US3881

CMOS Low Voltage Hall Effect Latch

Features and Benefits

- Chopper stabilized amplifier stage
- Optimized for BDC motor applications
- New miniature package / thin, high reliability package
- Operation down to 2.2V
- CMOS for optimum stability, quality, and cost

Applications

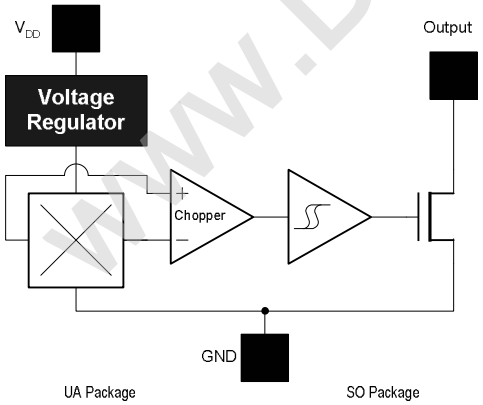
- Solid state switch
- Brushless DC motor commutation
- Speed sensing
- Linear position sensing
- Angular position sensing
- Current sensing

Ordering Information

Part No.	Temperature Suffix	Package
US3881	E (-40°C to 85°C)	SO (SOT-23) or UA (TO-92)
US3881	L (-40°C to 150°C)	SO (SOT-23) or UA (TO-92)

* Contact factory or Sale Representative for legacy temperature options

Functional Diagram



Description

The US3881 is a bipolar Hall effect sensor IC fabricated from mixed signal CMOS technology. It incorporates advanced chopper stabilization techniques to provide accurate and stable magnetic switch points. There are many applications for this sensor in addition to those listed above. The design, specifications, and performance have been optimized for commutation applications in 5V and 12V brushless DC motors.

The output transistor will be latched on (B_{OP}) in the presence of a sufficiently strong South pole magnetic field facing the marked side of the package. Similarly, the output will be latched off (B_{RP}) in the presence of a North field.

The SOT-23 device is reversed from the UA package. The SOT-23 output transistor will be latched on in the presence of a sufficiently strong North pole magnetic field subjected to the marked face.

Note: *Static sensitive device; please observe ESD precautions. Reverse V_{DD} protection is not included. For reverse voltage protection, a 100W resistor in series with V_{DD} is recommended.*

US3881 Electrical Specifications

DC Operating Parameters: T_A = 25, V_{DD} = 12V_{DC} (unless otherwise specified).

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	V_{DD}	Operating	2.2		18	V
Supply Current	I_{DD}	B<B_{OP}	1.5	2.5	4.0	mA
Saturation Voltage	$V_{DS(on)}$	I_{OUT} = 20 mA, B>B_{OP}		0.4	0.5	V
Output Leakage	I_{OFF}	B<B_{RP}, V_{OUT} = 20V		0.01	10.0	µA
Output Rise Time	t_r	V_{DD} = 12V, R_L = 1.1KΩ, C_L = 20pf		0.04		µs
Output Fall Time	t_f	V_{DD} = 12V, R_L = 1.1KΩ, C_L = 20pf		0.18		µs

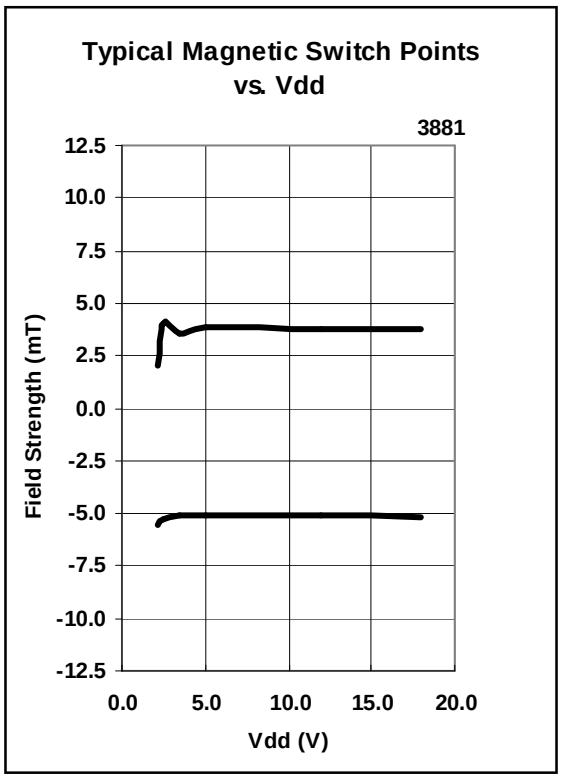
US3881 Magnetic Specifications

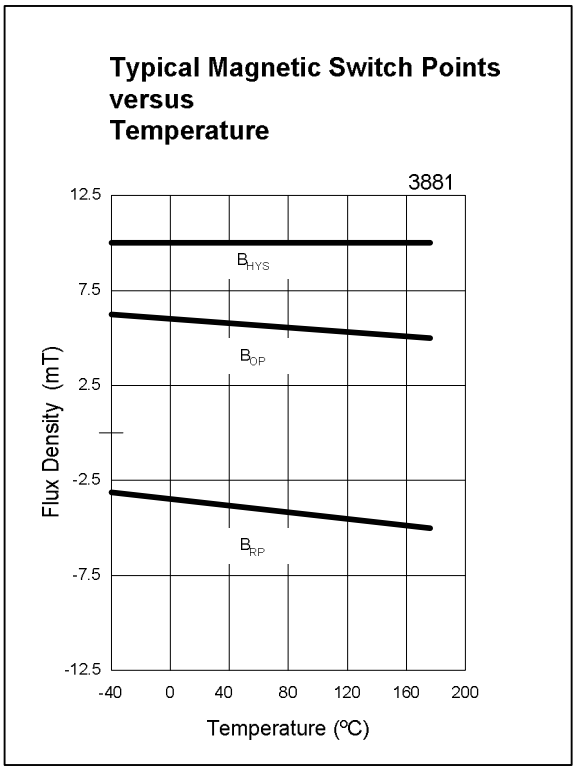
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operating Point	B_{OP}	EUA,ESO 25 & 85°C, Vdd=2.2 & 18 volts DC	1.0	5.0	9.0	mT
Release Point	B_{RP}	EUA,ESO 25 & 85°C, Vdd=2.2 & 18 volts DC	-9.0	-5.0	-1.0	mT
Hysteresis	B_{hys}	EUA,ESO 25 & 85°C, Vdd=2.2 & 18 volts DC	5.5	10.0	12.0	mT
Operating Point	B_{OP}	LUA, LSO 25 & 150°C, Vdd=2.2 & 18 volts DC	1.0	5.0	9.0	mT
Release Point	B_{RP}	LUA,LSO 25 & 150°C, Vdd=2.2 & 18 volts DC	-9.0	-5.0	-1.0	mT
Hysteresis	B_{hys}	LUA,LSO 25 & 150°C, Vdd=2.2 & 18 volts DC	5.5	10.0	12.0	mT

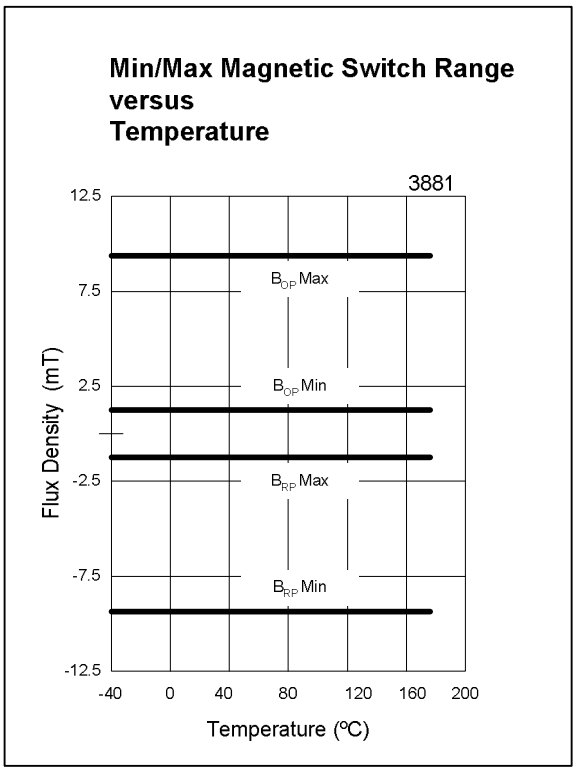
Absolute Maximum Ratings

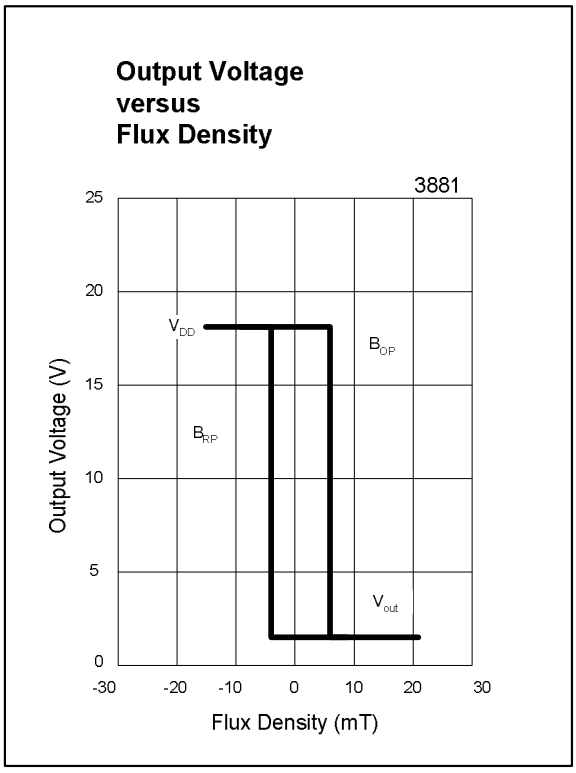
Supply Voltage (Operating), V_{DD}	18V
Supply Current (Fault), I_{DD}	50mA
Output Voltage, V_{OUT}	18V
Output Current (Fault), I_{OUT}	50mA
Power Dissipation, P_D	100mW
Operating Temperature Range, T_A	-40 to 150°C
Storage Temperature Range, T_S	-65 to 150°C
Maximum Junction Temp, T_J	175°C

Performance Graphs



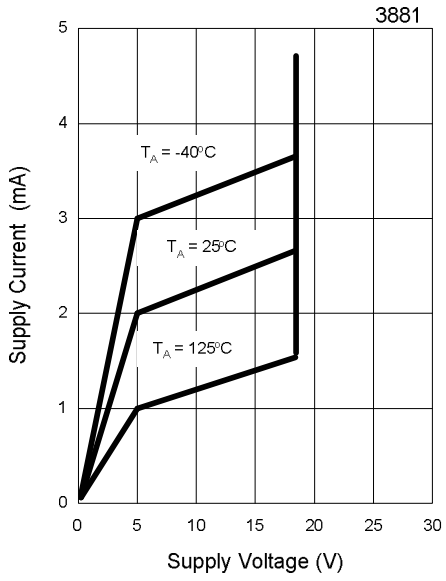




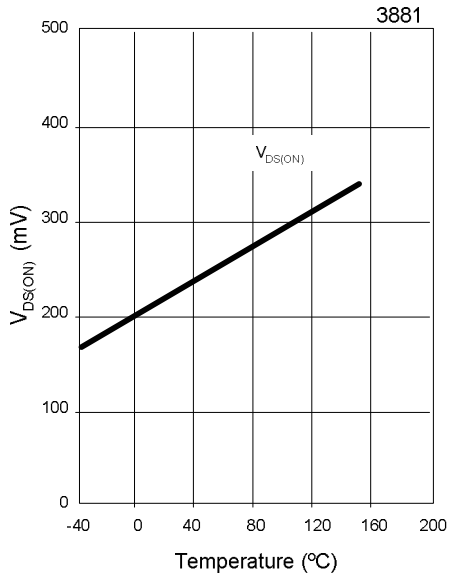


Performance Graphs

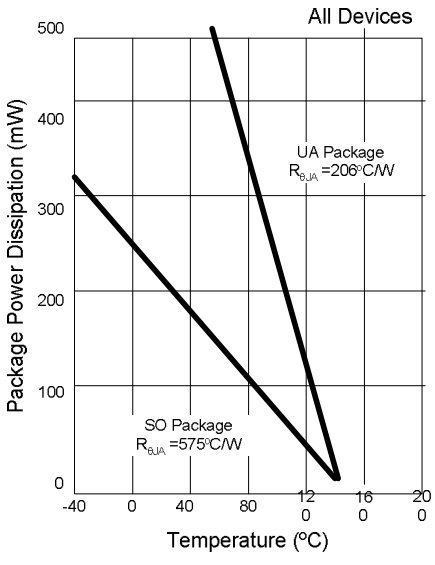
Typical Supply Current versus Supply Voltage



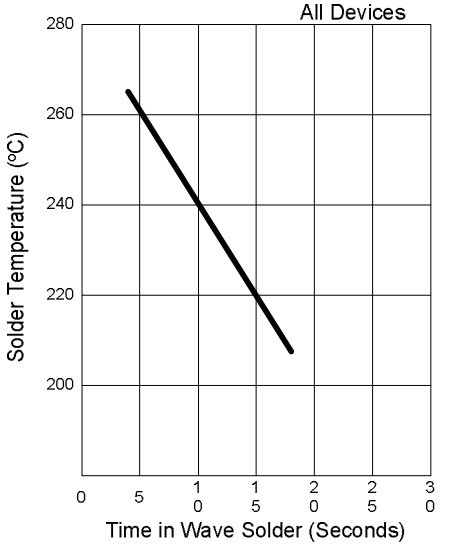
Typical Saturation Voltage versus Temperature
V_{DD} = 12 V, I_{OUT} = 20mA



Power Dissipation versus Temperature



Wave Soldering Parameters



Unique Features

CMOS Hall IC Technology

The chopper stabilized amplifier uses switched capacitor techniques to eliminate the amplifier offset voltage, which, in bipolar devices, is a major source of temperature sensitive drift. CMOS makes this advanced technique possible. The CMOS chip is also much smaller than a bipolar chip, allowing very sophisticated circuitry to be placed in less space. The small chip size also contributes to lower physical stress and less power consumption.

Installation

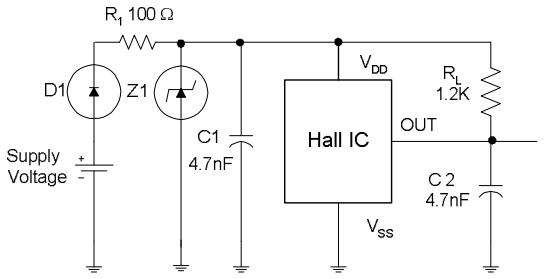
Consider temperature coefficients of Hall IC and magnetics, as well as air gap life time variations. Observe temperature limits during wave soldering.

Applications

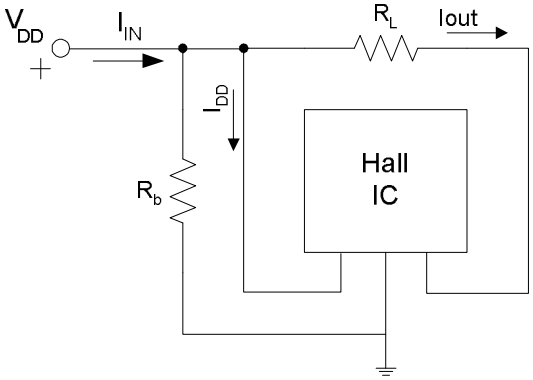
If reverse supply protection is desired, use a resistor in series with the V_{DD} pin. The resistor will limit the Supply Current (Fault), I_{DD}, to 50 mA. For severe EMC conditions, use the application circuit below.

Applications Examples

Automotive and Severe Environment Protection Circuit



Two Wire Optional Current Biasing Circuit

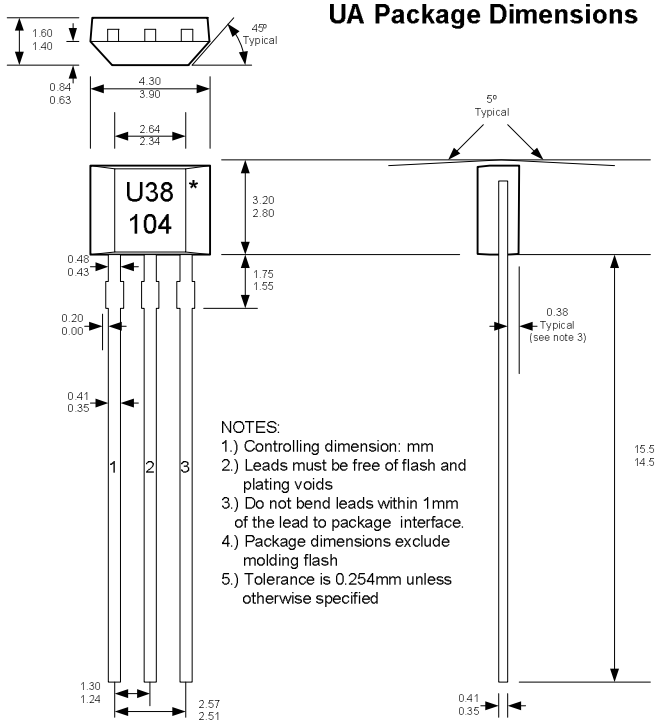


The resistors R_b and R_L can be used to bias the input current, Iin. Refer to the part specification for limiting values. This circuit will help in getting the precise ON and OFF currents desired.

B_{RP} = Ioff = (V_{DD} / Rb + I_{DD})
B_{OP} = Ion = (Ioff + V_{DD} / R_L)

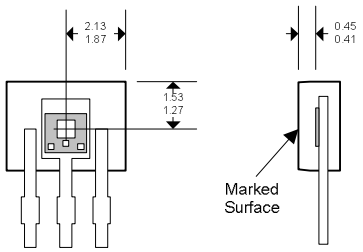
Physical Characteristics

UA Package Dimensions



NOTES:
1.) Controlling dimension: mm
2.) Leads must be free of flash and plating voids
3.) Do not bend leads within 1mm of the lead to package interface.
4.) Package dimensions exclude molding flash
5.) Tolerance is 0.254mm unless otherwise specified

UA Hall Plate / Chip Location



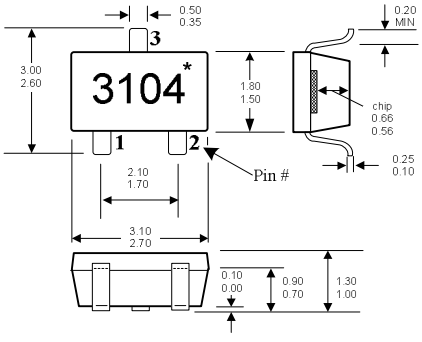
All Dimensions in millimeters

* MARKING:
Line 1:
1st digit (U) = Supplier (Melexis)
2nd and 3rd digits (38) = Series (3880)

Line 2:
1st digit (1) = Year (2001)
2nd and 3rd digits(04) = Week of Year

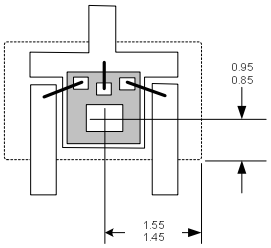
PINOUT:
Pin 1 V_{DD}
Pin 2 GND
Pin 3 Output

SOT-23 Package Dimensions (Top View)



NOTES:
1. MARKING:
   1st Digit (3) = Series (3881)
   2nd Digit(1) = Year - 2001
   Last Digits (04) = Week of Year
2. PINOUT (See Top View at left):
   Pin 1 VDD
   Pin 2 Output
   Pin 3 GND
3. Controlling dimension: mm.
4. Lead thickness after solder plating will be 0.254 mm maximum.
5. Package dimensions exclude molding flash.
6. The end flash shall not exceed 0.127 mm on each side of package.
7. Tolerance is +/- 0.254 mm unless otherwise specified.

SOT-23 Hall Plate / Chip Location (Bottom View)



Reliability Information

Melexis devices are classified and qualified regarding suitability for infrared, vapor phase and wave soldering with usual (63/37 SnPb-) solder (melting point at 183degC).
The following test methods are applied:

- IPC/JEDEC J-STD-020A (issue April 1999)
  Moisture/Reflow Sensitivity Classification For Nonhermetic Solid State Surface Mount Devices
- CECC00802 (issue 1994)
  Standard Method For The Specification of Surface Mounting Components (SMDs) of Assessed Quality
- MIL 883 Method 2003 / JEDEC-STD-22 Test Method B102
  Solderability

For all soldering technologies deviating from above mentioned standard conditions (regarding peak temperature, temperature gradient, temperature profile etc) additional classification and qualification tests have to be agreed upon with Melexis.

The application of Wave Soldering for SMD's is allowed only after consulting Melexis regarding assurance of adhesive strength between device and board.

For more information on manufacturability/solderability see quality page at our website: http://www.melexis.com/

ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

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