ISL73007SEHDEMO3Z

The ISL73007SEHDEMO3Z demonstration 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. The ISL73007SEH 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. 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 BOM count and complexity of design.

The ISL73007SEHDEMO3Z demonstration board and this accompanying manual provide a quick and easy method to evaluate the ISL73007SEH part, see the ISL73007SEH datasheet for information about the operation, function, and performance of the device.

Features

- Easy to use
- Optimized for 12V to 3.3V conversion, externally set 500kHz switching frequency, external slope and compensation configuration
- 3A Output current

Specifications

The ISL73007SEHDEMO3Z demonstration board is by default externally configured for immediate evaluation with minimum components and connections, which allows for other conditions to be evaluated with user modification of components and connections.

The electrical ratings of the ISL73007SEHDEMO3Z demonstration board are shown in Table 1.

Table 1. Electrical Ratings

Parameter	Rating
PVIN Supply Voltage	10.8V - 18V
DC Output Voltage	3.3V
Operating Frequency	500kHz
Output Current	3A
Temperature	-55ºC to +125ºC

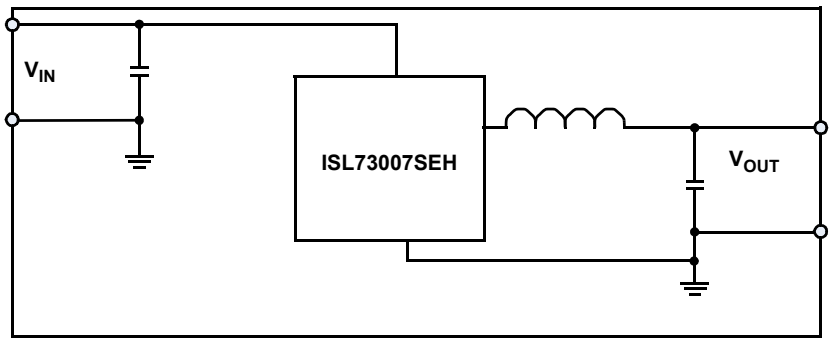

Figure 1. Block Diagram

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Contents

1. Functional Description

The ISL73007SEHDEMO3Z demonstration board is default configured for 12V to 3.3V conversion with a 3A maximum output current and contains the ISL73007SEH voltage regulator IC in the external configuration for the switching frequency, and for control loop and slope compensations. Figure 1 shows the ISL73007SEHDEMO3Z demonstration board block diagram. Photographs of the ISL73007SEHDEMO3Z are shown in Figure 3 and Figure 4.

The ISL73007SEHDEMO3Z demonstration board provides access to the pins of the IC device and convenient pads for connecting test equipment. For more information, see the schematic (Figure 5), PCB layers (Figure 6 through Figure 11), and Bill of Materials. Performance data taken using the ISL73007SEHDEMO3Z and basic lab equipment is shown in Figure 12 through Figure 19.

1.1 Operational Characteristics

The ISL73007SEHDEMO3Z only requires a single voltage supply >10.8V connected to the PVIN pad to operate, outputting 3.3V 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 (R_1 and R_2) on the ENABLE pin. **Note:** Do not exceed 5V on the ENABLE pin.

1.2 Setup and Configuration

The following equipment is recommended for testing the board.

- 12V 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 a 12V power supply to the PVIN pad.
3. Using the oscilloscope to look at VIN and VOUT waveforms 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 to observe 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 input and output voltages and currents.

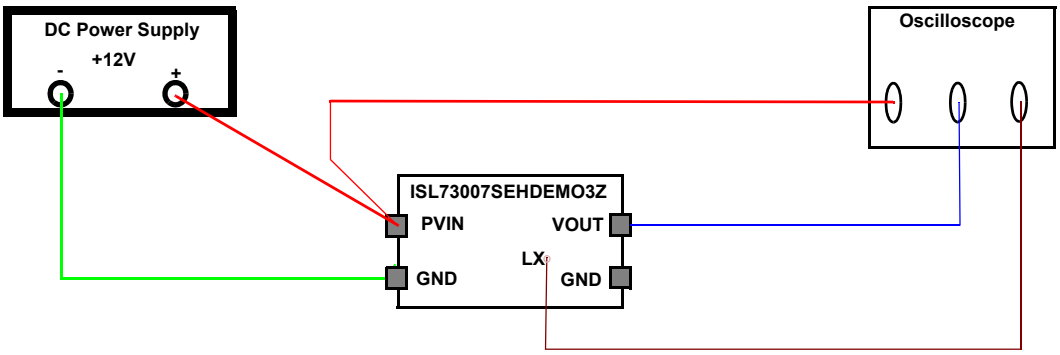

Figure 2. ISL73007SEH Basic Evaluation Test Setup Block Diagram

2. Board Design

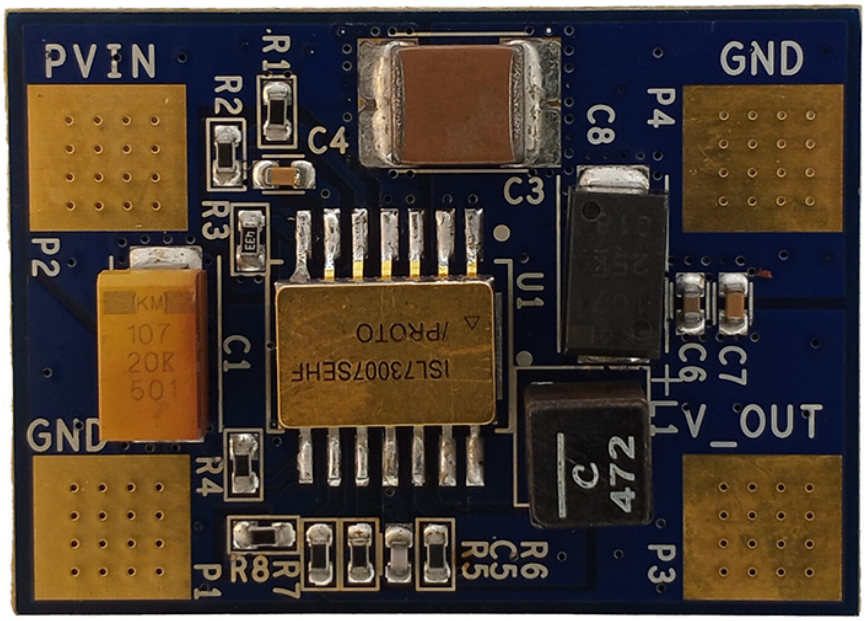

Figure 3. ISL73007SEHDEMO3Z Evaluation Board (Top)

Figure 4. ISL73007SEHDEMO3Z Evaluation Board (Bottom)

2.1 Basic Layout

The ISL73007SEH is located in the center of the board and is labeled U1. Input power is to be connected across the yellow Tantalum capacitor, the bulk input capacitance (C_1) at the PVIN and GND pads. The output voltage then appears across the V_OUT and GND pads near the output inductor (L_1) and the output capacitance (C_8), respectively. Additional C_{IN} is provided by C_2 (flip side) and C_3. 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 on the edge of the PCB are for switching frequency and output voltage setting, compensating the external loop error amplifier and PGOOD pull-up. Consult the schematic in (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 in order would be the loop compensation RC, the slope resistor, and the low ESR ceramic input capacitors. Avoid placing any traces or components under the LX shapes to avoid noise coupling from the switching node.

2.3 Schematic Diagrams

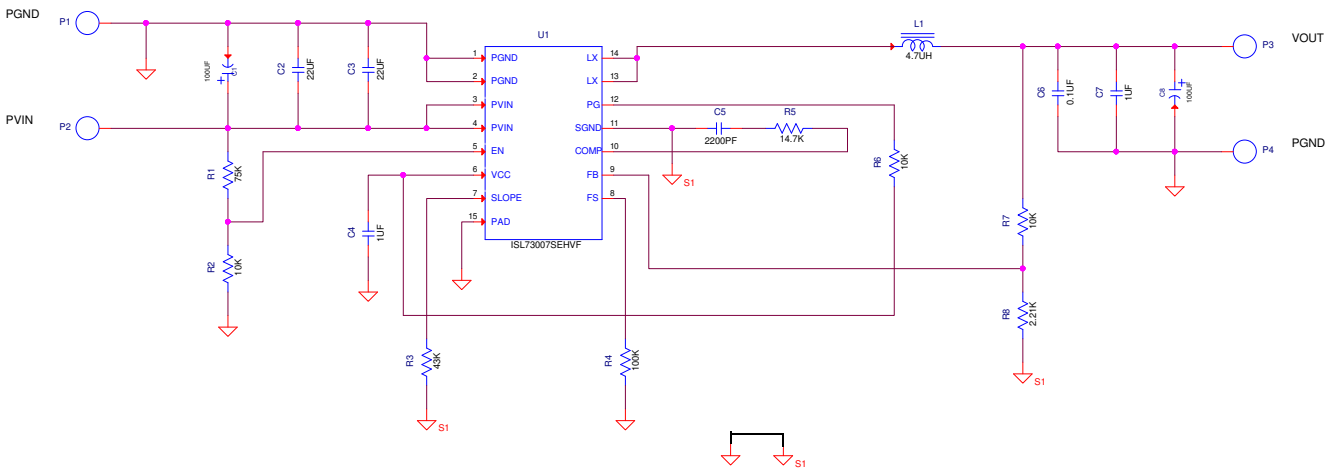

Figure 5. Schematic

2.4 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part
1		PWB-PCB, ISL73007SEHDEMO3Z, REVA, ROHS	Imagineering Inc	ISL73007SEHDEMO3ZREVAPCB
2	C2, C3	CAPACITOR, SMD, 2220, 22µF, 25V, 20%, X7R, ROHS	TDK	C5750X7R1E226M
2	C4, C7	CAP-AEC-Q200, SMD, 0603, 1µF, 25V, 10%, X7R, ROHS	Murata	GCM188R71E105KA64D
1	C5	CAP, SMD, 0603, 2200pF, 50V, 1%, C0G/NP0, ROHS	Murata	GRM1885C1H222FA01D
1	C6	CAP, SMD, 0603, 0.1µF, 25V, 10%, X7R, ROHS	Yageo	CC0603KRX7R8BB104
1	C8	CAP-TANT, SMD, 7.3x4.3mm, 100µF, 25V, 20%, 30mΩ at 100MHz, ROHS	Kemet	T521X107M025ATE030
1	C1	CAP-TANT, SMD, 7.3x4.3x4.0, 100µF, 20V, 20%, POLYMER	Kemet	T541X107M020AH6510
1	L1	COIL-PWR INDUCT, SMD, 5.4x5.2mm, 4.7µH.20%, 7.4A, 19.6mohm, ROHS	Coilcraft	XEL5050-472MEC
1	U1	IC-RAD LIGHT 3A POL REGULATOR, 14P, CFP, ROHS	Renesas Electronics	ISL73007SEHF/PROTO
1	R3	RES, SMD, 0603, 43k, 1/10W, 0.1%, TF, ROHS	Panasonic	ERA-3AEB433V
3	R2, R6, R7	RES, SMD, 0603, 10k, 1/10W, 1%, TF, ROHS	Venkel	CR0603-10W-1002FT
1	R4	RES, SMD, 0603, 100k, 1/10W, 1%, TF, ROHS	Venkel	CR0603-10W-1003FT
1	R5	RES, SMD, 0603, 14.7k, 1/10W, 1%, TF, ROHS	Venkel	CR0603-10W-1472FT
1	R8	RES, SMD, 0603, 2.21k, 1/10W, 1%, TF, ROHS	Yageo	RC0603FR-072K21L
1	R1	RES, SMD, 0603, 75k, 1/10W, 1%, TF, ROHS	Venkel	CR0603-10W-7502FT
0	P1, P2, P3, P4	DO NOT POPULATE OR PURCHASE		

2.5 Board Layout

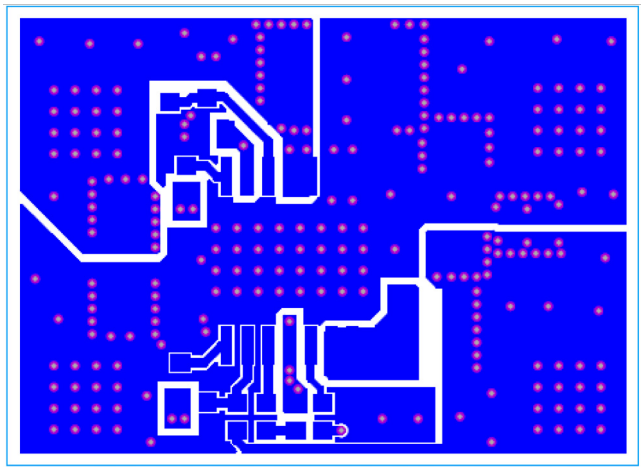

Figure 6. Top Layer

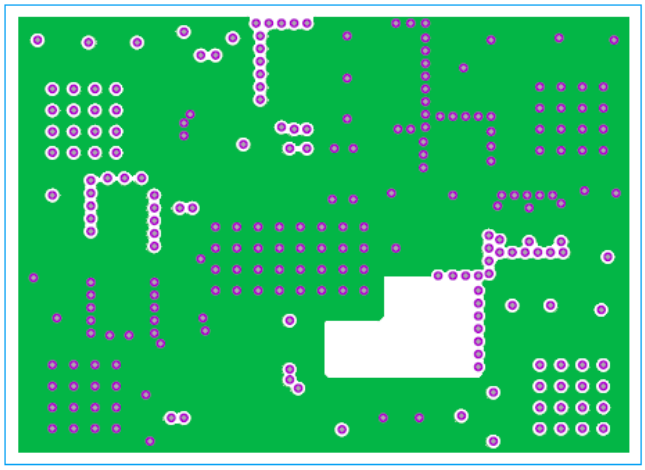

Figure 7. Layer 2

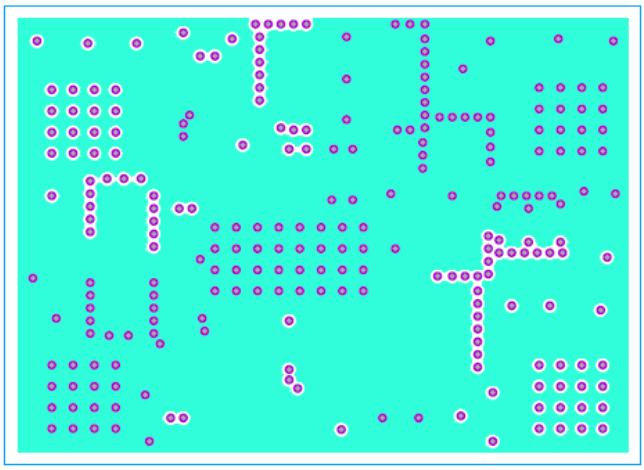

Figure 8. Layer 3

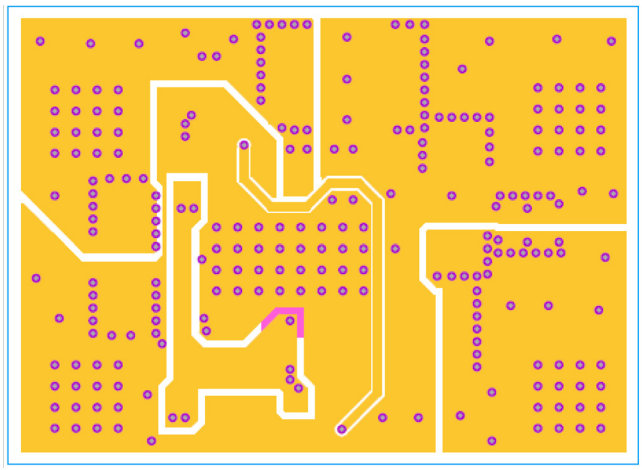

Figure 9. Bottom Layer

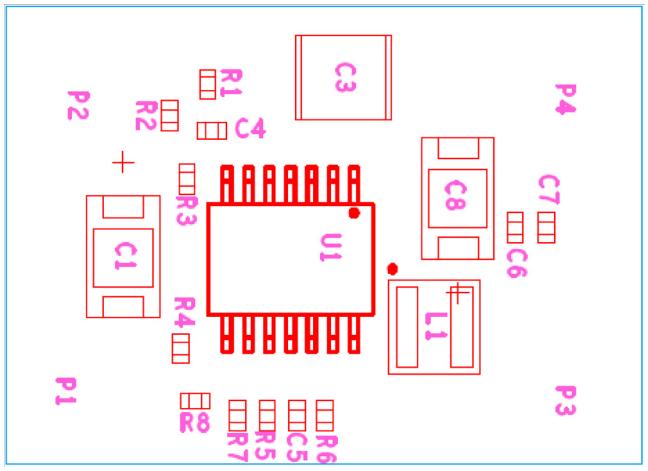

Figure 10. Top Silk Layer

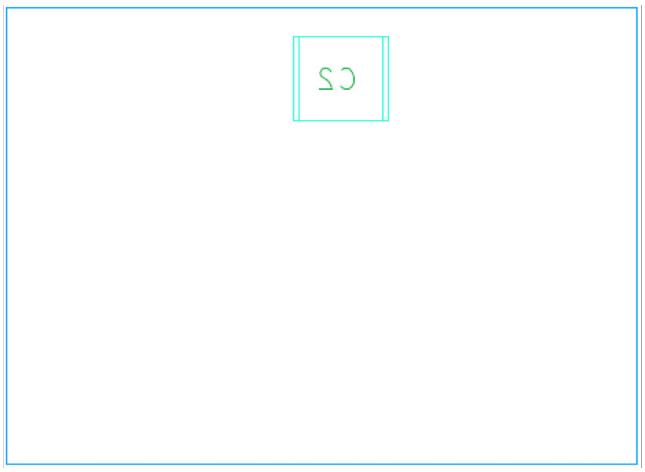

Figure 11. Bottom Silk Layer

3. Typical Performance Graphs

Unless otherwise noted, PVIN = 12V; V_{OUT} = 3.3V, f_{SW} = 500kHz, T_A = Room Ambient

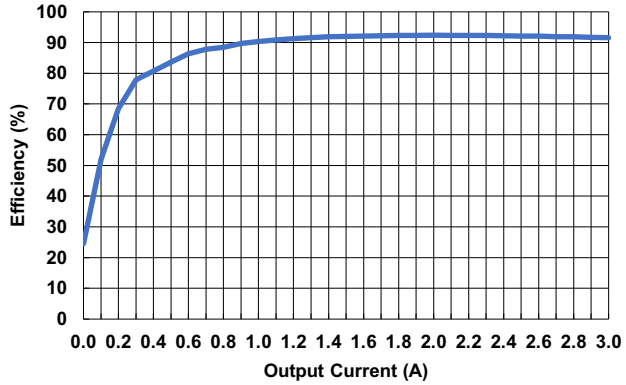

Figure 12. Efficiency

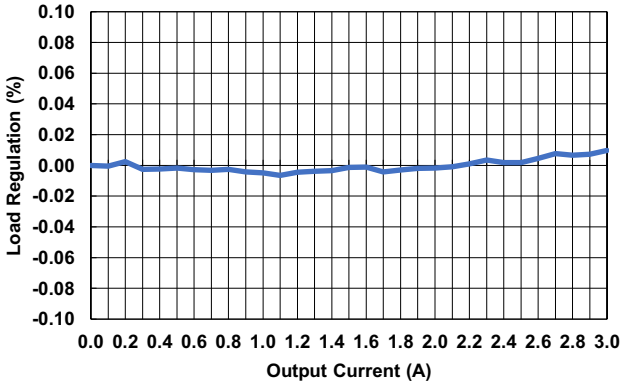

Figure 13. Load Regulation

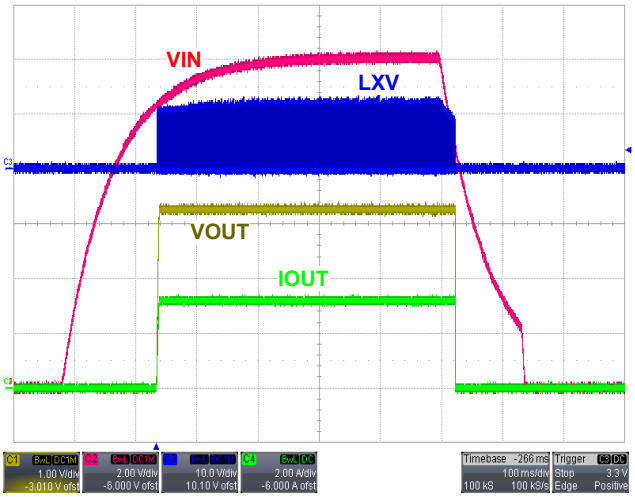

Figure 14. Turn-on /off, 1Ω load

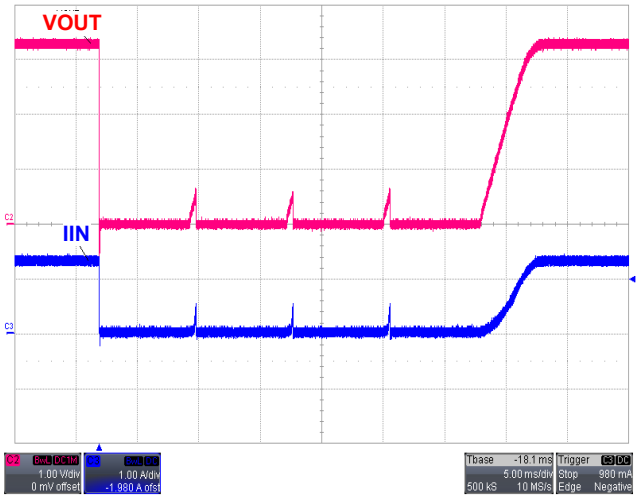

Figure 15. Shorted Output into Restart through Hiccup

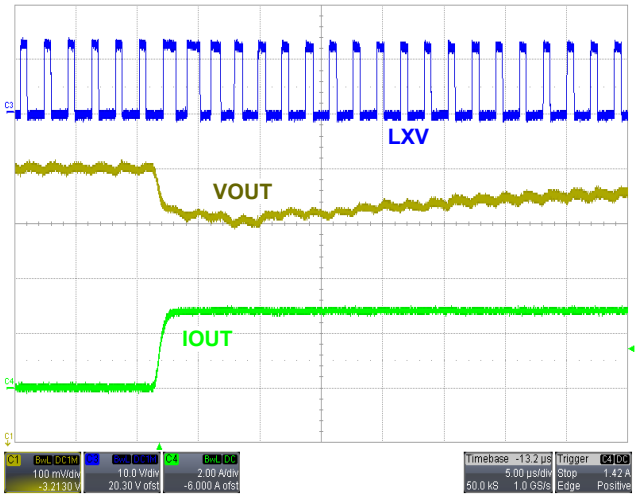

Figure 16. +2.8A Output Current Transient

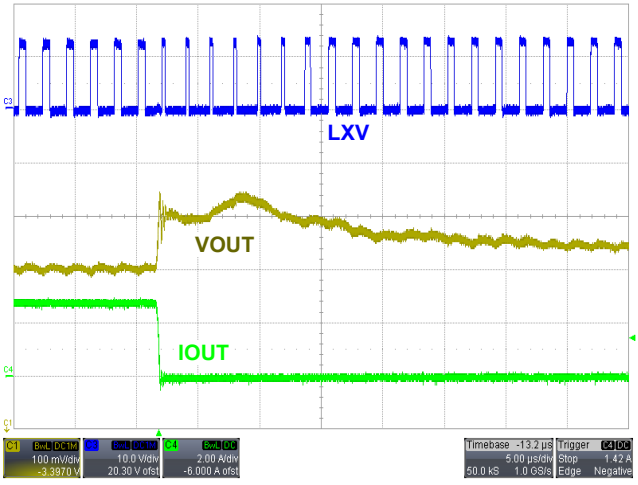

Figure 17. -2.8A Output Current Transient

Unless otherwise noted, PVIN = 12V; V_{OUT} = 3.3V, f_{SW} = 500kHz, T_A = Room Ambient (Cont.)

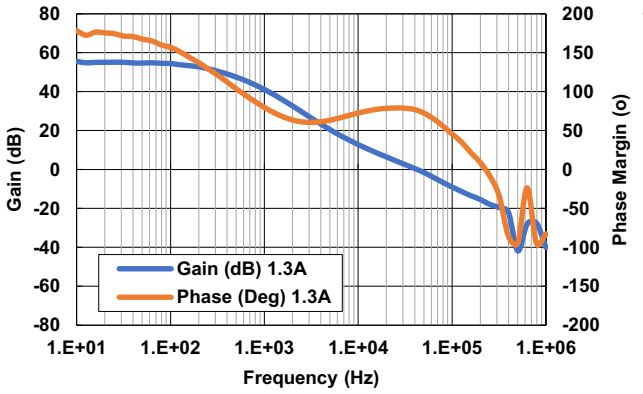

Figure 18. Gain/Phase BODE Plot, I_{OUT} = 1.3A

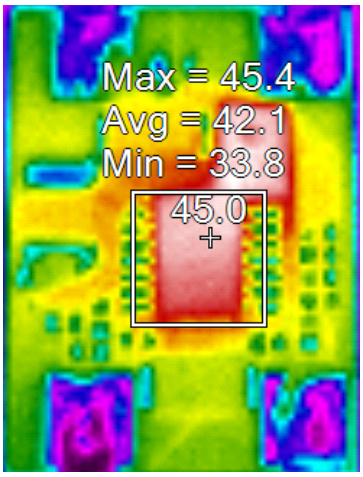

Figure 19. Package Temperature at I_{OUT} = 3A

4. Ordering Information

Part Number	Description
ISL73007SEHDEMO3Z	Radiation Hardened ISL73007SEH buck regulator demonstration board

5. Revision History

Revision	Date	Description
1.01	May 19, 2023	Updated Figure 3.
1.00	Mar 16, 2022	Initial release

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