SiP2211

Vishay Siliconix

Dual Output 150/300-mA Low Dropout Regulator

DESCRIPTION

SiP2211 is a dual output low dropout regulator capable of supplying 150 mA from output 1 and 300 mA from output 2. The SiP2211 has the outputs independently enabled. Also the SiP2211 offers a low dropout, low ground current and extremely low noise with the addition of a bypass capacitor.

Protection features include undervoltage lockout, output current limit, and thermal shutdown.

The Fixed output version of SiP2211 is available in a lead (Pb)-free MLP33-10 PowerPAK package and the adjustable version is available in a lead (Pb)-free MLP44-16 PowerPak package. Both packages ares specified to operate over the range of - 40 °C to 85 °C.

FEATURES

- 2.25 V to 5.5 V Input Voltage Range
- Two Outputs - 150 mA and 300 mA
- Low Ground Current of 48 μA
- Low Dropout Voltage of 65 mV at 100 mA
- Current Limit
- Thermal Shutdown
- MLP33-10 PowerPAK® Package (Fixed Output)
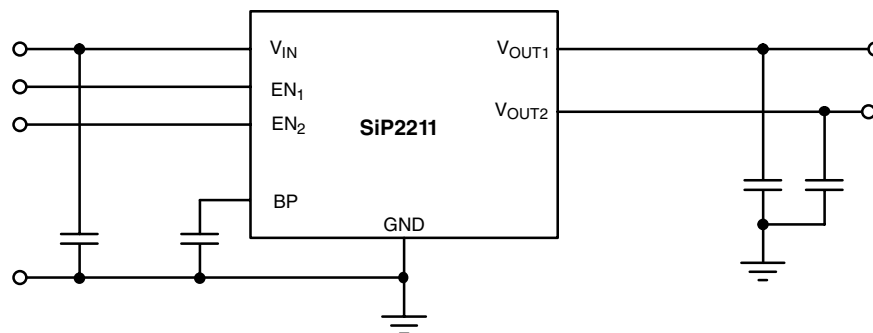- MIC2211 Pin for Pin Replacement

APPLICATIONS

- Cellular Phones
- Wireless Modems
- PDAs

RoHS
COMPLIANT

TYPICAL APPLICATION CIRCUIT

SiP2211

Vishay Siliconix

VISHAY.

ABSOLUTE MAXIMUM RATINGS

Parameter		Limit	Unit
V_{IN}, V_{EN}, to GND		- 0.3 to 7	V
Power Dissipation	MLP33-10 PowerPAK[b]	1600	mW
	MLP44-16 PowerPAK[c]	1880	
Storage Temperature		- 55 to 150	°C
Thermal Resistance (MLP10 PowerPAK)		50	°C/W

Notes:

a. Device Mounted with all leads soldered or welded to PC board.

b. Derate 20 mW/°C above 70 °C.

c. Derate 23.5 mW/°C above 70 °C.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING RANGE

Parameter	Limit	Unit
Input Voltage Range	2.25 to 5.5	V
Enable Voltage Range	0 to 5.5	
Operating Temperature Range T_A	- 40 to 85	°C
Operating Temperature Range T_J	- 40 to 125	

SPECIFICATIONS

Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = V_{OUT} + 1\ V^e$, C_{OUT} 1 µF, I_{OUT} = 100 µA, T_A = 25 °C	Temp[a]	Min[b]	Typ[c]	Max[b]	Unit
Regulators							
Output Voltage Accuracy		From Nominal V_{OUT}	Room	- 1		1	%
			Full	- 2		2	
Output Voltage Temperature Coefficient			Room		40		ppm/°C
Line Regulation[e]		$V_{IN} = V_{OUT} + 1\ V$ to 5.5 V	Room	- 0.3	0.2	0.3	%
			Full	- 0.6		0.6	
Load Regulation		I_{OUT} = 100 µA to 150 mA (LDO 1 and 2)	Room		0.2	1.0	
		I_{OUT} = 100 µA to 300 mA (LDO 2)	Room			1.5	
Dropout Voltage[f]	V_{DROP}	I_{OUT} = 150 mA (LDO 1 and 2)	Room		120	190	mV
			Full			250	
		I_{OUT} = 300 mA (LDO 2)	Room		240	340	
			Full			420	
Ground Pin Current	I_G	$I_{OUT1} = I_{OUT2}$ = 0 µA	Room		48	65	µA
		$I_{OUT1} = I_{OUT2}$ = 0 µA	Full			80	
		I_{OUT1} = 150 mA, I_{OUT2} = 300 mA	Room		60		
		V_{EN} < 0.4 V	Full			2.0	
Sequence Time Delay[d]	t_{SEQ}		Room		70		µs
Output Voltage Noise		C_{BP} = 0.01 µF			30		µVrms
Ripple Rejection		f = 1 kHz, C_{OUT} = 1 µF, C_{BP} = 10 nF	Room		60		dB
		f = 20 kHz, C_{OUT} = 1 µF, C_{BP} = 10 nF	Room		40		
Inputs							
EN Input Voltage	V_{IL}	Logic Low	Full			0.6	V
	V_{IH}	Logic High	Full	1.8			
EN Input Current	I_{IL}	V_{IL} < 0.6 V	Room	- 1	0.01	1	µA
	I_{IH}	V_{IH} > 1.8 V	Room	- 1	0.01	1	

SiP2211

Vishay Siliconix

SPECIFICATIONS

Parameter	Symbol	Test Conditions Unless Specified $V_{IN} = V_{OUT} + 1$ V[e], C_{OUT} 1 μF, $I_{OUT} = 100$ μA, $T_A = 25$ °C	Temp[a]	Limits			Unit
				Min[b]	Typ[c]	Max[b]	
Protection							
Current Limit	I_{IL}	$V_{OUT1} = 0$ V	Room	150	280	460	mA
		$V_{OUT1} = 0$ V	Room	300	450	700	
Thermal Shutdown Temperature			Room		165		°C
Thermal Hysteresis			Room		25		

Notes:

a. Room = 25 °C, Full = - 40 to 85 °C.

b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum.

c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

d. Timing is measured from 90 % of LDO #1's final value to 90 % of LDO #2's final value.

e. For higher output of the regulator pair.

f. Dropout voltage is defined as the input to output differential voltage at which the output voltage drops 2 % below the output voltage measured with a 1 V differential, provided that V_{IN} does not drop below 2.25 V. When $V_{OUT(nom)}$ is less than 2.25 V, the output will be in regulation when 2.25 V - $V_{OUT(nom)}$ is greater than the dropout voltage specified.

FUNCTIONAL BLOCK DIAGRAM
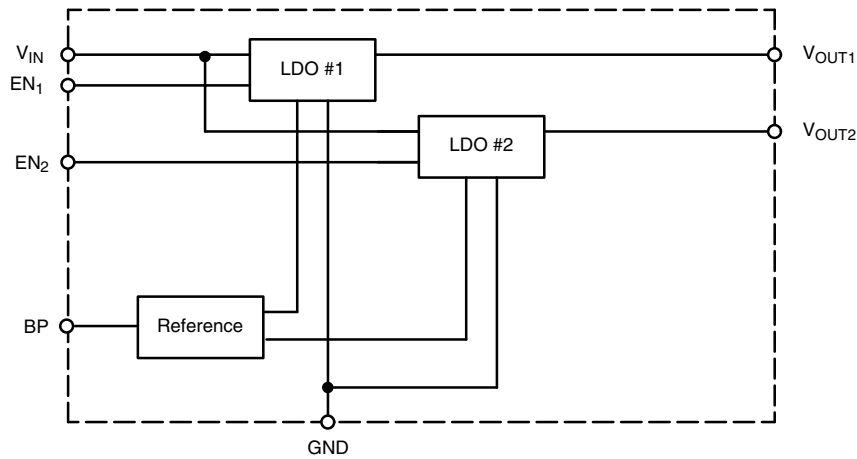
Fixed Voltage Version
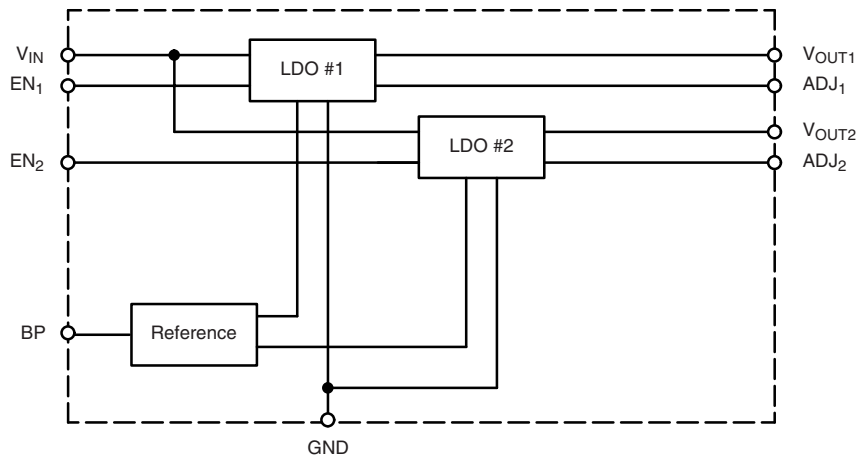
Adjustable Voltage Version
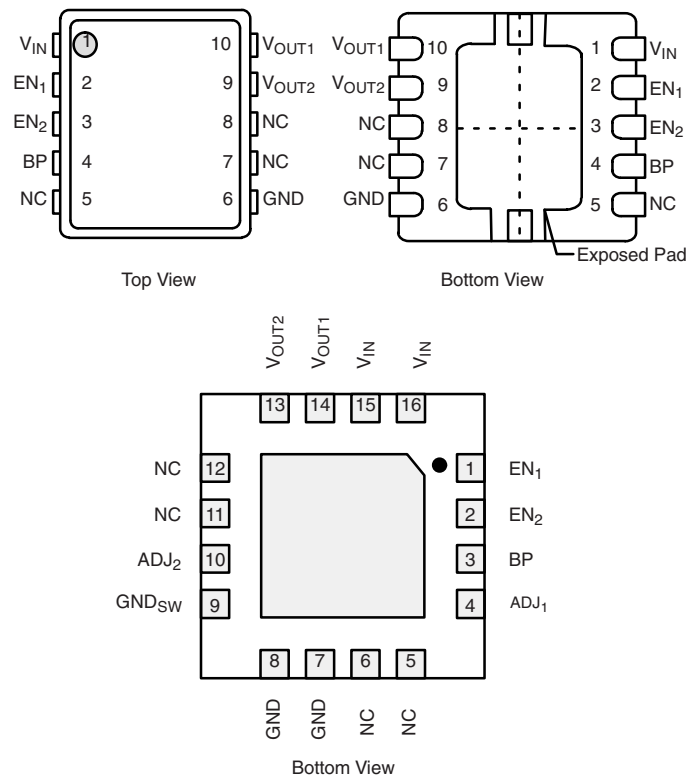
SiP2211

Vishay Siliconix

VISHAY

PIN CONFIGURATION AND ORDERING INFORMATION

PowerPAK MLP33-10 with Large Pad

Top View

Bottom View

Bottom View

VOLTAGE OPTIONS	
Voltage	**Code (x, Z)**
Adj	A
1.5	F
1.6	W
1.8	G
1.85	D
1.9	Y
2.0	H
2.1	E
2.5	J
2.6	K
2.7	L
2.8	M
2.85	N
2.9	O
3.0	P
3.1	Q
3.2	R
3.3	S
3.4	T
3.5	U
3.6	V

ORDERING INFORMATION

Part Number	Temp Range	Package	Marking
SiP2211DMP-XZ-E3	- 40 to 85 °C	PowerPAK MLP33-10	11XZ
SiP2211DLP-AA-E3		PowerPAK MLP44-16	11AA

X: Output 1 voltage code
Z: Output 2 voltage code

PIN DESCRIPTION

| Pin Number		Name	Function
MLP33-10	**MLP44-16**		
1	15, 16	V_{IN}	Input voltage for the power MOSFETs and their gate drive
2	1	EN_1	Enables LDO #1 output
	6	NC	No Connection
3	2	EN_2	Enables LDO #2 output
4	3	BP	Bypass for noise reduction
	4	ADJ_1	Feedback connection for LDO #1
5	5	NC	No Connection
6	7, 8	GND	Ground
	9	GND_{SW}	Ground for the internal N-Channel MOSFET switch
	10	ADJ_2	Feedback connection for LDO #2
7	11	NC	No Connection
8	12	NC	No Connection
9	13	V_{OUT2}	Output of LDO #2 - 300 mA
10	14	V_{OUT1}	Output of LDO #1 - 150 mA

The exposed pad on both packages must be connected externally to the GND pin.
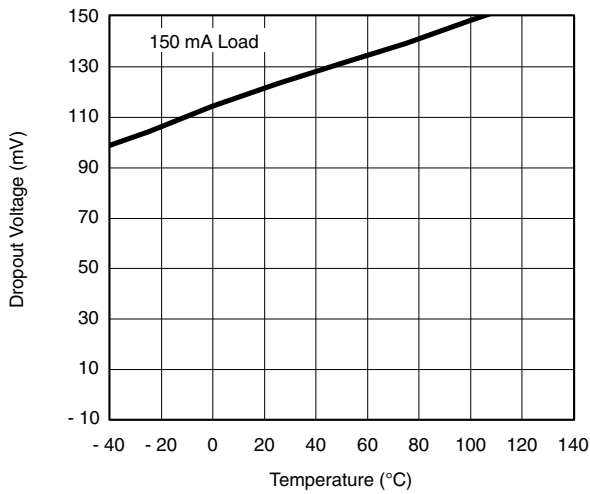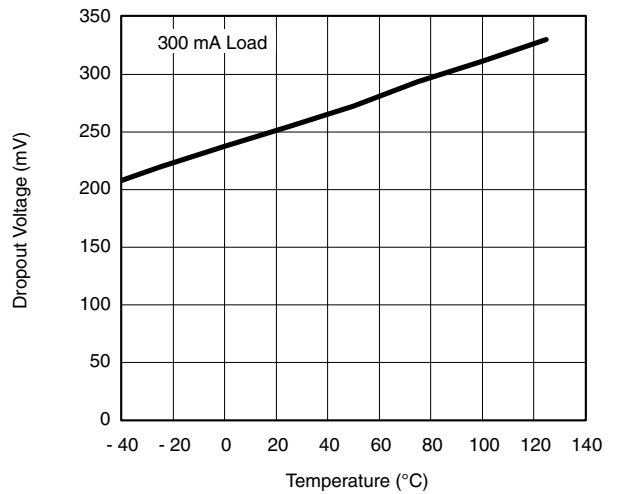
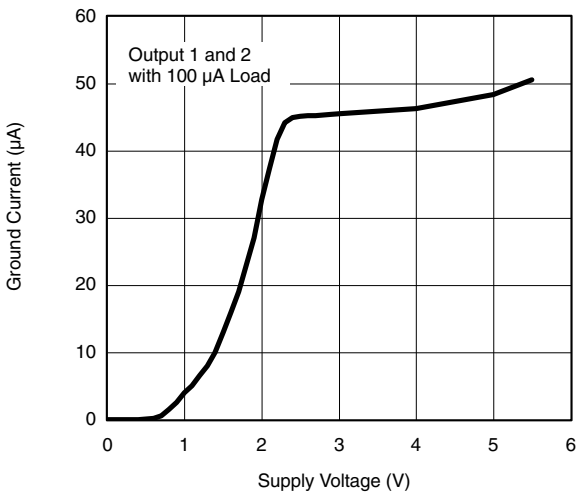## TYPICAL CHARACTERISTICS
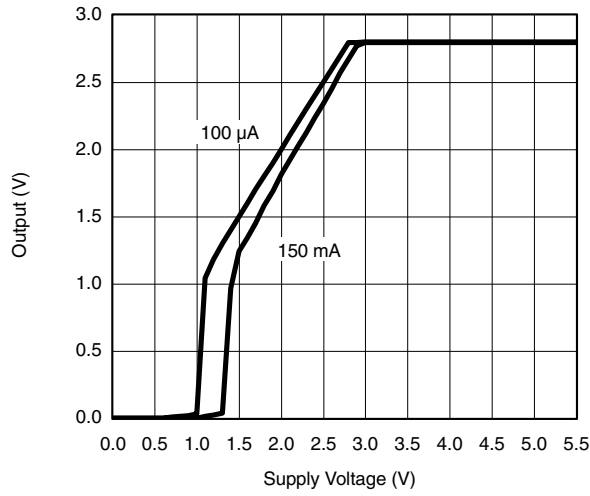
Dropout Characteristics-Output 1
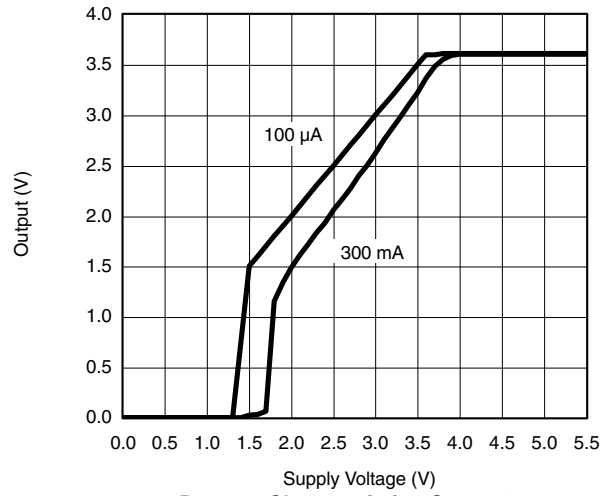
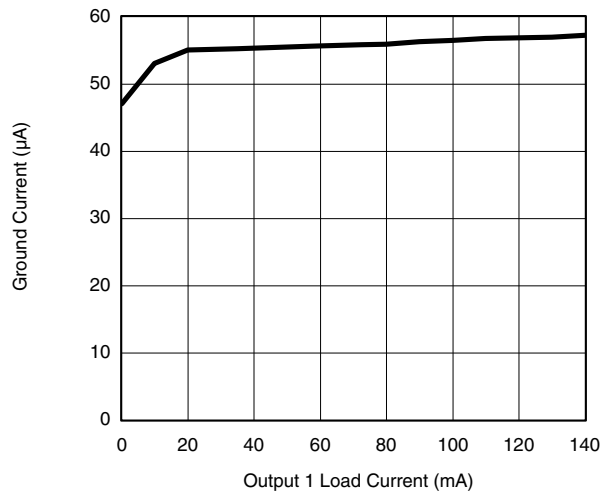**Dropout Characteristics-Output 2**

Dropout Voltage-Output 1

Dropout Voltage-Output 2

Ground Current vs. Supply Voltage

Ground Current vs. Output 1 Current
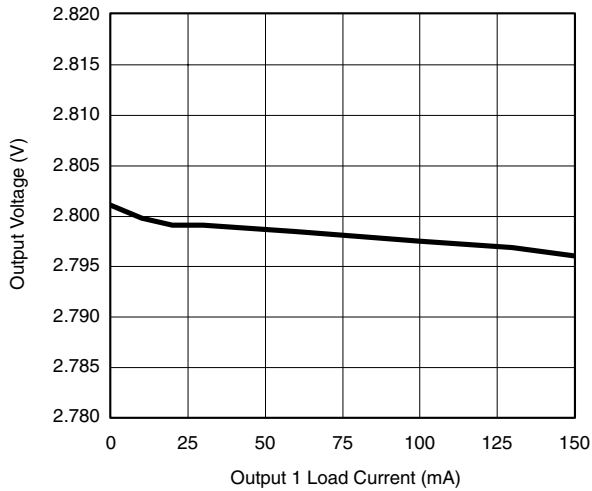
SiP2211
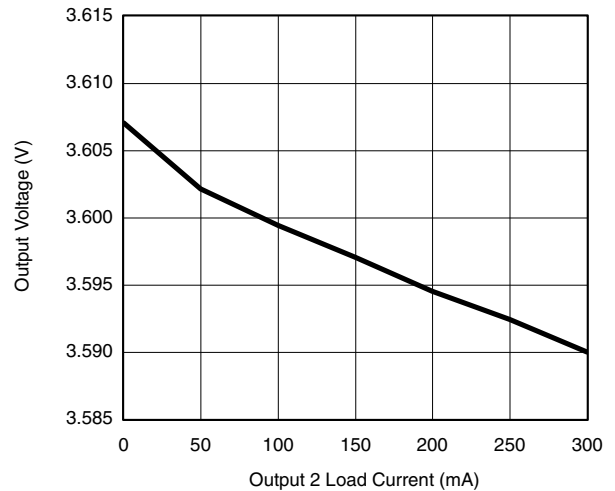
Vishay Siliconix

TYPICAL CHARACTERISTICS
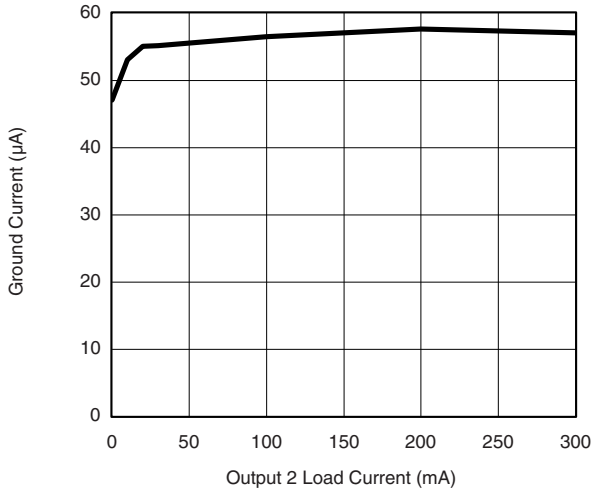
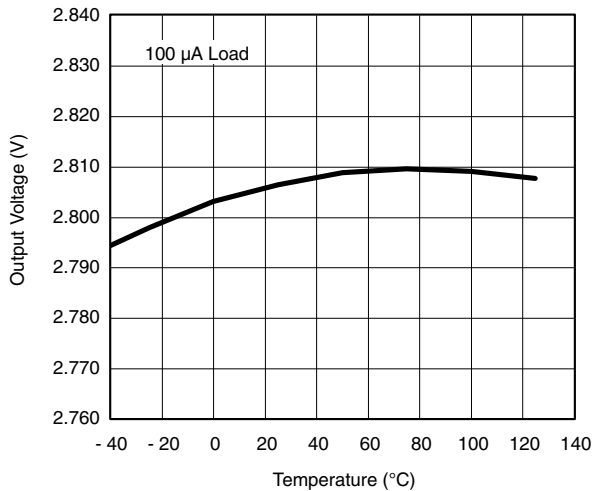**Ground Current vs. Output 2 Current**
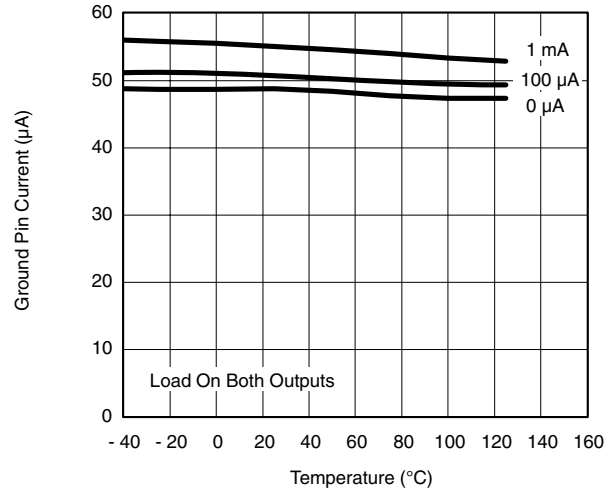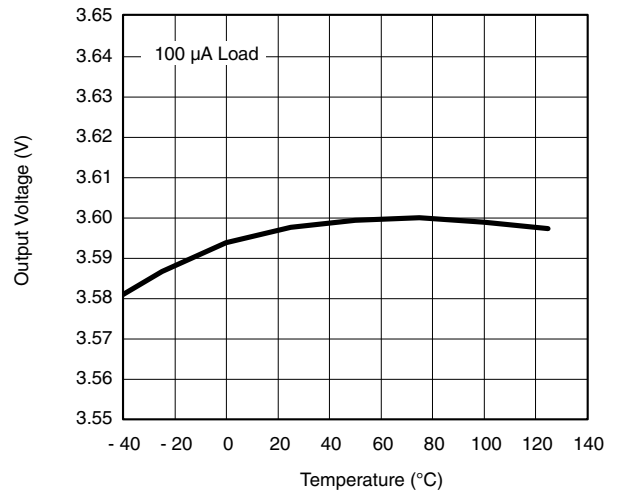
Ground Pin Current

Output Voltage vs. Load Current-Output 1
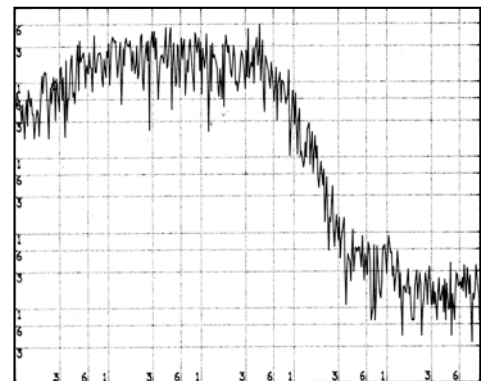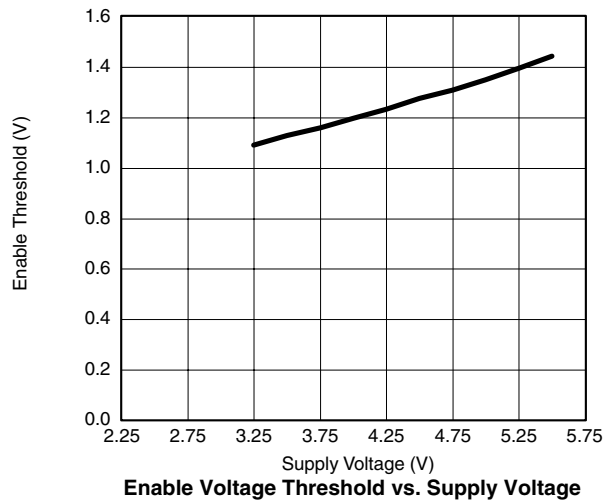
Output Voltage vs. Load Current-Output 2
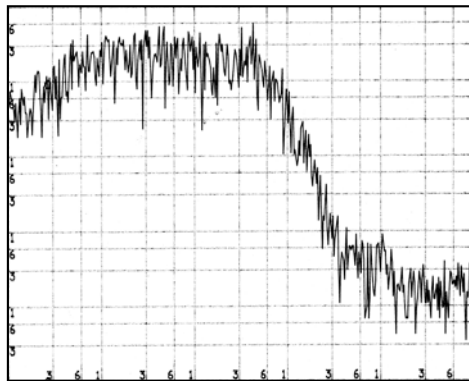
Output Voltage 1 vs. Temperature

Output Voltage 2 vs. Temperature

TYPICAL CHARACTERISTICS

Enable Voltage Threshold vs. Supply Voltage

Noise Spectrum Output 1

Noise Spectrum Output 2

C_{IN} = 1 µF
C_{OUT} = 1 µF
C_{BP} = 0.01 µF
V_{IN} = 5 V

100 µs/div

Enable Sequence

150 mA

C_{IN} = 1 µF
C_{OUT} = 1 µF
C_{BP} = 0.01 µF
V_{IN} = 5 V

5 µs/div

Load Transient Response LDO #1

300 mA

C_{IN} = 1 µF
C_{OUT} = 1 µF
C_{BP} = 0.01 µF
V_{IN} = 5 V

5 µs/div

Load Transient Response LDO #2
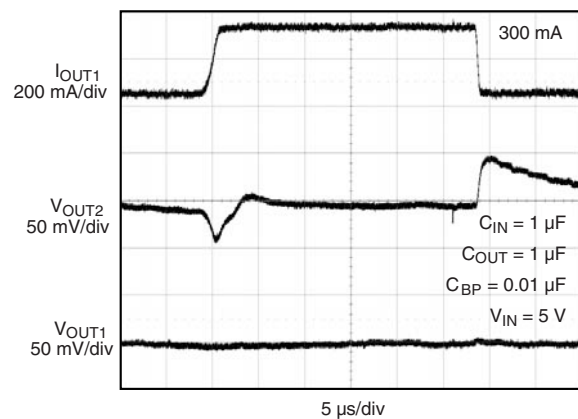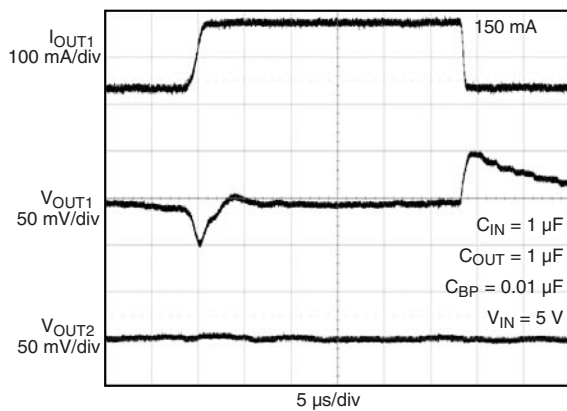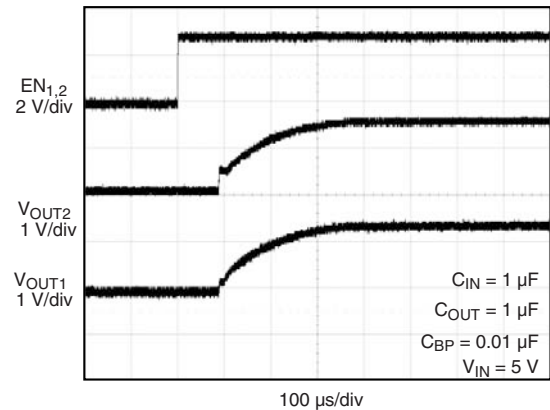
DETAILED OPERATION

The SiP2211 is a low drop out, low quiescent current monolithic dual linear regulator, with power-on reset and open drain driver output features. With output voltage range from 1.25 V to 5 V the first regulator can source 150 mA and the second regulator can source 300 mA. The open drain driver has the capability to drive LED's for backlighting applications.

V_{IN}

V_{IN} is the input supply pin for both LDO's. The bypass capacitor for this pin is not critical as long as the input supply has low enough source impedance. For practical circuits, a 1.0 µF or larger ceramic capacitor is recommended. When the source impedance is not low enough and/or the source is several inches from the SiP2211, then a larger input bypass capacitor is needed. When the source impedance, wire and trace impedance are unknown, it is recommended that an input bypass capacitor be used of a value that is equal to or greater than the output capacitor.

$V_{OUT1,2}$ (LDO Outputs)

The V_{OUT} is the output voltage of the regulator. Connect a bypass capacitor from V_{OUTx} to ground. The output capacitor can be any value from 1.0 µF to 10.0 µF. A ceramic capacitor with X5R or X7R dielectric type is recommended for best output noise, line transient, and load transient performance.

Enable

The EN1 and EN2 pins control the turning on and off of their respective regulators in the SiP2211. V_{OUT} of both outputs are guaranteed to be on when the Enable pin voltage is equal or greater than 1.8 V. V_{OUT} is guaranteed to be off when the Enable pin voltage equals or is less than 0.6 V. To automatically turn on V_{OUT} whenever the Input is applied, tie the Enable pin to V_{IN}.

Bypass Capacitor

For low noise application and/or increase in power supply rejection ration (PSRR) connect a high frequency ceramic capacitor from BP to ground. A 0.01 µF X5R or X7R ceramic capacitor is recommended.

Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.