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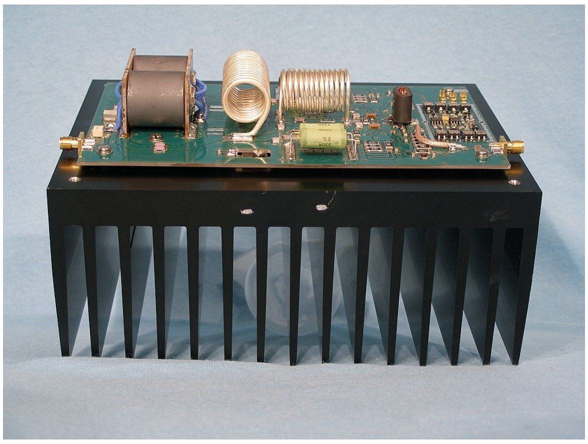
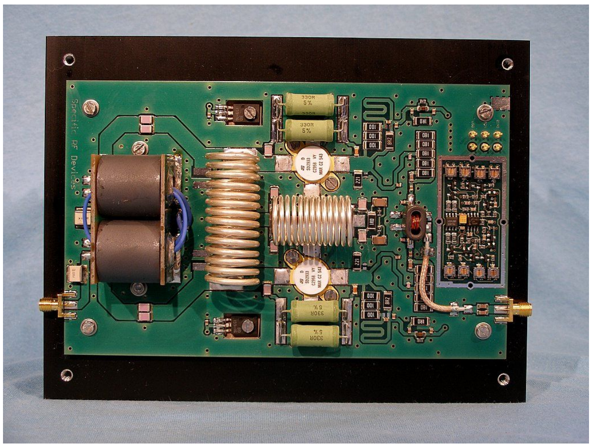
SPECIFICATION DB2933_54

BROADBAND
HF / VHF POWER AMPLIFIER



- Output power min. 300 W / 54.8 dBm with 16 dB gain
- Frequency range 1.6… 54 MHz
- 2 RF power MOSFETs in push-pull configuration
- Temperature compensating biasing circuit supporting class B and class AB operation
- 3 : 1 load VSWR capability
- Mounted on 0.38 K/W heatsink



DESCRIPTION

The DB2933_54 is a RF broadband power amplifier intended for linear or nonlinear operation within the frequency range 1.6… 54 MHz.
The two RF power MOSFETs SD2933 in push-pull configuration provide typically 56 dBm / 400 W at 48 V.

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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Test condition	Value
P_{in}	Input power		+42 dBm / 16 W
P_{out}	Output power	See “considerations on output power”	+57 dBm / 500 W
V_{DD}	Supply voltage drain	V_{GG} = 9...15 V, $P_{in} \leq$ 42 dBm	50 V
V_{GG}	Supply voltage gate biasing		15 V
I_{DD}	Drain current		20 A
P_{DISS}		See “considerations on power dissipation”	500 W

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RF CHARACTERISTICS FOR f = 1.6… 54 MHZ

Symbol	Parameter	Test conditions	min.	typ.	max.
P_{out}	Output power	V_{DD} = 40 V I_{dq} = 2 x 90 mA P_{in} = + 40 dBm	53 dBm 200 W	54,5 dBm 280 W	
		V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{in} = + 40 dBm	54.8 dBm 300 W	56 dBm 400 W	
G	Small signal gain	V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{in} = + 30 dBm		17 dB	
η	Drain efficiency	V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{in} = + 40 dBm	55%	65%	
S_{in}	VSWR at input	V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{in} = + 40 dBm	1	1,2	2
IMA 3	Third order intermodulation (2 tone test)	V_{DD} = 48 V I_{dq} = 2 x 900 mA $P_{average}$ = 51,8 dBm/150 W PEP = 54,8 dBm/300 W		27 dB	
ΔP_{2f}	2^{nd} order harmonic distortion	V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{out} = 54,8 dBm/300 W		25 dB	
ΔP_{3f}	3^{rd} order harmonic distortion	V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{out} = 54,8 dBm/300 W		15 dB	

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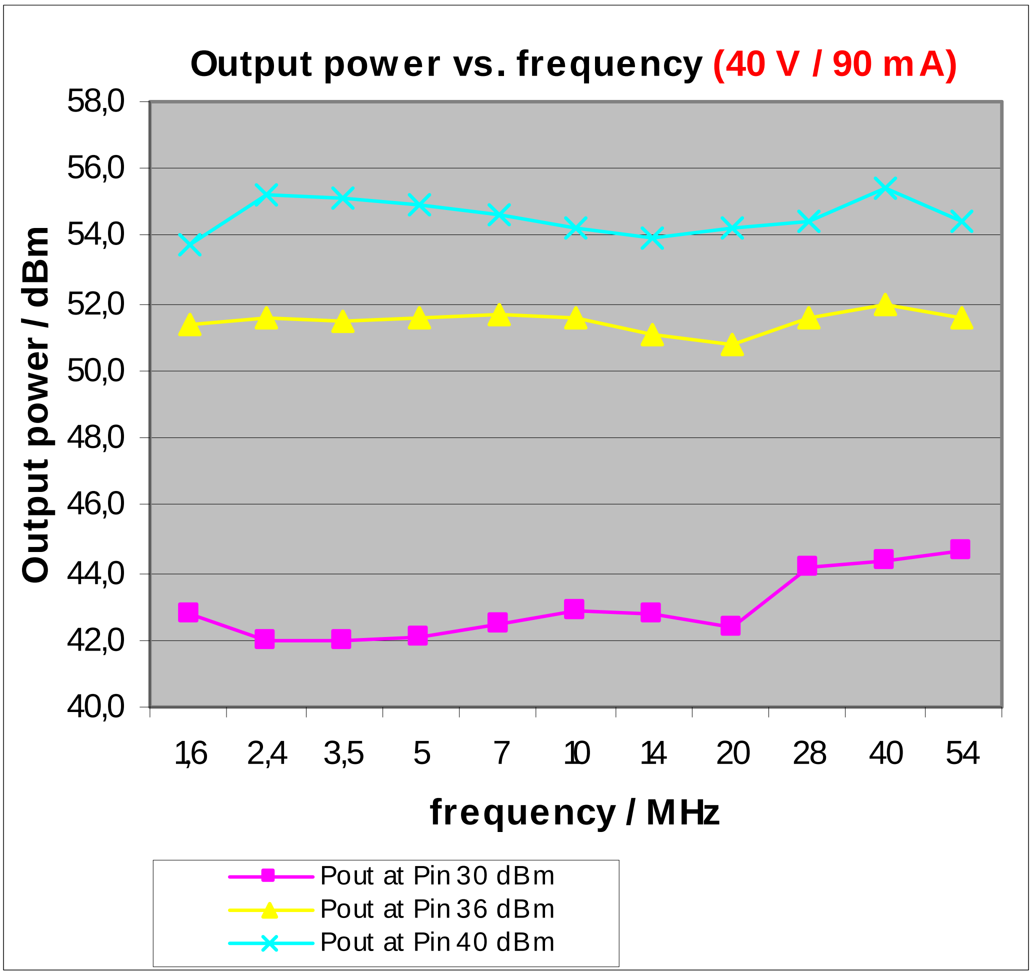
TYPICAL PERFORMANCE



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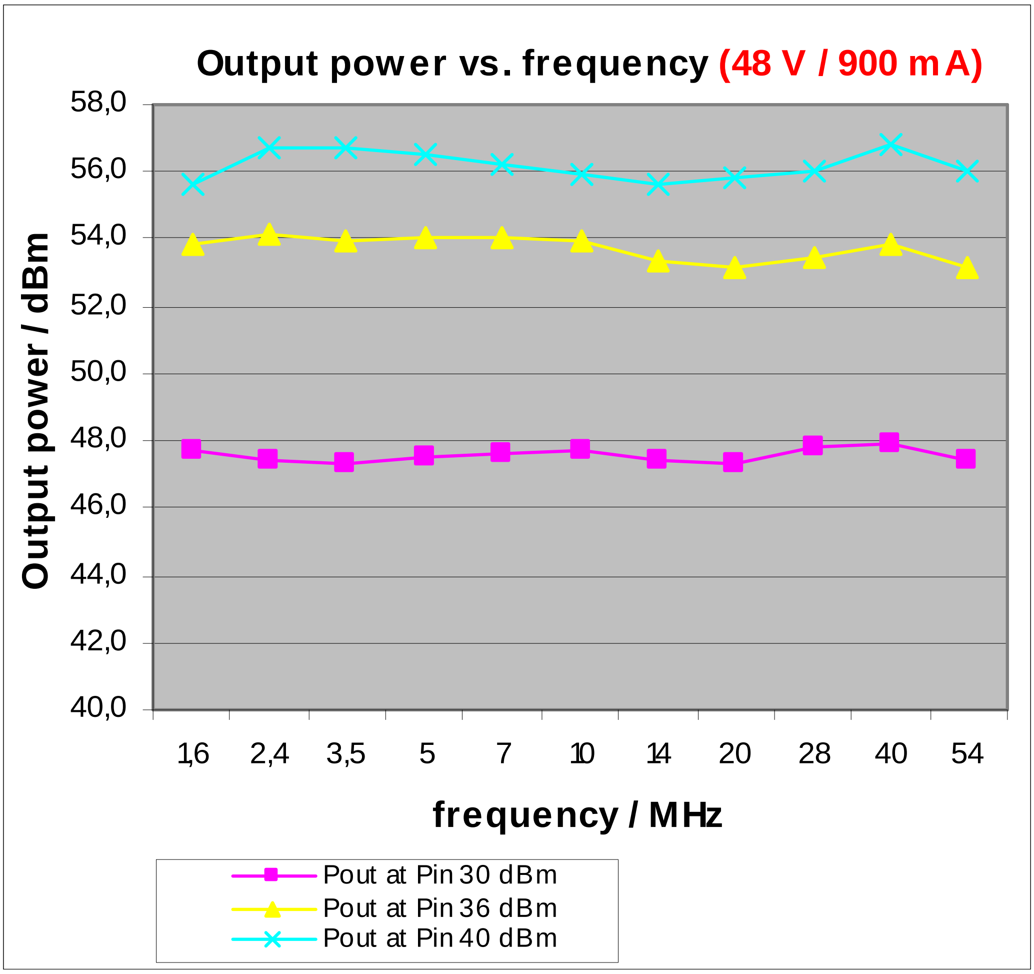
TYPICAL PERFORMANCE



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OPERATION OF DB2933_54

DB2933_54 supports 2 biasing modes:

- A low bias point with approximately 90 mA per transistor (class B)
- A higher bias point with approximately 900 mA per transistor (class AB).

To choose a bias point, DB 2933_54 has a control port “BIAS”. The bias point is 2 x 90 mA if “BIAS” is left open (in this case a DC voltage of ~ 5 V is present); it is 2 x 900 mA if “BIAS” is connected to ground.

DB2933_54 also has a control port “PAON”.
To turn on the biasing circuit, “PAON” has to be connected to ground.
If “PAON” is left open (in this case a DC voltage of ~5 V is present), the biasing circuit will deliver a DC voltage of < 0.5 V, which will switch of the RF power MOSFETs.

SETTING DB2933_54 INTO OPERATION:

Connect the output terminal of the amplifier to a 50 Ω load or attenuator with appropriate power capabilities (~ 500 W).

Switch on the supply voltage for the gate biasing circuit V_{GG} (9…15V).If the control port “PAON” is kept open, the DC voltage at the gates of the power MOSFETs will be ~ 0.4 V.

Connect the control port “PAON” to ground. The DC voltage at the gates will be within the range of 1.5… 3.0 V. The measurable DC voltage will be ~ 0.2…0.3 V lower for “BIAS” open than for “BIAS” connected to ground.

Switch on the drain voltage V_{DD}. Make sure that the current limitation is set to a value <20A.
For V_{DD} = 48 V and depending on the chosen bias point (“BIAS”), the current consumption will be approximately 0.2 A / 1.8 A, respectively.

Connect the input terminal of the amplifier to a RF source with adjustable power (~ 27… 42 dBm / 0.5… 16 W).

Apply RF to the input terminal of the amplifier, beginning with moderate power. The amplifier will deliver output power according to the prevailing parameters.

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CONSIDERATIONS ON POWER DISSIPATION

The SD2933 has a specified thermal resistance of $R_{th\ (j\text{-}c)}$ = 0,27 K/W (junction to case), additional $R_{th(c\text{-}s)}$ = 0,15 K/W have to be taken into account for thermal resistance from case to heatsink.

The thermal resistance of the heatsink is ≈ 0,38 K/W, this corresponds to $R_{th(s\text{-}a)}$ = 0,76 K/W for one of the transistors.

If assuming an ambient temperature of T_{amb} = 20 °C and making use of the maximum operating junction temperature of the SD2933 T_j = 200 °C; the maximum power dissipation for one transistor is:

$$P_{DISS} = \frac{T_j - T_{amb}}{R_{th\ (j\text{-}c)} + R_{th(c\text{-}s)} + R_{th(s\text{-}a)}} = 150\ \text{W}$$

For 300 W of dissipated power for both transistors, approximately 200 W of RF output power (+ 53 dBm) are available. (η > 40 % for P_{out} = 53 dBm)

When operating the DB2933_54 with higher power dissipation, the thermal resistance of the heatsink has to be reduced. This can be easily done by directing the air flow of a blower onto the heatsink. The resulting thermal resistance can be brought into the range of ~ 0.1K/W. In this case, a power dissipation of max. 500W can be handled.

Upon request, DB2933_54 can also be delivered mounted on a cooling aggregate instead of the heatsink. The thermal resistance of the cooling aggregate is <0.1K/W.

When exceeding an output power of + 55 dBm, some additional cooling should be applied onto the component side of DB2933_54 to prevent overheating of the RF output transformer. Usually a moderate airflow should be sufficient.

SRFD can deliver an assembly with a blower to be placed on top of DB2933_54.

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CONSIDERATIONS ON OUTPUT POWER

DB2933_54 is specified for operation on a 50 Ω load. As it is intend for a supply voltage of 48 V and employs a 1 : 4 transformer on the output, an output power of ~ 56 dBm / 400 W is achieved.

However, output power can be increased by applying load impedances different to 50 Ω to the output of the amplifier, as these will alter the load impedance present at the drains of the SD2933.

Do be aware of the maximum output power of + 57 dBm / 500 W and the enhanced cooling requirements when doing so.

An impact on efficiency and maximum output power (and hereby intermodulation distortion) has also the termination of harmonics, especially 3 order harmonics. Further improvement can be achieved by designing the lowpass filter succeeding the amplifier to inhibit an advantageous phase angle for harmonic frequencies.

Specific RF Devices can develop a lowpass filter to your requirements.

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REVISION HISTORY:

Rev.1: First release May 2010