Single 3 Amp Point-of-Load Switching Regulator

MHP8565A

Product Overview

Description

The MHP series are non-isolated point-of-load switching regulators for high reliability military and space distributed power applications (MIL-PRF-38534 certified facility). Fully integrated, these include a buck controller, inductor, and input/output capacitors combined in a single package. They operate from an input voltage of +4.5V to +12V, providing step down power conversion to output voltages as low as 0.5V or lower. Operating features include output voltage adjust, output current limit, and output enable/disable. Careful design and layout ensure excellent stability, transient response, and low noise operation. Packaged in a compact metal case, it operates over the full -55 °C to +125 °C temperature range.

Features

- Now available as SMD: 5962R1323601xxx
- Single 3 amp product
- Efficiencies to 87%, see Figure 6-7
- Radiation hard to 100K rad TID
- Single-event results show no significant output transients through an LET of 58 MeV/(mg/cm^2).
- Optimized for 5V input. Consult factory for higher input voltages.
- Operates down to 4.5 volts input
- Current mode control
- Adjustable output voltage between 0.5V and 4V (depends on model, see Table 3-1)
- Enable function available
- Operates at a nominal frequency of 500 KHz

Applications/Benefits

- More efficient than competitive POLs (See Figure 6-6).
- FPGA power supply – satellite
- ASIC power supply – satellite

Figure 1. MO-078 (MHP8565)

Levels Available

COTS

Military

Space

Table of Contents

1. Absolute Maximum Ratings

Table 1-1. Absolute Maximum Ratings (Tc = +25 °C unless otherwise note)

Parameters / Test Conditions	Symbol	Value	Unit
Input voltage[1]	V_{in}	16	Vdc
Output current[2]	Io	4	A
Enable input voltage	V_{en}	7	Vdc
Approximate weight	MO-078	10	Grams
Operating temperature range, base of package	T_c	-55 to +125	°C
Storage temperature range	T_{stg}	-65 to +150	°C

Table 1-2. Thermal Characteristics

Parameters / Test Conditions	Symbol	Value	Unit
Series switch Thermal resistance, junction-to-case, MO-78 package	$R_{\theta JC}$	2.5	°C/W

Notes:

1. Most internal components are rated at +16 volts maximum and are therefore properly de-rated for operation at a nominal input of +5 volts. Operation at +12V will decrease that de-rating.
2. Internal series switch is self- protected and is rated to conduct 4.0 amps minimum. However, limitations on internal components plus the characteristics of PWM operation conspire to reduce further the minimum available output current, especially at output voltages above Vin/2. Minimum available output current is guaranteed to be as specified at output voltage of 2.5V down to 1.21V, assuming a clean layout. At output voltages below 1.21V, maximum output current may reduce by up to 1 amp, depending on actual output voltage, and load regulation may degrade slightly (up to 1%). At 3.3V output with a 5V input, output current reduces by 0.5A from the value specified at 2.5V out.

1.1 Mechanical Packaging

See Figure 6-1, Figure 6-2, Figure 6-3, Figure 6-4, and Table 6-1.

2. Electrical Characteristics

Table 2-1. Electrical Characteristics[1] (TA = -55 °C to +125 °C unless otherwise noted)

Parameters / Test Conditions	Symbol	Value			Unit
		Min.	Nom.	Max.	
Minimum input voltage[2]	Vin(min)	4.5	—	—	V
Output voltage accuracy Vo = 1.21V	Vout	1.19	—	1.23	V
Post 100K irradiation, 25 °C	Vout	1.17	—	1.24	V
Line regulation 4.5V < Vin < 5.5V Vo = 1.21V	Kvi	-0.5	—	+0.5	%
Load regulation 1A < Iout < 2A	Kvo	-1	—	+1	%
Current limit Vo = 2.5V	ICL	3.5	5	—	A
Post 100K irradiation, 25 °C		3.0	—	—	
Input voltage on enable pin to guarantee shutdown[3, 4] Io = 0A	Vshdn	0.13	0.40	0.60	V

Notes:

1. Testing is accomplished at an output load of 1A, and at an output voltage of 2.5V and an input of 5V unless otherwise specified. Only the specifications with post irradiation limits are tested after radiation exposure.
2. Minimum input voltage is guaranteed by line regulation test.
3. If not used, or when on, the enable pin should be pulled up to a logic one (2.5V min, 7V max) through a resistor of no more than 5K ohms. Voltage on this pin to disable operation needs to be less than 0.13V.
4. Not tested in production. Parameters are for reference only.

3. Model Number Functionality Chart

Table 3-1. Model Number Functionality Chart

Model Number[1]	Notes	Package Type	Output Type	Other Functionality					Former P/N
		MO-078	Adj	Enable Pin	Parallelable Note A	Output Voltage Range[2, 3]	Package Body	Internal Compensation	
MHP8565A**$&***	3 amp series	✓	✓	✓	No	0.5 - 4V	Isolated	✓	SAT8565A-3$T-ADJ

Replace "**$**" with letter to denote required screening level

- C = COTS
- M = MIL-PRF-38534, Class H
- S = MIL-PRF-38534, Class K

Replace "**&**" with lead lend option

- Blank = No lead-bend
- -1 = SMT lead-bend
- -2 = lead-bend down
- -3 = lead-bend up

Replace "*****" with lead finish option

- C = Gold plate
- A = Solder dipped

Notes:

1. See DSCC SMD 5962-13236 for DSCC part number options.
2. Internal series switch is self-protected and is rated to conduct 4.0 amps minimum. However, limitations on internal components plus the characteristics of PWM operation conspire to reduce further the minimum available output current, especially at output Voltages above Vin/2. Minimum available output current is guaranteed to be as specified at output voltage of 2.5V down to 1.21V, assuming a clean layout. At output voltages below 1.21V, maximum output current may reduce by up to 1 amp, depending on actual output voltage, and load regulation may degrade slightly (up to 1%). At 3.3V output with a 5V input, output current reduces by 0.5A from the value specified at 2.5V out.
3. Minimum input voltage is guaranteed by line regulation test.

Table 3-2. Example SMD Part Numbers

Standard Microcircuit Drawing	Microchip Similar Part[1]
5962R1323601KUC	MHP8565ASC
5962R1323601KUA	MHP8565ASA
5962R1323601KXC	MHP8565AS-1C
5962R1323601KXA	MHP8565AS-1A
5962R1323601KYC	MHP8565AS-2C
5962R1323601KYA	MHP8565AS-2A

.....continued

Standard Microcircuit Drawing	Microchip Similar Part[1]
5962R1323601KZC	MHP8565AS-3C
5962R1323601KZA	MHP8565AS-3A

The SMD number shown is for Class K screening and radiation hardness level R. See the SMD 13236 for the numbers for other screening and radiation levels. For exact specifications for an SMD product, refer to the SMD drawing. SMD's can be downloaded from the DLA Land and Maritime website.

Note:

1. Do not use the Microchip similar part number to order the SMD device.

4. Screening Options

Table 4-1. Screening Options

Test	Commercial	Military = Class H	Space = Class K	MIL-STD-883 Method
	COTS	MIL-PRF-38534		
Element evaluation	N/A	Military	Space	Note 1
Non-destruct wirebond pull	N/A	Sample	100%	2023
Pre-cap visual	N/A	100%	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	N/A	100%	100%	—
Burn-in	N/A	100% (160 hours)	100% (320 hours)	1015
Final electrical tests	100% (25 °C)	100%	100%	Note 1
Hermeticity (fine and gross leak)	100%	100%	100%	1014
X-ray[2]	N/A	N/A	Yes	2012
External visual	Sample	100%	100%	2009

NOTES:

1. Microchip is a DLA approved facility. Testing is performed per MIL-PRF-38534.
2. Maximum solder reflow temperature = 180 °C. Do not exceed.

5. Application Circuits, 3 Amp Product

Figure 5-1. 3A Adjustable Configuration

Vout = Vref x (1+Radj / 2490), with Vref ~ 1.21 Volts

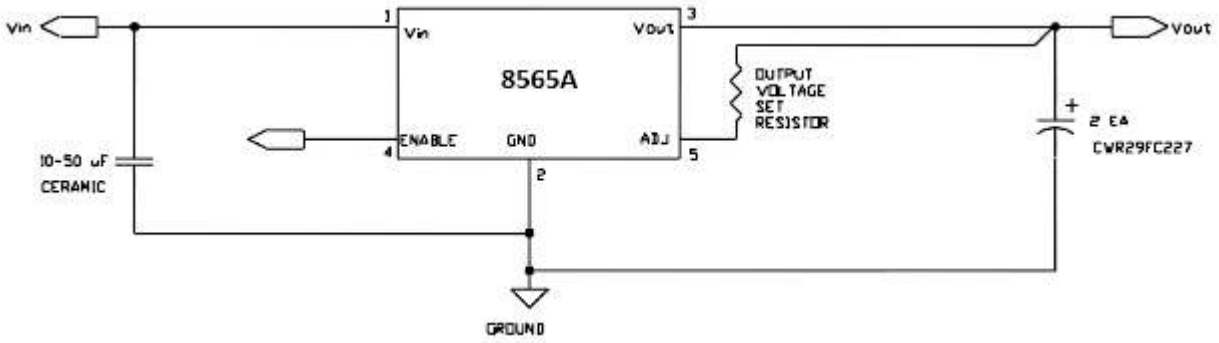
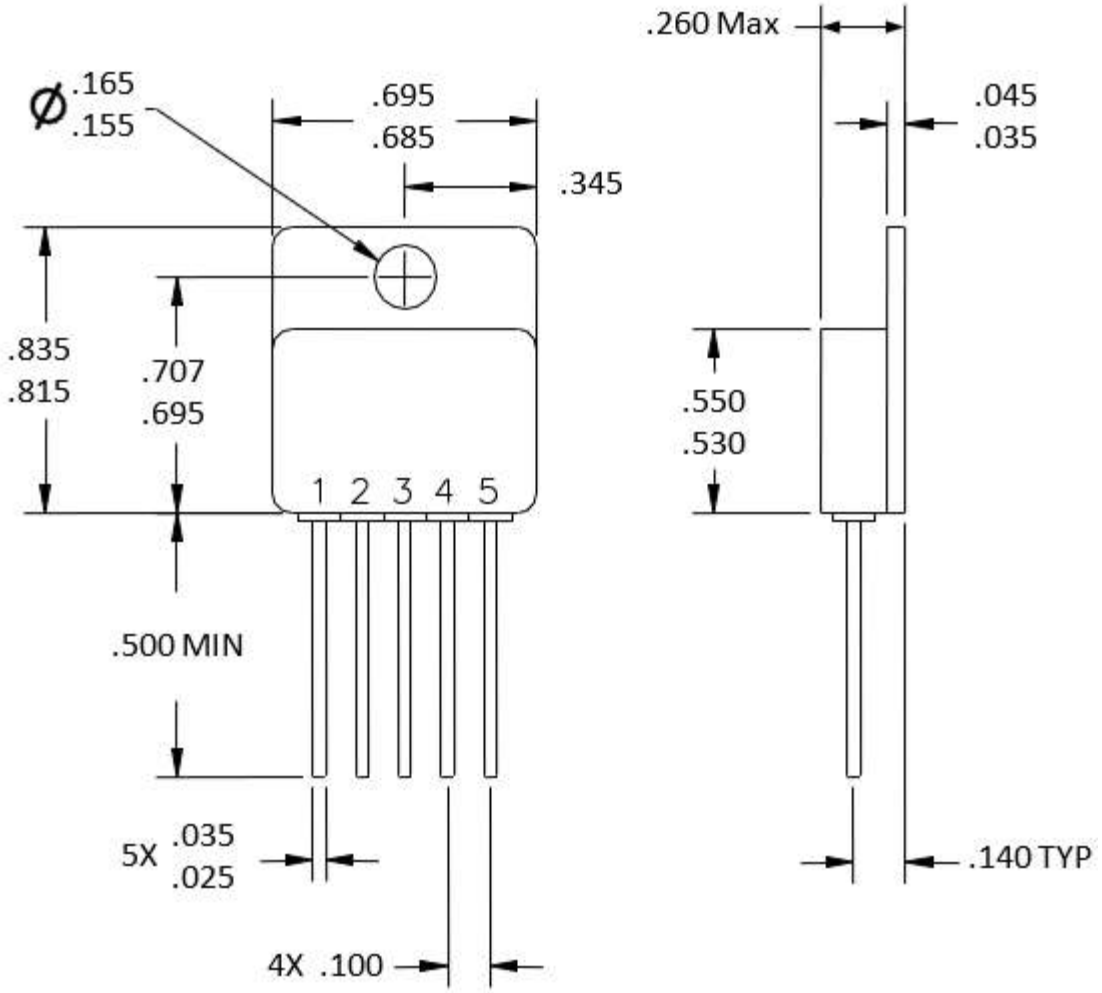


Table 5-1. Commonly Available 1% Resistor Values for Various Output Voltage for 3A Product

V_{out} (V)	R_{adj} (Ω)	V_{out} (V)	R_{adj} (Ω)
1.21	0	2.8	3240
1.5	590	3.0	3650
1.8	1210	3.3	4320
2.0	1620	3.5	4750
2.2	2050	3.8	5360
2.5	2670	4.0	5760

6. Package Outlines, 3 Amp Product (8565A)

Figure 6-1. Standard Straight Package



Dimensions are in inches
Tolerances .XXX = ± .005”
.XX = ± .010”

Figure 6-2. Surface Mount Lead-Bend (-1 Option)

Figure 6-3. Right Angle Lead-Bend (-2 Option Lead-Bend Down)

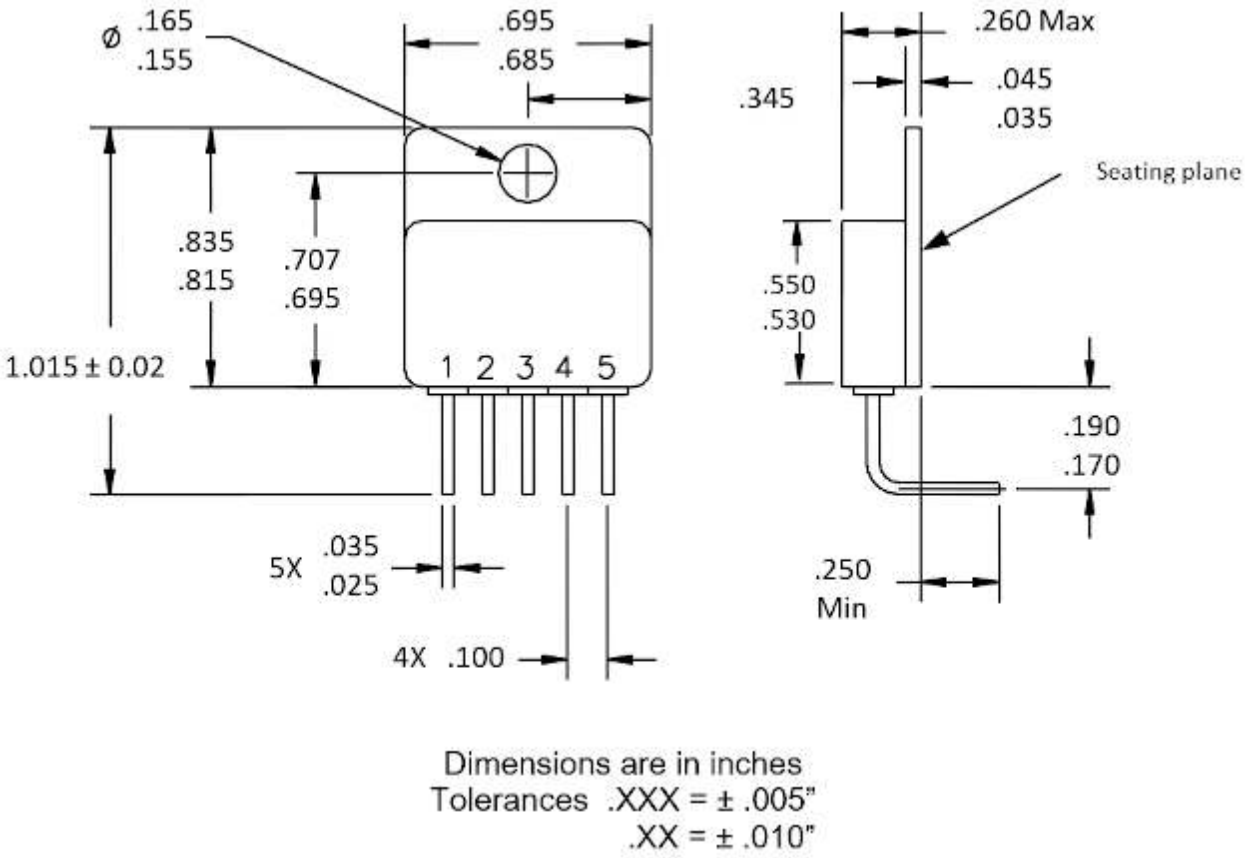


Figure 6-4. -3 Option Lead-Bend Up

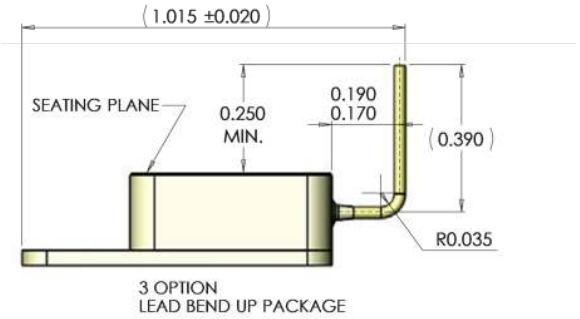


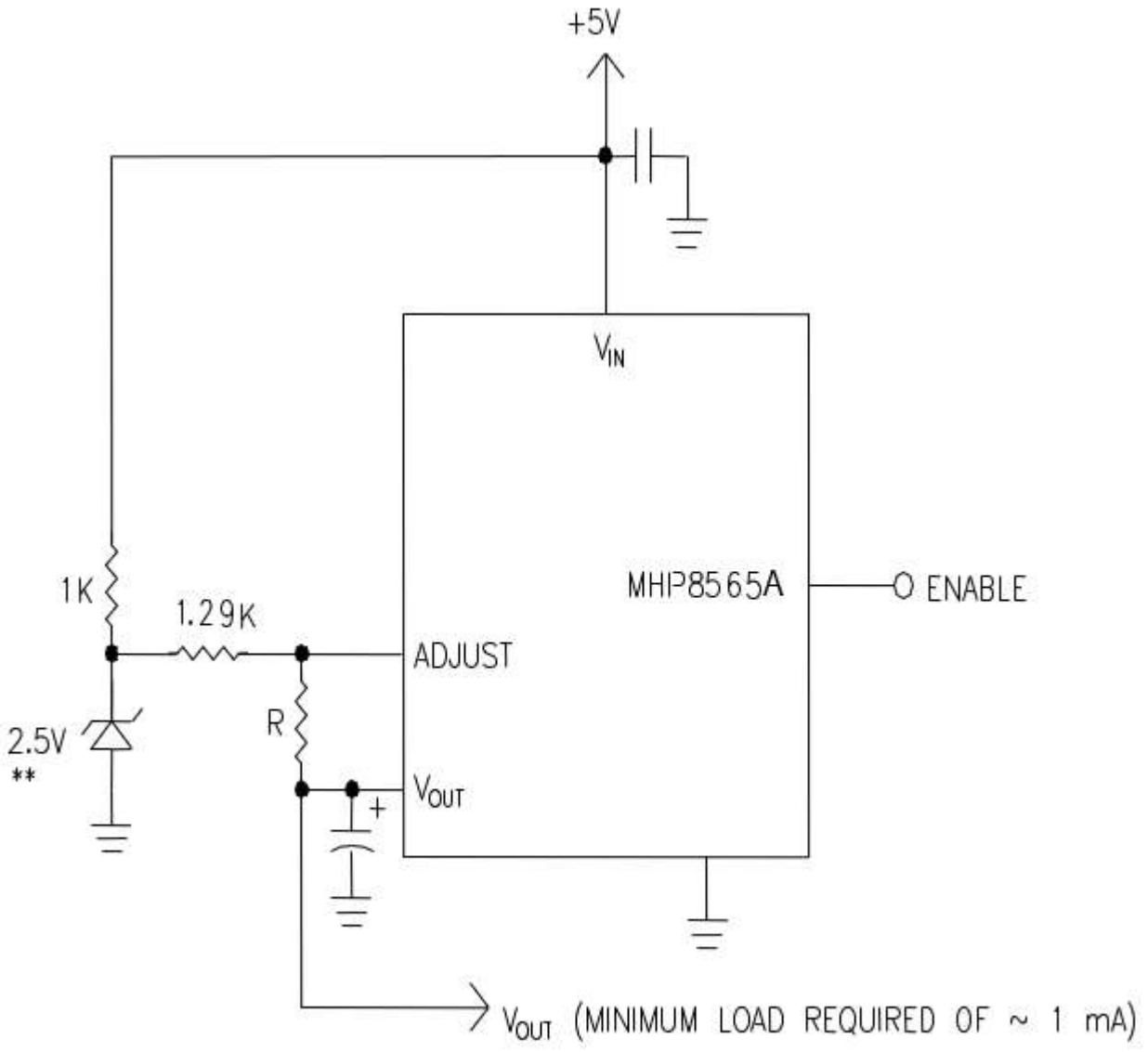
Table 6-1. Pin Assignments for 3 Amp Product

Pin No	8565A	
	Pin Name	Pin Description
1	Vin	Input voltage
2	GND	Current ground
3	Vout	Output voltage

.....continued

Pin No	8565A	
	Pin Name	Pin Description
4	Enable	Enable output
5	Adjust	Output voltage adjust
Case	N/C	Isolated

Figure 6-5. Circuit for Creating Regulated Output Voltages Below 1.21 Volts



Vout = 1.21 – R (K-Ohms)

Example: If R = 0.21K Ohms (210 Ohms), Vout = 1.21 – 0.21 = 1.0V, within the limits of the tolerances of the components used.

Note:
** RAD Hard Zener or other fixed voltage > 2V may be used. For any voltage other than 2.5V, resistor values would have to be adjusted accordingly.

Figure 6-6. MHP8565 Typical Efficiency Vs. Typical Competitive POL (Vin = 5V, Vout = 3.3V)

Figure 6-7. Typical Efficiency Curves (Vin = 5V)

7. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	09/2023	Initial revision.

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ISBN: 978-1-6683-3081-4

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