



Adding Wake on Sound (WoS) to Amazon Tap

**Application Note
Rev1.0
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Introduction

The Amazon Tap is a portable Alexa-enabled Bluetooth speaker. Its voice interface is usually triggered by pressing a button, but it also has a 'hands-free' always-listening mode which allows it to respond to the 'Alexa' keyword from afar. However, this mode is very power-intensive and will completely drain the batteries of the Tap in about 8 hours.

This document describes how to retrofit an Amazon Tap with Vesper's S-VM1010-D Wake-on-Sound development board. This retrofit creates a 'hands-free' always-listening mode which can run at extremely low-power, so that a single battery charge can last for many months. It works by electronically triggering the 'talk' and 'power' buttons of the Tap, to turn it on when the 'Alexa' keyword is heard and put it back to sleep ten seconds later.

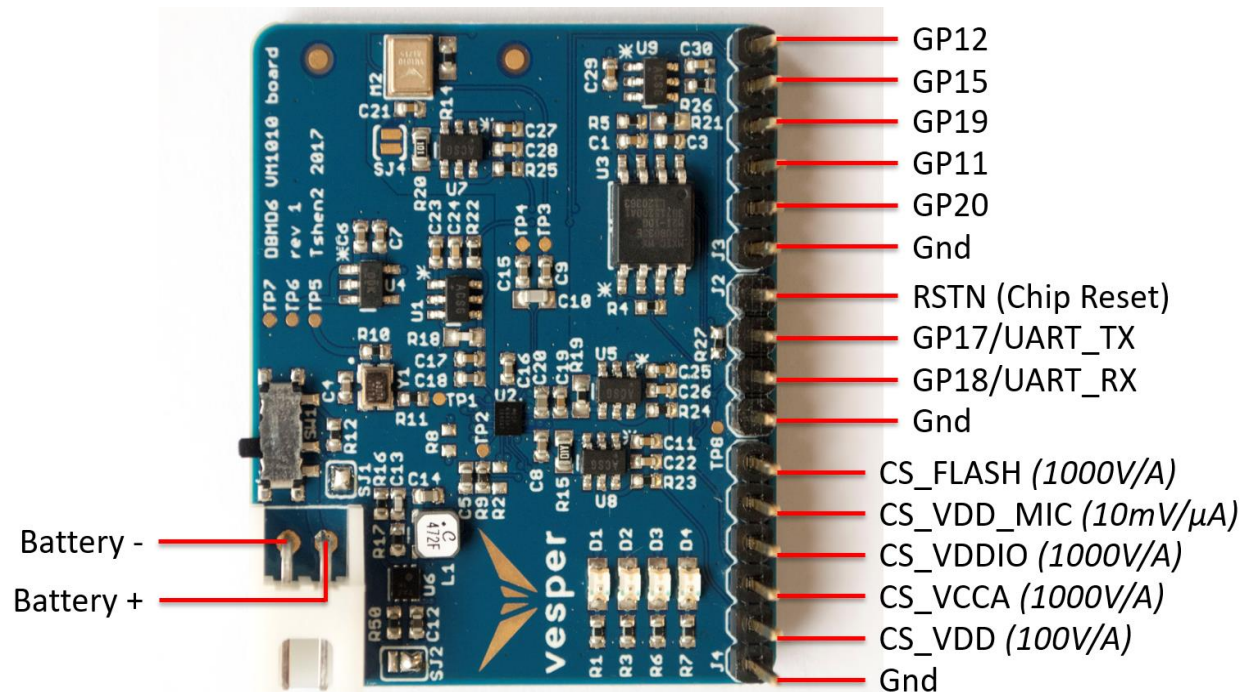


Figure 1:S-VM1010-D Pin description

The retrofit can be divided into four sections:

- 1) 'Talk' button wiring
- 2) 'Power' button wiring
- 3) Battery voltage wiring (to power the S-VM1010-D board)
- 4) Current monitoring (with NI USB-6000 interface)

Part 1: 'Talk' button wiring

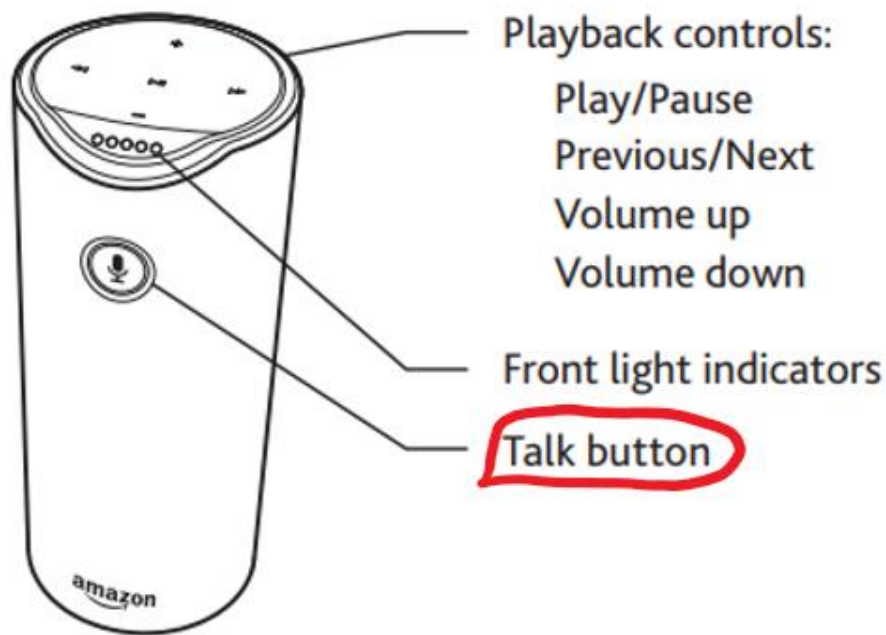


Figure 2: Controls on Amazon Tap

The 'talk' button is a pull-down momentary tactile switch. We short it to ground using a low-Vt N-channel MOSFET. See below for a wiring on the Tap PCB ('yellow' circuitry is added).

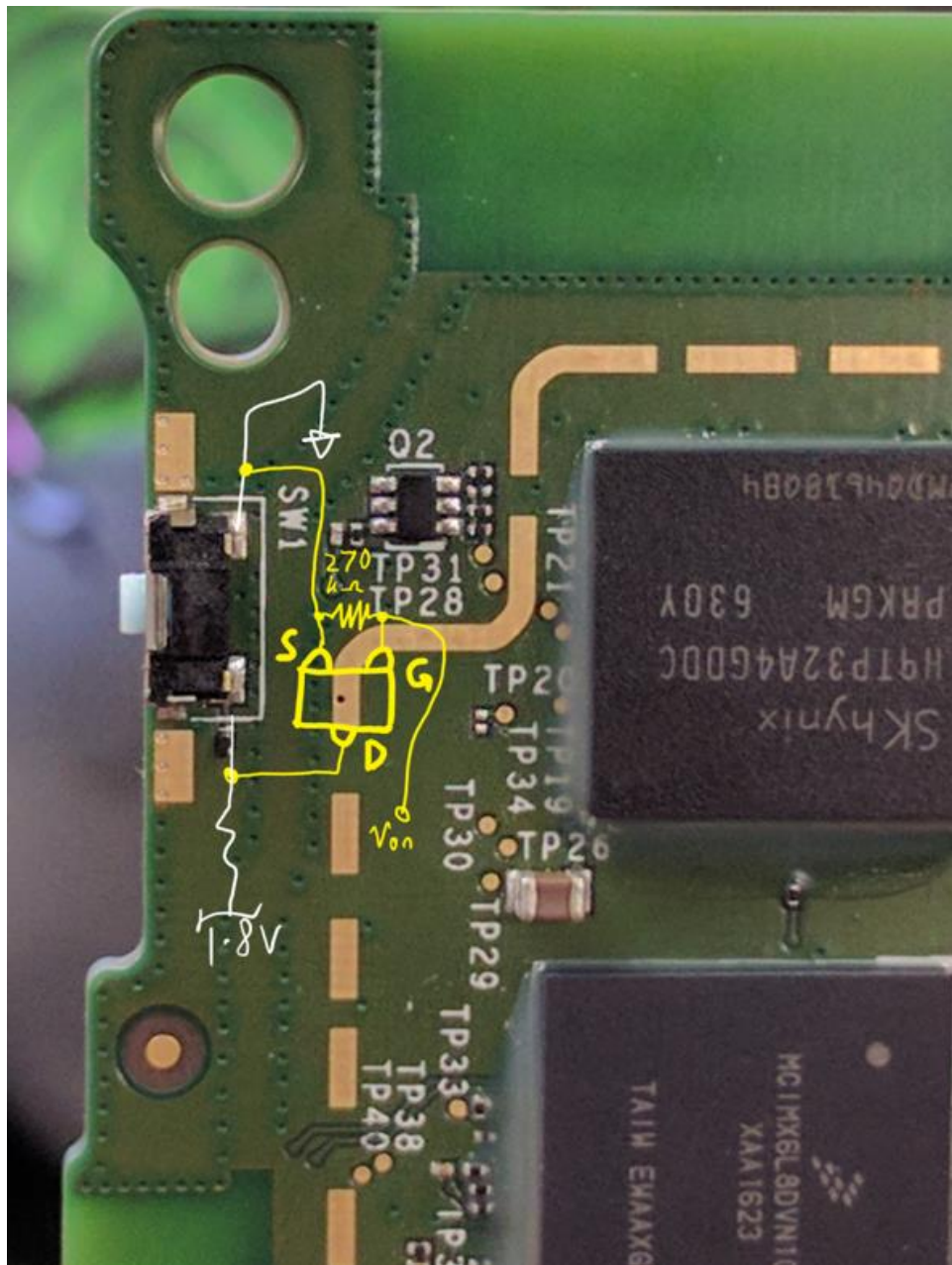


Figure 3: Wiring on the Tap PCB ('yellow' circuitry is added)

As you can see, the added components are one low-Vt N-channel MOSFET and one resistor ($\sim 270\text{k}\Omega$). The resistor's function is to bias the MOSFET's gate to ground, so that the switch is open by default. The MOSFET's gate (V_{on}) is wired to GP12 on the S-VM1010-D board.

Part 2: 'Power' button wiring

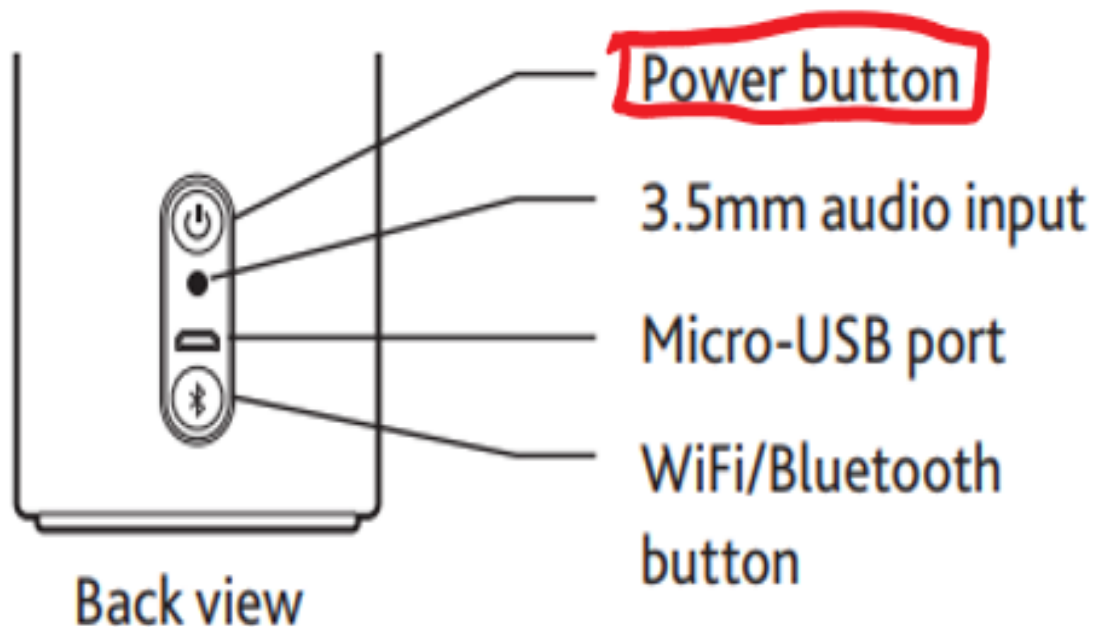


Figure 4: Power button on Amazon Tap

The 'power' button is also a pull-down momentary tactile switch. It is not easy to reach, and the best way to access it is to solder to the 5th pin of the Flat-flex Connector on the Tap PCB. This pin is shown in the following diagram.

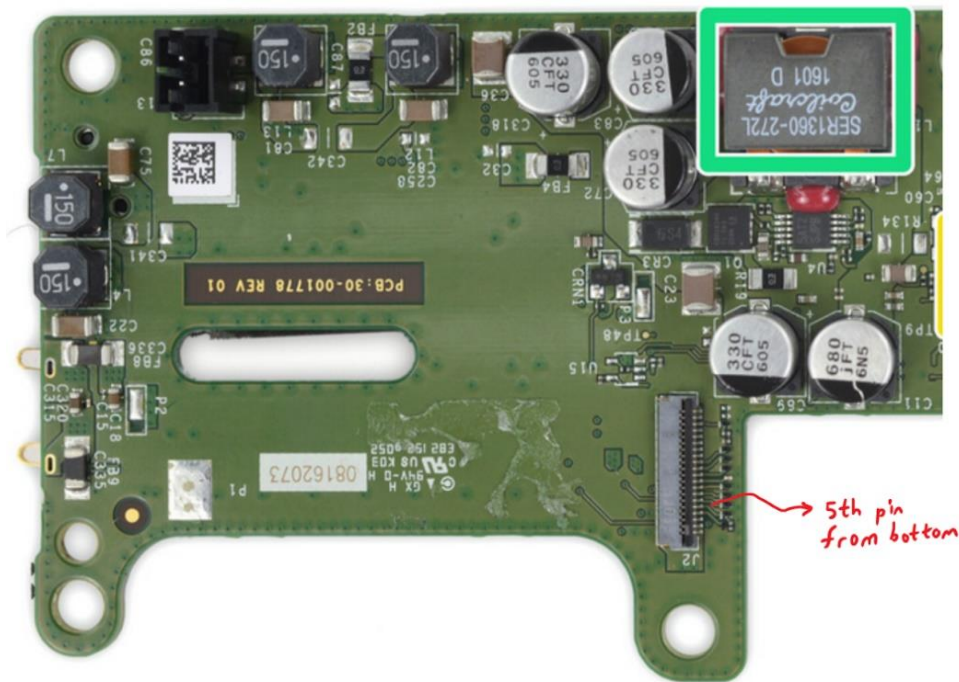


Figure 5: Pin for Power button (5th pin) on the Flat-flex Connector on the Tap PCB

Below is how to wire the N-channel MOSFET to the 'power' button:

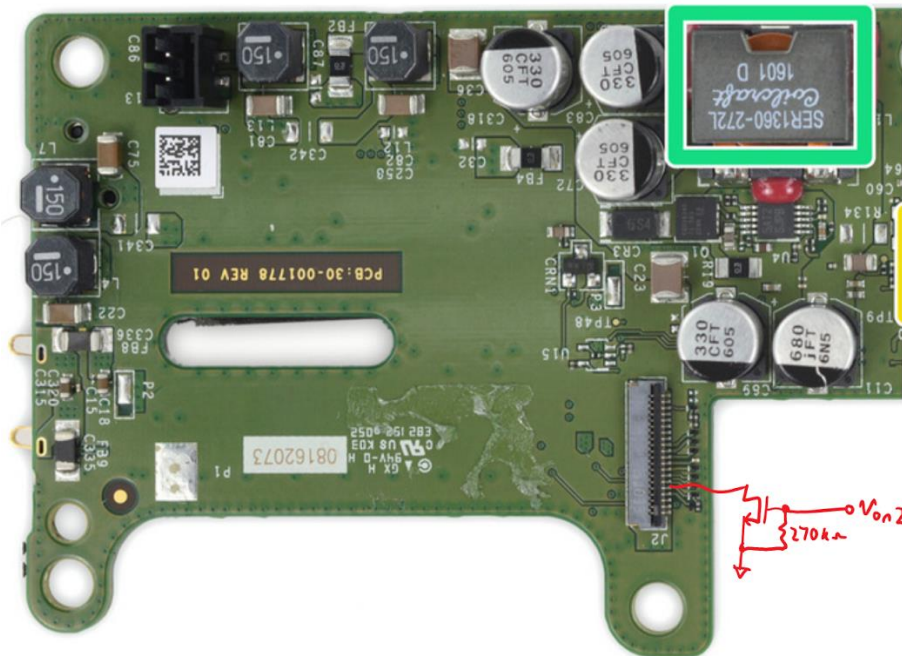


Figure 6: Wiring n-channel MOSFET to Power button

The MOSFET's gate (V_{on}) is wired to GP19 on the S-VM1010-D board. You also need to connect GND (from the main ground plane of the Tap PCB) to the S-VM1010-D board.

Part 3: Battery voltage wiring

VM1010+DBMD6 board needs to share the battery voltage of the battery inside the Tap to power the S-VM1010-D board. Below is the easiest way to access the battery voltage.

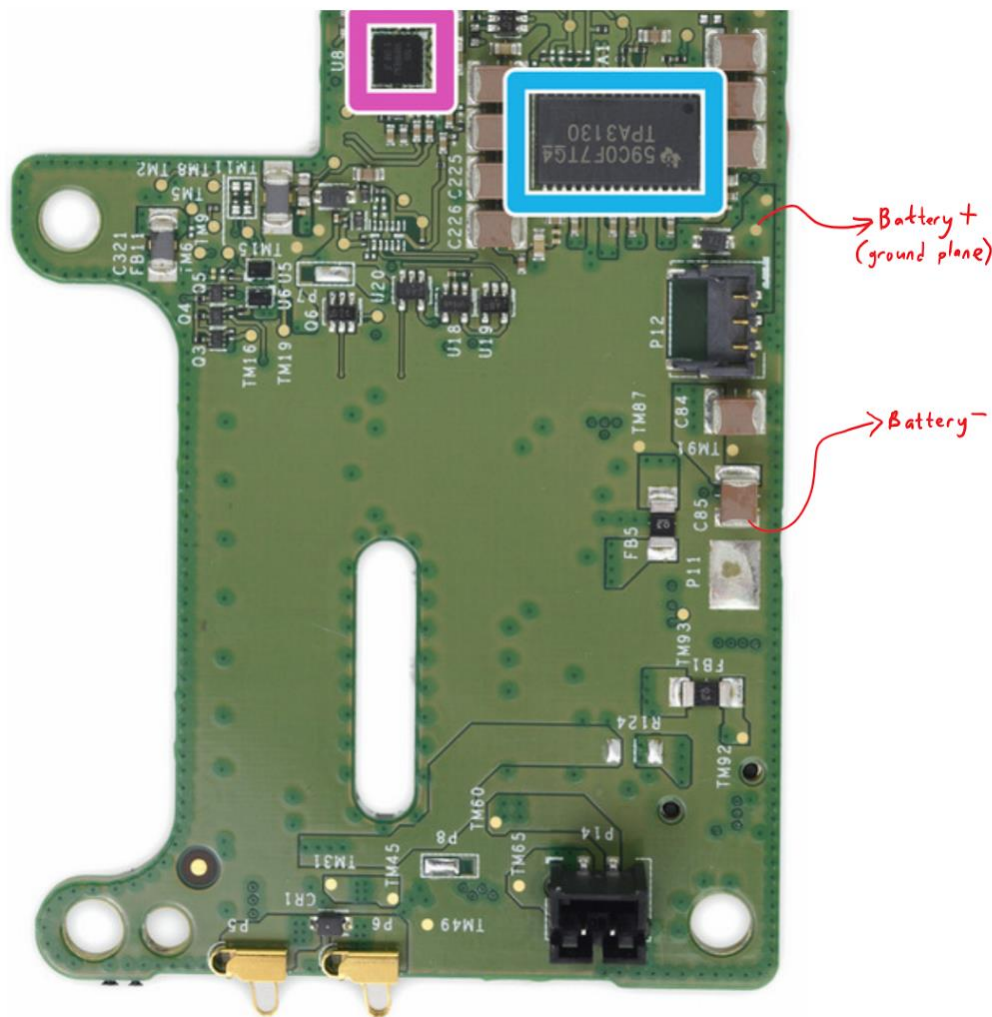


Figure 7: Accessing the battery voltage

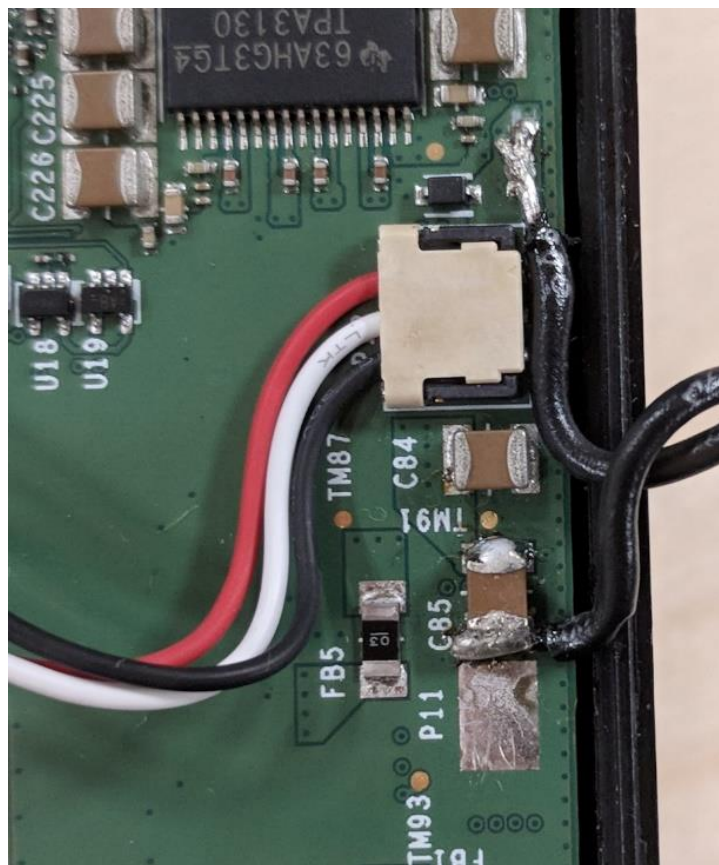
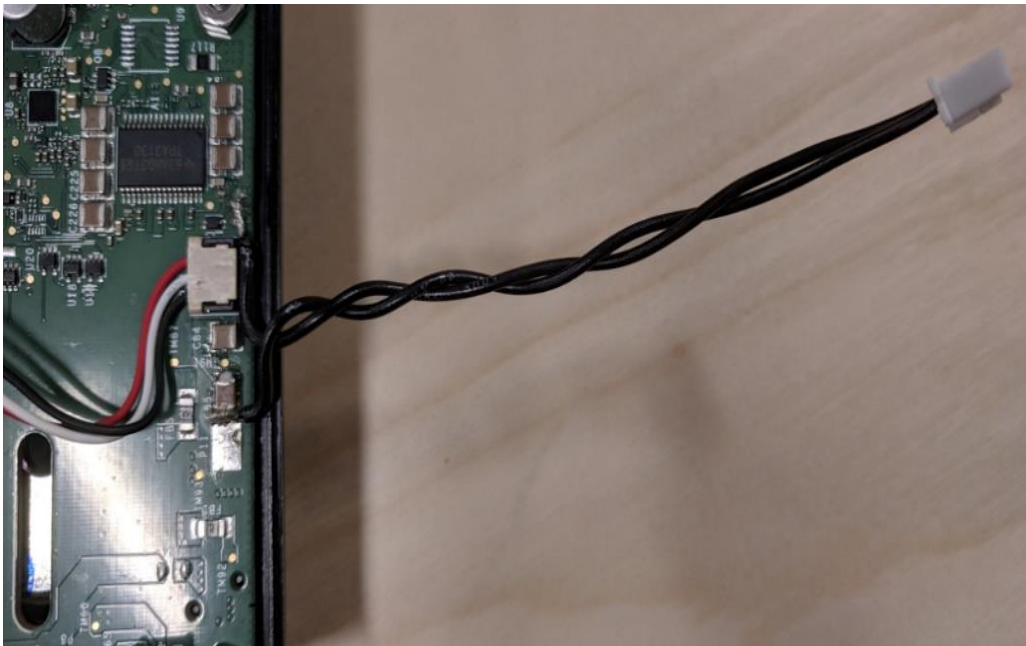


Figure 8: Implementation images, Top (far view) and bottom (Zoomed in view)

Below is the complete assembled system, from the outside:

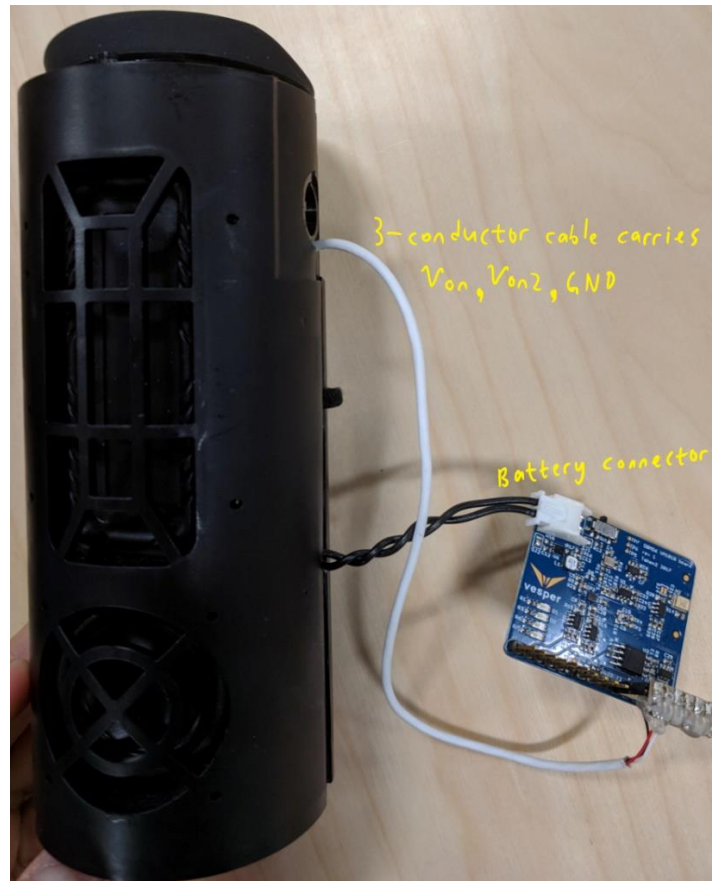


Figure 9: Complete assembled system from the outside

Part 4: Current monitoring (with NI USB-6000 interface)

The S-VM1010-D board displays the supply current of five separate power domains. These currents are displayed as five ratiometric voltages which can be measured with a 5-channel ADC. We perform this measurement using a National Instruments USB-6000 interface.

Multiplying the current by the supply voltage at each point, this allows real-time monitoring of the power consumption of each part of the board.

Table 1: Power domains of S-VM1010-D

The diagram shows the underside of the USB-6000 module with the following components and connections:

- CS_FLASH (1000V/A)**: Connected to pin 7 of the USB-6000 connector.
- CS_VDD_MIC (10mV/μA)**: Connected to pin 6 of the USB-6000 connector.
- CS_VDDIO (1000V/A)**: Connected to pin 5 of the USB-6000 connector.
- CS_VCCA (1000V/A)**: Connected to pin 4 of the USB-6000 connector.
- CS_VDD (100V/A)**: Connected to pin 3 of the USB-6000 connector.
- Gnd**: Connected to pins 1 and 2 of the USB-6000 connector.

The module also features a **vesper** logo, various components (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R113, R114, R115, R116, R117, R118, R119, R120, R121, R122, R123, R124, R125, R126, R127, R128, R129, R130, R131, R132, R133, R134, R135, R136, R137, R138, R139, R140, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, R174, R175, R176, R177, R178, R179, R180, R181, R182, R183, R184, R185, R186, R187, R188, R189, R190, R191, R192, R193, R194, R195, R196, R197, R198, R199, R200, R201, R202, R203, R204, R205, R206, R207, R208, R209, R210, R211, R212, R213, R214, R215, R216, R217, R218, R219, R220, R221, R222, R223, R224, R225, R226, R227, R228, R229, R230, R231, R232, R233, R234, R235, R236, R237, R238, R239, R240, R241, R242, R243, R244, R245, R246, R247, R248, R249, R250, R251, R252, R253, R254, R255, R256, R257, R258, R259, R260, R261, R262, R263, R264, R265, R266, R267, R268, R269, R270, R271, R272, R273, R274, R275, R276, R277, R278, R279, R280, R281, R282, R283, R284, R285, R286, R287, R288, R289, R290, R291, R292, R293, R294, R295, R296, R297, R298, R299, R300, R301, R302, R303, R304, R305, R306, R307, R308, R309, R310, R311, R312, R313, R314, R315, R316, R317, R318, R319, R320, R321, R322, R323, R324, R325, R326, R327, R328, R329, R330, R331, R332, R333, R334, R335, R336, R337, R338, R339, R340, R341, R342, R343, R344, R345, R346, R347, R348, R349, R350, R351, R352, R353, R354, R355, R356, R357, R358, R359, R360, R361, R362, R363, R364, R365, R366, R367, R368, R369, R370, R371, R372, R373, R374, R375, R376, R377, R378, R379, R380, R381, R382, R383, R384, R385, R386, R387, R388, R389, R390, R391, R392, R393, R394, R395, R396, R397, R398, R399, R400, R401, R402, R403, R404, R405, R406, R407, R408, R409, R410, R411, R412, R413, R414, R415, R416, R417, R418, R419, R420, R421, R422, R423, R424, R425, R426, R427, R428, R429, R430, R431, R432, R433, R434, R435, R436, R437, R438, R439, R440, R441, R442, R443, R444, R445, R446, R447, R448, R449, R450, R451, R452, R453, R454, R455, R456, R457, R458, R459, R460, R461, R462, R463, R464, R465, R466, R467, R468, R469, R470, R471, R472, R473, R474, R475, R476, R477, R478, R479, R480, R481, R482, R483, R484, R485, R486, R487, R488, R489, R490, R491, R492, R493, R494, R495, R496, R497, R498, R499, R500, R501, R502, R503, R504, R505, R506, R507, R508, R509, R510, R511, R512, R513, R514, R515, R516, R517, R518, R519, R520, R521, R522, R523, R524, R525, R526, R527, R528, R529, R530, R531, R532, R533, R534, R535, R536, R537, R538, R539, R540, R541, R542, R543, R544, R545, R546, R547, R548, R549, R550, R551, R552, R553, R554, R555, R556, R557, R558, R559, R560, R561, R562, R563, R564, R565, R566, R567, R568, R569, R570, R571, R572, R573, R574, R575, R576, R577, R578, R579, R580, R581, R582, R583, R584, R585, R586, R587, R588, R589, R590, R591, R592, R593, R594, R595, R596, R597, R598, R599, R600, R601, R602, R603, R604, R605, R606, R607, R608, R609, R610, R611, R612, R613, R614, R615, R616, R617, R618, R619, R620, R621, R622, R623, R624, R625, R626, R627, R628, R629, R630, R631, R632, R633, R634, R635, R636, R637, R638, R639, R640, R641, R642, R643, R644, R645, R646, R647, R648, R649, R650, R651, R652, R653, R654, R655, R656, R657, R658, R659, R660, R661, R662, R663, R664, R665, R666, R667, R668, R669, R670, R671, R672, R673, R674, R675, R676, R677, R678, R679, R680, R681, R682, R683, R684, R685, R686, R687, R688, R689, R690, R691, R692, R693, R694, R695, R696, R697, R698, R699, R700, R701, R702, R703, R704, R705, R706, R707, R708, R709, R710, R711, R712, R713, R714, R715, R716, R717, R718, R719, R720, R721, R722, R723, R724, R725, R726, R727, R728, R729, R730, R731, R732, R733, R734, R735, R736, R737, R738, R739, R740, R741, R742, R743, R744, R745, R746, R747, R748, R749, R750, R751, R752, R753, R754, R755, R756, R757, R758, R759, R760, R761, R762, R763, R764, R765, R766, R767, R768, R769, R770, R771, R772, R773, R774, R775, R776, R777, R778, R779, R780, R781, R782, R783, R

Figure 10: Wiring Diagram for NI USB-6000

Below is a photo of the completed wiring for current-monitoring:



Figure 11: completed wiring for current monitoring

A complete demo of Wake on Sound operation with VM1010 microphone and DSP Group DBMD6 reference board can be seen in [1] . For additional information on Vesper's latest roadmap of microphone products, visit our website [2] or reach out to info@vespermems.com.

References

- [1] "Wake On Sound demo with VM1010 + DSP Group DBMD6 on Amazon Tap," [Online]. Available: <https://www.youtube.com/watch?v=4WAguQw4RYo>.
- [2] "Vesper Technologies," [Online]. Available: www.vespermems.com.