NXP Semiconductors

Technical Note

Document Number: SLN-VIZN-IOT-POWER-CONSUMPTION

Rev. 1.0, 02/2020

MCU VIZN IoT Solution Technical Note

Contents

1. Introduction

NXP's MCU-based SLN-VIZN-IOT solution provides OEMs with a fully integrated, self-contained, software and hardware solution. This includes the i.MX RT106F and pre- integrated machine learning face recognition algorithms that provides the NXP i.MX RT run-time library, as well as all required drivers for peripherals, such as camera and memories.

The present note provides power consumption figures when running NXP demonstration software (sln_vizn_iot_userid_oobe) on SLN-VIZN-IOT hardware. The note highlights typical current consumption data by splitting the system into 4 major contributors:

1. i.MXRT106F
2. SDRAM
3. Hyper-Flash
4. Additional contributors including LEDs, audio section (not enabled⇔standby mode), WLAN module (not enabled⇔standby mode), IO expander, PIR section (to recover from Low power mode), power section, and more.

In summary:

- When the platform is running the userid_oobe demo detecting a face (video over USB), the average current drawn from the **5V supply is typically 180mA**. This is equivalent to an **average of 0.9W**. In that configuration, the main contributors are as follows: iMXRT106F (78mA), camera (40mA), hyper-flash memory (30mA), SDRAM (19mA) while other functions represents 8.4mA.
- The peak current consumption is observed when a face is detected/recognized: about 235mA. This is equivalent to a **peak power of 1.18W**.

2. SLN-VIZN-IOT hardware description

Figure 1 details SLN-VIZN-IOT hardware architecture.

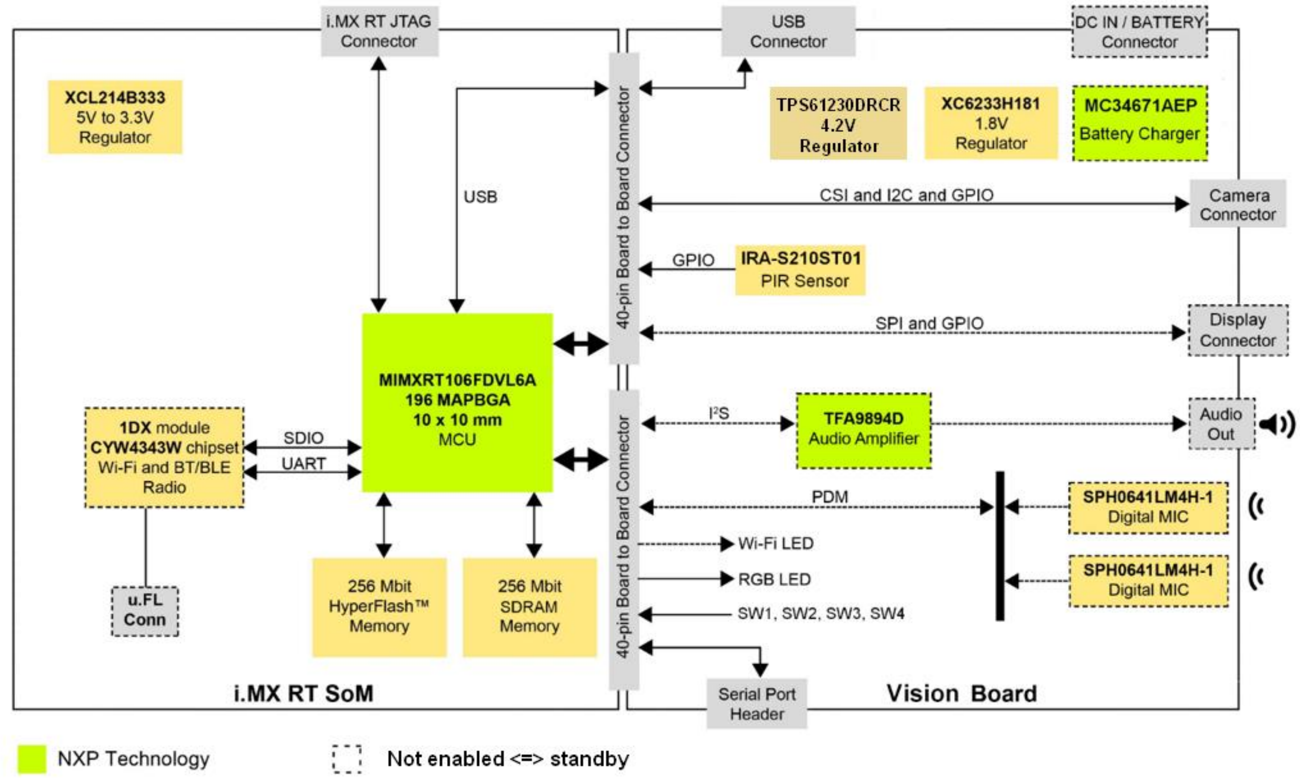

Figure 1. MCU SLN-VIZN-IOT hardware block diagram

3. Power Supply section

The platform is supplied with a +5V DC input, typically delivered via a USB type C connector.
To power the various sections of the platform, the +5V is down-converted to +3.3V using a DCDC buck converter and to +1.8V using a Low Drop Out Linear regulator. It also includes a +4.2V DCDC boost converter to supply an optional LED driver.
As a second power option, the platform also embeds a Li-ion battery charger connected to the +5V DC input. In this configuration, 2x Li-ion 18650 (parallel) type batteries are recommended.

Main component	Description	Supply voltage	Note
iMXRT106A	MCU	+3.3V	Supply to the embedded DCDC converter, to the peripherals, etc…
		+5V	Supply to the USB interface
LBEEKL1DX	WLAN module	+3.3V	Not enabled in this test
IS26KL256S	Hyperflash memory	+3.3V	
W9825G6JB-6I	SDRAM	+3.3V	
PCAL6524	24-bit I/O expander	+3.3V	

FXOS8700CQ	6-axis Motion sensor	+3.3V	Not enabled in this test
IRA-S210ST01	PIR + signal conditioning		Motion detection. Can be used as a wake-up source
SPH0641LM4H	PDM microphone	+3.3V	Not enabled in this test
TFA9894D	Audio amplifier (Not enabled in this test)	+5V	Supply to DCDC boost converter and class-D amplifier
		+3.3V	Supply for the digital interface to i.MXRT
		+1.8V	Supply for the audio DSP

Table 1. Power supplies of the main components.

4. Current consumption test setup

The diagram below details how power consumption is measured.

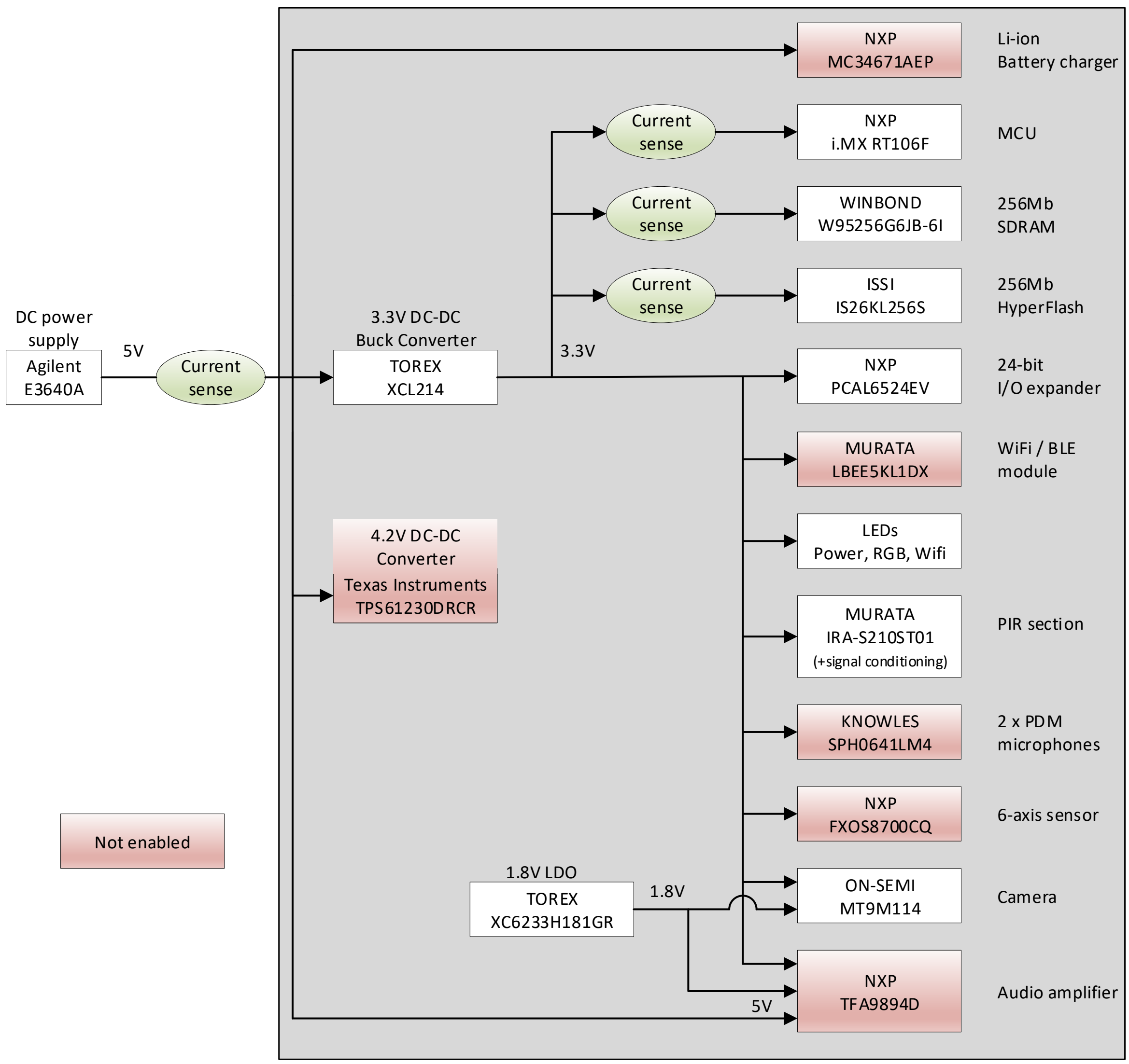

Figure 2. Current Sensing on SLN-VIZN-IOT

Notes:

- The HW needs to be modified to allow the current measurements. Cf. Annex – HW modifications for current consumption measurements).
- The current contributions are measured using Keysight CX332A (Device Current Waveform Analyzer) together with the associated current probe CX1101A and Fluke 8842A (Multimeter)

5. Current consumption data

In the following measurement results, the SLN-VIZN-IOT kit has been streaming video to a PC running the Windows camera application via USB.
2 situations were evaluated:

a. Running the OoBE with an already-registered face in front of the camera (detection resolution: QVGA),
b. i.MXRT106F being in Suspend mode, all other parts being in standby mode or disabled when allowed by the hardware. A PIR sensor is used for wakeup. Please also note that those numbers are only for reference, this kit not being designed for the lowest possible power consumption (No power switch, SNVS mode of MCU not supported).

5.1. Summary

The table shows the current consumption from the +5V supply or from the +3.3V line (i.e. after the DCDC buck regulator). *Grey figures* are estimated currents either based on the datasheets or differential measurements, assuming that the DCDC buck regulator has a power efficiency of 88% @180mA and 87% @14mA.

		On +5V supply		On +3.3V supply		On +1.8V supply	
Operating mode	section	Average current	Average power	Average current	Average power	Average current	Average power
Running userid_oobe	i.MXRT106F	*78mA*	*390mW*	106mA	350mW	n.a	n.a
	SDRAM	*19.2mA*	*96mW*	26mA	86mW	n.a	n.a
	Hyper-flash	*30.3mA*	*151mW*	41mA	135mW	n.a	n.a
	Camera	*40mA*	*200mW*	*27mA*	*89mW*	*18mA*	*32mW*
	Other	*12.5mA*	*62.5mW*	*11mA*	*36mW*	n.a	n.a
	Total	180mA	900mW	*211mA*	*696mW*	*18mA*	*32mW*
MCU in Suspend mode. PIR sensor for wake-up	i.MXRT106F	*250µA*	*1.25mW*	330µA	1.1mW	n.a	n.a
	SDRAM	*1.78mA*	*8.9mW*	2.38mA	7.9mW	n.a	n.a
	Hyper-flash	*19µA*	*95µW*	30µA	0.1mW	n.a	n.a
	Camera	*220µA*	*1.1mW*	*330µA*	*1mW*	*0*	*0*
	Other	*11.7mA*	*58.5mW*	*11mA*	*36mW*	n.a	n.a
	Total	14mA	70mW	*14.1mA*	*70mW*	*0*	*0*

Table 2. Current consumption figures

Note:

1. Decreasing the MCU frequency to 528MHz or even lower would allow a significant reduction in the total power consumption. The impact on the inference time (not reported in this document) needs to be evaluated.
2. Removing LEDs (Power, RGB, WiFi) + removing/increasing some pull-up resistors allows a decrease in current consumption from the +5V supply to 8mA (40mW) in Low Power mode (PIR to wake-up)

5.2. i.MXRT106F

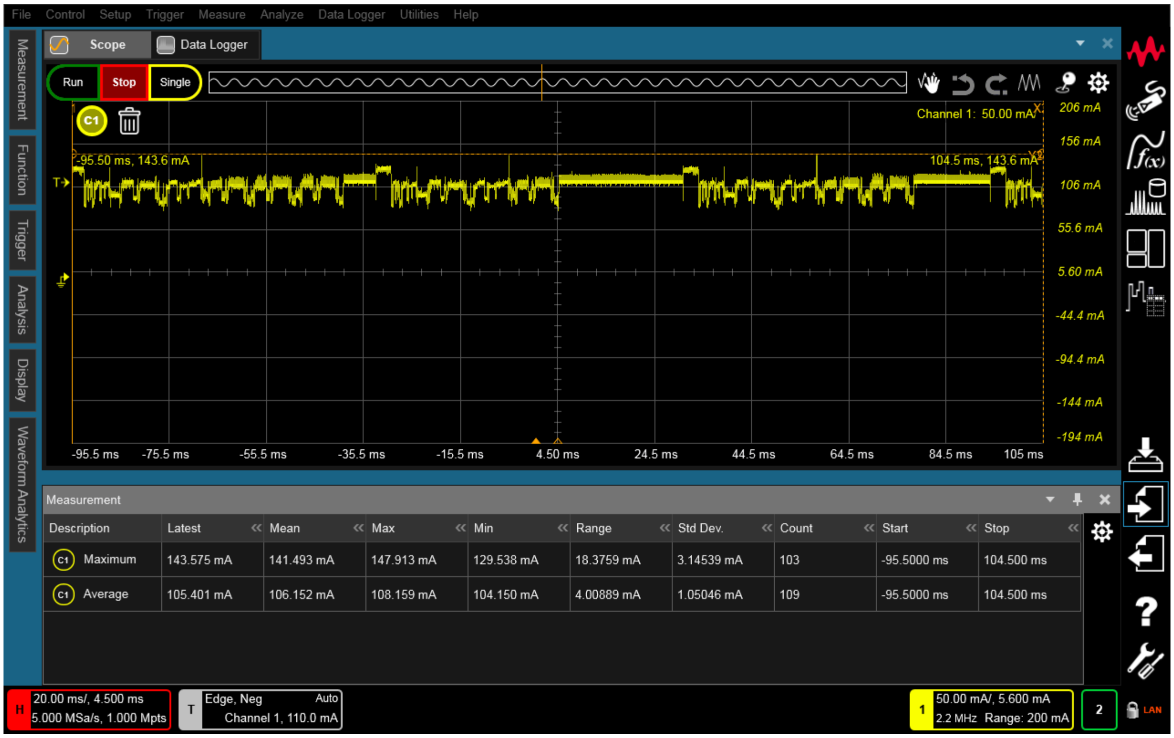

Figure 3. +3.3V Current consumption of i.MXRT106F – Running userid_oobe.

Figure 4. +3.3V Current consumption of i.MXRT106F – Suspend mode.

5.3. SDRAM

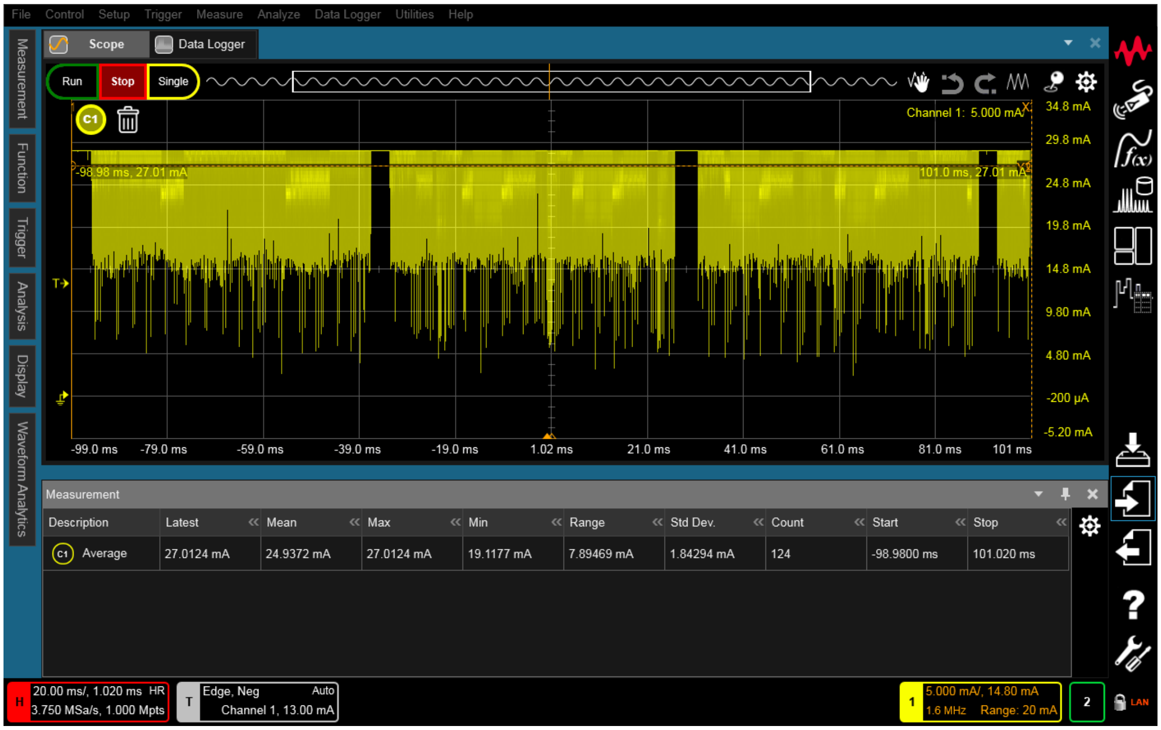

Figure 5. +3.3V Current consumption of SDRAM – Running userid_oobe

5.4. SLN-VIZN-IOT kit

Figure 6. +5V Current consumption of SLN-VIZN-IOT kit – running userid_oobe.

6. Annex – HW & SW versions

PCB	Description	Version
SPF-SOL0001	i.MXRT106F connected module	D
SPF-SOL0002	Vision Board	C

Table 3. HW revision.

Application	Version
Sln_vizn_iot_userid_oobe	Beta05

Table 4. SW revision.

7. Annex – HW modifications for current consumption measurements

The following snapshots illustrate the changes made to the reference schematic to enable the current measurements.

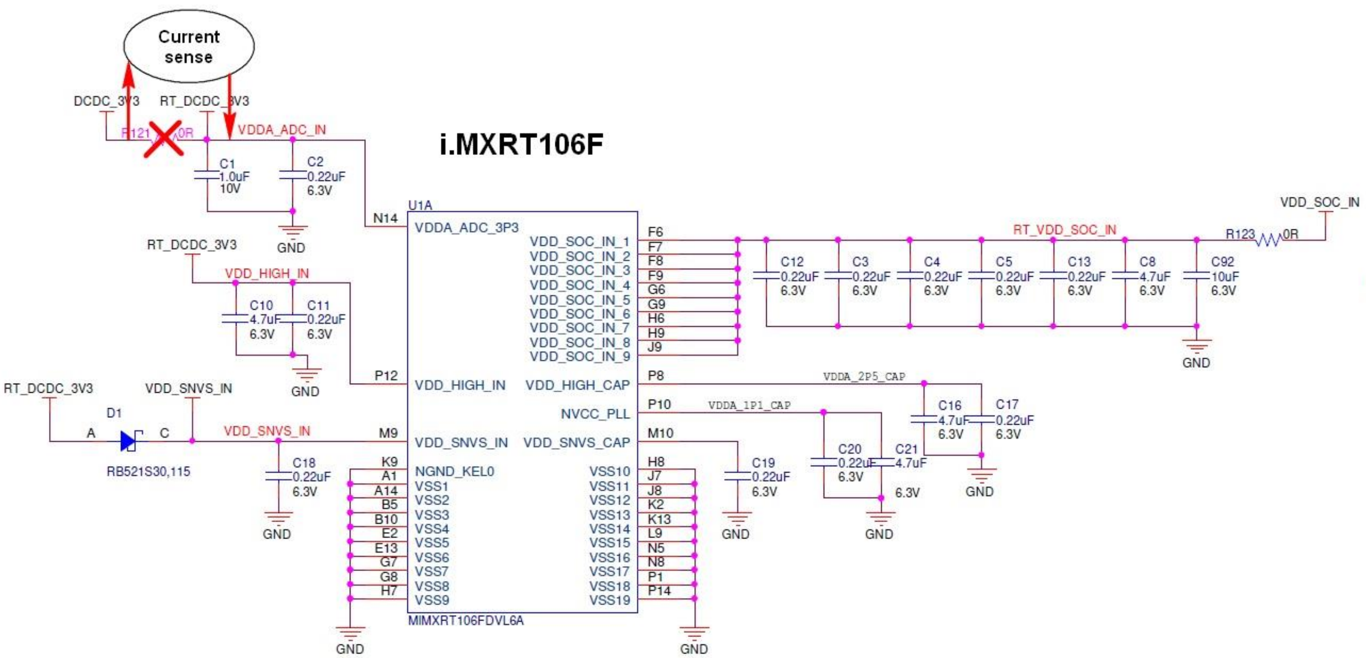

Figure 7. i.MXRT106F section, modification to measure the current.

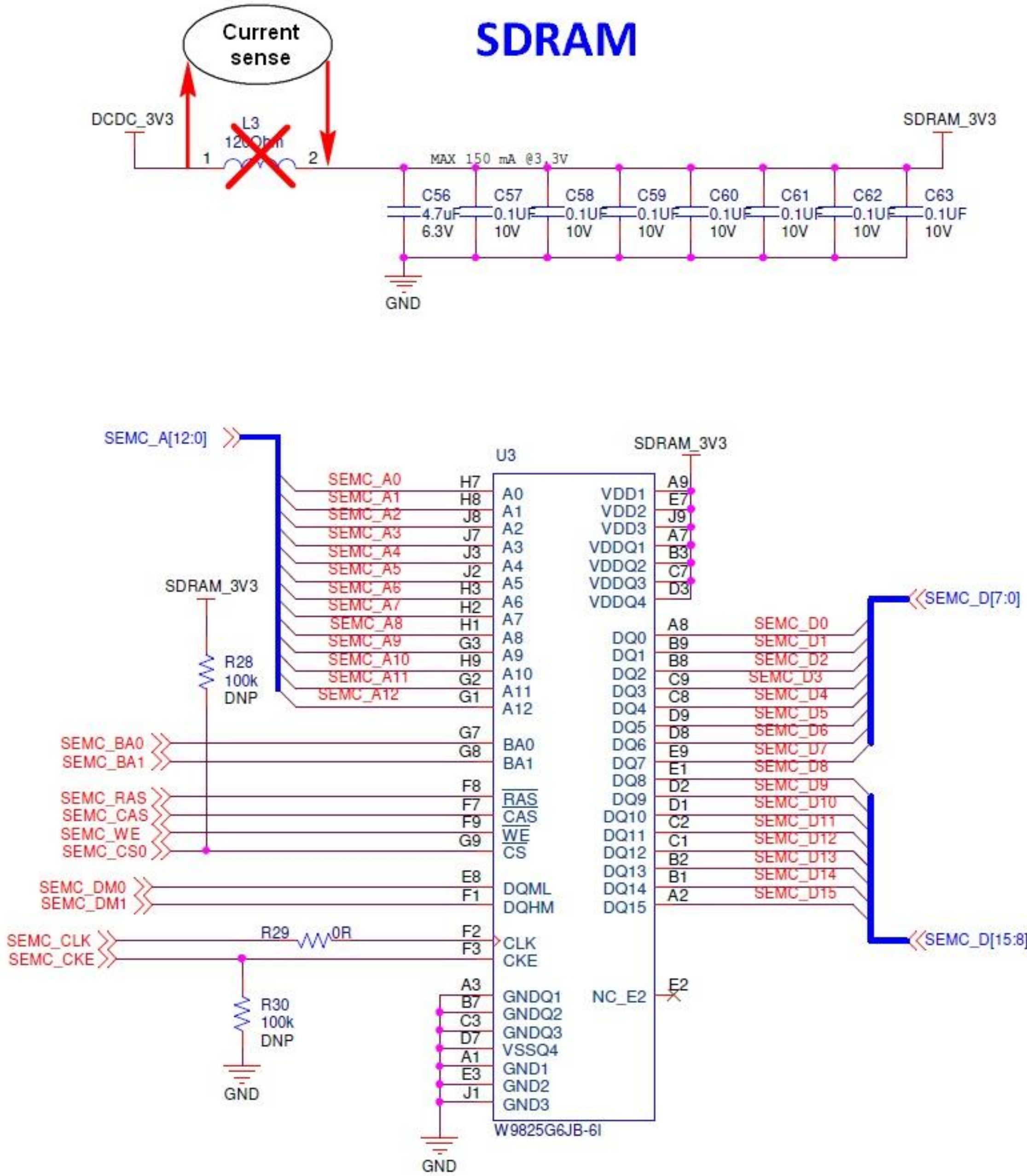

Figure 8. SDRAM section, modification to measure the current.

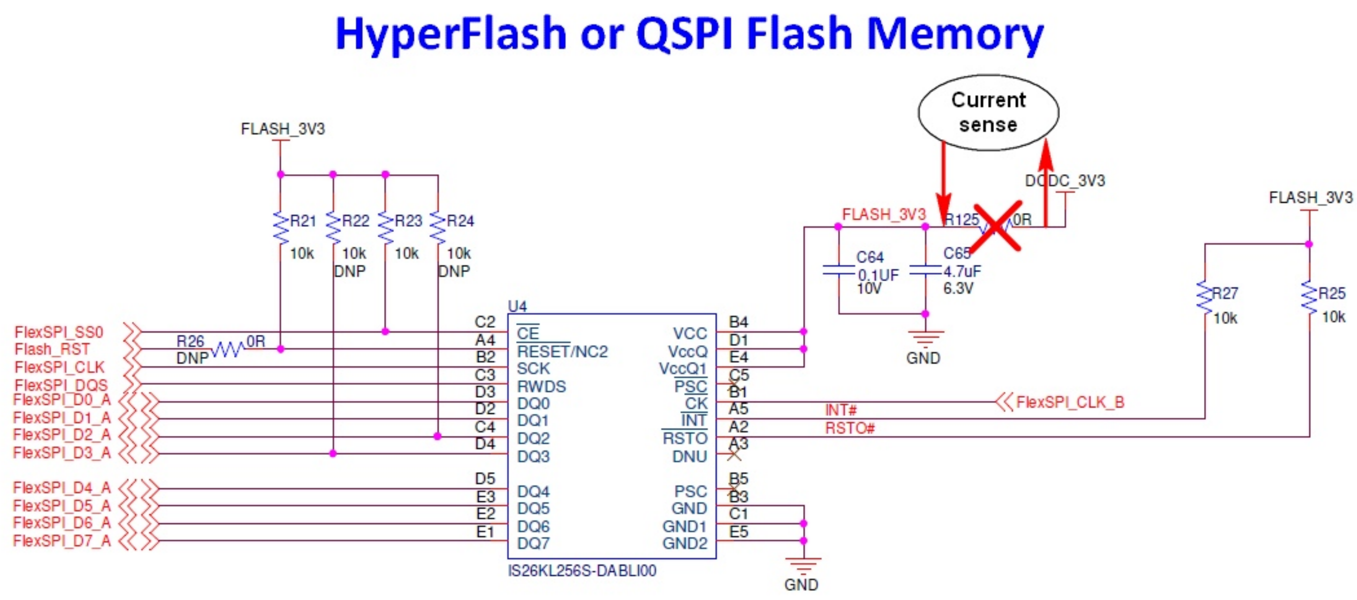

Figure 9. Hyper-Flash section, modification to measure the current.

Document Details

3.1. Revision History

Date	Version	Details of change	Author	Reviewers
10-02-2020	Draft 1.0	Initial version based on sln_vizn_userid_oobe Beta_05	Vincent FILLATRE	

3.2. References

Document/Link	Remark
SPF_SOL0001_D	Connected module schematic
SPF_SOL0005_C	Vision board schematic

3.3. Definitions

Term	Definition

3.4. Acronyms & Abbreviations

Term	Definition

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