1. Features and Benefits

- +/-0.5% full scale lifetime accuracy
- Digital SENT output
- Option to output linear temperature measured by external NTC thermistor
- Flexible NTC input supports wide range of different NTC characteristics without calibration
- All-in-one solution: MEMS, interface and passive components in one easy to integrate package validated according to leading OEM EMC standards
- -40°C to 160°C temperature range, up to 170°C for short durations
- Excellent harsh media resistance against halogens, acids, …
- Qualified according to AEC-Q100 and AEC-Q103-002
- Configurable diagnostic features like output out of range, over voltage, under voltage, …
- Factory calibrated and fully programmable through the connector with the PTC04 programming tool for customized calibration curves
- Extended over (+40V) and reverse (-40V) voltage capabilities (supply & output)
- Easy to use due to its PCB-less package with ridges to enable glued pressure seals
- ASIL compliant developed as an ASIL B SEooC as per ISO 26262

2. Application Examples

- Automotive applications with relative pressure spans from 0.1 bar to 1.5 bar
- Fuel vapor pressure sensor
- Crankcase ventilation pressure sensor
- Pressure sensor for filter monitoring

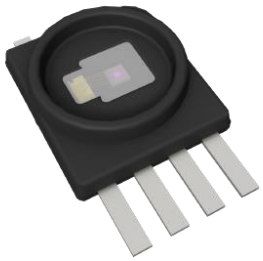
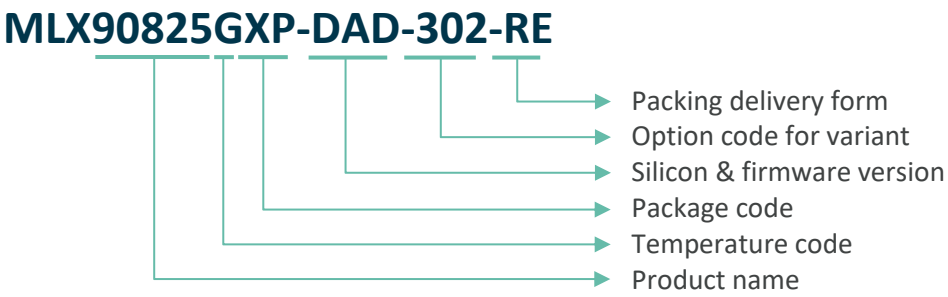


Figure 1: MLX90825

3. Ordering information

Ordering Code	Temperature	Package	Option code	Packing
MLX90825GXP-DAD-302-RE	-40°C to 160°C	SMP7	0 to 0.5 bar relative pressure / 193 to 3896LSB SENT output / standalone / No NTC	Reel
MLX90825GXP-DAD-300-RE	-40°C to 160°C	SMP7	-0.2 to 0.8 bar relative pressure / 193 to 3896LSB SENT output / standalone / No NTC	Reel
MLX90825GXP-DAD-400-RE	-40°C to 160°C	SMP7	-0.2 to 0.8 bar relative pressure / 193 to 3896LSB SENT output / Master / No NTC	Reel
MLX90825GXP-DAD-500-RE	-40°C to 160°C	SMP7	-0.2 to 0.8 bar relative pressure / UART output / Slave / No NTC	Reel
MLX90825GXP-DAD-404-RE	-40°C to 160°C	SMP7	-0.3 to 1 bar relative pressure / 193 to 3896LSB SENT output / Master / No NTC	Reel
MLX90825GXP-DAD-504-RE	-40°C to 160°C	SMP7	-0.3 to 1 bar relative pressure / UART output / Slave / No NTC	Reel



4. Package diagram

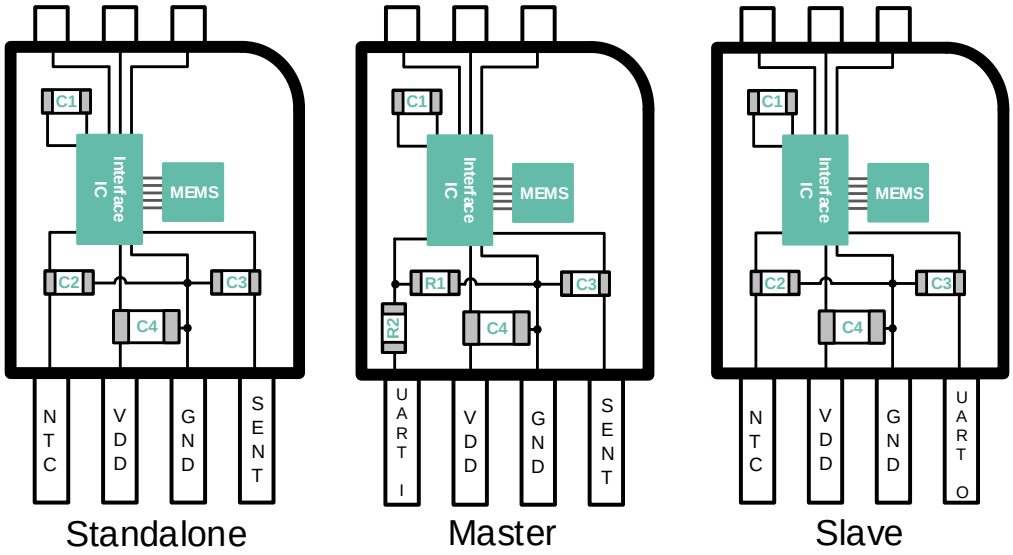


Figure 2: package diagrams of MLX90825 standalone, master and slave variants

Component	Value
C1	100nF
C2	10nF
C3	2.2nF
C4	100nF
R1	2.7kΩ
R2	5.6kΩ

Table 1: MLX90825 passive component configuration

5. General Description

The MLX90825 is a packaged, factory calibrated, relative pressure sensor measuring spans from 0.1 bar to 1.5 bar. It delivers a digital output signal using the SENT protocol.
The MLX90825 consists of a MEMS pressure sensor element, an interface chip (CMOS technology) and passive components. The optimized solution exhibits excellent EMC performance. The DSP based signal interface provides outstanding initial accuracy. A smart package and die assembly concept enable high output stability over life, even in stringent automotive temperature and stress conditions.

Contents

6. Glossary of Terms

Relative pressure: Pressure difference between applied pressure on the top side and atmospheric pressure on the bottom side
ADC: Analog to Digital Converter
Bar: Pressure unit (1bar = 100kPa)
DSP: Digital Signal Processor
EMC: Electro Magnetic Compatibility
ESD: Electrostatic discharge
FC: SENT Fast Channel
FC1: SENT Fast Channel 1
FC2: SENT Fast Channel 2
FS: Full scale, span
LSB: Least Significant Bits
MSN: Most significant Nibble
NTC: Negative Temperature Coefficient thermistor
OV: Over Voltage
PCB: Printed Circuit Board
PTAT: Internal temperature reference Proportional To Absolute Temperature
PTC04: Melexis Programming Tool
RV: Reverse Voltage
SCD: Slow channel diagnostic
SENT: Single Edge Nibble Transmission
SEooC: Safety Element out of Context
T_A: Ambient temperature
UART: universal asynchronous receiver / transmitter protocol

7. Absolute Maximum Ratings

Parameter	Symbol	Value	Units	Comment
Supply Voltage (overvoltage)	OV	40	V	Max 2 hours
Reverse Voltage Protection	RV	-40	V	
Positive output voltage		40	V	
Reverse output voltage [1]		-40	V	
Max voltage on NTC/UART input pin		-0.2 to 2	V	Max 1 minute at Ta = 25°C
Operating Ambient Temperature Range	T_A	-40 to 160	°C	
Extended Operating Ambient Temperature Range		-40 to 170	°C	10 minutes continuous period, max 20 hours total duration over life
Storage Temperature Range		-40 to 160	°C	
Programming Ambient Temperature Range		-40 to 125	°C	
Proof pressure (top side)		5	Bar	
Burst pressure (top side)		7	Bar	
Proof pressure (bottom side)		5	Bar	
Burst pressure (bottom side)		5	Bar	

Table 2: 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] *Absolute maximum DC negative output at floating supply or supply shorted to output. Maximum DC negative output at operating supply: -5.5V.*

8. Pin Definitions and Descriptions

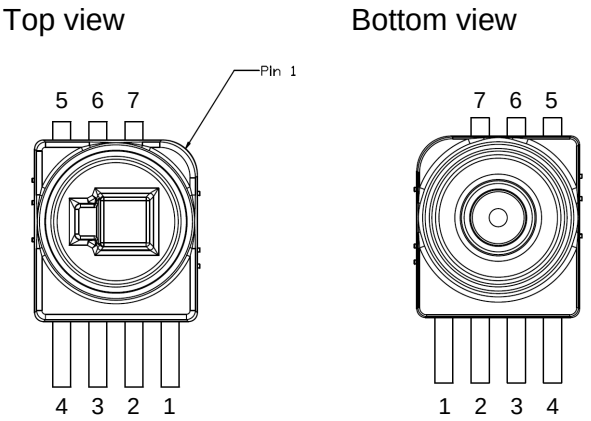


Figure 3: Package pinout

Pin number	Description		
	Standalone	Master	Slave
1	SENT output	SENT output	UART output
2	Ground (GND)	Ground (GND)	Ground (GND)
3	Supply input (VDD)	Supply input (VDD)	Supply input (VDD)
4	NTC input	UART input	NTC input
5	Test pin	Test pin	Test pin
6	Test pin	Test pin	Test pin
7	Test pin	Test pin	Test pin

Table 3: Pinout definitions and descriptions

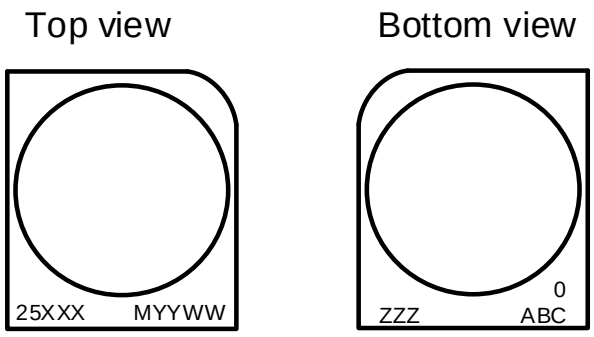


Figure 4: Package marking

Symbol	Function / Description
XXX	MEMS and ASIC traceability letter [2]
ZZZ	Last three characters of lot number
ABC	Sub lot indication
YYWW	Date code
M	'M' marking a master device on front side
0	'0' marking a master device on back side

Table 4: Package marking definition

2 *Linked to first three letters of option code.*

9. General Electrical Specifications

DC Operating Parameters T_A = -40°C to 160°C

Parameter	Symbol	Remarks	Min	Typ[3]	Max	Units
Nominal supply voltage	Vdd		4.5	5	5.5	V
Nominal supply current	Idd	Including external NTC, no additional load at the output.		10.5	12	mA
Current consumption at overvoltage	IDD_OV				20	mA
Current consumption at reverse voltage	IDD_RV				20	mA
Output short-circuit current	IOUT_SH		-20		20	mA
Resistive load on output	$R_{PULL-UP}$	Pull-up to Vdd at receiver[4]	10		55	kOhm
Under voltage detection range		Programmable value. In default configuration set to 4.3V	4.25		4.8	V
Over voltage detection range		Programmable value. In default configuration set to 5.7V	5.2		5.75	V
Under voltage detection tolerance			-50		50	mV
Over voltage detection tolerance			-50		50	mV
Power up time		Time from reaching minimum allowed supply voltage of 4.5V till the first falling edge of the first SENT frame			5	msec
Pressure response time[5]		Using default filter settings. Tick time = 3us and Pause Pulse enabled.			3	SENT frames
Pressure output noise		Default configuration DAD-302, DAD-300, DAD-400, DAD-404, DAD-500 and DAD-504		2	3	LSB pk-pk
Pressure output update time		SENT frame of at least 0.528ms.			1	SENT frame
Internal temperature start up time				5 +1	9 +1	ms temperature output period[6]
Internal temperature update time				10	20	ms
Internal temperature accuracy		On chip PTAT temperature	-10		10	°C
NTC temperature output noise					4	LSB pk-pk

[3] *Typical values are defined at TA = +25°C and VDD = 5V.*

[4] *As specified in the SENT standard.*

[5] *Number of SENT frames between pressure step and 90% settled output (last frame containing stable pressure data).*

[6] *The temperature output period is the time interval between two moments where temperature information is transmitted. If the internal temperature is transmitted in fast channel 2 this duration is one SENT frame. If the internal temperature is only transmitted in the slow channel this is the time between two slow channel messages with ID 23.*

Parameter	Symbol	Remarks	Min	Typ[3]	Max	Units
NTC start up time				10 +1	12 +1	ms temperature output period[7]
NTC temperature update time				18	22	ms
NTC temperature response time		From temperature change to end of frame with output >= 90% of step size			100 +1	ms temperature output period
NTC temperature range	T_NTC		-50		210	°C
NTC resistance range	R_NTC		20		1M	ohm

Table 5: Electrical specifications

10. Detailed General Description

The MLX90825 consists of a pressure sensor element, a DSP-based interface chip and passive components.

The pressure sensor element consists of a diaphragm realized in the silicon. The diaphragm reacts to a change in relative pressure between the top and bottom side. The internal strain increases, in particular at the border of the diaphragm. Here, the piezo-resistive elements have been implanted into the silicon diaphragm forming a Wheatstone bridge, which act as a transducer.

The analog front-end of the interface chip applies filtering and converts the analog signal to a digital value. The DSP performs the compensations over temperature. Furthermore, the digital circuit provides some filtering, the possibility to linearize the pressure signal and also implements the clamping function. This chip transmits a SENT output compliant with SAE J2716 spec dated April 2016. On one of the fast channels of the SENT message it is possible to transmit linearized and calibrated temperature information measured by an external NTC thermistor. An analog interface is available for the external thermistor and the 16bits DSP performs the calibration and linearization of the measured thermistor temperature.

Extensive protection of the supply lines and output allows the MLX90825 to handle extreme overvoltage conditions and is resistant to severe external disturbances. Several diagnostic functions (over-voltage, under-voltage, overpressure, under pressure detections) have been implemented on the MLX90825 and can be enabled by programming EEPROM settings. Figure 5 shows the MLX90825 block diagram. Passive components are integrated in the package to bring excellent EMC performance without the need for additional components at module level.

[7] The temperature output period is the time interval between two moments where temperature information is transmitted. If the NTC temperature is transmitted in fast channel 2 this duration is one SENT frame. If the NTC temperature is only transmitted in the slow channel this is the time between two slow channel messages with ID 10.

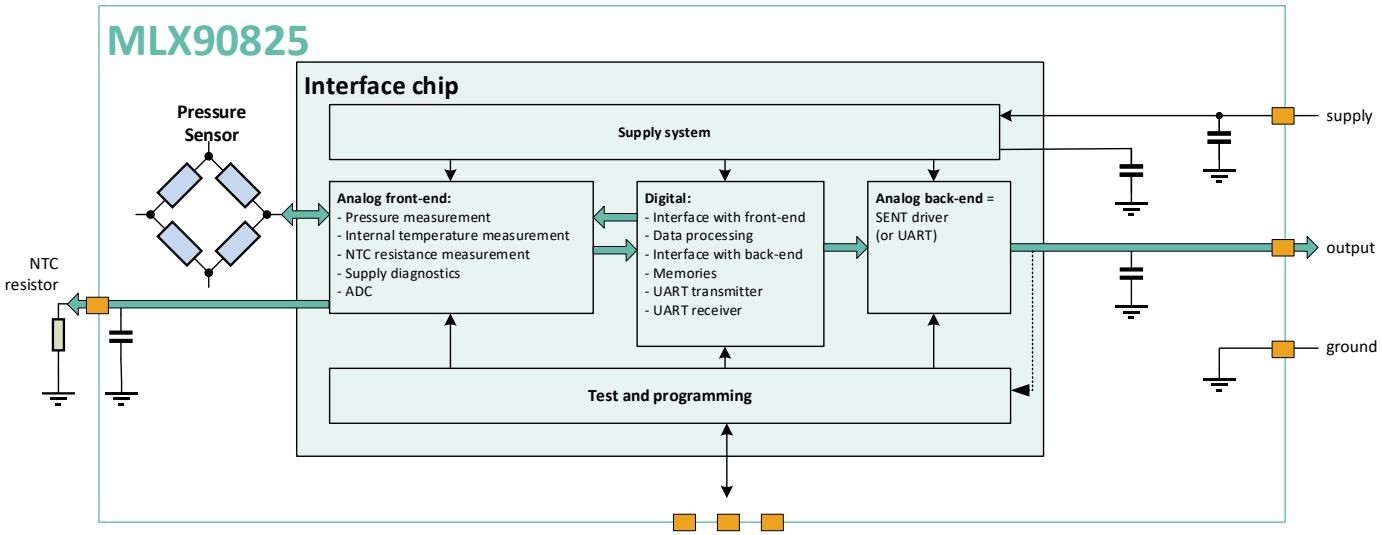


Figure 5: MLX90825 functional block diagram

11. Default programmed settings

The MLX90825 is calibrated at the final manufacturing test steps. During the calibration, settings are stored in the on chip EEPROM to define the pressure transfer curve. Besides pressure, the internal temperature and optionally the NTC temperature calibrations are performed. An external NTC can be connected to a standalone or slave device. Versions DAD-302, DAD-300, DAD-500 and DAD-504 have it disabled in their default configuration.

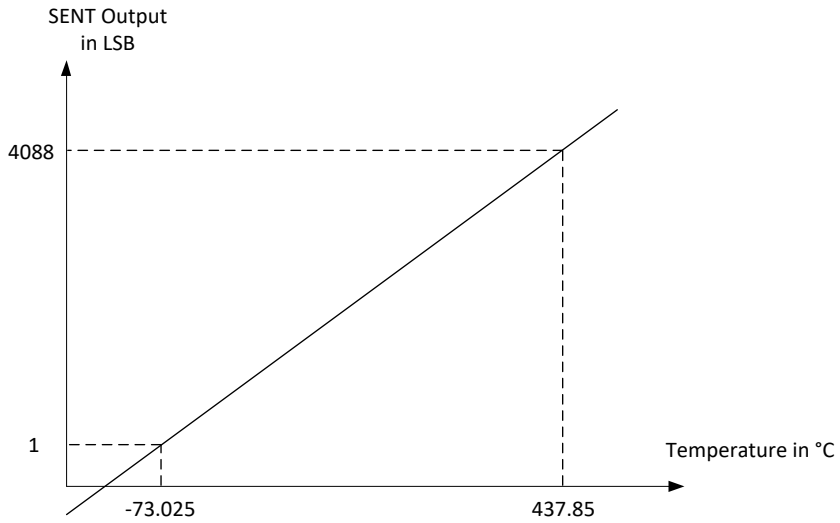


Figure 6: NTC and internal temperature transfer function

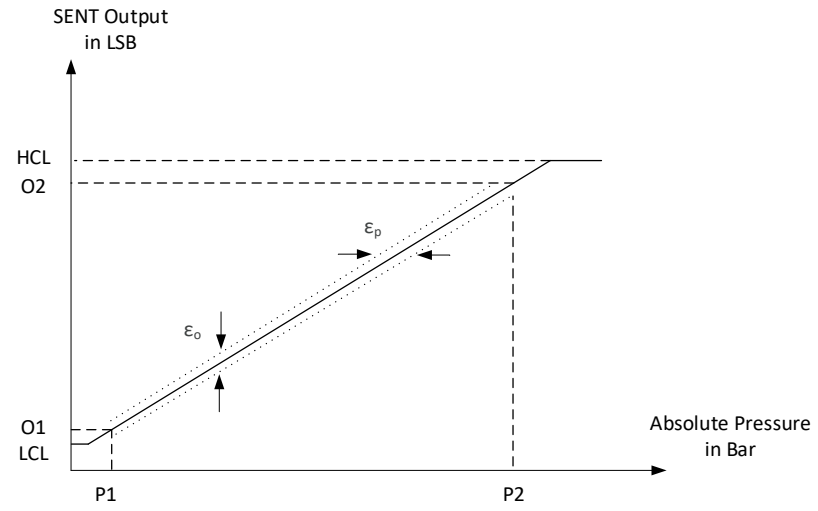


Figure 7: Pressure transfer function description

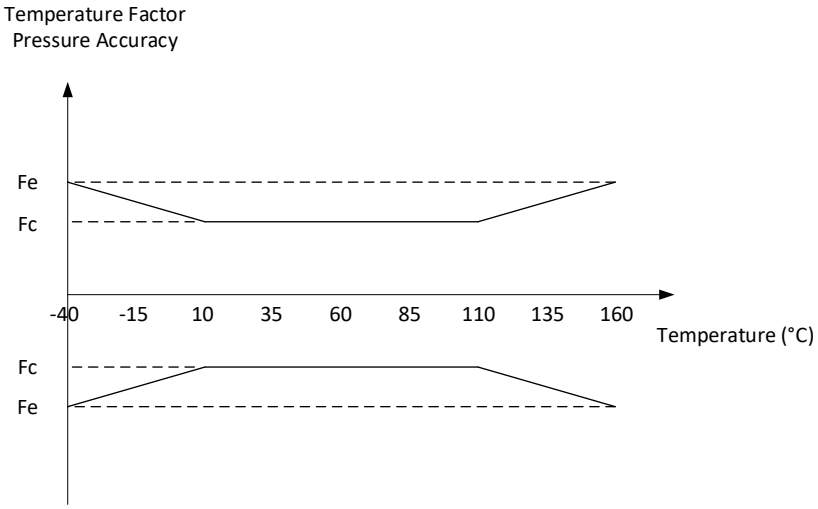


Figure 8: Pressure accuracy temperature factor

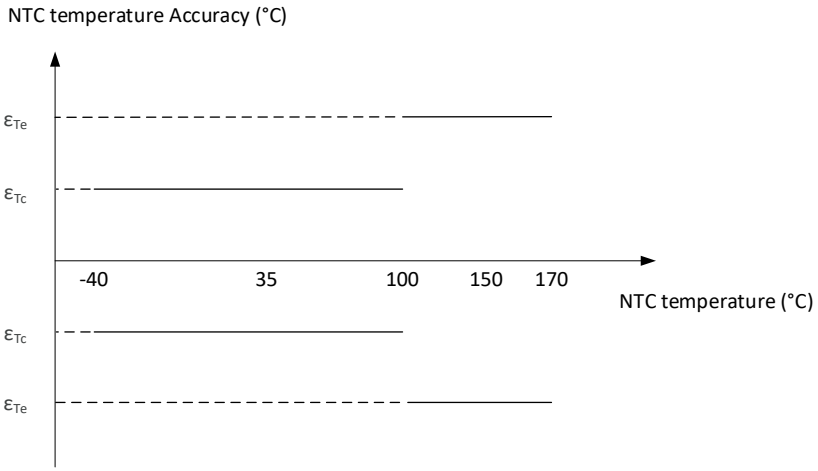


Figure 9: NTC temperature accuracy

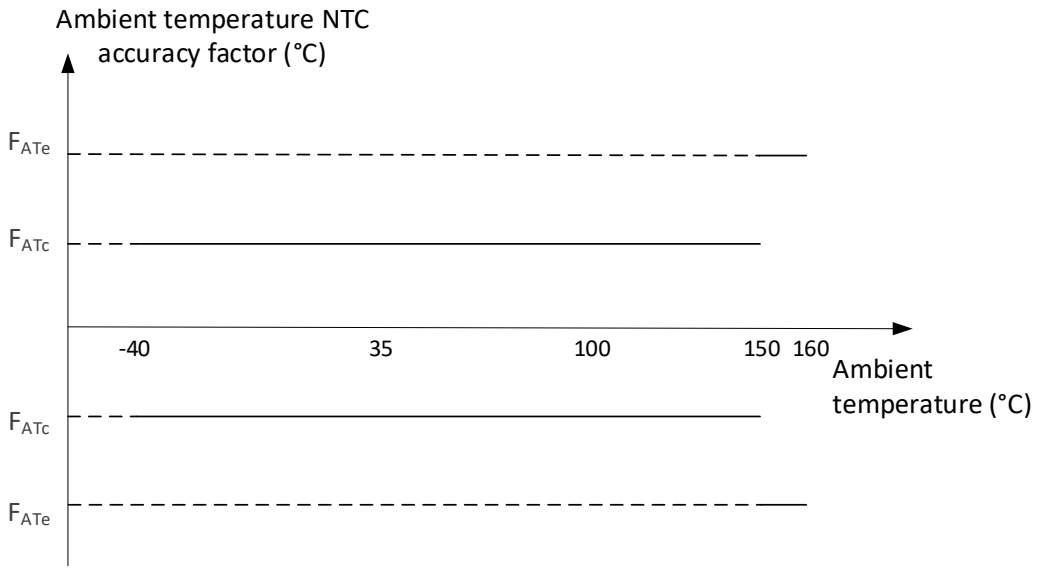


Figure 10: Ambient temperature accuracy factor on NTC

NTC Accuracy Parameter	Symbol	Remarks	Min	Typ	Max	Unit
Center NTC temperature accuracy	ε_{Tc}	Overall accuracy using the default NTC as described in Table 13. See Figure 9: NTC temperature accuracy	-0.75		0.75	°C
Extended NTC temperature accuracy	ε_{Te}		-1		1	°C
Center ambient temperature factor on NTC accuracy	F_{ATc}	NTC accuracy factor related to the ambient temperature of the pressure sensor, independent of NTC temperature. See Figure 10			1	
Extended ambient temperature factor on NTC accuracy	F_{ATe}				1.5	

Table 6: NTC accuracy

11.1. MLX90825GXP-DAD-302 – standalone

Transfer Curve Parameter	Symbol	Remarks	Value			Unit
Pressure 1	P1	See Figure 7: Pressure transfer function description .	0			Bar
Pressure 2	P2		0.5			Bar
Output 1	O1		193			LSB
Output 2	O2		3896			LSB
Low clamping level	LCL		1			LSB
High clamping level	HCL		4088			LSB
Pressure Accuracy Parameter	**Symbol**	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Output accuracy	ε_o	Overall accuracy expressed as output value (FS range from 193 to 3896)	-19 -0.5		19 0.5	LSB %FS
Pressure accuracy	ε_p	Overall accuracy expressed as pressure value	2.5		2.5	mBar
Center temperature accuracy factor	Fc	See Figure 8: Pressure accuracy temperature factor			1	
Extended temperature accuracy factor	Fe				1.5	

Table 7: DAD-302 Default configuration

11.2. MLX90825GXP-DAD-300 – standalone

Transfer Curve Parameter	Symbol	Remarks	Value			Unit
Pressure 1	P1	See Figure 7: Pressure transfer function description .	-0.2			Bar
Pressure 2	P2		0.8			Bar
Output 1	O1		193			LSB
Output 2	O2		3896			LSB
Low clamping level	LCL		1			LSB
High clamping level	HCL		4088			LSB
Pressure Accuracy Parameter	**Symbol**	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Output accuracy	ε_o	Overall accuracy expressed as output value (FS range from 193 to 3896)	-19 -0.5		19 0.5	LSB %FS
Pressure accuracy	ε_p	Overall accuracy expressed as pressure value	-5		5	mBar
Center temperature accuracy factor	Fc	See Figure 8: Pressure accuracy temperature factor			1	
Extended temperature accuracy factor	Fe				1.5	

Table 8: DAD-300 Default Configuration

11.3. MLX90825GXP-DAD-400 – master

Transfer Curve Parameter	Symbol	Remarks	Value			Unit
Pressure 1	P1	See Figure 7: Pressure transfer function description	-0.2			Bar
Pressure 2	P2		0.8			Bar
Output 1	O1		193			LSB
Output 2	O2		3896			LSB
Low clamping level	LCL		1			LSB
High clamping level	HCL		4088			LSB
Pressure Accuracy Parameter	**Symbol**	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Output accuracy	ε_o	Overall accuracy expressed as output value (FS range from 193 to 3896)	-19 -0.5		19 0.5	LSB %FS
Pressure accuracy	ε_p	Overall accuracy expressed as pressure value	-5		5	mBar
Center temperature accuracy factor	Fc	See Figure 8: Pressure accuracy temperature factor			1	
Extended temperature accuracy factor	Fe				1.5	

Table 9: DAD-400 Default Configuration

11.4. MLX90825GXP-DAD-500 – slave

Transfer Curve Parameter	Symbol	Remarks	Value			Unit
Pressure 1	P1	See Figure 7: Pressure transfer function description	-0.2			Bar
Pressure 2	P2		0.8			Bar
Output 1	O1		-			LSB
Output 2	O2		-			LSB
Low clamping level	LCL		1			LSB
High clamping level	HCL		4088			LSB
Pressure Accuracy Parameter	**Symbol**	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Output accuracy	ε_o	Overall accuracy expressed as output value (FS range from 193 to 3896)	-19 -0.5		19 0.5	LSB %FS
Pressure accuracy	ε_p	Overall accuracy expressed as pressure value	-5		5	mBar
Center temperature accuracy factor	Fc	See Figure 8: Pressure accuracy temperature factor			1	
Extended temperature accuracy factor	Fe				1.5	

Table 10: DAD-500 Default Configuration

11.5. MLX90825GXP-DAD-404 – master

Transfer Curve Parameter	Symbol	Remarks	Value			Unit
Pressure 1	P1	See Figure 7: Pressure transfer function description	-0.3			Bar
Pressure 2	P2		1			Bar
Output 1	O1		193			LSB
Output 2	O2		3896			LSB
Low clamping level	LCL		1			LSB
High clamping level	HCL		4088			LSB
Pressure Accuracy Parameter	**Symbol**	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Output accuracy	ε_o	Overall accuracy expressed as output value (FS range from 193 to 3896)	-19 -0.5		19 0.5	LSB %FS
Pressure accuracy	ε_p	Overall accuracy expressed as pressure value	-6.5		6.5	mBar
Center temperature accuracy factor	Fc	See Figure 8: Pressure accuracy temperature factor			1	
Extended temperature accuracy factor	Fe				1.5	

Table 11: DAD-404 Default Configuration

11.6. MLX90825GXP-DAD-504 – slave

Transfer Curve Parameter	Symbol	Remarks	Value			Unit
Pressure 1	P1	See Figure 7: Pressure transfer function description	-0.3			Bar
Pressure 2	P2		1			Bar
Output 1	O1		-			LSB
Output 2	O2		-			LSB
Low clamping level	LCL		1			LSB
High clamping level	HCL		4088			LSB
Pressure Accuracy Parameter	**Symbol**	**Remarks**	**Min**	**Typ**	**Max**	**Unit**
Output accuracy	ε_o	Overall accuracy expressed as output value (FS range from 193 to 3896)	-19 -0.5		19 0.5	LSB %FS
Pressure accuracy	ε_p	Overall accuracy expressed as pressure value	-6.5		6.5	mBar
Center temperature accuracy factor	Fc	See Figure 8: Pressure accuracy temperature factor			1	
Extended temperature accuracy factor	Fe				1.5	

Table 12: DAD-504 Default Configuration

12. Digital

The digital is built around a 16-bit microcontroller. It contains besides the processor also ROM, RAM and EEPROM and a set of user and system IO registers. Temperature compensation of the pressure signal and pressure linearization is handled by the microcontroller. For the pressure compensation there are EEPROM parameters allocated to be able to cover a large variety of calibration approaches.
Both for gain and offset of the pressure signal, there is a separate temperature dependency which is programmable up to a third order compensation. This is reflected in EEPROM parameters for the offset (O0, O1, O2 and O3) and for the gain (G0, G1, G2 and G3).
If required, the linearity of the pressure signal can also be compensated with a first order temperature dependency through EEPROM parameters L0 and L1.
Linearization of the NTC temperature is also covered by the microcontroller.

13. NTC Temperature Linearization

The standalone and slave versions of the MLX90825 have an input to connect an external NTC. In versions DAD-302, DAD-300, DAD-500 and DAD-504 the NTC is disabled in their default configuration. If the NTC is enabled it will use the NTC characteristic in Table 13. This characteristic can be found for example in a TDK G1551 series 2.5K NTC.

T (°C)	R (Ω)	T (°C)	R (Ω)
-55	139867.5	75	455.425
-50	101912.5	80	393.35
-45	75035	85	340.975
-40	55802.5	90	296.65
-35	41900	95	258.95
-30	31750	100	226.8175
-25	24272.25	105	199.305
-20	18713.25	110	175.6725
-15	14544.75	115	155.31
-10	11393	120	137.7025
-5	8991.25	125	122.435
0	7146.5	130	109.155
5	5719.5	135	97.5725
10	4607.75	140	87.4375
15	3735.75	145	78.55
20	3047	150	70.7325
25	**2500**	155	63.84
30	2062.7	160	57.7475
35	1711.1	165	52.3475
40	1426.825	170	47.555
45	1195.725	175	43.2875
50	1006.9	180	39.435
55	851.8	185	36.0175
60	723.825	190	32.9725
65	617.725	195	30.2475
70	529.35	200	27.8

Table 13: Default NTC characteristic

The MLX90825 EEPROM configuration can be changed with a PTC04 programming to work with an NTC with different coefficients. There is no additional calibration needed for this change.

14. SENT Configuration

The SENT output is designed to be compliant with the SAE J2716 rev. Apr 2016 SENT standard. The tick time can be configured between 2.667us and 20us. 3 us tick time is configured as default for the option codes listed in this datasheet. An optional pause pulse can also be enabled to have a fixed frame length. This frame length is configurable and has a maximum of 420 ticks/SENT frame. The default configuration is 282 ticks.
Devices configured as slave do not have a SENT output, instead they transmit pressure information via UART. As an option temperature information from an external NTC can also be transmitted in addition to the pressure information.

14.1. Fast Channel Configuration

There are 7 different options available to configure fast channel 1 and fast channel 2. An overview of these different options and how to configure them can be found in Table 14.

#	FC_CFG setting	Fast Channel 1	Fast Channel 2	Remark	Default Configuration[8]
1	0	Pressure (3x 4 bit)	NTC temperature (3x 4 bit)		
2	1	Pressure (3x 4 bit)	Internal temperature (3x 4 bit)	PTAT temperature	
3	2	Pressure (3x 4 bit)	Reverse pressure (3x 4 bit)		
4	3	Pressure (3x 4 bit)	0 (3x 4 bit)		
5	4	Pressure (3x 4 bit)	Single secure sensor format: Rolling counter (2x 4bit) and Inverted MSN of pressure (1x 4bit)		DAD-302, DAD-300
6	5	Pressure only (3x 4 bit)	/		
7	6	Pressure high speed (4x 3 bit)	/		
8	8	Pressure 1 (3x 4 bit, master)	Pressure 2 (3x 4 bit, slave)		
9	9	Differential pressure (3x 4bit)	Pressure 1 (3x 4 bit, master)		DAD-400, DAD-404
10	10	Differential pressure (3x 4bit)	Pressure 2 (3x 4 bit, slave)		

Table 14: Fast channel configuration options

14.2. Slow Channel Configuration

The Slow Serial Channel is implemented according to the Enhanced Serial Message Format using 12-bit data and 8-bit message ID as described in the SENT protocol standard SAE J2716 rev. Apr 2016. The MLX90825 offers a large number of available slow channel messages. Some of these messages have a pre-defined ID as they are advised by the SENT standard, for example ID29-2C, ID01, ID03, ID10, ID23, … On top of these messages which are already partially pre-defined, another 24 full configurable messages are available.
Table 15 lists the available slow channel messages and which messages are enabled by default on the standalone and master versions. The UART output of slave devices do not have slow channel information.

[8] *MLX90825 Option Code default configuration*

Name	ID	Description	Data	DAD-302, DAD-300	DAD-400	DAD-404
ID_01	0x01	Diagnostic codes	Error_flags (See section 14.3.3)	REP[9]	REP[9]	REP[9]
ID_03	0x03	Sensor Type	-	0x007	0x009	0x009
ID_04	0x04	Configuration code	-	0x001	0x001	0x001
ID_05	0x05	Manufacturer Code	-	0x006	0x006	0x006
ID_06	0x06	SENT revision	-	0x004	0x003	0x004
ID_07	0x07	Fast channel 1 Characteristic X1	According to transfer curve	✓	✓	✓
ID_08	0x08	Fast channel 1 Characteristic X2	According to transfer curve	✓	✓	✓
ID_09	0x09	Fast channel 1 Characteristic Y1	Low range threshold	0x0C1		0x0C1
ID_0A	0x0A	Fast channel 1 Characteristic Y2	High range threshold	0xF38		0xF38
ID_10	0x10	NTC temperature	According to default linear temperature transfer characteristic in SAE J2716 standard		REP[9]	
ID_23	0x23	Internal temperature	According to default linear temperature transfer characteristic in SAE J2716 standard	✓	REP[9]	✓
ID_29	0x29	Melexis ID1	Unique combination of IDs with traceability data	✓	✓	✓
ID_2A	0x2A	Melexis ID2	Unique combination of IDs with traceability data	✓	✓	✓
ID_2B	0x2B	Melexis ID3	Unique combination of IDs with traceability data	✓	✓	✓
ID_2C	0x2C	Melexis ID4	Unique combination of IDs with traceability data	✓	✓	✓
PR0	0xXY	Programmable ID and DATA	-			
PR1	0xXY	Programmable ID and DATA	-			0x80 : 0x000
PR2	0xXY	Programmable ID and DATA	-	0x81 : 0x000	0x90 : 0x000	0x81 : 0x000
PR3	0xXY	Programmable ID and DATA	-	0x82 : 0x000	0x91 : 0x000	0x82 : 0x000
PR4	0xXY	Programmable ID and DATA	-			
PR5	0xXY	Programmable ID and DATA	-			
PR6	0xXY	Programmable ID and DATA	-			
PR7	0xXY	Programmable ID and DATA	-			
PR8	0xXY	Programmable ID and DATA	-	0x90 : 0x000	0x92 : 0x000	0x90 : 0x000
PR9	0xXY	Programmable ID and DATA	-	0x91 : 0x000	0x93 : 0x000	0x91 : 0x000
PR10	0xXY	Programmable ID and DATA	-	0x92 : 0x000	0x94 : 0x000	0x92 : 0x000
PR11	0xXY	Programmable ID and DATA	-	0x93 : 0x000	0x95 : 0x000	0x93 : 0x000
PR12	0xXY	Programmable ID and DATA	-	0x94 : 0x000	0x96 : 0x000	0x94 : 0x000
PR13	0xXY	Programmable ID and DATA	-	0x95 : 0x000	0x97 : 0x000	0x95 : 0x000
PR14	0xXY	Programmable ID and DATA	-	0x96 : 0x000	0x0B : 0x9C2	0x96 : 0x000
PR15	0xXY	Programmable ID and DATA	-	0x97 : 0x000	0x0C : 0x283	0x97 : 0x000
PR16	0xXY	Programmable ID and DATA	-			
PR17	0xXY	Programmable ID and DATA	-			
PR18	0xXY	Programmable ID and DATA	-			
PR19	0xXY	Programmable ID and DATA	-			
PR20	0xXY	Programmable ID and DATA	-			
PR21	0xXY	Programmable ID and DATA	-			
PR22	0xXY	Programmable ID and DATA	-			
PR23	0xXY	Programmable ID and DATA	-			

Table 15: Available slow channel messages

With the PTC04 programming tool other combinations of slow channel messages can be configured. Some messages can only be enabled and disabled together in a group:

- ID_07 and ID_08
- ID_09 and ID_0A
- ID_29, ID_2A, ID_2B and ID_2C
- PR2 and PR3

[9] *Disabled in regular sequence but enabled as repeating message according to Table 16*

- PR4 to PR7
- PR8 to PR15
- PR16 to PR23

Slow channel messages ID01, ID10 and ID23 (diagnostics, NTC temperature and internal temperature respectively) can be set to appear multiple times during the sequence of slow channel messages. Table 16 shows the options and the default configuration.

Repetition Factor Setting	Real Repetition Factor	DAD-302, DAD-300	DAD-400	DAD-404
0	Message repetition disabled	ID10, ID23		ID10, ID23
1	Message repeat every 2 messages			
2	Message repeat every 3 messages			
3	Message repeat every 4 messages			
4	Message repeat every 5 messages			
5	Message repeat every 6 messages		ID01	
6	Message repeat every 7 messages	ID01		ID01
7	Message repeat every 8 messages			
8	Message repeat every 9 messages			
9	Message repeat every 10 messages			
10	Message repeat every 12 messages		ID10, ID23	
11	Message repeat every 16 messages			
12	Message repeat every 20 messages			
13	Message repeat every 24 messages			
14	Message repeat every 28 messages			
15	Message repeat every 30 messages			

Table 16: Slow channel repetition factor

14.3. Diagnostics

The MLX90825 can use the SENT output to transmit diagnostic conditions through multiple channels. The first one is by setting status bits to notify of an error happening to fast channel 1 or 2. The second option is by replacing fast channel 1 or fast channel 2 data with an error code. The last diagnostic option is by setting an error code at slow channel ID01. Each method can be configured independent from the others.

14.3.1. Status Bits

Table 17 and Table 18 show the possible status bit diagnostics and which ones are enabled on status bit #0 or status bit #1 in the default configuration.

Bit	Status bit diagnostic	DAD-302, DAD300		DAD-500		DAD-504	
		SB0	SB1	SB0	SB1	SB0	SB1
0	Fast channel 2 out of range low						
1	Fast channel 2 clamp low						
2	Fast channel 2 out of range high						
3	Fast channel 2 clamp high						
4	Fast channel 1 out of range low						
5	Fast channel 1 clamp low	✓		✓		✓	
6	Fast channel 1 out of range high						
7	Fast channel 1 clamp high	✓		✓		✓	
8	Medium temperature below lower limit						
9	Medium temperature above upper limit						
10	Supply voltage too high	✓					
11	Supply voltage too low	✓					
12	Other internal error	✓			✓		✓
13	Internal temperature output error	✓			✓		✓
14	NTC temperature output error						
15	Pressure output error	✓		✓		✓	

Table 17: Status bit diagnostics for standalone and slave devices

Bit	Status bit diagnostic	DAD-400		DAD-404	
		SB0	SB1	SB0	SB1
0	Fast channel 2 out of range low		✓		✓
1	Fast channel 2 clamp low		✓		✓
2	Fast channel 2 out of range high		✓		✓
3	Fast channel 2 clamp high		✓		✓
4	Fast channel 1 out of range low	✓		✓	
5	Fast channel 1 clamp low	✓		✓	
6	Fast channel 1 out of range high	✓		✓	
7	Fast channel 1 clamp high	✓		✓	
8	UART receive error	✓		✓	✓
9	UART status bit #1	✓		✓	✓
10	Supply voltage too high				
11	Supply voltage too low				
12	Other internal error	✓		✓	
13	Internal temperature output error	✓		✓	
14	UART status bit #0	✓	✓	✓	✓
15	Pressure output error	✓		✓	

Table 18: Status bit diagnostics for master devices

14.3.2. Fast Channel Diagnostics

A diagnostic condition can replace fast channel messages with code 4090 or 4091. Both the codes and priority of diagnostic sources can be programmed separately for each channel. If two diagnostic sources trigger at the same the error code matching the higher priority diagnostic is shown on the fast channel. Table 19 and Table 20 show the available diagnostic sources for the fast channels and the default configurated settings.

Bit	Fast channel diagnostic	DAD-302, DAD300		DAD-500		DAD-504	
		FC1	FC2	FC1	FC2	FC1	FC2
0	Medium temperature below lower limit	-	-	-	-	-	-
1	Medium temperature above upper limit	-	-	-	-	-	-
2	Supply voltage too high	-	-	-	-	-	-
3	Supply voltage too low	-	-	-	-	-	-
4	Other internal error	4091	-	-	-	-	-
5	Internal temperature output error	4091	-	-	-	-	-
6	NTC temperature output error	-	-	-	-	-	-
7	Pressure output error	4090 [10]	-	-	-	-	-

Table 19: Fast channel diagnostics for standalone and slave devices

Bit	Fast channel diagnostic	DAD-400		DAD-404	
		FC1	FC2	FC1	FC2
0	UART receive error	4090	-	4090	4090
1	UART status bit #1	4090	-	-	-
2	Supply voltage too high	-	-	-	-
3	Supply voltage too low	-	-	-	-
4	Other internal error	4090	-	-	-
5	Internal temperature output error	4090	-	-	-
6	UART status bit #0	4090	-	4090	4090
7	Pressure output error	4090	4090	4090	-

Table 20: Fast channel diagnostics for master devices

[10] *In this configuration the 4090 error code has a higher priority than the 4091 error code*

14.3.3. Slow Channel Diagnostics

The combination of status bits and fast channel combinations provides a quick indication whether something is wrong and whether it is a critical error. The diagnostic message ID01 in the slow channel shows specific error codes. Table 21 displays the available diagnostics flags on the slow channel and the default configuration.

SCD	Diagnostic flag	DAD-302, DAD300	DAD-400	DAD-404
1	Pressure out error	0x003	0x901	0x901
2	NTC temp error	0x006	0x902	0x902
3	Internal temp	0x40C	0x903	0x903
4	Internal error	0xA05	0x904	0x904
5	Supply too low	0x020	0x000	0x000
6	Supply too high	0x021	0x000	0x000
7	Medium temp too high	0x004	0x905	0x905
8	Medium temp too low	0x005	0x906	0x906
9	FC1 too high	0x001	0x001	0x001
10	FC1 too low	0x002	0x002	0x002
11	FC2 too high	0x004	0x004	0x004
12	FC2 too low	0x005	0x005	0x005

Table 21: Slow channel diagnostics

15. Application Information

The calibrated pressure ranges are defined as the pressure applied to the gel side as shown in Figure 11.

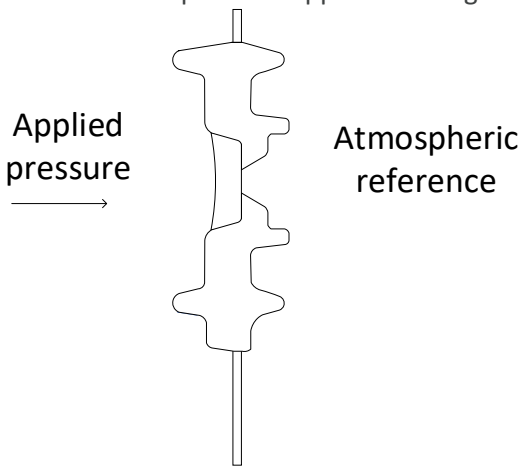


Figure 11: Pressure application

15.1. Standalone product

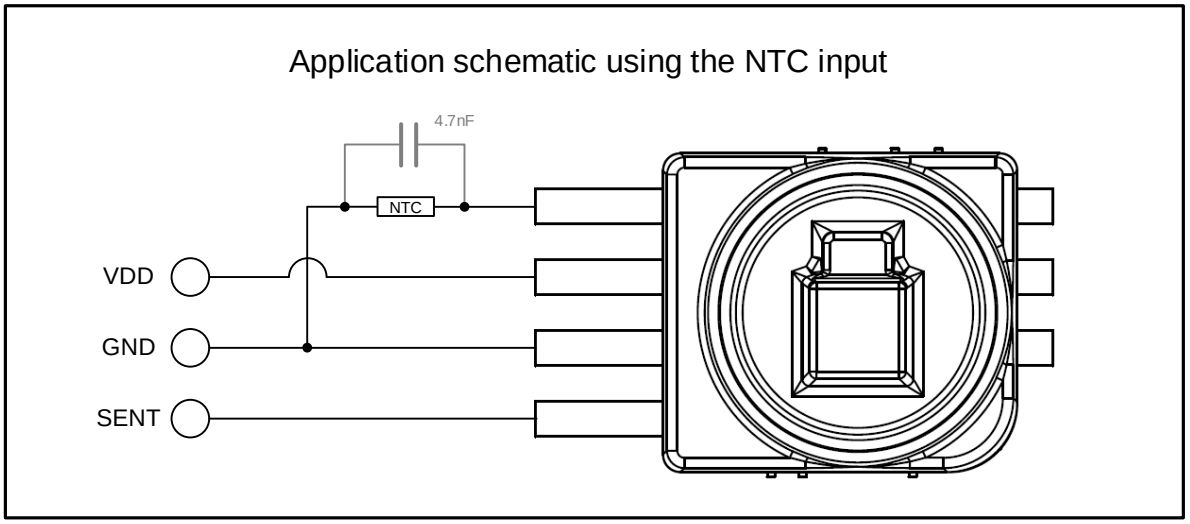


Figure 12: Basic application schematic using NTC

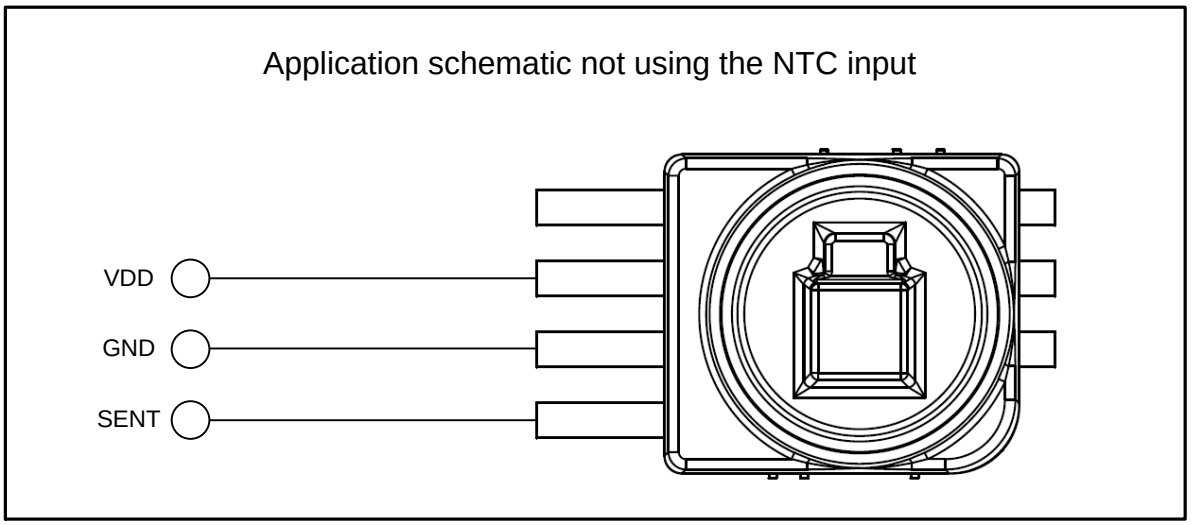


Figure 13: Basic application schematic without NTC

15.2. Master and slave products

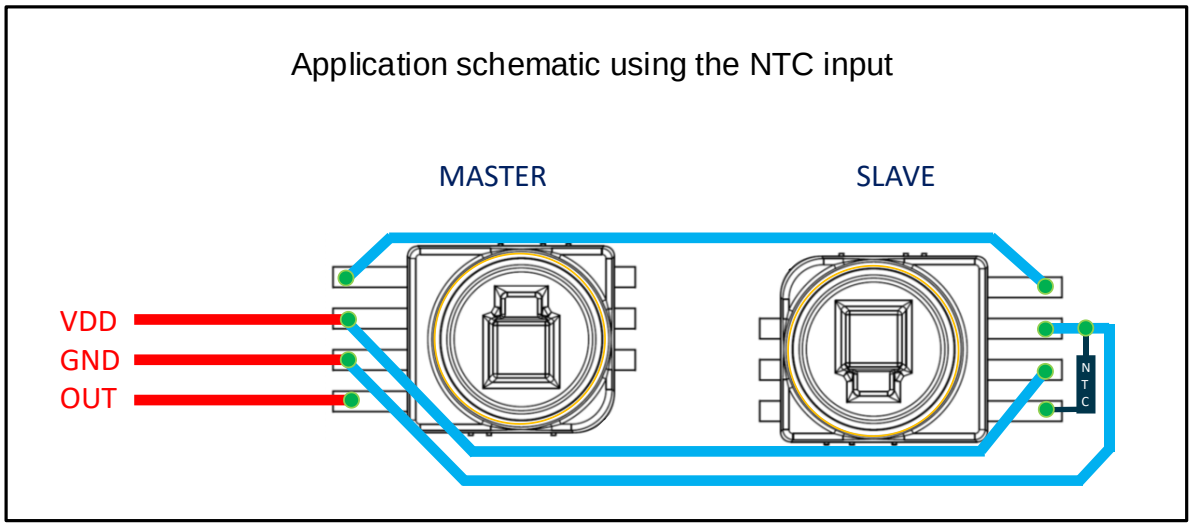


Figure 14: Basic master and slave application schematic using NTC

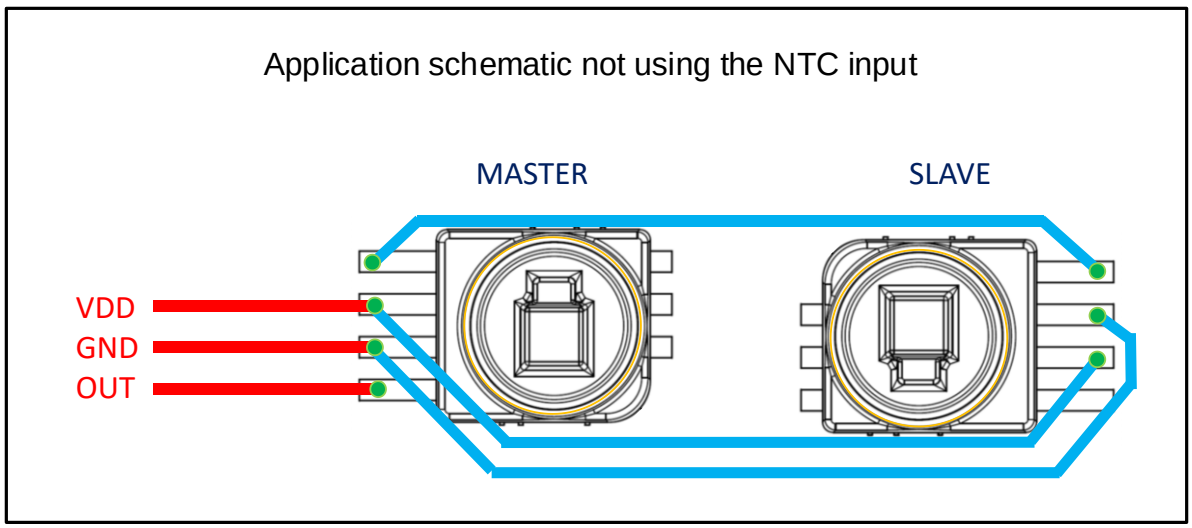


Figure 15: Basic master and slave application schematic without NTC

The lead frame design inside an application module can impact EMC performance. Please contact Melexis to have your designs reviewed.

16. Storage and handling of plastic encapsulated ICs

Plastic encapsulated ICs shall be stored and handled according to their MSL categorization level (specified in the packing label) as per J-STD-033.

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD). The component assembly shall be handled in EPA (Electrostatic Protected Area) as per ANSI S20.20

For more information refer to Melexis *Guidelines for storage and handling of plastic encapsulated ICs* [11]

17. Assembly of encapsulated ICs

For Surface Mounted Devices (SMD, as defined according to JEDEC norms), the only applicable soldering method is reflow.

For Through Hole Devices (THD), the applicable soldering methods are reflow, wave, selective wave and robot point-to-point. THD lead pre-forming (cutting and/or bending) is applicable under strict compliance with Melexis *Guidelines for lead forming of SIP Hall Sensors* [11].

Melexis products soldering on PCB should be conducted according to the requirements of IPC/JEDEC and J-STD-001. Solder quality acceptance should follow the requirements of IPC-A-610.

For PCB-less assembly refer to the relevant application notes [11] or contact Melexis.

Electrical resistance welding or laser welding can be applied to Melexis products in THD and specific PCB-less packages following the *Guidelines for welding of PCB-less devices*[11].

Environmental protection of customer assembly with Melexis products for harsh media application, is applicable by means of coating, potting or overmolding considering restrictions listed in the relevant application notes [11]

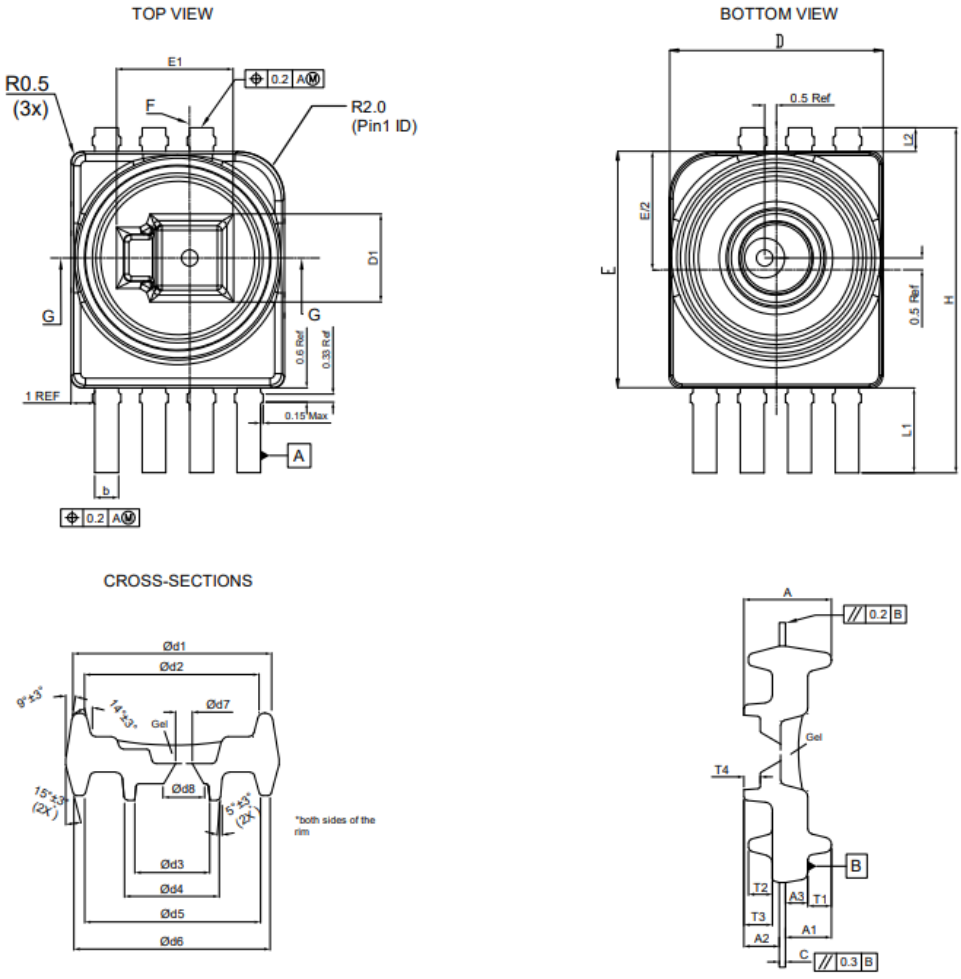
For other specific process, contact Melexis via www.melexis.com/technical-inquiry

18. Environment and sustainability

Melexis is contributing to global environmental conservation by promoting non-hazardous solutions. For more information on our environmental policy and declarations (RoHS, REACH…) visit www.melexis.com/environmental-forms-and-declarations

[11] www.melexis.com/ic-handling-and-assembly

19. Package Information



SYMBOL	MINIMUM	NOMINAL	MAXIMUM	NOTES
A	3.6	3.7	3.8	
A1	1.9	1.95	2	
A2	1.45	1.5	1.55	
A3	0.9	0.95	1	
b	0.95	1	1.05	5
C		0.25 REF		
D	8.9	9	9.1	2 and 3
D1		3.72 REF		
E	9.9	10	10.1	2 and 3
E1		4.91 REF		
e		2 BSC		
H	14.4	14.6	14.8	
L1	3.5	3.6	3.7	
L2	0.9	1	1.1	
T1	1	1.05	1.1	6
T2	1	1.05	1.1	
T3	1.15	1.2	1.25	
T4	0.65	0.7	0.75	
d1	8.28	8.38	8.48	7
d2	7.22	7.32	7.42	7
d3	3.06	3.16	3.26	7
d4	3.94	4.04	4.14	7
d5	7.29	7.39	7.49	7
d6	8.2	8.3	8.4	7
d7	0.7	-	-	
d8		1.76 REF		

Note:

1. All dimensions are in mm
2. Package dimensions "D", "E" and "R2.0" do not include mold flashes, protrusions or gate burrs and shall not exceed 0.15mm for D, 0.25mm for E and 0.50mm for R2.0 per end dimensions, meaning the D and E maximum dimension including mold flash, protrusion and gate burr shall not exceed 9.4 mm and 10.6 mm, respectively. In absence of mold flash, protrusion and gate burr the tabulated values are valid.
3. Package top maybe smaller than package bottom
4. Shiny surface outlook due to use of film
5. Dimension b does not include dambar protrusion
6. This dimension is influenced by the molding film. Since it is impossible to predict the local film stretch condition, the values here should be considered as TARGET only.
7. Min & max values depend on the radius of the rim which can vary from position to position.
8. R2.0 mold flash is measured from the center of rounded corner to the tangent line

Figure 16: MLX90825 package drawing

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