

# Design Notes from Franco 19-Jun-2023

Franco VENTURI\ Mon, 19 Jun, 21:51 (10 hours ago)

to me, tangerinesdr, Majid, Rob, Tom, John

## A few quick comments

### Maximum Throughput:

- regarding the maximum throughput achievable with the FX3 the best place to start IMHO is Cypress AN86947 ([https://www.infineon.com/dgdl/Infineon-AN86947\\_Optimizing\\_USB\\_3.0\\_Throughput\\_with\\_EZ-USB\\_FX3-ApplicationNotes-v05\\_00-EN.pdf?fileId=8ac78c8c7cdc391c017d073e3a2e6243](https://www.infineon.com/dgdl/Infineon-AN86947_Optimizing_USB_3.0_Throughput_with_EZ-USB_FX3-ApplicationNotes-v05_00-EN.pdf?fileId=8ac78c8c7cdc391c017d073e3a2e6243)) - as you can see there the maximum throughput is achieved using an AUTO DMA channel with the GPIF II interface, 32bit wide, and with a clock rate of 100MHz (and with 4 DMA buffer of 8kB each - bulk transfer mode)

### Important App Notes:

- if I remember correctly, Oscar Steila IK1XPV design is based on the 'cyfxbulklpauto' example (you can find it in 'cyfx3sdk/firmware/dma\_examples/cyfxbulklpauto' in the FX3 firmware SDK file 'fx3\_firmware\_linux.tar.gz'), and on a couple of very useful application notes from Cypress/Infineon: AN65974 "Designing with the EZ-USB FX3 slave FIFO interface" ([https://www.infineon.com/dgdl/Infineon-AN65974\\_Designing\\_with\\_the\\_EZ-USB\\_FX3\\_Slave\\_FIFO\\_Interface-ApplicationNotes-v17\\_00-EN.pdf?fileId=8ac78c8c7cdc391c017d07396c095deb](https://www.infineon.com/dgdl/Infineon-AN65974_Designing_with_the_EZ-USB_FX3_Slave_FIFO_Interface-ApplicationNotes-v17_00-EN.pdf?fileId=8ac78c8c7cdc391c017d07396c095deb)),
- and the 'ping-pong' DMA buffers approach shown in AN75779 "How to implement an image sensor interface using EZ-USB FX3 in a USB Video Class (UVC) framework" ([https://www.infineon.com/dgdl/Infineon-AN75779How\\_to\\_Implement\\_an\\_Image\\_Sensor\\_Interface\\_with\\_EZ-USB\\_FX3\\_in\\_a\\_USB\\_Video\\_Class\(UVC\)\\_Framework-ApplicationNotes-v13\\_00-EN.pdf?fileId=8ac78c8c7cdc391c017d073ad2b85f0d](https://www.infineon.com/dgdl/Infineon-AN75779How_to_Implement_an_Image_Sensor_Interface_with_EZ-USB_FX3_in_a_USB_Video_Class(UVC)_Framework-ApplicationNotes-v13_00-EN.pdf?fileId=8ac78c8c7cdc391c017d073ad2b85f0d)))

### Previous Code:

- when I looked at what he did a few years ago I didn't think it was exceedingly difficult; I remember the one thing to get right is the design of the GPIF II state machine using the program 'GPIF II Designer' (that I think runs only on Windows), but we can definitely look at what Oscar did and follow his footsteps (I think the design of his GPIF II state machine is in his GitHub repository too, so we can use that as a starting point)

### Keep Things Simple:

- if I have to give you one advice is to try to 'keep things as simple as possible'; this is what Oscar did in his design of the BBRF103, which he was able to design and make in a relatively short period of time. I think the important thing is to get a prototype out that works even if it is not perfect and meet all the specifications. We can always improve from that but at least the first step is done.

### **Choice of ADC:**

- regarding the choice of the ADC I don't think 14bit or 16bit makes much of a difference in terms of ENOB, since I read somewhere about diminishing returns at those resolutions (can't find the link now); since the FX3 GPIF II works with 16/32 bits at a time, using a 14bit ADC would give us two extra bits for each sample: one could be used for the overflow bit, and the MSB for the PPS from the GPSDO, which I think is what Tom is doing in the TangerineSDR.

### **General advice:**

- and finally I expect that someone will eventually come out with the "ClementineSDR+" that uses the LTC2208-16, since for some reason they are dirt cheap on AliExpress.

73,

Franco K4VZ