

**"Innovation,  
not imitation"**

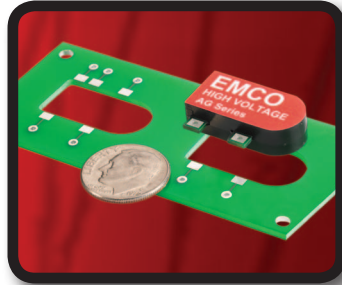
PATENT PENDING

# AG SERIES

ISOLATED, PROPORTIONAL DC TO HV DC CONVERTERS

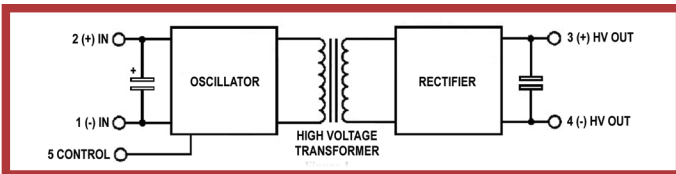
100V to 6000V @ 1.0 and 1.5 Watts

**Extremely Low Profile: 0.128 inches  
and volume of < 0.100 cubic inches\***



## PRODUCT DESCRIPTION

The AG Series is a new line of ultra-miniature DC to HV DC converters that set an industry standard in high voltage miniaturization. These component-sized converters are ideal for applications requiring minimal size and weight. Occupying less than one tenth of a cubic inch of volume\*, this unique package features an extremely low profile of only 0.128 inches (3.25mm) when mounted in from the top, or 0.152 (3.86mm) when mounted in from the bottom of the PCB! The AG Series converter can also mount off the PCB with .030" diameter pins. See page 9 for illustrations. Controllable output voltages range from 100 volts to 6000 volts. For information on the built in pin option, please refer to the A Series data sheet.



## APPLICATIONS

Avalanche Photodiodes  
Capacitor Charging  
Electrophoresis  
Photomultiplier Tubes  
Piezo Devices  
Mass Spectrometry  
Sustaining Ion Pumps

## OPTIONS

1 Watt and 1.5 Watt Versions Available (AG/AGH)  
Available in Three Standard Input Voltage Ranges: 0 to 5, 12 or 24VDC  
Polarity: Choose Positive or Negative Output (P/N)  
Extended Operating Temperature (AG Models / 1.0W) (T Suffix)  
Alternate Input / Output Voltages (Consult Factory)  
See Ordering Information (Page 12)

## PRODUCT SELECTION TABLE

VDC	STANDARD 1 WATT - AG MODEL		1.5 WATT OPTION - AGH MODEL	
	MODEL	MAXIMUM OUTPUT CURRENT*1	MODEL	MAXIMUM OUTPUT CURRENT*1
100 VDC	<b>AG01</b>	10 mA	<b>AGH01</b>	15 mA
200 VDC	<b>AG02</b>	5 mA	<b>AGH02</b>	7.5 mA
250 VDC	<b>AG025</b>	4 mA	<b>AGH025</b>	6 mA
300 VDC	<b>AG03</b>	3.33 mA	<b>AGH03</b>	5mA
400 VDC	<b>AG04</b>	2.5 mA	<b>AGH04</b>	3.75 mA
500 VDC	<b>AG05</b>	2 mA	<b>AGH05</b>	3 mA
600 VDC	<b>AG06</b>	1.67 mA	<b>AGH06</b>	2.5 mA
700 VDC	<b>AG07</b>	1.43 mA	<b>AGH07</b>	2.15 mA
800 VDC	<b>AG08</b>	1.25 mA	<b>AGH08</b>	1.87 mA
900 VDC	<b>AG09</b>	1.1 mA	<b>AGH09</b>	1.67 mA
1000 VDC	<b>AG10</b>	1 mA	<b>AGH10</b>	1.5 mA
1200 VDC	<b>AG12</b>	0.83 mA	<b>AGH12</b>	1.25 mA
1500 VDC	<b>AG15</b>	0.66 mA	<b>AGH15</b>	1 mA
2000 VDC	<b>AG20</b>	0.5 mA	<b>AGH20</b>	0.75 mA
3000 VDC	<b>AG30</b>	0.32 mA	<b>AGH30</b>	0.5 mA
4000 VDC	<b>AG40</b>	0.24 mA	<b>AGH40</b>	0.375 mA
5000 VDC	<b>AG50</b>	0.2 mA	<b>AGH50</b>	0.3 mA
6000 VDC	<b>AG60</b>	0.167 mA	<b>AGH60</b>	0.25 mA

Complete List of Models on page 2

## FEATURES

- Proportional Input/Output
- Low Noise Quasi-sinewave Oscillator
- Control Pin
- Low Leakage Current
- Low Input/Output Capacitance
- Input to Output Galvanic Isolation
- Short Circuit Protection, 1 Minute Minimum
- No Minimum Load Required
- Designed to meet RoHS and REACH Directives
- MTBF > 1,862,000 hours, per Bellcore TR 332
- Surface Mount Package
- UL 94V-0 Listed Proprietary Encapsulant
- No external components required

**ELECTRICAL SPECIFICATIONS\*3**

OUTPUT VOLTAGE*2 (To select polarity, see pg. 12 - How to Order)	STANDARD 1 WATT - AG MODEL			1.5 WATT OPTION - AGH MODEL		
	MODEL	MAXIMUM OUTPUT CURRENT*1	RIPPLE P-P*4	MODEL	MAXIMUM OUTPUT CURRENT*1	RIPPLE P-P*4
0 to 100 VDC	<b>AG01</b>	10 mA	5%	<b>AGH01</b>	15 mA	4%
0 to 200 VDC	<b>AG02</b>	5 mA	1%	<b>AGH02</b>	7.5 mA	3%
0 to 250 VDC	<b>AG025</b>	4 mA	.90%	<b>AGH025</b>	6 mA	1.2%
0 to 300 VDC	<b>AG03</b>	3.33 mA	.70%	<b>AGH03</b>	5 mA	.70%
0 to 400 VDC	<b>AG04</b>	2.5mA	.50%	<b>AGH04</b>	3.75 mA	.75%
0 to 500 VDC	<b>AG05</b>	2 mA	.50%	<b>AGH05</b>	3 mA	.70%
0 to 600 VDC	<b>AG06</b>	1.67 mA	1%	<b>AGH06</b>	2.5 mA	2%
0 to 700 VDC	<b>AG07</b>	1.43 mA	.50%	<b>AGH07</b>	2.15 mA	1.2%
0 to 800 VDC	<b>AG08</b>	1.25 mA	1%	<b>AGH08</b>	1.87 mA	1.2%
0 to 900 VDC	<b>AG09</b>	1.1 mA	1%	<b>AGH09</b>	1.67 mA	1.2%
0 to 1000 VDC	<b>AG10</b>	1 mA	.79%	<b>AGH10</b>	1.5 mA	1%
0 to 1200 VDC	<b>AG12</b>	0.83 mA	.50%	<b>AGH12</b>	1.25 mA	.60%
0 to 1500 VDC	<b>AG15</b>	0.67 mA	.40%	<b>AGH15</b>	1 mA	.60%
0 to 2000 VDC	<b>AG20</b>	0.5 mA	.30%	<b>AGH20</b>	0.75 mA	.50%
0 to 3000 VDC	<b>AG30</b>	0.33 mA	.20%	<b>AGH30</b>	0.5 mA	.20%
0 to 4000 VDC	<b>AG40</b>	0.25 mA	.12%	<b>AGH40</b>	0.37 mA	.18%
0 to 5000 VDC	<b>AG50</b>	0.2 mA	.15%	<b>AGH50</b>	0.3mA	.16%
0 to 6000 VDC	<b>AG60</b>	0.167 mA	.15%	<b>AGH60</b>	0.25 mA	.25%

	INPUT CURRENT			
	AG MODELS - 1 Watt		AGH MODELS - 1.5 Watt	
VIN	NO-LOAD	FULL-LOAD	NO-LOAD	FULL-LOAD
5 VDC	<200mA	<470mA	<300mA	<550mA
12 VDC	<100mA	<185mA	<125mA	<250mA
24 VDC	<25mA	<60mA	<40mA	<120mA

## ELECTRICAL SPECIFICATIONS\*3

PARAMETER	VALUE
INPUT VOLTAGE	0 TO 5, 12, OR 24V (FOR MODELS UP TO 3KV)
	0 TO 5V (FOR MODELS OVER 3KV)
TURN-ON VOLTAGE	<0.7 VDC
ISOLATION	< +/- 500V BIAS ON PIN 4
OUTPUT VOLTAGE TOLERANCE	+10%, -10% FULL LOAD, MAX. INPUT VOLTAGE
INPUT/OUTPUT COUPLING CAPACITANCE	<250 pf TYPICAL
INPUT/OUTPUT LEAKAGE CURRENT	<50 nA TYPICAL
CONTROL PIN	ON/OFF CONTROL
INTERNAL OSCILLATOR FREQUENCY	50kHz - 350kHz
STANDARD TEMPERATURE RANGES	OPERATING: -25° TO +75°C (CASE)
	STORAGE: -55° TO +105°C
EXTENDED TEMPERATURE RANGES (-T OPTION)	OPERATING: -55° TO +85°C (CASE) (AG Models/1.0W)
	STORAGE: -55° TO +105°C

## DETAILED PRODUCT DESCRIPTION

The AG Series is a new line of ultra-miniature, DC to HV DC converters that set an industry standard in high voltage miniaturization. These component-sized converters are ideal for applications requiring minimal size and weight. Occupying less than one tenth of a cubic inch of volume<sup>5</sup>, this unique package features an extremely low profile of only 0.128 inches (3.25mm) when mounted in from the top, or 0.152 (3.86mm) when mounted in from the bottom of the PCB! The AG Series converter can also mount off the PCB with .030" diameter pins. See page 9 for illustrations. Controllable output voltages range from 100 volts to 6000 volts.

Turn-on voltage is very low at less than 0.7 volts, allowing for wide output voltage operating range. Use of a resonant, quasi-sinewave oscillator and fully shielded transformer result in clean, reliable high voltage conversion with inherently low ripple, EMI/RFI and input ripple current, making this product ideal for integration into noise sensitive equipment.

A separate high impedance control pin is standard and is designed for external error amplifier and/or DAC control in closed or open loop systems, or simply connect the control pin to the + input for proportional input to output operation (see schematic and performance charts below).

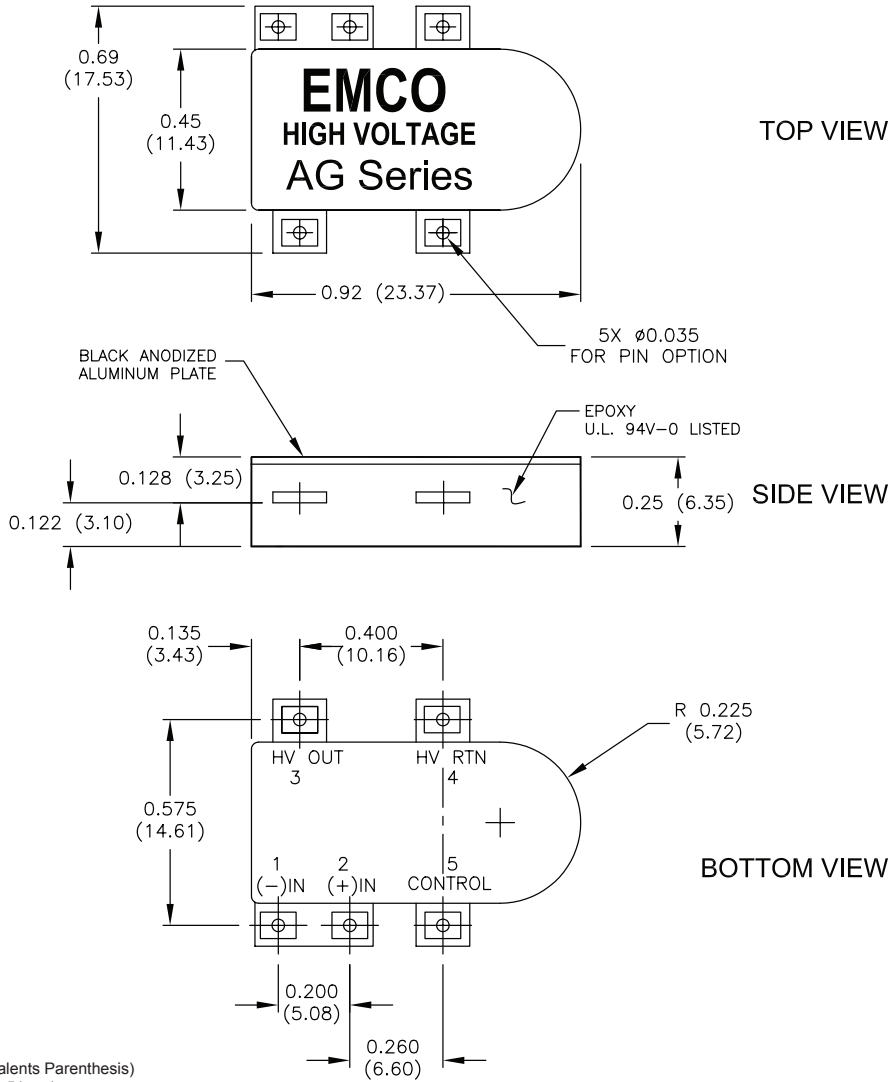
Output power is 1 watt standard, with 1.5 watts available as an option. No minimum load is required. A proprietary encapsulation process and custom 94V-0 listed, high performance formula are used to achieve excellent high voltage and thermal properties. Isolation is +/- 500V bias on the output return. Input to output leakage current is very low at less than 100 nA and coupling capacitance is also low at <250 pF.

The AG Series leverages EMCO's Best-in-Class long-term reliability, utilizing proven DC to high voltage DC conversion technology, perfected by over four decades of high voltage design experience in the most demanding applications. Our specialized engineers and scientists design all EMCO products. Our extensive in-house capabilities enable us to meet specific customer requirements with standard, modified and custom solutions quickly, easily, and economically. Technical assistance is readily available.

The AG Series is designed and manufactured to provide consistent, built-in, long-term reliability for which EMCO products are known. The AG Series is manufactured in EMCO's "Flex-Chain" lean, demand-flow process that provides maximum quality, short lead times, and assures our customers the lowest total cost of ownership.

Small quantities are readily available. For large quantities, please consult our sales office or stocking distributor in Switzerland, Condatas AG.

## MECHANICAL SPECIFICATIONS (100V - 2,000V)

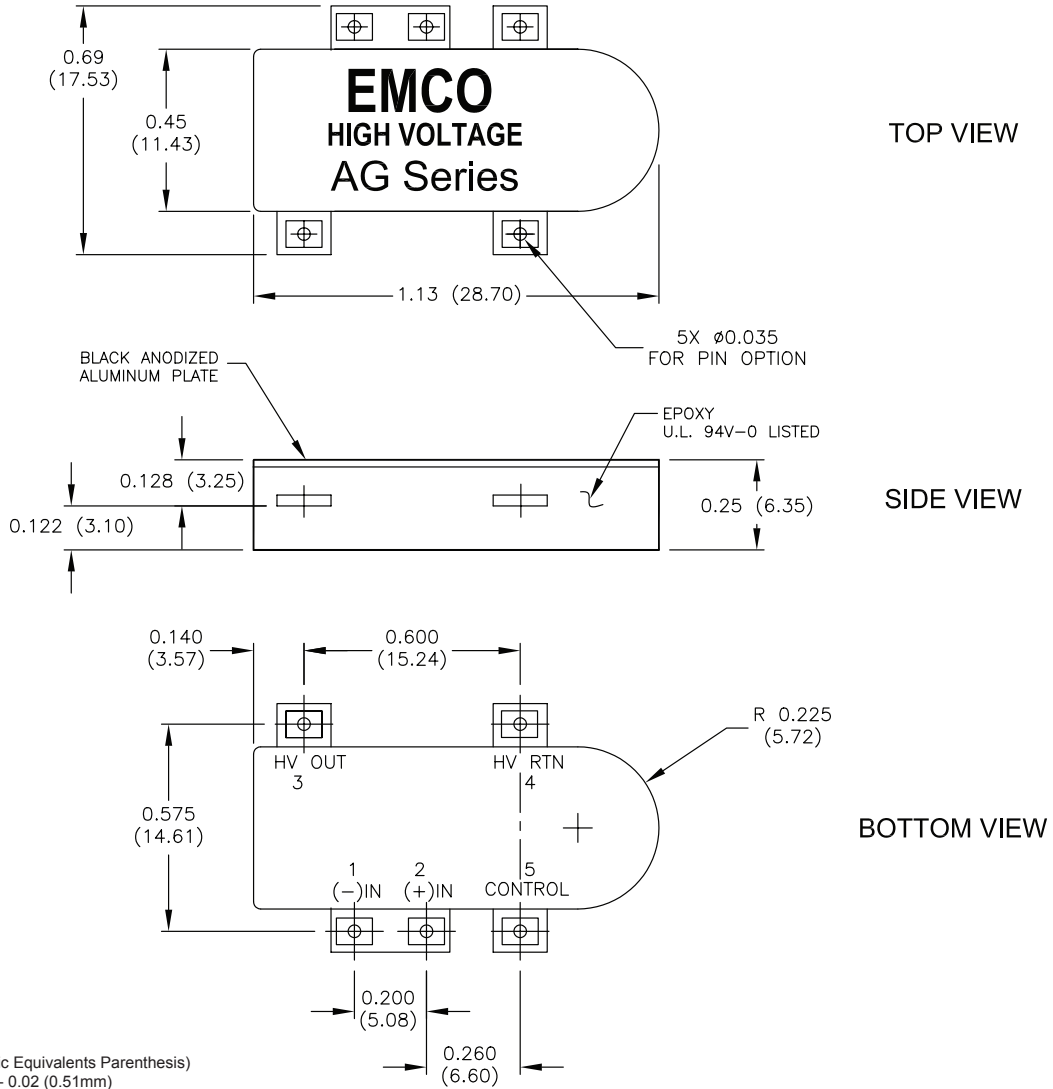


Dimensions are in inches (Metric Equivalents Parenthesis)  
Dimensional Tolerances: .xx +/- 0.02 (0.51mm)  
.xxx +/- 0.005 (0.127mm)

PARAMETER	VALUE
WEIGHT	< 0.20 OZ. (5.66 GRAMS)
VOLUME	< 0.10 CUBIC INCHES (1.639 CUBIC CENTIMETERS)
BODY DIMENSIONS	0.92L (23.37L) x 0.45W (11.43W) x 0.25H (6.35H)
BODY + WING DIMENSIONS	0.92L (23.37L) x 0.69W (17.53W) x 0.25H (6.35H)

PIN #	FUNCTION
1	(-) INPUT
2	(+) INPUT
3	HV OUT
4	HV RTN
5	CONTROL

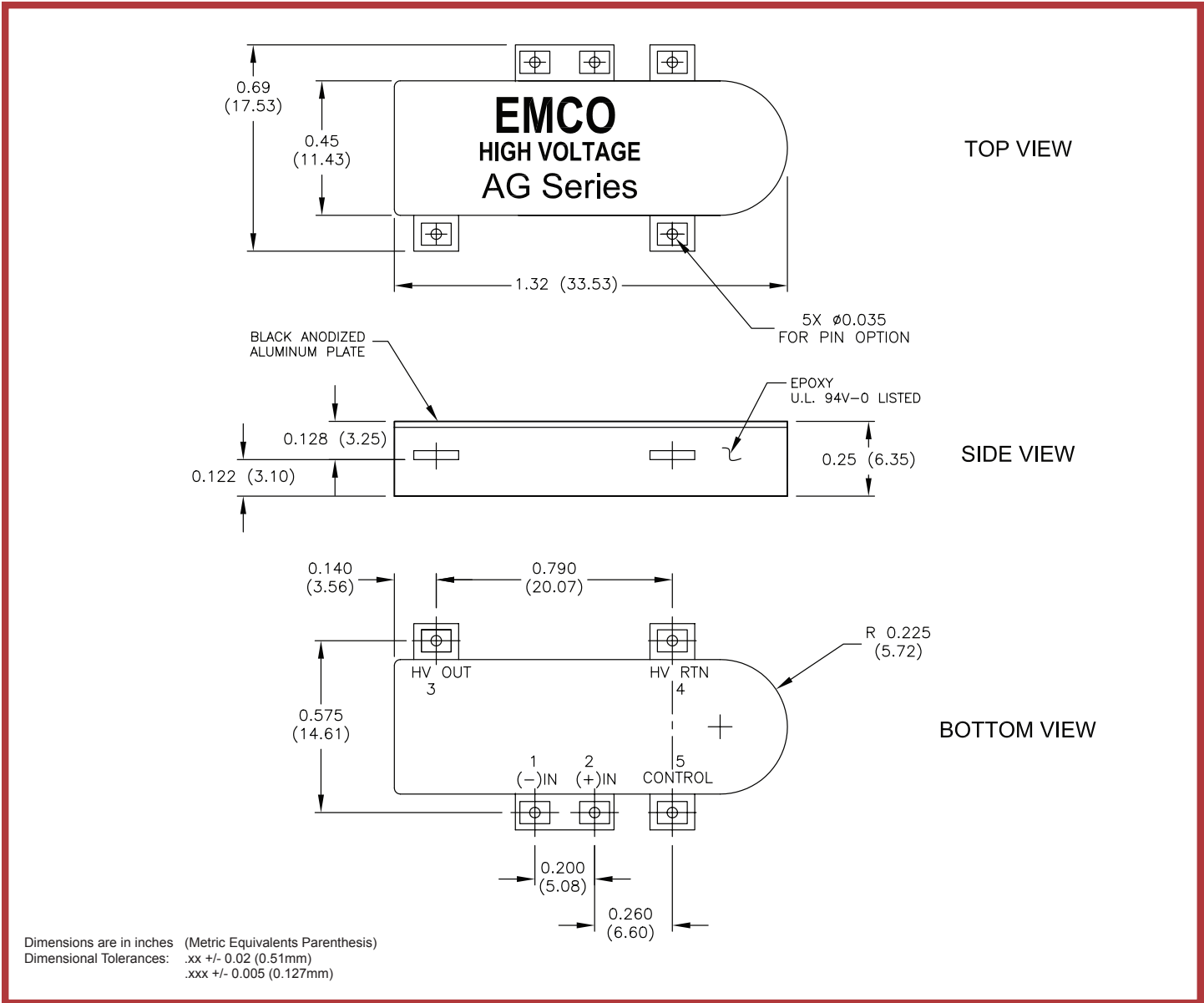
## MECHANICAL SPECIFICATIONS (3,000V – 5,000V)



PARAMETER	VALUE
WEIGHT	< 0.20 OZ. (5.66 GRAMS)
VOLUME	<0.125 CUBIC INCHES (2.048 CUBIC CENTIMETERS)
BODY DIMENSIONS	1.13L (28.70L) x 0.45W (11.43W) x 0.25H (6.35H)
BODY + WING DIMENSIONS	1.13L (28.70L) x 0.69W (17.53W) x 0.25H (6.35H)

PIN #	FUNCTION
1	(-) INPUT
2	(+) INPUT
3	HV OUT
4	HV RTN
5	CONTROL

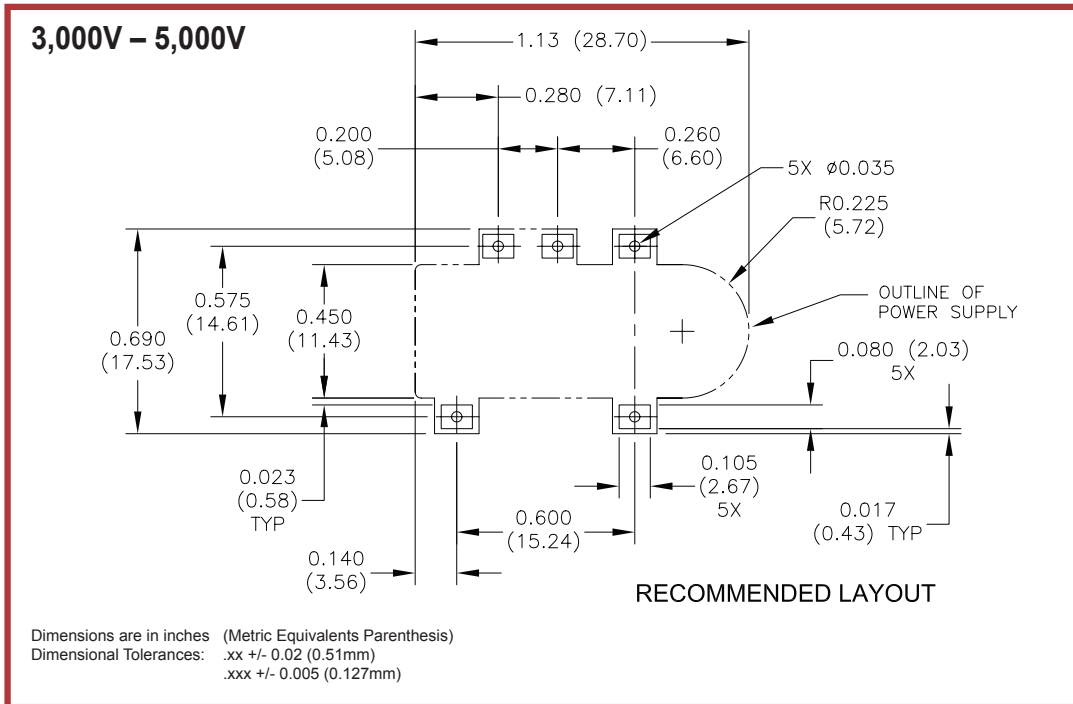
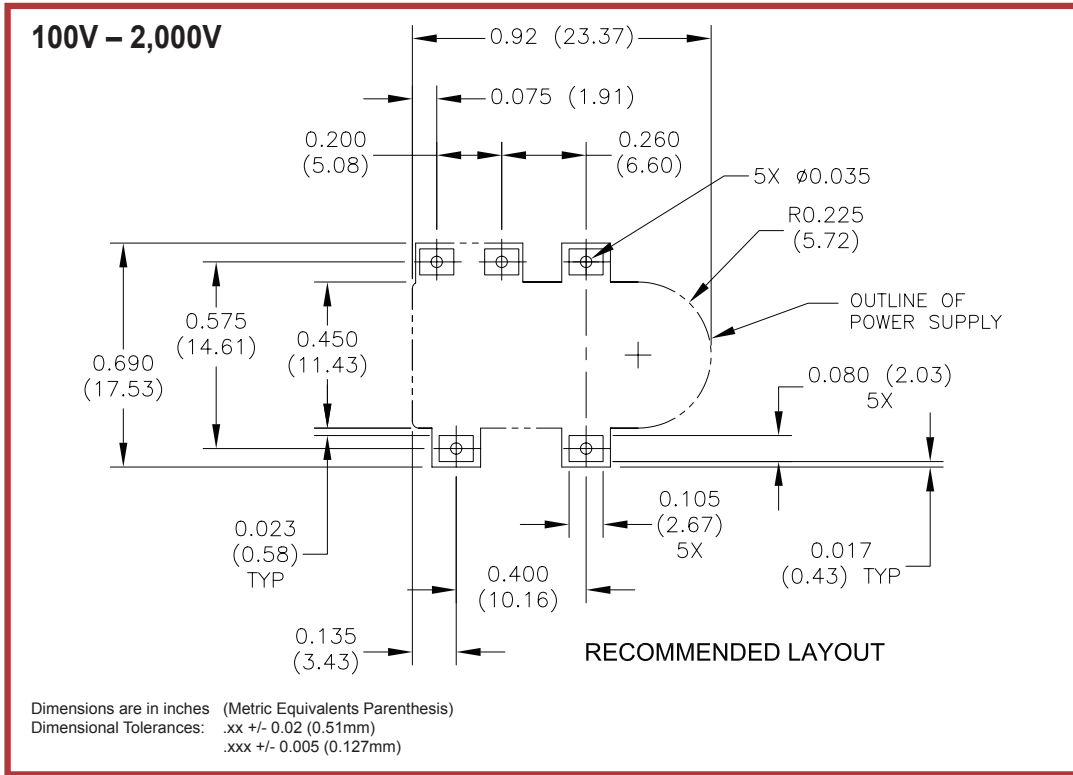
MECHANICAL SPECIFICATIONS (6,000V)



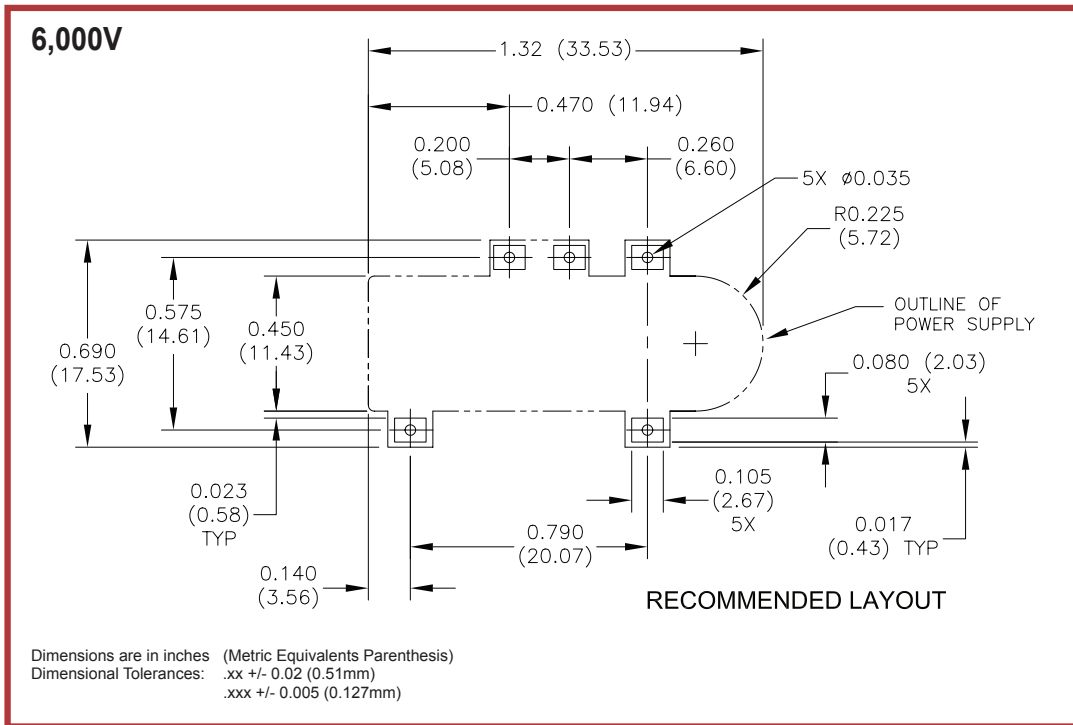
PARAMETER	VALUE
WEIGHT	< 0.20 OZ. (5.66 GRAMS)
VOLUME	<0.156 CUBIC INCHES (2.556 CUBIC CENTIMETERS)
BODY DIMENSIONS	1.32L (33.53L) x 0.45W (11.43W) x 0.25H (6.35H)
BODY + WING DIMENSIONS	1.32L (33.53L) x 0.69W (17.53W) x 0.25H (6.35H)

PIN #	FUNCTION
1	(-) INPUT
2	(+) INPUT
3	HV OUT
4	HV RTN
5	CONTROL

MECHANICAL SPECIFICATIONS



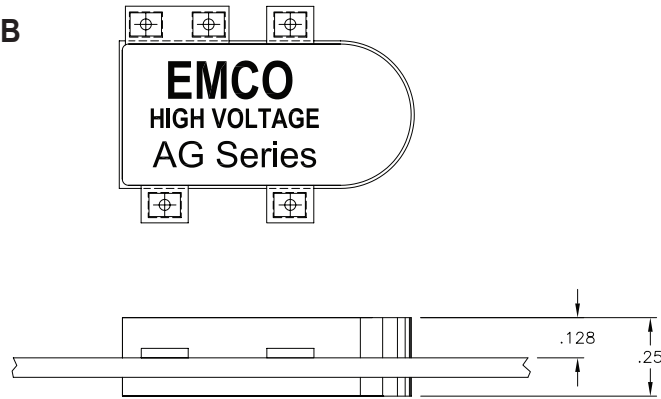
MECHANICAL SPECIFICATIONS



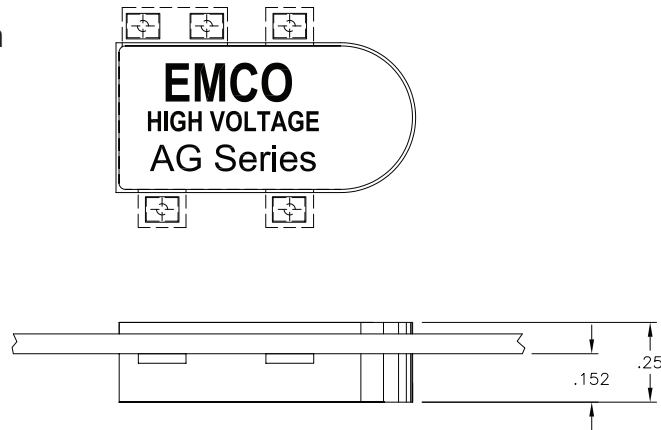


AG INSTALLATION

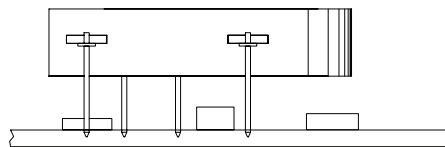
AG Mounted  
on Top of PCB



AG Mounted  
From Bottom  
of PCB



AG Mounted Off  
PCB With .030"  
DIA Pins



\*Height of pin can vary depending upon application

AG RoHS REFLOW PROFILE

Probe	Reflow Results						
	Positive Slope (°C/sec)	Positive Slope Time (mm:ss.tt)	Rise Time (120.0 - 180.0°C) (mm:ss.tt)	Mean Slope to Peak (°C/sec)	Time Above Liquidus (217.0°C) (mm:ss.tt)	Peak Temperature (°C)	Negative Slope (°C/sec)
(°C) Module Lead Top	2.62	03:43.50	01:17.00	0.77	00:44.00	237.5	-2.59

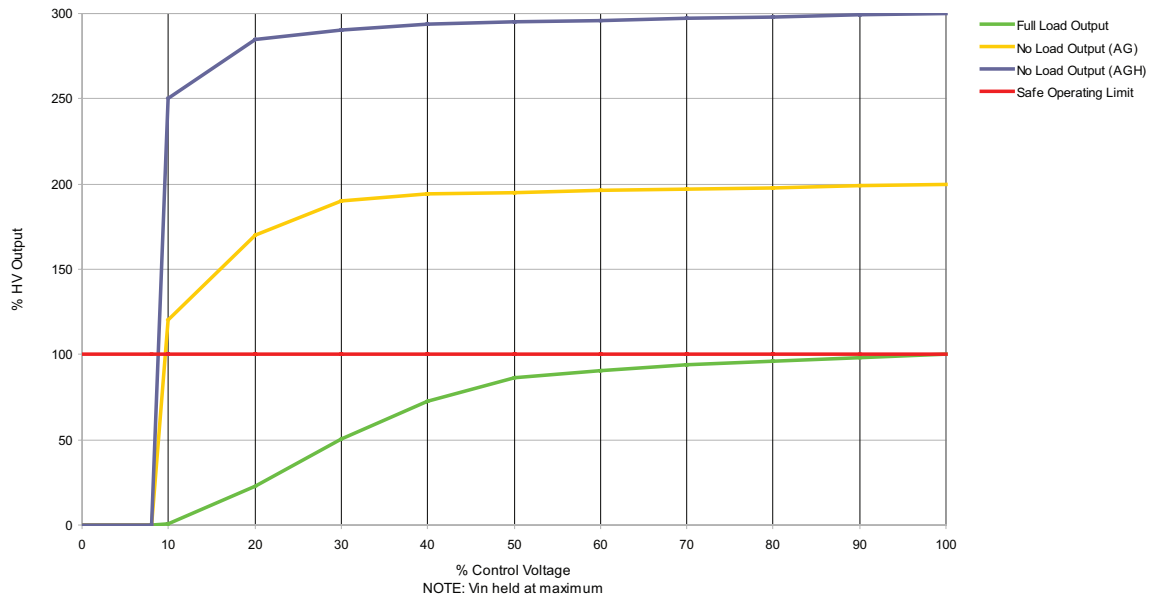
Probe	Maximum / Minimum						
	Maximum (°C)	Max. Reached (mm:ss.tt)	Mean (°C)	Deviation from 255.0°C	Standard deviation	Minimum (°C)	Min. Reached (mm:ss.tt)
(°C) Module Lead Top	237.5	04:18.00	139.8	-17.5	56.5	38.5	00:00.00

Probe	Time at Temperature		Slopes	
	Time Above 230.0°C (mm:ss.tt)	Time to Reach 230.0°C (mm:ss.tt)	Positive Slope (°C/sec)	Mean Slope (°C/sec)
(°C) Module Lead Top	00:16.00	04:09.50	2.62	0.38

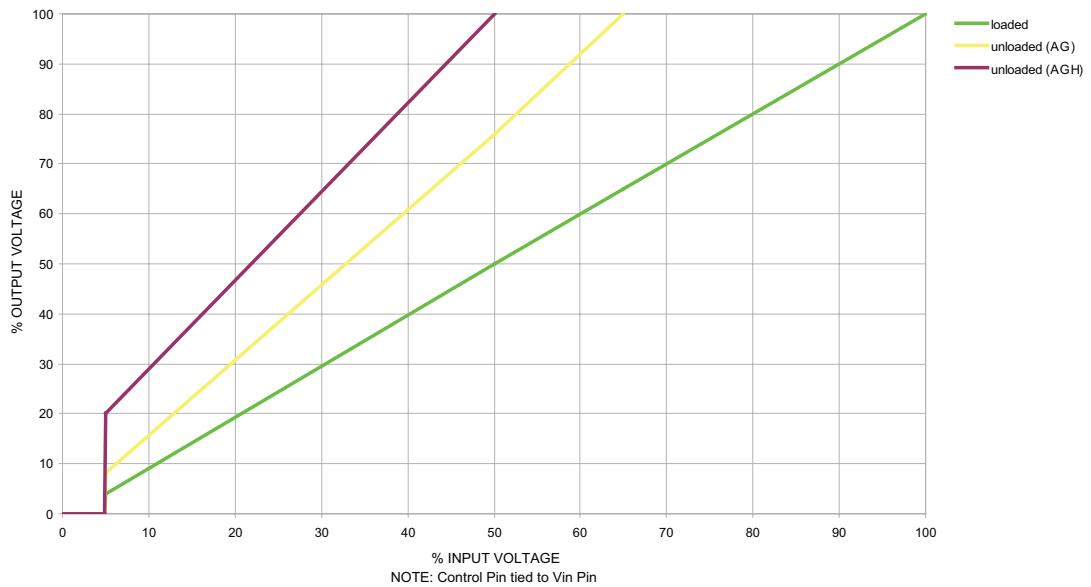
\*Reflow profile is subject to change based on your application

APPLICATION NOTES

Typical HV Output vs. Control Voltage



TYPICAL INPUT vs. OUTPUT VOLTAGE



OPTION CODES

ORDERING INFORMATION		ORDER CODE
OUTPUT VOLTAGE	1 WATT	AG
	1.5 WATT	AGH
POLARITY DESIGNATOR	POSITIVE OUTPUT	P
	NEGATIVE OUTPUT	N
INPUT VOLTAGE	5 VDC	5
	12 VDC	12
	24 VDC	24
STANDARD TEMPERATURE RANGES	OPERATING: -25 TO +75°C (CASE)	BLANK
	STORAGE: -55 TO +105°C	BLANK
EXTENDED TEMPERATURE RANGES	OPERATING: -55 TO +85°C (CASE) (AG Models/1.0W)	T
	STORAGE: -55 TO +105°C	T

HOW TO ORDER

PART NUMBER SELECTOR:

Model Number:

**AG 20 N - 12 T**



EXAMPLE: **AG20N-12T** (**AG** - Model, **20** - Output Voltage, **N** - Negative, **12** - Input Voltage, **T** - Extended Operating Temperature)

\*Note:

1. At maximum rated output voltage.
2. Output Voltage is load dependent. Under light or no-load conditions, reduce the Input Voltage so maximum rated Output Voltage is not exceeded.
3. Specifications after 30 minute warm-up, full-load, at 25°C, unless otherwise noted.
4. Ripple may be reduced substantially by the addition of an external RC filter.
5. Volume will vary depending on package size.

We Reserve the Right To Make Changes without Notification.