

# ISL71090SEH25

## 2.5V Radiation Hardened Ultra Low Noise, Precision Voltage Reference

The ISL71090SEH25 is an ultra low noise, high DC accuracy precision voltage reference with a wide input voltage range from 4V to 30V. The ISL71090SEH25 uses the Advanced Bipolar technology to achieve  $2\mu V_{P-P}$  noise at 0.1Hz with an accuracy over temperature of 0.15%.

The ISL71090SEH25 offers a 2.5V output voltage with 10ppm/°C temperature coefficient and also provides excellent line and load regulation. The device is offered in an 8 Ld flatpack package.

The ISL71090SEH25 is ideal for high-end instrumentation, data acquisition and applications requiring high DC precision where low noise performance is critical.

### Applications

- RH voltage regulators precision outputs
- Precision voltage sources for data acquisition system for space applications
- Strain and pressure gauge for space applications

### Features

- Reference output voltage: 2.5V  $\pm 0.05\%$
- Accuracy over temperature:  $\pm 0.15\%$
- Output voltage noise:  $2\mu V_{P-P}$  typical (0.1Hz to 10Hz)
- Voltage accuracy over radiation:  $\pm 0.175\%$
- Supply current: 930 $\mu A$  (typical)
- Tempco (box method): 10ppm/°C Max
- Output current capability: 20mA
- Line regulation: 8ppm/V
- Load regulation: 2.5ppm/mA
- Operating temperature range: -55°C to +125°C
- Radiation acceptance testing (see TID report)
  - High dose rate (50-300rad(Si)/s): 100krad(Si)
  - Low dose rate (0.01rad(Si)/s): 50krad(Si)
- SEE hardness (see SEE report for details)
  - SET/SEL/SEB 86MeV•cm<sup>2</sup>/mg
- Electrically screened to SMD 5962-13211

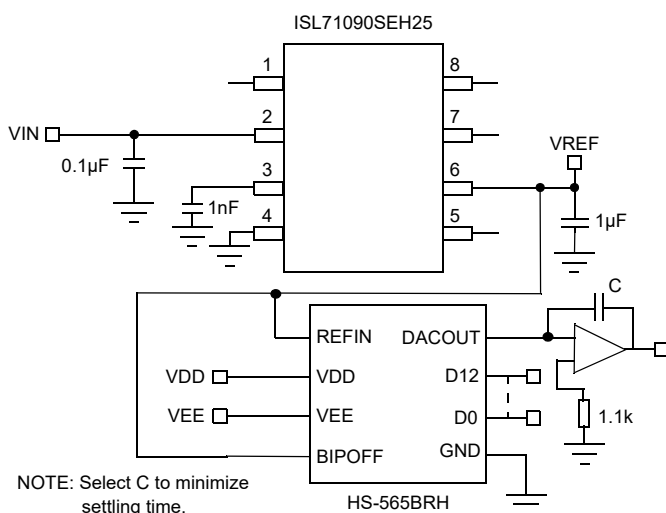


Figure 1. ISL71090SEH25 Typical Application Diagram

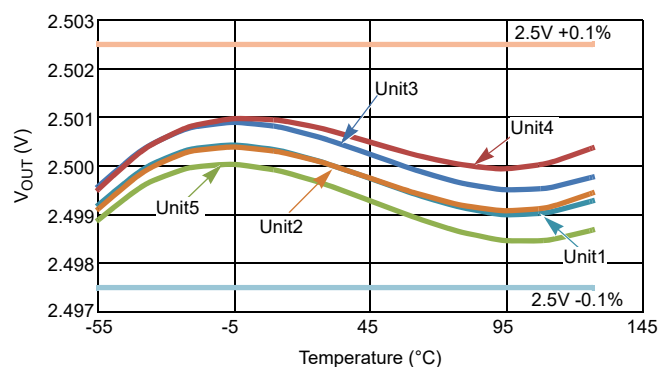


Figure 2. V<sub>OUT</sub> vs Temperature

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# 1. Overview

## 1.1 Functional Block Diagram

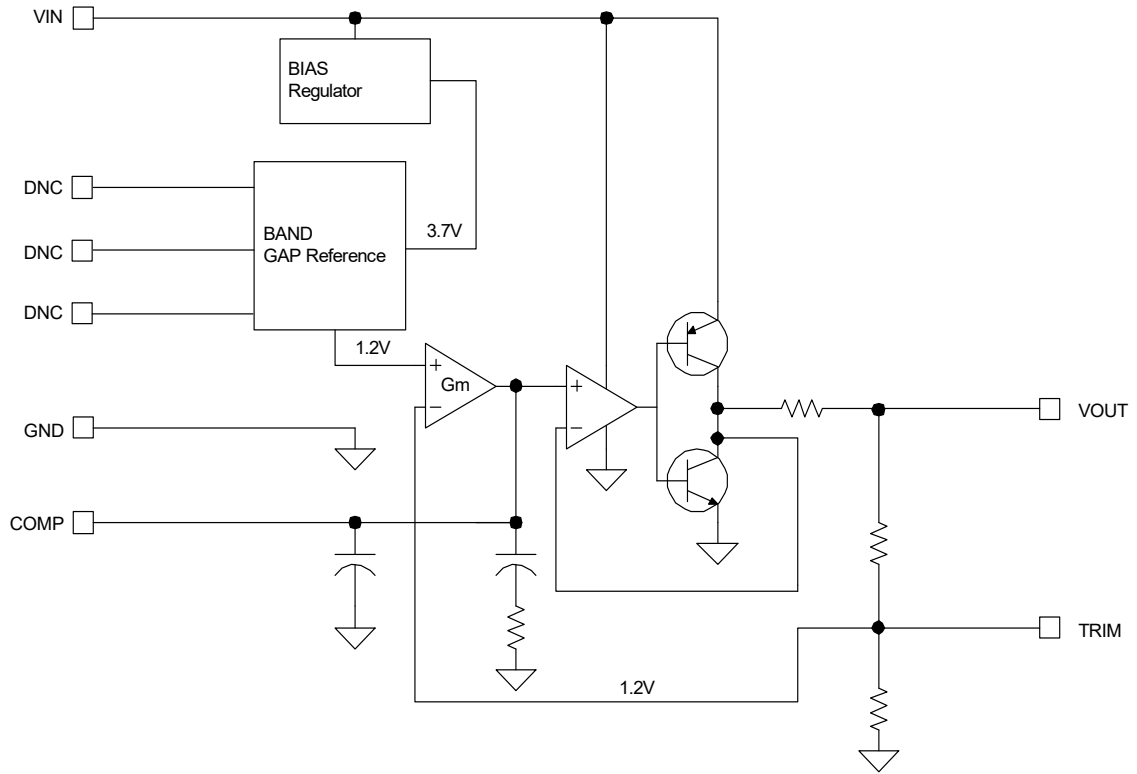


Figure 3. Functional Block Diagram

## 1.2 Typical Trim Application Diagram

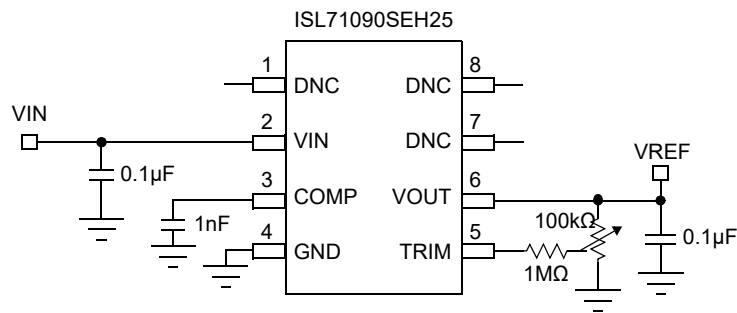
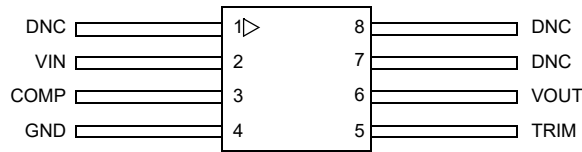


Figure 4. Typical Trim Application Diagram

## 2. Pin Information

### 2.1 Pin Assignments

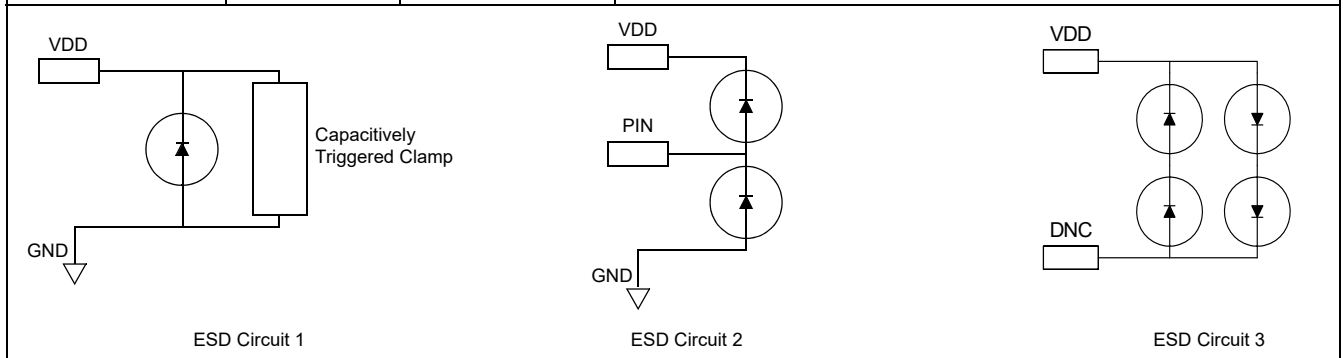


Note: The ESD triangular mark is indicative of pin #1. It is a part of the device marking and is placed on the lid in the quadrant where pin #1 is located.

Figure 5. Pin Assignments - Top View

### 2.2 Pin Descriptions

| Pin Number | Pin Name | ESD Circuit | Description                                   |
|------------|----------|-------------|---|
| 1, 7, 8    | DNC      | 3           | Do not connect. Internally terminated.        |
| 2          | VIN      | 1           | Input voltage connection                      |
| 3          | COMP     | 2           | Compensation and noise reduction capacitor    |
| 4          | GND      | 1           | Ground connection. Also connected to the lid. |
| 5          | TRIM     | 2           | Voltage reference trim input                  |
| 6          | VOUT     | 2           | Voltage reference output                      |



### 3. Specifications

#### 3.1 Absolute Maximum Ratings

**Caution:** Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

| Parameter <sup>[1][2]</sup>                      | Minimum | Maximum                 | Unit |
|--|---------|-------------------------|------|
| VIN to GND                                       | -0.5    | 40                      | V    |
| VIN to GND at an LET = 86MeV•cm <sup>2</sup> /mg | -0.5    | 36                      | V    |
| VOU to GND (10s)                                 | -0.5    | V <sub>OUT</sub> + 0.5V | V    |
| Voltage on any Pin to Ground                     | -0.5    | V <sub>OUT</sub> + 0.5V | V    |
| Voltage on DNC Pins <sup>[3]</sup>               | -       | -                       | -    |
| Input Voltage Slew Rate (Max)                    | -       | 0.1                     | V/μs |
| Maximum Junction Temperature                     | -       | +150                    | °C   |
| Maximum Storage Temperature Range                | -65     | +150                    | °C   |
| Human Body Model (Tested per MIL-PRF-883 3015.7) | -       | 2                       | kV   |
| Machine Model (Tested per JESD22-A115-A)         | -       | 200                     | V    |
| Charged Device Model (Tested per JESD22-C101D)   | -       | 750                     | V    |

1. Product capability established by initial characterization. Radiation acceptance tested on a wafer-by-wafer basis to 100krad(Si) at high dose rate and to 50krad(Si) at low dose rate.
2. The output capacitance used for SEE testing is C<sub>IN</sub> = 0.1μF and C<sub>OUT</sub> = 1μF.
3. No connections permitted to these pins.

#### 3.2 Recommended Operating Conditions

| Parameter                      | Minimum | Maximum | Unit |
|--------------------------------|---------|---------|------|
| Input Voltage, V <sub>IN</sub> | 4.0     | 30      | V    |
| Ambient Temperature            | -55     | +125    | °C   |

#### 3.3 Thermal Specifications

| Parameter          | Package               | Symbol                         | Conditions          | Typical Value | Unit |
|--------------------|-----------------------|--------------------------------|---------------------|---------------|------|
| Thermal Resistance | 8 Ld Flatpack Package | θ <sub>JA</sub> <sup>[1]</sup> | Junction to ambient | 140           | °C/W |
|                    |                       | θ <sub>JC</sub> <sup>[2]</sup> | Junction to case    | 15            | °C/W |

1. θ<sub>JA</sub> is measured with the component mounted on a high-effective thermal conductivity test board in free air. See [TB379](#) for details.
2. For θ<sub>JC</sub>, the case temperature location is the center of the ceramic on the package underside.

## 3.4 Electrical Specifications

### 3.4.1 Flatpack Packaged Device

$V_{IN} = 5V$ ,  $I_{OUT} = 0mA$ ,  $C_{OUT} = 0.1\mu F$ ,  $COMP = 1nF$  unless otherwise specified. **Boldface limits apply after radiation at +25°C and across the operating temperature range, -55°C to +125°C without radiation, unless otherwise specified.**

| Parameter   | Symbol                            | Test Conditions  | Min <sup>[1]</sup> | Typ   | Max <sup>[1]</sup> | Unit            |
|---|-----------------------------------|--|--------------------|-------|--------------------|-----------------|
| Output Voltage  | $V_{OUT}$                         | -  | -                  | 2.5   | -                  | V               |
| $V_{OUT}$ Accuracy                                    | $V_{OA}$                          | $V_{OUT} = 2.5V^{[2]}$ , $T_A = +25^\circ C$                   | -0.05              | -     | +0.05              | %               |
|   |                                   | $V_{OUT} = 2.5V^{[2]}$ , $T_A = -55^\circ C$ to $+125^\circ C$ | <b>-0.15</b>       | -     | <b>+0.15</b>       |                 |
|   |                                   | $V_{OUT} = 2.5V^{[2]}$ , $T_A = +25^\circ C$ , Post Rad        | -0.175             | -     | +0.175             |                 |
| Output Voltage Temperature Coefficient <sup>[3]</sup> | TC $V_{OUT}$                      | -  | -                  | -     | <b>10</b>          | ppm/°C          |
| Input Voltage Range                                   | $V_{IN}$                          | -  | <b>4</b>           | -     | <b>30</b>          | V               |
| Supply Current  | $I_{IN}$                          | -  | -                  | 0.930 | <b>1.280</b>       | mA              |
| Line Regulation                                       | $\Delta V_{OUT} / \Delta V_{IN}$  | $V_{IN} = 4V$ to $30V$   | -                  | 8     | <b>18</b>          | ppm/V           |
| Load Regulation                                       | $\Delta V_{OUT} / \Delta I_{OUT}$ | Sourcing: $0mA \leq I_{OUT} \leq 20mA$                         | -                  | 20    | <b>35</b>          | ppm/mA          |
|   |                                   | Sinking: $-10mA \leq I_{OUT} \leq 0mA$                         | -                  | 40    | <b>70</b>          |                 |
| Dropout Voltage <sup>[4]</sup>                        | $V_D$                             | $I_{OUT} = 10mA$   | -                  | 1.1   | <b>1.7</b>         | V               |
| Short-Circuit Current                                 | $I_{SC+}$                         | $T_A = +25^\circ C$ , $V_{OUT}$ tied to GND                    | -                  | 55    | -                  | mA              |
| Short-Circuit Current                                 | $I_{SC-}$                         | $T_A = +25^\circ C$ , $V_{OUT}$ tied to $V_{IN}$               | -                  | -61   | -                  | mA              |
| Turn-On Settling Time                                 | $t_R$                             | 90% of final value, $C_L = 1.0\mu F$ , $C_C = open$            | -                  | 150   | -                  | $\mu s$         |
| Ripple Rejection                                      |                                   | $f = 120Hz$  | -                  | 90    | -                  | dB              |
| Output Voltage Noise                                  | $e_N$                             | $0.1Hz \leq f \leq 10Hz$                                       | -                  | 1.9   | -                  | $\mu V_{P-P}$   |
| Broadband Voltage Noise                               | $V_N$                             | $10Hz \leq f \leq 1kHz$  | -                  | 1.6   | -                  | $\mu V_{RMS}$   |
| Noise Density   | -                                 | $f = 1kHz$   | -                  | 50    | -                  | nV/ $\sqrt{Hz}$ |
| Long Term Drift                                       | $\Delta V_{OUT} / \Delta t$       | $T_A = +125^\circ C$ , 1000Hrs                                 | -                  | 15    | -                  | ppm             |

- Compliance to datasheet limits is assured by one or more methods: production test, characterization and/or design.
- Post-reflow drift for the ISL71090SEH25 devices can be 100 $\mu V$  typical based on experimental results with devices on FR4 double sided boards. The engineer must take this into account when considering the reference voltage after assembly.
- Over the specified temperature range. Temperature coefficient is measured by the box method whereby the change in  $V_{OUT}$  is divided by the temperature range; in this case,  $-55^\circ C$  to  $+125^\circ C = +180^\circ C$ .
- Dropout Voltage is the minimum  $V_{IN} - V_{OUT}$  differential voltage measured at the point where  $V_{OUT}$  drops 1mV from  $V_{IN} = nominal$  at  $T_A = +25^\circ C$ .

### 3.4.2 Die

$V_{IN} = 5V$ ,  $I_{OUT} = 0mA$ ,  $C_{OUT} = 0.1\mu F$ ,  $COMP = 1nF$  unless otherwise specified. **Boldface limits apply after radiation at +25°C and across the operating temperature range, -55°C to +125°C without radiation, unless otherwise specified. Specifications over temperature are guaranteed but not production tested on die.**

| Parameter   | Symbol                            | Conditions   | Min <sup>[1]</sup> | Typ   | Max <sup>[1]</sup> | Unit   |
|---|-----------------------------------|--|--------------------|-------|--------------------|--------|
| Output Voltage  | $V_{OUT}$                         | -  | -                  | 2.5   | -                  | V      |
| $V_{OUT}$ Accuracy                                    | $V_{OA}$                          | $V_{OUT} = 2.5V^{[2]}$ , $T_A = +25^\circ C$                   | -0.05              | -     | +0.05              | %      |
|   |                                   | $V_{OUT} = 2.5V^{[2]}$ , $T_A = -55^\circ C$ to $+125^\circ C$ | <b>-0.15</b>       | -     | <b>+0.15</b>       |        |
|   |                                   | $V_{OUT} = 2.5V^{[2]}$ , $T_A = +25^\circ C$ , Post Rad        | -0.175             | -     | +0.175             |        |
| Output Voltage Temperature Coefficient <sup>[3]</sup> | TC $V_{OUT}$                      | -  | -                  | -     | <b>10</b>          | ppm/°C |
| Input Voltage Range                                   | $V_{IN}$                          | -  | <b>4</b>           | -     | <b>30</b>          | V      |
| Supply Current  | $I_{IN}$                          | -  | -                  | 0.930 | <b>1.280</b>       | mA     |
| Line Regulation                                       | $\Delta V_{OUT} / \Delta V_{IN}$  | $V_{IN} = 4V$ to $30V$   | -                  | 8     | <b>18</b>          | ppm/V  |
| Load Regulation                                       | $\Delta V_{OUT} / \Delta I_{OUT}$ | Sourcing: $0mA \leq I_{OUT} \leq 20mA$                         | -                  | 20    | <b>35</b>          | ppm/mA |
|   |                                   | Sinking: $-10mA \leq I_{OUT} \leq 0mA$                         | -                  | 40    | <b>70</b>          |        |
| Dropout Voltage <sup>[4]</sup>                        | $V_D$                             | $I_{OUT} = 10mA$   | -                  | 1.1   | <b>1.7</b>         | V      |

1. Compliance to datasheet limits is assured by one or more methods: production test, characterization and/or design.
2. The  $V_{OUT}$  accuracy is based on die mount with Silver Glass die attach material such as QMI 2569 or equivalent in a package with an Alumina ceramic substrate.
3. Over the specified temperature range. Temperature coefficient is measured by the box method whereby the change in  $V_{OUT}$  is divided by the temperature range; in this case,  $-55^\circ C$  to  $+125^\circ C = +180^\circ C$ .
4. Dropout Voltage is the minimum  $V_{IN} - V_{OUT}$  differential voltage measured at the point where  $V_{OUT}$  drops 1mV from  $V_{IN} = \text{nominal}$  at  $T_A = +25^\circ C$ .

## 4. Typical Performance Curves

$V_{IN} = 5V$ ,  $V_{OUT} = 2.5V$ ,  $T_A = +25^\circ C$ ,  $C_{OUT} = 0.1\mu F$ ,  $COMP = 1nF$  unless otherwise specified.

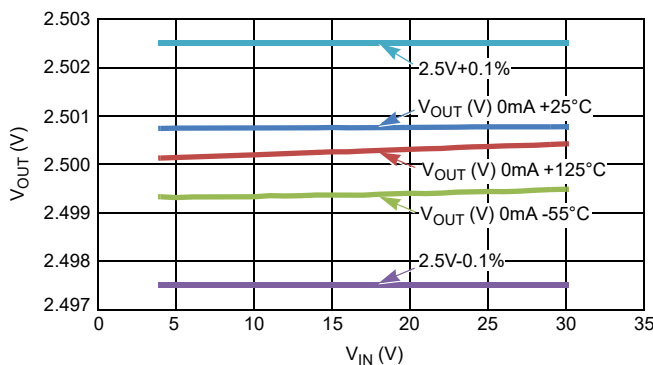


Figure 6.  $V_{OUT}$  Accuracy Over-Temperature

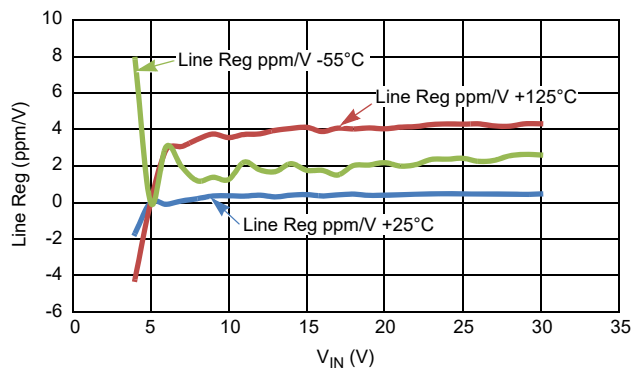


Figure 7. Line Regulation Over-Temperature (0mA)

$V_{IN} = 5V$ ,  $V_{OUT} = 2.5V$ ,  $T_A = +25^\circ C$ ,  $C_{OUT} = 0.1\mu F$ ,  $COMP = 1nF$  unless otherwise specified. (Cont.)

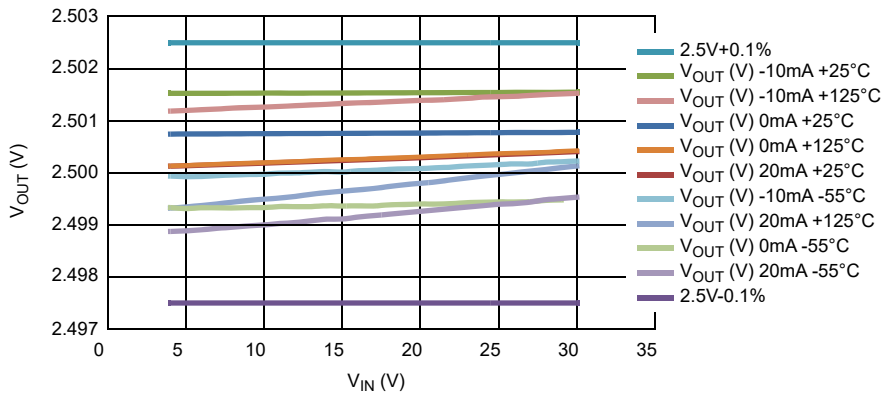


Figure 8.  $V_{OUT}$  vs  $V_{IN}$  at 0mA, 20mA and -10mA

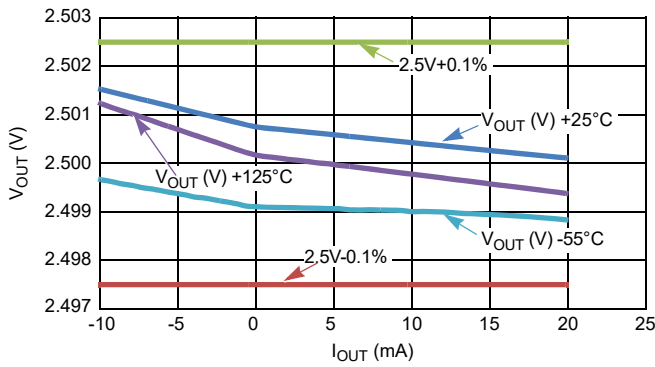


Figure 9. Load Regulation Over-Temperature at  $V_{IN} = 5V$  (V)

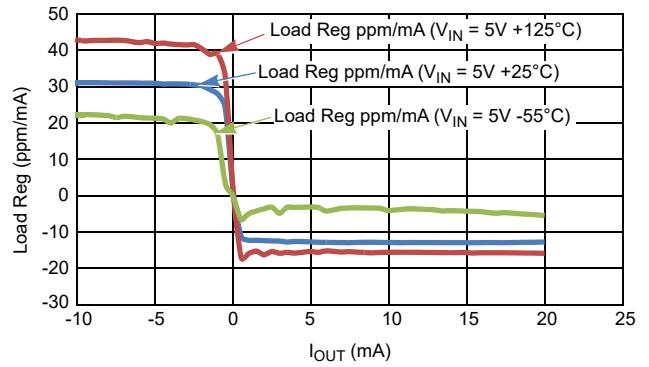


Figure 10. Load Regulation Over-Temperature at  $V_{IN} = 5V$  (ppm/mA)

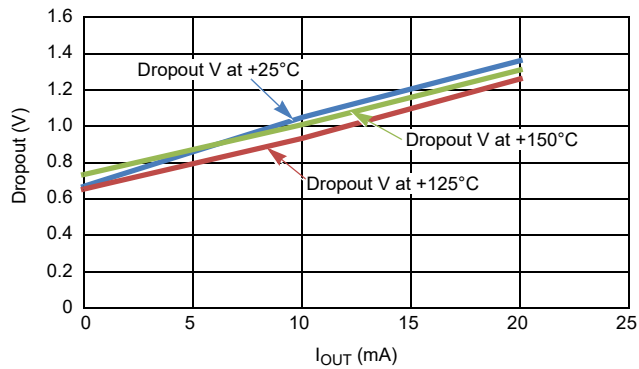


Figure 11. Dropout Voltage for 2.5V

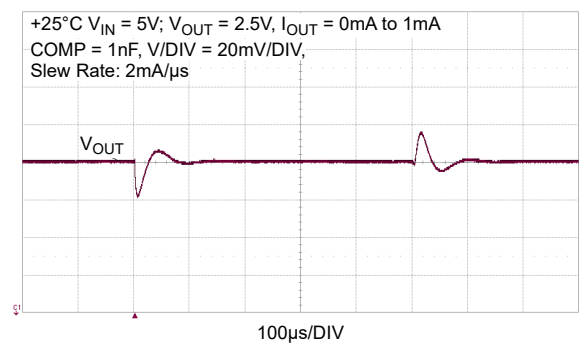


Figure 12. Load Transient (0mA to 1mA)



$V_{IN} = 5V$ ,  $V_{OUT} = 2.5V$ ,  $T_A = +25^\circ C$ ,  $C_{OUT} = 0.1\mu F$ ,  $COMP = 1nF$  unless otherwise specified. (Cont.)

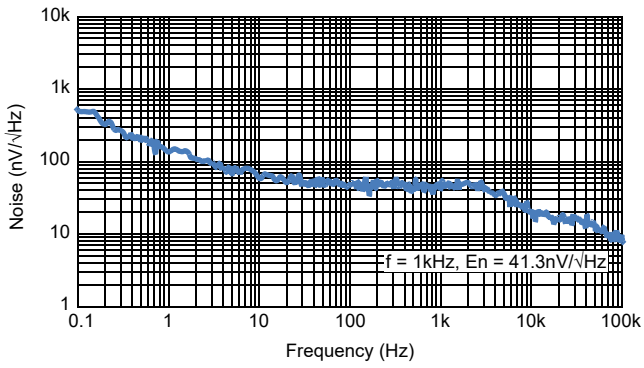


Figure 13. Noise Density vs Frequency ( $V_{IN} = 5.0V$ ,  $I_{OUT} = 0mA$ ,  $C_{IN} = 0.1\mu F$ ,  $C_{OUT} = 1\mu F$ ,  $COMP = 1nF$ )

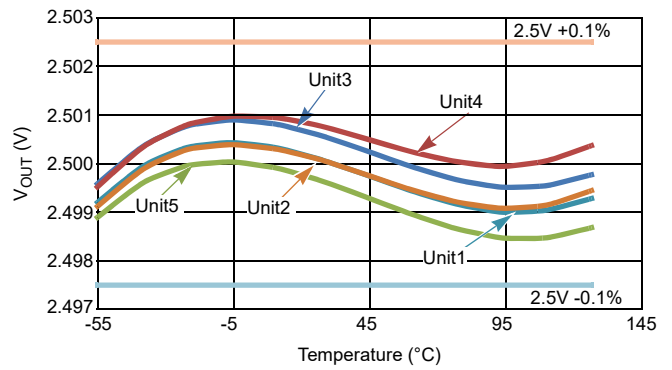


Figure 14. Typical Temperature Coefficient Plot for 5 Units

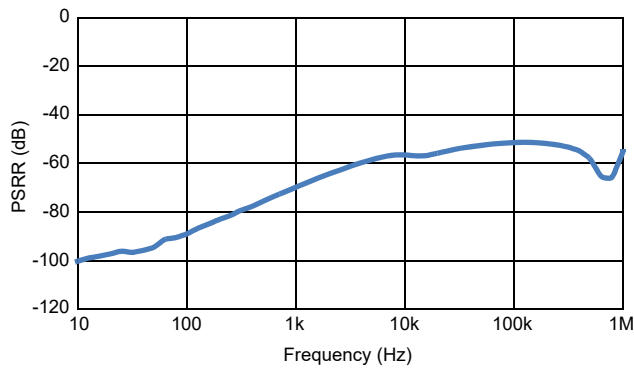


Figure 15. PSRR ( $+25^\circ C$ ,  $V_{IN} = 5V$ ,  $V_{OUT} = 2.5V$ ,  $I_{OUT} = 0mA$ ,  $C_{IN} = C_{OUT} = 0.1\mu F$ ,  $COMP = 1nF$ ,  $VSIG = 300mV_{p-p}$ )

## 5. Device Operation

### 5.1 Bandgap Precision Reference

The ISL71090SEH25 uses a bandgap architecture and special trimming circuitry to produce a temperature compensated, precision voltage reference with high input voltage capability and moderate output current drive.

## 6. Applications Information

### 6.1 Board Mounting Considerations

For applications requiring the highest accuracy, board mounting location should be reviewed. The device uses a ceramic flatpack package. Generally, mild stresses to the die when the Printed Circuit (PC) board is heated and cooled, can slightly change the shape. Because of these die stresses, placing the device in areas subject to slight twisting can cause degradation of reference voltage accuracy. It is normally best to place the device near the edge of a board, or on the shortest side, because the axis of bending is most limited in that location. Mounting the device in a cutout also minimizes flex. Obviously, mounting the device on flexprint or extremely thin PC material will likewise cause loss of reference accuracy.

### 6.2 Board Assembly Considerations

Some PC board assembly precautions are necessary. Normal output voltage shifts of typically 100 $\mu$ V can be expected with Pb-free reflow profiles or wave solder on multi-layer FR4 PC boards. Precautions should be taken to avoid excessive heat or extended exposure to high reflow or wave solder temperatures.

### 6.3 Noise Performance and Reduction

The output noise voltage over the 0.1Hz to 10Hz bandwidth is typically 2 $\mu$ V<sub>P-P</sub> ( $V_{OUT} = 2.5V$ ). The noise measurement is made with a 9.9Hz bandpass filter. Noise in the 10Hz to 1kHz bandwidth is approximately 1.6 $\mu$ V<sub>RMS</sub> ( $V_{OUT} = 2.5V$ ), with 0.1 $\mu$ F capacitance on the output. This noise measurement is made with a band pass filter of 990Hz. Load capacitance up to 10 $\mu$ F (with COMP) can be added but will result in only marginal improvements in output noise and transient response.

### 6.4 Turn-On Time

Normal turn-on time is typically 150 $\mu$ s, the circuit designer must take this into account when looking at power-up delays or sequencing.

### 6.5 Temperature Coefficient

The limits stated for temperature coefficient (Tempco) are governed by the method of measurement. The overwhelming standard for specifying the temperature drift of a reference is to measure the reference voltage at two temperatures, which provide for the maximum voltage deviation and take the total variation, ( $V_{HIGH} - V_{LOW}$ ), this is then divided by the temperature extremes of measurement ( $T_{HIGH} - T_{LOW}$ ). The result is divided by the nominal reference voltage (at  $T = +25^{\circ}C$ ) and multiplied by  $10^6$  to yield ppm/ $^{\circ}C$ . This is the "Box" method for specifying temperature coefficient.

### 6.6 Output Voltage Adjustment

The output voltage can be adjusted above and below the factory-calibrated value via the trim terminal. The trim terminal is the negative feedback divider point of the output op amp. The voltage at the trim pin is set at approximately 1.216V by the internal bandgap and amplifier circuitry of the voltage reference. The suggested method to adjust the output is to connect a 1M $\Omega$  external resistor directly to the trim terminal and connect the other end to the wiper of a potentiometer that has a 100k $\Omega$  resistance and whose outer terminals connect to  $V_{OUT}$

and ground. If a 1M $\Omega$  resistor is connected to trim, the output adjust range will be  $\pm 6.3$ mV. The TRIM pin should not have any capacitor tied to its output, also it is important to minimize the capacitance on the trim terminal during layout to preserve output amplifier stability. It is also best to connect the series resistor directly to the trim terminal, to minimize that capacitance and also to minimize noise injection. Small trim adjustments will not disturb the factory-set temperature coefficient of the reference, but trimming near the extreme values can.

## 6.7 Output Stage

The output stage of the device has a push-pull configuration with a high-side PNP and a low-side NPN. This helps the device to act as a source and sink. The device can source 20mA and sink 10mA.

## 6.8 Use of COMP Capacitor

The reference can be compensated for the C<sub>OUT</sub> capacitors used by adding a capacitor from COMP pin to GND. See [Table 1](#) for recommended values of the COMP capacitor.

**Table 1. Recommended Values of COMP Capacitor**

| C <sub>OUT</sub> ( $\mu$ F) | C <sub>COMP</sub> (nF) |
|-----------------------------|------------------------|
| 0.1                         | 1                      |
| 1                           | 1                      |
| 10                          | 10                     |

## 6.9 SEE Testing

The device was tested under ion beam at an LET of 86MeV $\cdot$ cm<sup>2</sup>/mg. The device did not latch-up or burn out to a VDD of 36V and at +125°C. Single Event transients were observed and are summarized in the [Table 2](#).

**Table 2. Observation of Single Event Transients**

| V <sub>IN</sub> (V) | I <sub>OUT</sub> (mA) | C <sub>OUT</sub> ( $\mu$ F) | SET (% V <sub>OUT</sub> ) |
|---------------------|-----------------------|-----------------------------|---------------------------|
| 4                   | 5                     | 1                           | -4.6                      |
| 30                  | 5                     | 1                           | -4.4                      |
| 30                  | 5                     | 10                          | -1.0                      |

## 6.10 DNC Pins

These pins are for trimming purpose and for factory use only. Do not connect these to the circuit in any way. It will adversely effect the performance of the reference.

## 7. Package and Die Characteristics

Table 3. Die and Assembly Related Information

| <b>Die Information</b>        |  |
|-------------------------------|--|
| Dimensions                    | 1464 $\mu$ m $\times$ 1744 $\mu$ m (58 mils $\times$ 69 mils)<br>Thickness: 483 $\mu$ m $\pm$ 25 $\mu$ m (19 mils $\pm$ 1 mil) |
| <b>Interface Materials</b>    |  |
| Glassivation                  | Type: Nitrox<br>Thickness: 15k $\text{Å}$  |
| Top Metallization             | Type: AlCu (99.5%/0.5%)<br>Thickness: 30k $\text{Å}$   |
| Backside Finish               | Silicon  |
| Process                       | Dielectrically Isolated Advanced Bipolar Technology- PR40 SOI  |
| <b>Assembly Information</b>   |  |
| Substrate Potential           | Floating   |
| <b>Additional Information</b> |  |
| Worst Case Current Density    | $<2 \times 10^5 \text{A/cm}^2$   |
| Transistor Count              | 182  |
| Weight of Packaged Device     | 0.31 grams (Typical)   |
| Lid Characteristics           | Finish: Gold<br>Potential: Connected to pin #4 (GND)<br>Case Isolation to Any Lead: $20 \times 10^9 \Omega$ (min)              |

## 7.1 Metallization Mask Layout

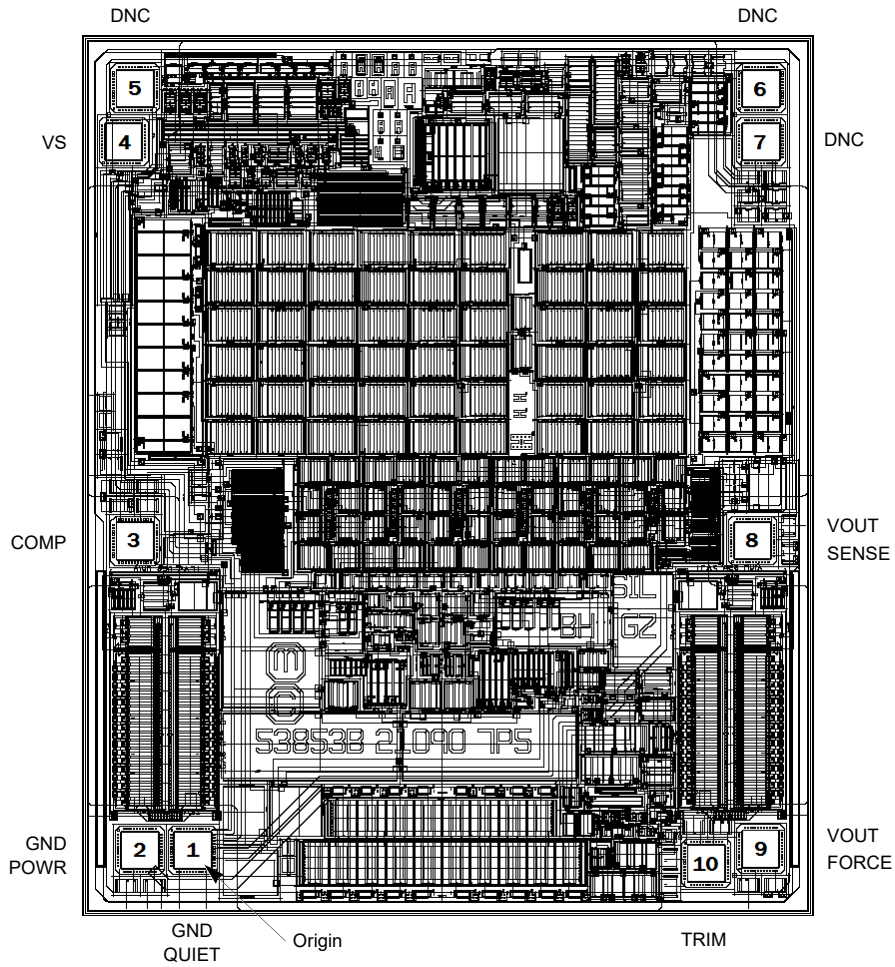


Table 4. Die Layout X-Y Coordinates

| Pad Name                 | Pad Number | X (μm) | Y (μm) | Bond Wires per Pad <sup>[1]</sup> |
|--------------------------|------------|--------|--------|-----------------------------------|
| GND PWR                  | 2          | -104   | 0      | 1                                 |
| GND QUIET <sup>[2]</sup> | 1          | 0      | 0      | 1                                 |
| COMP                     | 3          | -108   | 589    | 1                                 |
| VS                       | 4          | -125   | 1350   | 1                                 |
| DNC                      | 5          | -108   | 1452   | 1                                 |
| DNC                      | 6          | 1089   | 1452   | 1                                 |
| DNC                      | 7          | 1089   | 1350   | 1                                 |
| VOUT SENSE               | 8          | 1072   | 598    | 1                                 |
| VOUT FORCE               | 9          | 1088   | 1      | 1                                 |
| TRIM                     | 10         | 985    | -25    | 1                                 |

1. Bond wire size is 1 mil.

2. Origin of coordinates is the centroid of GND QUIET.

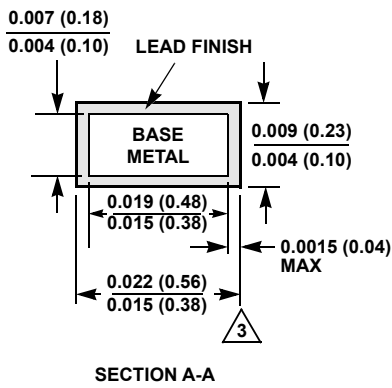
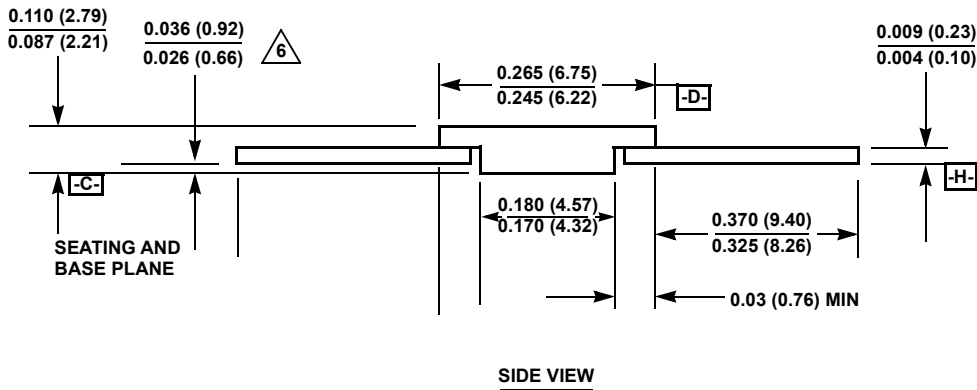
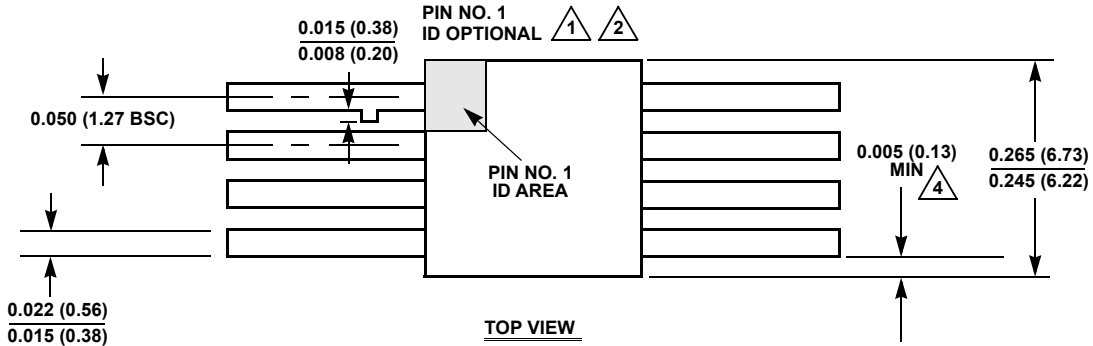
## 8. Package Outline Drawing

For the most recent package outline drawing, see [K8.A](#).

K8.A

8 Lead Ceramic Metal Seal Flatpack Package

Rev 4, 12/14



**NOTES:**

1. Index area: A notch or a pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark. Alternately, a tab may be used to identify pin one.
2. If a pin one identification mark is used in addition to or instead of a tab, the limits of the tab dimension do not apply.
3. The maximum limits of lead dimensions (section A-A) shall be measured at the centroid of the finished lead surfaces, when solder dip or tin plate lead finish is applied.
4. Measure dimension at all four corners.
5. For bottom-brazed lead packages, no organic or polymeric materials shall be molded to the bottom of the package to cover the leads.
6. Dimension shall be measured at the point of exit (beyond the meniscus) of the lead from the body. Dimension minimum shall be reduced by 0.0015 inch (0.038mm) maximum when solder dip lead finish is applied.
7. Dimensioning and tolerancing per ANSI Y14.5M - 1982.
8. Controlling dimension: INCH.

## 9. Ordering Information

| SMD Ordering Number <sup>[1]</sup> | Part Number <sup>[2]</sup>             | V <sub>OUT</sub> Option (V) | Radiation Hardness (Total Ionizing Dose) | Package Description (RoHS Compliant) | Pkg. Dwg. # | Carrier Type | Temp Range    |
|------------------------------------|--|-----------------------------|--|--------------------------------------|-------------|--------------|---------------|
| 5962R1321102VXC                    | ISL71090SEHVF25                        | 2.50                        | HDR to 100krad(Si),<br>LDR to 50krad(Si) | 8 Ld Flatpack                        | K8.A        | Tray         | -55 to +125°C |
| N/A                                | ISL71090SEHF25/PROTO <sup>[3]</sup>    | 2.50                        | N/A                                      |                                      |             |              |               |
| 5962R1321102V9A                    | ISL71090SEHVX25 <sup>[4]</sup>         | 2.50                        | HDR to 100krad(Si),<br>LDR to 50krad(Si) | Die                                  | -           | -            |               |
| N/A                                | ISL71090SEHX25SAMPLE <sup>[3][4]</sup> | 2.50                        | N/A                                      |                                      |             |              |               |
| N/A                                | ISL71090SEH25EV1Z <sup>[5]</sup>       | Evaluation Board            |  |                                      |             |              |               |

- Specifications for Rad Hard QML devices are controlled by the Defense Logistics Agency Land and Maritime (DLA). The SMD numbers listed must be used when ordering.
- These Pb-free Hermetic packaged products employ 100% Au plate - e4 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations.
- The /PROTO and /SAMPLE are not rated or certified for Total Ionizing Dose (TID) or Single Event Effect (SEE) immunity. These parts are intended for engineering evaluation purposes only. The /PROTO parts meet the electrical limits and conditions across temperature specified in the DLA SMD and are in the same form and fit as the qualified device. The /SAMPLE parts are capable of meeting the electrical limits and conditions specified in the DLA SMD. The /SAMPLE parts do not receive 100% screening across temperature to the DLA SMD electrical limits. These part types do not come with a Certificate of Conformance because they are not DLA qualified devices.
- Die product tested at TA = + 25°C. The wafer probe test includes functional and parametric testing sufficient to make the die capable of meeting the electrical performance outlined in [Electrical Specifications](#).
- Evaluation board uses the /PROTO parts and /PROTO parts are not rated or certified for Total Ionizing Dose (TID) or Single Event Effect (SEE) immunity.

**Table 5. Key Differences Between Family of Parts**

| Part Number   | V <sub>OUT</sub> (V) | TEMPCO (ppm/°C) | Output Voltage Noise (μV <sub>p-p</sub> ) | Load Regulation (ppm/mA) |
|---------------|----------------------|-----------------|---|--------------------------|
| ISL71090SEH12 | 1.25                 | 10              | 1   | 35                       |
| ISL71090SEH25 | 2.5                  | 10              | 2   | 2.5                      |
| ISL71090SEH50 | 5.0                  | 10              | 1.1                                       | 10                       |
| ISL71090SEH75 | 7.5                  | 10              | 1   | 10                       |

## 10. Revision History

| Revision | Date          | Change   |
|----------|---------------|--|
| 5.02     | Sept 20, 2023 | Applied new template formatting throughout.<br>Updated Radiation Acceptance Tested feature bullets.<br>Added Figure 4.<br>Updated Note 1 in Abs Max section. |
| 5.01     | Jan 20, 2022  | Updated Figure 9.  |

| Revision | Date         | Change   |
|----------|--------------|--|
| 5.0 0    | May 14, 2021 | Updated the Radiation Features bullet.<br>Updated Ordering Information table formatting and added Notes 3, 4, and 5.<br>Added the Transistor Count to the Assembly Related Information.<br>Removed Related Literature and About Intersil sections.   |
| 4.00     | Mar 18, 2016 | -Changed title From: "Radiation Hardened Ultra Low Noise, Precision Voltage Reference" to: "2.5V Radiation Hardened Ultra Low Noise, Precision Voltage Reference"<br>-Updated Related Literature document titles to match titles on the actual documents.<br>-Corrected the Evaluation board part number in the Ordering Information table on page 2.<br>-Added Table 1 on page 2.<br>On page 5:<br>-Changed Electrical Specification for Flatpack heading from: "Boldface limits apply over the operating temperature range, -55°C to +125°C and radiation." to: "Boldface limits apply after radiation at +25°C or across the operating temperature range, -55°C to +125°C without radiation, unless otherwise specified."<br>-For parameters $V_{OA}$ (rows 2, 3, 4) in Electrical Specifications for Flatpack table added "Note 13" to Conditions. column.<br>-Removed reference to TB493 as this is not applicable to hermetic packages.<br>On page 6:<br>-Changed Electrical Specification for Die heading from: "Boldface limits apply over the operating temperature range, -55°C to +125°C and radiation." to: "Boldface limits apply after radiation at +25°C or across the operating temperature range, -55°C to +125°C without radiation, unless otherwise specified."<br>-For parameters $V_{OA}$ (rows 2, 3, 4) in Electrical Specifications for Die table added "Note 14" to Conditions column.<br>Updated POD K8.A to the latest revision changes are as follows:<br>-Modified Note 2 by adding the words "...in addition to or instead of..." |
| 3.00     | Feb 27, 2014 | On page 1, Under features: Added voltage accuracy over radiation with $\pm 0.175\%$ value.<br>On page 1: Under features changed the text from accuracy over temperature and radiation to: accuracy over temperature.<br>"Pin Description" on page 3: Under description for pin number 4 added the lid connected to ground.<br>Electrical specifications table for "Die" on page 6 under accuracy post rad updated min from -0.152 to -0.175 and max from +0.15 to +0.175.  |
| 2.00     | Sep 13, 2013 | Electrical specifications table for Output Voltage ( $V_{OUT}$ ) on page 5 and page 6: Removed $V_{IN} = 5V$ from conditions cell.<br>Electrical specifications table for dropout voltage on page 5 and page 6: Changed $V_{OUT} = 2.5V$ at $10mA$ to $I_{OUT} = 10mA$ .<br>Electrical specifications table for "Flatpack" on page 5 as follow: Removed $V_{OUT} = 2.5V$ from Input Voltage Range, Line Regulation, Dropout Voltage, Output Voltage Noise, Broadband Voltage Noise, Noise Density.<br>Electrical specifications table for "Die" on page 6 as follow: Removed $V_{OUT} = 2.5V$ from Input Voltage Range, Line Regulation, Dropout Voltage.<br>Typical Performance Curves on page 7 added " $C_{OUT} = 0.1\mu F$ , $COMP = 1nF$ " to header.<br>Added $C_{OUT} = 0.1\mu F$ , $COMP = 1nF$ to Electrical spec table on page 6.<br>Added die sale part number to Electrical spec table on page 6.<br>Added $1nF$ $COMP$ to figure 1 on page 1.<br>Electrical Spec on page 5: Changed $I_{OUT} = 0$ to $I_{OUT} = 0mA$ .<br>Added die sale part number to electrical spec table on page 6.  |
| 1.00     | Aug 8, 2013  | Page 1, Related Literature. Updated title of AN1847 from "ISL71090SEH25 Evaluation Board User's Guide" to "ISL71090SEHXX Evaluation Board User's Guide"  |
| 0.00     | Jun 6, 2013  | Initial Release.   |



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