AR201104 ART2K0FE, 41MHz v1.0 — 20-May-2020



| Document information | | | | | | |
|-----------------------|--|--|--|--|--|--|
| Status Company Public | | | | | | |
| Author(s) | | | | | | |
| Abstract | Measurement results of a Class AB planar balun design for the 41MHz band with the ART2K0FE | | | | | |

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41MHz

1. Revision History

| Revision | Date | Description | Author | |
|----------|------------|------------------|--------|--|
| 1.0 | 2020.05.20 | Initial document | | |

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5. Introduction

5.1 General description

This document shows the measurement results of a 41MHz demo amplifier (Board AR201104) with 1x ART2K0FE.

5.2 Test object details

| Transistor type: | ART2K0FE (Soldered down) |
|------------------|--|
| Production code: | 6337 m1952 W3 Philippines |
| Package: | SOT539 |
| Board: | ART2K0_41MHz_coplanar_balun_input_output |
| Demo number: | AR201104 |

5.3 Used Test signals

| CW: | CW |
|------------|--|
| CW-pulsed: | Pulsed CW, Pulse Width 100us, Duty Cycle 10% |

5.4 Test circuit

A description of this circuit can be found in Appendix A.

The INPUT and OUTPUT board of the test circuit have been designed on Rogers RO4350, h=0.762mm, $\epsilon r=3.48$, 2x35um.

Supply voltage (drain-source) is typical 65V. Increase Vgs until the total Idq will be 320mA.

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6. Measurement Results

6.1 Gain & Efficiency @ Frequency=41MHz CW



| Figure 1 | CW | Gain and Efficiency vs Pout [W] |
|----------|----|---------------------------------|
|----------|----|---------------------------------|

| Table 1 – RF Performance overview | | | | | | | | | | | |
|-----------------------------------|--------------|----------------------|-------------|-------------|-------------|---------------|------------------------|--------------------|--------------------|--------------------|--|
| Freq [MHz] | Gmax [dB] | Pout@ Gmax [W] | P1dB [W] | P2dB [W] | P3dB [W] | Effmax [%] | Pout@ Effmax [W] | Eff P1dB [%] | Eff P2dB [%] | Eff P3dB [%] | |
| 41 | 30.7 | 754.9 | 1489.8 | 1620.9 | 1679.4 | 79.6 | 1681.1 | 77.2 | 79.2 | 79.5 | |

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6.2 Gain & Efficiency @ Frequency=41MHz CW-Pulsed



Figure 2 PCW Gain and Efficiency vs Pout[W]

| Table 2 - | RF Performance | overview |
|-----------|----------------|----------|
| | | |

| Freq [MHz] | Gmax [dB] | Pout@ Gmax [W] | P1dB [W] | P2dB [W] | P3dB [W] | Effmax [%] | Pout@ Effmax [W] | Eff P1dB [%] | Eff P2dB [%] | Eff P3dB [%] |
|---------------|--------------|----------------------|-------------|-------------|-------------|---------------|------------------------|--------------------|--------------------|--------------------|
| 41 | 30.9 | 870.3 | 1582.2 | 1692.4 | 1748.8 | 81.2 | 1746.6 | 79.5 | 80.9 | 81.2 |

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7. Appendix A – PCB Layout and components

7.1 PCB OUTPUT





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7.2 Component list OUTPUT

Table 2: Component list output

| Output Board | | | |
|---|----------------------------------|-----------------|---|
| Component | Value | manufacturer | Remarks |
| C1, C2 | 47pF | ATC | 800B |
| C3 | 82pF | ATC | 800B |
| C4 | 220pF | PPI | Туре 2225 |
| C5, C6 | 47pF | ATC | 800B |
| C7 | 82pF | ATC | 800B |
| C8 | 220pF | PPI | 2225 |
| C9, C10, C13, C14 | 510p | ATC | 100B |
| C11, C15 | 100nf | ТDК | 100Volts |
| C12, C16 | 4u7 | ТDК | 100Volts |
| C17, C18 | 1000uF | | 100Volts Electrolitic |
| C19 - C20 | 680pF | PPI | Туре 2225 |
| C21 - C22 | 680pF | PPI | Туре 2225 |
| S1, S2 | short | | Copper foil |
| L1, L2 | Air coil 6turns, 6mm diameter | | Enamel 1.6 mm copper wire |
| L3 | 66nH | Coilcraft | 1212VS-66NME |
| Board | Ro 4350 double sided | Rogers | Er=3.5 substrate=0.76mm Tcopper= 70um |
| Thermal conductor under Output Balun | Thermipad TP22626 | Mueller Ahlhorn | |
| Baseplate | Copper with cooling channel | | Cavities for coplanar baluns are 5mm deep |

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7.3 PCB INPUT



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7.4 Component list INPUT

| Input Board | | | |
|-------------|---------|--------------|---------|
| Component | Value | manufacturer | remarks |
| C1 | 560pF | ATC | 100B |
| C2 | 470pF | ATC | 100B |
| C3 | 470pF | ATC | 100B |
| C4 | 100pF | ATC | 100B |
| C5 | 100n | ATC | 100B |
| C6 | 100n | ATC | 100B |
| C7, C8 | 1n | ATC | 100B |
| R1 | 22Ohm | | 0812 |
| R2 | 22Ohm | | 0812 |
| Board | Ro 4350 | Rogers | Er=3.5 |

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7.5 Baseplate

The demo amplifier pcb boards are mounted on a full copper base plate. The base plate contains a water channel to supply the amplifier with sufficient cooling.

The base plate contains two cavities for the coplanar baluns. The input balun cavity is air filled. The output balun cavity is filled with a thermal conductive material that has good electrical properties. The material is conducting the heat from the balun, generated as a result of RF losses, to the baseplate. The thermal conductive material is absolutely necessary to cool the coplanar output balun.

A drawing of the base plate is shown below.



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7.6 Photo's Demo Board



Figure 4 Picture Top View Demo Board



Figure 5 Side View Picture Demo Board

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