ISL73007SEHEV3Z

The ISL73007SEHEV3Z evaluation board (shown in Figure 3) features the ISL73007SEH buck regulator. This IC is a small foot print radiation hardened POL designed for critical low power applications.

The ISL73007SEH is operational over 3V to 18V integrating both high-side and low-side power FETs and switches at a default 500kHz frequency. The switching frequency can also be programmed from 300kHz up to 1MHz using an external resistor. The ISL73007SEH uses constant-frequency peak current mode control architecture for fast loop transient response and can use either its internal compensation at the 500kHz default switching frequency or an external Type II compensation at other frequencies to stabilize the loop as determined by specific design and performance requirements. When integrating both P-channel and N-channel power devices and with the option of internal compensation, a minimum of external components are required, thereby reducing the BOM count and complexity of the design.

The ISL73007SEHEV3Z evaluation board and this accompanying manual provide a quick and easy method to evaluate the ISL73007SEH part, see the *ISL73007SEH datasheet* for information about the device operation, function, and performance.

Features

- Optimized for 12V to 5V conversion and set up for a minimum 8V input with internal 500kHz switching frequency, slope and compensation configuration
- 3A output current

Specifications

The ISL73007SEHEV3Z evaluation board is by default internally configured for immediate evaluation with a minimum of components and connections.

The electrical ratings of the ISL73007SEHEV3Z evaluation board are shown in Table 1.

Table 1. Electrical Ratings

Parameter	Rating
PVIN Supply Voltage	8V - 18V
DC Output Voltage	5V
Operating Frequency	500kHz
Output Current	3A
Temperature	-55°C to +125°C

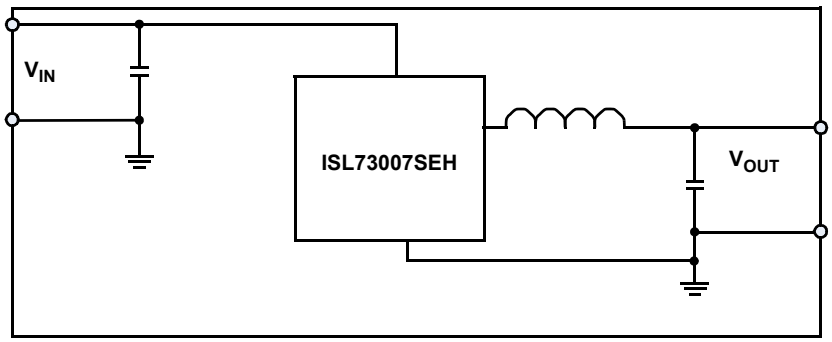

Figure 1. Block Diagram

Contents

1. Functional Description

The ISL73007SEHEV3Z evaluation board has a default configuration of 8V -18V input to 5V output conversion with a 3A maximum output current and contains the ISL73007SEH voltage regulator IC in the internal configuration for the switching frequency, and for control loop and slope compensations. Figure 1 shows the ISL73007SEHEV3Z evaluation board block diagram. A photograph of the ISL73007SEHEV3Z is shown in Figure 3 and Figure 4.

The ISL73007SEHEV3Z evaluation board provides access to the pins of the IC device and convenient input and output points for connecting test equipment. For more information, see the Schematic Diagram, top layer silkscreen (Figure 11), and Bill of Materials. Performance data taken using the ISL73007SEHEV3Z and basic lab equipment is shown in Figure 12 through Figure 19.

1.1 Operational Characteristics

The ISL73007SEHEV3Z only requires a single voltage supply > 7.8V connected to the PVIN pad to operate, outputting 5V on the VOUT pad with a 3A output current capability. Configured for a nominal PVIN voltage of 12V, the input operating voltage at which the IC turns on is set by the resistor divider (R1 and R2) on the ENABLE pin. **Important:** Do not exceed 5V on the ENABLE pin.

1.2 Setup and Configuration

The following equipment is recommended for testing the board:

- Voltage power supply
- 100MHz oscilloscope

Complete the following steps to configure and use the board:

1. Configure the board as shown in Figure 2.
2. Connect and turn on an 8V to 16V power supply to the PVIN pad.
3. Using the oscilloscope to look at VIN and VOUT waveforms and to also observe the behavior of the LX phase node located on pins 13 and 14 of the IC package. Proper probe grounding must be practiced when observing clean waveforms.
4. Output current loading can be externally added at the VOUT and GND pads for loaded output evaluations. A DVM(s) can be employed to monitor the input and output voltages and currents.

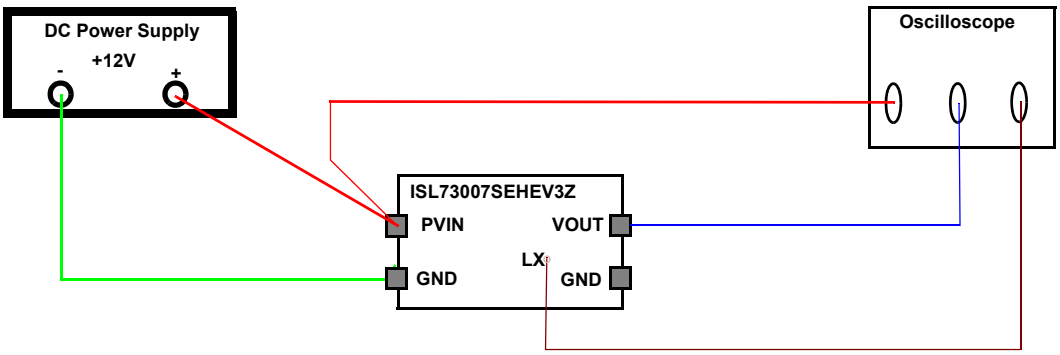

Figure 2. ISL73007SEH Basic Evaluation Test Setup Block Diagram

2. Board Design

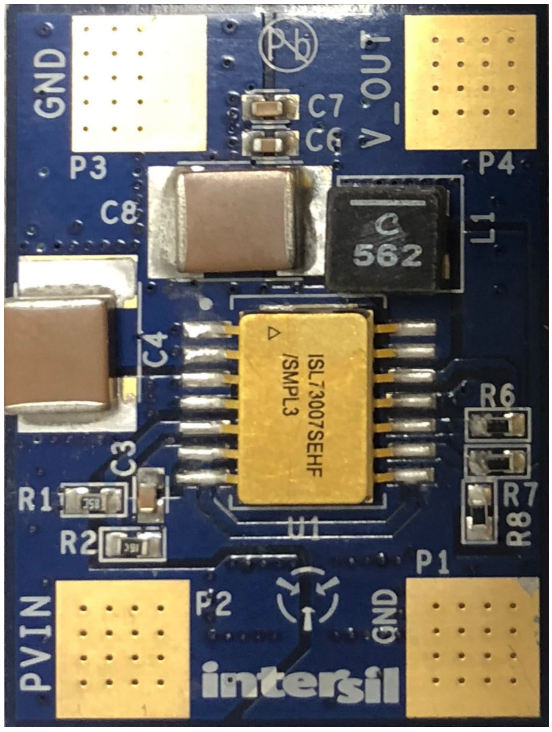

Figure 3. ISL73007SEHEV3Z Evaluation Board (Top)

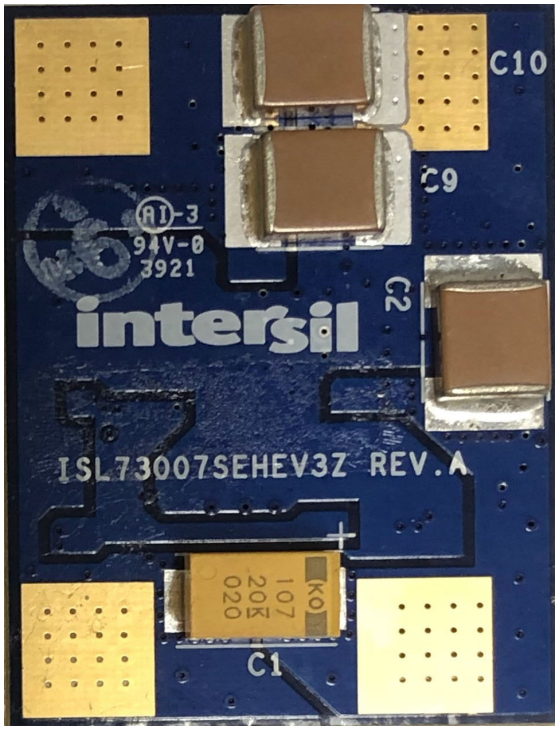

Figure 4. ISL73007SEHEV3Z Evaluation Board (Bottom)

2.1 Basic Layout

The ISL73007SEH is located in the upper center of the board and is labeled U1.

Connect the input power across the yellow Tantalum capacitor, the bulk input capacitance (C_{IN}) at the PVIN and GND pads. The output voltage then appears on the V_OUT and GND pads near the output inductor (L_{OUT}) and the output capacitance (C_{OUT}), respectively. Additional C_{IN} is provided by C2 (flip side) and C4. The other passive components near the PVIN pad are for setting the EN POR, slope compensation and VCC decoupling. The passive components between the GND and V_OUT pads are for output voltage setting and PGOOD pull-up. Consult the schematic (Figure 5) for details.

2.2 Layout Guidelines

PCB design is critical to reduce parasitic inductances with critical components being closely placed to the IC. The critical components being the low ESR ceramic input capacitors for first placement. Avoid placing any traces or components under the LX shapes to avoid noise coupling from the switching node.

2.3 Schematic Diagram

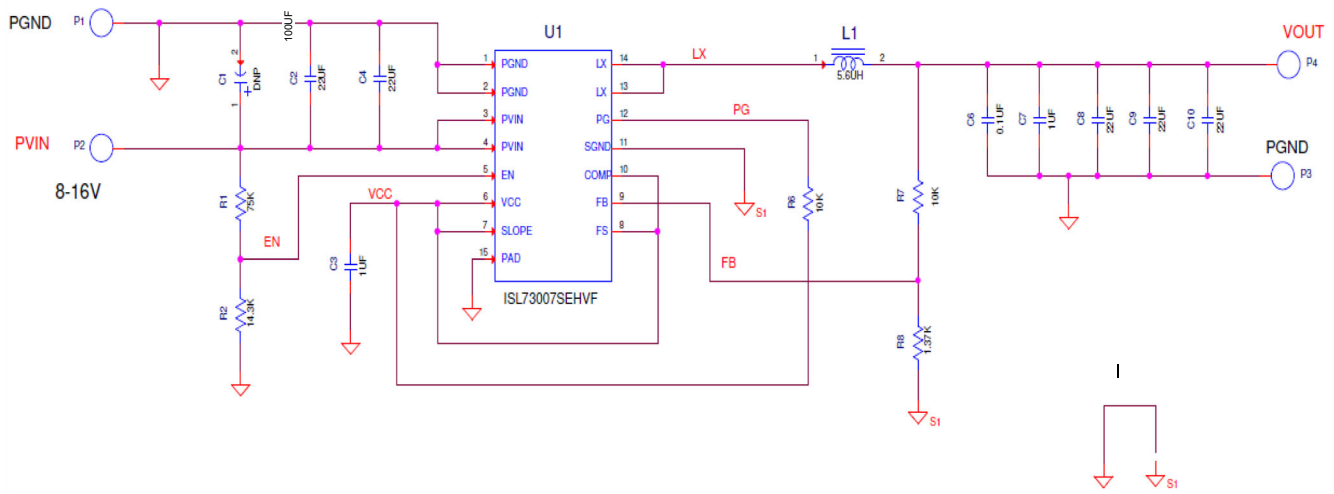

Figure 5. ISL73007SEHEV3Z Schematic

2.4 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1	U1	ISL73007SEH - 18V, 3A Rad Hard Buck Regulator	Renesas	ISL73007SEH/PROTO
5	C2, C4, C8-C10	22µF, 2220 MLCC	TDK	C5750X7R1E226M
2	C3, C7	1µF, 0603 MLCC	Various	GCM188R71E105KA64D
1	C6	0.1µF, 0603 MLCC	Various	Generic
2	R6, R7	10k, 0603 Metal Film Chip Resistor	Various	Generic
1	R2	14.3k, 0603 Metal Film Chip Resistor	Various	Generic
1	R8	1.371k, 0603 Metal Film Chip Resistor	Various	Generic
1	R1	75k, 0603 Metal Film Chip Resistor	Various	Generic
1	C1	100µF, ESR 10mΩ POLYMER CAPACITOR	KEMET	T541X107M020AH6510
1	L1	5.6µH, IND_XEL5050, Shielded Power Inductor	CoilCraft	XEL5050-562ME

2.5 Board Layout

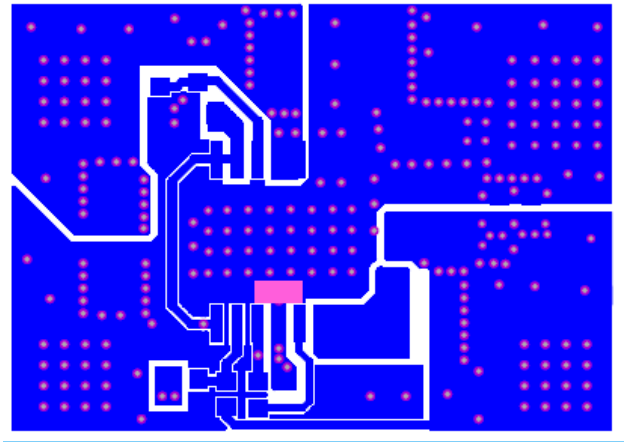

Figure 6. Top Layer

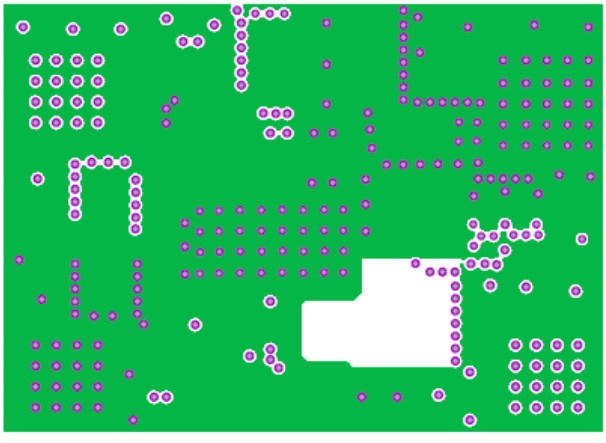

Figure 7. Layer 2

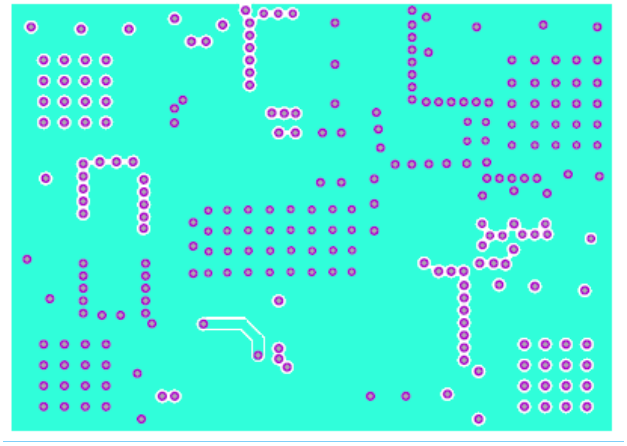

Figure 8. Layer 3

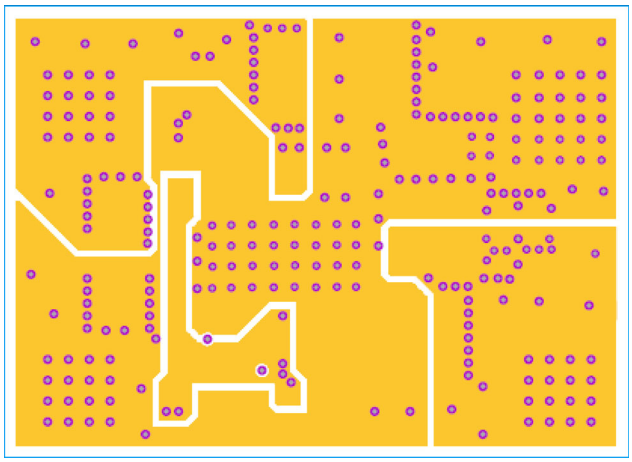

Figure 9. Bottom Layer

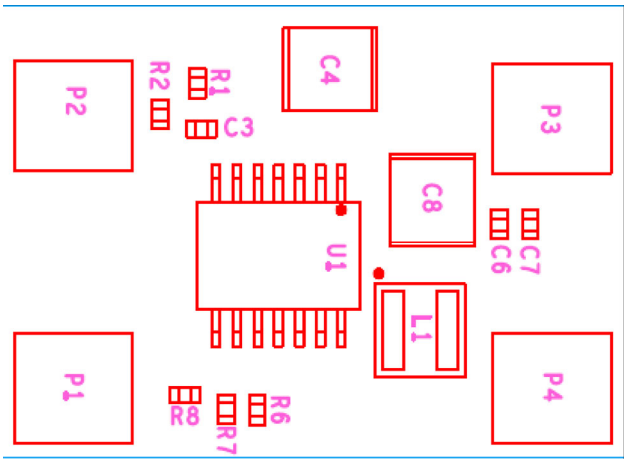

Figure 10. Top Assembly Layer

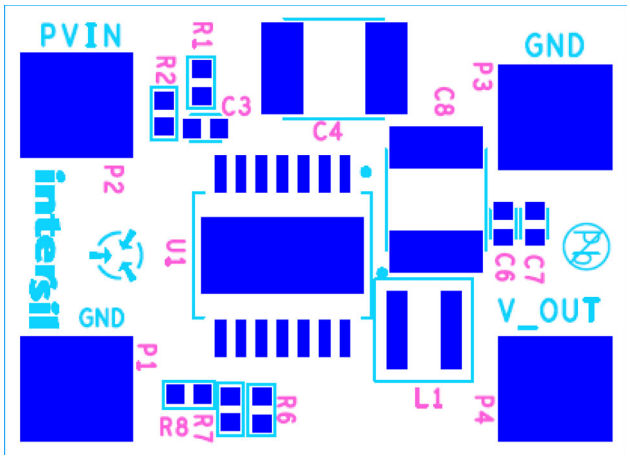

Figure 11. Top Silk Layer

3. Typical Performance Graphs

Unless otherwise noted, PVIN = 12V; V_{OUT} = 5V, f_{SW} = 500kHz, T_A = Room Ambient

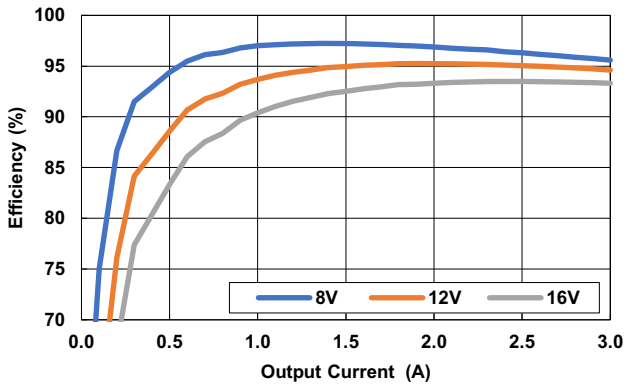

Figure 12. Efficiency

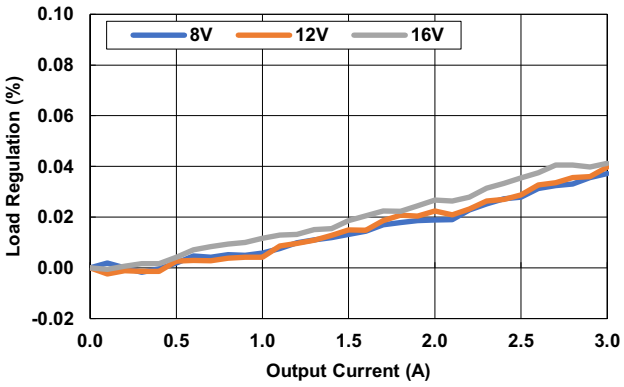

Figure 13. Load Regulation

Unless otherwise noted, PVIN = 12V; V_{OUT} = 5V, f_{SW} = 500kHz, T_A = Room Ambient (Cont.)

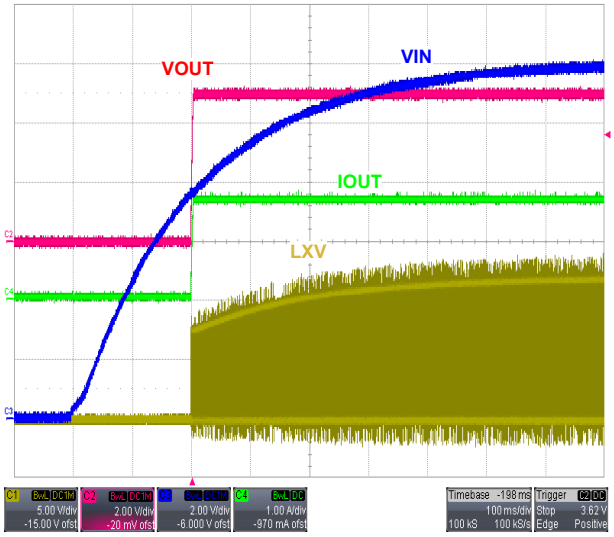

Figure 14. Turn-on, 3Ω load

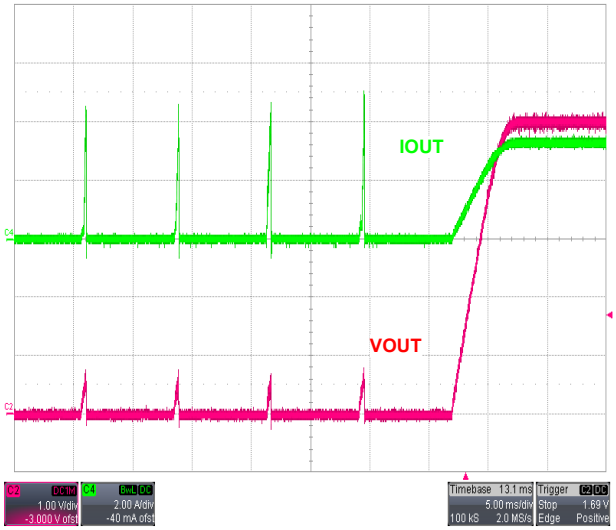

Figure 15. Shorted Output into Restart after Hiccup

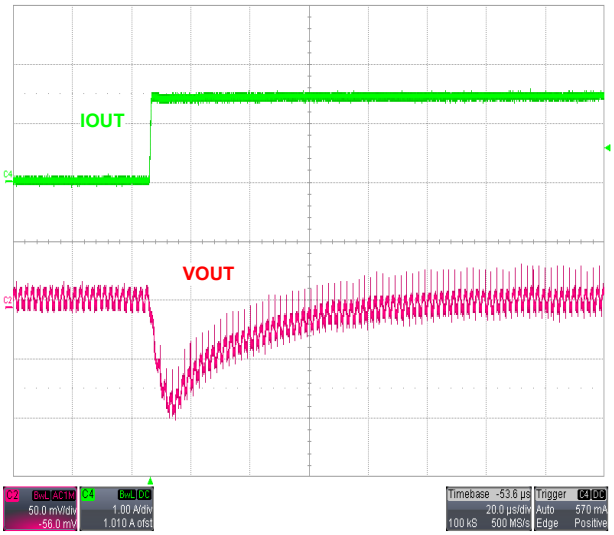

Figure 16. +1.5A Output Current Transient

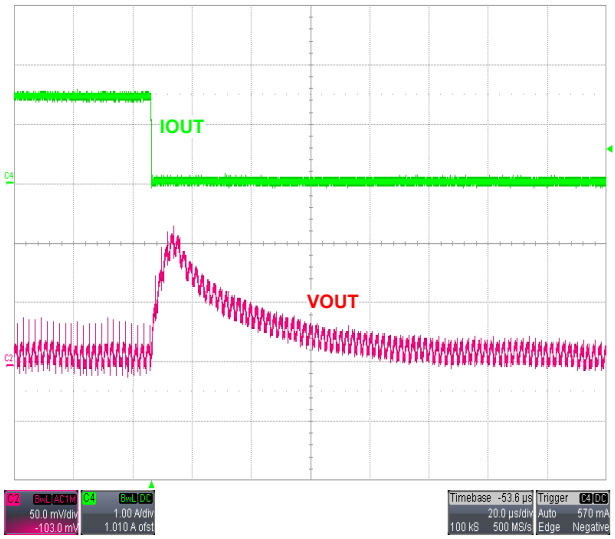

Figure 17. -1.5A Output Current Transient

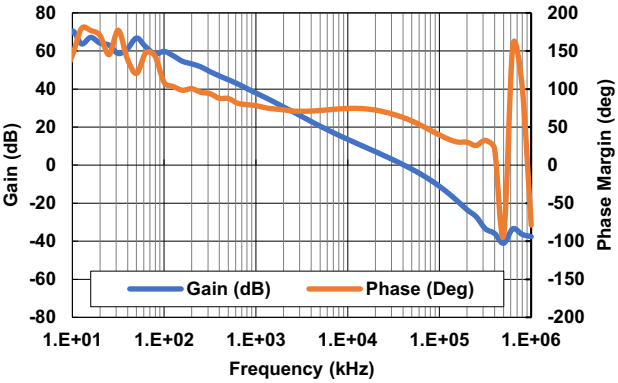

Figure 18. Gain/Phase Bode Plot, I_{OUT} = 2.5A

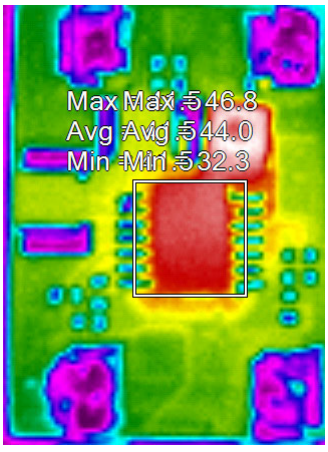

Figure 19. Package Temperature at I_{OUT} = 3A

4. Ordering Information

Part Number	Description
ISL73007SEHEV3Z	Radiation Hardened ISL73007SEH buck regulator evaluation board

5. Revision History

Revision	Date	Description
1.00	Mar 23, 2022	Initial release

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