Abstract

Sirenza Microdevices' XD010 series of LDMOS power modules operate in the 400, 800, 900, 1800, 1900, and 2100 MHz frequency bands. They deliver greater than 15W of CW output power when used in a single-ended configuration. This application note demonstrates how to combine two XD modules in a balanced configuration to obtain greater than 30 Watts of CW output power. Assembly diagrams, BOM's and performance data are presented.

General Discussion

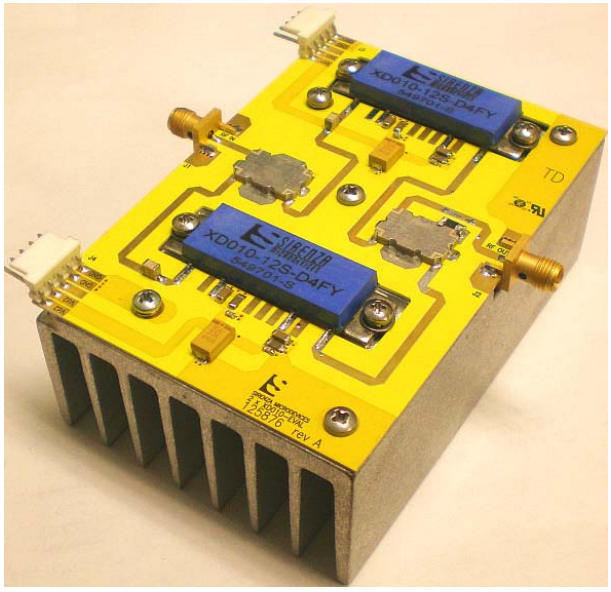
This circuit was based on it's single-ended predecessor, the XD010-EVAL. Information on that circuit is available at www.sirenza.com. The single-ended version was mirrored to maintain symmetry and balance between the two modules.

The balanced nature of this circuit is based on the 90 degree combiners used herein. The XD modules are all internally matched to 50 ohms at the input an output leads. The quadrature combiners ensure excellent S11 and S22, and provide some stage-to-stage isolation.

The combiners do require a 50 ohm termination on the "'isolation" port. An 0603 50 ohm resistor is used for the input combiner as power levels are very low (less than 20 mWatts). Conversely, a power termination is required for the output combiner. This power termination should survive an imbalanced condition which directs power into the "isolation" port of the combiner.

The combiners must be selected based on the operational band of the XD modules. The combiners are readily available from Anaren for each of the frequency bands noted herein.

It is important to mount the PCB to a heatsink. In this case the heatsink is extruded Aluminum. Holes in the PCB allow the modules to be bolted directly to the heatsink for optimum heat transfer and electrical grounding.



The reader should refer to application note "AN-060 - Installation Instructions for XD Module Series" for mounting instructions. This application note can be downloaded from www.sirenza.com.

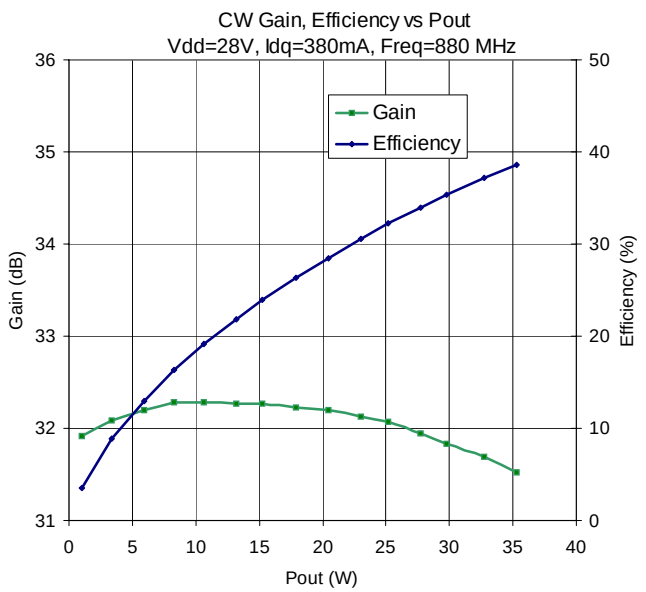
The PCB is constructed using Rogers 4350 material, 30 mils thick, 1 Oz Copper cladding, plated up to 2 Oz, and ENIG gold finish. The backside is fully metallized and serves as the RF ground plane.

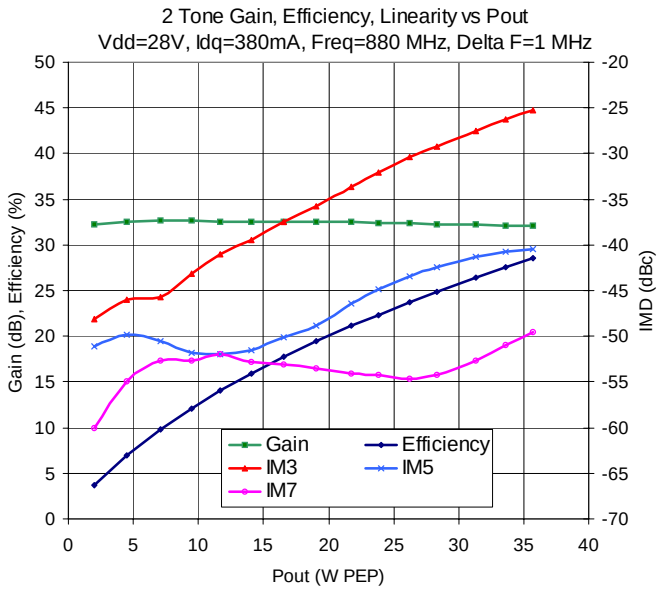
Performance Discussion

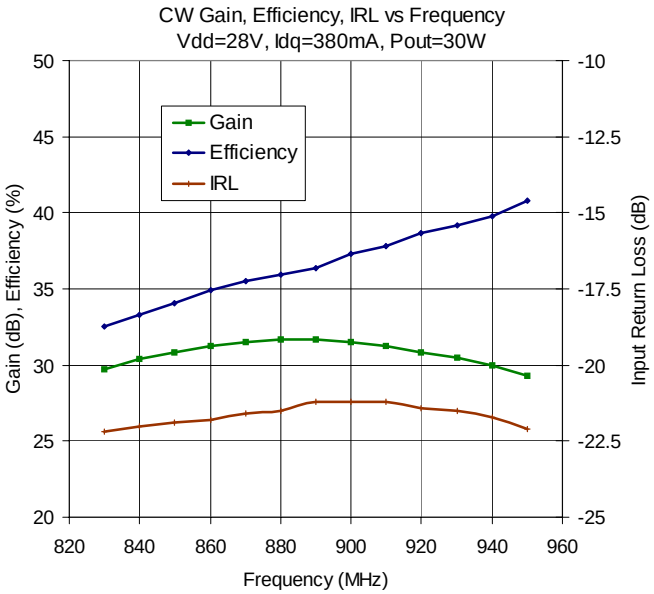
The circuit was populated with two XD010-12S-D4FY modules. Performance data is shown on the following pages. Noteworthy performance highlights include:

- **P1dB > 35 Watts CW output at 880 MHz.**
- **Efficiency approaching 40% at 35 Watts CW output power, 880 MHz.**
- **Only 2.4 dB gain variation over 120 MHz bandwidth at 30 Watts CW output power, 880 MHz.**
- **IMD3 < -27dBc at 30W PEP at 880 MHz.**

Typical Performance of Balanced XD010-12S-D4FY Modules







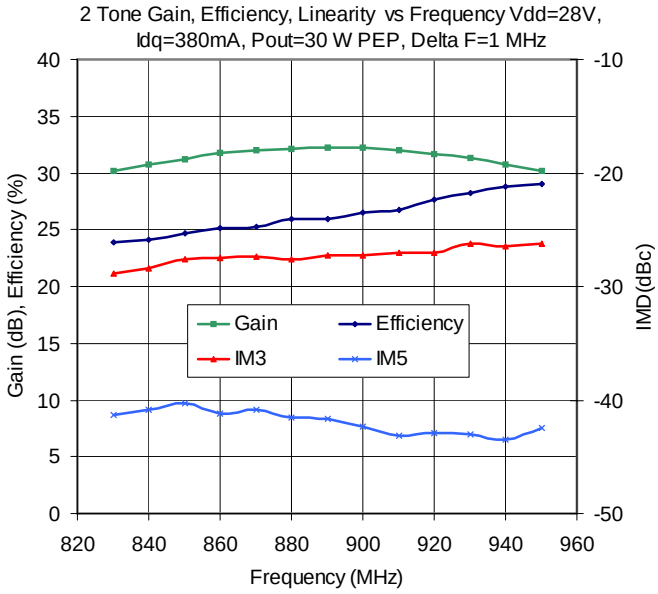
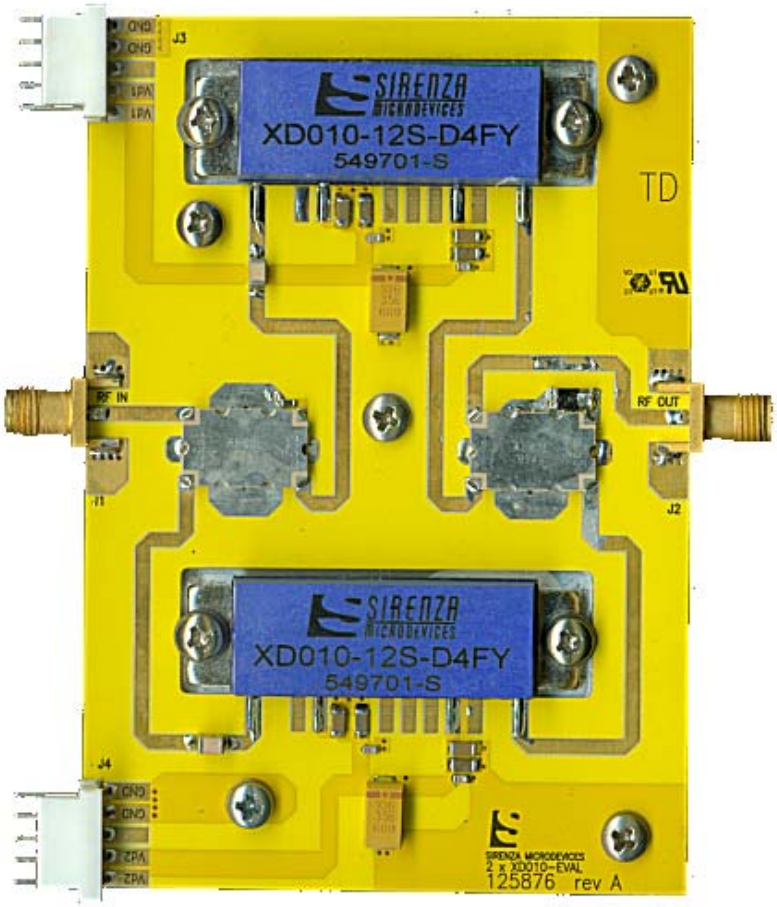


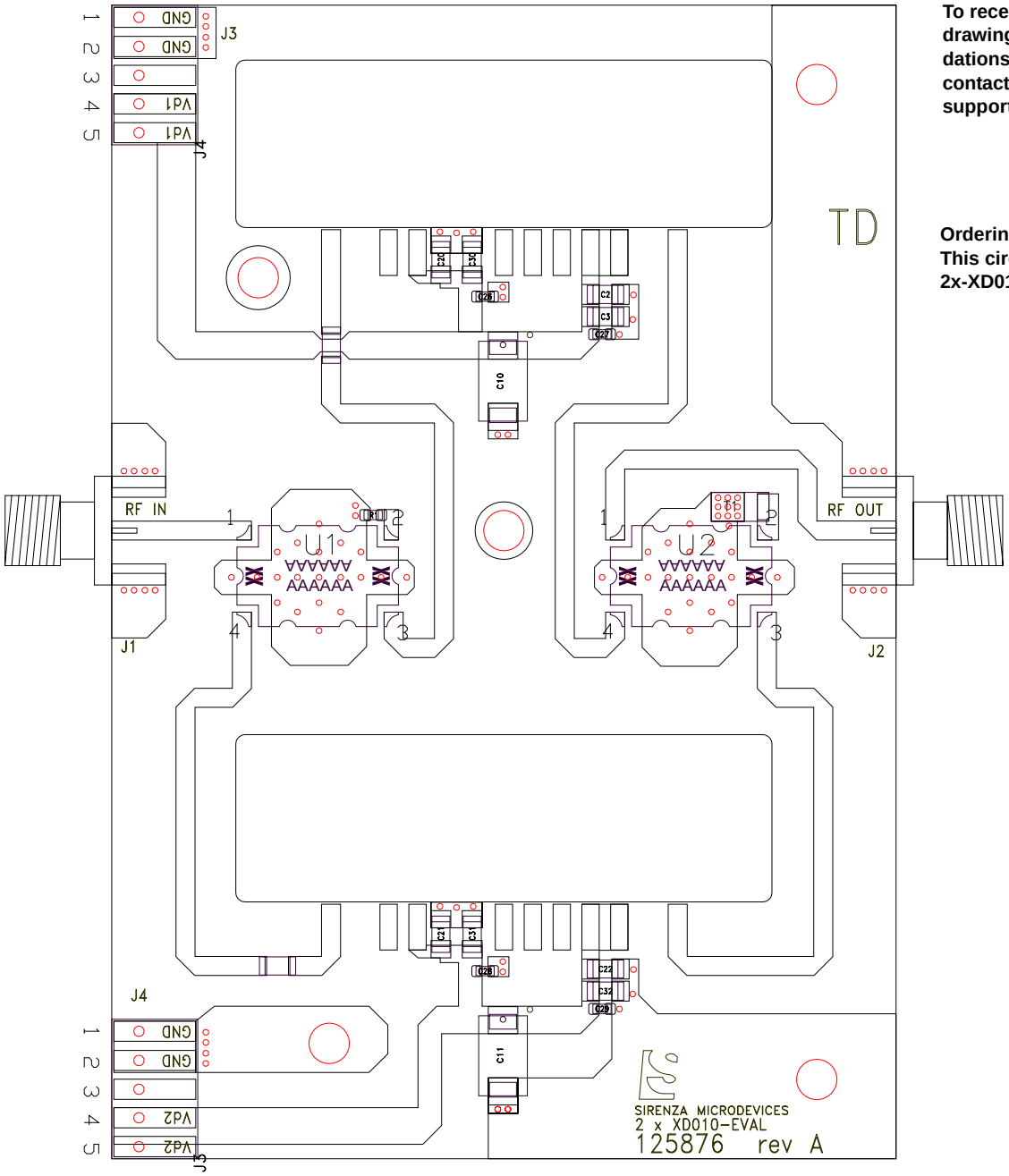
Photo - 2 x XD010 Balanced Application Circuit



Bill of Materials

Manufacturer	Mfg. Part #	Item Description	Qty	Ref Des
Johanson Technology	101R18W104KV4E	CAP, 0.1 UF,100V,10%,1206,LEAD FREE	4	C2,C20-C22
Johanson Technology	101R18W102KV4E	CAP, 1000 PF,100V,10%,1206,LEAD FREE	4	C3,C30-C32
Panasonic	ERJ-EKF49R9V	Resistor, 49.9 Ohms, 1%, 0603	1	R1
ATC	100B560GW500XT	CAP, 56 PF, 500V, 2%, "B"	2	C98, C99
Kemet	T494D106M035AS	CAP, 10 UF, 35V, 20%, TANT, ELECT, D	2	C10, C11
ATC	600S680JT250XT	CAP, 68PF,250V,5%,0603,LF LEAD FREE	4	C26-C29
Johnson Comp	142-0751-821	CONNECTOR,SMA END,0.037 JOHNSON COMP	2	J1, J2
Amp	640455-6	CONNECTOR, MTA,SMD,R/A,6 PIN	2	J3, J4
ATC	CZ12010T0050G	Power termination, 50 Ohms	1	T1
Anaren	depends on frequency, XC series	Xinger 2 series Hybrid Coupler, 3dB 90^{o}	2	U1, U2
Various		SCREW, #4-40 PHILLIPS PAN HEAD, 5/16, SS	9	
Rogers 4350, D_k=3.48, 30 mils thick, 1 oz Cu both sides		PCB, 2x XD010-EVAL	1	
Wakefield	2063-HS Extrusion	Heatsink - Extruded Aluminum, machined	1	

Assembly / Layout Drawing - 2 x XD010 Balanced Application Circuit



To receive Gerber files, DXF drawings, and assembly recommendations for the test board with fixture, contact applications support at support@sirenza.com.

Ordering info:
This circuit has Sirenza part number 2x-XD010-EVAL

Heatsink Drawing