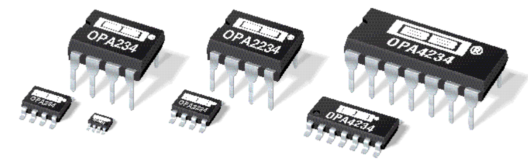
BURR - BROWN®



OPA234
OPA2234
OPA4234

Low Power, Precision
SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

FEATURES

- **WIDE SUPPLY RANGE:**
  Single Supply: V_S = +2.7V to +36V
  Dual Supply: V_S = ±1.35V to ±18V
- **GUARANTEED PERFORMANCE:**
  +2.7V, +5V, and ±15V
- **LOW QUIESCENT CURRENT: 250μA/amp**
- **LOW INPUT BIAS CURRENT: 25nA max**
- **LOW OFFSET VOLTAGE: 100μV max**
- **HIGH CMRR, PSRR, and A_{OL}**
- **SINGLE, DUAL, and QUAD VERSIONS**

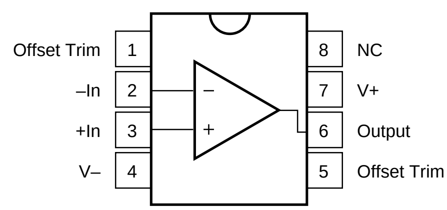
DESCRIPTION

The OPA234 series low cost op amps are ideal for single supply, low voltage, low power applications. The series provides lower quiescent current than older "1013"-type products and comes in current industry-standard packages and pinouts. The combination of low offset voltage, high common-mode rejection, high power supply rejection, and a wide supply range provides excellent accuracy and versatility. Single, dual, and quad versions have identical specifications for maximum design flexibility. These general purpose op amps are ideal for portable and battery powered applications.

OPA234 series op amps operate from either single or dual supplies. In single supply operation, the input common-mode range extends below ground and the output can swing to within 50mV of ground. Excellent phase margin makes the OPA234 series ideal for demanding applications, including high load capacitance. Dual and quad designs feature completely independent circuitry for lowest crosstalk and freedom from interaction.

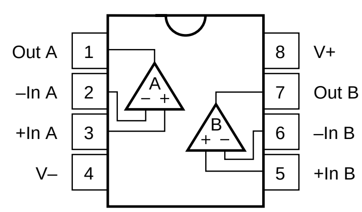
Single version packages are 8-Pin DIP, SO-8 surface-mount, and a space-saving MSOP-8 surface-mount. Dual packages are 8-Pin DIP and SO-8 surface-mount. Quad packages are 14-Pin DIP and SO-14 surface-mount. All are specified for –40°C to +85°C operation.

OPA234



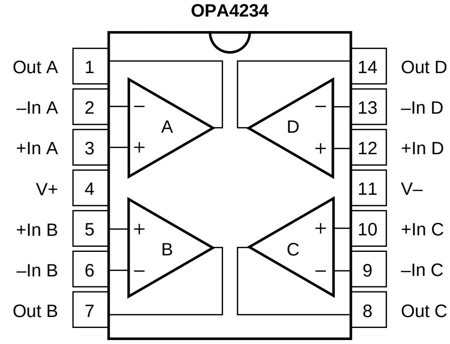
8-Pin DIP, SO-8, MSOP-8

OPA2234



8-Pin DIP, SO-8

OPA4234



14-Pin DIP
SO-14

International Airport Industrial Park • Mailing Address: PO Box 11400, Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd., Tucson, AZ 85706 • Tel: (520) 746-1111 • Twx: 910-952-1111
Internet: http://www.burr-brown.com/ • FAXLine: (800) 548-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

PDS-1318A
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SPECIFICATIONS: V_S = +5V

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

		OPA234P, U, E OPA2234P, U			OPA234PA, UA, EA OPA2234PA, UA OPA4234PA, UA, U			
PARAMETER	**CONDITION**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
OFFSET VOLTAGE								
Input Offset Voltage V_{OS}	V_{CM} = 2.5V		±40	±100		*	±250	µV
OPA234E, EA			±100	±150		*	±350	µV
vs Temperature(1) dV_{OS}/dT	Operating Temperature Range		±0.5	±3		*	*	µV/°C
vs Power Supply PSRR	V_S = +2.7V to +30V, V_{CM} = 1.7V		3	10		*	20	µV/V
vs Time			0.2			*		µV/mo
Channel Separation (Dual, Quad)			0.3			*		µV/V
INPUT BIAS CURRENT								
Input Bias Current(2) I_B	V_{CM} = 2.5V		–15	–25		*	–50	nA
Input Offset Current I_{OS}	V_{CM} = 2.5V		±1	±5		*	*	nA
NOISE	f = 1kHz							
Input Voltage Noise Density v_n			25			*		nV/√Hz
Current Noise Density i_n			80			*		fA/√Hz
INPUT VOLTAGE RANGE								
Common-Mode Voltage Range		–0.1		(V+) –1	*		*	V
Common-Mode Rejection CMRR	V_{CM} = –0.1V to 4V	96	106		86	*		dB
INPUT IMPEDANCE								
Differential			10^7 || 5			*		Ω || pF
Common-Mode	V_{CM} = 2.5V		10^{10} || 6			*		Ω || pF
OPEN-LOOP GAIN	V_O = 0.25V to 4V							
Open-Loop Voltage Gain A_{OL}	R_L = 10kΩ	110	120		100	*		dB
	R_L = 2kΩ	90	96		86	*		dB
FREQUENCY RESPONSE								
Gain-Bandwidth Product GBW	C_L = 100pF		0.35			*		MHz
Slew Rate SR			0.2			*		V/µs
Settling Time: 0.1%	G = 1, 3V Step, C_L = 100pF		15			*		µs
0.01%	G = 1, 3V Step, C_L = 100pF		25			*		µs
Overload Recovery Time	(V_{IN}) (Gain) = V_S		16			*		µs
OUTPUT								
Voltage Output: Positive	R_L = 10kΩ to V_S/2	(V+) –1	(V+) –0.65		*	*		V
Negative	R_L = 10kΩ to V_S/2	0.25	0.05		*	*		V
Positive	R_L = 10kΩ to Ground	(V+) –1	(V+) –0.65		*	*		V
Negative	R_L = 10kΩ to Ground	0.1	0.05		*	*		V
Short-Circuit Current I_{SC}			±11			*		mA
Capacitive Load Drive (Stable Operation)(3)	G = +1		1000			*		pF
POWER SUPPLY								
Specified Operating Voltage			+5			*		V
Operating Voltage Range		+2.7		+36	*		*	V
Quiescent Current (per amplifier) I_Q	I_O = 0		250	300		*	*	µA
TEMPERATURE RANGE								
Specified Range		–40		+85	*		*	°C
Operating Range		–40		+125	*		*	°C
Storage		–55		+125	*		*	°C
Thermal Resistance θ_{JA}								
8-Pin DIP			100			*		°C/W
SO-8 Surface-Mount			150			*		°C/W
MSOP-8 Surface-Mount			220			*		°C/W
14-Pin DIP			80			*		°C/W
SO-14 Surface-Mount			110			*		°C/W

* Specifications same as OPA234P.

NOTES: (1) Guaranteed by wafer-level test to 95% confidence level. (2) Positive conventional current flows into the input terminals. (3) See "Small-Signal Overshoot vs Load Capacitance" typical curve.

SPECIFICATIONS: V_S = +2.7V

At T_A = 25°C, V_S = +2.7V, R_L = 10kΩ connected to V_S/2 and V_{OUT} = V_S/2, unless otherwise noted.

		OPA234P, U, E OPA2234P, U			OPA234PA, UA, EA OPA2234PA, UA OPA4234PA, UA, U			
PARAMETER	**CONDITION**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
OFFSET VOLTAGE								
Input Offset Voltage V_{OS}	V_{CM} = 1.35V		±40	±100		∗	±250	μV
OPA234E, EA			±100	±150		∗	±350	μV
vs Temperature(1) dV_{OS}/dT	Operating Temperature Range		±0.5	±3		∗	∗	μV/°C
vs Power Supply PSRR	V_S = +2.7V to +30V, V_{CM} = 1.7V		3	10		∗	20	μV/V
vs Time			0.2			∗		μV/mo
Channel Separation (Dual, Quad)			0.3			∗		μV/V
INPUT BIAS CURRENT								
Input Bias Current(2) I_B	V_{CM} = 1.35V		–15	–25		∗	–50	nA
Input Offset Current I_{OS}	V_{CM} = 1.35V		±1	±5		∗	∗	n
NOISE	f = 1kHz							
Input Voltage Noise Density v_n			25			∗		nV/√Hz
Current Noise Density i_n			80			∗		fA/√Hz
INPUT VOLTAGE RANGE								
Common-Mode Voltage Range		–0.1		(V+) –1	∗		∗	V
Common-Mode Rejection CMRR	V_{CM} = –0.1V to 1.7V	96	106		86	∗		dB
INPUT IMPEDANCE								
Differential			10^7 || 5			∗		Ω || pF
Common-Mode	V_{CM} = 1.35V		10^{10} || 6			∗		Ω || pF
OPEN-LOOP GAIN	V_O = 0.25V to 1.7V							
Open-Loop Voltage Gain A_{OL}	R_L = 10kΩ	110	125		100	∗		dB
	R_L = 2kΩ	90	96		86	∗		dB
FREQUENCY RESPONSE								
Gain-Bandwidth Product GBW	C_L = 100pF		0.35			∗		MHz
Slew Rate SR			0.2			∗		V/μs
Settling Time: 0.1%	G = 1, 1V Step, C_L = 100pF		6			∗		μs
0.01%	G = 1, 1V Step, C_L = 100pF		16			∗		μs
Overload Recovery Time	(V_{IN}) (Gain) = V_S		8			∗		μs
OUTPUT								
Voltage Output: Positive	R_L = 10kΩ to V_S/2	(V+) –1	(V+) –0.6		∗	∗		V
Negative	R_L = 10kΩ to V_S/2	0.25	0.05		∗	∗		V
Positive	R_L = 10kΩ to Ground	(V+) –1	(V+) –0.65		∗	∗		V
Negative	R_L = 10kΩ to Ground	0.1	0.05		∗	∗		V
Short-Circuit Current I_{SC}			±8			∗		mA
Capacitive Load Drive (Stable Operation)(3)	G = +1		1000			∗		pF
POWER SUPPLY								
Specified Operating Voltage			+2.7			∗		V
Operating Voltage Range		+2.7		+36	∗		∗	V
Quiescent Current (per amplifier) I_Q	I_O = 0		250	300		∗	∗	μA
TEMPERATURE RANGE								
Specified Range		–40		+85	∗		∗	°C
Operating Range		–40		+125	∗		∗	°C
Storage		–55		+125	∗		∗	°C
Thermal Resistance θ_{JA}								
8-Pin DIP			100			∗		°C/W
SO-8 Surface-Mount			150			∗		°C/W
MSOP-8 Surface-Mount			220			∗		°C/W
14-Pin DIP			80			∗		°C/W
SO-14 Surface-Mount			110			∗		°C/W

∗ Specifications same as OPA234P.

NOTES: (1) Guaranteed by wafer-level test to 95% confidence level. (2) Positive conventional current flows into the input terminals. (3) See “Small-Signal Overshoot vs Load Capacitance” typical curve.

SPECIFICATIONS: $V_S = \pm 15V$

At $T_A = 25°C$, $V_S = \pm 15V$, $R_L = 10k\Omega$ connected to ground, unless otherwise noted.

PARAMETER	CONDITION	OPA234P, U, E OPA2234P, U			OPA234PA, UA, EA OPA2234PA, UA OPA4234PA, UA, U			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
OFFSET VOLTAGE								
Input Offset Voltage V_{OS}	$V_{CM} = 0V$		±70	±250		*	±500	μV
OPA4234U Model						±70	±250	μV
vs Temperature[(1)] dV_{OS}/dT	Operating Temperature Range		±0.5	±5		*	*	μV/°C
vs Power Supply PSRR	$V_S = \pm 1.35V$ to $\pm 18V$, $V_{CM} = 0V$		3	10		*	20	μV/V
vs Time			0.2			*		μV/mo
Channel Separation (Dual, Quad)			0.3			*		μV/V
INPUT BIAS CURRENT								
Input Bias Current[(2)] I_B	$V_{CM} = 0V$		–12	–25		*	–50	nA
Input Offset Current I_{OS}	$V_{CM} = 0V$		±1	±5		*	*	nA
NOISE	f = 1kHz							
Input Voltage Noise Density v_n			25			*		nV/√Hz
Current Noise Density i_n			80			*		fA/√Hz
INPUT VOLTAGE RANGE								
Common-Mode Voltage Range		(V–)		(V+) –1	*		*	V
Common-Mode Rejection CMRR	$V_{CM} = -15V$ to 14V	96	106		86	*		dB
INPUT IMPEDANCE								
Differential			$10^7 \parallel 5$			*		Ω ∥ pF
Common-Mode	$V_{CM} = 0V$		$10^{10} \parallel 6$			*		Ω ∥ pF
OPEN-LOOP GAIN								
Open-Loop Voltage Gain A_{OL}	$V_O = -14.5V$ to 14V	110	120		100	*		dB
FREQUENCY RESPONSE								
Gain-Bandwidth Product GBW	$C_L = 100pF$		0.35			*		MHz
Slew Rate SR			0.2			*		V/μs
Settling Time: 0.1%	G = 1, 10V Step, $C_L = 100pF$		41			*		μs
0.01%	G = 1, 10V Step, $C_L = 100pF$		47			*		μs
Overload Recovery Time	(V_{IN}) (Gain) $= V_S$		22			*		μs
OUTPUT								
Voltage Output: Positive		(V+) –1	(V+) –0.7		*	*		V
Negative		(V–) +0.5	(V–) +0.15		*	*		V
Short-Circuit Current I_{SC}			±22			*		mA
Capacitive Load Drive (Stable Operation)[(3)]	G = +1		1000			*		pF
POWER SUPPLY								
Specified Operating Voltage			±15			*		V
Operating Voltage Range		±1.35		±18	*		*	V
Quiescent Current (per amplifier) I_Q	$I_O = 0$		±275	±350		*	*	μA
TEMPERATURE RANGE								
Specified Range		–40		+85	*		*	°C
Operating Range		–40		+125	*		*	°C
Storage		–55		+125	*		*	°C
Thermal Resistance θ_{JA}								
8-Pin DIP			100			*		°C/W
SO-8 Surface-Mount			150			*		°C/W
MSOP-8 Surface-Mount			220			*		°C/W
14-Pin DIP			80			*		°C/W
SO-14 Surface-Mount			110			*		°C/W

* Specifications same as OPA234P.

NOTES: (1) Guaranteed by wafer-level test to 95% confidence level. (2) Positive conventional current flows into the input terminals. (3) See "Small-Signal Overshoot vs Load Capacitance" typical curve.

ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V+ to V–	36V
Input Voltage	(V–) –0.7V to (V+) +0.7V
Output Short-Circuit(1)	Continuous
Operating Temperature	–40°C to +125°C
Storage Temperature	–55°C to +125°C
Junction Temperature	150°C
Lead Temperature (soldering, 10s)	300°C

NOTE: (1) Short-circuit to ground, one amplifier per package.

PACKAGE/ORDERING INFORMATION

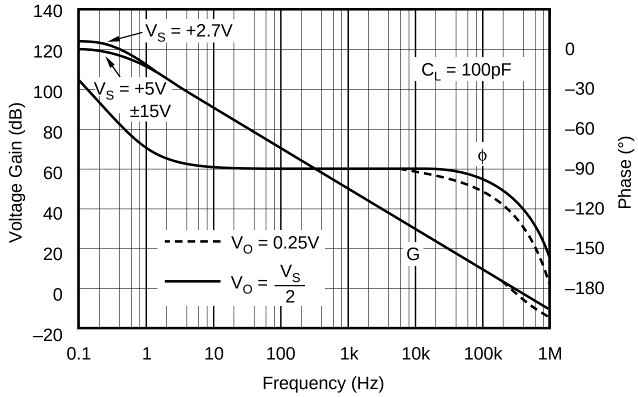
PRODUCT	PACKAGE	PACKAGE DRAWING NUMBER(1)	TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER(2)
Single					
OPA234EA	MSOP-8 Surface-Mount	337	–40°C to +85°C	A34(3)	OPA234EA-250 OPA234EA-2500
OPA234E	MSOP-8 Surface-Mount	337	–40°C to +85°C	A34(3)	OPA234E-250 OPA234E-2500
OPA234PA	8-Pin Plastic DIP	006	–40°C to +85°C	OPA234PA	OPA234PA
OPA234P	8-Pin Plastic DIP	006	–40°C to +85°C	OPA234P	OPA234P
OPA234UA	SO-8 Surface-Mount	182	–40°C to +85°C	OPA234UA	OPA234UA
OPA234U	SO-8 Surface-Mount	182	–40°C to +85°C	OPA234U	OPA234U
Dual					
OPA2234PA	8-Pin Plastic DIP	006	–40°C to +85°C	OPA2234PA	OPA2234PA
OPA2234P	8-Pin Plastic DIP	006	–40°C to +85°C	OPA2234P	OPA2234P
OPA2234UA	SO-8 Surface-Mount	182	–40°C to +85°C	OPA2234UA	OPA2234UA
OPA2234U	SO-8 Surface-Mount	182	–40°C to +85°C	OPA2234U	OPA2234U
Quad					
OPA4234PA	14-Pin Plastic DIP	010	–40°C to +85°C	OPA4234PA	OPA4232PA
OPA4234UA	SO-14 Surface-Mount	235	–40°C to +85°C	OPA4234UA	OPA4234UA
OPA4234U	SO-14 Surface-Mount	235	–40°C to +85°C	OPA4234U	OPA4234U

NOTE: (1) For detailed drawing and dimension table, please see end of data sheet, or Appendix C of Burr-Brown IC Data Book. (2) Models with -250 and -2500 are available only in Tape & Reel in the quantity indicated (e. g., -250 indicates 250 devices per reel). Ordering 2500 pieces of "OPA234EA-2500" will get a single 2500 piece Tape & Reel. For detailed Tape & Reel mechanical information, refer to Appendix B of Burr-Brown IC Data Book. (3) The grade will be marked on the Reel.

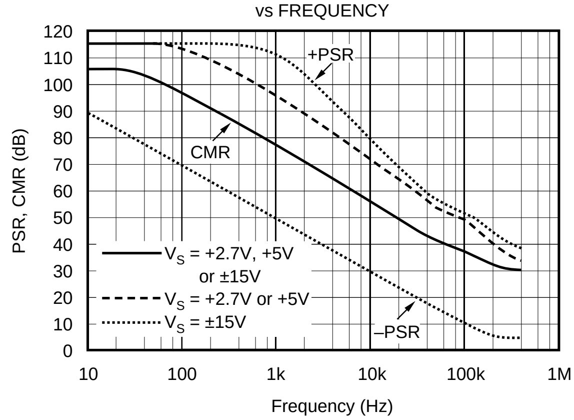
TYPICAL PERFORMANCE CURVES

At $T_A = +25°C$ and $R_L = 10k\Omega$ unless otherwise noted.

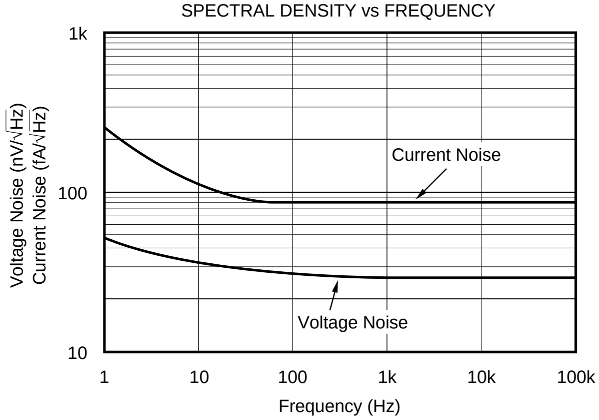
OPEN-LOOP GAIN/PHASE vs FREQUENCY



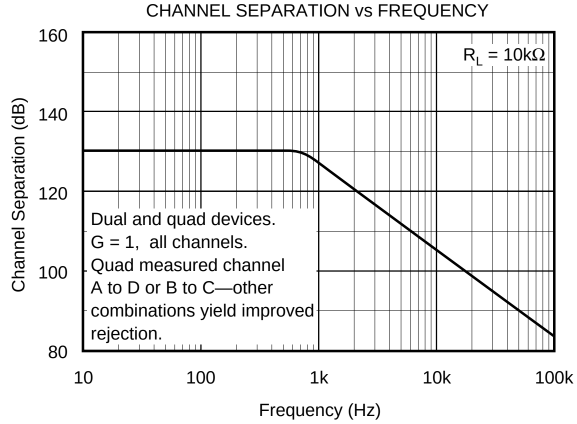
POWER SUPPLY AND COMMON-MODE REJECTION vs FREQUENCY



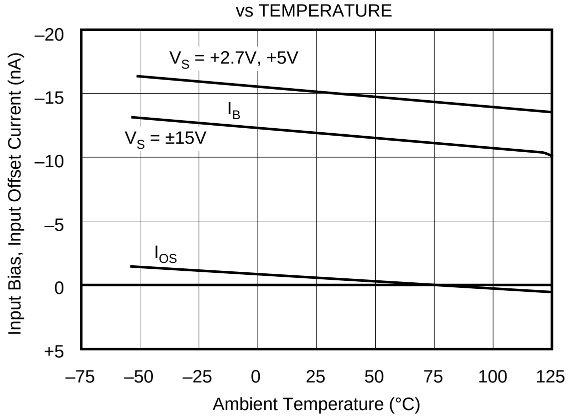
INPUT NOISE AND CURRENT NOISE SPECTRAL DENSITY vs FREQUENCY



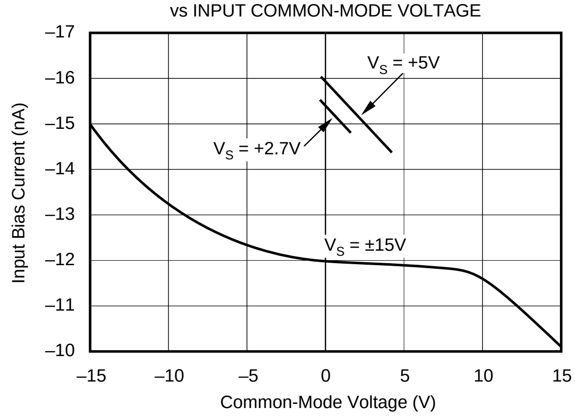
CHANNEL SEPARATION vs FREQUENCY



INPUT BIAS AND INPUT OFFSET CURRENT vs TEMPERATURE

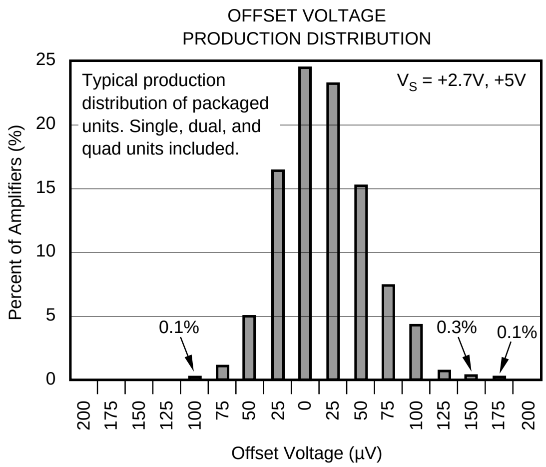


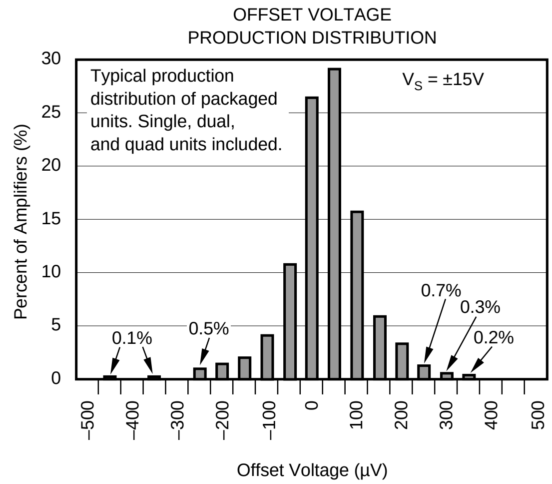
INPUT BIAS CURRENT vs INPUT COMMON-MODE VOLTAGE

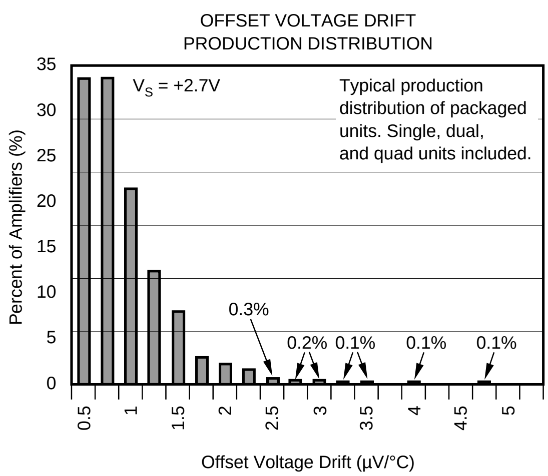


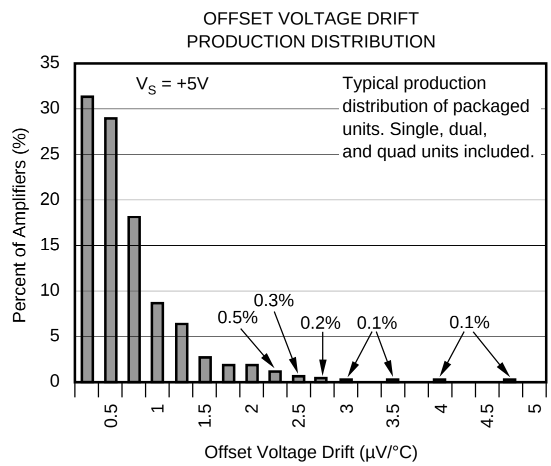
TYPICAL PERFORMANCE CURVES (CONT)

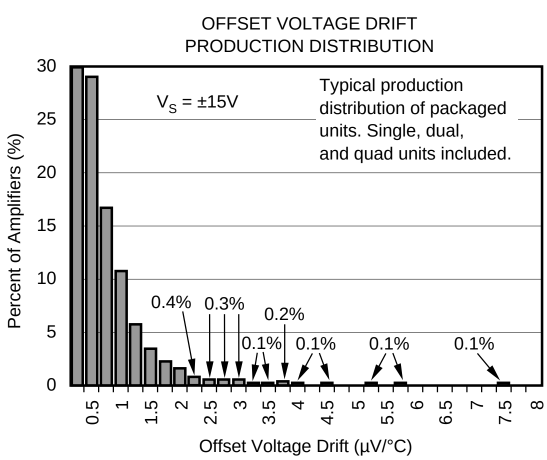
At T_A = +25°C and R_L = 10kΩ unless otherwise noted.

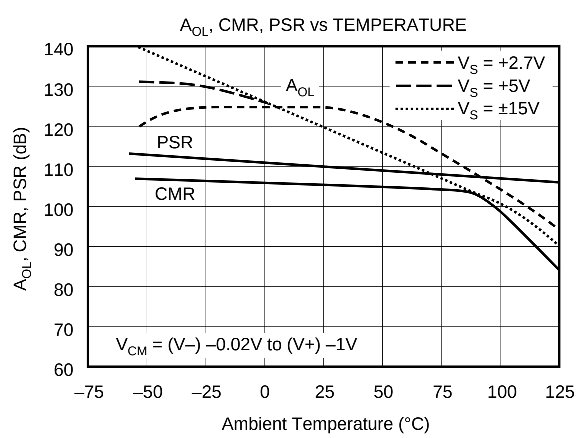








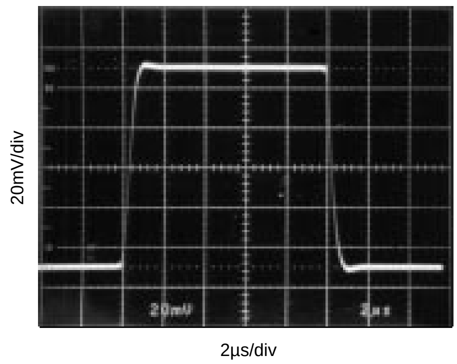




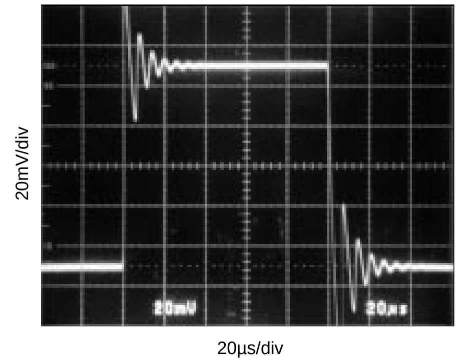
TYPICAL PERFORMANCE CURVES (CONT)

At T_A = +25°C and R_L = 10kΩ unless otherwise noted.

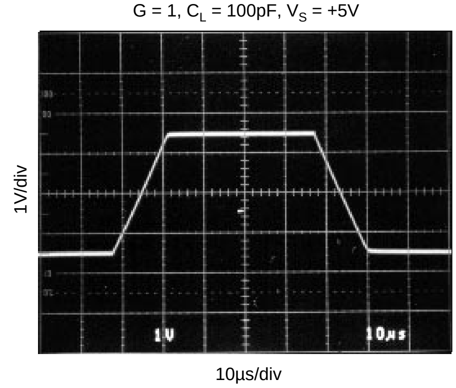
SMALL-SIGNAL STEP RESPONSE
G = 1, C_L = 100pF, V_S = +5V



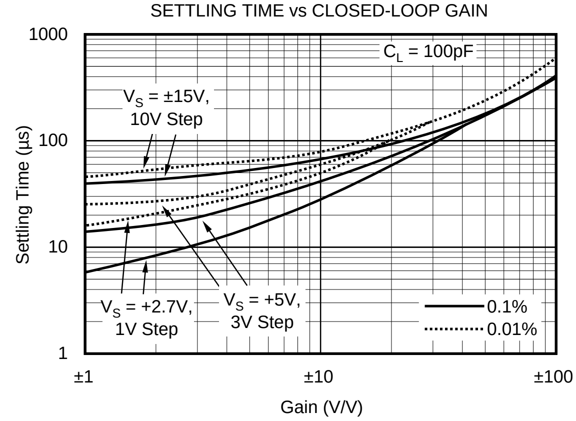
SMALL-SIGNAL STEP RESPONSE
G = 1, C_L = 10,000pF, V_S = +5V



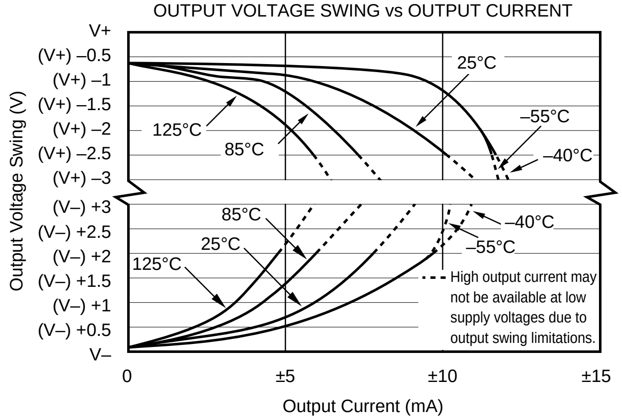
LARGE-SIGNAL STEP RESPONSE
G = 1, C_L = 100pF, V_S = +5V



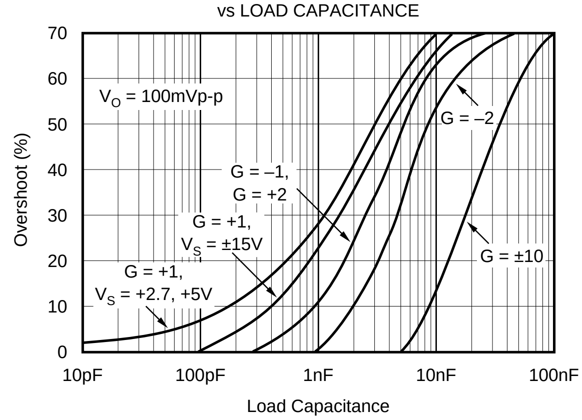
SETTLING TIME vs CLOSED-LOOP GAIN



OUTPUT VOLTAGE SWING vs OUTPUT CURRENT

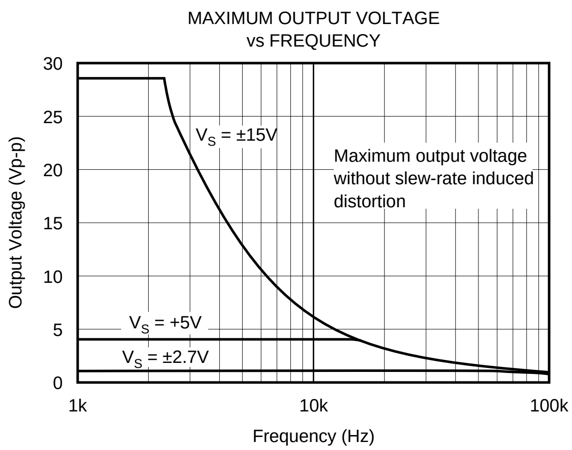


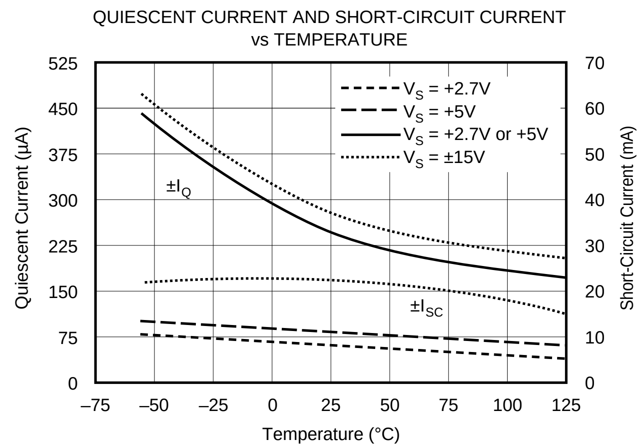
SMALL-SIGNAL OVERSHOOT
vs LOAD CAPACITANCE



TYPICAL PERFORMANCE CURVES (CONT)

At T_A = +25°C and R_L = 10kΩ unless otherwise noted.





APPLICATIONS INFORMATION

OPA234 series op amps are unity-gain stable and suitable for a wide range of general-purpose applications. Power supply pins should be bypassed with 10nF ceramic capacitors.

OPERATING VOLTAGE

OPA234 series op amps operate from single (+2.7V to +36V) or dual (±1.35V to ±18V) supplies with excellent performance. Specifications are production tested with +2.7V, +5V, and ±15V supplies. Most behavior remains unchanged throughout the full operating voltage range. Parameters which vary significantly with operating voltage are shown in typical performance curves.

OFFSET VOLTAGE TRIM

Offset voltage of OPA234 series amplifiers is laser trimmed and usually requires no user adjustment. The OPA234 (single op amp version) provides offset voltage trim connections on pins 1 and 5. Offset voltage can be adjusted by connecting a potentiometer as shown in Figure 1. This adjustment should be used only to null the offset of the op amp, not to adjust system offset or offset produced by the signal source. Nulling offset could degrade the offset drift behavior of the op amp. While it is not possible to predict the exact change in drift, the effect is usually small.

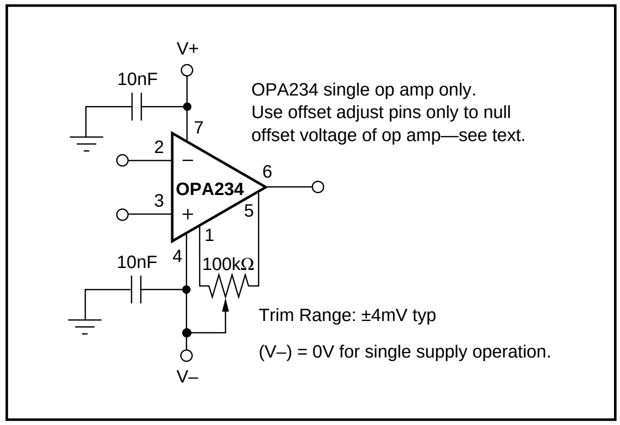


FIGURE 1. OPA234 Offset Voltage Trim Circuit.