IEC 62779-3

Edition 1.0 2016-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Semiconductor devices – Semiconductor interface for human body communication –
Part 3: Functional type and its operational conditions

Dispositifs à semiconducteurs – Interface à semiconducteurs pour les communications via le corps humain –
Partie 3: Type fonctionnel et ses conditions d'utilisation

IEC 62779-3:2016-04(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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SEMICONDUCTOR DEVICES – SEMICONDUCTOR INTERFACE FOR HUMAN BODY COMMUNICATION –

Part 3: Functional type and its operational conditions

FOREWORD

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The text of this standard is based on the following documents:

FDIS	Report on voting
47/2282/FDIS	47/2292/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62779 series, published under the general title *Semiconductor devices – Semiconductor interface for human body communication,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The IEC 62779 series is composed of three parts as follows:

- IEC 62779-1 defines general requirements of a semiconductor interface for human body communication. It includes general and functional specifications of the interface.
- IEC 62779-2 defines a measurement method on electrical performances of an electrode that constructs a semiconductor interface for human body communication.
- IEC 62779-3 defines functional type of a semiconductor interface for human body communication, and operational conditions of the interface.

IEC 60748-4 gives requirements on interface integrated circuits for semiconductor devices. Especially, Chapter III, Section 7 in this standard is applied to interface circuits for a communication network using a general channel, such as wire or wireless. However, a channel for HBC is the human body whose channel properties, such as signal loss and delay profile, are different from the general channel, so the Chapter III, Section 7 cannot be applied to an interface for HBC. Furthermore, a standard on a communication protocol for body area network (BAN) – IEEE 802.15.6 (IEEE Std 802.15.6-2012), which includes a communication protocol for HBC was published in 2012. A common interface for HBC should be defined to secure communication compatibility between various devices that are implemented on/inside the human body or embedded in peripheral equipments.

SEMICONDUCTOR DEVICES – SEMICONDUCTOR INTERFACE FOR HUMAN BODY COMMUNICATION –

Part 3: Functional type and its operational conditions

1 Scope

This part of IEC 62779 series defines a functional type of a semiconductor interface for human body communication (HBC). An interface for HBC includes an electrode that is physical structure to transmit a data signal to the human body or receive a transmitted data signal from the body. An electrode directly contacts with the human body in many cases, but it cannot maintain the contact condition when an object, such as clothes, exists between the interface and the body or a near field communication is required; hence, depending on the contact condition, an interface for HBC can be categorized into a contact and non-contact type as shown in Figure 1. This part includes the categorization of the interface for HBC according to the contact condition; and performance parameters characterizing the interface of each category.

a) contact type **b) non-contact type**

Key

Human Body	Human body of a user using HBC	Electrode	Physical structure to transmit an electrical signal to the human body or receive a signal from the human body

Figure 1 – HBC interfaces

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

None.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Interface type

3.1.1
contact-type HBC interface
HBC interface whose electrode has a physical contact with the human body

Note 1 to entry: A contact-type HBC interface generates a strong electromagnetic field which is coupled with the human body through an electrode because a physical contact by an electrode causes a decrease in load impedance of the interface and an increase in output current accordingly.

Note 2 to entry: This note applies to the French language only.

3.1.2
noncontact-type HBC interface
HBC interface whose electrode does not have a physical contact with the human body

Note 1 to entry: Unlike a contact-type HBC interface, a noncontact-type HBC interface generates a weak electromagnetic field through the electrode, in which the field is coupled with the human body through an electrode and an object located between the human body and an electrode.

Note 2 to entry: This note applies to the French language only.

3.2 Detection of HBC interface

3.2.1
contact detection
detection process that determines whether an electrode has a physical contact with the human body or not in the case of a contact-type HBC interface

3.2.2
proximity detection
detection process that determines whether an electrode is within a specific distance from the human body or not in the case of a noncontact-type HBC interface

3.3 Electromagnetic field coupling

3.3.1
field coupling
coupling with the human body of an electromagnetic field generated from a HBC interface

Note 1 to entry: Depending on a frequency of a signal to be transmitted or received, an electric or magnetic field is involved in the field coupling.

3.3.2
directional coupling
field coupling whose amount is dependent on the coupling direction from an electrode to the human body

3.3.3
non-directional coupling
field coupling whose amount is independent on the coupling direction from an electrode to the human body

3.4 Essential rating and characteristics

3.4.1 Signal transmission

3.4.1.1
coupling loss
$L_{coupling}$
signal loss caused by an electrode of a HBC interface

Note 1 to entry: In the case of a directional coupling, a coupling loss is dependent on a coupling direction from the electrode to the human body; however, a coupling loss is a constant irrespective of a coupling direction in the case of a non-directional field coupling.

Note 2 to entry: A coupling loss is represented with a voltage or power ratio.

3.4.1.2
coupling efficiency
$E_{coupling}$
transmission efficiency caused by an electrode of a HBC interface

Note 1 to entry: A transmission efficiency can be obtained by converting a dB scale of a coupling loss into a % scale.

3.4.1.3
coupling conductance
$G_{coupling}$
conductance component in a field coupling that corresponds to a magnitude value of the coupling loss

3.4.1.4
coupling capacitance
$C_{coupling}$
capacitance component in a field coupling that corresponds to a phase value of the coupling loss

3.4.1.5
coupling bandwidth
$BW_{coupling}$
frequency range over which a coupling loss is equal to or less than a specific value

Note 1 to entry: The specific value is usually determined larger by 3 dB from a minimum coupling loss.

3.4.2 Signal radiation

3.4.2.1
coupling distance
$D_{coupling}$
physical distance between the human body and a HBC interface at which the coupling loss is equal to or less than a specific value

Note 1 to entry: The specific value is determined to satisfy a proper sensitivity level of a HBC interface.

Note 2 to entry: The coupling distance is defined only for a noncontact-type interface.

3.4.2.2
directivity
$DIR_{coupling}$
range of direction in angle or distance at which a coupling loss is equal to or less than a specific value in the case of a directional coupling

Note 1 to entry: The specific value is determined to satisfy a proper sensitivity level of a HBC interface.

3.5 Other terms and definitions

3.5.1
load impedance
Z_{load}
impedance seen by a HBC interface in a direction from an electrode towards the human body

Note 1 to entry: In the case of a noncontact-type interface, the load impedance includes an impedance by an object between the human body and a HBC interface.

3.5.2
detection time
$T_{detection}$
minimum required time to detect a physical contact or proximity of an electrode

4 Interface type

4.1 General specifications

4.1.1 Function

4.1.1.1 Category

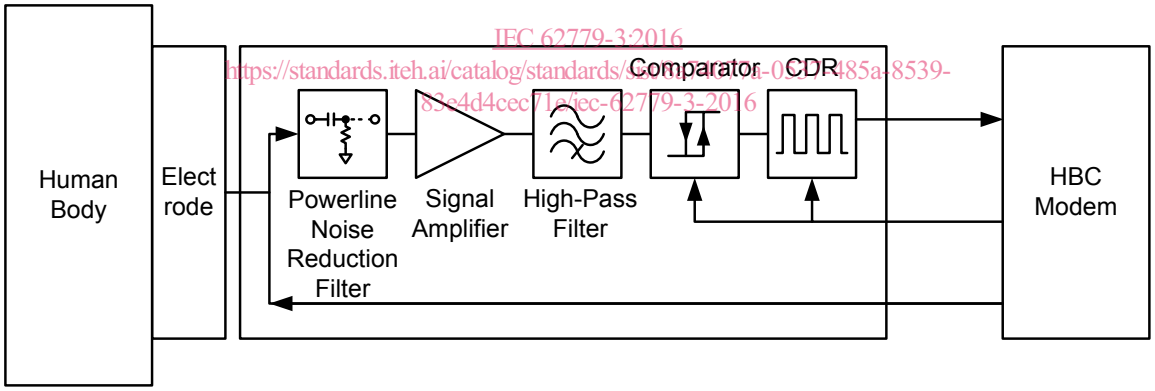
If a HBC interface has a different category, a contact or non-contact type, according to a contact condition, the condition and type of contact should be provided.

4.1.1.2 Functional description

An interface for HBC is a device to transmit a data signal to the human body or receive a transmitted data signal from the body. If applicable, differences in functions of each interface type shall be given.

4.1.1.3 Block diagram

Interface's overall structure shall be given. Details of the structure shall be given using a block diagram as presented in Figure 2 below.



IEC

Key

Human Body	Human body of a user using HBC	Electrode	Physical structure to transmit an electrical signal to the human body or receive a signal from the human body
Powerline Noise Reduction Filter	Circuit to remove a noise signal generated from a powerline in a narrow frequency-band	Signal Amplifier	Circuit to amplify a receiving signal
High Pass Filter	Circuit to remove a noise signal in a wide frequency-band	Comparator	Circuit to transform an analog signal into a digital signal
CDR	Clock-data-recovery circuit to remove jitter in a digital signal	HBC Modem	Circuit to modulate and demodulate a data signal

Figure 2 – Block diagram of interface

NOTE 1 The powerline noise reduction filter can be removed if the power of the noise signal is not high enough to saturate the active components in the interface.

NOTE 2 Order of the components in the interface can be changed.

If applicable, a functional part for contact or proximity detection shall be defined in a block diagram. Also, control signals to support a detection process should be defined.

4.1.2 Implementation

4.1.2.1 Interface Package

Package type, for example ceramic, plastic or glass, shall be given. If applicable, IEC and/or national reference number of the outline drawing shall be stated.

4.1.2.2 Electrode

4.1.2.2.1 Electrode appearance

Material properties with respect to an electrode and electrode's physical dimensions shall be stated.

4.1.2.2.2 Electrode location

The position of the electrode to be implemented in a HBC interface shall be given. Details on the position, such as distances from a reference point in a HBC interface, shall be included.

If applicable, the position where an electrode shall not be implemented shall be stated.

4.1.3 Compatibility

Compatibility between interfaces having a different type shall be stated.

If applicable, required conditions to achieve compatibility should be given.

4.2 Electrical specifications

4.2.1 Coupling specifications

Coupling specifications of a HBC interface shall be given as shown in Table 1 below.

Table 1 – Coupling specifications of a HBC interface

Specification	Symbol	Value			Unit
		Min.	Typ.	Max.	
Coupling loss	$L_{coupling}$				dB
Coupling efficiency	$E_{coupling}$				%
Coupling conductance	$G_{coupling}$				S
Coupling capacitance	$C_{coupling}$				F
Coupling bandwidth	$BW_{coupling}$				Hz
Coupling distance	$D_{coupling}$				M
Load impedance	Z_{load}				Ω
Detection time	$T_{detection}$				s

4.2.2 Directional specifications

Direction specifications of a HBC interface shall be given as shown in Table 2 below.