Microchips and Components of a Goflex™ Desk Adapter USB 3.0

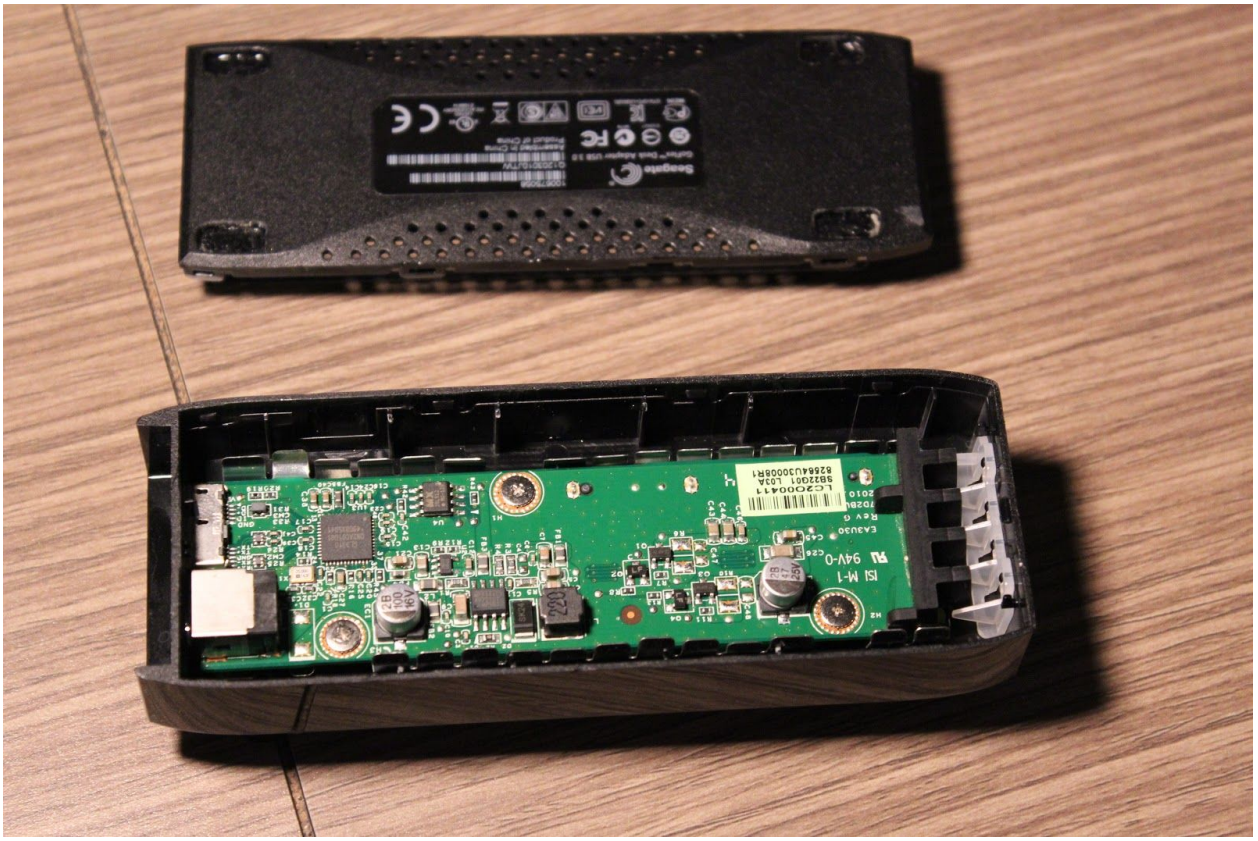
By Team 6546A "One Degree North A"
For the Electronics Online Challenge sponsored by Texas Instruments

Introduction

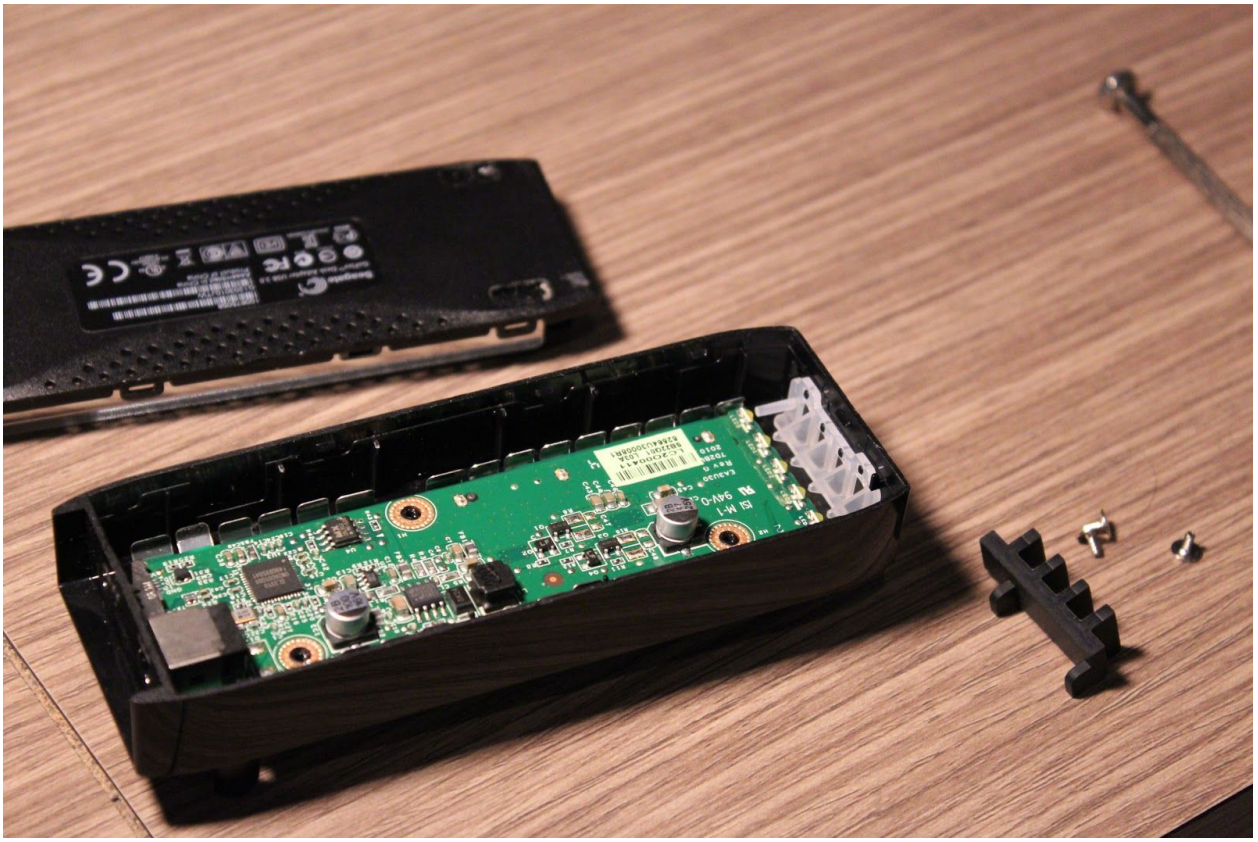
The Seagate Goflex™ Desk USB 3.0 Adapter is the bottom portion of a seagate external hard drive. This adapter converts 12V power from a barrel jack and USB 3.0 Micro-B to SATA III 3.0Gbps and SATA power (12V/5V). Our team chose this device to investigate what chips made it possible to convert my USB 3.0 into SATA III: How does a device take two completely different standards and convert them?

Disassembly

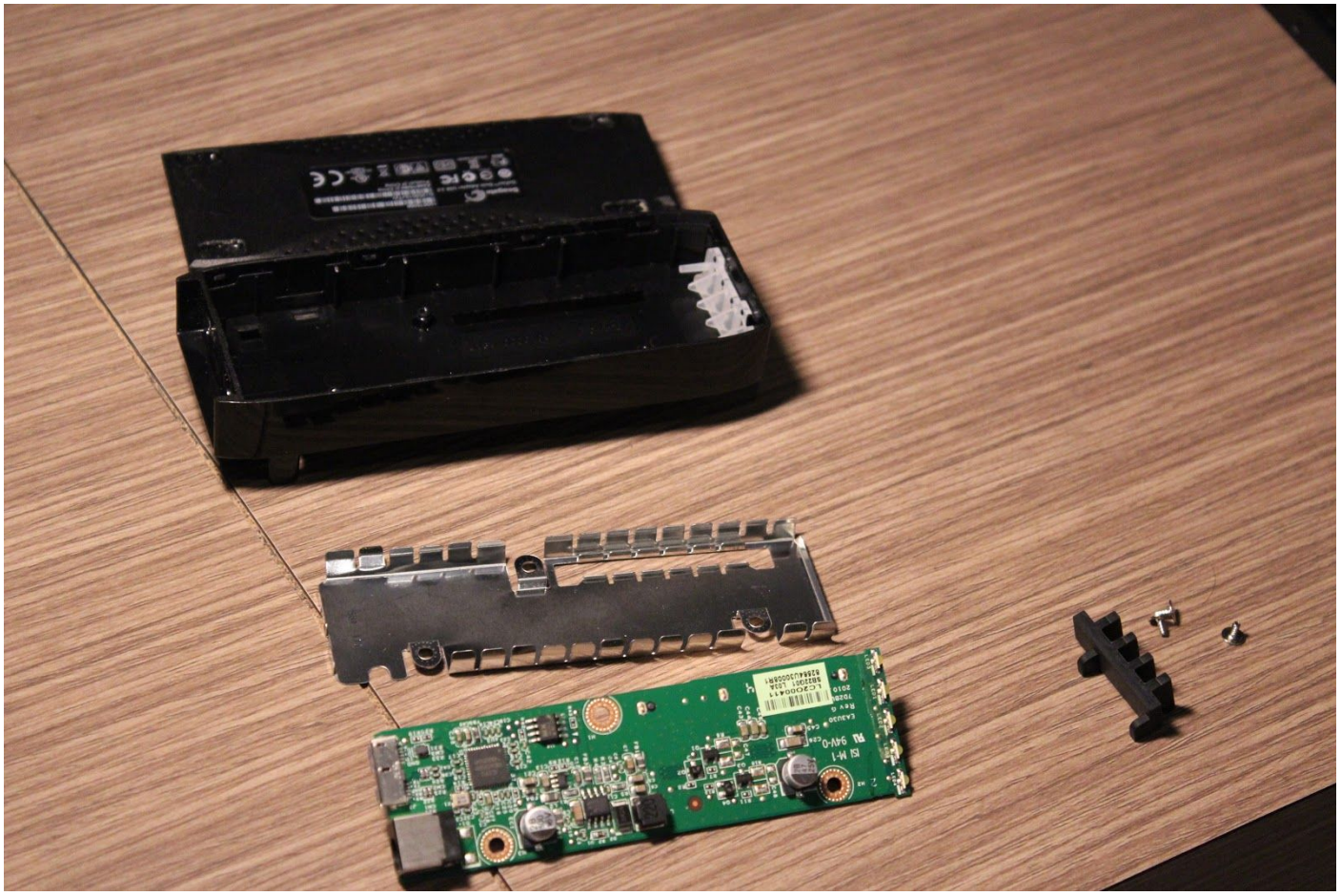
External View of Device with no modifications (excluding rubber bits being removed)



This device utilized plastic tabs that needed to be released by inserting a small slot head screwdriver in between the plastic pieces.

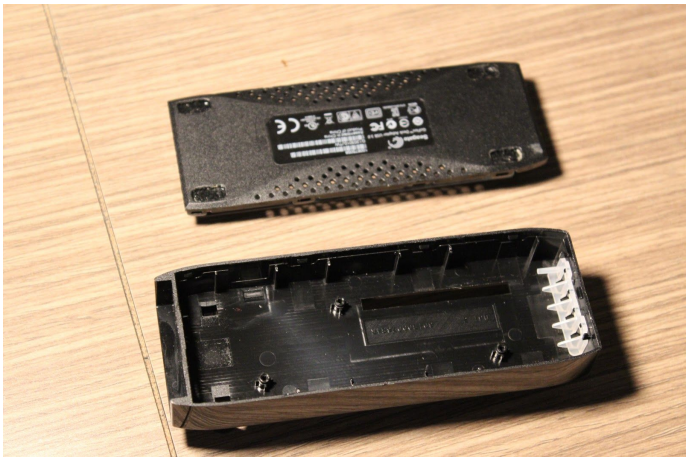


The PCB was held in place with 3 phillips head screws and a rubber piece for the LEDs.

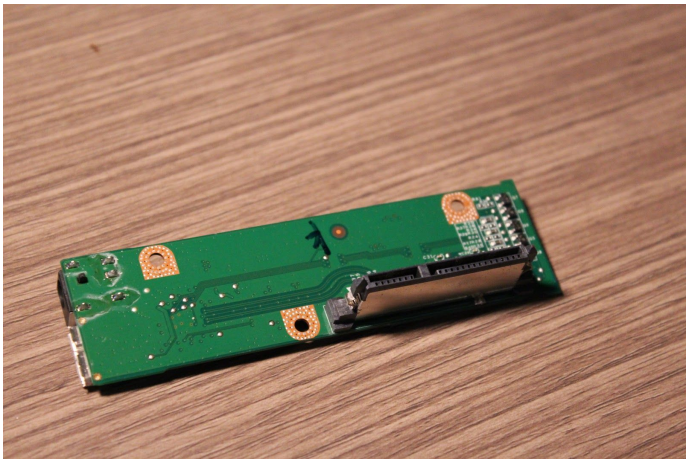


After the screws and rubber piece were removed the PCB and metal tray were removed.

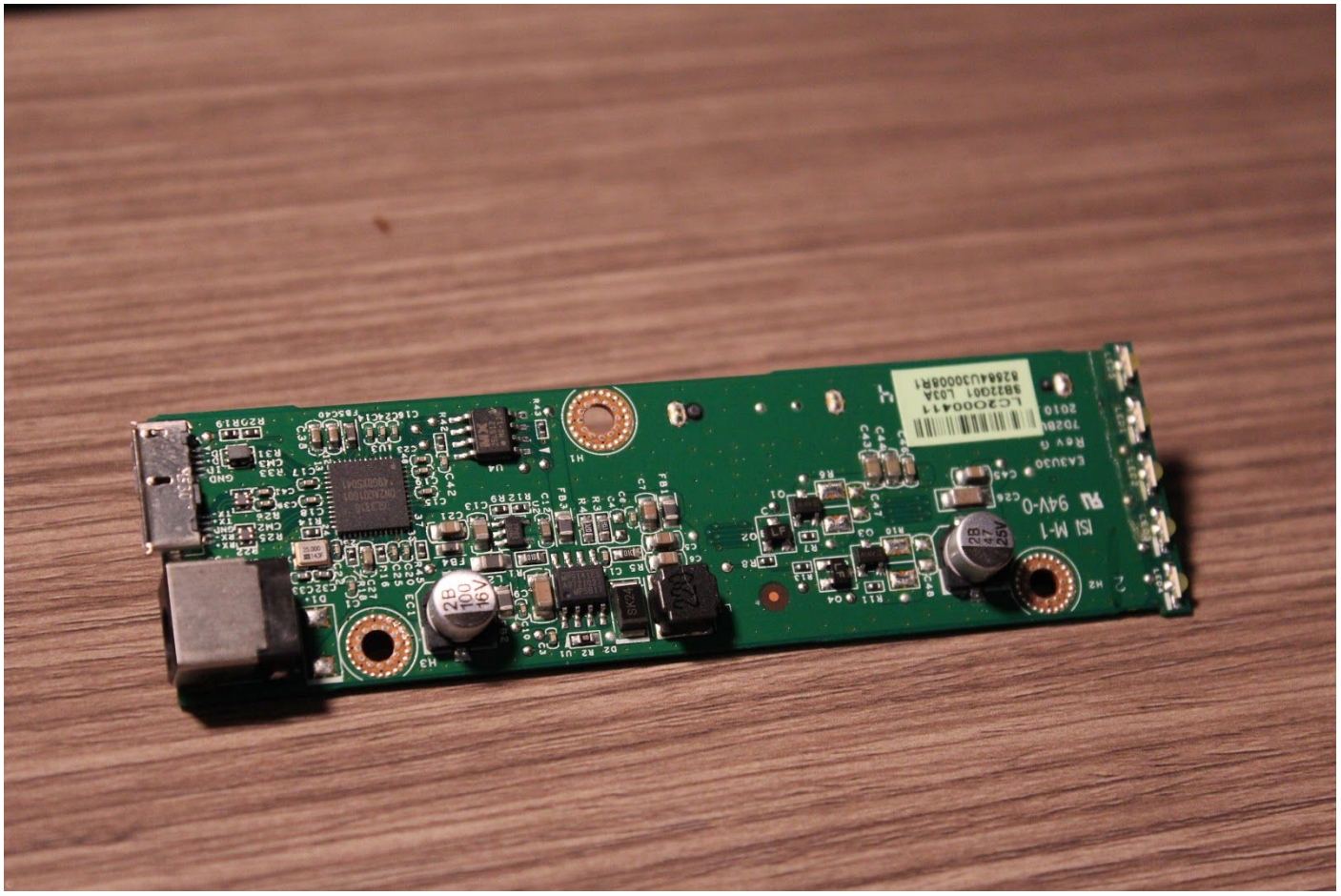
Device Images



Case of Device

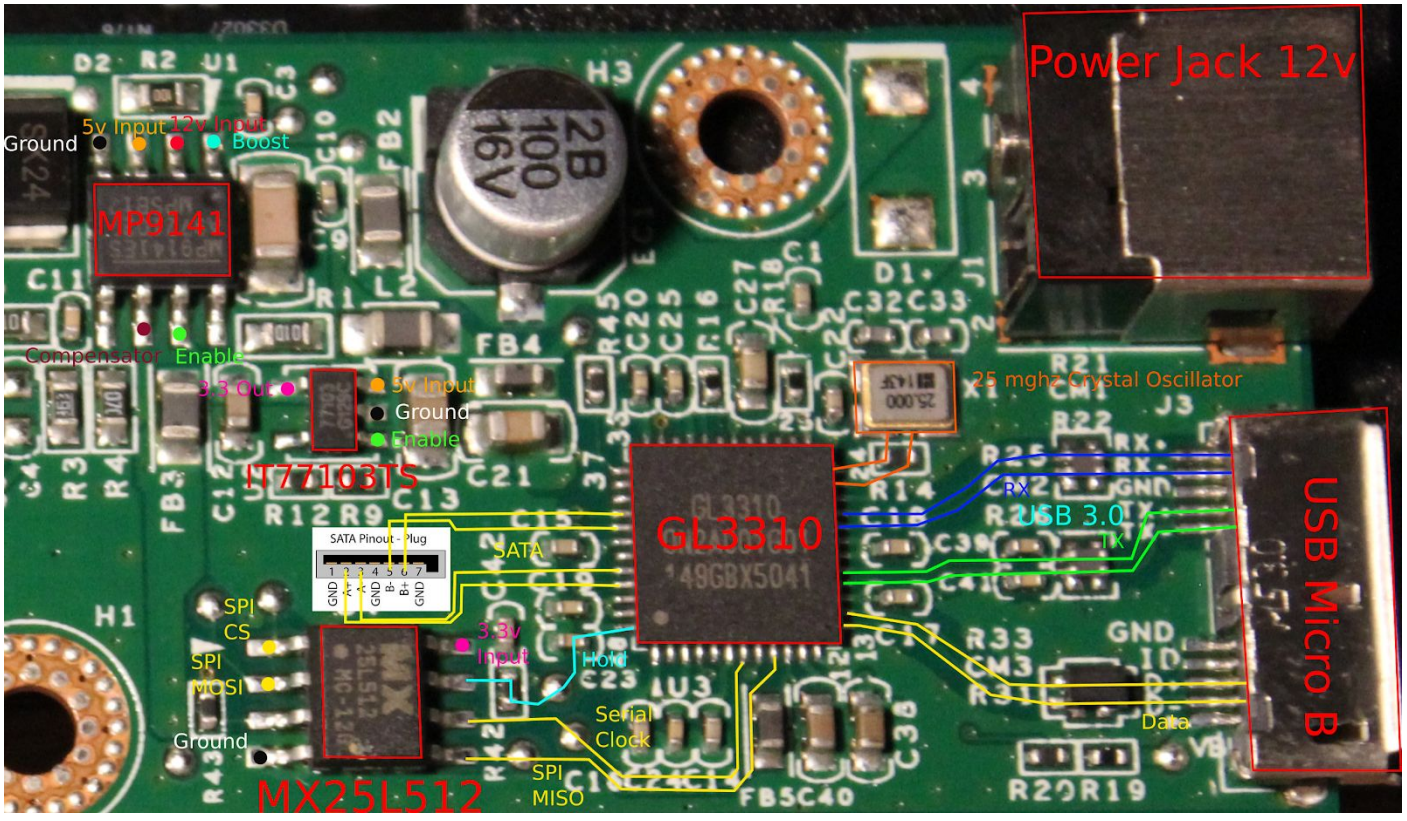


Back of PCB



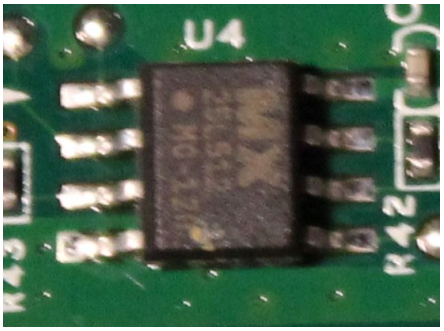
Front of PCB

Layout



Area of PCB where most components are located, traced and labelled by function and type of connection.

Semiconductor chips



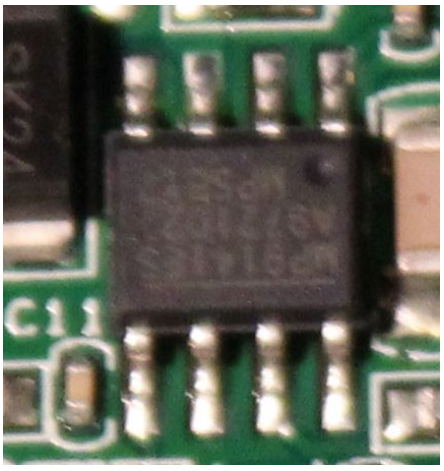
MXIC MX25L512

Specifications:
SPI Interface
524288 bits (512Kib)
16 sectors
4096 bits per sector
85MHz interface clock
SOP-8 Package

Pinout:

Description:
This chip is an SPI flash storage chip that contains firmware for the GL3310. The last 128Kib of the chip is additionally used for caching to speed up common interface commands.

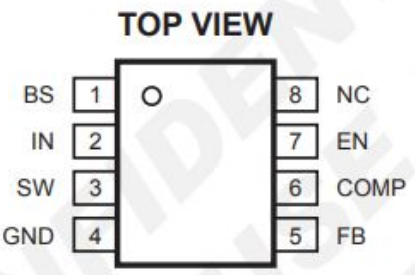
Function in Device:
Contains necessary firmware and acts as cache for the GL3310 (Controller)



MPS MP9141ES

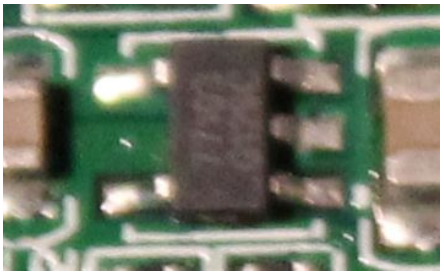
Specifications:
DC-DC Buck Converter
1.8A Output Current
92% Efficiency
380KHz Switching Freq.
Input 4.75-20V
Output 1.22-12V (adj)
Integrated overvoltage and peak protection
SOIC-8 Package

Pinout:



Description:
This step-down converter converts the standard 12V barrel jack input, prone to voltage spikes, into a consistent 5V output to power both the SATA drive through SATA5V and the onboard circuitry.

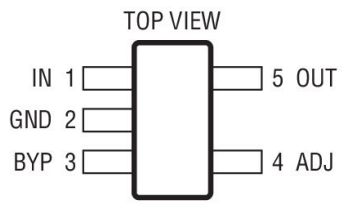
Function in Device:
Converts unstable 12V input to a consistent 5V 1.8A output to power both the SATA Drive and the control circuitry.



M3tek IT77103

Specifications:
DC-DC Buck Converter
800mA Output Current
Up to 95% Efficiency
1.2MHz Switching Freq.
Input 2.5-6.0V

Pinout:



	Output 0.6-5.5V SOT23-5 Package	
Description: This secondary step-down converter converts 5V current from the MP9141ES into 3.3V to power the SPI Flash chip (MX25L512) and USB/SATA Bridge Controller (GL3310).		**Function in Device:** Converts 5V to 3.3V for SPI Flash and GL3310 (Controller)

	**Genesys GL3310**	
	Specifications: **USB 3.0 to SATA 3Gb/s Bridge Controller** **USB 3.0/2.0 PHY** **25MHz clock source** **Embedded 8051 MCU (16KB ROM, 48KB RAM, 25MHz)** **Dual SPI, 2 GPIO, I2C** **UART interface for debugging/programming**	*Pinout unknown*
Description: This chip is a bridge between the USB 3.0 Mass Storage standard interface and SATA III 3.0Gbps. This is done through an integrated SATA III controller and a xHCI/EHCI USB controller. Additionally, it requires interfacing through SPI to a flash chip (MX25L512) for firmware reading and for caching. It can be optionally connected to an SPI Display Driver like the ST7735 for a simple graphic UI.		**Function in Device:** Acts as central bridge adapter to bridge the interface between USB3.0 Mass Storage and SATA III 3.0Gbps

Conclusion

One crucial lesson is the importance of having publicly available datasheets; not having access to the GL3310's datasheet frustrated us during circuit analysis. Furthermore,we discovered the way conventional interface adapters work: in this, the USB was converted to SATA through a bridge chip with its own peripherals, before connecting to the output interface.