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RF9810

Quad Band GPRS/Linear EDGE + 3.2V TD-SCDMA Multi-Mode TRANSMIT MODULE

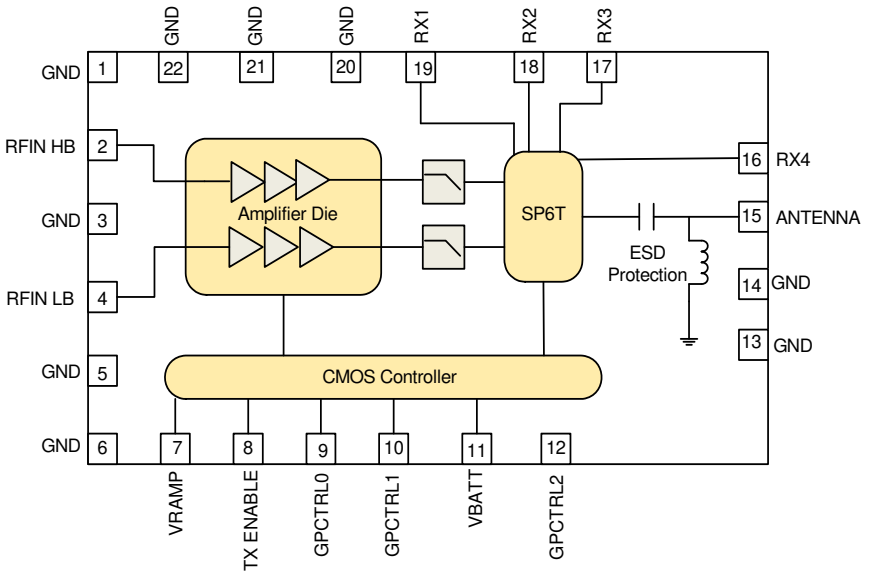
Package: Module, 6.63mm x 5.24mm x 1.00mm

Features

- TD-SCDMA Compliant B34/39
- +25dBm Output Power TD-SCDMA
- Proven PowerStar® Architecture
- High Efficiency at Rated P_{OUT}
  V_{BATT} = 3.5V
  GSM850/EGSM900 = 41%
  DCS1800/PCS1900 = 38%
- Integrated Power Flattening Circuit for Lower Power Variation under Mismatch Conditions
- Integrated V_{BATT} Tracking Circuit for Improved Switching Spectrum under Low V_{BATT} Conditions
- Digital Bias Control
- EDGE Low Current Mode
- Symmetrical Rx Ports
- High Gain Supports Low Drive Level
- Robust 8kV ESD Protection at Antenna Port
- Pin Compatible with RF716x GPRS, TxM Family, and Linear EDGE TxM's RF9801/2

Applications

- 3.2V Quad-Band GSM/GPRS/ EDGE and Dual-Band TD-SCDMA Handsets
- Mobile GPRS/EDGE Data Products
- GPRS Class 12 Compliant Products
- TD-SCDMA Wireless Handsets and Data Cards



Functional Block Diagram

Product Description

The RF9810 is a Quad Band EDGE + TD-SCDMA Multi-Mode Transmit Module with the capability to support both GSM/GPRS/Linear EDGE (GSM850/EGSM900/DCS1800/PCS1900) and TD-SCDMA (1880MHz to 1920MHz and 2010MHz to 2025MHz) B34/39 frequency bands. The RF9810 continues to build upon RFMD's leading patented PowerStar® Architecture to include such features as a Power Flattening Circuit, V_{RAMP} Filtering, V_{BATT} Tracking, EDGE Low Power Mode. And, RFMD has integrated TD-SCDMA functionality into the RF9810, so it can be used as the transmit module in 3.2V, 50Ω GSM/TD-SCDMA dual-mode cellular equipment. The RF9810 module includes a multi-function CMOS controller, GaAs HBT power amplifier, and pHEMT front end antenna switch. The amplifier devices are manufactured on RFMD's Advance Gallium Arsenide Heterojunction Bipolar Transistor (GaAs HBT) Process, which is designed to operate either in saturated mode for GMSK or linear mode for EDGE 8PSK and TD-SCDMA signaling. The highly integrated EDGE + TD-SCDMA transmit module simplifies GSM/TD-SCDMA dual-mode handset and data card design by eliminating the need for complicated control loop design, output RF spectrum (ORFS) optimization, harmonic filtering, and component matching, all of which combine to provide best in class RF performance, solution size, and ease of implementation for GSM/TD-SCDMA dual-mode cellular phone and data card systems. The RF ports are 50Ω matched and the antenna port includes ESD protection circuitry which meets the stringent 8kV industry standards requiring no additional components. All of these eliminated factors help to improve the customer's product time to market.

Optimum Technology Matching® Applied

☑ GaAs HBT	☐ SiGe BiCMOS	☑ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☑ Si CMOS	☐ BiFET HBT
☐ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ SOI

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	-0.3 to +6.0	V
Power Control Voltage (V_{RAMP})	-0.3 to +3.0	V
Input RF Power	+10	dBm
Max Duty Cycle	50	%
Output Load VSWR	20:1	
Operating Temperature	-30 to +85	°C
Storage Temperature	-55 to +150	°C

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Recommended Operating Conditions					
ESD					
ESD RX Pins			1000	V	HBM, JESD22-A114
			500	V	CDM, JESD22-C101C
ESD Antenna Pin			8	kV	IEC 61000-4-2
ESD All Other Pins			1000	V	HBM, JESD22-A114
			500	V	CDM, JESD22-C101C
Overall Power Control V_{RAMP}					
$V_{RAMP,MAX}$ GMSK Mode			1.8	V	Max. P_{OUT}
$V_{RAMP,MIN}$ GMSK Mode		0.25		V	Min. P_{OUT}
$V_{RAMP, MAX}$ High Power EDGE Mode	1.25		3	V	
$V_{RAMP, MIN}$ Low Power EDGE Mode	0		0.5	V	
V_{RAMP} Input Capacitance			10	pF	DC to 200kHz
V_{RAMP} Input Current			10	µA	$V_{RAMP} = V_{RAMP\ MAX}$
Power Control Range		50		dB	V_{RAMP} = 0.25V to $V_{RAMP\ MAX}$
Overall Power Supply					
Power Supply Voltage	3.2	3.5	4.2	V	Operating Limits
Power Supply Current			10	µA	P_{IN} < -30dBm, TX Enable = Low, V_{RAMP} = 0.25V, Temp = -20°C to +85°C, V_{BATT} = 4.2V
Overall Control Signals					
GpCtrl0, GpCtrl1, GpCtrl2 “Low”	0	0	0.5	V	
GpCtrl0, GpCtrl1, GpCtrl2 “High”	1.25	2.0	3.0	V	
GpCtrl0, GpCtrl1, GpCtrl2 “Input Current”			10	µA	
TX Enable “Low”	0	0	0.5	V	
TX Enable “High”	1.25	2.0	3.0	V	
TX Enable “Input Current”			10	µA	
RF Port Input and Output Impedance		50		Ω	

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Module Control and Antenna Switch Logic

TX Enable	GpCtrl2	GpCtrl1	GpCtrl0	VRAMP	Mode
0	0	0	0	0	Standby
0	1	0	0	X	RX1
0	0	1	0	X	RX2
0	0	1	1	X	RX3
0	0	0	1	X	RX4
1	0	1	0	Ramp	Low Band GMSK
1	0	1	1	Ramp	High Band GMSK
1	0	0	0	1	Low Band 8PSK (High Gain)
1	0	0	0	0	Low Band 8PSK (Low Gain)
1	0	0	1	1	High Band 8PSK (High Gain)
1	0	0	1	0	High Band 8PSK (Low Gain)
1	0	0	1	0	TD-SCDMA

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
GSM850 Band GMSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP}=$V_{RAMP, MAX}$ GMSK Mode, P_{IN} = 1dBm, Temp = +25°C, Duty Cycle = 25%, Pulse Width=1154 ms,. All unused ports = 50W. Refer to logic table for mode of operation.
Operating Frequency Range	824		849	MHz	
Input Power	-2	+1	+4	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2:1	2.5:1		Over P_{OUT} range (5dBm to 33dBm)
Maximum Output Power	33	34		dBm	
	31			dBm	V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C.
Minimum Power Into 3:1 VSWR	30			dBm	Minimum power delivered to the load over 360° phase sweep.
PAE (Max P_{OUT})	37	45		%	Max P_{OUT}
PAE (Rated P_{OUT})	34	41		%	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm
Peak Supply Current (Max P_{OUT})		1750	2250	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		1400	1700	mA	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm
2nd Harmonic		-40	-33	dBm	
3rd Harmonic		-40	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Forward Isolation 1		-56	-41	dBm	TX Enable = Low, P_{IN} = 4dBm, V_{RAMP} = 0.25V
Forward Isolation 2		-28	-15	dBm	TX Enable = High, P_{IN} = 4dBm, V_{RAMP} = 0.25V
Output Noise Power					
869MHz to 894MHz		-87	-83	dBm	V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm, RBW = 100kHz
1930MHz to 1990MHz		-117	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for P_{OUT} ≤33dBm into 50W load; load switched to VSWR = 10:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm into 50W load; load switched to VSWR = 20:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -30°C to +85°C

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
GSM850 Band 8PSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP} = $V_{RAMP, MAX}$ High Power EDGE Mode, Temp = +25°C, Duty Cycle = 25%, Pulse Width=1154 μs. Pin adjusted for required P_{OUT}. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	824		849	MHz	
Input VSWR		2:1	3:1		
Maximum Output Power Meeting EVM and ACPR Spectrum	27	28		dBm	
	26			dBm	V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C.
	13	19		dBm	V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Gain, High Power Mode	32		38	dB	P_{OUT} = 27dBm
Gain, Low Power Mode	30		36	dB	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Peak Supply Current, High Power Mode		850	1500	mA	P_{OUT} = 27dBm
Peak Supply Current, Low Power Mode		270	1000	mA	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
PAE, High Power Mode	10	17		%	P_{OUT} = 27dBm
PAE, Low Power Mode	0	2		%	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
ACPR and Spectrum Mask, High Power Mode		-63	-57	dBc	At 400kHz in 30kHZ BW, P_{OUT}=27dBm
ACPR and Spectrum Mask, Low Power Mode		-63	-57	dBc	At 400kHz in 30kHZ BW, P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
EVM RMS, High Power Mode		2	5	%	P_{OUT} = 27dBm
EVM RMS, Low Power Mode		2	5	%	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Output Noise Power					
869MHz to 894MHz		-85	-83	dBm	P_{OUT} = 5dBm to 27dBm
1930MHz to 1990MHz		-117	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	Load VSWR = 10:1;all phase angles (Set P_{OUT} = 27dBm into 50Ω load; load switched to VSWR=10:1), V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
EGSM900 Band GMSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP} = $V_{RAMP, MAX}$ GMSK Mode , P_{IN} = 1dBm, Temp = +25°C, Duty Cycle = 25%, Pulse Width = 1154 µs. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	880		915	MHz	
Input Power	-2	+1	+4	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2:1	2.5:1		Over P_{OUT} range (5dBm to 33dBm)
Maximum Output Power	33	34		dBm	
	31			dBm	V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C.
Minimum Power Into 3:1 VSWR	30			dBm	Minimum power delivered to the load over 360° phase sweep.
PAE (Max P_{OUT})	36	44		%	Max P_{OUT}
PAE (Rated P_{OUT})	33	40		%	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm
Peak Supply Current (Max P_{OUT})		1800	2300	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		1450	1750	mA	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm
2nd Harmonic		-40	-33	dBm	
3rd Harmonic		-40	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Forward Isolation 1		-56	-41	dBm	TX Enable = Low, P_{IN} = 4dBm, V_{RAMP} = 0.25V
Forward Isolation 2		-28	-15	dBm	TX Enable = High, P_{IN} = 4dBm, V_{RAMP} = 0.25V
Output Noise Power					
925MHz to 935MHz		-83	-77	dBm	V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm, RBW = 100kHz
935MHz to 960MHz		-87	-83	dBm	
1805MHz to 1880MHz		-117	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for $P_{OUT} \leq$33dBm into 50Ω load; load switched to VSWR = 10:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm into 50Ω load; load switched to VSWR = 20:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -30°C to +85°C

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
EGSM900 Band 8PSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP} = $V_{RAMP, MAX}$ High Power EDGE Mode, Temp = +25°C, Duty Cycle = 25%, Pulse Width = 1154 µs, Pin adjusted for required P_{OUT}. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	880		915	MHz	
Input VSWR		2:1	3:1		
Maximum Output Power Meeting EVM and ACPR Spectrum	27	28		dBm	
	26			dBm	V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C.
	13	19		dBm	V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Gain, High Power Mode	32		38	dB	P_{OUT} = 27dBm
Gain, Low Power Mode	30		36	dB	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Peak Supply Current, High Power Mode		870	1500	mA	P_{OUT} = 27dBm
Peak Supply Current, Low Power Mode		270	1000	mA	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
PAE, High Power Mode	9.5	16.5		%	P_{OUT} = 27dBm
PAE, Low Power Mode	0	2		%	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
ACPR and Spectrum Mask, High Power Mode		-63	-57	dBc	At 400kHz in 30kHZ BW, P_{OUT} = 27dBm
ACPR and Spectrum Mask, Low Power Mode		-63	-57	dBc	At 400kHz in 30kHZ BW, P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
EVM RMS, High Power Mode		2	5	%	P_{OUT} = 27dBm
EVM RMS, Low Power Mode		2	5	%	P_{OUT} = 13dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Output Noise Power					
925MHz to 935MHz		-83	-77	dBm	P_{OUT} = 5dBm to 27dBm
935MHz to 960MHz		-85	-83	dBm	
1805MHz to 1880MHz		-117	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	Load VSWR = 10:1;all phase angles (Set P_{OUT} = 27dBm into 50Ω load; load switched to VSWR=10:1), V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
DCS1800 Band GMSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP} = $V_{RAMP,MAX}$ GMSK Mode, P_{IN} = 1dBm, Temp = +25°C, Duty Cycle = 25%, Pulse Width = 1154µs. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	1710		1785	MHz	
Input Power	-2	+1	+4	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2:1	2.5:1		Over P_{OUT} range (0dBm to 30dBm)
Maximum Output Power	30	31.5		dBm	
	28			dBm	V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C
Minimum Power Into 3:1 VSWR	27			dBm	Minimum power delivered to the load over 360° phase sweep
PAE (Max P_{OUT})	32	40		%	Max P_{OUT}
PAE (Rated P_{OUT})	32	38		%	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm
Peak Supply Current (Max P_{OUT})		1100	1600	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		750	1000	mA	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm
2nd Harmonic		-40	-33	dBm	
3rd Harmonic		-36	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Forward Isolation 1		-62	-53	dBm	TX Enable = Low, P_{IN} = 4dBm, V_{RAMP} = 0.25V
Forward Isolation 2		-31	-15	dBm	TX Enable = High, P_{IN} = 4dBm, V_{RAMP} = 0.25V
Output Noise Power					
925MHz to 935MHz		-100	-81	dBm	V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm, RBW = 100kHz
935MHz to 960MHz		-100	-85	dBm	
1805MHz to 1880MHz		-90	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for $P_{OUT} \leq$ 30dBm into 50Ω load; load switched to VSWR = 10:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm into 50Ω load; load switched to VSWR = 20:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -30°C to +85°C

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
DCS1800 Band 8PSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP} = $V_{RAMP, MAX}$ High Power EDGE Mode, Temp = +25°C, Duty Cycle = 25%, Pulse Width=1154µs. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	1710		1785	MHz	
Input VSWR		2:1	2.5:1		
Maximum Output Power Meeting EVM and ACPR Spectrum	26.5	27		dBm	
	25			dBm	V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C.
	12	18		dBm	V_{RAMP}=$V_{RAMP, MIN}$ Low Power EDGE Mode
Gain, High Power Mode	31.5		37.5	dB	P_{OUT} = 26.5dBm
Gain, Low Power Mode	29		35	dB	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Peak Supply Current, High Power Mode		830	1500	mA	P_{OUT} = 26.5dBm
Peak Supply Current, Low Power Mode		200	1000	mA	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
PAE, High Power Mode	8	15		%	P_{OUT} = 26.5dBm
PAE, Low Power Mode	0	2		%	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
ACPR and Spectrum Mask, High Power Mode		-67	-57	dBc	At 400kHz in 30kHZ BW, P_{OUT} = 26.5dBm
ACPR and Spectrum Mask, Low Power Mode		-67	-57	dBc	At 400kHz in 30kHz BW, P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
EVM RMS, High Power Mode		3	5	%	P_{OUT} = 26.5dBm
EVM RMS, Low Power Mode		1	5	%	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Output Noise Power					
925MHz to 935MHz		-95	-81	dBm	P_{OUT} = 0dBm to 26.5dBm
935MHz to 960MHz		-95	-85	dBm	
1805MHz to 1880MHz		-85	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1; all phase angles (Set P_{OUT} = 26.5dBm into 50Ω load; load switched to VSWR = 10:1), V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
PCS1900 Band GMSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP} = $V_{RAMP, MAX}$ GMSK Mode, P_{IN} = 1dBm, Temp = +25°C, Duty Cycle = 25%, Pulse Width = 1154µs. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	1850		1910	MHz	
Input Power	-2	+1	+4	dBm	Full P_{OUT} guaranteed at minimum drive level.
Input VSWR		2:1	2.5:1		Over P_{OUT} range (0dBm to 30dBm)
Maximum Output Power	30	31.5		dBm	
	28			dBm	V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C
Minimum Power Into 3:1 VSWR	27			dBm	Minimum power delivered to the load over 360° phase sweep
PAE (Max P_{OUT})	32	39		%	Max P_{OUT}
PAE (Rated P_{OUT})	32	38		%	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm
Peak Supply Current (Max P_{OUT})		1100	1600	mA	Max P_{OUT}
Peak Supply Current (Rated P_{OUT})		750	1000	mA	Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm
2nd Harmonic		-40	-33	dBm	
3rd Harmonic		-40	-33	dBm	
All other harmonics up to 12.75GHz		-40	-33	dBm	
Forward Isolation 1		-60	-53	dBm	TX Enable = Low, P_{IN} = 4dBm, V_{RAMP} = 0.25V
Forward Isolation 2		-30	-15	dBm	TX Enable = High, P_{IN} = 4dBm, V_{RAMP} =0.25V
Output Noise Power					
869MHz to 894MHz		-100	-85	dBm	V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm, RBW = 100kHz
1930MHz to 1990MHz		-90	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for $P_{OUT} \leq$ 30dBm into 50Ω load; load switched to VSWR = 10:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations
Output Load VSWR Ruggedness	No damage or permanent degradation to device				VSWR = 20:1; all phase angles (Set V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm into 50Ω load; load switched to VSWR = 20:1), V_{BATT} = 3.2V to 4.2V, P_{IN} = -2dBm to +4dBm, Temp = -30°C to +85°C

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
PCS1900 Band 8PSK Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, V_{RAMP} = $V_{RAMP, MAX}$ High Power EDGE Mode, Temp = +25°C, Duty Cycle = 25%, Pulse Width = 1154µs. Pin adjusted for required P_{OUT}. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	1850		1910	MHz	
Input VSWR		2:1	2.5:1		
Maximum Output Power Meeting EVM and ACPR Spectrum	26.5	27		dBm	
	25			dBm	V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C.
	12	18		dBm	V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Gain, High Power Mode	31.5		37.5	dB	P_{OUT} = 26.5dBm
Gain, Low Power Mode	29		35	dB	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Peak Supply Current, High Power Mode		830	1500	mA	P_{OUT} = 26.5dBm
Peak Supply Current, Low Power Mode		200	1000	mA	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
PAE, High Power Mode	8	15		%	P_{OUT} = 26.5dBm
PAE, Low Power Mode	0	2		%	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
ACPR and Spectrum Mask, High Power Mode		-67	-57	dBc	At 400kHz in 30kHZ BW, P_{OUT} = 26.5dBm
ACPR and Spectrum Mask, Low Power Mode		-67	-57	dBc	At 400kHz in 30kHz BW, P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
EVM RMS, High Power Mode		3	5	%	P_{OUT} = 26.5dBm
EVM RMS, Low Power Mode		1	5	%	P_{OUT} = 12dBm, V_{RAMP} = $V_{RAMP, MIN}$ Low Power EDGE Mode
Output Noise Power					
869MHz to 894MHz		-95	-85	dBm	P_{OUT} = 0dBm to 26.5dBm
1930MHz to 1990MHz		-85	-77	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1; all phase angles (Set P_{OUT} = 26.5dBm into 50Ω load; load switched to VSWR = 10:1), V_{BATT} = 3.2V to 4.2V, Temp = -20°C to +85°C, RBW = 3MHz, no oscillations

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Band 39 and Band 34 TD-SCDMA Mode					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, Temp = +25°C. All unused ports = 50Ω. Refer to logic table for mode of operation.
Operating Frequency Range	1880		1920	MHz	
	2010		2025	MHz	
Maximum Linear Output Power	25			dBm	See Note.
B39 Gain	29		35	dB	P_{OUT} = 25dBm
B34 Gain	28		34	dB	
Gain Linearity		1		dB	$P_{OUT} \leq$ 25dBm
ACLR ± 1.63MHz Offset		-40	-35	dBc	P_{OUT} = 25dBm
ACLR ± 3.2MHz Offset		-60	-48	dBc	
Quiescent Current		250		mA	DC only
Output Noise Power					
925MHz to 935MHz		-100	-81	dBm	P_{OUT} = 25dBm, RBW = 100kHz
935MHz to 965MHz		-100	-85	dBm	
1805MHz to 1880MHz		-90	-75	dBm	
Input Impedance			2.5:1		P_{OUT} = 25dBm
All Harmonics up to 12.75GHz		-40	-36	dBm	
Output Load VSWR Stability (Spurious Emissions)			-36	dBm	VSWR = 10:1; all phase angles (Set P_{OUT} = 25dBm into 50Ω load; load switched to VSWR = 10:1), V_{BATT} = 3.2V to 4.2V, Temp. = -20°C to +85°C, RBW = 3MHz, no oscillations
EVM		1	5	%	P_{OUT} = 25dBm

Note: P_{OUT} is specified for TD-SCDMA modulation.

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
RX Section					Nominal test conditions unless otherwise stated. V_{BATT} = 3.5V, Temp = +25°C, Duty Cycle = 25%, Pulse Width = 1154 µs, V_{RAMP} = $V_{RAMP, MIN}$. All unused ports = 50Ω. Refer to logic table for mode of operation.
Insertion Loss GSM850 ANT-RX1/RX2/RX3/RX4		1	1.3	dB	Freq = 869MHz to 894MHz. See Note 1.
In-Band Ripple GSM850 ANT-RX1/RX2/RX3/RX4			0.2	dB	Freq = 869MHz to 894MHz
Input VSWR GSM850 ANT-RX1/RX2/RX3/RX4		1.2:1	1.5:1		
Insertion Loss EGSM900 ANT-RX1/RX2/RX3/RX4		1	1.3	dB	Freq = 925MHz to 960MHz. See note 1.
In-Band Ripple EGSM900 ANT-RX1/RX2/RX3/RX4			0.2	dB	Freq = 925MHz to 960MHz
Input VSWR EGSM900 ANT-RX1/RX2/RX3/RX4		1.2:1	1.5:1		
Insertion Loss DCS1800 ANT-RX1/RX2/RX3/RX4		1.3	1.7	dB	Freq = 1805MHz to 1880MHz. See Note 1.
In-Band Ripple DCS1800 ANT-RX1/RX2/RX3/RX4			0.2	dB	Freq = 1805MHz to 1880MHz
Input VSWR DCS1800 ANT-RX1/RX2/RX3/RX4		1.8:1	2:1		
Insertion Loss PCS1900 ANT-RX1/RX2/RX3/RX4		1.6	1.9	dB	Freq = 1930MHz to 1990MHz. See note 1.
In-Band Ripple PCS1900 ANT-RX1/RX2/RX3/RX4			0.2	dB	Freq = 1930MHz to 1990MHz
Input VSWR PCS1900 ANT-RX1/RX2/RX3/RX4		1.9:1	2.1:1		
Insertion Loss B39 ANT-RX1/RX2/RX3/RX4		1.4	1.9	dB	Freq = 1880MHz to 1920MHz. See Note 1.
In-Band Ripple B39 ANT-RX1/RX2/RX3/RX4			0.2	dB	Freq = 1880MHz to 1920MHz
Input VSWR B39 ANT-RX1/RX2/RX3/RX4		1.7:1	2.1:1		
Insertion Loss B34 ANT-RX1/RX2/RX3/RX4		1.5	1.9	dB	Freq = 2010MHz to 2025MHz. See Note 1.
In-Band Ripple B34 ANT-RX1/RX2/RX3/RX4			0.2	dB	Freq = 2010MHz to 2025MHz
Input VSWR B34 ANT-RX1/RX2/RX3/RX4		1.8:1	2.1:1		
TX Section					
TX Leakage to RX Ports (RX1/RX2/RX3/RX4) GSM850		-3	4	dBm	LB TX mode: Freq = 824MHz to 849MHz, V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm at Antenna port. See Note 2.
TX Leakage to RX Ports (RX1/RX2/RX3/RX4) EGSM900		-2	4	dBm	LB TX mode: Freq = 880MHz to 915MHz, V_{RAMP} = V_{RAMP} rated for P_{OUT} = 33dBm at Antenna port. See Note 2.
TX Leakage to RX Ports (RX1/RX2/RX3/RX4) DCS1800		1	5	dBm	HB TX mode: Freq = 1710MHz to 1785MHz, V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm at Antenna port. See Note 2.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
TX Section (continued)					
TX Leakage to RX Ports (RX1/RX2/RX3/RX4) PCS1900		2.5	5	dBm	HB TX mode: Freq = 1850MHz to 1910MHz, V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm at Antenna port. See Note 2.
TX Leakage to RX Ports (RX1/RX2/RX3/RX4) B39		-2	5	dBm	TD-SCDMA TX mode: Freq = 1880MHz to 1920MHz, V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm at Antenna port. See Note 2.
TX Leakage to RX Ports (RX1/RX2/RX3/RX4) B34		-2	5	dBm	TD-SCDMA TX mode: Freq = 2010MHz to 2025MHz, V_{RAMP} = V_{RAMP} rated for P_{OUT} = 30dBm at Antenna port. See Note 2.

Note 1: The insertion loss values listed are the values guaranteed at the DUT port reference plane (i.e. excludes external mismatch and resistive trace losses).
Note 2: Isolation specification set to ensure at least the following isolation at rated P_{OUT}:
Calculation Example using typical values: Isolation = P_{OUT} at Antenna-P_{OUT} at RX Port. Isolation LB = 33-3 = 30dB, Isolation HB = 30-3 = 27dB.

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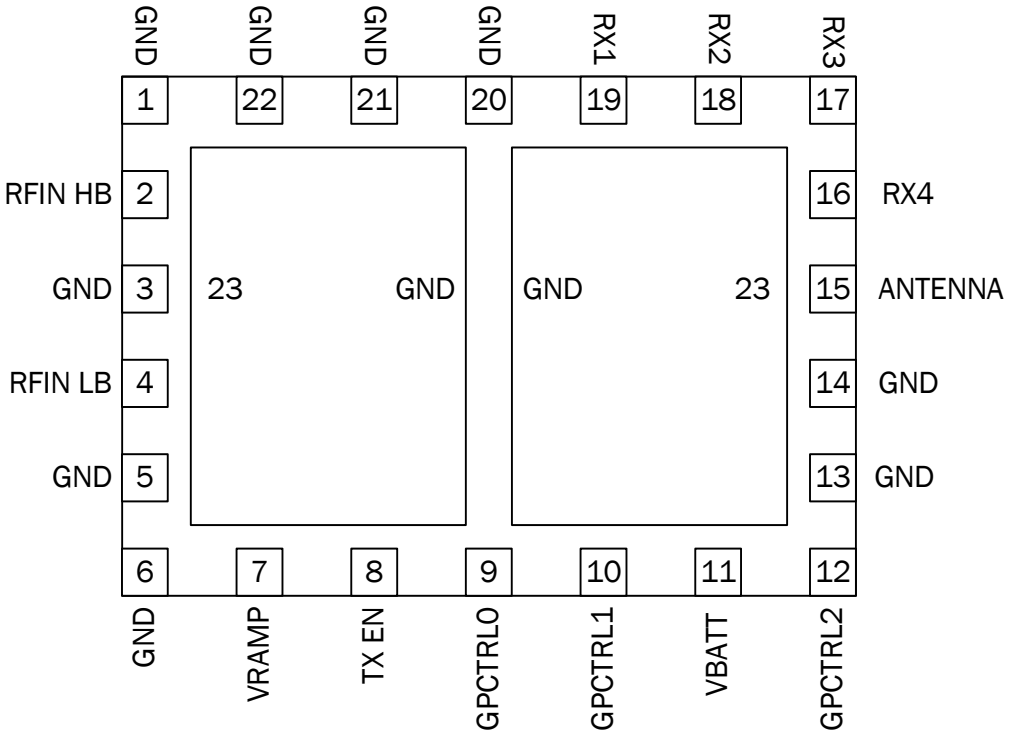
Pin Names and Descriptions

Pin	Name	Description
1	GND	Pin connected to module Ground.
2	RFIN HB	RF input to the DCS1800/PCS1900 band. This is a 50Ω input.
3	GND	Pin connected to module Ground.
4	RFIN LB	RF input to the GSM850/EGSM900 band. This is a 50Ω input.
5	GND	Pin connected to module Ground.
6	GND	Pin connected to module Ground.
7	VRAMP	V_{RAMP} ramping signal from DAC. A simple RC filter is integrated into the RF9810 module. V_{RAMP} may or may not require additional filtering depending on the baseband selected.
8	TX ENABLE	This signal enables the PA module for operation with a logic high. The switch is put in TX mode determined by GpCtrl0 and GpCtrl1.
9	GPCTRL0	Control pin that together with GpCtrl1 and GpCtrl2 selects mode of operation.
10	GPCTRL1	Control pin that together with GpCtrl0 and GpCtrl2 selects mode of operation.
11	VBATT	Power supply for the module. This should be connected to the battery terminal using as wide a trace as possible.
12	GPCTRL2	Control pin that together with GpCtrl0 and GpCtrl1 selects mode of operation.
13	GND	Pin connected to module Ground.
14	GND	Pin connected to module Ground.
15	ANTENNA	Antenna port.
16	RX4	RX4 port of antenna switch. This is a 50Ω output. RX4 is interchangeable with RX1, RX2, RX3.
17	RX3	RX3 port of antenna switch. This is a 50Ω output. RX3 is interchangeable with RX1, RX2, RX4.
18	RX2	RX2 port of antenna switch. This is a 50Ω output. RX2 is interchangeable with RX1, RX3, RX4.
19	RX1	RX1 port of antenna switch. This is a 50Ω output. RX1 is interchangeable with RX2, RX3, RX4.
20	GND	Pin connected to module Ground.
21	GND	Pin connected to module Ground.
22	GND	Pin connected to module Ground.
23	GND	Pin connected to module Ground.

Pin Out

(Top View)



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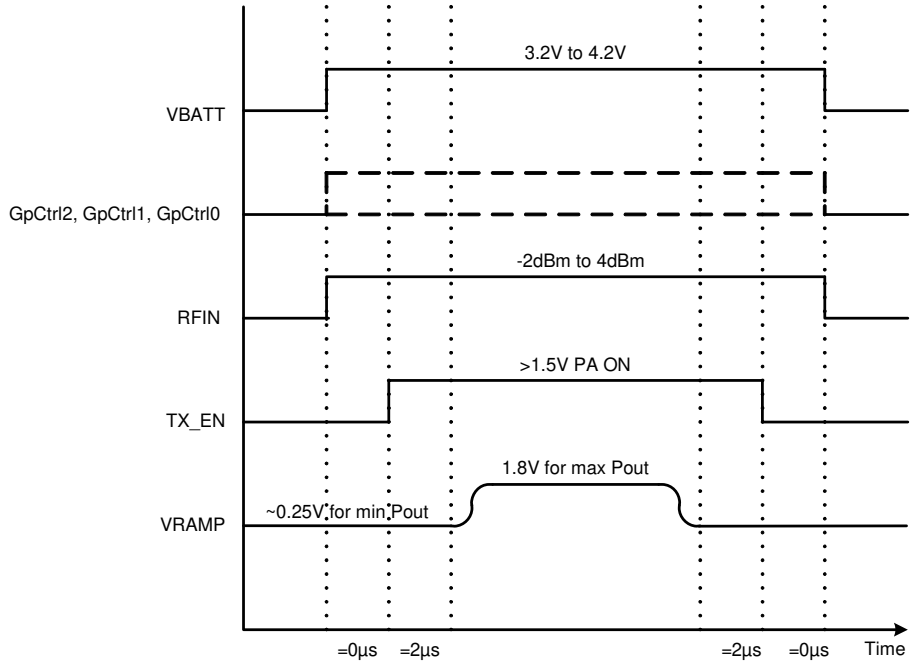
Power-On Sequence

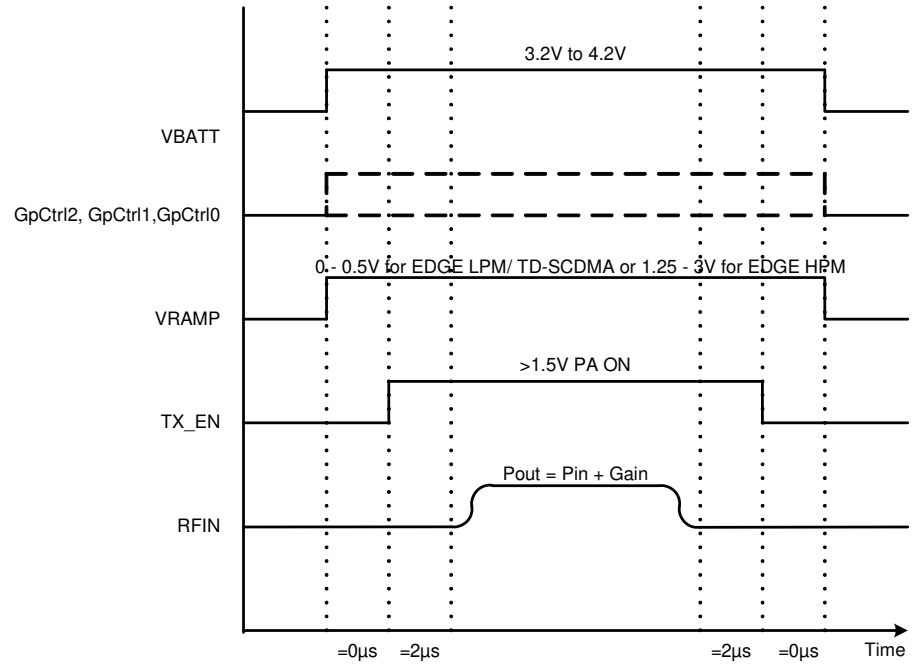


GMSK Power On Sequence:

1. Apply VBATT
2. Apply GpCtrl2, GpCtrl1, GpCtrl0
3. Apply minimum VRAMP (~0.25V)
4. Apply TX_EN
5. Apply VRAMP for desired output power

RFIN can be applied at any time. For good transient response it must be applied before power ramp begins.

The Power Down Sequence is the reverse order of the Power On Sequence.



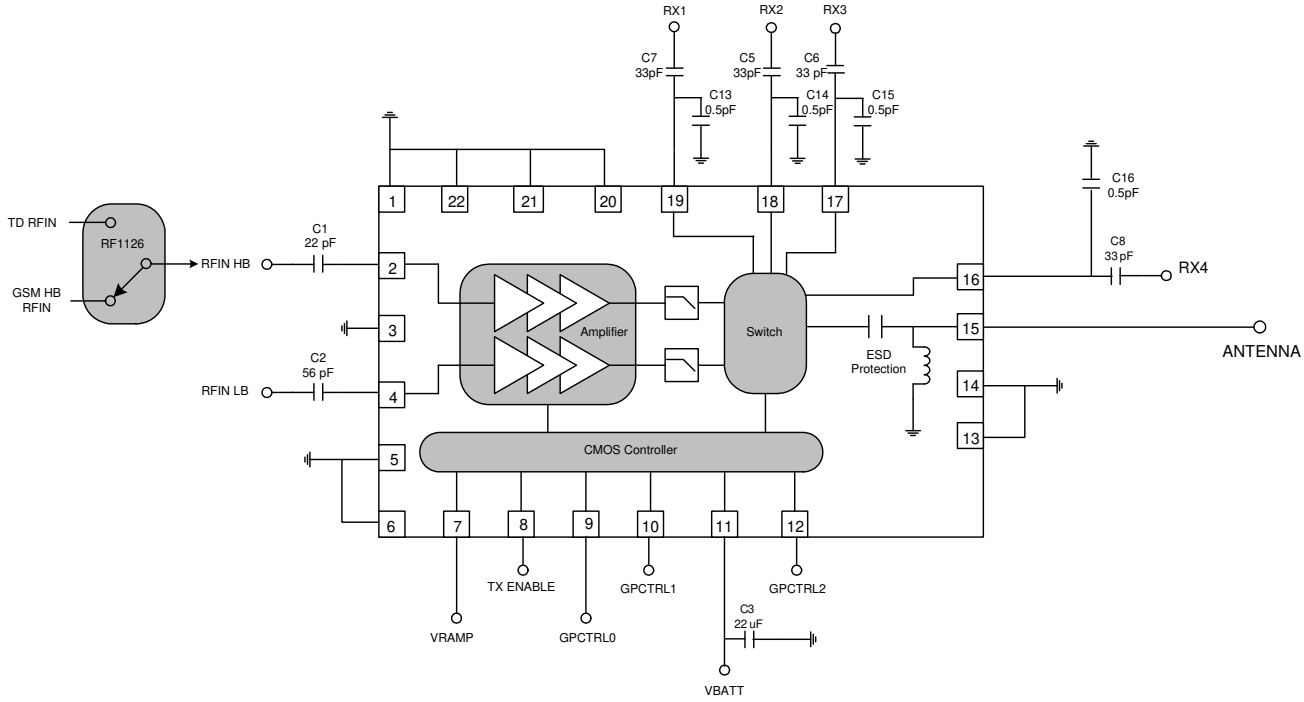
8PSK/ TD-SCDMA Power On Sequence:

1. Apply VBATT
2. Apply GpCtrl2, GpCtrl1, GpCtrl0
3. Apply TX_EN
4. Ramp RFIN amplitude for desired output power

VRAMP is a constant DC input and can be applied anytime after Vbatt.

The Power Down Sequence is the reverse order of the Power On Sequence.

Application Schematic



*All input, output, and antenna traces are 50W microstrip.

**VBATT capacitor value may change depending on application.

***Series capacitors C5 – C8 are required to block the DC voltage that is present on the RX pins. RX ports usually connect to SAW filters. C13 – C16 will be useful to provide the most flexibility for optimally matching the RX ports to the SAW filter for best RX performance. It may not needed depending on application.

****The recommended ordering of the RX ports for transceiver layout compatibility and isolation requirements is as follows: RX1=GSM850, RX2=EGSM900, RX3=DCS1800, and RX4=PCS1900.

*****If placing an attenuation network on the input to the power amplifier, ensure that it is positioned on the transceiver side of the capacitor Cl (or C2) to prevent adversely affecting the base biasing of the power amplifier.

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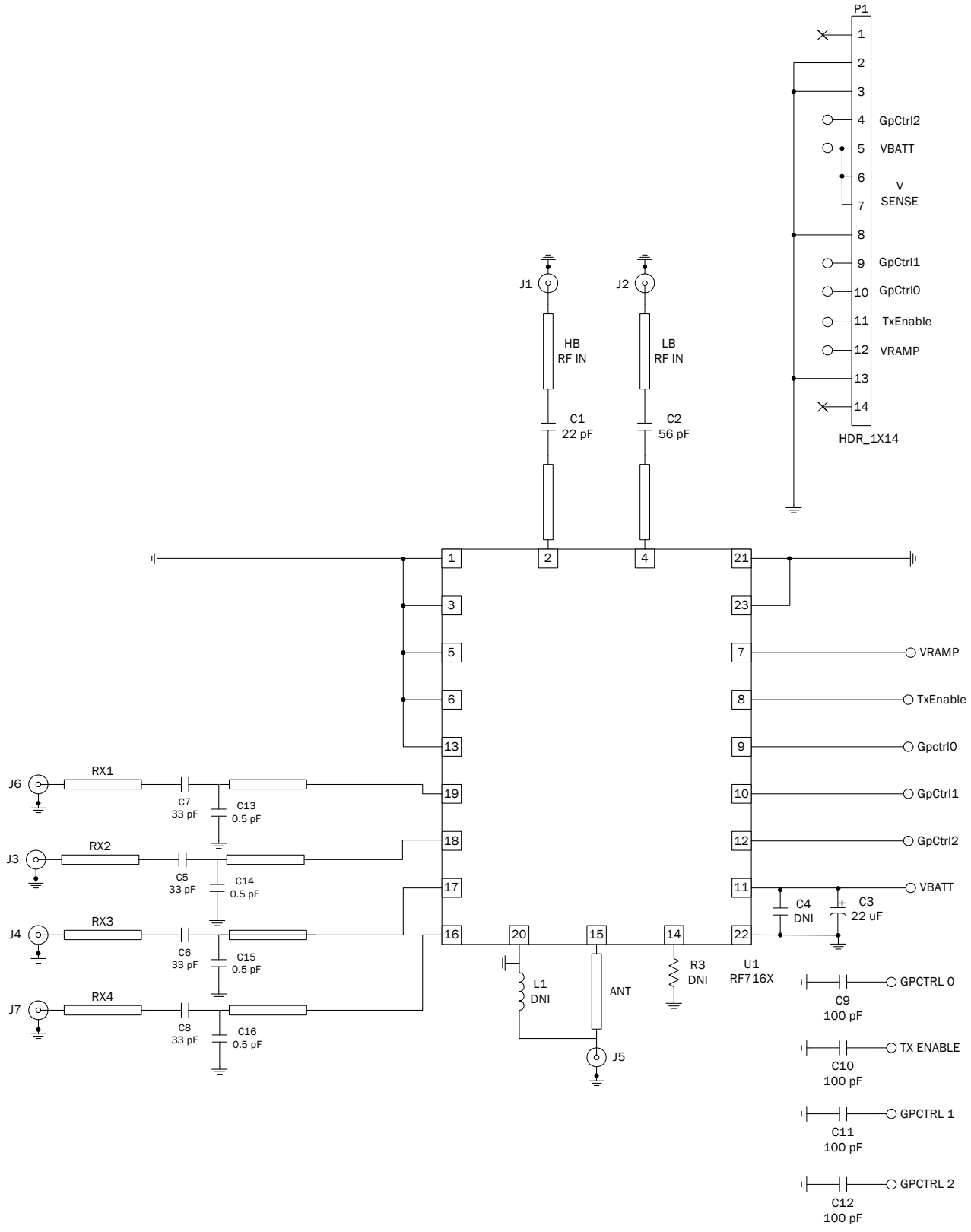
Evaluation Board Schematic



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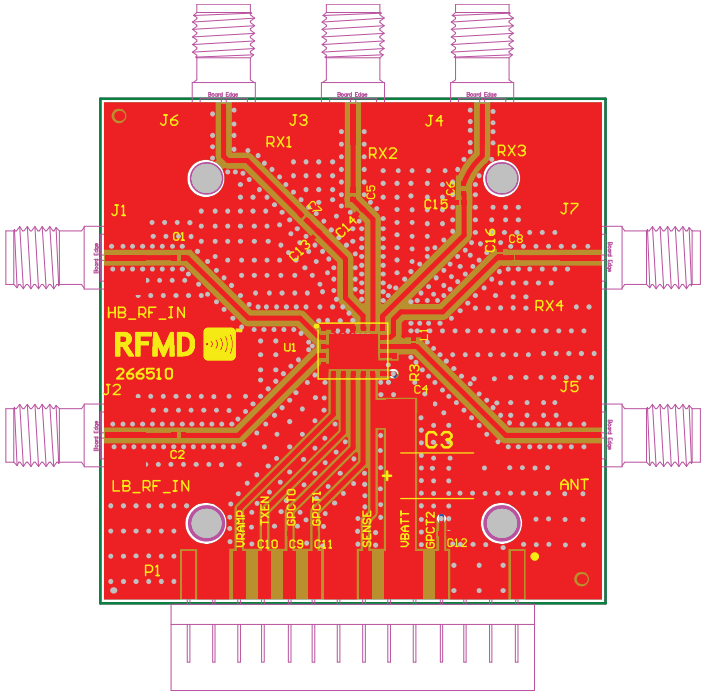
Evaluation Board Layout
Board Size 2.0” x 2.0”



Notes: All inputs, outputs, and antenna traces are 50Ω micro strip.

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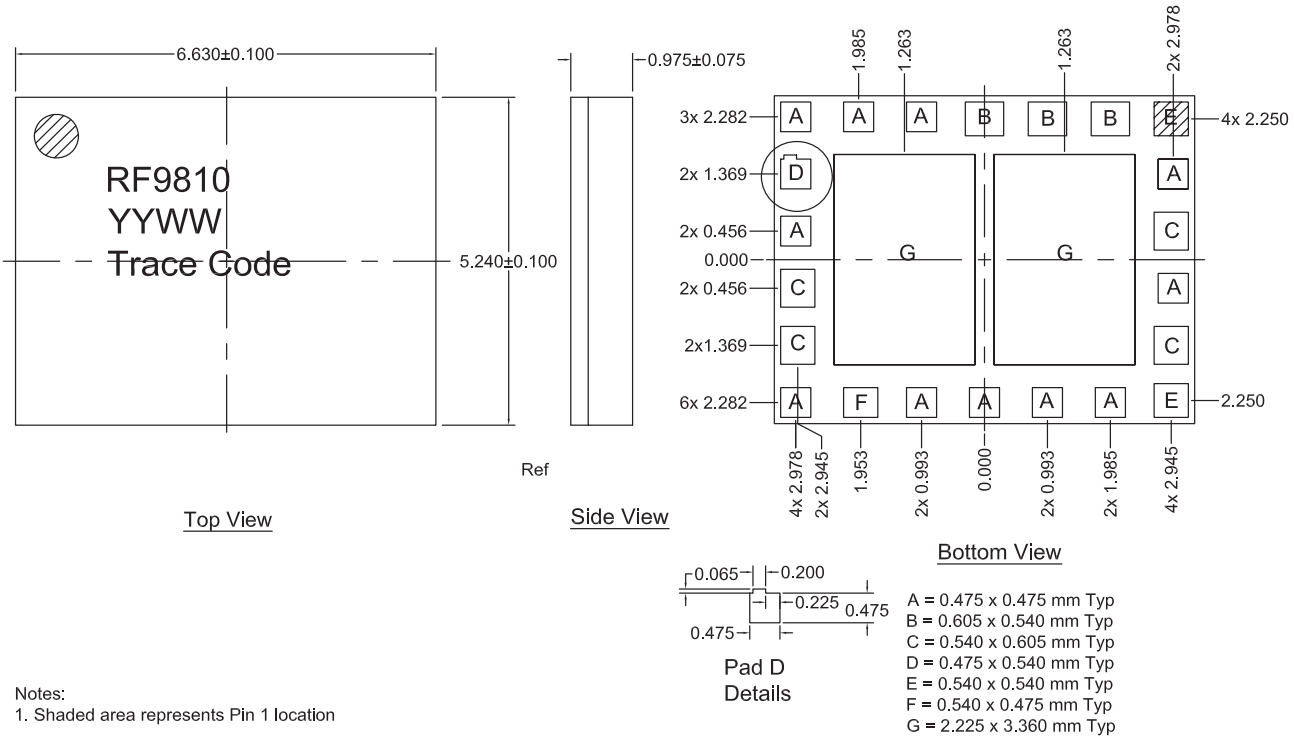
Package Drawing



Notes:

YY indicates year, WW indicates work week, and Trace Code is a sequential number assigned at device assembly.

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PCB Design Requirements

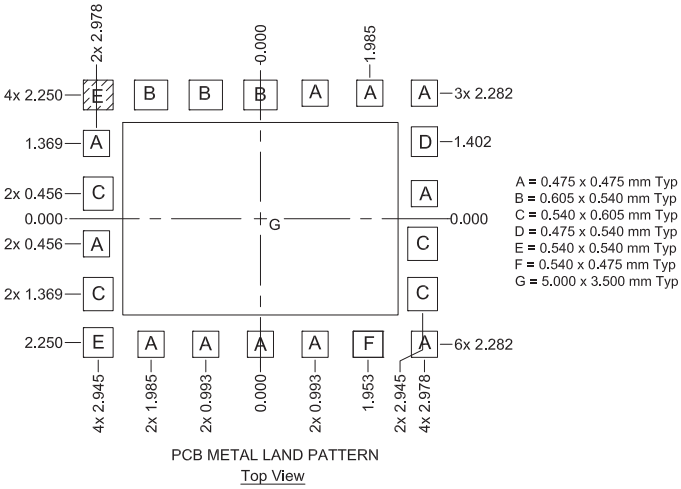
PCB Surface Finish

The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3µinch to 8µinch gold over 180µinch nickel.

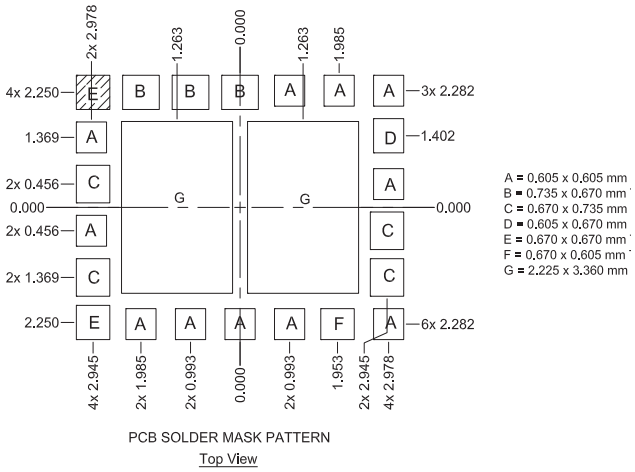
PCB Land Pattern Recommendation

PCB land patterns for RFMD components are based on IPC-7351 standards and RFMD empirical data. The pad pattern shown has been developed and tested for optimized assembly at RFMD. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

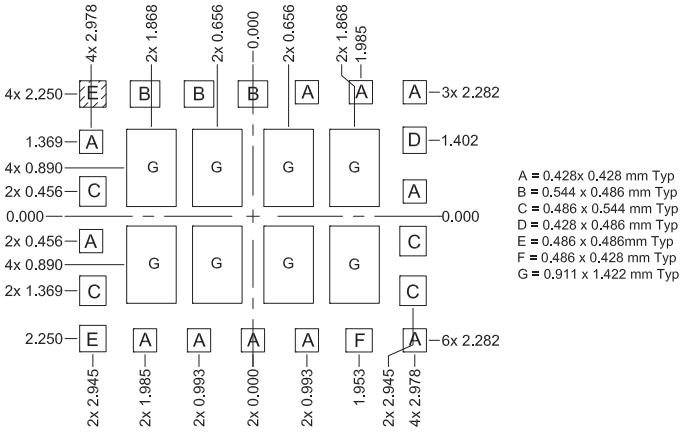
PCB Metal Land and Solder Mask Pattern



PCB METAL LAND PATTERN
Top View



PCB SOLDER MASK PATTERN
Top View



PCB STENCIL PATTERN
Top View

Note:
Shaded area represents pin 1 location.

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Tape and Reel

Carrier tape basic dimensions are based on EIA 481. The pocket is designed to hold the part for shipping and loading onto SMT manufacturing equipment, while protecting the body and the solder terminals from damaging stresses. The individual pocket design can vary from vendor to vendor, but width and pitch will be consistent.

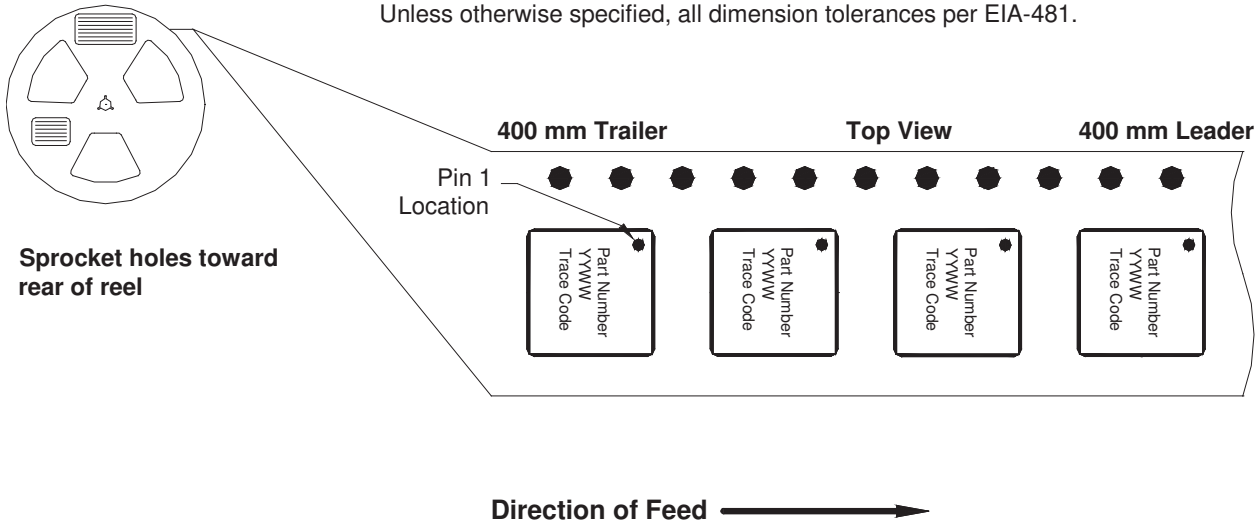
Carrier tape is wound or placed onto a shipping reel either 330mm (13 inches) in diameter or 178mm (7 inches) in diameter. The center hub design is large enough to ensure the radius formed by the carrier tape around it does not put unnecessary stress on the parts.

Prior to shipping, moisture sensitive parts (MSL level 2a-5a) are baked and placed into the pockets of the carrier tape. A cover tape is sealed over the top of the entire length of the carrier tape. The reel is sealed in a moisture barrier ESD bag with the appropriate units of desiccant and a humidity indicator card, which is placed in a cardboard shipping box. It is important to note that unused moisture sensitive parts need to be resealed in the moisture barrier bag. If the reels exceed the exposure limit and need to be rebaked, most carrier tape and shipping reels are not rated as bakeable at 125°C. If baking is required, devices may be baked according to section 4, table 4-1, of Joint Industry Standard IPC/JEDEC J-STD-033.

The table below provides information for carrier tape and reels used for shipping the devices described in this document.

Tape and Reel

RFMD Part Number	Reel Diameter Inches (mm)	Hub Diameter Inches (mm)	Tape Width (mm)	Pocket Pitch (mm)	Feed	Units per Reel
RF9810TR13	13 (330)	4 (102)	12	8	Single	2500
RF9810TR7	7 (178)	2.4 (61)	12	8	Single	750



Ordering Information

Ordering Code	Description
RF9810	Quad-Band GSM850/EGSM900/DCS1800/PCS1900 Transmit Module
RF9810SB	Transmit Module 5-Piece Sample Pack
RF9810PCBA-41X	Fully Assembled Evaluation Board

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