

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Applications

- Smart Meters
- In-home appliances
- Smart thermostats

Features

- Integrated PA with 27 dBm output power
- Integrated LNA with programmable bypass
- Integrated antenna switching with Tx and Rx diversity function
- Low FEM noise figure of 2.5 dB typical
- Differential 100 Ω common Tx/Rx RF interface
- Fast switch ON/OFF time <1 μsec
- 2.0 V – 4.8 V supply operation
- Sleep mode current <1 μA
- 4 x 4 x 0.9 mm 24 pin QFN
- Pb-free, RoHS compliant and Halogen free

Product Description

The SE2436L is a high performance, fully integrated RF Front End Module designed for ZigBee/Smart Energy and 802.15.4 applications requiring high transmit power.

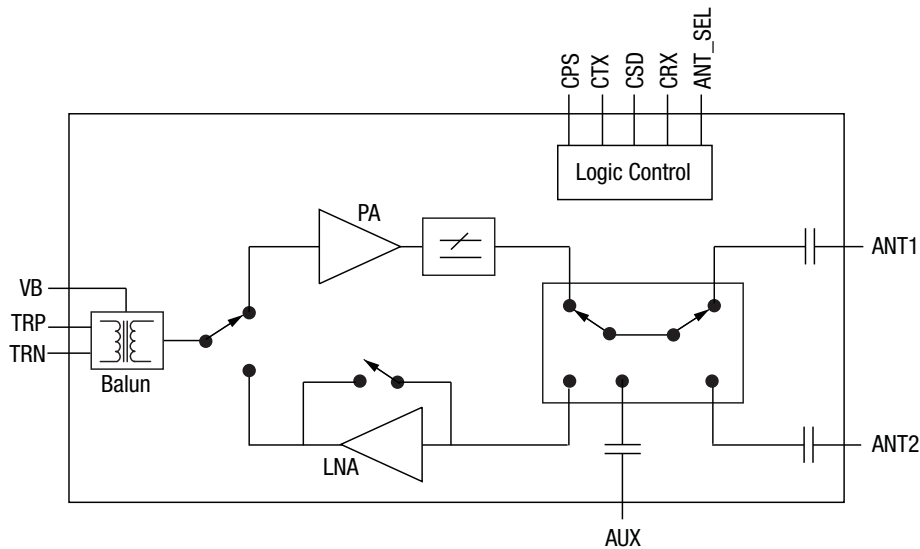
The SE2436L is designed for ease of use and maximum flexibility, with fully matched 50 Ω output, and 100 Ω differential input, integrated inter-stage matching and harmonic filter, and digital controls compatible with 1.6 – 3.6 V CMOS levels.

The RF blocks operate over a wide supply voltage range from 2.0 to 4.8V allowing the SE2436L to be used in battery powered applications over a wide spectrum of the battery discharge curve.

Ordering Information

| Part No. | Package | Remark |
|-------------|------------|----------------|
| SE2436L-S | 24 pin QFN | Samples |
| SE2436L-R | 24 pin QFN | Tape & Reel |
| SE2436L-EK1 | N/A | Evaluation kit |

Functional Block Diagram



K071

Figure 1: Functional Block Diagram

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Pin Out Diagram

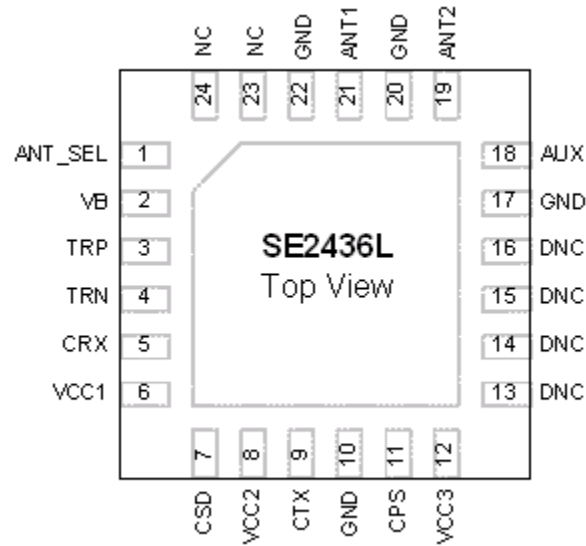


Figure 2: SE2436L Pinout

Pin Out Description

| Pin No. | Name | Description |
|---------|---------|---|
| 1 | ANT_SEL | Connect to GPIO signal to control antenna switch (see “Logic controls” table) |
| 2 | VB | I/O balun DC connection (optional, please refer to SoC or RFIC requirements) |
| 3 | TRP | Transmit/Receive port from/to transceiver, 100 Ω differential |
| 4 | TRN | Transmit/Receive port from/to transceiver, 100 Ω differential |
| 5 | CRX | Connect to GPIO signal to control SE2436L modes (see “Logic controls” table) |
| 6 | VCC1 | Connect to positive supply |
| 7 | CSD | Connect to GPIO signal to control SE2436L modes (see “Logic controls” table) |
| 8 | VCC2 | Connect to positive supply |
| 9 | CTX | Connect to GPIO signal to control SE2436L modes (see “Logic controls” table) |
| 10 | GND | Connect to PCB ground |
| 11 | CPS | Connect to GPIO signal to control SE2436L modes (see “Logic controls” table) |
| 12 | VCC3 | Connect to positive supply |
| 13 | DNC | Leave unconnected |
| 14 | DNC | Leave unconnected |
| 15 | DNC | Leave unconnected |
| 16 | DNC | Leave unconnected |

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

| Pin No. | Name | Description |
|---------|------|--|
| 17 | GND | Connect to PCB ground |
| 18 | AUX | Auxiliary I/O port |
| 19 | ANT2 | Connect to 50 Ω antenna |
| 20 | GND | Connect to PCB ground |
| 21 | ANT1 | Connect to 50 Ω antenna |
| 22 | GND | Connect to PCB ground |
| 23 | NC | Not internally connected |
| 24 | NC | Not internally connected |
| Paddle | GND | Exposed die paddle; electrical and thermal ground; Connect to PCB ground |

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module
Absolute Maximum Ratings

These are stress ratings only. Exposure to stresses beyond these maximum ratings may cause permanent damage to, or affect the reliability of the device. Avoid operating the device outside the recommended operating conditions defined below. This device is ESD sensitive. Handling and assembly of this device should be at ESD protected workstations.

| Symbol | Definition | Min. | Max. | Unit |
|----------------------|--------------------------------------|------|------|------|
| VCC | Supply Voltage | -0.3 | 4.8 | V |
| T _{OP} | Operating temperature | -40 | 85 | °C |
| T _{STORAGE} | Storage temperature | -40 | 125 | °C |
| | ESD all pins (HBM) | - | 1000 | V |
| Pin_Tx_max | Tx input power at TR port | - | +6 | dBm |
| Pin_Rx_max | Rx input power at ANT1 or ANT2 ports | - | +10 | dBm |
| VSWR | Voltage Standing Wave Ratio | | 10:1 | |

Recommended Operating Conditions

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|----------------|--|------|------|------|------|
| T _A | Ambient temperature | -40 | 25 | 85 | °C |
| | Current drive capability from VB_IN to TRN and TRP ports | | | 30 | mA |
| VCC | Supply voltage on VCC | 2.0 | 4.0 | 4.8 | V |
| | Logic input voltages | 0 | - | 3.6 | V |

DC Electrical Characteristics

Conditions: VCC = 4.0 V, T_A = 25 °C, as measured on Skyworks Solutions's SE2436L-EK1 evaluation board (de-embedded to device), unless otherwise noted

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--------------------------|----------------------|--|------|------|------|------|
| I _{CC-Tx27} | Total Supply Current | Tx mode P _{OUT} = 27 dBm CPS = CSD = CTX = Logic '1' | - | 400 | - | mA |
| I _{CQ-Tx} | Quiescent Current | No RF CPS = CSD = CTX = Logic '1' | - | 80 | - | mA |
| I _{CC-Rx} | Total Supply Current | Rx mode CRX = CPS = CSD = Logic '1', CTX = 0 V | - | 5 | 7 | mA |
| I _{CC-RxBypass} | Total Supply Current | Rx bypass mode CRX = CSD = Logic '1', CPS = CTX = 0 V | - | - | 300 | uA |

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------|----------------------|--|------|------|------|------|
| I _{CC_OFF} | Sleep Supply Current | No RF, CSD = 0 V or CRX = CTX = 0 V, all digital controls at 0 V | - | - | 1 | μA |

Logic Characteristics

Conditions: VCC = 4.0 V, TA = 25 °C, as measured on Skyworks Solutions' SE2436L-EK1 evaluation board (de-embedded to device), unless otherwise noted.

| Symbol | Parameter | Note | Min. | Typ. | Max. | Unit |
|-----------------|------------------|------|------|------|------|------|
| V _{IH} | Logic input high | | 1.6 | - | 3.6 | V |
| V _{IL} | Logic input low | | 0 | - | 0.3 | V |
| I _{IH} | Logic input high | | - | - | 2 | μA |
| I _{IL} | Logic input low | | - | - | 1 | μA |

Logic Controls

Conditions: VCC = 4.0 V, TA = 25 °C

| Mode | Mode description | Note | CPS | CSD | CRX | CTX |
|------|----------------------|---------|-----|-----|-----|-----|
| 0 | All off (sleep mode) | 1, 3 | 0 | 0 | 0 | 0 |
| 0 | All off (sleep mode) | 1, 2, 3 | 0 | 1 | 0 | 0 |
| 1 | Rx bypass mode | 1, 2 | 0 | 1 | 1 | 0 |
| 2 | Rx mode | 1, 2 | 1 | 1 | 1 | 0 |
| 3 | TX bypass mode | 1,2 | 0 | 1 | 0 | 1 |
| 4 | Tx mode | 1, 2 | 1 | 1 | 0 | 1 |
| 5 | Auxiliary mode | 1,2 | 1 | 0 | 1 | X |

- Note:**
- (1) Logic '0' level compliant to V_{IL} as specified in the "Logic Characteristics" table
 - (2) Logic '1' level compliant to V_{IH} as specified in the "Logic Characteristics" table
 - (3) All logic signals must be in a defined state in order to meet the sleep current specification at 1 uA max

Conditions: VCC = 4.0 V, TA = 25 °C

| Mode description | Note | CPS | CSD | CTX | CRX | ANT_SEL |
|-------------------|------|-----|-----|-----|-----|---------|
| ANT1 port enabled | 1 | X | X | X | X | 0 |
| ANT2 port enabled | 2 | X | X | X | X | 1 |

- Note:**
- (1) Logic '0' level compliant to V_{IL} as specified in the "Logic Characteristics" table
 - (2) Logic '1' level compliant to V_{IH} as specified in the "Logic Characteristics" table

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

AC Electrical Characteristics, Transmit

Conditions: VCC = 4.0 V, TA = 25 °C, as measured on Skyworks Solutions' SE2436L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 Ω, unless otherwise noted.

| Symbol | Parameter | Condition | Note | Min. | Typ. | Max. | Unit |
|--------------------|------------------------------------|--|------|--|----------------|------|---------|
| F _{IN} | Frequency Range | | | 2400 | - | 2483 | MHz |
| P _{out} | Output power at ANT1 or ANT2 ports | VCC = 4.0 V VCC = 3.3 V VCC = 3.0 V | 1 | - | 27 25 22 | - | dBm |
| S ₂₁ | Small Signal Gain | | 1 | 27 | 30 | 33 | dB |
| ΔS ₂₁ | Small Signal Gain Variation | | 1 | - | - | 2 | dBp-p |
| S _{21byp} | Small Signal Gain bypass | | 1 | - | -2.5 | - | dB |
| Tx_G | Large Signal Gain Variation | Pin at 0 dBm | 1 | - | - | 1 | dBp-p |
| HD2-HD10 | Harmonics | P _{OUT} = 27 dBm | 1, 2 | - | - | -42 | dBm/MHz |
| ACP | Spectral Mask | | 1, 3 | - | - | -30 | dBm |
| Trise | Turn on time | | 4 | - | - | 800 | ns |
| Tfall | Turn off time | | 5 | - | - | 800 | ns |
| STAB | Stability | CW, P _{IN} = 0 dBm 0.1 GHz – 20 GHz Load VSWR = 6:1 | | All non-harmonically related outputs less than -42 dBm/MHz | | | |
| RU | Ruggedness | CW, P _{IN} = +6 dBm, Load VSWR = 10:1 | | No permanent damage | | | |

- Note:**
- (1) 2400 – 2483 MHz
 - (2) IEEE 802.15.4 source
 - (3) Integrated power from band edges to Fc ± 3.5 MHz
 - (4) From 50% of CTX edge to 90% of final RF output power
 - (5) From 50% of CTX edge to 10% of final RF output power

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

AC Electrical Characteristics, Receive

Conditions: VCC = 4.0 V, TA = 25 °C, as measured on Skyworks Solutions' SE2436L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 Ω, unless otherwise noted.

| Symbol | Parameter | Condition | Note | Min. | Typ. | Max. | Unit |
|--------------------|---|---|------|------|------|------|------|
| F _{IN} | Frequency Range | | | 2400 | - | 2483 | MHz |
| Rx_gain | Receive gain | CPS = CSD = logic '1', CTX = logic '0' | 1 | 9.0 | 11.5 | 14 | dB |
| NF | Receive noise figure | CPS = CSD = logic '1', CTX = logic '0' | 1 | - | 2.5 | 3.5 | dB |
| IIP3 | Input 3 rd order intercept | CPS = CSD = logic '1', CTX = logic '0' | 1 | -3 | 2 | - | dBm |
| IP1dB | Input 1-dB compression point | CPS = CSD = logic '1', CTX = logic '0' | 1 | -13 | -8 | - | dBm |
| S _{11ANT} | Antenna port return loss | | 1 | - | -14 | -10 | dB |
| Trise | Turn on time | | 2 | - | - | 800 | ns |
| Tfall | Turn off time | | 3 | - | - | 800 | ns |
| G_bp | Gain in bypass mode | CPS = CTX = logic '0', CSD = logic '1' | | - | -3 | - | dB |
| IP1dB | Input 1-dB compression point in bypass mode | CPS = CTX = logic '0', CSD = logic '1' | | 19 | - | - | dBm |

- Note:**
- (1) 2400 – 2483 MHz
 - (2) From 50% of CTX edge to 90% of final RF output power
 - (3) From 50% of CTX edge to 10% of final RF output power

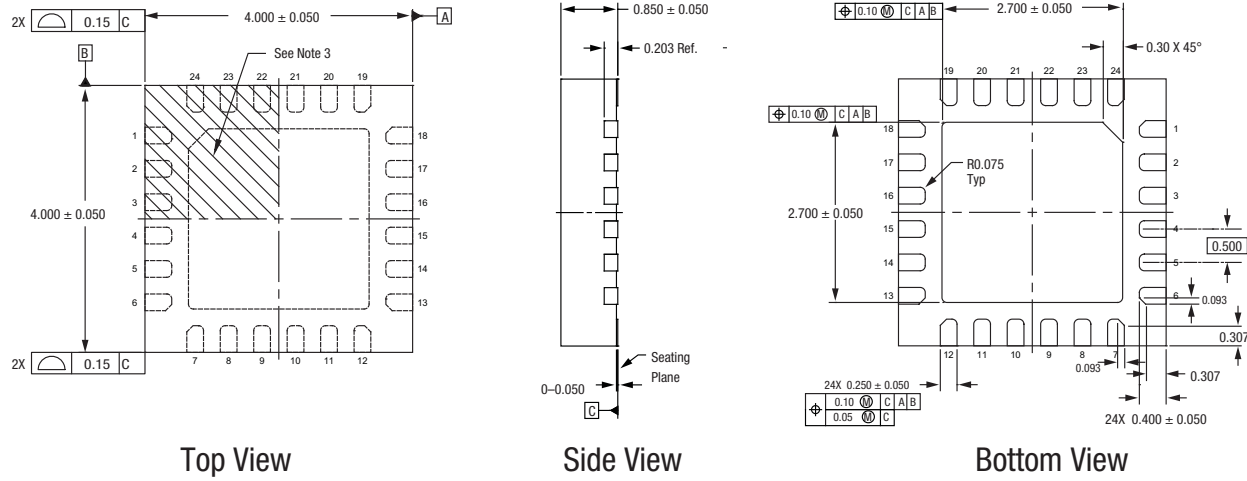
AC Electrical Characteristics, Diversity Antenna Function

Conditions: VCC = 4.0 V, TA = 25 °C, as measured on Skyworks Solutions' SE2436L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 Ω, unless otherwise noted.

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|------------------------|---|------|------|------|------|
| ISOL _{ANTSW} | Isolation Between ANT1 and ANT2 Ports | - | -20 | - | dB |
| S _{11ANT1,2} | Input return loss into 50 Ω, ANT1 and ANT2 ports | - | -14 | -6 | dB |
| S _{22ANT1,2} | Output return loss into 50 Ω, ANT1 and ANT2 ports | - | -14 | -6 | dB |
| T _{ANT1-ANT2} | Antenna 1 to Antenna 2 switching time | - | 800 | - | nsec |

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Package Drawing



- Notes:
1. All measurements are in millimeters.
 2. Dimensions and tolerances according to ASME Y14.5M-1994.
 Unless otherwise specified, the following values apply:
 Decimal Tolerance: Angular Tolerance:
 X.X (1 place) ± 0.1 mm ±1°
 X.XX (2 places) ± 0.05 mm
 X.XXX (3 places) ± 0.025 mm
 3. Terminal #1 identification mark located within marked area.
 4. Unless specified, dimensions are symmetrical about center lines.

Y0676

Figure 3: Package Drawing

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Tape and Reel Information

| Parameter | Value |
|------------------|----------------|
| Devices Per Reel | 3000 |
| Reel Diameter | 13 inches |
| Tape Width | 12 millimeters |

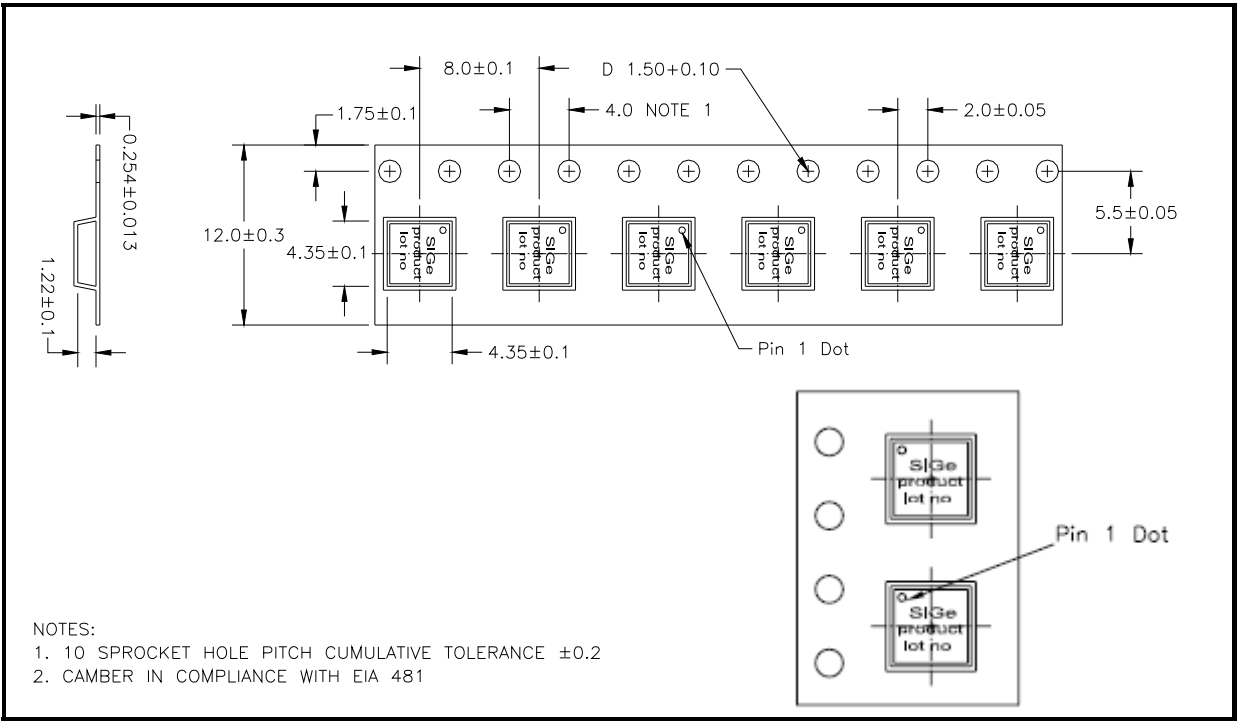


Figure 4: Detailed Tape and Reel Information (All diminsions in Millimeters)

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Recommended Reflow Temperature Profile

| Profile Feature | SnPb Eutectic Assembly | Lead (Pb) Free Assembly |
|--|------------------------|-------------------------|
| Average Ramp-up Rate (T_L to T_P) | 3°C/s (max) | 3°C/s (max) |
| Preheat | | |
| Temperature Min. (T_{smin}) | 100°C | 150°C |
| Temperature Max. (T_{smax}) | 150°C | 200°C |
| Time (Min. to Max) (t_s) | 60 - 120s | 60 - 80s |
| Ramp Up | | |
| T_{smax} to t_L | - | 3°C/s (max) |
| Time 25°C to Peak Temperature | 6 mins. (max) | 8 mins. (max) |
| Reflow | | |
| Temperature (t_L) | 183°C | 217°C |
| Time maintained above t_L | 60 - 150s | 60 - 150s |
| Peak Temperature (t_p) | 240 ±5°C | 260 +0/-5°C |
| Time Within 5°C of Actual Peak Temperature (t_p) | 10 - 30s | 20 - 40s |
| Ramp-Down | | |
| Ramp-Down Rate | 6°C/s (max) | 6°C/s (max) |



DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Reflow Profile (Reference JEDEC J-STD-020)

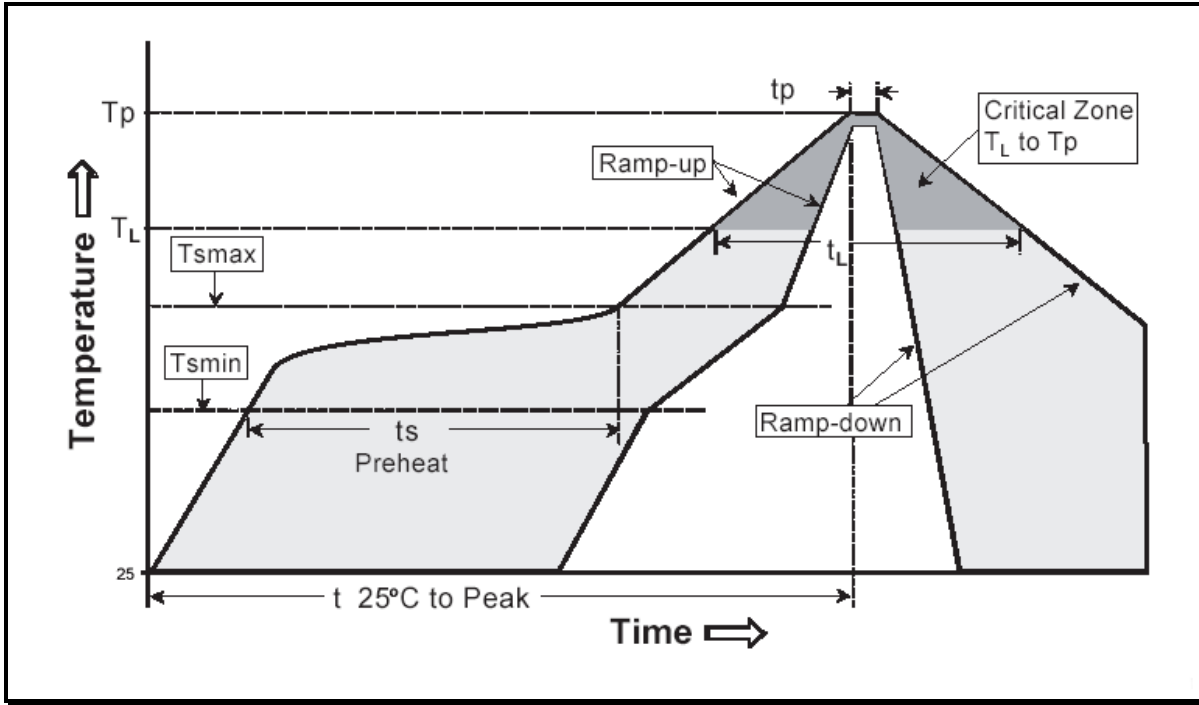


Figure 5: Reflow temperature profile

DATA SHEET
SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Branding Information

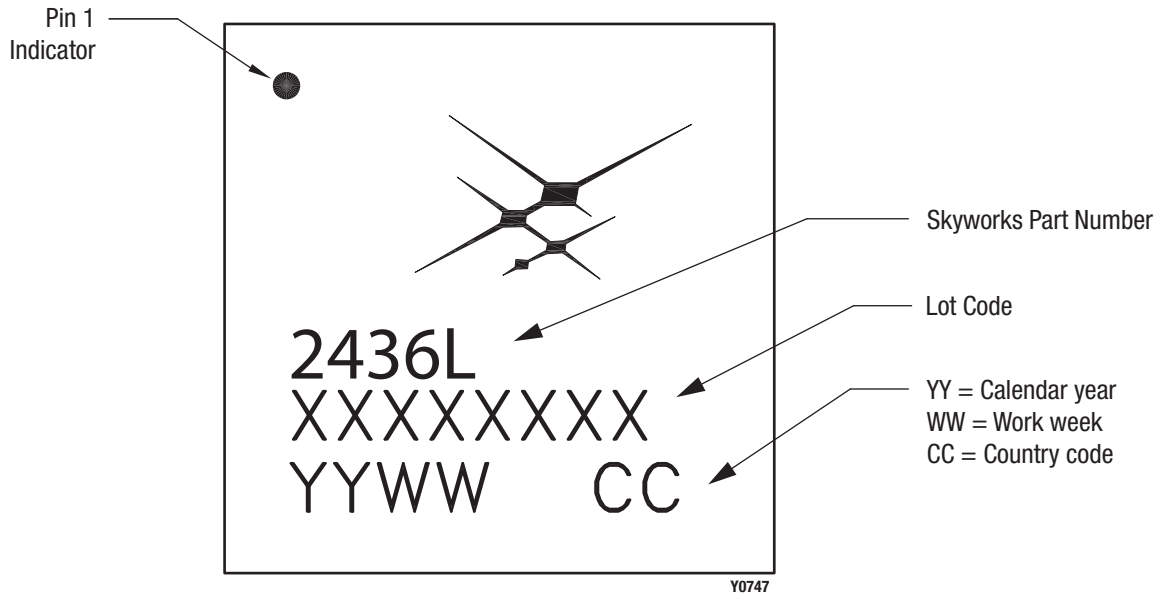


Figure 6: SE2436L Typical Part Marking

Copyright © 2012, 2014 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks.



DATA SHEET

SE2436L: High Power 2.4 GHz 802.15.4 Front End Module

Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks, the Skyworks symbol, and "Breakthrough Simplicity" are trademarks or registered trademarks of Skyworks Solutions, Inc., in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at www.skyworksinc.com, are incorporated by reference.

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».



JONHON

«**JONHON**» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А