CX74037

Transmit RF IC for TDMA or AMPS Applications

Conexant's CX74037 Transmit RF Application-Specific Integrated Circuit (ASIC) is a triple-mode, dual-band transmitter intended for use in IS-136 compliant cellular phones. As a dual mode IC, it can be used in Time Division Multiple Access (TDMA) mode or Advanced Mobile Phone System (AMPS) mode. The device is available in a 48-pin 7x7 Land Grid Array (LGA) package with downset paddle.

The CX74037 RF IC device includes the following functional components:

- In-Phase and Quadrature (I/Q) modulator
- Two Intermediate Frequency (IF) Voltage Controlled Oscillator (VCO) inputs
- IF Variable Gain Amplifier (VGA)
- Two upconverters
- Two drivers for external Power Amplifiers (PAs).

The CX74037 48-pin, 7x7 LGA package pin configuration is shown in Figure 1. A CX74037 block diagram is shown in Figure 2.

Features

- Sectional enable lines for independent control of circuits within the chip
- 90 dB IF VGA range
- Separate IF frequencies can be used for the 800 MHz (AMPS) and 1900 MHz Bands (PCS)
- Dual drivers for 800 MHz and 1900 MHz
- PA driver is deactivated by using the Driver Enable signal when there is no transmission
- Available in a 48-pin, 7x7 LGA package with downset paddle

Applications

- Cellular and/or PCS-band phones
- TDMA and/or AMPS-mode phones
- Portable battery powered equipment

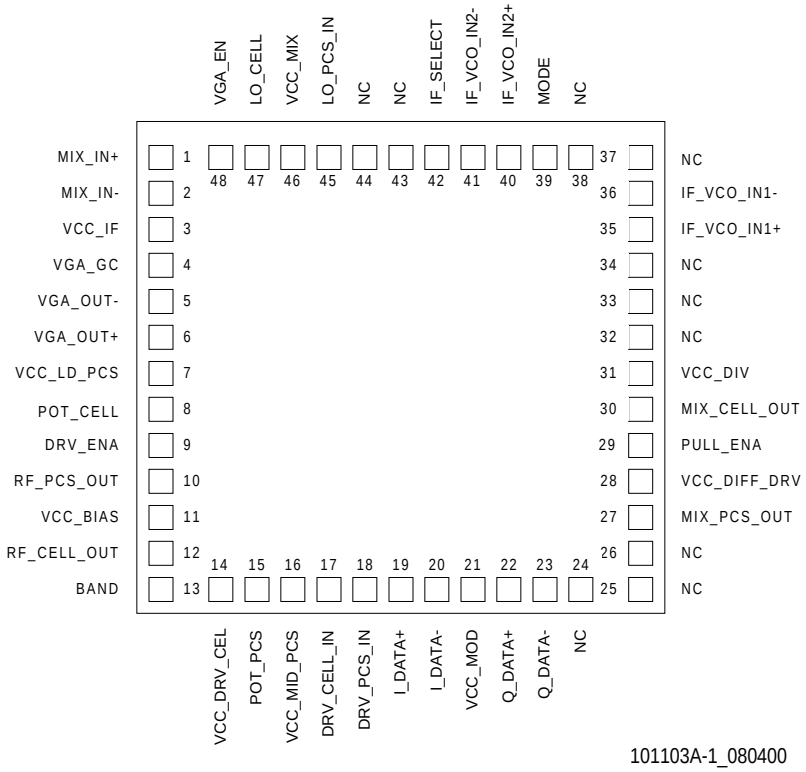


Figure 1. CX74037 48-Pin, 7x7 LGA Package Pin Configuration

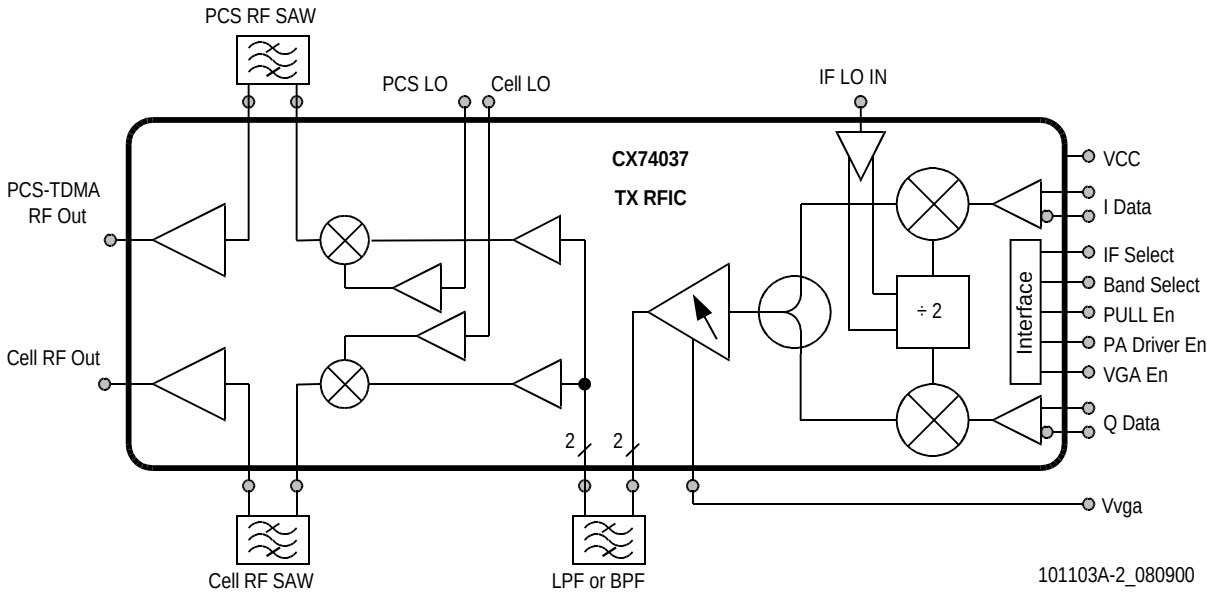


Figure 2. CX74037 Functional Block Diagram

Technical Description

The CX74037 is a TDMA transmitter for the 800 MHz and 1900 MHz bands. It also can be used as an FM transmitter in AMPS mode at the 800 MHz band. A band select command chooses between the 800 MHz band and the 1900 MHz band. A mode select command chooses between TDMA and AMPS mode. The chip consist of an I/Q modulator, IF LO input buffer, IF VGA, two upconverters for the 800 MHz and 1900 MHz bands, and two PA drivers for the 800 MHz and the 1900 MHz bands.

I/Q Modulator. The I/Q modulator converts the incoming I/Q signal to an IF signal using one of the two local oscillator inputs. This signal is fed directly to the VGA amplifier.

Variable Gain Amplifier. The VGA is a differential amplifier that receives its signal from the I/Q modulator, amplifies it, and then is taken off-chip to be filtered before routing it to the upconverter. A dynamic range of 90 dB is available on the amplifier. A DC voltage of 0.2 to 2.5 V is needed to control the gain of the amplifier.

Upconverters. The 800 MHz and 1900 MHz upconverters receive the IF signal from the VGA amplifier. Each upconverter requires an external LO controlled by an external Phase Locked Loop (PLL). The band select command switches between the 800 MHz and the 1900 MHz bands.

PA Drivers. Two PA drivers are included, the 800 MHz driver and the 1900 MHz driver. Each driver takes its input from the upconverter after passing through an image rejection filter. The driver amplifies the signal and sends it to an external PA.

Electrical and Mechanical Specifications

The signal pin assignments and functional pin descriptions are found in Table 1. The absolute maximum ratings of the CX74037 are provided in Table 2, the recommended operating conditions are specified in Table 3. Electrical characteristics for the CX74037 are shown in Table 4. Table 5 defines the control signal logic.

Figure 3 provides the package dimensions for the 48-pin, 7x7 LGA package.

ESD Sensitivity

The CX74037 is a static-sensitive electronic device. Do not operate or store near strong electrostatic fields. Take proper ESD precautions.

Table 1. CX74037 Signal Definition (1 of 2)

Pin NO.	Name	Description
1	Mix_IN+	Input to RF Upconverters. Internally AC coupled, high impedance.
2	Mix_IN-	Input to RF Upconverters. Internally AC coupled, high impedance.
3	VCC_IF	Supply voltage for the AGC amplifier.
4	VGA_GC	The input pin for AGC gain control. A DC control voltage should be applied to this pin to vary the gain of the IF amplifier.
5	VGA_OUT-	VGA Output, open collector. External resistive (300 ohms) pull up to Vcc required.
6	VGA_OUT+	VGA Output, open collector. External resistive (300 ohms) pull up to Vcc required.
7	VCC_LD_PCS	Supply voltage for the PCS last stage driver amplifier.
8	POT_CELL	This pin is connected to an external resistor. The value of the resistor will vary the bias current of the cellular driver.
9	DRV_ENA	This is the input pin for the upconverter and the driver control signal. When the pin is low the driver and the upconverter are deactivated.
10	RF_PCS_OUT	Output pin for the PCS driver amplifier. Impedance matching is required.
11	VCC_BIAS	Supply voltage of bias cells.
12	RF_CELL_OUT	Output pin for the cellular driver amplifier. Impedance matching is required.
13	BAND	This is a control signal input pin. It selects between cellular band and PCS band. When the input is low, the cellular band is chosen. When the input is high, the PCS band is chosen.
14	VCC_DRV_CEL	Supply voltage for the driver of the cellular band.
15	POT_PCS	This pin is connected to an external resistor. The value of the resistor will vary the bias current of the PCS driver.
16	VCC_MID_PCS	Supply voltage for the first amplifier in the PCS driver block.
17	DRV_CELL_IN	The Cellular driver amplifier input pin. Impedance matching is required.
18	DRV_PCS_IN	The PCS driver amplifier input pin. Impedance matching is required.
19	I_DATA+	The baseband input for I channel. This is a balanced input. A DC bias has to be supplied to the pin.
20	I_DATA-	Same as pin 20, except complementary input. This pin should be pull low (0 V) in FM mode.
21	VCC_MOD	Supply voltage for the I/Q modulator.
22	Q_DATA+	The baseband input for Q channel. This is a balanced input. A DC bias has to be supplied to the pin.
23	Q_DATA-	Same as pin 23, except complementary input.
24	NC	There is no connection on this pin. Should be tied to ground.
25	NC	There is no connection on this pin. Should be tied to ground.
26	NC	There is no connection on this pin. Should be tied to ground.
27	MIX_PCS_OUT	Output of the PCS upconverter. Impedance matching required.
28	VCC_DIFF_DRV	Supply voltage for a differential amplifier in the upconverter block.
29	PULL_ENA	This is a control signal input pin. When the input is low, the IF VCOs, RF Mixer and buffers, and divide by 2 sections will be disabled. When the input is high, the mentioned sections will be enabled.
30	MIX_CELL_OUT	Output of the Cellular upconverter. Impedance matching required.
31	VCC_DIV	Supply voltage for the dividers and VCO buffer.
32	NC	There is no connection on this pin. Should be tied to ground.
33	NC	There is no connection on this pin. Should be tied to ground.
34	NC	There is no connection on this pin. Should be tied to ground.
35	IF VCO IN1+	Input pin for the modulator LO signal. The frequency is 2xIF. Can be used single-ended. AC ground the unused pin.
36	IF VCO IN1-	Input pin for the modulator LO signal. The frequency is 2xIF. Can be used single-ended. AC ground the unused pin.
37	NC	There is no connection on this pin. Should be tied to ground.
38	NC	There is no connection on this pin. Should be tied to ground.
39	MODE	This is a control signal input pin. When the input is low, the AMPS mode is selected. If the input is high, TDMA mode is selected. FM output is 9 dB higher at the modulator output.
40	IF VCO IN2+	Input pin for the modulator LO signal. The frequency is 2xIF. Can be used single-ended. AC ground the unused pin.
41	IF VCO IN2-	Input pin for the modulator LO signal. The frequency is 2xIF. Can be used single-ended. AC ground the unused pin.
42	IF_SELECT	Control signal to select IF VCO INPUT1 or INPUT2. “1” will select IF VCO INPUT1 and “0” will select IF VCO INPUT2.

Table 1. CX74037 Signal Definition (2 of 2)

Pin No.	Name	Description
43	NC	Connect to ground.
44	NC	Connect to ground.
45	LO_PCS_IN	This is the input pin for the local oscillator for the PCS band. It is internally matched.
46	VCC_MIX	Supply voltage for the mixer in the upconverter block and for the LO buffer.
47	LO_CELL	This is the input pin for the local oscillator for the cellular band. It is internally matched.
48	VGA_EN	This is a control signal input pin. When the input is low, the VGA and I/Q Modulator sections will be disabled. When the input is high, the mentioned sections will be enabled.

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage	VCC	–0.3		+5.0	V
Input voltage range		–0.3		VCC	V
Power dissipation				600	mW
Ambient operating temperature		–30		+80	°C
Storage temperature		–40		+125	°C

Table 3. CX74037 Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage		2.7	3.0	3.6	V
Logic level high		1.9			V
Logic level low				0.8	V
Supply current in 800 MHz TDMA @ 7 dBm			75		mA
Supply current in 800 MHz AMPS @ 7 dBm			75		mA
Supply current in 800 MHz (DRV_ENA off)			45		mA
Supply current in 1900 MHz TDMA @ 8.0 dBm			84		mA
Supply current in 1900 MHz TDMA (DRV_ENA off)			48		mA
Supply current in sleep mode				20	µA

Table 4. CX74037 Electrical Characteristics (1 of 3)
VCC = 3.0 V, T_A = 25 °C, PLO = –10 dBm, input externally matched

Parameter	Symbol	Test Conditions	Min	Typical	Max	Units
IF VCO Input						
Input frequency range (2X IF frequency)			100		640	MHz
Input signal level			–10	–3	+3	dBm
I/Q Modulator (Output Not Measurable)						
Input voltage level, differential				1.4		Vp-p
Common mode input voltage level			1.4	1.85	2.1	V
Input DC offset					4	mV
Input impedance			100K			Ω
Gain variation over process, temperature, VCC				0.4		dB
I/Q gain mismatch				0.3	0.4	dB
I/Q phase imbalance				2	4	degrees
Transmit VGA						
VGA frequency range (–1 dB bandwidth)			50		320	MHz
VGA gain (with a 600 Ω differential load): Maximum Minimum			 22 –64	 24 –62	 26 –60	 dB dB
VGA gain variation with VCC 3.0 to 3.6 V @ VCTRL 2 V			–3		+3	dB
Gain variation with temperature			–1.0		+1.0	dB
Gain control input impedance				40K		Ω
VGA gain slope			45	50	55	dB/V
VGA gain control range			0.5		2.5	V
Gain slope variation over any 6 dB segment			–3		+3	dB/V
Output power level @ 20 dB gain				–13		dBm
P1dB @ 22 dB gain				–3		dBm
NF @ 22 dB gain					6	dB
NF at -52 dB gain				52	53	dB
Operating temperature range			–30	+25	+80	°C
Cellular Upconverter						
LO frequency range			1017		1043	MHz
LO input return loss (reference to 50 Ω)				–10		dB
Output frequency			824		849	MHz
Output return loss from 824 MHz to 849 MHz (reference to 50 Ω)					–15	dB
Conversion gain			7	8	9	dB
Gain degradation @ VCC 2.7 V				0.1		dB
ACPR in 30 kHz at 30 kHz offset @ –5 dBm output; cascaded				–33		dBc
ACPR in 30 kHz at 60 kHz offset @ –5 dBm output; cascaded				–56		dBc

Table 4. RF150 Electrical Characteristics (2 of 3)
V_{DD} = 2.7 V, –40 °C < T_A < +85 °C, unless specified

Parameter	Symbol	Test Conditions	Min	Typical	Max	Units
Cellular Upconverter (continued)						
Output P1dB			2	3		dBm
Noise figure @ 8 dB gain				12	13	dB
LO to RF leakage @ maximum gain, LO = –10 dBm				–35		dBm
Operating temperature range			–30	+25	+80	°C
PCS Upconverter						
LO frequency range			2078		2139	MHz
LO input return loss (reference to 50 Ω)				–10		dB
Output frequency			1850		1910	MHz
Conversion gain			8	9	10	dB
ACPR in 30 kHz at 30 kHz offset @ –4 dBm output; cascaded				–33		dBc
ACPR in 30 kHz at 60 kHz offset @ –4 dBm output; cascaded				–57		dBc
Noise figure @ 9 dB gain				9	10	dB
P1dB				0		dBm
LO to RF leakage @ maximum gain, LO = –15 dBm				–35		dBm
Operating temperature range			–30	+25	+80	°C
Cellular PA Driver						
Output frequency			824		849	MHz
Gain			13	14	15	dB
Output power level @ 14 dB gain				7		dBm
Input return loss (reference to 50 Ω)				–15		dB
Output P1dB			14.5			dBm
ACPR in 30 kHz band at 30 kHz offset @ 7 dBm output; cascaded				–32		dBc
ACPR in 30 kHz band at 60 kHz offset @ 7 dBm output; cascaded				–55		dBc
Output return loss (reference to 50 Ω)				–15		dB
Noise figure				6	8	dB
Operating temperature range			–30	+25	+80	°C
External bias resistor value for +14.5 dBm P1dB				120		Ω

Table 4. RF150 Electrical Characteristics (3 of 3)
V_{DD} = 2.7 V, –40 °C < T_A < +85 °C, unless specified

Parameter	Symbol	Test Conditions	Min	Typical	Max	Units
PCS PA Driver						
Input return loss (reference to 50 Ω)				–15		dB
Output frequency			1850		1910	MHz
Gain			15	16	17	dB
Output power level @ 16 dB gain				8.0		dBm
Output P1dB			14			dBm
ACPR in 30 kHz band at 30 kHz offset @ 8.0 dBm output; cascaded				–32		dBc
ACPR in 30 kHz band at 60 kHz offset @ 8.0 dBm output; cascaded				–55		dBc
Output return loss (reference to 50 Ω)				–15		dB
Noise figure				9	10	dB
Operating temperature range			–30	+25	+80	°C
External bias resistor value for +16 dBm of P1dB				130		Ω

Table 5. Control Signal Truth Table

Signal Name	Logic 1	Logic 0	Remark
VGA_ENA	ON	OFF	
DRV_ENA	ON	OFF	Cell and PCS band
BAND	PCS	Cell	
PULL_ENA	ON	OFF	IF VCO, RF mixer buffers, divide-by-2
IF_Select	IF VCO IN1	IF VCO IN2	
MODE	TDMA	FM	In FM mode: Normal DC bias on I+, 0 V bias on I–

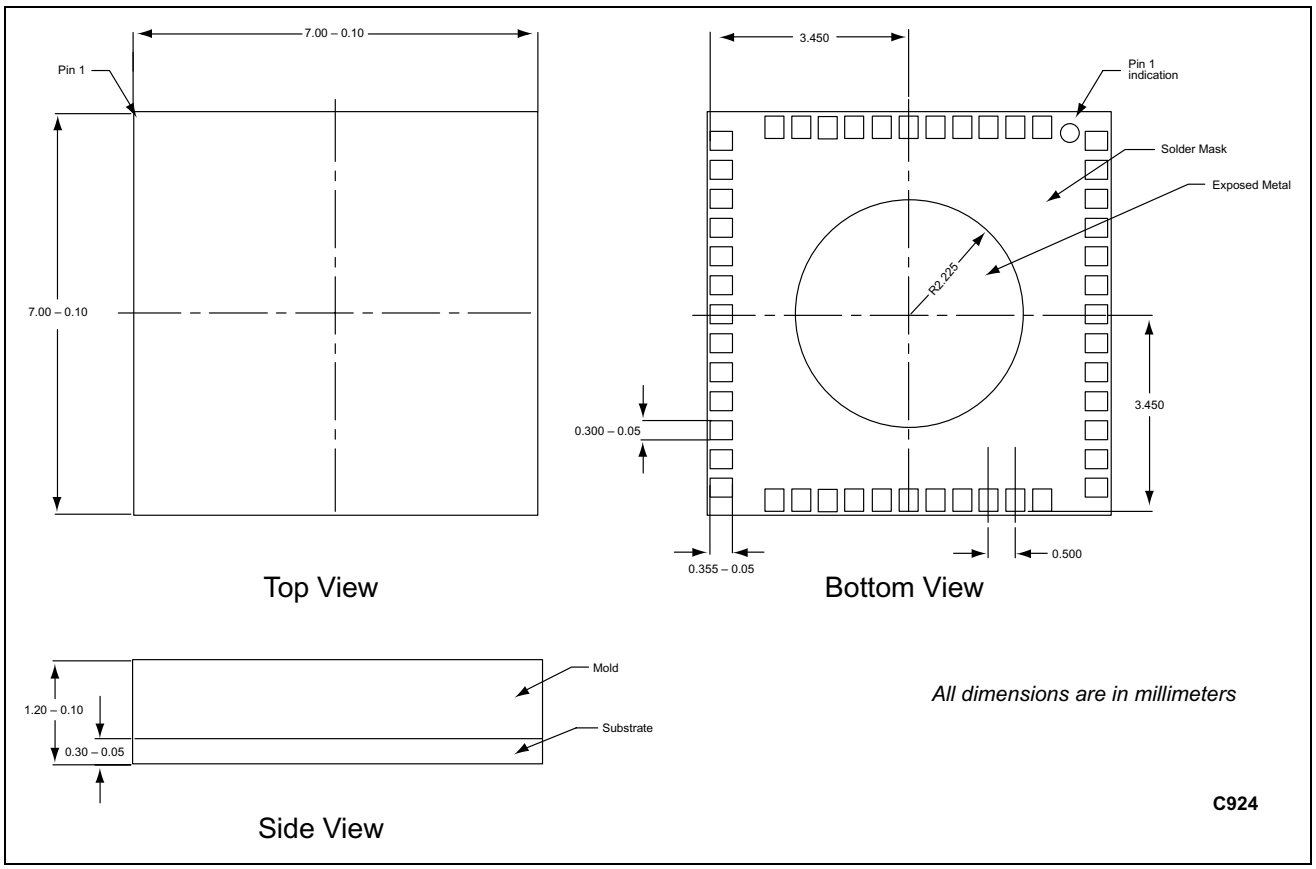


Figure 3. CX74037 Package Dimensions for a 48-Pin, 7x7 LGA Package

Ordering Information

Model Name	Manufacturing Part Number
Transmit RF IC	CX74037

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