



ON Semiconductor®

NCxx164A

Strata Enabled Adjustable LDO

Variant Name = NCV8164A DFN8

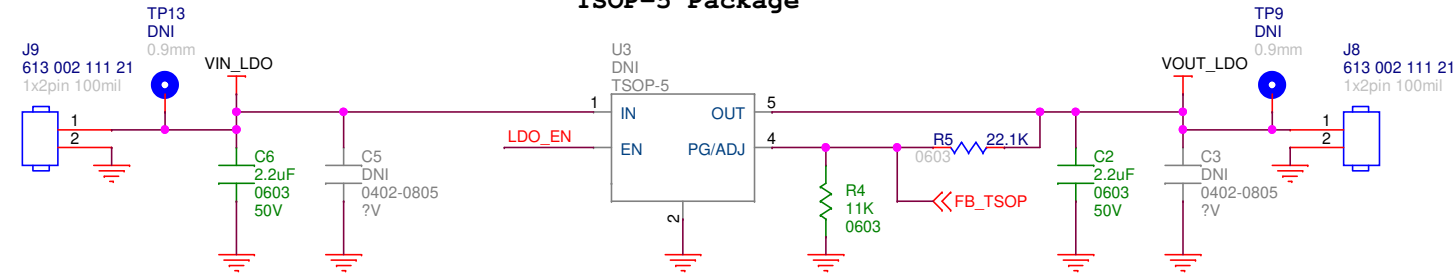
Comment Legend

- Description**
Description of circuit that is intended to be evaluated with this PCB.
- Optional**
Circuits that customer could optionally implement yet do not affect PCB purpose.
- Not Required**
Circuits that support the Strata ecosystem that customer would not implement.

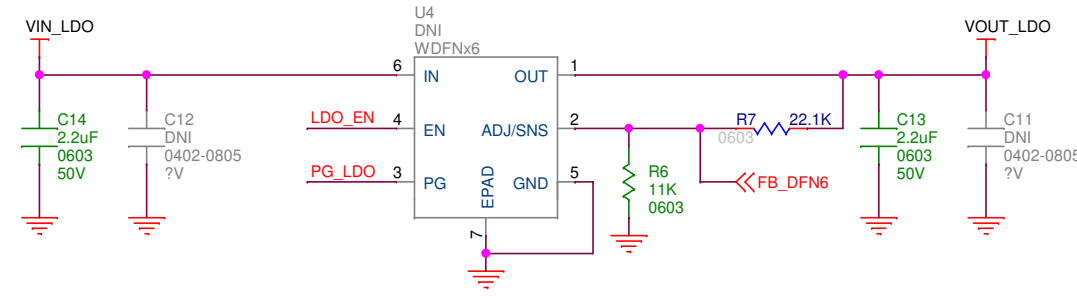
ON Semiconductor		
Title NCxx164A Strata Enabled Adjustable LDO		
Size Custom	Document Number ONSEC-19-017	Rev REV1
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NCxx164A Adjustable LDO

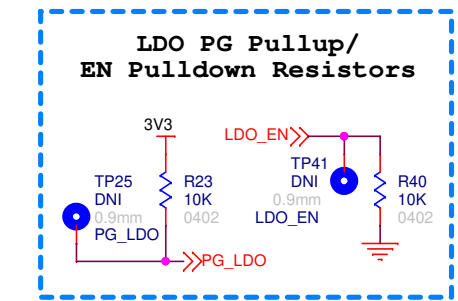
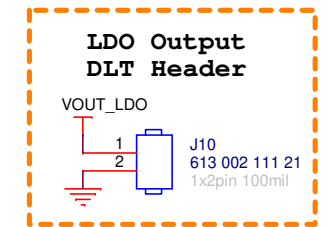
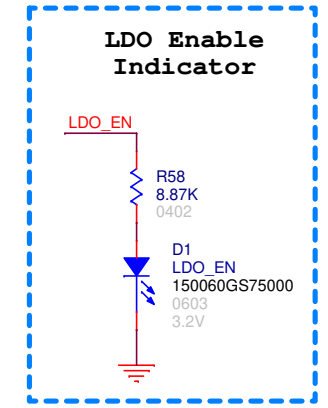
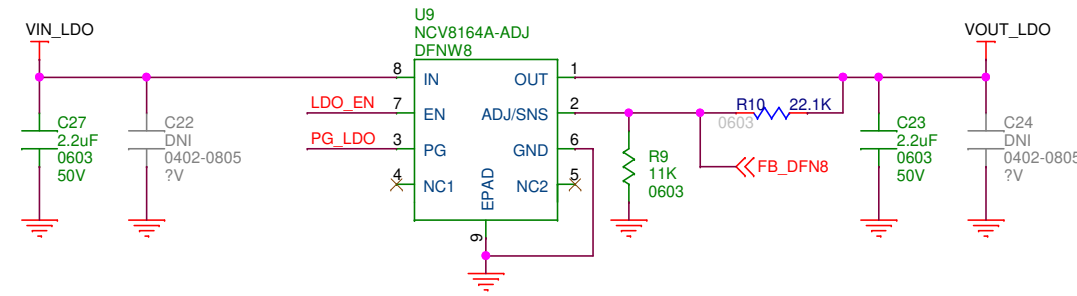
TSOP-5 Package



DFN6 Package



DFN8 Package



Note - There are six BOM variants:

- NCP164A TSOP5
- NCP164A DFN6
- NCP164A DFN8
- NCV8164A TSOP5
- NCV8164A DFN6
- NCV8164A DFN8

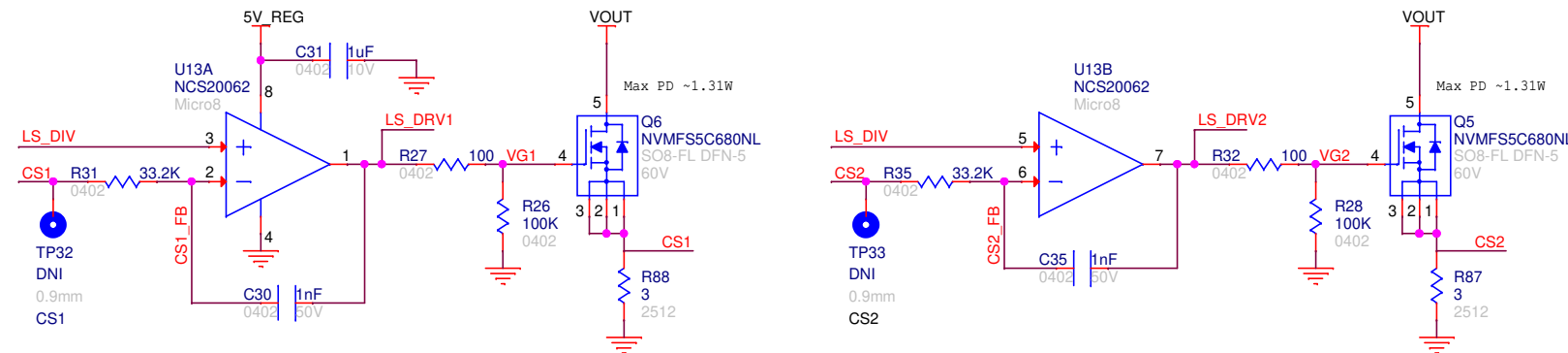
Max input voltage = 5.5V
 Min input voltage = 1.6V
 Output voltage adjusted via Strata interface (see Strata Control page)
 Max rated output current = 300 mA
 No PG output for adjustable TSOP-5 version
 LDO_EN pin is pulled low so LDOs are off at startup
 1 uF Cin/Cout datasheet recommended values
 No minimum Cout ESR requirement for stability

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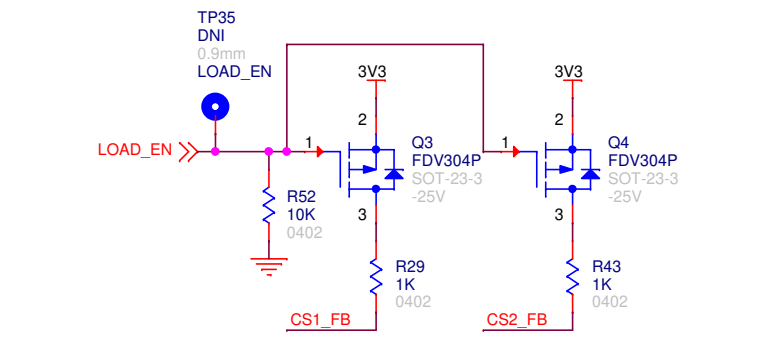
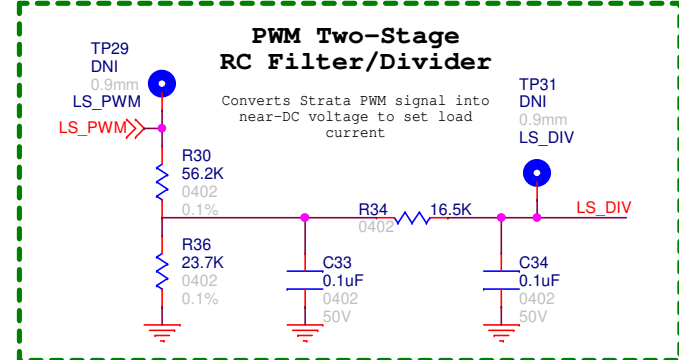
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Size Custom	Document Number ONSEC-19-017	Rev REV1
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Strata Control

650mA Max Adjustable Onboard Load

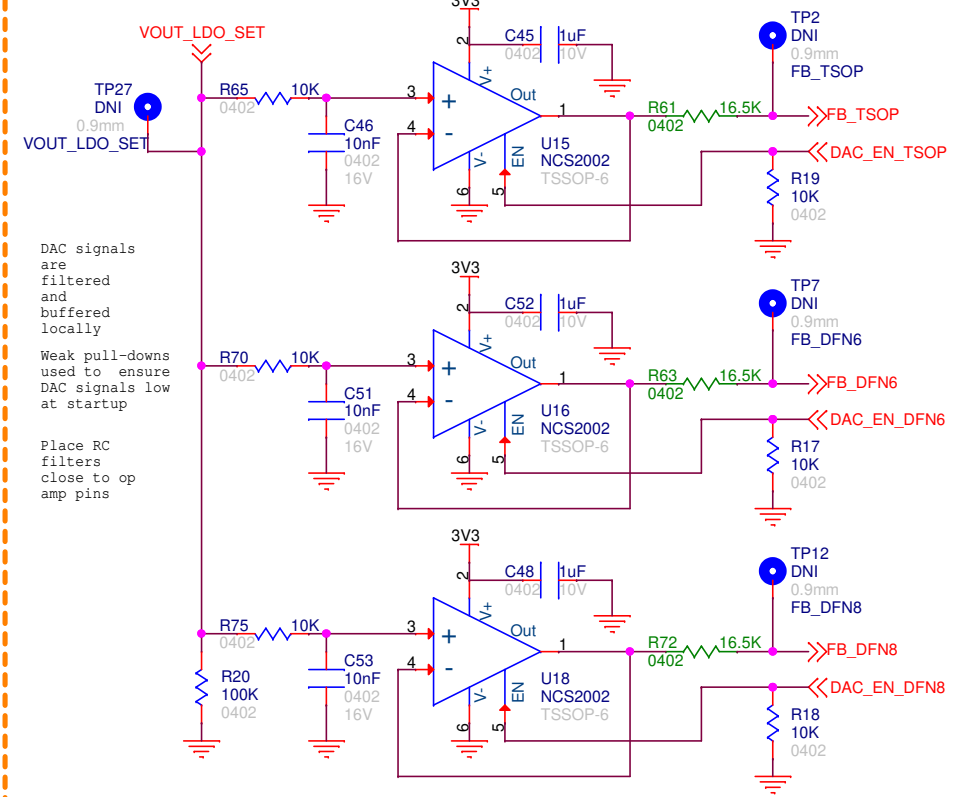


$LS_DIV = 0.297 * (LS_PWM \text{ amplitude}) * [(LS_PWM \text{ duty cycle}) / 100]$
 $I_{OUT} = 2 * (LS_DIV / 3) = 0.198 * (LS_PWM \text{ amplitude}) * [(LS_PWM \text{ duty cycle}) / 100]$
 $I_{OUT} = \sim 650\text{mA max @ } LS_PWM \text{ amplitude} = 3.3\text{V, } 100\% \text{ duty cycle}$
 For PWM frequency = 10 kHz, MCU clock = 48 MHz, IOUT resolution = $\sim 136 \mu\text{A}$
 RC filter cutoff frequency = $\sim 100 \text{ Hz}$



Used to turn off onboard load quickly. Also forces load circuit off at startup

LDO/Buck Output Voltage Set

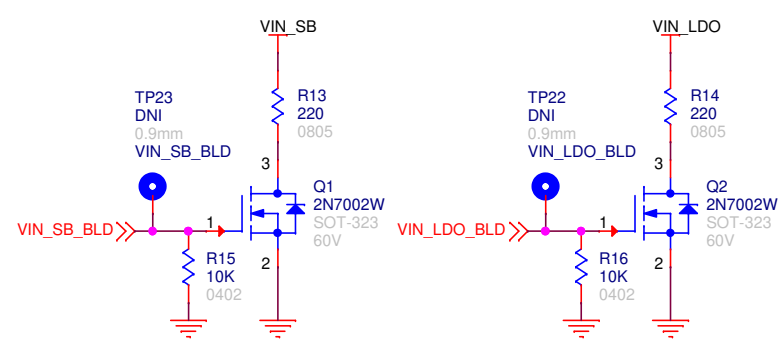


DAC signals are filtered and buffered locally. Weak pull-downs used to ensure DAC signals low at startup. Place RC filters close to op amp pins.

VOUT_LDO_SET range: 0.1V - 3V
 VOUT_LDO range:
 1.1V - 5.2V NCP164A
 1.2V - 5.2V NCV8164A

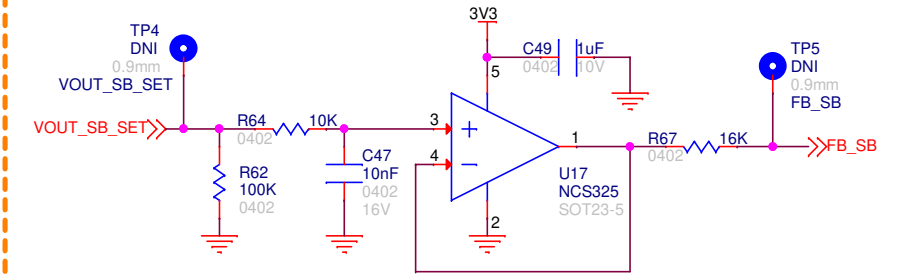
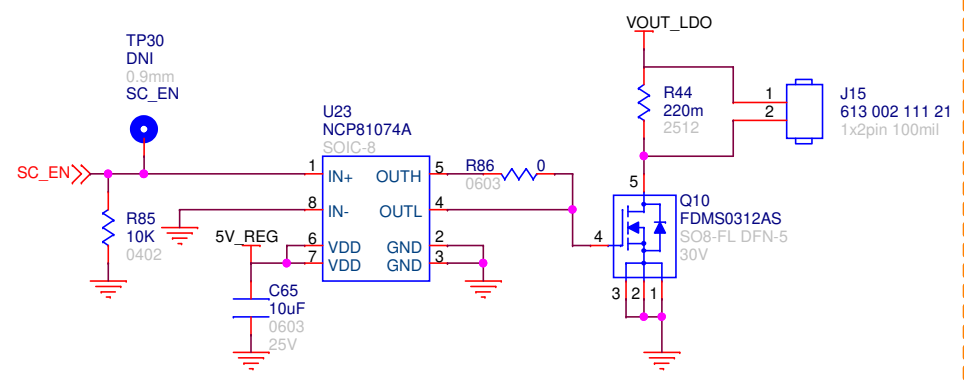
Bleed Circuits

Allow manual bleeding off of charge at VIN_SB/VIN_LDO nodes if load switches are disabled



Short Circuit Load

This is meant to short the output to test LDO current limiting



VOUT_SB_SET range: 0.1V - 3V
 VOUT_SB range:
 1.6V - 5.5V

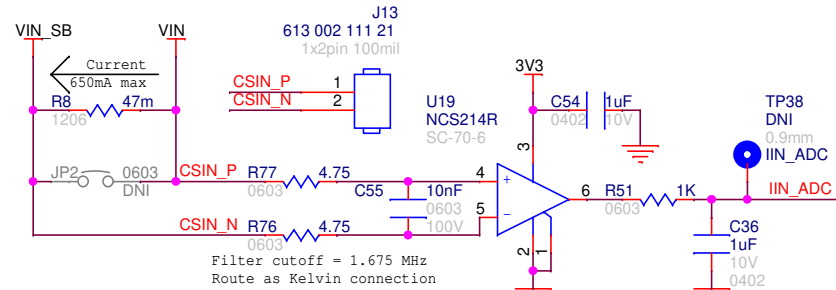
Variant Name = NCV8164A DFN8

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Embedded Interface/Telemetry

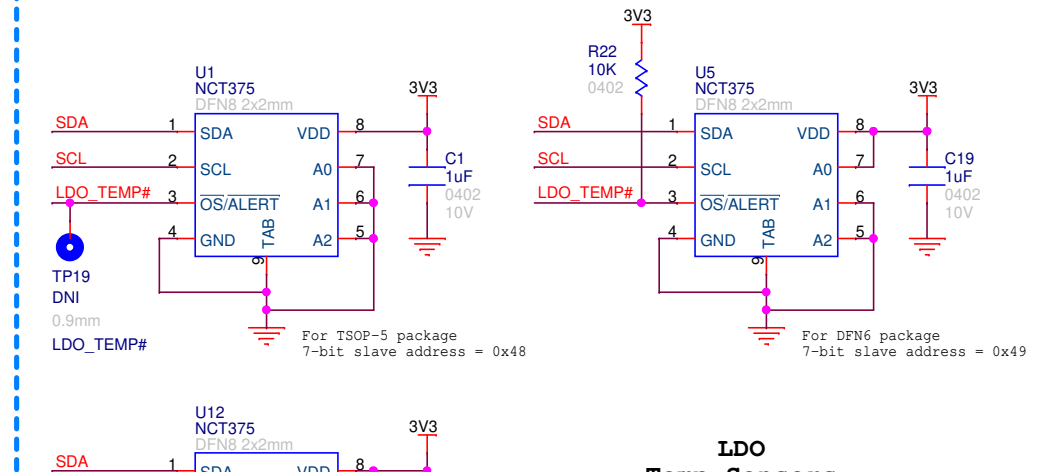
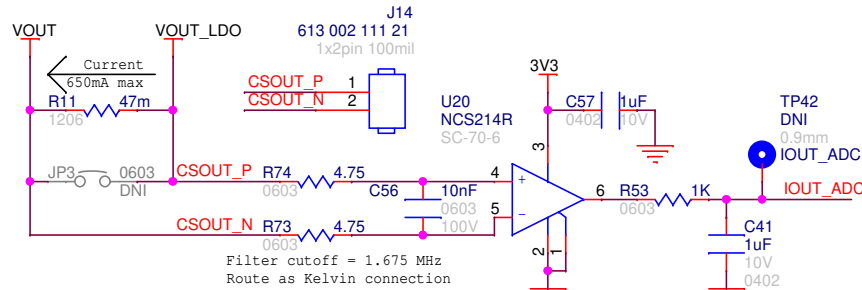
Input Current Sense

NCS214R gain = 100V/V
Output signal range 3.06V
Max input signal 30.6mV
Output filter cutoff = 159 Hz



Output Current Sense

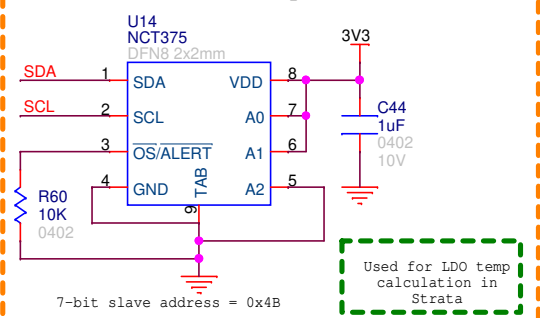
NCS214R Gain = 100V/V
Output signal range 3.06V
Max input signal 30.6mV
Output filter cutoff = 159 Hz



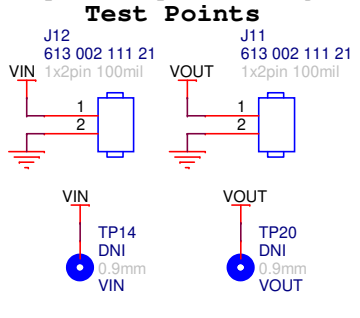
LDO Temp Sensors

Monitor temperatures of LDO ground pads. LDO_TEMP# is interrupt to alert MCU when temperature is over threshold.

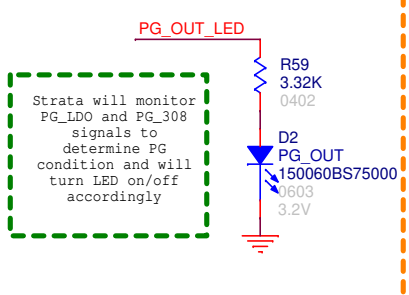
Ambient Temp Sensor



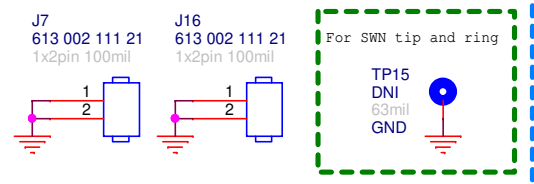
Input/Output Voltage Test Points



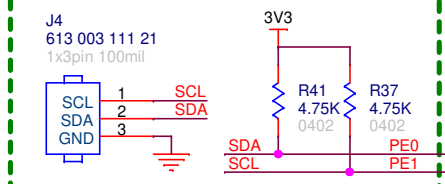
Output Power Good Indicator



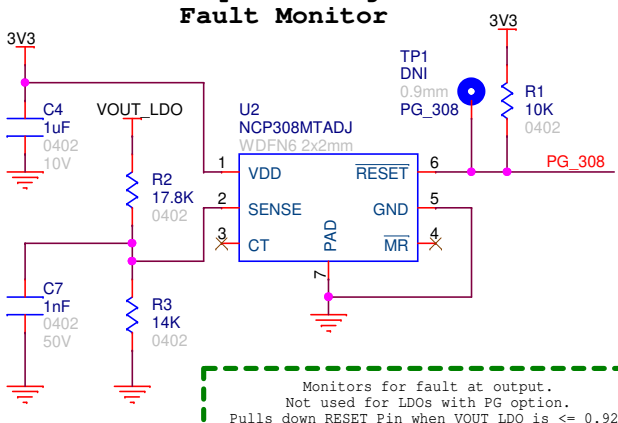
Ground Test Points



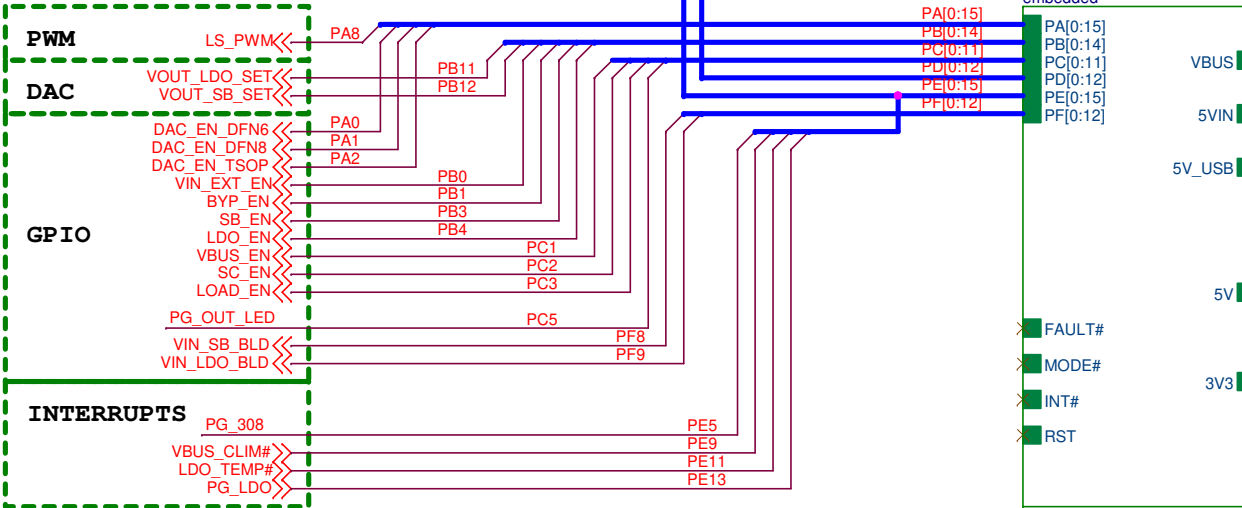
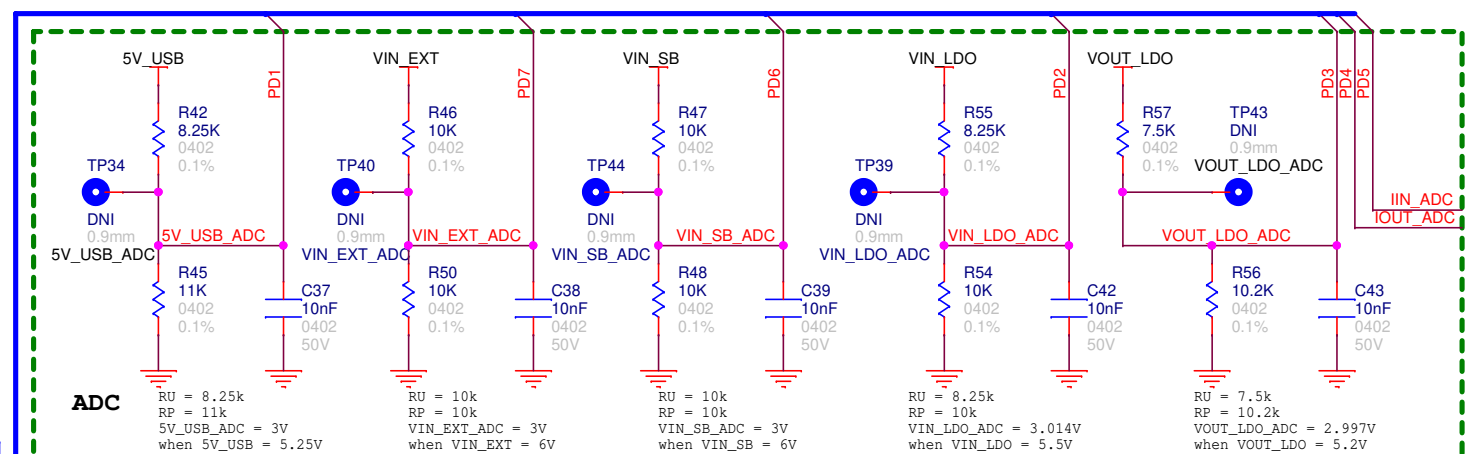
I2C



Output Voltage Fault Monitor



Monitors for fault at output. Not used for LDOs with PG option. Pulls down RESET pin when VOUT_LDO is <= 0.92V



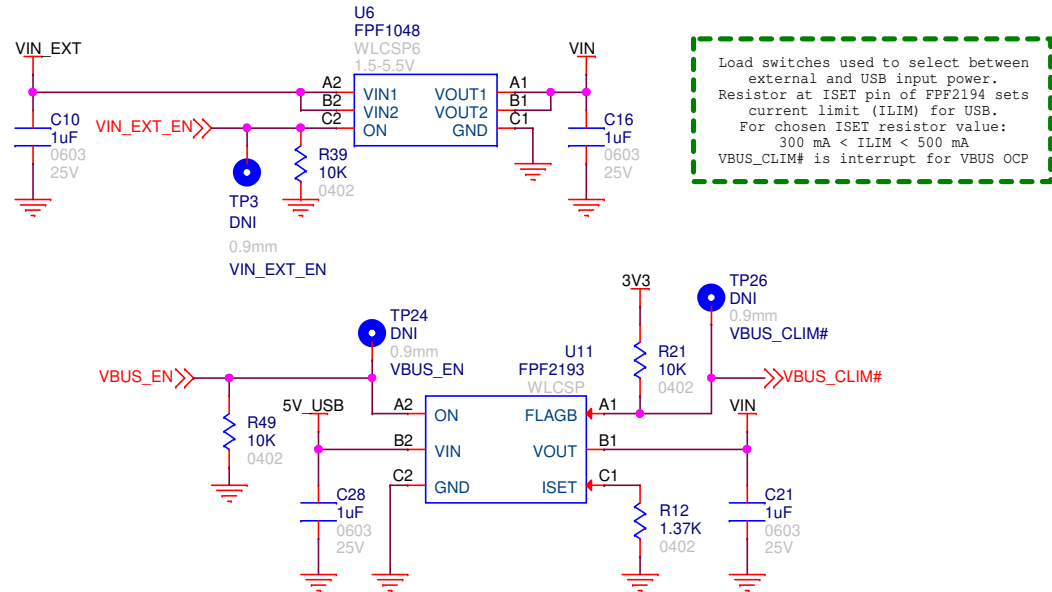
Port pins being used by Strata
DO NOT USE THESE PINS!!
PA = None
PB = 7, 8, 9, 10, 13, 14
PC = None
PD = None
PE = 10, 14, 15
PF = 0, 1, 2, 3, 4, 5

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Power/Load Switches/Connectors

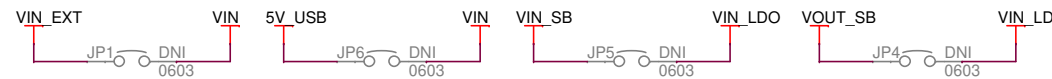
External/VBUS Input Power Selection



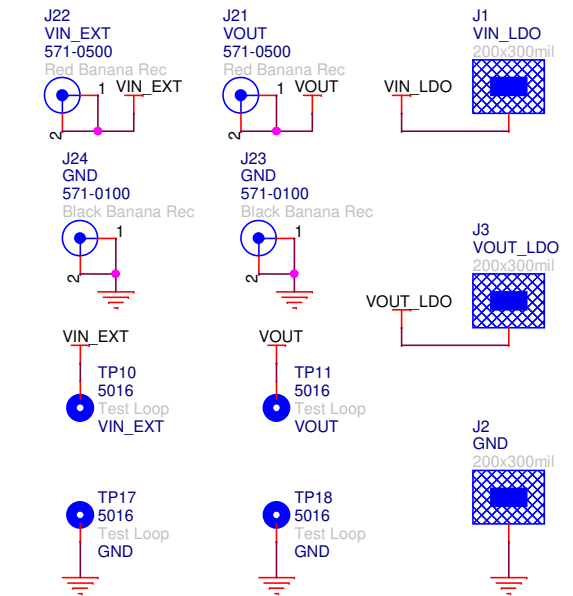
LDO Input Power Configurations

VIN_EXT_EN	VBUS_EN	BYP_EN	SB_EN	LDO Input
LOW	LOW	-	-	Pulled low or solder pad input
-	-	LOW	LOW	Pulled low or solder pad input
LOW	HIGH	LOW	HIGH	Buck regulator step-down from USB 5V
LOW	HIGH	HIGH	LOW	USB 5V
HIGH	LOW	LOW	HIGH	Buck regulator step-down from external input
HIGH	LOW	HIGH	LOW	External input (VIN_EXT)
-	-	HIGH	HIGH	Not allowed
HIGH	HIGH	-	-	Not allowed

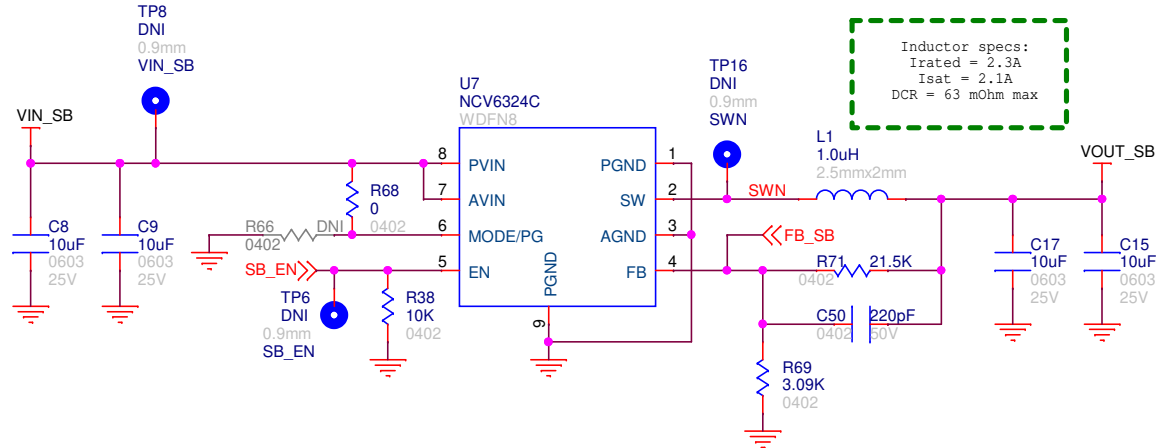
Load Switch Bypass Jumpers



External Power Connectors

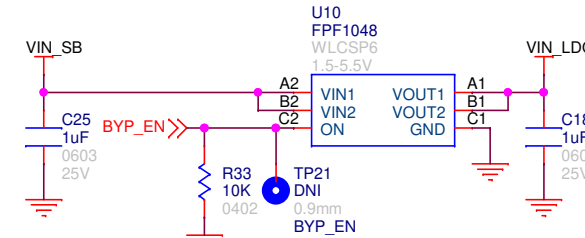


LDO Input Voltage Control NCV6324 Sync Buck with Adjustable Output Voltage



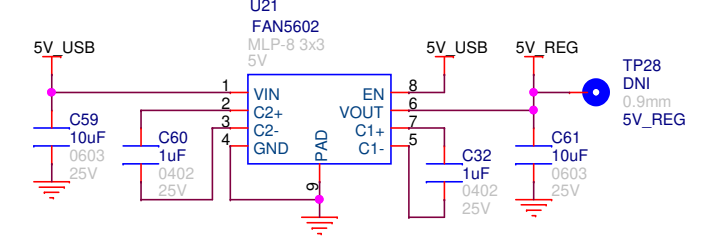
Input voltage range: 2.5V - 5.5V
 Designed for IOUT max = 1A
 Fsw = 3 MHz
 SB_MODE = HIGH -> Forced PWM mode
 SB_MODE = LOW -> Auto PWM/PFM mode
 Output voltage adjusted via Strata interface (see Strata Control page).
 Allows user to adjust LDO input voltage via Strata using fixed USB 5V or external input voltage

Sync Buck Bypass Switch



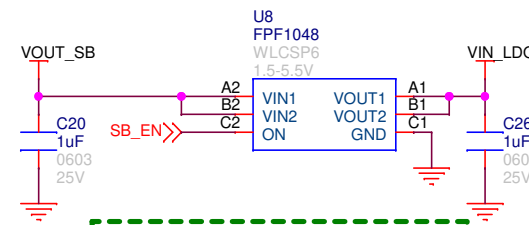
Allows user to choose to power the LDO externally by bypassing the adjustable output sync buck. Bypass option is disabled by default at startup.

5V LDO/Charge Pump



Creates regulated 5V supply for analog components from 4.5V-5.25V USB voltage

Sync Buck Output Enable Switch



Connects SB output to input of LDO. Needed due to active output discharge functionality of NCV6324C when disabled. Disabled by default at startup.

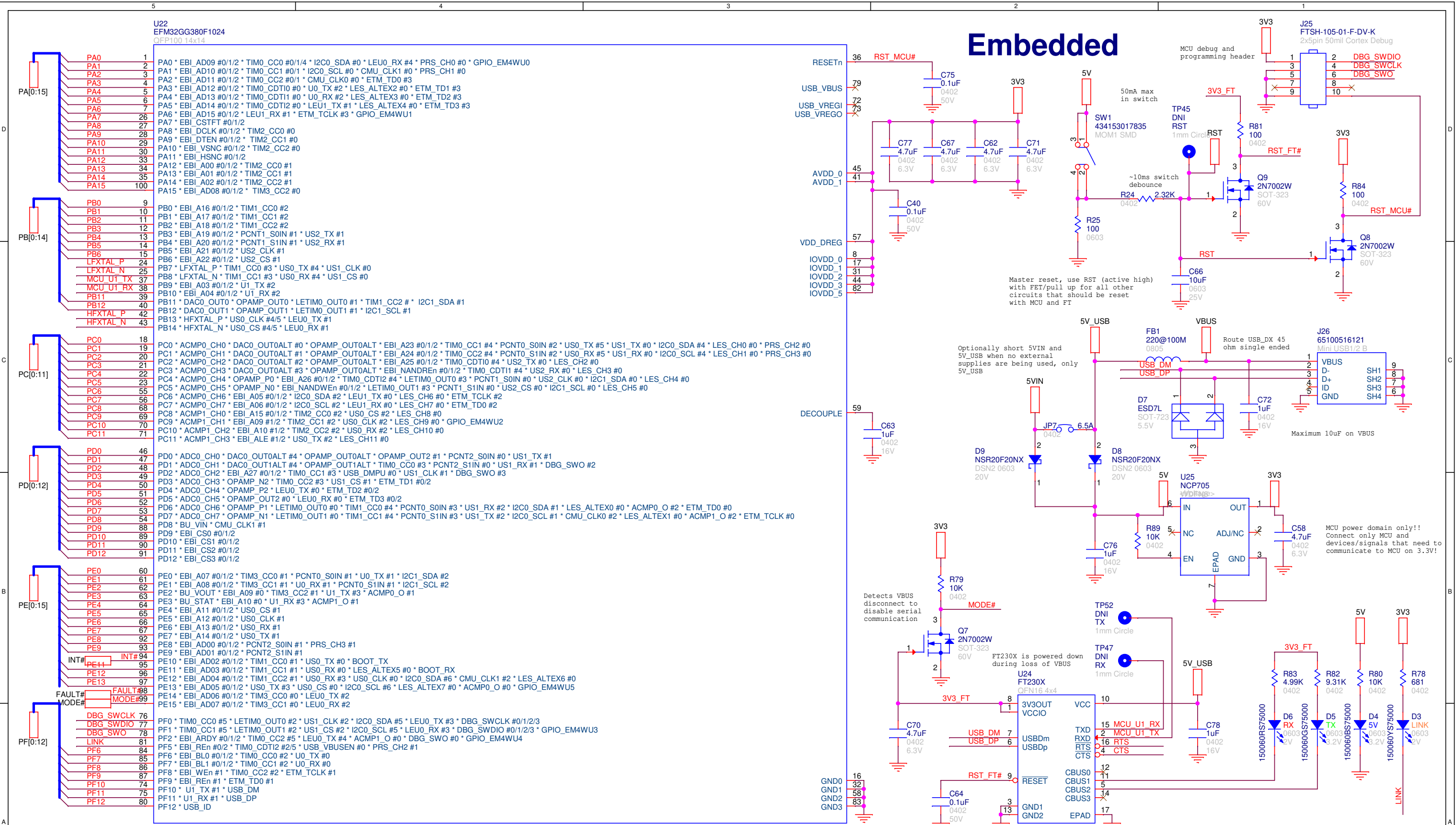
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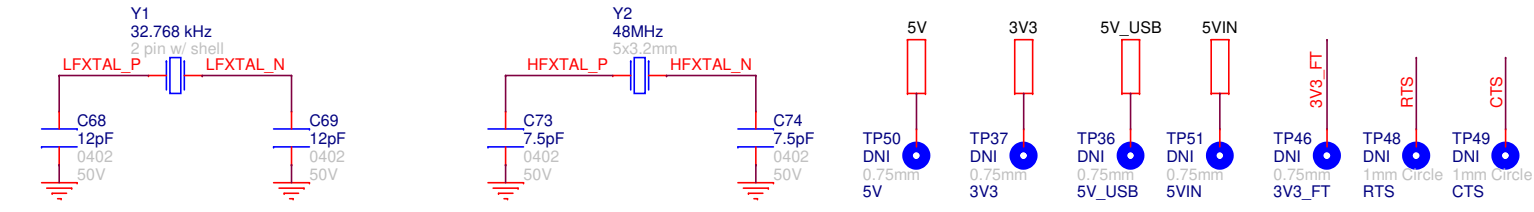
Title
Power/Load Switches/Connectors

Size Custom Document Number ONSEC-19-017 Rev REV1

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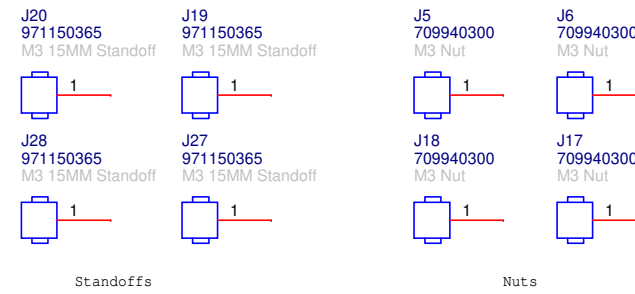


PA0	1	PA0 * EBI_AD09 #0/1/2 * TIM0_CC0 #0/1/4 * I2C0_SDA #0 * LEU0_RX #4 * PRS_CH0 #0 * GPIO_EM4WU0
PA1	2	PA1 * EBI_AD10 #0/1/2 * TIM0_CC1 #0/1 * I2C0_SCL #0 * CMU_CLK1 #0 * PRS_CH1 #0
PA2	3	PA2 * EBI_AD11 #0/1/2 * TIM0_CC2 #0/1 * CMU_CLK0 #0 * ETM_TD0 #3
PA3	4	PA3 * EBI_AD12 #0/1/2 * TIM0_CDTI0 #0 * U0_TX #2 * LES_ALTEX2 #0 * ETM_TD1 #3
PA4	5	PA4 * EBI_AD13 #0/1/2 * TIM0_CDTI1 #0 * U0_RX #2 * LES_ALTEX3 #0 * ETM_TD2 #3
PA5	6	PA5 * EBI_AD14 #0/1/2 * TIM0_CDTI2 #0 * LEU1_TX #1 * LES_ALTEX4 #0 * ETM_TD3 #3
PA6	7	PA6 * EBI_AD15 #0/1/2 * LEU1_RX #1 * ETM_TCLK #3 * GPIO_EM4WU1
PA7	26	PA7 * EBI_CSTFT #0/1/2
PA8	27	PA8 * EBI_DCLK #0/1/2 * TIM2_CC0 #0
PA9	28	PA9 * EBI_DTEN #0/1/2 * TIM2_CC1 #0
PA10	29	PA10 * EBI_VSNC #0/1/2 * TIM2_CC2 #0
PA11	30	PA11 * EBI_HSNC #0/1/2
PA12	33	PA12 * EBI_A00 #0/1/2 * TIM2_CC0 #1
PA13	34	PA13 * EBI_A01 #0/1/2 * TIM2_CC1 #1
PA14	35	PA14 * EBI_A02 #0/1/2 * TIM2_CC2 #1
PA15	100	PA15 * EBI_AD08 #0/1/2 * TIM3_CC2 #0
PB0	9	PB0 * EBI_A16 #0/1/2 * TIM1_CC0 #2
PB1	10	PB1 * EBI_A17 #0/1/2 * TIM1_CC1 #2
PB2	11	PB2 * EBI_A18 #0/1/2 * TIM1_CC2 #2
PB3	12	PB3 * EBI_A19 #0/1/2 * PCNT1_S0IN #1 * US2_TX #1
PB4	13	PB4 * EBI_A20 #0/1/2 * PCNT1_S1IN #1 * US2_RX #1
PB5	14	PB5 * EBI_A21 #0/1/2 * US2_CLK #1
PB6	15	PB6 * EBI_A22 #0/1/2 * US2_CS #1
LFXTAL_P	24	PB7 * LFXTAL_P * TIM1_CC0 #3 * US0_TX #4 * US1_CLK #0
LFXTAL_N	25	PB8 * LFXTAL_N * TIM1_CC1 #3 * US0_RX #4 * US1_CS #0
MCU_U1_TX	37	PB9 * EBI_A03 #0/1/2 * U1_TX #2
MCU_U1_RX	38	PB10 * EBI_A04 #0/1/2 * U1_RX #2
PB11	39	PB11 * DAC0_OUT0 * OPAMP_OUT0 * LETIM0_OUT0 #1 * TIM1_CC2 #2 * I2C1_SDA #1
PB12	40	PB12 * DAC0_OUT1 * OPAMP_OUT1 * LETIM0_OUT1 #1 * I2C1_SCL #1
HFXTAL_P	42	PB13 * HFXTAL_P * US0_CLK #4/5 * LEU0_TX #1
HFXTAL_N	43	PB14 * HFXTAL_N * US0_CS #4/5 * LEU0_RX #1
PC0	18	PC0 * ACMP0_CH0 * DAC0_OUT0ALT #1 * OPAMP_OUT0ALT * EBI_A23 #0/1/2 * TIM0_CC1 #4 * PCNT0_S0IN #2 * US0_TX #5 * US1_TX #0 * I2C0_SDA #4 * LES_CH0 #0 * PRS_CH2 #0
PC1	19	PC1 * ACMP0_CH1 * DAC0_OUT0ALT #1 * OPAMP_OUT0ALT * EBI_A24 #0/1/2 * TIM0_CC2 #4 * PCNT0_S1IN #2 * US0_RX #5 * US1_RX #0 * I2C0_SCL #4 * LES_CH1 #0 * PRS_CH3 #0
PC2	20	PC2 * ACMP0_CH2 * DAC0_OUT0ALT #2 * OPAMP_OUT0ALT * EBI_A25 #0/1/2 * TIM0_CDTI0 #4 * US2_TX #0 * LES_CH2 #0
PC3	21	PC3 * ACMP0_CH3 * DAC0_OUT0ALT #2 * OPAMP_OUT0ALT * EBI_A25 #0/1/2 * TIM0_CDTI0 #4 * US2_TX #0 * LES_CH2 #0
PC4	22	PC4 * ACMP0_CH3 * DAC0_OUT0ALT #3 * OPAMP_OUT0ALT * EBI_NANDREN #0/1/2 * TIM0_CDTI1 #4 * US2_RX #0 * LES_CH3 #0
PC5	23	PC4 * ACMP0_CH4 * OPAMP_P0 * EBI_A26 #0/1/2 * TIM0_CDTI2 #4 * LETIM0_OUT0 #3 * PCNT1_S0IN #0 * US2_CLK #0 * I2C1_SDA #0 * LES_CH4 #0
PC6	55	PC5 * ACMP0_CH5 * OPAMP_N0 * EBI_NANDWEN #0/1/2 * LETIM0_OUT1 #3 * PCNT1_S1IN #0 * US2_CS #0 * I2C1_SCL #0 * LES_CH5 #0
PC7	56	PC6 * ACMP0_CH6 * EBI_A05 #0/1/2 * I2C0_SDA #2 * LEU1_TX #0 * LES_CH6 #0 * ETM_TCLK #2
PC8	68	PC7 * ACMP0_CH7 * EBI_A06 #0/1/2 * I2C0_SCL #2 * LEU1_RX #0 * LES_CH7 #0 * ETM_TD0 #2
PC9	69	PC8 * ACMP1_CH0 * EBI_A15 #0/1/2 * TIM2_CC0 #2 * US0_CS #2 * LES_CH8 #0
PC10	70	PC9 * ACMP1_CH1 * EBI_A09 #1/2 * TIM2_CC1 #2 * US0_CLK #2 * LES_CH9 #0 * GPIO_EM4WU2
PC11	71	PC10 * ACMP1_CH2 * EBI_A10 #1/2 * TIM2_CC2 #2 * US0_RX #2 * LES_CH10 #0
PC11	71	PC11 * ACMP1_CH3 * EBI_ALE #1/2 * US0_TX #2 * LES_CH11 #0
PD0	46	PD0 * ADC0_CH0 * DAC0_OUT0ALT #4 * OPAMP_OUT0ALT * OPAMP_OUT2 #1 * PCNT2_S0IN #0 * US1_TX #1
PD1	47	PD1 * ADC0_CH1 * DAC0_OUT1ALT #4 * OPAMP_OUT1ALT * TIM0_CC0 #3 * PCNT2_S1IN #0 * US1_RX #1 * DBG_SWO #2
PD2	48	PD2 * ADC0_CH2 * EBI_A27 #0/1/2 * TIM0_CC1 #3 * USB_DMPU #0 * US1_CLK #1 * DBG_SWO #3
PD3	49	PD3 * ADC0_CH3 * OPAMP_N2 * TIM0_CC2 #3 * US1_CS #1 * ETM_TD1 #0/2
PD4	50	PD4 * ADC0_CH4 * OPAMP_P2 * LEU0_TX #0 * ETM_TD2 #0/2
PD5	51	PD5 * ADC0_CH5 * OPAMP_OUT2 #0 * LEU0_RX #0 * ETM_TD3 #0/2
PD6	52	PD6 * ADC0_CH6 * OPAMP_P1 * LETIM0_OUT0 #0 * TIM1_CC0 #4 * PCNT0_S0IN #3 * US1_RX #2 * I2C0_SDA #1 * LES_ALTEX0 #0 * ACMP0_O #2 * ETM_TD0 #0
PD7	53	PD7 * ADC0_CH7 * OPAMP_N1 * LETIM0_OUT1 #0 * TIM1_CC1 #4 * PCNT0_S1IN #3 * US1_TX #2 * I2C0_SCL #1 * CMU_CLK0 #2 * LES_ALTEX1 #0 * ACMP1_O #2 * ETM_TCLK #0
PD8	54	PD8 * BU_VIN * CMU_CLK1 #1
PD9	88	PD9 * EBI_CS0 #0/1/2
PD10	89	PD10 * EBI_CS1 #0/1/2
PD11	90	PD11 * EBI_CS2 #0/1/2
PD12	91	PD12 * EBI_CS3 #0/1/2
PE0	60	PE0 * EBI_A07 #0/1/2 * TIM3_CC0 #1 * PCNT0_S0IN #1 * U0_TX #1 * I2C1_SDA #2
PE1	61	PE1 * EBI_A08 #0/1/2 * TIM3_CC1 #1 * U0_RX #1 * PCNT0_S1IN #1 * I2C1_SCL #2
PE2	62	PE2 * BU_VOUT * EBI_A09 #0 * TIM3_CC2 #1 * U1_TX #3 * ACMP0_O #1
PE3	63	PE3 * BU_STAT * EBI_A10 #0 * U1_RX #3 * ACMP1_O #1
PE4	64	PE4 * EBI_A11 #0/1/2 * US0_CS #1
PE5	65	PE5 * EBI_A12 #0/1/2 * US0_CLK #1
PE6	66	PE6 * EBI_A13 #0/1/2 * US0_RX #1
PE7	67	PE7 * EBI_A14 #0/1/2 * US0_TX #1
PE8	92	PE8 * EBI_AD00 #0/1/2 * PCNT2_S0IN #1 * PRS_CH3 #1
PE9	93	PE9 * EBI_AD01 #0/1/2 * PCNT2_S1IN #1
INT#	94	PE10 * EBI_AD02 #0/1/2 * TIM1_CC0 #1 * US0_TX #0 * BOOT_TX
PE11	95	PE11 * EBI_AD03 #0/1/2 * TIM1_CC1 #1 * US0_RX #0 * LES_ALTEX5 #0 * BOOT_RX
PE12	96	PE12 * EBI_AD04 #0/1/2 * TIM1_CC2 #1 * US0_RX #3 * US0_CLK #0 * I2C0_SDA #6 * CMU_CLK1 #2 * LES_ALTEX6 #0
PE13	97	PE13 * EBI_AD05 #0/1/2 * US0_TX #3 * US0_CS #0 * I2C0_SCL #6 * LES_ALTEX7 #0 * ACMP0_O #0 * GPIO_EM4WU5
FAULT#	98	PE14 * EBI_AD06 #0/1/2 * TIM3_CC0 #0 * LEU0_TX #2
MODE#	99	PE15 * EBI_AD07 #0/1/2 * TIM3_CC1 #0 * LEU0_RX #2
PF0	76	PF0 * TIM0_CC0 #5 * LETIM0_OUT0 #2 * US1_CLK #2 * I2C0_SDA #5 * LEU0_TX #3 * DBG_SWCLK #0/1/2/3
DBG_SWCLK	77	PF1 * TIM0_CC1 #5 * LETIM0_OUT1 #2 * US1_CS #2 * I2C0_SCL #5 * LEU0_RX #3 * DBG_SWCLK #0/1/2/3 * GPIO_EM4WU4
DBG_SWIO	78	PF2 * EBI_ARDY #0/1/2 * TIM0_CC2 #5 * LEU0_TX #4 * ACMP1_O #0 * DBG_SWO #0 * GPIO_EM4WU4
LINK	81	PF5 * EBI_REN #0/2 * TIM0_CDTI2 #2/5 * USB_VBUSEN #0 * PRS_CH2 #1
PF6	84	PF6 * EBI_BL0 #0/1/2 * TIM0_CC0 #2 * U0_TX #0
PF7	85	PF7 * EBI_BL1 #0/1/2 * TIM0_CC1 #2 * U0_RX #0
PF8	86	PF8 * EBI_WEN #1 * TIM0_CC2 #2 * ETM_TCLK #1
PF9	87	PF9 * EBI_REN #1 * ETM_TD0 #1
PF10	74	PF10 * U1_TX #1 * USB_DM
PF11	75	PF11 * U1_RX #1 * USB_DP
PF12	80	PF12 * USB_ID



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