Interpreting Results

Interpreting Calculation Results

Understanding what the calculator's output values mean and how to use them for practical circuit construction. This page helps you translate numbers into actionable design decisions.

Understanding Output Values

Inductance Results

Output	Typical Range	What It Means
L (inductance)	1-100 mH	Primary choke property, affects f_0 and Q
DCR	0.1-50 Ω	Wire resistance, major Q limiter
SRF	50 kHz - 1 MHz	Maximum usable frequency
$C_{parasitic}$	10-500 pF	Stray capacitance, determines SRF
Wire Length	1-50 m	Total wire needed for winding

Capacitance Results

Output	Typical Range	What It Means
C_{wfc}	1-100 nF	WFC capacitance, sets resonance with L
$R_{solution}$	0.1-100 Ω	Water resistance, affects Q
Z_0 (characteristic)	100-10,000 Ω	√(L/C), impedance at resonance

Circuit Results

Output	Typical Range	Interpretation
f_0 (resonant freq)	1-100 kHz	Where circuit resonates naturally
Q factor	5-200	Resonance sharpness, voltage gain
Bandwidth	50 Hz - 5 kHz	Usable frequency range around f_0
$V_{magnification}$	5× - 200×	Voltage gain at resonance
Ring-down τ	0.1-10 ms	Decay time constant
Ring-down cycles	3-150	Oscillations during decay

What "Good" Values Look Like

? Well-Designed VIC Circuit:

- Q factor: 30-100 (good balance of gain vs. stability)
- f_0: Within your driver's frequency range
- Operating frequency: < 30% of SRF (preferably < 10%)
- Primary/Secondary f_0 match: Within 5-10%
- Bandwidth: Wide enough to accommodate drift
- Voltage magnification: As needed for your application

? Warning Signs:

- Q < 10: Very low—circuit barely resonates
- Q > 300: Extremely sharp—hard to tune, sensitive to drift
- f_{op} > 0.5 × SRF: Operating too close to SRF
- DCR > Z_0/10: Resistance dominates, poor Q
- Primary/Secondary mismatch > 20%: Poor energy transfer

Translating Results to Construction

Wire Length and Turns

The calculator provides wire length and turn count. When winding:

- **Add 10-20% to wire length** for lead connections and margins
- **Count turns carefully**—L varies as N^2, so turn count is critical
- **Verify L after winding**—actual may differ from calculated

Component Selection

Calculated Value	Selection Guidance
C1 = 47.3 nF	Use 47 nF standard value (within 1%)
C1 = 31.2 nF	Use 33 nF or parallel 22+10 nF
L = 15.7 mH	Wind for 16 mH, fine-tune with parallel C

Understanding Accuracy Limits

Know what to expect from calculated vs. measured values:

Parameter	Expected Accuracy	Why Variation Occurs
Inductance	±10-20%	Core μ_r varies, winding geometry imperfect
DCR	±5%	Wire tables accurate, but length varies
SRF	±30%	Parasitic C is hard to model precisely
C_{wfc}	±15%	Fringe effects, water purity variation
$R_{solution}$	±20%	Conductivity varies with temperature
f_0 (calculated)	±15%	Depends on L and C accuracy
Q factor	±25%	Multiple loss mechanisms combine

Comparing Calculated vs. Measured

When Measured f? is Lower Than Calculated:

- Actual L is higher than calculated
- Stray capacitance adding to C_{total}
- WFC capacitance underestimated

When Measured f? is Higher Than Calculated:

- Actual L is lower than calculated
- Core saturation reducing effective L
- WFC capacitance overestimated

When Measured Q is Lower Than Calculated:

- Additional losses not accounted for (core loss, skin effect)
- Poor connections adding resistance
- Water conductivity different than assumed

Using Results for Troubleshooting

Observation	Calculator Check	Likely Issue
No resonance found	Check SRF vs. operating frequency	Operating above SRF
Very weak resonance	Check calculated Q	High losses, low Q

Observation	Calculator Check	Likely Issue
Resonance at wrong frequency	Verify L and C inputs	Input error or mismeasurement
Less voltage gain than expected	Compare Q values	Actual losses higher
Resonance drifts during use	Check temperature effects	Water heating, capacitance changing

Results Summary Checklist

Before building, verify these from your results:

1. ☐ f_0 is within driver frequency range
2. ☐ f_0 is < 30% of SRF (ideally < 10%)
3. ☐ Q is in acceptable range (typically 20-150)
4. ☐ Voltage magnification won't exceed component ratings
5. ☐ Wire gauge handles expected current
6. ☐ Primary and secondary frequencies are matched
7. ☐ No warning indicators are present
8. ☐ Results are saved for reference

Final Advice: The calculator gives you an excellent starting point. Always plan to measure your actual circuit and iterate. The goal is to get close enough that minor tuning (adjusting C1, trimming frequency) achieves optimal performance.

Chapter 7 Complete. Next: Advanced Topics →

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