# US2881/2882

## *CMOS High Sensitivity Latch*

## *Features and Benefits*

- Chopper stabilized amplifier stage
- Optimized for BDC motor applications
- New miniature package / thin, high reliability package
- Operation down to 3.5V
- CMOS for optimum stability, quality, and cost
- Ultra low $I_{DD}$ current

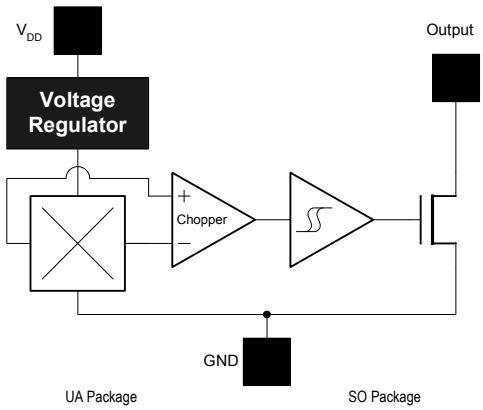
## *Applications*

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

## Ordering *Information*

| Part No. | Temperature Suffix | Package |
|---|---|---|
| US2881 / US2882 | E ( -40°C to 85°C ) | SO(SOT-23) or UA (TO-92 flat) |
| US2881 / US2882 | L ( -40°C to 150°C ) | SO(SOT-23) or UA (TO-92 flat) |

## *Functional Diagram*




***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.*

## *Description*

The design specifications and performance of the Melexis US2881 have been optimized for commutation applications in brushless DC motors and automotive speed sensing.

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 ($B_{OP}$) in the presence of a sufficiently strong North pole magnetic field subjected to the marked face.

## US2881 and US2882 Electrical Specifications

DC operating parameters: $T_A$ = 25°C, $V_{DD}$ = 12$V_{DC}$ (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<$B_{OP}$ | 1.1 | 2.0 | 5.0 | mA |
| Saturation Voltage | $V_{DS(on)}$ | Vdd=12V,$I_{OUT}$ = 20 mA, B>$B_{OP}$ | | 0.4 | 0.5 | V |
| Output Leakage | $I_{OFF}$ | B<$B_{RP}$, $V_{OUT}$ = 24V | | 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 |

## US2881 Magnetic Specifications

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Operating Point | $B_{OP}$ | E/L UA, E/L SO, Ta= 25<br>Vdd=3.5 & 24 volts DC Vdd | 0.5 | 2.0 | 4.5 | mT |
| Release Point | $B_{RP}$ | E/L UA, E/L SO, Ta= 25<br>Vdd=3.5 & 24 volts DC Vdd | -4.5 | -2.0 | -0.5 | mT |
| Hysteresis | $B_{hys}$ | E/L UA, E/L SO, Ta= 25<br>Vdd=3.5 & 24 volts DC Vdd | 1.5 | 4.0 | 5.0 | mT |
| Operating Point | $B_{OP}$ | EUA, ESO, Ta= 85<br>Vdd=3.5 & 24 volts DC Vdd | -1.0 | 2.0 | 6.0 | mT |
| Release Point | $B_{RP}$ | EUA, ESO, Ta= 85<br>Vdd=3.5 & 24 volts DC Vdd | -6.0 | -2.0 | -1.0 | mT |
| Hysteresis | $B_{hys}$ | EUA, ESO, Ta= 85<br>Vdd=3.5 & 24 volts DC Vdd | 1.5 | 4.0 | 5.5 | mT |
| Operating Point | $B_{OP}$ | LUA, LSO, Ta=150°C,<br>Vdd=3.5 & 24 volts DC Vdd | -2.0 | 2.0 | 6.0 | mT |
| Release Point | $B_{RP}$ | LUA, LSO, Ta=150°C,<br>Vdd=3.5 & 24 volts DC Vdd | -6.0 | -2.0 | 2.0 | mT |
| Hysteresis | $B_{hys}$ | LUA, LSO, Ta=150°C,<br>Vdd=3.5 & 24 volts DC Vdd | 1.5 | 4.0 | 5.5 | mT |

**Note:** 1 mT = 10 Gauss.

## US2882 Magnetic Specifications

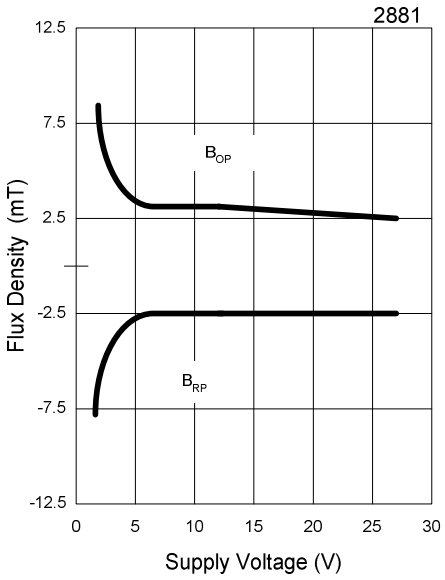
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Operating Point | $B_{OP}$ | E/L UA, E/L SO, Ta= 25<br>Vdd=3.5 & 24 volts DC Vdd | -2.0 | 2.0 | 6.0 | mT |
| Release Point | $B_{RP}$ | E/L UA, E/L SO, Ta= 25<br>Vdd=3.5 & 24 volts DC Vdd | -6.0 | -2.0 | 2.0 | mT |
| Hysteresis | $B_{hys}$ | E/L UA, E/L SO, Ta= 25<br>Vdd=3.5 & 24 volts DC Vdd | 1.5 | 4.0 | 5.0 | mT |
| Operating Point | $B_{OP}$ | EUA, ESO, Ta= 85<br>Vdd=3.5 & 24 volts DC Vdd | -3.0 | 2.0 | 6.0 | mT |
| Release Point | $B_{RP}$ | EUA, ESO, Ta= 85<br>Vdd=3.5 & 24 volts DC Vdd | -6.0 | -2.0 | 3.0 | mT |
| Hysteresis | $B_{hys}$ | EUA, ESO, Ta= 85<br>Vdd=3.5 & 24 volts DC Vdd | 1.5 | 4.0 | 6.0 | mT |
| Operating Point | $B_{OP}$ | LUA, LSO, Ta=150°C,<br>Vdd=3.5 & 24 volts DC Vdd | -3.5 | 2.0 | 6.0 | mT |
| Release Point | $B_{RP}$ | LUA, LSO, Ta=150°C,<br>Vdd=3.5 & 24 volts DC Vdd | -6.0 | -2.0 | 3.5 | mT |
| Hysteresis | $B_{hys}$ | LUA, LSO, Ta=150°C,<br>Vdd=3.5 & 24 volts DC Vdd | 1.5 | 4.0 | 6.0 | mT |

## Absolute Maximum Ratings

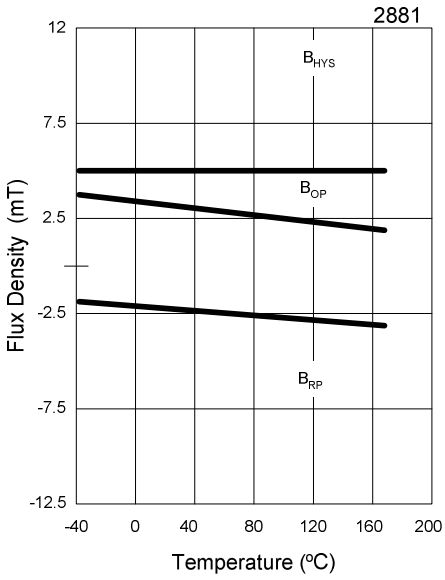
| | |
|---|---|
| Supply Voltage (Operating), $V_{DD}$ | 24V |
| Supply Current (Fault), $I_{DD}$ | 50mA |
| Output Voltage, $V_{OUT}$ | 24V |
| Output Current (Fault), $I_{OUT}$ | 50mA |
| Power Dissipation, $P_D$ | 100mW |
| Operating Temperature Range, $T_A$ | -40 to 150°C |
| Storage Temperature Range, $T_S$ | -65 to 150°C |
| Maximum Junction Temp, $T_J$ | 175°C |

## Performance Graphs

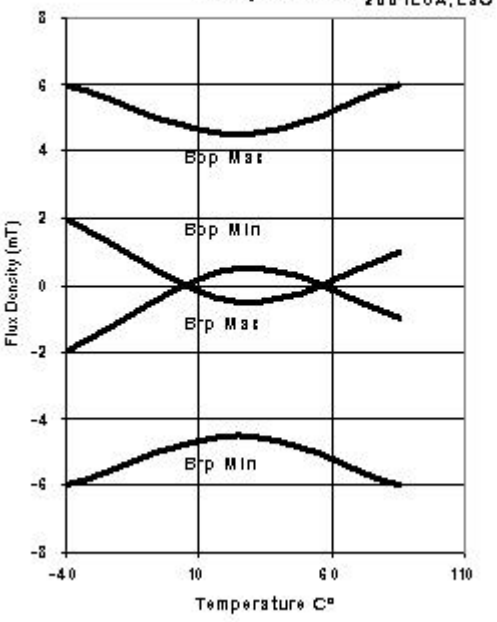
**Typical Magnetic Switch Points versus Supply Voltage**



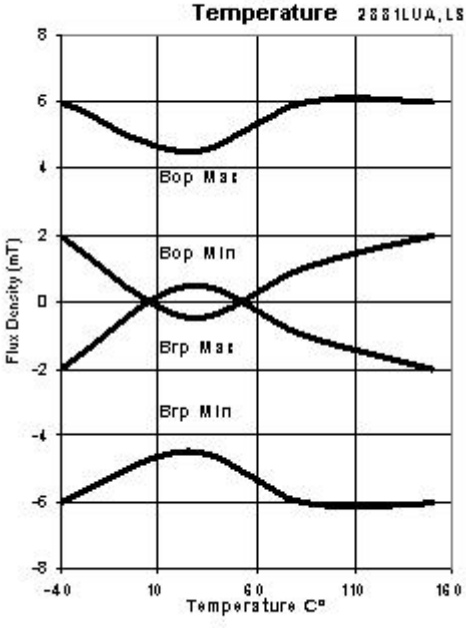

**Typical Magnetic Switch Points versus Temperature**

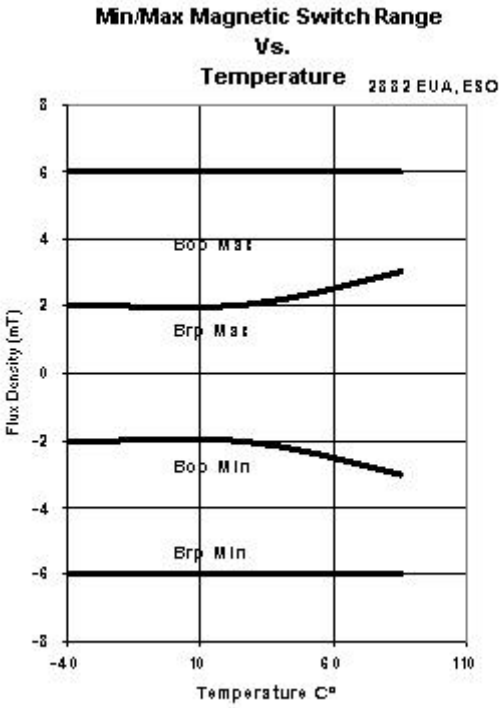


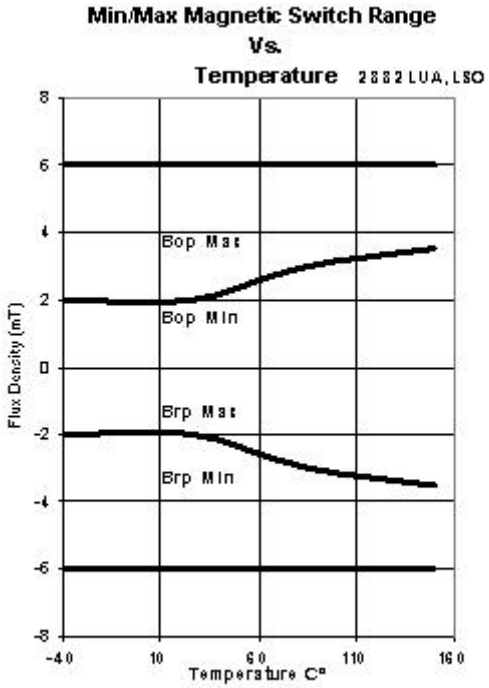

**Min/Max Magnetic Switch Range Vs. Temperature**

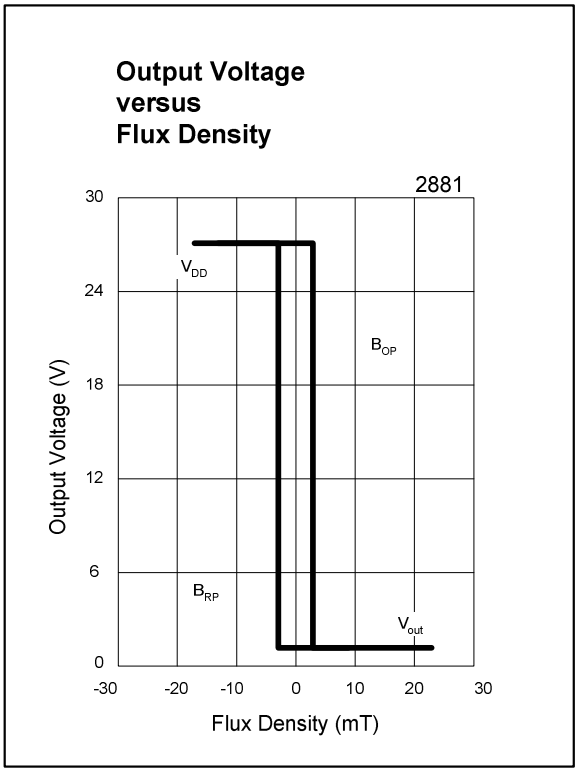



**Min/Max Magnetic Switch Range Vs. Temperature**



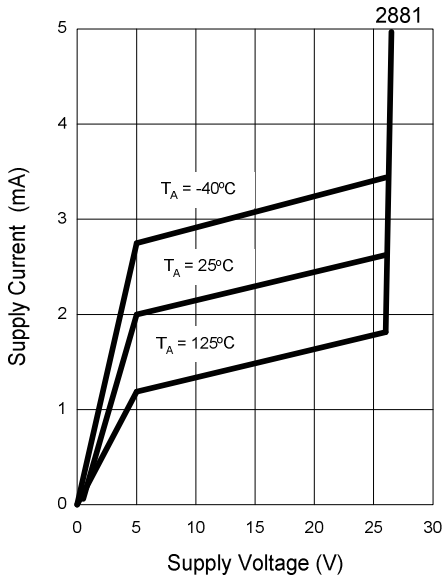

Min/Max Magnetic Switch Range
Vs.
Temperature
2882 EUA, ESO
Bop Max
Brp Max
Bop Min
Brp Min
Flux Density (mT)
Temperature C°


Min/Max Magnetic Switch Range
Vs.
Temperature
2882 LUA, LSO
Bop Max
Bop Min
Brp Max
Brp Min
Flux Density (mT)
Temperature C°

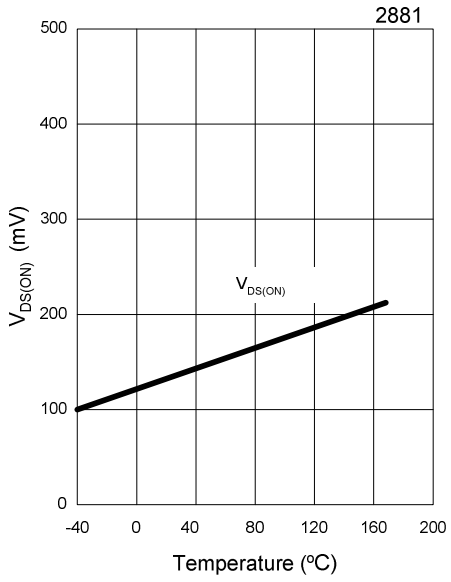

Output Voltage
versus
Flux Density
2881
$V_{DD}$
$B_{OP}$
$B_{RP}$
$V_{out}$
Output Voltage (V)
Flux Density (mT)

## *Performance Graphs*

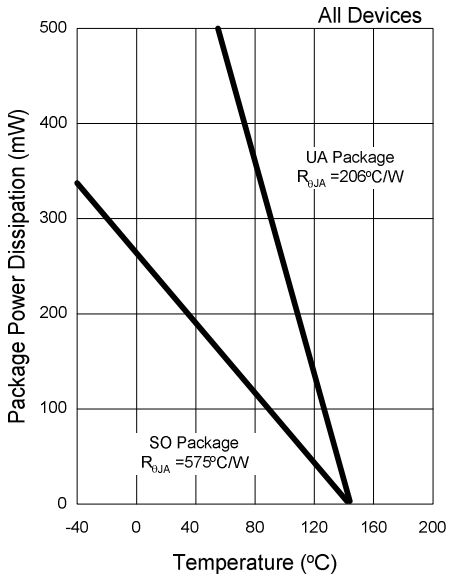
**Typical Supply Current versus Supply Voltage**



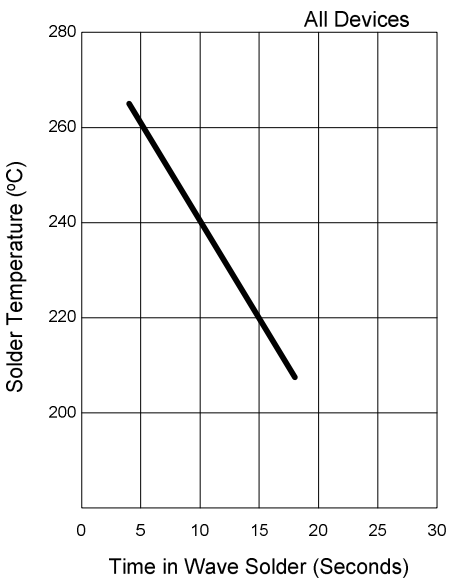

**Typical Saturation Voltage versus Temperature**
***$V_{DD}$ = 12 V, $I_{OUT}$ = 20mA***




**Power Dissipation versus Temperature**




**Wave Soldering Parameters**



## Unique Features

### CMOS Hall IC Technology

The Chopper Stabilized Amplifier, using switched capacitor techniques, eliminates 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 the 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

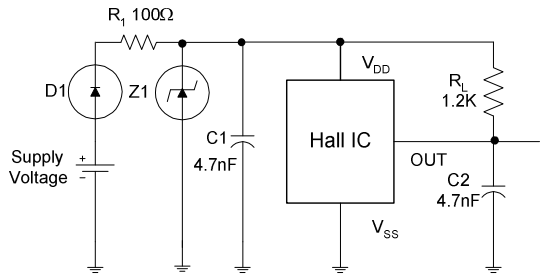
Consider temperature coefficients of Hall IC and magnetics, as well as air gap and life time variations. Observe temperature limits during wave soldering.

### Application Comments

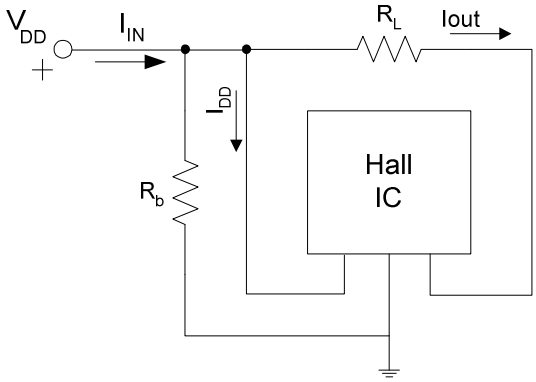
If reverse supply protection is desired, use a resistor in series with the $V_{DD}$ pin. The resistor will limit the Supply Current (Fault), $I_{DD}$, to 50mA. For severe EMC conditions, use the application circuit below.

## Applications Examples

**Automotive and Severe Environment Protection Circuit**




**Two Wire Optional Current Biasing Circuit**

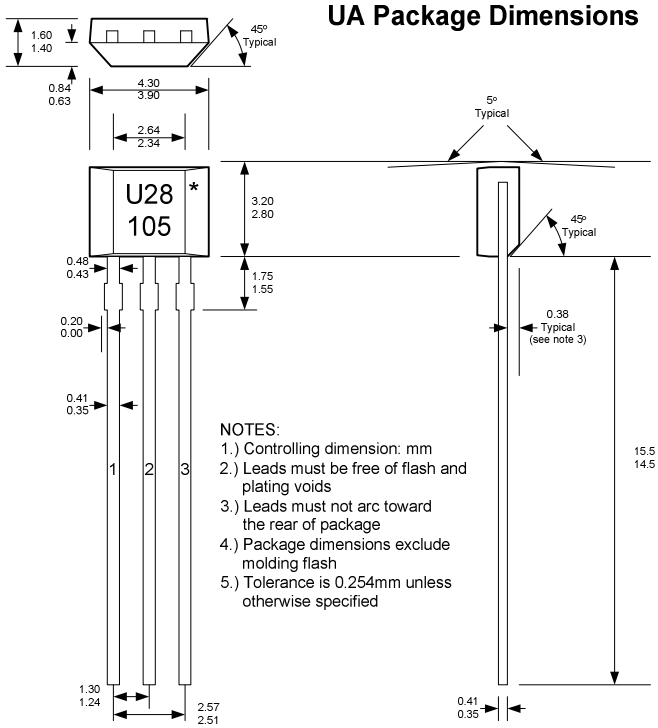



The resistors $R_b$ and $R_L$ can be used to bias the input current, Iin. Refer to the part specification for limiting values. This circuit will help in getting the precise ON and OFF currents desired.

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

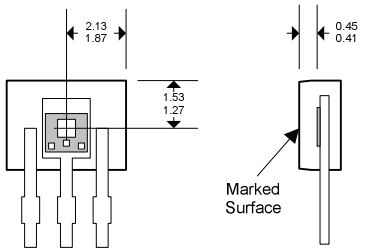
## Package Information

### UA Package Dimensions




NOTES:
1.) Controlling dimension: mm
2.) Leads must be free of flash and plating voids
3.) Leads must not arc toward the rear of package
4.) Package dimensions exclude molding flash
5.) Tolerance is 0.254mm unless otherwise specified

### UA Hall Plate / Chip Location



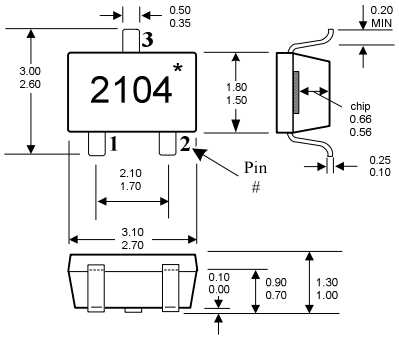

*All Dimensions in millimeters*

* MARKING:
Line 1:
1st digit (U) = Supplier (Melexis)
2nd and 3rd digits (28) = Series (2880)

Line 2:
1st digit (1) = Year (2001)
2nd and 3rd digits(05) = Week of Year

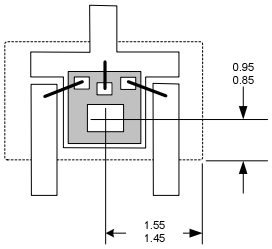
PINOUT:
Pin 1 $V_{DD}$
Pin 2 GND
Pin 3 Output

### SOT-23 Package Dimensions (Top View)




NOTES:
1. MARKING:
   1st Digit (2) = Series (2881)
   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

This Melexis device is classified and qualified regarding soldering technology, solderability and moisture sensitivity level, as defined in this specification, according to following test methods:

- IPC/JEDEC J-STD-020
  Moisture/Reflow Sensitivity Classification For Nonhermetic Solid State Surface Mount Devices (classification reflow profiles according to table 5-2)
- EIA/JEDEC JESD22-A113
  Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing
  (reflow profiles according to table 2)
- CECC00802
  Standard Method For The Specification of Surface Mounting Components (SMDs) of Assessed Quality
- EIA/JEDEC JESD22-B106
  Resistance to soldering temperature for through-hole mounted devices
- EN60749-15
  Resistance to soldering temperature for through-hole mounted devices
- MIL 883 Method 2003 / EIA/JEDEC JESD22-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.

Based on Melexis commitment to environmental responsibility, European legislation (Directive on the Restriction of the Use of Certain Hazardous substances, RoHS) and customer requests, Melexis has installed a Roadmap to qualify their package families for lead free processes also.

Various lead free generic qualifications are running, current results on request.

For more information on manufacturability/solderability see quality page at our website: http://www.melexis.com/html/pdf/MLXleadfree-statement.pdf

## ESD Precautions

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

## Disclaimer

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