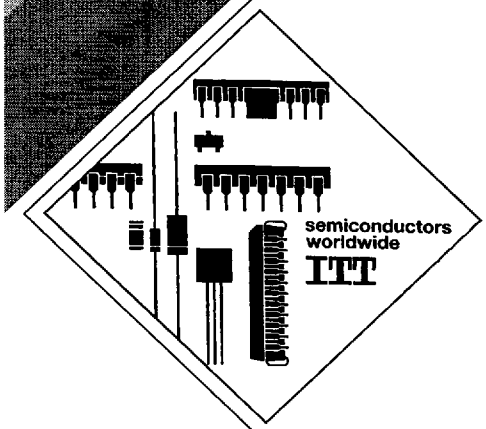


PRELIMINARY DATA SHEET

HAL115
Hall Effect Sensor IC

4682711 0005213 410

Edition June 30, 1995
6251-414-2PD

ITT Semiconductors

Hall Effect Sensor IC
in CMOS technology

Release Notes: Revision bars indicate significant changes to the previous edition.

Features:

- operates up to 24 V supply voltage with reverse voltage protection
- operates with magnetic fields from DC to 20 kHz
- over-voltage and reverse-voltage protection
- on-chip temperature compensation circuitry minimizes shifts in on and off points and hysteresis over temperature and supply voltage
- the decrease of magnetic flux density caused by rising temperature in the sensor system is compensated by a built-in negative temperature coefficient of hysteresis
- ideal sensor for speed measurement, revolution counting, positioning, and DC brushless motors
- short circuit protection

Specifications

- bipolar switching
- output turns low with magnetic south pole on branded side of package

Marking Code

Type	Marking
HAL 115UA	115
HAL 115S	115

Solderability

- Package SOT-89A: according to IEC68-2-58
- Package TO-92UA: according to IEC68-2-20

Device is available in the packages SOT-89A and TO-92UA. Please use the letter 'S' after the type designation (e.g. HAL115S) when ordering the SOT-89A package and the letters 'UA' after the type designation (e.g. HAL115UA) when ordering the TO-92UA package.

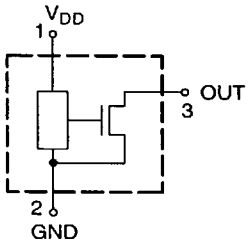


Fig. 1: Pin configuration

Functional Description

Shunt protection devices clamp voltage peaks at the V_{DD}-Pin and Output-Pin together with external series resistors. Reverse current is limited at the V_{DD}-Pin by an internal series resistor up to −15 V. The output is short-circuit protected by limiting high currents and by sensing overtemperature. The temperature-dependent bias increases the supply voltage of the hall plates and adjusts the switching points to the decreasing induction of magnets at higher temperatures. The hall voltage is compared with the actual switching point. Subsequently, the open drain output switches to the appropriate state.

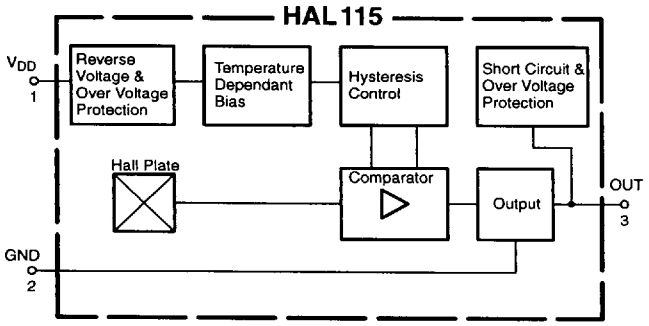


Fig. 2: HAL115 block diagram

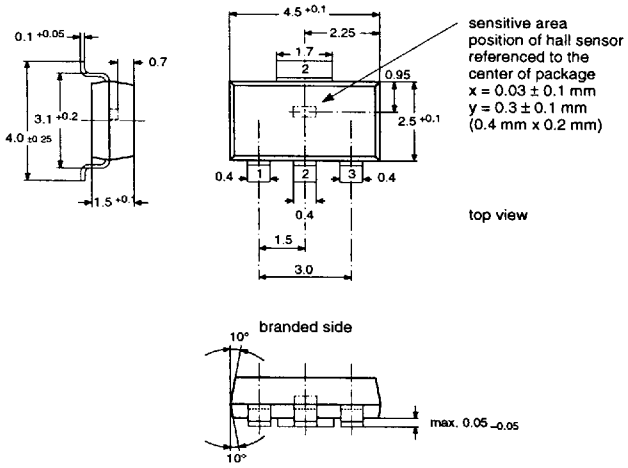


Fig. 3:
Plastic Small Outline Transistor Package
(SOT-89A)
Weight approximately 0.04 g
Dimensions in mm

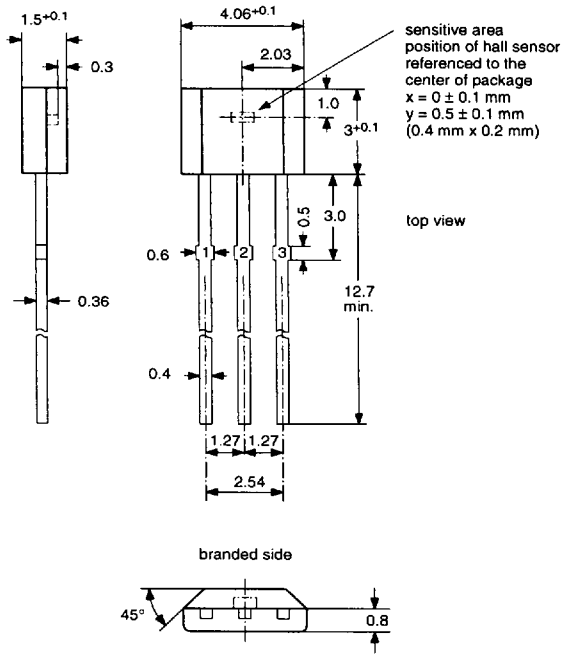


Fig. 4:
Plastic Transistor Single Outline Package
(TO-92UA)
Weight approximately 0.12 g
Dimensions in mm

Absolute Maximum Ratings

Symbol	Parameter	Pin No.	Min.	Max.	Unit
V_{DD}	Supply Voltage	1	–15	24	V
V_{OH}	Output Off Voltage	3	–	24	V
I_O	Continuous Output On Current	3	–	10	mA
I_O	Peak Output On Current	3	–	250	mA
$-I_{DD}$	Reverse Supply Current	3		25	mA
T_s	Storage Temperature Range		–65	150	°C
T_J	Junction Temperature Range		–20	150	°C

Stresses beyond those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only. Functional operation of the device at these or any other conditions beyond those indicated in the "Recommended Operating Conditions/Characteristics" of this specification is not implied. Exposure to absolute maximum ratings conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Symbol	Parameter	Pin No.	Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage	1	4.5	–	24	V
I_O	Continuous Output On Current	3	0	–	12.5	mA

Electrical Characteristics at T_J = 0 °C to +100 °C, V_{DD} = 4.5 V to 24 V, Typical Characteristics for T_J = 25 °C and V_{DD} = 12 V

Symbol	Parameter	Pin No.	Min.	Typ.	Max.	Unit	Test Conditions
V_{OL}	Output Voltage	3	50	175	400	mV	I_O = 12.5 mA, T_J = 25 °C
V_{OL}	Output Voltage over Temperature Range	3	50	175	400	mV	I_O = 12.5 mA
I_{OH}	Output Leakage Current	3	–	–	1	µA	B < B_{off}, T_J = 25 °C
I_{OH}	Output Leakage Current over Temperature Range	3	–	–	10	µA	B < B_{off}
I_{DD}	Supply Current	1	6.5	8.3	11	mA	T_J = 25 °C, V_{DD} = 12 V
I_{DD}	Supply Current over Temperature Range	1	5.5	8.3	11	mA	
$t_{en(O)}$	Enable Time of V_{DD} (Output is valid after Enable Time)	1	–	6	50	µs	V_{DD} = 12 V
t_r	Output Rise Time	3	–	85	400	ns	V_{DD} = 12 V, RL = 820 Ohm, CL = 20 pF
t_f	Output Fall Time	3	–	60	400	ns	V_{DD} = 12 V, RL = 820 Ohm,

Electrical Characteristics, continued

Symbol	Parameter	Pin No.	Min.	Typ.	Max.	Unit	Test Conditions
R_{thJSB} case SOT-89A	Thermal Resistance Junction to Substrate Backside		–	150	200	K/W	Fiberglass Substrate, 30 mm x 10 mm x 1,5mm pad size see Fig. 6
R_{thJA} case TO-92UA	Thermal Resistance Junction to Soldering Point		–	150	200	K/W	Leads at ambient temperature at a distance of 2 mm from case

Magnetic Characteristics at T_J = 0 °C to +100 °C, V_{DD} = 4.5 V to 24 V,
Typical Characteristics for T_J = 25 °C and V_{DD} = 12 V

Magnetic flux density values of switching points.
Positive flux density values refer to the magnetic south pole at the branded side of the package.

Parameter	Min.	Typ.	Max.	Unit
On point B_{ON}	–22.5	2.25	25	mT
Off point B_{OFF}	–25	–2.25	22.5	mT
Hysteresis B_{HYS}	2.8	4.5	7	mT

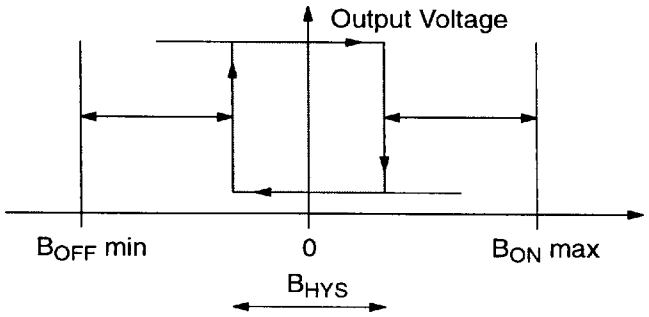


Fig. 5: Definition of magnetic switching points and hysteresis

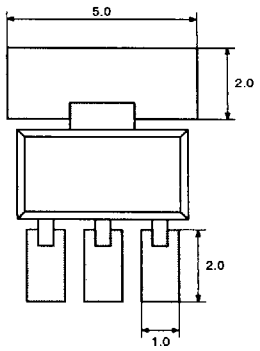
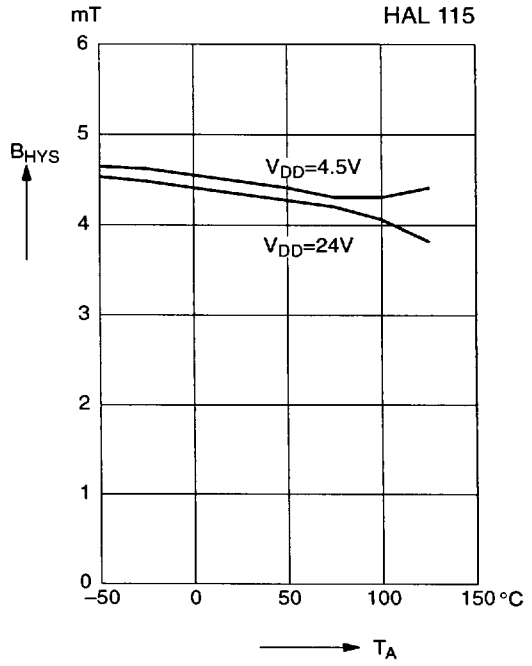


Fig. 6: Recommended pad size SOT-89A
Dimensions in mm

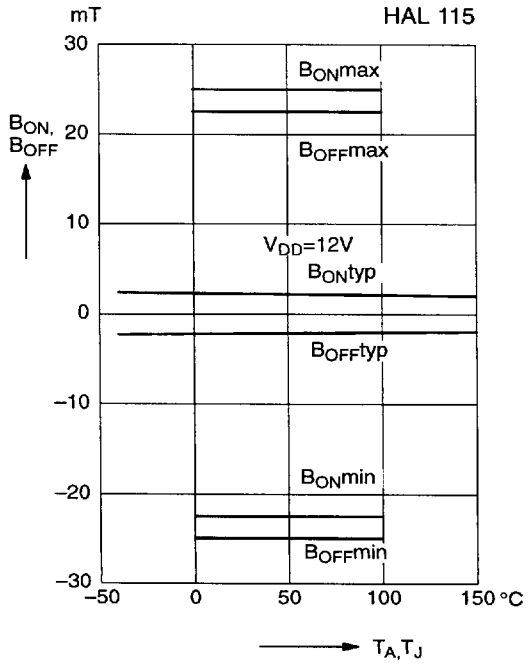
Note 1: In the following diagrams "Magnetic switch points versus ambient temperature" , the curves for B_{ON}min, B_{ON}max, B_{OFF}min, and B_{OFF}max refer to junction temperature, whereas typical curves refer to ambient temperature.

Note 2: The dropping characteristic of the supply current versus the supply voltage is caused by the internal power dissipation.

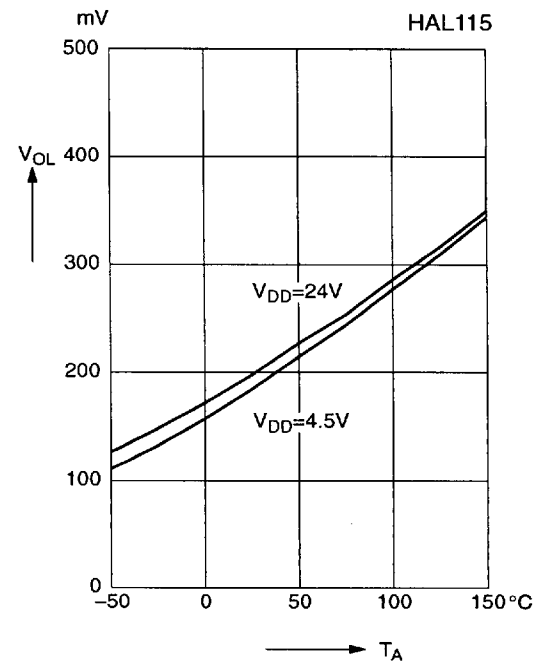
Typical hysteresis versus ambient temperature



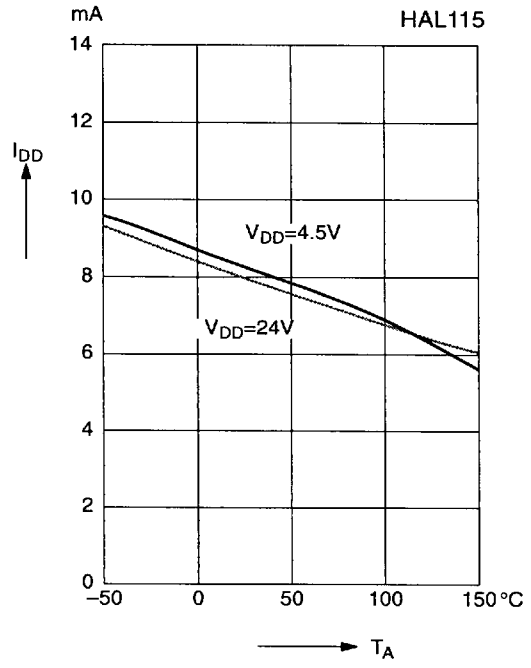
Magnetic switching points versus ambient temperature



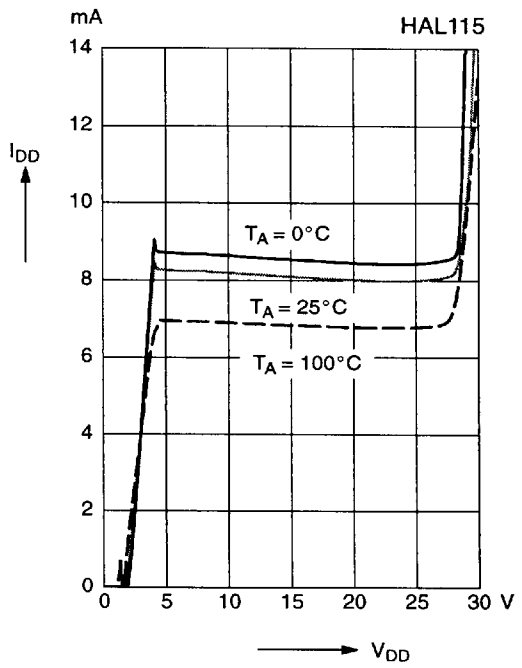
Typical output low voltage versus ambient temperature



Typical supply current versus ambient temperature



Typical supply current versus supply voltage



Application Note

For electromagnetic immunity, it is recommended to apply a 330 pF minimum capacitor between V_{DD} (pin 1) and Ground (pin 2).

For applications requiring robustness to conducted disturbances (transients), a 220 Ω series resistor to pin 1 and a 4.7 nF capacitor between V_{DD} (pin 1) and Ground (pin 2) is recommended.

Because of the I_{DD} peak at 4.1 V, the series resistor should not be greater than 270 Ω.

HAL 115 Documentation History

1. Preliminary data sheet: "HAL115 Hall Effect Sensor IC", March 3, 1995, 6251-414-1PD. First release of the preliminary data sheet.

2. Preliminary data sheet: "HAL115 Hall Effect Sensor IC", June 30, 1995, 6251-414-2PD. Second release of the preliminary data sheet.
Major changes:

– short circuit protection

ITT Semiconductors Group
World Headquarters
INTERMETALL
Hans-Bunte-Strasse 19
D-79108 Freiburg (Germany)
P.O. Box 840
D-79008 Freiburg (Germany)
Tel. +49-761-517-0
Fax +49-761-517-2174

Printed in Germany
by Systemdruck+Verlags-GmbH, Freiburg (6/95)