MLX90326
Analog 0-5V Sensor Interface IC

Features and Benefits

- Analog 0-5V ratiometric output
- Single pin programming (through output)
- Fast response time
- Extended temperature range
- Cost effective "electronic trimming"
- Second order compensation of offset and gain
- Internal temperature sensor provided

Application Examples

- Pressure transducers, strain gauges, accelerometers, position sensors, etc…
- Industrial sensors
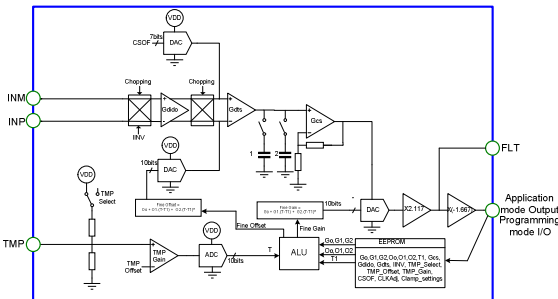- Automotive after market sensors
- All resistive bridge sensors

Ordering Information

Part No.	Temperature Code	Package Code
MLX90326LFR	L (-40°C to 150°C)	FR (SSOP 209 mil)

1 Functional Diagram

2 General Description

The MLX90326 covers the most typical resistive type of Wheatstone bridge applications for use in an industrial or automotive after market environment. It is a monolithic silicon analog integrated sensor interface that converts small changes in resistors, configured in a full Wheatstone bridge on a sensing element, to large output voltage variations.

The signal conditioning includes gain adjustment, offset control and second order temperature compensation in order to accommodate variations of the different resistive sensing elements. Compensation values are stored in EEPROM and can be reprogrammed with an interface circuit and a provided software.

The MLX90326 is programmed with a single wire serial interface through the output pin.

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3 Absolute Maximum Ratings

Parameter.	Min	Max	Units	Comments
Supply Voltage, V_{DD}- V_{SS}	4.5	5.5	V	Operating within specifications
Operating Temperature Range, $T_{environment}$	-40	150	°C	
Storage Temperature Range	-50	150	°C	
Programming Temperature Range	-40	125	°C	
Package Thermal Resistance		130	°C/W	
ESD Sensitivity	2		kV	HBM. CDF - AEC - Q100-002

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.

4 Pin Definitions and Descriptions
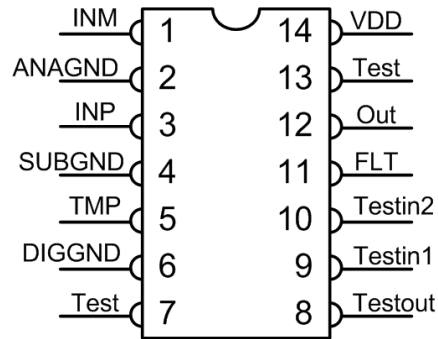
Package Pin Nr	Short Name	Dir	Type	Function / Description
1	INM	IN	Analog	Bridge Sensor Negative
2	ANAGND	gnd		Analog Ground
3	INP	IN	Analog	Bridge Sensor Positive
4	SUB	gnd		Substrate Ground
5	TMP	IN	Temp	External Temperature Sensor (Resistor to supply)
6	DIGGND	gnd		Digital Ground
7	Test	NC		On module to ground.
8	TESTOUT	OUT	Test	Test Output. On module to ground
9	TESTIN1	IN	Test	Test Input 1: CLKEXT, TEST (3 level)
10	TESTIN2	IN	Test	Test Input 2: DATAIN, SCAN (3 level)
11	FLT	OUT	Analog	Filter pin
12	OUT	BI	Analog	Analog output and communication pin
13	Test	NC		On module to ground
14	VDD	power	Supply	Supply

Table 2: Pin definitions and descriptions

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5 General Electrical Specifications

DC Operating Parameters T_A = -40°C to 150°C, V_{DD} = 5.0V (unless otherwise specified)

Parameter.	Symbol	Comments	Min	Typ	Max	Units
Supply Voltage	VDD		4.5		5.5	V
Supply Current	IDD	No output load, V_{DD}=5V±10%	4		9	mA
Output capacitive load		10Ω < R_{SERIES} < 10 kΩ	0		100	nF
Output resistive load		To reach 5%VDD to 95%VDD	2.4			kΩ
Output current capability			± 1.9			mA
Output short circuit current		V_{DD}=5V±10%			±50	mA
Digital output current			±2		±5	mA
V_{DD} line inductance			0		22	µH

Signal path general Specifications						
Parameter.	Symbol	Comments	Min	Typ	Max	Units
Overall gain			12.7		442	V/V
Coarse gain	G_{dido}	1bit programmable		3.25 (Gdido = 0) 13 (Gdido = 1)		V/V
	G_{dts}	1bit programmable		2 (Gdts = 0) 5 (Gdts = 1)		V/V
	G_{cs}	1bit programmable		1.24 (Gcs = 0) 1.9375 (Gcs =1)		V/V
Fine gain	Fgain	10 bit programmable	0.448		0.99	V/V
Typical sensor output span that can be accommodated to achieve 4V output span			1.8		63	mV/V$_{supply}$

				97.2	mV/V$_{supply}$
Typical sensor offset that can be compensated				97.2	mV/V$_{supply}$
Output Offset programmable		10		90	%V$_{DD}$
Output Offset resolution				0.1	%V$_{DD}$
Overall non linearity	Best fit value			±0.1	%V$_{DD}$
Wake-up time at power up				10	ms
Output noise	47nF FLT capacitance with maximum gain			5	mV$_{rms}$
Response time	Set by an external capacitor			0.1	ms

Table 3: Electrical specifications

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6 General Description

The MLX90326 can be used with almost any type of resistive bridge sensor without the need of any additional signal conditioning.

The differential input signal is offset compensated and amplified to achieve the desired output voltage. With a coarse gain calibration the MLX90326 can easily accommodate sensor output spans in the 1.8mV/V to 63mV/V range to achieve 4 V output span. Sensor output offsets up to 97.2mV/V (depending on the sensor output span and on the desired output offset) can be compensated with the coarse offset calibration to achieve an output offset in the 0.5V to 4.5V range.

7 Unique Features

Offset canceling

The offset of amplifier DIDO is cancelled by using a chopping mechanism. Also the amplifier DTS and all sample-and-hold circuits make use of an offset canceling mechanism. This means that the contribution of the on-chip offsets and offset drifts is negligible compared to the external sensor offset and offset drift.

### Coarse and fine second order calibration of the sensitivity and offset.

The MLX90326 can be calibrated to achieve 4V output span for a sensor output span in the 1.8mV/V to 63mV/V and can compensate 0.4mV/V to 97.2mV/V input offset depending on the sensor output span and on the desired MLX90326 output offset voltage. A wide range of sensor sensitivity and offset temperature drift can be compensated with the second order fine gain and offset calibration.

EEPROM

All the calibration data is stored three times on an EEPROM and a majority voting is done when accessing data. Parity check is used to diagnose data corruption. After all calibrations parameters were successfully written to EEPROM, the EEPROM can be locked by sending a 'Lock EEPROM' command (see paragraph 6). This is strongly recommended to avoid in application mode data corruption. For reliability reasons, actually each calibration bit is stored three times in the EEPROM and the circuit uses a hardware majority voting system when accessing data.

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8 Application Information

8.1 Ratio-metric mode with external temperature sensor.
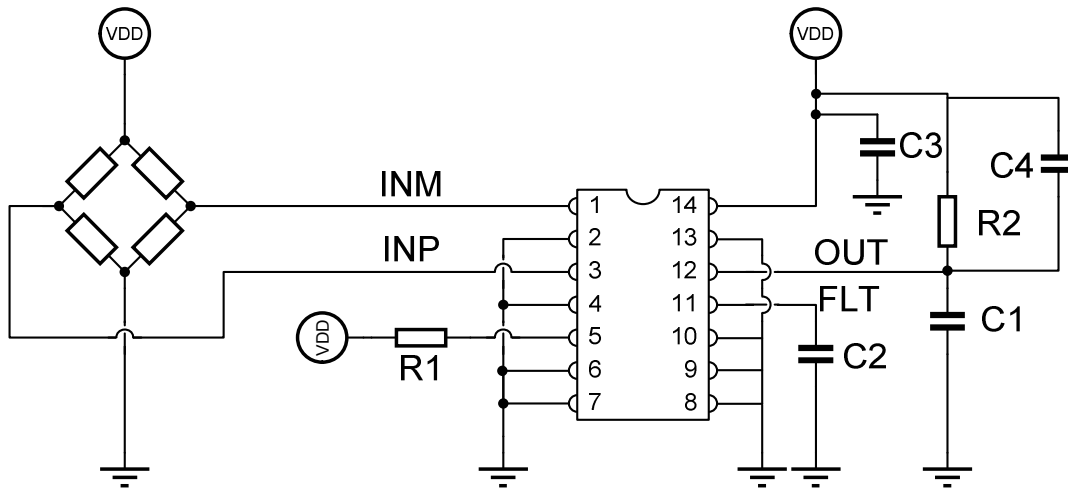
The external temperature sensor is only needed for applications where the temperature surrounding the customer sensor is different from the temperature surrounding the MLX90326. In the ratio-metric application mode, to keep the accuracy, the same supply should be used for the customer sensor, the MLX90326 and an ADC that makes the digital conversion of the analog output signal.

The C1 capacitor value (output) is typically 47nF. Range: 0 – 100nF.

The capacitor C2 on the FLT pin is optional. Typical value = 10nF. Range: 0 – 100nF. It is used to decrease the noise and set the bandwidth of the system. The decoupling capacitors C3 between the supply and the ground and C4 between output and supply have a typical value of 47nF.

The external resistor R1 is placed between the TMP pin and the supply. It is used as an external temperature sensor. The external temperature sensor could be of type Panasonic, ERAS15J103V (R1 = 10k +/- 5%, TCR = 1500ppm/degC +/- 200ppm/degC) for the -40ºC to 140ºC temperature range.

Typical pull up resistor R2 value is 2.4kOhm.

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8.2 Ratio-metric mode with no external temperature sensor.
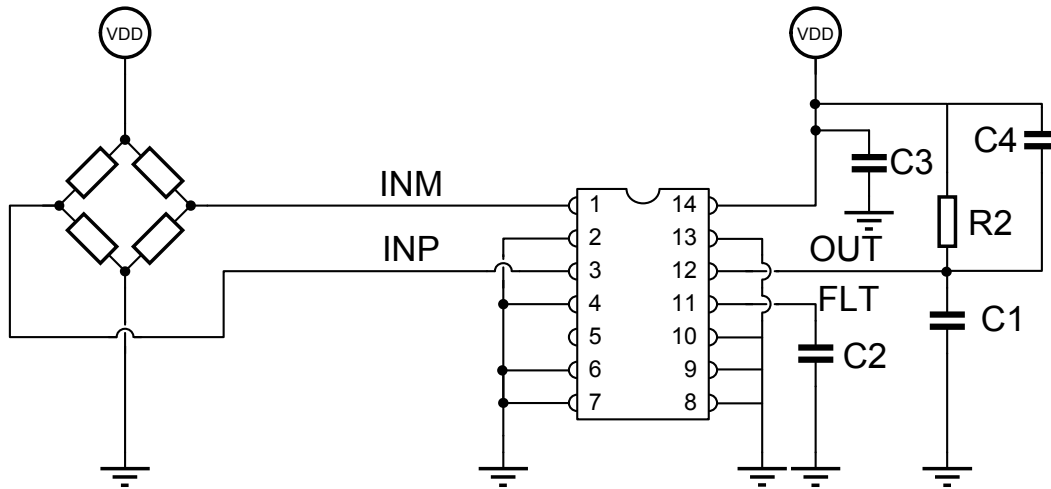
C1, C2, C3, C4 and R2 have the same values as for the ratio-metric application with use of external temperature sensor.
The internal temperature sensor can be used when the temperature surrounding the customer sensor and the MLX90326 is the same.

8.3 Non Ratio-metric mode with external temperature sensor.
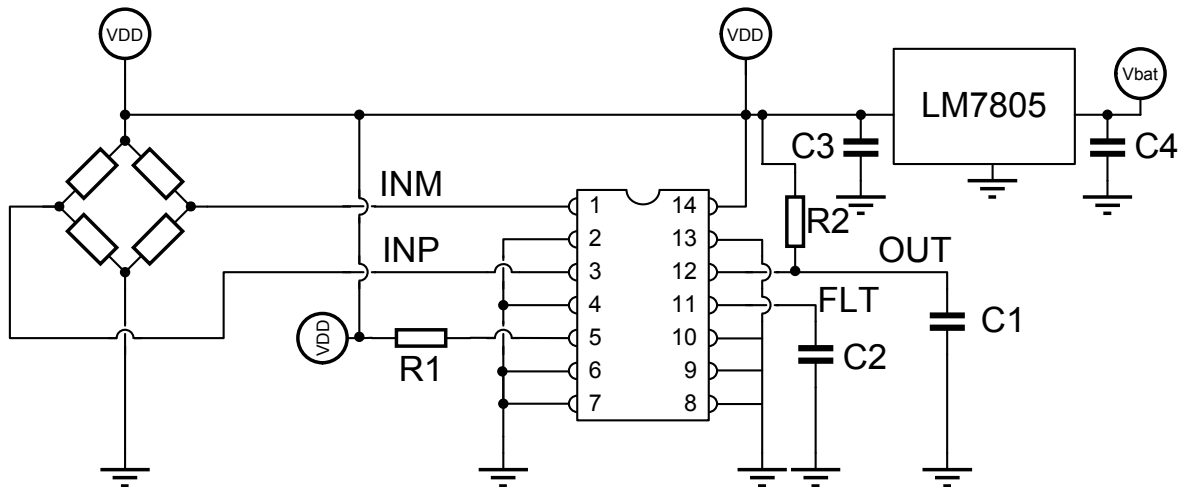
With the use of an external voltage regulator to supply the sensor, the MLX90326 as well as an ADC used for converting the analog output signal, the MLX90326 can be used in a non ratio-metric mode. An example of standard voltage regulator is the LM7805. C1, C2, R1 and R2 are the same as in the ratio-metric application mode. C4 has a typical value of 330nF and C3 of 100nF in this application mode.

8.4 Non Ratio-metric mode with no external temperature sensor.
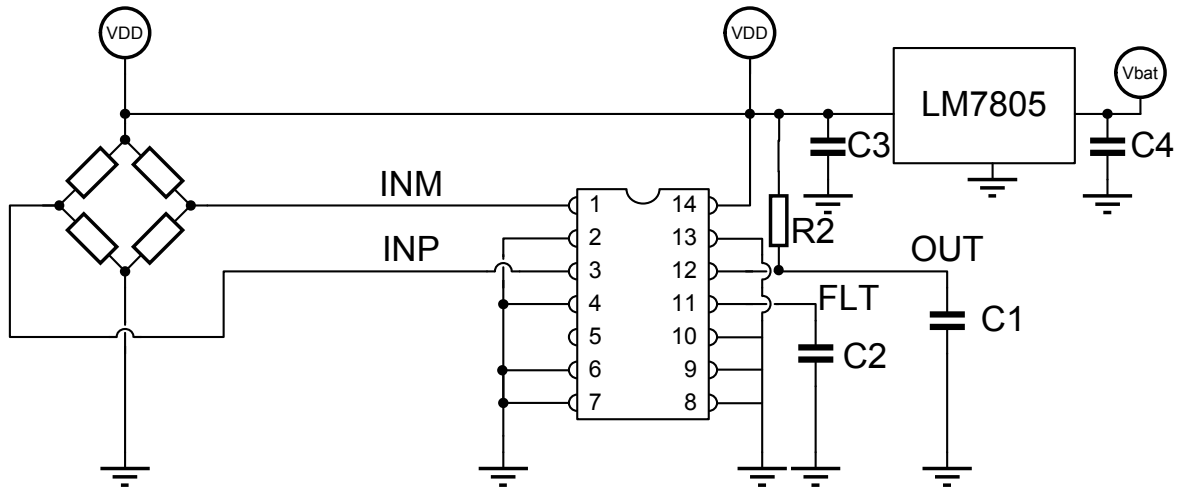
In this application mode the LM7805 generates the supply for the sensor, for the MLX90326 and for an ADC used to convert the analog output signal in a digital value. C1, C2, C3, C4 and R2 are the same as in the non ratio-metric application mode with external temperature sensor.

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9 Standard information regarding manufacturability of Melexis products with different soldering processes

Our products are classified and qualified regarding soldering technology, solderability and moisture sensitivity level according to following test methods:

Reflow Soldering SMD's (Surface Mount Devices)

- 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)

Wave Soldering SMD's (Surface Mount Devices) and THD's (Through Hole Devices)

- EN60749-20
  Resistance of plastic- encapsulated SMD's to combined effect of moisture and soldering heat
- EIA/JEDEC JESD22-B106 and EN60749-15
  Resistance to soldering temperature for through-hole mounted devices

Iron Soldering THD's (Through Hole Devices)

- EN60749-15
  Resistance to soldering temperature for through-hole mounted devices

Solderability SMD's (Surface Mount Devices) and THD's (Through Hole Devices)

- EIA/JEDEC JESD22-B102 and EN60749-21
  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.

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/quality.asp

10 ESD Precautions

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

11 Package Information
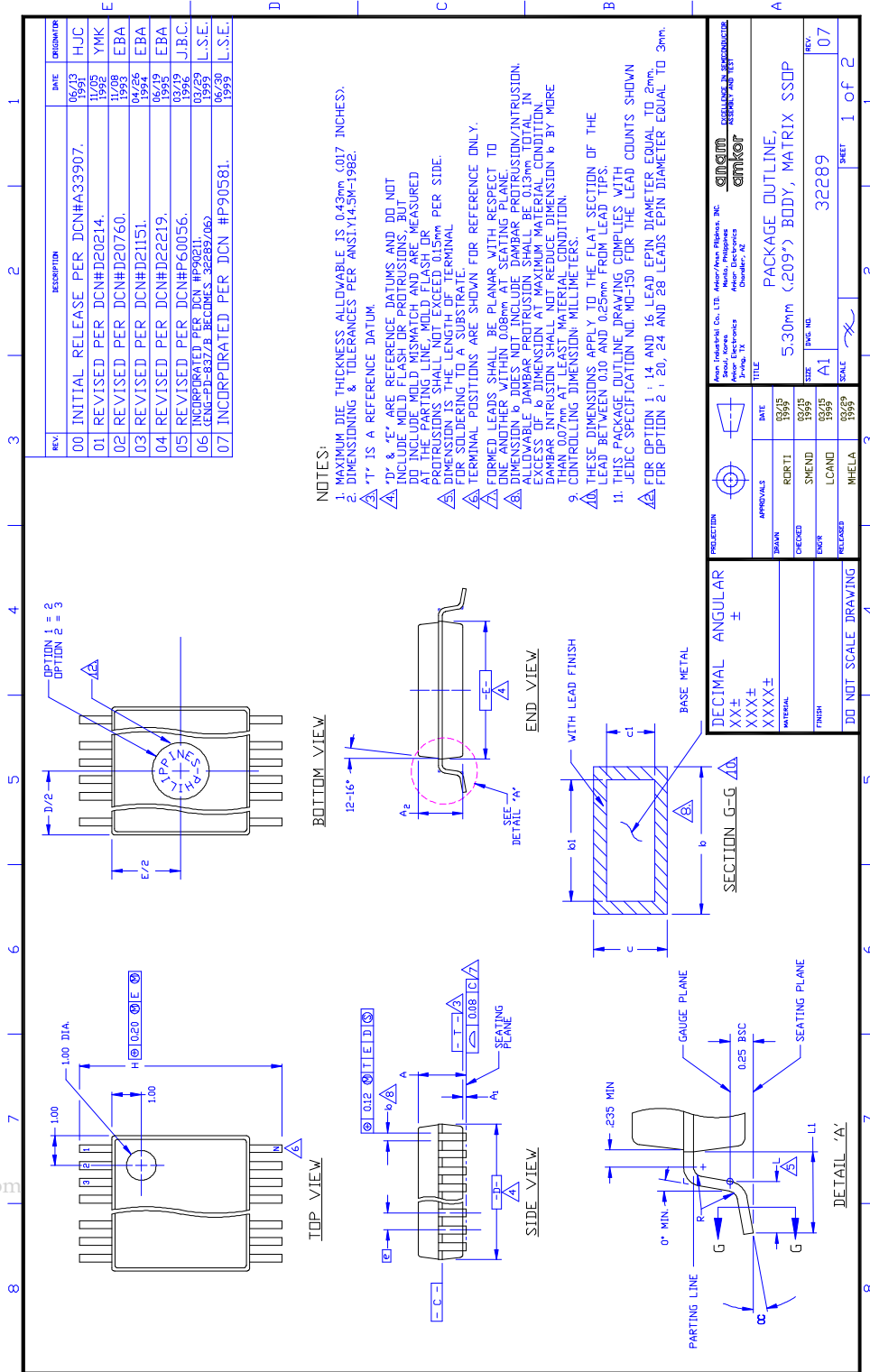
12 Disclaimer

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