EFM32 Happy Gecko STK

Board Function	Page
Title Page	1
User Interface	2
EFM32 Signal Assignments	3
EFM32 Power & USB	4
EFM32 I/O	5
STK Board Controller	6
AEM - Current Sense	7
AEM - Gain stages	8
Debug Interface	9
Power & Misc	10

Revision History

Rev.	Description
A00	First production release.
B00	Updated Board Controller pin-out.
B01	Minor update to secondary (target USB) AEM channel.

PCB1

PCB2012

/
EFM32 HG STK

Schematic Title	EFM32 Happy Gecko Starter Kit
Page Title	Title Page
Designed: DDB / Approved: JNO	
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Document number: BRD2012A	Revision: B01
Design Created Date: Wednesday, December 03, 2008	
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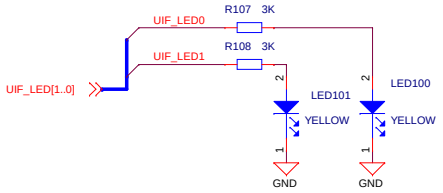
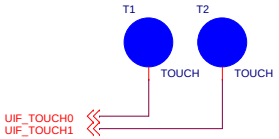
	Sheet 1 of 10

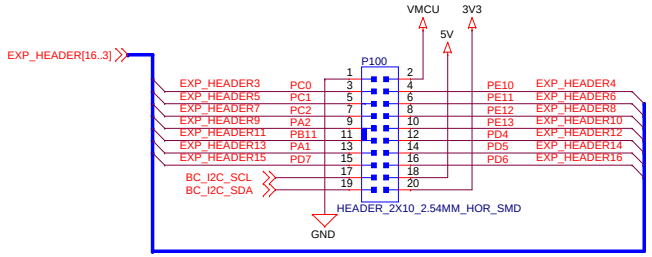
User LEDs



Touch Pads



EXP Header

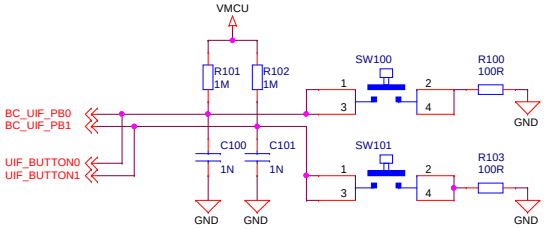


EXP-Header Functionality

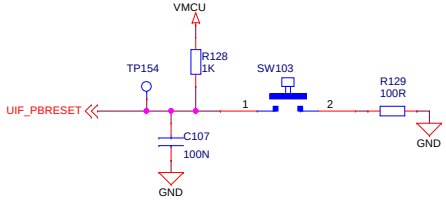
1	GND		
3	PC0		ACMP0_CH0
5	PC1		ACMP0_CH1
7	PC2		ACMP0_CH2
9	PA2		
11	PB11		IDAC0_OUT
13	PA1		
15	PD7	I2C0_SCL	ADC0_CH7
17	Reserved for EXP Board Identification		
19	Reserved for EXP Board Identification		

2	VMCU		
4	PE10	US0_TX	
6	PE11	US0_RX	
8	PE12	US0_CLK	ADC0_CH0
10	PE13	US0_CS	ADC0_CH1
12	PD4	LEU0_TX	ADC0_CH4
14	PD5	LEU0_RX	ADC0_CH5
16	PD6	I2C0_SDA	ADC0_CH6
18	5V		
20	3V3		

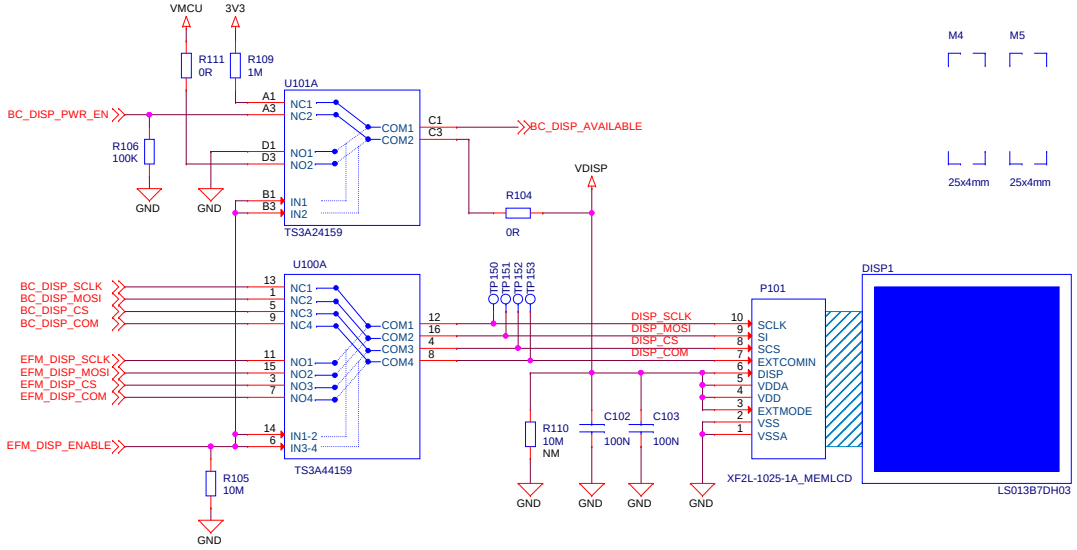
User Pushbuttons



RESET Pushbutton

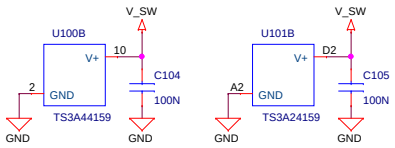


Memory LCD-TFT Display & Multiplexer

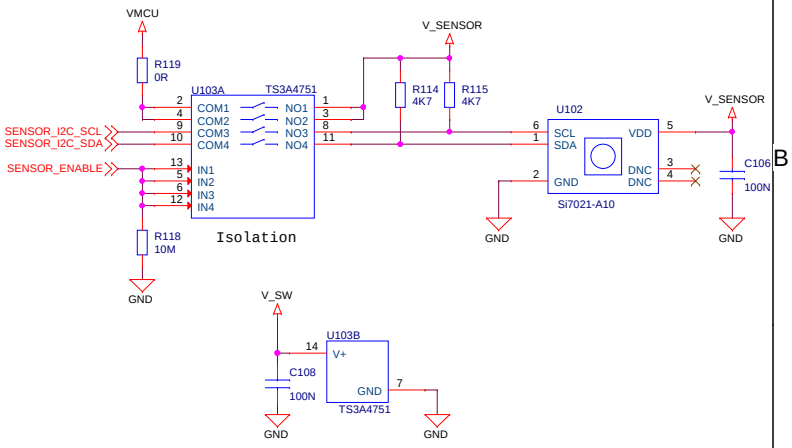


EFM_DISP_ENABLE	DISP_CTRL	VDISP	BC_DISP_AVAILABLE
1	EFM	VMCU	0
0	BC	BC_DISP_PWR_EN	1

The EFM32 always controls ownership of the display using the EFM_DISP_ENABLE signal.



Relative Humidity & Temperature Sensor



EFM32 HG STK

SILICON LABS

Designed: DDB	Approved: JNO
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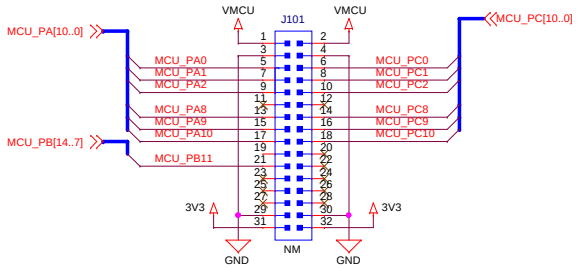
Design Created Date: Wednesday, December 03, 2008	

Schematic Title: **EFM32 Happy Gecko Starter Kit**

Page Title: **User Interfaces**

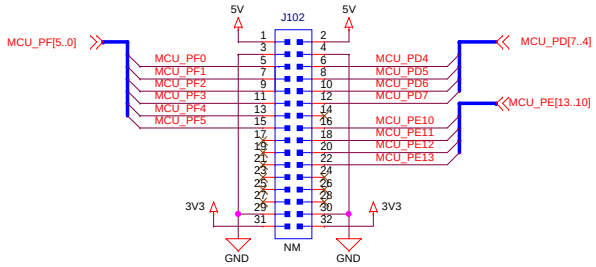
Document number: BRD2012A	Revision: B01
Sheet Created Date: Friday, October 31, 2014	Sheet Modified Date: Thursday, March 26, 2015
Sheet: 2 of 10	

Breakout Connections



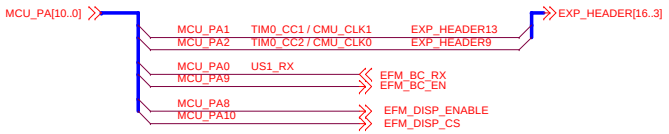
Breakout header labels:

VMCU	VMCU
GND	GND
PA0	PC0
PA1	PC1
PA2	PC2
NC	NC
PA8	PC8
PA9	PC9
PA10	PC10
NC	NC
PB11	NC
NC	NC
NC	NC
NC	NC
NC	NC
GND	GND
3V3	3V3

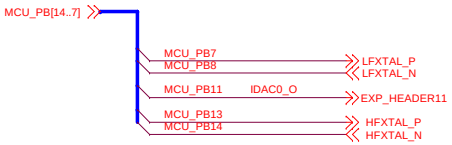


5V	5V
GND	GND
PF0	PD4
PF1	PD5
PF2	PD6
PF3	PD7
PF4	NC
PF5	PE10
NC	PE11
NC	PE12
NC	PE13
NC	NC
NC	NC
NC	NC
NC	NC
GND	GND
3V3	3V3

PA Connections

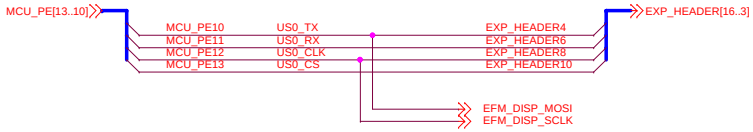


PB Connections

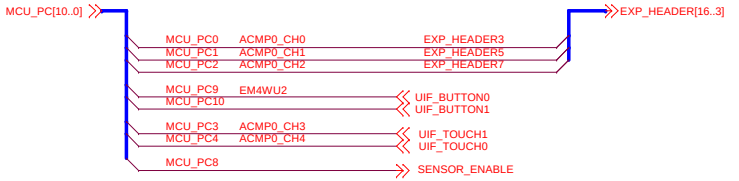


PE Connections

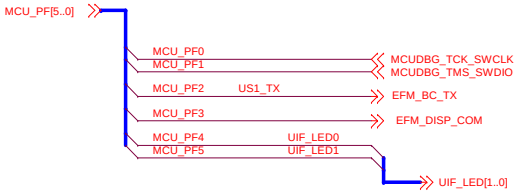
PE10 - PE13 (USART1) are used for the EXP Header
SPI port as well as the display clock and data.



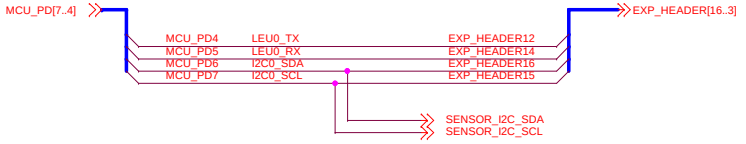
PC Connections



PF Connections



PD Connections



SILICON LABS

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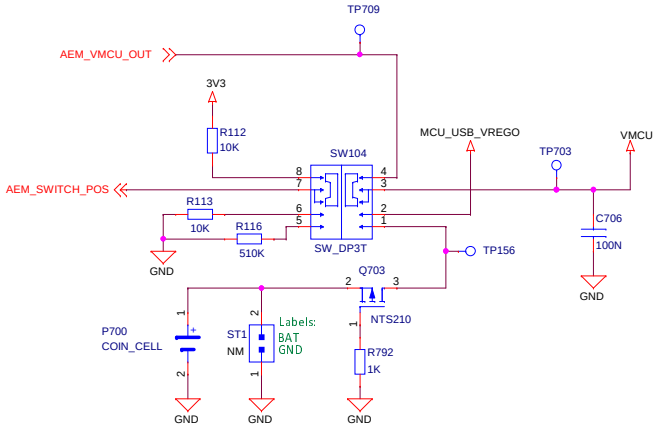
Design Created Date: Wednesday, December 03, 2008	

Schematic Title: **EFM32 Happy Gecko Starter Kit**

Page Title: **Signal Assignments**

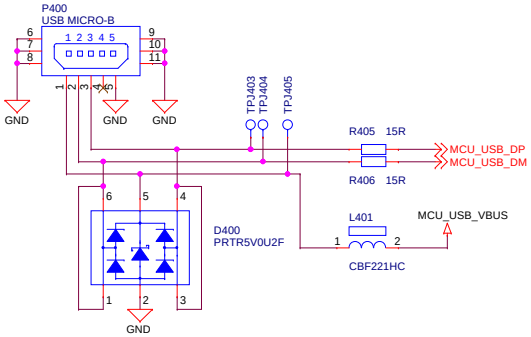
Document number: **BRD2012A**		Revision: B01
Sheet Created Date: Friday, October 31, 2014	Sheet Modified Date: Thursday, March 26, 2015	Sheet: 3 of 10

Power Select Switch: AEM/USB/BAT

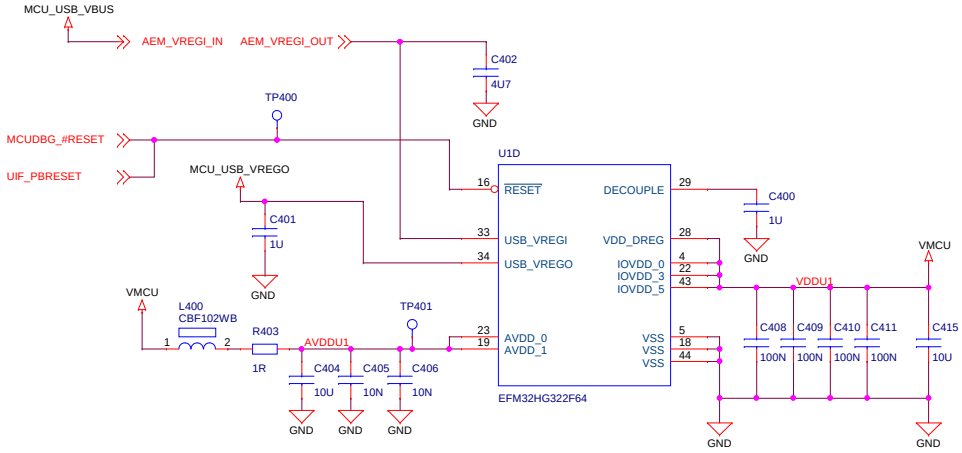


SWITCH POS	MODE DESCRIPTION
AEM	AEM Enabled, VMCU sourced from external 3.3V LDO powered by BC USB 5V supply
USB	AEM Enabled. VMCU sourced from internal 3.3V LDO powered by MCU USB 5V supply
BAT	AEM Disabled, VMCU sourced from coin-cell battery or external power supply

USB Connection and ESD Protection



EFM32 Power and Decoupling



Schematic Title	EFM32 Happy Gecko Starter Kit
Page Title	EFM32 Power & USB
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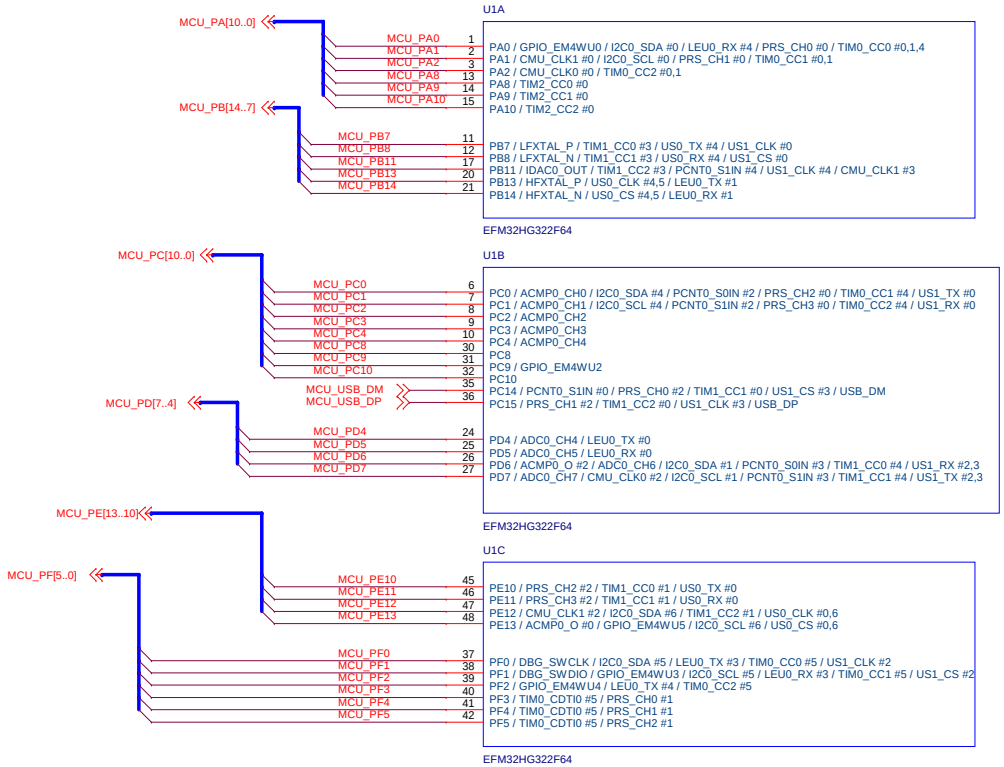
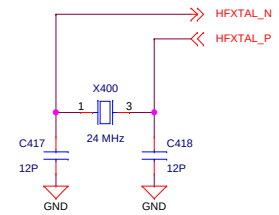
Size A3	BOM Doc No: <Cage Code>
Document number	BRD2012A
Revision	B01
Design Created Date:	Wednesday, December 03, 2008
Sheet Created Date	Friday, October 31, 2014
Sheet Modified Date	Thursday, March 19, 2015
Sheet	4 of 10

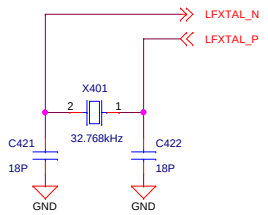
EFM32 HG MCU



High Frequency Clock



Low Frequency Clock



SILICON LABS

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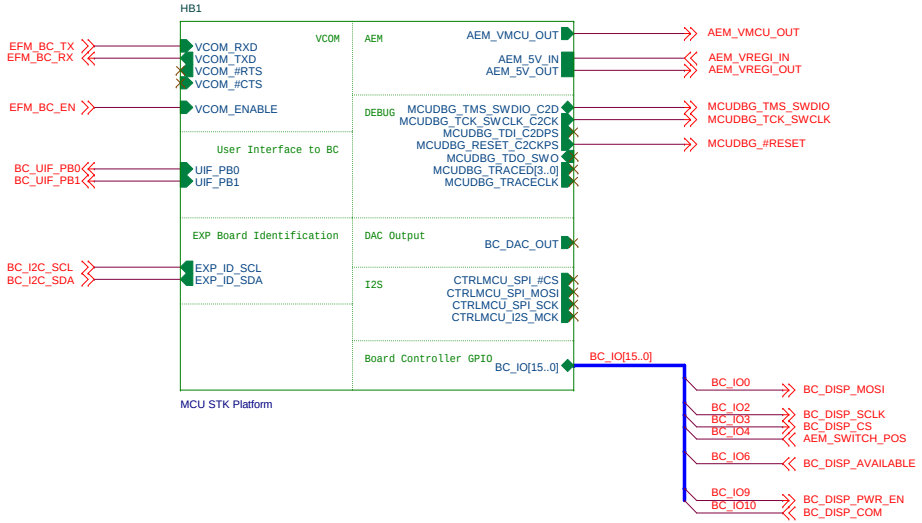
Design Created Date: Wednesday, December 03, 2008	

Schematic Title: **EFM32 Happy Gecko Starter Kit**

Page Title: **EFM32 IO**

Document number: **BRD2012A**	Revision: B01
Sheet Created Date: Monday, November 17, 2014	Sheet Modified Date: Tuesday, March 24, 2015
Sheet: 5 of 10	

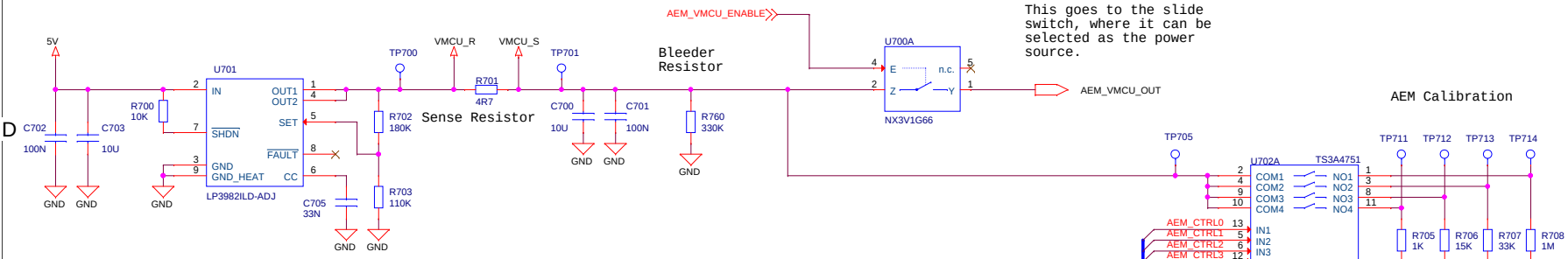
Board Controller Functional Block



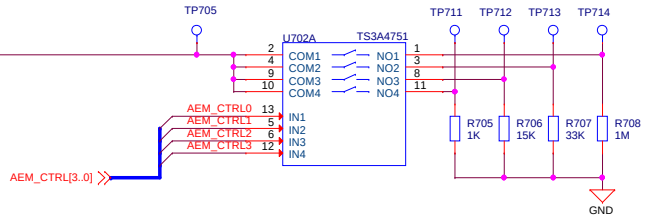
SILICON LABS

Schematic Title	EFM32 Happy Gecko Starter Kit
Page Title	Board Controller Functional Block
Designed: DDB	Approved: JNO
Size: A3	BOM Doc No: <Cage Code>
Document number: BRD2012A	Revision: B01
Design Created Date: Wednesday, December 03, 2008	Sheet Created Date: Friday, October 31, 2014
Sheet Modified Date: Thursday, March 19, 2015	Sheet: 6 of 10

MCU power regulator

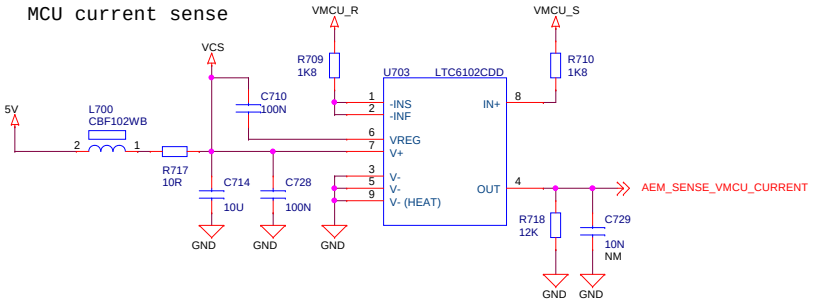


AEM Calibration

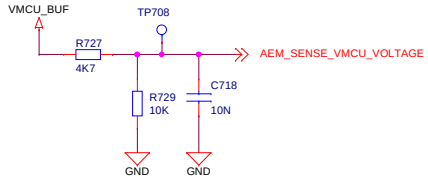


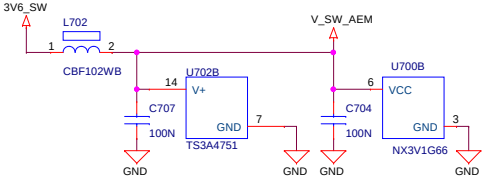
AEM_CTRL	Calibration Current
0x1	3.30 uA
0x2	100 uA
0x4	220 uA
0x6	320 uA
0x8	3.30 mA

MCU current sense

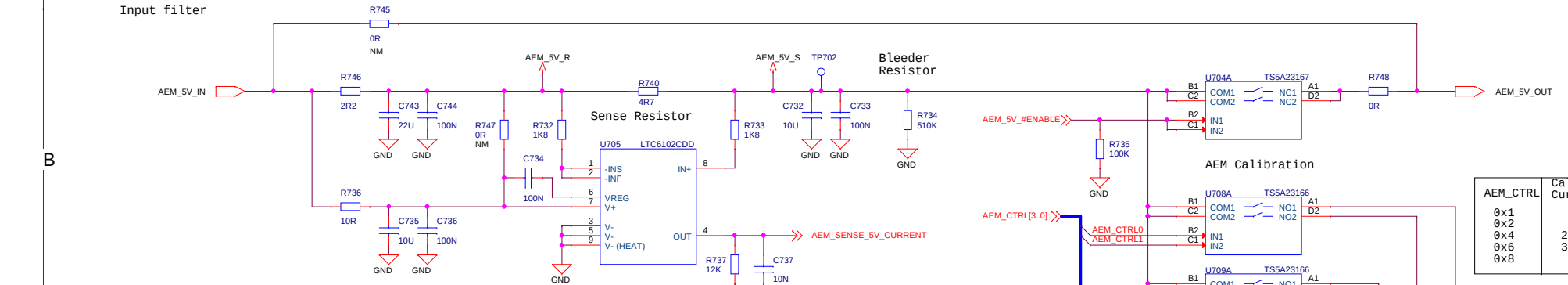


MCU Voltage Sense

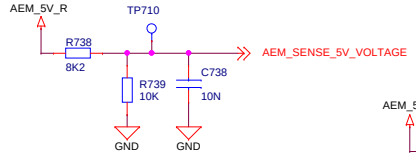




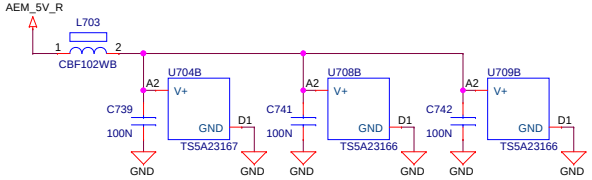
Input filter

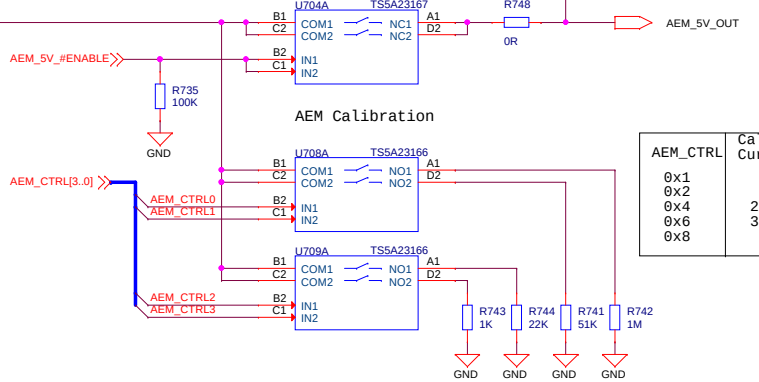


Target USB Voltage Sense



Decoupling





AEM_CTRL	Calibration Current
0x1	5 uA
0x2	98 uA
0x4	227 uA
0x6	325 uA
0x8	5 mA

*Bypass: remove R736 & R746 and add R745 to bypass current sense and filters completely if required for USB compliance testing.

/HB1
MCU STK Platform

SILICON LABS

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Schematic Title: **EFM32 Happy Gecko Starter Kit**

Page Title: **Advanced Energy Monitor - Current Sense**

Document number: BRD2012A	Revision: B01
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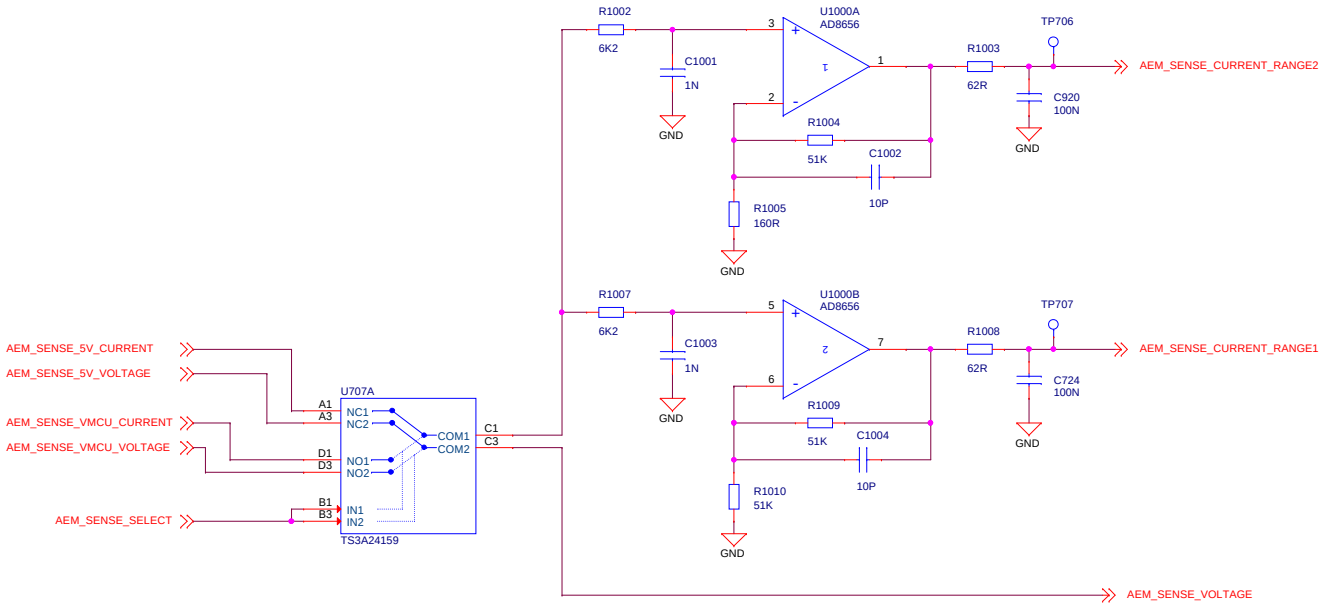
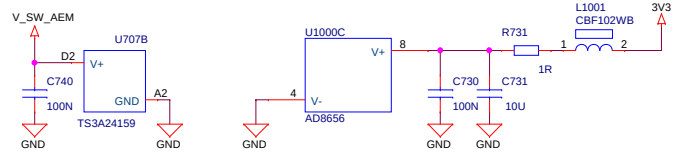
Sheet: 7 of 10	





/HB1
MCU STK Platform

SILICON LABS

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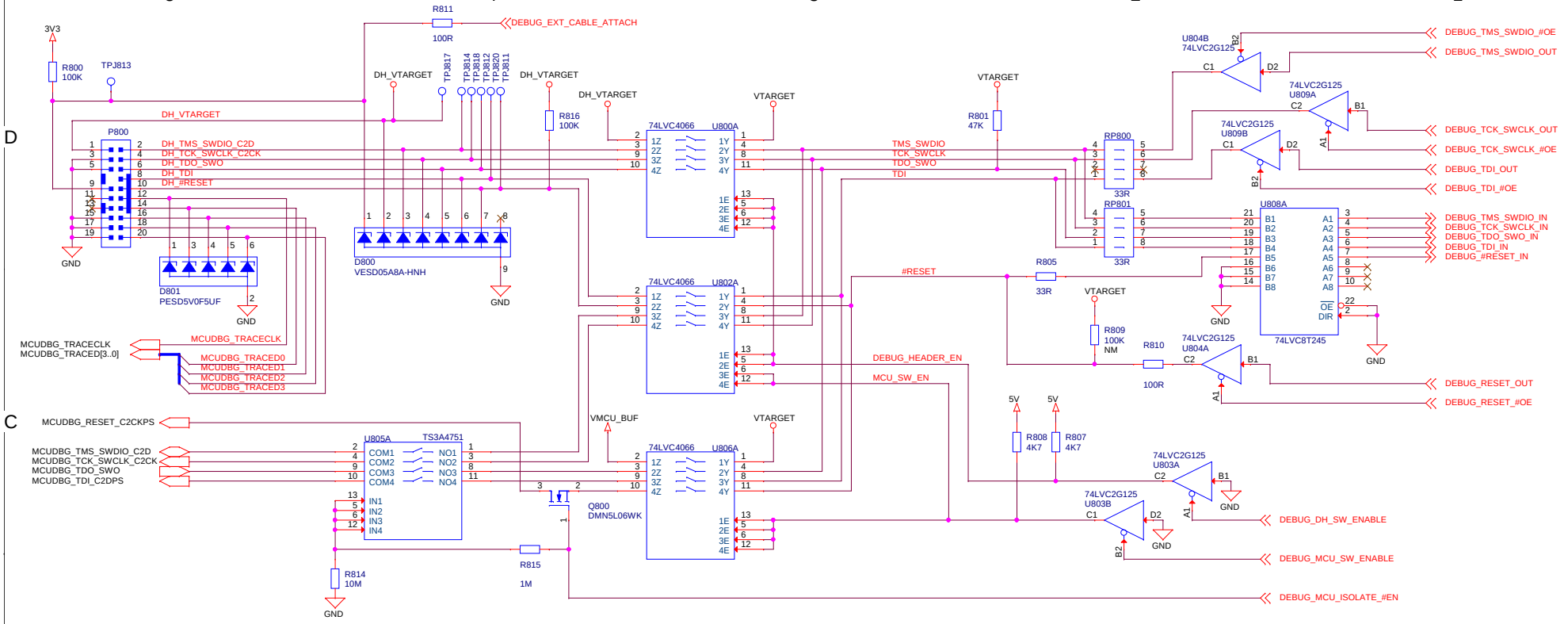
Size A3	BOM Doc No: <Cage Code>
Design Created Date: Monday, May 12, 2014	

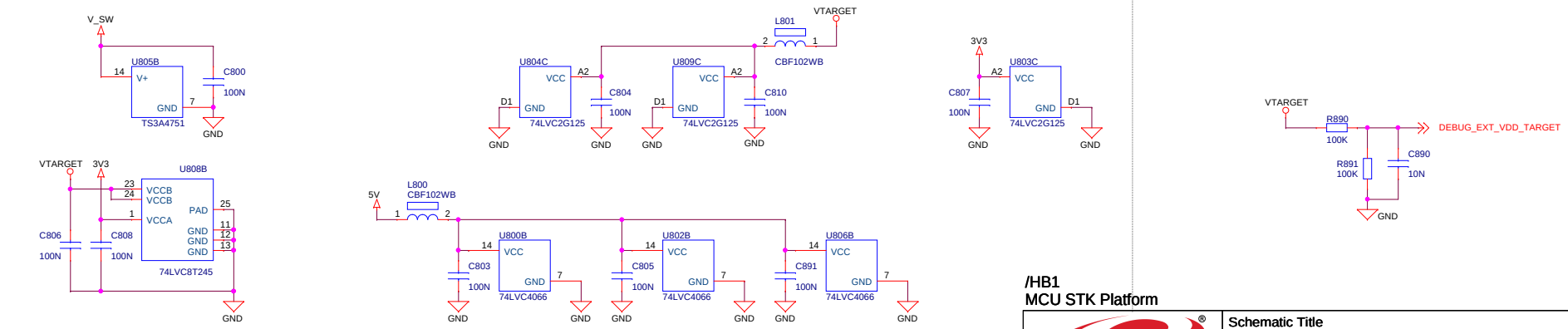
Schematic Title
EFM32 Happy Gecko Starter Kit

Page Title
Advanced Energy Monitor - Gain Stages

Document number **BRD2012A**		Revision B01
Sheet Created Date Saturday, March 21, 2015	Sheet Modified Date Monday, March 23, 2015	Sheet 8 of 10



Power & Decoupling



Mode	DEBUG_MCU_SW_ENABLE	DEBUG_DH_SW_ENABLE	DEBUG_BUF_#OE	ISOLATE_#EN	DH_VTARGET	VTARGET
Debug Out	0	1	0	0	External voltage	External voltage
MCU Debug	1	0	0	1	Disconnected	VMCU
Debug In	1	1	1	1	VMCU	VMCU
Debug Off	1	1	1	0	-	-

/HB1
MCU STK Platform

SILICON LABS

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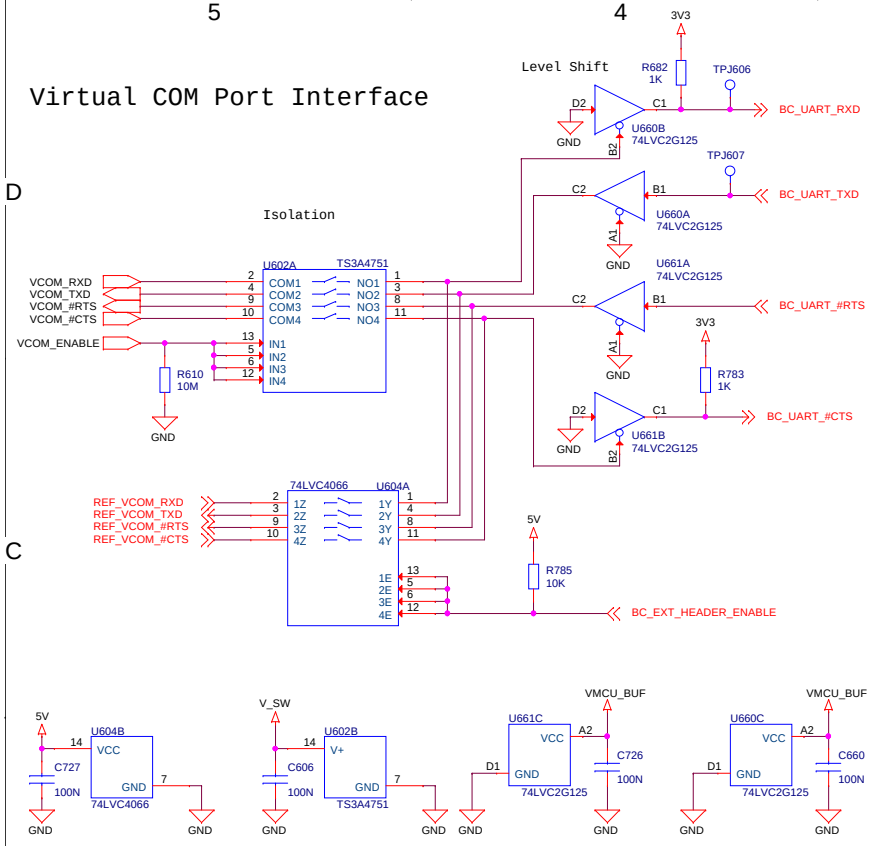
Size: A3	BOM Doc No: <Cage Code>
Design Created Date: Monday, May 12, 2014	

Schematic Title
EFM32 Happy Gecko Starter Kit

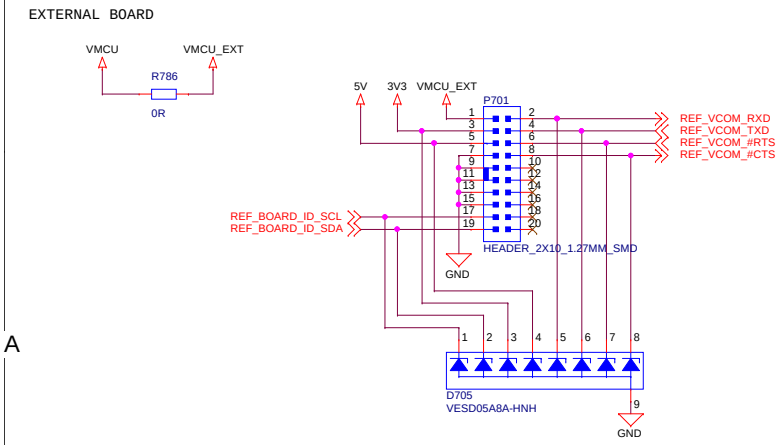
Page Title
Debug Interface

Document number: BRD2012A	Revision: B01
Sheet Created Date: Monday, May 12, 2014	Sheet Modified Date: Monday, March 16, 2015
Sheet: 9 of 10	

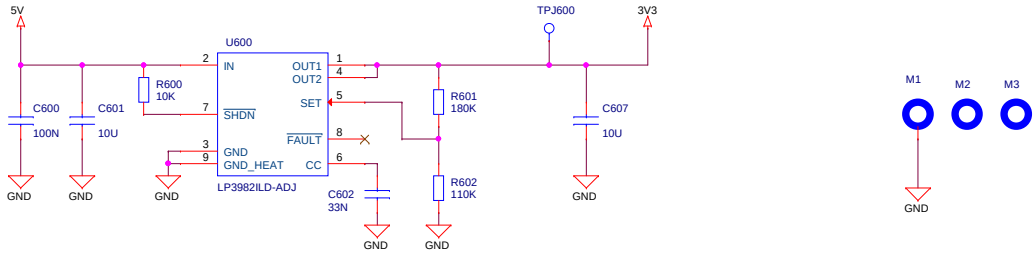
Virtual COM Port Interface



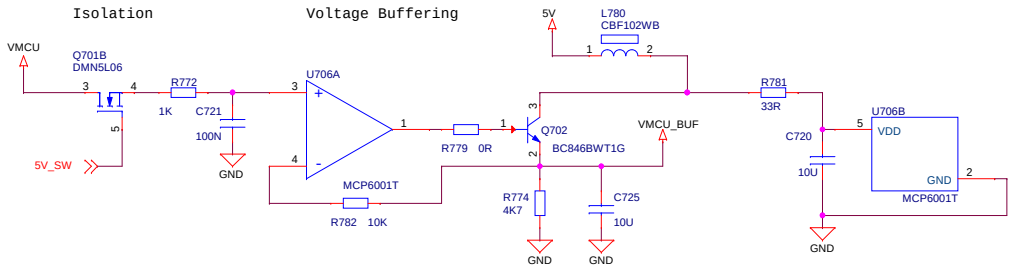
Connector for external reference designs boards



3V3 Regulator



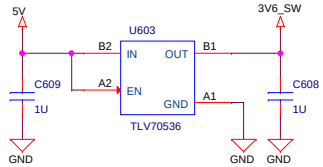
VMCU Voltage Mirror

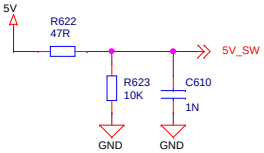


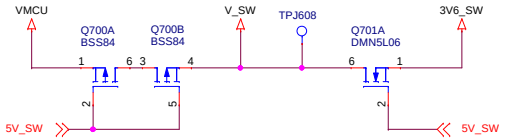
Power Supply for Analog Switches

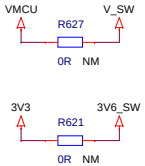
The USB VBUS voltage is used to bias these transistors, turning the P-Channel MOSFETs (Q700) off, and the N-Channel MOSFETs (Q701) on.

J-Link USB Cable	PMOS State	NMOS State	V_SW	VMCU_SENSE
Connected Disconnected	Off ON	ON OFF	3.6V VMCU	VMCU Isolated









/HB1
MCU STK Platform

SILICON LABS

Schematic Title	EFM32 Happy Gecko Starter Kit
Page Title	Power & Misc
Designed: DDB	Approved: JNO
Size: A3	BOM Doc No: <Cage Code>
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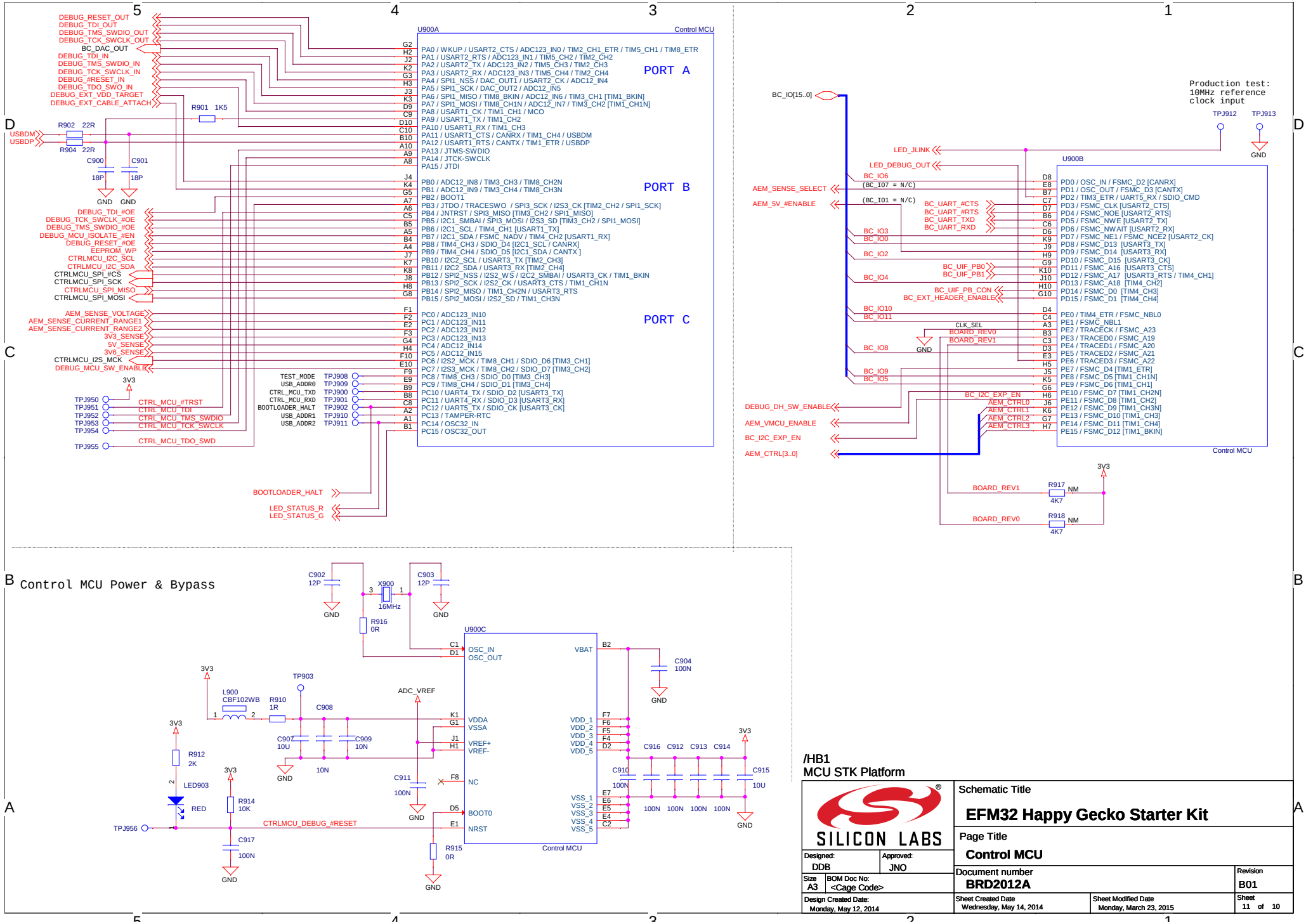
Sheet: 10 of 10	


U900A
Control MCU
PORT A
PORT B
PORT C
DEBUG_RESET_OUT
DEBUG_TDI_OUT
DEBUG_TMS_SWDIO_OUT
DEBUG_TCK_SWCLK_OUT
BC_DAC_OUT
DEBUG_TDI_IN
DEBUG_TMS_SWDIO_IN
DEBUG_TCK_SWCLK_IN
DEBUG_#RESET_IN
DEBUG_TDO_SWO_IN
DEBUG_EXT_VDD_TARGET
DEBUG_EXT_CABLE_ATTACH
R901 1K5
USBDM
USBDP
R902 22R
R904 22R
C900 18P
C901 18P
GND
DEBUG_TDI_#OE
DEBUG_TCK_SWCLK_#OE
DEBUG_TMS_SWDIO_#OE
DEBUG_MCU_ISOLATE_#EN
DEBUG_RESET_#OE
EEPROM_WP
CTRLMCU_I2C_SCL
CTRLMCU_I2C_SDA
CTRLMCU_SPI_#CS
CTRLMCU_SPI_SCK
CTRLMCU_SPI_MISO
CTRLMCU_SPI_MOSI
AEM_SENSE_VOLTAGE
AEM_SENSE_CURRENT_RANGE1
AEM_SENSE_CURRENT_RANGE2
3V3_SENSE
5V_SENSE
3V6_SENSE
CTRLMCU_I2S_MCK
DEBUG_MCU_SW_ENABLE
3V3
TPJ950
TPJ951
TPJ952
TPJ953
TPJ954
TPJ955
CTRL_MCU_#TRST
CTRL_MCU_TDI
CTRL_MCU_TMS_SWDIO
CTRL_MCU_TCK_SWCLK
CTRL_MCU_TDO_SWD
TEST_MODE TPJ908
USB_ADDR0 TPJ909
CTRL_MCU_TXD TPJ900
CTRL_MCU_RXD TPJ901
BOOTLOADER_HALT TPJ902
USB_ADDR1 TPJ910
USB_ADDR2 TPJ911
BOOTLOADER_HALT
LED_STATUS_R
LED_STATUS_G
PA0 / WKUP / USART2_CTS / ADC123_IN0 / TIM2_CH1_ETR / TIM5_CH1 / TIM8_ETR
PA1 / USART2_RTS / ADC123_IN1 / TIM5_CH2 / TIM2_CH2
PA2 / USART2_TX / ADC123_IN2 / TIM5_CH3 / TIM2_CH3
PA3 / USART2_RX / ADC123_IN3 / TIM5_CH4 / TIM2_CH4
PA4 / SPI1_NSS / DAC_OUT1 / USART2_CK / ADC12_IN4
PA5 / SPI1_SCK / DAC_OUT2 / ADC12_IN5
PA6 / SPI1_MISO / TIM8_BKIN / ADC12_IN6 / TIM3_CH1 [TIM1_BKIN]
PA7 / SPI1_MOSI / TIM8_CH1N / ADC12_IN7 / TIM3_CH2 [TIM1_CH1N]
PA8 / USART1_CK / TIM1_CH1 / MCO
PA9 / USART1_TX / TIM1_CH2
PA10 / USART1_RX / TIM1_CH3
PA11 / USART1_CTS / CANRX / TIM1_CH4 / USBDM
PA12 / USART1_RTS / CANTX / TIM1_ETR / USBDP
PA13 / JTMS-SWDIO
PA14 / JTCK-SWCLK
PA15 / JTDI
PB0 / ADC12_IN8 / TIM3_CH3 / TIM8_CH2N
PB1 / ADC12_IN9 / TIM3_CH4 / TIM8_CH3N
PB2 / BOOT1
PB3 / JTDO / TRACESWO / SPI3_SCK / I2S3_CK [TIM2_CH2 / SPI1_SCK]
PB4 / JNTRST / SPI3_MISO [TIM3_CH2 / SPI1_MISO]
PB5 / I2C1_SMBAI / SPI3_MOSI / I2S3_SD [TIM3_CH2 / SPI1_MOSI]
PB6 / I2C1_SCL / TIM4_CH1 [USART1_TX]
PB7 / I2C1_SDA / FSMC_NADV / TIM4_CH2 [USART1_RX]
PB8 / TIM4_CH3 / SDIO_D4 [I2C1_SCL / CANRX]
PB9 / TIM4_CH4 / SDIO_D5 [I2C1_SDA / CANTX]
PB10 / I2C2_SCL / USART3_TX [TIM2_CH3]
PB11 / I2C2_SDA / USART3_RX [TIM2_CH4]
PB12 / SPI2_NSS / I2S2_WS / I2C2_SMBAI / USART3_CK / TIM1_BKIN
PB13 / SPI2_SCK / I2S2_CK / USART3_CTS / TIM1_CH1N
PB14 / SPI2_MISO / TIM1_CH2N / USART3_RTS
PB15 / SPI2_MOSI / I2S2_SD / TIM1_CH3N
PC0 / ADC123_IN10
PC1 / ADC123_IN11
PC2 / ADC123_IN12
PC3 / ADC123_IN13
PC4 / ADC12_IN14
PC5 / ADC12_IN15
PC6 / I2S2_MCK / TIM8_CH1 / SDIO_D6 [TIM3_CH1]
PC7 / I2S3_MCK / TIM8_CH2 / SDIO_D7 [TIM3_CH2]
PC8 / TIM8_CH3 / SDIO_D0 [TIM3_CH3]
PC9 / TIM8_CH4 / SDIO_D1 [TIM3_CH4]
PC10 / UART4_TX / SDIO_D2 [USART3_TX]
PC11 / UART4_RX / SDIO_D3 [USART3_RX]
PC12 / UART5_TX / SDIO_CK [USART3_CK]
PC13 / TAMPER-RTC
PC14 / OSC32_IN
PC15 / OSC32_OUT
Production test:
10MHz reference
clock input
TPJ912
TPJ913
GND
U900B
Control MCU
BC_IO[15..0]
LED_JLINK
LED_DEBUG_OUT
BC_IO6
(BC_IO7 = N/C)
AEM_SENSE_SELECT
AEM_5V_#ENABLE
(BC_IO1 = N/C)
BC_UART_#CTS
BC_UART_#RTS
BC_UART_TXD
BC_UART_RXD
BC_IO3
BC_IO0
BC_IO2
BC_UIF_PB0
BC_UIF_PB1
BC_IO4
BC_UIF_PB_CON
BC_EXT_HEADER_ENABLE
BC_IO10
BC_IO11
CLK_SEL
BOARD_REV0
BOARD_REV1
BC_IO8
BC_IO9
BC_IO5
BC_I2C_EXP_EN
AEM_CTRL0
AEM_CTRL1
AEM_CTRL2
AEM_CTRL3
DEBUG_DH_SW_ENABLE
AEM_VMCU_ENABLE
BC_I2C_EXP_EN
AEM_CTRL[3..0]
R917 NM 4K7
R918 NM 4K7
PD0 / OSC_IN / FSMC_D2 [CANRX]
PD1 / OSC_OUT / FSMC_D3 [CANTX]
PD2 / TIM3_ETR / UART5_RX / SDIO_CMD
PD3 / FSMC_CLK [USART2_CTS]
PD4 / FSMC_NOE [USART2_RTS]
PD5 / FSMC_NWE [USART2_TX]
PD6 / FSMC_NWAIT [USART2_RX]
PD7 / FSMC_NE1 / FSMC_NCE2 [USART2_CK]
PD8 / FSMC_D13 [USART3_TX]
PD9 / FSMC_D14 [USART3_RX]
PD10 / FSMC_D15 [USART3_CK]
PD11 / FSMC_A16 [USART3_CTS]
PD12 / FSMC_A17 [USART3_RTS / TIM4_CH1]
PD13 / FSMC_A18 [TIM4_CH2]
PD14 / FSMC_D0 [TIM4_CH3]
PD15 / FSMC_D1 [TIM4_CH4]
PE0 / TIM4_ETR / FSMC_NBL0
PE1 / FSMC_NBL1
PE2 / TRACECK / FSMC_A23
PE3 / TRACED0 / FSMC_A19
PE4 / TRACED1 / FSMC_A20
PE5 / TRACED2 / FSMC_A21
PE6 / TRACED3 / FSMC_A22
PE7 / FSMC_D4 [TIM1_ETR]
PE8 / FSMC_D5 [TIM1_CH1N]
PE9 / FSMC_D6 [TIM1_CH1]
PE10 / FSMC_D7 [TIM1_CH2N]
PE11 / FSMC_D8 [TIM1_CH2]
PE12 / FSMC_D9 [TIM1_CH3N]
PE13 / FSMC_D10 [TIM1_CH3]
PE14 / FSMC_D11 [TIM1_CH4]
PE15 / FSMC_D12 [TIM1_BKIN]
Control MCU Power & Bypass
C902 12P
C903 12P
X900 16MHz
R916 0R
U900C
OSC_IN
OSC_OUT
VBAT
C904 100N
L900 CBF102WB
R910 1R
TP903
C908
ADC_VREF
C907 10U
C909 10N
R912 2K
LED903
RED
R914 10K
C911 100N
NC
BOOT0
NRST
R915 0R
TPJ956
CTRLMCU_DEBUG_#RESET
C917 100N
VDDA
VSSA
VREF+
VREF-
VDD_1
VDD_2
VDD_3
VDD_4
VDD_5
VSS_1
VSS_2
VSS_3
VSS_4
VSS_5
C910 100N
C916 C912 C913 C914
100N 100N 100N 100N
C915 10U
/HB1
MCU STK Platform
SILICON LABS
Schematic Title
EFM32 Happy Gecko Starter Kit
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Control MCU
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Sheet Created Date Wednesday, May 14, 2014
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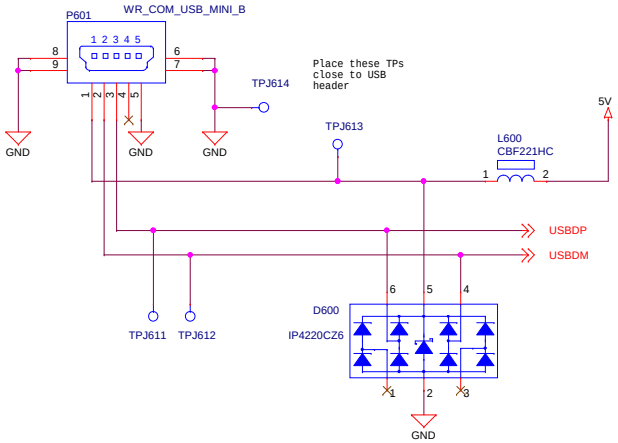
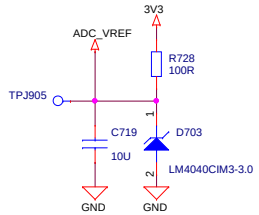
Sheet 11 of 10

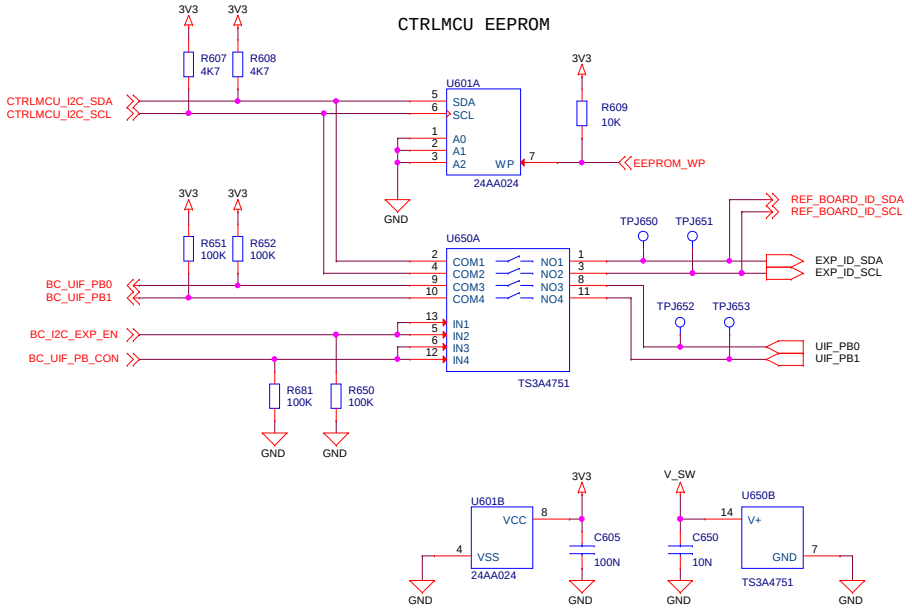
J-Link USB Port



ADC reference voltage



CTRLMCU EEPROM



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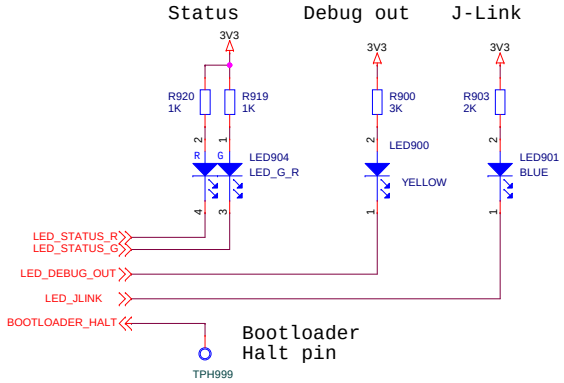
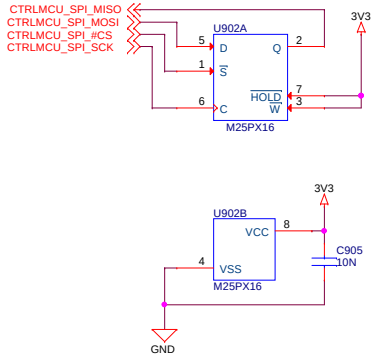
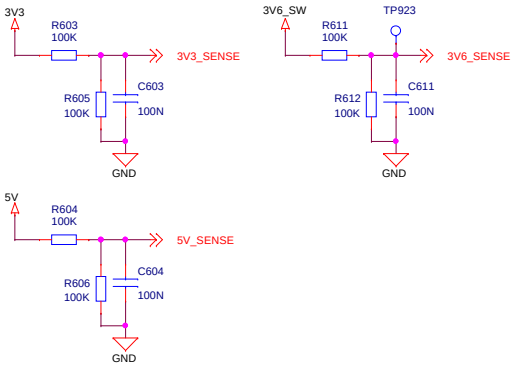


CTRLMCU SERIAL FLASH



POWER SENSE



/HB1
MCU STK Platform

SILICON LABS

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Design Created Date: Monday, May 12, 2014	

Schematic Title: **EFM32 Happy Gecko Starter Kit**

Page Title: **Board Controller Misc**

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Sheet Created Date: Wednesday, May 14, 2014	Sheet Modified Date: Monday, March 16, 2015
	Sheet: 12 of 10