



SPX1580

7A Ultra Low Dropout Voltage Regulator Fast Response, Adjustable & Fixed

FEATURES

- Low Dropout Voltage 540mV at 7A Full Load Current
- Adjustable Output Down to 1.2V from ATX Power Supply
- Fixed Output Voltages of 3.3V, 2.8V & 2.5V
- Extremely Tight Voltage and Line Regulation
- Standard 5-Terminal Low Cost TO-220 & TO-263
- Replacement to Industry Standard LT1580

APPLICATIONS

- 3.3V to 2.8V ATX Power Supplies
- 3.3V to 2.9V for Portable PENTIUM™ Processor
- 5V to 3.5V VRE Supply
- High Efficiency “Green” Computer Systems

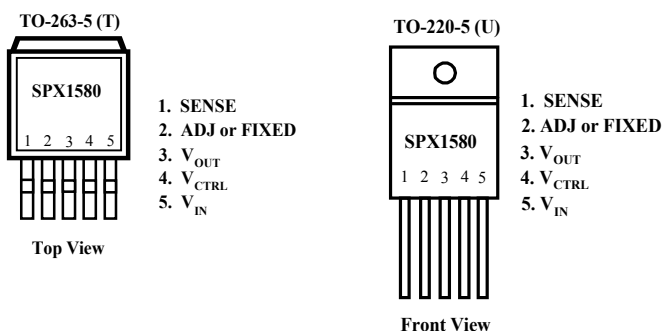
PRODUCT DESCRIPTION

The SPX1580 is a 7A Low Dropout Regulator with extremely low dropout voltage. The adjustable version requires only two external resistors to set the output voltage. The fixed version has a preset output of 3.3V, 2.8V or 2.5V and does not require any external resistors. The SPX1580 features a low dropout of 540mV(Typ.) and offers fast transient response. **This device is suitable for Pentium applications requiring 2.8V or 2.5V from 3.3V ATX power supplies**, where a low current input voltage 1V greater than the output voltage is needed. With an external sense pin the load regulation is less than 1mV. This device is an excellent choice for the use in powering low voltage microprocessors that require a lower dropout, fast transient response to regulate from 3.3V and 5V supplies. The SPX1580 is also an excellent choice as a post regulator for switching supplies applications.

The SPX1580 offers protection against over-current faults, reversed input polarity, over temperature operation and positive and negative transient voltage.

The SPX1580 is offered in a 5 pin TO-220 and TO-263 compatible with industry standard 5-terminal regulators. For 5A, 3A and 1.5A ultra low dropout versions refer to SPX1581, SPX1582 and SPX1583 data sheets respectively

PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

Power Dissipation.....	Internally Limited	Input Supply Voltage	6V
Lead Temp (soldering, 10 seconds).....	300°C	V _{CTRL} Input Voltage	13V
Storage Temperature Range	-65°C to +150°C		
Operating Junction Temperature Range			
SPX1580 Control Section	0°C to +125°C		
SPX1580 Power Transistor	0°C to +150°C		

ELECTRICAL CHARACTERISTICS at V_S=14V, T_a=25°C, I_O=10mA, C₂=10μF, C₄ = 33μF (Tantalum cap unless otherwise specified. (Note 1) (Boldface applies over full temperature range).

Parameters		Conditions	SPX1580			Units
			Min	Typ	Max	
2.5V Version						
Output Voltage	V _{CTRL} =6.0V to 12V, V _{IN} =3.0V to 5.0V, I _O =10mA I _O =10mA to 7A		2.450 2.400	2.5 2.5	2.550 2.600	V
2.8V Version						
Output Voltage	V _{CTRL} =6.3V to 12V, V _{IN} =3.3V to 5.0V, I _O =10mA I _O =10mA to 7A		2.744 2.688	2.8 2.8	2.856 2.912	V
3.3V Version						
Output Voltage	V _{CTRL} =6.3V to 12V, V _{IN} =3.3V to 5.0V, I _O =10mA I _O =10mA to 7A		3.234 3.168	3.3 3.3	3.366 3.432	V
All Voltage Options						
Reference Voltage (Note 3)	V _{CTRL} =2.75V, V _{IN} =2.00V, I _O =10mA V _{CTRL} =2.7V to 12V, V _{IN} =2.05V to 5.5V, I _O =10mA to 7A		1.2375	1.25	1.375	V
Line Regulation	V _{CTRL} =2.5V to 12V, V _{IN} =1.75V to 5.5V, I _O =10mA V _{ADJ} =0V			1.0	3.0	mV
Load Regulation (Note1)	V _{CTRL} =2.75V, V _{IN} =2.1V, I _O =10mA to 7A, V _{ADJ} =0V			1.0	5.0	mV
Dropout Voltage Minimum V _{CTRL} (Note2) (V _{CTRL} – V _{OUT})	V _{ADJ} =0V V _{IN} =2.05V, I _O =1A			1.00	1.20	V
Dropout Voltage Minimum V _{IN} (Note2) (V _{IN} - V _{OUT})	V _{ADJ} =0V V _{IN} =2.75V, I _O =7A			0.54	0.62	V
Current Limit	V _{CTRL} =2.75V, V _{IN} =2.05V, dV _O =100mV, V _{ADJ} =0V		7	8		A
Minimum Load Current	V _{CTRL} =5V, V _{IN} =3.3V, V _{ADJ} =0V			5	10	mA
Thermal Regulation	30ms Pulse			0.002	0.02	%W
Ripple Rejection	V _{CTRL} =3.75V V _{IN} =3.75V, I _O =2.7A, V _{ADJ} =0V T _J =25, V _{RIPPLE} =1V _{pp} at 120Hz		60	80		dB
Control Pin Current	V _{ADJ} =0V V _{CTRL} =2.75V, V _{IN} =2.05V, I _O =7A			60	130	mA
Adjustable Pin Current	V _{CTRL} =2.75V, V _{IN} =2.05V, V _{ADJ} =0V I _O =10mA			50	120	μA
Thermal Resistance	TO-220-5	Junction to Case (θ _{JC})			3	°C/W
		Junction to Ambient (θ _{JA})			50	°C/W
	TO-263-5	Junction to Case (θ _{JC})			3	°C/W
		Junction to Ambient (θ _{JA})			60	°C/W

The **Bold** specifications applying to the over full operating temperature range.

Note 1: Low duty cycle pulse testing with Kelvin connections is required to maintain accurate data.

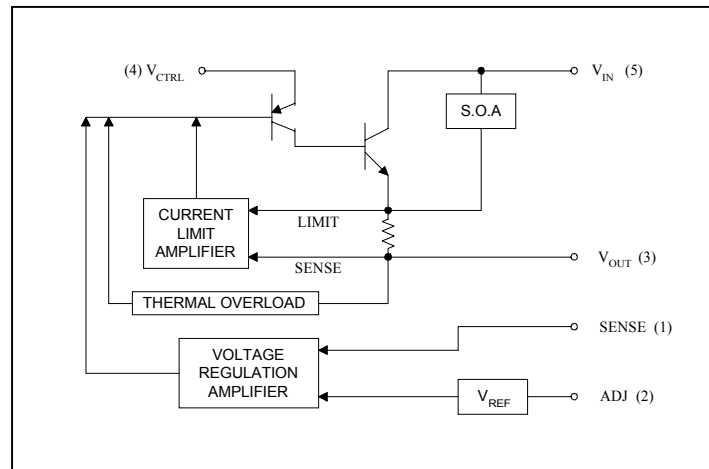
Note 2: Dropout voltage is defined as the minimum differential between V_{IN} and V_{OUT} or V_{CTRL} and V_{OUT} required to maintain regulation at V_{OUT} 99% Nominal V_{OUT}.

Note 3: V_{REF} is measured across Adjust pin to Sense pin.

PIN DESCRIPTION

1. Sense = Allows Kelvin sense of V_{OUT} at the load. (Positive side of the reference voltage of the device).
2. ADJ = Negative side of the reference voltage for the device. Adding a small bypass capacitor from the ADJ pin to ground will improve the transient response.
3. V_{OUT} = Power output of the device.
4. V_{CTRL} = Supply pin for the control circuitry of the device. The current flow into this pin will be about 1% of the output current. V_{CTRL} must be between 1.0V and 1.3V greater than the output voltage for the device to regulate.
5. V_{IN} = Output load current is supplied through this pin. V_{IN} must be between 0.1V and 0.8V greater than the output voltage for the device to regulate.

BLOCK DIAGRAM



APPLICATIONS NOTES

The SPX1580 is designed as a high performance and low cost solution for application requiring a lower dropout than traditional NPN regulators.

The SPX1580 uses a separate input voltage V_{CTRL} ($V_{CTRL} \geq V_{OUT} + 1.3V$) to minimize the dropout voltage. This allows the 2.5V power for the load to come from a 3.3V system supply. As added benefit this will reduce the heat dissipation*, and lower heatsink and cooling fan cost. A typical application would use 3.3V for V_{IN} and 5.0V for V_{CTRL} from a motherboard power supply to provide a nominal 2.5V output. Using the sense pin allows to Kelvin measure the output, reducing resistive-associated errors.

The SPX1580 can power the 2.5V core voltage for microprocessors such as Pentium™, P55C™, AMD5k86™ and K6™ and the IBM PowerPC™ 603EV and 604EV processors.

Output Capacitor

An output capacitor for SPX1580 is for circuit compensation for the device to prevent oscillation. The minimum size of the output capacitor is either a 330μF Aluminum electrolytic capacitor or 33μF tantalum. Larger capacitor values improve the regulator transient response performance and increase

surge load capability. The output capacitor should have an ESR not more than 280mΩ.

Adjustable Regulator Design

1.25V reference voltage is being developed between the SENSE pin and the ADJ pin of the SPX1580. Adding two external resistors (see fig 1.) will allow setting the output voltage from 1.25V to 6V. R_1 is chosen so that this current is specified minimum load current of 10mA. R_2 is given by the formula: $V_{OUT} = V_{REF} (1 + R_2/R_1) + I_{ADJ} (R_2)$. The current flowing from the ADJ pin is typically 50μA. This ADJ pin contributes to the final V_{OUT} but is usually neglected. Connecting the sense pin to the top of the resistor divider will improve load regulation.

Lowering Noise

Using the SENSE pin to Kelvin the load will increase accuracy of the output voltage during load regulation. For the fixed voltage device, adding a bypass capacitor from ADJ pin to ground improves transient response. A 330pF ceramic capacitor is recommended.

TYPICAL APPLICATION

Fig. 1 Adjustable Regulator

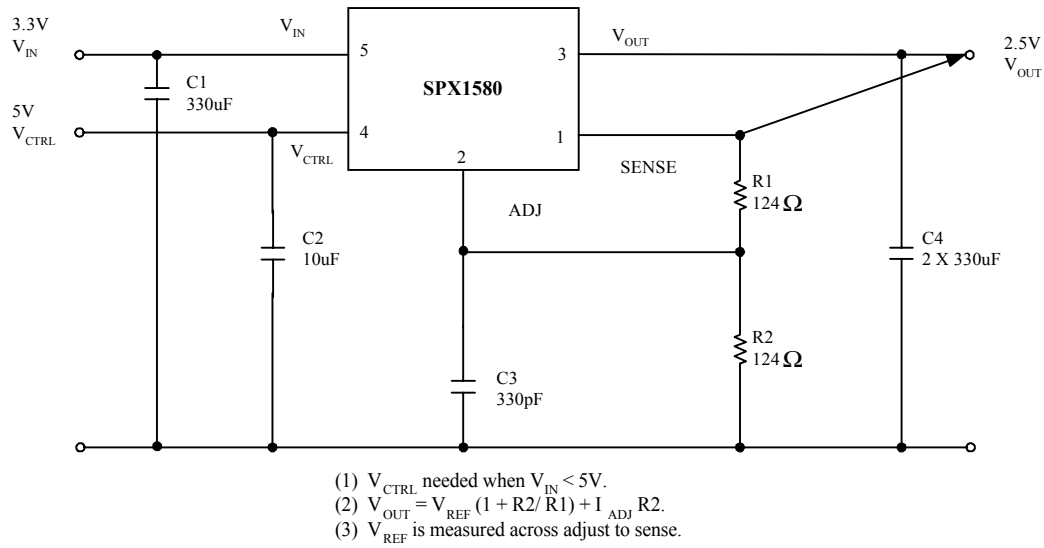
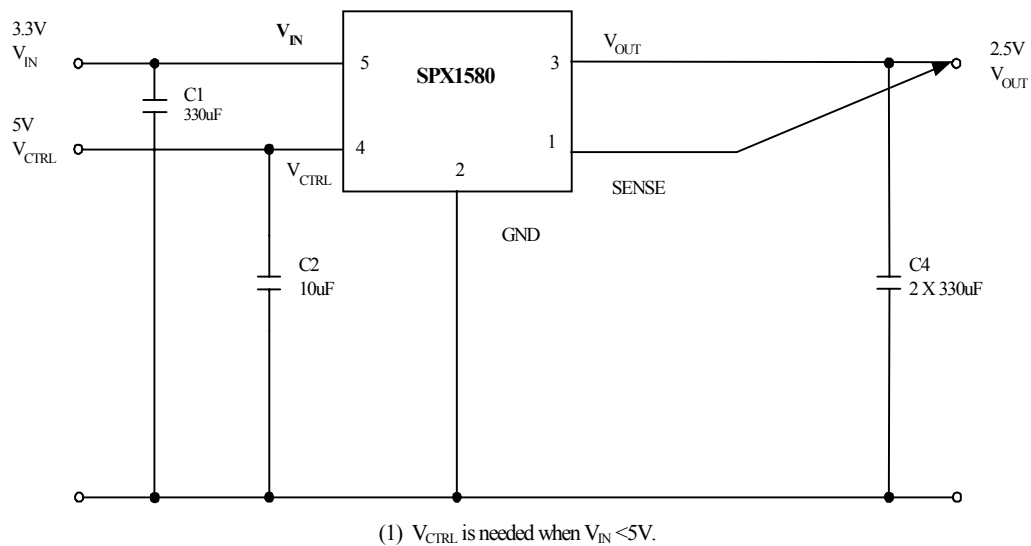


Fig.2 Typical Fixed Regulator



ORDERING INFORMATION

Ordering No.	Precision	Output Voltages	Packages
SPX1580U5	0.6%	Adj	5 Lead TO-220
SPX1580U5-2.5	0.6%	2.5V	5 Lead TO-220
SPX1580U5-2.8	0.6%	2.8V	5 Lead TO-220
SPX1580U5-3.3	0.6%	3.3V	5 Lead TO-220
SPX1580T5	0.6%	Adj	5 Lead TO-263
SPX1580T5-2.5	0.6%	2.5V	5 Lead TO-263
SPX1580T5-2.8	0.6%	2.8V	5 Lead TO-263
SPX1580T5-3.3	0.6%	3.3V	5 Lead TO-263



SIGNAL PROCESSING EXCELLENCE

Sipex Corporation

Headquarters and Main Offices:

22 Linnell Circle
Billerica, MA 01821
TEL: (978) 667-8700
FAX: (978) 670-9001
e-mail: sales@sipex.com

233 South Hillview Drive
Milpitas, CA 95035
TEL: (408) 935-7600
FAX: (408) 934-7500

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