

# HAF1009(L), HAF1009(S)

## Silicon P Channel MOS FET Series Power Switching

REJ03G0029-0100Z (Previous ADE-208-1525 (Z)) Rev.1.00 May.13.2003

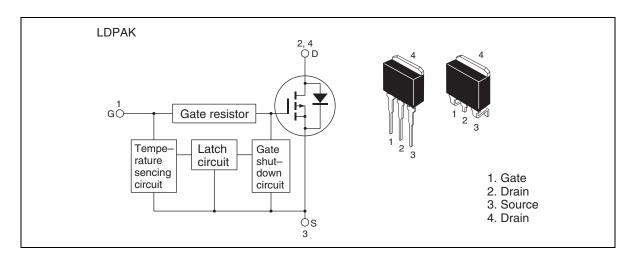
### **Description**

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**

 $(Ta = 25^{\circ}C)$ 

Item	Symbol	Ratings	Unit
Drain to source voltage	$V_{DSS}$	-60	V
Gate to source voltage	V <sub>GSS</sub>	-16	V
Gate to source voltage	$V_{GSS}$	2.5	V
Drain current	I <sub>D</sub>	-40	A
Drain peak current	I <sub>D</sub> (pulse) Note1	-80	A
Body-drain diode reverse drain current	$I_{DR}$	<b>-40</b>	A
Channel dissipation	Pch <sup>Note2</sup>	50	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	-55 to +150	°C

Notes: 1. PW  $\leq$  10 $\mu$ s, duty cycle  $\leq$  1 %

2. Value at Tc = 25°C

### **Typical Operation Characteristics**

 $(Ta = 25^{\circ}C)$ 

Item	Symbol	Min	Тур	Max	Unit	Test Conditions
Input voltage	$V_{IH}$	-3.5	_	_	V	
	V <sub>IL</sub>	_	_	-1.2	V	
Input current (Gate non shut down)	I <sub>IH1</sub>	_	_	-100	μΑ	Vi = -8 V, V <sub>DS</sub> = 0
	I <sub>IH2</sub>	_	_	-50	μΑ	$Vi = -3.5 V, V_{DS} = 0$
	I <sub>IL</sub>	_	_	-1	μΑ	$Vi = -1.2 V, V_{DS} = 0$
Input current (Gate shut down)	I <sub>IH(sd)1</sub>	_	-0.8	_	mA	$Vi = -8 V, V_{DS} = 0$
	I <sub>IH(sd)2</sub>	_	-0.35	_	mA	$Vi = -3.5 V, V_{DS} = 0$
Shut down temperature	Tsd	_	175	_	°C	Channel temperature
Gate operation voltage	Vop	-3.5	_	-12	V	

### **Electrical Characteristics**

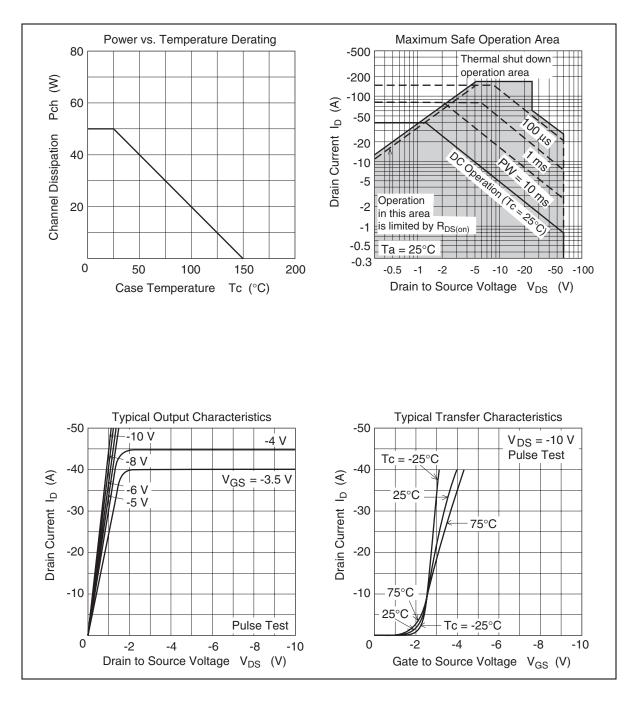
 $(Ta = 25^{\circ}C)$ 

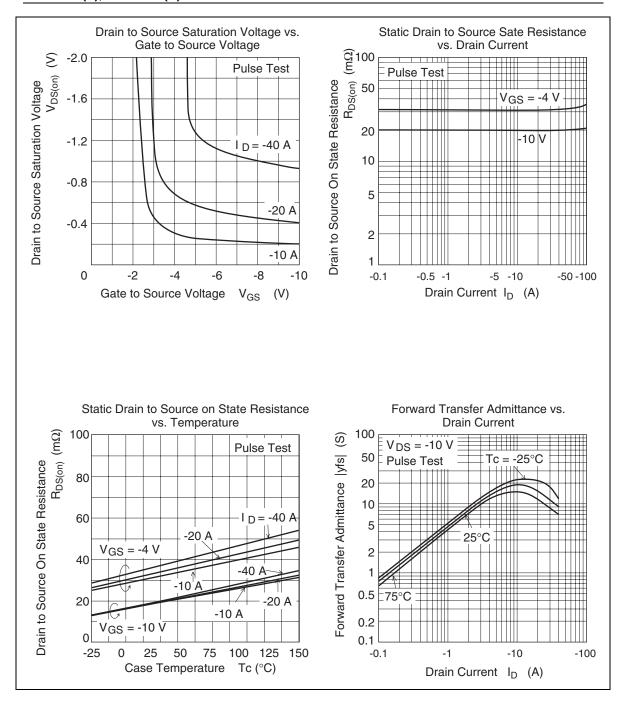
Item	Symbol	Min	Тур	Max	Unit	Test Conditions
Drain current	I <sub>D1</sub>	-10	_	_	Α	$V_{GS} = -3.5, V_{DS} = -2 V$
Drain current	I <sub>D2</sub>	_	_	-10	mA	V <sub>GS</sub> = -1.2V, V <sub>DS</sub> = -2 V
Drain to source breakdown voltage	$V_{(BR)DSS}$	-60	_	_	V	$I_D = -10 \text{ mA}, V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	-16	_	_	V	$I_G = -800 \ \mu A, \ V_{DS} = 0$
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 <sub>GSS1</sub>	_	_	-100	μA	$V_{GS} = -8 \text{ V}, V_{DS} = 0$
	I <sub>GSS2</sub>	_	_	-50	μA	$V_{GS} = -3.5 \text{ V}, V_{DS} = 0$
	I <sub>GSS3</sub>	_	_	-1	μΑ	$V_{GS} = -1.2 \text{ V}, V_{DS} = 0$
	I <sub>GSS4</sub>	_	_	100	μΑ	V <sub>GS</sub> = 2.4 V, V <sub>DS</sub> = 0
Input current (shut down)	I <sub>GS(OP)1</sub>	_	-0.8	_	mA	$V_{GS} = -8 \text{ V}, V_{DS} = 0$
	I <sub>GS(OP)2</sub>	_	-0.35	_	mA	$V_{GS} = -3.5 \text{ V}, V_{DS} = 0$
Zero gate voltage drain current	I <sub>DSS</sub>	_	_	-10	μΑ	$V_{DS} = -60 \text{ V}, V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	-1.1	_	-2.15	V	$V_{DS} = -10 \text{ V}, I_{D} = -1 \text{ mA}$
Forward transfer admittance	y <sub>fs</sub>	8.4	14.8	_	S	$I_D = -20 \text{ A}, V_{DS} = -10 \text{ V}^{\text{Note3}}$
Static drain to source on stat	e R <sub>DS(on)</sub>	_	33	50	mΩ	$I_D = -20 \text{ A}, V_{GS} = -4 \text{ V}^{\text{Note3}}$
resistance	R <sub>DS(on)</sub>	_	20	27	mΩ	$I_D = -20 \text{ A}, V_{GS} = -10 \text{ V}^{\text{Note3}}$
Output capacitance	Coss	_	1500	_	pF	$V_{DS} = -10 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$
Turn-on delay time	td(on)	_	10.6	_	μs	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -20 A,
Rise time	tr	_	45	_	μs	¯R <sub>L</sub> = 1.5 Ω −
Turn-off delay time	td(off)	_	12	_	μs	
Fall time	tf	_	13	_	μs	_
Body-drain diode forward voltage	$V_{DF}$	_	-0.95	_	V	$I_F = -40 \text{ A}, V_{GS} = 0$
Body-drain diode reverse recovery time	trr	_	100	_	ns	$I_F = -40 \text{ A}, V_{GS} = 0$ diF/dt = 50 A/ $\mu$ s
Over load shut down	4		4.1		ms	$V_{GS} = -5 \text{ V}, V_{DD} = -16 \text{ V}$
operation time Note4	t <sub>os1</sub>		<del></del>		1110	VGS = -3 V, VDD = -10 V

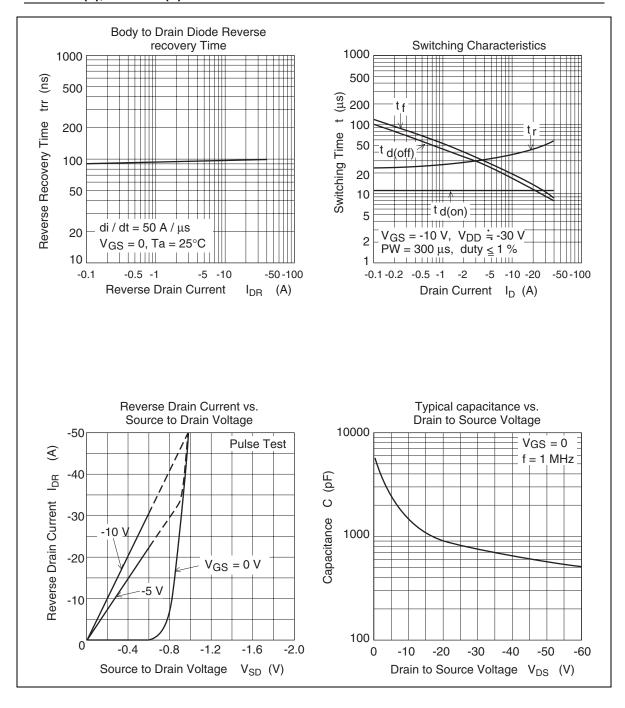
Notes: 3. Pulse test

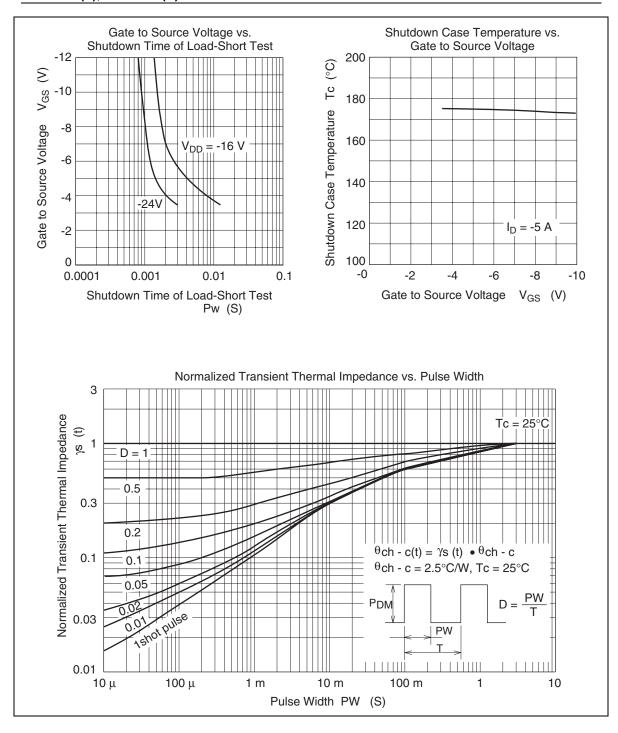
4. Including the junction temperature rise of the over loaded condition.

### **Main Characteristics**

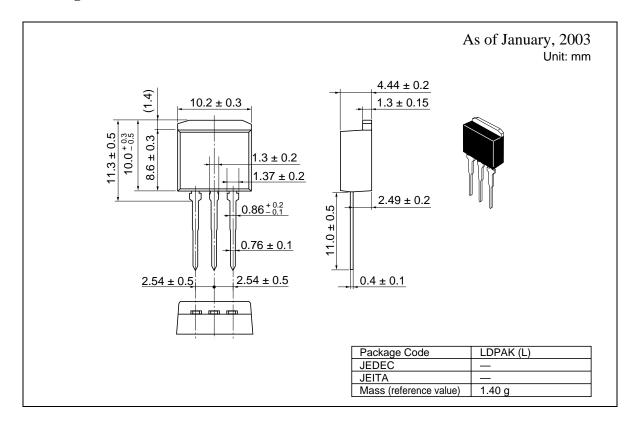


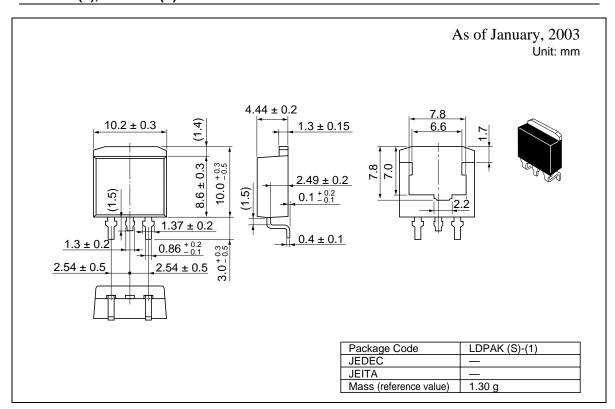






### **Package Dimensions**





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