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: -40ºC to 85ºC

Applications

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

SOIC-8　　　　　　　　MSOP-8

Figure 1. Package Types of AZV832

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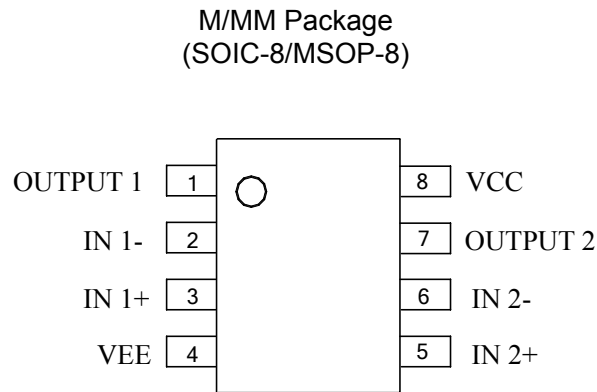## Pin Configuration

M/MM Package
(SOIC-8/MSOP-8)

Figure 2.   Pin Configuration of AZV832 (Top View)
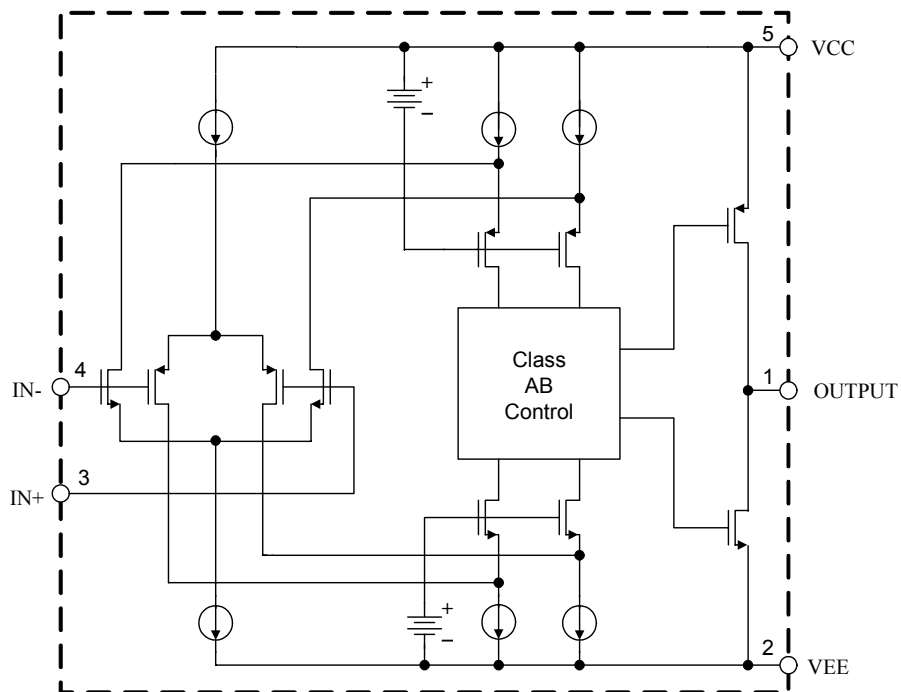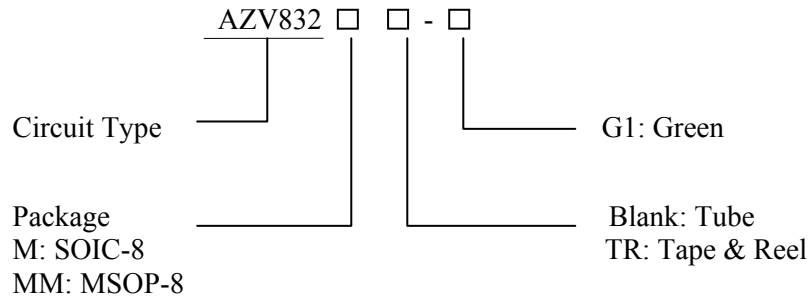
Function Block Diagram

Figure 3. Functional Block Diagram of AZV832/Amplifier

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Ordering Information

AZV832 ☐ ☐ - ☐

Circuit Type ————

G1: Green ————

Package ————
M: SOIC-8
MM: MSOP-8

Blank: Tube
TR: Tape & Reel

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.

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Absolute Maximum Ratings (Note 1)

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		ºC
Thermal Resistance (Junction to Ambient)	θ_{JA}	SOIC-8	150	ºC /W
		MSOP-8	200	
Storage Temperature Range	T_{STG}	-65 to 150		ºC
Lead Temperature (Soldering,10 Seconds)	T_{LEAD}	260		ºC
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	ºC

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1.6V DC Electrical Characteristics

V_{CC}=1.6V, V_{EE}=0, V_{CM}=V_{CC}/2, T_A=25°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=10kΩ 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		μV/ °C
Output Voltage Swing from Rail		V_{OL}/V_{OH}	V_{ID}=0.5V, R_L=1kΩ connect to V_{CC}/2		30	50	mV
			V_{ID}=0.5V, R_L=10kΩ 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°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	R_L=100kΩ		1.0		MHz
Slew Rate	SR	G=1, 1V Step, C_L=100pF, R_L=10kΩ		0.32		V/μs
Phase Margin	φ_M	R_L=100kΩ		67		Degrees
Total Harmonic Distortion+Noise	THD+N	f=1kHz, G=1, V_{IN}=1V_{pp} R_L=10kΩ, 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°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=10kΩ 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		μV/ °C
Output Voltage Swing from Rail		V_{OL}/V_{OH}	V_{ID}=0.5V, R_L=1kΩ connect to V_{CC}/2		25	50	mV
			V_{ID}=0.5V, R_L=10kΩ 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°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	R_L=100kΩ		1.0		MHz
Slew Rate	SR	G=1, 1V Step, C_L=100pF, R_L=10kΩ		0.34		V/μs
Phase Margin	φ_M	R_L=100kΩ		67		Degrees
Total Harmonic Distortion+Noise	THD+N	f=1kHz, G=1, V_{IN}=1V_{pp} R_L=10kΩ, 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°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=1kΩ connect to V_{CC}/2, V_O=0.2V to 2.8V	90	110		dB
			R_L=10kΩ 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		μV/ °C
Output Voltage Swing from Rail		V_{OL}/V_{OH}	V_{IN}=0.5V, R_L=1kΩ connect to V_{CC}/2		20	50	mV
			V_{IN}=0.5V, R_L=10kΩ 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°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	R_L=100kΩ		1.0		MHz
Slew Rate	SR	G=1, 2V Step, C_L=100pF, R_L=10kΩ		0.40		V/μs
Phase Margin	φ_M	R_L=100kΩ		67		Degrees
Total Harmonic Distortion+Noise	THD+N	f=1kHz, G=1, V_{IN}=1V_{pp} R_L=10kΩ, 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°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=1kΩ connect to V_{CC}/2, V_O=0.2V to 4.8V	80	92		dB
			R_L=10kΩ 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		μV/°C
Output Voltage Swing from Rail		V_{OL}/V_{OH}	V_{IN}=0.5V, R_L=1kΩ connect to V_{CC}/2		25	50	mV
			V_{IN}=0.5V, R_L=10kΩ 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°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain Bandwidth Product	GBP	R_L=100kΩ		1.0		MHz
Slew Rate	SR	G=1, 2V Step, C_L=100pF, R_L=10kΩ		0.45		V/μs
Phase Margin	φ_M	R_L=100kΩ		67		Degrees
THD+N	THD+N	f=1kHz, G=1, V_{IN}=1V_{PP} R_L=10kΩ,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
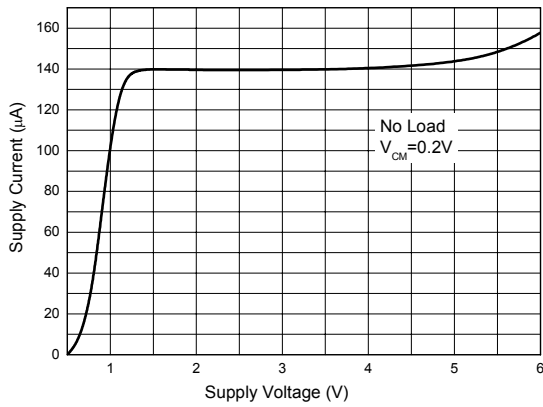
Figure 4. Supply Current vs. Supply Voltage
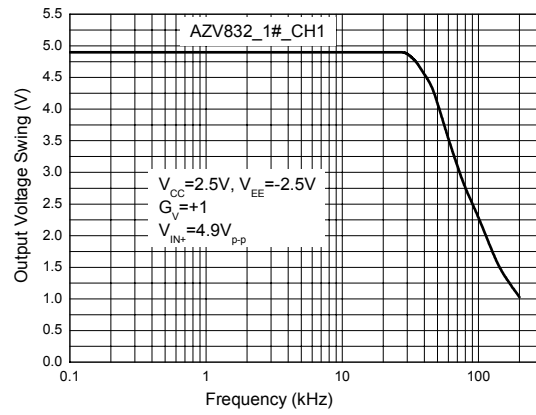

Figure 5. Closed-loop Output Voltage Swing vs. Frequency
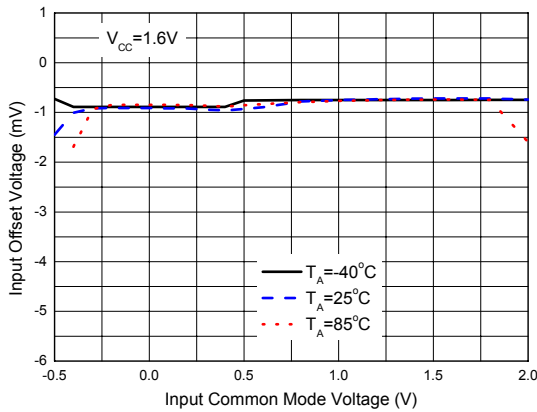
Figure 6. Offset Voltage vs. Common Mode Voltage
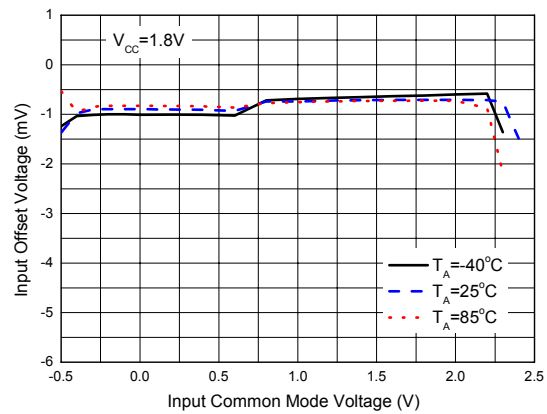
Figure 7. Offset Voltage vs. Common Mode Voltage

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## Typical Performance Characteristics (Continued)
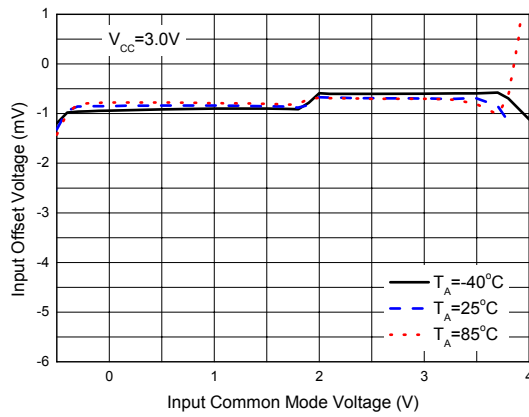
Figure 8. Offset Voltage vs. Common Mode Voltage
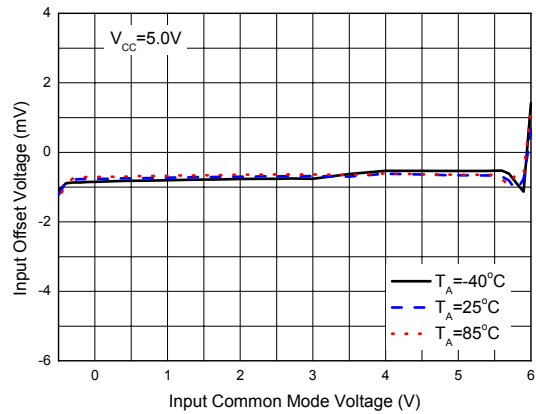
Figure 9. Offset Voltage vs. Common Mode Voltage
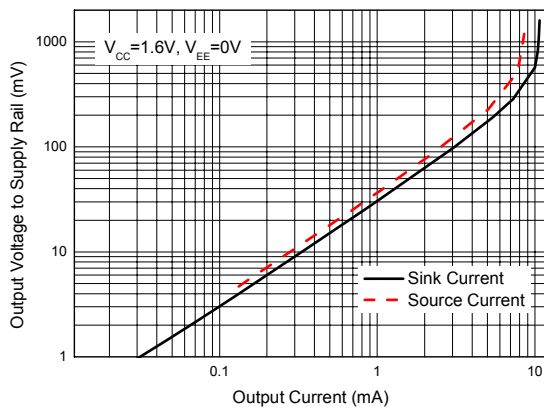
Figure 10. Output Voltage vs. Output Current
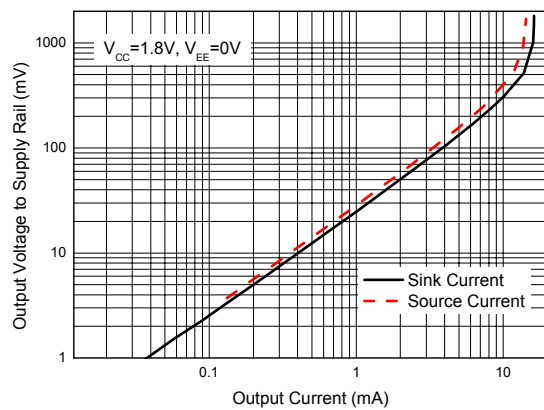
Figure 11. Output Voltage vs. Output Current

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Typical Performance Characteristics (Continued)
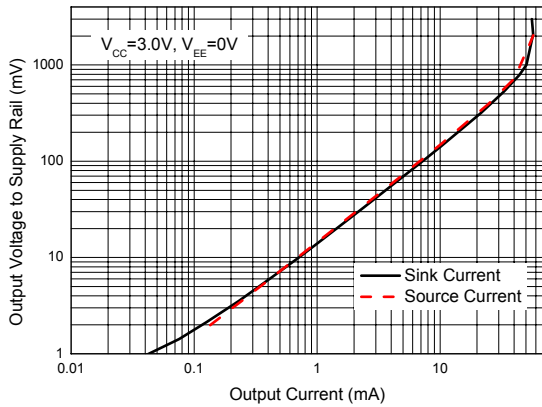
Figure 12. Output Voltage vs. Output Current
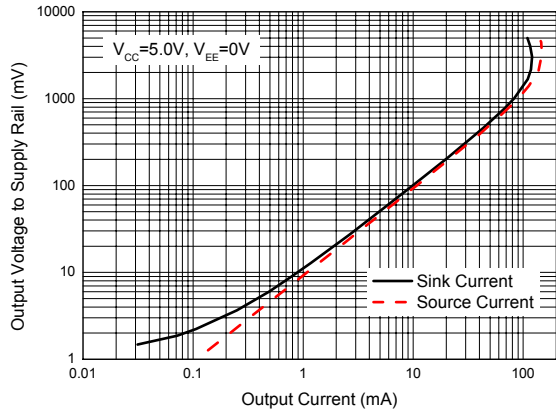
Figure 13. Output Voltage vs. Output Current
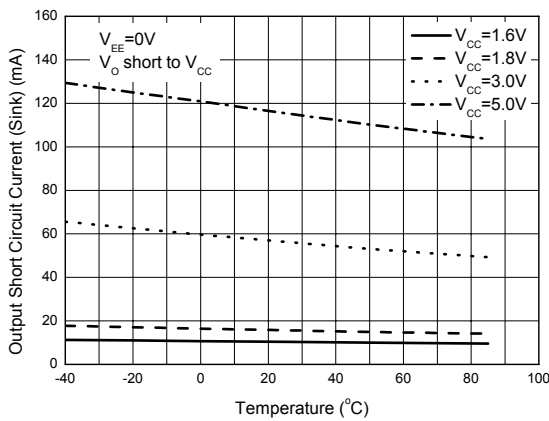
Figure 14. Output Short Circuit Current vs. Temperature
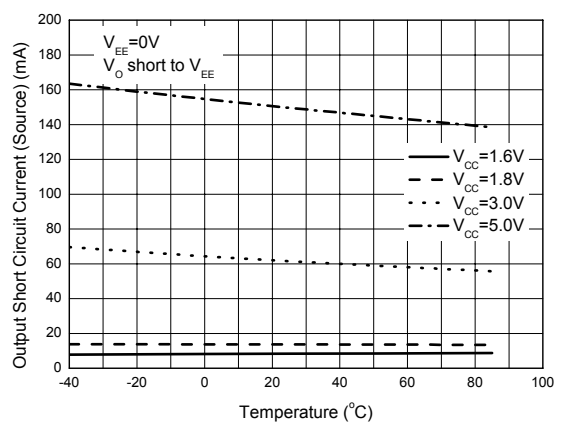
Figure 15. Output Short Circuit Current vs. Temperature

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Typical Performance Characteristics (Continued)
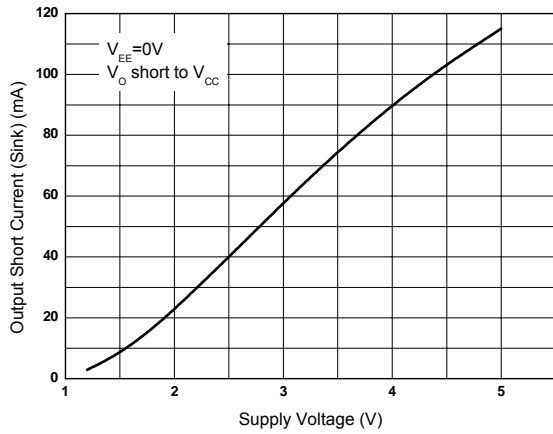
Figure 16. Output Short Circuit Current
vs. Supply Voltage
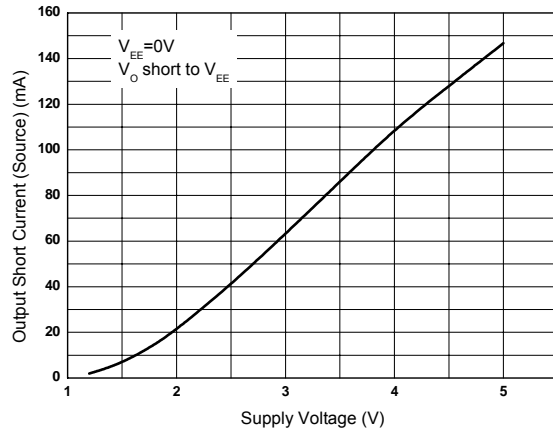
Figure 17. Output Short Circuit Current
vs. Supply Voltage
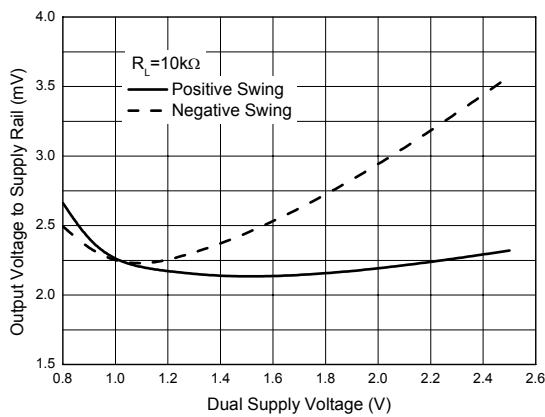
Figure 18. Output Voltage Swing vs. Supply Voltage
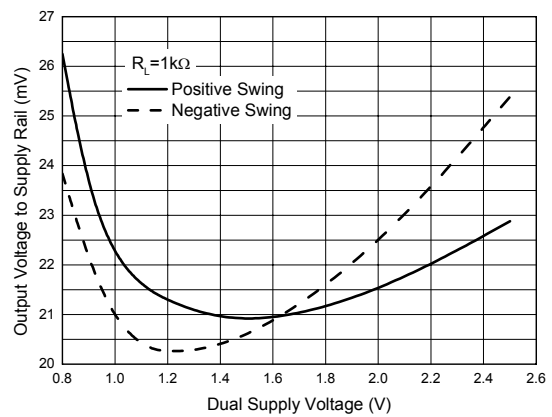
Figure 19. Output Voltage Swing vs. Supply Voltage

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Typical Performance Characteristics (Continued)
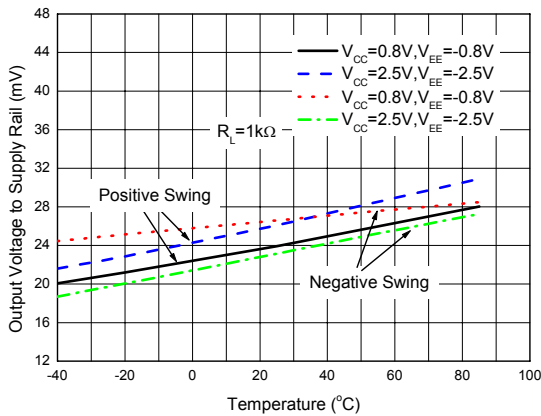
Figure 20. Output Voltage Swing vs. Temperature
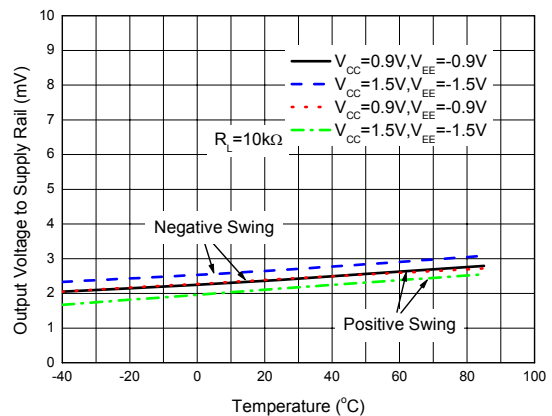
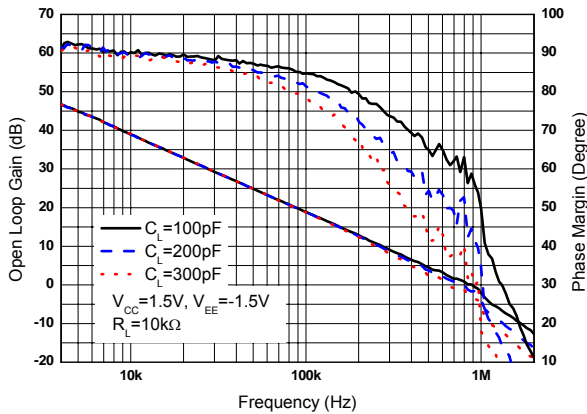Figure 21. Output Voltage Swing vs. Temperature
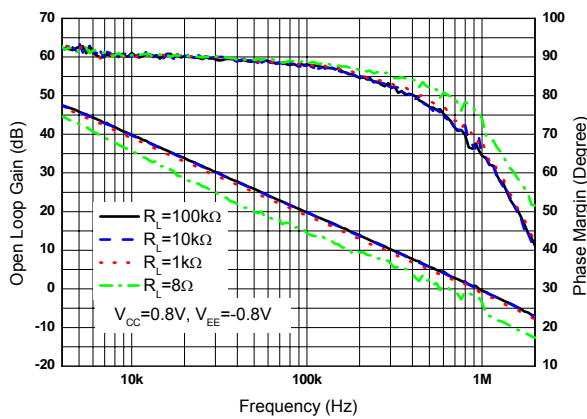
Figure 22. Gain and Phase vs. Frequency
and Resistive Load
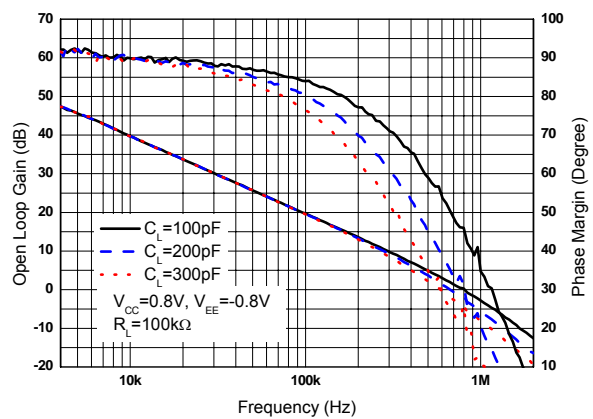
Figure 23. Gain and Phase vs. Frequency
and Capacitive Load

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Typical Performance Characteristics (Continued)
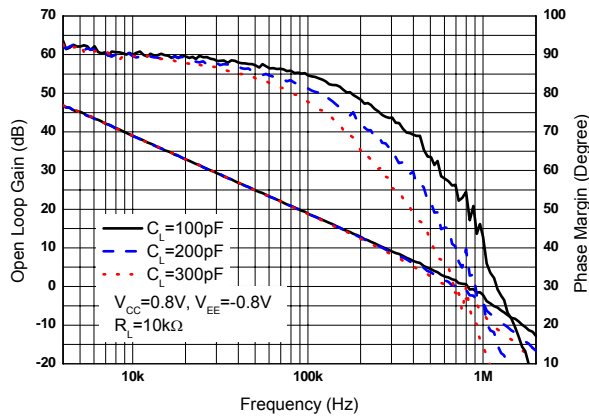
Figure 24. Gain and Phase vs. Frequency
and Capacitive Load
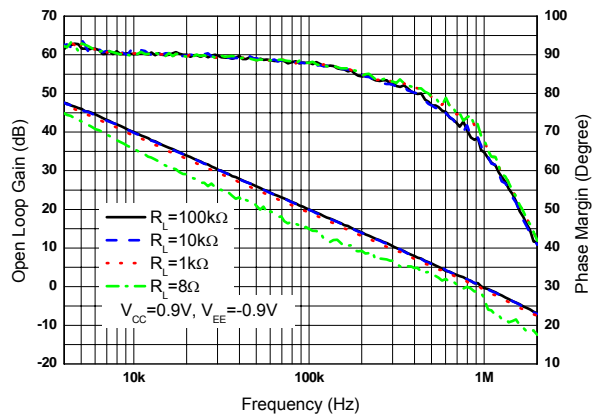
Figure 25. Gain and Phase vs. Frequency
and Resistive Load
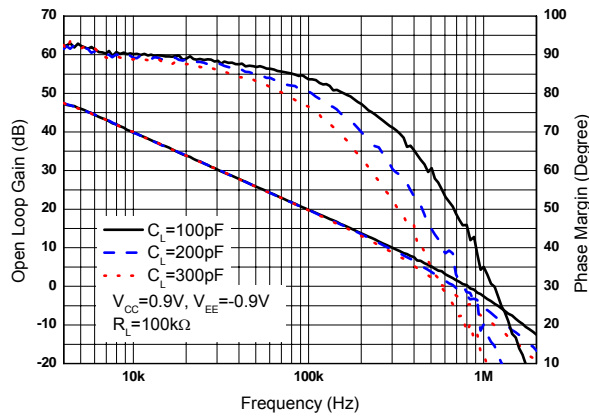
Figure 26. Gain and Phase vs. Frequency
and Capacitive Load
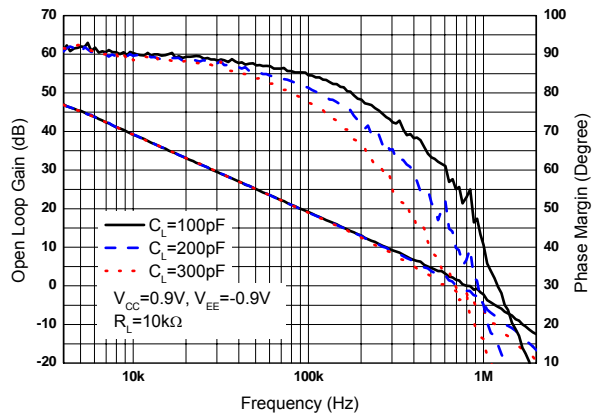
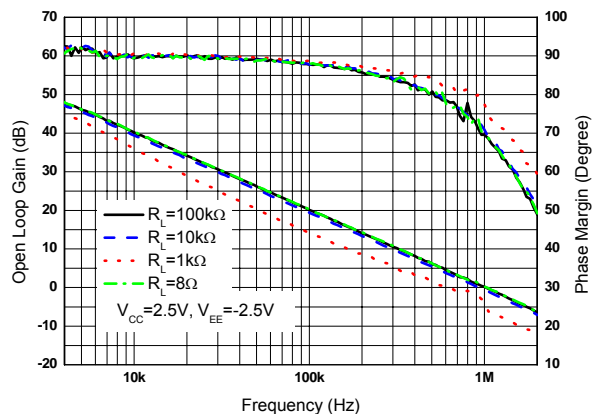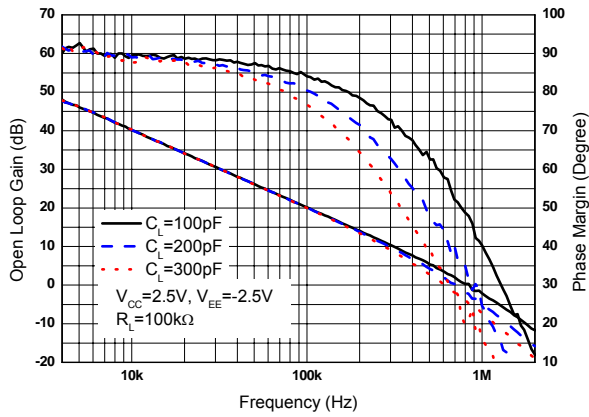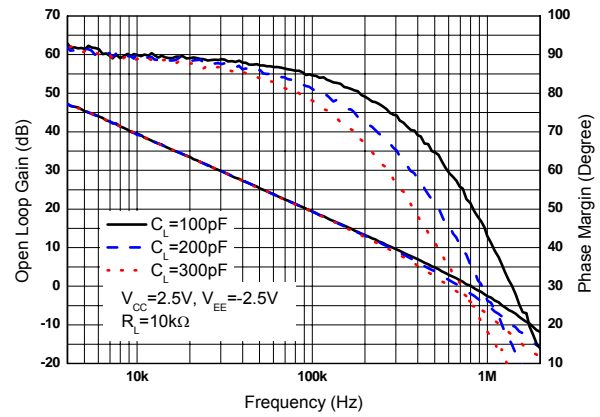Figure 27. Gain and Phase vs. Frequency
and Capacitive Load

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Typical Performance Characteristics (Continued)
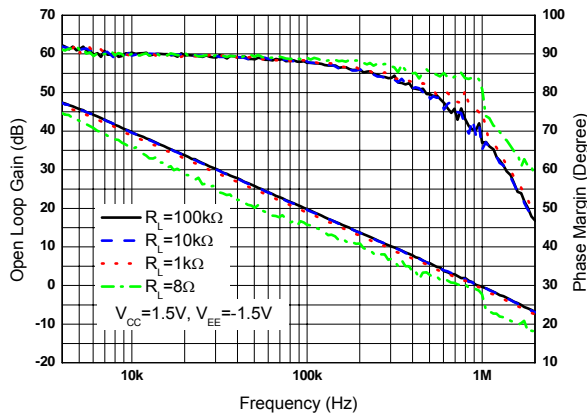
Figure 28. Gain and Phase vs. Frequency
and Resistive Load
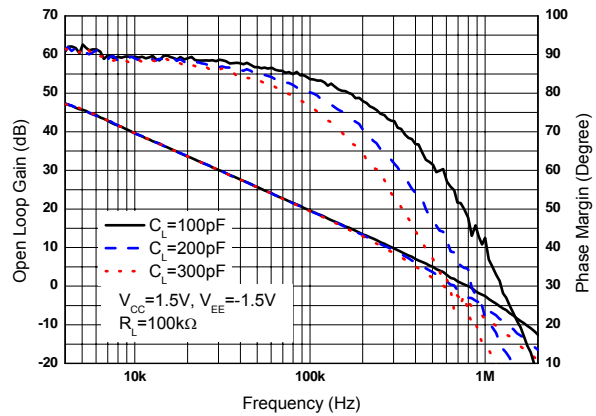
Figure 29. Gain and Phase vs. Frequency
and Capacitive Load

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
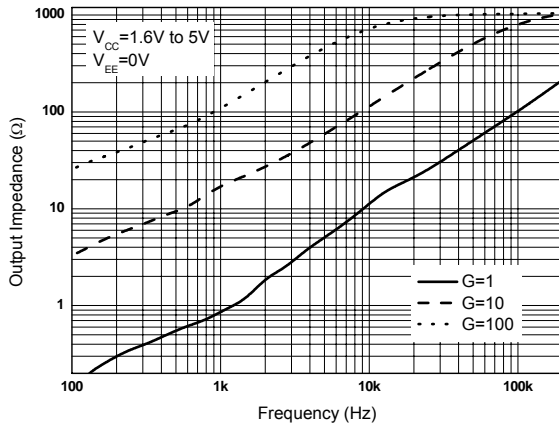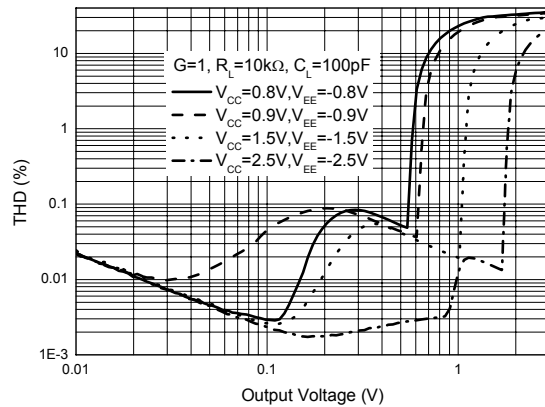

Figure 34. Output Impedance vs. Frequency

Figure 35. THD+N vs. Output Voltage

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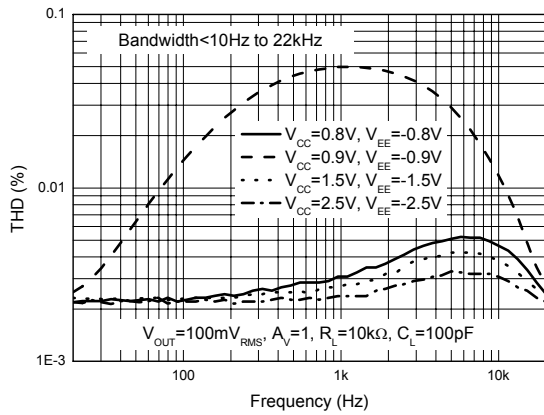## Typical Performance Characteristics (Continued)
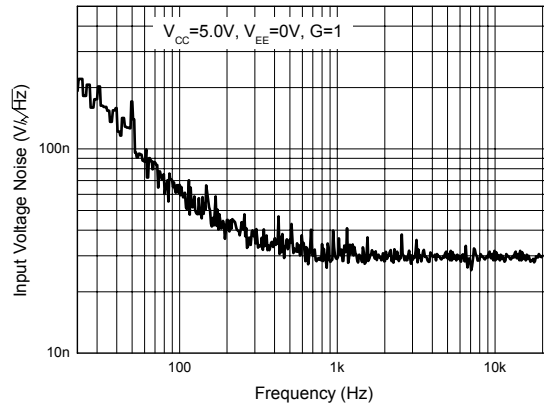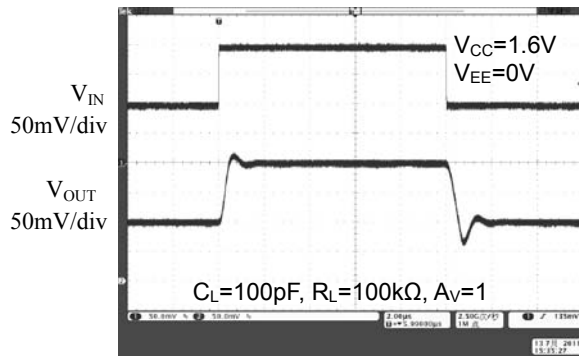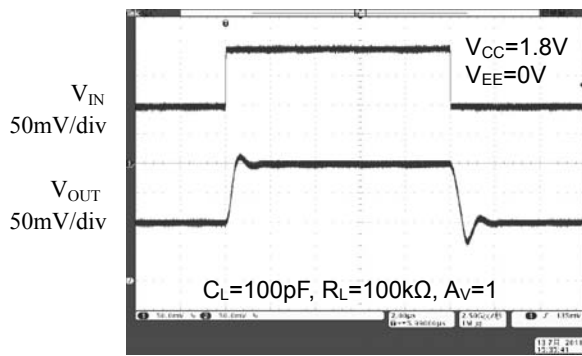

Figure 36. THD+N vs. Frequency

Figure 37. Input Voltage Noise Density

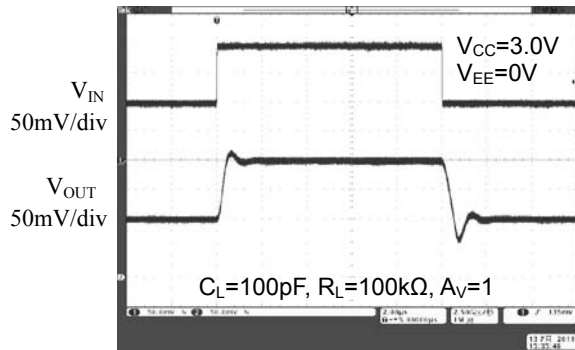Time (2μs/div)

Figure 38. Small Signal Pulse Response

Time (2μs/div)

Figure 39. Small Signal Pulse Response

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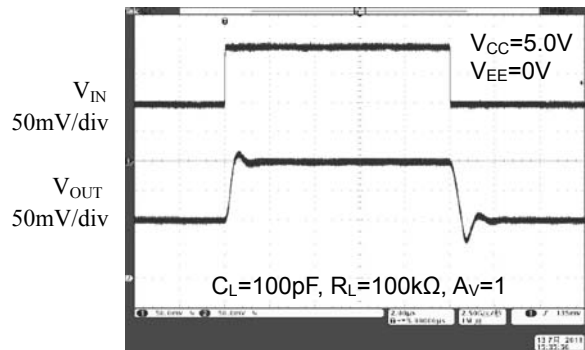
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Typical Performance Characteristics (Continued)

$V_{CC}=3.0V$
$V_{EE}=0V$

V_{IN}
50mV/div

V_{OUT}
50mV/div

$C_L=100pF, R_L=100k\Omega, A_V=1$

Time (2μs/div)

Figure 40. Small Signal Pulse Response

$V_{CC}=5.0V$
$V_{EE}=0V$

V_{IN}
50mV/div

V_{OUT}
50mV/div

$C_L=100pF, R_L=100k\Omega, A_V=1$

Time (2μs/div)

Figure 41. Small Signal Pulse Response

$V_{CC}=1.6V$
$V_{EE}=0V$

V_{IN}
500mV/div

V_{OUT}
500mV/div

$C_L=200pF, R_L=100k\Omega, A_V=1$

Time (10μs/div)

Figure 42. Large Signal Pulse Response

$V_{CC}=1.8V$
$V_{EE}=0V$

V_{IN}
500mV/div

V_{OUT}
500mV/div

$C_L=200pF, R_L=100k\Omega, A_V=1$
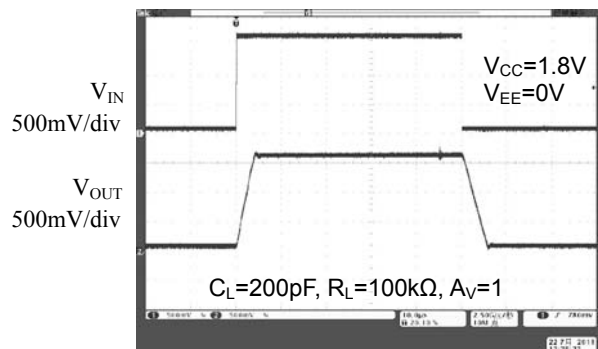
Time (10μs/div)

Figure 43. Large Signal Pulse Response

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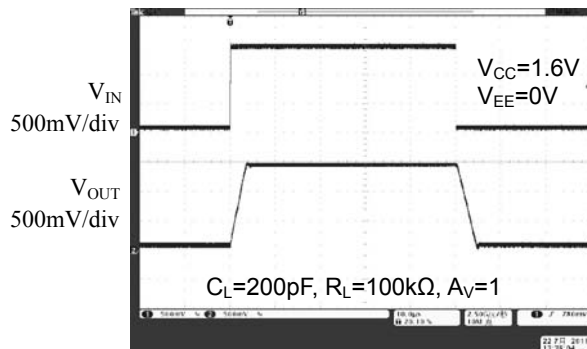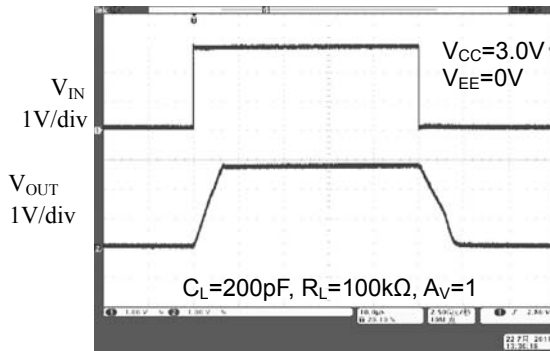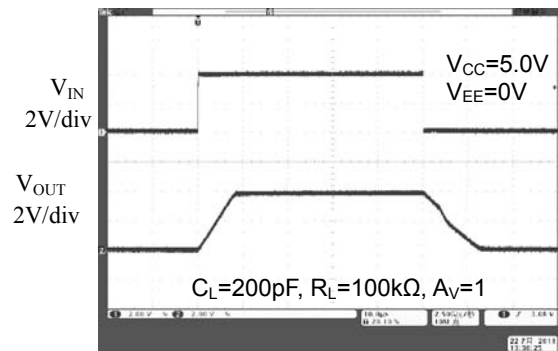## Typical Performance Characteristics (Continued)

$V_{CC}=3.0V$
$V_{EE}=0V$

V_{IN}
1V/div

V_{OUT}
1V/div

$C_L=200pF, R_L=100k\Omega, A_V=1$

Time (10μs/div)

Figure 44. Large Signal Pulse Response

$V_{CC}=5.0V$
$V_{EE}=0V$

V_{IN}
2V/div

V_{OUT}
2V/div

$C_L=200pF, R_L=100k\Omega, A_V=1$

Time (10μs/div)

Figure 45. Large Signal Pulse Response

$V_{CC}=1.6V$
$V_{EE}=0V$

V_{IN}
500mV/div

V_{OUT}
500mV/div

$C_L=200pF, R_L=10k\Omega, A_V=1$

Time (10μs/div)

Figure 46. Large Signal Pulse Response

$V_{CC}=1.8V$
$V_{EE}=0V$

V_{IN}
500mV/div

V_{OUT}
500mV/div

$C_L=200pF, R_L=10k\Omega, A_V=1$
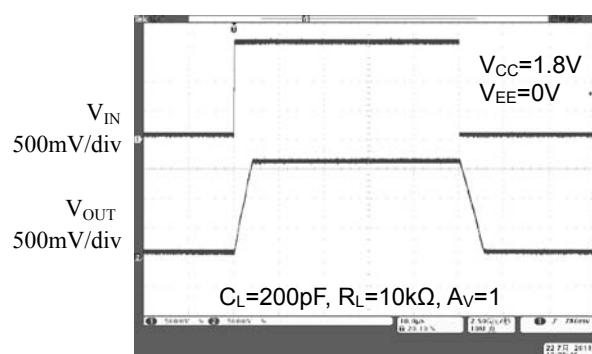
Time (10μs/div)

Figure 47. Large Signal Pulse Response

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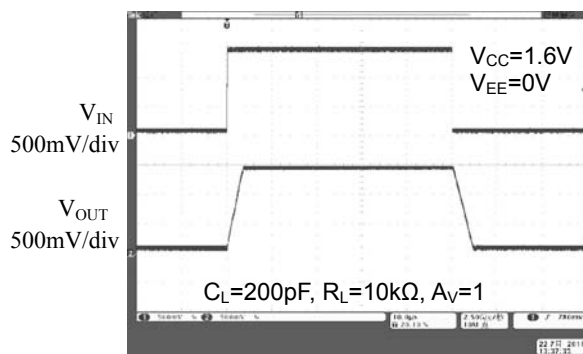
AZV832
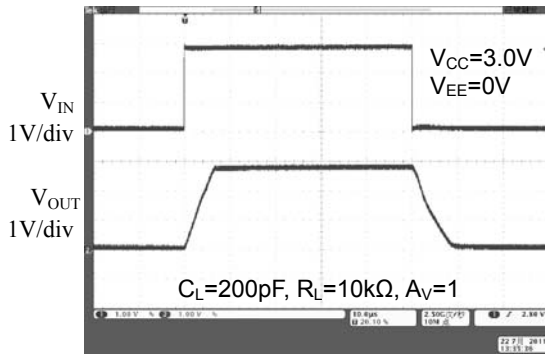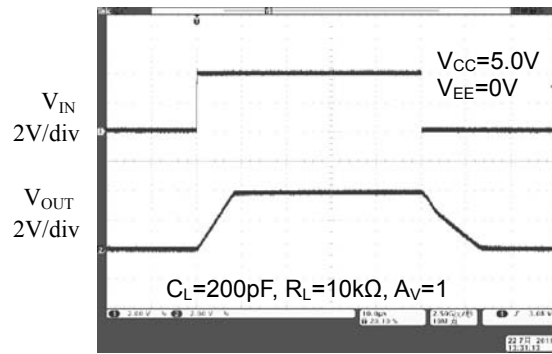
Typical Performance Characteristics (Continued)

V_{CC}=3.0V
V_{EE}=0V

V_{IN}
1V/div

V_{OUT}
1V/div

C_L=200pF, R_L=10kΩ, A_V=1

Time (10μs/div)

Figure 48. Large Signal Pulse Response

V_{CC}=5.0V
V_{EE}=0V

V_{IN}
2V/div

V_{OUT}
2V/div

C_L=200pF, R_L=10kΩ, A_V=1

Time (10μs/div)

Figure 49. Large Signal Pulse Response

V_{IN}

V_{CC}=2.5V
V_{EE}=-2.5V

V_{IN}
1V/div

V_{OUT}
1V/div

V_{OUT}

f=1kHz, R_L=10kΩ, V_{IN}=6V_{PP}, A_V=1

Time (200μs/div)

Figure 50. No phase Reversal

V_{CC}=2.5V
V_{EE}=-2.5V

V_{IN}
50mV/div

V_{OUT}
1V/div

C_L=100pF, R_L=100kΩ, A_V=-50
V_{IN}=0 to -100mV

Time (20μs/div)

Figure 51. Overload Recovery Time

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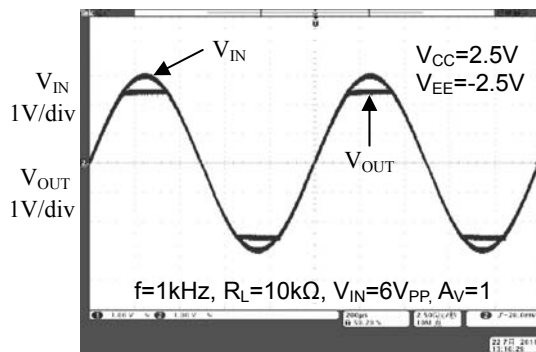## Typical Performance Characteristics (Continued)
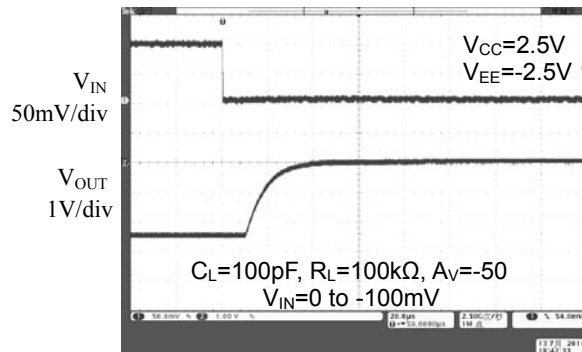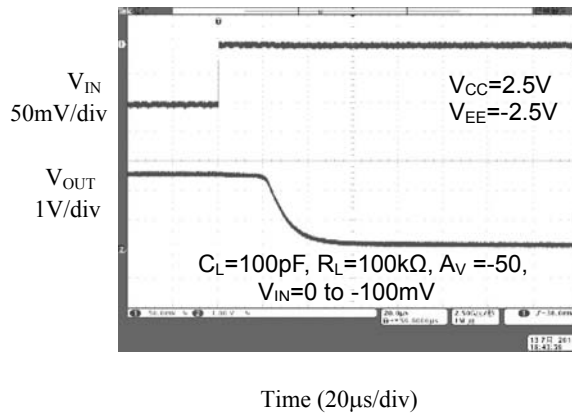

Time (20μs/div)

Figure 52. Overload Recovery Time

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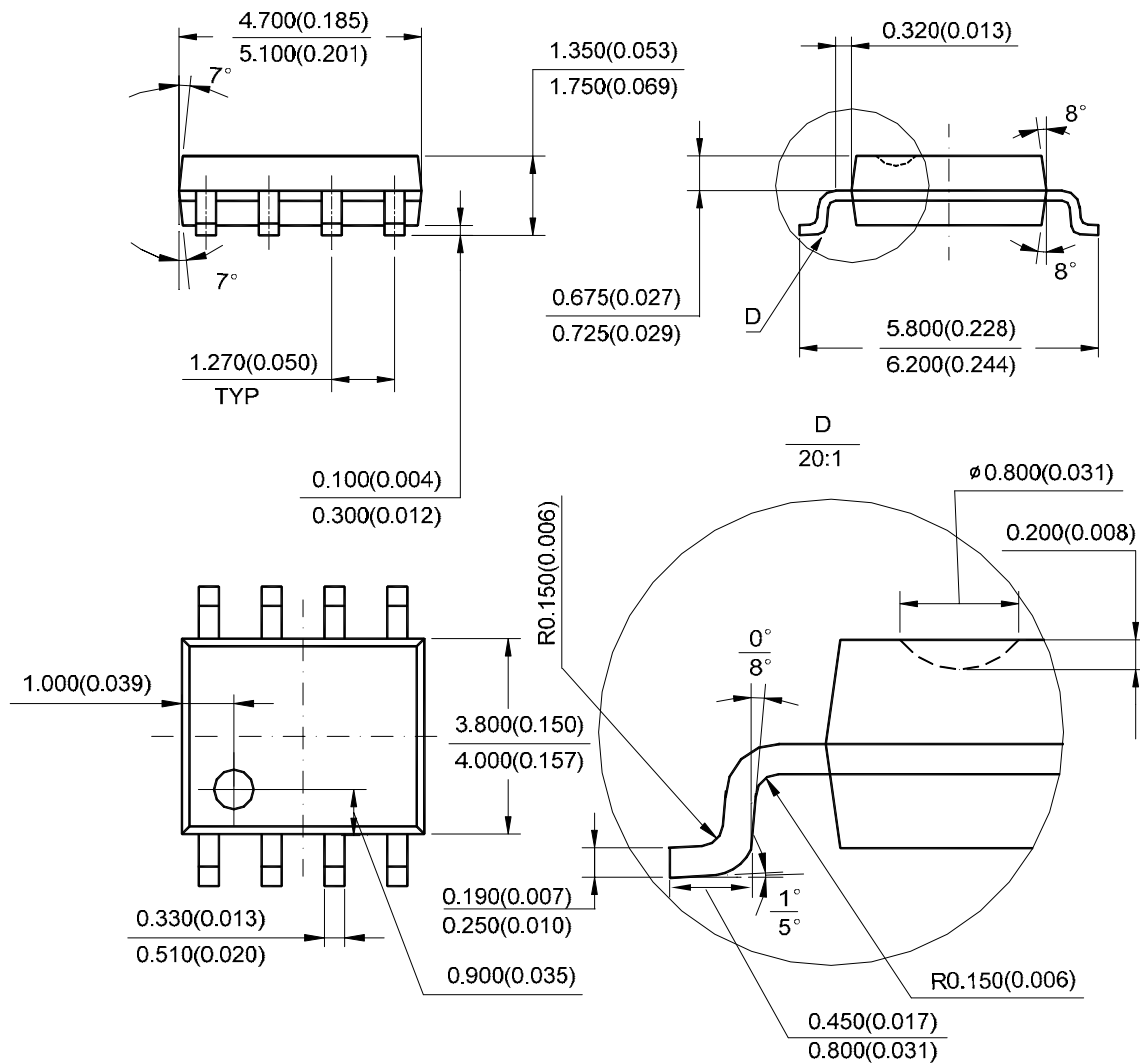
Dual Low Bias Current, Low Voltage, Rail-to-Rail Input/Output CMOS Operational Amplifiers

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Mechanical Dimensions

SOIC-8   **Unit: mm(inch)**

4.700(0.185)
5.100(0.201)

7°

7°

1.270(0.050)
TYP

0.100(0.004)
0.300(0.012)

1.350(0.053)
1.750(0.069)

0.675(0.027)
0.725(0.029)

0.320(0.013)

8°

8°

D

5.800(0.228)
6.200(0.244)

D
20:1

R0.150(0.006)

1.000(0.039)

3.800(0.150)
4.000(0.157)

0.330(0.013)
0.510(0.020)

0.190(0.007)
0.250(0.010)

0.900(0.035)

⌀0.800(0.031)

0.200(0.008)

0°
8°

1°
5°

0.450(0.017)
0.800(0.031)

R0.150(0.006)

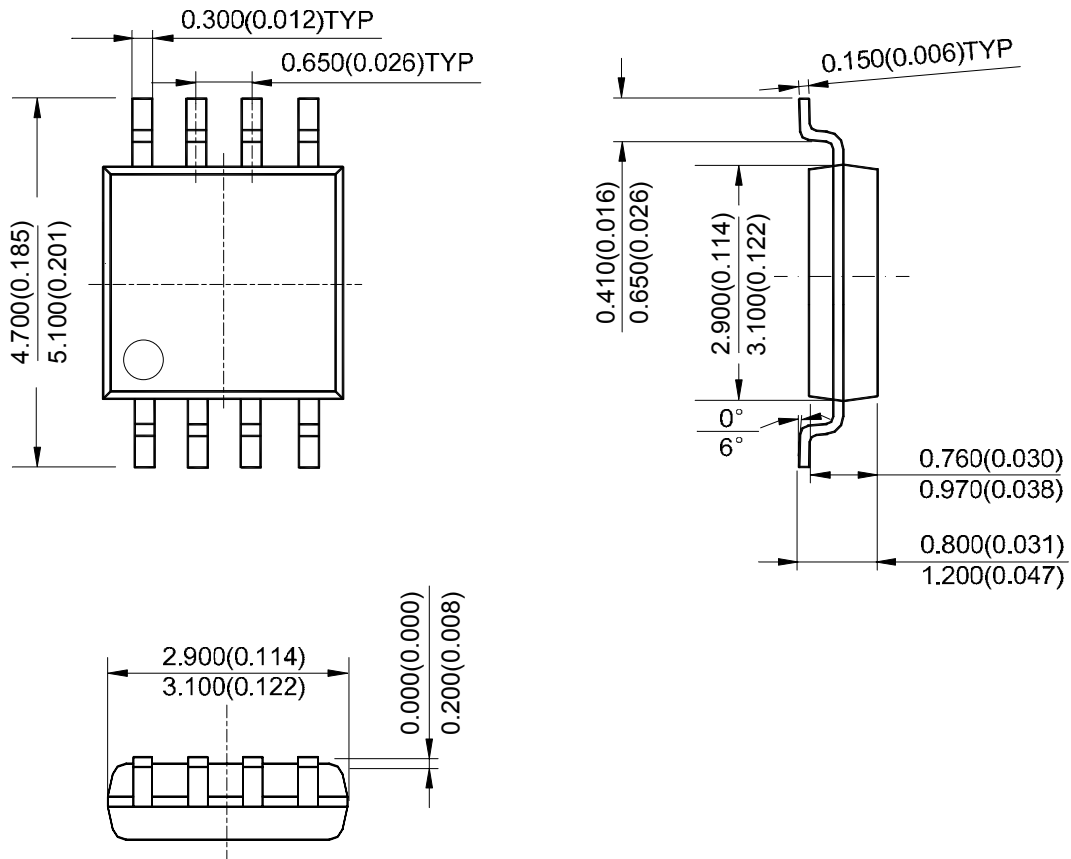Note: Eject hole, oriented hole and mold mark is optional.

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

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Mechanical Dimensions (Continued)

MSOP-8   **Unit: mm(inch)**

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

BCD Semiconductor Manufacturing Limited

http://www.bcdsemi.com

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