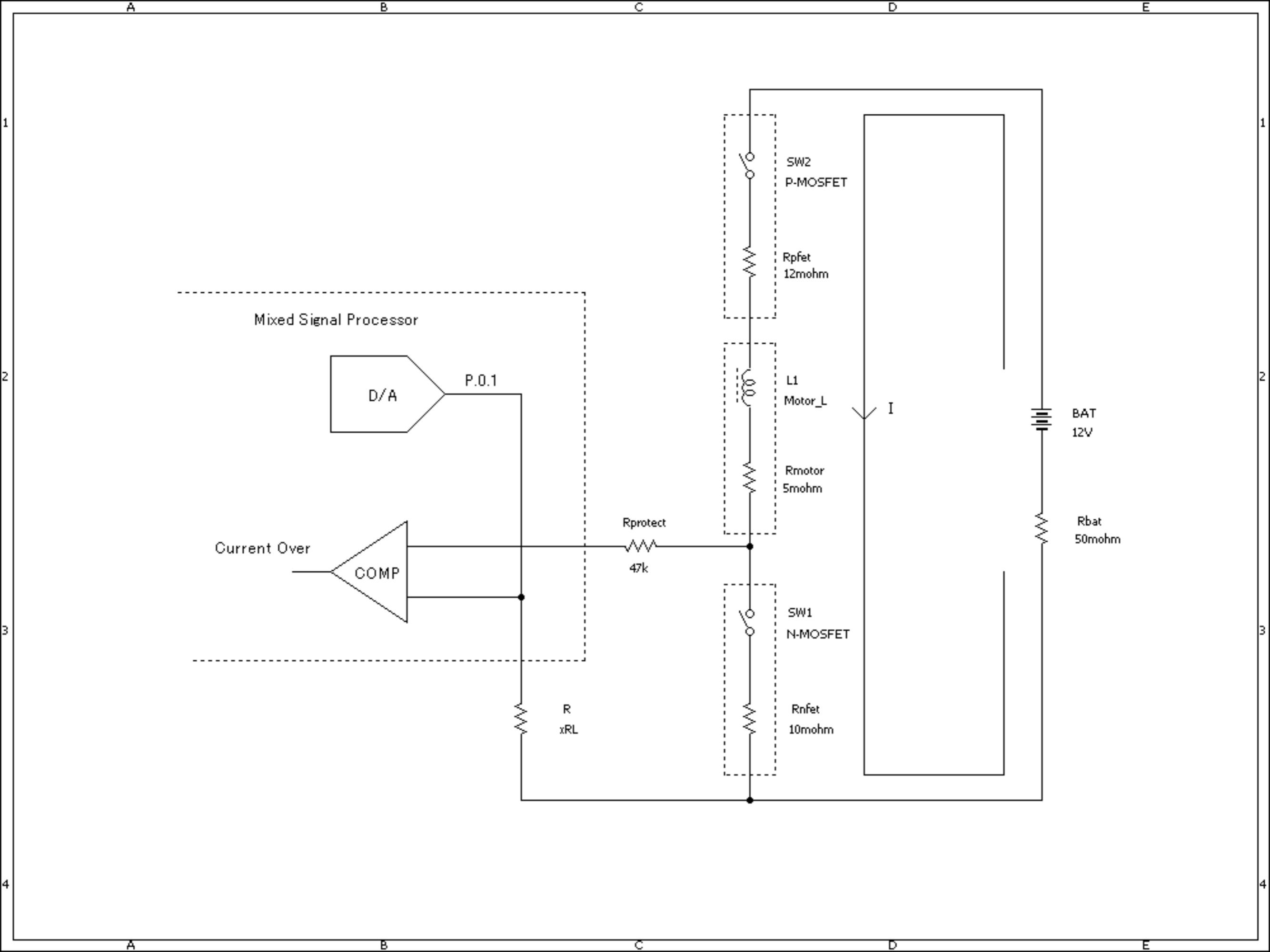
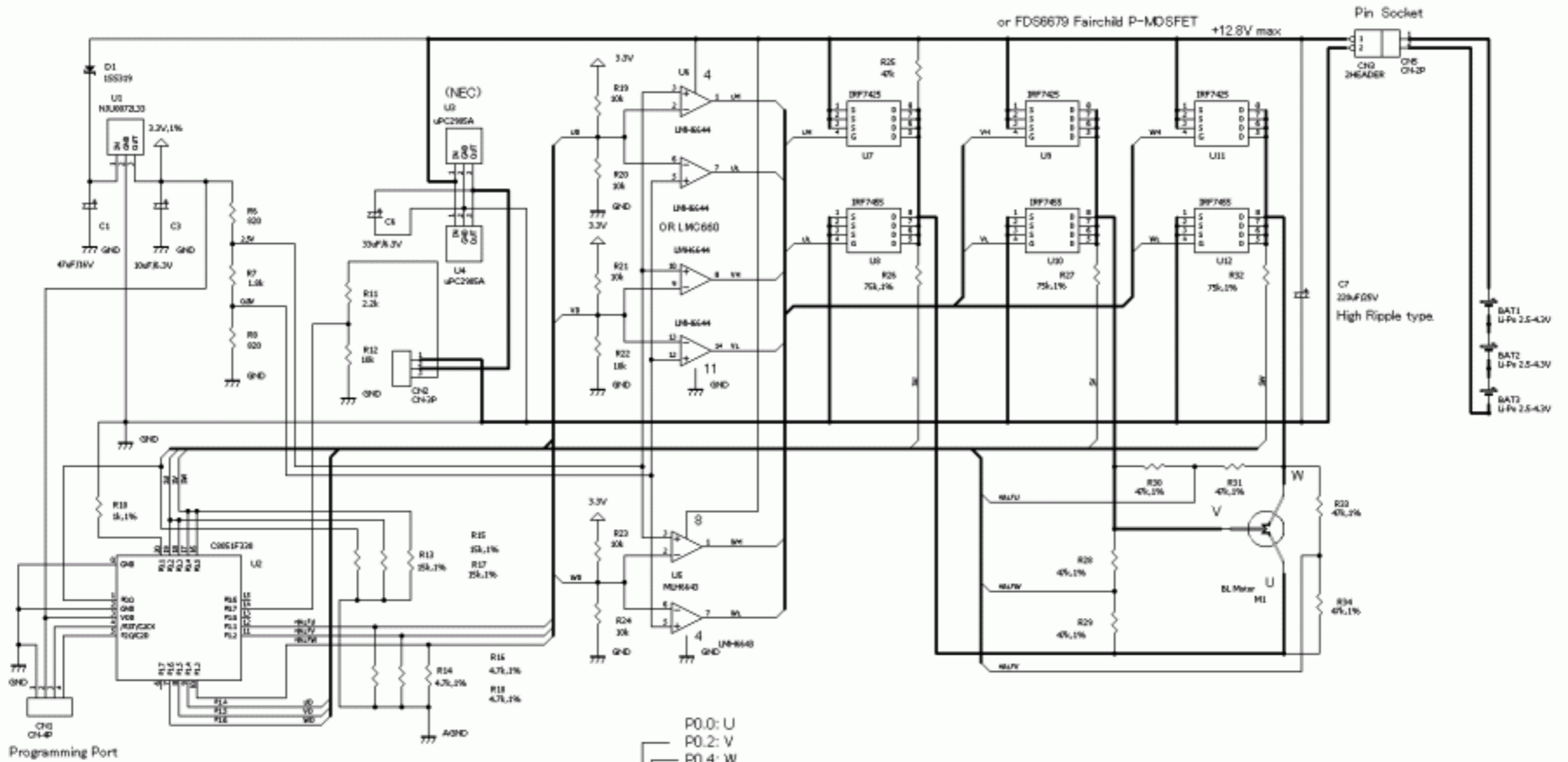


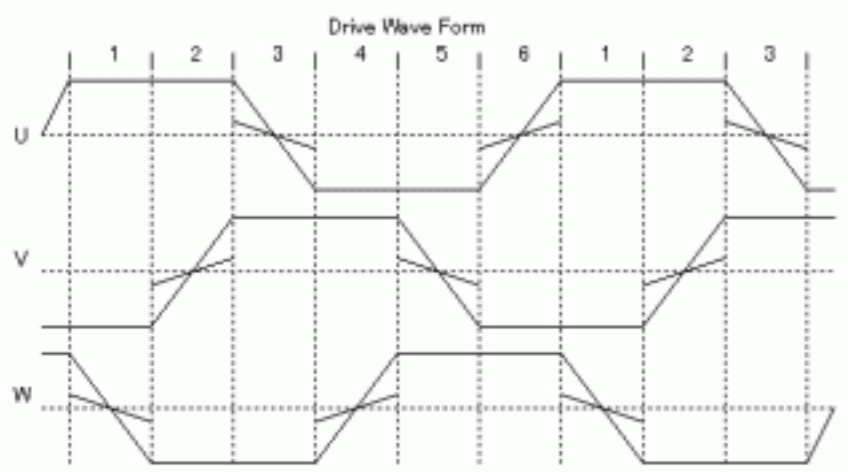
Date	Rev.	Designed by	Title	Page
'05/08/15	0.5	Takao Shimizu	Brushless Sensor-less Electric Speed Controller Schematic	1/1





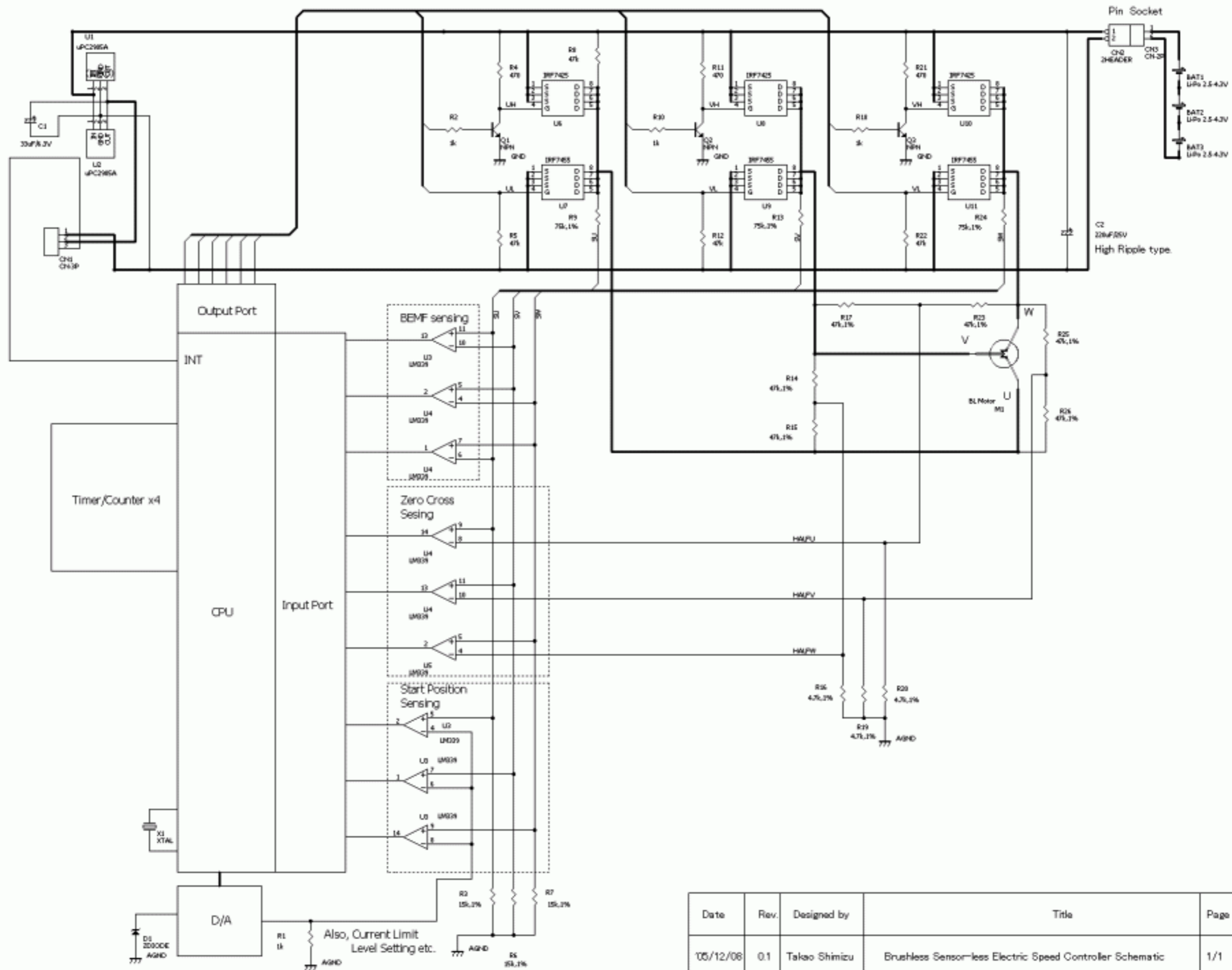
or FDS8679 Fairchild P-MOSFET +12.8V max

- P0.0: U
- P0.2: V
- P0.4: W
- P1.2: HV
- P0.1: D/A Vout
- P0.3: V
- P0.5: W
- P1.1: HU
- P1.3: HW



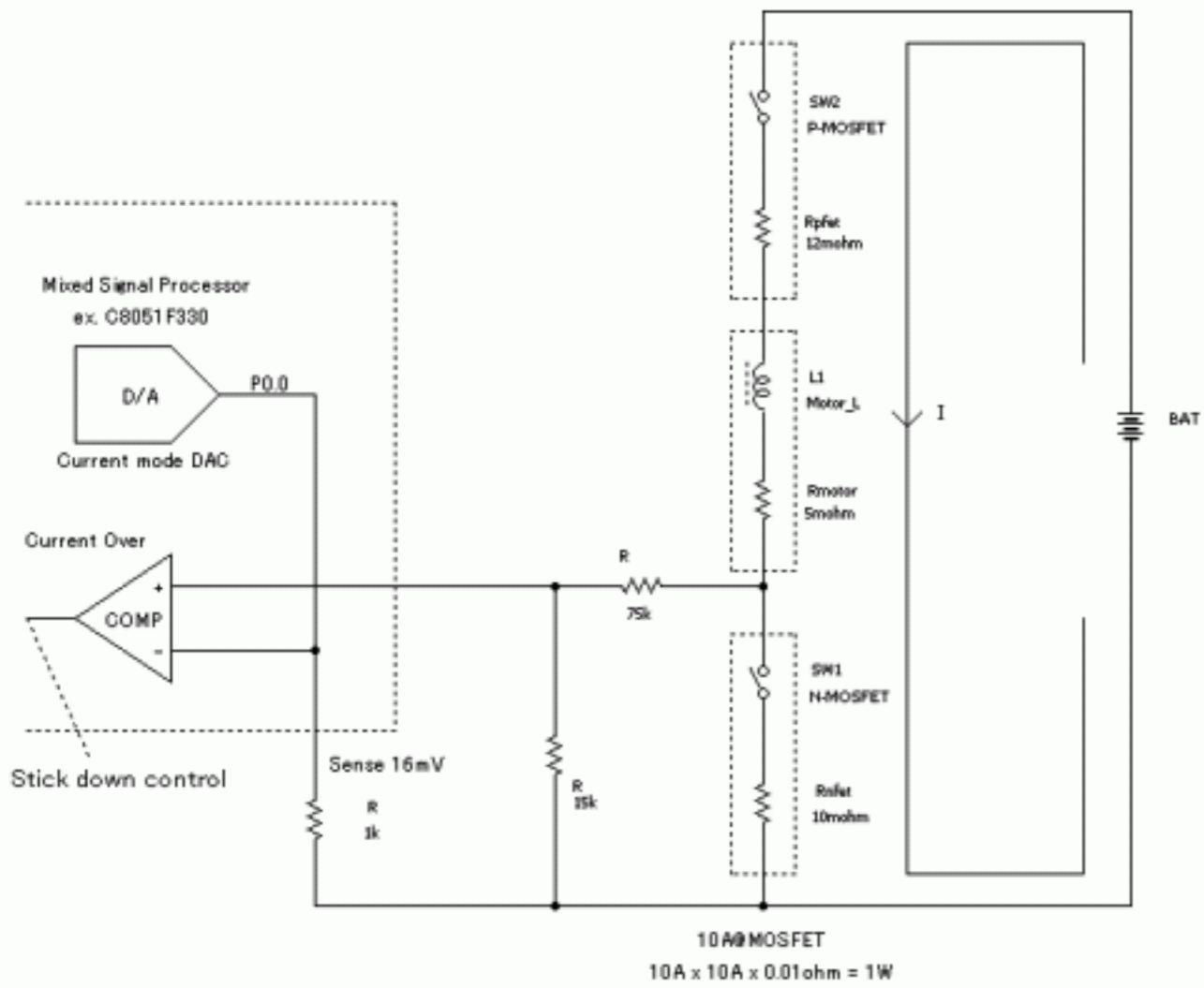
Date	Rev.	Designed by	Title	Page
05/11/05	2	Takao Shimizu	Brushless Sensor-less Electric Speed Controller Schematic	1/1

Note: D/A output(P0.1) can be used for the hi-speed current limiter and vary of cut-off voltage since Rev.2.

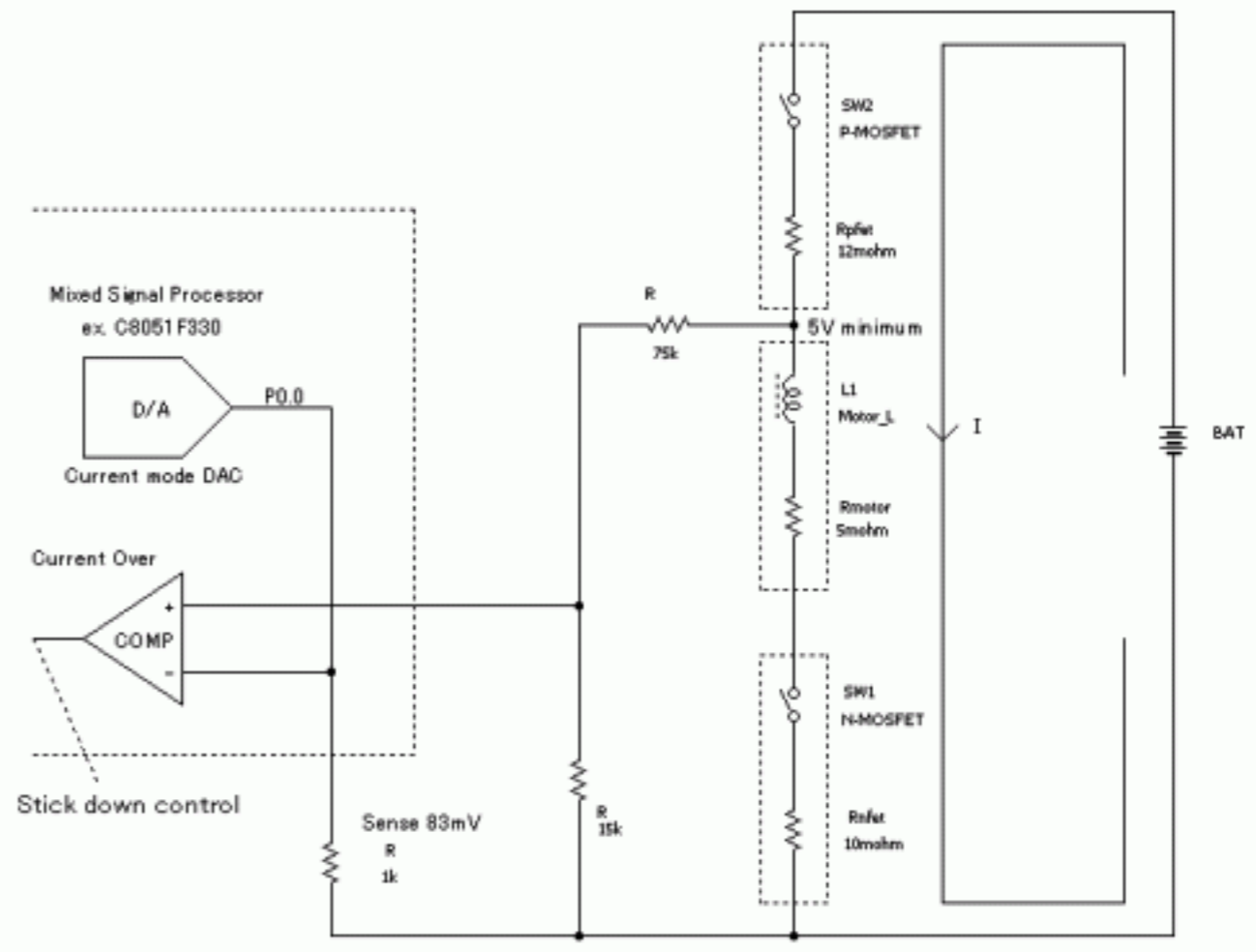


Date	Rev.	Designed by	Title	Page
05/12/08	0.1	Takao Shimizu	Brushless Sensor-less Electric Speed Controller Schematic	1/1

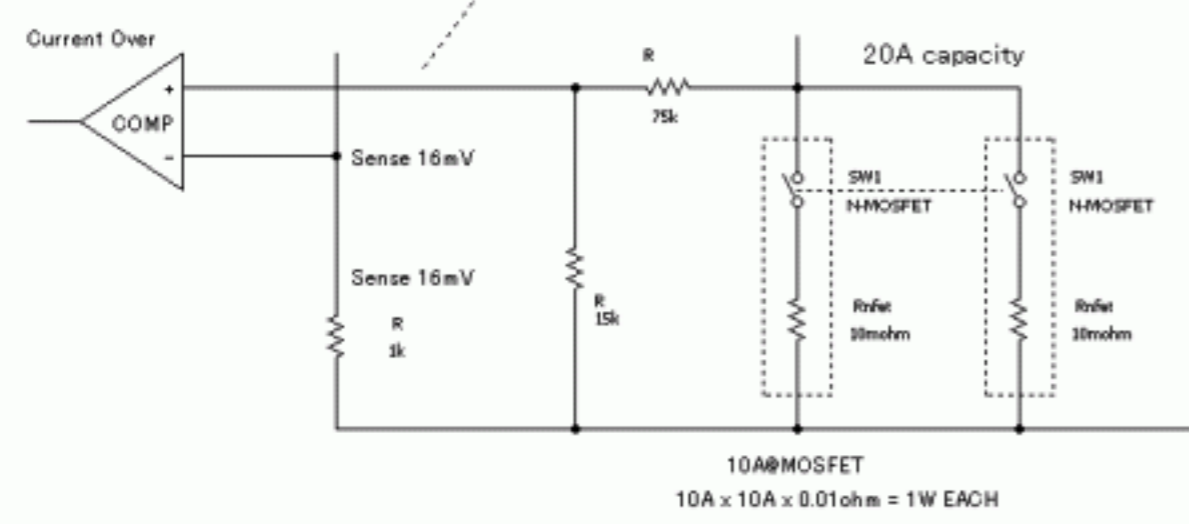
Current Limiter function



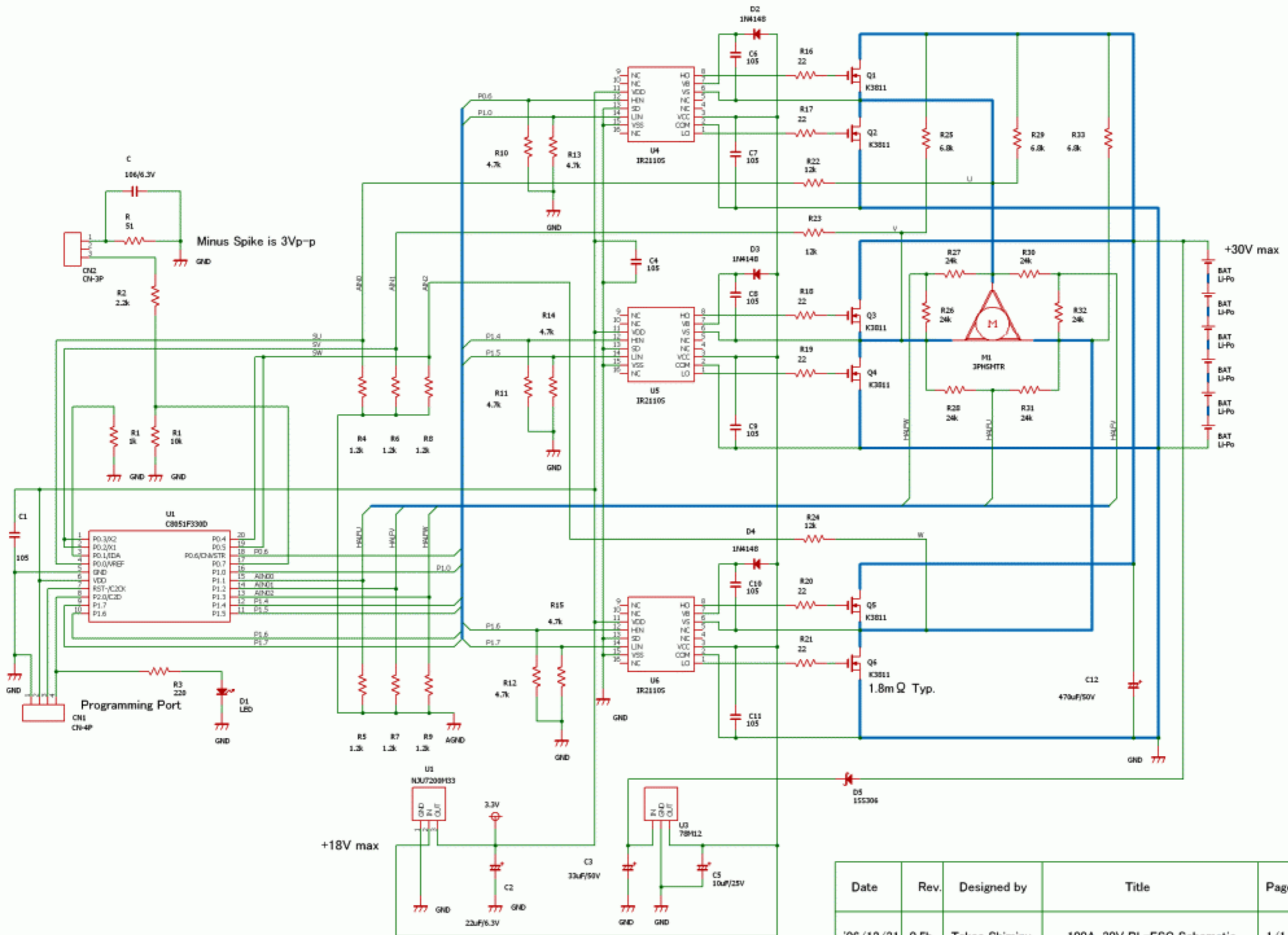
Keep the lowest operation voltage



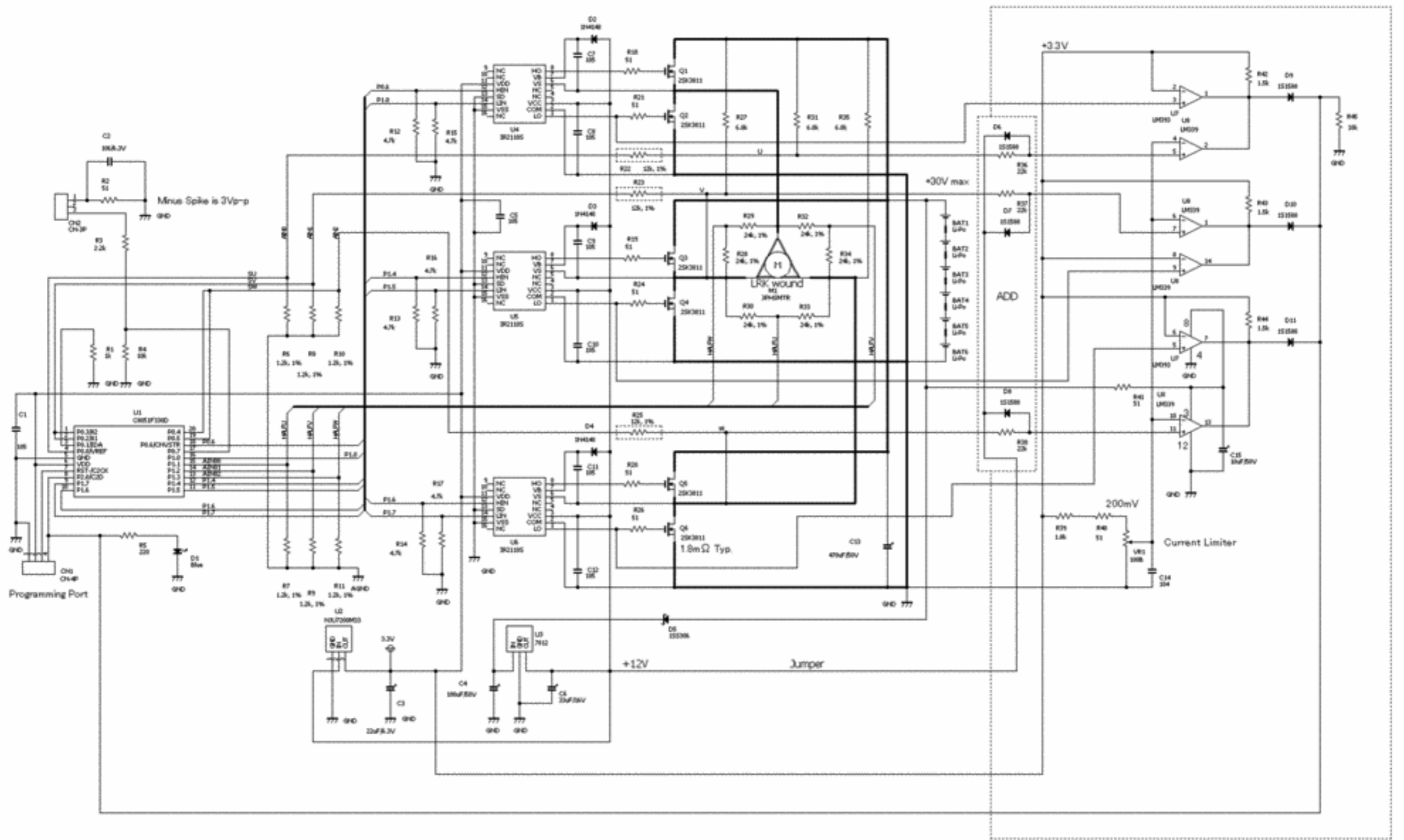
The sensing voltage is same as single MOSFET drive!



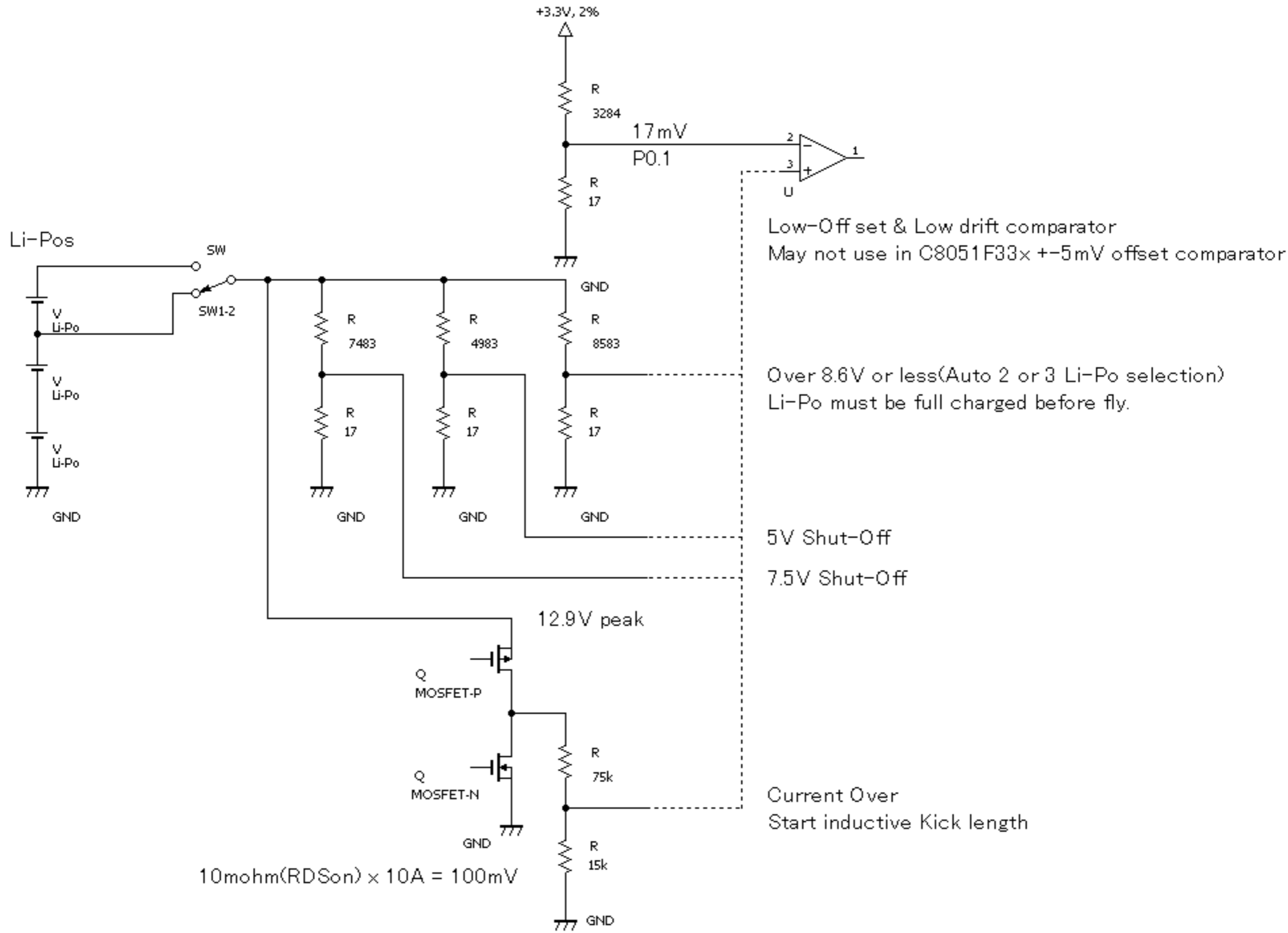
Date	Rev.	Designed by	Title	Page
'05/12/30	2	Takao Shimizu	BL-ESC Protection diagram in MPU	1/1

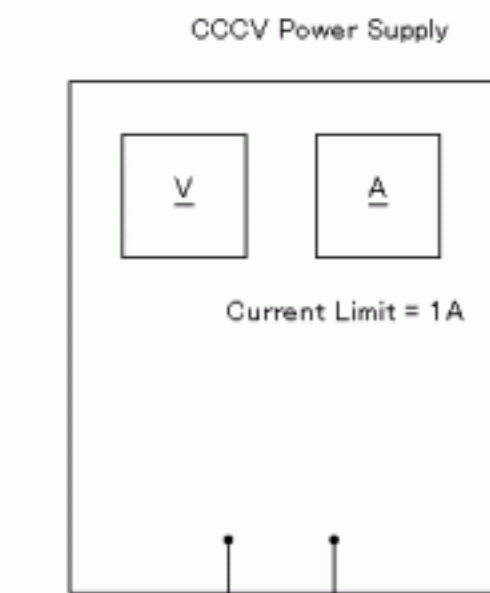


Date	Rev.	Designed by	Title	Page
'06/12/31	0.5b	Takao Shimizu	100A, 30V BL-ESC Schematic	1/1



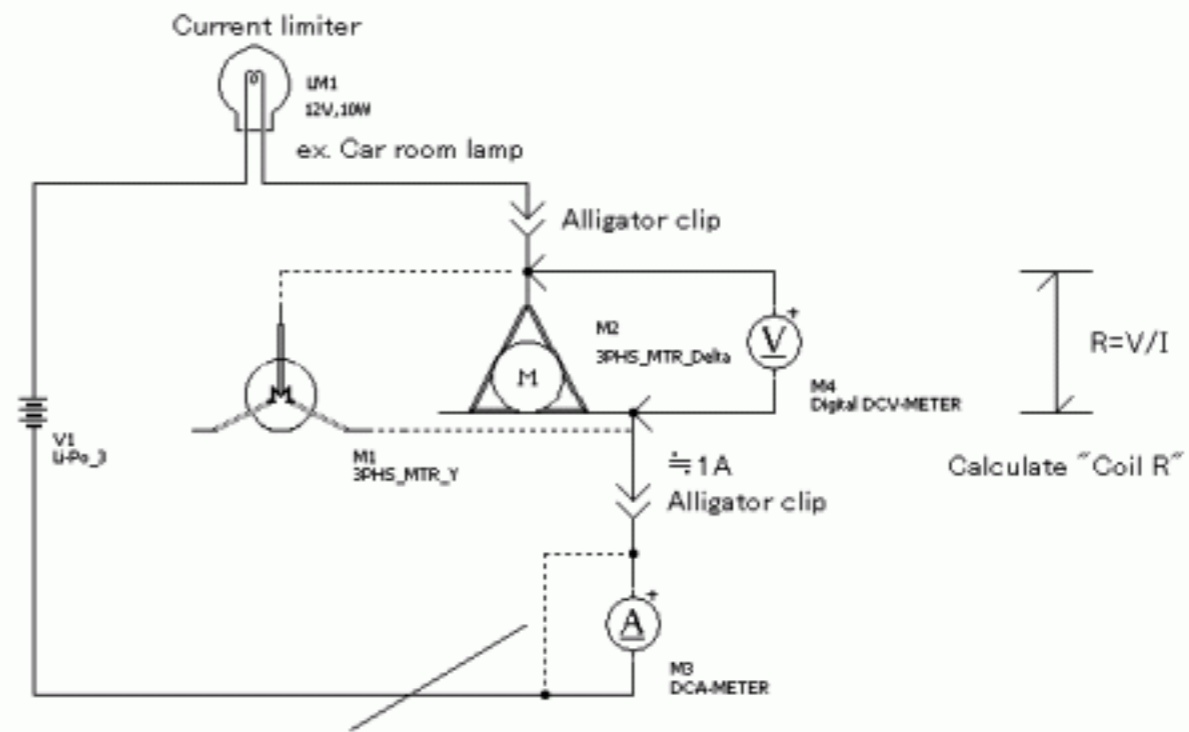
Date	Rev.	Designed by	Title	Page
07/11/13	0.1	Takao Shimizu	7S Li-Po 100A BL-ESC + Current_Limiter	1/1



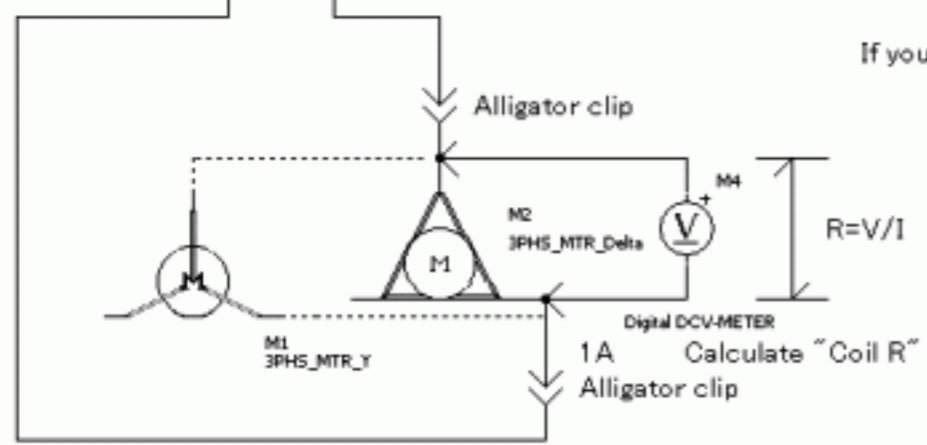


OR

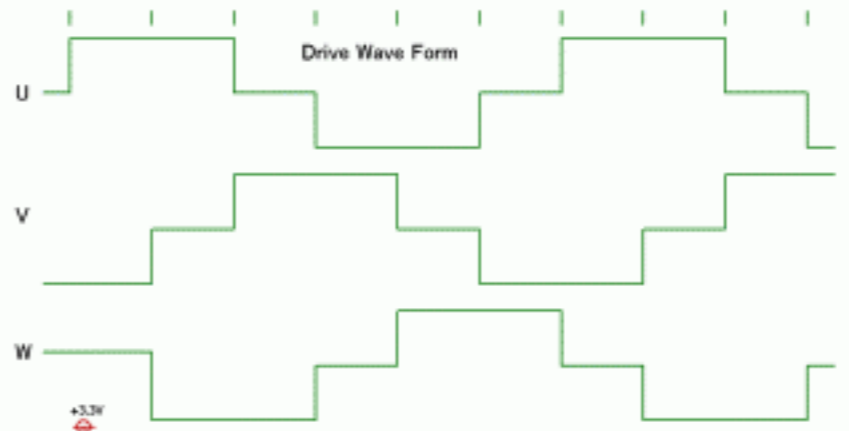
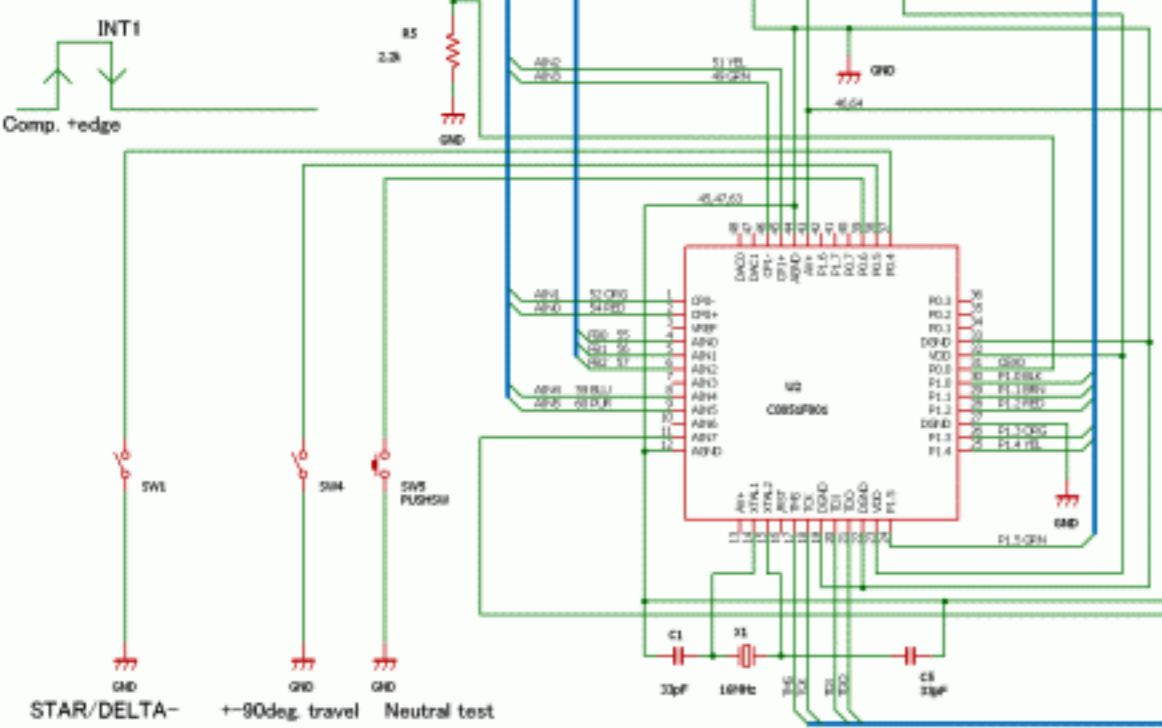
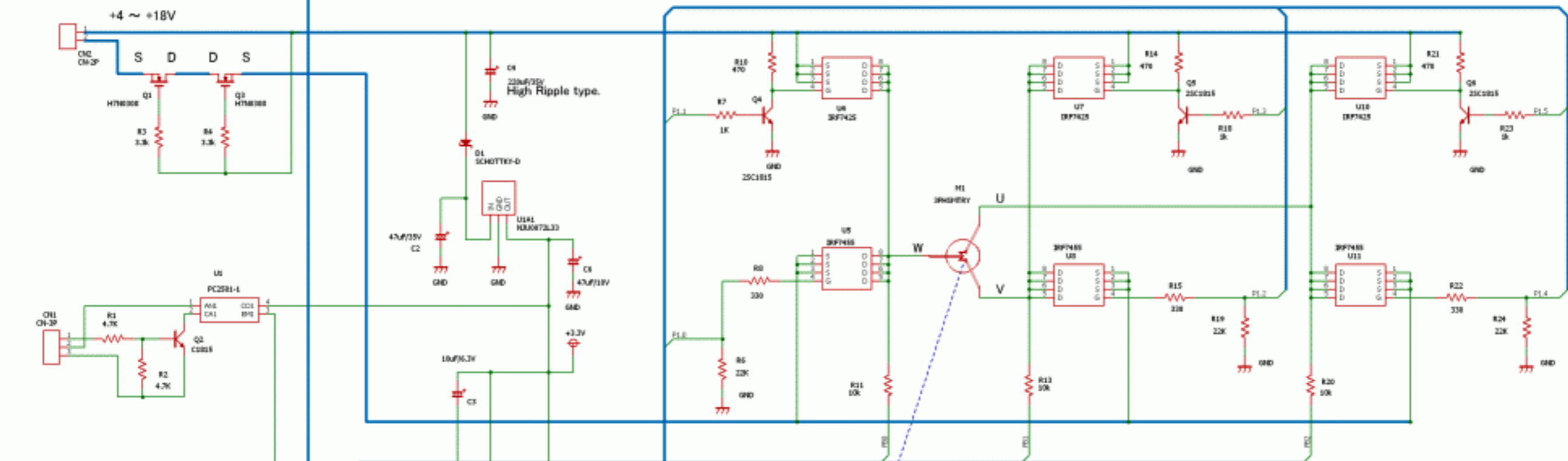
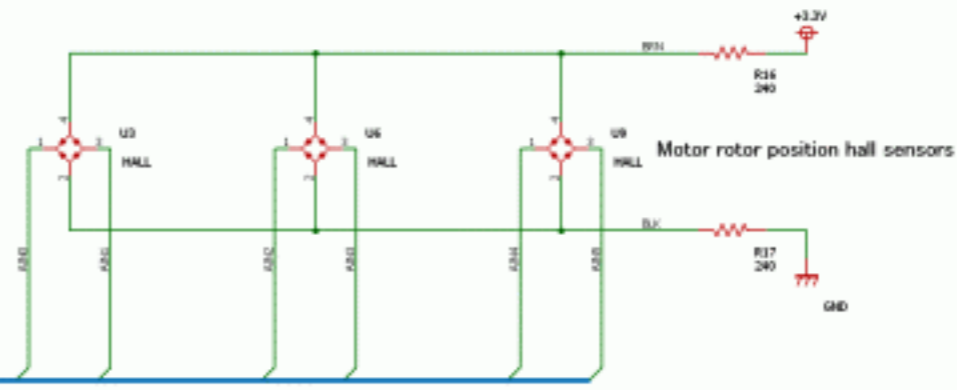
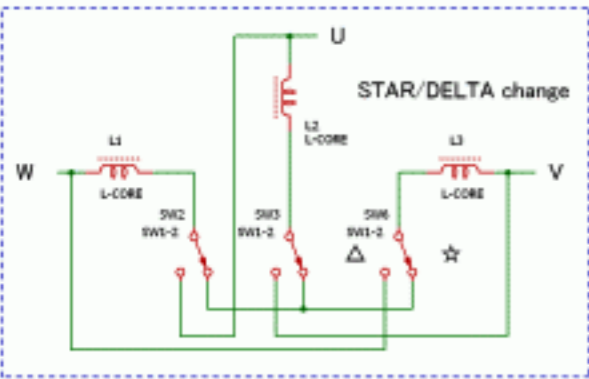
→



If you have one multi meter, you could short here by the lamp I constant characteristic after "I" has been measured.



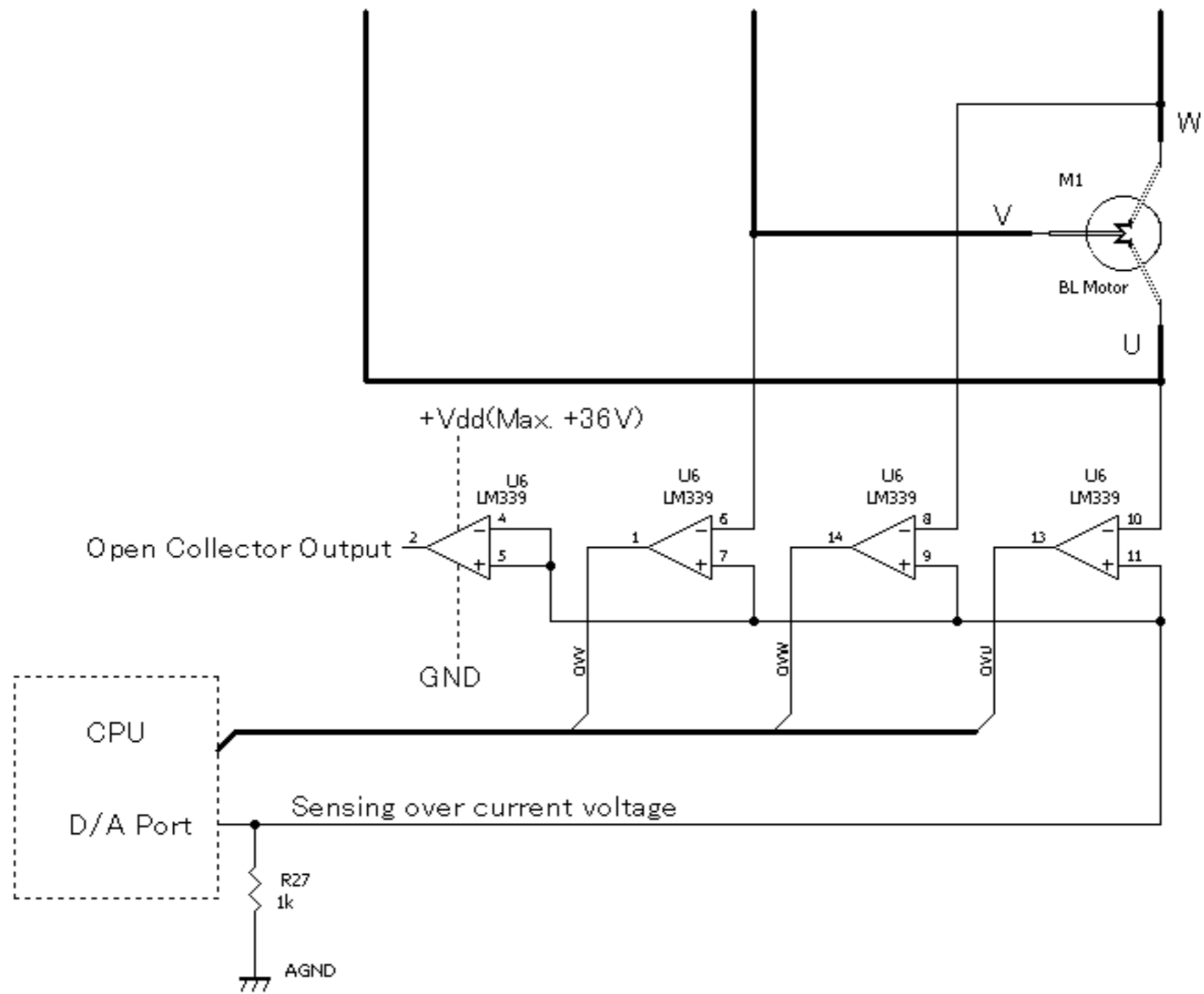
Date	Rev.	Designed by	Title	Page
'06/01/10	0.1	Takao Shimizu	Measuring method of motor coil resistance	1/1



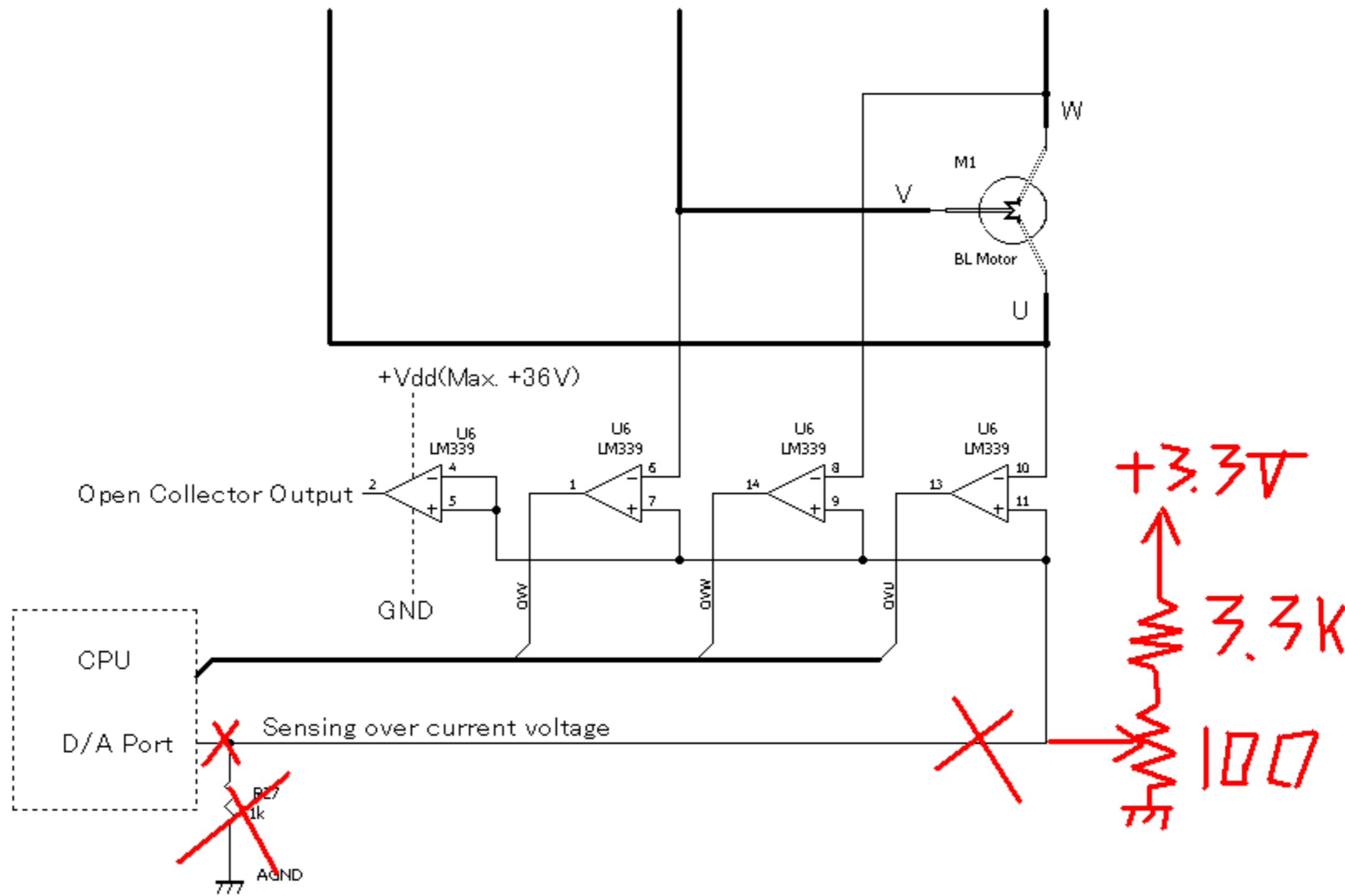
STAR/DELTA- +90deg. travel Neutral test

Current Limiter enable/disable

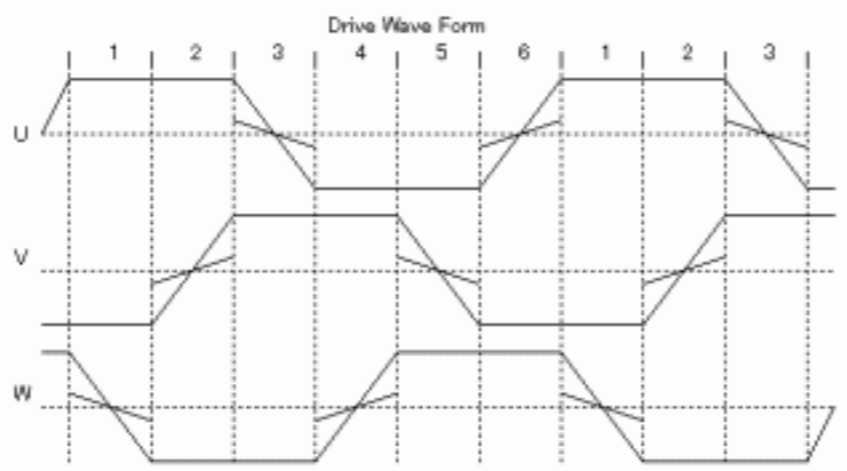
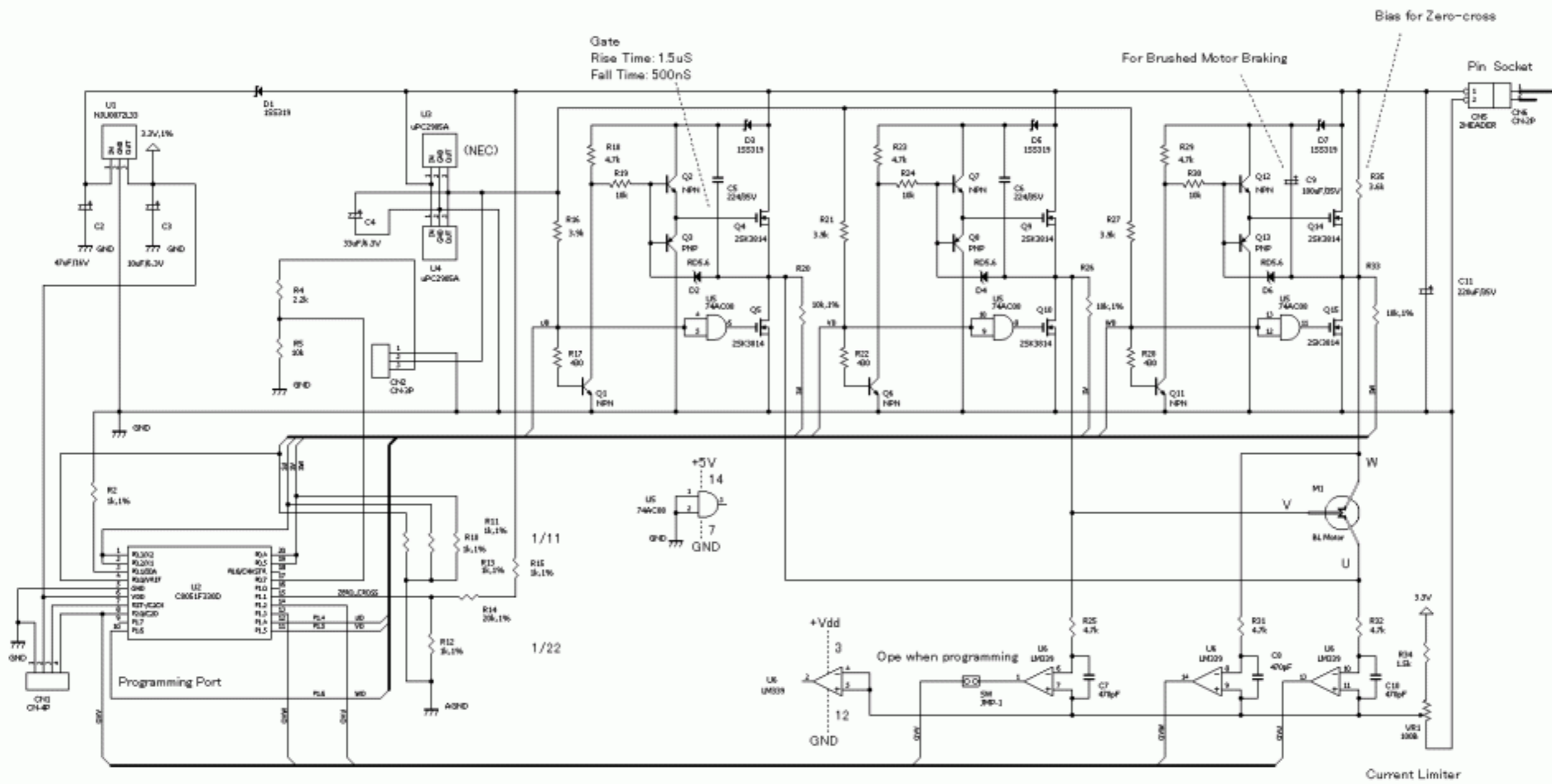
Date	Rev.	Designed by	Title	Page
'06/10/10	0.3b	Takao Shimizu	Brushless Digital Proportional Servo Schematic	1/1



Date	Rev.	Designed by	Title	Page
'05/01/25	0.1	Takao Shimizu	BL-Motor over current sensing schematic	1/1

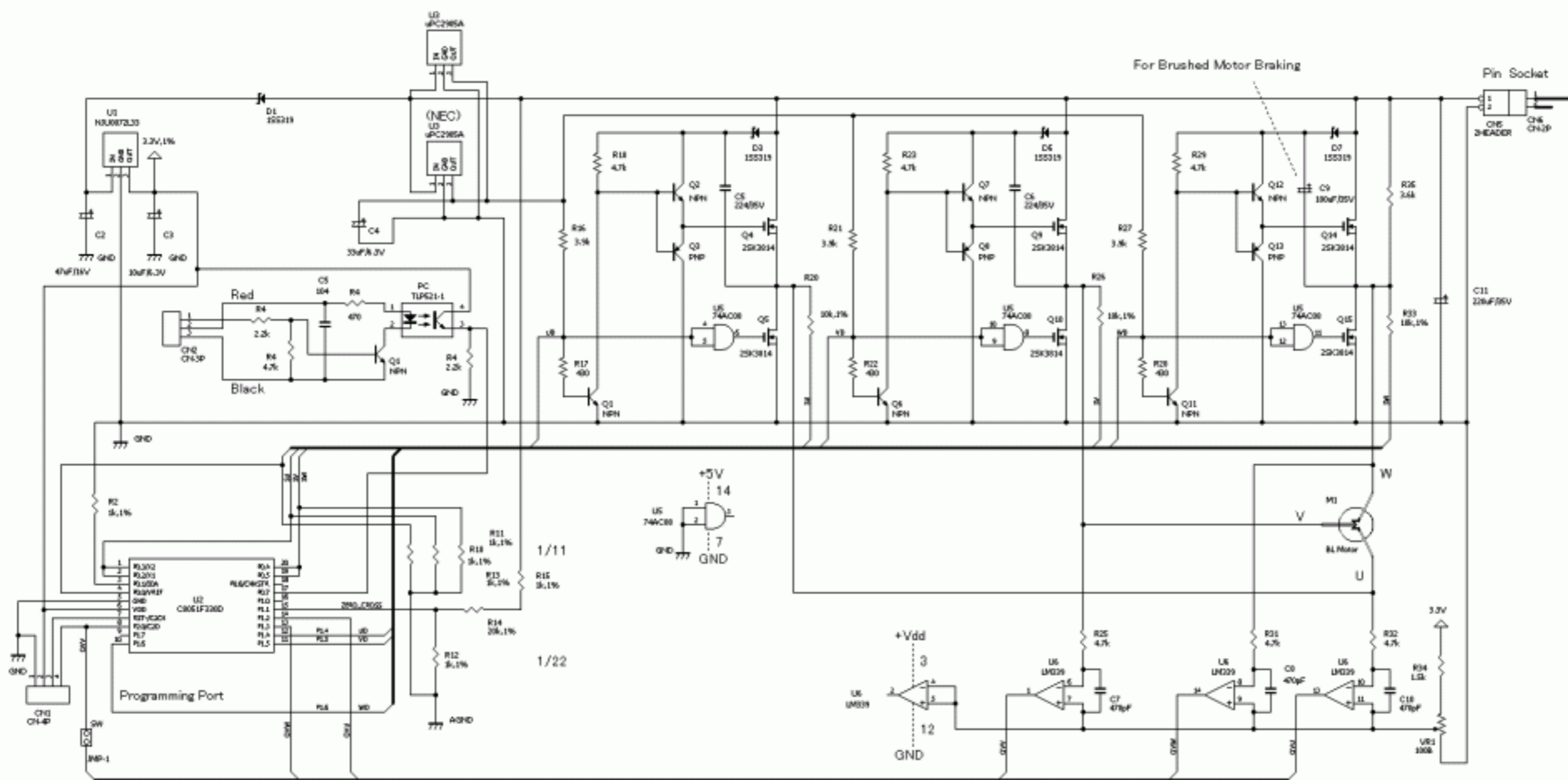


Date	Rev.	Designed by	Title	Page
'05/01/25	0.1	Takao Shimizu	BL-Motor over current sensing schematic	1/1



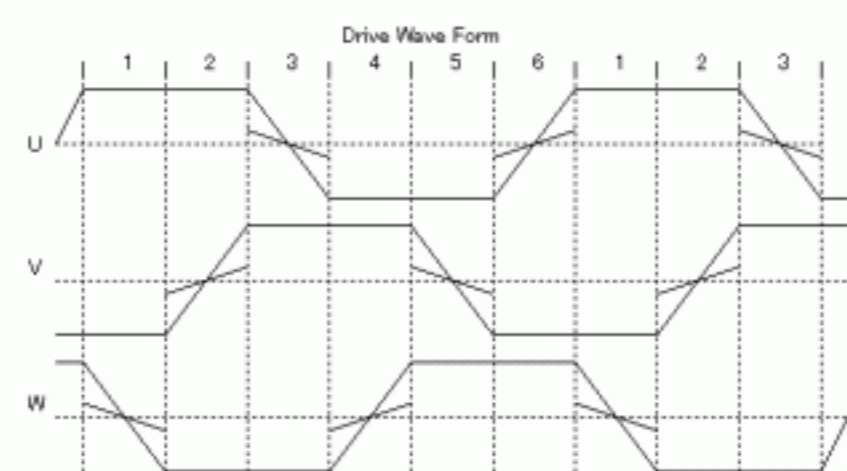
Each Cell Voltage Monitor

Date	Rev.	Designed by	Title	Page
05/01/14	0.1	Takao Shimizu	Brushless Sensorless Electric Speed Controller Schematic	1/1



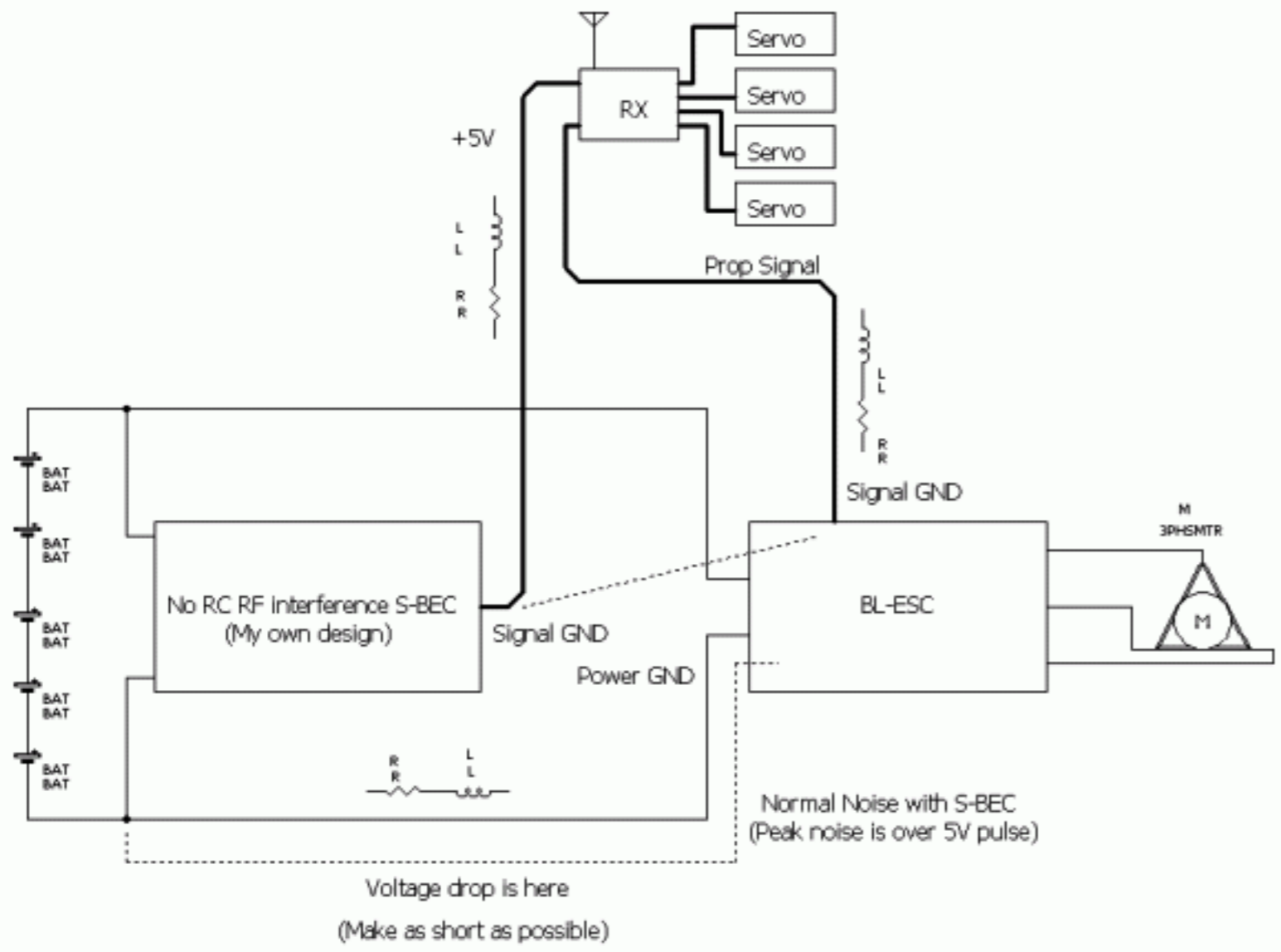
Open when programming

Current Limiter

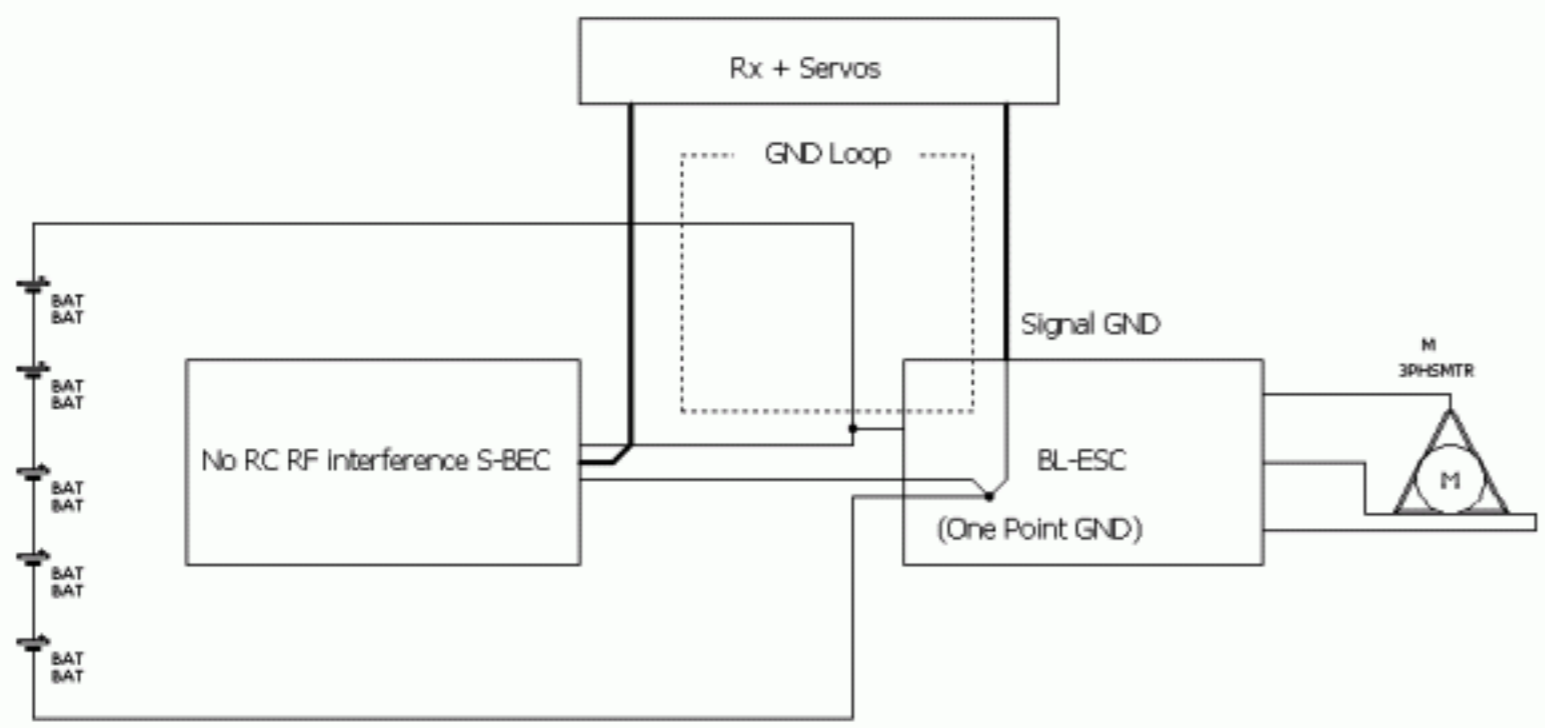


Each Cell Voltage Monitor

Date	Rev.	Designed by	Title	Page
05/02/17	0.1	Takao Shimizu	Brushless Sensorless Electric Speed Controller Schematic	1/1

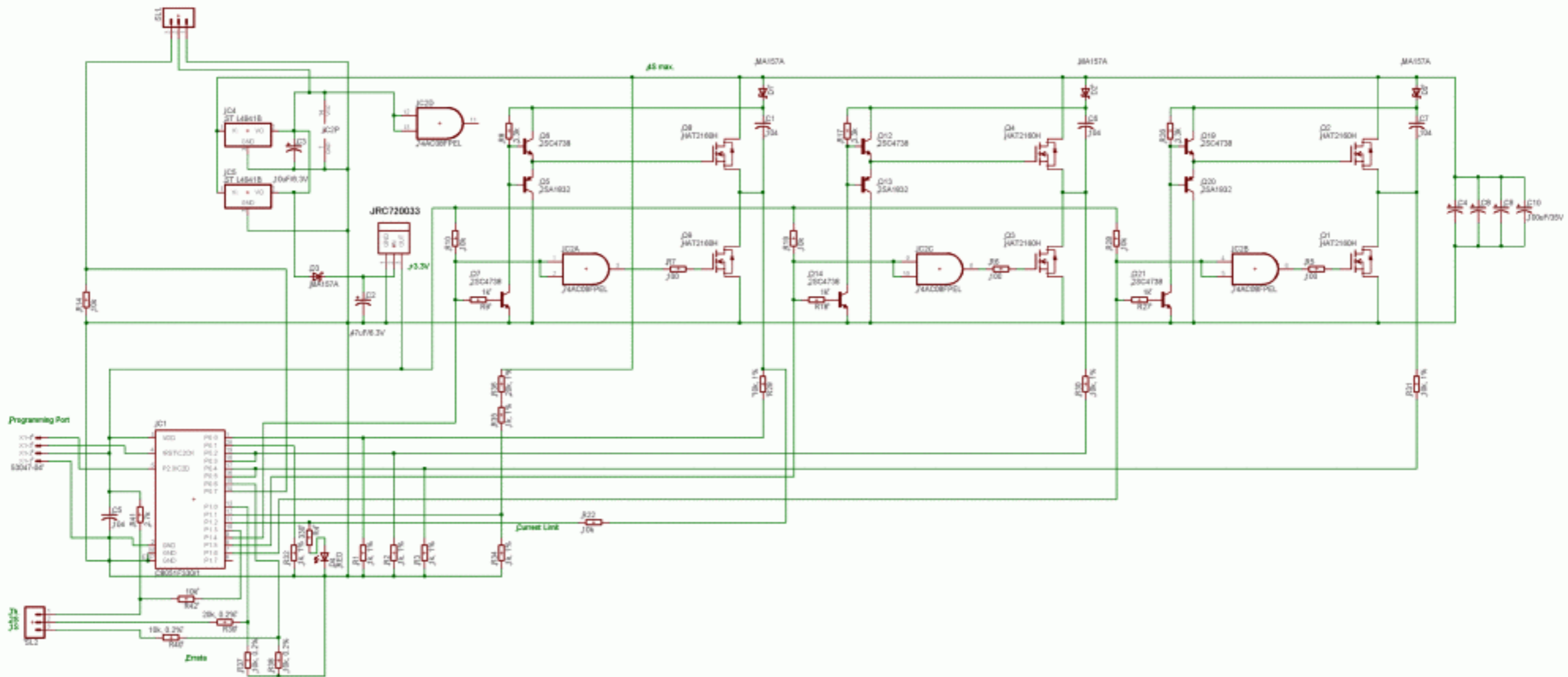


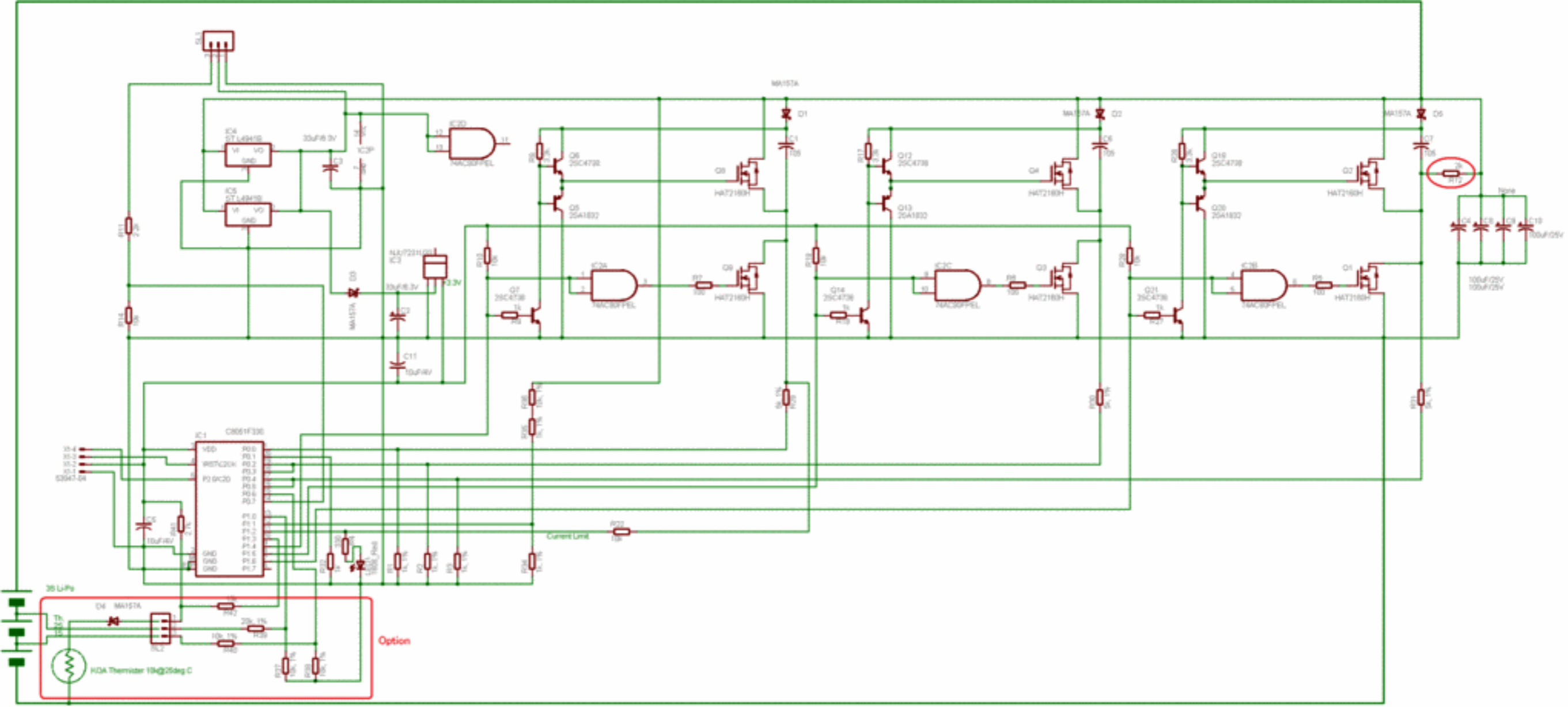
S-BEC connection Problem
(System can not start)



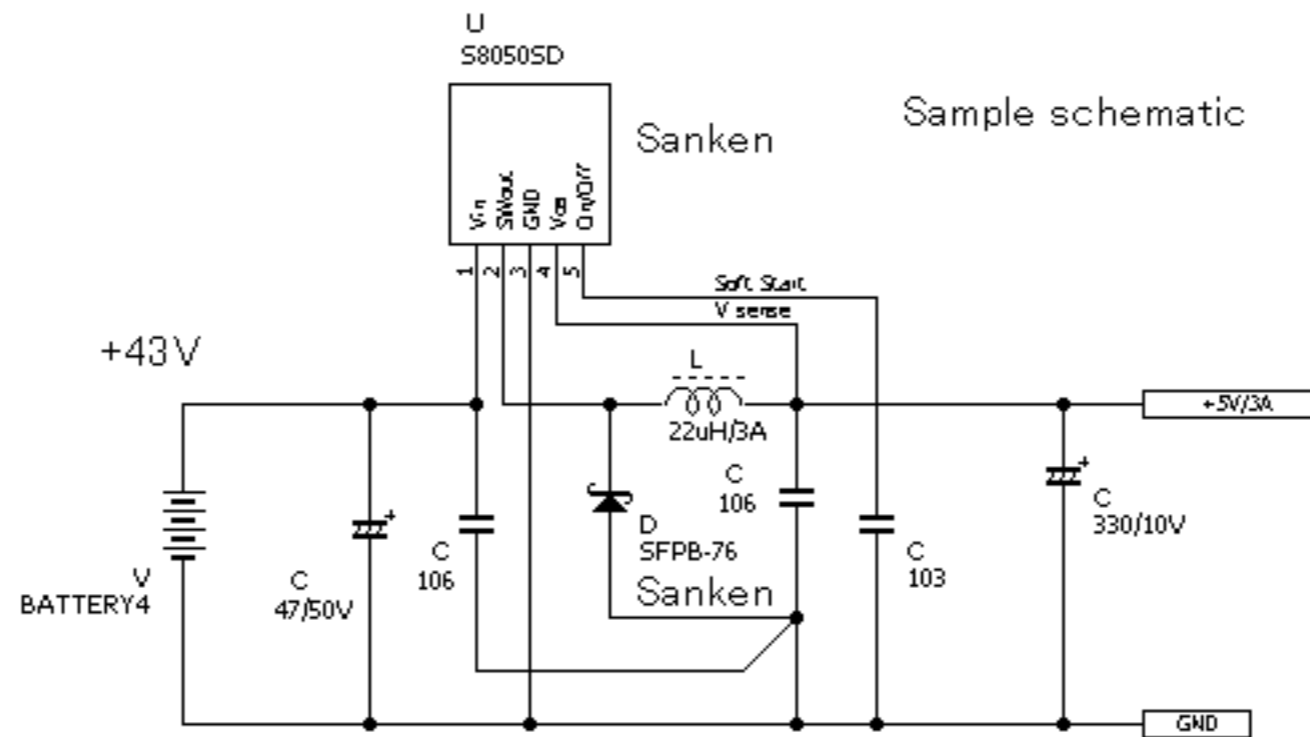
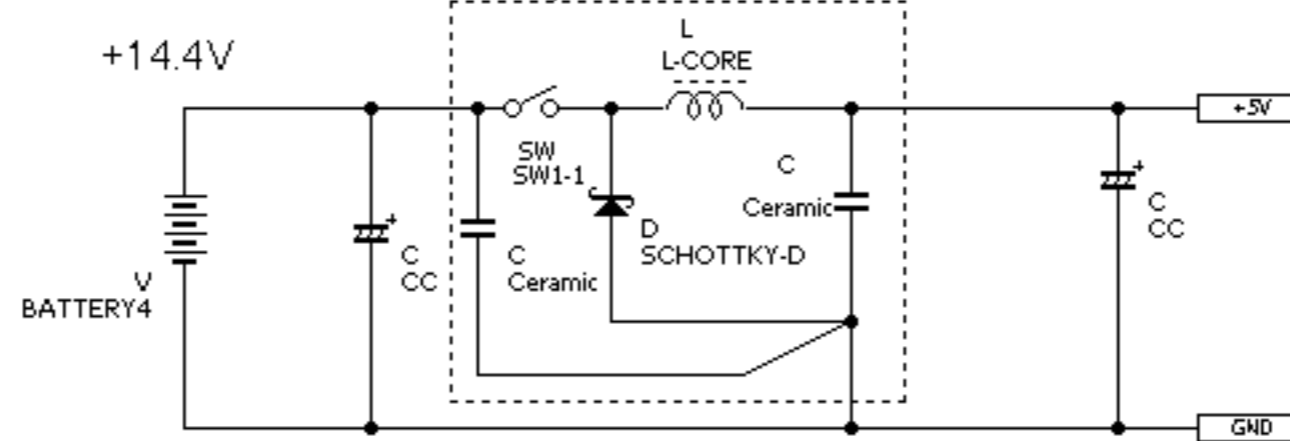
The S-BEC power line GND loop problem

Date	Rev.	Designed by	Title	Page
Feb. 20, '06	0.1	Takao Shimizu	S-BEC Connection Problem	1/1

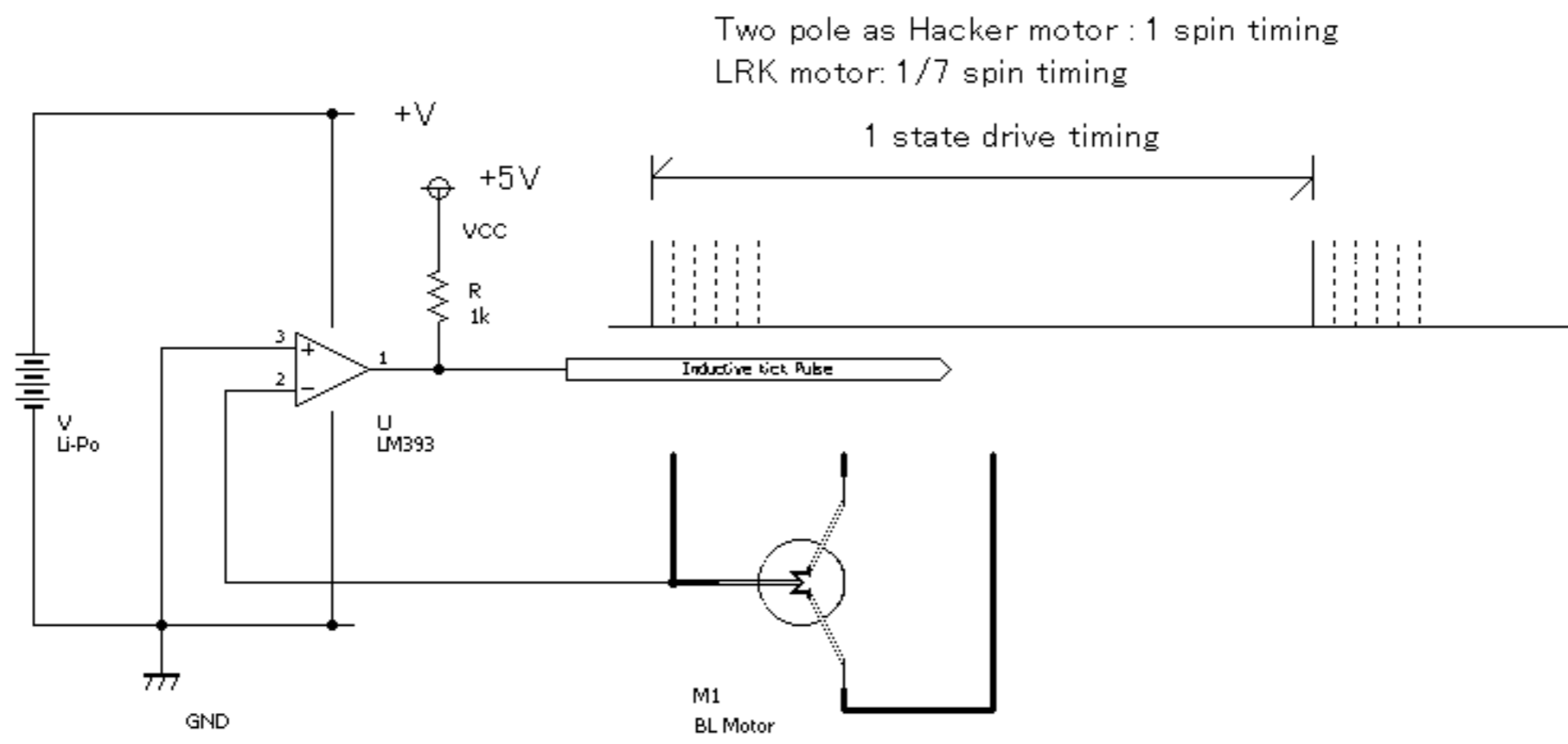




There is a possibility of RF interference from Sw. BEC.
 The wiring point is making small as possible at switching area.
 as the smallest antenna in high current loop.



Sample schematic



Date	Rev.	Designed by	Title	Page
'06/08/15	0.2	Takao Shimizu	RPM sensing tap	1/1

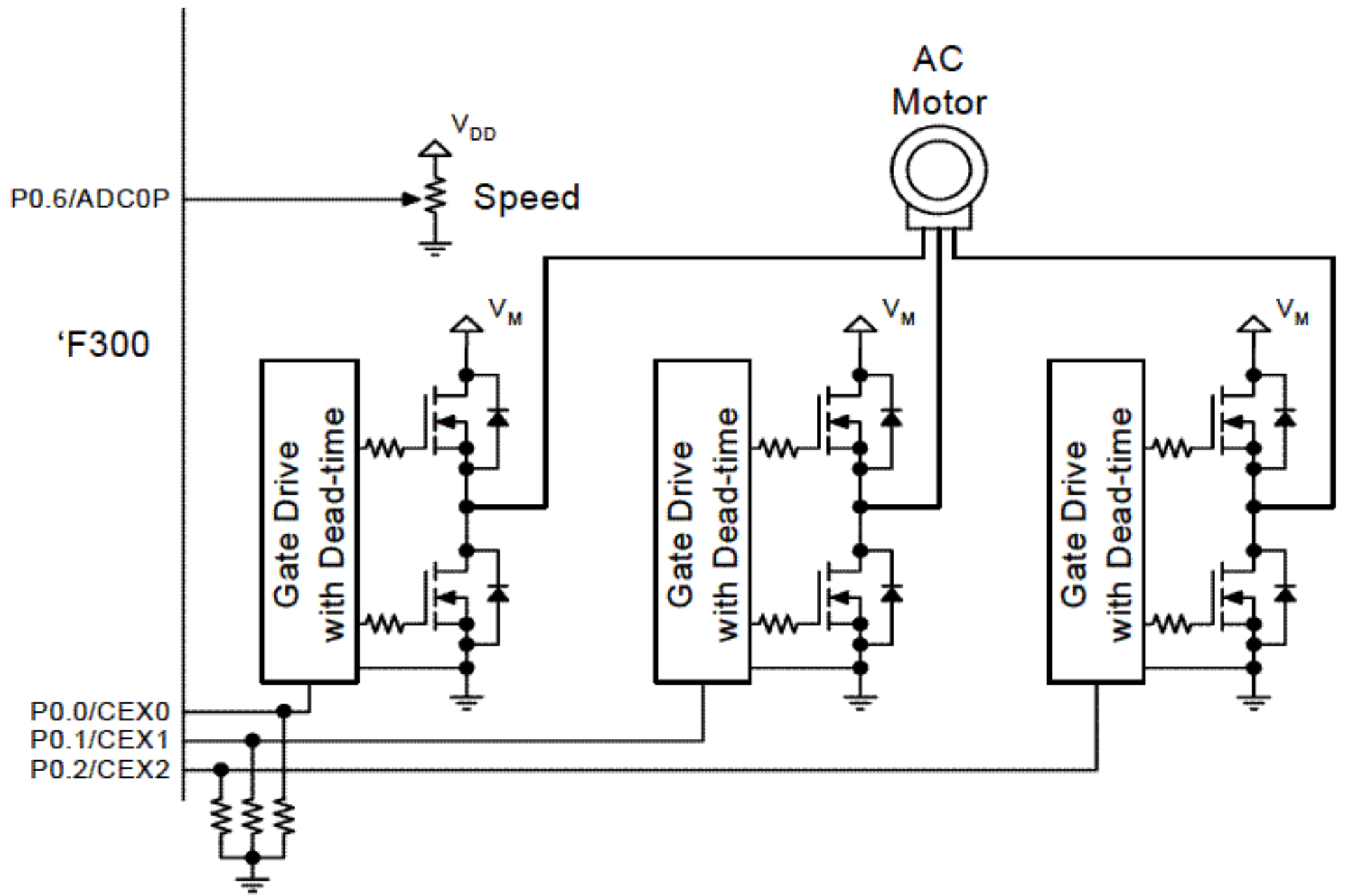
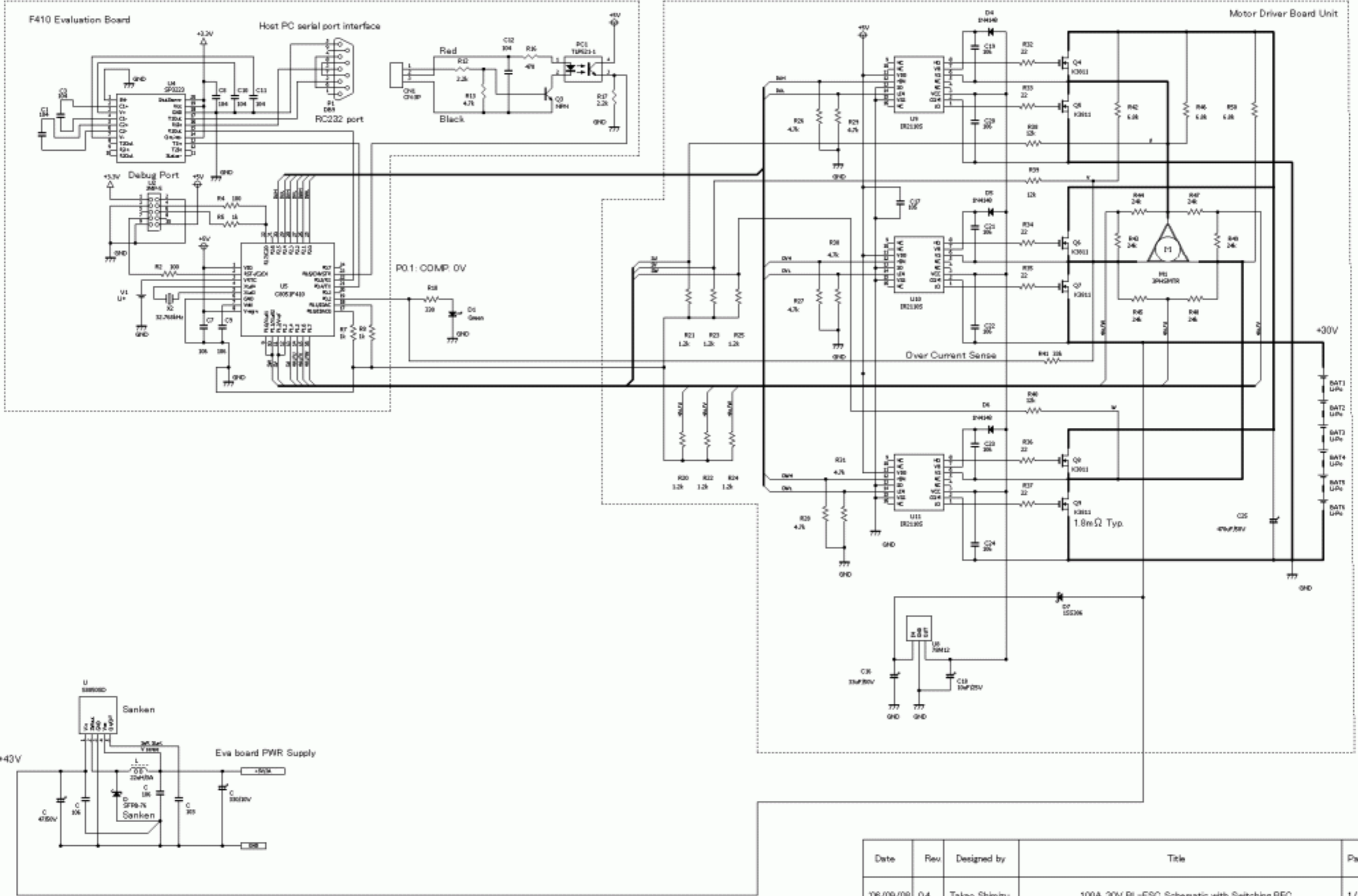
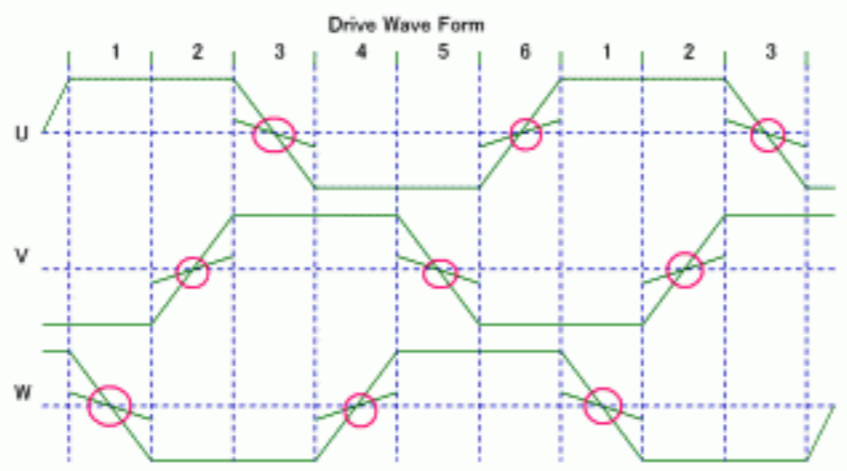
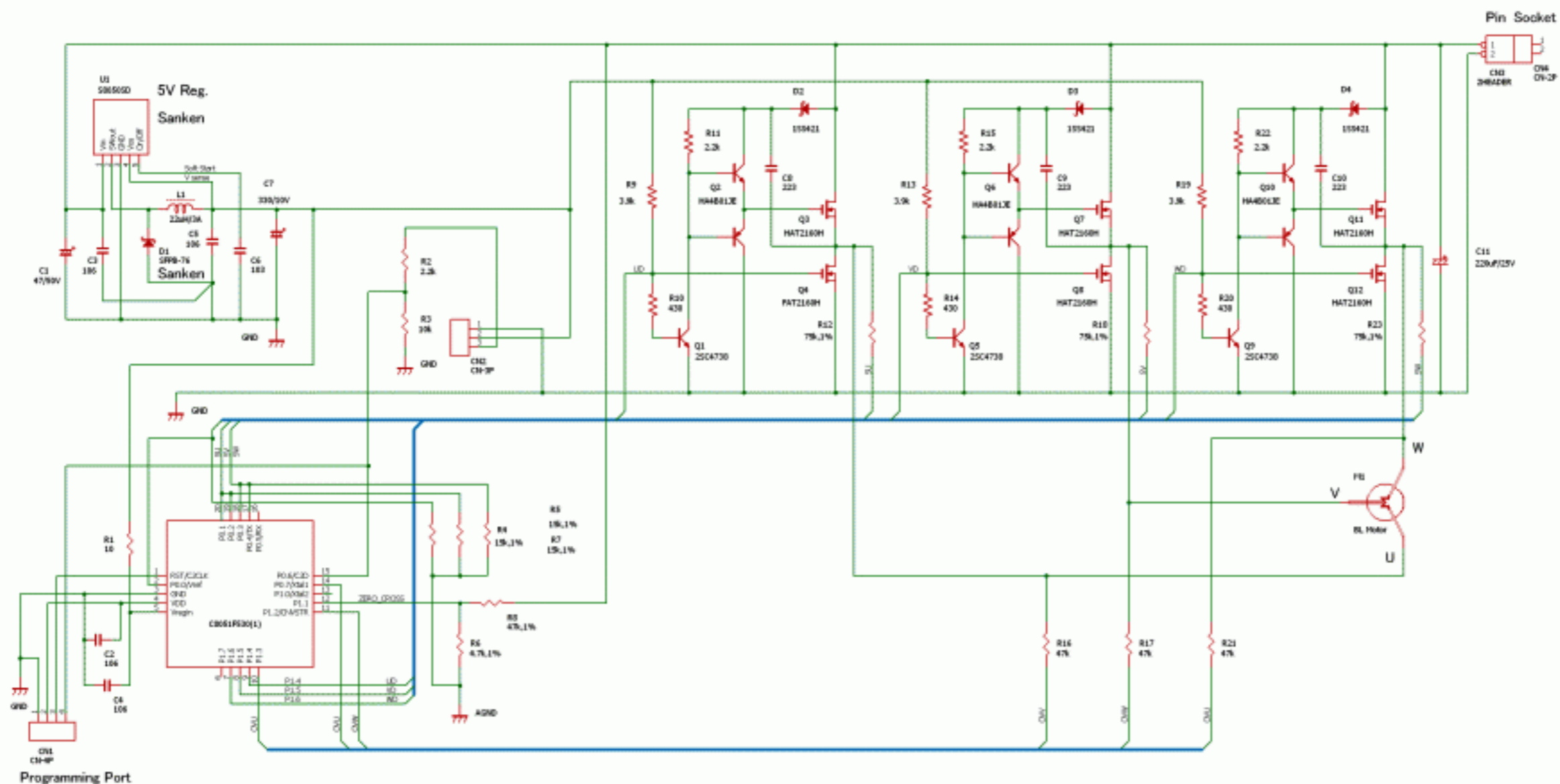


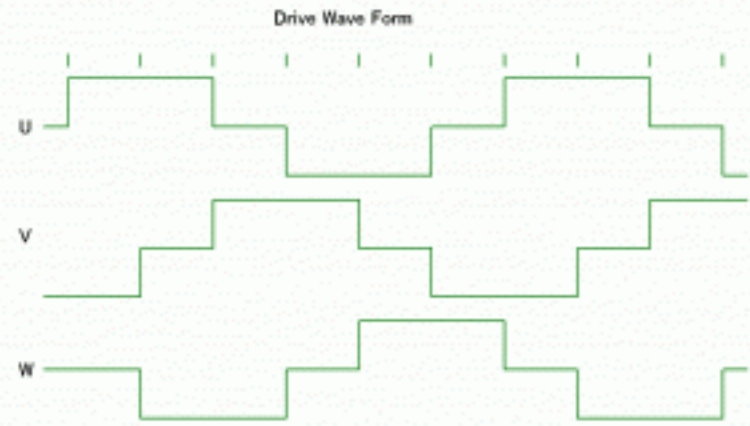
Figure 7. AC Induction Motor Drive



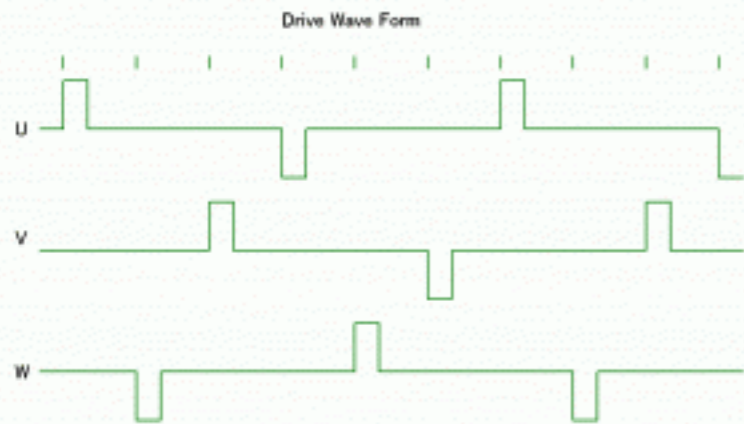
Date	Rev	Designed by	Title	Page
06/08/08	04	Takao Shimizu	100A, 30V BL-ESC Schematic with Switching BEC	1/1



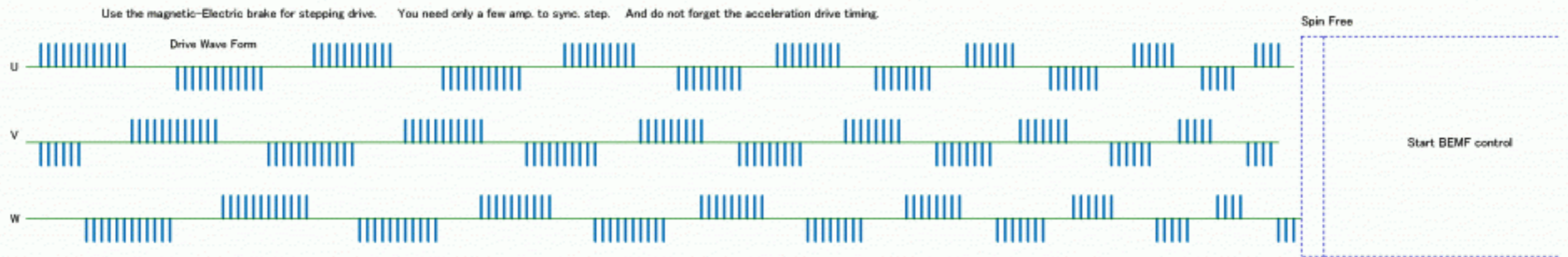
Date	Rev.	Designed by	Title	Page
'06/12/06	0.1a	Takao Shimizu	Brushless Sensor-less Electric Speed Controller Schematic	1/1



Can not drive the coil too small resistance.

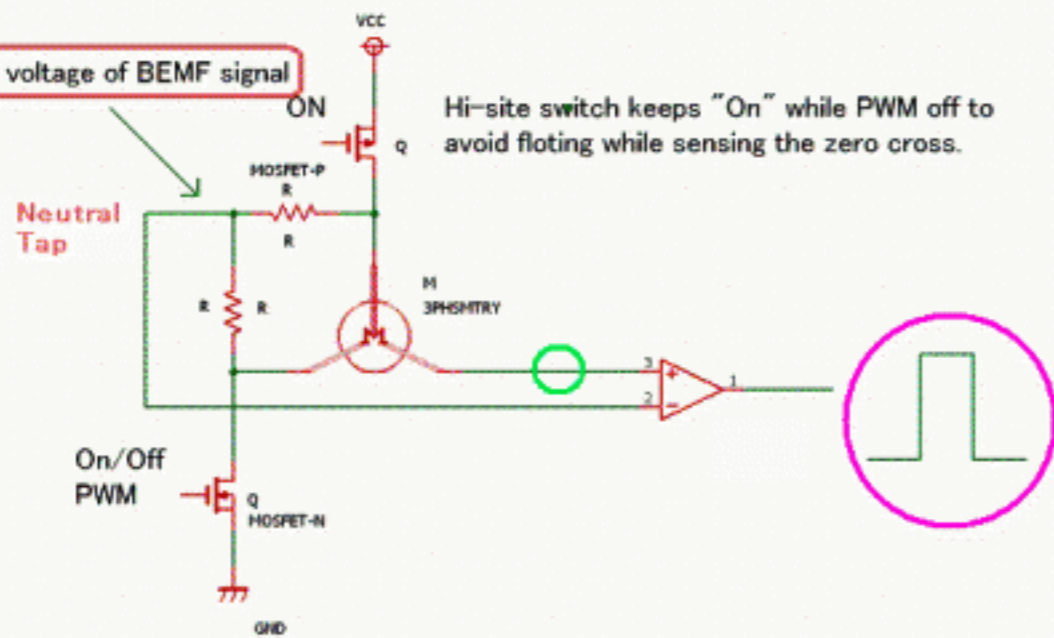


You can reduce the starting current. But, It only vibrate only. Never start.

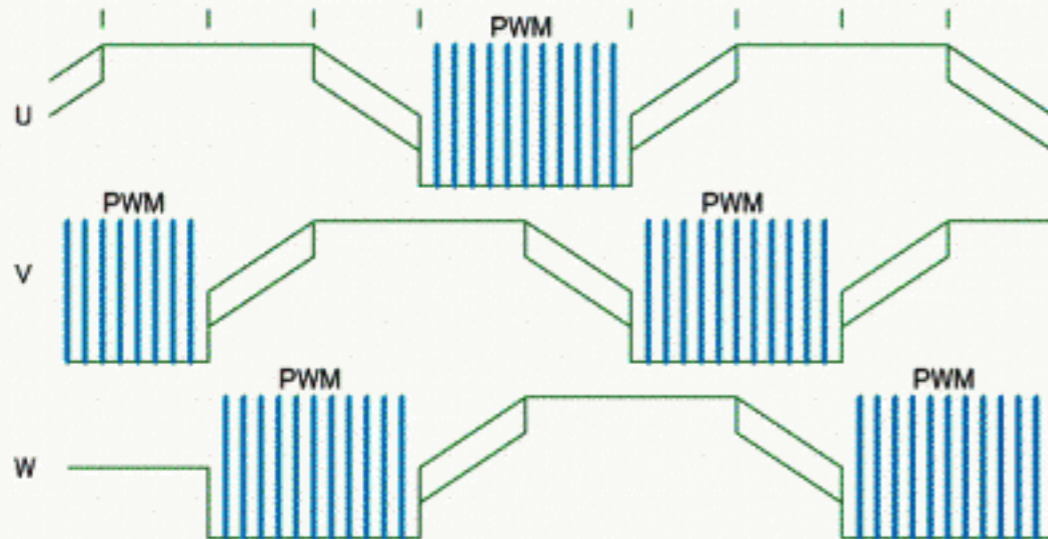


Date	Rev.	Designed by	Title	Page
'07/01/13	0.1	Takao Shimizu	Sensor-less Brush-less Motor starting control image	1/1

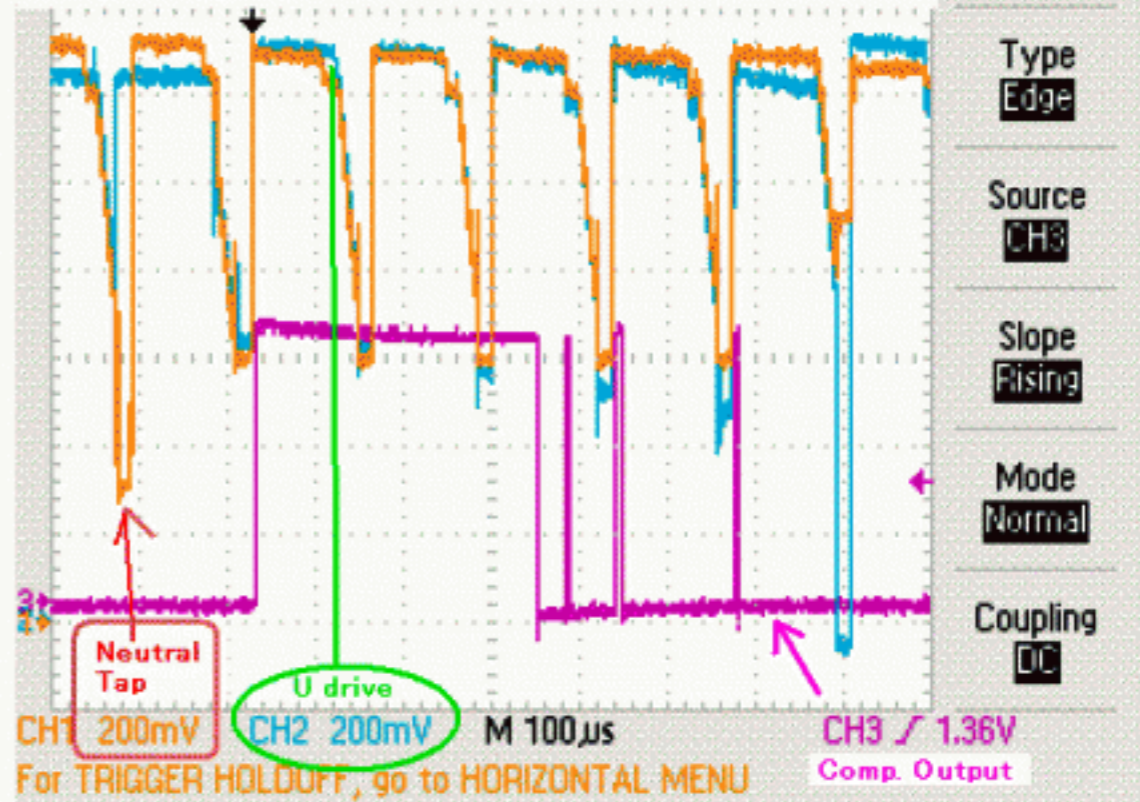
Still keep center voltage of BEMF signal



Drive Wave Form



Check the zero cross over at each end of PWM state



Date	Rev.	Designed by	Title	Page
'07/01/20	0.1	Takao Shimizu	Zero Cross sensing while PWM switching	1/1

Still keep center voltage of BEMF signal while switching. and in inductive kick

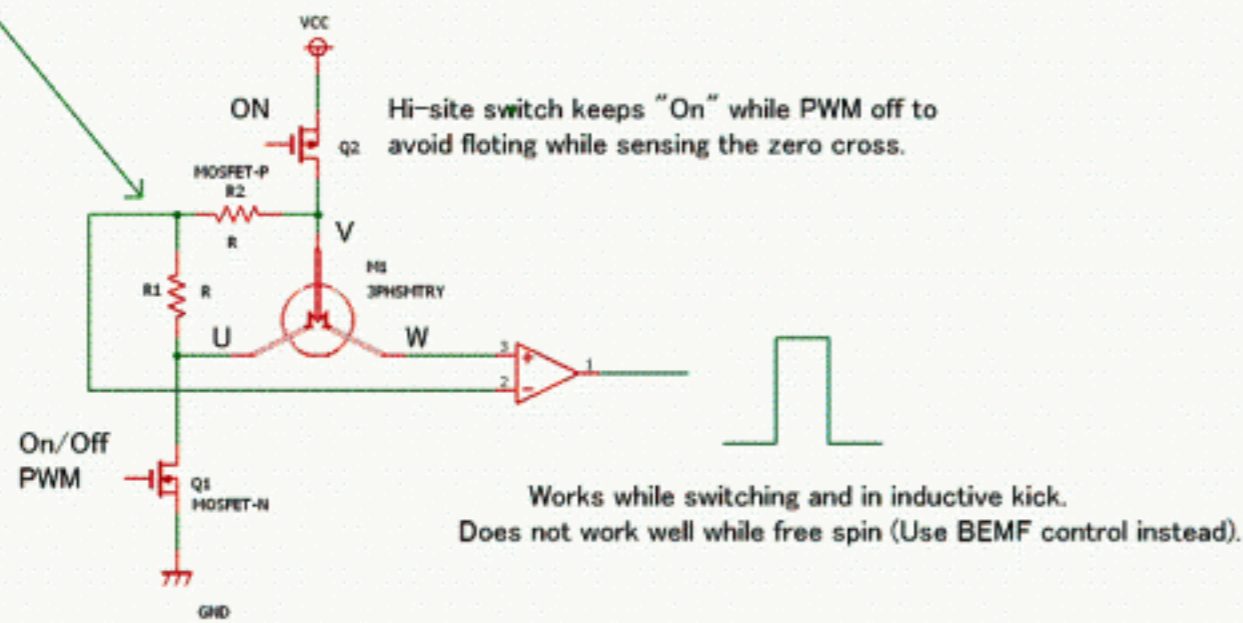


Fig.1: Two wire center tap sensing

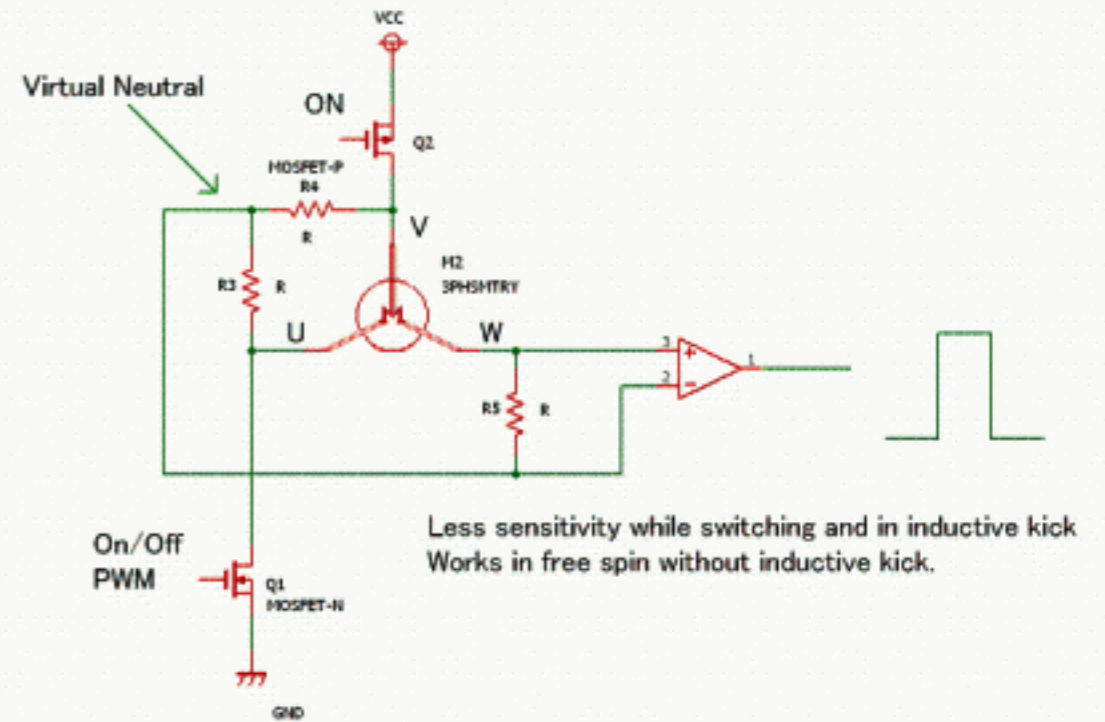
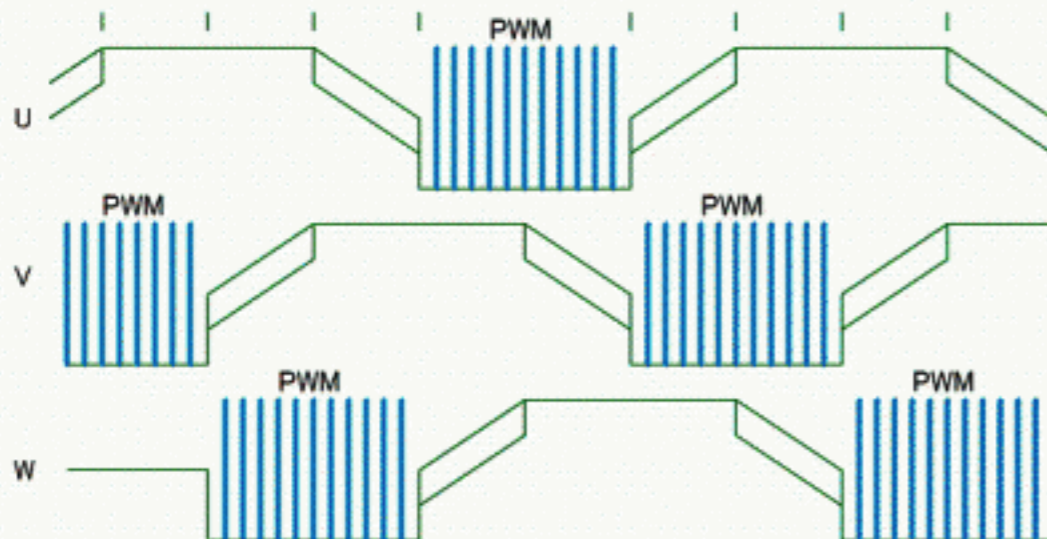


Fig 2: Virtual Neutral sensing

Drive Wave Form



Note:

- * Each generative voltage wave is 120 degree difference while PWM off as free spin. But, the activated lines are 180 degree difference in switching drive mode.
- * There is the difference of Rds-ON between Q1 and Q2

Date	Rev.	Designed by	Title	Page
'07/01/27	0.2	Takao Shimizu	Zero Cross sensing while PWM switching	1/1

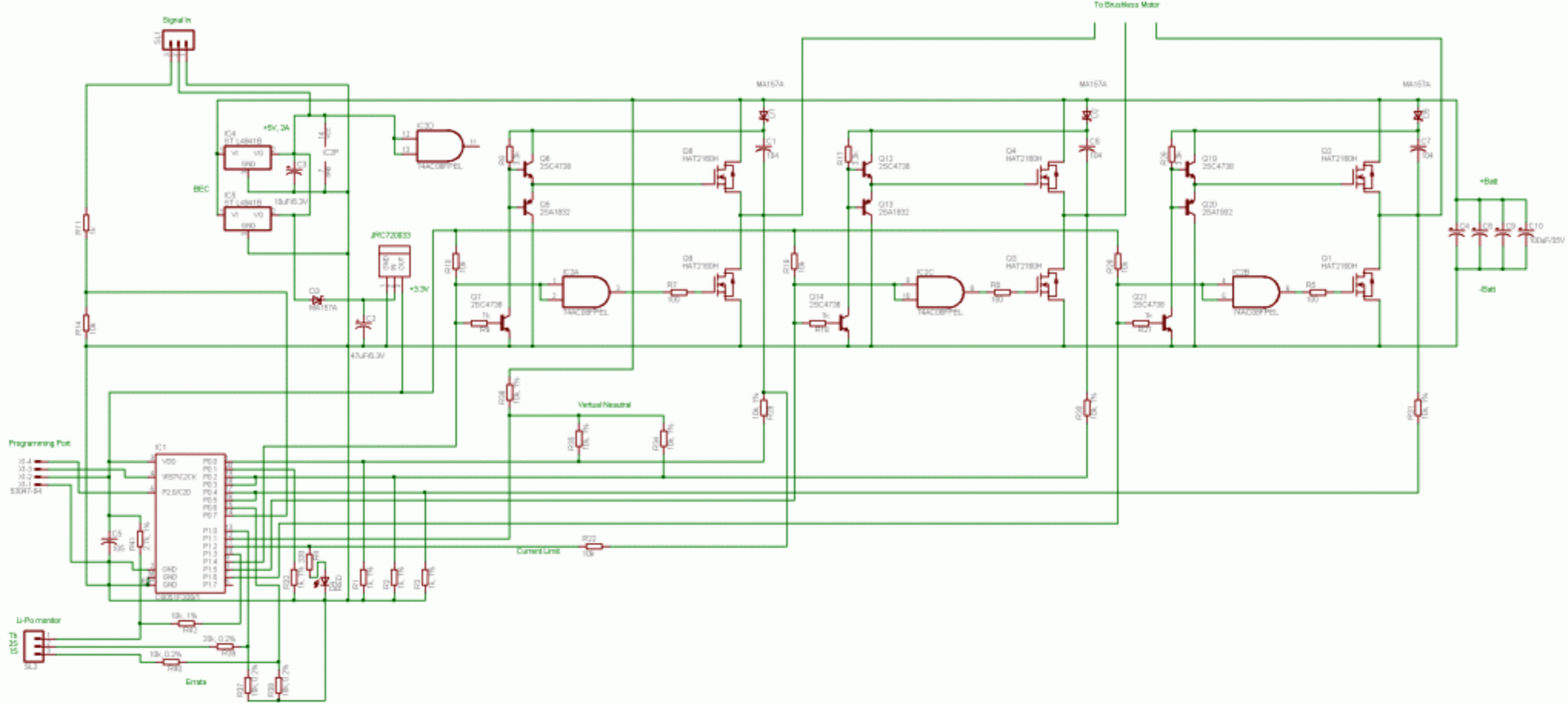
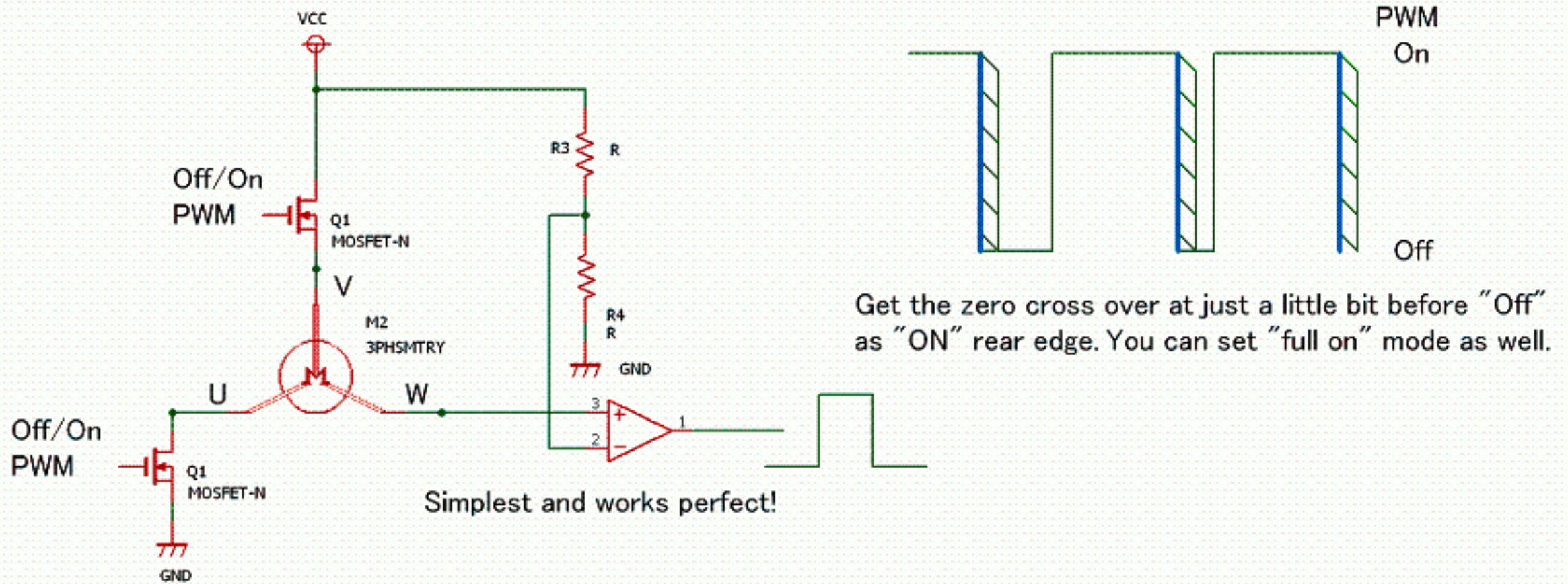


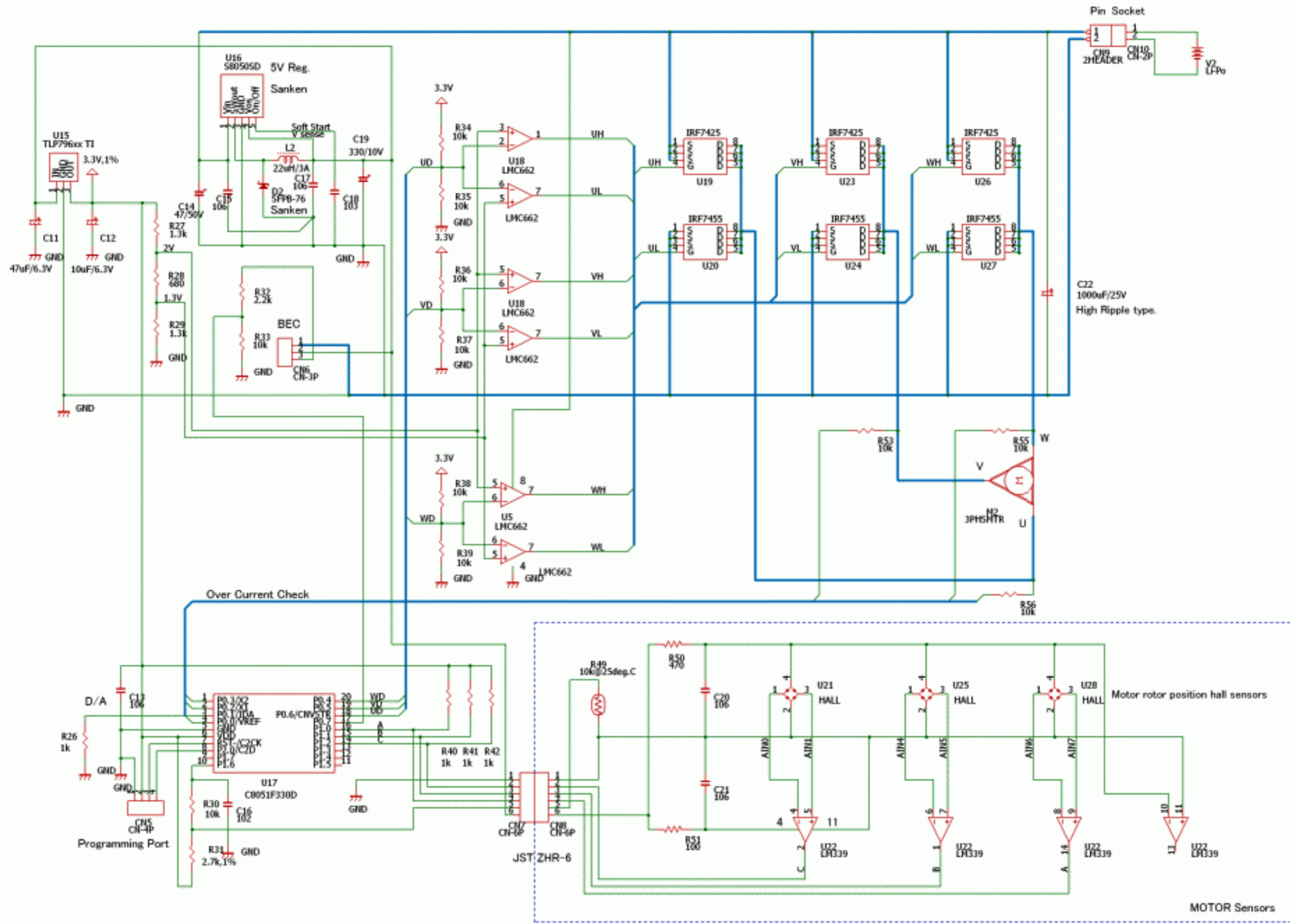
Fig : 1/2 VDD sensing



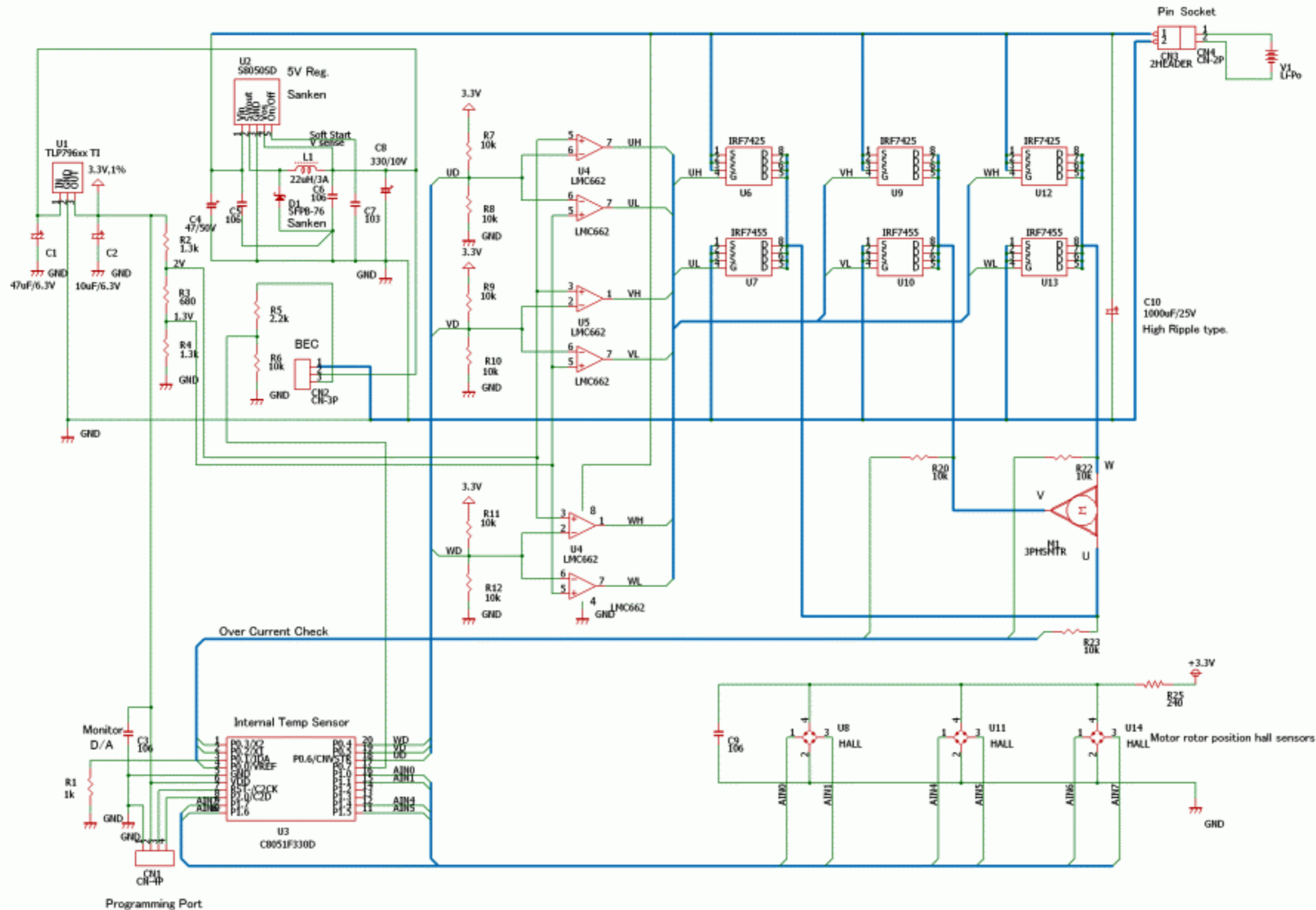
Note:

- *Use same MOSFET both H/L site.
- *"Off" first, And "On". Get the zero cross detect result at the of "ON" fall egde for sampling.

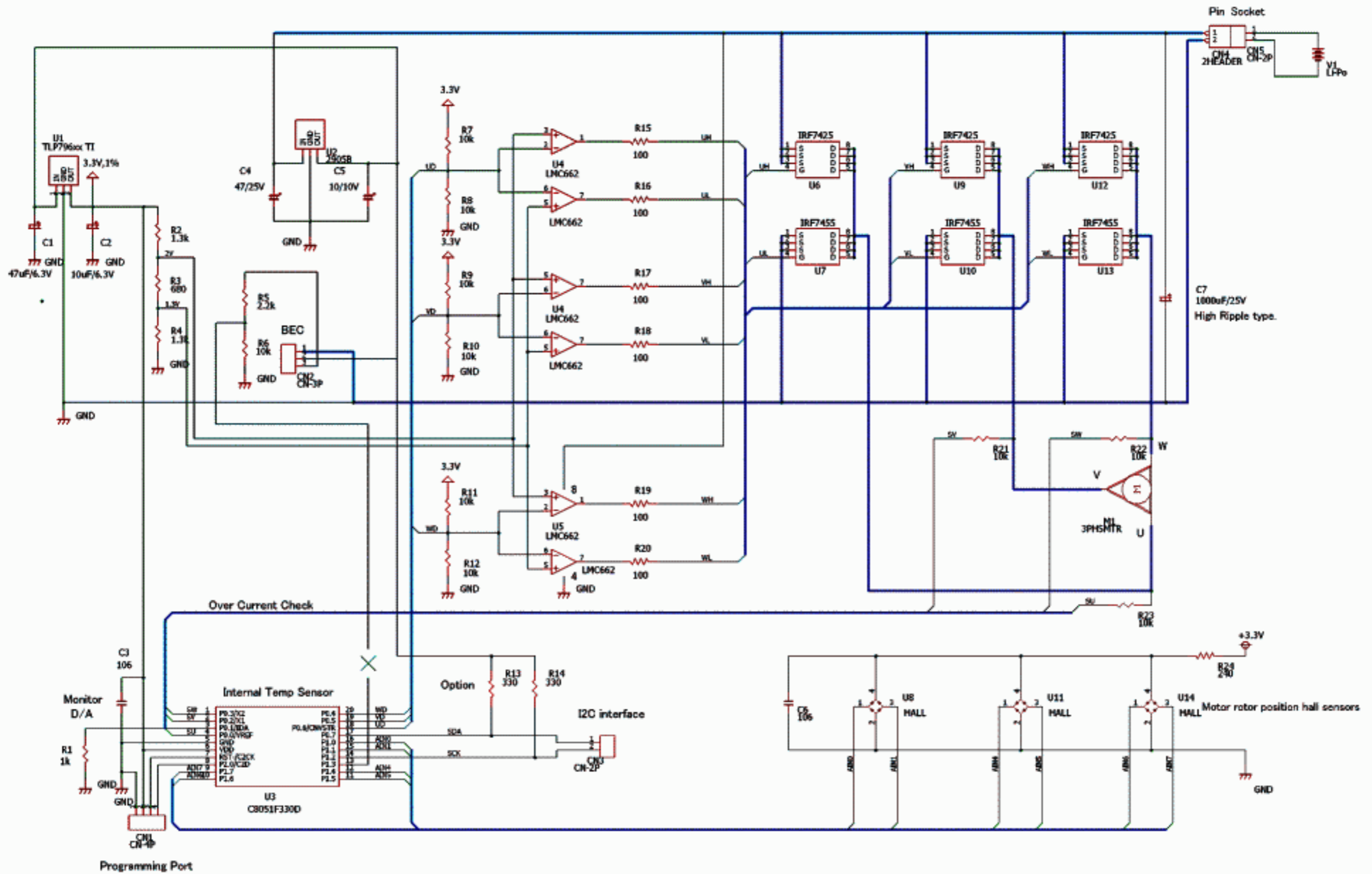
Date	Rev.	Designed by	Title	Page
'07/01/27	0.2	Takao Shimizu	Zero Cross sensing while PWM switching	1/1



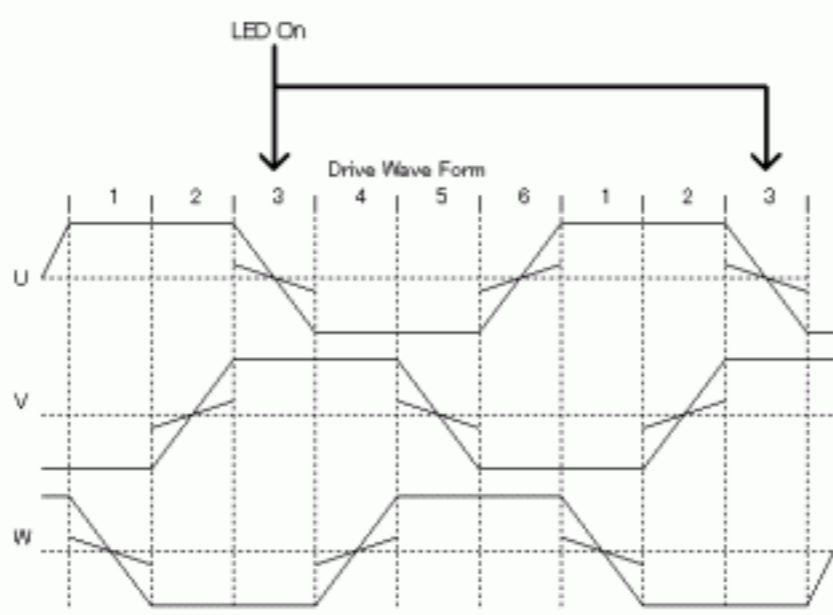
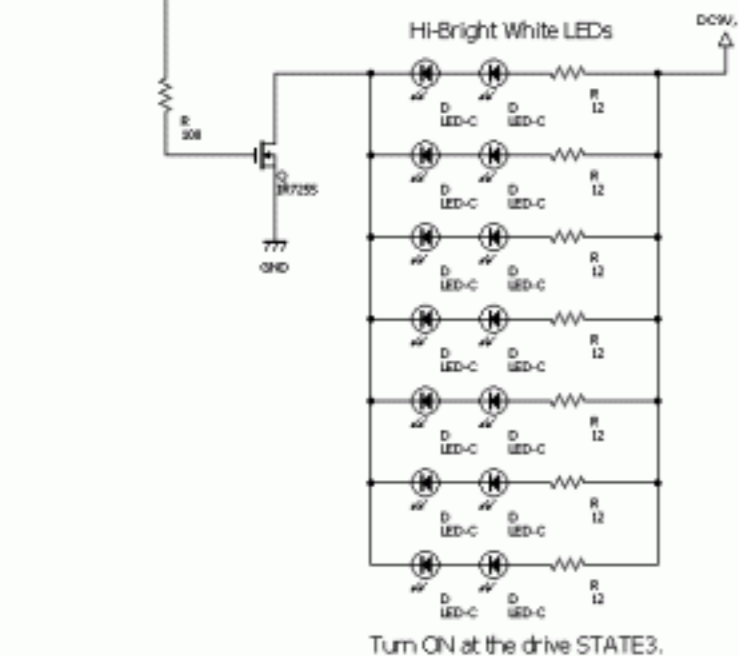
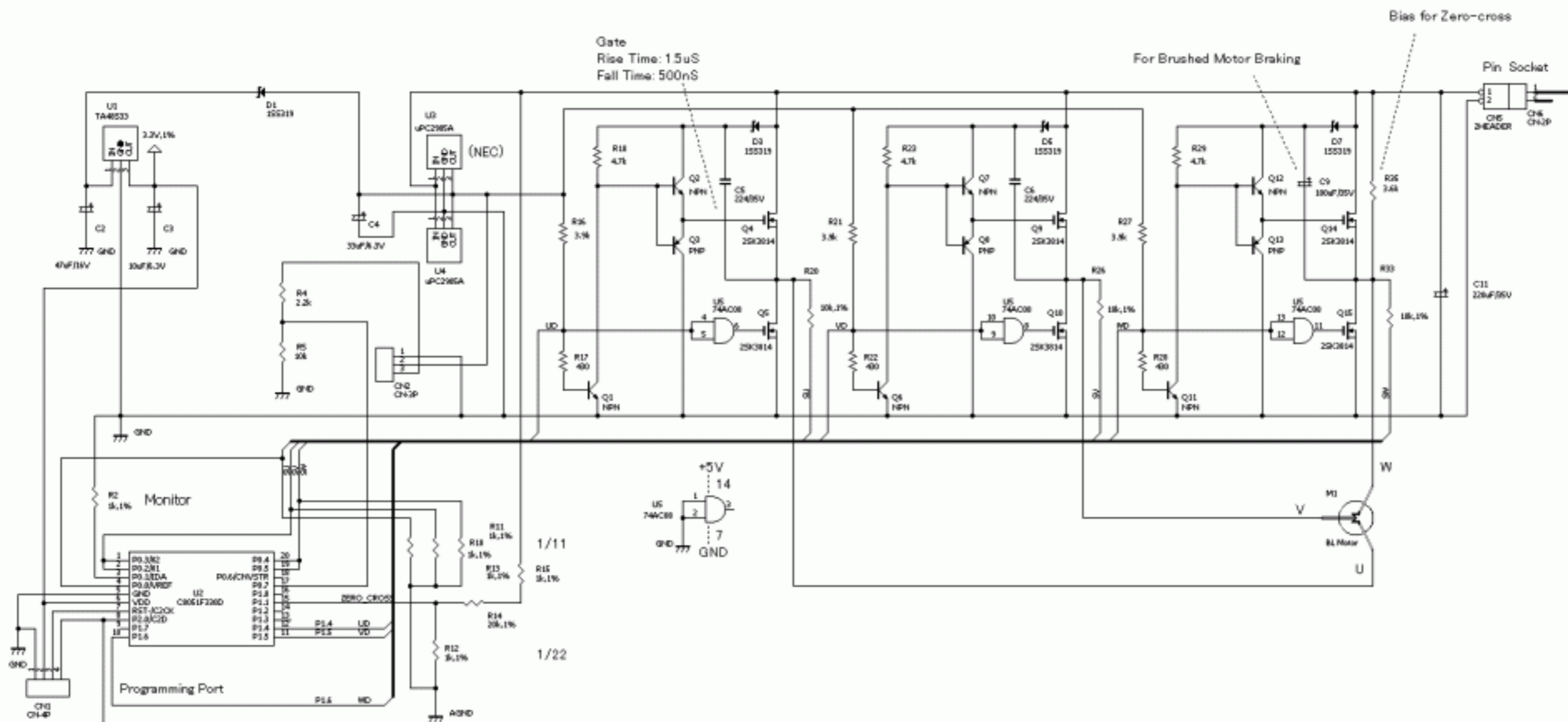
Date	Rev.	Designed by	Title	Page
'07/04/03	0.1	Takao Shimizu	Sensored Brushless Motor Driver Schematic 0	1/1



Date	Rev.	Designed by	Title	Page
'07/04/03	0.1	Takao Shimizu	Sensored Brushless Motor Driver Schematic	1/1

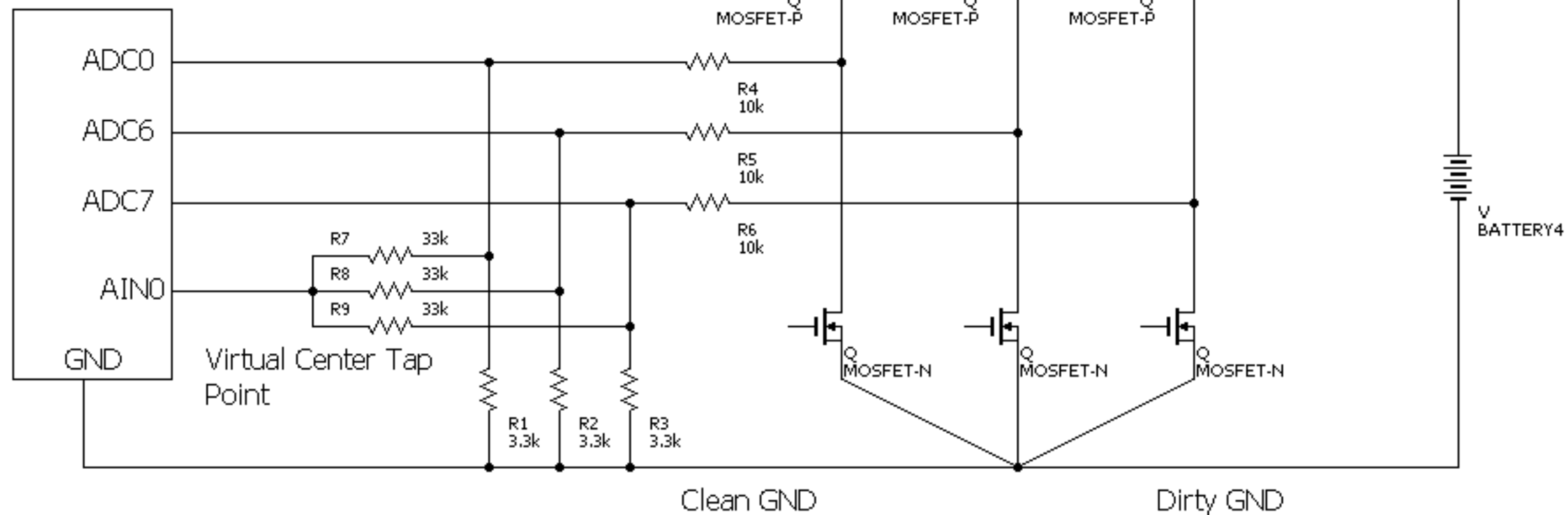


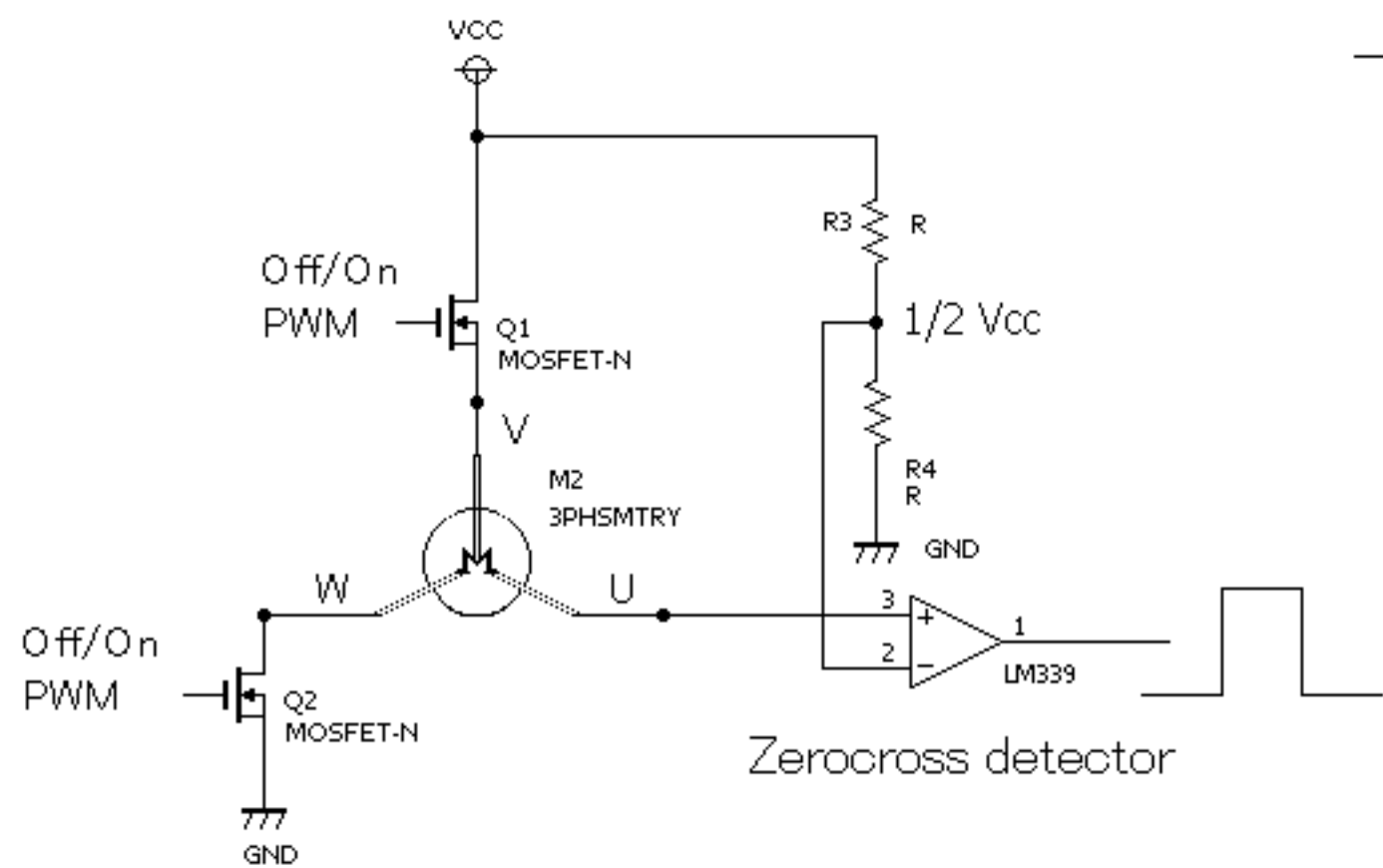
Date	Rev.	Designed by	Title	Page
'07/04/07	0.2	Takao Shimizu	Sensored Brushless Motor Driver Schematic with I2C interface	1/1



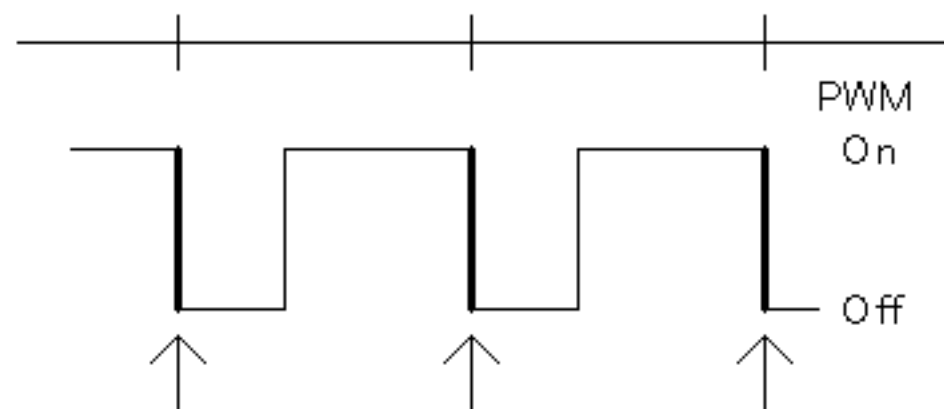
Date	Rev.	Designed by	Title	Page
07/12/25	0.1a	Takao Shimizu	Brushless Sensorless Electric Speed Controller Schematic	1/1

ATmega48

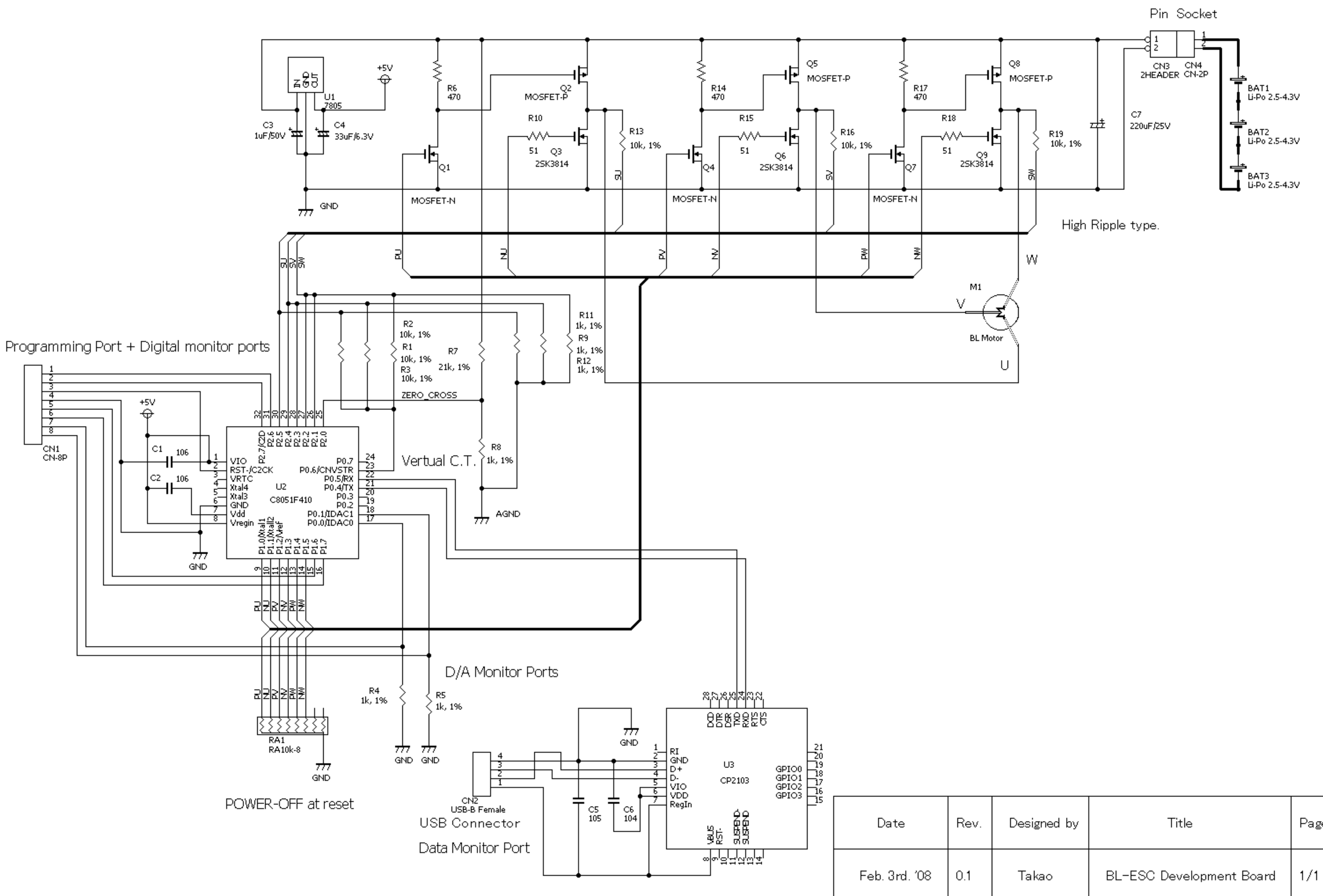




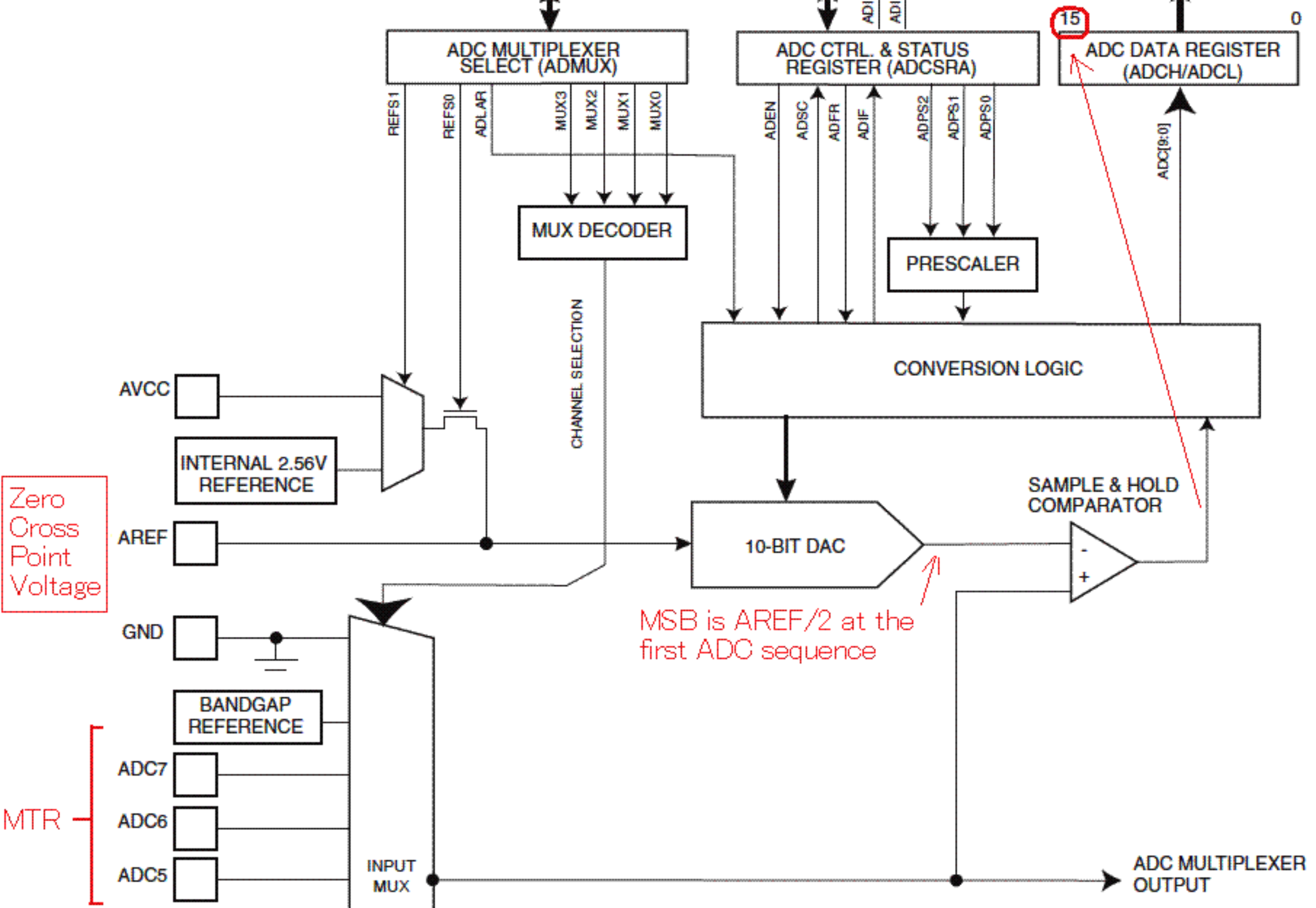
サンプリングタイミング

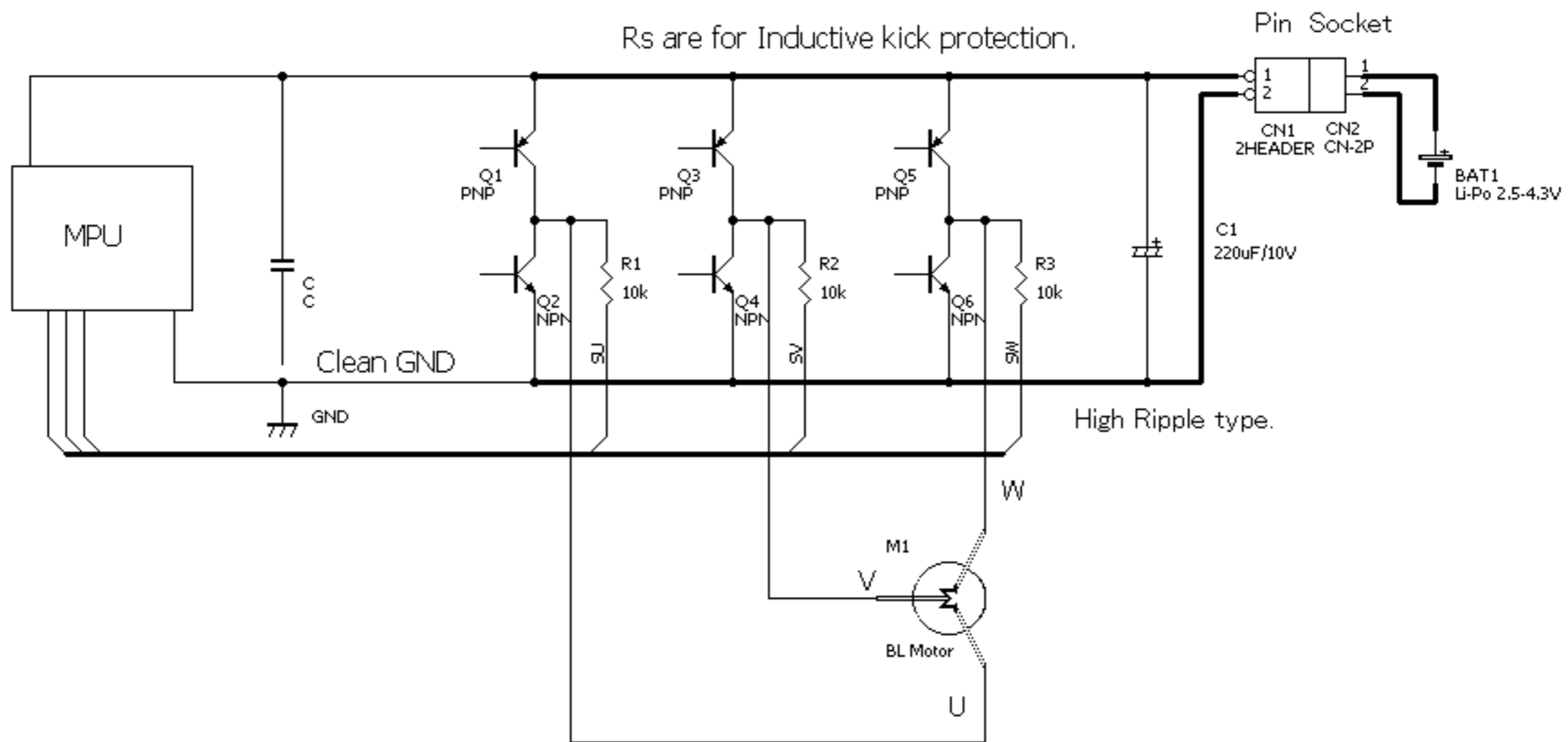


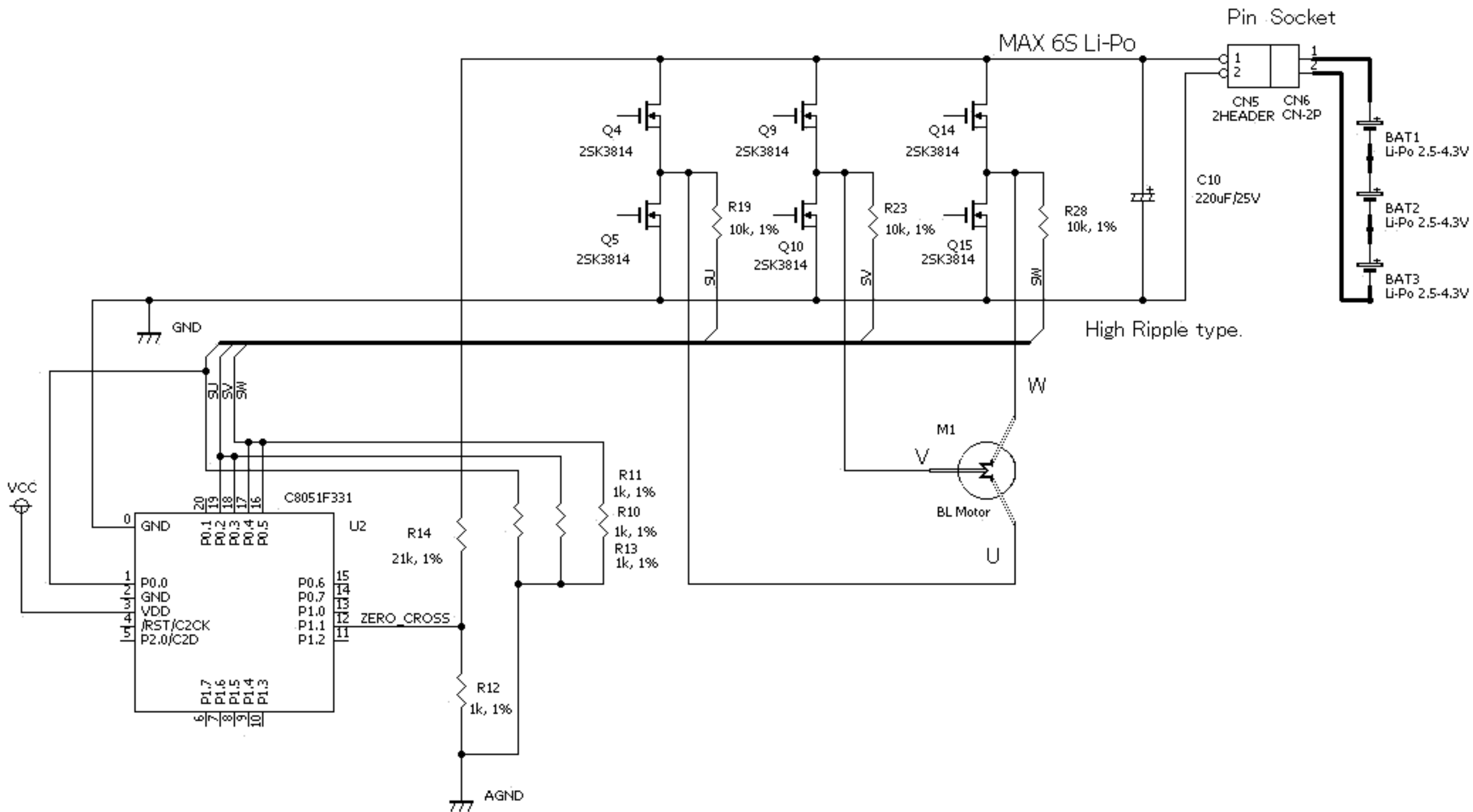
The Zero-cross detection timing is just before PWM off as PWM on rear edge. Also, "Full On" 100% power PWM rear edge timing. This timing does not cause any transient noise problem. And C8051Fxxx's comparator can be hysteresis level and response timing by software.



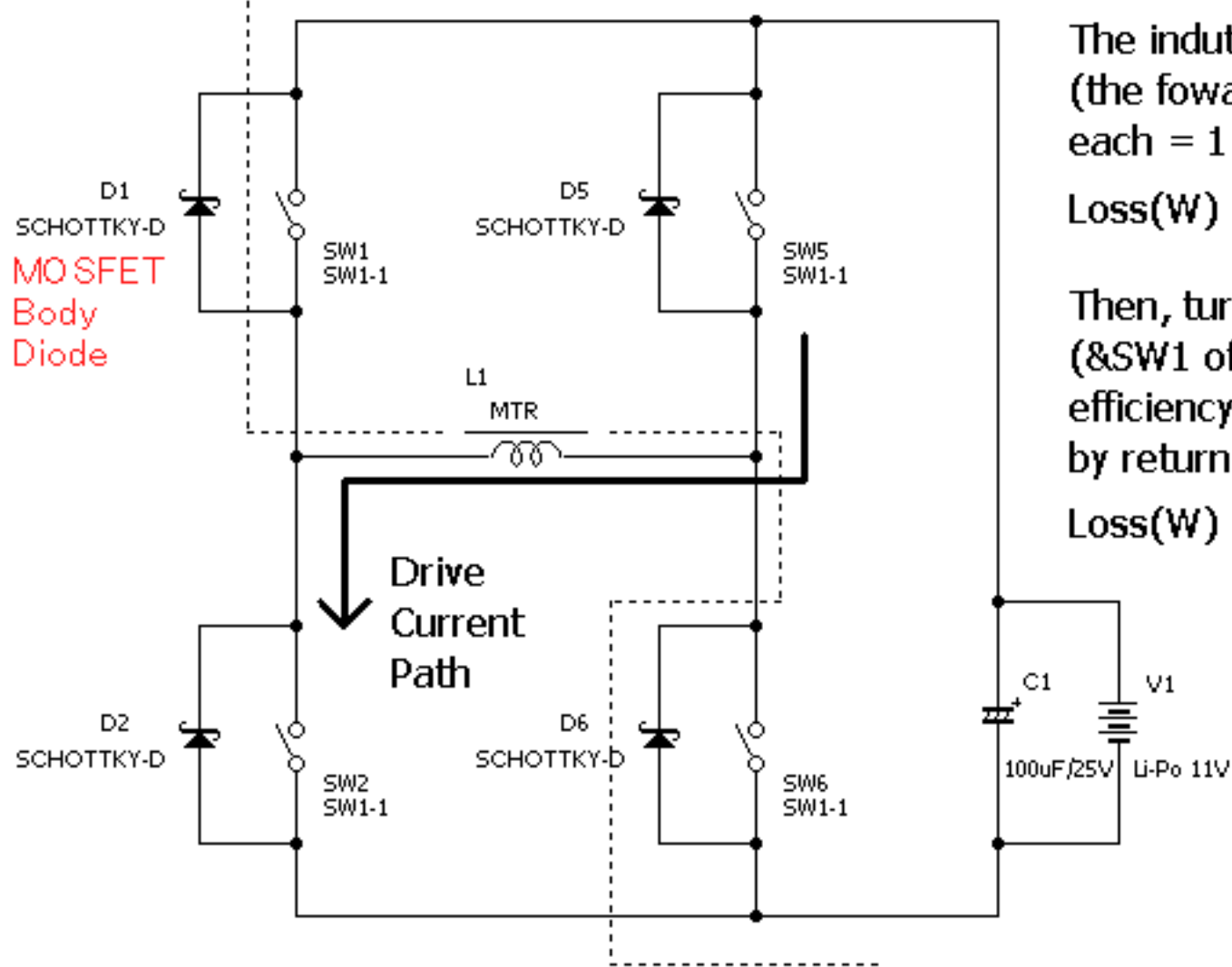
Date	Rev.	Designed by	Title	Page
Feb. 3rd. '08	0.1	Takao	BL-ESC Development Board	1/1







Inductive Kick Path (Charge up C1&V1)

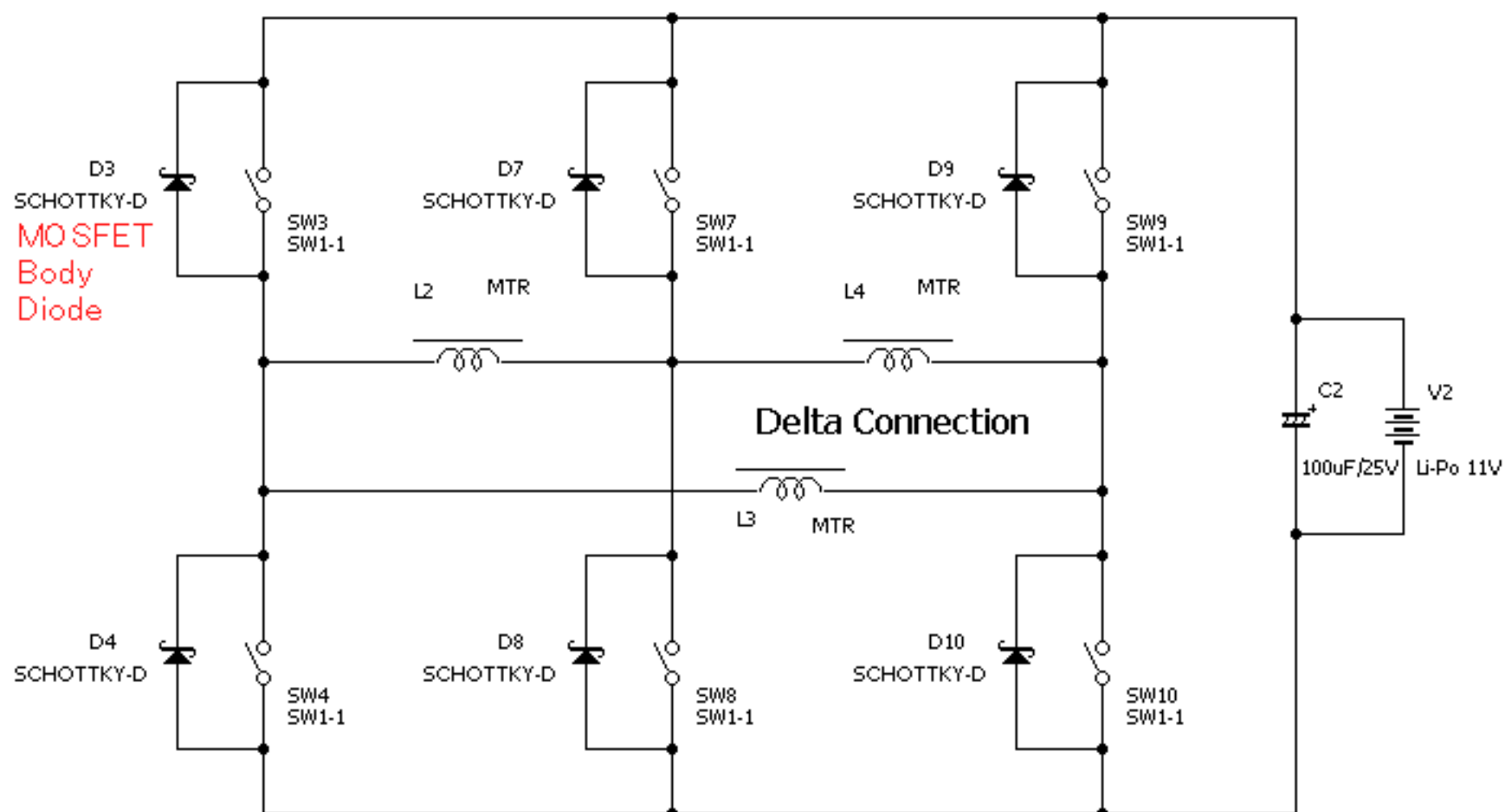


The inductive kick heats up D1&D6
(the forward voltage drop loss is about 0.6V each = 1.2V) just after SW2&SW5 PWM turn-off.

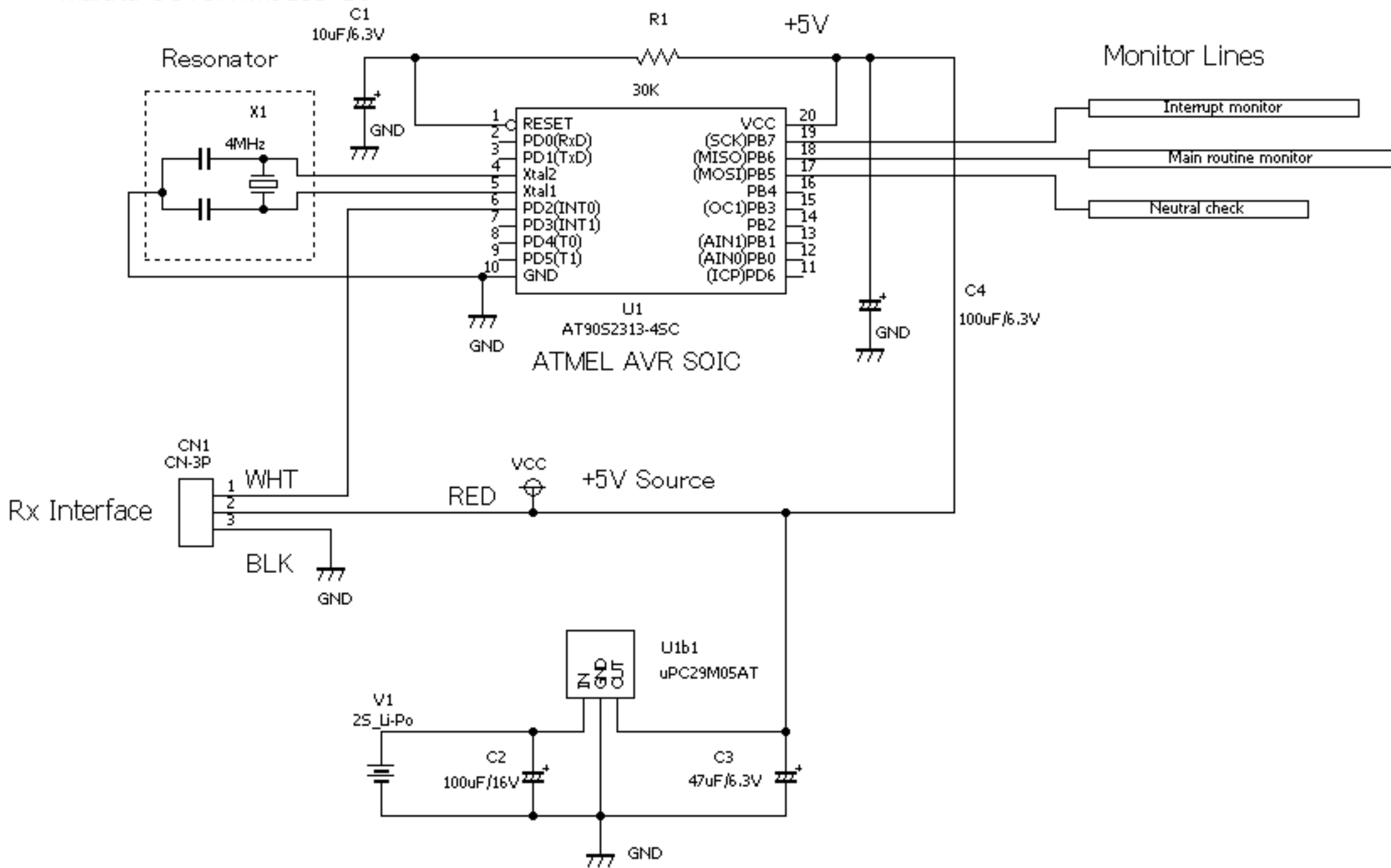
$$\text{Loss(W)} = 1.2\text{V} \times \text{Kick current}$$

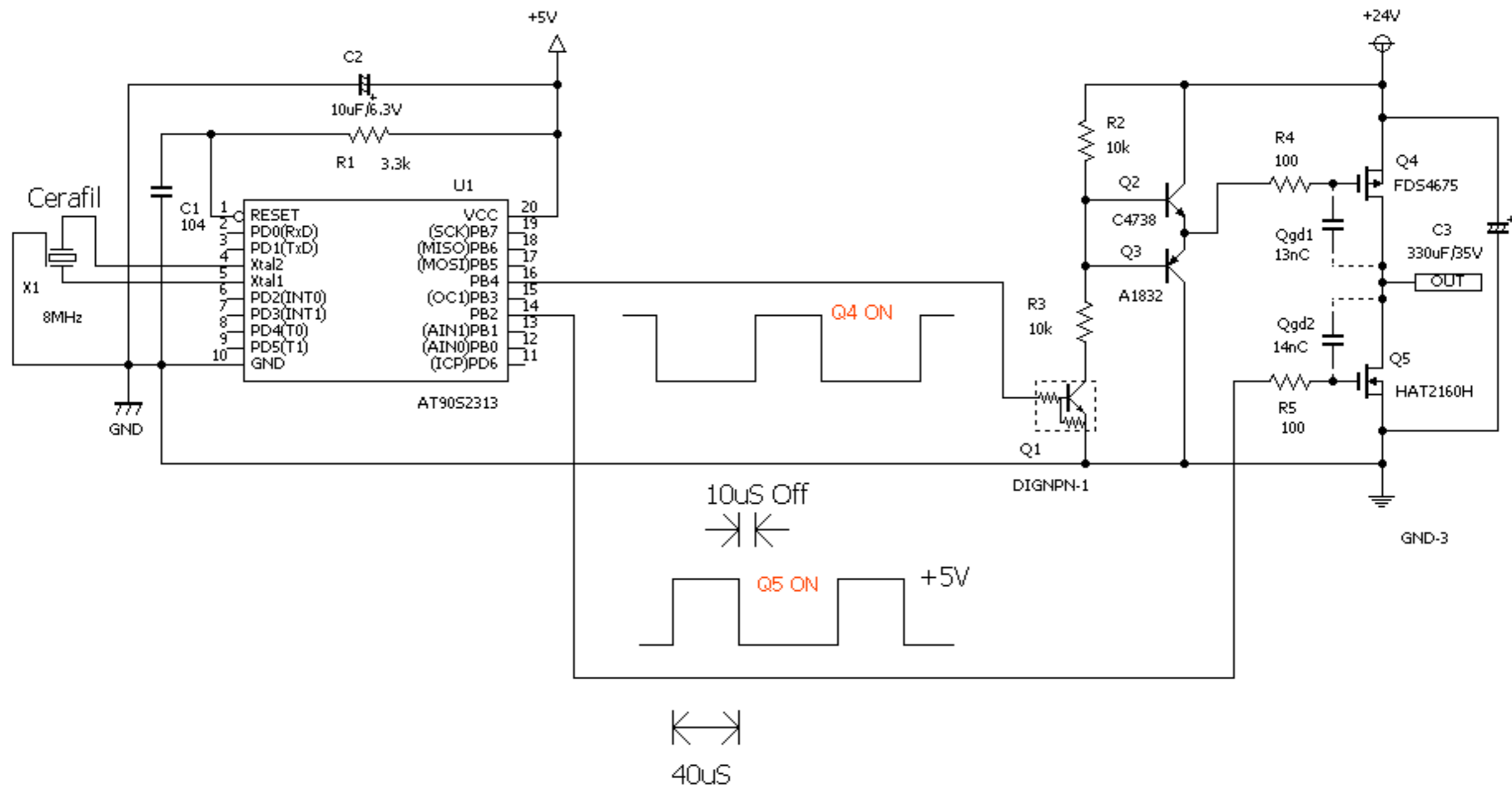
Then, turn-on SW1 on(& SW6 off) or SW6 on (&SW1 off) at PWM-off to get more power efficiency(only one diode voltage drop = 0.6V) by returning the inductive kick energy to C1&V1.

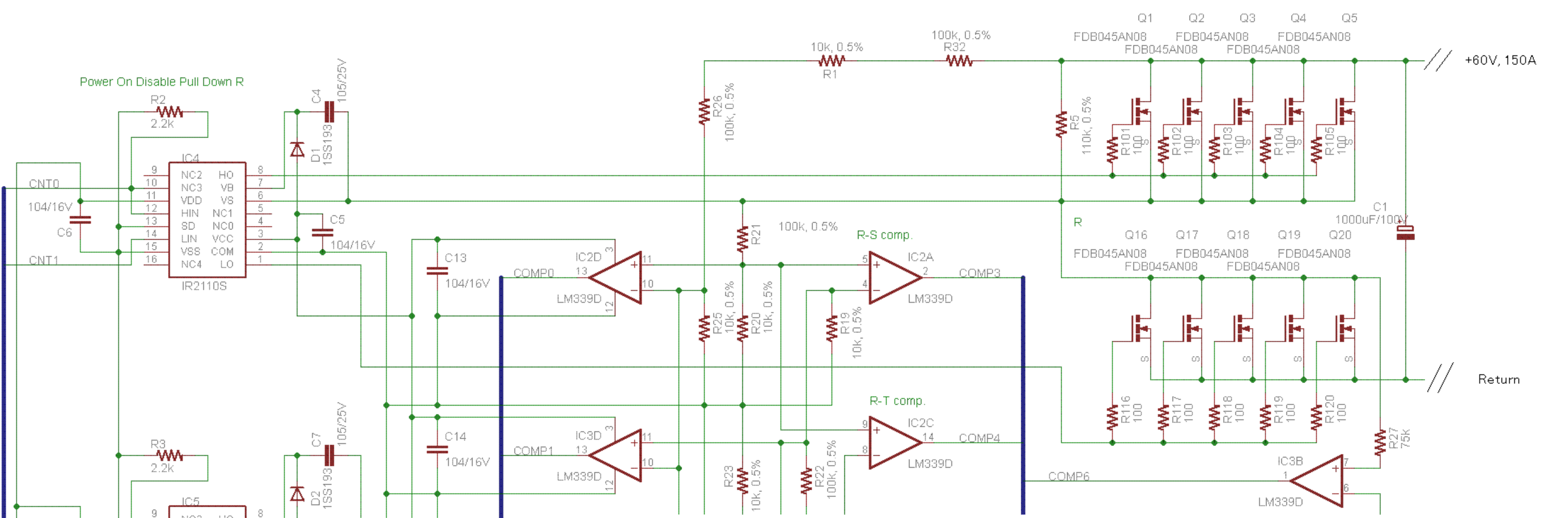
$$\text{Loss(W)} = 0.6\text{V} \times \text{Kick current}$$

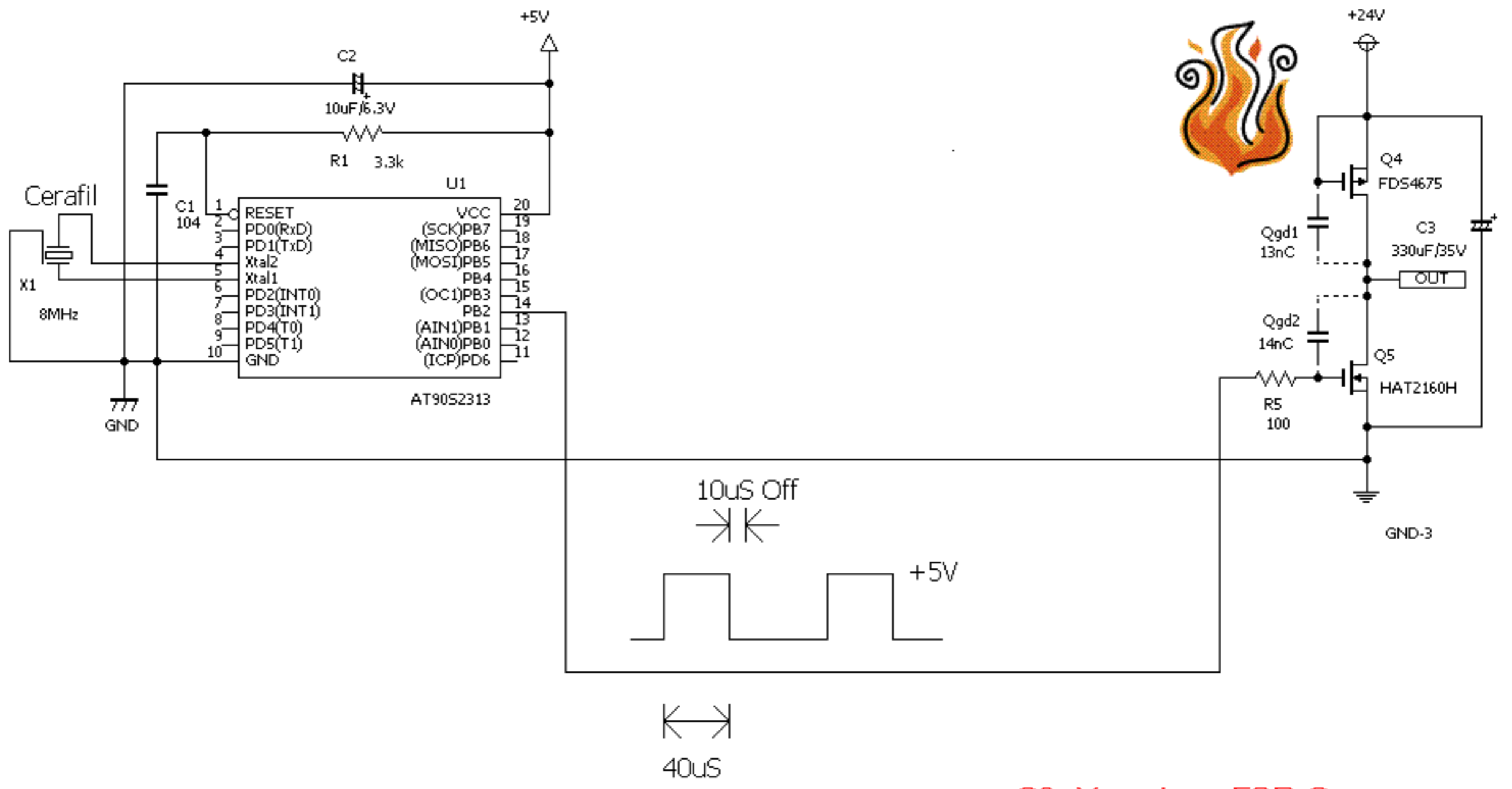


Murata CSTCR4M0G53-B0

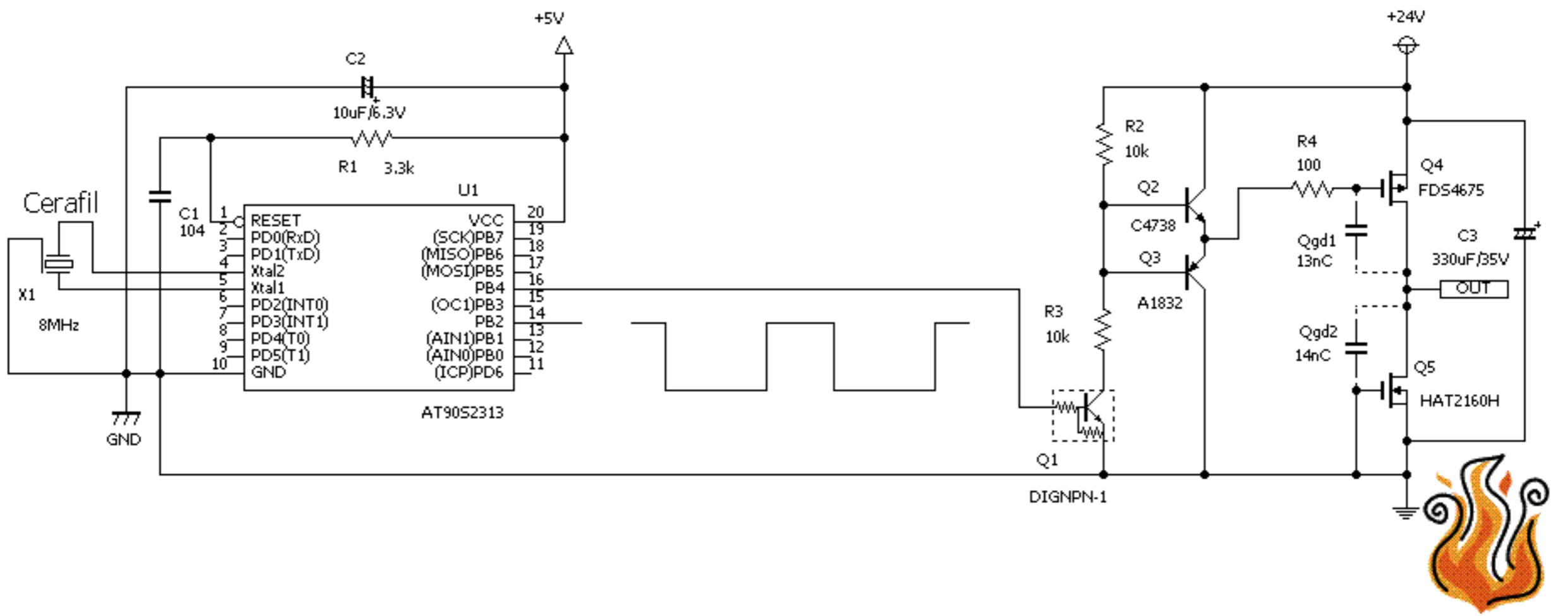




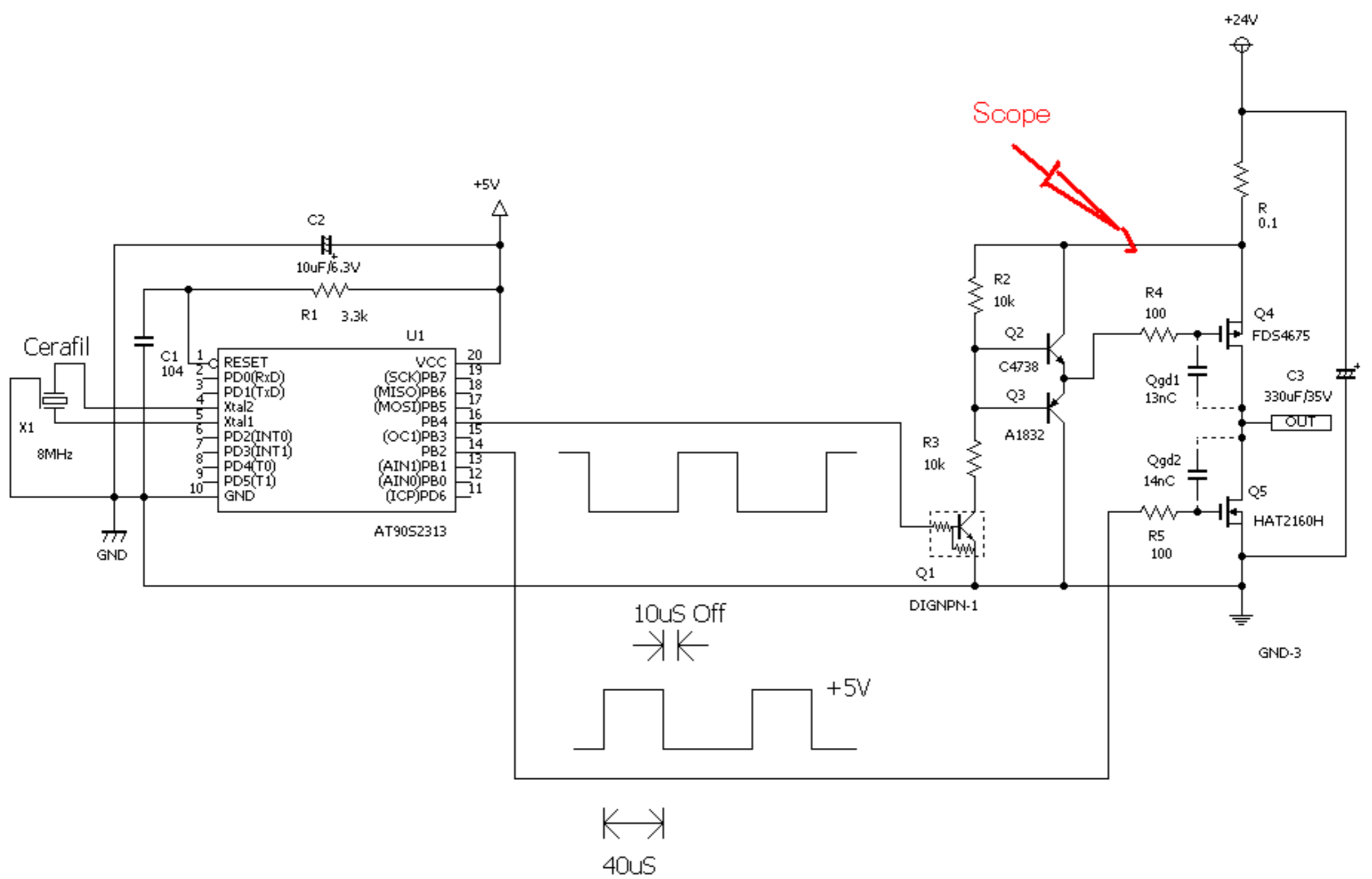


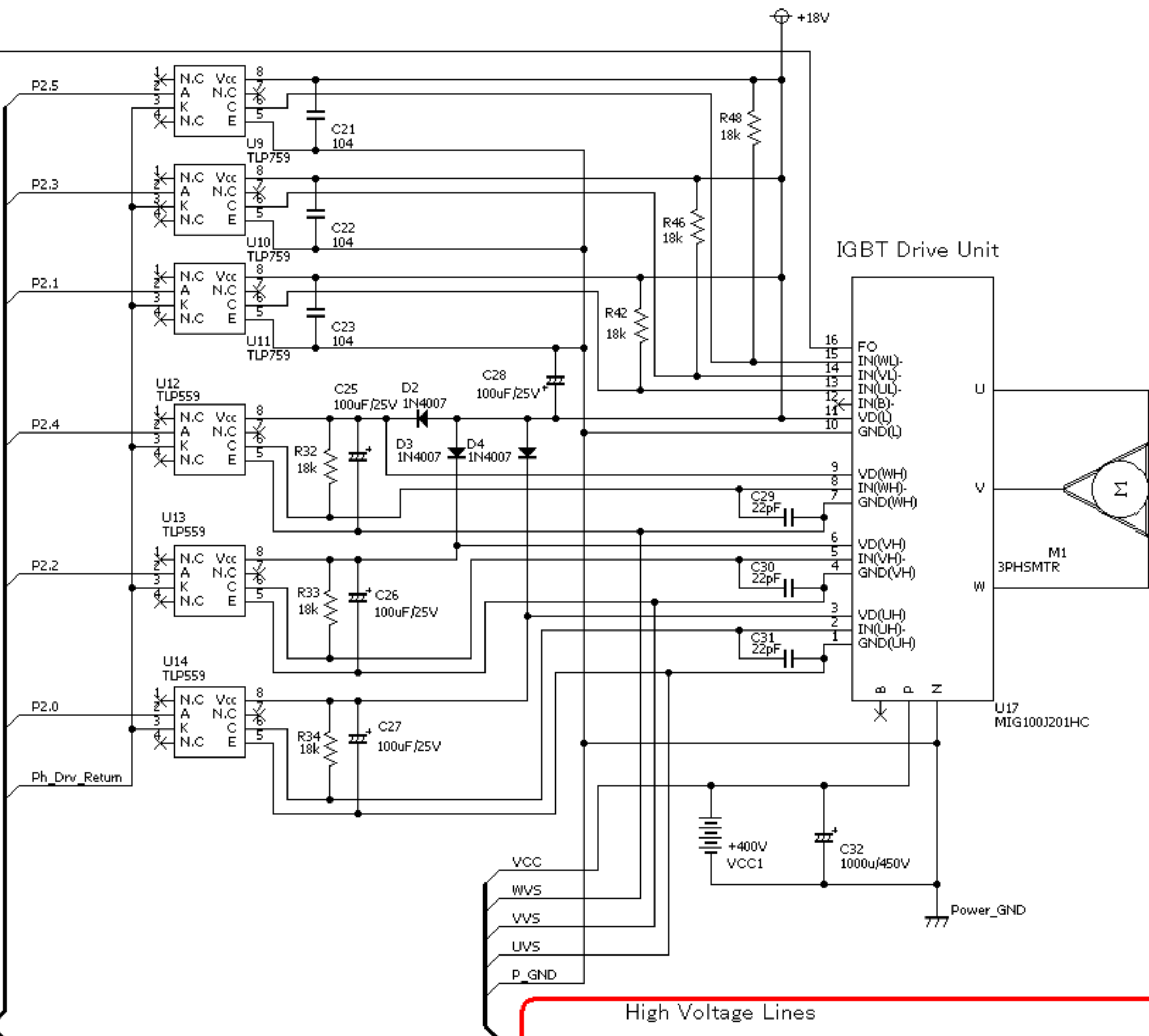


C3: Very Low ESR Cap.

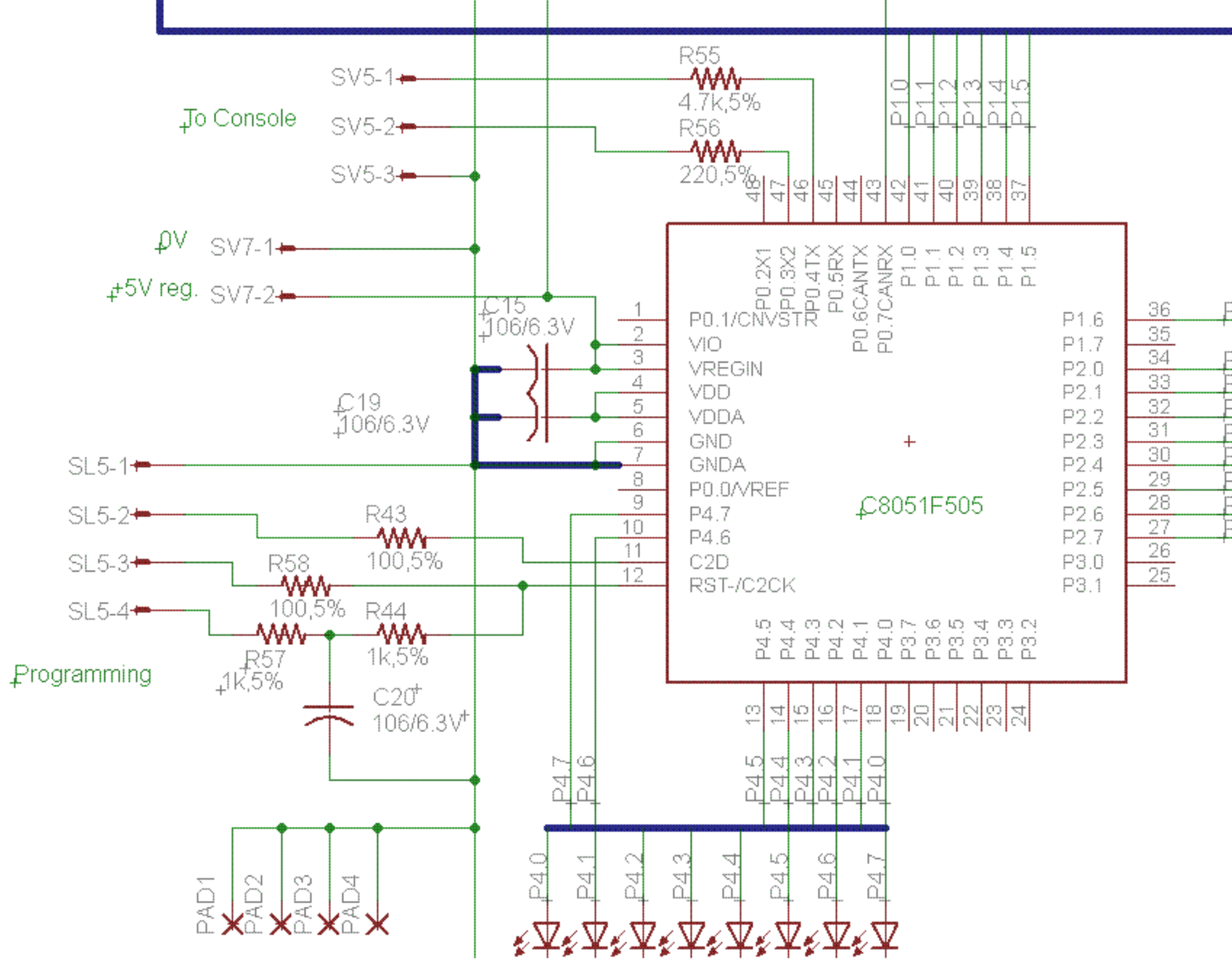


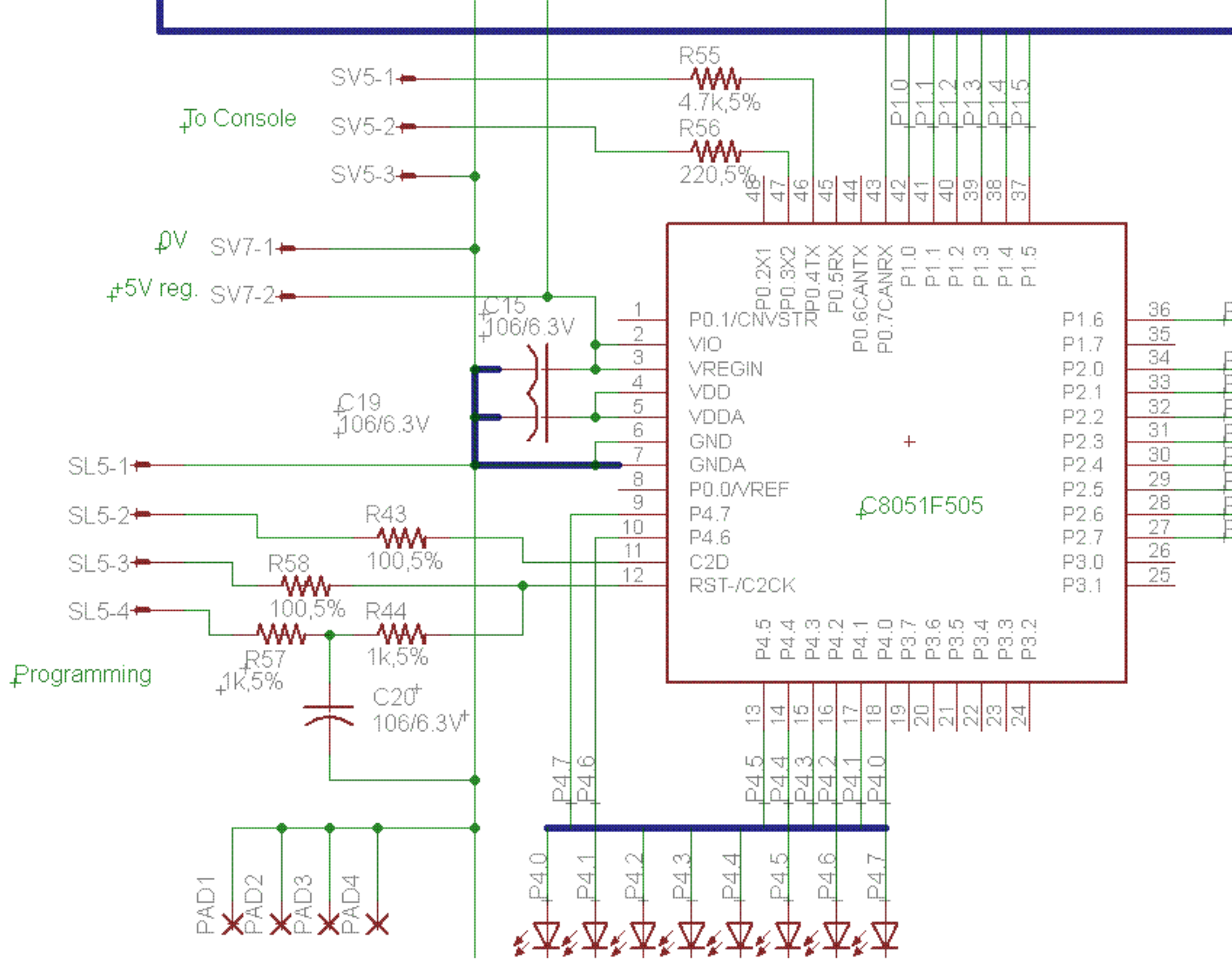
Scope

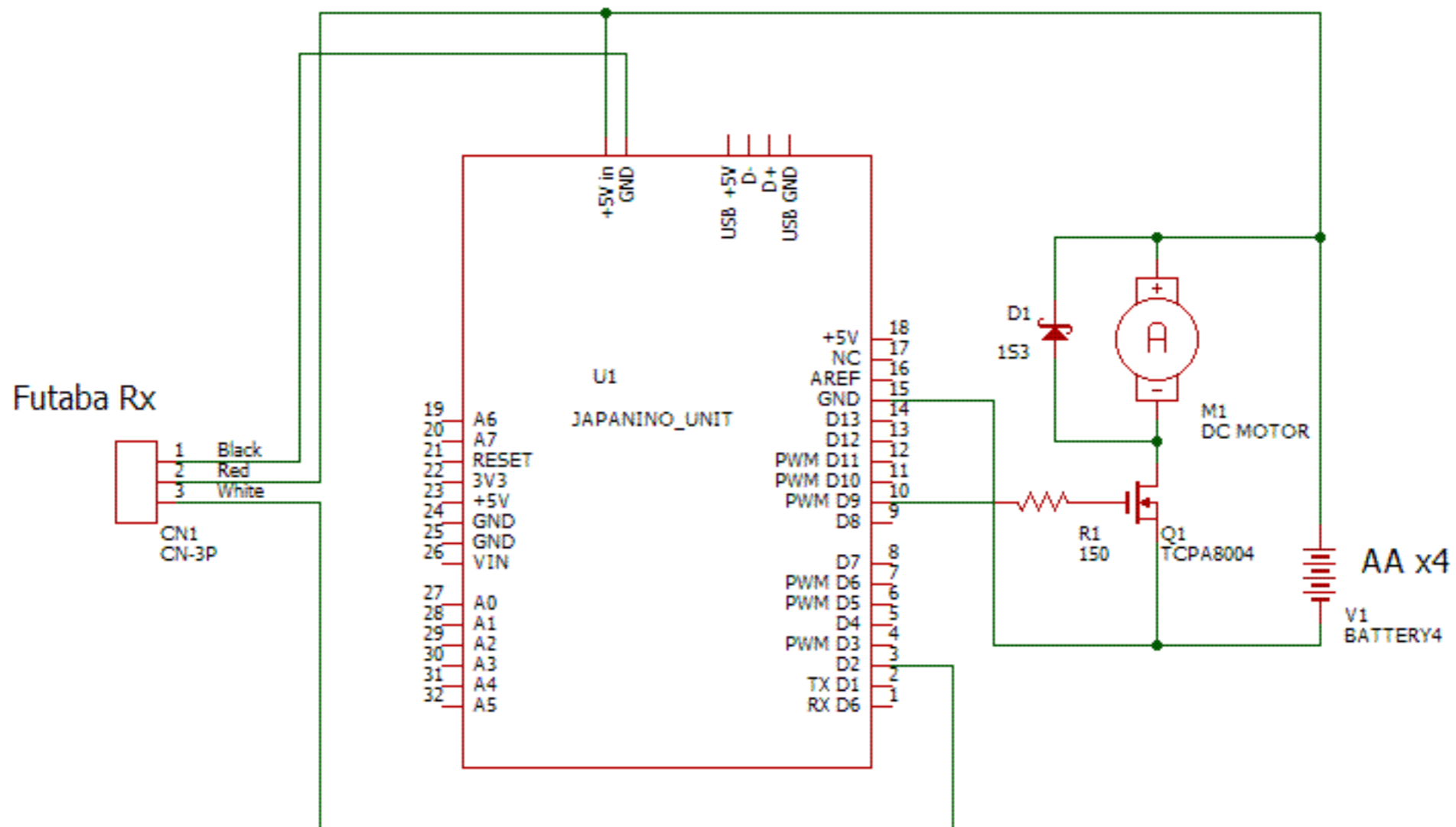




High Voltage Lines
Caution! the PCB isolation for BEMF sensing

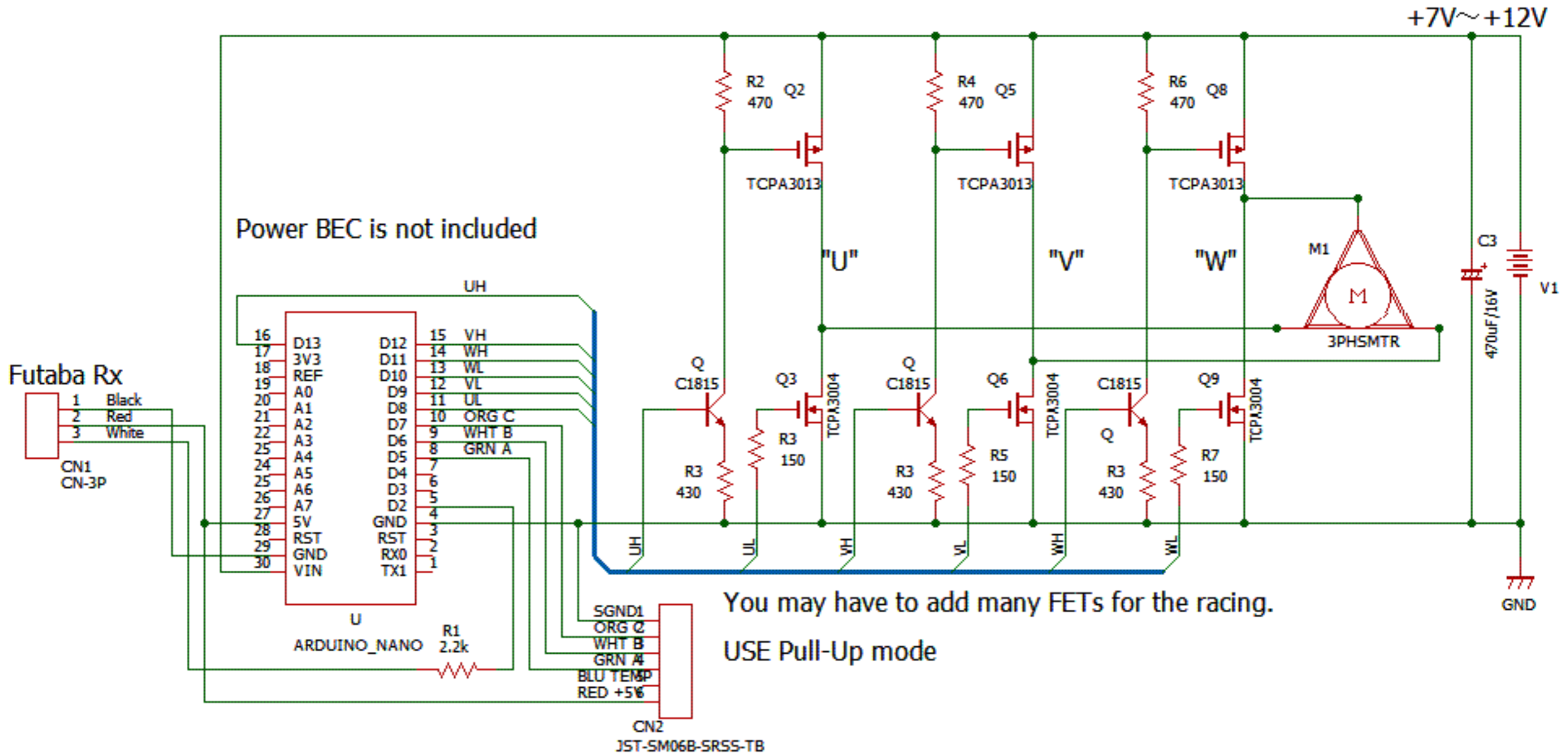






Ver.1.0

Designed	Date	Title	Page
大王怒	10/10/31	Japanino Speed Controller	1/1



<http://www.rcgroups.com/forums/attachment.php?attachmentid=1244043>
 But, the blue line is connected to +5V at Hobby king BL540ST.

Ver.1.0

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