National Semiconductor

LP2986
Micropower, 200 mA Ultra Low-Dropout Fixed or Adjustable Voltage Regulator

General Description

The LP2986 is a 200 mA precision LDO voltage regulator which offers the designer a higher performance version of the industry standard LP2951.

Using an optimized VIP™ (Vertically Integrated PNP) process, the LP2986 delivers superior performance:

Dropout Voltage: Typically 180 mV @ 200 mA load, and 1 mV @ 1 mA load.

Ground Pin Current: Typically 1 mA @ 200 mA load, and 200 µA @ 10 mA load.

Sleep Mode: The LP2986 draws less than 1 µA quiescent current when shutdown pin is pulled low.

Error Flag: The built-in error flag goes low when the output drops approximately 5% below nominal.

Precision Output: The standard product versions available can be pin-strapped (using the internal resistive divider) to provide output voltages of 5.0V, 3.3V, or 3.0V with guaranteed accuracy of 0.5% ("A" grade) and 1% (standard grade) at room temperature.

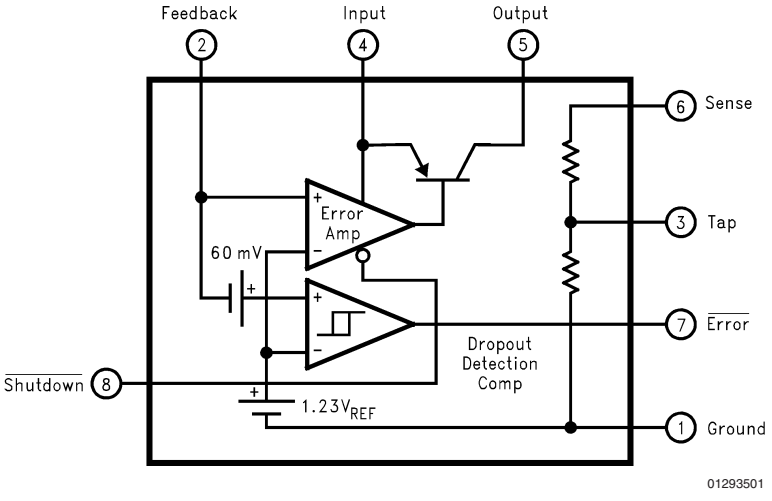
Features

- Ultra low dropout voltage
- Guaranteed 200 mA output current
- SO-8 and mini-SO8 surface mount packages
- <1 µA quiescent current when shutdown
- Low ground pin current at all loads
- 0.5% output voltage accuracy ("A" grade)
- High peak current capability (400 mA typical)
- Wide supply voltage range (16V max)
- Overtemperature/overcurrent protection
- −40˚C to +125˚C junction temperature range

Applications

- Cellular Phone
- Palmtop/Laptop Computer
- Camcorder, Personal Stereo, Camera

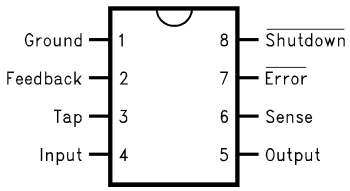
Block Diagram



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Connection Diagrams and Ordering Information

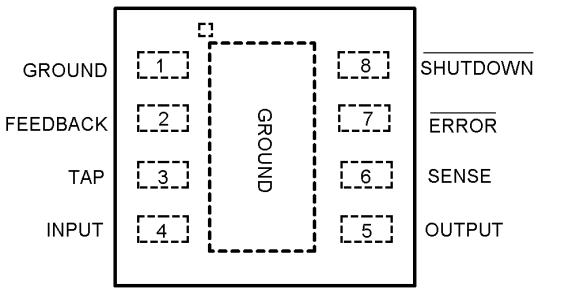
Surface Mount Packages:



01293502

SO-8/Mini SO-8 Package
See NS Package Drawing Number M08A/MUA08A

8-Lead LLP Surface Mount Package

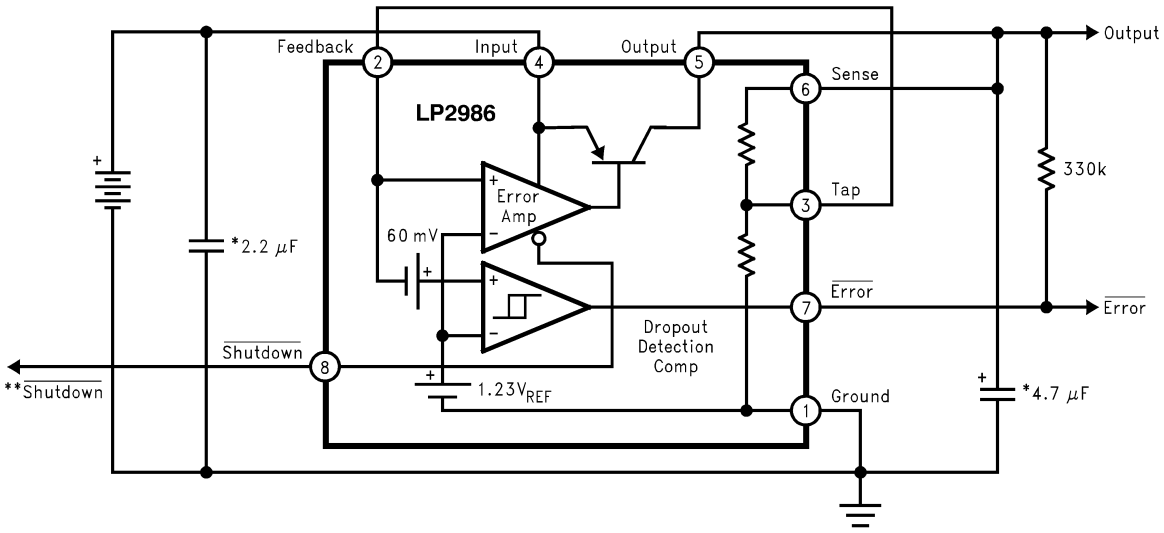


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Top View
See NS Package Drawing Number LDC08A

Basic Application Circuits

Application Using Internal Resistive Divider



* Minimum capacitance shown to assure stability, but may be increased without limit. Larger output capacitor provides improved dynamic response.

** Shutdown input must be actively terminated. Tie to V_{IN} if not used.

01293503

Ordering Information (Continued)

TABLE 1. Package Marking and Ordering Information (Continued)

Output Voltage	Grade	Order Information	Package Marking	Supplied as:
SO-8				
5	A	LP2986AIMX-5.0	2986AIM5.0	2500 Units on Tape and Reel
5	A	LP2986AIM-5.0	2986AIM5.0	Shipped in Anti-Static Rails
5	STD	LP2986IMX-5.0	2986IM5.0	2500 Units on Tape and Reel
5	STD	LP2986IM-5.0	2986IM5.0	Shipped in Anti-Static Rails
3.3	A	LP2986AIMX-3.3	2986AIM3.3	2500 Units on Tape and Reel
3.3	A	LP2986AIM-3.3	2986AIM3.3	Shipped in Anti-Static Rails
3.3	STD	LP2986IMX-3.3	2986IM3.3	2500 Units on Tape and Reel
3.3	STD	LP2986IM-3.3	2986IM3.3	Shipped in Anti-Static Rails
3.0	A	LP2986AIMX-3.0	2986AIM3.0	2500 Units on Tape and Reel
3.0	A	LP2986AIM-3.0	2986AIM3.0	Shipped in Anti-Static Rails
3.0	STD	LP2986IMX-3.0	2986IM3.0	2500 Units on Tape and Reel
3.0	STD	LP2986IM-3.0	2986IM3.0	Shipped in Anti-Static Rails
8-Lead LLP				
5	A	LP2986AILD-5	L006A	1000 Units on Tape and Reel
5	A	LP2986AILDX-5	L006A	4500 Units on Tape and Reel
5	STD	LP2986ILD-5	L006AB	1000 Units on Tape and Reel
5	STD	LP2986ILDX-5	L006AB	4500 Units on Tape and Reel
3.3	A	LP2986AILD-3.3	L005A	1000 Units on Tape and Reel
3.3	A	LP2986AILDX-3.3	L005A	4500 Units on Tape and Reel
3.3	STD	LP2986ILD-3.3	L005AB	1000 Units on Tape and Reel
3.3	STD	LP2986ILDX-3.3	L005AB	4500 Units on Tape and Reel
3.0	A	LP2986AILD-3.0	L004A	1000 Units on Tape and Reel
3.0	A	LP2986AILDX-3.0	L004A	4500 Units on Tape and Reel
3.0	STD	LP2986ILD-3.0	L004AB	1000 Units on Tape and Reel
3.0	STD	LP2986ILDX-3.0	L004AB	4500 Units on Tape and Reel

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Storage Temperature Range	−65˚C to +150˚C
Operating Junction Temperature Range	−40˚C to +125˚C
Lead Temperature (Soldering, 5 seconds)	260˚C
ESD Rating (Note 2)	2 kV
Power Dissipation (Note 3)	Internally Limited
Input Supply Voltage (Survival)	−0.3V to +16V
Input Supply Voltage (Operating)	2.1V to +16V
Shutdown Pin	−0.3V to +16V
Feedback Pin	−0.3V to +5V
Output Voltage (Survival) (Note 4)	−0.3V to +16V
I_{OUT} (Survival)	Short Circuit Protected
Input-Output Voltage (Survival) (Note 5)	−0.3V to +16V

Electrical Characteristics

Limits in standard typeface are for T_J = 25˚C, and limits in **boldface type** apply over the full operating temperature range. Unless otherwise specified: $V_{IN} = V_O(NOM) + 1V$, I_L = 1 mA, C_{OUT} = 4.7 µF, C_{IN} = 2.2 µF, $V_{S/D}$ = 2V.

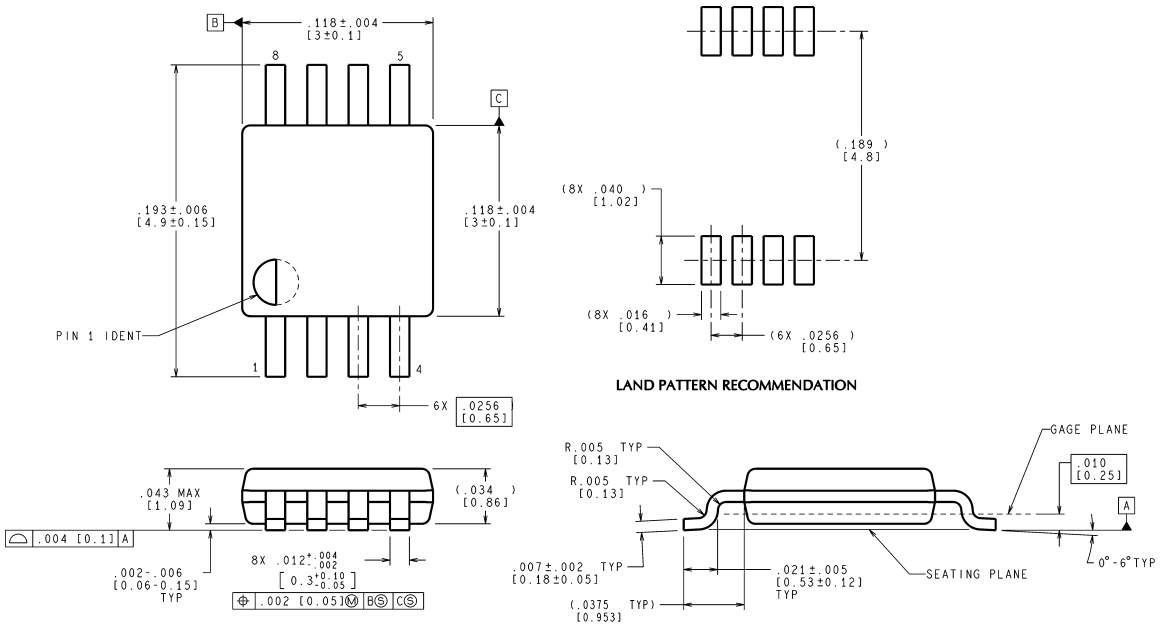
Symbol	Parameter	Conditions	Typical	LM2986AI-X.X (Note 6)		LM2986I-X.X (Note 6)		Units
				Min	Max	Min	Max	
V_O	Output Voltage (5.0V Versions)		5.0	4.975	5.025	4.950	5.050	V
		0.1 mA < I_L < 200 mA	5.0	4.960	5.040	4.920	5.080	
				4.910	**5.090**	**4.860**	**5.140**	
	Output Voltage (3.3V Versions)		3.3	3.283	3.317	3.267	3.333	
		0.1 mA < I_L < 200 mA	3.3	3.274	3.326	3.247	3.353	
				3.241	**3.359**	**3.208**	**3.392**	
	Output Voltage (3.0V Versions)		3.0	2.985	3.015	2.970	3.030	
		0.1 mA < I_L < 200 mA	3.0	2.976	3.024	2.952	3.048	
				2.946	**3.054**	**2.916**	**3.084**	
$\frac{V_O}{\Delta V_{IN}}$	Output Voltage Line Regulation	$V_O(NOM) + 1V \le V_{IN} \le 16V$	0.007		0.014		0.014	%/V
					0.032		**0.032**	
$V_{IN}-V_O$	Dropout Voltage (Note 7)	I_L = 100 µA	1		2.0		2.0	mV
					3.5		**3.5**	
		I_L = 75 mA	90		120		120	
					170		**170**	
		I_L = 200 mA	180		230		230	
					350		**350**	
I_{GND}	Ground Pin Current	I_L = 100 µA	100		120		120	µA
					150		**150**	
		I_L = 75 mA	500		800		800	
					1400		**1400**	
		I_L = 200 mA	1		2.1		2.1	mA
					3.7		**3.7**	
		$V_{S/D}$ < 0.3V	0.05		**1.5**		**1.5**	µA
$I_O(PK)$	Peak Output Current	$V_{OUT} \ge V_O(NOM) - 5\%$	400	250		250		mA
$I_O(MAX)$	Short Circuit Current	R_L = 0 (Steady State) (Note 11)	400					
e_n	Output Noise Voltage (RMS)	BW = 300 Hz to 50 kHz, C_{OUT} = 10 µF	160					µV(RMS)
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Ripple Rejection	f = 1 kHz, C_{OUT} = 10 µF	65					dB
$\frac{\Delta V_{OUT}}{\Delta T}$	Output Voltage Temperature Coefficient	(Note 9)	20					ppm/˚C

Electrical Characteristics (Continued)

Limits in standard typeface are for T_J = 25˚C, and limits in **boldface type** apply over the full operating temperature range. Unless otherwise specified: $V_{IN} = V_O(NOM) + 1V$, I_L = 1 mA, C_{OUT} = 4.7 µF, C_{IN} = 2.2 µF, $V_{S/D}$ = 2V.

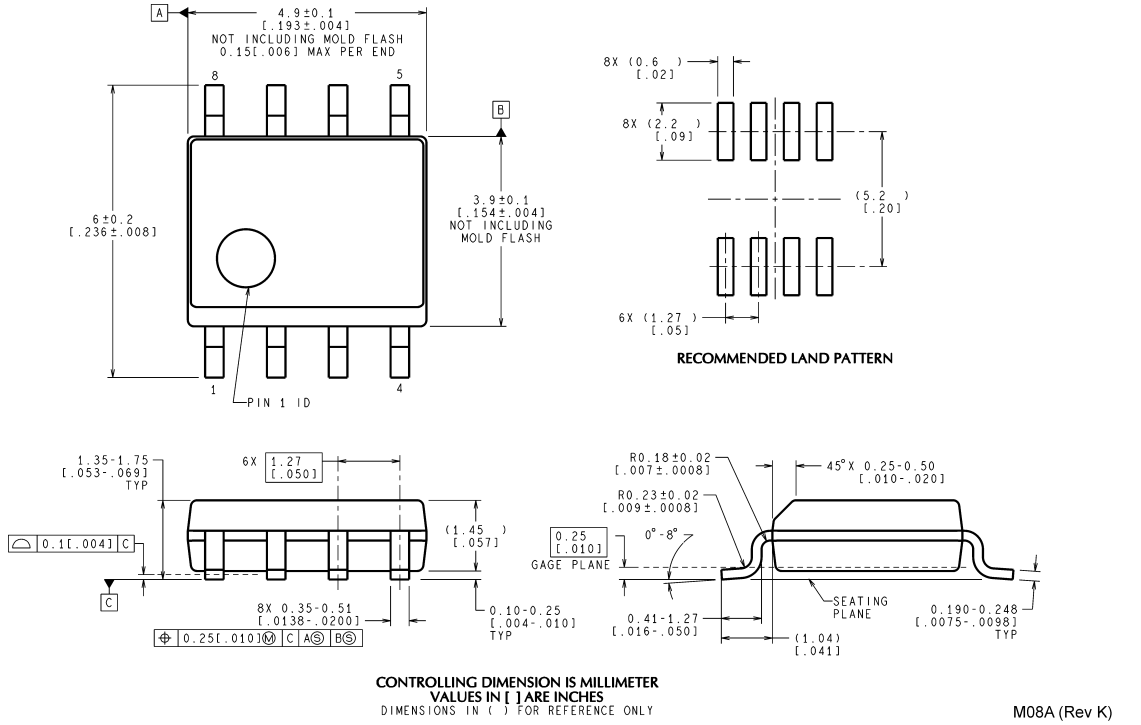
Symbol	Parameter	Conditions	Typical	LM2986AI-X.X (Note 6)		LM2986I-X.X (Note 6)		Units
				Min	Max	Min	Max	
FEEDBACK PIN								
V_{FB}	Feedback Pin Voltage		1.23	1.21	1.25	1.20	1.26	V
				1.20	**1.26**	**1.19**	**1.27**	
		(Note 10)	1.23	**1.19**	**1.28**	**1.18**	**1.29**	
$\frac{\Delta V_{FB}}{\Delta T}$	FB Pin Voltage Temperature Coefficient	(Note 9)	20					ppm/˚C
I_{FB}	Feedback Pin Bias Current	I_L = 200 mA	150		330		330	nA
					760		**760**	
$\frac{I_{FB}}{\Delta T}$	FB Pin Bias Current Temperature Coefficient	(Note 9)	0.1					nA/˚C
SHUTDOWN INPUT								
$V_{S/D}$	S/D Input Voltage (Note 8)	V_H = O/P ON	1.4	**1.6**		**1.6**		V
		V_L = O/P OFF	0.55		**0.18**		**0.18**	
$I_{S/D}$	S/D Input Current	$V_{S/D}$ = 0	0		**–1**		**–1**	µA
		$V_{S/D}$ = 5V	5		**15**		**15**	
ERROR COMPARATOR								
I_{OH}	Output “HIGH” Leakage	V_{OH} = 16V	0.01		1		1	µA
					2		**2**	
V_{OL}	Output “LOW” Voltage	$V_{IN} = V_O(NOM) - 0.5V$, $I_O(COMP)$ = 300 µA	150		220		220	mV
					350		**350**	
V_{THR} (MAX)	Upper Threshold Voltage		–4.6	–5.5	–3.5	–5.5	–3.5	%V_{OUT}
				–7.7	**–2.5**	**–7.7**	**–2.5**	
V_{THR} (MIN)	Lower Threshold Voltage		–6.6	–8.9	–4.9	–8.9	–4.9	
				–13.0	**–3.3**	**–13.0**	**–3.3**	
HYST	Hysteresis		2.0					

Physical Dimensions inches (millimeters)
unless otherwise noted



MUA08A (Rev E)

8-Lead Mini-Small Outline Molded Package, JEDEC
NS Package Number MUA08A



M08A (Rev K)

8-Lead (0.150" Wide) Molded Small Outline Package, JEDEC
NS Package Number M08A