CMOSTEK

CMT2210LA

300 – 480 MHz OOK Stand-Alone RF Receiver

Features

- Embedded EEPROM
- Frequency Range: 300 - 480 MHz
- Data Rate: 0.1 – 40 kbps
- Sensitivity: -113 dBm @ 1 kbps, 0.1% BER
- Configurable Receiver Bandwidth: 50 - 330 kHz
- 3-wire SPI Interface for EEPROM Programming
- Configurable Duty-Cycle Operation Mode
- Low Power Consumption:
  - 3.7 mA @ 315 MHz
  - 3.8 mA @ 434 MHz
- Low Sleep Current: 60 nA
- RoHS Compliant
- 8-pin SOP Package Options

Applications

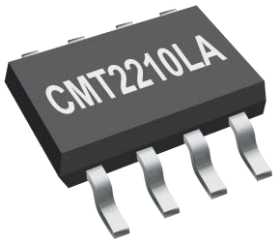
- Low-Cost Consumer Electronics Applications
- Home and Building Automation
- Infrared Receiver Replacements
- Industrial Monitoring and Controls
- Remote Automated Meter Reading
- Remote Lighting Control System
- Wireless Alarm and Security Systems
- Remote Keyless Entry (RKE)

Ordering Information

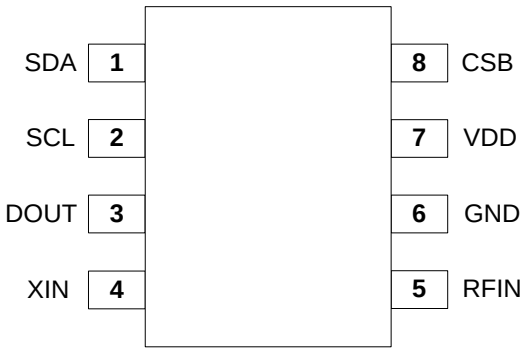
Part Number	Frequency	Package	MOQ
CMT2210LA-ESR	433.92 MHz	SOP8/T&R	2,500 pcs
CMT2210LA-ESB	433.92 MHz	SOP8/Tube	1,000 pcs
More Ordering Info: See Page 17			

Descriptions

The CMT2210LA device is an ultra-low power, high performance, low-cost OOK stand-alone RF receiver for various 300 to 480 MHz wireless applications. It is part of the CMOSTEK NextGenRF™ family, which includes a complete line of transmitters, receivers and transceivers. An embedded EEPROM allows the frequency, data rate and other features to be programmed into the device using the CMOSTEK USB Programmer and RFPDK. Alternatively, in stock products of 433.92 MHz is available for immediate demands without the need of EEPROM programming. When the CMT2210LA is always on, it consumes only 3.8 mA current while achieving -113 dBm receiving sensitivity. It consumes even less power when working in duty-cycle operation mode. The CMT2210LA receiver together with the CMT211x transmitter enables an ultra-low cost RF link.



SOP8 PACKAGE



CMT2210LA Top View

Typical Application

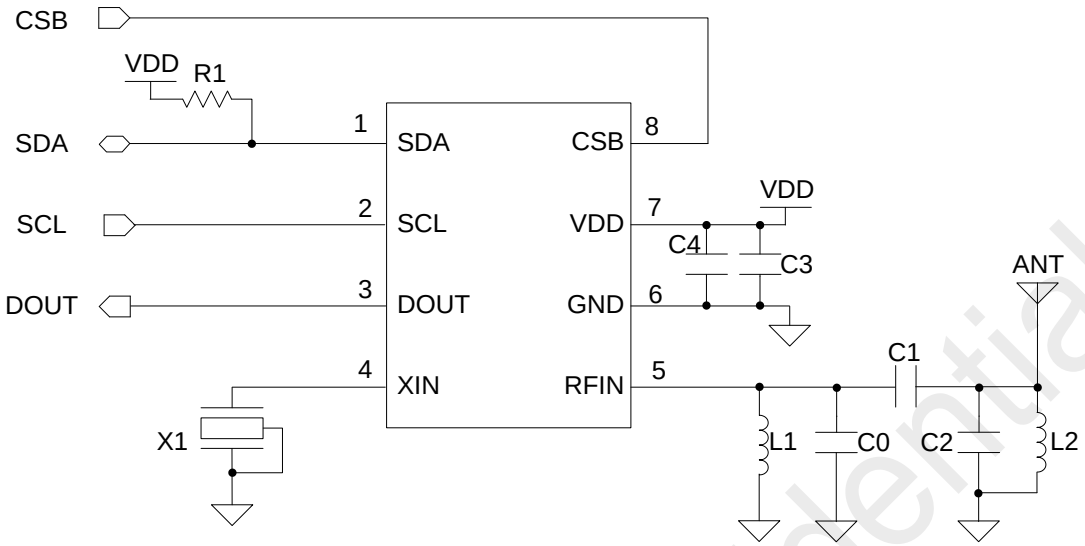


Figure 1. CMT2210LA Typical Application Schematic

Table 1. BOM of 315/433.92 MHz Typical Application

Designator	Descriptions	Value (Matched to λ/4 ANT)		Unit	Manufacturer
		315 MHz	433.92 MHz		
U1	CMT2210LA，300-480 MHz Standalone OOK Receiver	--		--	CMOSTEK
X1	±20 ppm, SMD32*25 mm, crystal	26.2736	27.1383	MHz	EPSON
L1	±10%, 0603 multilayer chip inductor	39	33	nH	Murata LQG18
C0	±0.25 pF, 0402 NP0, 50 V	3.6	NA	pF	Murata GRM15
C1	±0.25 pF, 0402 NP0, 50 V	3.6	2.7	pF	Murata GRM15
L2	±10%, 0603 multilayer chip inductor	22	22	nH	Murata LQG18
C2	±0.25 pF, 0402 NP0, 50 V	12	6.2	pF	Murata GRM15
C3	±20%, 0402 X7R, 25 V	0.1		uF	Murata GRM15
C4	±20%, 0603 NP0, 50 V	1		nF	Murata GRM15
R1	Pull up resistor	10		kΩ	

Abbreviations

Abbreviations used in this data sheet are described below

AGC	Automatic Gain Control
AN	Application Notes
BER	Bit Error Rate
BOM	Bill of Materials
BSC	Basic Spacing between Centers
BW	Bandwidth
DC	Direct Current
EEPROM	Electrically Erasable Programmable Read-Only Memory
ESD	Electro-Static Discharge
ESR	Equivalent Series Resistance
Ext	Extended
IF	Intermediate Frequency
LNA	Low Noise Amplifier
LO	Local Oscillator
LPOSC	Low Power Oscillator
Max	Maximum
MCU	Microcontroller Unit
Min	Minimum
MOQ	Minimum Order Quantity
NP0	Negative-Positive-Zero
NC	Not Connected
OOK	On-Off Keying
PC	Personal Computer
PCB	Printed Circuit Board
PLL	Phase Lock Loop
PN9	Pseudorandom Noise 9
POR	Power On Reset
PUP	Power Up
QFN	Quad Flat No-lead
RF	Radio Frequency
RFPDK	RF Products Development Kit
RoHS	Restriction of Hazardous Substances
RSSI	Received Signal Strength Indicator
Rx	Receiving, Receiver
SAR	Successive Approximation Register
SOP	Small Outline Package
SPI	Serial Port Interface
TH	Threshold
Tx	Transmission, Transmitter
Typ	Typical
USB	Universal Serial Bus
VCO	Voltage Controlled Oscillator
WOR	Wake On Radio
XOSC	Crystal Oscillator
XTAL/Xtal	Crystal

Table of Contents

1. Electrical Characteristics

VDD = 3.3 V, T_{OP} = 25 ℃, F_{RF} = 433.92 MHz, sensitivities are measured in receiving a PN9 sequence and matching to 50 Ω impedance, with the BER of 0.1%. All measurements are performed using the board CMT2210LA-EM V1.0, unless otherwise noted.

1.1 Recommended Operation Conditions

Table 2. Recommended Operation Conditions

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operation Voltage Supply	V_{DD}	From -10 ℃ to + 85 ℃	1.8		3.6	V
		From -40 ℃ to + 85 ℃	2.4		3.6	V
Operation Temperature	T_{OP}		-40		85	℃
Supply Voltage Slew Rate			1			mV/us

Note:

[1]. When the chip operates at low temperature and low supply voltage, starting from -10℃/1.8 V, the minimum supply voltage should be 0.2 V higher when the lowest operation temperature is increased by 10℃. When the chip needs to operate over large temperature range, the user should select proper crystal that can cover the desired temperature range.

1.2 Absolute Maximum Ratings

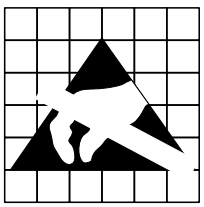
Table 3. Absolute Maximum Ratings[1]

Parameter	Symbol	Conditions	Min	Max	Unit
Supply Voltage	V_{DD}		-0.3	3.6	V
Interface Voltage	V_{IN}		-0.3	V_{DD} +0.3	V
Junction Temperature	T_J		-40	125	℃
Storage Temperature	T_{STG}		-50	150	℃
Soldering Temperature	T_{SDR}	Lasts at least 30 seconds		255	℃
ESD Rating[2]		Human Body Model (HBM)	-2	2	kV
Latch-up Current			-100	100	mA

Notes:

[1]. Stresses above those listed as “absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

[2]. The CMT2210LA is a high-performance RF integrated circuit with the ESD rating over 2 kV HBM. However, handling and assembly of this device should only be done at ESD-protected workstations.



Caution! ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

1.3 Receiver Specifications

Table 4. Receiver Specifications

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Frequency Range	F_{RF}		300		480	MHz
Data Rate	DR		0.1		40	kbps
Sensitivity	S_{315}	F_{RF} = 315 MHz, DR = 1 kbps, BER = 0.1%		-112		dBm
	S_{315}	F_{RF} = 315 MHz, DR = 3 kbps, BER = 0.1%		-110		dBm
	$S_{433.92}$	F_{RF} = 433.92 MHz, DR = 1 kbps, BER = 0.1%		-113		dBm
	$S_{433.92}$	F_{RF} = 433.92 MHz, DR = 3 kbps, BER = 0.1%		-110		dBm
Saturation Input Signal Level	P_{LVL}			10		dBm
Working Current	I_{DD}	F_{RF} = 315 MHz		3.7		mA
		F_{RF} = 433.92 MHz		3.8		mA
Shut Down Current	$I_{SHUTDOWN}$			60		nA
Blocking Immunity @ 100 kHz BW, 433.92 MHz	BI	DR = 1 kbps, ±1 MHz offset, CW interference		32		dB
		DR = 1 kbps, ±2 MHz offset, CW interference		42		dB
		DR = 1 kbps, ±10 MHz offset, CW interference		61		dB
Image Rejection Ratio	IMR			30		dB
Input 3rd Order Intercept Point	IIP3	Two tone test at 10 MHz and 20 MHz offset frequency. Maximum system gain settings		-23		dBm
Receiver Bandwidth	BW		50		330	kHz
Receiver Start-up Time	$T_{START-UP}$	From power up to receive, in Always Receive Mode		3		ms

1.4 Crystal Oscillator

Table 5. Crystal Oscillator Specifications

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Crystal Frequency[1]	F_{XTAL}	F_{RF} = 315 MHz		26.2736		MHz
		F_{RF} = 433.92 MHz		27.1383		MHz
Crystal Tolerance[2]				±20		ppm
Load Capacitance	C_{LOAD}			15		pF
Crystal ESR	Rm				60	Ω
XTAL Startup Time[3]	t_{XTAL}			400		us

Notes:

[1]. The CMT2210LA can directly work with external reference clock input to XIN pin (a coupling capacitor is required) with peak-to-peak amplitude of 0.3 to 0.7 V.

[2]. This is the total tolerance including: (1) initial tolerance; (2) crystal loading; (3) aging; and (4) temperature dependence. The acceptable crystal tolerance depends on RF frequency and channel spacing/bandwidth.

[3]. This parameter is to a large degree crystal dependent.

2. Pin Descriptions

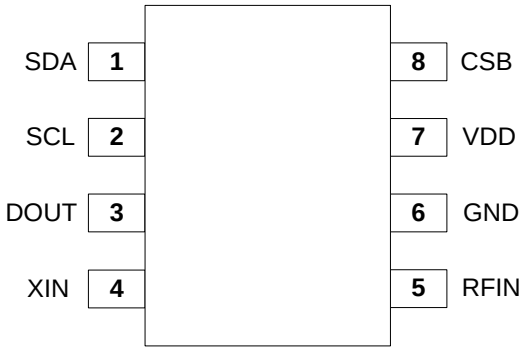


Figure 2. CMT2210LA Pin Assignments

Table 6. CMT2210LA Pin Descriptions

Pin Number	Name	I/O	Descriptions
1	SDA	IO	3-wire SPI data input and output for EEPROM programming
2	SCL	I	3-wire SPI clock input for EEPROM programming, internally pulled low
3	DOUT	O	Received data output
4	XIN	I	Crystal oscillator input or external reference clock input
5	RFIN	I	RF signal input to the LNA
6	GND	I	Ground
7	VDD	I	Power supply input
8	CSB	I	3-wire SPI chip select input for EEPROM programming, internally pulled high

3. Typical Performance Characteristics

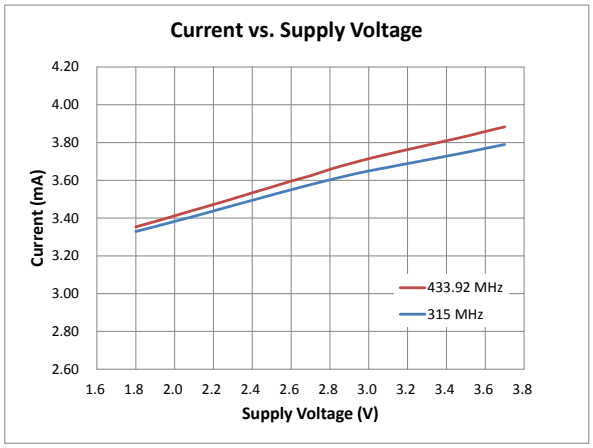


Figure 3. Current vs. Voltage, F_{RF} = 315 / 433.92 MHz, DR = 1 kbps

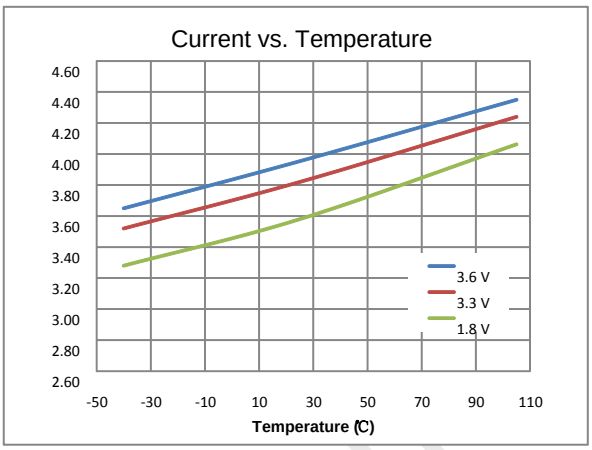


Figure 4. Current vs. Temperature, F_{RF} = 433.92 MHz, DR = 1 kbps

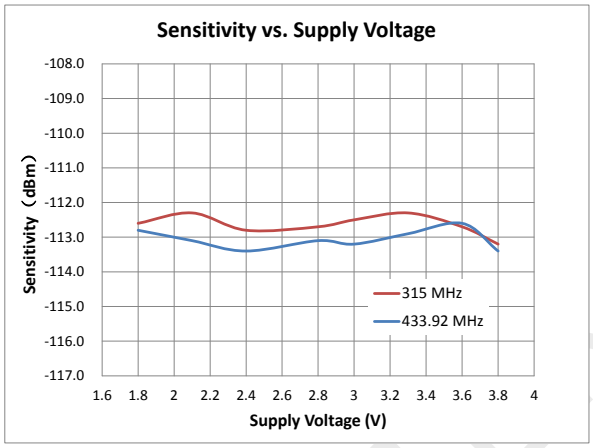


Figure 5. Sensitivity vs. Supply Voltage, DR = 1 kbps, BER = 0.1%

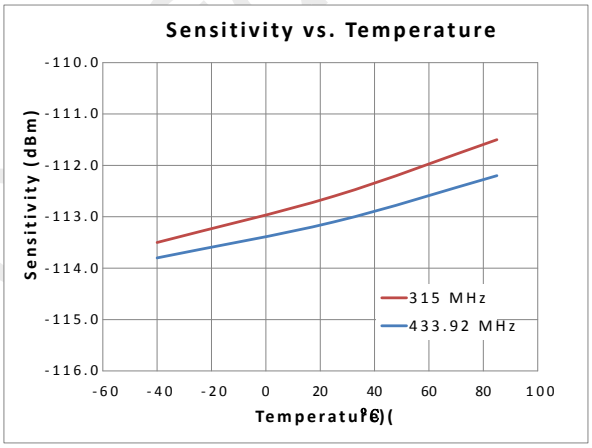


Figure 6. Sensitivity vs. Temperature, F_{RF} = 315 / 433.92 MHz, DR = 1 kbps, BER = 0.1%

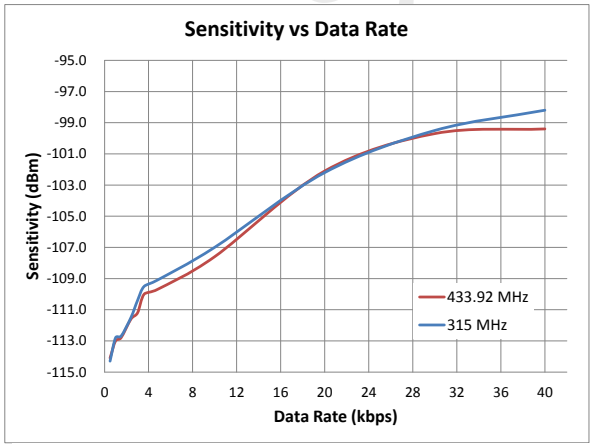


Figure 7. Sensitivity vs. DR, F_{RF} = 315 / 433.92 MHz, V_{DD} = 3.3 V, BER = 0.1%

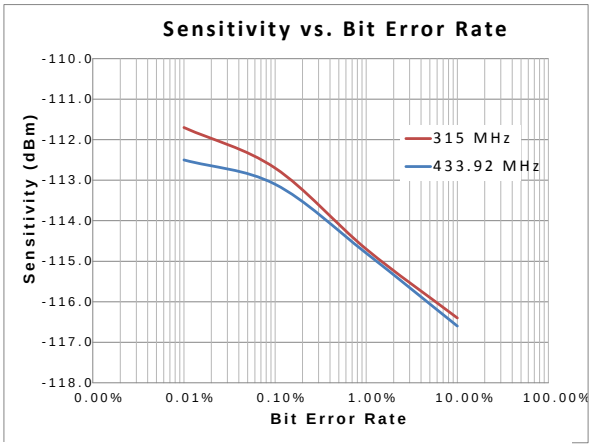


Figure 8. Sensitivity vs. BER, F_{RF} = 315 / 433.92 MHz, V_{DD} = 3.3 V, DR = 1 kbps

4. Typical Application Schematic

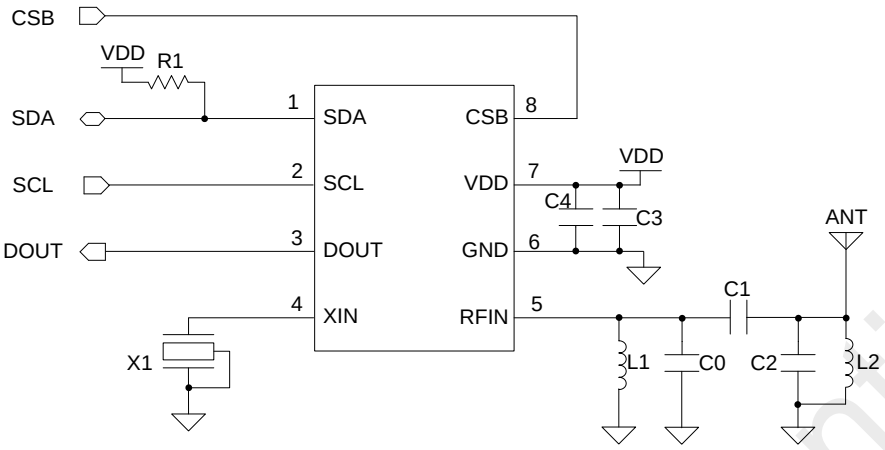


Figure 9. Typical Schematic of Enhanced Anti-interference Application

Notes:

1. Pins CSB, SDA (pull up resistor R1 is required), SCL, VDD and GND should be connected to a connector if the user requires accessing the CMT2210LA EEPROM during development or manufacture.
2. The general layout guidelines are listed below. For more design details, please refer to "AN107 CMT221x Schematic and PCB Layout Design Guideline".
   - Use as much continuous ground plane metallization as possible.
   - Use as many grounding vias (especially near to the GND pins) as possible to minimize series parasitic inductance between the ground pour and the GND pins.
   - Avoid using long and/or thin transmission lines to connect the components.
   - Place C3 and C4 as close to the CMT2210LA as possible for better filtering.
   - Place the crystal as close to the CMT2210LA as possible, the metal case of crystal needs grounding.
3. It is strongly recommended that the chip should be reset periodically by controlling the VDD on and off to maintain the optimized performance over ambient temperature, supply voltage and etc.
4. The table below shows the BOM of typical application.

Table 7. BOM of 315/433.92 MHz Typical Enhanced Anti-interference Application

Designator	Descriptions	Value (Matched to λ/4 ANT)		Unit	Manufacturer
		315 MHz	433.92 MHz		
U1	CMT2210LA，300-480 MHz Standalone OOK Receiver	--		--	CMOSTEK
X1	±20 ppm, SMD32*25 mm, crystal	26.2736	27.1383	MHz	EPSON
L1	±10%, 0603 multilayer chip inductor	39	33	nH	Murata LQG18
C0	±0.25 pF, 0402 NP0, 50 V	3.6	NA	pF	Murata GRM15
C1	±0.25 pF, 0402 NP0, 50 V	3.6	2.7	pF	Murata GRM15
L2	±10%, 0603 multilayer chip inductor	22	22	nH	Murata LQG18
C2	±0.25 pF, 0402 NP0, 50 V	12	6.2	pF	Murata GRM15
C3	±20%, 0402 X7R, 25 V	0.1		uF	Murata GRM15
C4	±20%, 0603 NP0, 50 V	1		nF	Murata GRM15
R1	Pull up resistor	10		kΩ	

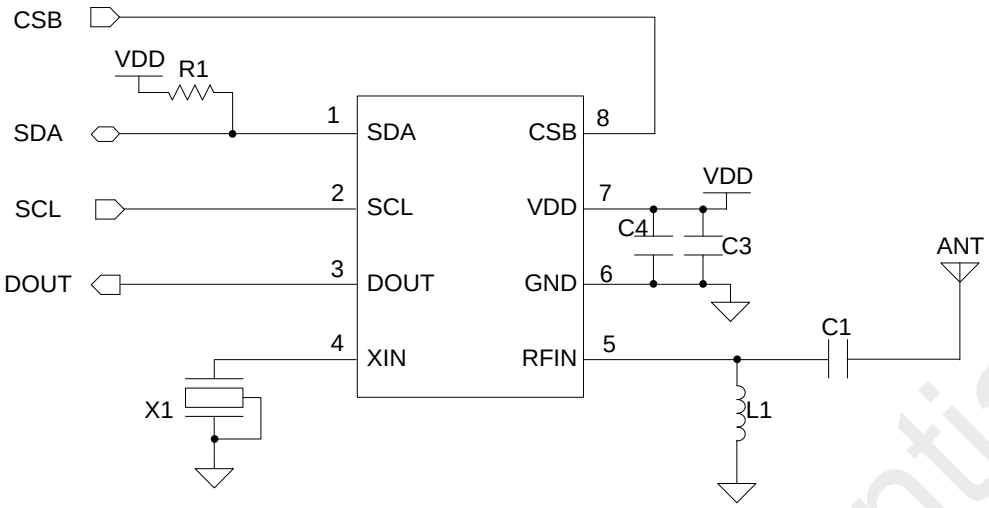


Figure 10. Typical Schematic of Simplified L-type Matching Application

Table 8. BOM of 315/433.92 MHz Simplified L-type Matching Application

Designator	Descriptions	Value (Matched to 50Ω ANT)		Value (Matched to λ/4 ANT)		Unit	Manufacturer
		315MHz	433.92MHz	315MHz	433.92MHz		
U1	CMT2210LA，300-480 MHz Standalone OOK Receiver	--		--		--	CMOSTEK
X1	±20 ppm, SMD32*25 mm, crystal	26.2736	27.1383	26.2736	27.1383	MHz	EPSON
L1	±10%, 0603 multilayer chip inductor	39	27	75	33	nH	Murata LQG18
C1	±0.25 pF, 0402 NP0, 50 V	5.6	3.3	4.3	2.7	pF	Murata GRM15
C3	±20%, 0402 X7R, 25 V	0.1		0.1		uF	Murata GRM15
C4	±20%, 0603 NP0, 50 V	1		1		nF	Murata GRM15
R1	Pull up resistor	10		10		kΩ	

5. Functional Descriptions

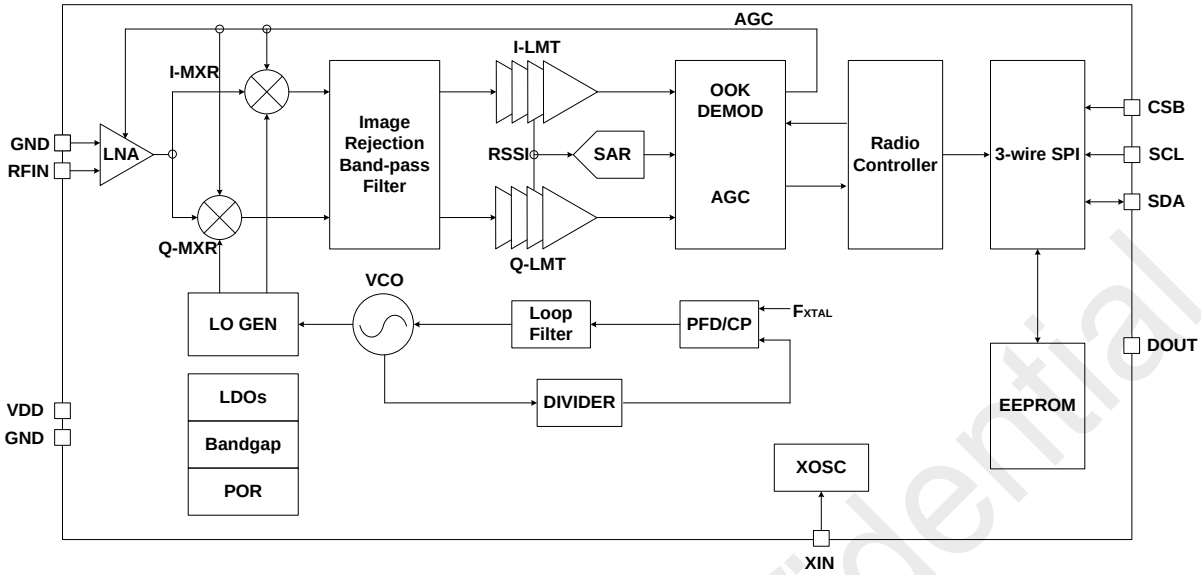


Figure 11. Functional Block Diagram

5.1 Overview

The CMT2210LA devices are ultra-low power, high performance, and low cost OOK stand-alone RF receiver for various 300 to 480 MHz wireless applications. It is part of the CMOSTEK NextGenRF™ family, which includes a complete line of transmitters, receivers and transceivers. The chip is based on fully integrated, low-IF receiver architecture. The low-IF architecture facilitates a very low external component count and does not suffer from powerline-induced interference problems. The VCO operates at 2x the Local Oscillator (LO) frequency to reduce spurious emissions. Every analog block is calibrated on each Power-on Reset (POR) to the internal reference voltage. The calibration helps the device to finely work under different temperatures and supply voltages. The baseband filtering and demodulation is done by the digital demodulator. The demodulated signal is output to the external MCU via the DOUT pin. No external MCU control is needed in the applications.

The 3-wire SPI interface is only used for configuring the device. The configuration can be done with the RFPDK and the USB Programmer. The data rate and other product features are all configurable. This saves the cost and simplifies the design, development and manufacture. Alternatively, in stock products of 433.92 MHz are available for immediate demands without the need of EEPROM programming. The CMT2210LA operates from 1.8 to 3.6 V so that it can finely work with most batteries to their useful power limits. The receive current is only 3.8 mA at 433.92 MHz. It is strongly recommended that the chip should be reset periodically by controlling the VDD on and off to maintain the optimized performance over ambient temperature, supply voltage and etc. The CMT2210LA receiver together with the CMT211x transmitter enables an ultra-low cost RF link.

5.2 Modulation, Frequency and Data Rate

The CMT2210LA supports OOK demodulation with the data rate from 0.1 to 40 kbps. The CMT2210LA continuously covers the frequency range from 300 to 480 MHz, including the license free ISM frequency band around 315 MHz and 433.92 MHz. See table below for the demodulation, frequency and data rate information.

Table 9. Modulation, Frequency and Data Rate

Parameter	Value	Unit
Demodulation	OOK	-
Frequency	300 - 480	MHz
Data Rate	0.1 - 40	kbps

5.3 Embedded EEPROM and RFPDK

The RFPDK is a PC application developed to help the user to configure the CMOSTEK NextGenRF™ products in the most intuitional way. The user only needs to connect the USB Programmer between the PC and the device, fill in and select the proper value of each parameter on the RFPDK, and click the “Burn” button to program the configurations into the device. The configurations of the device will then remain unchanged until the next programming. No external MCU control is required in the application program.

The RFPDK also allows the user to save the active configuration into a list by clicking on the “List” button, so that the saved configuration can be directly reloaded from the list in the future. Furthermore, it supports exporting the configuration into a hexadecimal file by clicking on the “Export” button. This file can be used to burn the same configuration into a large amount of devices during the mass production. See the figure below for the accessing of the EEPROM.

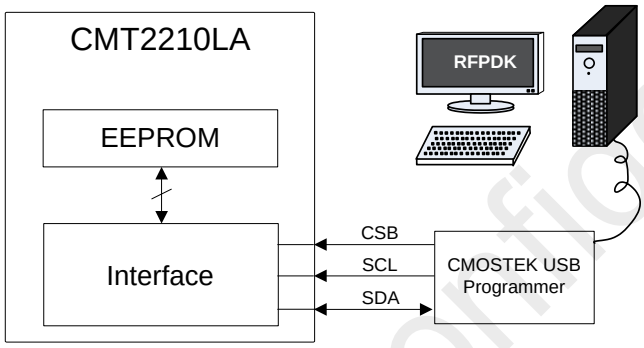


Figure 12. Accessing Embedded EEPROM

For more details of the CMOSTEK USB Programmer and the RFPDK, please refer to “AN103CMT211xA-221xA One-Way RF Link Development Kits Users Guide”.

5.4 All Configurable Options

Besides the demodulation, frequency, data rate and more other options can be used to customize the device. The following is a table of all the configurable options. On the RFPDK, the Basic Mode only contains a few options allowing the user to perform easy and fast configurations.

Table 10. Configurable Parameters in RFPDK

Category	Parameters	Descriptions	Default
RF Settings	Frequency	The receive radio frequency, the range is from 300 to 480 MHz, with resolution of 0.001 MHz. The Xtal Freq. will be calculated based on this parameter.	433.920 MHz
	Xtal Freq.	The crystal frequency required for the receive radio frequency.	27.1383 MHz
	Demodulation	The demodulation type, only OOK demodulation is supported in this product.	OOK
	Data Rate	The receiver data rate, the range is from 0.1 to 40 kbps, with resolution of 0.1 kbps.	2.4 kbps
	Tx Freq. Offset	The frequency offset on the Tx side, this is used to calculate the required Rx Bandwidth	± 75 kHz

Category	Parameters	Descriptions	Default
	Rx Xtal Tol.	Crystal frequency tolerance, this is used to calculate the required Rx Bandwidth	± 20 ppm
	AGC	Automatic Gain Control, the options are: on or off.	On
OOK Settings	Bandwidth Options | Real BW	The Rx Bandwidth setting, ranging from 50 kHz to 330 kHz. The user can select Auto-Select to allow the device select the bandwidth based on the RF settings. The real bandwidth will be displayed as Real BW.	Auto-Select
	Demod Method	To select the demodulation method, the options are Middle and Average.	Middle
	Long-Zero Number	To select the maximum number of consecutive zeros the receiver might handle, ranging from 4 to 255.	31
	Auto Squelch Enable	To enable the auto squelch function. When it is enabled, the device will calculate the noise floor level automatically and configure the squelch threshold according to the noise floor level and the Auto Squelch value being set.	off
	Auto Squelch	This set the squelch level above the calculated noise floor level, when the Auto Squelch function is enabled.	40

5.5 Internal Blocks Description

5.5.1 RF Front-end and AGC

The CMT2210LA features a low-IF receiver. The RF front-end of the receiver consists of a Low Noise Amplifier (LNA), I/Q mixer and a wide-band power detector. Only a low-cost inductor and a capacitor are required for matching the LNA to any common used antennas. The input RF signal induced on the antenna is amplified and down-converted to the IF frequency for further processing.

By means of the wide-band power detector and the attenuation networks built around the LNA, the Automatic Gain Control (AGC) loop regulates the RF front-end's gain to get the best system linearity, selectivity and sensitivity performance, even though the receiver suffers from strong out-of-band interference.

5.5.2 IF Filter

The signals coming from the RF front-end are filtered by the fully integrated 3rd-order band-pass image rejection IF filter which achieves over 30 dB image rejection ratio typically. The IF center frequency is dynamically adjusted to enable the IF filter to locate to the right frequency band, thus the receiver sensitivity and out-of-band interference attenuation performance are kept optimal despite the manufacturing process tolerances. The IF bandwidth is automatically computed according to the basic system parameters input from the RFPDK: Tx Freq. Offset, Rx Xtal Tol., and Data Rate.

5.5.3 RSSI

The subsequent multistage I/Q Log amplifiers enhance the output signal from IF filter before it is fed for demodulation. Receive Signal Strength Indicator (RSSI) generators are included in both Log amplifiers which produce DC voltages that are directly proportional to the input signal level in both of I and Q path. The resulting RSSI is a sum of both these two paths. Extending from the nominal sensitivity level, the RSSI achieves over 66 dB dynamic range.

The CMT2210LA integrates a patented DC-offset cancellation engine. The receiver sensitivity performance benefits a lot from the novel, fast and accurate DC-offset removal implementation.

5.5.4 SAR ADC

The on-chip 8-bit SAR ADC digitalizes the RSSI for OOK demodulation.

5.5.5 Crystal Oscillator

The CMT2210LA uses a 1-pin crystal oscillator circuit with the required crystal load capacitance fully integrated. The recommended specification for the crystal is ±20 ppm, ESR (Rm) < 60 Ω, with 15 pF load capacitance, the XTAL frequency can be obtained when the desired F_{RF} is input on the RFPDK, with the calculation shown below.

$$F_{XTAL} = \frac{F_{RF}}{11.98923}, \quad 300\ \text{MHz} \leqslant F_{RF} < 360\ \text{MHz}$$

$$F_{XTAL} = \frac{F_{RF}}{15.98923}, \quad 360\ \text{MHz} \leqslant F_{RF} \leqslant 480\ \text{MHz}$$

For examples:

1. When F_{RF} = 315 MHz, we get F_{XTAL} = 26.27358 MHz;
2. When F_{RF} = 433.92 MHz, we get F_{XTAL} = 27.13827 MHz.

If the RCLK (reference clock) is available in the system, the user can directly use it to drive the CMT2210LA by feeding the clock into the chip via the XIN pin. This further saves the system cost due to the removal of the crystal. A coupling capacitor is required if the RCLK is used. The recommended peak-to-peak amplitude of the RCLK is 0.3 to 0.7 V on the XIN pin.

5.5.6 Frequency Synthesizer

An integer-N frequency synthesizer is used to generate the LO frequency for the down conversion I/Q mixer. The frequency synthesizer is fully integrated. Using the reference clock provided by the crystal oscillator or the external clock source, it can generate any receive frequency between 300 to 480 MHz.

Multiple subsystem calibrations are performed dynamically to ensure the frequency synthesizer operates reliably in any working conditions.

5.6 Duty-Cycle Receive Mode

By controlling the VDD on and off, the chip can work in duty cycle operation mode, this can reduce the average current consumption effectively, and can be better employed in some lower power application, shown as below.

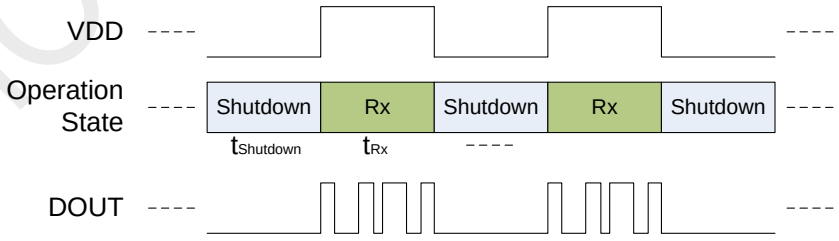


Figure 13. Duty Cycle Operation Mode

Average current consumption can be calculated as below:

$$I_{AVG} = I_{DD} \times \frac{t_{Rx}}{t_{Rx} + t_{Shutdown}}$$

It should be noticed that, when the chip work in always receive mode, it is still recommended to reset the chip by controlling the VDD on and off to maintain the optimized performance over ambient temperature, supply voltage and etc. The Rx time can be long according to the system requirement, such as 2 seconds, 10 seconds or even longer. And the shut down time should be longer than 3 ms. It also should be noticed that the on and off of the VDD should meet the Supply Voltage Slew Rate shown in Table 2. Within the 3 ms shutdown time and 3 ms startup time, the chip is not in effective receive state, as shown in the figure below.

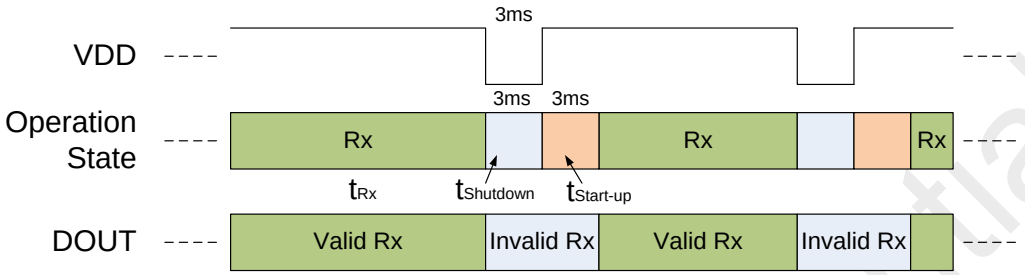


Figure 14. VDD Control in Always Receive Mode

6. Ordering Information

Table 11. CMT2210LA Ordering Information

Part Number	Descriptions	Package Type	Package Option	Operating Condition	MOQ / Multiple
CMT2210LA-ESR[1]	300 – 480 MHz OOK Stand-Alone RF Receiver	SOP8	Tape & Reel	2.4[2] to 3.6 V, -40 to 85 ℃	2,500
CMT2210LA-ESB[1]	300 – 480 MHz OOK Stand-Alone RF Receiver	SOP8	Tube	2.4[2] to 3.6 V, -40 to 85 ℃	1,000

Notes:

[1]. "E" stands for extended industrial product grade, which supports the temperature range from -40 to +85 ℃.
"S" stands for the package type of SOP8.
"R" stands for the tape and reel package option, the minimum order quantity (MOQ) for this option is 2,500 pieces. "B" stands for the tube package option, the minimum order quantity (MOQ) for this option is 1,000 pieces.

[2]. When the chip operates at low temperature and low supply voltage, starting from -10℃/1.8 V, the minimum supply voltage should be 0.2 V higher when the lowest operation temperature is increased by 10℃. When the chip needs to operate over large temperature range, the user should select proper crystal that can cover the desired temperature range.

Visit www.cmostek.com/products to know more about the product and product line.
Contact sales@cmostek.com or your local sales representatives for more information.

7. Package Outline

The SOP8 illustrates the package details for the CMT2210LA. The table below lists the values for the dimensions shown in the illustration.

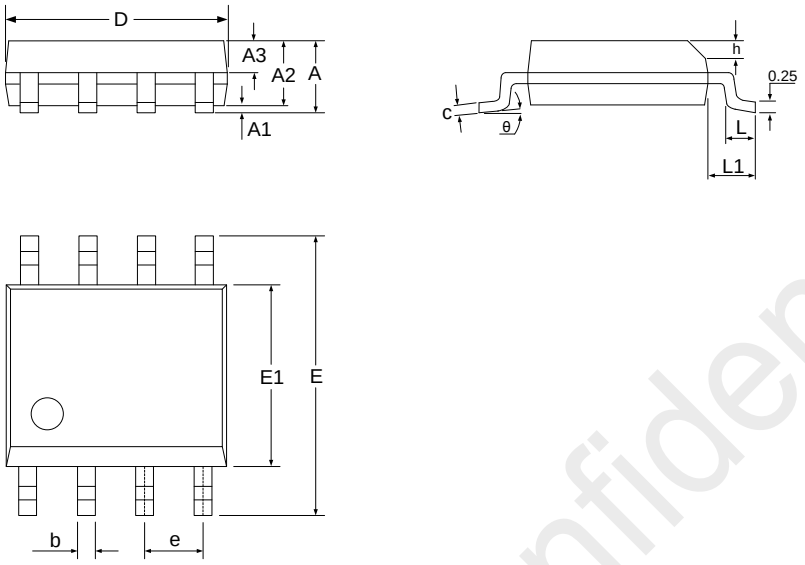


Figure 15. SOP8 Package

Table 12. SOP8 Package Dimensions

Symbol	Size (millimeters)		
	Min	Typ	Max
A	-	-	1.75
A1	0.10	-	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	-	0.48
c	0.21	-	0.26
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27 BSC		
h	0.25	-	0.50
L	0.50	-	0.80
L1	1.05 BSC		
θ	0	-	8°

8. Top Marking

8.1 CMT2210LA Top Marking

Figure 16. CMT2210LA Top Marking in SOP8 Package

Table 13. CMT2210LA SOP8 Top Marking Explanation

Mark Method	Laser
Pin 1 Mark	Circle's diameter = 1 mm
Font Height	0.6 mm, right-justified
Font Width	0.4 mm
Line 1 Marking	CMT2210LA, represents part number CMT2210LA
Line 2 Marking	YYWW is the Date code assigned by the assembly house. YY represents the last two digits of the mold year and WW represents the workweek. ①②③④⑤⑥ is the internal tracking number

9. Other Documentations

Table 14. Other Documentations for CMT2210LA

Brief	Name	Descriptions
AN103	CMT211xA-221xA One-Way RF Link Development Kits Users Guide	User's Guides for CMT211xA and CMT221xA Development Kits, including Evaluation Board and Evaluation Module, CMOSTEK USB Programmer and RFPDK.
AN107	CMT221x Schematic and PCB Layout Design Guideline	Details of CMT2210/13/17/19A and CMT2210L PCB schematic and layout design rules, RF matching network and other application layout design related issues.
AN151	CMT2210B-LA Configuration Guideline	Details of configuring CMT2210B-LA features on the RFPDK.

10. Document Change List

Table 15. Document Change List

Rev. No.	Chapter	Description of Changes	Date
0.6	All	Initial released version	2016-5-18
0.7	4 5.6	Update 4. Typical Application Schematic Update the description of 5.6 Duty Cycle Operation Mode	2016-10-27

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