

858D++ Hot Air Rework Station

Revi si on: 1
Date: 29-8-2017
Vari ant: [No Vari ations]
Status: Draft

Revi si on Management

REV #	Date	Approved By	Changes (Page title, page number; changes made)
001	YYYY-MM-DD	*	Initial Release

DRAFT!!!! Can (will) contain errors. Copy at own risk!

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- Thermocouple amplifier, over-temperature comparator, reed switch comparator
- Fan driver and monitor
- Microcontroller and User Interface
- Heater Driver, Zero-cross detector, +5V board supply

Desi gn Notes Legend

DESIGN NOTE:
Informational design note

DESIGN NOTE:
Cautionary note

DESIGN NOTE:
Note for debugging and firmware

DESIGN NOTE:
Critical design information

LAYOUT NOTE:
Important PCB layout information

LAYOUT NOTE:
Critical PCB layout information

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Drawing Title: 858D++ Hot Air Rework Station

Page Title: Cover Page

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Checked by: *

Approved by: *

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Revi si on

1

Vari ant

[No Vari ations]

Size A2

Sheet 1 of 5

K-Type Thermocouple Amplifier with reference junction compensation

Over-temperature protection Comparator

DESIGN NOTE:
This pull-up provides protection in case of open thermocouple by pulling the input to the supply rail and saturating the amplifier's output.
The value of 10M is chosen to make sure as little offset current as possible runs through the circuit. Capacitor is placed to filter noise on the high-value resistor.

DESIGN NOTE:
The circuit must be calibrated for gain and offset after manufacturing.
See documentation for procedure.

DESIGN NOTE:
Reference level:
 $5V0 * (56.2k / (10k + 56.2k)) = 4.24V$

LAYOUT NOTE:
Place filter components physically close to ADC input pin.

DESIGN NOTE:
The ADC is used in 10 bits mode. The Kinetics KE02 data sheet states that R14 must be $\leq 5k\Omega$. So 4k7 is selected. This leaves room for an additional 100R resistor between R14 and the microcontroller pin.

DESIGN NOTE:
The measurement range for the thermocouple must be 0-500°C. This relates to 0-20.5mV at the amplifier's input, including the reference junction compensation voltage.
Additional offset voltage is generated through the 10M pull-up, the 10k RF filter resistor and the 102R to 0V. This is 5.05mV, and relates to a temperature range of 123°C.
The amplifier's gain of 159 is chosen to make sure that 4.096V (the ADC reference voltage) relates to 502°C as measured by the thermocouple. Due to the additional offset a 0V output of the amplifier now relates to -123°C.
Calibration of the circuit is required to mitigate circuit tolerances and provide a gain and offset value for the firmware to calculate actual thermocouple voltage/temperature.

DESIGN NOTE:
Thermocouple reference junction compensation is done by providing an offset voltage of 41µV/°C. This is the near enough the same sensitivity as the K-type thermocouple.
The temperature sensor gives a 10mV/°C output. The voltage divider brings this down to the desired 41µV/°C.

Layout Note:
Place R7 and R7' next to each other for close thermal coupling.
Place tracks and copper in such a way both resistors behave the same thermally.

Reed Switch filter and debounce

DESIGN NOTE:
The reed switch is NOT referenced to 0V but connected to negative lead of the blower fan. This means the reed switch is connected to 0V through a 2.20 resistor (see picture).
Fan current can be up to 250mA and has commutation noise on it. This results in a noise voltage as seen from the reed switch comparator of $250mA * 2.2\Omega = 550mV$. For this reason a 74x14 logic type Schmitt trigger cannot be used as its input low voltage level can be as low as <0.2V. Hence the choice for an analog comparator and a reference at 2.5V for convenient resistor choices.

Reed Switch Circuit

This Schematic Sheet

Fan drive circuit

To current sense circuit

2R2

Wired together inside handle

Blower Fan

*note: wiring colours here do not represent actual wiring colours

DESIGN NOTE:
Debounce time 20ms

DESIGN NOTE:
Reference voltage 2.5V ± hysteresis of 0.5V
 $Ref_L = 100 / ((220 + 10) / ((100 / ((220 + 10) + 100)) * 5V = 2.05V$
 $Ref_H = 100 / ((100 / (220 + 100)) * 5V = 2.96V$

DESIGN NOTE:
Output High = handle in cradle (reed switch closed)

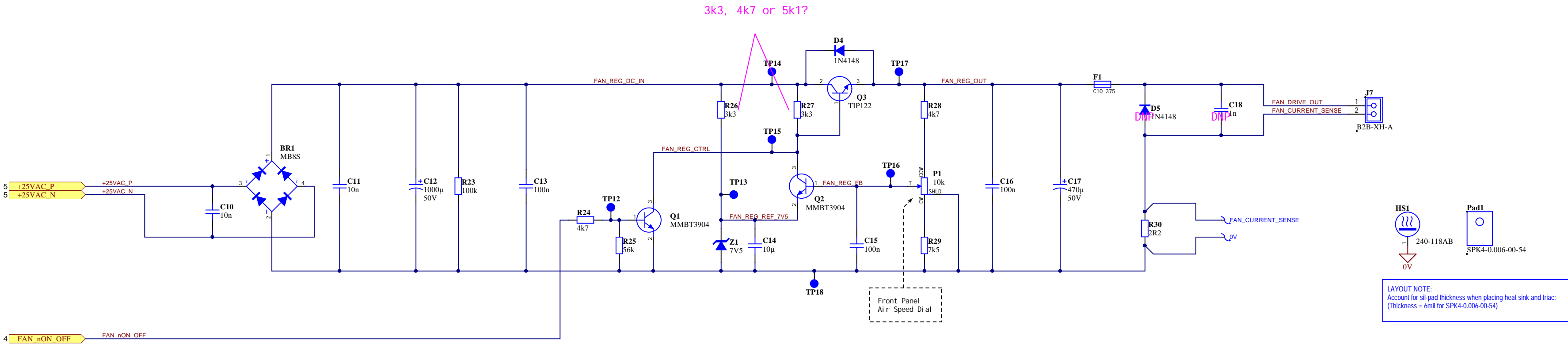
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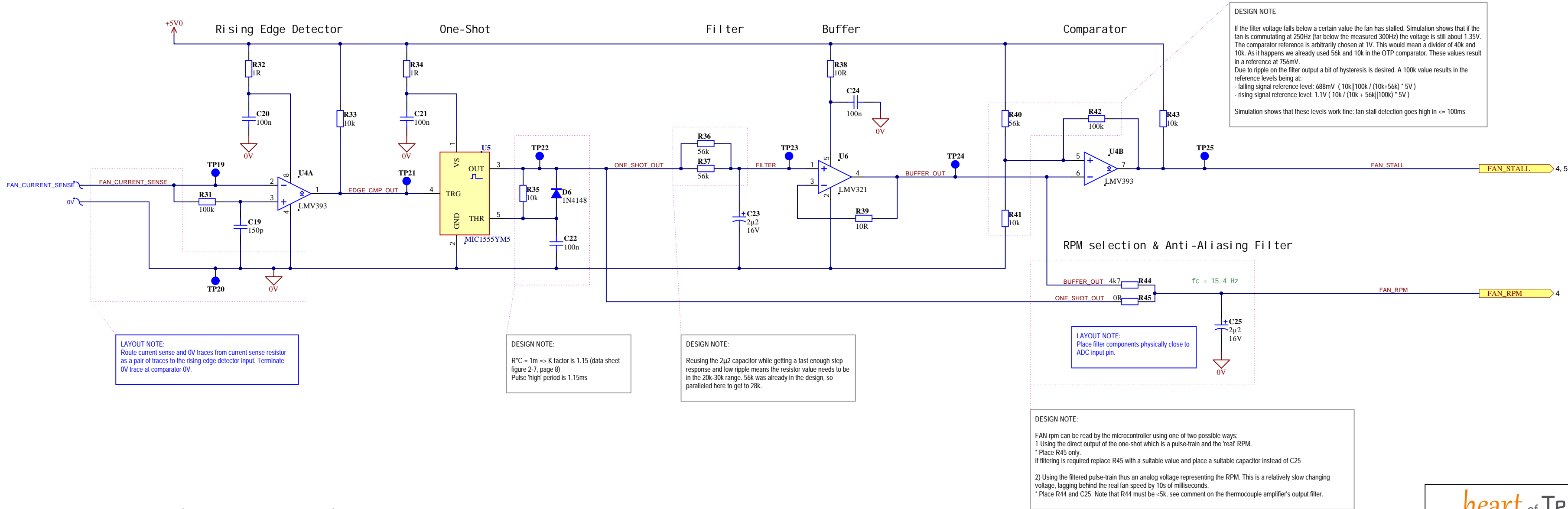
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Page Title:		TC amplifier, OTP, Reed Switch	
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Fan Driver



Fan Monitor

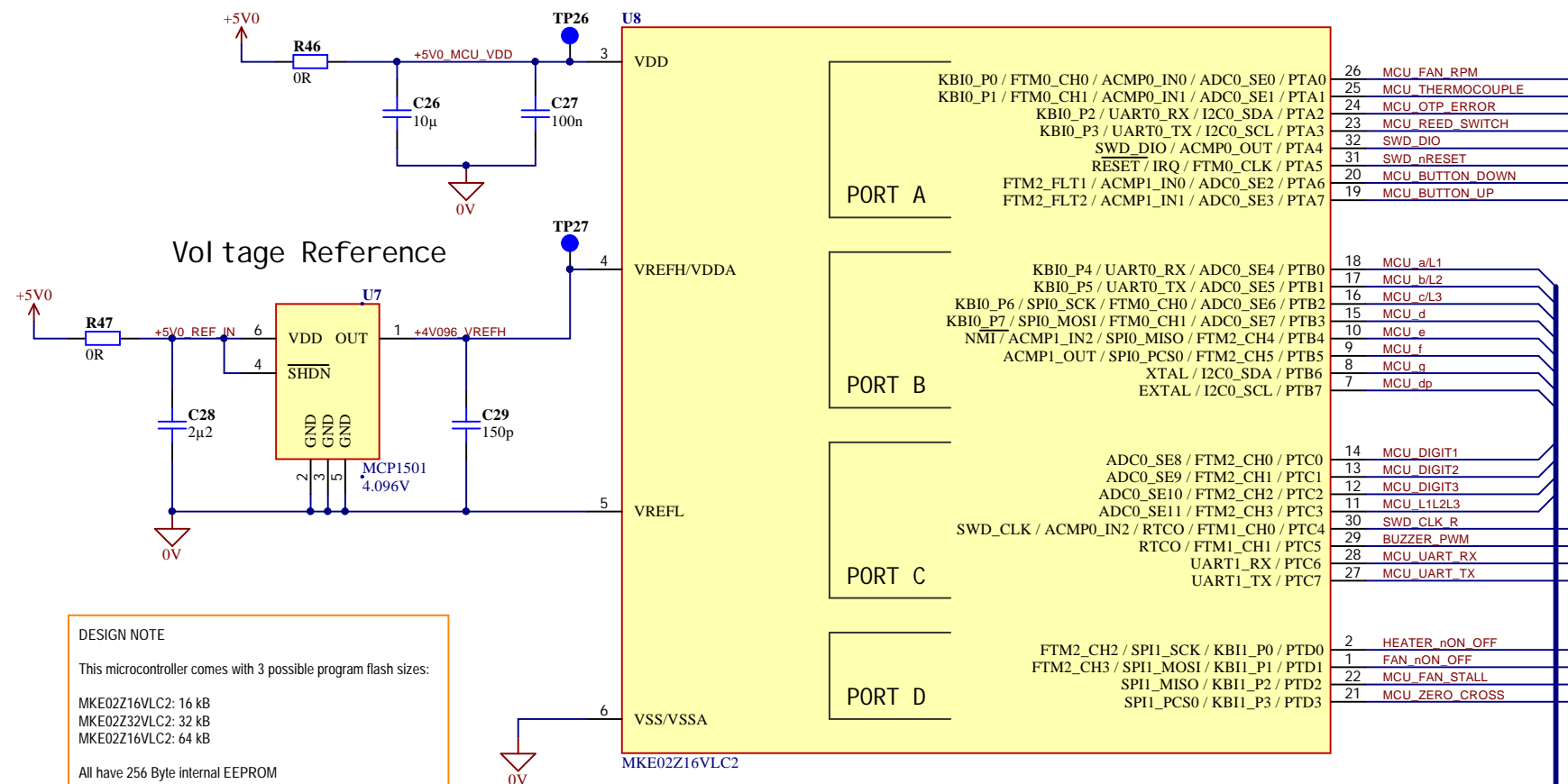


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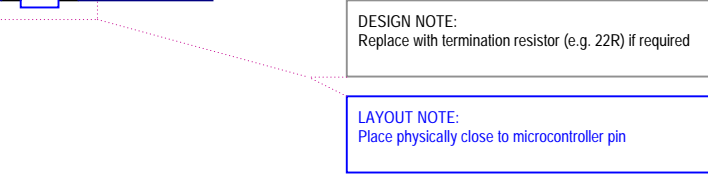
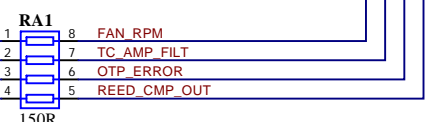
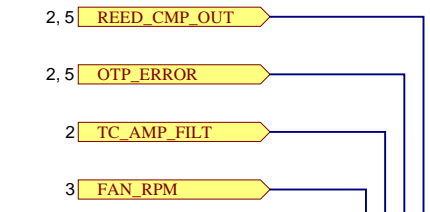
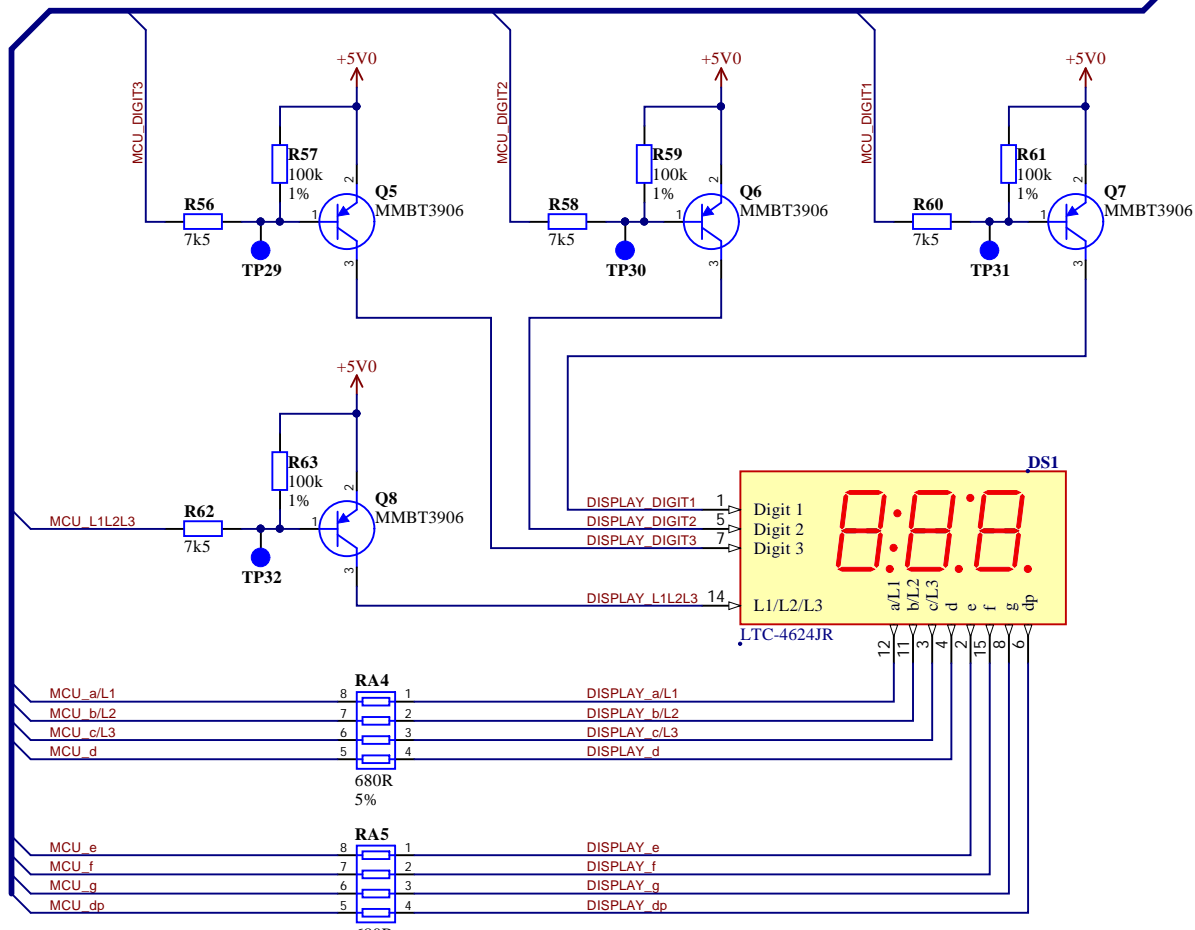
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Page Title: Fan Driver and Monitor			
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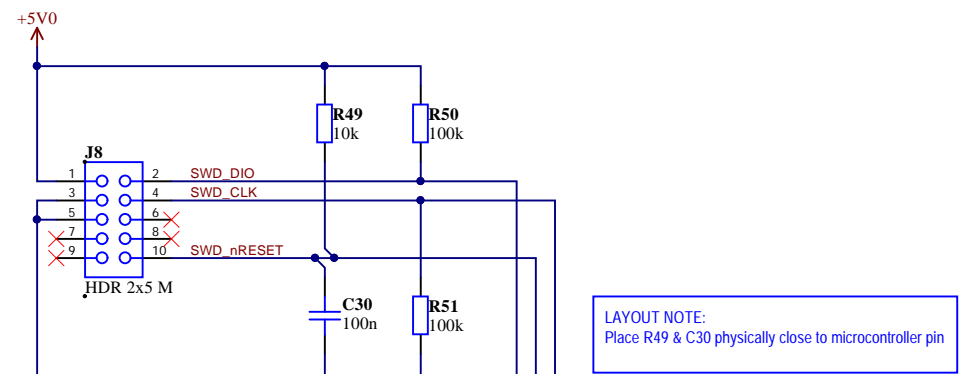
KE02Z Microcontroller



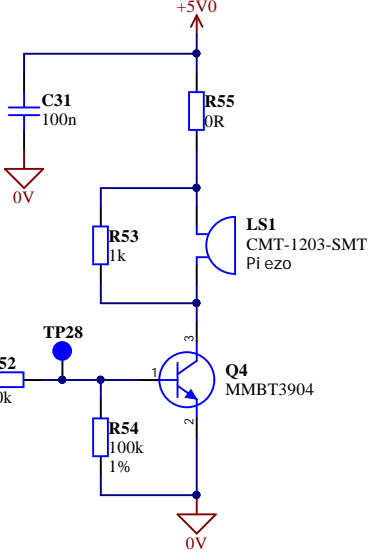
Display



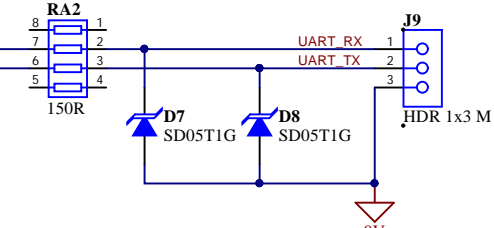
ARM SWD Programming I/F



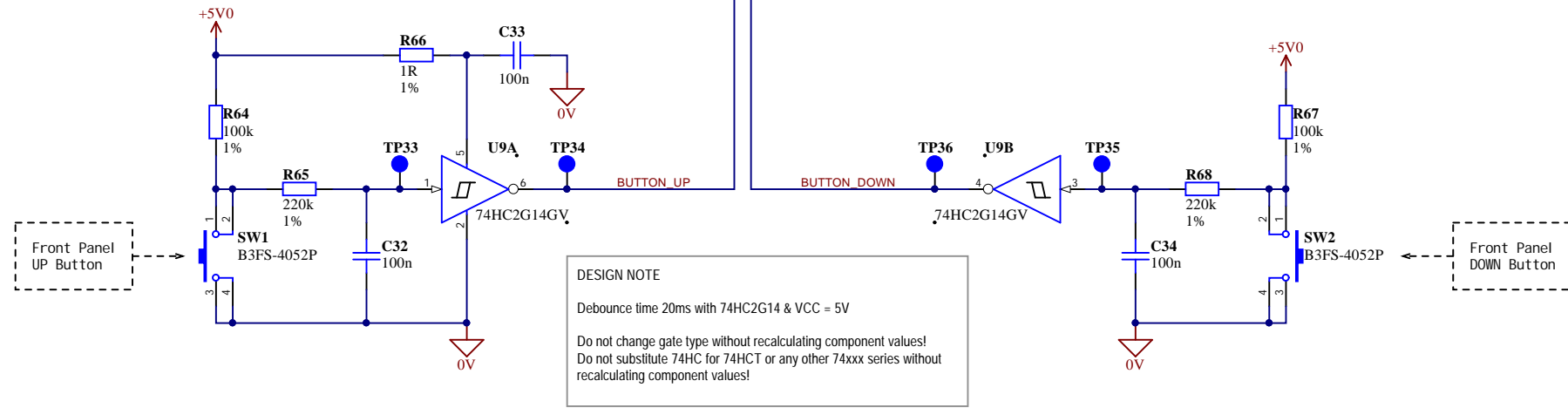
Buzzer



Serial I/F



Front panel buttons debouncing



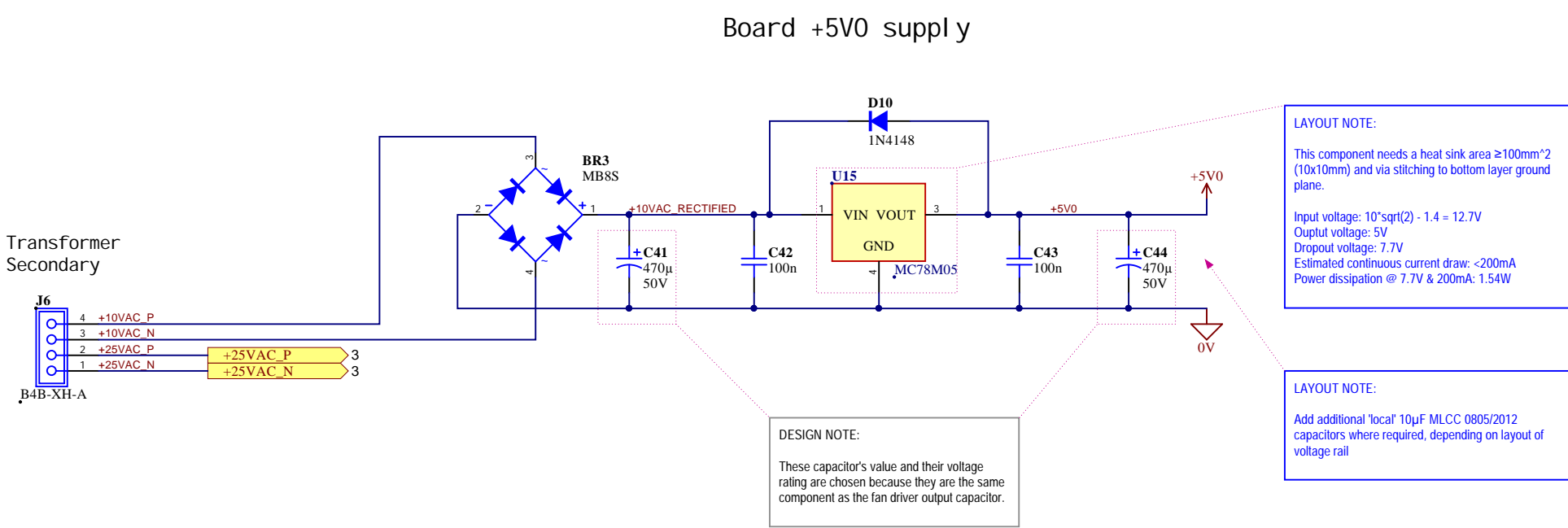
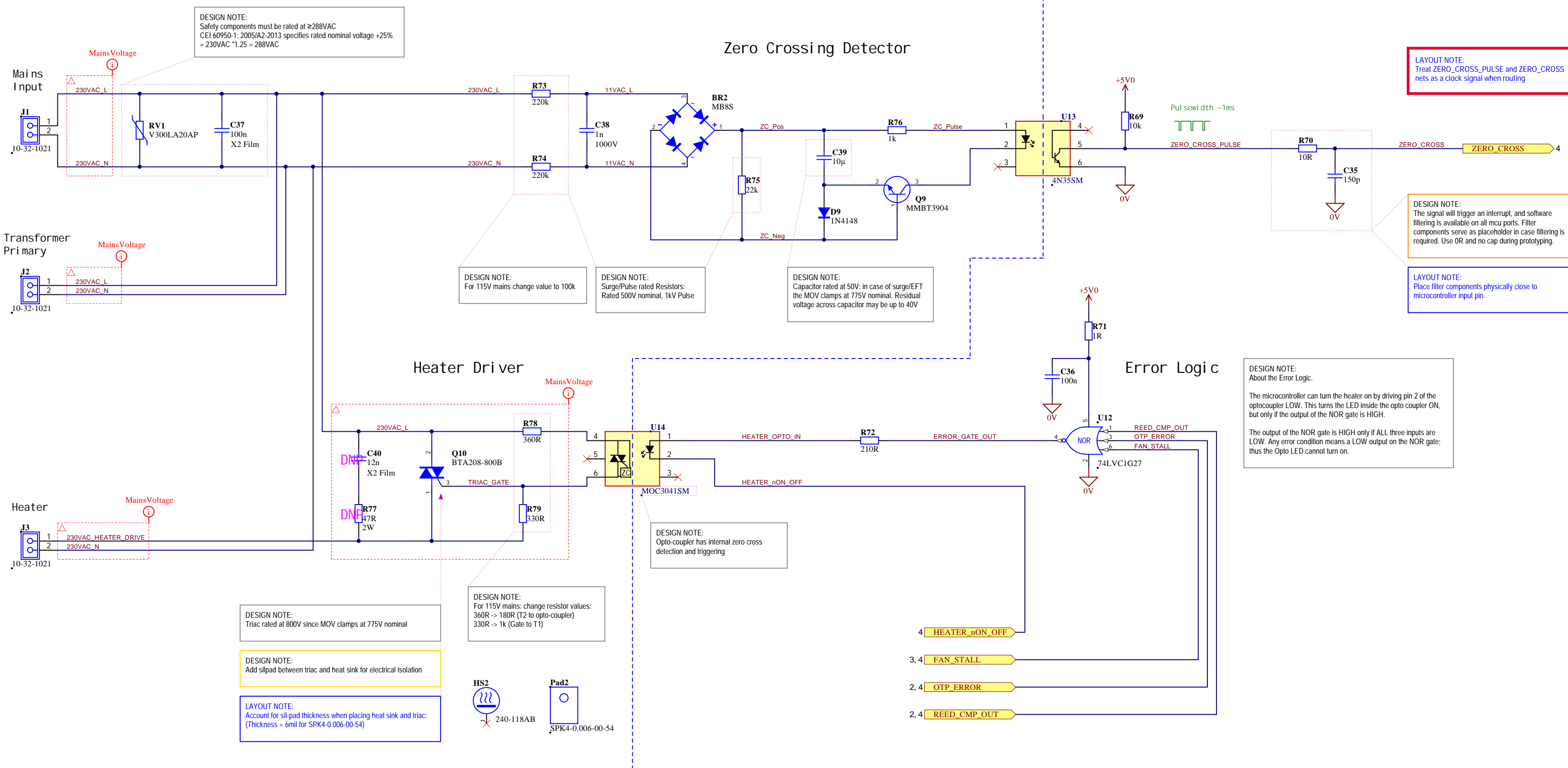
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