

# HAF2002

## Silicon N Channel MOS FET Series Power Switching

REJ03G1135-0300  
(Previous: ADE-208-503A)  
Rev.3.00  
Sep 07, 2005

### Description

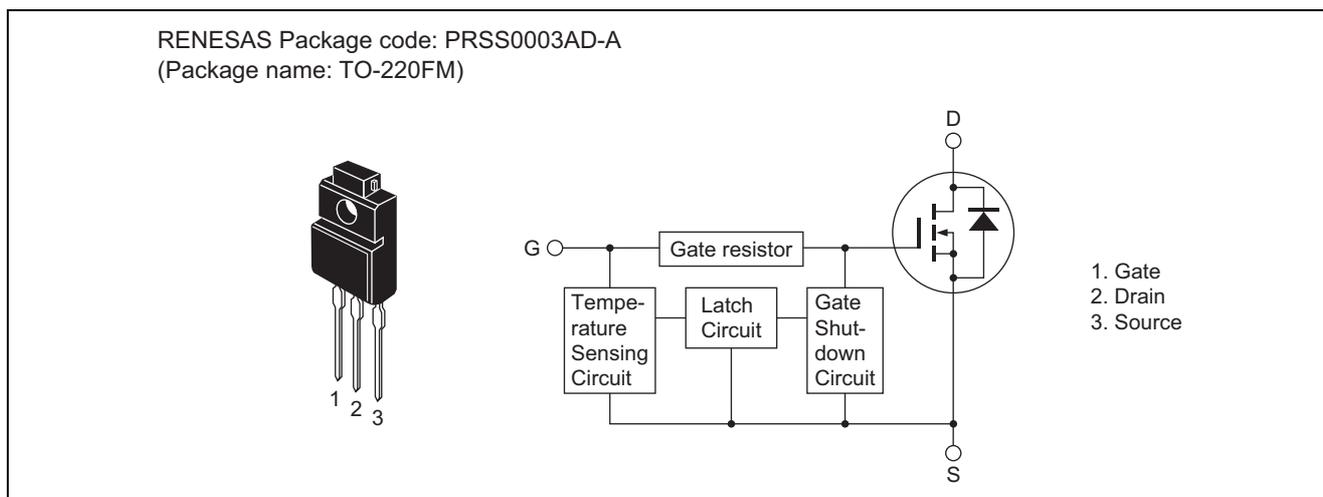
This FET has the over temperature shut-down capability sensing to the junction temperature.

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



## 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>	30	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	—	13	V	

## Electrical Characteristics

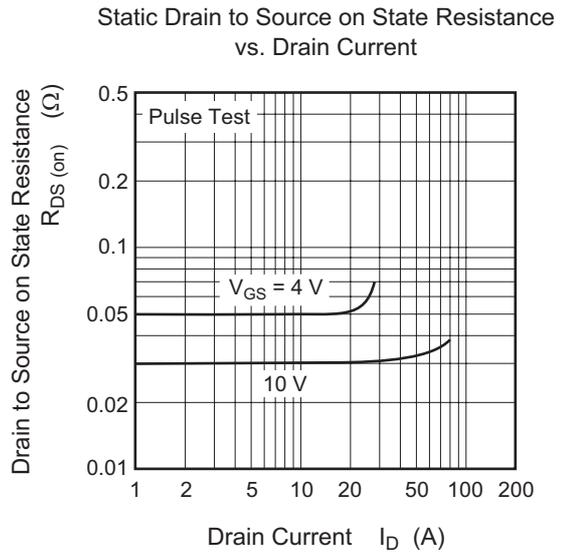
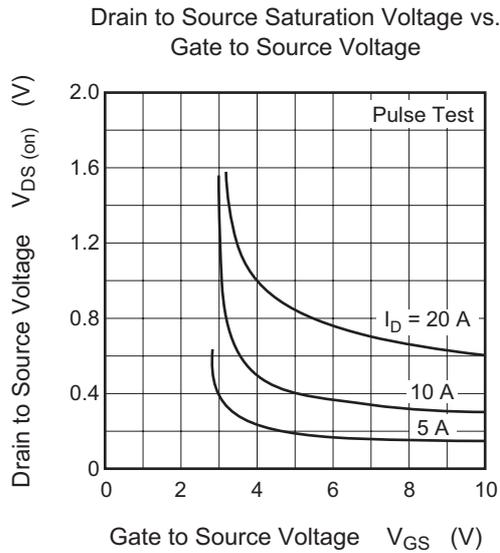
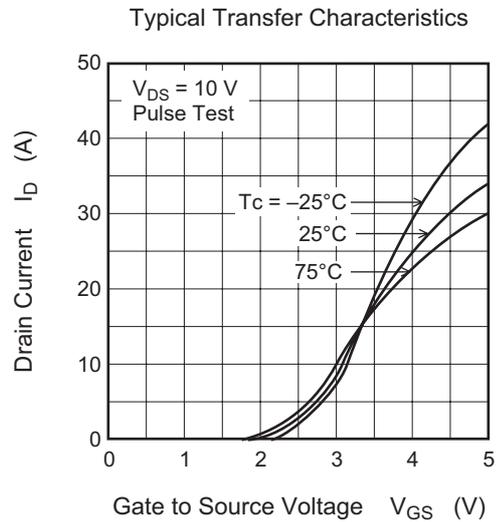
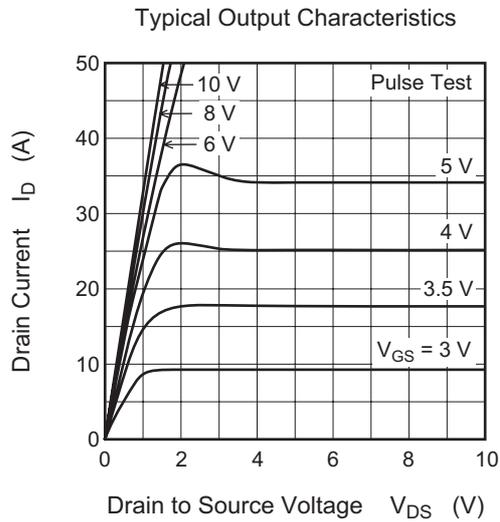
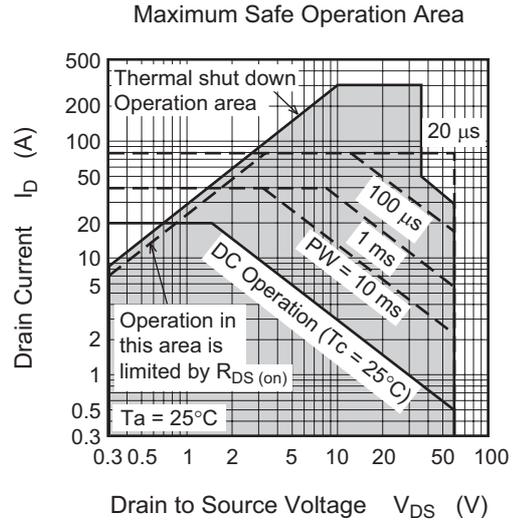
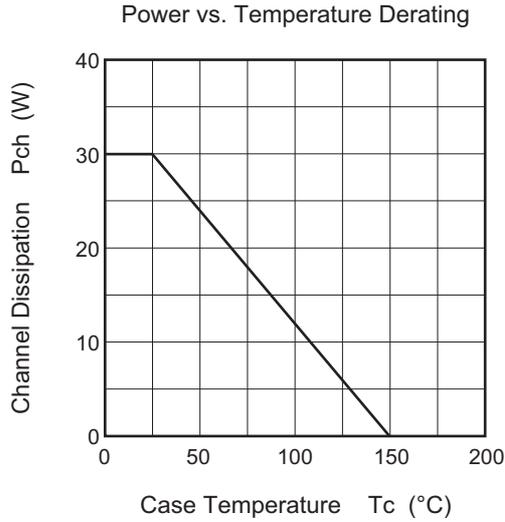
(Ta = 25°C)

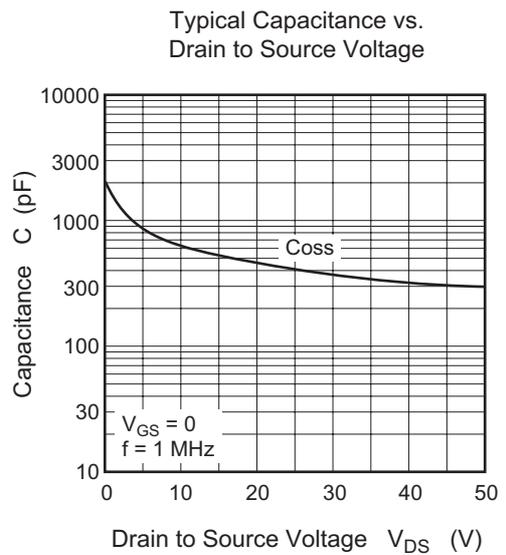
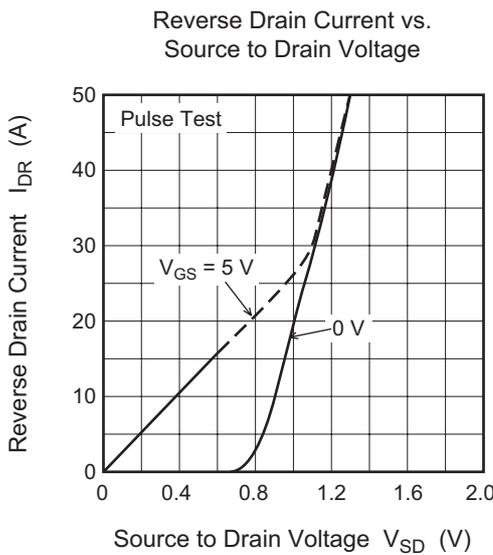
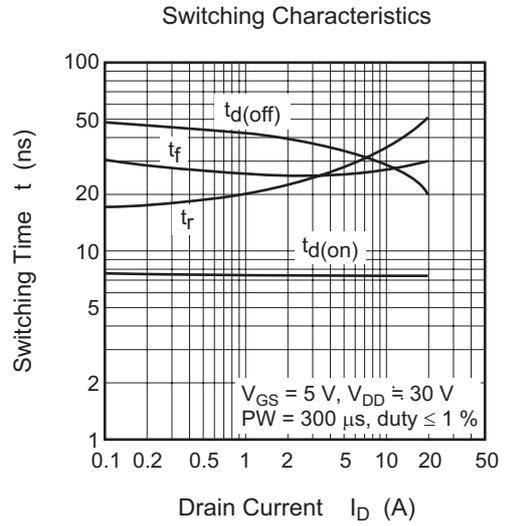
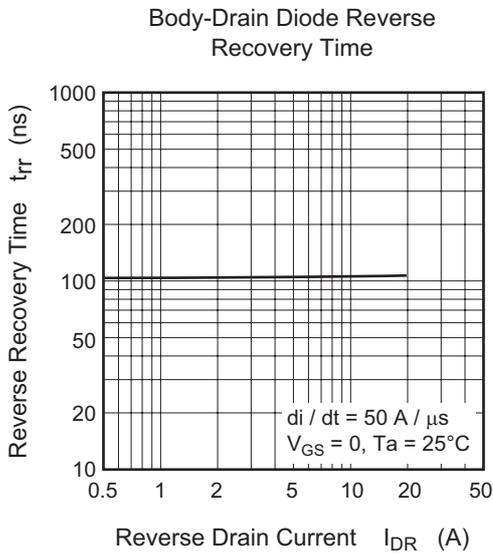
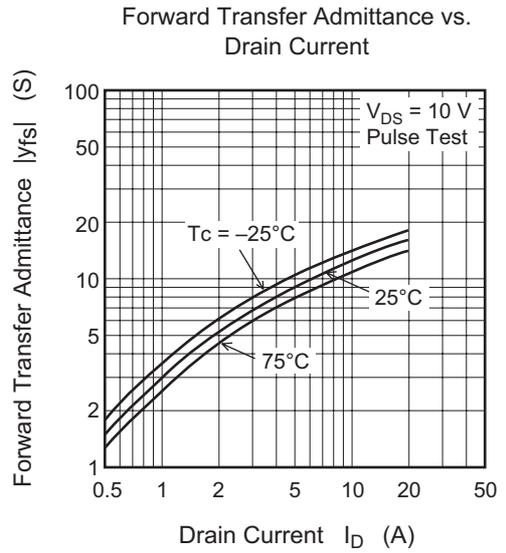
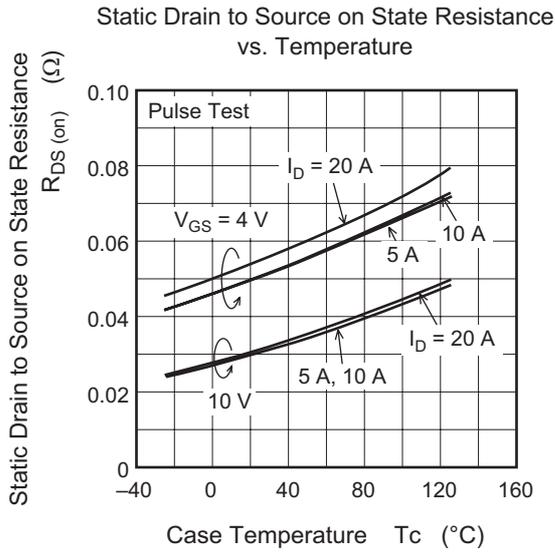
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	10	—	—	A	$V_{GS} = 3.5 \text{ V}, V_{DS} = 2 \text{ V}$
	$I_{D2}$	—	—	10	mA	$V_{GS} = 1.2 \text{ V}, V_{DS} = 2 \text{ V}$
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	$I_D = 10 \text{ mA}, V_{GS} = 0$
Gate to source breakdown 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	m $\Omega$	$I_D = 10 \text{ A}, V_{GS} = 4 \text{ V}$ <sup>Note 3</sup>
	$R_{DS(on)}$	—	30	43	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	$V_{GS} = 5 \text{ V}, V_{DD} = 24 \text{ V}$

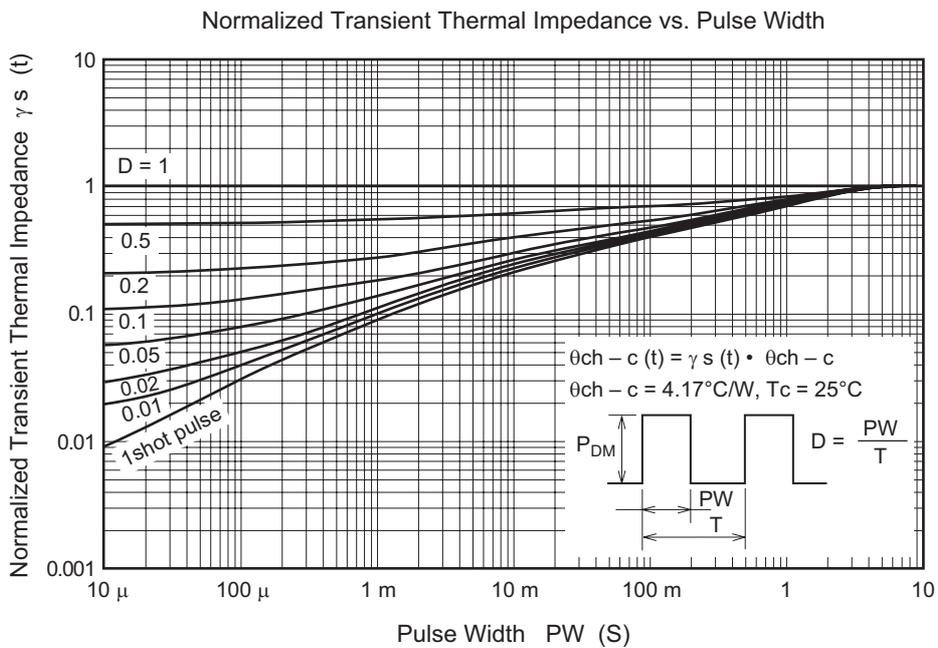
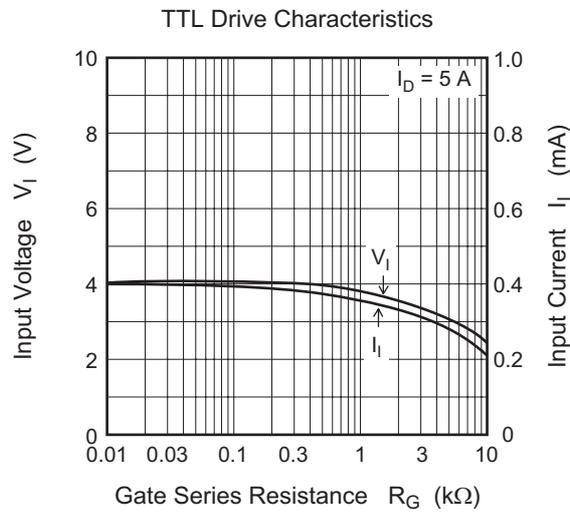
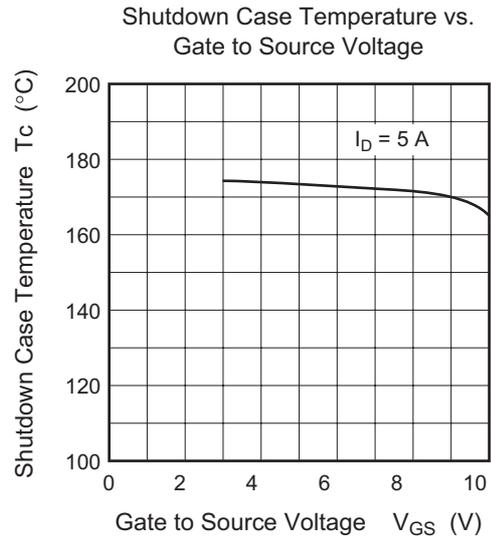
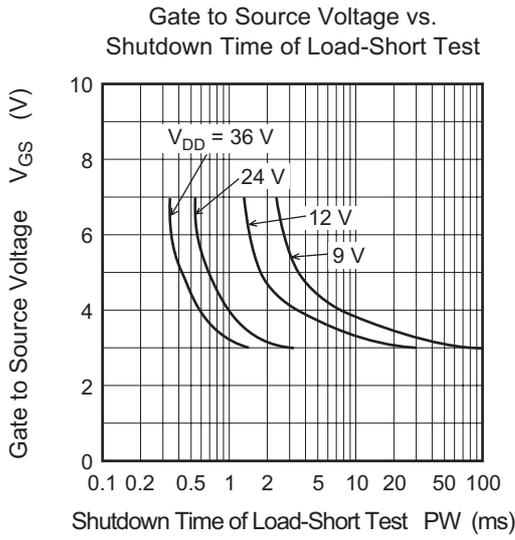
Notes: 3. Pulse test

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

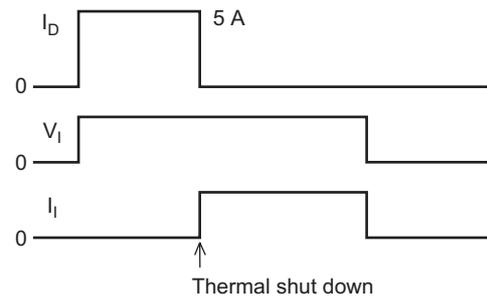
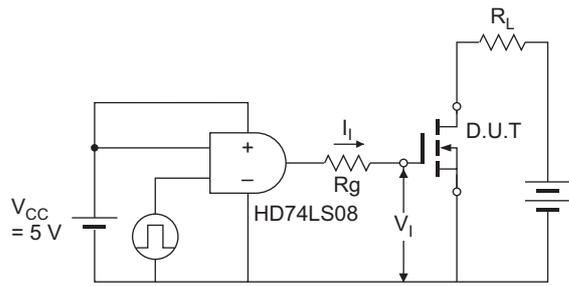
### Main Characteristics



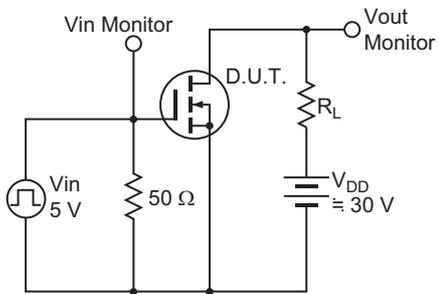




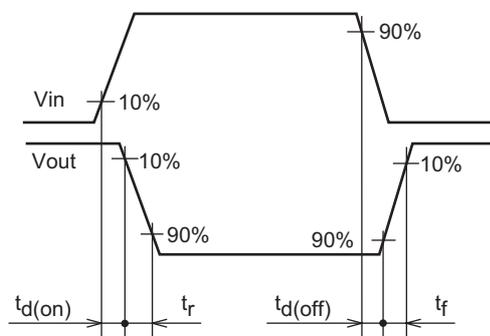
Test Circuit



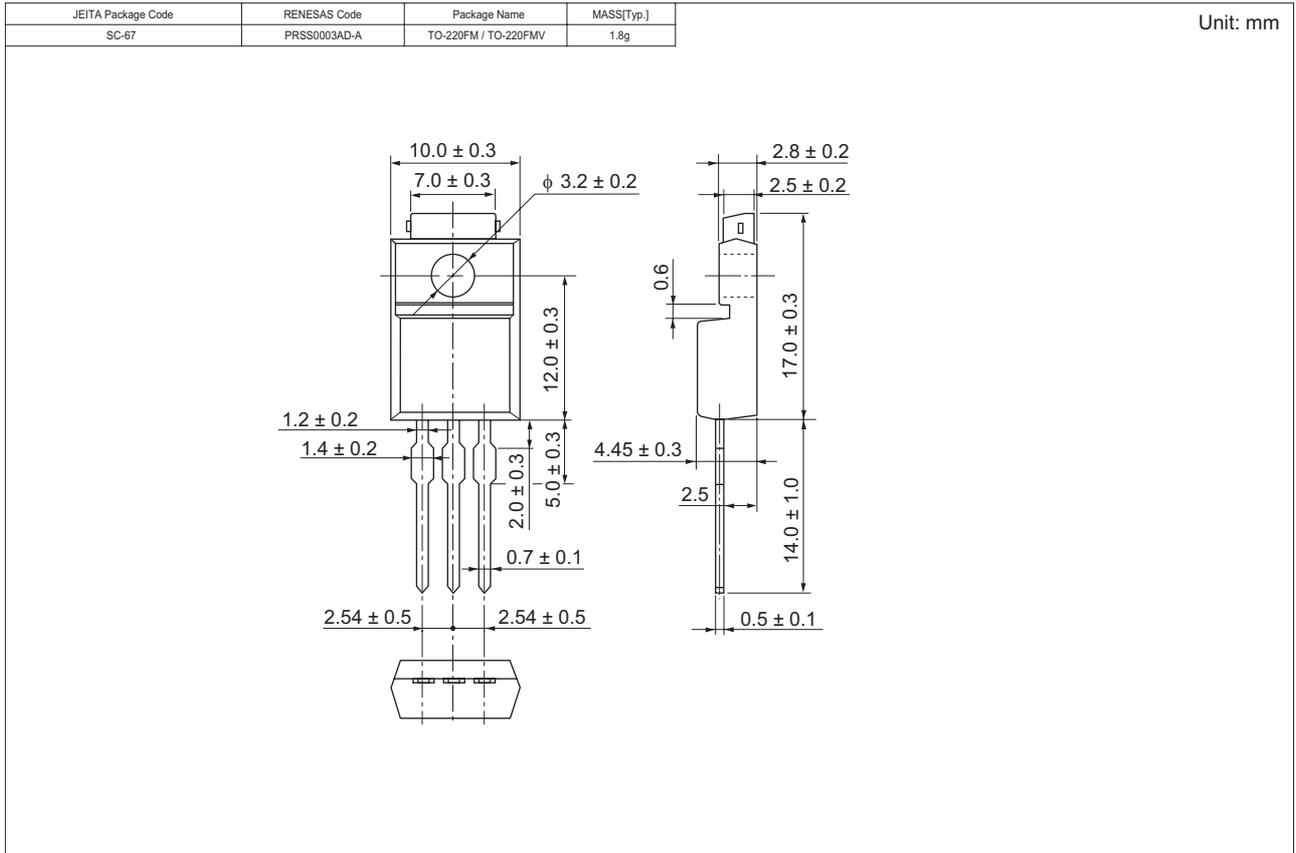
Switching Time Test Circuit



Waveform



### Package Dimensions



### Ordering Information

Part Name	Quantity	Shipping Container
HAF2002-90	Max: 50 pcs/sack	Sack

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