Product Document

Published by
ams OSRAM Group

Application Note

AN000323

AS62xx

Thermal Design Guideline for Wearables

v4-00 • 2020-Nov-23

Content Guide

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

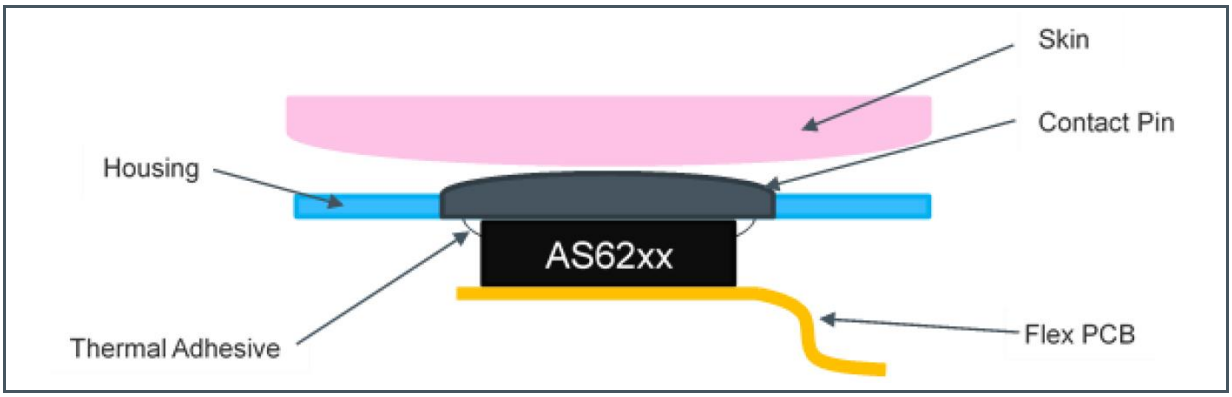
Ordering Code	Package	Marking	Delivery Form	Delivery Quantity
AS6221-AWLT-S	WLCSP	AS6221	Tape & Reel	500 pcs/reel
AS6221-AWLT-L	WLCSP	AS6221	Tape & Reel	5000 pcs/reel
AS6212-AWLT-S	WLCSP	AS6212	Tape & Reel	500 pcs/reel
AS6212-AWLT-L	WLCSP	AS6212	Tape & Reel	5000 pcs/reel
AS6214-AWLT-S	WLCSP	AS6214	Tape & 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.

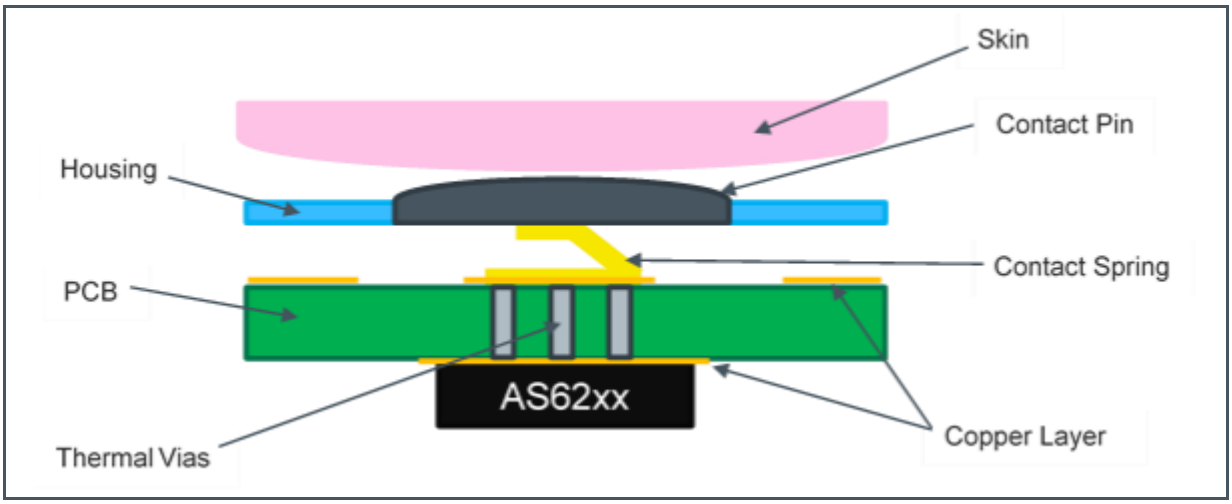
Figure 1:
Flex Mounted Sensor



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.

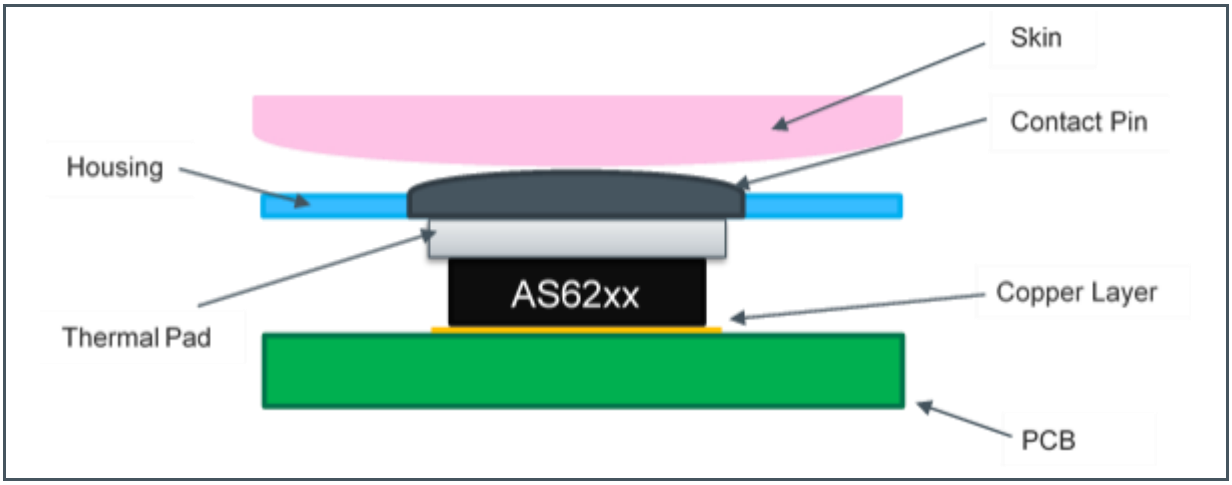
Figure 2:
PCB Mounted Sensor (Contact Spring)



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. Therefor 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.

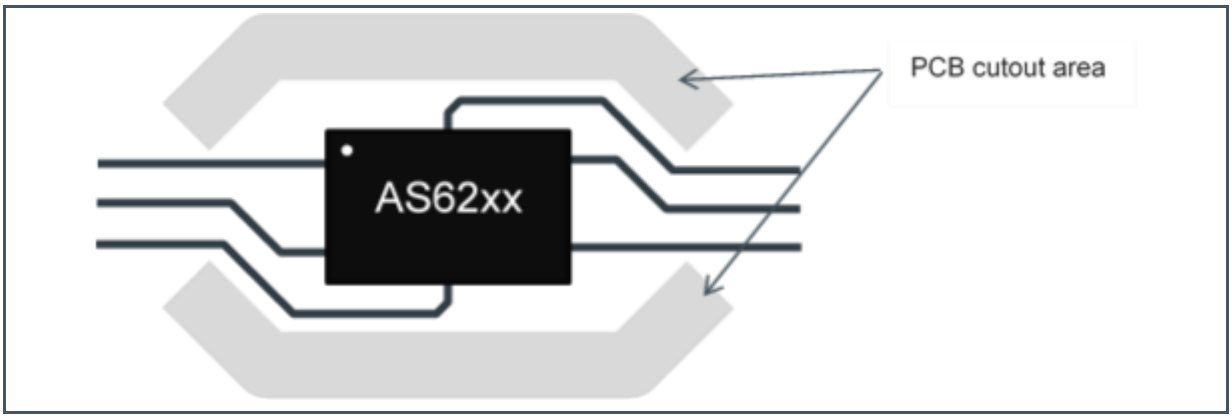
Figure 3:
PCB Mounted Sensor (Thermal Pad)



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.

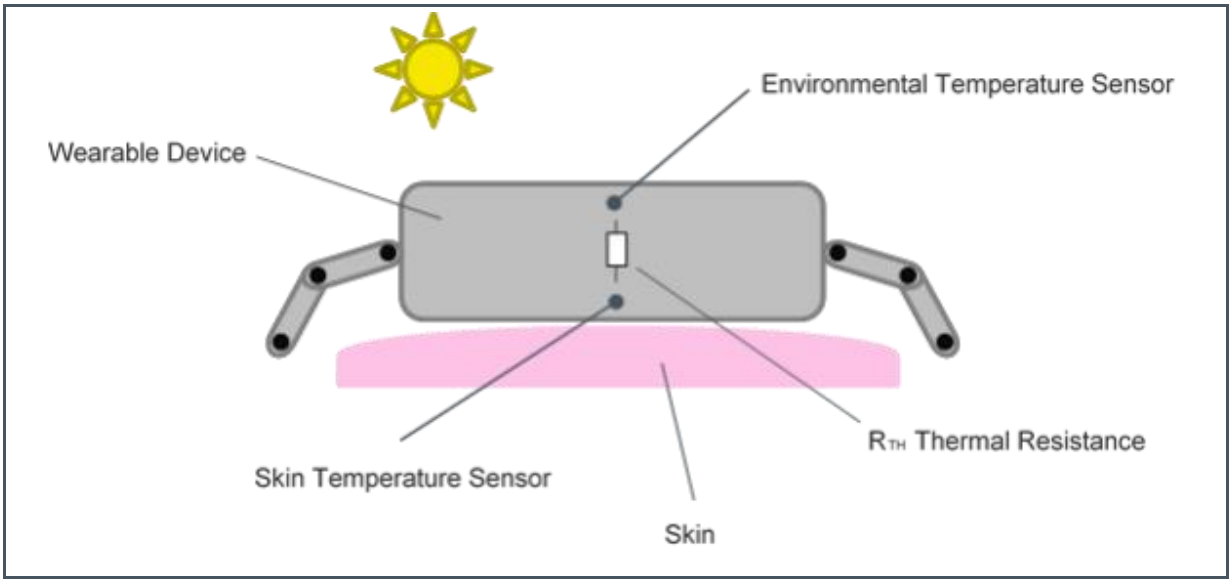
Figure 4:
PCB Cutout



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

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