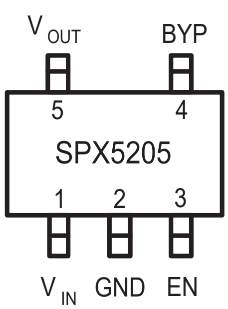
SPX5205

150mA, Low-Noise LDO Voltage Regulator

Description

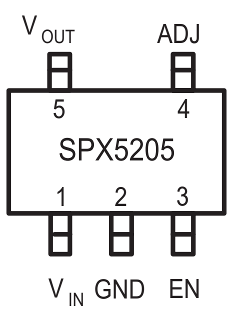
The SPX5205 is a positive voltage regulator with very low dropout voltage, output noise and ground current (750µA at 100mA). V_{OUT} has a tolerance of less than 1% and is temperature compensated. Fixed output voltages 1.8V, 3.0V, 3.3V, and 5.0V and an adjustable version are available in a small 5-pin SOT-23 package. Other key features include zero off-mode current, reverse battery protection, thermal shutdown and current limit. The SPX5205 is an excellent choice for use in batterypowered applications, and where power conservation is desired such as: cellular/ cordless telephones, radio control systems and portable computers.

Top View



Fixed Output Voltage

Top View



Adjustable Output Voltage

FEATURES

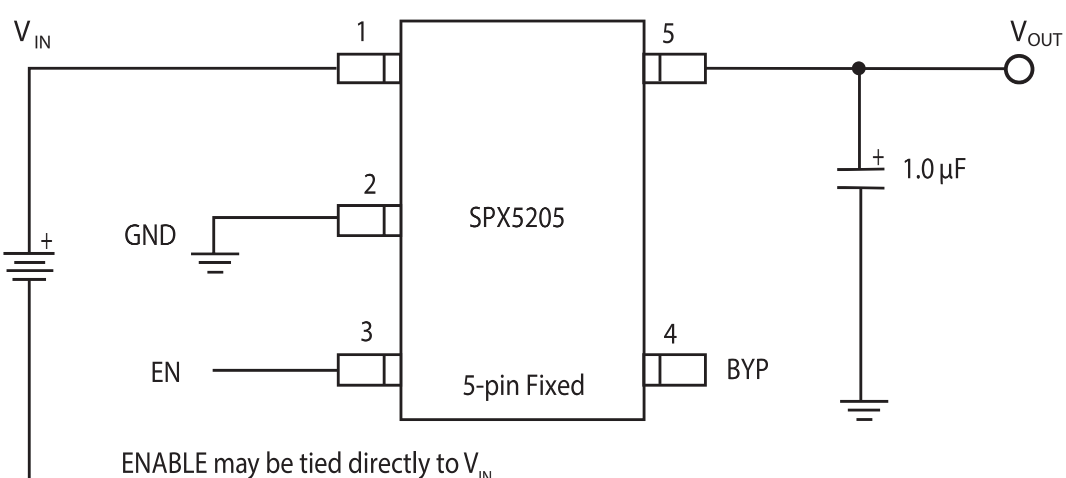
- Low Noise Output LDO: 40µVRMS Possible
- 1% Initial Accuracy
- Very Low Quiecent Current: 70µA
- Low Dropout Voltage (210mV at 150mA)
- Current and Thermal Limiting
- Reverse-Battery Protection
- Wide Range of Fixed Output Voltages: 1.8V, 3.0V, 3.3V and 5.0V
- Zero Off-Mode Current
- Small 5-Pin SOT-23
- Pin Compatible to MIC5205/MAX8877 (fixed options only) and LP2985

APPLICATIONS

- PDA
- Battery Powered Systems
- Cellular Phone
- Cordless Telephones
- Radio Control Systems
- Laptop, Palmtop and Notebook Computers
- Portable Consumer Equipment
- Portable Instrumentation
- Bar Code Scanners
- SMPS Post-Regulator

Ordering Information - Back Page

Typical Applications Circuit



TOP View

Absolute Maximum Ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

Thermal Shutdown .... Internally limited

Lead Temperature (Soldering, 5 seconds) ....260˚C

Input Supply Voltage .... -20V to +20V

Enable Input Voltage .... -20V to +20V

Recommended Operating Conditions

Input Supply Voltage .... +2.5V to +16V

Operating Junction Temperature Range ....-40˚C to +125˚C

Enable Input Voltage ....0V to V_{IN}

SOT-23-5 (θ_{JA}) .... See Note 1

Electrical Characteristics

T_J = 25°C, V_{IN} = V_{OUT} + 1V, I_L = 100µA, C_L = 1µF, and V_{ENABLE} ≥ 2.4V. The "•" denotes the specifications which apply over full junction temperature range -40°C to +125°C, unless otherwise specified.

PARAMETER	MIN.	TYP.	MAX.	UNITS	•	CONDITIONS
Output voltage tolerance (V_{OUT})	-1		+1	$\%V_{NOM}$		
	-2		+2		•	
Output voltage temperature coefficient		57		ppm/°C	•	
Line regulation		0.03	0.1	%/V		V_{IN} = V_{OUT} + 1 to 16V and V_{EN} ≤ 6V
			0.2		•	V_{IN} = V_{EN} = V_{OUT} + 1 ≤ 8V
			0.2			V_{IN} = V_{EN} = V_{OUT} + 1 to 16V T_A = 25°C to 85°C
Load regulation		0.1	0.2	%		V_{IN} = V_{OUT} + 1 ≥ 2.5V
			0.5		•	I_L= 1mA to 150mA
			1.0		•	I_L= 100µA to 1mA
Dropout voltage(2) (V_{IN} - V_O)		30	50	mV		I_L= 100µA
			70		•	
		140	190	mV		I_L= 50mA
			230		•	
		180	250	mV		I_L= 100mA
			300		•	
		210	275	mV		I_L= 150mA
			350		•	
Quiescent current (I_{GND})		0.05	1	µA		V_{ENABLE} ≤ 0.4V
			5		•	V_{ENABLE} ≤ 0.25V
Ground pin current (I_{GND})		70	125	µA		I_L= 100µA
			150		•	
		350	600	µA		I_L= 50mA
			800		•	
		750	1000	µA		I_L= 100mA
			1500		•	
		1300	1900	µA		I_L= 150mA
			2500		•	

Electrical Characteristics (Continued)

T_J = 25°C, V_{IN} = V_{OUT} + 1V, I_L = 100µA, C_L = 1µF, and V_{ENABLE} ≥ 2.4V. The "•" denotes the specifications which apply over full junction temperature range -40°C to +125°C, unless otherwise specified.

PARAMETER	MIN.	TYP.	MAX.	UNITS	•	CONDITIONS
Ripple rejection		70		dB		
Current limit (I_{LIMIT})		360	500	mA		V_{OUT} = 0V
Output noise (e_{NO})		300		µV_{RMS}		I_L = 10mA, C_L = 1µF, C_{IN} = 1µF (10Hz - 100kHz)
		40				I_L = 10mA, C_L = 10µF, C_{BYP} = 1µF, C_{IN} = 1µF (10Hz - 100kHz)
Input voltage level logic low (V_{IL})			0.4	V		OFF
Input voltage level logic high (V_{IL})	2.0			V		ON
Enable input current		0.01	2	µA		V_{IL} ≤ 0.4V
		3	20			V_{IH} ≥ 2.0V

NOTE:

1. The maximum allowable power dissipation is a function of maximum operating junction temperature, $T_{J(max)}$, the junction to ambient thermal resistance, and the ambient θ_{JA}, and the ambient temperature T_A. The maximum allowable power dissipation at any ambient temperature is given: $P_{D(max)} = (T_{J(max)} - T_A) / \theta_{JA}$, exceeding the maximum allowable power limit will result in excessive die temperature; thus, the regulator will go into thermal shutdown. The θ_{JA} of the SPX5205 is 220°C/W mounted on a PC board.
2. Not applicable to output voltages of less than 2V.

Typical Performance Characteristics

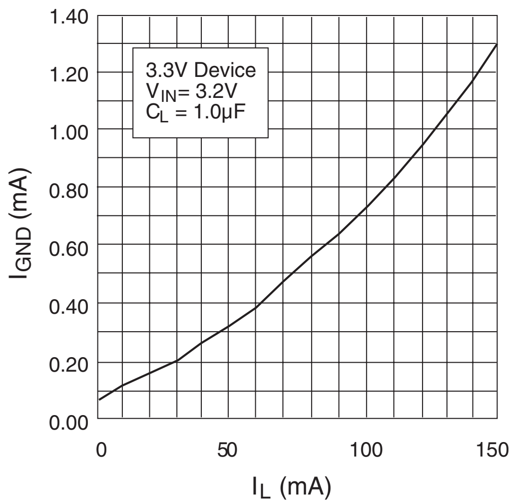


Figure 1. Ground Current vs. Load Current

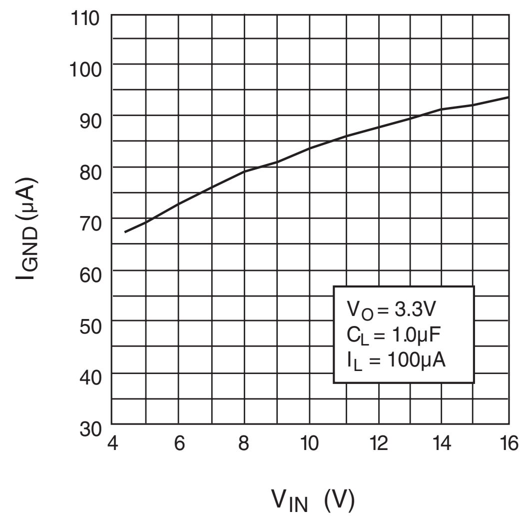


Figure 2. Ground Current vs. Input Voltage

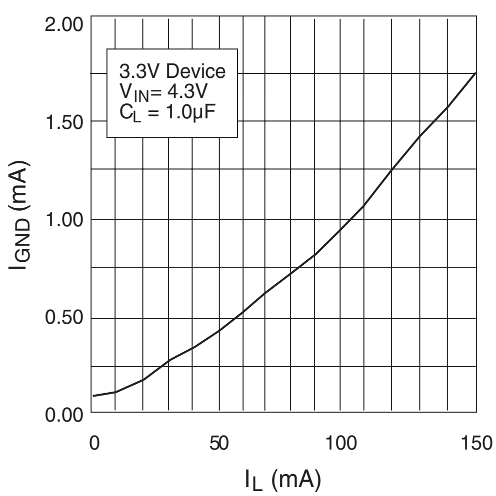


Figure 3. Ground Current vs. Load Current in Dropout

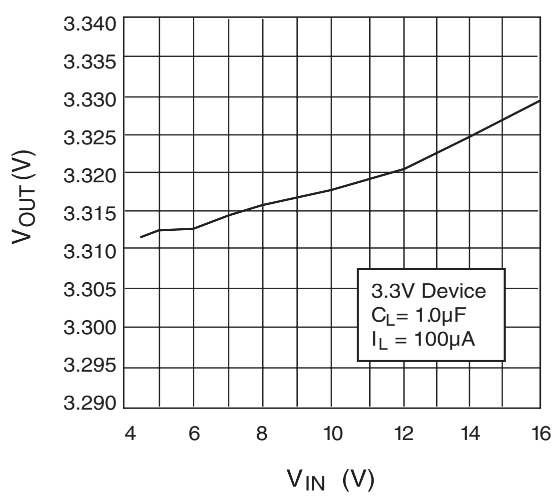


Figure 4. Output Voltage vs. Input Voltage

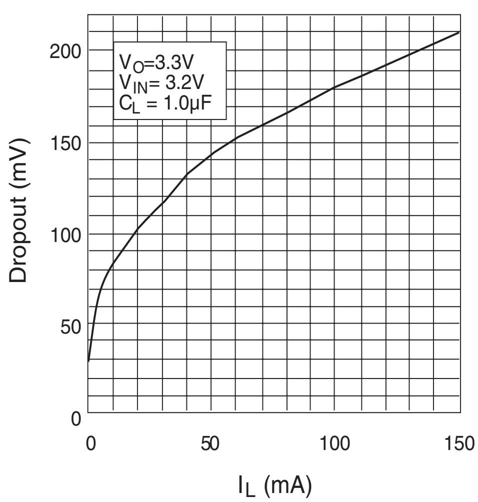


Figure 5. Dropout Voltage vs. Load Current

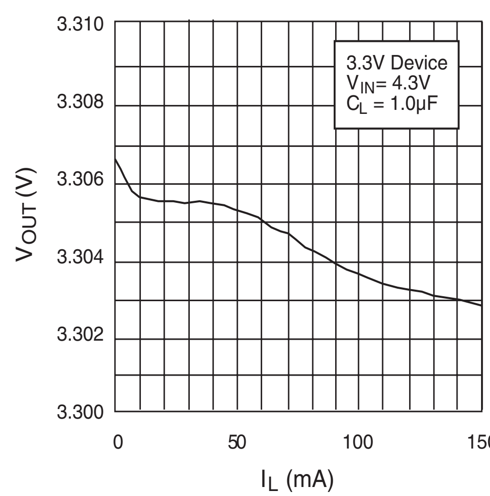


Figure 6. Output Voltage vs. Load Current

Typical Performance Characteristics (Continued)

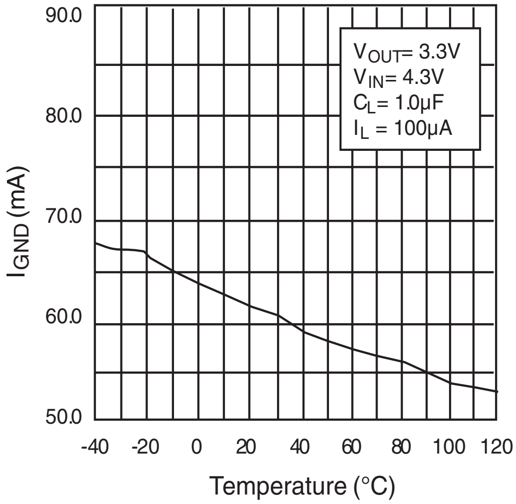


Figure 7. Ground Current vs. Temperature at I_{LOAD} = 100µA

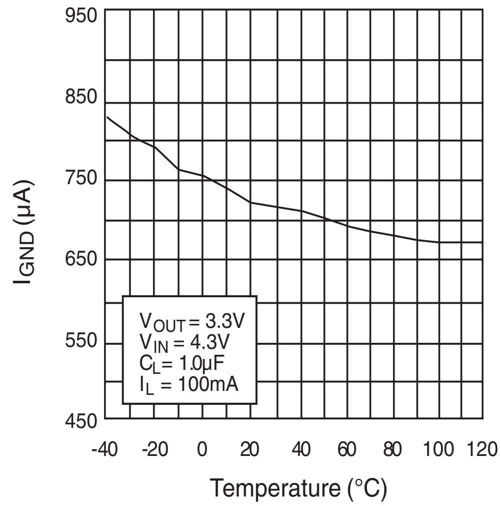


Figure 8. Ground Current vs. Temperature at I_{LOAD} = 100mA

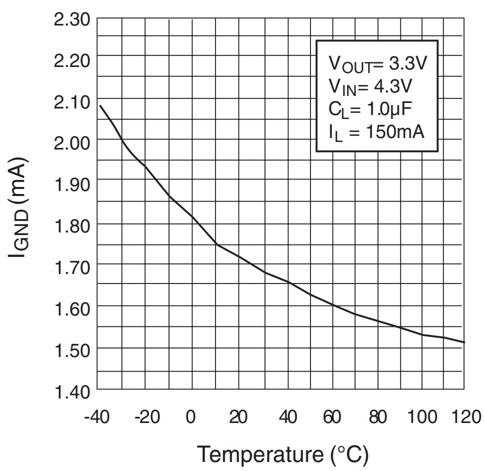


Figure 9. Ground Current in Dropout vs. Temperature

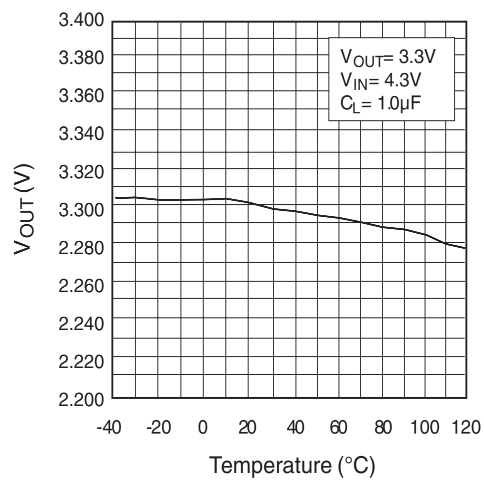


Figure 10. Output Voltage vs. Temperature

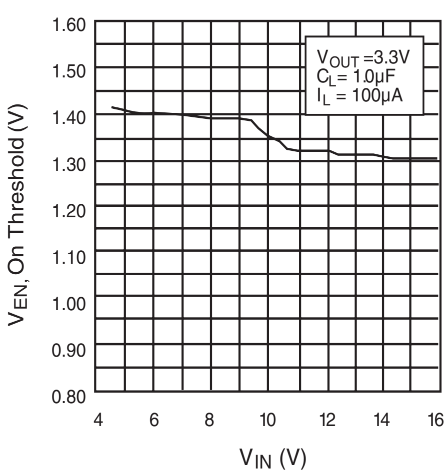


Figure 11. ENABLE Voltage, ON Threshold vs. Input Voltage

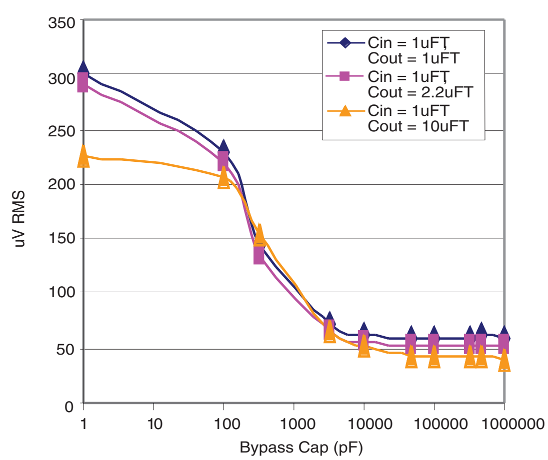


Figure 12. Output Noise vs. Bypass Capacitor Value

Application Information

The SPX5205 requires an output capacitor for device stability. Its value depends upon the application circuit. In general, linear regulator stability decreases with higher output currents. In applications where the SPX5205 is putting out less current, a lower output capacitance may be sufficient. For example, a regulator sourcing only 10mA, requires approximately half the capacitance as the same regulator sourcing 150mA.

Bench testing is the best method for determining the proper type and value of the capacitor since the high frequency characteristics of electrolytic capacitors vary widely, depending on type and manufacturer. A high quality 2.2µF aluminum electrolytic capacitor works in most application circuits, but the same stability often can be obtained with a 1µF tantalum electrolytic.

With the SPX5205 adjustable version, the minimum value of output capacitance is a function of the output voltage. The value decreases with higher output voltages, since closed loop gain is increased.

Typical Applications Circuits

A 10nF capacitor on the BYP pin will significantly reduce output noise but it may be left unconnected if the output noise is not a major concern. The SPX5205 start-up speed is inversely proportional to the size of the BYP capacitor. Applications requiring a slow ramp-up of the output voltage should use a larger C_{BYP}. However, if a rapid turn-on is necessary, the BYP capacitor can be omitted.

The SPX5205's internal reference is available through the BYP pin.

The Typical Application Circuit shown on page 1 represents a SPX5205 standard application circuit. The EN (enable) pin is pulled high (>2.0V) to enable the regulator. To disable the regulator, EN < 0.4V.

The SPX5205 in Figure 13 illustrates a typical adjustable output voltage configuration. Two resistors (R1 and R2) set the output voltage. The output voltage is calculated using the formula:

$$V_{OUT} = 1.235V \times (1 + R1/R2)$$

R2 must be >10 kΩ, and for best results, R2 should be between 22 kΩ and 47kΩ.

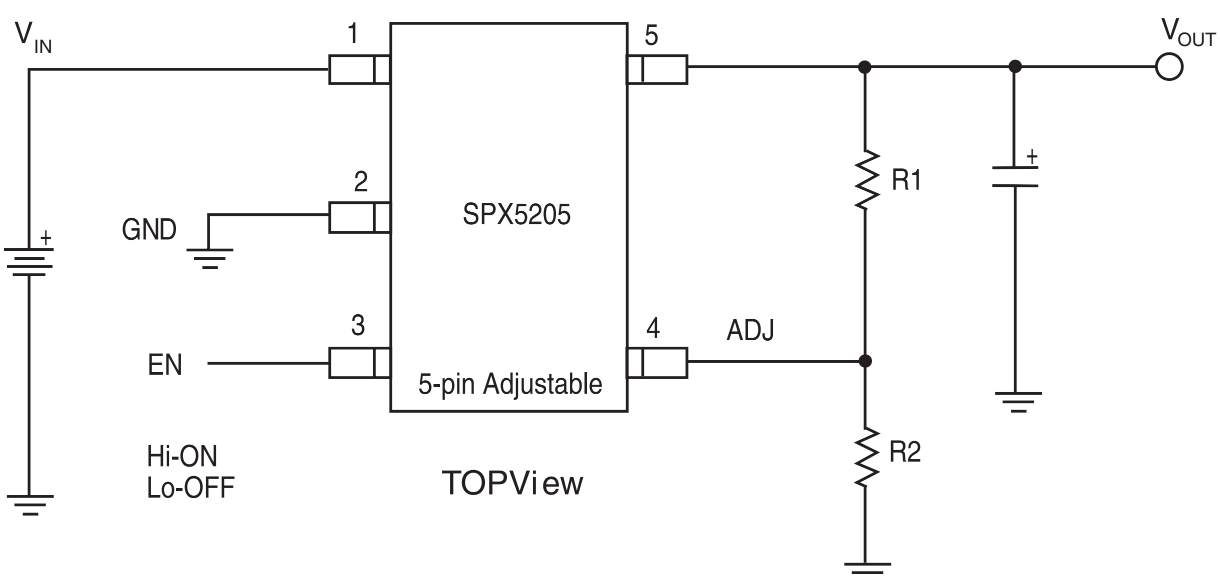
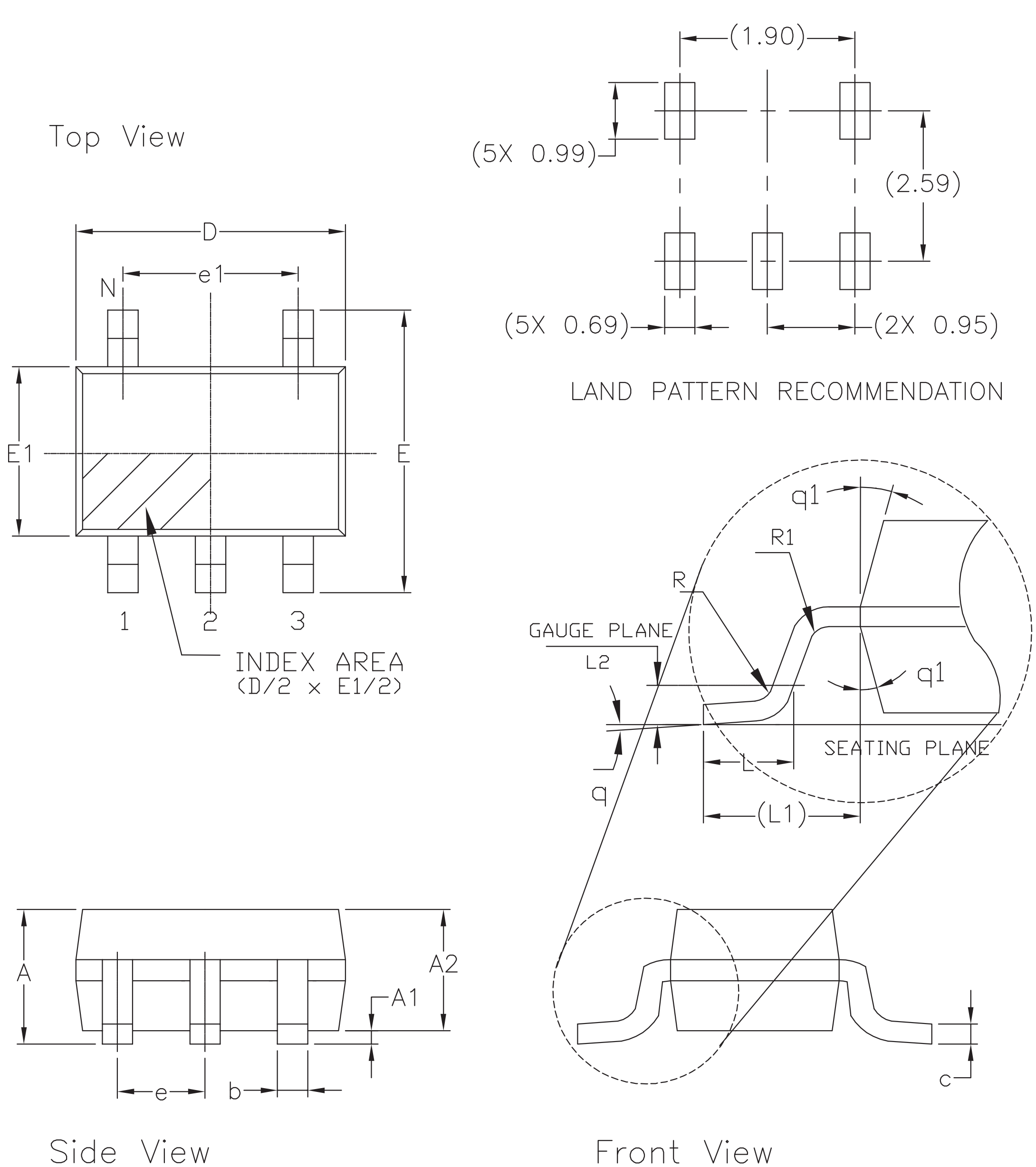


Figure 13. Typical Adjustable Output Voltage

Mechanical Dimensions

SOT-23-5

FOR REFERENCE ONLY



5 Pin SOT–23 JEDEC MO–178 Variation AA						
SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	1.45	—	—	0.057
A1	0.00	—	0.15	0.000	—	0.006
A2	0.90	1.15	1.30	0.036	0.045	0.051
b	0.30	—	0.50	0.012	—	0.020
c	0.08	—	0.22	0.003	—	0.009
D	2.90 BSC			0.115 BSC		
E	2.80 BSC			0.111 BSC		
E1	1.60 BSC			0.063 BSC		
e	0.95 BSC			0.038 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024
L1	0.60 REF			0.024 REF		
L2	0.25 BSC			0.010 BSC		
R	0.10	—	—	0.004	—	—
R1	0.10	—	0.25	0.004	—	0.010
q	0°	4°	8°	0°	4°	8°
q1	5°	10°	15°	5°	10°	15°
N	5			5		

Drawing No: POD–00000025
Revision: B

Ordering Information(1)

Part Number	Operating Temperature Range	Lead-Free	Package	Packaging Method	Accuracy	Output Voltage
SPX5205M5-L/TR	-40°C ≤ T_J ≤ 125°C	Yes(2)	5-pin SOT-23	Tape and Reel	1%	Adjustable
SPX5205M5-L-1-8/TR						1.8V
SPX5205M5-L-3-0/TR						3.0V
SPX5205M5-L-3-3/TR						3.3V
SPX5205M5-L-5-0/TR						5.0V

NOTE:
1. Refer to www.exar.com/SPX5205 for most up-to-date Ordering Information.
2. Visit www.exar.com for additional information on Environmental Rating.

Revision History

Revision	Date	Description
K	--	Sipex / Exar legacy datasheet
L	8/31/18	Update to MaxLinear logo. Update format and Ordering Information. Added Figure numbers. Corrected C_L unit in Figure 11. Updated Typical Application Circuit on page 1 and Figure 13 to differentiate between fixed and adjustable versions. Updated last paragraph of Typical Applications Circuits section. Updated temperature at top of Electrical Characteristics.

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