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NCAT00LKT002G4

Product Preview

NCS36510 RF Module

The NCS36510 is a low power, fully integrated, System on Chip that integrates a 2.4 GHz IEEE 802.15.4−2006 compliant transceiver, ARM® Cortex®−M3 microprocessor, RAM and FLASH memory, a true random number generator, and multiple peripherals to support design of a complete and secure wireless network with minimal external components.

The NCS36510 offers advanced power management techniques that allow operation down to supply voltages as low as 1 V while minimizing current consumption. The NCS36510 is specifically designed for applications requiring maximum battery life while minimizing cost.

The NCS36510 incorporates an industry leading 32−bit ARM Cortex−M3 for high performance, low power and low cost processing. The NCS36510 includes 640 kB of embedded FLASH memory for program storage along with 48 kB of RAM for data storage. NCS36510 uses a hardware accelerated MAC to minimize processor overhead while maximizing available processor power for running application software.

Peripherals include DMA, UART(2), SPI(2), I2C(2), PWM, RTC, three programmable timers, WDT, 18 GPIO, 10 bit ADC with four external inputs and integrated temperature and voltage sensors.

GENERAL INFORMATION

Note that some of the specifications refer to either “NCS36510” or “Module”. Please note specifications cited as NCS36510 are taken from the NCS36510 datasheet (this should also be noted where referred to). “Module” means measurements taken with the production module

MEMORY

Table 1. MEMORY

RAM (Kb)	On−Chip Flash (kB)
48	640

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

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Figure 1. LKT00

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

MODULE PINOUT

Module Pad	NCS36510 GPIO (NCS36510 Pin Number)
1	DBG_TEST_EN (35)
2	DIO17 (40)
3	DIO10 (1)
4	DIO16 (4)
5	VDDIO (5)
6	GND
7	DIO8 (3)
8	DIO7 (7)
9	DIO6 (8)
10	DIO5 (9)
11	DIO4 (10)
12	DIO3 (11)
13	DIO2 (12)
14	DIO1 (13)
15	DIO0 (14)
16	nReset (36)
17	DIO9 (2)
18	VDD (22, 34)
19	GND
20	A0 (23)
21	DIO13 (37)
22	DIO12 (38)
23	DIO11 (39)
24	GND
25	A1 (24)
26	DIO15 (6)
27	DIO14 (15)
28	A2 (29)
29	A3 (30)

DEBUG AND PROGRAMMING INTERFACE

In order to access the NCS36510 for programming and debug purposes, it is recommended that the designer incorporate an ARM SWD interface connector. This will allow any SWD compliant hardware debugger interface to interact with the NCS36510.

ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Max	Unit
Supply Voltage (VDD, VDDIO)	−0.3	3.9	V
Voltage on any GPIO (DIO0:DIO17, nReset, Test)	−0.3	VDDIO+0.3, <3.9	V
Analog pin voltage (A0:A3)	−0.3	VDD+0.3, <3.9	V
Ambient Operating Temperature	−40	+85	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

RECOMMENDED OPERATING CONDITIONS

Parameter	Min	Typ	Max	Unit
Supply Voltage (VDD) – 3 V Mode	2.0	3.0	3.6	V
Supply Voltage (VDDIO)	1.0	3.3	3.6	V
Temperature Range	−40	27	85	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC CHARACTERISTICS (For typical values TA = 27°C, for min/max values TA = −40°C to 85°C; Power supplies VDD = 3 V, VDDIO = 3.3 V, unless otherwise noted)

Parameter	Test Condition	Min	Typ	Max	Unit
Coma Mode Sleep Current (Note 1)	3 V Mode, Switching Regulator 3 V Mode, Linear Regulator (Note 2)	– –	0.65 4.96	– –	μA μA
FLASH Erase Cycles Before Failure (Note 3)		10k	–	–	cycles
FLASH Read Current (Note 3)		–	–	2.3	mA
FLASH Erase Current (Note 3)		–	–	5	mA
FLASH Write Current (Note 3)		–	–	3	mA
Data Retention at 85°C		10	–	–	years
CORE POWER CONSUMPTION					
3 V Mode Idle Current – Linear Regulator (Note 4)		–	3.7	–	mA
3 V Mode Transmit Current – Linear Regulator (Note 4)	+8.1 dBm (Max. Power Setting) 0 dBm −15.4 dBm (Min. Power Setting)	– – –	18.2 11 6.5	– – –	mA mA mA
3 V Mode Receive Current – Linear Regulator (Note 4)		–	7.7	–	mA
DIGITAL I/O CHARACTERISTICS					
Input Pullup Resistance (Note 5)		8	10	12	kΩ
Input Pulldown Resistance (Note 5)		8	10	12	kΩ
Output Voltage for Logic 0		–	–	0.3*VDDIO	V
Output Voltage for Logic 1		0.7*VDDIO	–	–	V
Logic Low Sink Current, I_{OL}	VDDIO = 3.3 V, pad driven to V_{OL} = 0.2* VDDIO	8.1	11.6	15	mA
Logic High Source Current, I_{OH}	VDDIO = 3.3 V, pad driven to V_{OH} = 0.8* VDDIO	−12	−8	−6	mA

1. Coma mode = CPU running on internal 32 kHz OSC and waiting for interrupt, both retention RAMS disabled, all other functions powered down
2. VDD = 2.0 V
3. Guaranteed by design
4. Peripherals disabled, CPU halted, 32 MHz crystal oscillator, CW Mode, 2.445 GHz, ON Semiconductor evaluation board, conducted measurement, 50 Ω system
5. RESET pin has a fixed pullup and TEST has a fixed pulldown.

TX POWER SETTING

The RF Output power of the Module can be adjusted via the SoC's TX Power settings. The Transmit Current will also vary according to the TX Power setting. The charts below show the relationship between the Transmit Current or Output Power vs the TX Power setting.

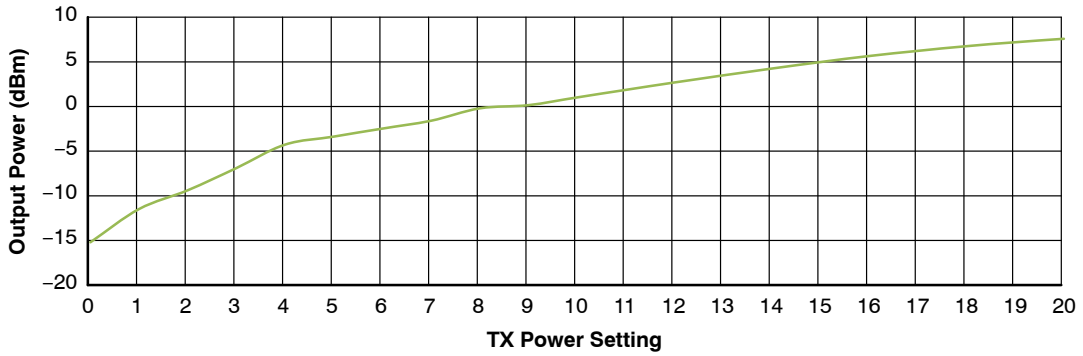

Figure 2. Output Power vs TX Power Setting

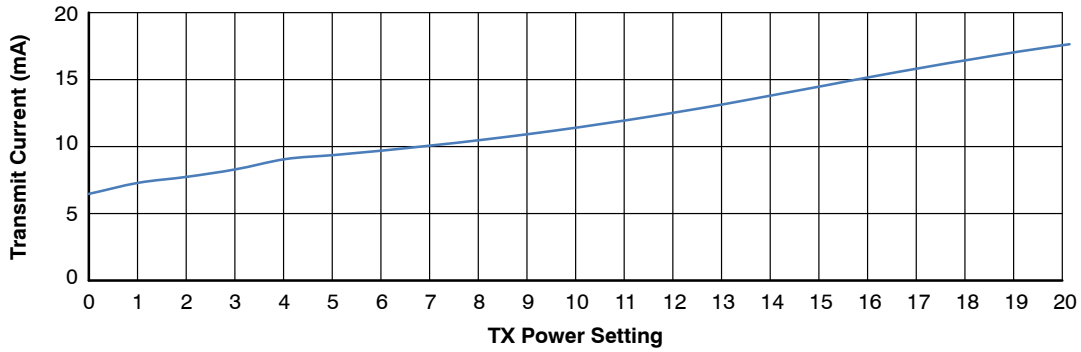

Figure 3. Transmit Current vs TX Power Setting

RF SPECIFICATIONS

Table 2. RECEIVE SPECIFICATIONS

Parameter	Test Condition	Min	Typ	Max	Unit
Frequency range		2405	–	2480	MHz
Sensitivity		–	–97	–	dBm
Saturation (Note 6)	Maximum of –20 dBm at PER of 1% as per IEEE 802.15.4	–20	–	–	dBm
High–Side Adjacent Channel Rejection (Note 6)	IEEE 802.15.4–2006 signal at –82dBm	–	30	–	dB
Low–Side Adjacent Channel Rejection	IEEE 802.15.4–2006 signal at –82dBm	–	32	–	dB
2nd High–Side Adjacent Channel Rejection (Note 6)	IEEE 802.15.4–2006 signal at –82dBm	–	34	–	dB
2nd Low–Side Alternate Channel Rejection (Note 6)	IEEE 802.15.4–2006 signal at –82dBm	–	37	–	dB
Frequency Error Tolerance		–100	–	+100	ppm
RSSI Dynamic Range		40	80	–	dB

Table 3. TRANSMIT SPECIFICATIONS

Parameter	Test Condition	Min	Typ	Max	Unit
Output Power at highest TX Power setting		–	8.5	–	dBm
Error Vector Magnitude (Note 6)	At maximum recommended power setting as per IEE 802.15.4, which sets a 35% maximum	–	14	25	%
Carrier Frequency Error		–40	–	40	ppm

6. Conducted measurement, 50 Ω system.

FUNCTIONAL SPECIFICATIONS

Serial Ports

Refer to the NSC36510 datasheet for functionality and associated GPIO pinouts.

NOTE: The module pinout table in section 3 of this document provides a cross reference between the module pins and the NSC36510 GPIO's.

Serial Controller

The following interfaces are available on the NSC36510:

- 2 x UART interfaces, UART1 and UART2
  - UART1 is complete implementation of a 16550 UART
  - UART2 is a reduced functionality of UART1
- 2 x identical I^2C bus master interfaces, I2C1 and I2C2
- 2 x SPI bus controllers, SPI1 and SPI2
  - SPI1 supports up to 4 slaves
  - SPI2 supports 1 slave

For more details, please refer to the NSC36510 datasheet.

GPIO

The NSC36510 has 18 identical GPIO. The programmable options available independently for each GPIO are listed below:

- Bi−directional capability
- Individually configurable interrupt lines
- Rising, falling, or both edge interrupt
- High, low, or both logic level interrupt
- Loopback mode
- Push pull or open drain
- Four programmable drive strengths
- Pullup, pulldown or neither

For more details, please refer to the NSC36510 datasheet.

Analog to Digital Converter (ADC)

The ADC on the NSC36510 is a successive approximation converter with the following features:

- Resolution of up to 10 bits
- Sample times as fast as 5 μs (200 kHz)
- Single−ended conversions from up to four external and two internal signals
- Support a wide range of input voltages using a programmable resistive voltage divider

For more details, please refer to the NSC36510 datasheet.

MECHANICAL SPECIFICATIONS

Physical Dimensions

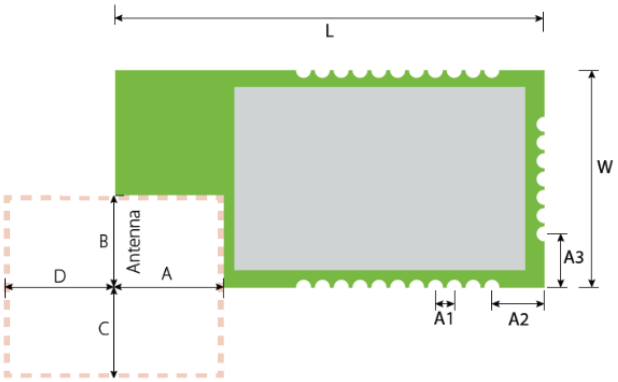

Figure 4. Physical Dimensions

Table 4. PHYSICAL DIMENSIONS

Symbol	Description	Distance (mm)
L	Length of the module	22.9
W	Width of the module	15
H	Height of the module	2.64
A1	Pitch	1.27
A2	Distance center of pad to PCB edge	2.1
A3	Distance center of pad to PCB edge	3.69
A	Length of keep−out zone	7.34
B	Width of keep−out zone	7.76
C	Keep−out zone from corner of PCB	≥6
D	Keep−out zone from corner of PCB	≥6

Recommended Land Pattern (Surface Mount)

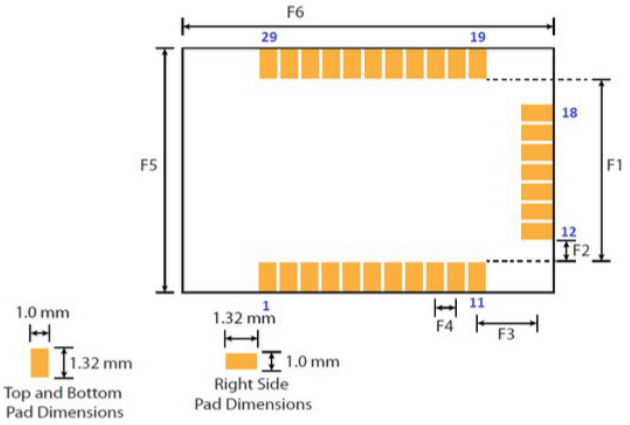

Figure 5. Recommended Land Pattern (Surface Mount)

Table 5. PHYSICAL DIMENSIONS

Symbol	Description	Distance (mm)
F1	Distance pad edge to pad edge	13
F2	Distance pad edge to pad edge	2.19
F3	Distance pad center to pad center	1.76
F4	Pitch	1.27
F5	Module silkscreen outline	15.31
F6	Module silkscreen outline	23.21

LABELLING

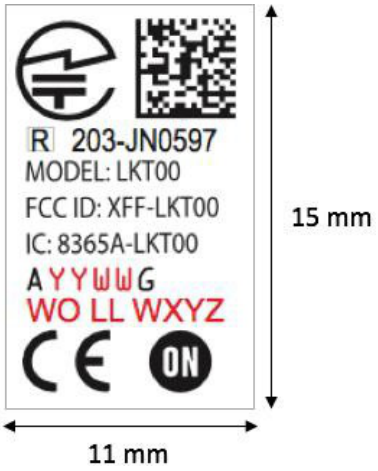

Figure 6. Labelling

A: Assembly location
YY: Year WW: Week G: Lead free
WO: Work order
LL: Lot
WXYZ: Serial number

SOLDERING TEMPERATURE TIME PROFILE FOR REFLOW SOLDERING (LEAD−FREE SOLDER)

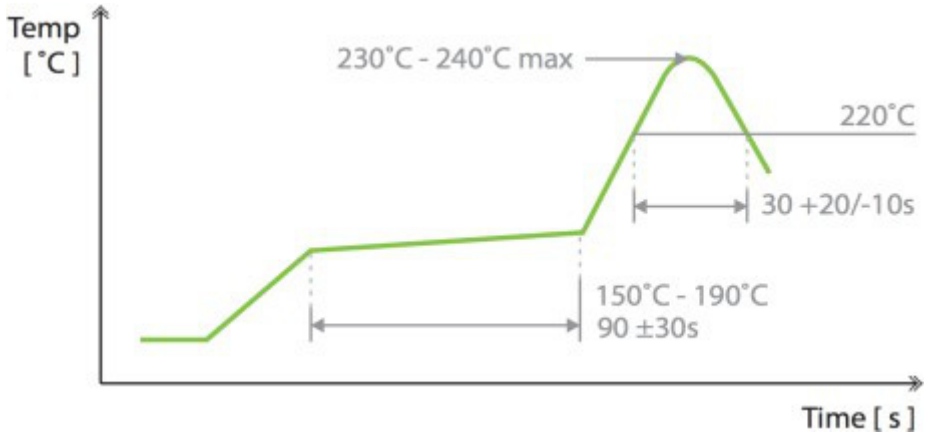

Figure 7. Soldering Temperature Time Profile for Reflow Soldering (Lead−Free Solder)

REGULATORY APPROVALS

Approved Antennae

The LKT00 module has been certified with one onboard chip antenna. See the individual jurisdictions below for the detailed output power settings.

Federal Communications Commission (FCC, US)

RF Output Power Settings

The LKT00 module using the onboard chip antenna can be operated up to the maximum software configurable power level for channels 11 − 25.

FCC Notice

The LKT00 device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

To comply with FCC RF Exposure requirements, users of this device must ensure that the module be installed and/or configured to operate with a separation distance of 20 cm or more from all persons. Usage of Channel 26 at full power will result in non−compliance to FCC standards. ON Semiconductor recommends avoiding use of channel 26 and if necessary only use with a reduced power setting. For further details, please contact ON Semiconductor.

Modular Approval

The LKT00LKT00 device meets the requirements for modular transmitter approval as detailed in the FCC public notice DA 00−1407.

It should be noted that:

“While the applicant for a device into which an authorized module is installed is not required to obtain a new authorization for the module, this does not preclude the possibility that some other form of authorization or testing may be required for the device (e.g., a WLAN into which an authorized module is installed must still be authorized as a PC peripheral, subject to the appropriate equipment authorization).”

— FCC Public Notice DA 00−1407

Caution:

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Labeling Requirements

The user of this device is responsible for meeting the FCC labeling requirements. A clearly visible label on the exterior enclosure of an incorporating device must list the FCC ID “XFF−LKT00” and the FCC. Notice above

The exterior label should use the wording “Contains” or “Contains Transmitter Module”. For example:

Contains FCC ID: XFF−LKT00

Or

Contains Transmitter Module FCC ID: XFF−LKT00

Any similar wording that expresses the same meaning may be used.

Industry Canada (IC)

RF Output Power Settings

The LKT00 module using the onboard chip antenna can be operated up to the maximum software configurable power level for channels 11 – 25.

IC Notice

This device complies with Industry Canada licence−exempt RSS standard(s). Operation is subject to the following two conditions:

1. this device may not cause interference, and
2. this device must accept any interference, including interference that may cause undesired operation of the device.

Le preìsent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autoriseìe aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioeìlectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Labeling Requirements

The host device shall be properly labelled to identify the modules within the host device. The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the Industry Canada certification number of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains transmitter module IC: 8365A−LKT00

ETSI (EU)

RF Output Power Settings

The LKT00 module using the onboard chip antenna can be operated up to the maximum software configurable power level for channels 11 – 25.

ETSI Approval

Provided that the above TX Power settings are used, the LKT00 module is compliant with the following EU standards: ETSI EN 300 328 (v1.9.1), ETSI EN 301 489 1 (v1.9.2) , ETSI EN 301 489 17 (v2.2.1) and EN 60950−1

Japan

The LKT00 module has obtained Technical Regulations Conformity Certification as a low power data communications device in the 2.4 Ghz band (ARIB STD−66) based on the Radio Law in Japan.

Certification Number: 203−JN0597

Warnings:

1. Do not modify or disassemble the module. These activities may be punished by the Radio Law.
2. Removal of the product label with the technical conformity mark and certification number can be an infringement of the Radio Law.
3. The assessment was completed using only the onboard chip antenna.
4. The certification number must not be shown on the end product.

When operating the LKT00 module it is recommended that the instructions in the ARIB STD−T66 Low Power Data Comms. in the 2.4 GHz band are followed.

ORDERING INFORMATION

SKU	Package	Description	Shipping (Qty / Packing)
NCAT00LKT002G4MNG	TBD	Low power SoC for 2.4Ghz IEEE 802.15.4−2006 Applications	TBD

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
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Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
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