Description

The OPA340 series rail-to-rail CMOS operational amplifiers are optimized for low-voltage, single-supply operation. Rail-to-rail input and output and high-speed operation make them ideal for driving sampling analog-to-digital (A/D) converters. They are also well-suited for general purpose and audio applications as well as providing I/V conversion at the output of digital-to-analog (D/A) converters. Single, dual, and quad versions have identical specifications for design flexibility.

The OPA340 series operate on a single supply as low as 2.5 V with an input common-mode voltage range that extends 500 mV below ground and 500 mV above the positive supply. Output voltage swing is to within 1 mV of the supply rails with a 100-kΩ load. These devices offer excellent dynamic response (BW = 5.5 MHz, SR = 6 V/µs), yet quiescent current is only 750 A. Dual and quad designs feature completely independent circuitry for lowest crosstalk and freedom from interaction.

All are specified from –40°C to 85°C and operate from –55°C to 125°C.

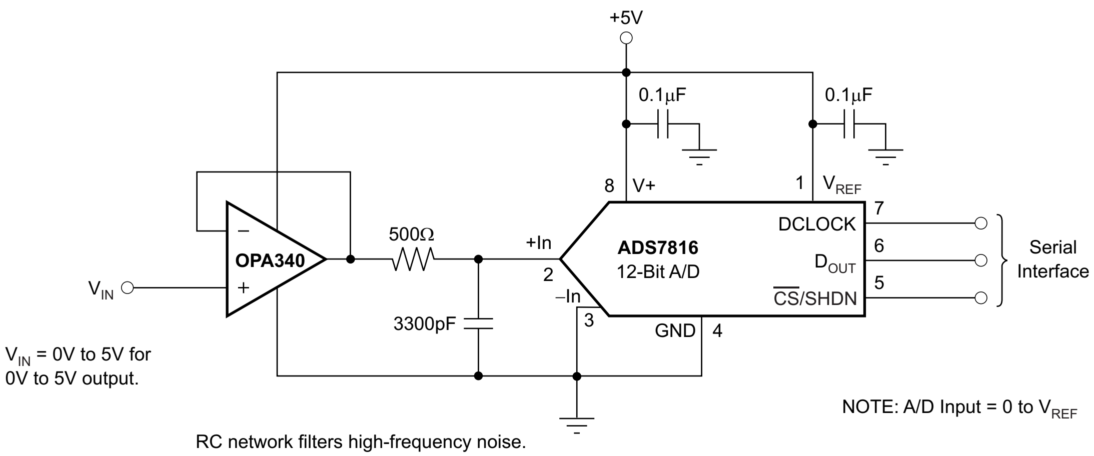
Features

- Rail-to-Rail Input
- Rail-to-Rail Output (Within 1 mV)
- MicroSize Packages
- Wide Bandwidth: 5.5 MHz
- High Slew Rate: 6 V/µs
- Low THD + Noise: 0.0007% (f = 1 kHz)
- Low Quiescent Current: 750 µA/Channel
- Single, Dual, and Quad Versions

Applications

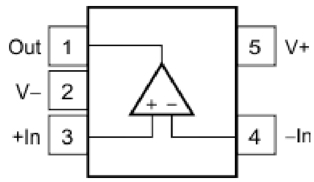
- Driving A/D Converters
- PCMCIA Cards
- Data Acquisition
- Process Control
- Audio Processing
- Communications
- Active Filters
- Test Equipment

OPA340 in Noninverting Configuration Driving ADS7816

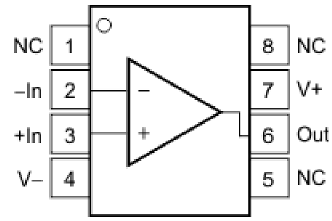


Pin Configuration and Functions

OPA340: 5-Pin SOT-23
Top View



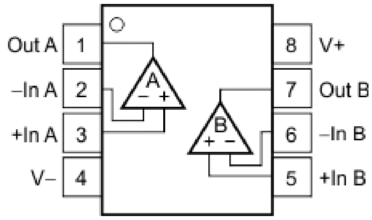
OPA340: 8-Pin SOP-8
Top View



Pin Functions: OPA340

PIN			I/O	DESCRIPTION
NAME	SOT-23	SOP		
–IN	4	2	I	Negative (inverting) input
+IN	3	3	I	Positive (noninverting) input
NC	—	1, 5, 8	—	No internal connection (can be left floating)
OUT	1	6	O	Output
V–	2	4	—	Negative (lowest) power supply
V+	5	7	—	Positive (highest) power supply

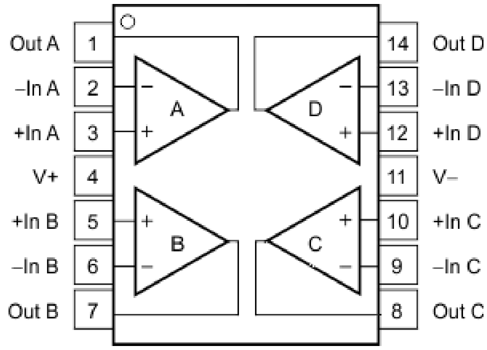
OPA2340: 8-Pin SOP-8
Top View



Pin Functions: OPA2340

PIN		I/O	DESCRIPTION
NAME	SOP		
–IN A	2	I	Negative (inverting) input channel A
+IN A	3	I	Positive (noninverting) input channel A
–IN B	6	I	Negative (inverting) input channel B
+IN B	5	I	Positive (noninverting) input channel B
OUT A	1	O	Output channel A
OUT B	7	O	Output channel B
V–	4	—	Negative (lowest) power supply
V+	8	—	Positive (highest) power supply

OPA4340: Package
SOP-14
Top View



Pin Functions: OPA4340

PIN		I/O	DESCRIPTION
NAME	SOP		
–IN A	2	I	Negative (inverting) input channel A
–IN B	6	I	Negative (inverting) input channel B
–IN C	9	I	Negative (inverting) input channel C
–IN D	13	I	Negative (inverting) input channel D
+IN A	3	I	Positive (noninverting) input channel A
+IN B	5	I	Positive (noninverting) input channel B
+IN C	10	I	Positive (noninverting) input channel C
+IN D	12	I	Positive (noninverting) input channel D
NC	—	—	No internal connection (can be left floating)
OUT A	1	O	Output, channel A
OUT B	7	O	Output, channel B
OUT C	8	O	Output, channel C
OUT D	14	O	Output, channel D
V–	11	—	Negative (lowest) power supply
V+	4	—	Positive (highest) power supply

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

		MIN	MAX	UNIT
Voltage	Supply voltage		5.5	V
	Signal input terminals(2)	–0.5	0.5	
Current	Signal input terminals(2)		10	mA
	Output short circuit(3)	Continuous		
Temperature	Operating, T_A	–55	125	°C
	Junction, T_J		150	
	Storage, T_{stg}	–55	125	

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5 V beyond the supply rails should be current limited to 10 mA or less.
(3) Short-circuit to ground, one amplifier per package.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±600	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±250	

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Supply voltage	2.7	5.5	V
Specified temperature	–40	125	°C

Thermal Information OPA340

THERMAL METRIC(1)		OPA340			UNIT
		(SOT-23)	(SOP)	(SOP)	
		5 PINS	8 PINS	14 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	207.9	142	83.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	71.2	90.2	70.7	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	36.0	82.5	59.5	°C/W
ψ_{JT}	Junction-to-top characterization parameter	2.0	39.4	11.6	°C/W
ψ_{JB}	Junction-to-board characterization parameter	35.2	82	37.7	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	—	—	—	°C/W

Thermal Information – OPA2340

THERMAL METRIC(1)		OPA2340 (SOP) 8 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	138.4	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	89.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	78.6	°C/W
ψ_{JT}	Junction-to-top characterization parameter	29.9	°C/W
ψ_{JB}	Junction-to-board characterization parameter	78.1	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	—	°C/W

Electrical Characteristics

At T_A = 25°C, R_L = 10 kΩ connected to V_S/2, and V_{OUT} = V_S/2, unless otherwise noted.

PARAMETER			TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
V_{OS}	Input offset voltage		V_S = 5 V		±150	±500	µV
dV_{OS}/dt	Input offset voltage vs temperature		T_A = –40°C to 85°C, V_S = 5 V		±2.5		µV/°C
PSRR	Input offset voltage vs power supply		V_S = 2.7 V to 5.5 V, V_{CM} = 0 V		30	120	µV/V
		Over temperature	V_S = 2.7 V to 5.5 V, V_{CM} = 0 V, T_A = –40°C to 85°C, V_S = 5 V			120	µV/°C
	Channel separation, DC				0.2		µV/V
I_S	Input bias current				±0.2	±10	pA
		Over temperature	T_A = –40°C to 85°C, V_S = 5 V			±60	pA
I_{OS}	Input offset current				±0.2	±10	pA
	Input voltage noise		f = 0.1 kHz to 50 kHz		8		$µV_{RMS}$
e_n	Input voltage noise density		f = 1 kHz		25		nV/√Hz
i_n	Current noise density		f = 1 kHz		3		fA/√Hz
V_{CM}	Common-mode voltage range			–0.3		(V+) + 0.3	V
CMRR	Common-mode rejection ratio		–0.3 V < V_{CM} < (V+) – 1.8 V	80	92		dB
			V_S = 5 V, –0.3 V < V_{CM} < 5.3 V	70	84		dB
			V_S = 2.7 V, –0.3 V < V_{CM} < 3 V	66	80		dB

(1) V_S = 5 V.

Electrical Characteristics (continued)

At T_A = 25°C, R_L = 10 kΩ connected to $V_S/2$, and $V_{OUT} = V_S/2$, unless otherwise noted.

PARAMETER			TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
	Differential				10^{13} || 3		Ω || pF
	Common-mode				10^{13} || 6		Ω || pF
A_{OL}	Open-loop voltage gain		R_L = 100 kΩ, 5 mV < V_O < (V+) – 5 mV	106	124		dB
			R_L = 10 kΩ, 5 mV < V_O < (V+) – 50 mV	100	120		
			R_L = 2 kΩ, 200 mV < V_O < (V+) – 200 mV	94	114		
		Over temperature	R_L = 100 kΩ, 5 mV < V_O < (V+) – 5 mV, T_A = –40°C to 85°C, V_S = 5 V	106			
			R_L = 10 kΩ, 5 mV < V_O < (V+) – 50 mV, T_A = –40°C to 85°C, V_S = 5 V	100			
			R_L = 2 kΩ, 200 mV < V_O < (V+) – 200 mV, T_A = –40°C to 85°C, V_S = 5 V	94			
GBW	Gain-bandwidth product		G = 1		5.5		MHz
SR	Slew rate		V_S = 5 V, G = 1, C_L = 100 pF		6		V/µs
	Settling time, 0.1%		V_S = 5 V, 2-V step, C_L = 100 pF		1		µs
	Settling time, 0.01%		V_S = 5 V, 2-V step, C_L = 100 pF		1.6		µs
	Overload recovery time		V_{IN} × G = V_S		0.2		µs
THD+N	Total harmonic distortion + noise		V_S = 5 V, V_O = 3V_{PP}(2), G = 1, f = 1 kHz		0.0007%		
	Voltage output swing from rail(2)		R_L = 100 kΩ, A_{OL} ≥ 106 dB		1	5	mV
			R_L = 10 kΩ, A_{OL} ≥ 106 dB		10		
			R_L = 2 kΩ, A_{OL} ≥ 106 dB		40		
		Over temperature	R_L = 100 kΩ, A_{OL} ≥ 106 dB, T_A = –40°C to 85°C, V_S = 5 V			5	
			R_L = 10 kΩ, A_{OL} ≥ 106 dB, T_A = –40°C to 85°C, V_S = 5 V			50	
			R_L = 2 kΩ, A_{OL} ≥ 106 dB, T_A = –40°C to 85°C, V_S = 5 V			200	
I_{SC}	Short-circuit current				±50		mA
C_{LOAD}	Capacitive load drive			See Typical Characteristics			
V_S	Specified voltage range			2.7		5	V
	Operating voltage range		Lower end		2.5		V
			Higher end		5.5		
I_Q	Quiescent current (per amplifier)		I_O = 0, V_S = 5 V		750	950	µA
		Over temperature	I_O = 0, V_S = 5 V, T_A = –40°C to 85°C			100	
	Specified range			–40		85	°C
	Operating range			–55		125	°C
	Storage range			–55		125	°C

(2) Output voltage swings are measured between the output and power-supply rails.

Typical Characteristics

At T_A = 25°C, V_S = 5 V, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted.

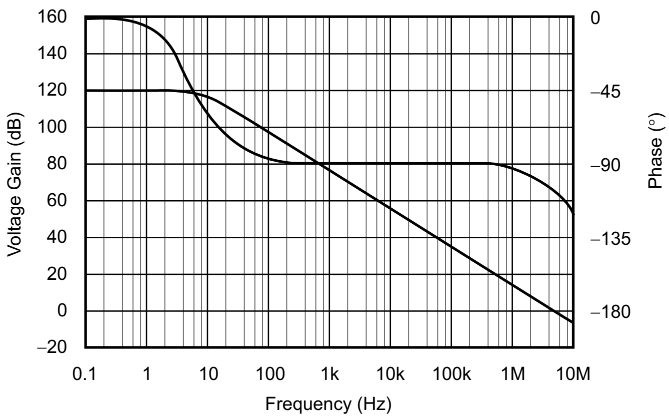


Figure 1. Open-Loop Gain/Phase vs Frequency

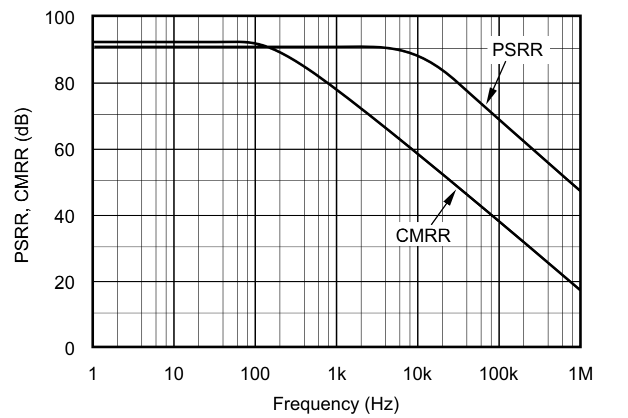


Figure 2. Power-Supply and Common-Mode Rejection vs Frequency

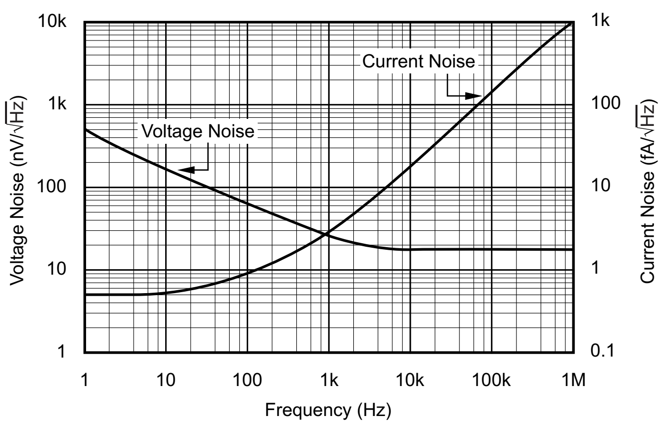


Figure 3. Input Voltage and Current Noise Spectral Density vs Frequency

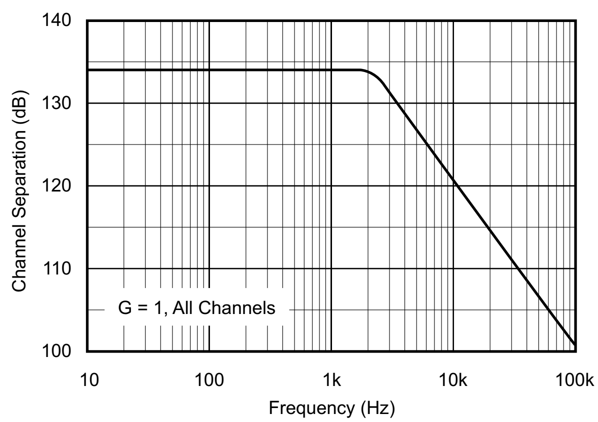


Figure 4. Channel Separation vs Frequency

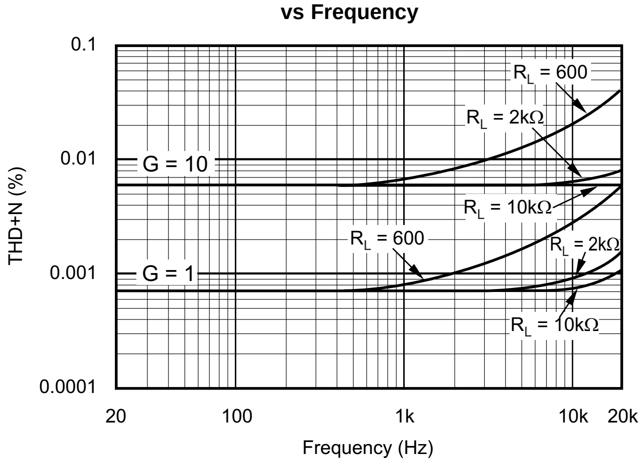


Figure 5. Total Harmonic Distortion + Noise vs Frequency

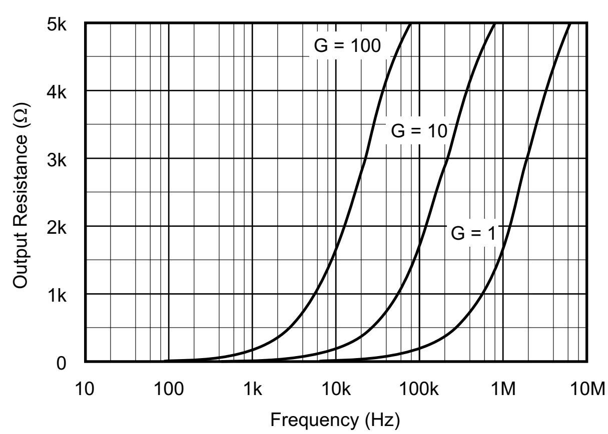


Figure 6. Closed-Loop Output Impedance vs Frequency

Typical Characteristics

At T_A = 25°C, V_S = 5 V, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted.

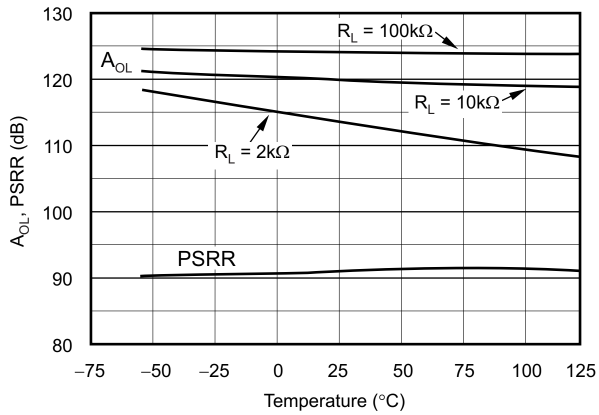


Figure 7. Open-Loop Gain and Power-Supply Rejection vs Temperature

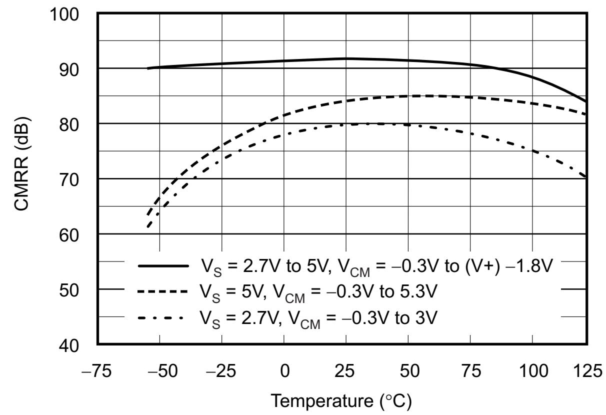


Figure 8. Common-Mode Rejection vs Temperature

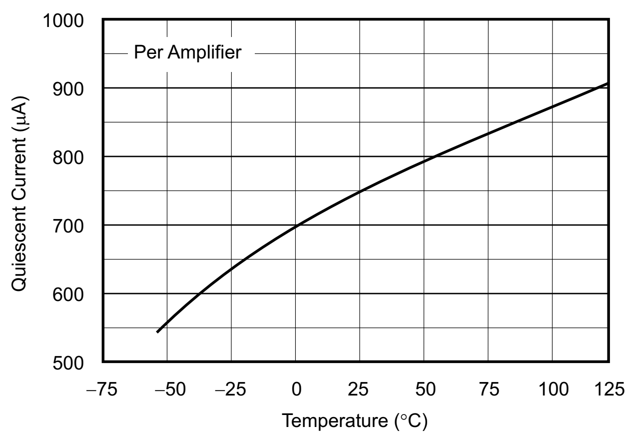


Figure 9. Quiescent Current vs Temperature

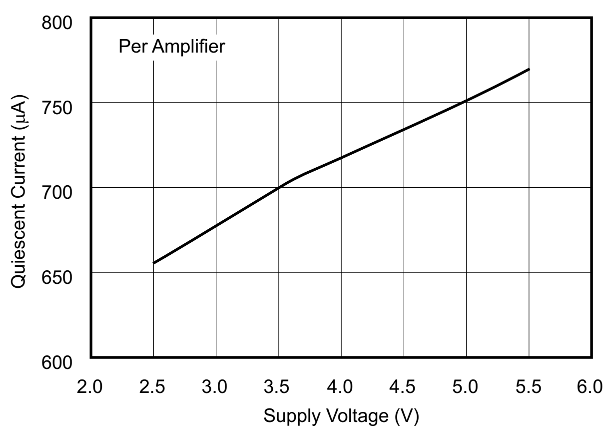


Figure 10. Quiescent Current vs Supply Voltage

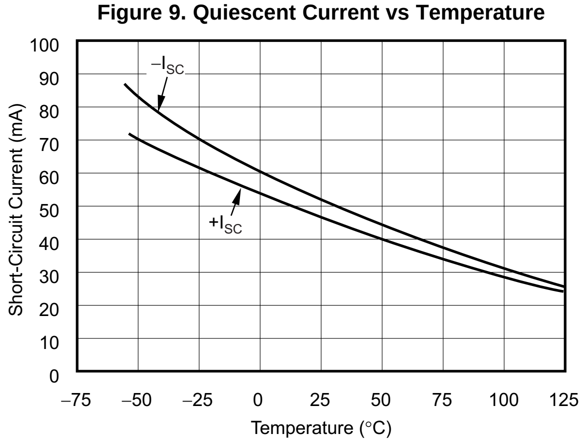


Figure 11. Short-Circuit Current vs Temperature

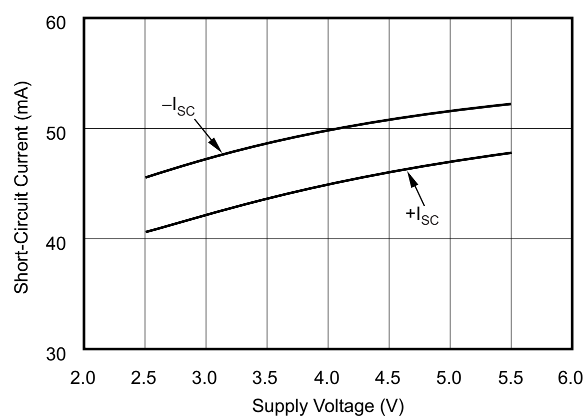


Figure 12. Short-Circuit Current vs Supply Voltage

Typical Characteristics

At T_A = 25°C, V_S = 5 V, and R_L = 10 kΩ connected to $V_S/2$, unless otherwise noted.

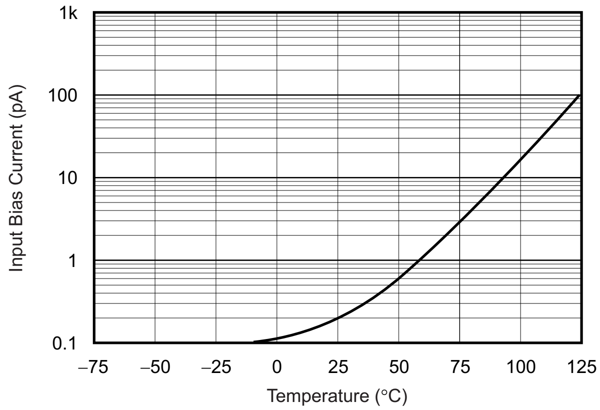


Figure 13. Input Bias Current vs Temperature

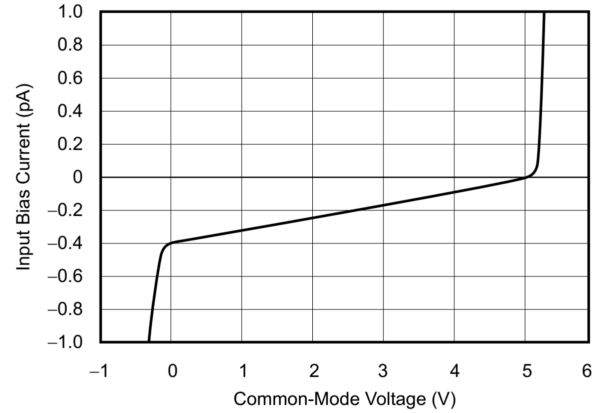


Figure 14. Input Bias Current vs Input Common-Mode Voltage

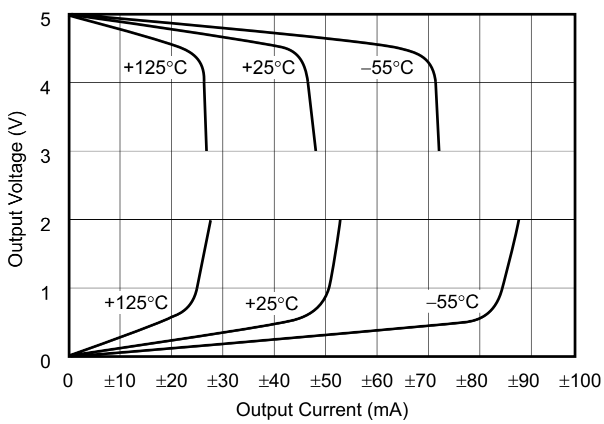


Figure 15. Output Voltage Swing vs Output Current

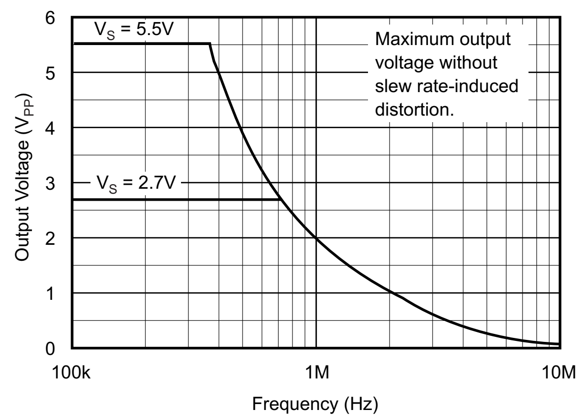


Figure 16. Maximum Output Voltage vs Frequency

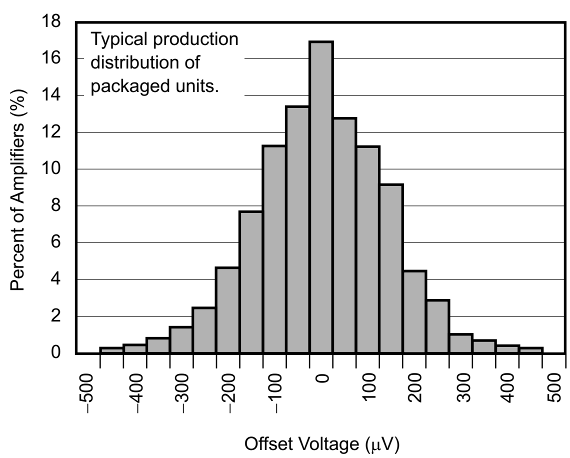


Figure 17. Offset Voltage Production Distribution

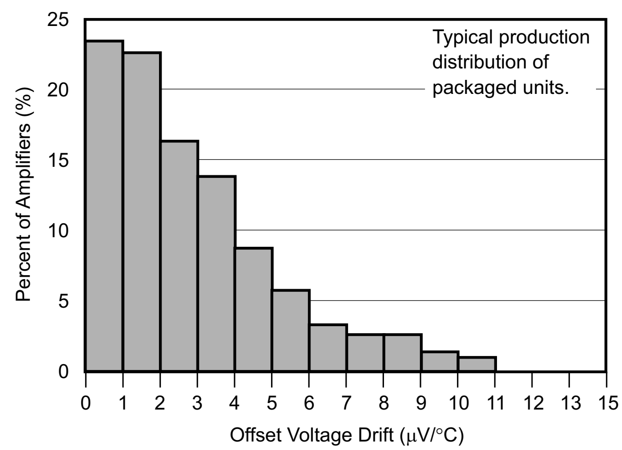
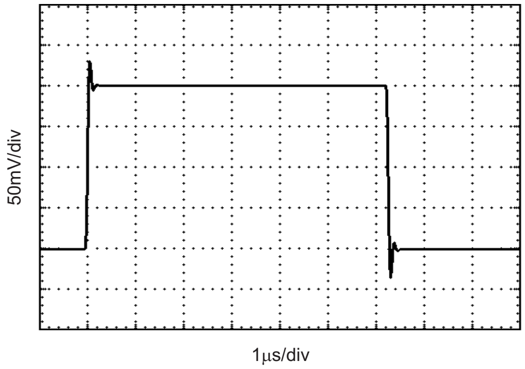


Figure 18. Offset Voltage Drift Magnitude Production Distribution

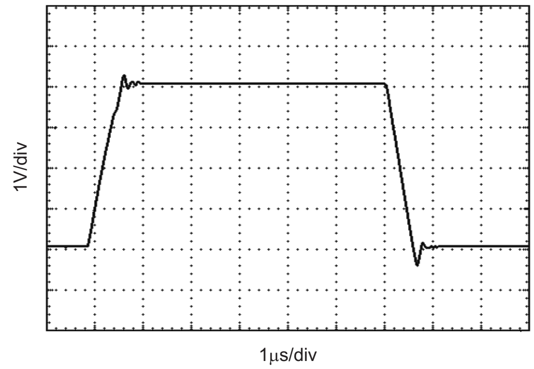
Typical Characteristics

At T_A = 25°C, V_S = 5 V, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted.



C_L = 100 pF

Figure 19. Small-Signal Step Response



C_L = 100 pF

Figure 20. Large-Signal Step Response

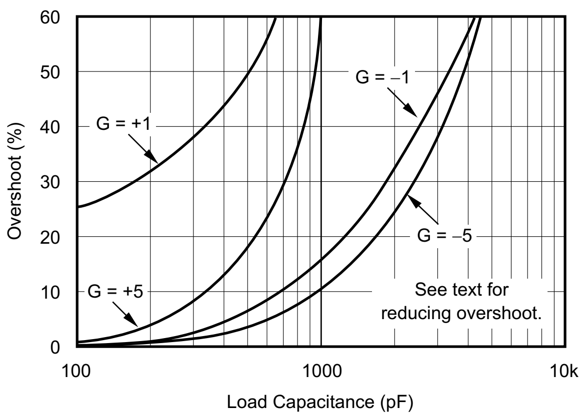


Figure 21. Small-Signal Overshoot vs Load Capacitance

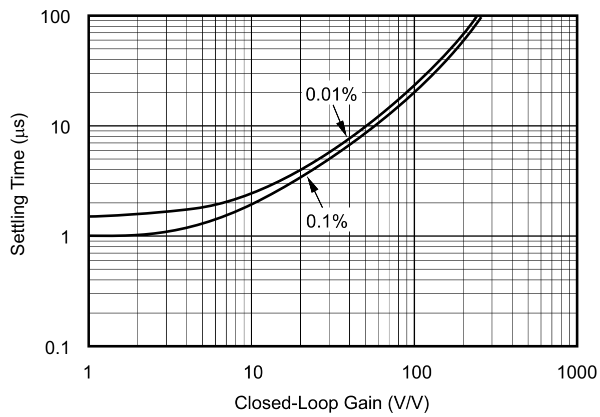
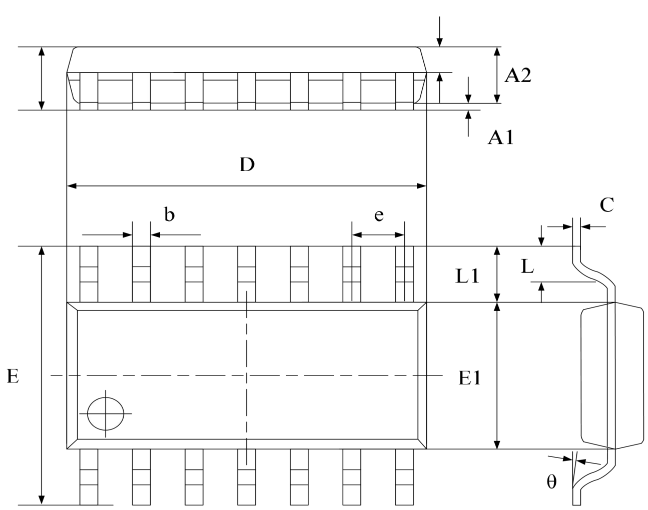


Figure 22. Settling Time vs Closed-Loop Gain

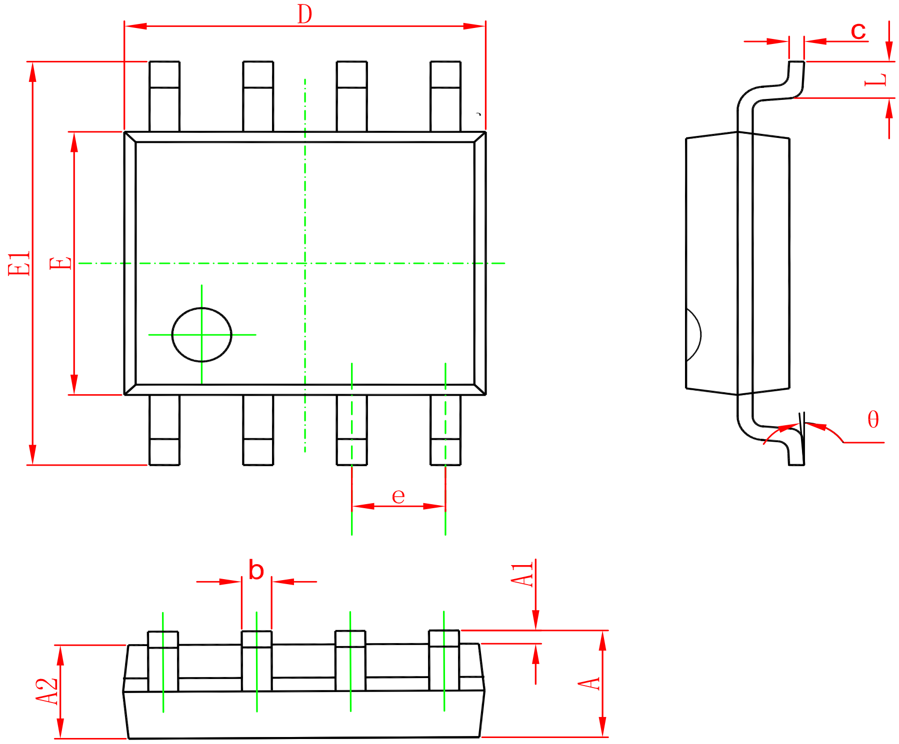
Package Dimension

SOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	1.850	0.059	0.076
A1	0.100	0.300	0.004	0.012
A2	1.350	1.550	0.055	0.063
A3	0.550	0.750	0.022	0.031
b	0.406typ.		0.017typ.	
C	0.203typ.		0.008typ.	
D	8.630	8.830	0.352	0.360
E	5.840	6.240	0.238	0.255
E1	3.850	4.050	0.157	0.165
e	1.270 typ.		0.050 typ.	
L1	1.040 ref.		0.041 ref.	
L	0.350	0.750	0.014	0.031
θ	2°	8°	2°	8°

SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Ordering information

Order code	Package	Baseqty	Deliverymode	Marking
UMW OPA4340UA	SOP-14	2500	Tape and reel	OPA4340UA
UMW OPA2340UA	SOP-8	2500	Tape and reel	OPA2340UA
UMW OPA340UA	SOP-8	2500	Tape and reel	OPA340UA
UMW OPA340NA	SOT23-5	3000	Tape and reel	A40 U