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AS1369

200mA Ultra-Compact Low Dropout Regulator

Data Sheet

1 General Description

The AS1369 is an ultra compact high-performance low-dropout 200mA voltage regulator designed for use with very-low ESR output capacitors. The device can deliver superior performance in all specifications critical to battery-powered designs, and is perfectly suited for mobile phones, PDAs, MP3 players, and other battery powered devices.

The AS1369 is working with small input and output capacitor of only 0.47µF offering PSRR of 72dB typical and a noise level of 30µVRMS.

Typical quiescent current is around 25µA while in shutdown the AS1369 requires less than 0.1µA quiescent current.

Regulation performance is excellent even under low dropout conditions, when the power transistor has to operate in linear mode.

The AS1369 offers excellent low-noise performance requiring no external bypass capacitance.

Multiple output voltage options between 1.2 and 5.0V in 100mV steps are available and the the minimum input voltage is as low as 2.0V (depending on the output voltage version), so the component can be used with the coming new battery technologies.

The AS1369 is available in a 4-bump WL-CSP package.

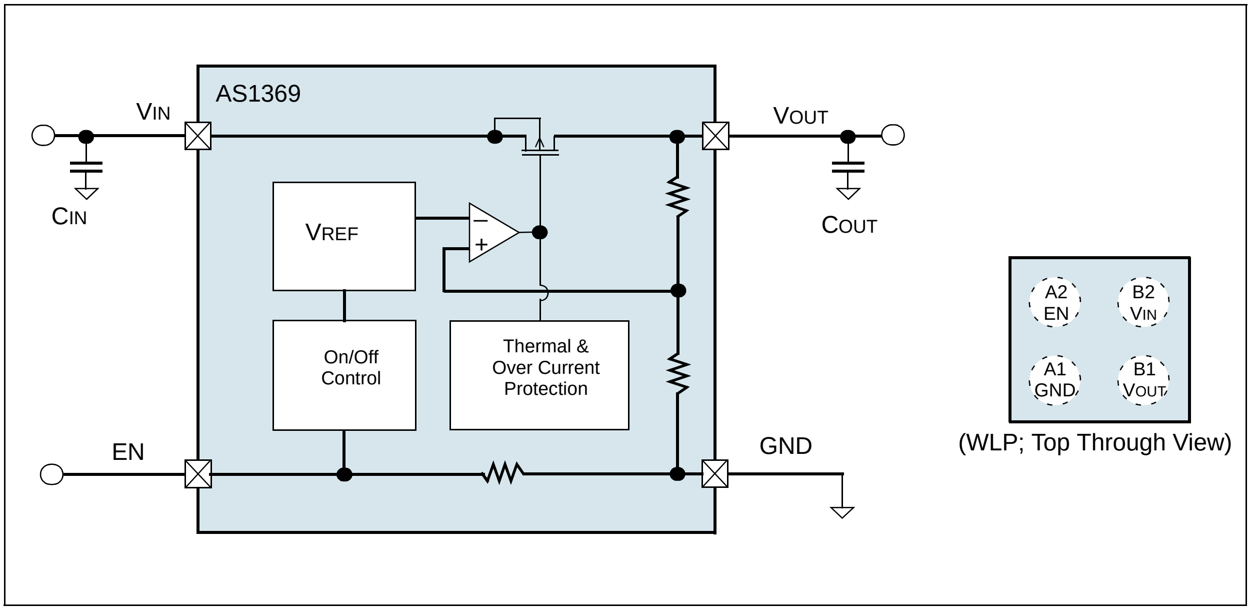
2 Key Features

- Low Dropout Voltage: typ. 40mV @ 100mA
- 200mA High Maximum Load Current
- 2.0 to 5.5V Input Voltage
- 1.2 to 5.0V Output Voltage (in 100mV steps)
- High Accuracy: ±2% Over Temperature
- Thermal and Over Current Protection
- 25µA Quiescent Current
- <0.1µA Standby Current
- High PSRR: 72dB @ 1kHz
- No Noise Bypass Capacitor Required
- Low Noise: 30µVRMS
- Enable Pin
- Package: 4-bump WL-CSP 0.5mm pitch

3 Applications

The device is ideal for mobile communication, battery powered systems and any electronic equipment.

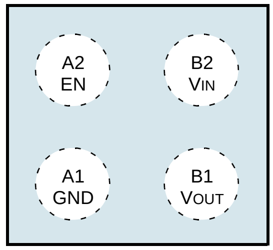
Figure 1. Block Diagram



4 Pinout

Pin Assignments

Figure 2. Pin Assignments (Top View)



AS1369
(WLP; Top Through View)

Pin Descriptions

Table 1. Pin Descriptions

Name	WLP	Description
GND	A1	**Ground**
EN	A2	**Logic-High Enable Input**. $V_{IH} \geq 1.2V$: V_{OUT} is enabled. $V_{IH} \leq 0.4V$: V_{OUT} is disabled. **Note:** This pin is internally pulled down and must not float.
VOUT	B1	**Regulated Output Voltage**
VIN	B2	**Input Voltage**

5 Absolute Maximum Ratings

Stresses beyond those listed in Table 2 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 Electrical Characteristics on page 4 is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 2. Absolute Maximum Ratings

Parameter	Min	Max	Units	Comments
Input Supply Voltage	-0.3	+7	V	
Shutdown Input Voltage	-0.3	+7	V	
Output Voltage	-0.3	+7	V	
I_{OUT}				Short-circuit protected.
Input/Output Voltage[1]	-0.3	+7	V	
Power Dissipation [2]		360	mW	Internally limited. Mounted on PCB.
Operating Junction Temperature	-40	+125	ºC	
Storage Temperature Range	-65	+150	ºC	
ESD		2	kV	*HBM MIL-Std. 883E 3015.7* methods
		500	V	*CDM JESD22-C101C* methods
Latch-Up	-100	+100	mA	*JEDEC 78*
Package Body Temperature		+260	ºC	The reflow peak soldering temperature (body temperature) specified is in accordance with *IPC/JEDEC J-STD-020C "Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices".* The lead finish for Pb-free leaded packages is matte tin (100% Sn).

1. The output PNP structure contains a diode between pins V_{IN} and V_{OUT} that is normally reverse-biased. reversing the polarity of pins V_{IN} and V_{OUT} will activate this diode.
2. The maximum allowable power dissipation is a function of the maximum junction temperature ($T_{J(MAX)}$), the junction-to-ambient thermal resistance (Θ_{JA}), and the ambient temperature (T_{AMB}). The maximum allowable power dissipation at any ambient temperature is calculated as:

$$P_{(MAX)} = (T_{J(MAX)} - (T_{AMB}))/\Theta_{JA} \quad \text{(EQ 1)}$$

Where:

The value of Θ_{JA} for the WLP package is 345°C/W.

Note: Exceeding the maximum allowable dissipation will cause excessive device temperature and the regulator will go into thermal shutdown.

The AS1369 uses an internal protective structure against light influence. However, exposing the WLP package to direct light could cause device malfunction.

6 Electrical Characteristics

T_{AMB} = -40 to 85ºC , V_{IN} = $V_{OUT(NOM)}$ + 0.5V, C_{OUT} = C_{IN} = 0.47µF, I_{OUT} = 1mA, V_{IH} = 1.2V (unless otherwise specified)

Table 3. Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
	Operational Voltage Range		2.0		5.5	V
	Input Undervoltage Lockout			1.8		V
	Accuracy	Over full V_{IN}, V_{OUT}, T_{AMB} = 25ºC including line and load regulation	-0.7		+0.7	%
		Over full V_{IN}, V_{OUT} and temperature including line and load regulation	-2		+2	
V_{DROP}	Dropout Voltage [1]	I_{OUT} = 50mA		20	50	mV
		I_{OUT} = 100mA		40	100	
		I_{OUT} = 150mA		60	150	
		I_{OUT} = 200mA		80	200	
ΔV_{OUT}	Line Regulation	V_{IN} = $V_{OUT(NOM)}$ + 0.5V to 5.5V, $V_{OUT} \geq 2.5V$		0.02	0.1	%/V
		V_{IN} = $V_{OUT(NOM)}$ + 0.5V to 5.5V, $V_{OUT} < 2.5V$		0.02	0.2	
	Load Regulation	I_{OUT} = 5 to 100mA		0.001	0.003	%/mA
		I_{OUT} = 5 to 200mA		0.001	0.003	
ΔV_{OUT} / ΔT_{AMB}	Output voltage/ temperature	I_{OUT} = 5mA		50		ppm/°C
	Output current	Maximum output current	210			mA
I_Q	Quiescent current	I_{LOAD} = 0mA		25	50	µA
		I_{LOAD} = 200mA		35	60	µA
I_{SHDN}	Standby current	In Shutdown		5	500	nA
t_{ON}	Turn On Time [2]			30		µs
	PSRR	I_{out} = 10mA, f = 1kHz, V_{OUT} = 1.5V		72		dB
		I_{out} = 10mA, f = 100kHz, V_{OUT} = 1.5V		55		dB
		I_{out} = 10mA, f = 1kHz, V_{OUT} = 2.8V		80		dB
		I_{out} = 10mA, f = 100kHz, V_{OUT} = 2.8V		56		dB
	Load transient resp.	1 to 150mA, T_{rise} = T_{fall} = 1µs, C_{out} = C_{in} = 1µF, ESR load capacitor = 0		±65		mV
eN	Output Noise Voltage	BW = 400Hz to 80kHz, C_{OUT} = 1µF, I_{OUT} = 30mA		30		μV_{RMS}
I_{EN}	Enable Input Current	V_{EN} = 0.4V, V_{IN} = 5.5V		±1		µA
V_{EN}	Enable Input Logic Low	V_{IN} = 2.0 to 5.5V, T_{AMB} = -40 to 85ºC			0.4	V
	Enable Input Logic High		1.2			
$I_{IN(start)}$	Startup Peak Current	I_{OUT} = 0mA		340		mA
I_{SC}	Short Circuit Current	V_{OUT} = 0V	210	350		mA
T_{OFF}	Temperature Shutdown	Temperature rising		160		ºC
		Hysteresis		20		

1. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100mV below its nominal value (does not apply to input voltages below 2.0V).
2. Turn on time is time measured between the enable input just exceeding the V_{EN} high value and the output voltage just reaching 95% of its nominal value.

Figure 3. AC Line Regulation Input Voltage Test Signal

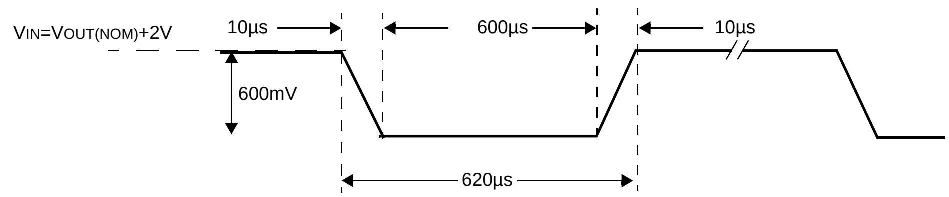
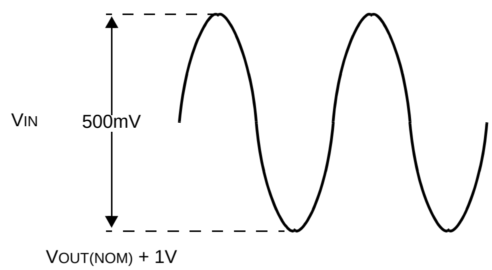


Figure 4. SVR Input Voltage Test Signal



7 Typical Operating Characteristics

$V_{IN} = V_{OUT} + 0.5V$, $C_{IN} = C_{OUT} = 1\mu F$, $T_{AMB} = 25°C$ (unless otherwise specified).

Figure 5. ΔV_{OUT} vs. V_{IN}; $V_{OUT(NOM)} = 1.5V$

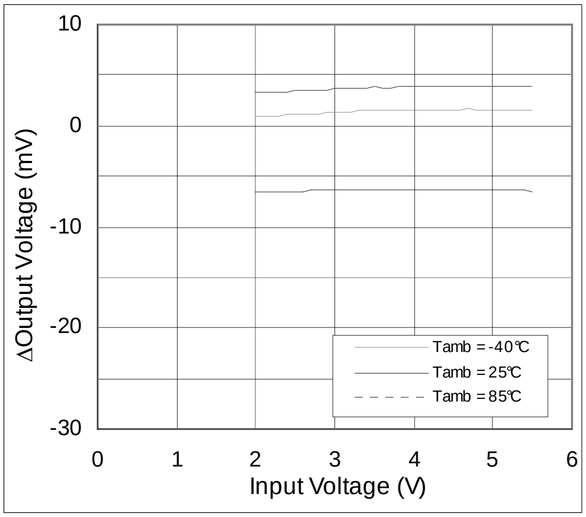


Figure 6. ΔV_{OUT} vs. V_{IN}; $V_{OUT(NOM)} = 2.8V$

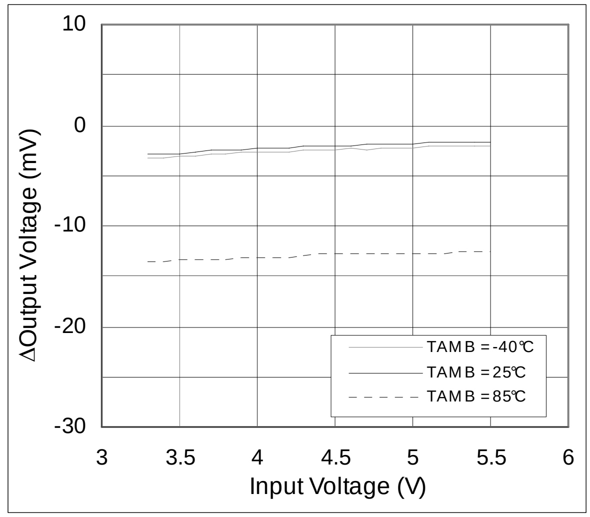


Figure 7. ΔV_{OUT} vs. $(V_{IN}-V_{OUT})$; $T_{AMB} = -40°C$

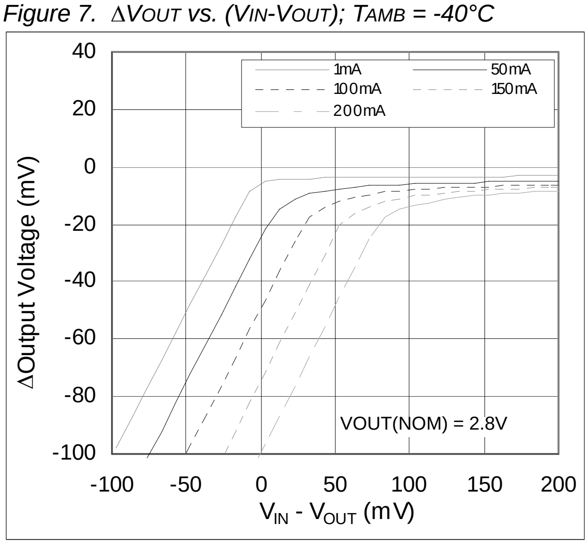


Figure 8. ΔV_{OUT} vs. $(V_{IN}-V_{OUT})$; $T_{AMB} = +25°C$

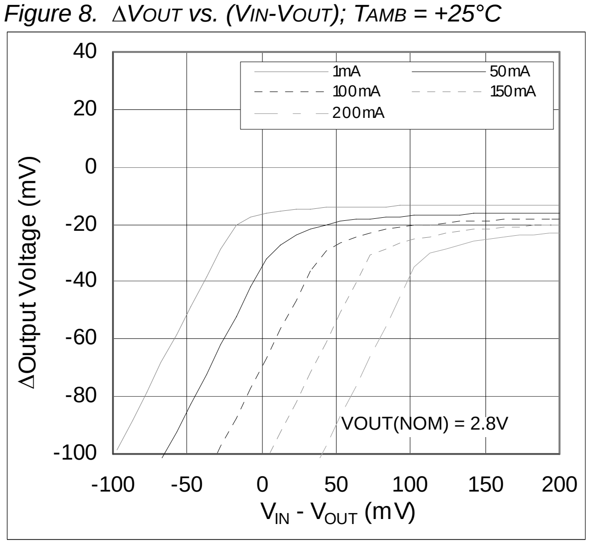


Figure 9. ΔV_{OUT} vs. $(V_{IN}-V_{OUT})$; $T_{AMB} = +85°C$

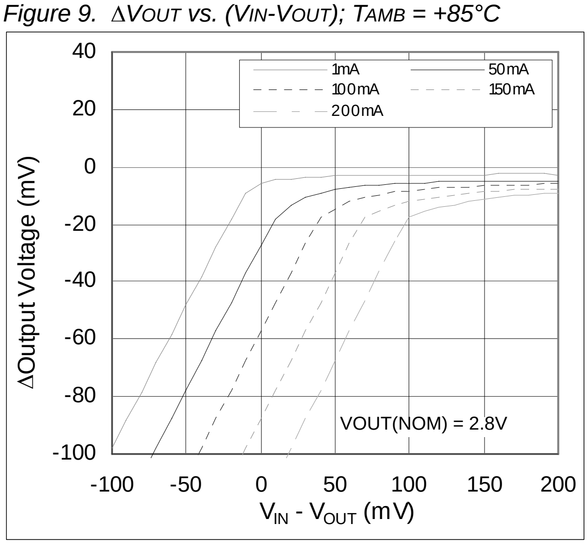


Figure 10. Dropout Voltage vs. I_{OUT}; $V_{OUT} = 2.8V$

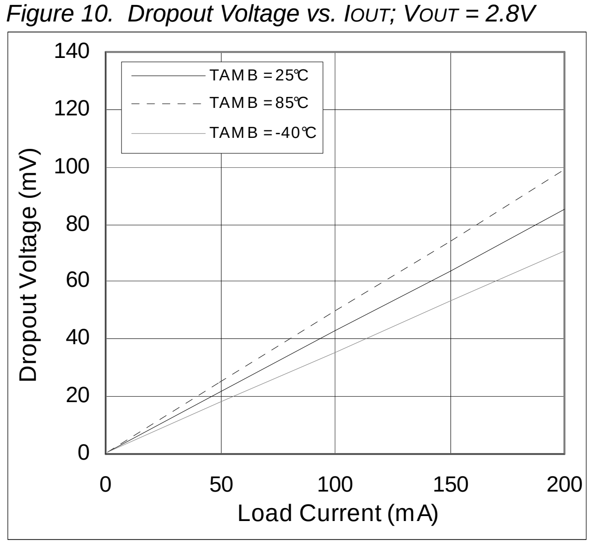


Figure 11. VOUT vs. IOUT; VOUT(NOM) = 1.5V

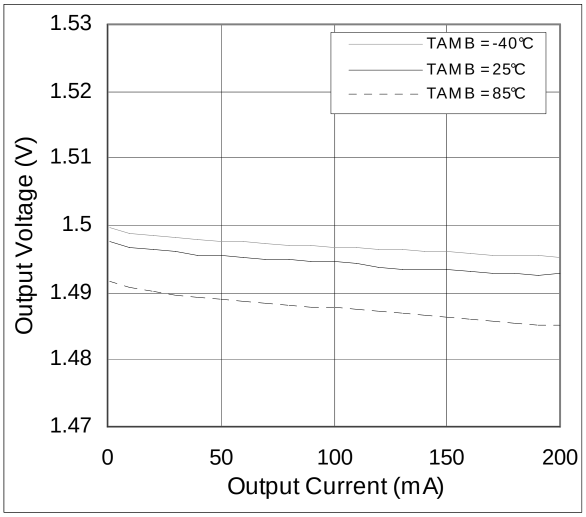


Figure 12. VOUT vs. IOUT; VOUT(NOM) = 2.8V

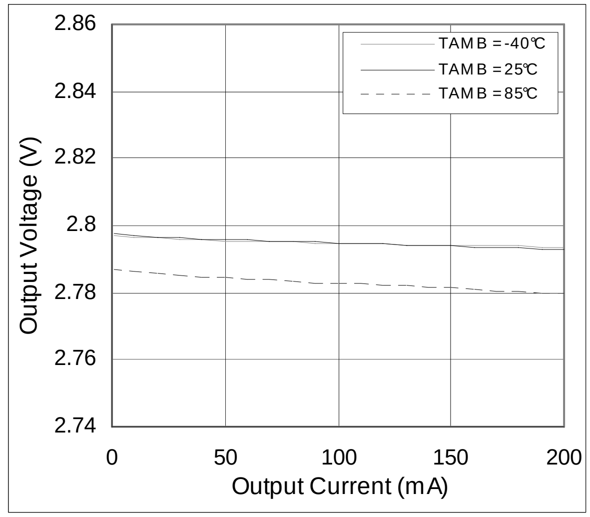


Figure 13. ΔVOUT vs. IOUT; VOUT(NOM) = 1.5V

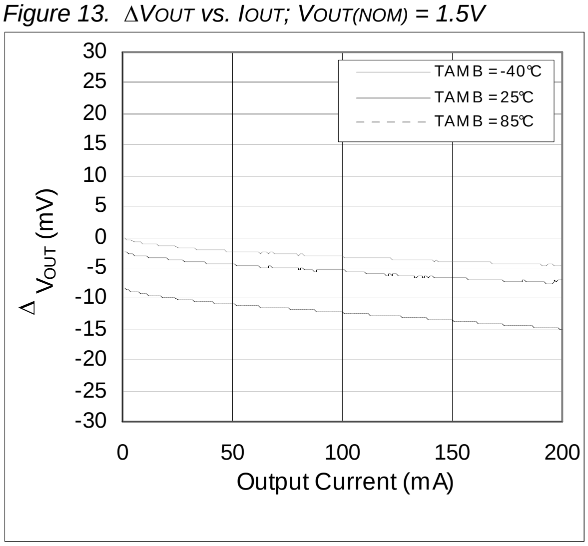


Figure 14. ΔVOUT vs. IOUT; VOUT(NOM) = 2.8V

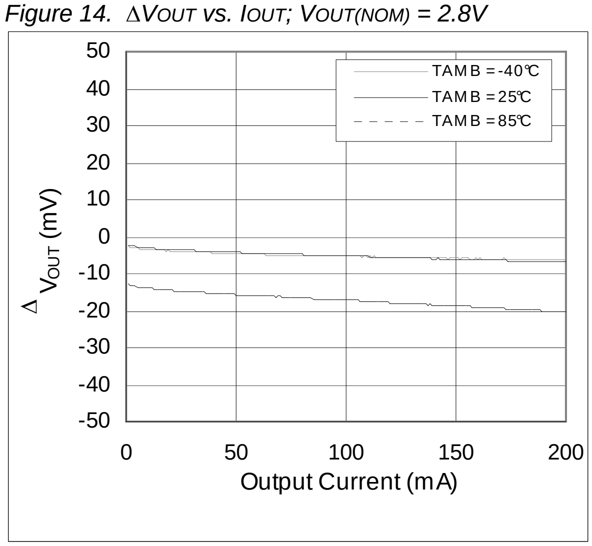


Figure 15. ΔVOUT vs. Temp.; VOUT(NOM) = 1.5V

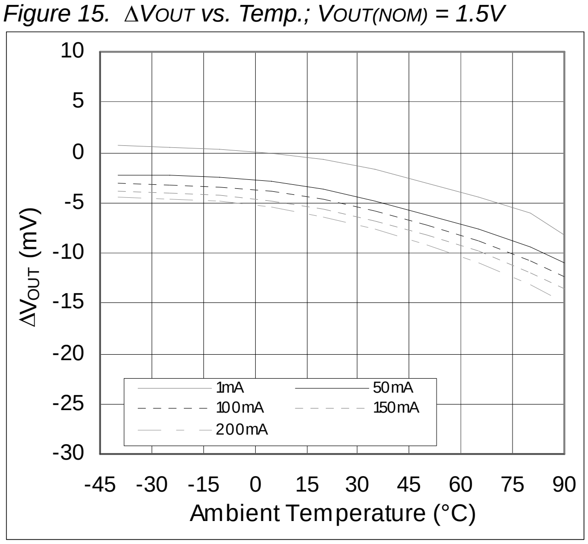


Figure 16. ΔVOUT vs. Temp.; VOUT(NOM) = 2.8V

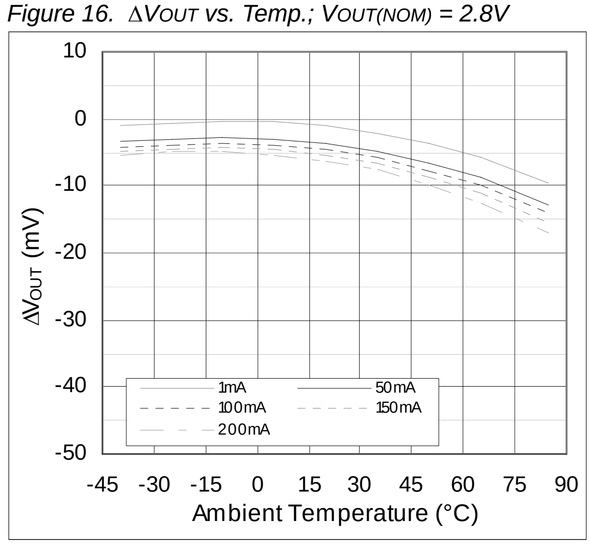


Figure 17. Dropout Voltage vs. Temp.; V_{OUT} = 2.8V

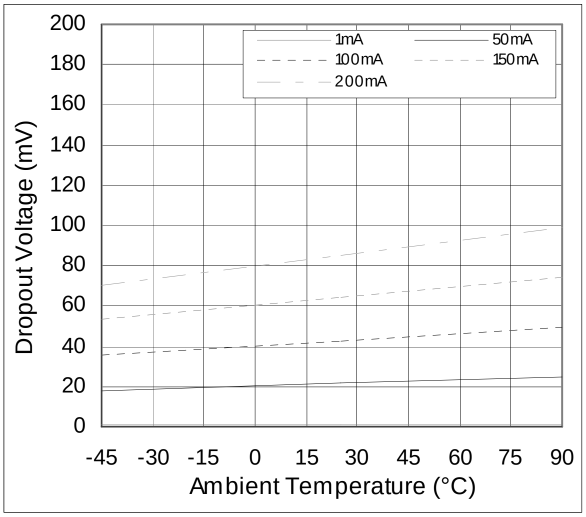


Figure 18. $I_{OUT(MAX)}$ vs. Temp.

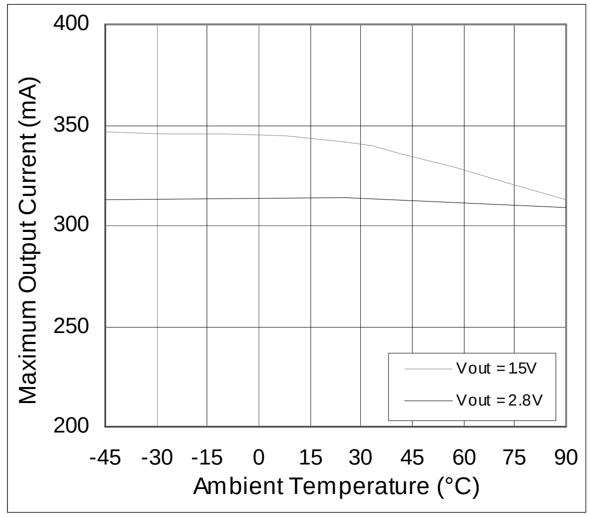


Figure 19. Quiescent Current vs. V_{IN}

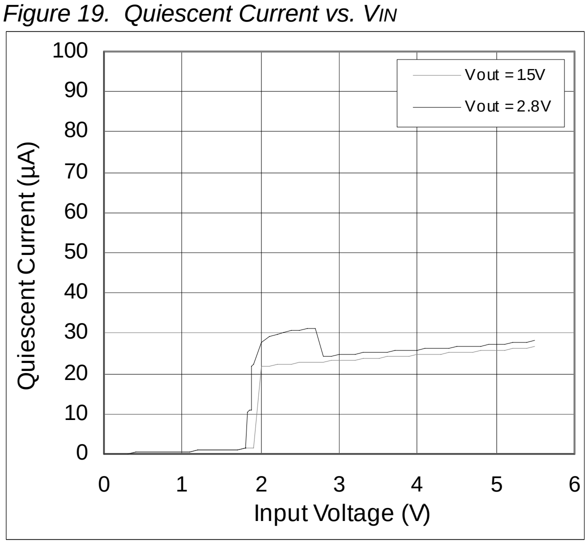


Figure 20. Standby Current vs. V_{IN}

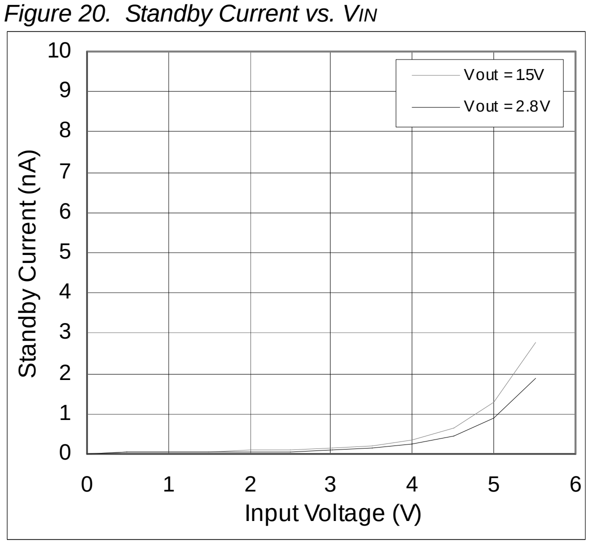


Figure 21. Ground Current vs. I_{OUT}

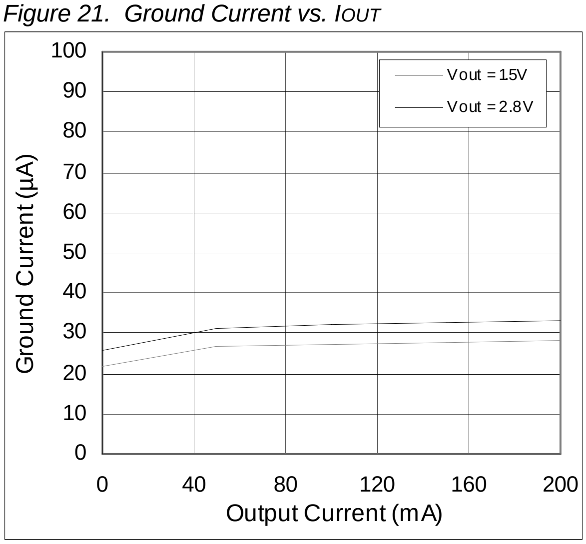


Figure 22. Quiescent Current vs. Temperature

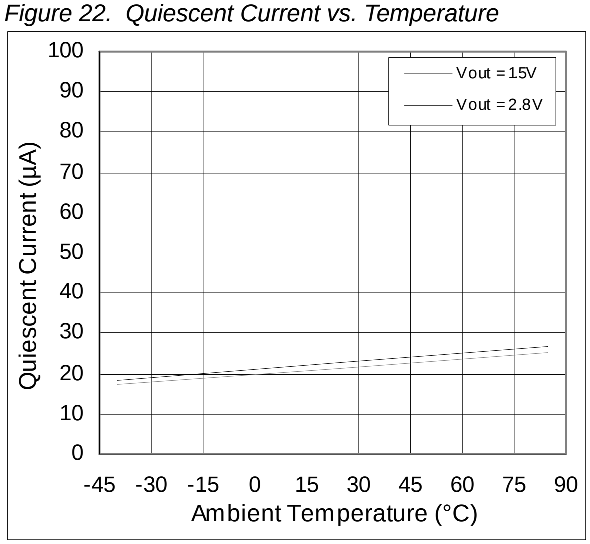


Figure 23. Ground Current vs. Temp.; VOUT = 1.5V

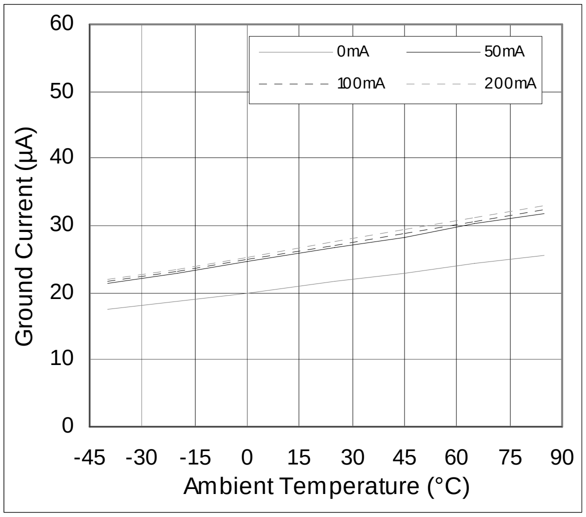


Figure 24. Ground Current vs. Temp.; VOUT = 2.8V

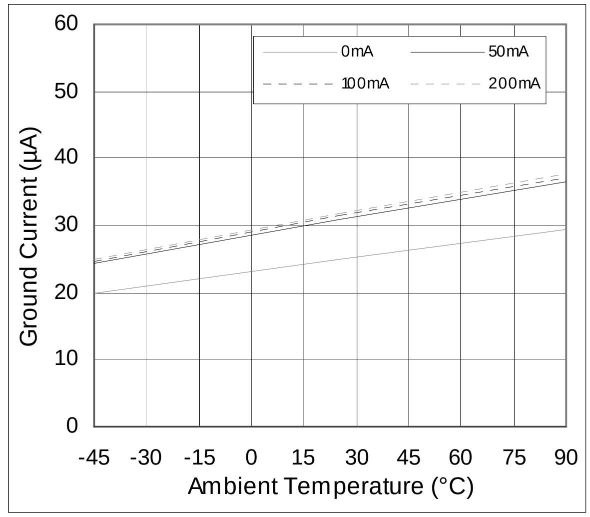


Figure 25. IEN vs. VOUT; VOUT = 1.5V

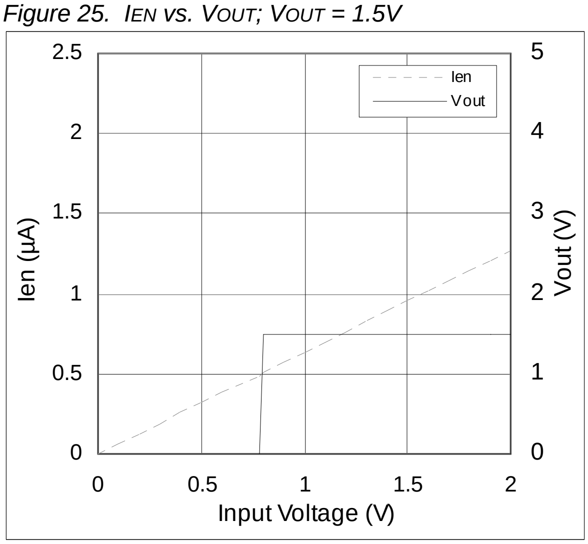


Figure 26. IEN vs. VOUT; VOUT = 2.8V

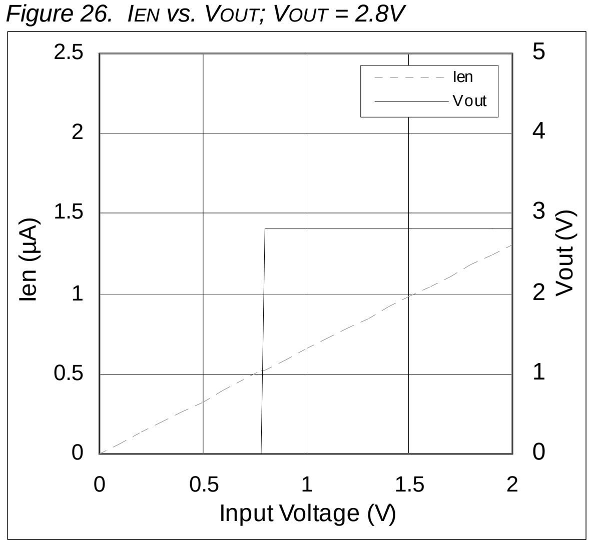


Figure 27. VEN vs. Temperature

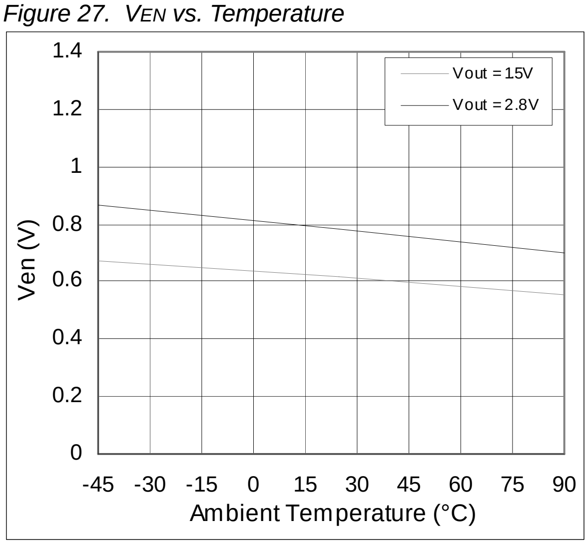


Figure 28. IEN vs. Temperature

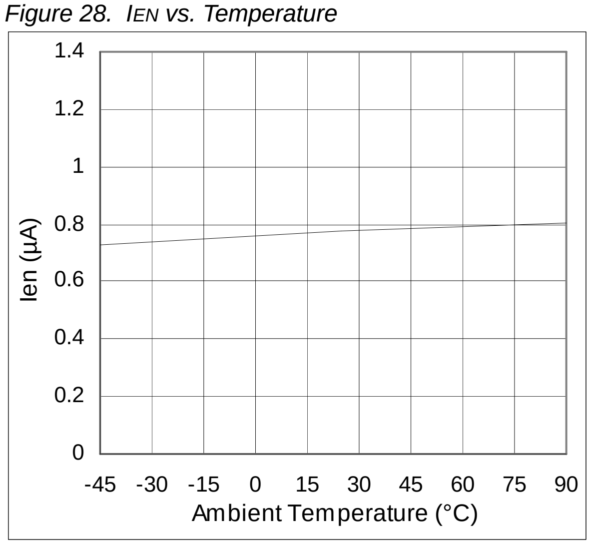


Figure 29. PSRR vs. VIN-VOUT(NOM), VOUT = 1.5V

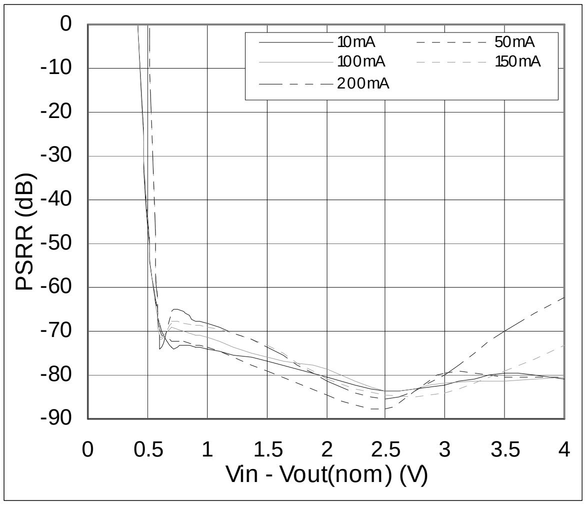


Figure 30. PSRR vs. VIN-VOUT(NOM), VOUT = 2.8V

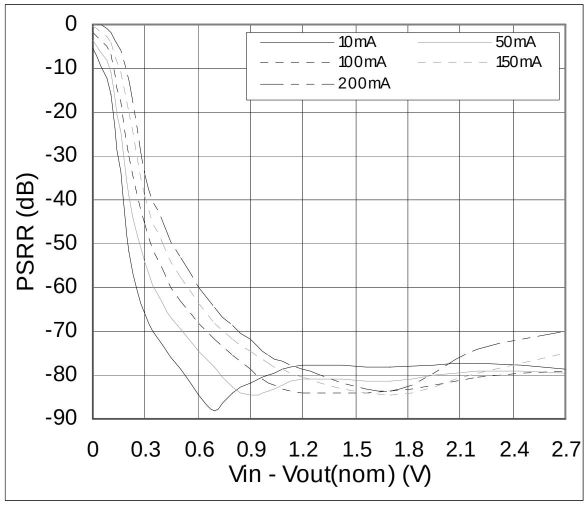


Figure 31. PSRR vs. Frequency, IOUT = 10mA

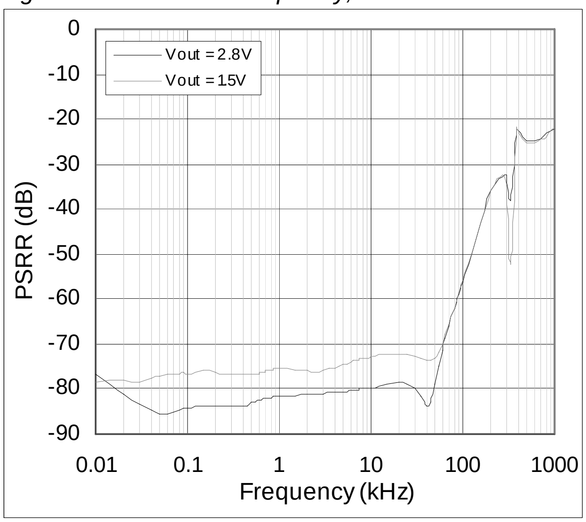


Figure 32. Spectral Noise vs. Frequency, IOUT = 10mA

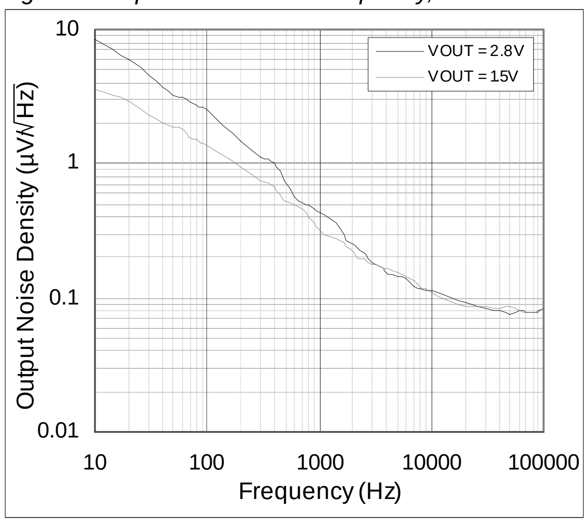


Figure 33. Voltage Noise vs. VOUT, IOUT = 30mA

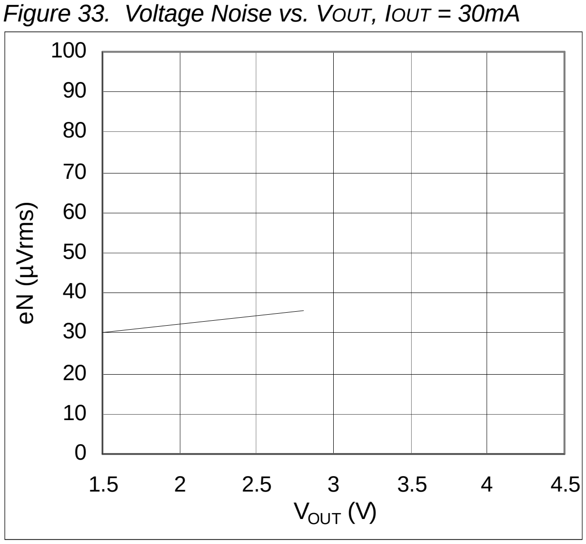


Figure 34. Line Transient Response; I_{OUT} = 50mA, V_{OUT} = 1.5V, V_{IN} = 3.5 to 2.9V

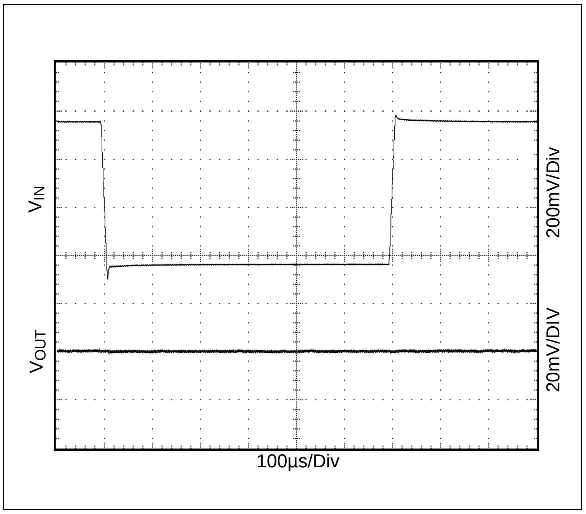


Figure 35. Line Transient Response; I_{OUT} = 50mA, V_{OUT} = 2.8V, V_{IN} = 4.8 to 4.2V

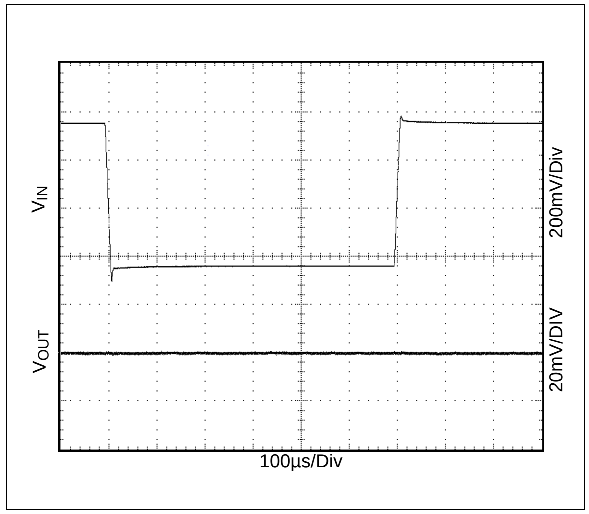


Figure 36. Line Transient Response; I_{OUT} = 100mA, V_{OUT} = 1.5V, V_{IN} = 3.5 to 2.9V

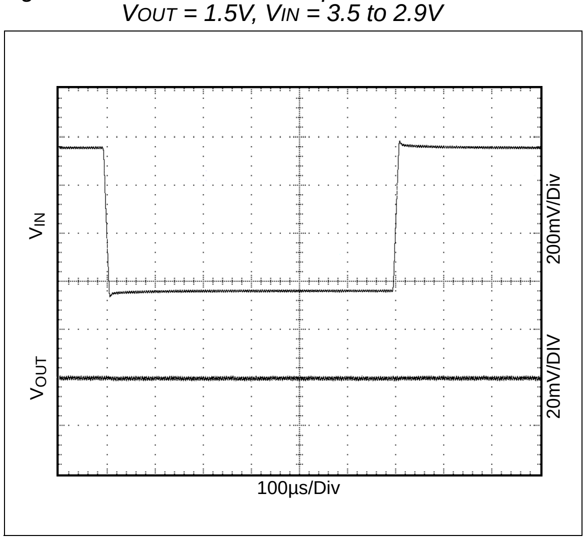


Figure 37. Line Transient Response; I_{OUT} = 100mA, V_{OUT} = 2.8V, V_{IN} = 4.8 to 4.2V

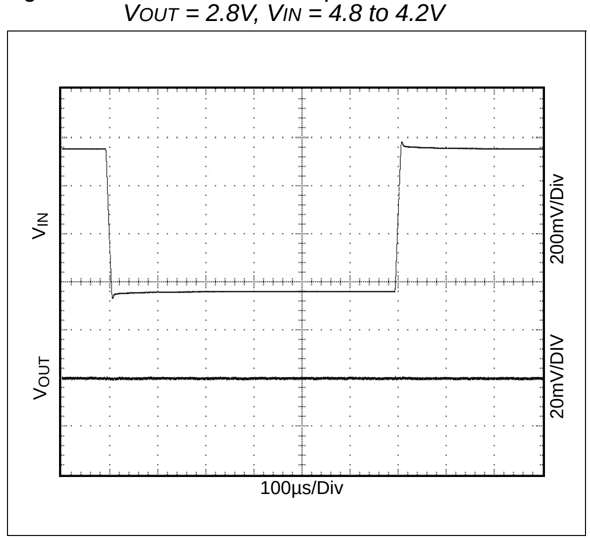


Figure 38. Line Transient Response; I_{OUT} = 200mA, V_{OUT} = 1.5V, V_{IN} = 3.5 to 2.9V

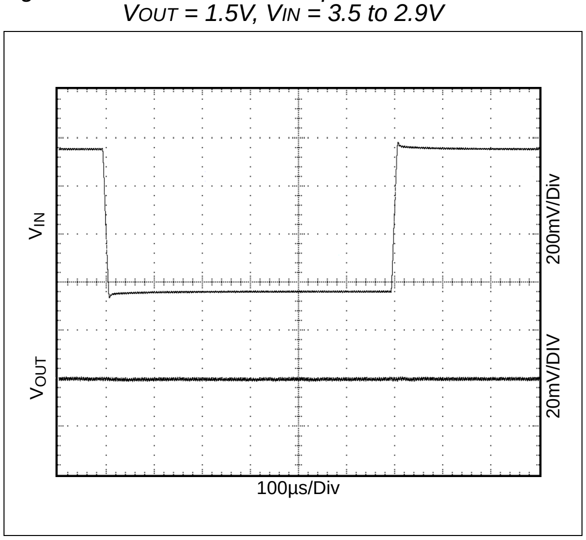
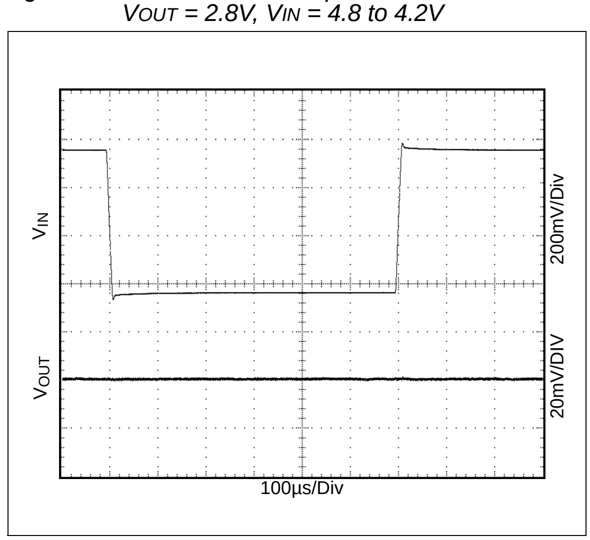


Figure 39. Line Transient Response; I_{OUT} = 200mA, V_{OUT} = 2.8V, V_{IN} = 4.8 to 4.2V



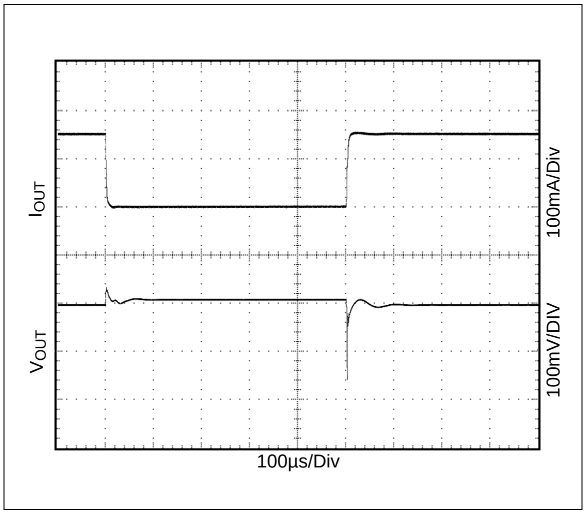


Figure 40. Load Transient; I_{OUT} = 0 to 150mA
V_{IN} = 2.0V, V_{OUT} = 1.5V

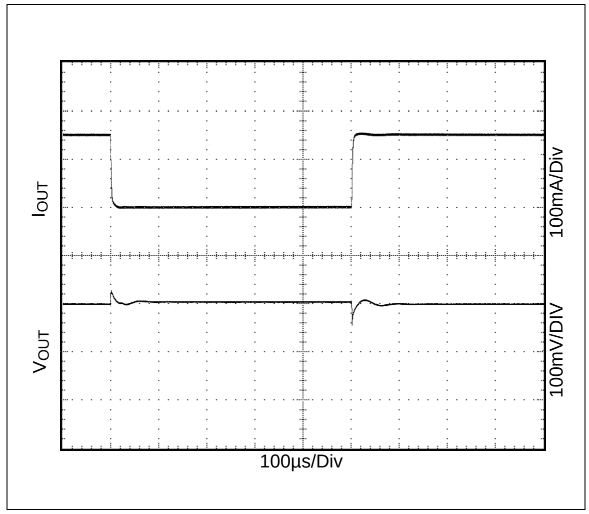


Figure 41. Load Transient; I_{OUT} = 0 to 150mA
V_{IN} = 3.3V, V_{OUT} = 2.8V

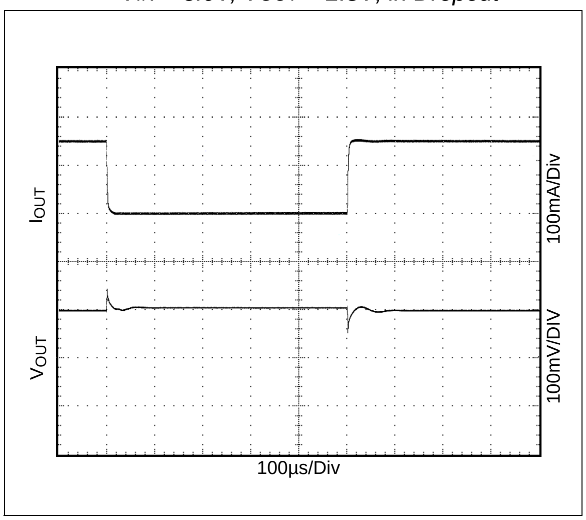


Figure 42. Load Transient; I_{OUT} = 0 to 150mA
V_{IN} = 3.0V, V_{OUT} = 2.8V, in Dropout

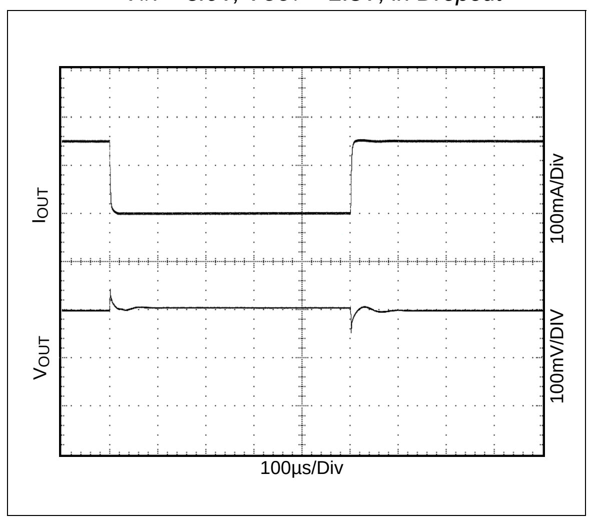


Figure 43. Load Transient; I_{OUT} = 1 to 150mA
V_{IN} = 3.0V, V_{OUT} = 2.8V, in Dropout

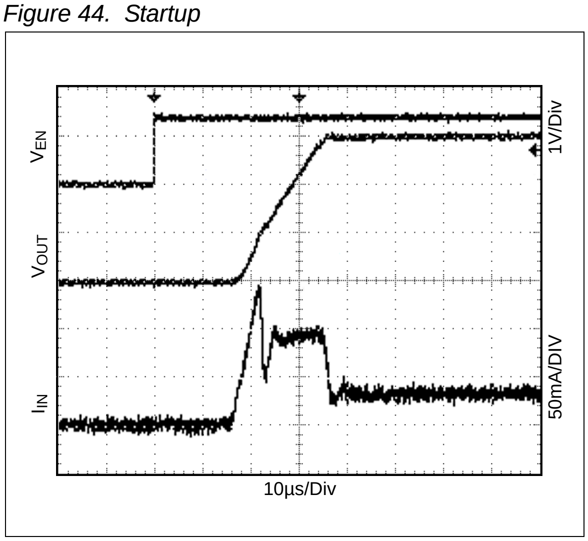


Figure 44. Startup

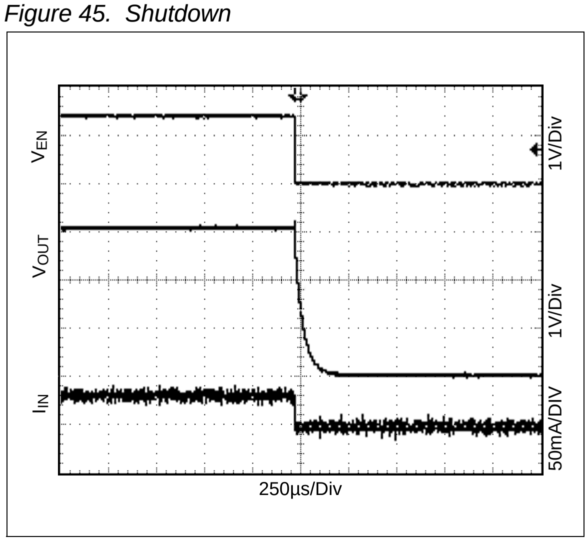
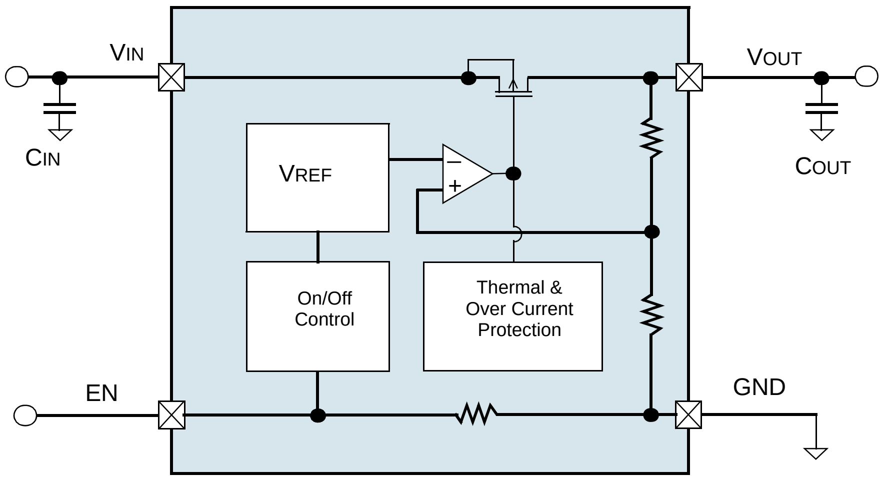


Figure 45. Shutdown

8 Typical Application

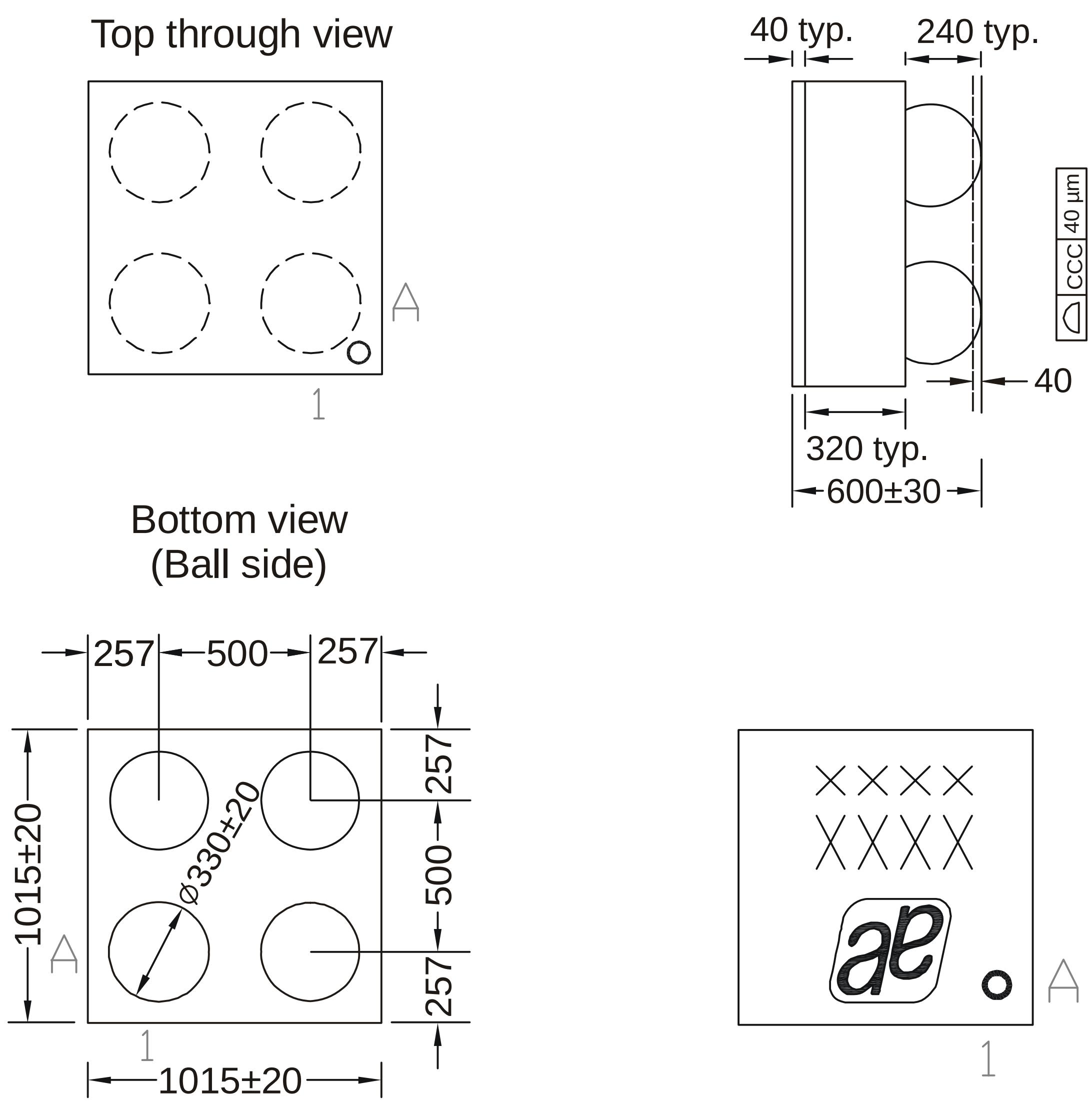
Figure 46. Typical Application Diagram



9 Package Drawings and Markings

The AS1369 is available in a 4-bump WL-CSP package.

Figure 47. 4-bump WL-CSP Package



Notes:

1. All dimensions are in µm.

10 Ordering Information

The AS1369 is available as the standard versions listed in Table 4. Other versions are available upon request. Contact austriamicrosystems, AG for more information.

Table 4. Ordering Information

Model	Marking	Description	Delivery Form	Package
AS1369-BWLT-15	ASPZ	1.5V LDO, 200mA	Tape and Reel	4-bump WL-CSP
AS1369-BWLT-18	ASP0	1.8V LDO, 200mA	Tape and Reel	4-bump WL-CSP
AS1369-BWLT-25	ASP1	2.5V LDO, 200mA	Tape and Reel	4-bump WL-CSP
AS1369-BWLT-28	ASP2	2.8V LDO, 200mA	Tape and Reel	4-bump WL-CSP
AS1369-BWLT-30	ASP3	3.0V LDO, 200mA	Tape and Reel	4-bump WL-CSP
AS1369-BWLT-33	ASP4	3.3V LDO, 200mA	Tape and Reel	4-bump WL-CSP
AS1369-BWLT-45*	ASP5	4.5V LDO, 200mA	Tape and Reel	4-bump WL-CSP
AS1369-BWLT-50*	ASP6	5.0V LDO, 200mA	Tape and Reel	4-bump WL-CSP

* Available upon request. Contact austriamicrosystems AG for details.

All devices are RoHS compliant and free of halogene substances.

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