



Defense and Aerospace Solutions Guide



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Precision Power Analog Applications

Our Value

- Broad product portfolio of fully-certified "M/883" compliant amplifier solutions
- Commercial/Industrial Grade and Non-Compliant "M" Grade products suited to COTS level circuits
- All products are "off-the-shelf" to deliver high reliability and trim design time
- Dedicated power analog applications engineering technical support to guide product selection, review schematics, and de-bug circuits
- DLA MIL-PRF-38534 Certified and ISO9001 (2008) Registration
- Certified and Qualified MIL-PRF-38534 manufacturing facility since 1990

For product selection assistance and technical support, call the Apex Microtechnology Applications Engineering Team.

800-546-2739
(toll free in the USA and Canada)

A Comprehensive Portfolio of Precision Power Analog Products for Defense and Aerospace Applications

Precision control in any type of application requires high power analog to generate movement. As a system's power level increases above 100mA, or greater than 24V, so do the complexities of designing power circuitry that is highly reliable and highly stable. The precision control of high current or high voltage also generates a complex set of electrical and thermal management issues. Apex Microtechnology mitigates these issues by offering off-the-shelf solutions that simplify these challenges.

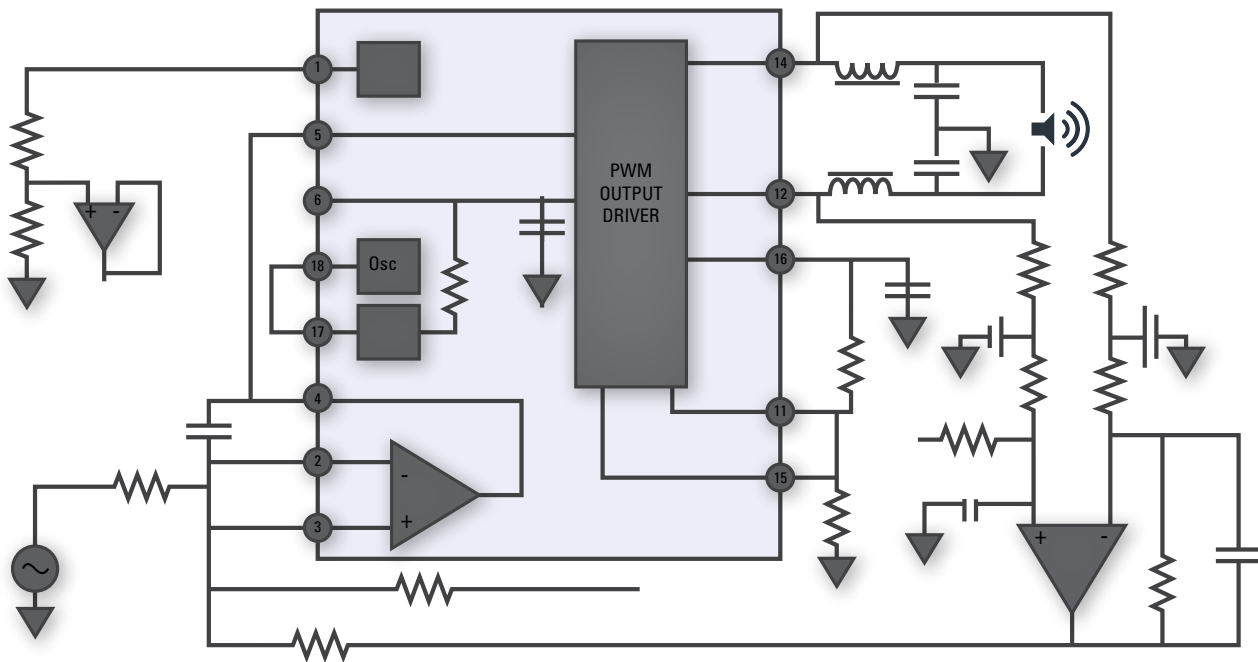
For more than 30 years, customers working in the defense and aerospace industries have relied upon Apex Microtechnology power operational amplifiers, switching (PWM) amplifiers and precision voltage references to meet the rigorous demands of their operating environments. Apex products are offered in a commercial/industrial grade, with select models also made available in either a non-compliant "M" (high reliability) or full "M/883" compliant grade.

The information provided in this brochure outlines specific defense and aerospace applications with suggested compatible products. Additional product selection assistance, design suggestions, schematic review, and circuit debugging is available by contacting the Apex Microtechnology Applications Engineering Team.

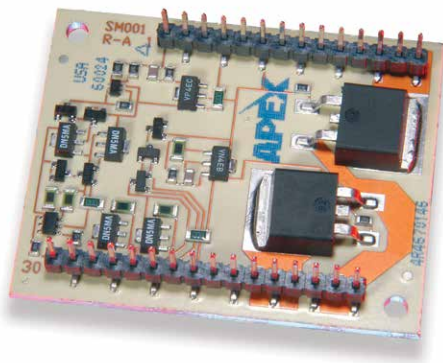
AUDIO, NOISE CANCELLATION

Application	Product Type	Product Model
Flight Control Actuators, Gimbal Positioning	Power Operational Amplifiers	MP38, MP39, MP103, MP108, MP111, MP118, PA01, PA02*, PA03, PA04, PA05, PA07*, PA09*, PA10*, PA12*, PA13, PA16, PA50, PA51*, PA52, PA61*, PA73*, PA74*, PA75, PA76, PA92, PA93, PA96, PA107, PA162, PA119
	PWM Amplifiers	SA01, SA03, SA09, SA12, SA53, SA57, SA160, SA303, SA306, MSA240, MSA260
	Power Boosters	PB50, PB51, PB58
Guidance and Systems Calibration	Precision Voltage References	VRE102*, VRE204*, VRE205, VRE210*

* Available in a non-compliant "M" or fully-certified M/883 product grade



Aircraft Audio Amplifier



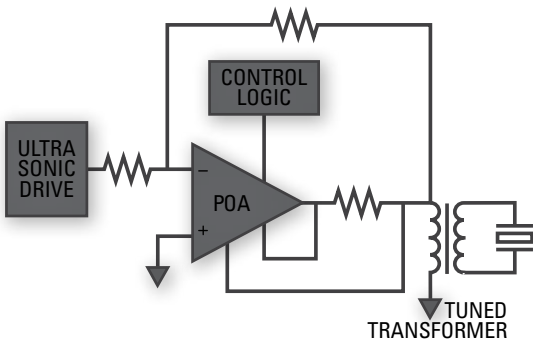
Reducing the size and weight of aircraft electrical systems is of paramount importance. Even the slightest reduction in the number of system components can provide a benefit. System reliability is also a critical factor to avoid costly down time. Because of their reputation for high reliability, Apex products are designed into aircraft audio and noise cancellation systems, as well as for the high level of integration they provide inside a single, space-saving package. These off-the-shelf solutions can be the best choice to reduce a system's overall component count and simplify heat sinking requirements.

PIEZO TRANSDUCERS, DEFLECTION



Application	Product Type	Product Model
Sonar	Power Operational Amplifiers	MP38, MP39, MP103, MP108, MP111, MP118, MP400, PA02*, PA03, PA04, PA05, PA07*, PA08*, PA09*, PA10*, PA12*, PA15, PA73*, PA78, PA79, PA81, PA82, PA83*, PA84*, PA85*, PA88, PA89, PA90, PA91, PA92, PA93, PA94, PA95, PA96, PA97, PA98, PA107, PA119, PA441, PA443
	Power Boosters	PB50, PB51, PB58, PB63

* Available in a non-compliant "M" or fully-certified M/883 product grade



Sonar Transducer Driver

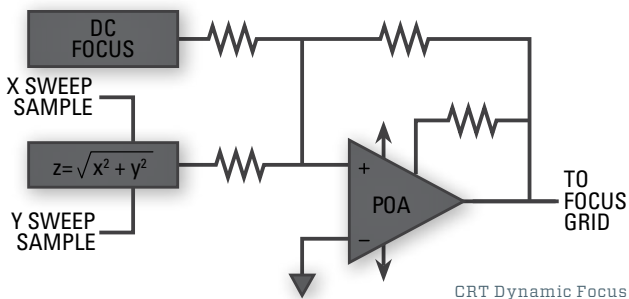
Apex operational power amplifiers are designed into a wide range of piezo and deflection applications for their exceptional linearity, high slew rates, high voltage output, fast settling times, low crossover distortion and low internal losses. Typical applications include sonar transducer drivers and mirror positioning which require random beam positioning. For high current applications, Apex power boosters are selected for their slew rates and power bandwidth.

HIGH VOLTAGE DRIVERS



Application	Product Type	Product Model
Heads-Up Displays	Power Operational Amplifiers	MP38, MP39, MP103, MP108, MP111, MP118, PA03, PA04, PA05, PA07*, PA08*, PA15, PA78, PA79, PA81, PA82, PA83*, PA84*, PA85*, PA88, PA89, PA90, PA91, PA92, PA93, PA94, PA95, PA97, PA98, PA107, PA441, PA443
	Power Boosters	PB50, PB51, PB58

* Available in a non-compliant "M" or fully-certified M/883 product grade



CRT Dynamic Focus

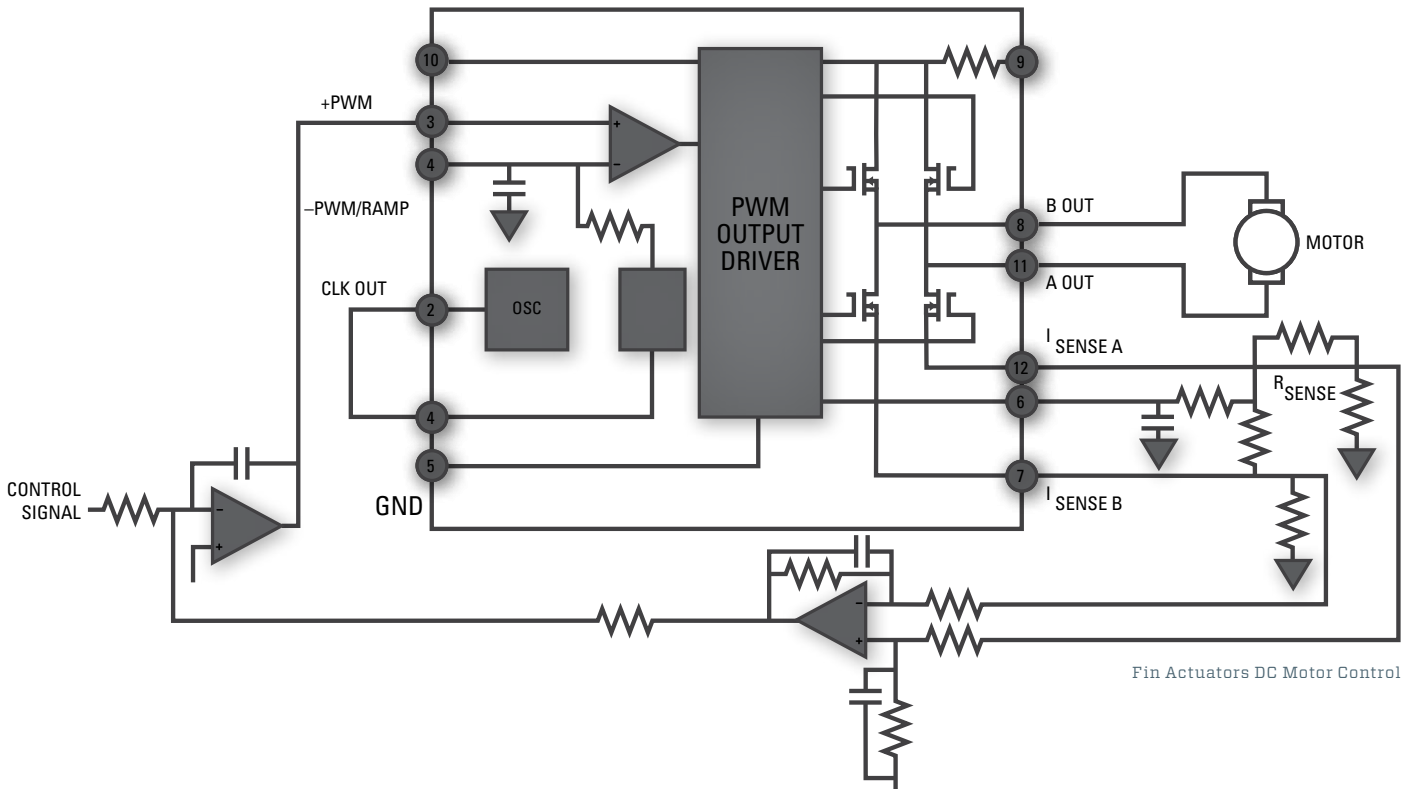
By offering multiple combinations of high speed and high voltage power amplifiers, Apex can drive the rapid correction of focus in high resolution displays. Dynamic focusing is the active correction of focusing voltage as a beam moves from the center to the edges of a CRT. Power operational amplifiers lend themselves well to this application with their ability to be connected as a summing amplifier with inputs from the nominal focus potential and the dynamic correction.

MOTOR DRIVERS



Application	Product Type	Product Model
Flight Control Actuators, Gimbal Positioning	Power Operational Amplifiers	PA02*, PA04, PA05, PA07*, PA10*, PA12*, PA73*, PA74*, PA75, PA76, MP38, MP39
	PWM Amplifiers	SA03, SA53, SA57, SA160, SA303, SA306, MSA240, MSA260

* Available in a non-compliant "M" or fully-certified M/883 product grade



Fin Actuators DC Motor Control

Motor drive applications represent the most common application within the defense and aerospace industries. Apex high current operational and PWM amplifiers are popular choices for motor control applications because of their high reliability and their ability to perform as promised. Choosing between a power op amp or a switching (PWM) amplifier typically comes down to the power requirements of the application circuit. A project can become unmanageable when internal power dissipation requirements are significant, thus indicating a PWM solution may be the best option. These amplifiers also offer varying levels of integration, including cycle-by-cycle current limiting and integrated gate driver logic in the most sophisticated models.

PRECISION VOLTAGE REFERENCES



The 100 and 200 series of precision voltage references are zener-based references that offer either a single or dual output voltage. These are popular in systems where positive and negative reference voltages are required. Packaged in 14-pin DIPs and 20-pin LCCs, many are available with military process options (class H).

Model	Output(V)	Initial Error (mV)	TempCo (ppm/oC)	Noise (μ Vp-p)	Package	Feature
VRE102*	\pm 10	1.0, 1.2, 1.5, 1.7	1.09, 1.11, 1.33, 1.45	6	DIP14 (HC)	High Temp Range
VRE104*	4.5	0.8	1.48, 1.62, 1.70, 1.98	3	DIP14 (HC)	High Temp Range
VRE107*	\pm 5	0.8, 0.9	1.33, 1.56	3	DIP14 (HC)	High Rel Military
VRE204*	4.5	0.8	1.48, 1.70	3	LCC20 (HD)	Small Pkg, High Rel Military
VRE205	5	0.8	1.33, 1.45, 1.56, 1.82	3	LCC20 (HD)	Small Pkg, High Rel Military
VRE210*	10	0.5, 0.8, 1.0	1.09, 1.11, 1.33, 1.45	6	LCC20 (HD)	Small Pkg, High Rel Military

* Available in a non-compliant "M" product grade

PRODUCT GRADE BY OPERATING TEMPERATURE RANGE

Apex products are graded across four specific operating temperature ranges: commercial, industrial, non-compliant “M”, and fully-compliant “M/883”. Depending on the application, a commercial grade product may be a suitable solution if the operating environment is less rigorous. A good example is the ongoing expansion of the COTS program. Commercial grade Apex products are routinely used in COTS level circuits; however, for applications that are more demanding, customers can opt for a fully compliant, fully certified “M/883” device that is capable of guaranteed operation over the military temperature range.

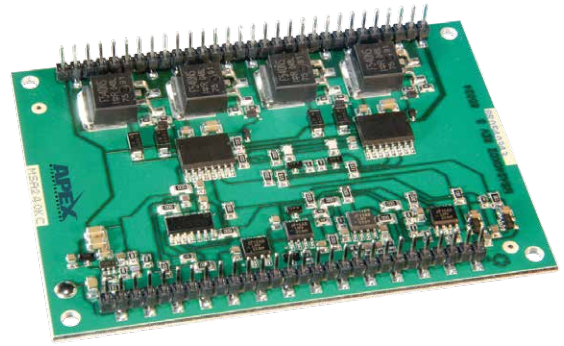


Package type is another variable to be considered during the product selection process. Apex offers a number of packaging options suited to a wide spectrum of operating conditions. Taking the time to make the right packaging choice can also deliver cost savings. For less rigorous environments, a low-cost, non-hermetic package such as a plastic PowerSIP, or an open frame module, can be suitable choices that are also very cost effective. However, a hermetically sealed, metal package may be the best option to provide long-term reliability in the most rigorous operating conditions.

Operating Temperature Range (°C)	Product Grade	Packaging Options
0°C to +70°C	Commercial	PowerSIP, TO-220, LCC, Open Frame Modules, PowerDIP
-25°C to +85°C	Industrial	PowerSIP, TO-220, LCC, Open Frame Modules, PowerDIP
-55°C to +125°C	Non-Compliant “M”	QFPs, TO-3, LCC, CERDIP
-55°C to +125°C	M/883 Compliant Military	TO-3

PRODUCT GRADE BY SCREENING PROCESS

The chart below outlines the static and dynamic test operations performed for the commercial/industrial, non-compliant “M” and fully-certified “M/883” compliant grades. In addition, the non-compliant “M” grade and fully-certified “M/883” are distinguished further by the DLA certification which substantiates the level of quality screening required.



Operation	Commercial/ Industrial	Non-Compliant “M”	/883 Compliant Military
Clean Room Processing	Yes	Yes	Yes
Clean Room Testing	Yes	Yes	Yes
Solder Integrity Testing	Yes	Yes	Yes
Wire Bond Integrity	Yes	Yes	Yes
All Processing Under Document Control	Yes	Yes	Yes
High Power Die Inspection	No	Yes	Yes
Processed on Military Line	Yes	Yes	Yes
Pre-cap Visual	Sample	100%	100%
Pre-seal Vacuum Bake	Yes	Yes	Yes
Welded in Controlled Atmosphere ¹	Yes	Yes	Yes
Checked for Hermeticity ¹	No	100%	100%
Temperature Cycle: - 65°C to +150°C for 10 Cycles	No	Yes	Yes
Constant Acceleration Condition 5000G	No	Yes	Yes
Burn-in: 160 hours @ TC = 125°C	No	Yes	Yes
Dynamic Testing	+25°C	-55°C, +25°C, +125°C	-55°C, +25°C, +125°C
External Visual Inspection	Yes	Yes	Yes
Pin Finish	Ni or Sn	Solder	Solder

Maximum Number of Re-work Cycles Specified

Solder	Yes	Yes	Yes
Epoxy	No	Yes	Yes
Wirebond	Yes	Yes	Yes

¹Metal Packaged Hybrid Models

AVAILABLE “M” GRADE AND “M/883” SMD GRADE PRODUCTS

The listing below captures the complete Apex Microtechnology product offerings that are available as either non-compliant “M” grade, or full-compliant “M/883” with Standard Military Drawing (SMD) numbers. Please refer to www.apexanalog.com for the current technical product data sheets for each of these models.



Power Operational Amplifiers	Non-Compliant “M”	Full-Compliant “M/883”	Stocked SMD #
PA02M/883		x	5962-9067901HXA
PA07M/883		x	5962-9063801HXA
PA08M/883		x	5962-9072301HXA
PA09M/883		x	5962-9170001HXA
PA10M/883		x	5962-9082801HXA
PA12M/883		x	5962-9065901HXA
PA51M/883		x	5962-8762001,02YA
PA61M/883		x	
PA73M/883		x	
PA74M	x		
PA83M/883		x	5962-9162101HXA
PA84M/883		x	5962-9073601HXA
PA85M	x		

Precision Voltage References	Non-Compliant “M”	Full-Compliant “M/883”	Stocked SMD #
VRE102M	x		
VRE104M	x		
VRE107M	x		
VRE204M	x		
VRE210M	x		

DLA MIL-PRF-38534 CERTIFIED, DUAL ISO9001 REGISTRATION AND CERTIFIED PRODUCT BUILD FOR ALL GRADES

Apex Microtechnology products deliver high quality and reliability by using the same DLA MIL-PRF-38534 certification, ISO9001 registration and qualified manufacturing systems and processes across all product grades. Apex operates a DLA certified and qualified QML-38534 manufacturing facility with our certification maintained since November 8, 1989, and a QML listing as of May 31, 1990. All products are screened to MIL-PRF-38534 and Class H.

The only point at which variables occur is during electrical testing. The non-compliant "M" grade products are tested over a wider temperature range, in addition to certain environmental screenings and internal visual inspection criteria. Commercial and industrial grade products are 100% static and dynamic tested at +25°C. Military level products are 100% tested over their respective full temperature ranges.

For complete product and quality information, including complete technical data sheets and supporting design documentation, or to request product samples, visit www.apexanalog.com.

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