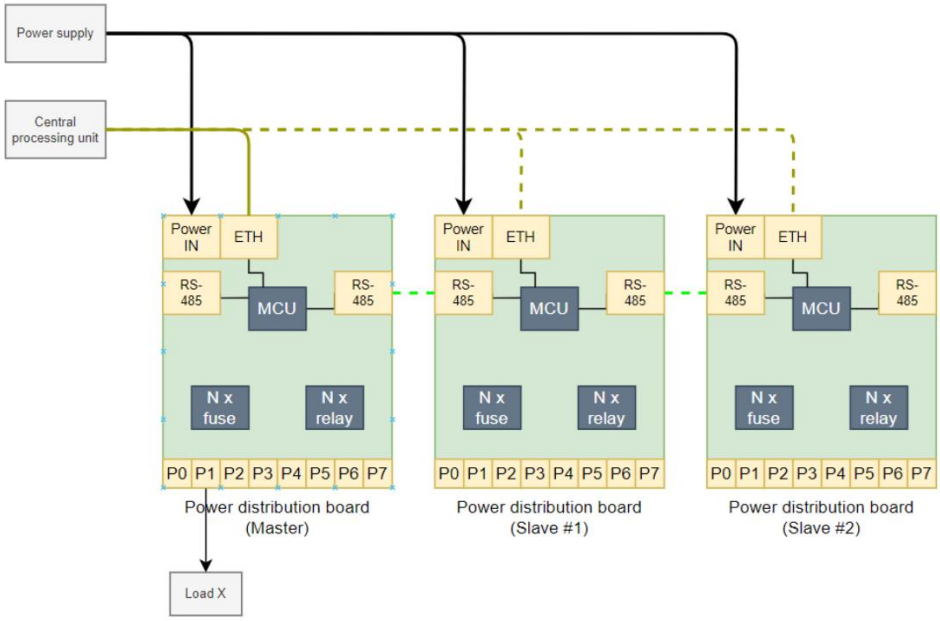
1. Introduction

This is for DefSecIntel Fuse Board Hardware version v0. Project code is KR-Df-01-EL-00 and this can be used to find and view schematic and layout in Altium Viewer.
See also HW requirements: Fuse board requirements.docx.

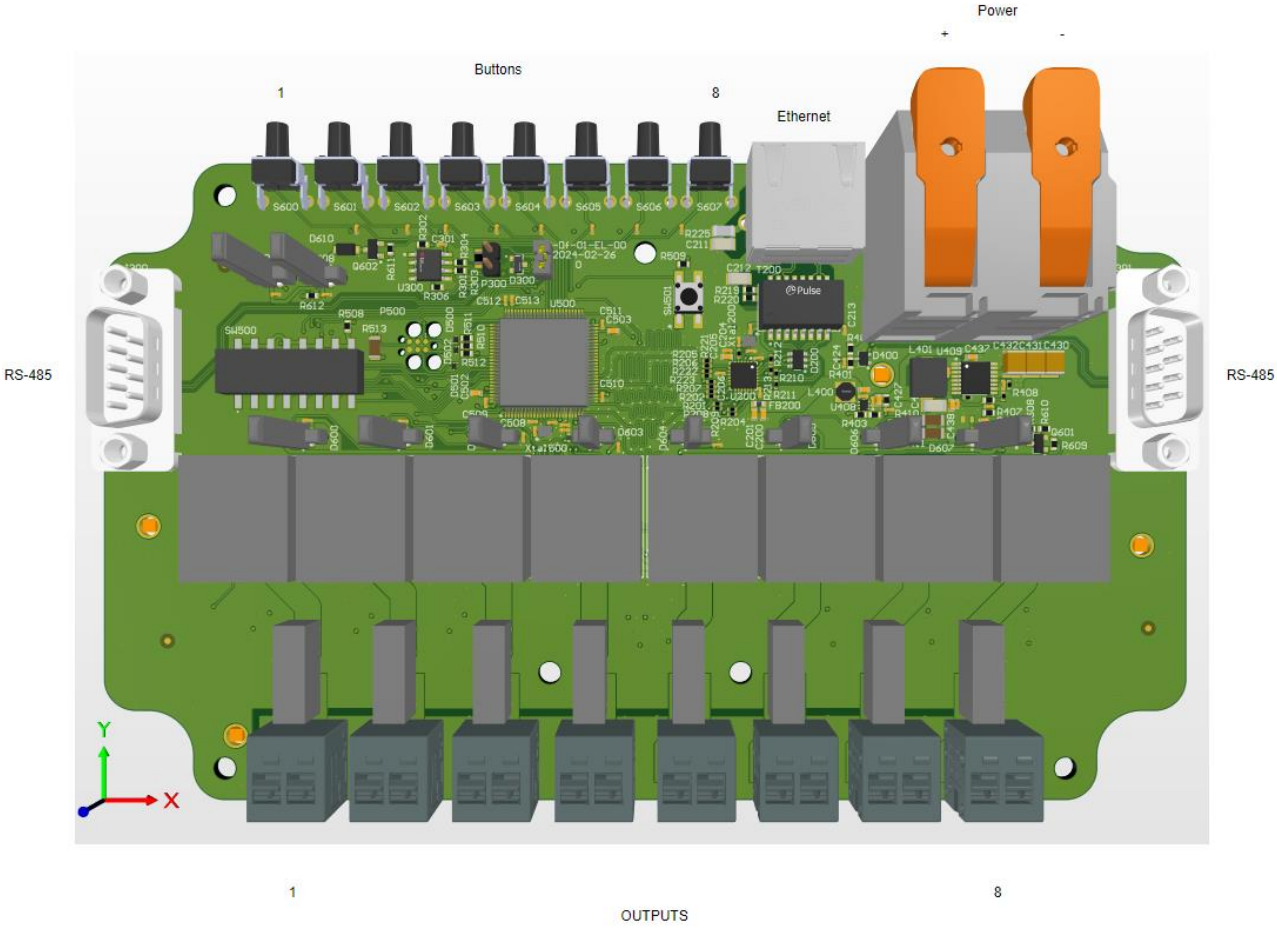
The PCBA can be configured as master or slave.



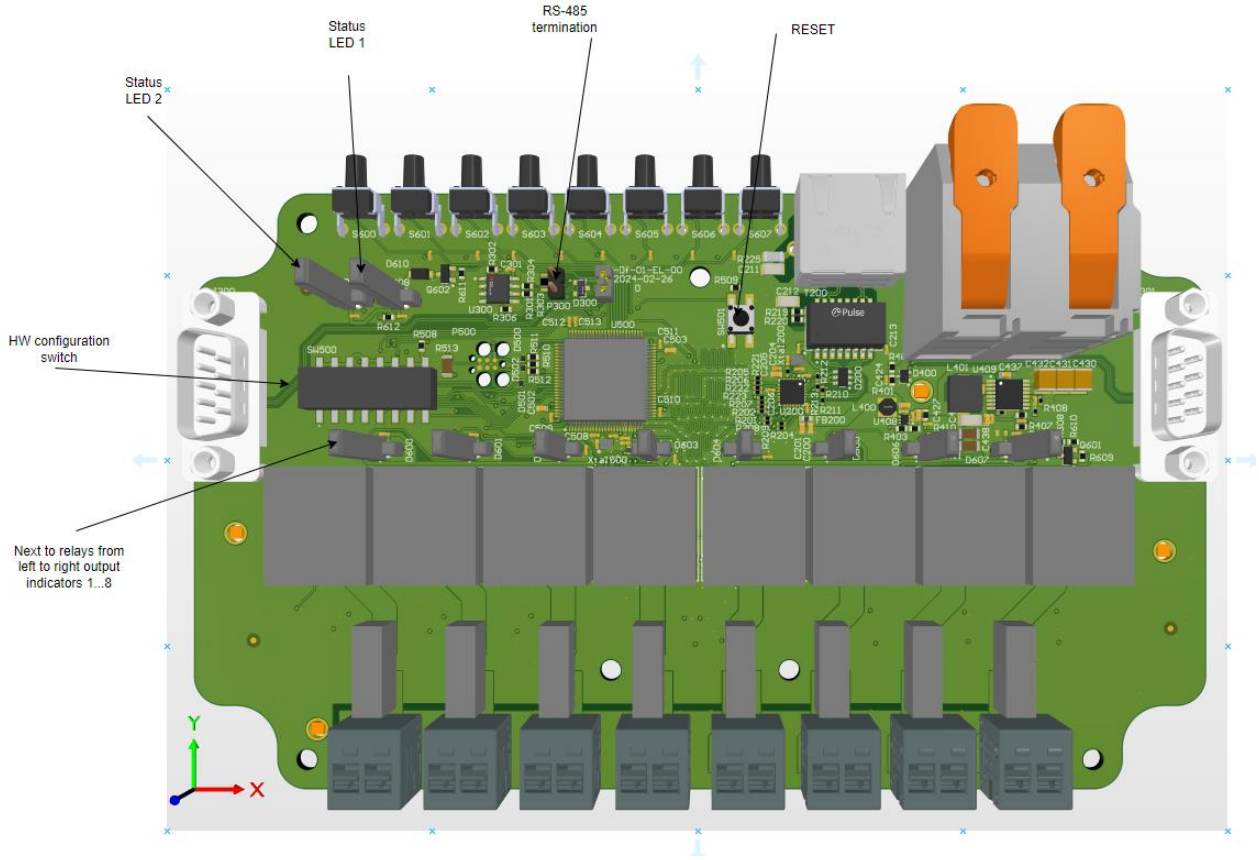
System commander connects to master over ethernet and master forwards commands to slaves via RS-485.

MCU used: STM32H573VIT6

2. Board inputs, outputs and interfaces

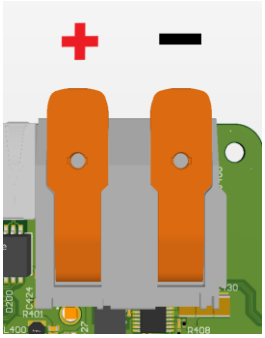


3. Configurations and status



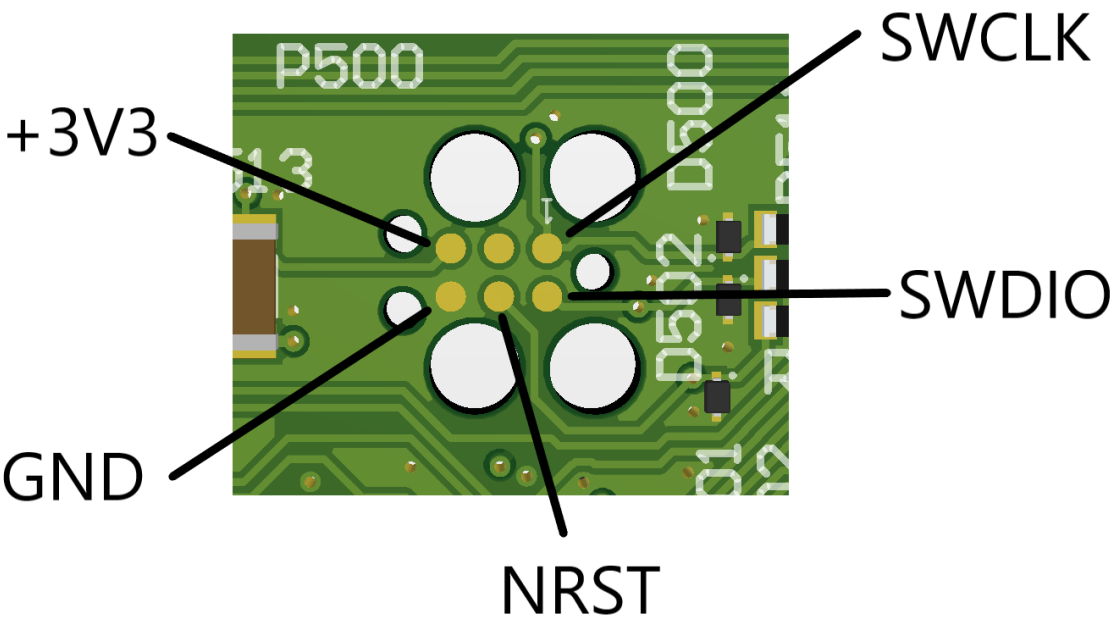
4. Power input

Connect 24V supply to connector J400.

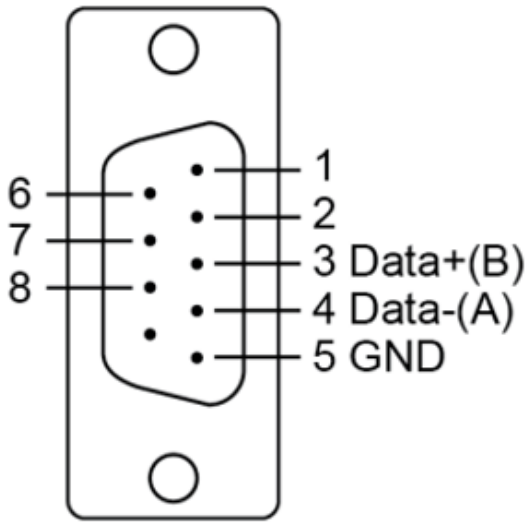


5. Programming header

Captive 6-Tag connect header is used. [6-pin small PCB footprint to IDC MCU debug cable | Tag-Connect]



6. RS-485 connection



7. Buttons

Buttons 1..8 are meant to switch outputs 1..8 on /off respectively. Short push to toggle state. Other functions are permitted with longer presses or pressing a combination of buttons simultaneously. Button inputs need to have MCU internal pull-down enabled.

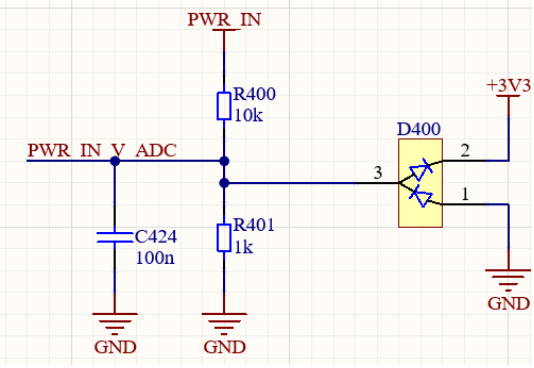
8. HW configuration switches

The switches have external pull-up.
Optional: For the duration of reading the digital input enable the internal pull-down. This minimizes the risk that residual current/voltage causes an error.

SW nr	
1	Master – 1, Slave 0
2	Not defined
3	Not defined
4	Not defined
5	Not defined
6	Not defined
7	Not defined
8	Not defined

9. Voltage measurement

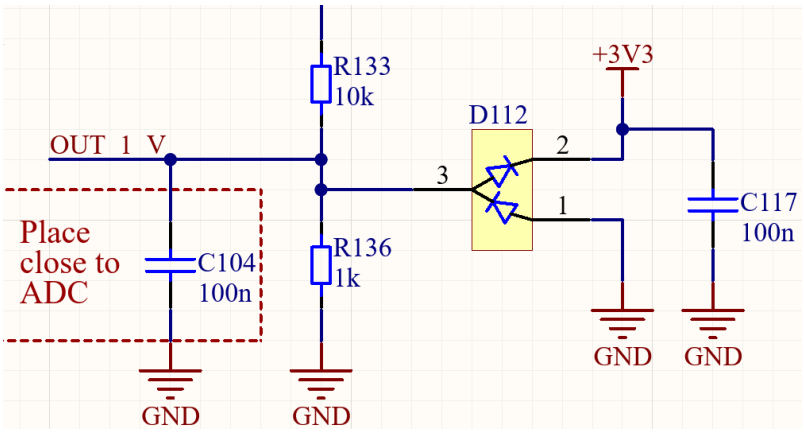
Main power input voltage measurement is connected directly to MCU.



ADC on STM32H573VIT6 is 12b.
ADC reference is from 3,3V rail thus one ADC bit corresponds to 0,806 mV.
The following equation can be used to calculate PWR_IN voltage from ADC reading.

$$V_{PWR\_IN} = ADC * 0{,}000806V * 11$$

Each output has voltage feedback.



The same basic equation applies.

$$V_{OUT\_n} = ADC * 0{,}000806V * 11$$

Output voltage measurements are multiplexed to single ADC input on the MCU. Multiplexer IC P/N: TMUX1208PWR.

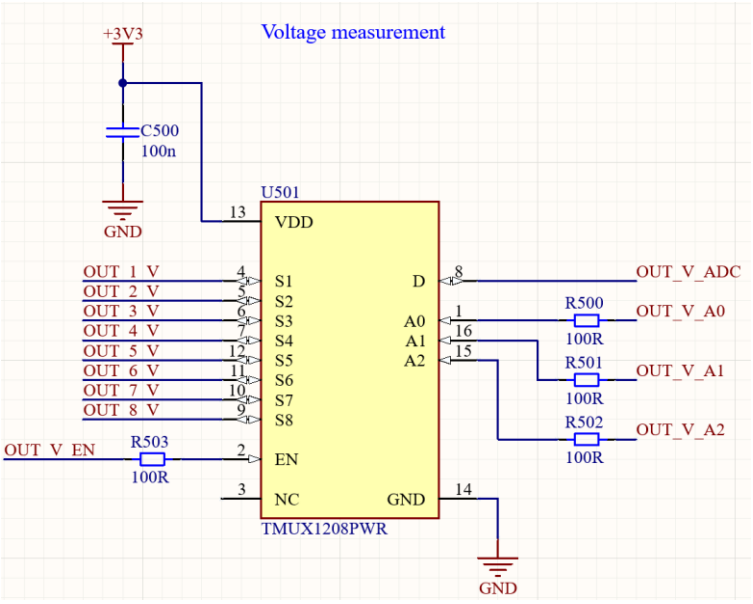
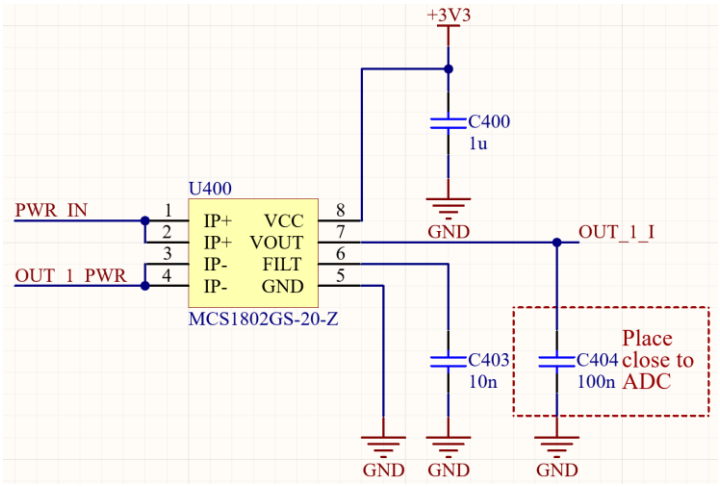


Table 1. TMUX1208 Truth Table

EN	A2	A1	A0	Selected Inputs Connected To Drain (D) Pin
0	X(1)	X(1)	X(1)	All channels are off
1	0	0	0	S1
1	0	0	1	S2
1	0	1	0	S3
1	0	1	1	S4
1	1	0	0	S5
1	1	0	1	S6
1	1	1	0	S7
1	1	1	1	S8

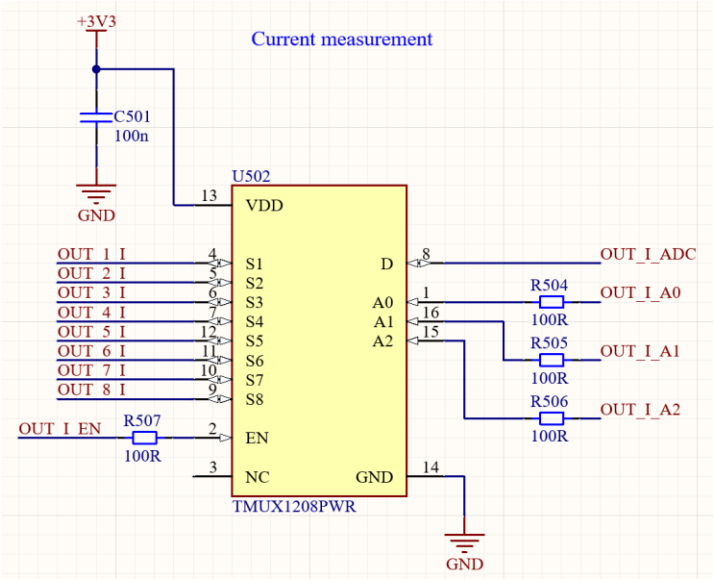
(1) X denotes *don't care*.

10. Output current measurement.



MCS1802GS-20-Z is used for current measurement. It generated 66mV/A at VOUT pin. Bidirectional current can be measured and at I_OUT=0A the output voltage is equal to VCC/2 or 1,65V.
The equation for output current is

$$I_{OUT} = \frac{(ADC - 2048) * 0{,}000806}{0{,}066}$$



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1	1	1	0	S7
1	1	1	1	S8

(1) X denotes *don't care*.

11. Output switch driver

Driving OUT_n_EN HIGH enables n-th output. Meaning it will turn the relay on. No pull-up or pull-down is required.

12. RGB LEDs

IN-PI22TAT5R5G5B are used. These are chained together in the following order:
Status LED 1
Status LED 2
Relay 1 LED
Relay 2 LED
Relay 3 LED
Relay 4 LED
Relay 5 LED
Relay 6 LED
Relay 7 LED
Relay 8 LED

Consult datasheet for information regarding how the LEDs should be driven.
IN_PI20TAT_X_R_X_G_X_B_v1_0-2000967.pdf (mouser.com)

Status LED 1 should be green when system is operational.
Status LED 2 – should blink green when a command is received.

Output LED-s should be green when the output is on and off when output is off. If problem is detected with the output and it's disabled the LED should be red.

Power to LED-s must be enabled by driving LED_PWR_EN HIGH. No pull-up/down needed.

13. MCU Pin list

Pin Nr	Pin Name	Function	Comment
1	PE2	RS485_T	
2	PE3	OUT_I_EN	Current measurement MUX control
3	PE4	OUT_I_A0	
4	PE5	OUT_I_A1	
5	PE6	OUT_I_A2	
6	VBAT	POWER	
7	PC13		
8	PC14-OSC32_IN		
9	PC15-OSC32_OUT		
10	VSS		
11	VDD		
12	PH0-OSC_IN	Crystal	
13	PH1-OSC_OUT	Crystal	
14	NRST	Reset	
15	PC0		
16	PC1	RMII_MDC	+
17	PC2		
18	PC3	PWR_IN_V_ADC	
19	VSSA	POWER	
20	VREF-	POWER	
21	VREF+	POWER	
22	VDDA	POWER	
23	PA0	ETH_nRST	
24	PA1	RMII_REFCLK	+
25	PA2	RMII_MDIO	+
26	PA3		
27	VSS	POWER	
28	VDD	POWER	
29	PA4		
30	PA5	RMII_TXEN	+
31	PA6		
32	PA7	RMII_CRS_DV	+
33	PC4	RMII_RXD0	
34	PC5	RMII_RXD1	
35	PB0	OUT_V_ADC	
36	PB1	OUT_I_ADC	
37	PB2		
38	PE7	OUT_V_EN	

39	PE8	OUT_V_A0	Voltage measurement MUX control
40	PE9	OUT_V_A1	
41	PE10	OUT_V_A2	
42	PE11		
43	PE12		
44	PE13	LED_PWR_EN	
45	PE14		
46	PE15		
47	PB10	LED_DATA	
48	VCAP	POWER	
49	VSS	POWER	
50	VDD	POWER	
j51	PB12	RMII_TXD0	
52	PB13		
53	PB14		
54	PB15	RMII_TXD1	
55	PD8	OUT_1_EN	Active HIGH. Drive high to enable output. Pull-up/-down not needed.
56	PD9	OUT_2_EN	
57	PD10	OUT_3_EN	
58	PD11	OUT_4_EN	
59	PD12	OUT_5_EN	
60	PD13	OUT_6_EN	
61	PD14	OUT_7_EN	
62	PD15	OUT_8_EN	
63	PC6		
64	PC7		
65	PC8	USB_SOF - Reserved	
66	PC9	USB_DM - Reserved	
67	PA8	USB_DP - Reserved	
68	PA9		
69	PA10		
70	PA11		
71	PA12		
72	PA13	SWDIO	
73	VDDUSB	POWER	
74	VSS	POWER	
75	VDD	POWER	
76	PA14	SWCLK	
77	PA15	BTN_1	Button inputs. Activate internal pull-down for these inputs.
78	PC10	BTN_2	
79	PC11	BTN_3	

80	PC12	BTN_4	
81	PD0	BTN_5	
82	PD1	BTN_6	
83	PD2	BTN_7	
84	PD3	BTN_8	
85	PD4		
86	PD5	SW_1	
87	PD6	SW_2	
88	PD7	SW_3	
89	PB3	SW_4	
90	PB4	SW_5	
91	PB5	SW_6	
92	PB6	SW_7	
93	PB7	SW_8	HW configuration switch input
94	BOOT0		
95	PB8		
96	PB9	RS485_DIR	
97	PE0	RS485_R	
98	VCAP	POWER	
99	VSS	POWER	
100	VDD	POWER	