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-Ω Impedances on All Three Ports**
- **Small SSO16 Package**

Applications

- **Digital Communication Systems**
- **800 MHz to 1000 MHz Transceivers for Base Stations**

Electrostatic sensitive device.
Observe precautions for handling.

800-1000 MHz High Linearity SiGe Active Receive Mixer

T0780

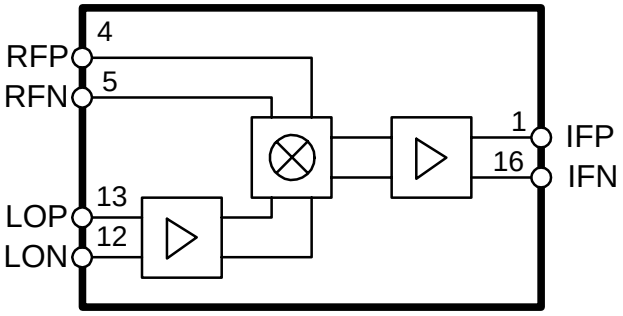
Preliminary

Description

The T0780 is a high linearity active mixer which is manufactured using Atmel's advanced Silicon-Germanium technology. This mixer features a frequency range of 800 MHz to 1000 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 T0780 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.

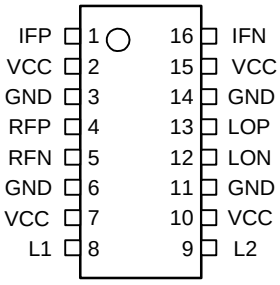
Figure 1. Block Diagram



Rev. 4525B–SIGE–09/02

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 5.5	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}	-65 to +150	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	TBD	K/W
Junction case	R_{thJC}	46	°C/W

Electrical Characteristics

Test Conditions: V_{CC} = +5 V, T_{amb} = +25°C; RF input: -20 dBm at 900 MHz; LO output: 0 dBm at 700 MHz

No.	Parameters	Test Conditions / Pins	Pin	Symbol	Min.	Typ.	Max.	Unit	Type *
1	**AC Performance**								
1.1	RF frequency range			f_{RF}	800		1000	MHz	B, C
1.11	LO frequency range			f_{LO}	500		1000	MHz	B, C
1.2	IF frequency range			F_{IF}	30	200	300	MHz	B, C
1.5	Conversion gain				7	10		dB	A
1.6	SSB noise figure					15	19	dB	D
1.3	Input IP3	RF1 = RF2 = –15 dBm/tone, 1 MHz spacing		IP3	15	19		dBm	D
1.4	Input P1dB				2	5		dBm	D
1.7	RF return loss	Matched to 50 Ω (1)				20		dB	D
1.8	LO return loss	Matched to 50 Ω (1)				20		dB	D
1.9	IF return loss	Matched to 50 Ω (1)				20		dB	D
1.10	LO drive	Matched to 50 Ω (1)			-3	0	+3	dBm	D
2	**Isolation Performance**								
2.1	Leakage (LO-RF)	Single-ended configuration				-40	-35	dBm	D
2.2	Leakage (LO-IF)	Single-ended configuration				-26	-20	dBm	D
2.3	Leakage (RF-IF)	Single-ended configuration				-40	-35	dBm	D
3	**Miscellaneous**								
3.1	Supply voltage			V_{CC}	4.75	5	5.25	V	A
3.1	Supply current			I_{CC}		160	180	mA	A

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

Notes: 1. The return losses shown were measured with the T0780 mounted on Atmel's FR4 evaluation boards using standard matching practices as indicated on the application schematic page herein. Users following the RF, LO and IF matching guidelines will achieve similar performance.

Typical Device Performance

Figure 3. Conversion Gain Versus Temperature

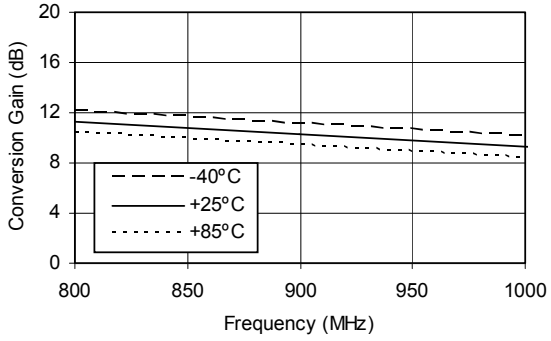


Figure 4. Conversion Gain Versus LO Drive, T_{amb} = 25°C

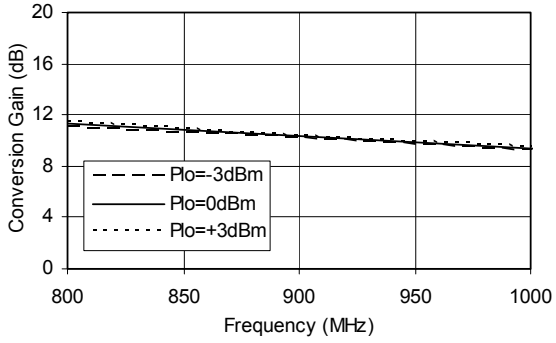


Figure 5. Leakages, Plo = 0 dBm, Prf = -20 dBm, Single-ended Configuration (see Note 1)

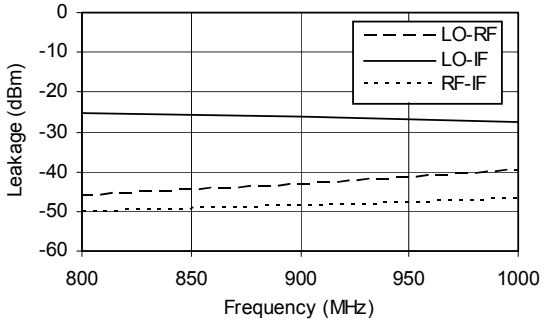


Figure 6. Input IP3 Versus Temerature

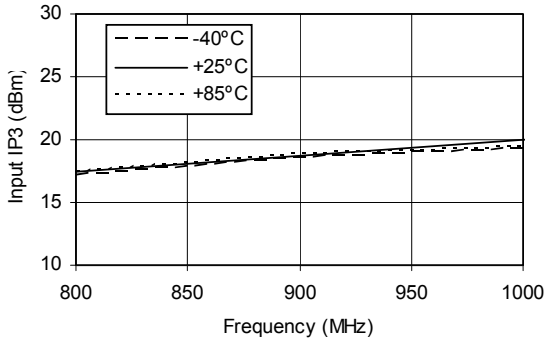


Figure 7. Input IP3 Versus LO Drive, T_{amb} = 25°C

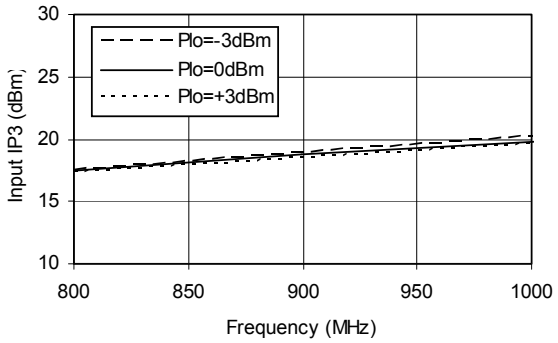


Figure 8. Noise Figure Versus Temperature, Plo = 0 dBm

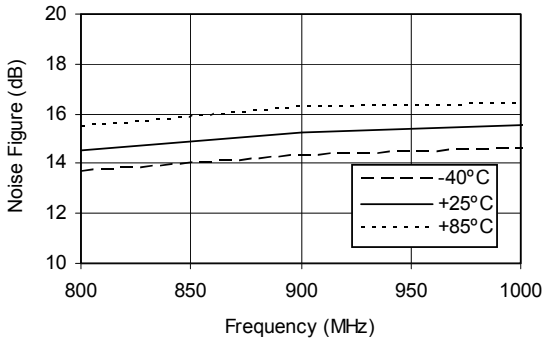


Figure 9. RF & LO Return Loss (see Note 2), T_{amb} = 25°C

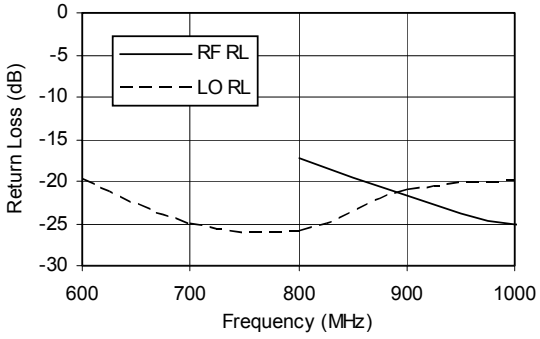


Figure 10. IF Return Loss (see Note 2), T_{amb} = 25°C

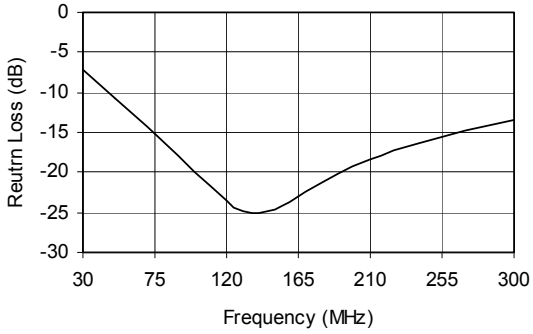


Figure 11. Input P1dB Versus Temperature, Plo = 0 dBm

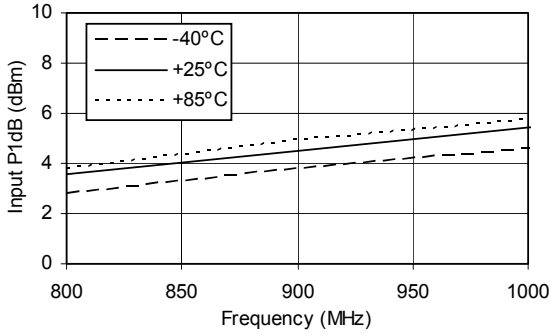


Figure 12. Input P1dB Versus LO Drive, T_{amb} = 25°C

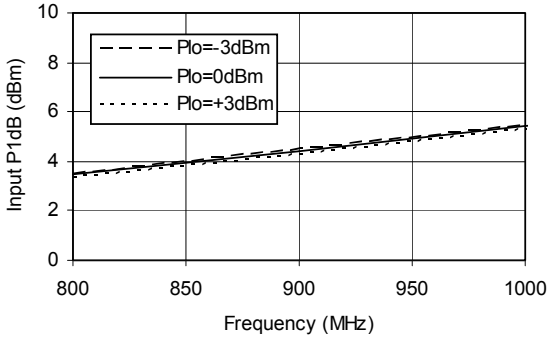
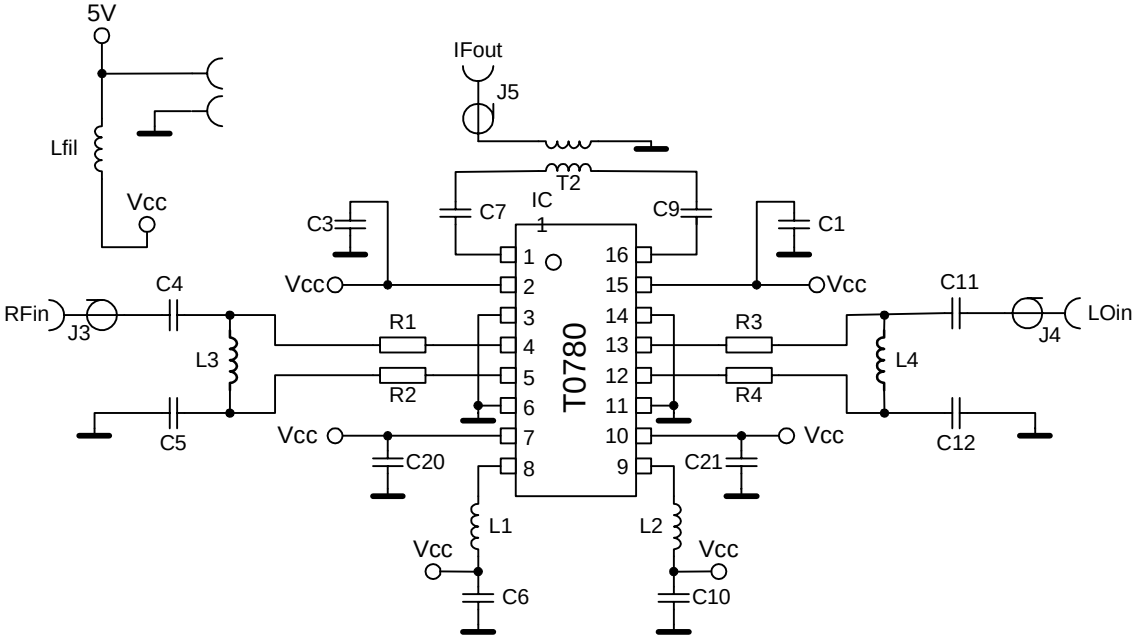


Figure 13. Demo Test Board Schematic



Bill of Material

Component Designator	Value	Vendor	Part Number	Description
IC1		Atmel	T0780	SiGe receiver mixer
J3, J4, J5		Johnson Components	142-0701-851	SMA connector, end launch with tab, for 0.062 inch board
T2	1:1	Mini-circuits	TC1-1	IF transformer
Lfil	1 µH	Würth Elektronik	74476401	Inductor, 1210 footprint, minimum 200 mA rating
L1, L2	see Table 1	TOKO	LL1608-FSR10J	Inductor, 0603 footprint, high Q series
L3, L4	180 nH	TOKO	LL1608-FSR18J	Inductor, 0603 footprint, high Q series
C1, C3, C20, C21	27 pF			Capacitor, 0603 footprint
C6, C10	100 pF			Capacitor, 0603 footprint
C7, C9	120 pF			Capacitor, 0603 footprint
C4, C5	10 pF			Capacitor, 0603 footprint
C11, C12	15 pF			Capacitor, 0603 footprint
R1, R2, R3, R4	0 Ω			Resistor, 0603 footprint

The T0780 utilizes an IF tank circuit to maximize performance across the entire IF bandwidth. the off-chip inductors L1 and L2 resonate with an on-chip capacitor (4 pF) to provide IF tunability. therefore, L1 and L2 must be selected such that the resonance occurs at the desired IF.

The following table provides the inductor values required on the evaluation board for some common intermediate frequencies. By default, all evaluation board are shipped with L1 = L2 = 100 nH, resulting in a 200 MHz resonant IF.

Table 1. IF Tank Circuit

IF (MHz) Typical	L1, L2 (nH)	TOKO Part Number
70	680	LL2012-FHR68J
150	150	LL1608-FSR15J
200	100	LL1608-FSR10J
300	39	LL1608-FS39NJ

The following procedure may be used to ensure that the proper inductor values have been selected for a given IF.

1. Prepare the evaluation board for a conversion gain measurement by using the “General Test Set-up”.
2. Enable the “Max Hold” function on the spectrum analyzer and set the “SPAN” to 200 MHz.
3. Vary the LO frequency while maintaining a consonant input frequency.
4. The resonant will be observed at the peak of the response.

Figure 14. Demo Test Board (Fully Assembled PCB)

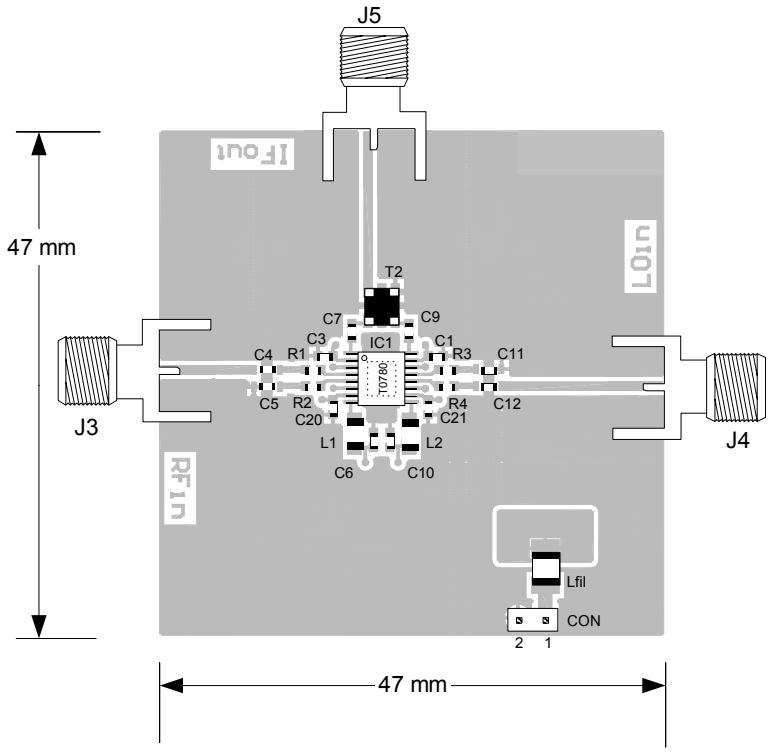
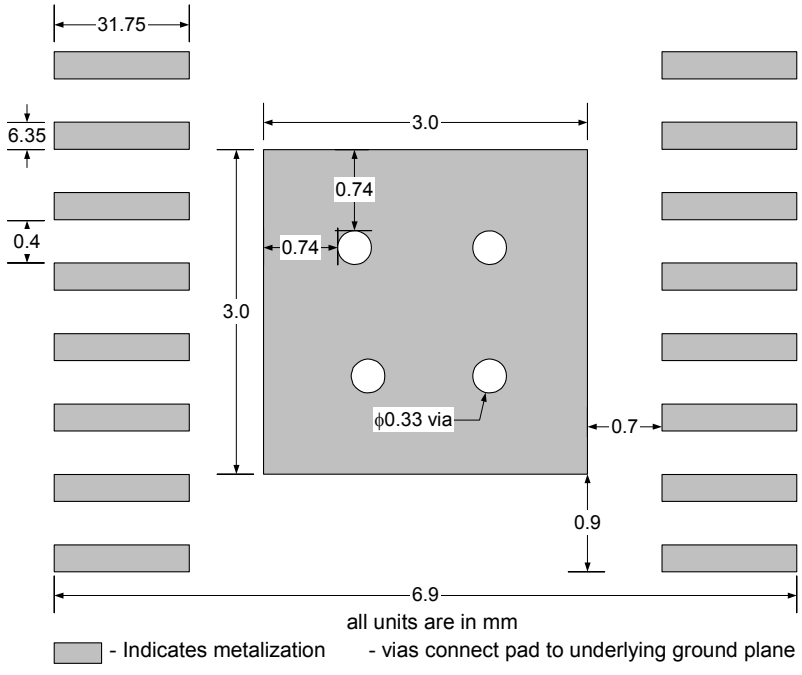


Figure 15. Recommended Package Footprint

In order to avoid soldering problems, plugging of the ground vias under the heat slug is recommended!



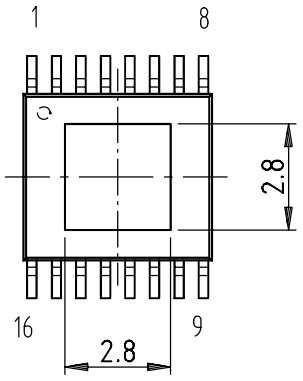
Remark: heatslug must be soldered to GND.

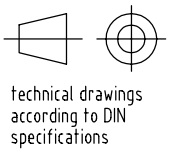
Ordering Information

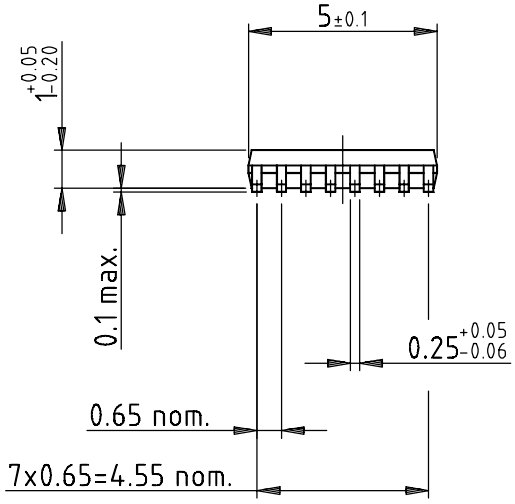
Extended Type Number	Package	Remarks
T0780-6C	SSOP16	–

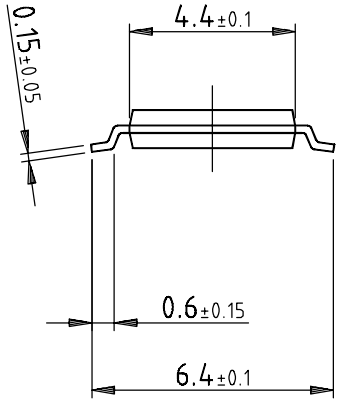
Package Information

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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