MAX2870/MAX2871 Evaluation Kits

General Description

The MAX2870/MAX2871 evaluation kits (EV kits) simplify the testing and evaluation of the MAX2870 and MAX2871 ultra-wideband phase-locked loop (PLL) with integrated voltage-control oscillators (VCOs). Each EV kit is fully assembled and tested at the factory. Standard 50Ω SMA connectors are included on the EV kits for the inputs and outputs to enable quick and easy evaluation on the test bench.

This document provides a *Quick Start* guide, a description of the EV kit circuit, a *Troubleshooting Guide*, the circuit schematic, a list of components for the EV kit, and diagrams for each layer of the PCB.

Note: This EV kit data sheet supports the MAX2870 (Rev B) and MAX2871 EV kits. Customers using MAX2870 (Rev A) EV kit can access the schematic, PCB layout, and user guide under the Help menu of the EV kit software.

Quick Start

Required Equipment

- MAX2870/MAX2871 EV kit board
- Mini-USB type A-to-type B cable (included)
- User-supplied Windows PC
- User-supplied spectrum analyzer or signal analyzer

Note: In the following sections, software-related items are identified by bolding. Text in **bold** refers to items from the EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

Procedure

Hardware Connection Guide

Each EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Verify that all jumpers are in their default positions, as shown in Figure 1.
2) Connect the USB cable from the PC to the EV kit.
3) Connect one of the RFOUT SMA connectors to a signal analyzer or spectrum analyzer.
4) Terminate the remaining unused RFOUT ports with a 50Ω pad.

Features

- Easy Evaluation of the MAX2870 and MAX2871
- 50Ω SMA Connectors
- All Critical Peripheral Components Included
- PC Control Software
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information **appears at end of data sheet.**

Software Installation and Evaluation Guide

1) Visit **www.maximintegrated.com/evkitsoftware** to download the latest version of the EV kit software, Max287X_Setup_1-1-x.zip.
2) Extract the zip file and run the installation file. Restart the PC after installation.
3) Run the MAX287x.exe file. Choose the correct IC type (MAX2870 or MAX2871) at the front page and click the **Continue** button. The EV kit GUI appears and looks similar to Figure 2.
4) Verify that **USB Connected** is displayed in green in the lower right-hand corner of the GUI.
5) Verify that the EV kit **TCXO (U2)** frequency matches the EV kit software **REF. FREQ**. If not, enter the correct value in MHz (default is 50) and press the Enter key.
6) In the GUI, click on the **Defaults** button and then the **Send All** button located at the top of the GUI.
7) Enter the desired output frequency in MHz in the **RF_OUTA** or **RF_OUTB** edit box and press the Enter key.
8) Verify that the **PLL Lock** indicator in the lower right-hand corner of the GUI is displayed in green.
9) Use the signal analyzer to verify the performance of the MAX2870 or MAX2871.
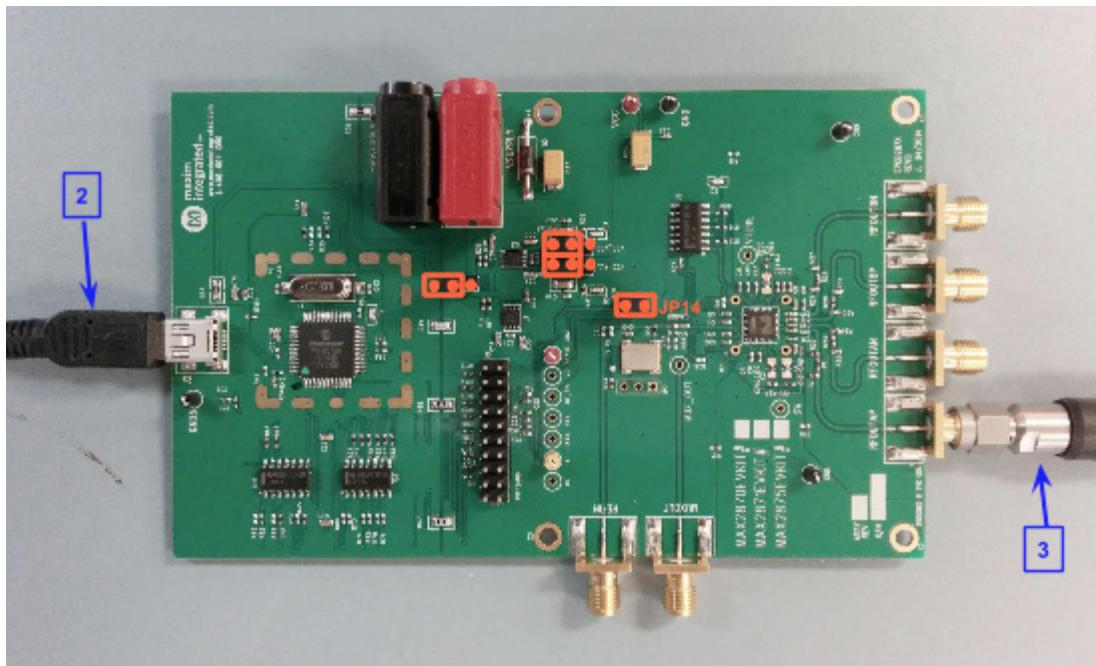
Figure 1. MAX2870/MAX2871 EV Kit Hardware Connection

Troubleshooting Guide

External Reference Source

The default on-board crystal oscillator frequency is 50MHz. To use a different reference frequency, perform the following steps:

1) Remove jumper JP14 (disables on-board XTAL oscillator).

2) Apply a reference signal to the REFIN SMA port, (power > 0 dBm).

3) Update the **REF. FREQ**. value in the EV kit GUI .

4) Program the IC to the desired frequency.

5) Optional: It is recommended to measure the reference-source phase noise and check the

MAX2870 simulated phase noise (using the Maxim EE-Sim® PLL tool). **Note:** If the reference-source phase noise is poor, it could impact the ICs' output phase noise.

RF Output Level

There is a 3dB pad at each RFOUT port. The purpose of these 3dB pads is to provide reasonable matched load to the ICs' outputs when unused. Therefore, direct power measurement at the EV kit's RF OUT SMA ports is 3dB lower than the actual output level. To measure the true output level, remove the 3dB pads and terminate all active unused ports with a 50Ω load.

EE-Sim is a registered trademark of Maxim Integrated Products, Inc.
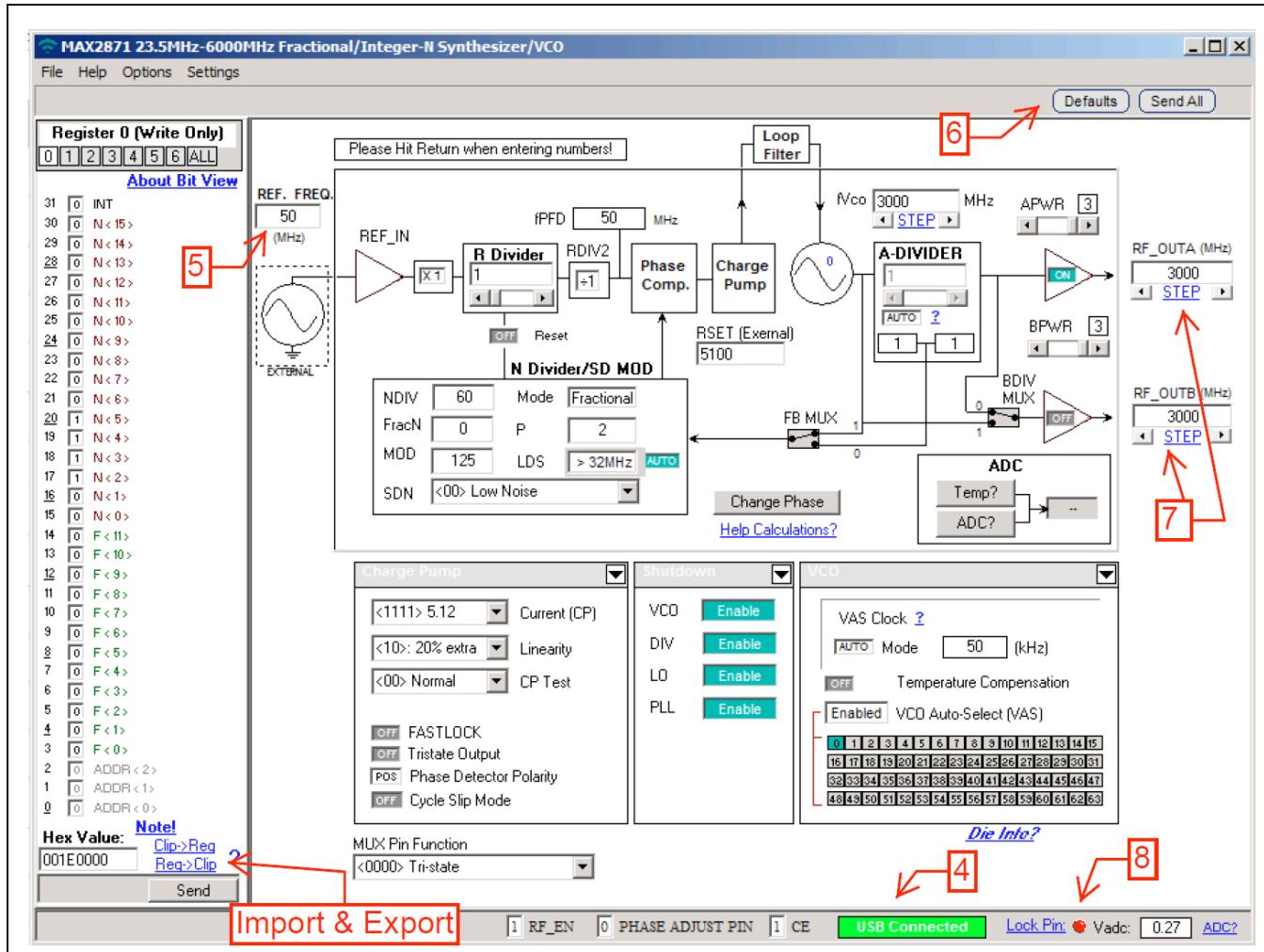
Figure 2. MAX2870/MAX2871 EV Kit Software GUI

Export/Import Full Register Settings

To export the full register settings from the MAX2870/MAX2871, perform the following steps:

- Click on **Reg → Clip** in the lower left-hand corner of the GUI. The registers are then saved to the clipboard.

- Paste the clipboard to any text editor.

To import full register settings to the MAX2870/MAX2871, perform the following steps:

- Copy the register settings (comma delimited) from a text editor to the clipboard.

- Click on **Clip → Reg** in the lower left-hand corner of the GUI.

- Click the **Send All** button in the top right-hand corner of the GUI.

Component List, PCB Layout, and Schematics

See the following links for component information, PCB layout diagrams, and schematics.

- **MAX2870/MAX2871 EV BOM**
- **MAX2870/MAX2871 EV PCB Layout**
- **MAX2870/MAX2871 EV Schematics**

Ordering Information

PART	TYPE
MAX2870VKIT#	EV Kit
MAX2871VKIT#	EV Kit

#Denotes RoHS compliant.

Note: *Customers using older versions of the MAX2870 EV kit can access the EV kit data sheet from the Help menu in the software GUI.*

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/13	Initial release	—
1	10/14	Added MAX2871 to data sheet	1–15
2	11/15	Step 4 added to hardware connections to terminate unused ports	1

MAX2870/MAX2871 Bil Value= open or NPI, means Do Not install

Item	Qty	Reference	Value	Toler	Description	Part Name	Manufacturer	Part Number
1	1	C72	10nF	10%	Capacitor	0.01UF_10%_TR\GRM155R71E\610MURA, 10nF,10%		GRM155R71E103K
2	5	C28-29 C41 C44 C71	0.1uF	10%	0603 Capacitor	0.1UF_10%_TR\GRM188R71C\610MURA,0.1uF,10%		GRM188R71C104K
3	4	D1 D3-5	Green LED		GREEN LED	0603_LED,Green LED		LT L29S-P2R1-25-Z
4	1	D2	Diode		GENERIC DIODE AXIAL LEAD	1N4001,Diode		1N4001
5	2	C38 C56	330pF	10%	0402 Capacitor	330PF_10%_TR\GRM155R71H\610MURA, 330pF,10%		GRM155R71H331K
6	2	C42-43	33pF	5%	0402 Capacitor	33PF_5%_TR\GRM1555C1H\610MURA,33 pF,5%		GRM1555C1H330J
7	1	U6	SN74LV07ADR		Hex Buffer/Driver OC	74LV07A,SN74LV07ADR		SN74LV07ADR
8	1	GNDSUPPLY	Bananna Plug Black		Red Bananna Plug	BANANNA_JACK,Bananna Plug Black		571-0500-01
9	1	VSUPPLY	Bananna Plug Red		Red Bananna Plug	BANANNA_JACK,Bananna Plug Red		571-0500-01
10	0	S1	NPI		Shield	BMIS-203MOD1,NPI		BMI-S-205
11	2	C48 C50	4.7 uf		0805 Capacitor	CAP0805MIL,4.7 uf	MURATA	GRM219R61A475K
12	2	C23 C37	10uF	10%	Tantalum Capacitor - C-Case	CAPT6032N,10uF,10%		TAJC106K016R
13	1	Y1	ECS-60-20-5PX-TR		6 MHz Crystal	CSM-7,ECS-60-20-5PX-TR		ECS-60-20-5PX-TR
14	1	U2	CWX823-050.0M			CWX8XX_5X7MM,CWX823-050.0M		CWX823-050.0M
15	0	INTF2400	Open		0.1 Centers 2x10 Header	INTERFACE_2300\730\HEAD,Open		PEC36DAAN
16	1	JP14	2 Pin Header		2 Pin In-Line Header - 100 Mil Centers	JUMPER2,2 Pin Header		PEC36SAAN

17	1	JP7	NPI		3 Pin In-Line Header - 100 Mil Center	JUMPER3,NPI		PEC36SAAN
18	3	VCC_PLL VCC_VCO VUSB	3 Pin Header		3 Pin In-Line Header - 100 Mil Center	JUMPER3_SHORT,3 Pin Header		PEC36SAAN
19	1	U1	MAX2870 /MAX2871		6GHz Pll withopen VCO	MAX2870/MAX2871	MAXIM	MAX2870ETJ+/MAX2871ETJ+
20	2	U3 U5	MAX8559ET		LDO	MAX8559_JLA,MAX8559ET	MAXIM	MAX8559ETAAA+
21	1	U8	PIC16C765-I/PT		PIC MICROCONTROLLER	PIC16C765_TQFQ,PIC16C765-I/PT		PIC16C765-I/PT
22	1	R104	0 ohm		0402 Resistor	SHORT\0402\600WIND,0 ohm		Use Lead-Free parts only
23	6	MUXOUT REFIN RFOUTAN RFOUTAP RFOUTBN RFOUTBP	SMA		SMA End Launch Jack Receptacle 0.062"	SMA_EDGE_MOUNT,SMA		142-0701-851
24	2	U4 U10	SN74LV07ADR		Hex Buffer/Driver OC	SN74LV07A,SN74LV07ADR		SN74LV07ADR
25	1	R46	0	0.05	0402 Resistor	TBD\0402\600WIND,0,5%		Use Lead-Free parts only
26	9	R18 R112-117 R119-120	0 ohm	5%	0402 Resistor	TBD\0402\600WIND,0 ohm,5%		Use Lead-Free parts only
27	2	R10 R51	0 ohms		0402 Resistor	TBD\0402\600WIND,0 ohms		
28	1	R33	1.5K	0.05	0402 Resistor	TBD\0402\600WIND,1.5K,5%		Use Lead-Free parts only
29	4	R42 R55 R61-62	100	5%	0402 Resistor	TBD\0402\600WIND,100,5%		Use Lead-Free parts only
30	4	R11 R17 R39-40	10k		0402 Resistor	TBD\0402\600WIND,10k		
31	1	R54	10kohms		0402 Resistor	TBD\0402\600WIND,10kohms		
32	3	R12-14	120	0.05	0402 Resistor	TBD\0402\600WIND,120,5%		
33	4	R1 R23 R26 R29	18 Ohms	0.01	0402 Resistor	TBD\0402\600WIND,18 Ohms,1%		
34	1	R3	240 ohms	5%	0402 Resistor	TBD\0402\600WIND,240 ohms,5%		
35	2	R6-7	27nH	1%	0402 inductor	TBD\0402\600WIND,27nH,1%		LQP15MN27NG02
36	2	R45 R64	3.09K	1%	0402 Resistor	TBD\0402\600WIND,3.1K		Use Lead-Free parts only
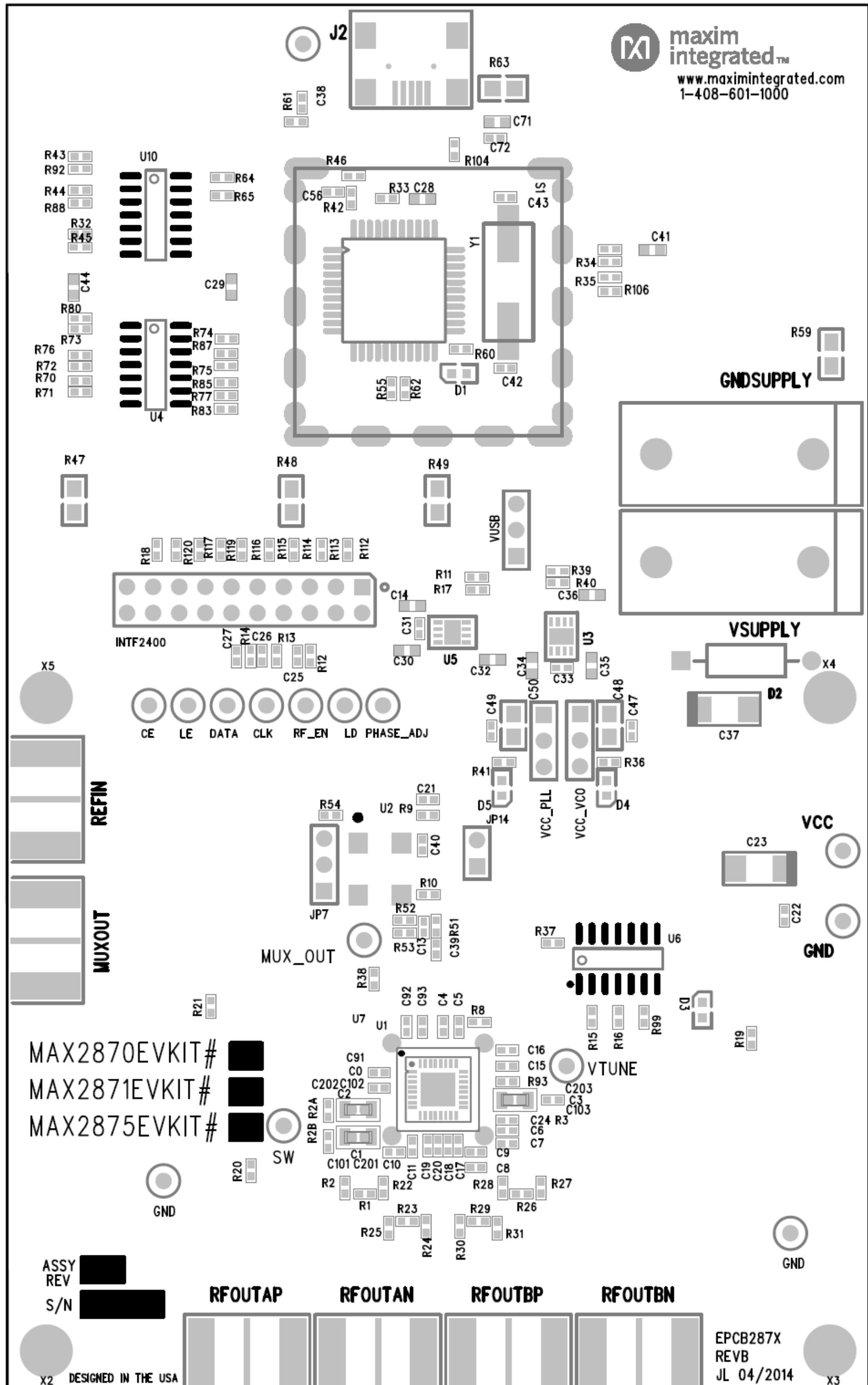
37	6	R71-73 R83 R85 R87	3.09K	1%	0402 Resistor	TBD\0402\600WIND,3.1K,5%		
38	1	R2A	30.1 Ohms	1%	0402 Resistor	TBD\0402\600WIND,30.1 Ohms,1%		
39	8	R2 R22 R24-25 R27-28 R30-31	300 Ohms	1%	0402 Resistor	TBD\0402\600WIND,300 Ohms,1%		
40	2	R4-5	49.9 Ohms	1%	0402 Resistor	TBD\0402\600WIND,49.9 Ohms,1%		
41	12	R32 R65 R70 R74-77 R80 R88 R92 R105-106	5.1K		0402 Resistor	TBD\0402\600WIND,5.1K		Use Lead-Free parts only
42	5	R15-16 R36 R41 R99	5.1k		0402 Resistor	TBD\0402\600WIND,5.1k		
43	1	R93	5.1k	1%	0402 Resistor	TBD\0402\600WIND,5.1k,1%		
44	1	R60	5.1k	5%	0402 Resistor	TBD\0402\600WIND,5.1k,5%		Use Lead-Free parts only
45	1	R2B	90.9 Ohms	0.01	0402 Resistor	TBD\0402\600WIND,90.9 Ohms,1%		
46	0	R8-9 R52-53	OPEN		0402 Resistor	TBD\0402\600WIND,OPEN		
47	0	R19-21	Open	0.01	0402 Resistor	TBD\0402\600WIND,Open,1%		
48	0	R37-38	open		0402 Resistor	TBD\0402\600WIND,open		
49	0	R43-44	open		0402 Resistor	TBD\0402\600WIND,open		Use Lead-Free parts only
50	0	R34-35	open	0.05	0402 Resistor	TBD\0402\600WIND,open,5%		Use Lead-Free parts only
51	1	C1	0.012uF		0402 Capacitor	TBD\0402\610WIND,0.012uF	MURATA	GRM155R71C123K
52	13	C5-6 C9-10 C21-22 C31 C33 C39-40 C45-46 C92	0.01uF		0402 Capacitor	TBD\0402\610WIND,0.01uF	MURATA	GRM155R71C103K
53	4	C2 C47 C49 C91	0.1uF		0402 Capacitor	TBD\0402\610WIND,0.1uF	MURATA	GRM155R61C104K
54	3	C15-16 C24	1.0uF	10%	0402 Capacitor	TBD\0402\610WIND,1.0uF,10%	MURATA	GRM155R61A105K
55	10	C0 C4 C7-8 C11 C17-20 C93	100pF	5%	0402 Capacitor	TBD\0402\610WIND,100pF,5%	TAIYOYUDEN	C1005C0G1H101K
56	3	C25-27	10pF	0.05	0402 Capacitor	TBD\0402\610WIND,10pF,5%	TDK CORPORATION	C1005C0G1H100D
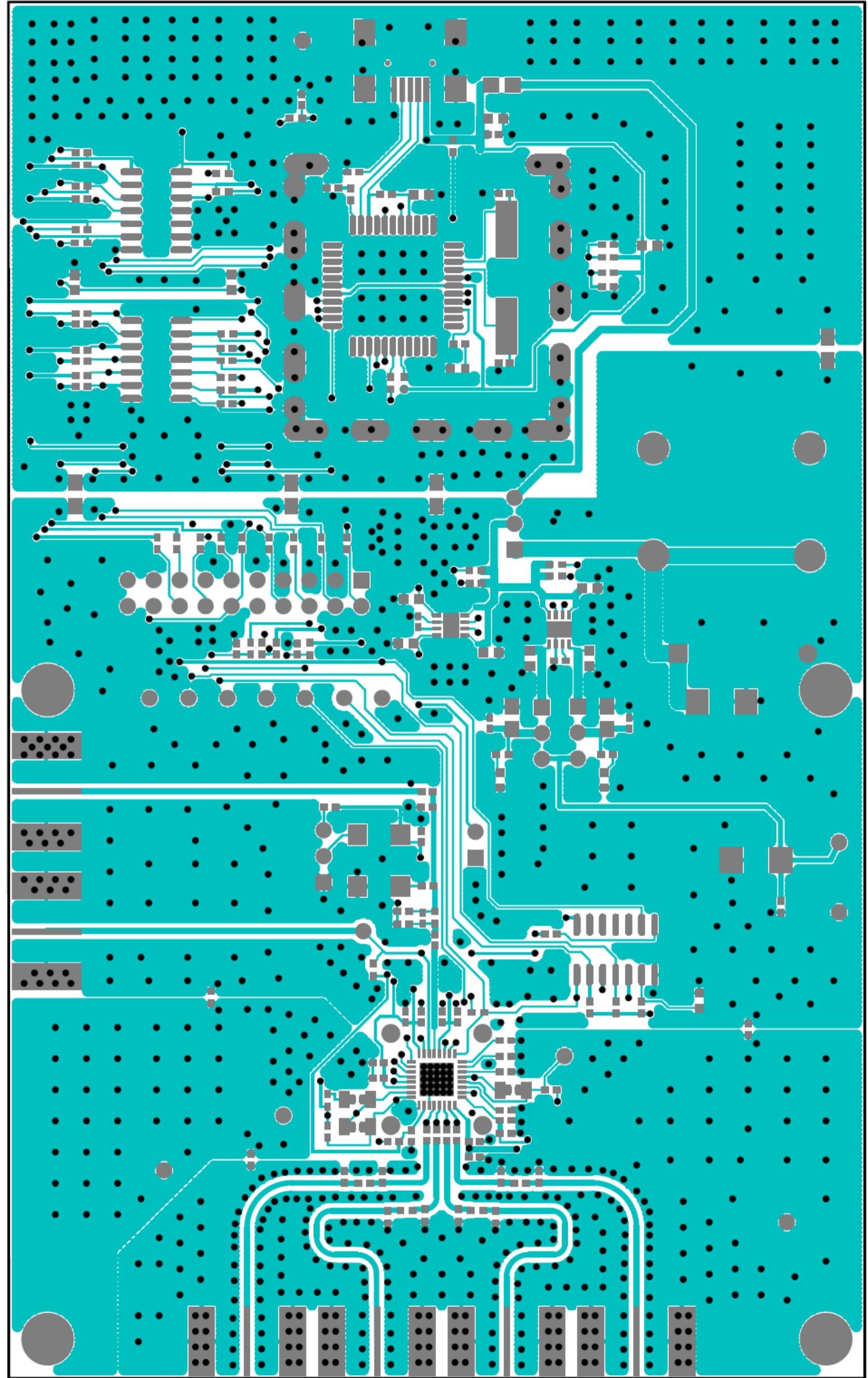
57	1	C3	820pF		0402 Capacitor	TBD\0402\610WIND,820pF	MURATA	GRM155R71H821K
58	0	C12	NPI		0402 Capacitor	TBD\0402\610WIND,NPI		
59	0	C13	open		0402 Capacitor	TBD\0402\610WIND,open		
60	6	C14 C30 C32 C34-36	2.2uF		0603 Capacitor	TBD\0603\610WIND,2.2uF	MURATA	GRM188R61A225K
61	0	C101-103	NPI		0603 Capacitor	TBD\0603\610WIND,NPI		
62	9	R47-50 R56-59 R63	0	0.01	0805 Resistor	TBD\0805\600WIND,0,1%		
63	0	C201-202	NPI		1206 Capacitor	TBD\1206\610WIND,NPI		
64	0	C203	NPI		1206 Capacitor	TBD\1206\610WIND,NPI		
65	0	CE CLK DATA LD MUX_OUT RF_EN SW VTUNE	NPI		Testpoint	TESTPOINT,NPI		5000
66	1	VCC	PC Mini - Red		Testpoint	TESTPOINT,PC Mini - Red		5000
67	4	GND GND1-3	PC Mini-Black		Testpoint	TESTPOINT,PC Mini-Black		5001
68	2	LE PHASE_ADJ	PC Mini-Yellow		Testpoint	TESTPOINT,PC Mini-Yellow		5000
69	1	J2	Mini USB		MINI-USB TYPE B	USB_MINI_B,Mini USB		897-43-005-00100001
70	1	Mini USB Cable	Mini USB Cable		This is USB cable should be placed in EVK package, not the component on PCB			Qualtek 3021003-03 digikey # Q362-ND

J2

R63
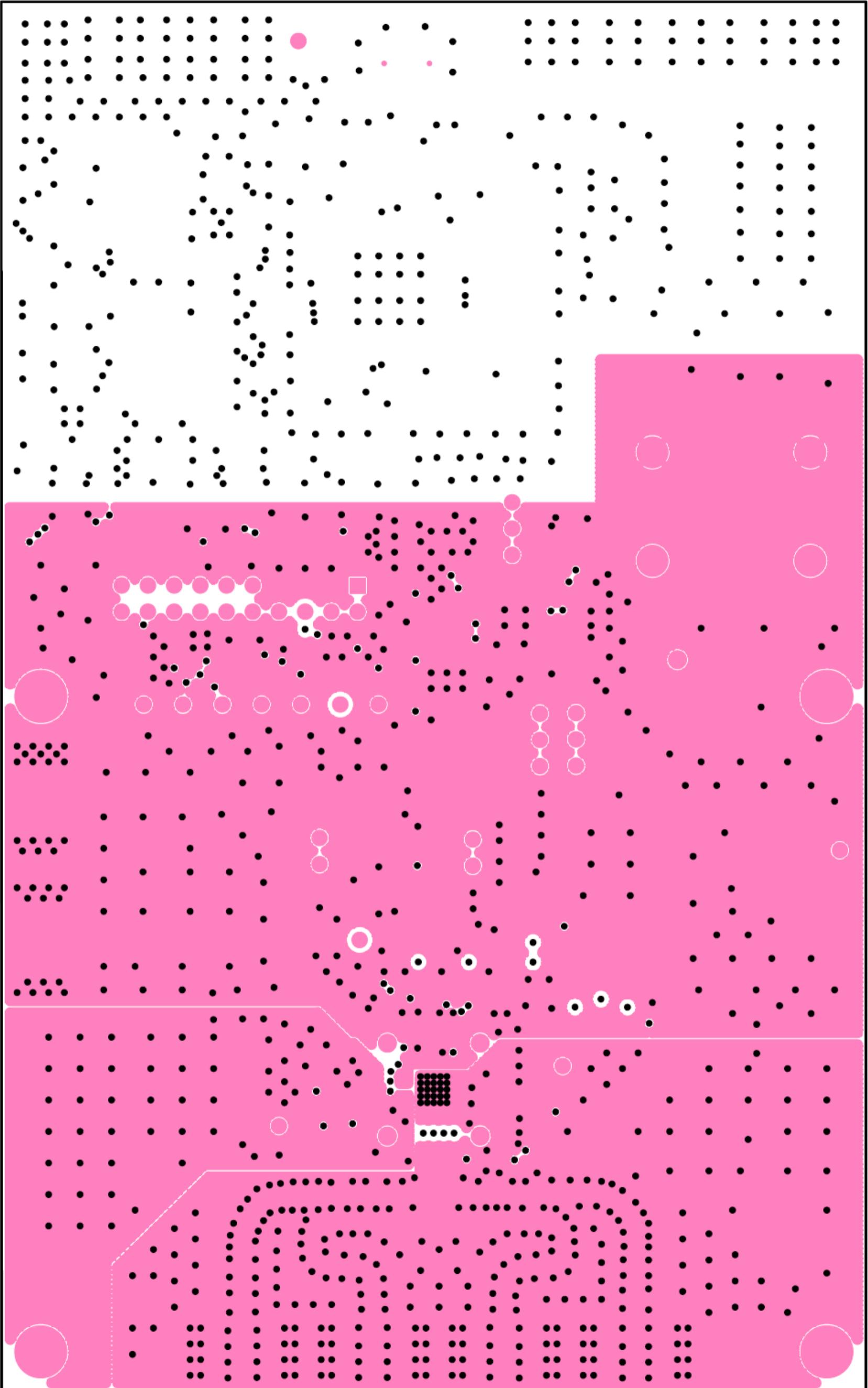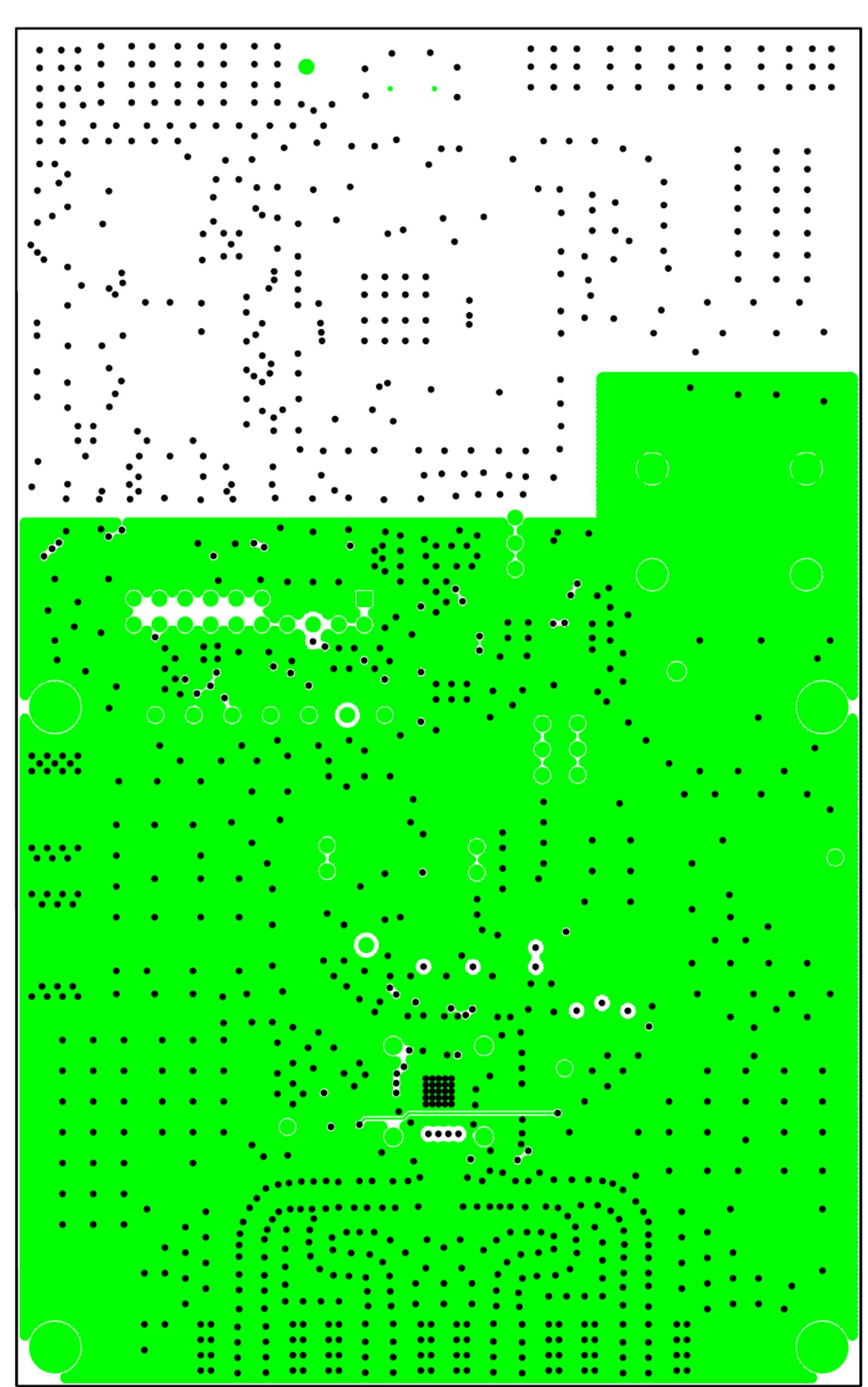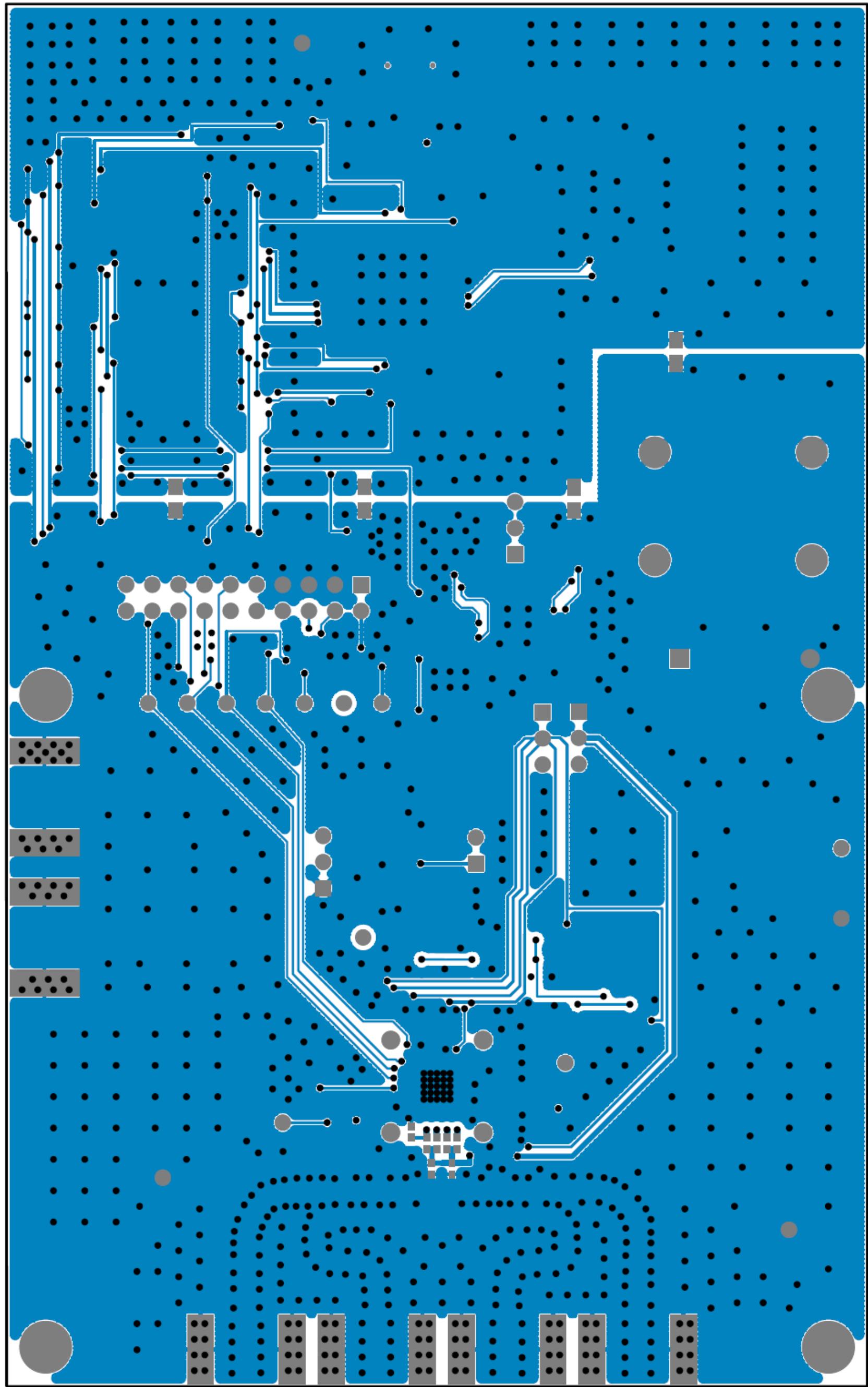
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R61

C38

C71

C72

R104

R43
R92

U10

R64

R46

R65

C56

R33 C28

R42

S1

C43

R44
R88

R32
R45

C29

Y1

C41

R34

R35

R106

C44

R80

R59

R73

R74

R76

R87

GNDSUPPLY

R72
R70

R75

R71

R85

R77

R83

R60

U4

C42

R55

R62

D1

R47

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VUSB

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R11

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R39

R40

C36

VSUPPLY

C14

C31

X4

INTF2400

C27 R14 C26 R13

C30

U5

C32

C34

C33

U3

C35

D2

C37

X5

C25

R12

C49

C50

C48

C47

CE   LE   DATA   CLK   RF_EN   LD   PHASE_ADJ

R41

D5

JP14

VCC_PLL

VCC_VC0

R36

D4

VCC

C23

REFIN

R54

U2 R9

C21

C40

JP7

R10

R52

MUX_OUT

R53 C13

C39 R51

R37

U6

C22

GND

MUXOUT

JP7

R38

R15 R16 R99

D3

R19

R21

C92 C93 C4 C5

R8

C16

C15

VTUNE

MAX2870EVKIT#

U7 U1

C91

C0

R93

C203

MAX2871EVKIT#

C202 C102

C2

C3

C103

MAX2875EVKIT#

R2B R2A

SW

C24 R3

C6

C7

R20

GND

C1

C101 C201 C10

C11 C19 C20 C18 C17

C9

C8

R2

R22

R28

R27

R1

R23

R29

R26

R25

R24

R30

R31

ASSY
REV

S/N

RFOUTAP

RFOUTAN

RFOUTBP

RFOUTBN

EPCB287X
REVB
JL 04/2014

X2   DESIGNED IN THE USA

X3

R57

R56

R58

R50

C45
R47
R53
R41
C49
C48

MAX2870/MAX2871

A11 components are 0402, accept C29, C28, C11, C42, C43 and C44