



# TX-IF SiMMIC FOR W-CDMA AGC + I/Q MODULATOR

## UPC8195K

### FEATURES

- **TX-IF:**  
380 MHz
- **LOW POWER CONSUMPTION:**  
 $V_{CC} = 3.0\text{ V}$
- **SMALL 20 PIN QFN PACKAGE:**  
Flat lead style for better performance
- **TAPE AND REEL PACKAGING AVAILABLE**

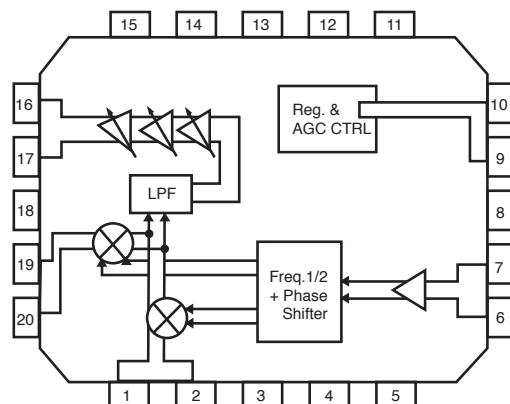
### DESCRIPTION

NEC's UPC8195K is a Silicon Microwave Monolithic Integrated Circuit designed as a transmitter/TX section for W-CDMA. The UPC8195K is a TX-IF IC including IF-AGC amplifier and modulator. This IC is suitable for kit-use for W-CDMA IF section.

This IC was developed using NEC's new ultra high seed silicon bipolar process.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

### BLOCK DIAGRAM



### APPLICATIONS

- **W-CDMA**

### ELECTRICAL CHARACTERISTICS

(unless otherwise specified,  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 3.0\text{ V}$ ,  $f_{IF} = 380\text{ MHz}$ ,  $f_{LO} = 760\text{ MHz}$ ,  $P_{LO} = -15\text{ dBm}$ ,  $f_{I/Q} = 10\text{ kHz}$ , 400 mVp-p balanced sine-wave)

| PART NUMBER<br>PACKAGE OUTLINE |                                                                                                                          |       | UP8195K<br>QFN-20 |      |     |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------|-------------------|------|-----|
| SYMBOLS                        | PARAMETERS AND CONDITIONS                                                                                                | UNITS | MIN               | TYP  | MAX |
| I <sub>CC</sub>                | Circuit Current, no input signals<br>At power saving mode                                                                | mA    | —                 | 25.5 | 30  |
|                                |                                                                                                                          | μA    | —                 | —    | 1   |
| P <sub>OUT</sub>               | Output Power, $V_{CONT} = 2.3\text{ V}$ , I/Q = 400mVp-p balanced<br>$V_{CONT} = 0.3\text{ V}$ , I/Q = 400mVp-p balanced | dBm   | -17               | -13  | —   |
|                                |                                                                                                                          |       | —                 | -88  | -83 |
| LoL                            | Local Leakage, $V_{CONT} = 2.3\text{ V}$ , I/Q = 400mVp-p balanced                                                       | dBc   | —                 | —    | -30 |
| ImR                            | Image Rejection, $V_{CONT} = 2.3\text{ V}$ , I/Q = 400mVp-p balanced                                                     | dBc   | —                 | —    | -30 |
| TPS(Rise)                      | Rise time from power-saving mode                                                                                         | us    | —                 | —    | 10  |
| VPS(Rise)                      | Rising voltage from power-saving mode                                                                                    | V     | 2.2               | —    | —   |
| VPS(fall)                      | Falling voltage from power-saving mode                                                                                   | V     | —                 | —    | 0.5 |

## STANDARD CHARACTERISTICS FOR REFERENCE (unless otherwise specified, $T_A = 25^\circ\text{C}$ , $V_{CC} = 3.0\text{ V}$ , $f_{IF} = 380\text{ MHz}$ , $f_{LO} = 760\text{ MHz}$ , $P_{LO} = -15\text{ dBm}$ , $I/Q = 10\text{ kHz}$ , $400\text{ mVp-p}$ balanced sine-wave)

| PART NUMBER<br>PACKAGE OUTLINE |                                                                                         |        | UP8195K<br>QFN-20 |      |      |
|--------------------------------|-----------------------------------------------------------------------------------------|--------|-------------------|------|------|
| SYMBOLS                        | PARAMETERS AND CONDITIONS                                                               | UNITS  | MIN               | TYP  | MAX  |
| NFL1                           | Output Noise Level 1, $P_{out} = -25\text{ dBm}$ , $f_{IF} \pm 20\text{ MHz}$           | dBm/Hz | —                 | -147 | —    |
| NFL2                           | Output Noise Level 2, $P_{out} = -65\text{ dBm}$ , $f_{IF} \pm 20\text{ MHz}$           | dBm/Hz | —                 | -160 | —    |
| GF                             | Gain Flatness, $f_{IF} \pm 2.5\text{ MHz}$                                              | dB     | —                 | —    | 0.25 |
| EVM                            | Error Vector Magnitude, $I/Q = 3.84\text{ Msps QPSK}$                                   | %rms   | —                 | 3    | —    |
| ACPR                           | Adjacent Channel Power Ratio, $f_{IF} \pm 5\text{ MHz}$ , $I/Q = 3.84\text{ Msps QPSK}$ | dBc    | —                 | -55  | —    |

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup> ( $T_A = 25^\circ\text{C}$ )

| SYMBOLS               | PARAMETERS                    | UNITS            | RATINGS                |
|-----------------------|-------------------------------|------------------|------------------------|
| $V_{CC}$              | Supply Voltage                | V                | 4.0                    |
| $V_{PS}$ , $V_{CONT}$ | Applied Voltage               | V                | -0.3 to $V_{CC} + 0.3$ |
| $T_A$                 | Operating Ambient Temperature | $^\circ\text{C}$ | -40 to +85             |
| $T_{STG}$             | Storage Temperature           | $^\circ\text{C}$ | -55 to +150            |
| $P_D$                 | Power Dissipation             | mW               | 309                    |

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.

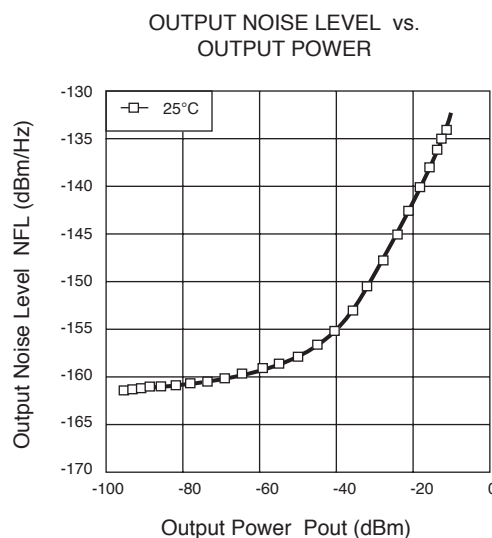
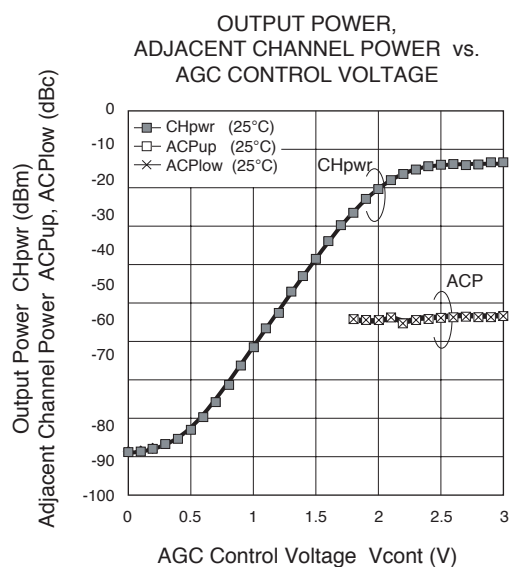
## RECOMMENDED OPERATING CONDITIONS

| SYMBOLS   | PARAMETERS                                                     | UNITS            | MIN | TYP | MAX |
|-----------|----------------------------------------------------------------|------------------|-----|-----|-----|
| $V_{CC}$  | Supply Voltage                                                 | V                | 2.7 | 3.0 | 3.3 |
| $T_A$     | Operating Ambient Temperature                                  | $^\circ\text{C}$ | -25 | +25 | +85 |
| $f_{IF}$  | IF Frequency                                                   | MHz              | —   | 380 | —   |
| $f_{LO}$  | Local Frequency                                                | MHz              | —   | 760 | —   |
| $P_{LO}$  | Local input Level                                              | dBm              | -18 | -15 | -12 |
| ZIF       | IF output impedance,<br>Balanced output internal<br>resistance | $k\Omega$        | —   | 1   | —   |
| $V_{I/Q}$ | I/Q Maximum Input<br>Voltage                                   | V                | —   | 0.4 | 1   |

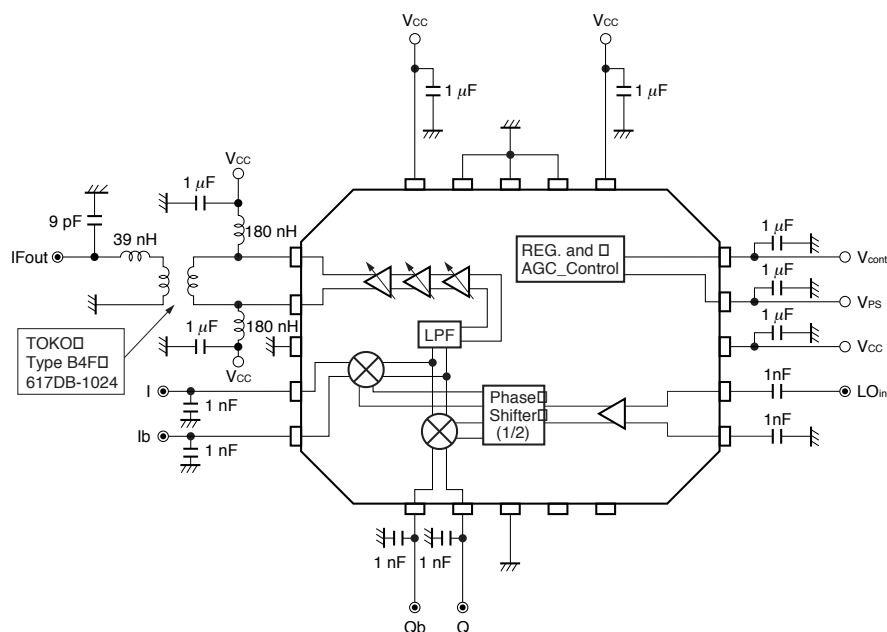
## ORDERING INFORMATION

| Part Number   | Package            |
|---------------|--------------------|
| UPC8195K-E1-A | 20 Pin plastic QFN |

## TYPICAL PERFORMANCE CURVES ( $T_A = 25^\circ\text{C}$ )



## MEASUREMENT CIRCUIT (Units in mm)



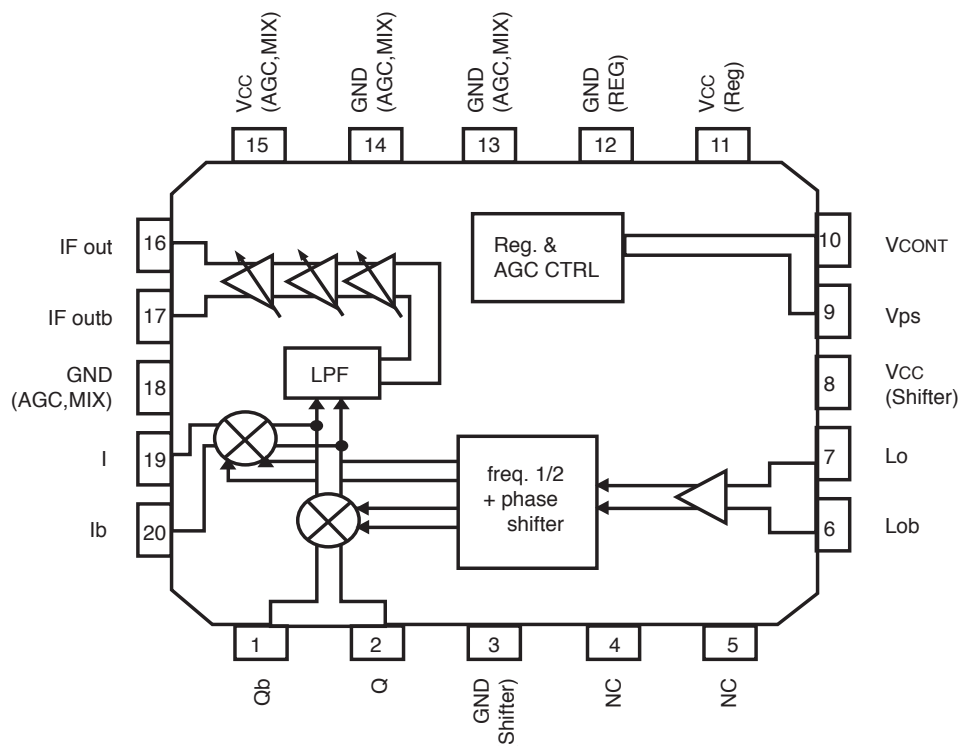
Remarks 1.  $\odot$  : AC connector

$\square \circ$  : DC terminal

2. In the case of ACPR, output noise level, EVM measurement, 1 nF capacitors of I, Ib, Q, Qb are removed.

$\square$

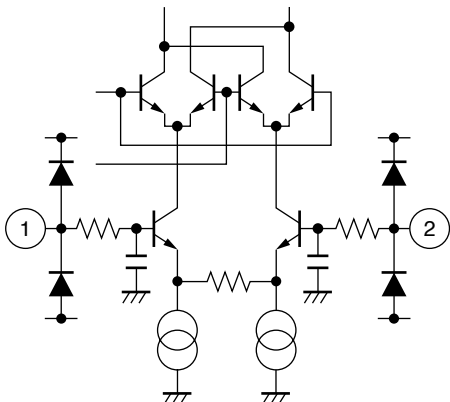
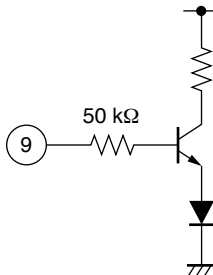
## BLOCK DIAGRAM (Units in mm)



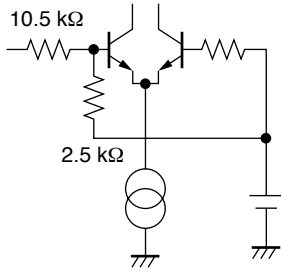
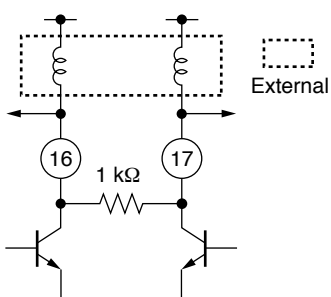
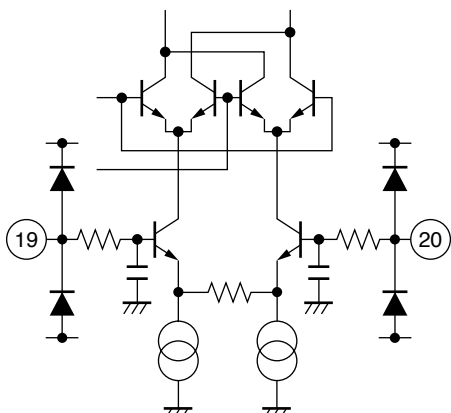
### PASSW

- UPC8191K: Mix = two pieces of Divide-by-2 F/F phase shifter ( $\approx 3/4$ ). Pin 4, 5 are for external Tank circuit.
- UPC8195K: Only one piece of Divide-by-2 F/F phase shifter ( $\approx 1/2$ ). Pin 4, 5 are non-connection.

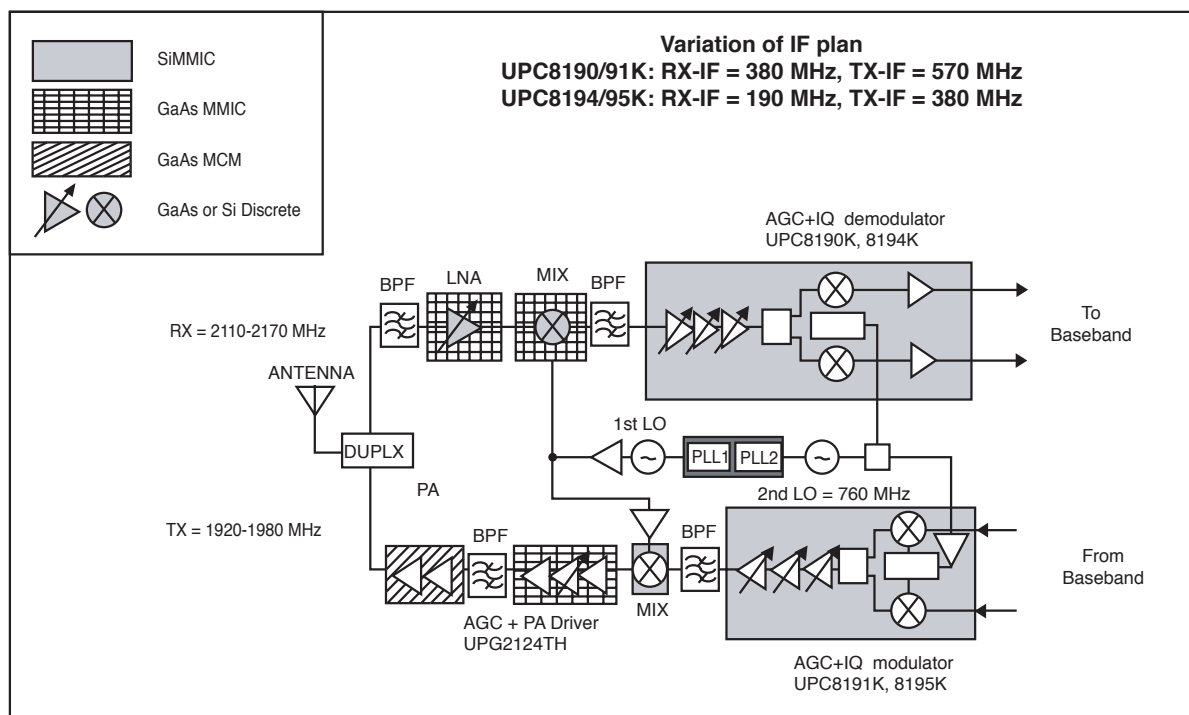
**PIN FUNCTIONS** (Pin Voltage is measured at  $V_{CC} = 2.85\text{ V}$ )

| Pin No.             | Pin Name                  | Applied Voltage (V) | Pin Voltage (V) | Functions and Applications                                                                                                                                                                                                                                                                                                                                               | Internal Equivalent Circuits                                                        |       |          |            |          |             |                                                                                       |
|---------------------|---------------------------|---------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------|----------|------------|----------|-------------|---------------------------------------------------------------------------------------|
| 1                   | Qb                        | V <sub>cc</sub> /2  | -               | Q signal input pin.<br>Apply bias voltage externally.<br>Maximum balance input voltage is 1 000 mV <sub>p-p</sub> (balance).                                                                                                                                                                                                                                             |  |       |          |            |          |             |                                                                                       |
| 2                   | Q                         | V <sub>cc</sub> /2  | -               |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                     |       |          |            |          |             |                                                                                       |
| 3                   | GND (Shifter)             | 0                   | -               | Ground pin of I/Q modulator.<br>This pin should be grounded with minimum inductance.<br>Form the ground pattern as widely as possible to minimize ground impedance.                                                                                                                                                                                                      | —                                                                                   |       |          |            |          |             |                                                                                       |
| 4<br>5              | N.C.                      | 0                   | -               | No connection<br><br>This pin is not connected to internal circuit<br><br>This pin should be opened or grounded.                                                                                                                                                                                                                                                         | —                                                                                   |       |          |            |          |             |                                                                                       |
| 6                   | LOb                       | 0                   | 2.02            | Bypass pin of local signal input for I/Q modulator.<br><br>In the case of single local input, this pin must be decoupled with capacitor ex. 1 000 pF.                                                                                                                                                                                                                    | —                                                                                   |       |          |            |          |             |                                                                                       |
| 7                   | LO                        | 0                   | 2.02            | Local signal input of I/Q modulator.<br>The DC cut capacitor ex. 1 000 pF must be attached to this pin.                                                                                                                                                                                                                                                                  | —                                                                                   |       |          |            |          |             |                                                                                       |
| 8                   | V <sub>cc</sub> (Shifter) | 2.7 to 3.3          | -               | Supply voltage pin of I/Q modulator.                                                                                                                                                                                                                                                                                                                                     | —                                                                                   |       |          |            |          |             |                                                                                       |
| 9                   | V <sub>Ps</sub>           | 0 to 3.0            | -               | Power saving pin of I/Q modulator + AGC amplifier.<br><br>This pin modulator can control Active/Sleep state with bias as follows.<br><table border="1"><thead><tr><th>V<sub>Ps</sub> (V)</th><th>State</th></tr></thead><tbody><tr><td>0 to 0.5</td><td>Sleep Mode</td></tr><tr><td>2.2 to 3</td><td>Active Mode</td></tr></tbody></table> | V <sub>Ps</sub> (V)                                                                 | State | 0 to 0.5 | Sleep Mode | 2.2 to 3 | Active Mode |  |
| V <sub>Ps</sub> (V) | State                     |                     |                 |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                     |       |          |            |          |             |                                                                                       |
| 0 to 0.5            | Sleep Mode                |                     |                 |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                     |       |          |            |          |             |                                                                                       |
| 2.2 to 3            | Active Mode               |                     |                 |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                     |       |          |            |          |             |                                                                                       |

**PIN FUNCTIONS** (Pin Voltage is measured at  $V_{CC} = 2.85\text{ V}$ )

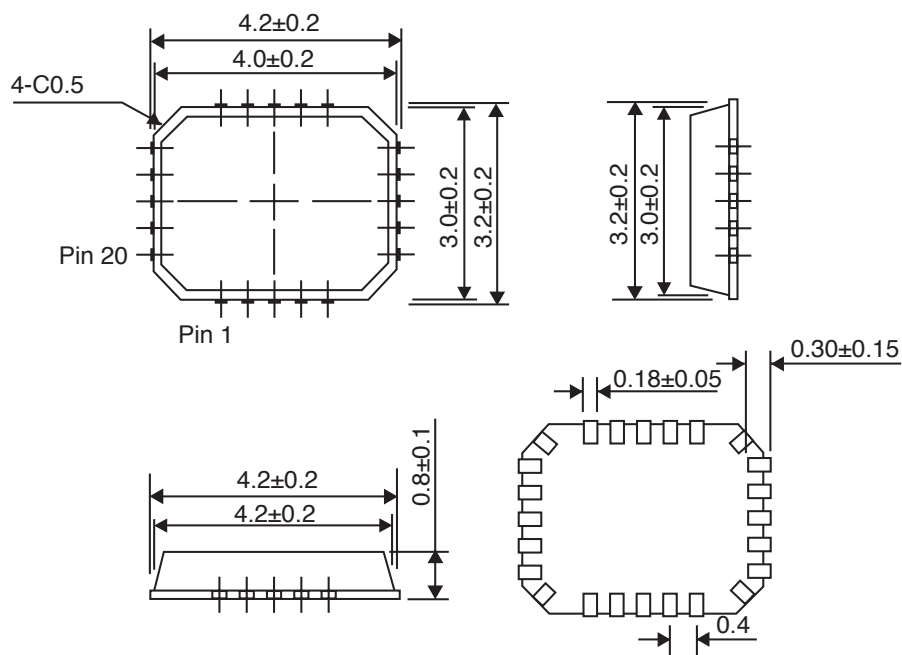
| Pin No.        | Pin Name            | Applied Voltage (V) | Pin Voltage (V) | Functions and Applications                                                                                                                                                                    | Internal Equivalent Circuits                                                          |
|----------------|---------------------|---------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 10             | Vcont               | 0 to 3.0            | -               | Gain control pin of AGC amplifier. Variable gains are available in accordance with applied voltage between 0 to 3.0 V.                                                                        |    |
| 11             | $V_{CC}$ (REG.)     | 2.7 to 3.3          | -               | Supply voltage pin of internal regulator.                                                                                                                                                     | —                                                                                     |
| 12             | GND (REG.)          | 0                   | -               | Ground pin internal regulator. This pin should be grounded with minimum inductance.<br><br>Form the ground pattern as widely as possible to minimize ground impedance.                        | —                                                                                     |
| 13<br>14<br>18 | GND (AGC, MIX)      | 0                   | -               | Ground pin of AGC amplifier + I/Q Mixer. This pin should be grounded with minimum inductance.<br><br>Form the ground pattern as widely as possible to minimize ground impedance.              | —                                                                                     |
| 15             | $V_{CC}$ (AGC, MIX) | 2.7 to 3.3          | -               | Supply voltage pin of AGC amplifier + I/Q Mixer.                                                                                                                                              | —                                                                                     |
| 16             | IFout               | 2.7 to 3.3          | -               | IF output pin.<br><br>The inductor must be attached between $V_{CC}$ and output pin due to open collector.<br><br>Output frequency is 570 MHz which is 3/4 of local signal frequency 760 MHz. |  |
| 17             | IFoutb              | 2.7 to 3.3          | -               | Balance output of IFout pin.<br><br>The inductor must be attached between $V_{CC}$ and output pin due to open collector.                                                                      |                                                                                       |
| 19             | I                   | $V_{CC}/2$          | -               | I signal input pin.<br><br>Apply bias voltage externally.<br><br>Maximum balance input voltage is 1 000 mVP-P (balance).                                                                      |  |
| 20             | Ib                  | $V_{CC}/2$          | -               |                                                                                                                                                                                               |                                                                                       |

## APPLICATION EXAMPLE: W-CDMA



## OUTLINE DIMENSIONS (Units in mm)

### Package Outline QFN-20



### Life Support Applications

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04/15/2002

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| Restricted Substance<br>per RoHS | Concentration Limit per RoHS<br>(values are not yet fixed) | Concentration contained<br>in CEL devices |            |
|----------------------------------|------------------------------------------------------------|-------------------------------------------|------------|
|                                  |                                                            | -A<br>Not Detected                        | -AZ<br>(*) |
| Lead (Pb)                        | < 1000 PPM                                                 |                                           |            |
| Mercury                          | < 1000 PPM                                                 | Not Detected                              |            |
| Cadmium                          | < 100 PPM                                                  | Not Detected                              |            |
| Hexavalent Chromium              | < 1000 PPM                                                 | Not Detected                              |            |
| PBB                              | < 1000 PPM                                                 | Not Detected                              |            |
| PBDE                             | < 1000 PPM                                                 | Not Detected                              |            |

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