GAP9 Evaluation Hardware

Overview

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Rel. March, 2022

Generic Eval Kit Overview - GAP9Mod + GAP9_EVK

GAP9Mod

GAP9-centric Core Module

22x30mm

GAP9_EVK
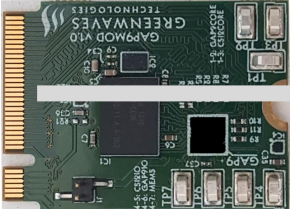
Generic Evaluation Kit

Plug M.2 format Card

into receptacle
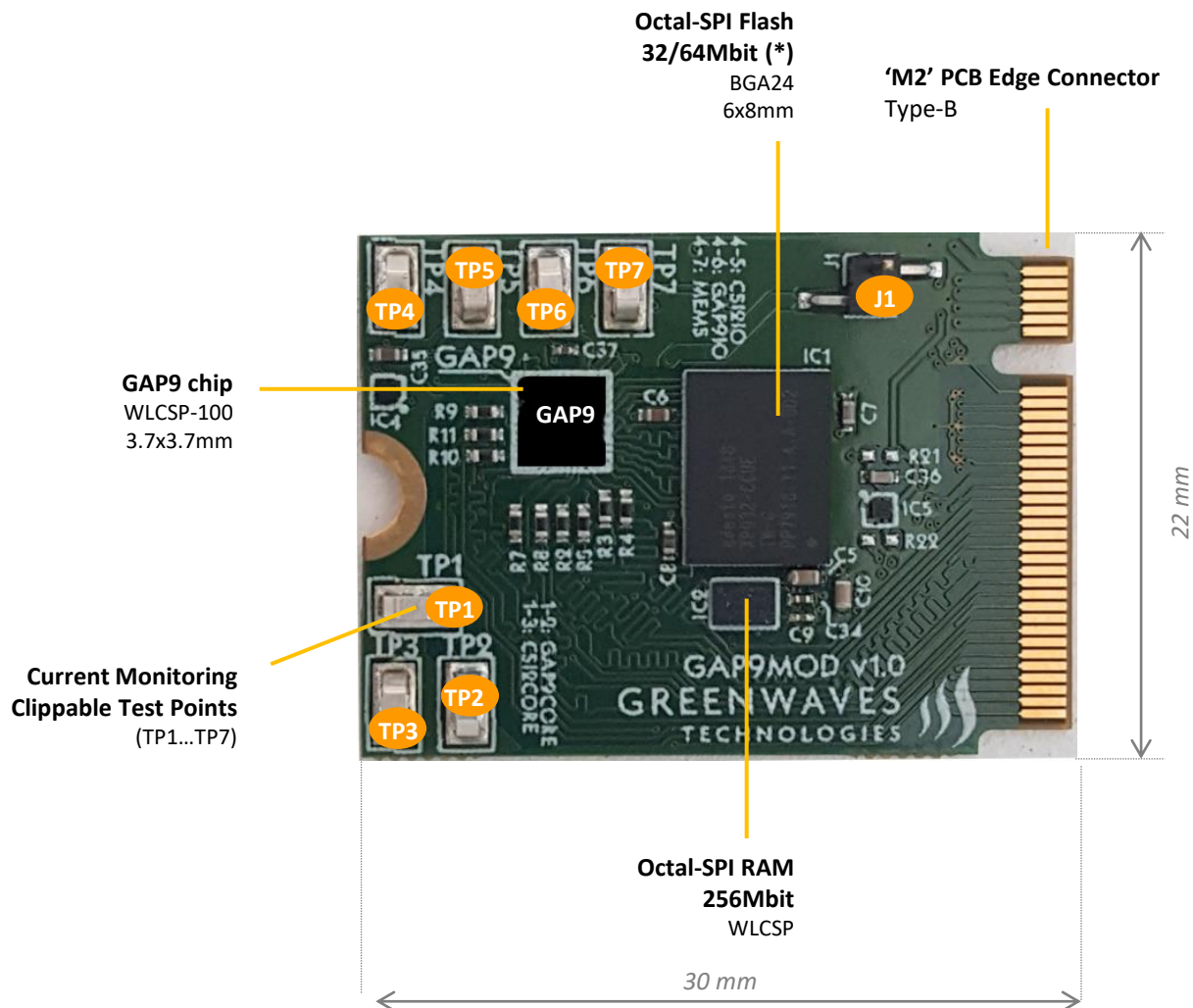
MIPI CSI-2
camera connector
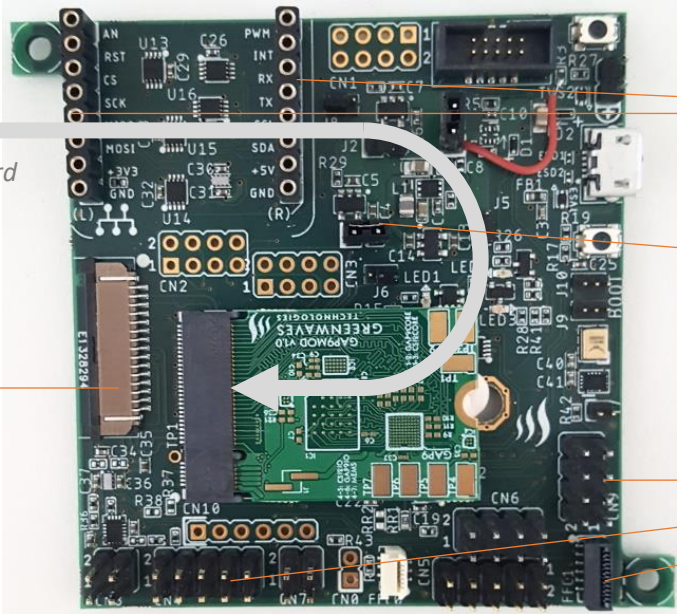
63x68mm

Proto V1.0 shown
V1.1 with minor updates available

mikroBus™ connector
to connect off-the-shelf MikroE *Click* boards
-- or custom add-on board

Multiple Test Points at strategic locations
to measure current consumption

Headers + FFC connectors
on top & bottom side
to connect add-on boards
(gwt-provided or customer-designed)
or 3rd party DevKits
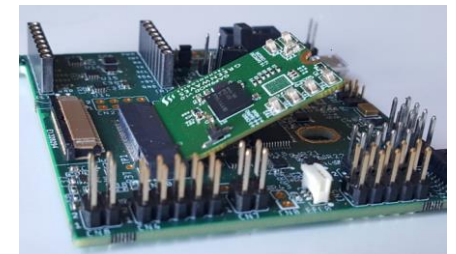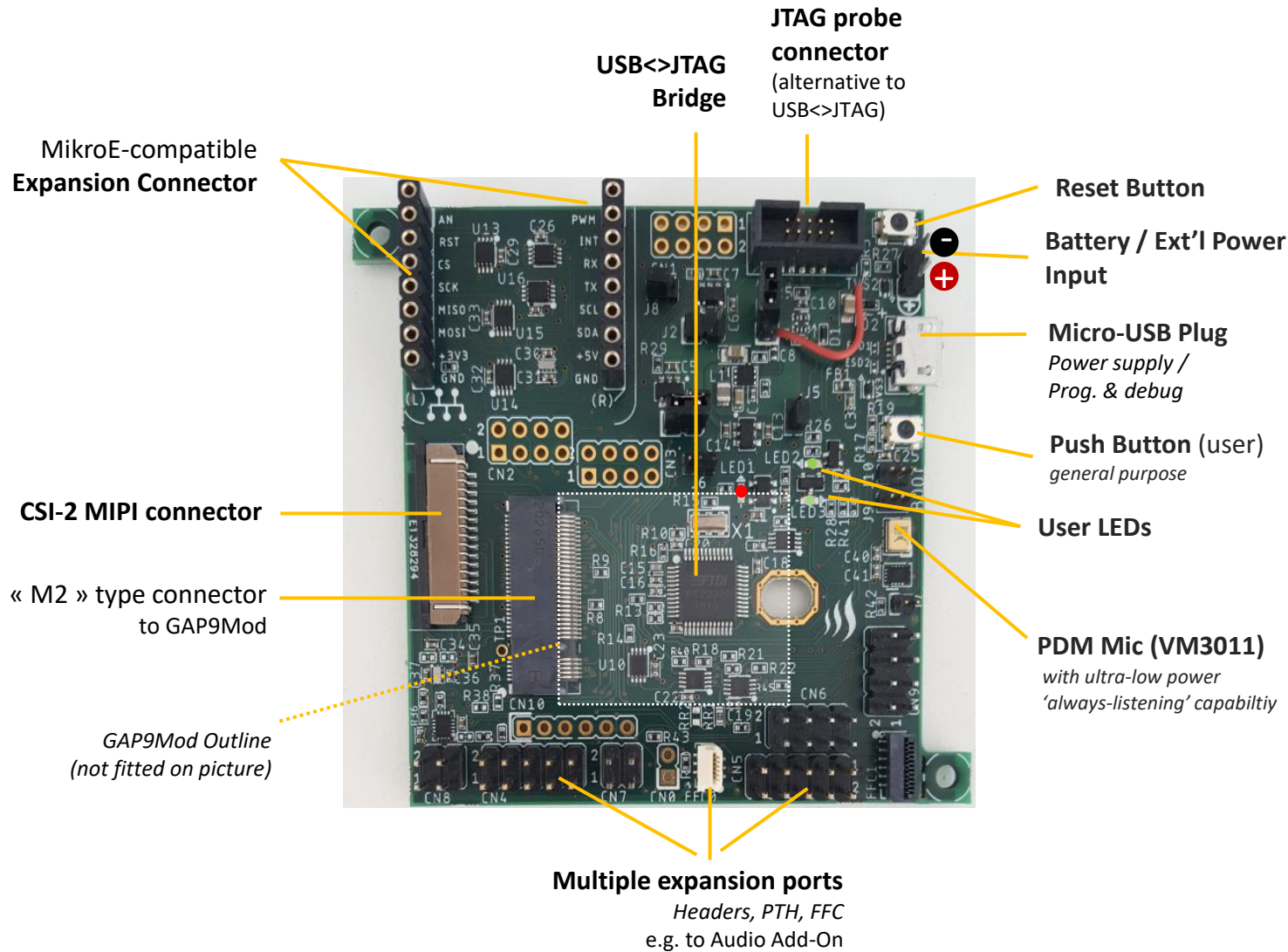
GAP9Mod Details - GAP9 Core Module

**Octal-SPI Flash
32/64Mbit (*)**
BGA24
6x8mm

'M2' PCB Edge Connector
Type-B

GAP9 chip
WLCSP-100
3.7x3.7mm

**Current Monitoring
Clippable Test Points**
(TP1...TP7)

**Octal-SPI RAM
256Mbit**
WLCSP

22 mm

30 mm

Generic GAP9 subsystem including all « invariants »
Concentrates all the more challenging PCB design aspects
Select hardware for wide use case coverage (osc., memory capacity...)
Area : 22mm x 30mm

- External Flash : Octal-SPI, BGA24 6x8, 64Mbit (subject to evolution)
  Standard package, enables assembly variants (different capacities, different vendors) –

- External RAM: Octal-SPI, 256Mbit, WLCSP
  Small package to keep small overall GAP9Mod size –

- Connection to carrier board through **M2 connector** (a.k.a NGFF)
  - Low-cost, high-speed compact connector widely used in laptop to various cards such as SSDs etc.
  - Card-edge connection on daughter board

- « Physical » exploitation of connector only
  - No protocol compatibility involved

- 67 I/Os on 2 sides of card edge, 0.5mm pitch, ~22mm wide

GAP9_EVK Details – Generic Eval Kit

MikroE-compatible Expansion Connector

USB<>JTAG Bridge

JTAG probe connector
(alternative to USB<>JTAG)

Reset Button

Battery / Ext'l Power Input

Micro-USB Plug
Power supply / Prog. & debug

Push Button (user)
general purpose

User LEDs

CSI-2 MIPI connector

« M2 » type connector to GAP9Mod

GAP9Mod Outline (not fitted on picture)

PDM Mic (VM3011)
with ultra-low power 'always-listening' capabiltiy

Multiple expansion ports
Headers, PTH, FFC
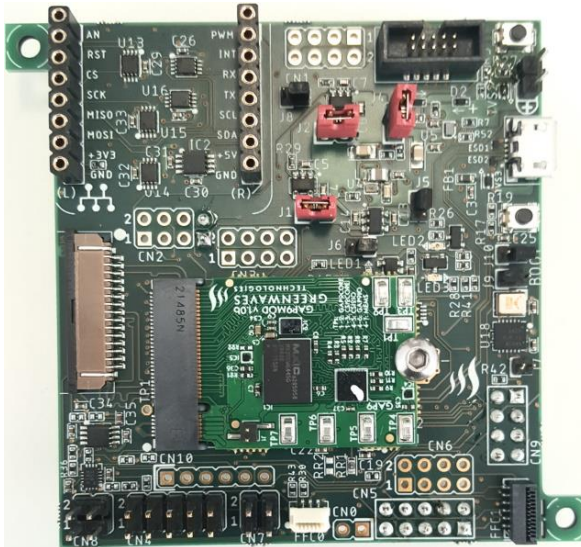**e.g. to Audio Add-On**

Insertion of M.2 format module (GAP9Mod)

Add-On Board Examples

GAP9_EVK

Generic Evaluation Kit

Stack GAP9_EVK (on tp)

with Audio Add-On (underneath)

Audio Add-On

Audio-centric Expansion Board

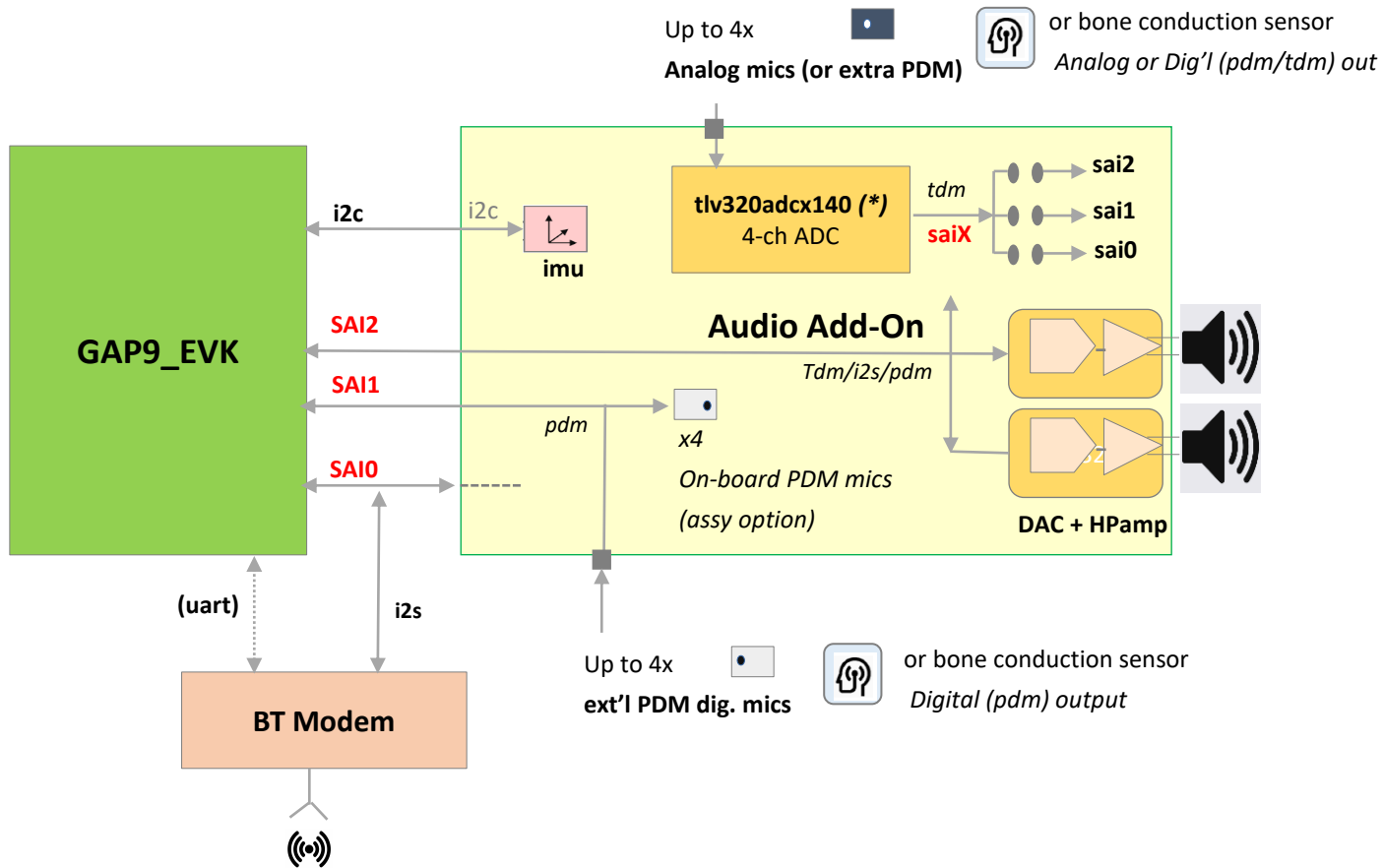*by GreenWaves Technologies*

92x82mm

Plug a Mikro-E 'Click' board

into GAP9_EVK

Multiple off-the-shelf models:

Displays, radios, sensors, etc.
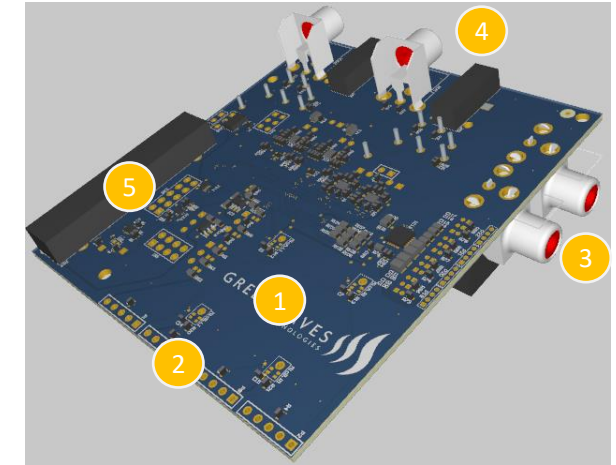
GAP9_EVK typical connectivity

shown with Audio Add-On here

GAP9_EVK TYPICAL USAGE OF SAIs:

- **SAI1** intended for (up to 4) **PDM mics** on Audio Add-On

- **SAI2** assigned to **DAC+Amplifer** (AK4332 or Gwt PDMamp) of Audio Add-On

  - AK4332 supports TDM/I2S, Fs=192KHz max, bit clock 24.576MHZ max,
    also PDM/DSD64 for significantly better group delay (9.5us)

  - GWT PDMamp requires clockless diff'l PDM (full SAI2 used up)

- **SAI0** not used by default on Audio Add-On

  - **Can be used to connect BT modem**, else may be assigned to ADC

  - If system architecture allows, **connecting BT by other means (e.g., UART) removes some constraints** on system design when analog mics are required

    - If BT uses SAI0, ADC has to share an SAI

Audio Add-on Board - Overview (1/2)

AUDIO ADD-ON BOARD

- Header pins
- **Power Management** → All on-board supplies (1.8V, 3.3V, 3V)
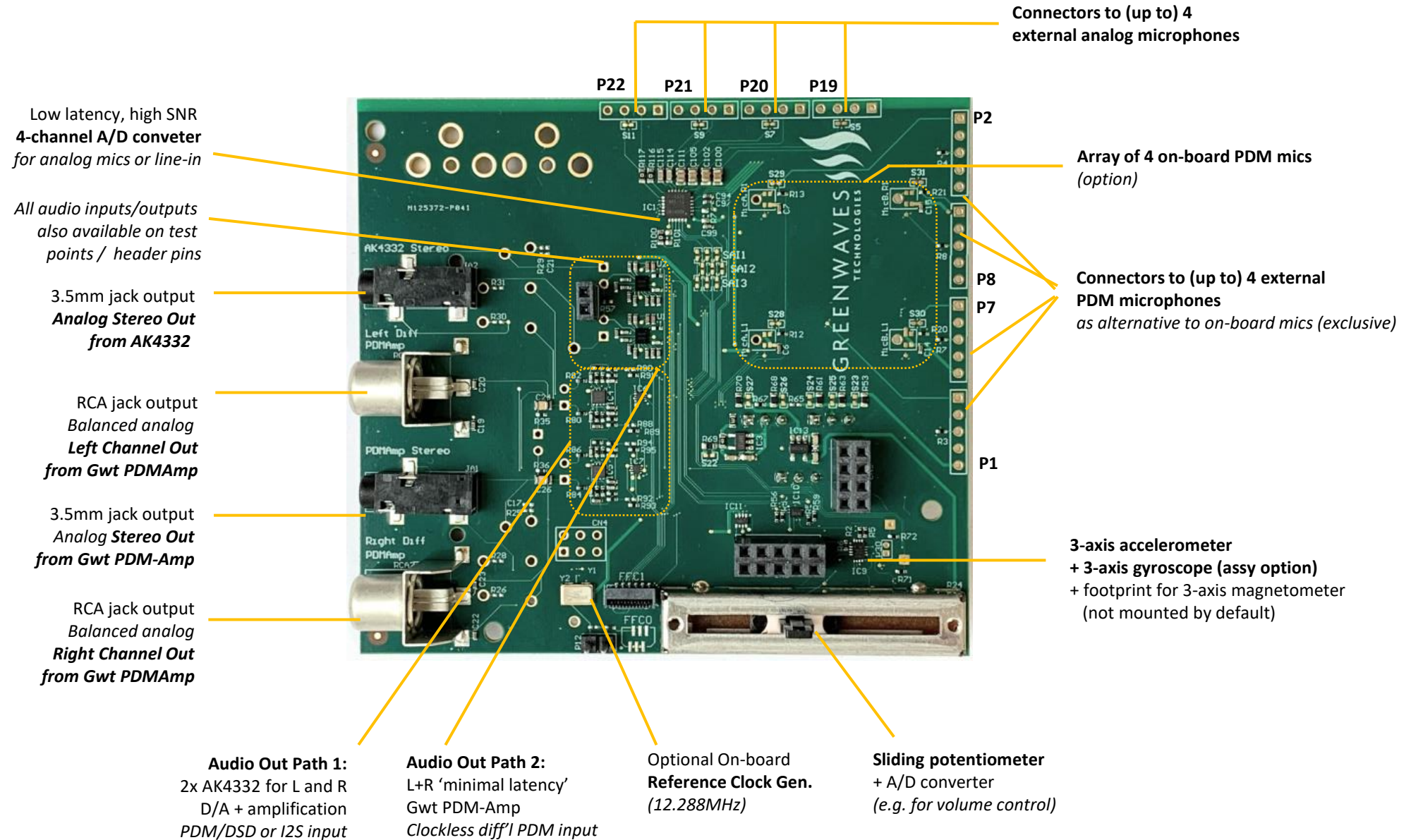- Pwr supplies
- ctrl
- Clock Gen. *e.g. 12.288MHz*
- FFC
- *Optional ext'l master clock*
- **External Master Clock (option)** — *Typ. from test equipment*
- ① 4 PDM Mics (option)
- *Bone Conduction Mic*
- SAI1 (pdm/i2s/tdm)
- **Sound capture (digital)** ②
- **Mic array board (PDM/TDM) or mic 'coupons'** *(up to 4 PDM incl. bone conduction)*
- **Or :** **Digital Audio In** *Typ. from test equipment*
- I2s/tdm
- **4x ADC**
- ③ **Analog Audio In** — Line-In or optional Analog mics (up to 4)
- ctrl
- **Audio D/A + Amplification** *Multiple options*
- SAI2 (pdm/i2s)
- ④ **Analog Audio Out** — *Typ. to speakers or test equipment*
- Header pins
- ctrl
- **Motion sensors and basic UI** ⑤
- I2C + gpios

Key Active Parts

- On-board PDM mics: **TDK Invensense T3902** (low power, high AOP, good SNR, PDMclk up to 4.8MHz)

- D/A + amplification – 2 options :
  > 2x mono **AK4332** (PDM/DSD or I2S in)
  > custom ultra-low latency sigma-delta analog amp

- DAC for analog line-in or analog mics :
  TI **TLV320ADCx140** (high SNR, high DR, 4 single or diff'l inputs, low latency w/ up to 768KHz sample rate)

- Motion sensors : Memsic **MXC6655** (accel.) + Invensense **ICG-20330** (gyro.) + Memsic MMC5633NJL (not mounted)

- Slide potentiometer + low speed ADC (ADS1014) for user interface (e.g. volume control)

Audio Add-on Board - Overview (2/2)

Connectors to (up to) 4
external analog microphones

P22   P21   P20   P19

P2

Array of 4 on-board PDM mics
(option)

Low latency, high SNR
4-channel A/D conveter
for analog mics or line-in

*All audio inputs/outputs
also available on test
points / header pins*

3.5mm jack output
***Analog Stereo Out
from AK4332***

Connectors to (up to) 4 external
PDM microphones
as alternative to on-board mics (exclusive)

P8

P7

RCA jack output
Balanced analog
***Left Channel Out
from Gwt PDMAmp***

3.5mm jack output
*Analog **Stereo Out
from Gwt PDM-Amp***

P1

RCA jack output
Balanced analog
***Right Channel Out
from Gwt PDMAmp***

**3-axis accelerometer
+ 3-axis gyroscope (assy option)**
+ footprint for 3-axis magnetometer
  (not mounted by default)

Audio Out Path 1:
2x AK4332 for L and R
D/A + amplification
PDM/DSD or I2S input

Audio Out Path 2:
L+R 'minimal latency'
Gwt PDM-Amp
Clockless diff'l PDM input

Optional On-board
Reference Clock Gen.
(12.288MHz)

Sliding potentiometer
+ A/D converter
(e.g. for volume control)

More Information

GREENWAVES
TECHNOLOGIES

GAP9 EVALUATION KIT

(GAP9_EVK)

USER MANUAL

Rel.1.4
16 March. 2022

Restricted to customers under NDA

CONTENTS

GREENWAVES TECHNOLOGIES

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11.Mar. 2022

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THANK YOU