
Features

- KPCS Band CDMA and GPS Operation
- Low Current Consumption
- Excellent Noise and IP3 Performance
- Adjustable Third Order Intercept on LNA Stage
- Flexible IF Frequency Range from 80 MHz to 230 MHz
- Excellent Cross Modulation Performance

Applications

- Quad-mode/Dual-band CDMA IS-95/98 Based Mobile Phones with GPS Support
- Other Familiar Applications

Benefits

- High Linearity Eliminates Potential Call Drop Issues Associated with Gain Switching
- Most Compact Integrated Receiver for K-PCS and A-GPS Applications
- IM98 IMD Requirements Met with two Gain States Simplifying Calibration Procedure
- Best in Class A-GPS Cascade Gain for Maximum Take-over
- TX LO Buffer Included
- Few External Components
- Fully ESD Protected

Electrostatic sensitive device.

Observe precautions for handling.



Description

The T0352 is a CDMA front-end receiver RFIC designed for dual-band, dual-mode operation. The device supports Korean PCS (K-PCS) CDMA and A-GPS operation. The IF range is from 80 MHz to 230 MHz with external tuning. The K-PCS low noise amplifier has an adjustable third order intercept (IP3) to minimize inter-modulation and cross-modulation effects. The mixers are designed for differential IF outputs (single-ended or differential IF outputs for GPS modes), and they feature excellent linearity and low noise figure.

The T0352 device is available in a 4 mm × 4 mm MLF package with 24 pins. This front-end receiver is capable of meeting all electrical requirements in accordance with the TIA/EIA 98-C Wireless Communication standard.



2.8 V Dual-band/ Dual-mode RF Receiver for K-PCS/GPS

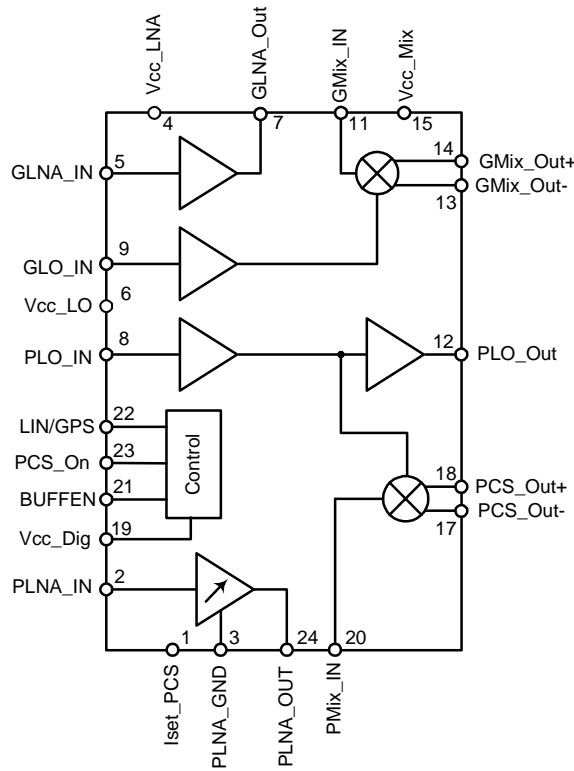
T0352

Preliminary (Summary)

Rev. 4579AS-CDMA-11/02

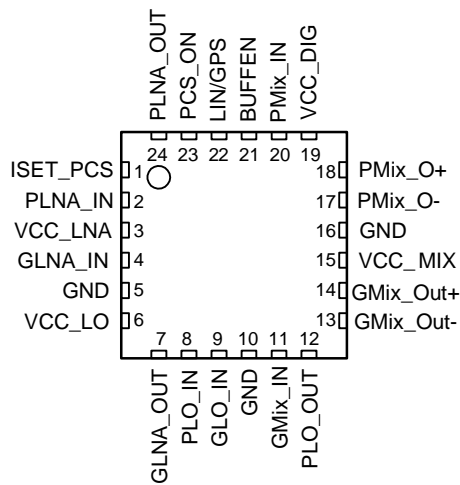


Figure 1. Block Diagram



Pin Configuration

Figure 2. Pinning HP-VFQFP-N24



Pin Description

Pin	Symbol	Function
1	Iset_PCS	Bias resistor for K-PCS LNA. For typical bias use a 560 Ω resistor to ground which set the bias current for HGHL mode.
2	PLNA_IN	PCS LNA input. Requires a DC blocking capacitor and an L-C (shunt C/series L) matching network for optimum gain, intercept and noise performance.
3	Vcc_LNA	Power supply pin for K-PCS LNA. Bypass with a capacitor as close to the pin as possible.
4	GLNA_IN	GPS LNA input. Requires LC match, see Pin 2.
5	GLNA_GND	GPS LNA emitter-ground. The LNA emitter ground should be grounded immediately to the ground plane to reduce stray inductance and capacitance that may affect performance.
6	Vcc_LO	Supply voltage for LO buffer.
7	GLNA_OUT	GPS LNA output.
8	PLO_IN	K-PCS LO input.
9	GLO_IN	GPS LO input.
10	GND	Device ground.
11	GMix_IN	GPS mixer input.
12	PLO_OUT	K-PCS LO buffer output. Internally matched to 100 Ω . Does not require a blocking capacitor.
13	GMix_OUT-	Negative GPS IF output.
14	GMix_OUT+	Positive GPS IF output.
15	Vcc_Mix	Supply voltage for all mixers.
16	GND	Device ground.
17	PMix_OUT-	Negative CDMA IF output.
18	PMix_OUT+	Positive CDMA IF output.
19	Vcc_DIG	Supply voltage for logic control circuits.
20	PMix_IN	K-PCS Mixer RF input.
21	BUFFEN	LO output buffer enable. Set BUFFEN pin HIGH to power up the PCS LO buffer output.
22	LIN/GPS	–
23	PCS_ON	Logic input for activating PCS LNA; Logic high selects PCS. Logic low means inactive.
24	PLNA_OUT	PCS LNA output. Requires a pull-up inductor to Vcc and a series blocking capacitor, which can be used as the output matching network.
–	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 +4.0	V
Logic control voltages	V_{CTRL}	-0.5 to + V_{CC} +0.5	V
Supply current	I_{CC}	50.0	mA
RF and LO input signals	P_{LO} ; G_{LO} ; PLNA_IN; GLNA_IN;	5.0	dBm
I_{SET_PCS} ; I_{SET_CELL}	LNA IP3 Adjustment	1	mA
Operating case temperature	T_C	-40 to +100	°C
Storage temperature	T_{STG}	-55 to +150	°C

Thermal Resistance

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

DC Supply Characteristics

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions (no RF applied): $V_{CC} = +2.75$ V, $T_{amb} = 25^\circ\text{C}$.

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	All Modes								
	Supply voltage		3, 15, 19	V_{CC}	2.7	2.8	3.3	V	
	Control voltage high		23, 21, 22	V_{CTRL}	1.7			V	
	Control voltage low		21, 22, 23	V_{CTRL}			0.5	V	
	LO Rx buffer supply current		15	I_{CC_MIX}		7.0		mA	
	LO Tx buffer current	BUFFEN = High	15	I_{CC_MIX}		6.0		mA	
	Logic-high current		21, 22, 23	I_{CTRL}			100	μA	
	Logic-low current		21, 22, 23	I_{CTRL}	-5.0			μA	
	Power-down supply current	PCS_On, LIN = Low	3, 13, 14, 15, 17, 18, 19, 24	I_{CC}			10	μA	

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

AC Electrical Characteristics

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: $V_{CC} = +2.75\text{ V}$, $T_{amb} = 25^\circ\text{C}$, all RF inputs and outputs with a return loss of 10 dB minimum.

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
General Performance									
	Operating frequency range	K-PCS band	2, 20	f_{PCS}	1840	1855	1870	MHz	
		A-GPS band	4, 11	f_{GPS}		1575.42		MHz	
	LO frequency range	K-PCS band: IF = 183.6 MHz	8	f_{LOPCS}	1656		1686	MHz	
			8	f_{LOPCS}	2023		2053	MHz	
		GPS band: IF = 183.6 MHz	9	f_{LOGPS}		1391.82		MHz	
			9	f_{LOGPS}		1759.02		MHz	
	IF frequency range	K-PCS and GPS Band	13, 14, 17, 18	f_{IF}	80	85	230	MHz	
	LO input power level	K-PCS and GPS Band	8, 9	P_{LO}	-10	-5	0	dBm	
	LO Tx buffer output power level	K-PCS band; not matched at dedicated frequency	12	P_{LOOUT}	-8	-3		dBm	

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

Cascade RF Electrical Characteristics (K-PCS Band)

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: $V_{CC} = +2.75\text{ V}$, $T_{amb} = 25^\circ\text{C}$, RF = 1960 MHz; LO = 2045 MHz; IF = 85 MHz; LO input = -5.0 dBm; RF input = -30 dBm (high gain mode)

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
Combined LNA and Mixer Performance (CDMA Modulation)									
High-gain High-linearity Mode (HGHL)									
	Gain	PCS_On = High; LIN = High		G		26		dB	
	Noise figure			NF		2.2		dB	
	Input IP3			IIP3		-1.5		dBm	
	Supply current			I_{CC}		30		mA	
High-gain Low-linearity Mode (HGLL, Paging Mode)									
	Gain	PCS_On = High; LIN = Low		G		25.3		dB	
	Noise figure			NF		2.2		dB	
	Input IP3			IIP3		-5.3		dBm	
	Supply current			I_{CC}		24		mA	

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

Cascade RF Electrical Characteristics (GPS Band)

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: $V_{CC} = +2.75\text{ V}$, $T_{amb} = 25^{\circ}\text{C}$, $RF = 1575.42\text{ MHz}$; $LO = 1490.42\text{ MHz}$; $IF = 85\text{ MHz}$; $LO\text{ input} = -5.0\text{ dBm}$; $RF\text{ input} = -45\text{ dBm}$

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
Combined LNA and Mixer Performance									
A-GPS LNA PERFORMANCE									
	Gain	PCS_On = Low; LIN = High		G		37		dB	
	Noise figure			NF		1.5		dB	
	Input IP3			IIP3		-17.5		dBm	
	Supply current			I_{CC}		21		mA	

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

Typical Electrical Characteristics LNA and Mixer Separately (K-PCS Band)

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: $V_{CC} = +2.75\text{ V}$, $T_{amb} = 25^{\circ}\text{C}$, $RF = 1960\text{ MHz}$; $LO = 2045\text{ MHz}$; $IF = 85\text{ MHz}$; $LO\text{ input} = -5.0\text{ dBm}$; $RF\text{ input} = -25\text{ dBm}$ (high gain mode)

No.	Parameters	Test Conditions	Gain (dB)	NF (dB)	IIP3 (dBm)	Type*
K-PCS Band, High-gain High-linearity Mode (HGHL); CDMA Modulation						
	K-PCS LNA	PCS_On = High; LIN = High	15.5	1.6	9.0	
	K-PCS mixer		13.5	6.2	11.0	
K-PCS Band, High-gain Low-linearity Mode (HGLL); CDMA Modulation						
	K-PCS LNA	PCS_On = High; LIN = Low	15	1.6	7.5	
	K-PCS mixer		13.3	6.0	7.5	

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

Typical Electrical Characteristics LNA and Mixer separately (GPS Band)

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: $V_{CC} = +2.75\text{ V}$, $T_{amb} = 25^{\circ}\text{C}$, $RF = 1575.42\text{ MHz}$; $LO = 1490.42\text{ MHz}$; $IF = 85\text{ MHz}$; $LO\text{ input} = -5.0\text{ dBm}$; $RF\text{ input} = -35\text{ dBm}$

No.	Parameters	Test Conditions	Gain (dB)	NF (dB)	IIP3 (dBm)	Type*
A-GPS Mode						
	GPS LNA	PCS_On = High; LIN = Low	19.5	1.5	-2.8	
	GPS Mixer		17.5	5.9	-3.0	

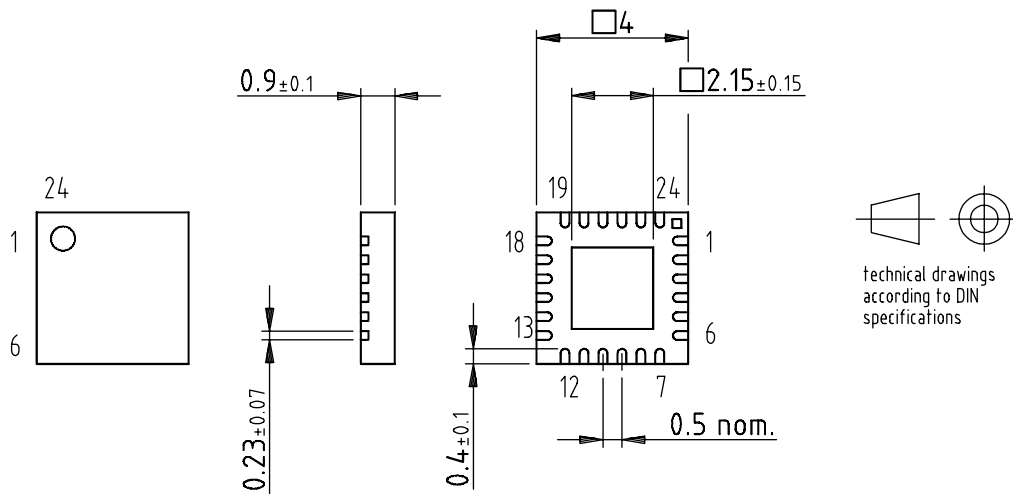
*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Ordering Information

Extended Type Number	Package	Remarks
T0352	HP-VFQFP-N24	4 mm × 4 mm

Package Information

Package: HP-VFQFP-N24
 (acc. JEDEC OUTLINE No. MO-220)
 Dimensions in mm



Drawing-No.: 6.543-5086.01-4
 Issue: 1; 26.02.02

Note: 1. GND solder mask opening is not centered on the package.



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>

© Atmel Corporation 2002.

Atmel Corporation makes no warranty for the use of its products, other than those expressly contained in the Company's standard warranty which is detailed in Atmel's Terms and Conditions located on the Company's web site. The Company assumes no responsibility for any errors which may appear in this document, reserves the right to change devices or specifications detailed herein at any time without notice, and does not make any commitment to update the information contained herein. No licenses to patents or other intellectual property of Atmel are granted by the Company in connection with the sale of Atmel products, expressly or by implication. Atmel's products are not authorized for use as critical components in life support devices or systems.

Atmel® is the registered trademark of Atmel.

Other terms and product names may be the trademarks of others.



Printed on recycled paper.