Application Measurement Report

AR132170 BLF188XR Board 2323 VHF Band DVB-T

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Document information

Info	Content
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Keywords	AR132170
Abstract	This report documents the measurement results of a BLF188XR device in a VHF band application circuit. Pulsed results and DVB-T results are shown in this revision of the report. An exciter has been used to generate a DVB-T signal. Raw DVB-T performance through the amplifier is measured. Additionally, the exciter has been used to precorrect the DVB-T performance through the amplifier. This performance has also been recorded.

Revision History

Revision	Date	Description	Author
1.0	2013-June-13	Initial version	Scott Blum

Contents

1. Introduction

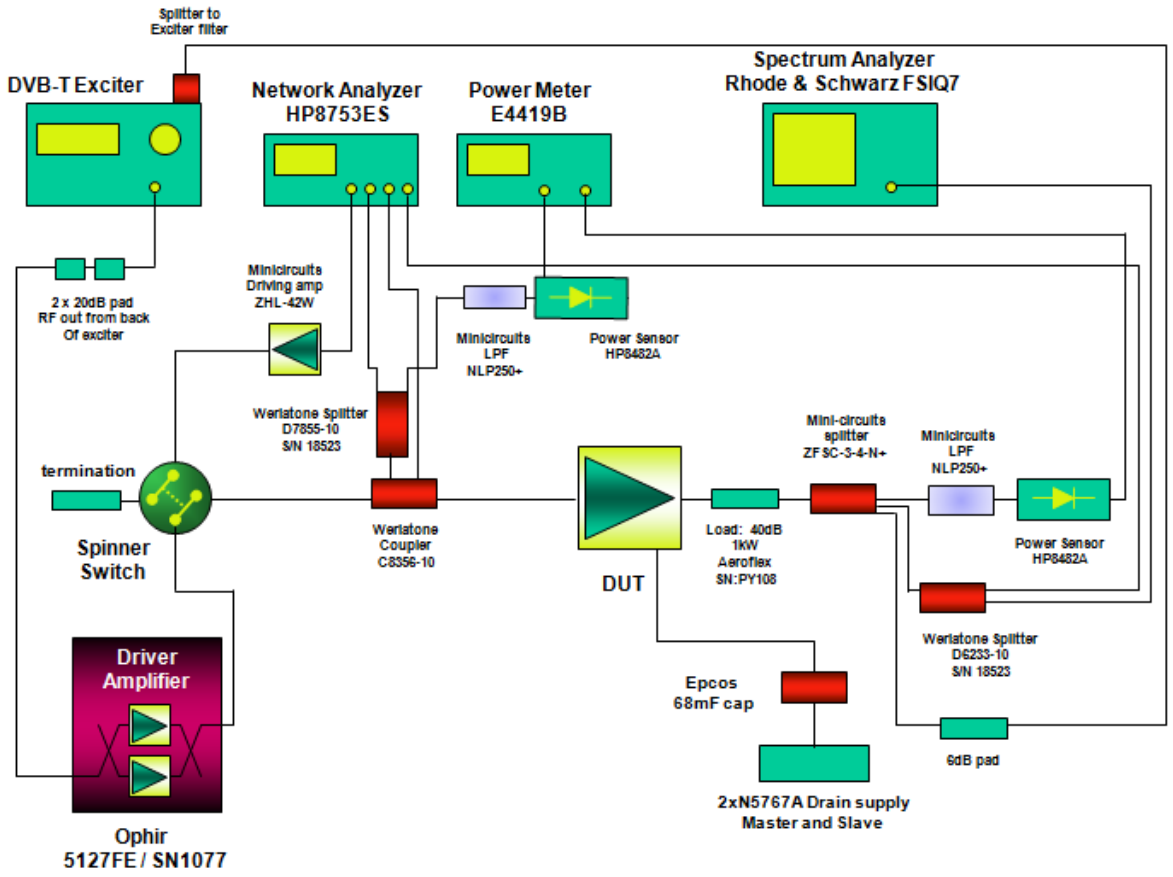
1.1 General Description

This document contains measurement results of a BLF188XR device in an Ampleon application circuit for the 174 to 230 MHz VHF band. The application board was designed in Ampleon Smithfield and tested with an Exciter in the Ampleon Smithfield, RI lab. The demo was tested with an 8MHz DVB-T signal, at 50V_{DS}, and 2500mA I_{DQ} in the VHF band at 225W of average DVB-T power. The uncorrected and precorrected linearity is measured at the low, mid, and high parts of the VHF band. Additionally, the pulsed peak power and efficiency are tested.

1.2 Test object details

Transistor type:	BLF188XR
Production code:	RFA D131301
Board:	30mil thick Taconic RF35TC
Demo number:	2323
Cooling:	The demo has been greased down to a water cooled chill plate at 25 deg C
Exciter Software:	Apex M2X Exciter running code APEXM2X_DVB_REVAG.s19

1.3 Test Setup



Exciter Software: Apex M2X Exciter running code APEXM2X_DVB_REVAG.s19

Figure 1. Test Equipment Setup

1.4 Typical Performance

Symbol	Parameter	Value	Unit
Freq.	Frequency Range	174-230	MHz
P_{out}	Average DVB-T output power	225	W
V_{DS}	Power supply	50	V
I_{DQ}	Quiescent drain current (total device)	2500	mA
P_{3dB}	Pulsed peak power 3dB compression	1511	W
ACPR $_{Un\text{-}Corr.}$	DVB-T ACPR Un-Corrected @225W	-30	dBc
ACPR $_{Corr.}$	DVB-T ACPR Corrected @225W *	-36	dBc
$Eff._{@225W}$	Minimum Efficiency at 225W DVB-T Power	29	%
$G_{min.@225W}$	Minimum DVB-T Gain at 225W	23.8	dB
$G_{flatness}$	Gain flatness from 174 to 230MHz at 225W DVB-T power	0.7	dB

*Corrected using Vendor's Exciter

ACPR is measured at +/- 4.3MHz. The other test specifics will be shown later in the report in the relevant sections.

2. Summary

This document contains measurement results of a BLF188XR device in an Ampleon application circuit designed to cover the 174-230MHz VHF band. The results were measured using the exciter with an 8MHz DVB-T signal with the device bias set at 50V_{DS} and 2500mA I_{DQ}. These preliminary results show that the BLF188XR can achieve 225W of DVB-T power in this band at greater than 29% efficiency.

This tune has been optimized for DVB-T peak power and linearity. Higher efficiency operation can be obtained at the cost of lower DVB-T operating power.

3. Measurement Results

3.1 Network Analyzer Plots

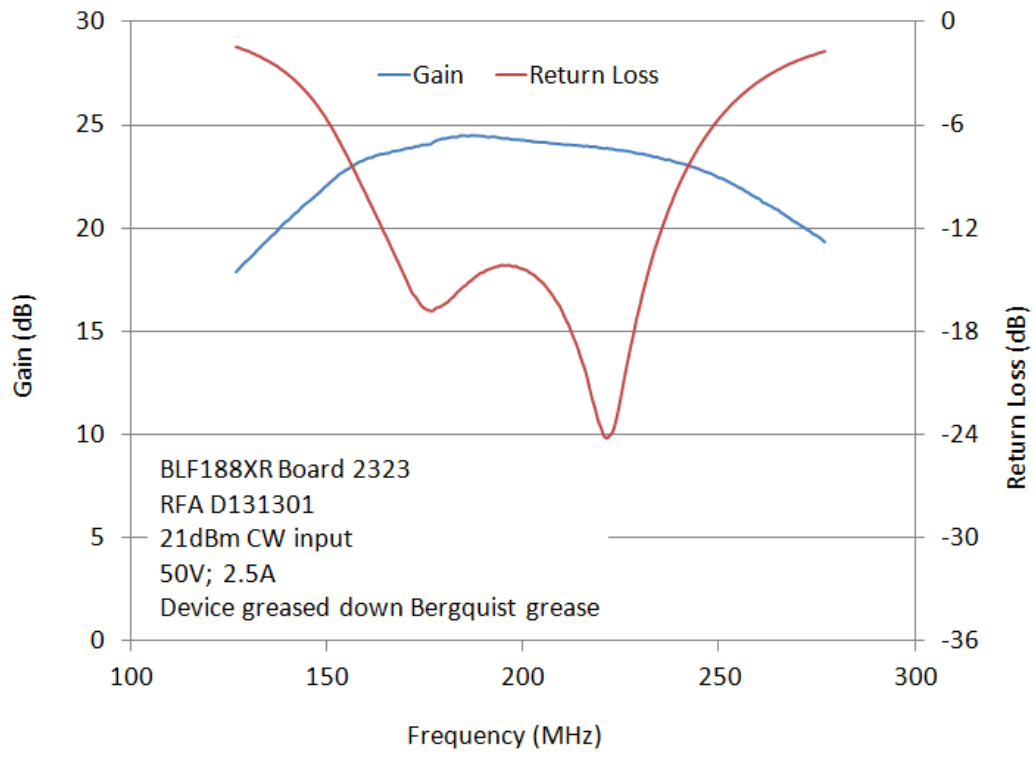


Figure 2. Network Analyzer Plots

3.2 Summary: DVB-T and Pulse

The table below shows the DVB-T and pulse performance of the demo circuit. For the DVB-T linearity, both upper and lower side ACPR readings are shown. These are listed as 'U' and 'L' in the table.

Frequency (MHz)	DVB-T Pout (Watts)	DVB-T Gain (dB)	DVB-T ID / Eff (Amps / %)	DVB-T ACP U/L Corrected (dBc)	DVB-T ACP U/L Uncorrected (dBc)	Pulsed P3dB (Watts)	Pulsed P3dB Eff (%)
174	150	24.5	12.6 / 24%	-50 / -50	-39 / -39	1534 W	62%
	175	24.4	13.6 / 25.7%	-47 / -45	-37 / -37		
	200	24.4	14.6 / 27%	-43 / -42	-34 / -35		
	225	24.4	15.5 / 29%	-39 / -39	-31 / -33		
202	150	24.6	11.9 / 25%	-47 / -48	-36 / -38	1511 W	65%
	175	24.6	12.8 / 27%	-44 / -47	-34 / -37		
	200	24.5	13.6 / 29%	-41 / -43	-33 / -35		
	225	24.5	14.5 / 31%	-37 / -41	-31 / -33		
230	150	23.9	12.1 / 25%	-46 / -48	-35 / -39	1551 W	67%
	175	23.9	12.8 / 27%	-43 / -46	-34 / -36		
	200	23.9	13.65 / 29%	-40 / -43	-32 / -35		
	225	23.8	14.5 / 31%	-36 / -41	-30 / -33		

Table 1. RF Performance Summary V_{DD} = 50V, I_{DQ} = 2500 mA, 12uS 10% for pulsed signals, 8MHz wide signal for DVB-T from Exciter

3.3 Pulsed Performance

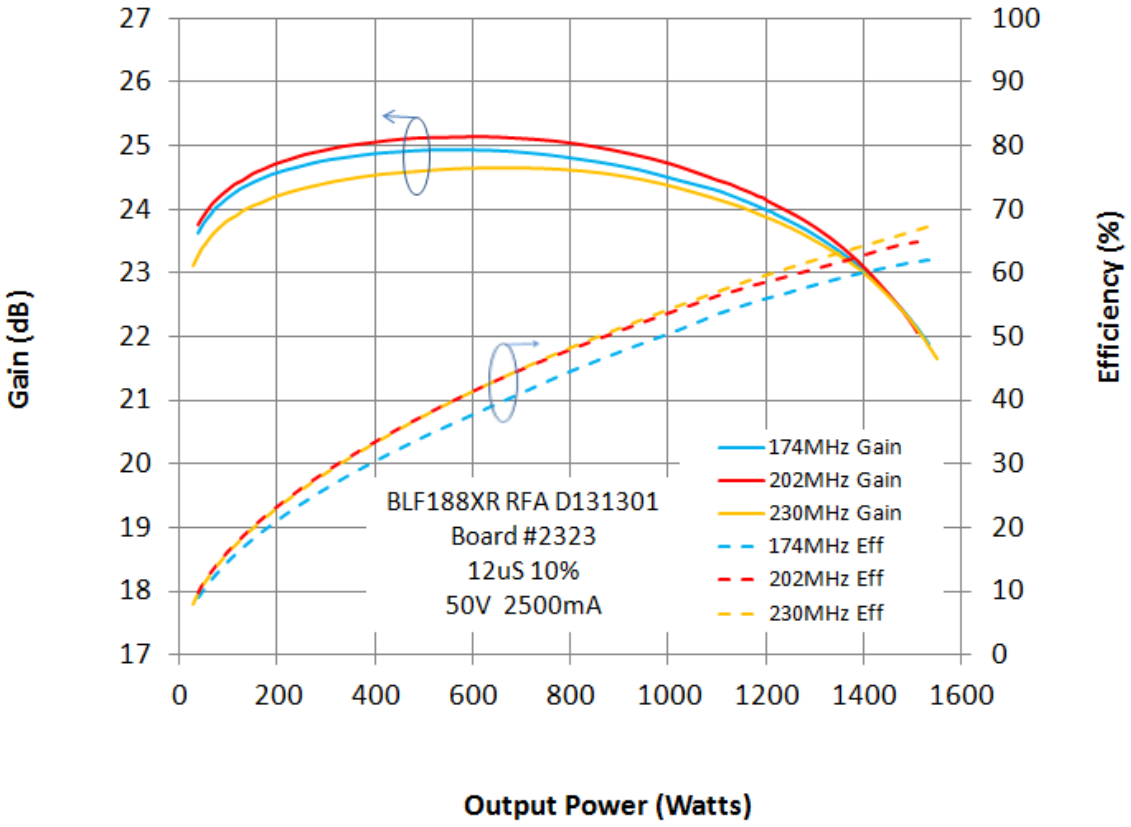


Figure 3. Pulsed Gain and Efficiency Drive-up Curves

3.4 Customer Specific Testing

The customer has a specific way of setting up the spectrum analyzer for raw DVB-T testing. The settings are shown later in the report. The table below shows the results. 225W of DVB-T power can be achieved at -30dBc as measured with the customer's method. This was confirmed using both an FSIQ and an FSV spectrum analyzer.

Frequency (MHz)	DVB-T Pout (Watts)	DVB-T Gain (dB)	DVB-T ID / Eff (Amps / %)	DVB-T ACP Uncorrected -4.3MHz / +4.1MHz (dBc)
178	150	24.6	12.4 / 24%	-38 / -38
	175	24.6	13.3 / 26%	-38 / -38
	200	24.5	14.3 / 28%	-35 / -34
	225	24.5	15.1 / 30%	-32 / -32
202	150	24.7	11.9 / 25%	-38 / -36
	175	24.7	12.8 / 27%	-37 / -35
	200	24.6	13.5 / 30%	-36 / -33
	225	24.6	14.3 / 31%	-34 / -31
226	150	24.2	11.8 / 25%	-38 / -33
	175	24	12.75 / 27%	-35 / -31
	200	24	13.6 / 29%	-34 / -31
	225	24	14.35 / 31%	-33 / -30

Table 2. Customer Analyzer Setup RF Performance Summary V_{DD} = 50V, I_{DQ} = 2500 mA, 8MHz wide signal for DVB-T from Exciter

3.5 Measurement Settings

DVB-T Exciter Settings:

Bandwidth = 8 MHz

Profile 7

BPF On

DVB-T FSIQ Spectrum Analyzer Settings:

RBW = 5kHz

VBW = 2kHz

Sweep Time = 2.5S

RF Attenuation: Auto Low Noise Mode,- 20dB

Mixer Level: -20dBm

Integration bandwidth is 30kHz for both the desired signal and the ACPR

ACPR is the ratio of power in the integration bandwidths at the center of the carrier relative to power at +/- 4.3MHz from the carrier

3.6 Customer Specific Measurement Settings

1. Set Spectrum Analyzer frequency at channel center plus 100kHz.
2. Set SPAN to 10MHz.
3. Set SWEEP to AUTO.
4. Set RES BW to 30kHz.
5. Set VIDEO BW to 30kHz.
6. Set AVERAGE to 20.
7. Set LOG dB/DIV to 10.
8. Set REF LEVEL to have haystack 1 DIV below top reference line.
9. Set ATTENUATION to minimize the influence of drive level on the Spectrum Analyzer's display of the shoulders and to keep shoulders out of the noise floor.
10. Set MARKER to at center frequency plus 100kHz.
11. Set MARKER to DELTA at -4.3MHz. Measure shoulders.
12. Set MARKER to DELTA at +4.1MHz. Measure shoulders.

4. Photo

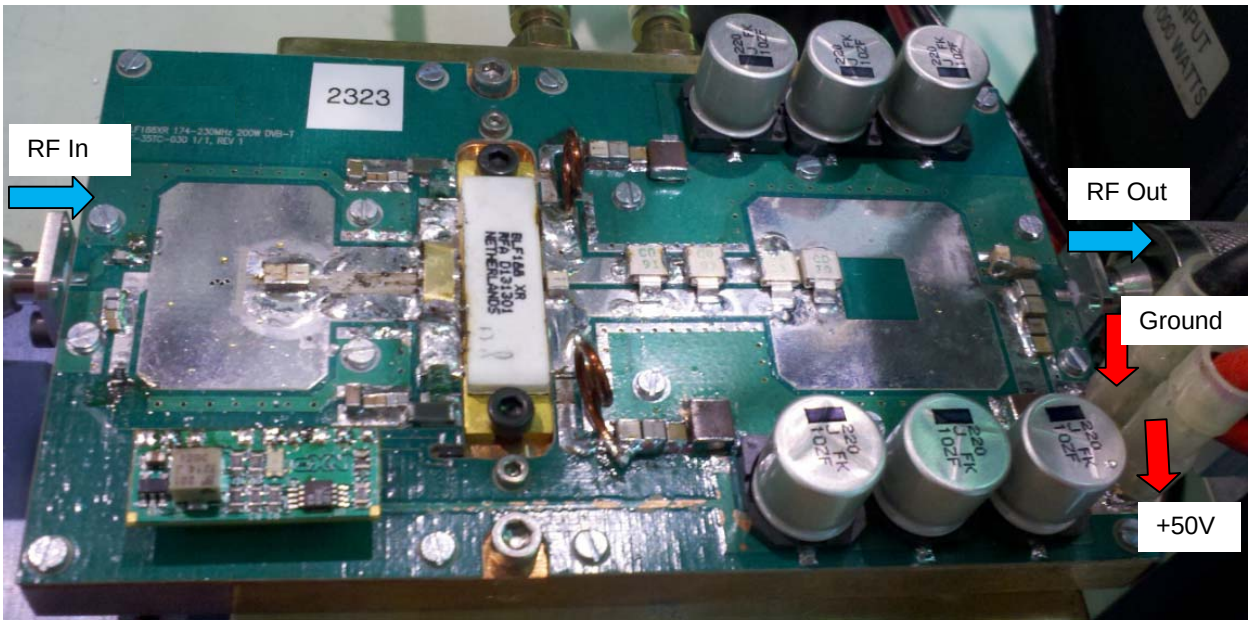


Figure 4. BLF188XR Board 2323

5. Layout

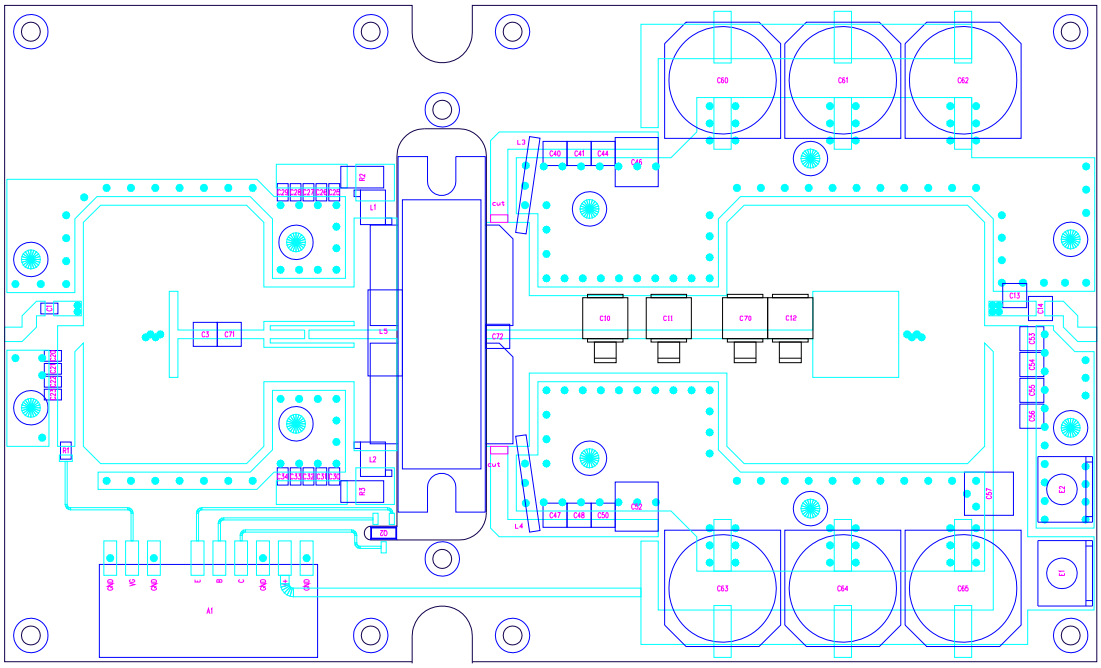


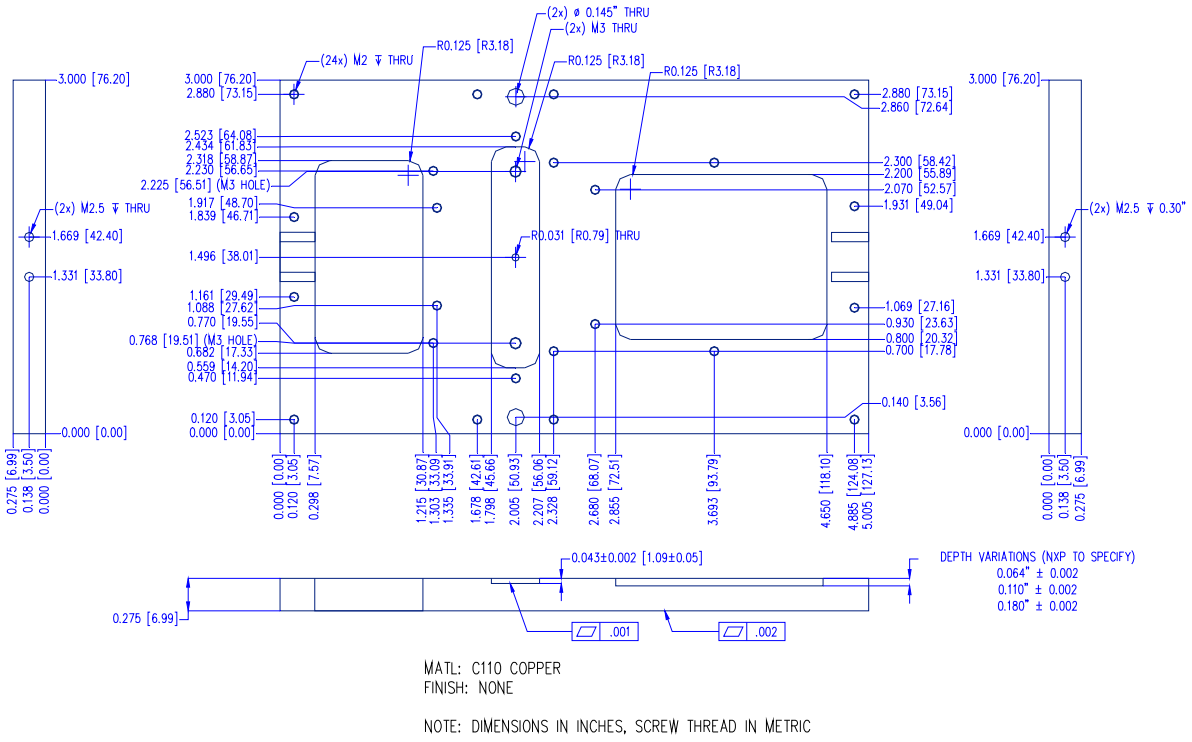
Figure 5. Layout

6. Bill of Materials

Component	Description	Value	Remarks
			Ampleon per CA-330-11
A1	LDMOS bias module		R10=24kOhm not 10kOhm
C1,C20,C25,C30	Capacitor, 100V 5% NP0	100pF	PassivePlus 0805N
C2	Not placed		
C3	Capacitor	120pF	ATC 100B121JW300XC
C10, C11	Capacitor	91pF	CDE MIN02-002 series
C12	Capacitor	70pF	CDE MIN02-002 series
C13	Capacitor (on edge)	4.7pF	ATC 100B4R70JW500XC
C14	Capacitor, 200V 5% NP0 (on edge)	220pF	PassivePlus 1111N
C21,C26,C31	Capacitor, 100V 5% NP0, 0805	1nF	Generic
C22,C27,C32	Capacitor, 50V 10% X7R, 0805	10nF	Generic
C23,C28,C33	Capacitor, 50V 10% X7R, 0805	100nF	Generic
C29,C34	Capacitor, 100V 10% X7R, 1206	1uF	Generic
C40,C47	Capacitor	100pF	ATC 100B101JW500XC
C53	Capacitor, 500V 5% NP0	100pF	PassivePlus 1111N
C41,C48,C54	Capacitor, 100V 10% NP0	910pF	PassivePlus 1111C
C55	Capacitor	4700pF	TDK3225C0G2J472K
C44,C50,C56	Capacitor, 100V 10% NP0 1210	100nF	TDK C3225C0G1H104K
C46,C52,C57	Capacitor, 100V 10% X7S, 2220	10uF	TDK C5750X7S2A106M
C60-C65	Capacitor, 63V 20%, alum elec	220uF	Panasonic EEV-FK1J221Q
C70	Capacitor	15pF	CDE MIN02-002 series
C71	Capacitor	33pF	ATC 100B330JW500XC
C72	Capacitor	15pF	ATC 100B150JW500XC
E1,E2	Conn tab, Faston 0.250 RA		Tyco 42117-2
L1,L2	Inductor, 5%, 3T air core	8nH	Coilcraft A03T
L3, L4	Inductor, 1 Turn		16 gauge, inner dia 0.23"
L5	Inductor, strap, 5 mil thick Brass	4x18mm	4mm high per side
Q1	Transistor, 1.25kW 500MHz LDMOS		Ampleon BLF188XR
Q2	Transistor, NPN 45V 100mA GP		NXP BC847
R1	Resistor, zero-ohm jumper, 0805	0 Ohms	Generic
R2,R3	Resistor, 5% 75W AlN, 2010	5 Ohms	IMS NDC-2010WA5R00J
PCB	Taconic RF35-TC		Er = 3.5, 30 mils thick, 1oz
Thermal pad	Chromerix Therm-a-gap 976		61-20-0404-976

Figure 6. BLF188XR Board 2323 Material List

7. Baseplate Drawing



Note: A thermal pad is installed in the baseplate pocket below the output transformer. This helps remove heat from the transformer traces. This pad is a Chromerics Therm-a-gap 976 pad. The Part Number is 61-20-0404-976.

Figure 7. Baseplate Drawing

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