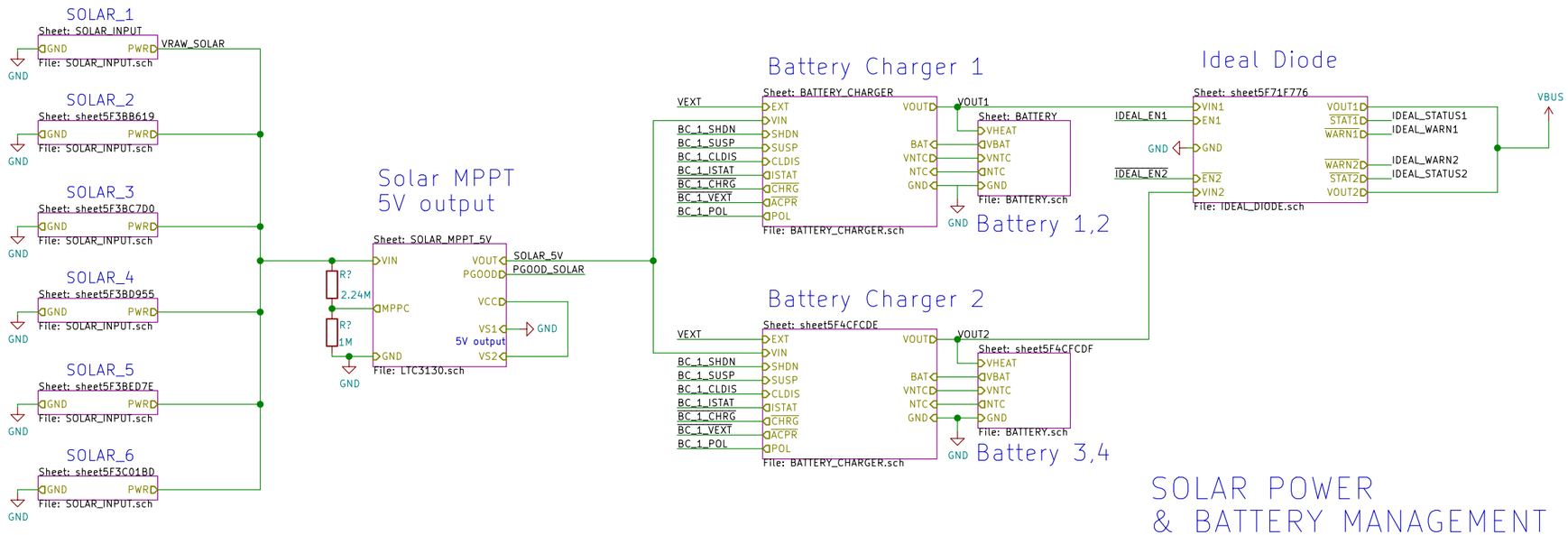
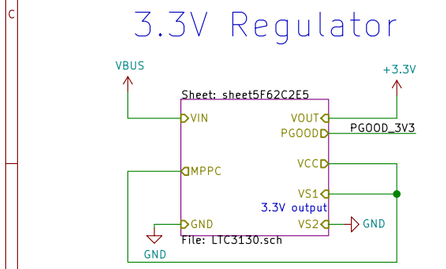
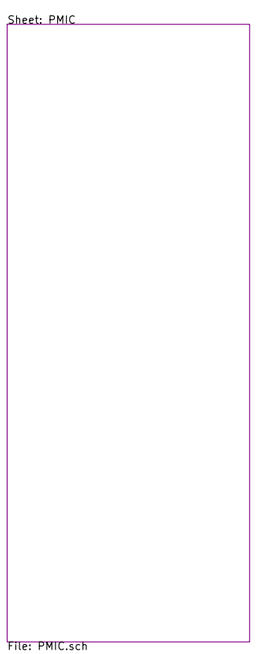
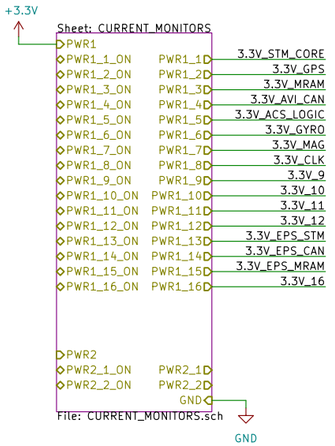
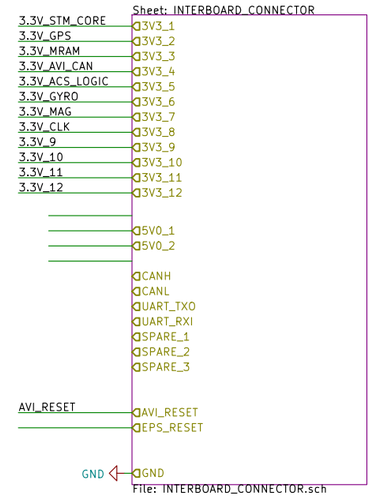










Sheet: /
File: EPS.sch

Title: Current Monitor

Size: B	Date: 2020-08-09	**Rev:**
KiCad E.D.A.	kicad 5.1.6-c6e7f7d87ubuntu16.04.1	Id: 1/35

NRVB120VLSFT1G

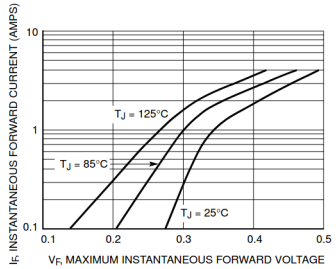


Figure 2. Maximum Forward Voltage

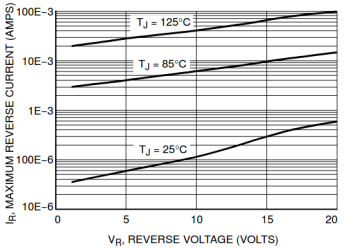
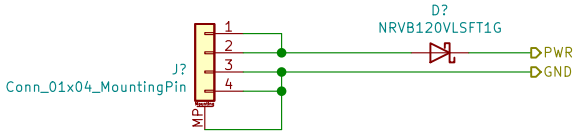
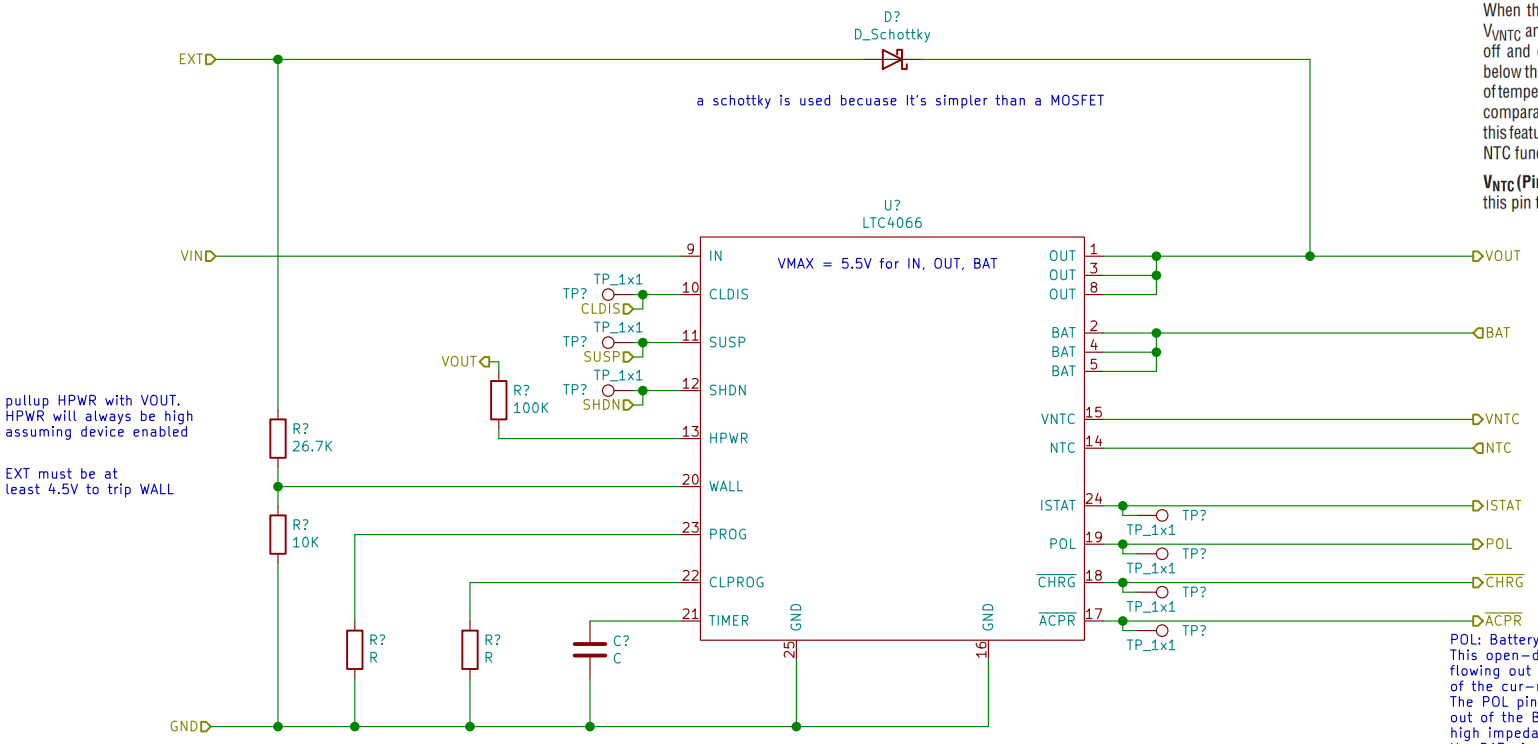


Figure 4. Maximum Reverse Current



Sheet: /SOLAR_INPUT/		
File: SOLAR_INPUT.sch		
Title: Solar Input		
Size: A	Date: 2020-08-09	**Rev:**
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 2/35



NTC (Pin 14): Input to the NTC Thermistor Monitoring Circuits. Under normal operation, tie a thermistor from the NTC pin to ground and a resistor of equal value from NTC to V_{NTC}. When the voltage on this pin is above 0.74 • V_{VNTC} (Cold, 0°C) or below 0.29 • V_{VNTC} (Hot, 50°C) the timer is suspended, but not cleared, the charging is disabled and the $\overline{CHRG}$ pin remains in its former state. When the voltage on NTC comes back between 0.74 • V_{VNTC} and 0.29 • V_{VNTC}, the timer continues where it left off and charging is re-enabled if the battery voltage is below the recharge threshold. There is approximately 3°C of temperature hysteresis associated with each of the input comparators. Connect the NTC pin to ground to disable this feature. This will disable all of the LTC4066/LTC4066-1 NTC functions.

V_{NTC} (Pin 15): Output Bias Voltage for NTC. A resistor from this pin to the NTC pin will bias the NTC thermistor.

POL: Battery Current Status Polarity Pin.
This open-drain output pin indicates whether the current flowing out of the ISTAT pin represents one-thousandth of the cur-rent flowing into or out of the BAT pins. The POL pin will pull down when current is fl owing out of the BAT pin (i.e., charging) and will assume a high impedance state when current is flowing into the BAT pin (i.e., ideal diode).

CHRG: Open-Drain Charge Status Output.
When the battery is beingcharged, the CHRG pin is pulled low by an internal N-channel MOSFET. When the timer runs out or the charge current drops below a programmable current level or the input supply or output supply is removed, the CHRG pin is forced to a high impedance state.

ACPR: Wall Adapter present. Active Low open drain.
Indicates wall adapter present.
Disabled if IN==OUT==BAT==0V or shutdown

CLDIS (Pin 10): Current Limit Disable. This logic input is used to disable the input current limit programmed by CLPROG. A voltage greater than 1.2V on the pin will set the current limit to $I_{IN(MAX)}$ (typically 2.6A). A weak pull-down current is internally applied to this pin to ensure it is low at power-up when the input is not being driven externally.

SUSP (Pin 11): Suspend Mode Input. Pulling this pin above 1.2V will disable the power path from IN to OUT. The supply current from IN will be reduced to comply with the USB specification for Suspend mode. Both the ability to charge the battery from OUT and the ideal diode function (from BAT to OUT) will remain active. Suspend mode will reset the charge timer if V_{OUT} is less than V_{BAT} while in suspend mode. If V_{OUT} is kept greater than V_{BAT}, such as when a wall adapter is present, the charge timer will not be reset when the part is put in suspend. A weak pull-down current is internally applied to this pin to ensure it is low at power-up when the pin is not being driven externally.

SHDN (Pin 12): Shutdown Input. Pulling this pin greater than 1.2V will disable the entire part and place it in a low supply current mode of operation. All power paths will be disabled. A weak pull-down current is internally applied to this pin to ensure it is enabled at power-up when the pin is not being driven externally.

HPWR (Pin 13): High Power Select. This logic input is used to control the input current limit. A voltage greater than 1.2V on the pin will set the input current limit to 100% of the current programmed by the CLPROG pin. A voltage less than 0.4V on the pin will set the input current limit to 20% of the current programmed by the CLPROG pin. A weak pull-down current is internally applied to this pin to ensure it is low at power-up when the pin is not being driven externally.

TIMER (Pin 21): Timer Capacitor. Placing a capacitor, C_{TIMER}, to GND sets the timer period. The timer period is:

$$t_{TIMER}(Hours) = \frac{C_{TIMER} \bullet R_{PROG} \bullet 3Hours}{0.1\mu F \bullet 100k}$$

Charge time is increased if charge current is reduced due to load current, thermal regulation and current limit selection (HPWR). Shorting the TIMER pin to GND disables the battery charging functions.

CLPROG (Pin 22): Current Limit Program and Input Current Monitor. Connecting a resistor, R_{CLPROG}, to ground programs the input to output current limit. The current limit is programmed as follows:

$$I_{CL}(A) = \frac{1000V}{R_{CLPROG}}$$

In USB applications the resistor R_{CLPROG} should be set to no less than 2.1k.

The voltage on the CLPROG pin is always proportional to the current flowing through the IN to OUT power path. This current can be calculated as follows:

$$I_{IN}(A) = \frac{V_{CLPROG}}{R_{CLPROG}} \bullet 1000$$

PROG (Pin 23): Charge Current Program. Connecting a resistor, R_{PROG}, to ground programs the battery charge current. The battery charge current is programmed as follows:

$$I_{CHG}(A) = \frac{50.000V}{R_{PROG}}$$

I_{STAT} (Pin 24): Battery Current Status Pin. One-thousandth of the current flowing into or out of the BAT pins flows out of this pin. The POL polarity pin indicates which direction current is flowing. If the current flowing into the BAT pins drops below 1mA, then the I_{STAT} pin will continue to source 1µA. The I_{STAT} pin also programs the charge current level at which the $\overline{CHRG}$ pin transitions to its high impedance state. When the I_{STAT} voltage drops below 0.1V while charging in constant voltage mode the $\overline{CHRG}$ pin will transition to a high impedance state. This corresponds to a BAT current of:

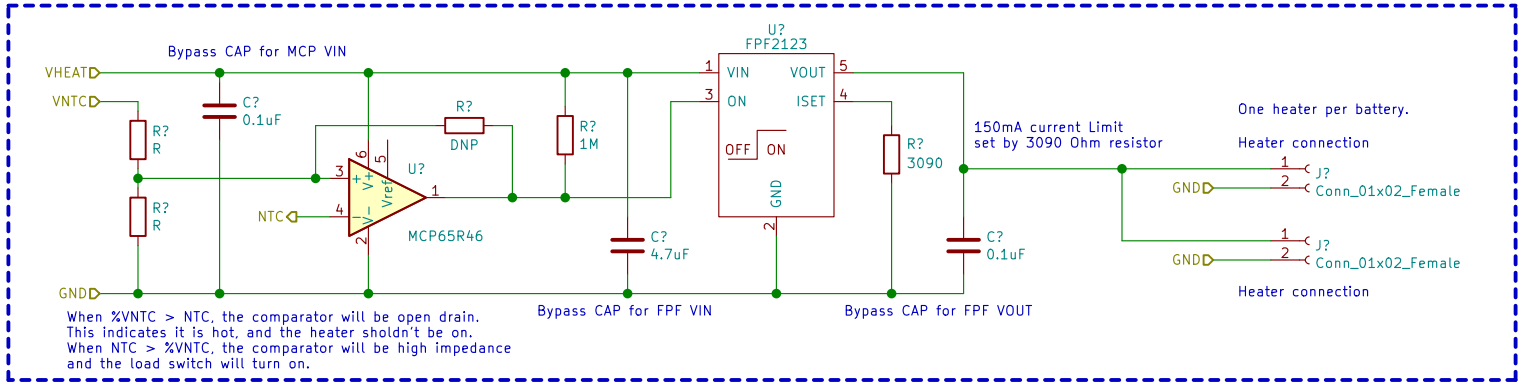
$$I_{BAT}(A) = \frac{0.1V}{R_{ISTAT}} \bullet 1000$$

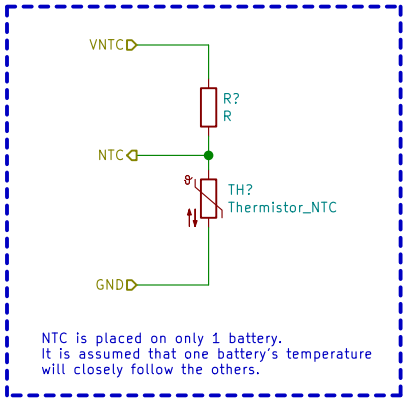
Sheet: /BATTERY_CHARGER/
File: BATTERY_CHARGER.sch

Title: LTC4066

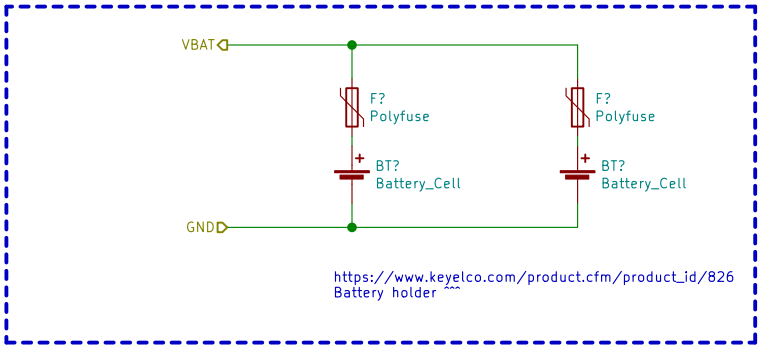
Size: A	Date: 2020-08-09	**Rev:**
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 3/35

Battery heater control circuit





NTC output for battery charger
and heater circuit (see above)



Batteries & fuses

Sheet: /BATTERY/		
File: BATTERY.sch		
Title: Battery, Battery Heater, NTC		
Size: A	Date: 2020-08-11	**Rev:**
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 4/35

NRVB120VLSFT1G

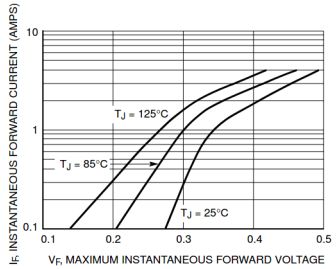


Figure 2. Maximum Forward Voltage

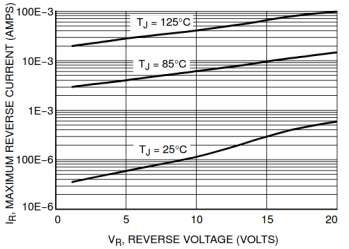
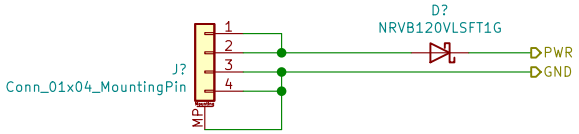


Figure 4. Maximum Reverse Current



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Size: A	Date: 2020-08-09	**Rev:**
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NRVB120VLSFT1G

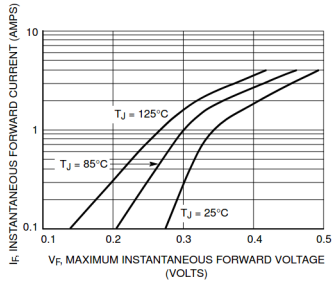


Figure 2. Maximum Forward Voltage

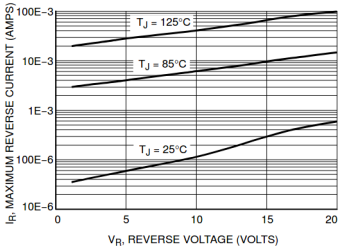
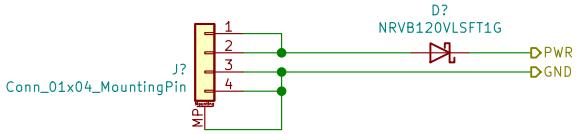


Figure 4. Maximum Reverse Current



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Title: Solar Input		
Size: A	Date: 2020-08-09	**Rev:**
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NRVB120VLSFT1G

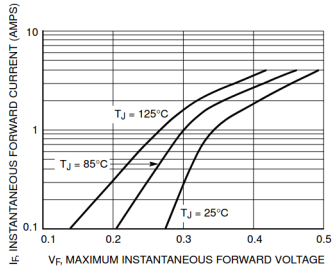


Figure 2. Maximum Forward Voltage

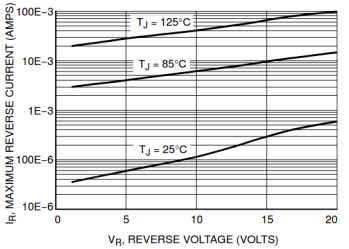
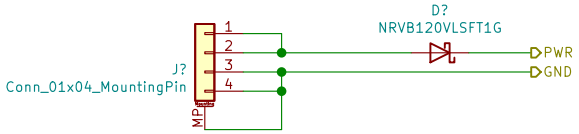


Figure 4. Maximum Reverse Current



Sheet: /sheet5F3BD955/
File: SOLAR_INPUT.sch

Title: Solar Input

Size: A	Date: 2020-08-09	**Rev:**
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NRVB120VLSFT1G

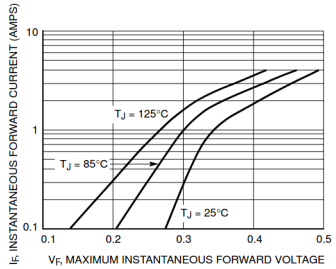


Figure 2. Maximum Forward Voltage

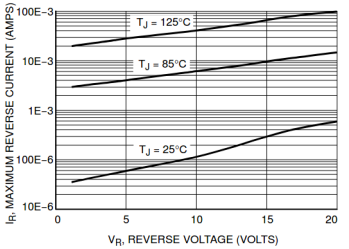
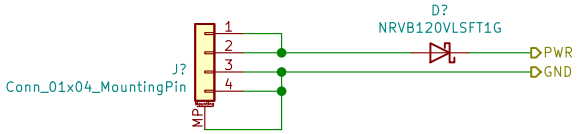


Figure 4. Maximum Reverse Current



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Title: Solar Input		
Size: A	Date: 2020-08-09	**Rev:**
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NRVB120VLSFT1G

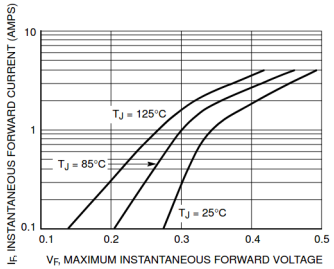


Figure 2. Maximum Forward Voltage

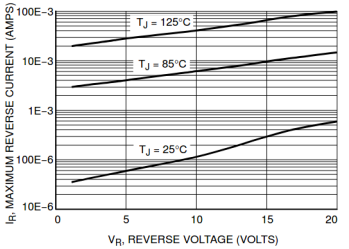
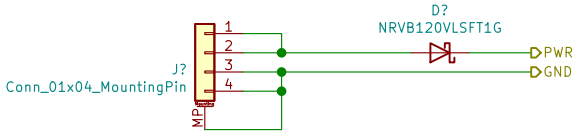


Figure 4. Maximum Reverse Current



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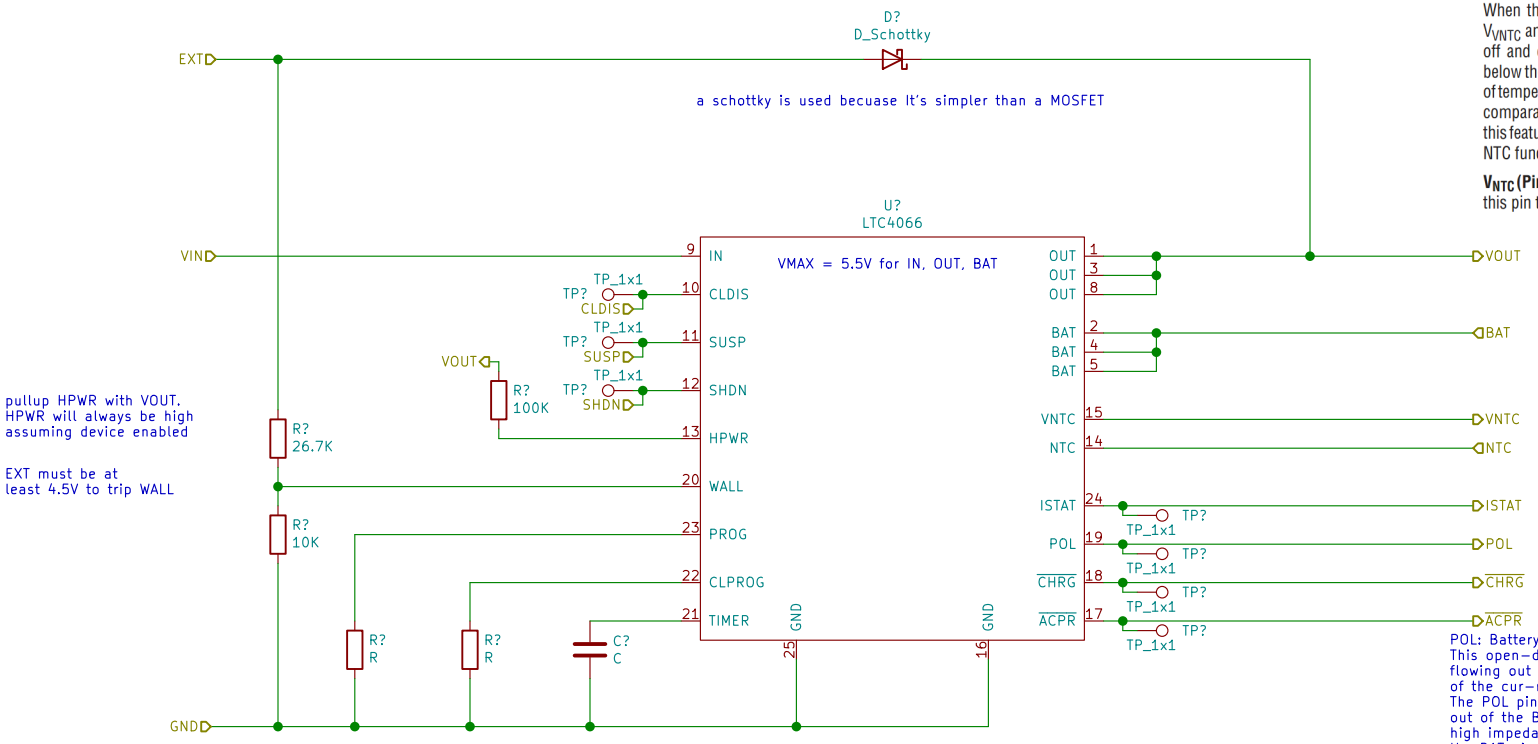
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 9/35



NTC (Pin 14): Input to the NTC Thermistor Monitoring Circuits. Under normal operation, tie a thermistor from the NTC pin to ground and a resistor of equal value from NTC to V_{NTC}. When the voltage on this pin is above 0.74 • V_{VNTC} (Cold, 0°C) or below 0.29 • V_{VNTC} (Hot, 50°C) the timer is suspended, but not cleared, the charging is disabled and the $\overline{CHRG}$ pin remains in its former state. When the voltage on NTC comes back between 0.74 • V_{VNTC} and 0.29 • V_{VNTC}, the timer continues where it left off and charging is re-enabled if the battery voltage is below the recharge threshold. There is approximately 3°C of temperature hysteresis associated with each of the input comparators. Connect the NTC pin to ground to disable this feature. This will disable all of the LTC4066/LTC4066-1 NTC functions.

V_{NTC} (Pin 15): Output Bias Voltage for NTC. A resistor from this pin to the NTC pin will bias the NTC thermistor.

POL: Battery Current Status Polarity Pin.
This open-drain output pin indicates whether the current flowing out of the ISTAT pin represents one-thousandth of the cur-rent flowing into or out of the BAT pins. The POL pin will pull down when current is fl owing out of the BAT pin (i.e., charging) and will assume a high impedance state when current is flowing into the BAT pin (i.e., ideal diode).

CHRG: Open-Drain Charge Status Output.
When the battery is beingcharged, the CHRG pin is pulled low by an internal N-channel MOSFET. When the timer runs out or the charge current drops below a programmable current level or the input supply or output supply is removed, the CHRG pin is forced to a high impedance state.

ACPR: Wall Adapter present. Active Low open drain.
Indicates wall adapter present.
Disabled if IN==OUT==BAT==0V or shutdown

CLDIS (Pin 10): Current Limit Disable. This logic input is used to disable the input current limit programmed by CLPROG. A voltage greater than 1.2V on the pin will set the current limit to $I_{IN(MAX)}$ (typically 2.6A). A weak pull-down current is internally applied to this pin to ensure it is low at power-up when the input is not being driven externally.

SUSP (Pin 11): Suspend Mode Input. Pulling this pin above 1.2V will disable the power path from IN to OUT. The supply current from IN will be reduced to comply with the USB specification for Suspend mode. Both the ability to charge the battery from OUT and the ideal diode function (from BAT to OUT) will remain active. Suspend mode will reset the charge timer if V_{OUT} is less than V_{BAT} while in suspend mode. If V_{OUT} is kept greater than V_{BAT}, such as when a wall adapter is present, the charge timer will not be reset when the part is put in suspend. A weak pull-down current is internally applied to this pin to ensure it is low at power-up when the pin is not being driven externally.

SHDN (Pin 12): Shutdown Input. Pulling this pin greater than 1.2V will disable the entire part and place it in a low supply current mode of operation. All power paths will be disabled. A weak pull-down current is internally applied to this pin to ensure it is enabled at power-up when the pin is not being driven externally.

HPWR (Pin 13): High Power Select. This logic input is used to control the input current limit. A voltage greater than 1.2V on the pin will set the input current limit to 100% of the current programmed by the CLPROG pin. A voltage less than 0.4V on the pin will set the input current limit to 20% of the current programmed by the CLPROG pin. A weak pull-down current is internally applied to this pin to ensure it is low at power-up when the pin is not being driven externally.

TIMER (Pin 21): Timer Capacitor. Placing a capacitor, C_{TIMER}, to GND sets the timer period. The timer period is:

$$t_{TIMER}(Hours) = \frac{C_{TIMER} \bullet R_{PROG} \bullet 3Hours}{0.1\mu F \bullet 100k}$$

Charge time is increased if charge current is reduced due to load current, thermal regulation and current limit selection (HPWR). Shorting the TIMER pin to GND disables the battery charging functions.

CLPROG (Pin 22): Current Limit Program and Input Current Monitor. Connecting a resistor, R_{CLPROG}, to ground programs the input to output current limit. The current limit is programmed as follows:

$$I_{CL}(A) = \frac{1000V}{R_{CLPROG}}$$

In USB applications the resistor R_{CLPROG} should be set to no less than 2.1k.

The voltage on the CLPROG pin is always proportional to the current flowing through the IN to OUT power path. This current can be calculated as follows:

$$I_{IN}(A) = \frac{V_{CLPROG}}{R_{CLPROG}} \bullet 1000$$

PROG (Pin 23): Charge Current Program. Connecting a resistor, R_{PROG}, to ground programs the battery charge current. The battery charge current is programmed as follows:

$$I_{CHG}(A) = \frac{50.000V}{R_{PROG}}$$

I_{STAT} (Pin 24): Battery Current Status Pin. One-thousandth of the current flowing into or out of the BAT pins flows out of this pin. The POL polarity pin indicates which direction current is flowing. If the current flowing into the BAT pins drops below 1mA, then the I_{STAT} pin will continue to source 1µA. The I_{STAT} pin also programs the charge current level at which the $\overline{CHRG}$ pin transitions to its high impedance state. When the I_{STAT} voltage drops below 0.1V while charging in constant voltage mode the $\overline{CHRG}$ pin will transition to a high impedance state. This corresponds to a BAT current of:

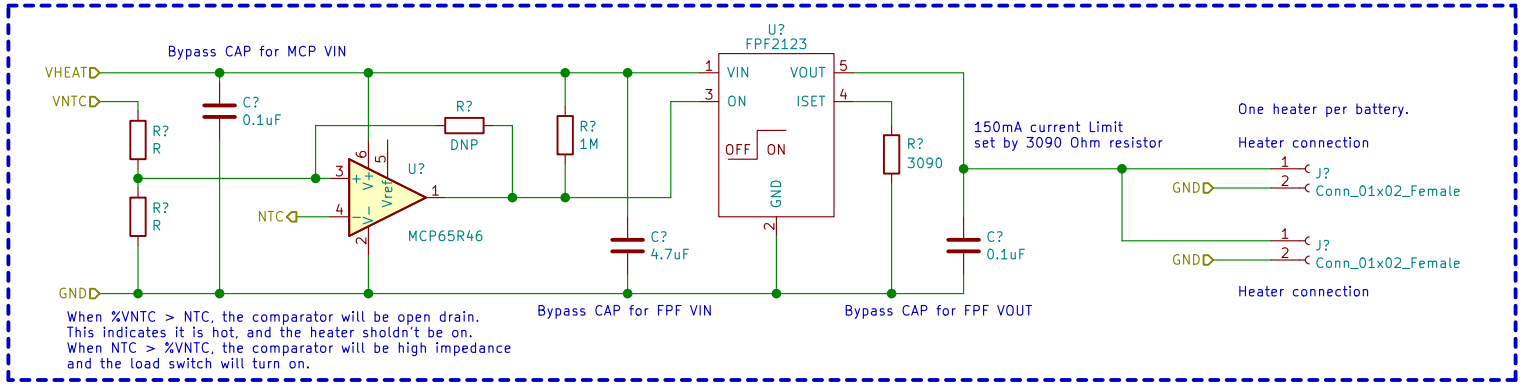
$$I_{BAT}(A) = \frac{0.1V}{R_{ISTAT}} \bullet 1000$$

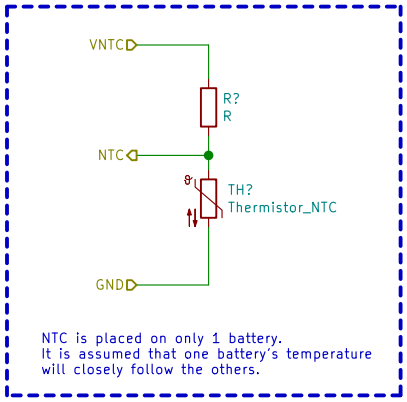
Sheet: /sheet5F4CFCDE/
File: BATTERY_CHARGER.sch

Title: LTC4066

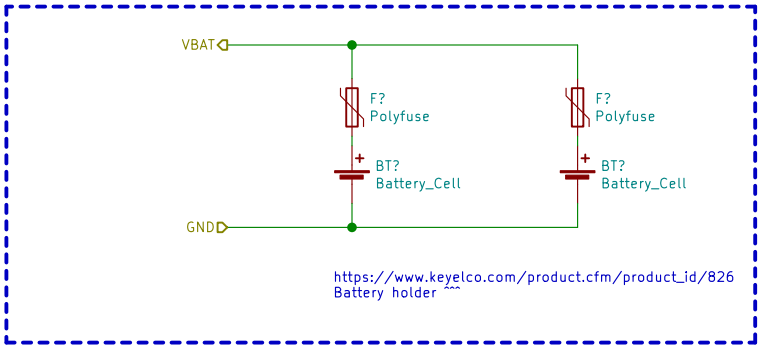
Size: A	Date: 2020-08-09	Rev:
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 10/35

Battery heater control circuit





NTC output for battery charger
and heater circuit (see above)



Batteries & fuses

Sheet: /sheet5F4CFCDF/		
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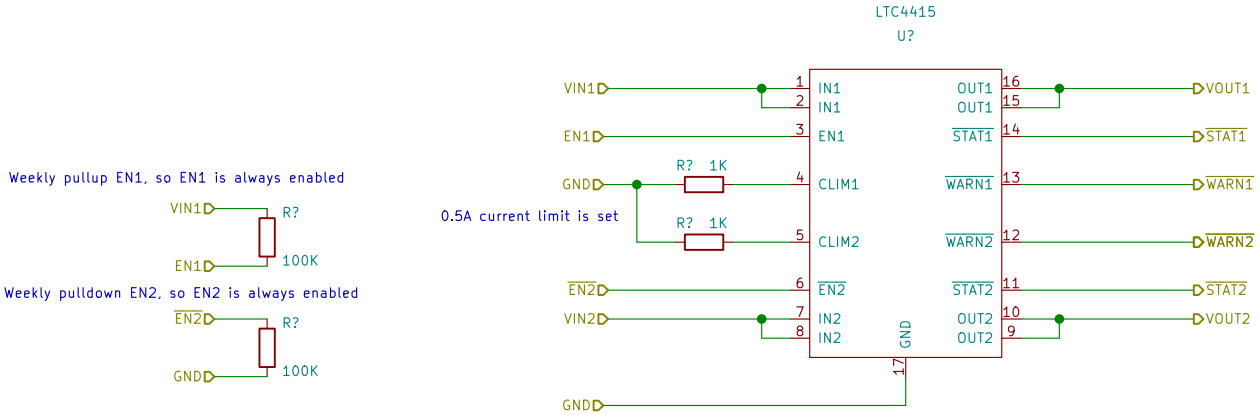
Title: Battery, Battery Heater, NTC		
Size: A	Date: 2020-08-11	**Rev:**
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 11/35



Voltage Threasholds for the Enable pins:
Venth = 0.8V with Venhyst = 0.055V

Current Limit Setting

The output current limit of each diode can be set independently by connecting resistors from the current limit adjust pins CLIM1 and CLIM2 to ground. The current out of the CLIM1 and CLIM2 pins are 1/1000 of the ideal diode output currents I_{OUT1} and I_{OUT2} respectively. When the load currents increase so that the CLIM1 or CLIM2 pin voltages exceeds 0.5V, the LTC4415 detects an overcurrent condition and regulates the current to a fixed value. The required value of resistor R_{CLIM} for output current limit of I_{LIM} is calculated as follows:

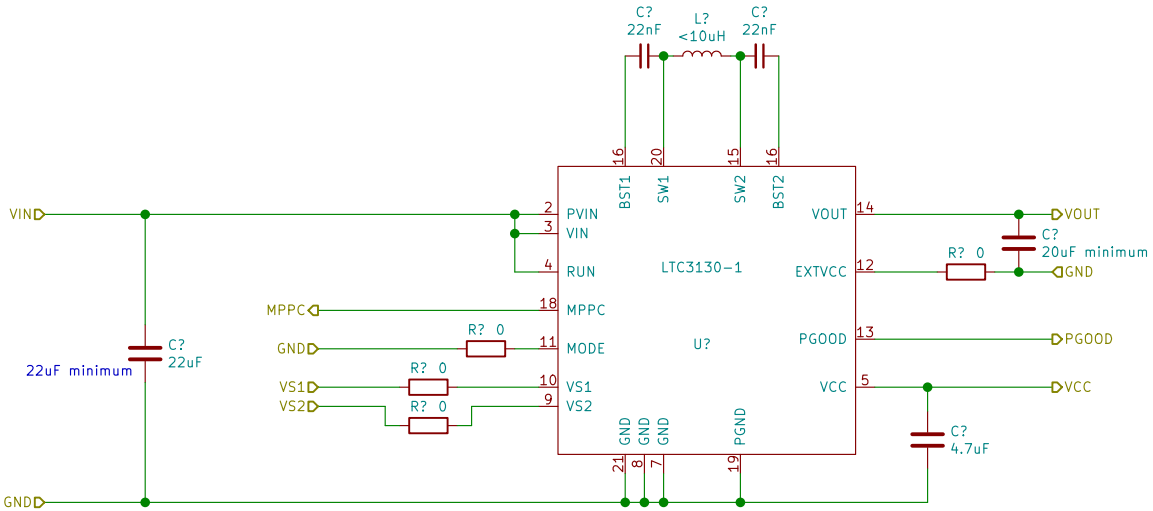
$$R_{CLIM} = 1000 \bullet \frac{0.5V}{I_{LIM}}$$

The allowed range of R_{CLIM} is 125Ω to 1000Ω unless the CLIM1/CLIM2 pins are shorted to GND, in which case the LTC4415 limits the load current using a fixed internal current limit of 6A.

Sheet: /sheet5F71F776/
File: IDEAL_DIODE.sch

Title: LTC4415

Size: A4	Date: 2020-09-06	**Rev:**
KiCad E.D.A.	kicad 5.1.6-c6e7f7d87ubuntu16.04.1	Id: 12/35



Maximum Power Point Control (MPPC)

The MPPC input of the LTC3130/LTC3130-1 can be used with an optional external voltage divider to dynamically adjust the commanded inductor current in order to maintain a minimum input voltage when using high resistance sources, such as photovoltaic panels, so as to maximize input power transfer and prevent V_{IN} from dropping too low under load.

Referring to Figure 4, the MPPC pin is internally connected to the noninverting input of a g_m amplifier, whose inverting input is connected to the 1.0V reference. If the voltage at MPPC, using the external voltage divider, falls below the reference voltage, the output of the amplifier pulls the internal VC node low. This reduces the commanded average inductor current so as to reduce the input current and regulate V_{IN} to the programmed minimum voltage, as given by:

$$V_{IN(MPPC)} = 1.00V \bullet \left(1 + \frac{R5}{R6}\right)$$

Note that external compensation should not be required for MPPC loop stability if the input filter capacitor, C_{IN}, is at least 22µF.

The MPPC divider resistor values can be in the MΩ range so as to minimize the input current in very low power applications. However, stray capacitance and noise pickup on the MPPC pin must also be minimized. If the MPPC function is not required, the MPPC pin should be tied to V_{CC}.

Beware of adding a noise filter capacitor to the MPPC pin, as the added filter pole may cause the MPPC control loop to be unstable.

Note that because Burst Mode operation will be inhibited if the MPPC loop takes control, the converter will be operating in fixed frequency mode, and will therefore require a minimum of about 6mA of continuous input current to operate. For operation from weaker sources, such as small indoor solar panels, refer to the Applications Information section to see how the RUN pin may be programmed to control the converter in a hysteretic manner while providing an effective MPPC function by maintaining V_{IN} at the desired voltage. This technique can be used with sources as weak as 3µA (enough to power the IC in UVLO and the external RUN divider).

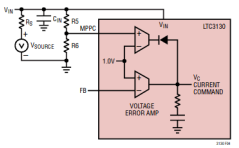


Figure 4. MPPC Amplifier with External Resistor Divider

PGOOD is open drain.
Pulled low when VOUT is less than 7.5% programmed value
High−Z when VOUT is within 5% programmed value

MODE (Pin 11/Pin 11): Mode Select Pin.

MODE = Low (ground): Enables automatic Burst Mode operation

MODE = High (tie to V_{CC}): Fixed frequency PWM operation

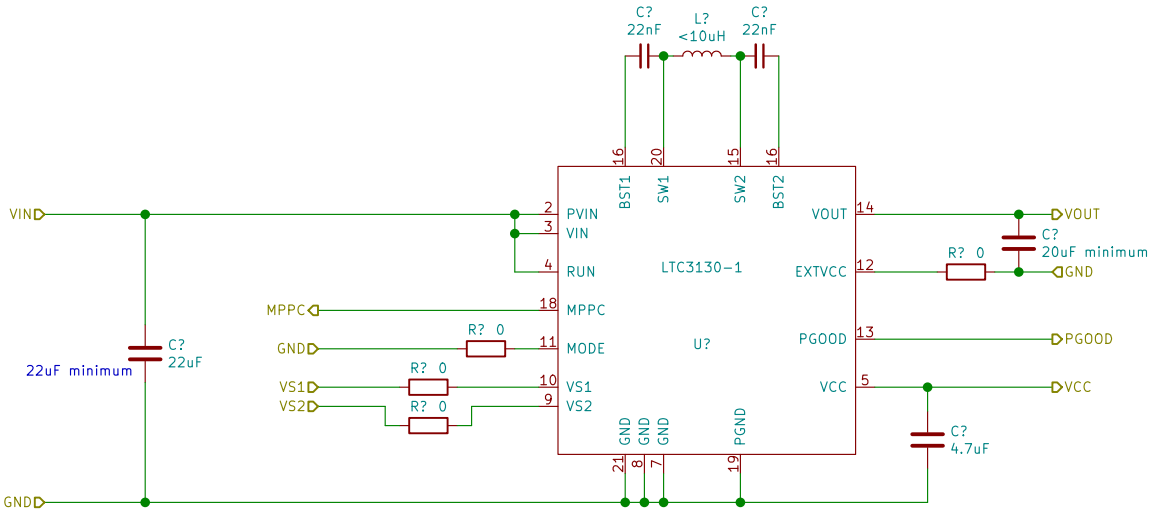
Table 1. V_{OUT} Program Settings for the LTC3130-1

VS2	VS1	V_{OUT}
0	0	1.8V
0	V_{CC}	3.3V
V_{CC}	0	5.0V
V_{CC}	V_{CC}	12V

Sheet: /SOLAR_MPPT_5V/
File: LTC3130.sch

Title: LTC3130

Size: A | Date: 2020−08−09 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 13/35



Maximum Power Point Control (MPPC)

The MPPC input of the LTC3130/LTC3130-1 can be used with an optional external voltage divider to dynamically adjust the commanded inductor current in order to maintain a minimum input voltage when using high resistance sources, such as photovoltaic panels, so as to maximize input power transfer and prevent V_{IN} from dropping too low under load.

Referring to Figure 4, the MPPC pin is internally connected to the noninverting input of a g_m amplifier, whose inverting input is connected to the 1.0V reference. If the voltage at MPPC, using the external voltage divider, falls below the reference voltage, the output of the amplifier pulls the internal VC node low. This reduces the commanded average inductor current so as to reduce the input current and regulate V_{IN} to the programmed minimum voltage, as given by:

$$V_{IN(MPPC)} = 1.00V \bullet \left(1 + \frac{R5}{R6}\right)$$

Note that external compensation should not be required for MPPC loop stability if the input filter capacitor, C_{IN}, is at least 22µF.

The MPPC divider resistor values can be in the MΩ range so as to minimize the input current in very low power applications. However, stray capacitance and noise pickup on the MPPC pin must also be minimized. If the MPPC function is not required, the MPPC pin should be tied to V_{CC}.

Beware of adding a noise filter capacitor to the MPPC pin, as the added filter pole may cause the MPPC control loop to be unstable.

Note that because Burst Mode operation will be inhibited if the MPPC loop takes control, the converter will be operating in fixed frequency mode, and will therefore require a minimum of about 6mA of continuous input current to operate. For operation from weaker sources, such as small indoor solar panels, refer to the Applications Information section to see how the RUN pin may be programmed to control the converter in a hysteretic manner while providing an effective MPPC function by maintaining V_{IN} at the desired voltage. This technique can be used with sources as weak as 3µA (enough to power the IC in UVLO and the external RUN divider).

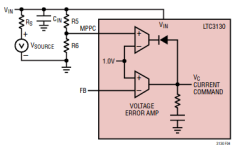


Figure 4. MPPC Amplifier with External Resistor Divider

PGOOD is open drain.
Pulled low when VOUT is less than 7.5% programmed value
High-Z when VOUT is within 5% programmed value

MODE (Pin 11/Pin 11): Mode Select Pin.

MODE = Low (ground): Enables automatic Burst Mode operation

MODE = High (tie to V_{CC}): Fixed frequency PWM operation

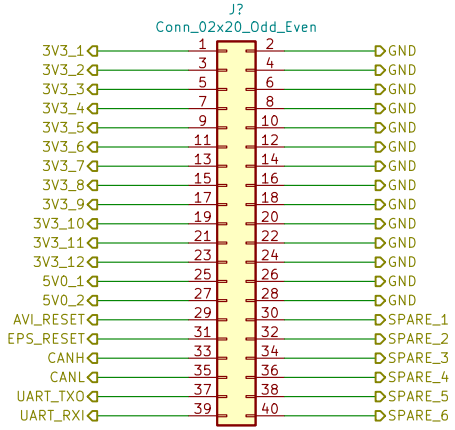
Table 1. V_{OUT} Program Settings for the LTC3130-1

VS2	VS1	V_{OUT}
0	0	1.8V
0	V_{CC}	3.3V
V_{CC}	0	5.0V
V_{CC}	V_{CC}	12V

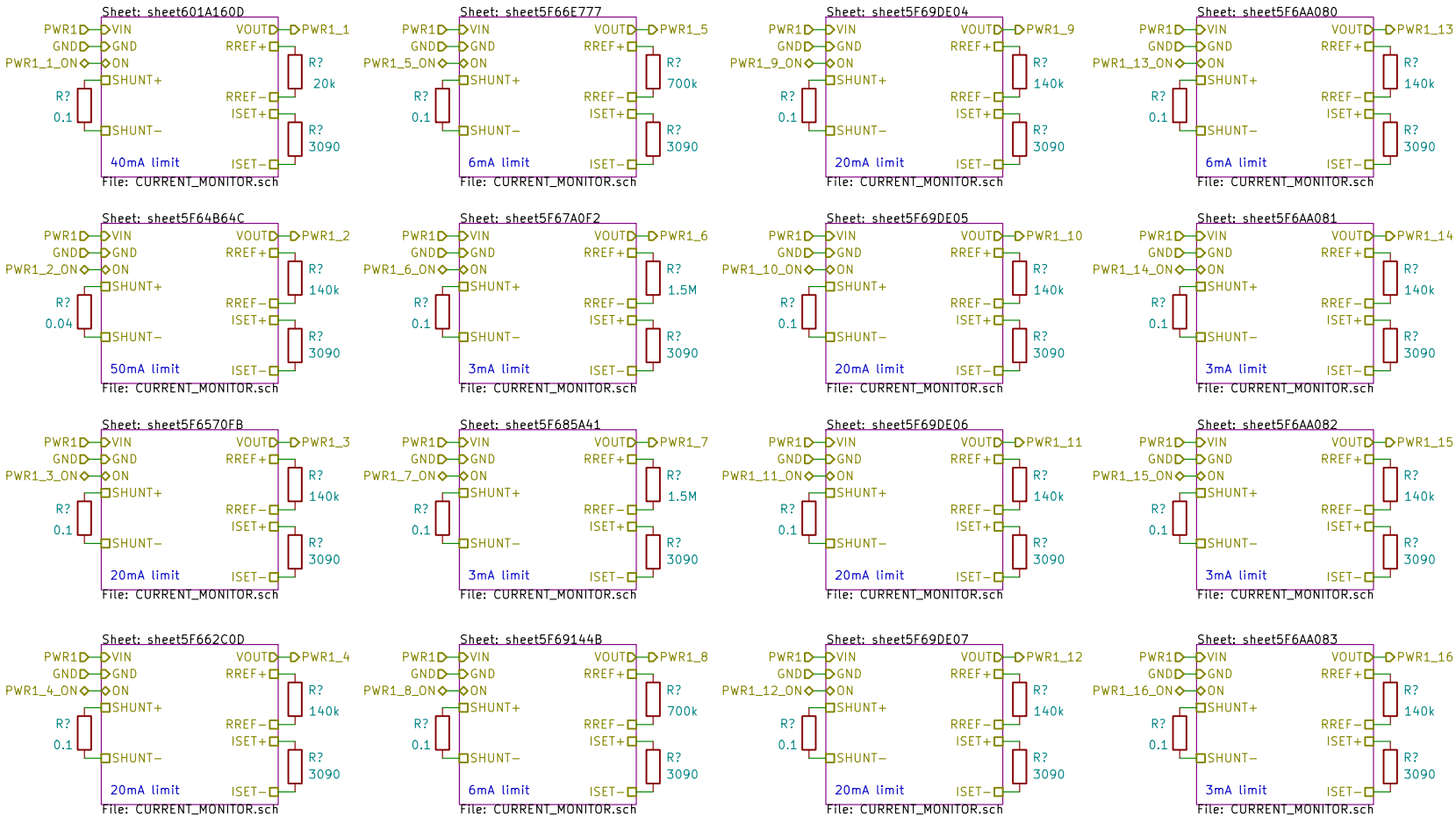
Sheet: /sheet5F62C2E5/
File: LTC3130.sch

Title: LTC3130

Size: A | Date: 2020-08-09 | **Rev:**
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1 | Id: 14/35



Sheet: /INTERBOARD_CONNECTOR/		
File: INTERBOARD_CONNECTOR.sch		
Title: Current Monitor		
Size: A	Date: 2020-05-25	**Rev:**
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 15/35



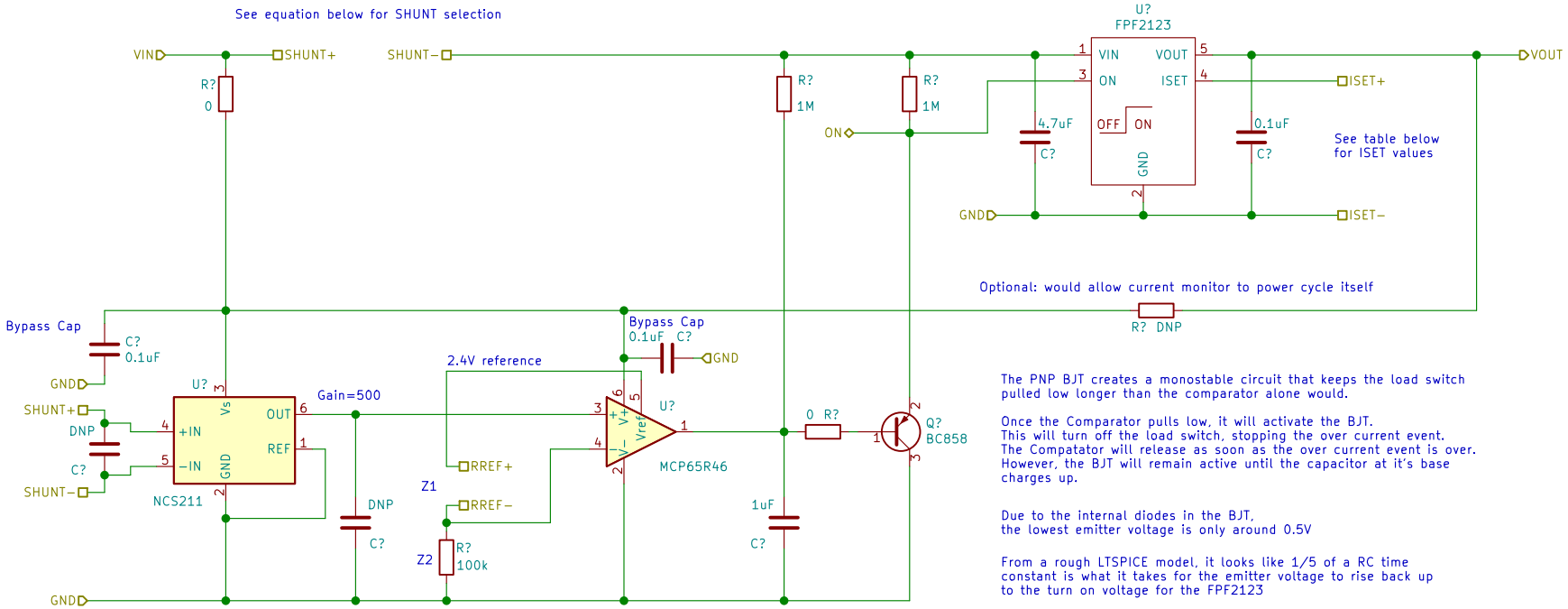
Sheet: /CURRENT_MONITORS/
File: CURRENT_MONITORS.sch

Title: All Current Monitors

Size: A	Date: 2020-09-06	Rev:
KiCad E.D.A. kicad 5.1.6-c6e7f7d87ubuntu16.04.1		Id: 16/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

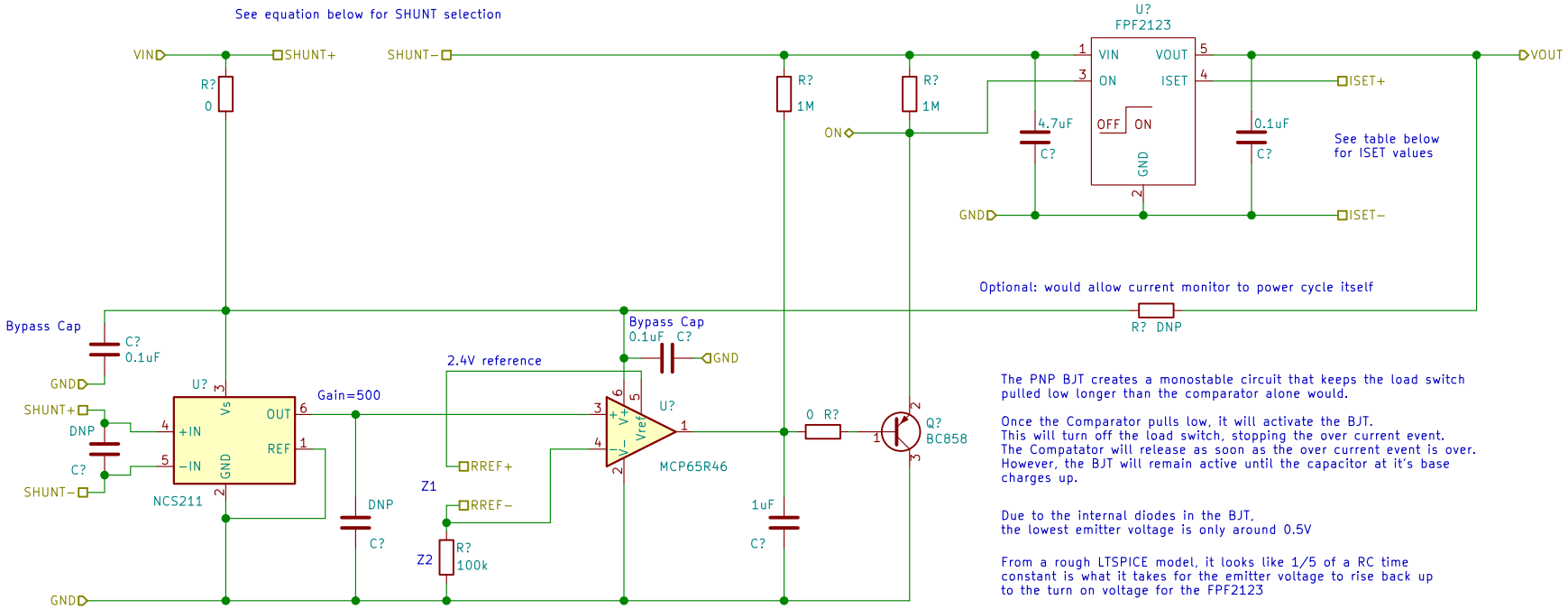
Sheet: /CURRENT_MONITORS/sheet5F64B64C/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 17/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

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of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
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374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

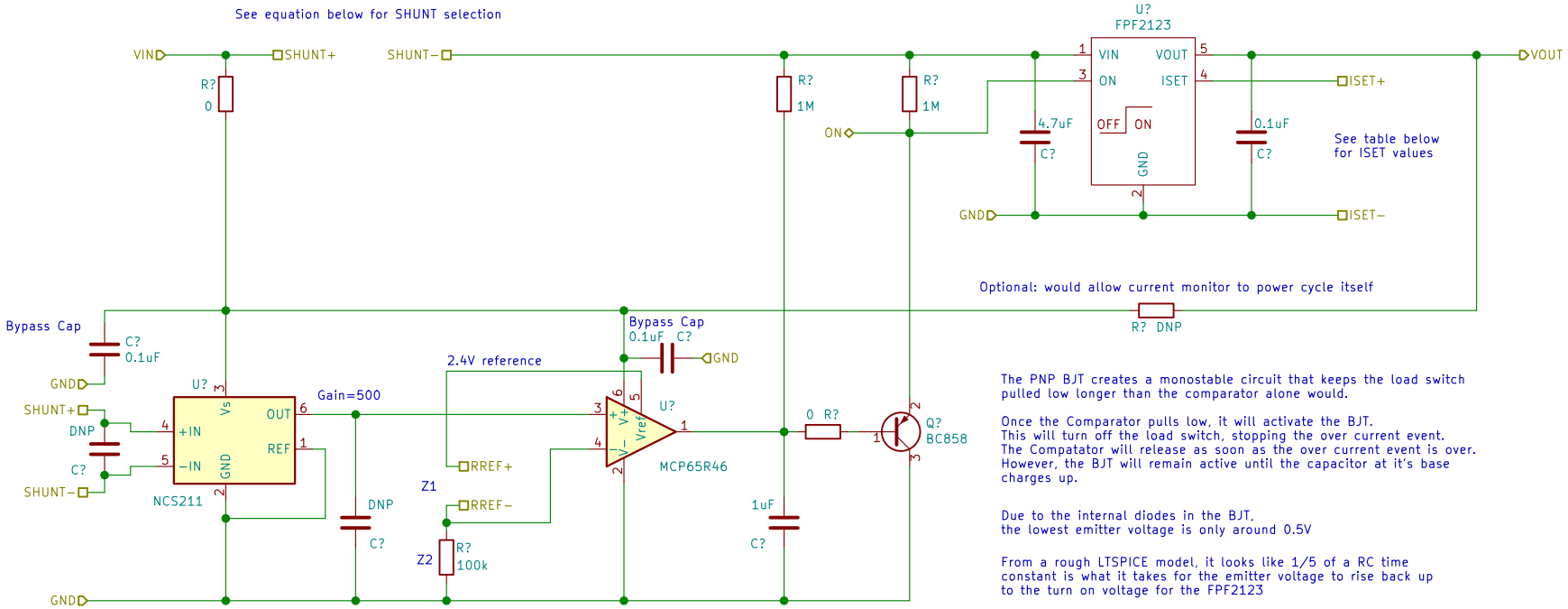
Sheet: /CURRENT_MONITORS/sheet5F6570FB/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 18/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
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It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
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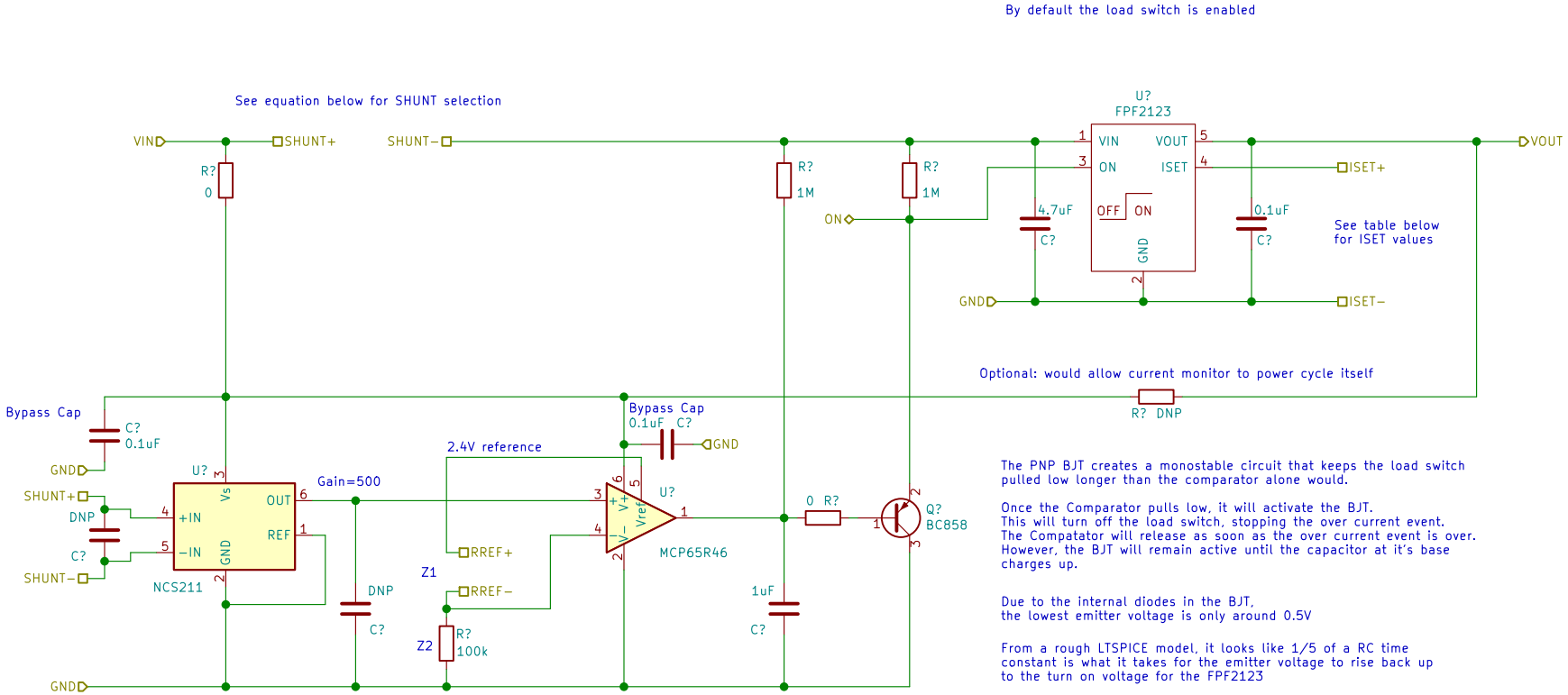
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

Sheet: /CURRENT_MONITORS/sheet5F662C0D/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | Rev:
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 19/35



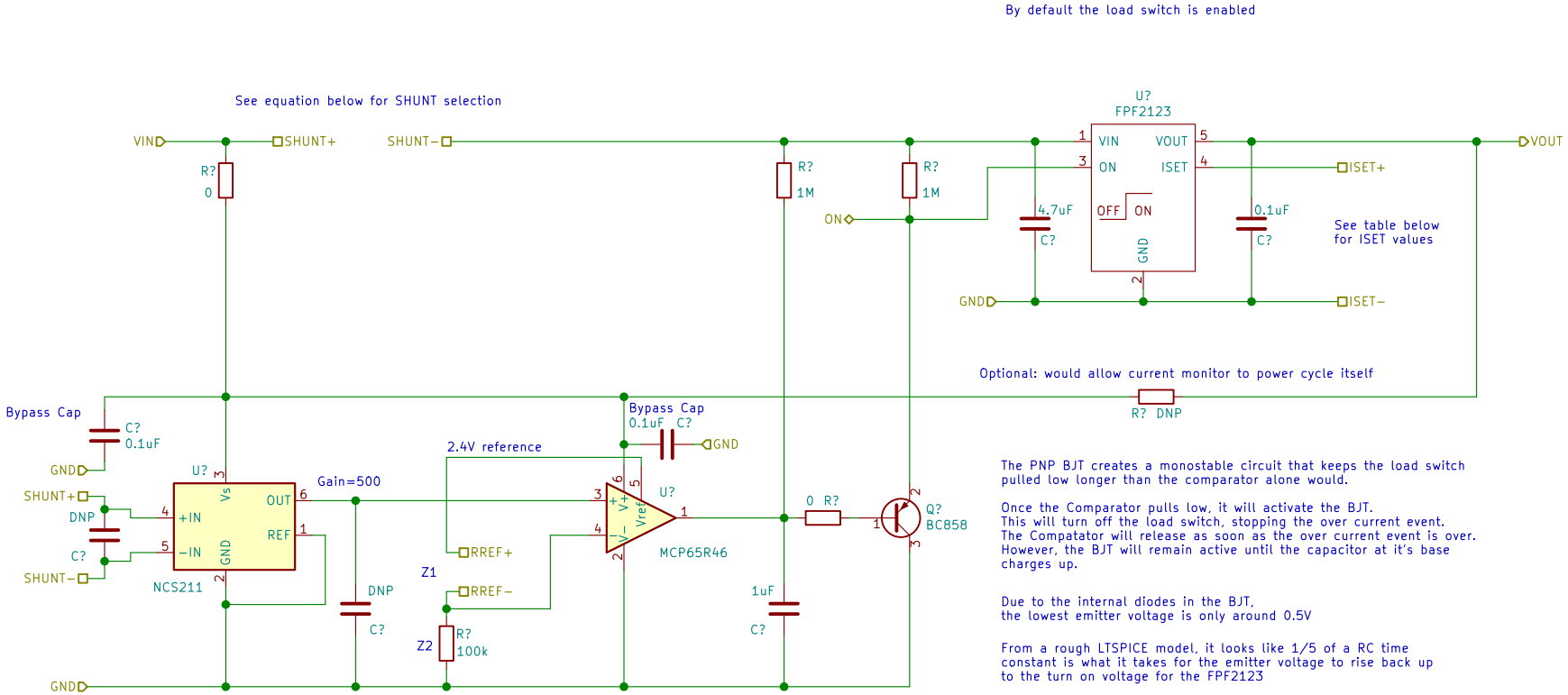
Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

Sheet: /CURRENT_MONITORS/sheet5F6AA080/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A	Date: 2020−09−06	Rev:
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1		Id: 20/35



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage, the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get. Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference instead of the 1.2V reference because we can get a larger range of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
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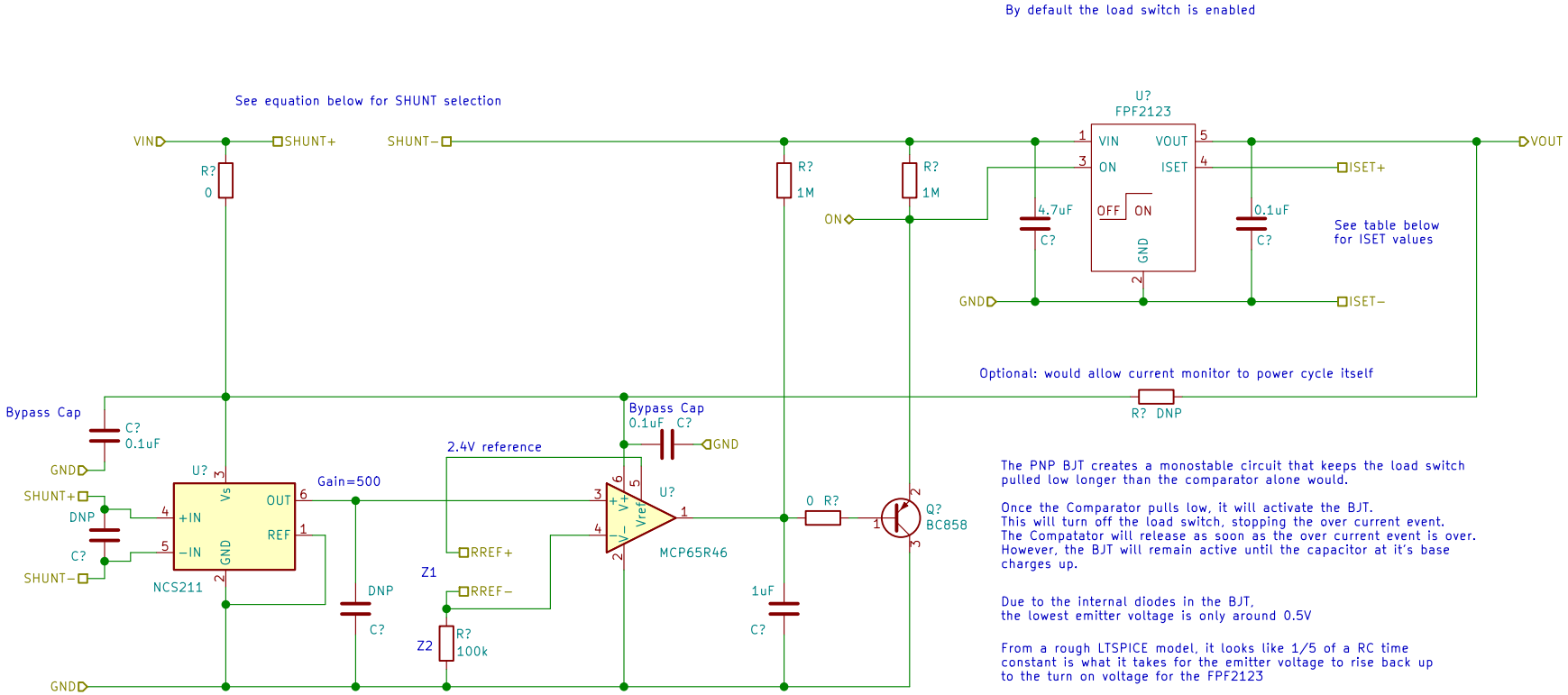
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

Sheet: /CURRENT_MONITORS/sheet5F6AA081/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 21/35



Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
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374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

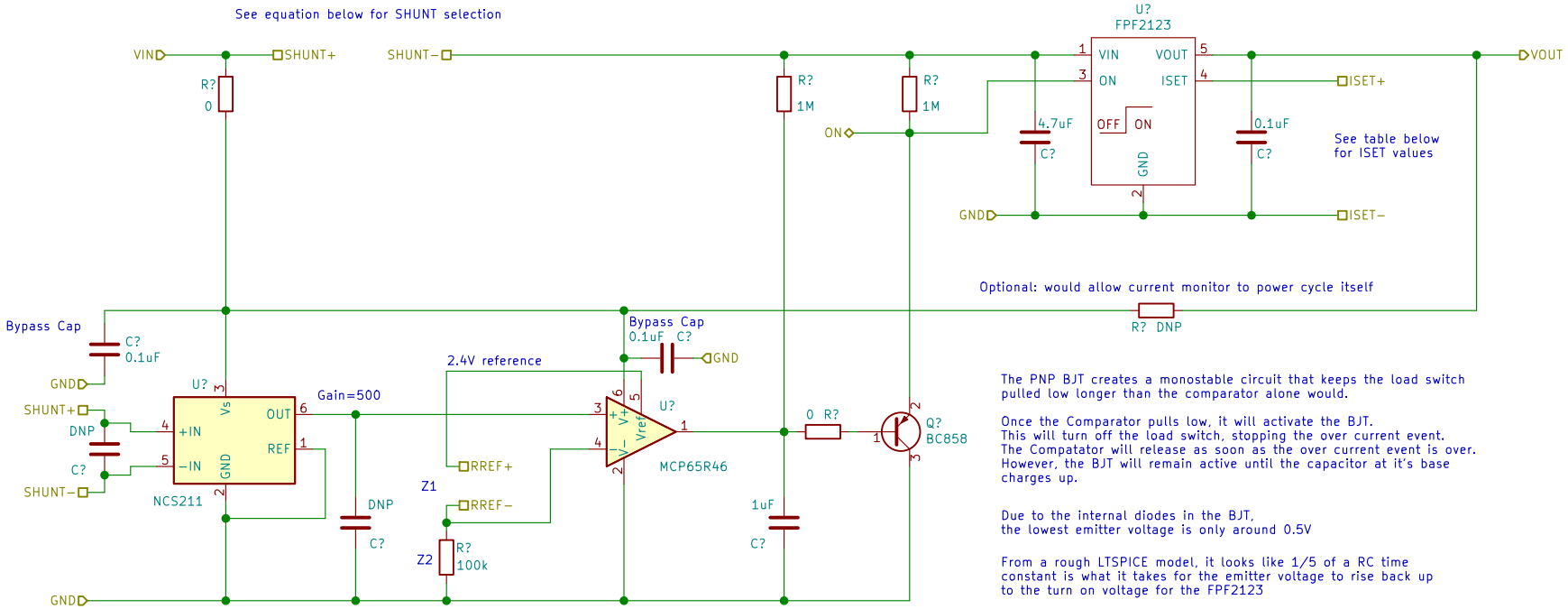
Sheet: /CURRENT_MONITORS/sheet5F6AA082/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 22/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
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374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

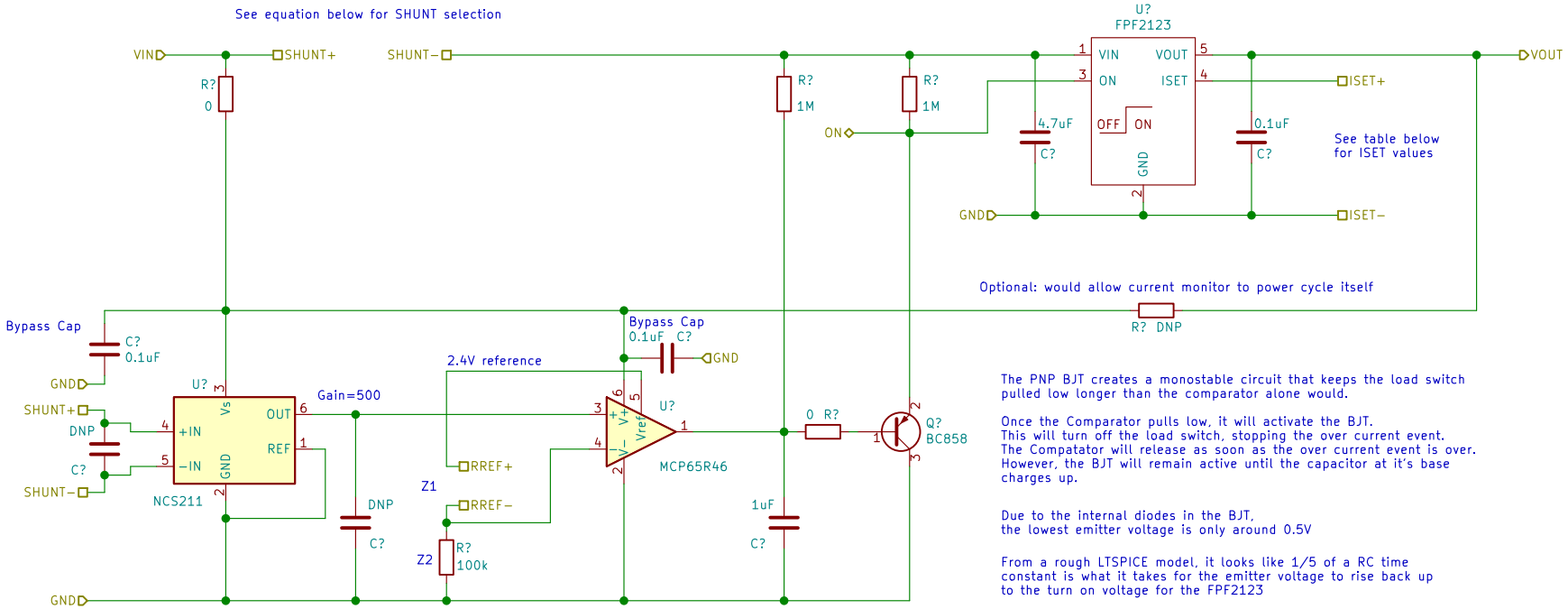
Sheet: /CURRENT_MONITORS/sheet5F6AA083/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 23/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

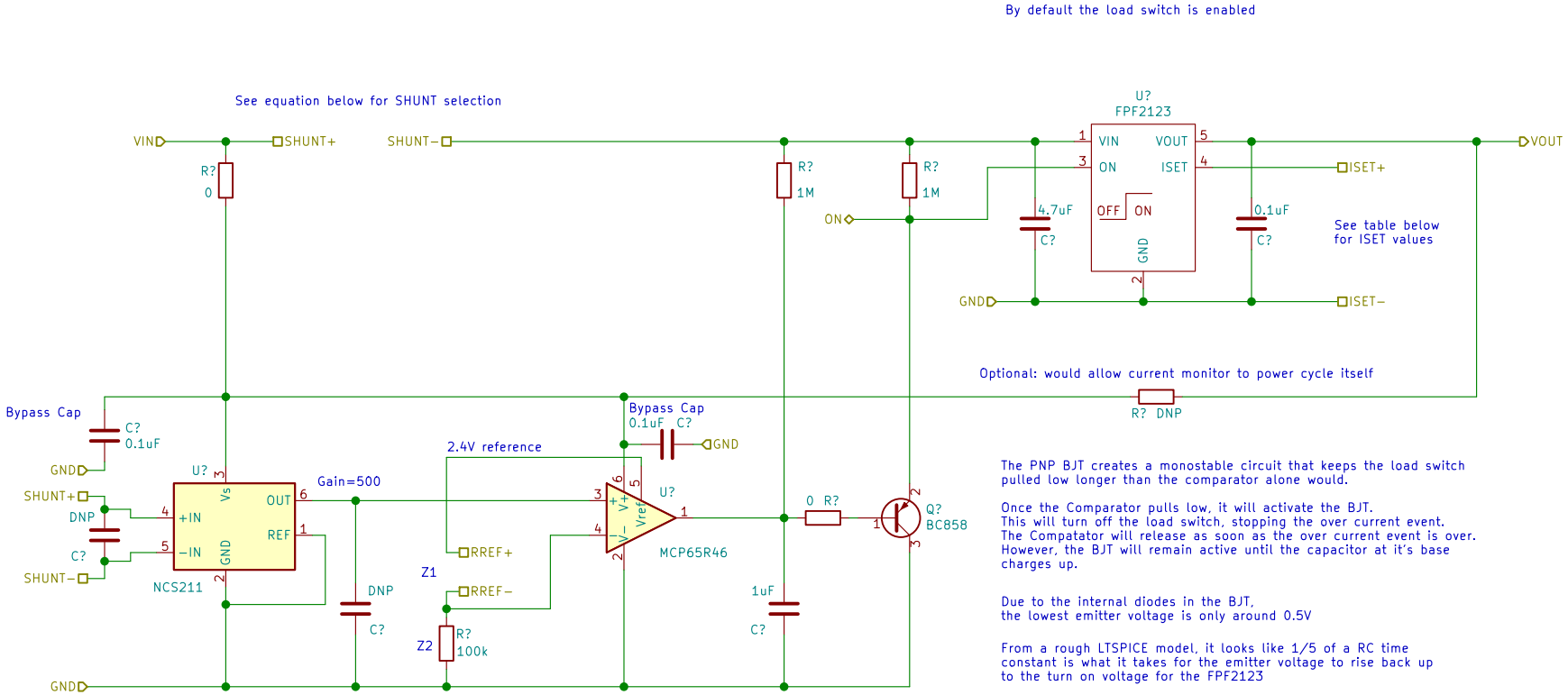
Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

Sheet: /CURRENT_MONITORS/sheet5F69144B/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 24/35



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage, the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get. Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference instead of the 1.2V reference because we can get a larger range of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

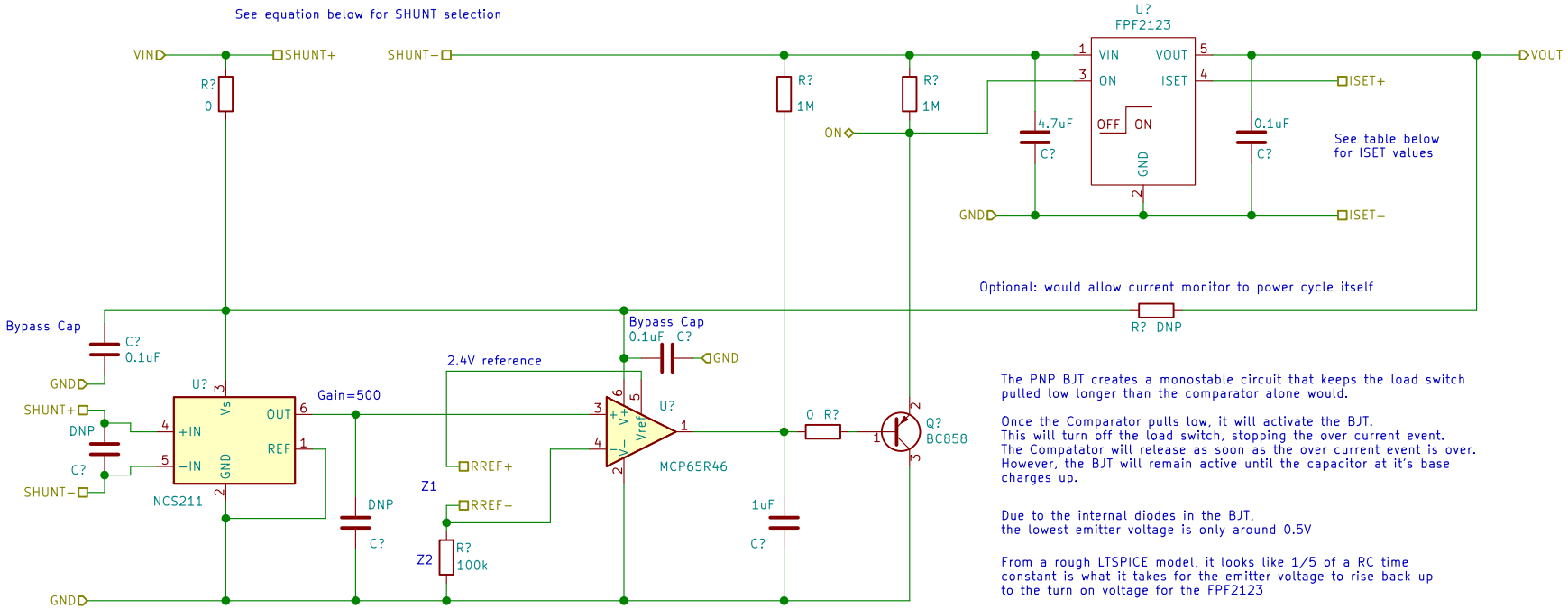
Sheet: /CURRENT_MONITORS/sheet5F685A41/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 25/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

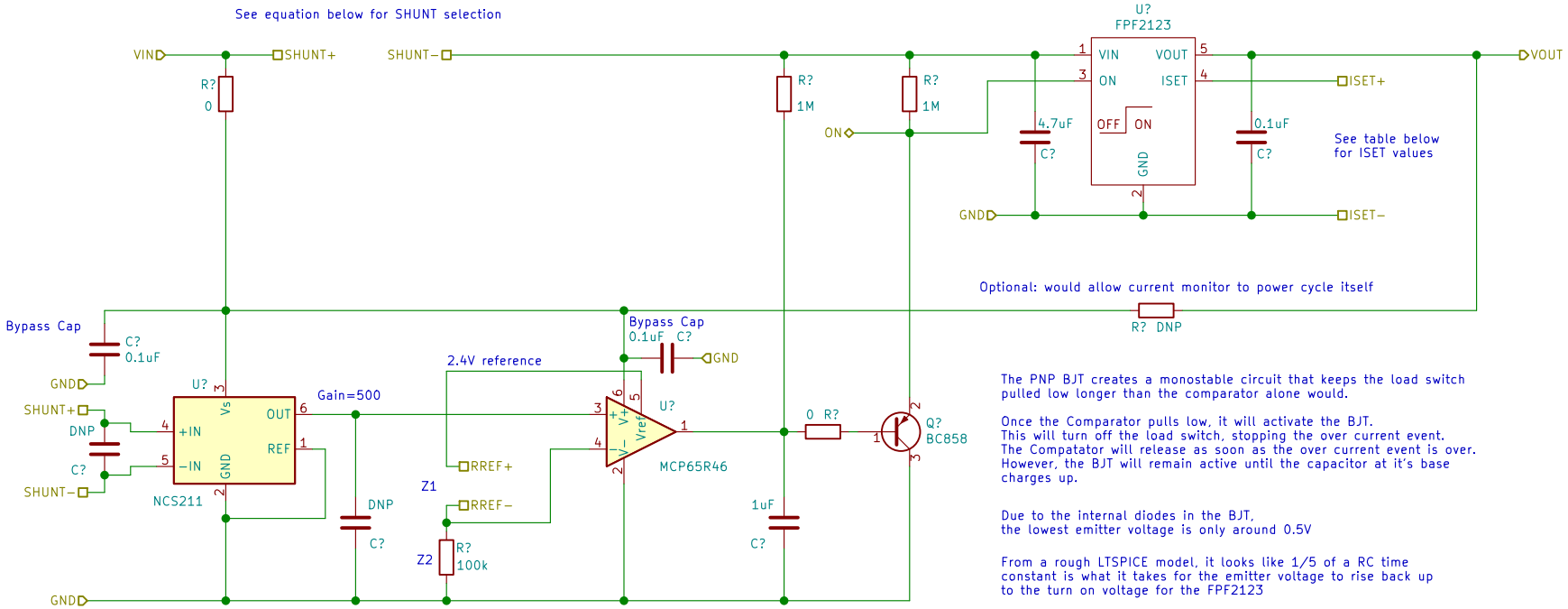
Sheet: /CURRENT_MONITORS/sheet5F67A0F2/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | Rev:
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 26/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage, the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get. Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference instead of the 1.2V reference because we can get a larger range of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

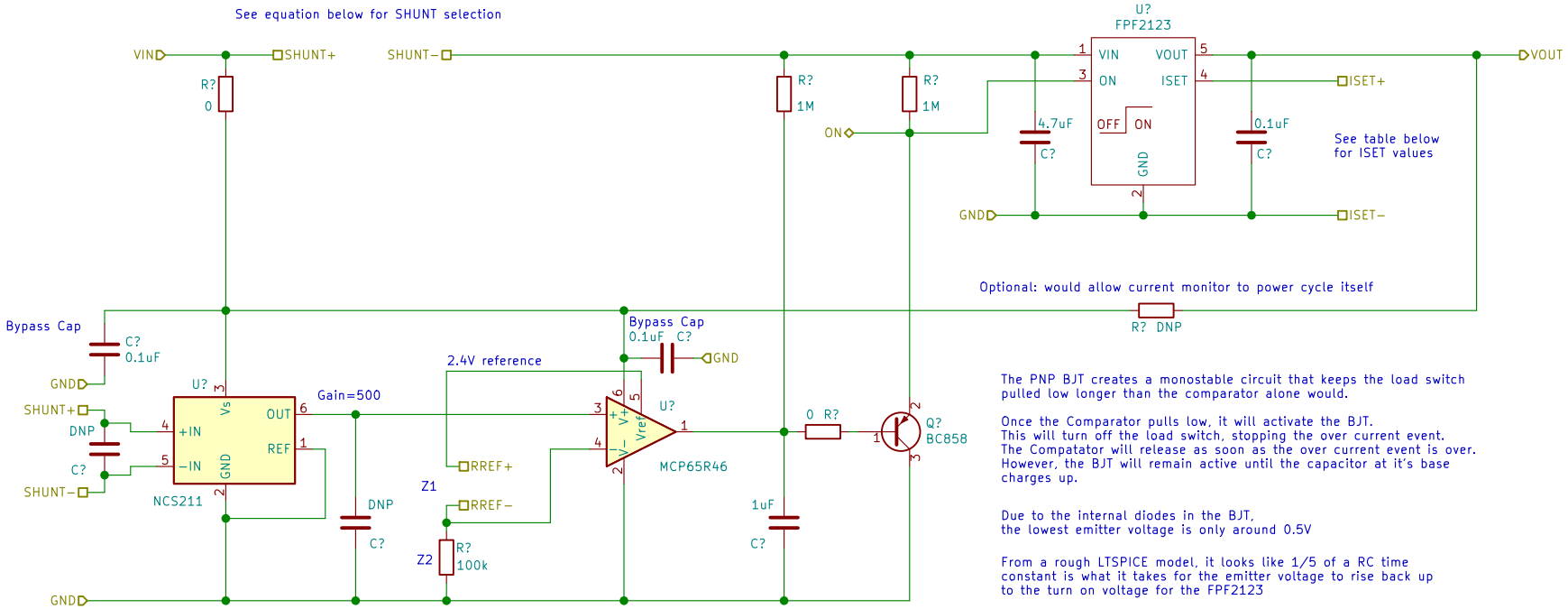
Sheet: /CURRENT_MONITORS/sheet5F66E777/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | Rev:
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 27/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

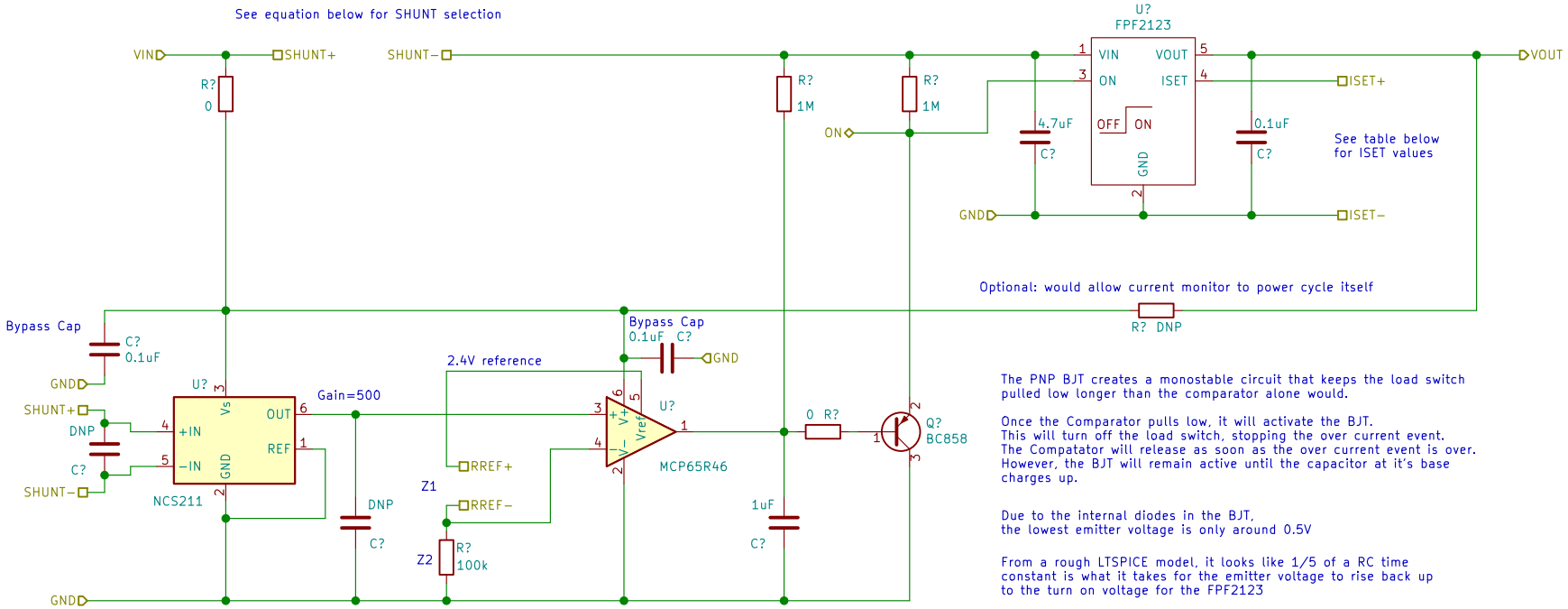
Sheet: /CURRENT_MONITORS/sheet5F69DE07/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 28/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

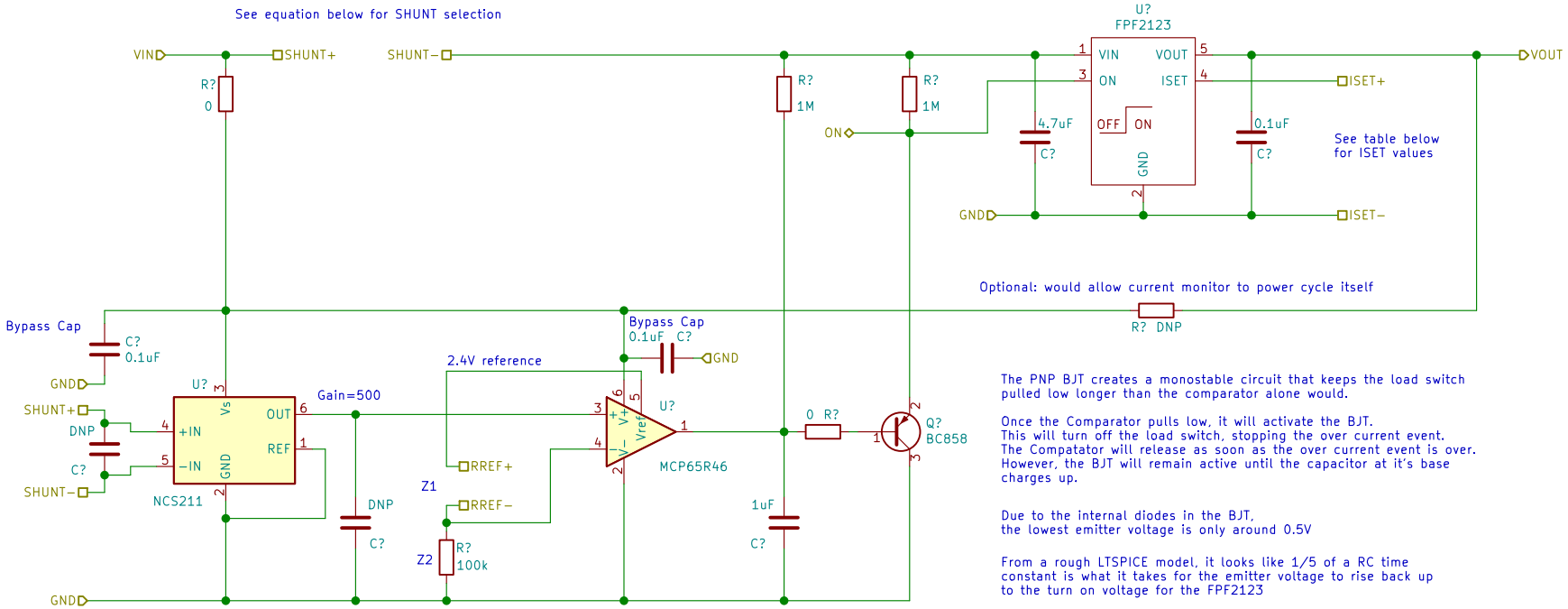
Sheet: /CURRENT_MONITORS/sheet5F69DE06/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 29/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

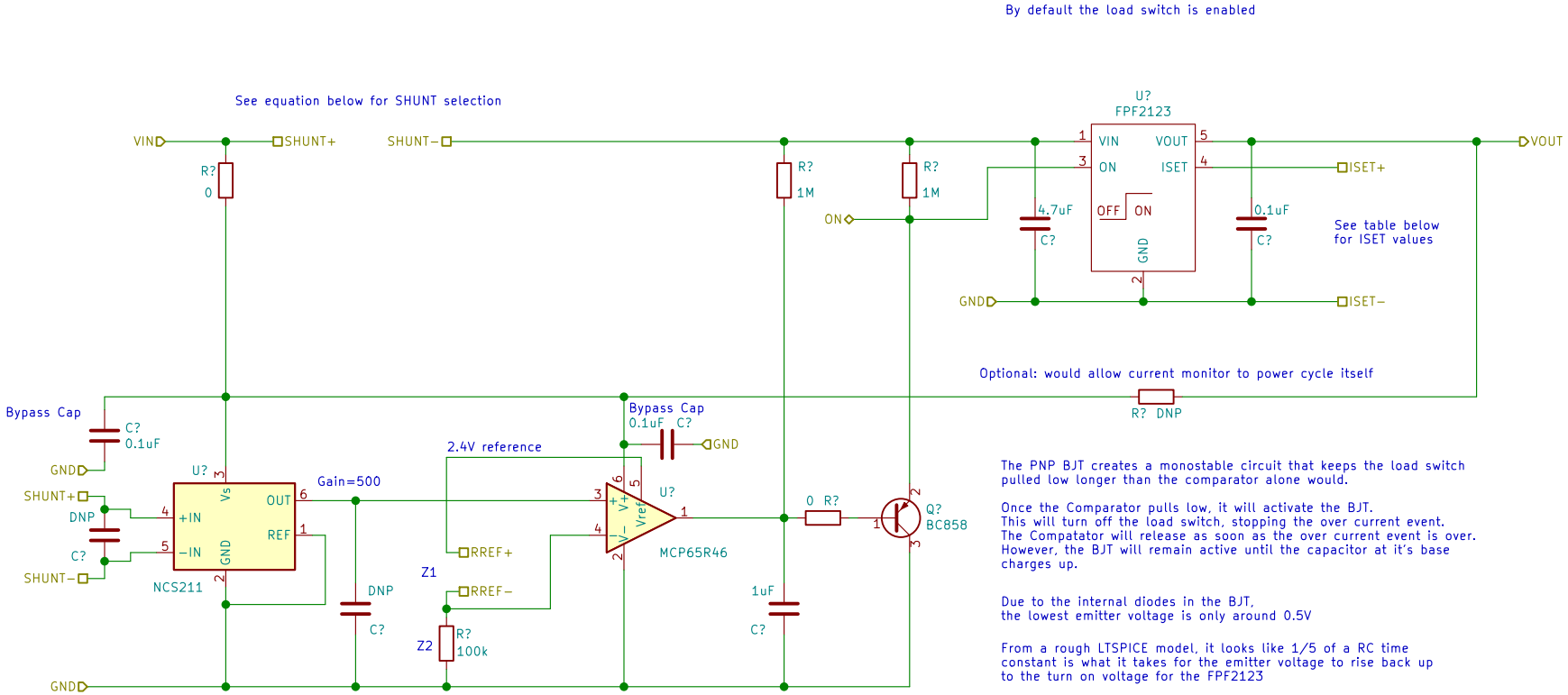
Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

Sheet: /CURRENT_MONITORS/sheet5F69DE05/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 30/35



Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

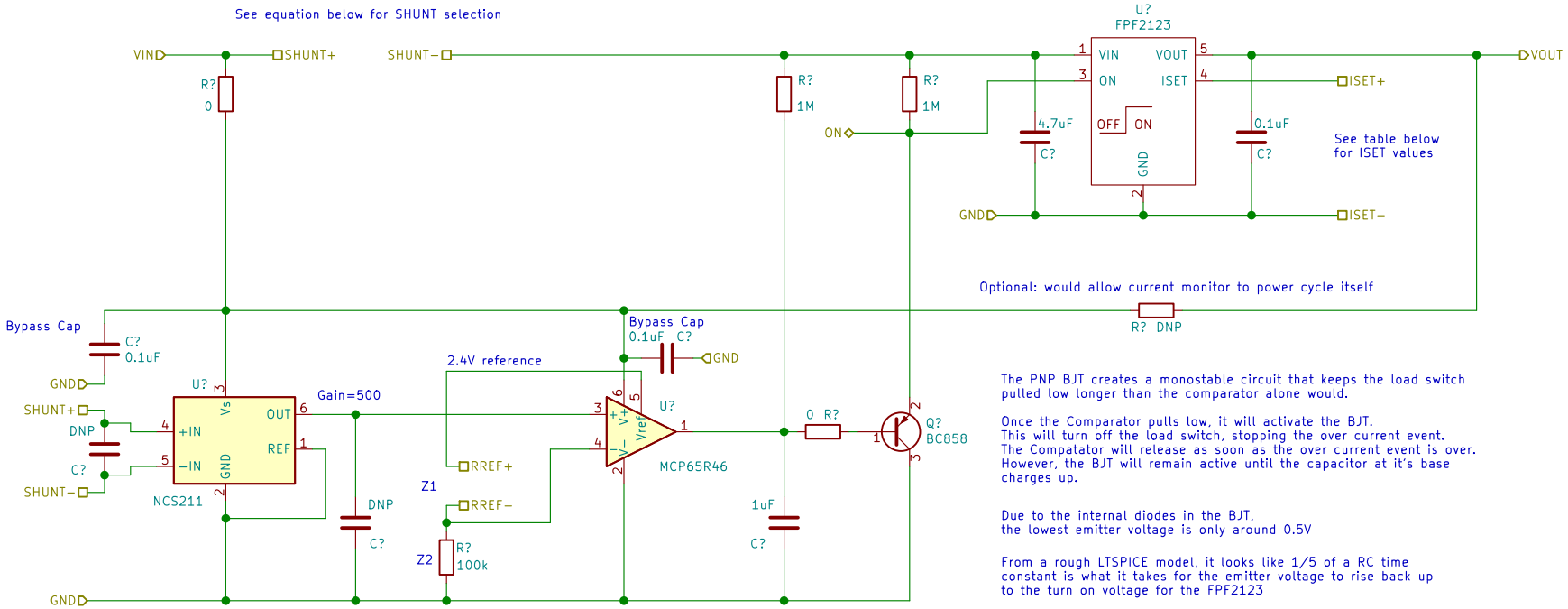
Sheet: /CURRENT_MONITORS/sheet5F69DE04/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 31/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

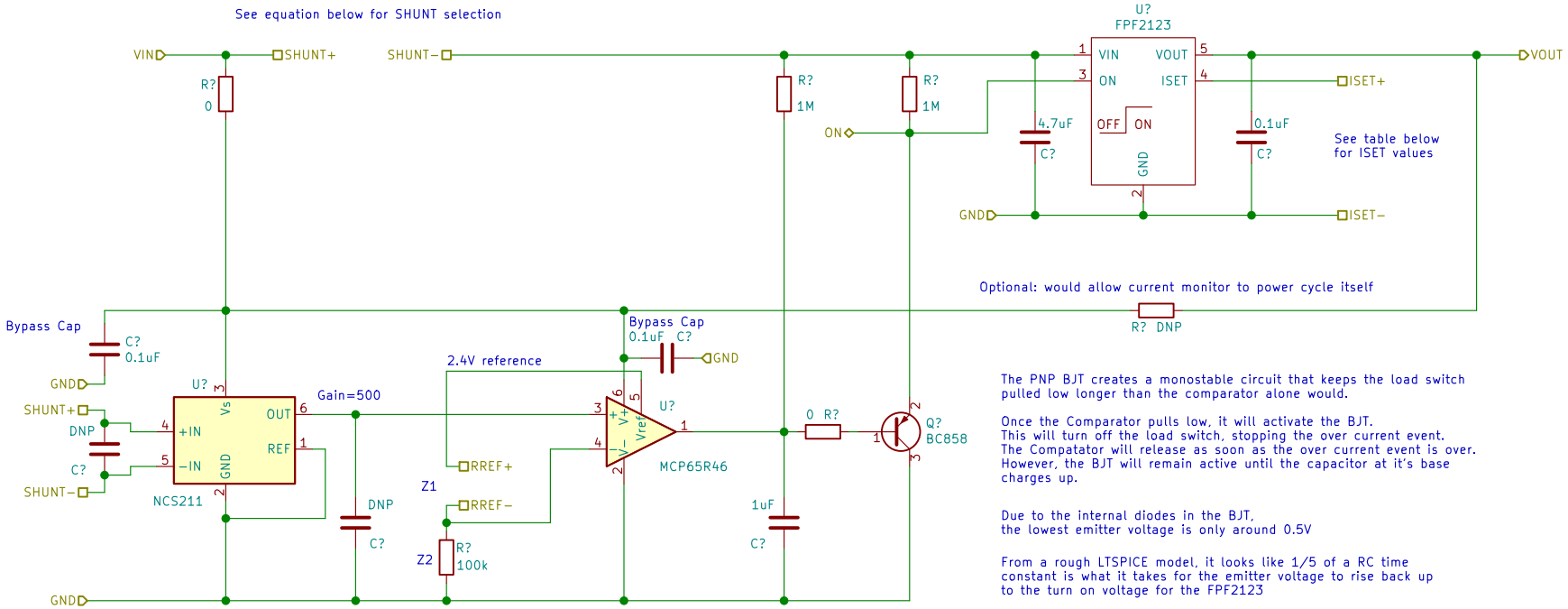
Sheet: /CURRENT_MONITORS/sheet601A160D/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 32/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

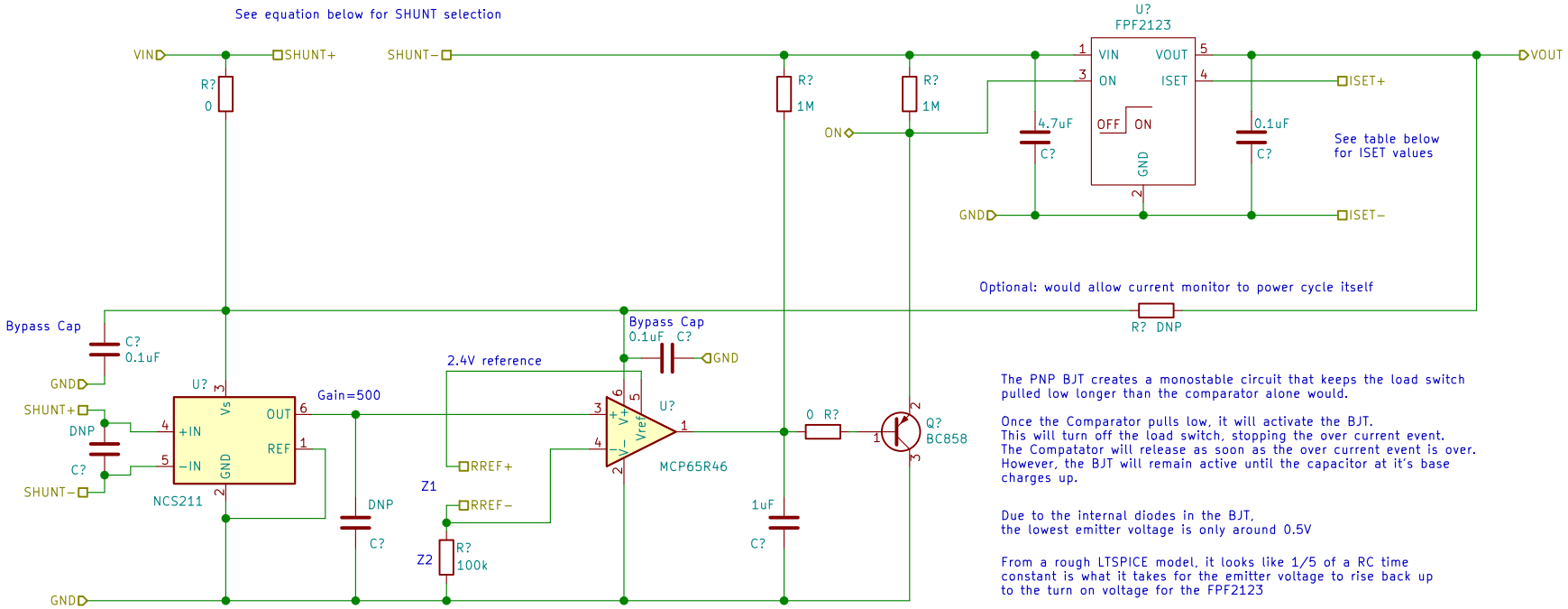
Sheet: /CURRENT_MONITORS/sheet5FABABE2/
File: CURRENT_MONITOR.sch

Title: Current Monitor

Size: A | Date: 2020−09−06 | **Rev:**
KiCad E.D.A. kicad 5.1.6−c6e7f7d87ubuntu16.04.1 | Id: 33/35

By default the load switch is enabled

See equation below for SHUNT selection



The PNP BJT creates a monostable circuit that keeps the load switch pulled low longer than the comparator alone would.

Once the Comparator pulls low, it will activate the BJT.
This will turn off the load switch, stopping the over current event.
The Compatator will release as soon as the over current event is over.
However, the BJT will remain active until the capacitor at it's base charges up.

Due to the internal diodes in the BJT,
the lowest emitter voltage is only around 0.5V

From a rough LTSPICE model, it looks like 1/5 of a RC time constant is what it takes for the emitter voltage to rise back up to the turn on voltage for the FPF2123

Use this equation to select the current limit

Z1 = (Z2*(1−g/vref*r*i)) / (g/vref*r*i)

Where:
g = Gain
r = shunt resistance
i = max/trip current (in Amps)
Z1 = 'top' resistor in reference divider leg
Z2 = 'bottom' resistor in reference divider leg

When IN+ is greater than the reference voltage,
the comparator's open drain output turns on.

The MCP65R46 has two VRef voltages based on the package you get.
Either 2.4V or 1.2V

It's slightly adventageous to use the higher 2.4V Reference
instead of the 1.2V reference because we can get a larger range
of configurable trip currents

Current Limit Various R_{SET} Values

R_{SET} [Ω]	Min. Current Limit [mA]	Typ. Current Limit [mA]	Max. Current Limit [mA]
309	1120	1490	1860
340	1010	1350	1690
374	920	1230	1540
412	840	1120	1400
453	760	1010	1270
499	690	920	1150
549	630	840	1050
576	600	800	1000
604	570	760	950
732	470	630	790
887	390	520	650
1070	320	430	540
1300	260	350	440
1910	180	240	300
3090	110	150	190

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