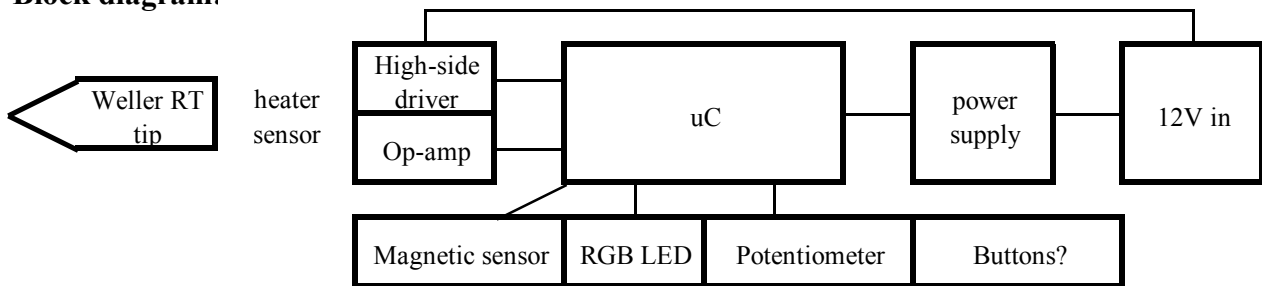


Soldering pen

For Weller RT tips

Block diagram:



Main assumptions:

Tip rated voltage:

12 V

Tip rated power:

40 W

Safety factor for tip resistance

110%

Power supply:

10-20V power supply - can be used with laptop power supply

min. typ. max.

10 12 20 V

Non-fully operational power supply

uC is working, heater may be of

min. max.

8 30 V

Reverse power supply protection

min. max.

0 -30 V

Ambient temperature:

min. typ. max.

0 25 40 °C

Solder temperature

min. max.

0 400 °C

Output protection for:

Short between any pins

Open circuit on any pins

Connection to external voltage?

uC regulator

Supply voltage range:

Operational

min.	max.
10	20

V

Non operational

min.	max.
8	30

V

Reverse power supply protection

min.	max.
0	-30

V

Diode or MOSFET can be used for reverse protection. As heater should be protected from reverse supply current, MOSFET will be used on the power supply input. It will be placed before uC regulator and heater driver.

Tip heater resistance, nominal:

3,33

Ω

Safety factor

110%

Maximum input current (peak):

6,6

A

Regulator should withstand 30V. Simple 78L05/78L33 will withstand that.

Reverse protection P MOSFET:

IPD50P04P4-13

Max on resistance:

12,6

mΩ

Heater driver

Power supply

min. typ. max.

10 12 20 V

Tip heater resistance, nominal:

3,33 Ω

Safety factor

110%

Current on nominal voltage - PWM up to 100%, safety factor included

3,96 A

Peak current on max. voltage

6,60 A

Max. PWM on max. voltage

36%

Driver chosen:

BTS5012SDA

On-state resistance

typ. max.

12 24 m Ω

Power dissipation

typ. max.

0,19 0,38 W

Rthja, open air, typical

80 K/W

Temperature rise at max power output

typ. max.

15 30 $^{\circ}\text{C}$

Maximum temperature at max. ambier

70 $^{\circ}\text{C}$

Driver provides short circuit protection and output current measurement.

Sensor amplifier

Input thermocouple: K, thermal coefficient
41 uV/*C

Op-amp: single supply, precision, at least lower rail capable input

Selected amplifier:

MCP6051

Offset voltage max. @25*C	150 uV	Input bias current max.	5 nA	Negligible	
Offset voltage temp. drift	1,5 uV/*C	Offset voltage from temp. @Tmin	38 uV	Offset voltage max. @whole temp. range	188 uV

Op-amp resistors

	typ.	tolerance	temp. coef.	Stability, short time	Total error, short time, excl. tolerance
Rfb	27 kΩ	1,0%	100 ppm/K	0,3%	0,5%
Rin	0,1 kΩ	1,0%	100 ppm/K	0,3%	0,5%
Gain	271	tolerance, excl. op-amp offset		short time stability, excl. op-amp offset	
	271	2,0%		1,0%	
Tout	max. 400 *C				
Tamb.	min 0 *C				
Vout @Tamb=min,Tout=max.	typ. 4,44 V	tolerance error 0,09 V 8,0 *C	short time error, incl. op-amp 0,10 V 8,6 *C		Vout max. 4,63 V

uC

- Pins used:
- 2 heater driver
 - 2 sensor
 - 3 LED
 - 1 potentiometer
 - 1 Vin measurement
 - 1 Magnetic sensor
 - 1 Buttons?

11 Total

uC selected:
STM32F070F6
in TSSOP20 package

0,39	79,79	*C/V	0,01 V/*C
#####		uV/*C	19,4 uV/*C

5,29

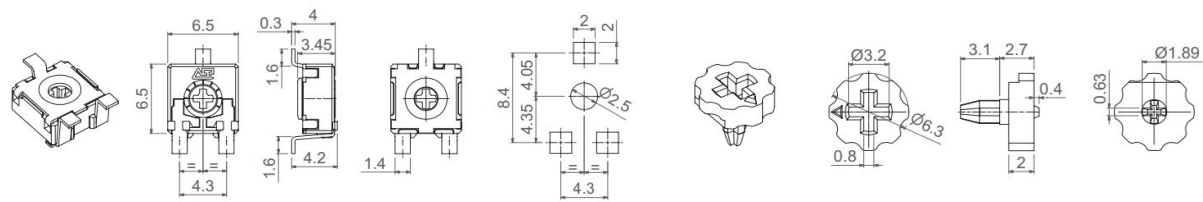
val
0
1023 399

5 399

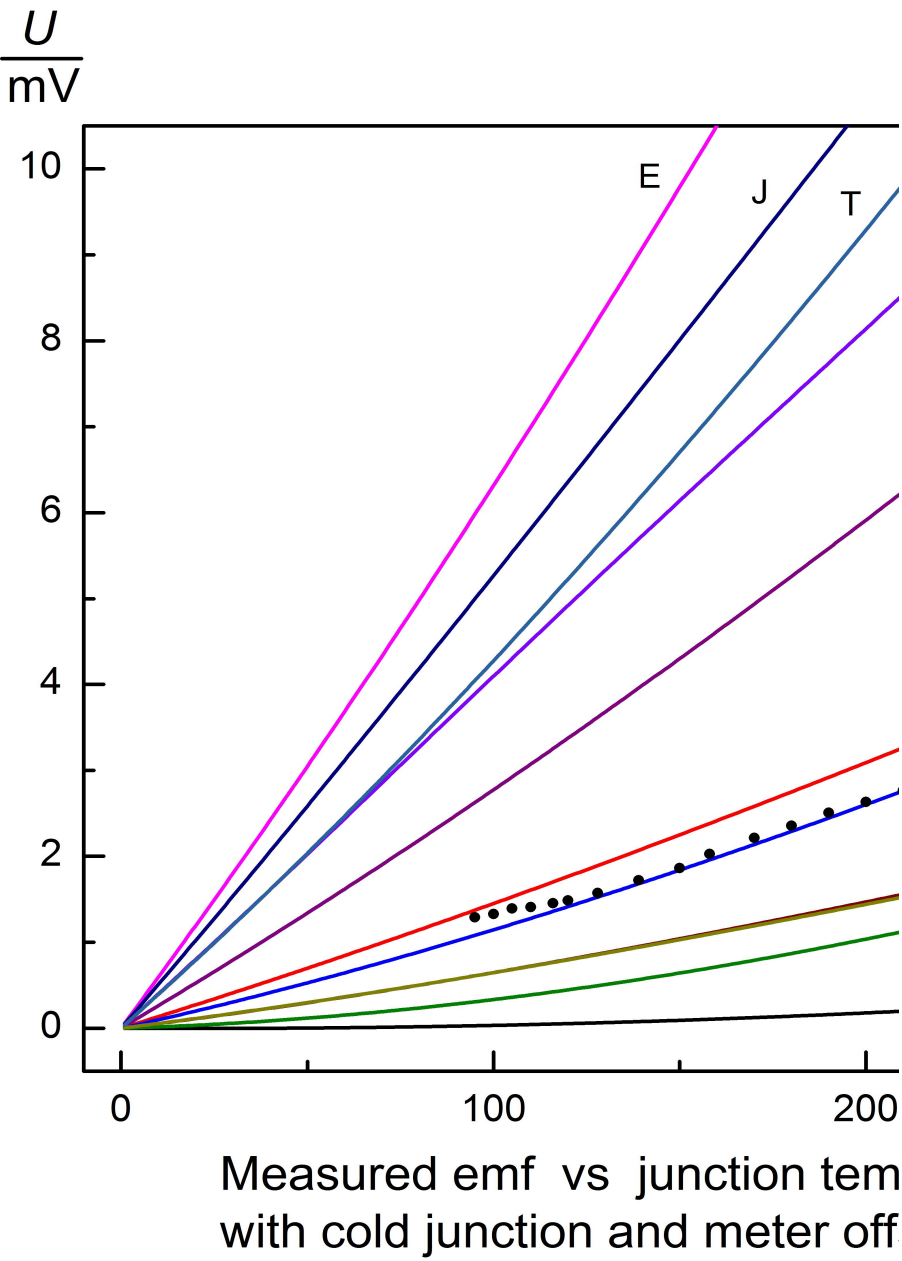
Potentiometer

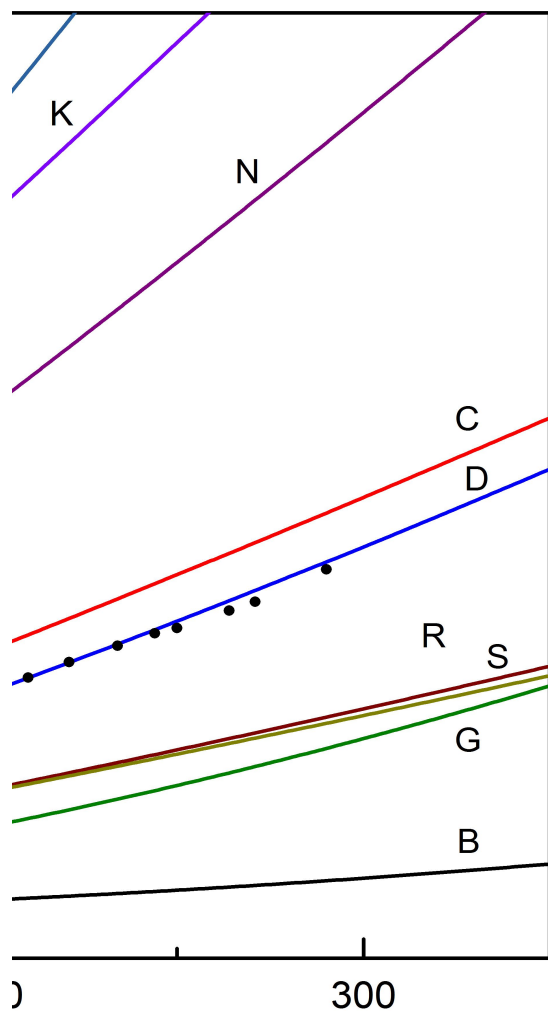
Selected potentiometer is CA6XVSMD-10KA2525. It's basically a trimmer, but with longer mechanical life (1000 cycles) than standard trimmers (100 cycles). It has also a couple of safts and thumbweels available. 6001 type thumbwheel is selected to ensure that change of temperature setting is available but not too easy.

VSMD	6001
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Read temperature when heater is off
Thermocouple is probably type D with cold junction compensation





$$\frac{\Delta T}{K}$$

Temperature difference
Offset compensation

Title