



## SPX2941

### 1A Low Dropout Voltage Regulators (ADVANCED INFORMATION)

#### FEATURES

- Output Current 1A
- Internal Short Circuit Current Limit
- Dropout Voltage 0.5V at 1A Output
- Extremely Tight Load and Line Regulation
- Very Low Temperature Coefficient
- Mirror Image Insertion Protection
- Unregulated DC Input Can Withstand -20V Reverse Battery and +60V Positive Transients
- Direct Replacement For LM2941 Socket
- Adjustable Output Between 5V to 20V
- TTL, CMOS Compatible ON/OFF Switch

#### APPLICATIONS

- Battery Powered Systems
- Cordless Telephones
- Automotive Electronics
- Portable / Palm Top / Notebook Computers
- Portable Consumer Equipment
- Portable Instrumentation
- SMPS Post-Regulator
- Voltage Reference

#### PRODUCT DESCRIPTION

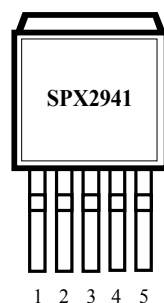
The SPX2941 is a low power positive Adjustable Voltage Regulator. The SPX2941 offers 1A output current with dropout voltage of only 0.5 Volts with a maximum of 1V dropout over temperature. The quiescent current is 30mA at differential output of 5V and output current of 1A. The higher quiescent current exists only when the device is in dropout mode ( $V_{IN} - V_{OUT} \leq 3V$ ).

Other key features of this device include higher output current, positive transient protection up to 60V (Load dump), and ability to survive an unregulated input voltage transient of -20V below ground (reverse battery). The regulator will automatically shut down to protect both the internal circuits and the load. This device also features short circuit and thermal overload protection.

The SPX2941 is offered in a 5-pin TO-263 and TO-220 package compatible with other adjustable regulators. This device offers an adjustable output voltage from 5V to 20V. SPX2941 is a direct replacement to LM2941.

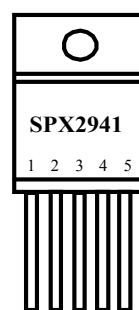
#### PIN CONNECTIONS

TO-263-5 Package



Top View

TO-220-5 Package



- 1) ADJ
- 2) Shutdown
- 3) GND
- 4)  $V_{IN}$
- 5)  $V_{OUT}$

## ABSOLUTE MAXIMUM RATINGS

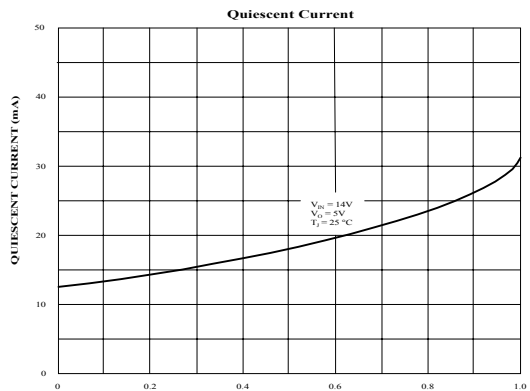
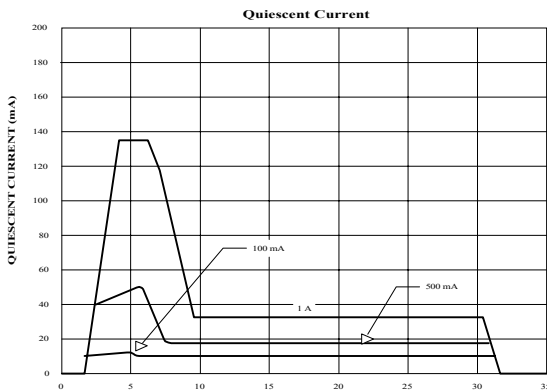
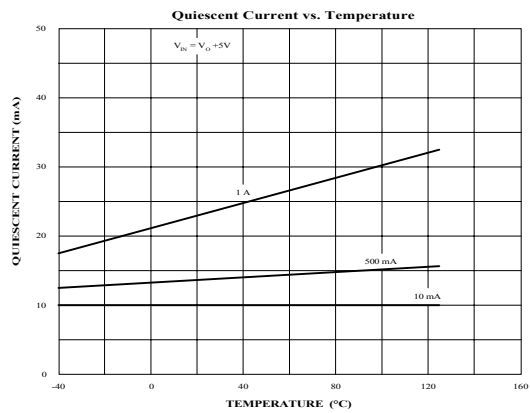
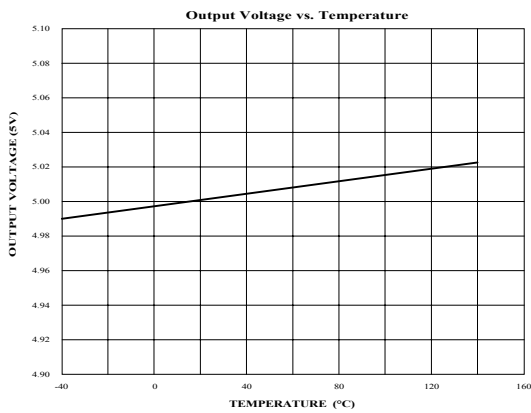
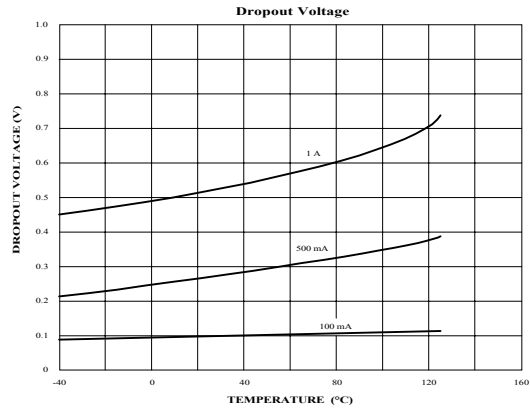
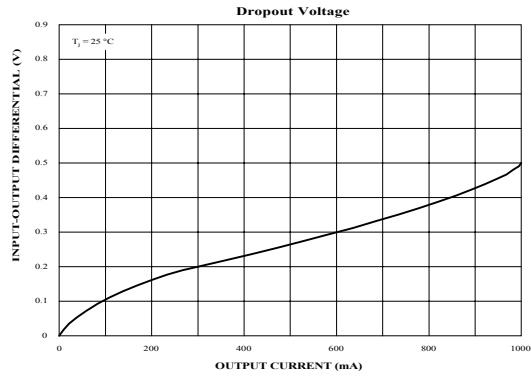
Power Dissipation ..... Internally Limited  
 Lead Temp. (Soldering, 10 seconds)..... 260°C  
 Storage Temperature Range ..... -65°C to +150°C  
 Operating Junction Temperature Range ..... +150°C

Operating Input Supply Voltage .....+12V  
 Feedback Input Voltage ..... -1.5V to +30V  
 Shutdown Input Voltage .....-0.3V to 30V  
 Error Comparator Output ..... -0.3 to 30V  
 ESD Rating is to be determined

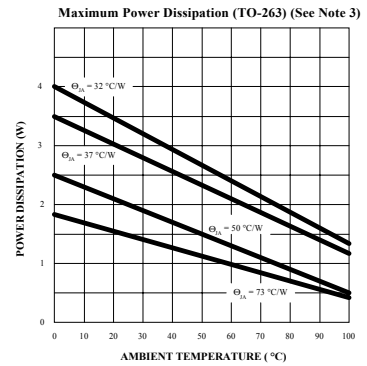
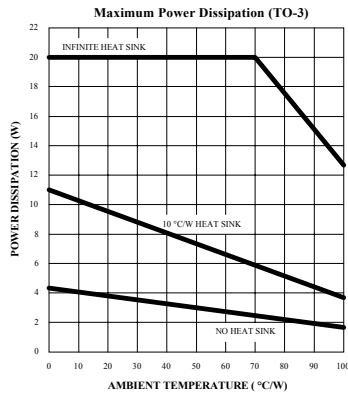
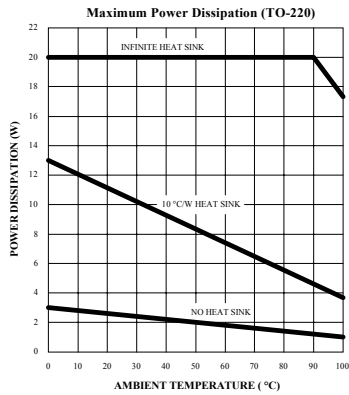
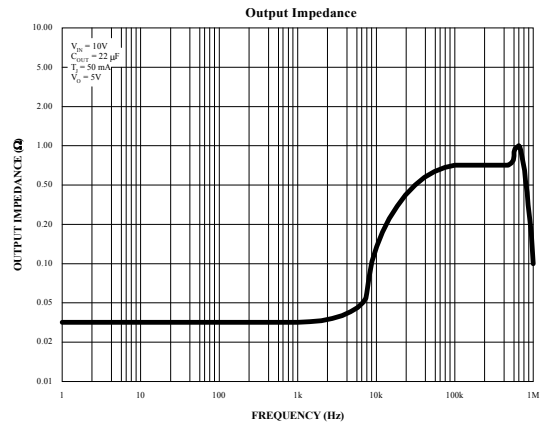
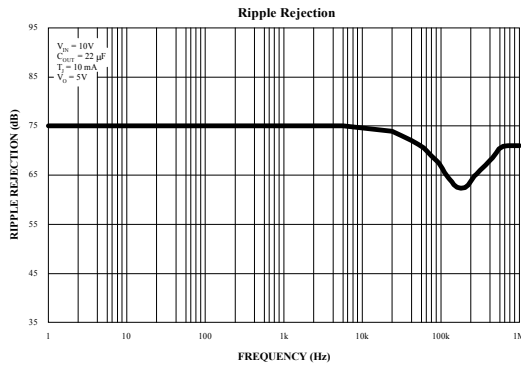
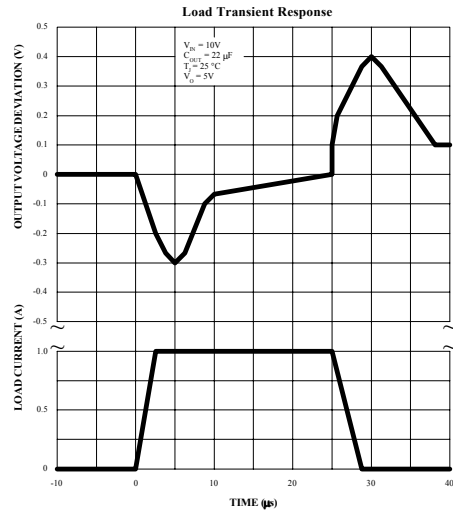
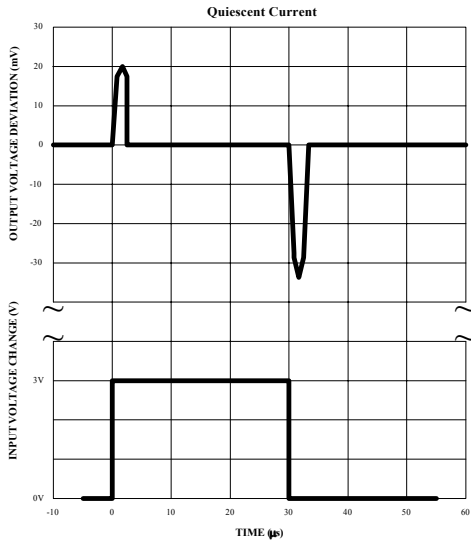
**ELECTRICAL CHARACTERISTICS** at  $V_{IN} = V_O + 5V$ ,  $I_O = 1A$ ,  $C_O = 22 \mu F$ ,  $5V \leq V_O \leq 20V$ , unless otherwise specified.  
**Boldface limits are over the entire operating temperature range.** All other specifications apply are  $T_A = 25^\circ C$ .

Parameter	Conditions	SPX2941			Units
		Min	Typ	Max	
Output Voltage	$5mA \leq I_O \leq 1A$	1.237	1.275	1.313	V
		<b>1.211</b>		<b>1.339</b>	V
Line Regulation	$V_O + 2V \leq V_{IN} \leq 26V$ $I_O = 5mA$		4	10 <b>10</b>	mV
Load Regulation	$50mA \leq I_O \leq 1A$		7	10 <b>10</b>	mV
Dropout Voltage	$I_L = 100mA$ $I_L = 1A$		110	200/ <b>200</b>	mV
			0.5	0.8/ <b>1.0</b>	V
Output Impedance	100mADC, 20mArms, $f_O = 120Hz$		7		mΩ
Quiescent Current	$V_O + 2V \leq V_{IN} \leq 26V$ $I_O = 5mA$ $V_{IN} = V_O + 5V$ $I_O = 5mA$		10	15	mA
			30	45	mA
				<b>60</b>	mA
RMS Output Noise % Voltage Out	10Hz - 100kHz $I_O = 5mA$		0.003		%
Ripple Rejection	$f_O = 120Hz$ , 1 $V_{rms}$ $I_O = 100mA$		0.005	0.02 <b>0.04</b>	%V
Long Term Stability			0.4		%/1000Hr
ON/OFF Threshold ON	$I_O \leq 1A$		1.3	0.80/ <b>0.80</b>	V
ON/OFF Threshold OFF	$I_O \leq 1A$	2.00/ <b>2.00</b>	1.3		V
ON/OFF Threshold Current	$I_O \leq 1A$ $V_{ON/OFF} = 2.0V$		50	100/ <b>300</b>	V
Short Circuit Current		1.6	1.9		A
Maximum Line Transient	$R_O = 100\Omega$ $T \leq 100mS$	60	75		V
		<b>60</b>			
Reverse Polarity DC Input Voltage	$R_O = 100\Omega$	-15	-30		V
		<b>-15</b>	<b>-30</b>		
Reverse Polarity Transient Input Voltage	$R_O = 100\Omega$ $T \leq 100mS$	-50	-75		V
		<b>-50</b>			
Maximum Operating Input Voltage			31	26	V

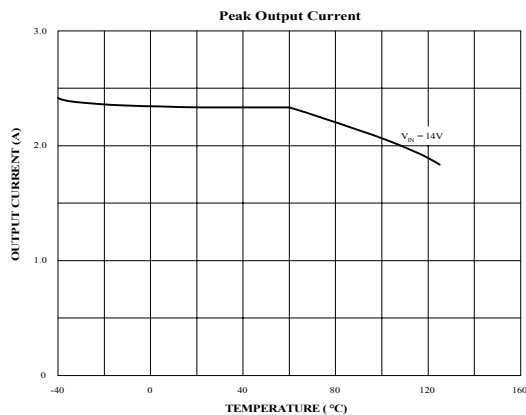
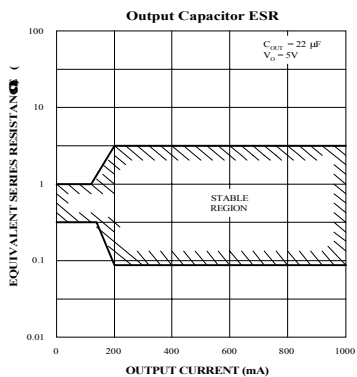
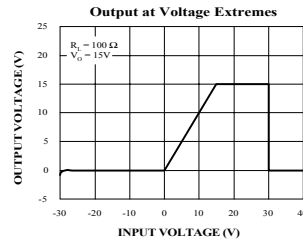
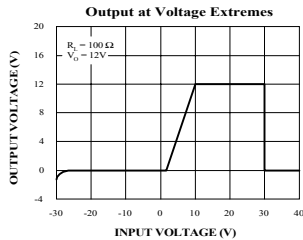
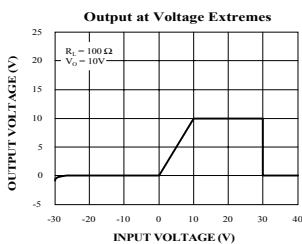
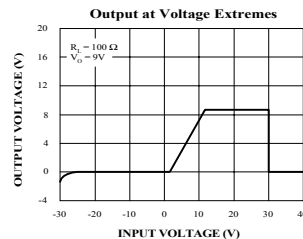
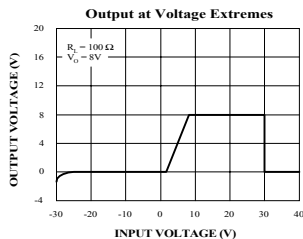
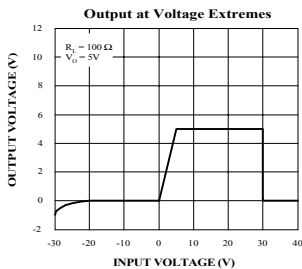
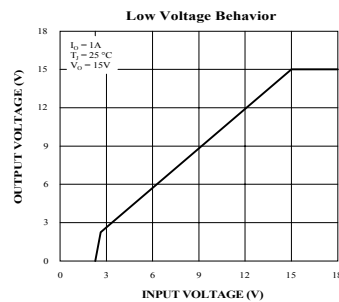
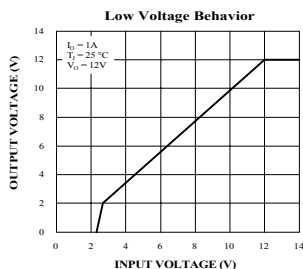
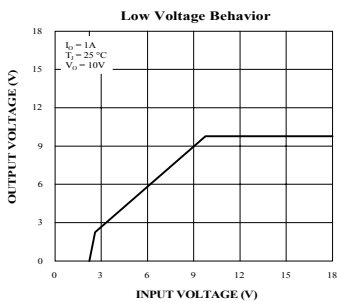
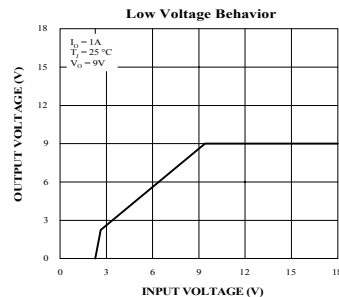
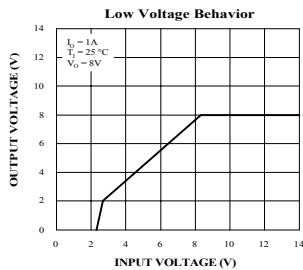
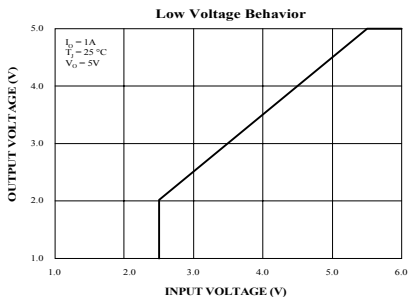
## ELECTRICAL CHARACTERISTICS $V_{IN} = V_O + 5V$ , $I_O = 1A$ , $C_O = 22 \mu F$ , unless otherwise specified.



## ELECTRICAL CHARACTERISTICS $V_{IN} = V_O + 5V$ , $I_O = 1A$ , $C_O = 22 \mu F$ , unless otherwise specified.



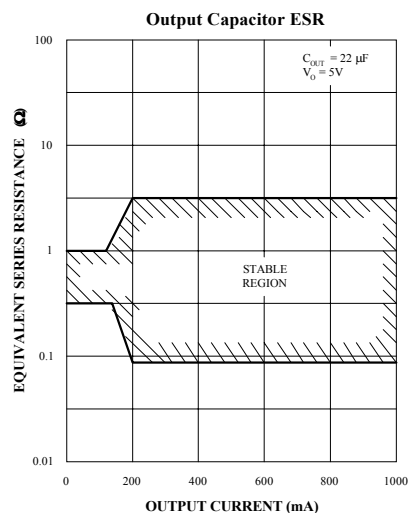
ELECTRICAL CHARACTERISTICS  $V_{IN} = V_O + 5V$ ,  $I_O = 1A$ ,  $C_O = 22 \mu F$ , unless otherwise specified.



## APPLICATION HINTS

### External Capacitors

A minimum capacitance of 22 $\mu$ F and conditions on ESR (Equivalent Series Resistance) must be met. The minimum value for the capacitance is 22 $\mu$ F and can be increased without limit. However the ESR may cause loop instability if it is too high or too low. The following graph shows the acceptable range for the ESR.



If the capacitor does not meet these requirements oscillation can result.

ESR is specified only at room temperature. Therefore the designer must ensure the proper behavior of the ESR over the temperature range. ESR, for electrolytic capacitor, will increase by about 30X as the temperature is reduced from 25°C to -40°C. Aluminum electrolytic capacitors are not well suited for low temperature operation.

Solid tantalum capacitors' ESR are more stable over temperature, but expensive. A cost-effective approach is then to put in parallel solid tantalum and aluminum electrolytic capacitors in the ratio 25/75%.

### Thermal Consideration

Although the SPX2941 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.

## ORDERING INFORMATION

Ordering No.	Output Voltage	Packages
SPX2941T5	Adj	5 Lead TO-263
SPX2941U5	Adj	5 Lead TO-220



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

Sipex Corporation reserves the right to make changes to any products described herein. Sipex does not assume any liability arising out of the application or use of any product or circuit described hereing; neither does it convey any license under its patent rights nor the rights of others.