1 - Cover Sheet
2 - Connector+IO: HSEC connector and Device IO
3 - Power+Misc: LDO, optional SVS, optional XTAL, LEDs
4 - ADC: ADC interface circuitry
5 - Xds100v2_Emu: isolated xds100v2 emulator
6 - EmuInterface: isolation circuitry for emulator
7 - EVM Hardware and Silkscreen components

Note that all switches are displayed in the schematic as they
are oriented in the layout.

Revision History

Rev	ECN #	Approved Date	Approved by	Notes
E1	N/A	15Dec2015	BL	First Draft
E2	N/A	20Sept2016	BL	Second Draft
A	N/A	06Jan2016	BL	Add CE Mark; Fix silkscreen issues

Orderable: TMDSCNCD280049M
TID #: N/A
Number: MCU009   Rev: A
SVN Rev: Version control disabled
Drawn By: Brett Larimore
Engineer: Brett Larimore

Designed for: Public Release
Project Title: F280049M controlCARD
Sheet Title: Cover Sheet
Assembly Variant: 001
File: MCU009A_CoverSheet.SchDoc
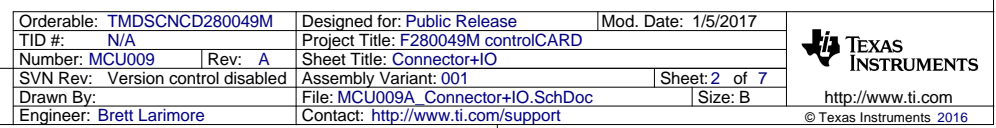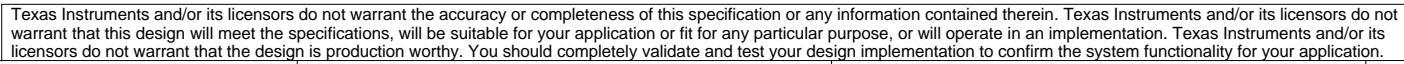Contact: http://www.ti.com/support
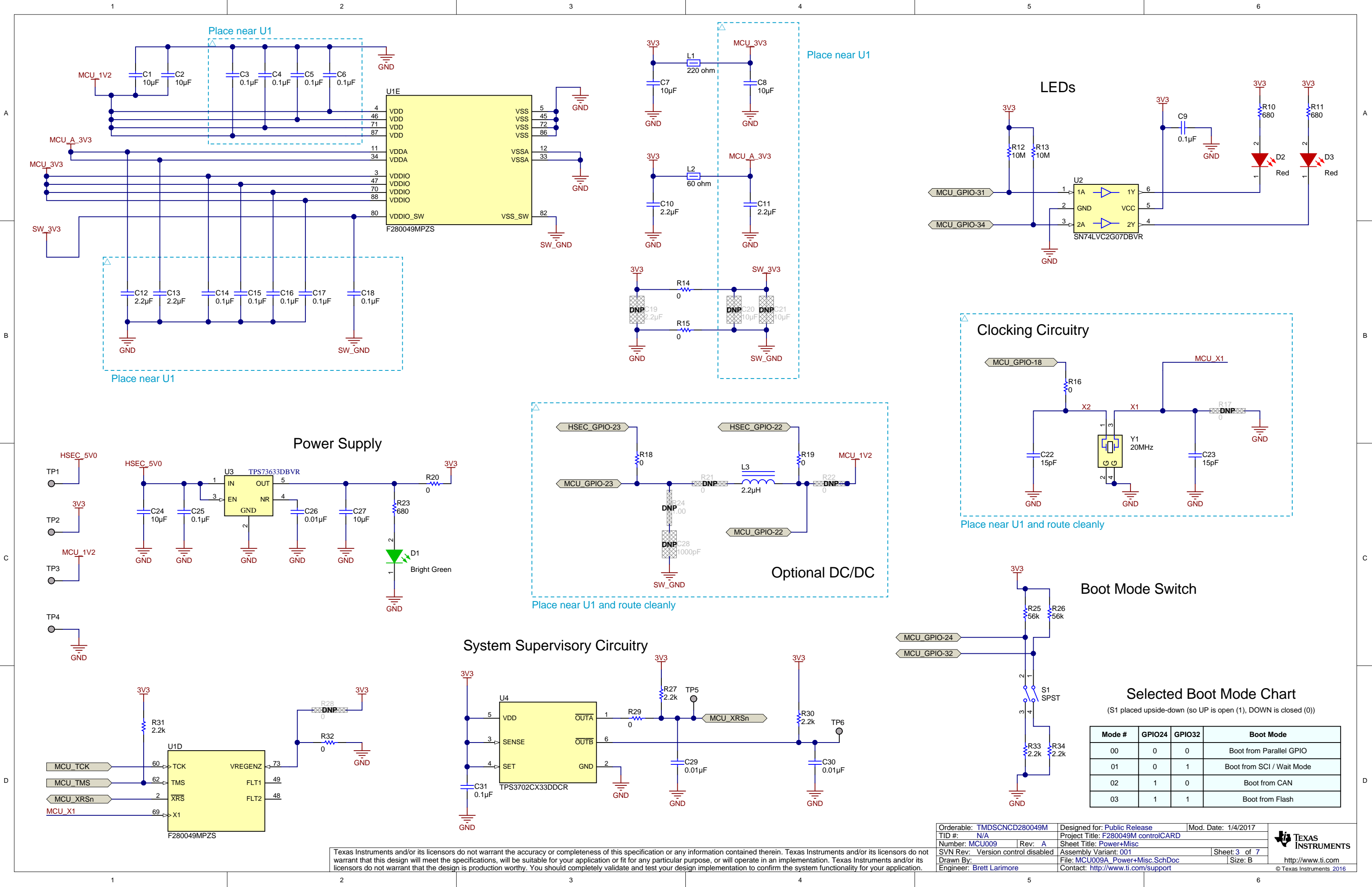
Mod. Date: 1/5/2017
Sheet: 1 of 7
Size: B

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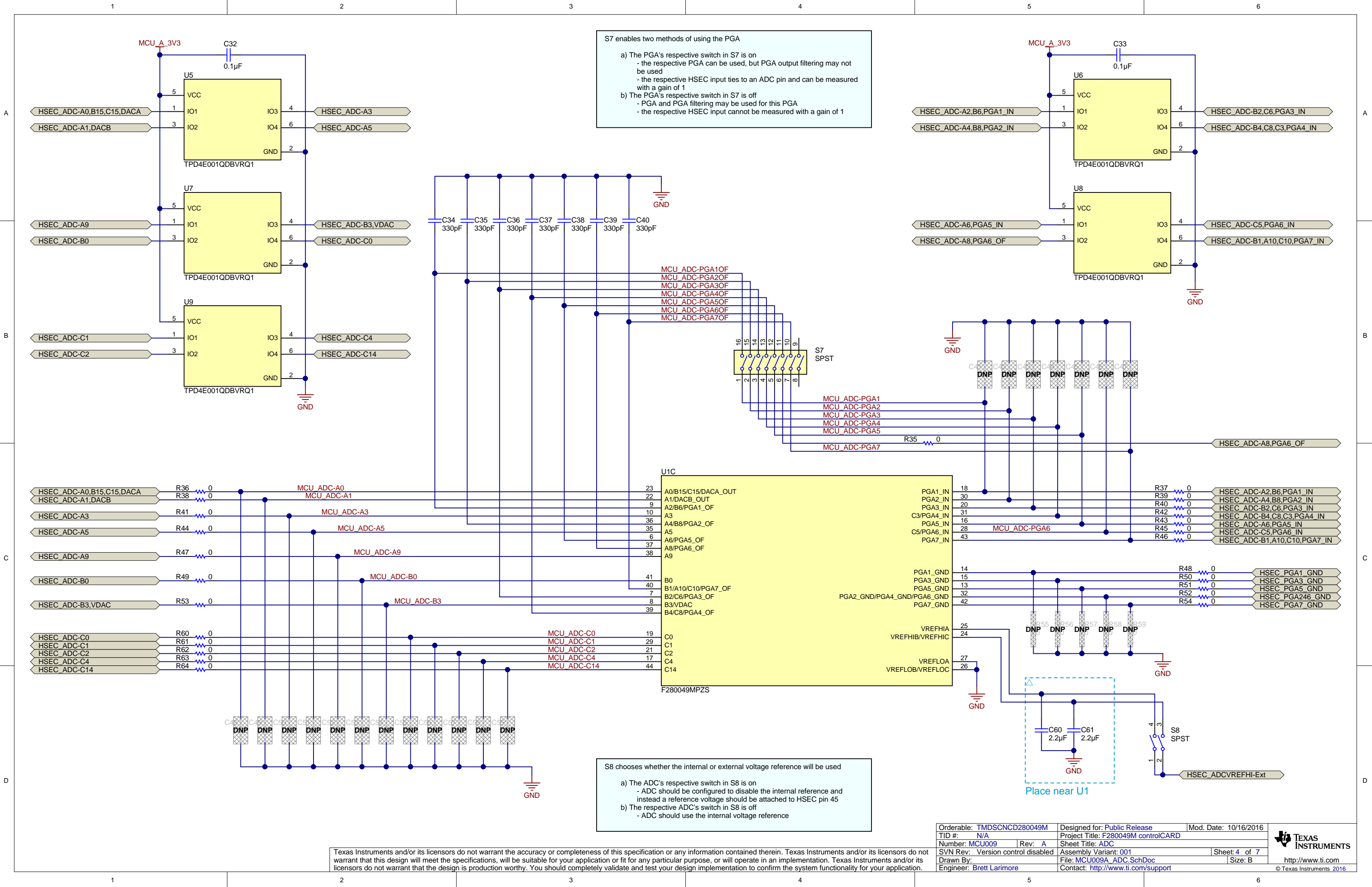http://www.ti.com
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Connector + IO Schematic

Connector EC1

TOP / BOT

Signal (TOP)	Pin	Pin	Signal (BOT)
MCU_TMS	1	2	
	3	4	
MCU_TCK	5	6	HSEC_TDO
	7	8	HSEC_TDI
HSEC_ADC-A0,B15,C15,DACA	9	10	HSEC_PGA7_GND
HSEC_ADC-A1,DACB	11	12	HSEC_ADC-B0
HSEC_PGA1_GND	13	14	HSEC_ADC-B1,A10,C10,PGA7_IN
HSEC_ADC-A2,B6,PGA1_IN	15	16	HSEC_PGA3_GND
HSEC_ADC-A3	17	18	HSEC_ADC-B2,C6,PGA3_IN
HSEC_PGA246_GND	19	20	HSEC_ADC-B3,VDAC
HSEC_ADC-A4,B8,PGA2_IN	21	22	HSEC_PGA246_GND
HSEC_ADC-A5	23	24	HSEC_ADC-B4,C8,C3,PGA4_IN
HSEC_ADC-A6,PGA5_IN	25	26	HSEC_ADC-C0
HSEC_ADC-A9	27	28	HSEC_ADC-C1
HSEC_PGA5_GND	29	30	HSEC_ADC-C2
HSEC_ADC-C5,PGA6_IN	31	32	
HSEC_ADC-A8,PGA6_OF	33	34	HSEC_ADC-C4
HSEC_PGA246_GND	35	36	HSEC_ADC-C14
	37	38	
	39	40	
	41	42	
	43	44	
HSEC_ADCVREFHI-Ext	45	46	
	47	48	
MCU_GPIO-00	49	50	MCU_GPIO-04
MCU_GPIO-01	51	52	MCU_GPIO-05
MCU_GPIO-02	53	54	MCU_GPIO-06
MCU_GPIO-03	55	56	MCU_GPIO-07
HSEC_GPIO-12	57	58	HSEC_pin58
HSEC_GPIO-13	59	60	HSEC_pin60
MCU_GPIO-14	61	62	MCU_GPIO-39
MCU_GPIO-15	63	64	HSEC_GPIO-23
	65	66	
MCU_GPIO-16	67	68	MCU_GPIO-40
MCU_GPIO-17	69	70	MCU_GPIO-57
MCU_GPIO-09	71	72	HSEC_GPIO-22
MCU_GPIO-11	73	74	MCU_GPIO-31
HSEC_pin75	75	76	MCU_GPIO-28
HSEC_pin77	77	78	MCU_GPIO-29
HSEC_pin79	79	80	MCU_GPIO-30
HSEC_pin81	81	82	MCU_GPIO-32
	83	84	
HSEC_pin85	85	86	MCU_GPIO-34
HSEC_pin87	87	88	
MCU_GPIO-18 R7 DNP	89	90	
	91	92	
	93	94	
	95	96	
	97	98	
MCU_GPIO-58	99	100	HSEC_pin100
MCU_GPIO-59	101	102	HSEC_pin102
MCU_GPIO-56	103	104	
MCU_GPIO-33	105	106	
HSEC_pin107	107	108	
HSEC_pin109	109	110	
	111	112	
	113	114	
	115	116	
	117	118	
	119	120	MCU_XRSn

R1 4.7k (3V3), R2 4.7k (3V3)

HSEC_5V0

U1A — F280049MPZS

Net	Pin	GPIO
MCU_GPIO-00	79	GPIO00
MCU_GPIO-01	78	GPIO01
MCU_GPIO-02	77	GPIO02
MCU_GPIO-03	76	GPIO03
MCU_GPIO-04	75	GPIO04
MCU_GPIO-05	89	GPIO05
MCU_GPIO-06	97	GPIO06
MCU_GPIO-07	84	GPIO07
MCU_GPIO-08	74	GPIO08
MCU_GPIO-09	90	GPIO09
MCU_GPIO-10	93	GPIO10
MCU_GPIO-11	52	GPIO11
MCU_GPIO-12	51	GPIO12
MCU_GPIO-13	50	GPIO13
MCU_GPIO-14	96	GPIO14
MCU_GPIO-15	95	GPIO15
MCU_GPIO-16	54	GPIO16
MCU_GPIO-17	55	GPIO17
MCU_GPIO-18	68	GPIO18_X2
MCU_GPIO-22	83	GPIO22_SW
MCU_GPIO-23	81	GPIO23_SW
MCU_GPIO-24	56	GPIO24
MCU_GPIO-25	57	GPIO25
MCU_GPIO-26	58	GPIO26
MCU_GPIO-27	59	GPIO27
MCU_GPIO-28	1	GPIO28
MCU_GPIO-29	100	GPIO29
MCU_GPIO-30	98	GPIO30
MCU_GPIO-31	99	GPIO31

U1B — F280049MPZS

Net	Pin	GPIO
MCU_GPIO-32	64	GPIO32
MCU_GPIO-33	53	GPIO33
MCU_GPIO-34	94	GPIO34
MCU_GPIO-35	63	GPIO35/TDI
MCU_GPIO-37	61	GPIO37/TDO
MCU_GPIO-39	91	GPIO39
MCU_GPIO-40	85	GPIO40
MCU_GPIO-56	65	GPIO56
MCU_GPIO-57	66	GPIO57
MCU_GPIO-58	67	GPIO58
MCU_GPIO-59	92	GPIO59

J1 (FSI)

Pin	Function
1	FSI-RX0
3	FSI-RXCLK
5	FSI-TX0
7	FSI-TXCLK

MCU_GPIO-12 — R3 0 — HSEC_GPIO-12
MCU_GPIO-13 — R4 0 — HSEC_GPIO-13
MCU_GPIO-26 — R5 0 — SW_GPIO-26
MCU_GPIO-27 — R6 0 — SW_GPIO-27

GND

Switches

S5 SPDT
- 1 HSEC_pin100 — 4 HSEC_pin102
- 2 MCU_GPIO-24 — 5 MCU_GPIO-25
- 3 HSEC_pin75 — 6 HSEC_pin77

S6 SPDT
- 1 HSEC_pin107 — 4 HSEC_pin109
- 2 SW_GPIO-26 — 5 SW_GPIO-27
- 3 HSEC_pin79 — 6 HSEC_pin81

S4
Up - cJTAG (2pin debug access) only
Down - standard JTAG (use for onboard xds100v2)

S2 DPDT
- 1 — 4
- 2 MCU_GPIO-10 — 5
- 3 — 6

S4 DPDT
- 1 — 4
- 2 MCU_GPIO-35 — 5 MCU_GPIO-37
- 3 HSEC_TDI — 6 HSEC_TDO

S3 DPDT
- 1 — 4
- 2 — 5 MCU_GPIO-08
- 3 — 6

HSEC_pin60, HSEC_pin85, HSEC_pin58, HSEC_pin87

R8 10k (3V3), R9 10k (3V3)

Power Supply

LEDs

Clocking Circuitry

Optional DC/DC

System Supervisory Circuitry

Boot Mode Switch

Selected Boot Mode Chart

(S1 placed upside-down (so UP is open (1), DOWN is closed (0))

Mode #	GPIO24	GPIO32	Boot Mode
00	0	0	Boot from Parallel GPIO
01	0	1	Boot from SCI / Wait Mode
02	1	0	Boot from CAN
03	1	1	Boot from Flash

Place near U1

Place near U1

Place near U1

Place near U1 and route cleanly

Place near U1 and route cleanly

U1E F280049MPZS

VDD	4
VDD	46
VDD	71
VDD	87
VDDA	11
VDDA	34
VDDIO	3
VDDIO	47
VDDIO	70
VDDIO	88
VDDIO_SW	80

VSS 5 / VSS 45 / VSS 72 / VSS 86
VSSA 12 / VSSA 33
VSS_SW 82

U3 TPS73633DBVR
IN / OUT / EN / NR / GND

U2 SN74LVC2G07DBVR
1A / 1Y / GND / VCC / 2A / 2Y

U4 TPS3702CX33DDCR
VDD / SENSE / SET / OUTA / OUTB / GND

U1D F280049MPZS
TCK / TMS / XRS / X1 / VREGENZ / FLT1 / FLT2

Y1 20MHz

L1 220 ohm
L2 60 ohm
L3 2.2µH

Orderable: TMDSCNCD280049M	Designed for: Public Release	Mod. Date: 1/4/2017
TID #: N/A	Project Title: F280049M controlCARD	
Number: MCU009 Rev: A	Sheet Title: Power+Misc	
SVN Rev: Version control disabled	Assembly Variant: 001	
Drawn By:	File: MCU009A_Power+Misc.SchDoc	Size: B
Engineer: Brett Larimore	Contact: http://www.ti.com/support	

Sheet: 3 of 7

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S7 enables two methods of using the PGA

a) The PGA's respective switch in S7 is on
   - the respective PGA can be used, but PGA output filtering may not be used
   - the respective HSEC input ties to an ADC pin and can be measured with a gain of 1
b) The PGA's respective switch in S7 is off
   - PGA and PGA filtering may be used for this PGA
   - the respective HSEC input cannot be measured with a gain of 1

C32 0.1µF   MCU_A_3V3
C33 0.1µF   MCU_A_3V3

U5 TPD4E001QDBVRQ1
- 5 VCC
- 1 IO1 — HSEC_ADC-A0,B15,C15,DACA
- 3 IO2 — HSEC_ADC-A1,DACB
- 4 IO3 — HSEC_ADC-A3
- 6 IO4 — HSEC_ADC-A5
- 2 GND

U6 TPD4E001QDBVRQ1
- 5 VCC
- 1 IO1 — HSEC_ADC-A2,B6,PGA1_IN
- 3 IO2 — HSEC_ADC-A4,B8,PGA2_IN
- 4 IO3 — HSEC_ADC-B2,C6,PGA3_IN
- 6 IO4 — HSEC_ADC-B4,C8,C3,PGA4_IN
- 2 GND

U7 TPD4E001QDBVRQ1
- 5 VCC
- 1 IO1 — HSEC_ADC-A9
- 3 IO2 — HSEC_ADC-B0
- 4 IO3 — HSEC_ADC-B3,VDAC
- 6 IO4 — HSEC_ADC-C0
- 2 GND

U8 TPD4E001QDBVRQ1
- 5 VCC
- 1 IO1 — HSEC_ADC-A6,PGA5_IN
- 3 IO2 — HSEC_ADC-A8,PGA6_OF
- 4 IO3 — HSEC_ADC-C5,PGA6_IN
- 6 IO4 — HSEC_ADC-B1,A10,C10,PGA7_IN
- 2 GND

U9 TPD4E001QDBVRQ1
- 5 VCC
- 1 IO1 — HSEC_ADC-C1
- 3 IO2 — HSEC_ADC-C2
- 4 IO3 — HSEC_ADC-C4
- 6 IO4 — HSEC_ADC-C14
- 2 GND

C34 330pF C35 330pF C36 330pF C37 330pF C38 330pF C39 330pF C40 330pF

MCU_ADC-PGA1OF
MCU_ADC-PGA2OF
MCU_ADC-PGA3OF
MCU_ADC-PGA4OF
MCU_ADC-PGA5OF
MCU_ADC-PGA6OF
MCU_ADC-PGA7OF

S7 SPST
16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8

MCU_ADC-PGA1
MCU_ADC-PGA2
MCU_ADC-PGA3
MCU_ADC-PGA4
MCU_ADC-PGA5
MCU_ADC-PGA7

R35 0 — HSEC_ADC-A8,PGA6_OF

DNP DNP DNP DNP DNP DNP DNP

U1C F280049MPZS

Pin	Signal		Pin	Signal
23	A0/B15/C15/DACA_OUT		18	PGA1_IN
22	A1/DACB_OUT		30	PGA2_IN
9	A2/B6/PGA1_OF		20	PGA3_IN
10	A3		31	C3/PGA4_IN
36	A4/B8/PGA2_OF		16	PGA5_IN
35	A5		28	C5/PGA6_IN
6	A6/PGA5_OF		43	PGA7_IN
37	A8/PGA6_OF			
38	A9		14	PGA1_GND
41	B0		15	PGA3_GND
40	B1/A10/C10/PGA7_OF		13	PGA5_GND
7	B2/C6/PGA3_OF		32	PGA2_GND/PGA4_GND/PGA6_GND
8	B3/VDAC		42	PGA7_GND
39	B4/C8/PGA4_OF			
19	C0		25	VREFHIA
29	C1		24	VREFHIB/VREFHIC
21	C2			
17	C4		27	VREFLOA
44	C14		26	VREFLOB/VREFLOC

HSEC_ADC-A0,B15,C15,DACA — R36 0 — MCU_ADC-A0
HSEC_ADC-A1,DACB — R38 0 — MCU_ADC-A1
HSEC_ADC-A3 — R41 0 — MCU_ADC-A3
HSEC_ADC-A5 — R44 0 — MCU_ADC-A5
HSEC_ADC-A9 — R47 0 — MCU_ADC-A9
HSEC_ADC-B0 — R49 0 — MCU_ADC-B0
HSEC_ADC-B3,VDAC — R53 0 — MCU_ADC-B3
HSEC_ADC-C0 — R60 0 — MCU_ADC-C0
HSEC_ADC-C1 — R61 0 — MCU_ADC-C1
HSEC_ADC-C2 — R62 0 — MCU_ADC-C2
HSEC_ADC-C4 — R63 0 — MCU_ADC-C4
HSEC_ADC-C14 — R64 0 — MCU_ADC-C14

R37 0 — HSEC_ADC-A2,B6,PGA1_IN
R39 0 — HSEC_ADC-A4,B8,PGA2_IN
R40 0 — HSEC_ADC-B2,C6,PGA3_IN
R42 0 — HSEC_ADC-B4,C8,C3,PGA4_IN
R43 0 — HSEC_ADC-A6,PGA5_IN
MCU_ADC-PGA6 — R45 0 — HSEC_ADC-C5,PGA6_IN
R46 0 — HSEC_ADC-B1,A10,C10,PGA7_IN

R48 0 — HSEC_PGA1_GND
R50 0 — HSEC_PGA3_GND
R51 0 — HSEC_PGA5_GND
R52 0 — HSEC_PGA246_GND
R54 0 — HSEC_PGA7_GND

DNP DNP DNP DNP DNP (R55 R56 R57 R58 R59)

DNP DNP DNP DNP DNP DNP DNP DNP DNP DNP DNP DNP

C60 2.2µF   C61 2.2µF

Place near U1
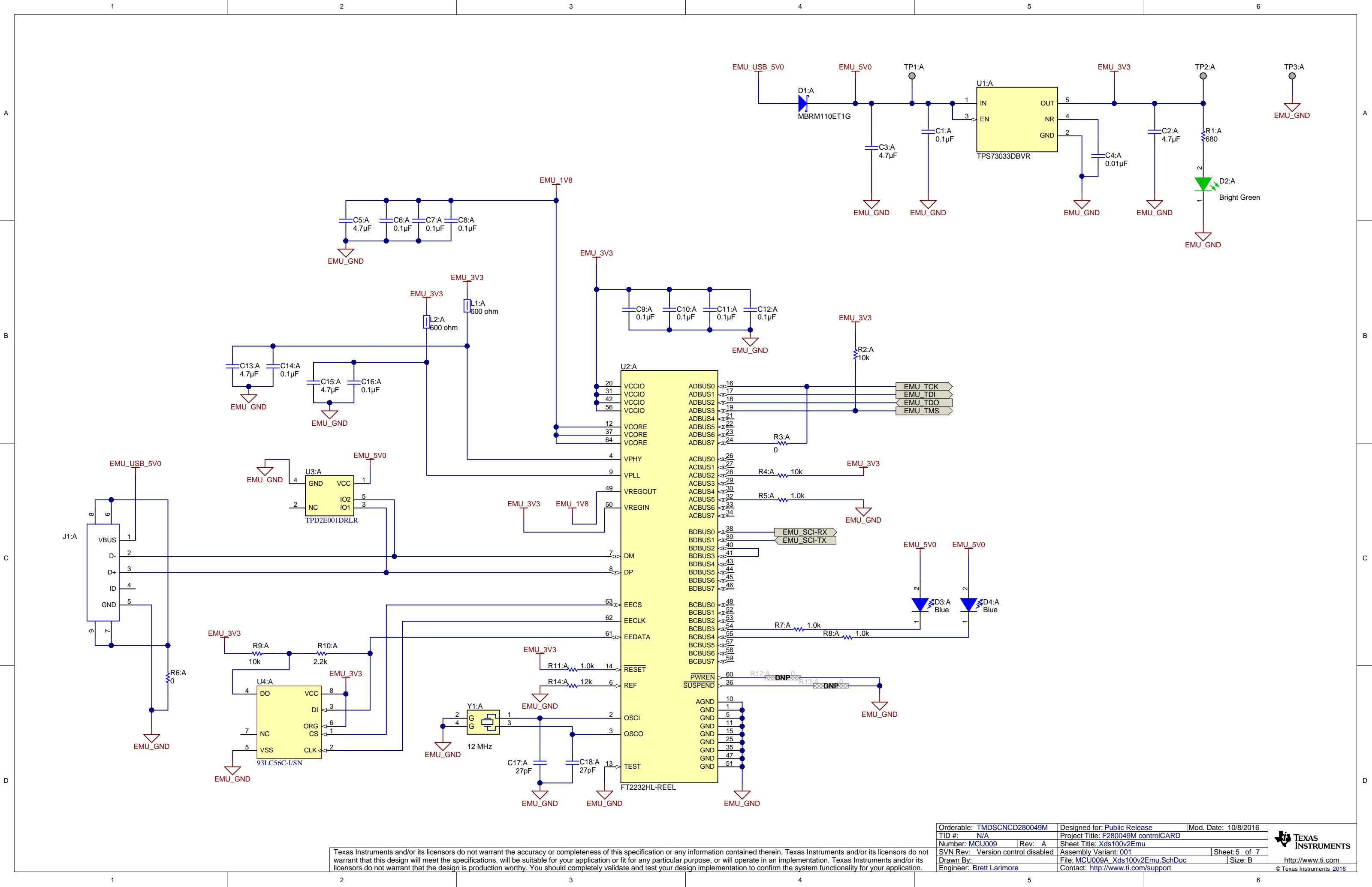
S8 SPST
4 3
1 2

HSEC_ADCVREFHI-Ext

S8 chooses whether the internal or external voltage reference will be used

a) The ADC's respective switch in S8 is on
   - ADC should be configured to disable the internal reference and instead a reference voltage should be attached to HSEC pin 45
b) The respective ADC's switch in S8 is off
   - ADC should use the internal voltage reference

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 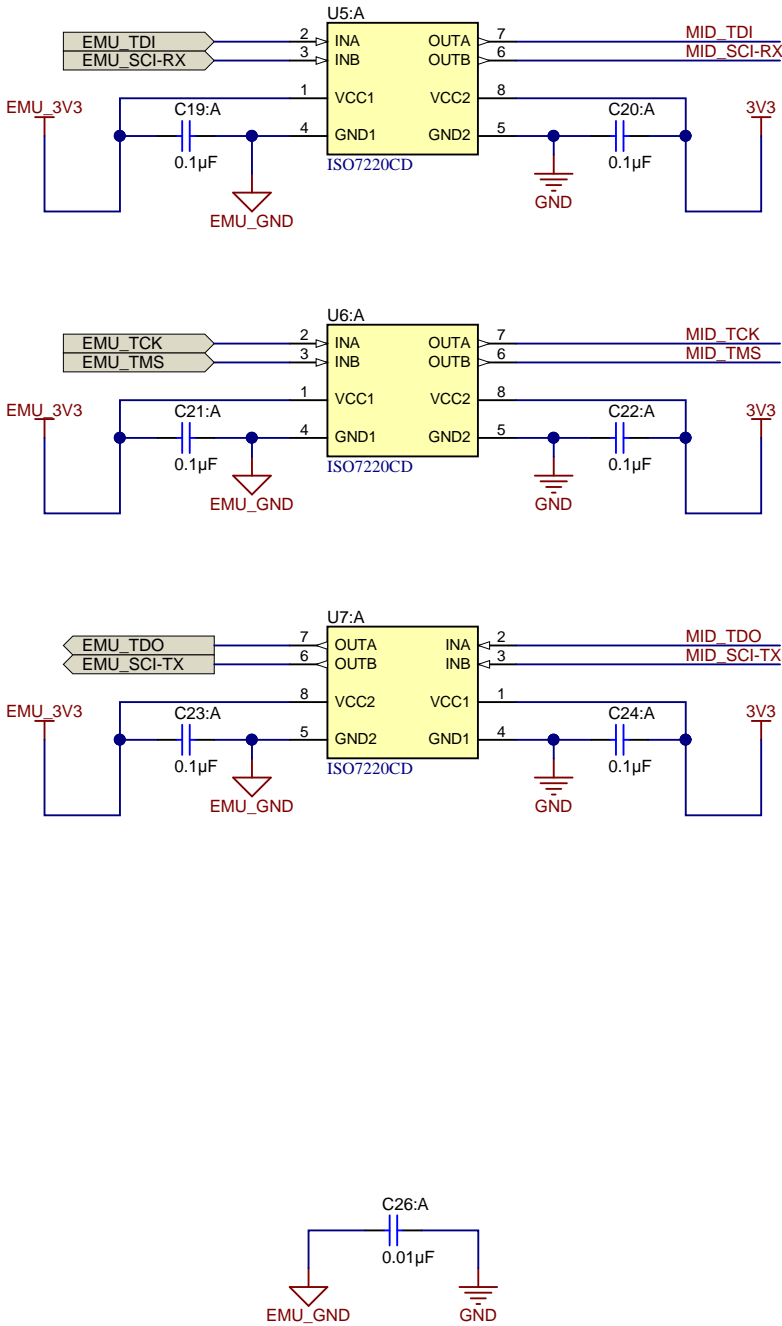
EMU_USB_5V0
EMU_5V0
TP1:A
EMU_3V3
TP2:A
TP3:A
D1:A
MBRM110ET1G
U1:A
IN
EN
OUT
NR
GND
TPS73033DBVR
C3:A 4.7µF
C1:A 0.1µF
C4:A 0.01µF
C2:A 4.7µF
R1:A 680
D2:A
Bright Green
EMU_GND
EMU_1V8
C5:A 4.7µF
C6:A 0.1µF
C7:A 0.1µF
C8:A 0.1µF
C9:A 0.1µF
C10:A 0.1µF
C11:A 0.1µF
C12:A 0.1µF
L1:A 600 ohm
L2:A 600 ohm
C13:A 4.7µF
C14:A 0.1µF
C15:A 4.7µF
C16:A 0.1µF
R2:A 10k
U2:A
VCCIO
VCORE
VPHY
VPLL
VREGOUT
VREGIN
DM
DP
EECS
EECLK
EEDATA
RESET
REF
OSCI
OSCO
TEST
ADBUS0
ADBUS1
ADBUS2
ADBUS3
ADBUS4
ADBUS5
ADBUS6
ADBUS7
ACBUS0
ACBUS1
ACBUS2
ACBUS3
ACBUS4
ACBUS5
ACBUS6
ACBUS7
BDBUS0
BDBUS1
BDBUS2
BDBUS3
BDBUS4
BDBUS5
BDBUS6
BDBUS7
BCBUS0
BCBUS1
BCBUS2
BCBUS3
BCBUS4
BCBUS5
BCBUS6
BCBUS7
PWREN
SUSPEND
AGND
GND
FT2232HL-REEL
EMU_TCK
EMU_TDI
EMU_TDO
EMU_TMS
R3:A 0
R4:A 10k
R5:A 1.0k
EMU_SCI-RX
EMU_SCI-TX
D3:A Blue
D4:A Blue
R7:A 1.0k
R8:A 1.0k
R12:A 0 DNP
R13:A 0 DNP
R11:A 1.0k
R14:A 12k
Y1:A
12 MHz
C17:A 27pF
C18:A 27pF
U3:A
GND
VCC
NC
IO2
IO1
TPD2E001DRLR
J1:A
VBUS
D-
D+
ID
GND
R6:A 0
R9:A 10k
R10:A 2.2k
U4:A
DO
DI
ORG
CS
CLK
VCC
NC
VSS
93LC56C-I/SN

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Orderable: TMDSCNCD280049M
TID #: N/A
Number: MCU009 Rev: A
SVN Rev: Version control disabled
Drawn By:
Engineer: Brett Larimore

Designed for: Public Release
Mod. Date: 10/8/2016
Project Title: F280049M controlCARD
Sheet Title: Xds100v2Emu
Assembly Variant: 001
Sheet: 5 of 7
File: MCU009A_Xds100v2Emu.SchDoc
Size: B
Contact: http://www.ti.com/support

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A:SW1 - Emulation & GPIO28 Switch

POS 1 ON: Use xds100v2 emulator that is on the cCARD

POS 1 OFF: Boot from FLASH/peripheral (see boot mode switch) OR use emulator on baseboard

POS 2 ON: GPIO-28 will be controlled by the USB-to-UART adapter on the FTDI chip

POS 2 OFF: GPIO-28 can be controlled by a pin in HSEC connector

U5:A

Pin	Signal		Signal	Pin
2	INA	OUTA	7	MID_TDI
3	INB	OUTB	6	MID_SCI-RX
1	VCC1	VCC2	8	
4	GND1	GND2	5	

EMU_TDI, EMU_SCI-RX (inputs)

EMU_3V3 — C19:A 0.1µF — EMU_GND

C20:A 0.1µF — 3V3 / GND

ISO7220CD

U6:A

Pin	Signal		Signal	Pin
2	INA	OUTA	7	MID_TCK
3	INB	OUTB	6	MID_TMS
1	VCC1	VCC2	8	
4	GND1	GND2	5	

EMU_TCK, EMU_TMS (inputs)

EMU_3V3 — C21:A 0.1µF — EMU_GND

C22:A 0.1µF — 3V3 / GND

ISO7220CD

U7:A

Pin	Signal		Signal	Pin
7	OUTA	INA	2	MID_TDO
6	OUTB	INB	3	MID_SCI-TX
8	VCC2	VCC1	1	
5	GND2	GND1	4	

EMU_TDO, EMU_SCI-TX

EMU_3V3 — C23:A 0.1µF — EMU_GND

C24:A 0.1µF — 3V3 / GND

ISO7220CD

C26:A 0.01µF — EMU_GND / GND

S1:A SPST
GND
3V3
R15:A 10k
R16:A 10k

U8:A

Pin	Signal		Signal	Pin
1	1OE	VCC	20	3V3
2	1A1	1Y1	18	HSEC_TDI
4	1A2	1Y2	16	MCU_TCK
6	1A3	1Y3	14	MCU_TMS
8	1A4	1Y4	12	MID_TDO
19	2OE			
11	2A1	2Y1	9	MCU_GPIO-28
13	2A2	2Y2	7	MID_SCI-TX
15	2A3	2Y3	5	
17	2A4	2Y4	3	
		GND	10	

MID_TDI, MID_TCK, MID_TMS, HSEC_TDO, MID_SCI-RX, MCU_GPIO-29 (inputs)

C25:A 0.1µF — GND

SN74ALVC244PWR

GND

DNP
FID1

DNP
FID2

DNP
FID3

DNP
FID4

DNP
FID5

DNP
FID6

PCB Number: MCU009
PCB Rev: A

PCB
LOGO
Texas Instruments

PCB
LOGO
Pb-Free Symbol

PCB
LOGO
FCC disclaimer

CE

CE Mark

ZZ1
Assembly Note
This Assembly Note will show in the PcbDoc and associated outputs

ZZ2
Assembly Note
This Assembly Note will show in the PcbDoc and associated outputs

ZZ3
Assembly Note
This Assembly Note will show in the PcbDoc and associated outputs

Orderable: TMDSCNCD280049M	Designed for: Public Release	Mod. Date: 1/5/2017
TID #: N/A	Project Title: F280049M controlCARD	
Number: MCU009	Rev: A	Sheet Title: EVM Hardware	
SVN Rev: Version control disabled	Assembly Variant: 001	
Drawn By:	File: MCU009A_EVM_Hardware.SchDoc	Sheet: 7 of 7
Engineer: Brett Larimore	Contact: http://www.ti.com/support	Size: B

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