SPX2810

1A Low Dropout Voltage Regulator
Adjustable & Fixed Output,
Fast Response

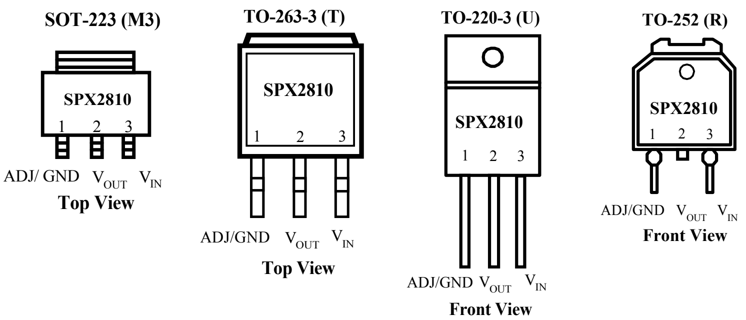
FEATURES
- Adjustable Output Down To 1.2V
- Fixed Output Voltages 1.5V, 2.5V, 3.0V, 3.3V, 5.0V
- Output Current Of 1A
- Low Dropout Voltage 1.2V Typ.
- Extremely Tight Load And Line Regulation
- Current & Thermal Limiting
- Standard 3-Terminal Low Cost TO-220, TO-263, TO-252 & SOT-223

APPLICATIONS
- Portable Palmtop/Notebook Computer
- SMPS Post-Regulator
- Disk Drives
- Portable Consumer Equipment
- Portable Instrumentation
- Battery charger

PRODUCT DESCRIPTION
The SPX2810 is a low power positive voltage regulator designed to source 1A output current. This device is an excellent choice for use in battery-powered applications and portable computers. The SPX2810 features very low quiescent current and very low dropout voltage of 1.2V at a full load and lower as output current decreases. This product is available as adjustable or fixed 1.5V, 2.5V, 3.0V, 3.3V, and 5V output voltages.

The SPX2810 is offered in a 3-pin surface mount packages SOT-223, TO-220, TO-252 & DD package. The output capacitor of 10µF or larger is needed for the output stability of SPX2810 as required by most other regulator circuits

PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

Lead Temp. (Soldering, 10 Seconds) .... 300°C
Storage Temperature Range .... -65° to +150°C
Operating Junction Temperature Range ....
SPX2810 Control Section.......................... -45°C +125°C
SPX2810 Power Transistor.........................-45°C +150°C

Input Voltage... 10V
Input to Output Voltage Differential 10V

ELECTRICAL CHARACTERISTICS (NOTE 1) at I_{OUT} = 10mA, T_A=25°C, unless otherwise specified.

PARAMETER	CONDITIONS	Typ	SPX2810A		SPX2810		UNITS
			Min	Max	Min	Max	
1.5V Version							
Output Voltage (Note 2)	SPX2810-1.5V, 0 < I_{OUT} < 1A, 3.3V<V_{IN}<10V	1.5	1.485	1.515	1.470	1.530	V
			1.47	**1.53**	**1.455**	**1.545**	
2.5V Version							
Output Voltage (Note 2)	SPX2810-2.5V, 0 < I_{OUT} < 1A, 4.0V<V_{IN}<10V	2.5	2.475	2.525	2.450	2.550	V
			2.45	**2.55**	**2.425**	**2.575**	
2.85V Version							
Output Voltage (Note 2)	SPX2810-2.85V, 0 ≤ I_{OUT} ≤ 1A, 4.5V≤V_{IN}≤10V	2.85	2.822	2.879	2.793	2.907	V
			2.793	**2.907**	**2.650**	**2.936**	
3.0V Version							
Output Voltage (Note 2)	SPX2810-3.0V, 0 ≤ I_{OUT} ≤ 1A, 4.5V≤V_{IN}≤10V	3	2.970	3.030	2.94	3.06	V
			2.940	**3.060**	**2.79**	**3.09**	
3.3V Version							
Output Voltage (Note 2)	SPX2810-3.3V, 0 ≤ I_{OUT} ≤ 1A, 4.8V≤V_{IN}≤10V	3.3	3.267	3.333	3.234	3.366	V
			3.234	**3.366**	**3.069**	**3.399**	
5.0V Version							
Output Voltage (Note 2)	SPX2810-5.0V, 0 ≤ I_{OUT} ≤ 1A, 6.5V≤V_{IN}≤12V	5	4.950	5.050	4.9	5.1	V
			4.900	**5.100**	**4.65**	**5.15**	
All Voltage Options							
Reference Voltage (V_{REF})	V_{IN}≤ 7V, P≤ Pmax 1.5V≤ (V_{IN} -V_{OUT})≤5.75V, 10mA≤I_{OUT}≤1A	1.250	1.225 **1.263**	1.270 **1.225**	1.225 **1.212**	1.270 **1.288**	V
Min. Load Current (Note 3)	1.5V≤ (V_{IN} –V_{OUT})≤5.75V	**5**		**10**		**10**	mA
Line Regulation ($\Delta V_{REF}(V_{in})$)	2.75V≤V_{IN} ≤7V, I_{OUT}=10mA, T_J=25ºC (Note 3)	0.005		0.2		0.2	%
	V_{IN}≤7V, I_{OUT}=0mA, T_J=25ºC (Note 2)	0.005		0.2		0.2	
Load Regulation($\Delta V_{REF}(I_{OUT})$)	10mA≤I_{OUT} ≤1A, (V_{IN}-V_{OUT})=3V, T_J=25ºC (Note 3)	0.05		0.3		0.3	%
	0≤I_{OUT} ≤1A, V_{IN}=7V, T_J=25ºC (Note 2)	0.05		0.3		0.3	
Dropout Voltage	ΔV_{REF}=1% I_{OUT} = 1A (Note 3) I_{OUT} ≤ 1A (Note 2)	1.1		1.2		1.2	
Current Limit I_{OUT}(MAX)	V_{IN}=7V 1.4V ≤ (V_{IN}- V_{OUT}) (Note3)	2	1.2		1.2		A

ELECTRICAL CHARACTERISTICS (Cont.)

Long Term Stability	T_A=125ºC, 1000 Hrs.		0.3 (Note 2)		1		1	%
Thermal Regulation (ΔV_{OUT}(Pwr))	T_A=25ºC, 20 ms pulse		0.01		0.020		0.020	%/W
Temperature Stability (ΔV_{OUT}(T))			0.25					%
Output Noise, RMS	10Hz to 10kHz T_A=25ºC		0.003					% Vo
Thermal Resistance	TO-220	Junction to Tab			3.0		3.0	ºC/W
		Junction to Ambient			60		60	
	DD Package	Junction to Tab			3.0		3.0	
		Junction to Ambient			60		60	
	SOT-223 Package	Junction to Tab			15		15	
		Junction to Ambient			156		156	

The Bold specifications apply to the full operating temperature range.
Note 1: Changes in output voltage due to heating effects are covered under the specification for thermal regulation.
Note 2: Fixed Version Only
Note 3: Adjustable Version Only

APPLICATION HINTS

The SPX2810 incorporates protection against over-current faults, reversed load insertion, over temperature operation, and positive and negative transient voltage. However, the use of an output capacitor is required in order to improve the stability and the performances.

Stability

The output capacitor is part of the regulator's frequency compensation system. Either a 22µF aluminum electrolytic capacitor or a 10µF solid tantalum capacitor between the output terminal and ground guarantees stable operation for all operating conditions.
However, in order to minimize overshoot and undershoot, and therefore optimize the design, please refer to the section 'Ripple Rejection'.

Ripple Rejection

Ripple rejection can be improved by adding a capacitor between the ADJ pin and ground as shown in figure 6. When ADJ pin bypassing is used, the value of the output capacitor required increases to its maximum (22µF for an aluminum electrolytic capacitor, or 10µF for a solid tantalum capacitor). If the ADJ pin is not bypass, the value of the output capacitor can be lowered to 10µF for an electrolytic aluminum capacitor or 4.7µF for a solid tantalum capacitor.
However the value of the ADJ-bypass capacitor should be chosen with respect to the following equation:
$C = 1 / (6.28 * F_R * R_1)$

Where C = value of the capacitor in Farads (select an equal or larger standard value),
F_R = ripple frequency in Hz,
R_1 = value of resistor R_1 in Ohms.

If an ADJ-bypass capacitor is use, the amplitude of the output ripple will be independent of the output voltage. If an ADJ-bypass capacitor is not used, the output ripple will be proportional to the ratio of the output voltage to the reference voltage:
$M = V_{OUT} / V_{REF}$
Where M = multiplier for the ripple seen when the ADJ pin is optimally bypassed.
V_{REF} = Reference Voltage

Reducing parasitic resistance and inductance

One solution to minimize parasitic resistance and inductance is to connect in parallel capacitors. This arrangement will improve the transient response of the power supply if your system requires rapidly changing current load condition.

Thermal Consideration

Although the SPX2810 offers some limiting circuitry for overload conditions, it is necessary not to exceed the maximum junction temperature, and therefore to be careful about thermal resistance. The heat flow will follow the lowest resistance path, which is the Junction-to-case thermal resistance. In order to insure the best thermal flow of the component, a proper mounting is required. Note that the case of the device is electrically connected to the output. In case the case has to be electrically isolated, a thermally conductive spacer can be used. However do not forget to consider its contribution to thermal resistance.

Assuming:
$V_{IN} = 10V$, $V_{OUT} = 5V$, $I_{OUT} = 1.5A$, $T_A = 50°C/W$,
$\theta_{Heatsink\ Case} = 6°C/W$, $\theta_{Heatsink\ Case} = 0.5°C/W$, $\theta_{JC} = 3°C/W$

Power dissipation under this condition
$P_D = (V_{IN} - V_{OUT}) * I_{OUT} = 7.5W$

Junction Temperature
$T_J = T_A + P_D * (\theta_{Case - HS} + \theta_{HS} + \theta_{JC})$

For the Control Sections
$T_J = 50 + 7.5*(0.5+6=3) = 121.25°C$
$121.25°C < T_{J\,(max)}$ for the Control & Power Sections.

In both case reliable operation is insured by adequate junction temperature.

Basic Adjustable Regulator

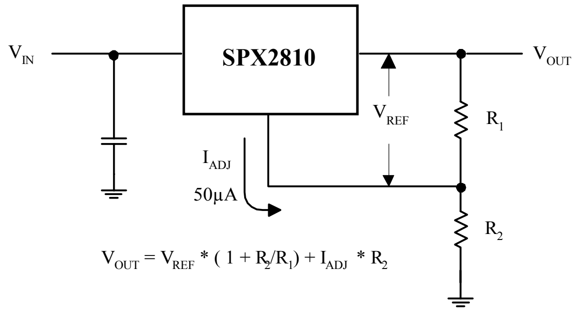
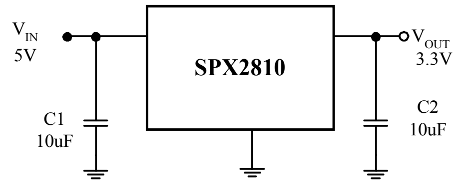


Fig.2 Basic Adjustable Regulator



Basic Fixed Regulator

Output Voltage

Consider Figure 2. The resistance R_1 generates a constant current flow, normally the specified load current of 10mA. This current will go through the resistance R_2 to set the overall output voltage. The current I_{ADJ} is very small and constant. Therefore its contribution to the overall output voltage is very small and can generally be ignored.

Load Regulation

Parasitic line resistance can degrade load regulation. In order not to affect the behavior of the regulator, it is best to connect directly the R_1 resistance from the resistor divider to the case,

and not to the load. For the same reason, it is best to connect the resistor R_2 to the Negative side of the load.

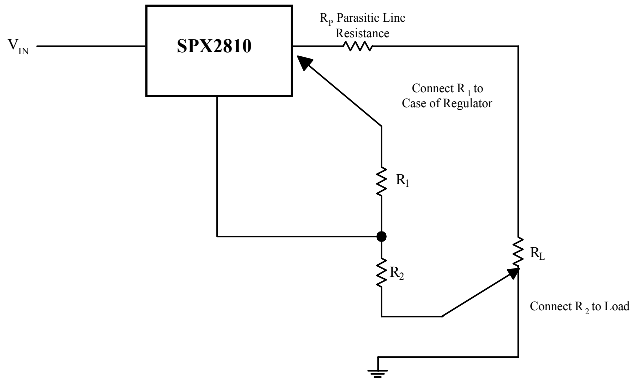


Fig.3 Basic Adjustable Regulator

Output Voltage

The fixed voltage LDO voltage regulator are simple to use regulators since the V_{OUT} is preset to the specifications. It is important however, to provide the proper output capacitance for stability and improvement. For most operating conditions a capacitance of 22uF tantalum or 100uF electrolytic will ensure stability and prevent oscillation.

TYPICAL APPLICATIONS

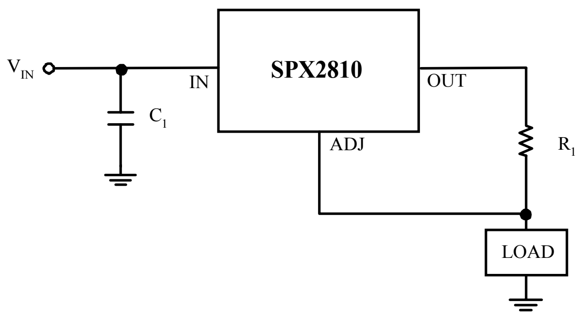


Fig. 4 1A Current output Regulator

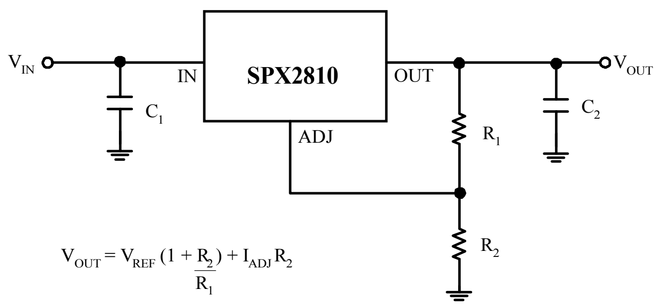


Fig. 5 Typical Adjustable Regulator

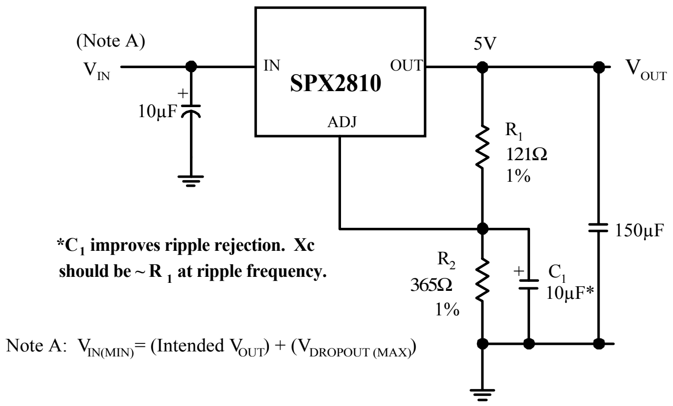


Fig. 6 Improving Ripple Rejection

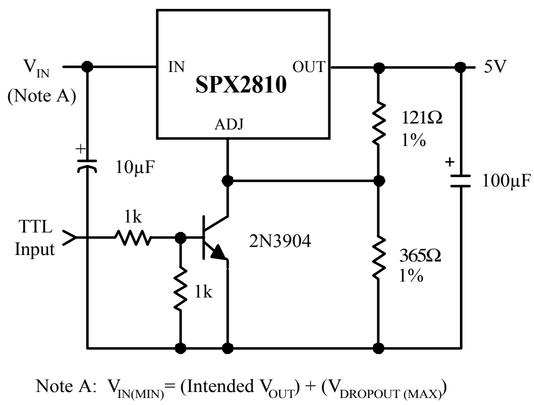
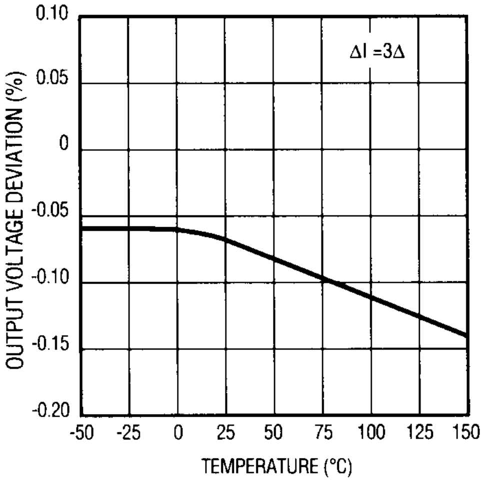


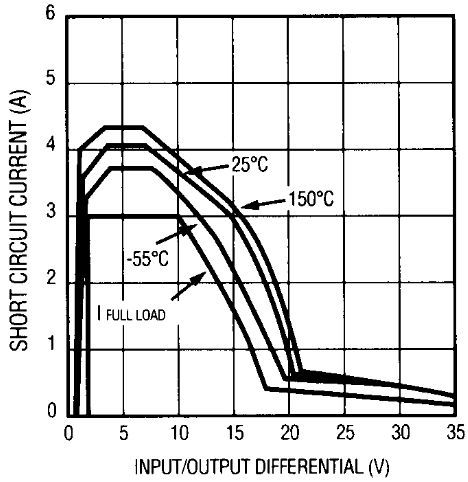
Fig.7 5V Regulator with Shutdown

TYPICAL CHARACTERISTICS

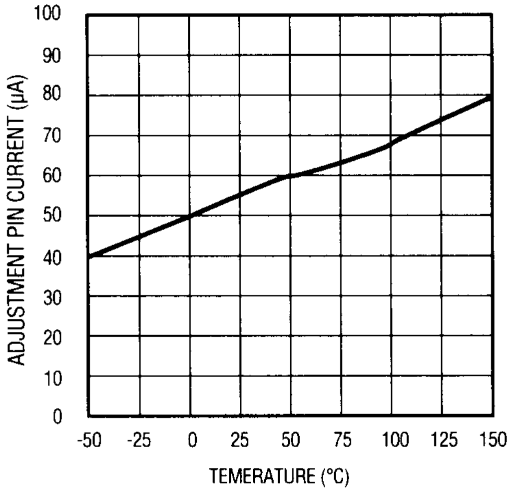
LOAD REGULATION



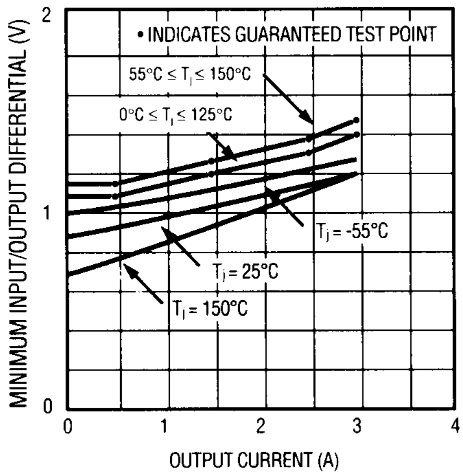
SHORT CIRCUIT CURRENT



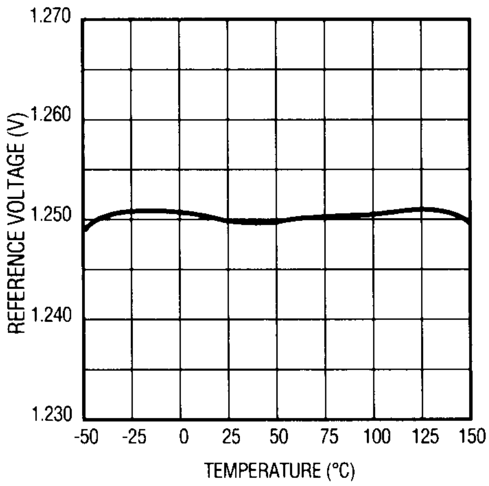
ADJUSTMENT PIN CURRENT



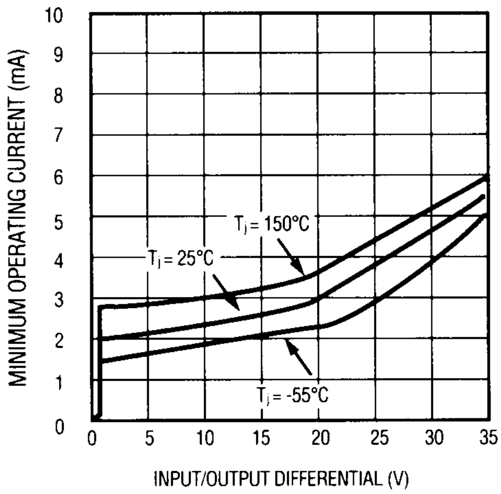
DROPOUT VOLTAGE



TEMPERATURE STABILITY



MINIMUM OPERATING CURRENT



ORDERING INFORMATION

Ordering No	Precision	Output Voltage	Packages
SPX2810U	2%	Adj	3 Lead TO-220
SPX2810U-1.5	2%	1.5V	3 Lead TO-220
SPX2810U-2.5	2%	2.5V	3 Lead TO-220
SPX2810U-3.0	2%	3.0V	3 Lead TO-220
SPX2810U-3.3	2%	3.3V	3 Lead TO-220
SPX2810U-5.0	2%	5.0V	3 Lead TO-220
SPX2810AU	1%	Adj	3 Lead TO-220
SPX2810AU-1.5	1%	1.5V	3 Lead TO-220
SPX2810AU-2.5	1%	2.5V	3 Lead TO-220
SPX2810AU-3.0	1%	3.0V	3 Lead TO-220
SPX2810AU-3.3	1%	3.3V	3 Lead TO-220
SPX2810AU-5.0	1%	5.0V	3 Lead TO-220
SPX2810T	2%	Adj	3 Lead TO-263
SPX2810T-1.5	2%	1.5V	3 Lead TO-263
SPX2810T-2.5	2%	2.5V	3 Lead TO-263
SPX2810T-3.0	2%	3.0V	3 Lead TO-263
SPX2810T-3.3	2%	3.3V	3 Lead TO-263
SPX2810T-5.0	2%	5.0V	3 Lead TO-263
SPX1202AT	1%	Adj	3 Lead TO-263
SPX2810AT-1.5	1%	1.5V	3 Lead TO-263
SPX2810AT-2.5	1%	2.5V	3 Lead TO-263
SPX2810AT-3.0	1%	3.0V	3 Lead TO-263
SPX2810AT-3.3	1%	3.3V	3 Lead TO-263
SPX2810AT-5.0	1%	5.0V	3 Lead TO-263
SPX2810M3	2%	Adj	3 Lead TO-223
SPX2810M3-1.5	2%	1.5V	3 Lead TO-223
SPX2810M3-2.5	2%	2.5V	3 Lead TO-223
SPX2810M3-3.0	2%	3.0V	3 Lead TO-223
SPX2810M3-3.3	2%	3.3V	3 Lead TO-223
SPX2810M3-5.0	2%	5.0V	3 Lead TO-223
SPX2810AM3	1%	Adj	3 Lead TO-223
SPX2810AM3-1.5	1%	1.5V	3 Lead TO-223
SPX2810AM3-2.5	1%	2.5V	3 Lead TO-223
SPX2810AM3-3.0	1%	3.0V	3 Lead TO-223
SPX2810AM3-3.3	1%	3.3V	3 Lead TO-223
SPX2810AM3-5.0	1%	5.0V	3 Lead TO-223
SPX2810R	2%	Adj	3 Lead TO-252
SPX2810R-1.5	2%	1.5V	3 Lead TO-252
SPX2810R-2.5	2%	2.5V	3 Lead TO-252
SPX2810R-3.0	2%	3.0V	3 Lead TO-252
SPX2810R-3.3	2%	3.3V	3 Lead TO-252
SPX2810R-5.0	2%	5.0V	3 Lead TO-252
SPX2810AR	1%	Adj	3 Lead TO-252
SPX2810AR-1.5	1%	1.5V	3 Lead TO-252
SPX2810AR-2.5	1%	2.5V	3 Lead TO-252
SPX2810AR-3.0	1%	3.0V	3 Lead TO-252
SPX2810AR-3.3	1%	3.3V	3 Lead TO-252
SPX2810AR-5.0	1%	5.0V	3 Lead TO-252

SIGNAL PROCESSING EXCELLENCE

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