Origami-EC status update for the G505s

Embedded Freedom

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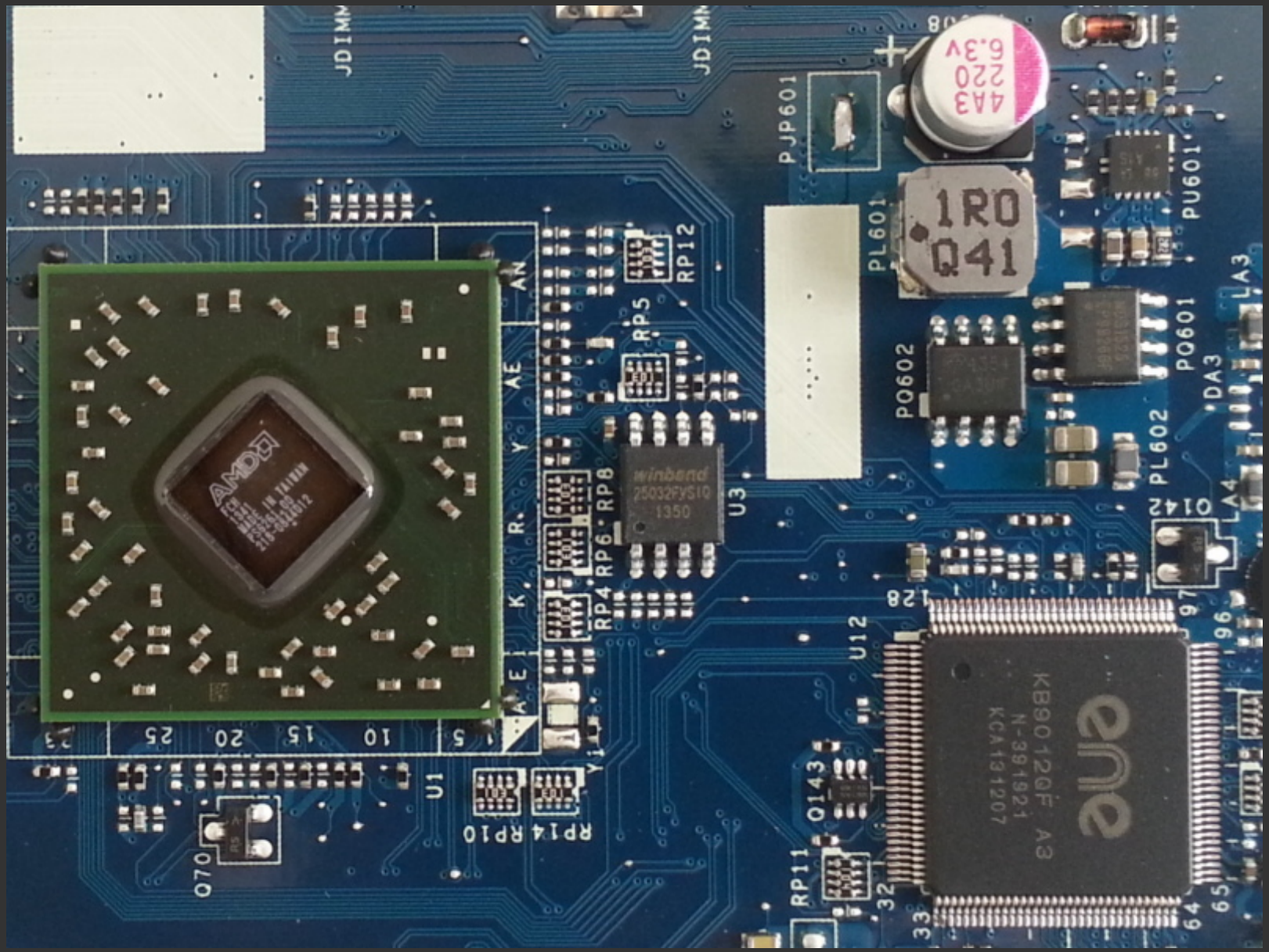
EUROPEAN COREBOOT CONFERENCE 2017

KB9012 EC on the G505s

Straight from SF (2016)

Hardware Investigation



Documentation

Laptop (G505s) documentation:

- Full schematics:
  `Lenovo G405S Compal VALGC_GD LA-A091P.pdf`
- Power sequencing diagram
- No PCB layout, labels

EC (KB9012) documentation:

- Extensive datasheet:
  - Platform description
  - Registers description
- Some application notes

KB9012 Platform Description

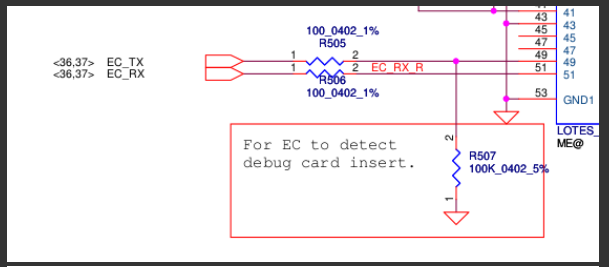
KB9012 platform:

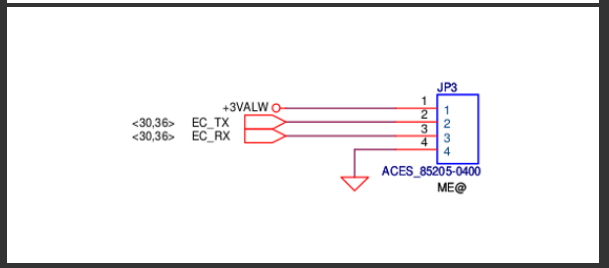
- 8051-based CPU:
  - 8-32 MHz clock frequency
  - 8-bit words
  - Memory layout: program, external, internal, SFR
  - Interrupt controller, timers
  - Specific extensions
- Storage memory (128 kiB flash)
- Volatile memory (4 kiB SRAM)
- Controllers:
  - LPC, SMBUS (I2C), SPI
  - GPIO, ADC, DAC
  - Keyboard, PS/2
  - IR, FAN, OW
  - Some more

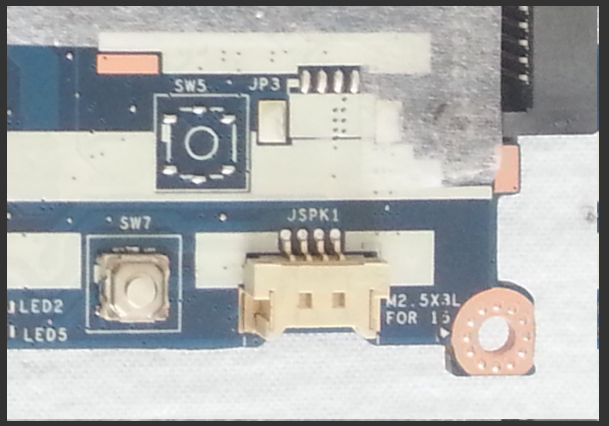
Serial and Debug Output

Serial port:

- UART from the 8051 CPU
- Exported to:
  - PCI-e
  - Pads (*JP3*)





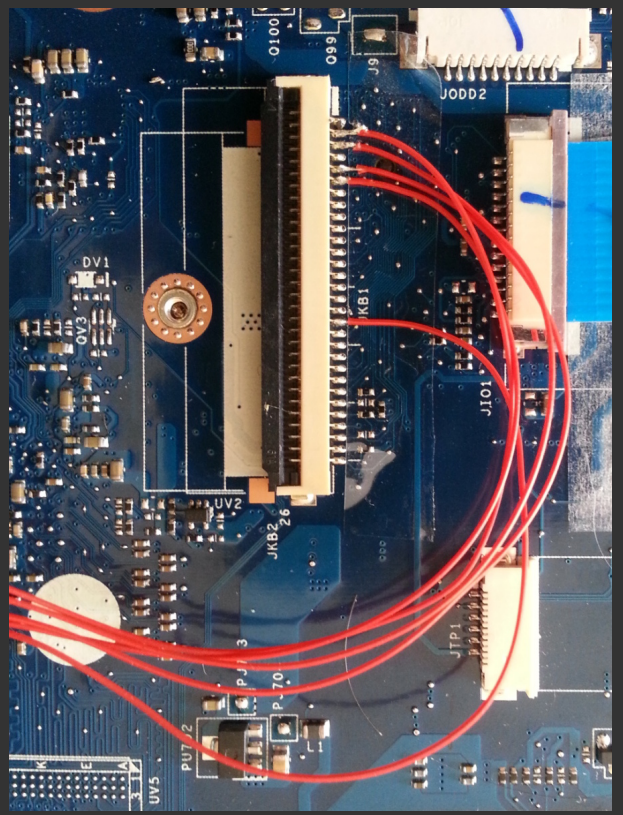



```
KSTART!R
EF-01,E7,E0,ON01,NON1N2N3N3N4N5N6EXN7
EF-01,E0,F0,N8NANANANANANANBNBNBNBNBNBNB
I52,KC52,DA4,KDA4,O00,NBO,
e59,Kc59,dE9,KdE9,
KxFF,NB
I52,KC52,DA4,KDA4,O00,O,
e59,Kc59,NBdE9,KdE9,NBNBNBNB
MC4E,MDED,
EF-01,E0,ED,MrFF,
MC4E,MDEC,
EF-01,E0,EC,Mr06,NBVFF,NBC,RFA,OFA,RAA,K20
MC42,MDO0,
MC4E,MDEB,
EF-01,E0,EB,Mr55,O,NB
```

Flashing the Firmware

Internal memory access:

- X-Bus interface, commands
- LPC Index-I/O:
  - CrOS Flashrom support (KB9xx)
  - Firmware-disabled
- ENE Debug Interface (EDI):
  - SPI protocol
  - Application note (commands)
  - Keyboard pins



Flashrom support (under review)!

Origami-EC Project

Origami-EC Introduction

Origami Embedded Controller firmware (Origami-EC)

A flexible free software embedded controller firmware implementation for 8051-based platforms.

- Written in C, SDCC toolchain
- Flexible implementation, not only KB9012
- Personal git: `https://git.code.paulk.fr` (temporary)
- GPLv3+ license

Origami-EC Architecture

Code directions:

- Generic APIs
- Platform and device-specific implementations
- Common code (AMAP)
- Tasks with priorities
  no context switching

Origami-EC Current Support

Supported features:

- Console, commands
  including history
- LEDs
- Buttons, switches
- Early power on implementation
  not there yet
- Segments remapping support
- EC suspend mode

Origami-EC Current and Future Work

Work in progress:

- Battery support (SBS)
- Charging

Future work:

- Proper boot support
- Host communication (LPC)
- Keyboard support
- Peripherals support
- Advanced power management (*suspend/resume*)

Thank-You!

Questions?