

# HAF2008

## Silicon N Channel MOS FET Series Power Switching

# HITACHI

Target specification  
ADE-208-707 (Z)  
1st. Edition  
Dec. 1998

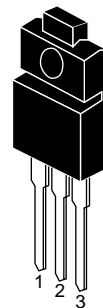
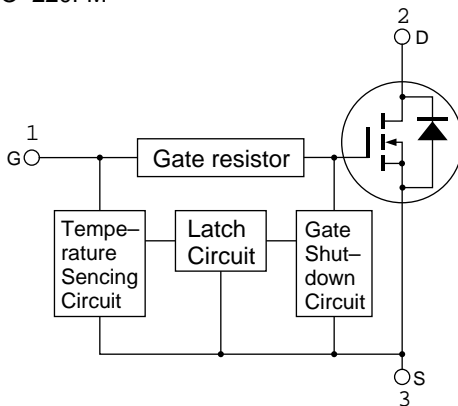
This FET has the over temperature shut-down capability sensing to the junction temperature. This FET has the built-in over temperature shut-down circuit in the gate area. And this circuit operation to shut-down the gate voltage in case of high junction temperature like applying over power consumption, 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

TO-220FM



1. Gate
2. Drain
3. Source

**Absolute Maximum Ratings** (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V <sub>DSS</sub>	60	V
Gate to source voltage	V <sub>GSS</sub>	(16)	V
Gate to source voltage	V <sub>GSS</sub>	(−2.5)	V
Drain current	I <sub>D</sub>	20	A
Drain peak current	I <sub>D(pulse)</sub> <sup>Note1</sup>	40	A
Body-drain diode reverse drain current	I <sub>DR</sub>	20	A
Channel dissipation	Pch <sup>Note2</sup>	30	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	−55 to +150	°C

Note: 1. PW ≤ 10μs, 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	Vi = 8V, V <sub>DS</sub> = 0
	I <sub>IH2</sub>	—	—	50	μA	Vi = 3.5V, V <sub>DS</sub> = 0
	I <sub>IL</sub>	—	—	1	μA	Vi = 1.2V, V <sub>DS</sub> = 0
Input current (Gate shut down)	I <sub>IH(sd)1</sub>	—	0.8	—	mA	Vi = 8V, V <sub>DS</sub> = 0
	I <sub>IH(sd)2</sub>	—	0.35	—	mA	Vi = 3.5V, 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	

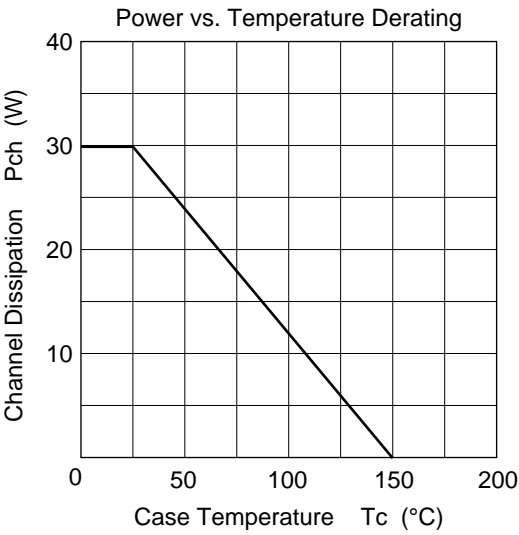
## Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	(25)	—	—	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	$I_G = (300\mu A), V_{DS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	(-2.5)	—	—	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	$I_{DSS}$	—	—	10	$\mu A$	$V_{DS} = 60V, V_{GS} = 0$
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	$R_{DS(on)}$	—	45	60	m $\Omega$	$I_D = 10A, V_{GS} = 4V$ <sup>Note3</sup>
Static drain to source on state resistance	$R_{DS(on)}$	—	28	40	m $\Omega$	$I_D = 10A, V_{GS} = 10V$ <sup>Note3</sup>
Forward transfer admittance	$ y_{fs} $	(11)	(17)	—	S	$I_D = 10A, V_{DS} = 10V$ <sup>Note3</sup>
Output capacitance	$C_{oss}$	—	(380)	—	pF	$V_{DS} = 10V, V_{GS} = 0$ $f = 1MHz$
Turn-on delay time	$t_{d(on)}$	—	( )	—	$\mu s$	$I_D = 10A, V_{GS} = 5V$
Rise time	$t_r$	—	( )	—	$\mu s$	$R_L = 3\Omega$
Turn-off delay time	$t_{d(off)}$	—	( )	—	$\mu s$	
Fall time	$t_f$	—	( )	—	$\mu s$	
Body-drain diode forward voltage	$V_{DF}$	—	(1.0)	—	V	$I_F = 20A, V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	( )	—	ns	$I_F = 20A, V_{GS} = 0$ $diF/dt = 50A/\mu s$
Over load shut down	$t_{os1}$	—	( )	—	ms	$V_{GS} = 5V, V_{DD} = 12V$
operation time <sup>Note4</sup>	$t_{os2}$	—	( )	—	ms	$V_{GS} = 5V, V_{DD} = 24V$

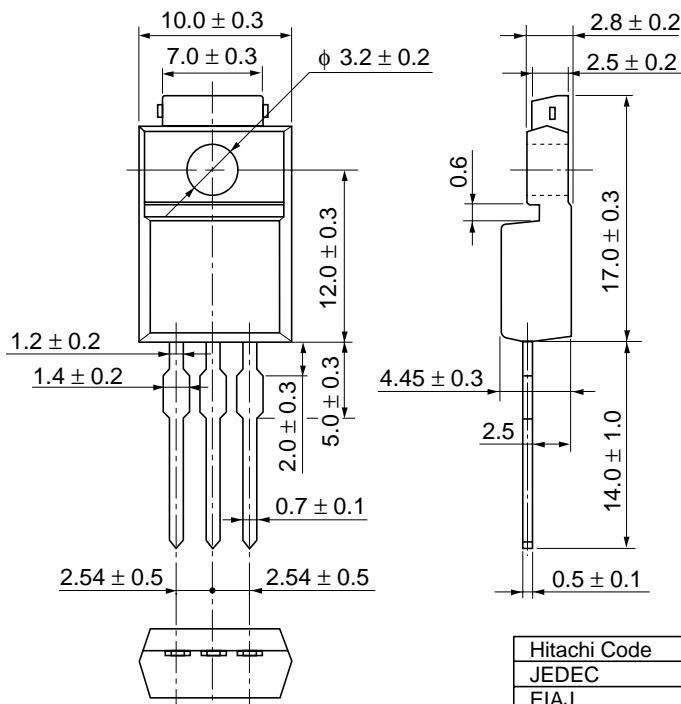
Note: 3. Pulse test

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

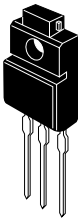
Main Characteristics



Package Dimensions



As of January, 2001  
Unit: mm



Hitachi Code	TO-220FM
JEDEC	—
EIAJ	Conforms
Mass (reference value)	1.8 g

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