

## Features

- Active Mixer with Conversion Gain
- No External LO Driver Necessary
- Low LO Drive Level Required
- RF and LO Ports May Be Driven Single-ended
- Single 5-V Supply Voltage
- High LO-RF Isolation
- Broadband Resistive 50- $\Omega$  Impedances on All Three Ports
- Small SSO16 Package

## Applications

- Digital Communication Systems
- 2200 MHz to 2700 MHz Transceivers for Base Stations

Electrostatic sensitive device.  
Observe precautions for handling.

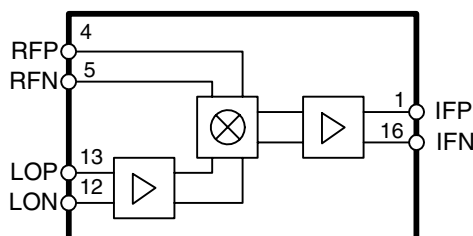


## Description

The T0782 is a high-linearity active mixer which is manufactured using Atmel's advanced Silicon-Germanium technology. This mixer features a frequency range of 2200 MHz to 2700 MHz. It operates from a single 5-V supply and provides 10 dB of conversion gain while requiring only 0 dBm input to the integrated LO driver. An IF amplifier is also included.

The T0782 incorporates internal matching on each RF, IF and LO port to enhance ease of use and to reduce the external components required. The RF and LO inputs can be driven differentially or single-ended.

**Figure 1.** Block Diagram



## 2200-2700 MHz High Linearity SiGe Active Receive Mixer

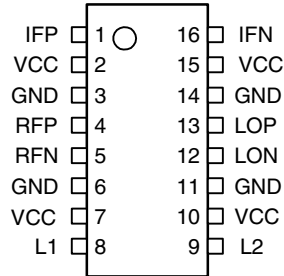
**T0782**

**Preliminary**



## Pin Configuration

**Figure 2.** Pinning SSOP16



## Pin Description

| Pin | Symbol | Function                         |
|-----|--------|----------------------------------|
| 1   | IFP    | IF positive output               |
| 2   | VCC    | 5-V power supply                 |
| 3   | GND    | Ground                           |
| 4   | RFP    | RF positive input                |
| 5   | RFN    | RF negative input                |
| 6   | GND    | Ground                           |
| 7   | VCC    | 5-V power supply                 |
| 8   | L1     | External inductor terminal       |
| 9   | L2     | External inductor terminal       |
| 10  | VCC    | 5-V power supply                 |
| 11  | GND    | Ground                           |
| 12  | LON    | Local oscillator, negative input |
| 13  | LOP    | Local oscillator, positive input |
| 14  | GND    | Ground                           |
| 15  | VCC    | 5-V power supply                 |
| 16  | IFN    | IF negative output               |

## Absolute Maximum Ratings

All voltages are referred to GND

| Parameters            | Symbol       | Value       | Unit |
|-----------------------|--------------|-------------|------|
| Supply voltage        | $V_{CC}$     | 5 to 6.0    | V    |
| LO input              | $LO_P, LO_N$ | 10          | dBm  |
| IF input              | $RF_P, RF_N$ | 15          | dBm  |
| Operating temperature | $T_{OP}$     | -40 to +85  | °C   |
| Storage temperature   | $T_{stg}$    | -40 to +150 | °C   |

## Thermal Resistance

| Parameter        | Symbol     | Value | Unit |
|------------------|------------|-------|------|
| Junction ambient | $R_{thJA}$ | TBD   | K/W  |

## Electrical Characteristics

Test conditions:  $V_{CC} = +5\text{ V}$ ,  $T_{amb} = +25^{\circ}\text{C}$

RF input:  $-20\text{ dBm}$  at  $2450\text{ MHz}$

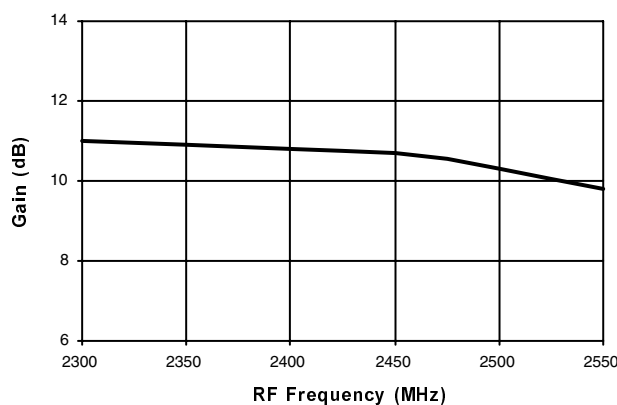
LO output:  $0\text{ dBm}$  at  $2250\text{ MHz}$

| No.                          | Parameters         | Test Conditions / Pins             | Pin | Symbol   | Min. | Typ.  | Max. | Unit | Type * |
|------------------------------|--------------------|------------------------------------|-----|----------|------|-------|------|------|--------|
| <b>AC Performance</b>        |                    |                                    |     |          |      |       |      |      |        |
|                              | Frequency range    |                                    |     | f        | 2200 |       | 2700 | MHz  |        |
|                              | IF frequency range |                                    |     | $F_{IF}$ | 10   | 200   | 300  | MHz  |        |
|                              | Output IP3         | RF1 = RF2 = $-17\text{ dBm/ tone}$ |     | IP3      |      | 15.5  |      | dBm  |        |
|                              | Output P1dB        |                                    |     |          |      | 4.5   |      | dBm  |        |
|                              | Conversion gain    |                                    |     |          |      | 10.5  |      | dB   |        |
|                              | SSB noise figure   |                                    |     |          |      | 15.5  |      | dB   |        |
|                              | RF return loss     |                                    |     |          |      | 14    |      | dB   |        |
|                              | LO return loss     |                                    |     |          |      | 14    |      | dB   |        |
|                              | IF return loss     |                                    |     |          |      | 14    |      | dB   |        |
|                              | LO drive           |                                    |     |          | $-3$ | 0     | $+3$ | dBm  |        |
| <b>Isolation Performance</b> |                    |                                    |     |          |      |       |      |      |        |
|                              | Leakage (LO-RF)    |                                    |     |          |      | $-30$ |      | dBm  |        |
|                              | Leakage (LO-IF)    |                                    |     |          |      | $-30$ |      | dBm  |        |
| <b>Miscellaneous</b>         |                    |                                    |     |          |      |       |      |      |        |
|                              | Supply voltage     |                                    |     | $V_{CC}$ | 4.75 | 5     | 5.25 | V    |        |
|                              | Supply current     |                                    |     | $I_{CC}$ |      | 150   |      | mA   |        |

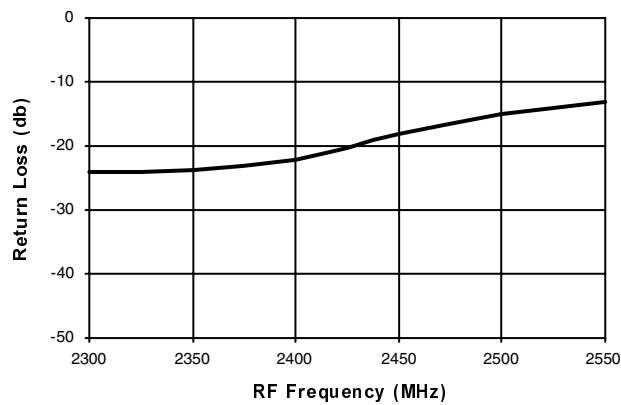
\*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

## Typical Device Performance

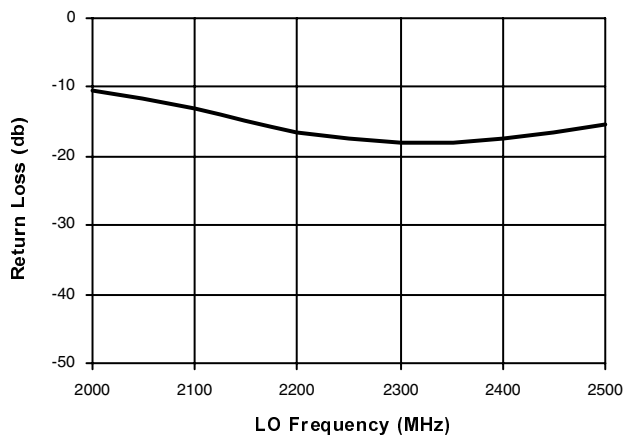
**Figure 3.** Conversion Gain versus RF Frequency,  $V_{CC} = 5.0\text{ V}$ , LO =  $0\text{ dBm}$ ,  $RF_{IN} = -20\text{ dBm}$ , IF =  $200\text{ MHz}$



**Figure 4.** Return Loss versus RF Frequency,  $V_{CC} = 5.0\text{ V}$



**Figure 5.** Return Loss at LO Input,  $V_{CC} = 5.0\text{ V}$



**Figure 6.** Return Loss versus IF Frequency,  $V_{CC} = 5.0\text{ V}$

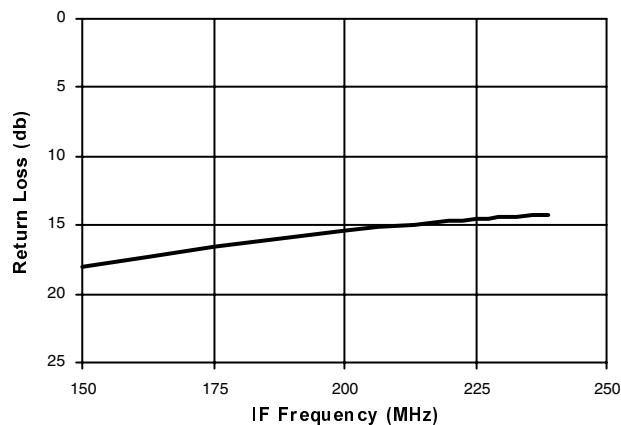
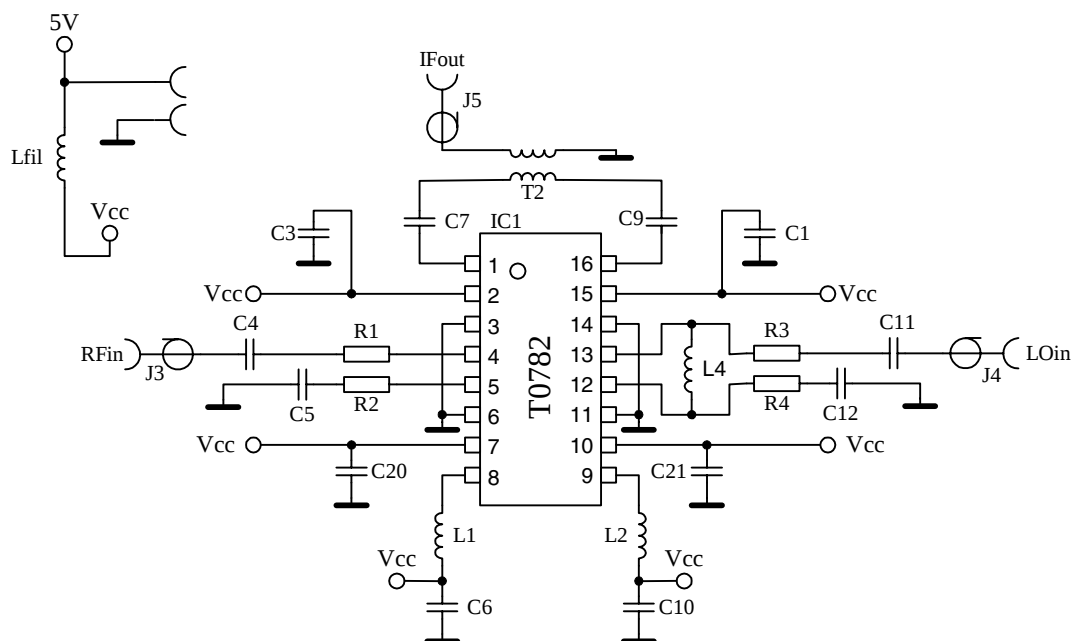
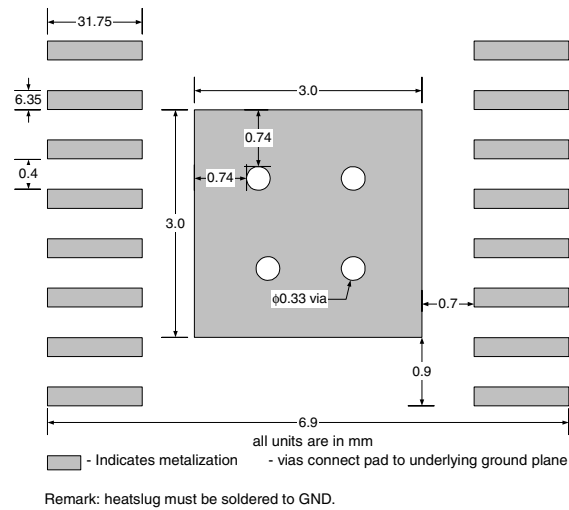
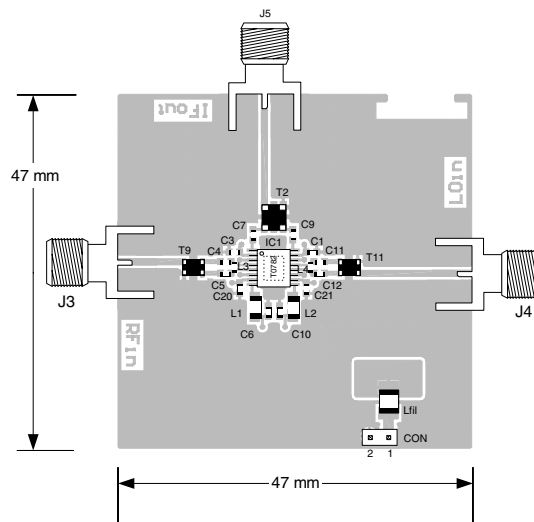


Figure 7. Demo Test Board Schematic



## Bill of Material

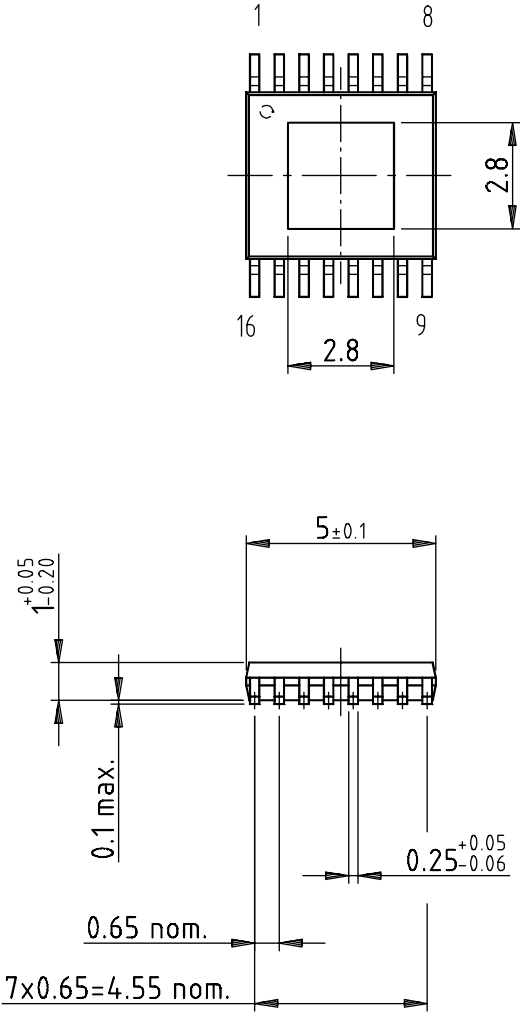
| Component Designator | Value      | Vendor             | Part Number   | Description                                                    |
|----------------------|------------|--------------------|---------------|----------------------------------------------------------------|
| IC1                  |            | Atmel              | T0782         | SiGe receiver mixer                                            |
| J3, J4, J5           |            | Johnson Components | 142-0701-851  | SMA connector, end launch with tab, for 0.062 inch thick board |
| T2                   | 1:1        | Mini-circuits      | TC1-1         | IF transformer                                                 |
| Lfil                 | 1 $\mu$ H  |                    |               | Inductor, 1210 footprint, minimum 200 mA rating                |
| L1, L2               | 100 nH     | TOKO               | LL1608-FSR10J | Inductor, 0603 footprint, high Q series                        |
| C1, C3, C20, C21     | 5.6 pF     |                    |               | Capacitor, 0603 footprint                                      |
| C6, C10              | 100 pF     |                    |               | Capacitor, 0603 footprint                                      |
| C7, C9               | 120 pF     |                    |               | Capacitor, 0603 footprint                                      |
| C4, C5               | 1.2 pF     |                    |               | Capacitor, 0603 footprint                                      |
| C11, C12             | 1.5 pF     |                    |               | Capacitor, 0603 footprint                                      |
| R1, R2, R3, R4       | 0 $\Omega$ |                    |               | Resistor, 0603 footprint                                       |
| L4                   | 27 nH      |                    |               | Inductor, 0603 footprint                                       |



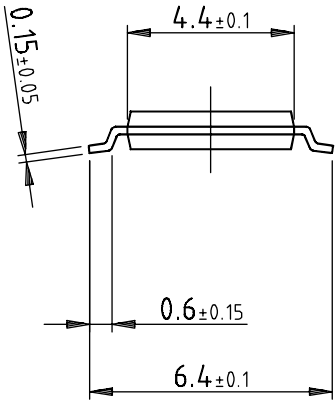
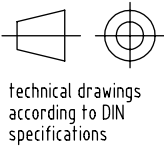
Ordering Information

| Extended Type Number | Package | Remarks |
|----------------------|---------|---------|
| T0782                | SSOP16  |         |

Package Information



Package: SSOP16  
( acc. JEDEC SMALL OUTLINE No. MO-153 )  
Dimensions in mm



Drawing-No.: 6.543-5079.01-4  
Issue: 1; 10.07.01



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