ISL74324REFEV1Z

Gain Block Reference Design Board

Description

The ISL74324REFEV1Z is a radiation-tolerant RF gain block reference design board.

The board highlights two components: the ISL74324M, a 500MHz to 6500MHz SiGe BiCMOS high-gain broadband radio-frequency (RF) amplifier, and the ISL75054M, an ultra-low noise, high PSRR, radiation tolerant low-dropout regulator.

The ISL74324M operates with a single 5V or 3.3V power supply and features an adjustable bias current ranging from 40mA to 60mA. A 40mA bias setting is used to improve overall efficiency. At a 5V supply voltage and 60mA bias current, the ISL74324M delivers 16.6dB of gain, +38.4dBm OIP3, and a 2.2dB noise figure at 4200MHz. The device also includes a convenient shutdown function using the STBY pin.

The ISL75054M has an operational supply voltage range from 2.7V to 30V, an output range of 0.5V to V_{IN}-V_{DO}, and an output current capability of 1A.

The ISL74324REFEV1Z board is bias adjustable. There are two switches that allow changing the ISL74324M quiescent current between 60mA and 40mA, and its supply voltage between 3.3V and 5V, as shown in Figure 1.

Features

This board demonstrates performance and operation of two system components: the LDO and the RF gain amplifier.

- V_{CC}: 3.3V or 5V
- I_{CC}: 40mA or 60mA
- RF range: 500MHz to 6500MHz
- Gain: 16.6dB at 4200MHz
- OIP3: +38.4dBm at 4200MHz
- Ultra-low noise LDO
- High PSRR LDO

Specifications

- +12V power supply input (from a benchtop power supply) or a 12V DC wall power supply.
- Main system components support -55°C to +125°C operation
- Supporting components support -40°C to +85°C operation

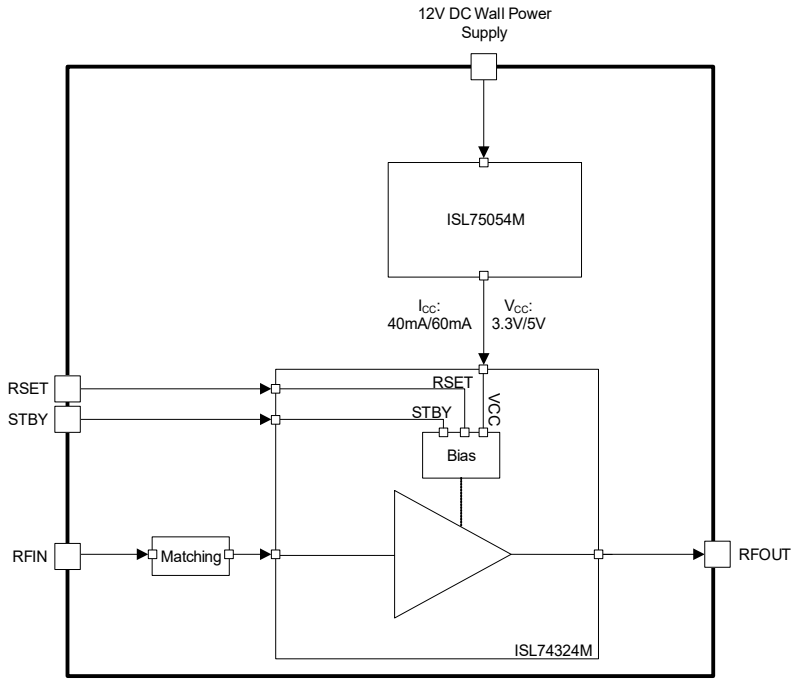


Figure 1. Board Block Diagram

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1. Functional Description

The ISL74324REFEV1Z provides the necessary components to fully evaluate the ISL74324M RF amplifier paired with the ISL75054M ultra-low noise LDO.

1.1 Operational Characteristics

The ISL74324REFEV1Z reference design board operates from a +12V power supply, which can be provided by either a benchtop power supply or a 12V DC wall power adapter.

Two switches located in the center of the board allow the selection of the ISL74324M quiescent current to be 40mA or 60mA, as well as the configuration of the ISL75054M output voltage to be either 3.3V or 5V. Adjacent to the switches, LEDs D2 to D5 indicate the selected bias configuration of the board.

To place the board into standby mode, set the STBY jumper to HIGH. When the STBY pin is asserted high, the device draws approximately 2mA to 3mA. To exit standby mode, set the jumper to LOW or leave the pin unconnected.

The ISL74324M and ISL75054M components support operation from -55°C to +125°C. However, many components (namely the surface mount passive components used on the board) support an industrial temperature range of -40°C to +85°C. This reference design board operates under ambient temperature conditions at or near 25°C.

1.2 Transmission Line

Figure 2 and Figure 3 can be referenced to calculate a more accurate gain by accounting for PCB transmission line loss. These figures were generated using the ISL74324MEVAL1Z board's through line, which maintains the same line width and spacing as the ISL74324REFEV1Z transmission line, and provides a 50Ω characteristic impedance up to 10GHz.

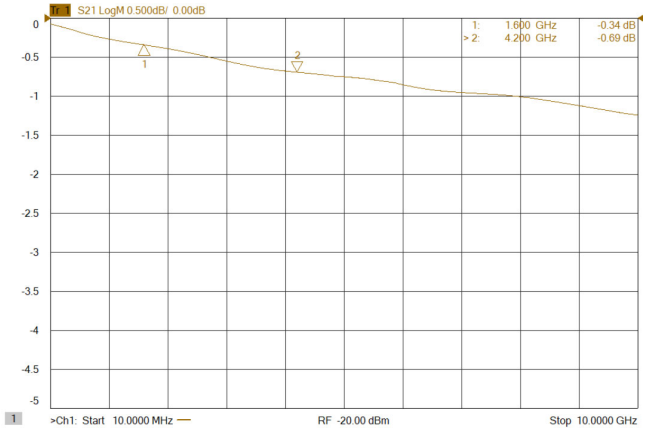


Figure 2. Through Line Insertion Loss

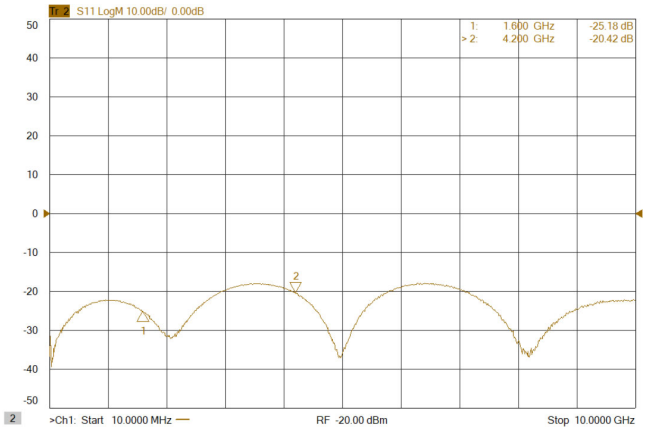


Figure 3. Through Line Return Loss

2. Board Design

The ISL74324REFEV1Z is a multi-layer RF PCB. Figure 4 and Figure 5 show the top and bottom of the reference design board.

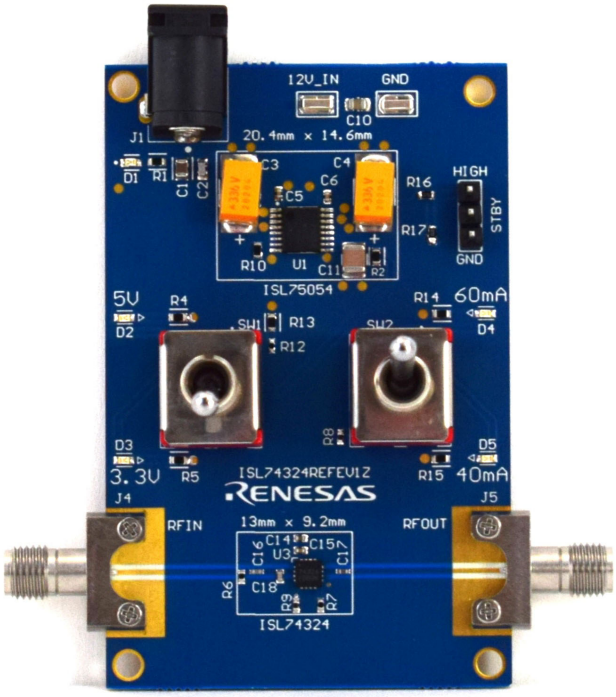


Figure 4. Reference Design Board (Top)

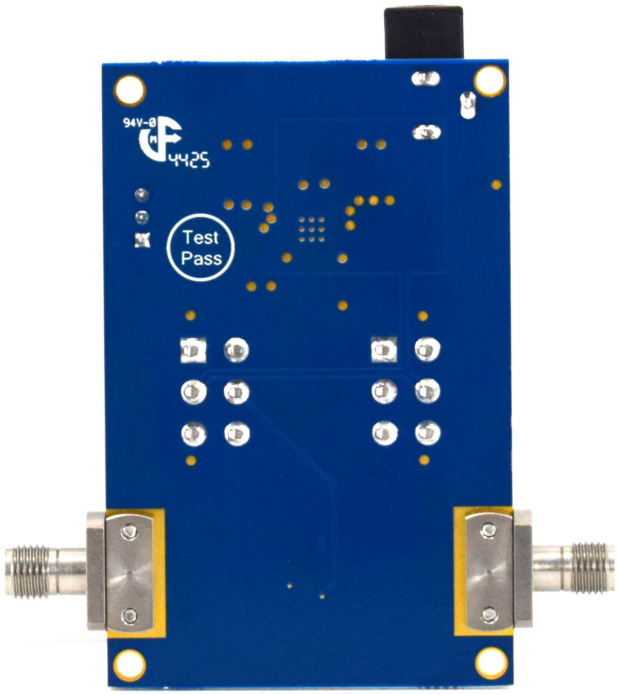


Figure 5. Reference Design Board (Bottom)

2.1 Schematic Diagrams

Figure 6 shows the schematic diagram for the ISL74324REFEV1Z board.

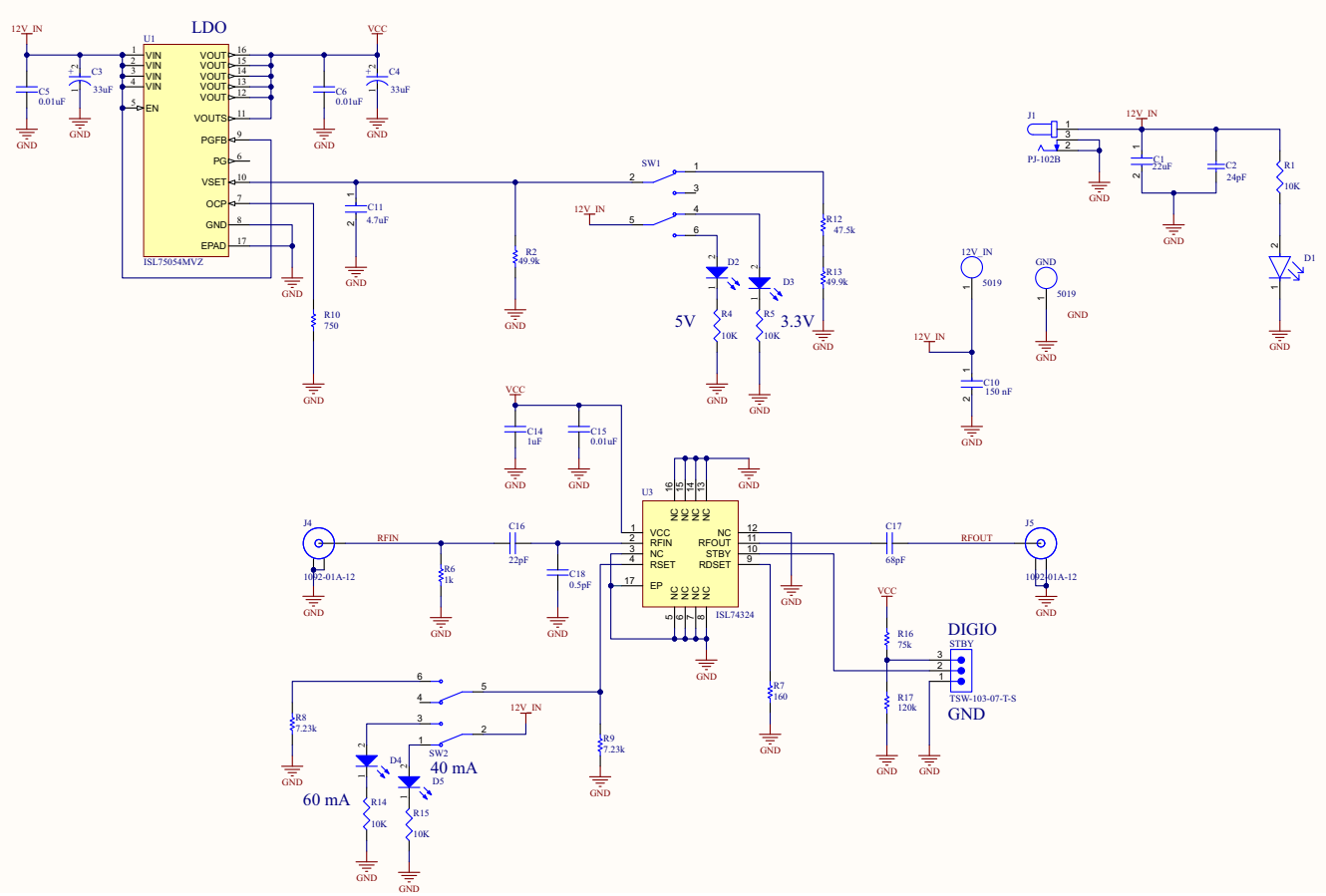


Figure 6. Schematic

2.2 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
2	12V_IN, GND	PC Test Point Miniature	Keystone Electronics	100DP1T1B1M2QEH
1	C1	Multi-Layer Ceramic Capacitor 22µF 25V X5R ±20% 0805 Emboss T/R	Murata Electronics	GRT21BR61E226ME13L
1	C2	CAP, SMD, 0603, 24pF, 50V, 5%, C0G/NP0, ROHS	Murata Electronics	GRM1885C1H240JA01D
2	C3, C4	Tantalum Capacitor, 35V, 10% +Tol, 10% -Tol, 33µF, Surface Mount	Kyocera AVX	TPME336K035R0065
1	C16	Multilayer Ceramic Capacitors MLCC - SMD/SMT KGM05ACG1H220JH NEW GLOBAL PN 50V 22pF	Kyocera AVX	04025A220JAT2A
1	C17	Multilayer Ceramic Capacitors MLCC - 50V 68pF	Kyocera AVX	04025A680JAT2A
1	C18	Multilayer Ceramic Capacitors MLCC - SMD/SMT	Johanson Technology	500R07S0R5AV4T

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	C14	CAP CER 1µF 10V X5R 0402	Kyocera AVX	0402ZD105KAT2A
3	C5, C6, C15	Multilayer Ceramic Capacitors MLCC - PN 25V 0.01µF	Kyocera AVX	04023C103KAT2A
1	C10	CAP CER 0.15µF 25V X7R 0805	Yageo	CC0805KRX7R8BB154
1	C11	Ceramic Capacitor, 1210, 4.7µF, 10%, X7R, 15%, 50V	Kyocera AVX	12105C475KAT2A
1	D1	LED Green Clear Chip SMD	Lite-On Inc	LTST-C190GKT
4	D2, D3, D4, D5	LED Blue Clear Chip SMD	Lite-On Inc	LTST-C190TBKT
1	J1	2.5mm Center Pin, 2.5 A, Right Angle, DC Power Jack Connector	Same Sky	PJ-102B
2	J4, J5	2.92mm Edge Launch	Southwest Microwave	1092-01A-12
5	R1, R4, R5, R14, R15	RES SMD 10kΩ 1% 100mW 0603	Vishay Dale	CRCW060310K0FKEA
2	R2, R13	RES SMD 49.9kΩ 1% 1/10W 0603	Panasonic	ERJ-3EKF4992V
1	R6	RES SMD 1kΩ 1% 1/16W 0402	Vishay Dale	CRCW04021K00FKED
1	R17	RES SMD 120kΩ 1% 1/8W 0603	Vishay Dale	CRCW0603120KFKEA
2	R8, R9	RES 7.23kΩ 0.1% 1/16W 0402	Vishay Dale	TNPW04027K23BETD
1	R7	160Ω ±1% 0.063W, 1/16W Chip Resistor 0402	Vishay Dale	CRCW0402160RFKED
1	R10	RES SMD 750Ω 1% 1/10W 0603	Vishay Dale	CRCW0603750RFKEA
1	R16	RES SMD 75kΩ 1% 1/8W 0603	Vishay Dale	CRCW060375K0FKEA
1	R12	47.5kΩ ±1% 0.063W, 1/16W Chip Resistor 0402	Vishay Dale	CRCW040247K5FKED
1	STBY	0.025" SQ Post Header, Through-hole, Vertical, -55 to 105°C, 2.54mm Pitch, 3-Pin, Male, RoHS	Samtec	TSW-103-07-T-S
2	SW1, SW2	Switch Toggle DPDT 5A 120V	E-Switch	100DP1T1B1M2QEH
1	U1	Renesas Radiation Tolerant Ultra Low Noise LDO	Renesas	ISL75054M30VZ
1	U3	6.5GHz Amplifier	Renesas	ISL74324M30RZ

2.3 Board Layout

Figure 7 through Figure 11 illustrate the individual layers that make up the PCB stack-up.

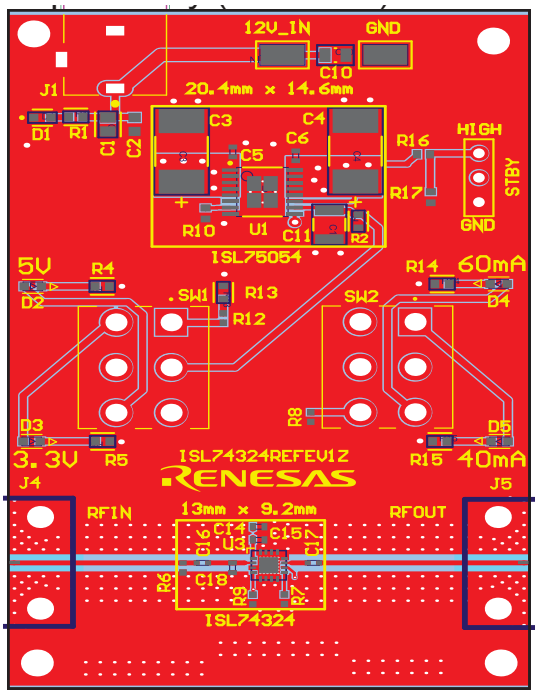


Figure 7. Top Silkscreen

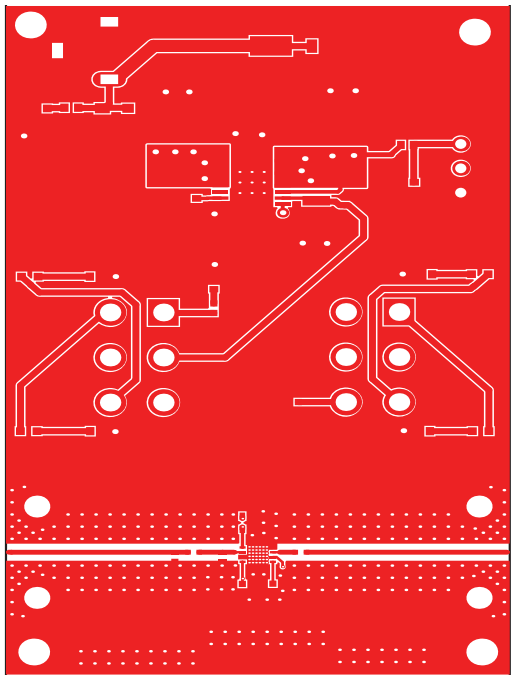


Figure 8. Top Layer

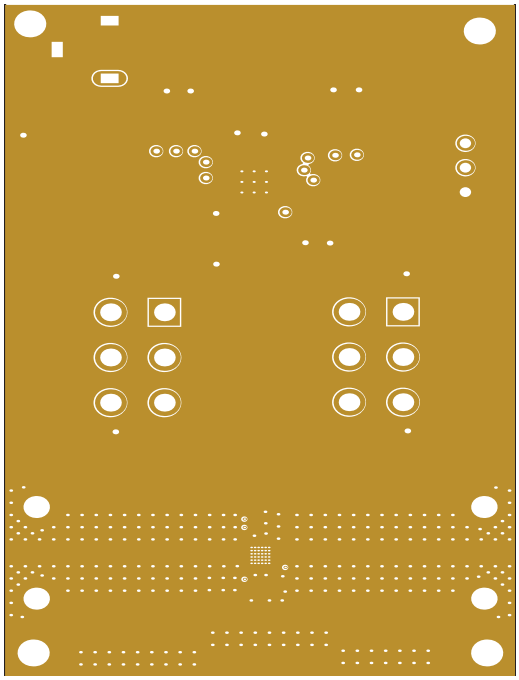


Figure 9. Layer 2

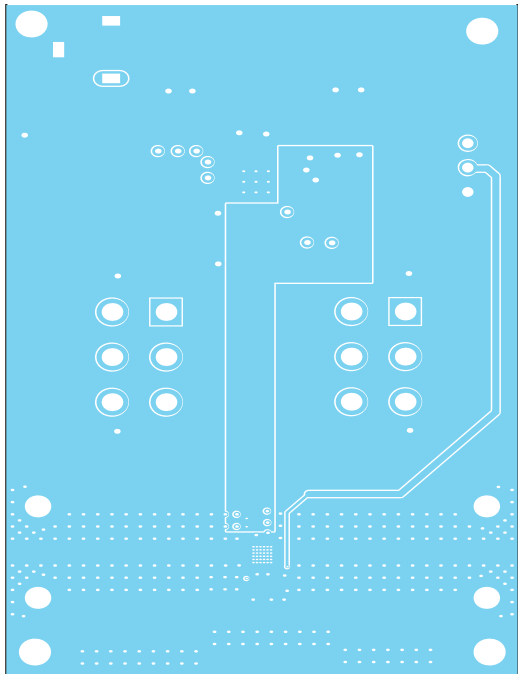


Figure 10. Layer 3

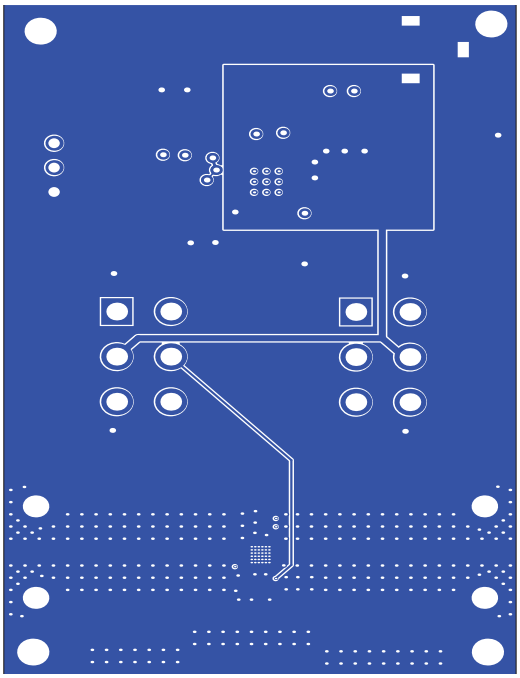


Figure 11. Bottom Layer

3. Typical Performance Graphs

Figure 12 through Figure 27 show typical s-parameter data for the ISL74324REFEV1Z board operating at four different bias configurations: 5V and 60mA, 5V and 40mA, 3.3V and 60mA, and 3.3V and 40mA.

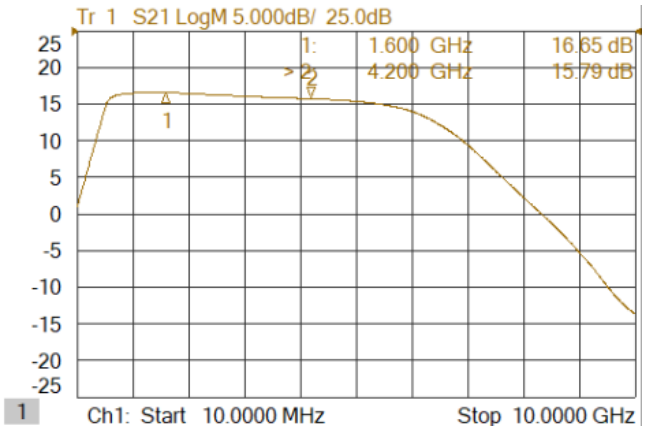


Figure 12. S21 - 5V, 60mA

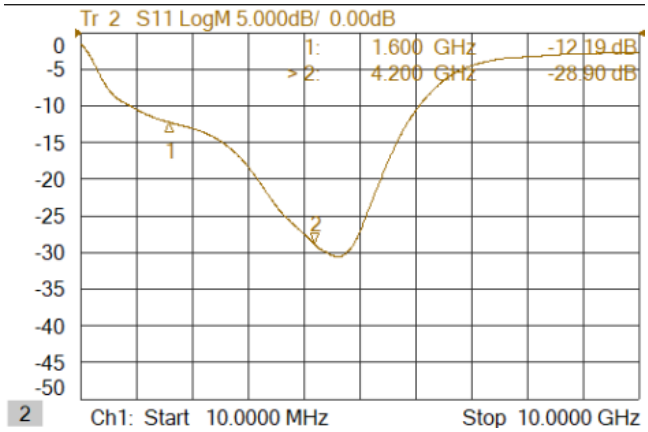


Figure 13. S11 - 5V, 60mA

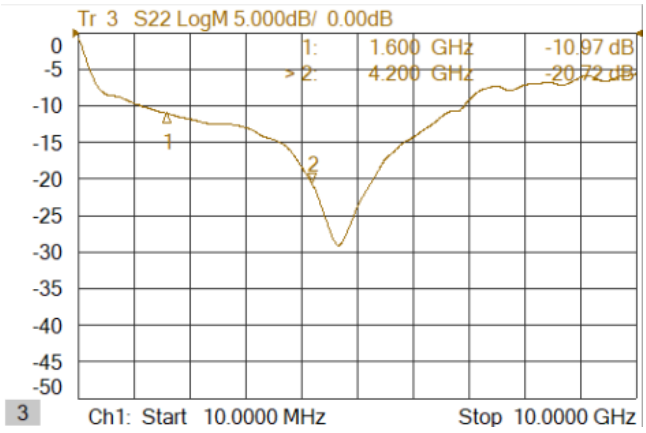


Figure 14. S22 - 5V, 60mA

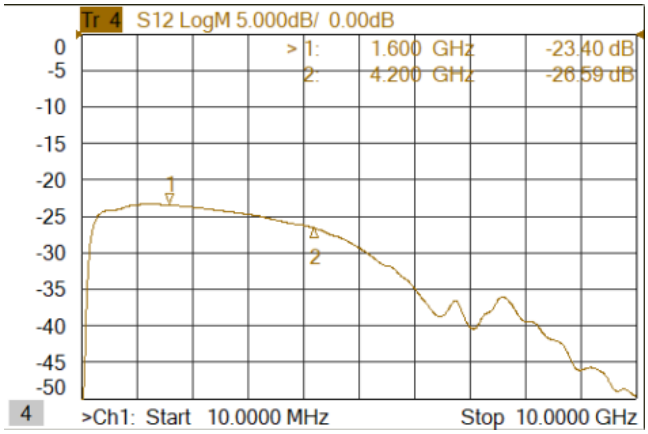


Figure 15. S12 - 5V, 60mA

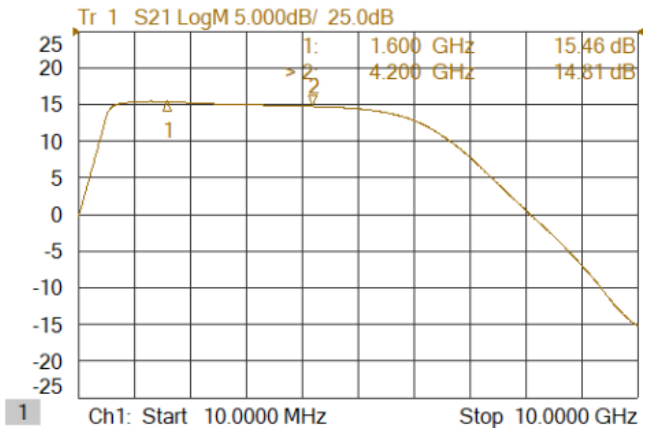


Figure 16. S21 - 5V, 40mA

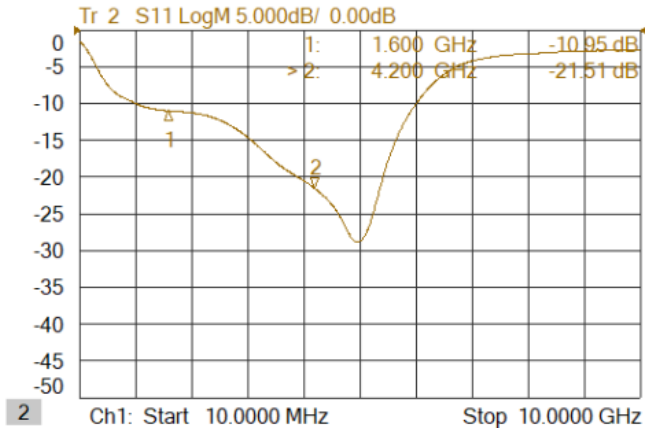


Figure 17. S11 - 5V, 40mA

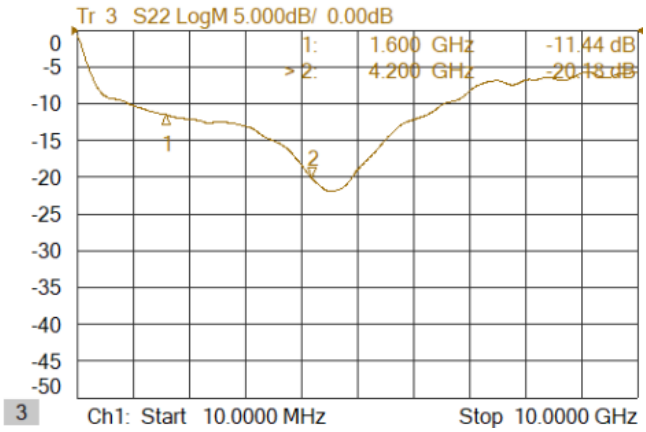


Figure 18. S22 - 5V, 40mA

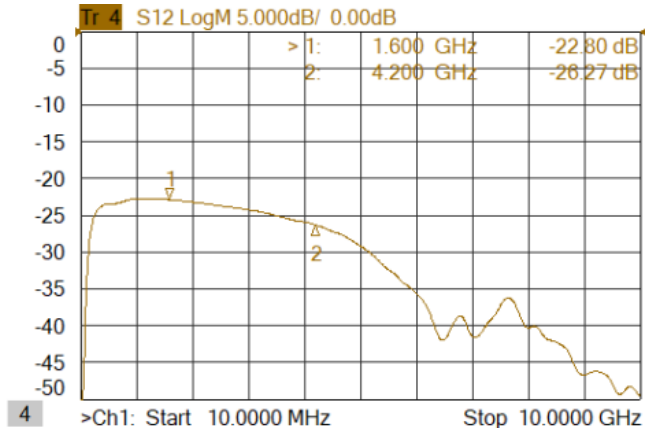


Figure 19. S12 - 5V, 40mA

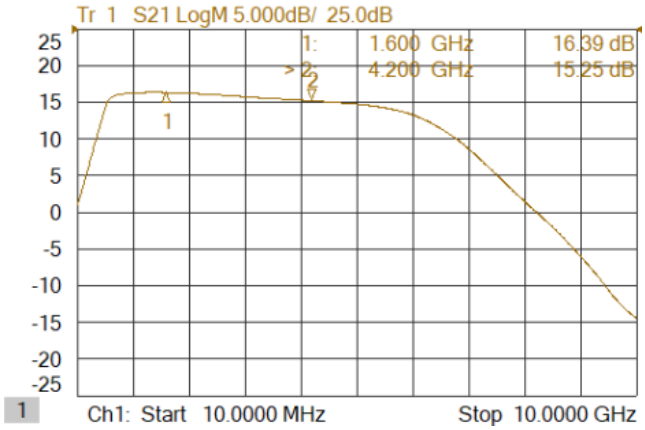


Figure 20. S21 - 3.3V, 60mA

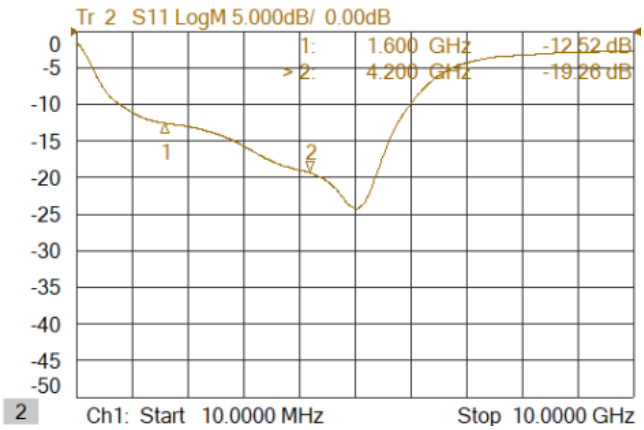


Figure 21. S11 - 3.3V, 60mA

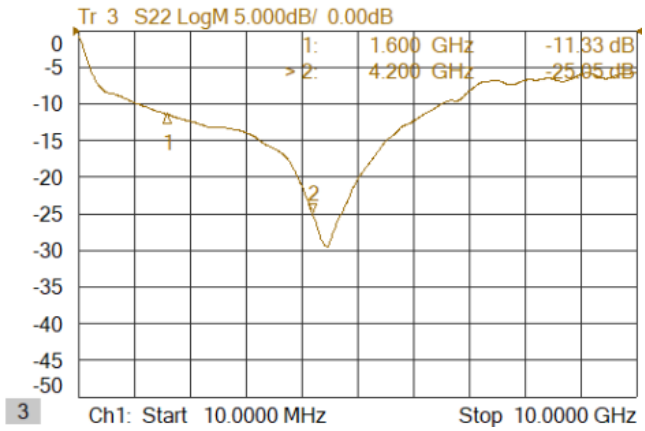


Figure 22. S22 - 3.3V, 60mA

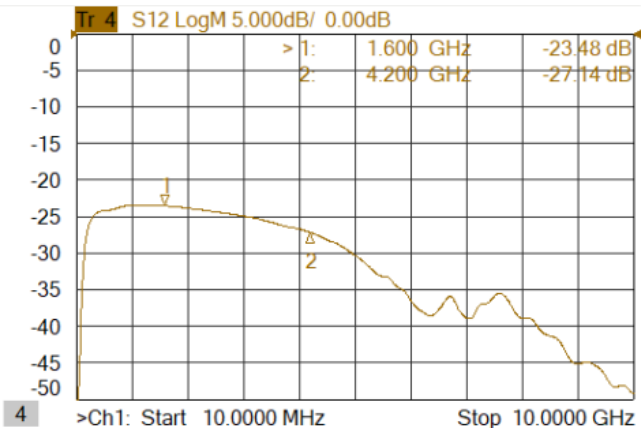


Figure 23. S12 - 3.3V, 60mA

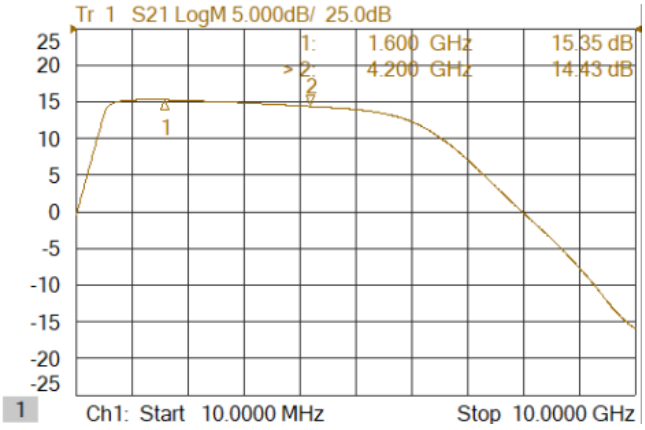


Figure 24. S21 - 3.3V, 40mA

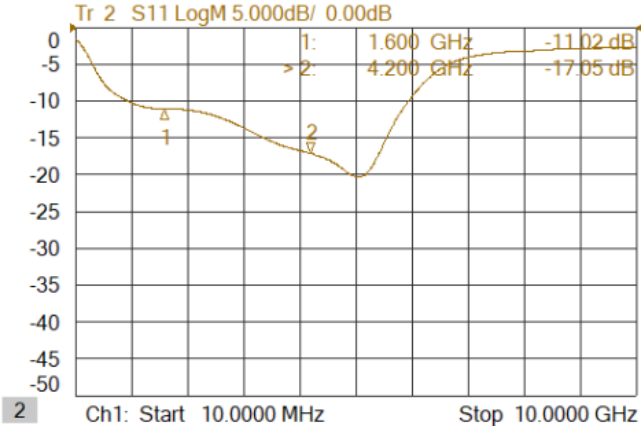


Figure 25. S11 - 3.3V, 40mA

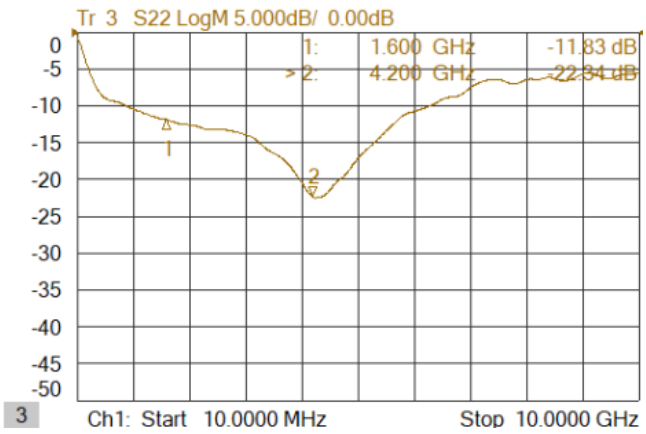


Figure 26. S22 - 3.3V, 40mA

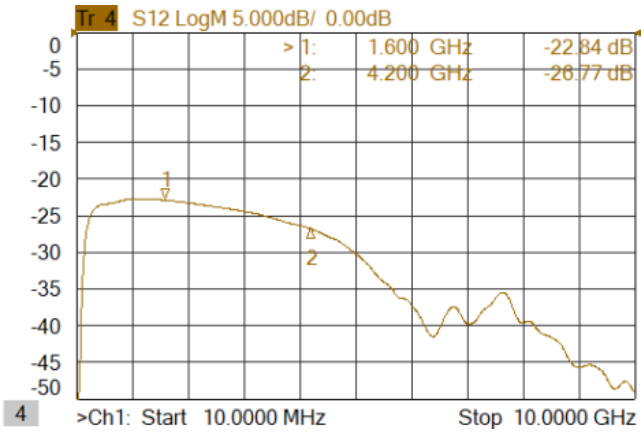


Figure 27. S12 - 3.3V, 40mA

4. Ordering Information

Part Number	Description
ISL74324REFEV1Z	Gain Block Reference Design Board

5. Revision History

Revision	Date	Description
1.00	Jan 27, 2026	Initial release.

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