Features

- **AMPS/Cell Band CDMA 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**

Benefits

- **Very Small 24 Pin 4 x 4 mm Package**
- **Few External Components**
- **Fully ESD Protected**

Application

- **Dual-mode/Single-band CDMA IS-95/98 Based Mobile Phones**

Electrostatic sensitive device.
Observe precautions for handling.

2.8 V Dual-mode RF Receiver for CDMA/AMPS

T0351

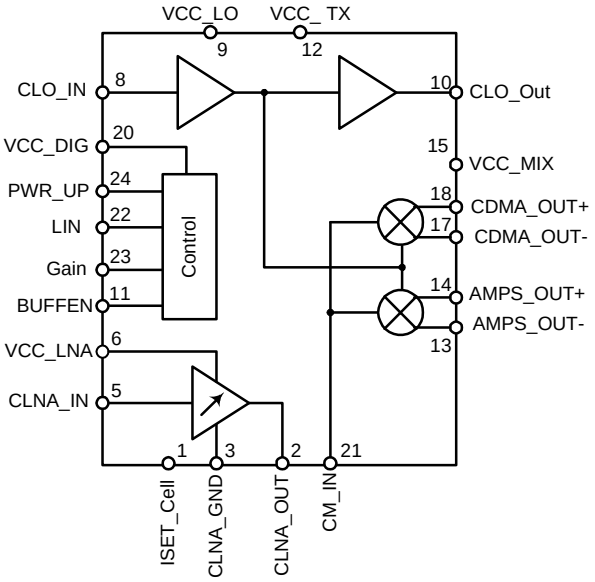
Preliminary (Summary)

Description

The T0351 is a front-end receiver RFIC designed for single-band, dual-mode operation. The device supports AMPS and Cell band CDMA operation. The IF range is from 80 MHz to 230 MHz with external tuning. The low-noise amplifier has an adjustable third order intercept point (IP3) to minimize inter-modulation and cross-modulation effects. The mixers are designed for differential IF outputs (single-ended or differential IF outputs for AMPS mode), and they feature excellent linearity and low-noise figure.

This device is available in a 4 × 4 mm MLF package with 24 pins. The T0351 front-end receiver is capable of meeting all electrical requirements in accordance with the TIA/EIA 98-C wireless communication standard.

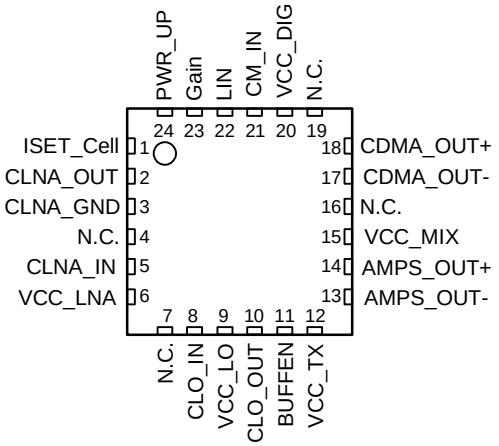
Figure 1. Block Diagram



Rev. 4558AS–CDMA–11/02

Pin Configuration

Figure 2. Pinning



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_Out	Cell LNA output. Requires a DC blocking capacitor and an L-C (shunt C/series L) matching network for optimum gain, intercept and noise performance.
3	CLNA_GND	Cell 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.
4	N.C.	Not connected.
5	CLNA_IN	Cell LNA input. Requires a DC blocking capacitor and an L-C (shunt C/series L) matching network for optimum gain, intercept and noise performance.
6	VCC_LNA	Power supply pin for Cell LNA. Bypass with a capacitor as close to the pin as possible.
7	N.C.	Not connected.
8	CLO_IN	Cell band LO input.
9	VCC_LO	Supply voltage for LO input buffer.
10	CLO_OUT	Cellular LO buffer output. Internally matched to 100 Ω. Does not require a blocking capacitor.
11	BUFFEN	LO output buffer enable. Set BUFFEN pin HIGH to power up the LO buffer output.
12	VCC_TX	Supply voltage for LO output buffer.
13	AMPS_OUT-	Negative AMPS IF output.
14	AMPS_OUT+	Positive AMPS IF output.
15	VCC_MIX	Supply voltage for both mixers.
16	N.C.	Not connected.
17	CDMA_OUT-	Negative CDMA IF output.
18	CDMA_OUT+	Positive CDMA output.
19	N.C.	Not connected.
20	VCC_DIG	Supply voltage for logic control circuits.
21	CM_IN	Cell RF input to Cell CDMA mixer and Cell AMPS mixer.
22	LIN	Logic input for high or low linearity. Logic HIGH selects High linearity.
23	Gain	Gain select logic input. Logic high selects High Gain.
24	PWR_UP	Power-up input. Logic low selects shutdown mode.
–	Paddle	Device ground and heat sink, requires good thermal path; RF reference plane.

Table 1. Mode Programming Truth Table

Mode	Condition	Gain	LIN	BUFFEN (1)	PWR_UP
Shut down	All circuits off	Low	Low	X	Low
Cell mode	High gain, high linearity	High	High	X	High
	High gain, low linearity	High	Low	X	High
	Low gain	Low	High	X	High
	AMPS mode	Low	Low	X	High
	Activate Cell LO output buffer	X	X	High	High

Note: 1. The symbol X (”do not care”) means a logic input does not affect an operating mode.

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} ; $C_{LO;}$ CLNA_IN	+5.0	dBm
I_{SET_CELL}	LNA IP3 adjustment	1	mA
Operating case temperature	T_C	-40 to +110	°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		6, 9, 12, 15, 20	V_{CC}	2.7	2.8	3.3	V	
	Control voltage High		11, 22, 23, 24	V_{CTRL}	1.7			V	
	Control voltage Low		11, 22, 23, 24	V_{CTRL}			0.5	V	
	LO Rx buffer supply current		8	I_{CCMIX}		6.0	7.0	mA	
	LO Tx buffer current		10	I_{CCMIX}		5.0		mA	
	Logic-High current		11, 22, 23, 24	I_{CTRL}			100	µA	
	Logic-Low current		11, 22, 23, 24	I_{CTRL}	-5.0			µA	
	Power-down supply current	Gain, LIN = LOW	6, 9, 12, 15, 20	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		5	f	869	881.5	894	MHz	
	LO frequency range	IF = 184 MHz	8	f_{LO}	685 1053		710 1078	MHz	
	IF frequency range		13, 14, 17, 18	f_{IF}	80	85	230	MHz	
	LO input power level		8	P_{LO}	-10	-5	0	dBm	
	LO Tx buffer output power level		10	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

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	Band_SEL = High; Gain = High; LIN = High		G		26		dB	
	Noise figure			NF		2.5		dB	
	Input IP3			IP3		-4		dBm	
	Supply current			I_{CC}		29		mA	
	High-Gain Low-Linearity Mode (HGLL Paging Mode)								
	Gain	Band_SEL = High; Gain = High; LIN = Low		G		25		dB	
	Noise figure			NF		2.7		dB	
	Input IP3			IP3		-5.5		dBm	
	Supply current			I_{CC}		21		mA	
	Low-Gain Mode (LG)								
	Gain	Band_SEL = High; Gain = Low; LIN = Low		G		9.5		dB	
	Noise figure			NF		14		dB	
	Input IP3			IP3		12		dBm	
	Supply current			I_{CC}		26		mA	
	Combined LNA and Mixer Performance, AMPS Modulation								
	Gain	Band_SEL = High; Gain = Low; LIN = Low		G		22		dB	
	Noise figure			NF		3.9		dB	
	Input IP3			IP3		-6		dBm	
	Supply current			I_{CC}		19		mA	

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

Typical Electrical Characteristics LNA and Mixer Separately

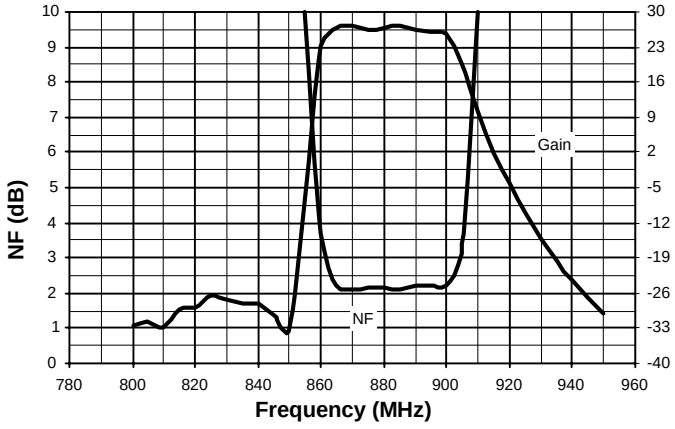
Test conditions: Unless otherwise noted, the following conditions apply to typical performance specification under static conditions: V_{CC} = +2.75 V, T_{amb} = 25°C, RF = 881.5 MHz; LO = 966.5 MHz; IF = 85 MHz; LO input = -5.0 dBm; RF input = -35 dBm (high gain mode)

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	15	1.7	12	
	Cell mixer		13	8.0	8	
	Cell Band, High-Gain Low-Linearity Mode (HGLL); CDMA Modulation					
	Cell LNA	Gain = High; LIN = Low	14.5	1.7	7	
	Cell mixer		13	7.5	6.5	
	Cell Band, Low-Gain Mode (LG); CDMA Modulation					
	Cell LNA	Gain = Low; LIN = Low	-2.5	7	20	
	Cell mixer		13	8.0	8	
	Cell Band, AMPS Modulation					
	Cell LNA	Gain = Low; LIN = Low	14.5	1.7	7	
	Cell mixer		9.5	12.6	6	

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

Typical Performance

Figure 3. Cellular Band, Cascade Performance (Gain + Noise Figure)

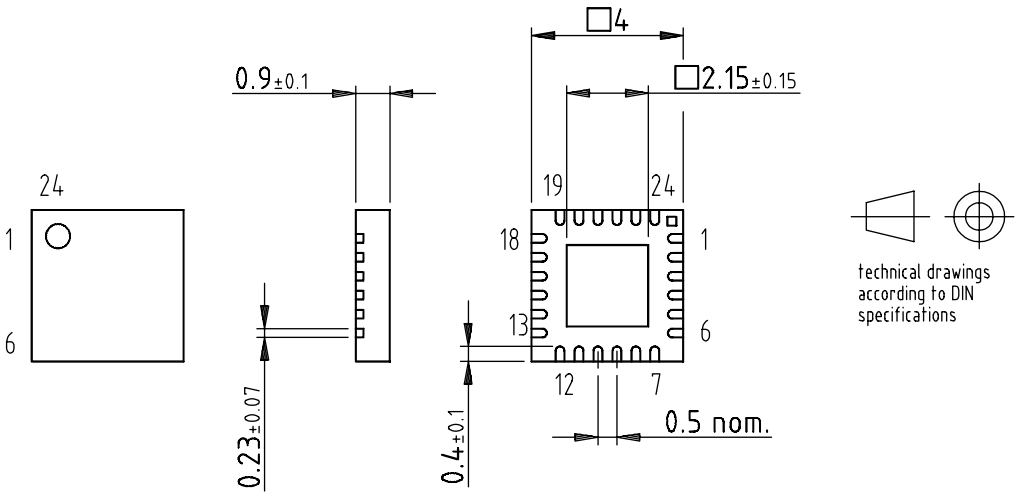


Ordering Information

Extended Type Number	Package	Remarks
T0351	HP-VFQFP-N24	TBD

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

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

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