Features

- **Active Mixer with Conversion Gain**
- **Integrated LO and IF Drivers**
- **Excellent Linearity**
- **Broadband 50 Ω Impedance on All Ports**
- **Low LO-RF Leakage**
- **Differential or Single Ended Inputs**

Applications

- **AMPS/GSM/TDMA/CDMA Transmitter**
- **Other Digital Communication Applications**
- **High Performance RF Instrumentation**

Benefits

- **Small and Thin 16-pin SSOP Package with Exposed Paddle**
- **Few External Components**
- **Fully ESD Protected**

Electrostatic sensitive device.
Observe precautions for handling.

High Linearity Active Transmit Mixer for 800 MHz to 1000 MHz

ATR0785

Preliminary

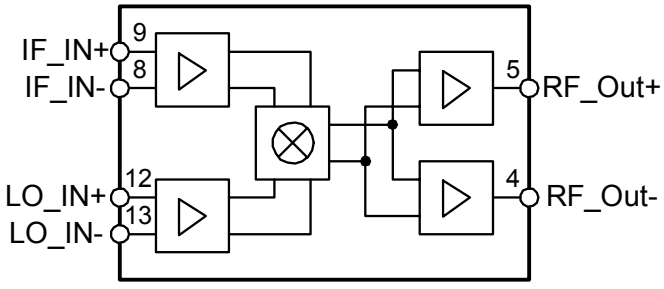
Description

The ATR0785 is a highly linearity active mixer which is manufactured using Atmel´s advanced Silicon Germanium technology for the use in a variety of high performance requiring RF systems such as digital communications.

This mixer features a frequency range of 800 MHz to 1000 MHz. It operates from a single 5 V supply and provides 14 dB of conversion gain while requiring only 0 dBm input to the integrated LO driver. An IF and an LO amplifier is also included.

The ATR0785 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.

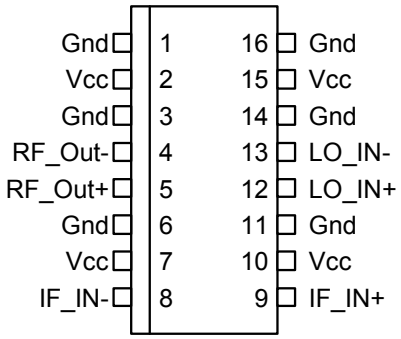
Figure 1. Block Diagram



Rev. 4585B–SIGE–02/03

Pin Configuration

Figure 2. Pinning TSSOP16



Pin Description

Pin	Symbol	Function
1	Gnd	Ground
2	Vcc	Supply voltage
3	Gnd	Ground
4	RF_OUT-	Negative RF output; nominal DC voltage is 2.3 V; (internally biased) input should be AC-coupled
5	RF_OUT+	Positive RF output; nominal DC voltage is 2.3 V; (internally biased) input should be AC-coupled
6	Gnd	Ground
7	Vcc	Supply voltage
8	IF_IN-	Negative IF input; nominal DC voltage is 2.3 V, provided through off-chip inductors
9	IF_IN+	Positive IF input; nominal DC voltage is 2.3 V, provided through off-chip inductors
10	Vcc	Supply voltage
11	Gnd	Ground
12	LO_IN+	Negative local oscillator input; nominal DC voltage is 2.3 V; (internally biased) input should be AC-coupled
13	LO_IN-	Positive local oscillator input; nominal DC voltage is 2.3 V; (internally biased) input should be AC-coupled
14	Gnd	Ground
15	Vcc	Supply voltage
16	Gnd	Ground
Paddle	–	Device ground and heat sink, requires good thermal path; RF reference plane

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Supply voltages, no RF applied	V_{CC}	-0.5 to +5.5	V
LO input signals	LO_IN-; LO_IN+	10.0	dBm
IF input signals	IF_IN-; IF_IN+	10.0	dBm
Operating case temperature	T_C	-40 to +85	°C
Storage temperature	T_{STG}	-55 to +150	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	25	K/W

Electrical Characteristics

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: V_{CC} = +5.0 V, T_{amb} = 25°C; P_{LO} = 0 dBm; IF = 200 MHz; P_{IF} = -20 dBm

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	General Performance								
	Supply voltage			V_{CC}	4.75	5.0	5.25	V	
	Supply current			I_{CC}		200		mA	
	LO drive	Matched to 50 Ω			-3	0	+3	dBm	
	LO, IF, RF return loss	Matched to 50 Ω				14		dB	

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

RF Electrical Characteristics

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: V_{cc} = +5.0 V, T_{amb} = 25°C; P_{LO} = 0 dBm; IF = 200 MHz; P_{IF} = -20 dBm

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	Mixer RF Performance								
	RF frequency			f_{RF}	800		900	MHz	
	LO frequency			f_{LO}	600		700	MHz	
	IF frequency			f_{IF}	30	200	400	MHz	
	Conversion gain			G	9	12	16	dB	
	SSB noise figure			NF		9.0	11.0	dB	
	Output IP3	IF1 = IF2 = -20 dBm/tone, 1 MHz spacing		OIP3	17	21		dBm	
	Output P1dB			P1dB	5	7		dBm	
	Leakage (LO-RF)					-35	-25	dBm	
	Leakage (LO-IF)					-40	-30	dBm	
	Mixer RF Performance								
	RF frequency			f_{RF}	900		1000	MHz	
	LO frequency			f_{LO}	700		800	MHz	
	IF frequency			f_{IF}	30	200	400	MHz	
	Conversion gain			G	11	14	16	dB	
	SSB noise figure			NF		9.0	11.0	dB	
	Output IP3	IF1 = IF2 = -20 dBm/tone, 1 MHz spacing		OIP3	19	22		dBm	
	Output P1dB			P1dB	6	8.5		dBm	
	Leakage (LO-RF)					-30	-20	dBm	
	Leakage (LO-IF)					-35	-25	dBm	

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

Typical Performance

Figure 3. Conversion Gain versus Frequency + Temperature

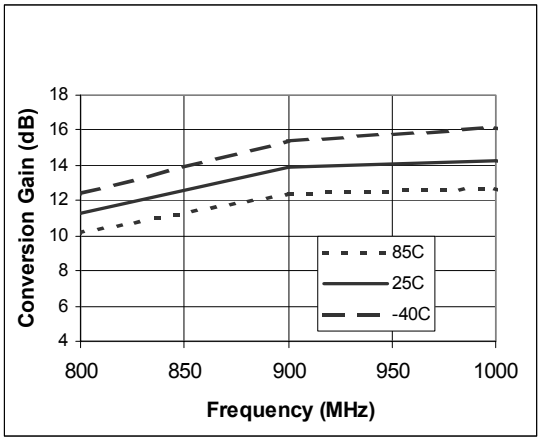


Figure 4. Output IP3 versus Frequency + Temperature

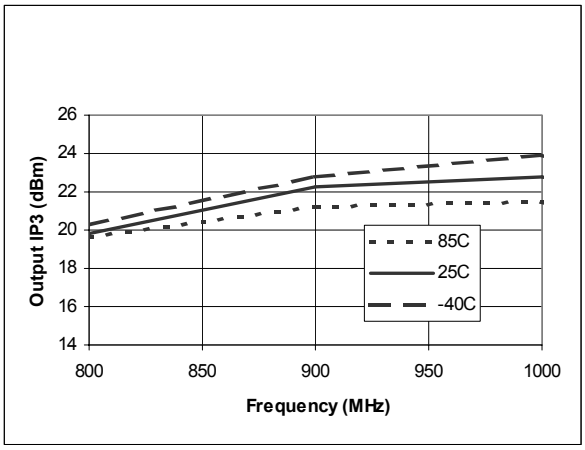


Figure 5. Output IP3 versus Frequency + LO Drive

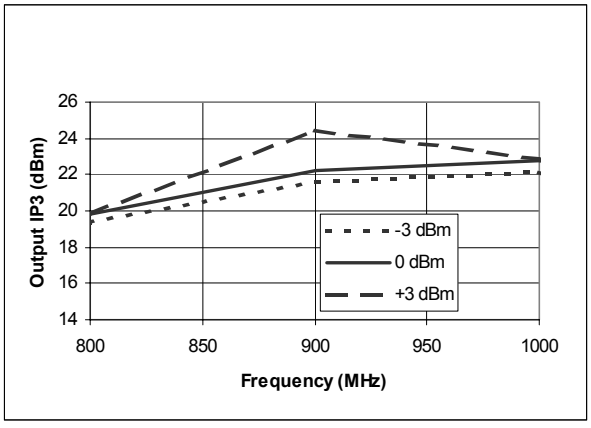


Figure 6. Leakages versus Frequency

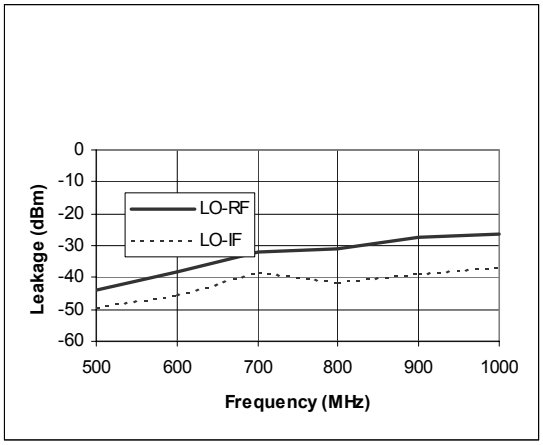


Figure 7. Noise Figure versus Frequency + Temperature

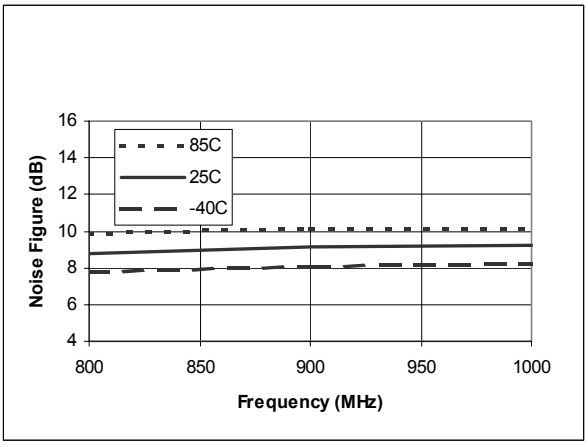


Figure 8. RF and LO Return Loss versus Frequency

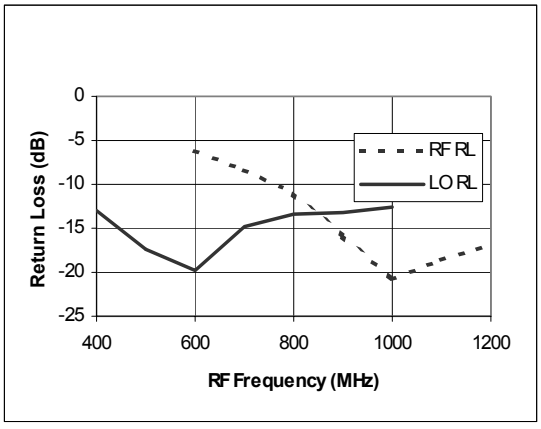


Figure 9. Output P1dB versus Frequency + Temperature

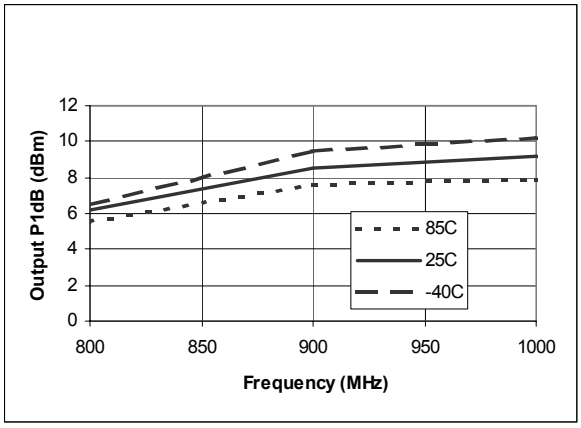


Figure 10. IF Return Loss versus Frequency

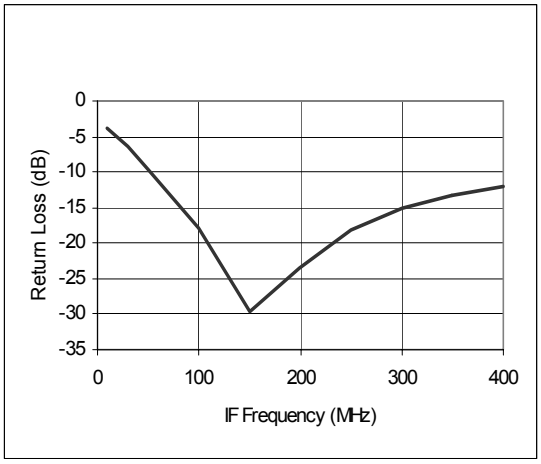


Figure 11. Output P1dB versus Frequency + LO Drive

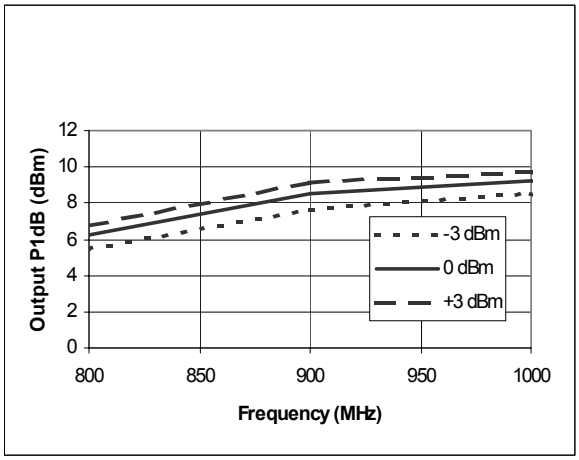
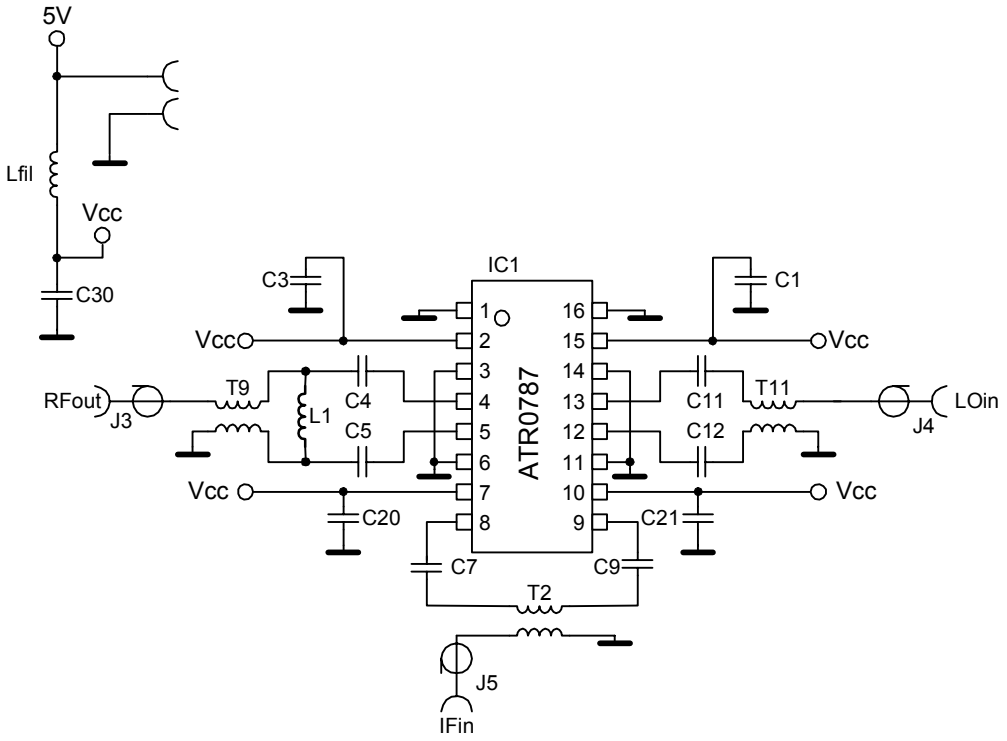


Figure 12. Demo Board Schematic

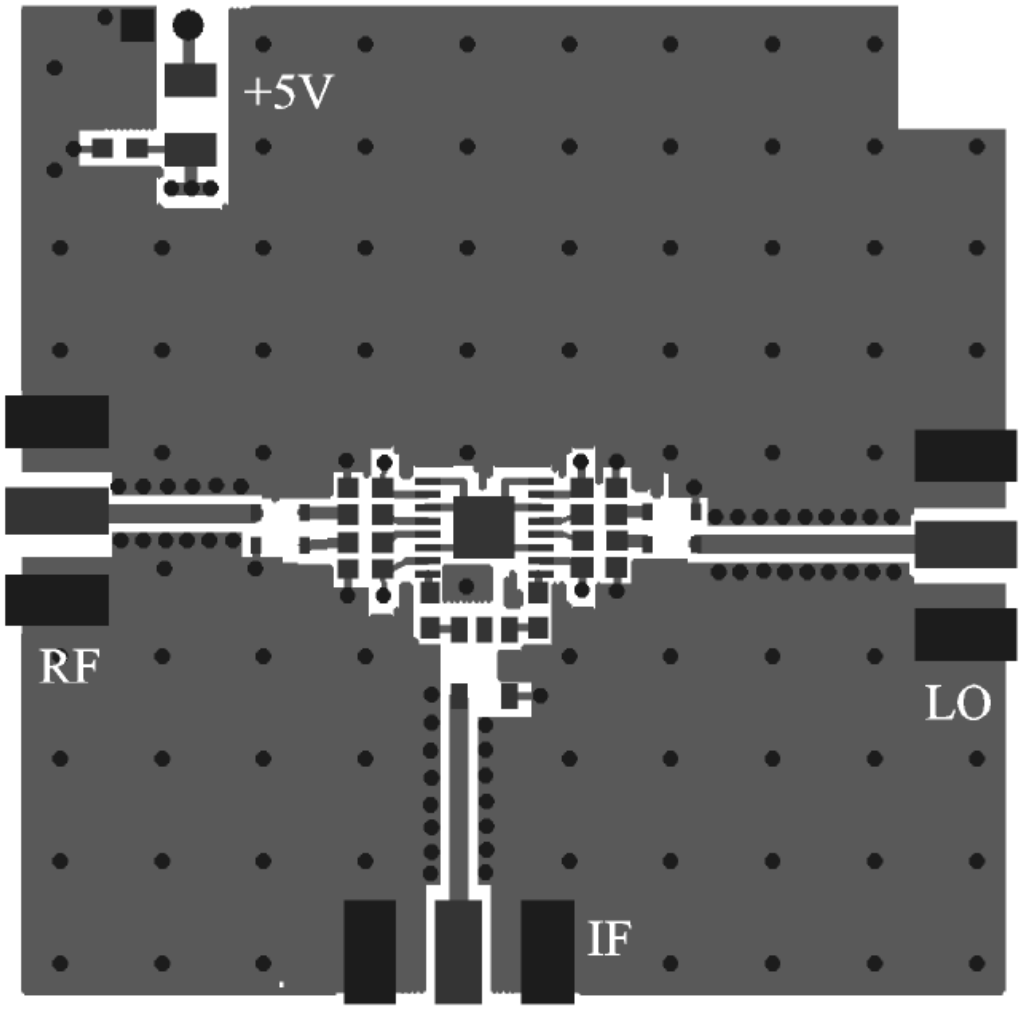


Bill of Material of Demo Board

Parameters	Test Conditions	Pin	Symbol	Min.	Typ.
Highly linear active mixer		Atmel	ATR0785		16-pin TSSOP
Capacitor	C7, C9			100 pF	0603
Capacitor	C1, C3, C20, C21, C30			27 pF	0603
Capacitor	C11, C12			22 pF	0603
Capacitor	C4, C5			5.6 pF	0603
Inductor	Lfil	Würth Elektronik	74476401	1 µH	1210
Inductor	L1	TOKO	LL1608-FS39NJ	39 nH	0603
Transformer	T9; T11	Panasonic	EHF-FD1618		
Transformer	T2	Mini-Circuits®	TC1-1		
RF connector		Johnson Components	142-0701-851		SMA

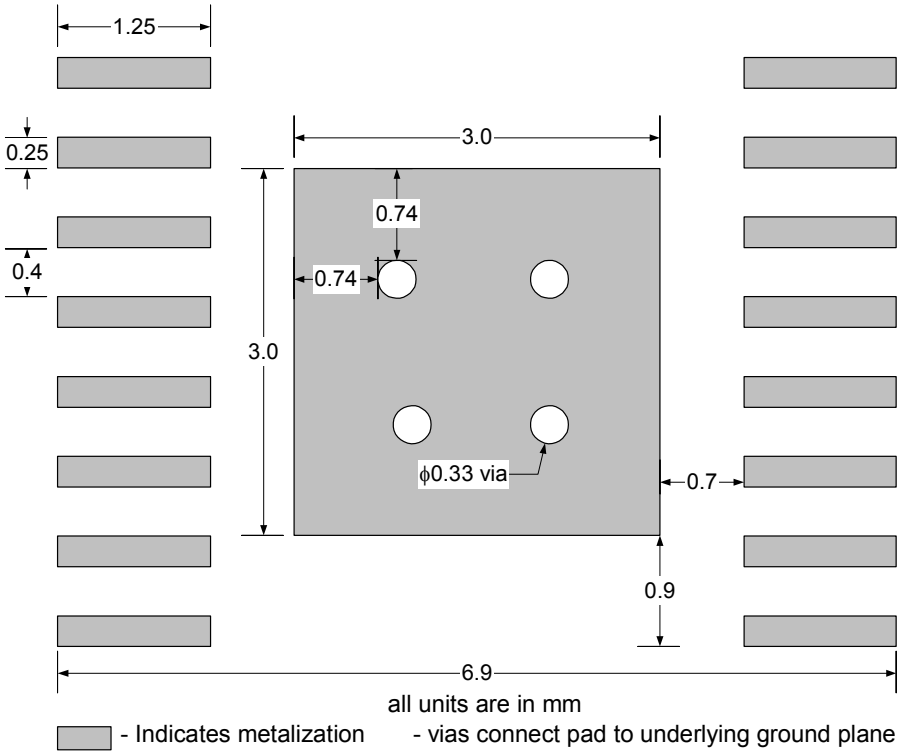
Note: 1. Other sizes are possible.

Figure 13. Demo Test Board



Recommended Package Footprint

Notes: 1. Only ground signal traces are allowed directly under the package.
2. Primary dimensions are in millimeter alternate dimensions are in inches.



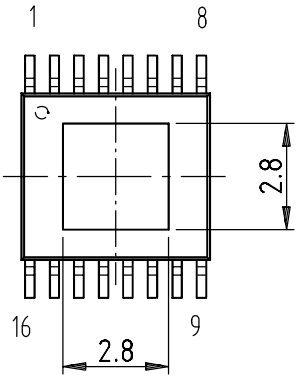
Remark: Heatslug must be soldered to GND!
Plugging of the ground vias under the heat slug is also recommended to avoid soldering problems.

Ordering Information

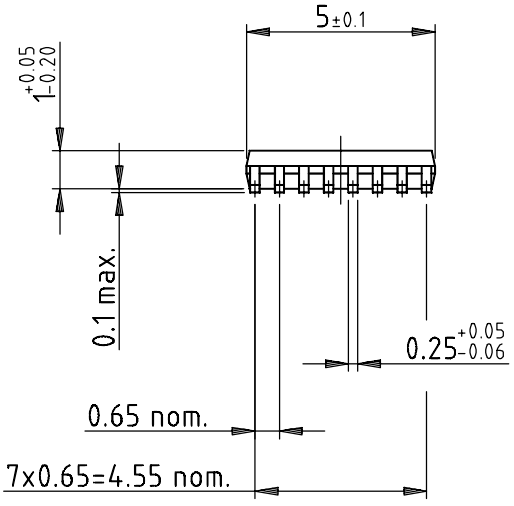
Extended Type Number	Package	Remarks
ATR0785	TSSOP16	5.0 mm × 6.4 mm

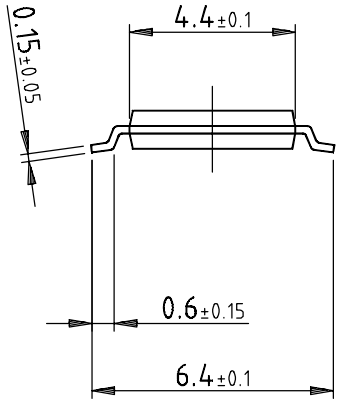
Package Information

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

Atmel Headquarters

Corporate Headquarters
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 487-2600

Europe
Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
TEL (41) 26-426-5555
FAX (41) 26-426-5500

Asia
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimhatsui
East Kowloon
Hong Kong
TEL (852) 2721-9778
FAX (852) 2722-1369

Japan
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
TEL (81) 3-3523-3551
FAX (81) 3-3523-7581

Atmel Operations

Memory
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 436-4314

Microcontrollers
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
TEL (33) 2-40-18-18-18
FAX (33) 2-40-18-19-60

ASIC/ASSP/Smart Cards
Zone Industrielle
13106 Rousset Cedex, France
TEL (33) 4-42-53-60-00
FAX (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL 1(719) 576-3300
FAX 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
TEL (44) 1355-803-000
FAX (44) 1355-242-743

RF/Automotive
Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
TEL (49) 71-31-67-0
FAX (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL 1(719) 576-3300
FAX 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/
High Speed Converters/RF Datacom
Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
TEL (33) 4-76-58-30-00
FAX (33) 4-76-58-34-80

---

e-mail
literature@atmel.com

Web Site
http://www.atmel.com

4585B–SIGE–02/03 xM