

MP3 Trigger v2 User Guide

2010.06.28 (Preliminary)

Overview

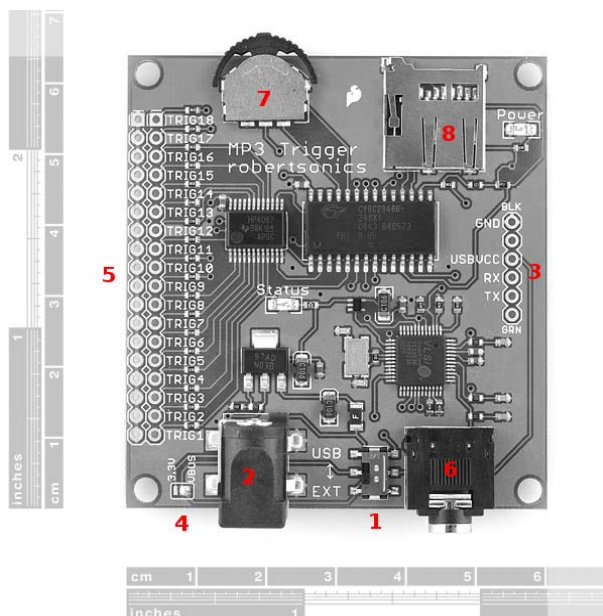
The MP3 Trigger v2 is a versatile, low-cost, low-power embedded audio unit that plays MP3 tracks directly from a FAT16-formatted microSD flash card to a stereo line-level 1/8" output jack, supporting up to 192Kbps stereo playback. The board has 18 external input pins that when pulled to ground, trigger pre-selected MP3 tracks, and a full-duplex serial control port that provides real-time volume control as well remote triggering for up to 255 tracks. There is also an on-board navigation switch for local access and playback of all MP3 tracks on the flash card.

The MP3 Trigger v2 has a resident, permanent boot-loader that enables firmware upgrades directly from the microSD card without the need for a hardware programming device.

The basic layout of the MP3 Trigger can be seen in Figure 1 below.

- 1) USB or external power switch
- 2) External power connector (5.5x2.1mm center positive)
- 3) UART and USB power interface for the FTDI Basic (DEV-09115)
- 4) Power selection jumper
- 5) Trigger pins
- 6) 1/8" stereo jack
- 7) Navigation switch
- 8) microSD socket

Figure 1



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Specifications

- Input Voltage Range: 4.5V to 12.0V DC, or regulated 3.3V (jumper selectable)
- Current Consumption: Approximately 45mA idle, 85mA playing
- File system: FAT16
- Audio output: Line level stereo (1/8" stereo jack)
- Trigger inputs: Logic level 3.3V – 5.0V, active low inputs, w/ internal pull-ups. (Connector provides individual grounds, allowing switches or jumpers to be connected directly to each trigger input).
- Serial: Full duplex, 8-bit, 38.4Kbaud.

Figure 2



Basic Operation

Simply transfer the desired MP3 files onto a microSD flash card using a PC. The MP3 Trigger currently supports only FAT16 formatting. Most microSD cards of 2GB or less are pre-formatted with FAT16. Cards larger than 2G, and smaller cards formatted with FAT32, will need to be reformatted to work with the MP3 Trigger.

The MP3 Trigger does not currently support hot-swapping of the microSD Card. While this will not damage anything, the microSD media is only initialized during power up. So whenever the card is changed or updated, be sure to power cycle the MP3 Trigger after installing the card.

When power is applied the MP3 Trigger, the on-board (green) status LED indicates the state of the installed media as follows:

- 1 long blink - No formatted microSD media found.
- 1 long blink, followed by 1 short blink - microSD media found, no MP3 files located.
- Constant short blinks - Hardware problem with MP3 Decoder.
- 3 short blinks - microSD media found, at least 1 MP3 file located.

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As soon as the MP3 Trigger powers up with 3 short blinks, the on-board navigation switch can be used to play all of the tracks on the card, regardless of the filenames

Left - Plays the previous MP3 file in the directory

Right - Plays the next MP3 file in the directory

Center - Starts/Stops the current MP3 file

Using the Trigger Inputs

The MP3 Trigger provides 18 input pins (TRIG01 – TRIG18) that can be used to trigger specific MP3 tracks on the microSD card. Use the following file naming convention to associate a particular track with a trigger:

TRIG01: filename = "TRACK001.MP3"

TRIG02: filename = "TRACK002.MP3"

...

TRIG18: filename = "TRACK018.MP3"

These inputs are active low and pulled high internally. Therefore, they can be activated either by digital outputs from another microcontroller (such as an Arduino) or by a simple contact closure (switch) to ground. The inputs support voltage levels of either 5V or 3.3V.

The trigger inputs are made available on the even-numbered pins of a dual row connector, and all the opposing (odd-numbered) pins are ground, making it easy to wire individual switches or contact closures directly to the MP3 Trigger board. Activation of a trigger immediately causes the corresponding track to play (if it exists).

Installing a 36-pin dual-row header allows shunt jumpers to be installed on the trigger inputs to automatically sequence and loop tracks on power-up as follows.

When a triggered track reaches the end, the MP3 Trigger looks to see if any trigger inputs are active, and will automatically start another track if so. If only the same trigger is active, then that track will restart (loop). If other triggers are active, the MP3 Trigger will always start the next higher trigger track, wrapping back to 1 after 18.

This, combined with the fact that the MP3 Trigger will automatically start the lowest numbered active trigger on power up, means that by installing shunt jumpers on the trigger inputs, the MP3 Trigger can be set to automatically sequence and loop from 1 to 18 tracks on power up with no externally programming or control required.

Quiet Mode

Beginning with firmware version 2.12, the MP3 Trigger can be placed into Quiet Mode using the serial control port. In this mode, the trigger inputs will not start tracks but instead will cause serial messages to be sent upon activation. (See "MP3 Trigger Outgoing Message Summary" below.) This allows the trigger inputs to be decoupled from specific tracks, so that a PC or microcontroller can monitor the trigger inputs and then start any track or sequence of tracks via the serial control port.

Quiet Mode is off by default and is not preserved through a power cycle.

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Serial Control Protocol

The MP3 Trigger comes with a full duplex 3.3-5V serial TTL interface that allows for control of all the MP3 tracks (up to 256) on the microSD card as well as volume, and for monitoring input trigger activity. You can use our FTDI Basic (DEV-09115) or connect to any serial interface that uses the format: 38.4Kbps, 8-bits, 1-start, 1-stop, no parity, flow control = none. All commands to the MP3 Trigger are 1 or 2 bytes in length.

1-byte commands are upper case ASCII characters.

2-byte commands start with an ASCII character. Those starting with an upper case character use an ASCII value ('0' – '9') as the second byte. (These commands can be typed on a keyboard.) 2-byte commands starting with a lower case character require a binary value (0 – 255) as the second byte.

Bytes sent to the MP3 Trigger are not echoed. If echoing is required, set your terminal program to echo locally.

Command Summary

Command: **Navigation – Start/Stop**

Number of bytes: 1

Command byte: 'O'

Data byte: none

Comments: This command performs the same function as pushing the on-board nav switch center position. If the current track is playing, it stops. If the current track is stopped, it will restart from the beginning

Command: **Navigation – Forward**

Number of bytes: 1

Command byte: 'F'

Data byte: none

Comments: This command performs the same function as pushing the on-board nav switch right position. The next MP3 track in the directory will be started.

Command: **Navigation – Reverse**

Number of bytes: 1

Command byte: 'R'

Data byte: none

Comments: This command performs the same function as pushing the on-board nav switch left position. The previous MP3 track in the directory will be started.

Command: **Trigger (ASCII)**

Number of bytes: 2

Command byte: 'T'

Data byte: N = ASCII '1' through '9'

Comments: If it exists, the track with the filename "TRACK00N.MP3" will be started, where N is the data byte.

Command: **Trigger (binary)**

Number of bytes: 2

Command byte: 't'

Data byte: n = 1 to 255

Comments: If it exists, the track with the filename "TRACKNNN.MP3" will be started, where NNN is the ASCII equivalent of the data byte n.

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Command: **Play (binary)**

Number of bytes: 2

Command byte: 'p'

Data byte: n = 0 to 255

Comments: If it exists, the nth track in the directory will be played. The total number of available tracks in the directory can be retrieved using Status Request command below.

Command: **Set Volume (binary)**

Number of bytes: 2

Command byte: 'v'

Data byte: n = 0 to 255

Comments: The VS1053 volume will be set to the value n. Per the VS1053 datasheet, maximum volume is 0x00, and values much above 0x40 are too low to be audible.

Command: **Status Request (ASCII)**

Number of bytes: 2

Command byte: 'S'

Data byte: N = ASCII '0' through '1'

Comments: If N = '0', the MP3 Trigger will respond with a version string. If N = '1', the MP3 Trigger will respond with the total number of tracks on the installed microSD card, in ASCII. Both responses will be preceded by the '=' character.

Command: **Quiet Mode (ASCII)**

Number of bytes: 2

Command byte: 'Q'

Data byte: N = ASCII '0' or '1'

Comments: If N='1', Quiet mode is turned on. If N='0', Quiet mode is turned off. Default state is off.

MP3 Trigger Outgoing Message Summary

The MP3 Trigger sends the following ASCII messages:

'X': When the currently playing track finishes.

'x': When the currently playing track is cancelled by a new command.

'E': When a requested track doesn't exist (error).

In response to a Status Request Command, data byte = '0', the MP3 Trigger sends an 18-byte version string: e.g. "=MP3 Trigger v1.00" .

In response to a Status Request Command, data byte = '1', the MP3 Trigger sends the number of MP3 tracks on the currently installed microSD card: e.g. "=14".

In Quiet Mode only, when one or more trigger inputs are activated, the MP3 Trigger sends 'M' followed by a 3-byte bit mask indicating which triggers were activated:

Data byte 0: TRIG01 through TRIG08

Data byte 1: TRIG09 through TRIG16

Data byte 2: TRIG17 and TRIG18

A value of 1 in a bit position indicates that the corresponding trigger input was activated.

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Bootloader

The MP3 Trigger v2 has a resident boot-loader that allows updating the firmware directly from the microSD card, alleviating the need for a hardware programmer. Because this boot-loader is located in protected sectors of the PSoC's flash memory, it cannot overwrite itself. The boot-loader will always run on power up, thus making it possible to recover from a bad firmware load.

IMPORTANT NOTE: Use of a hardware programmer, such as the Cypress MiniProg, to program the MP3 Trigger v2 with anything other than the boot-loader image will erase the boot-loader. Don't do it!

Using the boot-loader

To update the MP3 Trigger v2 firmware, copy the new firmware hex file to a FAT16-formatted micro-SD card and rename the file to "MP3TRIGR.HEX". It doesn't matter if it's the only file on the microSD card or not - the boot-loader will find it as long as it has this exact filename. Insert the microSD card into the MP3 Trigger v2 with the power off. Hold down the center nav switch while turning on the power. Wait for the status LED to go solid, then power cycle the MP3 Trigger to run the new firmware.

Here's how the boot-loader works in more detail:

The boot-loader is always entered whenever the board powers up. The first thing it does is look to see if the center nav switch is being held down. If not, it immediately vectors to the start of the firmware. Note that if you have previously loaded bad firmware, the board will simply halt or do whatever your bad code tells it to do – possibly with no activity other than the power LED. This is normal if there's no good firmware loaded.

If the center nav switch is being held on power up, the boot-loader searches the microSD card directory for a file named "MP3TRIGR.HEX". If there's no card installed, or the file doesn't exist on the card, it will blink the status LED very rapidly forever. If it finds and is able to open the file, it begins to program the PSoC Flash with the contents of the firmware file. The status LED will illuminate for each hex record programmed. If it successfully programs the entire file, the status LED will turn solid upon completion. You can then power cycle the MP3 Trigger and you will be running the new firmware (don't hold the nav switch down again or you will simply re-enter the boot-loader).

If there's a flash memory programming error (or you pull the microSD card out before it finishes, for example) the status LED will indicate a bad programming cycle by blinking briefly at about 1 Hz (This looks very different than the blinking for programming records). You need to cycle the power again holding the nav switch to re-enter the boot-loader.

The key is that the boot-loader cannot over-write any part of itself, no matter what's in the firmware image file. The worst thing that can happen is you load bad firmware and the board won't run. But you can always hold the nav switch down on power up and get into the boot-loader to load new firmware.