FAIRCHILD SEMICONDUCTOR®

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RMPA1852
Quad-Band GSM/EDGE PA Module

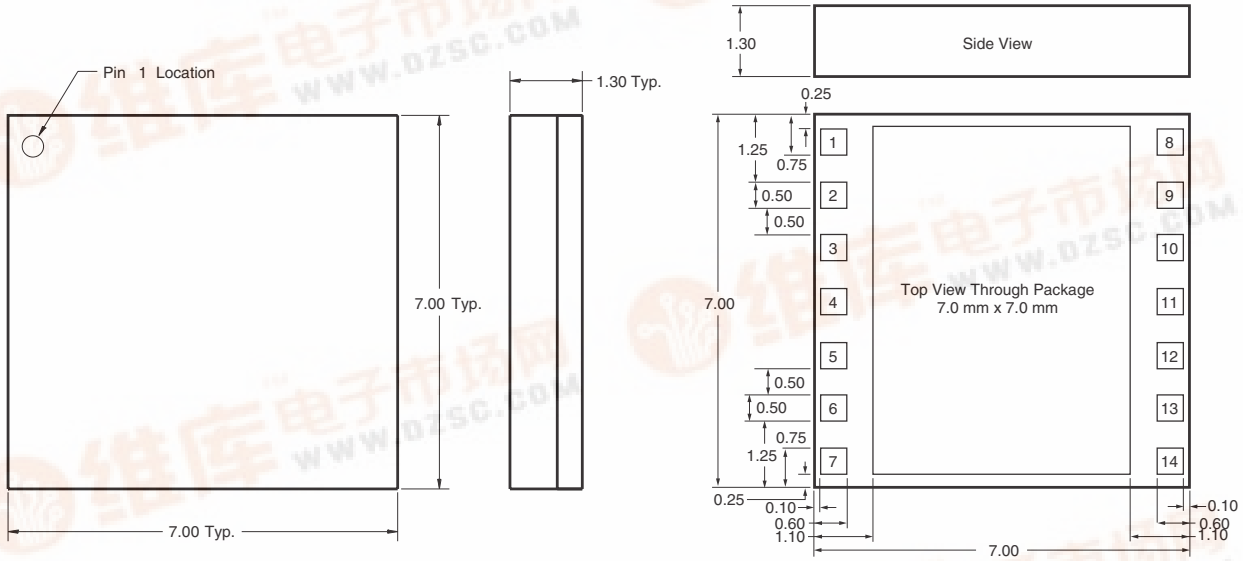
Features

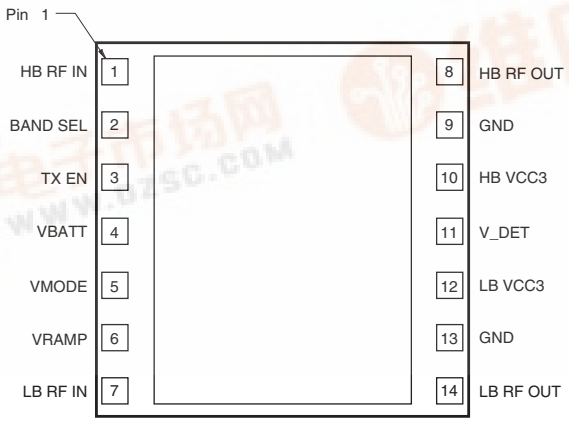
- Quad band, GSM/EDGE PA module
- 7.0 x 7.0 mm x 1.3 mm Package Size
- GSM Integrated Power Control Solution
- GSM High Efficiency – 55% GSM, 50% DCS/PCS
- EDGE mode – 29 dBm Output Power, 27% EDGE PAE
- Low current consumption for Pout<16 dBm in EDGE mode
- Shutdown/Standby Capability for Battery Operation
- 50Ω RF Inputs and Outputs

Description

This 7 x 7mm PAM is a 50Ω, quad-band dual mode, GSM/EDGE PA module for 2.75G radio applications. In EDGE mode, the module supports High/Low power mode feature to maximize efficiency in low power operation. The module provides 50Ω input and output terminals. The module also includes closed loop power control circuitry for GSM applications, minimizing the required external components and maximizing board yields.

Packaging





Package Footprint
(top view through package)

Absolute Maximum Ratings

Parameter	Value	Units
Supply Voltage (Vcc)	6	V
Input Power	12	dBm
Control Voltage (Vramp)	3.0	V
TX EN	3.0	V
BAND SEL	3.0	V
Duty Cycle at Max Power	50	%
Operating Temperature	-30 to +85	°C
Storage Temperature	-55 to +150	°C
Junction Temperature	150	°C

Operating Parameters

Parameter	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	VBATT and VCC	3.0	3.5	5.2	V
Supply Current	VBATT and VCC, Tx Enable Low			20	µA
Control Voltage Vramp “ON” — GSM Mode	For Pout max, 5µA max.		1.6	1.8	V
Control Voltage Vramp “OFF” — GSM Mode	For Pout min, 5µA max.	0.2			V
Control Voltage Vramp in EDGE Mode			1.6		V
Band Select Low	GSM850/GSM900	0		0.8	V
Band Select High	DCS/PCS	2.5		3.0	V
VMODE Select Low	GSM Mode ON	0		0.3	V
VMODE Select High	EDGE Mode ON	2.5		3.0	V
Band Select Current			20	50	µA
Tx Enable Low	PA Off	0		0.8	V
Tx Enable High	PA On	2.5		3.0	V
Tx Enable Current				20	µA

Electrical Specifications

Mode: GMSK **Band:** CEL Tx band (824–849 MHz)

Modulation: None (CW), Typical Peak/Average = 0dB

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Test conditions unless otherwise stated: Vcc = 3.5V, Vramp = Vramp Max., Zin = Zout = 50Ω, Pin = 3 dBm, Temperature = 25°C, Duty Cycle = 25%

Parameter	Test Conditions	Min	Typ	Max	Unit
Frequency		824	–	849	MHz
Output Power	Temp = 25°C, Vcc = 3.5 V	34.5	35	–	dBm
	Temp = 85°C, Vcc = 2.9 V	32.5	–	–	
Input Power Range		0	+3	+6	dBm
Power Added Efficiency	At Pout max	50	55	–	%
Input VSWR	Pout = 0 to 35 dBm	–	–	2.5:1	Ratio
Forward Isolation	Pin = 6 dBm	–	-35		dBm
Power Control Range	Vramp = 0.2 to 1.8 V	–	40	–	dB
Harmonics		–	–	-5	dBm
Cross Band Isolation @ 2fo	Measured at DCS/PCS output.	–	–	-20	dBm
Stability	Load 6:1, all phase angles, Pin = 3 dBm, Set Vramp where Pout less than or equal to 34 dBm into a 50Ω load.	–	–	-36	dBm
Noise Power	Ftx = 824–849, Frx = 869–894 MHz (RBW = 100 KHz)	-83			dBm
Ruggedness	VSWR = 10:1, All phase angles, Vcc = 4.8 V, Pin = 3 dBm, Set Vramp where Pout less than or equal to 34.5 dBm into a 50Ω load.	No Damage			
Output Power Switching Speed	RF Pout 5–35 dBm to within 1 dB of final value.	–	–	2	µS

Mode: EDGE **Band:** GSM850 Tx band (824–849 MHz)

Modulation: EDGE modulation (3π/8 O-8PSK at 270.833 ksps), Max Peak/Avg = 3.3dB (Probability < 0.1%).

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Input Power: Adjust to meet Output Power Requirement

Parameter	Test Conditions	Min	Typ	Max	Unit
Duty Cycle		1/8	1/4	1/4	
Output Power, Pout (H)	Max Pi = -0.5 (Temp = 25°C, Vcc = 3.5 V)	–	29.0	–	dBm
Power Added Efficiency	at Pout (H), (Temp = 25°C, Vcc = 3.5 V)	–	27	–	%
Low power current consumption mode (L)	Pout<16 dBm			200	mA
Gain	at Pout (H)			36	dB
	at Low power current consumption mode (L)			25	
Input VSWR		–	–	2.0:1	Ratio
Harmonics 2Fo Thru 5Fo	At Max Po (Temp = 25°C, Vcc = 3.5 V)	–	–	-5	dBm
Ruggedness	VSWR = 10:1, All phase angles, Vcc = 4.8 V, Max Pin = 8	No Damage			
Stability	All Spurious (Load VSWR = 6:1 at all angles Po < 29, Pin < 8 dBm)	–	–	-65	dBc
TX Noise in RX Band	Ftx = 824–849, Frx = 869–894 MHz (RBW = 100 KHz)	–	–	-83	dBm
Adjacent Channel Leakage	Offset : ±200 KHz	–	–	-33	dBc
	Offset : ±400 KHz	–		-57	
	Offset: ±600 KHz	–	–	-60	
Error Vector Magnitude	Load 50Ω	–	–	4	%

Electrical Specifications (Continued)

Mode: GMSK **Band:** EGSM Tx band (880–915 MHz)

Modulation: None (CW), Typical Peak/Average = 0dB

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Test conditions unless otherwise stated: Vcc = 3.5V, Vramp = Vramp Max., Zin = Zout = 50Ω, Pin = 3 dBm, Temperature = 25°C, Duty Cycle = 25%

Parameter	Test Conditions	Min	Typ	Max	Unit
Frequency		880	–	915	MHz
Output Power	Temp = 25°C, Vcc = 3.5 V	34.5	35	–	dBm
	Temp = 85°C, Vcc = 2.9 V	32.5	–	–	
Input Power Range		0	+3	+6	dBm
Power Added Efficiency	At Pout max	50	55	–	%
Input VSWR	Pout = 0 to 35 dBm	–	–	2.5:1	Ratio
Forward Isolation	Pin = 6 dBm	–	-35		dBm
Power Control Range	Vramp = 0.2 to 1.8V	–	40	–	dB
Harmonics		–	–	-5	dBm
Cross Band Isolation @ 2fo	Measured at DCS/PCS output.	–	–	-20	dBm
Stability	Load 6:1, all phase angles, Pin = 3 dBm, Set Vramp where Pout less than or equal to 34 dBm into a 50Ω load.	–	–	-36	dBm
Noise Power	Ftx = 890–915, Frx = 935–960 MHz (RBW = 100 KHz)	–	–	-83	dBm
	Ftx = 880–890, Frx = 925–935 MHz (RBW = 100 KHz)	–	–	-73	
Ruggedness	VSWR = 10:1, All phase angles, Vcc = 4.8 V, Pin = 3 dBm, Set Vramp where Pout less than or equal to 34.5 dBm into a 50Ω load.	No Damage			
Output Power Switching Speed	RF Pout 5–35 dBm to within 1 dB of final value.	–	–	2	µS

Mode: EDGE **Band:** GSM900 Tx band (880–915 MHz)

Modulation: EDGE modulation (3π/8 O-8PSK at 270.833 ksps), Max Peak/Avg = 3.3dB (Probability < 0.1%).

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Input Power: Adjust to meet Output Power Requirement

Parameter	Test Conditions	Min	Typ	Max	Unit
Duty Cycle		1/8	1/4	1/4	
Output Power	Max Pi = -0.5 (Temp = 25°C, Vcc = 3.5 V)	–	29.0	–	dBm
Power Added Efficiency	(Temp = 25°C, Vcc = 3.5 V)	–	27	–	%
Low power current consumption mode (L)	Pout<16 dBm			200	mA
Gain	at Pout (H)			36	dB
	at Low power current consumption mode (L)			25	
Input VSWR		–	–	2.0:1	Ratio
Harmonics 2Fo Thru 5Fo	At Max Po (Temp = 25°C, Vcc = 3.5 V)	–	–	-5	dBm
Ruggedness	VSWR = 10:1, All phase angles, Vcc = 4.8 V, Max Pin = 8	No Damage			
Stability	All Spurious (Load VSWR = 6:1 at all angles Po < 29, Pin < 8 dBm)	–	–	-65	dBc
TX Noise in RX Band	Ftx = 890–915, Frx = 935–960 MHz	–	–	-83	dBm
	Ftx = 880–890, Frx = 925–935 MHz (RBW = 100 KHz)	–	–	-73	
Adjacent Channel Leakage	Offset: ±200 KHz	–	–	-33	dBc
	Offset: ±400 KHz	–		-57	
	Offset: ±600 KHz	–	–	-60	
Error Vector Magnitude	Load 50Ω	–	–	4	%

Electrical Specifications (Continued)

Mode: GMSK **Band:** DCS Tx band (1710–1785 MHz)

Modulation: None (CW), Typical Peak/Average = 0dB

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Test conditions unless otherwise stated: Vcc = 3.5V, Vramp = Vramp Max., Zin = Zout = 50Ω, Pin = 3 dBm, Temperature = 25°C, Duty Cycle = 25%

Parameter	Test Conditions	Min	Typ	Max	Unit
Frequency	DCS	1710	–	1785	MHz
Output Power	Temp = 25°C, Vcc = 3.5 V	32	33	–	dBm
	Temp = 85°C, Vcc = 2.9 V	29.5	–	–	
Input Power Range		+0	+3	+6	dBm
Power Added Efficiency	At Pout max	45	50	–	%
Input VSWR	Pout = 0 to 35 dBm	–	–	2.5:1	Ratio
Forward Isolation	Pin = 6 dBm	–	-35		dBm
Power Control Range	Vramp = 0.2 to 1.8 V	–	40	–	dB
Harmonics		–	–	-5	dBm
Stability	Load 6:1, all phase angles, Pin = 3 dBm, Set Vramp where Pout less than or equal to 32 dBm into a 50Ω load.	–	–	-36	dBm
Noise Power	Ftx = 1710–1785, Frx = 1805–1880 MHz (RBW = 100 KHz)	–	–	-77	dBm
Ruggedness	Output VSWR = 10:1, All phase angles, Vcc = 4.8 V, Pin = 3 dBm, Set Vramp where Pout less than or equal to 32 dBm into a 50Ω load.	No Damage			
Output Power Switching Speed	RF Pout 5–35 dBm to within 1 dB of final value.	–	–	2	µS

Mode: EDGE **Band:** DCS Tx band (1710–1785 MHz)

Modulation: EDGE modulation (3π/8 O-8PSK at 270.833 ksps), Max Peak/Avg = 3.3dB (Probability < 0.1%).

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Input Power: Adjust to meet Output Power Requirement

Parameter	Test Conditions	Min	Typ	Max	Unit
Duty Cycle		1/8	1/4	1/4	
Output Power	Max Pi = -0.5 (Temp = 25°C, Vcc = 3.5 V)	–	28	–	dBm
Power Added Efficiency	(Temp = 25°C, Vcc = 3.5 V)	–	26	–	%
Low power current consumption mode (L)	Pout<16 dBm			200	mA
Gain	at Pout (H)			34	dB
	at Low power current consumption mode (L)			25	
Input VSWR		–	–	2.0:1	Ratio
Harmonics 2Fo Thru 5Fo	At Max Po (Temp = 25°C, Vcc = 3.5 V)	–	–	-10	dBm
Ruggedness	VSWR = 10:1, All phase angles, Vcc = 4.8 V, Max Pin = 8	No Damage			
Stability	All Spurious (Load VSWR = 6:1 at all angles Po < 28, Pin < 8 dBm)	–	–	-65	dBc
TX Noise in RX Band	Ftx = 1710–1785, Frx = 1805–1880 MHz (RBW = 100 KHz)	–	–	-77	dBm
Adjacent Channel Leakage	Offset: ±200 KHz	–	–	-33	dBc
	Offset: ±400 KHz	–		-57	
	Offset: ±600 KHz	–	–	-60	
Error Vector Magnitude	Load 50Ω	–	–	4	%

Electrical Specifications (Continued)

Mode: GMSK **Band:** PCS Tx band (1850–1910 MHz)

Modulation: None (CW), Typical Peak/Average = 0dB

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Test conditions unless otherwise stated: Vcc = 3.5V, Vramp = Vramp Max., Zin = Zout = 50Ω, Pin = 3 dBm, Temperature = 25°C, Duty Cycle = 25%

Parameter	Test Conditions	Min	Typ	Max	Unit
Frequency	PCS	1850	–	1910	MHz
Output Power	Temp = 25°C, Vcc = 3.5 V	32	33	–	dBm
	Temp = 85°C, Vcc = 2.9 V	29.5	–	–	
Input Power Range		+0	+3	+6	dBm
Power Added Efficiency	At Pout max	45	50	–	%
Input VSWR	Pout = 0 to 35 dBm	–	–	2.5:1	Ratio
Forward Isolation	Pin = 6 dBm	–	-35		dBm
Power Control Range	Vramp = 0.2 to 1.8 V	–	40	–	dB
Harmonics		–	–	-5	dBm
Stability	Load 6:1, all phase angles, Pin = 3 dBm, Set Vramp where Pout less than or equal to 32 dBm into a 50Ω load.	–	–	-36	dBm
Noise Power	Ftx = 1710–1785, Frx = 1805–1880 MHz(RBW = 100 KHz)	–	–	-77	dBm
Ruggedness	Output VSWR = 10:1, All phase angles, Vcc = 4.8 V, Pin = 3 dBm, Set Vramp where Pout less than or equal to 32 dBm into a 50Ω load.	No Damage			
Output Power Switching Speed	RF Pout 5–35 dBm to within 1 dB of final value.	–	–	2	µS

Mode: EDGE **Band:** PCS Tx band (1850–1910 MHz)

Modulation: EDGE modulation (3π/8 O-8PSK at 270.833 ksps), Max Peak/Avg = 3.3dB (Probability < 0.1%).

Pulse Rate: TX = 577µs, 25% duty cycle, Tframe = 4.615mS

Input Power: Adjust to meet Output Power Requirement

Parameter	Test Conditions	Min	Typ	Max	Unit
Duty Cycle		1/8	1/4	1/4	
Output Power	Max Pi = -0.5 (Temp = 25°C, Vcc = 3.5 V)	–	28	–	dBm
Power Added Efficiency	(Temp = 25°C, Vcc = 3.5 V)	–	26	–	%
Low power current consumption mode (L)	Pout<16 dBm			200	mA
Gain	at Pout (H)			34	dB
	at Low power current consumption mode (L)			25	
Input VSWR		–	–	2.0:1	Ratio
Harmonics 2Fo Thru 5Fo	At Max Po (Temp = 25°C, Vcc = 3.5 V)	–	–	-5	dBm
Ruggedness	VSWR = 10:1, All phase angles, Vcc = 4.8 V, Max Pin = 8	No Damage			
Stability	All Spurious (Load VSWR = 6:1 at all angles Po < 28, Pin < 8 dBm)	–	–	-65	dBc
TX Noise in RX Band	Ftx = 1850–1910, Frx = 1930–1990 MHz (RBW = 100 KHz)	–	–	-77	dBm
Adjacent Channel Leakage	Offset: ±200 KHz	–	–	-33	dBc
	Offset: ±400 KHz	–		-57	
	Offset: ±600 KHz	–	–	-60	
Error Vector Magnitude	Load 50Ω	–	–	4	%

I/O Pin Description

Section	Signal	Pin(s)	Description
RF	LB RF IN	7	RF Input (Low Bands), DC Blocked within the part.
	HB RF IN	1	RF Input (High Bands), DC Blocked within the part.
	LB RF OUT	14	RF Output (Low Bands), DC Blocked within the part.
	HB RF OUT	8	RF Output (High Bands), DC Blocked within the part.
Supply	VBATT	4	DC Supply for the Pre-Driver & Driver Stage of the PA's
	LB VCC3	12	DC Supply for Final Stage (Low Bands)
	HB VCC3	10	DC Supply for Final Stage (High Bands)
Control	BAND_SEL	2	Band Selection logic pin. A logic low selects the low band PA, and logic high selects the high band PA.
	TX EN	3	PA enable line. A logic high enables the selected PA operation
	VMODE	5	This pin selects either GMSK or 8PSK operation for the PA's. A logic low selects GMSK mode. A logic high selects 8PSK mode.
	VRAMP	6	In GMSK mode, the voltage on this pin controls the output power of the selected PA. In 8PSK mode, the voltage on this pin is a digital voltage selecting the normal or low power mode.
Power Detection	V_DET	11	Power Detector output voltage in EDGE mode
Ground	GND	9, 13	Ground

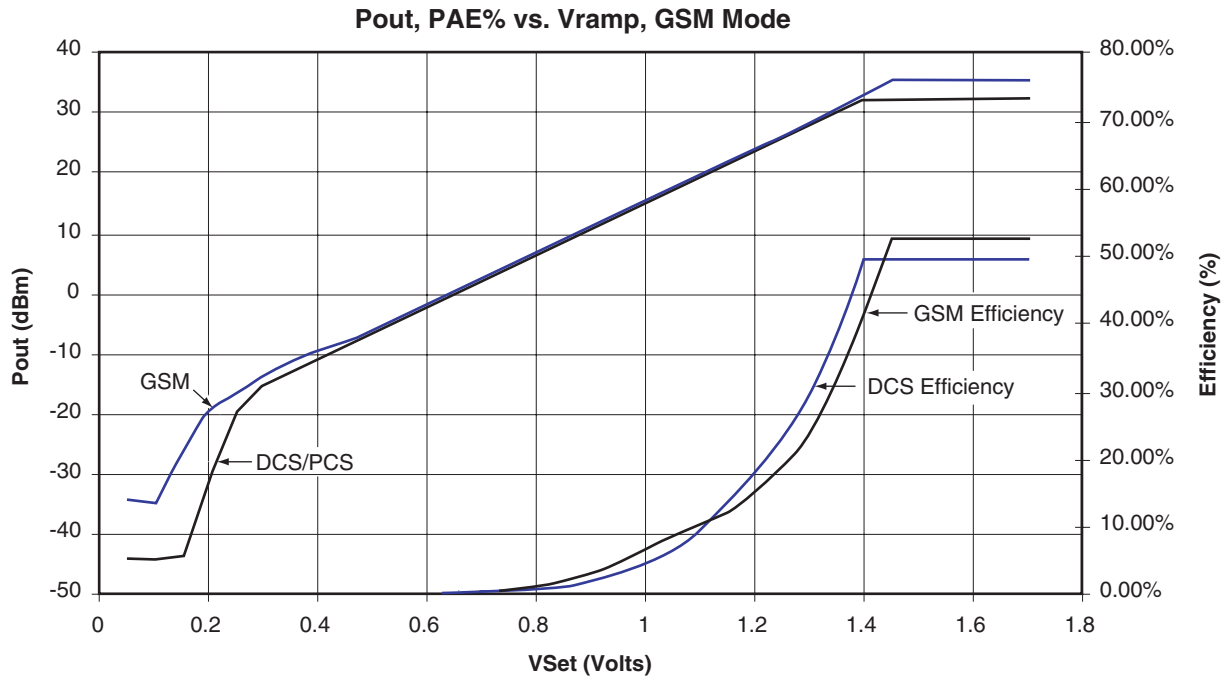
DC Control Requirements

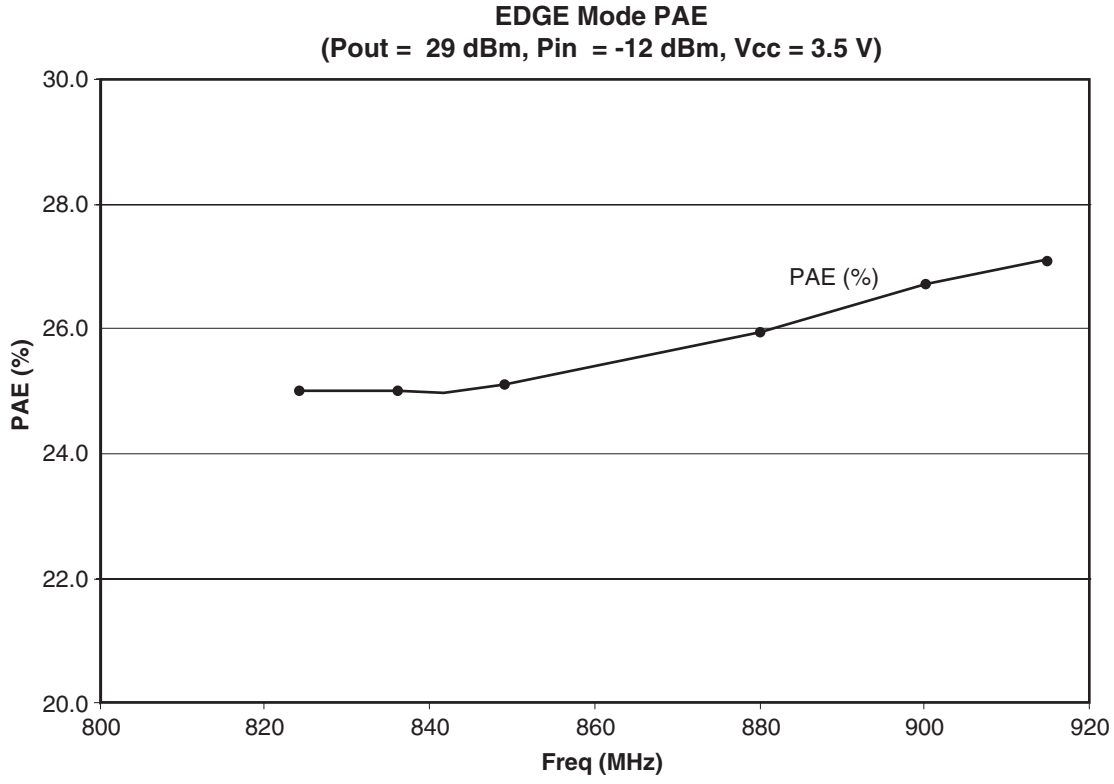
DC Control		Specification				
Description	Signal	Min	Typ	Max	Unit	Conditions
Supplies	VBATT	3.0	3.5	4.3	V	Not Charging, RF On
	LB VCC3	3.0	3.5	4.3	V	Not Charging, RF On
	HB VCC3	3.0	3.5	4.3	V	Not Charging, RF On
Control	BAND SEL	0	–	0.1	V	Band Select LOW
		2.5	–	2.85	V	Band Select HIGH
	TX EN	2.5	–	2.85	V	Enabled
		0.0	–	0.1	V	Disabled
	VMODE	2.5	–	2.85	V	Enabled (EDGE Mode)
		0.0	–	0.1	V	Disabled (GSM Mode)
	VRAMP (EDGE only)	2.5		2.85	V	Normal EDGE operation
		0		0.1	V	Low power EDGE operation

External Components

Type	Value	Size	Description	Pin
Cap	2.2 nF	0402	Vramp bypass	6
Cap	2.2 µF, 33 pF	0402	HB VCC3 bypass	10
Cap	2.2 µF, 33 pF	0402	LB VCC3 bypass	12

Closed Loop Power Control Data

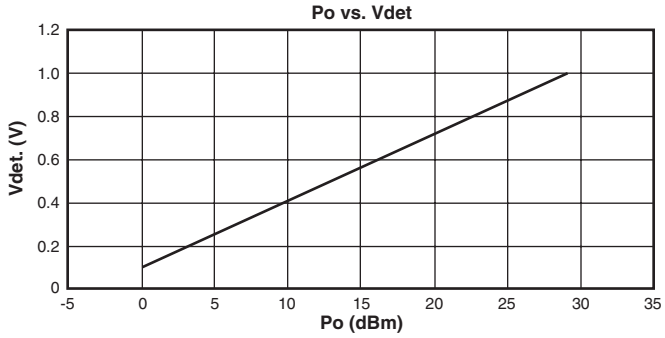




RF Detector (EDGE MODE)

Parameter	Condition	Limits			
Detector Voltage (VDET)		Min	Typ	Max	Units
Case #1	No RF Applied	45	50	55	mV
Case #2	Pout = 0 dBm		0.1		V
Case #3	Pout = 29 dBm		1		V

VDET vs. Power Output (EDGE MODE)



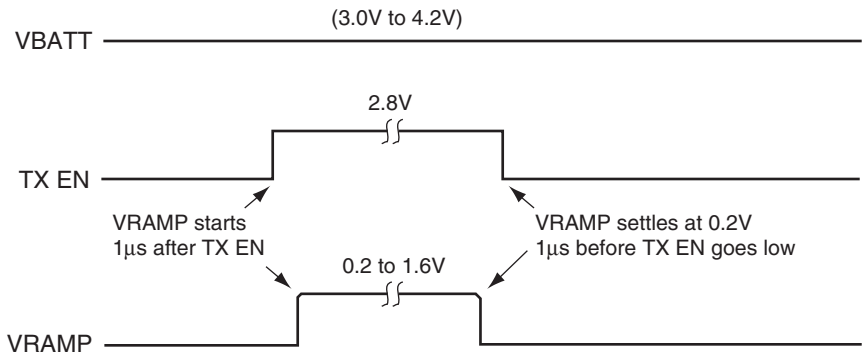
Dual Mode Operation

Mode of Operation	Band	Input			Output Power
		V_{RAMP}	V_{MODE}	Band_Set	
GMSK	Low Band	Analog	0	0	0 to 34.5 dBm (Vramp = 0.2 to 1.6V)
GMSK	High Band	Analog	0	1	0 to 32 dBm (Vramp = 0.2 to 1.6V)
8-PSK (Low Current)	Low Band	0	1	0	0 dBm to TBD dBm
8-PSK (High Current)	Low Band	1	1	0	TBD dBm to 29 dBm
8-PSK (Low Current)	High Band	0	1	1	0 dBm to TBD dBm
8-PSK (High Current)	High Band	1	1	1	TBD dBm to 28 dBm

Power On Sequence

GMSK Power On Sequence	EDGE Power on Sequence
Apply VCC3 and VBATT	Apply VCC3 and VBATT
Apply Band Select	Apply Band Select
VMODE (Low)	VMODE (High)
Apply RF	Apply RF
Apply TX EN & VRAMP in unison	Apply TX EN
	Set Vramp (Higyh or Low)

The Power Down sequence is in reverse order to the Power On Sequence.



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Programmable Active Droop™		Power247™	SuperSOT™-3	
		PowerEdge™	SuperSOT™-6	

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