

# LMX9820A to LMX9830 Conversion Guide

Texas Instruments  
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## 1.0 LMX9830

The Texas Instruments® LMX9830 Bluetooth™ Serial Port module is the next generation of the current LMX9820A. The LMX9830 includes some key changes

that must be considered in the system design and implementation. Table 1-1 on page 1 summarizes differences between LMX9820A and the LMX9830.

**Table 1-1. LMX9820A vs. LMX9830**

Specification	LMX9820A	LMX9830	Changes details
Main clock Frequency range	12 MHz Recommended	13 MHz Recommended 10 - 20 MHz frequency range supported	See LMX9830 datasheet for more information and Table 2-1 "System Clock Requirements" on page 2 for frequencies supported
Crystal Tuning Circuit	Load capacitance change -	Load capacitance change for 13 MHz use - Crystal Frequency range changes	See Section 2.0 "External Clock source"
Reset Baseband and Reset Radio	Reset Baseband and Reset Radio are tied together and driven externally	Only Reset Baseband is driven externally, but both should have an RC filter	See "Reset and system power up" on page 3, LMX9830 datasheet and LMX9830 DON-GL E schematic for details
Physical	116 Pins FR4 10.1mm x 14.1mm x 2.0mm	60 Pins BGA 6.1mm x 9.1mm x 1.2mm	Layout needs to be redesigned
Low Power Modes	32.768kHz Not Supported	32.768kHz Supported	See Section 3.0 "Optional 32 KHz for LOW power"
Loop filter	Internal	External To be done on layout	See LMX9830 datasheet
Antenna design		Chip antennas can be reused	For Antenna Matching, please see LMX9830 datasheet
Bluetooth settings memory	Internal Flash	ROM based External EEPROM	See LMX9830 datasheet
BD address	Organized by National - Included in Flash	Not included	<b>To be organized from IEEE by the customer</b>
Firmware update	Flash based, using ISP software	ROM based, no upgrade possible, Patch support for partial replacement	Using Patch RAM mechanism See Section 5.0 "Firmware upgrade and Patch RAM" on page 4
Additional features	Normal scan Up to 3 active links	Interlaced scan Up to 7 active links Scatternet supported Audio PCM slave Adaptive Frequency Hopping	
Command set			See Section 6.0 "Command set" on page 4 for details on added and removed commands

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## 2.0 External Clock source

On the LMX9830, a 12 MHz crystal can be reused from an old LMX9820A design. TI however recommends and uses on all reference designs a 13 MHz crystal. See Table 2-1 "System Clock Requirements" for the clock frequency range supported and the clock requirements.

In case of 12 MHz reuse, the tuning should be verified. For 13 MHz and other frequencies, the tuning needs to be redone.

For more information about crystals tested on LMX9830 and how to perform the tuning of the LMX9830, please refer to the LMX9830 datasheet.

See as well our LMX9830DONGLE documents for reference schematic and reference layout.

**Table 2-1. System Clock Requirements**

Parameter	Min	Typ	Max	Unit
External Reference Clock Frequency <sup>1</sup>	10	13	20	MHz
Frequency Tolerance (over full operating temperature and aging)	-20	±15	+20	ppm
Crystal Serial Resistance			230	Ω
External Reference Clock Power Swing, pk to pk	100	200	400	mV
Aging			±1	ppm per year

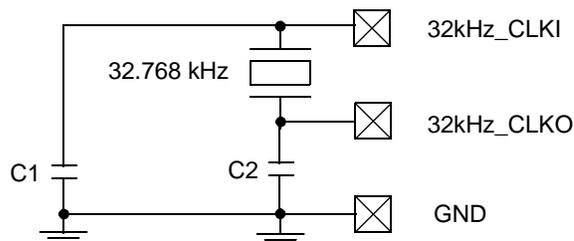
1. Supported frequencies **from external oscillator** (in MHz): 10.00, 10.368, 12.00, 12.60, 12.80, 13.00, 13.824, 14.40, 15.36, 16.00, 16.20, 16.80, 19.20, 19.68, 19.80

## 3.0 Optional 32 KHz for LOW power

On the LMX9830 a second oscillator is provided that is tuned to provide optimum performance and low-power consumption while operating with a 32.768 kHz crystal. By using this 32 KHz the current consumption can be reduced from 2.5 mA to 430 uA in low power mode PM2 (See Table 3-2 "Power Mode Activity").

An external crystal clock network is required between the 32kHz\_CLKI clock input (pad B13) and the 32kHz\_CLKO clock output (pad C13) signals. The oscillator is built in a Pierce configuration and uses two external capacitors. Table 3-1 provides the oscillator's specifications.

In case the 32KHz is placed optionally, it is recommended to remove C2 and replace C1 with a zero ohm resistor.



**Table 3-1. 32.768 kHz Oscillator Specifications**

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V <sub>DD</sub>	Supply Voltage		1.62	1.8	1.98	V
I <sub>DDACT</sub>	Supply Current (Active)			2		μA
f	Nominal Output Frequency			32.768		kHz
V <sub>PPOSC</sub>	Oscillating Amplitude			1.8		V
	Duty Cycle		38	48.3	58	%

The Table 3-2 "Power Mode Activity" sums up the different low power modes available with the LMX9830. Note that using the optional 32 KHz oscillator will improve the current consumption only for the low power mode PM2. For more information on Low Power mode operation on LMX9830 please refer to the LMX9830 datasheet and the LMX9830 Software User's Guide.

**Table 3-2. Power Mode Activity**

Power Mode	UART activity	Radio activity	Reference Clock
PM0	OFF	OFF	none
PM1	ON	OFF	Main Clock
PM2	OFF	Scanning	Main Clock / 32.768khz
PM3	ON	Scanning	Main Clock
PM4	OFF	SPP Link	Main Clock
PM5	ON	SPP Link	Main Clock

## 4.0 Reset and system power up

### 4.1 RESET#

On LMX9820A the baseband reset and the radio reset were tied together to provide a reset Pulse at the same time on both chips, with a constant time requirement of 2 ms.

The radio specification being different on the LMX9830, the two reset inputs, RESET\_RA# for the radio and RESET\_BB# for the baseband are separated. The baseband reset RESET\_BB# only needs to be driven by an external reset. Both reset pins should be connected to an external RC filter which guarantee a constant time difference of 1 ms. See Section 4.2 "System Power Up".

For recommended reset RC circuit, please refer to our LMX9830DONGLE reference schematic.

See also LMX9830 datasheet and LMX9830 Software User's Guide for more details on reset.

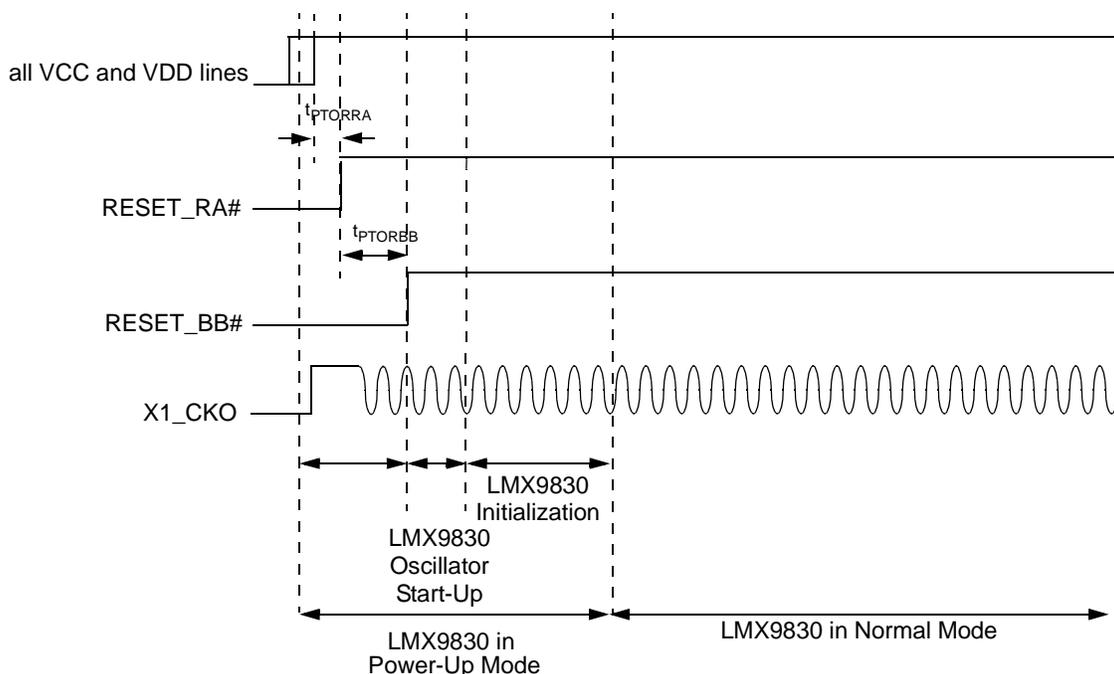
### 4.2 SYSTEM POWER UP

In order to correctly power-up the LMX9830 the following sequence is recommended to be performed:

Apply VCC\_IO and VCC to the LMX9830.

The RESET\_RA# should be driven high. Then RESET\_BB# should be driven high at a recommended time of 1ms after the LMX9830 voltage rails are high. The LMX9830 is properly reset.

Please see timing diagram, Figure 4-1 on page 3.



**Figure 4-1. LMX9830 Power on Reset Timing**

**Table 4-1. LMX9830 Power to Reset timing**

Symbol	Parameter	Condition	Min	Typ	Max	Unit
t <sub>PTORRA</sub>	Power to Reset _RA#	V <sub>CC</sub> and VCC_IO at operating voltage level to valid reset	<500 <sup>1</sup>			us
t <sub>PTORBB</sub>	Reset_RA# to Reset_BB#	V <sub>CC</sub> and VCC_IO at operating voltage level to valid reset	1 <sup>2</sup>			ms

1. Rise time on power must switch on fast, rise time <500us.
2. Recommended value.

## 5.0 Firmware upgrade and Patch RAM

A firmware upgrade on the LMX9820A was possible due to the on-chip flash. The use of ISP programming and the update software command was possible on LMX9820A.

The LMX9830 firmware is included in ROM and therefore can not be updated. To still be able to correct small errors or to do minor modifications to the software, the LMX9830 offers the so called "Patch" mechanism, which basically allows to replace small parts of the ROM code. This patch code is held in RAM and needs to be provided during "Initialization Mode", in which it is either read from EEPROM or pushed by the host.

For more information about the Patch RAM mechanism please refer to the LMX9830 Software User's Guide.

## 6.0 Command set

The command set changed slightly from LMX9820A to LMX9830. Some commands specific to the LMX9830 have been added and some have been removed.

### 6.1 REMOVED COMMANDS AND EVENTS

Below is the list of the commands removed from the LMX9830 command set:

- ▮ Store SPP Record
- ▮ Store DUN Record
- ▮ Store FAX Record
- ▮ Store OPP Record
- ▮ Store FTP Record
- ▮ Store IrMCSync Record

### 6.2 ADDED COMMANDS

Below is the list of the commands added to the LMX9830 command set:

- ▮ Set Clock Frequency
- ▮ Get Clock Frequency
- ▮ Set PCM Slave Configuration
- ▮ Enter Bluetooth Mode
- ▮ Set Clock And Baud Rate
- ▮ Get Pin response
- ▮ Replacing "Firmware upgrade" command to "Write ROM Patch": Using same opcode. See SimplyBlue Commander User's Guide for how to use the Write ROM Patch command
- ▮ Read Memory
- ▮ Write Memory
- ▮ Read NVS
- ▮ Write NVS
- ▮ Set GPIO WPU
- ▮ Get GPIO Input State
- ▮ Set GPIO Direction
- ▮ Set GPIO Output High
- ▮ Set GPIO Output Low

### 6.3 ADDED EVENTS/INDICATORS

Below is the list of the events or indicators added to the LMX9830 command set:

- ▮ Pin Request
- ▮ Await Initialization

For a detailed list of the functionality of those commands and how to use them, please refer to the LMX9830 Software User's Guide.

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