MHL117/A/B/Q

Linear Voltage Regulators

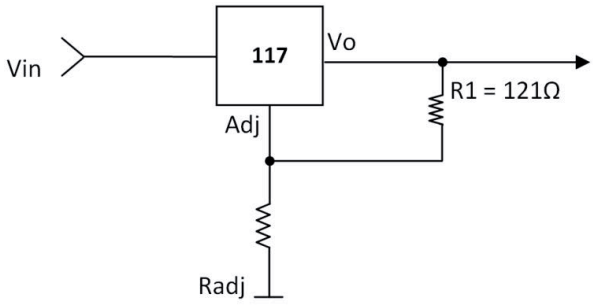
Introduction

The MHL117/A/B/Q linear voltage regulators are space-qualified, wide-input range, hermetically packaged, and are designed for military and space flight applications. They provide up to 1.5A of output current. The devices also feature internal thermal shutdown, output current-limiting circuitry, and one model ±1.5% initial output accuracy. These are a recommended choice for applications requiring high radiation tolerance, low noise, and high-power supply rejection ratios.

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

Figure 1. MHL117 Device—3D View

Figure 2. MHL117 Device—Schematic



Formula for V_{OUT}

$V_O = 1.25\ (1 + Radj/R1) + I_{ADJ}R_{ADJ}$

All ratings T_C = 25°C, unless otherwise specified.

Features

The following are the key features of MHL117 device:

- Rad-Tolerant to 300K rad TID[1]
- ELDRS effects free through 50K Rad TID[1]
- Wide Input Voltage: 40V
- Space level screening
- Excellent Temperature Stability
- 1.5% Accuracy –55°C to 125°C for MHL117A only

Applications/Benefits

The following are the applications/benefits of MHL117 device:

- Adjustable over a wide range of output voltages.

1. Electrical Specifications

This section provides the electrical specifications of the MHL117 device.

1.1 Absolute Maximum Ratings

The following table lists the absolute maximum ratings of the MHL117 device.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameters/Test Conditions	Value	Unit
$V_{In}–V_O$	DC input-output differential	40	V
V_O	DC output voltage	1.2 to 37	V
I_O	Output current	1.5	A
P_D	Power dissipation T_{CASE} = 25 °C	50	W
R_{thJC}	Junction-to-case thermal resistance	2.5	°C/W
T_{STG}	Storage temperature	–65 to 150	°C
T_{OP}	Operating temperature range	–55 to 125	°C
T_J	Maximum junction temperature	175	°C
W	Package weight	5	G
T_{solder}	Maximum soldering temperature, 10 sec	300	°C

1.2 Electrical Characteristics

The following table lists the electrical characteristics of the MHL117 device.

Note: T_A = –55°C to +125°C unless otherwise specified.

Table 1-2. Electrical Characteristics

Symbol	Parameters/Test Conditions	Test Conditions	MHL117			MHL117A and MHL117Q			MHL117B			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{REF}	Reference voltage accuracy[9]	V_{diff} = 3.25V IL = 10 mA (5.25 mA for 117)	1.200	1.25	1.300	1.231	1.25	1.269	1.225	1.25	1.275	V
V_{REF}	Reference voltage accuracy[7, 10]	V_{diff} = 40V IL = 10 mA	1.200	1.25	1.300	1.225	1.25	1.275	1.200	1.25	1.300	V
V_{LINE}	Line Regulation[2, 7]	$V_{out} = V_{ref}$ IL = 10 mA, 3.0 ≤ V_{diff} ≤ 40V	–10	—	10	–10	—	10	–10	—	10	mV
V_{load}	Load Regulation[2, 8]	V_{diff} = 5.25V 10 mA ≤ I_L ≤ 1.5A	–15	—	15	–15	—	15	–15	—	15	mV

.....continued

Symbol	Parameters/Test Conditions	Test Conditions	MHL117			MHL117A and MHL117Q			MHL117B			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
I_{ADJ}	Adjust-pin Current[7]	V_{diff} = 3.3V–40V I_{load} = 10 mA	—	—	100	—	—	100	—	—	100	µA
ΔI_{adj}	Adjust-pin Current Change[7]	V_{diff} = 5.25V–40V IL = 10 mA	–5	—	5	–5	—	5	–5	—	5	µA
ΔI_{adj}	Adjust-pin current change[8]	V_{diff} = 5.25V 10 mA ≤ I_L ≤ 1.5A	–5	—	5	–5	—	5	–5	—	5	µA
P_{SRR}	Ripple rejection	F = 120 Hz I_{out} = 50 mA V_{diff} = 5.25V $V_r = 2V_{p-p}$	65	—	—	65	—	—	65	—	—	dB
I_{OS}	Short-circuit current	V_{diff} = 3V	1.5	—	—	1.5	—	—	1.5	—	—	A
V_{rth}	Thermal Regulation[4]	T_A = 25°C V_{in} = 14.6V I_L = 1.5A P_d = 20W t = 20 mS	–5	—	5	–5	—	5	–5	—	5	mV

2. Radiation Ratings

The following table lists the radiation ratings of MHL117 device.

Table 2-1. Radiation Ratings

Symbol	Parameters/Test Conditions	Value	Unit
TID	Maximum total dose (Dose rate: 50–300 rad (Si)/s)	300	Krads (Si)
ELDRS	ELDRS (Low dose rate ≤ 10 mrad (Si)/s)	50	Krads (Si)
SET	Linear energy threshold, single event transient < 100 mV	15	MeV/mg/cm^2
SEL/SEB	Single-event latch-up linear energy threshold[5]	87.4	MeV/mg/cm^2

3. Screening Options

Table 3-1. 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°C)	100%	—
Burn-in	100% (320 hours)	1015
Final electrical	100%	—
Hermeticity (Fine and gross leak)	100%	1014
X-Ray[11]	100%	2012
External visual	100%	2009

Notes:

1. Certified to Appendix G of MIL-PRF-38534 for Radiation Hardness Assurance (RHA) requirements for Hybrid Microcircuits and Multichip Modules effective June 27, 2013 (See RHA Test Laboratory Suitability).
2. Load & Line regulation is measured at constant (TJ) 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. ELDRS tested per MIL-STD-883 method 1019 par. 3.13.11.
4. Not tested.
5. Latch up immune due to DI process.
6. Internal SOA protection limits output current with high input voltages.
7. V_{diff} = 39V at 125°C.
8. At 125°C, 1.5A is achievable at an I/O differential of 6.75V. At the stated 5.25V differential, 1.25 A is achievable at 125°C.
9. For MHL117Q, these specifications hold at 25°C only.
10. For MHL117Q, these specifications hold also for the above input conditions at temperature extremes.
11. Performed at a DLA approved facility.

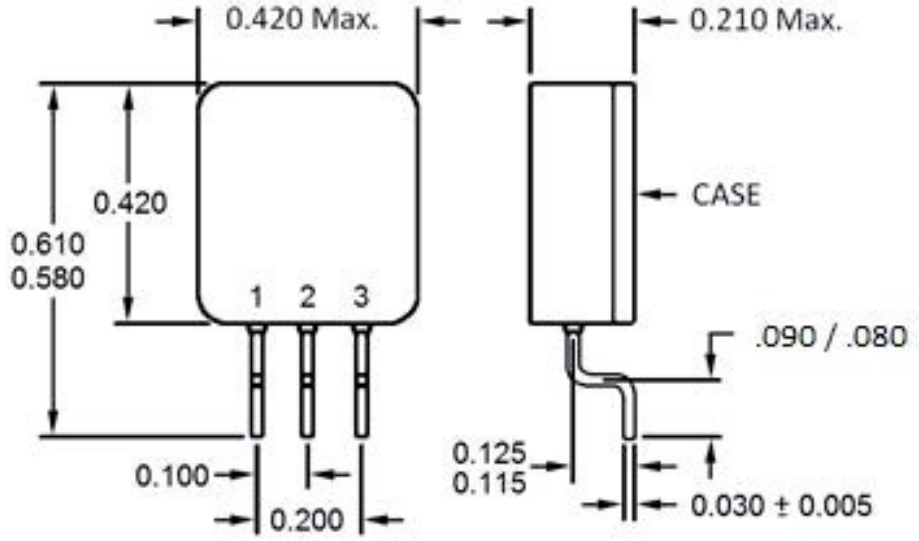
4. Package Specifications

The following section shows the package specification of the MHL117 device.

4.1 Package Outline

The following figure shows the package outline drawing of the MHL117 device. The dimensions in the following figure are in millimeters.

Figure 4-1. Package Outline Drawing—Tabless TO-254 (D2) (SMT Lead Bend Shown)



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

5. Ordering Information

The following table lists the ordering information.

Table 5-1. Ordering Information

Part Number	Regulator Accuracy
MHL117 40K &# Consult factory for availability	40V Standard
MHL117A 40K &#	40V 1.5% Accuracy
MHL117B 40K &# Consult factory for availability	40V 2% Accuracy
MHL117Q 40K &# Consult factory for availability	40V 1.5% Accuracy at 25°C, 2% Accuracy at temperature extremes

Replace **#** with lead finish option letter:

- C = Gold plate
- A = Solder dip over gold plate

Replace **&** with the dash and number to indicate the following lead bend options:

Table 5-2. Lead Bend Options

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

Note: Consult factory for latest package outline drawing and availability.

6. Revision History

Revision	Date	Description
A	09/2021	Initial Revision

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