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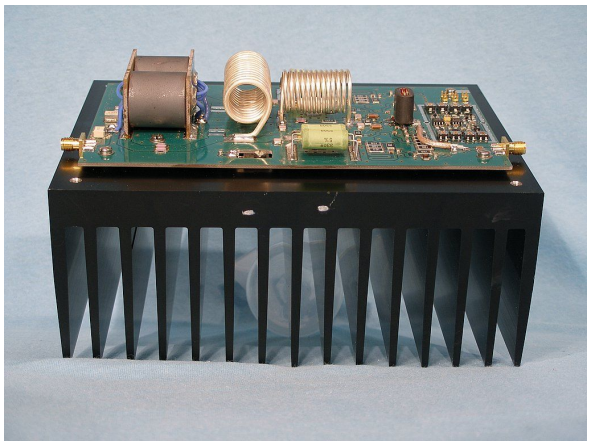
SPECIFICATION DB2943_54

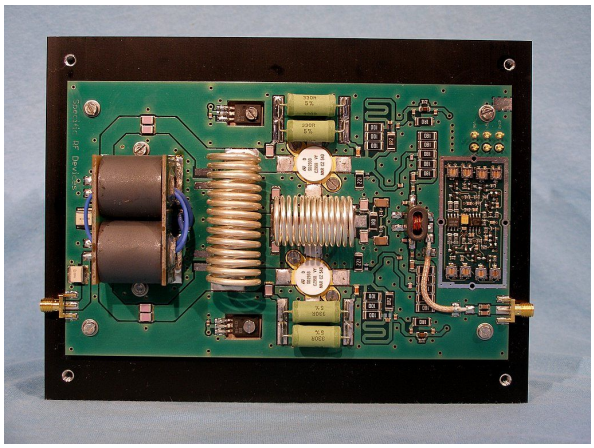
BROADBAND
HF / VHF POWER AMPLIFIER

- Output power min. 350 W / 55.5 dBm with 16 dB gain
- Frequency range 1.8… 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 DB2943_54 is a RF broadband power amplifier intended for linear or nonlinear operation within the frequency range 1.8… 54 MHz.
The two RF power MOSFETs SD2943 in push-pull configuration provide typically 56.5 dBm / 450 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 = 1.8… 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	53.8 dBm 240 W	54,8 dBm 300 W	
		V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{in} = + 40 dBm	55.5 dBm 350 W	56.5 dBm 450 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		24 dB	
ΔP_{2f}	2nd order harmonic distortion	V_{DD} = 48 V I_{dq} = 2 x 900 mA P_{out} = 54,8 dBm/300 W		25 dB	
ΔP_{3f}	3rd 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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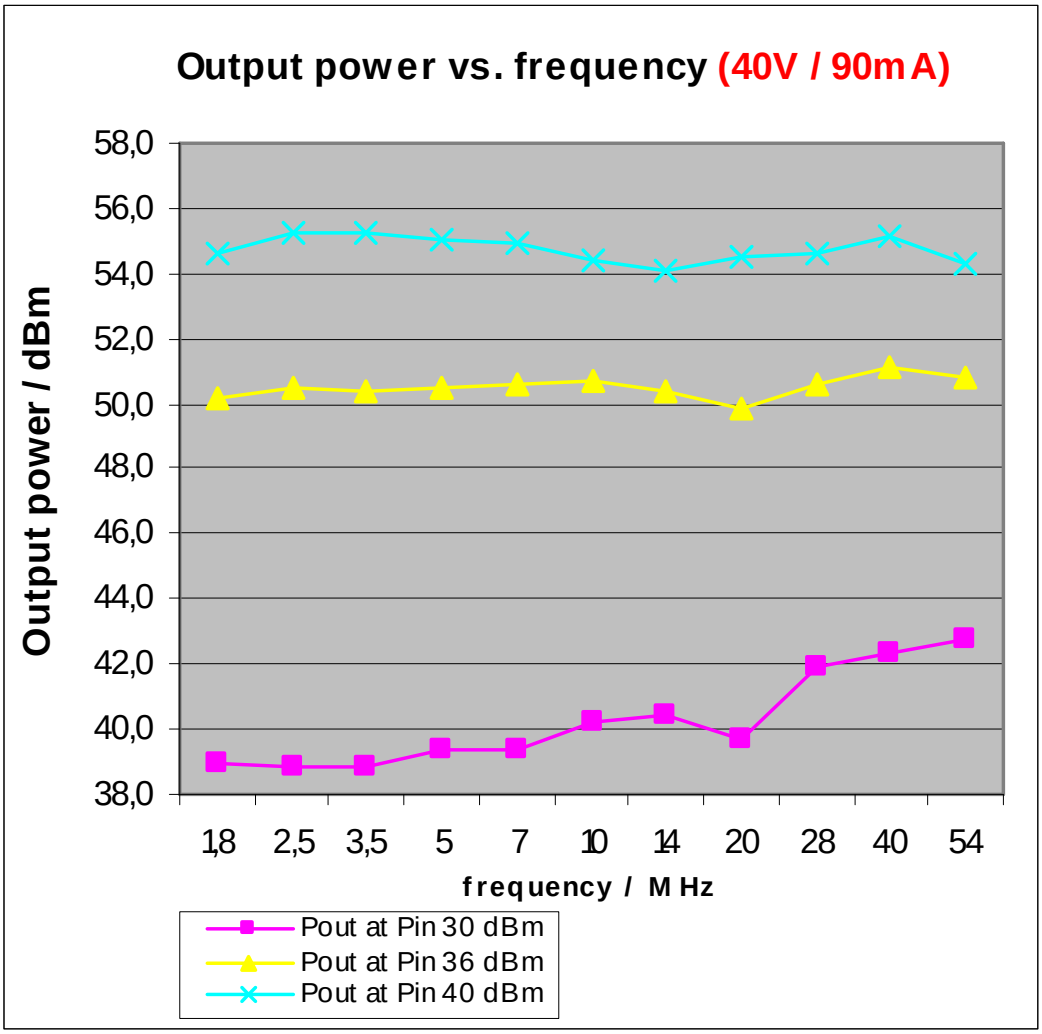
TYPICAL PERFORMANCE



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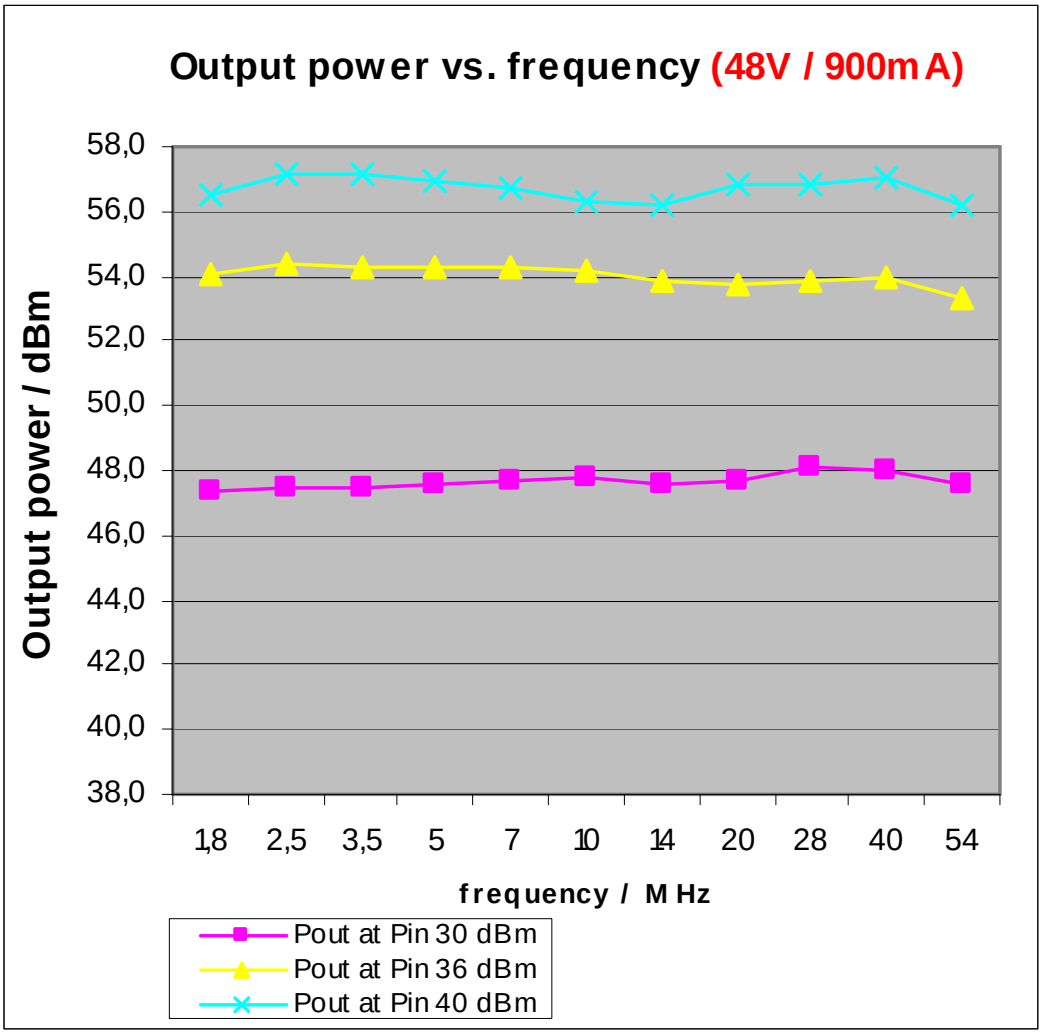

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OPERATION OF DB2943_54

DB2943_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 2943_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.

DB2943_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 DB2943_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 1.8… 3.6 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 SD2943 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 SD2943 T_j = 200 °C; the maximum power dissipation for one transistor is:

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

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 DB2943_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, DB2943_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 DB2943_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 DB2943_54.

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CONSIDERATIONS ON OUTPUT POWER

DB2943_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 SD2943.

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 3rd 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