# CWDC136SP4

V0.3 2107

Down-conversion

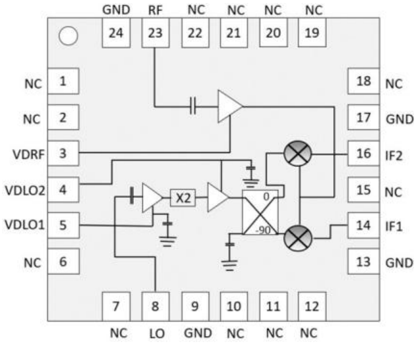
## Performance Features

- ● Conversion gain: 14.5dB
- ● Mirror rejection: 24dBc
- ● 2 LO to RF isolation: 50dB
- ● Noise factor: 2.5dB
- ● Input IP3: 1dBm
- ● Package size: 4mm*4mm 24-pin QFN

## Typical Applications

- ● Point-to-Point Communication
- ● Radar, satellite communications
- ● Point-to-Multiple Communications

## Functional Block Diagram



## Overview

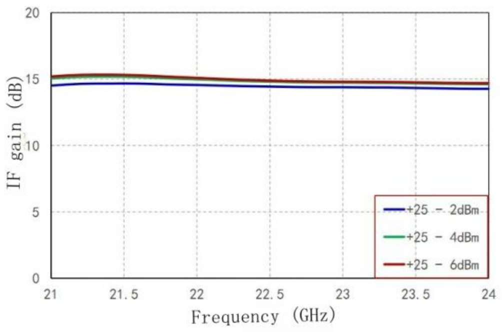
The CWDC136SP4 is a GaAs MMIC I/Q downconverter that integrates a double-balanced mixer, a fundamental quadrature amplifier, and an RF self-biasing low-noise amplifier. This downconverter is mainly used in typical commercial communication systems.

## Electrical performance table (TA=+25℃, IF=1000MHz, LO=+6dBm, VDRF/VDLO 1/VDLO 2=3.5V)

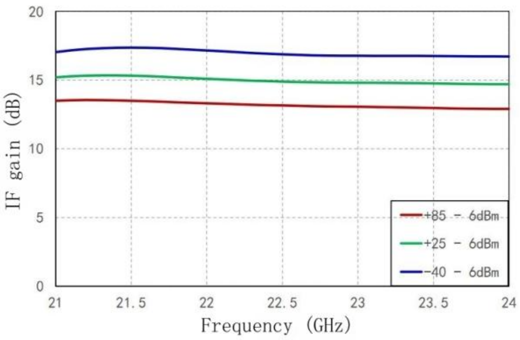
| Parameter Name | Description | Minimum value | Typical values | Maximum value | Unit |
|---|---|---|---|---|---|
| Frequency range | RF Port | | 21~24 | | GHz |
| Frequency range | LO Port | | 8.4~13.5 | | GHz |
| Frequency range | IF Port | | DC~3.5 | | GHz |
| Conversion gain | | | 14.5 | | dB |
| Noise factor | | | 2.5 | | dB |
| Mirror Suppression | | | 24 | | dBc |
| Input 1dB compression point | | | -8.5 | | dBm |
| Isolation degree | 2LO to RF port | | -50 | | dB |
| | 2LO to IF port | | -15 | | dB |
| Enter IP3 | | | 1 | | dBm |
| Operating current | | | 170 | 210 | mA |

## Test Curve

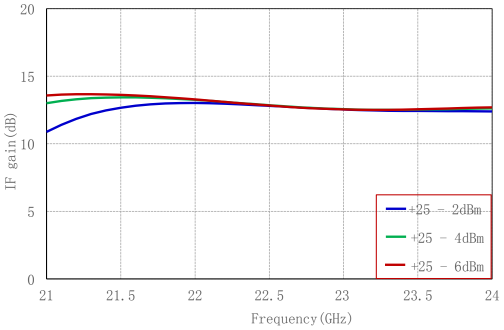
Variable gain vs. local oscillation power (USB IF=1GHz)



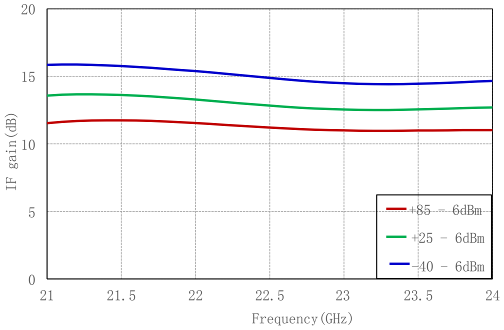
Variable gain vs. temperature (USB IF=1GHz)



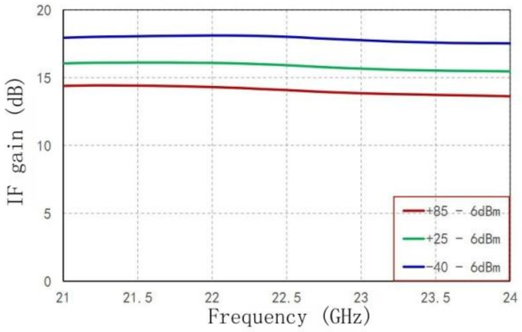
Variable gain vs. local oscillation power (USB IF=3.3GHz)



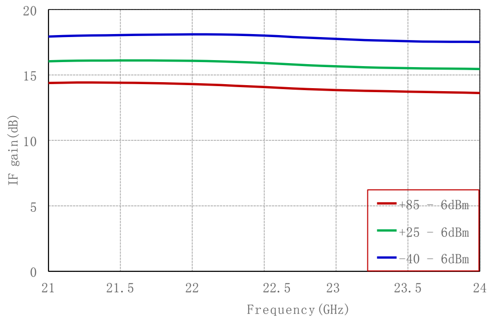
Variable gain VS temperature (USB IF=3.3GHz)



Variable frequency gain vs. local oscillation power (LSB IF=1GHz)

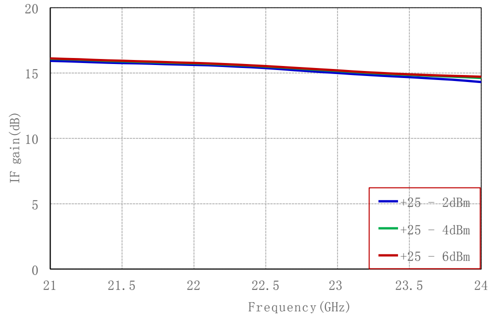


Variable frequency gain vs. temperature (LSB IF=1GHz)

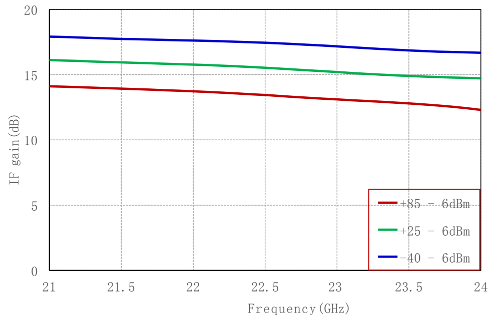


## Test Curve

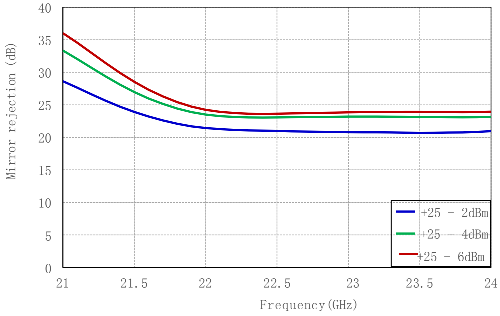
Variable frequency gain vs. local oscillation power (LSB IF=3.3GHz)



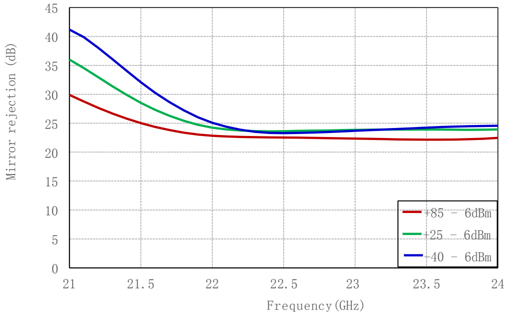
Variable gain VS temperature (LSB IF=3.3GHz)



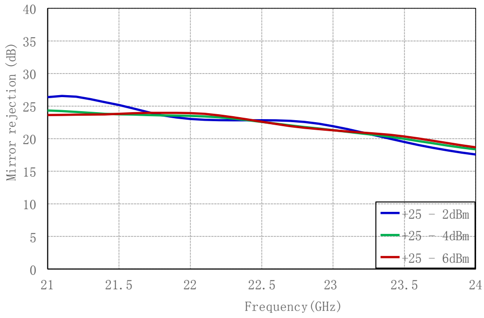
Mirror rejection vs. local oscillation power (USB IF=1GHz)



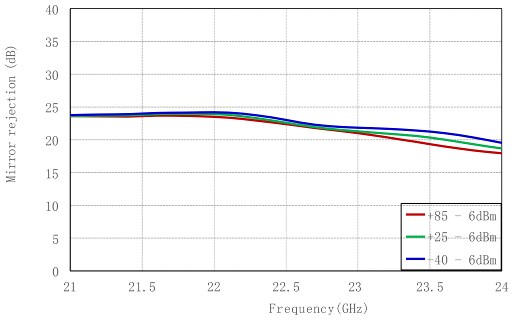
Mirror rejection vs. temperature (USB IF=1GHz)



Mirror rejection vs. local oscillation power (USB IF=3.3GHz)

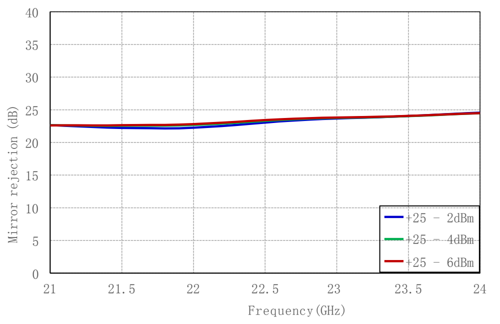


Mirror rejection vs. temperature (USB IF=3.3GHz)

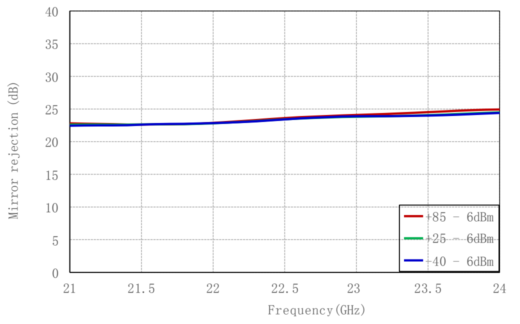


## Test Curve

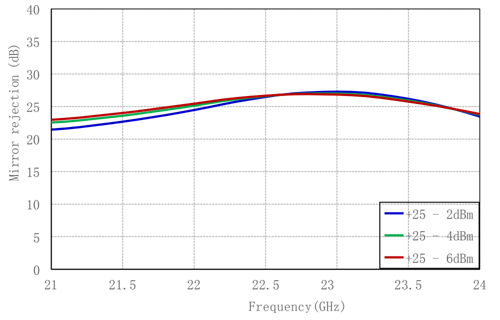
Mirror rejection vs. local oscillation power (LSB IF=1GHz)



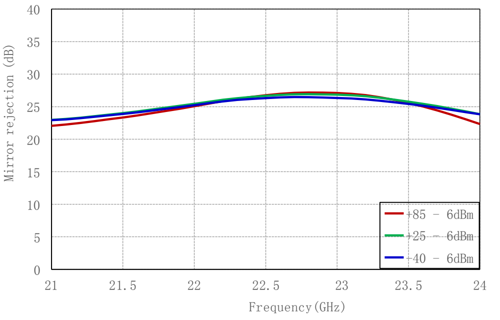
Mirror rejection vs. temperature (LSB IF=1GHz)



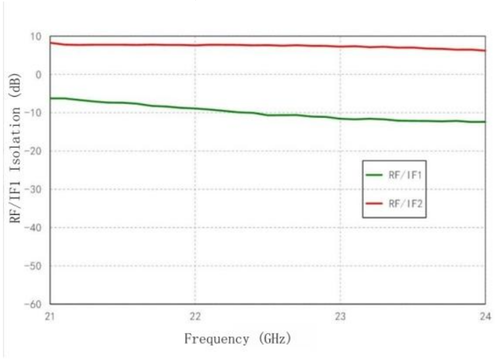
Mirror rejection vs. local oscillation power (LSB IF=3.3GHz)



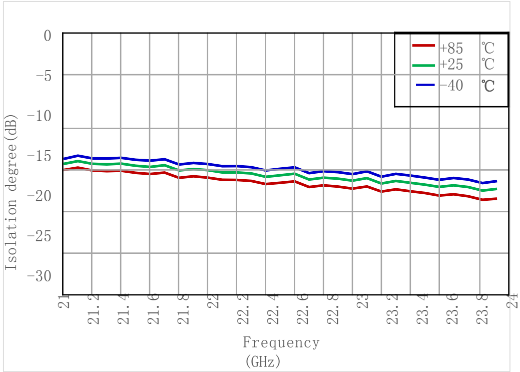
Mirror rejection vs. temperature (LSB IF=3.3GHz)



Isolation vs. frequency (RF–IF1, RF–IF2)

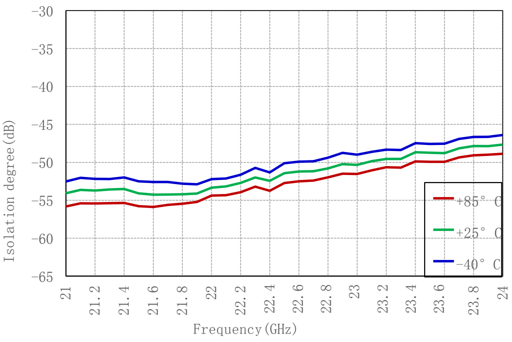


Isolation vs. temperature (2LO–IF)

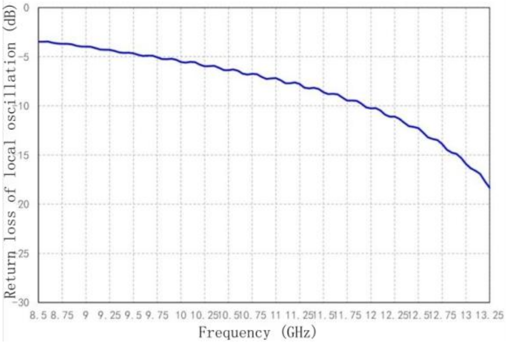


## Test Curve

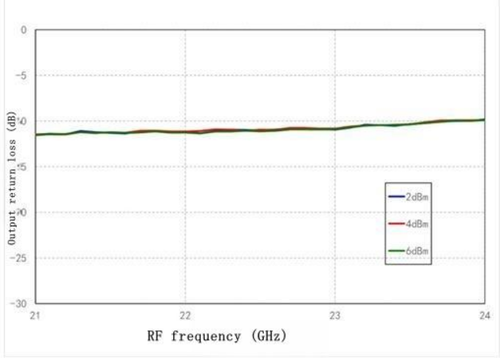
Isolation vs.
temperature (2LO-RF)



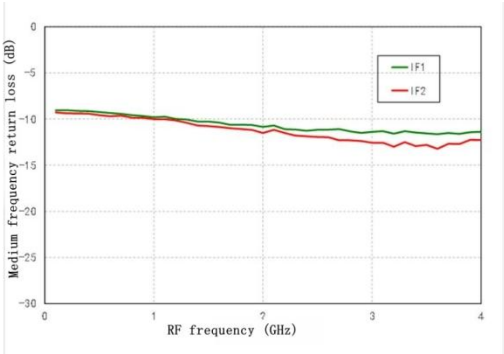
Return loss of the local
oscillation VS frequency



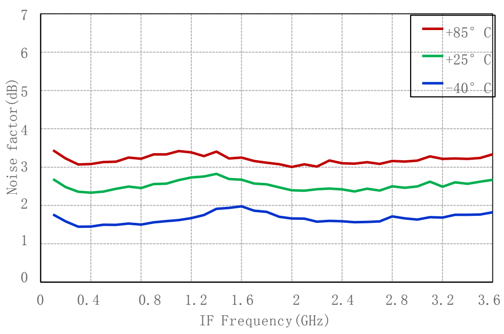
RF return loss vs.
local oscillation



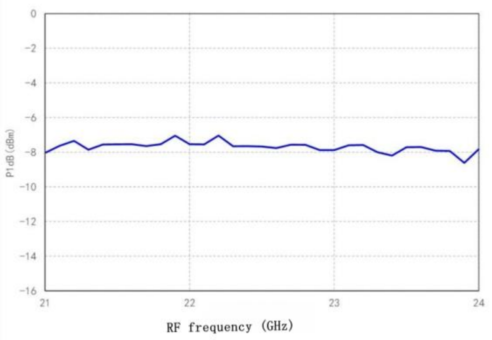
IF return loss vs. RF frequency (USB@LO=10.5GHz
power is 6dBm)



Noise factor vs. temperature
(LSB@LO=12.5GHz power is 6dBm)

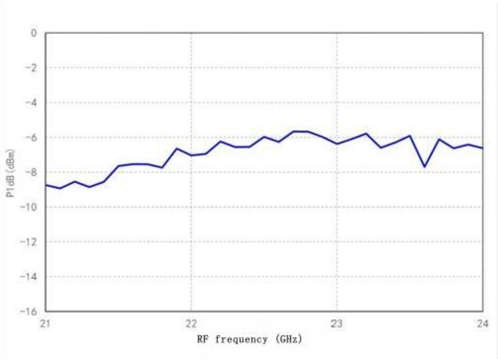


P1dB VS RF frequency (USB IF=0.5GHz power is
6dBm)

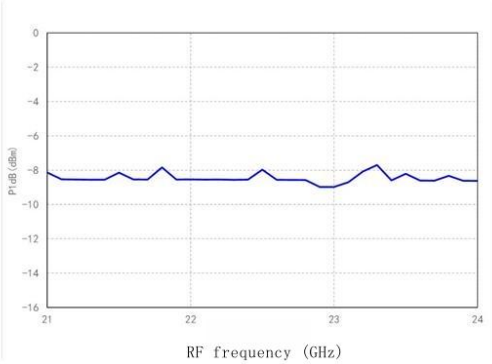


## Test Curve

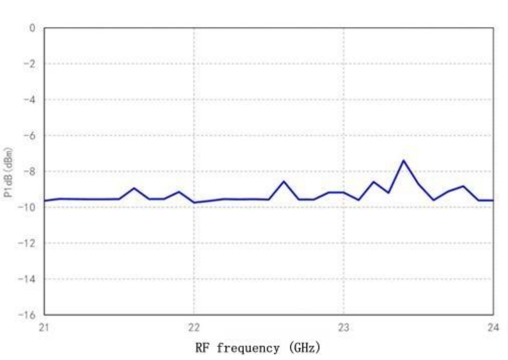
P1dB VS RF frequency （USB IF=3.3GHz power is 6dBm)



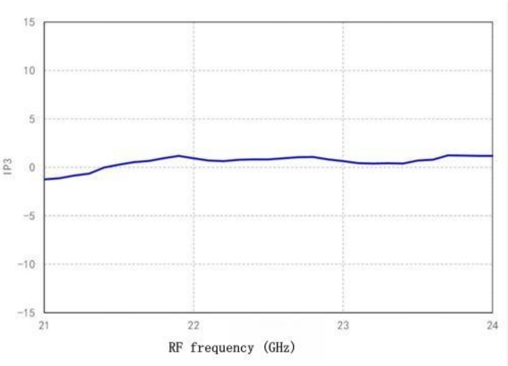
P1dB VS RF frequency （LSB IF=0.5GHz Power is 6dBm)



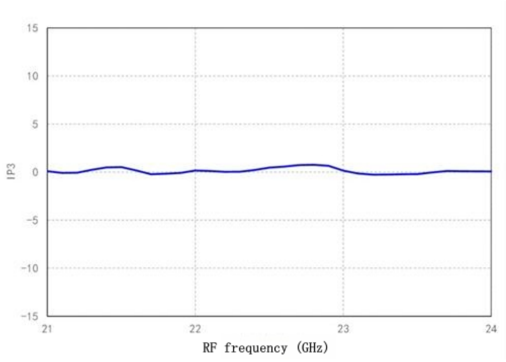
P1dB VS RF frequency （LSB IF=3.3GHz Power is 6dBm)



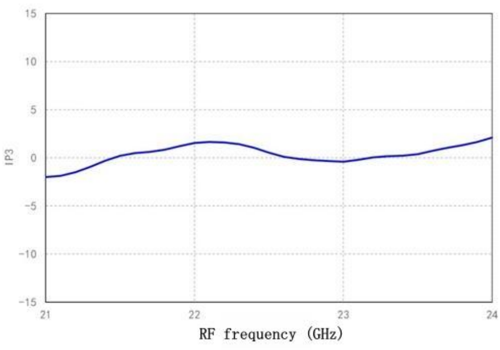
IP3 VS RF Frequency （USB IF=1GHz Power of 6dBm)



IP3 VS RF frequency （LSB IF=1GHz Power of 6dBm)

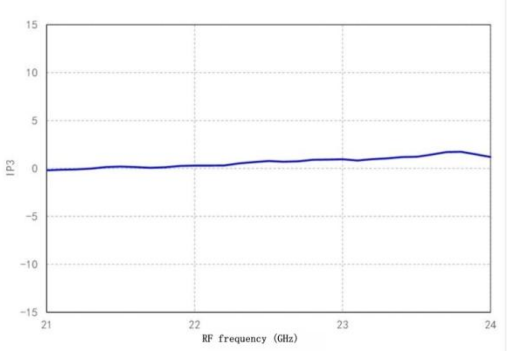


IP3 VS RF frequency （USB IF=3.3GHz power of 6dBm)



## Test Curve

IP3 VS RF frequency (LSB IF=3.3GHz Power is 6dBm)



Stray -136;lower sideband;+25℃

| | nLO | | | | | |
|---|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 | 5 |
| 0 | X | 49.7 | 20.6 | 70.2 | 51.1 | X |
| 1 | 16.3 | 49.1 | 0.0 | 47.1 | 50.7 | 99.6 |
| 2 | 72.8 | 98.4 | 52.7 | 83.6 | 47.6 | 70.1 |
| 3 | X | X | 89.6 | 90.6 | 71.6 | 72.2 |
| 4 | X | X | X | X | 91.3 | 99.1 |
| 5 | X | X | X | X | X | X |
| RF=22.0 GHz @ -15dBm | | | | | | |
| LO=11.735 GHz @ 6dBm | | | | | | |

Stray -136;Upper sideband;+25℃

| | nLO | | | | | |
|---|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 | 5 |
| 0 | X | 31.4 | 11.1 | 34.0 | 49.5 | X |
| 1 | 13.5 | 38.9 | 0.0 | 45.9 | 41.4 | 63.4 |
| 2 | 78.5 | 95.8 | 80.1 | 63.2 | 42.3 | 65.2 |
| 3 | X | X | 89.1 | 93.9 | 74.3 | 64.3 |
| 4 | X | X | X | X | 89.5 | 94.8 |
| 5 | X | X | X | X | X | X |
| RF=22.0 GHz @ -15dBm | | | | | | |
| LO=10.265 GHz @ 6dBm | | | | | | |

## Absolute maximum rating

| | |
|---|---|
| RF/LO input power | 10dBm |
| VDRF/VDLO1/VDLO2 | 4V |
| Channel temperature | 175° C |
| Storage temperature | -65℃～+150℃ |
| Operating temperature | -55℃～+85℃ |

## Working parameters

| | |
|---|---|
| LO input power | 2~6dB |
| VDRF/VDLO1/VDLO2 | 3.5v |

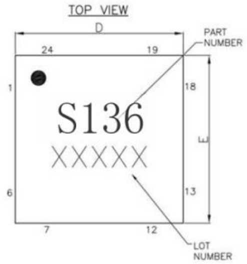
## Package Information

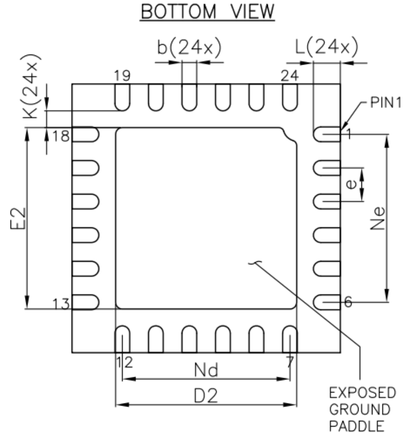
| Model | Packaging Materials | Solder plate plating | MSL level [1] | Package identification [2] | Environmental requirements |
|---|---|---|---|---|---|
| CWDC136SP4 | Green resin compounds | NiPdAuAg | MSL 3 | S136<br>XXXXX | RoHS compliant |

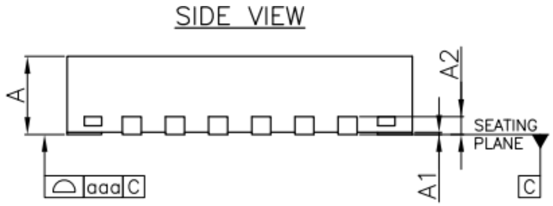
[1] Maximum reflow temperature 260° C

[2] XXXXX is the lot number

## Dimension







Description:

1. Unit: mm

2. Lead frame material: copper alloy

3. Package surface warpage: ≤0.05mm

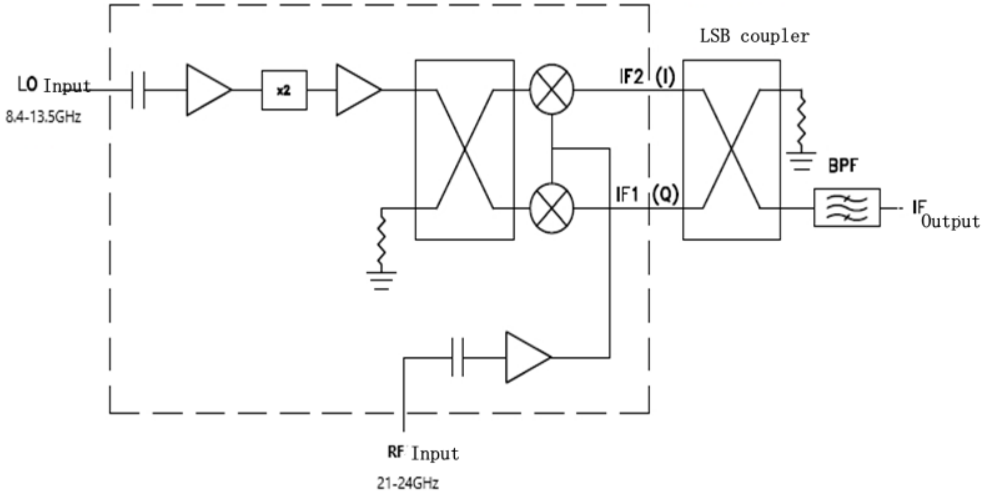
4. All ground pins please connect PCB RF ground

| Dimension Table (unit:mm) | | | |
|---|---|---|---|
| Symbol | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | 0.20Ref | | |
| b | 0.18 | 0.25 | 0.30 |
| D | 3.90 | 4.00 | 4.10 |
| D2 | 2.55 | 2.70 | 2.80 |
| e | 0.50BSC | | |
| Ne | 2.50BSC | | |
| Nd | 2.50BSC | | |
| E | 3.90 | 4.00 | 4.10 |
| E2 | 2.55 | 2.70 | 2.80 |
| K | 0.20 | --- | --- |
| L | 0.30 | 0.40 | 0.50 |
| aaa | 0.08 | | |

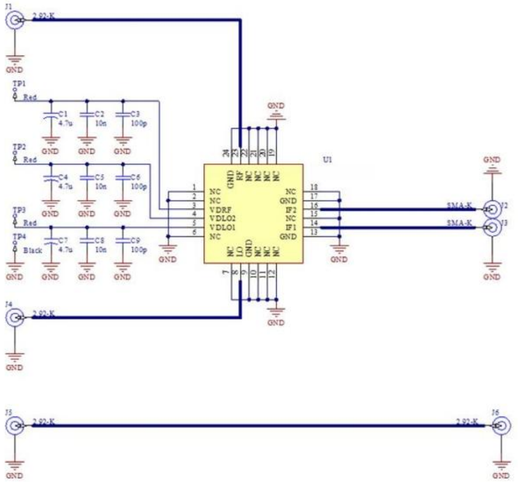
## Pin Definition

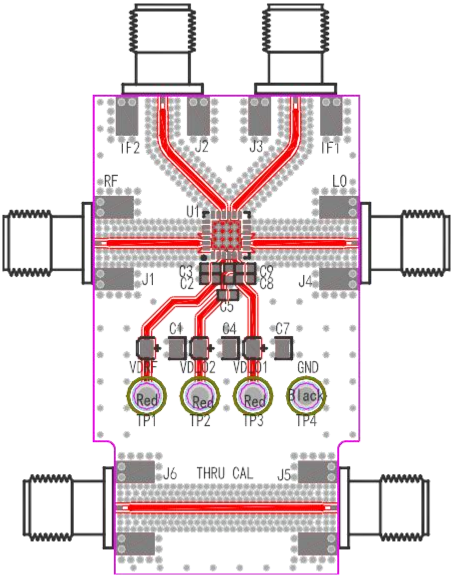
| Pin Number | Function Symbols | Function Description | Pin Number | Function Symbols | Function Description |
|---|---|---|---|---|---|
| 1 | NC | Vacant | 13 | GND | RF Ground |
| 2 | NC | Vacant | 14 | IF1 | IF output 1, DC coupling |
| 3 | VDRF | RF amplifier voltage | 15 | NC | Vacant |
| 4 | VDL2 | Local amplifier voltage2 | 16 | IF2 | IF output 2, DC coupling |
| 5 | VDL1 | Local oscillator amplifier voltage1 | 17 | GND | RF Ground |
| 6 | NC | Vacant | 18 | NC | Vacant |
| 7 | NC | Vacant | 19 | NC | Vacant |
| 8 | LO | Local oscillator input, AC coupling | 20 | NC | Vacant |
| 9 | GND | RF Ground | 21 | NC | Vacant |
| 10 | NC | Vacant | 22 | NC | Vacant |
| 11 | NC | Vacant | 23 | RF | RF input, AC coupling |
| 12 | NC | Vacant | 24 | GND | RF Ground |

## Typical Applications



## Evaluation Boards





| Designator | Description |
|---|---|
| C1, C4, C7 | 4.7uf Tantalum Capacitor 1206 |
| C2, C5, C8 | 10nf Ceramic Capacitor 0402 |
| C3, C6, C9 | 100pf Ceramic Capacitor 0402 |
| TP4 | Test point terminal red |
| TP1, TP2, TP3 | Test point terminal black |
| J2, J3 | SMA-K connector<br>Nanjing Aowen D550B12E01-048 |
| U1 | CWDC136SP4 |
| J1, J4, J5, J6 recommended to use 2.92-K connector | |

Circuit board material: Rogers 4350B

The circuit board for the device application should be designed in accordance with the RF circuit design method and the signal

The grounding pin of the package housing should be grounded nearby (similar to the diagram), and there should be enough ground holes to connect the top and bottom ground.