

Do **not** use for new designs. Use the RF212 device instead (Data Sheet No. 100780)



# RF210A and RF210B

## *Dual-Band, Image-Reject Downconverters For GSM Applications*

The RF210A and RF210B devices are available as a dual-band front end for Global System for Mobile Communications (GSM) handset applications. Both of these highly integrated, monolithic devices are optimized for dual-band use in GSM900/DCS1800 or GSM 900/PCS1900 applications. The devices include two Low Noise Amplifiers (LNAs), two image-reject mixers, and two Local Oscillator (LO) buffer amplifiers.

The main advantage of the RF210A and RF210B is their ability to provide 30 dB of image rejection for both the GSM900 and the DCS1800 (or PCS1900) bands without requiring the use of a post-LNA image reject filter. A block diagram of the RF210(A/B) is shown in Figure 1. The device package and pin configuration are shown in Figure 2.

### Features

- LNA/image-reject mixer for RF to IF conversion
- 10 dB (RF210A) or 20 dB (RF210B) switchable gain for GSM
- 8 dB (RF210A) or 16 dB (RF210B) switchable gain for DCS/PCS
- 30 dB of image rejection. No post-LNA filtering required
- High isolation LO input buffer
- Differential IF output
- High dynamic range
- Three-cell battery operation (2.7 to 5 V)
- 20-pin Thin Shrink Small Outline Package (TSSOP)

### Applications

- Dual-band digital cellular mobile telephony (GSM900/DCS 1800 or GSM900/PCS1900)

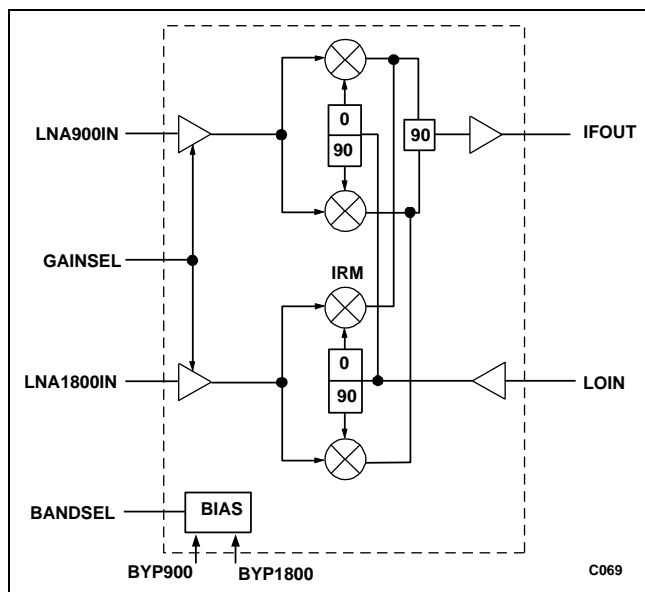


Figure 1. RF210(A/B) Block Diagram

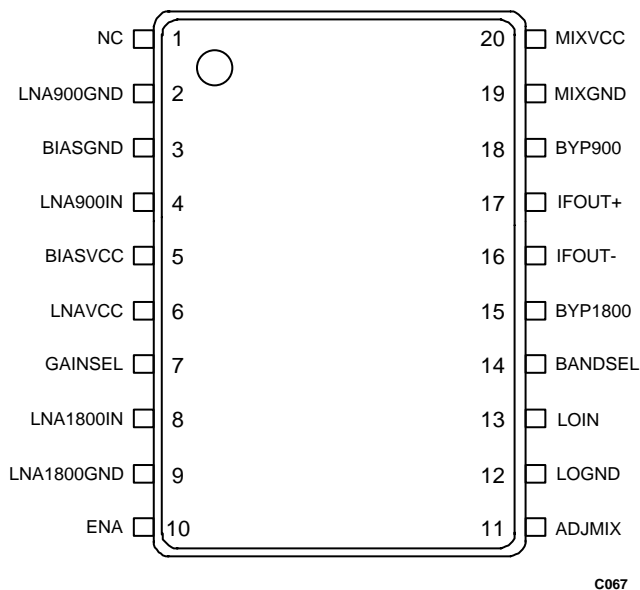


Figure 2. RF210(A/B) Pin Configuration – 20-Pin TSSOP

## Technical Description

The RF210(A/B) dual-band, image-reject downconverters implement the front-end functions of a dual-band super-heterodyne receiver. These devices consist of two receive paths, one for GSM900 and the other for DCS1800 (or PCS1900). Each receive path contains an LNA and an image-reject mixer. The IF and LO ports are common to both receive paths. The image-reject mixers can provide 30 dB of image rejection for both the GSM900 and the DCS1800 (or PCS1900) bands without using any post-LNA image reject filters.

The LNA/mixer combination has a switchable gain. The RF210A and RF210B both have 22 dB of gain in the high gain mode. For the RF210A, the gain is reduced by 10 dB (GSM band) and by 8 dB (DCS/PCS band) in the low gain mode. For the RF210B, the gain is reduced by 20 dB (GSM band) and by 16 dB (DCS/PCS band) in the low gain mode. The gain mode is selected using the GAINSEL pin (Pin 7). Low gain mode is selected by driving the GAINSEL signal high; high gain mode is selected by driving the signal low. In addition, small adjustments

of the mixer gain can be accomplished by varying the quiescent current on the ADJMIX pin (Pin 11). This pin can be connected to VCC or ground through resistors. The current will increase if the pin is connected to GND and decrease if connected to VCC. For optimal performance, this pin should be left unconnected.

The band of operation for RF210(A/B) is selected by the BANDSEL signal on Pin 14. It switches the receive path between GSM900 and DCS1800 (or PCS1900) bands.

The device can operate from a three-cell battery pack (2.7 V to 5.0 V). Standby mode current is extremely low at 20  $\mu$ A, which maximizes handset standby time.

The signal pin assignments and functional pin descriptions are found in Table 1. The absolute maximum ratings of the RF210(A/B) are provided in Table 2, the operating conditions are specified in Table 3, and electrical specifications are provided in Table 4. Figure 3 shows the diagram for a typical application circuit using the RF210(A/B) downconverter. Figure 4 provides the package dimensions for the 20-pin TSSOP device and Figure 5 provides the tape and reel dimensions.

Table 1. RF210(A/B) Signal Description

Pin #	Name	Description	Pin #	Name	Description
1	NC	No connect	11	ADJMIX	Mixer bias adjust pin
2	LNA900GND	900 MHz LNA ground	12	LOGND	LO input ground
3	BIASGND	Bias ground	13	LOIN	LO input
4	LNA900IN	900 MHz LNA input	14	BANDSEL	Band selection pin
5	BIASVCC	Bias supply	15	BYP1800	Bypass capacitor for 1800 MHz band
6	LNAVCC	LNA supply	16	IFOUT-	Mixer output (negative)
7	GAINSEL	LNA gain select	17	IFOUT+	Mixer output (positive)
8	LNA1800IN	1800 MHz LNA input	18	BYP900	Bypass capacitor for 900 MHz band
9	LNA1800GND	1800 MHz LNA ground	19	MIXGND	Mixer ground
10	ENA	Device enable (active high)	20	MIXVCC	Mixer supply

Table 2. Absolute Maximum Ratings

Parameter	Minimum	Maximum	Units
Storage Temperature	-40	+125	°C
LNA Input Power		+5	dBm
Supply Voltage (VCC)	-0.3	+6	V
Input Voltage Range	-0.3	Vcc	V

Table 3. RF210(A/B) Recommended Operating Conditions

Parameter	Min	Typical	Max	Units
Supply Voltage	2.7	3.0	5.0	V
Operating Temperature	-30	+25	+85	°C

Table 4. RF210(A/B) Electrical Specifications (1 of 2)

(T<sub>A</sub> = 25 °C, V<sub>CC</sub> = 3.0 V, f<sub>IF</sub> = 400 MHz, P<sub>lo</sub> = -10 dBm)

Parameter	Test Condition	Min	Typical	Max	Units
<b>GSM900 Mode, BANDSEL = 0</b>					
Supply current:					
Enable mode	ENA = 1		38		mA
Sleep mode	ENA = 0			10	μA
RF Input frequency		935		960	MHz
IF frequency		350	400	450	MHz
LO frequency		1285		1410	MHz
LO input power			-10		dBm
LO to RF input isolation		30			dB
Input impedance	LNA900IN = 950 MHz		40 – j50		Ω
Gain:					
High gain (RF210A and RF210B)	GAINSEL = 0		22		dB
Low gain (10 dB attenuation, RF210A)	GAINSEL = 1		12		dB
Low gain (20 dB attenuation, RF210B)	GAINSEL = 1		2		dB
Gain variation vs. Frequency			0.5	1	dB
Gain step tracking error				0.5	dB
Noise figure:					
High gain	No blocker, GAINSEL = 0		3.3	3.9	dB
Low gain (12 dB gain, RF210A)	GAINSEL = 1		9.0	11	dB
Low gain (2 dB gain, RF210B)	GAINSEL = 1		17	19	dB
High gain (Note 1)	-28 dBm blocker @ 915 MHz, GAINSEL = 0		3.9		dB
Input 1 dB compression point		-25			dBm
Input third order intercept point		-17			dBm
IF shunt resistance/side		400	500	600	Ω
Spurious response: 2(RF) x 2(LO) and 3(RF) x 3(LO) (Note 2):	Interferer input = -75 dBm		-45		dB
Image rejection		35			dB

**Table 4. RF210(A/B) Electrical Specifications (2 of 2)**  
 (T<sub>A</sub> = 25 °C, V<sub>CC</sub> = 3.0 V, f<sub>RF</sub> = 400 MHz, P<sub>LO</sub> = -10 dBm)

Parameter	Test Condition	Min	Typical	Max	Units
<b>DCS1800/PCS1900 Mode, BANDSEL = 1</b>					
Supply current: Enable mode Sleep mode	ENA = 1 ENA = 0		42	250	mA μA
RF input frequency		1805		1990	MHz
IF frequency		350	400	450	MHz
LO frequency		1355		1640	MHz
LO to RF input isolation		30			dB
Input impedance	LNA1800IN = 1900 MHz		40 – j10		Ω
Gain: High gain (RF210A and RF210B) Low gain (8 dB attenuation, RF210A) Low gain (16 dB attenuation, RF210B) Gain variation vs. Frequency Gain step tracking error	GAINSEL = 0 GAINSEL = 1 GAINSEL = 1		19 11 3 0.5	1 0.5	dB dB dB dB dB
Noise figure: High gain (19 dB gain, RF210A and RF210B)  Low gain (11 dB gain, RF210A) Low gain (3 dB gain, RF210B) High gain (19 dB gain, RF210A and RF210B) (Note 3)	No blocker, GAINSEL = 0 GAINSEL = 1 GAINSEL = 1 -22 dBm blocker, GAINSEL = 0		3.5 9.0 15 4.1	4.5 11 16	dB dB dB dB
Input 1 dB compression point		-24			dBm
Input third order intercept point		-17			dBm
IF shunt resistance/side		400	500	600	Ω
Spurious response (Note 2): 2(RF) x 2(LO) and 3(RF) x 3(LO)	Interferer = -65 dBm		-53		dB
Image rejection		35			dB
<b>Control Signals (All Modes)</b>					
Enable (ENA) and gain select (GAINSEL) input voltages: V <sub>IH</sub> V <sub>IL</sub>		1.9		0.8	V V
Enable (ENA) and gain select (GAINSEL) input currents: I <sub>IH</sub> I <sub>IL</sub>		-10	20 -1	100 0	μA μA
Enable time			15		μs
Bandselect switching time			15		μs
<b>Note 1:</b> Assumes 0 dBm @ 915 MHz blocker at the antenna input attenuated by 28 dB. <b>Note 2:</b> The rejection is specified with respect to the desired signal gain. <b>Note 3:</b> Assumes -12 dBm @ 1785 MHz blocker at the antenna input attenuated by 10 dB.					

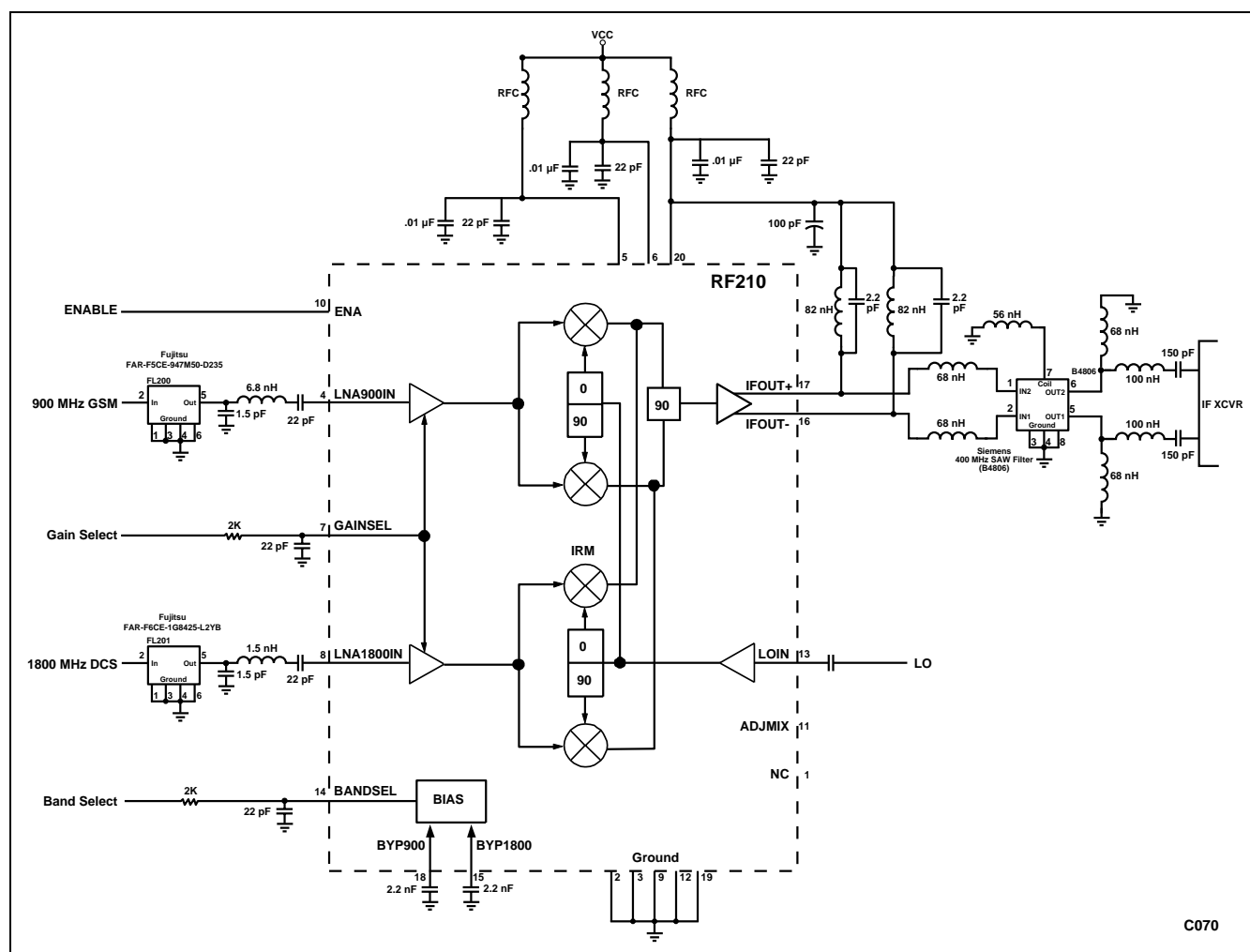


Figure 3. Typical RF210(A/B) Application Circuit

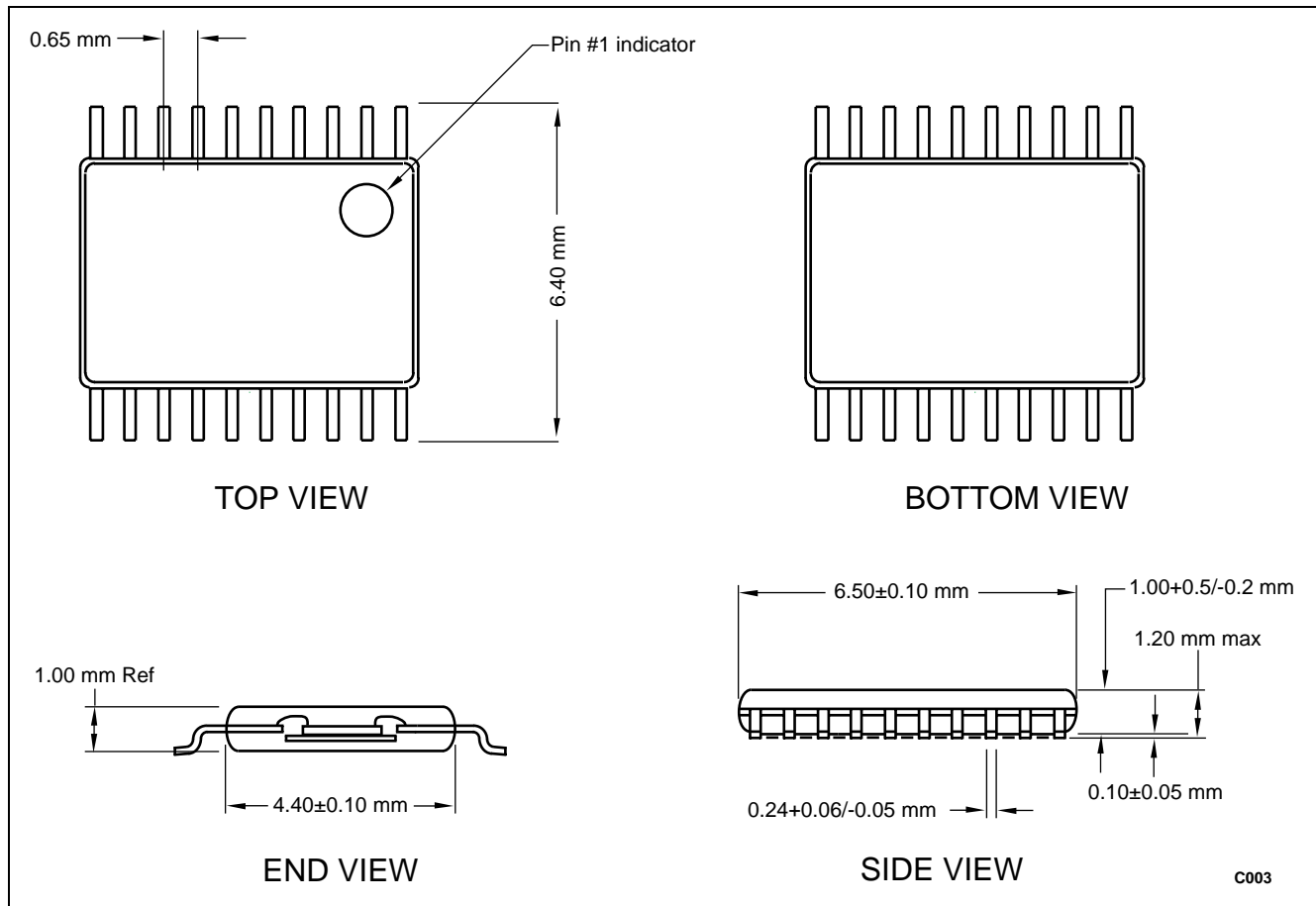


Figure 4. RF210(A/B) Package Dimensions – 20-Pin TSSOP

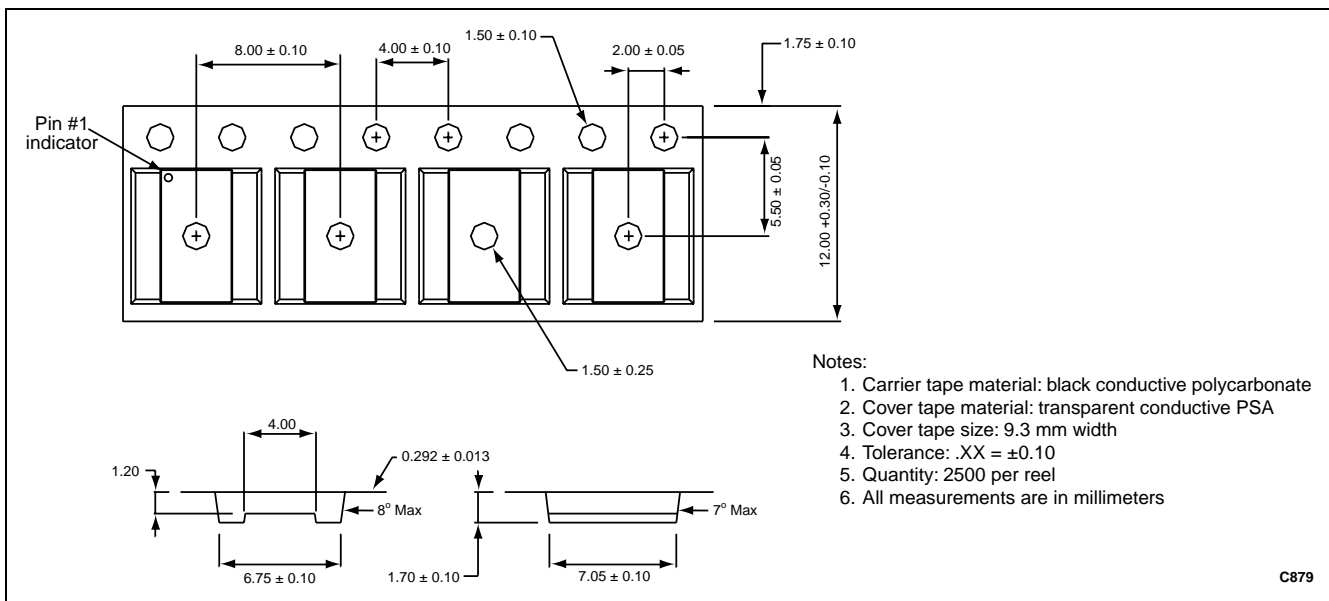


Figure 5. RF210(A/B) Tape and Reel Dimensions

## Ordering Information

Model Name	Manufacturing Part Number	Product Revision
Dual-Band, Image-Reject Downconverter: 10 dB switchable gain 20 dB switchable gain	RF210A RF210B	

© 2000, Conexant Systems, Inc. All Rights Reserved.

Information in this document is provided in connection with Conexant Systems, Inc. ("Conexant") products. These materials are provided by Conexant as a service to its customers and may be used for informational purposes only. Conexant assumes no responsibility for errors or omissions in these materials. Conexant may make changes to specifications and product descriptions at any time, without notice. Conexant makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Conexant's Terms and Conditions of Sale for such products, Conexant assumes no liability whatsoever.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF CONEXANT PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. CONEXANT FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. CONEXANT SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

Conexant products are not intended for use in medical, lifesaving or life sustaining applications. Conexant customers using or selling Conexant products for use in such applications do so at their own risk and agree to fully indemnify Conexant for any damages resulting from such improper use or sale.

The following are trademarks of Conexant Systems, Inc.: Conexant™, the Conexant C symbol, and "What's Next in Communications Technologies"™. Product names or services listed in this publication are for identification purposes only, and may be trademarks of third parties. Third-party brands and names are the property of their respective owners.

Additional information, posted at [www.conexant.com](http://www.conexant.com), is incorporated by reference.

**Reader Response:** Conexant strives to produce quality documentation and welcomes your feedback. Please send comments and suggestions to [tech.pubs@conexant.com](mailto:tech.pubs@conexant.com). For technical questions, contact your local Conexant sales office or field applications engineer.



**Further Information:**  
literature@conexant.com  
1-800-854-8099 (North America)  
33-14-906-3980 (International)

**Web Site**  
www.conexant.com

**World Headquarters**  
Conexant Systems, Inc.  
4311 Jamboree Road,  
P.O. Box C  
Newport Beach, CA 92658-8902  
Phone: (949) 483-4600  
Fax: (949) 483-6375

**U.S. Florida/South America**  
Phone: (727) 799-8406  
Fax: (727) 799-8306

**U.S. Los Angeles**  
Phone: (805) 376-0559  
Fax: (805) 376-8180

**U.S. Mid-Atlantic**  
Phone: (215) 244-6784  
Fax: (215) 244-9292

**U.S. North Central**  
Phone: (630) 773-3454  
Fax: (630) 773-3907

**U.S. Northeast**  
Phone: (978) 367-3200  
Fax: (978) 256-6868

**U.S. Northwest/Pacific West**  
Phone: (408) 249-9696  
Fax: (408) 249-7113

**U.S. South Central**  
Phone: (972) 733-0723  
Fax: (972) 407-0639

**U.S. Southeast**  
Phone: (919) 858-9110  
Fax: (919) 858-8669

**U.S. Southwest**  
Phone: (949) 483-9119  
Fax: (949) 483-9090

**APAC Headquarters**  
Conexant Systems Singapore,  
Pte. Ltd.  
1 Kim Seng Promenade  
Great World City  
#09-01 East Tower  
Singapore 237994  
Phone: (65) 737 7355  
Fax: (65) 737 9077

**Australia**  
Phone: (61 2) 9869 4088  
Fax: (61 2) 9869 4077

**China**  
Phone: (86 2) 6361 2515  
Fax: (86 2) 6361 2516

**Hong Kong**  
Phone: (852) 2 827 0181  
Fax: (852) 2 827 6488

**India**  
Phone: (91 11) 692 4780  
Fax: (91 11) 692 4712

**Korea - Seoul Office**  
Phone: (82 2) 565 2880  
Fax: (82 2) 565 1440

**Korea - Taegu Office**  
Phone: (82 53) 745 2880  
Fax: (82 53) 745 1440

**Europe Headquarters**  
Conexant Systems France  
Les Taissounieres B1  
1681 Route des Dolines  
BP 283  
06905 Sophia Antipolis Cedex  
France  
Phone: (33 1) 41 44 36 50  
Fax: (33 1) 93 00 33 03

**Europe Central**  
Phone: (49 89) 829 1320  
Fax: (49 89) 834 2734

**Europe Mediterranean**  
Phone: (39 02) 9317 9911  
Fax: (39 02) 9317 9913

**Europe North**  
Phone: (44 1344) 486 444  
Fax: (44 1344) 486 555

**Europe South**  
Phone: (33 1) 41 44 36 50  
Fax: (33 1) 41 44 36 90

**Middle East Headquarters**  
Conexant Systems Commercial  
(Israel) Ltd.  
P.O. Box 12660  
Herzlia 46733  
Israel  
Phone: (972 9) 952 4064  
Fax: (972 9) 951 3924

**Japan Headquarters**  
Conexant Systems Japan Co., Ltd.  
Shimomoto Building  
1-46-3 Hatsudai,  
Shibuya-ku  
Tokyo, 151-0061  
Japan  
Phone: (81 3) 5371 1567  
Fax: (81 3) 5371 1501

**Taiwan Headquarters**  
Conexant Systems, Taiwan Co.,  
Ltd.  
Room 2808  
International Trade Building  
333 Keelung Road, Section 1  
Taipei 110  
Taiwan, ROC  
Phone: (886 2) 2720 0282  
Fax: (886 2) 2757 6760