

# HAF2006R

## Silicon N Channel MOS FET Series Power Switching

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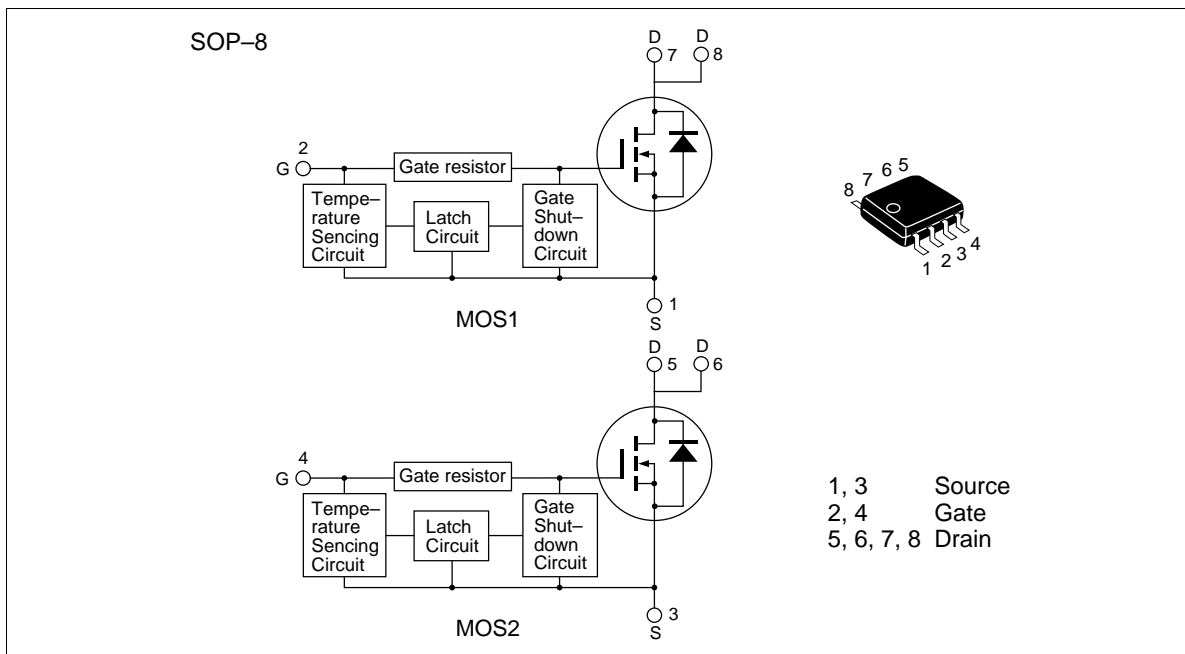
ADE-208-689 (Z)  
Target specification 1st. Edition  
Nov. 1998

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



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

Item	Symbol	Ratings	Unit
Drain to source voltage	$V_{DS}$	60	V
Gate to source voltage	$V_{GS}$	16	V
Gate to source voltage	$V_{GS}$	-2.5	V
Drain current	$I_D$	3	A
Drain peak current	$I_{D(pulse)}$ <sup>Note1</sup>	6	A
Body-drain diode reverse drain current	$I_{DR}$	3	A
Channel dissipation	$P_{ch}$ <sup>Note2</sup>	2	W
Channel dissipation	$P_{ch}$ <sup>Note3</sup>	3	W
Channel temperature	$T_{ch}$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

Note: 1.  $PW \leq 10\mu s$ , duty cycle  $\leq 1\%$   
 2. 1 Drive operation  $\Delta F$  When using the glass epoxy board (FR4 40 x 40 x 1.6mm),  $PW \leq 10s$   
 3. 2 Drive operation  $\Delta F$  When using the glass epoxy board (FR4 40 x 40 x 1.6mm),  $PW \leq 10s$

### 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	$\mu A$	$V_i = 8V, V_{DS} = 0$
	$I_{IH2}$	—	—	50	$\mu A$	$V_i = 3.5V, V_{DS} = 0$
	$I_{IL}$	—	—	1	$\mu A$	$V_i = 1.2V, V_{DS} = 0$
Input current (Gate non shut down)	$I_{IH(sd)1}$	—	0.8	—	mA	$V_i = 8V, V_{DS} = 0$
	$I_{IH(sd)2}$	—	0.35	—	mA	$V_i = 3.5V, V_{DS} = 0$
Shut down temperature	$T_{sd}$	—	175	—	°C	Channel temperature
Gate operation voltage	$V_{OP}$	3.5	—	12	V	

## Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	3	—	—	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	$I_{DSS}$	—	—	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	$R_{DS(on)}$	—	160	240	m $\Omega$	$I_D = 2A, V_{GS} = 4V$ <sup>Note3</sup>
Static drain to source on state resistance	$R_{DS(on)}$	—	70	100	m $\Omega$	$I_D = 2A, V_{GS} = 10V$ <sup>Note3</sup>
Forward transfer admittance	$ y_{fs} $	(3)	(6)	—	S	$I_D = 2A, V_{DS} = 10V$ <sup>Note3</sup>
Output capacitance	$C_{oss}$	—	210	—	pF	$V_{DS} = 10V, V_{GS} = 0$ $f = 1MHz$
Turn-on delay time	$t_{d(on)}$	—	(1.4)	—	$\mu s$	$I_D = 2A, V_{GS} = 5V$ $R_L = 15\Omega$
Rise time	$t_r$	—	(7.2)	—	$\mu s$	
Turn-off delay time	$t_{d(off)}$	—	(5.4)	—	$\mu s$	
Fall time	$t_f$	—	(6)	—	$\mu s$	
Body-drain diode forward voltage	$V_{DF}$	—	(0.8)	—	V	$I_F = 3A, V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	( )	—	ns	$I_F = 3A, V_{GS} = 0$ $diF/dt = 50A/\mu s$
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

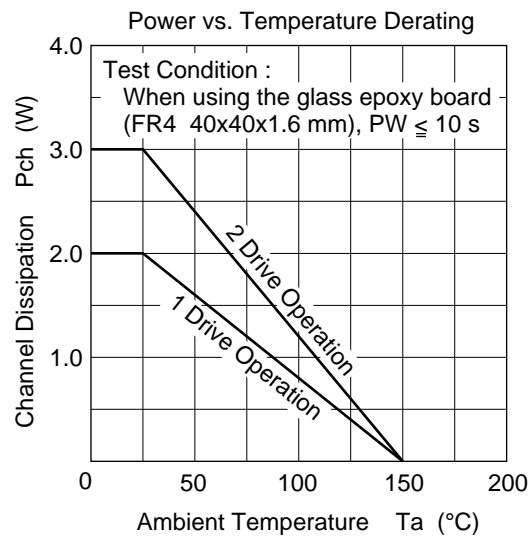
4. Include the time shift based on increasing of channel temperature when operate under over load condition.

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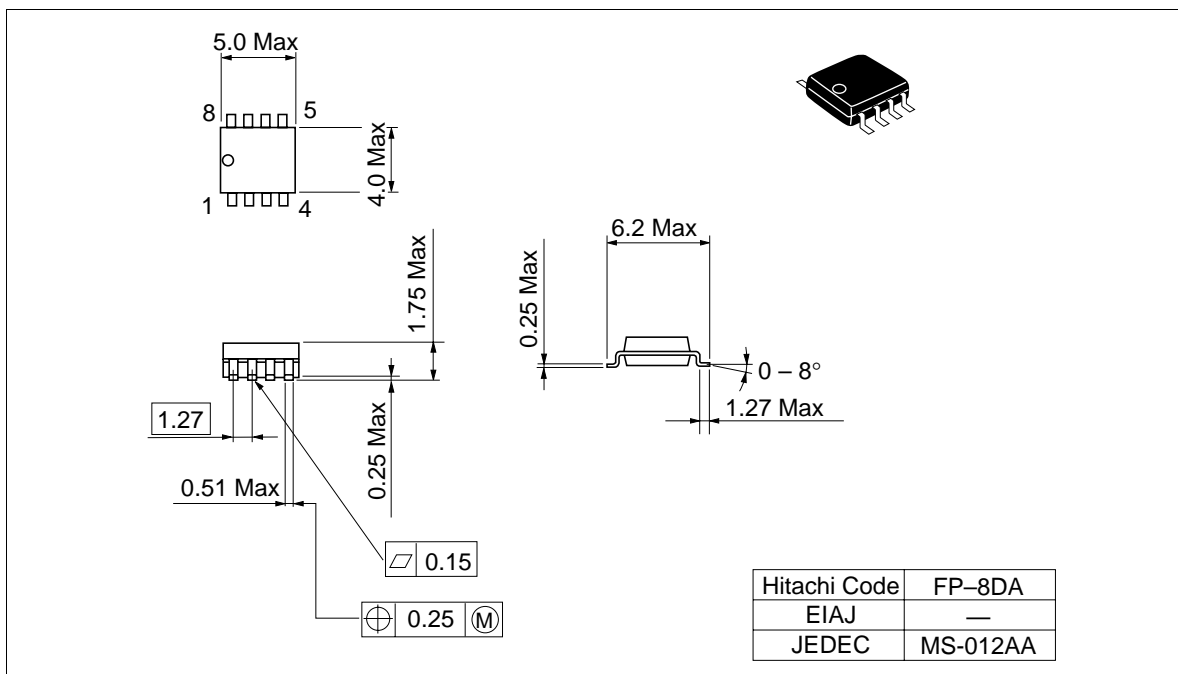
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### Main Characteristics



**Package Dimensions**

Unit: mm



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