

# HAF2002

## Silicon N Channel MOS FET Series Power Switching

# HITACHI

ADE-208-503 A (Z)  
2nd. Edition  
October 1997

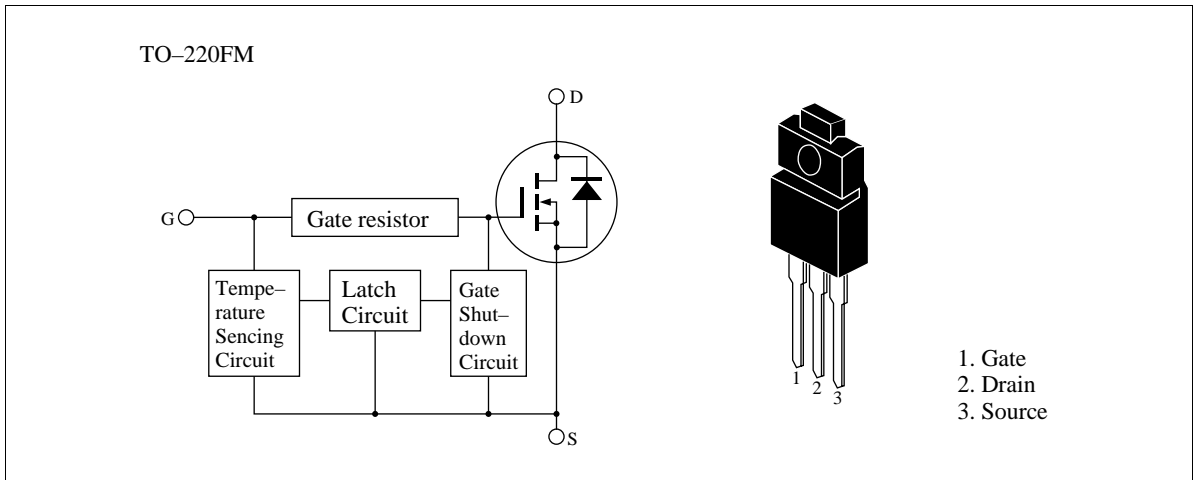
### Features

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.

- 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** ( $T_a = 25^\circ\text{C}$ )

Item	Symbol	Ratings	Unit
Drain to source voltage	$V_{DSS}$	60	V
Gate to source voltage	$V_{GSS}$	16	V
Gate to source voltage	$V_{GSS}$	-2.8	V
Drain current	$I_D$	20	A
Drain peak current	$I_{D(pulse)}$ <sup>Note1</sup>	40	A
Body-drain diode reverse drain current	$I_{DR}$	20	A
Channel dissipation	$P_{ch}$ <sup>Note2</sup>	30	W
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

Note: 1.  $PW \leq 10\mu\text{s}$ , duty cycle  $\leq 1\%$   
 2. Value at  $T_a = 25^\circ\text{C}$

**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	$\mu\text{A}$	$V_i = 8\text{V}$ , $V_{DS} = 0$
	$I_{IH2}$	—	—	50	$\mu\text{A}$	$V_i = 3.5\text{V}$ , $V_{DS} = 0$
	$I_{IL}$	—	—	1	$\mu\text{A}$	$V_i = 1.2\text{V}$ , $V_{DS} = 0$
Input current (Gate shut down)	$I_{IH(sd)1}$	—	0.8	—	$\text{mA}$	$V_i = 8\text{V}$ , $V_{DS} = 0$
	$I_{IH(sd)2}$	—	0.35	—	$\text{mA}$	$V_i = 3.5\text{V}$ , $V_{DS} = 0$
Shut down temperature	$T_{sd}$	—	175	—	$^\circ\text{C}$	Channel temperature
Gate operation voltage	$V_{OP}$	3.5	—	13	V	

## Electrical Characteristics (Ta = 25°C)

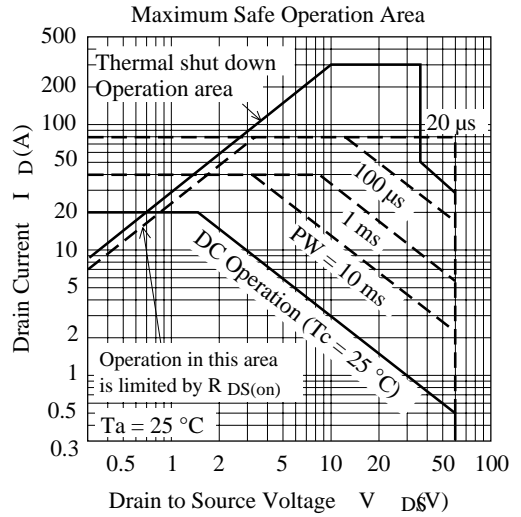
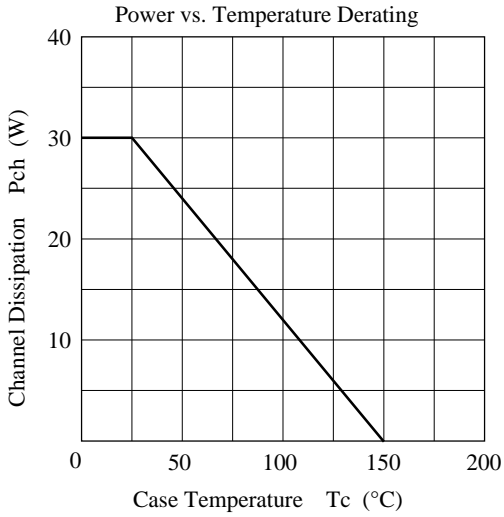
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	10	—	—	A	$V_{GS} = 3.5V, V_{DS} = 2V$
Drain current	$I_{D2}$	—	—	10	mA	$V_{GS} = 1.2V, V_{DS} = 2V$
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	$I_D = 10mA, V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	16	—	—	V	$I_G = 100\mu A, V_{DS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	-2.8	—	—	V	$I_G = -100\mu A, V_{DS} = 0$
Gate to source leak current	$I_{GSS1}$	—	—	100	$\mu A$	$V_{GS} = 8V, V_{DS} = 0$
	$I_{GSS2}$	—	—	50	$\mu A$	$V_{GS} = 3.5V, V_{DS} = 0$
	$I_{GSS3}$	—	—	1	$\mu A$	$V_{GS} = 1.2V, V_{DS} = 0$
	$I_{GSS4}$	—	—	-100	$\mu A$	$V_{GS} = -2.4V, V_{DS} = 0$
Input current (shut down)	$I_{GS(op)1}$	—	0.8	—	mA	$V_{GS} = 8V, V_{DS} = 0$
	$I_{GS(op)2}$	—	0.35	—	mA	$V_{GS} = 3.5V, V_{DS} = 0$
Zero gate voltage drain current	$I_{DSS}$	—	—	250	$\mu A$	$V_{DS} = 50V, V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.25	V	$I_D = 1mA, V_{DS} = 10V$
Static drain to source on state resistance	$R_{DS(on)}$	—	50	65	m $\Omega$	$I_D = 10A, V_{GS} = 4V$ <sup>Note3</sup>
Static drain to source on state resistance	$R_{DS(on)}$	—	30	43	m $\Omega$	$I_D = 10A, V_{GS} = 10V$ <sup>Note3</sup>
Forward transfer admittance	$ y_{fs} $	6	12	—	S	$I_D = 10A, V_{DS} = 10V$ <sup>Note3</sup>
Output capacitance	$C_{oss}$	—	630	—	pF	$V_{DS} = 10V, V_{GS} = 0$ $f = 1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	—	7.5	—	$\mu s$	$I_D = 5A, V_{GS} = 5V$
Rise time	$t_r$	—	29	—	$\mu s$	$R_L = 6\Omega$
Turn-off delay time	$t_{d(off)}$	—	34	—	$\mu s$	
Fall time	$t_f$	—	26	—	$\mu s$	
Body-drain diode forward voltage	$V_{DF}$	—	1.0	—	V	$I_F = 20A, V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	110	—	ns	$I_F = 20A, V_{GS} = 0$ $di_F/dt = 50A/\mu s$
Over load shut down operation time <sup>Note4</sup>	$t_{os1}$	—	1.8	—	ms	$V_{GS} = 5V, V_{DD} = 12V$
	$t_{os2}$	—	0.7	—	ms	$V_{GS} = 5V, V_{DD} = 24V$

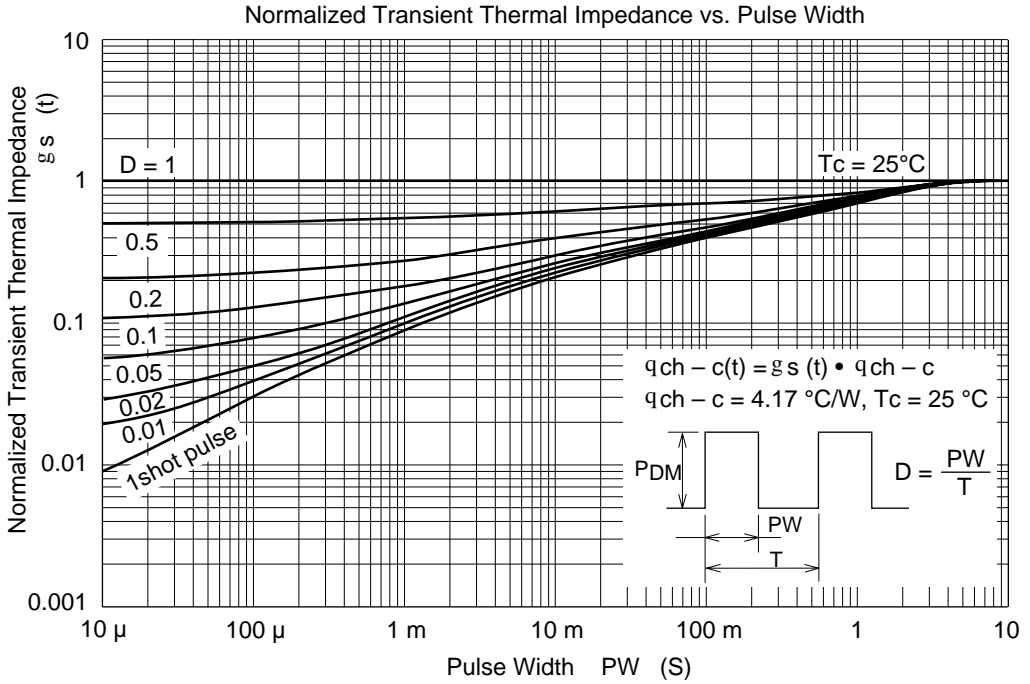
Note: 3. Pulse test

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

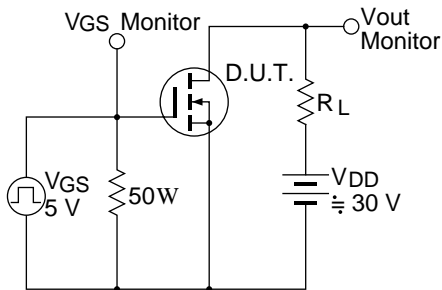
See characteristic curve of HAF2001.

## Main Characteristics

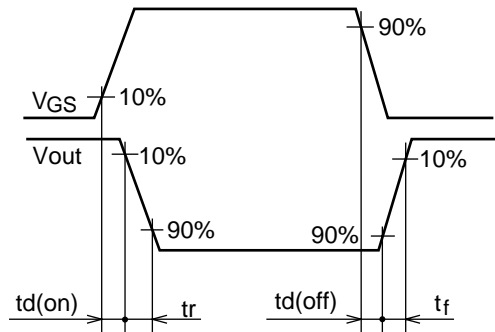




Switching Time Test Circuit

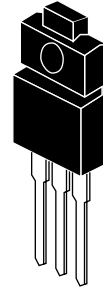
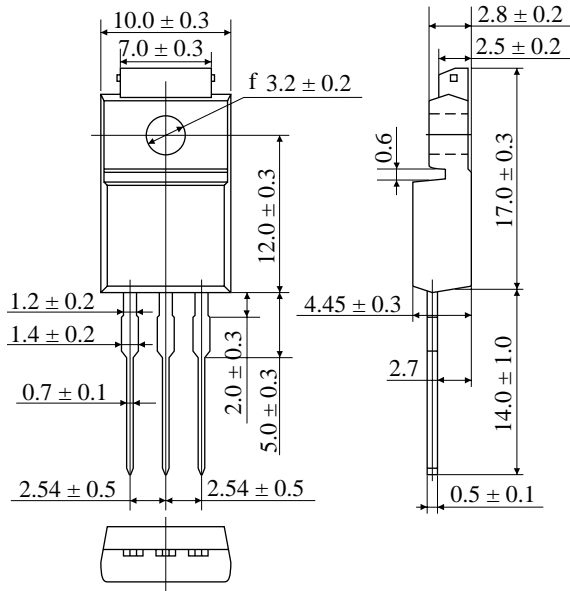


Waveform



## Package Dimensions

Unit: mm



Hitachi Code	TO-220FM
EIAJ	SC-67
JEDEC	—

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