![Texas Instruments logo]

LMX5452

Micro-Module Integrated *Bluetooth*® 1.2 Baseband Controller and Radio

Check for Samples: LMX5452

FEATURES

- **Compliant with the *Bluetooth* 1.2 Core Specification**
- **-80 dBm Receiver Sensitivity (Typical)**
- **Class 2 Operation**
- **Low Power Consumption:**
  - **Advanced Power Management Features**
  - **Clocking Option 12/13 MHz with PLL Bypass Mode for Power Reduction**
- **High integration:**
  - **Implemented in 0.18 μm CMOS Technology**
  - **RF Includes On-chip Antenna Filter and Switch**
  - **On-chip Firmware with Complete HCI**
- **Embedded ROM and Patch RAM Memory**
- **Up to Seven Asynchronous Connection Less (ACL) Links**
- **Support for Two Simultaneous Voice or Synchronous Connection Oriented (SCO) Links**
- **Accepts 10-20 MHz External Clock or Crystal Network**
- **Fractional-N Sigma/Delta Modulator**
- **Operating Voltage Range 2.5–3.6V**
- **I/O Voltage Range 1.6–3.6V**
- **60-pad micro-module NFBGA package (6.1 mm × 9.1 mm × 1.2 mm)**

APPLICATIONS

- **Mobile Handsets**
- **USB Dongles**
- **Stereo Headsets**
- **Personal Digital Assistants**
- **Personal Computers**
- **Automotive Telematics**

INTERFACES

- **Full-duplex UART Supporting Transfer Rates up to 921.6 kbps Including Baud Rate Detection for HCI**
- **Full Speed (12 Mbps) USB 2.0 for HCI**
- **ACCESS.bus and SPI/Microwire for Interfacing with External Non-volatile Memory**
- **Advanced Audio Interface (AAI) for Interfacing with External 8-kHz PCM Codec**
- **Up to 3 GPIO port Pins (OP4/PG4, PG6, PG7) Controllable by HCI Commands**
- **JTAG Based Serial On-chip Debug Interface**
- **Single Rx/Tx-pad Radio Interface**

DESCRIPTION

The LMX5452 is a highly integrated *Bluetooth* 1.2 compliant solution. The integrated baseband controller and 2.4 GHz radio combine to form a complete, small form-factor (6.1 mm × 9.1 mm × 1.2 mm) *Bluetooth* node.

The baseband controller has a standard Host Controller Interface (HCI). Based on the Texas Instruments CompactRISC™ 16-bit processor, the LMX5452 is optimized to handle the audio, data, and link management processing requirements of a *Bluetooth* node.

The on-chip memory, ROM, and Patch RAM provide lowest cost and minimize design risk with the flexibility of firmware upgrades.

The firmware supplied in the on-chip ROM supports a complete *Bluetooth* Link Manager and HCI with communication through a UART or USB interface. This firmware features point-to-point and point-to-multipoint link management, supporting data rates up to 723 kbps.

The radio employs an integrated antenna filter and switch to minimize the number of external components.

The radio has a heterodyne receiver architecture with a low intermediate frequency (IF), which enables the IF filters to be integrated on-chip. The transmitter uses direct IQ-modulation with Gaussian-filtered bit-stream data, a voltage-controlled oscillator (VCO) buffer, and a power amplifier.

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DESCRIPTION (CONTINUED)

The LMX5452 module is lead free and RoHS (Restriction of Hazardous Substances) compliant. For more information on those quality standards, please visit our quality and reliability website at http://focus.ti.com/quality/docs/qualityhome.tsp
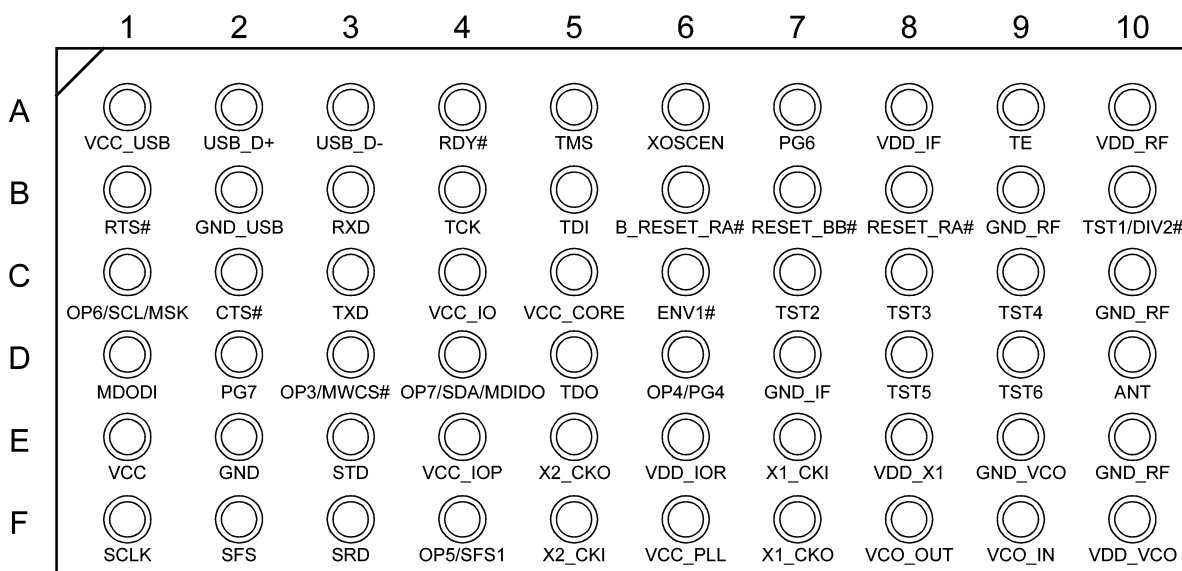
These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Functional Block Diagram
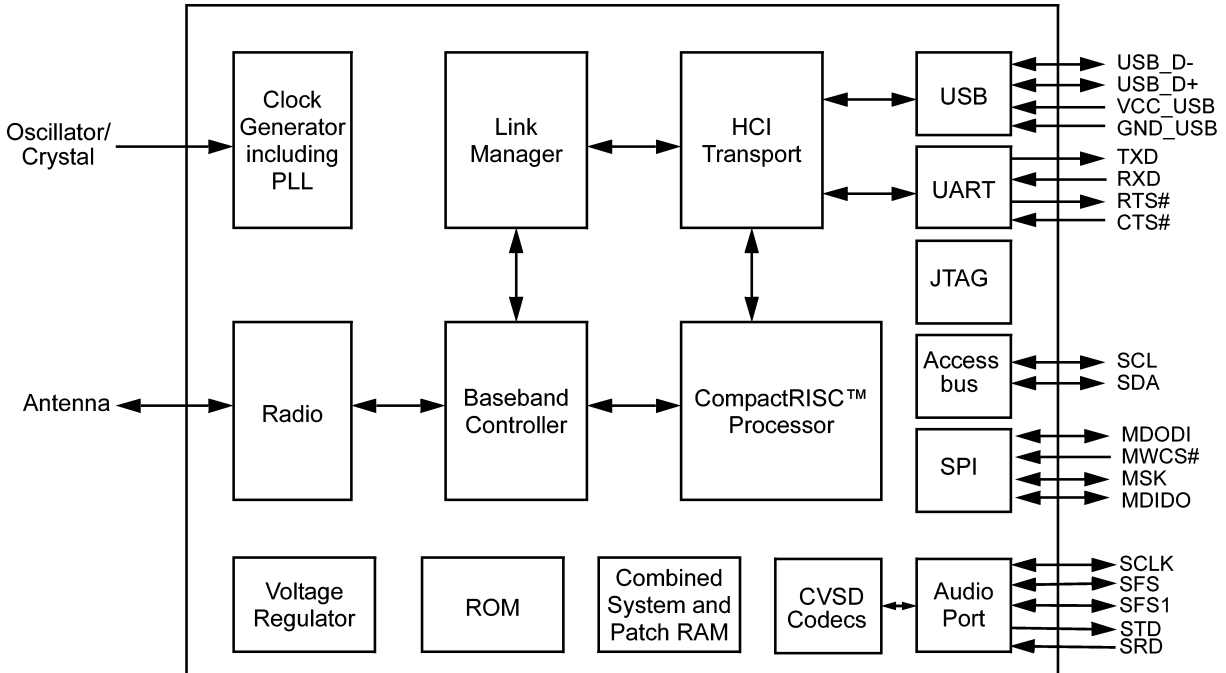
Connection Diagram

X-ray - Top View

Figure 1. NFBGA, Plastic, Laminate, 9x6x1.2mm, 60 Ball, 0.8mm Pitch Package

REVISION HISTORY

Changes from Original (March 2013) to Revision A   **Page**

Product Folder Links: *LMX5452*

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LMX5452SM/NOPB	ACTIVE	NFBGA	NZB	60		TBD	Call TI	Call TI	-40 to 85	5452SM	Samples
LMX5452SMX/NOPB	ACTIVE	NFBGA	NZB	60	2500	Green (RoHS & no Sb/Br)	SNAGCU	Level-4-260C-72 HR	-40 to 85	5452SM	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

*All dimensions are nominal

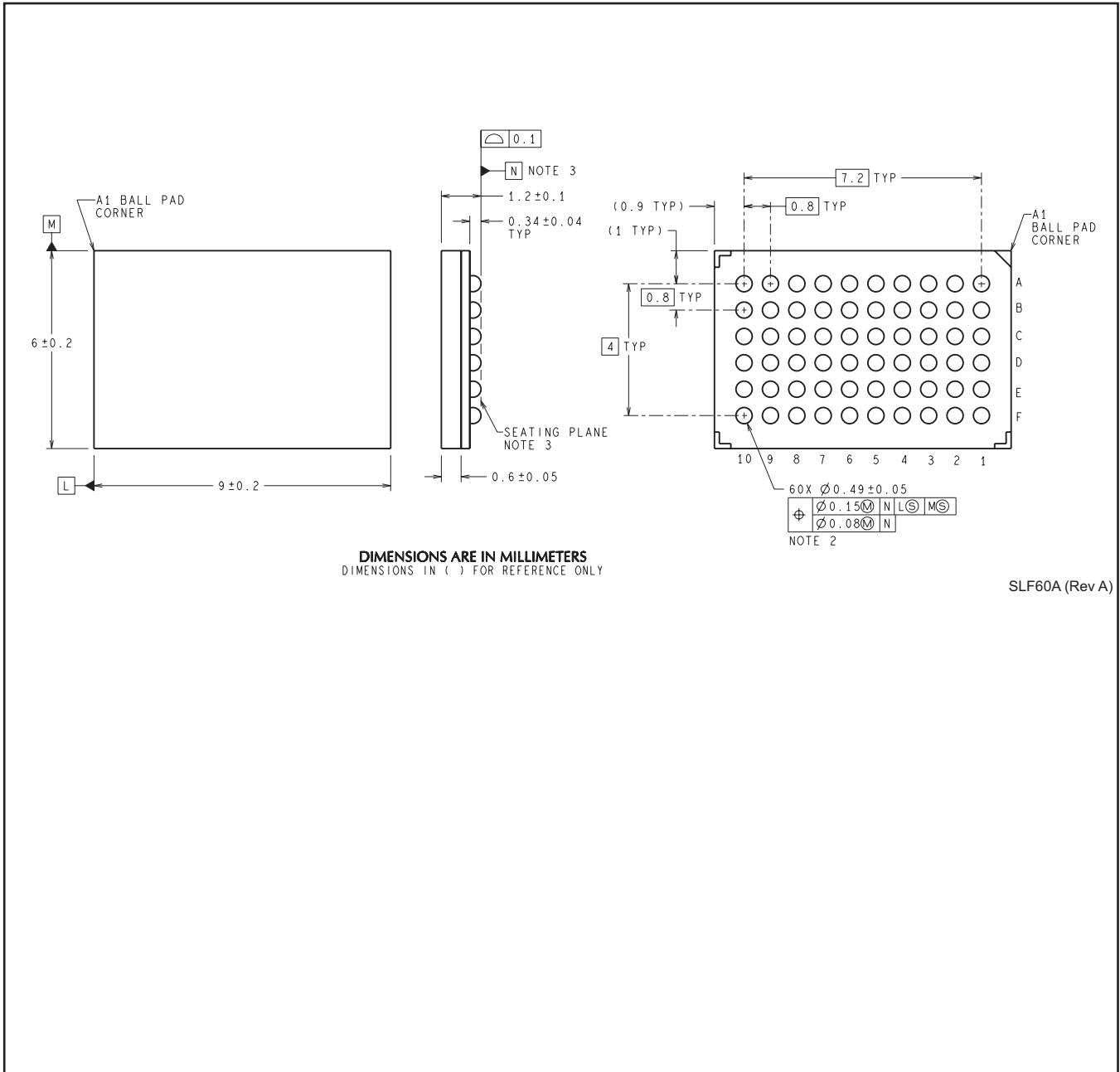| Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LMX5452SMX/NOPB	NFBGA	NZB	60	2500	330.0	16.4	6.4	9.4	2.3	8.0	16.0	Q2

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMX5452SMX/NOPB	NFBGA	NZB	60	2500	367.0	367.0	38.0

NZB0060A

A1 BALL PAD
CORNER

6 ±0.2

9 ±0.2

1.2 ±0.1

0.34 ±0.04
TYP

SEATING PLANE
NOTE 3

0.6 ±0.05

7.2 TYP

0.8 TYP

(0.9 TYP)

(1 TYP)

0.8 TYP

4 TYP

A1
BALL PAD
CORNER

A B C D E F

10 9 8 7 6 5 4 3 2 1

60X Ø0.49 ±0.05

Ø0.15 Ⓜ N LⓈ MⓈ
Ø0.08 Ⓜ N

NOTE 2

NOTE 3

DIMENSIONS ARE IN MILLIMETERS
DIMENSIONS IN ( ) FOR REFERENCE ONLY

SLF60A (Rev A)

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