

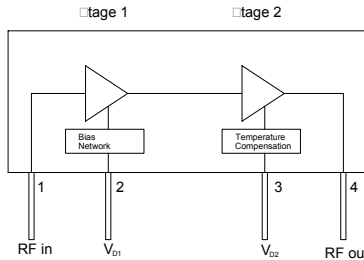
### Product Description

RFMD's XD010-12S-D4F is a 15Watt, 2-Stage Class A/AB LDMOS power amplifier designed for use in the 869MHz to 894MHz frequency band. The module is internally matched to 50Ω and operates directly from 28V making system integration very simple. Internal gate bias temperature compensation circuitry ensures consistent unit-to-unit performance over the full operating temperature range. The XD010-12S-D4FY offers a rugged class 3B HBM ESD rating (>8000V).

#### Optimum Technology Matching® Applied

- GaAs HBT
- GaAs MESFET
- InGaP HBT
- SiGe BiCMOS
- Si BiCMOS
- SiGe HBT
- GaAs pHEMT
- Si CMOS
- Si BJT
- GaN HEMT
- InP HBT
- RF MEMS
- LDMOS

### Functional Block Diagram



Case Flange = Ground

### Features

- 50Ω RF impedance, Fully Integrated Matching
- 15W Output P<sub>1dB</sub>
- Single Supply Operation: Nominally 28V
- High Gain: 32dB at 880MHz
- Internal Gate Bias Temperature Compensation
- Power Up/Down Control < 1μs
- ESD Rating (HBM): Class 3B (8000V)

### Applications

- Base Station PA Driver
- Repeater
- CDMA/WCDMA
- GSM/EDGE

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Frequency of Operation	869		894	MHz	
Output Power at 1dB Compression	12	15		W	880MHz
Gain	30	32		dB	1W Output Power, 880MHz
Peak to Peak Gain Variation		0.2	1.0	dB	869MHz to 849MHz
Drain Efficiency	27	33		%	12W CW, 880MHz
		12		%	12W CDMA (Single Carrier IS-95)
		7		%	1W CDMA (Single Carrier IS-95)
Input Return Loss	14	17		dB	869MHz to 894MHz
ACPR at 2W CDMA		-51		dB	Single Carrier IS-95, 9 Ch Fwd, Offset=750KHz, ACPR Integrated Bandwidth, 880MHz
ALT-1 at 2W CDMA		-70		dB	Single Carrier IS-95, 9 Ch Fwd, Offset=1980KHz, ACPR Integrated Bandwidth, 880MHz
Third Order IMD		-34	-30	dBc	12W PEP (Two Tone), 880MHz
		-45		dBc	1W PEP (Two Tone), 880MHz
Signal Delay from Pin 1 to Pin 4		2.5		nS	
Deviation from Linear Phase (Peak to Peak)		0.5		Deg	
Thermal Resistance Stage 1 (Junction to Case)		11		°C/W	
Thermal Resistance Stage 2 (Junction to Case)		4		°C/W	

Test Conditions: Z<sub>IN</sub>=Z<sub>OUT</sub>=50Ω V<sub>DD</sub>=28.0V I<sub>DQ1</sub>=230mA I<sub>DQ2</sub>=150mA T<sub>FLANGE</sub>=25°C

## Absolute Maximum Ratings

Parameter	Rating	Unit
1 <sup>st</sup> Stage Bias Voltage ( $V_{D1}$ )	35	V
2 <sup>nd</sup> Stage Bias Voltage ( $V_{D2}$ )	35	V
RF Input Power	+20	dBm
Load Impedance for Continuous Operation Without Damage	5:1	VSWR
Output Device Channel Temperature	+200	°C
Operating Temperature Range	-20 to +90	°C
Storage Temperature Range	-40 to +100	°C
ESD Rating - Human Body Model, JEDEC Document - JESD22-A114-B	8000	V
MTTF - 85°C Leadframe, 200°C Channel	$1.2 \times 10^6$	Hours

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.



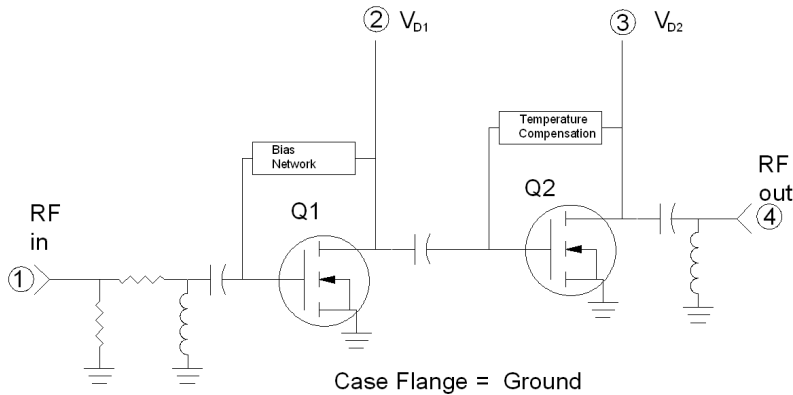
Caution! ESD sensitive device.

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.

RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

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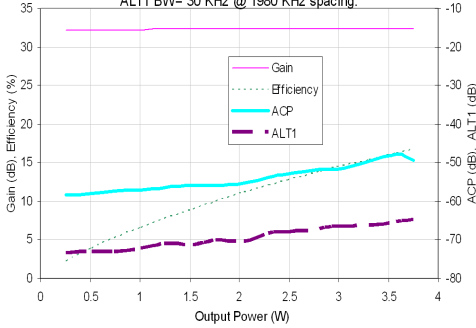
## Simplified Device Schematic



## Typical Performance Curves

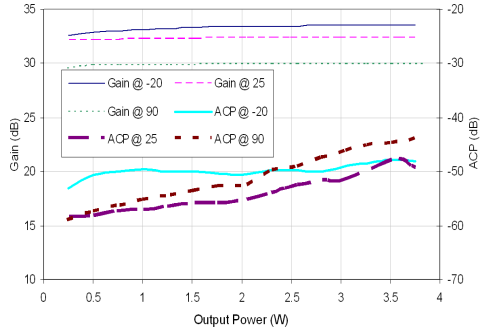
**Gain, Efficiency, ACP, ALT1 vs. Output Power**

Freq=881 MHz, Vdd=28 V, T<sub>Flange</sub>=25 °C  
 IS95 standard, channel BW= 1.23 MHz.  
 ADJ BW= 30 KHz @ 750 KHz spacing.  
 ALT1 BW= 30 KHz @ 1980 KHz spacing.



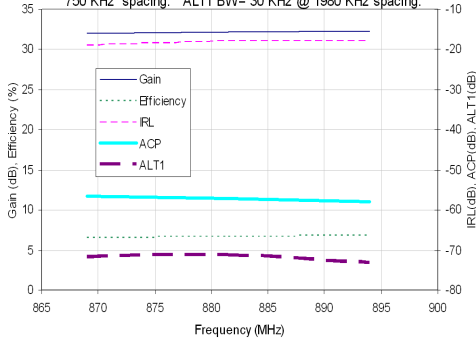
**Gain, ACP vs. Output Power over Temperature**

Freq=881 MHz, Vdd=28 V, T<sub>Flange</sub>=-20 °C, 25 °C, 90 °C  
 IS95 standard, channel BW= 1.23 MHz. ADJ BW= 30 KHz @ 750 KHz spacing. ALT1 BW= 30 KHz @ 1980 KHz spacing.



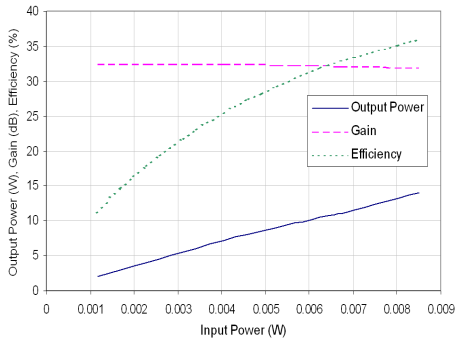
**Gain, Efficiency, IRL, ACP, ALT1 vs. Frequency**

Output Power= 1 Watt Vdd=28 V, T<sub>Flange</sub>=25 °C  
 IS95 standard, channel BW= 1.23 MHz. ADJ BW= 30 KHz @ 750 KHz spacing. ALT1 BW= 30 KHz @ 1980 KHz spacing.



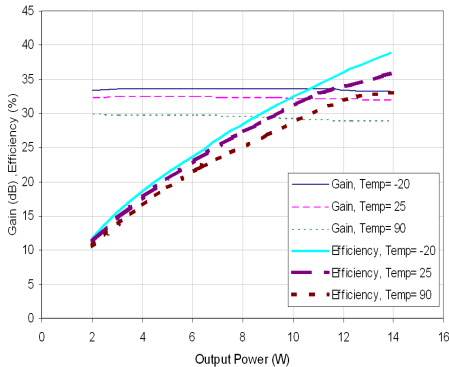
**Output Power, Gain, Efficiency vs. Input Power**

Freq=881 MHz, Vdd=28 V, T<sub>Flange</sub>=25 °C



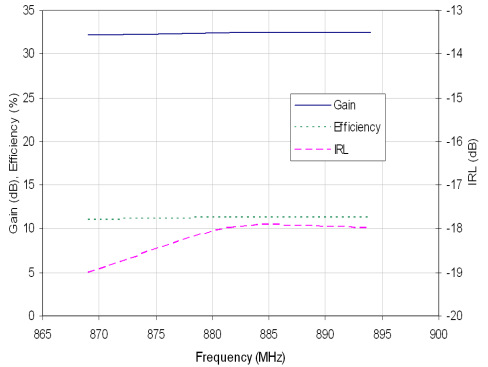
**Gain, Efficiency vs. Output Power over Temperature**

Freq=881 MHz, Vdd=28 V, T<sub>Flange</sub>=-20 °C, 25 °C, 90 °C



**Gain, Efficiency, IRL vs. Frequency**

Output Power=1 Watt, Vdd=28 V, T<sub>Flange</sub>=25 °C



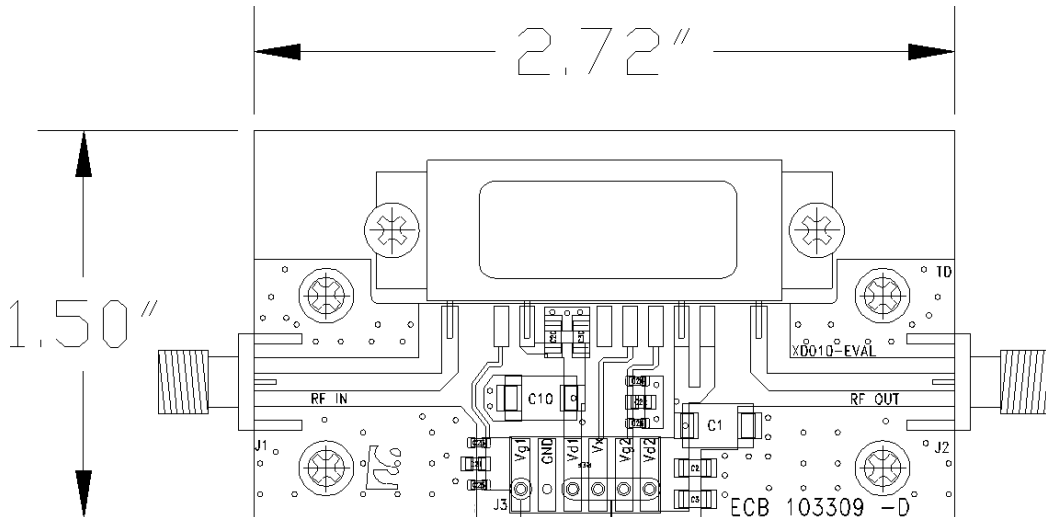
Pin	Function	Description
1	RFIN	Module RF input. This pin is internally connected to DC ground. Do not apply DC voltages to the RF leads. Care must be taken to protect against video transients that may damage the active devices.
2	VD1	This is the drain voltage for the first stage. Nominally +28Vdc
3	VD2	This is the drain voltage for the 2 <sup>nd</sup> stage of the amplifier module. The 2 <sup>nd</sup> stage gate bias is temperature compensated to maintain constant quiescent drain current over the operating temperature range. See Note 1.
4	RFOUT	Module RF output. This pin is internally connected to DC ground. Do not apply DC voltages to the RF leads. Care must be taken to protect against video transients that may damage the active devices.
Flange	GND	Exposed area on the bottom side of the package needs to be mechanically attached to the ground plane of the board for optimum thermal and RF performance. See mounting instructions in application note AN-060 on RFMD's web site.

Note 1: The internally generated gate voltage is thermally compensated to maintain constant quiescent current over the temperature range listed in the data sheet. No compensation is provided for gain changes with temperature. This can only be accomplished with AGC external to the module.

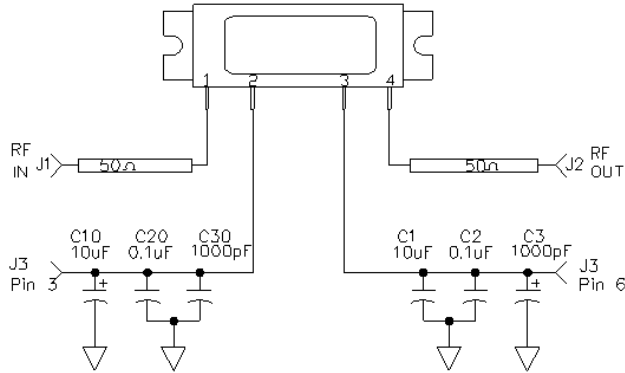
Note 2: Internal RF decoupling is included on all bias leads. No additional bypass elements are required, however some applications may require energy storage on the drain leads to accommodate time-varying waveforms.

Note 3: This module was designed to have its leads hand soldered to an adjacent PCB. The maximum soldering iron tip temperature should not exceed 700° F, and the soldering iron tip should not be in direct contact with the lead for longer than 10 seconds. Refer to app note AN060 ([www.RFMD.com](http://www.RFMD.com)) for further installation instructions.

## Test Board Layout



**Test Board Schematic with module connections shown**



**Test Board Bill of Materials**

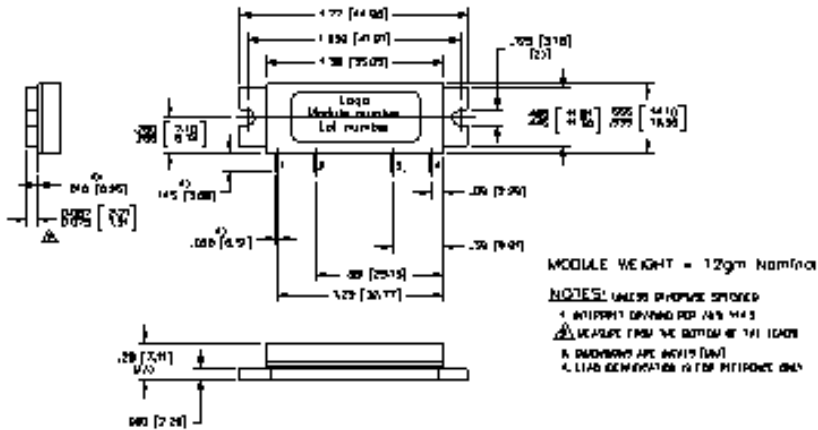
Component	Description	Manufacturer
PCB	Rogers 4350, $\epsilon_r=3.5$ , Thickness=30mils	Rogers
J1, J2	SMA, RF, Panel Mount Tab W / Flange	Johnson
J3	MTA Post Header, 6 Pin, Rectangle, Polarized, Surface Mount	AMP
C1, C10	Cap, 10 $\mu$ F, 35V, 10%, Tant, Elect, D	Kemet
C2, C20	Cap, 0.1 $\mu$ F, 100V, 10%, 1206	Johanson
C3, C30	Cap, 1000pF, 100V, 10%, 1206	Johanson
C25, C26	Cap, 68pF, 250V, 5%, 0603	ATC
C21, C22	Cap, 0.1mF, 100V, 10%, 0805	Panasonic
C23, C24	Cap, 1000pF, 100V, 10%, 0603	AVX
Mounting Screws	4-40 X 0.250"	Various

NOT FOR MOUNTING

## Package Outline Drawing

Dimensions in inches (millimeters)

Refer to drawing posted at [www.rfmd.com](http://www.rfmd.com) for tolerances.



## Recommended PCB Cutout and Landing Pads for the D4F Package

Dimensions in inches (millimeters)

