

**HS-117RH, HS-117EH**

Radiation Hardened Adjustable Positive Voltage Regulator

FN4560  
Rev.11.00  
Mar 28, 2019

The radiation hardened [HS-117RH](#) and [HS-117EH](#) are adjustable positive voltage linear regulators capable of operating with input voltages up to 40V<sub>DC</sub>. The HS-117EH encompasses all of the production testing of the HS-117RH and additionally is tested in the Enhanced Low Dose Rate Sensitivity (ELDRS) product manufacturing flow. The output voltage is adjustable from 1.25V to 37V with two external resistors. The device is capable of sourcing from 5mA to 1.25A max (0.5A max for the TO-39 package). Current protection is provided by the on-chip thermal shutdown and output current limiting circuitry.

The HS-117xH's advantage over other industry types is its incorporated circuitry that minimizes the effects of radiation and temperature on device stability.

The HS-117RH and HS-117EH are constructed in the dielectrically isolated Rad Hard Silicon Gate (RSG) process and are immune to single event latch-up and are specifically designed to provide highly reliable performance in harsh radiation environments.

**Applications**

- Adjustable voltage regulators
- Adjustable current regulators

**Features**

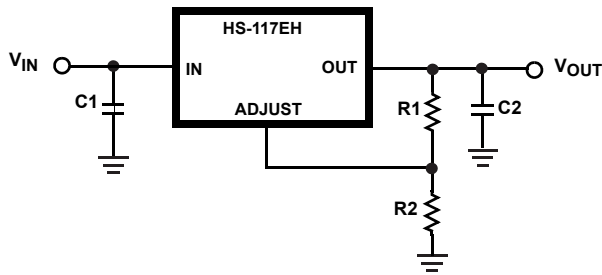
- Electrically screened to DLA SMD # [5962-99547](#)
- Superior temperature stability
- Overcurrent and over-temperature protection
- Wide input voltage range . . . . . 4.25V to 40V
- Operating temperature range. . . . . -55°C to +125°C
- QML qualified per MIL-PRF-38535 requirements
- Radiation environment
  - SEL/SEB LET<sub>TH</sub> (V<sub>S</sub> = 40V) . . . . . 87.4 MeV • cm<sup>2</sup>/mg
  - Total Dose, High Dose Rate . . . . . 300krad(Si)
  - Total Dose, Low Dose Rate . . . . . 100krad(Si)\*

\* Product capability established by initial characterization. The EH version is acceptance tested on a wafer-by-wafer basis to 50krad(Si) at low dose rate.

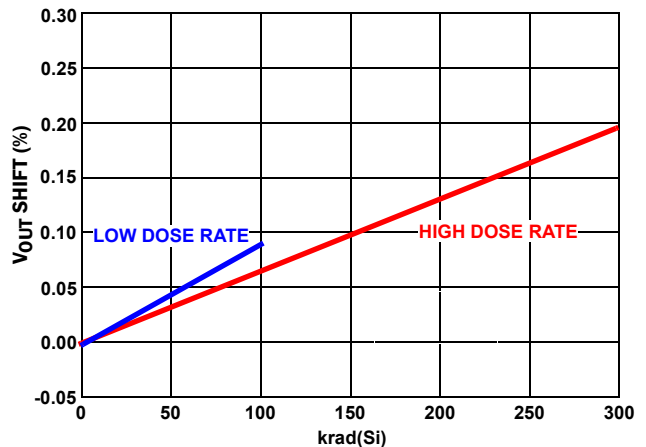
**Related Literature**

For a full list of related documents, visit our website

- [HS-117RH, HS-117EH](#) device pages

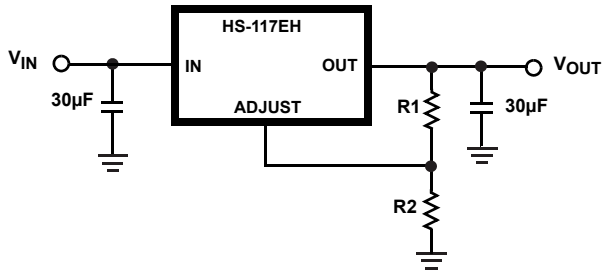


$V_{OUT} = V_{REF} (1+R2/R1) + I_{ADJ} R2$   
**FIGURE 1. TYPICAL APPLICATION**



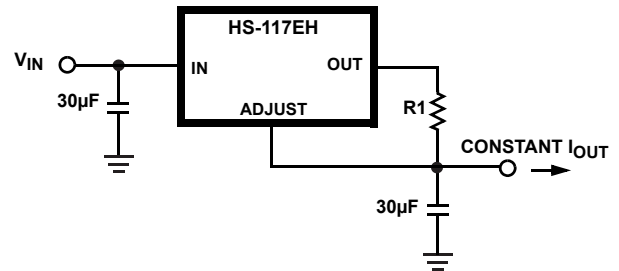
**FIGURE 2. V<sub>OUT</sub> SHIFT vs HIGH and LOW DOSE RATE RADIATION**

## Typical Applications



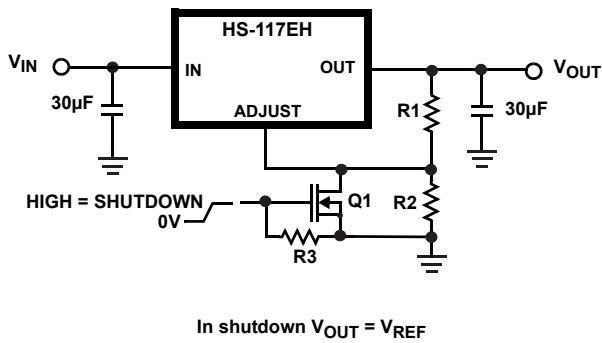
$$V_{OUT} = V_{REF} (1 + R2/R1) + I_{ADJ} * R2$$

FIGURE 3. RESISTOR ADJUSTED OUTPUT VOLTAGE



$$I_{OUT} = V_{REF} / R1$$

FIGURE 4. CONSTANT CURRENT REGULATOR



In shutdown  $V_{OUT} = V_{REF}$

FIGURE 5. REGULATOR SHUTDOWN

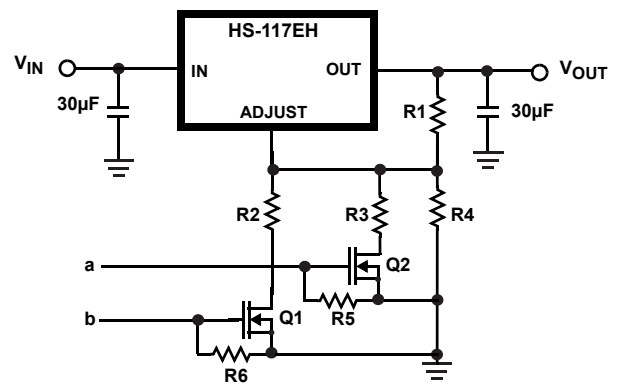
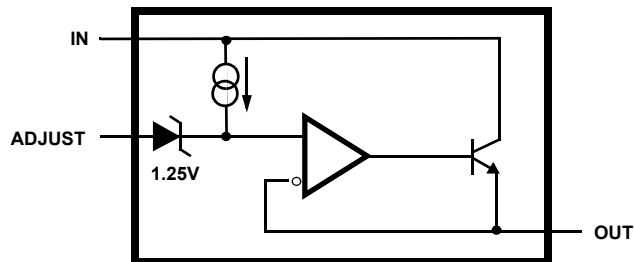


FIGURE 6. FOUR DIGITALLY PROGRAMMED OUTPUT VOLTAGES

## Functional Block Diagram



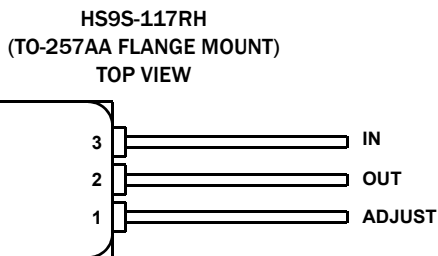
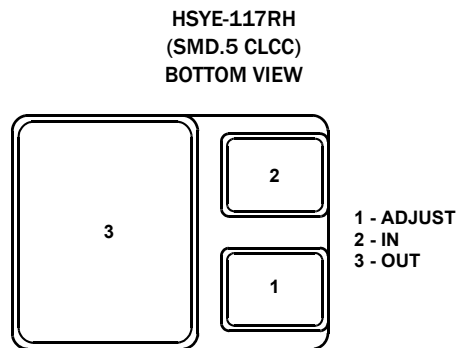
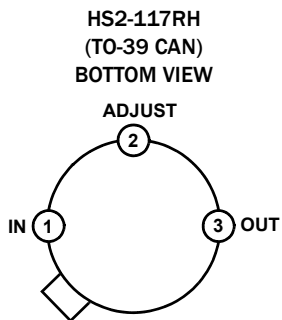
## Ordering Information

ORDERING SMD NUMBER (Note 2)	PART NUMBER (Note 1)	TEMPERATURE RANGE (°C)	PACKAGE (RoHS Compliant)	PKG. DWG. #
5962F9954702V9A	HS0-117EH-Q	-55 to +125	DIE	
5962F9954701V9A	HS0-117RH-Q	-55 to +125	DIE	
HS0-117RH/SAMPLE	HS0-117RH/SAMPLE (Note 3)	-55 to +125	DIE	
5962F9954702VUC	HS2-117EH-Q	-55 to +125	3 Ld METAL CAN	T3.C
5962F9954701VUC	HS2-117RH-Q	-55 to +125	3 Ld METAL CAN	T3.C
5962F9954701QUC	HS2-117RH-8	-55 to +125	3 Ld METAL CAN	T3.C
HS2-117RH/PROTO	HS2-117RH/PROTO (Note 3)	-55 to +125	3 Ld METAL CAN	T3.C
5962F9954702VYC	HSYE-117EH-Q	-55 to +125	3 PAD CLCC	J3.A
5962F9954701VYC	HSYE-117RH-Q	-55 to +125	3 PAD CLCC	J3.A
5962F9954701QYC	HSYE-117RH-8	-55 to +125	3 PAD CLCC	J3.A
HSYE-117RH/PROTO	HSYE-117RH/PROTO (Note 3)	-55 to +125	3 PAD CLCC	J3.A
5962F9954701VXC	HS9S-117RH-Q	-55 to +125	3 Ld TO-257	T3.D
5962F9954701QXC	HS9S-117RH-8	-55 to +125	3 Ld TO-257	T3.D
5962F9954702VXC	HS9S-117EH-Q	-55 to +125	3 Ld TO-257	T3.D
HS9S-117RH/PROTO	HS9S-117RH/PROTO (Note 3)	-55 to +125	3 Ld TO-257	T3.D

### NOTES:

1. 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.
2. 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.
3. 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 at +25 °C only. 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.

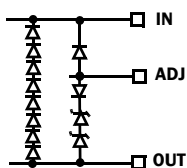
## Pin Configurations



NOTE: No current JEDEC outline for the SMD.5 package. See SMD for package dimensions. The TO-257 is a totally isolated metal package.

## Pin Descriptions

HS2-117RH (TO-39)	HS9S-117RH (TO-257AA)	HSYE-117RH (SMD.5 CLCC)	PIN NAME	DESCRIPTION
1	3	2	IN	Regulator Input
2	1	1	ADJUST	Voltage Adjust Feedback Input
3	2	3	OUT	Regulator Output



### Absolute Maximum Ratings

Input to Output Voltage Differential	40V
Input to Output Voltage Differential (Note 6)	40V
Maximum Output Current	1.5A
Maximum Power Dissipation $T_C = +25^\circ\text{C}$	
HS2-117 (TO-39 Can)	.8W
HS9S-117 (TO-257AA Flange Mount)	50W
HSYE-117 (SMD.5 CLCC)	27.5W
Maximum Power Dissipation $T_C = +100^\circ\text{C}$ (Note 7)	
HS2-117 (TO-39 Can)	3.3W
HS9S-117 (TO-257AA Flange Mount)	20W
HSYE-117 (SMD.5 CLCC)	11W
ESD Rating	
Human Body Model (HBM) (Tested per MIL-PRF-883 3015.7)	1500V
Machine Model (MM) (Tested per EIA/JESD22-A115-A)	350V

### Thermal Information

Thermal Resistance (Typical)	$\theta_{JA}$ ( $^\circ\text{C}/\text{W}$ )	$\theta_{JC}$ ( $^\circ\text{C}/\text{W}$ )
TO-39 (Notes 4, 5, 7)	125	15
TO-257AA (Notes 4, 5, 7)	26	2.5
SMD.5 (Notes 4, 5, 7)	42	4.5
Maximum Storage Temperature Range	-65 $^\circ\text{C}$ to +150 $^\circ\text{C}$	
Maximum Junction Temperature ( $T_{JMAX}$ )	+175 $^\circ\text{C}$	

### Recommended Operating Conditions

Ambient Operating Temperature Range	-55 $^\circ\text{C}$ to +125 $^\circ\text{C}$
Input Voltage Range	4.25V to 40V
Output Voltage Range	1.25V to 37V
Minimum Output Current	5mA

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.

NOTES:

- $\theta_{JA}$  is measured with the component mounted on a high-effective thermal conductivity test board in free air. See TB379 for details.
- For  $\theta_{JC}$ , the “case temp” location is the center of the exposed metal pad on the package underside.
- The maximum supply limit specified is for operation in a heavy ion environment at an LET = 87.4MeV • cm<sup>2</sup>/mg.
- The linear derating factor for TO-39 package is 0.067 W/ $^\circ\text{C}$ , for TO-257AA package is 0.4 W/ $^\circ\text{C}$ , for the SMD.5 package is 0.22 W/ $^\circ\text{C}$

### Electrical Specifications $V_{DIFF} = 3V, T_A = 25^\circ\text{C}$ , unless otherwise noted. **Boldface limits apply across the operating temperature range, -55 $^\circ\text{C}$ to +125 $^\circ\text{C}$ .**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN (Note 8)	TYP	MAX (Note 8)	UNIT
Reference Voltage	$V_{REF}$	$V_{DIFF} = 3V, V_{DIFF} = 40V,$ $5.0mA \leq I_{OUT} \leq 5.5mA$	<b>1.20</b>	1.255	<b>1.30</b>	V
Line Regulation	$R_{LINE}$	$V_{REF} = V_{OUT} - V_{ADJ}, 3V \leq V_{DIFF} \leq 40V,$ $5.0mA \leq I_{OUT} \leq 5.5mA$	<b>-0.02</b>	0.005	<b>0.02</b>	%
Load Regulation	$R_{LOAD}$	$V_{DIFF} = 3V, 5mA \leq I_{OUT} \leq 1.25A$ TO-257AA and SMD.5 packages only	<b>-1.5</b>	-0.1	<b>1.5</b>	%
		$V_{DIFF} = 3V, 5mA \leq I_{OUT} \leq 500mA$ TO-39 package	<b>-1.5</b>	-0.8	<b>1.5</b>	%
Adjust Pin Current	$I_{ADJ}$	$V_{DIFF} = 3V, V_{DIFF} = 40V,$ $5.0mA \leq I_{OUT} \leq 5.5mA$		64	<b>100</b>	$\mu\text{A}$
Adjust Pin Current Change	$dI_{ADJ}$	$3V I_{ADJ} - 40V I_{ADJ}$ $5.0mA \leq I_{OUT} \leq 5.5mA$	<b>-6</b>	2.36	<b>6</b>	$\mu\text{A}$
Maximum Output Current	$I_{OUT}$	TO-257AA and SMD.5 packages only	<b>1.25</b>			A
		TO-39 package	<b>0.5</b>			A
$V_{IN}$ Applied to $V_{OUT}$ Turn-On	$T_{ON}$			0.2		ms
Max. Output Short-Circuit Current Limit	$I_{sc}$	$V_{OUT} = 0V$		3		A
Over-Temperature Shutdown	OT			150	<b>175</b>	$^\circ\text{C}$
Over-Temperature Hysteresis	OT_HYS			20		$^\circ\text{C}$

**Post Radiation Electrical Specifications**  $V_{DIFF} = 3V, T_A = +25^\circ C$ , unless otherwise noted. **Boldface limits apply over a total ionizing dose of 300krad(Si) with exposure at a high dose rate of 50 to 300krad(Si)/s; or over a total ionizing dose of 50krad(Si) with exposure a low dose rate of <10mrad(Si)/s.**

PARAMETER	SYMBOL	CONDITIONS	MIN (Note 8)	MAX (Note 8)	UNIT
Reference Voltage	$V_{REF}$	$V_{DIFF} = 3V, V_{DIFF} = 40V, 5.0mA \leq I_{OUT} \leq 5.5mA$	<b>1.20</b>	<b>1.30</b>	V
Line Regulation	$R_{LINE}$	$V_{REF} = V_{OUT} - V_{ADJ}, 3V \leq V_{DIFF} \leq 40V, 5.0mA \leq I_{OUT} \leq 5.5mA$	<b>-0.02</b>	<b>0.02</b>	%
Load Regulation	$R_{LOAD}$	$V_{DIFF} = 3V, 5mA \leq I_{OUT} \leq 1.25A$ (TO-257AA and SMD.5 packages only)	<b>-1.5</b>	<b>1.5</b>	%
		$V_{DIFF} = 3V, 5mA \leq I_{OUT} \leq 500mA$ (TO-39 package)	<b>-1.5</b>	<b>1.5</b>	%
Adjust Pin Current	$I_{ADJ}$	$V_{DIFF} = 3V, V_{DIFF} = 40V, 5.0mA \leq I_{OUT} \leq 5.5mA$		<b>100</b>	$\mu A$
Adjust Pin Current Change	$dI_{ADJ}$	$3V I_{ADJ} - 40V I_{ADJ}, 5.0mA \leq I_{OUT} \leq 5.5mA$	<b>-6</b>	<b>6</b>	$\mu A$
Output Current	$I_{OUT}$	TO-257AA and SMD.5 packages only	<b>1.25</b>		A
		TO-39 package	<b>0.5</b>		A

NOTE:

8. Compliance to datasheet limits is assured by one or more methods: production test, characterization, and/or design.

**Post Radiation Characteristics** This data is a typical mean test data post total dose radiation exposure at both a low dose rate (LDR) of <10mrad(Si)/s to 100krad(Si) and at a high dose rate (HDR) of 50 to 300krad(Si)/s to 300krad(Si). This data is intended to show typical parameter shifts due to low dose rate radiation. These are not limits nor are they guaranteed.

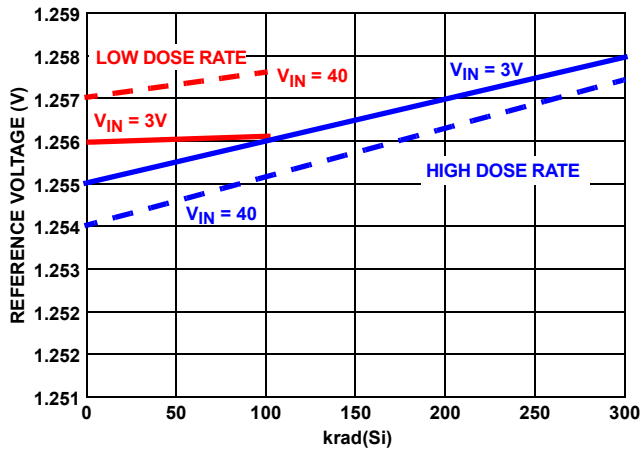


FIGURE 7. REFERENCE VOLTAGE vs RADIATION

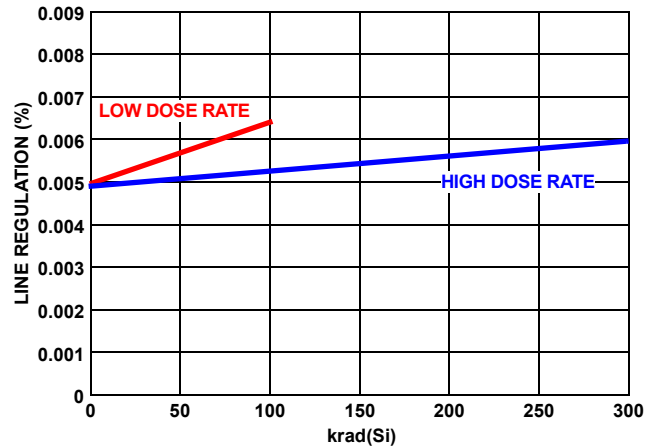


FIGURE 8. LINE REGULATION ( $3V \leq V_{DIFF} \leq 40V$ ) vs RADIATION

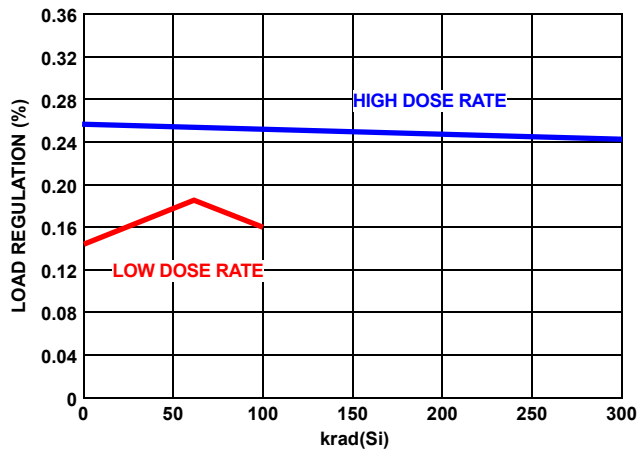


FIGURE 9. LOAD REGULATION ( $I_{OUT} 5mA$  to 1.25A) vs RADIATION

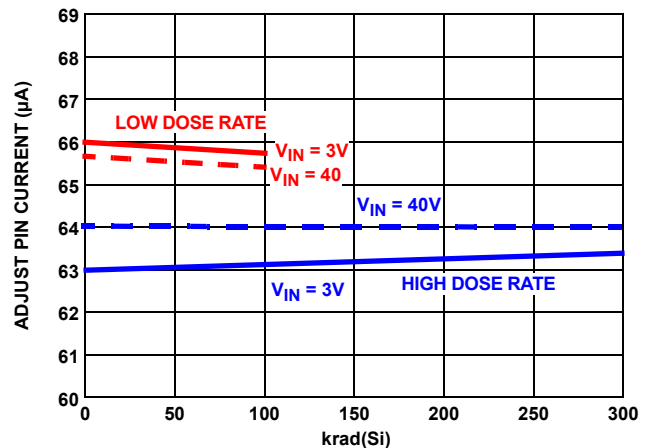


FIGURE 10. ADJUST PIN CURRENT vs RADIATION

# Typical Performance Curves

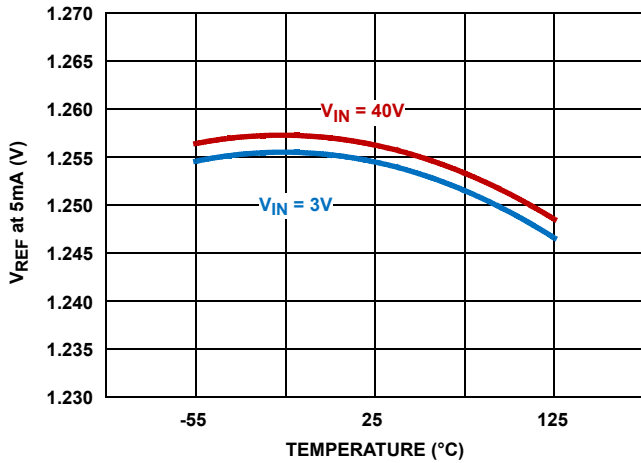


FIGURE 11. V<sub>REF</sub> vs TEMPERATURE

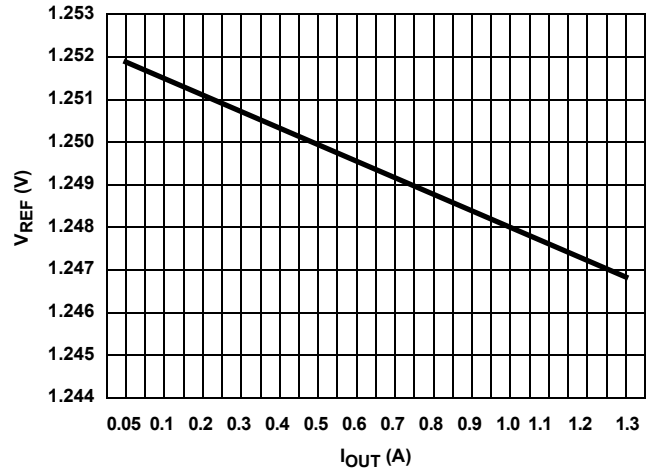


FIGURE 12. V<sub>REF</sub> vs OUTPUT CURRENT at T<sub>A</sub> = +25 °C

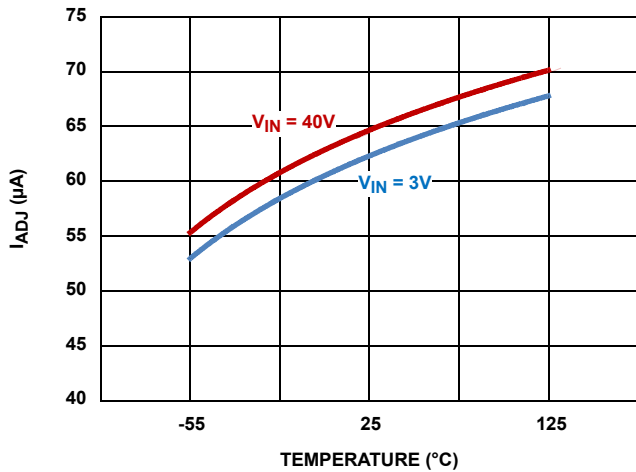


FIGURE 13. I<sub>ADJ</sub> vs TEMPERATURE

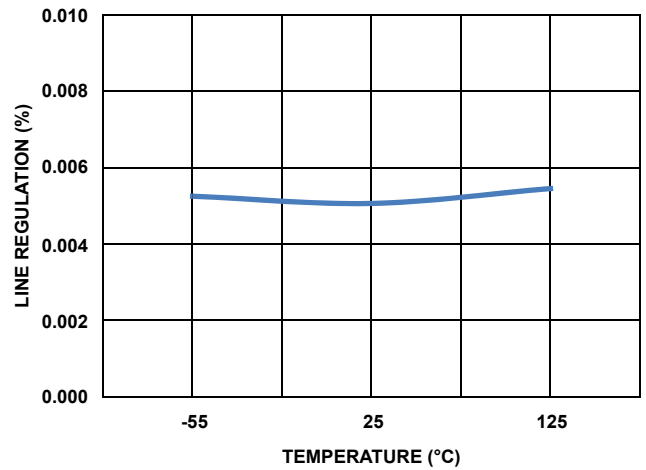


FIGURE 14. LINE REGULATION vs TEMPERATURE

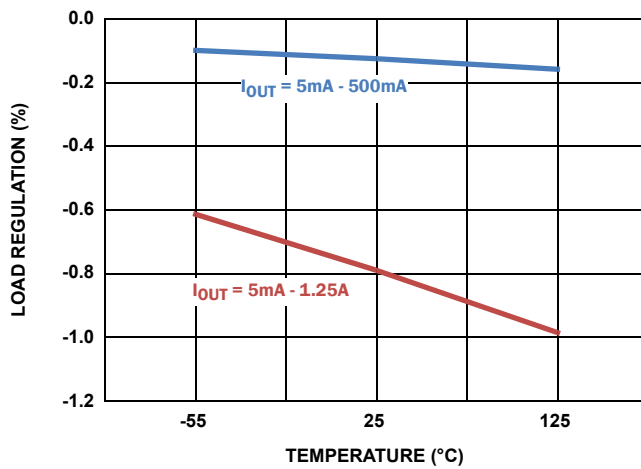


FIGURE 15. LOAD REGULATION vs TEMPERATURE

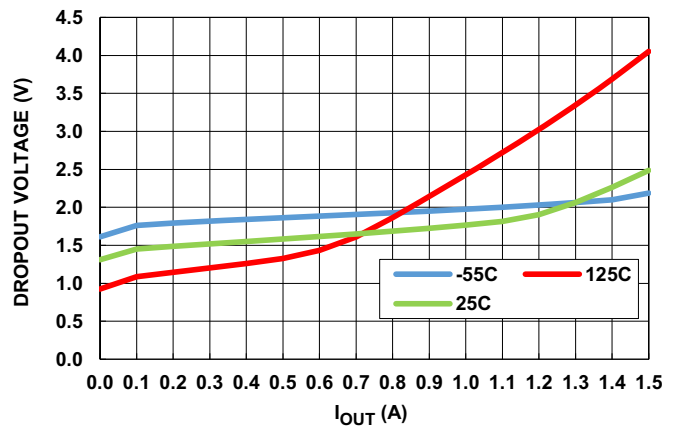


FIGURE 16. DROPOUT VOLTAGE vs OUTPUT CURRENT, V<sub>IN</sub> = 12V

# Typical Performance Curves (Continued)

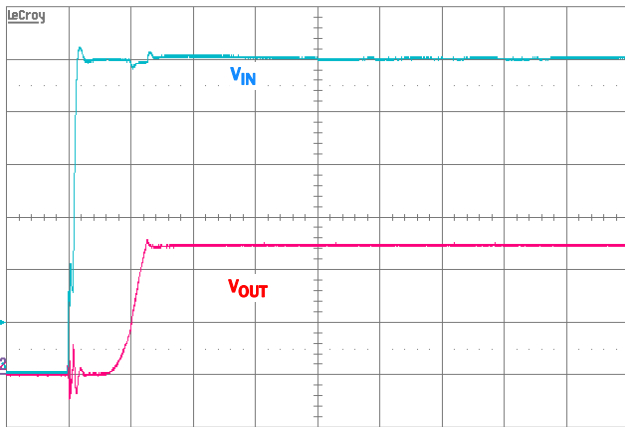


FIGURE 17. POWER-ON  $V_{IN} = 12V$ ,  $V_{OUT} = 5V$ ,  $R_I = 10\Omega$

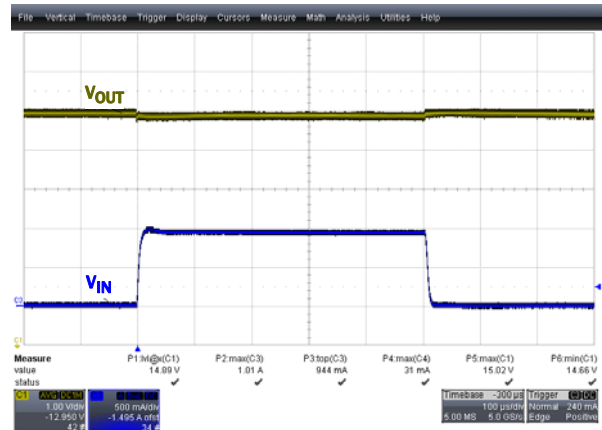


FIGURE 18.  $V_{IN} = 30V$ ,  $V_{OUT} = 15V$ ,  $I_{OUT} 0\text{-}1A$  STEP

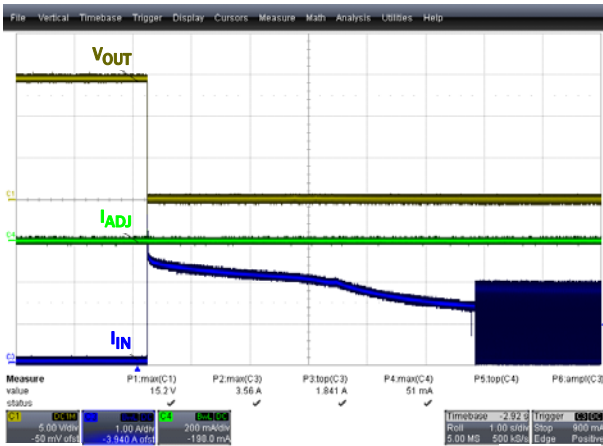


FIGURE 19. SHORT-CIRCUIT INTO OVER-TEMPERATURE PROTECTION

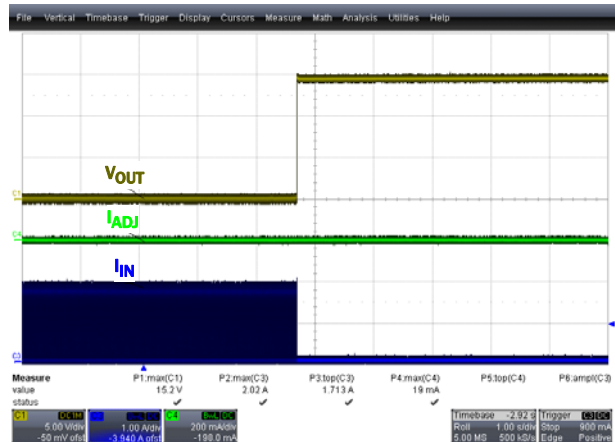


FIGURE 20. SHORT-CIRCUIT RECOVERY

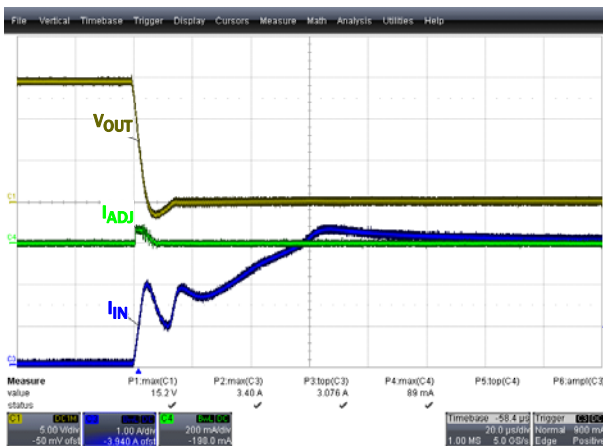


FIGURE 21. SHORT-CIRCUIT CURRENT LIMIT DETAIL

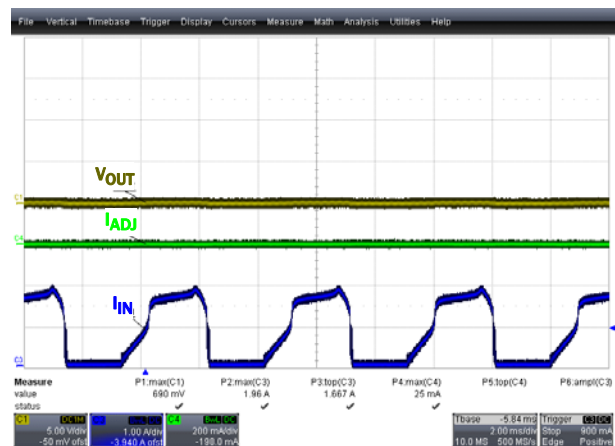


FIGURE 22. SHORT-CIRCUIT OVER-TEMPERATURE PROTECTION DETAIL



## Functional Description

### Functional Overview

The radiation hardened HS-117RH and HS-117EH are adjustable positive voltage linear regulators capable of operating with input voltages up to 40V<sub>DC</sub>. The output voltage is adjustable from 1.25V (V<sub>REF</sub>) to 37V with two external resistors. The device is capable of sourcing from 5mA to 1.25A<sub>PEAK</sub> (0.5A<sub>PEAK</sub> for the TO-39 can package). Dual mode protection is provided by the on-chip +175 °C thermal shutdown at output current limiting circuitry.

The HS-117xH's advantage over other industry types is its incorporated circuitry that minimizes the effects of radiation and temperature on device stability providing < 0.2% shifts in output voltage over 300krad(Si) of High Dose Rate (HDR) and 100krad(Si) of Low Dose Rate (LDR) gamma radiation.

The HS-117RH and HS-117EH are constructed in the dielectrically isolated Rad Hard Silicon Gate (RSG) process and are both immune to single event latch-up and are specifically designed to provide highly reliable performance providing power in harsh radiation environments.

### Output Voltage Adjustment

The HS-117 is an adjustable output voltage regulator operating with a 1.25V reference voltage developed between the OUT and ADJUST pins. The ADJ current (I<sub>ADJ</sub>) is typically 64µA at +25 °C and 100µA maximum over temperature.

The HS-117's minimum current load for the regulation amplifier feedback to maintain stability is 5mA. To ensure stability in all situations, the minimum resistor between the V<sub>OUT</sub> and ADJ should be 120Ω.

Referring to [Figure 1 on page 1](#), the reference voltage is programmed to a constant current source by resistor R<sub>1</sub>, and this current flows through R<sub>2</sub> to ground to set the output voltage. See [Equation 1](#).

$$V_{OUT} = 1.25(1 + R_2/R_1) + I_{ADJ}R_2 \quad (\text{EQ. 1})$$

In practical applications the R<sub>2</sub> value is in the range of a few kΩ, so that the I<sub>ADJ</sub> x R<sub>2</sub> contribution can be ignored in the V<sub>OUT</sub> calculation; simplifying the V<sub>OUT</sub> calculation to [Equation 2](#):

$$V_{OUT} = 1.25(1 + R_2/R_1) \quad (\text{EQ. 2})$$

### CURRENT LIMITING

The HS-117 has internal current limiting that is activated whenever the output current exceeds the lower limit of the Maximum Output Current parameter shown in the [“Electrical Specifications” on page 5](#), (typically limiting to ~1.5A) to a maximum limit of typically 3A in an output short-circuit condition.

During a short-circuit condition, if the regulator's differential voltage exceeds the Absolute Maximum Rating of 40V (for example, V<sub>IN</sub> ≥ 40V, V<sub>OUT</sub> = 0V), the device can be damaged.

## Performance and PCB Layout Considerations

To optimize load regulation performance, implement Kelvin connections for the R<sub>1</sub> and R<sub>2</sub> resistors. In practice, the R<sub>1</sub> connection must be close to the OUT and ADJUST pins. This connection eliminates PCB trace resistance being included in the constant current determination. In contrast, place the R<sub>2</sub> to ground connection as close as possible to the negative load pin to ensure that the voltage being delivered to the load is as designed for by the choice of R<sub>1</sub> and R<sub>2</sub> values.

Ripple rejection can be improved by placing a 10µF capacitor across the R<sub>2</sub> resistor. At low output voltage, increasing this capacitor value further decreases output ripple.

### External Bypass Capacitors

Input bypass capacitance is recommended to enhance regulator stability if the device is located more than a few inches from its power source. Mount the input bypass capacitor (C<sub>1</sub>) with the shortest possible track length directly across the regulator's input and ground terminals. A 30µF tantalum capacitor should be adequate for most applications. Frequency compensation for the regulator is provided by the output capacitor (C<sub>2</sub>) and is required to ensure output stability. A minimum (C<sub>2</sub>) capacitance value of 30µF is recommended. Higher values of output capacitance can be used to enhance loop stability, transient response, and output noise.

### Thermal Considerations

The HS-117 has a thermal limiting circuit that is designed to protect the regulator when the junction temperature is typically > +150 °C. The regulator output turns off and then on again as the die cools. If the device is continuously operated in an over-temperature condition, this feature provides protection from catastrophic device damage due to accidental or prolonged overheating.

The HS-117 is available in a TO-39 3 pin can, a TO-257AA flange mount, and a SMD.5 CLCC surface mount package. These packages represent a wide range of thermal resistance to the die and thus a wide range of power dissipation (P<sub>D</sub>) capabilities. See [“Thermal Information” on page 5](#) for the relevant package thermal impedances. The [“Absolute Maximum Ratings” on page 5](#) lists the power dissipation limitations by package.

When developing circuits using the HS-117, test thermal performance and limitations to ensure acceptable performance. As with all tabbed packaged devices, flange mounting to a thermal heat-sink is recommended for the TO-257AA best practices.

## T0-257AA Package Characteristics

### Weight of Packaged Device

4.50g (Typical)

### Case Characteristics

Finish: Gold  
Potential: Unbiased

## T0-39 Package Characteristics

### Weight of Packaged Device

0.91g (Typical)

### Case Characteristics

Finish: Steel, Gold  
Potential: Unbiased

## SMD.5 CLCC Package Characteristics

### Weight of Packaged Device

0.91g (Typical)

### Case Characteristics

Finish: Gold, Ceramic  
Potential: Unbiased

## Die Characteristics

### Die Dimensions

2616 $\mu$ m x 2794 $\mu$ m (103 mils x 110 mils)  
Thickness: 483 $\mu$ m  $\pm$ 25 $\mu$ m (19 mils  $\pm$ 1 mil)

### Interface Materials

#### GLASSIVATION

Type: PSG  
Thickness: 8k $\text{Å}$   $\pm$  1k $\text{Å}$

#### TOP METALLIZATION

Type: Al/Cu/Si (98.75%/0.5%/0.75%)  
Thickness: 16k $\text{Å}$

#### BACKSIDE FINISH

Gold

### Assembly Related Information

#### SUBSTRATE POTENTIAL

Unbiased (DI)

### Additional Information

#### WORST CASE CURRENT DENSITY

$< 2 \times 10^5$  A/cm<sup>2</sup>

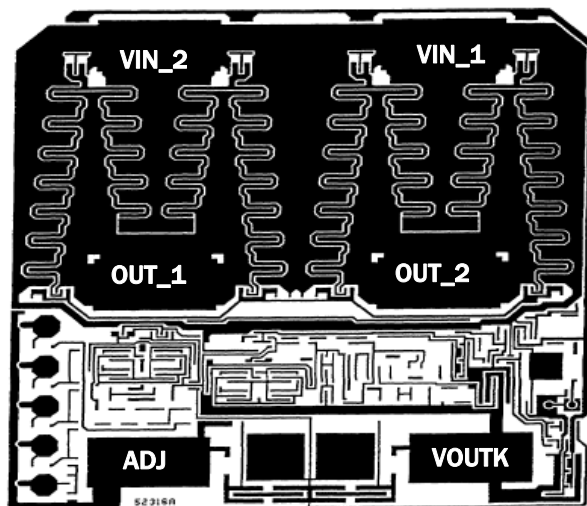
#### PROCESS

Dielectrically Isolated RH - Si-GATE

#### TRANSISTOR COUNT:

96

## Metallization Mask Layout



**TABLE 1. DIE LAYOUT X-Y COORDINATES (Notes 9, 10)**

<b>PAD NAME</b>	<b>X (<math>\mu\text{m}</math>)</b>	<b>Y (<math>\mu\text{m}</math>)</b>	<b>dX (<math>\mu\text{m}</math>)</b>	<b>dY (<math>\mu\text{m}</math>)</b>
VIN_1	1214	2191	514	257
VIN_2	14	2191	514	257
VOUT_1	14	934	514	257
ADJ	0	0	514	257
VOUTK	1361	14	514	257
VOUT_2	1214	934	514	257

**NOTES:**

- 9. Origin of coordinates is the centroid of pad ADJ.
- 10. Bond Pads sized for is 5mil diameter wire.

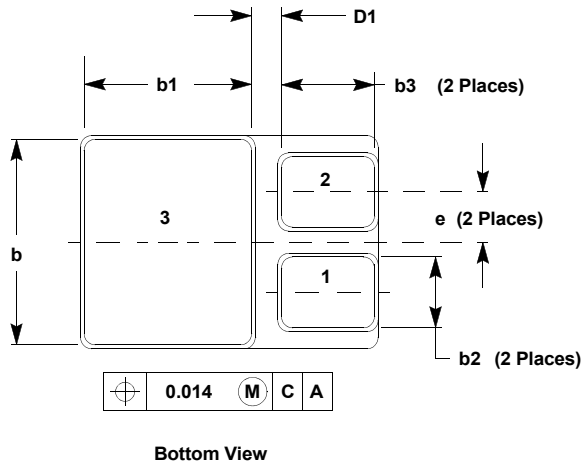
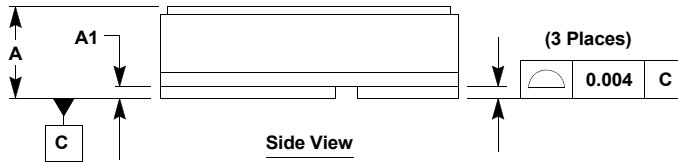
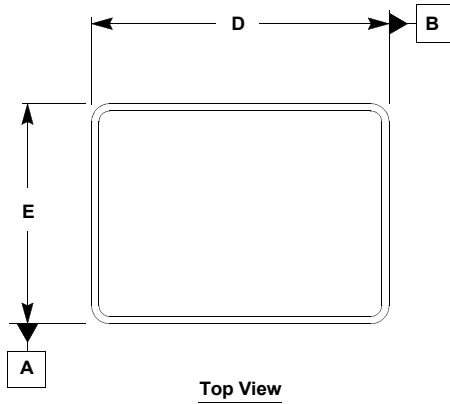
**Revision History** The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please visit our website to make sure you have the latest revision.

DATE	REVISION	CHANGE
Mar 28, 2019	FN4560.11	Updated links throughout document. Updated Related Literature section. Updated SEL/SEB LET <sub>TH</sub> information in Features section on page 1. Added Note 3. Updated Figure 16. Removed About Intersil section. Updated POD J3.A to the latest revision, changes are as follows: -Updated Max value for Symbol A from: 0.124inches/3.15mm to: 0.122inches/3.10mm Updated Disclaimer
Mar 25, 2014	FN4560.10	Updated "Ordering Information on page 3. Expanded content in datasheet from 3 to 15 pages.
Sep 4, 2012	FN4560.9	Added HS-117EH as Device # to datasheet (EH FGs already added to the Ordering Information table), making this a 2-part datasheet: HS-117RH, HS-117EH. Global search/change HS-117RH to HS-117RH, HS-117EH.
Dec 15, 2011	FN4560.8	Added parts to datasheet: HS2-117EH-Q, HS0-117EH-Q, HS9S-117EH-Q and HSYE-117EH-Q
Oct 10, 2003	FN4560.7	Revised datasheet includes a new date and file number.

# Package Outline Drawings

For the most recent package outline drawing, see [J3.A](#).

J3.A  
 3 Pad Hermetic SMD.5 Package  
 Bottom Terminal Ceramic Leadless Chip Carrier (CLCC)



Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
A	0.110	0.122	2.79	3.10	3
A1	0.010	0.020	0.25	0.51	-
b	0.281	0.291	7.13	7.39	-
b1	0.220	0.230	5.58	5.84	-
b2	0.090	0.100	2.28	2.54	-
b3	0.115	0.125	2.92	3.18	-
D	0.395	0.405	10.03	10.28	-
D1	0.030	-	0.76	-	-
E	0.291	0.301	7.39	7.64	-
e	0.075 BSC		1.91 BSC		-

Rev. 3 11/18

**Notes:**

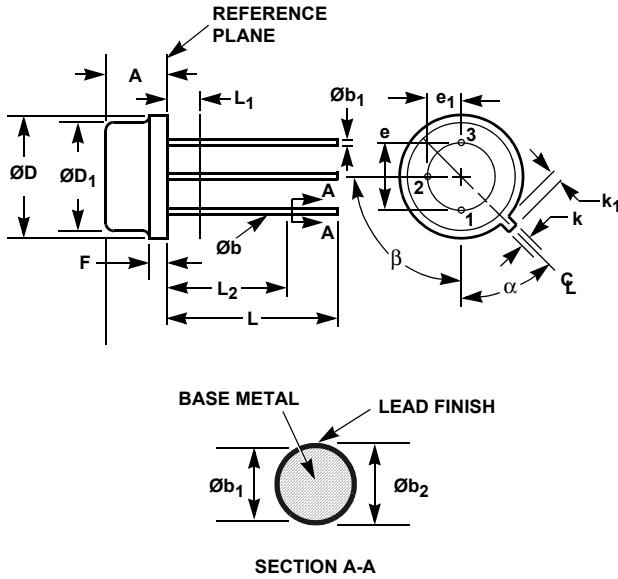
1. Controlling dimensions are in inches (mm for reference only).
2. Dimensioning and tolerance per ANSI Y14.5M - 1982.
3. The maximum "A" dimension is package height before being solder dipped.
4. Patterned after MIL-STD-1835 CBCC1-N3 (C-B1) Note: Not meeting the Mil-Std "A" minimum dimension of 0.112.

**Metal Can Package**

For the most recent package outline drawing, see [T3.C](#).

**T3.C**

**3 LEAD TO-39 (TO-205) METAL CAN PACKAGE**



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.160	0.180	4.07	4.58	-
Øb	0.016	0.019	0.41	0.48	1
Øb <sub>1</sub>	0.016	0.021	0.41	0.53	1
Øb <sub>2</sub>	0.016	0.024	0.41	0.61	-
ØD	0.350	0.370	8.89	9.40	-
ØD <sub>1</sub>	0.315	0.335	8.00	8.51	-
e	0.200 BSC		5.08 BSC		-
e <sub>1</sub>	0.100 BSC		2.54 BSC		-
F	0.009	0.050	0.23	1.27	-
k	0.027	0.034	0.69	0.086	-
k <sub>1</sub>	0.027	0.045	0.69	1.14	2
L	0.500	0.750	12.70	19.05	1
L <sub>1</sub>	-	0.050	-	1.27	1
L <sub>2</sub>	0.250	-	6.35	-	1
α	45° BSC		45° BSC		3
β	90° BSC		90° BSC		-
N	3		3		4

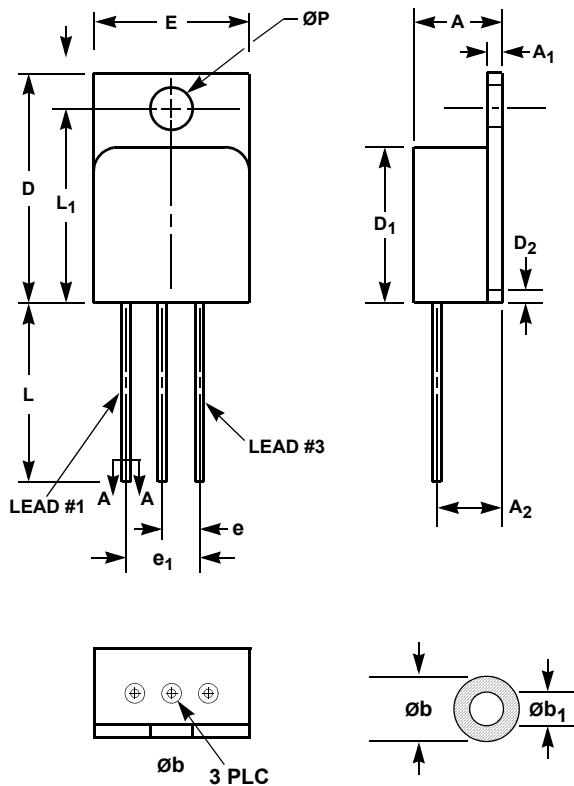
Rev. 0 6/01

**NOTES:**

1. (All leads) Øb applies between L<sub>1</sub> and L<sub>2</sub>. Øb<sub>1</sub> applies between L<sub>2</sub> and 0.500 from the reference plane. Diameter is uncontrolled in L<sub>1</sub> and beyond 0.500 from the reference plane.
2. Measured from maximum diameter of the product.
3. α is the basic spacing from the centerline of the tab to terminal 1 looking at the bottom of the package.
4. N is the maximum number of terminal positions.
5. Controlling dimension: Millimeter.

**Hermetic Metal Package**

For the most recent package outline drawing, see [T3.D](#).



**T3.D**

**3 LEAD JEDEC TO-257AA HERMETIC METAL PACKAGE**

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.188	0.200	4.78	5.08	7
A <sub>1</sub>	0.035	0.045	0.89	1.14	-
A <sub>2</sub>	0.120 BSC		3.05 BSC		-
D	0.645	0.665	16.39	16.89	-
D <sub>1</sub>	0.410	0.430	10.41	10.92	-
D <sub>2</sub>	-	0.038	-	0.97	-
e	0.100 BSC		2.54 BSC		-
e <sub>1</sub>	0.200 BSC		5.08 BSC		-
E	0.410	0.420	10.41	10.67	-
Øb	0.025	0.040	0.64	1.02	1, 2
Øb <sub>1</sub>	0.025	0.035	0.64	0.89	1, 2
L	0.500	0.750	12.70	19.05	-
L <sub>1</sub>	0.527	0.537	13.39	13.64	-
P	0.140	0.150	3.56	3.81	-
N	3		3		5

Rev. 2 3/09

**NOTES:**

1. Dimension Øb<sub>1</sub> applies to base metal only.  
Dimension Øb applies to plated part.
2. Section A-A dimension apply between 0.100 inch (2.54mm) to 0.150 inch (3.81mm) from lead tip.
3. Die to base BeO isolated, terminals to case is plated.
4. Controlling dimensions are in inches (mm for reference only).
5. N is the maximum number of terminal positions.
6. Patterned after MIL-STD-1835 MSFM1-P3AA.
7. "A" minimum dimension not meeting the MIL-STD 0.190 minimum dimension.

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### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

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