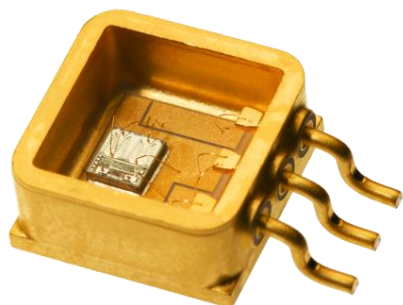


# Rad-Hard Adjustable Positive Linear Voltage Regulator



## Features

- Rad-Hard to 300 krad TID <sup>1</sup>
- Single Event, latch-up immune (LET= 87 MeV/mg/cm<sup>2</sup>)
- Wide Input/Output Voltage Differential: 40V
- K-level screening
- Excellent Temperature Stability

The AP117/117A are space qualified, wide-input range positive linear voltage regulators designed for military and space flight applications. Packaged in a hermetic tabless TO-257 package, the AP117/117A provides up to 1.5A of output current over the full input voltage range of 2.5V to 40V. The device also features internal thermal shutdown, output current-limiting circuitry and up to  $\pm 1\%$  initial output accuracy. The AP117/117A is an excellent choice for applications requiring high radiation tolerance, low noise and high power supply rejection ratios.

These voltage regulators are provided in adjustable output voltage configurations only. Consult the factory for fixed output versions. The adjustable version requires only 2 external resistors to program the output from 1.25V to 37V.

## Absolute Maximum Ratings

(Exceeding maximum ratings may damage the device.)

Symbol	Parameter	Value	Unit
Vin- Vo	DC input- Output Differential	40	V
I <sub>o</sub>	Output Current	1.5	A
P <sub>d</sub>	Power Dissipation T <sub>case</sub> =25°C	50	W
R <sub>thjc</sub>	Thermal Resistance, Junction to Case	2.5	°C/W
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
T <sub>op</sub>	Operating Temperature Range	-55 to +125	°C
T <sub>j</sub>	Maximum Junction Temperature	175	°C
W	Package weight	5	G
T <sub>sold</sub>	Maximum Soldering Temperature, 10sec	265	°C

## Radiation Ratings

Symbol	Parameter	Value	Unit
TID	Minimum in Spec Total Dose Performance (Dose Rate: 50-300 rad(Si)/s)	> 300	krads (Si)
ELDRS	Minimum in Spec Low Dose Rate Performance (Dose Rate $\leq$ 10 mRad (Si)/s)	> 50	krads (Si)
SET	Linear Energy Threshold, Single Event Transients < 100mV, (note 5)	> 15	MeV/mg/cm <sup>2</sup>
SEL/SEB	Single-Event Latch-up Free linear Energy Transfer Threshold	> 87	MeV/mg/cm <sup>2</sup>

## Electrical Characteristics

@ Ta= -55°C to +125°C (Unless Otherwise Specified)

### Pre-Radiation

Symbol	Parameter	Test Conditions	API117A			API117			Units
			Min	Typical	Max	Min	Typical	Max	
V <sub>REF</sub>	Reference Voltage accuracy	V <sub>diff</sub> = 3.25 to 35 V, I <sub>L</sub> = 10mA, T <sub>j</sub> = 25°C	1.238	1.25	1.262				V
V <sub>REF</sub>	Reference Voltage accuracy <sup>(6)</sup>	V <sub>diff</sub> = 3.25 to 35V, I <sub>L</sub> = 10mA	1.225	1.25	1.275	1.200	1.250	1.300	V
V <sub>LINE</sub>	Line Regulation <sup>(6) (2)</sup>	V <sub>out</sub> = V <sub>ref</sub> , I <sub>L</sub> = 10mA, 3V ≤ V <sub>diff</sub> ≤ 40V			+/-0.02			+/-0.02	%/V
V <sub>load</sub>	Load Regulation <sup>(7) (2)</sup>	V <sub>diff</sub> = 5.25V, 10mA ≤ I <sub>L</sub> ≤ 1.25 A			+/-1.5			+/- 1.5	%
I <sub>ADJ</sub>	Adjust-Pin Current V <sub>load</sub> <sup>(6)</sup>	V <sub>diff</sub> = 3.3V - 40V, I <sub>load</sub> = 10mA			100			100	μA
ΔI <sub>ADJ</sub>	Adjust-Pin Current Change <sup>(6)</sup>	V <sub>diff</sub> = 5.25V, I <sub>L</sub> = 10mA	-5		5	-5		5	μA
ΔI <sub>ADJ</sub>	Adjust Current Change <sup>(7)</sup>	V <sub>diff</sub> = 5.25V, 10mA ≤ I <sub>L</sub> ≤ 1.5A	-5		5	-5		5	μA
I <sub>OUT</sub>	Output Current <sup>(7)</sup>		1.25			1.25			A
V <sub>in</sub> (Min)	Minimum I/O Differential <sup>(4) (7)</sup>	I <sub>o</sub> ≤ 1.25 A	3.0			3.0			V

### Post-Radiation

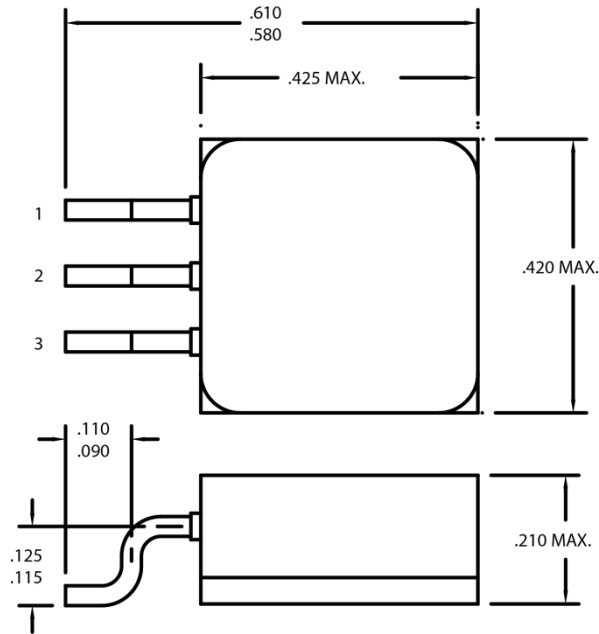
(Ta= 25 °C) Notes <sup>(1) (3)</sup>

Symbol	Parameter	Test Conditions	API117A			API117			Units
			Min	Typical	Max	Min	Typical	Max	
V <sub>REF</sub>	Reference Voltage accuracy	V <sub>diff</sub> = 3.0V, I <sub>L</sub> = 5 mA	1.225	1.25	1.270	1.15		1.35	V
V <sub>REF</sub>	Reference Voltage accuracy	V <sub>diff</sub> = 40V, I <sub>L</sub> = 5 mA	1.20	1.25	1.3	1.15		1.35	V
I <sub>ADJ</sub>	Adjust-pin current	V <sub>diff</sub> = 3-35V, I <sub>load</sub> = 5mA			+/-5			+/-5	μA

#### Notes:

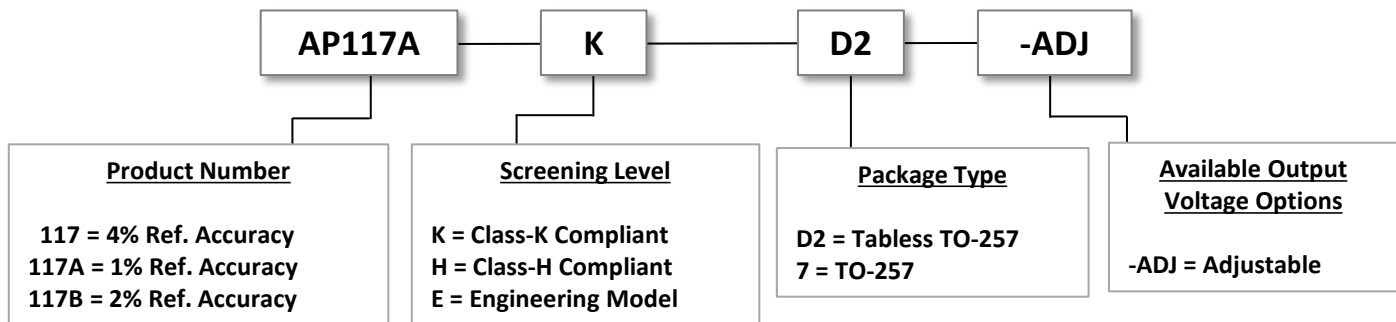
1. At the time of publication of this datasheet, API Technologies/Marlborough did not have a DLA certified radiation hardness assurance program.
2. Load & Line regulation are measured at constant (T<sub>j</sub>) junction temperature using a low duty cycle pulse. Changes in output voltage due to heating effects must be evaluated separately.
3. TID Radiation Testing is performed per MIL-STD-883, Method 1019.
4. Internal SOA Protection Limits Output Current With High Input Voltage.
5. V<sub>in</sub> ≥ 9V and C<sub>OUT</sub> ≥ 44 uF
6. V<sub>DIFF</sub> ≤ 39V @ 125°C
7. At 125°C, a 1.5A output requires an I/O differential of ≥ 6.75 V.

## Package Outline (Tabless TO-257)



Pin No	Pin Name	Pin Description
1	ADJ	Adjust Pin
2	OUT	Output Voltage
3	IN	Input Voltage
	Case	No Connection- Isolated

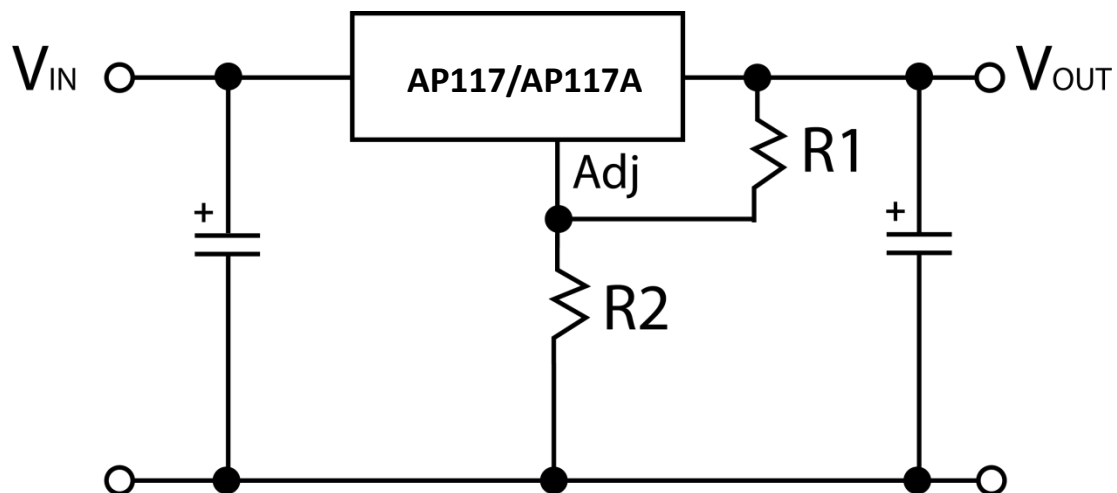
## Ordering Information



## Screening Options

Tests	Screening Levels			Mil-Std-883-Method
	EM	H	K	
	Engineering Models	Compliant-MIL-PRF-38534		
100 % Non-Destruct Wire-Pull	N/A	Sample	100%	2023
Pre-Cap Visual	N/A	N/A	100%	2017
Temperature Cycle	N/A	100%	100%	1010
Constant Acceleration	N/A	100%	100%	2001
PIND	N/A	N/A	100%	2020
Pre-Burn-In Electrical (Ta= 25C)	N/A	100%	100%	
Burn-In	N/A	100% (160 Hours)	100% (320 Hours)	1015
Final Electrical	100% (25C)	100%	100%	
Hermeticity (Fine & Gross Leak)	N/A	100%	100%	1014
X-Ray	N/A	N/A	100%	2012
External Visual	Sample	100%	100%	2009

**Figure 1 – Output Voltage Configuration**



**Notes:**

1.  $V_{OUT} = 1.25 (1 + R2/R1)$
2.  $R1$  is recommended to be  $\leq 125 \Omega$

**Figure 2 – Typical Application**

