

DATA SHEET

AP6684

*Quad-band GPRS Front-end Module
with Four UMTS Ports*

Datasheet

VERSION 1.00 24-Dec-2012

AIROHA
Airoha Technology Corp.

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Revision History

Version	Change Summary	Date	Author
1.00	Created	24-Dec-12	Chad Huang

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AP6684

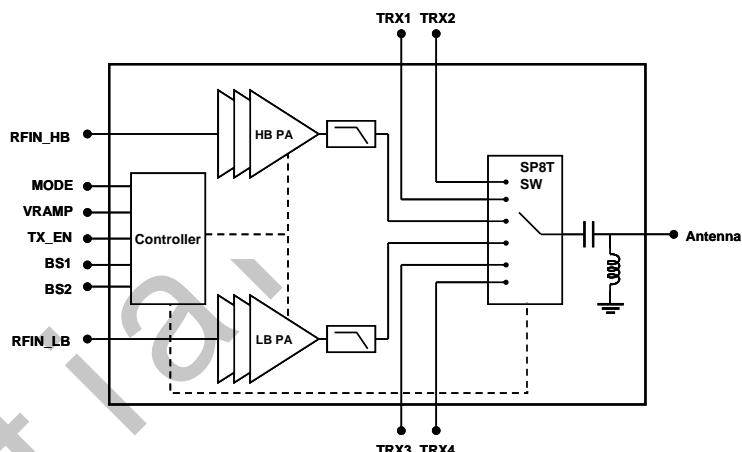
Quad-Band GPRS Front-End Module with Four UMTS Ports

Features

- Quad-band GSM, and Receive Front-end Module with Four High Linearity/ Low Insertion Loss TRX Ports
- High Efficiency
 - 38% for GSM850/EGSM900
 - 35% for DCS1800/PCS1900
- 0dBm to 6dBm Drive Level
- 50Ω Matched Input/Output
- >50dB Dynamic range
- Integrated Low Pass Filter for High Order Harmonics Rejection
- >8kV ESD Protection at Antenna Port
- Small Outline
 - 6mm x 6mm x 1.00mm
 - 28-pin configuration

Applications

- Multimode Mobile Phone
 - Class 4 GSM850/GSM900
 - Class 1 DCS/PCS
 - Class 12 GPRS Multi-slot operation
 - Four high linearity TRX ports for 3G application



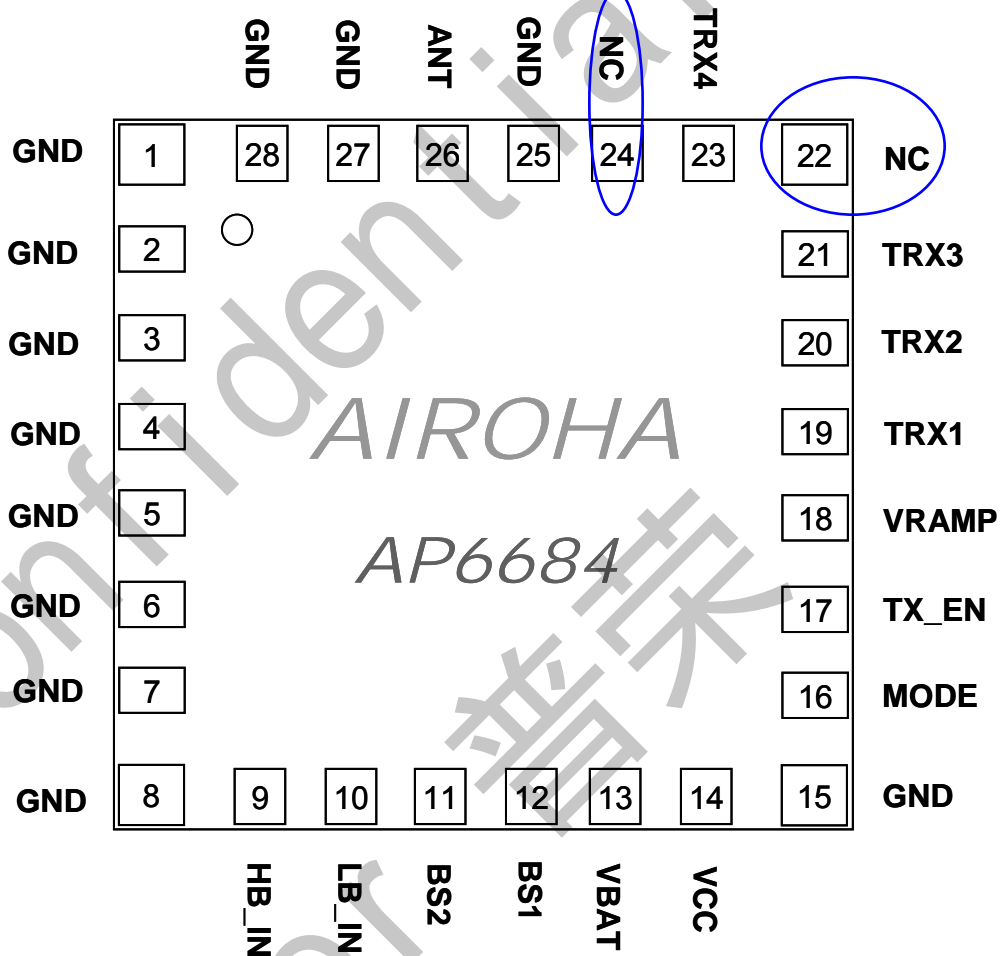
Description

AP6684 is a quad-band GSM/GPRS (GSM850 / GSM900 / DCS1800 / PCS1900) front-end module (FEM) with four high linearity/ low insertion loss TRX ports for multimode applications.

This front-end module integrates high power/high efficiency PA blocks, high linearity/low insertion loss antenna switch and controller in a compact module. In addition, the built-in low pass filter rejects higher order harmonics and eliminates the need of external low pass filter network.

The AP6684 provides 50Ω matched input and output ports requiring no external matching network. It also integrates an ESD protection circuit to provide robust ESD protection at the antenna port.

Pin Assignment

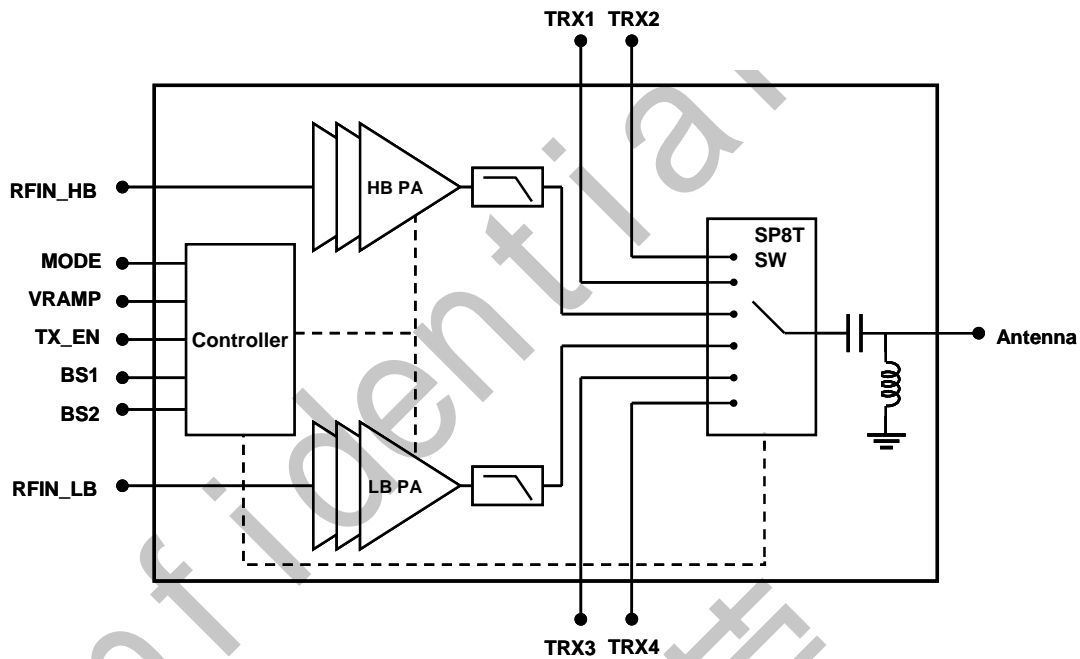


Top View

Pin Name Description

PIN	SIGNAL	TYPE	DESCRIPTION
1	GND	GND	Ground
2	GND	GND	Ground
3	GND	GND	Ground
4	GND	GND	Ground
5	GND	GND	Ground
6	GND	GND	Ground
7	GND	GND	Ground
8	GND	GND	Ground
9	HB_IN	Input, Analog	High Band RF Input port
10	LB_IN	Input, Analog	Low Band RF Input port
11	BS2	Input, Digital	Select the Band of Operation
12	BS1	Input, Digital	Select the Band of Operation
13	VBAT	Power	Power Supply
14	VCC	Power	Power Supply
15	GND	GND	Ground
16	MODE	Input, Digital	Select the Band of Operation
17	TX_EN	Input, Digital	TX mode enable
18	VRAMP	Input, Analog	RAMP Control
19	TRX1	Input/Output, Analog	W-CDMA TRX port
20	TRX2	Input/Output, Analog	W-CDMA TRX port
21	TRX3	Input/Output, Analog	W-CDMA TRX port
22	NC		No Use
23	TRX4	Input/Output, Analog	W-CDMA TRX port
24	NC		No Use
25	GND	GND	Ground
26	ANT	Input/Output, Analog	Antenna port
27	GND	GND	Ground
28	GND	GND	Ground

Block Diagram



Interface

Control Table

MODE	TX_EN	MODE	BS1	BS2
Standby	0	0	0	0
TRX1	0	1	0	0
TRX2	0	1	1	0
TRX3	0	1	0	1
TRX4	0	0	1	0
LB_GPRS	1	0	0	1
HB_GPRS	1	0	1	1

Electrical Characteristics

Absolute Maximum Ratings

AP6684 could be damaged by any stress in excess of the absolute maximum ratings listed below.

ITEM		MIN.	MAX.
Power supply voltage	VBAT	-0.3 V	5.5 V
	VCC	-0.3 V	5.5 V
Input RF Power			10dBm
Power Control Voltage (VRAMP)		-0.3 V	2 V
Output Load VSWR			20 : 1
Storage temperature		- 55°C	+150°C

Recommended Operating Conditions

Recommended operating ambient temperature range $T_a = -20$ to 85°C

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage	VBAT		3		4.8	V
	VCC		3		4.8	V
Operating temperature			- 20		+85	°C
TX_EN Control Voltage	Low	TXEN _ Low	0		0.5	V
	High	TXEN _ High	1.25		VBAT	V
BS1 Control Voltage	Low	Ctrl 0 _ Low	0		0.5	V
	High	Ctrl 0 _ High	1.25		VBAT	V
BS2 Control Voltage	Low	Ctrl 1 _ Low	0		0.5	V
	High	Ctrl 1 _ High	1.25		VBAT	V
Mode Control Voltage	Low	Ctrl 2 _ Low	0		0.5	V
	High	Ctrl 2 _ High	1.25		VBAT	V
VRAMP max., GPRS mode		Max. Pout			1.8	V
VRAMP min., GPRS mode		Min. Pout		0.2		V
VRAMP, EDGE HP mode			1.25		1.8	V
VRAMP, EDGE LP mode			0		0.4	V

Electrical Specification

Typical values are tested under VBAT=3.5V, PIN=3dBm, Duty Cycle=12.5%, Pulse Width=577us,

Ta=25°C unless otherwise specified

GSM 850 GMSK Mode					
PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
Frequency Range		824		849	MHz
Input Power		0		6	dBm
Input VSWR	Pout=5 ~33dBm		2.5:1		
Max. Output Power	VRAMP=1.8V	33	33.5		dBm
Power Added Efficiency	Max. Output Power		38		%
Min. Power into 3:1 VSWR	Load VSWR=3:1	30.5			dBm
Power Control Dynamic Range	VRAMP=0.2 to 1.8V	50			dB
2nd Harmonic	Pout=33dBm			-33	dBm
3rd Harmonic	Pout=33dBm			-33	dBm
All Other Harmonics up to 12.75GHz	Pout=33dBm			-33	dBm
Non-Harmonic Spurious up to 12.75GHz	Pout=33dBm			-36	dBm
Forward Isolation 1	TXEN=Low, Pin=6dBm, VRAMP=0.2V		-55		dBm
Forward Isolation 2	TXEN=High, Pin=6dBm, VRAMP=0.2V		-30		dBm
Output Noise Power	869~894 MHz	Pout=33dBm, RBW=100 kHz		-82	dBm
	1930~1990 MHz			-85	dBm
Output Load VSWR Stability	Load VSWR=10:1, all phase angles, Max. Pout			-36	dBm
Output Load VSWR Ruggedness	Load VSWR=20:1, all phase angles, Max. Pout	No damage or permanent degradation to device			

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Typical values are tested under VBAT=3.5V, PIN=3dBm, Duty Cycle=12.5%, Pulse Width=577us,
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EGSM 900 GMSK Mode						
PARAMETER		CONDITION	MIN.	TYP.	MAX.	UNIT
Frequency Range			880		915	MHz
Input Power			0		6	dBm
Input VSWR		Pout=5 ~33dBm		2.5 :1		
Max. Output Power		VRAMP=1.8V	33	33.5		dBm
Power Added Efficiency		Max. Output Power		38		%
Min. Power into 3:1 VSWR		Load VSWR=3:1	30.5			dBm
Power Control Dynamic Range		VRAMP=0.2 to 1.8V	50			dB
2nd Harmonic		Pout=33dBm			-33	dBm
3rd Harmonic		Pout=33dBm			-33	dBm
All Other Harmonics up to 12.75GHz		Pout=33dBm			-33	dBm
Non-Harmonic Spurious up to 12.75GHz		Pout=33dBm			-36	dBm
Forward Isolation 1		TXEN=Low, Pin=6dBm, VRAMP=0.2V		-55		dBm
Forward Isolation 2		TXEN=High, Pin=6dBm, VRAMP=0.2V		-30		dBm
Output Noise Power	925~935 MHz	Pout=33dBm, RBW=100 kHz			-82	dBm
	935~960 MHz				-82	dBm
	1805~1880 MHz				-85	dBm
Output Load VSWR Stability		Load VSWR=10:1, all phase angles, Max. Pout			-36	dBm
Output Load VSWR Ruggedness		Load VSWR=20:1, all phase angles, Max. Pout	No damage or permanent degradation to device			

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Typical values are tested under VBAT=3.5V, PIN=3dBm, Duty Cycle=12.5%, Pulse Width=577us,
 Ta=25°C unless otherwise specified

DCS 1800 GSMK Mode					
PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
Frequency Range		1710		1785	MHz
Input Power		0		6	dBm
Input VSWR	Pout =0 ~30dBm		2.5 :1		
Max. Output Power	VRAMP=1.8V	30	31		dBm
Power Added Efficiency	Max. Output Power		35		%
Min. Power into 3:1 VSWR	Load VSWR=3:1	27.5			dBm
Power Control Dynamic Range	VRAMP=0.2 to 1.8V	50			dB
2nd Harmonic	Pout=30dBm			-33	dBm
3rd Harmonic	Pout=30dBm			-33	dBm
All Other Harmonics up to 12.75GHz	Pout=30dBm			-33	dBm
Non-Harmonic Spurious up to 12.75GHz	Pout=30dBm			-36	dBm
Forward Isolation 1	TXEN=Low, Pin =6dBm, VRAMP=0.2V		-57		dBm
Forward Isolation 2	TXEN=High, Pin=6dBm, VRAMP=0.2V		-30		dBm
Output Noise Power	925~935 MHz			-87	dBm
	935~960 MHz	Pout=30dBm, RBW=100kHz		-87	dBm
	1805~1880 MHz			-85	dBm
Output Load VSWR Stability	Load VSWR=10:1, all phase angles, Max. Pout			-36	dBm
Output Load VSWR Ruggedness	Load VSWR=20:1, all phase angles, Max. Pout	No damage or permanent degradation to device			

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Typical values are tested under VBAT=3.5V, PIN=3dBm, Duty Cycle=12.5%, Pulse Width=577us,
Ta=25°C unless otherwise specified

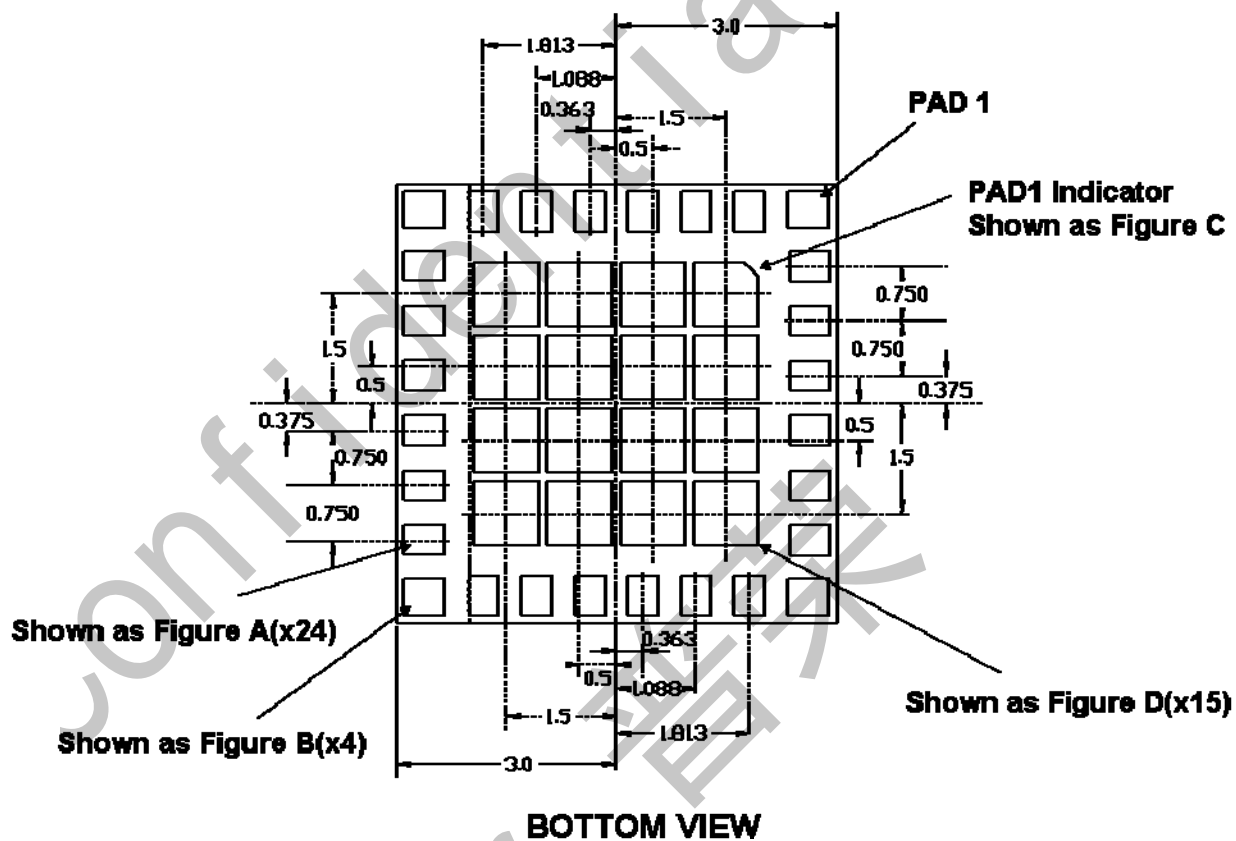
PCS 1900 GMSK Mode						
PARAMETER		CONDITION	MIN.	TYP.	MAX.	UNIT
Frequency Range			1850		1910	MHz
Input Power			0		6	dBm
Input VSWR		Pout =0 ~30dBm		2.5 :1		
Max. Output Power		VRAMP=1.8V	30	31		dBm
Power Added Efficiency		Max. Output Power		35		%
Min. Power into 3:1 VSWR		Load VSWR=3:1	27			dBm
Power Control Dynamic Range		VRAMP=0.2 to 1.8V	50			dB
2nd Harmonic		Pout=30dBm			-33	dBm
3rd Harmonic		Pout=30dBm			-33	dBm
All Other Harmonics up to 12.75GHz		Pout=30dBm			-33	dBm
Non-Harmonic Spurious up to 12.75GHz		Pout=30dBm			-36	dBm
Forward Isolation 1		TXEN=Low, Pin =6dBm, VRAMP=0.2V		-57		dBm
Forward Isolation 2		TXEN=High, Pin=6dBm, VRAMP=0.2V		-30		dBm
Output Noise Power	869~894 MHz	Pout=30dBm, RBW=100kHz			-87	dBm
	1930~1990 MHz				-85	dBm
Output Load VSWR Stability		Load VSWR=10:1, all phase angles, Max. Pout			-36	dBm
Output Load VSWR Ruggedness		Load VSWR=20:1, all phase angles, Max. Pout	No damage or permanent degradation to device			

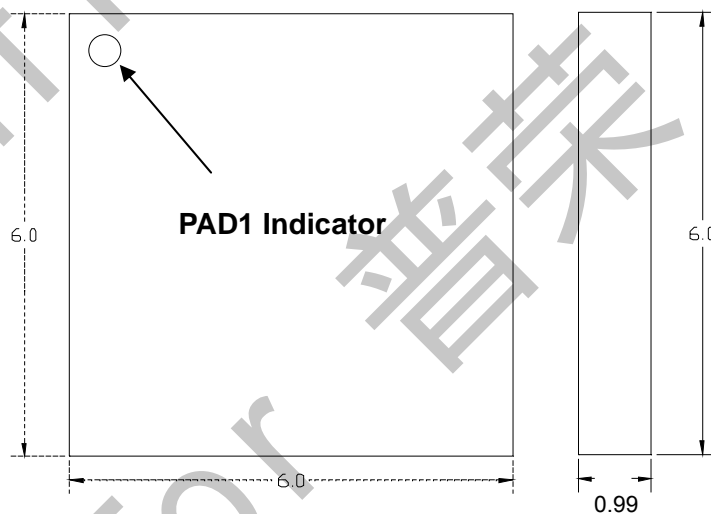
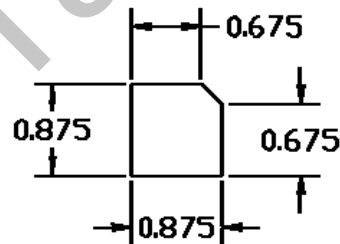
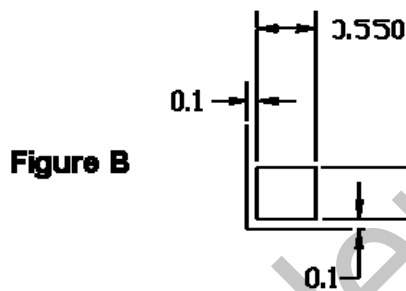
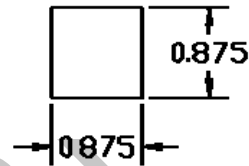
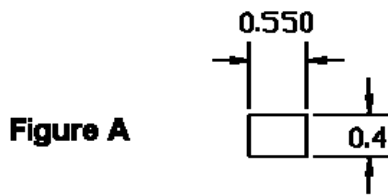
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UMTS TRX Mode					
PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT
Insertion Loss ANT. to TRX1 through TRX4	824 ~ 960 MHz			1.1	dB
	1710 ~ 2170 MHz			1.5	dB
Input VSWR ANT. to TRX1 through TRX4	824 ~ 960 MHz		1.5:1		
	1710 ~ 2170 MHz		1.5:1		
Isolation, Adjacent Port TRX1 through TRX4 to any other adjacent port	824 ~ 960 MHz, 1710 ~ 2170 MHz	20			dB
Isolation, Non-adjacent Port TRX1 through TRX4 to any other non-adjacent port	824 ~ 960 MHz, 1710 ~ 2170 MHz	25			dB
IMD2, TRX1 through TRX4	1 · Tx = 836.5MHz at 20dBm; Blocker = 45MHz, 1718 MHz at -15dBm; Rx = 881.5MHz 2 · Tx = 1950MHz at 20dBm; Blocker= 190MHz, 4.09GHz at -15dBm; Rx = 2.14GHz			-105	dBm
IMD3, TRX1 through TRX4	1 · Tx = 836.5MHz at 20dBm; Blocker=791.5MHz, 2544.5 MHz at -15dBm; Rx=881.5MHz 2 · Tx = 1.95GHz at 20dBm; Blocker=1.76GHz, 6.04GHz at -15dBm; Rx = 2.14GHz			-105	dBm
LB Tx Leakage to TRX1 through TRX4	GSM850/EGSM900 Tx mode: Freq = 824MHz to 915MHz, V _{RAMP} = V _{RAMP RATED} for P _{OUT} = 33dBm at Antenna port.			0	dBm
HB Tx Leakage to TRX1 through TRX4	DCS1800/PCS1900 Tx mode: Freq = 1710MHz to 1910MHz, V _{RAMP} = V _{RAMP RATED} for P _{OUT} = 30dBm at Antenna port.			0	dBm

Package Dimension





TOP VIEW

SIDE VIEW

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M 1994.