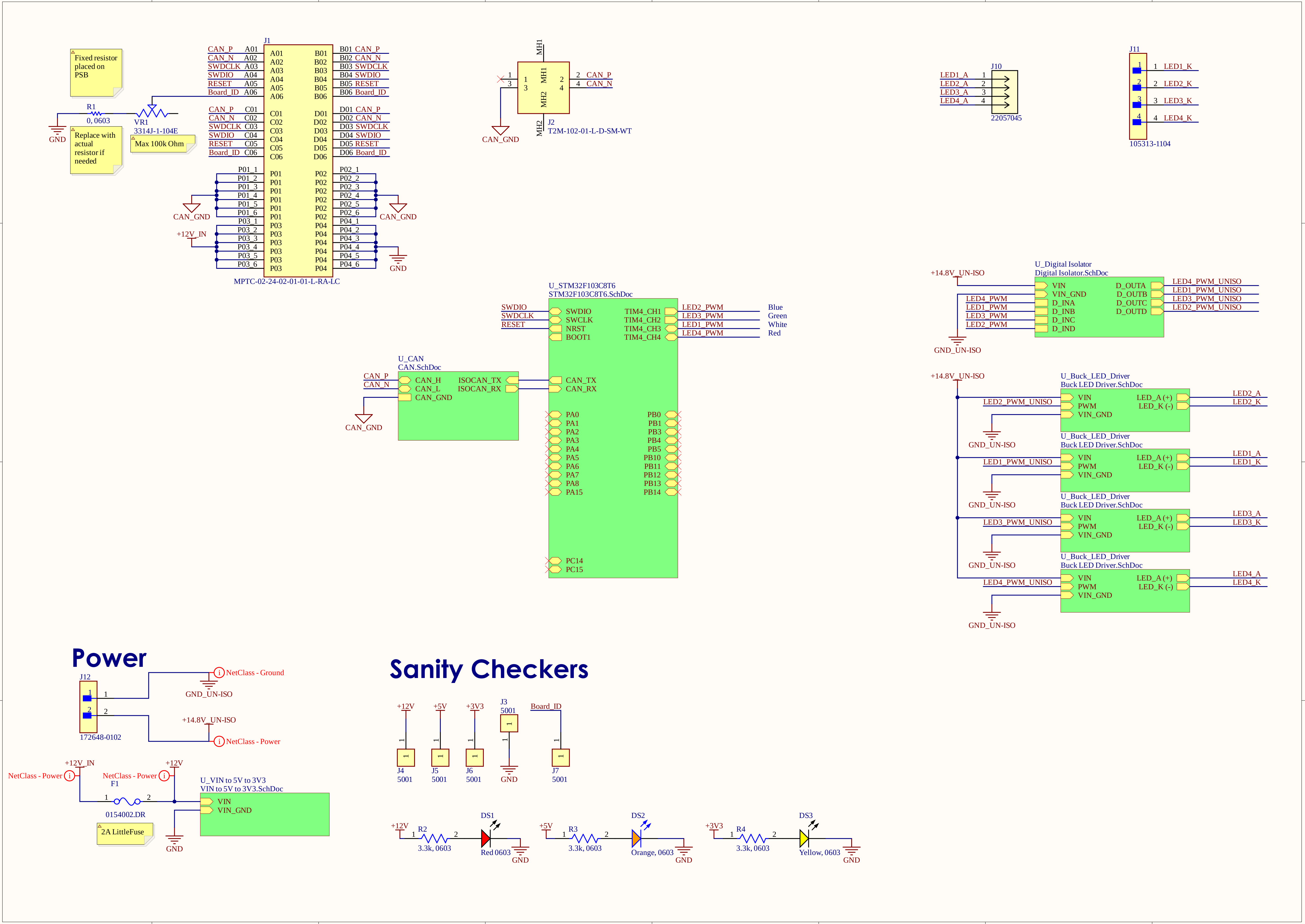
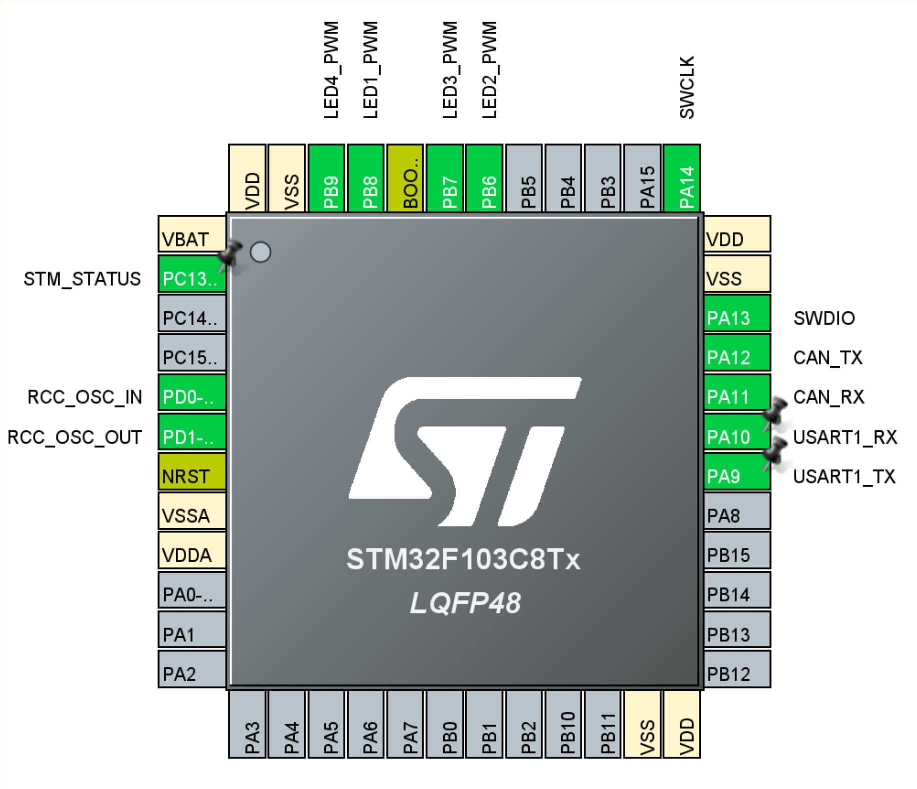
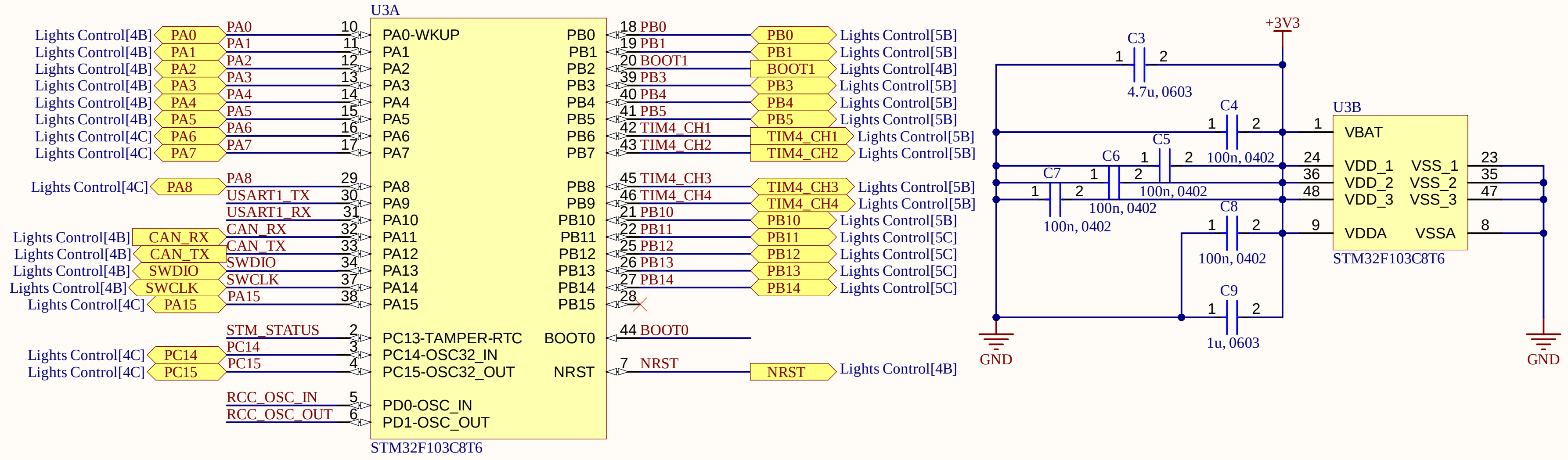


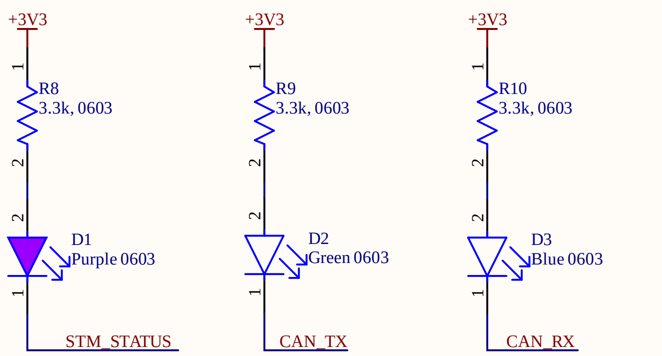
Fixed resistor placed on PSB
Replace with actual resistor if needed
R1
0, 0603
GND
VR1
3314J-1-104E
Max 100k Ohm
J1
MPTC-02-24-02-01-01-L-RA-LC
CAN_P
CAN_N
SWDCLK
SWDIO
RESET
Board_ID
CAN_GND
+12V_IN
GND
MH1
MH2
J2
T2M-102-01-L-D-SM-WT
J10
22057045
LED1_A
LED2_A
LED3_A
LED4_A
J11
105313-1104
LED1_K
LED2_K
LED3_K
LED4_K
U_STM32F103C8T6
STM32F103C8T6.SchDoc
SWDIO
SWCLK
NRST
BOOT1
TIM4_CH1
TIM4_CH2
TIM4_CH3
TIM4_CH4
LED2_PWM
LED3_PWM
LED1_PWM
LED4_PWM
Blue
Green
White
Red
CAN_TX
CAN_RX
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PA8
PA15
PB0
PB1
PB3
PB4
PB5
PB10
PB11
PB12
PB13
PB14
PC14
PC15
U_CAN
CAN.SchDoc
CAN_H
CAN_L
CAN_GND
ISOCAN_TX
ISOCAN_RX
U_Digital Isolator
Digital Isolator.SchDoc
+14.8V_UN-ISO
VIN
VIN_GND
D_INA
D_INB
D_INC
D_IND
D_OUTA
D_OUTB
D_OUTC
D_OUTD
LED4_PWM_UNISO
LED1_PWM_UNISO
LED3_PWM_UNISO
LED2_PWM_UNISO
GND_UN-ISO
U_Buck_LED_Driver
Buck LED Driver.SchDoc
VIN
PWM
VIN_GND
LED_A (+)
LED_K (-)
Power
J12
172648-0102
NetClass - Ground
NetClass - Power
+14.8V_UN-ISO
+12V_IN
+12V
F1
0154002.DR
2A LittleFuse
U_VIN to 5V to 3V3
VIN to 5V to 3V3.SchDoc
VIN
VIN_GND
Sanity Checkers
+12V
+5V
+3V3
J3
5001
Board_ID
J4
J5
J6
J7
5001
R2
R3
R4
3.3k, 0603
DS1
DS2
DS3
Red 0603
Orange, 0603
Yellow, 0603

MCU

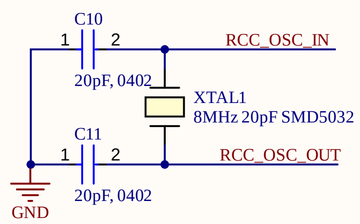




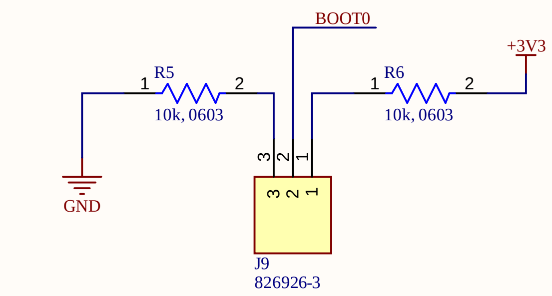
Indicator LEDs



Crystal

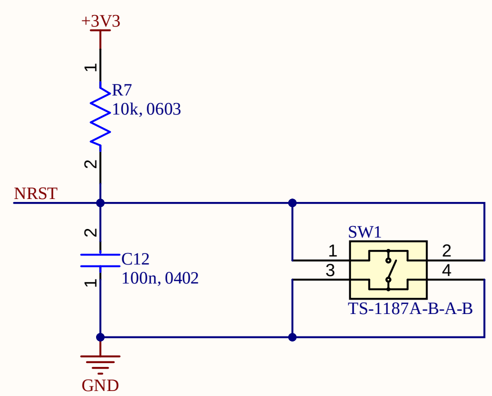


BOOT0 Header

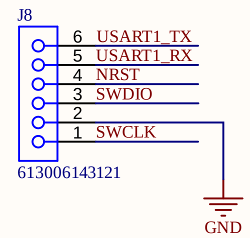


Leave at Floating for normal operation

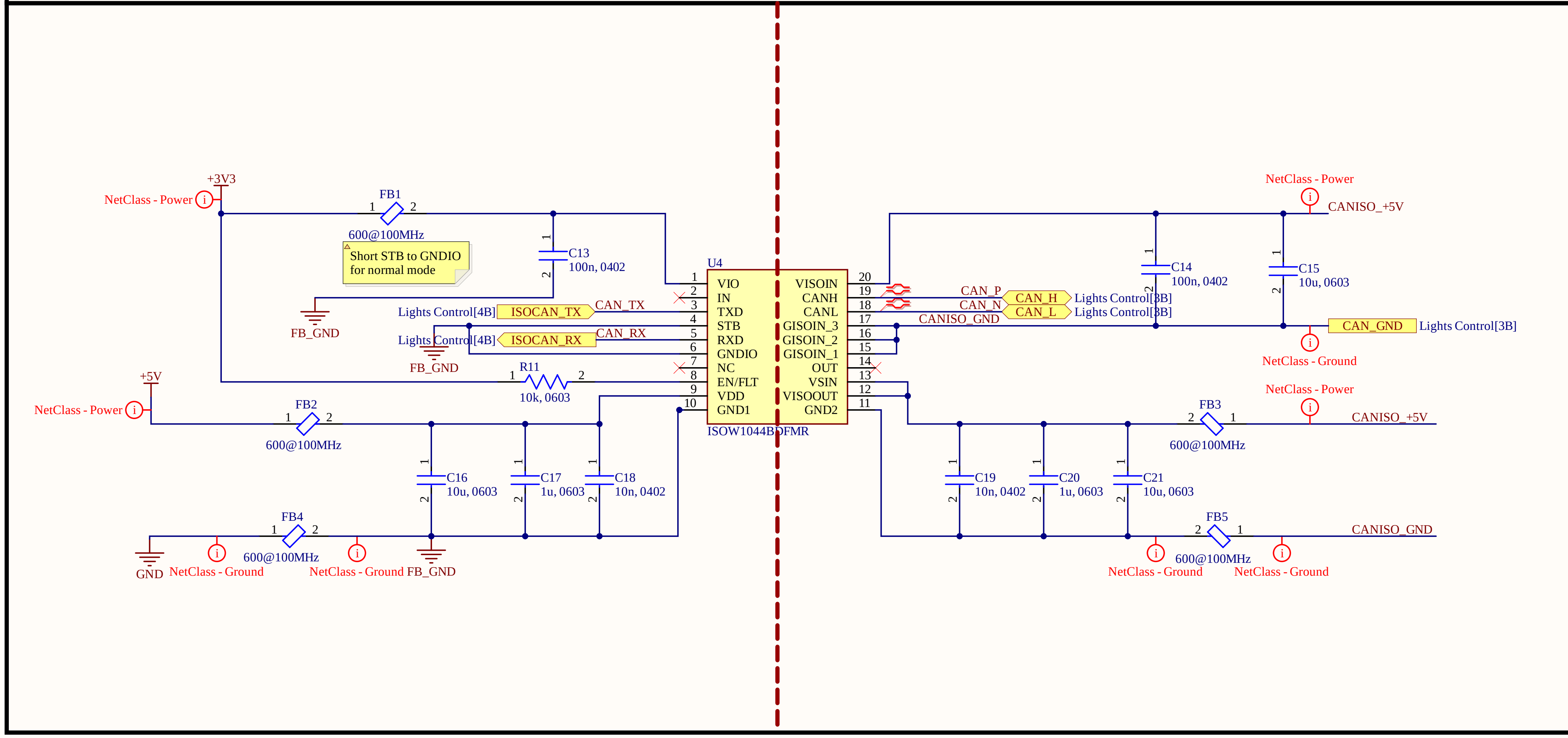
NRST Circuit



SWD Header

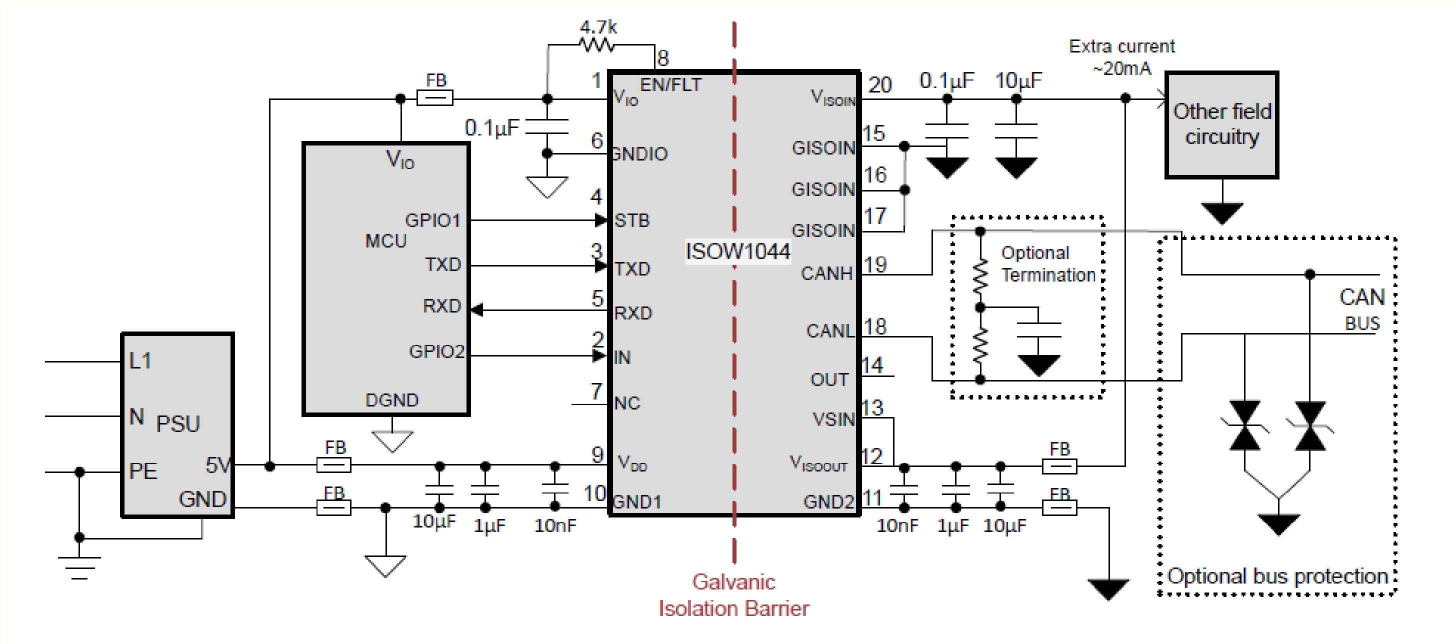


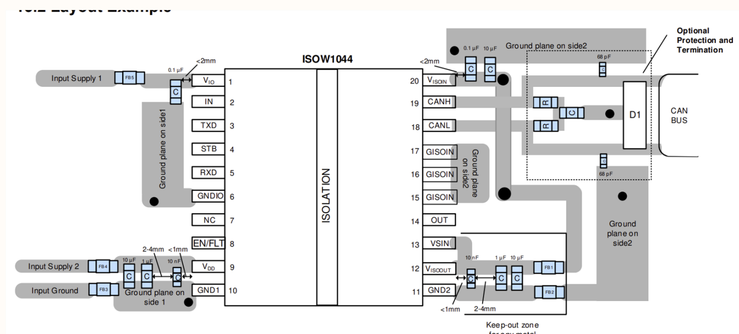
CAN Transceiver + DCDC Isolator



Test Points

Termination





13 Layout

13.1 Layout Guidelines

Figure 11-1 shows the recommended placement and routing of device bypass capacitors. Below guidelines must be followed to achieve low emissions design:

1. High frequency bypass capacitors 10 nF must be placed close to V_{DD} and V_{ISOOUT} pins, within 1 mm distance away from device pins. This is very essential for optimised radiated emissions performance. Ensure that these capacitors are 0402 size so that they offer least inductance (ESL).
2. Bulk capacitors of atleast 10 µF must be placed on power converter input (V_{DD}) and output (V_{ISOOUT}) supply pins after the 10 nF capacitor with a distance of 2 - 4 mm, as shown in Layout Example.
3. Traces on V_{DD} and GND1 must be symmetric till bypass capacitors. Similarly traces on V_{ISOOUT} and GND2 must be symmetric.
4. Place two 0402 size Ferrite beads (Part number: BLM15EX331SN1) on power supply pins, one between V_{ISOOUT} and V_{ISOIN} and the other between GND2 (pin 11) and GND2(pin 15), as shown in example PCB layout, so that any high frequency noise from power converter output sees a high impedance before it goes to other components on PCB.
5. Do not have any metal traces or ground pour within 4 mm of power converter output terminals V_{ISOOUT} (pin12) and GND2 (pin11).
6. Place the CAN BUS protection and filtering circuitry close to the bus connector to prevent transients, ESD, and noise from propagating onto the board. This layout example shows an optional transient voltage suppression (TVS) diode, D1, which may be implemented if the system-level requirements exceed the specified rating of the transceiver. This example also shows two optional 68pF bus filter capacitors
7. Common mode choke or ferrite beads on bus terminals (CANH/CANL) can minimise any high frequency noise that can couple of CAN bus cable which can act as antenna and amplify that noise. This will improve Radiated emissions performance on a system level.
8. Following the layout guidelines of EVM as much as possible is highly recommended for a low radiated emissions design. EVM Link is available in Related Documentation.

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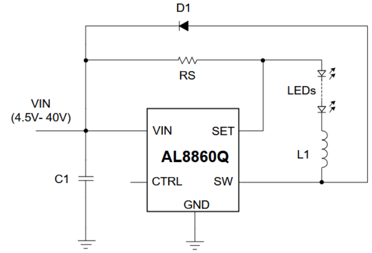


DC Power Source Input Buck Application

Pin Descriptions

Pin Number	Pin Name	Function
1	SET	Connect resistor R_S from this pin to VIN to define nominal average output current: $I_{OUT\_NOM} = 0.1/R_S$
2, 3	GND	Ground
4	CTRL	Multi-function On/Off and brightness control pin: • Leave floating for normal operation. • Drive voltage below 0.2V to turn off output current. • Drive with DC voltage ($0.3V < V_{CTRL} < 2.5V$) to adjust output current from 0 to 100% of I_{OUT_NOM}. Linear adjustment ranges from 5% to 100% of I_{OUTNOM} • Drive with PWM signal from open-collector or open-drain transistor to adjust output current. Linear adjustment ranges from 1% to 100% of I_{OUT_NOM} for f < 500Hz • Connect a capacitor from this pin to ground to increase soft-start time. (Default soft-start time = 0.1ms. Additional soft-start time is approximately 1.5ms/1nF)
5, 6	SW	Drain of NDMOS switch.
7	N/C	No Connection.
8	VIN	Input voltage (4.5V to 40V). Decouple to ground with 10μF or higher X7R ceramic capacitor close to device.
EP	EP	Exposed pad. Connect to GND and thermal mass for enhanced thermal impedance. Should not be used as electrical ground conduction path.

LED Current Configuration

The nominal average output current in the LED(s) is determined by the value of the external current sense resistor (R_S) connected between VIN and SET and is given by:

$$I_{OUT(NOM)} = \frac{0.1}{R_S}$$

The table below gives values of nominal average output current for several preferred values of current setting resistor (R_S) in the typical application circuit shown on page 2.

R_S (Ω)	Nominal Average Output Current (mA)
0.066	1500
0.1	1000
0.13	760
0.15	667
0.3	333

Inductor Selection

Recommended inductor value for the AL8860 are in the range 33μH to 100μH. Higher inductance are recommended at higher supply voltages in order to minimize output current tolerance due to switching delays, which will result in increased ripple and lower efficiency. Higher inductance also results in a better line regulation. The inductor should be mounted as close to the device as possible with low resistance connections to SW pins.

The chosen coil should have saturation current higher than the peak output current and a continuous current rating above the required mean output current.

The inductor value should be chosen to maintain operating duty cycle and switch 'on'/'off' times within the specified limits over the supply voltage and load current range. The following equations can be used as a guide.

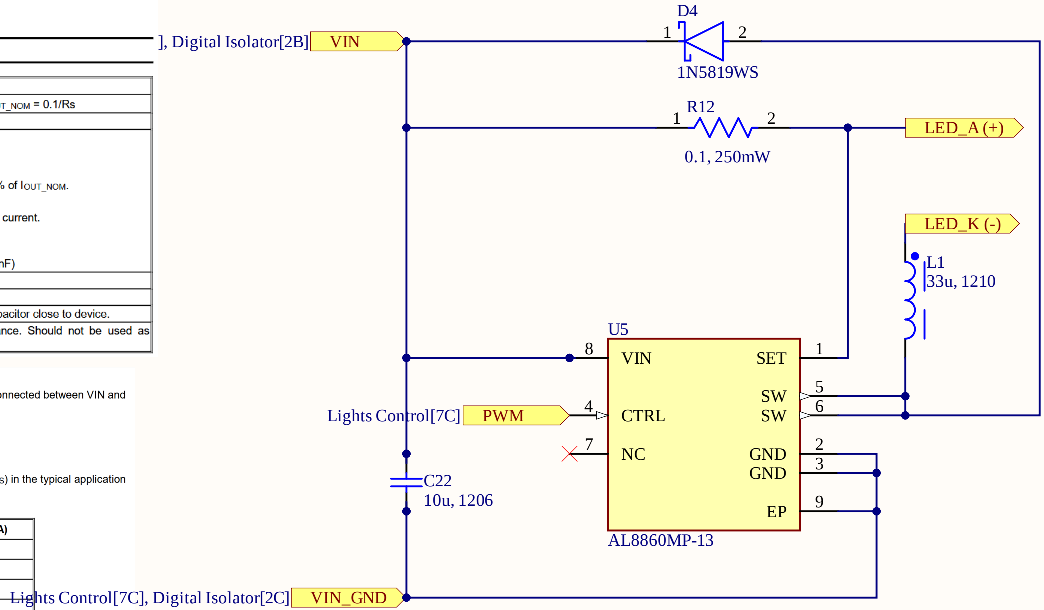
SW Switch 'On' time

$$t_{ON} = \frac{L\Delta I}{V_{IN} - V_{LED} - I_{LED}(R_S + R_L + R_{sw})}$$

SW Switch 'Off' time

$$t_{OFF} = \frac{L\Delta I}{V_{LED} + V_D + I_{LED}(R_S + R_L)}$$

Where: L is the coil inductance; R_L is the coil resistance; R_S is the current sense resistance; I_{LED} is the required LED current; ΔI is the coil peak-peak ripple current (Internally set to 0.40 x I_{LED}); V_{IN} is the supply voltage; V_{LED} is the total LED forward voltage; R_{SW} is the switch resistance (0.3Ω nominal); V_D is the diode forward voltage at the required load current.



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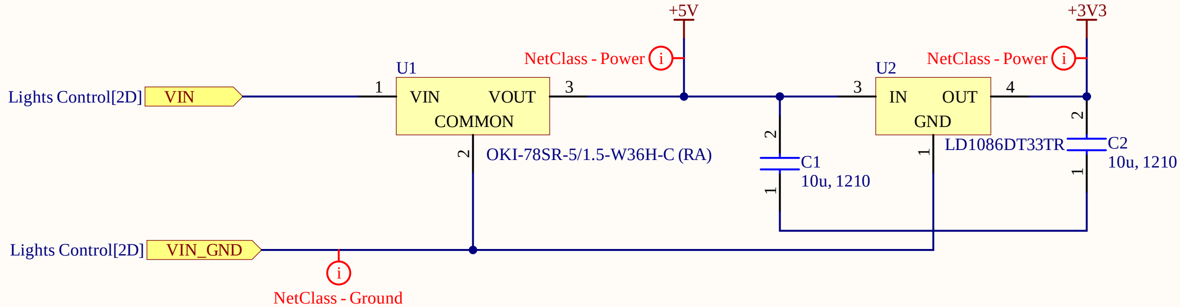

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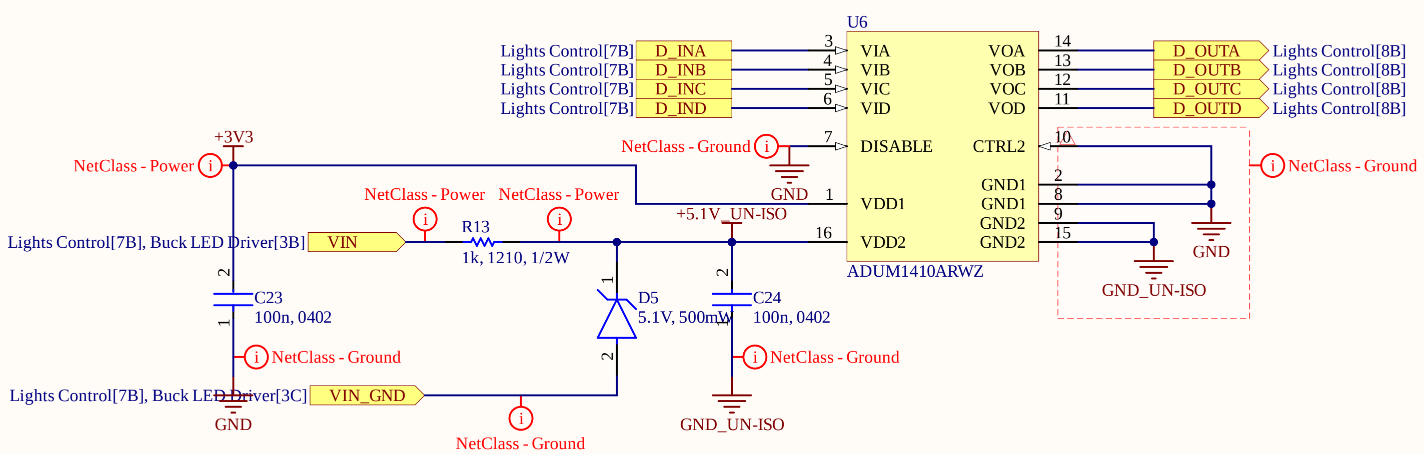

Type	Marking	Zener Voltage Range (1)				Dynamic Impedance	Reverse Current	
		V_{ZT} (at I_{ZT})			I_{ZT}	Z_{ZT} (at I_{ZT})	I_R	at V_R
		Min (V)	Nom (V)	Max (V)	(mA)	Max (Ω)	Max (μA)	(V)
BZT52C2V0	WY	1.8	2.0	2.15	5	100	120	0.5
BZT52C2V2	WZ	2.08	2.2	2.33	5	100	120	0.7
BZT52C2V4	WX	2.28	2.4	2.56	5	100	120	1
BZT52C2V7	W1	2.5	2.7	2.9	5	110	120	1
BZT52C3V0	W2	2.8	3.0	3.2	5	120	50	1
BZT52C3V3	W3	3.1	3.3	3.5	5	130	20	1
BZT52C3V6	W4	3.4	3.6	3.8	5	130	10	1
BZT52C3V9	W5	3.7	3.9	4.1	5	130	5	1
BZT52C4V3	W6	4	4.3	4.6	5	130	5	1
BZT52C4V7	W7	4.4	4.7	5	5	130	2	1
BZT52C5V1	W8	4.8	5.1	5.4	5	130	2	1.5

https://www.lcsc.com/datasheet/lcsc_datasheet_2407261727_MDD-Microdiode-Semiconductor-BZT52C5V1_C173407.pdf

ADuM1410, Total Supply Current, Four Channels[1]					
DC to 2 Mbps					
V_{DD1} Supply Current	$I_{DD1\ (Q)}$				
5 V/3 V Operation		2.4	3.2	mA	DC to 1 MHz logic signal frequency
3 V/5 V Operation		1.2	1.6	mA	DC to 1 MHz logic signal frequency
V_{DD2} Supply Current	$I_{DD2\ (Q)}$				
5 V/3 V Operation		0.8	1.0	mA	DC to 1 MHz logic signal frequency
3 V/5 V Operation		1.2	1.6	mA	DC to 1 MHz logic signal frequency

https://www.lcsc.com/datasheet/lcsc_datasheet_1811011923_Analog-Devices-ADUM1410ARWZ-RL_C19052.pdf

Reference: https://electronicsreference.com/analog/zener_diode_regulator/

For digital isolator power supply,

Using 500mW 5.1V zener diode,
Imax = Pmax / Vz
= 500mW / 5.1V
= 98.03mA

Vbatt, nominal is 14.8V, no load
Rmin = (Vin - Vz) / Imax
= (14.8V - 5.1V) / 68.6mA
= 0.10kOhm

Rmax = (Vin - Vz) / Izt
= (14.8V - 5.1V) / (5mA)
= 1.94kOhm

With load,
Imin = Izt + ILoad
= 5mA + 1.6mA
= 6.6mA

Rmax = (Vin - Vz) / Imin
= 14.8V - 5.1V / 6.6mA
= 1.46kOhm

Rmax = 1.46kOhm < R < Rmin = 0.10kOhm

Chosen R = 1kOhm, verify

Imax, 1k = (Vin, max - Vz) / Rchosen
= (16.8 - 5.1) / 1kOhm
= 11.7mA > Imin

Imin, 1k = (Vin, min - Vz) / Rchosen
= (14.8 - 5.1) / 1kOhm
= 9.7mA > Imin

Calculate max power dissipation across resistor:
Pmax = I^2R
= 11.7mA^2 x 1kOhm
= 136.89mA

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