

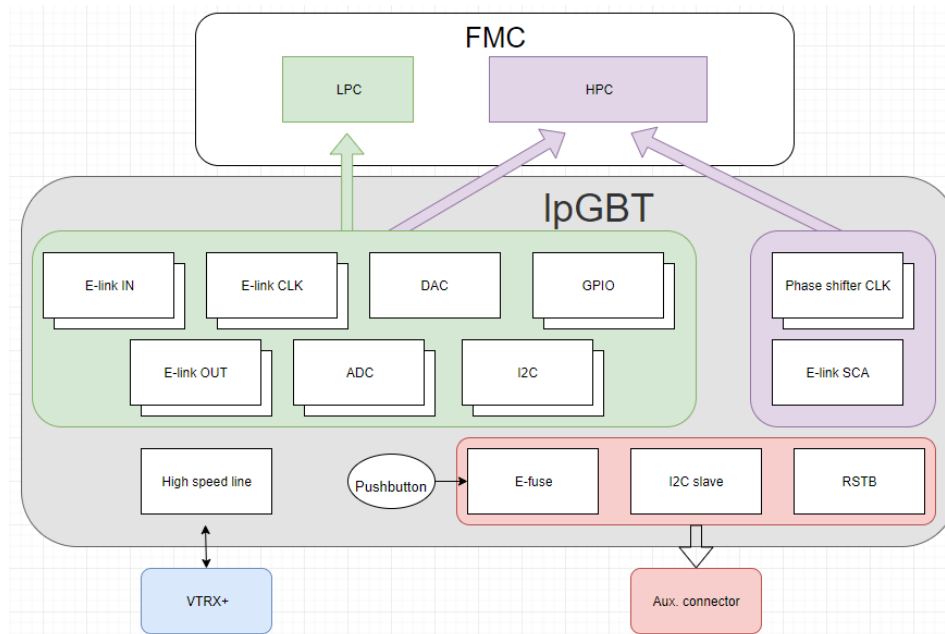


# **EMCI / EMP / ELMB2 monthly meeting January 2020**

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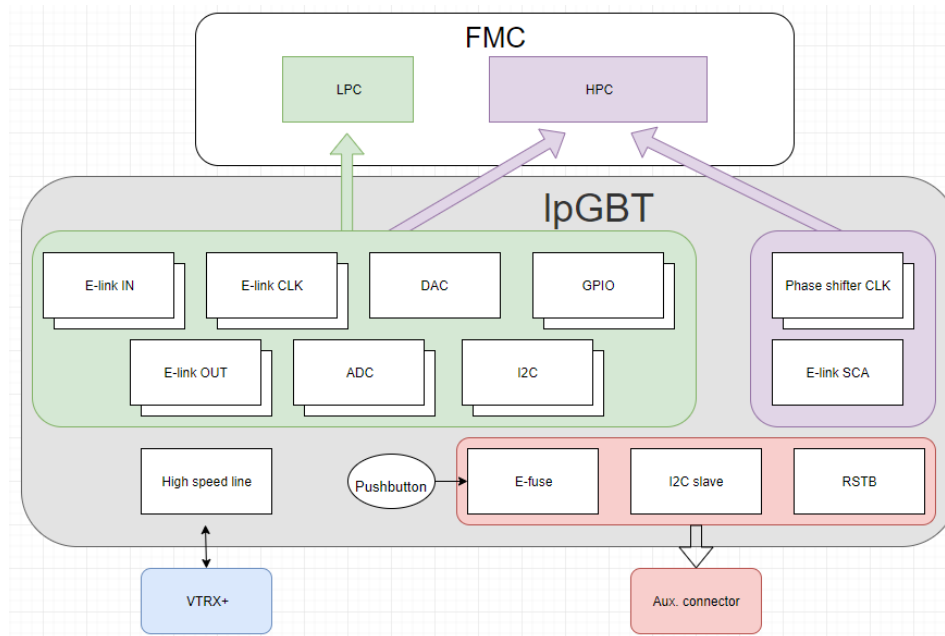
**EP-ESE-FE**

# EMCI features



- VTRX+ optical link to FMC connector through IpGBT
- Up to 28 TX and CLK e-links and 16 RX e-links
- FMC footprint (HPC) on both sides (only one at a time)
- Possibility to connect to FMC (LPC), losing some features
- Possibility to attach different connector (eg. SMA) to VTRX+ connector
- ADC (8 ch, 10 bit)
- DAC (1 ch, 12 bit)

# EMCI features



- Phase shifter CLK (4 ch.)
- GPIO (16 ch.)
- I2C (2 ch.) (there is a 3<sup>rd</sup> ch. for VTRX+)
- Extra SCA e-link (lower speed)
- Extra connector for IpGBT configuration
- DIP switches for extra IpGBT configuration (MODE, ADR, SC\_I2C)
- E-fuse through extra connector or pushbutton

# Power

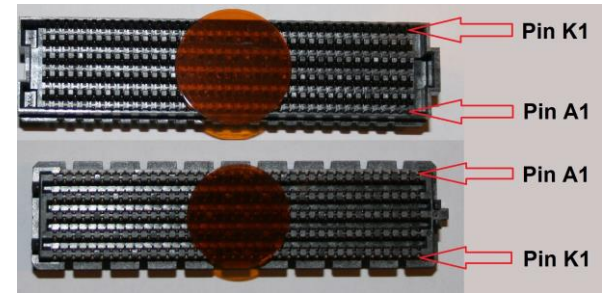
5-12V coming from FMC connector

- FEASTMP  $\rightarrow$  2.5V, 10W (flat version limits the power)
  - It may be possible to fit between PCBs
- bPOL2V5  $\rightarrow$  1.2V, 3.6W

# Not included IpGBT features

- External VREF for ADC/DAC
- External reference CLK (only needed when used as simplex TX)
- TSTOUT pins (used for IpGBT debugging)
- Other IpGBT debug lines (STATEOVRD, PORDIS, VCOBYPASS...)

# FMC standard



## User-defined pins:

- LA[00..33]\_P/N (LPC) (34 d) – User defined
- HA[00..23]\_P/N (HPC) (24 d) – User defined
- HB[00..21]\_P/N (HPC) (22 d) – User defined (not debuggable using FPGA eval. board)
- DP[0..9]\_M2C\_P/N (10 d) – Gigabit transceiver (not debuggable using FPGA eval. board)
- DP[0..9]\_C2M\_P/N (10 d) – Gigabit transceiver (not debuggable using FPGA eval. board)

## Example pinout:

- E-links (16+28+28 d):
  - LA[00..24]\_P/N (7 OUT, 9 IN, 9 CLK)
  - HA[00..13]\_P/N (3 OUT, 6 IN, 6 CLK)
  - HB[00..21]\_P/N (6 OUT, 8 IN, 8 CLK)
  - DP0\_M2C\_P/N and DP0\_C2M\_P/N (1 IN, 1 CLK)
  - DP1..9]\_M2C\_P/N (2 OUT, 6 IN, 6 CLK)
- ADC x8 (8 se, can be used in diff.)
  - LA[25..26]\_P/N (4 ch)
  - HA[14..15]\_P/N (4 ch)
- GPIO x16 (16 se)
  - LA[27..30]\_P/N (8 ch)
  - HA[16..19]\_P/N (8 ch)
- E-link for SCA (3 d)
  - HA[20..22]\_P/N
- DAC (1 se)
  - LA33\_P
- I2C x2 (4 se) (there is extra one for VTRX+)
  - LA[31..32]\_P/N
- Phase shifter CLK x4 (4 d)
  - HA23\_P/N (1 ch)
  - DP1..3]\_C2M\_P/N (3 ch)
- RSTOUTB (1 se)
  - LA33\_N

	K	J	H	G	F	E	D	C	B	A
1	VREF_B_M2C	GND	VREF_A_M2C	GND	PG_M2C	GND	PG_C2M	GND	RES1	GND
2	GND	CLK3_M2C_P	PRSNM2_M2C_L	CLK1_M2C_P	GND	HA01_P_CC	GND	DP0_C2M_P	GND	DP1_M2C_P
3	GND	CLK3_M2C_N	GND	CLK1_M2C_N	GND	HA01_N_CC	GND	DP0_C2M_N	GND	DP1_M2C_N
4	CLK2_M2C_P	GND	CLK0_M2C_P	GND	HA00_P_CC	GND	GBTCLK0_M2C_P	GND	DP9_M2C_P	GND
5	CLK2_M2C_N	GND	CLK0_M2C_N	GND	HA00_N_CC	GND	GBTCLK0_M2C_N	GND	DP9_M2C_N	GND
6	GND	HA03_P	GND	LA00_P_CC	GND	HA05_P	GND	DP0_M2C_P	GND	DP2_M2C_P
7	HA02_P	HA03_N	LA02_P	LA00_N_CC	HA04_P	HA05_N	GND	DP0_M2C_N	GND	DP2_M2C_N
8	HA02_N	GND	LA02_N	GND	HA04_N	GND	LA01_P_CC	GND	DP8_M2C_P	GND
9	GND	HA07_P	GND	LA03_P	GND	HA09_P	LA01_N_CC	GND	DP8_M2C_N	GND
10	HA06_P	HA07_N	LA04_P	LA03_N	HA08_P	HA09_N	GND	LA06_P	GND	DP3_M2C_P
11	HA06_N	GND	LA04_N	GND	HA08_N	GND	LA05_P	LA06_N	GND	DP3_M2C_N
12	GND	HA11_P	GND	LA08_P	GND	HA13_P	LA05_N	GND	DP7_M2C_P	GND
13	HA10_P	HA11_N	LA07_P	LA08_N	HA12_P	HA13_N	GND	GND	DP7_M2C_N	GND
14	HA10_N	GND	LA07_N	GND	HA12_N	GND	LA09_P	LA10_P	GND	DP4_M2C_P
15	GND	HA14_P	GND	LA12_P	GND	HA16_P	LA09_N	LA10_N	GND	DP4_M2C_N
16	HA17_P_CC	HA14_N	LA11_P	LA12_N	HA15_P	HA16_N	GND	GND	DP6_M2C_P	GND
17	HA17_N_CC	GND	LA11_N	GND	HA15_N	GND	LA13_P	GND	DP6_M2C_N	GND
18	GND	HA18_P	GND	LA16_P	GND	HA20_P	LA13_N	LA14_P	GND	DP5_M2C_P
19	HA21_P	HA18_N	LA15_P	LA16_N	HA19_P	HA20_N	GND	LA14_N	GND	DP5_M2C_N
20	HA21_N	GND	LA15_N	GND	HA19_N	GND	LA17_P_CC	GND	GBTCLK1_M2C_P	GND
21	GND	HA22_P	GND	LA20_P	GND	HB03_P	LA17_N_CC	GND	GBTCLK1_M2C_N	GND
22	HA23_P	HA22_N	LA19_P	LA20_N	HB02_P	HB03_N	GND	LA18_P_CC	GND	DP1_C2M_P
23	HA23_N	GND	LA19_N	GND	HB02_N	GND	LA23_P	LA18_N_CC	GND	DP1_C2M_N
24	GND	HB01_P	GND	LA22_P	GND	HB05_P	LA23_N	GND	DP9_C2M_P	GND
25	HB00_P_CC	HB01_N	LA21_P	LA22_N	HB04_P	HB05_N	GND	GND	DP9_C2M_N	GND
26	HB00_N_CC	GND	LA21_N	GND	HB04_N	GND	LA26_P	LA27_P	GND	DP2_C2M_P
27	GND	HB07_P	GND	LA25_P	GND	HB09_P	LA26_N	LA27_N	GND	DP2_C2M_N
28	HB06_P_CC	HB07_N	LA24_P	LA25_N	HB08_P	HB09_N	GND	GND	DP8_C2M_P	GND
29	HB06_N_CC	GND	LA24_N	GND	HB08_N	GND	TCK	GND	DP8_C2M_N	GND
30	GND	HB11_P	GND	LA29_P	GND	HB13_P	TDI	SCL	GND	DP3_C2M_P
31	HB10_P	HB11_N	LA28_P	LA29_N	HB12_P	HB13_N	TDO	SDA	GND	DP3_C2M_N
32	HB10_N	GND	LA28_N	GND	HB12_N	GND	3P3VAUX	GND	DP7_C2M_P	GND
33	GND	HB15_P	GND	LA31_P	GND	HB19_P	TMS	GND	DP7_C2M_N	GND
34	HB14_P	HB15_N	LA30_P	LA31_N	HB16_P	HB19_N	TRST_L	GA0	GND	DP4_C2M_P
35	HB14_N	GND	LA30_N	GND	HB16_N	GND	GA1	12P0V	GND	DP4_C2M_N
36	GND	HB18_P	GND	LA33_P	GND	HB21_P	3P3V	GND	DP6_C2M_P	GND
37	HB17_P_CC	HB18_N	LA32_P	LA33_N	HB20_P	HB21_N	GND	12P0V	GND	DP6_C2M_N
38	HB17_N_CC	GND	LA32_N	GND	HB20_N	GND	3P3V	GND	DP5_C2M_P	GND
39	GND	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	DP5_C2M_N
40	VIO_B_M2C	GND	VADJ	GND	VADJ	GND	3P3V	GND	RES0	GND

If the FMC connector is soldered in the bottom side of the PCB all the connections will be mirrored and this standard will not be met.

# E-links

28 TX, 28 CLK, 16 RX

DC coupling → 0R resistor

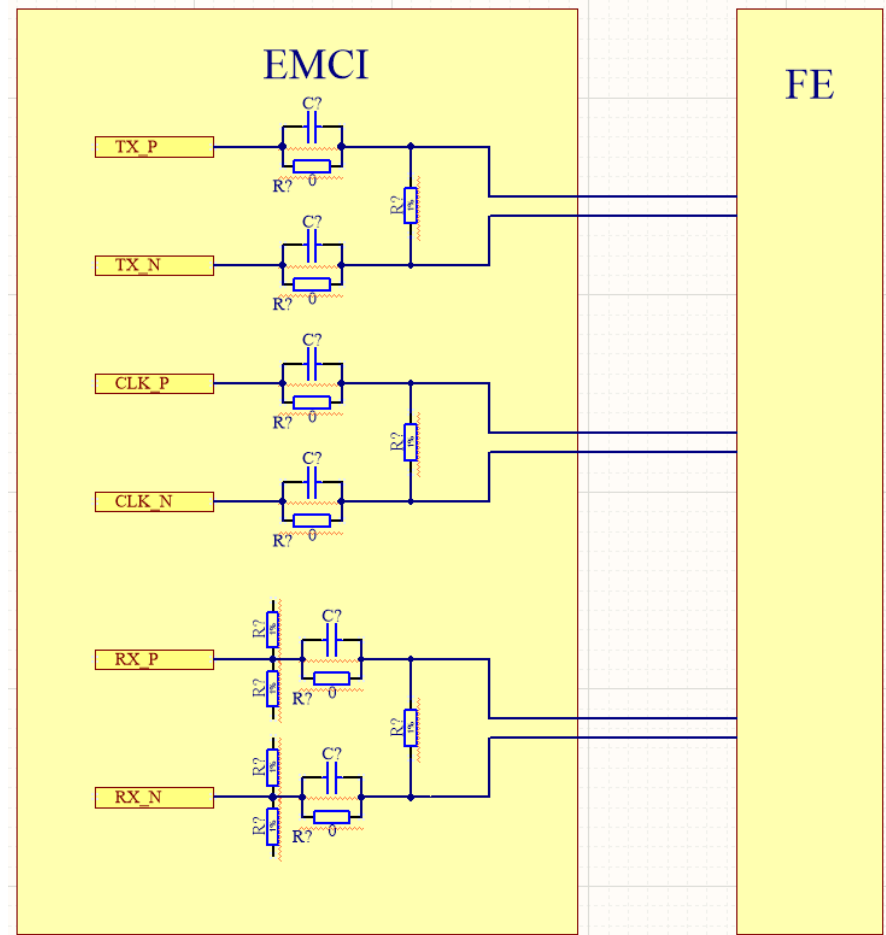
AC coupling → Capacitor

TX lines: terminator resistor

RX lines: balance resistors

Total footprints: 280

(if sharing footprint between  
C and R)





# Debug

Need to purchase:

- VLDB+ 2000 CHF
- VTRX+ 450 CHF
- Raspberry Pi kit for IpGBT 300 CHF
- Virtex-7 ev. board ~3500 USD

# Next steps

- First prototype?
- EMP?

# Thank you for your attention!

