Reflex
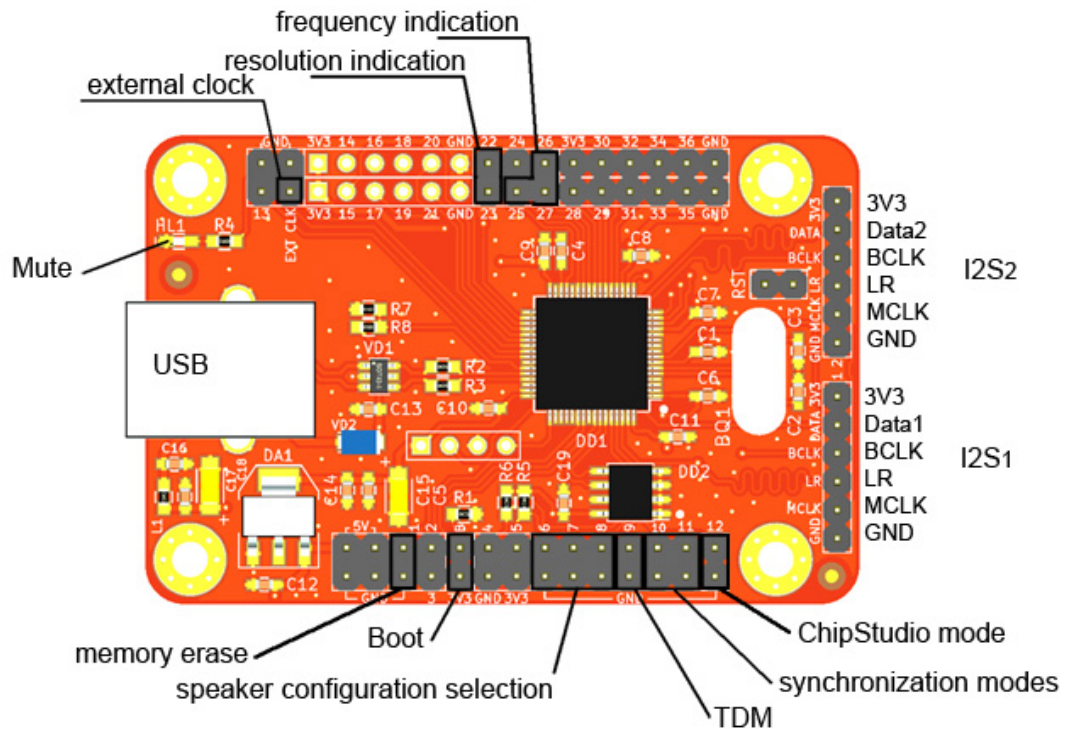## USB Hi-Res transport 32bit/96kHz, 2xI2S, TDM8, STM32F446RC

USB transport is intended for audio files playback with frequency up to 192 kHz and resolution up to 32 bits in I2S and TDM formats. Module supports multichannel speaker configurations up to 7.1. Reflex is recognized by OS as a standard USB audio class 1 device and works on MACs, PCs, tablets, smartphones under Windows, Linux, Android.
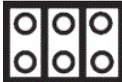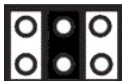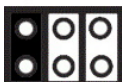
Speaker configurations

Possible speaker configurations

Speaker configuration	Resolution, bits	Frequency, kHz						Format	
		44,1	48	88,2	96	176,4	192	I2S	TDM
2.0	16	+	+	+	+	+	+	+	TDM2
	24	+	+	+	+	-	-	+	TDM2
	32	-	-	+	+	-	-	+	TDM2
3.1	16	+	+	+	+	-	-	+	TDM4
	24	+	+	-	-	-	-	+	TDM4
4.0	16	+	+	+	+	-	-	+	TDM4
	24	+	+	-	-	-	-	+	TDM4
7.1	16	+	+	-	-	-	-	-	TDM8

Pinout

Speaker configuration selection

Speaker configuration is selected by setting jumpers on pins 6, 7, 8.

| Speaker configuration	Jumpers setting
2.0	**6 7 8** (no jumpers set)
2.0 - 32 bits	**6 7 8** (jumper on pin 7)
3.1	**6 7 8** (jumper on pin 6)
4.0	**6 7 8** (jumpers on pins 6 and 7)
7.1	**6 7 8** (jumpers on pins 7 and 8)

TDM format activation

TDM format is activated by setting jumper on pin 9. If jumper on pin 9 is not set output format is I2S. In TDM mode port 1 is active.

Synchronization modes

Several synchronization modes are possible:
- master with internal synchronization
- master with external synchronization
- slave

In master mode with internal synchronization on-board crystal oscillator is used as source for generating I2S/TDM signals. In master mode with external synchronization reference frequency 256*Fs is applied on pin «EXT CLK». And when module is in slave mode I2S/TDM signals are generated by external master.

Synchronization mode	Jumpers setting	Signal type
master with internal synchronization	**10 11** (no jumpers set)	DATA – output BCLK – output LR – output MCLK – output EXT CLK – not used
master with external synchronization	**10 11** (jumper on pin 10)	DATA – output BCLK – output LR – output MCLK – output EXT CLK – input MCLK = EXT CLK
slave	**10 11** (jumper on pin 11)	DATA – output BCLK – input LR – input MCLK – not used EXT CLK – not used

When audio frequency and resolution are changed in OS settings module's output states are changed accordingly. Outputs 22 and 23 reflect current audio resolution. Outputs 25, 26 and 27 reflect audio frequency. They can be used for clock source selection in master mode with external synchronization or for indication.

Output states depending on audio resolution

Resolution, bit	Output state	
	Pin 22	Pin 23
16	0	0
24	0	1
32	1	0

Output states depending on audio frequency

Frequency, kHz	Output state		
	Pin 25	Pin 26	Pin 27
44,1	0	0	0
48	0	1	0
88,2	1	0	1
96	1	0	0
176,4	1	1	1
192	1	1	0

BCLK/Fs ratio

By default BCLK/Fs ratio depends on resolution. For 16 bit resolution BCLK = 32*Fs in I2S mode, TDM slot width is 16 BCLKs. For 24 and 32 bit resolution BCLK = 64*Fs in I2S mode, TDM slot width is 32 BCLKs. When jumper is set on pin 13, BCLK/Fs ratio is fixed and does not depend on resolution: BCLK = 64*Fs in I2S mode, TDM slot width is 32 BCLKs.

LED HL1

LED HL1 reflects «MUTE» state of OS sound settings. If «MUTE» is active LED is ON. If «MUTE» is not active, LED is OFF.

Device customization

It is possible to change USB_VID, USB_PID, manufacturer and device name of module via free software «ChipStudio». «ChipStudio» and driver «ChipDip USB device» are available for download on chipdip.ru website. Configuration mode is activated by setting jumper to pin 12.

It is strongly recommended to change USB_VID and USB_PID of module after driver «ChipDip USB device» installation. Otherwise, Reflex will not be recognized as sound card and to recover sound card functionality, driver «ChipDip USB device» will have to be deleted for all speaker configurations.

Device custom settings can be erased:
– disconnect module from PC
– set jumper to pin 12 and jumper to pin 1 of module
– launch ChipStudio, drag and drop Reflex to project field
– connect module to PC
– when erasing is complete block name is highlighted green and module information is shown

Firmware upgrade

Module firmware can be upgraded by means of «DfuSe» utility available for download on ST company website. A jumper should be set on pin «B» and pin «DATA» of port 2 should be connected to «GND» prior to connecting module to PC for firmware upgrading.