

MMC Stamp and its applications.

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microTCA
TECHNOLOGY LAB

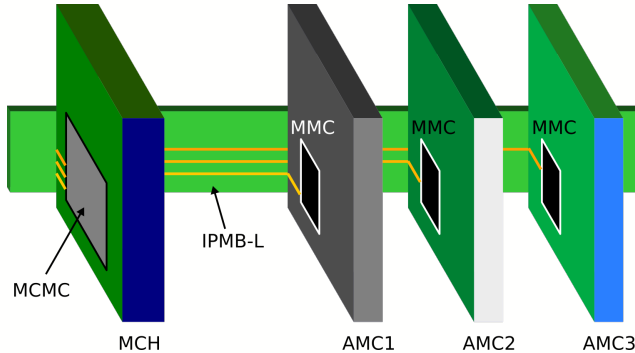
HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES



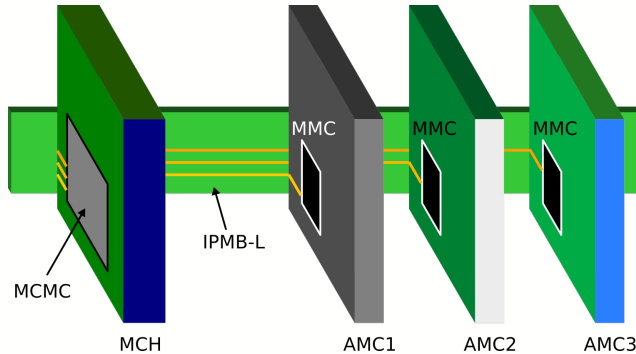
- ▶ Management in MicroTCA
- ▶ MMC solutions by MicroTCA Tech Lab
- ▶ Use cases for MMC solutions
- ▶ Conclusion

Management in MicroTCA

One of most important features of MicroTCA is out-of-band management interface.



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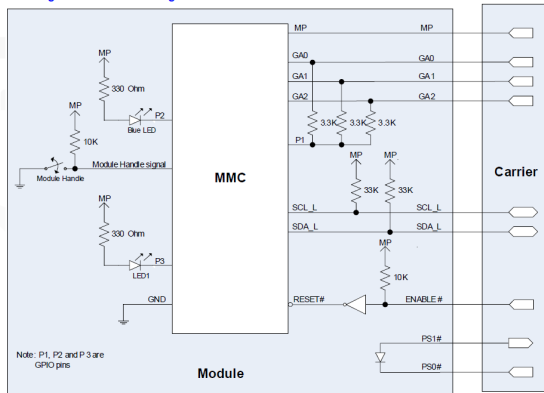


MicroTCA Carrier Management Controller (MCMC) (part of MicroTCA Carrier Hub - MCH) connects to Module Management Controller (MMC) on Advanced Mezzanine Card (AMC) over IPMB-L

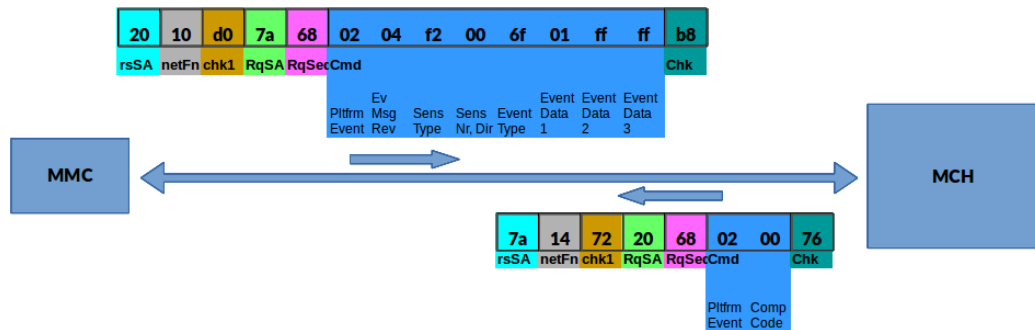
for more information: http://www.rehlich.com/MicroTCA_IPMI_management

Each Advanced Mezzanine Card (AMC) is required to implement an intelligent controller that manages the Module.

Figure 3-3 Module management hardware



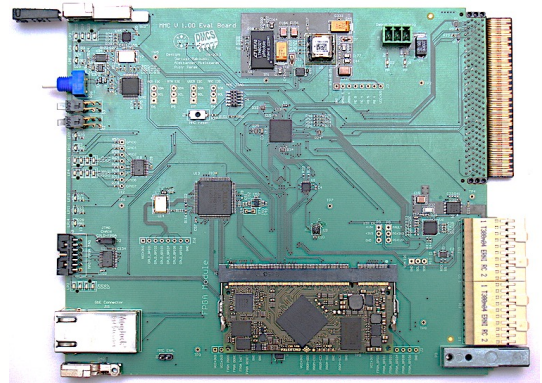
from PICMG Advanced Mezzanine Card AMC.0 Specification R2.0



- ▶ MCH and MMC on AMC exchange IPMI messages (I2C writes).
- ▶ Packets are defined in IPMI standard, and there are also PICMG extensions
- ▶ Table 3-54 "Command number assignments and requirement" from PICMG Advanced Mezzanine Card AMC.0 Specification R2.0 provides a list of commands

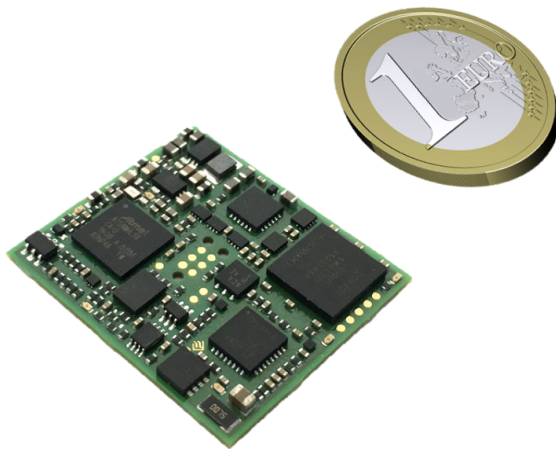
MMC Solutions

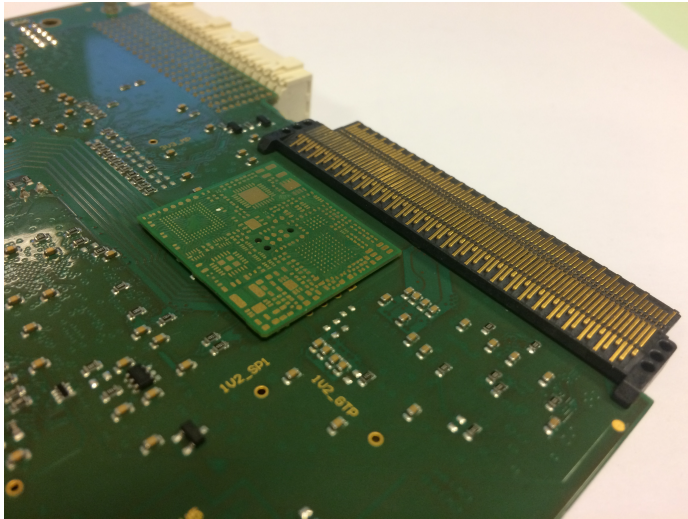
- ▶ MTCA management is a challenging part of the development
- ▶ We provided a reference design and ATxmega source code (“MMC V1.00”)
- ▶ Runs on more than 400 boards installed at DESY, several 100s more worldwide
- ▶ Idea: fully integrated SoM that contains all management functions + with complete software



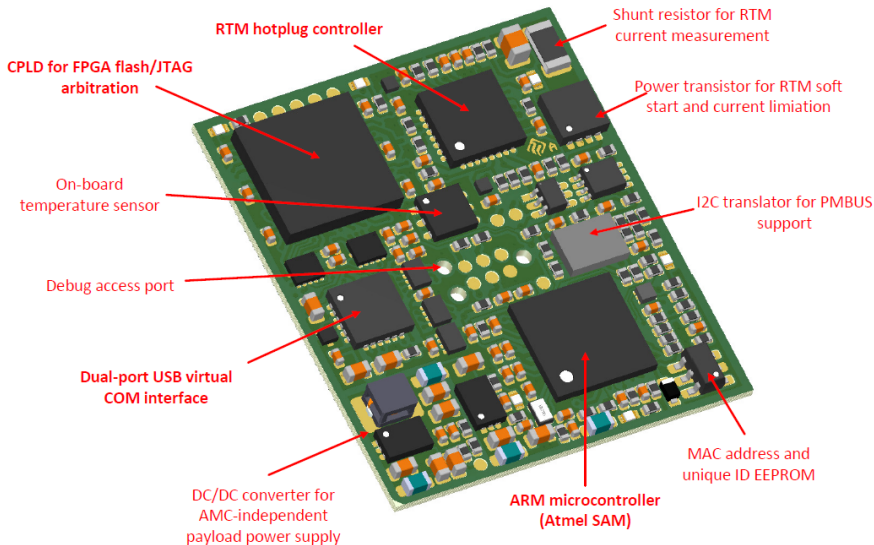
Design: Dariusz Makowski, DMCS

We have packed the entire MMC on a small module!

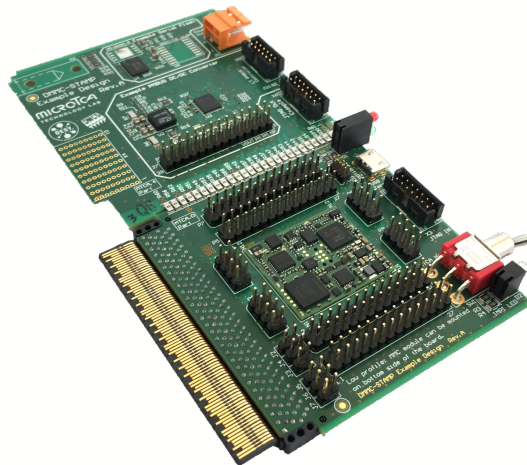


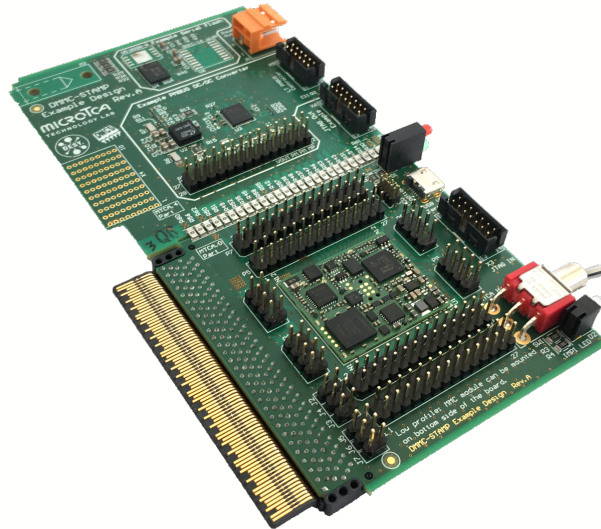


can be mounted on the back-side!

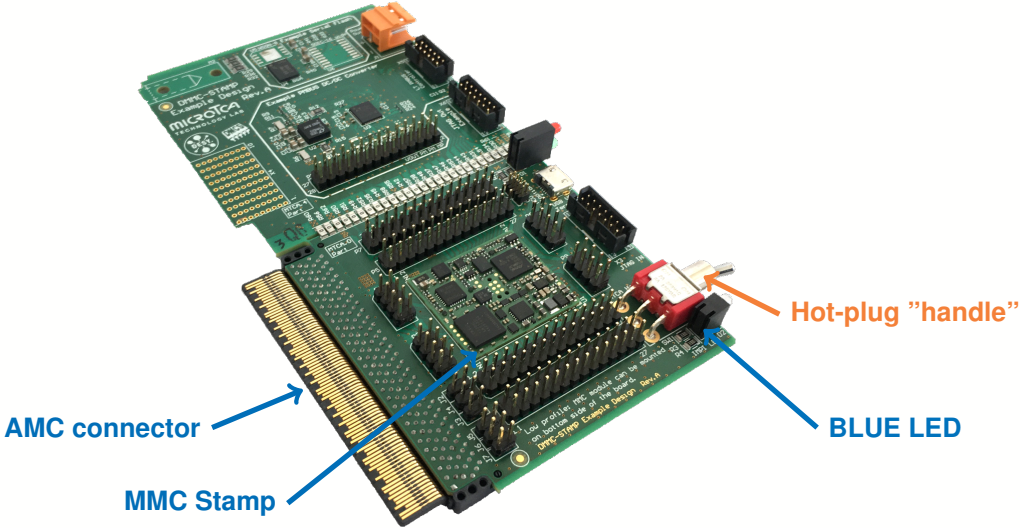


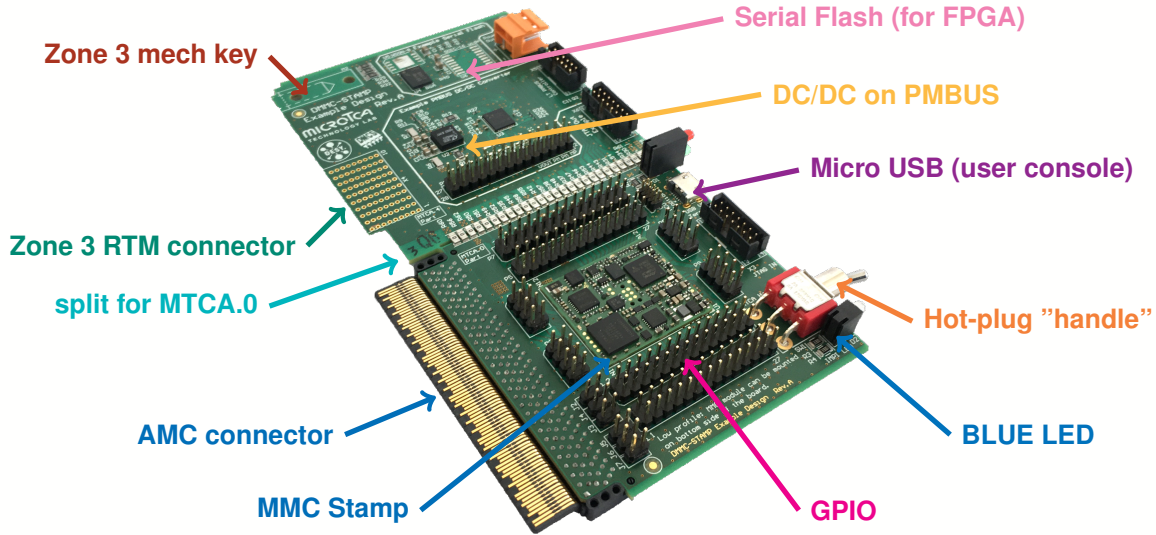
- ▶ 1/3 AMC format, incl. Zone 3
- ▶ Adaptable to single-width format (MTCA.0)
- ▶ No components except handle and LEDs necessary
- ▶ Basic RTM support (power, management)
- ▶ Full JTAG support
- ▶ Example PMBUS DC/DC converter
- ▶ Example serial Flash (image for payload FPGA)
- ▶ USB serial terminal connector for debugging
- ▶ Break-out section - pins for measurement
- ▶ First batch at test at DESY



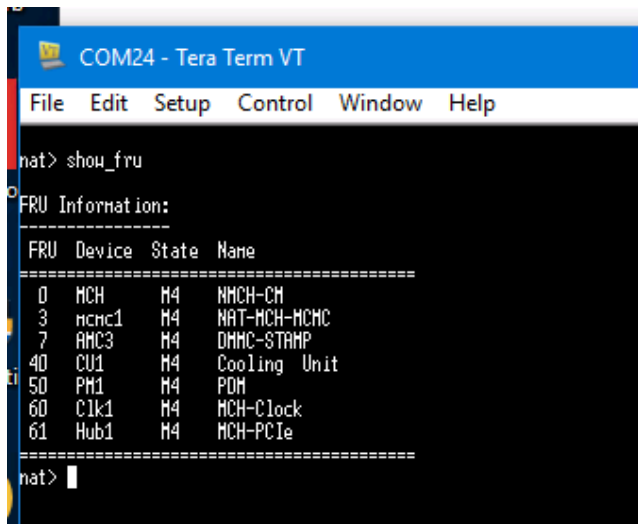


MMC Stamp Starter Kit



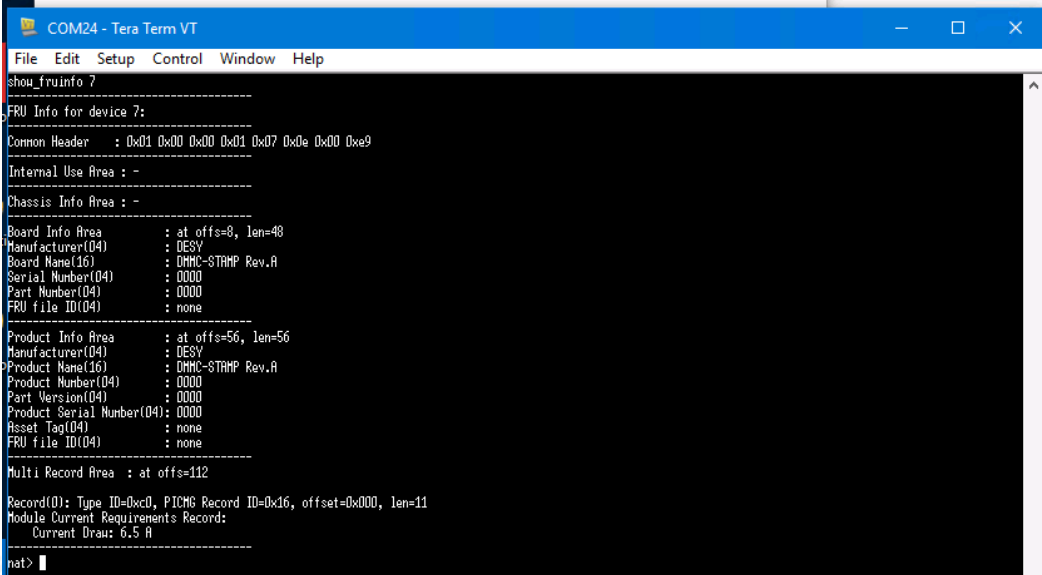


From MCH console we run `show_fru` to show the boards in the crate



```
COM24 - Tera Term VT
File Edit Setup Control Window Help
nat> show_fru
FRU Information:
-----
FRU Device State Name
-----
0 MCH M4 MCH-CM
3 mcnc1 M4 NAT-MCH-MCMC
7 AMC3 M4 DMHC-STAMP
40 CU1 M4 Cooling Unit
50 PM1 M4 PDM
60 Clk1 M4 MCH-Clock
61 Hub1 M4 MCH-PCIE
-----
nat> 
```

From MCH console we run `show_fruinfo` to show the information about the board



```
COM24 - Tera Term VT
File Edit Setup Control Window Help
show_fruinfo 7
-----
FRU Info for device 7:
-----
Common Header   : 0x01 0x00 0x00 0x01 0x07 0x0e 0x00 0xe9
-----
Internal Use Area : -
-----
Chassis Info Area : -
-----
Board Info Area   : at offs=8, len=48
Manufacturer(04)  : DESY
Board Name(16)    : DMHC-STAMP Rev.A
Serial Number(04) : 0000
Part Number(04)   : 0000
FRU file ID(04)   : none
-----
Product Info Area : at offs=56, len=56
Manufacturer(04)  : DESY
Product Name(16)  : DMHC-STAMP Rev.A
Product Number(04) : 0000
Part Version(04)  : 0000
Product Serial Number(04): 0000
Asset Tag(04)     : none
FRU file ID(04)   : none
-----
Multi Record Area : at offs=112
-----
Record(0): Type ID=0xc0, PICMG Record ID=0x16, offset=0x000, len=11
Module Current Requirements Record:
  Current Draw: 6.5 A
-----
nat> |
```

From MCH console we run `show_sensorinfo` to show the values of the sensors on the board

```

COM24 - Tera Term VT
File Edit Setup Control Window Help
show_sensorinfo 7
Sensor Information for FRU 7 / AMC3
=====
#  SDRType  Sensor Entity Inst  Value  State  Name
=====
0  HDevLoc   0xc1 0x63          DMHC-STAMP
0  Full      0xf2 0xc1 0x63 0x01      Hot Swap
1  Full      Temp 0xc1 0x63 28.0 C    ok      STAMP TEMP
2  Full      Voltage 0xc1 0x63 3.296 V   ok      3.3 V
3  Full      Voltage 0xc1 0x63 12.224 V  ok      12 V
4  Full      Voltage 0xc1 0x63 1.000 V   ok      ADC0
5  Full      Voltage 0xc1 0x63 1.000 V   ok      ADC1
6  Full      Voltage 0xc1 0x63 1.000 V   ok      ADC2
7  Full      Current 0xc1 0x63 0.0084 A  ok      I_RTH 3V3HP
8  Full      Current 0xc1 0x63 0.000 A   ok      I_RTH 12VPP
9  Full      Voltage 0xc1 0x63 3.296 V   ok      3.3V PMBUS volt.
10 Full      Current 0xc1 0x63 0.000 A   ok      3.3V PMBUS curr.
11 Full      Temp    0xc1 0x63 29.50 C   ok      3.3V PMBUS Temp.
12 Full      Temp    0xc1 0x63 27.50 C   ok      PMBUS Board Temp
13 Compact 0x0b 0xc1 0x63 0x00      0x00 801F127C3A3B
14 Compact 0x14 0xc1 0x63 0x00      0x00 PMBUS PGood
15 Compact 0x14 0xc1 0x63 0x01      0x00 FPGA1 INIT
16 Compact 0x14 0xc1 0x63 0x01      0x00 FPGA1 DONE
  
```

Terminal on USB port (useful for debugging the hardware on the table, without MTCA crate)

```
COM22 - Tera Term VT
File Edit Setup Control Window Help
help
help (h) - Show list of available commands
clear (c) - Clear screen
reset (r) - Reset MMC
crate_mode (cm) - In-crate mode
standalone_mode (sm) - Standalone mode
status (s) - Status
set_ipmb_addr (sia) - Manually set the IPMB address
led (lc) - LED control
set_evt_rcv (ser) - Set Event Receiver
power_up (pu) - Power-up
power_down (pd) - Power-down
version (v) - MMC Firmware Version
test (t) - Test
program_cpld (pc) - Switch CPLD to JTAG mode
set_jtag_mux (sj) - Set CPLD JTAG src/dest
DHMC-STAMP0x76 MMC>
```

Use cases

Use cases

MMC firmware is used at over 400 boards at DESY and at several hundred of other boards worldwide.

The MMC Stamp is used on several boards at DESY

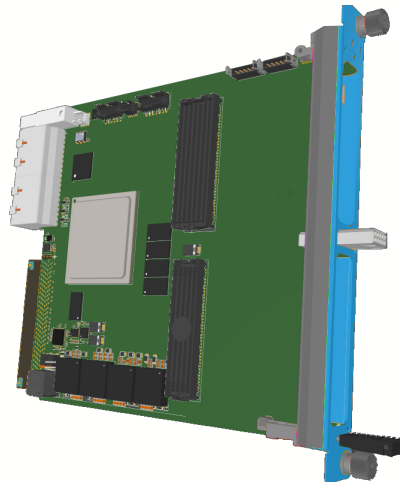
DAMC-FMC2ZUP FMC and FMC+ carrier based on Zynq MPSoC

DAMC-FMC1Z7IO FMC carrier and GPIO board based on Zynq 7000

DAMC-DSx00 500/800 MSPS 8 channel digitizer

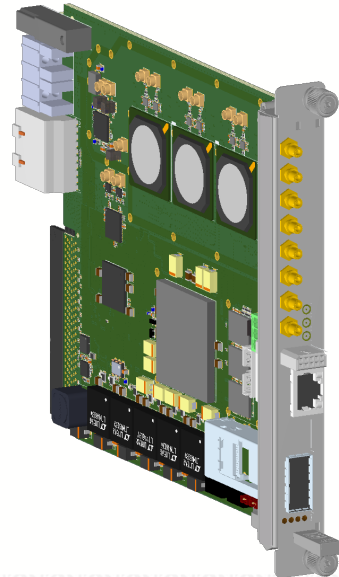
DAMC-FMC2ZUP

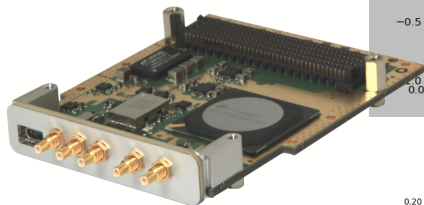
- ▶ high-end FMC+ carrier in MTCA.4 form factor
- ▶ based on Xilinx UltraScale+ MPSOC XCZU11EG-L2FFVC1760E
- ▶ one FMC+ Slot with 24 transceivers (16 GTY + 8 GTH), LA and HA pins
- ▶ one FMC slot with LA and HA pins and 8 transceivers (8 GTH)
- ▶ Zone 3 Class D1.1 compliance with full interlock support



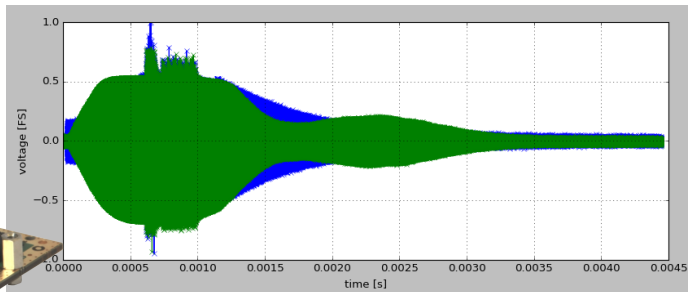
DAMC-DSx00

- ▶ 4x 12-Bit, 800 MSP/s Dual Ch., 1.6 GSP/s Single Ch. ADCs ADC input bandwidth: 2.7 GHz
- ▶ fully diff. amplifier LS bandwidth: 4.8 GHz
- ▶ XCZU7EG F1517 Zynq MPSoC Dual/Quad-Core ARM Cortex-A53
- ▶ Signal feed in via Zone3 and Front Panel
- ▶ Quad SFP, COAX IO, HARLINK LVDS at FP

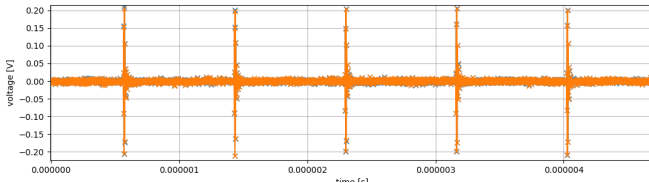




DFMC-DS500
as a testbed for AFE



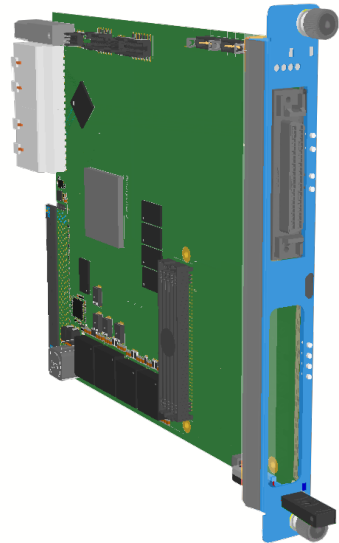
Higher-Order Mode couplers



Bunch Arrival Monitor

DAMC-FMC1Z710

- ▶ Cost-optimized AMC board, based on Xilinx Zynq
- ▶ 48 general-purpose IO: 3.3V (LVTTL) and true 5V (TTL)
- ▶ one FMC LPC slot
34 diff pairs, 1 or 4 transceivers
- ▶ Zone 3 according to D1.1
- ▶ connectivity: PCIe gen2 x2, 1/10G Ethernet, LLL, MLVDS
- ▶ Dual-Core ARM Cortex-A9 (frequency up to 1GHz)



Conclusion

Distributor for China:



Beijing DAQ Technology Co., Ltd.

刘熔 (Dr. Rong Liu)

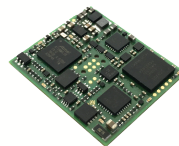
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100043 SHIJINGSHAN DST.,

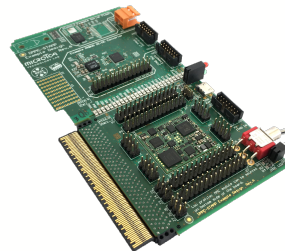
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MMC Stamp



MMC Stamp Starter Kit

Conclusion

- ▶ Each Advanced Mezzanine Card (AMC) requires Module Management Controller (MMC)
- ▶ MMC communicates with MicroTCA Carrier Hub (MCH), ...
- ▶ ... provides board information (vendor, board name, ...), ...
- ▶ ... and monitors on-board voltages, temperatures and hot-plug switch
- ▶ **MMC Stamp** is an implementation of MMC
- ▶ It is based on years of experience, more than 400 boards with the same firmware run at numerous facilities around the world
- ▶ Several "nice to have" features are also implemented
- ▶ **MMC Stamp Starter Kit** is provided as a starting point for custom hardware designs
- ▶ for more information:
https://techlab.desy.de/products/mmc/index_eng.html

Thank you
谢谢

<https://techlab.desy.de>

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