SPX5205

150 mA, Low-Noise LDO Voltage Regulator
(Preliminary Information)

FEATURES
- Low Noise Output LDO
- 1% Initial Accuracy At 150mA
- Very Low Quiescent Current
- Low Dropout Voltage (210mV At 150mA)
- Current & Thermal Limiting
- Reverse-Battery Protection
- Wide Range of Fix Output Voltages
  1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 4.0V, 4.5V, & 5.0V
- Zero Off-Mode Current
- Small 5-Pin SOT-23
- Pin Compatible to MIC5205/MAX8877 (Fixed Option Only)

APPLICATIONS
- PDA
- Battery Powered Systems
- Cellular Phone
- Cordless Telephones
- Radio Control Systems
- Portable/Palm Top/Notebook Computers
- Portable Consumer Equipment
- Portable Instrumentation
- Bar Code Scanners
- SMPS Post-Regulator

PRODUCT DESCRIPTION
The SPX5205 is an excellent choice for use in battery-powered applications, and where power conservation is desired. Such as: cellular/ cordless telephones, radio control systems, and portable computers.

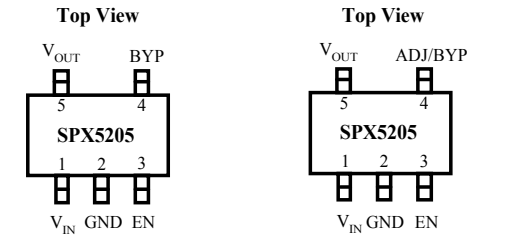
This device is a positive voltage regulator with very low dropout voltage and low output noise. It uses very little quiescent current of 750 µA at 100 mA output load. V_{OUT} tolerance is less than 1% with a compensated temperature coefficient. Many fixed output voltages, as listed below, or an adjustable version are available in a small 5-pin SOT-23 package.

Other key features include: Zero off-mode current, protection against reversed battery, thermal and current limiting.

MARKING INFORMATION

Voltage	Marking	Voltage	Marking
1.8	R1XX	4.0	R7XX
2.5	R2XX	4.5	R8XX
2.8	R3XX		
3.0	R5XX	5.0	RBXX
3.3	R6XX	ADJ	RCXX

PIN CONNECTIONS



Fixed Output Voltage **Adjustable Output Voltage**

ABSOLUTE MAXIMUM RATINGS

Thermal Shutdown ..... Internally Limited
Lead Temp. (Soldering, 5 Seconds) ..... 260°C
Operating Junction Temperature Range ..... -40°C to +125°C
Input Supply Voltage..... -20V to +20V
Enable Input Voltage..... -20V to +20V

RECOMMENDED OPERATING CONDITIONS

Input 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

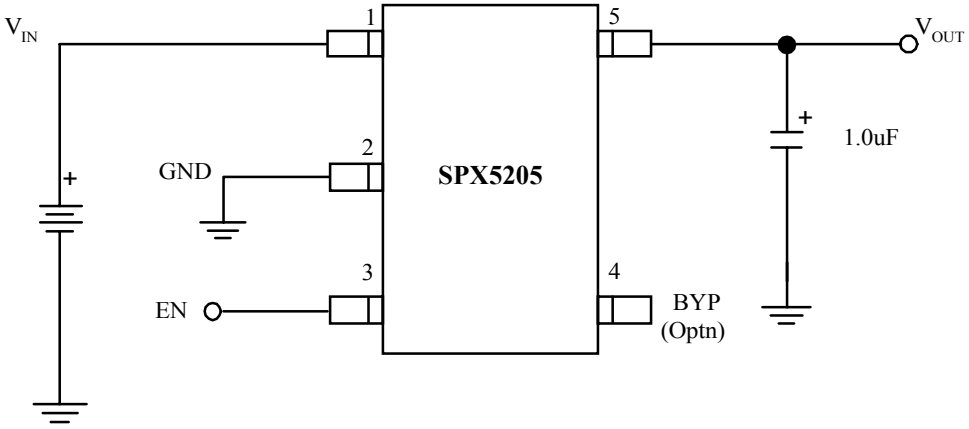
ELECTRICAL CHARACTERISTICS

T_J = 25°C, $V_{IN} = V_{OUT} + 1V$, I_L = 100µA, C_L = 1µF, and $V_{ENABLE} \geq 2.4V$. Unless otherwise specified **boldface** applies over the junction temperature range

Parameter	Test Conditions	Typ	Min	Max	Units
Output Voltage Tolerance (V_{OUT})	I_L = 100 µA I_L = 500 µA		-1 **-2**	+1 **+2**	$\%V_{NOM}$
Output Voltage Temperature Coefficient		**57**			ppm/°C
Line Regulation	$V_{IN} = V_{OUT}$ + 1V to 16V $V_{IN} = V_{OUT}$ + 1V to 16V	0.03		0.1 **0.2**	%/V
Load Regulation	I_L = 0.1mA to 150mA I_L = 0.1mA to 150mA	0.1		0.2 **0.5**	%
Dropout Voltage (See Note 2) (V_{IN} - V_O)	I_L = 100 µA	30		50 **70**	mV
	I_L = 50 mA	140		190 **230**	
	I_L = 100 mA	180		250 **300**	
	I_L = 150 mA	210		275 **350**	
Quiescent Current (I_{GND})	$V_{ENABLE} \leq 0.6V$ $V_{ENABLE} \leq 0.25V$	< 1		1 **5**	µA
Ground Pin Current (I_{GND})	I_L = 100 µA	80		125 **150**	µA
	I_L = 50 mA	350		600 **800**	
	I_L = 100 mA	750		1000 **1500**	
	I_L = 150 mA	1300		1900 **2500**	
Ripple Rejection (PSRR)		55			dB
Current Limit (I_{LIMIT})	V_{OUT} = 0V	360		500	mA
Output Noise (e_{NO})	I_L = 50mA, C_L = 1µF 10Hz – 100Khz.)	390			μV_{RMS}
Input Voltage Level Logic Low (V_{IL})	OFF			0.6	V
Input Voltage Level Logic High (V_{IL})	ON		2.0		
ENABLE Input Current	$V_{IL} \leq 0.6V$ $V_{IH} \geq 2.0V$	0.01 2		2 20	µA

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.
Note 2: Not apply to 1.8V version.

TYPICAL APPLICATION



ENABLE may be tied directly to V_{IN}

Application Hints

The SPX5205 requires an output capacitor for device stability. The value required varies greatly depending upon the application circuit. The high frequency characteristics of electrolytic capacitors depend greatly on the type and also on the manufacturer. Sometimes bench testing is the only means to determine the proper capacitor type and value. The high quality 2.2µF aluminum electrolytic capacitor covers all general application circuits; this stability can be obtained with a tantalum electrolytic value of 1µF.

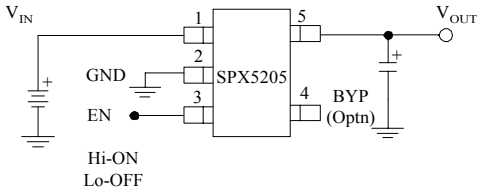
In general, linear regulator stability decreases with higher output currents. In most applications the SPX5205 is operating at few milliamps. In these applications the output capacitance can be further reduced. For example, when the regulator is running at 10mA output current the output capacitance value is half compared to the same regulator that is running at 150mA.

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

Typical Applications Circuits

The SPX5205 provides access to the internal reference. A 10µF capacitor on the BYP pin will provide a significant reduction in output noise. This pin 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 this capacitor. Applications requiring a slow ramp-up of output voltage should consider larger values of C_{BYP}. If the rapid turn-ON is necessary, omit bypass capacitor.

Figure 1 shows SPX5205 standard application circuit. The EN pin is pulled high (>2.0V) to enable the regulator. To disable the regulator, EN < 0.6V.

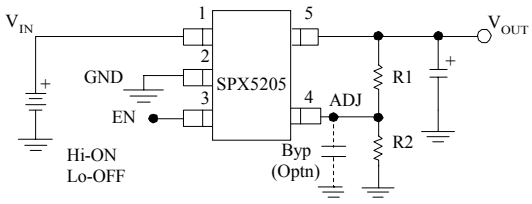


Top View **Fig. 1**

The SPX5205 in figure 2 shows adjustable output voltage configuration. Two resistors set the output voltage. The formula for output voltage is:

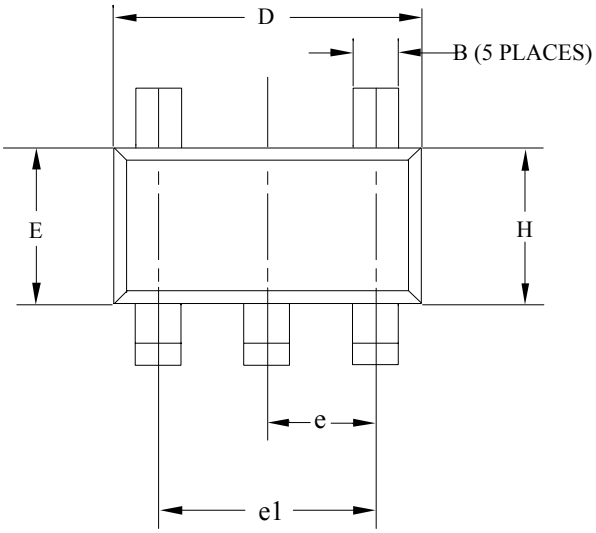
$$V_{OUT} = 1.235 \times \left(1 + \frac{R1}{R2}\right)$$

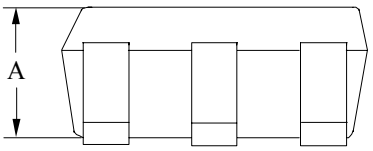
Resistor values are not critical as the ADJ pin has high input impedance, for best results use resistors of 47kΩ or less. A capacitor from ADJ to ground will provide improved noise performance.

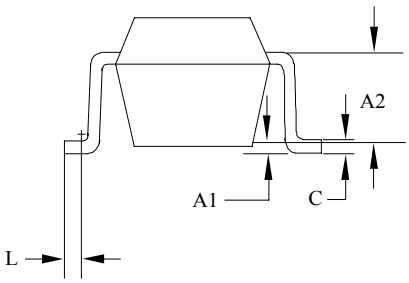


Top View **Fig. 2**

PACKAGE DRAWING
SOT-23-5L (M5)



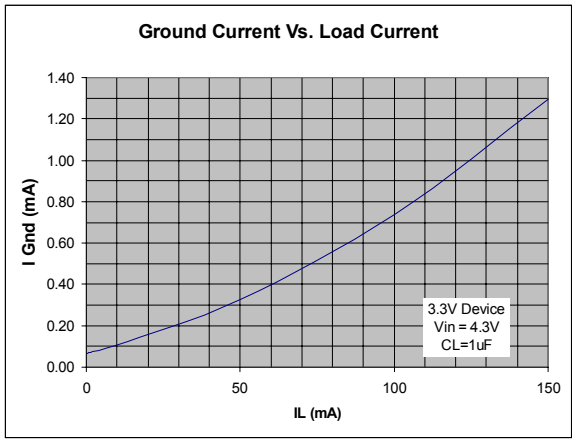


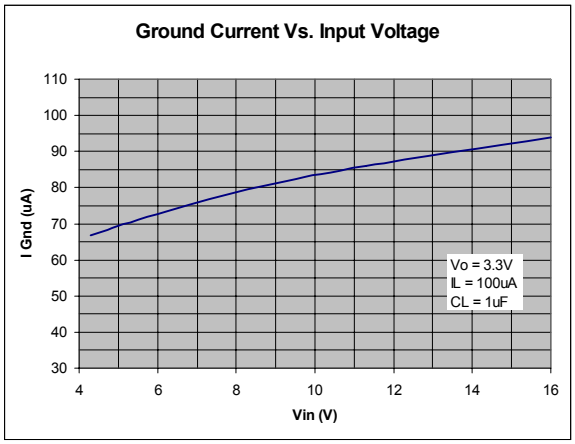


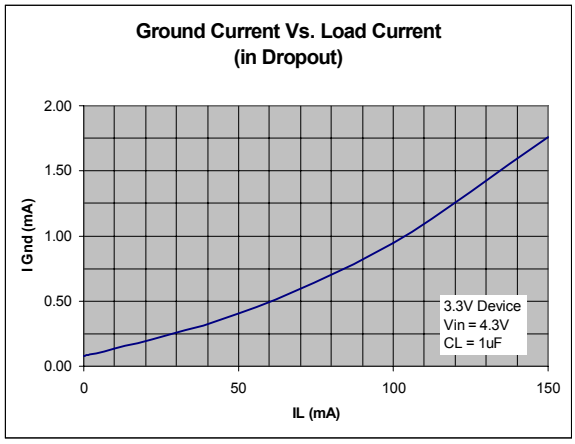
SYMBOL	MILLIMETERS			INCHES	
	MIN.	MAX		MIN.	MAX.
A	0.90	1.30		.035	.051
A1	0	0.10		0	.004
A2	0.80 REF			.0315 REF	
B	0.30	0.50		.012	.019
C	0.10	0.35		.004	.0137
D	2.70	3.10		.106	.122
E	1.40	1.80		.055	.071
e	0.95 BSC.			.037 BSC.	
e1	1.70	2.10		.066	.082
H	2.50	3.00		.098	.118
L	MIN 0.2			MIN .0078	

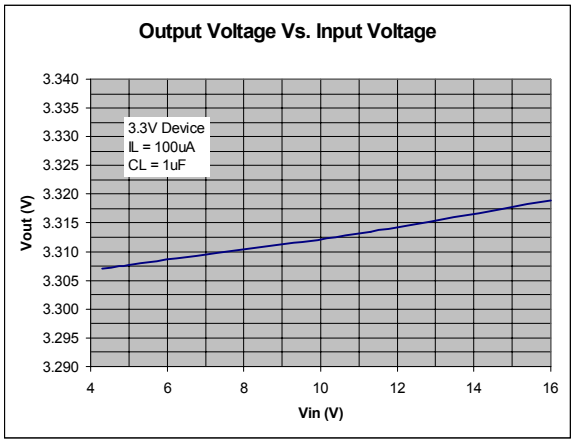
NOTE:

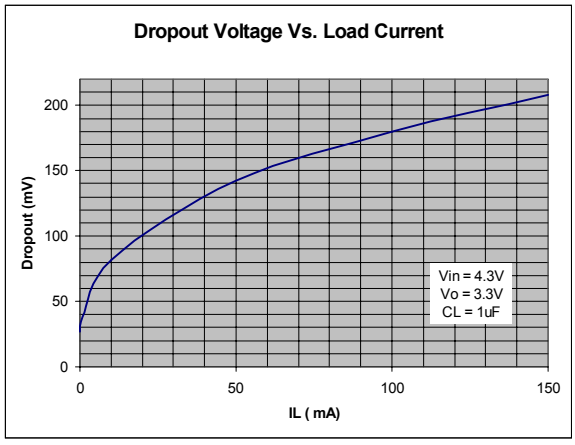
1. REFER TO APPLICABLE
2. CONTROLLING DIMENTION : MILLIMETER
3. PACKAGE SURFACE FINISHING TO BE SMOOTH FINISH.

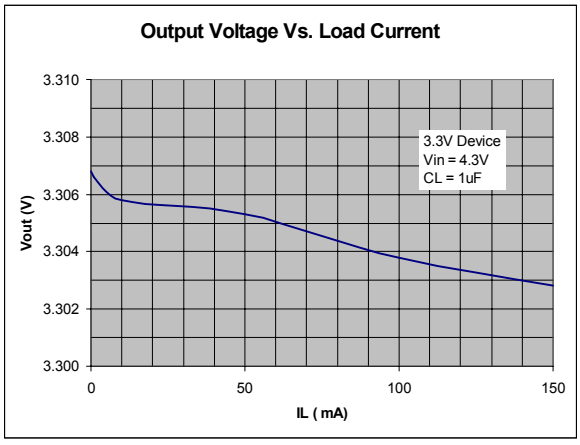

Ground Current Vs. Load Current
I Gnd (mA)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
50
100
150
IL (mA)
3.3V Device
Vin = 4.3V
CL=1uF

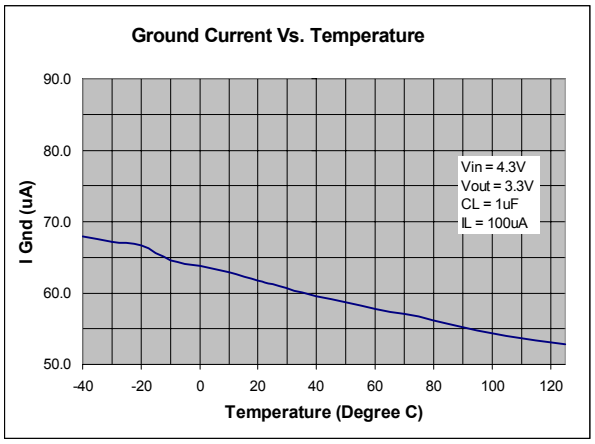

Ground Current Vs. Input Voltage
I Gnd (uA)
110
100
90
80
70
60
50
40
30
4
6
8
10
12
14
16
Vin (V)
Vo = 3.3V
IL = 100uA
CL = 1uF

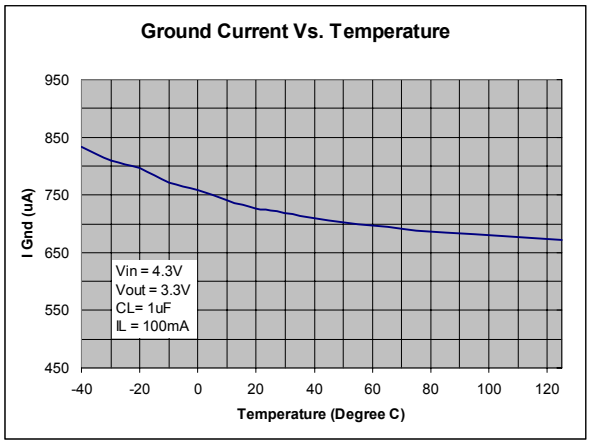

Ground Current Vs. Load Current
(in Dropout)
I Gnd (mA)
2.00
1.50
1.00
0.50
0.00
0
50
100
150
IL (mA)
3.3V Device
Vin = 4.3V
CL = 1uF

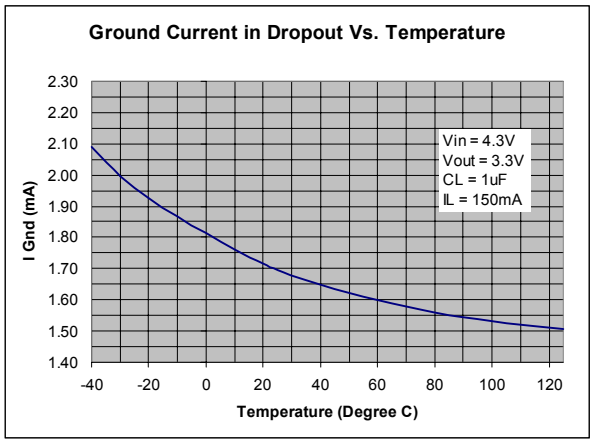

Output Voltage Vs. Input Voltage
Vout (V)
3.340
3.335
3.330
3.325
3.320
3.315
3.310
3.305
3.300
3.295
3.290
4
6
8
10
12
14
16
Vin (V)
3.3V Device
IL = 100uA
CL = 1uF

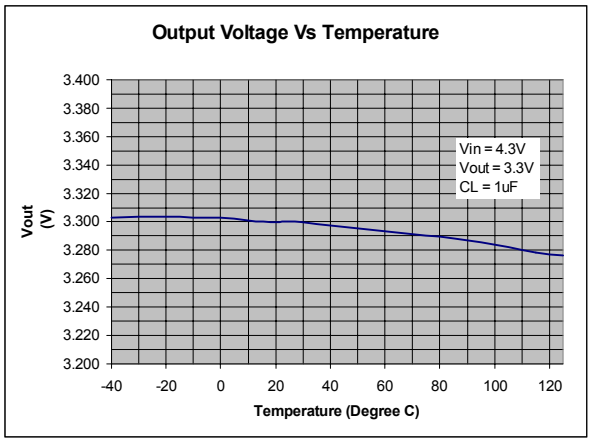

Dropout Voltage Vs. Load Current
Dropout (mV)
200
150
100
50
0
0
50
100
150
IL (mA)
Vin = 4.3V
Vo = 3.3V
CL = 1uF

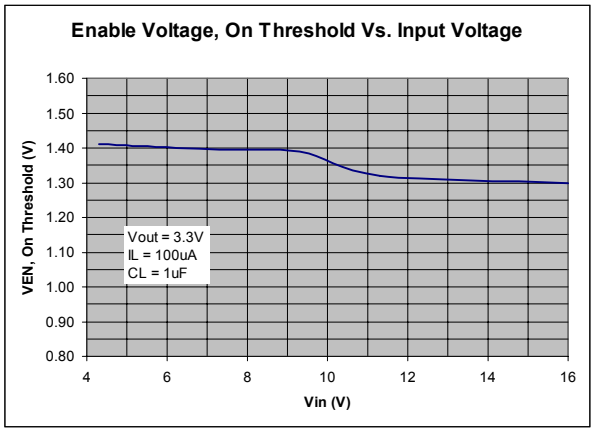

Output Voltage Vs. Load Current
Vout (V)
3.310
3.308
3.306
3.304
3.302
3.300
0
50
100
150
IL (mA)
3.3V Device
Vin = 4.3V
CL = 1uF

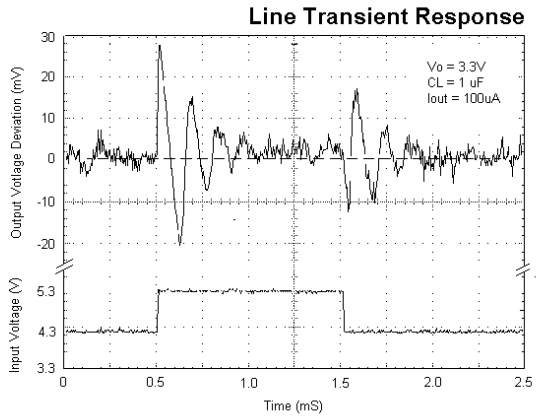

Ground Current Vs. Temperature
I Gnd (uA)
90.0
80.0
70.0
60.0
50.0
-40 -20 0 20 40 60 80 100 120
Temperature (Degree C)
Vin = 4.3V
Vout = 3.3V
CL = 1uF
IL = 100uA

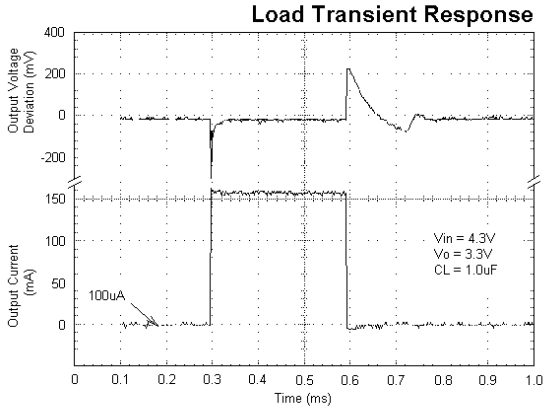

Ground Current Vs. Temperature
I Gnd (uA)
950
850
750
650
550
450
-40 -20 0 20 40 60 80 100 120
Temperature (Degree C)
Vin = 4.3V
Vout = 3.3V
CL= 1uF
IL = 100mA

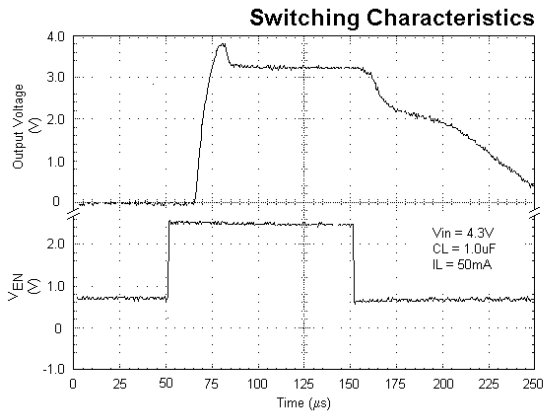

Ground Current in Dropout Vs. Temperature
I Gnd (mA)
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
-40 -20 0 20 40 60 80 100 120
Temperature (Degree C)
Vin = 4.3V
Vout = 3.3V
CL = 1uF
IL = 150mA


Output Voltage Vs Temperature
Vout (V)
3.400
3.380
3.360
3.340
3.320
3.300
3.280
3.260
3.240
3.220
3.200
-40 -20 0 20 40 60 80 100 120
Temperature (Degree C)
Vin = 4.3V
Vout = 3.3V
CL = 1uF


Enable Voltage, On Threshold Vs. Input Voltage
VEN, On Threshold (V)
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
4 6 8 10 12 14 16
Vin (V)
Vout = 3.3V
IL = 100uA
CL = 1uF


Line Transient Response
Vo = 3.3V
CL = 1 uF
Iout = 100uA
Output Voltage Deviation (mV)
Input Voltage (V)
Time (mS)


Load Transient Response
Output Voltage Deviation (mV)
Output Current (mA)
100uA
Vin = 4.3V
Vo = 3.3V
CL = 1.0uF
Time (ms)


Switching Characteristics
Output Voltage (V)
VEN (V)
Vin = 4.3V
CL = 1.0uF
IL = 50mA
Time (µs)

ORDERING INFORMATION

Ordering No.	Output Voltage	Packages
SPX5205M5	Adj	5 Lead SOT-23
SPX5205M5-1.8	1.5V	5 Lead SOT-23
SPX5205M5-2.5	2.5V	5 Lead SOT-23
SPX5205M5-2.8	2.8V	5 Lead SOT-23
SPX5205M5-3.0	3.0V	5 Lead SOT-23
SPX5205M5-3.3	3.3V	5 Lead SOT-23
SPX5205M5-4.0	4.0V	5 Lead SOT-23
SPX5205M5-4.5	4.5V	5 Lead SOT-23
SPX5205M5-5.0	5.0V	5 Lead SOT-23

Sipex Corporation

SIGNAL PROCESSING EXCELLENCE

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