



Application Note

AN000323

AS62xx

Thermal Design Guideline for Wearables

v4-00 • 2020-Nov-23

Content Guide

1	Introduction	3	4	Revision Information	8
1.1	Ordering Information	3	5	Legal Information.....	9
2	Sensing Skin Temperature	4			
2.1	Temperature Response Time.....	6			
3	Sensing Environmental Temperature.....	7			

1 Introduction

The AS62xx Product Family is a digital temperature sensor family for applications that require small form factors, ultra-low power consumption and high accuracy.

Apart from numerous other applications, wearables are a perfect fit for this sensor. Especially for wearable devices, designing a housing for a good skin and environmental temperature measurement could be challenging. In this document, some design guidelines are listed to support you in your product design.

1.1 Ordering Information

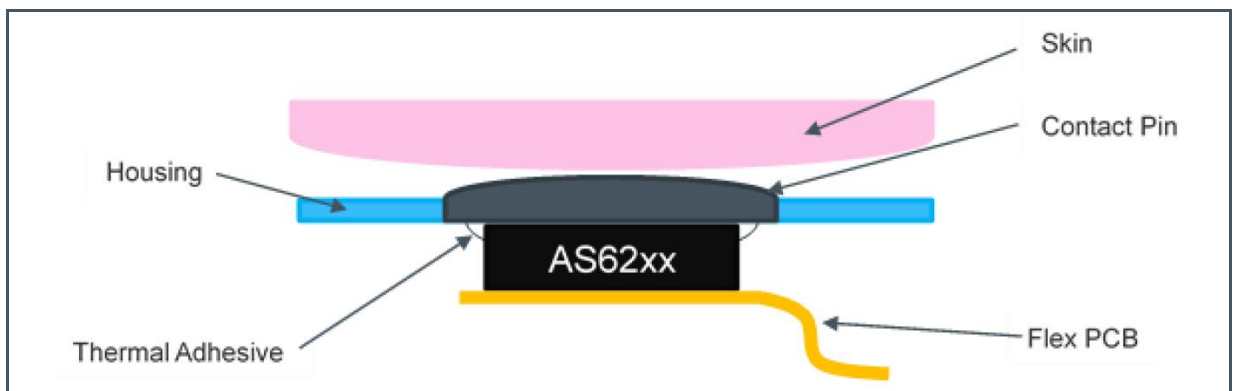
Ordering Code	Package	Marking	Delivery Form	Delivery Quantity
AS6221-AWLT-S	WLCSP	AS6221	Tape & Reel	500 pcs/reel
AS6221-AWLT-L	WLCSP	AS6221	Tape & Reel	5000 pcs/reel
AS6212-AWLT-S	WLCSP	AS6212	Tape & Reel	500 pcs/reel
AS6212-AWLT-L	WLCSP	AS6212	Tape & Reel	5000 pcs/reel
AS6214-AWLT-S	WLCSP	AS6214	Tape & Reel	500 pcs/reel
AS6214-AWLT-L	WLCSP	AS6214	Tape & Reel	5000 pcs/reel
AS6218-AWLT-S	WLCSP	AS6218	Tape & Reel	500 pcs/reel
AS6218-AWLT-L	WLCSP	AS6218	Tape & Reel	5000 pcs/reel
AS6204-AWLM-S	WLCSP	AS6204	Tape & Reel	500 pcs/reel
AS6204-AWLT-L	WLCSP	AS6204	Tape & Reel	5000 pcs/reel
AS6200C-AWLM-S	WLCSP	AS6MCC	Tape & Reel	500 pcs/reel
AS6200C-AWLT-L	WLCSP	AS6MCC	Tape & Reel	5000 pcs/reel
AS6200-AWLT-S	WLCSP	AS6200	Tape & Reel	500 pcs/reel
AS6200-AWLT-L	WLCSP	AS6200	Tape & Reel	5000 pcs/reel

2 Sensing Skin Temperature

To measure a proband's skin temperature with the AS62xx temperature sensor, it is mandatory to have a good thermal connection between the sensor and the skin. This can be achieved by placing a conductive pin in the housing of the device. The pin consists of a thermal conductive material like metal. In case of a metal housing, the pin should be isolated from the housing to reduce the thermal capacity of the temperature sensing.

The AS62xx temperature sensor is thermally connected to the pin with thermal adhesive or thermal paste and electrically with a flex PCB as shown in Figure 1.

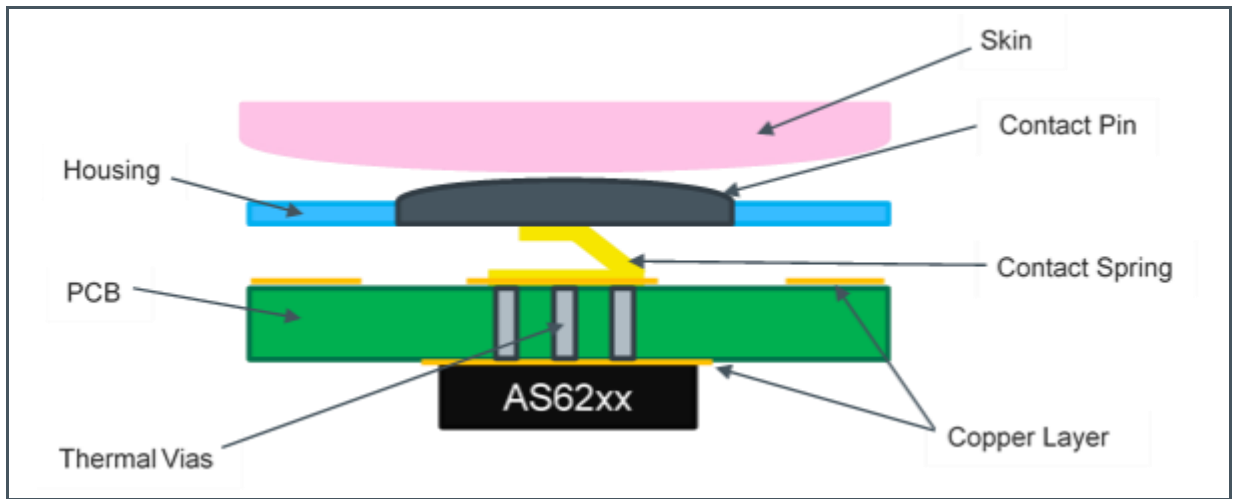
Figure 1:
Flex Mounted Sensor



This design has the advantage that it enables a higher degree of freedom for placing the sensor where it is convenient for the product design, but could increase the costs due to the more expensive flex PCB.

In case it is preferred to have the sensor mounted on the mainboard, it is possible to either use a contact spring or a thermal pad to establish a thermal connection. In the first case the sensors exposed pad (or GND pad) and the contact spring have to either be connected with a circuit path (top side mounted) or a thermal via (bottom side mounted) as shown in Figure 2. This design allows to have a cost effective design that can cover a relatively long distance between the PCB and the housing.

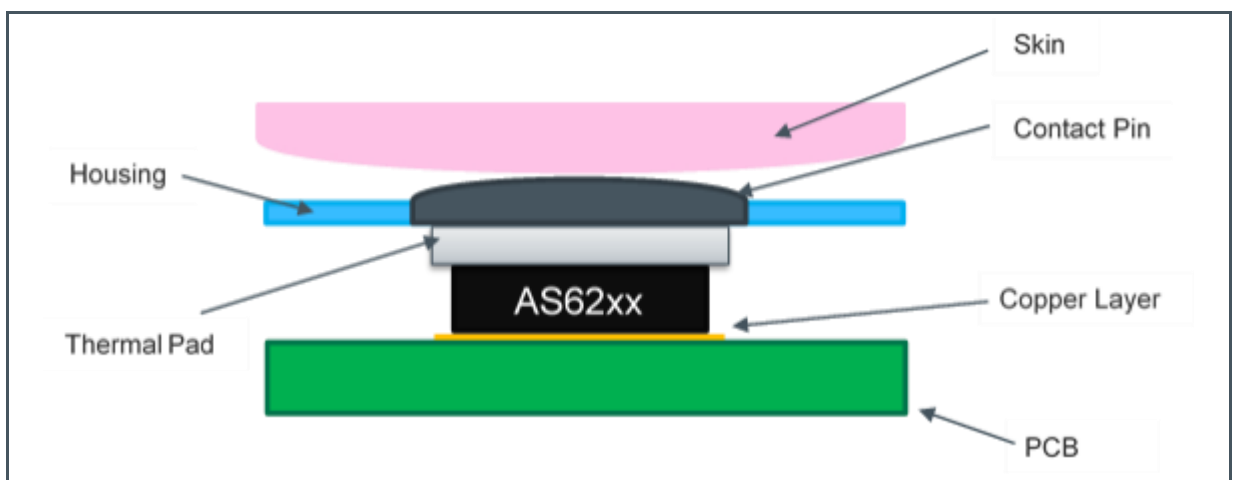
Figure 2:
PCB Mounted Sensor (Contact Spring)



Connecting the sensor via thermal pad is probably the easiest and cleanest way of establishing a thermal connection between the sensor and the outside of the wearable. Therefore a thermal pad of the size of the sensor is fitted between the device and the contact pin as seen in Figure 3

On the down side, it only allows a relatively small distance between the device and the contact pin. A pad with high thermal conductivity is the key factor to a fast and accurate temperature readout.

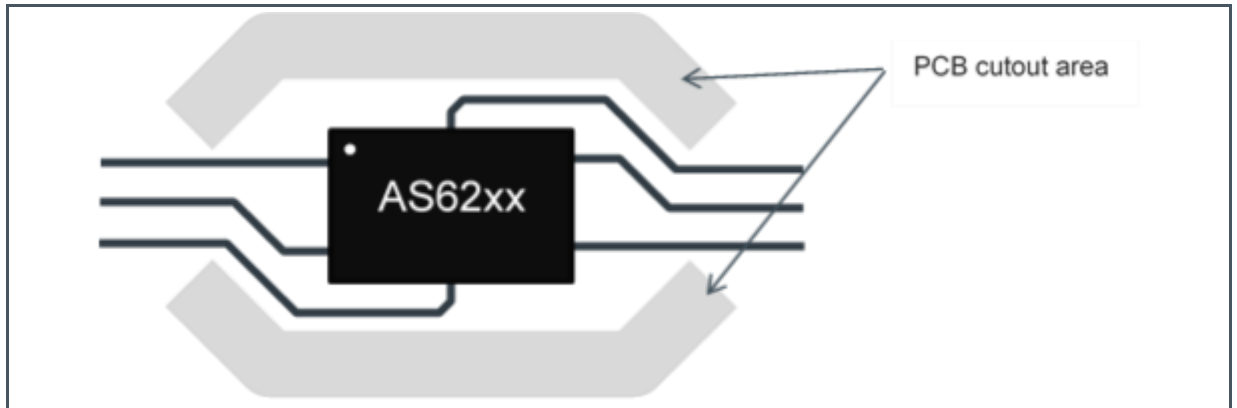
Figure 3:
PCB Mounted Sensor (Thermal Pad)



2.1 Temperature Response Time

To further improve the response time of the sensor, it is recommended to reduce the thermal capacity of the PCB. One important measure is to keep the area around the sensor free of any copper planes. In addition to that, a cutout as can be seen Figure 4 should be applied.

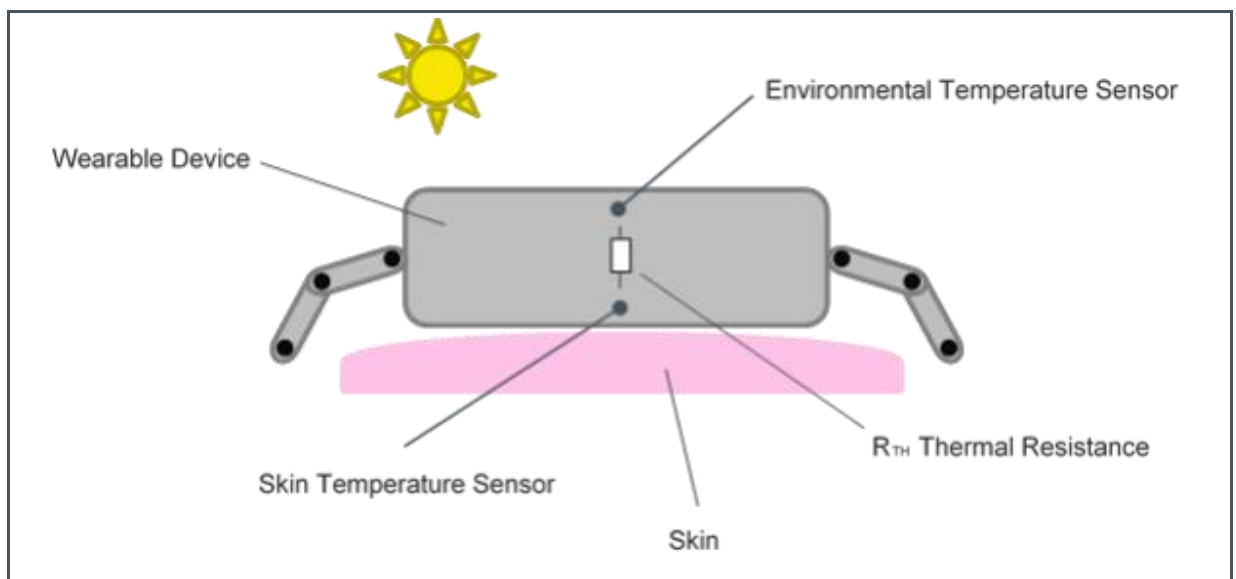
Figure 4:
PCB Cutout



3 Sensing Environmental Temperature

Sensing the environmental temperature is more challenging, as the housing is strongly influenced by the skin temperature of the proband. To avoid this, it is recommended to use two sensors. One sensing the skin temperature and the other to sense the environmental temperature. Developing a thermal model of the device and a temperature prediction algorithm provides the best results in determining this parameter.

Figure 5:
Environmental Sensing



The higher the thermal resistance between the environmental sensor and the skin sensor is, the more precise results are possible. This can be achieved by using low thermal conductive materials for the housing of the wearable device and deploying a good isolation between the sensor and the housing.

4 Revision Information

Changes from previous version to current revision v4-00	Page
Updated Ordering Information table with AS6221	3

- Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
- Correction of typographical errors is not explicitly mentioned.

5 Legal Information

Copyrights & Disclaimer

Copyright ams AG, Tobelbader Strasse 30, 8141 Premstaetten, Austria-Europe. Trademarks Registered. All rights reserved. The material herein may not be reproduced, adapted, merged, translated, stored, or used without the prior written consent of the copyright owner.

Information in this document is believed to be accurate and reliable. However, ams AG 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.

Applications that are described herein are for illustrative purposes only. ams AG makes no representation or warranty that such applications will be appropriate for the specified use without further testing or modification. ams AG takes no responsibility for the design, operation and testing of the applications and end-products as well as assistance with the applications or end-product designs when using ams AG products. ams AG is not liable for the suitability and fit of ams AG products in applications and end-products planned.

ams AG shall not be liable to recipient or any third party for any damages, including but not limited to personal injury, property damage, loss of profits, loss of use, interruption of business or indirect, special, incidental or consequential damages, of any kind, in connection with or arising out of the furnishing, performance or use of the technical data or applications described herein. No obligation or liability to recipient or any third party shall arise or flow out of ams AG rendering of technical or other services.

ams AG reserves the right to change information in this document at any time and without notice.

RoHS Compliant & ams Green Statement

RoHS Compliant: The term RoHS compliant means that ams AG products fully comply with current RoHS directives. Our semiconductor products do not contain any chemicals for all 6 substance categories plus additional 4 substance categories (per amendment EU 2015/863), including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, RoHS compliant products are suitable for use in specified lead-free processes.

ams Green (RoHS compliant and no Sb/Br/Cl): ams Green defines that in addition to RoHS compliance, our products are free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material) and do not contain Chlorine (Cl not exceed 0.1% by weight in homogeneous material).

Important Information: The information provided in this statement represents ams AG knowledge and belief as of the date that it is provided. ams AG bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. ams AG has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. ams AG and ams AG suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

Headquarters

ams AG
Tobelbader Strasse 30
8141 Premstaetten
Austria, Europe
Tel: +43 (0) 3136 500 0

Please visit our website at www.ams.com

Buy our products or get free samples online at www.ams.com/Products

Technical Support is available at www.ams.com/Technical-Support

Provide feedback about this document at www.ams.com/Document-Feedback

For sales offices, distributors and representatives go to www.ams.com/Contact

For further information and requests, e-mail us at ams_sales@ams.com