National Semiconductor

LP3882
1.5A Fast-Response Ultra Low Dropout Linear Regulators

General Description

The LP3882 is a high current, fast response regulator which can maintain output voltage regulation with minimum input to output voltage drop. Fabricated on a CMOS process, the device operates from two input voltages: Vbias provides voltage to drive the gate of the N-MOS power transistor, while Vin is the input voltage which supplies power to the load. The use of an external bias rail allows the part to operate from ultra low Vin voltages. Unlike bipolar regulators, the CMOS architecture consumes extremely low quiescent current at any output load current. The use of an N-MOS power transistor results in wide bandwidth, yet minimum external capacitance is required to maintain loop stability.

The fast transient response of these devices makes them suitable for use in powering DSP, Microcontroller Core voltages and Switch Mode Power Supply post regulators. The parts are available in TO-220, TO-263 and PSOP-8 packages.

Dropout Voltage: 110 mV (typ) @ 1.5A load current.

Ground Pin Current: 3 mA (typ) at full load.

Shutdown Current: 60 nA (typ) when S/D pin is low.

Precision Output Voltage: 1.5% room temperature accuracy.

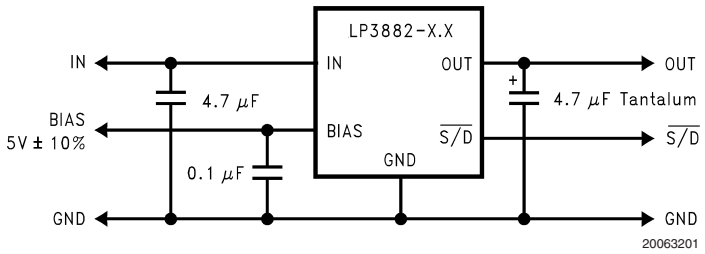
Features

- Ultra low dropout voltage (110 mV @ 1.5A typ)
- Low ground pin current
- Load regulation of 0.04%/A
- 60 nA typical quiescent current in shutdown
- 1.5% output accuracy (25˚C)
- TO-220, TO-263 and PSOP-8 packages
- Over temperature/over current protection
- –40˚C to +125˚C junction temperature range

Applications

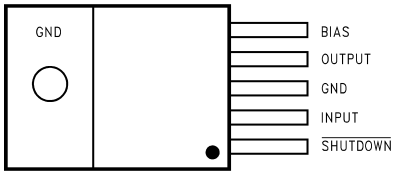
- DSP Power Supplies
- Server Core and I/O Supplies
- PC Add-in-Cards
- Local Regulators in Set-Top Boxes
- Microcontroller Power Supplies
- High Efficiency Power Supplies
- SMPS Post-Regulators

Typical Application Circuit

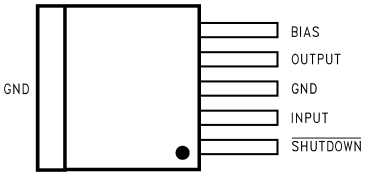


At least 4.7 µF of input and output capacitance is required for stability.

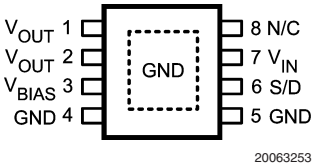
Connection Diagrams



TO-220, Top View



TO-263, Top View

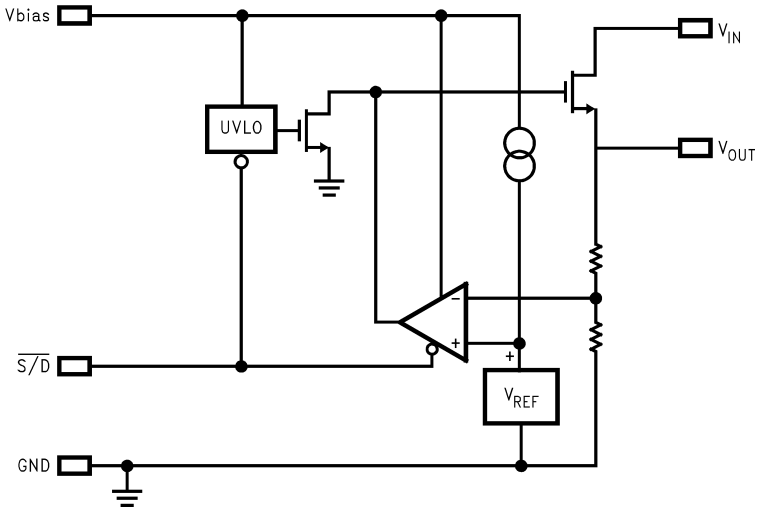


PSOP-8, Top View

Ordering Information

Order Number	Package Type	Package Drawing	Supplied As
LP3882ES-1.2	TO263-5	TS5B	Rail
LP3882ESX-1.2	TO263-5	TS5B	Tape and Reel
LP3882ET-1.2	TO220-5	T05D	Rail
LP3882ES-1.5	TO263-5	TS5B	Rail
LP3882ESX-1.5	TO263-5	TS5B	Tape and Reel
LP3882ET-1.5	TO220-5	T05D	Rail
LP3882ES-1.8	TO263-5	TS5B	Rail
LP3882ESX-1.8	TO263-5	TS5B	Tape and Reel
LP3882ET-1.8	TO220-5	T05D	Rail
LP3882EMR-1.2	PSOP-8	MRA08B	Rail
LP3882EMRX-1.2	PSOP-8	MRA08B	2500 Units on Tape and Reel
LP3882EMR-1.5	PSOP-8	MRA08B	Rail
LP3882EMRX-1.5	PSOP-8	MRA08B	2500 Units on Tape and Reel
LP3882EMR-1.8	PSOP-8	MRA08B	Rail
LP3882EMRX-1.8	PSOP-8	MRA08B	2500 Units on Tape and Reel

Block Diagram



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
Lead Temp. (Soldering, 5 seconds)	260˚C
ESD Rating	
Human Body Model (Note 3)	2 kV
Machine Model (Note 10)	200V
Power Dissipation (Note 2)	Internally Limited
V_{IN} Supply Voltage (Survival)	−0.3V to +6V
V_{BIAS} Supply Voltage (Survival)	−0.3V to +7V
Shutdown Input Voltage (Survival)	−0.3V to +7V
I_{OUT} (Survival)	Internally Limited
Output Voltage (Survival)	−0.3V to +6V
Junction Temperature	−40˚C to +150˚C

Operating Ratings

V_{IN} Supply Voltage	$(V_{OUT} + V_{DO})$ to 5.5V
Shutdown Input Voltage	0 to +6V
I_{OUT}	1.5A
Operating Junction Temperature Range	−40˚C to +125˚C
V_{BIAS} Supply Voltage	4.5V to 6V

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: $V_{IN} = V_O(NOM) + 1V$, V_{BIAS} = 4.5V, I_L = 10 mA, $C_{IN} = C_{OUT}$ = 4.7 µF, $V_{S/D} = V_{BIAS}$.

Symbol	Parameter	Conditions	MIN (Note 5)	Typical (Note 4)	MAX (Note 5)	Units
V_O	Output Voltage Tolerance	10 mA < I_L < 1.5A $V_O(NOM) + 1V \le V_{IN} \le 5.5V$ $4.5V \le V_{BIAS} \le 6V$	1.198 **1.186**	1.216	1.234 **1.246**	V
			1.478 **1.455**	1.5	1.522 **1.545**	
			1.773 **1.746**	1.8	1.827 **1.854**	
$\Delta V_O/\Delta V_{IN}$	Output Voltage Line Regulation (Note 7)	$V_O(NOM) + 1V \le V_{IN} \le 5.5V$		0.01		%/V
$\Delta V_O/\Delta I_L$	Output Voltage Load Regulation (Note 8)	10 mA < I_L < 1.5A		0.04 **0.06**		%/A
V_{DO}	Dropout Voltage (Note 9)	I_L = 1.5A (TO220 and TO263 only)		110	170 **270**	mV
		I_L = 1.5A (PSOP only)		125	190 **320**	
$I_Q(V_{IN})$	Quiescent Current Drawn from V_{IN} Supply	10 mA < I_L < 1.5A		3	7 **8**	mA
		$V_{\overline{S/D}} \le 0.3V$		0.03	1 **30**	µA
$I_Q(V_{BIAS})$	Quiescent Current Drawn from V_{BIAS} Supply	10 mA < I_L < 1.5A		1	2 **3**	mA
		$V_{\overline{S/D}} \le 0.3V$		0.03	1 **30**	µA
I_{SC}	Short-Circuit Current	V_{OUT} = 0V		4.3		A
Shutdown Input						
V_{SDT}	Output Turn-off Threshold	Output = ON	**1.3**	0.7		V
		Output = OFF		0.7	**0.3**	
Td (OFF)	Turn-OFF Delay	R_{LOAD} X C_{OUT} << Td (OFF)		20		µs
Td (ON)	Turn-ON Delay	R_{LOAD} X C_{OUT} << Td (ON)		15		
$I_{\overline{S/D}}$	$\overline{S/D}$ Input Current	$V_{\overline{S/D}}$ =1.3V		1		µA
		$V_{\overline{S/D}} \le 0.3V$		−1		

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: $V_{IN} = V_O(NOM) + 1V$, V_{BIAS} = 4.5V, I_L = 10 mA, $C_{IN} = C_{OUT}$ = 4.7 µF, $V_{S/D} = V_{BIAS}$. (Continued)

Symbol	Parameter	Conditions	MIN (Note 5)	Typical (Note 4)	MAX (Note 5)	Units
AC Parameters						
PSRR (V_{IN})	Ripple Rejection for V_{IN} Input Voltage	$V_{IN} = V_{OUT}$ +1V, f = 120 Hz		80		dB
		$V_{IN} = V_{OUT}$ + 1V, f = 1 kHz		65		
PSRR (V_{BIAS})	Ripple Rejection for V_{BIAS} Voltage	$V_{BIAS} = V_{OUT}$ + 3V, f = 120 Hz		70		
		$V_{BIAS} = V_{OUT}$ + 3V, f = 1 kHz		65		
	Output Noise Density	f = 120 Hz		1		µV/root–Hz
e_n	Output Noise Voltage V_{OUT} = 1.8V	BW = 10 Hz – 100 kHz		150		µV (rms)
		BW = 300 Hz – 300 kHz		90		

Note 1: Absolute maximum ratings indicate limits beyond which damage to the component may occur. Operating ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications, see Electrical Characteristics. Specifications do not apply when operating the device outside of its rated operating conditions.

Note 2: At elevated temperatures, device power dissipation must be derated based on package thermal resistance and heatsink thermal values. θ_{J-A} for TO-220 devices is 65˚C/W if no heatsink is used. If the TO-220 device is attached to a heatsink, a θ_{J-S} value of 4˚C/W can be assumed. θ_{J-A} for TO-263 devices is approximately 40˚C/W if soldered down to a copper plane which is at least 1.5 square inches in area. θ_{J-A} value for typical PSOP-8 PC board mounting is 166˚C/W. If power dissipation causes the junction temperature to exceed specified limits, the device will go into thermal shutdown.

Note 3: The human body model is a 100 pF capacitor discharged through a 1.5k resistor into each pin.

Note 4: Typical numbers represent the most likely parametric norm for 25˚C operation.

Note 5: Limits are guaranteed through testing, statistical correlation, or design.

Note 6: If used in a dual-supply system where the regulator load is returned to a negative supply, the output pin must be diode clamped to ground.

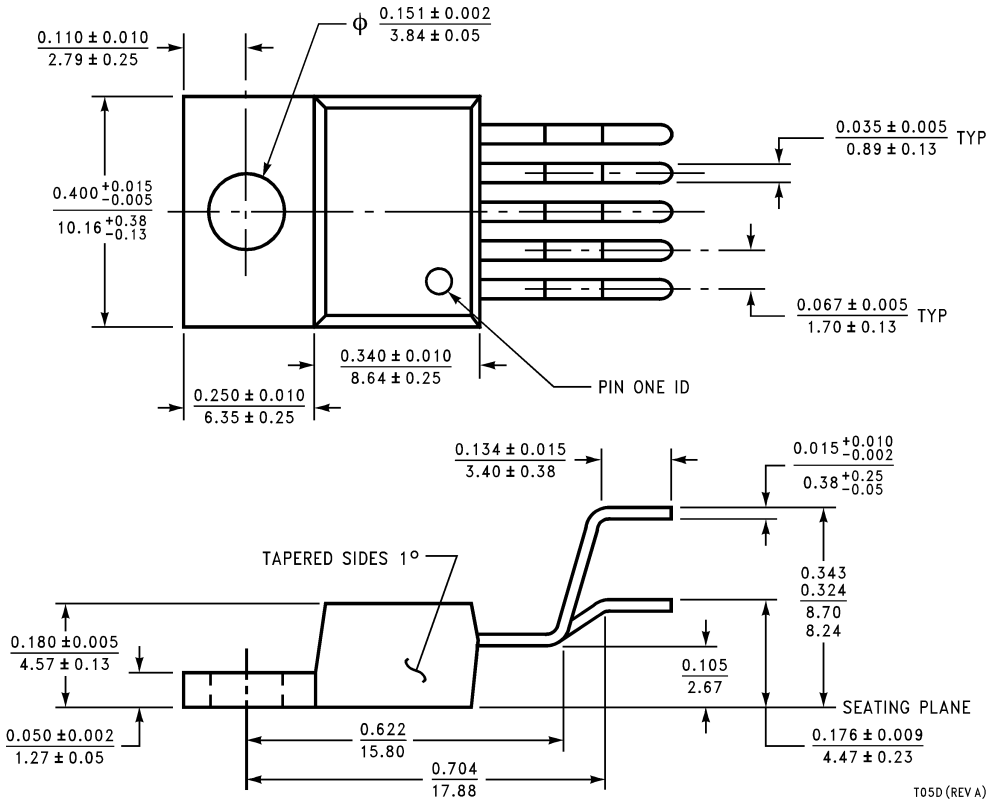
Note 7: Output voltage line regulation is defined as the change in output voltage from nominal value resulting from a change in input voltage.

Note 8: Output voltage load regulation is defined as the change in output voltage from nominal value as the load current increases from no load to full load.

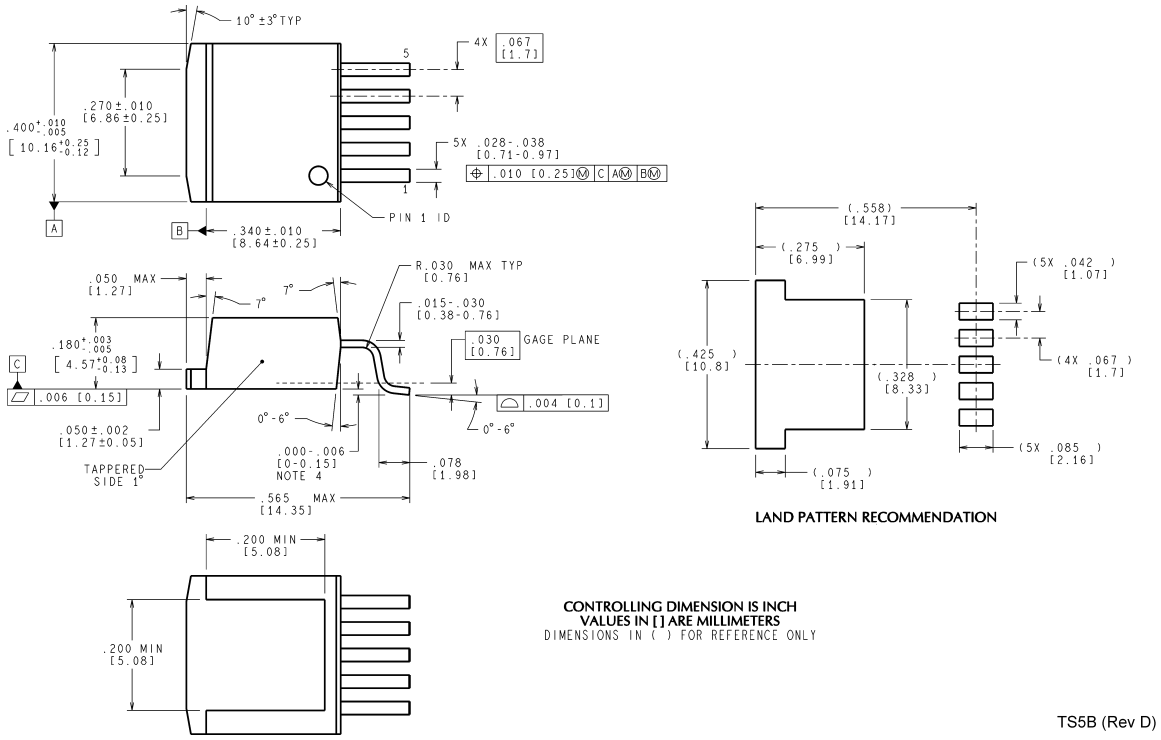
Note 9: Dropout voltage is defined as the minimum input to output differential required to maintain the output with 2% of nominal value. The PSOP-8 package devices have a slightly higher dropout voltage due to increased band wire resistance.

Note 10: The machine model is a 220 pF capacitor discharged directly into each pin. The machine model ESD rating of pin 5 is 100V.

Physical Dimensions inches (millimeters) unless otherwise noted



TO220 5-lead, Molded, Stagger Bend Package (TO220-5)
NS Package Number T05D



TO263 5-Lead, Molded, Surface Mount Package (TO263-5)
NS Package Number TS5B