

Module Datasheet

Headphone / Headset Wireless Receiver System, based on the AV6202 IC



AVNERA

General Description

The SWA19 module represents a new level of system integration offering customers fast time to market with a digital wireless receiver ideal for wireless headphone applications. The SWA19 Receiver module is optimized for low-cost, high-quality and ease-of-use.

The module incorporates Avnera's proprietary wireless audio protocol, designed from the ground up specifically for audio. It features low fixed latency, uncompressed CD quality stereo audio, superior interference immunity and industry leading coexistence with WiFi – even at close proximity to a WiFi device.

The SWA19 Receiver module integrates all features necessary to complete a wireless Headphone device, including AV6202 Wireless Audio Chip, diversity chip antennas, flash memory, and all passive components.

The module measures just 30 x 30 x 3.5 mm and is castellated for direct surface mount to a PCB.

The SWA19 receiver module may be paired with the SWA13 Transmitter device.

The module can be certified to worldwide standards.

Applications

- ✓ Premium Wireless Headphone

Ordering Options

SWA19

Features

- ✓ I2S Digital Output interface with >94dB end-to-end digital audio path
- ✓ Analog Headphone Driver
- ✓ Analog microphone input
- ✓ Direct connection to Li-Ion battery
- ✓ Integrated battery charger
- ✓ 2.4 GHz ISM band, continuous dynamic channel selection
- ✓ Auto-search/synch and dynamic channel selection
- ✓ Low and fixed latency
- ✓ 24 pin castellated module
- ✓ Over-the-air firmware update capability
- ✓ Customizable firmware for simple, low-cost, wireless headphone implementations
- ✓ General purpose over-the-air (OTA) serial interface:
 - ✓ 11 kbps, bi-directional, full duplex



1 Table of Contents

.....	1
General Description	1
Applications	1
Ordering Options	1
Features	1
1 Table of Contents	2
2 Lists of Figures and Tables	3
3 SWA19 Functional	4
3.1 SWA19 Module Connections	5
4 SWA19 Pin Def	6
5 SWA19 Mechanical Dimensions(unit :mm)	7
.....	7
.....	7
.....	8
.....	8
6 Electrical Specifications	9
6.1 Absolute Maximum Ratings	9
6.2 Recommended Operating Range	9
6.3 Electrical Characteristics	10
6.4 I²S Communication Interface Timing	11
6.5 I2C Master/Slave Communication Interface Timing (S_SCL, S_SDA)	12
7 FCC and Industry Canada certification information	13
8 Ordering Information	13

2 Lists of Figures and Tables

Table 1: SWA19 Connector Information	6
Table 2; SWA19 RF Transceiver Characteristics.....	10
Table 3; SWA19 Audio Characteristics	10
Table 4; SWA19 Audio Latency Characteristics	10
Table 5; SWA19 Current Characteristics	10
Table 6; SWA19 I2S Timing	11
Table 7; Characteristics of the S_SDA and S_SCL I/Os	12
Table 8: SWA19 Module Ordering Information	13

3 SWA19 Functional

The SWA19 module is a digital output receiver module. There is an I2S port for digital audio output that can be configured to be a master or a slave. In addition, MCLK can be generated from the module, or input to the module as required by the system application.

The highly integrated nature of the AV6202 transceiver IC results in few external components being required for the SWA19 module design. 2 chip antennas offer diversity, and the simple RF path consists only of the antennas, associated tuning components, An RF switch and a balun connected to the AV6202 IC. A 16MHz crystal generates the AV6202 system clock signal used as the basis for all RF and digital audio signals. In addition, a 2Mb flash memory stores the factory based firmware, as well as firmware upgrade images and configuration parameters.

The module firmware enables upgrades to be performed by the USB interface or over-the-air. The module can be controlled from an external

host device via the SPI interface. The I2C master port allows the module to control other system audio devices such as a DAC / amplifier system without having to add another MCU to the product design. 15 GPIOs are supported with the SWA19 module including I2C, SPI and I2S signals. This large number of GPIOs can be leveraged to implement low cost wireless audio products as outlined below.

The stereo 44.4 kSps over the air sample rate optimizes audio quality and WiFi co-existence performance.

Typical Headphone Implementation

An example of a simple wireless headphone that incorporates SWA19 as the wireless receiver and uses MCU for user interface and Codec control is shown in Fig. 2.

3.1 SWA19 Module Connections

Signal Type	Description
VDC IN	This module pin may be connected to VDC or VIN – depending on the customer requirement (to be determined before schematic finalization). If the battery charger function is to be used, VDC must be connected to 5V DC. If a direct connection to a battery or 3.3V supply is intended then VDC will connect to the VIN pin of AV6202
VIN	Direct battery connection or regulated supply, 3.3V or 3.6Vv
Vbat	Battery charger output
TS	Battery Temperature sensor input
PWR	Power button connection to the module. This feature can be used to wake the module from a shutdown state. Pull low through an open collector device or mechanical switch to wake the module.
Reset	Active low reset input. Reset the device by driving this pin low from an open collector/drain device such that it can pull to ground for the active reset state but, when released, must be allowed to go to a high impedance state. This pin should not be driven high.
I2S Out Port	The I2S output port can be configured as a master or slave. Consequently BCLK and LRCK can be either inputs or outputs. In addition, MCLK can be generated by the module on pin 16, or used as an input. Typically, as the AV6202 IC contains a sample rate converter, MCLK is not required to be supplied to the module when it is an I2S slave. CMOS 3.3 logic levels are used for all I2S signals.
SPI Slave Port	The SPI slave port is used for external host communication and during module test
I2C Master Port	The I2C master port is used to communicate with external audio devices such as a sub-woofer amplifier. The SDA and SCL require external pull ups, 2.7 to 3.3kohm.
GPIOs	3.3V CMOS logic level GPIOs available to connect to other devices, or to use as UI supporting GPIOs for LED and button support. All supported GPIOs can be configured as inputs or outputs.

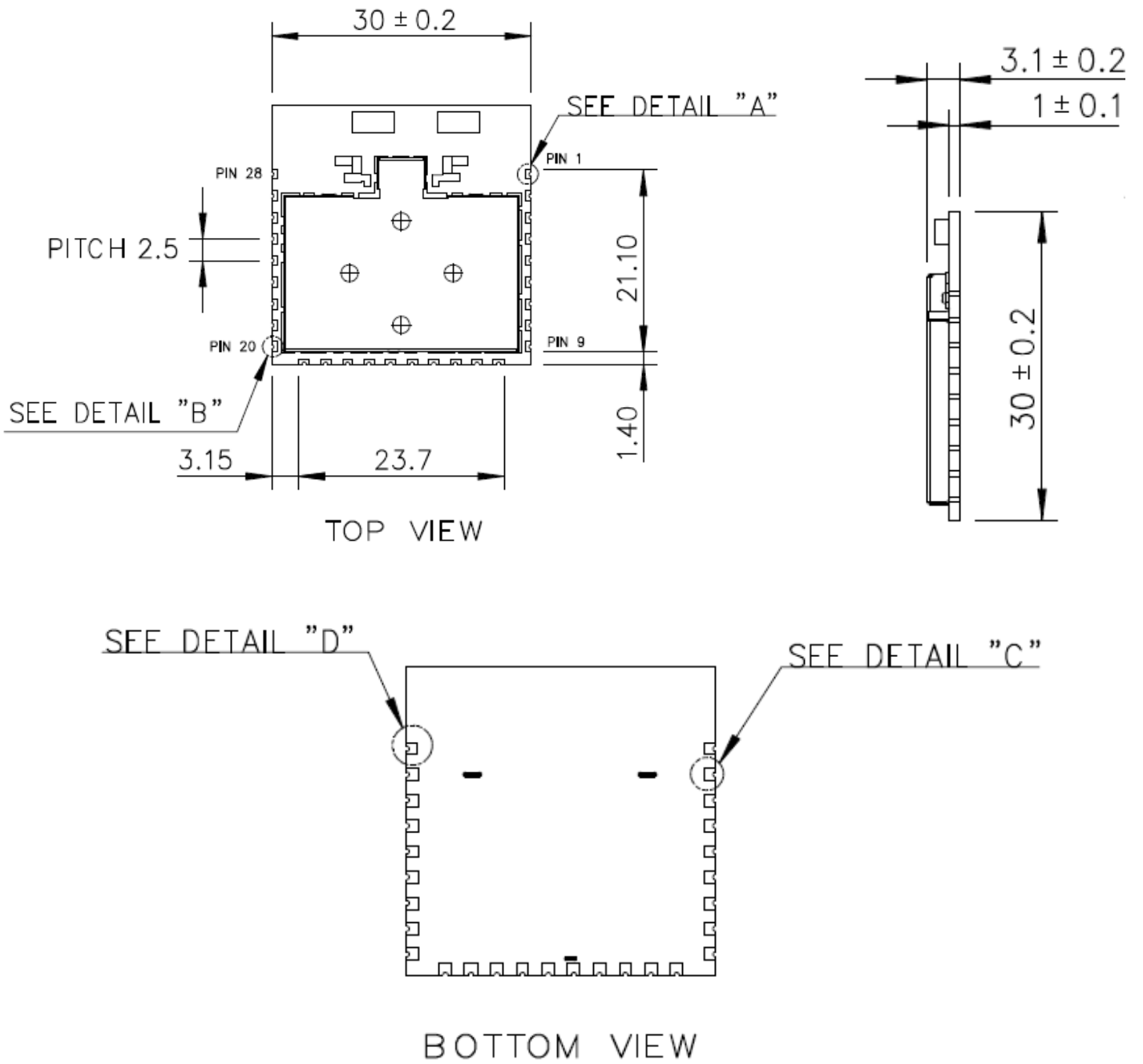
4 SWA19 Pin Def.

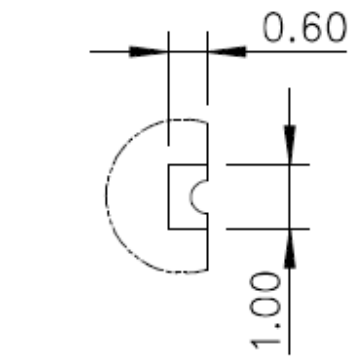
No	Pin Name	I/O	AV6202	Pin	Pin Description
1	1NC/ANT0	I/O			NC or Conductive Ant0 RF Output
2	GND	-			GND
3	3ADOUT/GPIO16	O/I	GPIO16	6	I2S stereo out or GPIO
4	4NC/GPIO1	I/O	GPIO1	4	NC or GPIO
5	5S_SSB/GPIO2	I/O	GPIO2	3	SPI slave port or GPIO ; HOST Control interface
6	6S_SCLK/GPIO3	I/O	GPIO3	2	SPI slave port or GPIO ; HOST Control interface
7	7S_MOSI/GPIO4	I/O	GPIO4	1	SPI slave port or GPIO ; HOST Control interface
8	8S_MISO/GPIO5	I/O	GPIO5	56	SPI slave port or GPIO ; HOST Control interface
9	9M_MISO/GPIO6	I/O	GPIO6	55	SPI MASTER port or GPIO
10	10M_MOSI/GPIO7	I/O	GPIO7	54	SPI MASTER port or GPIO
11	11M_SCLK/GPIO8	I/O	GPIO8	53	SPI MASTER port or GPIO
12	12M_SSB/GPIO9	I/O	GPIO9	52	SPI MASTER port or GPIO
13	13USB_DP	I/O	USBDP	45	USB2.0 positive transceiver I/O
14	14USB_DN	I/O	USBDN	44	USB2.0 negative transceiver I/O
15	GND	-			GND
16	16MCLK/GPIO17	O	GPIO17	51	I2S MCLK or GPIO
17	17BCLK/GPIO12	I/O	GPIO12	43	I2S BCLK or GPIO
18	18WCLK/GPIO13	I/O	GPIO13	42	I2S WCLK or GPIO
19	19GPIO14/M_SCL	I/O	GPIO14	41	Function defined by firmware application.
20	20GPIO15/M_SDA	I/O	GPIO15	40	Function defined by firmware application.
21	21RESETN	I	RESETN	39	Active-LOW Reset input expecting open drain connection
22	22NC/TEMP_SENS	O	TS	38	NC OR TEMP_SENS : connect to thermistor on the Li/Ion battery
23	23NC/~PWR	I	PWR	37	Active-LOW WAKE-UP input from shutdown mode expecting open-drain/collector type switch
24	24NC/VBAT	O	VBAT	34	NC or output of the battery charger
25	25VDC_IN*a	I	VDC	32	+5V +/- 10% ; only needed when USB used *a
26	26VIN*a	I	VIN	35	Module main power in 3.2-4.3 V *a
27	GND	-			GND
28	28NC/ANT1	I/O			NC or Conductive Ant1 RF Output

*a : When SWA19 not use USB/charger functionality, u only need to supply power to “26VIN” pin which is 3.2~4.3V input range, and float “25VDC_IN” pin.
When SWA19 need USB function, u only need to supply power to “25VDC_IN” pin, and float “26VIN” pin .

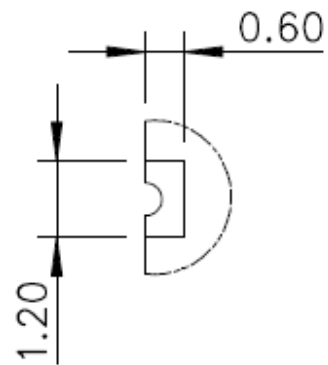
Table 1: SWA19 Connector Information

5 SWA19 Mechanical Dimensions(unit :mm)

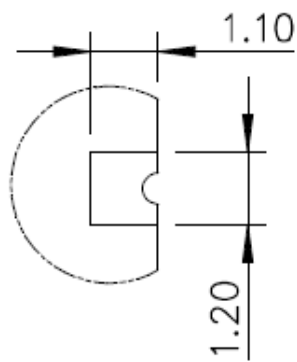




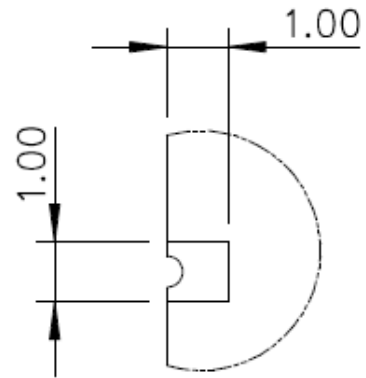
PIN 1 & 28
TOP GOLDEN PAD
SEE DETAIL "A"



PIN 2~27 TOP GOLDEN PAD
SEE DETAIL "B"



PIN 2~27 BOTTOM GOLDEN PAD
SEE DETAIL "C"



PIN 1 & 28
BOTTOM GOLDEN PAD
SEE DETAIL "D"

Figure 1: SWA19 Mechanical Dimensions

6 Electrical Specifications

6.1 Absolute Maximum Ratings

Absolute Maximum Ratings (AMR) are stress ratings only. AMR corresponds to the maximum value that can be applied without leading to instantaneous or very short-term unrecoverable hard failure (destructive breakdown). Stresses beyond those listed under AMR may cause permanent damage to the device.

Functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Range" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may adversely affect device reliability.

Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics at the test conditions specified.

CONDITION	MIN	MAX
VDC or VIN Supply Voltage Input	-0.3V	6.0V
Input Voltage Range – Digital Inputs	-0.3V	3.6V
Operating Temperature ¹	-10°C	+70°C
Storage Temperature	-20°C	+80°C
Static Discharge Voltage ¹	-10kV	+10kV

Notes:

Note 1: $\pm 10\text{kV}$, 150pF/330ohms discharge per IEC/EN61000-4-2

6.2 Recommended Operating Range

PARAMETER	MIN	TYP	MAX	UNIT
+5V Supply pin voltage	4.5	5.0	5.5	V
VIN Voltage range	3.2	3.6	4.3	V
Ambient Temperature (T_A)	0		60	°C

6.3 Electrical Characteristics

Test Conditions: $T_A=+25^{\circ}\text{C}$, $V_{DC}=+5.0\text{V}$

Table 2; SWA19 RF Transceiver Characteristics

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
RF Frequency Range		2403.35		2477.35	MHz
RX Sensitivity ¹			-88		dBm
Range (NLOS)			15		m
Range (LOS)			50		m

Note 1: Measured with the SWA19 PCB antenna disabled and test RF connector added. Sensitivity is defined as the onset of 0.2% BLER Clock Error Rate.

Table 3; SWA19 Audio Characteristics

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Response ¹	Stereo full band FW build	20		20K	Hz
Gain Flatness ²	0dB Input/Output Gain		± 0.2		dB
SNR	I2S Input/Output		94		dB
THD+N			94		dB

Note 1: 16 bit audio, 44.4KSps over-the-air sample rate firmware build

Note 2: 16 bit audio, 44.4KSps over-the-air sample rate firmware build – 20 KHz frequency response

Table 4; SWA19 Audio Latency Characteristics

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
44.4KSps OTA Sample Latency	Standard Firmware		14		ms

Table 5; SWA19 Current Characteristics

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Current	No Audio Linked ⁴		35		mA
	Searching ⁵		55		mA
	No Load, 1 kHz tone, 0 dB FS		50		mA

Note 4: Specification represents an average current with the I2S clocks running. Peak current is ~ 2x the average.

Note 5: Searching is where the Rx module is not linked but is attempting to find a Tx module to link with. Peak current is ~ 80mA.

Note 6: After the Rx module has not been linked for > 30 seconds it will go to a duty cycling standby state reflected by this specification. Peak current is ~ 80mA.

6.4 I²S Communication Interface Timing

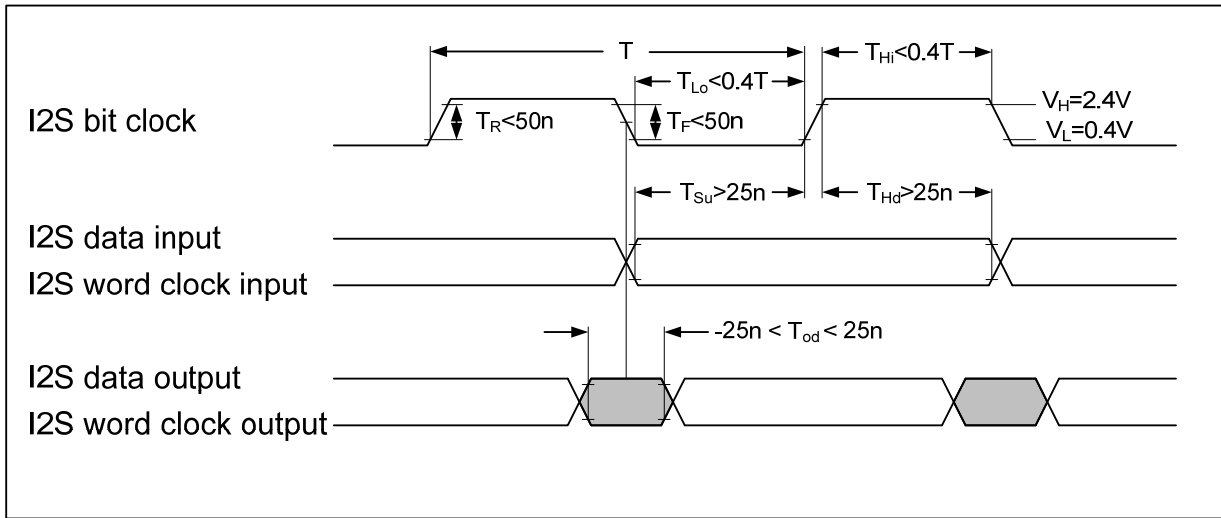
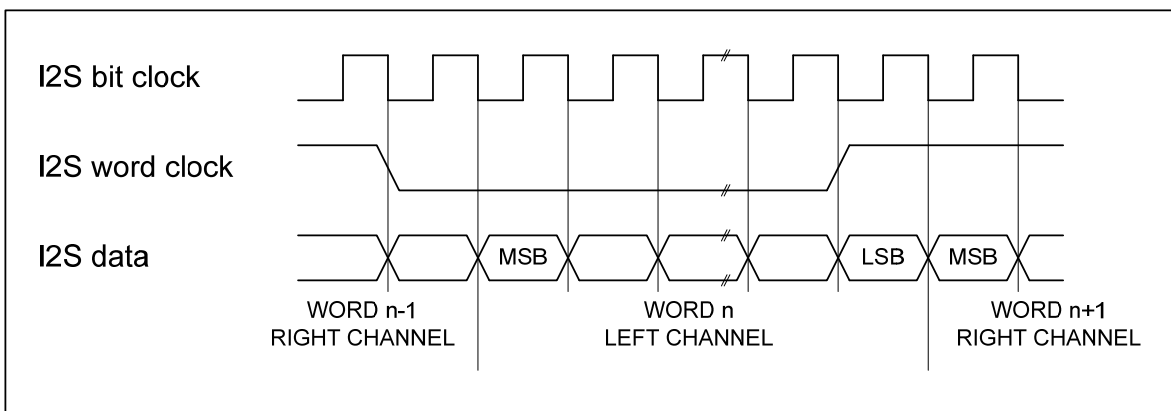


Table 6; SWA19I2S Timing

		MIN	TYP	MAX	UNIT	NOTES
V _L	low voltage level	-0.3V	0.0V	0.4V	V	
V _H	high voltage level	2.4V	3.3V	3.6V	V	
T	clock period		325.5n		s	1/3.072MHz
T _{Lo}	clock low period	0.4T		0.6T		
T _{Hi}	clock high period	0.4T		0.6T		
T _R	rise time			50n	s	Note 1
T _F	fall time			50n	s	Note 1
T _{Su}	setup time	25n			s	
T _{Hd}	hold time	25n			s	
T _{Od}	output delay	-25n		25n	s	
	bit clocks/word clock		64			

I2S protocol is "I2S Justified" as shown below.



Note 1: The timing specified for the rise and fall times represents the edge rates on the module itself. The rise and fall times of the I2S signals are determined by ESD/EMI mitigation components on the modules, as well as external loading, and will be higher than the specified numbers

6.5 I2C Master/Slave Communication Interface Timing (S_SCL, S_SDA)

The SWA19 has both I2C slave and master interfaces available with their respective pins S_SCL and S_SDA. The interfaces operate in I2C fast-mode and can receive and transmit at up to 400 kbit/s.

Bytes are 8 bits long and are transferred with the most significant bit (MSB) first. Each byte has to be followed by an acknowledge bit. The SWA19 will apply clock-stopping (by holding the clock line S_SCL LOW to force the master into a wait state) if necessary due to internal high-priority tasks.

The slave/master interface can be used both for writing (e.g. sending commands) or reading (e.g. requesting status).

The SWA19 slave interface responds to the 7-bit slave address 1000000 (0x40) as shown in Figure 1 below.

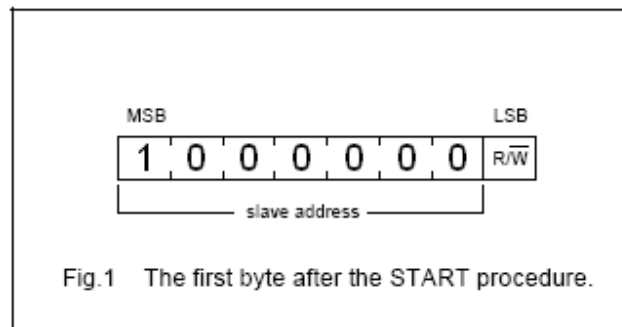


Fig.1 The first byte after the START procedure.

ELECTRICAL SPECIFICATIONS AND TIMING

Table 7; Characteristics of the S_SDA and S_SCL I/Os

PARAMETER	SYMBOL	FAST-MODE		UNIT
		MIN.	MAX.	
LOW level input voltage	V _{IL}	-0.3	0.8	V
HIGH level input voltage	V _{IH}	2.0	3.6	V
LOW level output voltage (open drain or open collector) at 1 mA sink current:	V _{OL}	0	0.4	V
Output fall time from V _{IHmin} to V _{ILmax} with a bus capacitance from 10 pF to 400 pF	t _{of}	0	250	ns
Pulse width of spikes which must be suppressed by the input filter	t _{SP}	0	50	ns
S_SCL clock frequency	f _{SCL}	0	400	kHz
LOW period of the S_SCL clock	t _{LOW}	1.3	–	μs
HIGH period of the S_SCL clock	t _{HIGH}	0.6	–	μs
Data hold time	t _{HD;DAT}	100	–	ns
Data set-up time	t _{SU;DAT}	100	–	ns

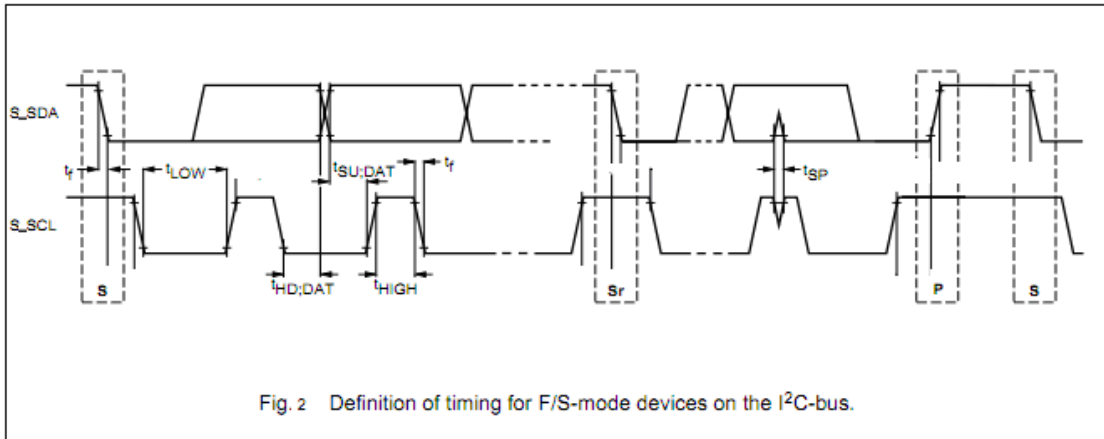


Fig. 2 Definition of timing for F/S-mode devices on the I²C-bus.

7 FCC and Industry Canada certification information

FCC : NKR-SWA19

IC : 4441A-SWA19

8 Ordering Information

Table 8: SWA19 Module Ordering Information

Module Part Number	Option Code	Description
SWA19		

FCC Statement:

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2P.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated.

Additional testing and certification may be necessary when multiple modules are used.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: NKR-SWA19 ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

IC Statement:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This device and its antenna(s) must not be co-located with any other transmitters except in accordance with IC multi-transmitter product procedures.

Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without reassessment permissive change.

Cet appareil et son antenne (s) ne doit pas être co-localisés ou fonctionnement en association avec une autre antenne ou transmetteur.

IMPORTANT NOTE:**IC Radiation Exposure Statement:**

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

This module is intended for OEM integrator. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX IC : 4441A-SWA19 ".

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	TDK	ANT016008LCS2442MA2	Chip Antenna	N/A	-2.68
2	TDK	ANT016008LCS2442MA2	Chip Antenna	N/A	-1.61