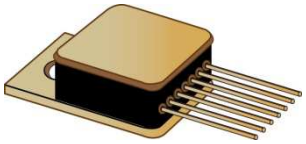
MHL8701 / MHL8705
SET Free 3 Amp & 5 Amp ULDO Regulators

Levels Available
COTS
MILITARY
SPACE

DESCRIPTION

The MHL8701 & MHL8705 are space qualified, very low dropout linear regulators designed for military and space flight applications. The MHL8701 is designed for a maximum output current of 3 A. The MHL8705 is designed for higher current operation, with a maximum output current rating of 5 A. Assembled in a hermetic package, these products provide a very low dropout voltage of 400 mV @ 2 A and a maximum dropout voltage of 0.65 V at 4 A. They are optimized for operation at +5 V input or +3.3 V input depending on the suffix ordered. In addition to having excellent TID capability, these linear regulators are designed to also provide Single-Event transient suppression capability. The resulting SET performance provides a significant improvement versus competing Rad-Tolerant regulators in this market.



Actual package appearance may vary

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

FEATURES

- Output is SET reduced for heavy ions (Note 1). (See Figure 6)
- Rad-Tolerant to 200 K rad TID (Note 1).
- Ultra Low Dropout Voltage – 400 mV @ 2.0 A.
- Space level screening available.
- Shutdown pin for output control.
- Thermal Shutdown @ 150 °C.
- Optimized for operation at an input voltage of 3.3 V or 5 V.
- Available in fixed or adjustable outputs.

APPLICATIONS / BENEFITS

- Commercial satellite .power supplies
- Distributed power systems
- Military power systems
- RTAX FPGA power supplies
- Provides quiet power for sensitive instrumentation

Table 1 – ABSOLUTE MAXIMUM RATINGS @ Tc = +25°C unless otherwise noted

Parameters / Test Conditions	Symbol	Value		Unit
		(3A Version)	(5A Version)	
DC input Voltage Vin-Vground	V_{in}	10.0	10.0	V
Output Current	I_o	3.3	5.25	A
Power Dissipation Tcase = 25°C	P_d	25	25	W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	3.0	°C/W
Storage Temperature	T_{stg}	-65 to +150	-65 to +150	°C
Operating Temperature Range	T_j	-55 to +125	-55 to +125	°C
Maximum Soldering Temperature, 10 sec.	T_{solder}	300	300	°C

MECHANICAL and PACKAGING

- See Figure 5 for package outlines and lead bend options.

MSC – Lawrence
6 Lake Street,
Lawrence, MA 01841
1-800-446-1158
(978) 620-2600
Fax: (978) 689-0803

Website:
www.microsemi.com

Table 2 – ELECTRICAL CHARACTERISTICS @ T_A = -55°C to +125°C unless otherwise noted
(Measured at Vo = Vref and a load of 1 A unless otherwise specified)
(Nominal reference voltage is 1.265V @ 25°C)

Parameters / Test Conditions	Symbol	(3A Version)			(5A Version)			Unit
		Min.	Typ	Max.	Min.	Typ	Max.	
Output Voltage Accuracy, Adjustable Units Vin = 3.3V or 5V as appropriate (Note 5)	Vout	1.24	1.265	1.29	1.24	1.265	1.29	V
Output Voltage Accuracy, Fixed Voltage Units (Note 5)	Vout	-3.0		+3.0	-3.0		+3.0	%
Dropout Voltage (Note 3) Iout = 2.0A, ΔVo $\leq$ 2% @ Vo $\geq$ 2.5V	Vdrop			0.40	N/A			V
Dropout Voltage (Note 3) Iout = 4.0A, ΔVo $\leq$ 2% @ Vo $\geq$ 2.5V	Vdrop	N/A					0.65	V
Shutdown Input threshold (Note 2) Vout < 0.5V, Vin = 3.3 or 5V as appropriate	Vshdn	1.0		1.6	1.0		1.6	V
Input Voltage Range: +3.3V Units (Note 5) Iout = 1.5A or 2.5A as appropriate, ΔVo $\leq$ 2%	Vin (+3.3)	3.0		3.6	3.0		3.6	V
Input Voltage Range: +5.0V Units (Note 5) Iout = 1.5A or 2.5A as appropriate, ΔVo $\leq$ 2%	Vin (+5.0)	4.5		5.5	4.5		5.5	V
Ripple Rejection Vin = 3.3V or 5V as appropriate (Note 7) Vr = 500mVpp; 1KHz < f < 10kHz, Iout = 100mA	PSR			-20			-20	dB
Current Limit T_A = 25°C Vout = 2.5V or V_{fixed} as appropriate Vin = 3.3V or 5V as appropriate	I_{latch}	3.3			5.25		9	A

Notes on page 5

Table 3 – POST-RADIATION (Notes 1, 4, 8) T_A = 25°C

Parameters / Test Conditions	Symbol	(3A Version)			(5A Version)			Unit
		Min.	Typ	Max.	Min.	Typ	Max.	
Output Voltage change, Adjustable Units Vin = 3.3V or 5V as appropriate (Note 5, 6, 8)	Vout	-75	±35	+75	-75	±35	+75	mV
Output Voltage Accuracy, Fixed Voltage Units (Note 5, 6)	Vout	-8.0	±6.6	+8.0	-8.0	±6.6	+8.0	%
Dropout Voltage (Note 3) Iout = 2.0A, Vout = +2.5V, ΔVo ≤ 2% @ Vo ≥ 2.5V	Vdrop			0.45	N/A			V
Dropout Voltage (Note 3) Iout = 4.0A, Vout = +2.5V, ΔVo ≤ 2% @ Vo ≥ 2.5V	Vdrop	N/A					0.65	V
Current Limit Vout = 2.5V or V_{fixed} as appropriate Vin = 3.3V or 5V as appropriate	Ilatch	3.3			5.25		9	A
Shutdown Input threshold (Note 2) Vout < 0.5V, Vin = 3.3 or 5V as appropriate	Vshdn	1.0		1.65	1.0		1.65	V

Notes on page 5

Table 4 – MODEL NUMBER FUNCTIONAL CHART

ADJUSTABLE OUTPUT VOLTAGE MODEL #'S	Input Voltage	I_{out} Range	V_{out} Range
MHL8701A3**xyz**	3.3 V	0 – 3 A	1.265 – 2.5 V
MHL8705A3**xyz**	3.3 V	0 – 5 A	1.265 – 2.5 V
MHL8701A5**xyz**	5.0 V	0 – 3 A	1.265 – 3.3 V
MHL8705A5**xyz**	5.0 V	0 – 5 A	1.265 – 3.3 V

Examples of Model Number with Fixed Output Voltage	Input Voltage	I_{out} Range	Output Voltage
MHL8701F325**xyz**	3.3 V	0 – 3 A	2.5 V
MHL8705F320**xyz**	3.3 V	0 – 5 A	2.0 V
MHL8701F530**xyz**	5.0 V	0 – 3 A	3.0 V
MHL8705F533**xyz**	5.0 V	0 – 5 A	3.3 V

Replace "**x**" with letter to denote required screening level
- C = COTS
- M = MILITARY
- S = SPACE

Replace "**y**" with lead lend option
- = No lead bend
- -1 = SMT lead bend
- -2 = lead bend down

Replace "**z**" with lead finish option
- A = Gold plate
- S = Solder dipped

Table 5 – SCREENING OPTIONS

TESTS	SCREENING LEVELS			MIL-STD-883 METHOD
	COTS	MILITARY	SPACE	
	Commercial	MIL-PRF-38534 Equivalent		
100% Non-Destruct Wire-Pull	N/A	N/A	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 (T_A= 25°C)	N/A	100%	100%	-
Burn-In	N/A	100% (160 hours)	100% (320 hours)	1015
Final Electrical	100% (25°C)	100%	100%	
Hermeticity (Fine & Gross Leak)	100%	100%	100%	1014
X-Ray (Note 10)	N/A	N/A	100%	2012
External Visual	Sample	100%	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.
2. Shutdown pin voltage must be > 1.6 V to initiate output inhibit or reset. Pin should be grounded if not used. Pin input voltage can exceed supply voltage.
3. Actual voltage dropout is affected by device operating point. Minimum operating input voltage is 2.9 V. As a result, the dropout specification applies to output voltage of 2.5 V and higher.
4. Radiation testing is per MIL-STD-883, Method 1019.
5. These regulators are optimized for specific Input Voltage ranges. The 3 volt input types will have peak performance at +3.0 V to +3.6 V. The 5 volt input types will have peak performance at +4.5 V to +5.5 V. Input voltages outside of this range can affect short-circuit current, load current capability and create electrical overstress to internal components.
6. Typical post 100 K Rad ELDRS radiation performance in the powered mode is <+/-5%. Typical unpowered performance is +/- 6.5%.
7. Guaranteed by design but not tested.
8. Measured at Vo = Vref and a load of 1 A (unless otherwise specified).
9. SET free is defined as output transients in the range of 100mV when unit is exposed to heavy ions.
10. Performed at a DLA approved facility.

RADIATION CHANGES

Figure 1 – Typical Radiation Characteristics – Vout

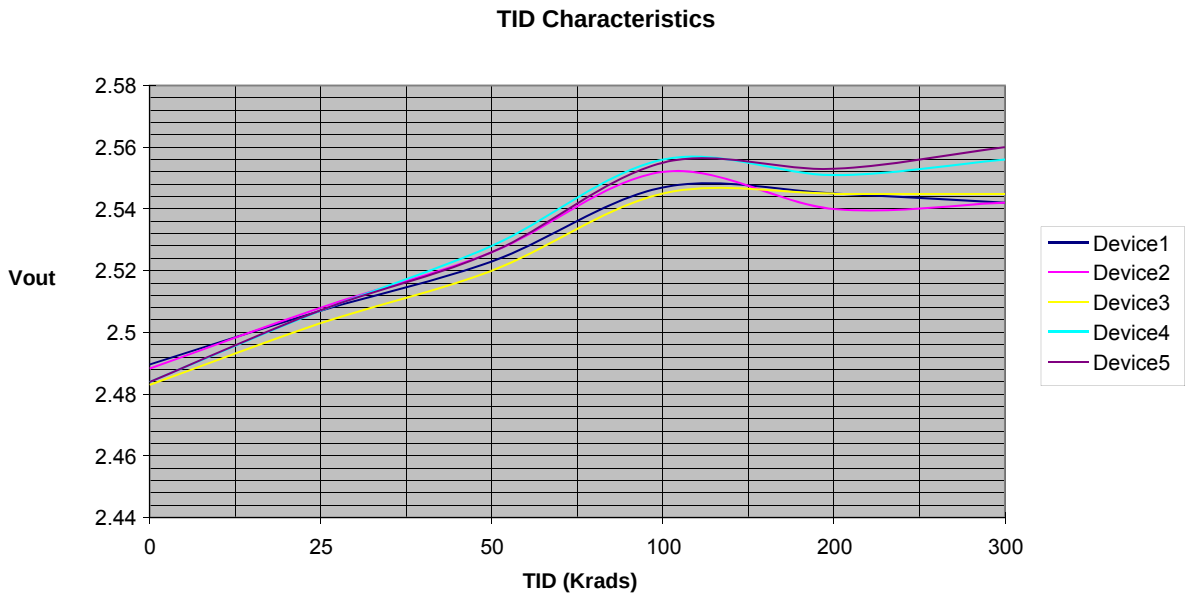
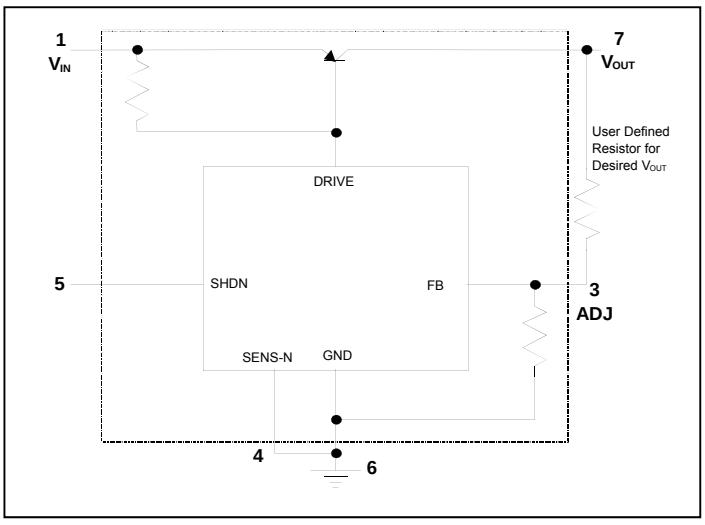
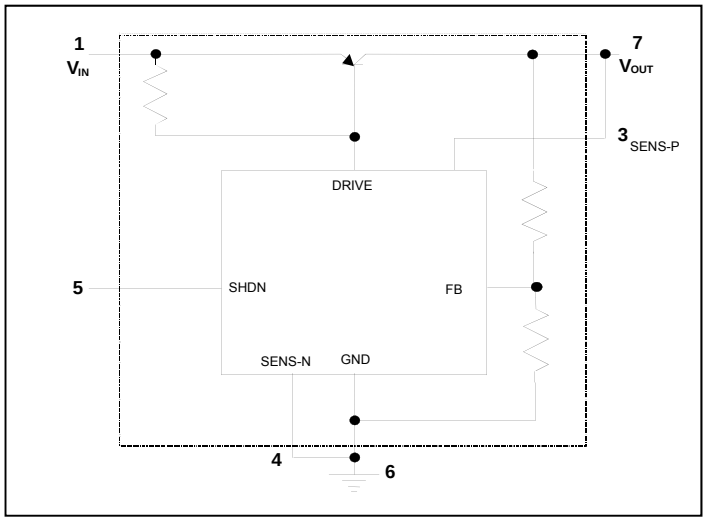


Figure 2 - Block Diagrams

Adjustable Version

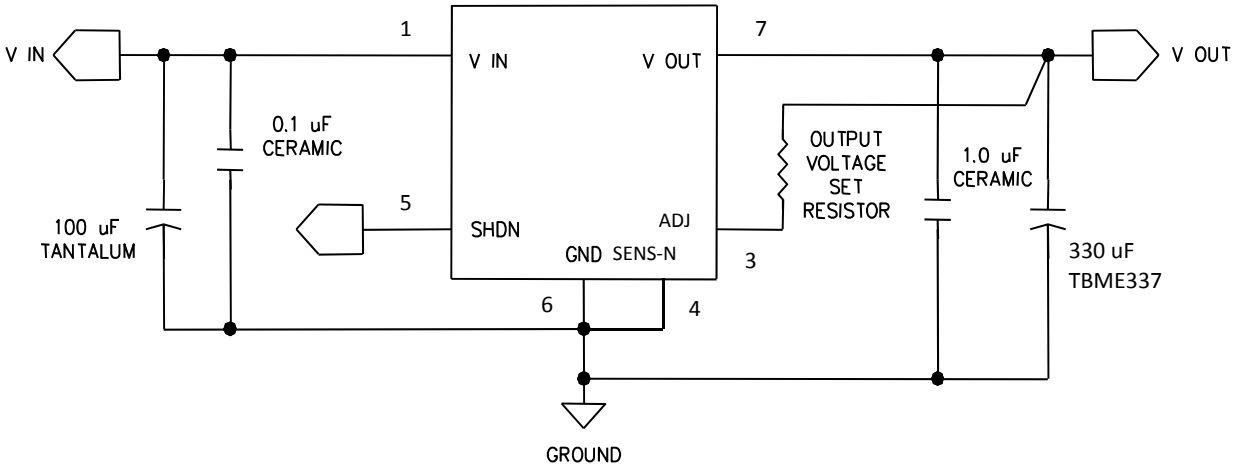


Fixed Output Version



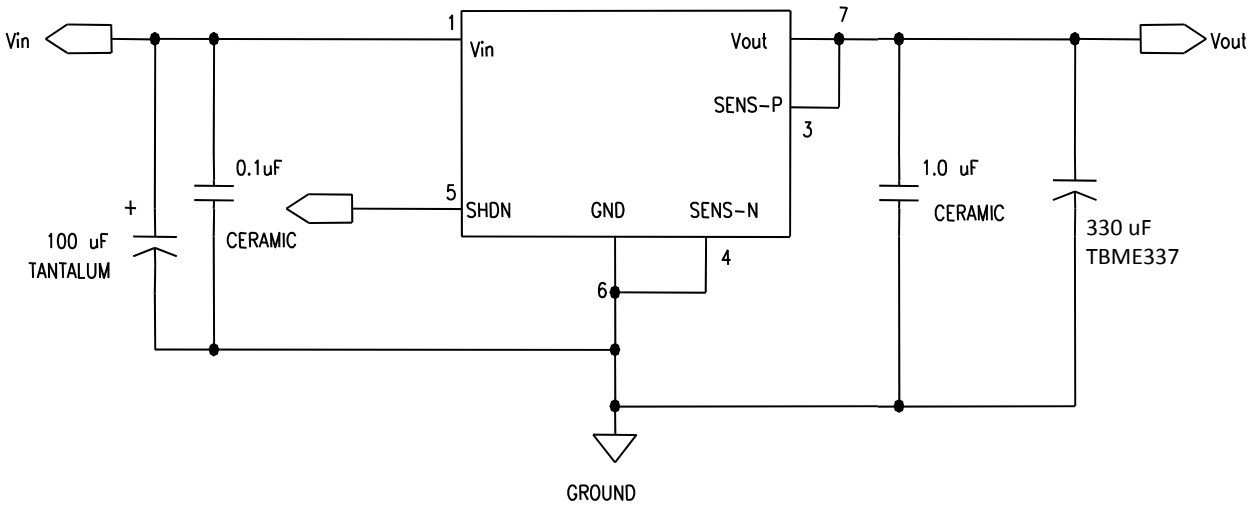
APPLICATIONS

Figure 3 – Application Circuit, Adjustable Output Circuit



$V_{out} = V_{ref} \times (1+R_{adj}/1000)$, with Vref~1.265 Volts

Figure 4 – Application Circuit, Fixed Output Circuit



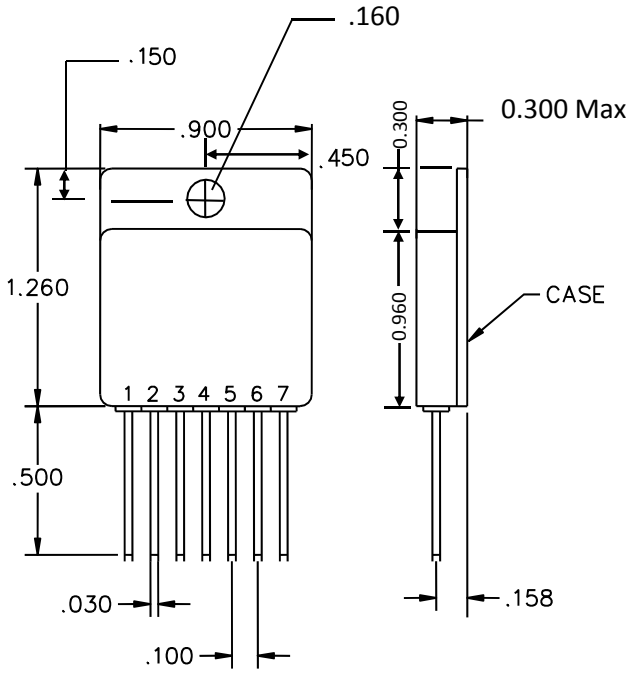
PACKAGING AND PIN CONNECTIONS

Figure 5 – Available Package Outlines

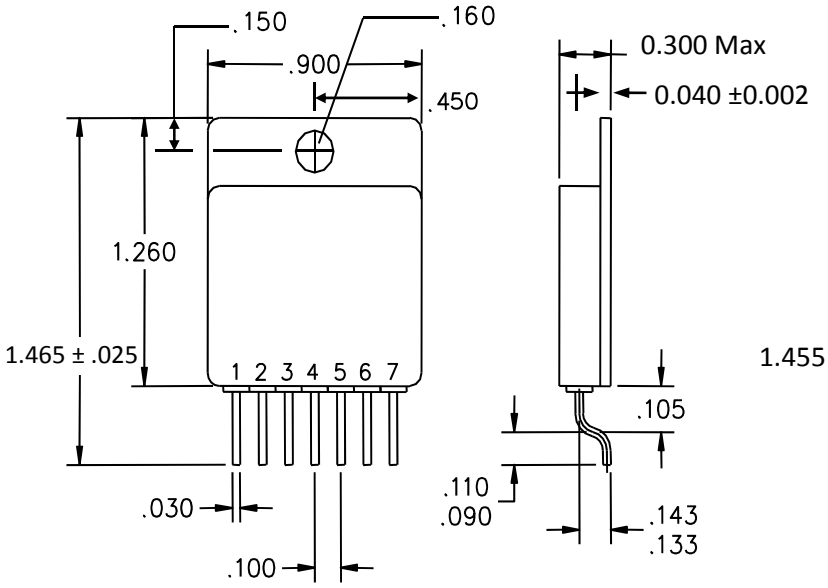
Pin Assignments Table

Pin #	Pin Name	Pin Description
1	Vin	Input Voltage
2	N/C	N/C
3	Sens-P or Adj	Positive Sense or ADJ
4	Sens-N	Negative Sense
5	SHDN	Shutdown
6	Gnd	Ground
7	Vo	Output Voltage

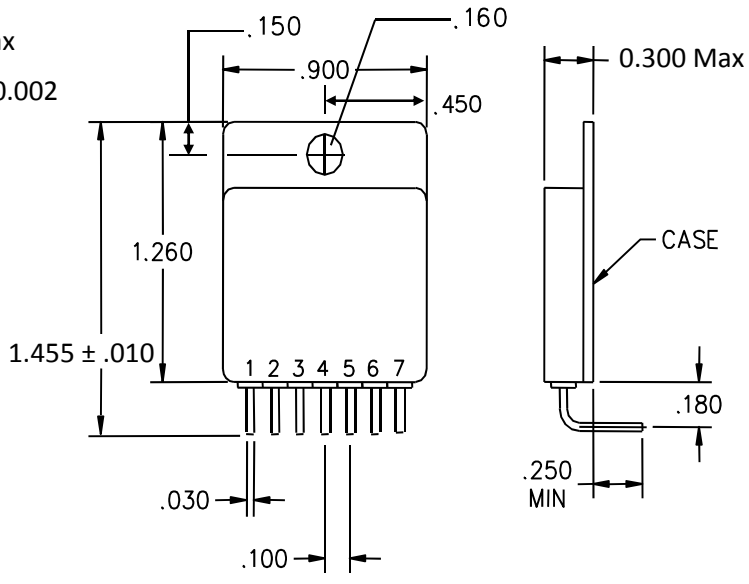
Standard Lead Option (Straight)



Surface Mount Outline – 1



Right Angle Down Outline – 2



All dimensions ±0.005 unless otherwise specified.

Figure 6: SET Reduction Achieved by MHL8701 / MHL8705 (Preliminary)