

Monolithic Amplifiers

50Ω, Broadband, DC to 8 GHz

Features

- InGaP HBT microwave amplifiers
- miniature SOT-89 package
- frequency range, DC to 8 GHz, usable to 10 GHz
- up to 18.2 dBm typ. output power
- excellent package for heat dissipation, exposed metal bottom
- low thermal resistance for high reliability
- protected by US Patent, 6,943,629



CASE STYLE : DF782

+ RoHS compliant in accordance with EU Directive (2002/95/EC)

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications.

Applications

- cellular
- PCS
- communication receivers & transmitters

Electrical Specifications @ 25°C

| | MODEL NO. | FREQ. ^A (GHz) | GAIN, dB Typical | | | | | | | MAXIMUM* POWER, dBm | | DYNAMIC RANGE* | | VSWR (:1) Typ. | | | | MAXIMUM RATING** | | DC OPERATING POWER @ Pin 3*** | | | | THERMAL RESISTANCE θ _{jc} , typ. °C/W | PRICE \$ Qty. (25) | | |
|--------------------|-------------|--------------------------|---------------------------------|------|------|------|------|------|------|----------------------------------|------------------------------|------------------|--------------------|-------------------|-------------------------|--------------------|-------------------------|------------------|-----------|-------------------------------|----------------------------|----|-----|---|-----------------------|-----|------|
| | | | over frequency, GHz | | | | | | | Output (1 dB Comp.) Typ. Min. | Input (no dmg.) Typ. Min. | NF dB Typ. | IP3 dBm Typ. | In DC-3 GHz | 3-f _U GHz | Out DC-3 GHz | 3-f _U GHz | I mA | P mW | Current (mA) Typ Min Max | Device Volt Typ Min Max | | | | | | |
| | | | f _L - f _U | 0.1 | 1 | 2 | 3 | 4 | 6 | 8 | Min. @ 2 GHz | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | | | | | | |
| LOW POWER | Gali-1(+) | DC-8 | 12.7 | 12.5 | 11.8 | 11.3 | 10.5 | 10.5 | 11.0 | 9 | 12.2 | 10.5 | 15 | 4.5 | 27 | 1.3 | 1.7 | 1.4 | 1.8 | 55 | 225 | 40 | 3.4 | 3.0 | 4.1 | 108 | .99 |
| | Gali-21(+) | DC-8 | 14.3 | 13.9 | 13.1 | 12.4 | 11.5 | 11.9 | 9.0 | 11.5 | 12.6 | 10.5 | 15 | 4.0 | 27 | 1.1 | 1.5 | 1.3 | 2.5 | 55 | 225 | 40 | 3.5 | 3.0 | 4.1 | 128 | .99 |
| | Gali-2(+) | DC-8 | 16.2 | 15.8 | 14.8 | 13.7 | 12.7 | 13.2 | 15.1 | 12 | 12.9 | 11.0 | 15 | 4.6 | 27 | 1.6 | 2.5 | 1.6 | 2.6 | 55 | 225 | 40 | 3.5 | 3.0 | 4.1 | 101 | .99 |
| | Gali-33(+) | DC-4 | 19.3 | 18.7 | 17.5 | 16.3 | 15.5 | 15.8 | — | 16 | 13.4 | 11.4 | 13 | 3.9 | 28 | 1.6 | 2.0 | 1.2 | 1.3 | 55 | 265 | 40 | 4.3 | 3.8 | 4.8 | 110 | .99 |
| | Gali-3(+) | DC-3 | 22.4 | 21.1 | 19.1 | 17.3 | 16.1 | 15.8 | — | 17.5 | 12.5 | 10.5 | 13 | 3.5 | 25 | 1.5 | — | 1.2 | — | 55 | 225 | 35 | 3.3 | 3.0 | 4.1 | 127 | .99 |
| INTERMEDIATE POWER | Gali-6F(+) | DC-4 | 12.1 | 12.0 | 11.6 | 11.4 | 10.9 | 12.3 | — | 10 | 15.8 | 14.3 | 20 | 4.5 | 35.5 | 1.5 | 1.5 | 1.9 | 2.2 | 65 | 350 | 50 | 4.8 | 4.2 | 5.4 | 93 | 1.29 |
| | Gali-4F(+) | DC-4 | 14.3 | 14.0 | 13.4 | 13.0 | 12.3 | 13.2 | — | 11 | 15.3 | 13.8 | 20 | 4.0 | 32 | 1.2 | 1.2 | 1.5 | 1.8 | 65 | 325 | 50 | 4.4 | 4.0 | 5.0 | 93 | 1.29 |
| | Gali-51F(+) | DC-4 | 18.0 | 17.3 | 15.9 | 14.8 | 13.4 | 13.3 | — | 14 | 15.9 | 14.4 | 13 | 3.5 | 32 | 1.2 | 1.3 | 1.5 | 1.7 | 65 | 325 | 50 | 4.4 | 4.0 | 5.0 | 78 | 1.29 |
| | Gali-5F(+) | DC-4 | 20.4 | 19.3 | 17.4 | 16.0 | 14.8 | 15.1 | — | 15.5 | 15.7 | 14.2 | 13 | 3.5 | 31.5 | 1.2 | 1.2 | 1.4 | 1.4 | 65 | 325 | 50 | 4.3 | 3.9 | 4.9 | 103 | 1.29 |
| | Gali-55(+) | DC-4 | 21.9 | 20.6 | 18.5 | 17.0 | 15.5 | 15.7 | — | 17 | 15.0 | 13.5 | 13 | 3.3 | 28.5 | 1.25 | 1.35 | 1.3 | 1.5 | 65 | 350 | 50 | 4.3 | 3.8 | 4.8 | 100 | 1.29 |
| | Gali-52(+) | DC-2 | 22.9 | 20.8 | 17.8 | 15.9 | 14.4 | — | — | 16 | 15.5 | 13.5 | 13 | 2.7 | 32 | 1.35 | — | 1.4 | — | 65 | 350 | 50 | 4.4 | 4.0 | 4.8 | 85 | 1.29 |
| MEDIUM POWER | Gali-6(+) | DC-4 | 12.2 | 12.2 | 11.8 | 11.3 | 11.4 | 12.3 | — | 10 | 18.2 | 16.5 | 20 | 4.5 | 35.5 | 1.5 | 1.4 | 1.8 | 2.0 | 85 | 475 | 70 | 5.0 | 4.6 | 5.6 | 93 | 1.49 |
| | Gali-4(+) | DC-4 | 14.4 | 14.1 | 13.5 | 12.9 | 12.5 | 13.1 | — | 11 | 17.5 | 16.0 | 20 | 4.0 | 34 | 1.2 | 1.2 | 1.4 | 1.7 | 85 | 475 | 65 | 4.6 | 4.2 | 5.5 | 93 | 1.49 |
| | Gali-51(+) | DC-4 | 18.1 | 17.5 | 16.1 | 14.7 | 13.7 | 13.4 | — | 14 | 18.0 | 16.5 | 13 | 3.5 | 35 | 1.3 | 1.2 | 1.5 | 1.7 | 85 | 475 | 65 | 4.5 | 4.2 | 5.5 | 78 | 1.49 |
| | Gali-5(+) | DC-4 | 20.6 | 19.4 | 17.5 | 16.0 | 14.9 | 15.1 | — | 16 | 18.0 | 16.0 | 13 | 3.5 | 35 | 1.2 | 1.2 | 1.4 | 1.4 | 85 | 475 | 65 | 4.4 | 4.0 | 4.9 | 103 | 1.49 |

^A Low frequency cutoff determined by external coupling capacitors.
^{*} Models tested at 2 GHz except Gali-4(+),5(+),51(+),52(+),6(+),4F(+),5F(+),51F(+),6F(+)
^{**} Permanent damage may occur if any of these limits are exceeded.
 These ratings are not intended for continuous normal operation.
^{***} Reliability predictions and normal operating conditions are applicable at current specified.

f_U is the upper frequency limit for each model as shown in the table.

Maximum Ratings

| | |
|-----------------------|----------------|
| Operating Temperature | -45°C to 85°C |
| Storage Temperature | -65°C to 150°C |

Pin Configuration

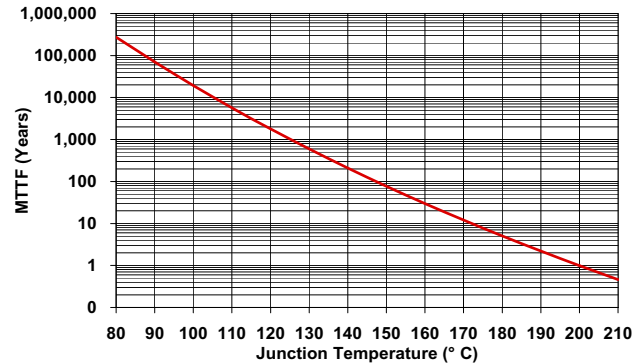
| | |
|--------|---|
| RF IN | 1 |
| RF OUT | 3 |
| DC | 3 |
| GROUND | 2 |

Model Identification

| Model | Marking [†] | Model | Marking [†] |
|-------------|----------------------|------------|----------------------|
| Gali-1(+) | 01 | Gali-5F(+) | 05F |
| Gali-21(+) | 21 | Gali-55(+) | 55 |
| Gali-2(+) | 02 | Gali-52(+) | 52 |
| Gali-33(+) | 33 | Gali-4(+) | 04 |
| Gali-3(+) | 03 | Gali-5(+) | 05 |
| Gali-6F(+) | 06F | Gali-51(+) | 51 |
| Gali-4F(+) | 04F | Gali-6(+) | 06 |
| Gali-51F(+) | 51F | | |

[†] Prefix letter (optional) designates assembly location.
 Suffix letters (optional) are for wafer identification.

MTTF vs. Junction Temp.



designers kits available

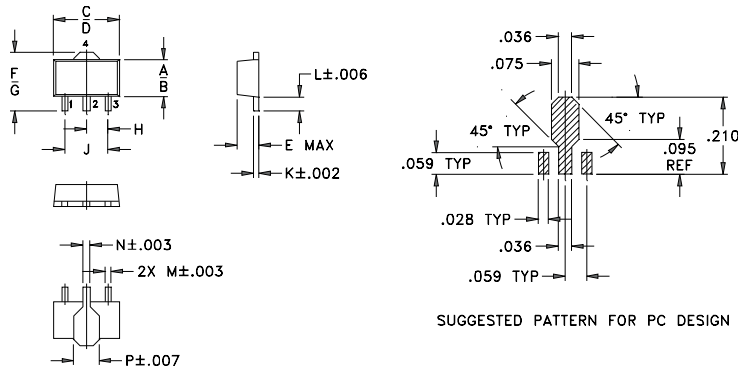
| KIT No. | No. of Units in KIT | Description | Price \$ per KIT |
|---------|---------------------|---|------------------|
| K1-Gali | 90 | Kit includes 1 test board plus 10 of each: Gali-1(+),21(+),2(+),33(+),3(+),6(+),4(+),51(+),5(+) | 99.95 |
| K2-Gali | 50 | Kit includes 1 test board plus 10 of each: Gali-6F(+),4F(+),51F(+),5F(+),55(+) | 64.95 |

REV. Q
 M102713
 D601029
 EE-7974Q
 Gali-SERIES
 RS/YB/FL
 060222

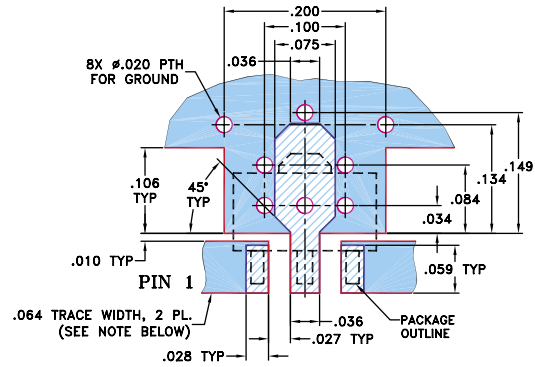
Gali SERIES

Gali SERIES



Outline Drawing



Demo Board MCL P/N: Gali-TB for Gali-1,-2,-21,-3,-33,-4,-5,-51,-6
 Gali-TBF for Gali-55,-52,-4F,-5F,-51F,-6F
 Suggested PCB Layout (PL-019)



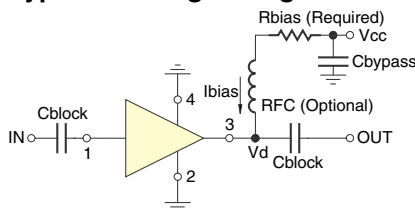
NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS $.030 \pm .002$ ”; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
 2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

-  DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
-  DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

Outline Dimensions (inch/mm)

| A | B | C | D | E | F | G | H |
|------|------|------|------|------|------|-------|------|
| .102 | .090 | .181 | .173 | .063 | .167 | .155 | .059 |
| 2.59 | 2.29 | 4.60 | 4.39 | 1.60 | 4.24 | 3.94 | 1.50 |
| J | K | L | M | N | P | wt | |
| .118 | .015 | .041 | .016 | .019 | .065 | grams | |
| 3.00 | 0.38 | 1.04 | 0.41 | 0.48 | 1.65 | grams | 0.2 |

Typical Biasing Configuration



R BIAS

"1%" Resistor Values (ohms) for Optimum Biasing of Gali Models

| Vcc | Gali-1(+) | Gali-2(+) | Gali-21(+) | Gali-3(+) | Gali-33(+) | Gali-4(+) | Gali-5(+) | Gali-51(+) | Gali-52(+) | Gali-55(+) | Gali-6(+) | Gali-4F(+) | Gali-5F(+) | Gali-51F(+) | Gali-6F(+) |
|-----|-----------|-----------|------------|-----------|------------|-----------|-----------|------------|------------|------------|-----------|------------|------------|-------------|------------|
| 7 | 90.9 | 88.7 | 88.7 | 107 | 69.8 | 38.3 | 40.2 | 40.2 | 51.1 | 52.3 | 30.1 | 51.1 | 52.3 | 52.3 | 49.9 |
| 8 | 113 | 113 | 113 | 133 | 93.1 | 52.3 | 53.6 | 53.6 | 69.8 | 71.5 | 43.2 | 69.8 | 71.5 | 71.5 | 69.8 |
| 9 | 137 | 137 | 137 | 162 | 115 | 66.5 | 68.1 | 68.1 | 88.7 | 90.9 | 56.2 | 90.9 | 90.9 | 90.9 | 88.7 |
| 10 | 162 | 162 | 162 | 191 | 140 | 80.6 | 82.5 | 82.5 | 110 | 110 | 69.8 | 110 | 110 | 110 | 110 |
| 11 | 187 | 187 | 187 | 221 | 165 | 95.3 | 97.6 | 97.6 | 130 | 130 | 84.5 | 130 | 130 | 130 | 127 |
| 12 | 215 | 215 | 210 | 249 | 191 | 110 | 113 | 113 | 150 | 150 | 97.6 | 150 | 150 | 150 | 147 |
| 13 | 237 | 237 | 237 | 280 | 215 | 127 | 127 | 127 | 169 | 169 | 113 | 169 | 169 | 169 | 165 |
| 14 | 261 | 261 | 261 | 309 | 243 | 143 | 143 | 143 | 191 | 191 | 127 | 191 | 191 | 191 | 187 |
| 15 | 287 | 287 | 287 | 340 | 267 | 158 | 158 | 158 | 210 | 215 | 140 | 210 | 210 | 210 | 205 |
| 16 | 309 | 316 | 316 | 365 | 287 | 174 | 174 | 174 | 232 | 232 | 154 | 232 | 232 | 232 | 226 |
| 17 | 332 | 340 | 340 | 392 | 316 | 187 | 191 | 191 | 261 | 249 | 169 | 249 | 249 | 249 | 249 |
| 18 | 357 | 365 | 365 | 422 | 340 | 205 | 205 | 205 | 280 | 274 | 182 | 274 | 274 | 274 | 267 |
| 19 | 383 | 392 | 392 | 453 | 365 | 221 | 221 | 221 | 301 | 287 | 196 | 294 | 294 | 294 | 287 |
| 20 | 412 | 412 | 412 | 475 | 392 | 237 | 237 | 237 | 316 | 309 | 210 | 316 | 316 | 316 | 309 |

S-parameters

Gali-1(+)

$I_d=40\text{mA}$, $V_d=3.4\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|--------|------------------|------|--------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -21.35 | 0.09 | 173.89 | 12.85 | 4.39 | 176.80 | -17.07 | 0.14 | 0.21 | -25.48 | 0.05 | -168.78 | 1.12 |
| 200.00 | -21.57 | 0.08 | 170.88 | 12.73 | 4.33 | 173.04 | -16.56 | 0.15 | -1.63 | -25.53 | 0.05 | -175.83 | 1.10 |
| 400.00 | -21.01 | 0.09 | 157.36 | 12.63 | 4.28 | 166.62 | -16.47 | 0.15 | -3.30 | -24.33 | 0.06 | -175.88 | 1.10 |
| 600.00 | -20.69 | 0.09 | 149.39 | 12.60 | 4.27 | 160.20 | -16.57 | 0.15 | -5.99 | -23.31 | 0.07 | -175.58 | 1.10 |
| 800.00 | -20.13 | 0.10 | 139.42 | 12.51 | 4.22 | 153.80 | -16.66 | 0.15 | -7.51 | -22.28 | 0.08 | -175.06 | 1.11 |
| 1000.00 | -19.63 | 0.10 | 131.52 | 12.42 | 4.18 | 147.56 | -16.71 | 0.15 | -9.67 | -21.28 | 0.09 | -175.71 | 1.12 |
| 1200.00 | -19.27 | 0.11 | 126.91 | 12.34 | 4.14 | 141.43 | -16.72 | 0.15 | -11.36 | -20.22 | 0.10 | -177.50 | 1.12 |
| 1400.00 | -18.93 | 0.11 | 120.14 | 12.21 | 4.08 | 135.29 | -16.79 | 0.14 | -12.98 | -19.58 | 0.11 | -178.22 | 1.13 |
| 1600.00 | -18.47 | 0.12 | 113.65 | 12.09 | 4.02 | 129.26 | -16.86 | 0.14 | -14.60 | -18.45 | 0.12 | -178.97 | 1.14 |
| 1800.00 | -18.29 | 0.12 | 107.64 | 11.97 | 3.97 | 123.34 | -16.93 | 0.14 | -16.99 | -17.71 | 0.13 | -178.73 | 1.16 |
| 2000.00 | -18.00 | 0.13 | 102.53 | 11.83 | 3.90 | 117.68 | -17.02 | 0.14 | -18.06 | -16.93 | 0.14 | -176.58 | 1.17 |
| 2200.00 | -17.89 | 0.13 | 97.35 | 11.71 | 3.85 | 112.00 | -17.01 | 0.14 | -19.91 | -16.51 | 0.15 | -174.48 | 1.18 |
| 2500.00 | -18.29 | 0.12 | 90.73 | 11.53 | 3.77 | 103.55 | -17.22 | 0.14 | -23.17 | -16.02 | 0.16 | -172.05 | 1.20 |
| 2800.00 | -18.37 | 0.12 | 81.33 | 11.35 | 3.69 | 95.34 | -17.22 | 0.14 | -26.31 | -15.45 | 0.17 | -168.54 | 1.22 |
| 3000.00 | -18.50 | 0.12 | 77.88 | 11.24 | 3.65 | 90.11 | -17.27 | 0.14 | -28.47 | -15.35 | 0.17 | -164.85 | 1.23 |
| 3200.00 | -18.76 | 0.12 | 75.27 | 11.12 | 3.60 | 84.74 | -17.41 | 0.13 | -30.65 | -15.32 | 0.17 | -160.95 | 1.25 |
| 3400.00 | -18.93 | 0.11 | 71.78 | 11.02 | 3.56 | 79.30 | -17.50 | 0.13 | -33.23 | -15.13 | 0.18 | -157.32 | 1.27 |
| 3600.00 | -19.24 | 0.11 | 67.55 | 10.94 | 3.52 | 74.16 | -17.62 | 0.13 | -35.53 | -14.95 | 0.18 | -153.02 | 1.28 |
| 3800.00 | -19.19 | 0.11 | 64.69 | 10.84 | 3.48 | 68.84 | -17.80 | 0.13 | -37.60 | -14.64 | 0.19 | -147.79 | 1.31 |
| 4000.00 | -18.90 | 0.11 | 62.38 | 10.76 | 3.45 | 63.59 | -17.91 | 0.13 | -41.36 | -14.29 | 0.19 | -142.20 | 1.32 |
| 4200.00 | -18.65 | 0.12 | 61.76 | 10.66 | 3.41 | 58.52 | -17.98 | 0.13 | -43.82 | -14.05 | 0.20 | -135.91 | 1.34 |
| 4400.00 | -18.61 | 0.12 | 59.65 | 10.61 | 3.39 | 53.49 | -18.12 | 0.12 | -47.19 | -13.61 | 0.21 | -130.52 | 1.35 |
| 4600.00 | -18.44 | 0.12 | 56.86 | 10.54 | 3.37 | 48.53 | -18.29 | 0.12 | -50.20 | -13.11 | 0.22 | -125.27 | 1.38 |
| 4800.00 | -18.10 | 0.12 | 54.96 | 10.48 | 3.34 | 43.21 | -18.42 | 0.12 | -53.77 | -12.41 | 0.24 | -120.09 | 1.39 |
| 5000.00 | -17.63 | 0.13 | 53.91 | 10.44 | 3.33 | 38.06 | -18.54 | 0.12 | -57.18 | -12.00 | 0.25 | -114.65 | 1.40 |
| 5200.00 | -17.09 | 0.14 | 51.96 | 10.39 | 3.31 | 32.95 | -18.71 | 0.12 | -61.19 | -11.54 | 0.26 | -109.59 | 1.42 |
| 5400.00 | -16.88 | 0.14 | 47.70 | 10.38 | 3.30 | 27.98 | -18.83 | 0.11 | -64.53 | -11.04 | 0.28 | -105.82 | 1.42 |
| 5600.00 | -16.88 | 0.14 | 42.51 | 10.44 | 3.33 | 22.92 | -19.05 | 0.11 | -68.51 | -10.65 | 0.29 | -102.35 | 1.43 |
| 5800.00 | -16.62 | 0.15 | 36.92 | 10.54 | 3.37 | 17.82 | -19.06 | 0.11 | -73.41 | -10.18 | 0.31 | -98.77 | 1.41 |
| 6000.00 | -16.29 | 0.15 | 34.75 | 10.61 | 3.39 | 12.13 | -19.17 | 0.11 | -77.23 | -9.75 | 0.33 | -94.79 | 1.40 |
| 6200.00 | -15.54 | 0.17 | 28.79 | 10.76 | 3.45 | 7.01 | -19.26 | 0.11 | -84.32 | -9.55 | 0.33 | -92.40 | 1.39 |
| 6400.00 | -15.75 | 0.16 | 20.35 | 11.03 | 3.56 | 0.45 | -19.46 | 0.11 | -89.66 | -8.89 | 0.36 | -89.68 | 1.36 |
| 6600.00 | -16.06 | 0.16 | 16.33 | 11.16 | 3.61 | -6.84 | -19.53 | 0.11 | -94.96 | -8.23 | 0.39 | -84.72 | 1.33 |
| 6800.00 | -15.40 | 0.17 | 11.66 | 11.26 | 3.66 | -14.28 | -19.60 | 0.10 | -100.70 | -7.65 | 0.41 | -78.61 | 1.31 |
| 7000.00 | -14.70 | 0.18 | 8.06 | 11.31 | 3.68 | -21.99 | -19.54 | 0.11 | -107.73 | -7.25 | 0.43 | -71.41 | 1.27 |
| 7500.00 | -12.86 | 0.23 | 1.52 | 11.46 | 3.74 | -42.43 | -19.49 | 0.11 | -127.26 | -6.02 | 0.50 | -52.45 | 1.18 |
| 8000.00 | -9.86 | 0.32 | -10.25 | 11.19 | 3.63 | -66.93 | -19.71 | 0.10 | -147.14 | -4.76 | 0.58 | -26.30 | 1.10 |

S-parameters

Gali-21(+)

$I_d=40mA$, $V_d=3.5V$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|-------|------------------|------|--------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -27.71 | 0.04 | 5.02 | 14.34 | 5.21 | 176.30 | -18.03 | 0.13 | -2.20 | -24.45 | 0.06 | -12.08 | 1.09 |
| 200.00 | -29.64 | 0.03 | 3.23 | 14.28 | 5.18 | 172.61 | -17.76 | 0.13 | -2.80 | -24.69 | 0.06 | -20.19 | 1.08 |
| 400.00 | -29.04 | 0.04 | 11.17 | 14.23 | 5.15 | 165.77 | -17.50 | 0.13 | -3.52 | -24.28 | 0.06 | -38.44 | 1.07 |
| 600.00 | -28.79 | 0.04 | 23.79 | 14.12 | 5.08 | 158.79 | -17.56 | 0.13 | -5.67 | -23.94 | 0.06 | -56.22 | 1.08 |
| 800.00 | -28.71 | 0.04 | 28.44 | 14.02 | 5.02 | 151.99 | -17.70 | 0.13 | -7.37 | -23.24 | 0.07 | -76.19 | 1.09 |
| 1000.00 | -28.29 | 0.04 | 36.93 | 13.91 | 4.96 | 145.23 | -17.67 | 0.13 | -9.54 | -21.98 | 0.08 | -92.02 | 1.09 |
| 1200.00 | -28.03 | 0.04 | 40.13 | 13.79 | 4.89 | 138.49 | -17.77 | 0.13 | -11.02 | -20.88 | 0.09 | -105.94 | 1.10 |
| 1400.00 | -27.59 | 0.04 | 42.90 | 13.66 | 4.82 | 132.02 | -17.83 | 0.13 | -12.77 | -19.71 | 0.10 | -117.70 | 1.11 |
| 1600.00 | -27.14 | 0.04 | 44.62 | 13.54 | 4.75 | 125.76 | -17.83 | 0.13 | -15.20 | -18.46 | 0.12 | -128.36 | 1.12 |
| 1800.00 | -26.42 | 0.05 | 45.25 | 13.38 | 4.67 | 119.26 | -17.88 | 0.13 | -16.65 | -17.45 | 0.13 | -136.67 | 1.13 |
| 2000.00 | -26.32 | 0.05 | 42.36 | 13.25 | 4.60 | 113.30 | -18.02 | 0.13 | -18.99 | -16.63 | 0.15 | -143.79 | 1.14 |
| 2200.00 | -25.81 | 0.05 | 40.37 | 13.09 | 4.51 | 107.05 | -17.95 | 0.13 | -20.44 | -15.73 | 0.16 | -150.18 | 1.14 |
| 2500.00 | -26.28 | 0.05 | 31.57 | 12.85 | 4.39 | 98.39 | -18.12 | 0.12 | -23.72 | -14.91 | 0.18 | -156.67 | 1.17 |
| 2800.00 | -25.84 | 0.05 | 23.68 | 12.64 | 4.29 | 89.72 | -18.25 | 0.12 | -27.24 | -14.24 | 0.19 | -164.05 | 1.19 |
| 3000.00 | -26.67 | 0.05 | 17.04 | 12.51 | 4.22 | 83.95 | -18.33 | 0.12 | -29.30 | -13.94 | 0.20 | -169.05 | 1.20 |
| 3200.00 | -27.51 | 0.04 | 13.80 | 12.40 | 4.17 | 78.30 | -18.36 | 0.12 | -31.23 | -13.70 | 0.21 | -173.86 | 1.21 |
| 3400.00 | -28.10 | 0.04 | 10.54 | 12.27 | 4.11 | 72.86 | -18.45 | 0.12 | -33.79 | -13.58 | 0.21 | -179.45 | 1.23 |
| 3600.00 | -28.69 | 0.04 | 8.97 | 12.18 | 4.06 | 67.49 | -18.51 | 0.12 | -36.69 | -13.43 | 0.21 | -175.35 | 1.24 |
| 3800.00 | -29.50 | 0.03 | 9.58 | 12.09 | 4.02 | 61.98 | -18.60 | 0.12 | -38.63 | -13.14 | 0.22 | -169.12 | 1.25 |
| 4000.00 | -30.10 | 0.03 | 15.60 | 11.99 | 3.98 | 56.49 | -18.65 | 0.12 | -41.96 | -12.86 | 0.23 | -162.52 | 1.26 |
| 4200.00 | -31.10 | 0.03 | 20.54 | 11.90 | 3.94 | 51.12 | -18.75 | 0.12 | -44.81 | -12.69 | 0.23 | -155.36 | 1.27 |
| 4400.00 | -30.64 | 0.03 | 30.71 | 11.85 | 3.91 | 45.70 | -18.91 | 0.11 | -48.68 | -12.27 | 0.24 | -148.52 | 1.29 |
| 4600.00 | -30.66 | 0.03 | 40.54 | 11.81 | 3.90 | 40.30 | -19.06 | 0.11 | -51.97 | -11.85 | 0.26 | -141.95 | 1.30 |
| 4800.00 | -29.81 | 0.03 | 54.26 | 11.77 | 3.88 | 34.75 | -19.16 | 0.11 | -55.41 | -11.41 | 0.27 | -135.05 | 1.31 |
| 5000.00 | -27.69 | 0.04 | 59.15 | 11.73 | 3.86 | 29.12 | -19.18 | 0.11 | -59.06 | -10.98 | 0.28 | -128.86 | 1.30 |
| 5200.00 | -26.05 | 0.05 | 60.45 | 11.67 | 3.83 | 23.64 | -19.28 | 0.11 | -63.27 | -10.65 | 0.29 | -123.18 | 1.31 |
| 5400.00 | -25.02 | 0.06 | 53.12 | 11.64 | 3.82 | 18.60 | -19.53 | 0.11 | -67.02 | -10.18 | 0.31 | -117.79 | 1.33 |
| 5600.00 | -24.70 | 0.06 | 48.17 | 11.73 | 3.86 | 13.41 | -19.61 | 0.10 | -71.77 | -9.78 | 0.32 | -112.80 | 1.32 |
| 5800.00 | -24.83 | 0.06 | 42.66 | 11.88 | 3.93 | 7.96 | -19.67 | 0.10 | -77.07 | -9.36 | 0.34 | -107.39 | 1.30 |
| 6000.00 | -23.48 | 0.07 | 49.46 | 11.99 | 3.98 | 1.59 | -19.66 | 0.10 | -81.21 | -8.89 | 0.36 | -103.09 | 1.27 |
| 6200.00 | -22.44 | 0.08 | 34.24 | 12.20 | 4.07 | -4.37 | -19.72 | 0.10 | -87.84 | -8.44 | 0.38 | -99.90 | 1.24 |
| 6400.00 | -23.14 | 0.07 | 26.61 | 12.47 | 4.20 | -11.54 | -19.94 | 0.10 | -93.91 | -7.55 | 0.42 | -95.39 | 1.20 |
| 6600.00 | -23.24 | 0.07 | 30.31 | 12.66 | 4.30 | -19.50 | -20.01 | 0.10 | -99.12 | -6.91 | 0.45 | -88.39 | 1.15 |
| 6800.00 | -21.47 | 0.08 | 30.17 | 12.79 | 4.36 | -28.00 | -19.91 | 0.10 | -105.19 | -6.40 | 0.48 | -80.93 | 1.11 |
| 7000.00 | -19.89 | 0.10 | 28.21 | 12.81 | 4.37 | -36.63 | -19.73 | 0.10 | -113.63 | -6.08 | 0.50 | -72.95 | 1.07 |
| 7500.00 | -15.04 | 0.18 | 18.19 | 12.93 | 4.43 | -59.63 | -19.43 | 0.11 | -133.32 | -5.02 | 0.56 | -48.71 | 0.96 |
| 8000.00 | -10.38 | 0.30 | 0.44 | 12.42 | 4.18 | -86.72 | -19.43 | 0.11 | -156.04 | -4.30 | 0.61 | -18.47 | 0.89 |



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S-parameters

Gali-2(+)

$I_d=40\text{mA}$, $V_d=3.5\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|--------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -12.33 | 0.24 | -0.40 | 16.20 | 6.46 | 176.48 | -20.05 | 0.10 | -0.80 | -11.47 | 0.27 | -5.09 | 1.07 |
| 200.00 | -12.22 | 0.25 | -1.44 | 16.07 | 6.36 | 172.74 | -19.64 | 0.10 | -1.07 | -11.55 | 0.26 | -8.06 | 1.06 |
| 400.00 | -12.31 | 0.24 | -1.45 | 15.98 | 6.30 | 165.63 | -19.51 | 0.11 | -3.57 | -11.73 | 0.26 | -16.53 | 1.06 |
| 600.00 | -12.32 | 0.24 | -2.91 | 15.93 | 6.26 | 158.80 | -19.49 | 0.11 | -5.45 | -12.00 | 0.25 | -24.31 | 1.06 |
| 800.00 | -12.38 | 0.24 | -3.86 | 15.80 | 6.17 | 151.85 | -19.61 | 0.10 | -6.33 | -12.27 | 0.24 | -32.85 | 1.07 |
| 1000.00 | -12.32 | 0.24 | -5.12 | 15.66 | 6.07 | 145.18 | -19.56 | 0.11 | -8.23 | -12.55 | 0.24 | -42.07 | 1.07 |
| 1200.00 | -12.33 | 0.24 | -6.85 | 15.51 | 5.96 | 138.73 | -19.67 | 0.10 | -9.78 | -12.76 | 0.23 | -50.95 | 1.08 |
| 1400.00 | -12.29 | 0.24 | -8.36 | 15.34 | 5.85 | 132.14 | -19.72 | 0.10 | -10.96 | -12.95 | 0.23 | -59.93 | 1.10 |
| 1600.00 | -12.19 | 0.25 | -9.49 | 15.15 | 5.72 | 125.98 | -19.92 | 0.10 | -12.40 | -13.06 | 0.22 | -70.15 | 1.12 |
| 1800.00 | -12.06 | 0.25 | -11.56 | 14.95 | 5.59 | 119.81 | -20.02 | 0.10 | -14.42 | -13.13 | 0.22 | -79.29 | 1.13 |
| 2000.00 | -11.98 | 0.25 | -14.07 | 14.75 | 5.46 | 114.04 | -20.20 | 0.10 | -15.65 | -13.12 | 0.22 | -88.89 | 1.15 |
| 2200.00 | -11.82 | 0.26 | -16.62 | 14.54 | 5.33 | 107.98 | -20.34 | 0.10 | -16.61 | -13.03 | 0.22 | -96.36 | 1.17 |
| 2500.00 | -11.52 | 0.27 | -21.86 | 14.21 | 5.13 | 99.68 | -20.61 | 0.09 | -20.05 | -12.88 | 0.23 | -107.16 | 1.21 |
| 2800.00 | -11.24 | 0.27 | -26.46 | 13.93 | 4.97 | 91.68 | -20.85 | 0.09 | -22.68 | -12.76 | 0.23 | -116.73 | 1.25 |
| 3000.00 | -11.10 | 0.28 | -30.41 | 13.74 | 4.86 | 86.50 | -21.00 | 0.09 | -23.56 | -12.68 | 0.23 | -122.47 | 1.28 |
| 3200.00 | -11.02 | 0.28 | -34.24 | 13.55 | 4.76 | 81.34 | -21.29 | 0.09 | -26.10 | -12.67 | 0.23 | -128.05 | 1.32 |
| 3400.00 | -10.90 | 0.29 | -37.61 | 13.39 | 4.67 | 76.19 | -21.59 | 0.08 | -27.63 | -12.67 | 0.23 | -133.86 | 1.36 |
| 3600.00 | -10.78 | 0.29 | -40.97 | 13.24 | 4.59 | 71.27 | -21.69 | 0.08 | -28.51 | -12.73 | 0.23 | -139.32 | 1.39 |
| 3800.00 | -10.69 | 0.29 | -44.00 | 13.09 | 4.51 | 66.38 | -22.01 | 0.08 | -29.47 | -12.77 | 0.23 | -145.92 | 1.43 |
| 4000.00 | -10.64 | 0.29 | -47.43 | 12.96 | 4.45 | 61.46 | -22.36 | 0.08 | -33.09 | -12.86 | 0.23 | -152.89 | 1.49 |
| 4200.00 | -10.57 | 0.30 | -50.51 | 12.84 | 4.39 | 56.87 | -22.73 | 0.07 | -34.52 | -12.89 | 0.23 | -158.19 | 1.55 |
| 4400.00 | -10.40 | 0.30 | -53.03 | 12.78 | 4.36 | 52.12 | -22.97 | 0.07 | -36.42 | -12.86 | 0.23 | -166.17 | 1.59 |
| 4600.00 | -10.40 | 0.30 | -56.52 | 12.70 | 4.32 | 47.14 | -23.16 | 0.07 | -38.88 | -12.70 | 0.23 | -174.34 | 1.62 |
| 4800.00 | -10.39 | 0.30 | -59.39 | 12.60 | 4.27 | 42.34 | -23.65 | 0.07 | -40.64 | -12.53 | 0.24 | 177.06 | 1.70 |
| 5000.00 | -10.42 | 0.30 | -63.24 | 12.52 | 4.23 | 37.33 | -24.09 | 0.06 | -43.58 | -12.35 | 0.24 | 169.87 | 1.78 |
| 5200.00 | -10.30 | 0.31 | -65.16 | 12.45 | 4.19 | 32.66 | -24.25 | 0.06 | -47.87 | -12.14 | 0.25 | 161.86 | 1.81 |
| 5400.00 | -10.03 | 0.32 | -67.67 | 12.40 | 4.17 | 27.91 | -24.78 | 0.06 | -50.46 | -11.85 | 0.26 | 155.80 | 1.90 |
| 5600.00 | -9.62 | 0.33 | -71.01 | 12.42 | 4.18 | 23.67 | -25.44 | 0.05 | -51.79 | -11.50 | 0.27 | 150.70 | 1.99 |
| 5800.00 | -9.16 | 0.35 | -74.91 | 12.56 | 4.25 | 19.04 | -25.83 | 0.05 | -56.10 | -11.07 | 0.28 | 146.02 | 2.01 |
| 6000.00 | -9.02 | 0.35 | -79.61 | 12.62 | 4.28 | 13.96 | -26.47 | 0.05 | -58.84 | -10.57 | 0.30 | 140.66 | 2.10 |
| 6200.00 | -8.32 | 0.38 | -80.88 | 12.84 | 4.39 | 9.61 | -27.72 | 0.04 | -69.79 | -9.84 | 0.32 | 139.39 | 2.27 |
| 6400.00 | -7.49 | 0.42 | -86.84 | 13.13 | 4.53 | 3.26 | -29.51 | 0.03 | -69.85 | -9.04 | 0.35 | 134.45 | 2.51 |
| 6600.00 | -7.18 | 0.44 | -94.09 | 13.29 | 4.62 | -3.47 | -29.35 | 0.03 | -67.82 | -8.25 | 0.39 | 127.55 | 2.31 |
| 6800.00 | -7.01 | 0.45 | -99.80 | 13.46 | 4.71 | -10.29 | -30.17 | 0.03 | -70.19 | -7.73 | 0.41 | 120.60 | 2.39 |
| 7000.00 | -6.76 | 0.46 | -105.51 | 13.61 | 4.79 | -17.28 | -30.45 | 0.03 | -79.04 | -7.03 | 0.45 | 113.80 | 2.32 |
| 7500.00 | -6.37 | 0.48 | -120.75 | 14.17 | 5.11 | -36.19 | -31.73 | 0.03 | -90.15 | -6.05 | 0.50 | 93.82 | 2.29 |
| 8000.00 | -7.11 | 0.44 | -138.78 | 14.65 | 5.40 | -61.00 | -30.03 | 0.03 | -108.71 | -5.04 | 0.56 | 64.61 | 1.73 |

S-parameters

Gali-33(+)

$I_d=40\text{mA}$, $V_d=4.3$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|---------|------------------------|------|--------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -24.23 | 0.06 | 4.64 | 19.23 | 9.15 | 175.70 | -21.75 | 0.08 | 0.02 | -19.84 | 0.10 | -4.83 | 1.04 |
| 200.00 | -23.11 | 0.07 | 20.25 | 19.22 | 9.14 | 171.74 | -21.97 | 0.08 | -2.56 | -19.67 | 0.10 | -7.45 | 1.05 |
| 400.00 | -21.86 | 0.08 | 32.56 | 19.10 | 9.02 | 163.64 | -21.72 | 0.08 | -3.99 | -19.93 | 0.10 | -15.87 | 1.04 |
| 600.00 | -19.78 | 0.10 | 38.90 | 19.00 | 8.91 | 155.86 | -21.54 | 0.08 | -5.09 | -20.56 | 0.09 | -26.67 | 1.04 |
| 800.00 | -18.11 | 0.12 | 39.50 | 18.84 | 8.75 | 148.46 | -21.78 | 0.08 | -7.11 | -21.19 | 0.09 | -37.59 | 1.05 |
| 1000.00 | -16.75 | 0.15 | 37.36 | 18.63 | 8.54 | 140.88 | -21.90 | 0.08 | -7.71 | -21.56 | 0.08 | -48.46 | 1.06 |
| 1200.00 | -15.69 | 0.16 | 34.50 | 18.46 | 8.38 | 133.66 | -22.01 | 0.08 | -9.57 | -22.11 | 0.08 | -59.78 | 1.07 |
| 1400.00 | -14.68 | 0.18 | 30.89 | 18.21 | 8.14 | 126.68 | -22.12 | 0.08 | -10.54 | -21.99 | 0.08 | -73.22 | 1.09 |
| 1600.00 | -13.93 | 0.20 | 25.90 | 17.97 | 7.92 | 119.76 | -22.32 | 0.08 | -13.46 | -21.89 | 0.08 | -86.66 | 1.11 |
| 1800.00 | -13.20 | 0.22 | 21.18 | 17.75 | 7.72 | 113.41 | -22.46 | 0.08 | -13.25 | -21.47 | 0.08 | -99.04 | 1.12 |
| 2000.00 | -12.68 | 0.23 | 15.62 | 17.51 | 7.51 | 106.95 | -22.55 | 0.07 | -15.27 | -20.99 | 0.09 | -109.66 | 1.14 |
| 2200.00 | -12.25 | 0.24 | 9.84 | 17.26 | 7.29 | 100.79 | -22.78 | 0.07 | -16.25 | -20.51 | 0.09 | -115.84 | 1.17 |
| 2500.00 | -11.60 | 0.26 | 0.97 | 16.93 | 7.02 | 91.63 | -23.05 | 0.07 | -18.49 | -19.52 | 0.11 | -124.80 | 1.20 |
| 2800.00 | -11.07 | 0.28 | -7.42 | 16.58 | 6.75 | 83.07 | -23.48 | 0.07 | -20.69 | -18.81 | 0.11 | -131.66 | 1.26 |
| 3000.00 | -10.80 | 0.29 | -13.47 | 16.41 | 6.61 | 77.39 | -23.74 | 0.07 | -22.21 | -18.54 | 0.12 | -135.62 | 1.30 |
| 3200.00 | -10.51 | 0.30 | -19.39 | 16.21 | 6.46 | 71.91 | -24.00 | 0.06 | -22.72 | -18.30 | 0.12 | -139.80 | 1.34 |
| 3400.00 | -10.23 | 0.31 | -24.85 | 16.03 | 6.33 | 66.41 | -24.44 | 0.06 | -23.62 | -17.99 | 0.13 | -144.75 | 1.40 |
| 3600.00 | -9.95 | 0.32 | -30.03 | 15.90 | 6.24 | 61.02 | -24.66 | 0.06 | -25.43 | -17.78 | 0.13 | -148.09 | 1.43 |
| 3800.00 | -9.69 | 0.33 | -35.24 | 15.78 | 6.15 | 55.79 | -25.12 | 0.06 | -25.31 | -17.81 | 0.13 | -153.59 | 1.49 |
| 4000.00 | -9.55 | 0.33 | -39.79 | 15.63 | 6.05 | 50.37 | -25.56 | 0.05 | -27.66 | -17.65 | 0.13 | -159.85 | 1.56 |
| 4200.00 | -9.32 | 0.34 | -44.51 | 15.51 | 5.96 | 45.26 | -26.04 | 0.05 | -28.30 | -17.68 | 0.13 | -166.81 | 1.64 |
| 4400.00 | -9.05 | 0.35 | -48.88 | 15.45 | 5.92 | 40.29 | -26.52 | 0.05 | -29.62 | -17.36 | 0.14 | -173.31 | 1.71 |
| 4600.00 | -8.83 | 0.36 | -53.97 | 15.44 | 5.92 | 34.93 | -27.07 | 0.04 | -29.00 | -16.88 | 0.14 | 178.82 | 1.78 |
| 4800.00 | -8.61 | 0.37 | -58.85 | 15.40 | 5.89 | 29.62 | -27.56 | 0.04 | -29.31 | -16.18 | 0.16 | 170.51 | 1.85 |
| 5000.00 | -8.46 | 0.38 | -63.80 | 15.39 | 5.88 | 24.02 | -28.22 | 0.04 | -30.48 | -15.63 | 0.17 | 161.94 | 1.96 |
| 5200.00 | -8.21 | 0.39 | -67.76 | 15.37 | 5.87 | 18.61 | -28.96 | 0.04 | -31.24 | -15.04 | 0.18 | 155.70 | 2.08 |
| 5400.00 | -7.76 | 0.41 | -72.05 | 15.40 | 5.89 | 13.46 | -29.45 | 0.03 | -33.06 | -14.34 | 0.19 | 150.59 | 2.13 |
| 5600.00 | -7.25 | 0.43 | -77.14 | 15.54 | 5.98 | 8.42 | -30.97 | 0.03 | -31.11 | -13.53 | 0.21 | 147.20 | 2.38 |
| 5800.00 | -6.55 | 0.47 | -83.27 | 15.78 | 6.15 | 2.68 | -32.13 | 0.02 | -30.41 | -12.71 | 0.23 | 144.43 | 2.49 |
| 6000.00 | -6.44 | 0.48 | -89.96 | 15.93 | 6.26 | -3.61 | -32.72 | 0.02 | -28.80 | -11.98 | 0.25 | 140.78 | 2.56 |
| 6200.00 | -5.51 | 0.53 | -93.44 | 16.32 | 6.55 | -9.25 | -36.52 | 0.02 | -19.99 | -10.93 | 0.28 | 141.67 | 3.40 |
| 6400.00 | -4.54 | 0.59 | -103.21 | 16.72 | 6.85 | -17.96 | -36.01 | 0.02 | 3.67 | -9.20 | 0.35 | 134.73 | 2.54 |
| 6600.00 | -4.22 | 0.62 | -112.99 | 16.94 | 7.03 | -26.93 | -33.14 | 0.02 | 9.15 | -8.34 | 0.38 | 126.37 | 1.59 |
| 6800.00 | -3.89 | 0.64 | -122.00 | 17.09 | 7.15 | -35.92 | -33.62 | 0.02 | 10.66 | -7.56 | 0.42 | 117.20 | 1.46 |
| 7000.00 | -3.63 | 0.66 | -131.39 | 17.26 | 7.29 | -45.09 | -32.79 | 0.02 | 10.79 | -6.94 | 0.45 | 110.46 | 1.15 |
| 7500.00 | -3.35 | 0.68 | -158.13 | 17.64 | 7.62 | -71.46 | -31.07 | 0.03 | -0.34 | -5.09 | 0.56 | 86.42 | 0.60 |
| 8000.00 | -4.67 | 0.58 | 166.79 | 17.24 | 7.28 | -104.65 | -32.07 | 0.03 | -46.70 | -4.06 | 0.63 | 51.93 | 0.83 |



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S-parameters

Gali-3 (+)

$I_d=35\text{mA}$, $V_d=3.3\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|-------|--------|------------------------|------|--------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -28.31 | 0.04 | 129.62 | 22.25 | 12.96 | 174.88 | -24.76 | 0.06 | -0.20 | -33.17 | 0.02 | -176.27 | 1.04 |
| 200.00 | -25.44 | 0.05 | 121.54 | 22.16 | 12.82 | 169.66 | -24.06 | 0.06 | 0.66 | -30.94 | 0.03 | -176.36 | 1.02 |
| 400.00 | -21.55 | 0.08 | 96.27 | 21.99 | 12.57 | 160.63 | -23.92 | 0.06 | 0.35 | -30.65 | 0.03 | -176.06 | 1.02 |
| 600.00 | -18.42 | 0.12 | 81.49 | 21.70 | 12.16 | 150.82 | -24.06 | 0.06 | -0.48 | -29.50 | 0.03 | -175.92 | 1.03 |
| 800.00 | -16.58 | 0.15 | 71.48 | 21.37 | 11.71 | 142.05 | -24.09 | 0.06 | -1.42 | -27.35 | 0.04 | -177.16 | 1.04 |
| 1000.00 | -15.19 | 0.17 | 62.50 | 20.99 | 11.21 | 133.66 | -24.04 | 0.06 | -2.32 | -26.07 | 0.05 | -178.72 | 1.04 |
| 1200.00 | -14.25 | 0.19 | 54.52 | 20.58 | 10.69 | 125.57 | -24.03 | 0.06 | -1.87 | -25.01 | 0.06 | -179.91 | 1.05 |
| 1400.00 | -13.55 | 0.21 | 47.17 | 20.16 | 10.19 | 118.23 | -24.06 | 0.06 | -1.96 | -24.14 | 0.06 | 178.19 | 1.07 |
| 1600.00 | -12.97 | 0.22 | 39.78 | 19.78 | 9.75 | 111.51 | -24.10 | 0.06 | -2.57 | -22.92 | 0.07 | 176.26 | 1.09 |
| 1800.00 | -12.48 | 0.24 | 32.86 | 19.37 | 9.30 | 104.51 | -24.10 | 0.06 | -2.00 | -22.10 | 0.08 | 174.61 | 1.10 |
| 2000.00 | -12.13 | 0.25 | 26.09 | 18.99 | 8.90 | 98.16 | -24.37 | 0.06 | -3.28 | -21.60 | 0.08 | 173.49 | 1.14 |
| 2200.00 | -11.81 | 0.26 | 20.10 | 18.59 | 8.50 | 92.03 | -24.28 | 0.06 | -3.17 | -20.93 | 0.09 | 172.38 | 1.16 |
| 2500.00 | -11.49 | 0.27 | 10.09 | 18.01 | 7.95 | 83.38 | -24.35 | 0.06 | -3.19 | -20.73 | 0.09 | 171.12 | 1.20 |
| 2800.00 | -10.95 | 0.28 | 1.30 | 17.51 | 7.51 | 75.24 | -24.58 | 0.06 | -4.02 | -20.35 | 0.10 | 169.73 | 1.25 |
| 3000.00 | -10.82 | 0.29 | -4.71 | 17.22 | 7.26 | 69.85 | -24.69 | 0.06 | -5.16 | -20.22 | 0.10 | 167.80 | 1.29 |
| 3200.00 | -10.73 | 0.29 | -9.76 | 16.93 | 7.02 | 64.60 | -24.69 | 0.06 | -4.69 | -20.30 | 0.10 | 164.83 | 1.32 |
| 3400.00 | -10.61 | 0.29 | -14.58 | 16.66 | 6.81 | 59.60 | -24.80 | 0.06 | -5.15 | -20.42 | 0.10 | 160.89 | 1.35 |
| 3600.00 | -10.49 | 0.30 | -18.99 | 16.42 | 6.62 | 54.58 | -24.92 | 0.06 | -7.04 | -20.31 | 0.10 | 157.09 | 1.39 |
| 3800.00 | -10.34 | 0.30 | -22.87 | 16.18 | 6.44 | 49.89 | -24.99 | 0.06 | -7.20 | -20.46 | 0.09 | 151.84 | 1.42 |
| 4000.00 | -10.20 | 0.31 | -26.82 | 16.03 | 6.33 | 45.15 | -25.33 | 0.05 | -8.37 | -20.07 | 0.10 | 146.03 | 1.47 |
| 4200.00 | -10.17 | 0.31 | -31.67 | 15.86 | 6.21 | 40.08 | -25.32 | 0.05 | -8.76 | -19.91 | 0.10 | 140.14 | 1.49 |
| 4400.00 | -10.06 | 0.31 | -35.89 | 15.73 | 6.12 | 35.32 | -25.71 | 0.05 | -9.95 | -19.21 | 0.11 | 134.56 | 1.55 |
| 4600.00 | -10.00 | 0.32 | -40.82 | 15.63 | 6.05 | 30.41 | -25.80 | 0.05 | -10.38 | -18.57 | 0.12 | 128.27 | 1.57 |
| 4800.00 | -10.02 | 0.32 | -45.09 | 15.53 | 5.98 | 25.40 | -26.05 | 0.05 | -9.92 | -17.61 | 0.13 | 122.87 | 1.62 |
| 5000.00 | -10.00 | 0.32 | -50.00 | 15.45 | 5.92 | 20.33 | -26.15 | 0.05 | -12.76 | -16.92 | 0.14 | 118.07 | 1.63 |
| 5200.00 | -9.95 | 0.32 | -53.87 | 15.37 | 5.87 | 15.57 | -26.45 | 0.05 | -13.73 | -16.55 | 0.15 | 113.73 | 1.69 |
| 5400.00 | -9.58 | 0.33 | -57.94 | 15.33 | 5.84 | 11.12 | -26.85 | 0.05 | -15.07 | -16.49 | 0.15 | 109.57 | 1.74 |
| 5600.00 | -9.08 | 0.35 | -63.27 | 15.45 | 5.92 | 6.64 | -27.50 | 0.04 | -15.68 | -16.62 | 0.15 | 105.92 | 1.81 |
| 5800.00 | -8.44 | 0.38 | -70.03 | 15.65 | 6.06 | 1.87 | -28.14 | 0.04 | -17.01 | -16.29 | 0.15 | 103.89 | 1.84 |
| 6000.00 | -8.54 | 0.37 | -76.17 | 15.82 | 6.18 | -4.08 | -27.99 | 0.04 | -20.88 | -15.70 | 0.16 | 102.27 | 1.78 |
| 6200.00 | -7.55 | 0.42 | -79.31 | 16.16 | 6.43 | -10.04 | -29.48 | 0.03 | -24.03 | -15.16 | 0.17 | 99.97 | 1.92 |
| 6400.00 | -6.60 | 0.47 | -88.45 | 16.47 | 6.66 | -18.01 | -30.29 | 0.03 | -15.93 | -13.24 | 0.22 | 97.48 | 1.85 |
| 6600.00 | -6.44 | 0.48 | -98.36 | 16.61 | 6.77 | -26.00 | -30.22 | 0.03 | -16.00 | -11.98 | 0.25 | 94.69 | 1.75 |
| 6800.00 | -6.28 | 0.49 | -106.54 | 16.72 | 6.85 | -34.53 | -30.50 | 0.03 | -21.50 | -11.31 | 0.27 | 86.84 | 1.73 |
| 7000.00 | -6.21 | 0.49 | -114.44 | 16.79 | 6.91 | -42.76 | -31.35 | 0.03 | -25.13 | -10.86 | 0.29 | 72.50 | 1.83 |
| 7500.00 | -6.44 | 0.48 | -137.28 | 17.17 | 7.22 | -66.02 | -32.94 | 0.02 | -32.84 | -9.01 | 0.35 | 53.87 | 2.00 |
| 8000.00 | -8.92 | 0.36 | -171.92 | 16.97 | 7.06 | -96.13 | -33.69 | 0.02 | -70.63 | -7.50 | 0.42 | 32.01 | 2.39 |

S-parameters

Gali-6F(+)

$I_d=50\text{mA}$, $V_d=4.8\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|---------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -12.49 | 0.24 | -2.52 | 12.05 | 4.00 | 175.95 | -17.04 | 0.14 | 1.17 | -10.29 | 0.31 | -4.87 | 1.11 |
| 200.00 | -12.79 | 0.23 | -3.73 | 12.08 | 4.02 | 172.59 | -17.05 | 0.14 | -3.80 | -10.25 | 0.31 | -8.76 | 1.11 |
| 400.00 | -12.89 | 0.23 | -8.00 | 12.03 | 3.99 | 164.94 | -17.12 | 0.14 | -3.84 | -10.40 | 0.30 | -18.61 | 1.12 |
| 600.00 | -13.02 | 0.22 | -12.13 | 11.97 | 3.97 | 157.66 | -17.01 | 0.14 | -6.84 | -10.54 | 0.30 | -27.90 | 1.12 |
| 800.00 | -13.07 | 0.22 | -16.15 | 11.92 | 3.94 | 150.43 | -17.09 | 0.14 | -8.50 | -10.61 | 0.29 | -37.13 | 1.13 |
| 1000.00 | -13.13 | 0.22 | -20.78 | 11.85 | 3.91 | 143.12 | -17.11 | 0.14 | -11.44 | -10.66 | 0.29 | -47.16 | 1.13 |
| 1200.00 | -13.20 | 0.22 | -24.95 | 11.80 | 3.89 | 135.89 | -17.18 | 0.14 | -13.22 | -10.67 | 0.29 | -57.23 | 1.14 |
| 1400.00 | -13.33 | 0.22 | -29.00 | 11.74 | 3.86 | 128.87 | -17.34 | 0.14 | -15.50 | -10.59 | 0.30 | -67.54 | 1.15 |
| 1600.00 | -13.51 | 0.21 | -33.63 | 11.67 | 3.83 | 121.83 | -17.35 | 0.14 | -17.22 | -10.58 | 0.30 | -76.95 | 1.15 |
| 1800.00 | -13.54 | 0.21 | -38.52 | 11.58 | 3.79 | 114.82 | -17.36 | 0.14 | -20.68 | -10.36 | 0.30 | -86.25 | 1.15 |
| 2000.00 | -13.33 | 0.22 | -43.97 | 11.48 | 3.75 | 108.10 | -17.48 | 0.13 | -22.14 | -10.13 | 0.31 | -95.26 | 1.16 |
| 2200.00 | -13.18 | 0.22 | -48.71 | 11.41 | 3.72 | 101.52 | -17.55 | 0.13 | -24.69 | -9.85 | 0.32 | -103.22 | 1.16 |
| 2500.00 | -12.97 | 0.22 | -56.91 | 11.30 | 3.67 | 91.73 | -17.71 | 0.13 | -28.36 | -9.48 | 0.34 | -114.25 | 1.16 |
| 2800.00 | -12.76 | 0.23 | -66.13 | 11.20 | 3.63 | 81.92 | -17.73 | 0.13 | -31.69 | -9.12 | 0.35 | -123.84 | 1.16 |
| 3000.00 | -12.46 | 0.24 | -72.47 | 11.16 | 3.61 | 75.73 | -17.90 | 0.13 | -34.00 | -8.91 | 0.36 | -130.45 | 1.16 |
| 3200.00 | -12.30 | 0.24 | -78.13 | 11.12 | 3.60 | 69.50 | -17.97 | 0.13 | -36.63 | -8.76 | 0.36 | -136.49 | 1.16 |
| 3400.00 | -12.30 | 0.24 | -83.93 | 11.13 | 3.60 | 63.13 | -17.86 | 0.13 | -38.32 | -8.65 | 0.37 | -143.05 | 1.14 |
| 3600.00 | -12.33 | 0.24 | -90.79 | 11.13 | 3.60 | 56.60 | -18.04 | 0.13 | -41.00 | -8.58 | 0.37 | -149.96 | 1.15 |
| 3800.00 | -12.20 | 0.25 | -97.73 | 11.19 | 3.63 | 50.23 | -17.98 | 0.13 | -43.67 | -8.48 | 0.38 | -157.24 | 1.12 |
| 4000.00 | -11.97 | 0.25 | -104.32 | 11.24 | 3.65 | 43.71 | -18.04 | 0.13 | -46.55 | -8.32 | 0.38 | -165.21 | 1.11 |
| 4200.00 | -11.95 | 0.25 | -109.80 | 11.33 | 3.69 | 37.38 | -17.93 | 0.13 | -49.17 | -8.12 | 0.39 | -173.46 | 1.08 |
| 4400.00 | -11.97 | 0.25 | -115.95 | 11.40 | 3.72 | 30.69 | -17.98 | 0.13 | -52.77 | -7.84 | 0.41 | -177.59 | 1.06 |
| 4600.00 | -11.98 | 0.25 | -123.45 | 11.47 | 3.75 | 23.85 | -17.90 | 0.13 | -56.30 | -7.55 | 0.42 | -168.55 | 1.03 |
| 4800.00 | -11.90 | 0.25 | -131.67 | 11.55 | 3.78 | 16.75 | -17.87 | 0.13 | -59.67 | -7.22 | 0.44 | -159.51 | 0.99 |
| 5000.00 | -11.93 | 0.25 | -139.47 | 11.64 | 3.82 | 9.50 | -17.63 | 0.13 | -64.27 | -6.83 | 0.46 | -149.96 | 0.94 |
| 5200.00 | -12.12 | 0.25 | -146.51 | 11.80 | 3.89 | 2.49 | -17.63 | 0.13 | -69.19 | -6.47 | 0.47 | -141.07 | 0.91 |
| 5400.00 | -12.03 | 0.25 | -153.92 | 11.98 | 3.97 | -4.43 | -17.48 | 0.13 | -73.75 | -6.03 | 0.50 | -132.07 | 0.86 |
| 5600.00 | -11.82 | 0.26 | -162.26 | 12.23 | 4.09 | -11.75 | -17.37 | 0.14 | -78.74 | -5.55 | 0.53 | -123.76 | 0.80 |
| 5800.00 | -11.28 | 0.27 | -170.68 | 12.55 | 4.24 | -20.30 | -17.27 | 0.14 | -83.84 | -4.94 | 0.57 | -114.86 | 0.73 |
| 6000.00 | -10.83 | 0.29 | 177.70 | 12.86 | 4.40 | -29.60 | -17.03 | 0.14 | -89.08 | -4.23 | 0.61 | -105.76 | 0.64 |
| 6200.00 | -10.77 | 0.29 | 166.18 | 13.16 | 4.55 | -39.77 | -16.71 | 0.15 | -95.36 | -3.63 | 0.66 | -95.50 | 0.57 |
| 6400.00 | -10.19 | 0.31 | 152.84 | 13.43 | 4.69 | -50.46 | -16.28 | 0.15 | -102.16 | -3.04 | 0.70 | -84.98 | 0.49 |
| 6600.00 | -9.88 | 0.32 | 134.52 | 13.61 | 4.79 | -62.59 | -15.79 | 0.16 | -110.04 | -2.45 | 0.75 | -72.40 | 0.41 |
| 6800.00 | -9.82 | 0.32 | 116.75 | 13.56 | 4.76 | -75.17 | -15.37 | 0.17 | -119.12 | -2.04 | 0.79 | -58.59 | 0.36 |
| 7000.00 | -9.88 | 0.32 | 97.52 | 13.30 | 4.62 | -87.72 | -15.08 | 0.18 | -128.32 | -1.83 | 0.81 | -44.42 | 0.34 |
| 7500.00 | -8.92 | 0.36 | 43.13 | 12.11 | 4.03 | -120.81 | -14.57 | 0.19 | -154.91 | -1.63 | 0.83 | 6.93 | 0.31 |
| 8000.00 | -7.78 | 0.41 | 0.93 | 9.73 | 3.07 | -150.74 | -15.06 | 0.18 | -179.48 | -2.27 | 0.77 | -26.49 | 0.41 |
| 8500.00 | -7.11 | 0.44 | -21.96 | 6.99 | 2.24 | -171.71 | -15.79 | 0.16 | 165.52 | -3.23 | 0.69 | -47.65 | 0.63 |
| 9000.00 | -7.23 | 0.44 | -33.88 | 4.79 | 1.74 | 170.08 | -16.04 | 0.16 | 154.84 | -4.33 | 0.61 | -60.99 | 0.94 |
| 9500.00 | -7.04 | 0.44 | -32.84 | 2.55 | 1.34 | 157.64 | -15.19 | 0.17 | 149.52 | -6.00 | 0.50 | -61.58 | 1.18 |

S-parameters

Gali-4F(+)

$I_d=50\text{mA}$, $V_d=4.4\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|---------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -35.41 | 0.02 | 167.75 | 14.24 | 5.15 | 175.51 | -18.08 | 0.12 | 1.37 | -26.04 | 0.05 | -24.44 | 1.10 |
| 200.00 | -32.57 | 0.02 | 143.71 | 14.27 | 5.17 | 171.57 | -17.84 | 0.13 | -4.87 | -27.09 | 0.04 | -29.26 | 1.08 |
| 400.00 | -28.78 | 0.04 | 125.45 | 14.17 | 5.11 | 163.14 | -18.03 | 0.13 | -5.07 | -25.39 | 0.05 | -58.22 | 1.10 |
| 600.00 | -26.49 | 0.05 | 106.59 | 14.08 | 5.06 | 155.04 | -17.79 | 0.13 | -8.00 | -23.75 | 0.07 | -80.23 | 1.09 |
| 800.00 | -25.19 | 0.06 | 92.02 | 14.00 | 5.01 | 147.08 | -17.95 | 0.13 | -10.41 | -21.85 | 0.08 | -95.10 | 1.10 |
| 1000.00 | -24.20 | 0.06 | 79.80 | 13.88 | 4.94 | 139.09 | -18.11 | 0.12 | -12.86 | -20.01 | 0.10 | -107.07 | 1.12 |
| 1200.00 | -23.21 | 0.07 | 69.33 | 13.75 | 4.87 | 131.32 | -18.30 | 0.12 | -15.36 | -18.45 | 0.12 | -118.60 | 1.13 |
| 1400.00 | -22.12 | 0.08 | 61.53 | 13.63 | 4.80 | 123.79 | -18.40 | 0.12 | -18.24 | -17.00 | 0.14 | -127.60 | 1.14 |
| 1600.00 | -21.61 | 0.08 | 53.91 | 13.49 | 4.73 | 116.27 | -18.46 | 0.12 | -19.45 | -15.98 | 0.16 | -136.08 | 1.15 |
| 1800.00 | -21.47 | 0.08 | 44.20 | 13.37 | 4.66 | 108.74 | -18.59 | 0.12 | -22.98 | -14.91 | 0.18 | -141.74 | 1.17 |
| 2000.00 | -21.15 | 0.09 | 29.42 | 13.23 | 4.59 | 101.58 | -18.68 | 0.12 | -24.25 | -14.01 | 0.20 | -147.56 | 1.18 |
| 2200.00 | -20.62 | 0.09 | 18.24 | 13.09 | 4.51 | 94.61 | -18.90 | 0.11 | -27.67 | -13.26 | 0.22 | -152.54 | 1.20 |
| 2500.00 | -20.38 | 0.10 | 1.97 | 12.93 | 4.43 | 84.09 | -19.12 | 0.11 | -31.04 | -12.42 | 0.24 | -159.77 | 1.22 |
| 2800.00 | -20.15 | 0.10 | -16.24 | 12.75 | 4.34 | 73.70 | -19.24 | 0.11 | -33.91 | -11.77 | 0.26 | -165.91 | 1.23 |
| 3000.00 | -19.78 | 0.10 | -30.06 | 12.69 | 4.31 | 66.90 | -19.51 | 0.11 | -36.48 | -11.39 | 0.27 | -170.92 | 1.25 |
| 3200.00 | -19.39 | 0.11 | -39.49 | 12.62 | 4.28 | 60.16 | -19.63 | 0.10 | -39.31 | -11.05 | 0.28 | -176.05 | 1.26 |
| 3400.00 | -19.36 | 0.11 | -47.43 | 12.56 | 4.25 | 53.46 | -19.68 | 0.10 | -41.51 | -10.79 | 0.29 | -177.95 | 1.26 |
| 3600.00 | -19.54 | 0.11 | -58.41 | 12.52 | 4.23 | 46.56 | -19.91 | 0.10 | -44.22 | -10.55 | 0.30 | -171.65 | 1.28 |
| 3800.00 | -19.49 | 0.11 | -69.73 | 12.51 | 4.22 | 39.64 | -19.99 | 0.10 | -46.74 | -10.20 | 0.31 | -164.73 | 1.28 |
| 4000.00 | -19.09 | 0.11 | -80.17 | 12.50 | 4.22 | 32.49 | -20.14 | 0.10 | -49.61 | -9.83 | 0.32 | -157.08 | 1.28 |
| 4200.00 | -18.91 | 0.11 | -87.19 | 12.55 | 4.24 | 25.66 | -20.17 | 0.10 | -52.52 | -9.33 | 0.34 | -149.58 | 1.26 |
| 4400.00 | -19.01 | 0.11 | -95.38 | 12.58 | 4.26 | 18.46 | -20.42 | 0.10 | -55.40 | -8.83 | 0.36 | -141.51 | 1.26 |
| 4600.00 | -19.17 | 0.11 | -107.31 | 12.59 | 4.26 | 11.11 | -20.36 | 0.10 | -59.03 | -8.27 | 0.39 | -133.38 | 1.22 |
| 4800.00 | -19.22 | 0.11 | -120.28 | 12.62 | 4.28 | 3.51 | -20.48 | 0.09 | -62.81 | -7.75 | 0.41 | -125.35 | 1.20 |
| 5000.00 | -19.25 | 0.11 | -130.73 | 12.64 | 4.29 | -4.28 | -20.35 | 0.10 | -67.61 | -7.16 | 0.44 | -116.97 | 1.15 |
| 5200.00 | -19.78 | 0.10 | -140.30 | 12.73 | 4.33 | -11.94 | -20.42 | 0.10 | -72.24 | -6.66 | 0.46 | -108.95 | 1.12 |
| 5400.00 | -19.82 | 0.10 | -153.02 | 12.89 | 4.41 | -19.79 | -20.31 | 0.10 | -77.48 | -6.14 | 0.49 | -101.15 | 1.06 |
| 5600.00 | -19.38 | 0.11 | -167.10 | 13.08 | 4.51 | -28.37 | -20.29 | 0.10 | -83.07 | -5.59 | 0.53 | -93.45 | 0.99 |
| 5800.00 | -18.58 | 0.12 | 177.93 | 13.23 | 4.59 | -37.64 | -20.14 | 0.10 | -88.18 | -5.07 | 0.56 | -84.96 | 0.92 |
| 6000.00 | -18.03 | 0.13 | 160.55 | 13.37 | 4.66 | -48.21 | -20.03 | 0.10 | -94.77 | -4.44 | 0.60 | -76.38 | 0.84 |
| 6200.00 | -17.82 | 0.13 | 142.30 | 13.44 | 4.70 | -59.45 | -19.75 | 0.10 | -100.96 | -3.98 | 0.63 | -66.29 | 0.77 |
| 6400.00 | -16.51 | 0.15 | 121.63 | 13.43 | 4.69 | -70.95 | -19.39 | 0.11 | -108.81 | -3.58 | 0.66 | -56.26 | 0.70 |
| 6600.00 | -15.38 | 0.17 | 96.66 | 13.27 | 4.61 | -83.84 | -19.14 | 0.11 | -118.18 | -3.23 | 0.69 | -44.47 | 0.64 |
| 6800.00 | -14.48 | 0.19 | 76.07 | 12.86 | 4.40 | -95.86 | -18.83 | 0.11 | -126.86 | -3.00 | 0.71 | -32.30 | 0.61 |
| 7000.00 | -13.57 | 0.21 | 55.91 | 12.31 | 4.13 | -107.60 | -18.57 | 0.12 | -136.09 | -2.97 | 0.71 | -20.12 | 0.62 |
| 7500.00 | -10.27 | 0.31 | 11.94 | 10.58 | 3.38 | -136.70 | -18.23 | 0.12 | -160.93 | -2.93 | 0.71 | -10.31 | 0.64 |
| 8000.00 | -8.29 | 0.39 | -16.46 | 8.11 | 2.54 | -162.52 | -18.35 | 0.12 | 178.08 | -3.37 | 0.68 | -35.81 | 0.80 |
| 8500.00 | -7.17 | 0.44 | -30.94 | 5.58 | 1.90 | 178.82 | -18.44 | 0.12 | 165.43 | -3.91 | 0.64 | -51.25 | 1.06 |
| 9000.00 | -7.00 | 0.45 | -39.42 | 3.49 | 1.49 | 161.98 | -18.28 | 0.12 | 157.65 | -4.67 | 0.58 | -61.79 | 1.41 |
| 9500.00 | -6.59 | 0.47 | -38.33 | 1.49 | 1.19 | 150.55 | -16.61 | 0.15 | 154.20 | -5.90 | 0.51 | -61.37 | 1.57 |
| 10000.00 | -7.03 | 0.45 | -38.63 | 0.78 | 1.09 | 138.80 | -14.25 | 0.19 | 152.13 | -6.54 | 0.47 | -63.80 | 1.40 |



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S-parameters

Gali-51F(+)

$I_d=50\text{mA}$, $V_d=4.4\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|---------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -23.13 | 0.07 | 5.83 | 17.95 | 7.90 | 174.92 | -20.46 | 0.09 | 3.23 | -18.44 | 0.12 | -14.91 | 1.04 |
| 200.00 | -23.59 | 0.07 | 1.29 | 17.97 | 7.92 | 170.54 | -20.57 | 0.09 | -4.00 | -18.48 | 0.12 | -17.92 | 1.04 |
| 400.00 | -23.96 | 0.06 | 8.86 | 17.83 | 7.79 | 161.08 | -20.75 | 0.09 | -2.62 | -18.67 | 0.12 | -38.21 | 1.05 |
| 600.00 | -23.28 | 0.07 | 14.19 | 17.67 | 7.65 | 152.02 | -20.65 | 0.09 | -5.03 | -18.39 | 0.12 | -56.73 | 1.05 |
| 800.00 | -22.68 | 0.07 | 13.15 | 17.48 | 7.48 | 143.25 | -20.62 | 0.09 | -5.31 | -17.85 | 0.13 | -74.81 | 1.06 |
| 1000.00 | -22.04 | 0.08 | 12.53 | 17.25 | 7.29 | 134.59 | -20.79 | 0.09 | -6.52 | -17.15 | 0.14 | -91.05 | 1.08 |
| 1200.00 | -21.58 | 0.08 | 11.14 | 17.00 | 7.08 | 126.13 | -20.75 | 0.09 | -8.00 | -16.23 | 0.15 | -106.11 | 1.08 |
| 1400.00 | -21.17 | 0.09 | 9.27 | 16.73 | 6.86 | 118.13 | -20.88 | 0.09 | -8.96 | -15.28 | 0.17 | -118.60 | 1.10 |
| 1600.00 | -21.09 | 0.09 | 7.18 | 16.45 | 6.65 | 110.27 | -20.89 | 0.09 | -9.66 | -14.62 | 0.19 | -130.43 | 1.11 |
| 1800.00 | -20.83 | 0.09 | 1.39 | 16.18 | 6.44 | 102.57 | -20.96 | 0.09 | -11.54 | -13.79 | 0.20 | -139.13 | 1.12 |
| 2000.00 | -20.29 | 0.10 | -6.62 | 15.88 | 6.22 | 95.26 | -20.89 | 0.09 | -12.40 | -13.06 | 0.22 | -147.39 | 1.13 |
| 2200.00 | -19.86 | 0.10 | -12.14 | 15.59 | 6.02 | 88.27 | -21.04 | 0.09 | -13.78 | -12.41 | 0.24 | -154.37 | 1.15 |
| 2500.00 | -19.68 | 0.10 | -23.99 | 15.20 | 5.75 | 77.98 | -21.00 | 0.09 | -15.71 | -11.73 | 0.26 | -163.41 | 1.17 |
| 2800.00 | -19.57 | 0.11 | -36.54 | 14.82 | 5.51 | 67.79 | -20.93 | 0.09 | -18.29 | -11.15 | 0.28 | -171.72 | 1.18 |
| 3000.00 | -19.20 | 0.11 | -46.66 | 14.59 | 5.36 | 61.28 | -21.08 | 0.09 | -19.38 | -10.88 | 0.29 | -177.15 | 1.20 |
| 3200.00 | -19.15 | 0.11 | -53.48 | 14.36 | 5.22 | 54.82 | -21.12 | 0.09 | -21.12 | -10.56 | 0.30 | -177.05 | 1.21 |
| 3400.00 | -19.37 | 0.11 | -59.87 | 14.16 | 5.11 | 48.46 | -20.97 | 0.09 | -22.67 | -10.35 | 0.30 | -170.71 | 1.21 |
| 3600.00 | -19.66 | 0.10 | -68.76 | 13.99 | 5.01 | 42.02 | -21.05 | 0.09 | -24.39 | -10.09 | 0.31 | -164.39 | 1.22 |
| 3800.00 | -19.82 | 0.10 | -78.82 | 13.81 | 4.90 | 35.49 | -21.04 | 0.09 | -26.54 | -9.74 | 0.33 | -157.54 | 1.22 |
| 4000.00 | -19.65 | 0.10 | -88.04 | 13.65 | 4.81 | 28.85 | -21.07 | 0.09 | -28.55 | -9.41 | 0.34 | -150.63 | 1.23 |
| 4200.00 | -19.67 | 0.10 | -93.78 | 13.54 | 4.75 | 22.51 | -20.99 | 0.09 | -31.03 | -8.93 | 0.36 | -143.95 | 1.21 |
| 4400.00 | -20.04 | 0.10 | -100.10 | 13.41 | 4.68 | 16.17 | -21.06 | 0.09 | -33.28 | -8.42 | 0.38 | -136.92 | 1.21 |
| 4600.00 | -20.54 | 0.09 | -109.60 | 13.25 | 4.60 | 9.63 | -21.07 | 0.09 | -36.32 | -7.95 | 0.40 | -130.13 | 1.20 |
| 4800.00 | -20.80 | 0.09 | -121.02 | 13.09 | 4.51 | 2.93 | -21.13 | 0.09 | -39.64 | -7.51 | 0.42 | -123.56 | 1.20 |
| 5000.00 | -21.09 | 0.09 | -130.08 | 12.94 | 4.44 | -3.89 | -21.03 | 0.09 | -43.28 | -7.06 | 0.44 | -116.82 | 1.18 |
| 5200.00 | -21.86 | 0.08 | -134.90 | 12.85 | 4.39 | -10.30 | -21.16 | 0.09 | -47.08 | -6.67 | 0.46 | -110.70 | 1.18 |
| 5400.00 | -22.00 | 0.08 | -142.54 | 12.82 | 4.38 | -16.79 | -21.04 | 0.09 | -51.70 | -6.24 | 0.49 | -105.12 | 1.14 |
| 5600.00 | -21.56 | 0.08 | -149.66 | 12.83 | 4.38 | -23.67 | -21.15 | 0.09 | -55.85 | -5.89 | 0.51 | -99.95 | 1.12 |
| 5800.00 | -20.85 | 0.09 | -158.99 | 12.82 | 4.38 | -31.05 | -21.30 | 0.09 | -59.99 | -5.52 | 0.53 | -94.16 | 1.09 |
| 6000.00 | -20.12 | 0.10 | -170.34 | 12.81 | 4.37 | -39.22 | -21.37 | 0.09 | -65.26 | -5.05 | 0.56 | -88.80 | 1.05 |
| 6200.00 | -20.06 | 0.10 | -178.23 | 12.78 | 4.36 | -47.77 | -21.36 | 0.09 | -69.95 | -4.74 | 0.58 | -82.55 | 1.02 |
| 6400.00 | -19.31 | 0.11 | -168.98 | 12.71 | 4.32 | -56.25 | -21.31 | 0.09 | -75.70 | -4.43 | 0.60 | -76.67 | 0.97 |
| 6600.00 | -19.30 | 0.11 | -149.98 | 12.62 | 4.28 | -65.74 | -21.26 | 0.09 | -82.31 | -4.09 | 0.62 | -69.39 | 0.93 |
| 6800.00 | -19.23 | 0.11 | -133.65 | 12.35 | 4.14 | -74.88 | -21.10 | 0.09 | -89.18 | -3.90 | 0.64 | -61.18 | 0.91 |
| 7000.00 | -19.45 | 0.11 | -116.40 | 12.00 | 3.98 | -84.04 | -21.02 | 0.09 | -96.86 | -3.84 | 0.64 | -53.10 | 0.93 |
| 7500.00 | -17.46 | 0.13 | -57.20 | 11.14 | 3.61 | -108.11 | -20.71 | 0.09 | -119.98 | -3.51 | 0.67 | -29.97 | 0.92 |
| 8000.00 | -13.71 | 0.21 | -16.55 | 9.61 | 3.02 | -133.12 | -20.75 | 0.09 | -144.24 | -3.59 | 0.66 | -5.38 | 1.04 |
| 8500.00 | -11.08 | 0.28 | -6.16 | 7.55 | 2.39 | -153.52 | -20.65 | 0.09 | -164.05 | -3.98 | 0.63 | -13.40 | 1.28 |
| 9000.00 | -10.33 | 0.30 | -16.96 | 5.67 | 1.92 | -172.41 | -20.69 | 0.09 | -179.32 | -4.67 | 0.58 | -26.97 | 1.66 |
| 9500.00 | -9.15 | 0.35 | -14.08 | 3.44 | 1.49 | -174.11 | -19.14 | 0.11 | -171.16 | -5.74 | 0.52 | -26.58 | 1.88 |
| 10000.00 | -9.21 | 0.35 | -9.10 | 2.48 | 1.33 | -161.14 | -16.98 | 0.14 | -163.88 | -6.08 | 0.50 | -25.74 | 1.68 |



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S-parameters

Gali-5F(+)

$I_d=50\text{mA}$, $V_d=4.3\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|-------|---------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -24.49 | 0.06 | 158.23 | 20.20 | 10.23 | 173.98 | -21.51 | 0.08 | 1.40 | -35.09 | 0.02 | -120.80 | 1.01 |
| 200.00 | -24.32 | 0.06 | 143.18 | 20.14 | 10.16 | 168.82 | -22.33 | 0.08 | -4.00 | -34.12 | 0.02 | -142.70 | 1.03 |
| 400.00 | -22.53 | 0.07 | 120.48 | 19.91 | 9.90 | 158.17 | -22.43 | 0.08 | -0.63 | -30.03 | 0.03 | -145.04 | 1.04 |
| 600.00 | -20.74 | 0.09 | 101.45 | 19.63 | 9.58 | 148.05 | -22.20 | 0.08 | -1.26 | -26.68 | 0.05 | -149.38 | 1.04 |
| 800.00 | -19.86 | 0.10 | 86.32 | 19.31 | 9.24 | 138.42 | -22.07 | 0.08 | -0.55 | -24.60 | 0.06 | -151.66 | 1.05 |
| 1000.00 | -19.16 | 0.11 | 72.80 | 18.95 | 8.86 | 129.19 | -22.20 | 0.08 | -1.85 | -22.62 | 0.07 | -156.93 | 1.07 |
| 1200.00 | -18.45 | 0.12 | 62.01 | 18.56 | 8.47 | 120.42 | -22.17 | 0.08 | -1.87 | -21.10 | 0.09 | -162.07 | 1.08 |
| 1400.00 | -17.75 | 0.13 | 53.32 | 18.16 | 8.09 | 112.21 | -22.22 | 0.08 | -3.20 | -19.63 | 0.10 | -167.17 | 1.10 |
| 1600.00 | -17.42 | 0.13 | 45.37 | 17.76 | 7.73 | 104.42 | -22.11 | 0.08 | -2.26 | -18.74 | 0.12 | -174.27 | 1.11 |
| 1800.00 | -17.33 | 0.14 | 36.04 | 17.39 | 7.40 | 96.70 | -22.04 | 0.08 | -4.73 | -17.96 | 0.13 | -177.19 | 1.13 |
| 2000.00 | -17.13 | 0.14 | 24.55 | 17.01 | 7.09 | 89.54 | -21.91 | 0.08 | -4.58 | -17.26 | 0.14 | -179.20 | 1.14 |
| 2200.00 | -16.77 | 0.15 | 15.41 | 16.65 | 6.80 | 82.80 | -22.04 | 0.08 | -5.73 | -16.78 | 0.14 | -176.12 | 1.17 |
| 2500.00 | -16.61 | 0.15 | 2.31 | 16.16 | 6.43 | 72.86 | -21.86 | 0.08 | -7.55 | -16.40 | 0.15 | -170.46 | 1.19 |
| 2800.00 | -16.48 | 0.15 | -11.57 | 15.73 | 6.12 | 63.13 | -21.64 | 0.08 | -9.55 | -16.31 | 0.15 | -166.07 | 1.20 |
| 3000.00 | -16.33 | 0.15 | -21.92 | 15.47 | 5.94 | 56.95 | -21.69 | 0.08 | -10.31 | -16.24 | 0.15 | -161.66 | 1.22 |
| 3200.00 | -16.15 | 0.16 | -29.72 | 15.24 | 5.78 | 50.90 | -21.72 | 0.08 | -13.13 | -16.18 | 0.16 | -157.48 | 1.24 |
| 3400.00 | -16.08 | 0.16 | -36.57 | 15.03 | 5.64 | 44.94 | -21.58 | 0.08 | -13.79 | -16.17 | 0.16 | -151.27 | 1.24 |
| 3600.00 | -16.20 | 0.15 | -44.40 | 14.86 | 5.53 | 38.82 | -21.61 | 0.08 | -16.39 | -16.10 | 0.16 | -144.81 | 1.26 |
| 3800.00 | -16.14 | 0.16 | -53.21 | 14.70 | 5.43 | 32.88 | -21.71 | 0.08 | -18.07 | -15.78 | 0.16 | -138.34 | 1.28 |
| 4000.00 | -15.86 | 0.16 | -62.36 | 14.56 | 5.35 | 26.79 | -21.74 | 0.08 | -20.36 | -15.47 | 0.17 | -130.69 | 1.29 |
| 4200.00 | -15.57 | 0.17 | -67.91 | 14.50 | 5.31 | 20.79 | -21.60 | 0.08 | -22.80 | -14.87 | 0.18 | -124.92 | 1.27 |
| 4400.00 | -15.39 | 0.17 | -73.80 | 14.44 | 5.27 | 14.78 | -21.77 | 0.08 | -25.00 | -14.26 | 0.19 | -117.94 | 1.28 |
| 4600.00 | -15.36 | 0.17 | -81.68 | 14.36 | 5.22 | 8.74 | -21.75 | 0.08 | -28.37 | -13.65 | 0.21 | -111.12 | 1.28 |
| 4800.00 | -15.31 | 0.17 | -90.47 | 14.32 | 5.20 | 2.43 | -21.96 | 0.08 | -30.55 | -13.03 | 0.22 | -105.00 | 1.29 |
| 5000.00 | -15.07 | 0.18 | -97.65 | 14.29 | 5.18 | -3.99 | -21.94 | 0.08 | -34.93 | -12.33 | 0.24 | -98.18 | 1.27 |
| 5200.00 | -14.87 | 0.18 | -102.67 | 14.34 | 5.21 | -10.08 | -22.00 | 0.08 | -37.92 | -11.82 | 0.26 | -92.05 | 1.26 |
| 5400.00 | -14.25 | 0.19 | -109.43 | 14.47 | 5.29 | -16.39 | -22.18 | 0.08 | -42.29 | -11.43 | 0.27 | -86.80 | 1.25 |
| 5600.00 | -13.37 | 0.21 | -117.17 | 14.68 | 5.42 | -23.29 | -22.33 | 0.08 | -46.97 | -11.10 | 0.28 | -82.19 | 1.22 |
| 5800.00 | -12.37 | 0.24 | -127.25 | 14.90 | 5.56 | -30.87 | -22.61 | 0.07 | -50.44 | -10.67 | 0.29 | -77.65 | 1.19 |
| 6000.00 | -11.45 | 0.27 | -138.70 | 15.16 | 5.73 | -39.28 | -23.01 | 0.07 | -54.88 | -10.04 | 0.31 | -74.06 | 1.16 |
| 6200.00 | -10.65 | 0.29 | -148.53 | 15.41 | 5.90 | -48.43 | -23.12 | 0.07 | -58.79 | -9.62 | 0.33 | -68.13 | 1.11 |
| 6400.00 | -9.72 | 0.33 | -162.31 | 15.58 | 6.01 | -58.05 | -23.17 | 0.07 | -63.29 | -9.14 | 0.35 | -63.69 | 1.04 |
| 6600.00 | -9.35 | 0.34 | -177.40 | 15.72 | 6.11 | -69.61 | -23.28 | 0.07 | -69.05 | -8.49 | 0.38 | -56.23 | 0.99 |
| 6800.00 | -8.93 | 0.36 | -168.35 | 15.63 | 6.05 | -80.45 | -23.35 | 0.07 | -74.97 | -7.96 | 0.40 | -47.51 | 0.96 |
| 7000.00 | -8.64 | 0.37 | -153.74 | 15.48 | 5.94 | -91.52 | -23.39 | 0.07 | -81.98 | -7.55 | 0.42 | -38.22 | 0.93 |
| 7500.00 | -7.98 | 0.40 | -107.57 | 14.87 | 5.54 | -122.38 | -23.13 | 0.07 | -106.18 | -6.18 | 0.49 | -11.73 | 0.83 |
| 8000.00 | -7.35 | 0.43 | -59.16 | 12.93 | 4.43 | -154.21 | -23.84 | 0.06 | -134.09 | -5.63 | 0.52 | -15.15 | 0.98 |
| 8500.00 | -6.36 | 0.48 | -24.02 | 10.18 | 3.23 | -179.09 | -24.13 | 0.06 | -153.45 | -5.51 | 0.53 | -32.27 | 1.27 |
| 9000.00 | -5.72 | 0.52 | -2.91 | 7.36 | 2.33 | -159.81 | -24.51 | 0.06 | -168.45 | -5.87 | 0.51 | -43.65 | 1.80 |
| 9500.00 | -5.03 | 0.56 | -6.12 | 4.43 | 1.67 | -148.47 | -22.02 | 0.08 | -172.64 | -6.44 | 0.48 | -40.75 | 1.74 |
| 10000.00 | -4.97 | 0.56 | -10.58 | 2.99 | 1.41 | -137.52 | -18.42 | 0.12 | -179.30 | -6.55 | 0.47 | -42.50 | 1.36 |

S-parameters

Gali-55(+)

$I_d=50\text{mA}$, $V_d=4.3\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|--------|------------------|-------|--------|------------------------|------|--------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -23.11 | 0.07 | 170.27 | 21.67 | 12.12 | 174.25 | -22.96 | 0.07 | -3.30 | -26.31 | 0.05 | 164.97 | 1.01 |
| 200.00 | -22.01 | 0.08 | 158.52 | 21.68 | 12.13 | 168.52 | -24.16 | 0.06 | -0.20 | -27.15 | 0.04 | 179.80 | 1.04 |
| 400.00 | -20.79 | 0.09 | 126.20 | 21.42 | 11.78 | 158.16 | -23.76 | 0.06 | -1.25 | -26.68 | 0.05 | -166.26 | 1.03 |
| 600.00 | -20.33 | 0.10 | 108.48 | 21.11 | 11.36 | 147.98 | -23.72 | 0.07 | -0.95 | -24.69 | 0.06 | -164.52 | 1.04 |
| 800.00 | -19.04 | 0.11 | 94.87 | 20.74 | 10.89 | 138.40 | -23.68 | 0.07 | -0.90 | -22.89 | 0.07 | -165.95 | 1.05 |
| 1000.00 | -18.35 | 0.12 | 82.31 | 20.33 | 10.39 | 129.31 | -23.71 | 0.07 | -1.01 | -21.05 | 0.09 | -167.77 | 1.07 |
| 1200.00 | -17.77 | 0.13 | 71.96 | 19.90 | 9.89 | 120.80 | -23.53 | 0.07 | -1.79 | -19.68 | 0.10 | -171.93 | 1.08 |
| 1400.00 | -17.41 | 0.13 | 63.16 | 19.46 | 9.40 | 113.00 | -23.44 | 0.07 | -0.88 | -18.62 | 0.12 | -174.85 | 1.09 |
| 1600.00 | -17.08 | 0.14 | 54.81 | 19.02 | 8.93 | 105.36 | -23.58 | 0.07 | -2.55 | -17.71 | 0.13 | -178.98 | 1.12 |
| 1800.00 | -16.87 | 0.14 | 45.50 | 18.60 | 8.51 | 98.25 | -23.32 | 0.07 | -3.06 | -16.93 | 0.14 | 177.16 | 1.13 |
| 2000.00 | -16.78 | 0.14 | 36.29 | 18.19 | 8.12 | 91.31 | -23.29 | 0.07 | -3.85 | -16.48 | 0.15 | 173.79 | 1.15 |
| 2200.00 | -16.50 | 0.15 | 28.78 | 17.79 | 7.75 | 84.90 | -23.31 | 0.07 | -4.80 | -16.16 | 0.16 | 170.36 | 1.18 |
| 2500.00 | -16.32 | 0.15 | 17.61 | 17.27 | 7.30 | 75.53 | -23.18 | 0.07 | -6.66 | -16.06 | 0.16 | 165.52 | 1.20 |
| 2800.00 | -16.29 | 0.15 | 6.23 | 16.81 | 6.93 | 66.61 | -23.19 | 0.07 | -8.72 | -16.01 | 0.16 | 160.05 | 1.24 |
| 3000.00 | -16.18 | 0.16 | -2.09 | 16.53 | 6.71 | 60.85 | -23.19 | 0.07 | -10.00 | -16.31 | 0.15 | 155.27 | 1.26 |
| 3200.00 | -16.08 | 0.16 | -8.83 | 16.28 | 6.52 | 55.19 | -23.07 | 0.07 | -11.92 | -16.43 | 0.15 | 149.70 | 1.27 |
| 3400.00 | -15.82 | 0.16 | -13.59 | 16.04 | 6.34 | 49.66 | -23.18 | 0.07 | -13.91 | -16.47 | 0.15 | 143.70 | 1.30 |
| 3600.00 | -15.92 | 0.16 | -18.28 | 15.85 | 6.20 | 44.03 | -23.39 | 0.07 | -17.17 | -16.57 | 0.15 | 136.68 | 1.35 |
| 3800.00 | -16.04 | 0.16 | -24.75 | 15.68 | 6.08 | 38.57 | -23.27 | 0.07 | -18.97 | -16.47 | 0.15 | 129.87 | 1.35 |
| 4000.00 | -15.85 | 0.16 | -30.76 | 15.54 | 5.98 | 33.08 | -23.41 | 0.07 | -21.85 | -16.19 | 0.16 | 122.39 | 1.37 |
| 4200.00 | -15.68 | 0.16 | -35.14 | 15.43 | 5.91 | 27.65 | -23.50 | 0.07 | -24.76 | -15.65 | 0.17 | 115.35 | 1.39 |
| 4400.00 | -15.53 | 0.17 | -39.71 | 15.36 | 5.86 | 22.37 | -23.75 | 0.07 | -27.86 | -15.09 | 0.18 | 108.61 | 1.42 |
| 4600.00 | -15.58 | 0.17 | -43.16 | 15.31 | 5.83 | 16.62 | -23.85 | 0.06 | -30.59 | -14.37 | 0.19 | 102.40 | 1.43 |
| 4800.00 | -15.76 | 0.16 | -47.63 | 15.26 | 5.79 | 10.99 | -24.12 | 0.06 | -35.86 | -13.62 | 0.21 | 96.89 | 1.46 |
| 5000.00 | -15.63 | 0.17 | -52.04 | 15.22 | 5.77 | 5.27 | -24.31 | 0.06 | -39.76 | -12.90 | 0.23 | 90.70 | 1.48 |
| 5200.00 | -15.18 | 0.17 | -54.98 | 15.24 | 5.78 | -0.17 | -24.62 | 0.06 | -43.83 | -12.37 | 0.24 | 84.93 | 1.50 |
| 5400.00 | -14.60 | 0.19 | -59.29 | 15.37 | 5.87 | -5.72 | -24.82 | 0.06 | -49.50 | -11.99 | 0.25 | 79.84 | 1.50 |
| 5600.00 | -13.92 | 0.20 | -65.50 | 15.56 | 6.00 | -11.63 | -25.13 | 0.06 | -53.29 | -11.59 | 0.26 | 74.63 | 1.50 |
| 5800.00 | -13.25 | 0.22 | -73.66 | 15.81 | 6.17 | -18.04 | -25.61 | 0.05 | -60.79 | -11.40 | 0.27 | 69.37 | 1.51 |
| 6000.00 | -12.58 | 0.24 | -84.83 | 16.15 | 6.42 | -25.24 | -26.30 | 0.05 | -66.89 | -11.04 | 0.28 | 65.64 | 1.54 |

S-parameters

Gali-52(+)

$I_d=50\text{mA}$, $V_d=4.4\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|--------|------------------|-------|--------|------------------------|------|--------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -25.79 | 0.05 | 170.16 | 23.53 | 15.01 | 173.44 | -25.60 | 0.05 | -0.48 | -30.08 | 0.03 | -169.13 | 1.03 |
| 200.00 | -22.83 | 0.07 | 151.76 | 23.38 | 14.76 | 168.02 | -24.90 | 0.06 | 0.80 | -28.80 | 0.04 | -163.00 | 1.01 |
| 400.00 | -21.77 | 0.08 | 127.57 | 23.10 | 14.29 | 156.77 | -25.20 | 0.06 | 1.22 | -25.82 | 0.05 | -159.69 | 1.03 |
| 500.00 | -20.90 | 0.09 | 116.51 | 22.92 | 14.00 | 151.47 | -25.27 | 0.05 | 2.60 | -24.69 | 0.06 | -158.23 | 1.03 |
| 600.00 | -20.44 | 0.10 | 106.81 | 22.71 | 13.66 | 146.20 | -24.93 | 0.06 | 3.72 | -23.66 | 0.07 | -160.20 | 1.03 |
| 700.00 | -19.90 | 0.10 | 99.39 | 22.51 | 13.35 | 141.23 | -24.93 | 0.06 | 3.03 | -22.67 | 0.07 | -160.33 | 1.04 |
| 800.00 | -19.40 | 0.11 | 92.83 | 22.27 | 12.99 | 136.34 | -24.75 | 0.06 | 5.05 | -21.70 | 0.08 | -162.9 | 1.04 |
| 1000.00 | -18.52 | 0.12 | 80.82 | 21.76 | 12.25 | 127.05 | -24.69 | 0.06 | 4.35 | -20.15 | 0.10 | -168.5 | 1.05 |
| 1200.00 | -18.15 | 0.12 | 71.89 | 21.23 | 11.52 | 118.65 | -24.67 | 0.06 | 4.55 | -18.94 | 0.11 | -174.03 | 1.07 |
| 1400.00 | -17.90 | 0.13 | 62.84 | 20.72 | 10.86 | 110.59 | -24.31 | 0.06 | 6.26 | -17.95 | 0.13 | -178.13 | 1.07 |
| 1600.00 | -17.56 | 0.13 | 54.86 | 20.20 | 10.23 | 103.15 | -24.13 | 0.06 | 6.03 | -17.07 | 0.14 | 177.73 | 1.09 |
| 1800.00 | -17.35 | 0.14 | 47.01 | 19.69 | 9.65 | 96.09 | -24.07 | 0.06 | 6.09 | -16.35 | 0.15 | 173.59 | 1.11 |
| 2000.00 | -17.24 | 0.14 | 41.23 | 19.19 | 9.11 | 89.54 | -23.84 | 0.06 | 5.24 | -15.77 | 0.16 | 170.06 | 1.12 |
| 2200.00 | -17.25 | 0.14 | 34.26 | 18.74 | 8.65 | 83.16 | -23.63 | 0.07 | 5.96 | -15.49 | 0.17 | 166.1 | 1.13 |
| 2500.00 | -17.31 | 0.14 | 22.62 | 18.11 | 8.04 | 74.36 | -23.51 | 0.07 | 4.03 | -15.20 | 0.17 | 161.21 | 1.16 |
| 2600.00 | -17.21 | 0.14 | 18.66 | 17.90 | 7.85 | 71.51 | -23.49 | 0.07 | 3.65 | -15.07 | 0.18 | 159.13 | 1.17 |
| 2700.00 | -17.29 | 0.14 | 15.22 | 17.69 | 7.66 | 68.72 | -23.18 | 0.07 | 3.42 | -15.10 | 0.18 | 157.55 | 1.16 |
| 2800.00 | -17.31 | 0.14 | 12.35 | 17.54 | 7.53 | 66.06 | -23.24 | 0.07 | 3.07 | -14.94 | 0.18 | 155.95 | 1.18 |
| 3000.00 | -17.24 | 0.14 | 6.19 | 17.21 | 7.25 | 60.56 | -23.08 | 0.07 | 0.38 | -14.96 | 0.18 | 151.48 | 1.19 |
| 3200.00 | -17.39 | 0.14 | 0.01 | 16.89 | 6.99 | 55.3 | -22.76 | 0.07 | -0.52 | -14.96 | 0.18 | 146.6 | 1.19 |
| 3400.00 | -17.42 | 0.13 | -7.15 | 16.60 | 6.76 | 50.12 | -22.92 | 0.07 | -2.61 | -14.93 | 0.18 | 141.84 | 1.22 |
| 3600.00 | -17.18 | 0.14 | -13.17 | 16.36 | 6.58 | 45.24 | -22.85 | 0.07 | -5.3 | -14.80 | 0.18 | 136.68 | 1.24 |
| 3800.00 | -17.13 | 0.14 | -18.38 | 16.11 | 6.39 | 40.07 | -22.88 | 0.07 | -7.71 | -14.69 | 0.18 | 130.52 | 1.26 |
| 4000.00 | -17.08 | 0.14 | -22.34 | 15.91 | 6.24 | 35.29 | -22.89 | 0.07 | -9.57 | -14.53 | 0.19 | 123.68 | 1.27 |
| 4200.00 | -16.81 | 0.14 | -26.57 | 15.72 | 6.11 | 30.61 | -23.10 | 0.07 | -12.81 | -14.37 | 0.19 | 116.34 | 1.31 |
| 4400.00 | -16.38 | 0.15 | -32.91 | 15.59 | 6.02 | 25.84 | -23.24 | 0.07 | -14.33 | -14.27 | 0.19 | 110.82 | 1.33 |
| 4600.00 | -15.91 | 0.16 | -37.63 | 15.51 | 5.96 | 21.18 | -23.40 | 0.07 | -17.85 | -13.83 | 0.20 | 104.94 | 1.35 |
| 4800.00 | -15.37 | 0.17 | -42.25 | 15.43 | 5.91 | 16.5 | -23.63 | 0.07 | -19.9 | -13.42 | 0.21 | 99.16 | 1.37 |
| 5000.00 | -14.75 | 0.18 | -46.87 | 15.38 | 5.87 | 11.81 | -24.21 | 0.06 | -24.74 | -13.15 | 0.22 | 92.66 | 1.43 |
| 5200.00 | -14.00 | 0.20 | -52.05 | 15.40 | 5.89 | 7.58 | -24.50 | 0.06 | -27.9 | -12.93 | 0.23 | 86.81 | 1.45 |
| 5400.00 | -12.82 | 0.23 | -59.33 | 15.52 | 5.97 | 3.53 | -25.31 | 0.05 | -31.63 | -13.00 | 0.22 | 81.83 | 1.52 |
| 5600.00 | -11.49 | 0.27 | -68.45 | 15.73 | 6.12 | -0.69 | -26.14 | 0.05 | -34.32 | -13.15 | 0.22 | 77.08 | 1.57 |
| 5800.00 | -10.10 | 0.31 | -77.91 | 16.06 | 6.35 | -5.19 | -27.52 | 0.04 | -36.48 | -13.68 | 0.21 | 73.34 | 1.70 |

S-parameters

Gali-6(+)

$I_d=70\text{mA}$, $V_d=5.2\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|--------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -13.11 | 0.22 | -1.78 | 12.27 | 4.11 | 176.37 | -17.52 | 0.13 | 0.09 | -10.83 | 0.29 | -4.48 | 1.14 |
| 200.00 | -13.17 | 0.22 | -4.07 | 12.27 | 4.11 | 173.30 | -17.36 | 0.14 | -2.04 | -10.64 | 0.29 | -8.24 | 1.12 |
| 400.00 | -13.40 | 0.21 | -7.61 | 12.20 | 4.07 | 166.51 | -17.24 | 0.14 | -2.87 | -10.79 | 0.29 | -16.30 | 1.12 |
| 600.00 | -13.46 | 0.21 | -10.92 | 12.20 | 4.07 | 159.80 | -17.09 | 0.14 | -4.96 | -10.91 | 0.28 | -25.30 | 1.11 |
| 800.00 | -13.65 | 0.21 | -14.78 | 12.16 | 4.06 | 153.49 | -17.19 | 0.14 | -7.13 | -10.99 | 0.28 | -34.35 | 1.12 |
| 1000.00 | -13.86 | 0.20 | -18.70 | 12.11 | 4.03 | 146.91 | -17.26 | 0.14 | -8.10 | -11.07 | 0.28 | -43.57 | 1.13 |
| 1200.00 | -14.10 | 0.20 | -23.11 | 12.10 | 4.03 | 140.29 | -17.29 | 0.14 | -10.06 | -11.19 | 0.28 | -52.63 | 1.13 |
| 1400.00 | -14.31 | 0.19 | -27.60 | 12.00 | 3.98 | 134.03 | -17.38 | 0.14 | -12.02 | -11.13 | 0.28 | -61.94 | 1.14 |
| 1600.00 | -14.37 | 0.19 | -31.90 | 11.96 | 3.96 | 127.59 | -17.36 | 0.14 | -14.06 | -11.05 | 0.28 | -71.77 | 1.14 |
| 1800.00 | -14.60 | 0.19 | -35.68 | 11.91 | 3.94 | 121.35 | -17.35 | 0.14 | -15.67 | -10.93 | 0.28 | -81.40 | 1.14 |
| 2000.00 | -14.68 | 0.18 | -39.78 | 11.85 | 3.91 | 115.14 | -17.44 | 0.13 | -17.71 | -10.75 | 0.29 | -90.13 | 1.14 |
| 2200.00 | -14.79 | 0.18 | -45.82 | 11.77 | 3.88 | 109.00 | -17.52 | 0.13 | -19.20 | -10.53 | 0.30 | -98.23 | 1.14 |
| 2500.00 | -14.69 | 0.18 | -54.24 | 11.68 | 3.84 | 99.71 | -17.62 | 0.13 | -22.21 | -10.06 | 0.31 | -109.17 | 1.14 |
| 2800.00 | -14.59 | 0.19 | -61.79 | 11.59 | 3.80 | 90.81 | -17.73 | 0.13 | -25.60 | -9.71 | 0.33 | -119.42 | 1.15 |
| 3000.00 | -14.51 | 0.19 | -68.62 | 11.57 | 3.79 | 84.95 | -17.75 | 0.13 | -26.94 | -9.53 | 0.33 | -125.84 | 1.14 |
| 3200.00 | -14.46 | 0.19 | -75.84 | 11.52 | 3.77 | 79.05 | -17.82 | 0.13 | -28.48 | -9.33 | 0.34 | -131.94 | 1.13 |
| 3400.00 | -14.31 | 0.19 | -81.85 | 11.48 | 3.75 | 73.12 | -17.91 | 0.13 | -30.68 | -9.13 | 0.35 | -138.37 | 1.13 |
| 3600.00 | -14.17 | 0.20 | -87.49 | 11.50 | 3.76 | 67.36 | -17.94 | 0.13 | -33.01 | -8.98 | 0.36 | -145.13 | 1.12 |
| 3800.00 | -14.19 | 0.20 | -94.16 | 11.51 | 3.76 | 61.50 | -17.96 | 0.13 | -35.04 | -8.83 | 0.36 | -152.00 | 1.11 |
| 4000.00 | -14.32 | 0.19 | -101.64 | 11.54 | 3.78 | 55.40 | -17.97 | 0.13 | -37.60 | -8.68 | 0.37 | -158.99 | 1.10 |
| 4200.00 | -14.36 | 0.19 | -108.34 | 11.54 | 3.78 | 49.59 | -17.98 | 0.13 | -40.17 | -8.54 | 0.37 | -166.23 | 1.09 |
| 4400.00 | -14.21 | 0.19 | -115.66 | 11.62 | 3.81 | 43.53 | -18.01 | 0.13 | -42.83 | -8.35 | 0.38 | -173.83 | 1.07 |
| 4600.00 | -14.21 | 0.19 | -123.75 | 11.69 | 3.84 | 37.32 | -18.02 | 0.13 | -45.46 | -8.06 | 0.40 | -178.02 | 1.05 |
| 4800.00 | -14.33 | 0.19 | -132.43 | 11.74 | 3.86 | 30.99 | -18.08 | 0.12 | -49.02 | -7.62 | 0.42 | -169.32 | 1.02 |
| 5000.00 | -14.29 | 0.19 | -141.59 | 11.79 | 3.89 | 24.52 | -17.95 | 0.13 | -52.14 | -7.24 | 0.43 | -161.22 | 0.98 |
| 5200.00 | -14.28 | 0.19 | -148.95 | 11.84 | 3.91 | 18.11 | -18.04 | 0.13 | -56.05 | -6.81 | 0.46 | -153.59 | 0.96 |
| 5400.00 | -14.02 | 0.20 | -155.52 | 11.97 | 3.97 | 12.16 | -17.94 | 0.13 | -59.48 | -6.29 | 0.48 | -147.45 | 0.91 |
| 5600.00 | -13.61 | 0.21 | -163.06 | 12.23 | 4.09 | 5.62 | -17.97 | 0.13 | -63.39 | -5.62 | 0.52 | -141.04 | 0.84 |
| 5800.00 | -13.41 | 0.21 | -171.66 | 12.48 | 4.21 | -1.89 | -17.77 | 0.13 | -67.75 | -4.96 | 0.57 | -133.75 | 0.77 |
| 6000.00 | -13.09 | 0.22 | -178.67 | 12.58 | 4.26 | -9.76 | -17.72 | 0.13 | -73.10 | -4.57 | 0.59 | -125.51 | 0.72 |
| 6200.00 | -12.53 | 0.24 | -173.56 | 12.90 | 4.42 | -17.01 | -17.74 | 0.13 | -78.12 | -3.96 | 0.63 | -119.11 | 0.65 |
| 6400.00 | -11.77 | 0.26 | -162.98 | 13.21 | 4.58 | -26.65 | -17.49 | 0.13 | -83.48 | -3.15 | 0.70 | -109.52 | 0.53 |
| 6600.00 | -11.19 | 0.28 | -149.14 | 13.36 | 4.66 | -36.92 | -17.11 | 0.14 | -88.91 | -2.58 | 0.74 | -99.08 | 0.44 |
| 6800.00 | -10.85 | 0.29 | -134.68 | 13.42 | 4.69 | -47.34 | -16.81 | 0.14 | -96.76 | -2.08 | 0.79 | -88.48 | 0.37 |
| 7000.00 | -10.43 | 0.30 | -120.13 | 13.41 | 4.68 | -58.60 | -16.41 | 0.15 | -104.52 | -1.69 | 0.82 | -77.97 | 0.31 |
| 7500.00 | -9.24 | 0.35 | -77.01 | 12.97 | 4.45 | -88.04 | -15.78 | 0.16 | -129.58 | -1.11 | 0.88 | -47.05 | 0.21 |

S-parameters

Gali-4 (+)

$I_d=65\text{mA}$, $V_d=4.6\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|---------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -29.62 | 0.03 | 166.71 | 14.42 | 5.26 | 175.82 | -17.88 | 0.13 | -0.70 | -29.62 | 0.03 | -25.76 | 1.08 |
| 200.00 | -28.55 | 0.04 | 156.69 | 14.41 | 5.25 | 172.21 | -18.10 | 0.12 | -2.70 | -30.03 | 0.03 | -29.73 | 1.09 |
| 400.00 | -26.43 | 0.05 | 140.55 | 14.33 | 5.21 | 164.43 | -18.01 | 0.13 | -4.26 | -29.17 | 0.03 | -61.45 | 1.09 |
| 600.00 | -25.29 | 0.05 | 122.00 | 14.28 | 5.18 | 156.97 | -17.97 | 0.13 | -6.55 | -26.15 | 0.05 | -87.46 | 1.09 |
| 800.00 | -24.18 | 0.06 | 111.79 | 14.19 | 5.12 | 149.81 | -18.16 | 0.12 | -8.76 | -23.77 | 0.06 | -104.28 | 1.10 |
| 1000.00 | -23.24 | 0.07 | 101.25 | 14.08 | 5.06 | 142.36 | -18.25 | 0.12 | -10.37 | -21.69 | 0.08 | -115.89 | 1.11 |
| 1200.00 | -22.62 | 0.07 | 92.56 | 14.01 | 5.02 | 135.16 | -18.37 | 0.12 | -13.21 | -20.17 | 0.10 | -125.89 | 1.12 |
| 1400.00 | -21.99 | 0.08 | 83.52 | 13.87 | 4.94 | 128.09 | -18.50 | 0.12 | -14.43 | -18.64 | 0.12 | -133.77 | 1.14 |
| 1600.00 | -21.61 | 0.08 | 74.94 | 13.75 | 4.87 | 121.05 | -18.55 | 0.12 | -16.86 | -17.18 | 0.14 | -141.27 | 1.15 |
| 1800.00 | -21.20 | 0.09 | 66.14 | 13.64 | 4.81 | 114.32 | -18.63 | 0.12 | -18.49 | -16.07 | 0.16 | -147.20 | 1.15 |
| 2000.00 | -21.10 | 0.09 | 56.92 | 13.50 | 4.73 | 107.53 | -18.82 | 0.11 | -20.35 | -15.11 | 0.18 | -152.66 | 1.17 |
| 2200.00 | -21.23 | 0.09 | 48.04 | 13.38 | 4.67 | 100.91 | -18.94 | 0.11 | -22.13 | -14.34 | 0.19 | -157.45 | 1.19 |
| 2500.00 | -21.44 | 0.08 | 32.53 | 13.21 | 4.58 | 90.96 | -19.21 | 0.11 | -25.36 | -13.34 | 0.22 | -163.58 | 1.21 |
| 2800.00 | -21.62 | 0.08 | 15.80 | 13.03 | 4.48 | 81.34 | -19.41 | 0.11 | -28.65 | -12.58 | 0.24 | -169.59 | 1.24 |
| 3000.00 | -21.93 | 0.08 | 4.86 | 12.96 | 4.45 | 75.05 | -19.59 | 0.10 | -30.12 | -12.14 | 0.25 | -173.99 | 1.25 |
| 3200.00 | -22.22 | 0.08 | -7.21 | 12.87 | 4.40 | 68.68 | -19.71 | 0.10 | -31.74 | -11.75 | 0.26 | -178.63 | 1.26 |
| 3400.00 | -22.39 | 0.08 | -18.28 | 12.79 | 4.36 | 62.33 | -19.90 | 0.10 | -33.85 | -11.40 | 0.27 | -176.46 | 1.28 |
| 3600.00 | -22.41 | 0.08 | -29.76 | 12.73 | 4.33 | 55.99 | -20.03 | 0.10 | -35.77 | -11.05 | 0.28 | -170.73 | 1.29 |
| 3800.00 | -22.37 | 0.08 | -41.38 | 12.73 | 4.33 | 49.83 | -20.27 | 0.10 | -37.47 | -10.70 | 0.29 | -166.13 | 1.30 |
| 4000.00 | -22.96 | 0.07 | -51.06 | 12.67 | 4.30 | 43.23 | -20.40 | 0.10 | -40.12 | -10.25 | 0.31 | -159.70 | 1.31 |
| 4200.00 | -23.16 | 0.07 | -59.66 | 12.64 | 4.29 | 36.89 | -20.52 | 0.09 | -42.38 | -9.84 | 0.32 | -153.21 | 1.31 |
| 4400.00 | -23.41 | 0.07 | -70.51 | 12.64 | 4.29 | 30.52 | -20.66 | 0.09 | -44.30 | -9.36 | 0.34 | -147.02 | 1.31 |
| 4600.00 | -24.13 | 0.06 | -84.05 | 12.65 | 4.29 | 23.57 | -20.90 | 0.09 | -46.92 | -8.83 | 0.36 | -140.41 | 1.31 |
| 4800.00 | -24.70 | 0.06 | -97.50 | 12.64 | 4.29 | 16.96 | -21.03 | 0.09 | -49.62 | -8.22 | 0.39 | -134.15 | 1.29 |
| 5000.00 | -25.01 | 0.06 | -111.36 | 12.62 | 4.28 | 10.17 | -21.13 | 0.09 | -53.08 | -7.64 | 0.42 | -127.83 | 1.28 |
| 5200.00 | -25.46 | 0.05 | -124.20 | 12.65 | 4.29 | 3.17 | -21.28 | 0.09 | -56.28 | -7.05 | 0.44 | -121.82 | 1.25 |
| 5400.00 | -24.85 | 0.06 | -139.73 | 12.73 | 4.33 | -3.57 | -21.34 | 0.09 | -59.46 | -6.48 | 0.47 | -116.70 | 1.21 |
| 5600.00 | -23.95 | 0.06 | -153.41 | 12.87 | 4.40 | -10.96 | -21.59 | 0.08 | -63.23 | -5.86 | 0.51 | -111.17 | 1.16 |
| 5800.00 | -22.98 | 0.07 | -166.36 | 13.02 | 4.48 | -18.93 | -21.46 | 0.08 | -66.99 | -5.26 | 0.55 | -105.35 | 1.08 |
| 6000.00 | -22.19 | 0.08 | 174.18 | 13.07 | 4.50 | -27.12 | -21.49 | 0.08 | -71.79 | -4.77 | 0.58 | -99.04 | 1.02 |
| 6200.00 | -21.64 | 0.08 | 164.52 | 13.31 | 4.63 | -35.65 | -21.55 | 0.08 | -78.11 | -4.10 | 0.62 | -93.41 | 0.93 |
| 6400.00 | -19.70 | 0.10 | 149.32 | 13.45 | 4.70 | -46.50 | -21.51 | 0.08 | -83.07 | -3.41 | 0.68 | -85.01 | 0.81 |
| 6600.00 | -18.08 | 0.12 | 127.82 | 13.36 | 4.66 | -57.35 | -21.34 | 0.09 | -89.24 | -2.98 | 0.71 | -75.69 | 0.72 |
| 6800.00 | -17.13 | 0.14 | 108.08 | 13.17 | 4.56 | -68.14 | -21.16 | 0.09 | -98.52 | -2.64 | 0.74 | -66.54 | 0.66 |
| 7000.00 | -15.88 | 0.16 | 89.35 | 12.88 | 4.41 | -79.20 | -20.78 | 0.09 | -106.57 | -2.40 | 0.76 | -57.29 | 0.61 |
| 7500.00 | -12.45 | 0.24 | 44.61 | 11.88 | 3.93 | -107.41 | -20.35 | 0.10 | -132.88 | -2.20 | 0.78 | 31.18 | 0.55 |

S-parameters

Gali-51(+)

$I_d=65\text{mA}$, $V_d=4.5\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|------|---------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -24.65 | 0.06 | -0.53 | 18.19 | 8.12 | 175.21 | -20.96 | 0.09 | 0.08 | -19.58 | 0.11 | -10.86 | 1.05 |
| 200.00 | -24.92 | 0.06 | 0.24 | 18.16 | 8.09 | 171.17 | -20.93 | 0.09 | -1.13 | -19.13 | 0.11 | -17.82 | 1.05 |
| 400.00 | -25.35 | 0.05 | 0.46 | 18.06 | 8.00 | 162.73 | -20.93 | 0.09 | -1.23 | -19.21 | 0.11 | -34.15 | 1.05 |
| 600.00 | -25.19 | 0.06 | 4.64 | 17.93 | 7.88 | 154.38 | -20.69 | 0.09 | -2.41 | -19.06 | 0.11 | -52.95 | 1.05 |
| 800.00 | -25.17 | 0.06 | 2.92 | 17.76 | 7.73 | 146.49 | -20.84 | 0.09 | -2.73 | -18.62 | 0.12 | -70.55 | 1.06 |
| 1000.00 | -25.27 | 0.05 | 3.08 | 17.55 | 7.54 | 138.52 | -20.85 | 0.09 | -3.65 | -17.99 | 0.13 | -86.59 | 1.06 |
| 1200.00 | -25.51 | 0.05 | -0.07 | 17.37 | 7.39 | 130.84 | -20.87 | 0.09 | -4.34 | -17.31 | 0.14 | -100.54 | 1.07 |
| 1400.00 | -25.39 | 0.05 | -2.63 | 17.10 | 7.16 | 123.43 | -20.87 | 0.09 | -4.25 | -16.40 | 0.15 | -113.01 | 1.08 |
| 1600.00 | -25.22 | 0.05 | -7.83 | 16.84 | 6.95 | 116.21 | -20.86 | 0.09 | -5.69 | -15.42 | 0.17 | -124.09 | 1.09 |
| 1800.00 | -25.09 | 0.06 | -11.02 | 16.59 | 6.75 | 109.29 | -20.89 | 0.09 | -6.01 | -14.62 | 0.19 | -133.70 | 1.10 |
| 2000.00 | -24.98 | 0.06 | -17.23 | 16.31 | 6.54 | 102.51 | -20.93 | 0.09 | -7.05 | -13.92 | 0.20 | -141.77 | 1.11 |
| 2200.00 | -24.96 | 0.06 | -27.49 | 16.06 | 6.35 | 95.98 | -20.96 | 0.09 | -7.45 | -13.36 | 0.21 | -148.59 | 1.12 |
| 2500.00 | -24.16 | 0.06 | -43.03 | 15.67 | 6.07 | 86.39 | -20.93 | 0.09 | -8.58 | -12.55 | 0.24 | -156.67 | 1.13 |
| 2800.00 | -23.22 | 0.07 | -54.13 | 15.31 | 5.83 | 77.27 | -20.94 | 0.09 | -10.39 | -11.91 | 0.25 | -164.71 | 1.15 |
| 3000.00 | -22.96 | 0.07 | -66.09 | 15.12 | 5.70 | 71.33 | -20.91 | 0.09 | -11.46 | -11.66 | 0.26 | -170.40 | 1.15 |
| 3200.00 | -22.43 | 0.08 | -77.33 | 14.91 | 5.57 | 65.38 | -21.02 | 0.09 | -11.72 | -11.42 | 0.27 | -175.52 | 1.17 |
| 3400.00 | -21.69 | 0.08 | -86.33 | 14.70 | 5.43 | 59.56 | -21.01 | 0.09 | -13.38 | -11.16 | 0.28 | -179.06 | 1.17 |
| 3600.00 | -20.97 | 0.09 | -93.36 | 14.55 | 5.34 | 53.77 | -20.97 | 0.09 | -14.30 | -10.94 | 0.28 | -173.32 | 1.17 |
| 3800.00 | -20.68 | 0.09 | -101.59 | 14.39 | 5.24 | 47.99 | -21.03 | 0.09 | -15.46 | -10.68 | 0.29 | -166.88 | 1.18 |
| 4000.00 | -20.51 | 0.09 | -109.88 | 14.27 | 5.17 | 42.46 | -20.97 | 0.09 | -17.39 | -10.57 | 0.30 | -161.93 | 1.18 |
| 4200.00 | -20.13 | 0.10 | -119.91 | 14.15 | 5.10 | 36.50 | -20.95 | 0.09 | -19.13 | -10.08 | 0.31 | -155.62 | 1.18 |
| 4400.00 | -19.70 | 0.10 | -128.93 | 14.04 | 5.04 | 30.71 | -20.93 | 0.09 | -20.79 | -9.72 | 0.33 | -148.88 | 1.17 |
| 4600.00 | -19.30 | 0.11 | -137.95 | 13.95 | 4.98 | 24.84 | -20.98 | 0.09 | -23.13 | -9.27 | 0.34 | -141.95 | 1.16 |
| 4800.00 | -19.06 | 0.11 | -148.38 | 13.86 | 4.93 | 18.95 | -21.05 | 0.09 | -25.32 | -8.72 | 0.37 | -135.25 | 1.16 |
| 5000.00 | -18.69 | 0.12 | -157.78 | 13.75 | 4.87 | 13.03 | -21.10 | 0.09 | -28.25 | -8.23 | 0.39 | -128.98 | 1.15 |
| 5200.00 | -18.42 | 0.12 | -165.37 | 13.73 | 4.86 | 7.11 | -21.14 | 0.09 | -31.00 | -7.78 | 0.41 | -123.49 | 1.13 |
| 5400.00 | -17.89 | 0.13 | -169.80 | 13.71 | 4.85 | 1.37 | -21.09 | 0.09 | -33.83 | -7.27 | 0.43 | -118.80 | 1.10 |
| 5600.00 | -17.32 | 0.14 | -174.20 | 13.81 | 4.90 | -4.84 | -21.22 | 0.09 | -36.20 | -6.71 | 0.46 | -114.54 | 1.06 |
| 5800.00 | -16.65 | 0.15 | 179.60 | 13.89 | 4.95 | -11.72 | -21.12 | 0.09 | -40.89 | -6.23 | 0.49 | -109.21 | 1.01 |
| 6000.00 | -16.14 | 0.16 | 169.47 | 13.90 | 4.95 | -18.49 | -21.22 | 0.09 | -45.13 | -5.92 | 0.51 | -103.62 | 0.99 |
| 6200.00 | -15.47 | 0.17 | 167.56 | 14.13 | 5.09 | -25.69 | -21.44 | 0.08 | -49.40 | -5.44 | 0.53 | -99.68 | 0.93 |
| 6400.00 | -14.44 | 0.19 | 161.45 | 14.25 | 5.16 | -35.08 | -21.39 | 0.09 | -54.67 | -4.68 | 0.58 | -92.34 | 0.84 |
| 6600.00 | -13.63 | 0.21 | 149.25 | 14.19 | 5.12 | -44.17 | -21.32 | 0.09 | -58.68 | -4.23 | 0.61 | -84.00 | 0.78 |
| 6800.00 | -13.33 | 0.22 | 137.17 | 14.07 | 5.05 | -53.33 | -21.44 | 0.08 | -66.42 | -3.87 | 0.64 | -76.09 | 0.75 |
| 7000.00 | -12.85 | 0.23 | 125.16 | 13.90 | 4.95 | -62.81 | -21.31 | 0.09 | -74.28 | -3.52 | 0.67 | -68.29 | 0.70 |
| 7500.00 | -11.54 | 0.26 | 90.27 | 13.38 | 4.67 | -87.82 | -21.49 | 0.08 | -98.41 | -2.89 | 0.72 | -45.14 | 0.62 |
| 8000.00 | -10.17 | 0.31 | 48.07 | 11.97 | 3.97 | -115.43 | -22.28 | 0.08 | -126.82 | -2.85 | 0.72 | -18.01 | 0.73 |



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Mini-Circuits ISO 9001 & ISO 14001 Certified

S-parameters

Gali-5 (+)

$I_d=65\text{mA}$, $V_d=4.4\text{V}$

| Freq. MHz | S11 (Input Return Loss) | | | S21 (Power Gain) | | | S12 (Isolation Out-in) | | | S22 (Output Return Loss) | | | K |
|--------------|-------------------------|------|---------|------------------|-------|---------|------------------------|------|---------|--------------------------|------|---------|------|
| | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | dB | Mag | Angle | |
| 100.00 | -21.32 | 0.09 | 171.87 | 20.64 | 10.76 | 174.23 | -23.64 | 0.07 | 0.13 | -25.06 | 0.06 | -179.09 | 1.06 |
| 200.00 | -20.58 | 0.09 | 159.94 | 20.58 | 10.69 | 169.55 | -22.84 | 0.07 | -0.17 | -25.33 | 0.05 | -175.23 | 1.03 |
| 400.00 | -19.69 | 0.10 | 141.45 | 20.37 | 10.44 | 159.64 | -22.77 | 0.07 | -0.61 | -24.21 | 0.06 | -171.29 | 1.04 |
| 600.00 | -19.16 | 0.11 | 124.37 | 20.13 | 10.15 | 150.05 | -22.45 | 0.08 | -0.86 | -22.47 | 0.08 | -168.97 | 1.03 |
| 800.00 | -18.58 | 0.12 | 109.97 | 19.83 | 9.81 | 141.15 | -22.82 | 0.07 | -1.04 | -21.03 | 0.09 | -170.08 | 1.05 |
| 1000.00 | -18.13 | 0.12 | 98.31 | 19.46 | 9.40 | 132.37 | -22.72 | 0.07 | -1.39 | -19.68 | 0.10 | -172.77 | 1.06 |
| 1200.00 | -17.94 | 0.13 | 87.95 | 19.11 | 9.03 | 124.19 | -22.69 | 0.07 | -1.83 | -18.68 | 0.12 | -176.59 | 1.08 |
| 1400.00 | -17.77 | 0.13 | 78.08 | 18.71 | 8.62 | 116.45 | -22.58 | 0.07 | -2.08 | -17.76 | 0.13 | -179.62 | 1.09 |
| 1600.00 | -17.77 | 0.13 | 68.66 | 18.31 | 8.23 | 108.86 | -22.46 | 0.08 | -2.65 | -16.80 | 0.14 | 177.63 | 1.10 |
| 1800.00 | -17.52 | 0.13 | 60.19 | 17.92 | 7.87 | 101.96 | -22.39 | 0.08 | -2.97 | -16.05 | 0.16 | 174.21 | 1.12 |
| 2000.00 | -17.54 | 0.13 | 51.37 | 17.54 | 7.53 | 95.20 | -22.41 | 0.08 | -3.62 | -15.45 | 0.17 | 170.88 | 1.14 |
| 2200.00 | -17.82 | 0.13 | 43.28 | 17.17 | 7.22 | 88.76 | -22.29 | 0.08 | -4.38 | -15.09 | 0.18 | 167.15 | 1.15 |
| 2500.00 | -18.09 | 0.12 | 28.86 | 16.67 | 6.82 | 79.38 | -22.21 | 0.08 | -5.61 | -14.73 | 0.18 | 163.77 | 1.18 |
| 2800.00 | -18.25 | 0.12 | 16.46 | 16.18 | 6.44 | 70.59 | -22.11 | 0.08 | -6.82 | -14.35 | 0.19 | 159.05 | 1.20 |
| 3000.00 | -18.55 | 0.12 | 8.06 | 15.94 | 6.27 | 64.86 | -22.11 | 0.08 | -8.32 | -14.29 | 0.19 | 155.26 | 1.22 |
| 3200.00 | -18.85 | 0.11 | -2.12 | 15.67 | 6.07 | 59.25 | -21.97 | 0.08 | -9.95 | -14.16 | 0.20 | 151.04 | 1.23 |
| 3400.00 | -18.80 | 0.11 | -11.61 | 15.42 | 5.90 | 53.58 | -22.01 | 0.08 | -11.41 | -14.01 | 0.20 | 147.27 | 1.25 |
| 3600.00 | -18.60 | 0.12 | -20.24 | 15.23 | 5.77 | 48.26 | -21.93 | 0.08 | -13.07 | -13.78 | 0.20 | 142.63 | 1.25 |
| 3800.00 | -18.72 | 0.12 | -28.26 | 15.07 | 5.67 | 42.88 | -21.96 | 0.08 | -14.87 | -13.56 | 0.21 | 137.14 | 1.26 |
| 4000.00 | -19.01 | 0.11 | -35.39 | 14.89 | 5.55 | 37.24 | -21.98 | 0.08 | -16.84 | -13.34 | 0.22 | 131.48 | 1.28 |
| 4200.00 | -19.10 | 0.11 | -43.18 | 14.73 | 5.45 | 32.03 | -21.97 | 0.08 | -18.91 | -13.24 | 0.22 | 127.02 | 1.29 |
| 4400.00 | -18.83 | 0.11 | -50.14 | 14.64 | 5.40 | 26.77 | -22.04 | 0.08 | -21.20 | -12.64 | 0.23 | 123.17 | 1.30 |
| 4600.00 | -18.99 | 0.11 | -58.15 | 14.55 | 5.34 | 21.21 | -22.15 | 0.08 | -23.64 | -12.06 | 0.25 | 116.93 | 1.31 |
| 4800.00 | -19.12 | 0.11 | -66.30 | 14.48 | 5.30 | 15.68 | -22.25 | 0.08 | -26.38 | -11.51 | 0.27 | 112.16 | 1.31 |
| 5000.00 | -19.14 | 0.11 | -74.38 | 14.41 | 5.25 | 10.07 | -22.35 | 0.08 | -29.25 | -10.96 | 0.28 | 106.78 | 1.31 |
| 5200.00 | -18.53 | 0.12 | -81.24 | 14.40 | 5.25 | 4.64 | -22.56 | 0.07 | -32.10 | -10.48 | 0.30 | 102.96 | 1.32 |
| 5400.00 | -17.71 | 0.13 | -87.45 | 14.48 | 5.30 | -0.75 | -22.70 | 0.07 | -35.76 | -9.99 | 0.32 | 99.68 | 1.31 |
| 5600.00 | -16.75 | 0.15 | -97.51 | 14.63 | 5.39 | -6.66 | -23.05 | 0.07 | -39.16 | -9.51 | 0.33 | 96.68 | 1.30 |
| 5800.00 | -15.72 | 0.16 | -106.88 | 14.76 | 5.47 | -13.12 | -23.21 | 0.07 | -42.98 | -9.27 | 0.34 | 93.53 | 1.28 |
| 6000.00 | -15.26 | 0.17 | -115.60 | 14.87 | 5.54 | -19.58 | -23.45 | 0.07 | -46.72 | -9.00 | 0.35 | 90.61 | 1.28 |
| 6200.00 | -13.49 | 0.21 | -121.80 | 15.25 | 5.79 | -26.23 | -24.07 | 0.06 | -50.44 | -8.69 | 0.37 | 90.61 | 1.27 |
| 6400.00 | -12.03 | 0.25 | -134.55 | 15.51 | 5.96 | -35.58 | -24.45 | 0.06 | -54.21 | -7.81 | 0.41 | 86.17 | 1.20 |
| 6600.00 | -11.35 | 0.27 | -149.69 | 15.63 | 6.05 | -44.95 | -24.33 | 0.06 | -58.88 | -7.26 | 0.43 | 79.36 | 1.11 |
| 6800.00 | -10.75 | 0.29 | -161.98 | 15.67 | 6.07 | -54.20 | -24.85 | 0.06 | -66.66 | -6.76 | 0.46 | 73.42 | 1.10 |
| 7000.00 | -10.04 | 0.31 | -175.70 | 15.72 | 6.11 | -63.96 | -24.75 | 0.06 | -79.62 | -6.30 | 0.48 | 67.55 | 1.03 |
| 7500.00 | -8.76 | 0.36 | 144.40 | 15.71 | 6.10 | -91.64 | -25.06 | 0.06 | -97.18 | -5.00 | 0.56 | 47.77 | 0.85 |
| 8000.00 | -8.19 | 0.39 | 93.91 | 14.54 | 5.33 | -124.44 | -26.18 | 0.05 | -117.74 | -4.45 | 0.60 | 21.30 | 0.94 |

S-parameters



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