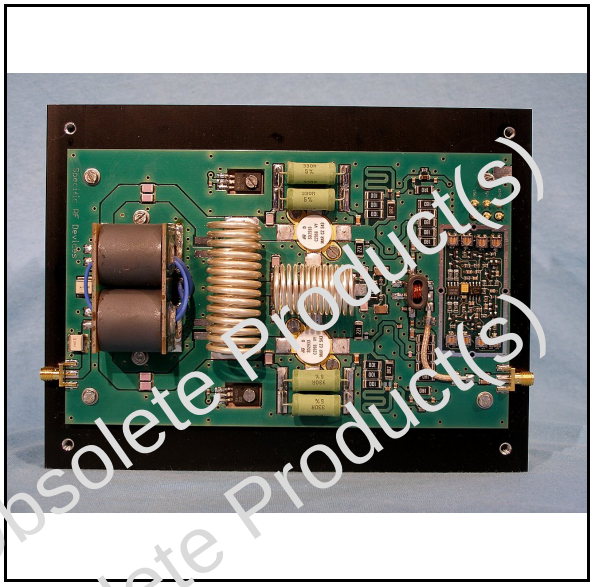
# DB-2933-54

## RF POWER amplifier using 2 x SD2933 N-Channel enhancement-mode lateral MOSFETs

## General feature

- Excellent thermal stability
- Frequency: 1.6 - 54MHz
- Supply voltage: 48V
- Output power: 400W typ.
- Input power 10W max.
- Efficiency: 57% - 76%
- IMD at 300WPEP < -26dBc
- Load mismatch: 3:1all phases



## Description

The DB-2933-54 is a RF broadband power amplifier intended for linear or nonlinear operation over the band 1.6 to 54 MHz using 2x SD2933 gold metallized N-channel MOS field-effect transistors. The temperature compensating biasing circuit supports class B and class AB operation.

DB-2933-54 is designed in cooperation with Specific RF Devices.

(e-mail : specific.rf.devices@t-online.de)

## Order code

- DB-2933-54

# Contents

# 1 Electrical data

## 1.1 Maximum ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $P_{IN}$ | Input power | 16 | W |
| $P_{OUT}$ | Output power | 500 | W |
| $V_{DD}$(1) | Drain supply voltage | 50 | V |
| $V_{GG}$ | Gate biasing voltage | 15 | V |
| $I_{DD}$ | Drain current | 20 | A |
| $P_{DISS}$ | Power dissipation | 400 | W |

1. $V_{GG}$ from 9 to 15V and $P_{IN}$ < 16W

# 2 Electrical characteristics

$T_A$ = +25 °C, $V_{DD}$ = 48V, $I_{DQ}$ = 2 x 900mA

**Table 2. Electrical Specification**

| Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Freq | Frequency range | 1.6 | | 54 | MHz |
| $P_{OUT}$ | $P_{IN}$ = 10W | 300 | 400 | | W |
| Gain | $P_{IN}$ = 10W | | 16.2 ±0.6dB | | dB |
| ND | $P_{IN}$ = 10W | | 57 - 76 | | % |
| H2 | $2^{ND}$ Harmonic @ $P_{OUT}$ = 300W | | -26 / -49 | | dBc |
| H3 | $3^{RD}$ Harmonic @ $P_{OUT}$ = 300W | | -13 / -58 | | dBc |
| VSWR | Load mismatch all phases @ $P_{OUT}$ = 300W | | | 3:1 | |

# 3 Typical performance

**Figure 1. Output power & efficiency vs frequency**

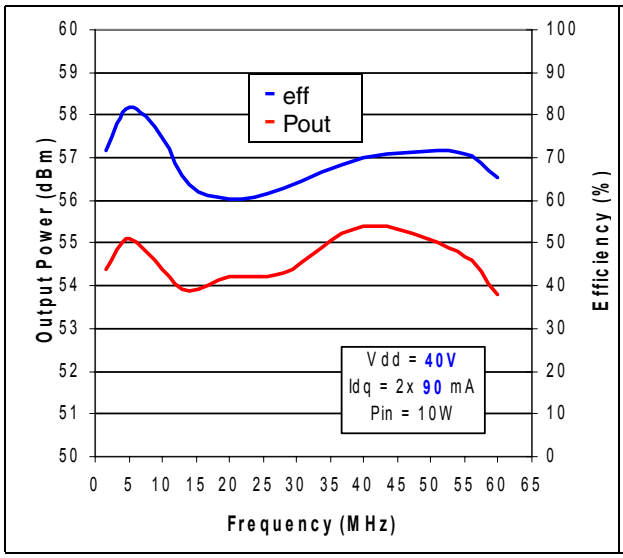



**Figure 2. Output power & efficiency vs frequency**

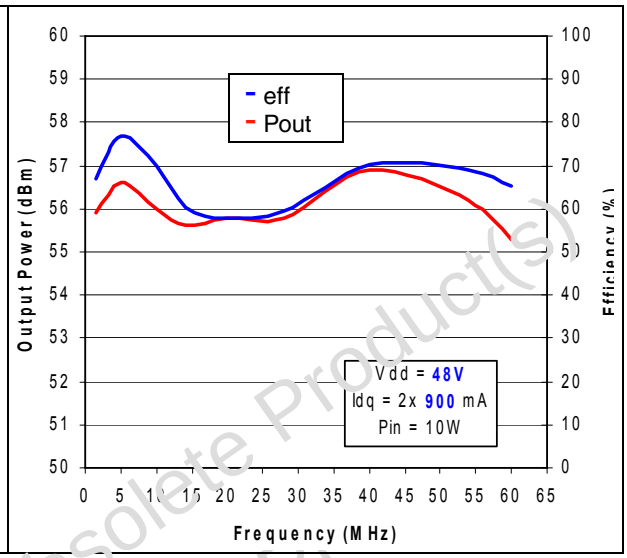



**Figure 3. IMD vs frequency**

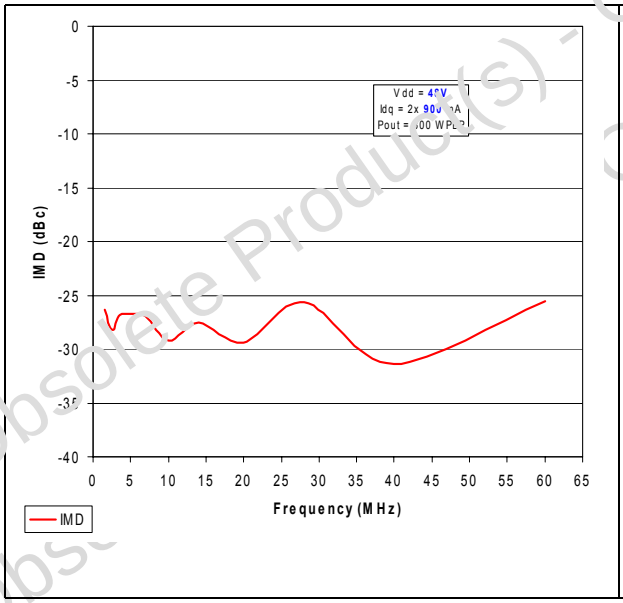



**Figure 4. Output power vs drain voltage**

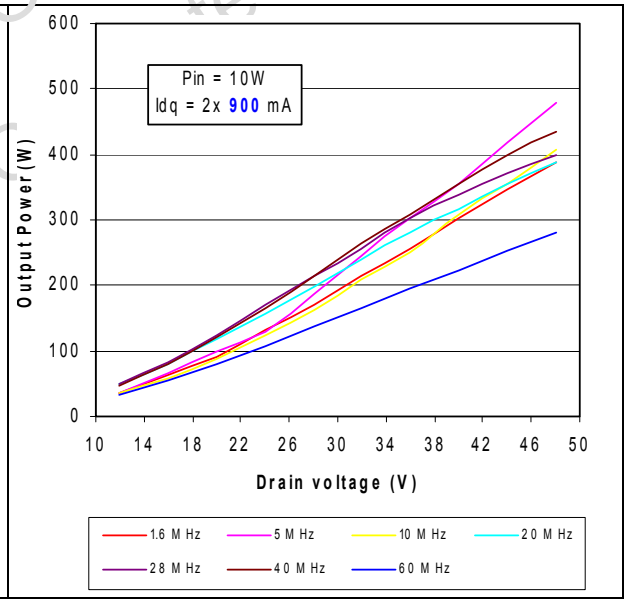
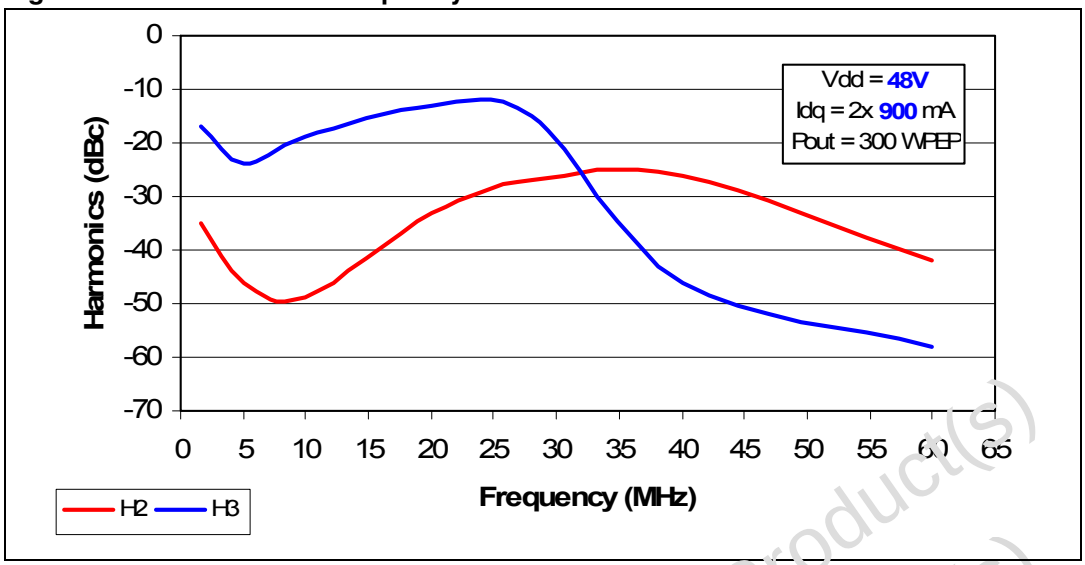


**Figure 5. Harmonics vs frequency**



# 4 Photos of DB-2933-54 amplifier

**Figure 6. Top view**

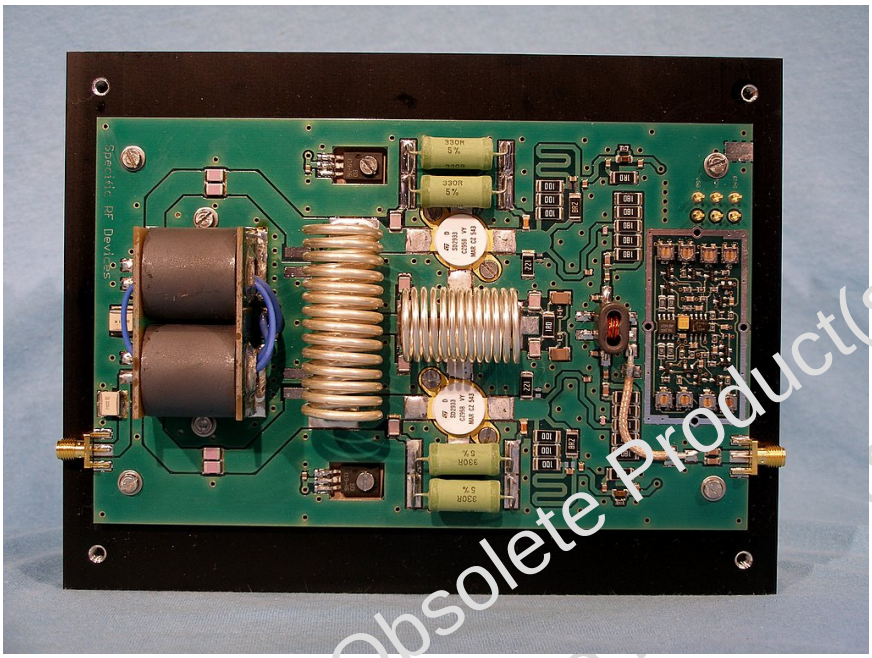
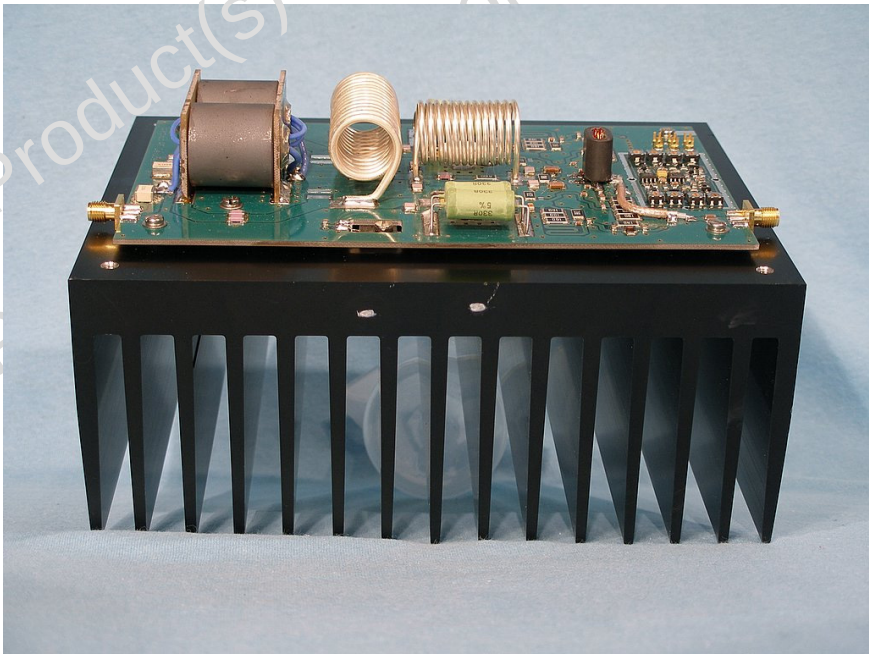


**Figure 7. Side view**



# 5 DB-2933-54 class of operation

- class B : a low bias point with ~100mA per transistor
- class AB : a higher bias point with ~ 900mA per transistor

To select a bias point, DB-2933-54 has a control port “BIAS”.

- The bias point is 2x 100 mA if “BIAS” is left open and in this case a DC voltage of ~5V is present
- The bias point is 2 x 900 mA if “BIAS” is connected to ground.

"PA_ON" control port / ON-OFF bias current

- To switch-on biasing circuit, connect “PA_ON” to ground.
- To switch-off biasing circuit, left open “PA_ON”

# 6 SD2933 mounting recommendations

## 6.1 Mounting recommendations

- Ensure holes in heatsinks are free from burrs;
- Minimum depth of tapped holes in heatsinks is 6 mm;
- Use 4-40 UNC-2A cheese-head screws with a flat washer to spread the joint pressure;
- The minimum flatness of the mounting area is 0.02 mm;
- Mounting area roughness should be less than 0.5 µm (micro);
- Avoid, as much as possible, use of flux or flux solutions because flux can penetrate even when hermetically sealed ceramic-capped transistors. Tin and wash the printed-circuit board BEFORE mounting the power transistors, then solder the transistor leads without using flux;
- Transistor leads may be tinned by dipping them full-length into a solder bath at a temperature of about 230°C. No flux should be used during tinning;
- Recommended heatsink compounds : WPSII (silicon free) from Austerlitz Electronics, 340 from Dow Corning etc.

## 6.2 Mounting sequence

- Apply a thin layer of evenly distributed heatsink compound to the flange;
- Position the device with flat washers in place;
- Tighten the screws until finger tight (0.05 Nm);
- Further tighten the screws until the specified torque is reached;
- For M174, M177 & M244 type of packages, torque should be minimum 0.6 Nm and 0.75 Nm max.

**Table 3. DMOS Packages - List of materials**

| Package Type | Description | Flange | Leadframe | Ceramic insulator | Plating | | Torque (Nm) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Leads | Flange | Min | Max |
| M174 | 0.500 DIA 4L NON HERM W/FLANGE | Cu | ALLOY 42 (Fe58 / Ni42) | BeO (99.5% min) | Au (100µ min) over Ni (100µ min / 350µ max) | Ni(100µ min) + Pd (10µ min) | 0.6 | 0.75 |
| M174 (Moly disk) | 0.500 DIA 4L NON HERM W/FLANGE (MOLY DISK) | Cu-Mo-Cu | ALLOY 42 (Fe58 / Ni42) | BeO (99.5% min) | Au (100µ min) over Ni (100µ min / 350µ max) | Ni(100µ min) + Pd (10µ min) | 0.6 | 0.75 |
| M177 | 0.550 DIA 4L NON HERM W/FLANGE | Cu-Mo-Cu | ALLOY 42 (Fe58 / Ni42) | BeO (99.5% min) | Au (60µ min) over Ni (100µ min / 350µ max) | Au (100µ min) over Ni (100µ min / 350µ max) | 0.6 | 0.75 |
| M244 | 2x 0.400x0.425 WIDE 2L LAP N/H FLANGE | W (85%) - Cu (15%) | ALLOY 42 (Fe58 / Ni42) | BeO(99.5 % min) | Au (60µ min) over Ni (100µ min / 350µ max) | Au (60µ min) over Ni (100µ min / 350µ max) | 0.6 | 0.75 |

# 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

# 8 Revision history

Table 4. Revision history

| Date | Revision | Changes |
|---|---|---|
| 19-Oct-2006 | 1 | Initial release |

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.



STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

**www.st.com**