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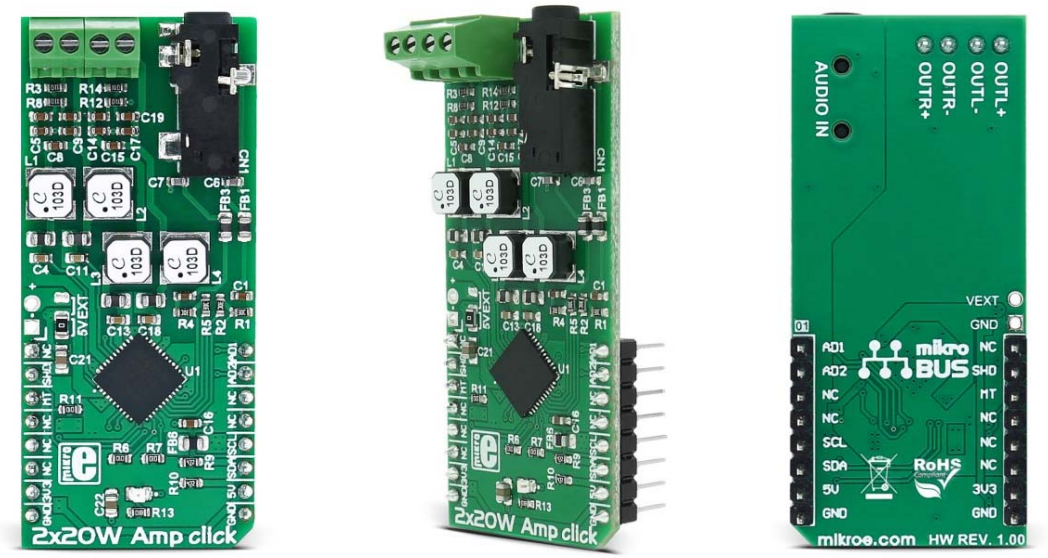
2x20W Amp click

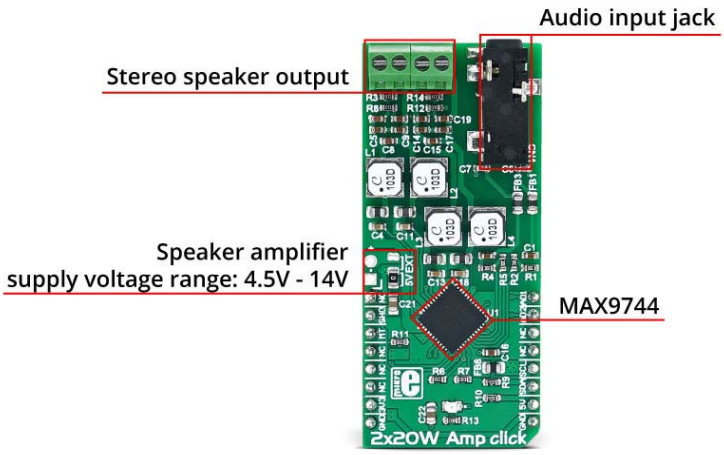
PID: MIKROE-2779

Weight: 30 g



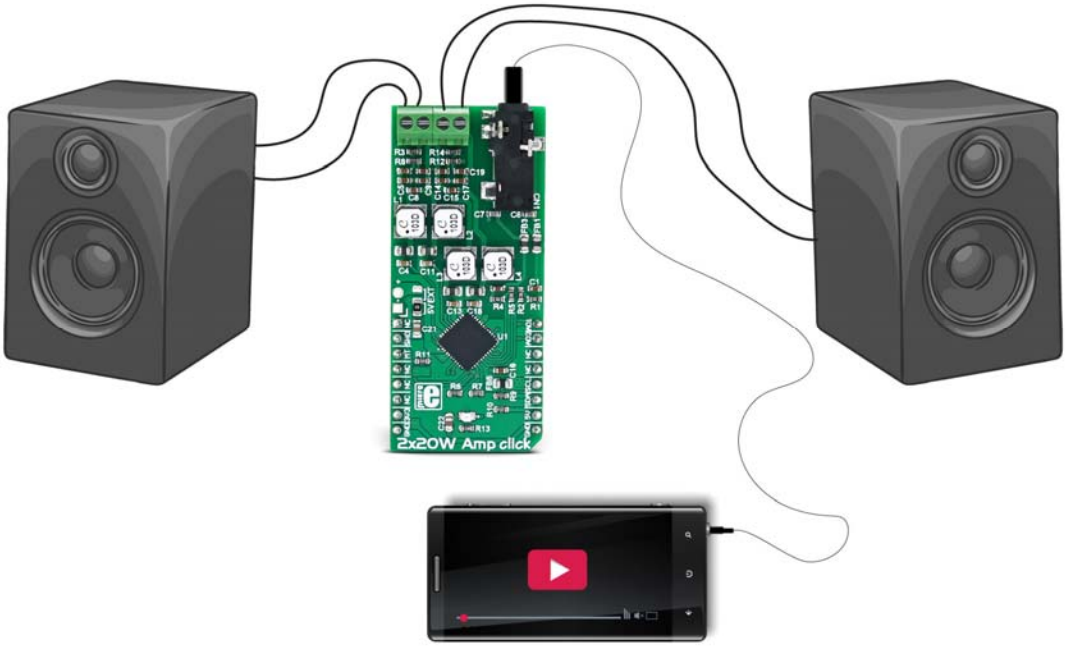
20W, stereo, high-performance digital amplifier

2x20W Amp click carries the MAX9744 stereo class D audio power amplifier from Maxim Integrated. This click brings the Class AB sound performance with Class D efficiency. The perfect combination for your speakers. 2x20W Amp click also offers 64 step volume control,single-supply operation, adjustable gain, and industry-leading click-and-pop suppression.



How the click works

Class-D amplifiers work by producing a series of square-shaped pulses of fixed amplitude, but varying duty cycle, representing the amplitude variations of the analog signal.



The output of the modulator is used to gate the output transistors on and off, alternately. The high efficiency of a Class D amplifier is due to the switching operation of the output stage transistors. Since the transistors are either fully ON or fully OFF, they spend a small amount of time in the linear region and consume little amounts of power.

In a Class D amplifier, the output transistors act as current steering switches and don't use a lot of additional power. A low-pass filter made of an inductor and a capacitor is used to produce a path for the low-frequencies of the audio signal (leaving the high-frequency pulses behind).

When the output current exceeds the current limit, 5.5A (typ), the MAX9744 disables the outputs and initiates a 220µs startup sequence. The shutdown and startup sequence is repeated until the output fault is removed.

When the die temperature exceeds the thermal-shutdown threshold, +165°C (typ), the MAX9744 outputs are disabled. Normal operation resumes when the die temperature decreases by a factor equal to the thermal-shutdown threshold minus the thermal-shutdown hysteresis, (typically below +150°C).

Power supply
The board logic is powered from the 3.3V supply over the mikroBUS™ socket, while the amplifier circuit is powered by the onboard 5V power supply or an external source that can go from 4.5V to 14V. In order to use an external power source, the jumper JP1 must be positioned to the EXT position (see more in the Jumpers and Settings table).

Shutdown mode
The MAX9744 features a shutdown mode that **reduces power consumption** and extends battery life. Driving SHDN pin low places the device in low-power shutdown mode. Connect SHDN pin to digital high for normal operation.

Volume control
For maximum flexibility, the click features volume control operation using an analog voltage input or through the I2C interface. To set the device to analog mode, connect ADDR1 and ADDR2 to GND. In analog mode, SDA/VOL pin is an analog input for volume control. The analog input range is ratiometric between 0.9 x VDD and 0.1 x VDD where 0.9 x VDD = full mute and 0.1 x VDD = full volume.

Use ADDR1 and ADDR2 to select I2C mode. There are three addresses that can be chosen, allowing for multiple devices on a single bus. In the I2C mode, the volume is controlled by choosing the speaker volume control register in the command byte. There are **64 volume settings**, where the lowest setting is full mute.

Specifications

Type	Amplifier
Applications	Battery powered devices, mobile phones, portable sound systems, etc.
Programming	MAX9744 20W stereo Class D audio power amplifier
Key Features	20W Stereo Output, integrated volume control, high 93% efficiency
Key Benefits	64 step volume control

Interface	I2C
Input Voltage	3.3V,5V
Click board size	L (57.15 x 25.4 mm)

Pinout diagram

This table shows how the pinout on **2x20W Amp click** corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
	NC	1	AN	PWM	16	**ADDR1**	Address Select Input
Shutdown Input	**#SHDN**	2	RST	INT	15	**ADDR2**	Address Select Input
Mute Input	**MUTE**	3	CS	TX	14	NC	
	NC	4	SCK	RX	13	NC	
	NC	5	MISO	SCL	12	**SCL**	I2C Serial Clock
	NC	6	MOSI	SDA	11	**SDA**	I2C Serial Data
Power supply	**+3.3V**	7	3.3V	5V	10	**+5V**	
Ground	**GND**	8	GND	GND	9	**GND**	Ground

- ADDR1 and ADDR2 - Sets the device address for the I2C address option. Connect ADDR1 and ADDR2 to GND to select analog volume control mode.
- MUTE - Drive the MUTE pin high to mute the speaker outputs. Connect MUTE to GND for normal operation (mute function controls speaker outputs).
- SHDN - Drive SHDN low to disable the audio amplifiers. Connect SHDN to VDD or drive high for normal operation.
- SCL - I2C Serial Clock Input and Modulation Scheme Select. In I2C mode (ADDR1 and ADDR2 ≠ GND), acts as the I2C serial clock input. When ADDR1 and ADDR2 = GND, set SCLK = 1 for standard PWM output scheme, or set SCLK = 0 for filterless modulation output scheme.
- SDA - I2C Serial Data I/O and Analog Volume Control Input.

Jumpers and settings

Designator	Name	Default Position	Default Option	Description
JP1	PWR.SEL.	Left	5V	Power Supply Voltage Selection between 5V and VDD ext. (4.5V-14V)

Programming

We provide a specific library for the 2x20W Amp click on our LibStock page, as well as a demo application (example), coded using MikroElektronika compilers. The demo can run on all the main MikroElektronika development boards.

Library Description

The library covers all functionalities of the 2x20W Amp click with just 6 functions implemented in addition to 2 HAL init functions.

Key functions :

- `void C2X20AMP_init()` - Driver Initialization
- `void C2X20AMP_setVolume(uint8_t newVolume)` - Volume Setup
- `void C2X20AMP_increaseVolume()` - Increase volume by one step
- `void C2X20AMP_decreaseVolume()` - Decrease volume by one step

More detailed description of library functions you can be found inside the library documentation.

Examples Description

The application is composed of three sections :

- **System Initialization** - Initializes I2C peripheral alongside with GPIO Pins
- **Application Initialization** - Initializes GPIO HAL, I2C HAL and driver related to 2x20 Amp click board and the sets the initial volume to 0x15.
- **Application Task** - (code snippet) Increases and decreases volume periodically every 5 seconds by 6 steps.

```
void applicationTask()
{
    C2X20AMP_decreaseVolume();
    C2X20AMP_decreaseVolume();
    C2X20AMP_decreaseVolume();
    C2X20AMP_decreaseVolume();
    C2X20AMP_decreaseVolume();
    C2X20AMP_decreaseVolume();
    Delay_ms (5000);
    C2X20AMP_increaseVolume();
    C2X20AMP_increaseVolume();
    C2X20AMP_increaseVolume();
    C2X20AMP_increaseVolume();
    C2X20AMP_increaseVolume();
    C2X20AMP_increaseVolume();
    Delay_ms(5000);
 }
```

The example application also carries implementation of three functions for GPIO pin control (CS, PWM, INT) provided during HAL GPIO initialization.

The full application code, and ready to use projects can be found on our LibStock pages.

Other mikroE Libraries used in the example:

- I2C