

**Proven  
Reliability**

# AG SERIES

ISOLATED, PROPORTIONAL DC TO HV DC CONVERTERS

100V to 6000V @ 1.0 and 1.5 Watts

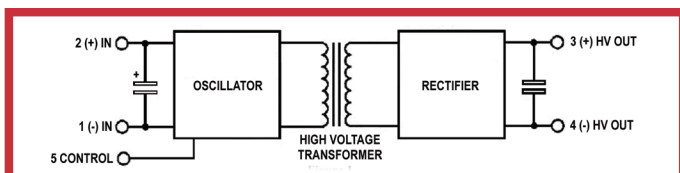
**Extremely Low Profile: 0.128 inches  
and volume of < 0.100 cubic inches<sup>\*5</sup>**

**NOW  
UL RECOGNIZED**



## 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. Please refer to the A Series data sheet for PCB pin mounting.



## 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 3 Standard Input Voltage Ranges: 0 to 5, 12 or 24VDC (up to 3 kV)  
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> <sup>*7</sup>  | 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                  | —                           | —                        |
| 5000 VDC | <b>AG50</b>                | 0.2 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 (can be used for on/off control)
- Low Leakage Current
- Low Input/Output Capacitance
- Input to Output Galvanic Isolation
- Short Circuit Protection, 1 Minute Minimum
- No Minimum Load Required<sup>\*2</sup>
- MTBF > 1,862,000 hours, per Bellcore TR 332
- Surface Mount Package
- No external components required
- RoHS Compliant
- UL Recognized

ISO 9001:2008  
CERTIFIED

ISO 14001:2004  
CERTIFIED

RoHS  
COMPLIANT

CAL US  
E139109

CE

IPC  
Certified J-STD-001  
Application Specialist

## ELECTRICAL SPECIFICATIONS\*3

| OUTPUT VOLTAGE*2<br>(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> <sup>7</sup>   | 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                     | 0.90%        | <b>AGH025</b>               | 6 mA                     | 1.2%         |
| 0 to 300 VDC                                                        | <b>AG03</b>                | 3.33 mA                  | 0.70%        | <b>AGH03</b>                | 5 mA                     | 0.70%        |
| 0 to 400 VDC                                                        | <b>AG04</b>                | 2.5mA                    | 0.50%        | <b>AGH04</b>                | 3.75 mA                  | 0.75%        |
| 0 to 500 VDC                                                        | <b>AG05</b>                | 2 mA                     | 0.50%        | <b>AGH05</b>                | 3 mA                     | 0.70%        |
| 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                  | 0.50%        | <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                     | 0.79%        | <b>AGH10</b>                | 1.5 mA                   | 1%           |
| 0 to 1200 VDC                                                       | <b>AG12</b>                | 0.83 mA                  | 0.50%        | <b>AGH12</b>                | 1.25 mA                  | 0.60%        |
| 0 to 1500 VDC                                                       | <b>AG15</b>                | 0.67 mA                  | 0.40%        | <b>AGH15</b>                | 1 mA                     | 0.60%        |
| 0 to 2000 VDC                                                       | <b>AG20</b>                | 0.5 mA                   | 0.30%        | <b>AGH20</b>                | 0.75 mA                  | 0.50%        |
| 0 to 3000 VDC                                                       | <b>AG30</b>                | 0.33 mA                  | 0.30%        | <b>AGH30</b>                | 0.5 mA                   | 0.30%        |
| 0 to 4000 VDC                                                       | <b>AG40</b>                | 0.25 mA                  | 0.30%        | –                           | –                        | –            |
| 0 to 5000 VDC                                                       | <b>AG50</b>                | 0.2 mA                   | 0.30%        | –                           | –                        | –            |
| 0 to 6000 VDC                                                       | <b>AG60</b>                | 0.167 mA                 | 0.30%        | <b>AGH60</b>                | 0.25 mA                  | 0.30%        |

|        | INPUT CURRENT      |           |                       |           |
|--------|--------------------|-----------|-----------------------|-----------|
|        | AG MODELS - 1 Watt |           | AGH MODELS - 1.5 Watt |           |
|        | NO-LOAD            | FULL-LOAD | NO-LOAD               | FULL-LOAD |
| VIN    |                    |           |                       |           |
| 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            | <100 nA TYPICAL                                               |
| CONTROL PIN                             | 0 TO MAX INPUT VOLTAGE                                        |
| STANDARD TEMPERATURE RANGES             | OPERATING: -25° TO +75°C <sup>6</sup> (CASE)                  |
|                                         | STORAGE: -55° TO +105°C                                       |
| EXTENDED TEMPERATURE RANGES (-T OPTION) | OPERATING: -55° TO +85°C <sup>6</sup> (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.

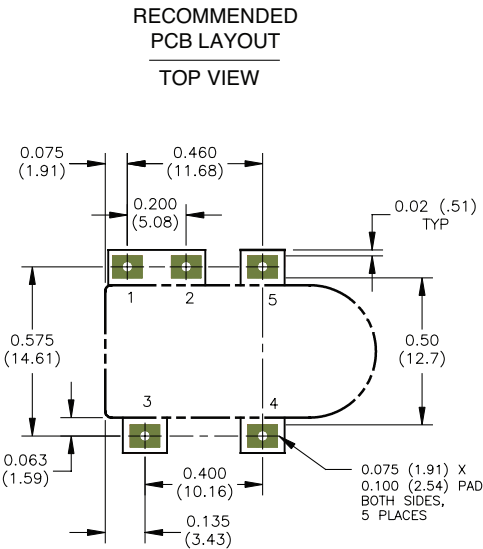
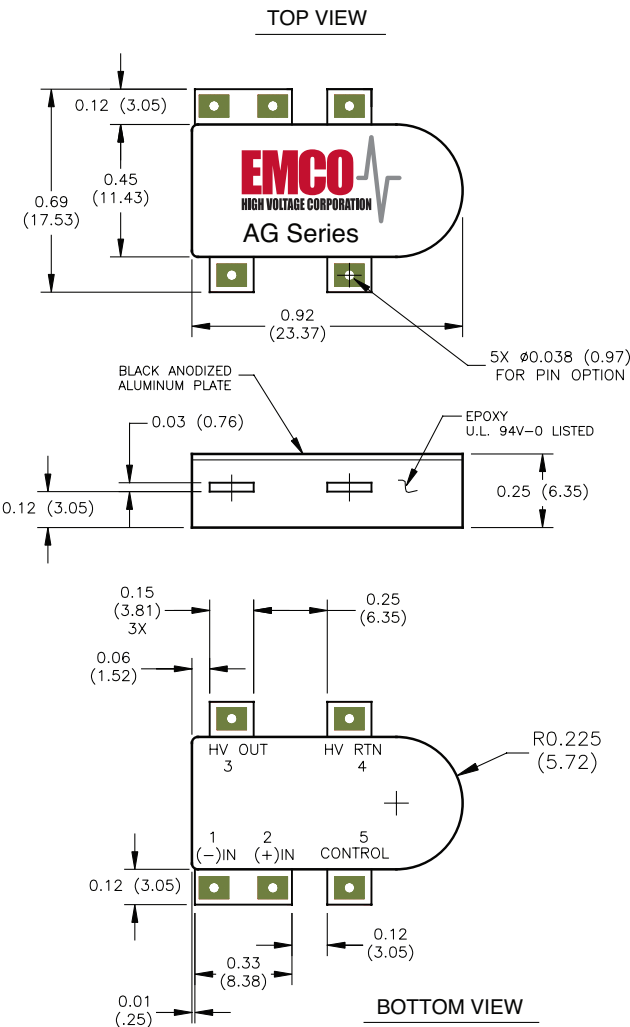
Turn-on voltage is very low at less than 0.7 volts, allowing for wide output voltage operating range. Use of a resonant, quasi-sinewave oscillator and fully shielded transformer result in clean, reliable high voltage conversion with inherently low ripple, EMI/RFI and input ripple current, making this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

Output power is 1 watt standard, with 1.5 watts available as an option. No minimum load is required. A proprietary vacuum 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 XP 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 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.

MECHANICAL SPECIFICATIONS (100V - 2,000V)

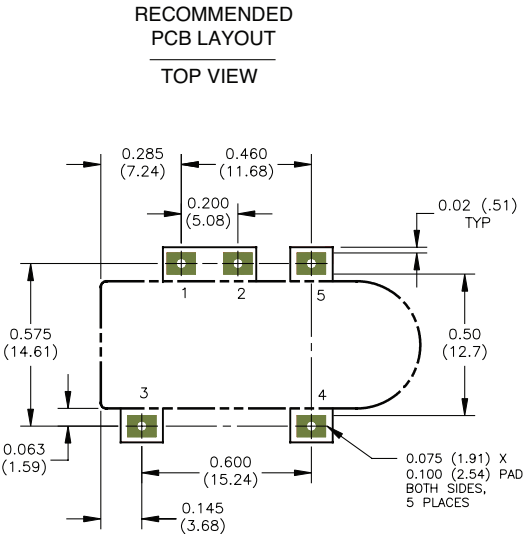
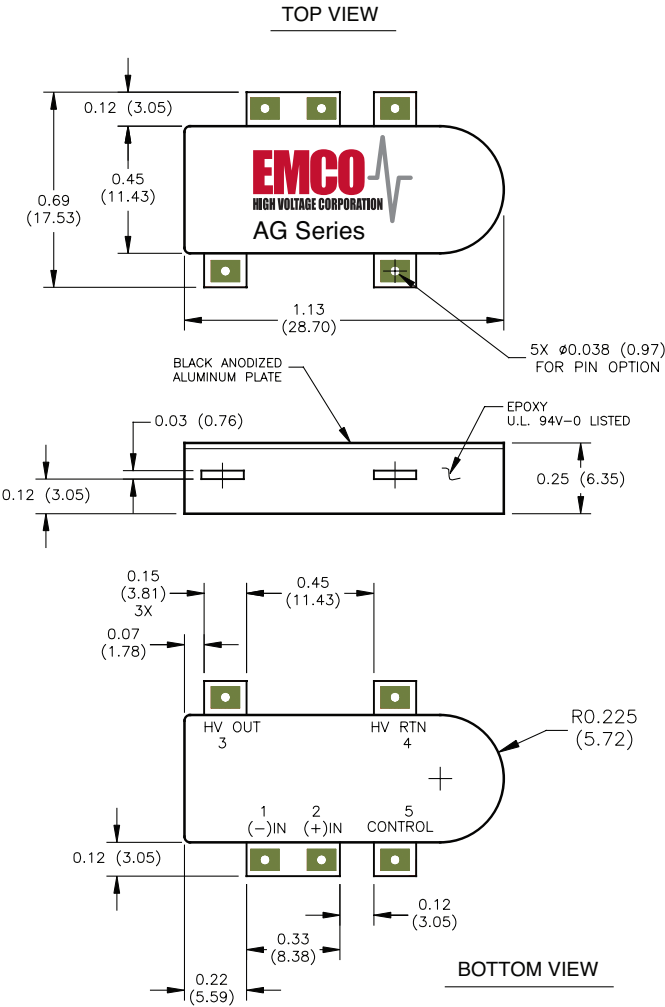


DIMENSIONS ARE IN INCHES (METRIC EQUIVALENTS ARE IN PARENTHESIS)  
DIMENSIONAL TOLERANCES: .XX = ± 0.02 (0.51), .XXX = ± 0.005 (0.127)

| 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)

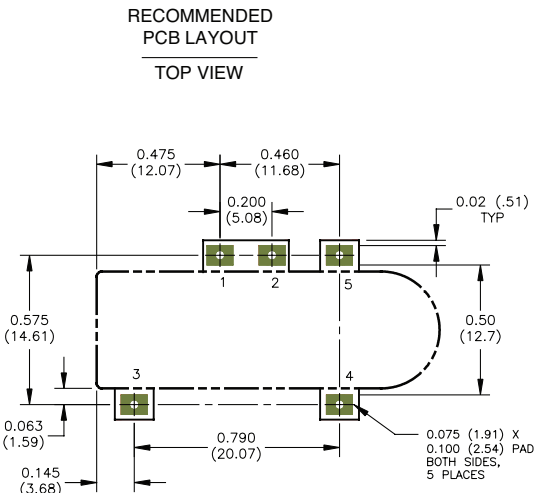
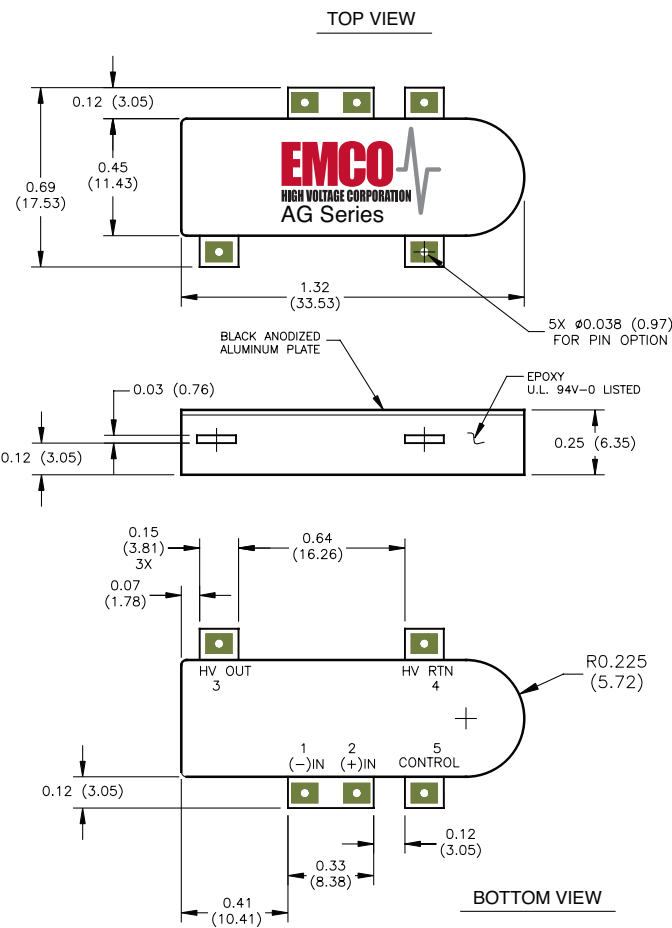


DIMENSIONS ARE IN INCHES (METRIC EQUIVALENTS ARE IN PARENTHESIS)  
DIMENSIONAL TOLERANCES: .XX =  $\pm$  0.02 (0.51), .XXX =  $\pm$  0.005 (0.127)

| PARAMETER              | VALUE                                           |
|------------------------|-------------------------------------------------|
| WEIGHT                 | 0.25 OZ. (7.09 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)

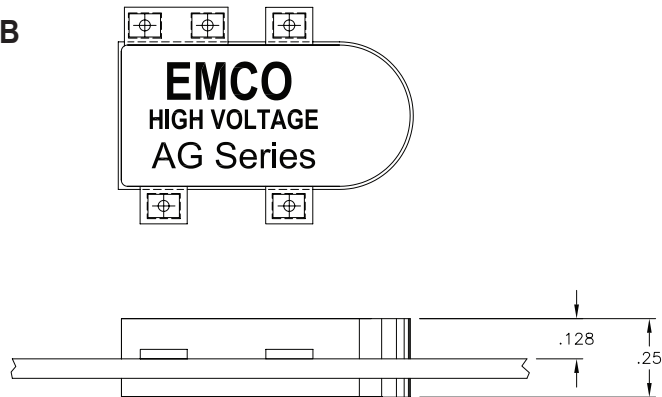
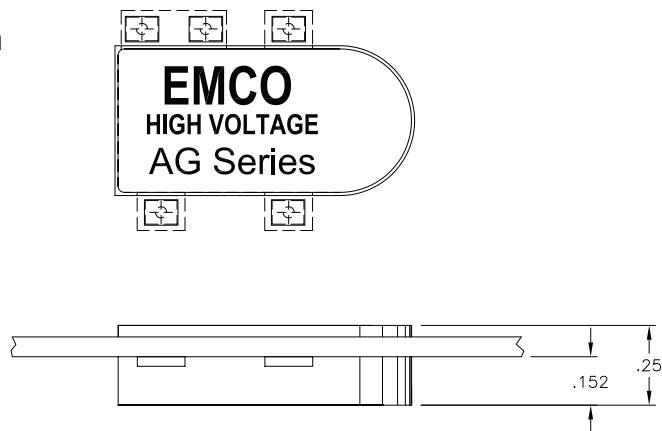
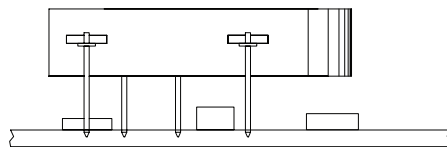


DIMENSIONS ARE IN INCHES (METRIC EQUIVALENTS ARE IN PARENTHESIS)  
DIMENSIONAL TOLERANCES: .XX = ± 0.02 (0.51), .XXX = ± 0.005 (0.127)

| PARAMETER              | VALUE                                           |
|------------------------|-------------------------------------------------|
| WEIGHT                 | 0.3 OZ (8.51 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   |

## 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                |

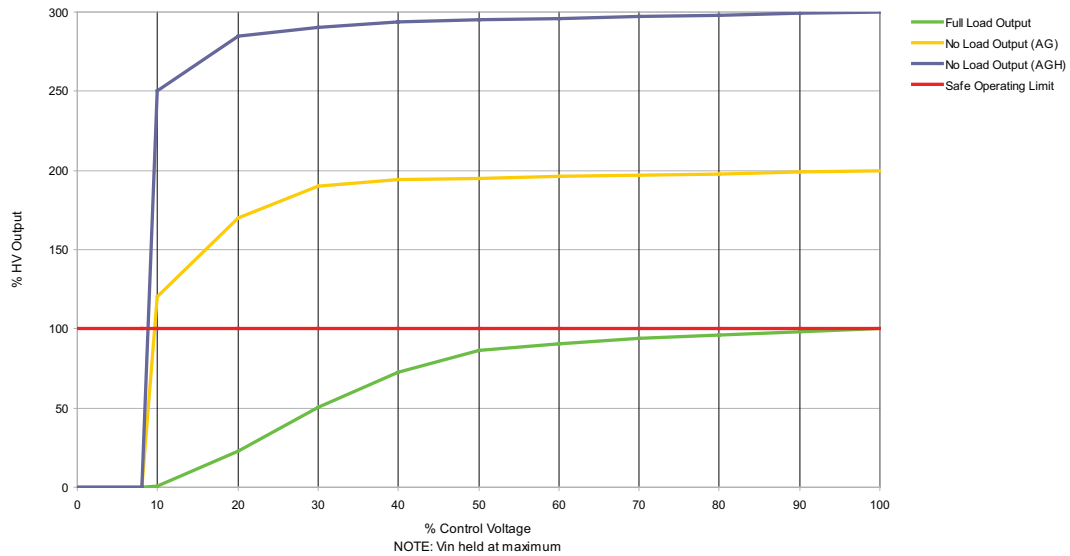
| Probe                | Time at Temperature           |                                  | Slopes                  |                     |
|----------------------|-------------------------------|----------------------------------|-------------------------|---------------------|
|                      | 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

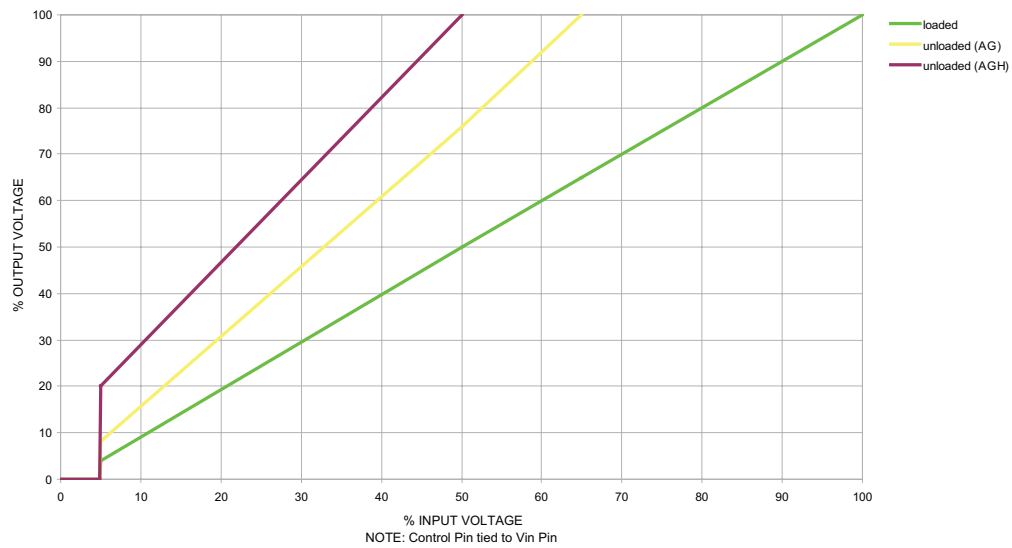


## APPLICATION NOTES

Typical HV Output vs. Control Voltage



TYPICAL INPUT vs. OUTPUT VOLTAGE



Output Voltage is load dependent. Under light or no-load conditions, reduce the Input Voltage so maximum rated Output Voltage is not exceeded.

## OPTION CODES

| ORDERING INFORMATION |                 | ORDER CODE | AVAILABILITY           |
|----------------------|-----------------|------------|------------------------|
| OUTPUT VOLTAGE       | 1 WATT          | AG         | ALL                    |
|                      | 1.5 WATT        | AGH        | ALL                    |
| POLARITY DESIGNATOR  | POSITIVE OUTPUT | P          | ALL                    |
|                      | NEGATIVE OUTPUT | N          | ALL                    |
| INPUT VOLTAGE        | 5 VDC           | 5          | ALL/Except AGH01 Model |
|                      | 12 VDC          | 12         | UP TO 3KV              |
|                      | 24 VDC          | 24         | UP TO 3KV              |
| OPTIONS              | EXTENDED TEMP   | T          | AG MODELS/1W           |

## HOW TO ORDER

## PART NUMBER SELECTOR:

Model Number:

**AG 20 N - 12 T**

**AG** - Model \_\_\_\_\_  
**20** - Output Voltage/100 (See table) \_\_\_\_\_  
**N** - Polarity Designator \_\_\_\_\_  
**12** - Input Voltage \_\_\_\_\_  
**T** - Extended Operating Temperature \_\_\_\_\_

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.
6. Proper thermal management techniques are required to maintain safe case temperature at maximum power output.
7. The AGH01 is only available in 12V or 24V.

XP EMCO reserves the right to make changes on products and literature, including specifications, without notice. XP EMCO standard product models are not recommended for "copy-exact" applications or any other application restricting product changes. "Copy-exact" options are available. Please contact an XP EMCO sales representative for more details.