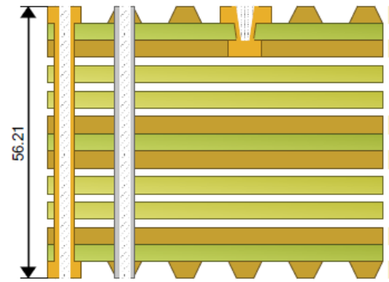
Revisions		
X	5/11/2018	Initial Release
X1	5/15/2018	IC1B AWR1642 Pins J5 H5 G5 Net name was AR-1p3-RF2 now AR-1p3-RF1
		Various Typos Fixed
A	7/10/2018	Added PMIC PG to nRESET of AWR1642
		Buffered 5V Legacy Display output to reduce leakage
		Changed GP-ADC Input Scaling per TI's Recomendations
		Released to Fab

Layer	Stack up	Description	Type	Base Thickness	Processed Thickness	er	Copper Coverage	Mask Thickness
1				0.689	2.067		100.000	
		Rogers 4835 4mil coreH/1 Low Pro	Rogers 4835	4.000	4.000	3.480		
2				1.260	1.260		73.000	
		Iteq IT180A Prepreg 1080	Dielectric	4.195	2.830	3.700		
		Iteq IT180A Prepreg 1080	Dielectric	4.195	2.830	3.700		
3				1.260	1.260		69.000	
		Iteq IT180A 28 mil core 1/1	FR4	28.000	28.000	4.280		
4				1.260	1.260		48.000	
		Iteq IT180A Prepreg 1080	Dielectric	4.195	2.691	3.700		
		Iteq IT180A Prepreg 1080	Dielectric	4.195	2.691	3.700		
5				1.260	1.260		72.000	
		Iteq IT180A 4 mil core 1/H	FR4	4.000	4.000	3.790		
6				0.689	2.067		100.000	

56.21

Copper Thickness = 9.173 |Dielectric Thickness = 47.041 |Solder Mask Thickness = 0.000 |Stack Up Thickness = 56.214 |Stack Up Thickness with Soldermask = 56.214 | Stack Up Cost = 0.00 |

Impedance ID	Structure Name	Impedance Signal Layer	Ref. Plane 1 in Layer	Ref. Plane 2 in Layer	Lower Trace Width (W1)	Trace Separation (S1)	Ground Strip Separation (D1)	Calculated Impedance	Target Impedance	Tol (+/- %)
1	Edge Coupled Surface Microstrip 1B	1	2	0	5.200	5.000	0.000	102.650	102.650	10.000
2	Surface Coplanar Strips With Lower Ground 1B	1	2	0	7.080	0.000	8.000	51.680	51.680	10.000
3	Surface Coplanar Strips With Lower Ground 1B	1	2	0	6.979	0.000	5.061	50.000	50.000	10.000
4	Edge Coupled Surface Microstrip 1B	6	5	0	5.661	6.339	0.000	100.000	100.000	10.000

Notes:

1) Some devices have thermal pads, and usually the manufacturer designates this as the highest pad number. Example is IC16, the thermal pad is 17 in literature. In this design all thermal pads' PCB footprint and schematic symbol is redesignated as "Pin 0 "in order to easily create, track, filter, and exclude violations in via-pad clearance rules in the PCB design rules construct as thermal pads typically have vias embedded in them for thermal performance.

2) mmWave RADAR PMIC (IC2, MP87524) power-on configuration straps read using pullups to net 5V-IN as this power domain is active prior to LP87524 outputs turning on.

.

3) Some devices have thermal pads, and usually the manufacturer designates this as the highest pad number. Example is IC16, the thermal pad is 17 in literature. I change the thermal pads' PCB footprint and schematic symbol from whatever it is to "Pin 0 "in order to easily create, track, and exclude violations in via-pad clearance rules in the PCB design rules construct as thermal pads typically have vias embedded in them for thermal performance.

5) mmWave RADAR PMIC (IC2, MP87524) power-on configuration straps read using pullups to net 5V-IN as this power domain is active prior to LP87524 outputs turning on.

6) The 3.3V output from the PMIC is use as PGOOD for the XDS110 Supply enable, not the actual PGOOD pin.

7) Final optimal values for passives calculated at fab release check, values such as resistive dividers for analog voltage sensing not calculated for optional internal buffer which has 1.4V range, not 1.8. Existing values are placeholders to get resistors into design.

U_System Block
System Block.SchDoc

U_Automotive Front End
Automotive Front End.SchDoc

U_Buck Boost Vreg
Buck Boost Vreg.SchDoc

U_mmWave RADAR PMIC
mmWave RADAR PMIC.SchDoc

U_Local Power Supplies
Local Power Supplies.SchDoc

U_AWR1642 Signal
AWR1642 Signal.SchDoc

U_AWR1642 Power
AWR1642 Power.SchDoc

U_XDS110 Interface
XDS110 Interface.SchDoc

U_Vehicle Interface
Vehicle Interface.SchDoc

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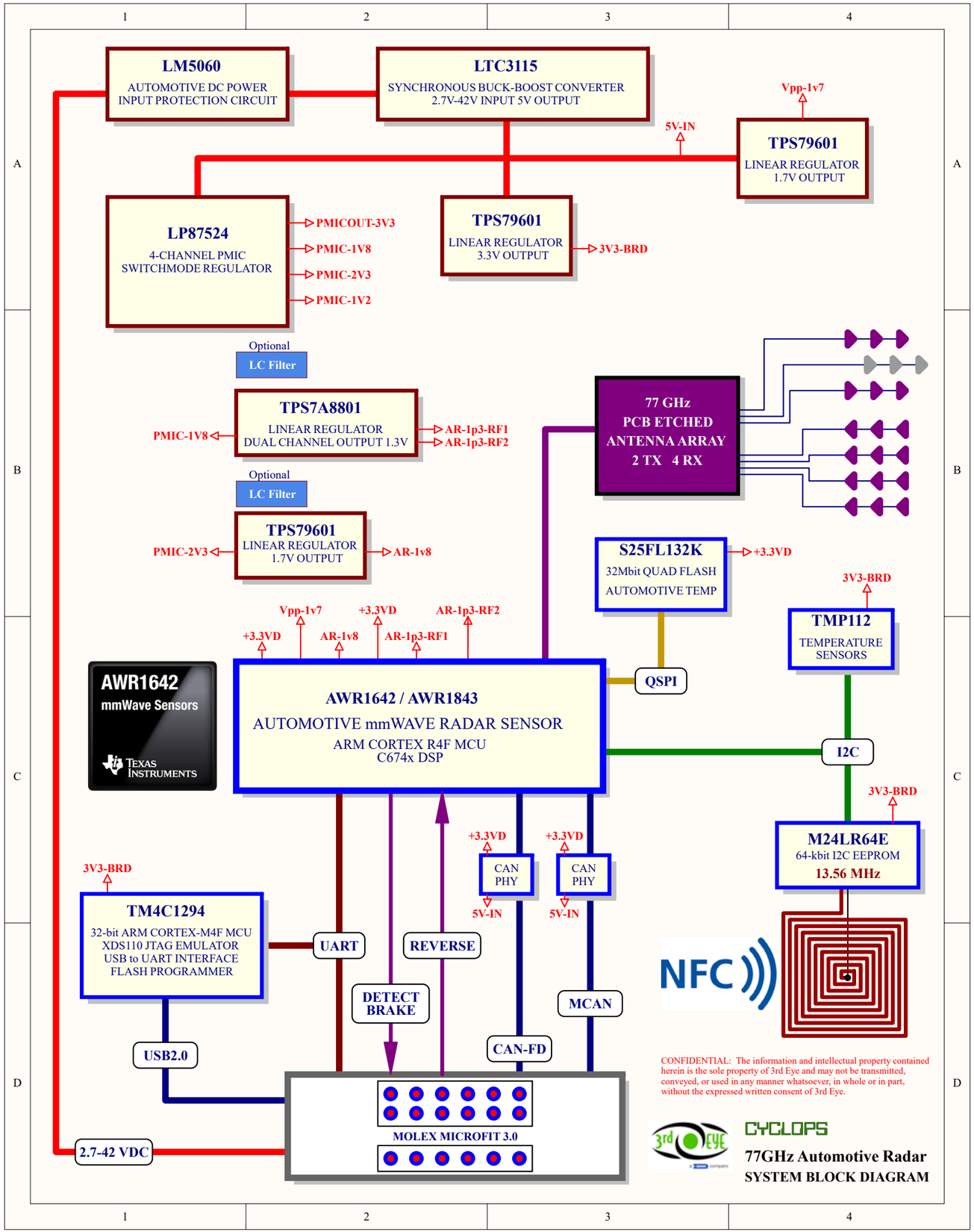
Date: 7/17/2018		Sheet	of
File: C:\Users\..\Cyclops.SchDoc		Drawn By:	John W. Whittaker


1
2
3
4
A
B
C
D
LM5060
AUTOMOTIVE DC POWER
INPUT PROTECTION CIRCUIT
LTC3115
SYNCHRONOUS BUCK-BOOST CONVERTER
2.7V-42V INPUT 5V OUTPUT
Vpp-1v7
5V-IN
TPS79601
LINEAR REGULATOR
1.7V OUTPUT
LP87524
4-CHANNEL PMIC
SWITCHMODE REGULATOR
PMICOUT-3V3
PMIC-1V8
PMIC-2V3
PMIC-1V2
TPS79601
LINEAR REGULATOR
3.3V OUTPUT
3V3-BRD
Optional
LC Filter
TPS7A8801
LINEAR REGULATOR
DUAL CHANNEL OUTPUT 1.3V
PMIC-1V8
AR-1p3-RF1
AR-1p3-RF2
77 GHz
PCB ETCHED
ANTENNA ARRAY
2 TX 4 RX
Optional
LC Filter
TPS79601
LINEAR REGULATOR
1.7V OUTPUT
PMIC-2V3
AR-1v8
S25FL132K
32Mbit QUAD FLASH
AUTOMOTIVE TEMP
+3.3VD
3V3-BRD
TMP112
TEMPERATURE
SENSORS
Vpp-1v7
+3.3VD
AR-1p3-RF2
+3.3VD
AR-1v8
AR-1p3-RF1
AWR1642
mmWave Sensors
Texas Instruments
AWR1642 / AWR1843
AUTOMOTIVE mmWAVE RADAR SENSOR
ARM CORTEX R4F MCU
C674x DSP
QSPI
I2C
3V3-BRD
+3.3VD
+3.3VD
CAN
PHY
CAN
PHY
5V-IN
5V-IN
M24LR64E
64-kbit I2C EEPROM
13.56 MHz
3V3-BRD
TM4C1294
32-bit ARM CORTEX-M4F MCU
XDS110 JTAG EMULATOR
USB to UART INTERFACE
FLASH PROGRAMMER
UART
REVERSE
DETECT
BRAKE
MCAN
CAN-FD
USB2.0
NFC
MOLEX MICROFIT 3.0
2.7-42 VDC
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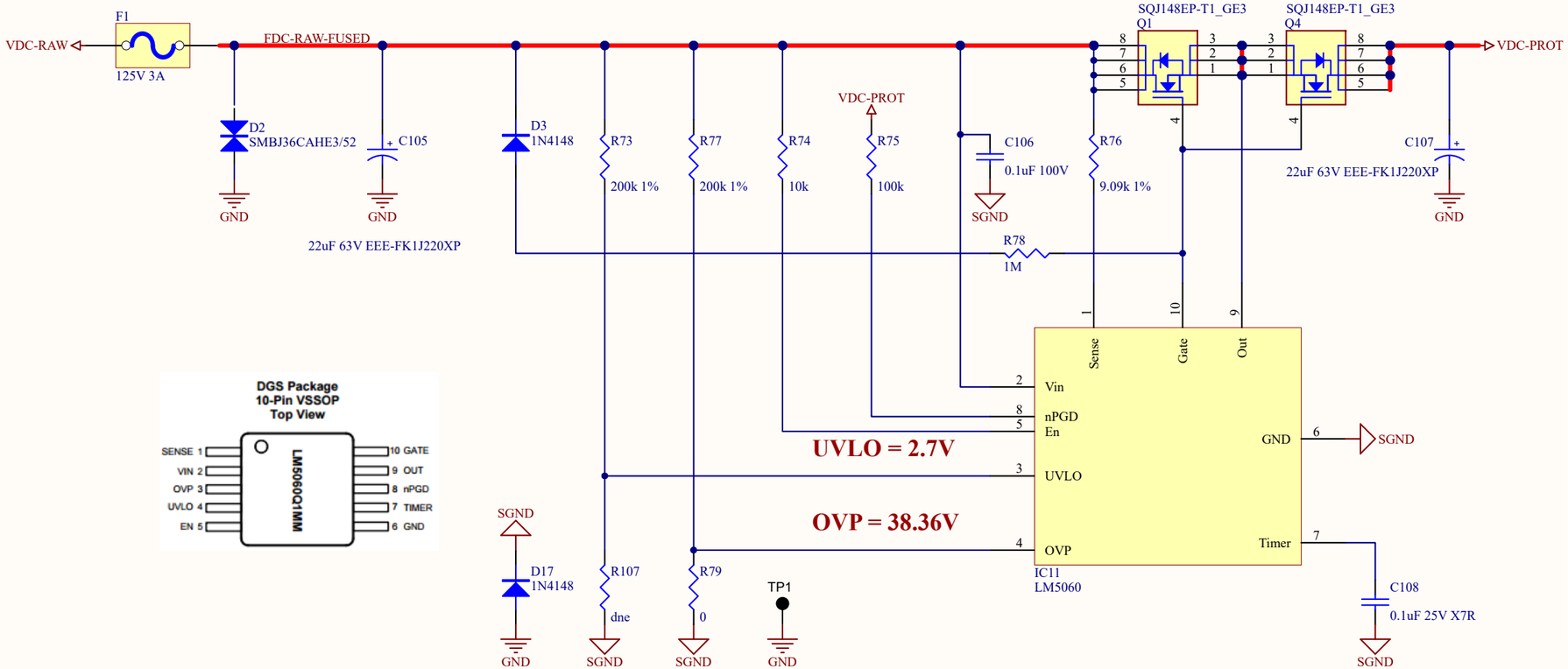
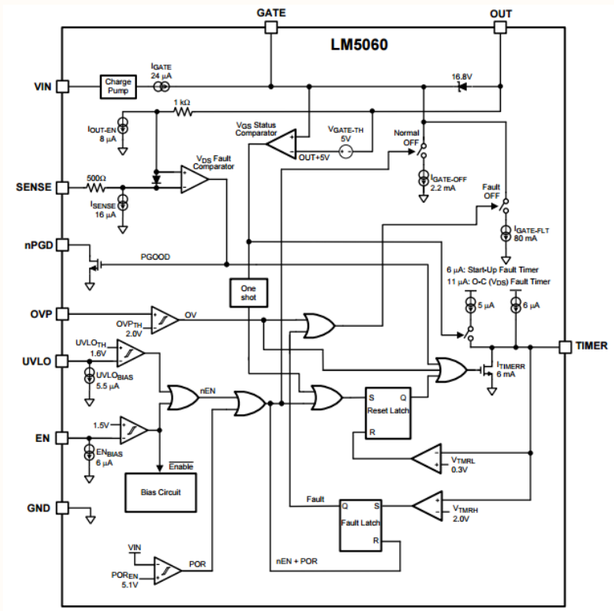
CYCLOPS
77GHz Automotive Radar
SYSTEM BLOCK DIAGRAM





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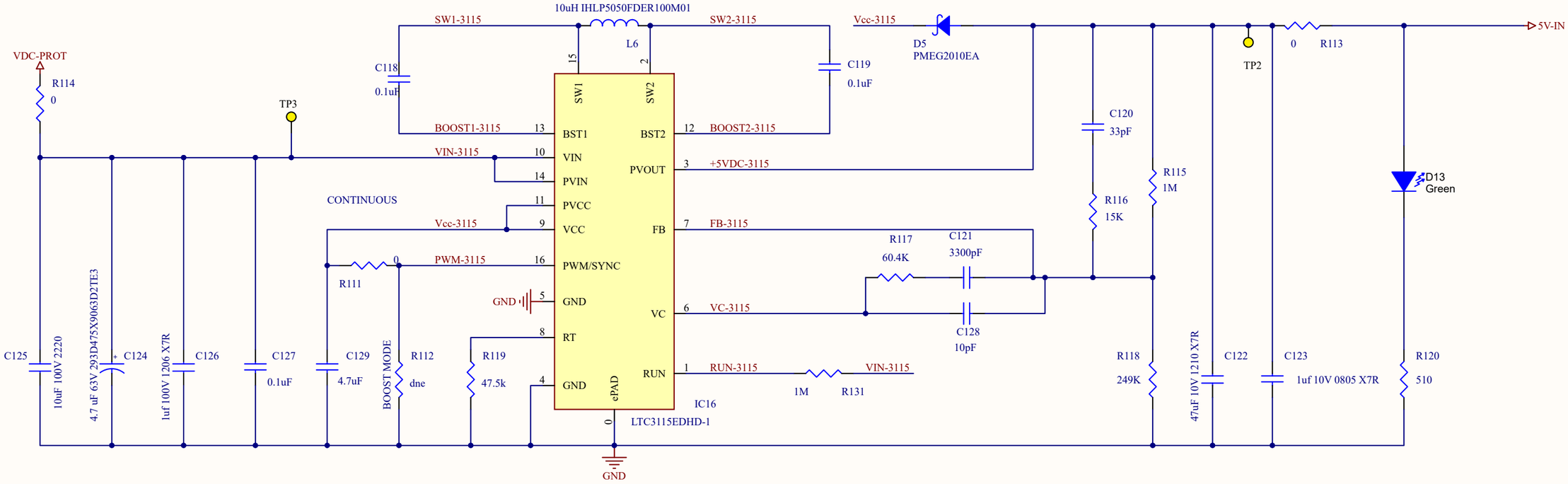

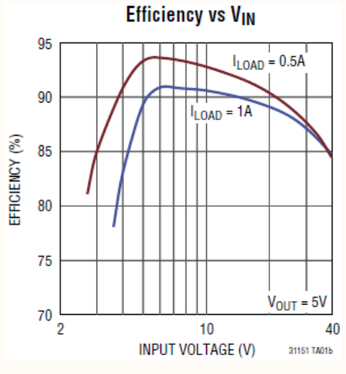

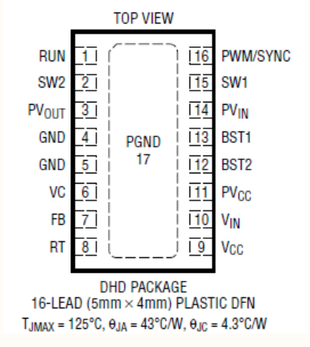

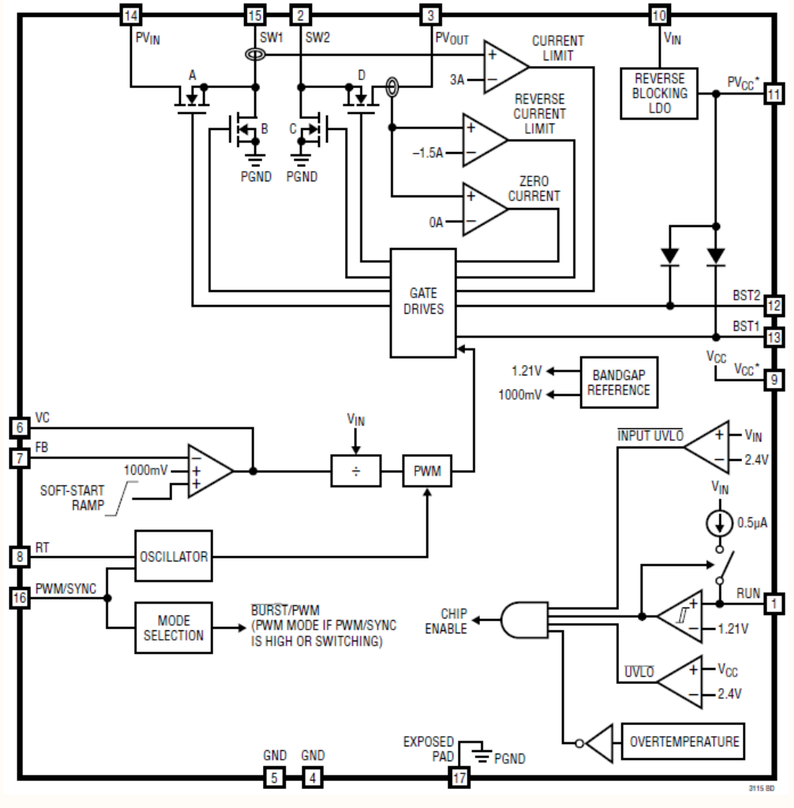

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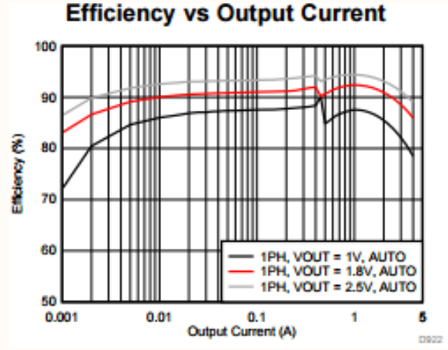
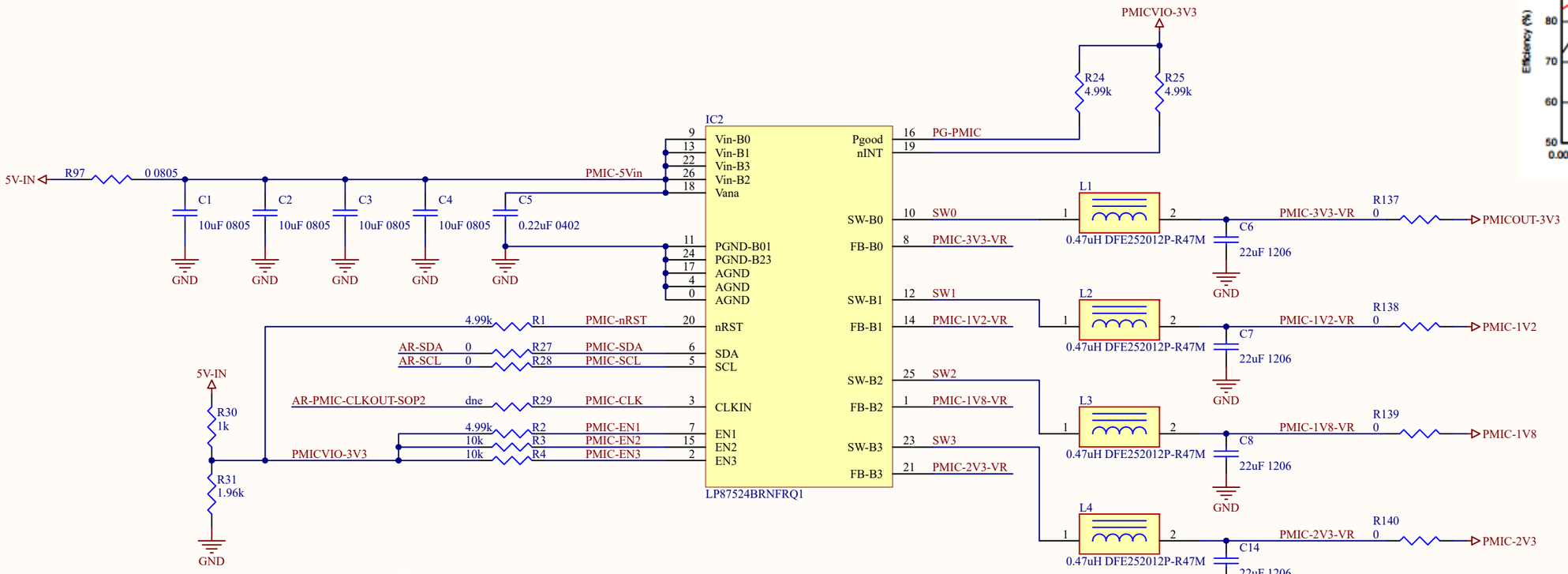
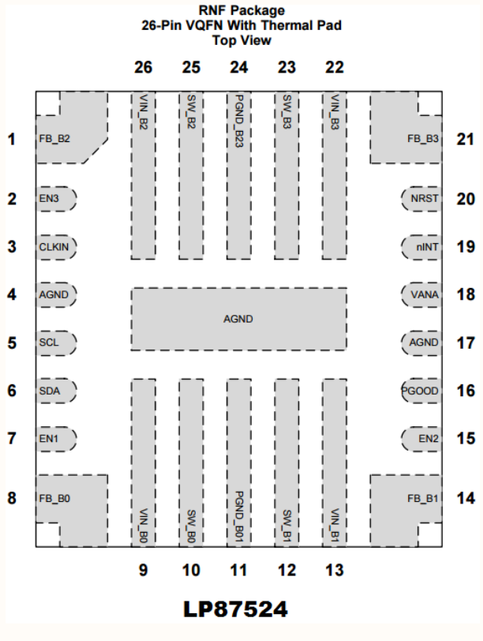
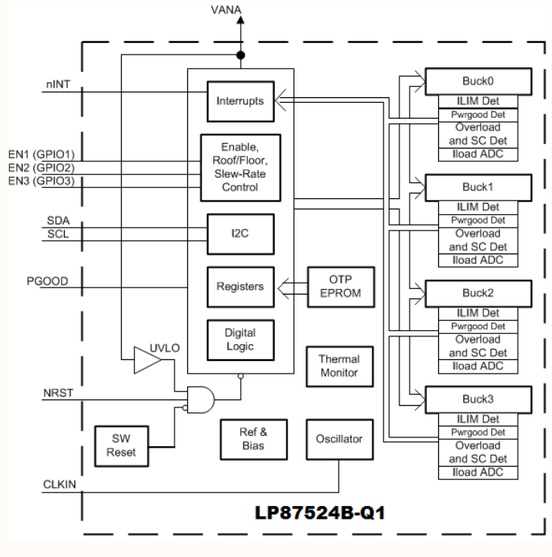
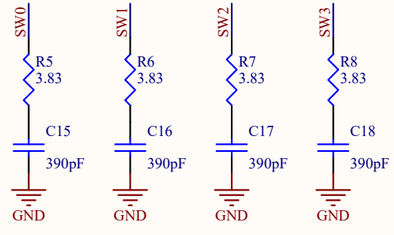
Date: 7/17/2018	Sheet of	
File: C:\Users\..\Buck Boost Vreg.SchDoc	Drawn By: John W. Whittaker	











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Date: 7/17/2018	Sheet of	
File: C:\Users\..\mmWave RADAR PMIC.SchDoc	Drawn By: John W. Whittaker	

PMIC-1v8
C91 22uF 1206 10V X7R
C92 22uF 1206 10V X7R
C93 10uF 10V 0805 X7R
C94 10uF 10V 0805 X7R
R57 10k
R58 dne
R63 dne
R64 0
LDO-02-EN
SS-CTRL
C95 0.01uF
C96 0.01uF
IC8
TPS7A8801RTJx
IN1 IN1 IN2 IN2 EN1 EN2 SS-CTRL1 SS-CTRL2 NR/SS1 NR/SS2 GND
OUT1 OUT1 OUT2 OUT2 FB1 FB2 PG1 PG2 GND GND ePAD
AR-1p3-RF1-VR
AR-1p3-RF2-VR
AR-1p3-FB-RF1
AR-1p3-FB-RF2
C83 0.01uF
R59 1.96k 1%
R61 3k 1%
C85 10uF 10V 0805 X7R
C86 10uF 10V 0805 X7R
C89 1uF
R132 0
AR-1p3-RF2
C84 0.01uF
R60 1.96k 1%
R62 3k 1%
AR-1p3-FB-RF1
R56 0
AR-1p3-RF1
C87 10uF
C88 10uF
C90 1uF
GND

XDS110 SUPPLY

5V-IN
R32 0
C67 2.2uF 10V X7R 0603
C68 0.1uF
PMICOUT-3V3
R33 PGOOD 0
R35 100k
5VIN-3.3
IC4 TPS79601DRB
IN IN nc EN GND FB ePAD
OUT OUT
3V3-BRD-VR
R34 49.9k 1%
R36 30k 1%
C66 15pF
R80 0
3V3-BRD
C69 2.2uF 10V X7R 0603
GND

DRB Package
8-Pin VSON
Top View
IN 1 | IN 2 | OUT 3 | OUT 4 | 8 EN | 7 N/C | 6 GND | 5 NR/FB
TPS79601

RTJ Package
4-mm × 4-mm 20-Pin WQFN
Top View
EN1 NR/SS1 SS_CTRL1 PG1 FB1 | IN1 IN1 GND IN2 IN2 | Thermal Pad | OUT1 OUT1 GND OUT2 OUT2 | EN2 NR/SS2 SS_CTRL2 PG2 FB2
TPS7A8801

5V-IN
R81 0
C98 2.2uF 10V X7R 0603
5VIN-1.7
IC9 TPS79601DRB
IN IN nc EN GND FB ePAD
OUT OUT
Vpp-1v7-VR
R67 10k
R66 14k 1%
R68 35k 1%
C97 33pf
R65 0
Vpp-1v7
C99 1uF
GND

PMIC-1v8
FB1 dne AR-1p3-RF1
FB2 dne AR-1p3-RF2
PMIC-2V3
FB3 dne AR-1v8

PMIC-2V3
C100 22uF 1206 10V X7R
C101 10uF 10V X7R
C103 0.1uF
R69 10k
R71 dne
C104 0.47uF
IC10
TPS7A8101QDRBx
IN IN EN NR ePAD GND FB/SNS
OUT OUT
R70 12.7k 1%
R72 10k
C113 0.47uF
C102 10uF 10V X7R
AR-1v8
GND

DRB PACKAGE
8-Pin SON With Exposed Thermal Pad
Top View
OUT 1 | OUT 2 | FB/SNS 3 | GND 4 | 8 IN | 7 IN | 6 NR | 5 EN
TPS7A8101

Title: CYCLOPS 77GHz Automotive RADAR		
Size: B	Number: Local Power Supplies	Revision: A
Date: 7/17/2018	Sheet of	
File: C:\Users\..\Local Power Supplies.SchDoc	Drawn By: John W. Whittaker	

ANTENNA TRACES on PCB

IC1A

AWR1443 mmWave Sensors

AWR1642

RADAR-RX1 M2
RADAR-RX2 K2
RADAR-RX3 H2
RADAR-RX4 F2
RADAR-TX1 B4
RADAR-TX2 B6
AR-OSC-CLKOUT A14
AR-PMIC-CLKOUT-SOP2 P9
AR-MCU-CLKOUT N8
AWR-ADC1 P1
AWR-ADC2 P2
AWR-ADC3 P3
AWR-ADC4 R2
B13
GND C14
N15
N14
AR-GPIO31 R4
P5
B15
C9
DCAN-TX2 C8
DCAN-RX2 B9
B8
A9
R5
P6
R7
AR-GPIO36-MSS-UARTB-TX P7
AR-GPIO37-BSS-UART-TX R8
AR-GPIO38-DSS-UART-TX P8
D14
B14
P4
AR-SYNC-OUT-SOP1 G13
AR-XTALP C15
AR-XTALN D15

RX1 - Antenna
RX2 - Antenna
RX3 - Antenna
RX4 - Antenna
TX1 - Antenna
TX2 - Antenna
OSC-CLKOUT
PMIC-CLKOUT
MCU-CLKOUT
GP-ADC1
GP-ADC2
GP-ADC3
GP-ADC4
GP-ADC5
GP-ADC6
DMM-CLK
DMM-SYNC
DP0
DP1
DP10
DP11
DP12
DP13
DP14
DP15
DP2
DP3
DP4
DP5
DP6
DP7
DP8
DP9
SYNC-IN
SYNC-OUT
CLKP
CLKM

NRESET R3 AR-NRST
Warm-Reset N9
NERROR-IN N7
NEROR-OUT N6
LVDS-TXP-0 J14
LVDS-TXM-0 J15
LVDS-TXP-1 K14
LVDS-TXM-1 K15
LVDS-CLKP L14
LVDS-CLKM L15
LVDS-FRCLKP M14
LVDS-FRCLKM M15
RS232-RX N4 AR-RS232RX
RS232-TX N5 AR-RS232TX
QSPI-CLK R12 AR-QSPI-rSCLK
QSPI-CS P11 AR-QSPI-CS
QSPI-0 R13 AR-QSPI-rD0
QSPI-1 N12 AR-QSPI-rD1
QSPI-2 R14 AR-QSPI-rD2
QSPI-3 P12 AR-QSPI-rD3
JTAG-TCK P10 JTAG-TCK 0
JTAG-TMS N10 JTAG-TMS 0
JTAG-TDO N13 JTAG-TDO-SOP0 0
JTAG-TDI R11 JTAG-TDI 0
SPI1-HOST-INTR P13 Configuration
SPI1-CLK E13 DCAN-RX1
SPI1-CS C13 DCAN-TX1
SPI1-MISO E14 CAN-FD-TX
SPI1-MOSI D13 CAN-FD-RX
SPI2-CLK F14 AR-MSS-LOGGER
SPI2-CS H14 AR-DSS-LOGGER
SPI2-MISO G14 AR-SCL
SPI2-MOSI F13 AR-SDA
GPIO-0 H13 AR-GPIO0
GPIO-1 J13 AR-GPIO1
GPIO-2 K13 AR-GPIO2

+3.3VD
R83 10k
R84 10k
R85 10k
R86 10k
C70 0.1uF
GND
R41 10k
R42 10k
R43 47.5k
100 R151 PG-PMIC
D18 1N4148
100 R142 AR-NRST-XDS
CLOSE TO PMIC
R22 XDSET-TCK
R133 XDSET-TDO
R134 XDSET-TDI
R135 XDSET-TDI
10k R91
10k R90

IC12 TMP112AIDRL
SCL SDA
GND V+
Alert Add0
AR-SCL
AR-SDA
3V3-BRD
C109 0.1uF

OBS
SCL 1
GND 2
ALERT 3
6 SDA
5 V+
4 ADD0

IC13 TMP112AIDRL
AR-SCL 0 R87
0 R88 AR-SDA
3V3-BRD
R89 0
AWAY FROM MMWAVE
AWAY FROM PMIC
C110 0.1uF

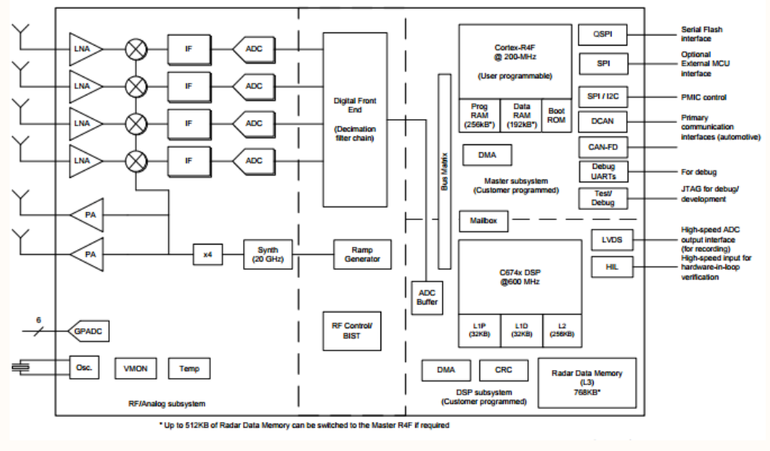
S25FL132K0XNFB01 XREF TBD
IC6 QSPI Flash
CS Vcc
SO/IO1 HOLD/IO3
WP/IO2 SCK
Vss SI/IO0
ePAD
33.2 R44 AR-QSPI-SCLK
AR-QSPI-CS
33.2 R45
AR-QSPI-D1
33.2 R46
AR-QSPI-D2
33.2 R47
33.2 R48
AR-QSPI-D0
AR-QSPI-D3
0
C78 0.1uF
C79 1uF
+3.3VD

X2
40MHz CX3225SA
C64 4.7pF
C65 4.7pF

R143 100k
R144 100k
R145 7.87k
R146 dne
R147 dne
AR-RS232RX
AR-RS232TX
AR-PMIC-CLKOUT-SOP2
AR-SYNC-OUT-SOP1
JTAG-TDO-SOP0
R148 82.5k
R149 82.5k
R150 82.5k

IC15 M24LR64EMN
Vout-RF 1
NFC-RF 2
AC0 3
AC1
Vss 4
Vout Vcc 8
RF WIP/Busy 7
SCL 6
SDA 5
Busy-RF
AR-SCL
AR-SDA
R21 10k
C117 0.1uF

PMIC-1v8 R23 14.7k 1% AWR-ADC1
R38 51.1k
5V-IN R26 14.7k 1% AWR-ADC2
R39 5.49k 1%
+3.3VD R37 14.7k 1% AWR-ADC3
R40 11k 1%



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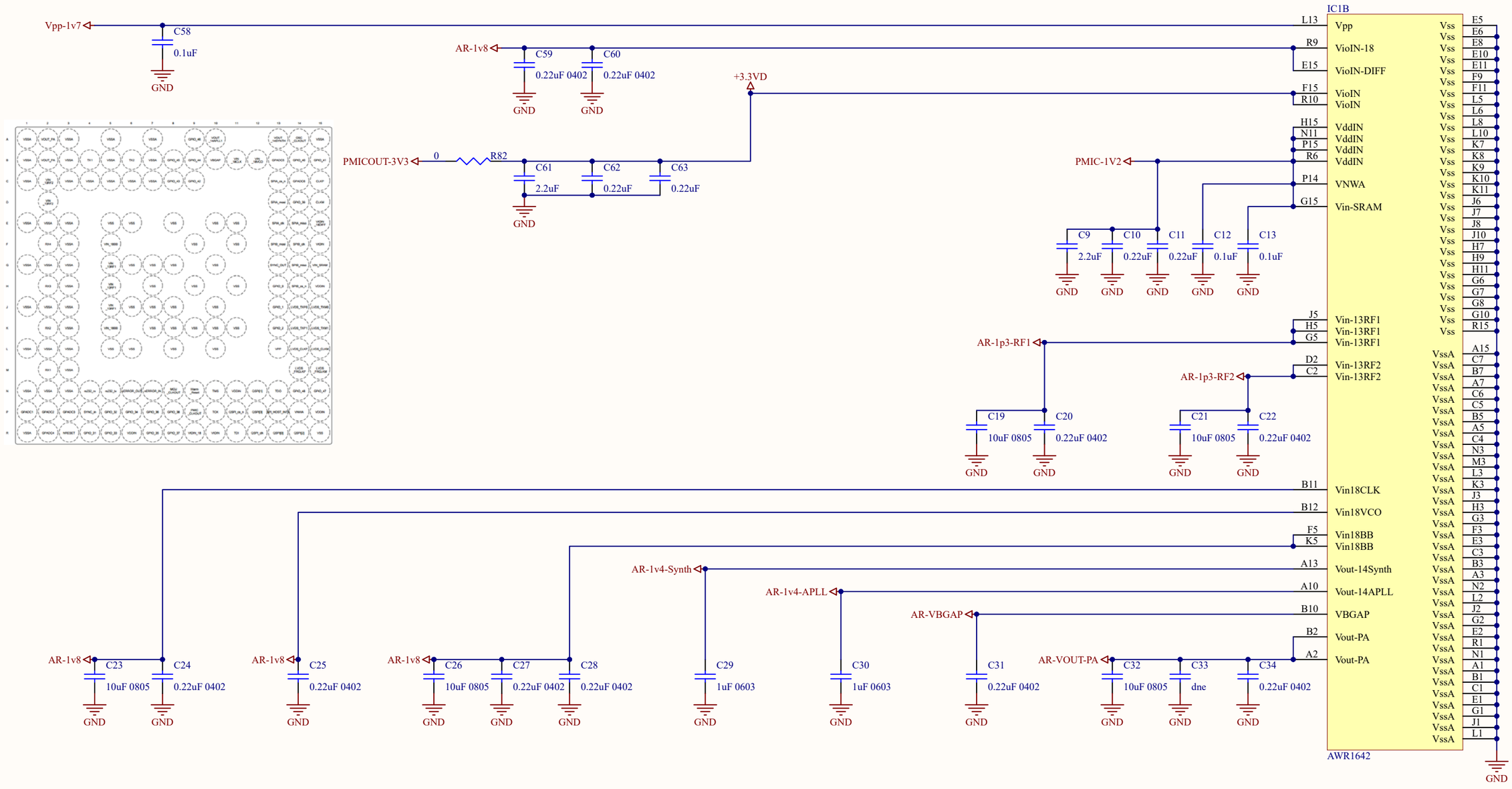

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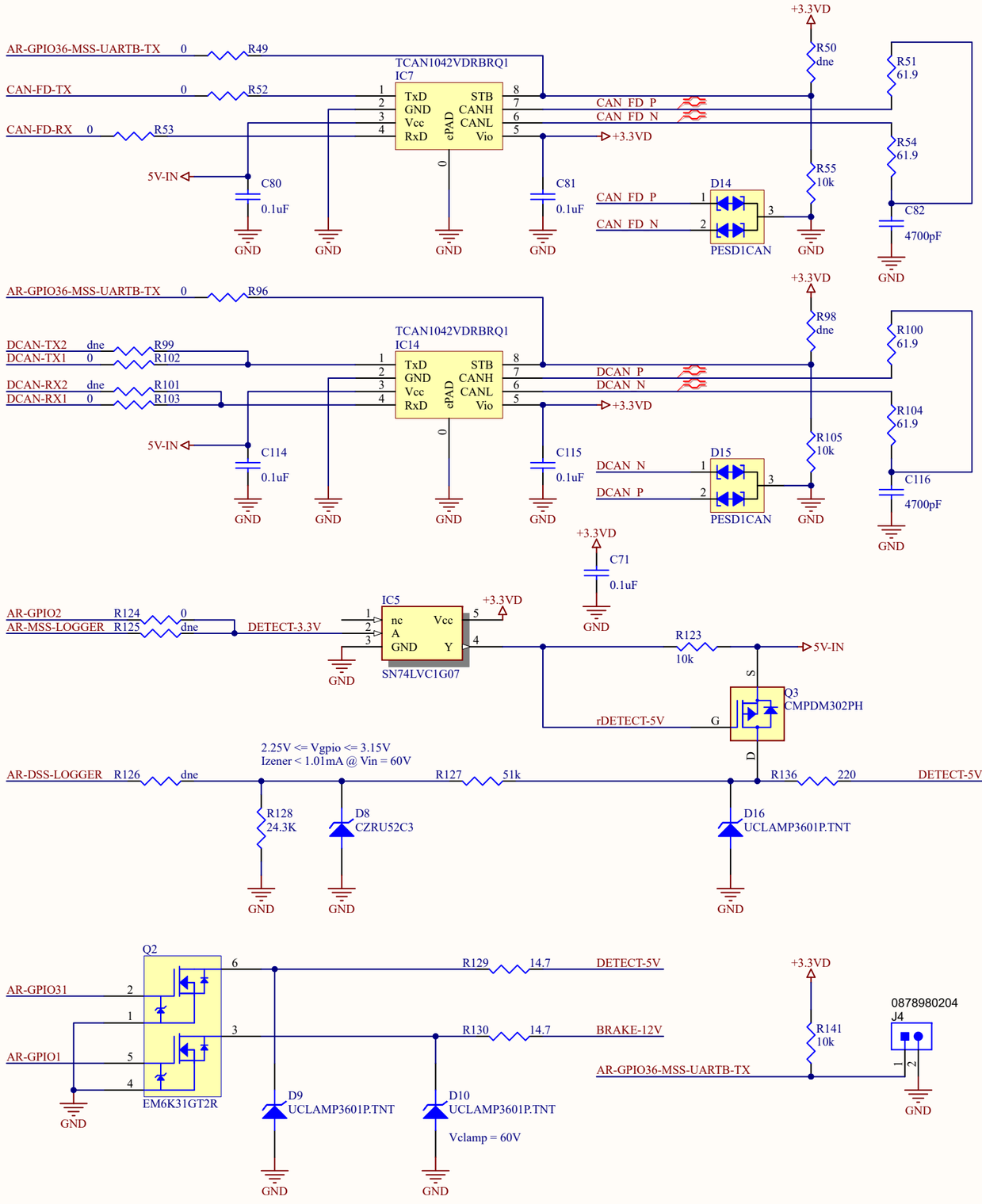

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Date: 7/17/2018	Sheet of	
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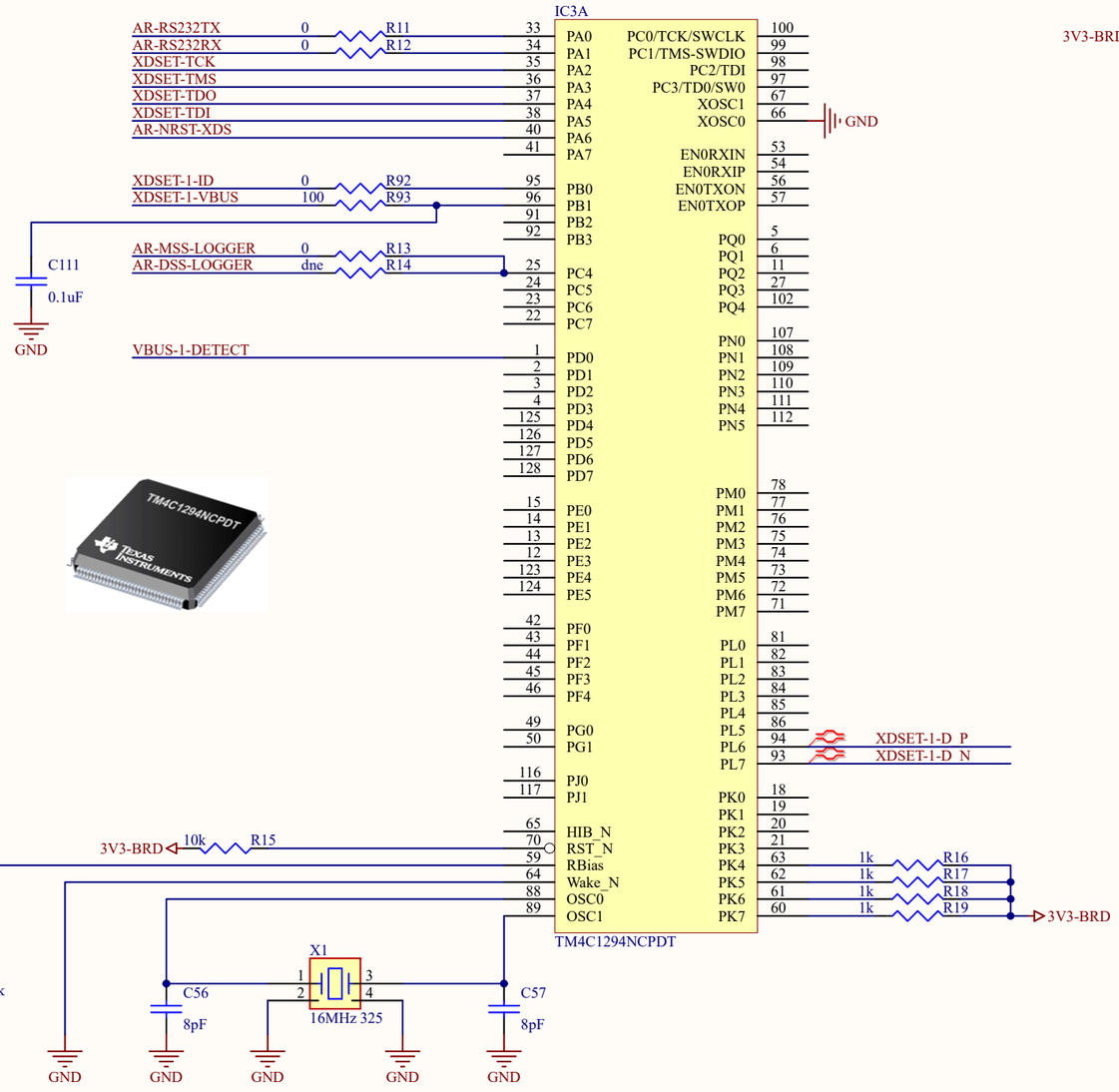

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Date: 7/17/2018	Sheet of	
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