MPL115A1S

Miniature SPI digital barometer, 50 to 115 kPa

Rev. 1.1 — 16 May 2022 **Objective data sheet**

1 General description

The MPL115A1S is an absolute pressure sensor with a digital SPI output targeting low-cost applications. A miniature 5 x 3 x 1.2 mm LGA package is ideally suited for the space constrained requirements of portable electronic devices. Low current consumptions of 5 µA during Active mode and 1 µA during Shutdown (Sleep) mode are essential when focusing on low-power applications. The wide operating temperature range spans from –40 °C to +105 °C to fit demanding environment conditions.

The MPL115A1S employs a MEMS pressure sensor with a conditioning IC to provide accurate pressure measurements from 50 kPa to 115 kPa. An integrated ADC converts pressure and temperature sensor readings to digitized outputs via a SPI port. Factory calibration data is stored internally in an onboard ROM. Utilizing the raw sensor output and calibration data, the host microcontroller executes a compensation algorithm to render *Compensated Absolute Pressure* with ±1 kPa accuracy.

The MPL115A1S pressure sensor's small form factor, low-power capability, precision, and digital output optimize it for barometric measurement applications.

2 Features

- Digitized pressure and temperature information together with programmed calibration coefficients for host micro use.
- Factory calibrated
- 50 kPa to 115 kPa absolute pressure
- ±1 kPa accuracy
- 2.375 V to 5.5 V supply
- Integrated ADC
- SPI Interface
- Monotonic pressure and temperature data outputs
- Surface mount RoHS compliant package

3 Applications

- Barometry (portable and desktop)
- Altimeters
- Weather stations
- Hard-disk drives (HDD)
- Industrial equipment
- Health monitoring
- Air control systems

4 Ordering information

Table 1. Ordering information

Type number	Package		
	Name	Description	Version
MPL115A1S	TSON8	LGA 8 I/O, 3 X 5 X 1.25 PITCH, SENSOR 1.2MAX MM PKG	SOT1769-1

4.1 Ordering options

Table 2. Ordering options

Device Name	Package Options	# of Ports			Pressure Type			Digital Interface
		None	Single	Dual	Gauge	Differential	Absolute	
MPL115A1ST1	Tape and Reel (1000)	•					•	SPI

5 Block diagram

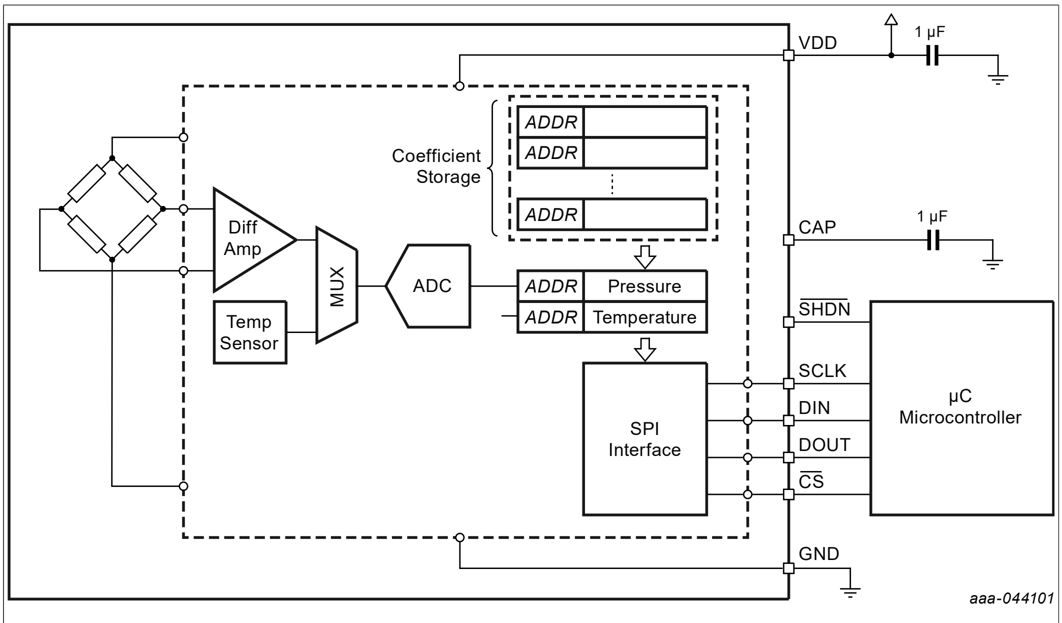


Figure 1. Block diagram of MPL115A1S

6 Pinning information

6.1 Pinning

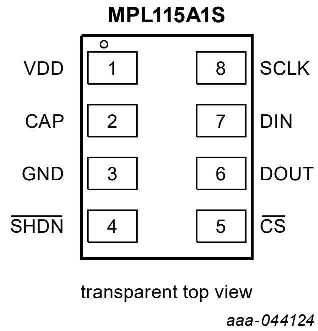


Figure 2. Pin configuration

6.2 Pin description

Table 3. Pin description

Pin	Name	Function
1	VDD	Power Supply Connection. VDD range is 2.375 V to 5.5 V.
2	CAP	External Capacitor: Output decoupling capacitor for main internal regulator. Connect a 1 μF ceramic capacitor to ground.
3	GND	Ground
4	$\overline{\text{SHDN}}$	Shutdown: Connect to GND to disable the device. When in shutdown, the part draws no more than 1 μA supply current and all communications pins ($\overline{\text{CS}}$, SCLK, DOUT, DIN) are high impedance. Connect to VDD for normal operation.
5	$\overline{\text{CS}}$	Chip Select line.
6	DOUT	Serial data output
7	DIN	Serial data input
8	SCLK	Serial clock input.

7 Handling and Board Mount Recommendations

The sensor die is sensitive to light exposure. Direct light exposure through the port hole can lead to varied accuracy of pressure measurement. Avoid such exposure to the port during normal operation.

7.1 Methods of Handling

Components can be picked from the carrier tape using either the vacuum assist or the mechanical type pickup heads. A vacuum assist nozzle type is most common due to its lower cost of maintenance and ease of operation. The recommended vacuum nozzle configuration should be designed to make contact with the device directly on the metal cover and avoid vacuum port location directly over the vent hole in the metal cover of the device. Multiple vacuum ports within the nozzle may be required to effectively handle the device and prevent shifting during movement to placement position.

Vacuum pressure required to adequately support the component should be approximately 25 inches Hg (85 kPa). This level is typical of in-house vacuum supply. Pickup nozzles are available in various sizes and configurations to suit a variety of component geometries. To select the nozzle best suited for the specific application, NXP recommends that the customer consult their pick and place equipment supplier to determine the correct nozzle. In some cases, it may be necessary to fabricate a special nozzle depending on the equipment and speed of operation.

Tweezers or other mechanical forms of handling that have a sharp point are not recommended since they can inadvertently be inserted into the vent hole of the device. These handling methods can lead to a puncture of the MEMS element that renders the device inoperable.

7.2 Board Mount Recommendations

Components can be mounted using solder paste stencil, screen printed or dispensed onto the PCB pads prior to placement of the component. The volume of solder paste applied to the PCB is normally sufficient to secure the component during transport to the subsequent reflow soldering process. Use of adhesives to secure the component is not recommended, but where necessary can be applied to the underside of the device.

Solder pastes are available in variety of metal compositions, particle size, and flux types. The solder paste consists of metals and flux required for a reliable connection between the component lead and the PCB pad. Flux aids the removal of oxides that may be present on PCB pads and prevents further oxidation from occurring during the solder process.

The use of a No-Clean (NC) flux is recommended for exposed cavity components. Using pressure spray, wire brush, or other methods of cleaning is not recommended since it can puncture the MEMS device and render it unusable. If cleaning of the PCB is performed, Water Soluble (WS) flux can be used. NXP recommends protecting the component cavity using adhesive Kapton tape, vinyl cap, or other means prior to the cleaning process. This covering prevents damage to the MEMS device, contamination, and foreign materials from being introduced into device cavity as result of cleaning processes.

Ultrasonic cleaning is not recommended as the frequencies can damage wire bond interconnections and the MEMS device.

8 Functional description

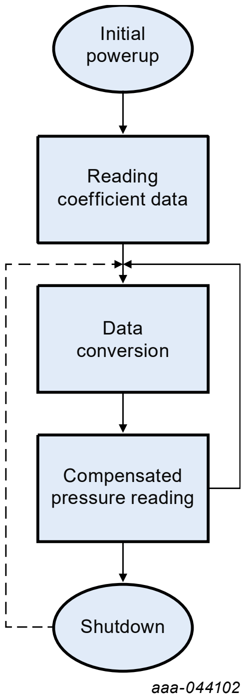


Figure 3. Sequence flowchart

The MPL115A interfaces to a host (or system) microcontroller in the user's application. All communications are via SPI. A typical usage sequence is as follows:

Initial power-up

All circuit elements are active. SPI port pins are high impedance and associated registers are cleared. The device then enters Standby mode.

Reading coefficient data

The user then typically accesses the part and reads the coefficient data. The main circuits within the client device are disabled during read activity. The coefficients are usually stored in the host microcontroller local memory but can be re-read at any time.

Reading of the coefficients may be executed only once and the values stored in the host microcontroller. It is not necessary to read this multiple times because the coefficients within a device are constant and do not change. However, note that the coefficients are different from device to device, and cannot be used for another part.

Data conversion

This is the first step that is performed each time a new pressure reading is required which is initiated by the host sending the CONVERT command. The main system circuits are activated (wake) in response to the command and after the conversion completes, the result is placed into the Pressure and Temperature ADC output registers.

The conversion completes within the maximum conversion time, tc (see row 6, in Table 11). The device then enters Standby mode.

Compensated pressure reading

After the conversion has been given sufficient time to complete, the host microcontroller reads the result from the ADC output registers and calculates the Compensated Pressure, a barometric/atmospheric pressure value which is compensated for changes in temperature and pressure sensor linearity. This is done using the coefficient data from the MPL115A and the raw sampled pressure and temperature ADC output values, in a compensation equation (detailed later). Note that this is an absolute pressure measurement with a vacuum as a reference.

From this step, the host controller may either wait and then return to the Data Conversion step to obtain the next pressure reading or it may go to the Shutdown step.

Shutdown

For longer periods of inactivity, the user may assert the $\overline{\text{SHDN}}$ input by driving this pin low to reduce system power consumption. This removes power from all internal circuits, including any registers. In the shutdown state, the Pressure and Temperature registers are reset, losing any previous ADC output values.

This step is exited by taking the $\overline{\text{SHDN}}$ pin high. Wait for the maximum wake-up time, tw (see row 7, in Table 11), after which another pressure reading can be taken by transitioning to the data Conversion step.

Table 4. Device memory map

Address	Name	Description
00h	Padc_MSB	10-bit Pressure ADC output value MSB
01h	Padc_LSB	10-bit Pressure ADC output value LSB
02h	Tadc_MSB	10-bit Temperature ADC output value MSB
03h	Tacd_LSB	10-bit Temperature ADC output value LSB
04h	a0_MSB	a0 coefficient MSB
05h	a0_LSB	a0 coefficient LSB
06h	b1_MSB	b1 coefficient MSB
07h	b1_LSB	b1 coefficient LSB
08h	b2_MSB	b2 coefficient MSB
09h	b2_LSB	b2 coefficient LSB
0Ah	c12_MSB	c12 coefficient MSB
0Bh	c12_LSB	c12 coefficient LSB
0Ch	reserved[1]	—
0Dh	reserved[1]	—
0Eh	reserved[1]	—
0Fh	reserved[1]	—
10h	reserved	—
11h	reserved	—
12h	CONVERT	Start Pressure and Temperature Conversion

[1] This register is set to 00h. It is reserved, and was previously utilized as Coefficient values, c11 and c22, which were always 00h.

For values with less than 16 bits, the lower LSBs are zero. For example, c12 is 14 bits and is stored into 2 bytes as follows:

c12 MSB = c12[13:6] = [$c12_{b13}$, $c12_{b12}$, $c12_{b11}$, $c12_{b10}$, $c12_{b9}$, $c12_{b8}$, $c12_{b7}$, $c12_{b6}$]
c12 LSB = c12[5:0] & "00" = [$c12_{b5}$, $c12_{b4}$, $c12_{b3}$, $c12_{b2}$, $c12_{b1}$, $c12_{b0}$, 0 , 0]

8.1 Pressure, temperature, and coefficient bit-width specifications

The table below specifies the initial coefficient bit-width specifications for the compensation algorithm and the specifications for Pressure and Temperature ADC values.

Table 5. Pressure, temperature, and compensation coefficient specifications

	a0	b1	b2	c12	Padc	Tadc
Total Bits	16	16	16	14	10	10
Sign Bits	1	1	1	1	0	0
Integer Bits	12	2	1	0	10	10
Fractional Bits	3	13	14	13	0	0
dec pt zero pad	0	0	0	9	0	0

Example Binary Format Definitions:

a0 Signed, Integer Bits = 12, Fractional Bits = 3 :	Coeff a0 = S I_{11} I_{10} I_9 I_8 I_7 I_6 I_5 I_4 I_3 I_2 I_1 I_0 . F_2 F_1 F_0
b1 Signed, Integer Bits = 2, Fractional Bits = 13 :	Coeff b1 = S I_1 I_0 . F_{12} F_{11} F_{10} F_9 F_8 F_7 F_6 F_5 F_4 F_3 F_2 F_1 F_0
b2 Signed, Integer Bits = 1, Fractional Bits = 14 :	Coeff b2 = S I_0 . F_{13} F_{12} F_{11} F_{10} F_9 F_8 F_7 F_6 F_5 F_4 F_3 F_2 F_1 F_0
c12 Signed, Integer Bits = 0, Fractional Bits = 13, dec pt zero pad = 9 :	Coeff c12 = S 0 . 000 000 000 F_{12} F_{11} F_{10} F_9 F_8 F_7 F_6 F_5 F_4 F_3 F_2 F_1 F_0
Padc Unsigned, Integer Bits = 10 :	Padc U = I_9 I_8 I_7 I_6 I_5 I_4 I_3 I_2 I_1 I_0
Tadc Unsigned, Integer Bits =10 :	Tadc U = I_9 I_8 I_7 I_6 I_5 I_4 I_3 I_2 I_1 I_0

Note: *Negative coefficients are coded in two's complement notation.*

8.2 Compensation

The 10-bit compensated pressure output, Pcomp, is calculated as follows:

$$Pcomp = a0 + (b1 + c12 \cdot Tadc) \cdot Padc + b2 \cdot Tadc \quad (1)$$

Where:

Padc is the 10-bit pressure ADC output of the MPL115A
Tadc is the 10-bit temperature ADC output of the MPL115A
a0 is the pressure offset coefficient
b1 is the pressure sensitivity coefficient
b2 is the temperature coefficient of offset (TCO)
c12 is the temperature coefficient of sensitivity (TCS)

Pcomp produces a value of 0 with an input pressure of 50 kPa and produces a full-scale value of 1023 with an input pressure of 115 kPa.

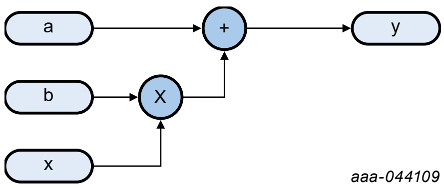
$$\text{Pressure (kPa)} = Pcomp \cdot \left[\frac{115-50}{1023} \right] + 50 \qquad (2)$$

8.3 Evaluation sequence, arithmetic circuits

The following is an example of the calculation for Pcomp, the compensated pressure output. Input values are in **bold.**

c12x2 = **c12** * **Tadc**
a1 = **b1** + c12x2
a1x1 = a1 * **Padc**
y1 = **a0** + a1x1
a2x2 = **b2** * **Tadc**
Pcomp = y1 + a2x2

This can be calculated as a succession of Multiply Accumulates (MACs) operations of the form *y = a + b * x:*



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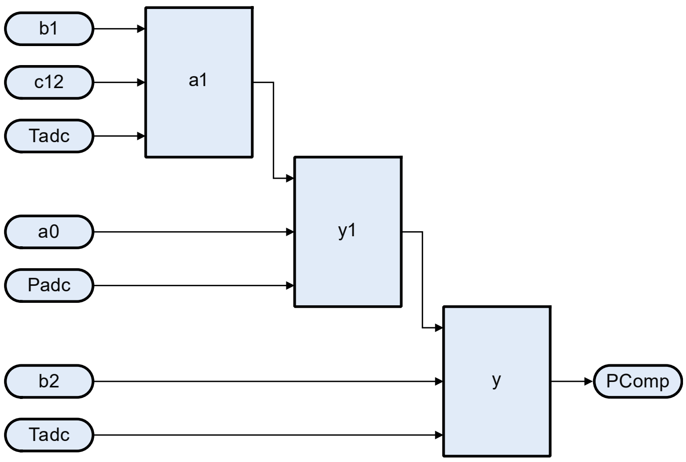
The polynomial can be evaluated (Equation 1) as a sequence of 3 MACs:



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Refer to NXP application note AN3785 for more detailed notes on implementation.

8.4 SPI device read/write operations

All device read/write operations are memory mapped. Device actions, for example, "Start Conversions" are controlled by writing to the appropriate memory address location. All memory address locations are 6-bit (see Table 2).

The 8-bit command word comprises:

- the most significant bit which is the Read/$\overline{\text{Write}}$ identifier which is '1' for read operations and '0' for write operations.
- the 6-bit address (from Table 4);
- the least significant bit which is not used and is don't care (X).

The device write commands are shown in Table 6.

Table 6. SPI write command

Legend: X = don't care

Command	Binary	HEX[1]
Start Conversions	0010010X	24h

[1] The command byte must be paired with a 00h as part of the SPI exchange to complete the passing of *Start Conversions*.

The actions taken by the part in response to each command are as follows:

Table 7. SPI Write command description

Command	Action taken
Start Conversions	Wake main circuits. Start clock. Allow supply stabilization time. Select pressure sensor input. Apply positive sensor excitation and perform A to D conversion. Select temperature input. Perform A to D conversion. Load the Pressure and Temperature registers with the result. Shut down main circuits and clock.

SPI Read operations are performed by sending the required address with a leading *Read* bit set to ‘1’. SPI operations require that each byte be addressed individually. All data is transmitted most significant bit first.

Table 8. Example SPI Read Commands

Legend: X = don't care

Command	Binary	HEX[1]
Read Pressure MSB	1000000X	80h
Read Pressure LSB	1000001X	82h
Read Temperature MSB	1000010X	84h
Read Temperature LSB	1000011X	86h
Read Coefficient data byte 1	1000100X	88h

[1] The command byte must be paired with a 00h as part of the SPI exchange to complete the passing of stated command.

8.5 SPI timing

Table 9 and Figure 4 describe the timing requirements for the SPI system.

Table 9. SPI timing

Ref	Symbol	Function	Min	Max	Unit
1	O*f*	Operating Frequency	—	8	MHz
2	tSCLK	SCLK Period	125	—	ns
3	tCLKH	SCLK High time	62.5	—	ns
4	tCLKL	SCLK Low time	62.5	—	ns
5	tSCS	Enable lead time	125	—	ns
6	tHCS	Enable lag time	125	—	ns
7	tSET	Data setup time	30	—	ns
8	tHOLD	Data hold time	30	—	ns
9	tDDLY	Data valid (after SCLK low edge)	—	32	ns
10	tWCS	Width CS High	30	—	ns

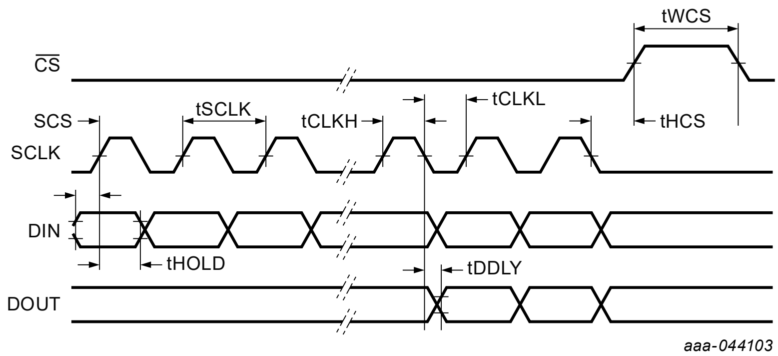


Figure 4. SPI timing diagram

8.6 Example of SPI reading of coefficients

These are MPL115A1S SPI commands to read coefficients, execute Pressure and Temperature conversions, and to read Pressure and Temperature data. The sequence of the commands for the interaction is given as an example to operate the MPL115A1S. Utilizing this gathered data, an example of the calculating the Compensated Pressure reading is given in floating point notation.

SPI Commands (simplified for communication)

Command to Write "Convert Pressure and Temperature" = 24h
Command to Read "Pressure ADC High byte" = 80h
Command to Read "Pressure ADC Low byte" = 82h
Command to Read "Temperature ADC High byte" = 84h
Command to Read "Temperature ADC Low byte" = 86h
Command to Read "Coefficient data byte 1 High byte" = 88h

Read coefficients:

[CS=0], [88h], [00h], [8Ah], [00h], [8Ch], [00h], [8Eh], [00h], [90h], [00h], [92h], [00h], [94h], [00h], [96h], [00h], [00h], [CS=1]

Start pressure and temperature conversion, read raw pressure:

[CS=0], [24h], [00h], [CS=1], [3 ms Delay]

[CS=0], [80h], [00h], [82h], [00h], [84h], [00h], [86h], [00h], [00h], [CS=1]

Note: *Extra [00h] at the end of each sequence to output the last data byte on the client side of the SPI.*

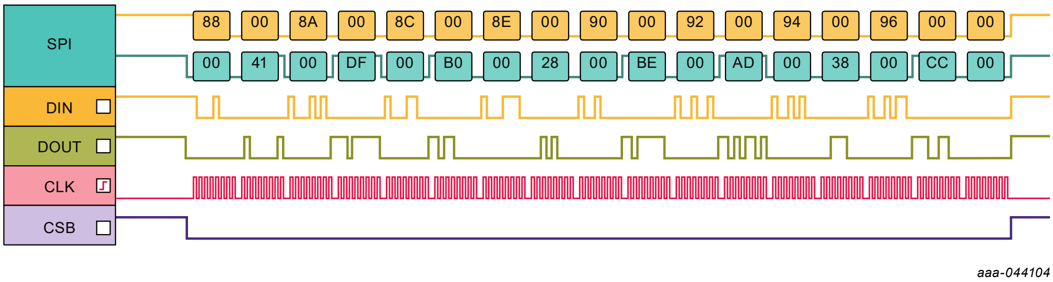


Figure 5. SPI read coefficient datagram

a0 coefficient MSB	=	41h					
a0 coefficient LSB	=	DFh	a0 coefficient	=	41DFh	=	2107.875
b1 coefficient MSB	=	B0h					
b1 coefficient LSB	=	28h	b1 coefficient	=	B028h	=	–2.49512
b2 coefficient MSB	=	BEh					
b2 coefficient LSB	=	ADh	b2 coefficient	=	BEADh	=	–1.02069
c12 coefficient MSB	=	38h					
c12 coefficient LSB	=	CCh	c12 coefficient	=	38CCh	=	0.00086665

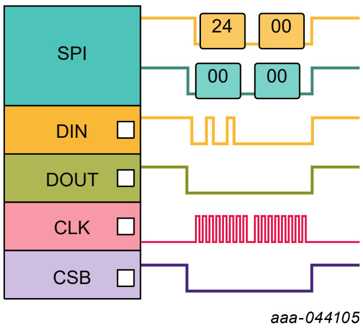


Figure 6. SPI start conversion datagram

Command to start pressure and temperature conversion, 24h.

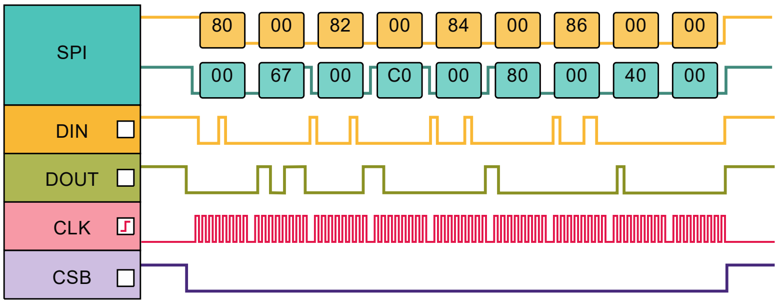


Figure 7. SPI read results datagram

Pressure MSB	=	67h					
Pressure LSB	=	C0h	Pressure	=	67C0h	=	**0110 0111 11** 00 0000
						=	415 ADC counts
Temperature MSB	=	80h					
Temperature LSB	=	40h	Temperature	=	8040h	=	**1000 0000 01** 00 0000
						=	513 ADC counts

8.7 Example of pressure compensated calculation in floating-point notation

a0 coefficient	=	2107.875
b1 coefficient	=	–2.49512
b2 coefficient	=	–1.02069
c12 coefficient	=	0.00086665
Pressure	=	415 ADC counts
Temperature	=	513 ADC counts

Pressure compensation

$$Pcomp = a0 + (b1 + c12 \cdot Tadc) \cdot Padc + b(c)$$

Using the evaluation sequence

The evaluation sequence is located in Section 8.3.

c12x2	=	c12 * Tadc	=	0.00086665 * 513	=	0.44459
a1	=	b1 + c12x2	=	–2.49512 + 0.44459	=	–2.05052
a1x1	=	a1 * Padc	=	–2.05052 * 415	=	–850.96785
y1	=	a0 + a1x1	=	2107.875 + (–850.96785)	=	1256.90715
a2x2	=	b2 * Tadc	=	–1.02069 * 513	=	–523.61444

PComp = y1 + a2x2 = 1256.90715 + (–523.61444) = 733.29270

$$\text{Pressure (kPa)} = Pcomp \cdot \left[\frac{115–50}{1023} \right] + 50$$

$$= 96.59kPa$$

$$= 733.19 \cdot \left[\frac{115–50}{1023} \right] + 50$$

9 Maximum ratings

Table 10. Maximum ratings

Voltage (with respect to GND unless otherwise noted)

Symbol	Value	Units
V_{DD}	–0.3 to +5.5	V
$\overline{SHDN}$, SCLK, $\overline{CS}$, D_{IN}, D_{OUT}	–0.3 to V_{DD} + 0.3	V
Operating Temperature Range	–40 to +105	°C
Storage Temperature Range	–40 to +125	°C
Overpressure	1000	kPa

10 Mechanical and electrical characteristics

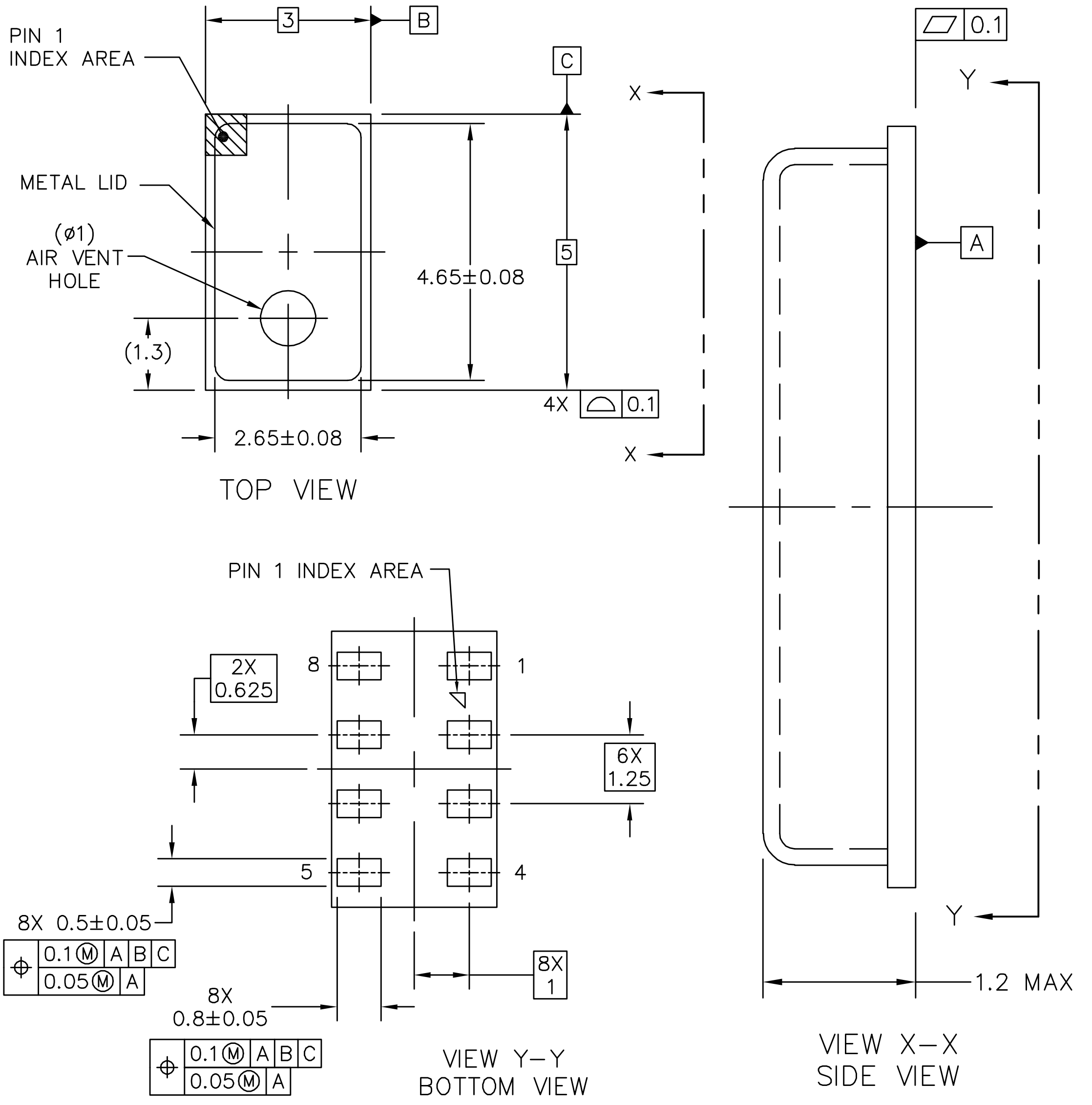
Table 11. Mechanical and electrical characteristics

V_{DD} = 2.375 V to 5.5 V, T_A = –40 °C to +105 °C, unless otherwise noted. Typical values are at V_{DD} = 3.3 V, T_A = +25 °C.

Ref	Parameters	Symbol	Conditions	Min	Typ	Max	Units
1	Operating Supply Voltage	V_{DD}		2.375	3.3	5.5	V
2	Supply Current	I_{DD}	Shutdown ($\overline{SHDN}$ = GND)	—	—	1	µA
			Standby	—	3.5	10	µA
			Average – at one measurement per second	—	5	—	µA
Pressure Sensor							
3	Range			50	—	115	kPa
4	Resolution			—	0.15	—	kPa
5	Accuracy		–20 ºC to 85 ºC	—	—	±1	kPa
6	Conversion Time *(Start Pressure and Temperature Conversion)*	tc	Time between start convert command and data available in the Pressure and Temperature registers	—	1.6	3	ms
7	Wake-up Time	tw	Time between leaving Shutdown mode ($\overline{SHDN}$ goes high) and communicating with the device to issue a command or read data.	—	3	5	ms
SPI Inputs: SCLK, $\overline{CS}$, D_{IN}							
8	SCLK Clock Frequency	f_{SCLK}	[1]	—	—	8	MHz
9	Low-level Input Voltage	VIL		—	—	$0.3V_{DD}$	V
10	High-level Input Voltage	VIH		$0.7V_{DD}$	—	—	V
SPI Outputs: D_{OUT}							
11	Low-level Output Voltage	VOL1	At 3 mA sink current	0	—	0.4	V
		VOL2	At 6 mA sink current	0	—	0.6	
12	High-level Output Voltage	VOH1	At 3 mA source current	V_{DD} – 0.4	—	—	

[1] Nominal maximum SPI clock frequency.

11 Package outline



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TITLE: LGA 8 I/O, 3 X 5 X 1.25 PITCH, SENSOR 1.2MAX MM PKG	DOCUMENT NO: 98ASA10829D	REV: B
	STANDARD: NON–JEDEC	
	SOT1769–1	19 JAN 2016

Figure 8. Package outline SOT1769-1 (TSON8)

NOTES:

1. ALL DIMENSIONS IN MILLIMETERS.

2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994

3. STYLE:

PIN 1: VDD	PIN 5: CS
PIN 2: CAP	PIN 6: DOUT
PIN 3: GND	PIN 7: DIN
PIN 4: SHDN	PIN 8: SCLK

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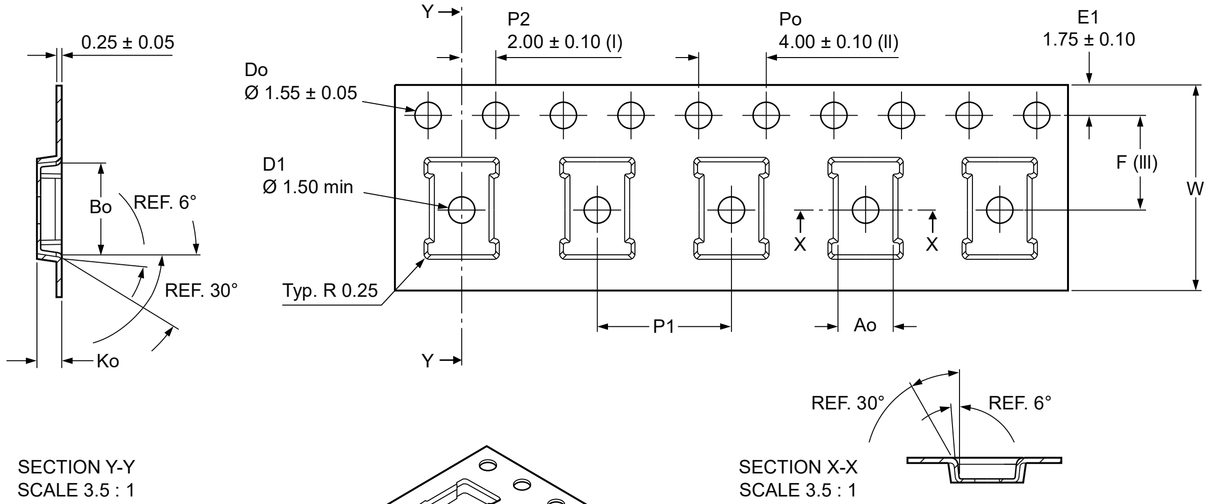
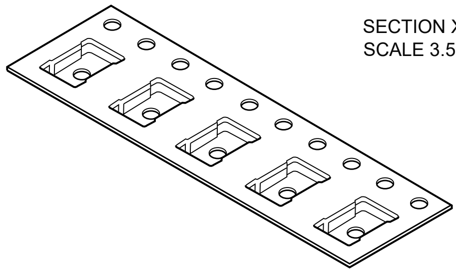
TITLE: LGA 8 I/O, 3 X 5 X 1.25 PITCH SENSOR 2.0MM PKG	DOCUMENT NO: 98ASA10829D	REV: B
	STANDARD: NON-JEDEC	
	SOT1769-1	19 JAN 2016

Figure 9. Package outline notes SOT1769-1 (TSON8)

12 Packing information





Ao	3.35 ± 0.10
Bo	5.35 ± 0.10
Ko	1.20 ± 0.10
F	5.50 ± 0.10
P1	8.00 ± 0.10
W	12.00 ± 0.10

(I) Measured from centerline of sprocket hole to centerline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20.
(III) Measured from centerline of sprocket hole to centerline of pocket.
(IV) Other material available.

Dimensions are in millimeters.

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Figure 10. LGA (3 x 5) embossed carrier tape dimensions

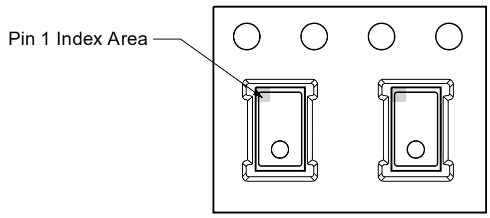

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Figure 11. Device orientation in chip carrier

13 Soldering

1. Use SAC solder alloy, Sn-Ag-Cu, with a melting point of about 217 °C. NXP recommends using SAC305, Sn-3.0 wt.% Ag-0.5 wt.% Cu.
2. Reflow
    - Ramp up rate: 2 °C/s to 3 °C/s.
    - Preheat flat (soak): 110 s to 130 s.
    - Reflow peak temperature: 250 °C to 260 °C (depends on exact SAC alloy composition).
    - Time above 217°C: 40 s to 90 s (depends on board type, thermal mass of the board/quantities in the reflow).
    - Ramp down: 5 °C/s to 6 °C/s.
    - Using an inert reflow environment (with O_2 level about 5 ppm to 15 ppm).

Note: *The stress level and signal offset of the device also depends on the board type, board core material, board thickness, and metal finishing of the board.*

14 Soldering/landing pad information

The LGA package is compliant with the RoHS standard. NXP recommends using a no-clean solder paste to reduce cleaning exposure to high pressure and chemical agents that can damage or reduce life span of the Pressure sensing element.

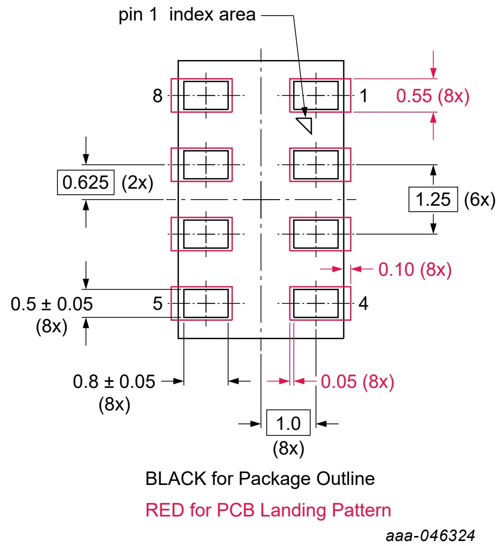

Figure 12. Recommended PCB landing pattern

15 Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
MPL115A1S v.1.1	20220516	Objective data sheet	—	MPL115A1S v.1
Modifications:	• Global changes as follows: – Revised cover page image. – Performed minor grammatical and typographical corrections throughout. – Updated all images to conform to NXP image standards. – Changed all references of "slave" to "client" to conform to the NXP inclusive language intiative. • Section 4, Table 2: Removed the row "MPL115A1S" with "Tray" in the "Package Options" column. • Section 11, split the package outline images into separate figures.			
MPL115A1S v.1	20211007	Objective data sheet	—	—
Modifications:	• Initial release.			

16 Legal information

16.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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Tables

Figures