Low Dropout Regulator

AVAILABLE AS MILITARY SPECIFICATIONS

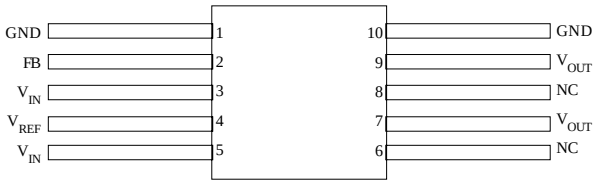
• Military Equipment Screening - MIL-STD-883, 1.2.2

FEATURES

• Low Resistance Pass Transistor: 0.25Ω
• Dropout Voltage: 0.75V at 2.7A
• ±1% Reference Voltage
• Accurate Programmable Current Limit
• Shutdown Capability
• Internal Reference Available
• Standard 10-Lead Packages
• Full Remote Sense
• Low Quiescent Current: ≈ 2.5mA
• Good High Frequency Ripple Rejection

PIN ASSIGNMENT

(Top View)



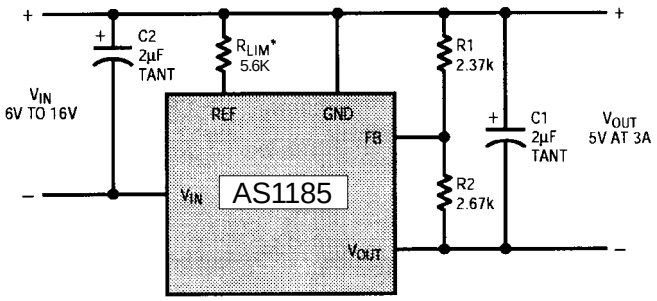
OPTIONS

• Packages
Ceramic Flatpack

MARKINGS

F

5V, 2.7A Regulator with 2.7A current limit



GENERAL DESCRIPTION

The AS1185 is a 2.7A low dropout regulator with adjustable current limit and remote sense capability. It can be used as a positive output regulator with floating input or as a standard negative regulator with grounded input. The output voltage range is 2.5V to 25V, with ±1% accuracy on the internal reference voltage.

The AS1185 uses a saturation-limited NPN transistor as the pass element. This device gives the linear dropout characteristics of a FET pass element with significantly less die area. High efficiency is maintained by using special anti-saturation circuitry that adjusts base drive to track load current. The "on resistance" is typically 0.25Ω.

Accurate current limit is programmed with a single 1/8W external resistor, with a range of zero to three amperes. A second, fixed internal limit circuit prevents destructive currents if the programming current is accidentally overranged.

Assembly considerations for this package requires that the fixed internal current limit circuit be bypassed at all times. An external current limit resistor set to a maximum of 2.7A must be used. Failure to do so on this package can result in damage to the device.

Shutdown of the regulator output is guaranteed when the program current is less than 1µA, allowing external logic control of output voltage.

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ABSOLUTE MAXIMUM RATINGS[1]

Input Voltage 35V
Input-Output Differential 30V
FB Voltage 7V
REF Voltage 7V
Output Voltage 30V
Output Reverse Voltage 2V
Operating Ambient Temperature Range
AS1185M ..... -55°C to 125°C
Operating Junction Temperature Range
Control Section
AS1185/IT ..... –40°C to 125°C
AS1185M/XT and /Mil ..... –55°C to 150°C
Power Transistor Section
AS1185/IT ..... –40°C to 150°C
AS1185M/XT and /MIL ..... –55°C to 175°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C
Theta J/C ..... 8.11°C/W
Max Power Dissipation (Tc = +125°C) 3.0W

NOTES:

1. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. Reference voltage is quaranteed both at nominal conditions (no load, 25°C) and at worst-case conditions of load, line, power, and temperature. An intermediate value can be calculated by adding the effects of these variables in the actual application.
3. Dropout voltage is tested by reducing input voltage until the output drops 1% below its nominal value. Tests are done at 0.5A and 2.7A. The power transistor looks basically like a pure resistance in this range so that minimum differential at any intermediate current can be calculated by interpolation; $V_{DROPOUT}$ = 0.25V + 0.25W • I_{OUT}. For load current less than 0.5A, see graph.
4. “Minimum input voltage” is limited by base emitter voltage drive of the power transistor section, not saturation as measured in Note 3. For output voltages below 4V, “minimum input voltage” specification may limit dropout voltage before transistor saturation limitation.
5. Supply current is measured on the ground pin, and does not include load current, R_{LIM}, or output divider current.
6. The 25W power level is guaranteed for an input-output voltage of 8.3V to 17V. At lower voltages the 2.7A limit applies, and at higher voltages the internal power limiting may restrict regulator power below 25W. See graphs.
7. Line and load regulation are measured on a pulse basis with a pulse width of »2ms, to minimize heating. DC regulation will be affected by thermal regulation and temperature coefficient of the reference.
8. Guaranteed by design and correlation to other tests, but not tested.
9. T_{JMIN} = – 40°C for AS1185I and –55°C for the AS1185M. Power transistor area and control circuit area have different maximum junction temperatures. Control area limits are T_{JMAX} = 125°C for the LT1185C and LT1185I and 150°C for the LT1185M. Power area limits are 150°C for AS1185I and 175°C for AS1185M.
10. V_{SAT} is the maximum specified dropout voltage; 0.25V + 0.25 • I_{OUT}.
11. Current limit is programmed with a resistor from REF pin to GND pin. The value is 15k/I_{LIM}.
12. For V_{IN} – V_{OUT} = 1.5V; V_{IN} = 5V, V_{OUT} = 3.5V. V_{OUT} = 1V for all other current limit tests.

ELECTRICAL CHARACTERISTICS: The • denotes specifications which apply over the operating temperature range, otherwise specifications are at T_A = 25°C. Adjustable version, V_{IN} = 7.4V, V_{OUT} = 5V, I_{OUT} = 1mA, R_{LIM} = 5.6k, unless otherwise noted.

PARAMETER	CONDITION		MIN	TYP	MAX	UNITS
Reference Voltage (@ FB Pin)				2.37		V
Rference Voltage Tolerance (@ FB Pin)[2]	V_{IN} - V_{OUT} = 5V, V_{OUT} = V_{REF}			0.3	±1	%
	1mA ≤ I_{OUT} ≤ 2.7A V_{IN} - V_{OUT} = 1.2V to V_{IN} = 30V P ≤ 25W[6], V_{OUT} = 5V T_{MIN} ≤ T_J ≤ T_{MAX}[9]	•		1	±2.5	%
Feedback Pin Bias Current	V_{OUT} = V_{REF}	•		0.7	2.0	µA
Dropout Voltage[3]	I_{OUT} = 0.5A, V_{OUT} = 5V			0.20	0.37	V
	I_{OUT} = 2.7A, V_{OUT} = 5V			0.67	1.00	V
Load Regulation[7]	I_{OUT} = 5mA to 2.7A V_{IN} - V_{OUT} = 1.5V to 10V, V_{OUT} = 5V			0.05	0.3	%
Line Regulation[7]	V_{IN} - V_{OUT} = 1V to 20V, V_{OUT} = 5V			0.002	0.01	%/V
Minimum Input Voltage	I_{OUT} = 1A[4], V_{OUT} = V_{REF}			4.0		V
	I_{OUT} = 2.7A			4.3		V
Internal Current Limit (See Graph for Guaranteed Curve)[8, 12]	1.5V ≤ V_{IN} - V_{OUT} ≤ 10V		3.3	3.6	4.2	A
		•	3.1		4.4	A
	V_{IN} - V_{OUT} = 15V	•	2.0	3	4.2	A
	V_{IN} - V_{OUT} = 20V	•	1.0	1.7	2.6	A
	V_{IN} - V_{OUT} = 30V	•	0.2	0.4	1.0	A
External Current Limit Programming Constant	5k ≤ R_{LIM} ≤ 15k, V_{OUT} = 1V[11]	•		15k		A•W
External Current Limit Error	1A ≤ I_{LIM} ≤ 2.7A			0.02 I_{LIM}	0.06 I_{LIM} + 0.03	A
	R_{LIM} = 15k • A/I_{LIM}	•		0.04 I_{LIM}	0.09 I_{LIM} + 0.05	A
Quiescent Supply Current	I_{OUT} = 5mA, V_{OUT} = V_{REF} 4V ≤ V_{IN} ≤ 25V[5]	•		2.5	3.5	mA
Supply Current Change with Load	V_{IN} - V_{OUT} = V_{SAT}[10]	•		25	40	mA/A
	V_{IN} - V_{OUT} > 2V	•		10	25	mA/A
REF Pin Shutoff Current		•	0.4	2	7	µA
Thermal Regulation (See Applications Information)	V_{IN} - V_{OUT} = 10V, I_{OUT} = 5mA to 2A[8]			0.005	0.014	%/W
Reference Voltage Temperature Coefficient[8]				0.003	0.01	%/°C

SETTING OUTPUT VOLTAGE

The AS1185 output voltage is set by two external resistors (see Figure 2). Internal reference voltage is trimmed to 2.37V so that a standard 1% 2.37k resistor (R1) can be used to set divider current at 1mA. R2 is then selected from:

$$R2 = \frac{(V_{OUT} - 2.37)\ R1}{V_{REF}}$$

for R1 = 2.37k and V_{REF} = 2.37V, this reduces to:

$$R2 = V_{OUT} - 2.37k$$

suggested values of 1% resistors are shown.

V_{OUT}	R2 WHEN R1 = 2.37k
5V	2.67k
5.2V	2.87k
6V	3.65k
12V	9.76k
15V	12.7k

External Current Limit

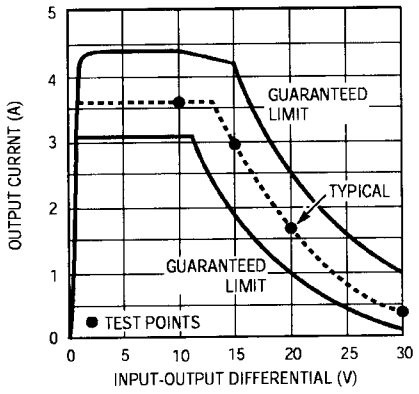
The AS1185 requires a resistor to set current limit. The value of this resistor is 15k divided by the desired current limit (in amps). The resistor for 2A current limit would be 15k/2A = 7.5k. Tolerance over temperature is ±10%, so current limit is normally set 15% above maximum load current. Foldback limiting can be employed if short-circuit current must be lower than full load current (see Typical Applications).

The AS1185 has internal current limiting which will override external current limit if power in the pass transistor is excessive. The internal limit is ≈ 3.6A with a foldback characteristic which is dependent on input-output voltage, not output voltage *per se* (see Typical Performace Characteristics).

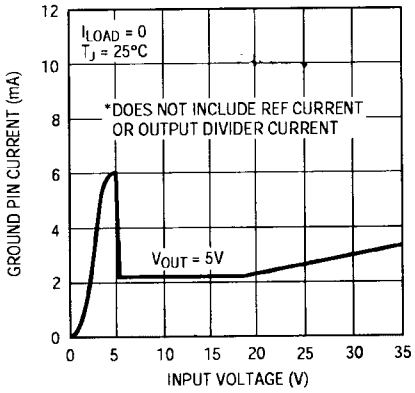
Assembly considerations for this package requires that the fixed internal current limit circuit be bypassed at all times. An external current limit resistor set to a maximum of 2.7A must be used. Failure to do so on this package can result in damage to the device.

TYPICAL PERFORMANCE CHARACTERISTICS

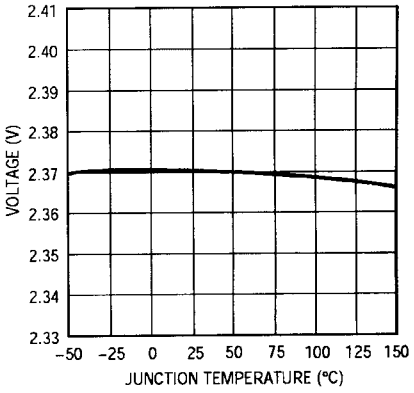
Internal Current Limit



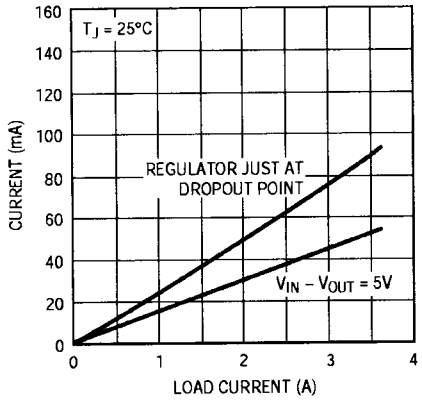
Quiescent Ground Pin Current*



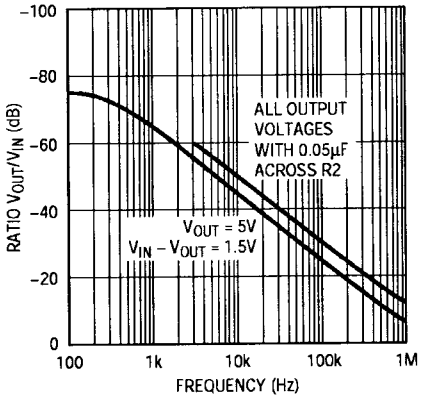
Feedback Pin Voltage Temperature Drift



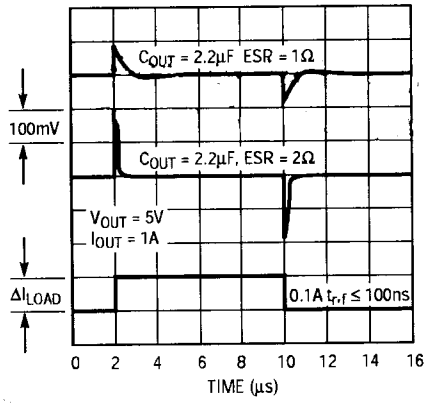
Ground Pin Current



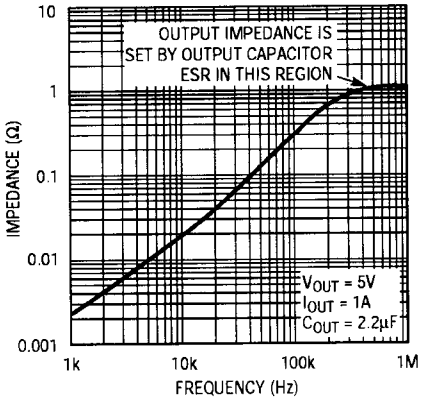
Ripple Rejection vs Frequency



Load Transient Response

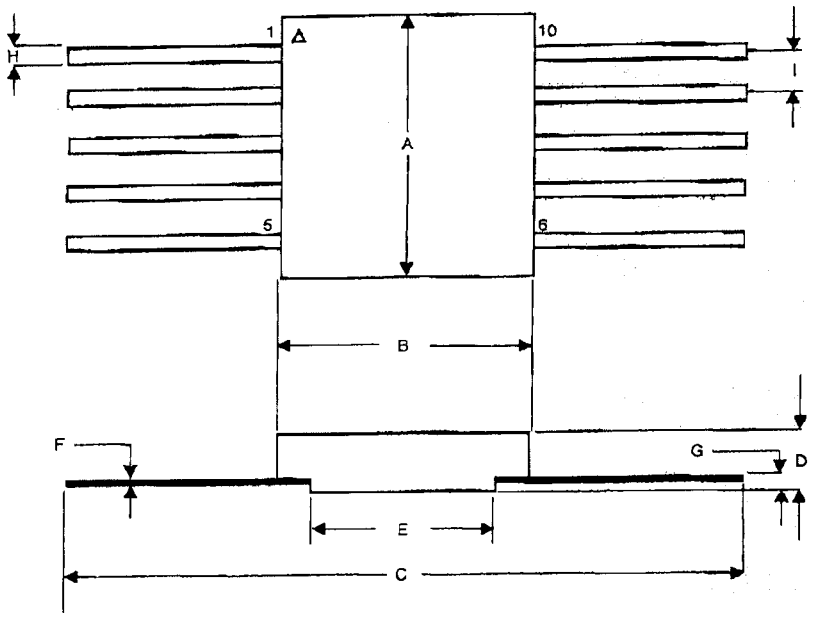


Output Impedance



MECHANICAL DEFINITIONS*

Package Designator F



SYMBOL	ASI SPECIFICATIONS	
	MIN	MAX
A	0.250	0.260
B	0.250	0.260
C	0.900	---
D	0.100	0.110
E	0.155	0.165
F	0.004	0.006
G	0.032	0.043
H	0.015	0.019
I	0.047	0.053

All measurements are in inches.

ORDERING INFORMATION

EXAMPLE: AS1185F/MIL

Device Number	Package Type	Process
AS1185	F	/*

***AVAILABLE PROCESSES**

IT = Industrial Temperature Range	-40°C to +85°C
XT = Extended Temperature Range	-55°C to +125°C
MIL = /883 equivalent processing compliant to paragraph 1.2.2	-55°C to +125°C
SPACE = ASI's DSCC approved V-level/Class S (Space) Manufacturing Flow	-55°C to +125°C