



# STM32 & MEMs Mic Interfacing

For WowWee “Switchbot” Design

- This document presents recommendations for connecting ST digital MEMs microphones to an STM32F417 on WowWee's "Switchbot" design, for the purposes of evaluating beamforming and other audio signal processing applications
- Summary of options:
  - **Option A:** Single serial I2S receiver connected to **2 digital mics**. Microphone PDM streams are interleaved
    - Minimizes # of I2S receivers and hence required DMA channels
    - Requires more board re-work + specific timers
  - **Option B:** Dual serial I2S receivers connected to **2 digital mics**. Microphone PDM streams are separate
    - Minimizes board re-work and no extra timer usage needed
    - Requires additional DMA channel vs. Option A
  - **Option C:** Combination of option A & B to support **4 digital mics** (2 serial data streams, each with 2 PDM streams interleaved)
    - Requires combination of resources from Options A & B

# Signal/Pin Mappings

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- WowWee board -> STM32F417 I2S pin mappings

WowWee	STM32F417
I2S1_CLK I2S1_DATA0 I2S1_DATA1 I2S1_WS	I2S2_CLK – PB12 <sup>a</sup> Grounded I2S2_SD – PC3 <sup>a</sup> I2S2_WS – PB13 <sup>a</sup>
I2S2_CLK I2S2_DATA I2S2_WS	I2S3_CLK – PC10 <sup>b</sup> I2S3_SD – PC12 <sup>b</sup> I2S3_WS – PA15

- Choice of which I2S to use for mic vs. SOM interfacing doesn't really matter
  - For the purposes of this document **we chose I2S3 (from STM32 perspective)** for microphone interfacing
  - May also require a timer with in/out to generate I2S clock divided by 2 (see next slides for proposed configs)
- a) These signals appear to have resistor pop/no-pop options for usage as I2S or SPI. Assumed I2S usage only here.
- b) Signal is routed to multiple pins via resistor options – only primary I2S usage is noted

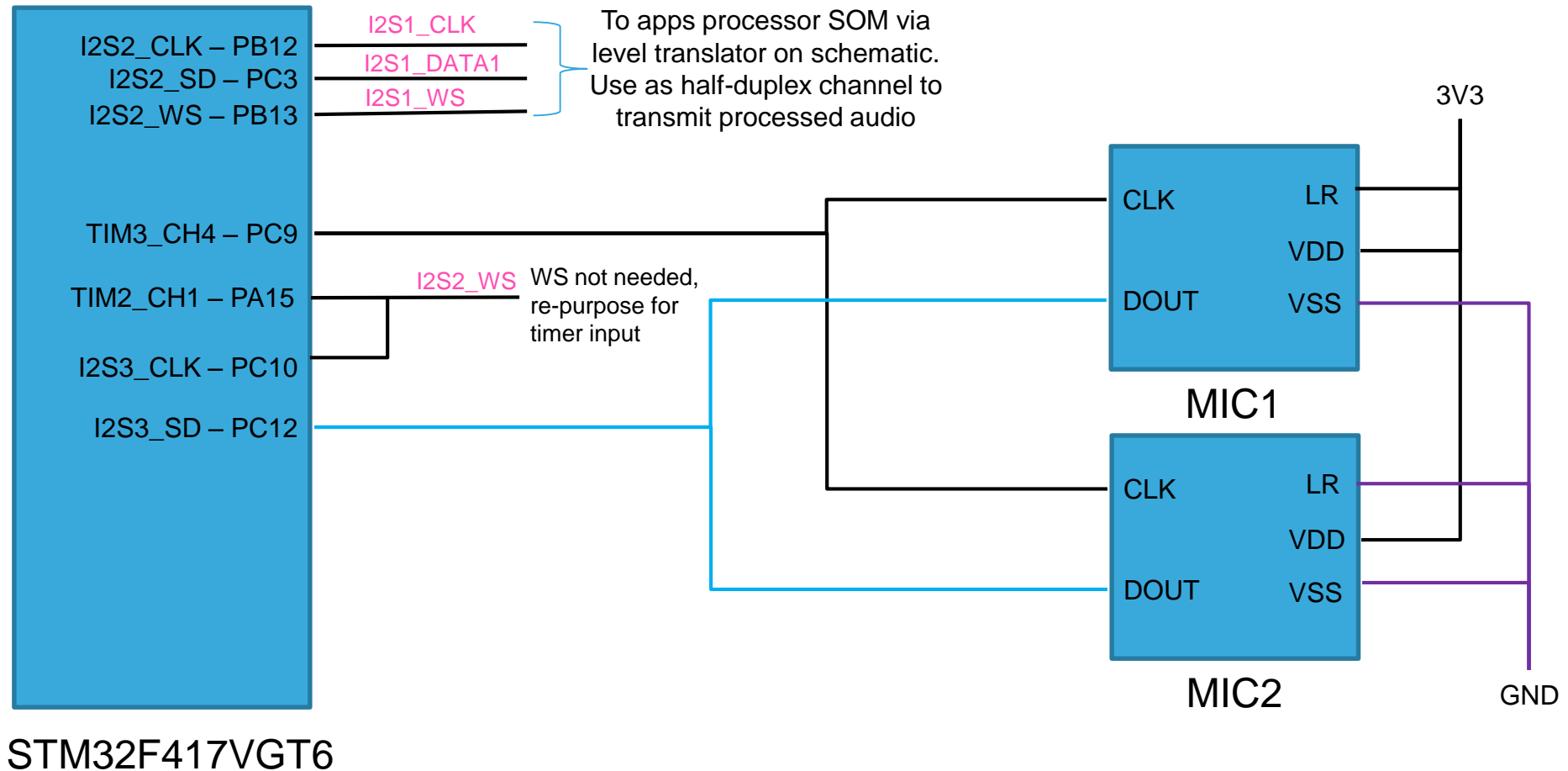
# Timer Config – Option A/C

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- To support two mics on a single I2S, we need to use a timer to generate I2S\_CLK/2 for each mic. Normally done with one STM32 timer.
- This is not fully accounted for in the I2S signals brought out by the design, but we can make use of some of the alternate signals that already have resistor options to simplify the board rework
- TIM2\_CH1 will be used as input (taking the full speed I2S\_CLK)
- TIM3 synchronized to TIM2 through internal trigger/synchronization
- TIM3\_CH4 used to generate I2S\_CLK/2 for microphones

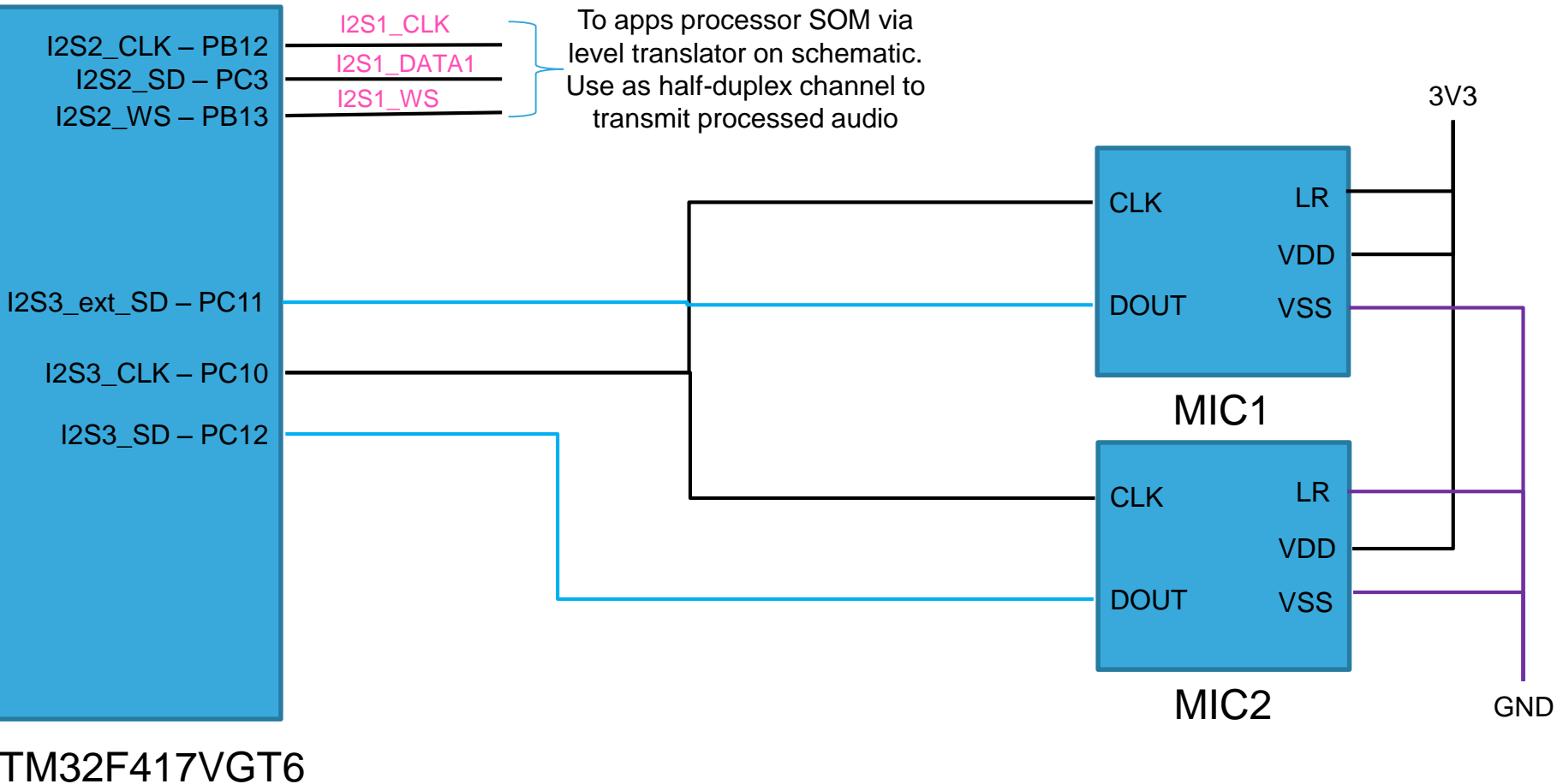
# Option A - Recommended Connections

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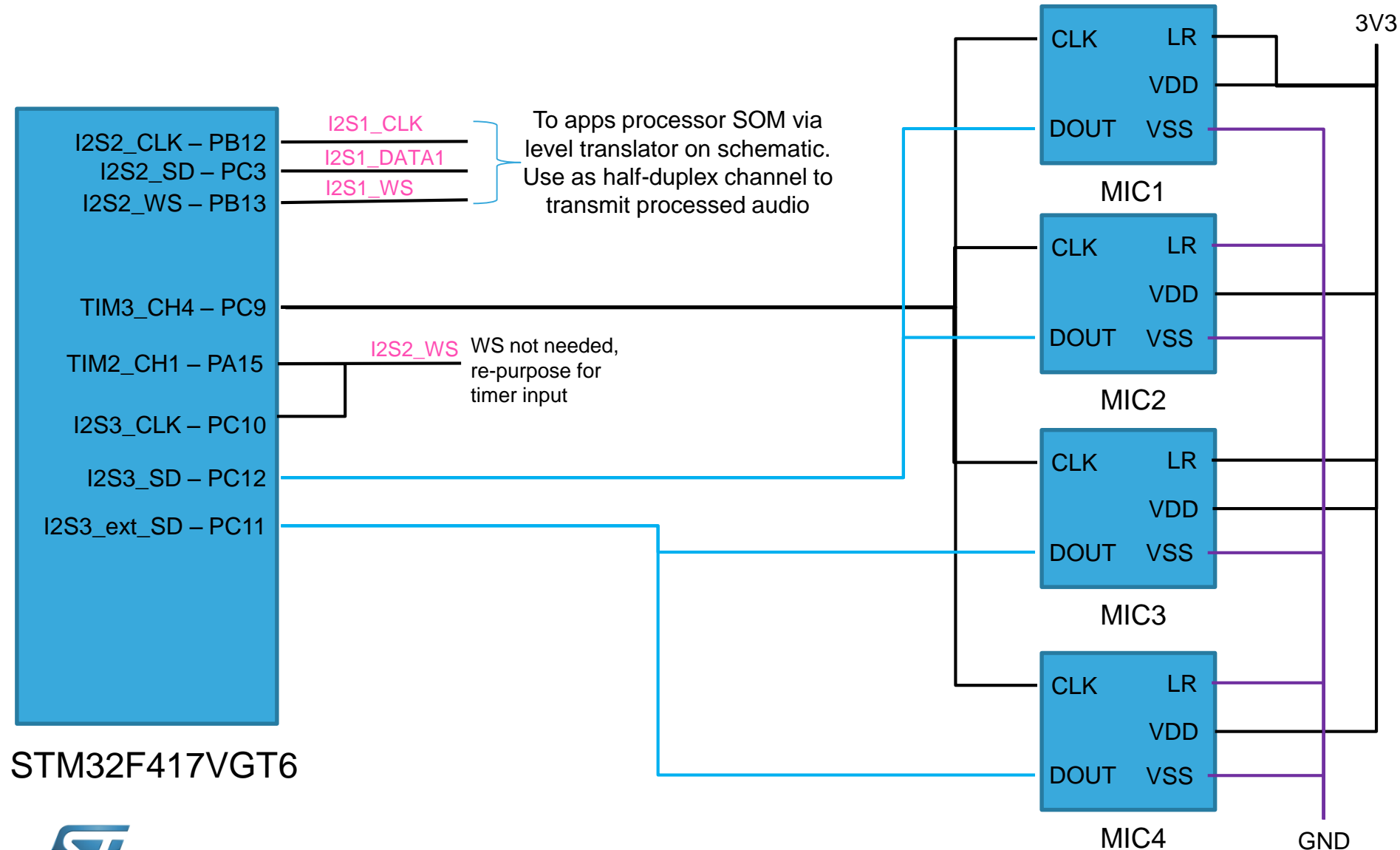
# Option B - Recommended Connections

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# Option C - Recommended Connections

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# Microphone Options

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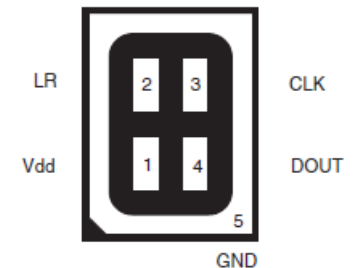
- All of the ST digital microphones are PDM output. The two that are suggested for this application are:

## MP34DT01-M

**Dimension:** 3 x 4 x 1.06

**Signal to noise ratio SNR = 61dB**

**Coupon Boards Available**



## MP34DT04

**Dimension:** 3 x 4 x 1.095

**Signal to noise ratio SNR = 64dB**

**Coupon Boards In Process**



For prototyping mics – recommend using ST “coupon” boards, e.g.:  
[http://www.st.com/content/st\\_com/en/products/evaluation-tools/product-evaluation-tools/audio-ic-eval-boards/steval-mki155v3.html](http://www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/audio-ic-eval-boards/steval-mki155v3.html)