

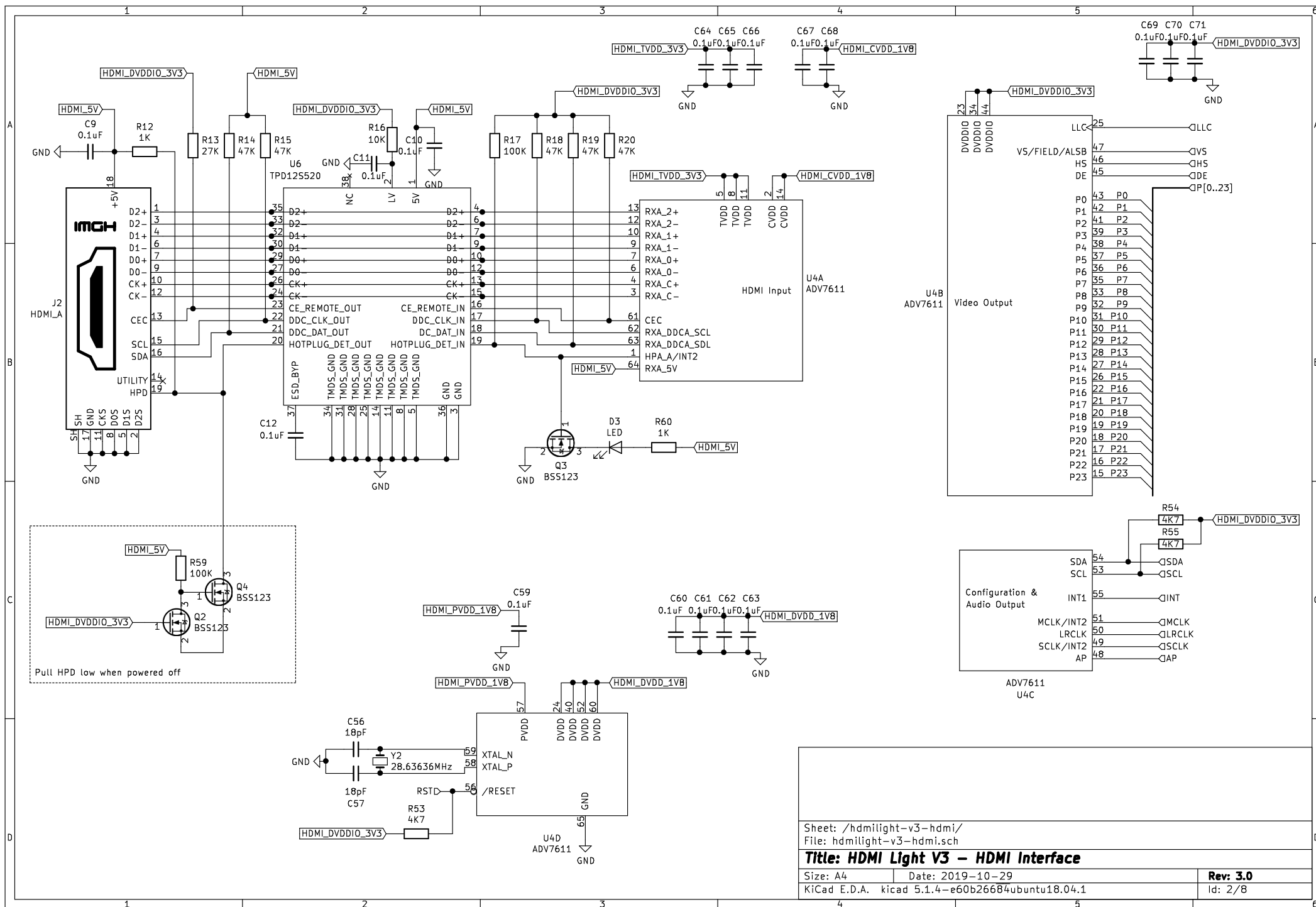
H1  
MountingHole

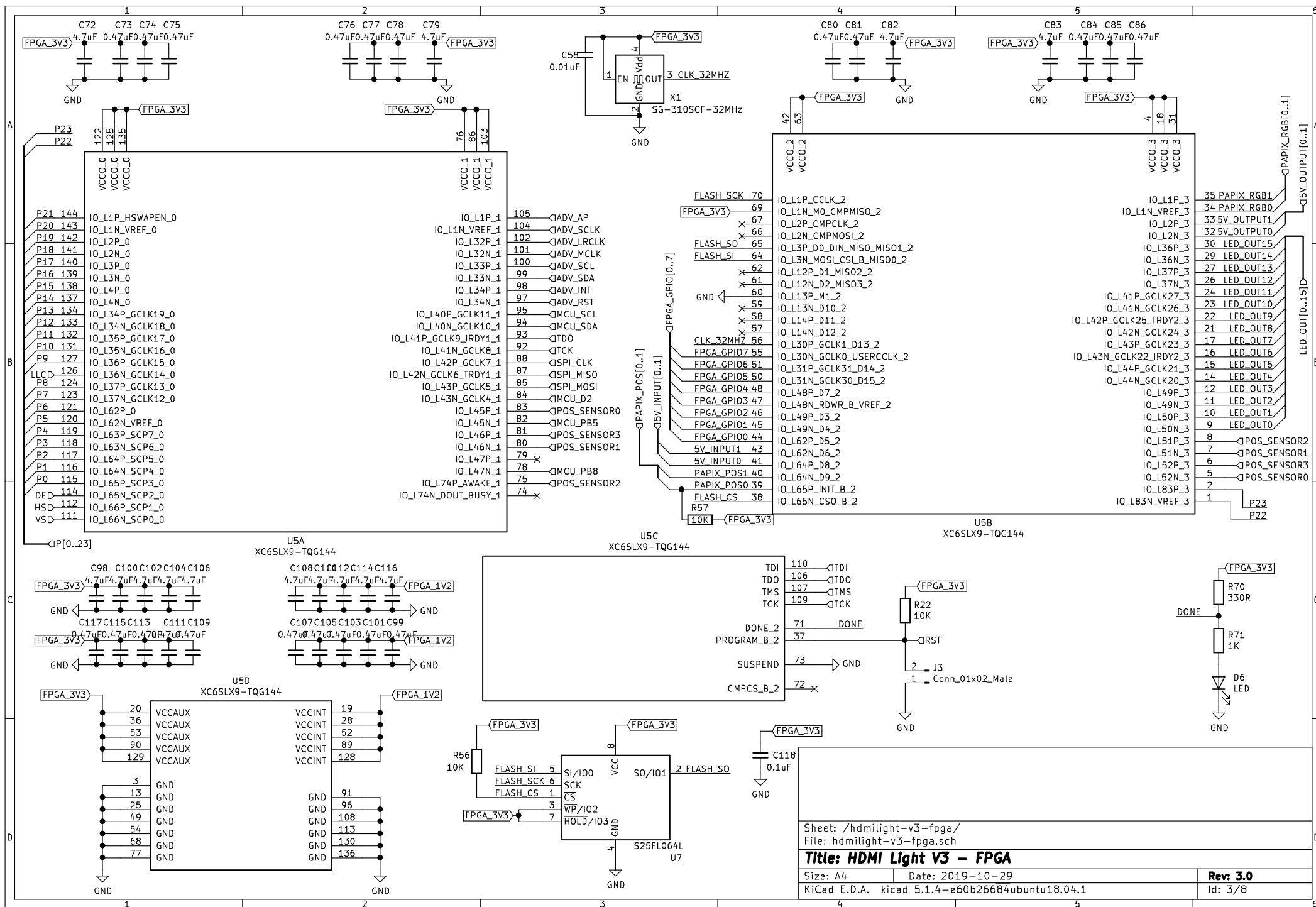
H2  
MountingHole

H3  
MountingHole

H4  
MountingHole

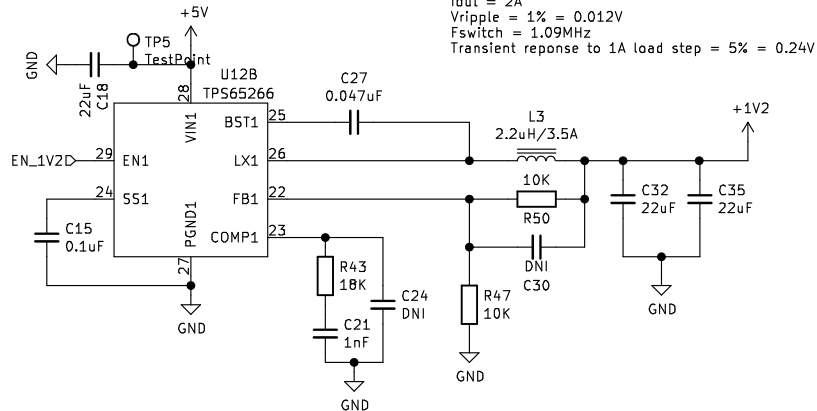
Sheet: /	
File: hdmilight-v3.sch	
Title: HDMI Light V3	
Size: A4	Date: 2019-10-29
KiCad E.D.A. kicad 5.1.4-e60b26684ubuntu18.04.1	
Rev: 3.0	
Id: 1/8	







## 1.2V Supply For FPGA Core



$$L = ((V_{in\_max} - V_{out}) / (I_{out} * LIR)) * (V_{out} / (V_{in\_max} * F_{switch}))$$

@2A  $L = ((6.5 - 1.2) / (2 * 0.2)) * (1.2 / (6.5 * 1090000)) = 2.2\mu H$

$$I_{ripple} = ((V_{in\_max} - V_{out}) / L) * (V_{out} / (V_{in\_max} * F_{switch}))$$

@2.2uH  $I_{ripple} = ((6.5 - 1.2) / 0.0000022) * (1.2 / (6.5 * 1090000)) = 0.41A$

$$\text{Min } C_{out} \text{ for transient response} = (2 * \Delta I) / (F_{switch} * \Delta V_{out})$$

$= (2 * 1) / (1090000 * 0.24) = 7.6\mu F$

$$\text{Min } C_{out} \text{ for ripple} = (1 / (8 * F_{switch})) * ((1 / V_{out\_ripple}) / I_{out\_ripple})$$

$= (1 / (8 * 1090000)) * ((1 / 0.012) / 0.41) = 23.3\mu F$

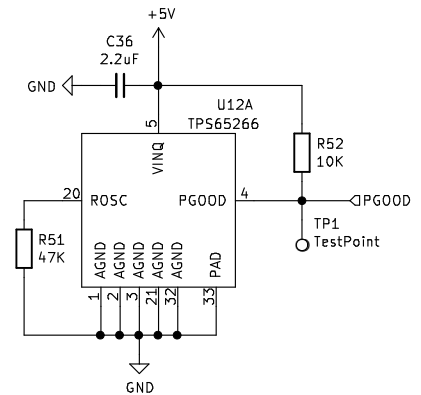
$$\text{Max ESR of } C_{out} = (V_{out\_ripple} / I_{out\_ripple}) = 0.012 / 0.41 = 29m\Omega$$

Chosen  $C_{out} = 2x 22\mu F$ , each with ESR below 58mΩ @ 1MHz

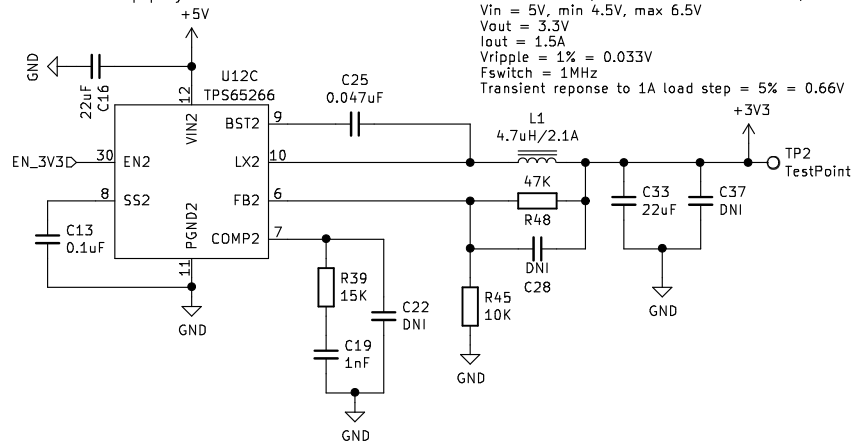
$$\text{Compensation resistor } R_c = (2 * \pi * (F_{switch} / 10) * V_{out} * C_{out}) / (G_{m\_ea} * V_{ref} * G_{m\_ps})$$

$= (2 * \pi * 109000 * 1.2 * 0.000044) / (0.00029 * 0.6 * 10) = 21K$   
 Adjust to common value = 22K

$$\text{Compensation capacitor } C_c = (R_{load} * C_{out}) / R_c = (0.5 * 0.000066) / 22000 = 1.5nF$$



## 3.3V Supply For Microcontroller, FPGA I/O, ADV7611 I/O



$$L = ((V_{in\_max} - V_{out}) / (I_{out} * LIR)) * (V_{out} / (V_{in\_max} * F_{switch}))$$

@1.5A  $L = ((6.5 - 3.3) / (1.5 * 0.2)) * (3.3 / (6.5 * 1090000)) = 5.0\mu H$

$$I_{ripple} = ((V_{in\_max} - V_{out}) / L) * (V_{out} / (V_{in\_max} * F_{switch}))$$

@4.7uH  $I_{ripple} = ((6.5 - 3.3) / 0.0000047) * (3.3 / (6.5 * 1090000)) = 0.32A$

$$\text{Min } C_{out} \text{ for transient response} = (2 * \Delta I) / (F_{switch} * \Delta V_{out}) = (2 * 1) / (1090000 * 0.66) = 2.8\mu F$$

$$\text{Min } C_{out} \text{ for ripple} = (1 / (8 * F_{switch})) * ((1 / V_{out\_ripple}) / I_{out\_ripple}) = (1 / (8 * 1090000)) * ((1 / 0.033) / 0.32) = 11\mu F$$

$$\text{Max ESR of } C_{out} = (V_{out\_ripple} / I_{out\_ripple}) = 0.033 / 0.32 = 103m\Omega$$

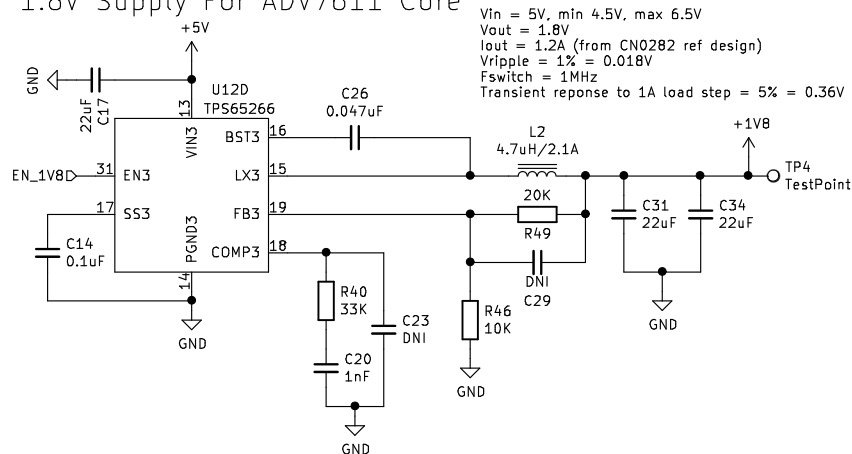
Chosen  $C_{out} = 1x 22\mu F$  with ESR below 103mΩ

$$\text{Compensation resistor } R_c = (2 * \pi * (F_{switch} / 10) * V_{out} * C_{out}) / (G_{m\_ea} * V_{ref} * G_{m\_ps})$$

$= (2 * \pi * 109000 * 3.3 * 0.000022) / (0.00029 * 0.6 * 10) = 29K$   
 Adjust to common value 27K

$$\text{Compensation capacitor } C_c = (R_{load} * C_{out}) / R_c = (1 * 0.000022) / 27000 = 0.81nF$$

## 1.8V Supply For ADV7611 Core



$$L = ((V_{in\_max} - V_{out}) / (I_{out} * LIR)) * (V_{out} / (V_{in\_max} * F_{switch}))$$

@1.2A  $L = ((6.5 - 1.8) / (1.2 * 0.2)) * (1.8 / (6.5 * 1090000)) = 5.0\mu H$

$$I_{ripple} = ((V_{in\_max} - V_{out}) / L) * (V_{out} / (V_{in\_max} * F_{switch}))$$

@4.7uH  $I_{ripple} = ((6.5 - 1.8) / 0.0000047) * (1.8 / (6.5 * 1090000)) = 0.25A$

$$\text{Min } C_{out} \text{ for transient response} = (2 * \Delta I) / (F_{switch} * \Delta V_{out}) = (2 * 1) / (1090000 * 0.36) = 5.1\mu F$$

$$\text{Min } C_{out} \text{ for ripple} = (1 / (8 * F_{switch})) * ((1 / V_{out\_ripple}) / I_{out\_ripple}) = (1 / (8 * 1090000)) * ((1 / 0.018) / 0.25) = 25\mu F$$

$$\text{Max ESR of } C_{out} = (V_{out\_ripple} / I_{out\_ripple}) = 0.018 / 0.25 = 72m\Omega$$

Chosen  $C_{out} = 2x 22\mu F$ , each with ESR below 144mΩ

$$\text{Compensation resistor } R_c = (2 * \pi * (F_{switch} / 10) * V_{out} * C_{out}) / (G_{m\_ea} * V_{ref} * G_{m\_ps})$$

$= (2 * \pi * 109000 * 1.8 * 0.000044) / (0.00029 * 0.6 * 10) = 31K$   
 Adjust to common value 33K

$$\text{Compensation capacitor } C_c = (R_{load} * C_{out}) / R_c = (1 * 0.000044) / 33000 = 1.33nF$$

Sheet: /hdmilight-v3-vreg/  
 File: hdmilight-v3-vreg.sch

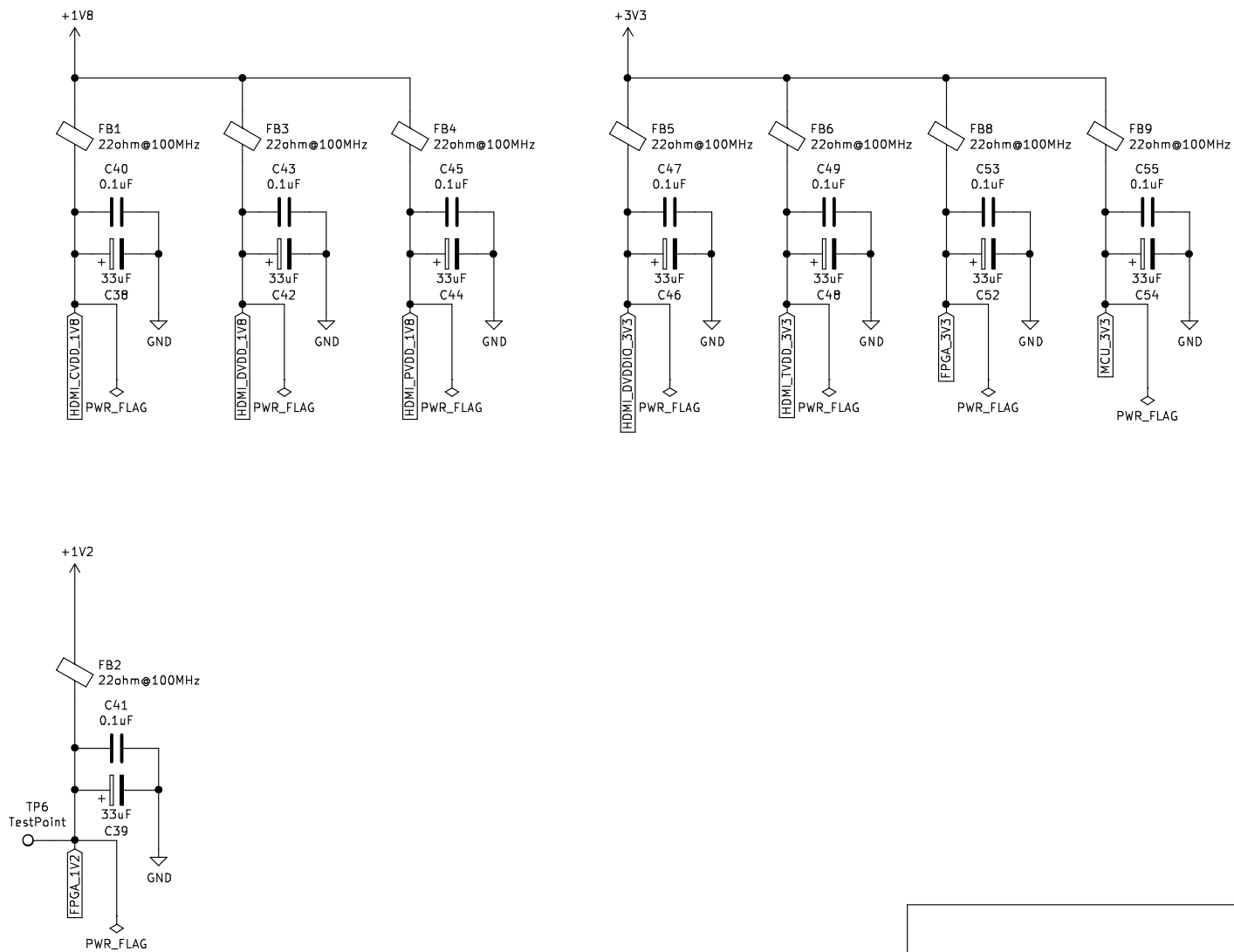
### Title: HDMI Light V3 – Voltage Regulator

Size: A4 Date: 2019-10-29

KiCad E.D.A. kicad 5.1.4-e60b26684ubuntu18.04.1

Rev: 3.0

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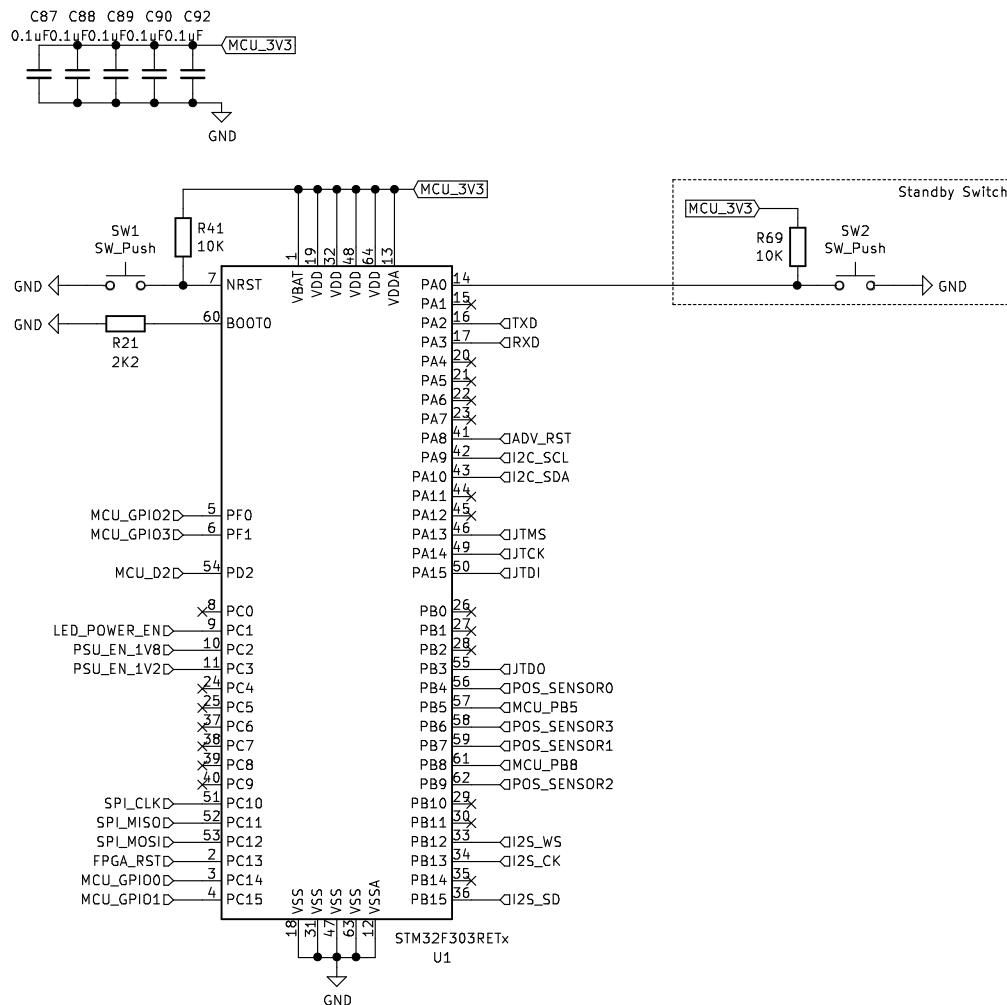


Sheet: /hdmilight-v3-power-dist/  
File: hdmilight-v3-power-dist.sch

# **Title: HDMI Light V3 - Power Distribution**

Size: A4 Date: 2019-10-29  
KiCad E.D.A. kicad 5.1.4-e60b26684ubuntu18.04.1

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## Pin Assignments

ADV7611 I2C (via FPGA)  
42: PA9: I2C2\_SCL  
43: PA10: I2C2\_SDA

ADV7611 I2S  
33: PB12: I2S2\_WS (LRCLK)  
34: PB13: I2S2\_CK (SCLK)  
36: PB15: I2S2\_SD (AP)

FPGA SPI  
51: PC10: SPI3\_SCLK  
52: PC11: SPI3\_MISO  
53: PC12: SPI3\_MOSI

VIVE POS SENSORS  
56: PB4: TIM3\_CH1 (sensor 0)  
58: PB6: TIM4\_CH1 (sensor 3)  
59: PB7: TIM3\_CH4 (sensor 1)  
62: PB9: TIM4\_CH4 (sensor 2)

SERIAL  
16: PA2: USART2\_TX  
17: PA3: USART2\_RX

RESET  
41: PA8: ADV7611 (Open Drain)  
2: PC13: FPGA (Open Drain)

POWER ENABLE  
9: PC1: LED  
10: PC2: ADV7611 1V8 (Open Drain)  
11: PC3: FPGA 1V2 (Open Drain)

JTAG  
46: PA13: JTMS  
49: PA14: JTCK  
50: PA15: JTDI  
55: PB3: JTD0

GPIO  
3: PC14: GPIO0  
4: PC15: GPIO1  
5: PF0: GPIO2 (5V Tolerant)  
6: PF1: GPIO3 (5V Tolerant)

UNUSED FPGA CONNECTIONS  
54: PD2  
57: PB5  
61: PB8

STANDBY SWITCH  
8: PA0: WKUP1

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