

**EM35xx Reference Design With 0805 Ceramic Balun Front End, Chip Antenna, 2 - Layer**

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This design is intended for use as a reference for custom designs utilizing EM35xx ZigBee radios which do not include the USB option. If you are unsure about use of the USB option or if you know your design will require USB, please contact your region’s Silicon Labs Sales Office for assistance with choosing the appropriate EM35xx ZigBee products, features and the corresponding reference design.

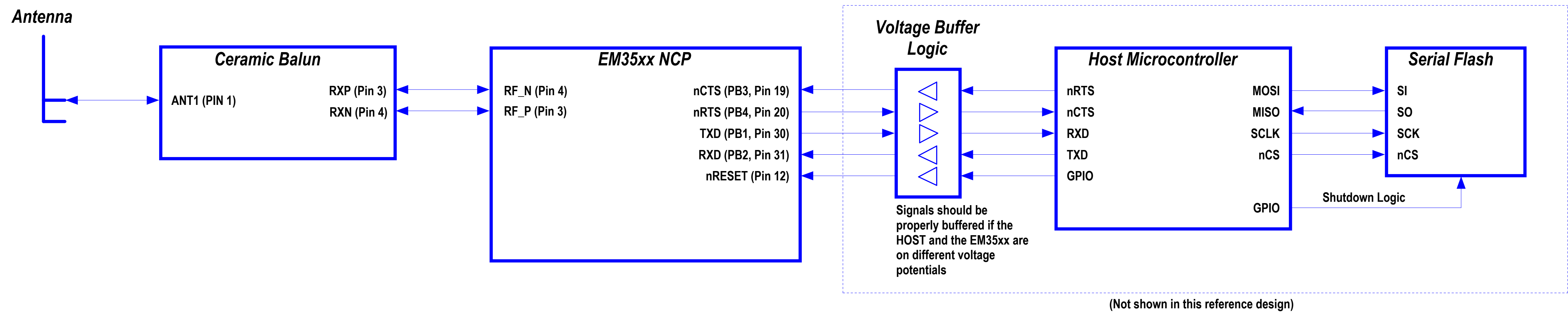
Click on the links below for additional information regarding EM35xx ZigBee products and for the location of the nearest Silicon Labs Sales office;

[EM35xx ZigBee Product Information](#)

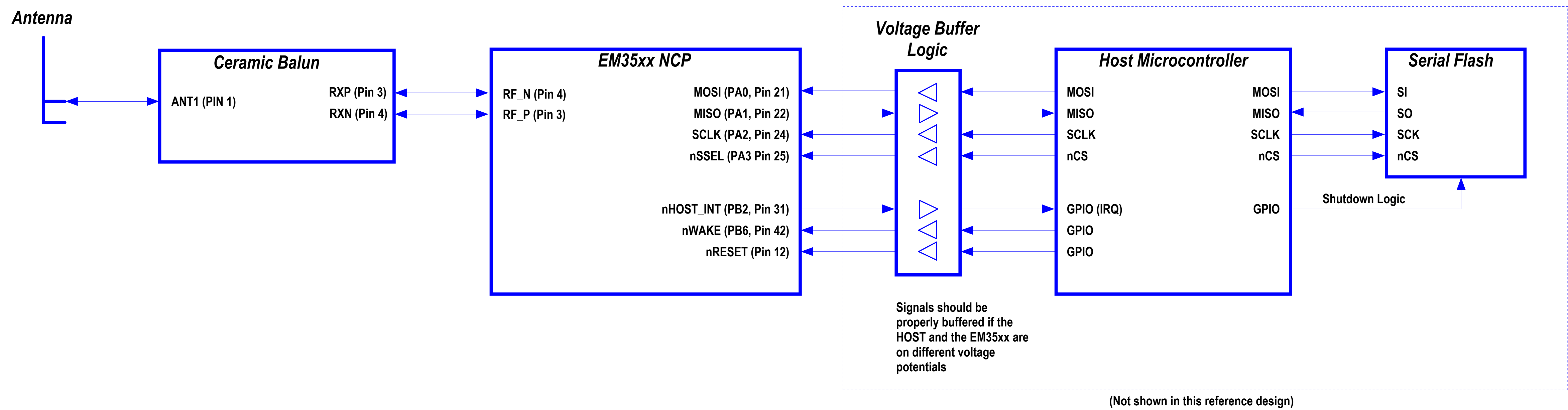
[Silicon Labs Sales Office Locations](#)

The schematics in this package can be used in both NCP & SOC designs involving the EM35xx. Connect NCP to the HOST using either UART or SPI serial connection as shown below.

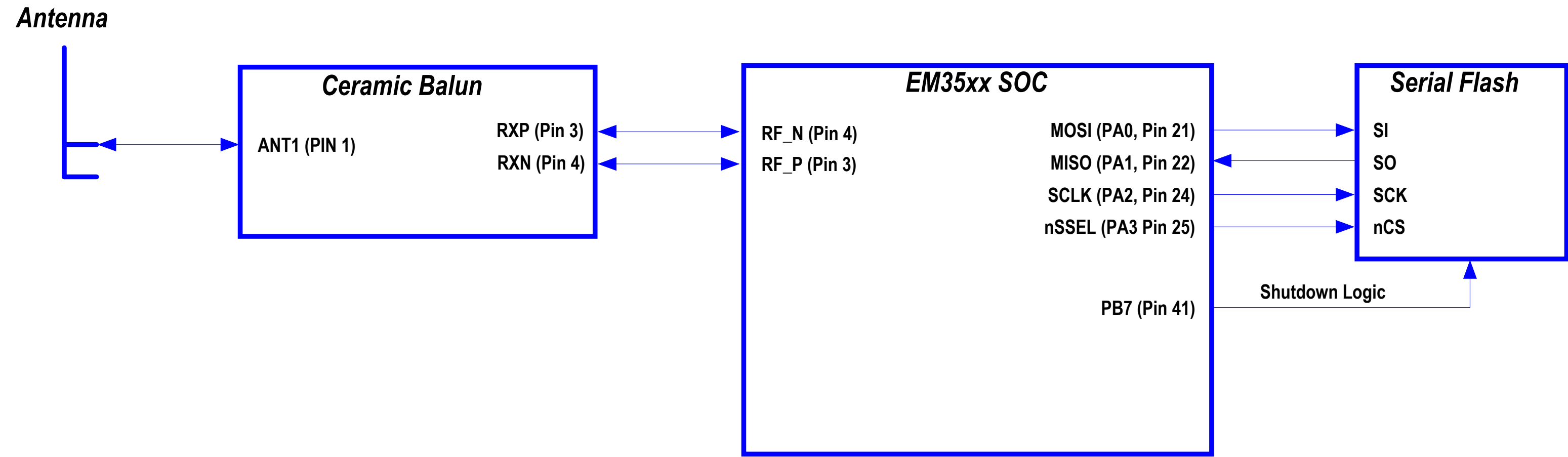
EM35xx NCP with EZSP over Asynchronous Serial (UART)



EM35xx NCP with EZSP over Synchronous Serial (SPI)



EM35xx SOC Reference Design









# Appendix A: Approved Serial Flash Providers for the EM35xx/0805 Ceramic Balun Front End 2-Layer Reference Design

The table below provides details for Serial Flash devices intended for this Reference Design. For a complete list of Serial Dataflash devices supported by the Silicon Labs ZigBee software stack, refer to the Table 2. Supported Serial Dataflash/EEPROM Remote Memory Parts, in Application Note AN772, Using Application Bootloader.

Table 1: Silicon Labs Zigbee Serial Flash Vendor Parts List

Manufacturer	Part Number	Description	Software Driver
WinBond	W25X20BVSNIG	2M (256K x 8)	spiflash-class1.c
WinBond	W25Q80BVSNIG	8M (256K x 32)	spiflash-class1.c
Macronix	MX25L2006EM1I-12G	2M (2M x 1, 1M x 2)	spiflash-class1.c
Macronix	MX25L8006EM1I-12G	8M (8M x 1, 4M x 2)	spiflash-class1.c

# Appendix B: Suggested 24MHz Crystal Providers for the EM35xx/0805 Ceramic Balun Front End 2-Layer Reference Design

The tables below provide details for 24MHz crystal devices which can be used with EM35xx series ZigBee products for the manufacture of ZigBee radio devices. Check with your preferred crystal vendor for the latest updates on their product offering or for additional information about crystals for the EM35xx ZigBee products in your target application.

Table 2: Suggested 24MHz ZigBee Crystal Vendor Parts List for Crystal Packages Used in this design

Manufacturer	Part Number	Package Size	Frequency Tol	Temperature Stability	Aging	Total Frequency Tol	ESR	Load Capacitance	Tuning Capacitor
Abrakon	ABLS-24.000MHZ-D1X-T	HC/49US (AT49)	+/- 10 ppm	+/- 20ppm (-40 +85)	+/- 10 ppm/5 years		40 ohms		
Abrakon	ABLS-24.000MHZ-D-R60-1-W-T	HC/49US (AT49)	+/- 10 ppm	+/- 15ppm (-40 +85)	+/-5 ppm/year		60 ohms	18pF	22pF
Abrakon	ABLS-438-24.000MHZ-T	HC/49US (AT49)	+/- 10 ppm	+/- 15ppm (-40 +85)	+/-15 ppm/20 years		40 ohms	18pF	22pF
ILSI	HC49USM-24.000000M-2435	HC49US	+/- 10 ppm	(-40 +85)			30 ohms	18pF	
AEL	X24M000000S067	HC49S SM	+/- 10 ppm @25C	+/- 25ppm (-40 +105)	+/- 3 ppm/year max		80 ohms	10pF	

Table 3: Suggested 24MHz ZigBee Crystal Vendor Parts List for High Temperature Rated Crystals Having Alternate Package/PCB Dimensions than is Used in this Design

Manufacturer	Part Number	Package Size	Frequency Tol	Temperature Stability	Aging	Total Frequency Tol	ESR	Load Capacitance	Tuning Capacitor
Abrakon	ABM8X-101-24.000MHZ	3.2 x 2.5 x 0.7mm	+/- 10 ppm	+/- 25 ppm (-40 +125)	+/- 5 ppm/10 years	+/- 40 ppm (-40 +125)/10 years max	60 ohms	10pF	6.8pF
Abrakon	ABM3Y-101-24.000MHZ-T	5.0 X 3.2 X 0.9mm	+/- 10 ppm	+/- 25 ppm (-40 +105)	+/- 10 ppm/5 years		30 ohms	10pF	
AEL	X24M000000S037	3.2 x 2.5 x 0.6mm	+/- 10 ppm @25C	+/- 25 ppm (-40 +105)	+/- 3 ppm/year max		80 ohms	10pF	
EPSON	TSX-3225 24.0000MF20G-C	3.2 x 2.5 x 0.6mm	+/- 10 ppm	+/- 20 ppm (-40 +105)	+/- 1 ppm/First year Max @ +25		60 ohms	18pF	
ILSI	ILCX07-24.000000M-2390	5.0 X 3.2 X 1.30mm		(-40 +105)			60 ohms	18pF	
ILSI	ILCX07-24.000000M-2392	3.2 x 2.5 x 0.9mm		(-40 +105)			60 ohms	18pF	

Table 4: Suggested 24MHz ZigBee Crystal Vendor Parts List for Commercial and Industrial Rated Crystals Having Alternate Package/PCB Dimensions than is Used in this Design

Manufacturer	Part Number	Package Size	Frequency Tol	Temperature Stability	Aging	Total Frequency Tol	ESR	Load Capacitance	Tuning Capacitor
Abrakon	ABM8-24.000MHZ-R60-D-1-W-T	3.2 x 2.5 x 0.7mm	+/- 10 ppm	+/- 25 ppm (-40 +85)	+/- 3 ppm/First year max @ +25		60 ohms	18pF	22pF
Abrakon	ABM8-24.000MHZ-R60-D-1-G-T	3.2 x 2.5 x 0.7mm	+/- 10 ppm	+/- 15 ppm (-40 +85)	+/- 3 ppm/First year max @ +25		60 ohms	18pF	22pF
Abrakon	ABM8-177-24.000mHz	3.2 x 2.5 x 0.7mm	+/- 10 ppm	+/- 15 ppm (-40 +85)	+/- 15 ppm/20 years		60 ohms	18pF	22pF
AEL	X24M000000S050	3.2 x 2.5 x 0.6mm	+/- 10 ppm @25C	+/- 25 ppm (-40 +85)	+/- 3 ppm/year max		60 ohms	10pF	8.2pF
AEL	X24M000000S058	3.2 x 2.5 x 0.6mm	+/- 10 ppm @25C	+/- 15 ppm (-40 +85)	+/- 15 ppm/20 years max		60 ohms	10pF	
EPSON	TSX-3225 24.0000MF18X-C 18pF	3.2 x 2.5 x 0.7mm	+/- 10 ppm	+/- 18 ppm	+/- 1 ppm/First year max @ +25		60 ohms	18pF	27pF
ILSI	ILCX13-24.000000M-2391	3.2 x 2.5 x 0.6mm		(-40 +85)			60 ohms	18pF	
ILSI	ILCX07-24.000000M-2389	5.0 X 3.2 X 1.30mm		(-40 +85)			60 ohms	18pF	
KDS	1ZCA24000ZZ0C	2.5 x 2.0 x 0.75mm				+/- 40 ppm (-40 +105)/10 years max	80 ohms	18pF	
KDS	1ZC224000ZZ0G	3.2 x 2.5 x 0.75mm				+/- 40 ppm (-40 +105)/10 years max	60 ohms	18pF	
KDS	1C324000ZZ0D	3.2 x 2.5 x 0.75mm				+/- 40 ppm (-40 +105)/10 years max	60 ohms	18pF	
KDS	1ZCB24000ZZ0B	2.5 x 2.0 x 0.75mm				+/- 40 ppm (-40 +105)/10 years max	60 ohms	18pF	
Precision Devices, Inc.	C324000XFAD13RX	3.2 x 2.5 x 0.7mm	+/- 10 ppm	+/- 20 ppm (-40 +70)	+/- 5 ppm/over life of the part		60 ohms	13pF	15pF
Partron America Corp	CX5X24000FHVRG01	3.2 x 2.5 x 0.75mm	+/- 10 ppm	+/- 15 ppm (-40 +85)	+/- 2 ppm/ year @ +25		60 ohms	18pF	27pF
Suntsu	SCM18D48-24.000MHZ	3.2 x 2.5 x 0.65mm	+/- 10 ppm	+/- 15 ppm (-40 +85)	+/- 2 ppm/1st Year max, then +/- 1ppm/year		80 ohms	18pF	22pF
TXC Technology	7B-24.000MEEQ-T	5.0 X 3.2 X 1.30mm	+/- 10 ppm	+/- 10 ppm (-40 +85)	+/- 3 ppm/year max		40 ohms	18pF	
TXC Technology	7M-24.000MEEQ-T	3.2 x 2.5 x 0.7mm	+/- 10 ppm	+/- 10 ppm (-40 +85)	+/- 3 ppm/year max		60 ohms	18pF	

# EM35xx\_REF\_DES\_CER\_BALUN\_AT1B

## Schematic Notes:

-- Version A0 --  
\*Released October 6, 2013  
\*Initial Release Version (for internal review)

-- Version A1 --  
\*Released August 1, 2014

- 1. Changed L5 to be C21.
- 2. Changed C21 to 0.75pF.
- 3. Changed L4, L7, L8 to be multi-layer inductors.
- 4. Changed L4 to a 2.7nH.

## PCB Layout Notes:

-- Version A0 --  
\*Released October 6, 2013  
\*Initial Release Version (for internal review)

-- Version A1 --  
\*Released August 1, 2014

- 1. Changed L5 to be C21.