Industrial Audio Player
MP3 SD with build-in amplifier
2x20 Watt and Bluetooth

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Table of contents

1. Short description of Embedded MP3 Player

Industrial 2x20 Watt audio player with built-in BlueTooth module. It is used to listen to music and sound messages from the SD card and thanks to the BlueTooth module it has the ability to play music from a tablet, smartphone, laptop or other device compatible with the BT A2DP profile.

Technical information:
- supported file format: MP3 – type MPEG I, II, III,
- class D audio amplifier,
- speaker impedance from 4 to 8 ohm,
- 28 gradual volume control,
- audio file sampling frequency MP3: 32 kHz, 44.1 kHz, 48 kHz,
- audio resolution 24 bit,
- bitrate MP3 96kbit – 320kbit
- wireless communication - BlueTooth 2.4GHz,
- profile BlueTooth - A2DP,
- build-in equalizer Bluetooth,
- Bluetooth range up to 10m,
- several different operation modes,

- simple player control: from microcontroller or buttons,

- supported file format type: FAT, FAT32,

- supported memory type: SD or SDHC,

- support of RS485 ModBus Slave,

- inputs 10x Binary Active 5V-24V,

- work temperature -20°C do +80°C (without SD),

- power supply 12-24V,

- aluminum case.

2. Pinout

The audio player has 4 configuration pins, 10 control pins, an output for connecting speakers, a power connector, a connector for an SD card and 2 two LEDs. The pinout layout is shown below:

a) front part of the player:
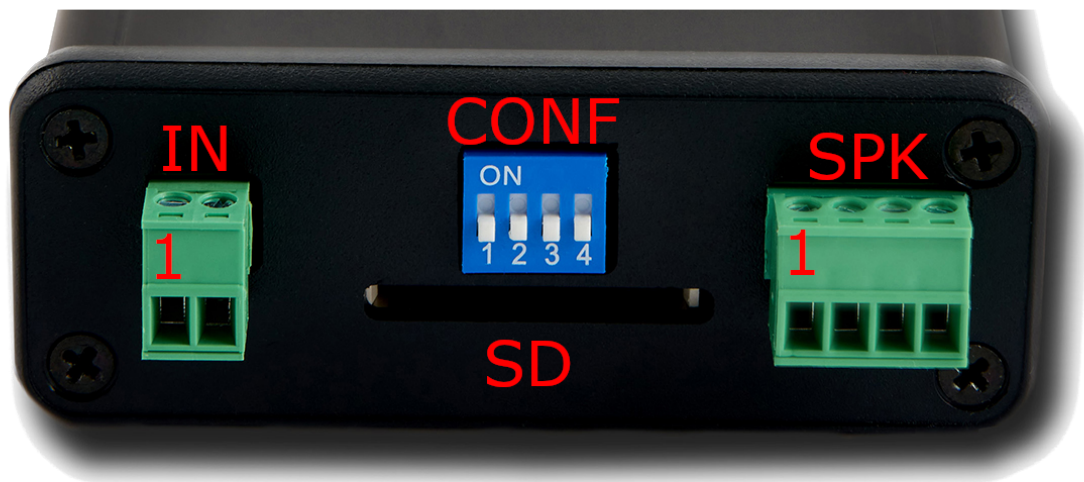
Configuration pins **CONF**:
They are used to select the operating mode. Their full description is presented in Chapter 3.

Power connector **IN**:
Pin 1 : GND –
Pin 2 : VCC +

Speaker connector **SPK**:
Pin 1 : output, right channel +
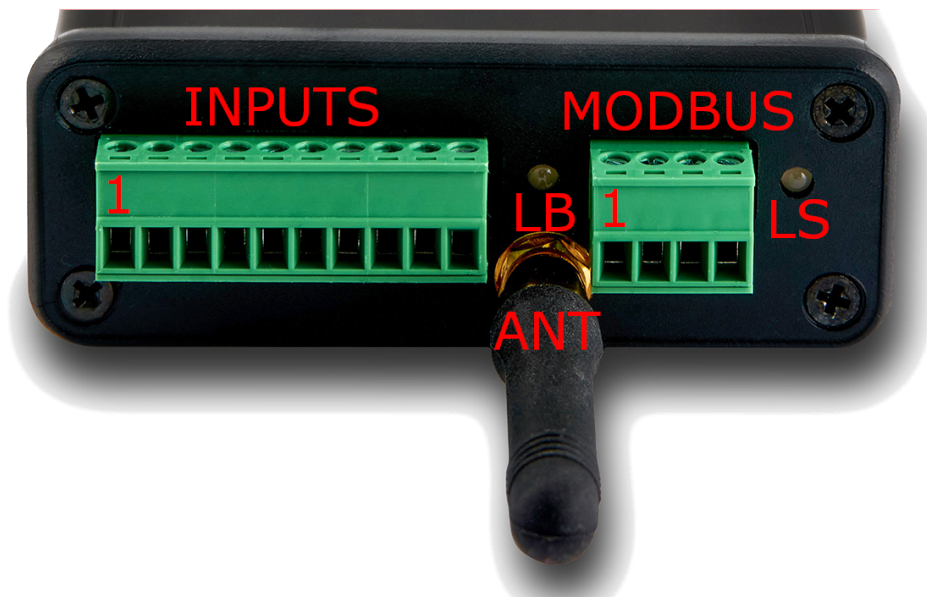Pin 2 : output, right channel -
Pin 3 : output, left channel -
Pin 4 : output, left channel +

Connector of **SD** card:
Connector for „big" SD card.

b) rear part of the player:

Connector **INPUTS**:

Pin 1 to 10 : their function depends on the selected operating mode, details in chapter 8,

Communication **MODBUS**:

Pin 1: VCC +, use only for driving a inputs IN1 do IN10

Pin 2: RS485 B,

Pin 3: RS485 A,

Pin 4: GND.

Antenna **ANT**:

Used with Bluetooth module.

Diode LED **LS**:

They indicate the current state of the player:

    a) LED is off - no SD card,

    b) orange diode is on - SD card OK.

Diode LED **LB**:

    a) LED is off - BT module not initialized,

    b) orange diode is on - BT module is ready to work,

    c) blue diode is on - connected BT device.

2.1 Device Dimensions

82,00 mm

150,00 mm

127,00 mm

All dimensions are in millimeters.

3. Description of the functionality

The operation of the MP3 module depends on its configuration. 4 configuration jumpers CONF1, CONF 2, CONF 3, CONF4 are used to determine the operating mode. In order to change the operating mode, move the appropriate jumper up or down. The jumper in the lower position is OFF, the jumper in the upper position is ON:

After purchasing the device, all jumpers are in the OFF position.

We can choose the following operating modes of the player:

Jumpers position CONF				Work Mode
4	3	2	1	
OFF	OFF	OFF	OFF	- normal The player works in the standard player mode. The following buttons are available: START, STOP, NEXT, PREV, VOL+, VOL-
OFF	OFF	OFF	ON	- unattended After turning on the module, the music is played over and over again, without interruption.

OFF	OFF	ON	OFF	- numbers After pressing the button, tracks with the file name 1.mp3, 2.mp3 etc. are played. Pressing another button does not interrupt the playback.
OFF	OFF	ON	ON	- numbers 2 After pressing the button, tracks with the file name 1.mp3, 2.mp3 etc. are played. Pressing another button interrupt the playback.
OFF	ON	OFF	ON	- BT Target Remote management of connected device.

4. Modes of operation

The player allows you to work in several operating modes. Each of them has a different mode of action.

Modbus communication can be used in each mode.

You can connect to the device at any time via the Bluetooth module.

The volume is set in the configuration file, see chapter 5.

The mp3 player can work in the following modes:

a) normal – in this mode the player waits for the user's reaction. We can choose the following actions:

- IN 1 - START – the player starts playing the mp3 file once,

- IN 2 - STOP – stopping playback,

- IN 3 - NEXT – go to the next file,

- IN 4 - PRV – go to the previous file,

- IN 5 - VOL+ - increases the volume level (28-step adjustment),

- IN 6 -VOL- - reduces the volume level (28-step adjustment),

b) unattended – the player starts playing music as soon as it finds the mp3 file.

c) numbers – Pressing the button causes playback of files with the specified name:

- IN 1 – the file is being played 1.mp3,

- IN 2 – the file is being played 2.mp3,

- IN 3 – the file is being played 3.mp3,

- IN 4 – the file is being played 4.mp3,

- IN 5 – the file is being played 5.mp3,

- IN 6 – the file is being played 6.mp3,

- IN 7 – the file is being played 7.mp3,

- IN 8 – the file is being played 8.mp3,

- IN 9 – the file is being played 9.mp3,

- IN 10 – the file is being played 10.mp3.

Playing the next file is possible only after the current file has finished playing.

d) numbers 2 – same as the special mode, except that during playback, pressing another button stops playback.

e) BT Target – the ability to remote management of connected device using inputs:

- IN 1 – BT START – remote start playing command,

- IN 2 - BT STOP – remote stop playing command,

- IN 3 - BT NEXT – remote next file command,

- IN 4 - BT PRV – remote previous command,

- IN 5 - BT VOL+ - remote increase volume command,

- IN 6 - BT VOL- - remote decrease volume command,

- IN 7 – BT Connect – enables BT pairing,

- IN 8 – BT Connect Time - enables BT pairing for 60 sec.

- IN 9 – BT Stop Connect – disables BT pairing.

5. Bluetooth

The device is equipped with a Bluetooth module with an external antenna, a preamplifier and a 2x20 Watt power amplifier. A2DP profile is used for wireless audio transmission from devices such as tablets, smartphones, laptops, etc. Stable Bluetooth connectivity ensures simplicity for the hotel guest and excellent sound quality. The device allows for easy configuration and complete management from the hotel's BMS system using the Modbus protocol.

Specifications:

- BlueTooth 4.2,
- profile A2DP,
- build-in equalizer,
- external antenna,
- range up to 10m.

5.1 BT operations

You can manage the Bluetooth module in two ways:

a) using the configuration file (described in chapter 6):

In this mode, you can set parameters such as:

- Bluetooth name,

- maximum volume,

- preamplifier settings.

Bluetooth connection is always available. At any time, the client can connect and play his music track. Once connected, playback from the internal SD card stops.

b) using the Modbus protocol (described in chapter 7):

Thanks to the Modbus protocol, we have greater possibilities of managing the Bluetooth module. We can set parameters such as:

- maximum volume,

- equalizer settings,

- managing the Bluetooth connection,

- remote playback of content from an SD card,

- reading the current state of the device.

6. Configuration file

In addition to the configuration jumpers described in chapter 3, you must configure the Bluetooth module using a configuration file. This file should be uploaded to the SD card and it is read each time the device is turned on. A sample file can be downloaded from the product page.

File details:

    Name: bt.txt

    Available settings:

    a) NAME:MY_BT
    b) BTVOL:10
    c) INTVOL:6
    d) EQEN:0
    e) EQ31:0
    f) EQ62:2
    g) EQ125:8
    h) EQ250:13
    i) EQ500:10
    j) EQ1K:2
    k) EQ2K:-3
    l) EQ4K:-6
    m) EQ8K:-10
    n) EQ16K:-13
    o) MBBAUD:38400
    p) MBPAR:0
    q) MBADDR:20

Description of settings:

- NAME – the name under which the Bluetooth device appears,

- BTVOL – the maximum volume level for Bluetooth playback (max 28),

- INTVOL - maximum volume level when playing MP3 files (max 28),

- EQEN – is the equalizer enabled (0 = disabled, 1 = enabled),

- EQ31.... EQ16K – signal level for the equalizer (min. -13, max. 13),

- MBBAUD – Modbus transmission speed (available speeds: 2400, 4800, 9600, 19200, 38400, 57600, 115200, 256000),

- MBPAR - Modbus parity (0 = ODD, 1 = EVEN, 2 = NONE),

- MBADDR – Modbus device address.

7. Modbus Slave

Modbus communication is always available in any mode. For correct communication, set the transmission parameters in the bt.txt file (see chapter 6), such as:

- baudrate: MBBAUD,

- parity: MBPAR,

- slave module address: MBADDR.

Other parameters:

- Number of bits: 8

- Stop bit: 1

- waiting time for a response: min. 2 sec.

The Modbus protocol supports the following functions:

   a)   readable:

   - Coils – address 51 – details in chapter 7.1

   - Holding Registers – addresses 101 and 201 - details in chapter 7.2

   b)   writable:

   - Holding Registers – addresses 101 and 201 - details in chapter 7.2

7.1 Modbus Slave - Coils

The supported function of the device is the ability to read Coils, starting with address 51. This function is only for reading the current status of the device. A maximum of 4 values can be read:

- address 51 (IS_READY): 0 = player not ready, 1 = player ready,

- address 52 (BT_CONNECTED): 0 = BT client not connected, 1 = connected to the device

- address 53 (BT_IS_PLAYING): 0 = music is not played from BT, 1 = client is playing music,

- address 54 (AUDIO_PLAYING): 0 = the audio track from the SD card is not played, 1 = it is playing the audio track from the SD card.

7.2 Modbus Slave – Holding Registers

The supported function of the device is the ability to read Holding Registers starting with addresses 101 and 201. Both addresses have possibility to read and write.

1. Holding Registers – address 101 - are used for general configuration of the device. It is enough to send all the settings once after starting the device (COILS IS_READY change from 0 to 1)

   Configuration options available:

   - address 101 (BT_VOL): playback volume using BT, from 0 = mute, the maximum volume level is 28.

   - address 102 (INT_VOL): playback volume from internal SD card, 0 = mute, the maximum volume level is 28.

   - address 103 (EQ_EN): 0 = equalizer off, 1 = on

   - address 104 (EQ_31): 31 Hz, range from -13 dB to +13 dB,

   - address 105 (EQ_62): 62 Hz, range from -13 dB to +13 dB,

   - address 106 (EQ_125): 125 Hz, range from -13 dB to +13 dB,

   - address 107 (EQ_250): 250 Hz, range from -13 dB to +13 dB,

   - address 108 (EQ_500): 500 Hz, range from -13 dB to +13 dB,

   - address 109 (EQ_1K): 1 kHz, range from -13 dB to +13 dB,

   - address 110 (EQ_2K): 2 kHz, range from -13 dB to +13 dB,

   - address 111 (EQ_4K): 4 kHz, range from -13 dB to +13 dB,

   - address 112 (EQ_8K): 8 kHz, range from -13 dB to +13 dB,

   - address 113 (EQ_16K): 16 kHz, range from -13 dB to +13 dB,

2. Holding Registers – address 201 - are used to set the current state of the device. You can send them at any time.

   Configuration options available:

   - address 201 (MODE): BT connection management mode, 0 = no change, 1 = AUTO, 2 = MANUAL. In AUTO mode, the player switches to NON_VISIBLE after connecting the device and to VISIBLE after disconnecting. In the MANUAL mode, you must manually control the visibility of the BT device. Address 202 is used for this purpose.

- address 202 (BT_VISIBILITY): 0 = no change, 1 = BT device visible (VISIBLE), 2 = BT device invisible (NON_VISIBLE), 3 = BT device invisible, connectable after pairing, 4 = force disconnect BT device.

- address 203 (PLAY_AUDIO): if the BT device is not connected, it plays music from the SD card, 0 = no change, 1-254 = plays 1.mp3-254.mp3 file, 255 = stop playback.

8. Inputs

In each of the selected operating modes of the device, set with jumpers (chapter 3), the control inputs IN1-IN10 perform a different function.

The functionalities depending on the mode are presented below:

Mode	IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10
Normal	START	STOP	NEXT	PREV	VOL+	VOL-				
Unattended										
Numbers	1.mp3	2.mp3	3.mp3	4.mp3	5.mp3	6.mp3	7.mp3	8.mp3	9.mp3	10.mp3
Numbers 2	1.mp3	2.mp3	3.mp3	4.mp3	5.mp3	6.mp3	7.mp3	8.mp3	9.mp3	10.mp3
BT Target	BT START	BT STOP	BT NEXT	BT PREV	BT VOL+	BT VOL-	BT Connect	BT Connect Time	BT Stop Connect	

8.1 Inputs - connections

The control inputs have been designed in such a way that they can be controlled by means of an active signal from 5V-24V. In order to control them, you can use the pin number 1 from the MODBUS connector (description in chapter 2).

You can use relays or normally open buttons to control the IN1-IN10 inputs. The minimum contact time is 100ms. Connection examples:
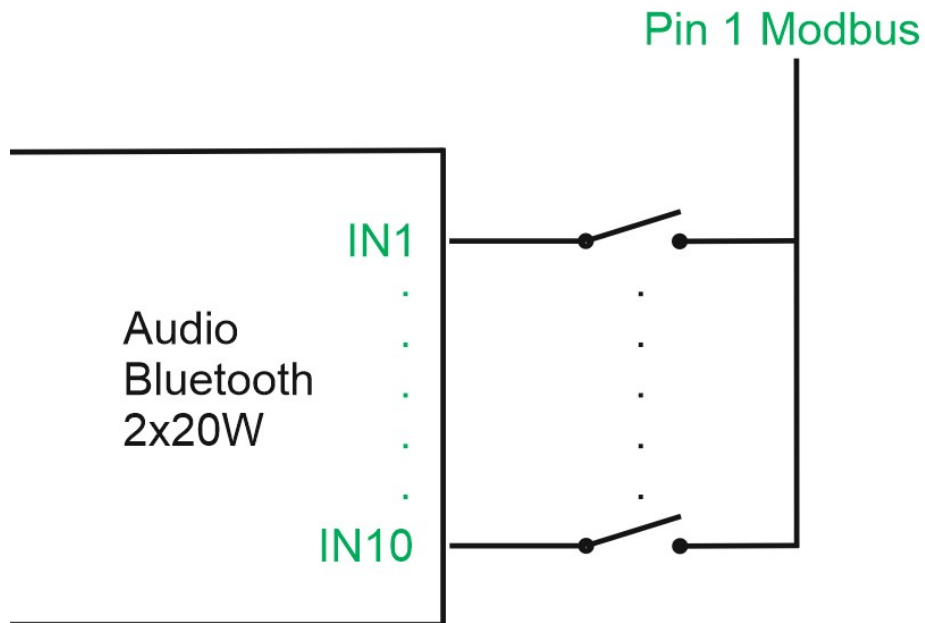
9. Preparing a SD card

MP3 Player support SD memory with FAT 16/32 file systems. In this case you need to prepare SD card memory using computer with Windows OS.

Put your SD card into free SD card reader to computer or by using USB<=>SD adapter. Click a right mouse button on new installed removable disk and select 'format' option. Choose an FAT32 partition type and press button 'start'.

Example:
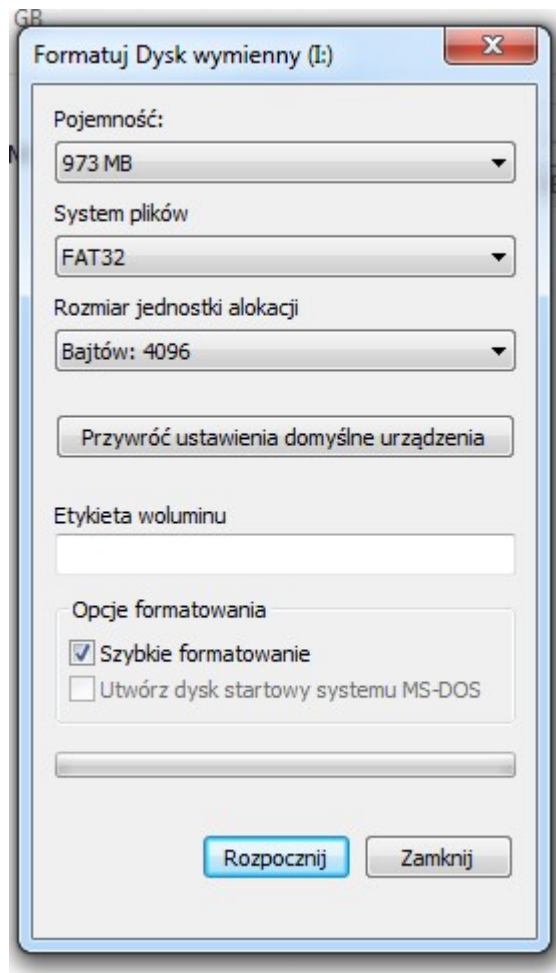
After successfully device format we can put mp3 files into removable disk:
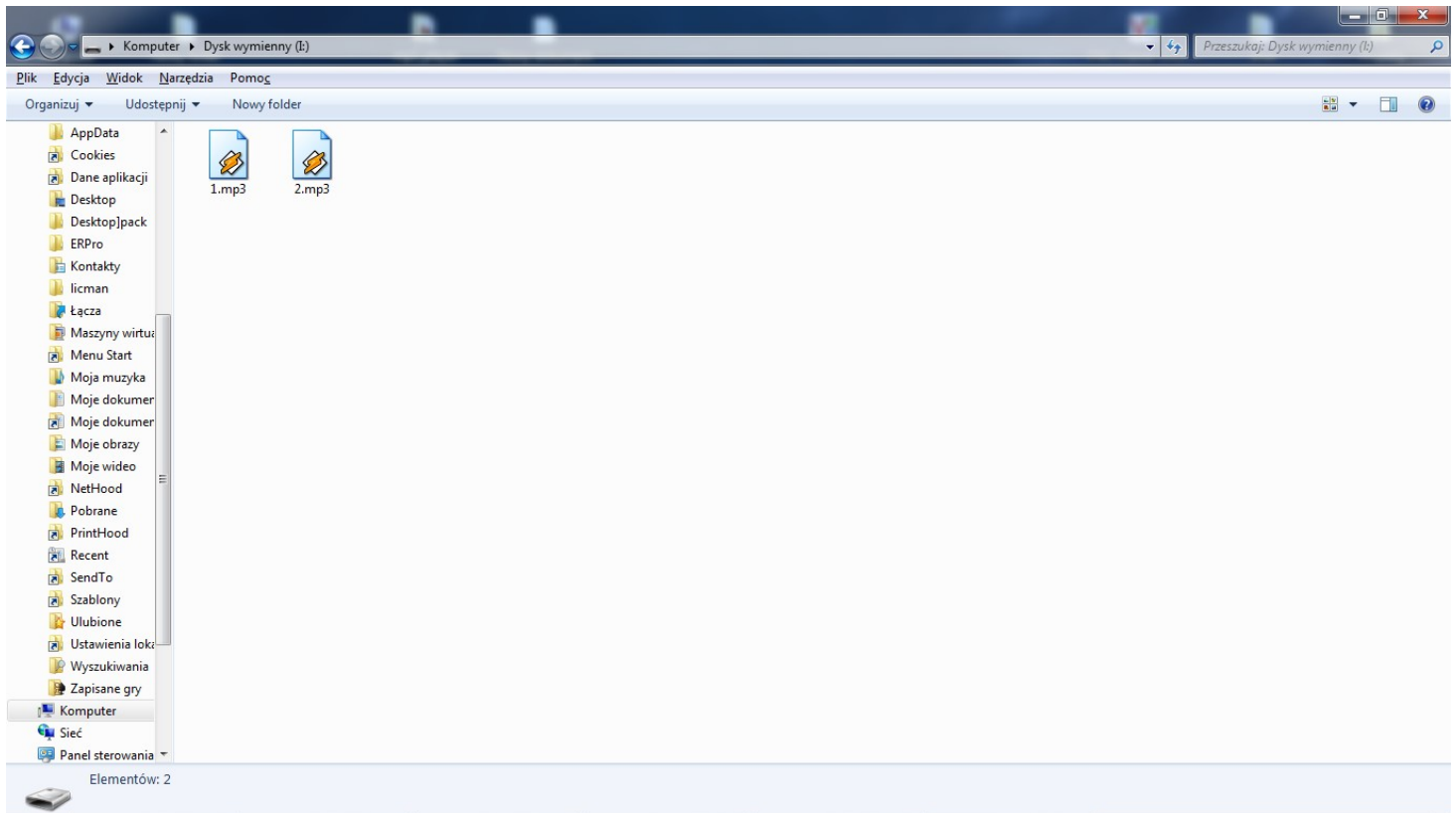
MP3 Player doesn't support any files other then .mp3 extension and folders other than root.

WARNING:

It is not recommended to format your SD card in PC with MAC OS.

10. Technical specification

Parameter	Comment	Min	Typ	Max	Unit.
Input Power Supply		11	-	25	V
Max Current Consumption				6	A
Signal to noise SNR	VDD = 12 V, RSPK = 8 Ω, -60dBFS Input		99.7		dB
	VDD = 24 V, RSPK = 8 Ω, -60dBFS Input		98.8		dB
Total Harmonic Distortion + Noise	VDD = 12 V, RSPK = 8Ω, Po = 1 W		0.02		%
	VDD = 24 V, RSPK = 8Ω, Po = 1 W		0.02		%
Amplifier Output Power per 1 channel	PVDD = 12 V, RSPK = 4 Ω, THD+N = 0.1%		14		W
	PVDD = 12 V, RSPK = 8 Ω, THD+N = 0.1%		8		W
	PVDD = 24 V, RSPK = 4 Ω, THD+N = 0.1%,		11		W
	PVDD = 24 V, RSPK = 8 Ω, THD+N = 0.1%		20		W