General Description

The SLD409S is a low V_{IN}, ultra-low noise, high PSRR and low dropout voltage linear regulator. It is capable of supplying 300mA output current with typical dropout voltage of only 72mV. The operating input voltage range is from 1.2V to 5.5V. The fixed output voltage range is from 1.2V to 3.3V and adjustable output voltage range is from 0.793V to 5.0V.

Other features include logic-controlled shutdown mode, short-circuit current limit and thermal shutdown protection.The SLD409S has automatic discharge function to quickly discharge V_{OUT} in the disabled status.

The SLD409S is suitable for applications which need low noise and fast transient response power supply, such as power supply of camera module in smart phone, etc.

The SLD409S is available in Green SOT23-5 packages. It operates over an operating temperature range of -40°C to +125°C.

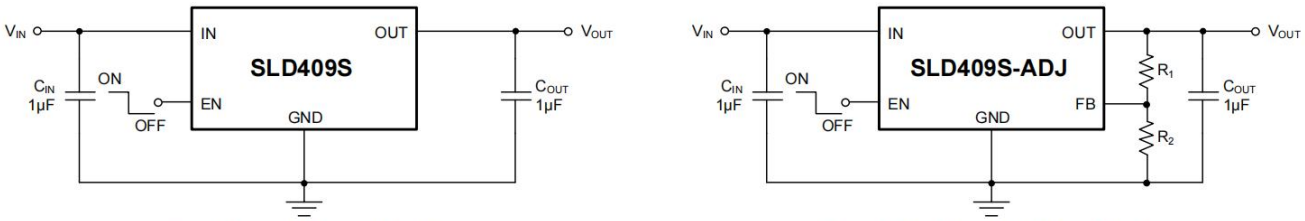
Features

- Input voltage range: 1.2V ~ 5.5V
- Fixed VOUT: 1.2V/1.5V/1.8V/2.5V/2.8V/3V/3.3V/ in different version
- Adjustable Output from 0.793V to 5V
- Output accuracy: ±1% for all version and temperature range
- High PSRR: 92 dB (TYP) @ 1Khz
- Low noise: 6μVRMS (TYP) @ 10Hz~100Khz
- Low Quiescent current: 13μA (TYP)
- Shutdown Supply Current: 0.03μA (TYP)
- Over Current protection
- Output Discharge
- Thermal Shutdown
- -40°C to +125°C Operating Temperature Range
- Excellent Load and Line Transient Responses
- Robust ESD immunity capability
  HBM > ±2KV
  CDM > ±1KV
- Available in Green SOT23-5 Packages

Applications

- Camera Power
- Wireless device Power
- Smartphone, Wearable device
- Noise sensitive device Power

Typical Application



Fixed Output Voltage Version

Adjustable Output Voltage Version

Figure 1. Typical Application Circuits

Block Diagram

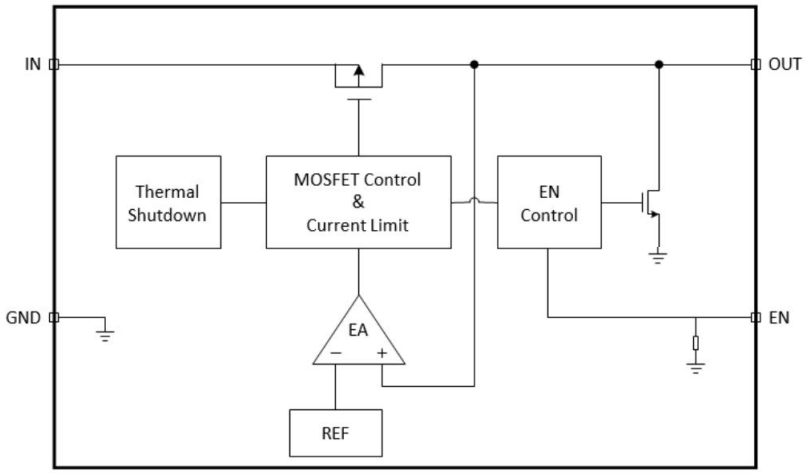


Figure 2. Block Diagram

Pin Configurations

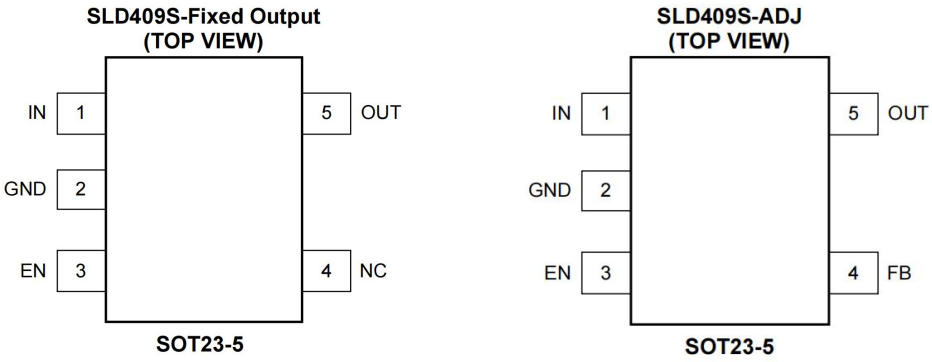


Figure 3. SLD409S SOT23-5 Pin Assignment(Top View)

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended.In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V_{IN}	IN to GND		-0.3	6	V
V_{OUT}	OUT to GND		-0.3	6	V
V_{EN}	EN to GND		-0.3	6	V
I_{IN}	Input Current (Continuous)			1	A
I_{OUT}	Output Current			1	A
T_{STG}	Storage Temperature Range		-65	+150	°C
T_J	Maximum Junction Temperature			+150	°C
ESD	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012	All Pins	2		KV
	Charged Device Model, JESD22-C101	All Pins	1		

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance.

Parameters	Min.	Max.	Unit
Input Voltage: V_{IN}	1.1	5.5	V
Operating Junction Temperature Range	-40	125	°C

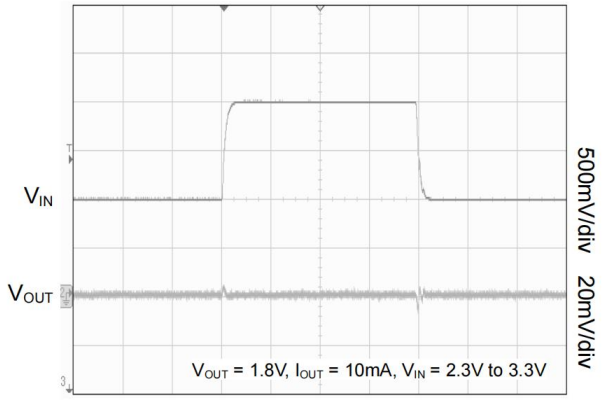
Electrical Characteristics

(V_{IN} = ($V_{OUT(NOM)}$ + 0.3V) or 1.1V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, T_J = -40°C to +125°C , typical values are at T_J = +25°C , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}	I_{OUT} =60 mA		1.1		5.5	V
		I_{OUT} =100 mA		1.2		5.5	
		I_{OUT} =200 mA		1.3		5.5	
		I_{OUT} =300 mA		1.4		5.5	
Output Voltage Accuracy	V_{OUT}	V_{IN} =1.5V to 5.5V, I_{OUT} =0.1mA, $V_{OUT(NOM)}$ ≥ 1.2V, T_J = +25°C		-1		1	%
		V_{IN}=1.5V to 5.5V, I_{OUT}=0.1mAto 300mA, $V_{OUT(NOM)}$ ≥ 1.2V, T_J = -40°C to +125°C		-2		2	
Feedback Voltage (SLD409S-ADJ)	V_{FB}	V_{IN} =1.5V to 5.5V, I_{OUT} = 0.1mA, T_J = +25°C		0.784	0.793	0.802	V
		V_{IN}=1.5V to 5.5V, I_{OUT} =0.1mAto 300mA, T_J = -40°C to +125°C		0.773		0.813	
Line Regulation	ΔV_{LNR}	V_{IN}=($V_{OUT(NOM)}$ + 0.3V) to 5.5V, I_{OUT} = 0.1mA			0.05	1	mV
Load Regulation	$\Delta V_{LDR}/V_{OUT}$	I_{OUT} = 0.1mA to 300mA, V_{OUT} ≥ 1.5V			1.2	5	mV/V
Dropout Voltage	V_{DROP}	V_{OUT}=$V_{OUT(NOM)}$-0.05V, I_{OUT} = 300mA	1.2V ≤ $V_{OUT(NOM)}$ < 1.5V		185	260	mV
			1.5V ≤ $V_{OUT(NOM)}$ < 1.8V		125	200	
			1.8V ≤ $V_{OUT(NOM)}$ < 2.8V		100	160	
			2.8V ≤ $V_{OUT(NOM)}$ ≤ 5.0V		72	120	
Output Current Limit	I_{LIMIT}	V_{OUT} =90% × $V_{OUT(NOM)}$		300	600		mA
Short Circuit Current	I_{SHORT}	V_{OUT} =0V			380		mA
Quiescent Current	I_Q	I_{OUT} =0mA			13	40	μA
Shutdown Supply Current	I_{SHDN}	V_{EN} =0V, V_{IN} = 5.5V			0.03	2	μA
EN Input Threshold	V_{IH}	V_{IN}=1.1V to 5.5V		0.7			V
	V_{IL}					0.3	
EN Pull-Down Current	I_{EN}	V_{EN}=V_{IN}			0.03	1	μA
Output Discharge Resistance	R_{DIS}	V_{EN}=0V, V_{IN} =3.3V			50		Ω
Turn-On Time	t_{ON}	From EN rising from 0V to V_{IN} to 90% × $V_{OUT(NOM)}$, no load			100	240	μs
Power Supply Rejection Ratio	PSRR	I_{OUT} = 20mA, V_{IN}=$V_{OUT(NOM)}$ + 1V	f = 100Hz		90		dB
			f = 1kHz		92		
			f = 10kHz		80		
			f = 100kHz		53		
Output Voltage Noise	e_n	f = 10Hz to 100kHz, I_{OUT} = 20mA			6		μV_{RMS}
Thermal Shutdown Temperature	T_{SHDN}				160		°C
Thermal Shutdown Hysteresis	ΔT_{SHDN}				20		°C

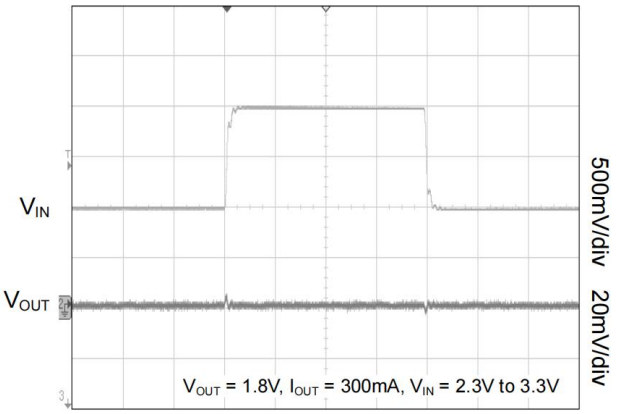
Typical Characteristics

Line Transient Response



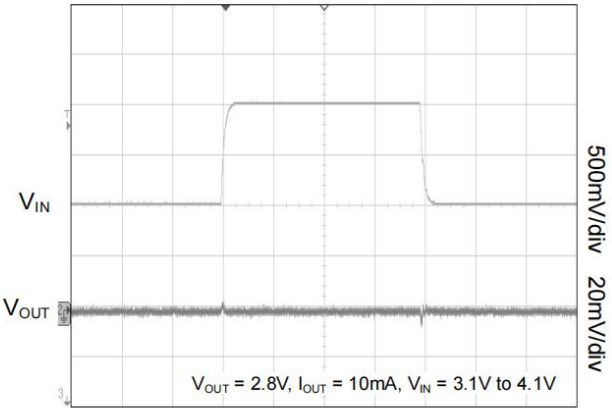
Time (20μs/div)

Line Transient Response



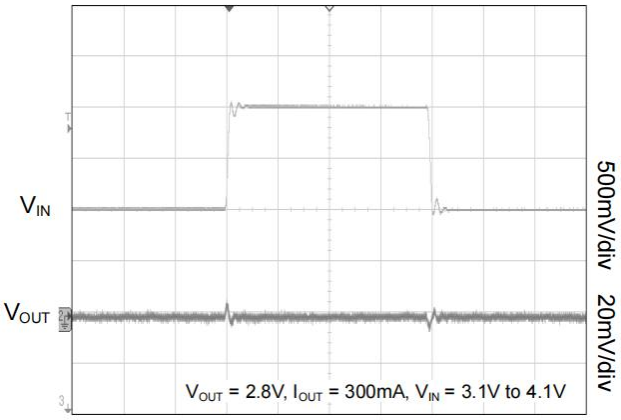
Time (20μs/div)

Line Transient Response



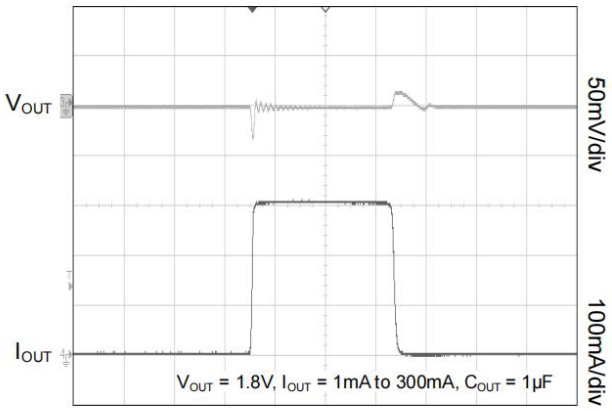
Time (20μs/div)

Line Transient Response



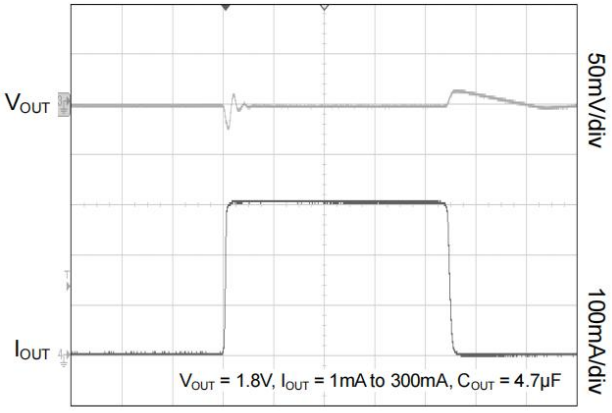
Time (20μs/div)

Load Transient Response



Time (10μs/div)

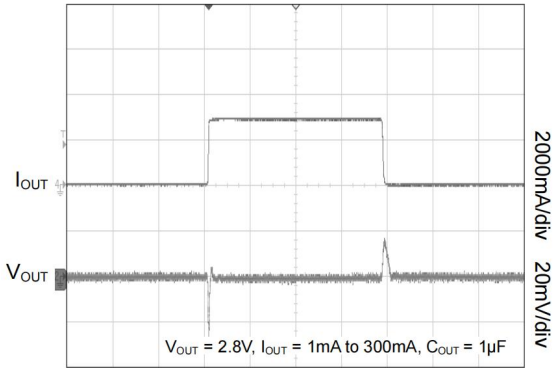
Load Transient Response



Time (10μs/div)

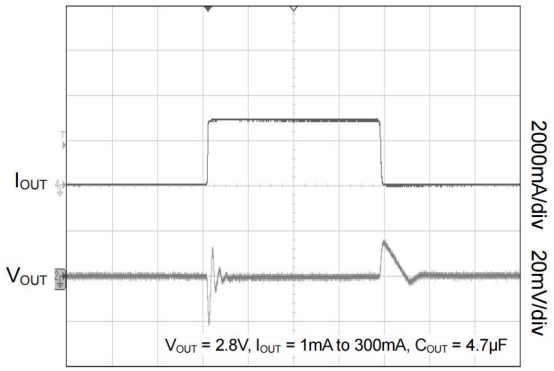
Typical Characteristics(continued)

Load Transient Response



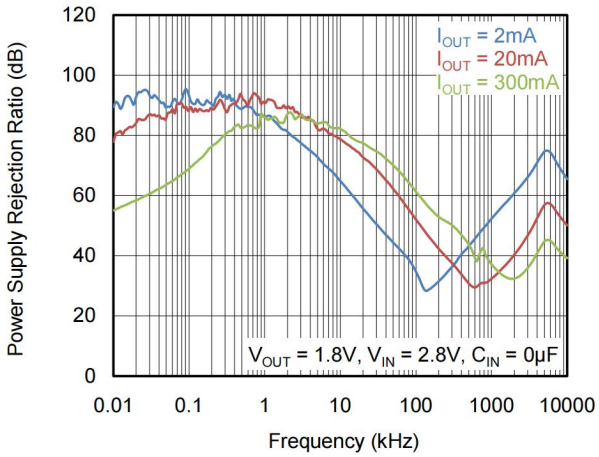
Time (20μs/div)

Load Transient Response

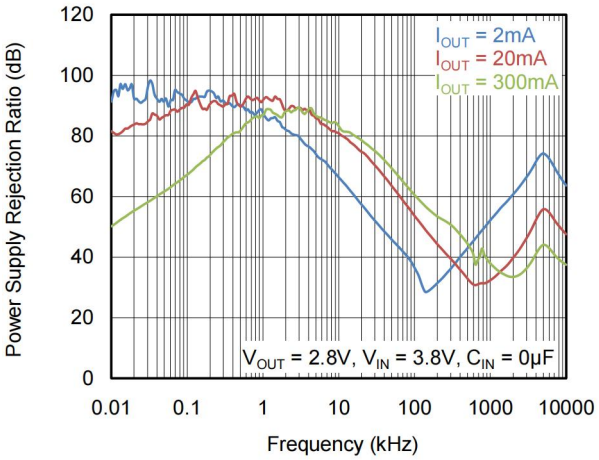


Time (20μs/div)

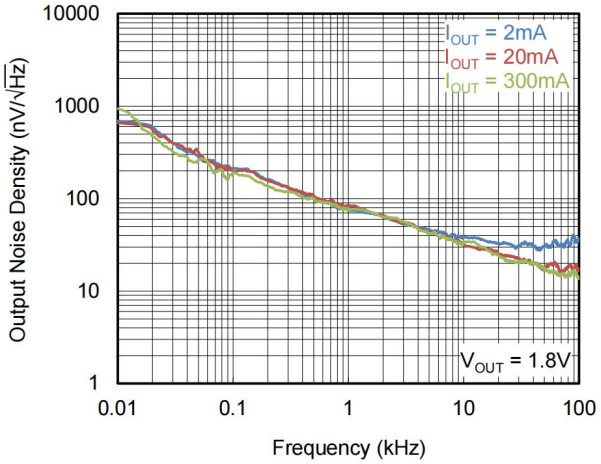
Power Supply Rejection Ratio vs. Frequency



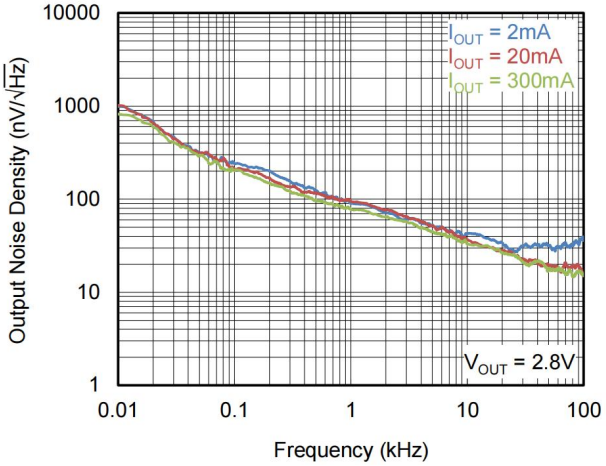
Power Supply Rejection Ratio vs. Frequency



Output Noise Density vs. Frequency

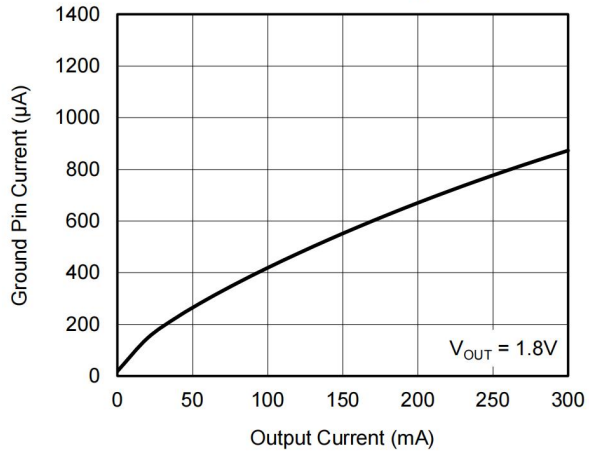


Output Noise Density vs. Frequency

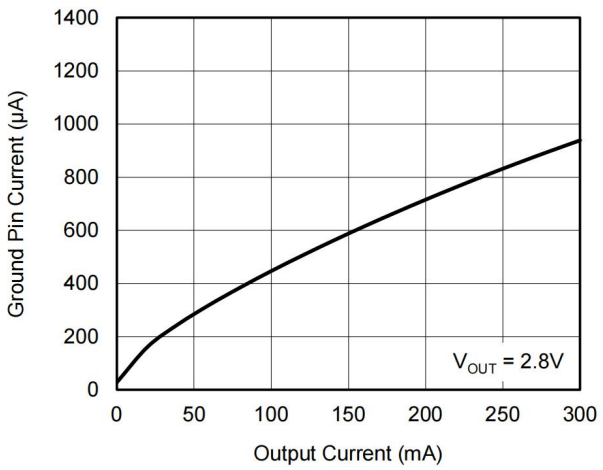


Typical Characteristics(continued)

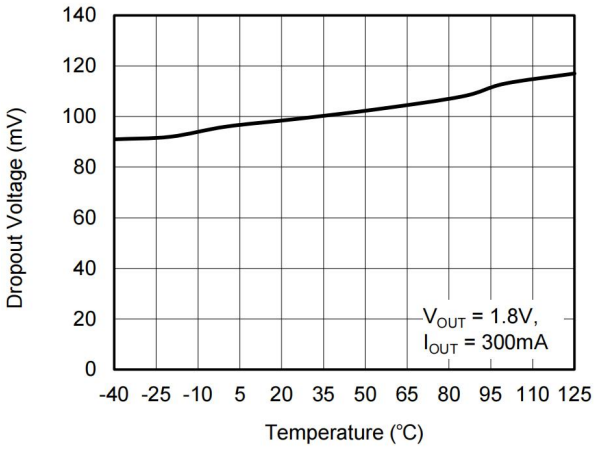
Ground Pin Current vs. Output Current



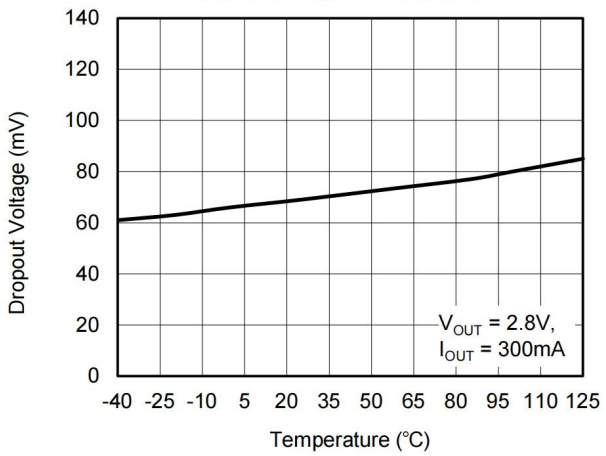
Ground Pin Current vs. Output Current



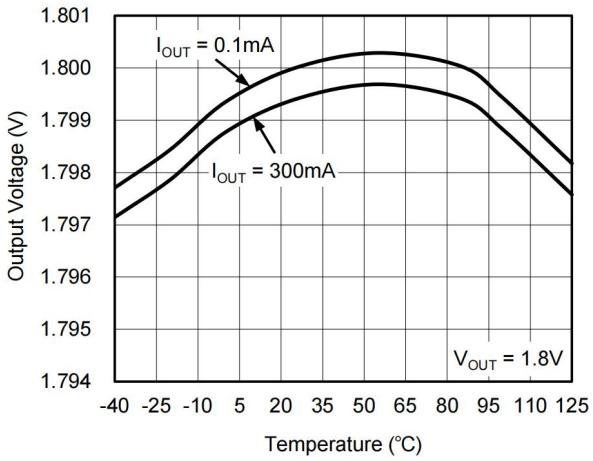
Dropout Voltage vs. Temperature



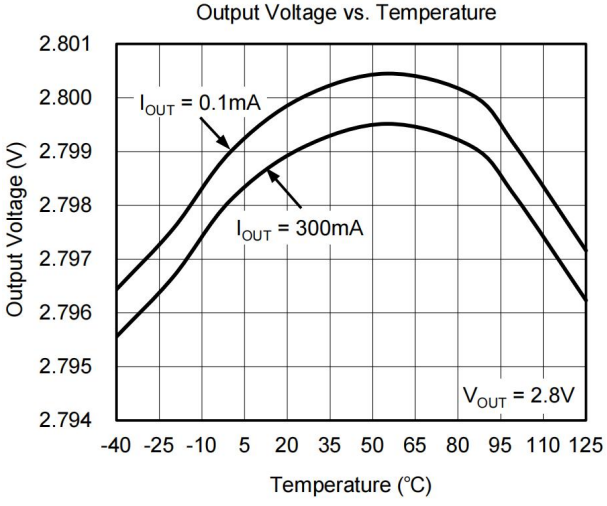
Dropout Voltage vs. Temperature



Output Voltage vs. Temperature

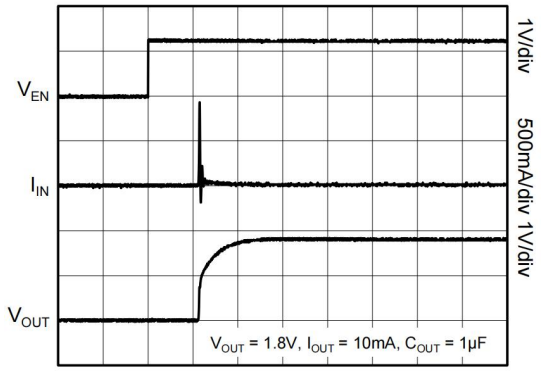


Output Voltage vs. Temperature



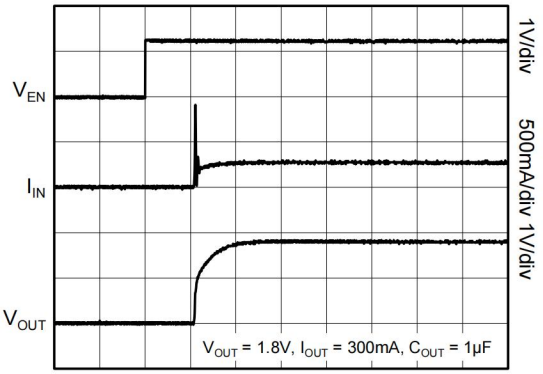
Typical Characteristics(continued)

Enable Turn-On Response



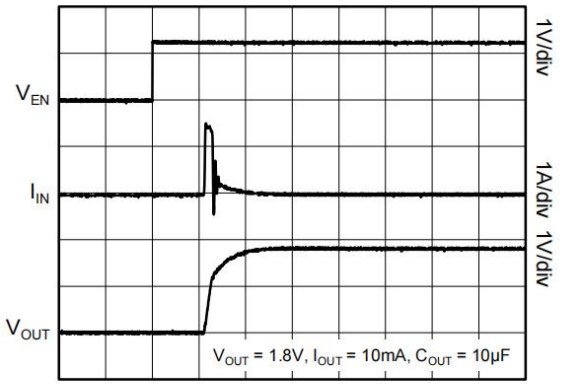
Time (50µs/div)

Enable Turn-On Response



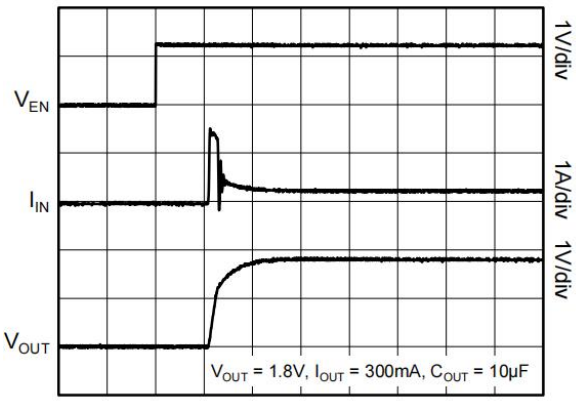
Time (50µs/div)

Enable Turn-On Response



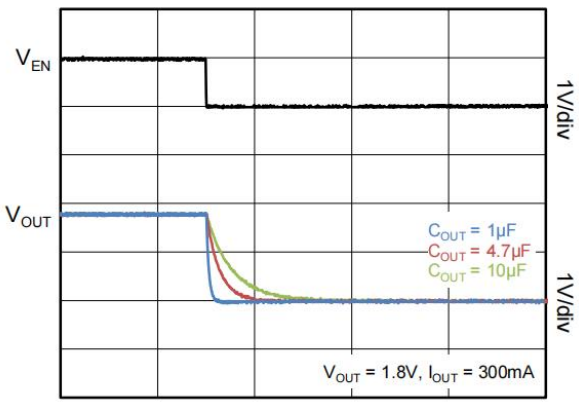
Time (50µs/div)

Enable Turn-On Response



Time (50µs/div)

Enable Turn-Off Response



Time (200µs/div)

Detailed Description

General Introduction

SLD409S is a low noise, high PSRR LDO which can provide 400mA output current. With very low quiescent current, SLD409S is suitable for high performance analog circuits and battery powered portable devices.

UVLO (Under-Voltage Lockout)

The device has a built-in under-voltage lockout (UVLO) circuit in LDO mode. When V_{IN} is rising, the output remains disconnected from the input until IN voltage is above 1.5V (TYP). This circuit has a 100mV hysteresis to provide noise immunity to transient conditions.

OCP (Over Current Protection)

The device enters foldback mode when the output load hit the over current threshold or in shorting event. The current is clamped. The output voltage drops. When the voltage drops below foldback voltage threshold, foldback current limit is activated and scales back to short circuit current.

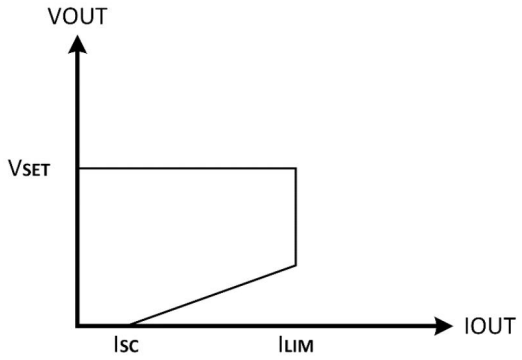


Figure 4. OCP behavior

The OPC threshold is 625mA(typical)

Thermal Shutdown

SLD409S has thermal shutdown function. When the junction temperature exceeds TSD, the device turns off internal MOSFET to protect itself. The device exits thermal shutdown after junction temperature cools down below TSD-THYS. And then the device full works after a soft start period.

SS function

To avoid high inrush current, SLD409S integrated soft-start function. When EN status changes from logic 0 to logic 1 or from thermal shutdown mode, SLD409S will regulate output current for about 1ms and then enter full function status.

Output discharge

SLD409S has output discharge function. The VOUT connects to GND with 150ohm resistor when EN=0 or thermal shutdown mode for 2ms and then disconnects this resistor.

Adjustable Regulator

The output voltage of the SLD409S-ADJ can be adjusted from 0.793V to 5.0V. The FB pin will be connected to two external resistors as shown in Figure 5. Capacitance CFF = 10nF can be added to improve stability and reduce noise. Use R2 = 40kΩ to maintain a 20μA minimum load. The output voltage is determined by the following equation:

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R_1}{R_2}\right) \qquad (1)$$

where:
V_{OUT} is output voltage and VFB is the internal voltage reference, VFB = 0.793V.

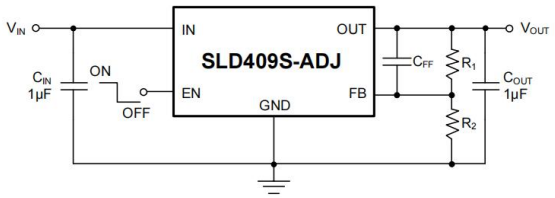
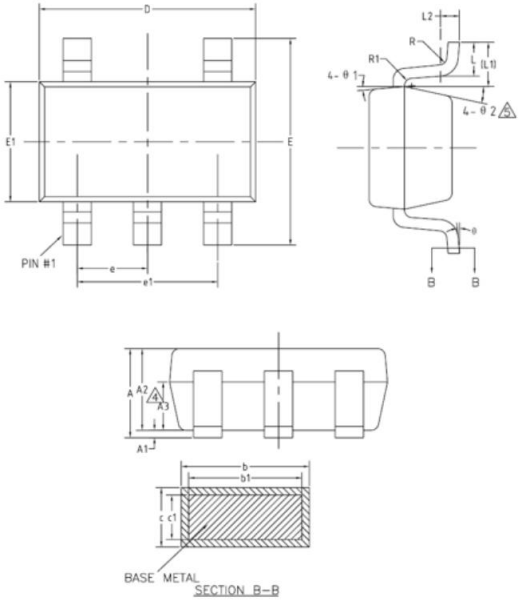


Figure 5. Adjustable Output Voltage Application

PACKAGE SOT23-5



(UNITS OF MEASURE=MILLIMETER)

	SYMOBL	MIN	NOW	MAX
3	A	-	-	1.25
	A1	0	-	0.15
	A2	1.00	1.10	1.20
	A3	0.60	0.65	0.70
	b	0.36	-	0.50
	b1	0.36	0.38	0.45
	c	0.14	-	0.20
	c1	0.14	0.15	0.16
	D	2.826	2.926	3.026
	E	2.60	2.80	3.00
	E1	1.526	1.625	1.726
5	e	0.90	0.95	1.00
5	e1	1.80	1.90	2.00
	L	0.35	0.45	0.60
	L1	0.59REF		
	L2	0.25BSC		
	R	0.10	-	-
	R1	0.10	-	0.25
	θ	0	-	8
	Θ1	3	5	7
5	Θ2	6	-	14

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD MO-178 AA
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS

SOT23-5 Package Outline Dimensio

PACKAGE/ORDERING INFORMATION

Product Name	①②③④⑤	Set Voltage	Package	Units Reel
SLD409S121A	SZSXX	1.2V	SOT23-5	3000
SLD409S151A	SZTXX	1.5V	SOT23-5	3000
SLD409S181A	SZUXX	1.8V	SOT23-5	3000
SLD409S251A	SZVXX	2.5V	SOT23-5	3000
SLD409S281A	SYGXX	2.8V	SOT23-5	3000
SLD409S301A	SZWXX	3.0V	SOT23-5	3000
SLD409S331A	SZXXX	3.3V	SOT23-5	3000
SLD409S-ADJ	SXZXX	0.793V-5.0V	SOT23-5	3000

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