Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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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**

Applications

- **Infrastructure Digital Communication Systems**
- **1700 MHz to 2300 MHz Receivers for CDMA/PCS/DCS/UMTS Base Stations**

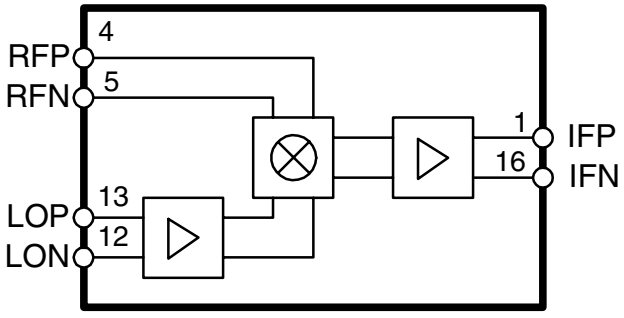
Electrostatic sensitive device.
Observe precautions for handling.

Description

The T0781 is a high linearity active mixer which is manufactured using Atmel's advanced Silicon-Germanium (SiGe) technology. This mixer features a frequency range of 1700 MHz to 2300 MHz. It operates from a single 5-V supply and provides 12 dB of conversion gain while requiring only 0 dBm input to the integrated LO driver. An IF amplifier is also included.

The T0781 incorporates internal matching on each RF, IF and LO ports 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



1700 MHz - 2300 MHz High Linearity SiGe Active Receiver Mixer

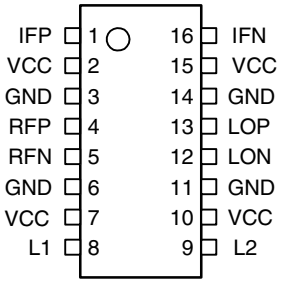
T0781

Preliminary

Rev. 4534C–SIGE–10/03

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 (1)

All voltages are referred to GND.

Parameters	Symbol	Value	Unit
Supply voltage	V_{CC}	5.5	V
LO input	LOP, LON	10	dBm
IF input	RFP, RFN	15	V
Operating temperature	T_{OP}	-40 to +85	°C
Storage temperature	T_{stg}	-65 to +150	°C

Notes: 1. The device may not survive all maximum values applied simultaneously.

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: -40 dB at 1880 MHz, LO input: 0 dBm at 1680 MHz

					1700 to 2000 MHz Operation			2000 to 2300 MHz Operation				
No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit	Type*
1	**AC Performance**											
1.1	RF frequency range	For RF = 2000 to 2300 MHz operation, single-ended RF + LO drive is recommended	4, 5	f_{RF}	1700		2000	2000		2300	MHz	B, C
1.1 1	LO frequency range			f_{LO}	1400		2000	1700		2300	MHz	B, C
1.2	IF frequency range		1, 16	F_{IF}	30	200	300	30	200	300	MHz	B, C
1.3	Input IP3	RF1 = RF2 = -15 dBm/tone, 1 MHz spacing	4, 5	IIP3	12	15		12	15		dBm	D
1.4	Input P1dB		4, 5	P1dB	1	2		3	5		dBm	D
1.5	Conversion gain		1, 16	G	9	12		6	9		dB	A

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

Note: 1. The return losses shown were measured with the T0781 mounted on Atmel's FR4 evaluation boards using standard matching practices as indicated on the respective application schematic (see Figure 23 on page 12 and Figure 24 on page 14). Users following the RF, LO and IF matching guidelines will achieve similar performance.

Electrical Characteristics (Continued)

Test Conditions: V_{CC} = 5 V, T_{amb} = 25°C, RF input: -40 dB at 1880 MHz, LO input: 0 dBm at 1680 MHz

No.	Parameters	Test Conditions	Pin	Symbol	1700 to 2000 MHz Operation			2000 to 2300 MHz Operation			Unit	Type*
					Min.	Typ.	Max.	Min.	Typ.	Max.		
1.6	SSB noise figure		1, 16	NF_{SSB}		14	15		16	19	dB	D
1.7	RF return loss	Matched to 50 Ω(1)	4, 5	RL_{RF}		20			20		dB	D
1.8	LO return loss	Matched to 50 Ω(1)	12, 13	RL_{LO}		20			20		dB	D
1.9	IF return loss	Matched to 50 Ω(1)	1, 16	RL_{IF}		20			20		dB	D
1.10	LO drive	Matched to 50 Ω	12, 13	P_{LO}	-3	0	+3	-3	0	+3	dBm	D
2	**Isolation Performance**											
2.1	Leakage (LO-RF)		12, 13	A_{LO-RF}		-60	-40		-30	-20	dBm	D
2.2	Leakage (LO-IF)		12, 13	A_{LO-IF}		-30	-20		-30	-20	dBm	D
2.3	Leakage (RF-IF)					-53	-40		-35	-25	dBm	D
3	**Miscellaneous**											
3.1	Supply voltage		2, 7, 10, 15	V_{CC}	4.75	5.0	5.25	4.75	5.0	5.25	V	A
3.2	Supply current		2, 7, 10, 15	I_{CC}		160	180		160	180	mA	A

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

Note: 1. The return losses shown were measured with the T0781 mounted on Atmel's FR4 evaluation boards using standard matching practices as indicated on the respective application schematic (see Figure 23 on page 12 and Figure 24 on page 14). Users following the RF, LO and IF matching guidelines will achieve similar performance.

1700 MHz to 2000 MHz: Typical Device Performance

Figure 3. Conversion Gain versus Temperature, P_{LO} = 0 dBm

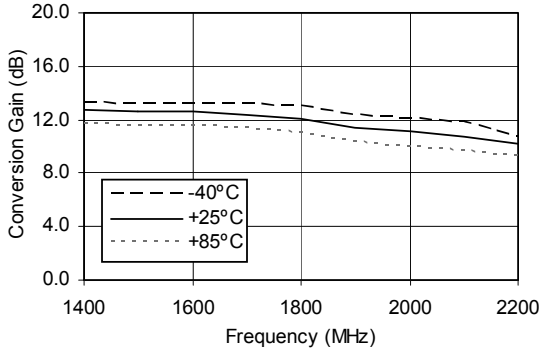


Figure 4. Conversion Gain versus LO Drive, T_{amb} = 25°C

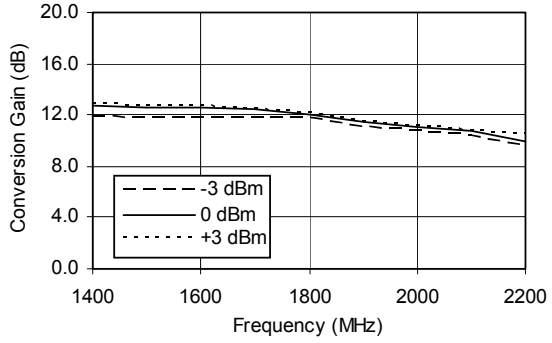


Figure 5. Leakages, P_{LO} = 0 dBm at Pins, P_{RF} = -20 dBm at Pins, T_{amb} = 25°C

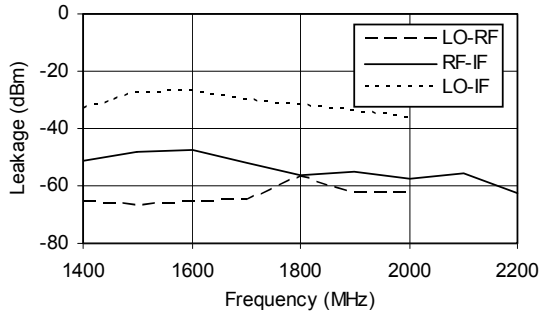


Figure 6. Input IP3 versus Temperature P_{LO} = 0 dBm

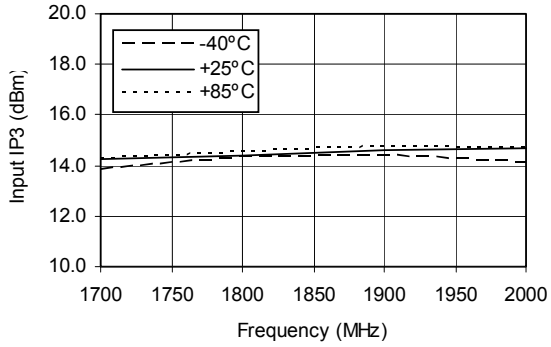


Figure 7. Input IP3 versus LO Drive, T_{amb} = 25°C

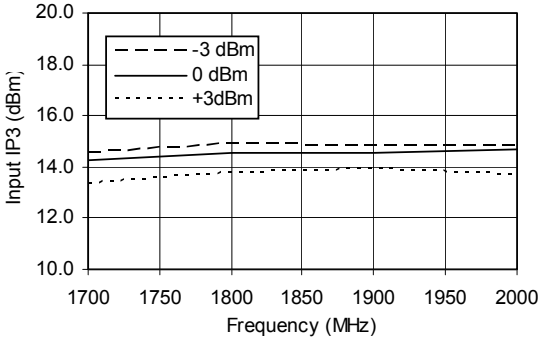


Figure 8. Noise Figure versus Temperature, P_{LO} = 0 dBm

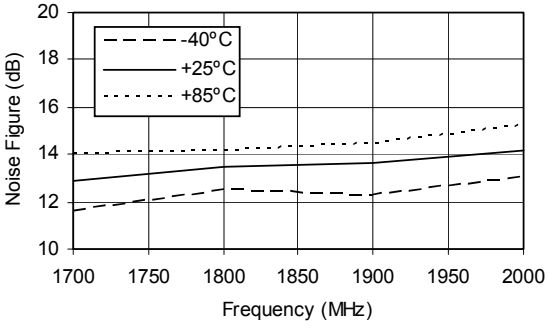


Figure 9. RF and LO Return Loss, T_{amb} = 25°C

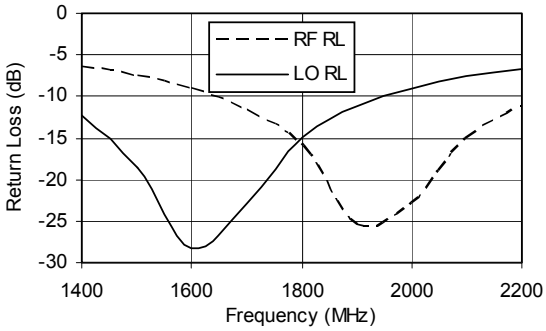


Figure 10. IF Return Loss, T_{amb} = 25°C

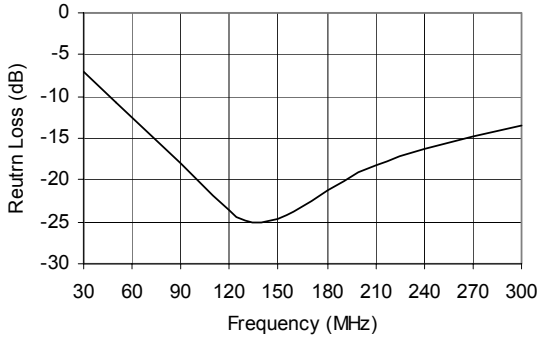


Figure 11. Input P1dB versus Temperature, P_{LO} = 0 dBm

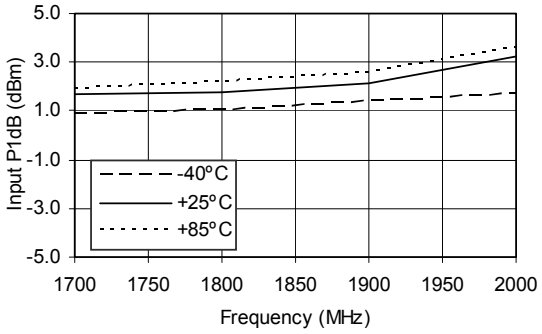
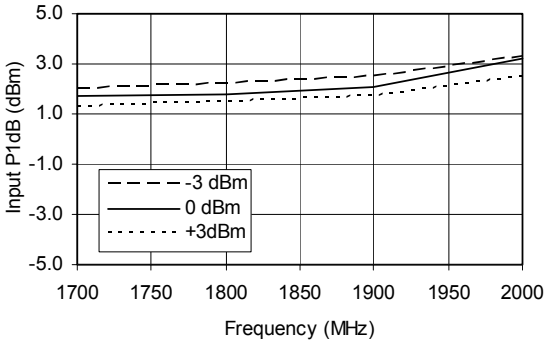


Figure 12. Input P1dB versus LO Drive, T_{amb} = 25°C



2200 MHz to 2300 MHz: Typical Device Performance, Single-ended Drive

Figure 13. Conversion Gain versus Temperature, P_{LO} = 0 dBm

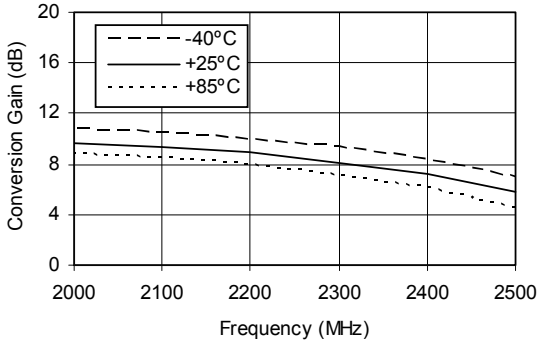


Figure 14. Conversion Gain versus LO Drive, T_{amb} = 25°C

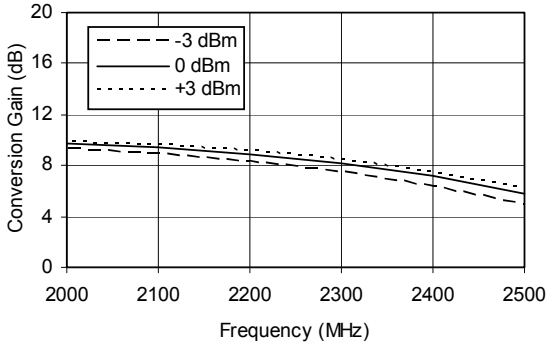


Figure 15. Leakages, P_{LO} = 0 dBm at Pins, P_{RF} = -20 dBm at Pins, T_{amb} = 25°C

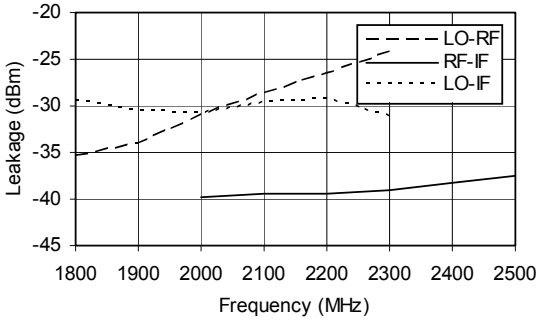


Figure 16. Input IP3 versus Temperature P_{LO} = 0 dBm

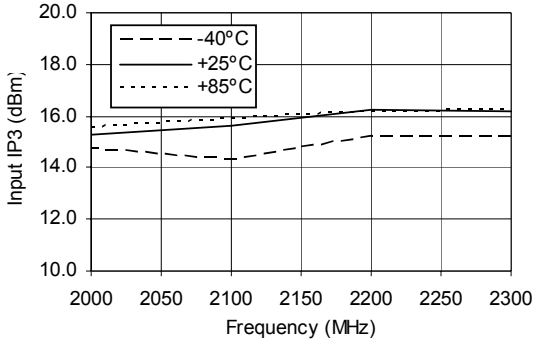


Figure 17. Input IP3 versus LO Drive, T_{amb} = 25°C

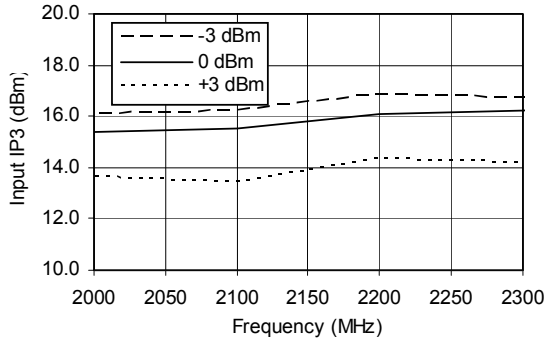


Figure 18. Input P1dB versus Temperature, T_{amb} = 25°C

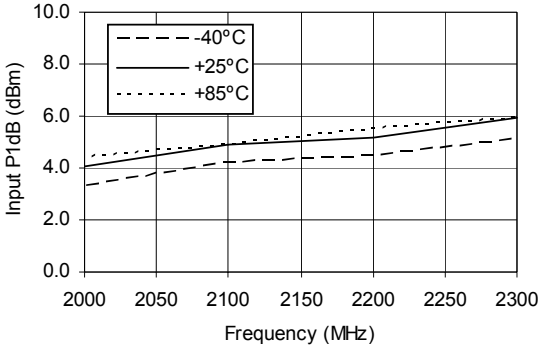


Figure 19. RF and LO Return Loss, V_{CC} = 5 V, T_{amb} = 25°C

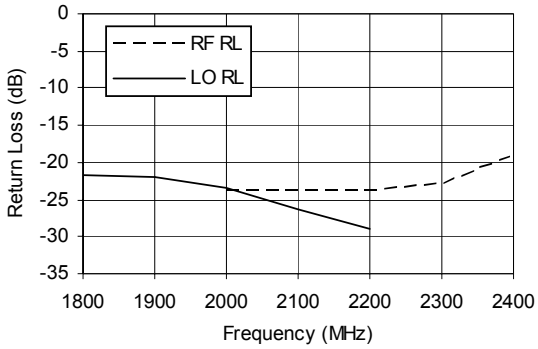


Figure 20. IF Return Loss, T_{amb} = 25°C

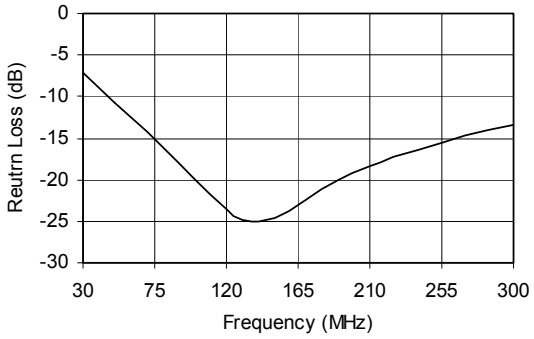


Figure 21. Input P1dB versus Temperature, P_{LO} = 0 dBm

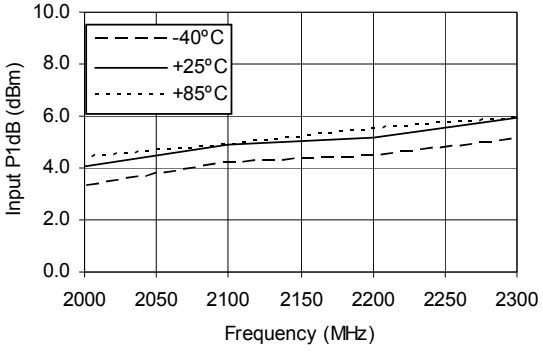


Figure 22. Input P1dB versus LO Drive, T_{amb} = 25°C

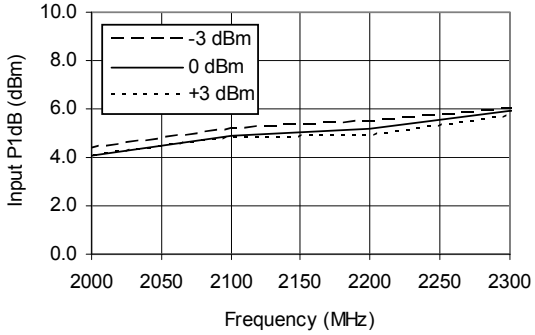
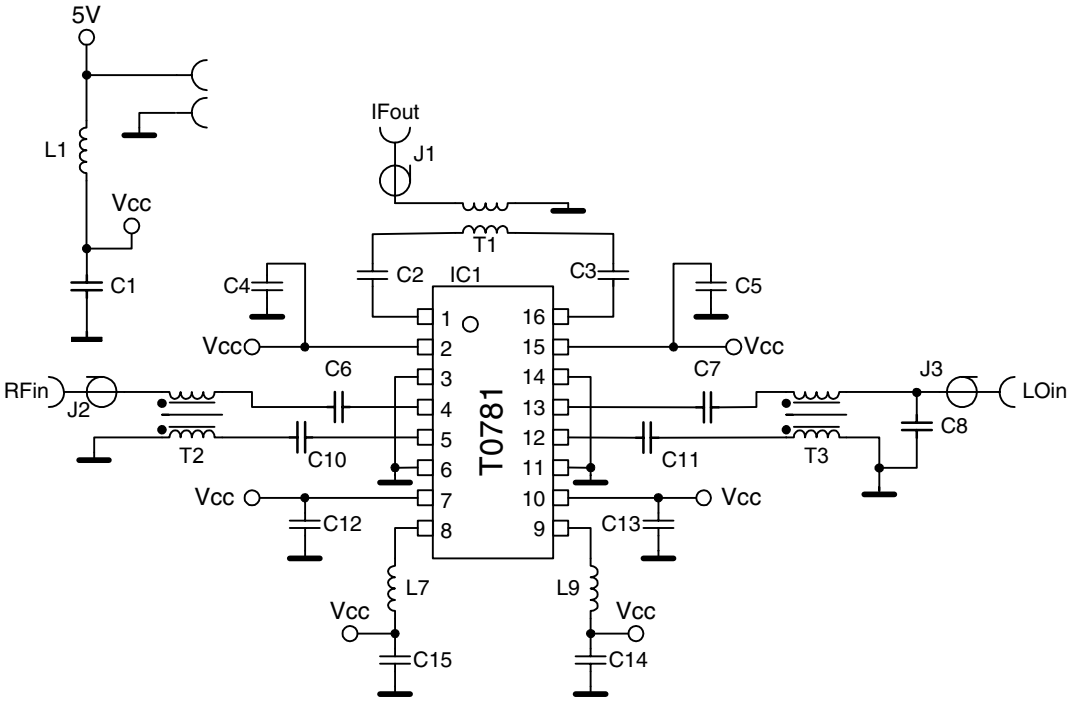


Figure 23. 1700 MHz to 2000 MHz Application Schematic (Differential Drive)



Bill of Materials (for 1700 MHz to 2000 MHz Evaluation Board)

Component Designator	Value	Vendor	Part Number	Description
IC1		Atmel	T0781	SiGe receiver mixer
J1, J2, J3		Johnson Components™	742-0711-841	SMA connector, end launch with tab, for 1.07 mm board
T2, T3	1:1	Panansonic®	EHF-FD1619	RF transformer
T1	1:1	Mini-Circuits®	TC1-1	IF transformer
L1	1 µH	Würth Elektronik®	74476401	Inductor, 1210 footprint, minimum 200 mA rating
L7, L9	see Table 1	Würth Elektronik	744786110	Inductor, 0603 footprint, high Q series
C1	10 µF	KEMET®	T491A106_010AS	Tantal chip capacitor, size A
C4, C5, C12, C13	6.8 pF	Vishay®	VJ0402A6R8JXXA_	Capacitor, 0402 footprint
C14, C15	100 pF	Vishay	VJ0402A101JXXA_	Capacitor, 0402 footprint
C2, C3	120 pF	Vishay	VJ0402A121JXXA_	Capacitor, 0402 footprint
C6, C10	2.7 pF	Vishay	VJ0402A2R7JXXA_	Capacitor, 0402 footprint
C7, C11	3.9 pF	Vishay	VJ0402A3R9JXXA_	Capacitor, 0402 footprint
C8	n.c.	-	-	Capacitor, 0402 footprint

The T0781 utilizes an IF tank circuit to maximize performance across the entire IF bandwidth. the off-chip inductors L7 and L9 resonate with an on-chip capacitor (4 pF) to provide IF tunability. therefore, L7 and L9 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 L7 = L9 = 100 nH, resulting in a 200 MHz resonant IF.

Table 1. IF Tank Circuit

IF (MHz) Typical	L7, L9 (nH)	Würth Elektronik Part Number
70	680	744780680
150	150	74478625
200	100	744786110
300	39	744786131

Bill of Materials (for 2000 MHz to 2300 MHz Evaluation Board)

Component Designator	Value	Vendor	Part Number	Description
IC1		Atmel	T0781	SiGe receiver mixer
J1, J2, J3		Johnson Components	742-0711-841	SMA connector, end launch with tab, for 1.07 mm board
T2, T3	1:1	Panansonic	EHF-FD1619	RF transformer
T1	1:1	Mini-Circuits	TC1-1	IF transformer
L1	1 µH	Würth Elektronik	74476401	Inductor, 1210 footprint, minimum 200 mA rating
L7, L9	see Table 1 on page 13	Würth Elektronik	744786110	Inductor, 0603 footprint, high Q series
C1	10 µF	KEMET	T491A106_010AS	Tantal chip capacitor, size A
C4, C5, C12, C13	6.8 pF	Vishay	VJ0402A6R8JXXA_	Capacitor, 0402 footprint
C14, C15	100 pF	Vishay	VJ0402A101JXXA_	Capacitor, 0402 footprint
C2, C3	120 pF	Vishay	VJ0402A121JXXA_	Capacitor, 0402 footprint
C6, C10	2.2 pF	Vishay	VJ0402A2R2JXXA_	Capacitor, 0402 footprint
C7, C11	2.2 pF	Vishay	VJ0402A2R2JXXA_	Capacitor, 0402 footprint
C8	1 pF	Vishay	VJ0402A1R0JXXA_	Capacitor, 0402 footprint

Figure 24. Demo Test Board (Fully Asembled PCB)

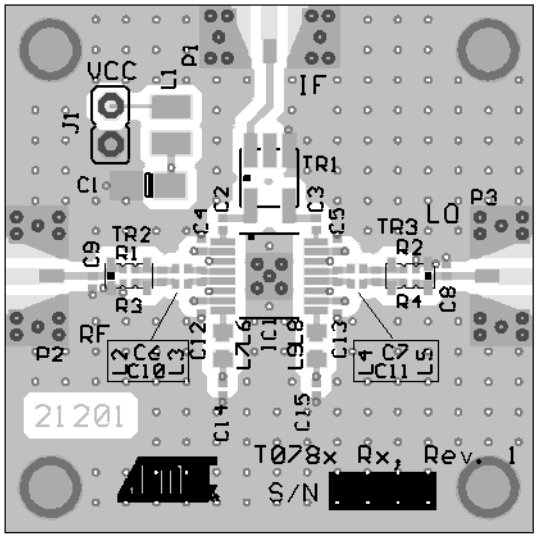
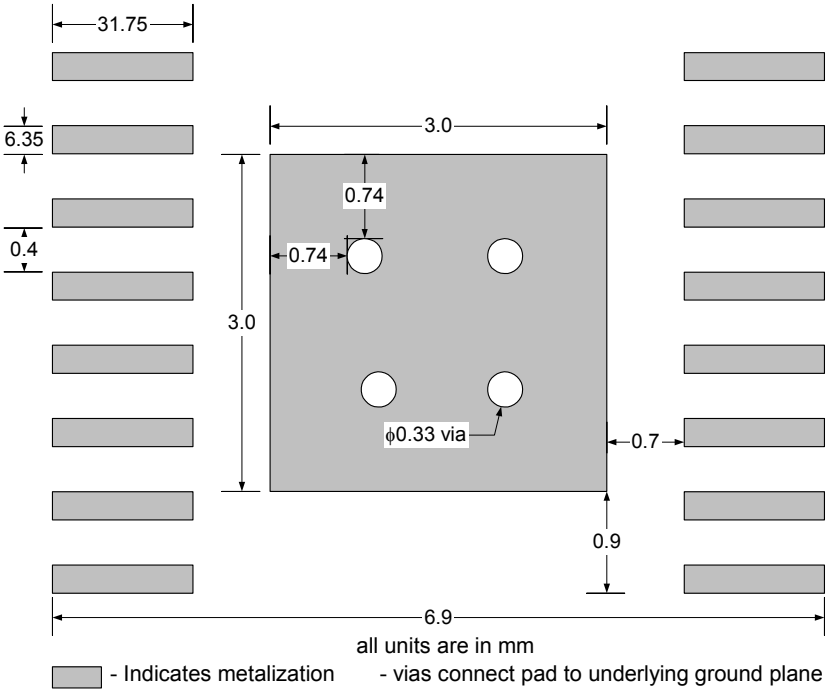


Figure 25. Recommended Package Footprint

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



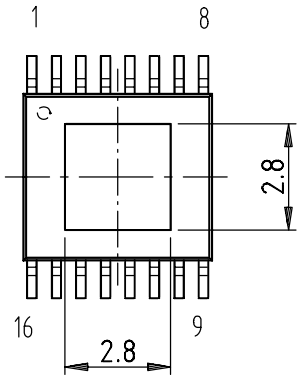
Remark: Heatslug must be soldered to GND.

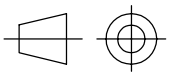
Ordering Information

Extended Type Number	Package	Remarks
T0781-6C	TSSOP16	–

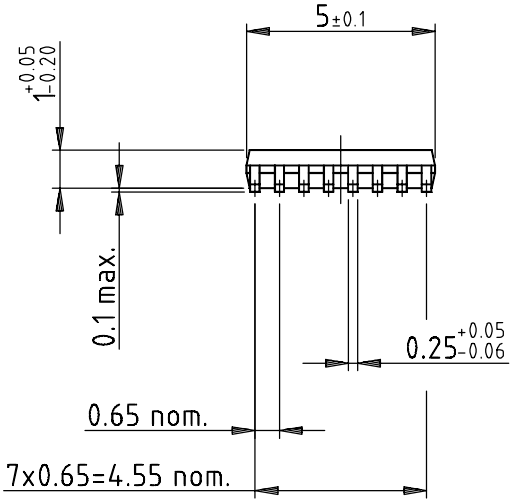
Package Information

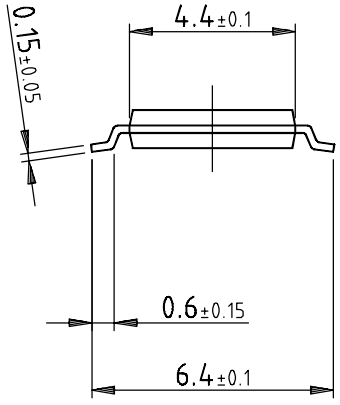
Package: SSOP16
(acc. JEDEC SMALL OUTLINE No. MO-153)
Dimensions in mm





technical drawings
according to DIN
specifications





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

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