

FXPS7400A4

Analog absolute pressure sensor, 20 kPa to 400 kPa

Rev. 5.1 — 3 November 2023

Product data sheet



1 General description

The FXPS7400A4 high-performance, high-precision absolute pressure sensor consists of a compact capacitive micro-electro-mechanical systems (MEMS) device coupled with a digital integrated circuit (IC) producing a fully calibrated analog output.

This sensor is ideal for many automotive applications such as manifold air pressure (MAP), turbo MAP, comfort seating, and other applications requiring operating absolute pressure ranges up to 400 kPa.

The sensing element is based on NXP's high precision capacitive pressure cell technology. The architecture benefits from redundant pressure transducers as an expanded quality measure. It delivers highly accurate ratiometric analog readings of absolute pressure while operating from either a 3.3 V or 5.0 V power supply.

The sensor operates over a pressure range of 20 kPa to 400 kPa and over a wide temperature range of $-40\text{ }^{\circ}\text{C}$ to $130\text{ }^{\circ}\text{C}$.

The sensor comes in an industry-leading 4 mm x 4 mm x 1.98 mm, restriction of hazardous substances (RoHS) compliant, high-power quad flat no-lead (HQFN) package^[1] suitable for small printed circuit board (PCB) integration. Its AEC-Q100^[2] compliance, high accuracy, reliable performance, and high media resistivity make it ideal for use in automotive, industrial, and consumer applications.

2 Features and benefits

- Absolute pressure range: 20 kPa to 400 kPa
- Operating temperature range: $-40\text{ }^{\circ}\text{C}$ to $130\text{ }^{\circ}\text{C}$
- Analog output for monitoring of the absolute pressure signal
- Pressure transducer and digital signal processor (DSP)
 - Internal self-test
- Capacitance to voltage converter with anti-aliasing filter
- Sigma delta ADC plus sinc filter
- 800 Hz or 1000 Hz low-pass filter for absolute pressure
- Lead-free, 16-pin HQFN, 4 mm x 4 mm x 1.98 mm package

3 Applications

3.1 Automotive

- Manifold air pressure
 - MAP, TurboMAP
- Small engine control



- Liquid propane gas (LPG) or compressed natural gas (CNG) engine management

3.2 Industrial

- Compressed air
- Manufacturing line control
- Gas metering
- Weather stations

3.3 Medical/Consumer

- Blood pressure monitor
- Medicine dispensing systems
- White goods

4 Ordering information

Table 1. Ordering information

Type number	Package		
	Name	Description	Version
FXPS7400A4	HQFN16	HQFN16, plastic, thermal enhanced quad flat pack; no leads; 16 terminals; 0.8 mm pitch; 4 mm x 4 mm x 1.98 mm body	SOT1573-1

4.1 Ordering options

Table 2. Ordering options

Device	Range (kPa)	Packing	Temperature range
FXPS7400A4T1	20 kPa to 400 kPa	Packing Tape and Reel	-40 °C to 130 °C

5 Block diagram

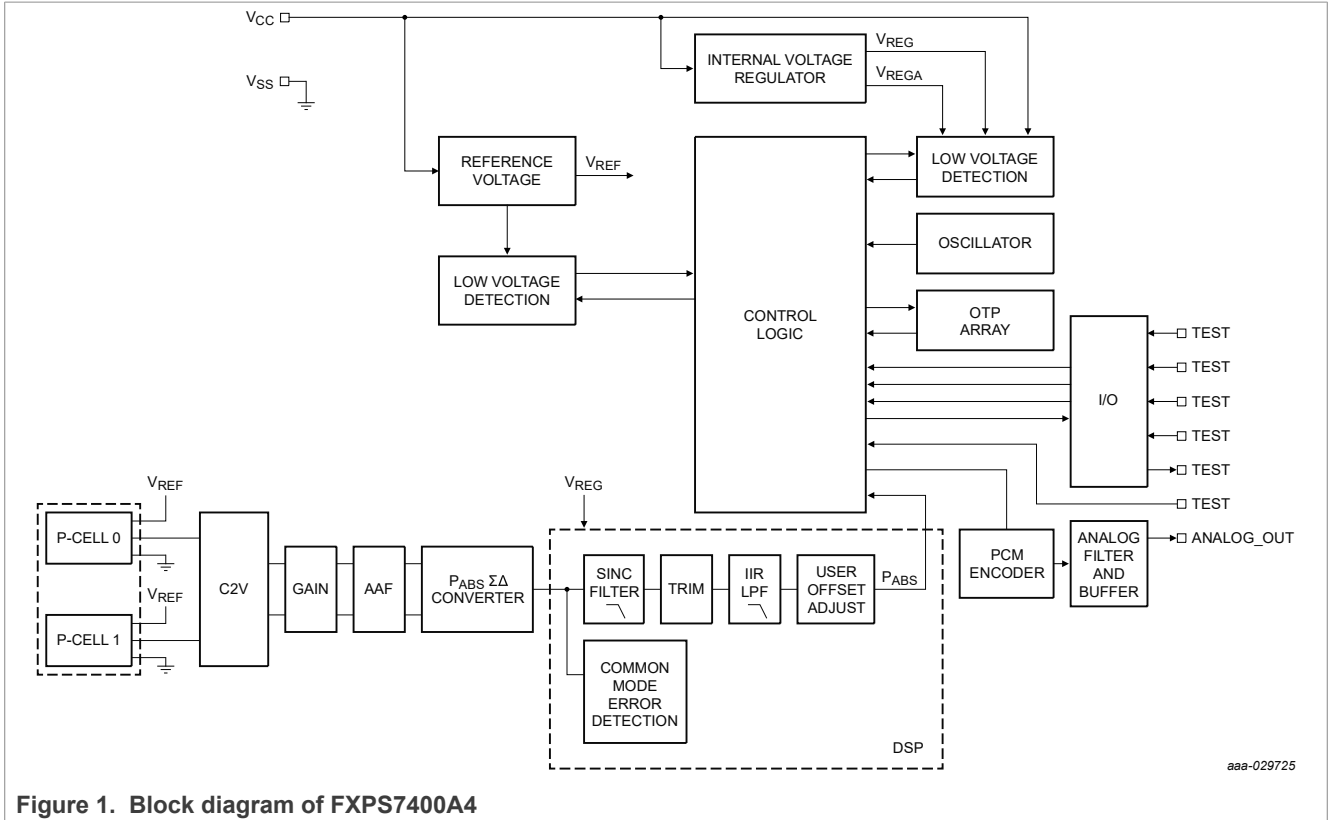


Figure 1. Block diagram of FXPS7400A4

6 Pinning information

6.1 Pinning

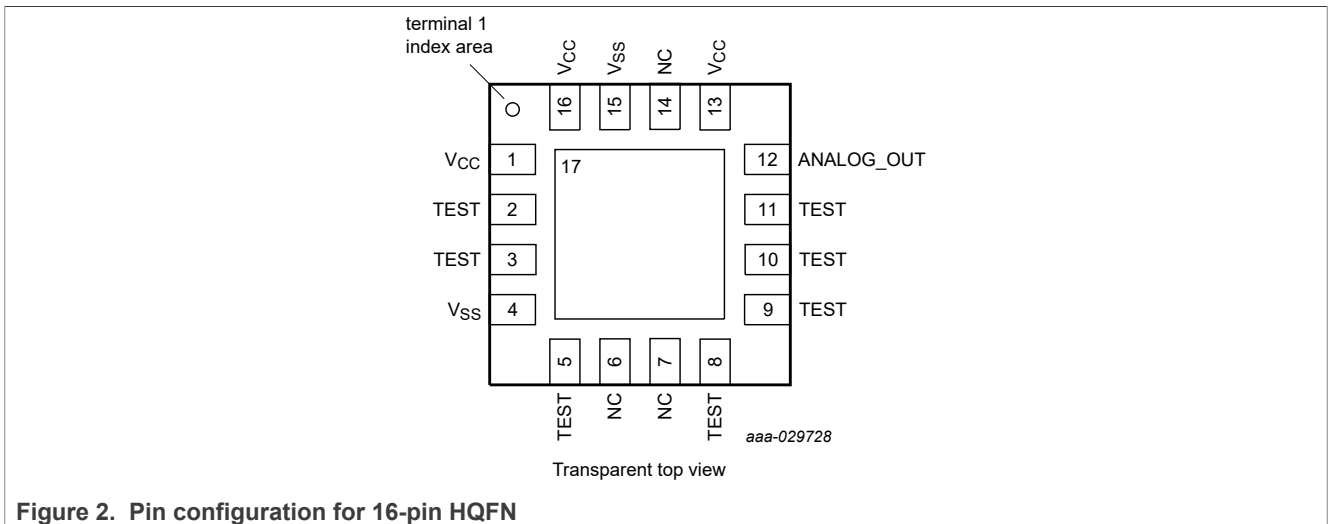


Figure 2. Pin configuration for 16-pin HQFN

6.2 Pin description

Table 3. Pin description

Pin	Pin name	Description
2, 8, 9, 10	TEST	Pins 2, 8, 9, and 10 are test pins and must be left unterminated in the application.
3	TEST	Pin 3 is required to be tied to V _{CC} for device operation.
4, 15	V _{SS}	Pins 4 and 15 are the supply return nodes and are connected internally to the die attach pad (pin 17).
5, 11	TEST	Pins 5 and 11 are test pins and must be tied to V _{SS} .
6, 7, 14	NC	Pins 6, 7 and 14 are not internally connected and can be left unconnected in the application.
12	ANALOG_OUT	Pin 12 provides a ratiometric analog output proportional to the absolute pressure sensor data.
1, 13, 16	V _{CC}	Pins 1, 13 and 16 supply power to the device. An external capacitor must be connected between these pins and V _{SS} , as shown in the application diagram.
17	PAD	Pin 17 is the die attach flag and must be connected to V _{SS} .

7 Functional description

7.1 Voltage regulators

The device derives its internal supply voltage from the V_{CC} and V_{SS} pins. An external filter capacitor is required for V_{CC}, as shown in [Figure 12](#).

A reference generator provides a reference voltage for the $\Sigma\Delta$ converter.

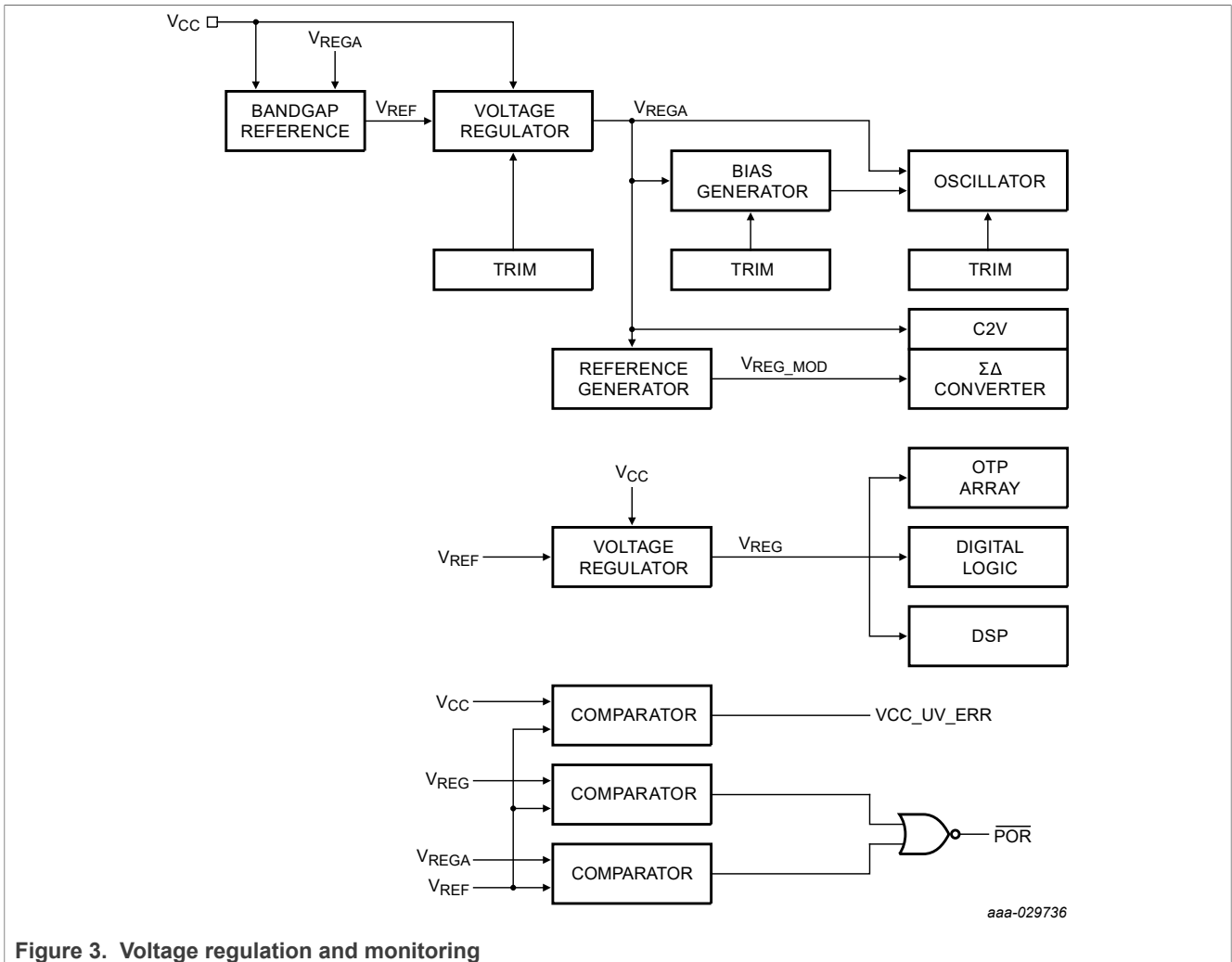
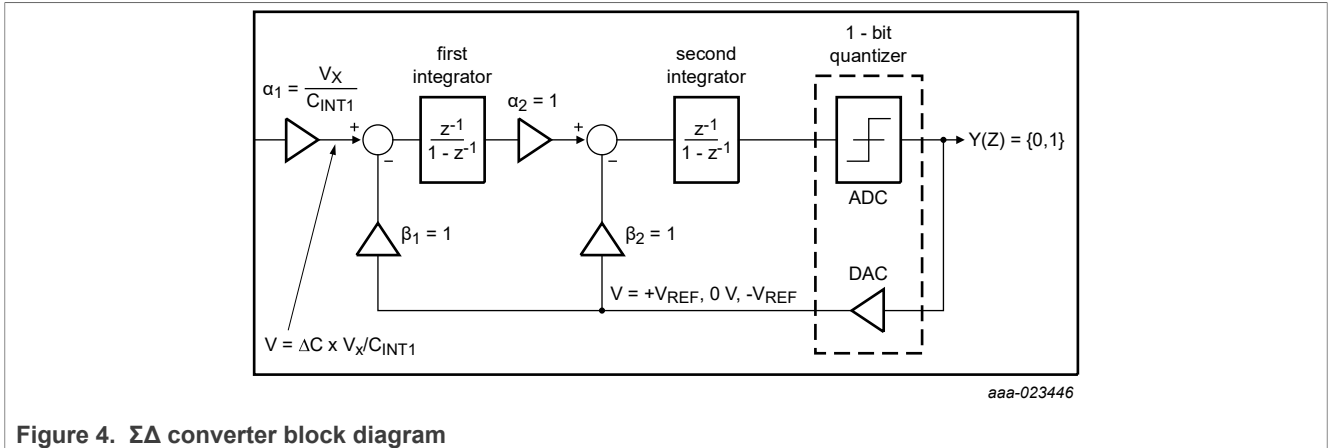


Figure 3. Voltage regulation and monitoring

7.2 Pressure sensor signal path

7.2.1 $\Sigma\Delta$ converter

A second order sigma delta modulator converts the voltage from the analog front end to a data stream that is input to the DSP. A simplified block diagram is shown in [Figure 4](#).

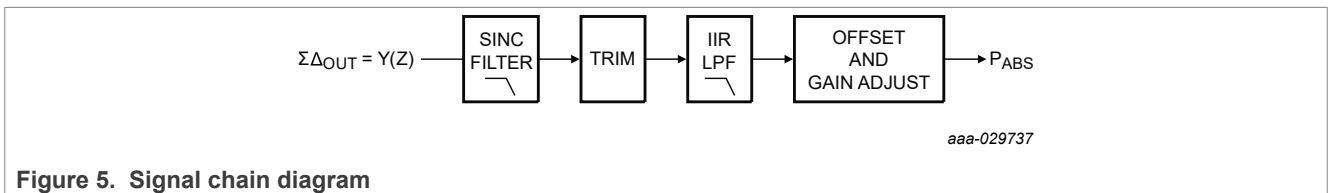


The sigma delta modulator operates at a frequency of 1 MHz, with the transfer function in [Equation 1](#).

$$H(Z) = \frac{\alpha_1}{Z^2} \tag{1}$$

7.2.2 Digital signal processor (DSP)

A DSP is used to perform signal filtering and compensation. A diagram illustrating the signal processing flow within the DSP is shown in [Figure 5](#).



7.2.2.1 Decimation sinc filter

In [Equation 2](#), the output of the ΣΔ modulator is decimated and converted to a parallel value by two third-order sinc filters; the first with a decimation ratio of 24 and the second with a decimation ratio of 4.

$$H(Z) = \left(\frac{1}{24^3}\right) \times \left(\frac{1 - Z^{-24}}{1 - Z^{-1}}\right)^3 \quad H(Z) = \left(\frac{1}{4^3}\right) \times \left(\frac{1 - Z^{-4}}{1 - Z^{-1}}\right)^3 \tag{2}$$

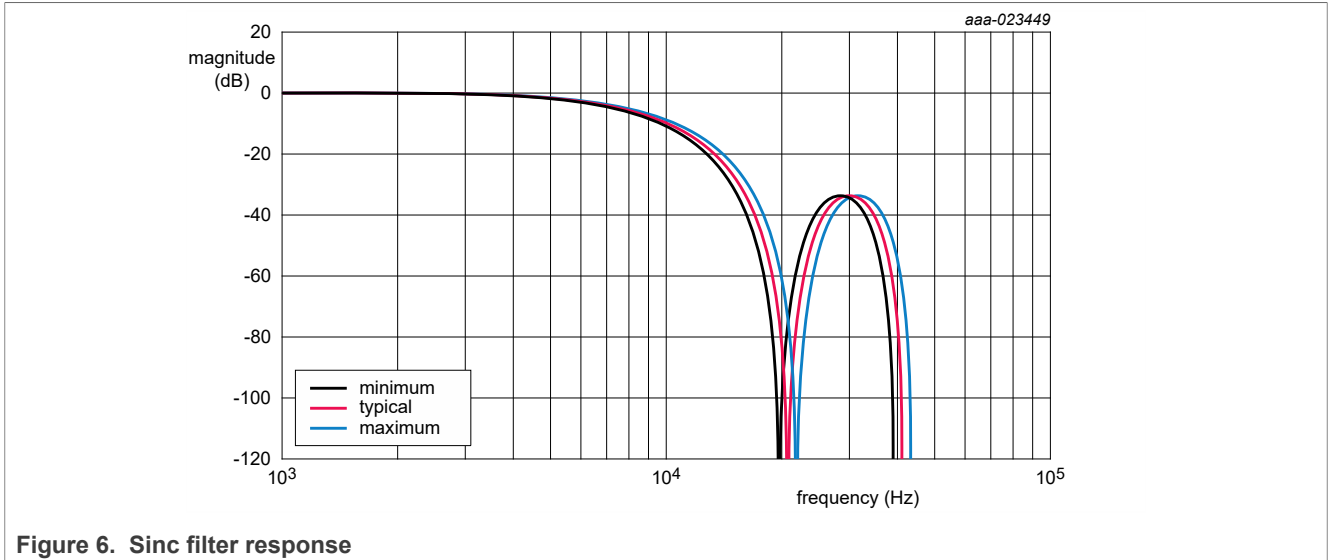


Figure 6. Sinc filter response

7.2.2.2 Signal trim and compensation

The device includes digital trim to compensate for sensor offset, sensitivity, and nonlinearity over temperature.

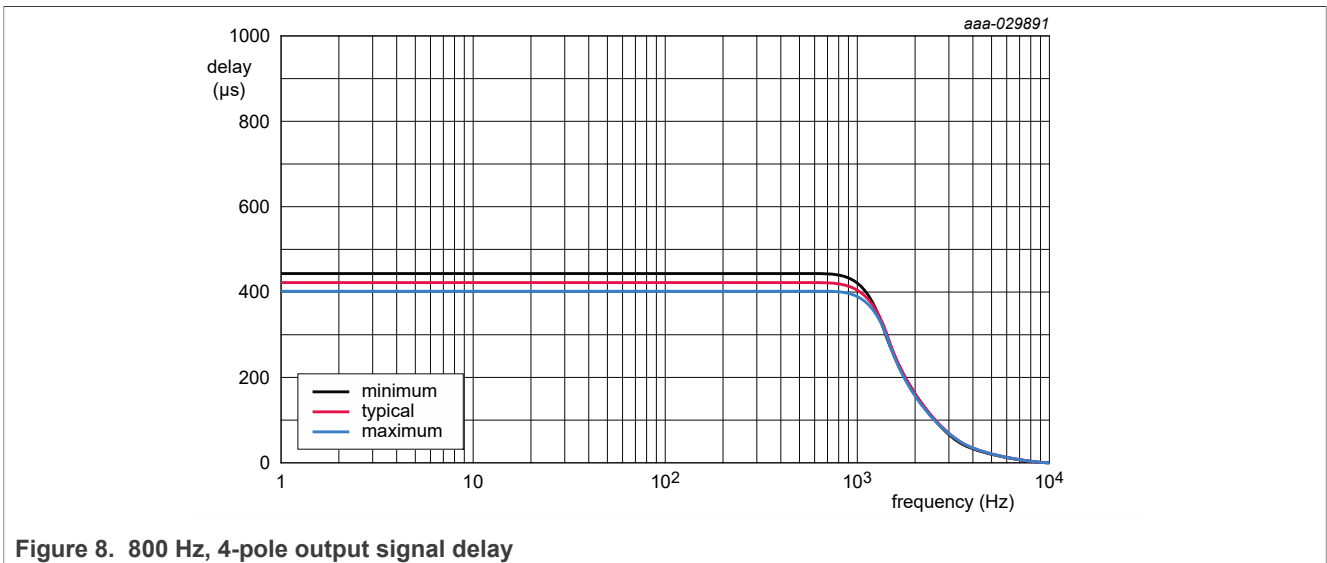
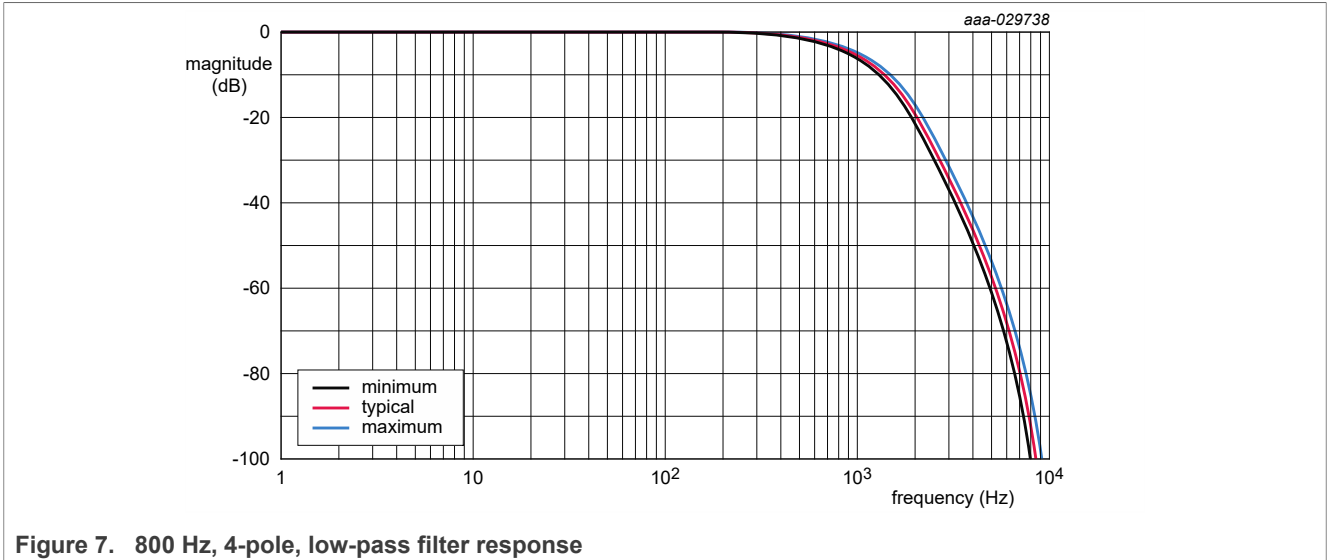
7.2.2.3 Low-pass filter

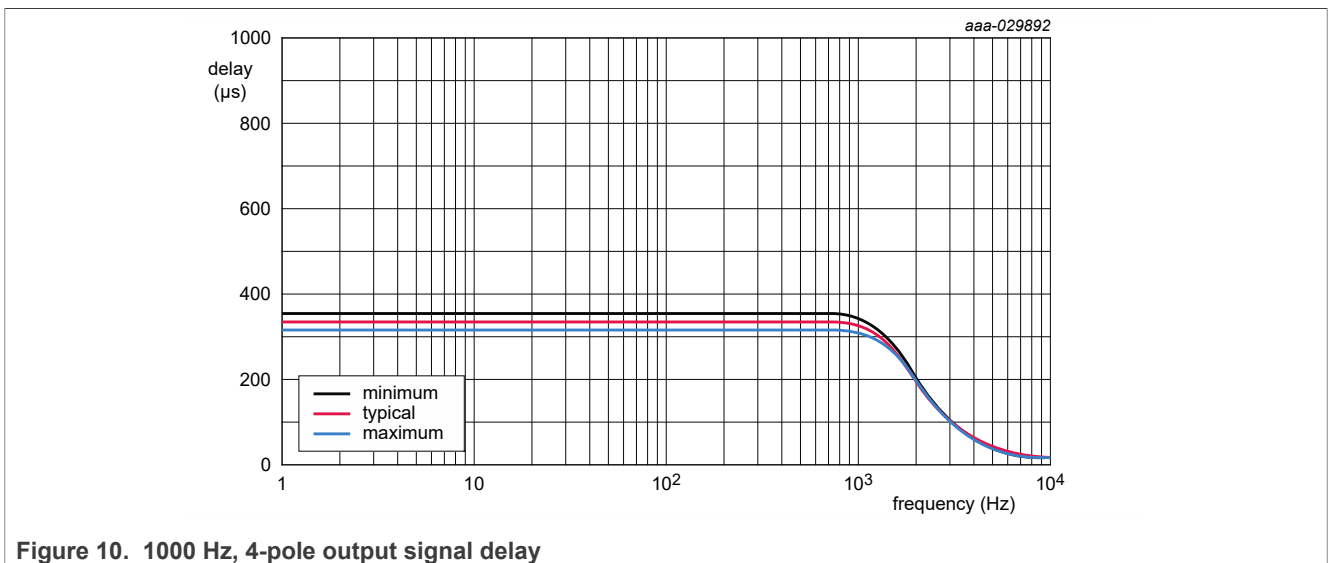
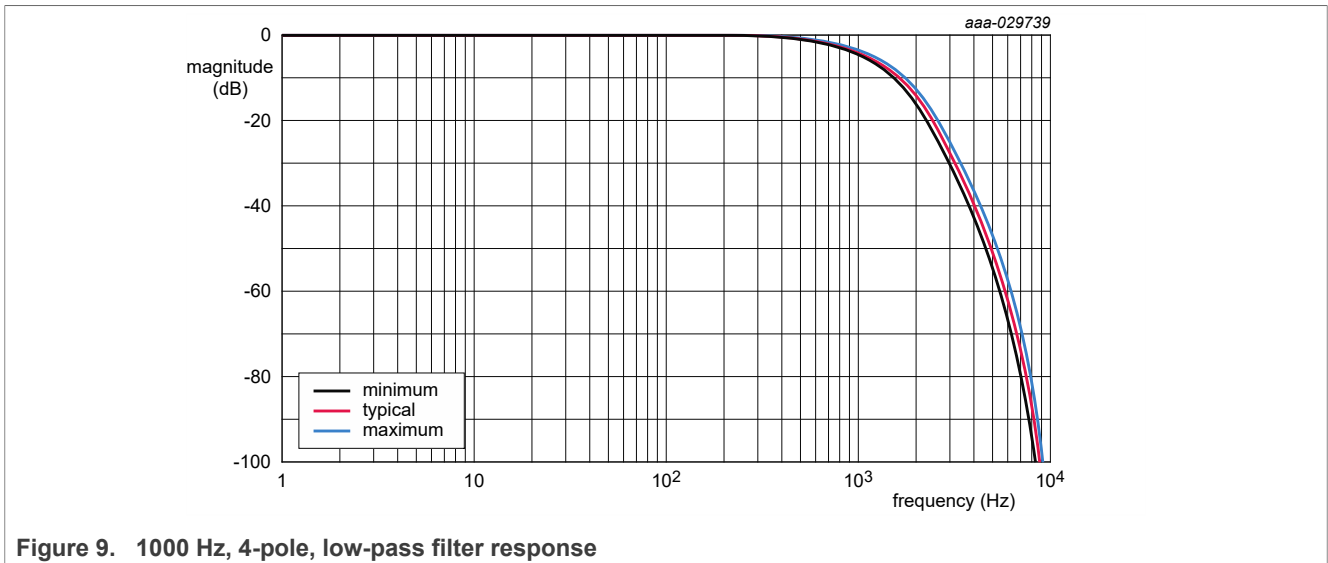
Data from the sinc filter is processed by an infinite impulse response (IIR) low-pass filter with the transfer function and coefficients shown in Equation 3.

$$H(Z) = a_0 \times \frac{(n_{11} \times z^0) + (n_{12} \times z^{-1}) + (n_{13} \times z^{-2})}{(d_{11} \times z^0) + (d_{12} \times z^{-1}) + (d_{13} \times z^{-2})} \times \frac{(n_{21} \times z^0) + (n_{22} \times z^{-1}) + (n_{23} \times z^{-2})}{(d_{21} \times z^0) + (d_{22} \times z^{-1}) + (d_{23} \times z^{-2})} \tag{3}$$

Table 4. IIR low pass filter coefficients

Filter number	Typical -3 dB frequency	Filter order	Filter coefficients (24 bit)				Group delay (µs)	Typical attenuation @ 1000 Hz (dB)				
			a ₀	n ₁₁	n ₁₂	n ₁₃			d ₁₁	d ₁₂	d ₁₃	n ₂₁
1	800 Hz	4	a ₀	0.088642612609670	—	—	418	4.95				
			n ₁₁	0.029638050039039	d ₁₁	1						
			n ₁₂	0.087543281056143	d ₁₂	-1.422792640957290						
			n ₁₃	0.029695285913601	d ₁₃	0.511435253566960						
			n ₂₁	0.250241278804809	d ₂₁	1						
			n ₂₂	0.499999767379068	d ₂₂	-1.503329908017845						
			n ₂₃	0.249758953816089	d ₂₃	0.621996524706640						
2	1000 Hz	4	a ₀	0.129604264748411	—	—	333	2.99				
			n ₁₁	0.043719804402508	d ₁₁	1						
			n ₁₂	0.087543281056143	d ₁₂	-1.300502656562698						
			n ₁₃	0.043823599710731	d ₁₃	0.430106921311110						
			n ₂₁	0.250296586927511	d ₂₁	1						
			n ₂₂	0.499999648540934	d ₂₂	-1.379959571988366						
			n ₂₃	0.249703764531484	d ₂₃	0.555046257157745						





7.3 Analog output function

7.3.1 Analog output signal chain

The device provides an analog output ratiometric to the supply voltage. The analog output is enabled by default. Selecting the analog output enables the following functions:

- The non-interpolated P_{ABS} sensor data output is saturated to 10 bits and converted to an unsigned value.
- The 10-bit sensor value is input into a summer clocked at 10 MHz.
- The carry from the summer circuit generates a PCM output.
- The PCM signal is filtered by a 2-pole active low pass filter to generate an analog signal.

7.3.2 Analog output transfer function

The FXPS7400A4 device provides an analog output voltage ratiometric to the supply voltage.

If using a supply voltage other than 5 V, the general form of the transfer function should be applied as described in equation [Equation 4](#):

$$Pressure_kPa = 3.4783 + 413.0435 \times (A_{OUT}/V_{CC}) \tag{4}$$

In addition, the absolute pressure analog offset, P_{OFF} and output voltage span, V_{FSS}, then becomes a ratio of their magnitude by applying the ratio of (V_{CC} / 5 V) to each of these parameters.

There can be slight variations in the P_{OFF} and V_{FSS} based on the temperature. The minimum and maximum variation of P_{OFF} and V_{FSS} can be assessed by applying the same ratio (V_{CC} / 5 V) to both of these parameters and then applying the error percentages to obtain these variations if needed.

The analog output transfer function for a 5.0 V supply is as shown in [Figure 11](#).

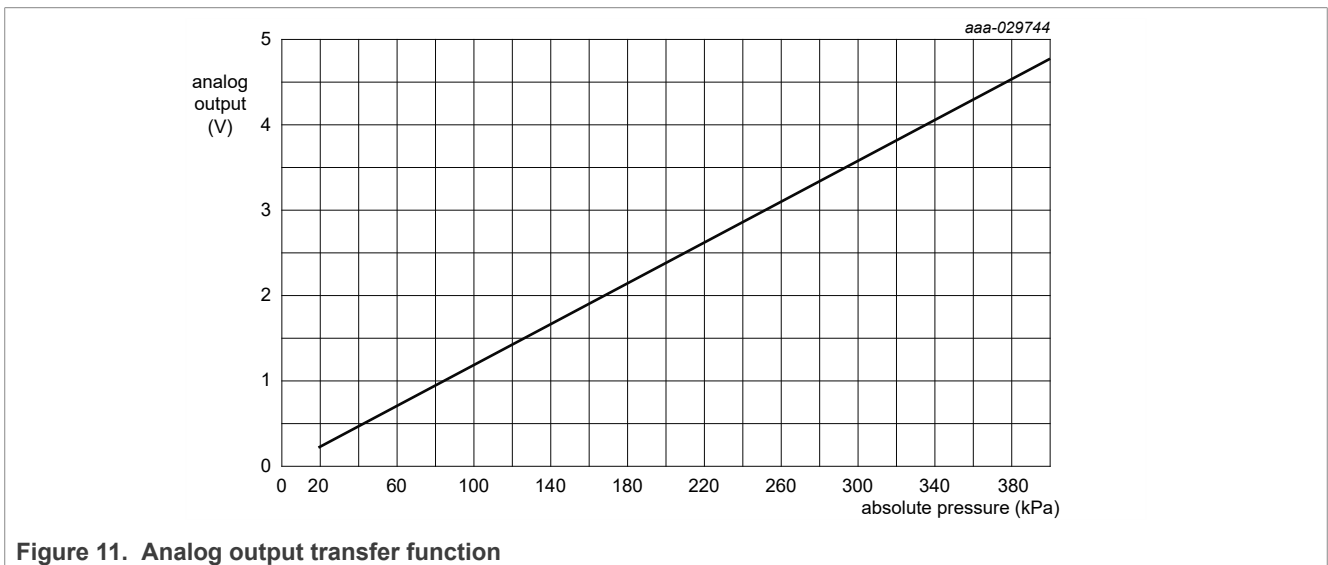


Figure 11. Analog output transfer function

8 Maximum ratings

Absolute maximum ratings are the limits that the device can be exposed to without permanently damaging it. Absolute maximum ratings are stress ratings only; functional operation at these ratings is not guaranteed. Exposure to absolute maximum ratings conditions for extended periods might affect device reliability.

This device contains circuitry to protect against damage due to high static voltage or electrical fields. NXP advises that normal precautions be taken to avoid application of any voltages higher than maximum-rated voltages to this high-impedance circuit.

Table 5. Maximum ratings

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CCMAX}	Supply Voltage	V _{CC} , V _{CCIO} ^[1]	—	+6.0	V
V _{IOMAX}	Input/Output Max on pins	ANALOG_OUT ^[1] TESTx	-0.3	V _{CC} + 0.3	V
h _{DROP}	Drop shock	To concrete, tile or steel surface, 10 drops, any orientation ^[2]	—	1.2	m
T _{stg}	Temperature range	Storage ^[2]	-40	+130	°C
T _J		Junction ^[3]	-40	+150	°C

Table 5. Maximum ratings...continued

Symbol	Parameter	Conditions	Min	Max	Unit
P _{MAX}	Maximum absolute pressure	Continuous [3]	—	450	kPa
P _{BURST}		Burst (tested at 100 ms) [2]	—	1650	kPa
P _{MIN}	Minimum absolute pressure	Continuous [1]	—	20	kPa
f _{SEAL}	Pressure sealing force	Applied to top face of package [1]	—	10	N
θ _{JA}	Thermal resistance	[4]	—	120	°C/W
ESD and latch-up protection characteristics					
V _{ESD}	Electrostatic discharge (per AEC-Q100, Rev H)	Human body model (HBM) [2]	-2000	2000	V
V _{ESD}		Charge device model (CDM) [2] [5]	-500	500	V

- [1] Parameter verified by parametric and functional validation.
- [2] Parameter verified by qualification testing (Per AEC-Q100 Rev H or per NXP specification).
- [3] Functionality verified by modeling, simulation and/or design verification.
- [4] Thermal resistance provided with device mounted to a two-layer, 1.6 mm FR-4 PCB as documented in AN1902^[1] with one signal layer and one ground layer.
- [5] CDM tested at ±750 V for corner pins and ±500 V for all other pins.

	Caution
This device is sensitive to mechanical shock. Improper handling can cause permanent damage to the part.	

	Caution
This is an ESD sensitive device. Improper handling can cause permanent damage to the part.	

9 Operating range

Table 6. Electrical characteristics — supply and I/O

$V_{CC_min} \leq (V_{CC} - V_{SS}) \leq V_{CC_max}$, $T_L \leq T_A \leq T_H$, $\Delta T \leq 25$ °C/min, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Max	Units
V _{CC}	Supply voltage	Measured at V _{CC} [1]	3.10	5.25	V
T _A	Operating temperature range	V _{CC} = 5.0 V, unless otherwise stated. Production tested operating temperature range [1]	T _L -40	T _H +130	°C
T _A		Guaranteed operating temperature range [1]	-40	+130	°C
V _{CC_RAMP}	Supply power on ramp rate	[2] [3]	0.00001	10	V/μs

- [1] Parameter tested at final test.
- [2] Functionality verified by modeling, simulation and/or design verification.
- [3] Parameter verified by parametric and functional validation.

10 Static characteristics

Table 7. Static characteristics

$V_{CC_min} \leq (V_{CC} - V_{SS}) \leq V_{CC_max}$, $T_L \leq T_A \leq T_H$, $\Delta T \leq 25 \text{ }^\circ\text{C/min}$, unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Units
Supply and I/O						
I_q	Supply current	$V_{CC} = 5.0 \text{ V}$ ^[1]	—	—	8.0	mA
Temperature sensor signal chain						
V_{OH_ANA}	Output high voltage	ANALOG_OUT, $I_{Load} = -100 \text{ }\mu\text{A}$ ^[1]	$V_{CC} - 0.2$	—	—	V
V_{OL_ANA}	Output low voltage	ANALOG_OUT, $I_{Load} = 100 \text{ }\mu\text{A}$ ^[1]	—	—	0.2	V
V_{OUT_3dB}	Analog output low-pass filter frequency typical value	-3 dB, 2-pole ^[2]	8	—	20	kHz
V_{OUT_3dBToI}	Analog output low-pass filter frequency typical tolerance	-3 dB, 2-pole ^[2]	-5	—	5	%
Absolute pressure sensor signal chain						
P_{ABS}	Absolute pressure range	^{[1] [3]}	20	—	400	kPa
P_{SENS}	Absolute pressure output sensitivity	$V_{CC} = 5.0 \text{ V}$. Tested at $P_A = 200 \text{ kPa}$ and 300 kPa ^[2]	—	12.1	—	mV/ kPa
P_{ACC_HiT}	Absolute pressure accuracy	$V_{CC} = 5.0 \text{ V}$. $85 \text{ }^\circ\text{C} < T_A \leq 130 \text{ }^\circ\text{C}$ ^[4]	-3	—	+3	%FSS
P_{ACC_Typ}	Absolute pressure accuracy	$V_{CC} = 5.0 \text{ V}$. $0 \text{ }^\circ\text{C} \leq T_A \leq 85 \text{ }^\circ\text{C}$ ^[4]	-2	—	+2	%FSS
P_{ACC_LoT}	Absolute pressure accuracy	$V_{CC} = 5.0 \text{ V}$. $-40 \text{ }^\circ\text{C} \leq T_A < 0 \text{ }^\circ\text{C}$ ^[4]	-3	—	+3	%FSS
P_{OFF}	Absolute pressure analog offset	At pressure span extremes $V_{CC} = 5.0 \text{ V}$. ^[4]	—	0.2	—	V
V_{FSS}	Output voltage span	At pressure span extremes $V_{CC} = 5.0 \text{ V}$. ^[5]	—	4.6	—	V

- [1] Parameter verified by pass/fail testing at final test.
- [2] Functionality verified by modeling, simulation and/or design verification.
- [3] Parameter verified by characterization.
- [4] Parameter tested at final test.
- [5] Parameter verified by functional evaluation.

11 Dynamic characteristics

Table 8. Dynamic characteristics

$V_{CC_min} \leq (V_{CC} - V_{SS}) \leq V_{CC_max}$, $T_L \leq T_A \leq T_H$, $\Delta T \leq 25$ °C/min, unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Units
Signal chain						
t _{SigChain}	P _{ABS} low-pass filter	Signal chain sample time ^[1]	—	48	—	µs
f _{c0}		Cutoff frequency, filter option #0, 4-pole ^{[1][2]}	—	800	—	Hz
f _{c1}		Cutoff frequency, filter option #1, 4-pole ^{[1][2]}	—	1000	—	Hz
t _{SigDelay}	Signal delay (sinc filter to output delay, excluding the P _{ABS} LPF)	^[1]	—	—	128	µs
t _{Delay_DataValid}	Supply recovery	V _{CC} to sensor data valid	300	—	—	ms
f _{Package}	Package resonance frequency	^[1]	27.1	—	—	kHz

[1] Functionality verified by modeling, simulation and/or design verification.

[2] Parameter verified by functional evaluation.

12 Media compatibility—pressure sensors only

For more information regarding media compatibility information, contact your local sales representative.

Note:

The devices contain a gel that protects the pressure transducer and its inter-die connection wires from corrosion, which might otherwise result in catastrophic failure modes. NXP has observed that direct exposure to materials with the same or nearly-the-same solubility can potentially result in a corruption of the protective gel. A corruption can be less than catastrophic in nature, however may result in an offset of the pressure measurement from its factory calibrated value. An offset can potentially be larger than the allowed tolerances published in this data sheet.

Further, NXP does not recommend direct exposure to strong acid or strong base compounds as they can potentially result in a similar corruption as described above, or may result in a dissolution of the protective gel and/or the metal lid adhesive and/or the plastic device body. Such a dissolution can be catastrophic in nature, damaging the transducer surfaces and/or internal wire bonds and/or the control die surfaces. A potential dissolution may result in a similar offset, or cause the device to indicate overflow/underflow status, or may cause the device to cease operating in the worst case.

For a list of compounds known to generate out-of-tolerance offsets and/or catastrophic device failure, please contact an NXP sales representative.

13 Application information

Note: A gel is used to provide media protection against corrosive elements which may otherwise damage metal bond wires and/or IC surfaces. Highly pressurized gas molecules may permeate through the gel and then occupy boundaries between material surfaces within the sensor package. When decompression occurs, the gas molecules may collect, form bubbles and possibly result in delamination of the gel from the material it protects. If a bubble is located on the pressure transducer surface or on the bond wires, the sensor measurement may shift from its calibrated transfer function. In some cases, these temporary shifts could be outside the tolerances listed in the data sheet. In rare cases, the bubble may bend the bond wires and result in a permanent shift.

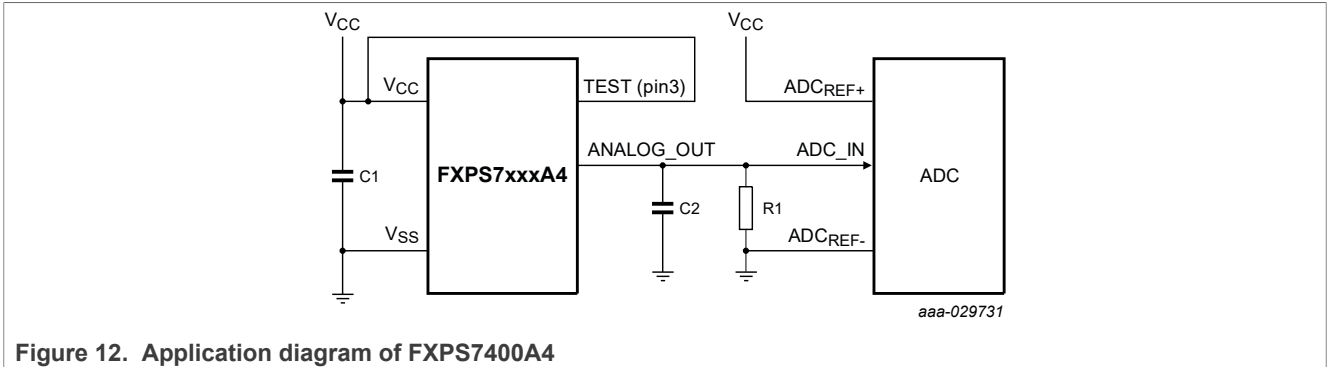


Figure 12. Application diagram of FXPS7400A4

Table 9. External component recommendations

Name	Type	Description	Purpose
C1	Ceramic	0.1 μ F, 10 %, 10 V minimum, X7R	V_{CC} power supply decoupling
C2	Ceramic	47 pF, 10 %, 10 V minimum, X7R	Analog output filtering
R1	General purpose	51 k Ω , 5 %, 200 PPM	Analog output pull-down resistor

14 Package outline

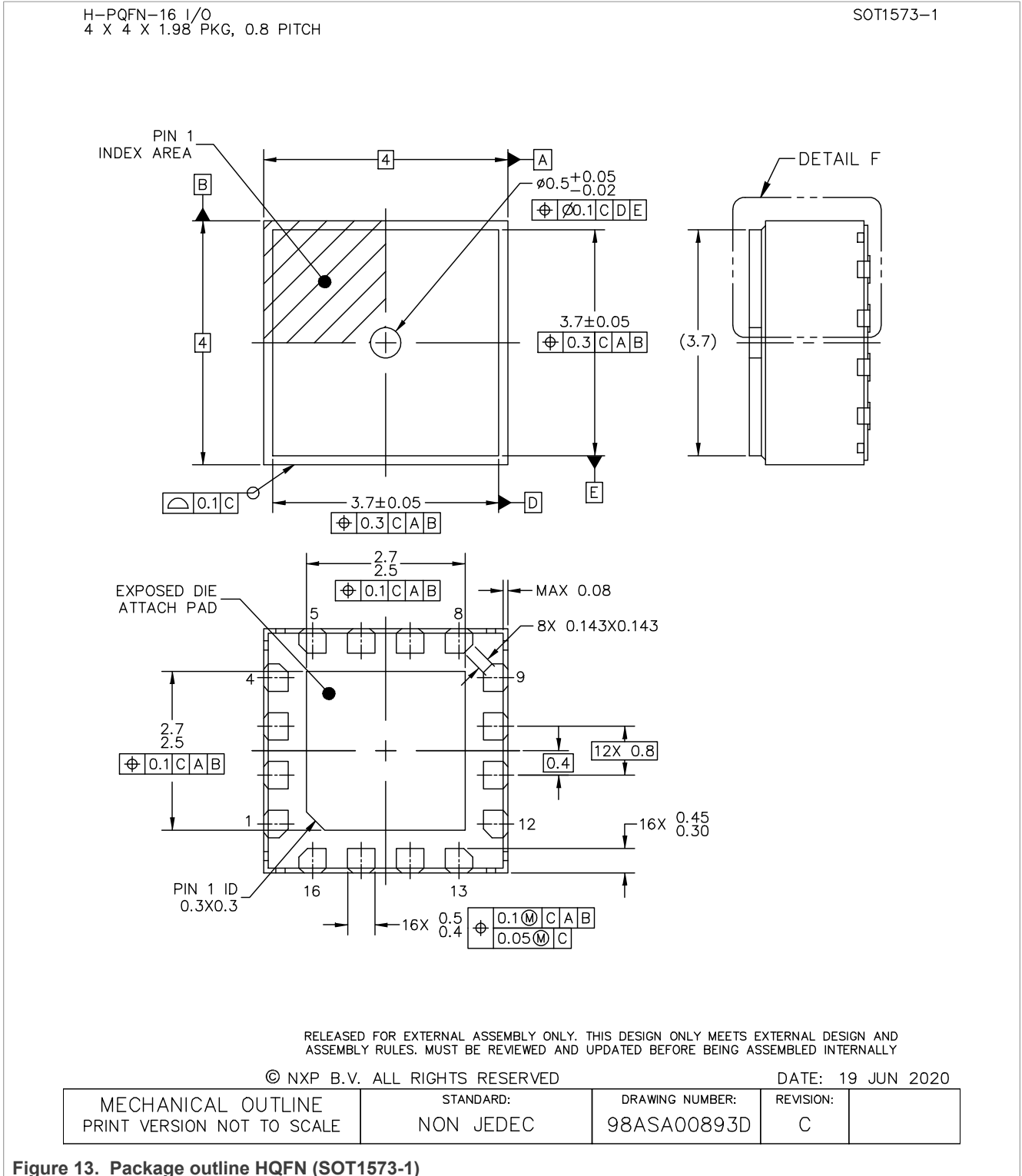
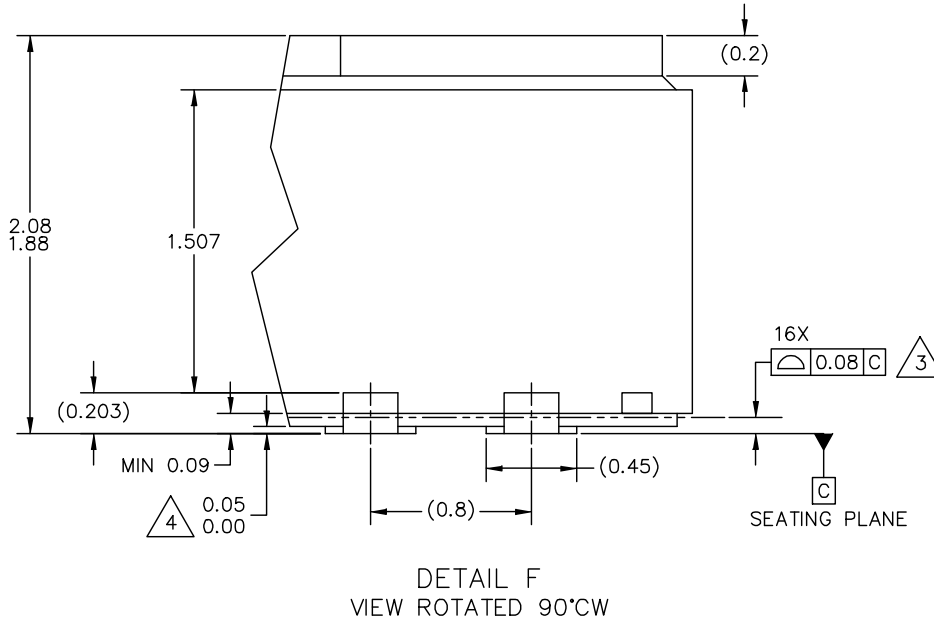


Figure 13. Package outline HQFN (SOT1573-1)

H-PQFN-16 I/O
4 X 4 X 1.98 PKG, 0.8 PITCH

SOT1573-1



RELEASED FOR EXTERNAL ASSEMBLY ONLY. THIS DESIGN ONLY MEETS EXTERNAL DESIGN AND ASSEMBLY RULES. MUST BE REVIEWED AND UPDATED BEFORE BEING ASSEMBLED INTERNALLY

© NXP B.V. ALL RIGHTS RESERVED

DATE: 19 JUN 2020

MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA00893D	REVISION: C	
--	------------------------	--------------------------------	----------------	--

Figure 14. Package outline detail HQFN (SOT1573-1)

H-PQFN-16 I/O
4 X 4 X 1.98 PKG, 0.8 PITCH

SOT1573-1

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. COPLANARITY APPLIES TO LEADS AND DIE ATTACH PAD.
4. DIMENSION APPLIES ONLY FOR TERMINALS.
5. MIN METAL GAP SHOULD BE 0.2 MM.

© NXP B.V. ALL RIGHTS RESERVED

DATE: 19 JUN 2020

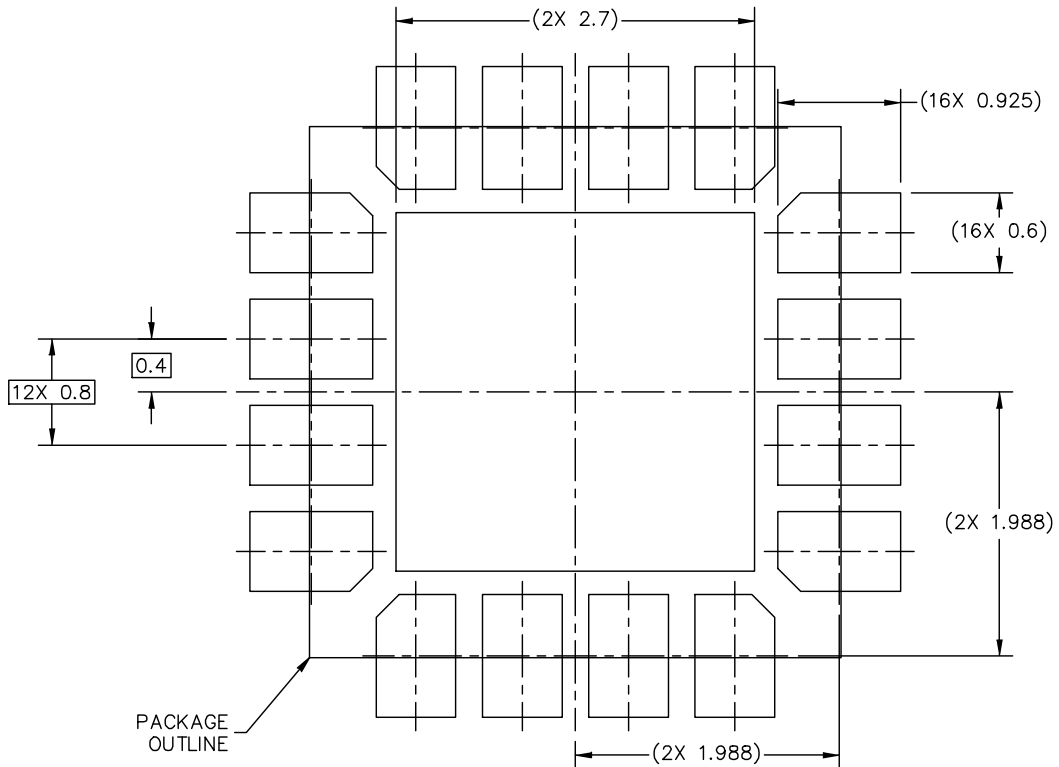
MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA00893D	REVISION: C	
--	------------------------	--------------------------------	----------------	--

Figure 15. Package outline note HQFN (SOT1573-1)

15 Soldering

H-PQFN-16 I/O
4 X 4 X 1.98 PKG, 0.8 PITCH

SOT1573-1



PCB DESIGN GUIDELINES – SOLDER MASK OPENING PATTERN

THIS SHEET SERVES ONLY AS A GUIDELINE TO HELP DEVELOP A USER SPECIFIC SOLUTION. DEVELOPMENT EFFORT WILL STILL BE REQUIRED BY END USERS TO OPTIMIZE PCB MOUNTING PROCESSES AND BOARD DESIGN IN ORDER TO MEET INDIVIDUAL/SPECIFIC REQUIREMENTS.

© NXP B.V. ALL RIGHTS RESERVED

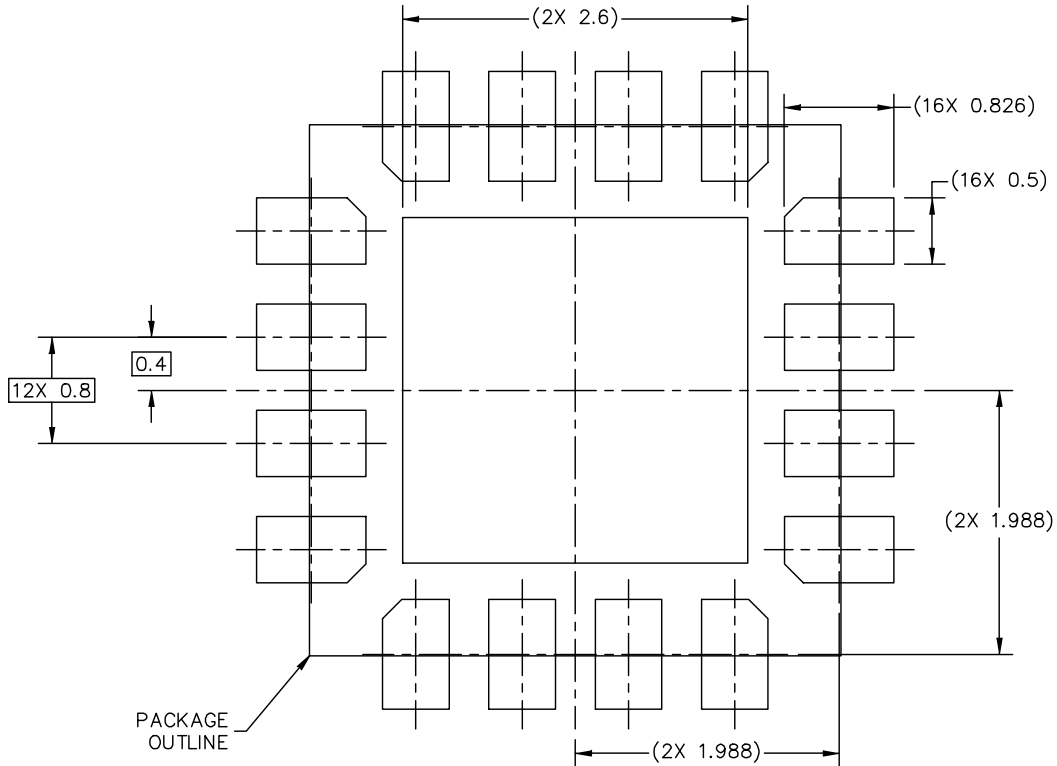
DATE: 19 JUN 2020

MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA00893D	REVISION: C	
--	------------------------	--------------------------------	----------------	--

Figure 16. SOT1573-1 PCB design guidelines - Solder mask opening pattern

H-PQFN-16 I/O
4 X 4 X 1.98 PKG, 0.8 PITCH

SOT1573-1



PCB DESIGN GUIDELINES – I/O PADS AND SOLDERABLE AREA

THIS SHEET SERVES ONLY AS A GUIDELINE TO HELP DEVELOP A USER SPECIFIC SOLUTION. DEVELOPMENT EFFORT WILL STILL BE REQUIRED BY END USERS TO OPTIMIZE PCB MOUNTING PROCESSES AND BOARD DESIGN IN ORDER TO MEET INDIVIDUAL/SPECIFIC REQUIREMENTS.

© NXP B.V. ALL RIGHTS RESERVED

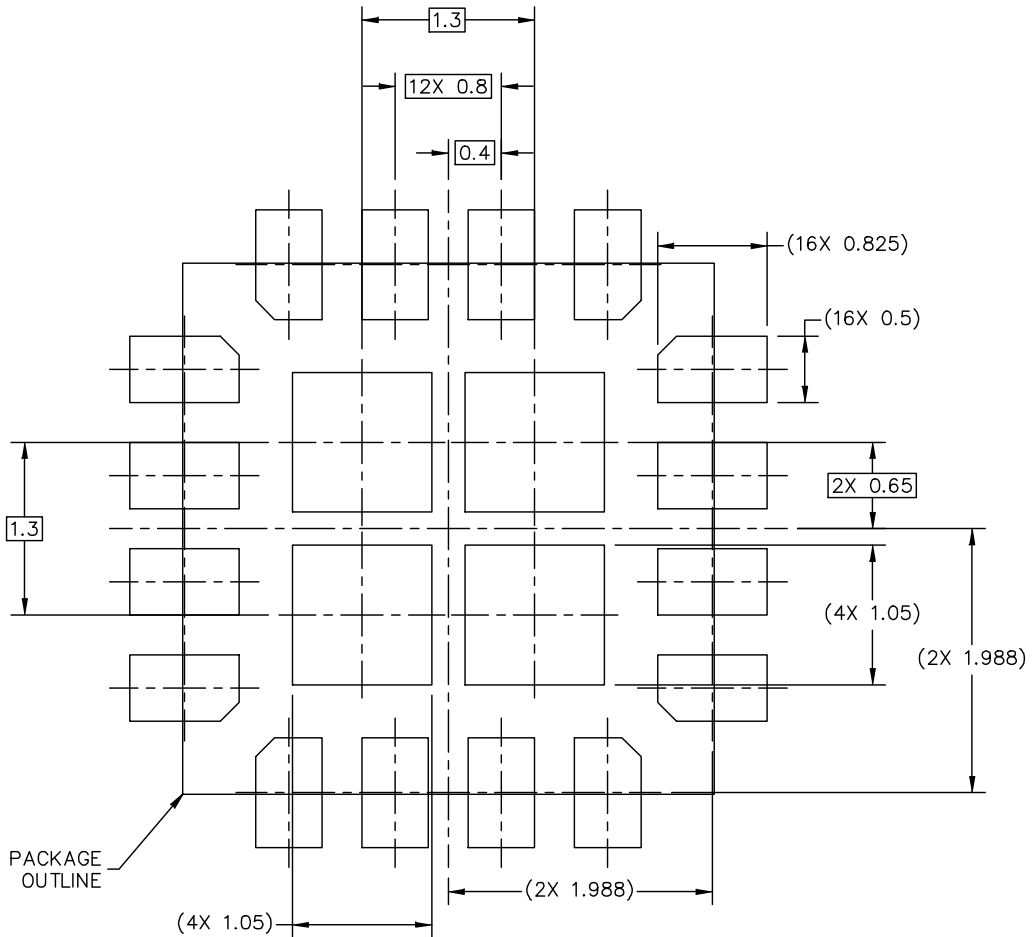
DATE: 19 JUN 2020

MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA00893D	REVISION: C	
--	------------------------	--------------------------------	----------------	--

Figure 17. SOT1573-1 PCB design guidelines - I/O pads and solderable area

H-PQFN-16 I/O
4 X 4 X 1.98 PKG, 0.8 PITCH

SOT1573-1



RECOMMENDED STENCIL THICKNESS 0.125 OR 0.15

PCB DESIGN GUIDELINES – SOLDER PASTE STENCIL

THIS SHEET SERVES ONLY AS A GUIDELINE TO HELP DEVELOP A USER SPECIFIC SOLUTION. DEVELOPMENT EFFORT WILL STILL BE REQUIRED BY END USERS TO OPTIMIZE PCB MOUNTING PROCESSES AND BOARD DESIGN IN ORDER TO MEET INDIVIDUAL/SPECIFIC REQUIREMENTS.

© NXP B.V. ALL RIGHTS RESERVED

DATE: 19 JUN 2020

MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA00893D	REVISION: C	
--	------------------------	--------------------------------	----------------	--

Figure 18. SOT1573-1 PCB design guidelines - Solder paste stencil

16 Mounting recommendations

The package should be mounted with the pressure port pointing away from sources of debris which might otherwise plug the sensor.

A plugged port exhibits no change in pressure and can be cross checked in the user software.

Refer to NXP application note AN1902^[1] for proper printed circuit board attributes and recommendations.

17 References

- [1] **AN1902 - Assembly guidelines for QFN (quad flat no-lead) and SON (small outline no-lead) packages**
<https://www.nxp.com/docs/en/application-note/AN1902.pdf>
- [2] **AEC documents on Automotive Electronics Council Component Technical Committee's site:**
<http://www.aecouncil.com/AECDocuments.html>

18 Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
FXPS7400A4 v.5.1	20231103	Product data sheet	—	FXPS7400A4 v.5
Modifications:	• Section 12 , inserted a new disclaimer note.			
FXPS7400A4 v.5	20220729	Product data sheet	—	FXPS7400A4 v.4.1
FXPS7400A4 v.4.1	20190529	Product data sheet	—	FXPS7400A4 v.4
FXPS7400A4 v.4	20190507	Product data sheet	—	FXPS7400A4 v.3
FXPS7400A4 v.3	20190506	Preliminary data sheet	—	FXPS7400A4 v.2
FXPS7400A4 v.2	20190408	Preliminary data sheet	—	FXPS7400A4 v.1
FXPS7400A4 v.1	20180913	Preliminary data sheet	—	—

Legal information

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 <https://www.nxp.com>.

Definitions

Draft — A draft status on a document indicates that the content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included in a draft version of a document and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <https://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Suitability for use in automotive applications — This NXP product has been qualified for use in automotive applications. If this product is used by customer in the development of, or for incorporation into, products or services (a) used in safety critical applications or (b) in which failure could lead to death, personal injury, or severe physical or environmental damage (such products and services hereinafter referred to as “Critical Applications”), then customer makes the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, safety, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP. As such, customer assumes all risk related to use of any products in Critical Applications and NXP and its suppliers shall not be liable for any such use by customer. Accordingly, customer will indemnify and hold NXP harmless from any claims, liabilities, damages and associated costs and expenses (including attorneys’ fees) that NXP may incur related to customer’s incorporation of any product in a Critical Application.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document, including the legal information in that document, is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Security — Customer understands that all NXP products may be subject to unidentified vulnerabilities or may support established security standards or specifications with known limitations. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer’s applications and products. Customer’s responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer’s applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately. Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP.

NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

NXP B.V. — NXP B.V. is not an operating company and it does not distribute or sell products.

Trademarks

Notice: All referenced brands, product names, service names, and trademarks are the property of their respective owners.

NXP — wordmark and logo are trademarks of NXP B.V.

I2C-bus — logo is a trademark of NXP B.V.

Tables

Tab. 1.	Ordering information	2	Tab. 6.	Electrical characteristics — supply and I/O	11
Tab. 2.	Ordering options	2	Tab. 7.	Static characteristics	12
Tab. 3.	Pin description	4	Tab. 8.	Dynamic characteristics	13
Tab. 4.	IIR low pass filter coefficients	7	Tab. 9.	External component recommendations	14
Tab. 5.	Maximum ratings	10	Tab. 10.	Revision history	21

Figures

Fig. 1.	Block diagram of FXPS7400A4	3	Fig. 12.	Application diagram of FXPS7400A4	14
Fig. 2.	Pin configuration for 16-pin HQFN	3	Fig. 13.	Package outline HQFN (SOT1573-1)	15
Fig. 3.	Voltage regulation and monitoring	5	Fig. 14.	Package outline detail HQFN (SOT1573-1)	16
Fig. 4.	$\Sigma\Delta$ converter block diagram	6	Fig. 15.	Package outline note HQFN (SOT1573-1)	17
Fig. 5.	Signal chain diagram	6	Fig. 16.	SOT1573-1 PCB design guidelines - Solder mask opening pattern	18
Fig. 6.	Sinc filter response	7	Fig. 17.	SOT1573-1 PCB design guidelines - I/O pads and solderable area	19
Fig. 7.	800 Hz, 4-pole, low-pass filter response	8	Fig. 18.	SOT1573-1 PCB design guidelines - Solder paste stencil	20
Fig. 8.	800 Hz, 4-pole output signal delay	8			
Fig. 9.	1000 Hz, 4-pole, low-pass filter response	9			
Fig. 10.	1000 Hz, 4-pole output signal delay	9			
Fig. 11.	Analog output transfer function	10			

Contents

1	General description	1
2	Features and benefits	1
3	Applications	1
3.1	Automotive	1
3.2	Industrial	2
3.3	Medical/Consumer	2
4	Ordering information	2
4.1	Ordering options	2
5	Block diagram	3
6	Pinning information	3
6.1	Pinning	3
6.2	Pin description	4
7	Functional description	4
7.1	Voltage regulators	4
7.2	Pressure sensor signal path	5
7.2.1	$\Sigma\Delta$ converter	5
7.2.2	Digital signal processor (DSP)	6
7.2.2.1	Decimation sinc filter	6
7.2.2.2	Signal trim and compensation	7
7.2.2.3	Low-pass filter	7
7.3	Analog output function	9
7.3.1	Analog output signal chain	9
7.3.2	Analog output transfer function	9
8	Maximum ratings	10
9	Operating range	11
10	Static characteristics	12
11	Dynamic characteristics	13
12	Media compatibility—pressure sensors only	13
13	Application information	13
14	Package outline	15
15	Soldering	18
16	Mounting recommendations	21
17	References	21
18	Revision history	21
	Legal information	22

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.
