

**Dual Low Bias Current, Low Voltage, Rail-to-Rail
Input/Output CMOS Operational Amplifiers**

AZV832

General Description

The AZV832 is low bias current, low voltage dual channel operational amplifiers which can be designed into a wide range of applications. The AZV832 has a quiescent current of 140µA at $V_{CC}=5V$.

The AZV832 features optimal performance in low voltage, low bias current systems. The IC can provide rail-to-rail output swing under heavy loads. The common-mode input voltage range could be designed 200mV exceeding the supply voltage range, thus enables the customer to expand its application scope. The AZV832 has a maximum input offset voltage of 2.5mV and its operating range is from 1.6V to 5.5V.

AZV832 is available in SOIC-8 and MSOP-8 packages.

Features

- Single Supply Voltage Range: 1.6V to 5.5V
- Ultra-low Input Bias Current: 1pA (Typ.)
- Offset Voltage: 0.5mV (Typ.), 2.5mV (Max.)
- Rail-to-Rail Input
 V_{CM} : 200mV beyond Rails
- Rail-to-Rail Output Swing:
10kΩ Load: 4mV from Rail
1kΩ Load: 25mV from Rail
- Supply Current: 140µA
- Unity Gain Stable
- Gain Bandwidth Product: 1.0MHz
- Slew Rate: 0.45V/µs @ $V_{CC}=5.0V$
- Operation Ambient Temperature Range: -40°C to 85°C

Applications

- Sensors
- Photodiode Amplification
- Battery-Powered Instrumentation
- Pulse Blood Oximeter, Glucose Meter



Figure 1. Package Types of AZV832

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Pin Configuration

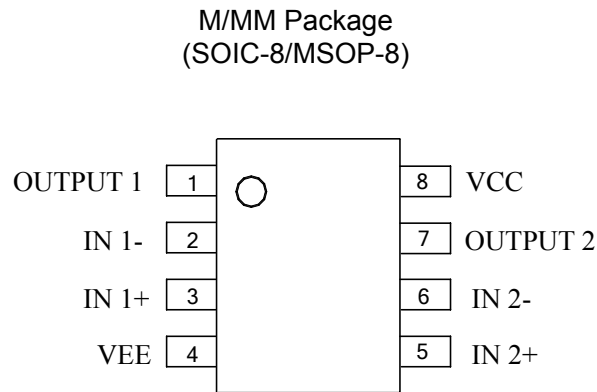


Figure 2. Pin Configuration of AZV832 (Top View)

Function Block Diagram

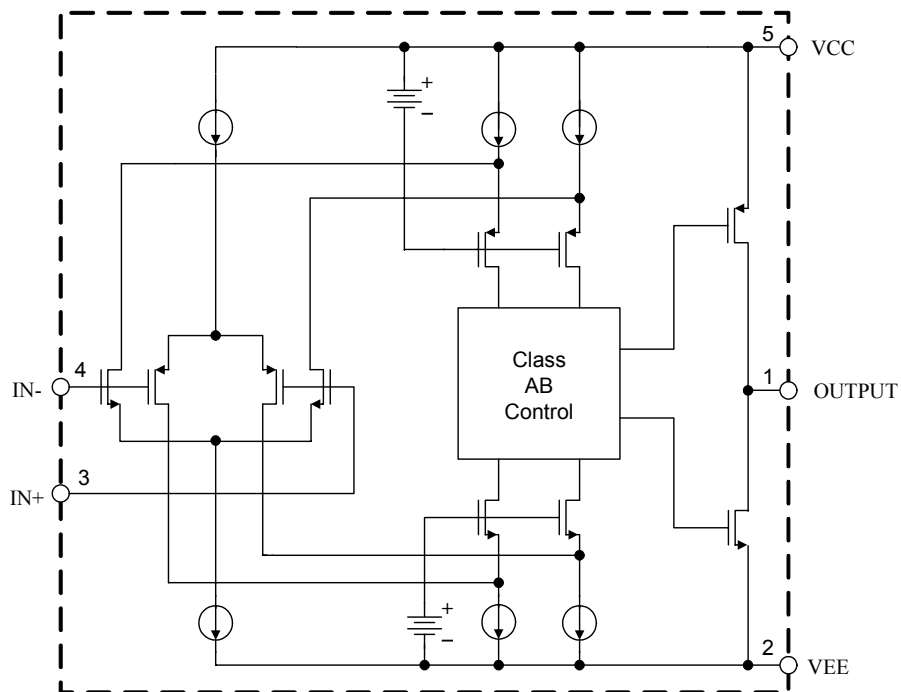


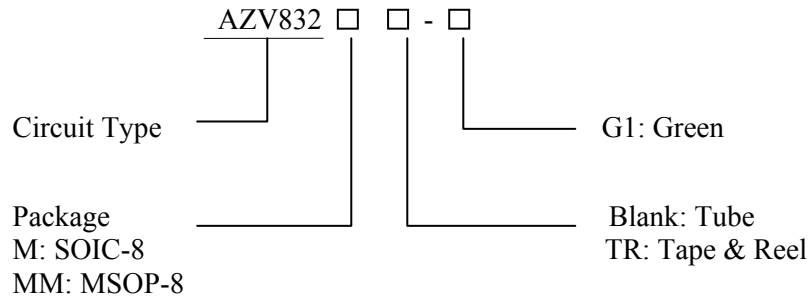
Figure 3. Functional Block Diagram of AZV832/Amplifier



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Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOIC-8	-40 to 85°C	AZV832M-G1	832M-G1	Tube
		AZV832MTR-G1	832M-G1	Tape & Reel
MSOP-8	-40 to 85°C	AZV832MM-G1	832MM-G1	Tube
		AZV832MMTR-G1	832MM-G1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

**Dual Low Bias Current, Low Voltage, Rail-to-Rail
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Parameter	Symbol	Value	Unit	
Power Supply Voltage	V_{CC}	6.0	V	
Differential Input Voltage	V_{ID}	6.0	V	
Input Voltage	V_{IN}	-0.3 to $V_{CC}+0.5$	V	
Operating Junction Temperature	T_J	150	°C	
Thermal Resistance (Junction to Ambient)	θ_{JA}	SOIC-8	150	°C/W
		MSOP-8	200	
Storage Temperature Range	T_{STG}	-65 to 150	°C	
Lead Temperature (Soldering,10 Seconds)	T_{LEAD}	260	°C	
ESD (Human Body Model)		4000	V	
ESD (Machine Model)		300	V	

Note 1: Stresses greater than 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 under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	1.6	5.5	V
Operation Ambient Temperature Range	T_A	-40	85	°C



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1.6V DC Electrical Characteristics

$V_{CC}=1.6V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^{\circ}C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{OS}			0.5	2.5	mV
Input Bias Current	I_B			1.0	5.0	pA
Input Offset Current	I_{OS}				2.0	pA
Input Common-mode Voltage Range	V_{CM}		-0.2		1.8	V
Common-mode Rejection Ratio	CMRR	$V_{CM}=-0.2V$ to $1.8V$	55	75		dB
Large Signal Voltage Gain	G_V	$R_L=10k\Omega$ connect to $V_{CC}/2$, $V_O=0.2V$ to $1.4V$	90	110		dB
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			2.0		$\mu V/^{\circ}C$
Output Voltage Swing from Rail	V_{OL}/V_{OH}	$V_{ID}=0.5V, R_L=1k\Omega$ connect to $V_{CC}/2$		30	50	mV
		$V_{ID}=0.5V, R_L=10k\Omega$ connect to $V_{CC}/2$		3	15	
Output Current	Sink	I_{SINK}	$V_{OUT}=V_{CC}$	8	10	mA
	Source	I_{SOURCE}	$V_{OUT}=0V$	5	8.5	
Closed-loop Output Impedance	Z_{OUT}	$f=10kHz, G=1$ (Note 2)		9		Ω
Power Supply Rejection Ratio	PSRR	$V_{CC}=1.6V$ to $5.0V, V_{CM}=0.5V$	70	80		dB
Supply Current	I_{CC}	$V_{CM}<V_{CC}-1V, I_{OUT}=0$		140	180	μA

1.6V AC Electrical Characteristics

$V_{CC}=1.6V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^{\circ}C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	$R_L=100k\Omega$		1.0		MHz
Slew Rate	SR	$G=1, 1V$ Step, $C_L=100pF, R_L=10k\Omega$		0.32		$V/\mu s$
Phase Margin	ϕ_M	$R_L=100k\Omega$		67		Degrees
Total Harmonic Distortion+Noise	THD+N	$f=1kHz, G=1, V_{IN}=1V_{pp}$ $R_L=10k\Omega, C_L=100pF$		-70		dB
Voltage Noise Density	e_n	$f=1kHz$		27		nV/\sqrt{Hz}

Note 2: G is Closed-Loop Voltage Gain.



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1.8V DC Electrical Characteristics

$V_{CC}=1.8V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^{\circ}C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{OS}			0.5	2.5	mV
Input Bias Current	I_B			1.0	5.0	pA
Input Offset Current	I_{OS}				2.0	pA
Input Common-mode Voltage Range	V_{CM}		-0.2		2.0	V
Common-mode Rejection Ratio	CMRR	$V_{CM}=-0.2V$ to $2.0V$	55	75		dB
Large Signal Voltage Gain	G_V	$R_L=10k\Omega$ connect to $V_{CC}/2$, $V_O=0.2V$ to $1.6V$	90	112		dB
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			2.0		$\mu V/^{\circ}C$
Output Voltage Swing from Rail	V_{OL}/V_{OH}	$V_{ID}=0.5V, R_L=1k\Omega$ connect to $V_{CC}/2$		25	50	mV
		$V_{ID}=0.5V, R_L=10k\Omega$ connect to $V_{CC}/2$		3	15	
Output Current	Sink	I_{SINK}	$V_{OUT}=V_{CC}$	12	16	mA
	Source	I_{SOURCE}	$V_{OUT}=0V$	10	14	
Closed-loop Output Impedance	Z_{OUT}	$f=10kHz, G=1$ (Note 2)		9		Ω
Power Supply Rejection Ratio	PSRR	$V_{CC}=1.6V$ to $5.0V, V_{CM}=0.5V$	70	80		dB
Supply Current	I_{CC}	$V_{CM}<V_{CC}-1V, I_{OUT}=0$		140	180	μA

1.8V AC Electrical Characteristics

$V_{CC}=1.8V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^{\circ}C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	$R_L=100k\Omega$		1.0		MHz
Slew Rate	SR	$G=1, 1V$ Step, $C_L=100pF, R_L=10k\Omega$		0.34		$V/\mu s$
Phase Margin	ϕ_M	$R_L=100k\Omega$		67		Degrees
Total Harmonic Distortion+Noise	THD+N	$f=1kHz, G=1, V_{IN}=1V_{pp}$ $R_L=10k\Omega, C_L=100pF$		-70		dB
Voltage Noise Density	e_n	$f=1kHz$		27		nV/\sqrt{Hz}

Note 2: G is Closed-Loop Voltage Gain.



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3.0V DC Electrical Characteristics

$V_{CC}=3.0V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^{\circ}C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{OS}			0.5	2.5	mV
Input Bias Current	I_B			1.0	5.0	pA
Input Offset Current	I_{OS}				2.0	pA
Input Common-mode Voltage Range	V_{CM}		-0.3		3.3	V
Common-mode Rejection Ratio	CMRR	$V_{CM}=-0.3V$ to 1.9V	62	80		dB
		$V_{CM}=-0.3V$ to 3.3V	58	75		
Large Signal Voltage Gain	G_V	$R_L=1k\Omega$ connect to $V_{CC}/2$, $V_O=0.2V$ to 2.8V	90	110		dB
		$R_L=10k\Omega$ connect to $V_{CC}/2$, $V_O=0.1V$ to 2.9V	95	115		
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			2.0		$\mu V/^{\circ}C$
Output Voltage Swing from Rail	V_{OL}/V_{OH}	$V_{IN}=0.5V, R_L=1k\Omega$ connect to $V_{CC}/2$		20	50	mV
		$V_{IN}=0.5V, R_L=10k\Omega$ connect to $V_{CC}/2$		3	15	
Output Current	Sink	I_{SINK}	$V_{OUT}=V_{CC}$	50	60	mA
	Source	I_{SOURCE}	$V_{OUT}=0V$	50	65	
Closed-loop Output Impedance	Z_{OUT}	$f=10kHz, G=1$ (Note 2)		9		Ω
Power Supply Rejection Ratio	PSRR	$V_{CC}=1.6V$ to 5.0V, $V_{CM}=0.5V$	70	80		dB
Supply Current	I_{CC}	$V_{CM}<V_{CC}-1V, I_{OUT}=0$		140	180	μA

3.0V AC Electrical Characteristics

$V_{CC}=3.0V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^{\circ}C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	$R_L=100k\Omega$		1.0		MHz
Slew Rate	SR	$G=1, 2V$ Step, $C_L=100pF, R_L=10k\Omega$		0.40		$V/\mu s$
Phase Margin	ϕ_M	$R_L=100k\Omega$		67		Degrees
Total Harmonic Distortion+Noise	THD+N	$f=1kHz, G=1, V_{IN}=1V_{pp}$ $R_L=10k\Omega, C_L=100pF$		-70		dB
Voltage Noise Density	e_n	$f=1kHz$		27		nV/\sqrt{Hz}

Note 2: G is Closed-Loop Voltage Gain.



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5.0V DC Electrical Characteristics

$V_{CC}=5.0V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^\circ C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{OS}			0.5	2.5	mV
Input Bias Current	I_B			1.0	5.0	pA
Input Offset Current	I_{OS}				2.0	pA
Input Common-mode Voltage Range	V_{CM}		-0.3		5.3	V
Common-mode Rejection Ratio	CMRR	$V_{CM}=-0.3V$ to 3.9V	70	85		dB
		$V_{CM}=-0.3V$ to 5.3V	65	90		
Large Signal Voltage Gain	G_V	$R_L=1k\Omega$ connect to $V_{CC}/2$, $V_O=0.2V$ to 4.8V	80	92		dB
		$R_L=10k\Omega$ connect to $V_{CC}/2$, $V_O=0.05V$ to 4.95V	85	98		
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			2.0		$\mu V/^\circ C$
Output Voltage Swing from Rail	V_{OL}/V_{OH}	$V_{IN}=0.5V, R_L=1k\Omega$ connect to $V_{CC}/2$		25	50	mV
		$V_{IN}=0.5V, R_L=10k\Omega$ connect to $V_{CC}/2$		4	15	
Output Current	Sink	I_{SINK}	$V_{OUT}=V_{CC}$	100	150	mA
	Source	I_{SOURCE}	$V_{OUT}=0V$	110	185	
Closed-loop Output Impedance		$f=1kHz, G=1$ (note 2)		9		Ω
Power Supply Rejection Ratio	PSRR	$V_{CC}=1.6V$ to 5.0V, $V_{CM}=0.5V$	70	80		dB
Supply Current	I_{CC}	$V_{CM}<V_{CC}-1V, I_{OUT}=0$		140	180	μA

5V AC Electrical Characteristics

$V_{CC}=5.0V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25^\circ C$, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	$R_L=100k\Omega$		1.0		MHz
Slew Rate	SR	$G=1, 2V$ Step, $C_L=100pF, R_L=10k\Omega$		0.45		V/ μs
Phase Margin	ϕ_M	$R_L=100k\Omega$		67		Degrees
THD+N	THD+N	$f=1kHz, G=1, V_{IN}=1V_{PP}$ $R_L=10k\Omega, C_L=100pF$		-70		dB
Voltage Noise Density	e_n	$f=1kHz$		27		nV/\sqrt{Hz}

Note 2: G is Closed-loop Voltage Gain.

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Typical Performance Characteristics

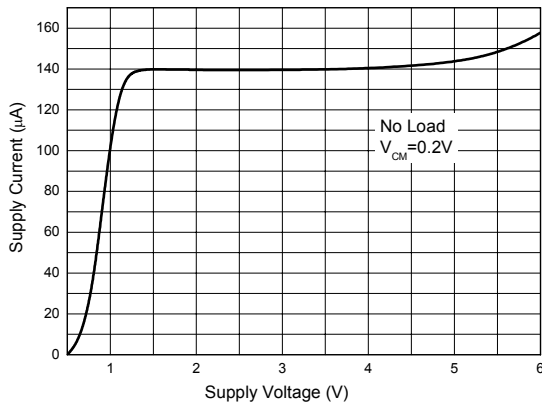


Figure 4. Supply Current vs. Supply Voltage

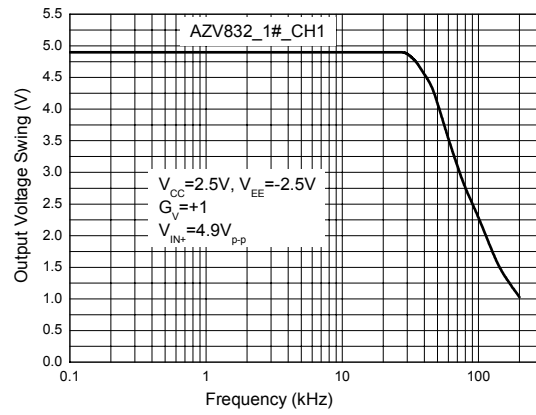


Figure 5. Closed-loop Output Voltage Swing vs. Frequency

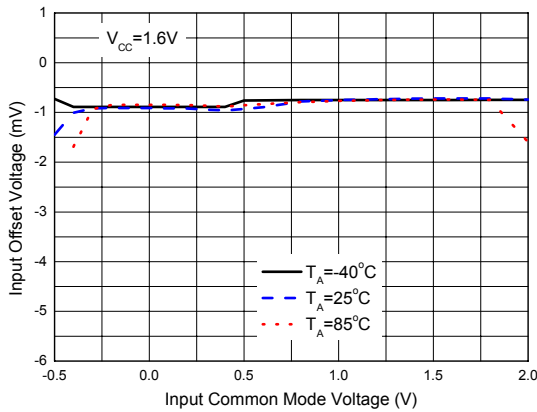


Figure 6. Offset Voltage vs. Common Mode Voltage

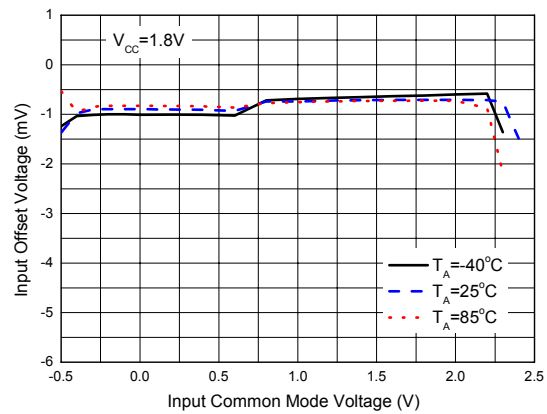


Figure 7. Offset Voltage vs. Common Mode Voltage

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Typical Performance Characteristics (Continued)

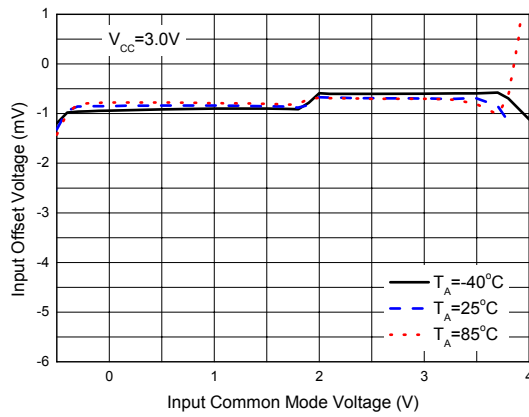


Figure 8. Offset Voltage vs. Common Mode Voltage

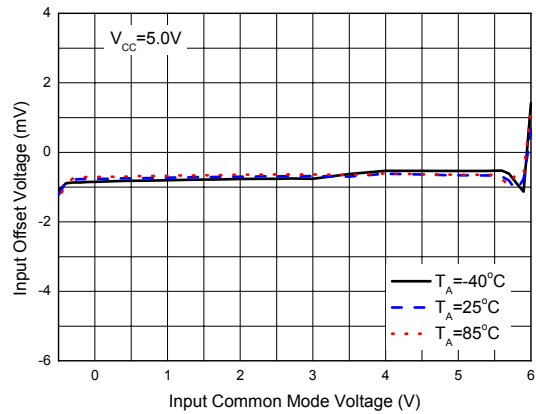


Figure 9. Offset Voltage vs. Common Mode Voltage

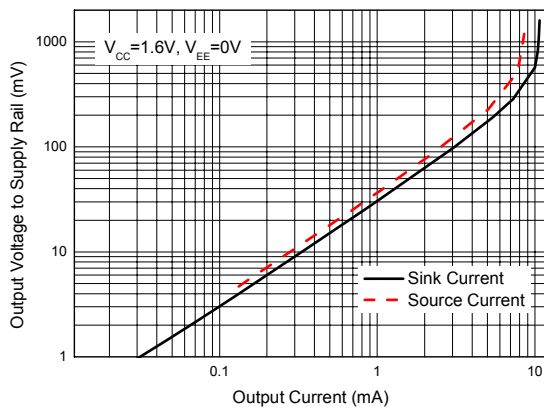


Figure 10. Output Voltage vs. Output Current

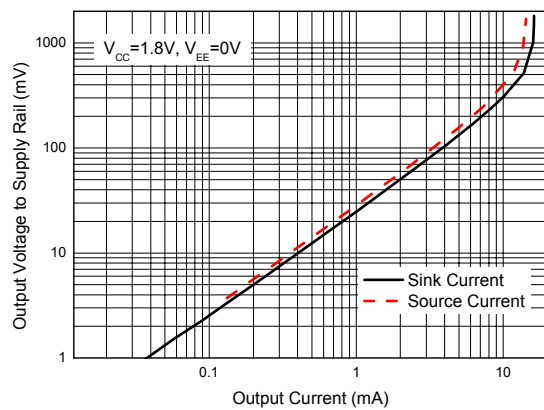


Figure 11. Output Voltage vs. Output Current

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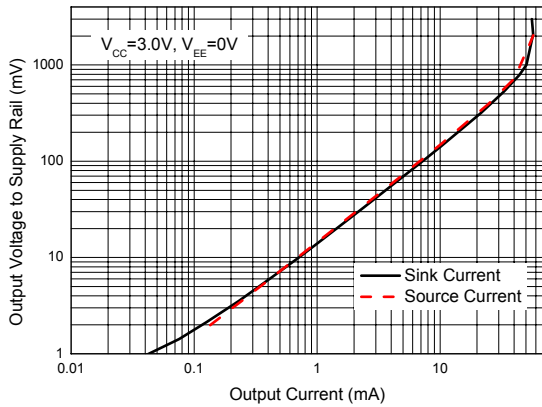


Figure 12. Output Voltage vs. Output Current

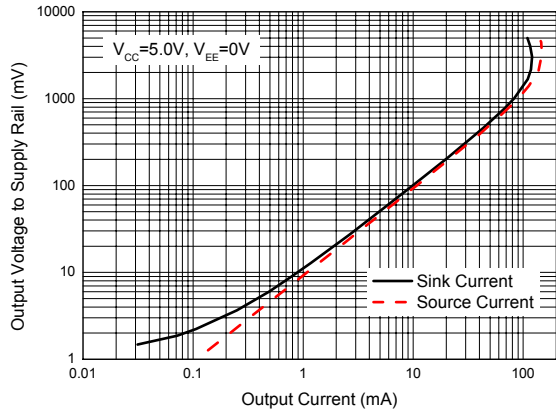


Figure 13. Output Voltage vs. Output Current

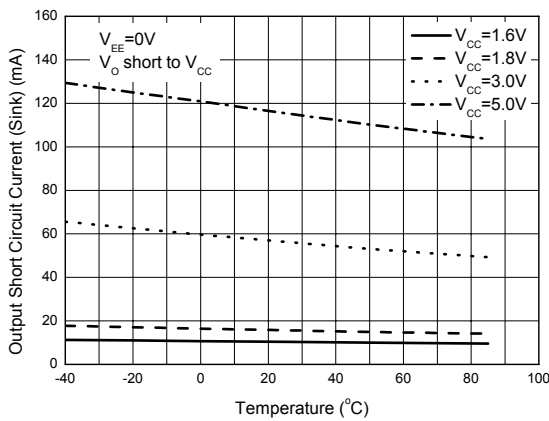


Figure 14. Output Short Circuit Current vs. Temperature

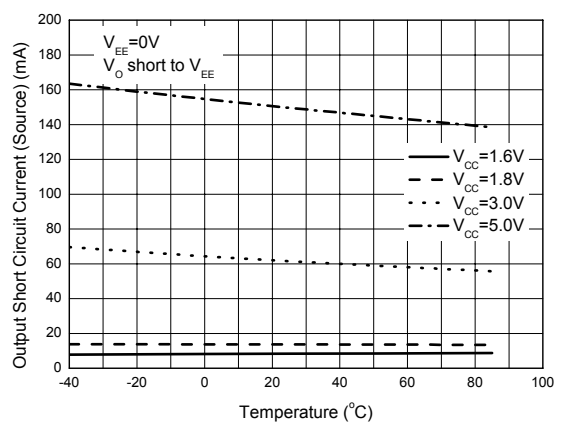


Figure 15. Output Short Circuit Current vs. Temperature

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Typical Performance Characteristics (Continued)

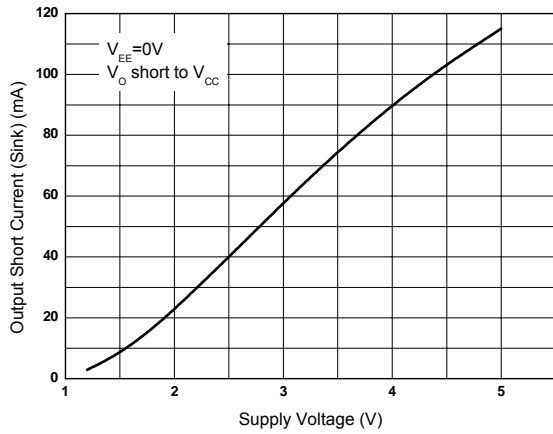


Figure 16. Output Short Circuit Current vs. Supply Voltage

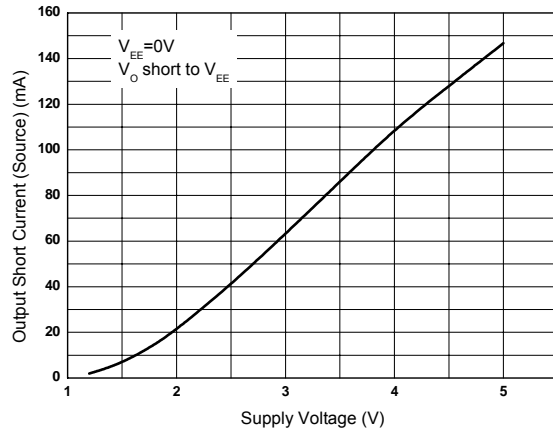


Figure 17. Output Short Circuit Current vs. Supply Voltage

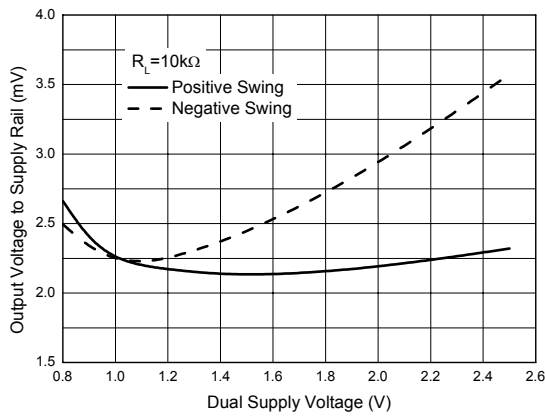


Figure 18. Output Voltage Swing vs. Supply Voltage

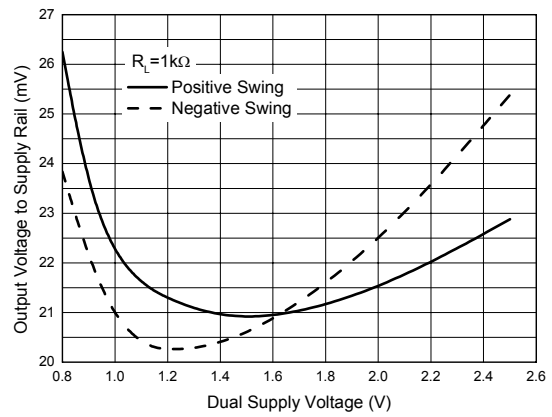


Figure 19. Output Voltage Swing vs. Supply Voltage

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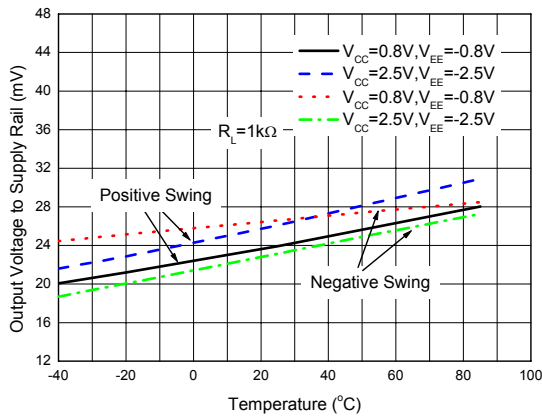


Figure 20. Output Voltage Swing vs. Temperature

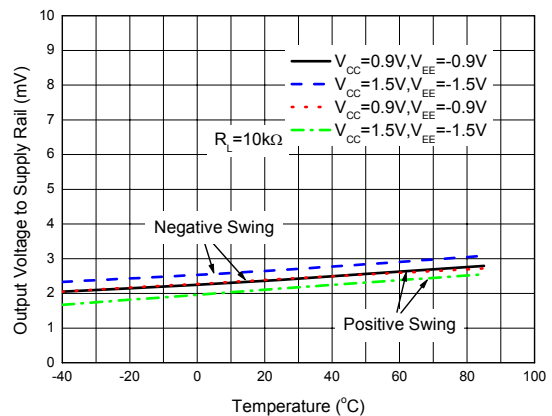


Figure 21. Output Voltage Swing vs. Temperature

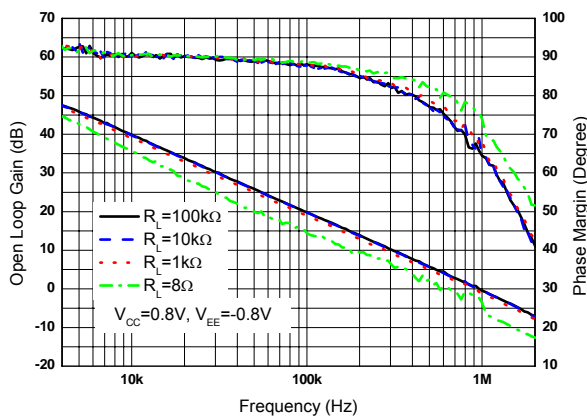


Figure 22. Gain and Phase vs. Frequency and Resistive Load

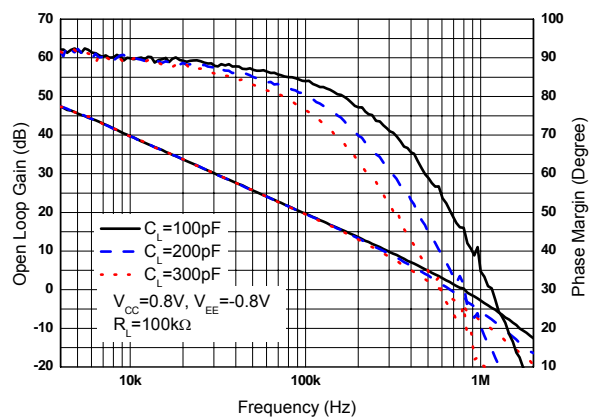


Figure 23. Gain and Phase vs. Frequency and Capacitive Load

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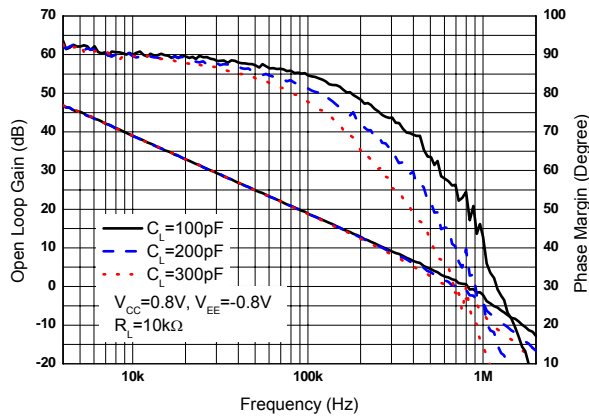


Figure 24. Gain and Phase vs. Frequency and Capacitive Load

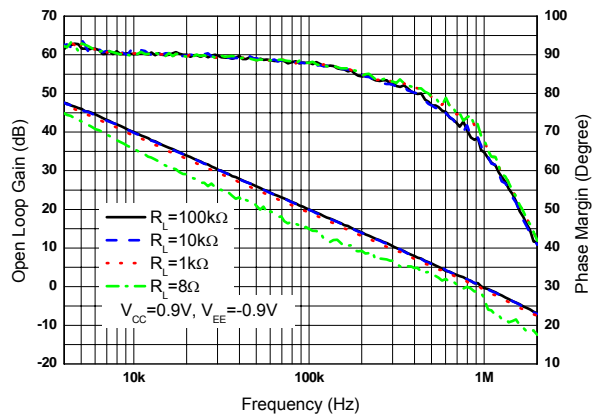


Figure 25. Gain and Phase vs. Frequency and Resistive Load

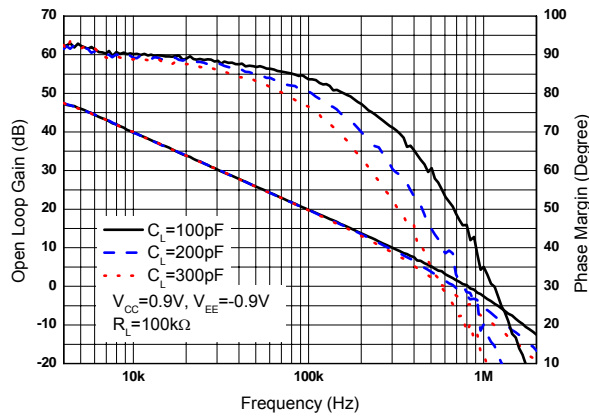


Figure 26. Gain and Phase vs. Frequency and Capacitive Load

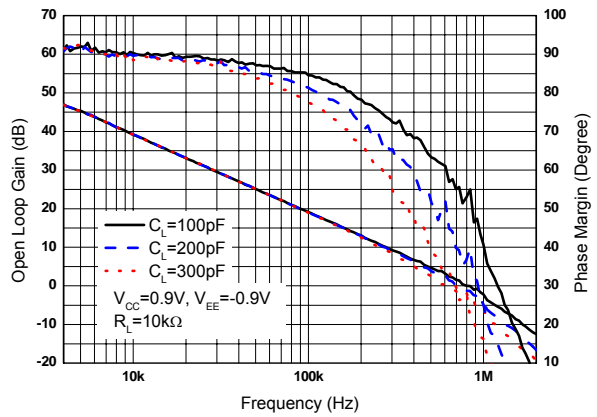


Figure 27. Gain and Phase vs. Frequency and Capacitive Load

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Typical Performance Characteristics (Continued)

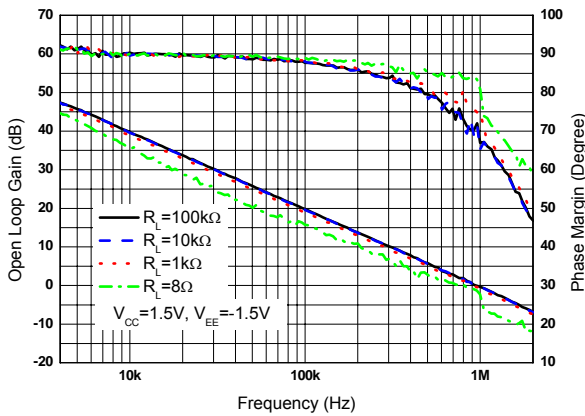


Figure 28. Gain and Phase vs. Frequency and Resistive Load

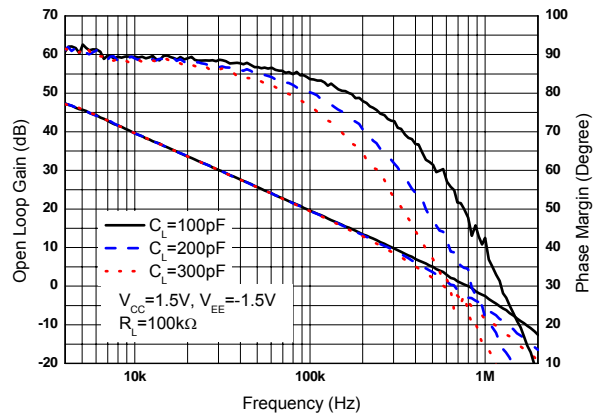


Figure 29. Gain and Phase vs. Frequency and Capacitive Load

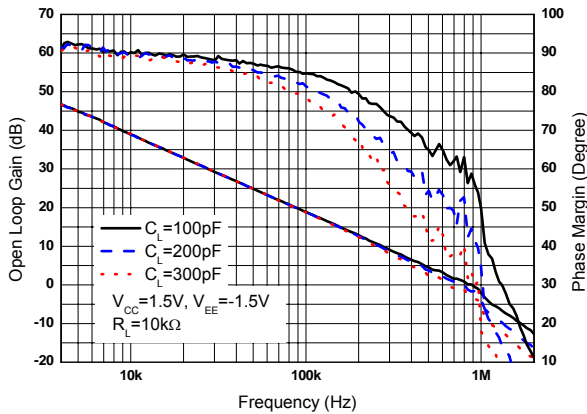


Figure 30. Gain and Phase vs. Frequency and Capacitive Load

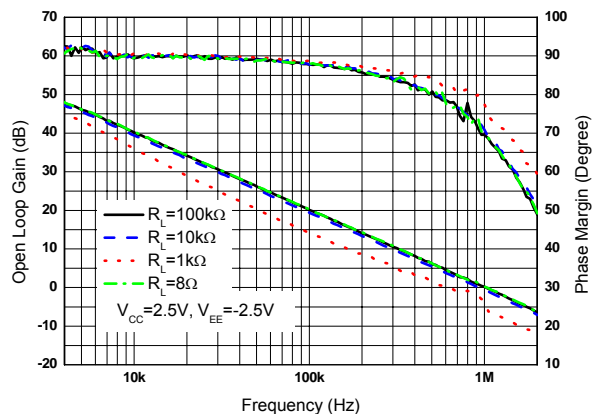


Figure 31. Gain and Phase vs. Frequency and Resistive Load

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Typical Performance Characteristics (Continued)

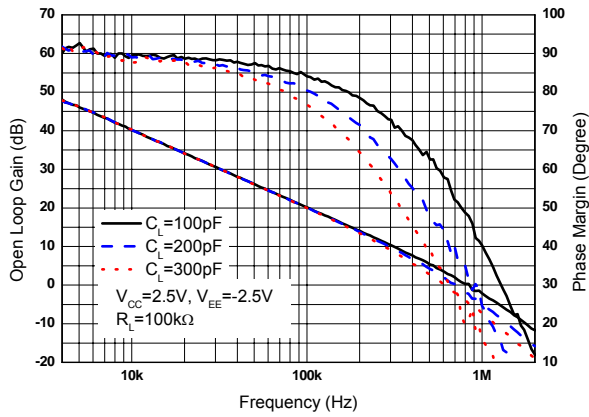


Figure 32. Gain and Phase vs. Frequency and Capacitive Load

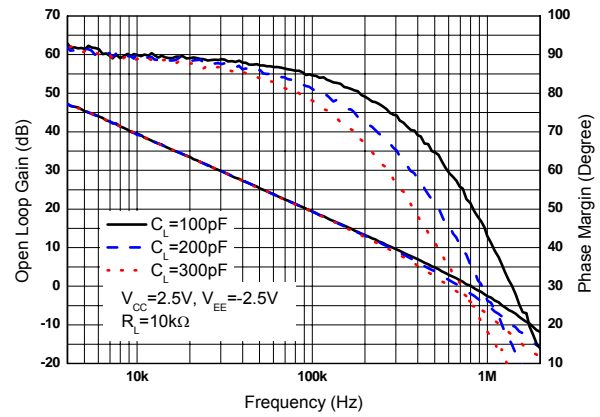


Figure 33. Gain and Phase vs. Frequency and Capacitive Load

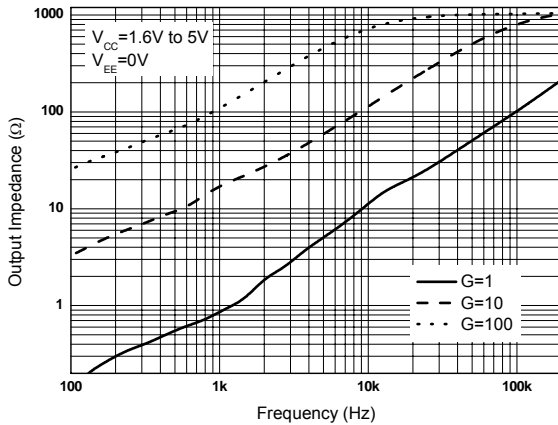


Figure 34. Output Impedance vs. Frequency

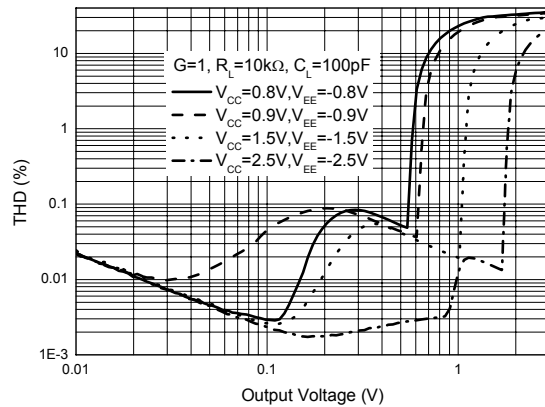


Figure 35. THD+N vs. Output Voltage

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Typical Performance Characteristics (Continued)

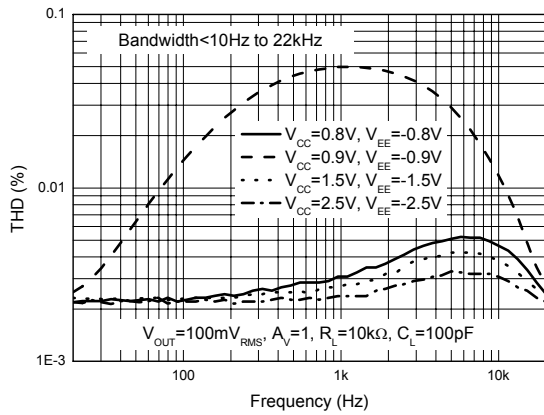


Figure 36. THD+N vs. Frequency

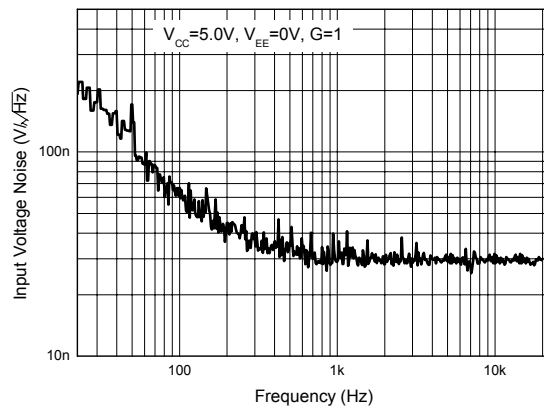
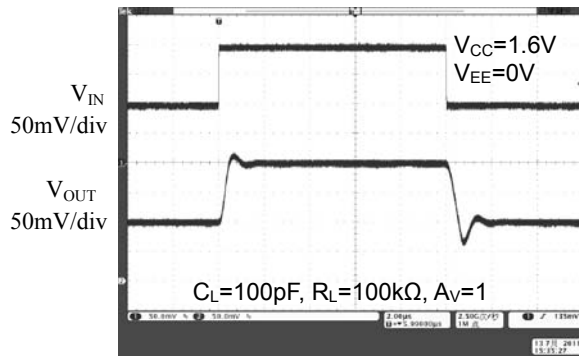
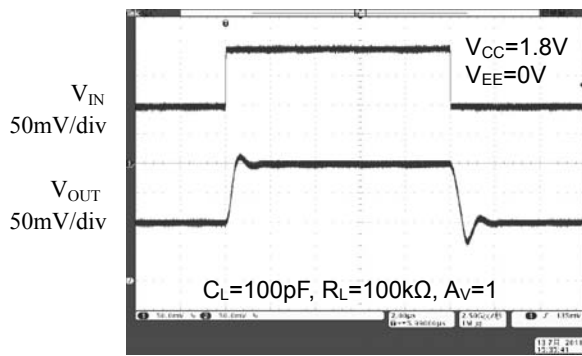


Figure 37. Input Voltage Noise Density



Time (2μs/div)

Figure 38. Small Signal Pulse Response



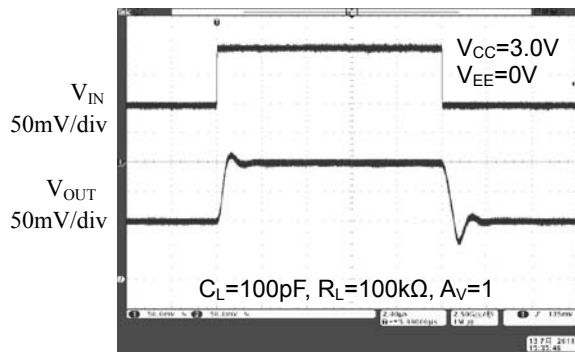
Time (2μs/div)

Figure 39. Small Signal Pulse Response

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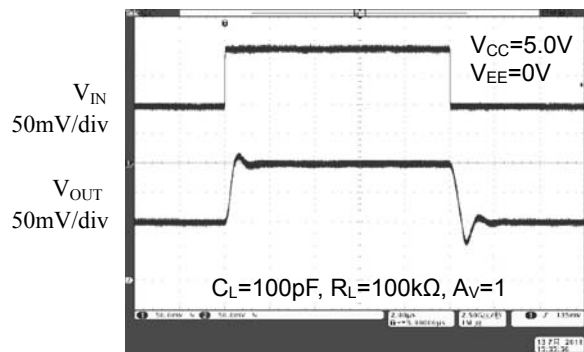
AZV832

Typical Performance Characteristics (Continued)



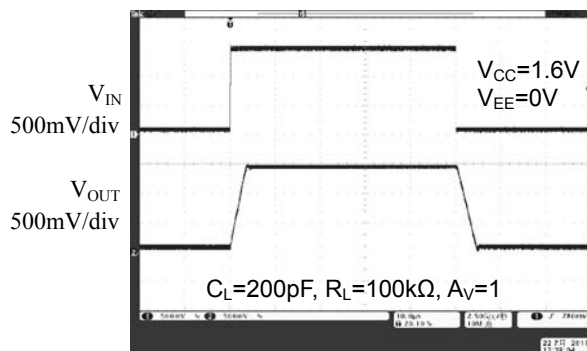
Time (2 μ s/div)

Figure 40. Small Signal Pulse Response



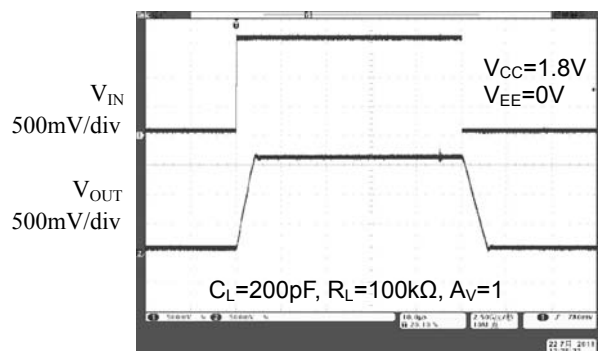
Time (2 μ s/div)

Figure 41. Small Signal Pulse Response



Time (10 μ s/div)

Figure 42. Large Signal Pulse Response



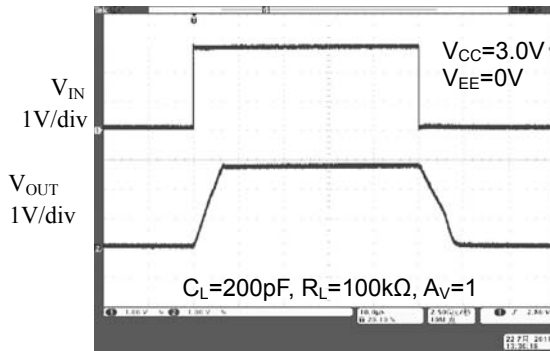
Time (10 μ s/div)

Figure 43. Large Signal Pulse Response

**Dual Low Bias Current, Low Voltage, Rail-to-Rail
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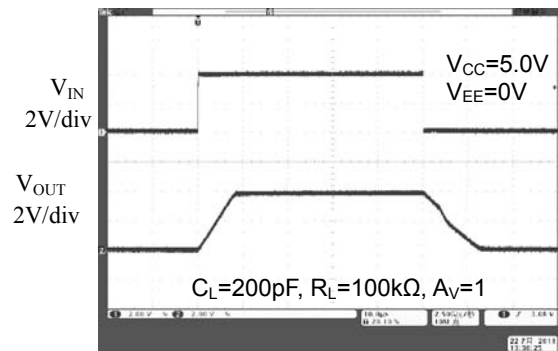
AZV832

Typical Performance Characteristics (Continued)



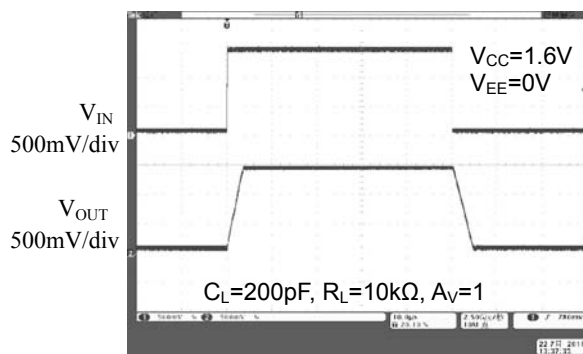
Time (10μs/div)

Figure 44. Large Signal Pulse Response



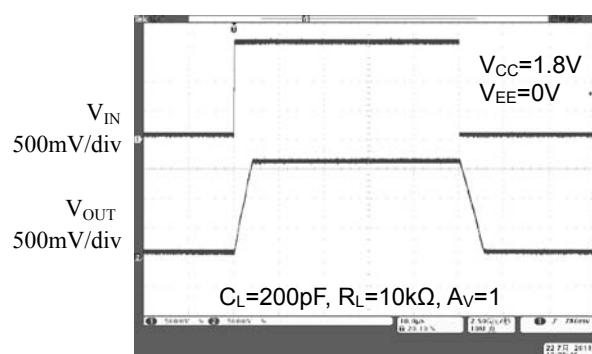
Time (10μs/div)

Figure 45. Large Signal Pulse Response



Time (10μs/div)

Figure 46. Large Signal Pulse Response



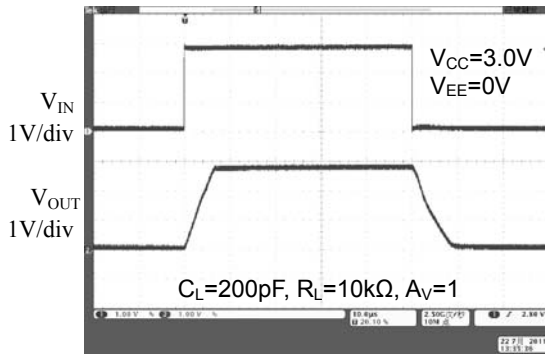
Time (10μs/div)

Figure 47. Large Signal Pulse Response

**Dual Low Bias Current, Low Voltage, Rail-to-Rail
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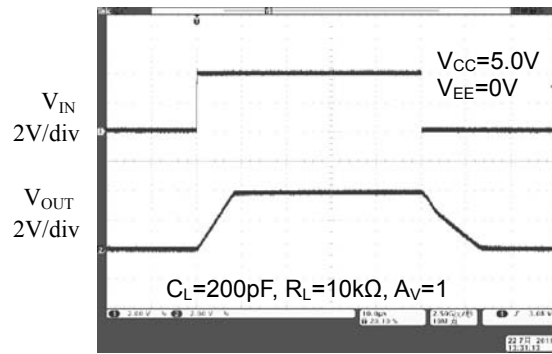
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Typical Performance Characteristics (Continued)



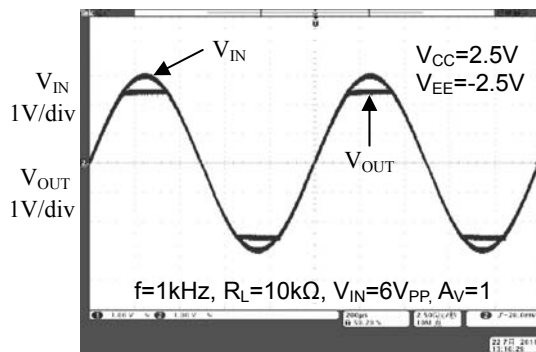
Time (10µs/div)

Figure 48. Large Signal Pulse Response



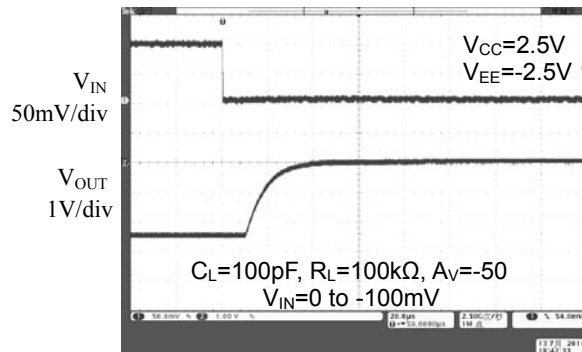
Time (10µs/div)

Figure 49. Large Signal Pulse Response



Time (200µs/div)

Figure 50. No phase Reversal



Time (20µs/div)

Figure 51. Overload Recovery Time

**Dual Low Bias Current, Low Voltage, Rail-to-Rail
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Typical Performance Characteristics (Continued)

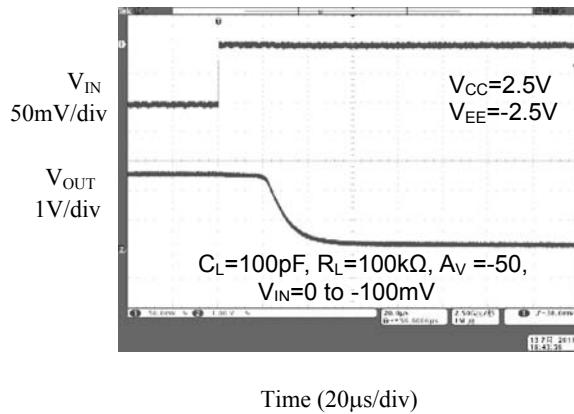


Figure 52. Overload Recovery Time

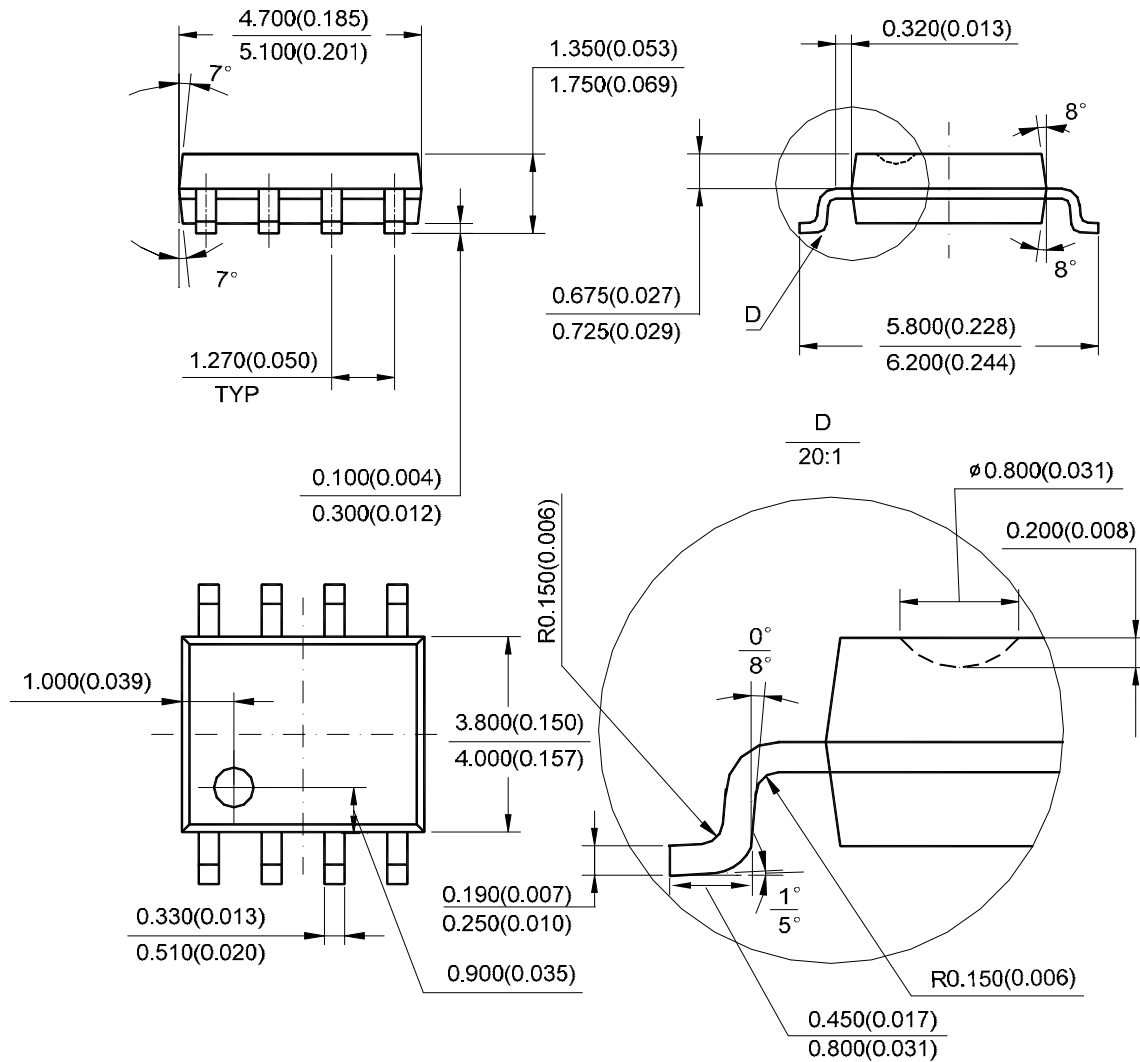
**Dual Low Bias Current, Low Voltage, Rail-to-Rail
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Mechanical Dimensions

SOIC-8

Unit: mm(inch)



Note: Eject hole, oriented hole and mold mark is optional.

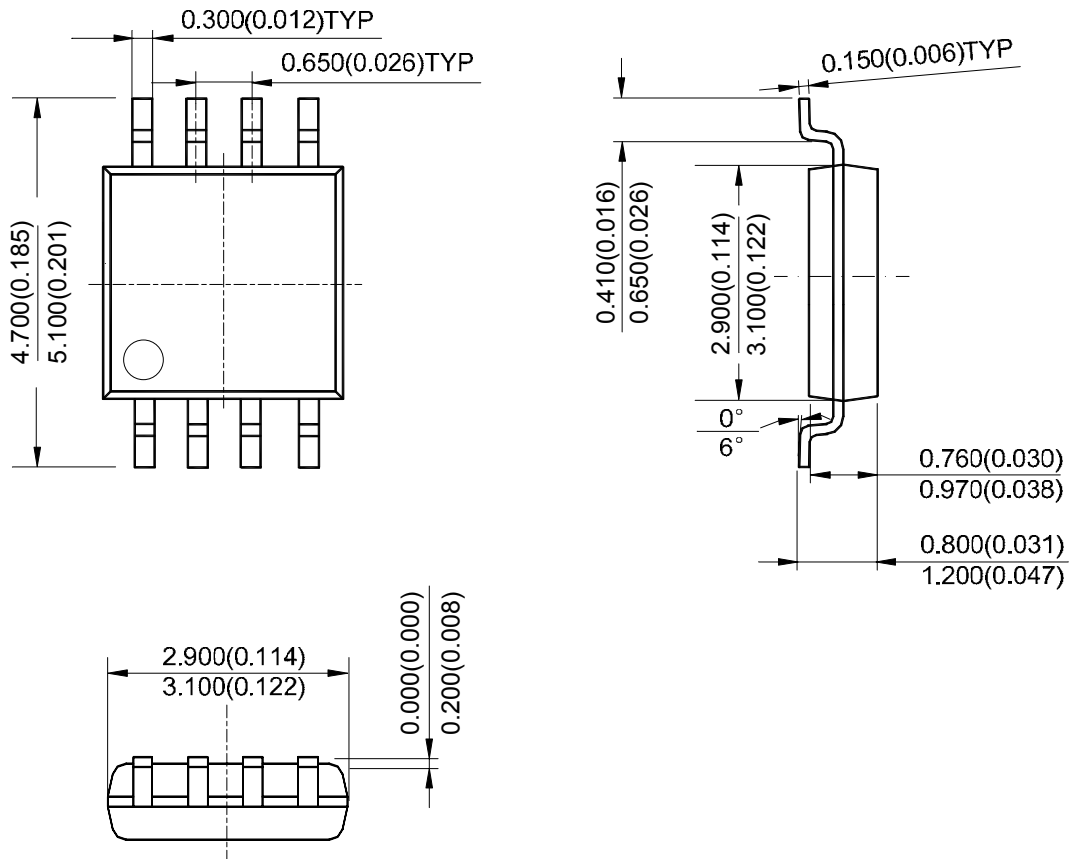
**Dual Low Bias Current, Low Voltage, Rail-to-Rail
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Mechanical Dimensions (Continued)

MSOP-8

Unit: mm(inch)



Note: Eject hole, oriented hole and mold mark is optional.



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