Features

- **Cell 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

- **Cell and GPS-mode/Cell and GPS-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 Cell Band CDMA and A-GPS Applications**
- **IM98 IMD Requirements Met With two Gain States Simplifying Calibration Procedure**
- **Best In Class A-GPS Cascade Gain for Maximum Takeover**
- **TX LO Buffer Included**
- **Very Small 24-pin 4 mm x 4 mm Package**
- **Few External Components**
- **Fully ESD Protected**

Electrostatic sensitive device.
Observe precautions for handling.

Description

The T0354 is a CDMA front-end receiver RFIC designed for cell-band, cell and GPS-mode operation. The device supports CDMA operation in the cellular band and A-GPS operation. The IF range is from 80 MHz to 230 MHz with external tuning. The cell-band 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 mode), and they feature excellent linearity and low noise figure.

The T0354 device is available in a 4 mm x 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.

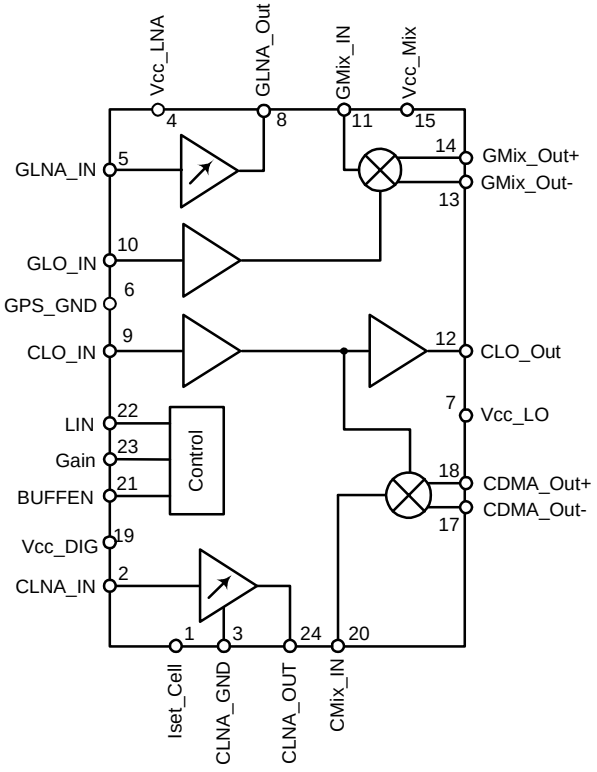
2.8 V Dual-band/ Dual-mode RF Receiver for Cell CDMA/GPS

T0354

Preliminary (Summary)

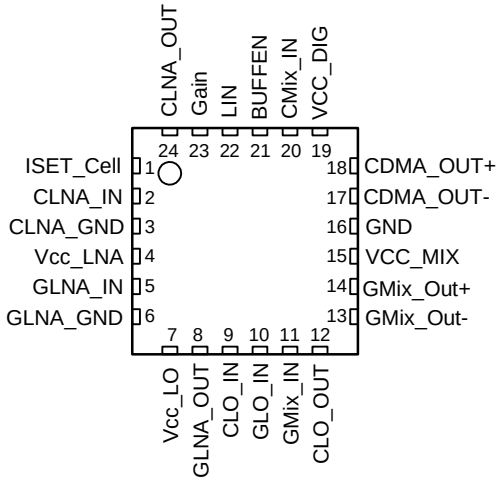
Rev. 4580AS–CDMA–11/02

Figure 1. Block Diagram



Pin Configuration

Figure 2. Pinning HP-VFQFP-N24



Pin Description

Pin	Symbol	Function
1	Iset_Cell	Bias resistor for cell LNA. For typical bias use a 390 Ω resistor to ground which sets the bias current for HGHL mode.
2	CLNA_IN	Cell band LNA input. Requires a blocking capacitor and an LC (shunt C/series L) matching network for optimum gain, intercept and noise performance.
3	CLNA_GND	Cell band LNA emitter ground. The LNA emitter ground should be connected immediately to the ground plane to reduce stray inductance and capacitance that may affect performance.
4	Vcc_LNA	Power supply pin for GPS and Cell LNAs. Bypass with a capacitor as close to the pin as possible.
5	GLNA_IN	GPS LNA input. Requires a DC blocking capacitor and an L-C shunt (shunt C/series L) matching network for optimum gain, intercept and noise performance.
6	GLNA_GND	Cell band LNA emitter ground. The LNA emitter ground should be connected immediately to the ground plane to reduce stray inductance and capacitance that may affect performance.
7	Vcc_LO_TX	Supply voltage for LO buffers.
8	GLNA_OUT	GPS LNA output.
9	CLO_IN	Cell band LO input.
10	GLO_IN	GPS LO input.
11	GMix_IN	GPS mixer input.
12	CLO_OUT	Cell band 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	CDMA_OUT-	Negative CDMA output.
18	CDMA_OUT+	Positive CDMA output.
19	Vcc_DIG	Supply voltage for logic control circuits.
20	CMix_IN	Cell band mixer RF input.
21	BUFFEN	LO output buffer enable. Set BUFFEN pin HIGH to power up the LO buffer output corresponding to the selected band.
22	LIN	Logic input for high or low linearity. Logic HIGH selects high linearity.
23	Gain	Logic input for activating Cell LNA; Logic LOW selects low gain.
24	CLNA_OUT	Cell band LNA output. Requires a pull-up inductor to Vcc and a series blocking capacitor, which can be used as part of the output matching network.
25	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	$C_{LO;}$ CLNA_IN; GLNA_IN;	5.0	dBm
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°C.

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	All Modes								
	Supply voltage		4, 7, 15, 19	V_{cc}	2.7	2.8	3.3	V	
	Control voltage high		21, 22, 23	V_{CTRL}	1.7			V	
	Control voltage low		21, 22, 23	V_{CTRL}			0.5	V	
	LO Rx buffer supply current		9, 10	I_{CCMIX}		8.0		mA	
	LO Tx buffer current	BUFFEN = High	12	I_{CCMIX}		5.0		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	Gain, LIN = LOW	4, 7, 15, 19	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 V, T_{amb} = 25°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	Cellular band	2	f_{CELL}	869	881.5	894	MHz	
		A-GPS band	5	f_{GPS}		1575.42		MHz	
	LO frequency range	Cellular band: IF = 85 MHz	9	f_{LOCELL}	784		809	MHz	
			9	f_{LOCELL}	954		979	MHz	
		GPS band: IF = 85 MHz	10	f_{LOGPS}		1490.04		MHz	
			10	f_{LOGPS}		1660.80		MHz	
	IF frequency range	Cell and GPS band	13, 14, 17, 18	f_{IF}	80	85	230	MHz	
	LO Input power level	Cell and GPS band	13, 14, 17, 18	P_{LO}	-10	-5	0	dBm	
	LO Tx buffer output power level	Cellular band; not matched at dedicated frequency	12	P_{LOOUT}	-8	-5.5		dBm	

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

Cascade RF Electrical Characteristics (Cellular Band)

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: V_{CC} = +2.75 V, T_{amb} = 25°C, RF = 881.5 MHz; LO = 966.5 MHz; IF = 85 MHz; LO input = -5.0 dBm; RF input = -35 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	Gain = High; LIN = High		G		28.5		dB	
	Noise figure			NF		2.0		dB	
	Input IP3			IP3		-8.0		dBm	
	Supply current			I_{CC}		26		mA	
	High-Gain Low-Linearity Mode (HGLL. Paging mode)								
	Gain	Gain = High; LIN = Low		G		28		dB	
	Noise figure			NF		2.1		dB	
	Input IP3			IP3		-10.0		dBm	
	Supply current			I_{CC}		19		mA	
	Low-Gain Mode (LG)								
	Gain	Gain = Low; LIN = High		G		12		dB	
	Noise figure			NF		11		dB	
	Input IP3			IP3		9.0		dBm	
	Supply current			I_{CC}		23		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 V, T_{amb} = 25°C, RF = 1575.42 MHz; LO = 1490.04 MHz; IF = 85.38 MHz; LO input = -5.0 dBm; RF input = -45 dBm.

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	Combined LNA and Mixer Performance								
	A-GPS LNA Performance								
	Gain	Gain = Low; LIN = Low; BUFFEN-GPS = High		G		33		dB	
	Noise figure			NF		1.8		dB	
	Input IP3			IIP3		-16		dBm	
	Supply current			Icc		17.5		mA	

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

Typical Electrical Characteristics LNA and Mixer Separately (Cellular Band)

Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: V_{CC} = +2.75 V, T_{amb} = 25°C, RF = 881.5 MHz; LO = 966.5 MHz; IF = 85 MHz; LO input = -5.0 dBm; RF input = -35 dBm (high gain mode).

No.	Parameters	Test Conditions	Gain (dB)	NF (dB)	IIP3 (dBm)	Type*
	Cell Band, High-Gain High-Linearity Mode (HGHL); CDMA Modulation					
	Cell LNA	Gain = High; LIN = High	16	1.5	10	
	Cell mixer		14.5	6.5	7	
	Cell Band, High-Gain Low-Linearity Mode (HGLL); CDMA Modulation					
	Cell LNA	Gain = High; LIN = Low	15.5	1.6	3.7	
	Cell mixer		14	6.0	4.0	
	Cell Band, Low-Gain Mode (LG); CDMA Modulation					
	Cell LNA	Gain = Low; LIN = High	-1	4.0	20	

*) 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 V, T_{amb} = 25°C, RF = 1575.42 MHz; LO = 1490.04 MHz; IF = 85.38 MHz; LO input = -5.0 dBm; RF input = -35 dBm; RF input = -35 dBm (high gain mode).

No.	Parameters	Test Conditions	Gain (dB)	NF (dB)	IIP3 (dBm)	Type*
	A-GPS Mode					
	GPS LNA	Gain = Low; LIN = Low; BUFFEN-GPS = High	18	1.5	-2.0	
	GPS mixer		16	5.5	-0.5	

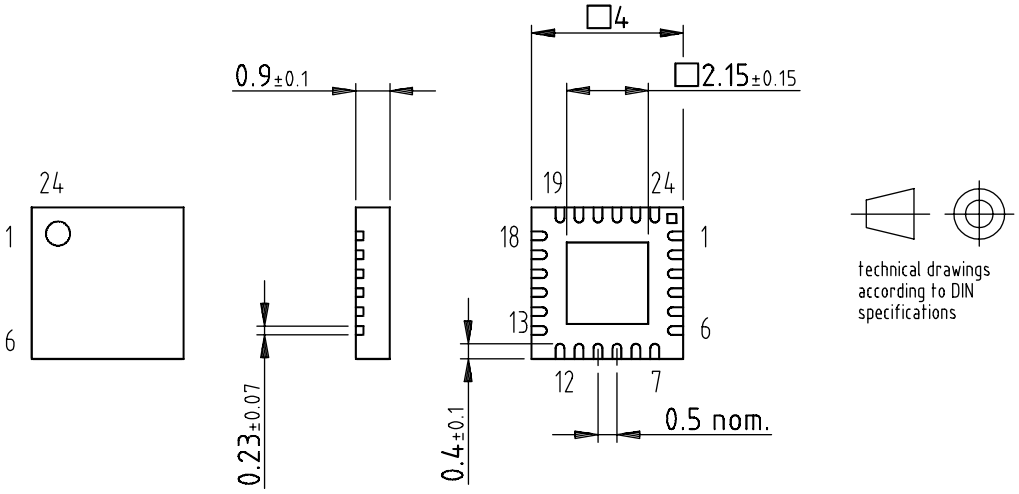
*) Type means: A =100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

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.

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