# MLX90290 Datasheet

High Speed Factory Trimmed Linear Hall IC

## 1. Features and Benefits

- Linear Hall Sensor
- Small Size
- High Sensitivity
- High Accuracy
- High Speed
- Fast Start-Up for power gating in Micro-power applications
- Factory Programmed Customization
  - Sensitivity
  - Magnet Thermal Drift Compensation
  - Supply Voltage
- Automotive AEC Q-100 Qualified

## 2. Application Examples

- Linear Position Sensor
- Rotary Position Sensor
- Current Sensing
- Motor Commutation/Resolving

## 3. Description

The Melexis MLX90290 is a Second Generation linear Hall-effect sensor designed in mixed signal CMOS technology.

The device integrates a voltage regulator, Hall sensor with advanced offset cancellation system, and an analog output driver, in a single package.

The Output voltage is proportional to the applied magnetic field and to the chip supply voltage (ratiometric). Multiple sensitivity codes & magnet compensation options exist.

The Output Offset Level (Quiescent Level) at zero magnetic field is 50% of the chip supply voltage.

The device is offered in a RoHS compliant Thin Small Outline Transistor (TSOT) for surface mount and UA (TO-92) for Pin Through Hole mount.

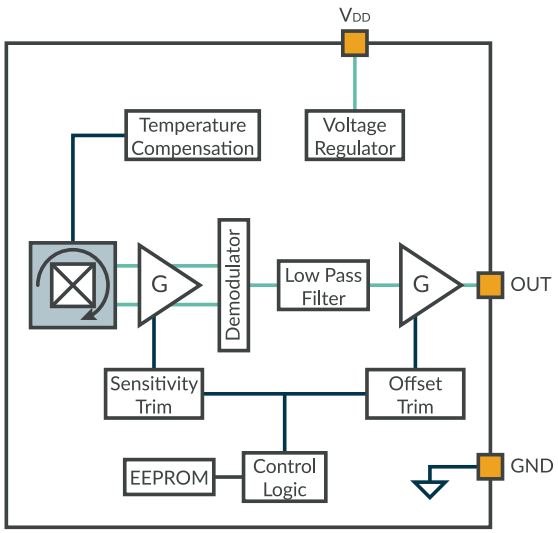



*Figure 1 Functional Block Diagram MLX90290*

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# 4. Ordering Information

| Product Code | Temperature Code | Package Code | Option Code | Packing Form Code |
|---|---|---|---|---|
| MLX90290 | L | UA | AAA-XYZ | BU |
| MLX90290 | L | SE | AAA-XYZ | RE |

**Legend:**

Temperature Code: L: (-40°C to 150°C)

Package Code:
UA: TO-92-3L
SE: TSOT-3L

Option Code:
AAA-XYZ:
AAA = die version

X = $V_{DDNOM}$ and trim & form options for UA package
- See Below Table: Package Options

Y= S

| | | | | | | |
|---|---|---|---|---|---|---|
| • 0: | 18.8 mV/mT | @ 5V | Or | 12.408 mV/mT | @ 3.3V |
| • 1: | 25 mV/mT | @ 5V | Or | 16.5 mV/mT | @ 3.3V |
| • 2: | 31.25 mV/mT | @ 5V | Or | 20.625 mV/mT | @ 3.3V |
| • 3: | 50 mV/mT | @ 5V | Or | 33 mV/mT | @ 3.3V |
| • 4: | 100 mV/mT | @ 5V | Or | 66 mV/mT | @ 3.3V |
| • 5: | 39 mV/mT | @ 5V | Or | N/A | @ 3.3V |

Z = TCS
- 0: 0 ppm/°C
- 1: 500 ppm/°C
- 2: 2000 ppm/°C
- 3: 650 ppm/°C

Important: S is expressed as mV/mT for 5V. This sensitivity scales with supply voltage.
E.g. Option 1 with 3.3V VDD supply voltage becomes 16.5mV/mT = 3.3/5*25mV/mT.

| | Package Options | |
|---|---|---|
| **Supply Voltage** | **SE**<br>**UA** with straight leads | **UA** with 2.54mm pitch, see section "UA package, trim and form" |
| 3.3 V ± 5 % | X=3 | X=4 |
| 5.0 V ± 10 % | X=5 | X=6 |

Packing Form:
RE = Reel for SE or UA
CR = Radial Tape for UA (Carton Tape on Reel)
CA = Radial Tape for UA (Carton Tape in Ammopack)
BU = Bulk for SE or UA

Ordering example: MLX90290-LUA-AAA-612-CR. This ordering code indicates a 5V supply part in TO92 (UA) component with leads separated to achieve a 2.54mm pitch delivered in Carton Tape on Reel. The sensitivity corresponds to 25mV/mT and a thermal coefficient of +2000 ppm/°C to compensate for the magnet thermal drift (assumed to be a ferrite magnet).


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| Ordering Code | Package | Supply Voltage | Absolute Sensitivity | TC | Lead Forming | Packing Form(1) |
|---|---|---|---|---|---|---|
| MLX90290LSE-AAA-300-RE | TSOT-3L | 3.3V | 12.408mV/mT(2) | 0ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-310-RE | TSOT-3L | 3.3V | 16.5mV/mT(2) | 0ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-320-RE | TSOT-3L | 3.3V | 20.625mV/mT(2) | 0ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-321-RE | TSOT-3L | 3.3V | 20.625mV/mT(2) | 500ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-332-RE | TSOT-3L | 3.3V | 33mV/mT(2) | 2000ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-510-RE | TSOT-3L | 5V | 25mV/mT | 0ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-511-RE | TSOT-3L | 5V | 25mV/mT | 500ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-520-RE | TSOT-3L | 5V | 31.25mV/mT | 0ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-521-RE | TSOT-3L | 5V | 31.25mV/mT | 500ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-522-RE | TSOT-3L | 5V | 31.25mV/mT | 2000ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-553-RE | TSOT-3L | 5V | 39mV/mT | 650ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-530-RE | TSOT-3L | 5V | 50mV/mT | 0ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-531-RE | TSOT-3L | 5V | 50mV/mT | 500ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-532-RE | TSOT-3L | 5V | 50mV/mT | 2000ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LSE-AAA-540-RE | TSOT-3L | 5V | 100mV/mT | 0ppm/°C | N/A | Plastic Tape on Reel |
| MLX90290LUA-AAA-500-BU | TO92-3L | 5V | 18.8mV/mT | 0ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-500-RE | TO92-3L | 5V | 18.8mV/mT | 0ppm/°C | Std 1.27mm | Plastic Tape on Reel |
| MLX90290LUA-AAA-510-BU | TO92-3L | 5V | 25mV/mT | 0ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-510-RE | TO92-3L | 5V | 25mV/mT | 0ppm/°C | Std 1.27mm | Plastic Tape on Reel |


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| Ordering Code | Package | Supply Voltage | Absolute Sensitivity | TC | Lead Forming | Packing Form(1) |
|---|---|---|---|---|---|---|
| MLX90290LUA-AAA-511-BU | TO92-3L | 5V | 25mV/mT | 500ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-512-BU | TO92-3L | 5V | 25mV/mT | 2000ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-612-CR | TO92-3L | 5V | 25mV/mT | 2000ppm/°C | 2.54mm spread | Carton Tape on Reel |
| MLX90290LUA-AAA-520-BU | TO92-3L | 5V | 31.25mV/mT | 0ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-520-CR | TO92-3L | 5V | 31.25mV/mT | 0ppm/°C | Std 1.27mm | Carton Tape on Reel |
| MLX90290LUA-AAA-620-CR | TO92-3L | 5V | 31.25mV/mT | 0ppm/°C | 2.54mm spread | Carton Tape on Reel |
| MLX90290LUA-AAA-521-BU | TO92-3L | 5V | 31.25mV/mT | 500ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-522-BU | TO92-3L | 5V | 31.25mV/mT | 2000ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-530-BU | TO92-3L | 5V | 50mV/mT | 0ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-531-BU | TO92-3L | 5V | 50mV/mT | 500ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-631-CA | TO92-3L | 5V | 50 mV/mT | 500ppm/°C | 2.54mm spread | Carton Tape in Ammopack |
| MLX90290LUA-AAA-631-CR | TO92-3L | 5V | 50 mV/mT | 500ppm/°C | 2.54mm spread | Carton Tape on Reel |
| MLX90290LUA-AAA-532-BU | TO92-3L | 5V | 50mV/mT | 2000ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-540-BU | TO92-3L | 5V | 100mV/mT | 0ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-541-BU | TO92-3L | 5V | 100mV/mT | 500ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-542-BU | TO92-3L | 5V | 100mV/mT | 2000ppm/°C | Std 1.27mm | Bulk |
| MLX90290LUA-AAA-553-BU | TO92-3L | 5V | 39mV/mT | 650ppm/°C | Std 1.27mm | Bulk |

*Table 1 Available option codes in production*

The above option codes are all released in production. An option code refers to the sensitivity and magnet compensation. In order to obtain a not listed option code in Table 1, please contact your local Sales Representative to explore the options of customization during Melexis factory trimming.

(1) Melexis can provide for a given option code a different packing forms, such as –RE for TSOT-3L surface mount package and –BU, –CR or –CA for TO92-3L through hole package. So, it is possible to obtain a different packing form for a product listed in Table 1.
(2) Sensitivity scaled for 3.3V supply.

Note: Delivery in bulk (packing form code BU) may cause some parts to have lead pitch and coplanarity deviation due to transport stress.
Especially when a fully automatic assembly process is applied by customer, Melexis recommends ordering parts on cardboard radial tape in ammopack (packing form code CA) or reel (packing form code CR) packing.


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## 5. Glossary of Terms

| Name | Definition |
|---|---|
| Tesla [T] | Units of magnetic flux density: 1mT = 10 Gauss |
| ESD | Electro-Static Discharge |
| TSOT | Thin Small Outline Transistor package |
| PSRR | Power Supply Rejection Ratio |
| SMD | Surface Mount Devices |
| THD | Through Hole Device |
| RoHS | Restriction of Hazardous Substances |

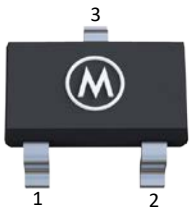
*Table 2*

## 6. Pin Definitions and Descriptions

| SE Pin № | UA Pin № | Name | Type | Function |
|---|---|---|---|---|
| 1 | 1 | VDD | Supply | Supply Voltage |
| 2 | 3 | OUT | I/O | Analog Output |
| 3 | 2 | GND | Ground | Ground |




**UA package**




**SE package**

*Table 3 Pin Definitions and Descriptions*


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## 7. Absolute Maximum Ratings

Operating Characteristics, $V_{DD}$ = 3.15V to 5.5V, $T_A$ = -40°C to 150°C, C1 ≥ 0.1µF (unless otherwise specified)

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | -0.3 to 7 | V |
| Supply Current[1] | $I_{DD}$ | ±20 | mA |
| Output Voltage | $V_{OUT}$ | -0.3 to $V_{DD}$+0.3 | V |
| Output Current[1] | $I_{OUT}$ | ±20 | mA |
| Operating Temperature Range | $T_A$ | -40 to 150 | °C |
| Maximum Junction Temperature | $T_J$ | 165 | °C |
| Storage Temperature Range | $T_S$ | -55 to 165 | °C |
| ESD Sensitivity (Human Body Model)[2] | $ESD_{HBM}$ | 8 | kV |
| ESD Sensitivity (Charged Device Model)[3] | $ESD_{CDM}$ | 500 | V |
| Maximum Flux Density | B | > 1000 | mT |

*Table 4 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.

[1] Including the current flowing through the protection structure. Maximum power dissipation should be also considered
[2] *Human Body Model according AEC-Q100-002 standard*
[3] *Charged Device Model according AEC-Q100-011 standard*


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## 8. General Electrical Specifications

Operating Characteristics, $V_{DD}$ = 3.15V to 5.5V, $T_A$ = -40°C to 150°C, C1 ≥ 0.1µF (unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ[4] | Max | Units |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | Operating | 3.15 | - | 5.5 | V |
| Supply Current | $I_{DD}$ | | 3 | 5 | 8 | mA |
| Reset Voltage | $V_{POR}$ | OUT → High Impedance | - | 2.7 | 2.95 | V |
| Load Current Range | $I_{OUT}$ | | -1 | - | 1 | mA |
| Load Resistance Range | $R_L$ | Connected between OUT and GND | 5 | - | Infinite | kΩ |
| Load Capacitor Range[5] | $C_L$ | Connected between OUT and GND | 0 | 10 | 100 with $R_S$=50Ω | nF |
| Output Saturation Voltage | $V_{OSHI}$ | $I_{OUT}$= -1mA, B=1.1*($V_{DD}$ - $V_{OQ}$)/S | $V_{DD}$ - 0.25 | - | $V_{DD}$ | V |
| | $V_{OSHI}$[5] | $I_{OUT}$= -0.1mA, B=1.1*($V_{DD}$ - $V_{OQ}$)/S | $V_{DD}$ - 0.1 | - | $V_{DD}$ | V |
| | $V_{OSLO}$ | $I_{OUT}$=1mA, B=1.1*(-$V_{OQ}$)/S | 0 | - | 0.25 | V |
| | $V_{OSLO}$[5] | $I_{OUT}$=0.1mA, B=1.1*(-$V_{OQ}$)/S | 0 | - | 0.1 | V |
| Output Resistance | $R_{OUT}$ | $I_{OUT}$= ±1mA | - | 1.5 | 5 | Ω |
| Power-On Time[6,7] | $t_{ON}$ | $V_{DD}$=$V_{DDNOM}$[8], B=0.4/$S_{REL}$, $dV_{DD}$/dt>2V/us | - | 40 | 70 | µs |
| Chopping Frequency | $F_{CHOP}$ | | - | 900 | - | kHz |
| Sample / Update Period | $T_{SAMPLE}$ | $T_{SAMPLE}$=1/$F_{CHOP}$ | - | 1.1 | - | us |
| Power Supply Rejection Ratio[5] | PSRR | From 80kHz to 200kHz | 20 | - | - | dB |
| Package Thermal Resistance Junction to Ambient | $R_{THJA}$ | TSOT-3L | - | 230 | - | °C/W |
| | | 3-SIP-UA / TO92-UA | - | 180 | - | °C/W |

*Table 5 : General Electrical Specification*

*[4] Typical values are defined at TA = 25°C and VDD = VDDNOM*
*[5] Guaranteed by design and characterization*
*[6] The Power-On Time represents the time from reaching VDD = 3.15V to VOUT settled within ±5% from its final value*
*[7] Power-On Slew Rate is not critical for the proper device start-up*
*[8] VDDNOM = 5V or 3.3V - the value used at trimming*


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# 9. Sensor Specific Specifications

Operating Characteristics, $V_{DD}$ = 3.15V to 5.5V, $T_A$ = -40°C to 150°C, C1 ≥ 0.1µF (unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ[9] | Max | Units |
|---|---|---|---|---|---|---|
| Sensitivity Accuracy | εS | $T_A$=25°C, $V_{DD}$=$V_{DDNOM}$[10] | -5 | - | 5 | % |
| Sensitivity Ratiometry | $\varepsilon^R$S | | -2.5 | - | 2.5 | % / V |
| Linearity | Lin | $V_{DD}$=$V_{DDNOM}$[10] | -1.5 | - | 1.5 | % |
| Symmetry | Sym | $V_{DD}$=$V_{DDNOM}$[10] | -1.5 | - | 1.5 | % |
| Relative Output Offset Level | $V_{OQREL}$ | B=0mT, $T_A$=25°C, $V_{DD}$=$V_{DDNOM}$[10] | 0.49 | 0.5 | 0.51 | - |
| Thermal Offset Drift | $\varepsilon^T V_{OQ}$[11] | B=0mT, $V_{DD}$=$V_{DDNOM}$[10] S in [mV/mT] | -(25mV+0.9mT*S) | 0 | +(25mV+0.9mT*S) | - |
| Output Offset Ratiometry | $\varepsilon^R V_{OQREL}$ | B=0mT | -2.5 | - | 2.5 | % / V |
| Signal Bandwidth | BW | At -3dB, B<0.4/$S_{REL}$,<br>UA package<br>SOT package | <br>15[12]<br>25[12] | <br>30[12]<br>50[12] | <br><br>- | kHz |
| Signal Phase Shift | PHI | Sine wave magnetic field at F = 1 kHz<br>UA package<br>SOT package | <br><br>- | <br>3.6[12]<br>2.4[12] | <br>5[12]<br>3.2[12] | Degree |
| Sensitivity Range | S | $V_{DD}$=$V_{DDNOM}$[10] | 9.9<br>15 | - | 66<br>100 | mV/mT@3.3V<br>mV/mT @5V |
| Sensitivity Temperature Coefficient | TCS | $V_{DD}$=$V_{DDNOM}$[10] | 0 | | 2000 | ppm/°C |

*Table 6 Magnetic specification*

*[9] Typical values are defined at TA = 25ºC and VDD = VDDNOM*
*[10] VDDNOM = 5V or 3.3V - the value used at trimming. This sensitivity scales with supply voltage. E.g. Y=1 with 3.3V VDD supply voltage becomes 16.5mV/mT = 3.3/5*25mV/mT.*
*[11] Guaranteed by design and characterization*
*[12] Signal Bandwidth & Signal Phase Shift mentioned here are defined for Z=1 & 2, resp. 500ppm/ºC & 2000ppm/ºC. The option code Z=0 has internal filtering disabled. Products for 0ppm/ºC are targeted for current measurement applications. Therefore, Bandwidth & Phase Shift are not specified. No internal filter enables a step response time in the order of us. To get an idea of the phase & amplitude behavior over frequency, use a bode diagram for a 1st order RC filter with the Frequencies specified under "Band width". Also note that Melexis can support you to get an application specific filter setting. Contact your sales contact in such case.*


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| Parameter | Code | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| Sensitivity Temperature Coefficient | Z = 0 | $TCS_{-40}$ [11] | $T_A$= -40°C, $V_{DD}=V_{DDNOM}$ [10] | | 0 | | ppm/°C |
| | | $TCS_{150}$ [13] | $T_A$=150°C, $V_{DD}=V_{DDNOM}$ [10] | | 0 | | ppm/°C |
| | Z = 1 | $TCS_{-40}$ [11] | $T_A$= -40°C, $V_{DD}=V_{DDNOM}$ [10] | 0 | 650 | 1300 | ppm/°C |
| | | $TCS_{150}$ [13] | $T_A$=150°C, $V_{DD}=V_{DDNOM}$ [10] | 0 | 500 | 1000 | ppm/°C |
| | Z = 2 | $TCS_{-40}$ [11] | $T_A$= -40°C, $V_{DD}=V_{DDNOM}$ [10] | 1100 | 2000 | 2900 | ppm/°C |
| | | $TCS_{150}$ [13] | $T_A$=150°C, $V_{DD}=V_{DDNOM}$ [10] | 1100 | 2000 | 2900 | ppm/°C |
| | Z = 3 | $TCS_{-40}$ [11] | $T_A$= -40°C, $V_{DD}=V_{DDNOM}$ [10] | 0 | 650 | 1300 | ppm/°C |
| | | $TCS_{150}$ [13] | $T_A$=150°C, $V_{DD}=V_{DDNOM}$ [10] | 0 | 500 | 1000 | ppm/°C |
| Sensitivity Range (factory trimmed) | Y = 0 | S | $V_{DD}=V_{DDNOM}$ [10] | | 12.4<br>18.8 | | mV/mT@3.3V<br>mV/mT@5V |
| | Y = 1 | S | $V_{DD}=V_{DDNOM}$ [10] | | 16.5<br>25 | | mV/mT@3.3V<br>mV/mT@5V |
| | Y = 2 | S | $V_{DD}=V_{DDNOM}$ [10] | | 20.625<br>31.25 | | mV/mT@3.3V<br>mV/mT@5V |
| | Y = 3 | S | $V_{DD}=V_{DDNOM}$ [10] | | 33<br>50 | | mV/mT@3.3V<br>mV/mT@5V |
| | Y = 4 | S | $V_{DD}=V_{DDNOM}$ [10] | | 66<br>100 | | mV/mT@3.3V<br>mV/mT@5V |
| | Y =5 | S | $V_{DD}=V_{DDNOM}$ [10] | | N/A<br>39 | | mV/mT@3.3V<br>mV/mT@5V |

*Table 7 Available Settings*

[13] *Guaranteed by correlation with wafer test and characterization*


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# 10. Detailed General Description

## 10.1. Characteristic Definitions

The Sensor DC Output Voltage is defined by:

$V_{OUT} = V_{DD} \cdot (V_{OQREL} + S_{REL} \cdot B)$, $[V]$, where:

$V_{OQREL} = \frac{V_{OQ}}{V_{DD}}$, $\left[\frac{V}{V}\right]$ is the measured relative quiescent output voltage, its nominal value is 0.5;

$V_{OQ} = V_{OUT}$, $[V]$ is the measured quiescent output voltage at $B = 0$;

$S_{REL} = \frac{S}{V_{DD}} = \frac{\Delta V_{OUT}}{\Delta B} \cdot \frac{1}{V_{DD}}$, $\left[\frac{1}{T}\right]$ is the relative magnetic sensitivity;

$S = \frac{\Delta V_{OUT}}{\Delta B} = S_{REL} \cdot V_{DD}$, $\left[\frac{V}{T}\right]$ is the magnetic sensitivity at given supply voltage $V_{DD}$.

Magnetic Sensitivity Temperature Coefficient TCS is defined by:

$$TCS = \frac{S_{REL}(T_A) - S_{REL}(25°C)}{S_{REL}(25°C) \cdot (T_A - 25°C)} \cdot 10^6, \left[\frac{ppm}{°C}\right].$$

Magnetic Sensitivity Ratiometry is defined by:

$$\varepsilon^R S = \frac{S_{REL}(V_{DD}) - S_{REL}(V_{DDNOM})}{S_{REL}(V_{DDNOM}) \cdot (V_{DD} - V_{DDNOM})} \cdot 100\%, \left[\frac{\%}{V}\right].$$

Linearity for both positive and negative magnetic fields is defined by:

$Lin = \frac{S_{REL}(B_2) - S_{REL}(B_1)}{S_{REL}(B_1)} \cdot 100\%$, $[\%]$, where $B_1 = \pm\frac{0.2}{S_{REL}}$, $B_2 = \pm\frac{0.4}{S_{REL}}$ and

$$S_{REL}(B_X) = \frac{V_{OUT}(B_X) - V_{OQ}}{B_X \cdot V_{DD}}.$$

Symmetry for positive and negative magnetic fields is defined by:

$Sym = \frac{S_{REL}(B_2) - S_{REL}(B_1)}{\frac{1}{2}(S_{REL}(B_1) + S_{REL}(B_2))} \cdot 100\%$, $[\%]$, where $B_1 = \frac{0.4}{S_{REL}}$, $B_2 = -\frac{0.4}{S_{REL}}$ and


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$$S_{REL}(B_X) = \frac{V_{OUT}(B_X) - V_{OQ}}{B_X \cdot V_{DD}}.$$

Output Offset Temperature Drift is defined by:

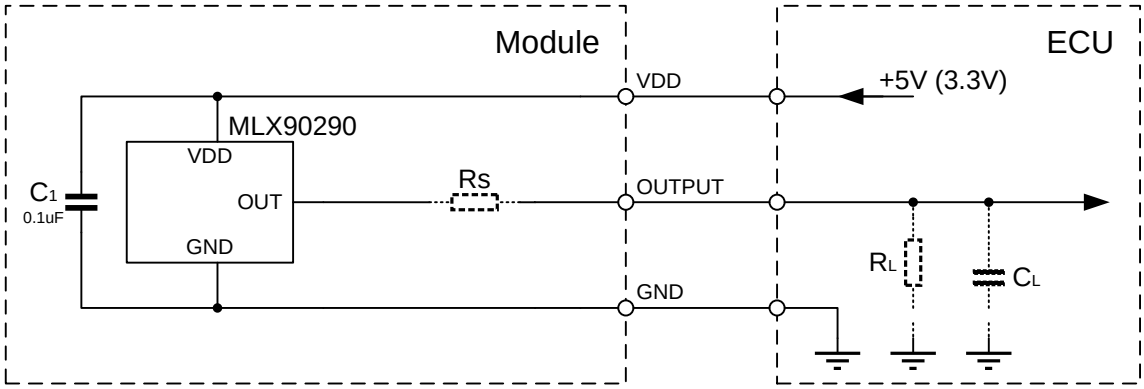
$$\varepsilon^T V_{OQ} = V_{OQ}(T_A) - V_{OQ}(25°C), \left[mV\right].$$

Output Offset Ratiometry is calculated by:

$$\varepsilon^R V_{OQREL} = \frac{V_{OQREL}(V_{DD}) - V_{OQREL}(V_{DDNOM})}{V_{OQREL}(V_{DDNOM}) \cdot (V_{DD} - V_{DDNOM})} \cdot 100\%, \left[\frac{\%}{V}\right].$$

# 11. Application Information

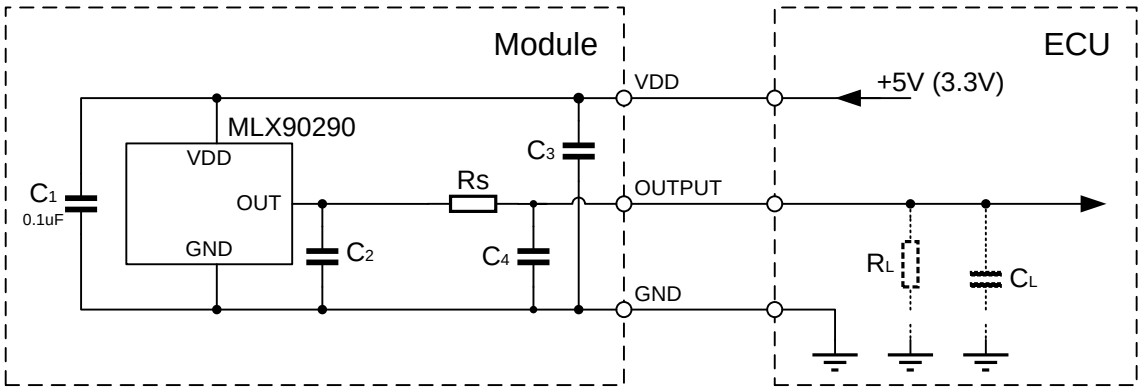
## 11.1. Typical Application Diagram




Notes:
For proper operation a 100nF or bigger bypass capacitor C1 should be placed as close as possible to the VDD and GND pins of MLX90290.
For embedded applications the components $R_S$, $R_L$ and $C_L$ are not required.


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## 11.2. Application Circuit for Harsh and Noisy Environment

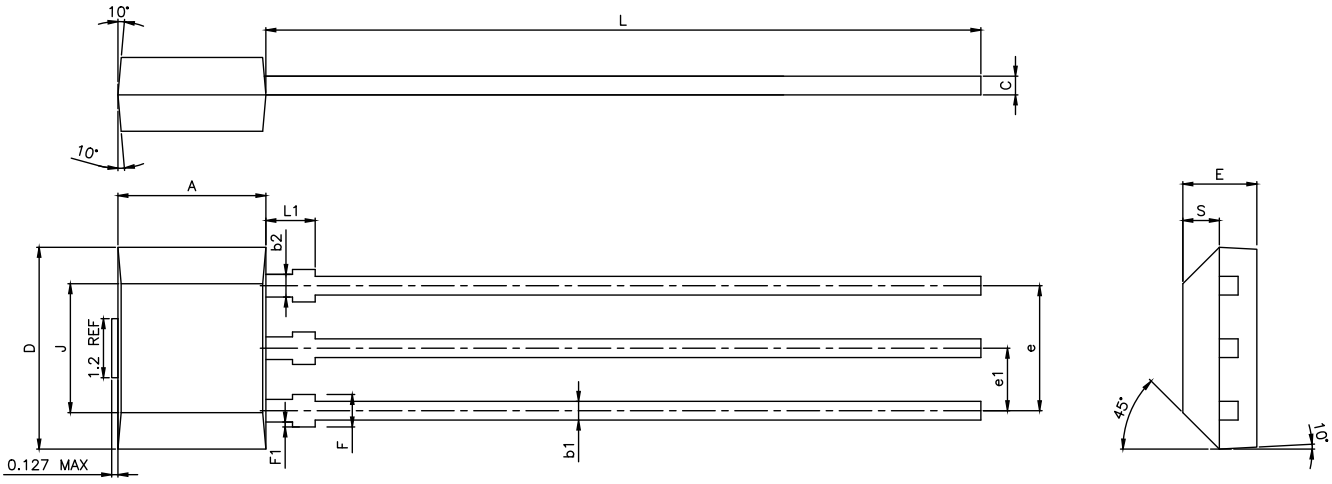



Notes:
For proper operation a 100nF or bigger bypass capacitor C1 should be placed as close as possible to the VDD and GND pins of MLX90290. For harsh and noisy environment, a bypass capacitor C2 of 1nF to 10nF can be placed on the output. For improved EMC performance an additional resistance, Rs and capacitors, C3 and C4 placed close to the connector of the module are recommended. Recommended values for: Rs ≥ 50E, 1nF ≥ C3 ≤ 4.7nF, 1nF ≥ C4 ≤ 10nF.
For embedded applications the components $R_L$ and $C_L$ are not required.


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# 12. Package Information –Example from MLX90290

## 12.1. UA (TO92-3L) Package Information



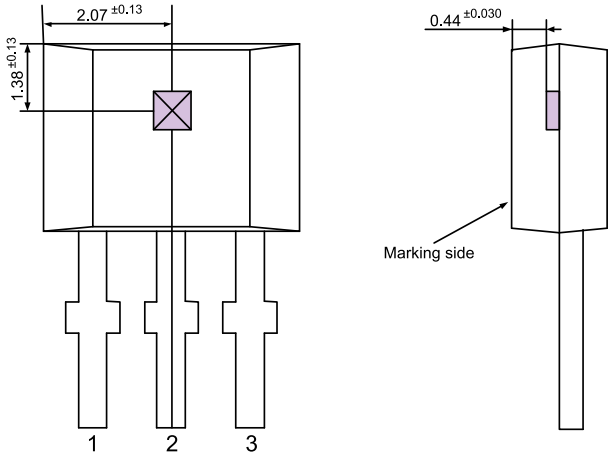

| | A | D | E | F | F1 | J | L | L1 | S | b1 | b2 | c | e | e1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | 2.90 | 4.00 | 1.45 | 0.45 | 0.00 | 2.51 | 14.0 | 0.90 | 0.63 | 0.35 | 0.43 | 0.35 | 2.49 | 1.22 |
| max | 3.10 | 4.20 | 1.55 | 0.66 | 0.15 | 2.72 | 15.0 | 1.10 | 0.84 | 0.44 | 0.53 | 0.44 | 2.59 | 1.32 |

Notes:

1. Dimensions in millimeters (mm) unless noted otherwise.
2. Package dimensions do not include mold flashes and protrusions.
3. Dimension A and D do not include mold gate and side flash (protrusion) of maximum 0.127 mm per side.

## 12.2. UA (TO92-3L) Hall Plate Location

**Hall plate location**

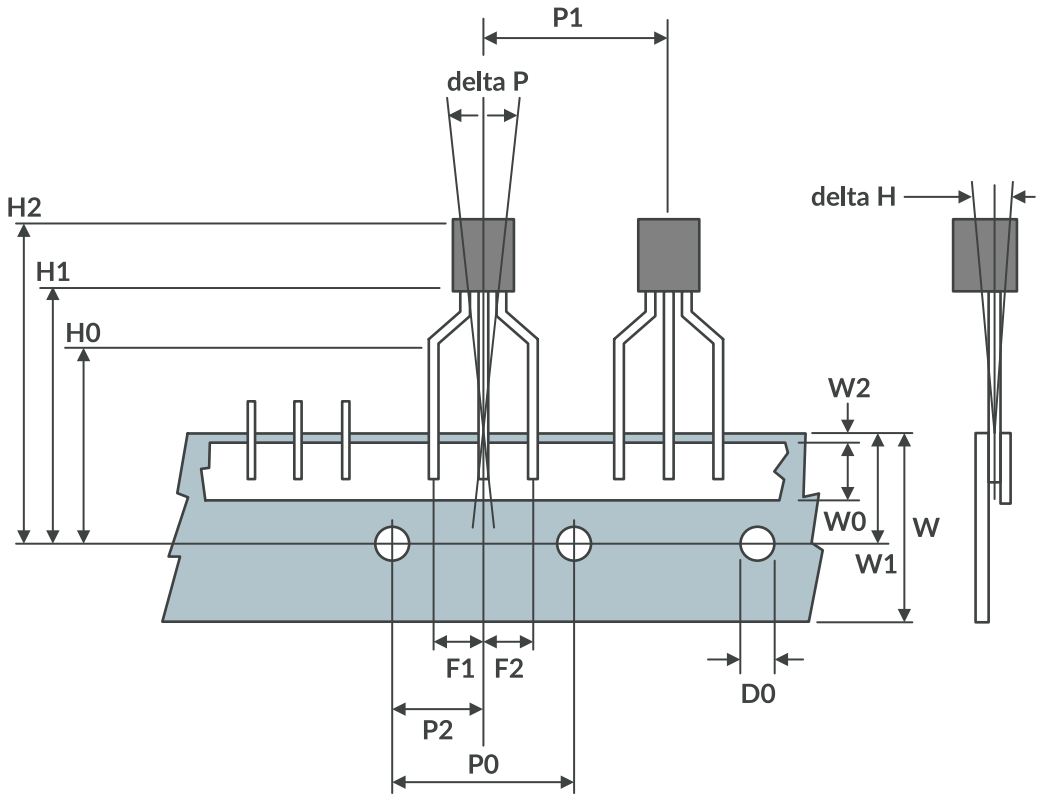



Notes
1. All dimensions are in millimeters
2. Mold flashes and protrusion are not included



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## 12.2.1. Trim and form with 2.54mm distance between leads; only available on tape

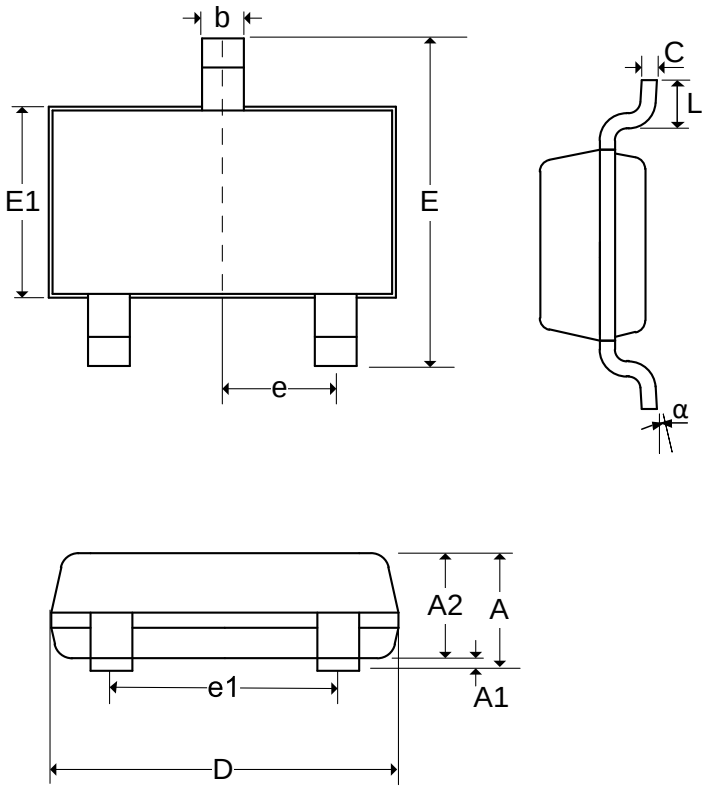



| Parameter | Component Height | Component Position | Hole Diameter | Hole Position | Hole Pitch | Component Pitch | Right-Left Bending |
|---|---|---|---|---|---|---|---|
| | H1 | P2 | Do | W1 | Po | P1 | ΔP |
| Nominal (& Tolerance) | 19mm (±0.5) | 6.35mm (±0.4) | 4mm (±0.2) | 9mm (-0.5; +0.75) | 12.7mm (±0.3) | 12.7mm (±0.3) | ±0.4mm |

| Parameter | Lead Spacing | Front-Rear Bending | Tape Width | Adhesive Tape Width | Adhesive to Carrier Tape Gap | Vertical Lead Length | Component Height Top |
|---|---|---|---|---|---|---|---|
| | F1 & F2 | ΔH | W | Wo | W2 | H0 | H2 |
| Nominal (& Tolerance) | 2.54mm (±0.25mm) | ±.0.3deg | 18mm (±0.5) | 6mm (±0.2) | 0.5mm (-0.5; +0.3) | 15.5mm (±0.5) | 22.0mm (±0.8mm) |


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## 12.3. SE (TSOT-3L) Package Information




Notes:

1. All dimensions are in millimeters
2. Outermost plastic extreme width does not include mold flash or protrusions. Mold flash and protrusions shall not exceed 0.15mm per side.
3. Outermost plastic extreme length does not include mold flash or protrusions. Mold flash and protrusions shall not exceed 0.25mm per side.
4. The lead width dimension does not include dambar protrusion. Allowable dambar protrusion shall be 0.07mm total in excess of the lead width dimension at maximum material condition.
5. Dimension is the length of terminal for soldering to a substrate.
6. Formed lead shall be planar with respect to one another with 0.076mm at seating plane.

Marking:

Top side :

90XXX
XXX: Last three digits of the lot

Bottom side:

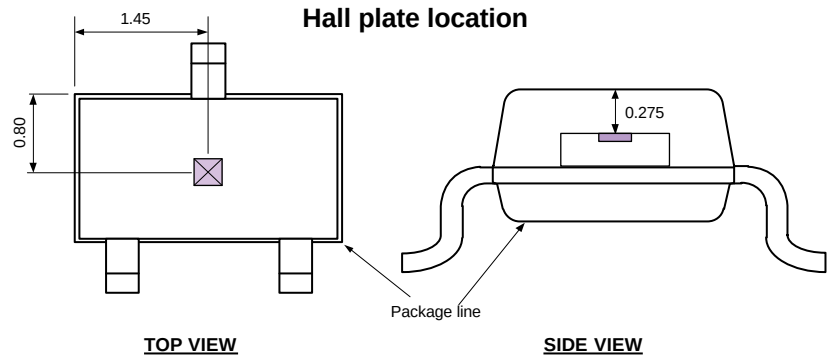
WWYY
WW: Calendar Week
YY: Calendar Year

| | A | A1 | A2 | D | E | E1 | L | b | c | e | e1 | α |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| min | – | 0.025 | 0.85 | 2.80 | 2.60 | 1.50 | 0.30 | 0.30 | 0.10 | 0.95 | 1.90 | 0° |
| max | 1.00 | 0.10 | 0.90 | 3.00 | 3.00 | 1.70 | 0.50 | 0.45 | 0.20 | BSC | BSC | 8° |

Notes:

1. Dimension “D” and “E1” do not include mold flash or protrusions. Mold flash or protrusion shall not exceed 0.15mm on “D” and 0.25mm on “E” per side.
2. Dimension “b” does not include dambar protrusion.

## 12.4. SE (TSOT-3L) Hall Plate Location






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## 13. Standard Information

Our products are classified and qualified regarding soldering technology, solderability and moisture sensitivity level according to standards in place in Semiconductor industry.

For further details about test method references and for compliance verification of selected soldering method for product integration, Melexis recommends reviewing on our web site the General Guidelines soldering recommendation. For all soldering technologies deviating from the one mentioned in above document (regarding peak temperature, temperature gradient, temperature profile, etc.), additional classification and qualification tests have to be agreed upon with Melexis.

For package technology embedding trim and form post-delivery capability, Melexis recommends to consult the dedicated trim & form recommendation application note: lead trimming and forming recommendations.

Melexis is contributing to global environmental conservation by promoting **lead free** solutions. For more information on qualifications of **RoHS** compliant products (RoHS = European directive on the Restriction Of the use of certain Hazardous Substances) please visit the quality page on our website: http://www.melexis.com/en/quality-environment.

## 14. ESD Precautions

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

## 15. Contact

For the latest version of this document, go to our website at www.melexis.com.

For additional information, please contact our Direct Sales team and get help for your specific needs:

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|---|---|
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# Revision History Table

| | | |
|---|---|---|
| Rev 001 | 6-Oct-2014 | Document Creation |
| Rev 002 | 22-May-2019 | Update to new Melexis branding template |
| Rev 003 | 15-Apr-2020 | Updated UA package outline drawing to current format<br>Added versions placed into production since latest update<br>Updated block diagram to standard Melexis format and colors<br>Added Automotive AEC Q-100 qualified note under "Features and Benefits" |
| | 23-Apr-2020 | Updated 3D package drawings in section 6 |
| Rev 004 | 1-Mar-2021 | Added MLX90290LSE-AAA-522-RE to the standard available options<br>Package outline dimensions for UA package updated<br>Hall plate location updated from 0.44±0.04 to 0.44±0.03<br>Added note regarding lead coplanarity and pitch in bulk packaging |
| Rev 005 | 21-Jun-2021 | Added MLX90290LUA-AAA-553-BU to the standard available options<br>Converted UA tape drawing to vector format for clarity |


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