Fallguy *ULTRA*

UNIVERSAL EMBEDDED MP3 MODULE
WITH SD-CARD SLOT
AND 3 SERIAL HIGH-SPEED-INTERFACES

Hardware Version Rev.E 09/2013
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1. Overview

The Fallguy ULTRA MP3 module is an universal and compact embedded module in credit-card size for playing compressed audio data (MP3). The module was designed for use in embedded systems and for integration in customer specific environment. It is a versatile audio module for working in rough industrial applications.
The module has a SD-card slot for using with SD cards type SD or SDHC.
Controlling the module could be done either by buttons, digital and analog inputs or via the different serial interfaces. A connection for additional electronic to connect to a RS232-, RS485- or LAN-network (XPORT), as well as to a LC-display is provided. The internal firmware of the module could be adapted to the customer needs. The playback behaviour is defined through the programmed firmware.
Optional adapter PCBs with RS232-, RS485- and LAN-interface, as well as connections for buttons, a LC-display and amplifiers for loudspeaker and headphones are available (Fallguy ULTRA Carrier Boards by LOETRONIC, see www.loetronic.com).

2. Technical data

Microcontroller:

- 16-Bit microcontroller MC9XD64CAA with 30 MHz
- 64 kByte flash memory for the internal firmware
- 4 kByte RAM
- 1 kByte internal EEPROM for storing configuration data
- Additional coprocessor (XGATE)

MP3-Decoder:

- Hardwaredecoder (DSP) STA013
- Decodes MPEG1, MPEG2 and MPEG2.5 Layer III (MP3) with up to 320 kbit/s or variable bitrate
- Volume and equalizer control

Audio-D/A-Converter:

- High quality 24 bit / 96 dB D/A converter CS4341

Flash-memory:

- SD-cards from 64 MB to 128 GB usable (SD and SDHC)
- FAT32 file format
- Playback length (example) with 4 GB memory and 128 kbit/s MP3 encoding about 72 hours

Operating temperature:

- -20 °C to +85 °C

Operating voltage:

- 3.3 V (DC) stabilized

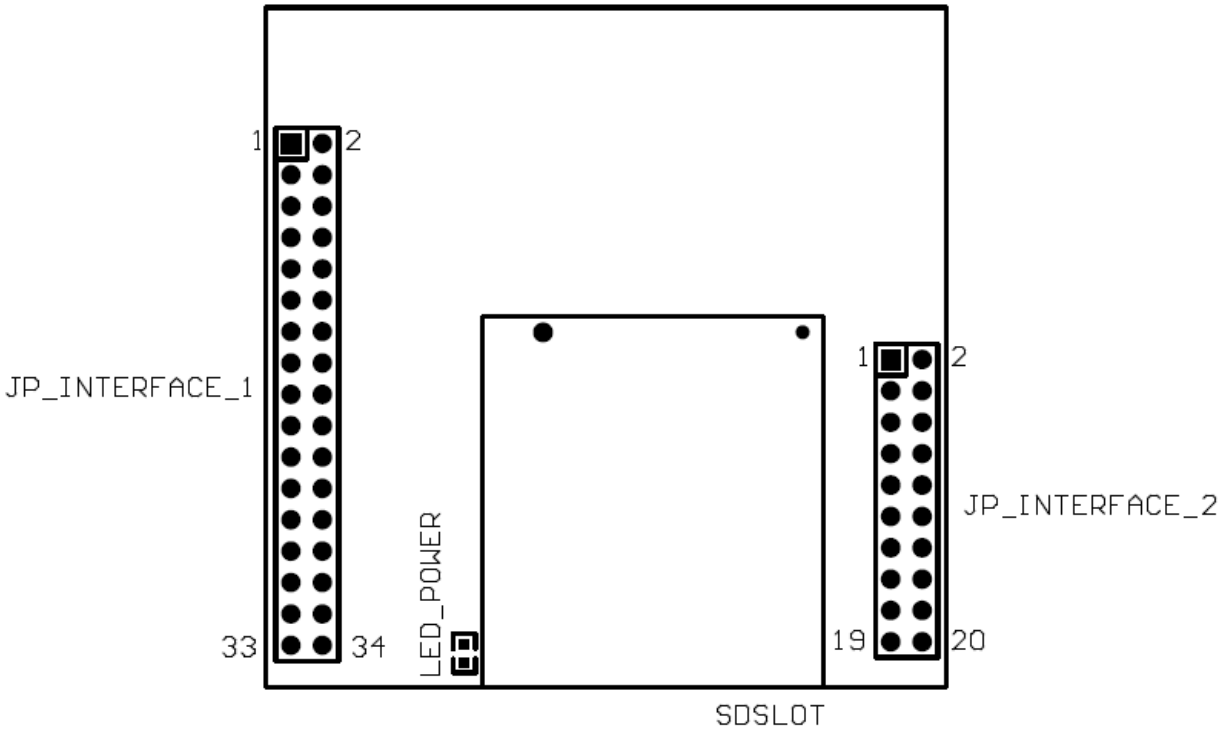
Current consumption:

- 80 mA (typical) with SD card

Interfaces:

- 8 button or analog inputs for connection of buttons, sensors or relais
- 10 digital in- or outputs
- 1 asynchronous serial interface (UART, 3.3V level, 115.200 bps) for RS232- or RS485 connections with hardware handshake
- 1 asynchronous serial interface (UART, 3.3V level, 921.600 bps) for LAN connections (XPORT) with hardware handshake
- 1 CAN interface
- 1 connection for a LC-display (4-bit)
- 5 connections for additional LEDs
- 1 analog audio output – Line level
- 1 digital audio output – I2S

3. Connection possibilities



Picture 3.1 Fallguy ULTRA MP3 module Rev.E – Connections

SDSLOT

- The SD flashcard slot is compatible with all SD-cards available.

JP_INTERFACE_1

- The JP_INTERFACE_1 interface is for connecting the power supply, external periphery and the audio outputs. The internal firmware of the module must be programmed to use the in- and outputs from this interface. Every ULTRA module is equipped with the standard firmware or a customer specific firmware and is delivered with a datasheet describing all functions of this interface.
- **All in- and outputs have 0 – 3.3 Volt level, unless otherwise noted!**
- Using the sockets from the interface (2x17, RM2.54) the module could be attached simply to another PCB (for example a Fallguy ULTRA Carrier Board by LOETRONIC, see www.loetronic.com).
- Depending on the functions external PullUp oder PullDown logic must be added!
- All in- and outputs of the J_INTERFACE_1 interface are connected directly to the microcontroller on the module. If they are used, they must be protected by series resistors and the voltage level of 0 – 3.3 V must be maintained.
- **Non conforming voltage levels could damage the microcontroller on the module!**

Assignment:

Pin-No.	Name	Description
1	A_LINE_L	Analog audio output left (Line level)
2	A_LINE_R	Analog audio output right (Line level)
3	3.3V	3.3 Volt external power supply for the module (DC, stabilized)
4	GND	Ground potential for the module
5	SCLK	Digital audio output I2S – SCLK
6	SDATA	Digital audio output I2S – SDATA
7	MCLK	Digital audio output I2S – MCLK
8	LRCK	Digital audio output I2S – LRCK
9	XPORT_CP3	Digital handshake line for XPORT (LAN-connection)– CP3
10	XPORT_CP1	Digital handshake line for XPORT (LAN-connection) – CP1
11	XPORT_RST	Reset line for XPORT (LAN-connection)
12	SERIAL_RTS	Digital handshake line for UART(RS232-function: RTS, RS485-function: RE)
13	SERIAL_CTS	Digital handshake line for UART(RS232-function: CTS, RS485-function: TE)
14	CAN_TX	Digital send line for CAN-interface (module->)
15	CAN_RX	Digital receive line for CAN-interface (module<-)
16	GPIO_1	Digital in- or output
17	GPIO_2	Digital in- or output
18	GPIO_3	Digital in- or output
19	GPIO_4	Digital in- or output
20	GPIO_5	Digital in- or output
21	GPIO_6	Digital in- or output
22	GPIO_7	Digital in- or output
23	GPIO_8	Digital in- or output
24	GPIO_9	Digital in- or output
25	GPIO_10	Digital in- or output
26	LCD_RS	Control line for LC-display – RS
27	LCD_E	Control line for LC-display – E
28	LCD_DB4	Data line for LC-display – DB4
29	LCD_DB5	Data line for LC-display – DB5
30	LCD_DB6	Data line for LC-display – DB6
31	LCD_DB7	Data line for LC-display – DB7
32	BKGD	Internal programming line
33	N.C.	Not connected
34	RESET	Internal reset line (Activ low)

JP_INTERFACE_2

- The JP_INTERFACE_2 interface is for connecting external periphery. The internal firmware of the module must be programmed to use the in- and outputs from this interface. Every ULTRA module is equipped with the standard firmware or a customer specific firmware and is delivered with a datasheet describing all functions of this interface.
- **All in- and outputs have 0 – 3.3 Volt level, unless otherwise noted!**
- Using the sockets from the interface (2x10, RM2.54) the module could be attached simply to another PCB (for example a Fallguy ULTRA Carrier Board by LOETRONIC, see www.loetronic.com).
- Depending on the functions external PullUp oder PullDown logic must be added!
- All in- and outputs of the J_INTERFACE_2 interface are connected directly to the microcontroller on the module. If they are used, they must be protected by series resistors and the voltage level of 0 – 3.3 V must be maintained.
- Using the serial interfaces (1. and 2. UART) the ULTRA module could be controlled externally by a PC or microcontroller. The voltage level is 0 – 3.3 Volt for both interfaces. An ASCII-based protocol is an element of the standard firmware and is the same for both interfaces. An MP3-upload on the SD-Karte is no problem using the serial interfaces. The 1. UART is for use with an RS232- or RS485-connection, the 2. UART is for use with a LAN-connection (using the XPORT). The necessary level converter or the XPORT must be provided externally or are provided using a Fallguy ULTRA Carrier Board. More adjustments of the serial interfaces are defined through the selected firmware and are not decribed in this datasheet. Every ULTRA module is equipped with the standard firmware or a customer specific firmware and is delivered with a datasheet describing all functions of the serial interface.
- **Non conforming voltage levels could damage the microcontroller on the module!**

Assignment:

Pin-No.	Name	Description
1	XPORT_DIN	Digital send line for the 2. serial UART (module->) – 921.600bps
2	XPORT_DOUT	Digital receive line for the 2. serial UART (module<-) – 921.600bps
3	SERIAL_TX	Digital send line for the 1. serial UART (module->) – 115.200bps
4	SERIAL_RX	Digital receive line for the 1. serial UART (module<-) – 115.200bps
5	BUTTON_8	Button- or analog input
6	BUTTON_7	Button- or analog input
7	BUTTON_6	Button- or analog input
8	BUTTON_5	Button- or analog input
9	BUTTON_4	Button- or analog input
10	BUTTON_3	Button- or analog input (Config LAN/XPORT function)
11	BUTTON_2	Button- or analog input (Config LAN/XPORT function)
12	BUTTON_1	Button- or analog input (Bootloader function)
13	LED_EXT5	Digital output for external LED 5
14	LED_EXT4	Digital output for external LED 4
15	LED_EXT3	Digital output for external LED 3
16	LED_EXT2	Digital output for external LED 2
17	LED_EXT1	Digital output for external LED 1
18	LED_NET	Digital output for network-LED (Serial interface or LAN activity)
19	LED_SD	Digital output for SD-LED (SD-card activity)
20	LED_BLD	Digital output for Bootloader-LED (Bootloader function)

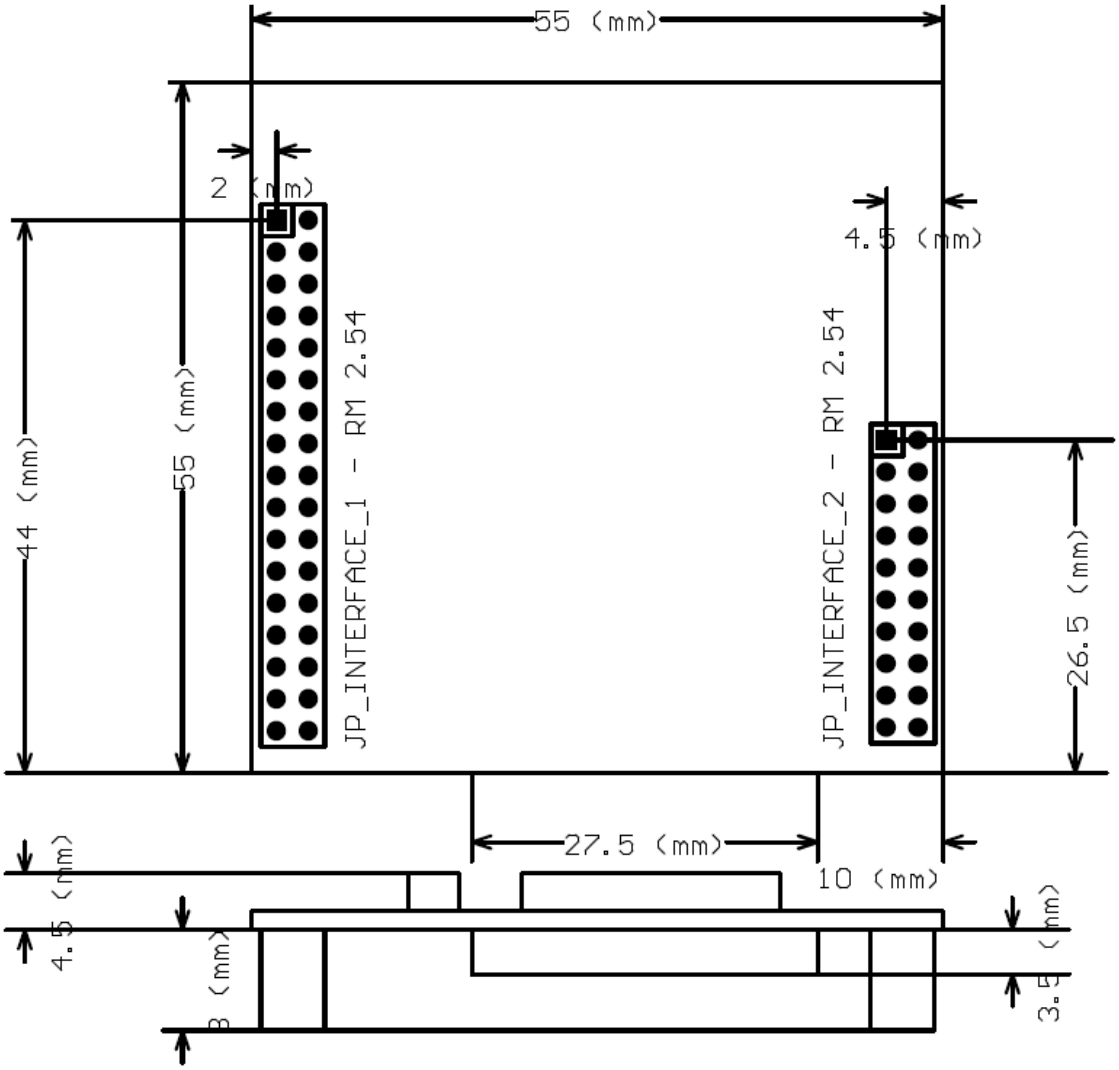
LED_POWER

- The led LED_POWER on the ULTRA module lights up, if the module is supplied with a voltage of 3.3 Volt.

4. Mechanical dimensions

Dimensions:

- Length: 55 mm / 2.17 inch, Width: 55 mm / 2.17 inch, Height: 12.5 mm / 0.49 inch



Picture 4.1 Fallguy ULTRA MP3 module Rev.E - Dimensions

5. Getting started

The Fallguy ULTRA MP3 module must be connected with a voltage source of 3.3 Volt (DC) at Pin 3 and 4. An external amplifier could be connected at Pin 1, 2 (Line level) and at Pin 4 (Ground) of JP_INTERFACE_1. More electronic can be connected according its function to the different in- an outputs. LOETRONIC recommends to use a Fallguy ULTRA Carrier Board (see www.loetronic.com) to use all the different in- and outputs. The MP3 module has to be clipped simply on the Carrier Board. Exemplary circuits for the different interfaces could be found also in the datasheet for the Fallguy ULTRA Carrier Board.

If no Fallguy ULTRA Carrier Board and also no other additional electronic is used, at least PullUp-resistors (10k Ohm to 3.3 V) at the 8 button inputs (respectively BUTTON_1 – BUTTON_8) must be connected!

Any SD flashcard – type SD or SDHC - could be used. The SD card must be formatted in **FAT32** with standard settings and there must only be one partition on it.

The playback attitude is defined through the programmed firmware and is not described in this datasheet. Every ULTRA module is equipped with the standard firmware or a customer specific firmware and is delivered with a datasheet describing all functions, settings and the ASCII protocol of this interface.

6. Firmware updates with the integrated bootloader

To program a new firmware file into the internal flash memory of the microcontroller, the firmware file (*.LOE) must be in the main directory of the SD card. There should be only one firmware file in the main directory!
Deleting and programming the internal flash memory is done by the internal bootloader of the ULTRA module. When the module is off, the first button (**Button_1 / T1 / T1A oder T1B / Play/Pause**) must be pressed (bridged with ground) and then it must be turned on with the button pressed down. The ULTRA module will now boot up the bootloader and the Bootloader-LED (LED_BLD) will light up. The programming sequence is automatically initiated, this means the module reads the firmware file in the main directory (*.LOE), erases the memory and programs it with the new firmware. As it is ready, the module will boot up the new firmware and the Bootloader-LED will go off.

To display errors and to diagnose them, the Bootloader-LED is used. It will blink every 0,5 s up, if there was a problem initialising the SD card or programming the flash memory. The counts of blinking up represent the error and will repeated every 3 s.

Error messages ULTRA BOOTLOADER V1.00:

1 – Sector could not be erased
2 – Erased sector could not be verified
3 – Sector could not be programmed
4 – Programmed sector could not be verified
5 – Firmware file (*.LOE) is not correct
6 – Partitition signature not found
7 – Partitition table not found
8 – Partitition table not ok
9 – Firmware file (*.LOE) not found in main directory
10 – SD card is not formatted in FAT32
11 – SD card is not present