

### Features and Benefits

- Wide operating voltage range from 3.5V to 24V
- High magnetic sensitivity – Multi-purpose
- CMOS technology
- Chopper-stabilized amplifier stage
- Low current consumption
- Open drain output
- Thin SOT23 3L and flat TO-92 3L both RoHS Compliant packages

### Application Examples

- Automotive, Consumer and Industrial
- Solid-state switch
- Brushless DC motor commutation
- Speed detection
- Linear position detection
- Angular position detection
- Proximity detection

### Ordering Code

Product Code	Temperature Code	Package Code	Option Code	Packing Form Code
US1881	E	UA	AAA-000	BU
US1881	K	UA	AAA-000	BU
US1881	L	UA	AAA-000	BU
US1881	E	SE	AAA-000	RE
US1881	K	SE	AAA-000	RE
US1881	L	SE	AAA-000	RE

#### Legend:

Temperature Code: L for Temperature Range -40°C to 150°C  
 E for Temperature Range -40°C to 85°C  
 K for Temperature Range -40°C to 125°C

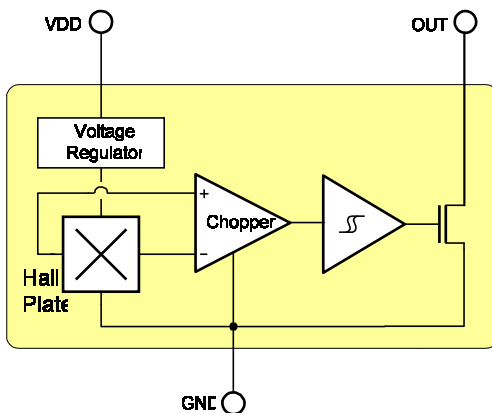
Package Code: UA for TO-92(Flat), SE for TSOT

Option Code: xxx-000: Standard version

Packing Form: RE for Reel, BU for Bulk

Ordering example: US1881KUA-AAA-000-BU

## 1 Functional Diagram



## 2 General Description

The Melexis US1881 is a Hall-effect latch designed in mixed signal CMOS technology.

The device integrates a voltage regulator, Hall sensor with dynamic offset cancellation system, Schmitt trigger and an open-drain output driver, all in a single package.

Thanks to its wide operating voltage range and extended choice of temperature range, it is quite suitable for use in automotive, industrial and consumer applications.

The device is delivered in a Thin Small Outline Transistor (TSOT) for surface mount process and in a Plastic Single In Line (TO-92 flat) for through-hole mount. Both 3-lead packages are RoHS compliant.

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### 3 Glossary of Terms

MilliTesla (mT), Gauss	Units of magnetic flux density: 1mT = 10 Gauss
RoHS	Restriction of Hazardous Substances
TSOT	Thin Small Outline Transistor (TSOT package) – also referred with the Melexis package code “SE”
ESD	Electro-Static Discharge
BLDC	Brush-Less Direct-Current
Operating Point ( $B_{OP}$ )	Magnetic flux density applied on the branded side of the package which turns the output driver ON ( $V_{OUT} = V_{DSon}$ )
Release Point ( $B_{RP}$ )	Magnetic flux density applied on the branded side of the package which turns the output driver OFF ( $V_{OUT} = \text{high}$ )

### 4 Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Supply Voltage	$V_{DD}$	28	V
Supply Current	$I_{DD}$	50	mA
Output Voltage	$V_{OUT}$	28	V
Output Current	$I_{OUT}$	50	mA
Storage Temperature Range	$T_S$	-50 to 150	°C
Maximum Junction Temperature	$T_J$	165	°C

Table 1: Absolute maximum ratings

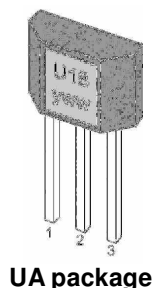
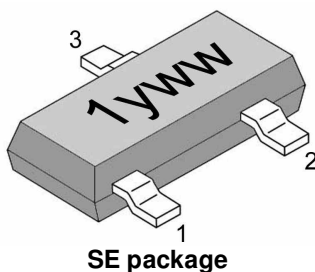
Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Operating Temperature Range	Symbol	Value	Units
Temperature Suffix “E”	$T_A$	-40 to 85	°C
Temperature Suffix “K”	$T_A$	-40 to 125	°C
Temperature Suffix “L”	$T_A$	-40 to 150	°C

### 5 Pin Definitions and Descriptions

SE Pin №	UA Pin №	Name	Type	Function
1	1	VDD	Supply	Supply Voltage pin
2	3	OUT	Output	Open Drain Output pin
3	2	GND	Ground	Ground pin

Table 2: Pin definitions and descriptions



### 6 General Electrical Specifications

DC Operating Parameters  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 3.5\text{V to }24\text{V}$  (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	$V_{DD}$	Operating	3.5		24	V
Supply Current	$I_{DD}$	$B < B_{RP}$			5	mA
Output Saturation Voltage	$V_{DSon}$	$I_{OUT} = 20\text{mA}$ , $B > B_{OP}$			0.5	V
Output Leakage Current	$I_{OFF}$	$B < B_{RP}$ , $V_{OUT} = 24\text{V}$		0.3	10	$\mu\text{A}$
Output Rise Time	$t_r$	$R_L = 1\text{k}\Omega$ , $C_L = 20\text{pF}$		0.25		$\mu\text{s}$
Output Fall Time	$t_f$	$R_L = 1\text{k}\Omega$ , $C_L = 20\text{pF}$		0.25		$\mu\text{s}$
Maximum Switching Frequency	$F_{SW}$			10		KHz
Package Thermal Resistance	$R_{TH}$	Single layer (1S) Jedec board		301		$^\circ\text{C/W}$

Table 3: Electrical specifications

### 7 Magnetic Specifications

DC Operating Parameters  $V_{DD} = 3.5\text{V to }24\text{V}$  (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operating Point	$B_{OP}$	E spec., $T_A = 85^\circ\text{C}$	0.5		9.5	mT
Release Point	$B_{RP}$		-9.5		-0.5	mT
Hysteresis	$B_{HYST}$		7		12	mT
Operating Point	$B_{OP}$	K spec., $T_A = 125^\circ\text{C}$	0.5		9.5	mT
Release Point	$B_{RP}$		-9.5		-0.5	mT
Hysteresis	$B_{HYST}$		7		12	mT
Operating Point	$B_{OP}$	L spec., $T_A = 150^\circ\text{C}$	0.5		9.5	mT
Release Point	$B_{RP}$		-9.5		-0.5	mT
Hysteresis	$B_{HYST}$		6		12.5	mT

Table 4: Magnetic specifications

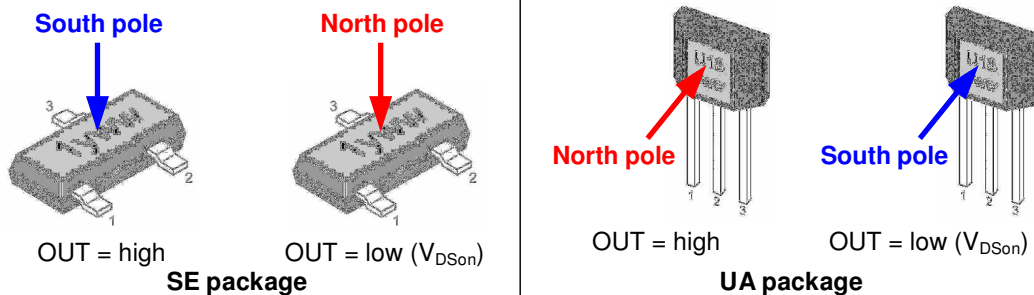
Note 1: For typical values, please refer to the performance graphs in section 11

### 8 Output Behaviour versus Magnetic Pole

DC Operating Parameters  $T_A = -40^\circ\text{C to }150^\circ\text{C}$ ,  $V_{DD} = 3.5\text{V to }24\text{V}$  (unless otherwise specified)

Parameter	Test Conditions (SE)	OUT (SE)	Test Conditions (UA)	OUT (UA)
South pole	$B < B_{RP}$	High	$B > B_{OP}$	Low
North pole	$B > B_{OP}$	Low	$B < B_{RP}$	High

Table 5: Output behaviour versus magnetic pole



### 9 Detailed General Description

Based on mixed signal CMOS technology, Melexis US1881 is a Hall-effect device with high magnetic sensitivity. This multi-purpose latch suits most of the application requirements.

The chopper-stabilized amplifier uses switched capacitor technique to suppress the offset generally observed with Hall sensors and amplifiers. The CMOS technology makes this advanced technique possible and contributes to smaller chip size and lower current consumption than bipolar technology. The small chip size is also an important factor to minimize the effect of physical stress.

This combination results in more stable magnetic characteristics and enables faster and more precise design.

The wide operating voltage from 3.5V to 24V, low current consumption and large choice of operating temperature range according to “L”, “K” and “E” specification make this device suitable for automotive, industrial and consumer applications.

The output signal is open-drain type. Such output allows simple connectivity with TTL or CMOS logic by using a pull-up resistor tied between a pull-up voltage and the device output.

### 10 Unique Features

The US1881 exhibits latch magnetic switching characteristics. Therefore, it requires both south and north poles to operate properly.



The device behaves as a latch with symmetric operating and release switching points ( $B_{OP} = |B_{RP}|$ ). This means magnetic fields with equivalent strength and opposite direction drive the output high and low.

Removing the magnetic field ( $B \rightarrow 0$ ) keeps the output in its previous state. This latching property defines the device as a magnetic memory.

A magnetic hysteresis  $B_{HYST}$  keeps  $B_{OP}$  and  $B_{RP}$  separated by a minimal value. This hysteresis prevents output oscillation near the switching point.