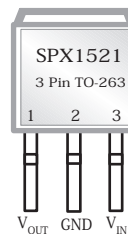


## 300mA Low Dropout Voltage Regulator

### FEATURES

- 1% Output Accuracy 3.3V, 5V, at 300mA Output
- Very Low Quiescent Current
- 0.3V (Typ.) Dropout Voltage at 300mA
- Extremely Tight Load and Line Regulation
- Current & Thermal Limiting
- Reverse Battery Protection
- Equivalent Replacement For LT1521



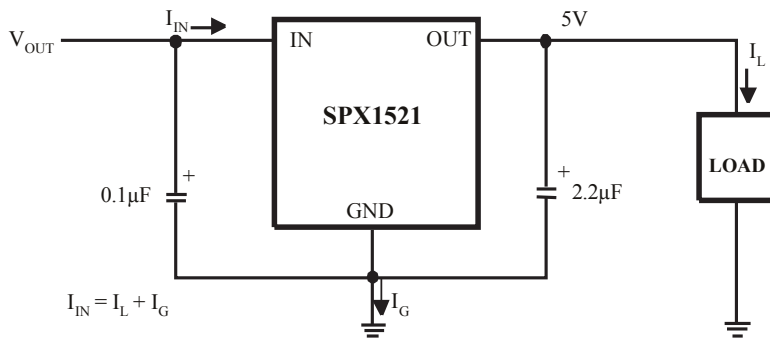
Now Available in Lead Free Packaging

### DESCRIPTION

The SPX1521 is a low power voltage regulator. This device is an excellent choice for use in battery-powered applications such as cordless telephones, radio control systems, and portable computers. The SPX1521 features very low quiescent current and very low dropout voltage. This includes a tight initial tolerance of  $\pm 1\%$  max, and very low output temperature coefficient, making the SPX1521 useful as a low-power voltage reference.

The SPX1521 is offered in 3 pin TO-252, SOT-223, TO-220 & TO-263 packages.

### TYPICAL APPLICATIONS CIRCUIT



## ABSOLUTE MAXIMUM RATINGS

Power Dissipation ..... Internally Limited  
 Lead Temp. (Soldering, 5 Seconds) ..... 260°C  
 Storage Temperature Range ..... -65°C to +150°C  
 Operating Junction Temperature Range ..... -40°C to +125°C  
 Input Supply Voltage ..... -20V to +20V

Shutdown Input Voltage ..... -0.6V to +6.5V  
 ESD Rating ..... 2kV Min

## ELECTRICAL CHARACTERISTICS

Electrical characteristics at  $V_{IN} = 6V$ ,  $I_O = 1mA$ ,  $C_{OUT} = 2.2\mu F$ ,  $T_A = 25^\circ C$ , unless otherwise specified.  
**Boldface** applies over the full operating temperature range.

PARAMETER	CONDITIONS (Note 2)	TYP	MIN	MAX	UNITS
<b>3.3V Version</b>					
Output Voltage	$1mA \leq I_L \leq 300mA$	3.3 <b>3.3</b>	3.267 <b>3.217</b>	3.333 <b>3.382</b>	V
Reverse Output Current	$V_{OUT} = 3.3V$ , $V_{IN} = 0V$	16		25	$\mu A$
<b>5.0V Version</b>					
Output Voltage	$1mA \leq I_L \leq 300mA$	5.0 <b>5.0</b>	4.950 <b>4.880</b>	5.050 <b>5.120</b>	V
Reverse Output Current	$V_{OUT} = 5.0V$ , $V_{IN} = 0V$	16		25	$\mu A$
<b>All Voltage Options</b>					
Output Voltage Temperature Coefficient	(Note1)	20		<b>100</b>	ppm/°C
Line Regulation	$6V \leq V_{IN} \leq 20V$ (Note 4)	1.5		<b>20</b>	mV
Load Regulation (Note 3)	$I_L = 1$ to 300mA	4		20 <b>30</b>	mV
Dropout Voltage (Note 5)	$I_L = 1mA$	0.13		0.17 <b>0.25</b>	V
	$I_L = 300mA$	0.30		0.55 <b>0.70</b>	
Ground Current	$I_L = 1mA$	<b>100</b>		<b>150</b>	$\mu A$
	$I_L = 10mA$	<b>350</b>		<b>500</b>	
	$I_L = 50mA$	<b>1.5</b>		<b>3</b>	mA
	$I_L = 100mA$	<b>2</b>		<b>6</b>	
	$I_L = 300mA$	<b>5</b>		<b>14</b>	
Current Limit	$V_{OUT} = 0$	330		<b>500</b>	mA
Ripple Rejection	$V_{IN} - V_{OUT} = 1V$ (Avg), $V_{RIPPLE} = 0.5V_{p-p}$ , $F_{RIPPLE} = 120Hz$ , $I_{LOAD} = 150mA$	58	50		dB
Input Reverse Leakage Current	$V_{IN} = -20V$ , $V_{OUT} = 0V$			<b>1.0</b>	mA

**Note 1:** Output or reference voltage temperature coefficients defined as the worst case voltage change divided by the total temperature range.

**Note 2:** Unless otherwise specified all limits are guaranteed for  $T_J = 25^\circ C$ ,  $V_{IN} = 6V$ ,  $I_L = 1mA$  and  $C_L = 2.2\mu F$ .

**Note 3:** Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specification for thermal regulation.

**Note 4:** Line regulation for the SPX1521 is tested at  $25^\circ C$  for  $I_L = 1mA$ . For  $T_J = 125^\circ C$ , line regulation is guaranteed by design.

**Note 5:** Dropout voltage is defined as the input to output differential at which the output voltage drops 100 mV below its nominal value measured at 1V differential.

## External Capacitors

The stability of the SPX1521 requires a 2.2 $\mu$ F or greater capacitor between output and ground. Oscillation could occur without this capacitor. Most types of tantalum or aluminum electrolytic works fine here. For operations of below -25°C solid tantalum is recommended since the many aluminum types have electrolytes that freeze at about -30°C. The ESR of about 5 $\Omega$  or less and resonant frequency above 500kHz are the most important parameters in the value of the capacitor. The capacitor value can be increased without limit.

The SPX1521, unlike other low dropout regulators will remain stable and in regulation with no load in addition to the internal voltage divider. This feature is especially important in applications like CMOS RAM keep-alive.

If there is more than 10 inches of wire between the input and the AC filter capacitor, or if a battery is used as the input, then a 0.1 $\mu$ F tantalum or aluminum electrolytic capacitor should be placed from the input to the ground.

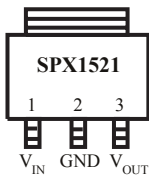
## Reducing Output Noise

It may be an advantage to reduce the AC noise present at the output. One way is to reduce the regulator bandwidth by increasing the size of the output capacitor. Increasing the capacitor from 1 $\mu$ F to 220 $\mu$ F only decreases the noise from 430 $\mu$ V to 160 $\mu$ Vrms for a 100kHz bandwidth at 5V output.

## PINOUTS

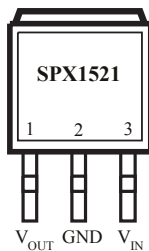
Note: Tab is connected to GND

SOT-223 (M3)



Top View

TO-263-3 (T)



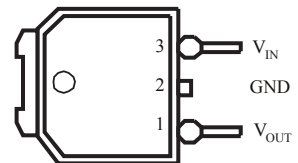
Top View

TO-220-3 (U)



Front View

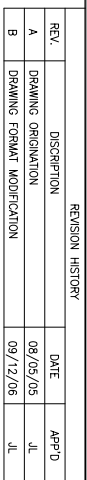
TO-252 (R)

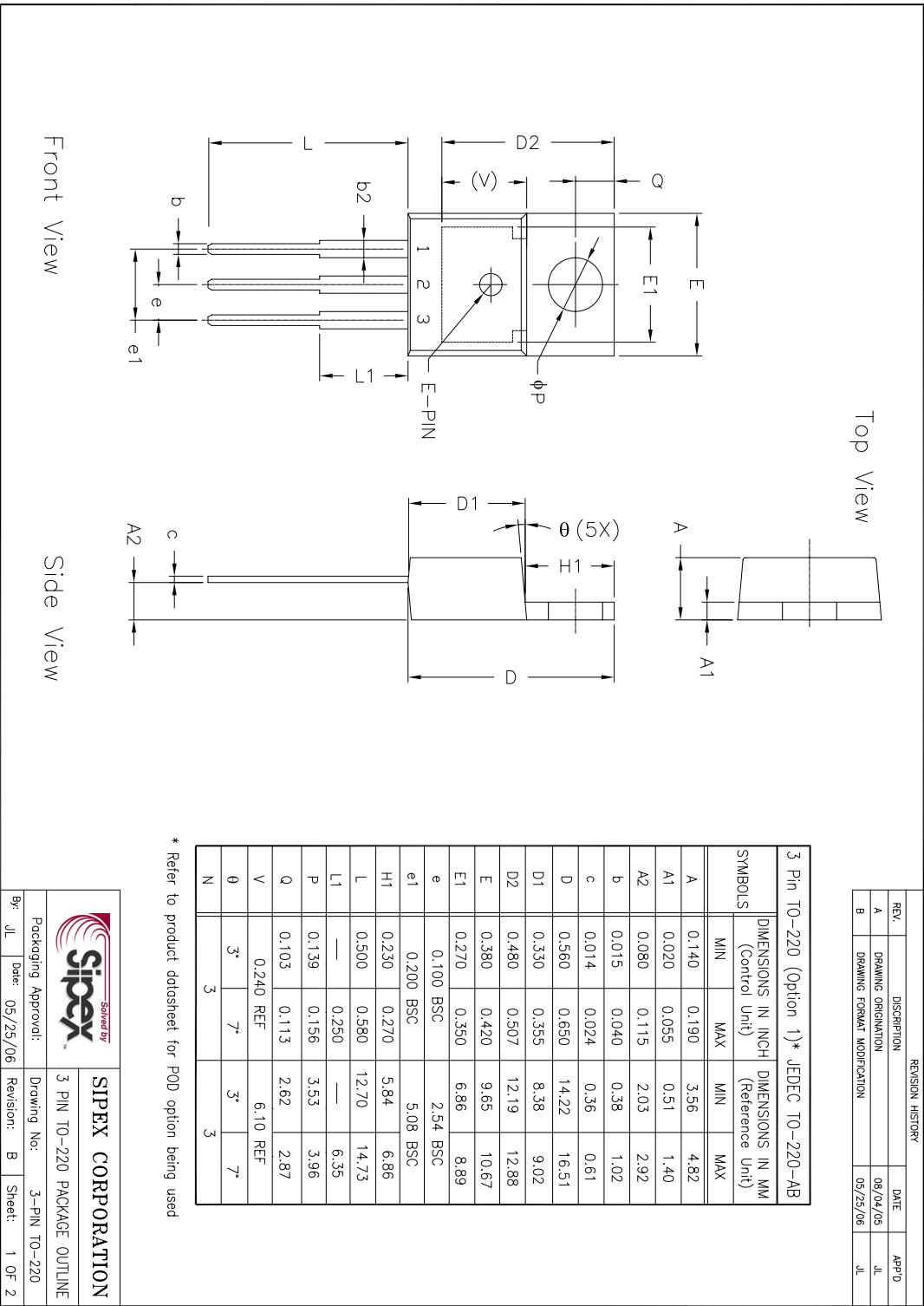


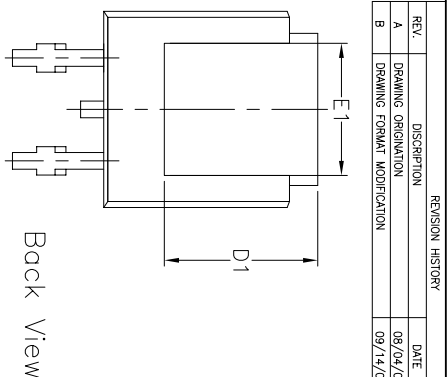
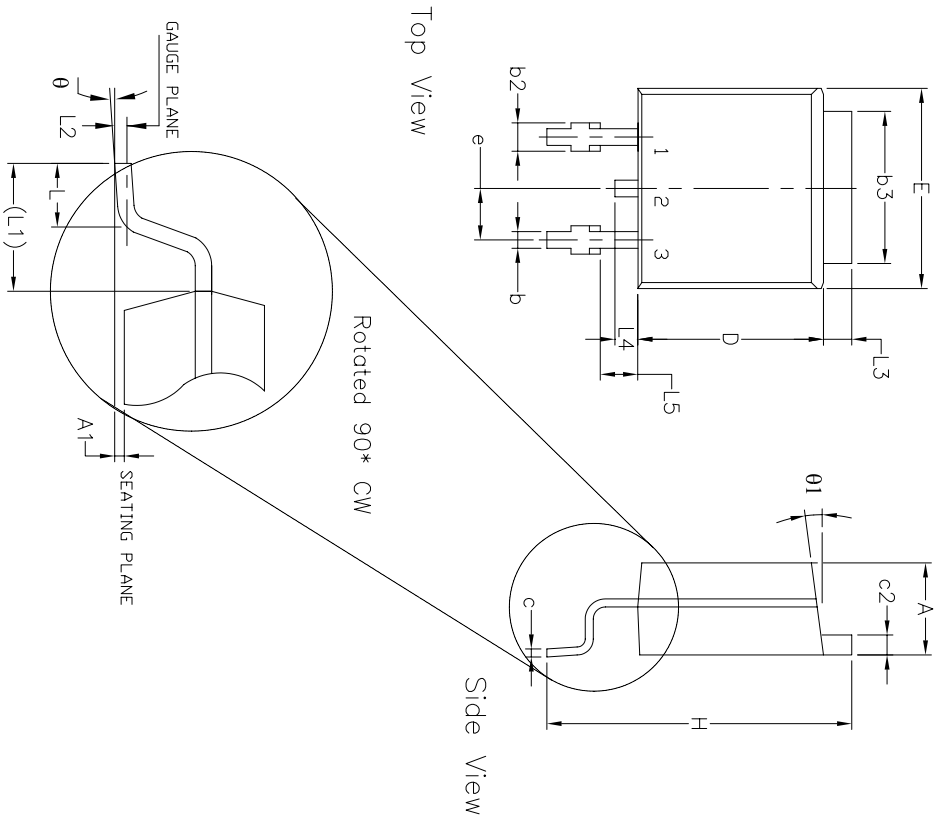
Front View

## Thermal Resistance (Theta JA)


SOT-223	-----62.3°C/W
TO-262	-----31.4°C/W
TO-220	-----29.4°C/W
TO-252	-----50.0°C/W

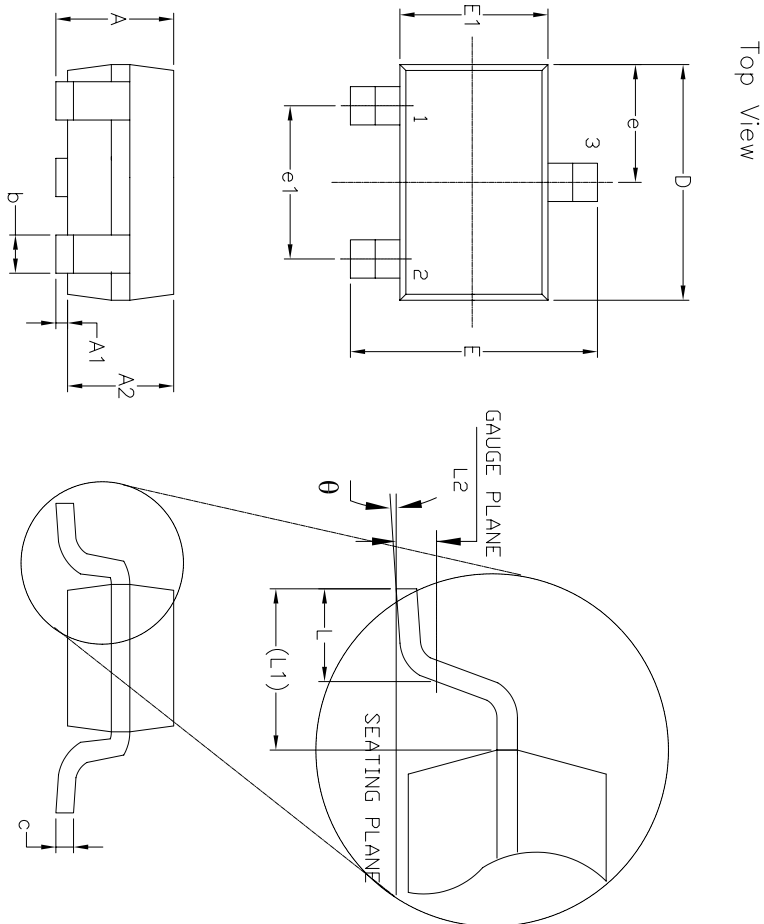






3 fm TO-252 JEDEC TO-252 Variation AA									
SYMBOLS	DIMENSIONS IN INCH (Control Unit)				DIMENSIONS IN MM (Reference Unit)				
	MIN	NOM	MAX		MIN	NOM	MAX		
A	0.086	—	0.094	2.18	—	—	2.39		
A1	—	—	0.005	—	—	—	0.13		
b	0.026	—	0.035	0.64	—	—	0.89		
b2	0.030	—	0.045	0.76	—	—	1.14		
b3	0.195	—	0.215	4.95	—	—	5.46		
c	0.018	—	0.024	0.46	—	—	0.61		
c2	0.018	—	0.035	0.46	—	—	0.89		
D	0.235	0.240	0.245	5.97	6.10	6.22			
D1	0.205	—	—	5.21	—	—			
E	0.250	—	0.265	6.35	—	—	6.73		
E1	0.170	—	—	4.32	—	—	—		
e	—	0.090 BSC	—	—	—	2.23 BSC	—		
H	0.370	—	0.410	9.40	—	—	10.41		
L	0.055	0.060	0.070	1.40	—	1.52	1.78		
L1	—	0.108 REF	—	—	—	2.74 REF	—		
L2	—	0.020 BSC	—	—	—	0.51 BSC	—		
L3	0.036	—	0.050	0.89	—	—	1.27		
L4	—	—	0.040	—	—	—	1.02		
U	0.045	—	0.060	1.14	—	—	1.52		
Ø	0"	—	10"	0"	—	—	10"		
Ø1	0"	—	15"	0"	—	—	15"		
N	—	3	—	—	—	3	—		

		<b>SIPEX CORPORATION</b>	
Drawing No. 3-PIN TO-252		3 PIN TO-252 PACKAGE OUTLINE	
Packaging Approval:		Revision: B	
By: JL Date: 09/14/06		Sheet: 1 OF 1	



REVISION HISTORY		
REV.	DISCRIPTION	APP'D
A	DRAWING ORIGINATION	JL
B	DRAWING FORMAT MODIFICATION	JL

3 Pin SOT-23 JEDEC TO-236 Variation AB									
SYMBOLS	DIMENSIONS IN MM (Control Unit)				DIMENSIONS IN INCH (Reference Unit)				
	MIN	NOM	MAX	MIN	NOM	MAX	MIN	MAX	
A	0.89	—	1.12	0.035	—	0.044	—	—	
A1	0.01	—	0.10	0.000	—	0.004	—	—	
A2	0.86	0.95	1.02	0.035	0.037	0.040	—	—	
b	0.30	—	0.50	0.012	—	0.020	—	—	
c	0.08	—	0.20	0.003	—	0.008	—	—	
D	2.80	2.90	3.04	0.110	0.114	0.120	—	—	
E	2.10	—	2.64	0.083	—	0.104	—	—	
ET	1.20	1.30	1.40	0.047	0.051	0.055	—	—	
e	0.95	BSC	—	—	0.038	BSC	—	—	
e1	1.90	BSC	—	—	0.075	BSC	—	—	
L	0.40	0.50	0.60	0.016	0.020	0.024	—	—	
L1	0.54	REF	—	—	0.021	REF	—	—	
L2	0.25	BSC	—	—	0.010	BSC	—	—	
θ	0°	—	8°	0°	—	8°	—	—	
N	3	—	—	—	3	—	—	—	

		<b>SIPEX CORPORATION</b>	
<b>Packaging Approval:</b>		<b>3 PIN SOT-23 PACKAGE OUTLINE</b>	
<b>By:</b> JL	<b>Date:</b> 07/25/06	<b>Drawing No:</b> 3-PIN SOT-23	
<b>Revision:</b> B	<b>Sheet:</b> 1 OF 1		

Part Number	Accuracy	Output Voltage	Package
SPX1521M3-3-3	1%	3.3V	3-Pin SOT-223
SPX1521M3-3-3/TR	1%	3.3V	3-Pin SOT-223
SPX1521M3-5-0	1%	5.0V	3-Pin SOT-223
SPX1521M3-5-0/TR	1%	5.0V	3-Pin SOT-223
SPX1521R-3-3	1%	3.3V	3-Pin TO-252
SPX1521R-3-3/TR	1%	3.3V	3-Pin TO-252
SPX1521R-5-0	1%	5.0V	3-Pin TO-252
SPX1521R-5-0/TR	1%	5.0V	3-Pin TO-252
SPX1521T-3-3	1%	3.3V	3-Pin TO-263
SPX1521T-3-3/TR	1%	3.3V	3-Pin TO-263
SPX1521T-5-0	1%	5.0V	3-Pin TO-263
SPX1521T-5-0/TR	1%	5.0V	3-Pin TO-263
SPX1521U-3-3	1%	3.3V	3-Pin TO-220
SPX1521U-5-0	1%	5.0V	3-Pin TO-220

Available in lead free packaging. To order add "-L" suffix to part number.

Example: SPX1521T-3-3/TR = standard; SPX1521T-L-3-3/TR = lead free

/TR = Tape and Reel

Pack quantity is 500 for TO-263; 2,000 for TO-252; and 2,500 for SOT-223.

TO-220 is not available in Tape & Reel.



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