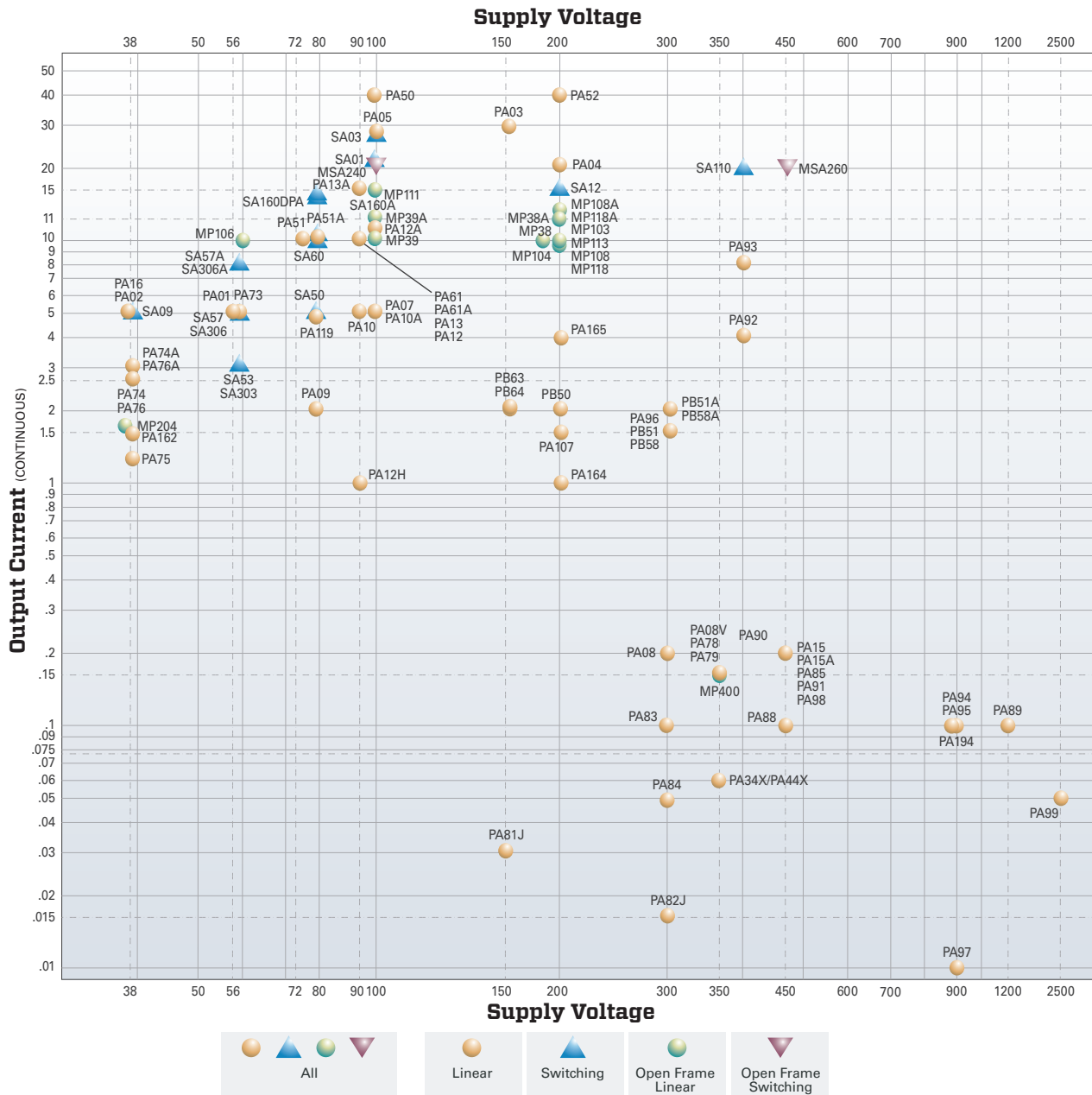


Product Summary Guide

APEX[®]
MICROTECHNOLOGY
PRECISION • POWER • ANALOG

Precision Power Analog

It's an exciting future for precision power analog! Apex Microtechnology is an industry leader for high-performance power operational amplifiers, pulse width modulation (PWM) amplifiers, and precision voltage references (VRE). Product form factors include monolithic ICs, board-level "open frame" modules, and traditional hybrid designs that can deliver up to 40A of continuous output current and voltage supply operation ranging from 5V to 2500V. Target applications focus on the high power precision control of current, voltage and speed for the industrial, test and measurement, aerospace, defense, and medical markets.



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HIGH CURRENT OPERATIONAL AMPLIFIERS

Model	Output Current CONTINUOUS (A)	Supply Voltage MAX (V)	Slew Rate TYP (V/ μ s)	Standby Current MAX (mA)	Power Dissipation MAX (W)	Package
PA50	40	100	50	36	400	12-pin MO-127 (CR)
PA52	40	200	50	36	400	12-pin MO-127 (CR)
PA03	30	150	8	300	500	12-pin MO-127 (CU)
PA05	30	100	100	120	250	12-pin MO-127 (CR)
PA04	20	200	50	90	200	12-pin MO-127 (CR)
MP111FD	15	100	130	157	170	34-pin Open Frame (FD)
PA13A	15	90	4	50	135	12-pin PowerSIP (DP)
MP38CLA	11	200	10	26	125	30-pin Open Frame (CL)
MP108FDA	11	200	170	65	100	34-pin Open Frame (FD)
MP118FDA	11	200	65	27	100	34-pin Open Frame (FD)
MP39CLA	11	100	10	26	125	30-pin Open Frame (CL)
MP108FD	10	200	170	65	100	34-pin Open Frame (FD)
MP103	10 (x2 channels)	200	167	26	35 per channel	42-pin Open Frame (FC)
MP118FD	10	200	65	30	100	34-pin Open Frame (FD)
MP38CL	10	200	10	26	125	30-pin Open Frame (CL)
MP104	10	180	50	26	100	42-pin DIP (KF)
MP113	10 (x2 channels)	180	50	50	75 per channel	64-pin Open Frame (NC)
MP39CL	10	100	10	26	125	30-pin Open Frame (CL)
PA12A	10 (15 PEAK)	100	4	50	125	8-pin TO-3 (CE)
PA12 (M)	10 (15 PEAK)	90	4	50	125	8-pin TO-3 (CE)
PA13	10	90	4	50	135	12-pin PowerSIP (DP)
PA51A	10	80	2.6	10	97	8-pin TO-3 (CE)
PA51 (M)	10	72	2.6	10	97	8-pin TO-3 (CE)
PA61 (M)	10	90	2.8	10	97	8-pin TO-3 (CE)
PA93	8	400	50	14	125	12-pin PowerSIP (DP)
PA07 (M)	5	100	5	30	67	8-pin TO-3 (CE)
PA10 (M)	5	90	3	30	67	8-pin TO-3 (CE)
PA119CE	5	80	900	120	75	8-pin TO-3 (CE)
PA73 (M)	5	60	2.6	5	67	8-pin TO-3 (CE)
PA01	5	56	2.6	50	67	8-pin TO-3 (CE)
PA02 (M)	5	38	20	40	48	8-pin TO-3 (CE)
PA16	5	38	20	40	62.5	12-pin PowerSIP (DP)
PA09 (M)	4.5	80	220	85	78	8-pin TO-3 (CE)
PA92	4	400	50	14	80	12-pin PowerSIP (DP)
PA165	4 (10 PEAK)	205	36	6	30	52-pin QFP Power Quad (PQ)
MP106	4 (30 PEAK)	60	50	36	130	42-pin Open Frame (FC)
PA74A	3 (x2 channels)	40	1.4	40	36/60	8-pin TO-3 (CE)
PA76A	3 (x2 channels)	40	1.4	40	36/60	8-pin TO-3 (CE)
PA74 (M)	2.5 (x2 channels)	40	1.4	40	36/60	8-pin TO-3 (CE)
PA76	2.5 (x2 channels)	40	1.4	40	36/60	8-pin TO-3 (CE)
PB63	2 (x2 channels)	150	1000	46	90	12-pin PowerSIP (DP)
PB64	2 (x2 channels)	150	800	20	90	12-pin PowerSIP (DP)
PB58A	2	300	100	18	83	8-pin TO-3 (CE)
PB51A	2	300	100	18	83	12-pin PowerSIP (DP)
PB50	2	200	100	25	35	8-pin TO-3 (CE)
PA96	1.5	300	250	35	70	8-pin TO-3 (CE)
PB58	1.5	300	100	18	83	8-pin TO-3 (CE)
PB51	1.5	300	100	18	83	12-pin PowerSIP (DP)
PA107DP	1.5	200	3000	56	62.5	12-pin PowerSIP (DP)
MP204	1.5 x 4 (7.5 PEAK x 4)	34	15	26	20 x 4	42-pin Open Frame (KK)

(M) = Available in military grade, please refer to apexanalog.com for more information.

HIGH CURRENT OPERATIONAL AMPLIFIERS (continued)

Model	Output Current CONTINUOUS (A)	Supply Voltage MAX (V)	Slew Rate TYP (V/ μ s)	Standby Current MAX (mA)	Power Dissipation MAX (W)	Package
PA162DK	1.5 (x4 channels)	40	1.4	50	45	20-pin PSOP (DK)
PA75	1.25 (x2 channels)	40	1.4	10	28.6 both channels	7-pin TO-220 (CX) 7-pin DDPACK (CC)
PA164	1 (4 PEAK)	205	36	6	25	52-pin QFP Power Quad (PQ)
PA12H	1 (10 PEAK)	90	4	50	125	8-pin TO-3 (CE)

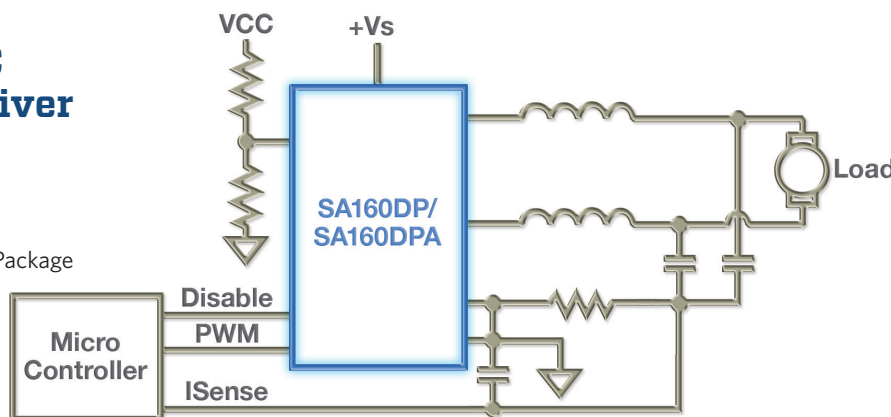
HIGH CURRENT PWM AMPLIFIERS

Model	Output Current CONTINUOUS (A)	Supply Voltage MAX (V)	Switching Frequency MAX (kHz)	Power Delivery MAX (W)	Internal Power Dissipation MAX (W)	Package
SA03	30	100	23	3000	300	12-pin MO-127(CR)
SA110	20	400	400	8000	178	12-pin PowerSIP (DP)
SA01	20	100	48.7	2000	185	10-pin PowerDIP (DE)
MSA260KC	20	450	50	9000	250	58-pin Open Frame (KC)
MSA240KC	20	100	50	2000	250	58-pin Open Frame (KC)
SA12	15	200	204	3000	250	12-pin MO-127(CR)
SA160DPA	14	80	250	1120	156	12-pin PowerSIP (DP)
SA160DP	10	80	250	800	156	12-pin PowerSIP (DP)
SA306AHR	8	60	300	480	100	44-pin HSOP (HR)
SA57AHU	8	60	300	480	100	44-pin HSOP (HU)
SA09	5	40	500	200	80	18-pin DIP (EL)
SA50CE	5	80	50	400	72	8-pin TO-3 (CE)
SA303HU	3	60	300	180	100	44-pin HSOP (HU)
SA53HU	3	60	300	180	100	44-pin HSOP (HU)

Brush DC Motor Driver

SA160DP

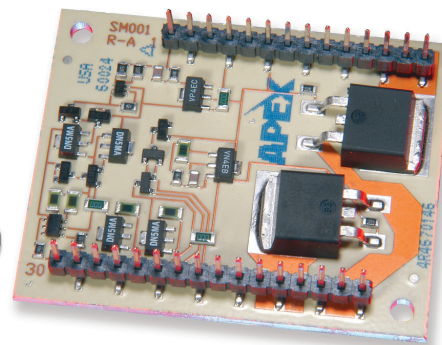
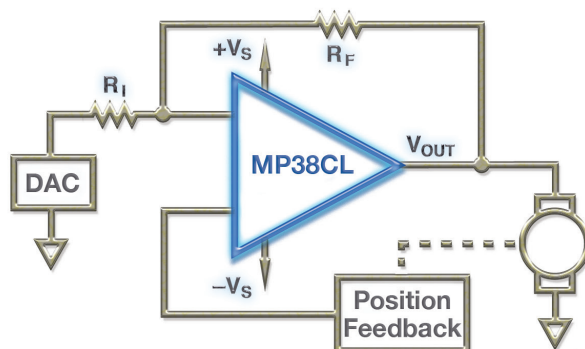
PWM Amplifier
15A PEAK, 80V
12-pin PowerSIP Package



Brush DC Motor Driver

MP38CL

Power Amplifier
10A, 200V
Open Frame CL
Package



HIGH SPEED OPERATIONAL AMPLIFIERS

Model	Slew Rate TYP (V/ μ s)	Supply Voltage MAX (V)	Output Current CONTINUOUS (A)	Standby Current MAX (mA)	Power Dissipation MAX (W)	Package
PA107DP	3000	200	1.5	56	62.5	12-pin PowerSIP (DP)
PA194	2100	900	0.10	4	30	8-pin PowerSIP (GN)
PA98	1000	450	0.20	25	30	12-pin PowerSIP (DP)
PA85 (M)	1000	450	0.20	25	30	8-pin TO-3 (CE)
PB63	1000	150	2.0 (x2 channels)	46	90	12-pin PowerSIP (DP)
PA119CE	900	80	5.0	120	75	8-pin TO-3 (CE)
PB64	800	150	2.0 (x2 channels)	20	90	12-pin PowerSIP (DP)
PA94	700	900	0.10	24	30	8-pin PowerSIP (DQ)
PA79DK	350	350	0.15 (x2 channels)	2.5	26 both channels	20-pin PSOP (DK)
PA78DK	350	350	0.15	2.5	14	20-pin PSOP (DK)
MP400FC	350	350	0.15	2.5	14.2	42-pin Open Frame (FC)
PA91	300	450	0.20	14	30	12-pin PowerSIP (DP)
PA90	300	400	0.20	14	30	12-pin PowerSIP (DP)
PA96	250	300	1.5	35	70	8-pin TO-3 (CE)
PA09 (M)	220	80	4.5	85	78	8-pin TO-3 (CE)
PA84 (M)	200	300	0.05	7.5	17.5	8-pin TO-3 (CE)
MP108FDA	170	200	11.0	65	100	34-pin Open Frame (FD)
MP108FD	170	200	10.0	65	100	34-pin Open Frame (FD)
MP103	167	200	10 (x2 channels)	26	35 per channel	42-pin Open Frame (FC)
MP111FD	130	100	15	157	170	34-pin Open Frame (FD)

HIGH VOLTAGE OPERATIONAL AMPLIFIERS

Model	Supply Voltage MAX (V)	Output Current CONTINUOUS (A)	Slew Rate TYP (V/ μ s)	Standby Current MAX (mA)	Power Dissipation MAX (W)	Package
PA99	2500	0.05	30	4	37	12-pin PowerDIP (CW)
PA89	1200	0.10	16	6	40	12-pin MO-127 (DC)
PA94	900	0.10	700	24	30	8-pin PowerSIP (DQ)
PA95	900	0.10	30	2.2	30	8-pin PowerSIP (DQ)
PA97	900	0.01	8	1	5	7-pin SIP (DR)
PA194	900	0.10	2100	4	30	8-pin PowerSIP (GN)
PA15	450	0.20	20	3	30	10-pin PowerSIP (FL/FU)
PA85 (M)	450	0.20	1000	25	30	8-pin TO-3 (CE)
PA91	450	0.20	300	14	30	12-pin PowerSIP (DP)
PA88	450	0.10	30	2	15	8-pin TO-3 (CE)
PA98	450	0.20	1000	25	30	12-pin PowerSIP (DP)
PA93	400	8	50	14	125	12-pin PowerSIP (DP)
PA92	400	4	50	14	80	12-pin PowerSIP (DP)
PA90	400	0.20	300	14	30	12-pin PowerSIP (DP)
PA340CC	350	0.06	32	2.5	14	7-pin DDDPAK (CC)
PA341CE PA341DF PA341DW PA441DF PA441DW	350	0.06	32	2.5	12 (CE) 12 (DF) 9 (DW)	8-pin TO-3 (CE) 24-pin PSOP (DF) 10-pin SIP (DW)
PA343DF/ PA443DF	350	0.06 (x2 channels)	32	2.5	12	24-pin PSOP (DF)
PA78DK	350	0.15	350	2.5	14	20-pin PSOP (DK)
PA79DK	350	0.15 (x2 channels)	350	2.5	26 both channels	20-pin PSOP (DK)
PA96	300	1.5	250	35	70	8-pin TO-3 (CE)
PB51	300	1.5	100	18	83	12-pin PowerSIP (DP)
PB58	300	1.5	100	18	83	8-pin TO-3 (CE)

(M) = Available in military grade, please refer to apexanalog.com for more information.

HIGH VOLTAGE OPERATIONAL AMPLIFIERS (continued)

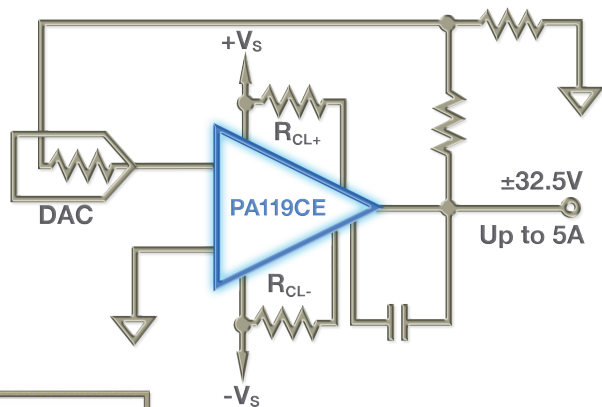
Model	Supply Voltage MAX (V)	Output Current CONTINUOUS (A)	Slew Rate TYP (V/ μ s)	Standby Current MAX (mA)	Power Dissipation MAX (W)	Package
PA08 (M)	300	0.20	30	8.5	17.5	8-pin TO-3 (CE)
PA83 (M)	300	0.10	30	8.5	17.5	8-pin TO-3 (CE)
PA84 (M)	300	0.05	200	7.5	17.5	8-pin TO-3 (CE)
PA82J	300	0.015	20	8.5	11.5	8-pin TO-3 (CE)
PA165	205	4 (10 PEAK)	36	6	30	52-pin QFP Power Quad (PQ)
PA164	205	1 (4 PEAK)	36	6	25	52-pin QFP Power Quad (PQ)
PA52	200	40	50	36	400	12-pin MO-127 (CR)
PA04	200	20	50	90	200	12-pin MO-127 (CR)
MP38CLA	200	11	10	26	125	30-pin Open Frame (CL)
MP108FD	200	10	170	65	100	34-pin Open Frame (FD)
MP118FD	200	10	65	30	100	34-pin Open Frame (FD)
MP38CL	200	10	10	26	125	30-pin Open Frame (CL)
MP103	200	10 (x2 channels)	167	26	35 per channel	42-pin Open Frame (FC)
PA107DP	200	5	3000	56	62.5	12-pin PowerSIP (DP)
PB50	200	2	100	25	35	8-pin TO-3 (CE)
MP104	180	10	50	50	100	42-pin DIP (KF)
MP113	180	10 (x2 channels)	50	50	75	64-pin Open Frame (NC)
PA03	150	30	8	300	500	12-pin MO-127 (CU)
PB63	150	2 (x2 channels)	1000	46	90	12-pin PowerSIP (DP)
PB64	150	2 (x2 channels)	800	20	90	12-pin PowerSIP (DP)
PA81J	150	0.03	20	8.5	11.5	8-pin TO-3 (CE)
PA05	100	30	100	120	250	12-pin MO-127 (CR)
MP111FD	100	15	130	157	170	34-pin Open Frame (FD)
MP39CLA	100	11	10	26	125	30-pin Open Frame (CL)
MP39CL	100	10	10	26	125	30-pin Open Frame (CL)
PA07 (M)	100	5	5	30	67	8-pin TO-3 (CE)

(M) = Available in military grade, please refer to apexanalog.com for more information.

Fast Power Driver with Current Output DAC

PA119CE

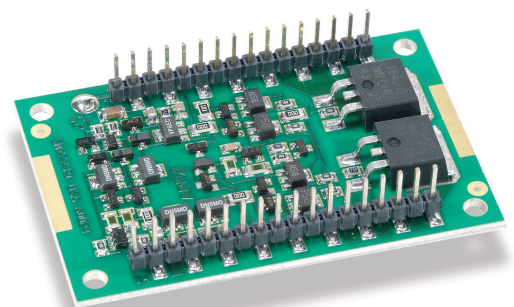
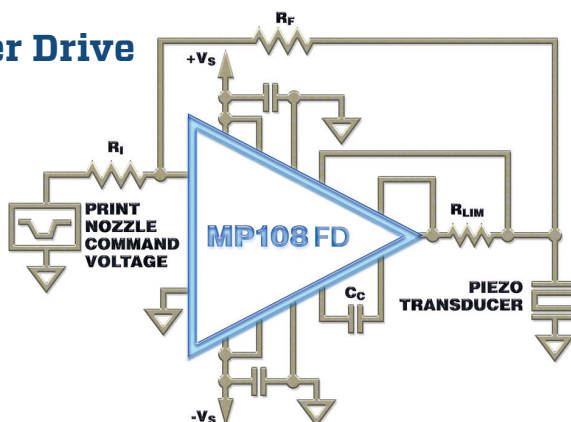
Power Amplifier
80V, 900V/ μ s
8-Pin TO-3 Package



Piezo Transducer Drive

MP108FD

Power Amplifier
200V, 170V/ μ s
Open Frame Package



HIGH VOLTAGE PWM AMPLIFIERS

Model	Supply Voltage MAX (V)	Output Current CONTINUOUS (A)	Switching Frequency MAX (kHz)	Power Delivery MAX (W)	Internal Power Dissipation MAX (W)	Package
MSA260KC	450	20	50	9000	250	58-pin Open Frame (KC)
SA110	400	20	400	8000	178	12-pin PowerSIP (DP)
SA12	200	15	204	3000	250	12-pin MO-127 (CR)
SA03	100	30	23	3000	300	12-pin MO-127 (CR)
MSA240KC	100	20	50	2000	250	58-pin Open Frame (KC)
SA01	100	20	48.7	2000	185	10-pin PowerDIP (DE)
SA160DPA	80	14	250	1120	156	12-pin PowerSIP (DP)
SA160DP	80	10	250	800	156	12-pin PowerSIP (DP)
SA50CE	80	5	50	400	72	8-pin TO-3 (CE)

PRECISION VOLTAGE REFERENCES

Model	Output (V)	Initial Error ($\pm$ mV)	TempCo (ppm/ $^{\circ}$ C)	Noise (μ Vp-p)	Package	Feature
VRE102	$\pm$ 10	1.0	1.09	6	DIP14 (HC)	Dual, High Temp Range
VRE104	4.5	0.8	1.48	3	DIP14 (HC)	Dual, High Temp Range
VRE107M	$\pm$ 5	0.9	1.33	3	DIP14 (HC)	High Rel Military, Dual, High Temp Range
VRE204M	4.5	0.8	1.48	3	LCC20 (HD)	Small Pkg, High Rel Military
VRE205	5	0.8	1.33	3	LCC20 (HD)	Small Pkg, High Rel Military
VRE210	10	0.5	1.11	6	LCC20 (HD)	Small Pkg, High Temp Range
VRE302	2.5	0.4	1.0	1.5	DIP8 (KD), SMT8 (GD)	Low Cost
VRE304	4.5	0.9	2.0	3	SMT8 (GD)	Low Cost
VRE305	5	0.5	0.6	3	DIP8 (KD), SMT8 (GD)	Low Cost
VRE306	6	0.6	0.6	4	SMT8 (GD)	Low Cost
VRE310	10	1.0	0.6	6	DIP8 (KD), SMT8 (GD)	Low Cost
VRE410	$\pm$ 10	1.6	1.0	6	SMT14 (GE)	Dual, Low Cost
VRE3025	2.5	0.25	0.6	1.5	DIP8 (KD), SMT8 (GF)	+10V Supply
VRE3050	5	0.5	0.6	3	SMT8 (GF)	+10V Supply

SINE WAVE REFERENCES

Model	Sine Wave Output (Vrms)	Initial Error ($\pm$ mV)	Temp Co (ppm/ $^{\circ}$ C)	Distortion (%THD)	Package
SWR200	7.071	0.5	20	0.1	DIP14 (HC)



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