

# HAF2012(L),HAF2012(S)

## Silicon N Channel MOS FET Series Power Switching

# HITACHI

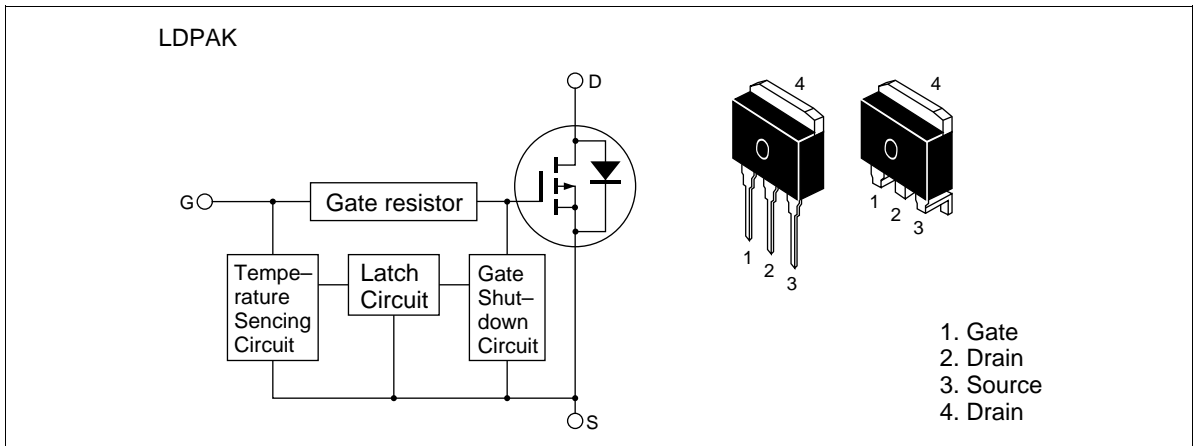
ADE-208-677A (Z)  
2nd. Edition  
July 2000

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



# HAF2012(L), HAF2012(S)

## Absolute Maximum Ratings (Ta = 25°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	Pch <sup>Note2</sup>	50	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	$V_{IH}$	3.5	—	—	V	
	$V_{IL}$	—	—	1.2	V	
Input current (Gate non shut down)	$I_{IH1}$	—	—	100	μA	Vi = 8V, V <sub>DS</sub> = 0
	$I_{IH2}$	—	—	50	μA	Vi = 3.5V, V <sub>DS</sub> = 0
	$I_{IL}$	—	—	1	μA	Vi = 1.2V, V <sub>DS</sub> = 0
Input current (Gate shut down)	$I_{IH(sd)1}$	—	0.8	—	mA	Vi = 8V, V <sub>DS</sub> = 0
	$I_{IH(sd)2}$	—	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	—	13	V	

**Electrical Characteristics (Ta = 25°C)**

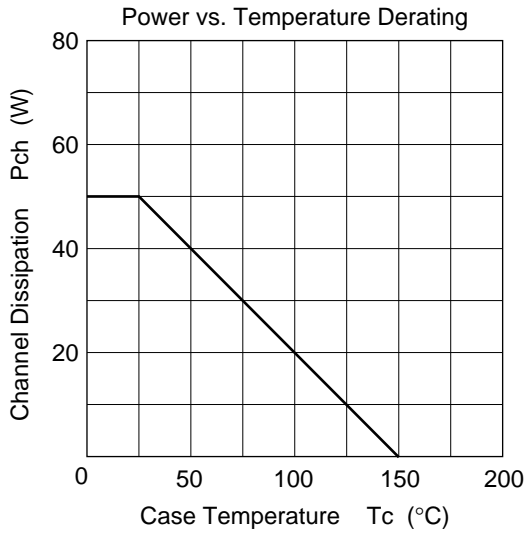
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	$I_{D1}$	10	—	—	A	$V_{GS} = 3.5V, V_{DS} = 2V$
Drain current	$I_{D2}$	—	—	10	mA	$V_{GS} = 1.2V, V_{DS} = 2V$
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	$I_D = 10mA, V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	16	—	—	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 junction temperature rise of the over loaded condition.

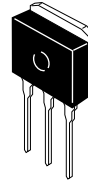
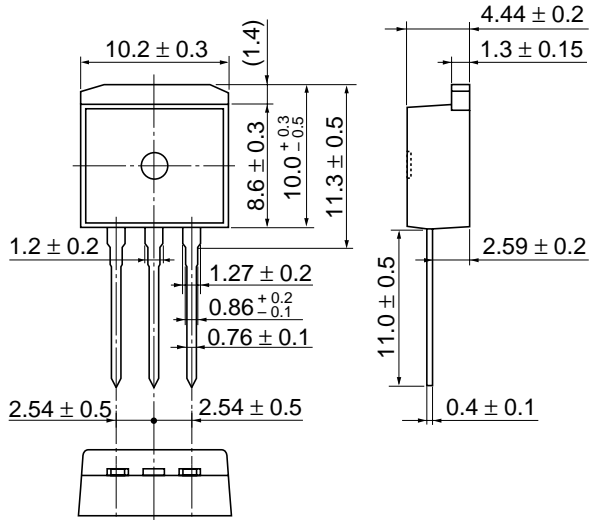
- See characteristic curve of HAF2001.

**Main Characteristics**



Package Dimensions

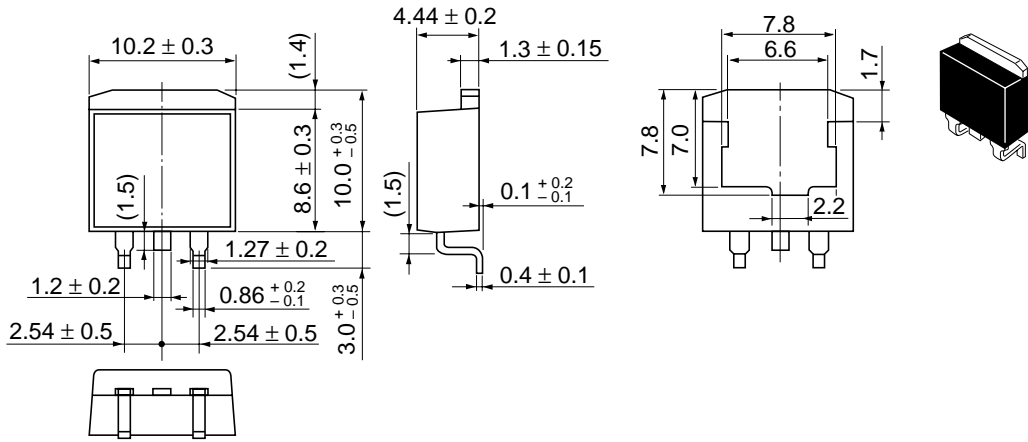
As of January, 2001  
Unit: mm



Hitachi Code	LDPAK (L)
JEDEC	—
EIAJ	—
Mass (reference value)	1.4 g

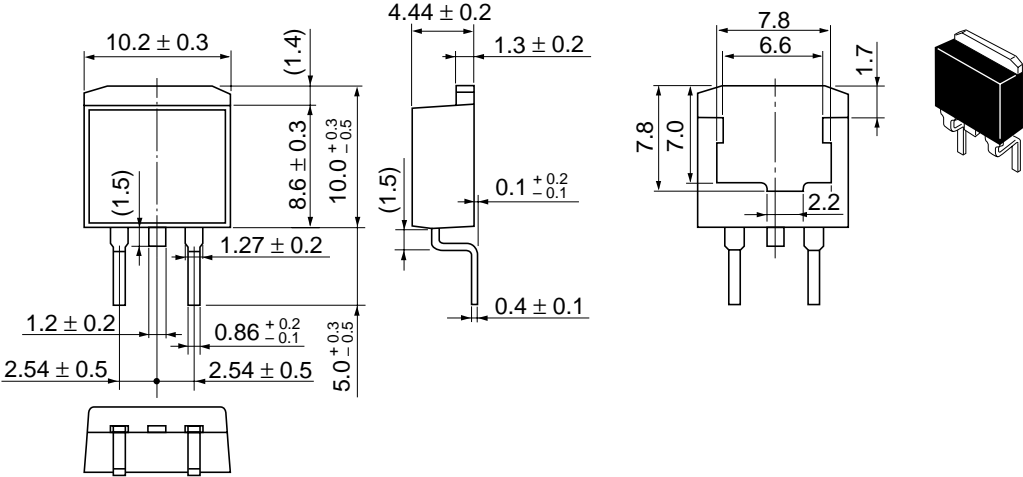
# HAF2012(L), HAF2012(S)

As of January, 2001  
Unit: mm



Hitachi Code	LDBPAK (S)-(1)
JEDEC	—
EIAJ	—
Mass (reference value)	1.3 g

As of January, 2001  
Unit: mm



Hitachi Code	LDBPAK (S)-(2)
JEDEC	—
EIAJ	—
Mass (reference value)	1.35 g

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