

### Features and Benefits

- Chopper stabilized amplifier stage
- New miniature package / thin, high reliability package
- Operation down to 3.5V
- CMOS for optimum stability, quality, and cost

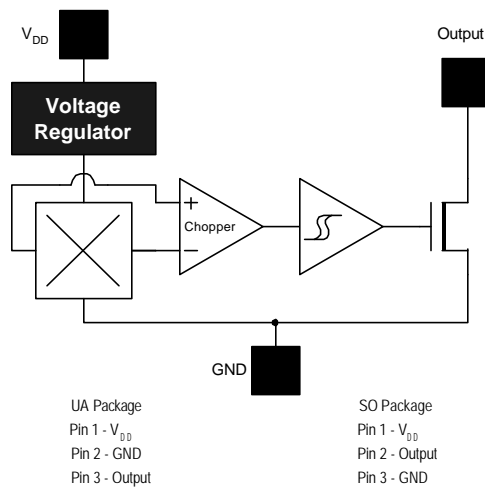
### Applications

- Solid state switch
- Limit switch
- Current limit
- Interrupter

### Ordering Information

Part No.	Temperature Suffix	Package	Temperature Range
US5781	E	SO or UA	-40°C to 85°C Extended
US5781	L	SO or UA	-40°C to 150°C Automotive

### Functional Diagram



### Description

The US5781 is a unipolar 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 applications of solid state switches.

The output transistor will be switched 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 switched off ( $B_{RP}$ ) in the presence of a weaker South field and remain off with "0" field. The SOT-23 device is reversed from the UA package. The SOT-23 output transistor will be switched on ( $B_{OP}$ ) in the presence of a sufficiently strong North pole magnetic field subjected to the marked face.

**Note:** This is a static-sensitive device; please observe ESD precautions. Reverse  $V_{DD}$  protection is not included. For reverse voltage protection, a 100  $\Omega$  resistor in series with  $V_{DD}$  is recommended.

## US5781 Electrical Specifications

DC operating parameters:  $T_A = -40$  to  $150^\circ\text{C}$ ,  $V_{DD} = 12V_{DC}$  (unless otherwise specified).

<i>Parameter</i>	<i>Symbol</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Units</i>
Supply Voltage	$V_{DD}$	Operating	3.5		24	V
Supply Current	$I_{DD}$	$B < B_{RP}$	0.5	2.5	5.0	mA
Saturation Voltage	$V_{DS(on)}$	$I_{OUT} = 20$ mA, $B > B_{OP}$		0.3	0.5	V
Output Leakage	$I_{OFF}$	$B < B_{RP}$ , $V_{OUT} = 27$ V		0.01	5.0	$\mu$ A
Output Rise Time	$t_r$	$V_{DD} = 12$ V, $R_L = 1.1$ k $\Omega$ , $C_L = 20$ pf		0.04		$\mu$ s
Output Fall Time	$t_f$	$V_{DD} = 12$ V, $R_L = 1.1$ k $\Omega$ , $C_L = 20$ pf		0.18		$\mu$ s

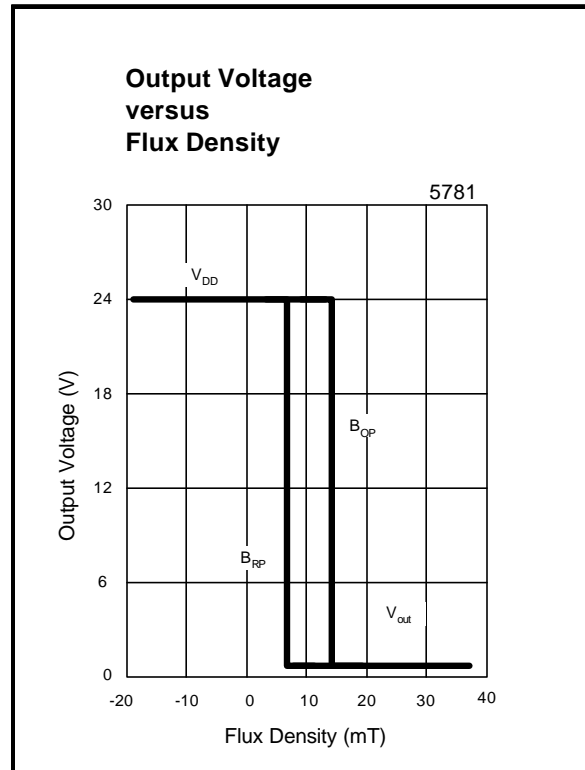
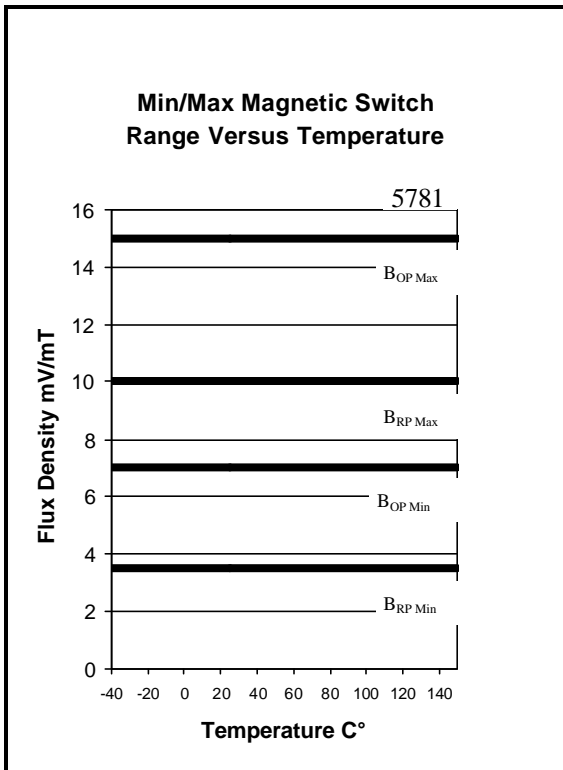
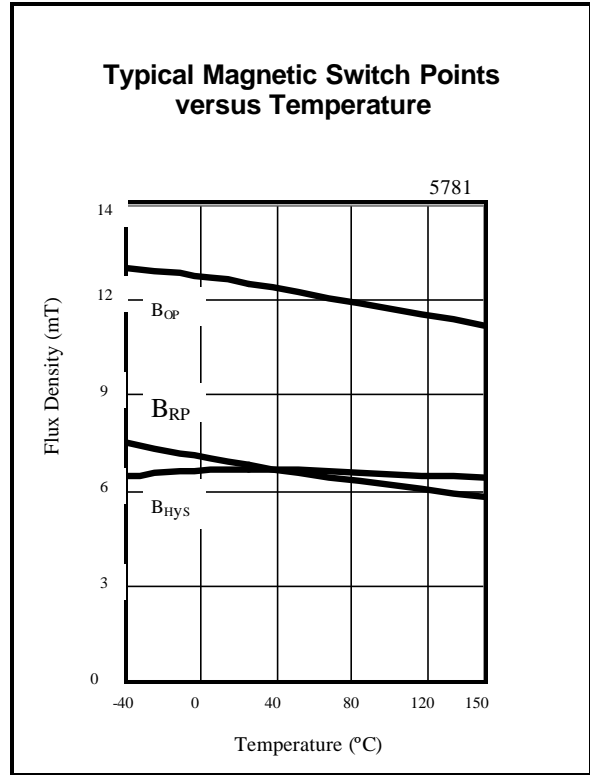
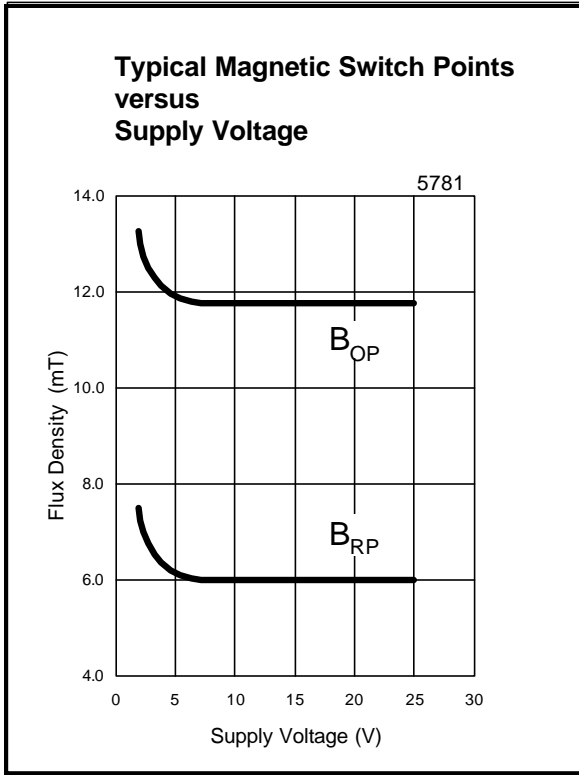
## US5781 Magnetic Specifications

Magnetic operating parameters:  $T_A = -40$  to  $150^\circ\text{C}$ ,  $V_{DD} = 12 V_{DC}$  (unless otherwise specified).

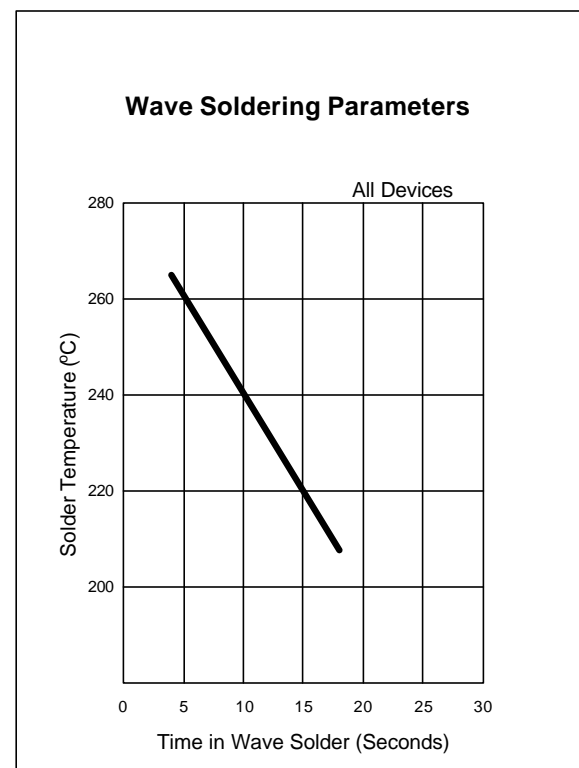
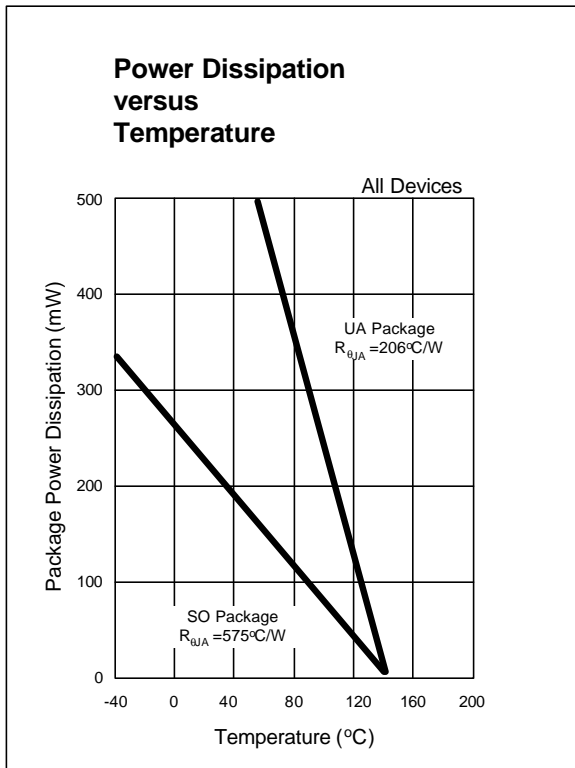
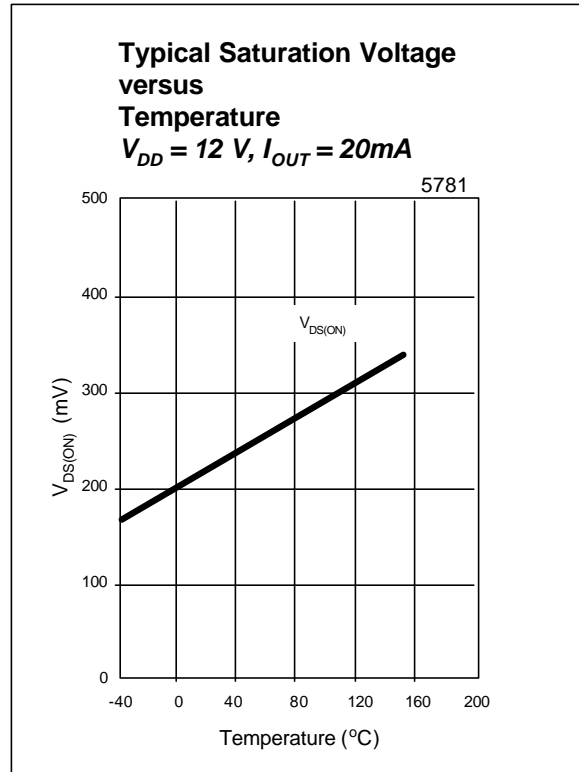
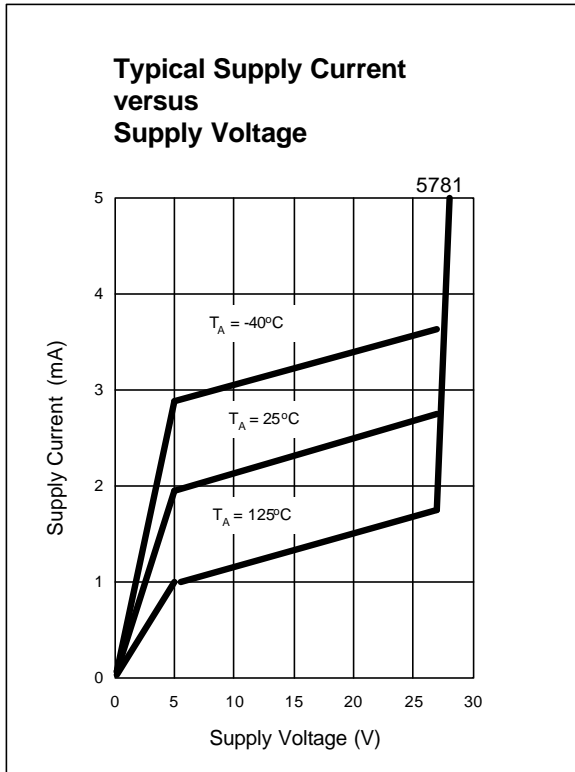
<i>Parameter</i>	<i>Symbol</i>	<i>Test Conditions</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Units</i>
Operating Point	$B_{OP}$		7.0	12.0	15.0	mT
Release Point	$B_{RP}$		3.5	7.0	10.0	mT
Hysteresis	$B_{hys}$		2.0	5.0	7.0	mT

Note: 1 mT = 10 Gauss.

**Performance Graphs**



**Performance Graphs**



## 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 Comments

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

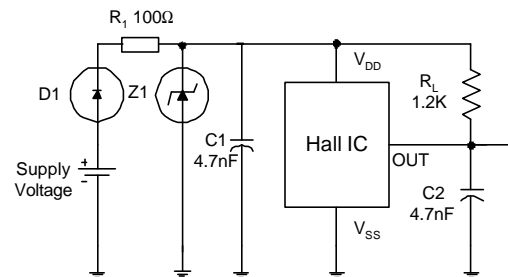
### Applications

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 on this page.

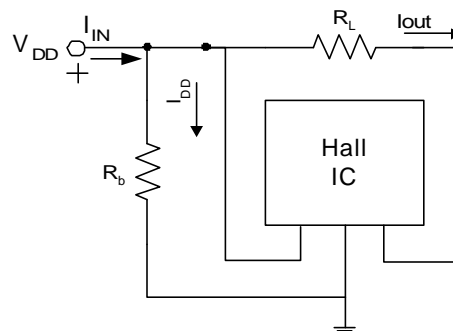
## Absolute Maximum Ratings

Supply Voltage (Operating), $V_{DD}$	3.5V to 24V
Supply Current (Fault), $I_{DD}$	50mA
Output Voltage, $V_{OUT}$	3.5V to 24V
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
ESD Sensitivity (All Pins)	+/- 2KV

### Automotive and Severe Environment Protection Circuit



### Two Wire Current Biasing Circuit

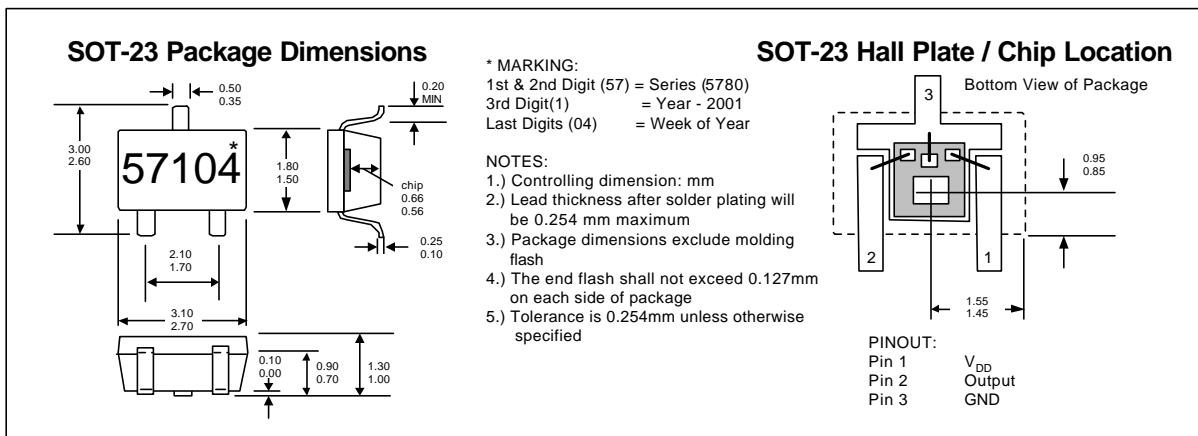
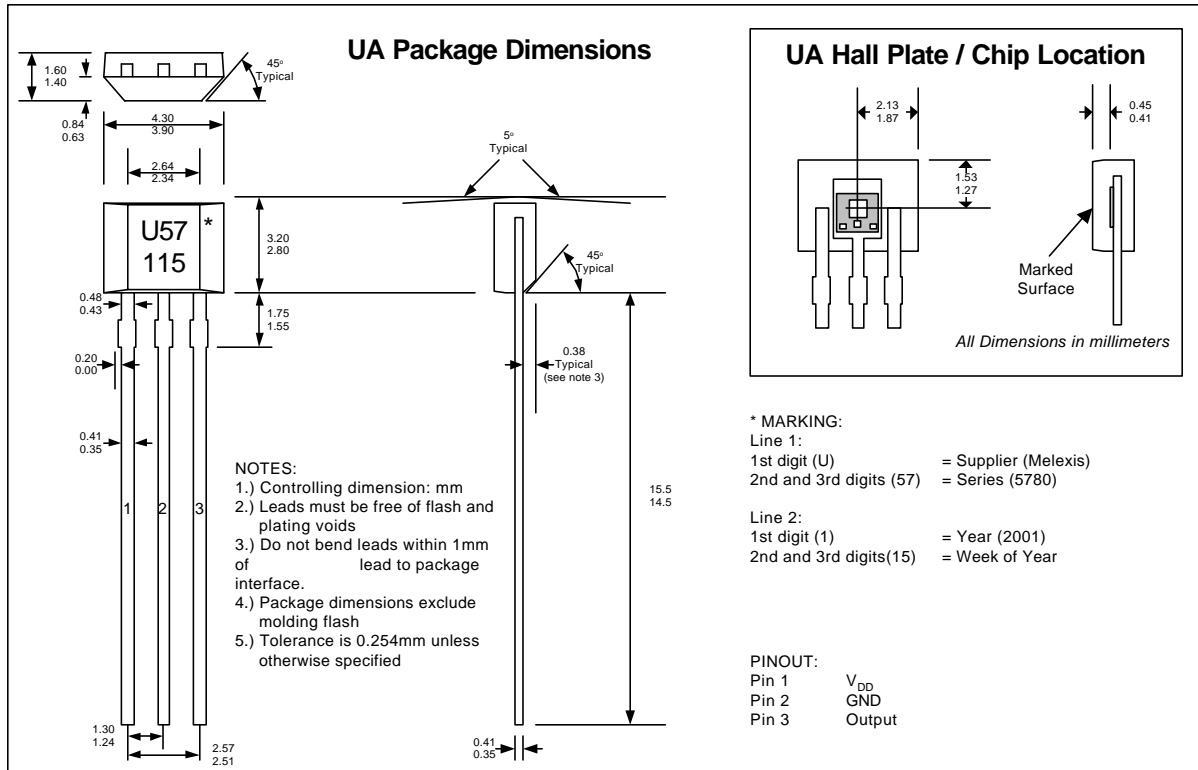


The resistors  $R_b$  and  $R_L$  can be used to bias the input current,  $I_{IN}$ . Refer to the part specification for limiting values. This circuit will help in getting the precise ON and OFF currents desired.

$$B_{OFF} = I_{OFF} = (V_{DD} / R_b + I_{DD})$$

$$B_{ON} = I_{ON} = (I_{OFF} + V_{DD} / R_L)$$

## Physical Characteristics



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Contact Melexis Direct:

Europe and Japan

E-mail: sales\_europe@melexis.com

Phone: 011-32-13-670-780

USA and rest of the world

E-mail: sales\_usa@melexis.com

Phone: (603)-223-2362