

## EN1010 c.LINK™ Coaxial Network Interface

### Product Description

The Entropic EN1010 Coaxial Network Interface is a highly integrated RF transceiver subsystem used in very high speed coaxial based networks.

The EN1010 includes an on chip PLL with fully integrated VCOs, low-noise receive amplifier, mixers, and filtering.

The EN1010's proprietary architecture allows coaxial based networks to co-exist with broadband services provided by Telco, CATV, or DBS service providers.

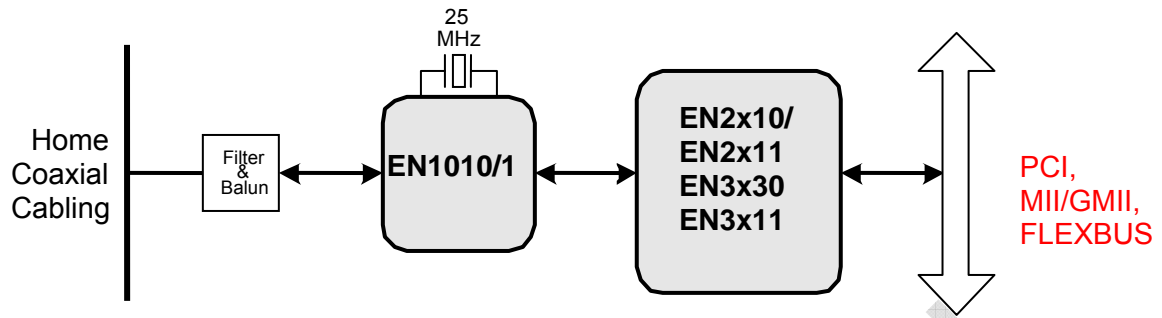
The EN1010 is part of the c.LINK™ chipset along with the EN2010/11 or EN2210/11 Coaxial Network Controller. This chipset enables very high speed coaxial based home networks without the addition of any new wires or devices at data rates sufficient to support multiple simultaneous HD and SD video streams.

The EN1010/1 is also part of the c.LINK™ Access Modem solution along with the EN3030, EN3230 Broadband Access client chip and EN3X11 Broadband Access Network controller

### Key Features

- ◆ Fully integrated RF transceiver for c.LINK™ coaxial network
- ◆ Low cost direct conversion architecture
- ◆ Simple support circuitry
- ◆ Single 25MHz crystal
- ◆ Tuning Range: 800 MHz to 1500 MHz
- ◆ Frequency selectable 25 MHz channels
- ◆ Direct interface with EN2x10/EN2x11
- ◆ Direct interface with EN3x30 and EN3x11
- ◆ Single 1.8V power supply
- ◆ 7 mm x 7 mm 48-QFN package
- ◆ Standard 0.18 um CMOS technology
- ◆ c.LINK™ chipset with EN2x10/EN2x11 supports all-CMOS solution for a multi-channel, high-speed coaxial home network.
- ◆ c.LINK™ chipset with EN3x30/EN3x11 supports all-CMOS solution for a multi-channel, high-speed coaxial access network.

### c.LINK™ System Block Diagram



CONFIDENTIAL

## CONTENTS

<b>Product Description .....</b>	<b>1</b>
<b>Key Features .....</b>	<b>1</b>
<b>c.LINK™ System Block Diagram.....</b>	<b>2</b>
<b>1 Internal Block Diagram.....</b>	<b>5</b>
<b>2 Interface Diagram.....</b>	<b>5</b>
<b>3 Pin Descriptions.....</b>	<b>6</b>
<b>4 Signal Definitions.....</b>	<b>7</b>
4.1 RF Signal Interface.....	7
4.2 RF Control Interface.....	7
4.3 Baseband Interface.....	8
4.4 PLL Interface.....	8
4.5 Digital Control Interface.....	9
4.6 Other Signals.....	10
<b>5 Electrical Characteristics.....</b>	<b>11</b>
5.1 Recommended Operating Conditions.....	11
5.2 Absolute Maximum Ratings.....	11
5.3 Power Characteristics.....	11
5.4 DC Characteristics.....	12
5.4.1 Digital Control Interface (from EN2x10/EN2x11).....	12
5.4.2 RF Control Interface.....	12
5.5 AC Characteristics.....	12
5.5.1 Receiver AC Characteristics.....	12
5.5.2 Transmitter AC Characteristics.....	13
5.5.3 PLL AC Characteristics.....	13
5.5.4 PLL XTAL Requirements.....	14
<b>6 Mechanical Information.....</b>	<b>15</b>
<b>7 Ordering Information.....</b>	<b>17</b>

## LIST OF TABLES

Table 1: EN1010 Pin Out.....	6
Table 2: RF Interface Signals.....	7
Table 3: RF Control Interface Signals.....	7
Table 4: Baseband Interface Signals.....	8
Table 5: PLL Interface Signals.....	8
Table 6: Digital Control Interface Signals.....	9
Table 7: Other Signals.....	10
Table 8: Recommended Operating Conditions.....	11
Table 9: Absolute Maximum Ratings.....	11
Table 10: Power Characteristics.....	11
Table 11: Digital Control Interface DC Characteristics.....	12
Table 12: RF Control Interface DC Characteristics.....	12
Table 13: Rx AC Characteristics.....	12
Table 14: Tx AC Characteristics.....	13
Table 15: PLL AC Characteristics.....	13
Table 16: PLL XTAL Requirements.....	14
Table 17: Ordering information.....	17

**LIST OF FIGURES**

Figure 1: EN1010 Block Diagram ..... 5  
Figure 2: EN1010 Interface Diagram..... 5  
Figure 3: RF IC PLL 25 MHz Crystal Configuration. .... 9  
Figure 4: RF IC PLL Loop Filter Configuration ..... 9  
Figure 5: Digital Control Interface Connections..... 10  
Figure 6: EN1010 Package Information ..... 15

1 Internal Block Diagram

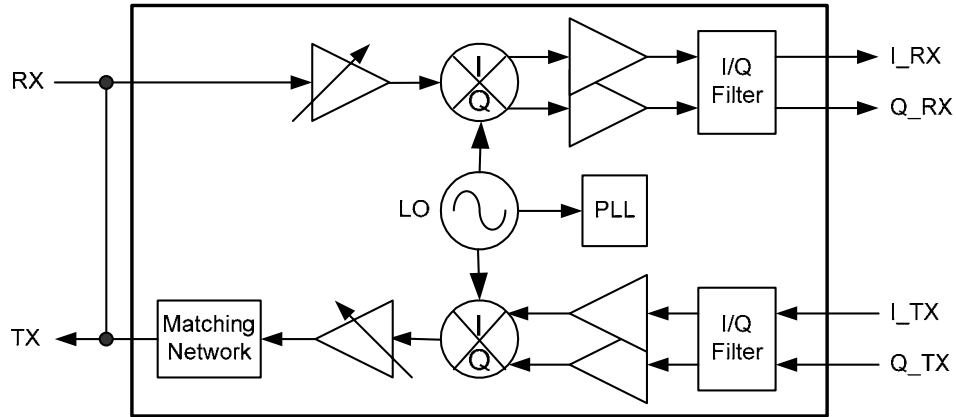


Figure 1: EN1010 Block Diagram

2 Interface Diagram

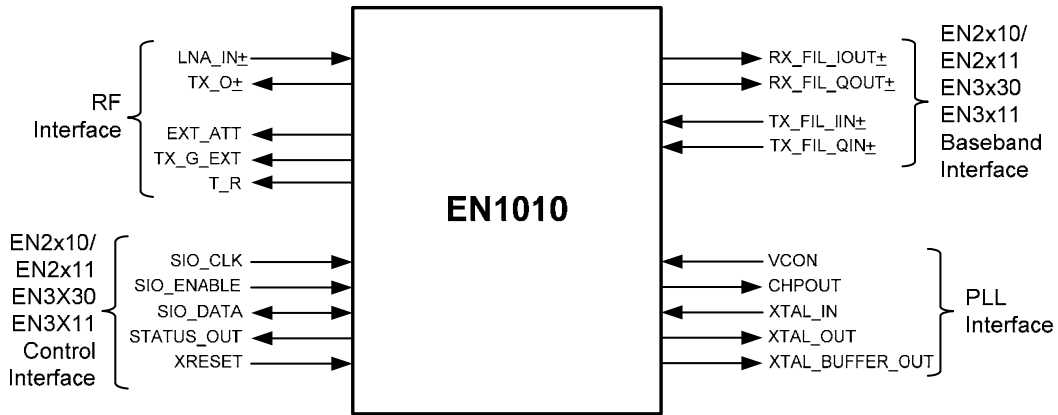


Figure 2: EN1010 Interface Diagram

### 3 Pin Descriptions

The EN1010 48 QFN package pin out is defined in the table below. The following definitions are used in the pin out table:

- ◆ NC indicates that no connection should be made to this pin
- ◆ - indicates the negative side of a differential signal
- ◆ + indicates the positive side of a differential signal

Pin	Signal	Pin	Signal
1	NC	25	XTAL_OUT
2	NC	26	XTAL_IN
3	NC	27	VDD
4	NC	28	CHPOUT
5	VDD	29	VDD
6	RX_FIL_IOUT+	30	VDD
7	RX_FIL_IOUT-	31	VCON
8	RX_FIL_QOUT-	32	VDD
9	RX_FIL_QOUT+	33	REXT18K
10	VDD	34	TX_G_EXT
11	TX_FIL_IIN+	35	REXT560
12	TX_FIL_IIN-	36	VDD
13	TX_FIL_QIN-	37	VDD
14	TX_FIL_QIN+	38	TX_O+
15	VDD	39	TX_O-
16	LO_BUFF_OUT+	40	T_R
17	LO_BUFF_OUT-	41	VDD
18	VDD	42	VDD
19	XRESET	43	VOP9
20	SIO_CLK	44	VDD
21	SIO_ENABLE	45	LNA_IN+
22	SIO_DATA	46	LNA_IN-
23	STATUS_OUT	47	EXT_ATT
24	XTAL_BUFFER_OUT	48	VDD

**Table 1: EN1010 Pin Out**

Exposed package backside paddle requires a ground reference connection. This connection establishes the ground reference for the entire chip. See Mechanical specification section for package and connection details.

## 4 Signal Definitions

The EN1010 signal definitions are shown in the tables below. The following signal types are used in these tables:

- ◆ **RF** indicates a high frequency analog signal
- ◆ **BB** indicates a baseband analog signal
- ◆ **Dig** indicates a digital control signal
- ◆ **PWR** indicates a power or ground signal

### 4.1 RF Signal Interface

Signal	Pin	I/O	Type	Description	Notes
LNA_IN+	45	I	RF	Receiver LNA + input	LNA_IN+/- Input trace pair must be run as 75 ohm differential
LNA_IN-	46	I	RF	Receiver LNA – input	LNA_IN+/- Input trace pair must be run as 75 ohm differential
TX_O+	38	O	RF	Transmitter + output	TX_O+/- Output trace pair must be run as 75 ohm differential
TX_O-	39	O	RF	Transmitter – output	TX_O+/- Output trace pair must be run as 75 ohm differential

Table 2: RF Interface Signals

### 4.2 RF Control Interface

Signal	Pin	I/O	Type	Description	Notes
T_R	40	O	Dig	External Tx/Rx switch control	TX = Logic Low RX = Logic High 20 mA drive
TX_G_EXT	34	O	Dig	External transmit attenuator control	Enable Att = Logic Low Disable Att = Logic High 10 mA drive
EXT_ATT	47	O	Dig	External receive attenuator control	Enable Att = Logic High Disable Att = Logic Low 10 mA drive

Table 3: RF Control Interface Signals

## 4.3 Baseband Interface

Signal	Pin	I/O	Type	Description	Notes
RX_FIL_IOUT+	6	O	BB	Receiver filtered I+ output to Controller IC	Output must be AC coupled with a 0.1uF cap
RX_FIL_IOUT-	7	O	BB	Receiver filtered I- output to Controller IC	Output must be AC coupled with a 0.1uF cap
RX_FIL_QOUT-	8	O	BB	Receiver filtered Q- output to Controller IC	Output must be AC coupled with a 0.1uF cap
RX_FIL_QOUT+	9	O	BB	Receiver filtered Q+ output to Controller IC	Output must be AC coupled with a 0.1uF cap
TX_FIL_IIN+	11	I	BB	Transmitter I+ filter input from Controller IC	Input must be AC coupled with a 0.1uF cap
TX_FIL_IIN-	12	I	BB	Transmitter I- filter input from Controller IC	Input must be AC coupled with a 0.1uF cap
TX_FIL_QIN-	13	I	BB	Transmitter Q- filter input from Controller IC	Input must be AC coupled with a 0.1uF cap
TX_FIL_QIN+	14	I	BB	Transmitter Q+ filter input from Controller IC	Input must be AC coupled with a 0.1uF cap

Table 4: Baseband Interface Signals

## 4.4 PLL Interface

Signal	Pin	I/O	Type	Description	Notes
XTAL_OUT	25	O	BB	XTAL output	25 MHz crystal connection. See Figure 3
XTAL_IN	26	I	BB	XTAL input	25 MHz crystal connection. See Figure 3
XTAL_BUFFER_OUT	24	O	BB	Buffered XTAL output to Controller IC	Buffered 25MHz XTAL output used to drive the Controller IC XTAL_IN pin.
LO_BUFF_OUT+	16	O	RF	Buffered LO+ output	LO Test Output. This output can remain unconnected if unused.
LO_BUFF_OUT-	17	O	RF	Buffered LO- output	LO Test Output. This output can remain unconnected if unused.
VCON	31	I	BB	PLL decoupling input	Decouple with 220 pF to ground as shown in Figure 4.
CHPOUT	28	O	BB	Charge pump output	PLL Error signal output. Connect loop filter as shown in Figure 4.
REXT18K	33	I	BB	Charge pump current set input	Connect to ground through an 18kΩ, 1% resistor as shown in Figure 4.

Table 5: PLL Interface Signals

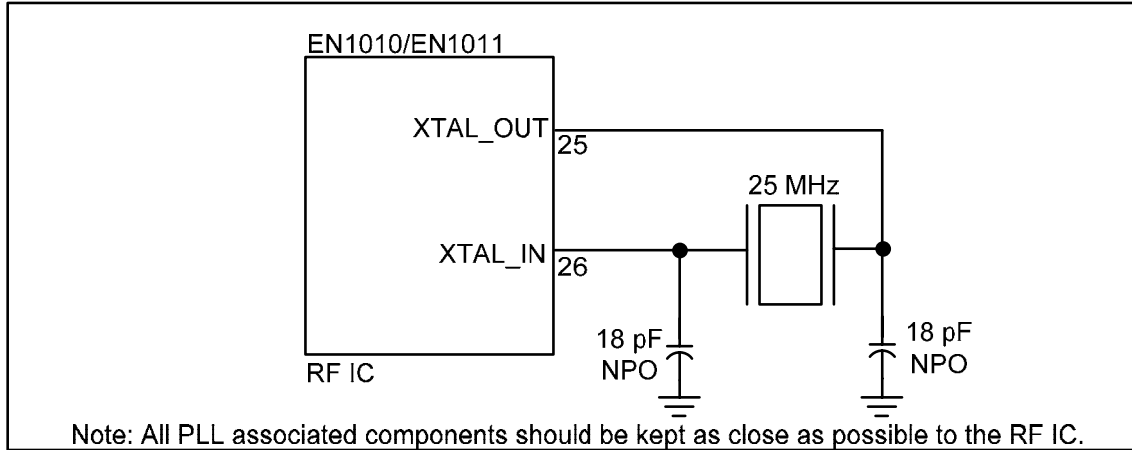


Figure 3: RF IC PLL 25 MHz Crystal Configuration.

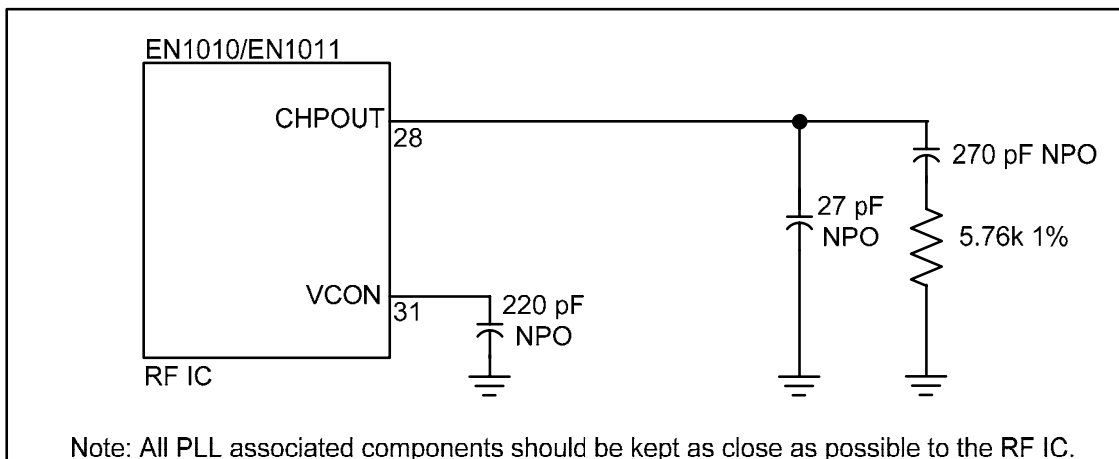


Figure 4: RF IC PLL Loop Filter Configuration

4.5 Digital Control Interface

Signal	Pin	I/O	Type	Description	Notes
XRESET	19	I	Dig	Active low device reset	Connect as shown in Figure 5.
SIO_CLK	20	I	Dig	Serial clock input	Connect as shown in Figure 5.
SIO_ENABLE	21	I	Dig	Serial data enable	Connect as shown in Figure 5.
SIO_DATA	22	I/O	Dig	Serial I/O data	Connect as shown in Figure 5.
STATUS_OUT	23	O	Dig	Status output	Connect as shown in Figure 5.

Table 6: Digital Control Interface Signals

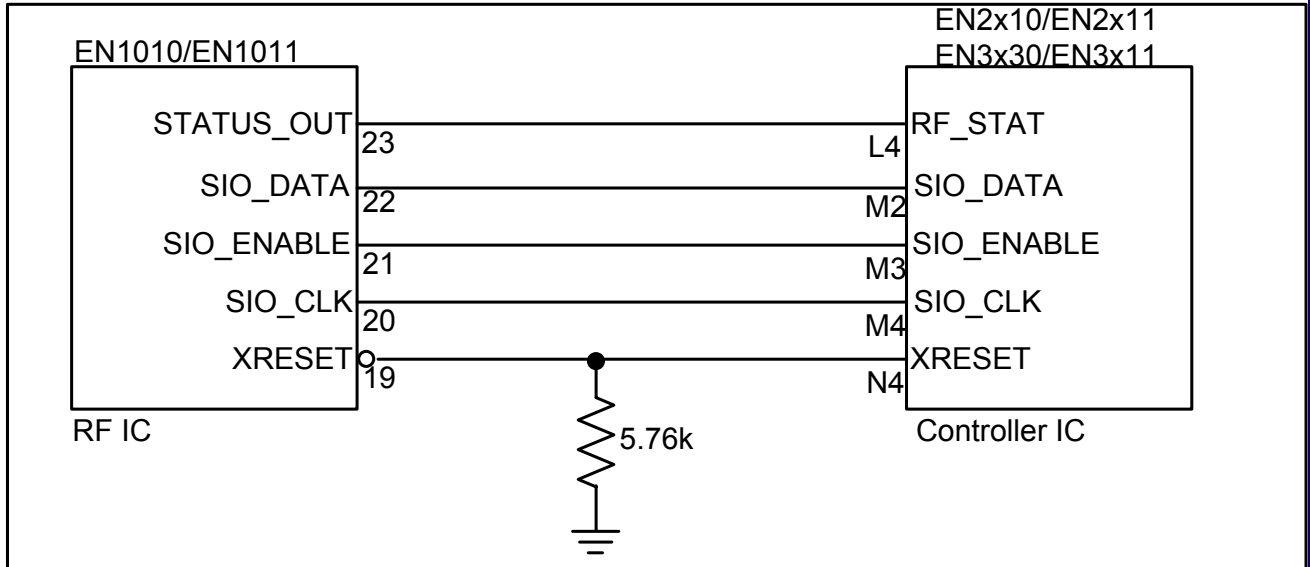


Figure 5: Digital Control Interface Connections

4.6 Other Signals

Signal	Pin	I/O	Type	Description	Notes
REXT560	35	I		Reference current setting resistor	Connect to ground through a 698Ω, 1% resistor.
VOP9	43	I		Reference voltage decoupling	Decouple with a 10uF and a 0.1uF cap to ground.
VDD <sub>ANALOG</sub>	5, 10, 18, 36, 37, 41, 42, 44, 48		PWR	1.8 volt supply voltage	Analog Power supply. Isolate from PLL power supply.
VDD <sub>PLL</sub>	15, 27, 29, 30, 32		PWR	1.8 volt supply voltage	PLL Power supply. Isolate from Analog power supply.
GND	Backside Paddle		PWR	Ground reference	Paddle must be electrically connected (soldered) to board ground for proper operation

Table 7: Other Signals

## 5 Electrical Characteristics

### 5.1 Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units	Notes
V <sub>DDANALOG</sub>	DC Supply Voltage	1.7	1.8	1.9	V	
V <sub>DDPLL</sub>	DC Supply Voltage	1.7	1.8	1.9	V	
T <sub>amb</sub>	Operating ambient temperature range	0		+70	°C	EN1010C1
T <sub>amb</sub>	Operating ambient temperature range	-40		+85	°C	EN1011C1
T <sub>JMAX</sub>	Maximum operating junction temperature			+110	°C	EN1010C1 and EN1011C1
CLK	XTAL frequency		25		MHz	See Table 17

**Table 8: Recommended Operating Conditions**

### 5.2 Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Units	Notes
V <sub>DDANALOG</sub>	DC Supply Voltage		2.0	V	
V <sub>DDPLL</sub>	DC Supply Voltage		2.0	V	
T <sub>str</sub>	Storage temperature range	-50	140	°C	
T <sub>amb</sub>	Operating ambient temperature range	0	+70	°C	EN1010C1
T <sub>amb</sub>	Operating ambient temperature range	-40	+85	°C	EN1011C1

**Table 9: Absolute Maximum Ratings**

### 5.3 Power Characteristics

Symbol	Parameter	Min	Typ	Max	Units	Notes
I <sub>DDPLL</sub>	1.8V PLL power supply current		65	80	mA	
I <sub>DDANALOG</sub>	1.8V Analog power supply current		335	420	mA	
P <sub>dTOTAL</sub>	Total power dissipation		0.68	0.95	W	
θ <sub>jc</sub>	Thermal resistance between die and package		17.7		°C/W	
θ <sub>ja</sub>	Thermal resistance between die and ambient temperature <sup>1</sup>		23.3		°C/W	(V <sub>air</sub> = 0 ft/min)

**Table 10: Power Characteristics**

Note<sup>1</sup>: Addition of a thermal pad between the case of the EN1010/EN1011 and the metal RF shield surrounding it will help remove heat from the package and decrease junction temperature. Use Thermagon part number T-FLEX-6160 or similar.

## 5.4 DC Characteristics

### 5.4.1 Digital Control Interface (from EN2x10/EN2x11 or EN3x30/EN3x11)

Symbol	Parameter	Min	Typ	Max	Units	Notes
V <sub>IL</sub>	Low input voltage			0.5	V	
V <sub>IH</sub>	High input voltage	1.2			V	
V <sub>OL</sub>	Low output voltage			0.5	V	I <sub>OUT</sub> = 200 uA
V <sub>OH</sub>	High output voltage	1.2			V	I <sub>OUT</sub> = 200 uA

Table 11: Digital Control Interface DC Characteristics

### 5.4.2 RF Control Interface

Symbol	Parameter	Min	Typ	Max	Units	Notes
V <sub>OH</sub>	High output voltage	V <sub>DD</sub> - 0.5			V	EXT_ATT: I <sub>LOAD</sub> = 10 mA TX_G_EXT: I <sub>LOAD</sub> = 10 mA T_R: I <sub>LOAD</sub> = 20 mA
V <sub>OL</sub>	Low output voltage			GND + 0.2	V	EXT_ATT: I <sub>LOAD</sub> = 10 mA TX_G_EXT: I <sub>LOAD</sub> = 10 mA T_R: I <sub>LOAD</sub> = 20 mA

Table 12: RF Control Interface DC Characteristics

## 5.5 AC Characteristics

Unless otherwise stated, the following characteristics are valid from -40 Deg. C to +85 Deg. C.

### 5.5.1 Receiver AC Characteristics

Parameter	Min	Typ	Max	Units	Notes
Input Center Frequency	800		1500	MHz	
Input Power	-80		-10	dBm	75 ohm differential input Not production tested. <sup>3</sup>
Input Signal Channel Bandwidth		50		MHz	Not production tested. <sup>3</sup>
Out of Band Energy Tolerance (100 MHz separated from input carrier)		Greater of -44 dBm or +8 dBc		dB	Less than 1 dB receiver sensitivity degradation. Not production tested. <sup>3</sup>
Noise Figure		7	12	dB	@ max LNA gain
LO Leakage		-25		dBc	Not production tested. <sup>3</sup>

Table 13: Rx AC Characteristics

### 5.5.2 Transmitter AC Characteristics

Parameter	Min	Typ	Max	Units	Notes
Output Center Frequency	800		1500	MHz	
Output Power	-12		-6	dBm	Tx Power control setting = 10 <sup>2</sup>
Output Power Variation	-3		+3	dB	800MHz – 1500 MHz
Output Power Range		35		dB	Not production tested. <sup>3</sup>
Output Signal Bandwidth		50		MHz	3dB Bandwidth Not production tested. <sup>3</sup>
Local Oscillator Harmonics			-20	dBm	Not production tested. <sup>3</sup>
Output Noise Power		-45		dBc	Not production tested. <sup>3</sup>
Output IP3	+10.5	+19		dBm	Tx Power control setting = 10 <sup>2</sup>
RF Spurious Signal Emissions (52 MHz to 850 MHz)			-60	dBm	Not production tested. <sup>3</sup>
RF Spurious Signal Emissions (850 MHz to 1500 MHz)			-60	dBm	Not production tested. <sup>3</sup>
LO Related Spurious			-60	dBm	Not production tested. <sup>3</sup>

**Table 14: Tx AC Characteristics**

Note<sup>2</sup>: Tx Power control settings available in software through EN2x10/EN2x11, EN3x30/EN3x11 and SIO interface.

Note<sup>3</sup>: These values are not tested in production. They have been verified during characterization and are guaranteed by design.

### 5.5.3 PLL AC Characteristics

Parameter	Min	Typ	Max	Units	Notes
LO Frequency Range	800		1500	MHz	
LO Step Size		25		MHz	
LO Stability	-100		+100	ppm	
Phase Noise					
1kHz offset		-95		dBc/Hz	
10kHz offset		-100	-98	dBc/Hz	
100kHz offset		-105	-98	dBc/Hz	
1MHz offset		-110		dBc/Hz	
10MHz offset		-130		dBc/Hz	

**Table 15: PLL AC Characteristics**

#### 5.5.4 PLL XTAL Requirements

The PLL circuitry requires a XTAL with the characteristics listed below:

Parameter	Conditions	Min	Typ	Max	Units
Nominal Frequency			25		MHz
Frequency Tolerance	25 °C	-30		+30	ppm
Frequency Stability		-30		+30	ppm
Operating Temperature (Commercial Grade)		0		80	°C
Operating Temperature (Industrial Grade)		-40		85	°C
ESR				40	Ω
Load Capacitance			12		pF
Shunt Capacitance		2.0	2.5	3.0	pF
Motional Capacitance		9.6	12	14.4	fF
Drive Level				300	uW
Aging		-3		+3	ppm/year
Spurious Frequency Amplitude Attenuation		-3			dB

**Table 16: PLL XTAL Requirements**

### 6 Mechanical Information

The EN1010 is packaged in 48-pin Quad Flat No-leads carrier (QFN). Mechanical drawings are shown below. Package drawing is for dimensional purposes only and is not representative of the actual package.

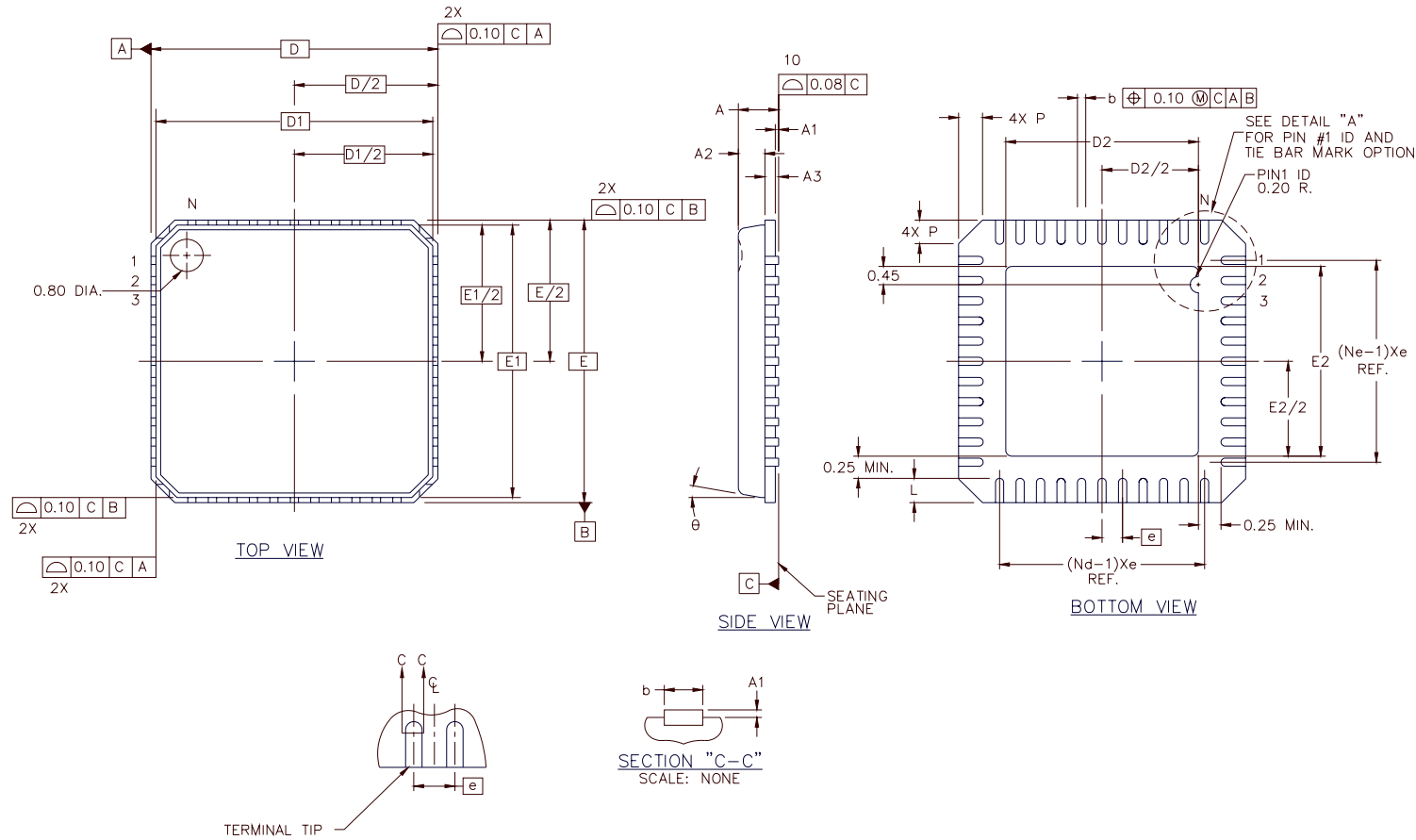


Figure 6: EN1010 Package Information

	Symbol	Dimension (mm) or where noted			Note
		Min	Nom	Max	
	e	0.50 BSC			
	N	48			3
	Nd	12			3
	Ne	12			3
	L	0.30	0.40	0.50	
	b	0.18	0.23	0.30	4
Exposed Pad	D2, E2	5.15	5.30	5.45	
	A	-	0.85	0.90	
	A1	0.00	0.01	0.05	5
	A2	-	0.65	0.70	
	A3	0.20 REF			
	D, E	7.00 BSC			
	D1, E1	6.75 BSC			
	Θ			12°	
	P	0.24	0.42	0.50	

- Notes:**
1. Maximum allowable die thickness is 0.305mm
  2. Dimensioning & tolerances conform to ASME Y14.5M – 1994
  3. N is the number of terminals. Nd is the # of terminals in X-dir. & Ne is the # of terminals in Y-dir.
  4. Dimension b applies to plated terminal & is measured between 0.20mm & 0.25mm from terminal tip.
  5. Applied only for terminals

## 7 Ordering Information

Package	Temp Range	Ordering Part Number	Comments
48 QFN	0°C to +70°C	EN1010C1	Green Package
48 QFN	-40°C to +85°C	EN1011C1	Green Package

**Table 17: Ordering information**

NOTE: All Green packages of the EN1010/11 are compliant to the IPC / JEDEC standard J-STD-020C for solder reflow for Pb-free applications. They are also acceptable for Pb based applications. The green packages are fully RoHS-6 compliant and do not contain mercury, cadmium, hexavalent chromium, PBB, or PBBE and contains less than 1000ppm lead.

*The information contained in this document is subject to change without notice. Entropic assumes no responsibility for the accuracy of the information contained in this document and assumes no responsibility for ensuring that users are notified of changes or updates.*



**www.entropic.com**

General Information:

Tel: 858.625.3200

Fax: 858.546.2409

9276 Scranton Road

San Diego, Ca 92121