



ochin_CM4 Hardware test number 4

USB current limiter

Devices used for tests

1. ochin CM4 carrier board
2. Raspberry Pi CM4 module with eMMC
3. Power Supply 0-30Vdc
4. JST GHR-06V-S with AWG28 cables

Test description

This test is intended to verify the functionality of the AP22615 current limiter.

This device has the purpose of limiting the flow of current drawn by USB peripherals by cutting the VBUS if the pre-set current threshold of 3A is exceeded.

Thanks to this device it is possible to guarantee the current necessary for the operation of the CM4 module, even in the case of high absorption by a USB peripheral, following a failure or malfunction.

To verify its operation, it is necessary to measure the VBUS and simultaneously increase the drawn current, until the threshold is reached, when the VBUS voltage will drop due to the opening of the switch.

Test execution

To increase the current over time, a programmable electronic load such as the DL24 must be connected to the VBUS. The DL24 allows you to set the current to be drawn and can be increased to reach the threshold to verify the intervention of the AP22615. The USB current threshold of the ochin_CM4 board is set to 3A, which is the maximum

recommended threshold for the AP22615. However, this component can reach higher currents, even if for short periods.

For this reason, in the ochin board used for the test, I decided to increase the threshold to 4A to verify the operation even above the maximum recommended limit.

Test result

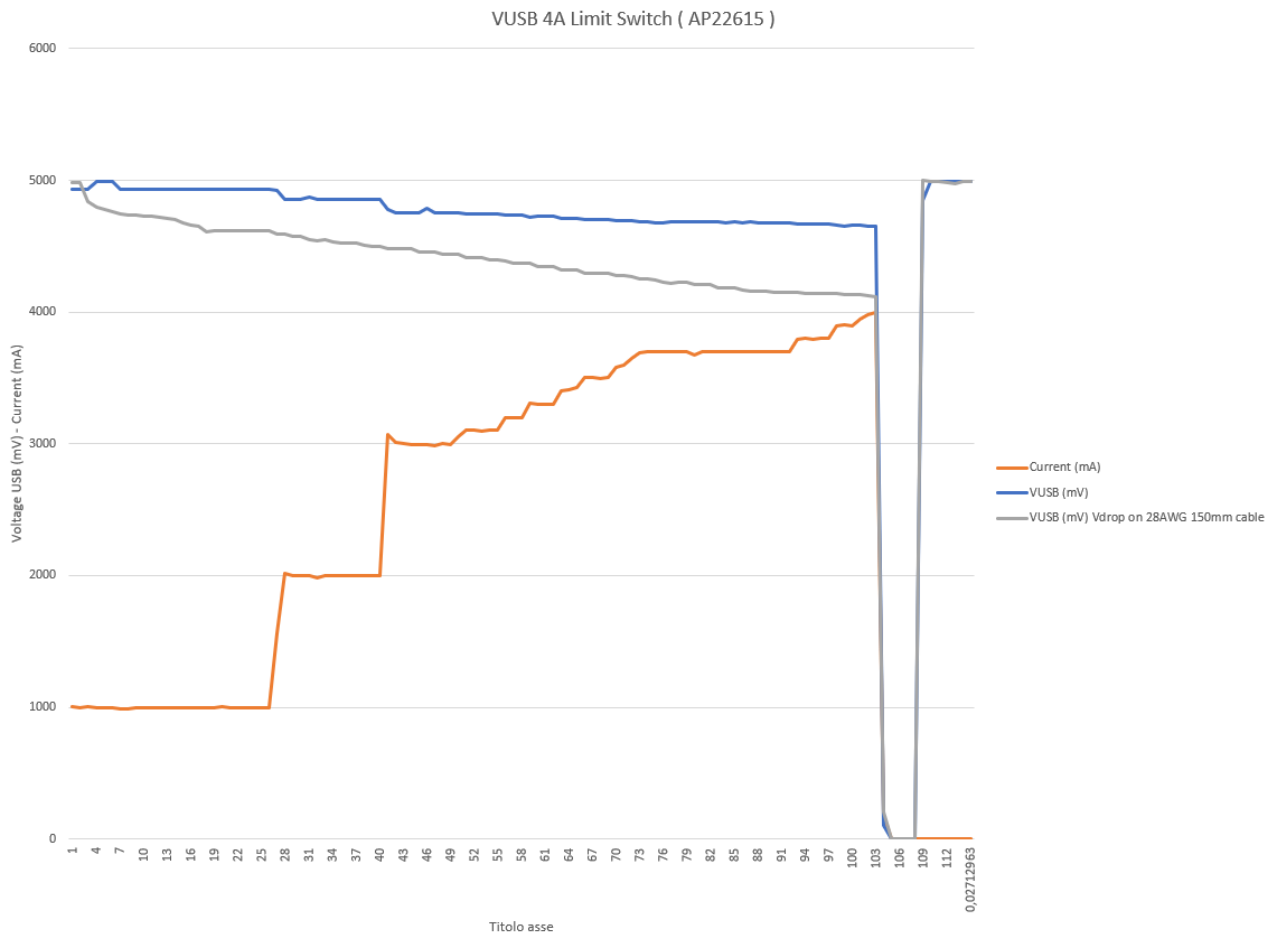
In the following plot it is possible to see the orange trace which represents the drawn current. The blue trace represents the VBUS voltage measured on the pins of the USB connectors present on the edge of the board.

As can be seen from the plot, as the drawn current increases, the voltage drop between the Vin and the VBUS also increase and reaches 350mV when the drawn current hit 4A.

Once the 4A threshold is reached, the current limiter opens the circuit and the VBUS goes to 0Vdc, to return to 5Vdc voltage when the load ceases.

In the plot there is a third gray trace, it represents the VBUS measured at the end of a 150mm long 28AWG wire (those that are normally connected to the GHR connectors). As can be seen, the voltage drop in this case is much larger, reaching almost 900mV with a drawn current of 4A.

This phenomenon is due to the small section of the conductor used and the length of the wire. For this reason, in case of big loads on the USBs, it is always necessary to choose a conductor of adequate size to avoid too high drop voltages.



The test demonstrates the correct functioning of the current limiter, even at currents higher than the recommended one of 3A.

Test Passed