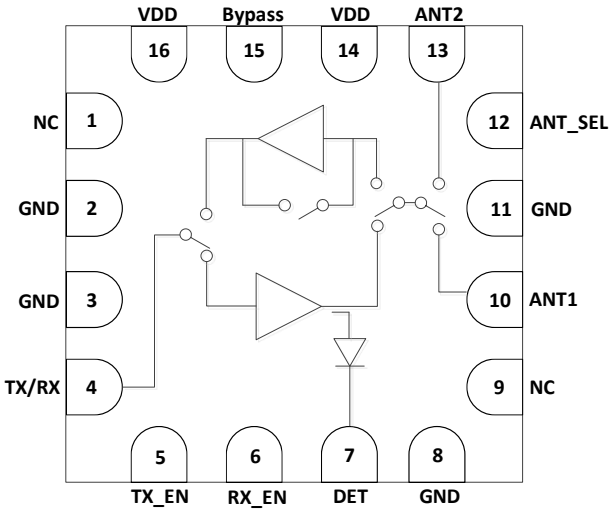
# 2.4G IoT/ZIGBEE HIGH EFFICIENCY RF FRONT END IC




## Description

KCT8206L is a fully integrated RFIC (RF Front-end Integrated Circuit) which incorporates key RF functionality. It integrates a high-efficiency PA, a low noise amplifier (LNA) with bypass mode, Transmit and Receive switching circuitry, the associated matching network, a harmonic filter and a diversity switch all in one device. The PA power detect circuit is also integrated.

KCT8206L has simple and low-voltage control logic, and requires minimal external components. Moreover, KCT8206L has ruggedized ESD, and VSWR protection.

KCT8206L is designed for use in 2.4GHz ISM band and supports the 802.15.4 and ZigBee standard. It's the perfect RF Front-end solution for applications requiring extended range and bandwidth.

## Applications

- ZigBee Extended Range Devices
- Wireless Sensor Networks
- IoT
- Bluetooth
- Home and Industrial Automation
- Custom 2.4GHz Radio Systems
- Remote Control

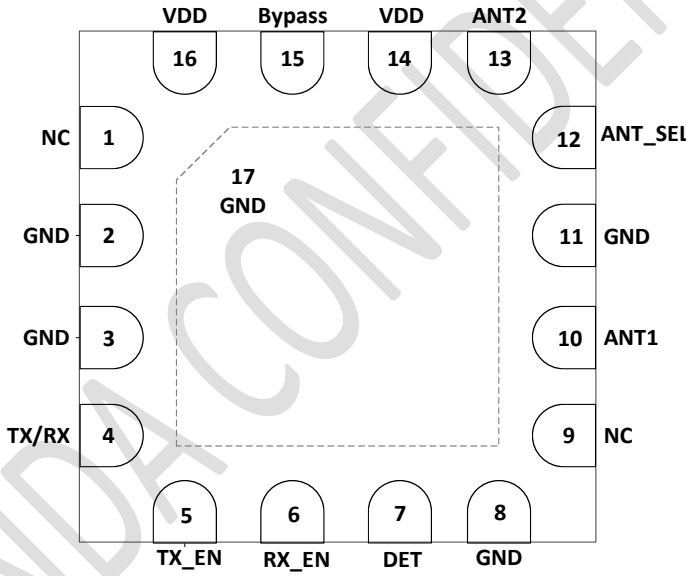
## FEATURES

- 2.4GHz ZigBee High Power, Fully Integrated RF Front-End IC with 22.5dBm Output Power
- Full On-chip 50Ω Input / Output Matching, Integrate Output Filter for Spurs / Harmonics Rejection
- Integrated Power Detector for Transmit Power Monitor and Control
- Dual Antenna for Range-extension
- Very Low DC Power Consumption
- Integrated Receive Bypass Function
- ESD Protection Circuitry on All Ports
- Small package: QFN-16L, 3mm × 3mm × 0.75mm (MSL3, 260 °C per JEDEC J-STD-020)
- Minimal External Components Required
- RoHS and REACH Compliant

## PIN ASSIGNMENTS

| Pin Number | Pin Name | Description |
|---|---|---|
| 1,9 | NC | Internally not connected |
| 2,3,8,11,17 | GND | Ground – must be connected to ground in the application circuit |
| 4 | TXRX | RF signal to / from the transceiver - DC Shorted to GND |
| 5 | TX_EN | TX Enable |
| 6 | RX_EN | RX Enable |
| 7 | DET | DC power detector |
| 10 | ANT1 | Antenna port – RF signal from the PA or RF signal applied to the LNA - DC Shorted to GND |
| 12 | ANT_SEL | Input for antenna diversity selection |
| 13 | ANT2 | Antenna port – RF signal from the PA or RF signal applied to the LNA - DC Shorted to GND |
| 14,16 | VDD | LNA Supply Voltage |
| 15 | Bypass | Input for bypass mode |

## PIN-OUT DIAGRAM




## ABSOLUTE MAXIMUM RATINGS

| Parameters | Units | Min | Max | Conditions |
|---|---|---|---|---|
| DC VDD Voltage Supply | V | 0 | 4.0 | All VDD Pins |
| DC Control Pin Voltage | V | 0 | 3.6 | |
| DC VDD Current Consumption | mA | | 350 | Through VDD Pins when TX is “ON” |
| DC Control Pin Current Consumption | uA | | 1 | |
| TX RF Input Power | dBm | | +5 | All Operating Modes |
| ANT RF Input Power | dBm | | +5 | When RX is “ON” |
| Junction Temperature | $^{o}$C | | 150 | |
| Storage Ambient Temperature | $^{o}$C | -50 | 150 | No RF and DC Voltage Applied Appropriate care required according to JEDEC Standards |

*NOTE: Sustained operation at or above the Absolute Maximum Ratings for any one 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.*

## NOMINAL OPERATING CONDITIONS

| Parameters | Units | Min | Typical | Max | Conditions |
|---|---|---|---|---|---|
| DC VDD Voltage Supply | V | 1.8 | 3.3 | 3.6 | All VDD Pins |
| Control Voltage “High” | V | 1.2 | | 3.3 | |
| Control Voltage “Low” | V | 0 | | 0.3 | |
| DC Control Pin Current Consumption | uA | | 1 | | |
| DC Shutdown Current | uA | | 2 | | |
| PA Turn On/Off Time | usec | | | 1 | |
| LNA Turn On/Off Time | usec | | | 1 | |
| Antenna Switch Time | usec | | | 1 | |
| Operating Ambient Temperature | ºC | -40 | | 125 | See note 2 |

*NOTE 2: For operation above +85* ºC, use the θja as guidance for system design to assure the junction temperature will not exceed the maximum of +150 ºC.

## KCT8206L ELECTRICAL SPECIFICATIONS

*(VDD= 3.3V, T = 25* ºC, *All RF Pins Terminated by 50 Ohm, Unless Otherwise Noted)*

| Parameters | Units | Min | Typical | Max | Conditions |
|---|---|---|---|---|---|
| Frequency Range | GHz | 2.4 | | 2.5 | |
| ***Transmit Mode*** | | | | | |
| Gain | dB | 22 | 24 | 27 | CW Signal; Input Power=-25dBm |
| Gain Flatness | dB | | ±0.3 | | Across any 40MHz bandwidth |
| Saturated output power | dBm | 20 | 21.5 | | |
| Current | mA | <br>115<br>140 | 33<br>135<br>170 | 45<br>155<br>200 | 100% duty modulated signal<br>@ No RF<br>@+20.0dBm<br>@+21.5dBm |
| Harmonics<br>2nd harmonics<br>3rd harmonics | dBm/MHz | | <br>-17<br>-10 | <br>-12<br>-5 | Pout=+20dBm, IEEE 802.15.4<br>CW signal |
| Input Return Loss | dB | 6 | 10 | | |
| Output Return Loss | dB | | 5 | | |
| Input / Output Impedance Single-Ended | ohm | | 50 | | |
| ***Receive Mode*** | | | | | |
| Gain | dB | 14 | 16 | 18 | |
| Noise Figure | dB | | 3 | 3.5 | |
| Input power of P1dB | dBm | -12 | -10 | | At ANT Pin |
| Input Return Loss | dB | 5 | 8 | | |
| Output Return Loss | dB | 5 | 8 | | |
| LNA Current | mA | | 9 | | No RF Applied |
| ***Bypass Mode*** | | | | | |
| Insertion Loss | dB | 3 | 5 | 7 | |
| Input power of P1dB | dBm | 8 | 10 | | At ANT1 or ANT2 Pin |
| Bypass Current | μA | 0 | 2 | 10 | |

## CONTROL LOGIC TABLE

| TX_EN | RX_EN | Bypass | Mode of Operation |
|---|---|---|---|
| 1 | X | X | Transmit Mode |
| 0 | 1 | NC/0 | Receive LNA Mode |
| 0 | 1 | 1 | Receive Bypass Mode |
| 0 | 0 | 0 | Shutdown Mode |

*Note: "1" denotes high voltage state*
*"0" denotes low voltage state*

| ANT_SEL | Mode of ANT |
|---|---|
| NC/0 | ANT1 |
| 1 | ANT2 |

## PRODUCT QUALIFICATION

| Parameters | Units | Min | Max | Conditions |
|---|---|---|---|---|
| ESD – Human Body Mode | V | | 5000 | HBM |
| ESD – Charge Device Mode | V | | 1500 | CDM |

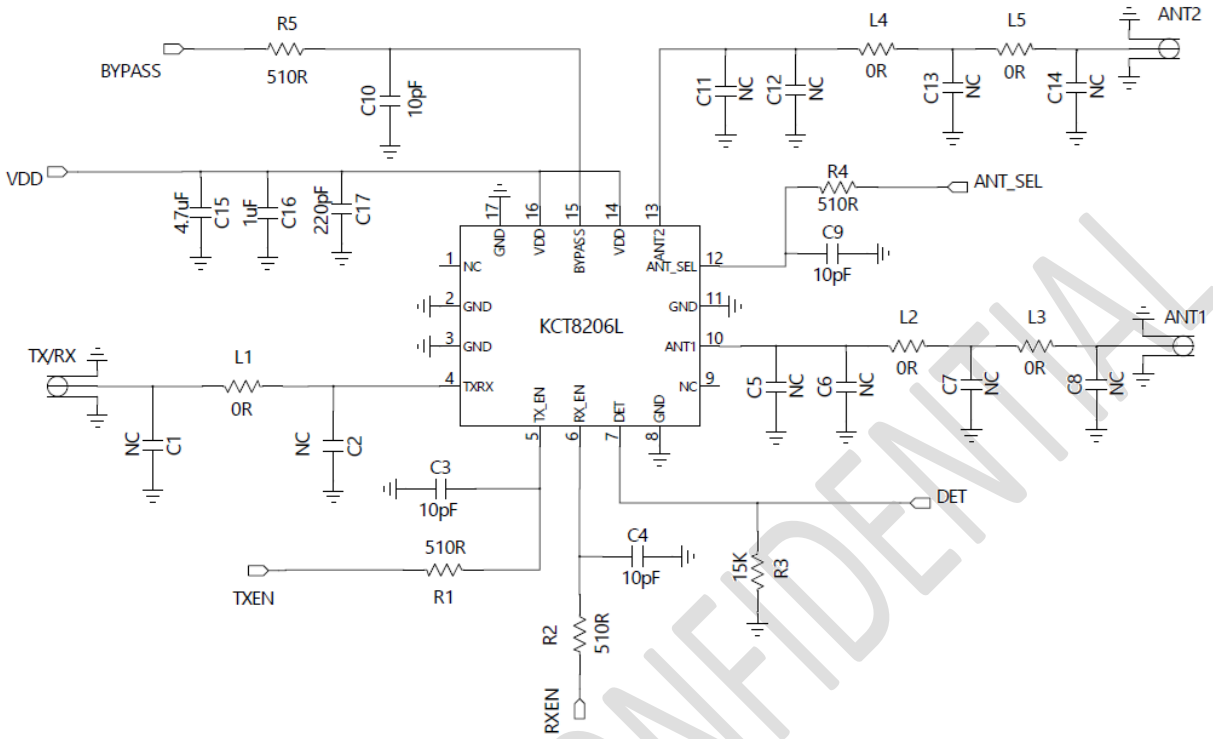
***ESD HANDLING:*** *Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection.*

*Industry-standard ESD handling precautions should be used at all times.*

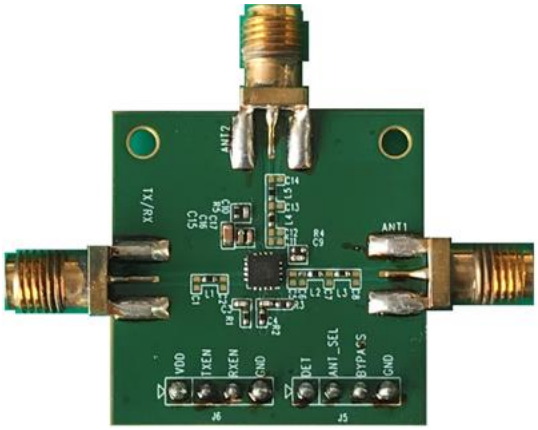
## ORDERING INFORMATION

| Product Description | Product Part Number | Package Type | Package Quantity |
|---|---|---|---|
| KCT8206L: 2.4GHz WLAN Front-End Module | KCT8206L | 13'' tape and reel | 5000pcs / reel |

## APPLICATION SCHEMATIC



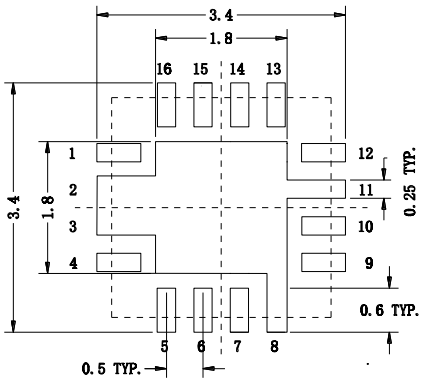
## EVB PICTURE and EVB BOM



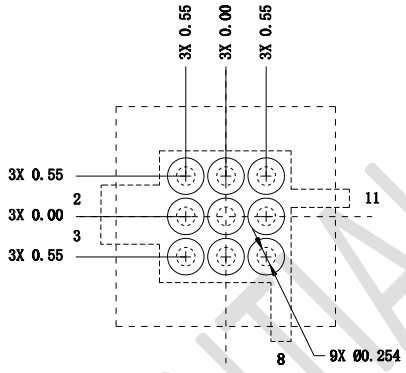

[EVB Assembly]

| Designator | Value | Footprint | Notes |
|---|---|---|---|
| C3,C4,C9,C10 | 10PF | 0402 | Murata C0G series |
| C17 | 220PF | 0402 | Murata X5R/X7R series |
| C16 | 1μF | 0402 | Murata X5R/X7R series |
| C15 | 4.7μF | 0603 | Murata X5R/X7R series |
| L1,L2,L3,L4,L5 | 0 ohm | 0402 | Yageo RC0402 series |
| R3 | 15K ohm | 0402 | Yageo RC0402 series |
| R1,R2,R4,R5 | 510 ohm | 0402 | Yageo RC0402 series<br>Control pin protect resistor |

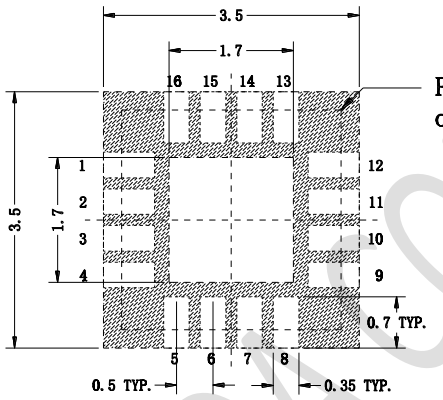
PCB LAYOUT FOOTPRINT (All dimensions are in millimeters)



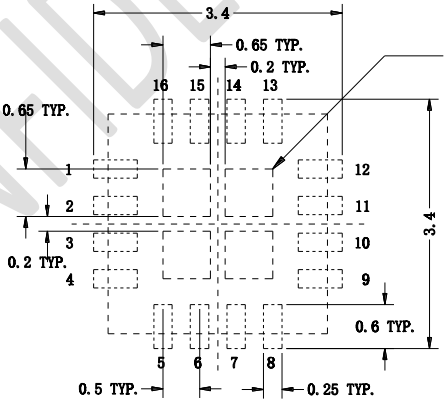

Board Metal




Via Pattern

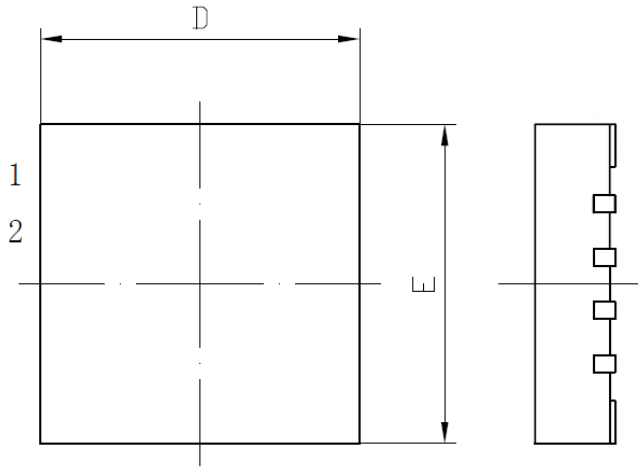



Solder Mask Pattern

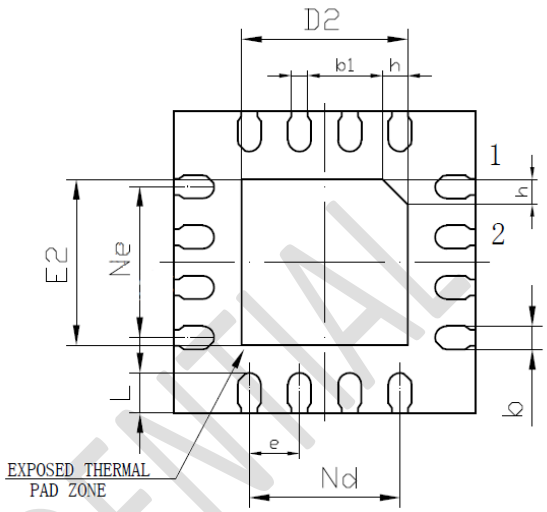



Stencil Pattern

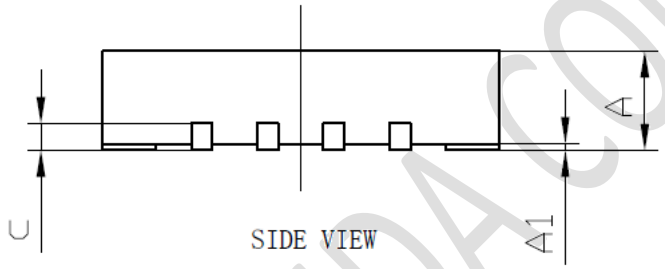
PACKAGE DIMENSIONS (All Dimensions in mm):




TOP VIEW

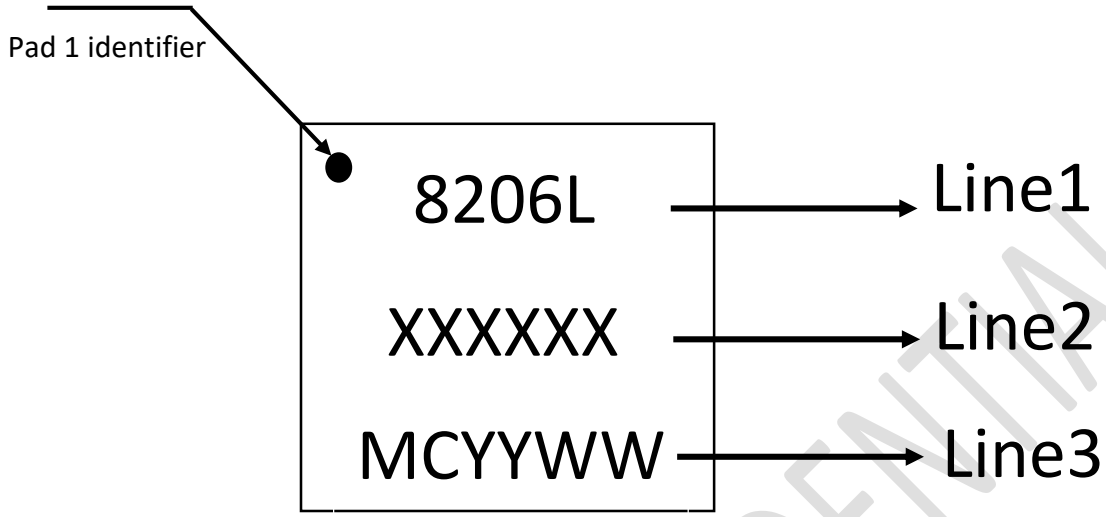



BOTTOM VIEW




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 |
| | 0.80 | 0.85 | 0.90 |
| | 0.85 | 0.90 | 0.95 |
| A1 | 0 | 0.02 | 0.05 |
| b | 0.18 | 0.25 | 0.30 |
| b1 | 0.16REF | | |
| c | 0.18 | 0.20 | 0.25 |
| D | 2.90 | 3.00 | 3.10 |
| D2 | 1.55 | 1.65 | 1.75 |
| e | 0.50BSC | | |
| Ne | 1.50BSC | | |
| Nd | 1.50BSC | | |
| E | 2.90 | 3.00 | 3.10 |
| E2 | 1.55 | 1.65 | 1.75 |
| L | 0.35 | 0.40 | 0.45 |
| h | 0.20 | 0.25 | 0.30 |
| L/F 载体尺寸 (mil) | 75×75 | | |

## PART MARKING




| Line | Marking | Description |
|---|---|---|
| 1 | 8206L | Product name |
| 2 | XXXXXX | Lot information |
| 3 | MCYYWW | MC: Manufacturer Code<br>YYWW: YY year WW week |

PIN 1 DIRECTION IN CARRIER TAPE