

Analog/Mixed-Signal Products

Designer's Master Selection Guide

Audio Products

August 2002



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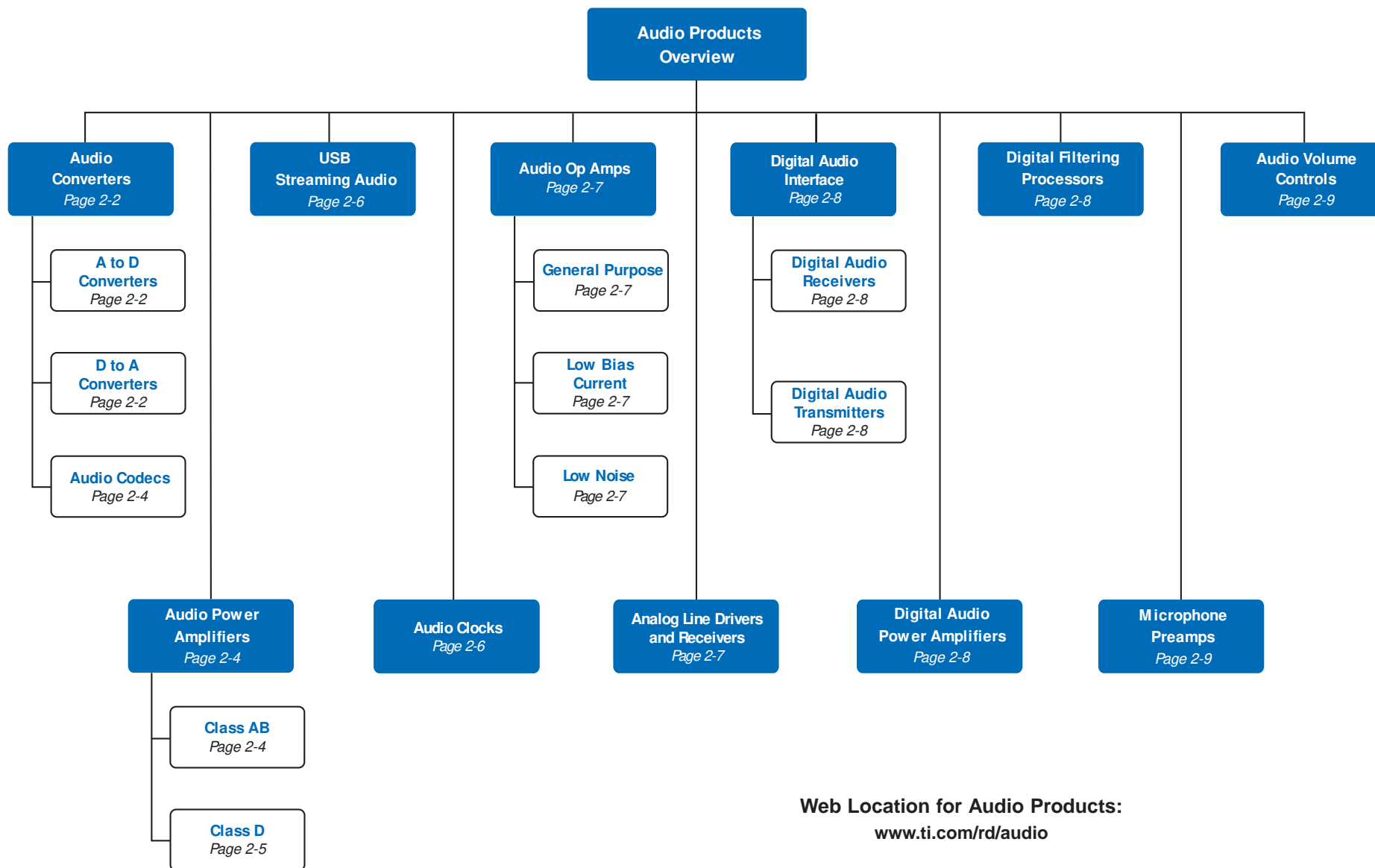
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Web Location for Audio Products:
www.ti.com/rd/audio

Audio Products

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For technical assistance, requesting datasheets or samples, see Contact Information on the last page of this book.

Two other resources for product information are:

- 1) the *Analog and Mixed-Signal* webpage at analog.ti.com
- 2) the Designer's Master Selection Guide CD-ROM (SLYC005G). Complete and return the attached business reply card to order.

Web Location for Audio Products:

www.ti.com/rd/audio

Audio Converters—A to D Converters

Device Name	Resolution (Bits)	Dynamic Range (typ) (dB)	Architecture	Supply Voltage(s) (V)	P _d (typ) (mW)	Sampling Rate (max) (kHz)	Package	Price*	Description
PCM1801	16	93	Delta-Sigma 2-ch DAC	5	90	48	SOIC	2.27	16-Bit, Stereo, Audio ADC
PCM1760	20	108	Delta-Sigma 2-ch DAC	±5	370	48	PDIP,SOIC	14.55	Multi-Bit Enhanced Noise Shaping 20-Bit A/D Conversion System
PCM1800	20	95	Delta-Sigma 2-ch DAC	5	90	48	SSOP	2.98	Single-Ended Analog Input 20-Bit Stereo ADC
PCM1802	24	100	Stereo ADC	3.3 and 5	225	96	SSOP	3.95	24-Bit Delta Sigma Audio ADC
PCM1804	24	111	Stereo ADC	3.3 and 5	225	192	SSOP	4.95	High-Performance 24-Bit Delta-Sigma Stereo ADC

Audio Converters—D to A Converters

Device Name	Resolution (Bits)	Dynamic Range (typ) (dB)	Architecture	Supply Voltage(s) (V)	P _d (typ) (mW)	Sampling Rate (max) (kHz)	Package	Price*	Description
1-Bit									
DSD1700	1	110	Direct Stream Digital	5	27.5	2822.4	SSOP	10.07	Direct Stream Digital (DSD) DAC
16-Bit									
PCM1725	16	95	Delta-Sigma 2-ch DAC	5	65	96	SOIC	1.26	SoundPlus™ Stereo Audio DAC 16 Bits, 96kHz Sampling
18-Bit									
PCM1717	18	96	Delta-Sigma 2-ch DAC	2.7 to 5.5		48	SSOP	3.19	SoundPlus Stereo Audio DAC
PCM1718	18	96	Delta-Sigma 2-ch DAC	2.7 to 5.5		48	SSOP	3.19	SoundPlus Stereo Audio DAC
PCM1719	18	96	Delta-Sigma 2-ch DAC	5	180	48	SSOP	4.20	SoundPlus Stereo Audio DAC
PCM1733	18	95	Delta-Sigma 2-ch DAC	5	65	96	SOIC	1.26	SoundPlus Stereo Audio DAC 18 Bits, 96kHz Sampling
20-Bit									
PCM1710	20	110		5		48	SOIC	4.00	Dual Voltage Output CMOS Delta-Sigma DAC with On-Chip Digital Filter
PCM1702	20	120	Sign-Magnitude DAC	±5	150	768	PDIP,SOP	11.78	High-Performance BiCMOS Advanced Sign Magnitude 20-Bit DAC
24-Bit									
PCM1770	24	96	Delta-Sigma	1.6 to 3.6	9.6	50	SSOP,TSSOP	1.95	Low Voltage, Low Power Stereo Audio DAC
PCM1771	24	96	Delta-Sigma	1.6 to 3.6	9.6	50	TSSOP	Call	Low Voltage, Low Power Stereo Audio DAC w/Headphone Amp
PCM1772	24	96	Delta-Sigma	1.6 to 3.6	9.6	50	TSSOP	Call	Low Voltage, Low Power Stereo Audio DAC with Line Amp
PCM1773	24	96	Delta-Sigma	1.6 to 3.6	9.6	50	TSSOP	Call	Low Voltage, Low Power Stereo Audio DAC with Line Amp
DF1704	24		Digital Filter	5	100	96	SSOP	10.07	SoundPlus Stereo, 24-Bit, 96kHz 8X Oversampling Digital Interpolation Filter DAC
PCM1600	24	105	Delta-Sigma 6-Ch DAC	3.3 and 5	266	96	LQFP	3.95	SoundPlus 24-Bit, 96kHz Sampling,6-Channel, Enhanced Multi-Level, Delta-Sigma DAC
PCM1601	24	105	Delta-Sigma 6-Ch DAC	3.3 and 5	266	96	QFP	3.95	SoundPlus 24-Bit, 96kHz Sampling,6-Channel, Enhanced Multi-Level, Delta-Sigma DAC
PCM1716	24	106	Delta-Sigma 2-ch DAC	5	160	96	SSOP	2.99	SoundPlus 24-Bit, 96kHz Sampling CMOS Delta-Sigma Stereo Audio DAC

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

■ Audio Converters—D to A Converters (Continued)

Device Name	Resolution (Bits)	Dynamic Range (typ) (dB)	Architecture	Supply Voltage(s) (V)	P _d (typ) (mW)	Sorted By	Package	Price*	Description
						Sampling Rate (max) (kHz)			
24-Bit (Continued)									
PCM1720	24	96	Delta-Sigma 2-ch DAC	5	90	96	SSOP	2.27	SoundPlus Stereo Audio DAC MPEG2/AC-3 Compatible
PCM1723	24	94	Delta-Sigma 2-ch DAC	5	100	96	SSOP	2.47	SoundPlus Stereo Audio DAC with Pgrmable PLL
PCM1727	24	92	Delta-Sigma 2-ch DAC	5	125	96	SSOP	2.97	SoundPlus Stereo Audio DAC with Pgrmable Dual PLL
PCM1728	24	106	Delta-Sigma 2-ch DAC	5	160	96	SSOP	2.99	SoundPlus 24-Bit, 96kHz Sampling CMOS Delta-Sigma Stereo Audio DAC
PCM1740	24	94	Delta-Sigma 2-ch DAC	5	125	96	SSOP	2.97	SoundPlus Stereo Audio DAC with VCXO and PLL
PCM1741	24	98	Multilevel Delta-Sigma	3.3	43	96	SSOP	1.46	+3.3V Single-Supply, 24-Bit, 96kHz Sampling Enh. Multilevel, D-S Audio DAC
PCM1744	24	95	Delta-Sigma 2-ch DAC	5	65	96	SOIC	1.26	SoundPlus 24 Bits, 96kHz, Sampling Stereo Audio DAC
PCM1748	24	100	Delta-Sigma	3.3, 5	62	96	SSOP	1.46	24-Bit 96kHz Sampling Enhanced Multilevel Delta-Sigma Audio DAC
TLV320DAC23	24	100	Delta-Sigma	±5	18	96	TSSOP,VFBGA	1.91	16/20/24/32-Bit, 8 to 96 kHz Stereo DSP DAC w/Integrated Headphone Amp
DF1706	24		Digital Filter	3.3		192	SOIC	11.08	Stereo, 24-Bit, 192kHz 8X Oversampling Digital Interpolation Filter
PCM1602	24	105	Delta-Sigma	3.3 and 5	171	192	LQFP	3.08	24-Bit 192kHz Sampling 6-Ch Enhanced Multilevel Delta-Sigma DAC
PCM1604	24	105	Delta-Sigma 6-Ch DAC	3.3 and 5	266	192	LQFP	4.35	SoundPlus 24-Bit, 192kHz Sampling, 6-Channel, Enhanced Multi-Level, Delta-Sigma DAC
PCM1605	24	105	Delta-Sigma 6-Ch DAC	3.3 and 5	266	192	QFP	4.35	SoundPlus 24-Bit, 192kHz Sampling, 6-Channel, Enhanced Multi-Level, Delta-Sigma DAC
PCM1606	24	103	Delta-Sigma 6-Ch DAC	5	250	192	SSOP	2.48	6-Channel, Enhanced Multi-Level, Delta-Sigma DAC
PCM1608	24	105	Delta-Sigma	3.3 and 5	224	192	LQFP	4.10	24-Bit 192kHz Sampling 8-Ch Enhanced Multilevel Delta-Sigma DAC
PCM1730	24	117	Delta-Sigma 2-ch DAC	3.3, 5	188	192	SSOP	4.95	High Performance 24-Bit, 192 kHz Sampling Advanced Segment, Audio Stereo DAC
PCM1737	24	106	Delta-Sigma 2-ch DAC	3.3, 5	93	192	SSOP	3.50	SoundPlus 24-Bit, 192kHz Sampling Enhanced Multi-Level, Delta-Sigma, Audio DAC
PCM1738	24	117	Advanced Segment DAC	3.3, 5	188	192	SSOP	5.01	High Performance 24-Bit, 192kHz Sampling Advanced Segment, Audio Stereo DAC
PCM1739	24	106	Delta-Sigma 2-ch DAC	3.3, 5	93	192	SSOP	3.50	SoundPlus 24-Bit, 192kHz Sampling Enhanced Multi-Level, Delta-Sigma, Audio DAC
PCM1742	24	106	Multilevel Delta-Sigma	3.3, 5	62	192	SSOP	1.62	24-Bit, 96kHz Sampling Enhanced Multilevel, Delta-Sigma, Audio DAC
PCM1704	24	120	Sign-Magnitude DAC	±5	175	768	SOP	12.96	High Performance 24-Bit, 96kHz BiCMOS Sign-Magnitude DAC
DSD1702							SSOP	2.48	Enhanced Multi-Format, Delta-Sigma, Audio DAC

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

Audio Converters—Codecs

Device Name	Sorted By		Dynamic Range (typ) (dB)	Architecture	Supply Voltage(s) (V)	Bandwidth (Hz)	P _d (typ) (mW)	Sampling Rate (max) (kHz)	Package	Price*	Description
	Resolution (Bits)	Resolution (Bits)									
PCM2900	16	89	89	Stereo Codec	2.7 to 5.5	20 to 20K	280	48	SSOP	3.95	Stereo Audio Codec with USB Interface
PCM2901	16	89	89	Stereo Codec	3.3	20 to 20K	178	48	SSOP	3.95	Stereo Audio Codec with USB Interface
PCM2902	16	89	89	Stereo Codec	2.7 to 5.5	20 to 20K	280	48	SSOP	4.25	Stereo Audio Codec with USB Interface and S/PDIF
PCM2903	16	89	89	Stereo Codec	3.3	20 to 20K	178	48	SSOP	4.25	Stereo Audio Codec with USB Interface and S/PDIF
PCM3006	16	93	93	Stereo	3	20 to 20K	54	48	SSOP	3.27	16-Bit, Single-Ended Analog Input/Output Stereo Audio Codec
PCM3008	16	88	88	Stereo	2.4	20 to 20K	32	48	TSSOP	2.99	Low Power, Low Voltage 16-Bit Stereo Audio Codec
PCM3500	16	92	92	Mono	3.3	3.4K to 11K	30	26	SSOP	2.50	Low Voltage, Low Power, 16-Bit, Mono SoundPlus Voice/Modem Codec
PCM3501	16	94	94	Mono	3.3	3.4K to 11K	30	26	SSOP	2.50	Low Voltage, Low Power, 16-Bit, Mono SoundPlus Voice/Modem Codec
PCM3000	18	98	98	Stereo	5	20 to 20K	160	48	SSOP	3.27	SoundPlus Stereo Audio Codec 18-bits, Serial Interface
PCM3001	18	98	98	Stereo	5	20 to 20K	160	48	SSOP	3.27	SoundPlus Stereo Audio Codec 18-bits, Serial Interface
PCM3002	20	94	94	Stereo	3	20 to 20K	54	48	SSOP	3.27	16-/20-Bit Single-Ended Analog Input/Output SoundPlus Stereo Audio Codecs
PCM3003	20	94	94	Stereo	3	20 to 20K	54	48	SSOP	3.27	16-/20-Bit Single-Ended Analog Input/Output SoundPlus Stereo Audio Codecs
TLC320AD77	24	100	100	Stereo	3.3	20 to 20K	160	96	SSOP	3.00	Stereo Audio ADA
TLV320AIC23	24	100	100	Stereo	1.5/3.3	20 to 20K	23	96	TSSOP,VFBGA	2.85	Stereo Codec for Portable Audio

Audio Power Amplifiers

Device Name	Sorted By		THD+N @ 1 kHz (%)	PSRR (dB)	I _Q per Channel (typ) (mA)	ISD (μA)	Package	Price*	Description	
	Output Power (W)	V _{CC} /V _{DD} (min) (V)								V _{CC} /V _{DD} (max) (V)
Class AB										
TPA6100A2	0.05	1.6	3.6	0.2	72	0.8	0.05	MSOP,SOIC	0.65	50-mW Ultra-Low Voltage Audio Power Amp
TPA6101A2	0.05	1.6	3.6	0.4	72	0.32	0.05	MSOP,SOIC	0.65	50-mW Ultra-Low Voltage Audio Power Amp
TPA6102A2	0.05	1.6	3.6	0.4	72	0.32	0.05	MSOP,SOIC	0.65	50-mW Ultra-Low Voltage Audio Power Amp
TPA152	0.075	4.5	5.5	0.02	81	2.8		SOIC	0.74	Single-Ended Audio Power Amp
TPA102	0.15	2.5	5.5	0.05	76	0.75	60	MSOP	0.80	Stereo headphone driver
TPA112	0.15	2.5	5.5	0.05	76	0.75		MSOP,SOIC	0.63	Stereo headphone driver
TPA122	0.15	2.5	5.5	0.05	76	0.75	60	MSOP,SOIC	0.70	Stereo headphone driver
TPA302	0.3	2.7	5.5	0.08	65	2	0.6	SOIC	0.97	Single-Ended Single-Supply Audio Amp
TPA301	0.35	2.5	5.5	0.3	78	0.7	0.15	MSOP,SOIC	0.43	Bridge-Tied-Load Single-Supply Audio Amp
TPA311	0.35	2.5	5.5	0.3	78	0.7	7	MSOP,SOIC	0.43	Bridge-Tied-Load and Single-Ended with Depop Single-Supply Amp
TPA321	0.35	2.5	5.5	0.3	78	0.7	0.15	MSOP,SOIC	0.43	350-mW Low-Voltage Audio Power Amp with differential inputs
TPA701	0.7	2.5	5.5	0.2	85	1.25	0.0015	MSOP,SOIC	0.48	700-mW Low-Voltage Audio Power Amp
TPA711	0.7	2.5	5.5	0.2	85	1.25	7	MSOP,SOIC	0.48	700-mW Low-Voltage Audio Power Amp
TPA721	0.7	2.5	5.5	0.2	85	1.25	7	MSOP,SOIC	0.48	700-mW Low-Voltage Audio Power Amp

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

Audio Power Amplifiers (Continued)

Device Name	Sorted By	V _{CC} /V _{DD}		THD+N @ 1 kHz (%)	PSRR (dB)	I _Q per Channel		Package	Price*	Description
	Output Power (W)	(min) (V)	(max) (V)			(typ) (mA)	ISD (μA)			
Class AB (Continued)										
TPA731	0.7	2.5	5.5	0.2	78	1.25	0.0015	MSOP,SOIC	0.48	700-mW Low-Voltage Audio Power Amp with Differential Inputs
TPA741	0.7	2.5	5.5	0.2	85	1.35	7	MSOP,SOIC	0.48	700-mW Low-Voltage Audio Power Amp with Differential Inputs
TPA0253	1	2.5	5.5	0.2	75	2.7	1	MSOP	1.45	1-W Mono Audio Power Amp with Headphone Drive
TPA4860	1	2.7	5.5	0.3	75	3.5	0.6	SOIC	1.31	Bridge-Tied-Load Single-Supply Amp
TPA4861	1	2.7	5.5	0.3	75	3.5	0.6	SOIC	1.31	Bridge-Tied-Load Single-Supply Amp
TPA6203A1	1.25	2.5	5.5	0.06	87	1.7	0.01	VFPGA	0.72	1.25-W Mono Fully-Differential Audio Power Amp
TPA0102	1.5	3	5.5	0.05	75	10	5	HTSSOP	1.91	Bridge-Tied-Load and Single-Ended, Single-Supply Amp
TPA0103	1.75	3	5.5	0.05	75	10	5	HTSSOP	1.91	Bridge-Tied-Load and Single-Ended with Center Channel Single-Supply Amp
TPA0112	2	4.5	5.5	0.75	77	3	150	HTSSOP	1.51	Stereo 2W APA
TPA0122	2	4.5	5.5	0.5	77	9	150	HTSSOP	1.51	2W Stereo APA
TPA0132	2	4.5	5.5	0.4	67	5	150	HTSSOP	2.50	2W Stereo APA with DC Volume Control
TPA0142	2	4.5	5.5	0.22	67	10	150	HTSSOP	2.50	2W Stereo APA
TPA0152	2	4.5	5.5	0.3	67	4.5	150	HTSSOP	2.50	Stereo Audio Power Amp
TPA0162	2	4.5	5.5	0.22	67	10	150	HTSSOP	2.50	2W Stereo APA
TPA0172	2	4.5	5.5	0.2	75	4	15	HTSSOP	2.81	Audio Power Amp
TPA0202	2	3	5.5	0.05	75	9.5	5	HTSSOP	2.08	Bridge-Tied-Load and Single-Ended with Depop Single-Supply Amp
TPA0211	2	2.5	5.5	0.2	75	4	1	MSOP	0.70	2-W Mono Audio Power Amp
TPA0212	2	4.5	5.5	0.75	77	3	150	HTSSOP	1.51	Audio Power Amp
TPA0213	2	2.5	5.5	0.2	75	3.6	1	MSOP	1.58	2-W Mono Audio Power Amp with Headphone Drive
TPA0222	2	4.5	5.5	0.5	77	9	150	HTSSOP	1.51	Audio Power Amp
TPA0223	2	2.5	5.5	0.2	75	10	1	MSOP	1.58	2-W Mono Audio Power Amp with Headphone Drive
TPA0232	2	4.5	5.5	0.4	67	5	150	HTSSOP	2.50	Audio Power Amp
TPA0233	2	2.5	5.5	0.2	75	3.3	1	MSOP	1.58	2-W Mono Audio Power Amp with Headphone Drive
TPA0242	2	4.5	5.5	0.22	67	10	150	HTSSOP	2.50	Audio Power Amp
TPA0243	2	2.5	5.5	0.2	75	9	1	MSOP	1.58	2-W Mono Audio Power Amp with Headphone Drive
TPA0252	2	4.5	5.5	0.3	67	4.5	150	HTSSOP	2.50	Stereo 2-W Audio Power Amp with Digital Volume Control and Memory
TPA6010A4	2	4.5	5.5	0.5	67	6	60	HTSSOP	2.81	2-W Stereo Audio Power Amp
TPA6011A4	2	4	5.5	0.2	70	7.5	1	HTSSOP	2.20	2-W Stereo Audio Power Amp with Advanced DC Volume Control
TPA6017A2	2	4.5	5.5	0.75	77	3	150	HTSSOP	1.24	2-W Stereo Audio Power Amp with Four Selectable Gain Settings
TPA1517	6	9.5	18	10	65	22.5	7	PDIP,SOIC	1.00	Single-Ended Single-Supply Audio Amp
Class D										
TPA2001D1	1	2.7	5.5	0.4	72	4	0.05	TSSOP	0.78	1-W Filterless Mono Class-D Audio Power Amp
TPA2001D2	1	4.5	5.5	0.5	77	4	1	HTSSOP	1.72	1-W Stereo Class-D Audio Power Amp
TPA005D12	2	4.5	5.5	0.2	40	12.5	0.2	HTSSOP	4.56	Class D Stereo Audio Power Amp
TPA005D14	2	4.5	5.5	0.2	40	12.5	0.2	HTSSOP	5.06	Class D Stereo Audio Power Amp

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■ Audio Power Amplifiers (Continued)

Device Name	Output Power (W)	V _{CC} /V _{DD}		THD+N @ 1 kHz (%)	PSRR (dB)	I _Q per Channel (typ) (mA)	ISD (μA)	Package	Price*	Description
		(min) (V)	(max) (V)							
Class D (Continued)										
TPA2000D1	2	2.7	5.5	0.04	77	4	0.05	TSSOP	1.15	2-W Mono Filterless Class-D Audio Power Amp
TPA2000D2	2	4.5	5.5	0.5	77	4	1	HTSSOP,TSSOP	1.91	2-W Stereo Audio Power Amp
TPA2000D4	2	3.7	5.5	0.3	70	4.5	0.05	HTSSOP	2.08	Filterless 2-W Class-D Audio Power Amp with Stereo Headphone Drive
TPA032D01	10	8	14	0.5	40	35	20	HTSSOP	4.53	Class-D Audio Power Amp
TPA032D02	10	8	14	0.5	40	12.5	20	HTSSOP	5.22	Class D Stereo Audio Power Amp
TPA032D03	10	8	14	0.5	40	12.5	20	HTSSOP	4.96	Class-D Audio Power Amp
TPA032D04	10	8	14	0.5	40	12.5	20	HTSSOP	5.45	Class D Stereo Audio Power Amp

■ USB Streaming Audio

Device Name	DMA Channels	Number of Audio Channels (max)	Supply Voltage(s) (V)	Application Code Space (kB)	Buffer Size (kB)	Package	Price*	Description
PCM2702			3.3 and 5			SSOP	5.52	16-Bit Stereo DAC with USB Interface
PCM2900			2.7 to 5.5			SSOP	3.95	Bus-Powered USB Codec
PCM2901			3.3			SSOP	3.95	Self-Powered USB Codec
PCM2902			2.7 to 5.5			SSOP	4.25	Bus-Powered USB Codec w/SPDIF
PCM2903			3.3			SSOP	9.25	Self-Powered USB Codec w/SPDIF
TAS1020A	2	4	3.3	6	1.4	TQFP	3.04	Stereo USB Audio Interface
TUSB3200	4	8	3.3	8	2	TQFP	4.21	USB Streaming Controller (STC)
TUSB3200A	4	8	3.3, 5	8	2	TQFP	4.21	USB Streaming Controller

■ Audio Clocks

Device Name	Supply Voltage(s) (V)	Package	Price*	Description
PLL1700	3.3 or 5	SSOP	1.98	Multi-Clock Generator

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

■ Audio Op Amps

Device Name	No. of Channels	V_S		I_Q per Channel (max) (mA)	GBW (typ) (MHz)	Slew Rate (typ) (V/ μ s)	V_{IO} (25°C) (max) (mV)	Offset Drift (typ) (μ V/°C)	IIB (max) (pA)	CMRR (min) (dB)	V_n at 1 kHz (typ) (nV/ \sqrt{Hz})	Package	Price*	Description
		(min) (V)	(max) (V)											
General Purpose														
OPA134	1	4.5	36	5	8	20	2	2	100	86	8	PDIP,SOIC	0.88	Audio, Wide Bandwidth, FET Input
Low Bias Current														
OPA604	1	9	48	6	20	25	5	8	50	80	11	PDIP,SOIC	0.92	Audio, FET Input
OPA627	1	9	36	7.5	16	55	0.1	0.4	1	106	5.2	PDIP,SOIC,TO/SOT	9.63	Ultra-Low THD+N, Wide Bandwidth, Precision
OPA637	1	9	36	7.5	80	135	0.1	0.4	1	106	5.2	PDIP,SOIC,TO/SOT	9.63	Decompensated OPA627, $G \geq 5$
Low Noise														
OPA227	1	5	36	3.8	8	2.3	0.075	0.1	10000	120	3	PDIP,SOIC	1.01	Precision, Ultra-Low Noise
OPA228	1	5	36	3.8	33	10	0.075	0.1	10000	120	3	PDIP,SOIC	1.01	Precision, Ultra-Low Noise, $G \geq 5$
OPA2134	2	5	36	5	8	20	2	2	100	86	8	PDIP,SOIC	1.11	Audio, Wide Bandwidth, FET Input
OPA2227	2	5	36	3.8	8	2	0.025	0.1	40000	114	3	PDIP,SOIC	1.72	Precision, Ultra-Low Noise
OPA2228	2	5	36	3.8	33	10	0.075	0.1	10000	120	3	PDIP,SOIC	1.72	Precision, Ultra-Low Noise, $G \geq 5$
OPA2604	2	9	48	6	20	25	5	8	100	80	10	PDIP,SOIC	1.66	Audio, FET Input
OPA4134	4	5	36	5	8	20	2	2	100	86	8	SOIC	1.72	Audio, Wide Bandwidth, FET Input
OPA4227	4	5	36	3.8	8	2	0.05	0.3	40000	114	3	PDIP,SOIC	3.84	High Precision, Ultra-Low Noise
OPA4228	4	5	36	3.8	33	10	0.075	0.1	10000	120	3	PDIP,SOIC	3.84	Ultra-low Noise, Precision, $G \geq 5$

■ Analog Line Drivers and Receivers

Device Name	Gain (V/V)	Common-Mode Input Range (min) (V)	Input Offset (max) (μ V)	Input Offset Drift (max) (μ V/°C)	CMRR (min) (dB)	Small-Signal Bandwidth (typ) (MHz)	Slew Rate (typ) (V/ μ s)	Quiescent Current (typ) (mA)	V_S		Package	Price*	Description
									(min) (V)	(max) (V)			
DRV134	2	15	10000	10	46	1.5	12	5.2	9	36	PDIP,SOIC	1.82	Audio Balanced Line Drivers
DRV135	2	15	10000	10	46	1.5	12	5.2	9	36	SOIC	1.82	Audio Balanced Line Drivers
INA134	1	25	1000	2	74	3.1	14	2.4	8	36	PDIP,SOIC	1.00	Audio Differential Line Receivers, 0dB ($G=1$)
INA137	0.5,2	25	1000	2	74	4	14	2.4	8	36	PDIP,SOIC	1.00	Audio Differential Line Receivers, ± 6 dB ($G=1/2$ or 2)
INA2134	1	25	1000	2	74	3.1	14	2.4	8	36	PDIP,SOIC	1.82	Audio Differential Line Receivers, 0dB ($G=1$)
INA2137	0.5,2	25	1000	2	74	4	14	2.4	8	36	PDIP,SOIC	1.82	Audio Differential Line Receivers, ± 6 dB ($G=1/2$ or 2)

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

Digital Audio Interface—Receivers

Device Name	Jitter (ps)	Sampling Rate (max) (kHz)	Supply Voltage(s) (V)	Package	Price*	Description
DIR1701	80	96	3.3	SSOP,XCEPT	2.48	Digital Audio Interface Receiver
DIR1703	75	96	3.3	SSOP	2.99	Digital Audio Interface Receiver

Digital Audio Interface—Transmitters

Device Name	Sampling Rate (max) (kHz)	Power Supply (V)	Package	Price*	Description
DIT4096	96	5	TSSOP	2.45	96 kHz Digital Audio Transmitter
DIT4192	192	5	TSSOP	2.95	192 kHz Digital Audio Transmitter

Digital Audio Power Amplifiers

Device Name	F _s		Dynamic Range (dB)	Power (WRMS at 4 ohms)	THD+N (System Performance) (%)	Efficiency (%)	Bits	Package	Price*	Description
	(min) (kHz)	(max) (kHz)								
TAS5000	44.1	96	93		<0.08		16, 20, 24	TQFP	3.42	Digital Audio PWM Processor
TAS5001	44.1	96	96		< 0.08		16, 20, 24	TQFP	2.26	Digital Audio PWM Processor
TAS5010	44.1	192	96		<0.08		16, 20, 24	TQFP	2.83	Digital Audio PWM Processor
TAS5012	44.1	192	102		<0.06		16, 20, 24	TQFP	5.26	Digital Audio PWM Processor
TAS5015	44.1	192	112		<0.01		16, 20, 24	TQFP	25.01	Digital Audio PWM Processor
TAS5100A	32	192		30	<0.08	>90		HTSSOP	3.15	30-W Digital Amp Power Stage

Digital Filtering Processors

Device Name	F _s (kHz)	Processing		I/O Resolution	Codec (dB)	IIR Filters per Channel	Vol, Bass, Treble	Compression	Loudness	Package	Price*	Description
		MIPS	Bits									
TAS3001	32 to 96	80	32	16 to 20		6	Yes	Yes	No	TSSOP	1.70	Stereo Audio Digital Equalizer
TAS3002	32 to 48	100	32	16 to 24	100	7	Yes	Yes	Yes	TQFP	3.36	Digital Audio Processor with Codec
TAS3004	32 to 48	100	32	16 to 24	100	7	Yes	Yes	Yes	TQFP	3.56	Digital Audio Processor with Codec

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

Microphone Preamps

Device Name	Input Type	Gain (V/V)	Non-Linearity (\pm)	Input Offset (\pm)	Input Offset Drift (\pm)	CMRR	Input Bias Current (\pm)	Noise at 1 kHz	Settling Time to 0.01%	Quiescent Current (\pm)	V_s		Package	Price*	Description
			(max) (%)	(max) (μ V)	(typ) (μ V/ $^{\circ}$ C)	(min) (dB)	(max) (nA)	(typ) (nV/ \sqrt Hz)	(typ) (μ s)	(typ) (mA)	(min) (V)	(max) (V)			
INA103	Bipolar	1 to 1000	0.004	100+5000/G	1+20/G	100	8000	1	3.5	9	18	50	PDIP,SOIC	4.65	Low Noise, Low Distortion Instrumentation Amp
INA163	Bipolar	1 to 10000	0.0006	250+5000/G	1+20/G	100	12000	1	3.5	10	8	36	SOIC	2.35	Low-Noise, Low-Distortion Instrumentation Amp

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

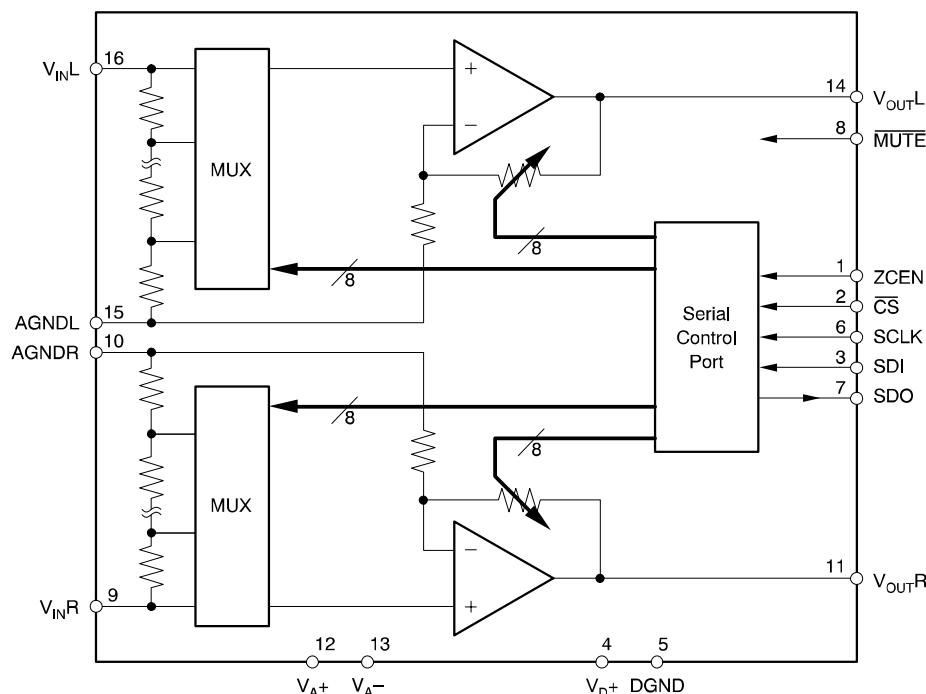
Audio Volume Controls

PGA2311 (Stereo Audio Volume Control)—Product Highlights

Features

- Digitally-Controlled Analog Volume Control:
 - Two Independent Audio Channels
 - Serial Control Interface
 - Zero Crossing Detection
 - Mute Function
- Wide Gain and Attenuation Range:
 - +31.5 dB to -95.5 dB with 0.5-dB Steps
- Low Noise and Distortion:
 - 120-dB Dynamic Range
 - 0.0004% THD+N at 1 kHz (U-Grade)
 - 0.0002% THD+N at 1 kHz (A-Grade)
- Noise-Free Level Transitions
- Low Interchannel Crosstalk: -130 dBFS
- Power Supplies: \pm 5 V Analog, +5 V Digital
- Available in DIP-16 and SOL-16 Packages
- Pin and Software Compatible with the Crystal CS3310

PGA2311 Block Diagram



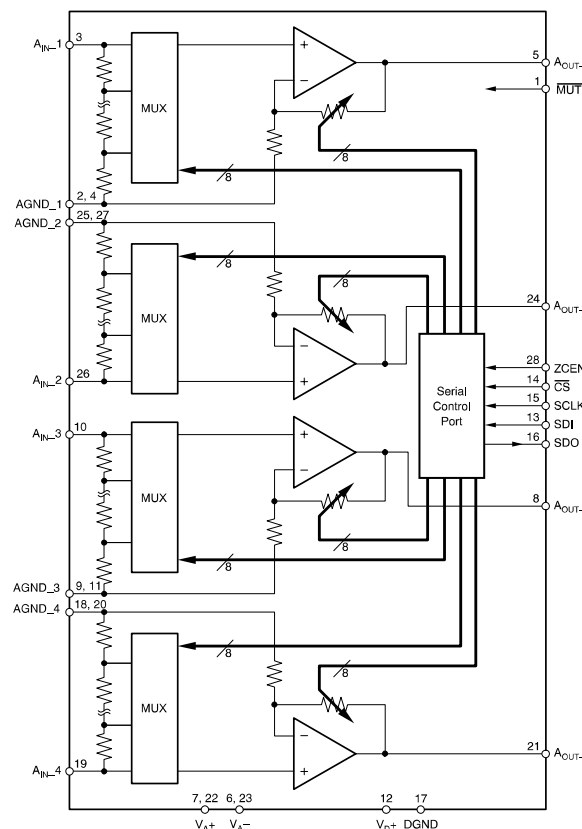
■ Audio Volume Controls (Continued)

PGA4311 (4-Channel Audio Volume Control)—Product Highlights

Features

- Digitally-Controlled Analog Volume Control:
 - Four Independent Audio Channels
 - Serial Control Interface
 - Zero Crossing Detection
 - Mute Function
- Wide Gain and Attenuation Range:
 - +31.5 dB to -95.5 dB with 0.5-dB Steps
- Low Noise and Distortion:
 - 120-dB Dynamic Range
 - 0.0004% THD+N at 1 kHz (U-Grade)
 - 0.0002% THD+N at 1 kHz (A-Grade)
- Noise-Free Level Transitions
- Low Interchannel Crosstalk: -130 dBFS
- Power Supplies: ±5 V Analog, +5 V Digital
- Available in an SOP-28 Package

PGA4311 Block Diagram



Device Name	Gain and Attenuation (dB)	Dynamic Range (dB)	THD+N @ 1 kHz (%)	Interchannel Crosstalk @ 1 kHz (dBFS)	Power Supply (V)	Voltage Swing (V _{pp})	Package	Price*	Description
PGA2310	+31.5 to -95.5 with 0.5-dB steps	120	0.0004	-126	±15	27	PDIP, SOIC	7.95	±15V Stereo Audio Volume Control
PGA2311	+31.5 to -95.5 with 0.5-dB steps	120	0.0002	-130	±5	7.5	PDIP, SOIC	4.95	±5V Stereo Audio Volume Control
PGA4311	+31.5 to -95.5 with 0.5-dB steps	120	0.0002	-130	±5	7.5	SOIC	8.95	4-Channel, ±5V Audio Volume Control

*Budgetary price per unit in U.S. dollars, lots of 1,000+

Preview devices announced but not yet in production appear in **BOLD**.

To order any of the following literature by telephone, please contact the Product Information Center nearest you. A complete listing of TI's Product Information Centers can be found on the last page of this guide.

For online access to a list of TI's Product Information Centers and distributors in your area, as well as links directing you to information on Evaluation Modules and Design Tools, go to: www.ti.com/sc/docs/msp/tools/tools.htm

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Literature

Audio A to D Converters

A Low Noise, Low Distortion Design For Antialiasing And Anti-Imaging Filters.	SBAA001
Control Port And Reset Operation SoundPlus Audio Converters and CODECs	SBAA032
DEM-DAI1802 EVM, PCM1802 w/Digital Audio Transmitter	SLEU017
DEM-DAI1804 PCM1804 Evaluation Board	SLEU015
Dyamic Performance Testing of Digital Audio D/A Converters	SBAA055
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Interfacing TLC320AD57 Sigma-Delta Stereo ADC (in Master Mode) w/ TMS320C5x™ DSP	SPRA090
Low Sampling Rate Operation SoundPlus Audio Data Converters and CODECs	SBAA033
Noise Sources In Applications Using Capacitive Coupled Isolated Amplifier	SBOA028
TLC320AD57C Sigma-Delta Stereo Analog-to-Digital Converter	SLAA010
TLC320AD58C Sigma-Delta Stereo Analog-to-Digital Converter	SLAA015

Audio D to A Converters

A Low Noise, Low Distortion Design For Antialiasing And Anti-Imaging Filters.	SBAA001
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DEM-DAI1608 PCM1608 Evaluation Board	SLEU013
DEM-DAI1704/06 Demo Board User's Guide	SLAU068
DEM-DAI1738 Instruction Manual	SLAU069
Dyamic Performance Testing of Digital Audio D/A Converters	SBAA055
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Output Spectrum and Post-LPF Design of the PCM1710	SBAA054
THDPLUSN Versus Frequency Characteristics and Spectra of the PCM1717/18/19/20/23/27	SBAA020

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TLV320AIC23 EVM2 Evaluation Platform for the TLV320AIC23 Stereo Audio CODEC	SLEU016
TLV320AIC23EVM User's Guide	SLEU003

Audio Codecs

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DEM-DAI3008 PCM3008 Evaluation Board	SLEU006
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TLV320AIC23 EVM2 Evaluation Platform for the TLV320AIC23 Stereo Audio CODEC	SLEU016

Audio Power Amplifiers

A Low-Cost, Single Coupling Capacitor Config. for Stereo Headphone Amplifiers	SLOA043
Audio Power Amplifier Solutions for New Wireless Phones.	SLOA053
PowerPAD™ Thermally Enhanced Package Application Report	SLMA002

USB Streaming Audio

DAREF107 TAS1020A Low-Cost Headset Reference Design Board.	SLEU005
DSREF100R0 Low-Cost USB Headset Board Reference Design.	SLAU064
Dyamic Performance Testing of Digital Audio D/A Converters I ² C and the TAS3001C	SLEA001
TLC320AD77C Clock and Timing Issues	SLEA002
TUSB3200 EVM Development Platform for the USB3200 Universal Serial Bus Streaming	SLAU059
TUSB3200 USB with EQ 2-Channel Reference Design	SLAU063

Audio Op Amps

Appendix A - Single-Supply Circuit Collection	SLOA091
BURR-BROWN™ SPICE Based Macromodels	SBFA009
Chapter 1 - The Op Amp's Place in the World	SLOA073
Chapter 2 - Review of Circuit Theory	SLOA074
Chapter 3 - Development of Ideal Op Amp Equations	SLOA075
Chapter 4 - Single-Supply Op Amp Design Techniques	SLOA076
Chapter 5 - Feedback and Stability Theory	SLOA077
Chapter 6 - Development of the Non-Ideal Op Amp Equations.	SLOA078
Chapter 7 - Voltage - Feedback Op Amp Compensation	SLOA079
Chapter 8 - Current - Feedback Op Amp Analysis	SLOA080
Chapter 9 - Voltage and Current-Feedback Op Amp Comparison.	SLOA081
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Chapter 17 - Circuit Board Layout Techniques	SLOA089
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Clamping Amplifier Tracks Power Supplies	SBOA078
Comparison of Noise Performance of FET Transimpedance Amp/Switched Integrator	SBOA034
Compensate Transimpedance Amplifiers Intuitively	SBOA055
Complete Audio Amplifier with Volume, Balance, and Treble Controls	SBOA082
Composite Op Amp Gives You The Best of Both Worlds	SBOA002
Double The Output Current To A Load With The Dual OPA2604 Audio Op Amp	SBOA031
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Digital Audio Receivers	
DEM-DIR1701 Demo Board User's Guide	SLAU070

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EMI Performance for Thunderbird TAS5100EVM Board	SLEU012
System Design Considerations for True Digital Audio Power Amplifiers	SLAA117A
TAS5100EVM Data Report User's Guide	SLEU011A
TAS5100EVM User's Guide	SLEU009A
Thunderbird TAS5100EVM Design Document	SLEU010A
Digital Filtering Processors	
DA-REF105 TAS3002/TAS3004 Reference Design Board	SLEU004
TAS3001 EVM Application Note	SLAU060
TUSB3200 USB with EQ 2-Channel Reference Design	SLAU063
Microphone Preamps	
AC Coupling Instrumentation and Difference Amplifiers	SBOA003
BURR-BROWN SPICE Based Macromodels	SBFA009
Audio Volume Controls	
BURR-BROWN SPICE Based Macromodels	SBFA009
PGA2310-EVM: Evaluation Module User's Manual	SBOU012

Evaluation Modules and Development Tools

To ease and speed the design process, TI offers evaluation modules (EVMs) for many analog and mixed-signal products.

EVMs contain a fully-assembled evaluation board, data sheet and user's guide. Some modules may include applications notes, software, cables and connectors.

To determine whether a product has an EVM, simply access the "product folder" for the part in question at <http://analog.ti.com> by entering the part number of the product in the "Search TI" field. The "product folder" will appear in the search results. Next, click on the "product folder" then click on "Development Tools" (upper right-hand section of the page) to determine EVM availability.

To place an order for an EVM or if you do not have Internet access, contact TI's Product Information Center (PIC) at 1-800-477-8924, ext. 5800 in North America, or go to: <http://support.ti.com> to locate the Product Information Center nearest you. EVMs may also be ordered through your local TI distributor. See <http://focus.ti.com/docs/general/distributor.jhtml> for distributor listings.

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