IS-1009RH, IS-1009EH

Radiation Hardened 2.5V Reference

Description

The Radiation Hardened IS-1009RH, IS-1009EH are 2.5V shunt regulator diodes designed to provide a stable 2.5V reference over a wide current range.

These devices are designed to maintain stability over the full military temperature range and over time. The 0.2% reference tolerance is achieved by on-chip trimming.

An adjustment terminal is provided to allow for the calibration of system errors. The use of this terminal to adjust the reference voltage does not effect the temperature coefficient.

Constructed with the dielectrically isolated EBHF process, these devices are immune to single event latch-up and have been specifically designed to provide highly reliable performance in harsh radiation environments.

The IS-1009EH replaces the obsoleted IS-1009RH.

Applications

- Power supply monitoring
- Reference for 5V systems
- A/D and D/A reference

Features

- Electrically screened to SMD #5962-00523
- QML qualified per MIL-PRF-38535 requirements
- EH version acceptance tested to 50krad(Si) (LDR)
- Radiation environment - IS-1009EH
  - High dose rate (50-300rad(Si)/s): 300krad(Si)
  - Low dose rate (0.01rad(Si)/s): 50krad(Si)
- Radiation environment - IS-1009RH
  - High dose rate (50-300rad(Si)/s): 300krad(Si)
- Latch-up immune: dielectrically isolated
- Reverse breakdown voltage (V_Z): 2.5V
- Change in V_Z vs current (400µA to 10mA): 6mV
- Change in V_Z vs temperature (-55°C to +125°C): 15mV
- Maximum reverse breakdown current: 20mA
- Stability Criteria
  - Optimum stability is achieved with C_L = 10µF between V+ and V- for heavy loads
  - Instability region with self-sustaining oscillations is from CL = 1nF to 3µF
- Interchangeable with 1009 and 136 industry types

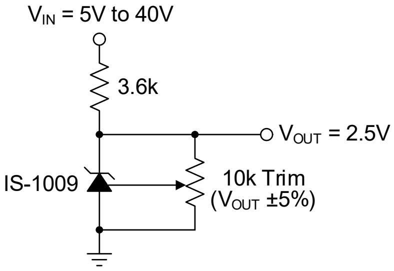

Figure 1. Typical Applicatin

Contents

1. Overview

1.1 Block Diagram

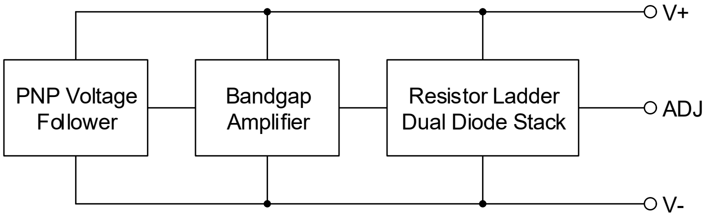

Figure 2.

2. Pin Information

2.1 Pin Assignments

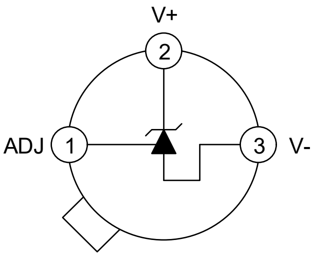

Figure 3. Pin Assignments - IS2-1009RH, IS2-1009EH (TO-206AB CAN) - Bottom View

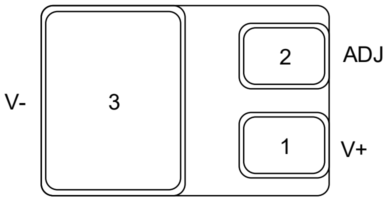

Figure 4. Pin Assignments - ISYE-1009RH, ISYE-1009EH (SMD.5) - Bottom View

2.2 Pin Descriptions

Pin Number TO-206AB CAN	Pin Number SMD.5	Function
1	2	Adjust
2	1	V+
3[1]	3	V-

[1] Pin 3 is electrically tied to the case.

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 may adversely impact product reliability and result in failures not covered by warranty.

Parameter	Minimum	Maximum	Unit
Reverse current	-	20	mA
Forward Current	-	10	mA
Lead Temperature (soldering 10 seconds)	-	265	°C
Junction Temperature (TJ)	-	175	°C
Storage temperature Range	-65	150	°C

3.2 Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Unit
Input Current	I_{IN}	0.4	10	mA
Ambient Operating Temperature Range	T_A	-55	125	°C

3.3 Thermal Specifications

Parameter	Package	Symbol	Conditions	Typical Value	Unit
Thermal Resistance	TO-206AB CAN	θ_{JA}	Junction to ambient	300	°C/W
		θ_{JC}	Junction to case	30	°C/W
	SMD.5	θ_{JA}	Junction to ambient	60	°C/W
		θ_{JC}	Junction to case	8	°C/W

3.4 Electrical Specifications

I_L = 1mA, I_R = 1mA and C_L = 10µF 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 Condition[1]	Min	Max	Unit
Reference Voltage	V_{REF}	I_L = 1mA, T_A = +25°C	2.495	2.505	V
		I_L = 1mA, T_A = -55°C to +125°C	2.480	2.510	V
		I_L = 1mA, T_A = +25°C, Post radiation	2.49	2.515	V
Reverse Voltage Change versus Reverse Current Change	$\Delta V_Z/\Delta I_Z$	400µA ≤ I_R ≤ 10mA, T_A = +25°C	-6	+6	mV
		400µA ≤ I_R ≤ 10mA, T_A = -55°C to +125°C	-10	+10	mV
		400µA ≤ I_R ≤ 10mA, T_A = +25°C, Post radiation	-15	+15	mV
Shunt Resistance[2]	r_Z 2)	I_R = 1mA, T_A = +25°C	0	0.6	Ω
		I_R = 1mA, T_A = -55°C to +125°C	0	1.0	Ω
		I_R = 1mA, T_A = +25°C, Post radiation	0	1.5	Ω

1. Device is tested with 10µF shunt capacitance connected from V+ to V-, which provides optimum stability. This reference is susceptible to output oscillation for a certain range of shunt capacitance. Shunt capacitance values from 1nF to 3µF inclusive must be avoided.
2. This parameter is guaranteed but not tested. This parameter is characterized upon initial design or process changes, which affect this characteristic.

4. Typical Performance Graphs

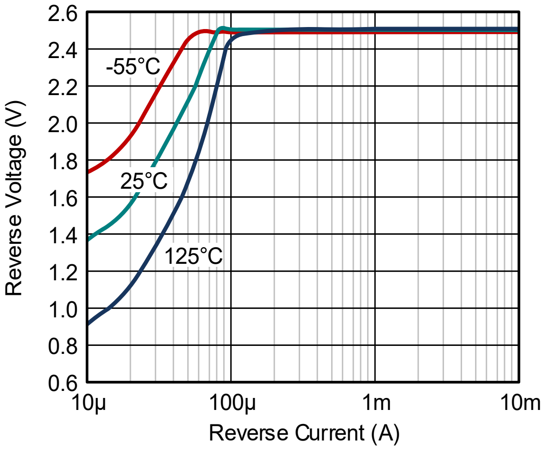

Figure 5. Reverse Voltage vs Reverse Current

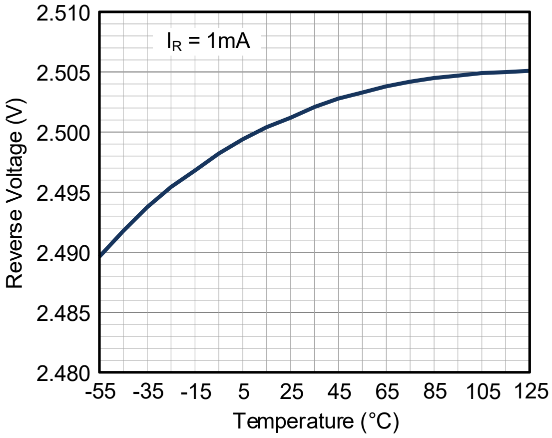

Figure 6. Reverse Voltage vs Temperature

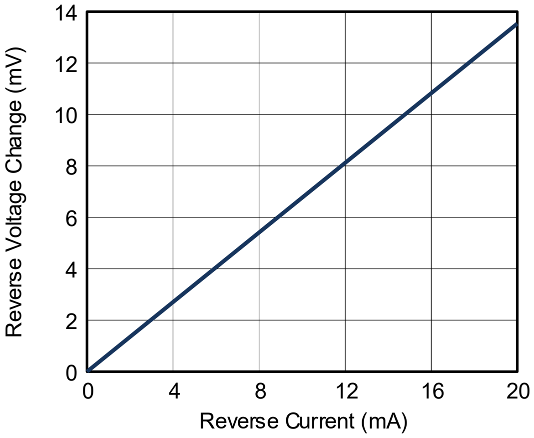

Figure 7. Reverse Voltage Change vs Reverse Current

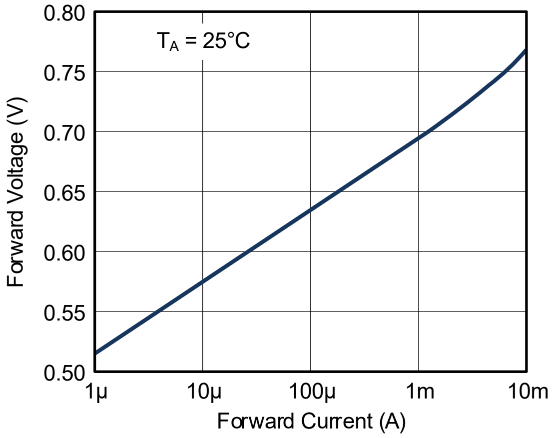

Figure 8. Forward Voltage vs Forward Current

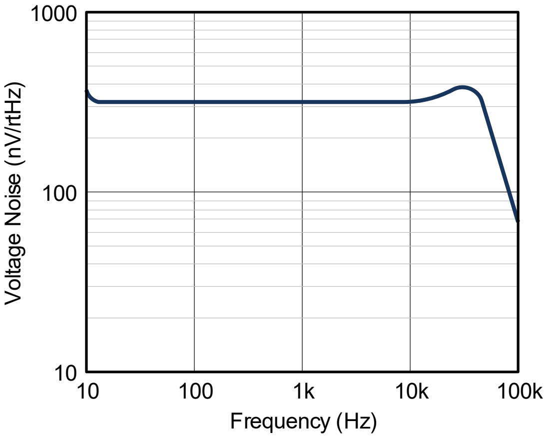

Figure 9. Voltage Noise Density

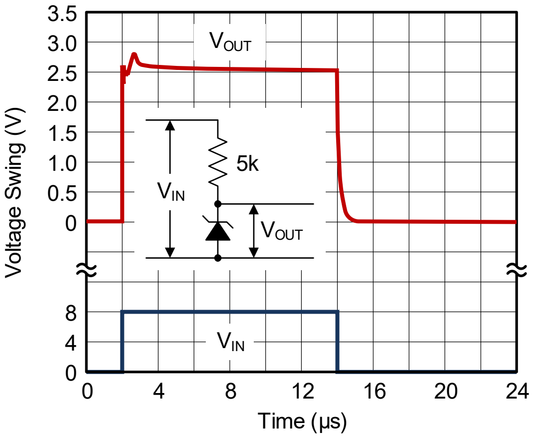

Figure 10. Transient Response

5. Package and Die Characteristics

Table 1. Die and Assembly Related Information

Die Information	
Dimensions	1270µm x 1778µm (50 mils x 70 mils) Thickness: 356µm ± 25.4µm (14 mils ± 1 mil)
Interface Materials	
Glassivation	Type: Silox (SiO2) 1:6:1 Thickness: 8kÅ ±0.8kÅ (1kÅ undopped, 6kÅ dopped, cap 1kÅ undopped)
Top Metallization	Type: Al Si Cu Thickness: 16.0kÅ ± 2kÅ
Backside Finish	Silicon
Process	EFSTDB: Single-poly dielectrically isolated complementary bipolar
Assembly Information	
Substrate Potential	Unbiased (DI)
Additional Information	
Worst Case Current Density	<1.0×10^5 A/cm^2
Transistor Count	26

6. Metallization Mask Layout

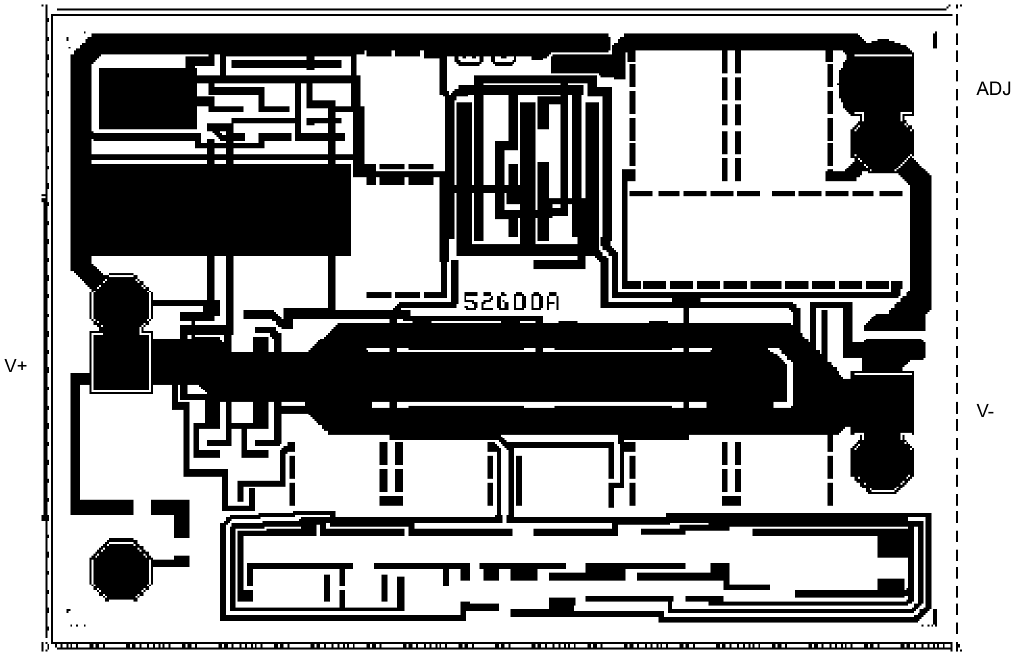

Figure 11. IS-1009RH, IS-1009EH

7. Ordering Information

Ordering SMD Number[1]	Internal Marketing Number[2]	Radiation Hardness (Total Ionizing Dose)	Package Description (RoHS Compliant)	Pkg. Dwg.#	Carrier Type	Temp. Range
5962F0052302VXC	IS2-1009EH-Q	HDR to 300krad(Si), LDR to 50krad(Si)	3 Lead Metal Can package TO-206AB (T0-46)	T3.B	Tray	-55 to +125°C
5962F0052302VYC	ISYE-1009EH-Q		3 Pad Hermetic CLCC	J3.A	Tube	-55 to +125°C
5962F0052302V9A	IS0-1009EH-Q[3]		Die	-	-	-55 to +125°C
N/A	IS2-1009EH/PROTO[4]	N/A	3 Lead Metal Can package TO-206AB (T0-46)	T3.B	Tray	-55 to +125°C
	ISYE-1009EH/PROTO[4]		3 Pad Hermetic CLCC	J3.A	Tube	-55 to +125°C
	IS0-1009EH/SAMPLE[3][4]		Die	-	-	-55 to +125°C
5962F0052301QXC	IS2-1009RH-8 **No longer available or supported**	HDR to 300krad(Si)	3 Lead Metal Can package TO-206AB (T0-46)	T3.B	Tray	-55 to +125°C
5962F0052301VYC	ISYE-1009RH-Q **No longer available or supported**		3 Pad Hermetic CLCC	J3.A	Tube	-55 to +125°C
5962F0052301QYC	ISYE-1009RH-8 **No longer available or supported**					-55 to +125°C

1. 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.
2. 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.
3. Die product tested at T_A = + 25°C. The wafer probe test includes functional and parametric testing sufficient to make the die capable of meeting the electrical performance outlined in the SMD.
4. 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.

8. Revision History

Revision	Date	Description
8.02	Feb 4, 2026	▪ Applied latest template. ▪ Added Figures 1 and 2. ▪ Added Pin Description, Specifications, Typical Performance Graphs sections. ▪ Updated the Ordering Information section.
8.01	Jun 25, 2025	Updated stability feature bullet.
8.0	May 18, 2021	▪ Updated Radiation Acceptance testing features bullets. ▪ Updated the Ordering Information table. ▪ Updated Die Characteristics for Glassivation and Substrate to match information in the SMD. ▪ Removed About Intersil section.
7.0	Nov 19, 2015	▪ Added Rev History and About Intersil verbiage. ▪ Added to page 1 introduction “The IS-1009EH replaces the obsoleted IS-1009RH.” ▪ Updated Ordering Information as follows: • Marked RH obsolete parts “No longer available or supported” • Added EH Proto and Sample parts.

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