

**MHL117 / MHL117A / MHL117B / MHL117Q**  
 (Formerly SAT117 / SAT117A / SAT117B)

Levels Available  
**SPACE**
**DESCRIPTION**

These devices are space qualified, wide-input range linear regulators designed for military and space flight applications. Hermetically packaged, they provide up to 1.5A of output current. The devices also feature internal thermal shutdown, output current-limiting circuitry and in one model  $\pm 1\%$  initial output accuracy. These are an excellent choice for applications requiring high radiation tolerance, low noise and high power supply rejection ratios.

Devices are available in adjustable output voltage configurations. The adjustable version requires only 2 external resistors to program the output from 1.25V to 37V.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

**FEATURES**

- Rad-Tolerant to 300K rad TID (Note 1)
- ELDRS effects free through 50K Rad TID (Note 1)
- Wide Input Voltage: 40V
- Space level screening
- Excellent Temperature Stability
- 1% Accuracy -55°C to 125°C for MHL117A only

**APPLICATIONS / BENEFITS**

- Adjustable over a wide range of output voltages.

**Table 1 – ABSOLUTE MAXIMUM RATINGS ( $T_c = +25^\circ\text{C}$  unless otherwise note)**  
*(Exceeding maximum ratings may damage the device)*

Parameters / Test Conditions	Symbol	Value	Unit
DC Input-Output differential	Vin-Vo	40	V
DC Output Voltage	Vo	1.2 – 37	V
Output Current	Io	1.5	A
Power Dissipation $T_{case} = 25^\circ\text{C}$	Pd	50	W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.5	$^\circ\text{C/W}$
Storage Temperature	Tstg	-65 to +150	$^\circ\text{C}$
Operating Temperature Range	Top	-55 to +125	$^\circ\text{C}$
Maximum Junction Temperature	Tj	175	$^\circ\text{C}$
Package weight	W	5	G
Maximum Soldering Temperature, 10sec	Tsolder	300	$^\circ\text{C}$

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**MECHANICAL and PACKAGING**

- See page 6 for package information.

**Website:**  
[www.microsemi.com](http://www.microsemi.com)

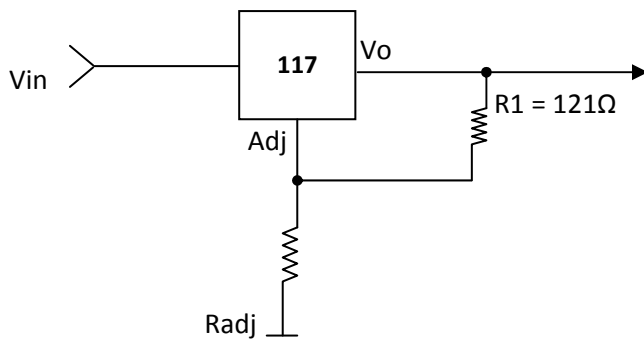
**Table 2 – ELECTRICAL CHARACTERISTICS (Note 9 & 10)**  
*(T<sub>A</sub> = -55°C to +125°C unless otherwise noted) (Nominal reference voltage is 1.265V @ 25°C)*

**PRE-RADIATION**

Parameters / Test Conditions	Symbol	MHL117			MHL117A, MHL117Q			MHL117B			Unit
		Min.	Typ	Max.	Min.	Typ	Max.	Min.	Typ	Max.	
Reference Voltage Accuracy (Note 9) V <sub>diff</sub> = 3.25V, I <sub>L</sub> = 10mA (5.25mA for 117)	V <sub>REF</sub>	1.200	1.25	1.300	1.238	1.25	1.262	1.225	1.25	1.275	V
Reference Voltage Accuracy (Note 10) V <sub>diff</sub> = 40V, I <sub>L</sub> = 10mA (Note 7)	V <sub>REF</sub>	1.200	1.25	1.300	1.225	1.25	1.275	1.200	1.25	1.300	V
Line Regulation (Note 2) V <sub>out</sub> = V <sub>ref</sub> , I <sub>L</sub> = 10mA, 3.0 ≤ V <sub>diff</sub> ≤ 40V (Note 7)	V <sub>LINE</sub>	-10		10	-10		10	-10		10	mV
Load Regulation (Note 2) V <sub>diff</sub> = 5.25V, 10mA ≤ I <sub>L</sub> ≤ 1.5A (Note 8)	V <sub>load</sub>	-15		15	-15		15	-15		15	mV
Adjust-pin Current (Note 7) V <sub>diff</sub> = 3.3V – 40V, I <sub>load</sub> = 10mA	I <sub>ADJ</sub>			100			100			100	μA
Adjust-pin Current Change (Note 7) V <sub>diff</sub> = 5.25V – 40V, I <sub>L</sub> = 10mA	ΔI <sub>adj</sub>	-5		5	-5		5	-5		5	μA
Adjust-pin Current Change (Note 8) V <sub>diff</sub> = 5.25V, 10mA ≤ I <sub>L</sub> ≤ 1.5A	ΔI <sub>adj</sub>	-5		5	-5		5	-5		5	μA
Ripple Rejection F = 120Hz, I <sub>out</sub> = 50mA, V <sub>diff</sub> = 5.25V, V <sub>r</sub> = 2 Vp-p	P <sub>SRR</sub>	65			65			65			dB
Short-circuit Current V <sub>diff</sub> = 10V	I <sub>os</sub>	1.5			1.5			1.5			A
Thermal Regulation (Note 4) T <sub>A</sub> = 25°C V <sub>in</sub> = 14.6V, I <sub>I</sub> = 1.5A, P <sub>d</sub> = 20W, t = 20mS	V <sub>rth</sub>	-5		5	-5		5	-5		5	mV

**Table 3 – RADIATION RATING**

Parameters / Test Conditions	Symbol	Value	Unit
Maximum Total Dose (Dose Rate: 50 – 300 rad (Si)/s)	TID	300	Krads (Si)
ELDRS (Low Dose Rate $\leq 10$ mrad (Si)/s)	ELDRS	50	Krads (Si)
Linear Energy Threshold, Single Event Transient < 100mV	SET	15	MeV/mg/cm <sup>2</sup>
Single-Event Latch-up linear Energy threshold (Note 5)	SEL / SEB	87.4	MeV/mg/cm <sup>2</sup>

**Application Circuits**

**Formula for Vout**

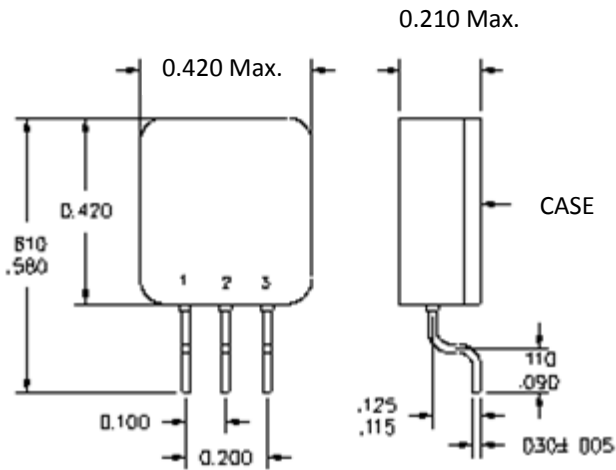
$$V_O = 1.25(1 + R_{adj} / R_1) + I_{ADJ}R_{ADJ}$$

**Table 4 – SCREENING OPTIONS**

TESTS	Screening Levels	MIL-STD-883 Method
	SPACE	
	MIL-PRF-38534 Certified	
100 % Non-Destruct Wire-Pull	100%	2023
Pre-Cap Visual	100%	2017
Temperature Cycle	100%	1010
Constant Acceleration	100%	2001
PIND	100%	2020
Pre-Burn-In Electrical ( $T_A = 25^\circ\text{C}$ )	100%	
Burn-In	100% (320 hours)	1015
Final Electrical	100%	
Hermeticity (Fine & Gross Leak)	100%	1014
X-Ray (Note 11)	100%	2012
External Visual	100%	2009

**NOTES:**

- At the time of publication of this datasheet, Microsemi did not have a DSCC certified MIL-PRF-38534 radiation hardness assurance program.
- Load & Line regulation are measured at constant ( $T_j$ ) junction temperature using a low duty cycle pulse. Changes in output voltage due to heating effects must be evaluated separately.
- TID Radiation Testing is performed per MIL-STD-883, Method 1019. "ELDRS tested per MIL-STD-883 method 1019 par. 3.13.11.
- Not Tested.
- Latch up immune due to DI process.
- Internal SOA protection limits output current with high input voltages.
- $V_{diff} = 39\text{V} @ 125^\circ\text{C}$
- At  $125^\circ\text{C}$ , 1.5A is achievable at an I/O differential of 6.75V. At the stated 5.25V differential, 1.25A is achievable at  $125^\circ\text{C}$ .
- For MHL117Q, these specifications hold at  $25^\circ\text{C}$  only.
- For MHL117Q, these specifications hold also for the above input conditions at temperature extremes.
- Performed at a DLA approved facility.

**PACKAGE OUTLINE – TABLES TO-257 (D2)**


Pin No	Pin Name	Pin Description
1	ADJ/GND	Adjust Pin or Ground for fixed versions
2	OUT	Output Voltage
3	IN	Input Voltage
	Case	No Connection- Isolated

(SMT lead bend shown)

**ORDERING INFORMATION**

PART NUMBER	REGULATOR ACCURACY
MHL117 40K	40V Standard
MHL117A 40K	40V 1% Accuracy
MHL117B 40K	40V 2% Accuracy
MHL117Q 40K	40V 1% Accuracy at 25°C, 2% Accuracy at temperature extremes

**Lead Bend Type**

-1	Straight
-2	SMT
-3	Up
-4	Down