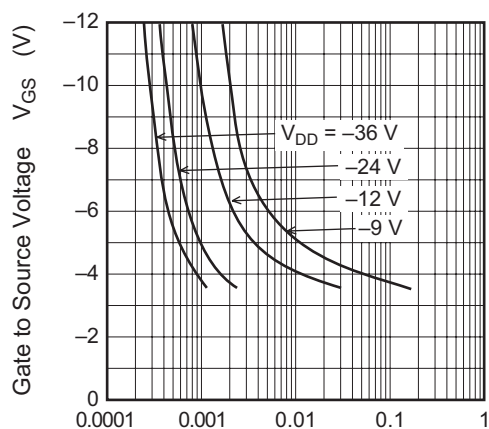


Static Drain to Source on State Resistance vs. Drain Current

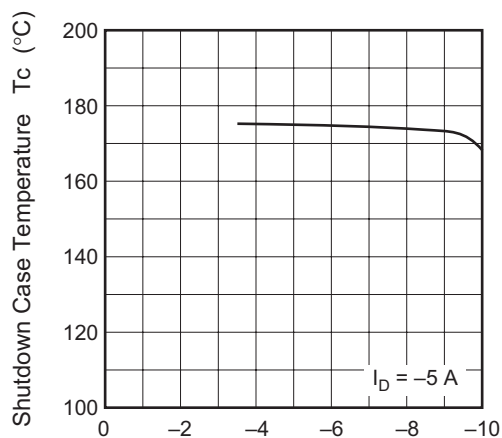




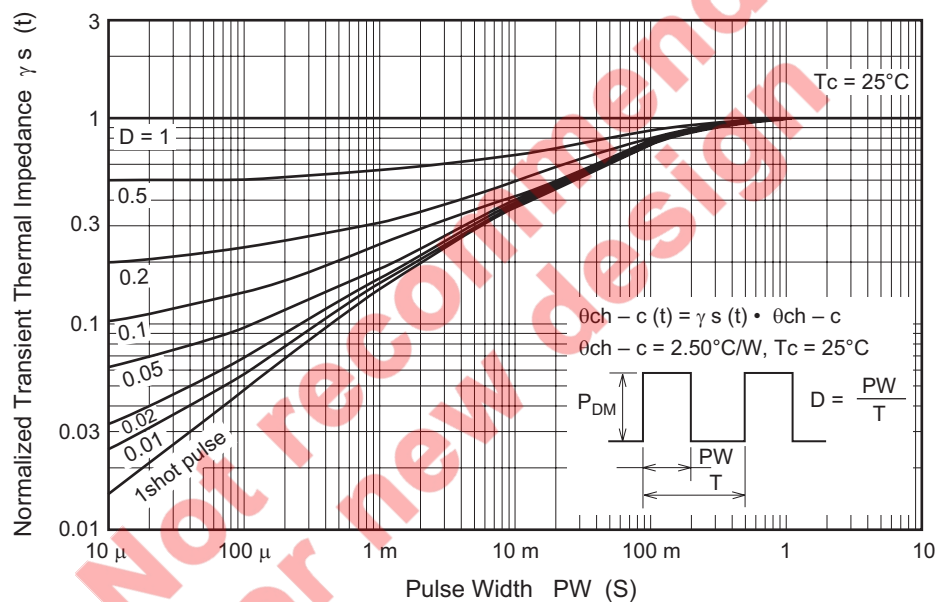
Gate to Source Voltage vs. Shutdown Time of Load-Short Test


Shutdown Time of Load-Short Test PW (S)

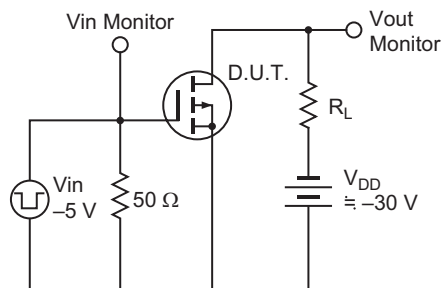
Shutdown Case Temperature vs. Gate to Source Voltage


Gate to Source Voltage V_{GS} (V)

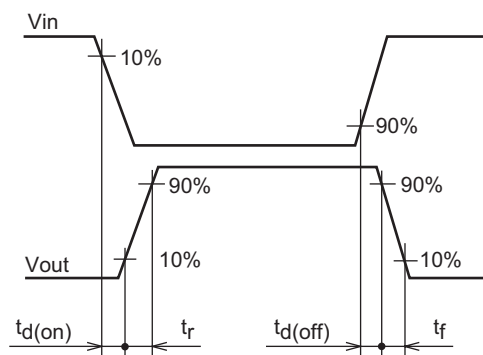
Normalized Transient Thermal Impedance vs. Pulse Width



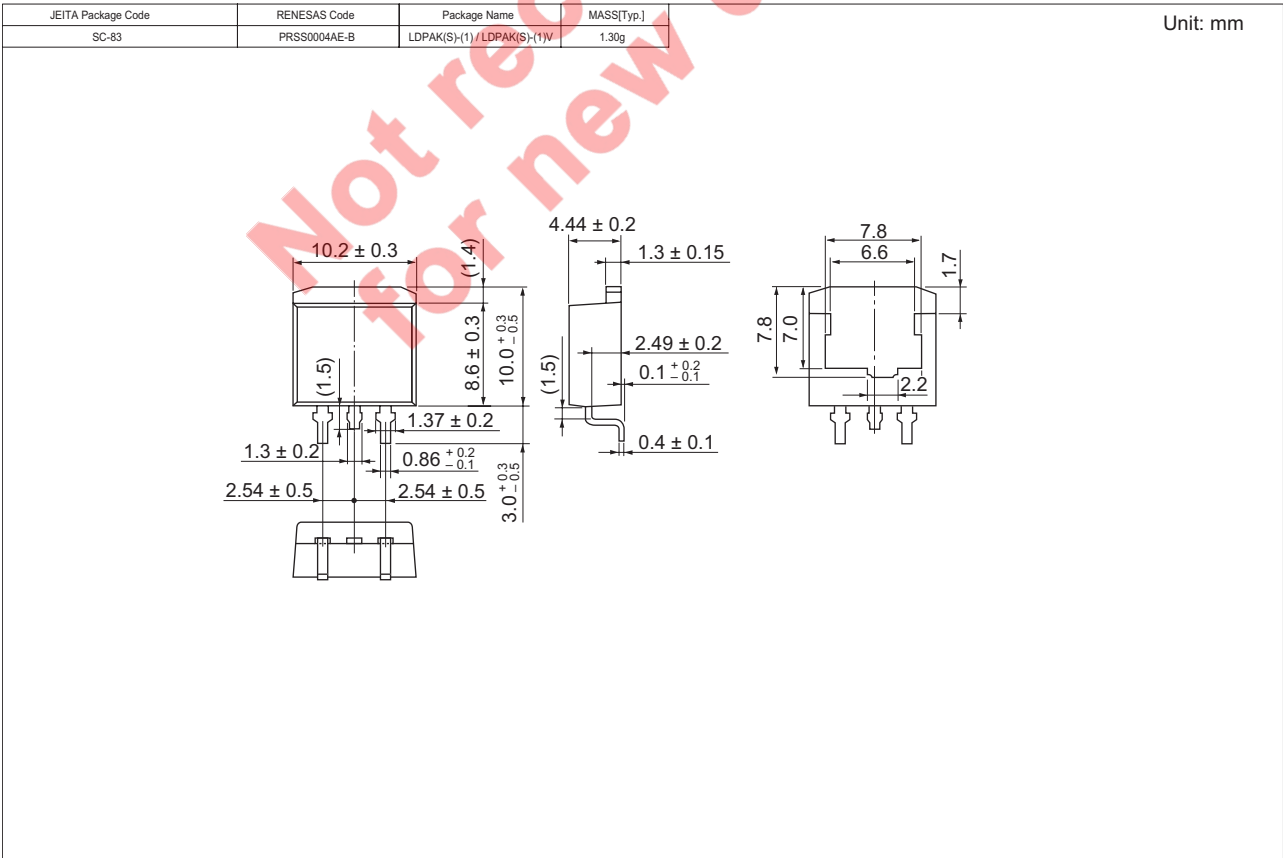
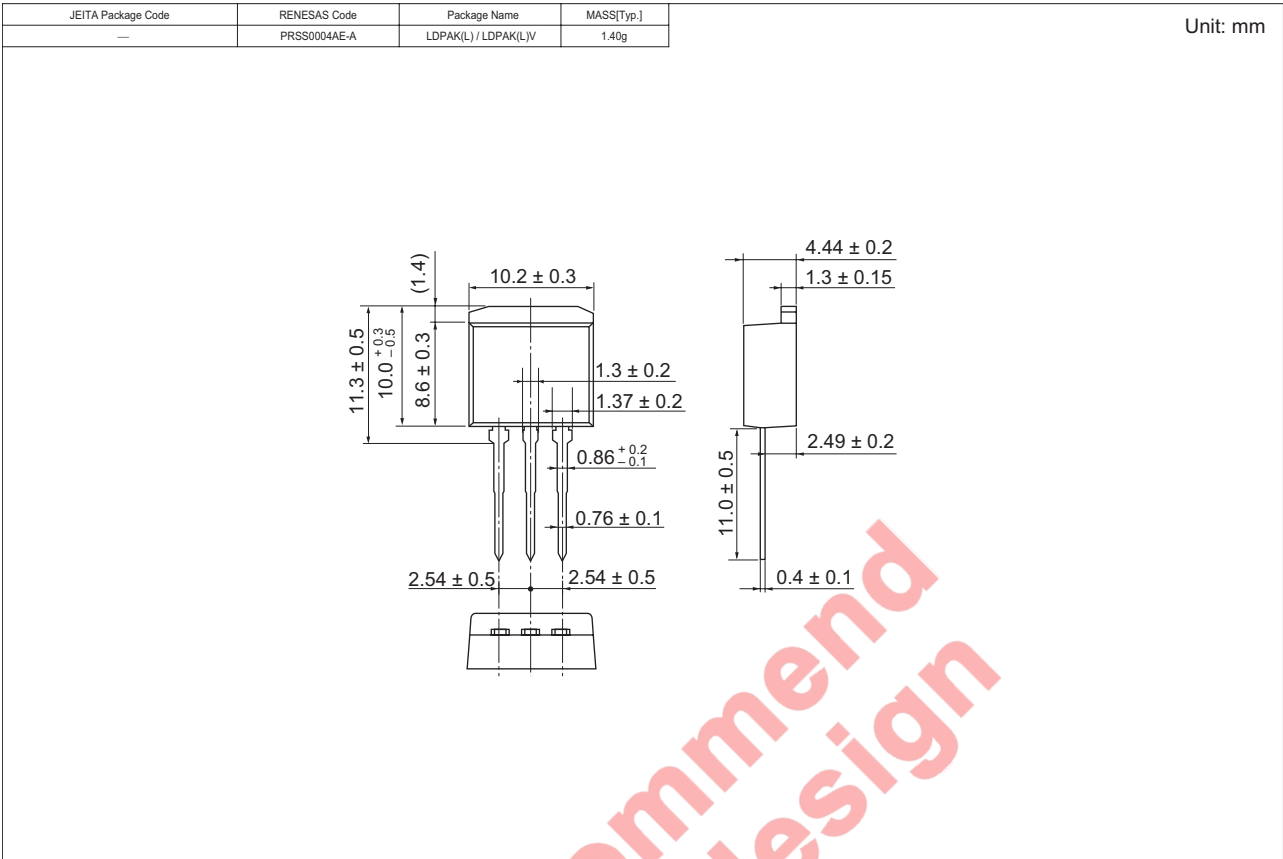
Switching Time Test Circuit



Waveform



Package Dimensions



Ordering Information

Part Name	Quantity	Shipping Container
HAF1002-90L	Max: 50 pcs/sack	Sack
HAF1002-90S	Max: 50 pcs/sack	Sack
HAF1002-90STL	1000 pcs/Reel	Embossed tape
HAF1002-90STR	1000 pcs/Reel	Embossed tape

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for new design

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