ON Semiconductor®

NCxx164A
Strata Enabled Adjustable LDO

Variant Name = NCV8164A TSOP5

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.

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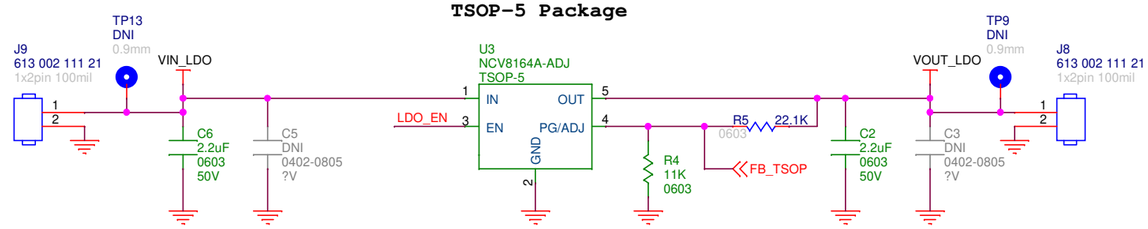
NCxx164A Adjustable LDO

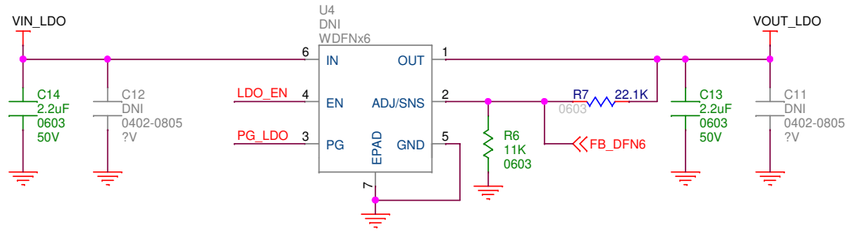
Note – There are six BOM variants:

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

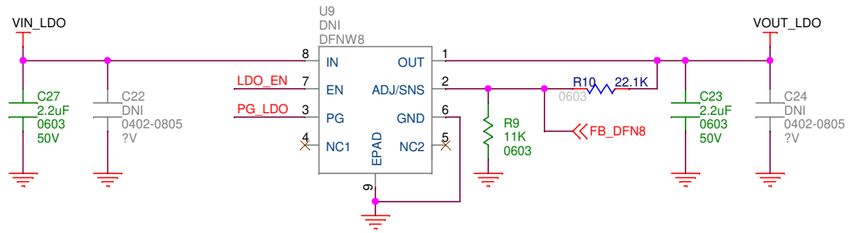
TSOP-5 Package



DFN6 Package



DFN8 Package



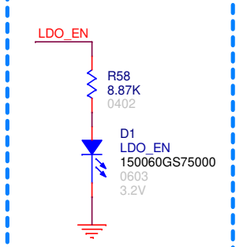
Max input voltage = 5.5V
Min input voltage = 1.6V
Output voltage adjusted via Strata interface (see Strata Control page)

Max rated output current = 300 mA

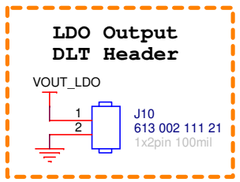
No PG output for adjustable TSOP-5 version
LDO_EN pin is pulled low so LDOs are off at startup

1 uF Cin/Cout datasheet recommended values
No minimum Cout ESR requirement for stability

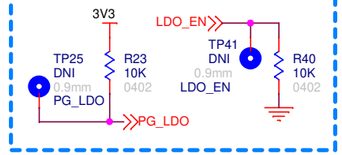
LDO Enable Indicator



LDO Output DLT Header



LDO PG Pullup/ EN Pulldown Resistors



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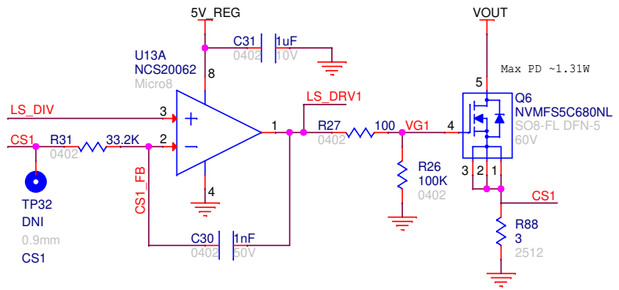
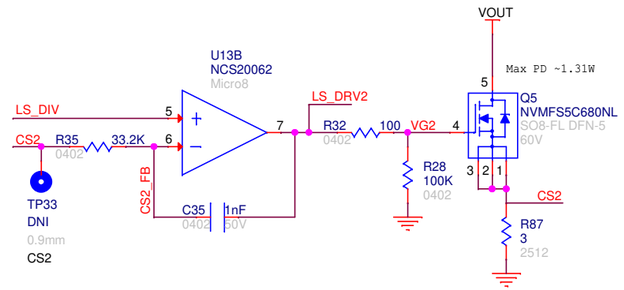
Strata Control

650mA Max Adjustable Onboard Load

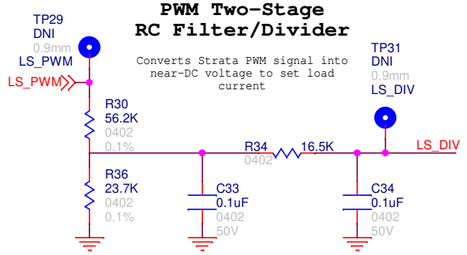


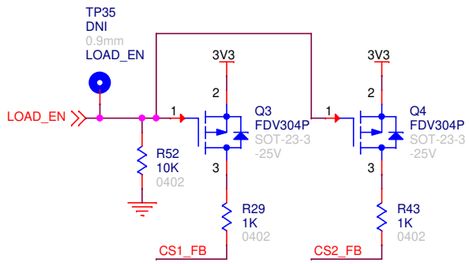


LS_DIV = 0.297*(LS_PWM amplitude)*[(LS_PWM duty cycle)/100]
IOUT = 2*(LS_DIV/3) = 0.198*(LS_PWM amplitude)*[(LS_PWM duty cycle)/100]
IOUT = ~650mA max @ LS_PWM amplitude = 3.3V, 100% duty cycle
For PWM frequency = 10 kHz, MCU clock = 48 MHz, IOUT resolution = ~136 uA
RC filter cutoff frequency = ~100 Hz

PWM Two-Stage RC Filter/Divider

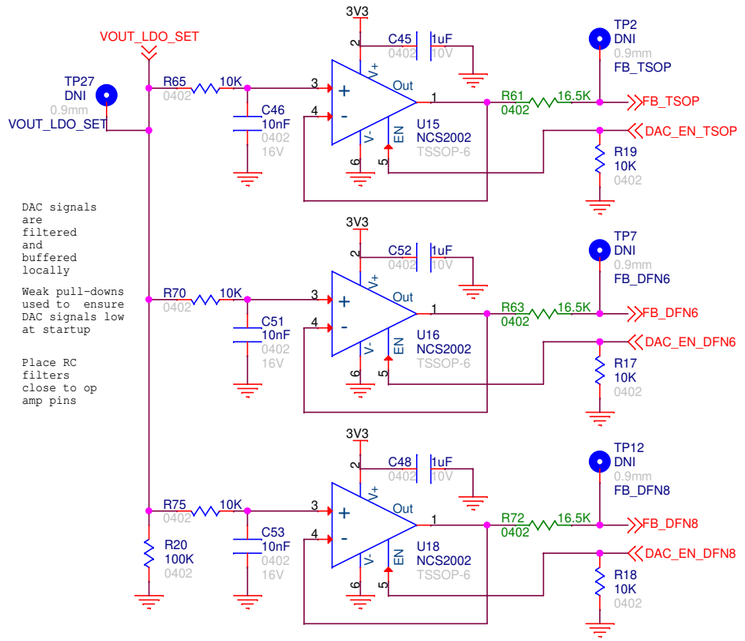
Converts Strata PWM signal into near-DC voltage to set load current



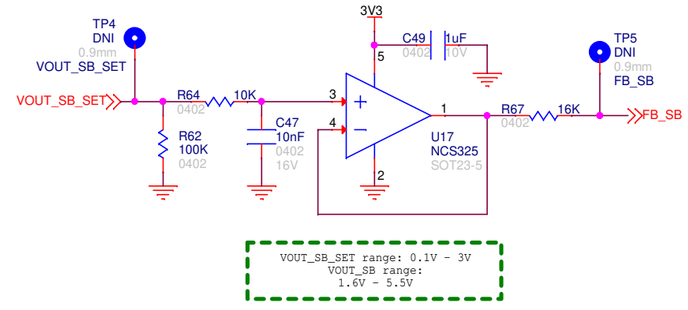


Used to turn off onboard load quickly. Also forces load circuit off at startup

LDO/Buck Output Voltage Set



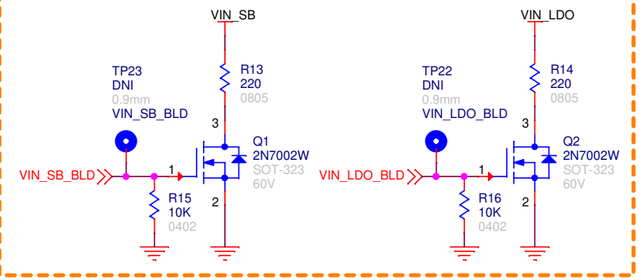
VOUT_LDO_SET range: 0.1V - 3V
VOUT_LDO range:
1.1V - 5.2V NCP164A
1.2V - 5.2V NCV8164A



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

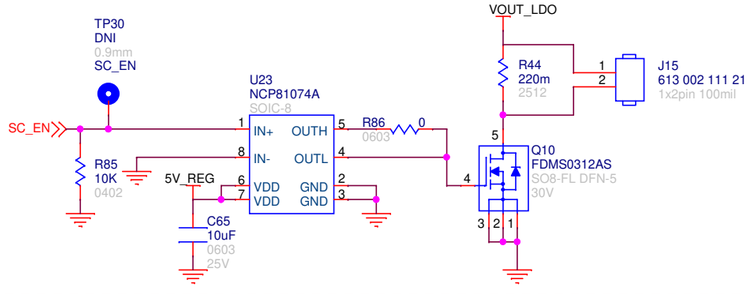
Bleed Circuits

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



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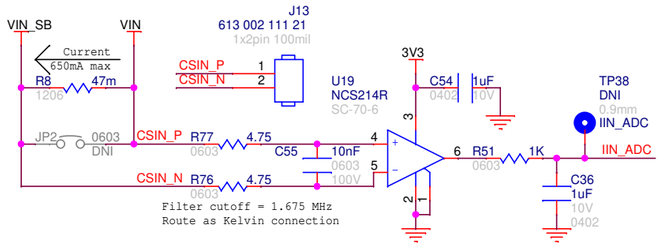
Embedded Interface/Telemetry

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

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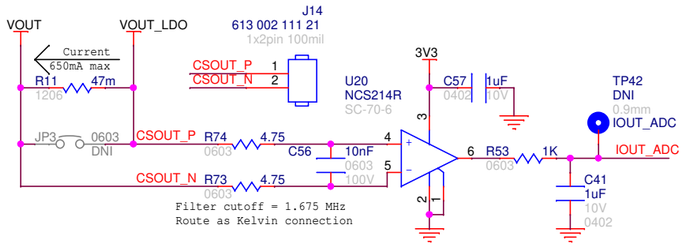
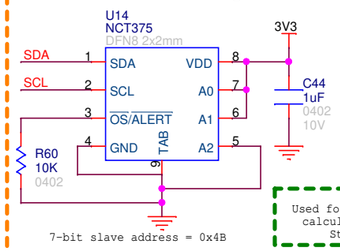
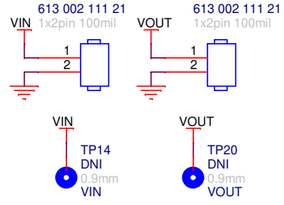


Ambient Temp Sensor



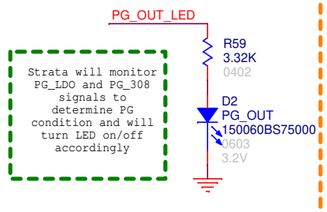
Used for LDO temp calculation in Strata

Input/Output Voltage Test Points

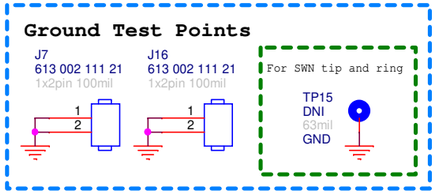


Output Power Good Indicator

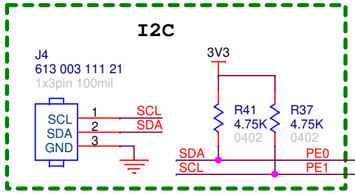
Strata will monitor PG_LDO and PG_308 signals to determine PG condition and will turn LED on/off accordingly



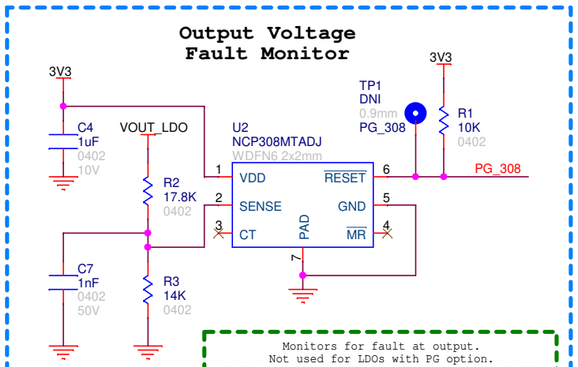
Ground Test Points



I2C

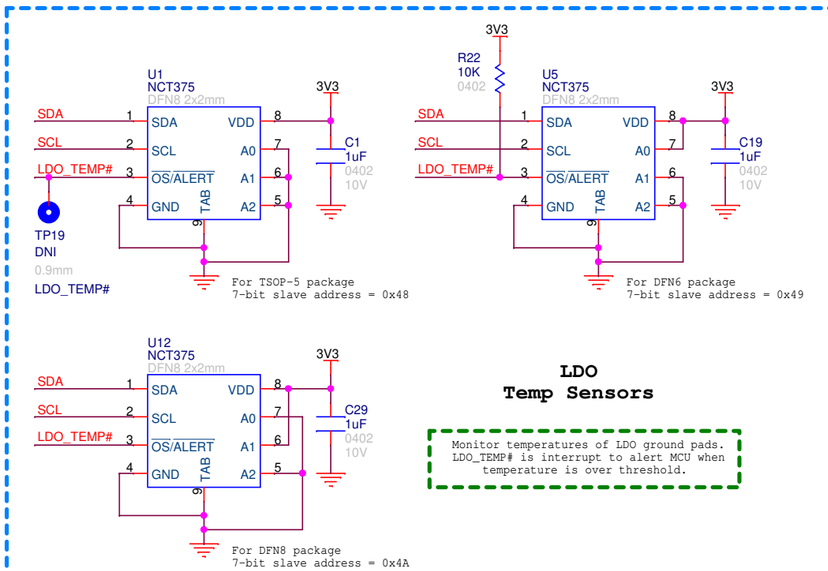


Output Voltage Fault Monitor



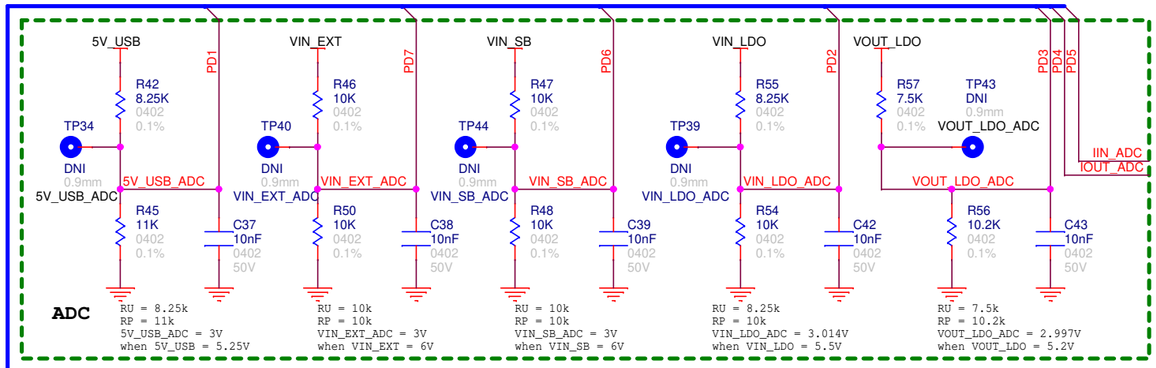
Monitors for fault at output.
Not used for LDOs with PG option.
Pulls down RESET Pin when VOUT_LDO is <= 0.92V

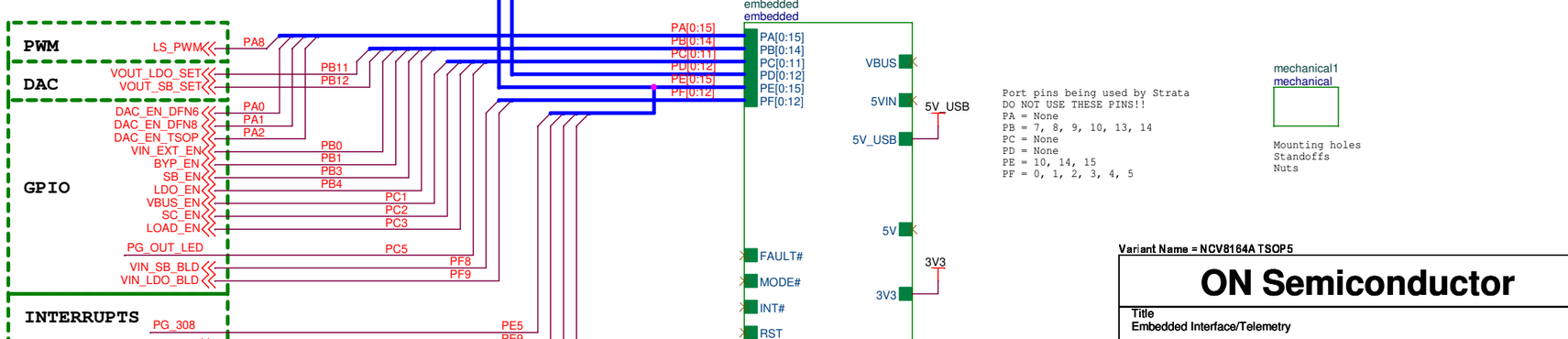
LDO Temp Sensors



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

ADC





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

mechanical1
mechanical

Mounting holes
Standoffs
Nuts

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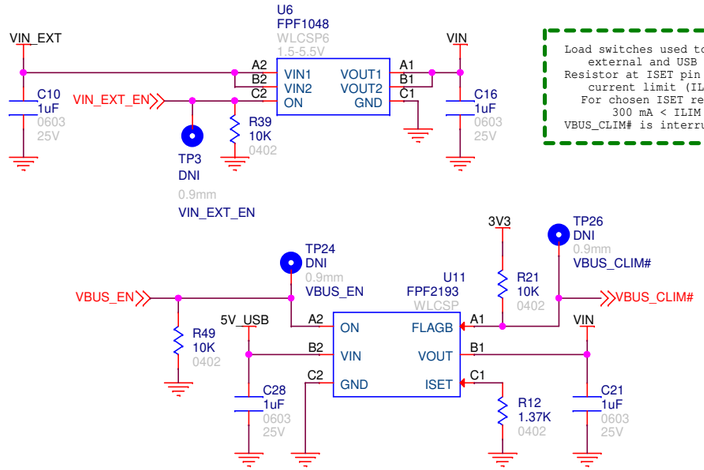
Power/Load Switches/Connectors

External/VBUS Input Power Selection

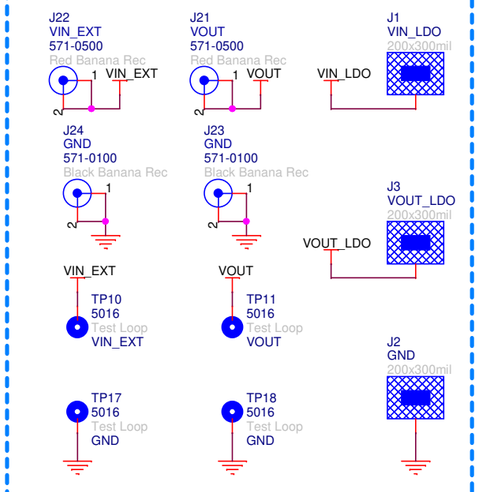


LDO Input Power Configurations

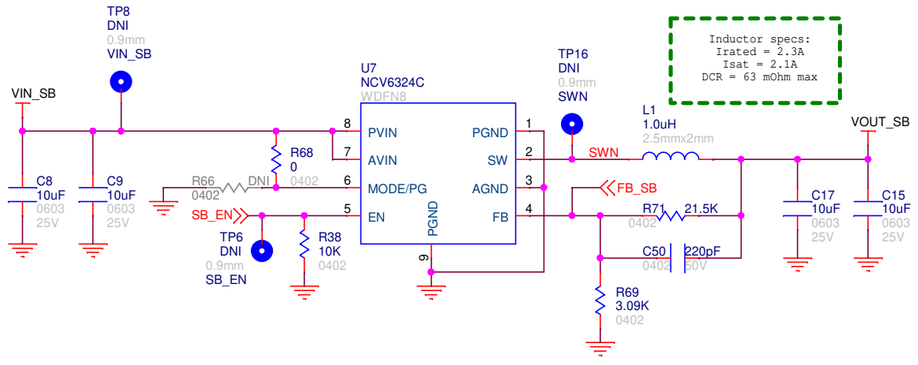
VIN_EXT_EN	VBUS_EN	BYP_EN	SB_EN	LDO Input
LOW	LOW	-	-	Pulled low or solder pad input
-	-	LOW	LOW	Pulled low or solder pad input
LOW	HIGH	LOW	HIGH	Buck regulator step-down from USB 5V
LOW	HIGH	HIGH	LOW	USB 5V
HIGH	LOW	LOW	HIGH	Buck regulator step-down from external input
HIGH	LOW	HIGH	LOW	External input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

Load Switch Bypass Jumpers

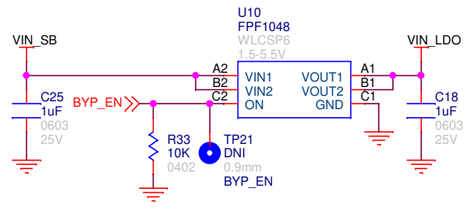
External Power Connectors



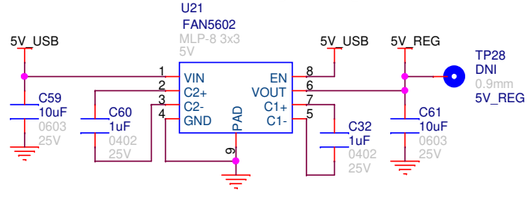
LDO Input Voltage Control
NCV6324 Sync Buck with Adjustable Output Voltage



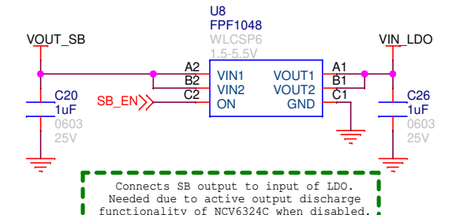
Sync Buck Bypass Switch



5V LDO/Charge Pump



Sync Buck Output Enable Switch



Variant Name = NCV8164A TSOP5

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Embedded

U22
EFM32GG380F1024
QFP100 14x14

PA[0:15]
PB[0:14]
PC[0:11]
PD[0:12]
PE[0:15]
PF[0:12]

PA0 * EBI_AD09 #0/1/2 * TIM0_CC0 #0/1/4 * I2C0_SDA #0 * LEU0_RX #4 * PRS_CH0 #0 * GPIO_EM4WU0
PA1 * EBI_AD10 #0/1/2 * TIM0_CC1 #0/1 * I2C0_SCL #0 * CMU_CLK1 #0 * PRS_CH1 #0
PA2 * EBI_AD11 #0/1/2 * TIM0_CC2 #0/1 * CMU_CLK0 #0 * ETM_TDO #3
PA3 * EBI_AD12 #0/1/2 * TIM0_CDTI0 #0 * U0_TX #2 * LES_ALTEX2 #0 * ETM_TD1 #3
PA4 * EBI_AD13 #0/1/2 * TIM0_CDTI1 #0 * U0_RX #2 * LES_ALTEX3 #0 * ETM_TD2 #3
PA5 * EBI_AD14 #0/1/2 * TIM0_CDTI2 #0 * LEU1_TX #1 * LES_ALTEX4 #0 * ETM_TD3 #3
PA6 * EBI_AD15 #0/1/2 * LEU1_RX #1 * ETM_TCLK #3 * GPIO_EM4WU1
PA7 * EBI_CSTFT #0/1/2
PA8 * EBI_DCLK #0/1/2 * TIM2_CC0 #0
PA9 * EBI_DTEN #0/1/2 * TIM2_CC1 #0
PA10 * EBI_VSNC #0/1/2 * TIM2_CC2 #0
PA11 * EBI_HSNC #0/1/2
PA12 * EBI_A00 #0/1/2 * TIM2_CC0 #1
PA13 * EBI_A01 #0/1/2 * TIM2_CC1 #1
PA14 * EBI_A02 #0/1/2 * TIM2_CC2 #1
PA15 * EBI_AD08 #0/1/2 * TIM3_CC2 #0

PB0 * EBI_A16 #0/1/2 * TIM1_CC0 #2
PB1 * EBI_A17 #0/1/2 * TIM1_CC1 #2
PB2 * EBI_A18 #0/1/2 * TIM1_CC2 #2
PB3 * EBI_A19 #0/1/2 * PCNT1_S0IN #1 * US2_TX #1
PB4 * EBI_A20 #0/1/2 * PCNT1_S1IN #1 * US2_RX #1
PB5 * EBI_A21 #0/1/2 * US2_CLK #1
PB6 * EBI_A22 #0/1/2 * US2_CS #1
PB7 * LFXTAL_P * TIM1_CC0 #3 * US0_TX #4 * US1_CLK #0
PB8 * LFXTAL_N * TIM1_CC1 #3 * US0_RX #4 * US1_CS #0
PB9 * EBI_A03 #0/1/2 * U1_TX #2
PB10 * EBI_A04 #0/1/2 * U1_RX #2
PB11 * DAC0_OUT0 * OPAMP_OUT0 * LETIM0_OUT0 #1 * TIM1_CC2 # * I2C1_SDA #1
PB12 * DAC0_OUT1 * OPAMP_OUT1 * LETIM0_OUT1 #1 * I2C1_SCL #1
PB13 * HFXTAL_P * US0_CLK #4/5 * LEU0_TX #1
PB14 * HFXTAL_N * US0_CS #4/5 * LEU0_RX #1

PC0 * ACMP0_CH0 * DAC0_OUT0ALT #0 * 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 * 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 * ACMP0_CH2 * DAC0_OUT0ALT #2 * OPAMP_OUT0ALT * EBI_A25 #0/1/2 * TIM0_CDTI0 #4 * US2_TX #0 * LES_CH2 #0
PC3 * ACMP0_CH3 * DAC0_OUT0ALT #3 * OPAMP_OUT0ALT * EBI_NANDREn #0/1/2 * TIM0_CDTI1 #4 * US2_RX #0 * LES_CH3 #0
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
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
PC6 * ACMP0_CH6 * EBI_A05 #0/1/2 * I2C0_SDA #2 * LEU1_TX #0 * LES_CH6 #0 * ETM_TCLK #2
PC7 * ACMP0_CH7 * EBI_A06 #0/1/2 * I2C0_SCL #2 * LEU1_RX #0 * LES_CH7 #0 * ETM_TDO #2
PC8 * ACMP1_CH0 * EBI_A15 #0/1/2 * TIM2_CC0 #2 * US0_CS #2 * LES_CH8 #0
PC9 * ACMP1_CH1 * EBI_A09 #1/2 * TIM2_CC1 #2 * US0_CLK #2 * LES_CH9 #0 * GPIO_EM4WU2
PC10 * ACMP1_CH2 * EBI_A10 #1/2 * TIM2_CC2 #2 * US0_RX #2 * LES_CH10 #0
PC11 * ACMP1_CH3 * EBI_ALE #1/2 * US0_TX #2 * LES_CH11 #0

PD0 * ADC0_CH0 * DAC0_OUT0ALT #4 * OPAMP_OUT0ALT * OPAMP_OUT2 #1 * PCNT2_S0IN #0 * US1_TX #1
PD1 * ADC0_CH1 * DAC0_OUT1ALT #4 * OPAMP_OUT1ALT * TIM0_CC0 #3 * PCNT2_S1IN #0 * US1_RX #1 * DBG_SWO #2
PD2 * ADC0_CH2 * EBI_A27 #0/1/2 * TIM0_CC1 #3 * USB_DMPU #0 * US1_CLK #1 * DBG_SWO #3
PD3 * ADC0_CH3 * OPAMP_N2 * TIM0_CC2 #3 * US1_CS #1 * ETM_TD1 #0/2
PD4 * ADC0_CH4 * OPAMP_P2 * LEU0_TX #0 * ETM_TD2 #0/2
PD5 * ADC0_CH5 * OPAMP_OUT2 #0 * LEU0_RX #0 * ETM_TD3 #0/2
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 * 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 * BU_VIN * CMU_CLK1 #1
PD9 * EBI_CS0 #0/1/2
PD10 * EBI_CS1 #0/1/2
PD11 * EBI_CS2 #0/1/2
PD12 * EBI_CS3 #0/1/2

PE0 * EBI_A07 #0/1/2 * TIM3_CC0 #1 * PCNT0_S0IN #1 * U0_TX #1 * I2C1_SDA #2
PE1 * EBI_A08 #0/1/2 * TIM3_CC1 #1 * U0_RX #1 * PCNT0_S1IN #1 * I2C1_SCL #2
PE2 * BU_VOUT * EBI_A09 #0 * TIM3_CC2 #1 * U1_TX #3 * ACMP0_O #1
PE3 * BU_STAT * EBI_A10 #0 * U1_RX #3 * ACMP1_O #1
PE4 * EBI_A11 #0/1/2 * US0_CS #1
PE5 * EBI_A12 #0/1/2 * US0_CLK #1
PE6 * EBI_A13 #0/1/2 * US0_RX #1
PE7 * EBI_A14 #0/1/2 * US0_TX #1
PE8 * EBI_AD00 #0/1/2 * PCNT2_S0IN #1 * PRS_CH3 #1
PE9 * EBI_AD01 #0/1/2 * PCNT2_S1IN #1
PE10 * EBI_AD02 #0/1/2 * TIM1_CC0 #1 * US0_TX #0 * BOOT_TX
PE11 * EBI_AD03 #0/1/2 * TIM1_CC1 #1 * US0_RX #0 * LES_ALTEX5 #0 * BOOT_RX
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 * EBI_AD05 #0/1/2 * US0_TX #3 * US0_CS #0 * I2C0_SCL #6 * LES_ALTEX7 #0 * ACMP0_O #0 * GPIO_EM4WU5
PE14 * EBI_AD06 #0/1/2 * TIM3_CC0 #0 * LEU0_TX #2
PE15 * EBI_AD07 #0/1/2 * TIM3_CC1 #0 * LEU0_RX #2

PF0 * TIM0_CC0 #5 * LETIM0_OUT0 #2 * US1_CLK #2 * I2C0_SDA #5 * LEU0_TX #3 * DBG_SWCLK #0/1/2/3
PF1 * TIM0_CC1 #5 * LETIM0_OUT1 #2 * US1_CS #2 * I2C0_SCL #5 * LEU0_RX #3 * DBG_SWDIO #0/1/2/3 * GPIO_EM4WU3
PF2 * EBI_ARDY #0/1/2 * TIM0_CC2 #5 * LEU0_TX #4 * ACMP1_O #0 * DBG_SWO #0 * GPIO_EM4WU4
PF5 * EBI_REn #0/2 * TIM0_CDTI2 #2/5 * USB_VBUSEN #0 * PRS_CH2 #1
PF6 * EBI_BL0 #0/1/2 * TIM0_CC0 #2 * U0_TX #0
PF7 * EBI_BL1 #0/1/2 * TIM0_CC1 #2 * U0_RX #0
PF8 * EBI_WEn #1 * TIM0_CC2 #2 * ETM_TCLK #1
PF9 * EBI_REn #1 * ETM_TD0 #1
PF10 * U1_TX #1 * USB_DM
PF11 * U1_RX #1 * USB_DP
PF12 * USB_ID

RESETn
USB_VBUS
USB_VREGI
USB_VREGO
AVDD_0
AVDD_1
VDD_DREG
IOVDD_0
IOVDD_1
IOVDD_2
IOVDD_3
IOVDD_5
DECOUPLE
GND0
GND1
GND2
GND3

RST_MCU#
C75 0.1uF 0402 50V
C77 4.7uF 0402 6.3V
C67 4.7uF 0402 6.3V
C62 4.7uF 0402 6.3V
C71 4.7uF 0402 6.3V
C40 0.1uF 0402 50V
C63 1uF 0402 16V

MCU debug and programming header
J25 FTSH-105-01-F-DV-K 2x5pin 50mil Cortex Debug
DBG_SWDIO
DBG_SWCLK
DBG_SWO

50mA max in switch
SW1 434153017835 MOM1 SMD
TP45 DNI RST 1mm Circle
R24 2.32K 0402
R25 100 0603
~10ms switch debounce
R81 100 0402
RST_FT#
Q9 2N7002W SOT-323 60V
R84 100 0402
RST_MCU#
Q8 2N7002W SOT-323 60V
C66 10uF 0603 25V
Master reset, use RST (active high) with FET/pull up for all other circuits that should be reset with MCU and FT

Optionally short 5VIN and 5V_USB when no external supplies are being used, only 5V_USB
FB1 220@100M 0805
Route USB_DX 45 ohm single ended
J26 65100516121 Mini USB1/2 B
VBUS
D-
D+
ID
GND
SH1
SH2
SH3
SH4
Maximum 10uF on VBUS
JP7 6.5A 0402
D7 ESD7L SOT-723 5.5V
C72 1uF 0402 16V
D9 NSR20F20NX DSN2 0603 20V
D8 NSR20F20NX DSN2 0603 20V
U25 NCP705 VDFN8
IN
OUT
NC
ADJ/NC
EN
GND
EPAD
R89 10K 0402
C76 1uF 0402 16V
C58 4.7uF 0402 6.3V
MCU power domain only!! Connect only MCU and devices/signals that need to communicate to MCU on 3.3V!

Detects VBUS disconnect to disable serial communication
R79 10K 0402
MODE#
Q7 2N7002W SOT-323 60V
TP52 DNI TX 1mm Circle
TP47 DNI RX 1mm Circle
FT230X is powered down during loss of VBUS
U24 FT230X QFN16 4x4
3V3OUT
VCCIO
USBDm
USBDp
RESET
GND1
GND2
VCC
TXD
RXD
RTS
CTS
CBUS0
CBUS1
CBUS2
CBUS3
EPAD
C70 4.7uF 0402 6.3V
C64 0.1uF 0402 50V
C78 1uF 0402 16V
R83 4.99K 0402
R82 9.31K 0402
R80 10K 0402
R78 681 0402
D6 RX 0603
D5 TX 0603
D4 5V 0603
D3 LINK 0603
150060RS75000
150060GS75000
150060BS75000
150060YS75000

Y1 32.768 kHz 2 pin w/ shell
C68 12pF 0402 50V
C69 12pF 0402 50V
Y2 48MHz 5x3.2mm
C73 7.5pF 0402 50V
C74 7.5pF 0402 50V
TP50 DNI 0.75mm 5V
TP37 DNI 0.75mm 3V3
TP36 DNI 0.75mm 5V_USB
TP51 DNI 0.75mm 5VIN
TP46 DNI 0.75mm 3V3_FT
TP48 DNI 1mm Circle RTS
TP49 DNI 1mm Circle CTS

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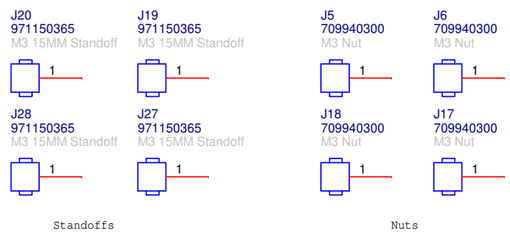
Mounting Holes, Standoffs, and Nuts



Variant Name = NCV8164A TSOP5

ON Semiconductor

Title: Mechanical		
Size: Custom	Document Number: ONSEC-19-017	Rev: REV1
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