CMOS 2.4GHZ ZIGBEE/ISM TRANSMIT/RECEIVE FEM

DESCRIPTION

The CB2401 is a fully integrated, single-chip, single-die RF Front-end Integrated Circuit. which incorporates all the RF functionality needed for IEEE 802.15.4/ZigBee, wireless sensor network, and any other wireless systems in the 2.4GHz ISM band. The CB2401 architecture integrates the PA, LNA, Transmit and Receive switching circuitry, the associated matching network, and the harmonic filter all in a CMOS single-chip device.

Typical high power applications include home and industrial automation, smart power, and RF4CE among others. Combining superior performance, high sensitivity and efficiency, low noise, small form factor, and low cost, CB2401 is the perfect solution for applications requiring extended range and bandwidth. CB2401 has simple and low-voltage CMOS control logic, and requires minimal external components for system implementation.

BLOCK DIAGRAM

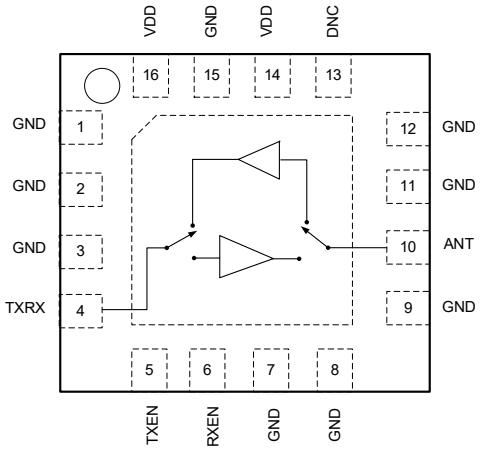


Figure 1. CB2401 Block Diagram

FEATURES

- 2.4GHz ZigBee High Power Single-Chip, Single-Die RF Front-End IC
- Combined TX / RX Transceiver Port and Single Antenna Port
- 2.4GHz Transmit High Power Amplifier with Low-Pass Harmonic Filter
- Low Noise Amplifier
- Transmit / Receive Switch Circuitry
- Low Voltage (1.2V) CMOS Control Logic
- ESD Protection Circuitry on All Ports
- DC Decoupled RF Ports
- Internal RF Decoupling on All VDD Bias Pins
- Low Noise Figure for the Receive Channel
- Very Low DC Power Consumption
- Full On-chip Matching and Decoupling Circuitry
- Minimal External Components Required
- 50-Ohm Input / Output Matching
- Market Proven CMOS Technology
- 3 x 3 x 0.55mm Small Outline QFN-16 Package with Exposed Ground Pad

APPLICATIONS

- ZigBee Extended Range Devices
- ZigBee Smart Power
- Wireless Sound and Audio Systems
- Home and Industrial Automation
- Wireless Sensor Networks
- Custom 2.4GH z Radio Systems

PIN-OUT DIAGRAM

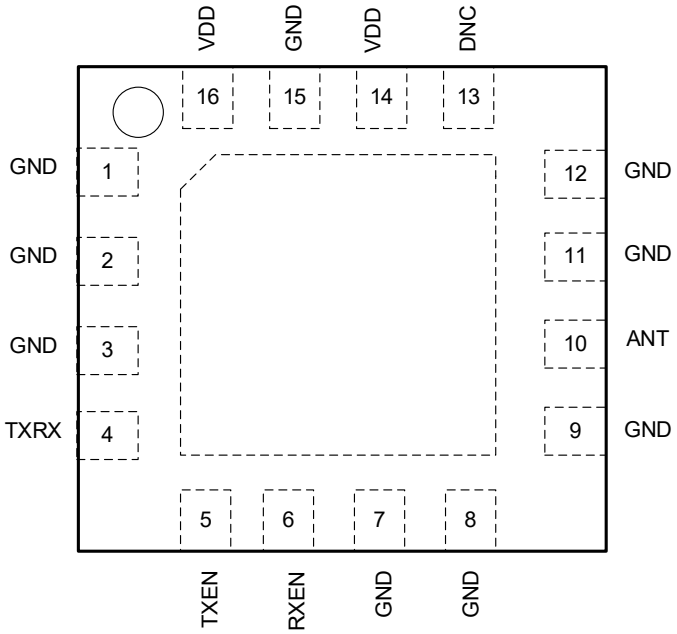


Figure 2. CB2401 Pin out (Top View)

PIN ASSIGNMENTS

Pin	Name	Description
4	TXRX	RF signal to / from the Transceiver: DC shorted to GND
5	TXEN	CMOS Input to Control TX Enable
6	RXEN	CMOS Input to Control RX Enable
10	ANT	RF Signal from the PA or RF Signal Applied to the LNA; DC Shorted to GND
1, 2, 3, 7, 8, 9,11, 12, 15, 17	GND	Ground – Must be connected to Ground in the Application Circuit
13	DNC	Reserved – Do Not Connect in the Application Circuit
14	VDD	Alternative Voltage Supply Pin, internally connected to Pin 16, no connection needed
16	VDD	Voltage Supply Connection

CB2401 ABSOLUTE MAXIMUM RATINGS

Parameters	Conditions	Minimum	Maximum	Units
DC VDD Voltage Supply	All VDD Pins	0	4.0	V
DC Control Pin Voltage	Through 1Kohm resistor	0	3.6	V
DC VDD Current Consumption	Through VDD Pins when TX is “ON”		350	mA
DC Control Pin Current Consumption			1	uA
TX RF Input Power			+5	dBm
ANT RF Input Power			+5	dBm
Storage Ambient Temperature	Appropriate care required according to JEDEC Standards	-50	+150	°C
ESD Voltage (HBM)	Human Body Model	2000		V

NOTE:
Sustained operation at or above the Absolute Maximum Ratings for any single or combinations of the above parameters may result in permanent damage to the device and is not recommended. All Maximum RF Input Power Ratings assume 50-Ohm terminal impedance.

RECOMMENDED OPERATING CONDITIONS

Parameters	Conditions	Minimum	Typical	Maximum	Units
Operating Frequency		2.4		2.5	GHz
DC VDD Voltage Supply	All VDD Pins	2.0	3.3	3.6	V
Control Voltage “High”		1.2		VDD	V
Control Voltage “Low”			0	0.3	V
Control Pin Current Consumption			1		μA
DC Shutdown Current				5	μA
PA Turn On/Off Time			0.8		μsec
Input/Output Single-Ended Impedance			50		Ω
Operating Ambient Temperature	All Operating Modes	-40		+85	°C

CB2401 ELECTRICAL SPECIFICATIONS[1]

Parameters	Test Condition	Min	Typ.	Max	Units
Transmit Mode：(VDD=3.3V; T=+25℃)					
Operating Frequency Band	All RF Pins Terminated by 50 Ohms	2.4		2.525	GHz
Saturated Output Power	CW		+22		dBm
Small-Signal Gain	CW		25		dB
Second Harmonic	POUT = +20dBm, IEEE 802.15.4 OQPSK modulation signal		-15		dBm/MHz
Third Harmonic			-20		dBm/MHz
Input Return Loss	POUT = +20dBm, IEEE 802.15.4 OQPSK modulation signal		-10		dB
Output Return Loss			-8		dB
Input / Output Impedance Single-Ended			50		Ohm
TX Quiescent Current	No RF Input Signal		17		mA
TX High Power Current	POUT = +20dBm		100		mA
Load VSWR for Stability	All non-harmonically related spurs less than -43 dBm/Hz	4:1	6:1		N/A
(CW, Fix Pin for POUT = +20dBm with 50Ω Load)	No damage	8:1	10:1		N/A

Parameters	Test Condition	Min	Typ.	Max	Units
Receive Mode：(VDD=3.3V; T=+25℃)					
Operating Frequency Band	All RF Pins Terminated by 50 Ohms	2.4		2.525	GHz
Gain			10		dB
Noise Figure			3.5		dB
Input Return Loss			-12		dB
Output Return Loss			-15		dB
RF Port Impedance			50		Ohm
RX Quiescent Current	No RF Applied		10		mA
Input P1dB	No RF Applied		-8		dBm

Parameters	Test Condition	Min	Typ.	Max	Units
Standby Mode：					
DC Shutdown Current				5	uA
TXRX-ANT Insertion Loss (S21)	Pin < -20dBm		-50		dB
ANT-TXRX Insertion Loss (S21)			-50		dB
Return Loss (S11)	From TXRX Port		-1.5		dB
Transmit-Receive Switching Time			800		ns
Shut-Down and “ON” State Switching Time			800		ns

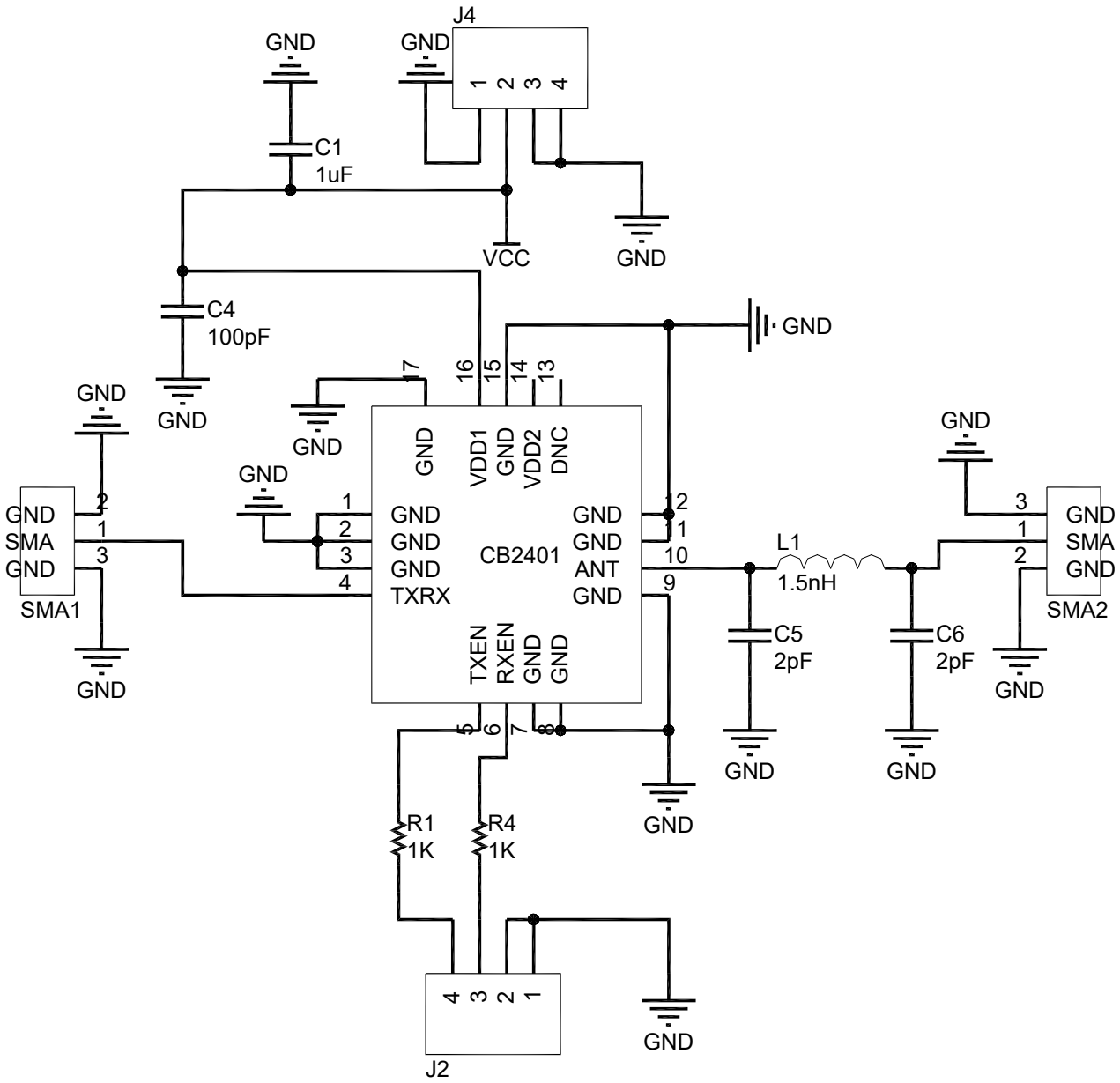
LOGIC TRUTH TABLE

Mode	LEN	PEN
TX Active	1	X
RX Active	0	1
Chip is Shut-down	0	0

NOTE:

1. “1” denotes high voltage state (> 1.2V)
2. “0” denotes low voltage stage (<0.3V) at Control Pins
3. “X” denotes do not care: either “1” or “0” can be applied

EVALUATION BOARD SCHEMATIC



*F*igure 3. CB2401 Evaluation Board Schematic

EVALUATION BOARD ASSEMBLY DRAWING

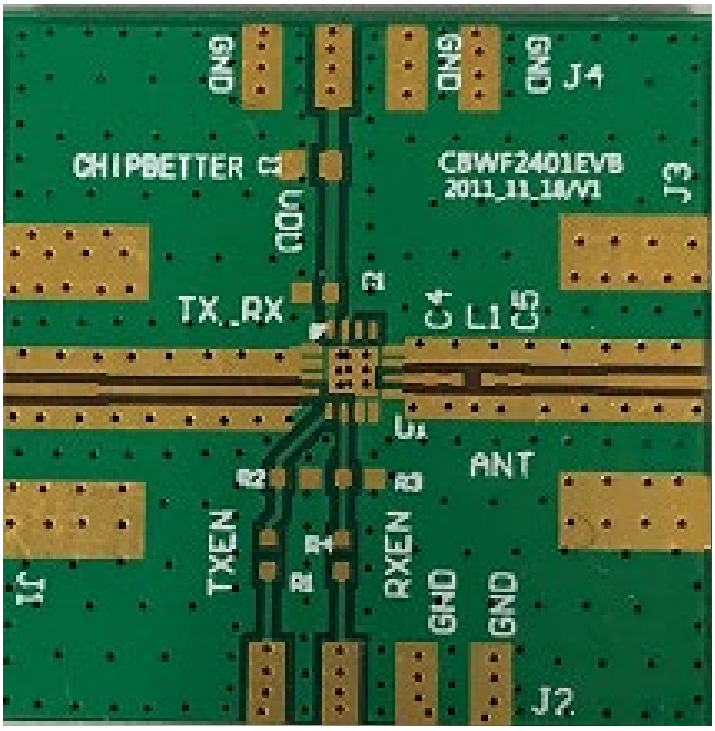
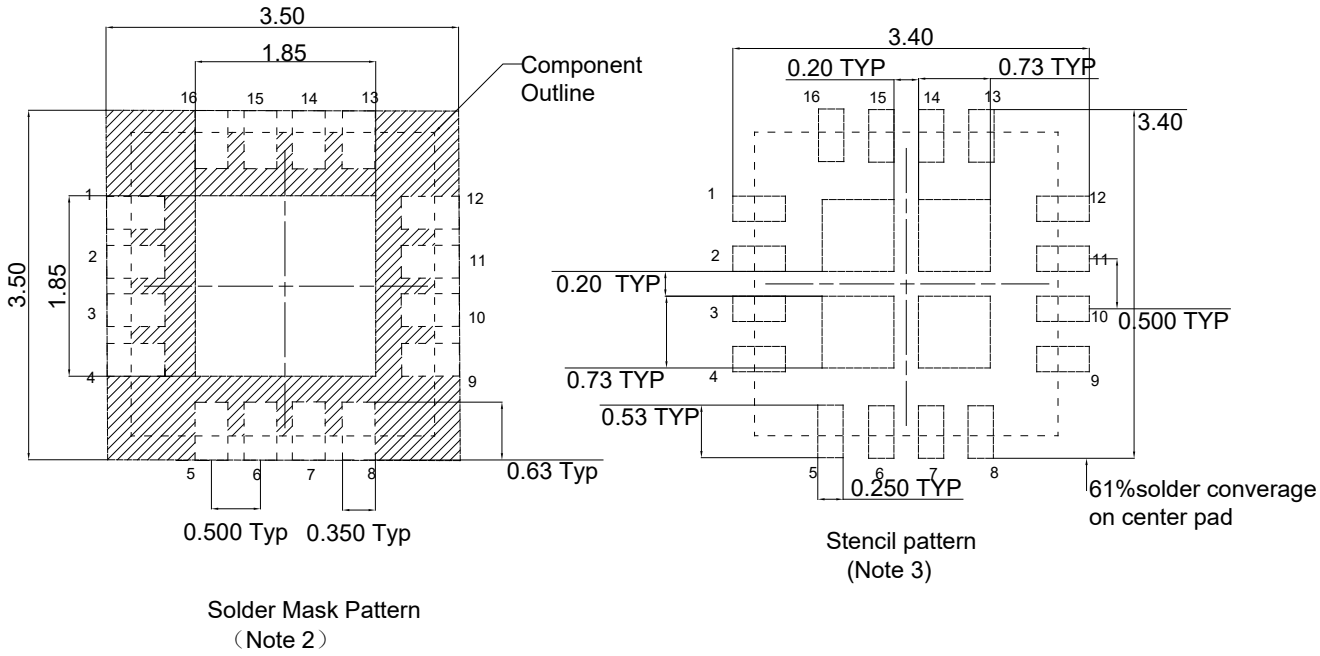


Figure 4. CB2401 Evaluation Board Assembly Drawing

PCB LAND PATTERN



NOTES:

1. Via hole recommendations:0.025mm Cu via wall plating(minimum).
   solder mask oon the far side should tent or plug via holes.
2. Soldermask recommendations:contact board fabricator for recommended
   soldermask offset and tolerance.
3. Stencil recommenfations:
   0.125 mm stencil thickness laser cut apertrues,
   trapezoidal walls and rounded comers offer better paste release.

Figure 5. CB2401 PCB Layout Footprint

TYPICAL PART MARKING

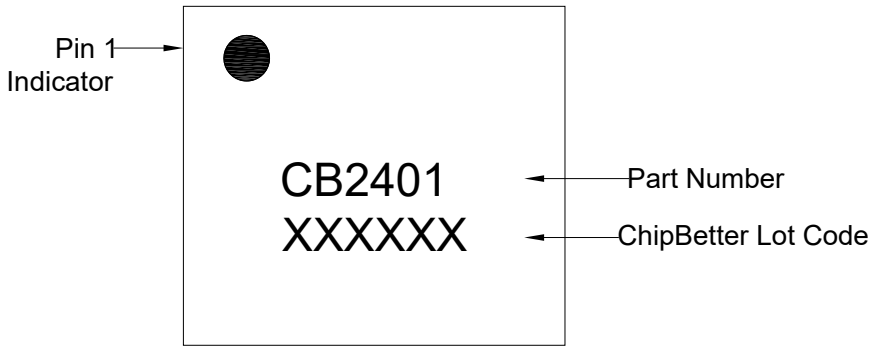
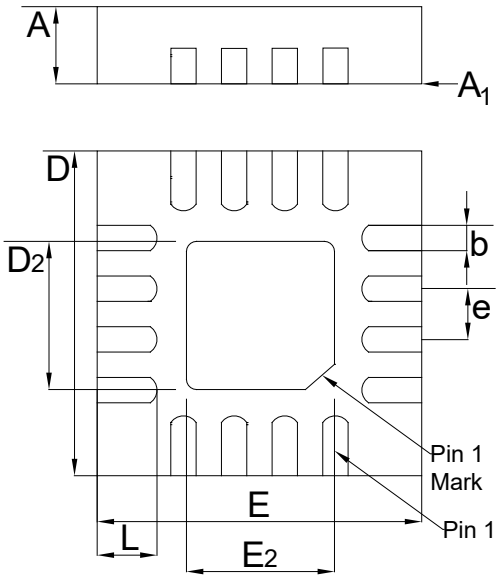


Figure 6. Typical Part Marking for the CB2401

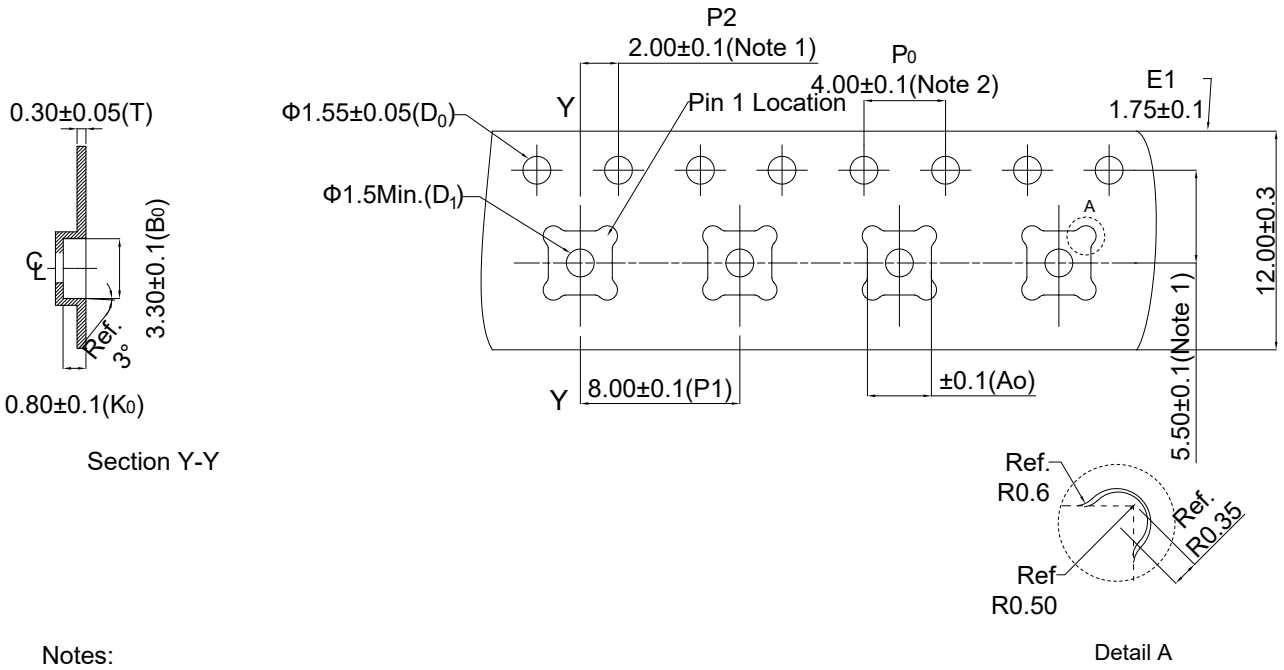
PACKAGE DIMENSIONS (All Dimensions in mm):



Dimensions (MM)			
	Min	Nom	Max
A	0.5	0.55	0.6
A_1	0.00	0.02	0.05
b	0.20	0.25	0.30
D	2.90	3.00	3.10
D_2	1.65	1.70	1.75
E	2.90	3.00	3.10
E_2	1.65	1.70	1.75
e	0.45	0.50	0.55
L	0.35	0.40	0.45

Figure 7. CB2401 Package Dimension

TAPE AND REEL DIMENSIONS



Notes:

1. Measured from center line of sprocket hole to center line of pocket.
2. Cumulative toelrance of 10 sprocket holes is ± 0.20mm.
3. Other material available.
4. Typical ESD surface resistivity is from 10^5 to 10^{11} Ohms/square per EIA,JEDEC.

All measurements are in millimeters.

Figure 8. CB2401 Tape and Reel Dimensions

CONTACT INFORMATION

For the latest specifications, additional product information, worldwide sales and distribution locations:

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