Enhanced Plastic 5A and 3A Low Dropout Fast Response Regulators

Check for Samples: LMS1585AEP, LMS1587EP

FEATURES

- **Fast transient response**
- **Available in Adjustable, 1.5V, and 3.3V versions**
- **Current limiting and thermal protection**
- **Line regulation 0.005% (typical)**
- **Load regulation 0.05% (typical)**

APPLICATIONS

- **Low voltage logic supplies**
- **Selected Military Applications**
- **Selected Avionics Applications**

DESCRIPTION

The LMS1585AEP and LMS1587EP are low dropout positive regulators with output load current of 5A and 3A respectively. Their low dropout voltage (1.2V) and fast transient response make them an excellent solution for low voltage microprocessor applications.

The LMS1585AEP/87EP are available in adjustable versions, which can set the output voltage with only two external resistors. In addition, they are also available in 1.5V and 3.3V fixed voltage versions [(1)].

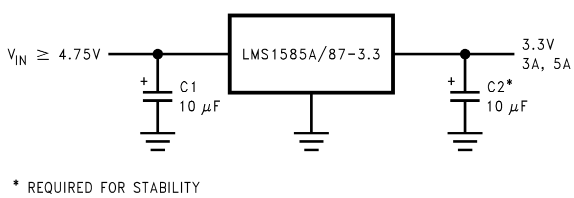
The LMS1585AEP/87EP circuits include a zener trimmed bandgap reference, current limiting and thermal shutdown.

The LMS1585AEP/87EP series are available in TO-220 and TO-263 packages.

ENHANCED PLASTIC

- Extended Temperature Performance of −40°C to 125°C
- Baseline Control - Single Fab & Assembly Site
- Process Change Notification (PCN)
- Qualification & Reliability Data
- Solder (PbSn) Lead Finish is standard
- Enhanced Diminishing Manufacturing Sources (DMS) Support

Typical Application



Connection Diagram

TO-220

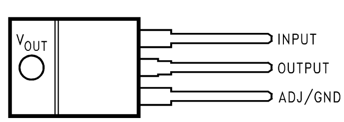


Figure 1. Top View

(1) Consult factory for other fixed voltage options.

TO-263

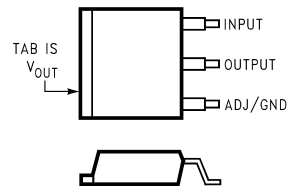
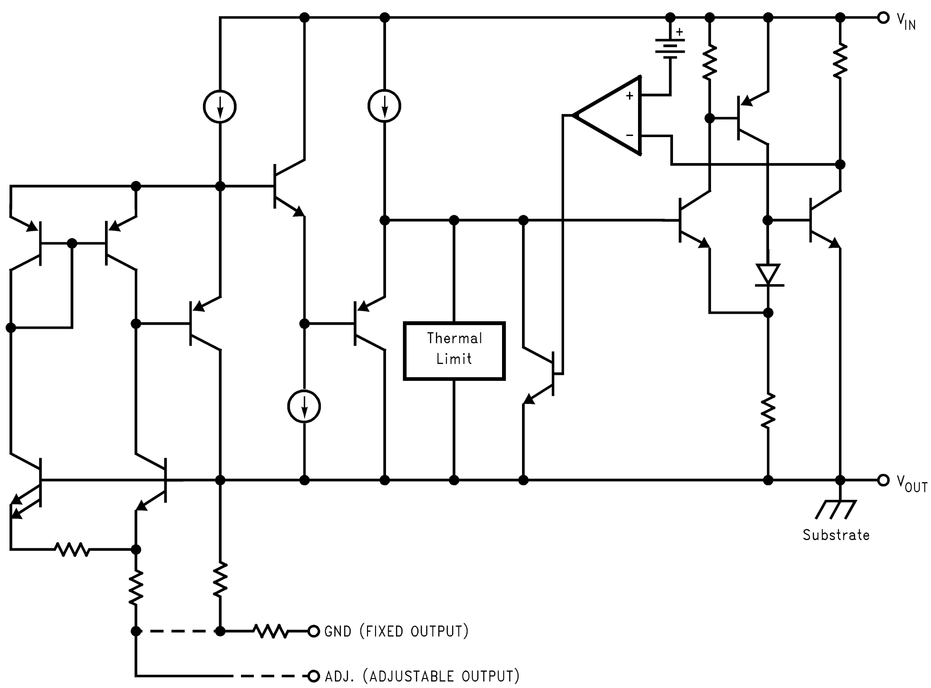


Figure 2. Top View

Simplified Schematic



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings (1)

Maximum Input to Output Voltage (V_{IN} to GND)	13V
Power Dissipation (2)	Internally Limited
Junction Temperature (T_J) (2)	150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature	260°C, 10 sec
ESD Tolerance (3)	2000V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Characteristics.

(2) The maximum power dissipation is a function of $T_{J(max)}$, θ_{JA}, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(max)} – T_A)/\theta_{JA}$. All numbers apply for packages soldered directly into a PC board.

(3) For testing purposes, ESD was applied using human body model, 1.5kΩ in series with 100pF.

Electrical Characteristics

Typicals and limits appearing in normal type apply for T_J = 25°C. Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, 0°C to 125°C for commercial grade and −40°C to 125°C for Enhanced Plastic.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
V_{REF}	Reference Voltage	LMS1585A-ADJEP $V_{IN}-V_{OUT}$ = 3V, I_{OUT} = 10mA 10mA ≤ I_{OUT} ≤ 5A, 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V	1.238 **1.225**	1.25 **1.250**	1.262 **1.275**	V V
		LMS1587-ADJEP 10mA ≤ I_{OUT} ≤ 3A, 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V	**1.225**	1.250	**1.275**	V
V_{OUT}	Output Voltage	LMS1585A-1.5EP I_{OUT} = 0mA, V_{IN} = 5V 0 ≤ I_{OUT} ≤ 5A, 3V ≤ V_{IN} ≤ 7V	1.485 **1.470**	1.500	1.515 **1.530**	V V
		LMS1585A-3.3EP I_{OUT} = 0mA, V_{IN} = 5V 0 ≤ I_{OUT} ≤ 5A, 4.75V ≤ V_{IN} ≤ 7V	3.267 **3.235**	3.300 3.300	3.333 **3.365**	V V
		LMS1587-1.5EP V_{IN} = 5V, I_{OUT} = 0mA, T_J = 25°C 0≤ I_{OUT} ≤ 3A, 3V ≤ V_{IN} ≤ 7V	1.485 **1.470**	1.500 1.500	1.515 **1.530**	V V
		LMS1587-3.3EP 0 ≤ I_{OUT} ≤ 3A, 4.75V ≤ V_{IN} ≤ 7V	**3.235**	3.300	**3.365**	V
ΔV_{OUT}	Line Regulation (3)	LMS1585AEP/87-ADJEP I_{OUT} = 10mA, 2.75V ≤ V_{IN} ≤ 7V		0.005	**0.2**	%
		LMS1585AEP/87-3.3EP I_{OUT} = 0mA, 4.75V ≤ V_{IN} ≤ 7V		0.005	**0.2**	%
		LMS1585AEP/87-1.5EP I_{OUT} = 0mA, 3V ≤ V_{IN} ≤ 7V		0.005	0.2	%
ΔV_{OUT}	Load Regulation (3)	LMS1585A-ADJEP $V_{IN}-V_{OUT}$ = 3V, 10mA ≤ I_{OUT} ≤ 5A		0.05	0.3 **0.5**	%
		LMS1585A-1.5EP/LMS1585A-3.3EP V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 5A		0.05 0.05	0.3 **0.5**	%
		LMS1587-ADJEP $V_{IN}-V_{OUT}$ = 3V, 10mA ≤ I_{OUT} ≤ 3A		0.05 0.05	0.3 **0.5**	%
		LMS1587-1.5EP/LMS1587-3.3EP V_{IN} = 5V, 0 ≤ I_{OUT} ≤ 3A		0.05 0.05	0.3 **0.5**	% %
$V_{IN}-V_{OUT}$	Dropout Voltage	LMS1585A-ADJEP/LMS1587-ADJEP ΔV_{REF} = 1%, I_{OUT} = 3A		1.15	**1.3**	V
		LMS1585A-3.3EP/LMS1587-3.3EP/ LMS1585A-1.5EP/LMS1587-1.5EP ΔV_{OUT} = 1%, I_{OUT} = 3A		1.15	**1.3**	V
		LMS1585A-ADJEP ΔV_{REF} = 1%, I_{OUT} = 5A		1.2	**1.4**	V
		LMS1585A-1.5EP/LMS1585A-3.3EP ΔV_{OUT} = 1%, I_{OUT} = 5A		1.2	**1.4**	V
I_{LIMIT}	Current Limit	LMS1585A-ADJEP/LMS1585A-3.3EP/ LMS1585A-1.5EP $V_{IN}-V_{OUT}$ = 5.5V	**5.0**	6.6		A
		LMS1587-ADJEP/LMS1587-3.3EP/ LMS1587-1.5EP $V_{IN}-V_{OUT}$ = 5.5V	**3.1**	4.3		A
	Minimum Load Current (4)	LMS1585AEP/87-ADJEP 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V		2.0	**10.0**	mA
	Quiescent Current	LMS1585A-3.3EP/LMS1587-3.3EP/ LMS1585A-1.5EP/LMS1587-1.5EP V_{IN} = 5V		7.0	**13.0**	mA

(1) All limits are guaranteed by testing or statistical analysis.
(2) Typical Values represent the most likely parametric norm.
(3) Load and line regulation are measured at constant junction temperature, and are guaranteed up to the maximum power dissipation of 30W. Power dissipation is determined by the input/output differential and the output current. Guaranteed maximum power dissipation will not be available over the full input/output range.
(4) The minimum output current required to maintain regulation.

Electrical Characteristics (continued)

Typicals and limits appearing in normal type apply for T_J = 25°C. Limits appearing in **Boldface** type apply over the entire junction temperature range for operation, 0°C to 125°C for commercial grade and −40°C to 125°C for Enhanced Plastic.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
	Thermal Regulation	T_A = 25°C, 30ms Pulse		0.003		%/W
	Ripple Rejection	LMS1585A-ADJEP f_{RIPPLE} = 120Hz, $V_{IN}-V_{OUT}$ = 3V, I_{OUT} = 5A, C_{OUT} = 25µF Tantalum		72		dB
		LMS1585A-1.5EP f_{RIPPLE} = 120Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 5A, V_{IN} = 4.5V	**60**	72		dB
		LMS1585A-3.3EP f_{RIPPLE} = 120Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 5A, V_{IN} = 6.3V		72		dB
		LMS1587-ADJEP f_{RIPPLE} = 120Hz, $V_{IN}-V_{OUT}$ = 3V, I_{OUT} = 3A C_{OUT} = 25µF Tantalum		72		dB
		LMS1587-1.5EP f_{RIPPLE} = 120Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 3A, V_{IN} = 4.5V	**60**	72		dB
		LMS1587-3.3EP f_{RIPPLE} = 120Hz, C_{OUT} = 25µF Tantalum, I_{OUT} = 3A, V_{IN} = 6.3V		72		dB
	Adjust Pin Current			55	**120**	µA
	Adjust Pin Current	10mA ≤ I_{OUT} ≤ $I_{FULLLOAD}$, 1.5V ≤ $V_{IN}-V_{OUT}$ ≤ 5.75V (5)		0.2		µA
	Temperature Stability			0.5		%
	Long Term Stability	T_A = 125°C, 1000Hrs		0.03		%
	RMS Output Noise (% of V_{OUT})	10Hz ≤ f ≤ 10kHz		0.003		%
	Thermal Resistance Junction-to-Case	3-Lead TO-263: Control/Output Section 3-Lead TO-220: Control/Output Section			0.65/2.7 0.65/2.7	°C/W °C/W

(5) $I_{FULLLOAD}$ is 5A for LMS1585AEP and 3A for LMS1587EP.

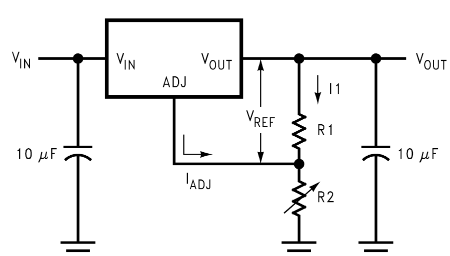
Application Note

Output Voltage

The adjustable version develops at 1.25V reference voltage, (V_{REF}), between the output and the adjust terminal. As shown in Figure 3, this voltage is applied across resistor R1 to generate a constant current I1. This constant current then flows through R2. The resulting voltage drop across R2 adds to the reference voltage to sets the desired output voltage.

The current I_{ADJ} from the adjustment terminal introduces an output error. But since it is small (120µA max), it becomes negligible when R1 is in the 100Ω range.

For fixed voltage devices, R1 and R2 are integrated inside the devices.



$$V_{OUT} = V_{REF}\left(1 + \frac{R2}{R1}\right) + I_{ADJ}\,R2$$

Figure 3. Basic Adjustable Regulator

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