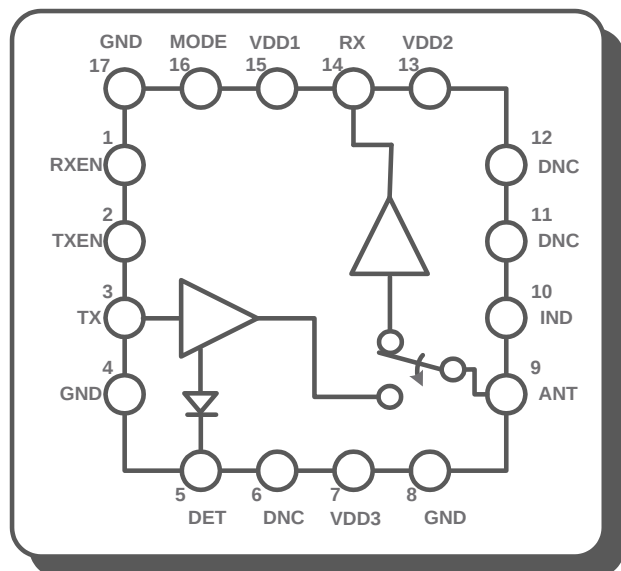


## 700 / 800 / 900MHz 0.5 WATT BROADBAND CMOS RF<sub>FE</sub>IC



### Description

The RFX1010 is a broadband, fully integrated, single-chip, single-die RF<sub>FE</sub>IC (RF Front-end Integrated Circuit) which incorporates all the RF functionality needed for a TDD-mode RF front-end operated in the 700/800/900MHz frequency bands.

The RFX1010 architecture integrates a linear PA, LNA, Transmit and Receive switching circuitry, associated matching networks, and harmonic filters all in a CMOS single-chip device. The RFX1010 requires minimal external components including the power supply bypass capacitors.

This RF<sub>FE</sub>IC is designed for medium to high output power, and consumes low current in receive mode. The combination of superior output power, high sensitivity and efficiency, low noise, small form factor and low cost makes RFX1010 the ideal solution for multiple applications including IEEE 802.15.4, ZigBee, AMR, Smart Home Area Network and other ISM applications in the sub-GHz bands from 780 to 960MHz. It can also be used for IEEE 802.11p and 802.11ah.

### Features

- ▶ 700/800/900MHz Single-Chip, Single-Die RF Front-End IC
- ▶ Separate TX and RX RF Transceiver Ports and Single Antenna Port
- ▶ 700/800/900MHz Power Amplifier with Low-Pass Harmonic Filters
- ▶ Low Noise Amplifier
- ▶ Transmit/Receive Switch Circuitry
- ▶ High Transmit Signal Linearity Meeting Standards for OQPSK Modulation
- ▶ Low Voltage (1.2V) CMOS Control Logic
- ▶ ESD Protection Circuitry on All Pins DC Grounded RF Ports
- ▶ Internal RF Decoupling on All VDD Bias Pins
- ▶ Low Noise Figure for the Receive Channel
- ▶ High Power Handling Capability for Received Signals
- ▶ Very Low DC Power Consumption
- ▶ Full On-chip Matching and Decoupling Circuitry
- ▶ Minimal External Components Required
- ▶ 50-Ohm Input / Output Matching
- ▶ Market Proven Low Cost CMOS Technology
- ▶ 3 x 3 x 0.55mm Small Outline QFN-16 Package with Exposed Ground Pad

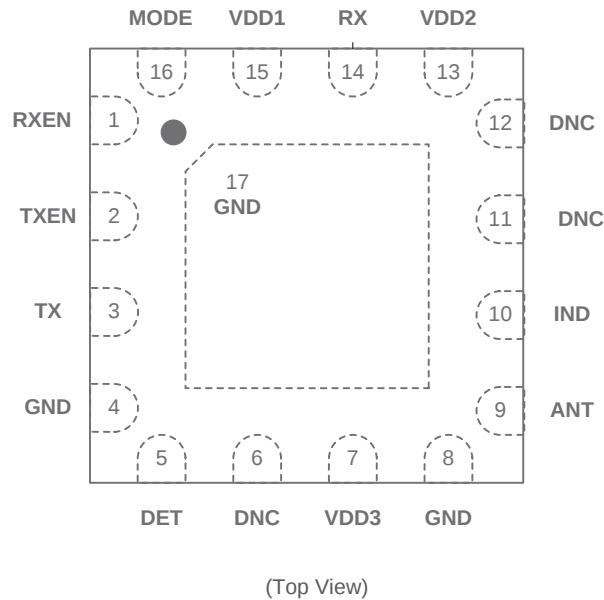
### Applications

- ▶ N. America 900MHz ISM Systems
- ▶ E Europe 870MHz SRD Systems
- ▶ Smart Grid/AMR/AMI
- ▶ Smart Home Appliances
- ▶ Remote Sensor and Control
- ▶ Other 700/800/900MHz Radios

### PIN ASSIGNMENTS:

| Pin Number | Pin Name | Description                                                       |
|------------|----------|-------------------------------------------------------------------|
| 1          | RXEN     | CMOS Input to Enable Receive Mode                                 |
| 2          | TXEN     | CMOS Input to Enable Transmit Mode                                |
| 3          | TX       | RF TX Signal from the Transceiver to the PA: DC Shorted to GND    |
| 5          | DET      | Analog Voltage Proportional to the PA Power Output                |
| 4, 8, 17   | GND      | Ground – Must Be Connected to Ground in the Application Circuit   |
| 7          | VDD3     | Voltage Supply Connection for the Power Stage of PA               |
| 9          | ANT      | Common RF Port Connected to the Antenna, DC Shorted to GND        |
| 10         | IND      | Port for Connecting ANT Matching Inductor                         |
| 6, 11, 12  | DNC      | Do Not Connect – Must be left floating in the Application Circuit |
| 13         | VDD2     | Voltage Supply Connection for the LNA                             |
| 14         | RX       | RF RX Signal from the LNA to the Transceiver, DC Shorted to GND   |
| 15         | VDD1     | Voltage Supply Connection for the Driver Stage of PA              |
| 16         | MODE     | CMOS Input to Control High Gain/Low Gain for RX                   |

### PIN-OUT DIAGRAM:



**ABSOLUTE MAXIMUM RATINGS:**

| Parameters                  | Units | Min | Max  | Conditions                                                                              |
|-----------------------------|-------|-----|------|-----------------------------------------------------------------------------------------|
| DC VDD Voltage Supply       | V     | 0   | 4.2  | All VDD Pins                                                                            |
| DC Control Pin Voltage      | V     | 0   | 3.6  |                                                                                         |
| TX RF Input Power           | dBm   |     | +7   |                                                                                         |
| ANT RF Input Power          | dBm   |     | +5   | When RX is "ON"                                                                         |
| Junction Temperature        | °C    |     | +150 |                                                                                         |
| Storage Ambient Temperature | °C    | -50 | +150 | No RF and DC Voltages Applied<br>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.*

**RECOMENDED OPERATING CONDITIONS:**

| Parameters                     | Units | Min | Typ | Max  | Conditions                |
|--------------------------------|-------|-----|-----|------|---------------------------|
| DC VDD Voltage Supply (Note 1) | V     | 2.7 | 3.3 | 3.6  | All VDD Pins              |
| Control Voltage "High"         | V     | 1.2 |     | VDD  | RXEN, TXEN, and MODE Pins |
| Control Voltage "Low"          | V     |     |     | 0.3  | RXEN, TXEN, and MODE Pins |
| Operating Ambient Temperature  | °C    | -40 |     | +125 | See note 2                |
| $\theta_{ja}$                  | °C/W  |     | 38  |      |                           |

*Note 1 – For normal operation of the RFX1010, VDD must be continuously applied to all VDD supply pins.*

*Note2 – For operation above +85 °C, use the  $\theta_{ja}$  as guidance for system design to assure the junction temperature will not exceed the maximum of +150 °C.*

**DC Characteristics (VDD=3.3V; T=+25 °C)**

| Parameters                              | Units | Min | Typ | Max | Conditions                |
|-----------------------------------------|-------|-----|-----|-----|---------------------------|
| DC Control Pin Current Consumption      | µA    |     | 0.1 |     | RXEN, TXEN, and MODE Pins |
| DC Shutdown Current                     | µA    |     | 1   |     |                           |
| Transmit-Receive Switching Time         | usec  |     |     | 1   |                           |
| Shut-Down and "ON" State Switching Time | usec  |     |     | 1   |                           |

**TRANSMIT TECHNICAL PARAMETERS (VDD=3.3V; T=+25 °C)**

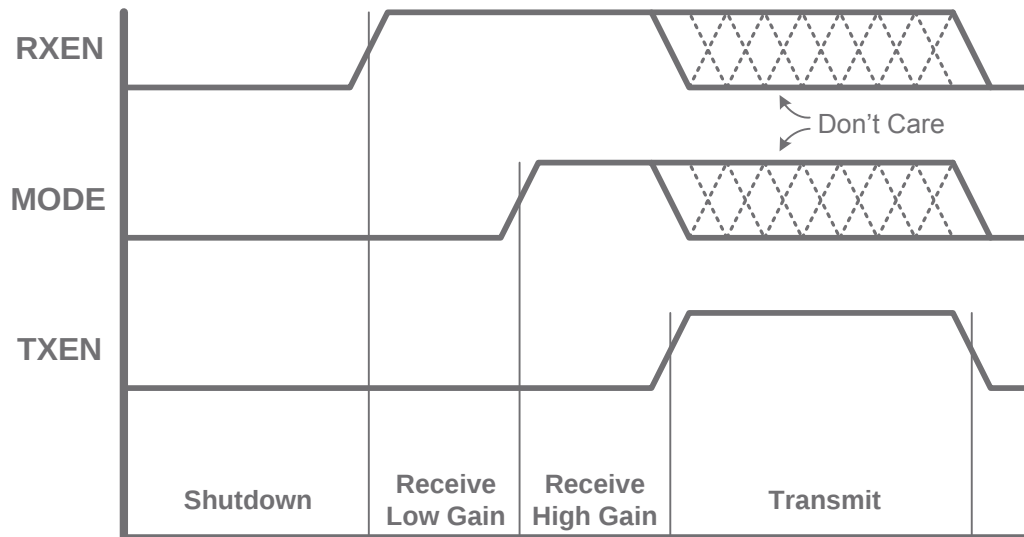
| Parameters                                | Units | Min | Typ  | Max  | Conditions                                                                                                              |
|-------------------------------------------|-------|-----|------|------|-------------------------------------------------------------------------------------------------------------------------|
| Operating Frequency Band <sup>NOTE1</sup> | MHz   | 780 |      | 960  | All RF Pins Loaded by 50-Ohms                                                                                           |
| Saturated Output Power                    | dBm   | +26 | +27  |      | In Band                                                                                                                 |
| Linear Output Power                       | dBm   |     | 16   |      | For 3% EVM, 802.11ah, 4MHz/64QAM                                                                                        |
| Large Signal Gain                         | dB    |     | 28   |      | P <sub>OUT</sub> = +27dBm                                                                                               |
| Large Signal Current                      | mA    |     | 350  |      | P <sub>OUT</sub> = +27dBm, Burst, 10% Duty Cycle                                                                        |
| Quiescent Current                         | mA    |     | 40   |      |                                                                                                                         |
| Second Harmonic                           | dBc   |     | -32  |      | P <sub>OUT</sub> = +27dBm                                                                                               |
| Third Harmonic                            | dBc   |     | -22  |      | P <sub>OUT</sub> = +27dBm                                                                                               |
| Input Return Loss (S11)                   | dB    |     | -10  |      |                                                                                                                         |
| Input/Output Impedance Single-Ended       | Ohm   |     | 50   |      |                                                                                                                         |
| Power Detector Voltage                    | mV    | 200 |      | 1800 | P <sub>out</sub> = +5 to +27dBm, 10kΩ load                                                                              |
| VSWR for stability                        |       |     | 6:1  |      | For all non-harmonic related spurs below -42dBm/MHz, P <sub>IN</sub> fixed for P <sub>OUT</sub> =+27dBm with 50ohm load |
| VSWR for ruggedness                       |       |     | 10:1 |      | No damage, Pin <= +5dBm                                                                                                 |

Note 1: Matching component will vary for different frequency bands

**RECEIVE TECHNICAL PARAMETERS (VDD=3.3V; T=+25 °C)**

| Parameters               | Units | Min | Typ | Max | Conditions                                |
|--------------------------|-------|-----|-----|-----|-------------------------------------------|
| Operating Frequency Band | MHz   | 780 |     | 960 | All RF Pins are Loaded by 50-Ohm          |
| Gain                     | dB    |     | 14  |     | High Gain Mode                            |
|                          |       |     | 12  |     | Low Gain Mode                             |
| Noise Figure             | dB    |     | 3   |     | High Gain Mode                            |
|                          |       |     | 3.5 |     | Low Gain Mode                             |
| Input Return Loss (S11)  | dB    |     | -10 |     | At ANT Pin                                |
| Output Return Loss (S22) | dB    |     | -10 |     | At RX Pin                                 |
| RF Port Impedance        | Ohm   |     | 50  |     | At RX and ANT Pins                        |
| DC Current               | mA    |     | 16  |     | P <sub>OUT</sub> < -10dBm, High Gain Mode |
| DC Current               | mA    |     | 10  |     | P <sub>OUT</sub> < -10dBm, Low Gain Mode  |
| Input P <sub>1dB</sub>   | dBm   |     | -5  |     | High Gain Mode                            |
|                          |       |     | -5  |     | Low Gain Mode                             |

## CONTROL SIGNAL DIAGRAM

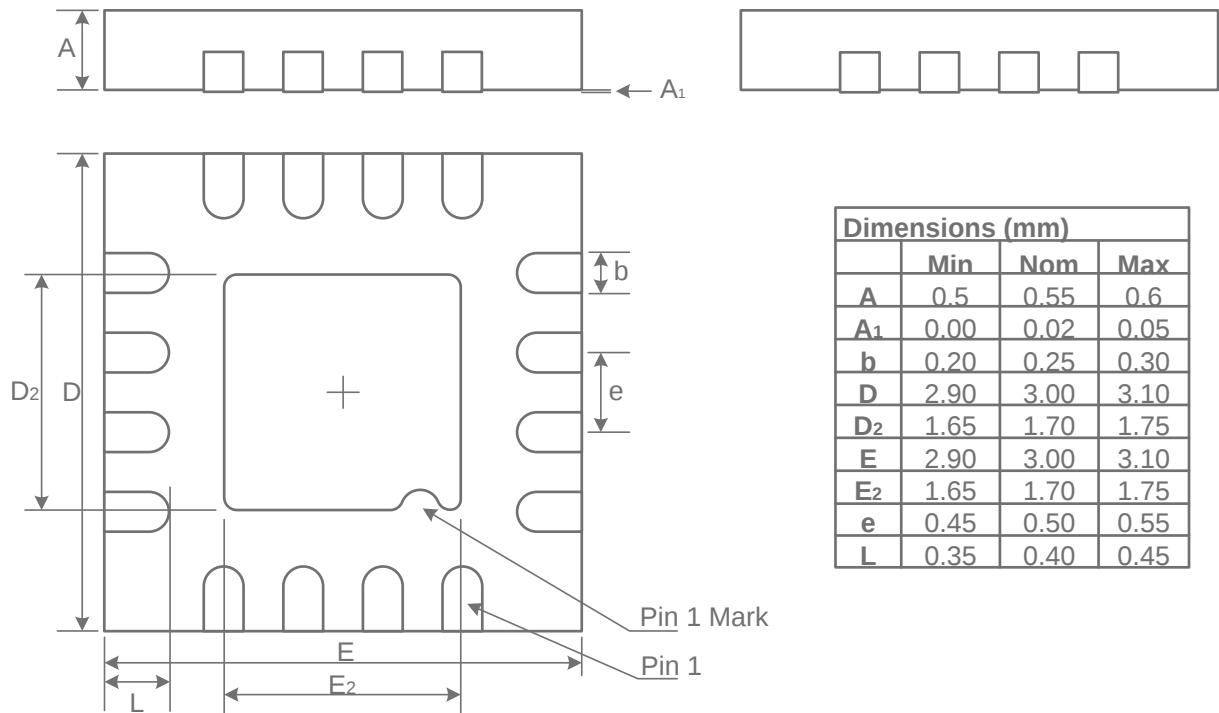


## CONTROL LOGIC TRUTH TABLE

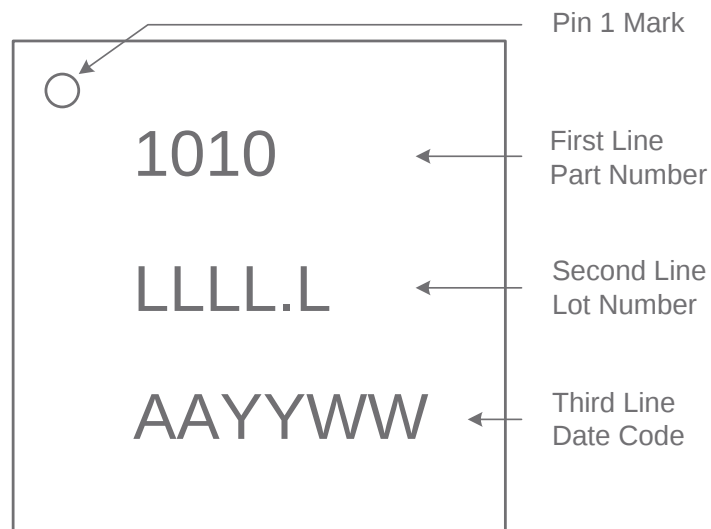
| TXON | RXON | MODE | Operating Conditions      |
|------|------|------|---------------------------|
| 0    | 0    | X    | Shut-down                 |
| 0    | 1    | 0    | RX Active, Low Gain Mode  |
| 0    | 1    | 1    | RX Active, High Gain Mode |
| 1    | X    | X    | TX Active                 |

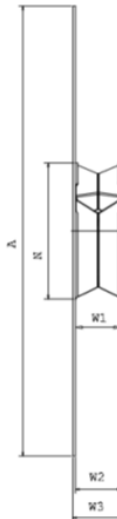
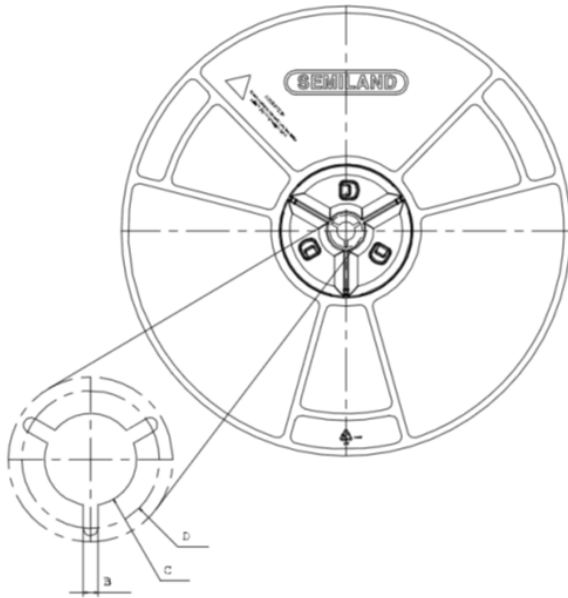
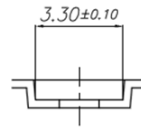
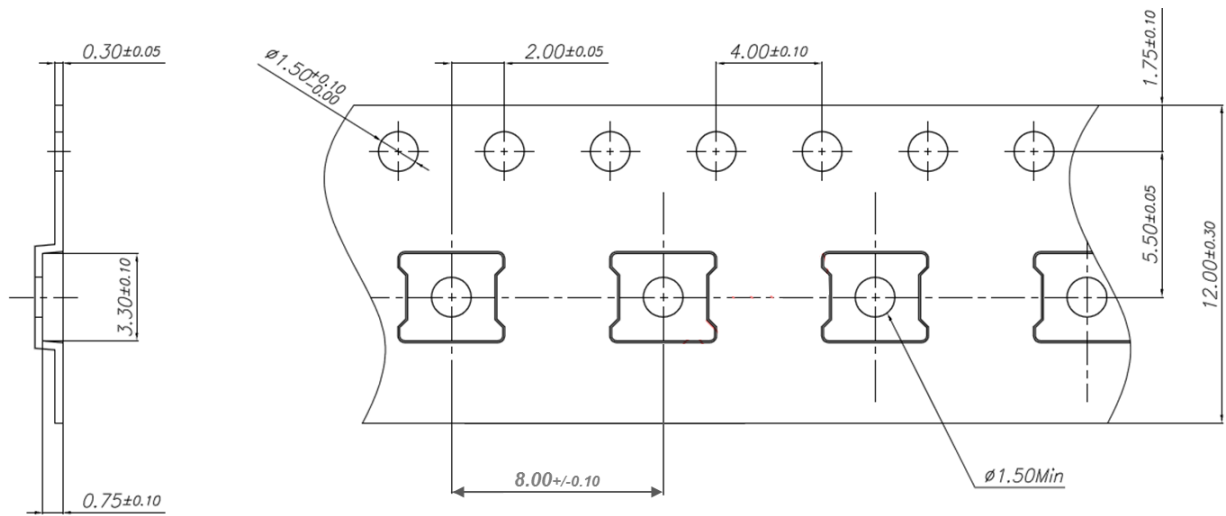
Note: "1" denotes high voltage state ( $> 1.2V$ )  
 "0" denotes low voltage stage ( $< 0.3V$ ) at Control Pins  
 "X" denotes the don't care state (Floating control pins is not allowed)

## PACKAGE DIMENSIONS



## PACKAGE MARKING





| Size  | 12mm                                 |
|-------|--------------------------------------|
| A     | 330 <sup>+0.2</sup> <sub>-2.0</sub>  |
| B     | 1.5min                               |
| C     | 13.0 <sup>+0.5</sup> <sub>-0.2</sub> |
| D     | 20.2min                              |
| N     | 100 <sup>+2.0</sup> <sub>-0.0</sub>  |
| W1    | 12.4 <sup>+3.0</sup> <sub>-0.0</sub> |
| W2    | 12.4 <sup>+3.0</sup> <sub>-0.0</sub> |
| W3    | 16.4 <sup>+2.0</sup> <sub>-2.0</sub> |
| PART# | SRL-12134H                           |

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