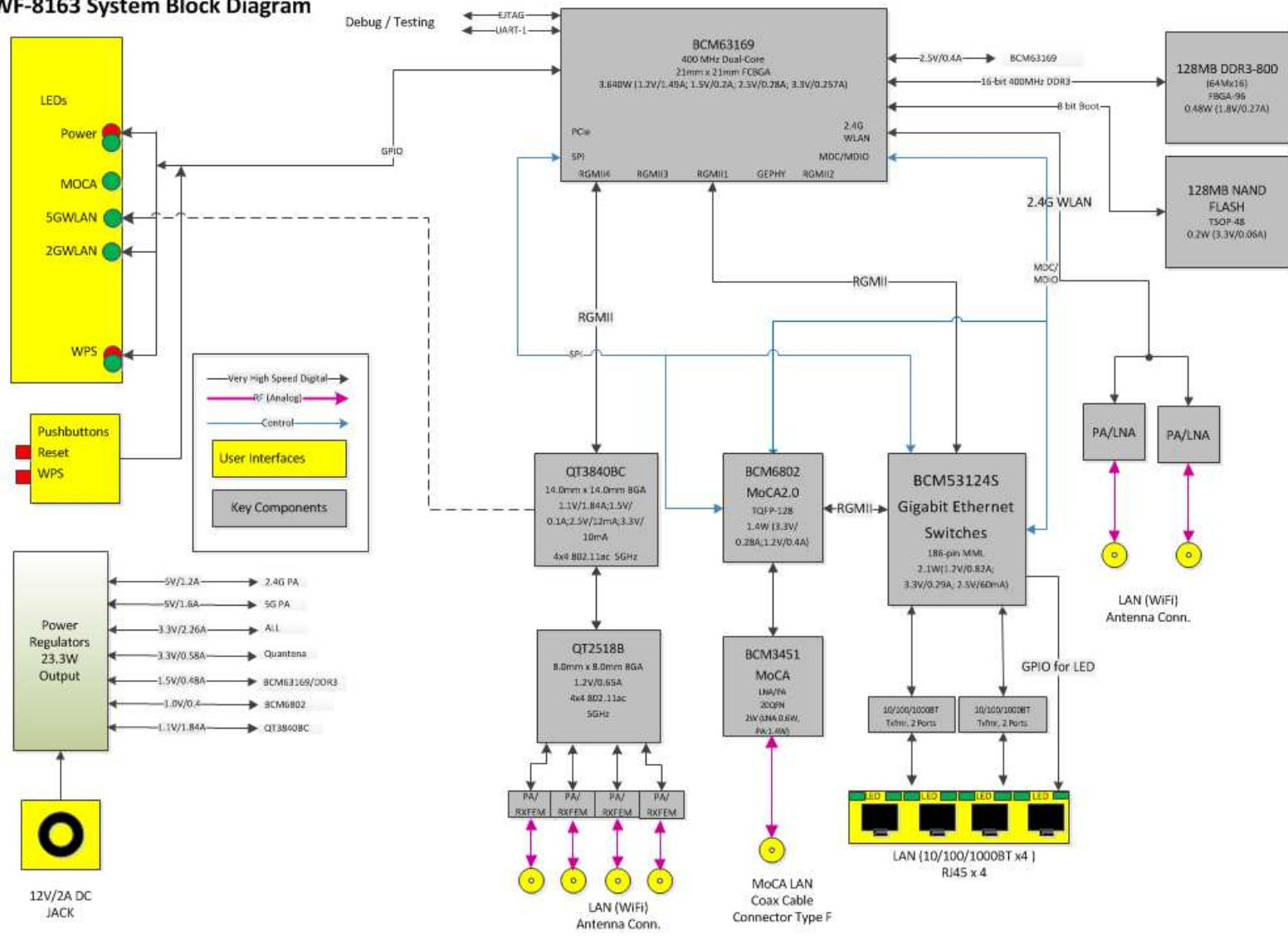


BLOCK DIAGRAM

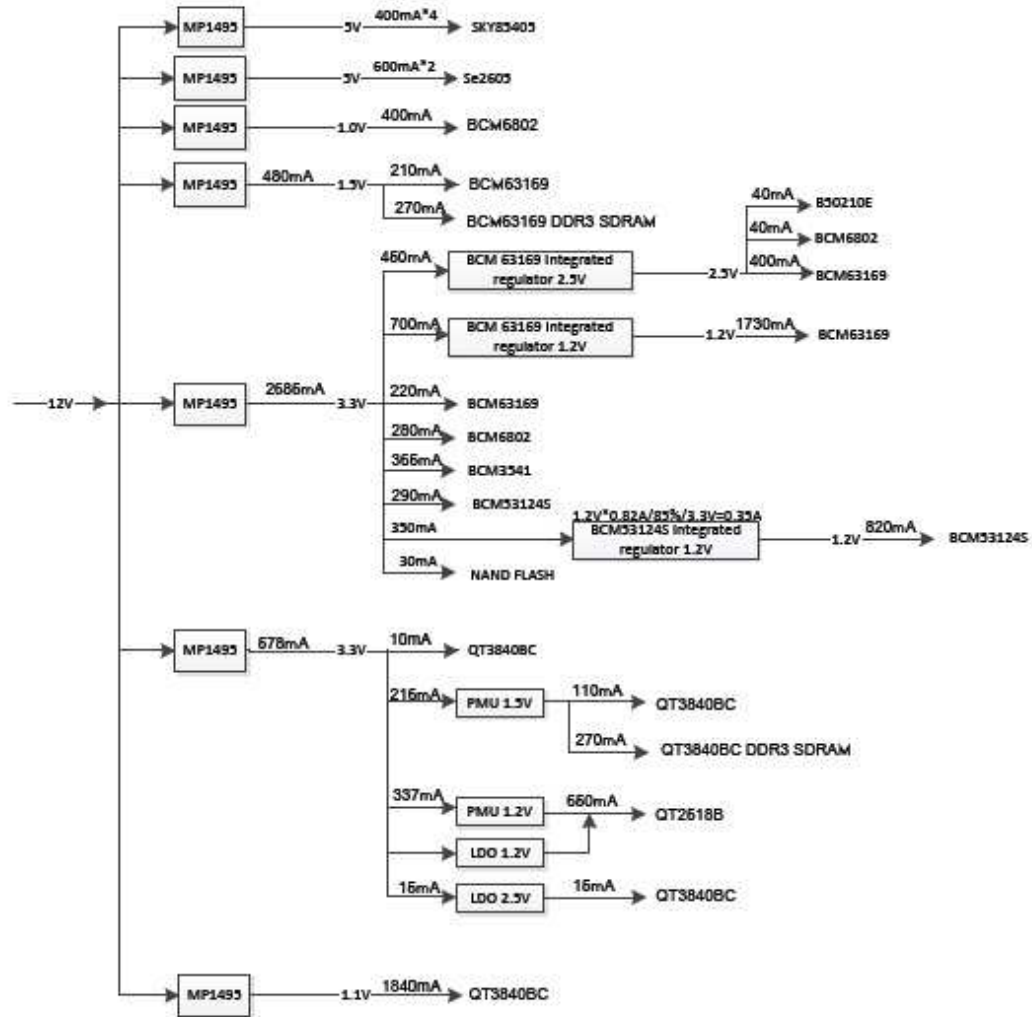
WF-8163 System Block Diagram




		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 1 OF 39	
		DRAWN CHECKED	MODEL: wf8163 DRAWING NO.:	VERSION: V1.0	

SIZE A4

POWER SCHEME



SIZE A4

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 2 OF 39	
		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED		DRAWING NO.:			

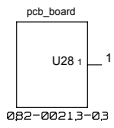
1 2 3 4 5 6 7

SHEET INDEX

SHEET	DESCRIPTION
1	BLOCK DIAGRAM
2	POWER SCHEME
3	INDEX
4	RECOED
5	BCM63169 POWER
6	BCM63169 VOLTAGE REGULATORS AND GND
7	BCM63169 MEMORY AND GPIO
8	BCM63169 BOOT STRAP; RESERVED PIN; RESET,WPS BUTTON
9	DDR3 AND NAND FLASH FOR BCM63169
10	BCM63169 RGMII INTERFACE
11	BCM63169 PHY INTERFACE
12	BCM531245 CRYSTAL
13	BCM531245 RGMIII AND GE
14	BCM531245
15	ETHERNET LAN INTERFACE
16	BCM63169 2.4G WLAN
17	2.4G PA
18	2.4G LNA AND RF SWITCH
19	MOCA BCM6802 GPIO/JTAG/MISC
20	MOCA BCM6802 POWER/GND
21	MOCA BCM6802/BCM3541 FRONT END
22	5G QT3840BC RGMII INTERFACE
23	5G QT3840BC DDR/DDR3
24	5G QT3840BC JATG/BOOT/GPIO
25	5G QT3840BC PMU
26	5G QT3840BC POWER
27	5G QT3840BC AFE
28	5G RFIC QT2518B POWER SUPPLY
29	5G RFIC QT2518B
30	5G CLK/5G QT3840BC FLASH/PCIE INTERFACE
31	5G RFIC QT2518B DECOUPLING AND FILTERING
32	5G CHANNEL1 AND CHANNEL2 PA/RXFEM
33	5G CHANNEL3 AND CHANNEL4 PA/RXFEM
34	LED
35	BOARD ID
36	POWER SUPPLY 12V/ MAIN SYSTEM POWER 3.3V
37	POWER SUPPLY 5V FOR 2.4G/5G RF PA
38	POWER SUPPLY 3.3V/1.1V FOR QT3840BC AND RTL8367
39	POWER SUPPLY1.5V/1.0V FOR BCM63169 DDR AND BCM6802 CORE
40	

FILTER OF BOM

BOM/FILTER									




A

B

C

D

SIZE:A4

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 3 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

RECORD:

A

2015/3/5 WF816.3 AM1 RELEASE

B

2015/7/8 WF816.3 AM2 RELEASE

CHANG LED OF LAN1/LAN2 TO LOW ACTIVE
ADD R22


C

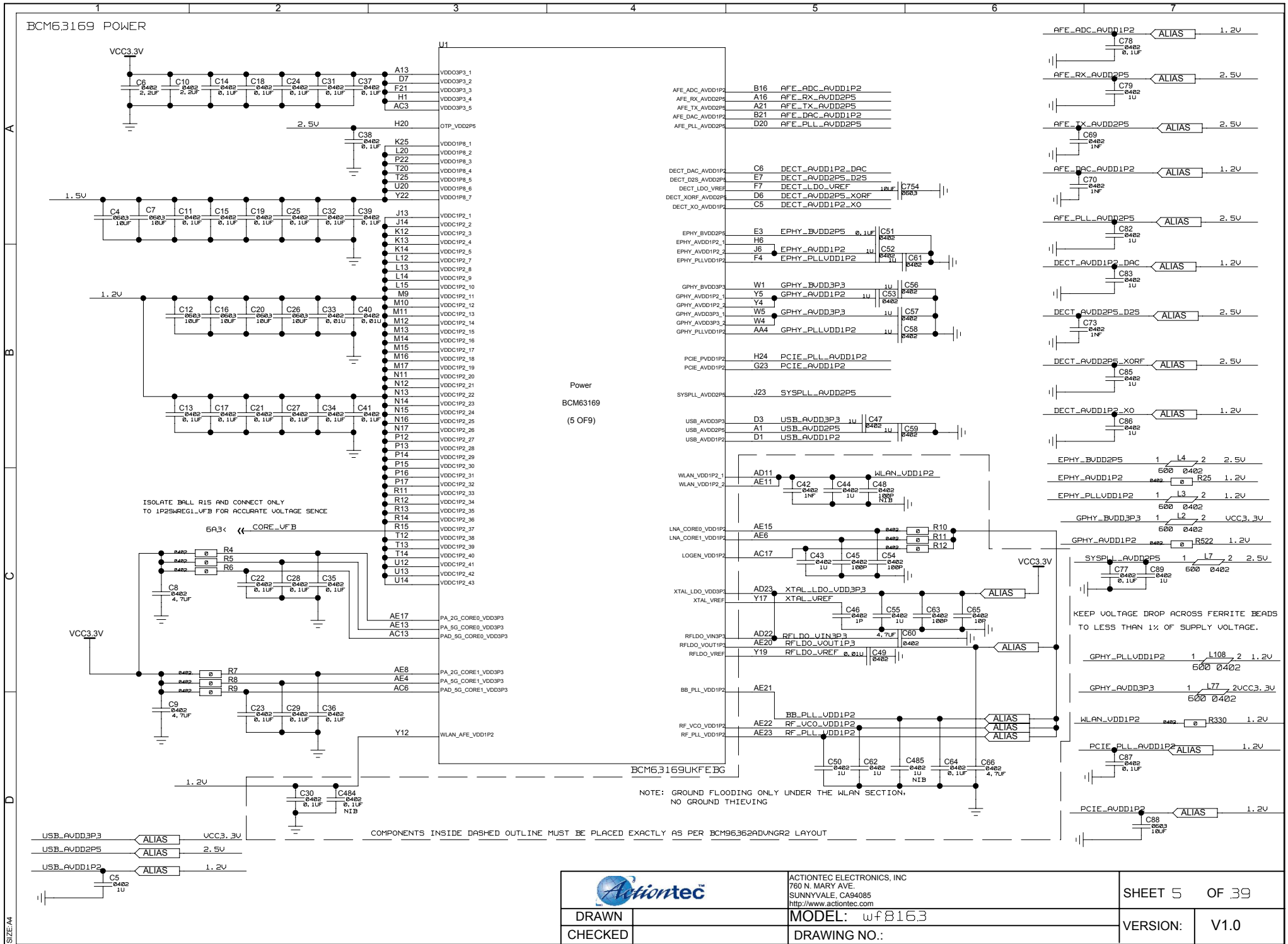
2015/7/28 WF816.3 AM3 RELEASE

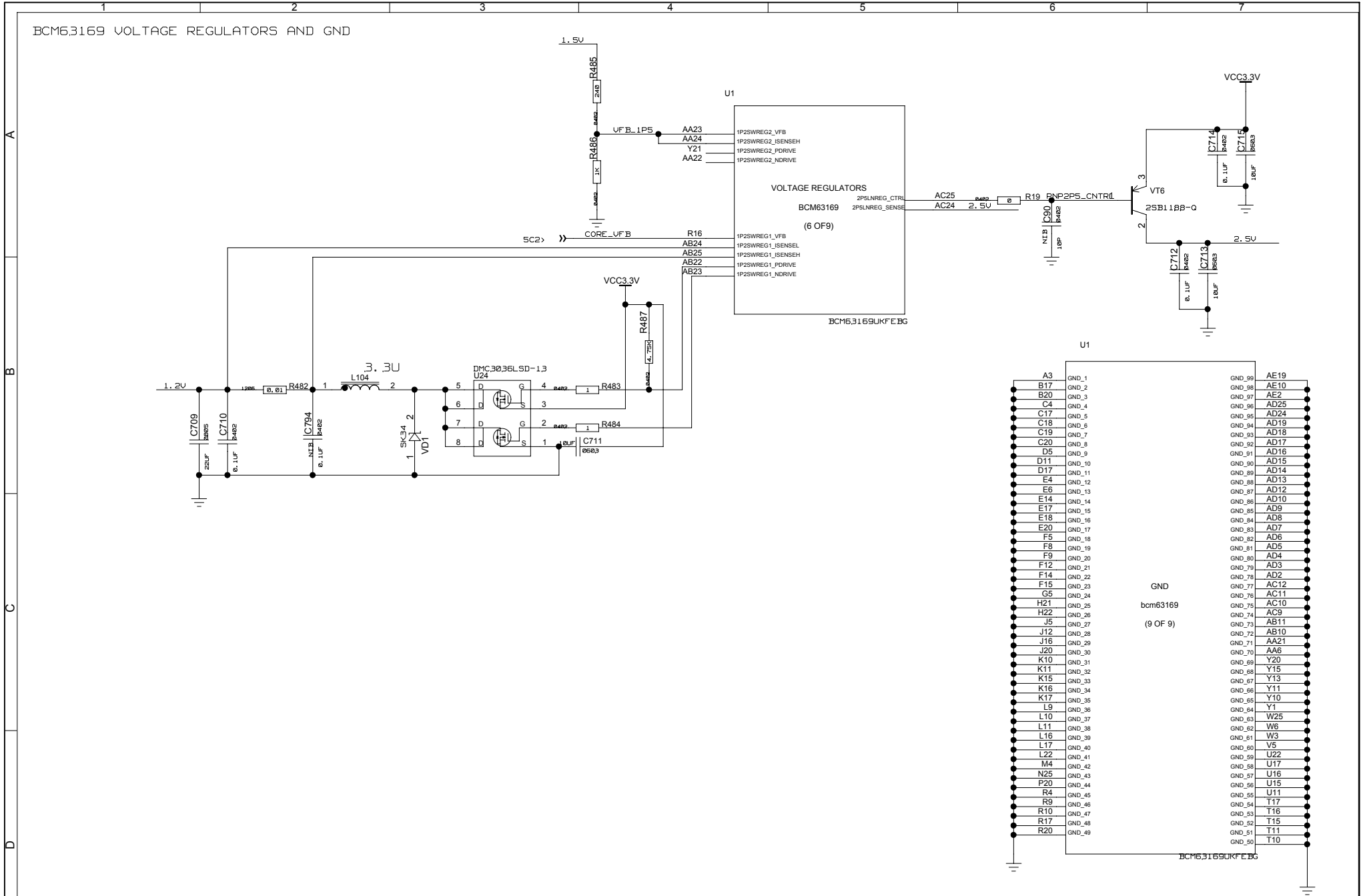
CHANG LEDS STRAPPING OPTIONS AND USE
BCM5.3124S PORT 5


D

SIZE A4

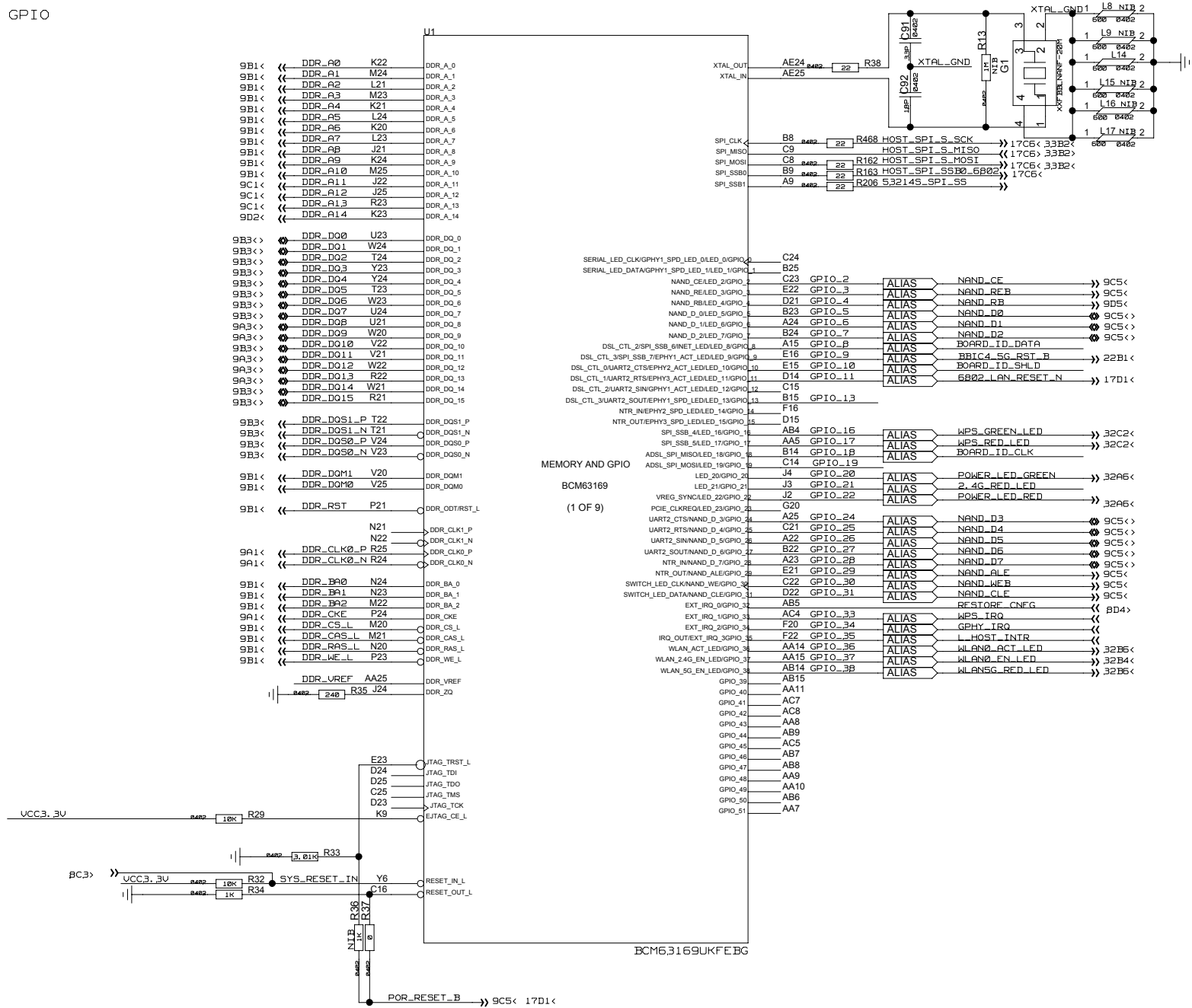
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 4 OF 39	
		DRAWN	CHECKED	MODEL: wf816.3	DRAWING NO.:






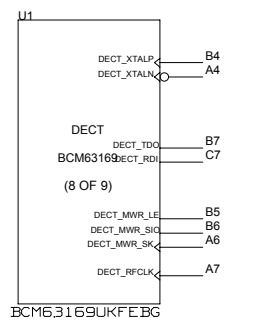
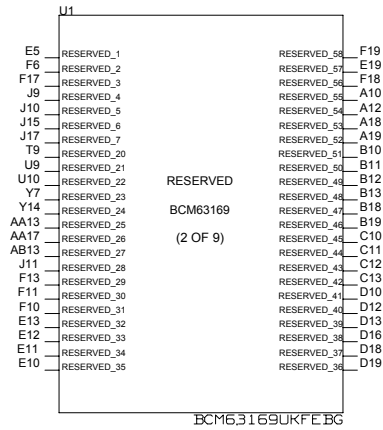
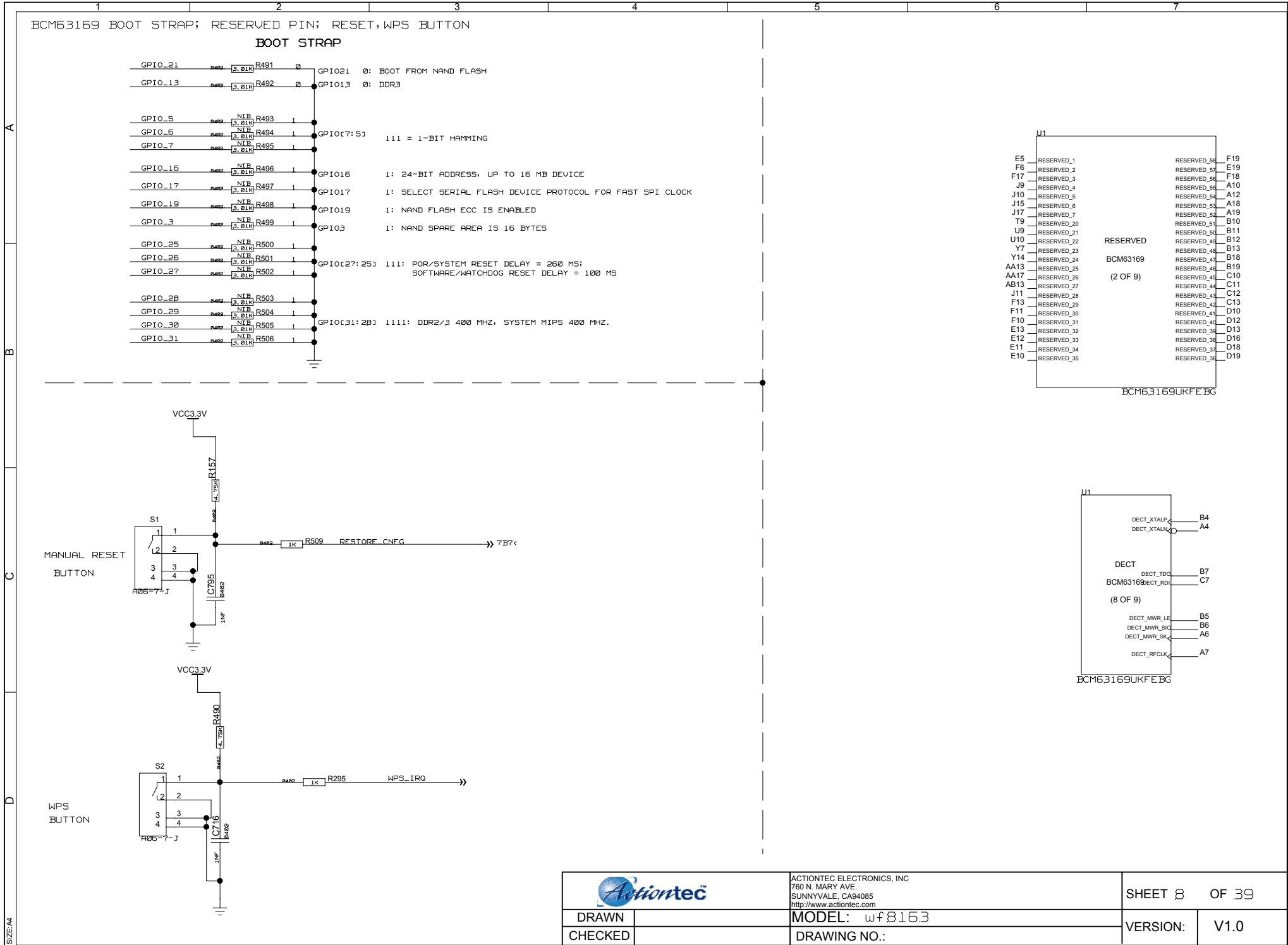
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 6 OF 39	
		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED	DRAWING NO.:				

BCM63169 MEMORY AND GPIO



		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com	
		SHEET 7 OF 39	
DRAWN		MODEL: wf8163	
CHECKED		DRAWING NO.:	VERSION: V1.0

SIZE:A4



		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 8 OF 39	
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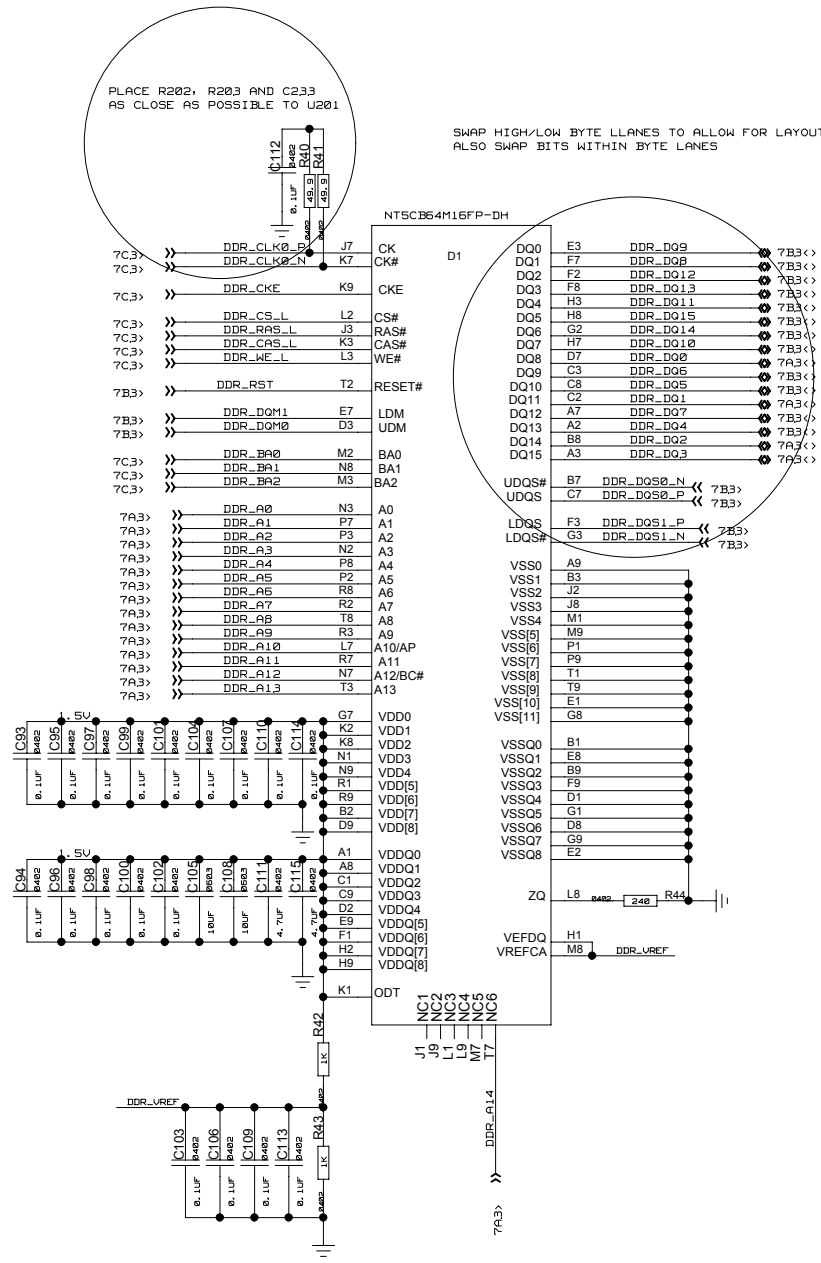
SIZE A4

DDR3 AND NAND FLASH FOR BCM63169

A
B
C
D
SIZE A4

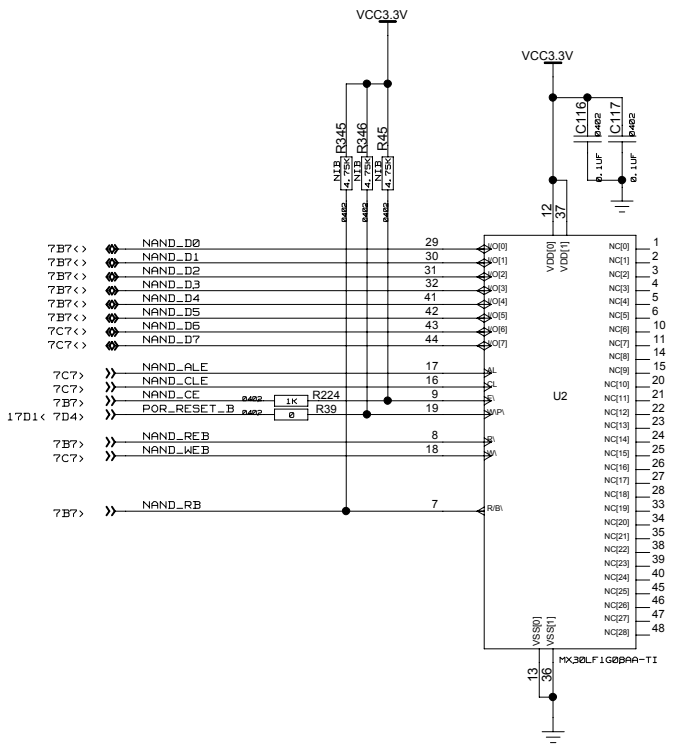
PLACE R202, R203 AND C233 AS CLOSE AS POSSIBLE TO U201

SWAP HIGH/LOW BYTE LANES TO ALLOW FOR LAYOUT OF DDR3. ALSO SWAP BITS WITHIN BYTE LANES

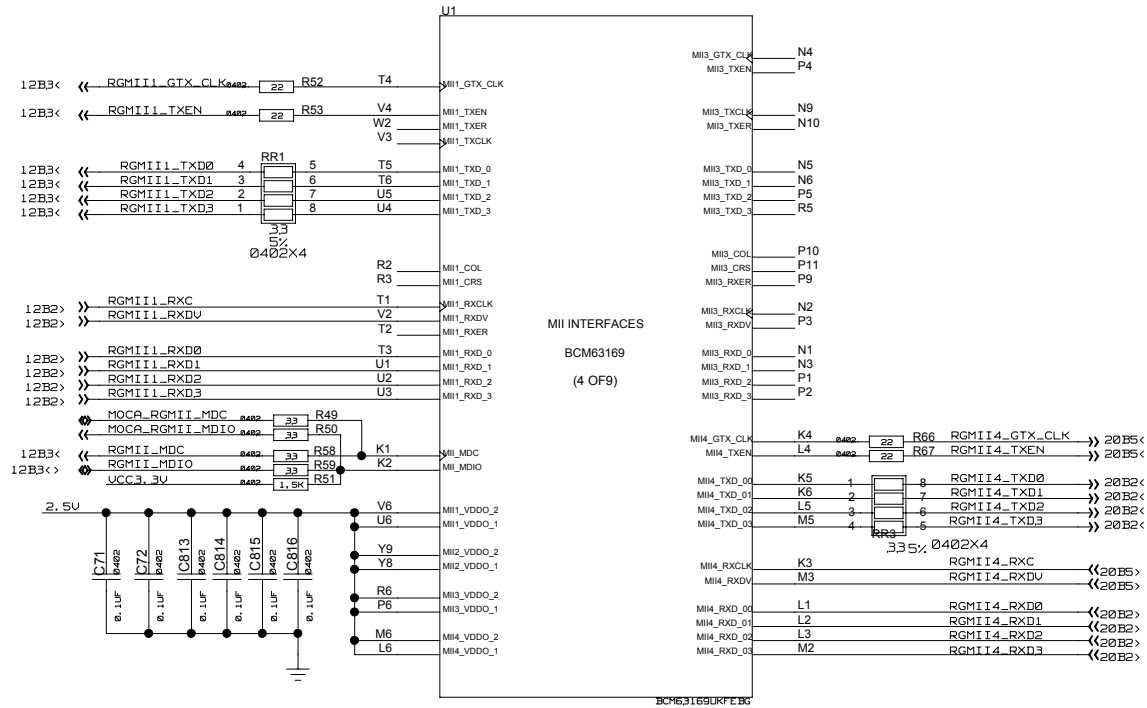
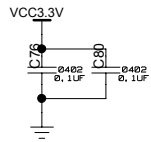


DDR SDRAM LAYOUT RULES:

- ALL TIMING IS RELATIVE THE CLK/CLKB THAT ARRIVE AT THE DESTINATION DDR SDRAM CHIP.
- 1: X=CLK/CLKB SHOULD BE A MATCHED DIFFERENTIAL PAIR WITH A LENGTH<4
- 2: ADDRESS AND CONTROL SHOULD BE X+/- 20MM.
- 3: DQS AND DQM SHOULD BE X+/- 20MM.
- 4: ALL DQS SHOULD MATCH CORRESPONDING BYTE LANE DQS/DQMS WITHIN +/- 10MM
- 5: TRACE IMPEDANCES SHOULD BE 50 OHMS +/- 10%(45-55OHMS)
- 6: ROUTE VREF WITH 30-MIL TRACE AND AT LEAST 1 HIGH QUALITY CERAMIC BYPASS CAPACITOR FOR EACH CONNECTION TO A DEVISE.
- 7: ALL TRACE SHOULD HAVE A>=3 TO 1 SPACING RATIO FROM THE REFERENCE GND/PWR LAYER (E.G. 15MIL LINE-TO -LINE SPACING FOR A 5MIL DIELECTRIC THICKNESS.



BCM63169 RGMII INTERFACE




A

B

C

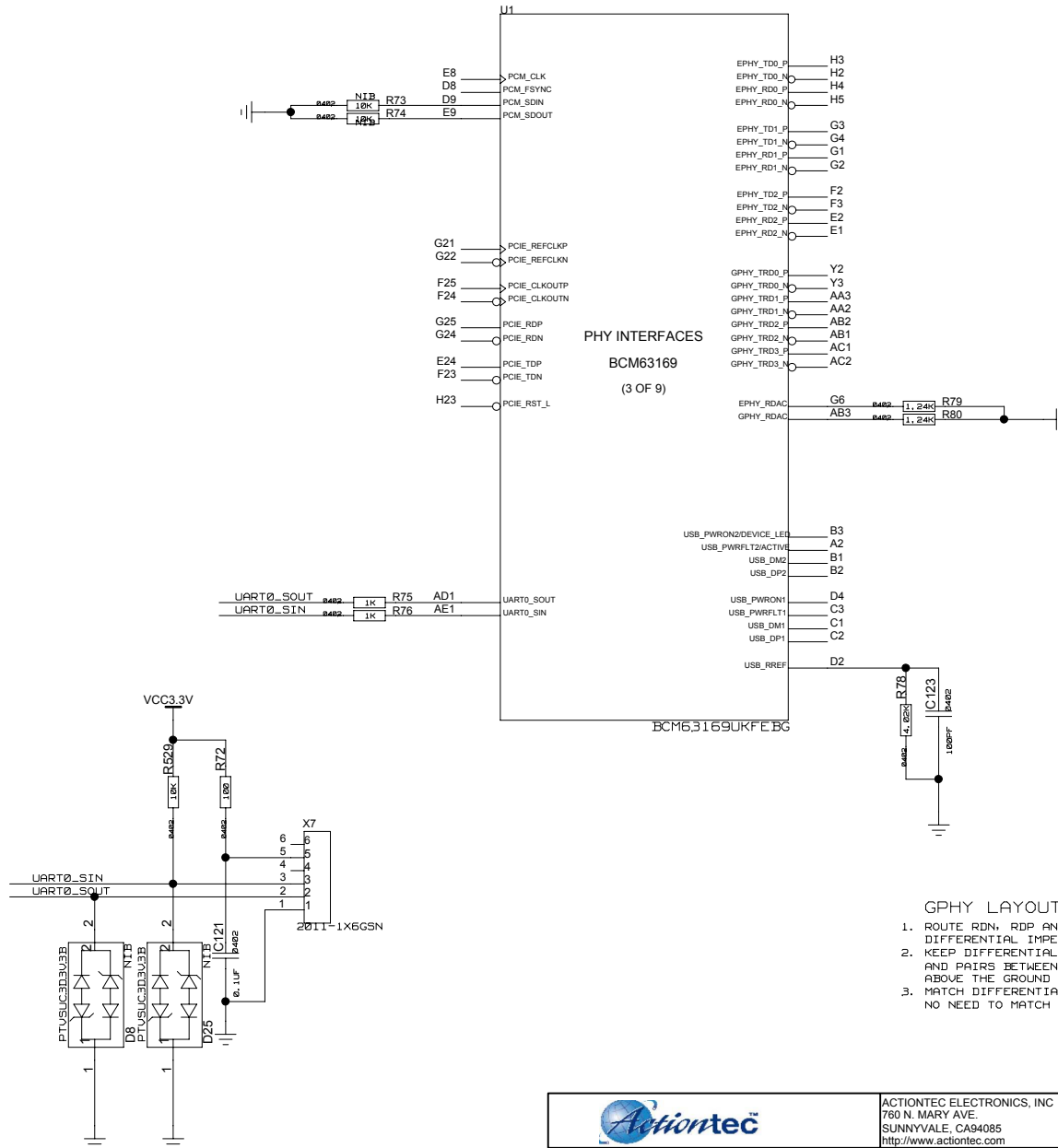
D

SIZE:A4

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 10 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:


BCM63169 PHY INTERFACE

INTEGRATED GPHY ADDRESS
 THE ADDRESS OF THE INTEGRATED GPHY (<EPHY3>) IS CONFIGURABLE
 WITH THE SETTING OF BITS[31:30] IN THE GPIO_GPHY_CTL REGISTER
 BITS[31:30] 2B' 00 2B' 01 2B' 10 2B' 11
 GPHY ADDRESS 0X04 0X0C 0X14 0X1C



- GPHY LAYOUT GUIDELINES & NOTES**
1. ROUTE RDN, RDP AND TDN, TDP PAIRS DIFFERENTIALLY, WITH 100OHM DIFFERENTIAL IMPEDANCE, ADJACENT TO THE GROUND PLANE.
 2. KEEP DIFFERENTIAL PAIRS WITHIN A PORT SEPARATED BY 3H DISTANCE AND PAIRS BETWEEN PORTS SEPARATED BY 5H WHERE H IS THE HEIGHT OF TRACES ABOVE THE GROUND PLANE, I.E. H = THE DIELECTRIC THICKNESS.
 3. MATCH DIFFERENTIAL PAIR TRACE LENGTH WITHIN THE PAIR (P AND N) TO 10MILS. NO NEED TO MATCH TRACE LENGTH BETWEEN DIFFERENTIAL PAIRS (RD AND TD).

SIZE A4

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 11 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

BCM53124S CRYSTAL

MODE SELECT IMP_MODE[1:0] IMP_VOL_SEL OVDD IMP_VOL_REF
 RGMII 2.5V 00 0 2.5V GND

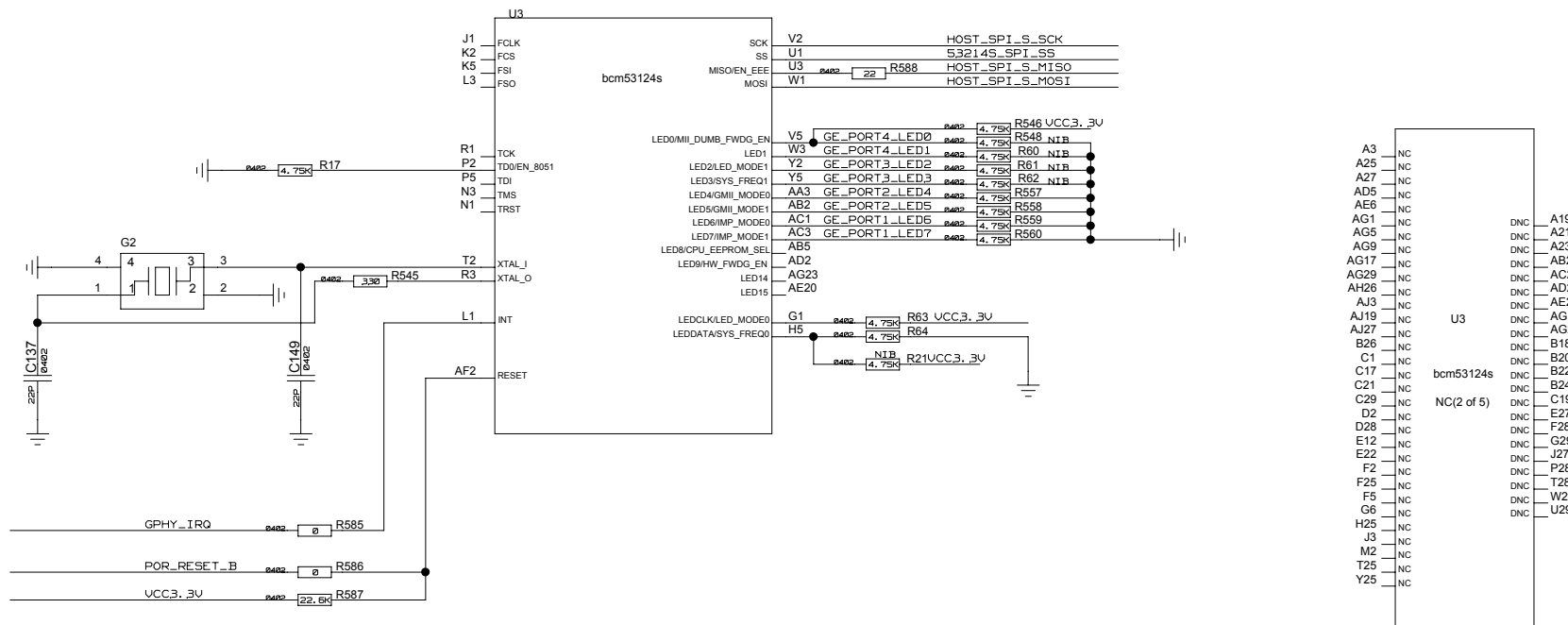
LED[0] / MII_DUMB_FWDG_EN: IMP PORT IN BLOCKING STATE FOR MANAGED MODE.

0: BLOCKING FOR MANAGED MODE

1: FORWARDING FOR DUMB MODE (UNMANAGED MODE)

B-LED DISPLAY MODE (GMII_LED_SEL=0) LED_MODE[1:0]

PORT1 PORT2 PORT3 PORT4 11
 LED6 LED4 LED2 LED0 1G/ACT
 LED7 LED5 LED3 LED1 100M/ACT

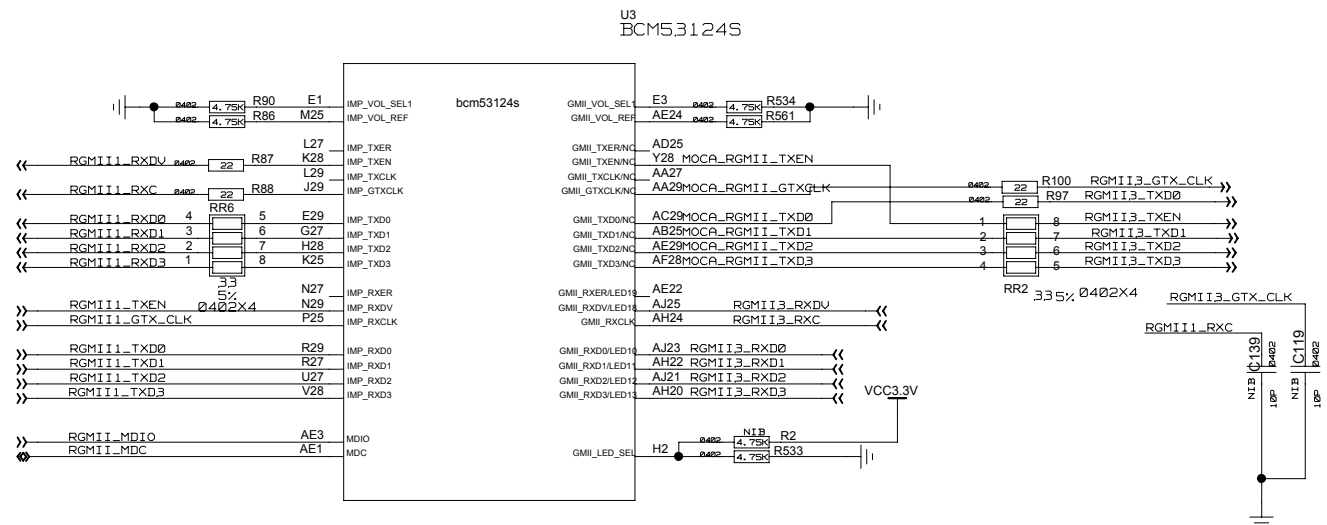


A3	NC		
A25	NC		
A27	NC		
AD5	NC		
AE6	NC		
AG1	NC	DNC	A19
AG5	NC	DNC	A21
AG9	NC	DNC	A23
AG17	NC	DNC	AB28
AG29	NC	DNC	AC27
AH28	NC	DNC	AD28
AJ3	NC	DNC	AE27
AJ19	NC	DNC	AG19
AJ27	NC	DNC	AG21
B26	NC	DNC	B18
C1	NC	DNC	B20
C17	NC	DNC	B22
C21	NC	DNC	B24
C29	NC	DNC	C19
D2	NC	DNC	E27
D28	NC	DNC	F28
E12	NC	DNC	G29
E22	NC	DNC	J27
F2	NC	DNC	P28
F25	NC	DNC	T28
F5	NC	DNC	W29
G6	NC	DNC	U29
H25	NC		
J3	NC		
M2	NC		
T25	NC		
Y25	NC		

A
B
C
D

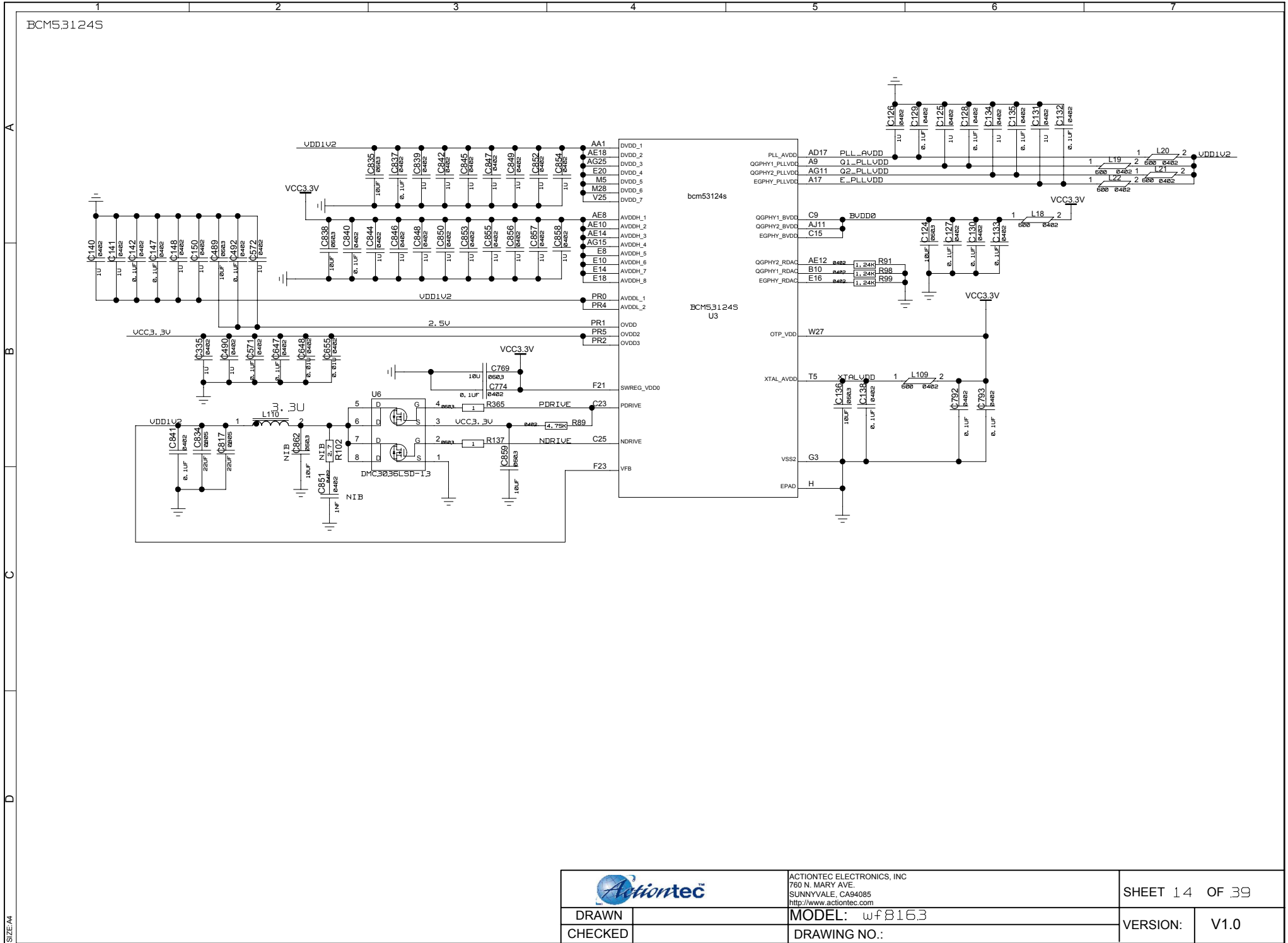
SIZE: A4


A
B
C
D
SIZE: A4



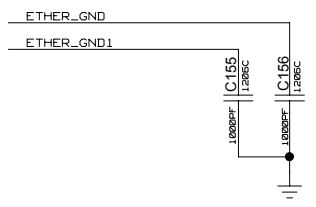
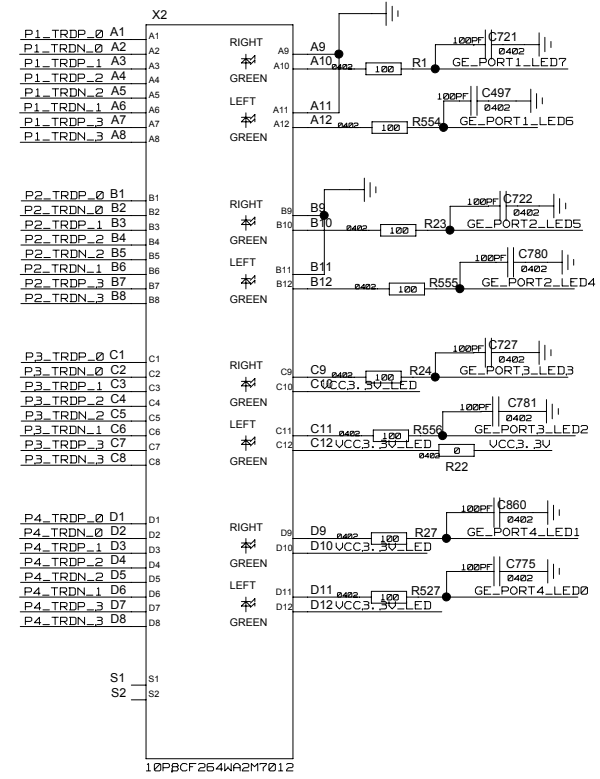
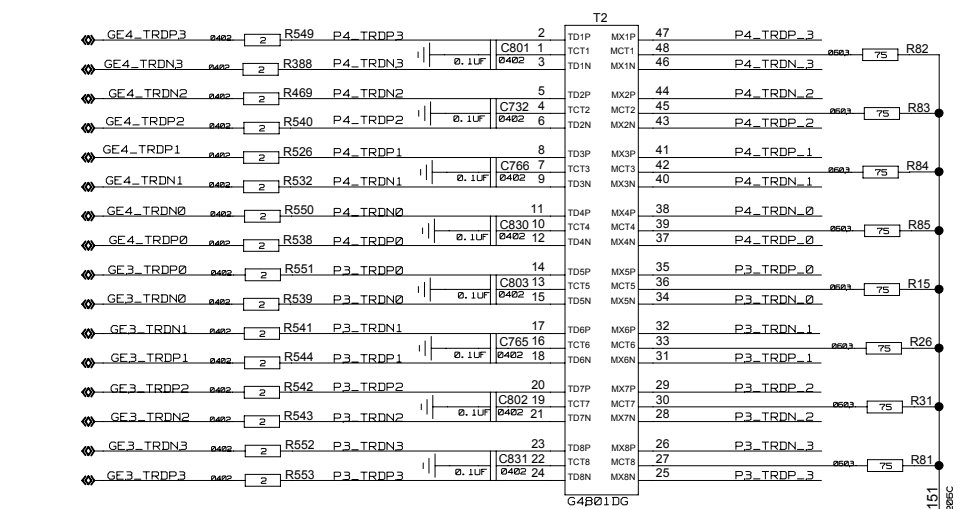
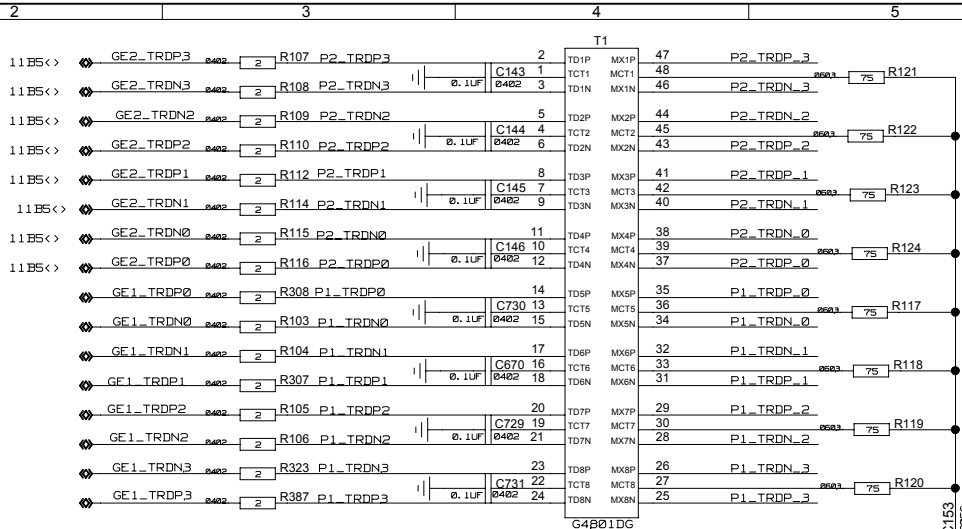
U3
BCM53124S

TDP_0,1	C11 GE1_TRDP0
TDN_0,1	A11 GE1_TRDN0
TDP_1,1	C13 GE1_TRDP1
TDN_1,1	B12 GE1_TRDN1
TDP_2,1	A13 GE1_TRDP2
TDN_2,1	B14 GE1_TRDN2
TDP_3,1	B16 GE1_TRDP3
TDN_3,1	A15 GE1_TRDN3
bcm53124s	
TDP_0,2	B8 GE2_TRDP0
TDN_0,2	A7 GE2_TRDN0
TDP_1,2	B6 GE2_TRDP1
TDN_1,2	C7 GE2_TRDN1
TDP_2,2	A5 GE2_TRDP2
TDN_2,2	B4 GE2_TRDN2
TDP_3,2	C3 GE2_TRDP3
TDN_3,2	C5 GE2_TRDN3
PHY(1 of 5)	
TDP_0,3	AH10 GE3_TRDP0
TDN_0,3	AJ9 GE3_TRDN0
TDP_1,3	AJ7 GE3_TRDP1
TDN_1,3	AH8 GE3_TRDN1
TDP_2,3	AG7 GE3_TRDP2
TDN_2,3	AH6 GE3_TRDN2
TDP_3,3	AH4 GE3_TRDP3
TDN_3,3	AJ5 GE3_TRDN3
TDP_0,4	AH12 GE4_TRDP0
TDN_0,4	AJ13 GE4_TRDN0
TDP_1,4	AH14 GE4_TRDP1
TDN_1,4	AG13 GE4_TRDN1
TDP_2,4	AJ15 GE4_TRDP2
TDN_2,4	AH16 GE4_TRDN2
TDP_3,4	AH18 GE4_TRDP3
TDN_3,4	AJ17 GE4_TRDN3



		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 14 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

ETHERNET LAN INTERFACE



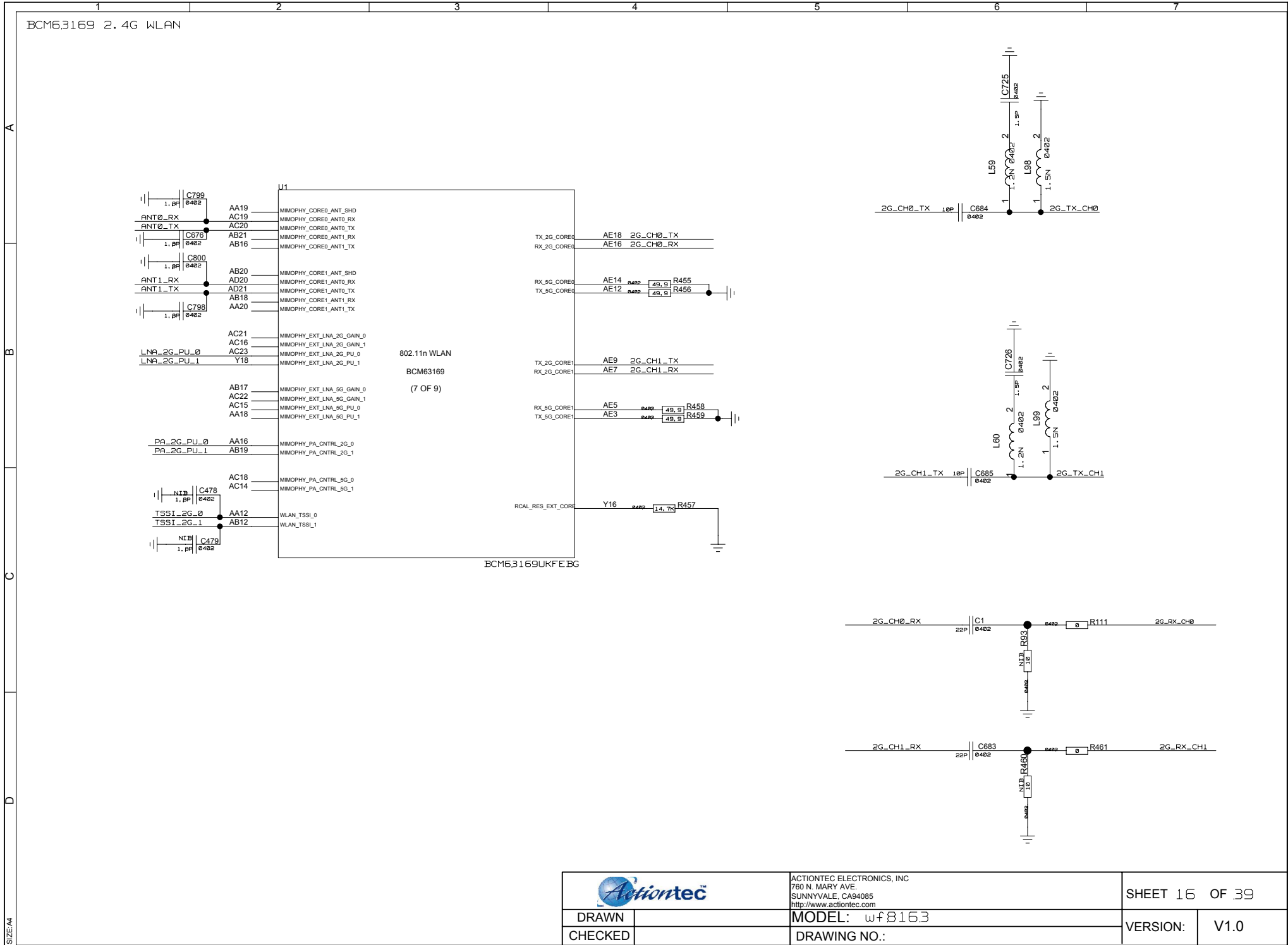
A


B

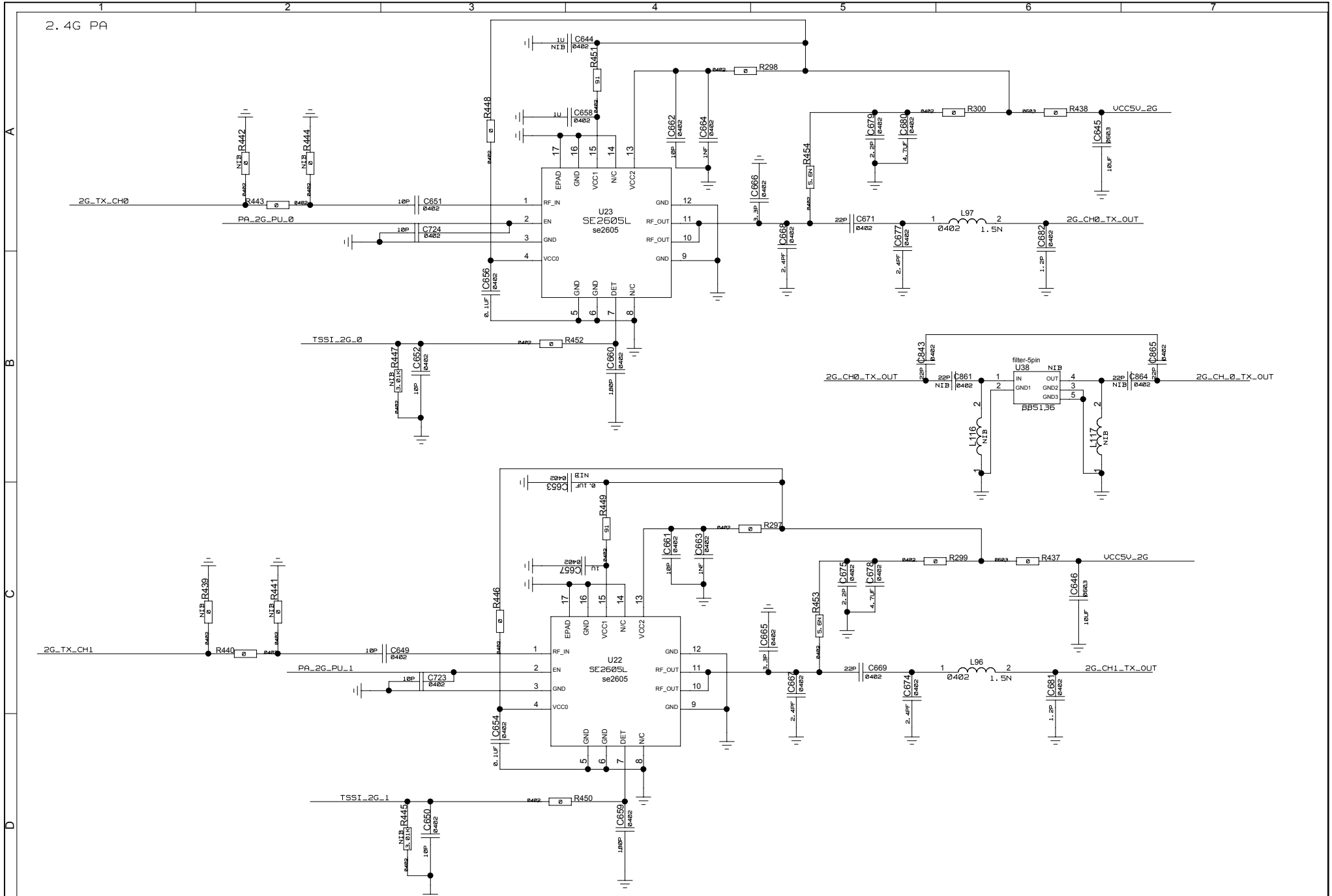
C


D

SIZE:A4



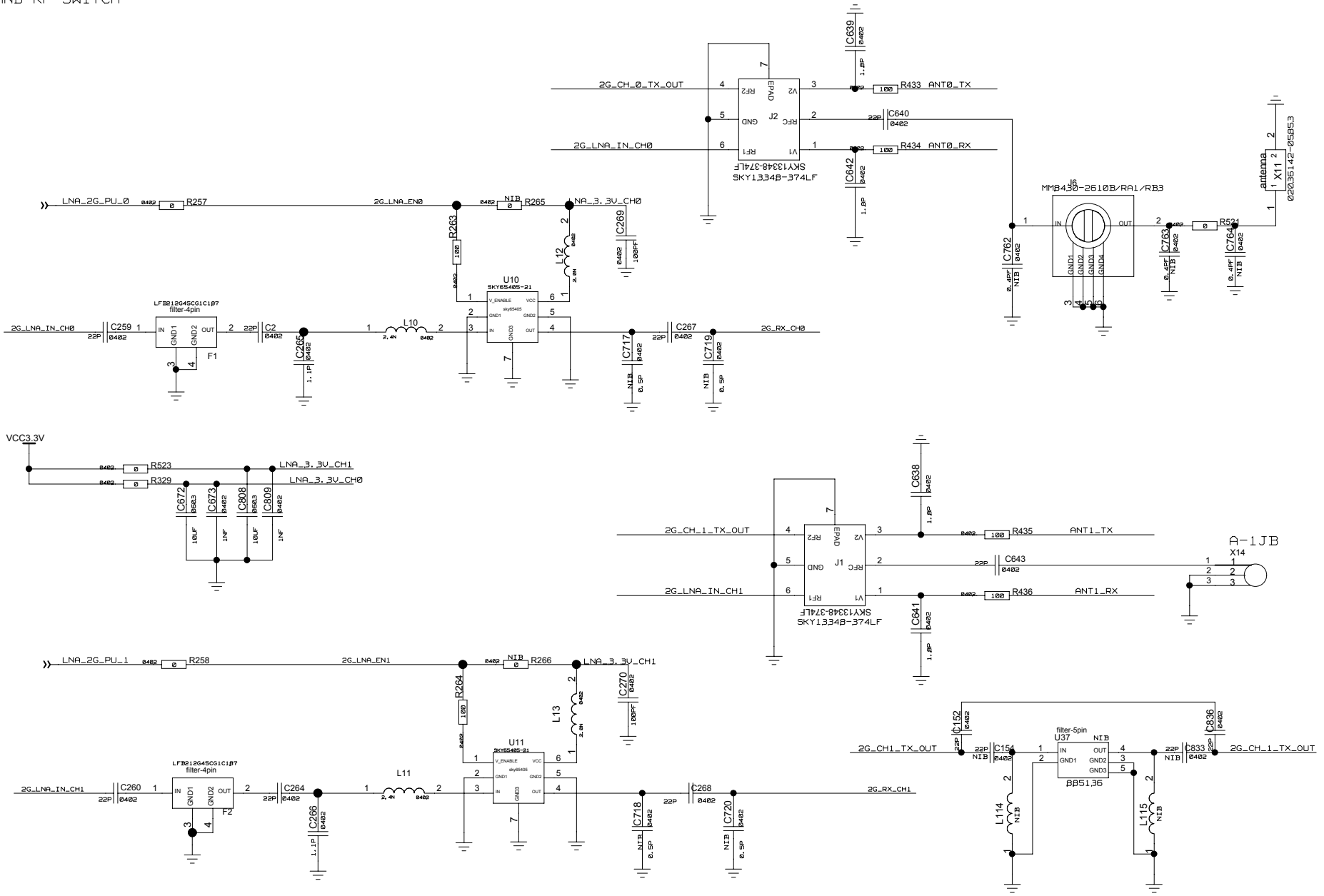
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		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:




		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 17 OF 39	
		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED	DRAWING NO.:				

SIZE: A4

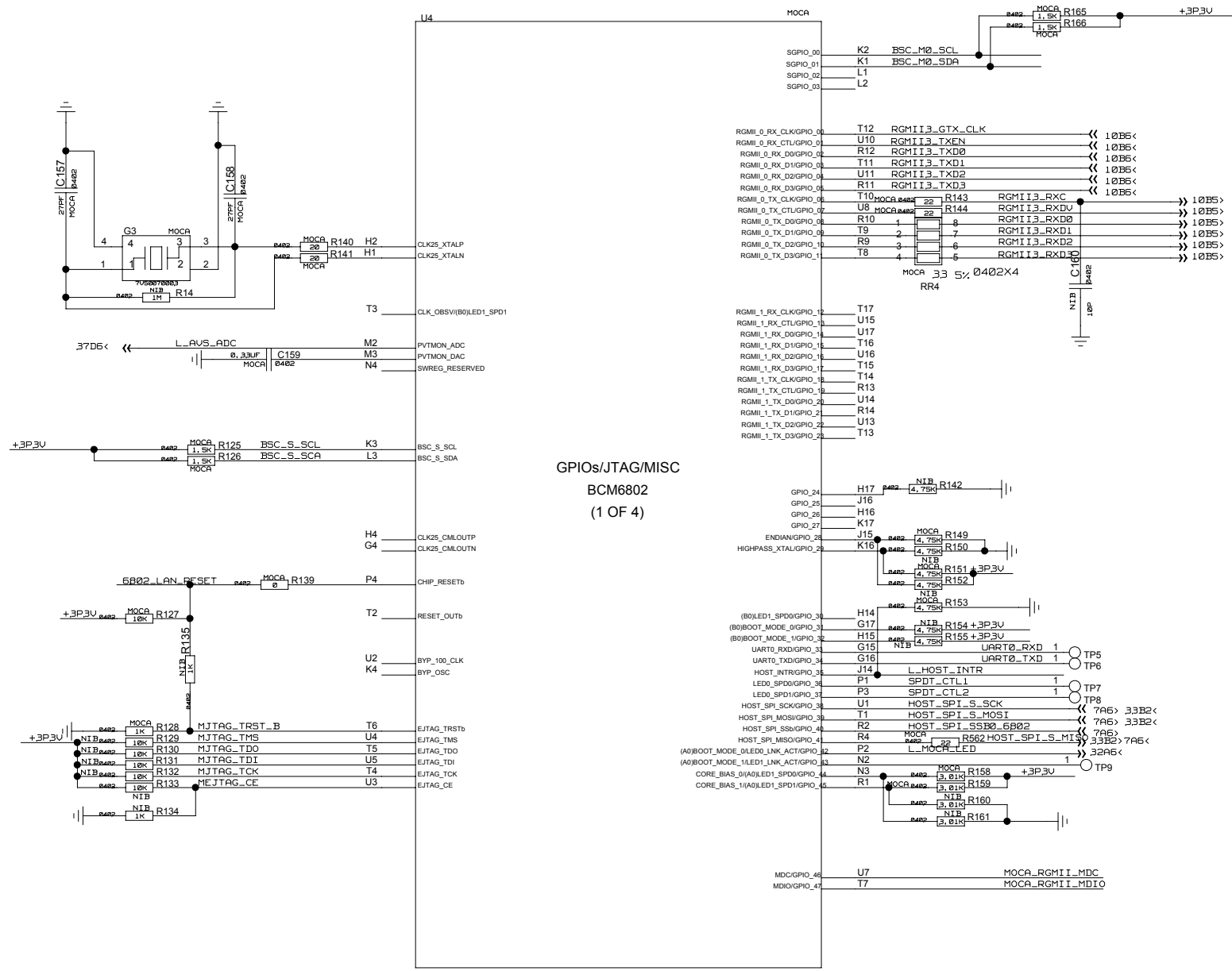
2.4G LNA AND RF SWITCH



		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 18 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

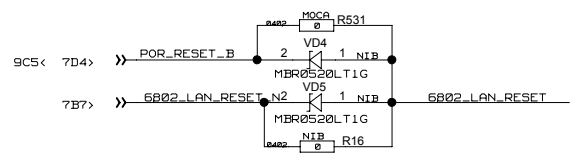
SIZE:A4

MOCA BCM6802 GPIO/JTAG/MISC



GPIOs/JTAG/MISC
BCM6802
(1 OF 4)

BCM6802KFSBG

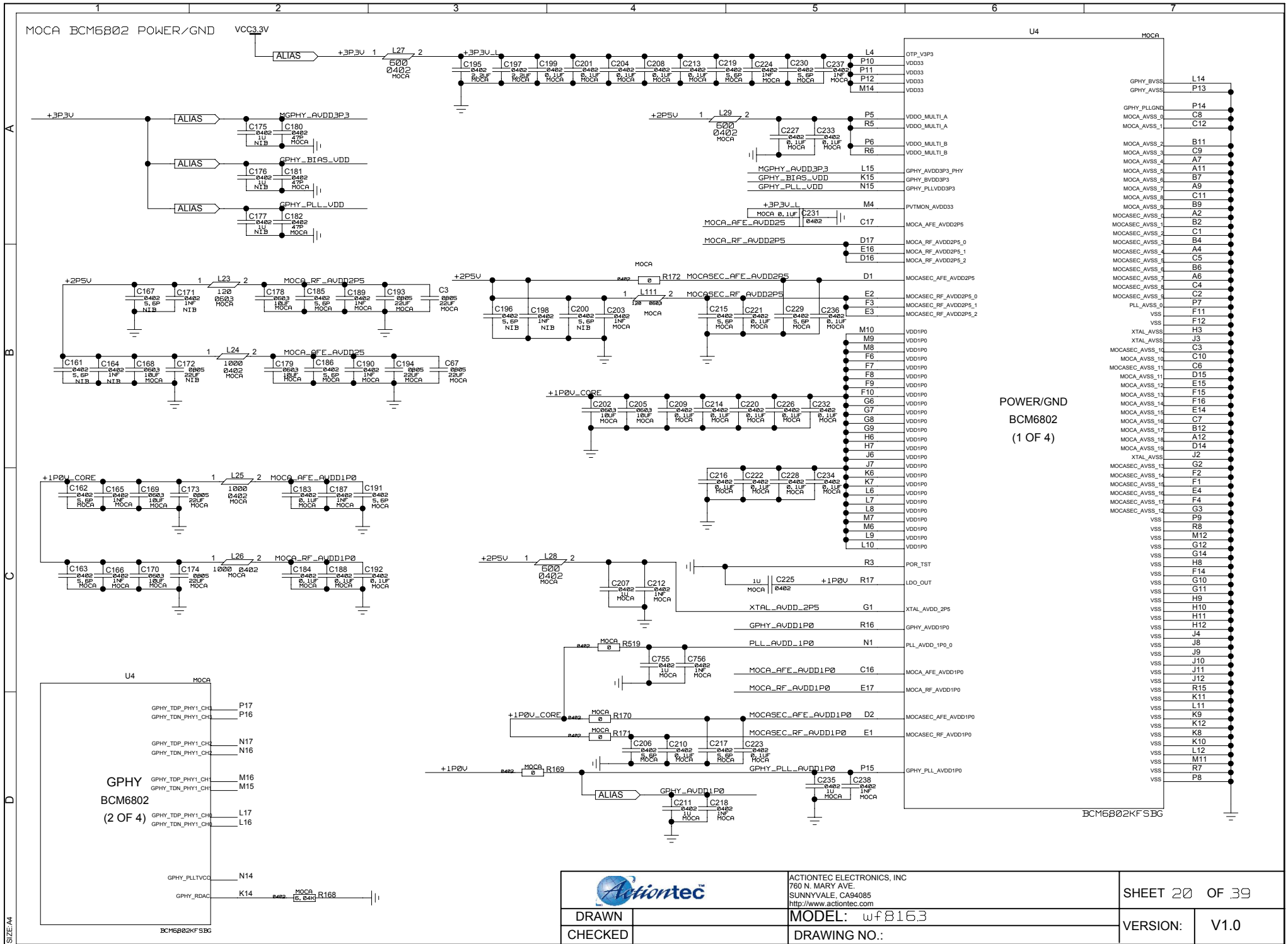


DRAWN	CHECKED

ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com	
MODEL:	wf8163
DRAWING NO.:	

SHEET 19 OF 39	
VERSION:	V1.0

A
B
C
D
SIZE:A4



POWER/GND
BCM6802
(1 OF 4)

U4
MOCA
GPHY
BCM6802
(2 OF 4)

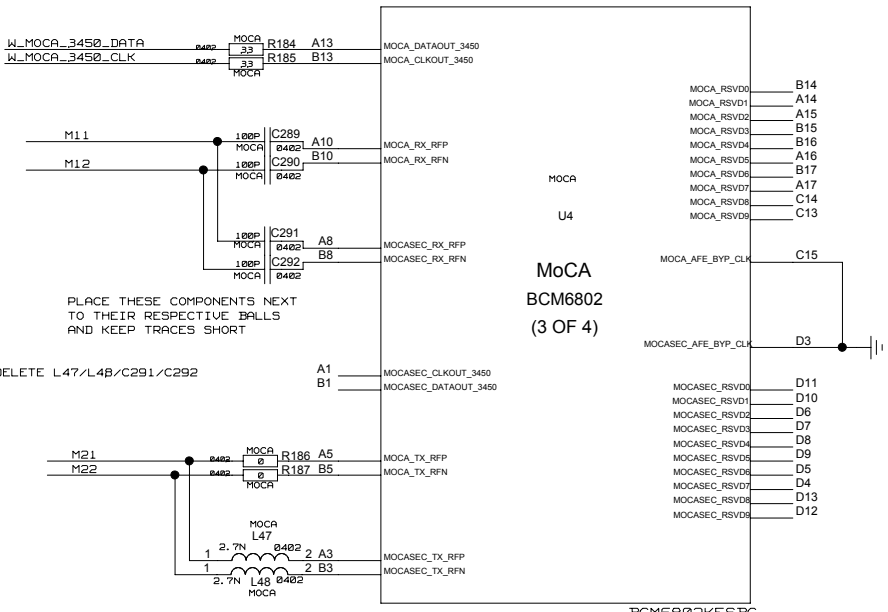
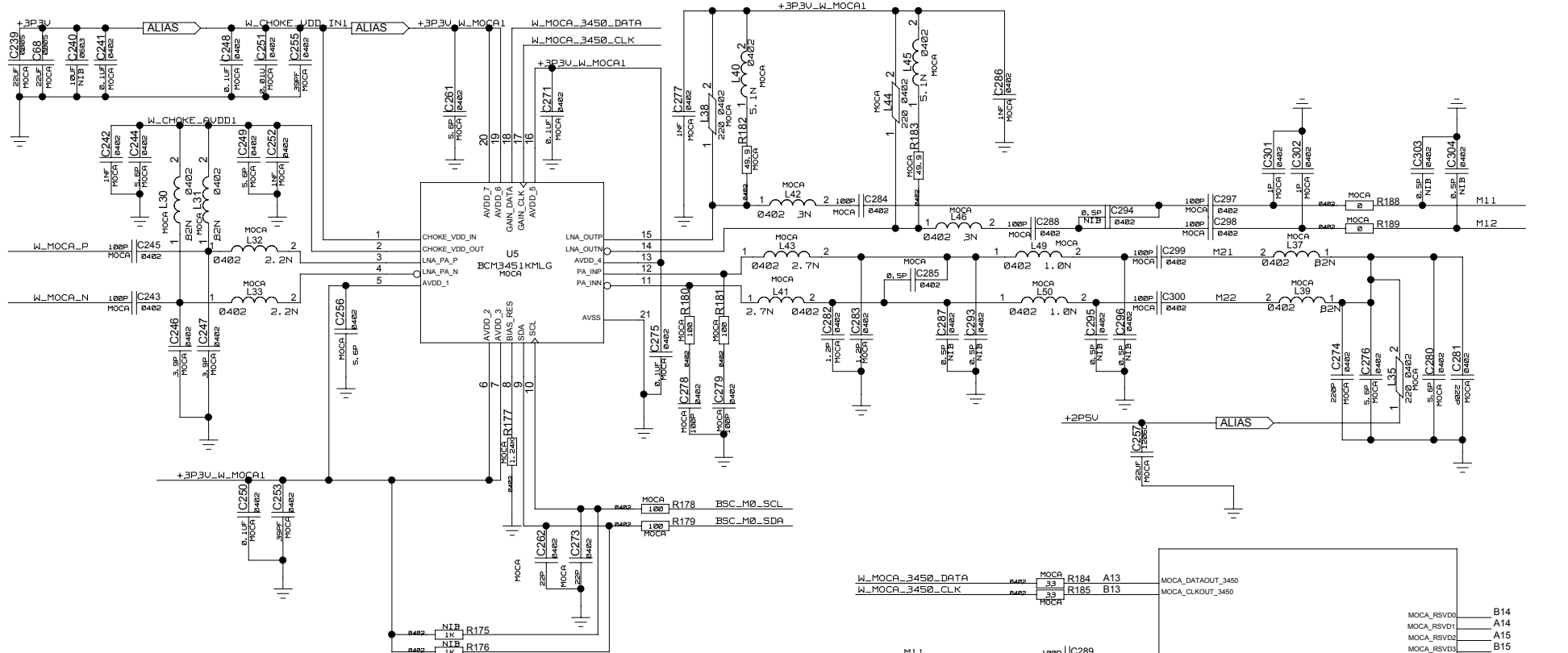
BCM6802KF5BG

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 20 OF 39	
		DRAWN CHECKED	MODEL: wf8163 DRAWING NO.:		VERSION: V1.0

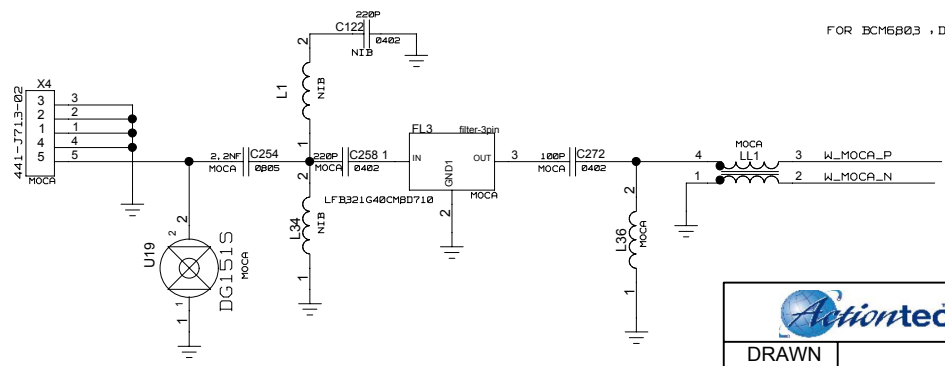
SIZE:A4

MOCA BCM6802/BCM3541 FRONT END

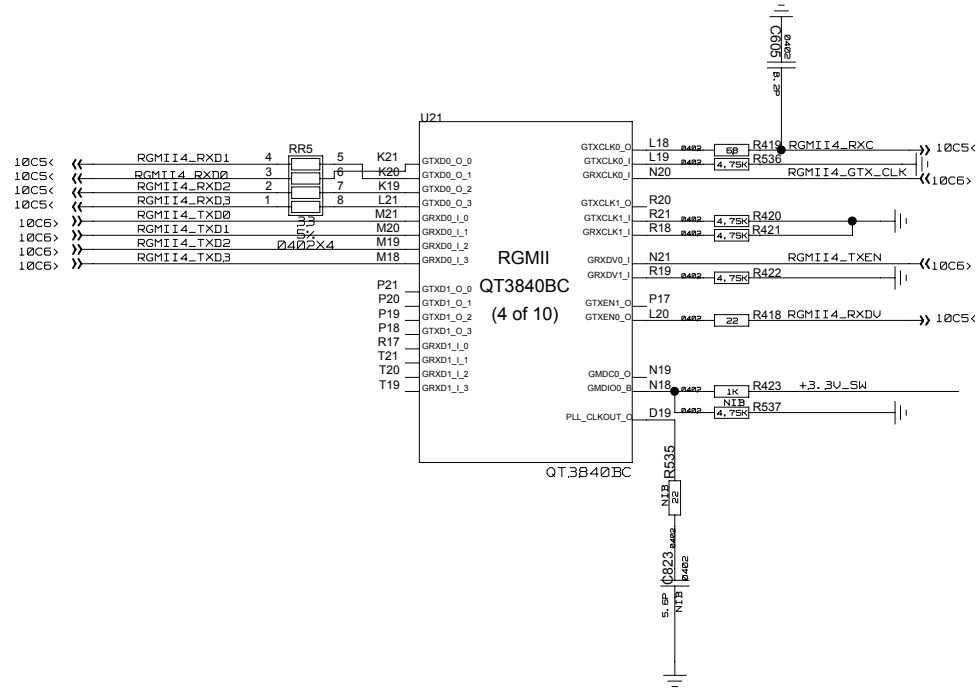
COVER THE CIRCUIT ON THIS PAGE WITH GND ON ALL LAYERS.




FOR BCM6803, DELETE L47/L48/C291/C292



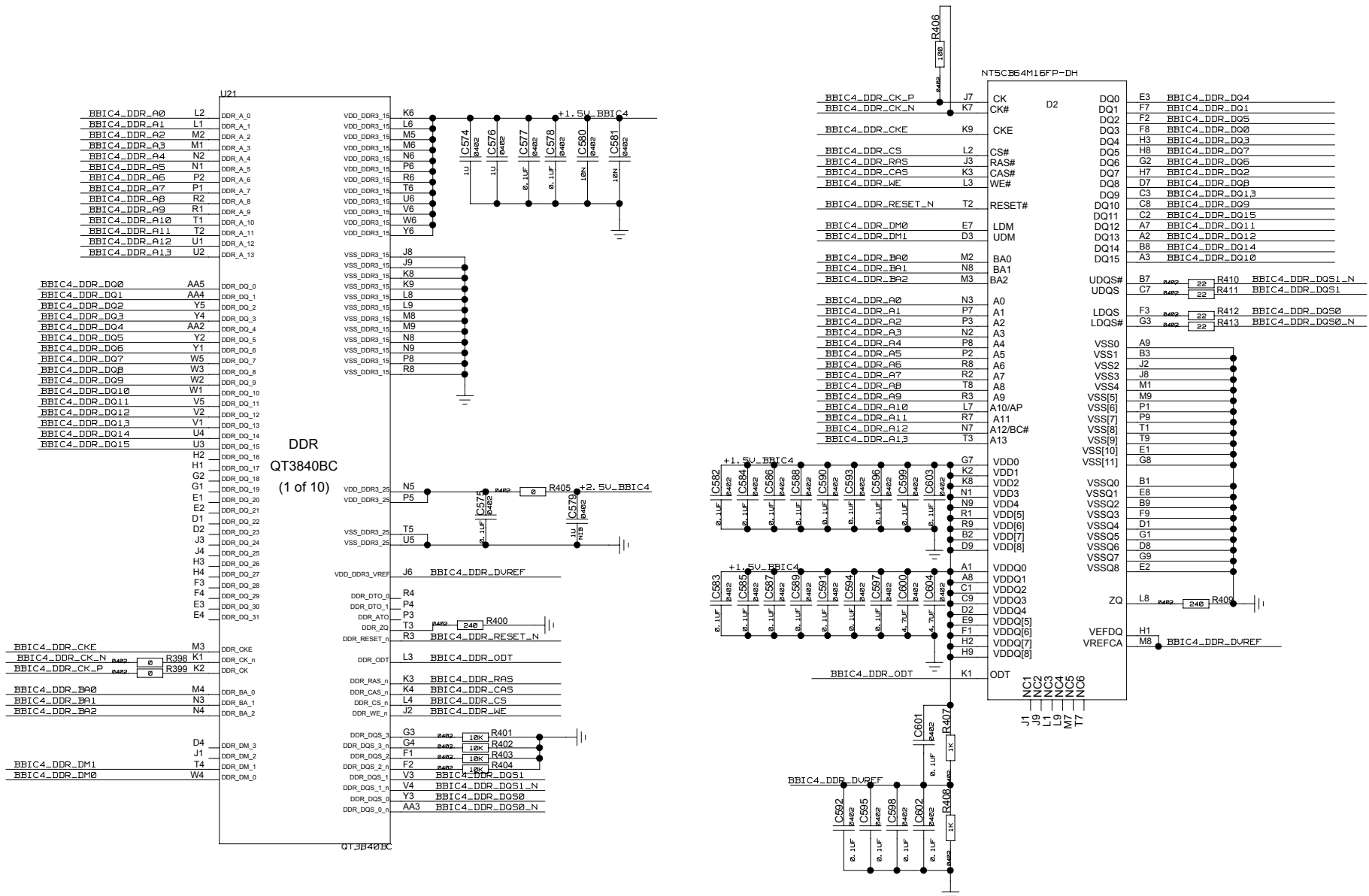
5G QT3B40BC RGMII INTERFACE




SIZE:A4

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 22 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

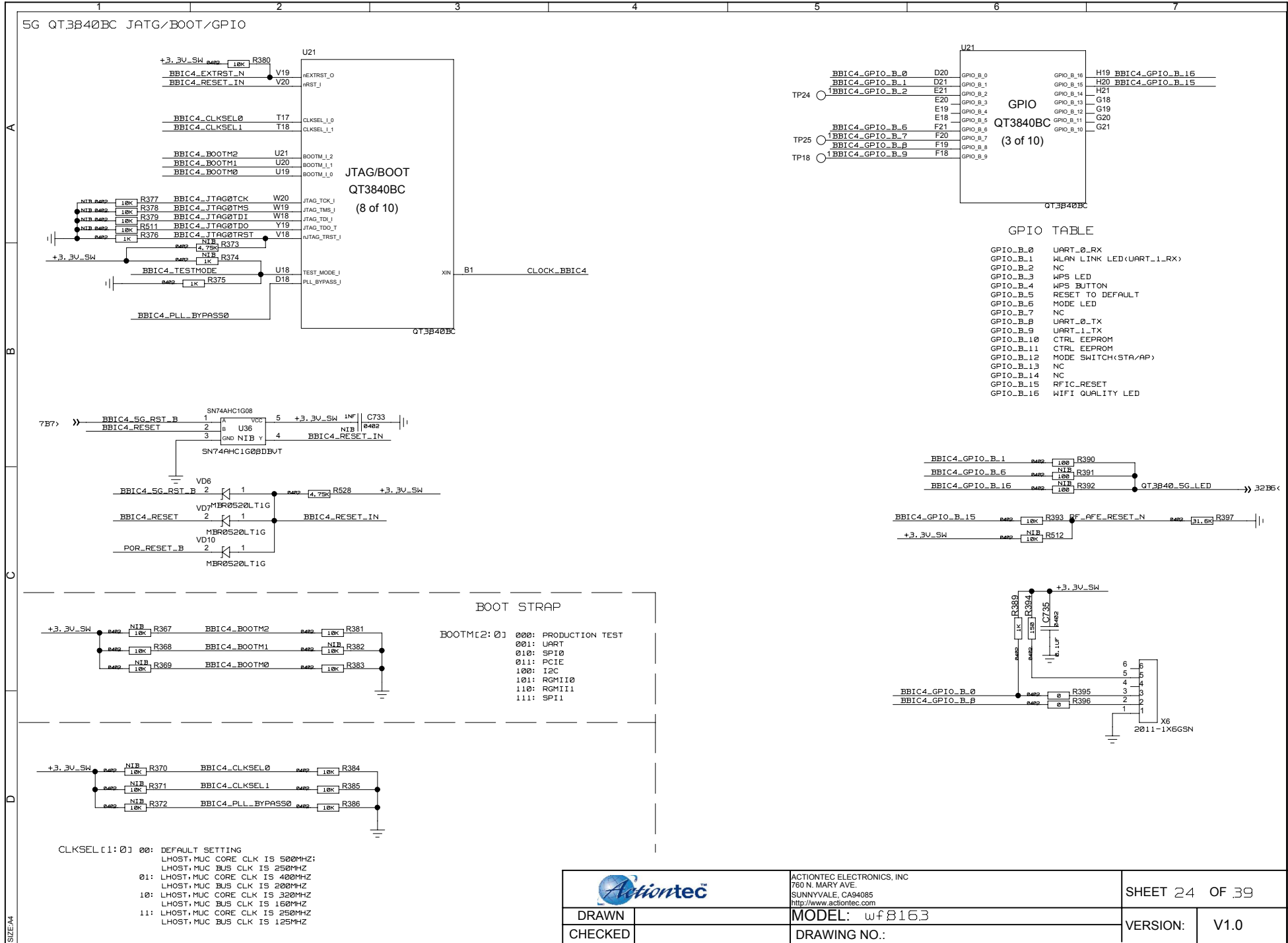
5G QT3840BC DDR/DDR3

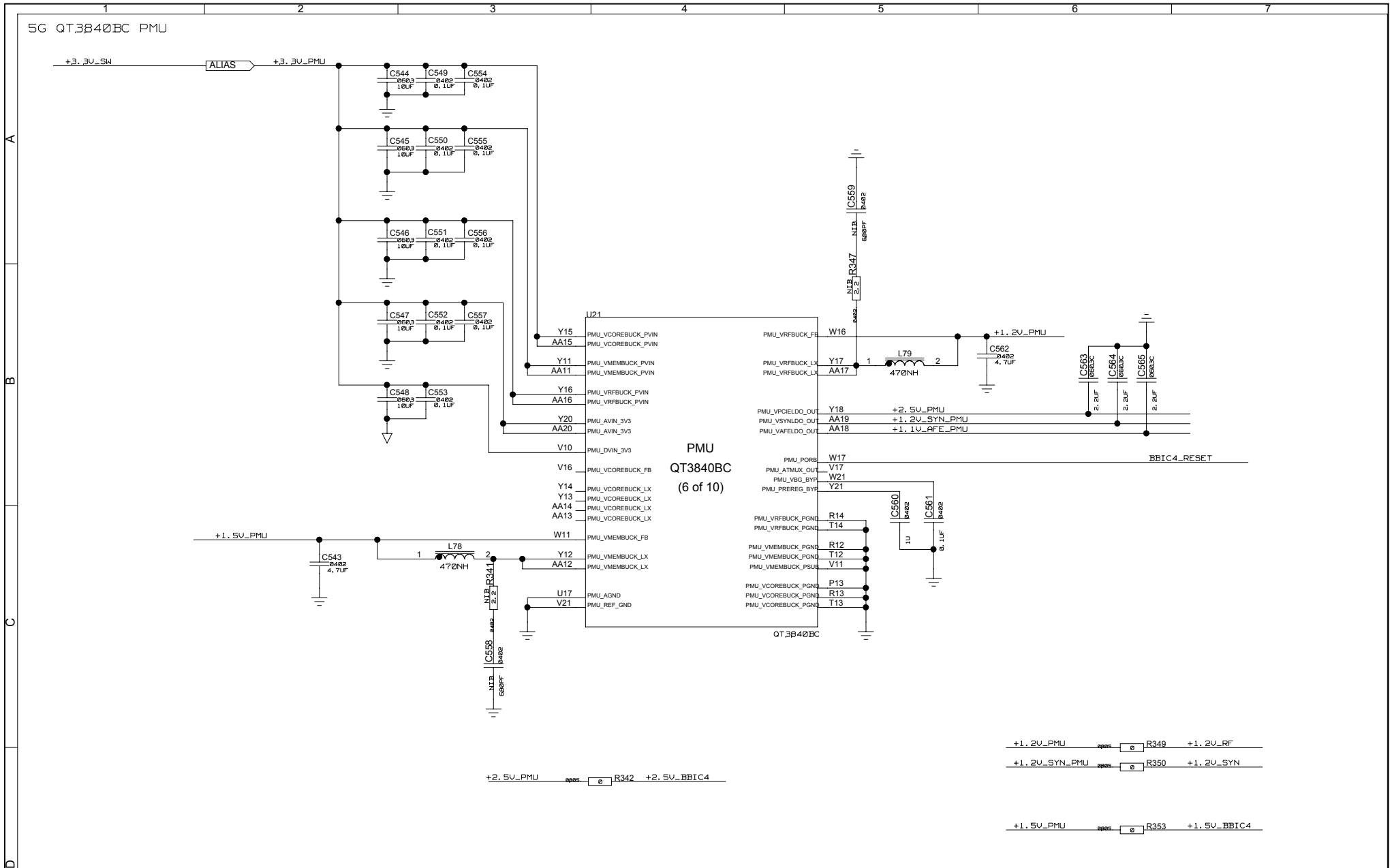


DDR
QT3840BC
(1 of 10)

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 2.3 OF 39	
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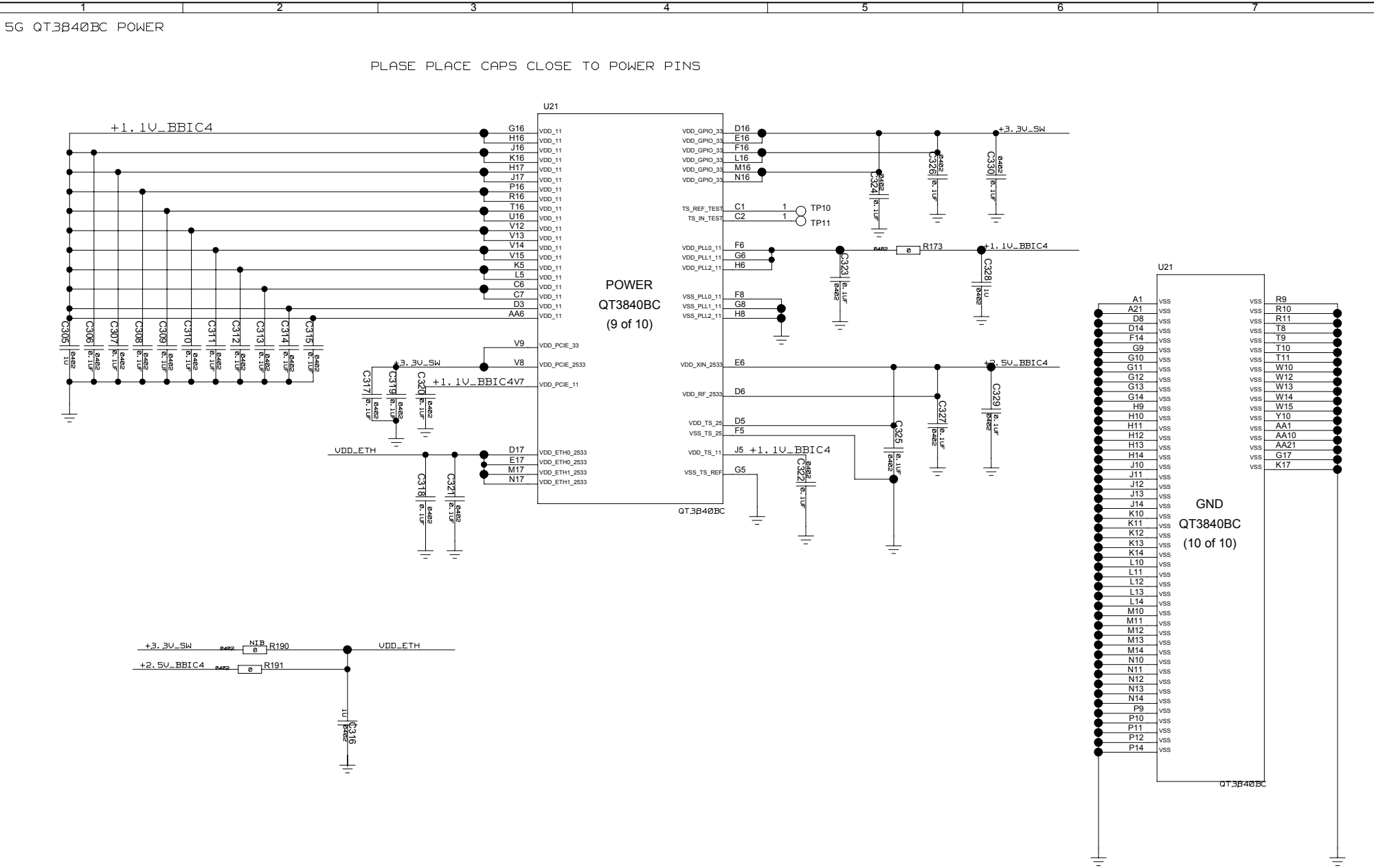
SIZE:A4





		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 25 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

SIZE:A4



A

B

C

D

SIZE:A4

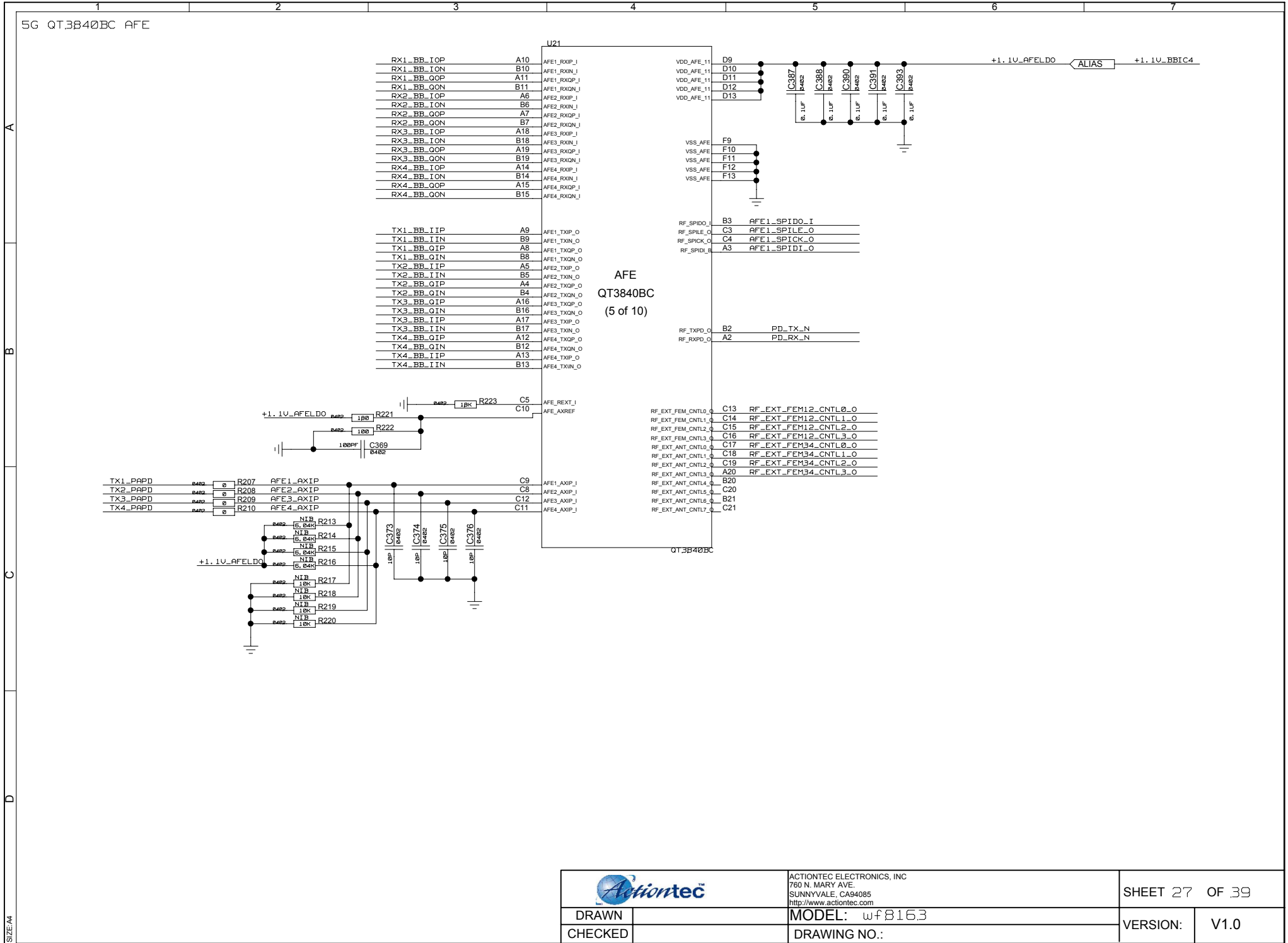
 ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA 94085 http://www.actiontec.com		SHEET 26 OF 39	
		VERSION: V1.0	DRAWING NO.:
DRAWN	CHECKED	MODEL: wf8163	

ACTIONTEC ELECTRONICS, INC
 760 N. MARY AVE.
 SUNNYVALE, CA 94085
<http://www.actiontec.com>

SHEET 26 OF 39

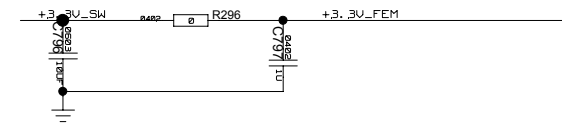
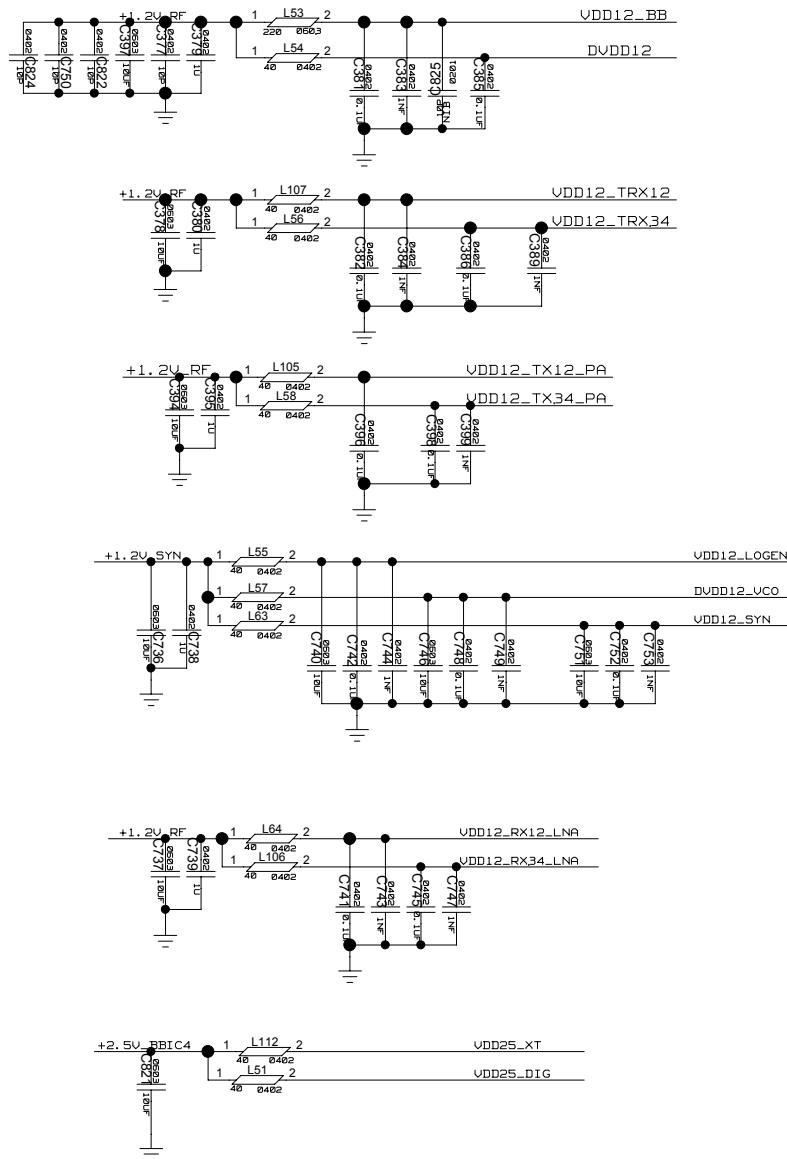
VERSION: V1.0

DRAWING NO.:




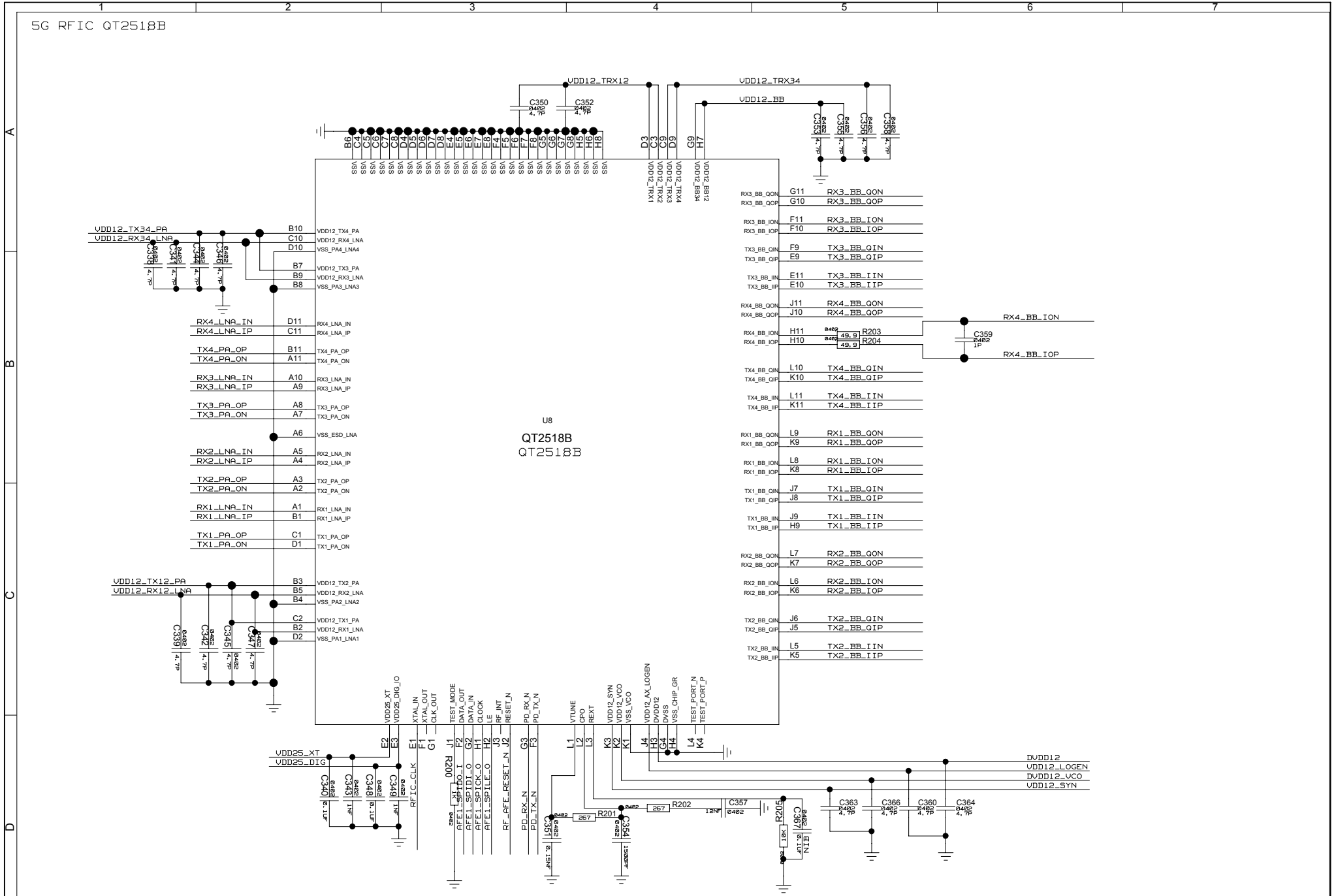
SIZE:A4


5G RFIC QT251BB POWER SUPPLY



SIZE:A4

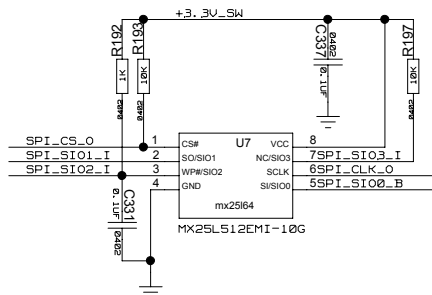
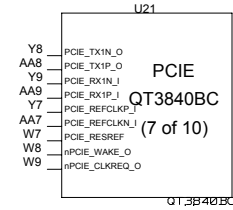
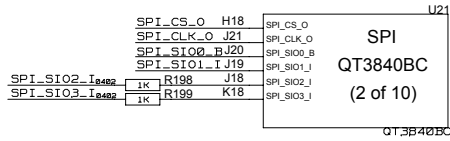
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 28 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:



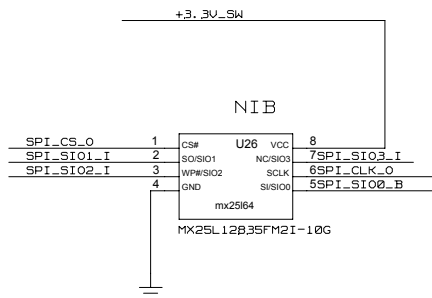
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 29 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

SIZE:A4

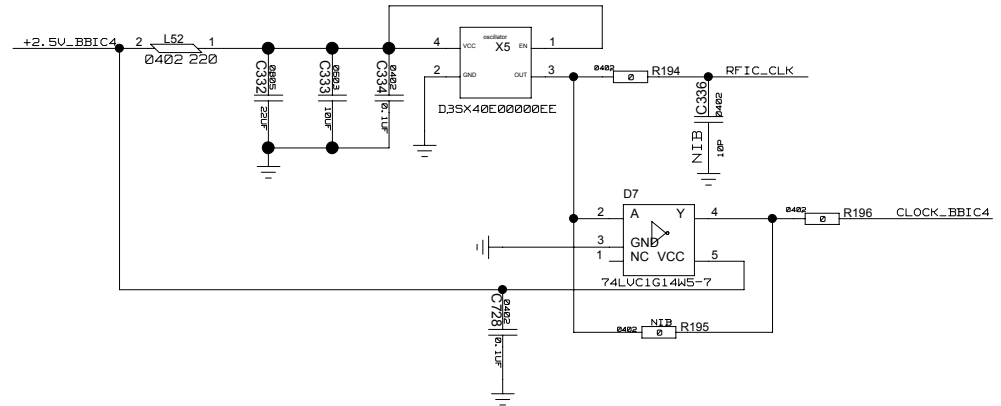
5G CLK/5G QT3B40BC FLASH/PCIE INTERFACE



SPI_FLASH



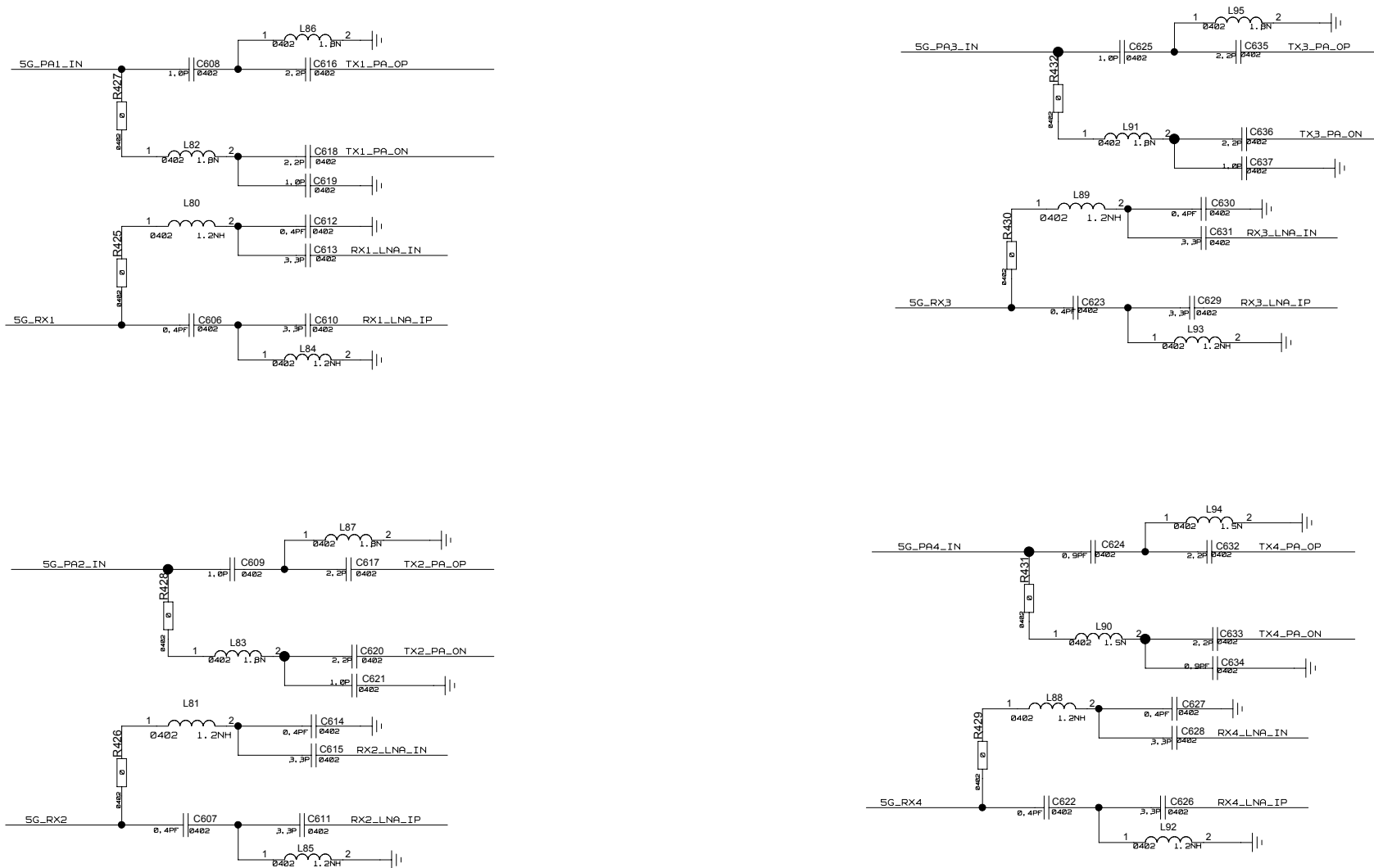
SPI_FLASH




SIZE:A4

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 30 OF 39	
		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED	DRAWING NO.:				

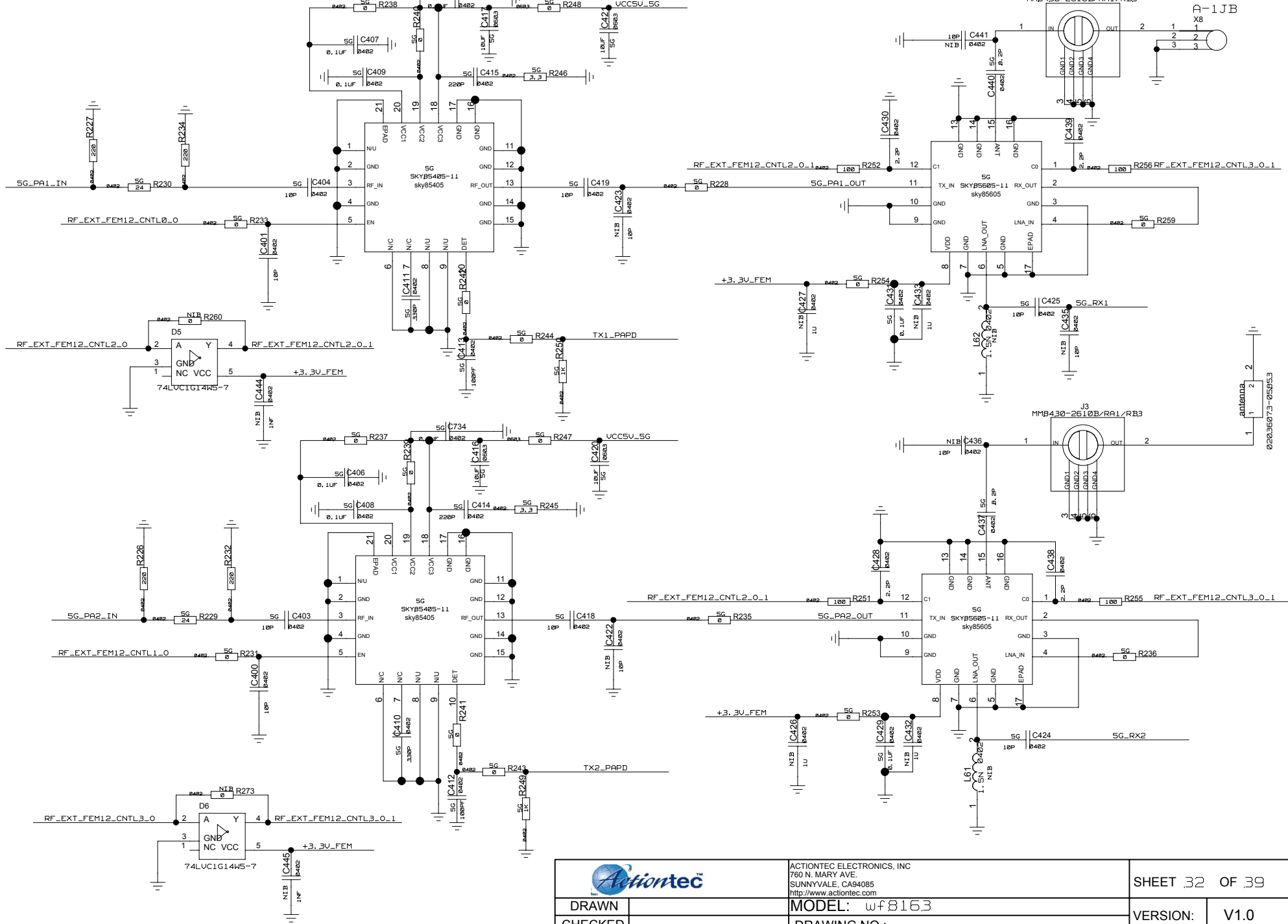
5G RFIC QT2518B DECOUPLING AND FILTERING




SIZE:A4

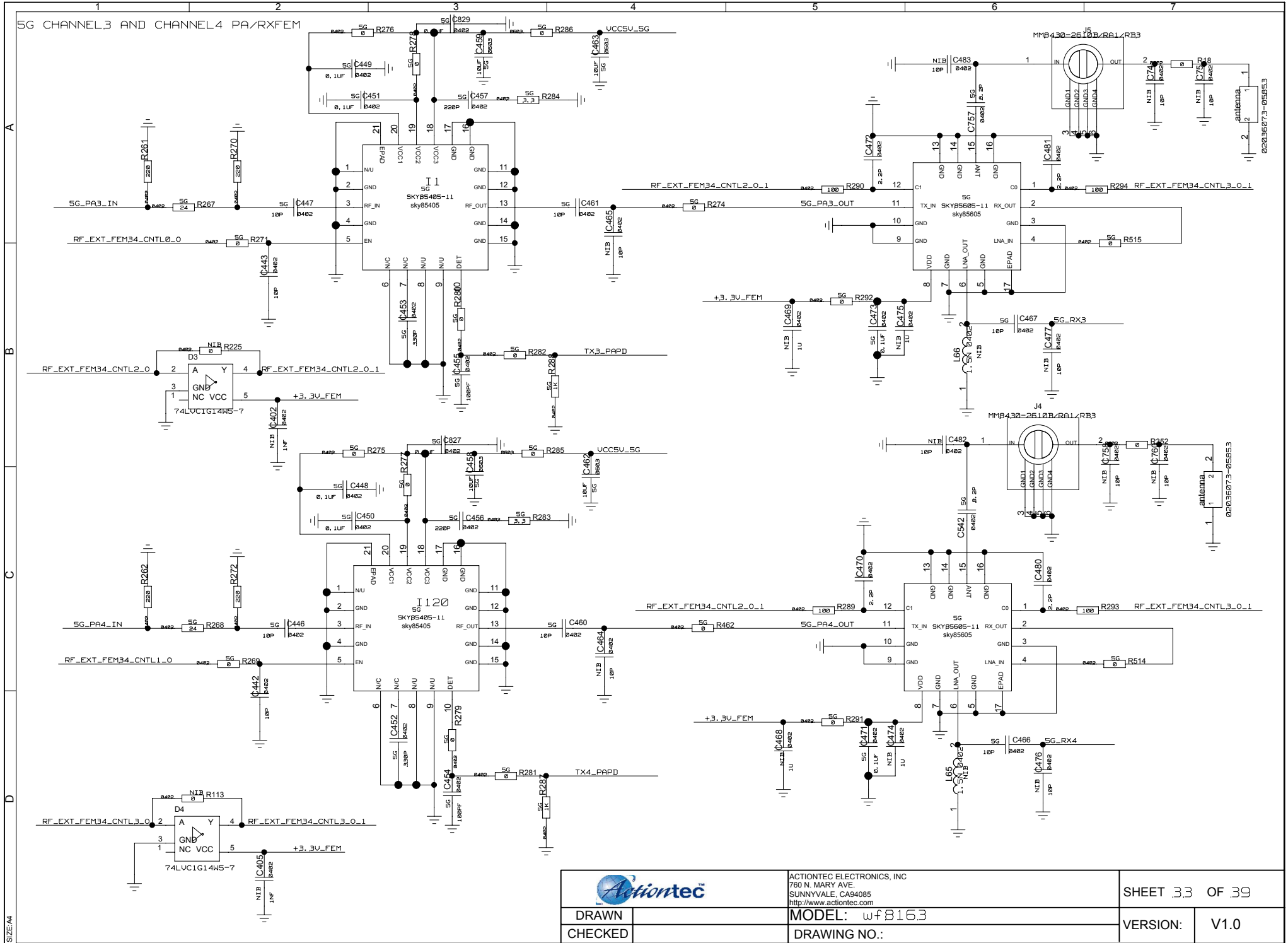
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 31 OF 39	
		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED	DRAWING NO.:				


5G CHANNEL 1 AND CHANNEL 2 PA/RXFEM

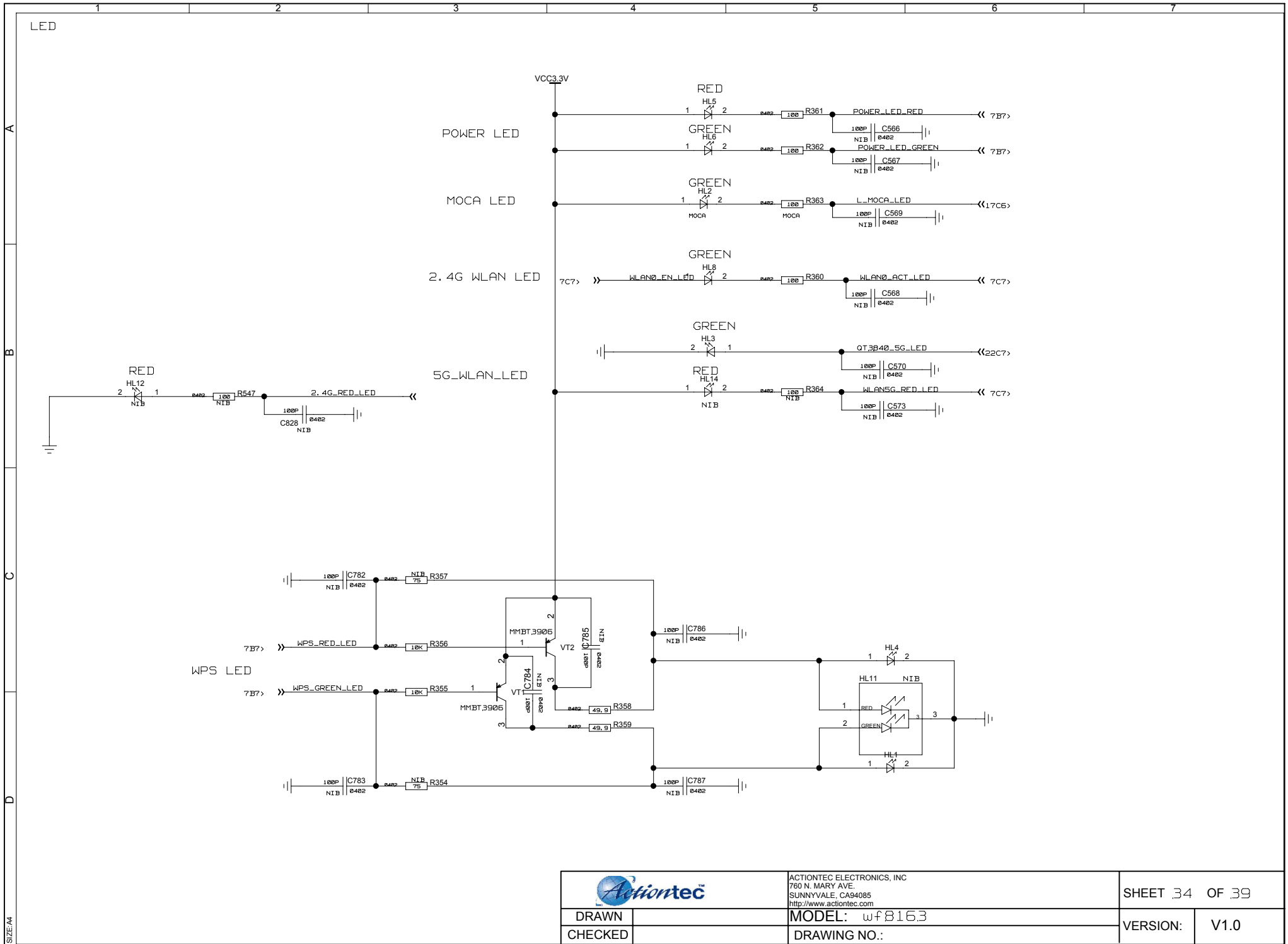



		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com	
		SHEET 32 OF 39	
DRAWN		MODEL: wf8163	
CHECKED		DRAWING NO.:	
		VERSION:	V1.0

SIZE:A4



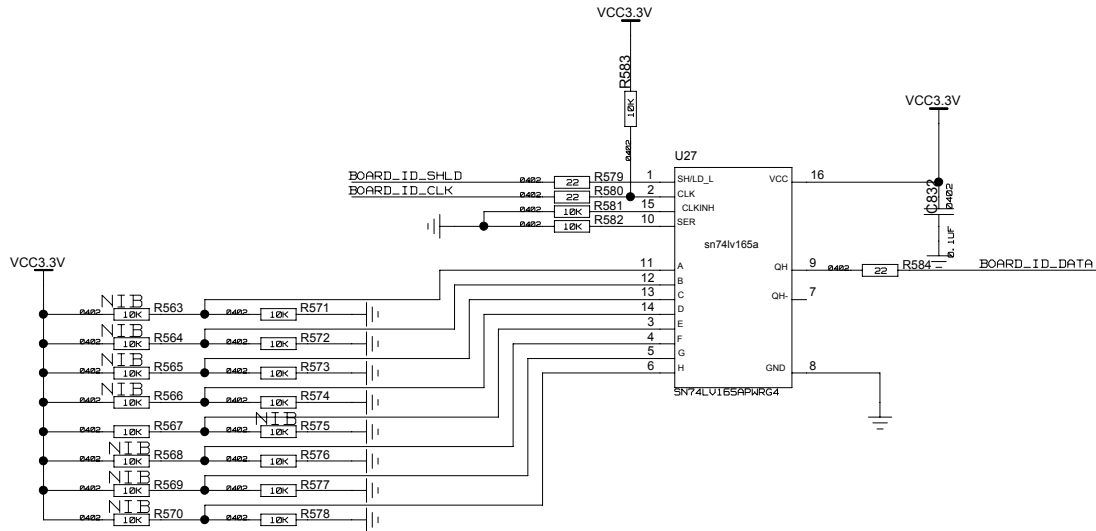
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com	
		SHEET 33 OF 39	
DRAWN	CHECKED	MODEL: wf8163	VERSION: V1.0
		DRAWING NO.:	02036073-05853



		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 34 OF 39	
		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED	DRAWING NO.:				

SIZE:A4

BOARD ID



Broadcom Based Processor Design

BHR5C	CIG	Design	Ethernet Gateway, 3x3 11n, 4x4 11ac, VoIP	BCM83138	0x05
WCB8240Q	CIG, Alex Dadnam	Design	Wi-Fi Extender - 4 Port Ethernet, Bonded MoCA, 4x4 11ac, 2x2 11n	BCM83169	0x09
WCB8040Q	CIG, Alex Dadnam	Design	Wi-Fi Extender - 4 Port Ethernet, Single MoCA, 4x4 11ac, 2x2 11n	BCM83170	0x10
WEB8040Q	CIG, Alex Dadnam	Design	Wi-Fi Extender - 4 Port Ethernet, 4x4 11ac, 2x2 11n	BCM83171	0x11



ACTIONTEC ELECTRONICS, INC
760 N. MARY AVE.
SUNNYVALE, CA94085
<http://www.actiontec.com>

DRAWN

CHECKED

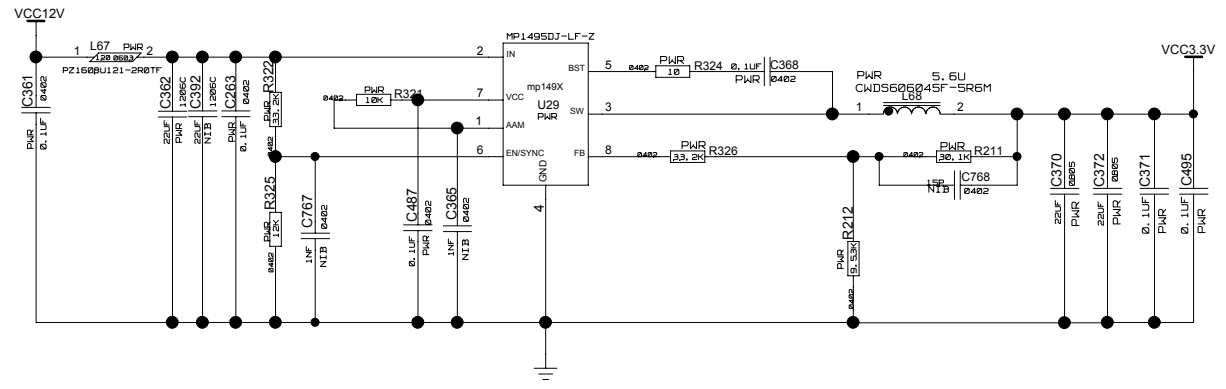
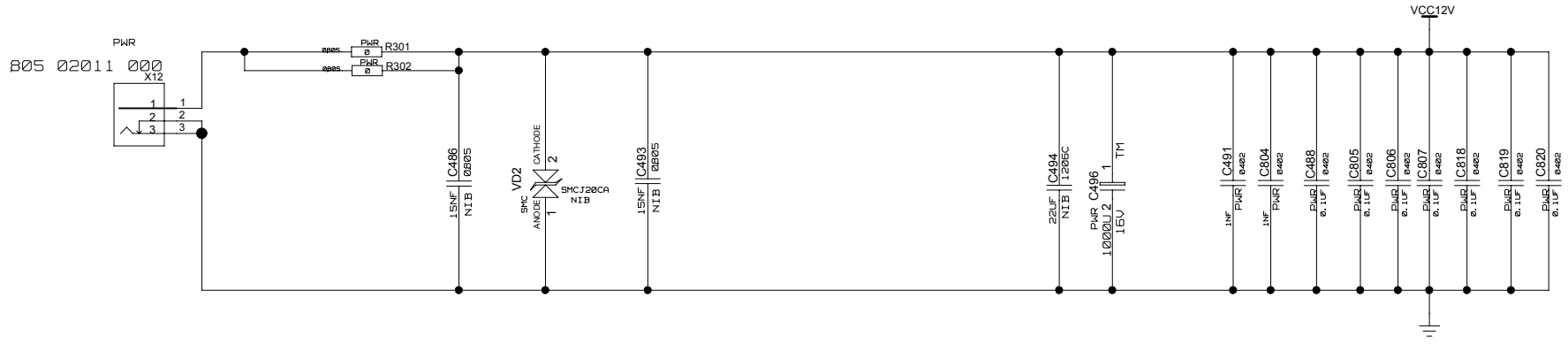
MODEL: wf8163

DRAWING NO.:


SHEET 35 OF 39

VERSION: V1.0

POWER SUPPLY 12V/ MAIN SYSTEM POWER .3.3V

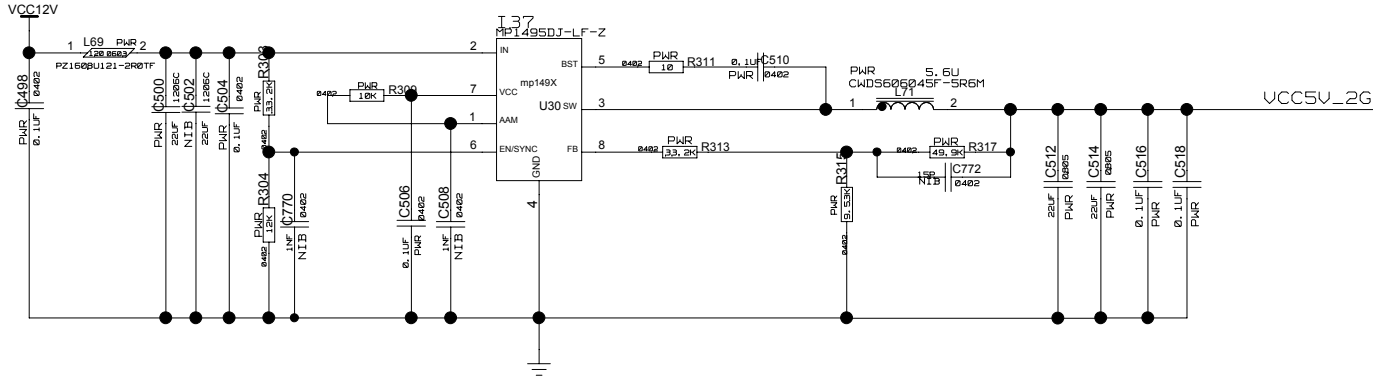


MAIN SYSTEM POWER .3.3V
 IMAX=2256MA
 VOUT=0.8*(1+R211/R212)
 =3.33V

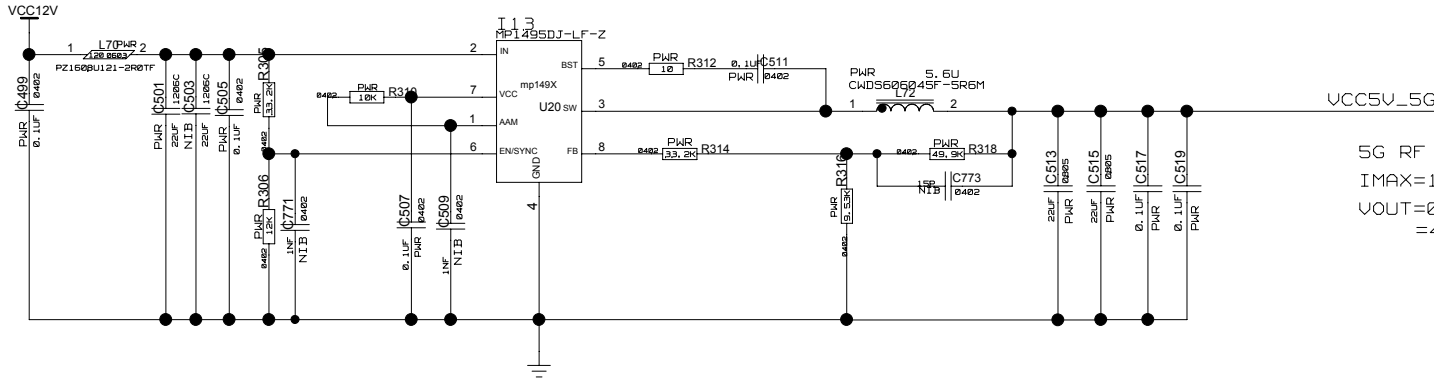
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 36 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

SIZE:A4

POWER SUPPLY 5V FOR 2.4G/5G RF PA




2.4G RF PA POWER
 I_{MAX}=1200MA
 $V_{OUT}=0.8 * (1 + R_{317}/R_{315})$
 =4.99V



5G RF PA POWER
 I_{MAX}=1600MA
 $V_{OUT}=0.8 * (1 + R_{318}/R_{316})$
 =4.99V

SIZE:A4

		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 37 OF 39	
		DRAWN	CHECKED	MODEL: wf8163	DRAWING NO.:

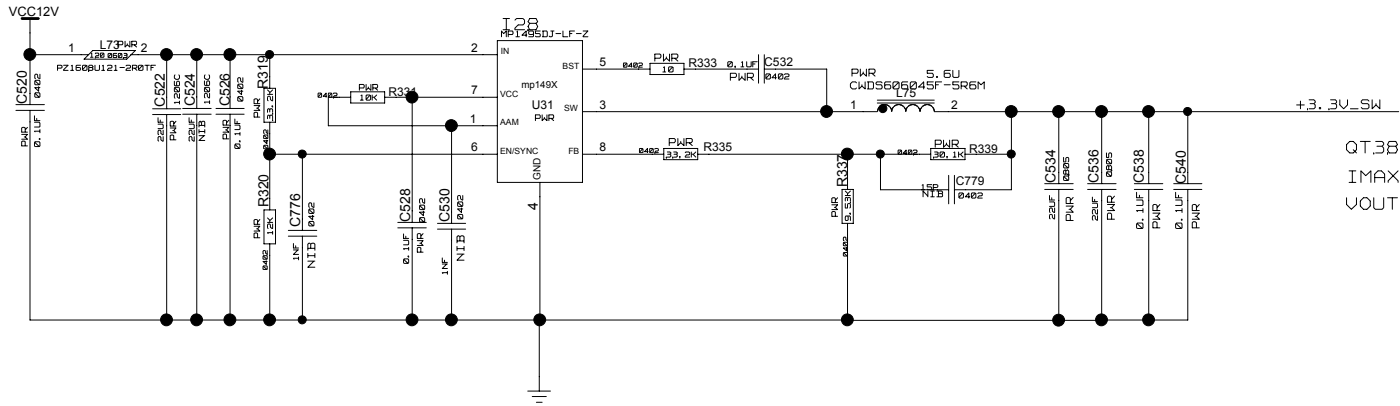
POWER SUPPLY 3.3V/1.1V FOR QT3B40BC AND RTL8367

A

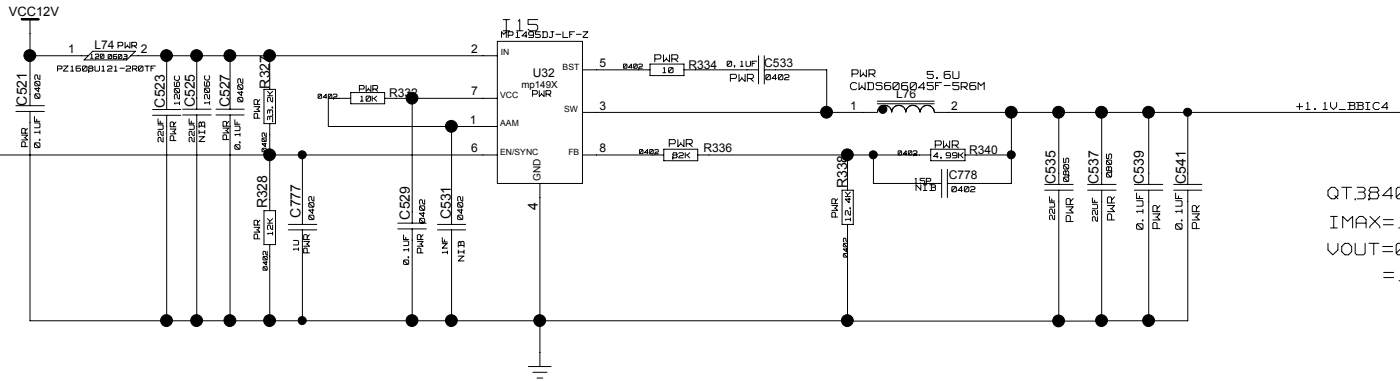
B

C


D



QT3B40BC 3.3V
 I_{MAX}=578mA
 $V_{OUT} = 0.8 * (1 + R_{339}/R_{337})$
 = 3.33V

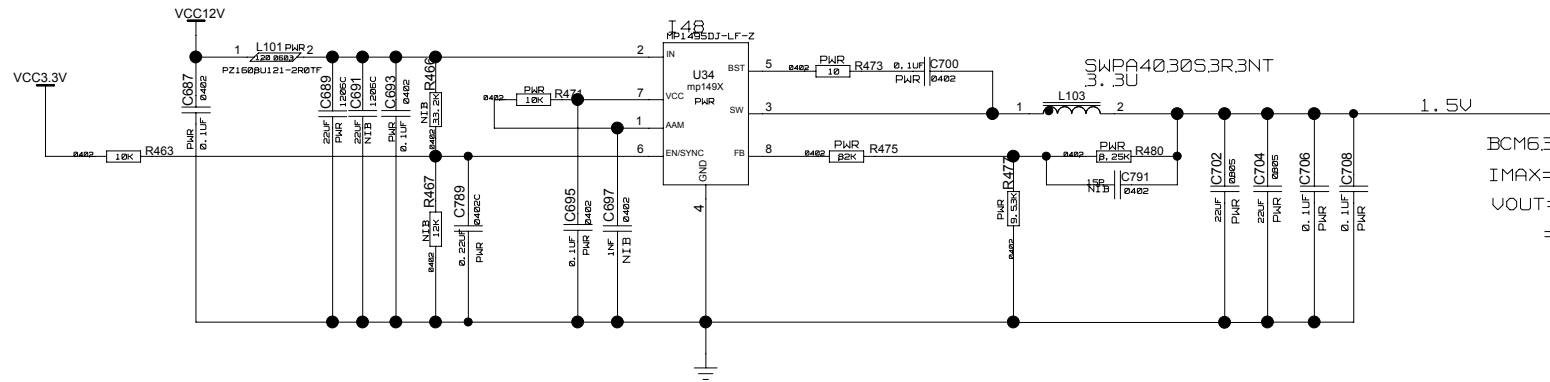


QT3B40BC 1.1V
 I_{MAX}=1840mA
 $V_{OUT} = 0.8 * (1 + R_{340}/R_{338})$
 = 1.12V

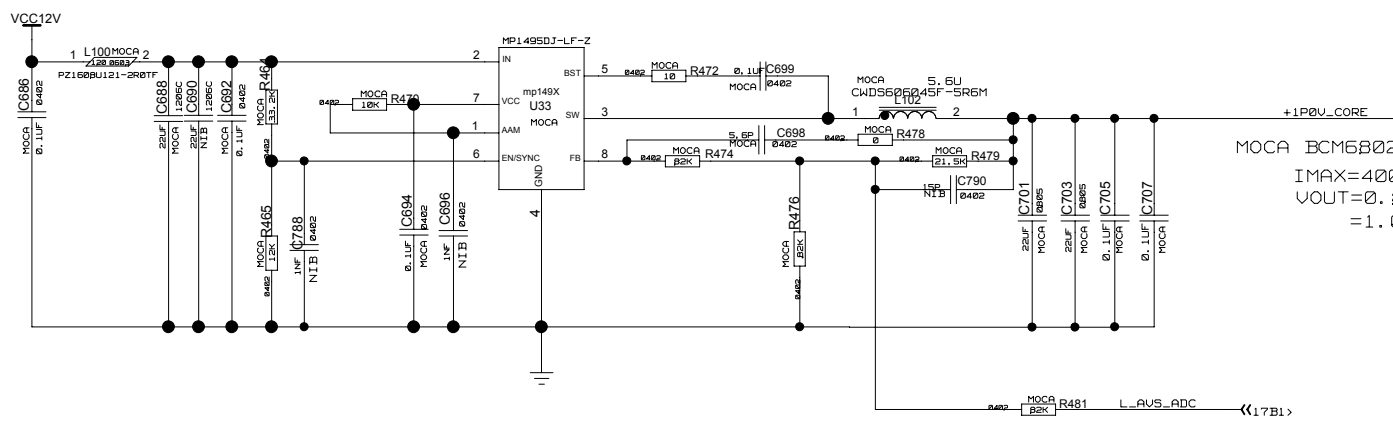
		ACTIONTEC ELECTRONICS, INC 760 N. MARY AVE. SUNNYVALE, CA94085 http://www.actiontec.com		SHEET 38 OF 39	
		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED	DRAWING NO.:				

SIZE:A4

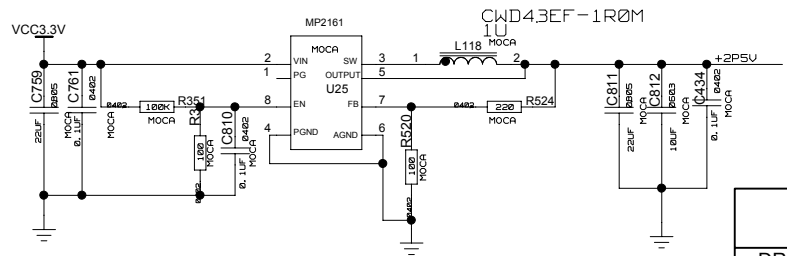
POWER SUPPLY 1.5V/1.0V FOR BCM63169 DDR AND BCM6802 CORE




BCM63169 DDR 1.5V
 I_{MAX}=480MA
 $V_{OUT} = 0.8 * (1 + R480/R477)$
 = 1.49V



MOCA BCM6802 CORE VOLTAGE 1.0V
 I_{MAX}=400MA
 $V_{OUT} = 0.8 * (1 + R479/R476)$
 = 1.0V



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		DRAWN	MODEL: wf8163	VERSION:	V1.0
CHECKED	DRAWING NO.:				

A
B
C
D
SIZE:A4